DL151/D
Rev. 3, Nov-2000

Rectifier Device Data

ON Semiconductor™

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DL151/D
Rev. 3, Oct–2000

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ON Semiconductor™

This book presents technical data for ON Semiconductor's broad line of rectifiers. Complete specifications are provided in the form of data sheets and accompanying selection guides provide a quick comparison of characteristics to simplify the task of choosing the best device for a circuit.

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ON SEMICONDUCTOR DEVICE CLASSIFICATIONS

In an effort to provide up–to–date information to the customer regarding the status of any given device, ON Semiconductor has classified all devices into three categories: Preferred devices, Current products and Not Recommended for New Design products.

A Preferred type is a device which is recommended as a first choice for future use. These devices are “preferred” by virtue of their performance, price, functionality, or combination of attributes which offer the overall “best” value to the customer. This category contains both advanced and mature devices which will remain available for the foreseeable future.

“Preferred devices” are denoted below the device part numbers on the individual data sheets.

Device types identified as “current” may not be a first choice for **new** designs, but will continue to be available because of the popularity and/or standardization or volume usage in current production designs. These products can be acceptable for new designs but the preferred types are considered better alternatives for long term usage.

Any device that has not been identified as a “preferred device” is a “current” device.

This data book does not contain any “Not Recommended for New Design” devices.

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Master Index

ALPHANUMERIC MASTER INDEX

CHAPTER 2
Selector Guide

Continuing investment in research and development for discrete products has created a rectifier manufacturing facility that matches the precision and versatility of the most advanced integrated circuits. As a result, ON Semiconductor's silicon rectifiers span all high tech applications with quality levels capable of passing the most stringent environmental tests . . . including those for automotive under–hood applications.

Product Highlights:

- Surface Mount Devices – A major thrust has been the development and introduction of a broad range of power rectifiers, Schottky and Ultrafast, 1/2 amp to 25 amp, 15 to 600 volts.
- Application Specific Rectifiers –
  - – Schottky rectifiers having lower forward voltage drop (0.3 to 0.6 volts) for use in low voltage SMPS outputs and as "OR"ing diodes.
  - – MEGAHERTZ™ series for high frequency power supplies and power factor correction.
  - – Ultrasoft rectifiers for high speed rectification.
  - – Energy rated rectifiers with guaranteed energy handling capability.
  - – Automotive transient suppressors.
- Ultrafast rectifiers having reverse recovery times as low as 25 ns to complement the Schottky devices for higher voltage requirements in high frequency applications.
- A wide variety of package options to match virtually any potential requirement.

The rectifier selector section that follows has generally been arranged by package and technology. The individual tables have been sorted by voltage and current with the package types for the devices listed shown above each table. The Application Specific Rectifiers are also included in their respective tables.

Page

RECTIFIER NUMBERING SYSTEM

PART NUMBER KEY XXX X XX XX XX X XX

PREFIX
(TYPE DESIGNATOR)

F = FULLY ISOLATED
A = SURFACE MT (SMA)
S = SURFACE MT (SMB/SMC)
D = DPAK
B = D^2PAK
H = MEGAHERTZ
M = POWERMITE
P = POWERTAP

I_O

V_R
(X10 EXCEPT SCHOTTKY)

R = REVERSE
L = LOW V_F
E = ENERGY

SUFFIX
(DUAL DESIGNATOR)

PACKAGING DESIGNATOR*

PREFIX KEY

MUR = ULTRA FAST RECTIFIER
MBR = (SCHOTTKY) BARRIER RECTIFIER
MR = STANDARD & FAST RECOVERY
MSR = ULTRASOFT

SUFFIX KEY

CT = CENTER TAP (DUAL) TO–220, POWERTAP, DPAK, D^2PAK
PT = CENTER TAP (DUAL) TO–218 PACKAGE
WT = CENTER TAP (DUAL) TO–247

EXAMPLE:	MUR	30	20	WT
	ULTRAFAST	30 AMP	200 V	CENTER TAP (DUAL) TO–247
EXAMPLE:	MBR	30	45	WT
	SCHOTTKY	30 AMP	45 V	CENTER TAP (DUAL) TO–247

*For available packaging options consult Sales Office or see Data Sheet.

Application Specific Rectifiers

Table 1. Low V_F Schottky Rectifiers

Device	I_O (Amps)	V_{RRM} (Volts)	V_F @ Rated I_O and T_C = 25°C Volts (Max)	I_R @ Rated V_{RRM} mAmps (Max)	Package
MBR0520LT1, T3	0.5	20	0.33	0.25	SOD-123
MBRS130LT3	1	30	0.395	1	SMB
MBRD835L	8	35	0.41	1.4	DPAK
MBRD1035CTL	10	35	0.41	6	DPAK
MBR2030CTL	20	30	0.48	5	TO-220
MBRB2535CTL	25	35	0.41	10	D^2PAK
MBR2535CTL	25	35	0.41	5	TO-220
MBRB2515L	25	15	0.42	15	D^2PAK
MBR2515L	25	15	0.42	15	TO-220
MBRB3030CTL	30	30	0.51	5	D^2PAK
MBR4015LWT	40	15	0.42	5	TO-247
MBRP20030CTL	200	30	0.52	5	POWERTAP II
MBRP20035L	200	35	0.57	10	POWERTAP III
MBRP30035L	300	35	0.57	10	POWERTAP III
MBRP40045CTL	400	45	0.57	10	POWERTAP II
MBRP400100CTL	400	100	0.83	6	POWERTAP II
MBRP60035CTL	600	35	0.57	10	POWERTAP II

Table 2. MEGAHERTZ™ Rectifiers

Device	I_O (Amps)	V_{RRM} (Volts)	Maximum		t_{rr} (Nanosecond)
			V_F @ Rated I_O and Temp. (Volts)	I_R @ Rated V_{RRM} (mAmps)	
MURH840CT/MURHB840CT	8	400	1.7	0.01	28
MURH860CT	8	600	2.0	0.01	35
MURHB860CT	8	600	2.0	0.01	35
MURHF860CT	8	600	2.0	0.01	35

Table 3. UltraSoft Rectifiers (For High Speed Rectification)

Device	I_O (Amps)	V_{RRM} (Volts)	Max V_F @ I_F (Volts)	Max t_{rr} (ηSec)	T_JMax (°C)
MSRP10040	100	400	1.75 @ 100 A	75	150
MSRD620CT	6	200	1.2 @ 6.0 A	55	150
MSR860	8	600	1.7 @ 8.0 A	120	150
MSR1560	15	600	1.8 @ 15 A	45	150

Table 4. Energy Rated Rectifiers

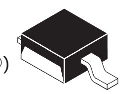
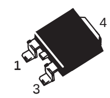
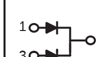
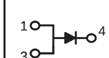
Device	I_O (Amps)	V_{RRM} (Volts)	Max V_F @ Rated unless Noted (Volts)	I_R @ V_{RRM} (mAmps)	Waval (M_J)
MUR180E	1.0	800	1.75	10	10
MUR1100E	1.0	1000	1.75	10	10
MUR480E	4.0	800	1.75	25	20
MUR4100E	4.0	1000	1.75	25	20
MUR880E	8.0	800	1.8	25	20
MUR8100E	8.0	1000	1.8	25	20
MUR10120E	10	1200	2.2 @ 6.5 A	100	20
MUR10150E	10	1500	2.5 @ 6.5 A	100	20
MUR5150E	5.0	1500	2.4	50	20

Table 5. Automotive Transient Suppressors

Device	I_O (Amps)	V_{RRM} (Volts)	Max V_F @ I_F (Volts)	I_{RSM} (Amps)	T_JMax (°C)
MR2535L	6.0	20	1.1 @ 100 A	62 @ 10 mS	175
MR2835S	32	23	1.1 @ 100 A	62 @ 10 mS	175
MR3227N, P	32	18	1.18 @ 100 A	90 @ 10 mS	200
MR4027N, P	40	18	1.1 @ 100 A	110 @ 10 mS	200
MR4045N, P	40	30	1.1 @ 100 A	55 @ 10 mS	200

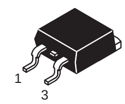
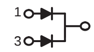
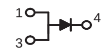
SCHOTTKY Rectifiers

Table 6. Surface Mount Schottky Rectifiers

V_{RRM} (Volts)	I_O(1) (Amperes)	I_O Rating Condition	Device	Max V_F @ i_F T_C = 25°C (Volts)	I_{FSM} (Amperes)	T_J Max (°C)	Max I_R(2) T_J = 25°C (mA)	Max I_R(3) (mA)	Package
20	0.5	T_L = 90°C	***MBR0520LT1*** ***MBR0520LT3***	0.310 @ 0.1 A 0.385 @ 0.5 A	5	125	.075 @ 10 V .250 @ 20 V	5 @ 10 V 8 @ 20 V	**CASE 425-04** (SOD-123) Cathode = Band 
30	0.5	T_L = 100°C	***MBR0530T1*** ***MBR0530T3***	0.375 @ 0.1 A 0.430 @ 0.5 A	5	125	.020 @ 15 V .130 @ 30 V	–	
40	0.5	T_L = 110°C	***MBR0540T1*** ***MBR0540T3***	0.53 @ 0.5 A	5	150	.010 @ 20 V .020 @ 40 V	–	
20	1	T_C = 130°C	***MBRM120ET3***	0.455 @ 0.1 A 0.530 @ 1.0 A	50	150	0.010 @ 20 V	1.6 @ 20 V	**CASE 457–04** (POWERMITE®) 
20	1	T_{tab} ≤ 100°C	***MBRM120LT3***	0.36 @ 0.1 A 0.45 @ 1 A	50	125	0.4 @ 20 V	N/A	
30	1	T_C = 135°C	***MBRM130LT3***⋆	0.45 @ 1.0 A	50	125	1	N/A	
40	1	T_{tab} ≤ 100°C	***MBRM140T3***	0.39 @ 0.1 A 0.55 @ 1 A	50	125	0.5 @ 40 V	N/A	
30	1	T_C ≤ 105°C	***MBRA130LT3***	0.41 @ 1 A 0.47 @ 2 A	25	125	1.0 @ 30 V 0.4 @ 15 V	25 @ 30 V	**CASE 403B-01** (SMA) Cathode = Notch or Polarity Band 
40	1	T_C ≤ 100°C	***MBRA140T3***	0.60 @ 1 A 0.73 @ 2 A	25	125	0.5 @ 40 V 0.1 @ 20 V	10 @ 40 V	
20	1	T_L = 115°C	***MBRS120T3***	0.55 @ 1.0 A	40	125	1	10	**CASE 403-03** (SMB) Cathode = Notch or Polarity Band 
30	1	T_L = 120°C	***MBRS130LT3***	0.395 @ 1.0 A	40	125	1	10	
30	1	T_L = 115°C	***MBRS130T3***	0.55 @ 1.0 A	40	125	1	10	
40	1	T_L = 115°C	***MBRS140T3***	0.6 @ 1.0 A	40	125	1	10	
40	1	T_C = 110°C	***MBRS140LT3***	0.5 @ 1.0 A	40	125	0.4	10	
90	1	T_L = 120°C	***MBRS190T3***	0.75 @ 1.0 A	50	125	0.5	5	
100	1	T_L = 120°C	***MBRS1100T3***	0.75 @ 1.0 A	40	150	0.5	5	
40	1.5	T_C = 100°C	***MBRS1540T3***	0.46 @ 1.5 A	40	125	0.8	5.7	
40	2	T_C ≤ 95°C	***MBRS240LT3***	0.43 @ 2 A 0.53 @ 4 A	25	125	2.0 @ 40 V 0.5 @ 20 V	60 @ 40 V 40 @ 20 V	
40	2	T_C = 103°C	***MBRS2040LT3***	0.43 @ 2 A 0.50 @ 4 A	70	125	0.80 @ 40 V 0.10 @ 20 V	20 @ 40 V 6.0 @ 20 V	
20	3	T_L = 100°C	***MBRS320T3***	0.50 @ 3.0 A	80	125	2	20	**CASE 403A-03** (SMC) Cathode = Notch 
30	3	T_L = 100°C	***MBRS330T3***	0.50 @ 3.0 A	80	125	2	20	
40	3	T_L = 100°C	***MBRS340T3***	0.525 @ 3.0 A	80	125	2	20	
60	3	T_L = 100°C	***MBRS360T3***	0.74 @ 3.0 A	80	125	0.5	20	
20	3	T_C = 125°C	***MBRD320T4***	0.60 @ 3.0 A	75	150	0.2	20 @ 125°C	**CASE 369A-13** (DPAK)   “CT” Suffix  Non-“CT” Suffix
30	3	T_C = 125°C	***MBRD330T4***	0.60 @ 3.0 A	75	150	0.2	20 @ 125°C	
40	3	T_C = 125°C	***MBRD340T4***	0.60 @ 3.0 A	75	150	0.2	20 @ 125°C	
50	3	T_C = 125°C	***MBRD350T4***	0.60 @ 3.0 A	75	150	0.2	20 @ 125°C	
60	3	T_C = 125°C	***MBRD360T4***	0.60 @ 3.0 A	75	150	0.2	20 @ 125°C	
20	6	T_C = 130°C	***MBRD620CTT4***	0.70 @ 3.0 A	75	150	0.1	15 @ 125°C	
30	6	T_C = 130°C	***MBRD630CTT4***	0.70 @ 3.0 A	75	150	0.1	15 @ 125°C	
40	6	T_C = 130°C	***MBRD640CTT4***	0.70 @ 3.0 A	75	150	0.1	15 @ 125°C	
50	6	T_C = 130°C	***MBRD650CTT4***	0.70 @ 3.0 A	75	150	0.1	15 @ 125°C	
60	6	T_C = 130°C	***MBRD660CTT4***	0.70 @ 3.0 A	75	150	0.1	15 @ 125°C	
35	8	T_C = 100°C	***MBRD835L***	0.40 @ 3.0 A 0.51 @ 8.0 A	100	125	1.4	35	
35	10	T_C = 90°C	***MBRD1035CTL***	0.49 @ 10 A	100	125	2	130 @ 125°C	

SCHOTTKY Rectifiers

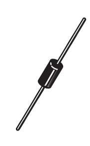
Table 6. Surface Mount Schottky Rectifiers (continued)

V_{RRM} (Volts)	I_O(1) (Amperes)	I_O Rating Condition	Device	Max V_F @ i_F T_C = 25°C (Volts)	I_{FSM} (Amperes)	T_J Max (°C)	Max I_R(2) T_J = 25°C (mA)	Max I_R(3) (mA)	Package	
10	45	T_C = 135°C	***MBRB1045★***	0.84 @ 20 A	150	150	0.1	15 @ 125°C	**CASE 418B-03** (D^2PAK) 	 "CT" Suffix  Non-"CT" Suffix
45	15	T_C = 105°C	***MBRB1545CT***	0.84 @ 15 A	150	150	0.1	15 @ 125°C		
60	20	T_C = 110°C	***MBRB2060CT***	0.95 @ 20 A	150	150	0.15	150 @ 125°C		
100	20	T_C = 110°C	***MBRB20100CT***	0.85 @ 10 A 0.95 @ 20 A	150	150	0.1	6 @ 125°C		
200	20	T_C = 125°C	***MBRB20200CT***	1.0 @ 20 A	150	150	1	50 @ 125°C		
15	25	T_C = 90°C	***MBRB2515L***	0.45 @ 25 A	150	100	15	200 @ 70°C		
35	25	T_C = 110°C	***MBRB2535CTL***	0.47 @ 12.5 A 0.55 @ 25 A	150	125	10	500 @ 125°C		
45	25	T_C = 130°C	***MBRB2545CT***	0.82 @ 30 A	150	150	0.2	40 @ 125°C		
30	30	T_C = 115°C	***MBRB3030CT***	0.54 @ 15 A 0.67 @ 30 A	300	150	1.2	145 @ 150°C 46 @ 10 V, 150°C		
30	30	T_C = 95°C	***MBRB3030CTL***	0.45 @ 15 A 0.51 @ 30 A	150	125	2	195 @ 125°C 75 @ 10 V, 125°C		
30	40	T_C = 110°C	***MBRB4030***	0.46 @ 20 A 0.55 @ 40 A	300	150	1	150 @ 125°C		

(1)I_O is total device current capability.
(2)V_{RRM} unless noted
(3)V_{RRM}, T_J = 100°C unless noted
★New Product

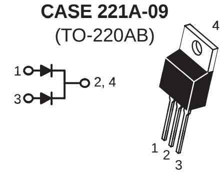
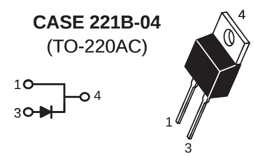
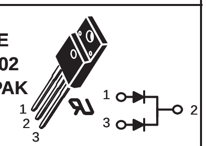
All devices listed are ON Semiconductor preferred devices

Table 7. Axial Lead Schottky Rectifiers

V_{RRM} (Volts)	I_O (Amperes)	I_O Rating Condition	Device	Max V_F @ i_F T_C = 25°C (Volts)	I_{FSM} (Amperes)	T_J Max (°C)	Max I_R(2) T_L = 25°C (mA)	Max I_R(3) T_L (mA)	Package
20	1	T_A = 55°C $R_{\theta JA}$ = 80°C/W	***1N5817***	0.45 @ 1.0 A	25	125	1	10	**CASE 59–04 Plastic**  Cathode = Polarity Band
30	1	T_A = 55°C $R_{\theta JA}$ = 80°C/W	***1N5818***	0.55 @ 1.0 A	25	125	1	10	
40	1	T_A = 55°C $R_{\theta JA}$ = 80°C/W	***1N5819***	0.60 @ 1.0 A	25	125	1	10	
50	1	T_A = 55°C	***MBR150***	0.75 @ 1.0 A	25	150	0.5	5	
60	1	T_A = 55°C $R_{\theta JA}$ = 80°C/W	***MBR160***	0.75 @ 1.0 A	25	150	0.5	5	
100	1	T_A = 120°C $R_{\theta JA}$ = 50°C/W	***MBR1100***	0.79 @ 1.0 A	50	150	0.5	5	
20	3	T_A = 76°C $R_{\theta JA}$ = 28°C/W	***1N5820***	0.457 @ 3.0 A	80	125	2	20	**CASE 267-03 Plastic**  Cathode = Polarity Band
30	3	T_A = 71°C $R_{\theta JA}$ = 28°C/W	***1N5821***	0.500 @ 3.0 A	80	125	2	20	
40	3	T_A = 61°C $R_{\theta JA}$ = 28°C/W	***1N5822***	0.525 @ 3.0 A	80	125	2	20	
40	3	T_A = 65°C $R_{\theta JA}$ = 28°C/W	***MBR340***	0.600 @ 3.0 A	80	150	0.6	20	
50	3	T_A = 65°C	***MBR350RL***	0.600 @ 3.0 A	80	150	0.6	20	
60	3	T_A = 65°C $R_{\theta JA}$ = 28°C/W	***MBR360RL***	0.740 @ 3.0 A	80	150	0.6	20	
100	3	T_A = 100°C $R_{\theta JA}$ = 28°C/W	***MBR3100***	0.79 @ 3.0 A	150	150	0.6	20	

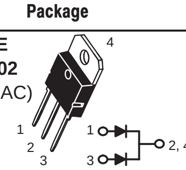
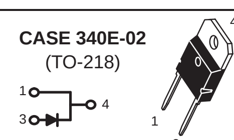
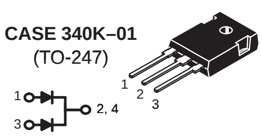
(2)V_{RRM} unless noted
(3)V_{RRM}, T_J = 100°C unless noted

Table 8. TO-220 Thru–Hole Schottky Rectifiers

V_{RRM} (Volts)	I_O (Amperes)	I_O Rating Condition	Device	Max V_F @ i_F $T_C = 25°C$ (Volts)	I_{FSM} (Amperes)	T_J Max (°C)	Max I_R[(2)] $T_C = 25°C$ (mA)	Max I_R[(3)] (mA)	Package
35	15	T_C = 105°C	***MBR1535CT***	0.84 @ 15 A	150	150	0.1	15 @ 125°C	**CASE 221A-09** (TO-220AB) 
45	15	T_C = 105°C	***MBR1545CT***	0.84 @ 15 A	150	150	0.1	15 @ 125°C	
100	16	T_C = 133°C	***MBR16100CT***	0.84 @ 16 A	150	175	0.1	5 @ 125°C	
30	20	T_C = 137°C	***MBR2030CTL***	0.52 @ 10 A 0.58 @ 20 A	150	150	5	40	
45	20	T_C = 135°C	***MBR2045CT***	0.84 @ 20 A	150	150	0.1	15 @ 125°C	
60	20	T_C = 133°C	***MBR2060CT***	0.85 @ 10 A 0.95 @ 20 A	150	150	0.1	6 @ 125°C	
80	20	T_C = 133°C	***MBR2080CT***	0.95 @ 20 A	150	150	0.1	6 @ 125°C	
90	20	T_C = 133°C	***MBR2090CT***	0.95 @ 20 A	150	150	0.1	6 @ 125°C	
100	20	T_C = 133°C	***MBR20100CT***	0.85 @ 10 A 0.95 @ 20 A	150	150	0.1	6 @ 125°C	
200	20	T_C = 125°C	***MBR20200CT***	1.0 @ 20 A	150	150	1	50 @ 125°C	
35	25	T_C = 95°C	***MBR2535CTL***	0.55 @ 25 A	150	125	5	500 @ 125°C	
45	25	T_C = 130°C	***MBR2545CT***	0.82 @ 30 A	150	150	0.2	40 @ 125°C	
45	30	T_C = 130°C	***MBR3045ST***	0.76 @ 30 A	150	150	0.2	40 @ 125°C	
35	7.5	T_C = 105°C	***MBR735***	0.84 @ 15 A	150	150	0.1	15 @ 125°C	**CASE 221B-04** (TO-220AC) 
45	7.5	T_C = 105°C	***MBR745***	0.84 @ 15 A	150	150	0.1	15 @ 125°C	
35	10	T_C = 135°C	***MBR1035***	0.84 @ 20 A	150	150	0.1	15 @ 125°C	
45	10	T_C = 135°C	***MBR1045***	0.84 @ 20 A	150	150	0.1	15 @ 125°C	
60	10	T_C = 133°C	***MBR1060***	0.80 @ 10 A	150	150	0.1	6 @ 125°C	
90	10	T_C = 133°C	***MBR1090***	0.70 @ 10 A	150	150	0.1	6 @ 125°C	
100	10	T_C = 133°C	***MBR10100***	0.80 @ 10 A	150	150	0.1	6 @ 125°C	
35	16	T_C = 125°C	***MBR1635***	0.63 @ 16 A	150	150	0.2	40 @ 125°C	
45	16	T_C = 125°C	***MBR1645***	0.63 @ 16 A	150	150	0.2	40 @ 125°C	
15	25	T_C = 90°C	***MBR2515L***	0.45 @ 25 A	150	100	15	200 @ 70°C	
60	20	T_C = 133°C	***MBRF2060CT***	0.95 @ 20 A	150	150	0.15	15 @ 125°C	**CASE 221D-02 FULL PAK** 
100	20	T_C = 133°C	***MBRF20100CT***	0.95 @ 20 A	150	150	0.15	15 @ 125°C	
200	20	T_C = 125°C	***MBRF20200CT***	1.0 @ 20 A	150	150	1	50 @ 125°C	
45	25	T_C = 125°C	***MBRF2545CT***	0.82 @ 25 A	150	150	0.2	40 @ 125°C	

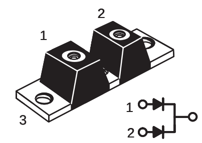
(2)V_{RRM} unless noted
(3)V_{RRM}, T_J = 100°C unless noted
Indicates UL Recognized – File #E69369

Table 9. TO-218 and TO-247 Schottky Rectifiers

V_{RRM} (Volts)	I_O (Amperes)	I_O Rating Condition	Device	Max V_F @ i_F $T_C = 25°C$ (Volts)	I_{FSM} (Amperes)	T_J Max (°C)	Max I_R[(2)] $T_C = 25°C$ (mA)	Max I_R[(3)] (mA)	Package
45	30	T_C = 105°C	***MBR3045PT***	0.76 @ 30 A	200	150	1	100 @ 125°C	**CASE 340D-02** (TO-218AC) 
45	40	T_C = 125°C	***MBR4045PT***	0.70 @ 20 A 0.80 @ 40 A	400	150	1	50	
45	60	T_C = 125°C	***MBR6045PT***	0.62 @ 30 A 0.75 @ 60 A	500	150	1	50	
25	50	T_C = 125°C	***MBR5025L***	0.54 @ 30 A 0.62 @ 50 A	300	150	0.5	60	**CASE 340E-02** (TO-218) 
45	30	T_C = 105°C	***MBR3045WT***	0.76 @ 30 A	200	150	1	100 @ 125°C	**CASE 340K–01** (TO-247) 
15	40	T_C = 125°C	***MBR4015LWT***	0.42 @ 20 A 0.50 @ 40 A	400	100	5	150 @ 75°C	
45	40	T_C = 125°C	***MBR4045WT***	0.70 @ 20 A 0.80 @ 40 A	400	150	1	50	
45	60	T_C = 125°C	***MBR6045WT***	0.62 @ 30 A 0.75 @ 60 A	500	150	1	50	

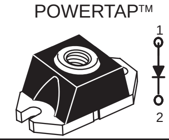
(2)V_{RRM} unless noted
(3)V_{RRM}, T_J = 100°C unless noted

Table 10. POWERTAP II Schottky Rectifiers

V_{RRM} (Volts)	I_O[1] (Amperes)	I_O Rating Condition	Device	Max V_F @ i_F $T_C = 25°C$ (Volts)	I_{FSM} (Amperes)	T_J Max (°C)	Max I_R(2) $T_C = 25°C$ (mA)	Max I_R[3] (mA)	Package
30	200	$T_C = 125°C$	***MBRP20030CTL***	0.52 @ 100 A 0.60 @ 200 A	1500	150	5	–	**CASE 357C-03** POWERTAP™  Cathode = Mounting Plate Anode = Terminal
30	400	$T_C = 100°C$	***MBRP40030CTL***★	0.50 @ 200 A	1500	150	20	1000 @ 100°C	
35	600	$T_C = 100°C$	***MBRP60035CTL***	0.57 @ 300 A	4000	150	10	250	
45	200	$T_C = 125°C$	***MBRP20045CT***	0.78 @ 100 A	1500	150	0.5	50 @ 125°C	
45	300	$T_C = 120°C$	***MBRP30045CT***	0.70 @ 150 A 0.82 @ 300 A	2500	150	0.8	75 @ 125°C	
45	400	$T_C = 100°C$	***MBRP40045CTL***	0.57 @ 200 A	2500	150	10	–	
60	200	$T_C = 125°C$	***MBRP20060CT***	0.800 @ 100 A	1500	150	0.5	50 @ 125°C	
60	300	$T_C = 120°C$	***MBRP30060CT***	0.79 @ 150 A 0.89 @ 300 A	2500	150	0.8	75 @ 125°C	
100	400	$T_C = 100°C$	***MBRP400100CTL***	0.83 @ 200 A	2500	150	6	–	

(1)I_O is total device current capability.
(2)V_{RRM} unless noted
(3)V_{RRM}, $T_J = 100°C$ unless noted

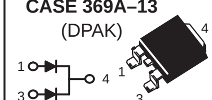
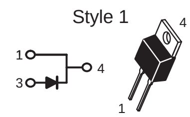
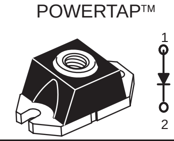
Table 11. POWERTAP III Schottky Rectifiers

V_{RRM} (Volts)	I_O[1] (Amperes)	I_O Rating Condition	Device	Max V_F @ i_F $T_C = 25°C$ (Volts)	I_{FSM} (Amperes)	T_J Max (°C)	Max I_R(2) $T_C = 25°C$ (μA)	Max I_R[3] (μA) $T_J = 100°C$	Package
35	200	$T_C = 100°C$	***MBRP20035L***	0.57 @ 200 A	2000	150	10	250	**CASE 357D-01** POWERTAP™ 
	300	$T_C = 100°C$	***MBRP30035L***	0.57 @ 300 A	3000	150	10	250	

(1)I_O is total device current capability. ★New Product
(2)V_{RRM} unless noted
(3)V_{RRM}, $T_J = 100°C$ unless noted

NEW UltraSoft Rectifiers

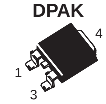
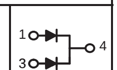
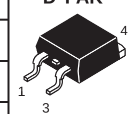
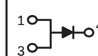
Table 12. UltraSoft Rectifiers (For High Speed Rectification)

V_{RRM} (Volts)	I_O[1] (Amperes)	I_O Rating Condition	Device	Max V_F @ i_F $T_C = 29°C$ (Volts)	t_{rr} (ηSec)	T_J Max (°C)	Max I_R(2) $T_C = 25°C$ (μA)	Max I_R[3] (μA) $T_J = 150°C$	Package
200	6	$T_C = 145°C$	***MSRD620CT***★	1.2 @ 6.0 A	55	150	5	200	**CASE 369A–13** (DPAK) 
600	8	$T_C = 125°C$	***MSR860***	1.7 @ 8.0 A	120	150	10 μA	1000	**CASE 221B–04** Style 1 
600	15	$T_C = 125°C$	***MSR1560***	1.8 @ 15 A	45	150	15	5000	
400	100	$T_C = 100°C$	***MSRP10040***★	1.75 @ 100 A	75	150	100	500	**CASE 357D-01** POWERTAP™ 

(1)I_O is total device current capability. ★New Product
(2)V_{RRM} unless noted
(3)V_{RRM}, $T_J = 150°C$ unless noted

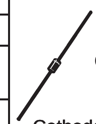
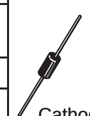
Ultrafast Rectifiers

Table 13. Surface Mount Ultrafast Rectifiers

V_{RRM} (Volts)	I_O(1) (Amperes)	I_O Rating Condition	Device	Max t_{rr} (ns)	Max V_F @ i_F $T_C = 25°C$ (Volts)	I_{FSM} (Amperes)	T_J Max (°C)	Max I_R(2) $T_J = 25°C$ (μA)	Max I_R(4) (μA) Package	Package	
50	1	$T_L = 155°C$	*MURS105T3*	35	0.875 @ 1.0 A	40	175	2	50	**SMB** Cathode = Polarity Band 	
100	1	$T_L = 155°C$	*MURS110T3*	35	0.875 @ 1.0 A	40	175	2	50		
150	1	$T_L = 155°C$	*MURS115T3*	35	0.875 @ 1.0 A	40	175	2	50		
200	1	$T_L = 155°C$	*MURS120T3*	35	0.875 @ 1.0 A	40	175	2	50		
400	1	$T_L = 150°C$	*MURS140T3*	75	1.25 @ 1.0 A	35	175	5	150		
600	1	$T_L = 150°C$	*MURS160T3*	75	1.25 @ 1.0 A	35	175	5	150		
200	2	$T_C = 145°C$	*MURS220T3*	35	0.95 @ 2.0 A	40	175	2	50		
300	2	$T_C = 125°C$	*MURS230T3*	65	1.15 @ 2.0 A	35	175	5	150		
400	2	$T_C = 125°C$	*MURS240T3*	65	1.15 @ 2.0 A	35	175	5	150		
600	2	$T_C = 125°C$	*MURS260T3*	75	1.15 @ 2.0 A	35	175	5	150		
400	3	$T_L = 130°C$	*MURS320T3*	35	0.875 @ 3.0 A	75	175	5	15	**SMC** Cathode = Notch 	
400	3	$T_L = 130°C$	*MURS340T3*	75	1.25 @ 3.0 A	75	175	10	250		
600	3	$T_L = 130°C$	*MURS360T3*	75	1.25 @ 3.0 A	75	175	10	250		
200	6	$T_L = 145°C$	*MURD620CT*	35	1.0 @ 3.0 A	63	175	5	250 @ 125°C	**DPAK** 	 "CT" Suffix
200	3	$T_C = 158°C$	*MURD320*	35	.95 @ 3.0 A	75	175	5	500 @ 125°C		
400	8	$T_L = 120°C$	*MURHB840CT*	28	2.2 @ 4.0 A	100	175	10	500	**D2PAK** 	 Non-"CT" Suffix
600	8	$T_L = 120°C$	*MURHB860CT*	35	2.8 @ 4.0 A	100	175	10	500		
200	16	$T_L = 150°C$	*MURB1620CT*	35	0.975 @ 8.0 A	100	175	5	250		
600	16	$T_C = 150°C$	*MURB1660CT*	60	1.5 @ 8.0 A	100	175	10	500		

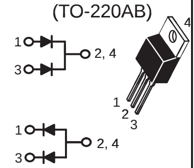
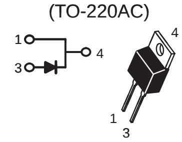
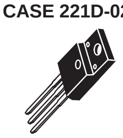
(1)I_O is total device current capability.
(2)V_{RRM} unless noted
(4)V_{RRM}, $T_J = 150°C$ unless noted
★New Product

Table 14. Axial Lead Ultrafast Rectifiers

V_{RRM} (Volts)	I_O (Amperes)	I_O Rating Condition	Device	Max t_{rr} (ns)	Max V_F @ i_F $T_C = 25°C$ (Volts)	I_{FSM} (Amperes)	T_J Max (°C)	Max I_R(2) $T_J = 25°C$ (μA)	Max I_R(4) (μA)	Package
50	1	$T_A = 130°C$	***MUR105***	35	0.875 @ 1.0 A	35	175	2	50	 **CASE 59-04** Plastic Cathode = Polarity Band
100	1	$T_A = 130°C$	***MUR110***	35	0.875 @ 1.0 A	35	175	2	50	
150	1	$T_A = 130°C$	***MUR115***	35	0.875 @ 1.0 A	35	175	2	50	
200	1	$T_A = 130°C$ $R_{\theta JA} = 50°C/W$	***MUR120***	25	0.875 @ 1.0 A	35	175	2	50	
300	1	$T_A = 120°C$	***MUR130***	75	1.25 @ 1.0 A	35	175	5	150	
400	1	$T_A = 120°C$	***MUR140***	75	1.25 @ 1.0 A	35	175	5	150	
600	1	$T_A = 120°C$ $R_{\theta JA} = 50°C/W$	***MUR160***	50	1.25 @ 1.0 A	35	175	5	150	
800	1	$T_A = 95°C$	***MUR180E***	100	1.75 @ 1.0 A	35	175	10	600	
1000	1	$T_A = 95°C$ $R_{\theta JA} = 50°C/W$	***MUR1100E***	75	1.75 @ 1.0 A	35	175	10	600 @ 100°C	
200	2	$T_A = 90°C$	***MUR220***	35	0.95 @ 2.0 A	35	175	2	50	
400	2	$T_A = 85°C$	***MUR240***	65	1.15 @ 2.0 A	35	175	5	150	
600	2	$T_A = 60°C$	***MUR260***	75	1.35 @ 2.0 A	35	175	5	150	
1000	2	$T_A = 35°C$	***MUR2100E***	100	2.2 @ 2.0 A	35	175	10	600	
50	4	$T_A = 80°C$	***MUR405***	35	0.89 @ 2.0 A	125	175	5	150	 **CASE 267-03** Plastic Cathode = Polarity Band
100	4	$T_A = 80°C$	***MUR410***	35	0.89 @ 2.0 A	125	175	5	150	
150	4	$T_A = 80°C$	***MUR415***	35	0.89 @ 2.0 A	125	175	5	150	
200	4	$T_A = 80°C$ $R_{\theta JA} = 28°C/W$	***MUR420***	25	0.875 @ 3.0 A	125	175	5	150	
400	4	$T_A = 40°C$	***MUR440***	75		75	175	10	250	
600	4	$T_A = 40°C$ $R_{\theta JA} = 28°C/W$	***MUR460***	50	1.25 @ 3.0 A	70	175	10	250	
800	4	$T_A = 35°C$	***MUR480E***	100	1.75 @ 3.0 A	70	175	25	900 @ 100°C	
1000	4	$T_A = 35°C$ $R_{\theta JA} = 28°C/W$	***MUR4100E***	75	1.75 @ 3.0 A	70	175	25	900 @ 100°C	

(2)V_{RRM} unless noted
(4)V_{RRM}, $T_J = 150°C$ unless noted

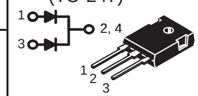
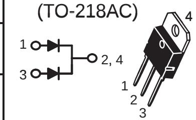
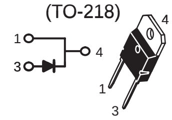
Table 15. TO-220 Ultrafast and MEGAHERTZ™ Rectifiers

V_{RRM} (Volts)	$I_O^{(1)}$ (Amperes)	I_O Rating Condition	Device	Max t_{rr} (ns)	Max V_F @ i_F T_C = 25°C (Volts)	I_{FSM} (Amperes)	T_J Max (°C)	Max $I_R^{(2)}$ T_C = 25°C (μA)	Max $I_R^{(4)}$ (μA)	Package
200	6	T_C = 130°C	***MUR620CT***	35	0.975 @ 3.0 A	75	175	5	250	**CASE 221A-09** (TO-220AB)  **MUR1620CTR Only**
400	8	T_C = 120°C	***MURH840CT***	28	2.0 @ 4.0 A	100	175	10	500	
600	8	T_C = 120°C	***MURH860CT***	35	2.8 @ 4.0 A	100	175	10	500	
100	16	T_C = 150°C	***MUR1610CT***	35	0.975 @ 8.0 A	100	175	5	250	
150	16	T_C = 150°C	***MUR1615CT***	35	0.975 @ 8.0 A	100	175	5	250	
200	16	T_C = 150°C	***MUR1620CT***	35	0.975 @ 8.0 A	100	175	5	250	
200	16	T_C = 160°C	***MUR1620CTR***	85	1.2 @ 8.0 A	100	175	5	500	
400	16	T_C = 150°C	***MUR1640CT***	60	1.30 @ 8.0 A	100	175	10	250	
600	16	T_C = 150°C	***MUR1660CT***	60	1.5 @ 8.0 A	100	175	10	500	
50	8	T_C = 150°C	***MUR805***	35	0.975 @ 8.0 A	100	175	5	250	**CASE 221B-04** (TO-220AC) 
100	8	T_C = 150°C	***MUR810***	35	0.975 @ 8.0 A	100	175	5	250	
150	8	T_C = 150°C	***MUR815***	35	0.975 @ 8.0 A	100	175	5	250	
200	8	T_C = 150°C	***MUR820***	35	0.975 @ 8.0 A	100	175	5	250	
400	8	T_C = 150°C	***MUR840***	50	1.30 @ 8.0 A	100	175	10	500	
600	8	T_C = 150°C	***MUR860***	50	1.50 @ 8.0 A	100	175	10	500	
800	8	T_C = 175°C	***MUR880E***	75	1.80 @ 8.0 A	100	175	25	500 @ 100°C	
100	15	T_C = 150°C	***MUR1510***	35	1.05 @ 15 A	200	175	10	500	
150	15	T_C = 150°C	***MUR1515***	35	1.05 @ 15 A	200	175	10	500	
200	15	T_C = 150°C	***MUR1520***	35	1.05 @ 15 A	200	175	10	500	
400	15	T_C = 150°C	***MUR1540***	60	1.25 @ 15 A	150	175	10	500	
600	15	T_C = 145°C	***MUR1560***	60	1.50 @ 15 A	150	175	10	1000	
200	20	T_C = 125°C	***MUR2020R***	95	1.10 @ 20 A	250	175	50	1000	
1000	8	T_C = 150°C	***MUR8100E***	75	1.80 @ 8.0 A	100	175	25	500 @ 100°C	
1200	10	T_C = 125°C	***MUR10120E***	175	2.2 @ 6.5 A	100	125	100	1000 @ 125°C	
1500	10	T_C = 125°C	***MUR10150E***	175	2.4 @ 6.5 A	100	125	100	1000 @ 125°C	
1500	5	T_C = 100°C	***MUR5150E***	175	2.4 @ 5 A	100	125	50	500 @ 125°C	
200	16	T_C = 150°C	ᴿᵁ ***MURF1620CT***	25	0.975 @ 8.0 A	100	150	5	250	**CASE 221D-02** 
600	16	T_C = 150°C	***MURF1660CT***	60	1.5 @ 8.0 A	100	175	10	500	
600	8	$T_C \leq$ 120°C	***MURHF860CT*** ★	35	2.8 @ 4.0 A	100	175	10	500	

(1)I_O is total device capability
(2)V_{RRM} unless noted
(4)V_{RRM}, T_J = 150°C unless noted

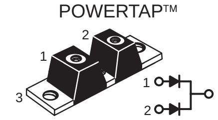
ᴿᵁ Indicates UL Recognized – File #E69369
★ New Product

Table 16. TO-218 and TO-247 Ultrafast Rectifiers

V_{RRM} (Volts)	I_O (Amperes)	I_O Rating Condition	Device	Max t_{rr} (ns)	Max V_F @ i_F T_C = 25°C (Volts)	I_{FSM} (Amperes)	T_J Max (°C)	Max I_R(2) T_J = 25°C (μA)	Max I_R(4) (mA)	Package
200	30	T_C = 145°C	***MUR3020WT***	35	1.05 @ 15 A	150	175	10	0.5	**CASE 340K–01** (TO-247) 
600	30	T_C = 145°C	***MUR3060WT***	60	1.70 @ 15 A	150	175	10	1	
200	30	T_C = 150°C	***MUR3020PT***	35	1.12 @ 15 A	200	175	10	0.5	**CASE 340D-02** (TO-218AC) 
400	30	T_C = 150°C	***MUR3040PT***	60	1.12 @ 15 A	150	175	10	0.5	
600	30	T_C = 145°C	***MUR3060PT***	60	1.20 @ 15 A	150	175	10	1	
400	30	T_C = 70°C	***MUR3040***	100	1.5 @ 30 A	300	175	35	6 @ 100°C	**CASE 340E-02** (TO-218) 
800	30	T_C = 70°C	***MUR3080***	110	1.90 @ 30 A	300	175	100	5 @ 100°C	
400	60	T_C = 70°C	***MUR6040***	100	1.50 @ 60 A	600	175	60	10 @ 100°C	

(1)I_O is total device capability
(2)V_{RRM} unless noted
(4)V_{RRM}, T_J = 150°C unless noted

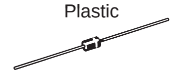
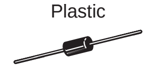
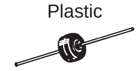
Table 17. POWERTAP II Ultrafast Rectifiers

V_{RRM} (Volts)	I_O(1) (Amperes)	I_O Rating Condition	Device	Max t_{rr} (ns)	Max V_F @ i_F T_C = 25°C (Volts)	I_{FSM} (Amperes)	T_J Max (°C)	Max I_R(2) T_J = 25°C (μA)	Max I_R(4) (mA)	Package
200	200	T_C = 130°C	***MURP20020CT***	50	1.00 @ 100 A	800	175	150	1 @ 125°C	**CASE 357C-03** POWERTAP™ 
400	200	T_C = 100°C	***MURP20040CT***	50	1.30 @ 100 A	800	175	50	0.5 @ 125°C	Cathode = Mounting Plate Anode = Terminal

(1)I_O is total device current capability.
(2)V_{RRM} unless noted
(4)V_{RRM}, T_J = 150°C unless noted
⋆ New Product

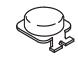
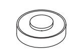
Fast Recovery Rectifiers/General-Purpose Rectifiers

Table 18. Fast Recovery Rectifiers/General Purpose Rectifiers

V_{RRM} (Volts)	I_O (Amperes)	I_O Rating Condition	Device	Max V_F @ i_F T_J = 25°C (Volts)	Max t_{rr} (ns)	I_{FSM} (Amperes)	T_J Max (°C)	Max I_R[2] T_J = 25°C (µA)	Max I_R[3] (µA)	Package
400	1.5	T_L = 118°C	***MRS1504T3***	1.04 @ 1.5 A	–	50	150	1	340	**CASE 403A-03** **SMB** 
300	1	T_L = 150°C	***MRA4003T3*** ⋆	1.1 @ 1.0 A	–	30	175	10	50	**CASE 403B-01** **SMA**  Cathode = Notch
400	1	T_L = 150°C	***MRA4004T3*** ⋆	1.1 @ 1.0 A	–	30	175	10	50	
600	1	T_L = 150°C	***MRA4005T3*** ⋆	1.1 @ 1.0 A	–	30	175	10	50	
800	1	T_L = 150°C	***MRA4006T3*** ⋆	1.1 @ 1.0 A	–	30	175	10	50	
1000	1	T_L = 150°C	***MRA4007T3*** ⋆	1.1 @ 1.0 A	–	30	175	10	50	
50	1	T_A = 75°C	***1N4001RL***	1.1 @ 1.0 A	–	30	150	10	50	**CASE 59-03**[7] Plastic  Cathode = Polarity Band
100	1	T_A = 75°C	***1N4002RL***	1.1 @ 1.0 A	–	30	150	10	50	
200	1	T_A = 75°C	***1N4003RL***	1.1 @ 1.0 A	–	30	150	10	50	
400	1	T_A = 75°C	***1N4004RL***	1.1 @ 1.0 A	–	30	150	10	50	
600	1	T_A = 75°C	***1N4005RL***	1.1 @ 1.0 A	–	30	150	10	50	
800	1	T_A = 75°C	***1N4006RL***	1.1 @ 1.0 A	–	30	150	10	50	
1000	1	T_A = 75°C	***1N4007RL***	1.1 @ 1.0 A	–	30	150	10	50	
50	1	T_A = 75°C	***1N4933RL***	1.2 @ 1.0 A	200	30	150	5	100	
100	1	T_A = 75°C	***1N4934RL***	1.2 @ 1.0 A	200	30	150	5	100	
200	1	T_A = 75°C	***1N4935RL***	1.2 @ 1.0 A	200	30	150	5	100	
400	1	T_A = 75°C	***1N4936RL***	1.2 @ 1.0 A	200	30	150	5	100	
600	1	T_A = 75°C	***1N4937RL***	1.2 @ 1.0 A	200	30	150	5	100	
50	3	T_L = 105°C	***1N5400RL***	1.2 @ 9.4 A	–	200	150	10	500 @ 150°C	**CASE 267-03** Plastic  Cathode = Polarity Band
100	3	T_L = 105°C	***1N5401RL***	1.2 @ 9.4 A	–	200	150	10	500 @ 150°C	
200	3	T_L = 105°C	***1N5402RL***	1.2 @ 9.4 A	–	200	150	10	500 @ 150°C	
400	3	T_L = 105°C	***1N5404RL***	1.2 @ 9.4 A	–	200	150	10	500 @ 150°C	
600	3	T_L = 105°C	***1N5406RL***	1.2 @ 9.4 A	–	200	150	10	500 @ 150°C	
800	3	T_L = 105°C	***1N5407RL***	1.2 @ 9.4 A	–	200	150	10	500 @ 150°C	
1000	3	T_L = 105°C	***1N5408RL***	1.2 @ 9.4 A	–	200	150	10	500 @ 150°C	
200	3	T_A = 80°C[8]	***MR852RL***	1.25 @ 3.0 A	200	100	150	10	150	
400	3	T_A = 80°C[8]	***MR854RL***	1.25 @ 3.0 A	200	100	150	10	150	
600	3	T_A = 80°C[8]	***MR856RL***	1.25 @ 3.0 A	200	100	150	10	150	
50	6	T_A = 60°C $R_{\theta JA}$ = 25°C/W	***MR750RL***	1.25 @ 100 A	–	400	175	25	1000	**CASE 194-04** Plastic  Cathode indicated by diode symbol
100	6	T_A = 60°C $R_{\theta JA}$ = 25°C/W	***MR751RL***	1.25 @ 100 A	–	400	175	25	1000	
200	6	T_A = 60°C $R_{\theta JA}$ = 25°C/W	***MR752RL***	1.25 @ 100 A	–	400	175	25	1000	
400	6	T_A = 60°C $R_{\theta JA}$ = 25°C/W	***MR754RL***	1.25 @ 100 A	–	400	175	25	1000	
600	6	T_A = 60°C $R_{\theta JA}$ = 25°C/W	***MR756RL***	1.25 @ 100 A	–	400	175	25	1000	
1000	6	T_A = 60°C $R_{\theta JA}$ = 25°C/W	***MR760RL***	1.25 @ 100 A	–	400	175	25	1000	
200	25	T_C = 150°C	***MR2502***	1.18 @ 78.5 A	–	400	175	100	500	**CASE 193-04** Plastic  Cathode = Polarity Band
400	25	T_C = 150°C	***MR2504***	1.18 @ 78.5 A	–	400	175	100	500	
1000	25	T_C = 150°C	***MR2510***	1.18 @ 78.5 A	–	400	175	100	500	
250	32	T_C = 150°C	***TRA3225***	1.15 @ 100 A	–	500	175	10	250	
250	25	T_C = 150°C	***TRA2525***	1.18 @ 100 A	–	400	175	10	250	

(2) V_{RRM} unless noted
(3) V_{RRM}, T_J = 100°C unless noted
(7) Package Size: 0.120” max diameter by 0.260” length.
(8) Must be derated for reverse power dissipation. See data sheet.
(9) Overvoltage Transient Suppressor: 24–32 volts avalanche voltage.
⋆ New Product

Table 19. Overvoltage Transient Suppressors

V_{RRM} (Volts)	V_{BR}(1) (Volts)	V_{BR} (Volts)	I_O (Amperes)	Device	Max V_F $T_J = 25°C$ (Volts)	I_{FSM} (Amperes)	T_J Max (°C)	I_{RSM} (Amperes)	Max I_R(7) (µA)	Package
23	24–32	40(4)	6 $T_L = 125°C$	***MR2520L***	1.25 $I_F = 100A$	400	175	58(5)	10	**CASE 194–04** Plastic  Cathode = Diode Symbol
20	24–32	40(2)	6 $T_C = 125°C$	***MR2535L***	1.1 $I_F = 100A$	400	175	62(5)	0.2	
20	24–32	40(3)	32 $T_C = 150°C$	***TRA2532***	1.18 $I_F = 100A$	500	175	80(5)	10	**CASE 193-04** Plastic  Cathode = Polarity Band
23	24–32	40(3)	32 $T_C = 150°C$	***MR2835S***	1.1 $I_F = 100A$	400	175	62(5)	5 @ 20 V	**CASE 460–02** Top Can  Cathode = Terminal
18	20–27	37(3) 35(4)	32 $T_C = 185°C$	***MR3227N*** and ***MR3227P***	1.18 $I_F = 100A$	400	200	90(5) 40(6)	1 @ 16 V	**CASE 193A–02** Button Can  N = Anode to Case P = Cathode to Case
18	20–27	37(3) 35(4)	40 $T_C = 185°C$	***MR4027N*** and ***MR4027P***	1.1 $I_F = 100A$	500	200	110(5) 50(6)	1 @ 16 V	
30	34–45	55(3) 53(4)	40 $T_C = 185°C$	***MR4045N*** and ***MR4045P***	1.1 $I_F = 100A$	500	200	55(5) 25(6)	1 @ 28 V	

(1)At Ir = 100 mA, 25°C
(2)At Ir = 90 A, Tc = 150°C, PW = 80 µS
(3)At Ir = 80 A, Tc = 85°C, PW = 80 µS
(4)At Ir = 80 A, Tc = 25°C, PW = 80 µS
(5)Time Constant = 10 mS, 25°C
(6)Time Constant = 80 mS, 25°C
(7)At V_{RRM}, $T_j = 25°C$ unless noted

CHAPTER 3
Schottky Data Sheets

MBR0520LT1, MBR0520LT3

Preferred Devices

Surface Mount Schottky Power Rectifier

Plastic SOD–123 Package

The Schottky Power Rectifier employs the Schottky Barrier principle with a barrier metal that produces optimal forward voltage drop–reverse current tradeoff. Ideally suited for low voltage, high frequency rectification, or as free wheeling and polarity protection diodes in surface mount applications where compact size and weight are critical to the system. This package provides an alternative to the leadless 34 MELF style package. These state–of–the–art devices have the following features:

- Guardring for Stress Protection
- Very Low Forward Voltage (0.38 V Max @ 0.5 A, 25°C)
- 125°C Operating Junction Temperature
- Epoxy Meets UL94, VO at 1/8″
- Package Designed for Optimal Automated Board Assembly

Mechanical Characteristics

- Reel Options: MBR0520LT1 = 3,000 per 7″ reel/8 mm tape.
  MBR0520LT3 = 10,000 per 13″ reel/8 mm tape.
- Device Marking: B2
- Polarity Designator: Cathode Band
- Weight: 11.7 mg (approximately)
- Case: Epoxy, Molded
- Finish: All External Surfaces Corrosion Resistant and Terminal Leads are Readily Solderable
- Lead and Mounting Surface Temperature for Soldering Purposes: 260°C Max. for 10 Seconds

MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Peak Repetitive Reverse Voltage Working Peak Reverse Voltage DC Blocking Voltage	V_{RRM} V_{RWM} V_R	20	V
Average Rectified Forward Current (Rated V_R, T_L = 90°C)	$I_{F(AV)}$	0.5	A
Non–Repetitive Peak Surge Current (Surge Applied at Rated Load Conditions Halfwave, Single Phase, 60 Hz)	I_{FSM}	5.5	A
Storage Temperature Range	T_{stg}	–65 to +125	°C
Operating Junction Temperature	T_J	–65 to +125	°C
Voltage Rate of Change (Rated V_R)	dv/dt	1000	V/μs

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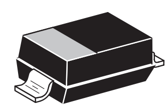
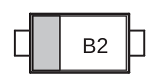
SCHOTTKY BARRIER RECTIFIER 0.5 AMPERES 20 VOLTS



SOD–123
CASE 425
STYLE 1

MARKING DIAGRAM



B2 = Device Code

ORDERING INFORMATION

Device	Package	Shipping
MBR0520LT1	SOD–123	3000/Tape & Reel
MBR0520LT3	SOD–123	10,000/Tape & Reel

Preferred devices are recommended choices for future use and best overall value.

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THERMAL CHARACTERISTICS

Rating	Symbol	Value	Unit
Thermal Resistance — Junction to Ambient (Note 1.)	$R_{\theta JA}$	206	°C/W
Thermal Resistance — Junction to Lead	$R_{\theta JL}$	150	°C/W

ELECTRICAL CHARACTERISTICS

Maximum Instantaneous Forward Voltage (Note 2.)	v_F	T_J = 25°C	T_J = 100°C	Volts
(i_F = 0.1 Amps) (i_F = 0.5 Amps)		0.300 0.385	0.220 0.330	
Maximum Instantaneous Reverse Current (Note 2.)	I_R	T_J = 25°C	T_J = 100°C	mA
(V_R = 10 V) (Rated dc Voltage = 20 V)		75 μA 250 μA	5 mA 8 mA	

1. 1 inch square pad size (1 x 0.5 inch for each lead) on FR4 board.
2. Pulse Test: Pulse Width = 300 μs, Duty Cycle ≤ 2%.

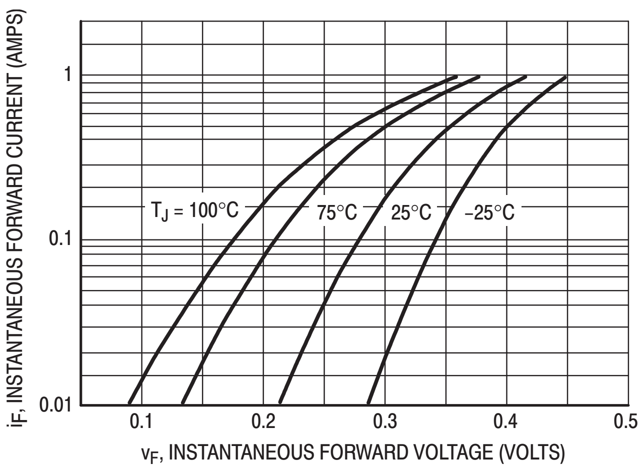

Figure 1. Typical Forward Voltage

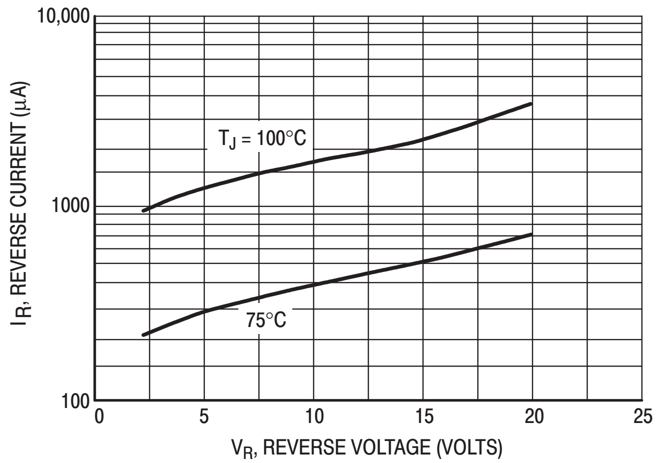

Figure 2. Typical Reverse Current

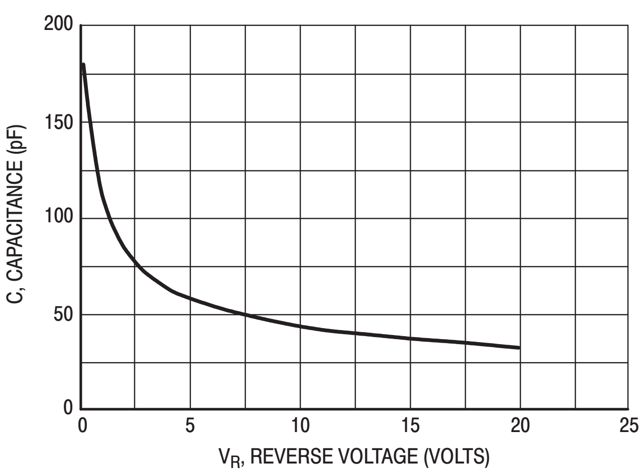

Figure 3. Typical Capacitance

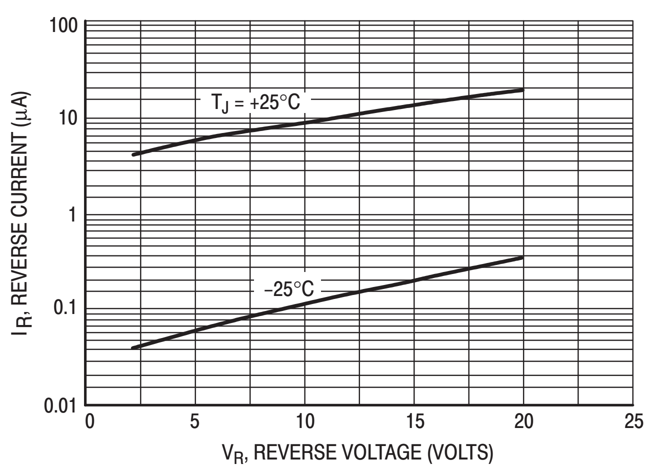

Figure 4. Typical Reverse Current

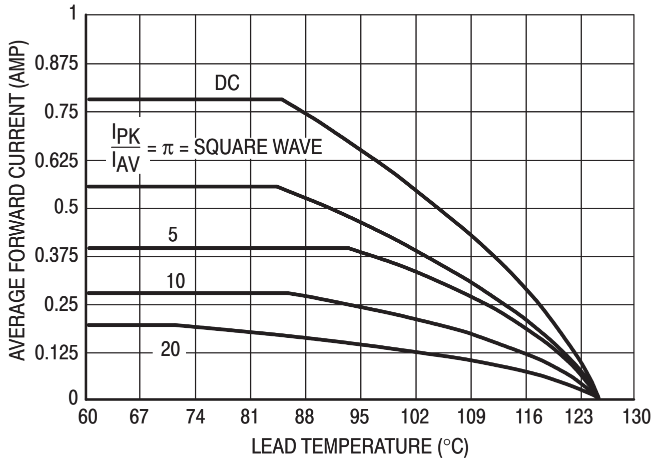

Figure 5. Current Derating (Lead)

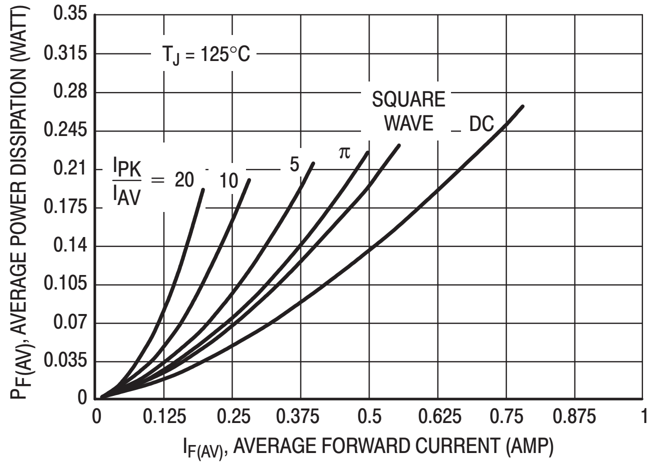

Figure 6. Power Dissipation

MBR0530T1, MBR0530T3

Preferred Devices

Surface Mount Schottky Power Rectifier

Plastic SOD–123 Package

. . . using the Schottky Barrier principle with a large area metal–to–silicon power diode. Ideally suited for low voltage, high frequency rectification or as free wheeling and polarity protection diodes in surface mount applications where compact size and weight are critical to the system. This package also provides an easy to work with alternative to leadless 34 package style. These state–of–the–art devices have the following features:

- Guardring for Stress Protection
- Low Forward Voltage
- 125°C Operating Junction Temperature
- Epoxy Meets UL94, VO at 1/8″
- Package Designed for Optimal Automated Board Assembly

Mechanical Characteristics

- Reel Options: MBR0530T1 = 3,000 per 7″ reel/8 mm tape
  MBR0530T3 = 10,000 per 13″ reel/8 mm tape
- Device Marking: B3
- Polarity Designator: Cathode Band
- Weight: 11.7 mg (approximately)
- Case: Epoxy, Molded
- Finish: All External Surfaces Corrosion Resistant and Terminal Leads are Readily Solderable
- Lead and Mounting Surface Temperature for Soldering Purposes: 260°C Max. for 10 Seconds

MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Peak Repetitive Reverse Voltage Working Peak Reverse Voltage DC Blocking Voltage	V_{RRM} V_{RWM} V_R	30	V
Average Rectified Forward Current (Rated V_R, T_L = 100°C)	$I_{F(AV)}$	0.5	A
Non–Repetitive Peak Surge Current (Surge Applied at Rated Load Conditions Halfwave, Single Phase, 60 Hz)	I_{FSM}	5.5	A
Storage Temperature Range	T_{stg}	–65 to +125	°C
Operating Junction Temperature	T_J	–65 to +125	°C
Voltage Rate of Change (Rated V_R)	dv/dt	1000	V/μs

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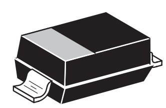
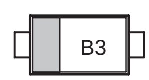
SCHOTTKY BARRIER RECTIFIER 0.5 AMPERES 30 VOLTS



SOD–123
CASE 425
STYLE 1

MARKING DIAGRAM



B3 = Device Code

ORDERING INFORMATION

Device	Package	Shipping
MBR0530T1	SOD–123	3000/Tape & Reel
MBR0530T3	SOD–123	10,000/Tape & Reel

Preferred devices are recommended choices for future use and best overall value.

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THERMAL CHARACTERISTICS

Rating	Symbol	Value	Unit
Thermal Resistance — Junction to Ambient (Note 1.)	$R_{\theta JA}$	206	°C/W
Thermal Resistance — Junction to Lead	$R_{\theta JL}$	150	°C/W

ELECTRICAL CHARACTERISTICS

Maximum Instantaneous Forward Voltage (Note 2.) (i_F = 0.1 Amps, T_J = 25°C) (i_F = 0.5 Amps, T_J = 25°C)	v_F	 0.375 0.43	Volts
Maximum Instantaneous Reverse Current (Note 2.) (Rated dc Voltage, T_C = 25°C) (V_R = 15 V, T_C = 25°C)	I_R	 130 20	μA

1. 1 inch square pad size (1 x 0.5 inch for each lead) on FR4 board.
2. Pulse Test: Pulse Width = 300 μs, Duty Cycle ≤ 2%.

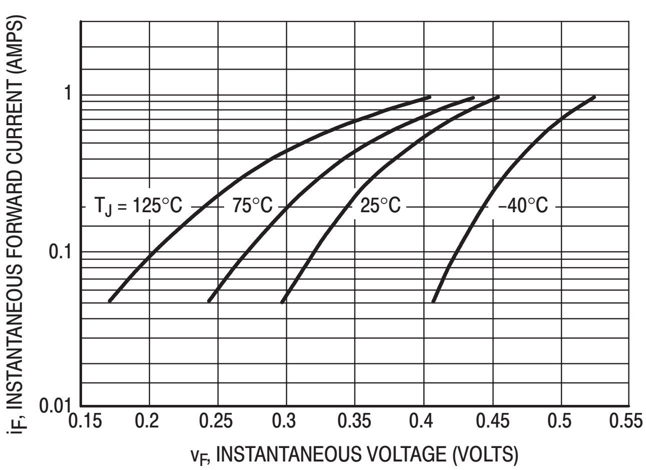


Figure 1. Typical Forward Voltage

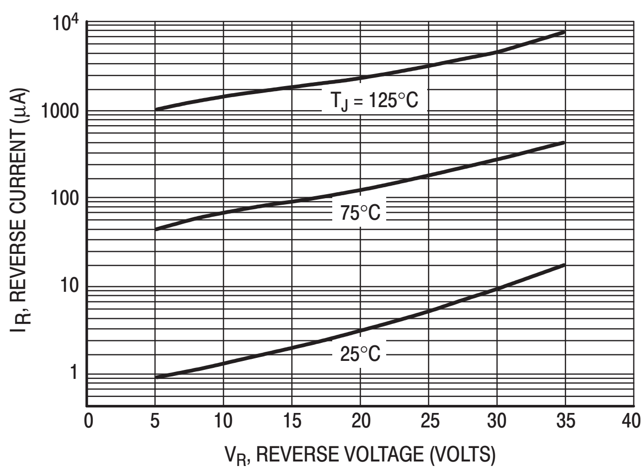


Figure 2. Typical Reverse Current

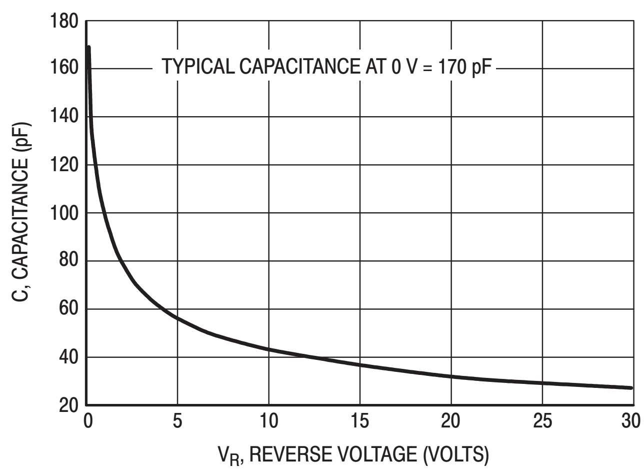


Figure 3. Typical Capacitance

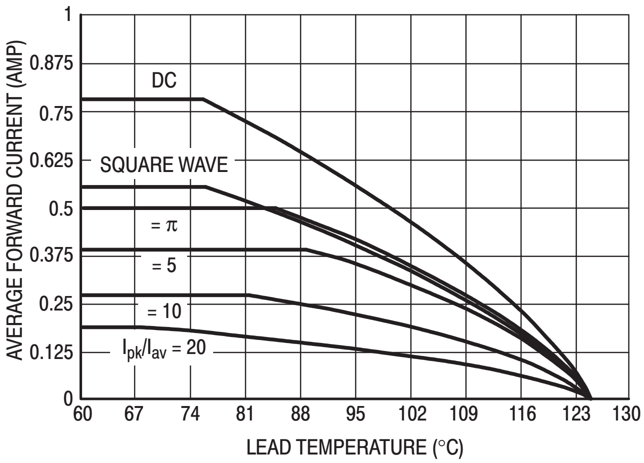


Figure 4. Current Derating (Lead)

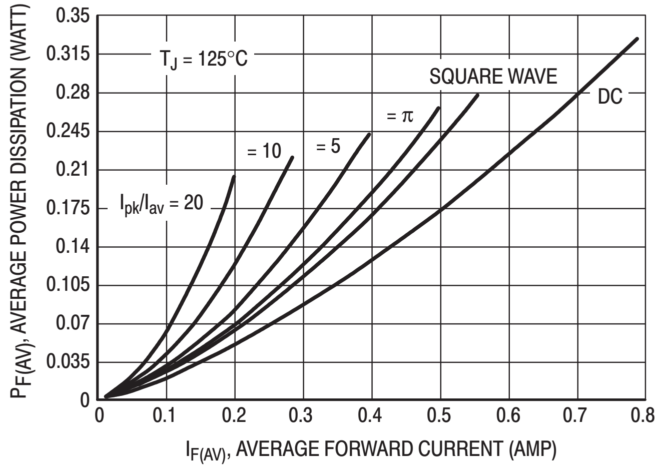


Figure 5. Power Dissipation

MBR0540T1, MBR0540T3

Surface Mount Schottky Power Rectifier

SOD–123 Power Surface Mount Package

ON Semiconductor™

http://onsemi.com

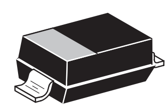
The Schottky Power Rectifier employs the Schottky Barrier principle with a barrier metal that produces optimal forward voltage drop–reverse current tradeoff. Ideally suited for low voltage, high frequency rectification, or as a free wheeling and polarity protection diodes in surface mount applications where compact size and weight are critical to the system. This package provides an alternative to the leadless 34 MELF style package. These state–of–the–art devices have the following features:

- Guardring for Stress Protection
- Very Low Forward Voltage
- Epoxy Meets UL94, VO at 1/8″
- Package Designed for Optimal Automated Board Assembly

Mechanical Characteristics:

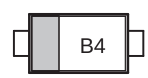
- Reel Options: 3,000 per 7 inch reel/8 mm tape
- Reel Options: 10,000 per 13 inch reel/8 mm tape
- Device Marking: B4
- Polarity Designator: Cathode Band
- Weight: 11.7 mg (approximately)
- Case: Epoxy Molded
- Finish: All External Surfaces Corrosion Resistant and Terminal Leads are Readily Solderable
- Lead and Mounting Surface Temperature for Soldering Purposes: 260°C max. for 10 Seconds

SCHOTTKY BARRIER RECTIFIER 0.5 AMPERES 40 VOLTS



SOD–123
CASE 425
STYLE 1

MARKING DIAGRAM



B4 = Device Code

MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Peak Repetitive Reverse Voltage Working Peak Reverse Voltage DC Blocking Voltage	V_{RRM} V_{RWM} V_R	40	V
Average Rectified Forward Current (At Rated V_R, T_C = 115°C)	I_O	0.5	A
Peak Repetitive Forward Current (At Rated V_R, Square Wave, 20 kHz, T_C = 115°C)	I_{FRM}	1.0	A
Non–Repetitive Peak Surge Current (Surge Applied at Rated Load Conditions Halfwave, Single Phase, 60 Hz)	I_{FSM}	5.5	A
Storage/Operating Case Temperature Range	T_{stg}, T_C	–55 to +150	°C
Operating Junction Temperature	T_J	–55 to +150	°C
Voltage Rate of Change (Rated V_R, T_J = 25°C)	dv/dt	1000	V/μs

ORDERING INFORMATION

Device	Package	Shipping
MBR0540T1	SOD–123	3000/Tape & Reel
MBR0540T3	SOD–123	10,000/Tape & Reel

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THERMAL CHARACTERISTICS

Rating	Symbol	Value	Unit
Thermal Resistance – Junction–to–Lead (Note 1.) Thermal Resistance – Junction–to–Ambient (Note 2.)	R_{tjl} R_{tja}	118 206	°C/W

ELECTRICAL CHARACTERISTICS

Maximum Instantaneous Forward Voltage (Note 3.)	v_F	**T_J = 25°C**	**T_J = 100°C**	V
(i_F = 0.5 A) (i_F = 1 A)		0.51 0.62	0.46 0.61	
Maximum Instantaneous Reverse Current (Note 3.)	I_R	**T_J = 25°C**	**T_J = 100°C**	μA
(V_R = 40 V) (V_R = 20 V)		20 10	13,000 5,000	

1. Mounted with minimum recommended pad size, PC Board FR4.
2. 1 inch square pad size (1 X 0.5 inch for each lead) on FR4 board.
3. Pulse Test: Pulse Width ≤ 250 μs, Duty Cycle ≤ 2.0%.

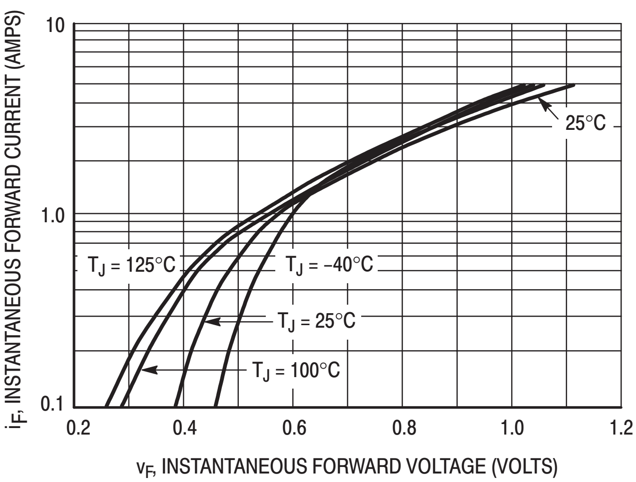


Figure 1. Typical Forward Voltage

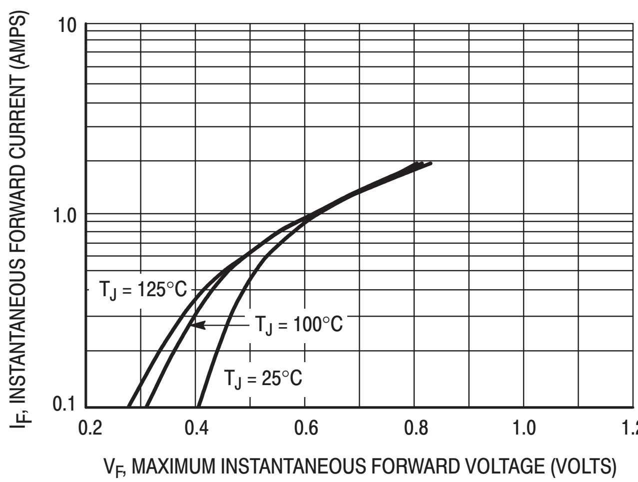


Figure 2. Maximum Forward Voltage

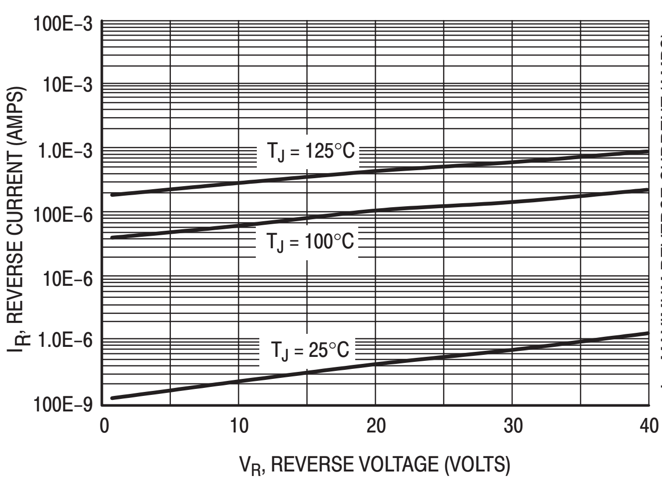


Figure 3. Typical Reverse Current

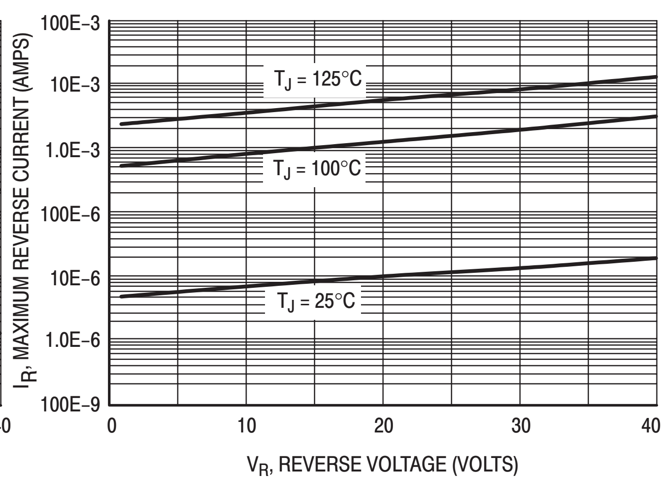


Figure 4. Maximum Reverse Current

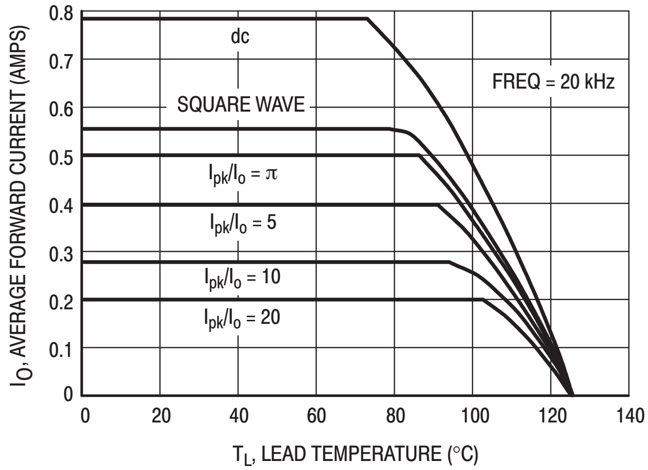


Figure 5. Current Derating

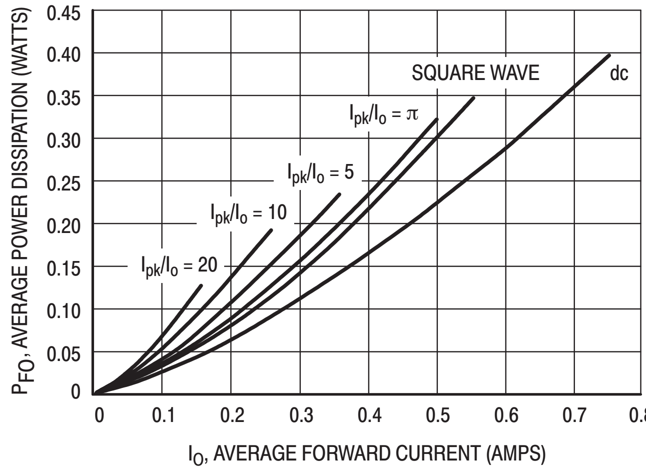


Figure 6. Forward Power Dissipation

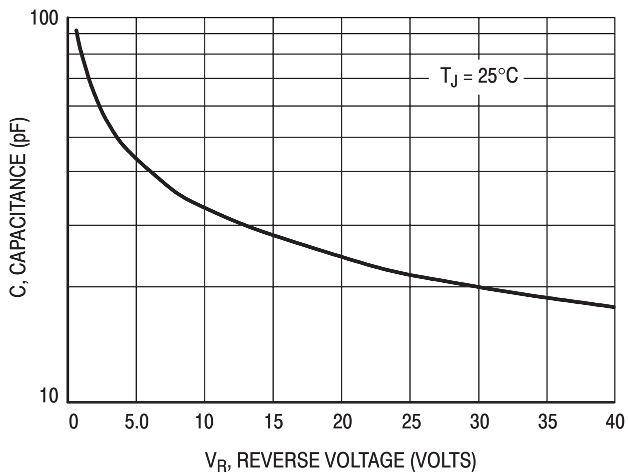


Figure 7. Capacitance

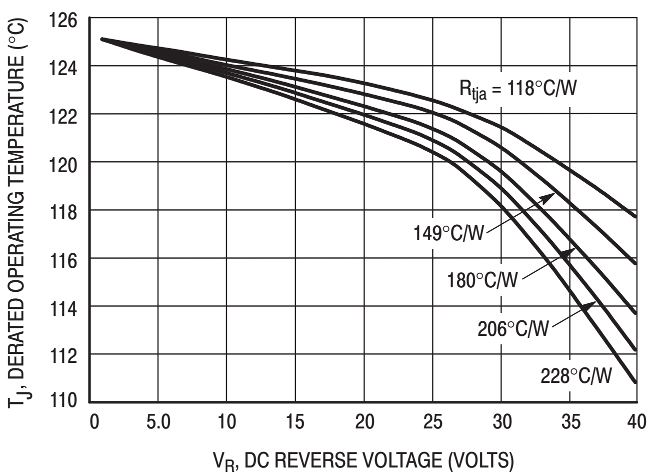


Figure 8. Typical Operating Temperature Derating*

* Reverse power dissipation and the possibility of thermal runaway must be considered when operating this device under any reverse voltage conditions. Calculations of T_J therefore must include forward and reverse power effects. The allowable operating T_J may be calculated from the equation: $T_J = T_{Jmax} – r(t)(Pf + Pr)$ where

r(t) = thermal impedance under given conditions,

Pf = forward power dissipation, and

Pr = reverse power dissipation

This graph displays the derated allowable T_J due to reverse bias under DC conditions only and is calculated as $T_J = T_{Jmax} – r(t)Pr$, where r(t) = Rthja. For other power applications further calculations must be performed.

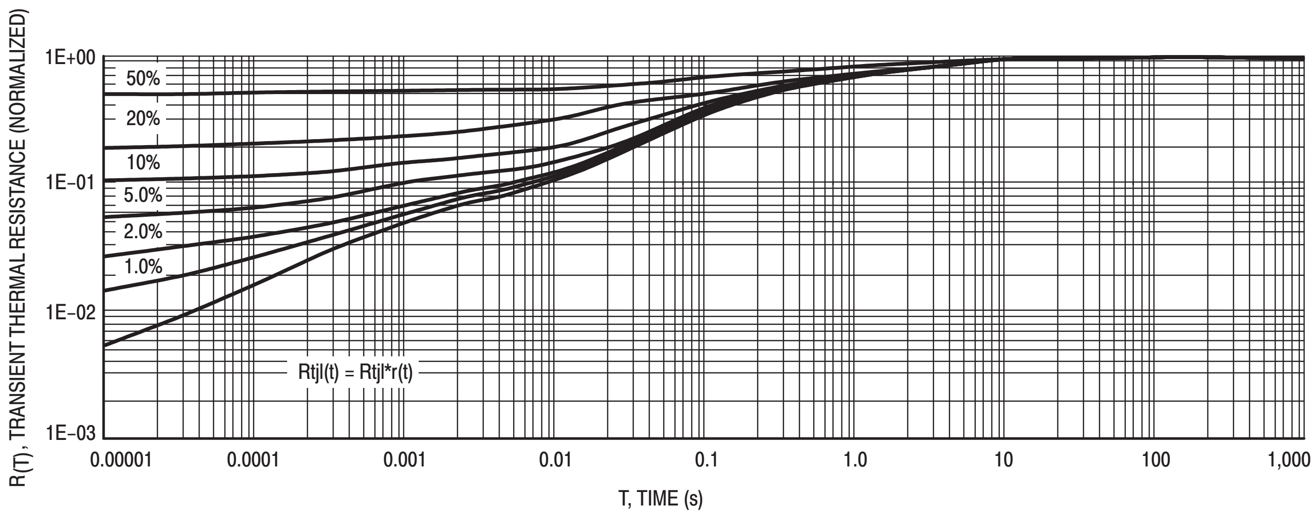


Figure 9. Thermal Response Junction to Lead

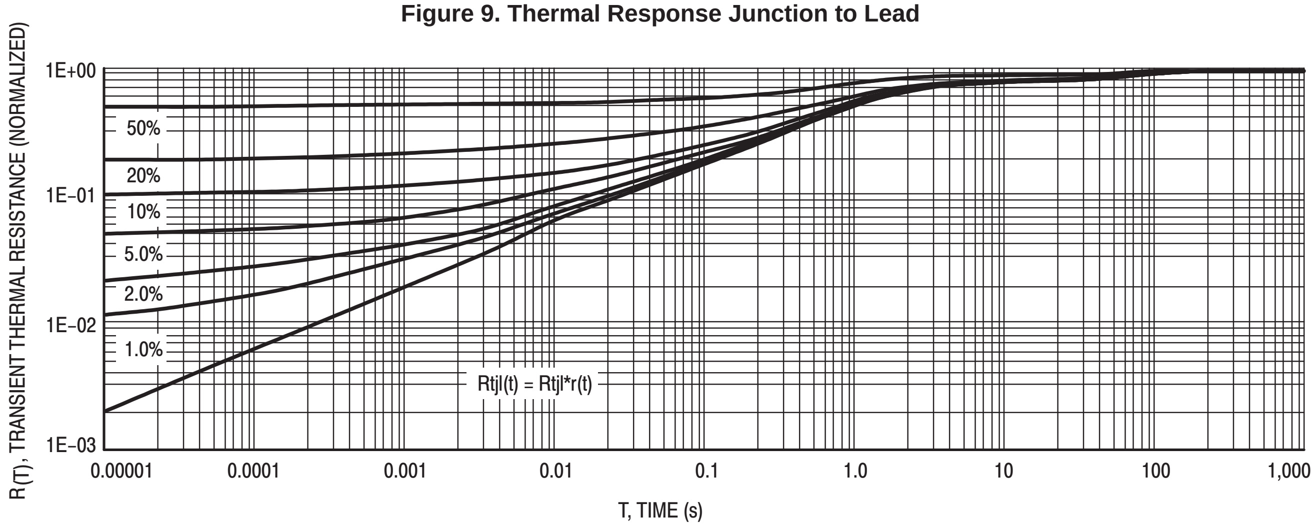


Figure 10. Thermal Response Junction to Ambient

MBRM120ET3

Surface Mount Schottky Power Rectifier

POWERMITE®
Power Surface Mount Package

The Schottky Powermite employs the Schottky Barrier principle with a barrier metal and epitaxial construction that produces optimal forward voltage drop–reverse current tradeoff. The advanced packaging techniques provide for a highly efficient micro miniature, space saving surface mount Rectifier. With its unique heatsink design, the Powermite has the same thermal performance as the SMA while being 50% smaller in footprint area, and delivering one of the lowest height profiles, < 1.1 mm in the industry. Because of its small size, it is ideal for use in portable and battery powered products such as cellular and cordless phones, chargers, notebook computers, printers, PDAs and PCMCIA cards. Typical applications are ac/dc and dc–dc converters, reverse battery protection, and “Oring” of multiple supply voltages and any other application where performance and size are critical.

Features:
- Low Profile — Maximum Height of 1.1 mm
- Small Footprint — Footprint Area of 8.45 mm2
- Low V_F Provides Higher Efficiency and Extends Battery Life
- Supplied in 12 mm Tape and Reel — 12,000 Units per Reel
- Low Thermal Resistance with Direct Thermal Path of Die on Exposed Cathode Heat Sink

Mechanical Characteristics:
- Powermite is JEDEC Registered as D0–216AA
- Case: Molded Epoxy
- Epoxy Meets UL94, VO at 1/8″
- Weight: 62 mg (approximately)
- Device Marking: BCV
- Lead and Mounting Surface Temperature for Soldering Purposes. 260°C Maximum for 10 Seconds

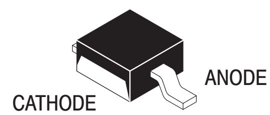
MAXIMUM RATINGS

Please See the Table on the Following Page

ON Semiconductor™

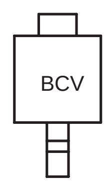
http://onsemi.com

SCHOTTKY BARRIER RECTIFIER 1.0 AMPERES 20 VOLTS



POWERMITE
CASE 457
PLASTIC

MARKING DIAGRAM



BCV = Device Code

ORDERING INFORMATION

Device	Package	Shipping
MBRM120ET3	POWERMITE	12,000/Tape & Reel

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MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Peak Repetitive Reverse Voltage Working Peak Reverse Voltage DC Blocking Voltage	V_{RRM} V_{RWM} V_R	20	V
Average Rectified Forward Current (At Rated V_R, T_C = 130°C)	I_O	1.0	A
Peak Repetitive Forward Current (At Rated V_R, Square Wave, 20 kHz, T_C = 135°C)	I_{FRM}	2.0	A
Non–Repetitive Peak Surge Current (Non–Repetitive peak surge current, halfwave, single phase, 60 Hz)	I_{FSM}	50	A
Storage Temperature	T_{stg}	–65 to 150	°C
Operating Junction Temperature	T_J	–65 to 150	°C
Voltage Rate of Change (Rated V_R, T_J = 25°C)	dv/dt	10,000	V/μs

THERMAL CHARACTERISTICS

Thermal Resistance – Junction–to–Lead (Anode) (Note 1.) Thermal Resistance – Junction–to–Tab (Cathode) (Note 1.) Thermal Resistance – Junction–to–Ambient (Note 1.)	R_{tjl} R_{tjtab} R_{tja}	35 23 277	°C/W

1. Mounted with minimum recommended pad size, PC Board FR4, See Figures 9 and 10.

ELECTRICAL CHARACTERISTICS

Maximum Instantaneous Forward Voltage (Note 2.), See Figure 2	V_F	**T_J = 25°C**	**T_J = 100°C**	V
(I_F = 0.1 A) (I_F = 1.0 A) (I_F = 2.0 A)		0.455 0.530 0.595	0.360 0.455 0.540	
Maximum Instantaneous Reverse Current (Note 2.), See Figure 4	I_R	**T_J = 25°C**	**T_J = 100°C**	μA
(V_R = 20 V) (V_R = 10 V) (V_R = 5.0 V)		10 1.0 0.5	1600 500 300	

2. Pulse Test: Pulse Width ≤ 250 μs, Duty Cycle ≤ 2%.

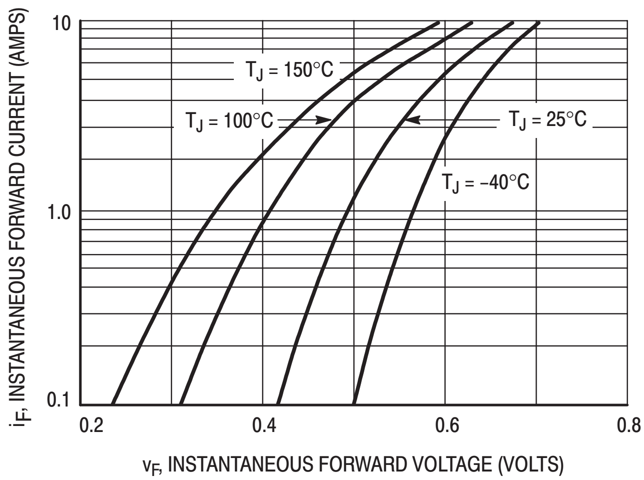


Figure 1. Typical Forward Voltage

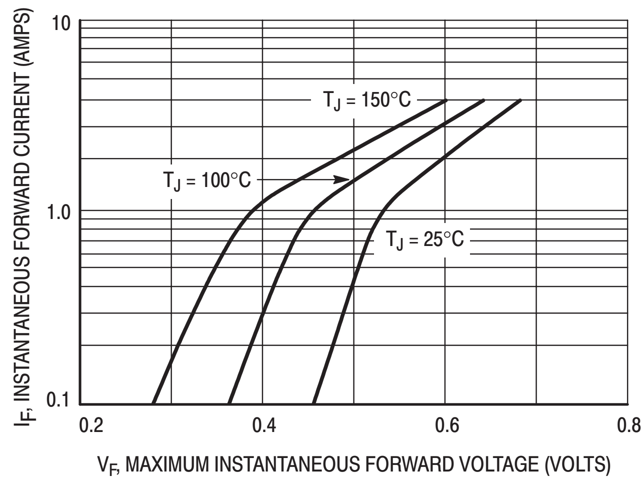


Figure 2. Maximum Forward Voltage

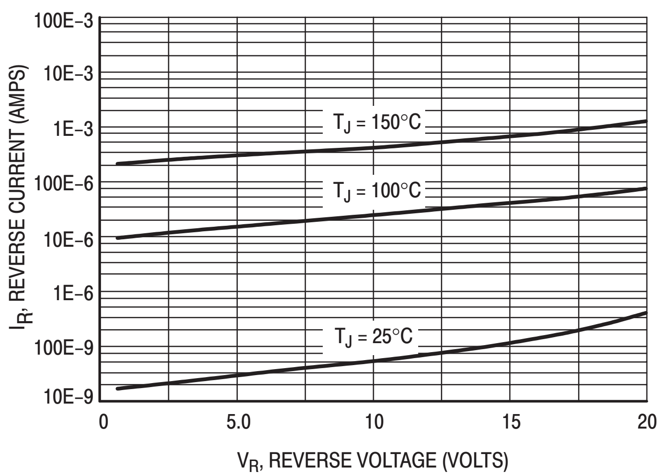


Figure 3. Typical Reverse Current

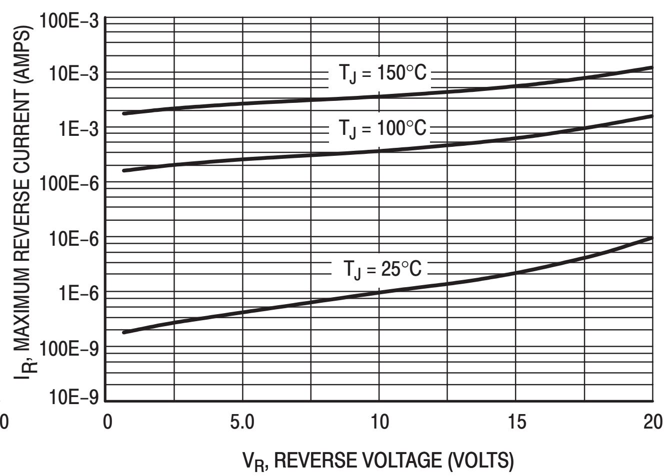


Figure 4. Maximum Reverse Current

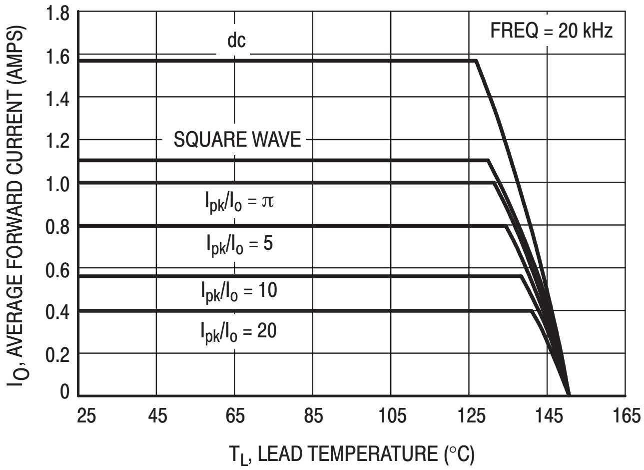


Figure 5. Current Derating

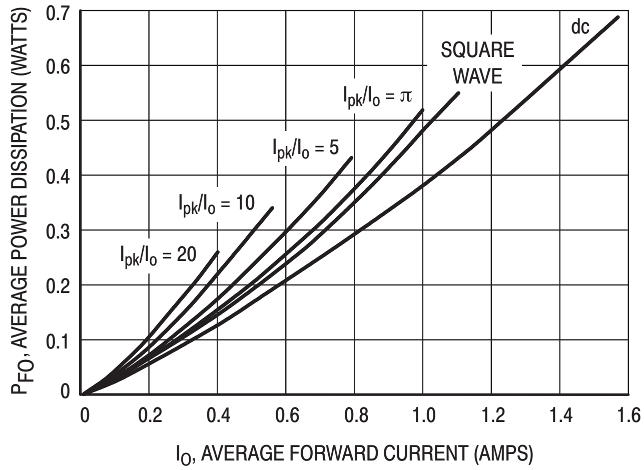


Figure 6. Forward Power Dissipation

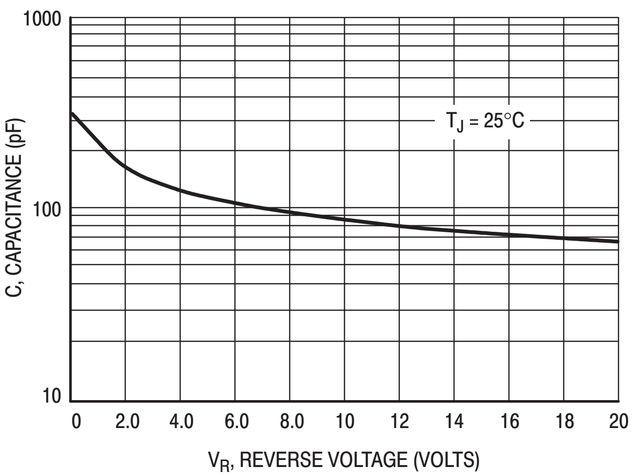


Figure 7. Capacitance

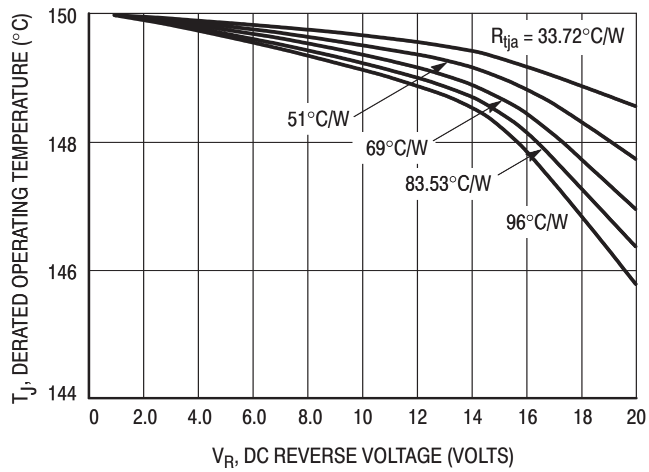


Figure 8. Typical Operating Temperature Derating*

* Reverse power dissipation and the possibility of thermal runaway must be considered when operating this device under any reverse voltage conditions. Calculations of T_J therefore must include forward and reverse power effects. The allowable operating T_J may be calculated from the equation: $T_J = T_{Jmax} - r(t)(Pf + Pr)$ where
r(t) = thermal impedance under given conditions,
Pf = forward power dissipation, and
Pr = reverse power dissipation

This graph displays the derated allowable T_J due to reverse bias under DC conditions only and is calculated as $T_J = T_{Jmax} - r(t)Pr$, where r(t) = Rthja. For other power applications further calculations must be performed.

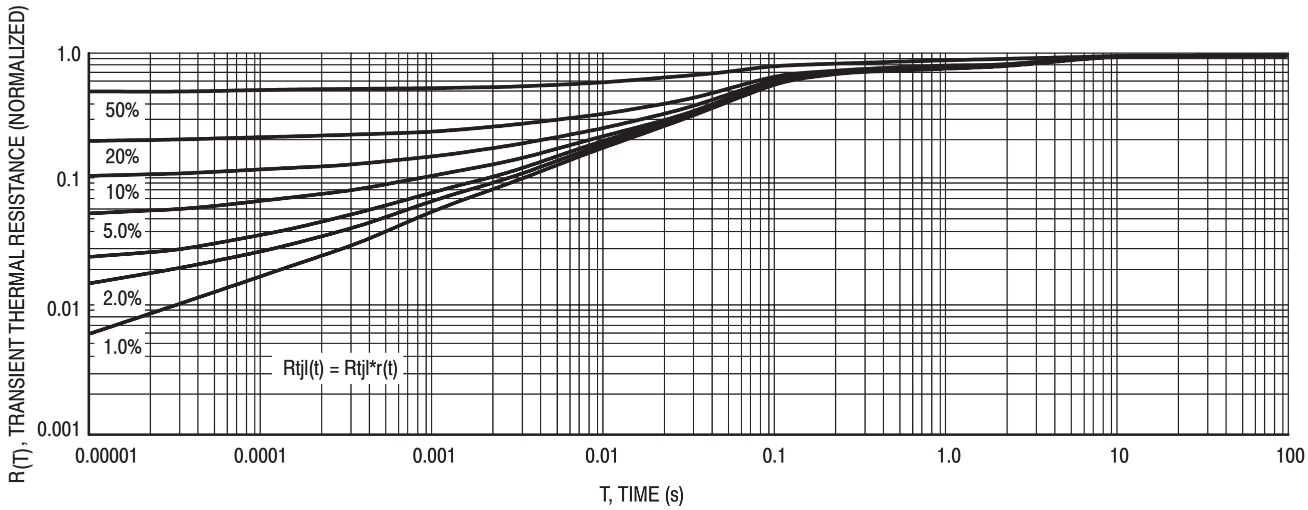


Figure 9. Thermal Response Junction to Lead

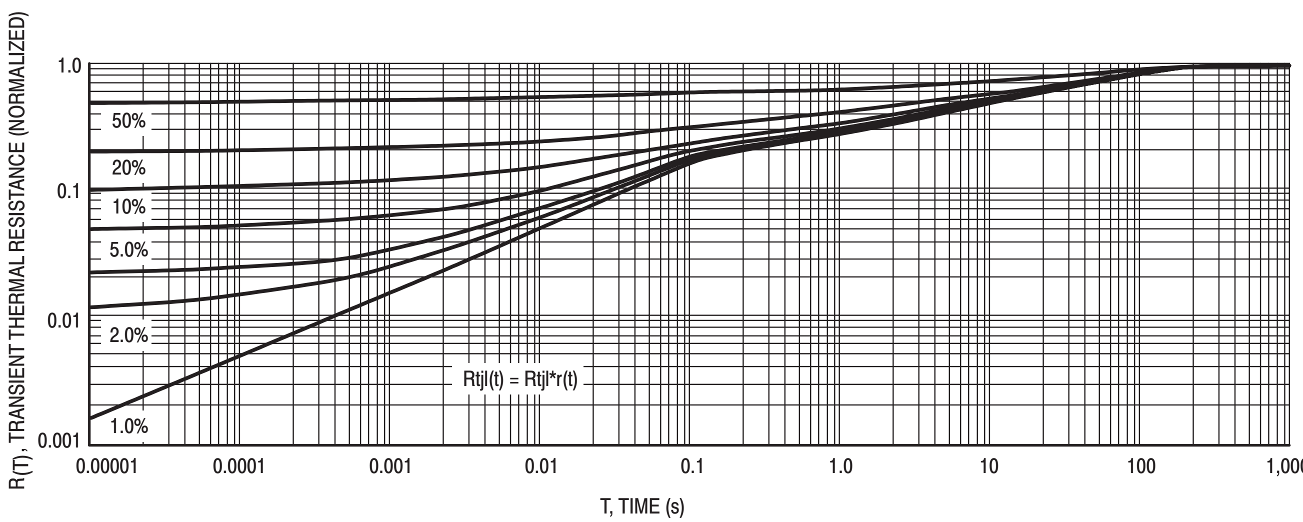


Figure 10. Thermal Response Junction to Ambient

MBRM120LT3

Surface Mount Schottky Power Rectifier

POWERMITE®
Power Surface Mount Package

The Schottky Powermite employs the Schottky Barrier principle with a barrier metal and epitaxial construction that produces optimal forward voltage drop–reverse current tradeoff. The advanced packaging techniques provide for a highly efficient micro miniature, space saving surface mount Rectifier. With its unique heatsink design, the Powermite has the same thermal performance as the SMA while being 50% smaller in footprint area, and delivering one of the lowest height profiles, < 1.1 mm in the industry. Because of its small size, it is ideal for use in portable and battery powered products such as cellular and cordless phones, chargers, notebook computers, printers, PDAs and PCMCIA cards. Typical applications are ac/dc and dc–dc converters, reverse battery protection, and “Oring” of multiple supply voltages and any other application where performance and size are critical.

Features:

- Low Profile — Maximum Height of 1.1 mm
- Small Footprint — Footprint Area of 8.45 mm2
- Low V_F Provides Higher Efficiency and Extends Battery Life
- Supplied in 12 mm Tape and Reel — 12,000 Units per Reel
- Low Thermal Resistance with Direct Thermal Path of Die on Exposed Cathode Heat Sink

Mechanical Characteristics:

- Powermite is JEDEC Registered as D0–216AA
- Case: Molded Epoxy
- Epoxy Meets UL94, VO at 1/8″
- Weight: 62 mg (approximately)
- Device Marking: BCF
- Lead and Mounting Surface Temperature for Soldering Purposes. 260°C Maximum for 10 Seconds

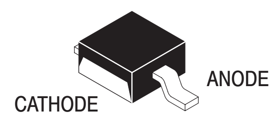
MAXIMUM RATINGS

Please See the Table on the Following Page

ON Semiconductor™

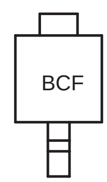
http://onsemi.com

SCHOTTKY BARRIER RECTIFIER
1.0 AMPERES
20 VOLTS



POWERMITE
CASE 457
PLASTIC

MARKING DIAGRAM



BCF = Device Code

ORDERING INFORMATION

Device	Package	Shipping
MBRM120LT3	POWERMITE	12,000/Tape & Reel

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MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Peak Repetitive Reverse Voltage Working Peak Reverse Voltage DC Blocking Voltage	V_{RRM} V_{RWM} V_R	20	V
Average Rectified Forward Current (At Rated V_R, T_C = 135°C)	I_O	1.0	A
Peak Repetitive Forward Current (At Rated V_R, Square Wave, 100 kHz, T_C = 135°C)	I_{FRM}	2.0	A
Non–Repetitive Peak Surge Current (Non–Repetitive peak surge current, halfwave, single phase, 60 Hz)	I_{FSM}	50	A
Storage Temperature	T_{stg}	–55 to 150	°C
Operating Junction Temperature	T_J	–55 to 125	°C
Voltage Rate of Change (Rated V_R, T_J = 25°C)	dv/dt	10,000	V/µs

THERMAL CHARACTERISTICS

Thermal Resistance – Junction–to–Lead (Anode) (Note 1.) Thermal Resistance – Junction–to–Tab (Cathode) (Note 1.) Thermal Resistance – Junction–to–Ambient (Note 1.)	R_{tjl} R_{tjtab} R_{tja}	35 23 277	°C/W

1. Mounted with minimum recommended pad size, PC Board FR4, See Figures 9 & 10.

ELECTRICAL CHARACTERISTICS

Maximum Instantaneous Forward Voltage (Note 2.), See Figure 2	V_F	**T_J = 25°C**	**T_J = 85°C**	V
(I_F = 0.1 A) (I_F = 1.0 A) (I_F = 3.0 A)		0.34 0.45 0.65	0.26 0.415 0.67	
Maximum Instantaneous Reverse Current (Note 2.), See Figure 4	I_R	**T_J = 25°C**	**T_J = 85°C**	mA
(V_R = 20 V) (V_R = 10 V)		0.40 0.10	25 18	

2. Pulse Test: Pulse Width ≤ 250 µs, Duty Cycle ≤ 2%.

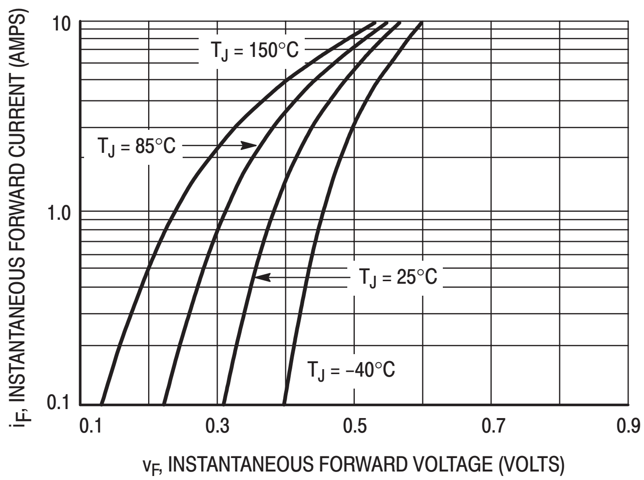

Figure 1. Typical Forward Voltage

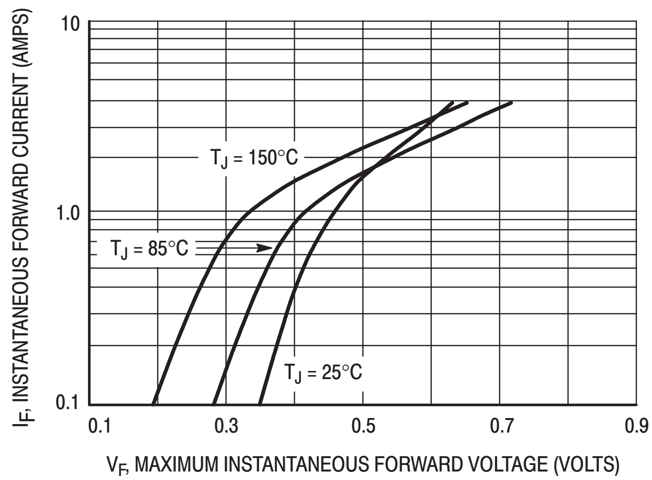

Figure 2. Maximum Forward Voltage

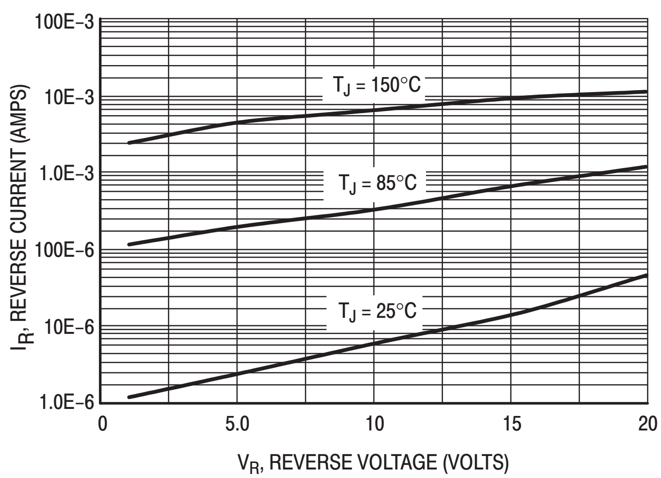

Figure 3. Typical Reverse Current

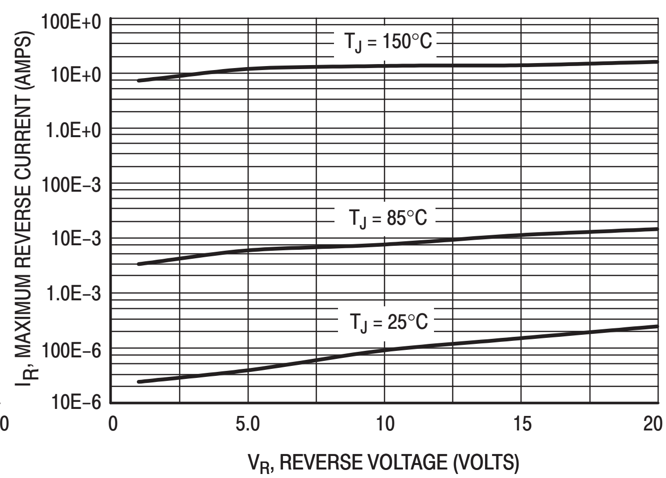

Figure 4. Maximum Reverse Current

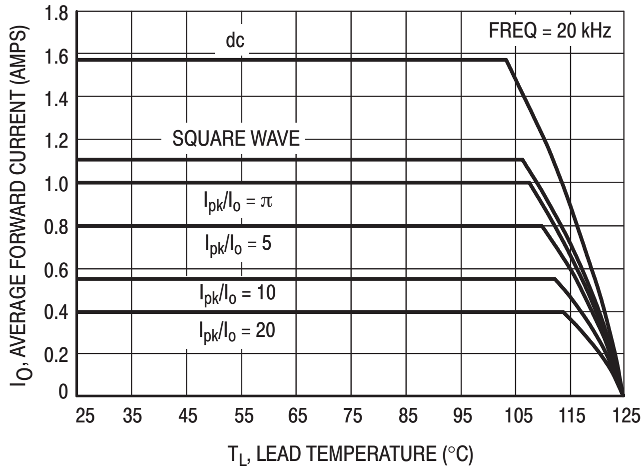

Figure 5. Current Derating

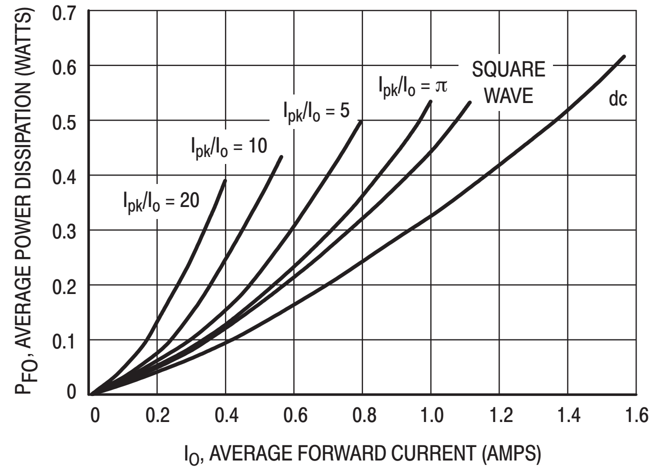

Figure 6. Forward Power Dissipation

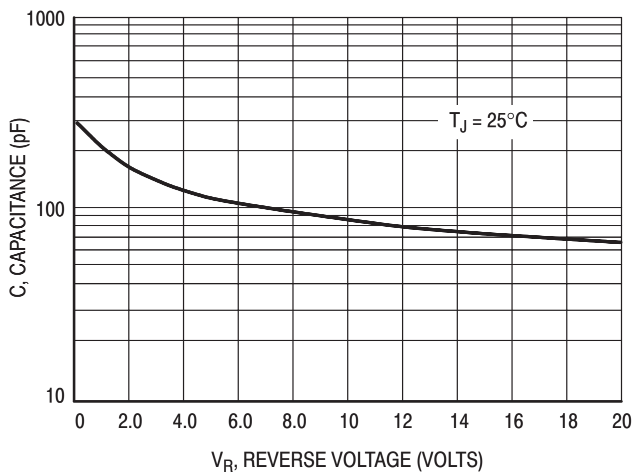

Figure 7. Capacitance

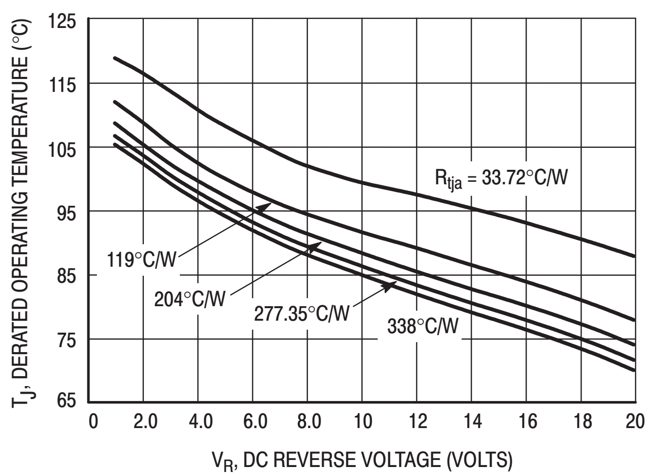

Figure 8. Typical Operating Temperature Derating*

* Reverse power dissipation and the possibility of thermal runaway must be considered when operating this device under any reverse voltage conditions. Calculations of T_J therefore must include forward and reverse power effects. The allowable operating T_J may be calculated from the equation: $T_J = T_{Jmax} - r(t)(Pf + Pr)$ where
r(t) = thermal impedance under given conditions,
Pf = forward power dissipation, and
Pr = reverse power dissipation

This graph displays the derated allowable T_J due to reverse bias under DC conditions only and is calculated as $T_J = T_{Jmax} - r(t)Pr$, where r(t) = Rthja. For other power applications further calculations must be performed.

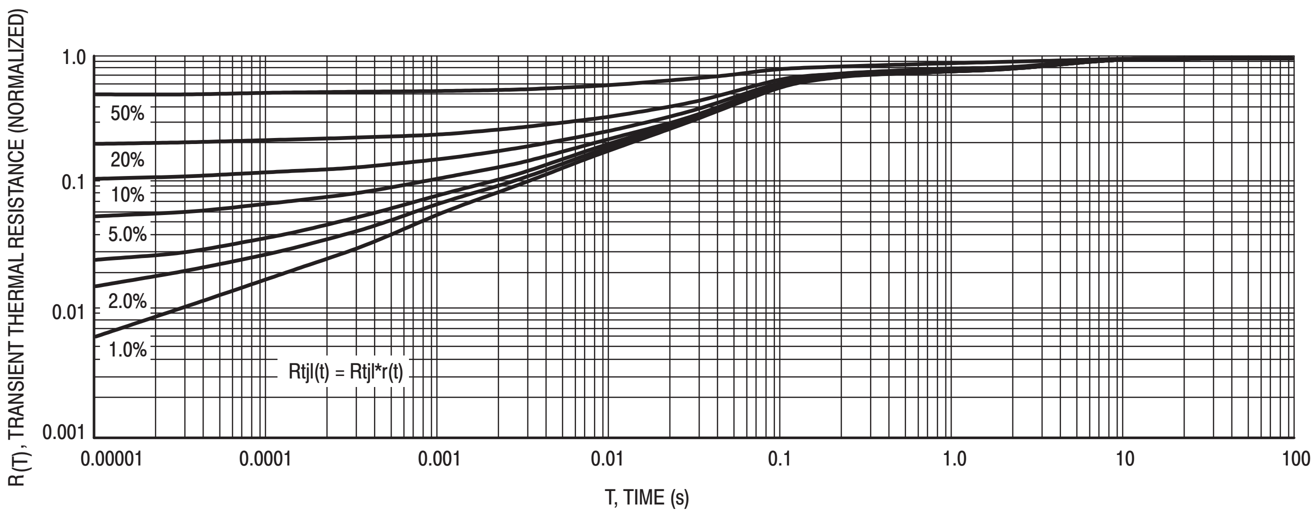

Figure 9. Thermal Response Junction to Lead

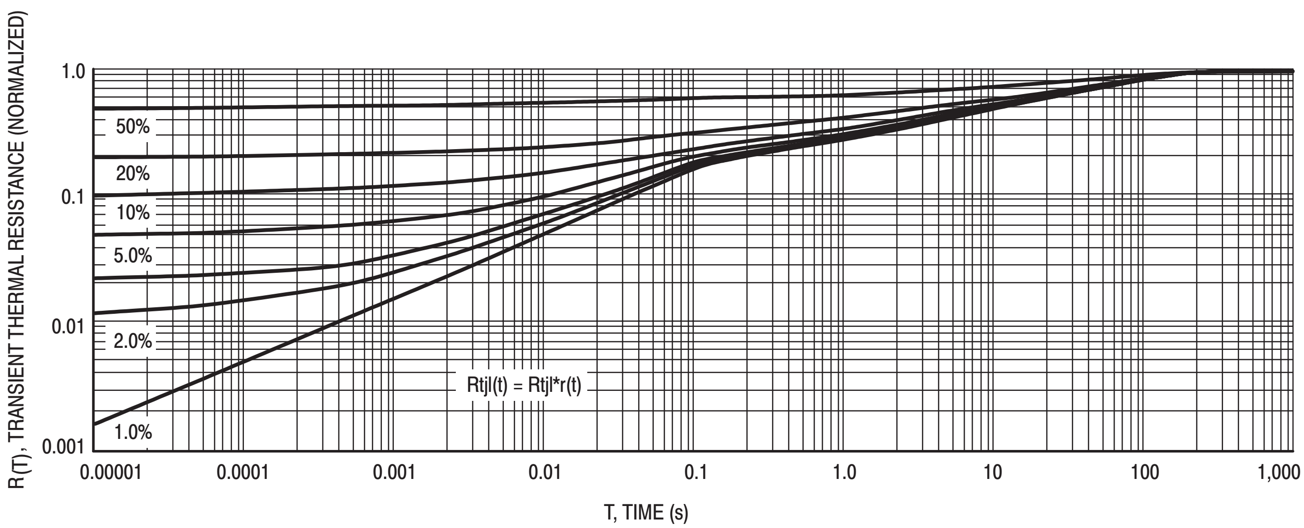

Figure 10. Thermal Response Junction to Ambient

MBRM130LT3

Surface Mount Schottky Power Rectifier

POWERMITE®
Power Surface Mount Package

The Schottky Powermite employs the Schottky Barrier principle with a barrier metal and epitaxial construction that produces optimal forward voltage drop–reverse current tradeoff. The advanced packaging techniques provide for a highly efficient micro miniature, space saving surface mount Rectifier. With its unique heatsink design, the Powermite has the same thermal performance as the SMA while being 50% smaller in footprint area, and delivering one of the lowest height profiles, < 1.1 mm in the industry. Because of its small size, it is ideal for use in portable and battery powered products such as cellular and cordless phones, chargers, notebook computers, printers, PDAs and PCMCIA cards. Typical applications are ac/dc and dc–dc converters, reverse battery protection, and “Oring” of multiple supply voltages and any other application where performance and size are critical.

Features:

- Low Profile — Maximum Height of 1.1 mm
- Small Footprint — Footprint Area of 8.45 mm2
- Low V_F Provides Higher Efficiency and Extends Battery Life
- Supplied in 12 mm Tape and Reel — 12,000 Units per Reel
- Low Thermal Resistance with Direct Thermal Path of Die on Exposed Cathode Heat Sink

Mechanical Characteristics:

- Powermite is JEDEC Registered as D0–216AA
- Case: Molded Epoxy
- Epoxy Meets UL94, VO at 1/8″
- Weight: 62 mg (approximately)
- Device Marking: BCG
- Lead and Mounting Surface Temperature for Soldering Purposes. 260°C Maximum for 10 Seconds

MAXIMUM RATINGS

Please See the Table on the Following Page

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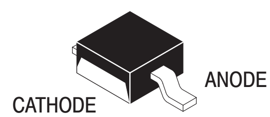
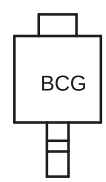
SCHOTTKY BARRIER RECTIFIER
1.0 AMPERES
30 VOLTS



POWERMITE
CASE 457
PLASTIC

MARKING DIAGRAM



BCG = Device Code

ORDERING INFORMATION

Device	Package	Shipping
MBRM130LT3	POWERMITE	12,000/Tape & Reel

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MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Peak Repetitive Reverse Voltage Working Peak Reverse Voltage DC Blocking Voltage	V_{RRM} V_{RWM} V_R	30	V
Average Rectified Forward Current (At Rated V_R, T_C = 135°C)	I_O	1.0	A
Peak Repetitive Forward Current (At Rated V_R, Square Wave, 100 kHz, T_C = 135°C)	I_{FRM}	2.0	A
Non–Repetitive Peak Surge Current (Non–Repetitive peak surge current, halfwave, single phase, 60 Hz)	I_{FSM}	50	A
Storage Temperature	T_{stg}	–55 to 150	°C
Operating Junction Temperature	T_J	–55 to 125	°C
Voltage Rate of Change (Rated V_R, T_J = 25°C)	dv/dt	10,000	V/μs

THERMAL CHARACTERISTICS

Thermal Resistance – Junction–to–Lead (Anode) (Note 1.) Thermal Resistance – Junction–to–Tab (Cathode) (Note 1.) Thermal Resistance – Junction–to–Ambient (Note 1.)	R_{tjl} R_{tjtab} R_{tja}	35 23 277	°C/W

1. Mounted with minimum recommended pad size, PC Board FR4, See Figures 9 & 10.

ELECTRICAL CHARACTERISTICS

Maximum Instantaneous Forward Voltage (Note 2.), See Figure 2	V_F	**T_J = 25°C**	**T_J = 85°C**	V
(I_F = 0.1 A) (I_F = 1.0 A) (I_F = 3.0 A)		0.30 0.38 0.52	0.20 0.33 0.50	
Maximum Instantaneous Reverse Current (Note 2.), See Figure 4	I_R	**T_J = 25°C**	**T_J = 85°C**	mA
(V_R = 30 V) (V_R = 20 V) (V_R = 10 V)		0.41 0.13 0.05	11 5.3 3.2	

2. Pulse Test: Pulse Width ≤ 250 μs, Duty Cycle ≤ 2%.

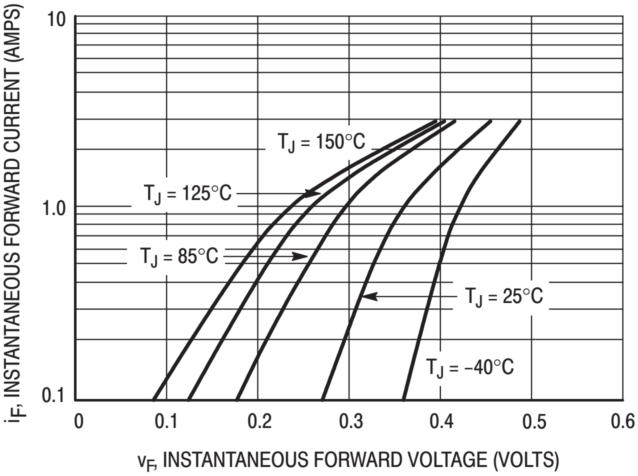

Figure 1. Typical Forward Voltage

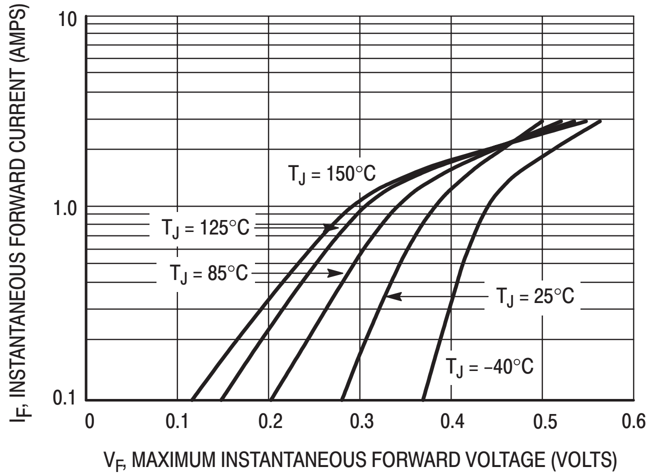

Figure 2. Maximum Forward Voltage

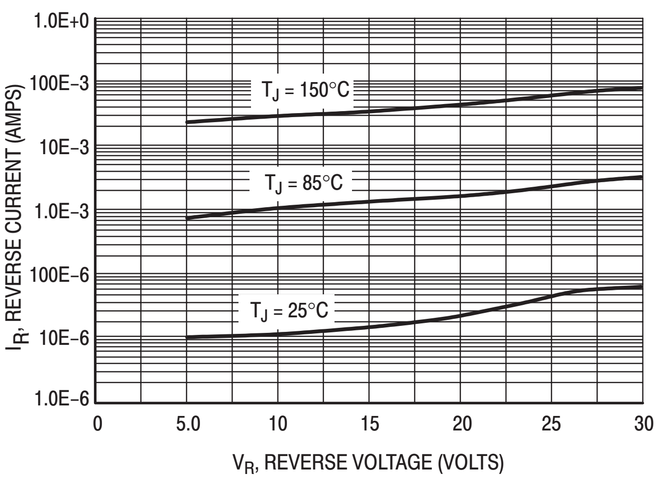

Figure 3. Typical Reverse Current

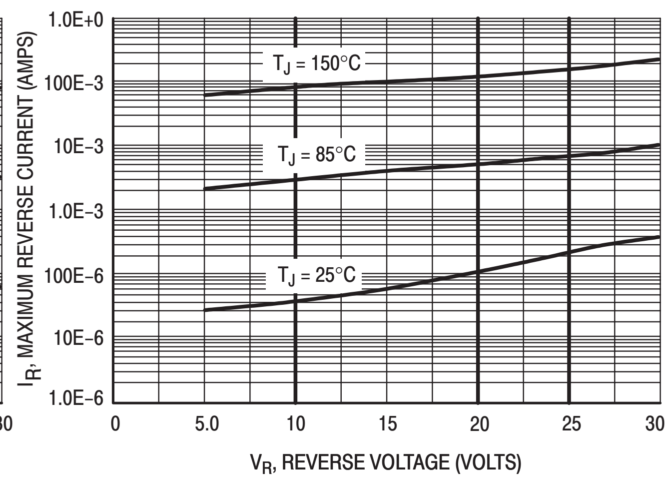

Figure 4. Maximum Reverse Current

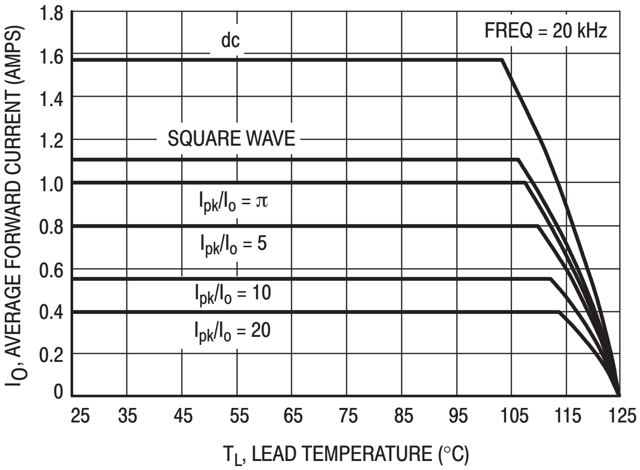

Figure 5. Current Derating

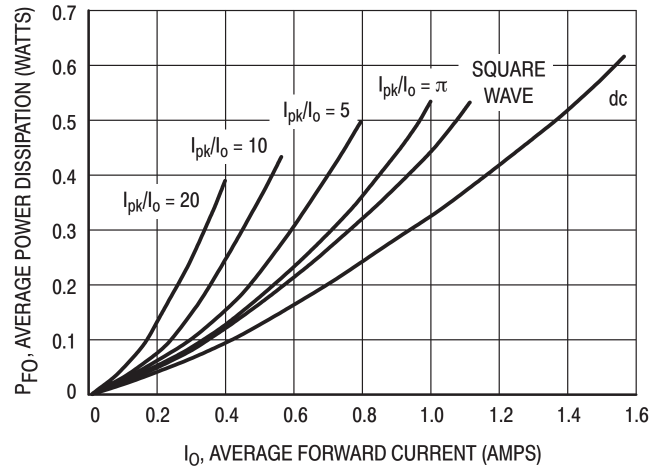

Figure 6. Forward Power Dissipation

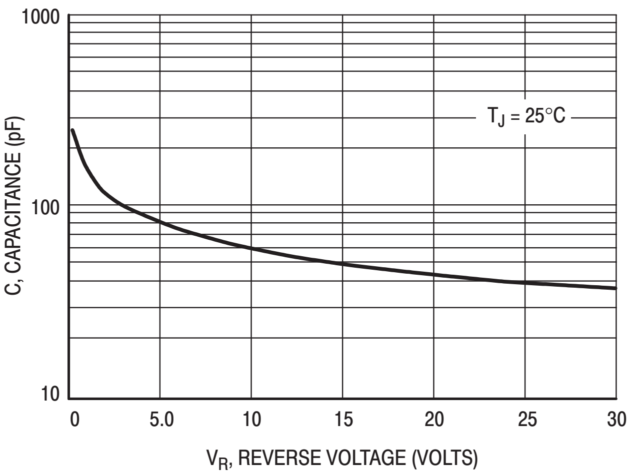

Figure 7. Capacitance

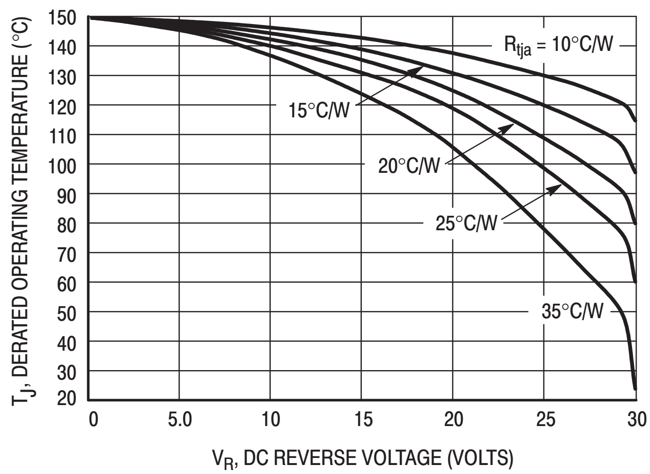

Figure 8. Typical Operating Temperature Derating*

* Reverse power dissipation and the possibility of thermal runaway must be considered when operating this device under any reverse voltage conditions. Calculations of T_J therefore must include forward and reverse power effects. The allowable operating T_J may be calculated from the equation: $T_J = T_{Jmax} - r(t)(Pf + Pr)$ where
r(t) = thermal impedance under given conditions,
Pf = forward power dissipation, and
Pr = reverse power dissipation

This graph displays the derated allowable T_J due to reverse bias under DC conditions only and is calculated as $T_J = T_{Jmax} - r(t)Pr$, where r(t) = Rthja. For other power applications further calculations must be performed.

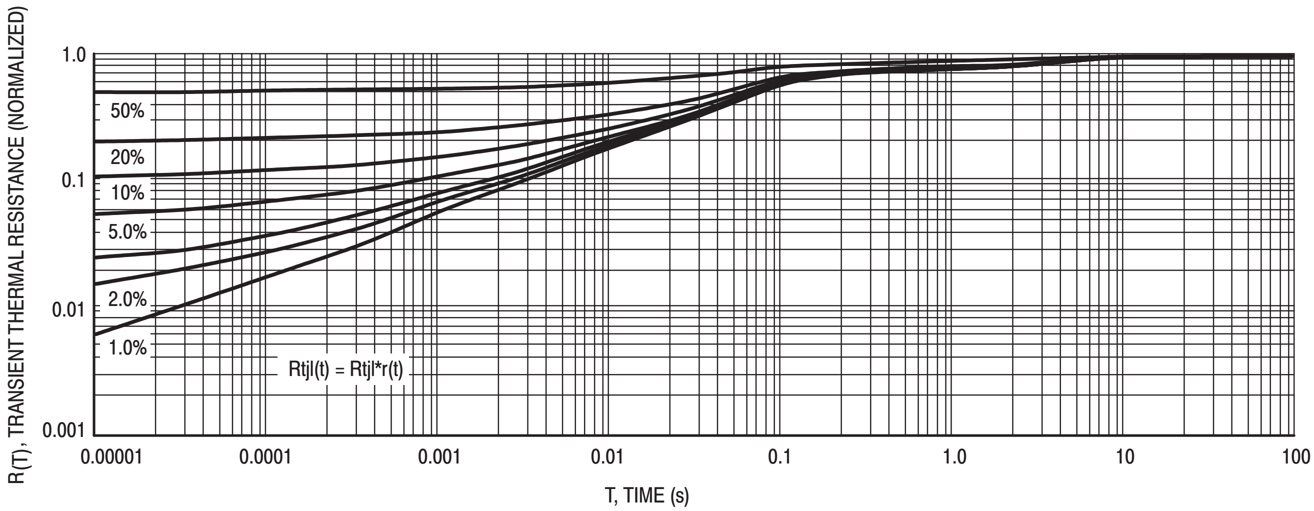

Figure 9. Thermal Response Junction to Lead

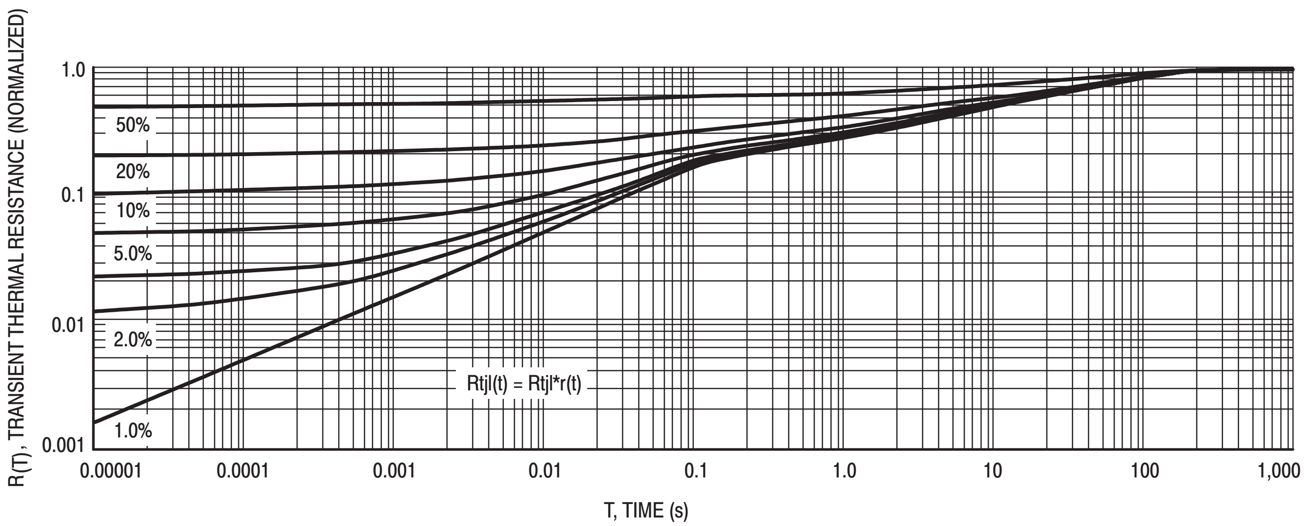

Figure 10. Thermal Response Junction to Ambient

MBRM140T3

Advance Information

Surface Mount Schottky Power Rectifier

POWERMITE®
Power Surface Mount Package

The Schottky Powermite employs the Schottky Barrier principle with a barrier metal and epitaxial construction that produces optimal forward voltage drop–reverse current tradeoff. The advanced packaging techniques provide for a highly efficient micro miniature, space saving surface mount Rectifier. With its unique heatsink design, the Powermite has the same thermal performance as the SMA while being 50% smaller in footprint area, and delivering one of the lowest height profiles, < 1.1 mm in the industry. Because of its small size, it is ideal for use in portable and battery powered products such as cellular and cordless phones, chargers, notebook computers, printers, PDAs and PCMCIA cards. Typical applications are ac/dc and dc–dc converters, reverse battery protection, and "Oring" of multiple supply voltages and any other application where performance and size are critical.

Features:

- Low Profile — Maximum Height of 1.1 mm
- Small Footprint — Footprint Area of 8.45 mm2
- Low V_F Provides Higher Efficiency and Extends Battery Life
- Supplied in 12 mm Tape and Reel — 12,000 Units per Reel
- Low Thermal Resistance with Direct Thermal Path of Die on Exposed Cathode Heat Sink

Mechanical Characteristics:

- Powermite is JEDEC Registered as D0–216AA
- Case: Molded Epoxy
- Epoxy Meets UL94, VO at 1/8″
- Weight: 62 mg (approximately)
- Device Marking: BCJ
- Lead and Mounting Surface Temperature for Soldering Purposes. 260°C Maximum for 10 Seconds

MAXIMUM RATINGS

Please See the Table on the Following Page

This document contains information on a new product. Specifications and information herein are subject to change without notice.

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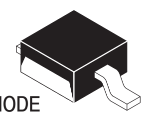
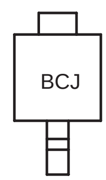
SCHOTTKY BARRIER RECTIFIER 1.0 AMPERES 40 VOLTS



POWERMITE
CASE 457
PLASTIC

MARKING DIAGRAM



BCJ = Device Code

ORDERING INFORMATION

Device	Package	Shipping
MBRM140T3	POWERMITE	12,000/Tape & Reel

MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Peak Repetitive Reverse Voltage Working Peak Reverse Voltage DC Blocking Voltage	V_{RRM} V_{RWM} V_R	40	V
Average Rectified Forward Current (At Rated V_R, T_C = 110°C)	I_O	1.0	A
Peak Repetitive Forward Current (At Rated V_R, Square Wave, 100 kHz, T_C = 110°C)	I_{FRM}	2.0	A
Non–Repetitive Peak Surge Current (Non–Repetitive peak surge current, halfwave, single phase, 60 Hz)	I_{FSM}	50	A
Storage Temperature	T_{stg}	–55 to 150	°C
Operating Junction Temperature	T_J	–55 to 125	°C
Voltage Rate of Change (Rated V_R, T_J = 25°C)	dv/dt	10,000	V/μs

THERMAL CHARACTERISTICS

Thermal Resistance – Junction–to–Lead (Anode) (Note 1.) Thermal Resistance – Junction–to–Tab (Cathode) (Note 1.) Thermal Resistance – Junction–to–Ambient (Note 1.)	R_{tjl} R_{tjtab} R_{tja}	35 23 277	°C/W

1. Mounted with minimum recommended pad size, PC Board FR4, See Figures 9 & 10.

ELECTRICAL CHARACTERISTICS

Maximum Instantaneous Forward Voltage (Note 2.), See Figure 2	V_F	**T_J = 25°C**	**T_J = 85°C**	V
(I_F = 0.1 A) (I_F = 1.0 A) (I_F = 3.0 A)		0.36 0.55 0.85	0.30 0.515 0.88	
Maximum Instantaneous Reverse Current (Note 2.), See Figure 4	I_R	**T_J = 25°C**	**T_J = 85°C**	mA
(V_R = 40 V) (V_R = 20 V)		0.5 0.15	25 18	

2. Pulse Test: Pulse Width ≤ 250 μs, Duty Cycle ≤ 2%.

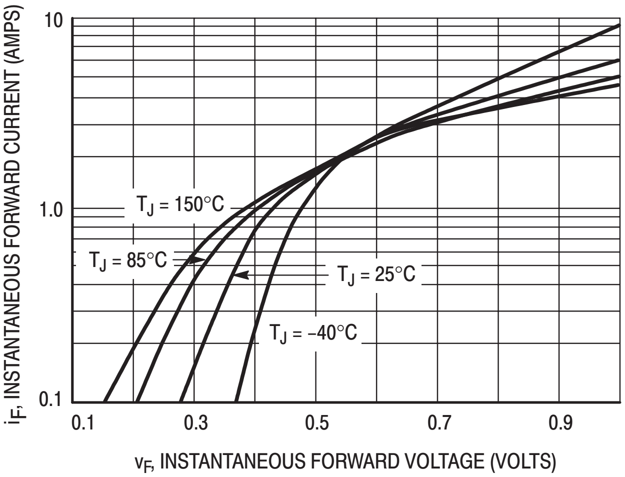


Figure 1. Typical Forward Voltage

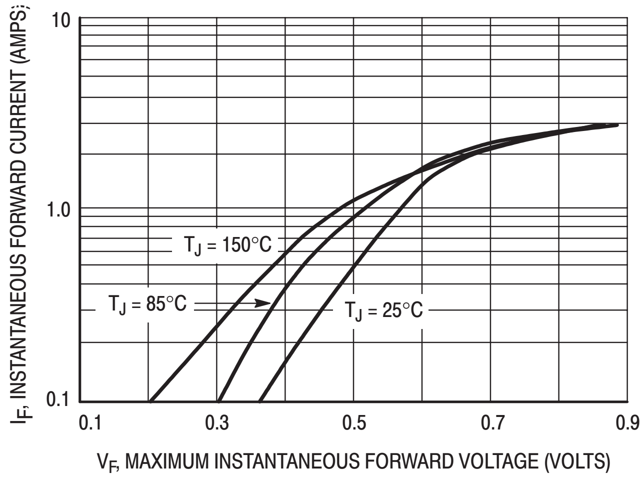


Figure 2. Maximum Forward Voltage

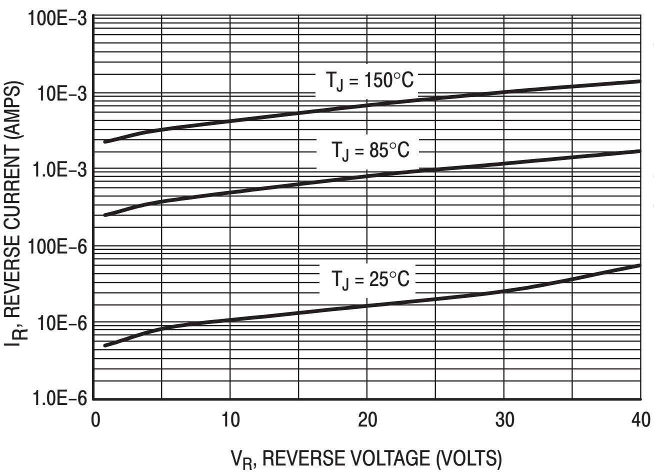


Figure 3. Typical Reverse Current

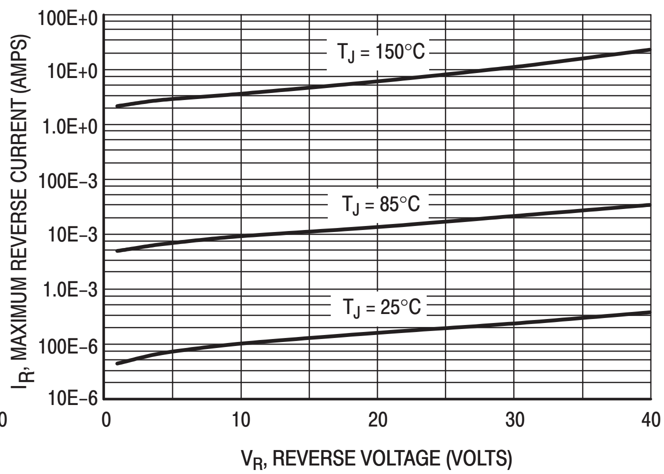


Figure 4. Maximum Reverse Current

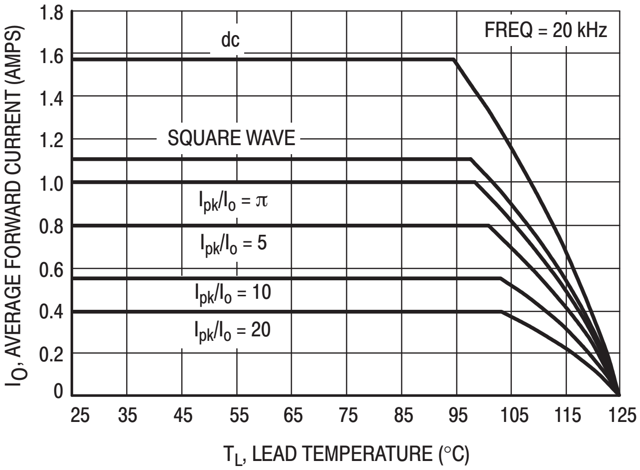


Figure 5. Current Derating

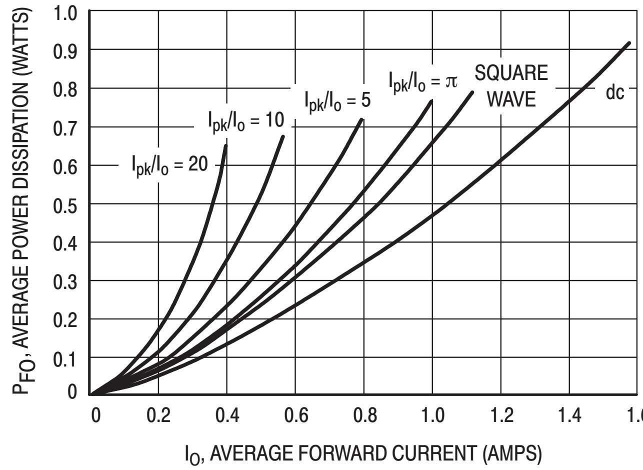


Figure 6. Forward Power Dissipation

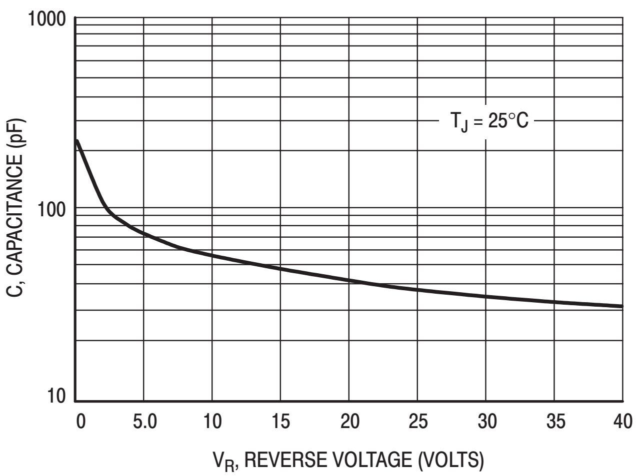


Figure 7. Capacitance

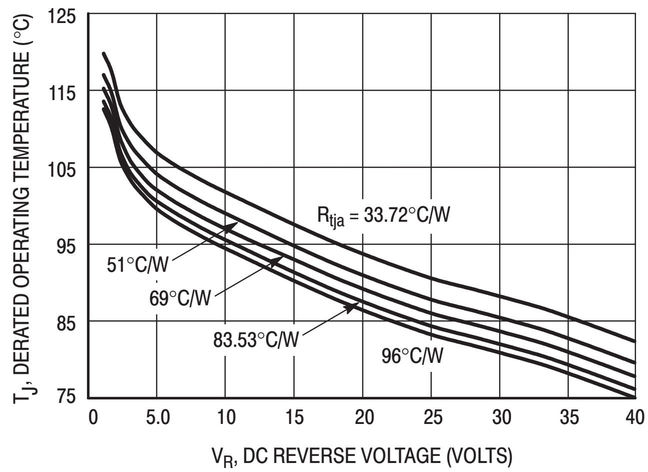


Figure 8. Typical Operating Temperature Derating*

* Reverse power dissipation and the possibility of thermal runaway must be considered when operating this device under any reverse voltage conditions. Calculations of T_J therefore must include forward and reverse power effects. The allowable operating T_J may be calculated from the equation: $T_J = T_{Jmax} - r(t)(Pf + Pr)$ where
r(t) = thermal impedance under given conditions,
Pf = forward power dissipation, and
Pr = reverse power dissipation

This graph displays the derated allowable T_J due to reverse bias under DC conditions only and is calculated as $T_J = T_{Jmax} - r(t)Pr$, where r(t) = Rthja. For other power applications further calculations must be performed.

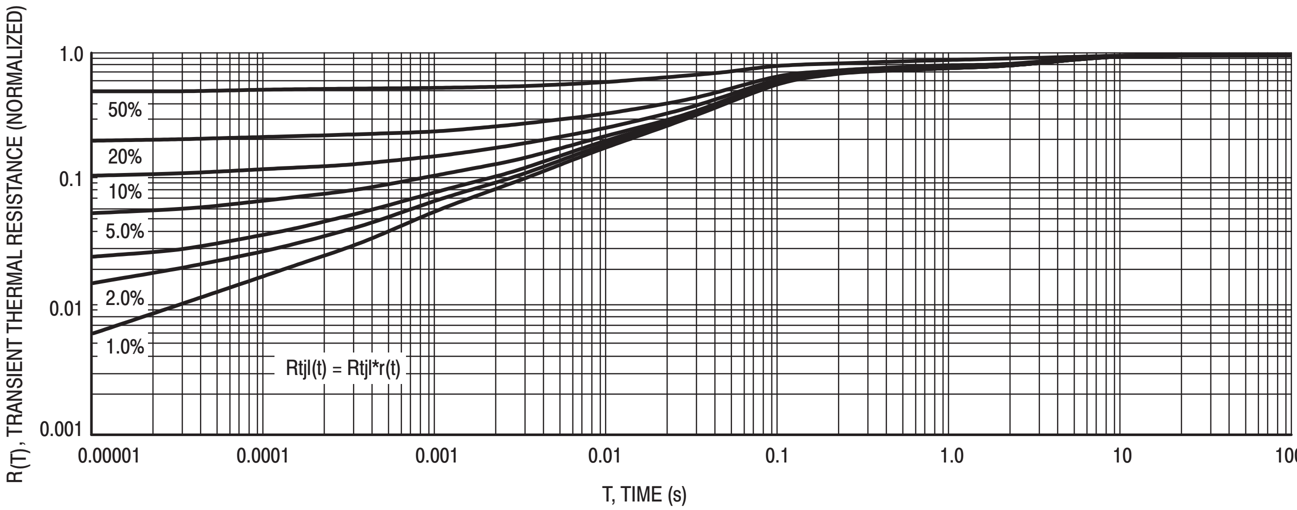


Figure 9. Thermal Response Junction to Lead

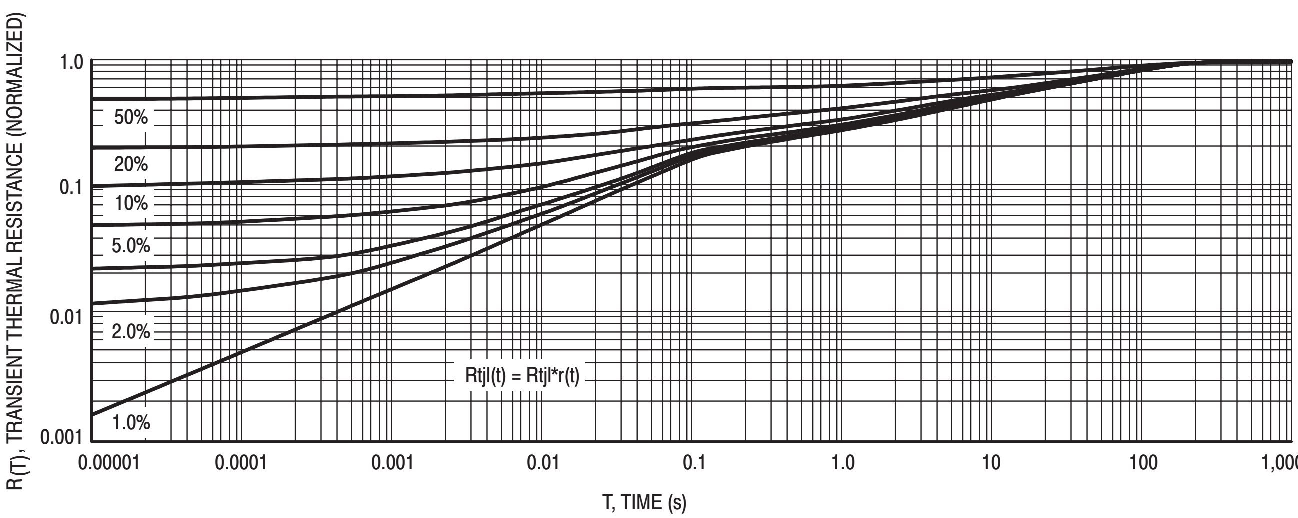


Figure 10. Thermal Response Junction to Ambient

MBRA130LT3

Surface Mount Schottky Power Rectifier

SMA Power Surface Mount Package

. . . employing the Schottky Barrier principle in a metal–to–silicon power rectifier. Features epitaxial construction with oxide passivation and metal overlay contact. Ideally suited for low voltage, high frequency switching power supplies; free wheeling diodes and polarity protection diodes.

- Compact Package with J–Bend Leads Ideal for Automated Handling
- Highly Stable Oxide Passivated Junction
- Guardring for Over–Voltage Protection
- Low Forward Voltage Drop

Mechanical Characteristics:

- Case: Molded Epoxy
- Epoxy Meets UL94, V_O at 1/8″
- Weight: 70 mg (approximately)
- Finish: All External Surfaces Corrosion Resistant and Terminal Leads are Readily Solderable
- Lead and Mounting Surface Temperature for Soldering Purposes: 260°C Max. for 10 Seconds
- Polarity: Cathode Lead Indicated by Either Notch in Plastic Body or Polarity Band
- Available in 12 mm Tape, 5000 Units per 13 inch Reel, Add “T3” Suffix to Part Number
- Marking: B1L3

MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Peak Repetitive Reverse Voltage Working Peak Reverse Voltage DC Blocking Voltage	V_{RRM} V_{RWM} V_R	30	V
Average Rectified Forward Current (At Rated V_R, T_C = 105°C)	I_O	1.0	A
Peak Repetitive Forward Current (At Rated V_R, Square Wave, 100 kHz, T_C = 105°C)	I_{FRM}	2.0	A
Non–Repetitive Peak Surge Current (Surge Applied at Rated Load Conditions Halfwave, Single Phase, 60 Hz)	I_{FSM}	25	A
Storage/Operating Case Temperature	T_{stg}, T_C	–55 to +150	°C
Operating Junction Temperature	T_J	–55 to +125	°C
Voltage Rate of Change (Rated V_R, T_J = 25°C)	dv/dt	10,000	V/μs

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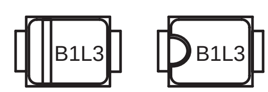
SCHOTTKY BARRIER RECTIFIER
1.0 AMPERES
30 VOLTS

SMA
CASE 403A
PLASTIC

SMA
CASE 403B
PLASTIC

MARKING DIAGRAM



B1L3 = Device Code

ORDERING INFORMATION

Device	Package	Shipping
MBRA130LT3	SMA	5000/Tape & Reel

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THERMAL CHARACTERISTICS

Characteristic	Symbol	Value	Unit
Thermal Resistance — Junction–to–Lead (Note 1.)	$R_{\theta JL}$	35	°C/W
Thermal Resistance — Junction–to–Ambient (Note 1.)	$R_{\theta JA}$	86	

ELECTRICAL CHARACTERISTICS

Characteristic	Symbol	Value		Unit
Maximum Instantaneous Forward Voltage (Note 2.)	V_F	T_J = 25°C	T_J = 100°C	Volts
(I_F = 1.0 A)		0.41	0.35	
see Figure 2 (I_F = 2.0 A)		0.47	0.43	
Maximum Instantaneous Reverse Current	I_R	T_J = 25°C	T_J = 100°C	mA
(V_R = 30 V)		1.0	25	
see Figure 4 (V_R = 15 V)		0.4	12	

1. Mounted on 2″ Square PC Board with 1″ Square Total Pad Size, PC Board FR4.
2. Pulse Test: Pulse Width ≤ 250 µs, Duty Cycle ≤ 2.0%.

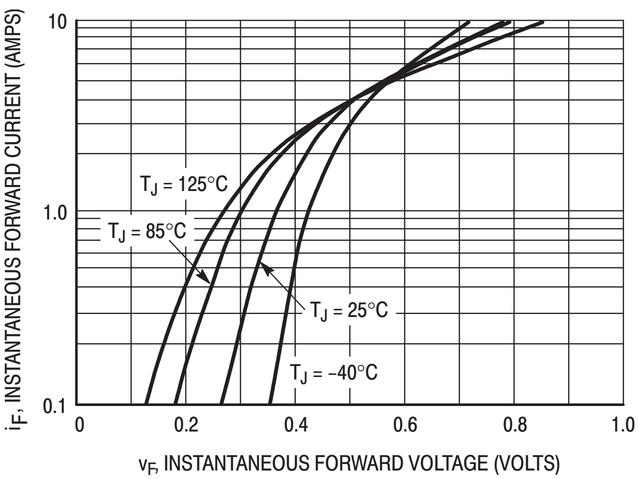

Figure 1. Typical Forward Voltage

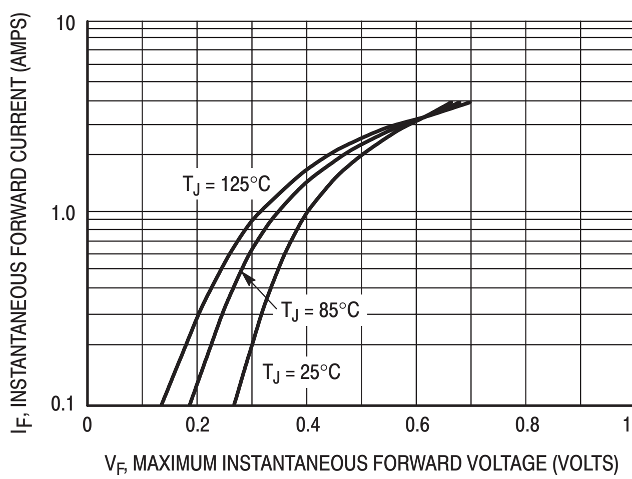

Figure 2. Maximum Forward Voltage

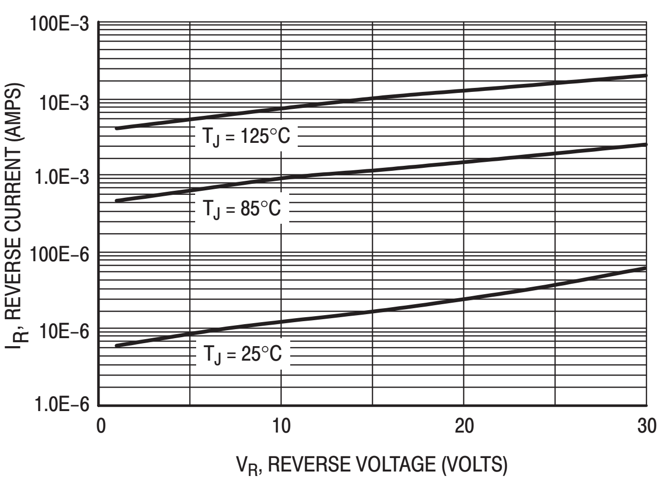

Figure 3. Typical Reverse Current

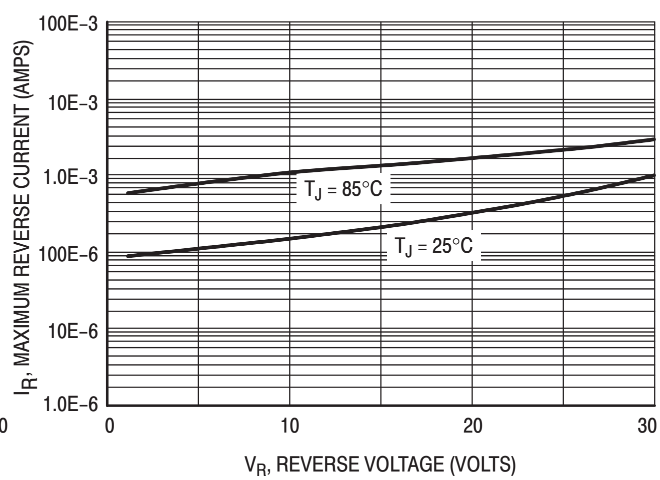

Figure 4. Maximum Reverse Current

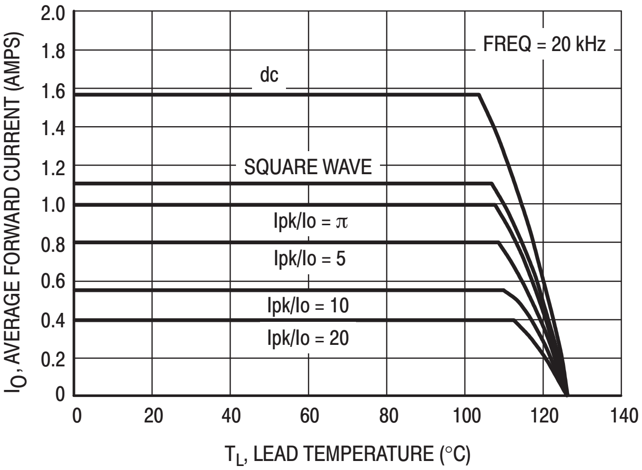

Figure 5. Current Derating

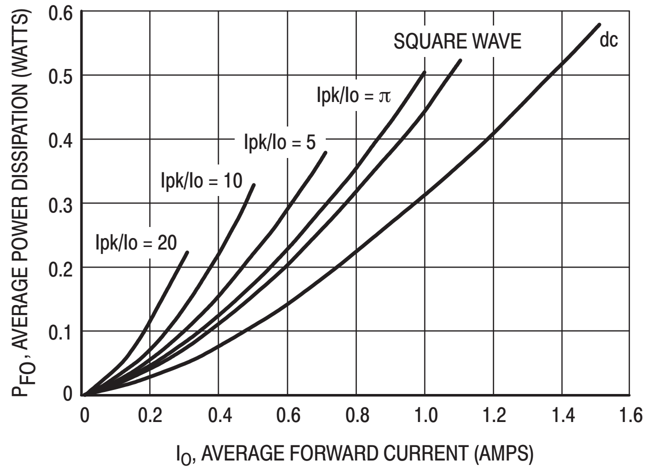

Figure 6. Forward Power Dissipation

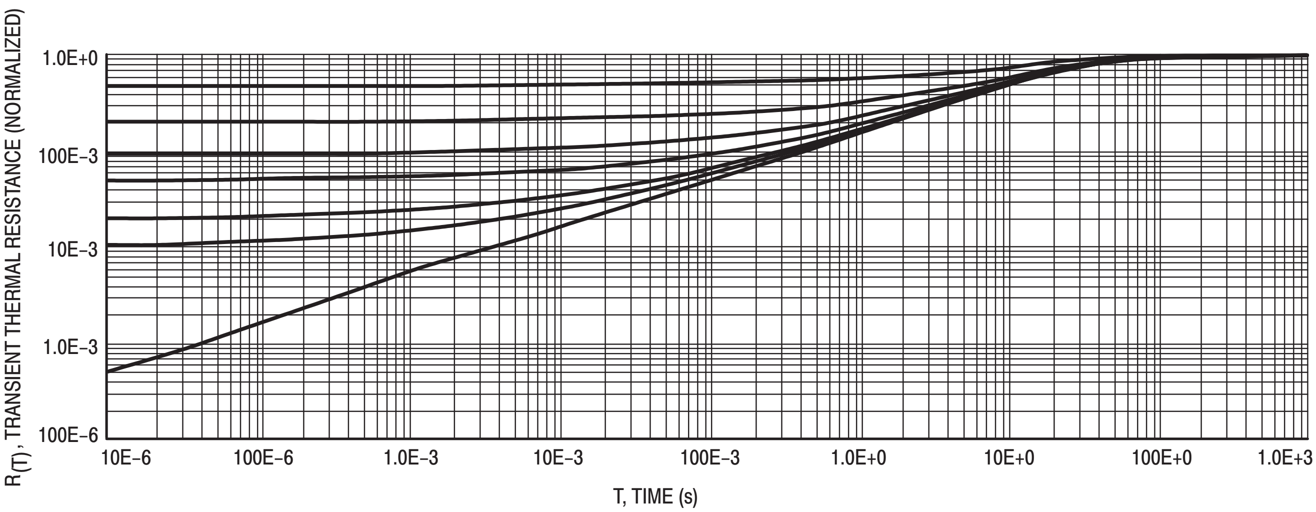

Figure 7. Thermal Response

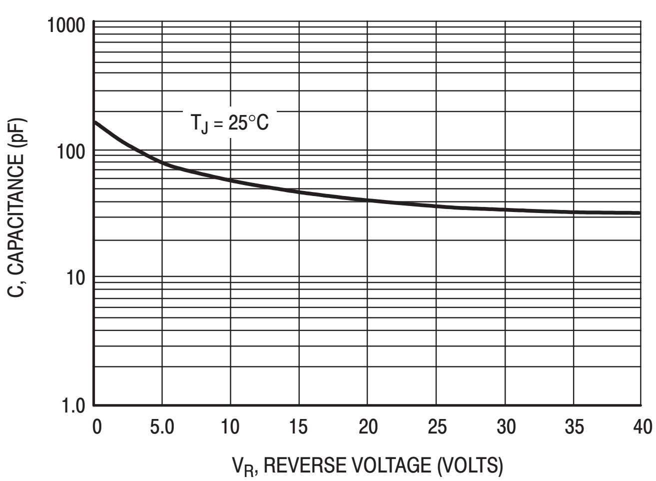

Figure 8. Capacitance

MBRA140T3

Surface Mount Schottky Power Rectifier

SMA Power Surface Mount Package

. . . employing the Schottky Barrier principle in a large area metal–to–silicon power diode. State of the art geometry features epitaxial construction with oxide passivation and metal overlay contact. Ideally suited for low voltage, high frequency rectification, or as free wheeling and polarity diodes in surface mount applications where compact size and weight are critical to the system.

- Small Compact Surface Mountable Package with J–Bent Leads
- Rectangular Package for Automated Handling
- Highly Stable Oxide Passivated Junction
- Very Low Forward Voltage Drop
- Guardring for Stress Protection

Mechanical Characteristics:

- Case: Epoxy, Molded
- Weight: 70 mg (approximately)
- Finish: All External Surfaces Corrosion Resistant and Terminal Leads are Readily Solderable
- Lead and Mounting Surface Temperature for Soldering Purposes: 260°C Max. for 10 Seconds
- Shipped in 12 mm tape, 5000 units per 13 inch reel
- Polarity: Cathode Lead Indicated by Either Notch in Plastic Body or Polarity Band
- Marking: B14

MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Peak Repetitive Reverse Voltage Working Peak Reverse Voltage DC Blocking Voltage	V_{RRM} V_{RWM} V_R	40	V
Average Rectified Forward Current (At Rated V_R, T_C = 95°C)	I_O	1.0	A
Peak Repetitive Forward Current (At Rated V_R, Square Wave, 20 kHz, T_C = 100°C)	I_{FRM}	2.0	A
Non–Repetitive Peak Surge Current (Surge Applied at Rated Load Conditions Halfwave, Single Phase, 60 Hz)	I_{FSM}	30	A
Storage/Operating Case Temperature	T_{stg}, T_C	–55 to +150	°C
Operating Junction Temperature	T_J	–55 to +125	°C
Voltage Rate of Change (Rated V_R, T_J = 25°C)	dv/dt	10,000	V/μs

ON Semiconductor™

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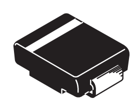
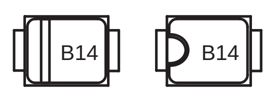
SCHOTTKY BARRIER RECTIFIER 1.0 AMPERES 40 VOLTS



SMA CASE 403A PLASTIC

SMA CASE 403B PLASTIC

MARKING DIAGRAM



B14 = Device Code

ORDERING INFORMATION

Device	Package	Shipping
MBRA140T3	SMA	5000/Tape & Reel

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THERMAL CHARACTERISTICS

Characteristic	Symbol	Value	Unit
Thermal Resistance — Junction–to–Lead (Note 1.)	$R_{\theta JL}$	35	°C/W
Thermal Resistance — Junction–to–Ambient (Note 1.)	$R_{\theta JA}$	86	

ELECTRICAL CHARACTERISTICS

Maximum Instantaneous Forward Voltage (Note 2.)		V_F	T_J = 25°C	T_J = 100°C	Volts
	(I_F = 1.0 A)		0.55	0.505	
see Figure 2 for other Values	(I_F = 2.0 A)		0.71	0.74	
Maximum Instantaneous Reverse Current		I_R	T_J = 25°C	T_J = 100°C	mA
	(V_R = 40 V)		0.5	10	
see Figure 4 for other Values	(V_R = 20 V)		0.1	4.0	

1. Mounted on 2″ Square PC Board with 1″ Square Total Pad Size, PC Board FR4.
2. Pulse Test: Pulse Width ≤ 250 µs, Duty Cycle ≤ 2.0%.

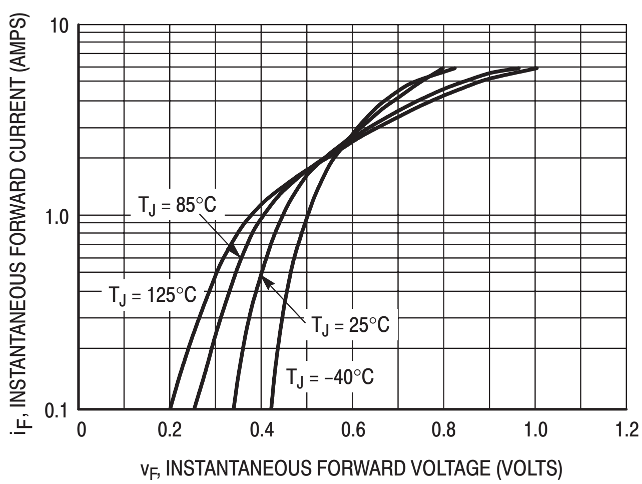

Figure 1. Typical Forward Voltage

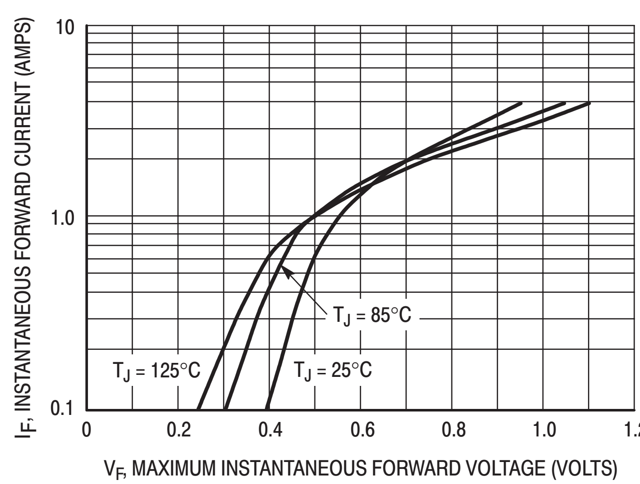

Figure 2. Maximum Forward Voltage

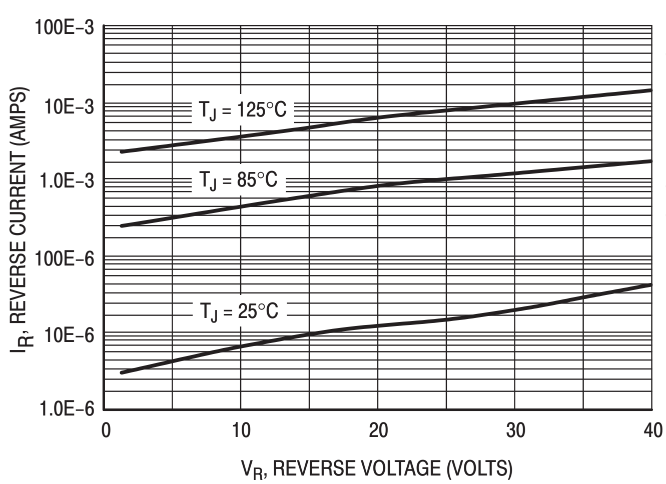

Figure 3. Typical Reverse Current

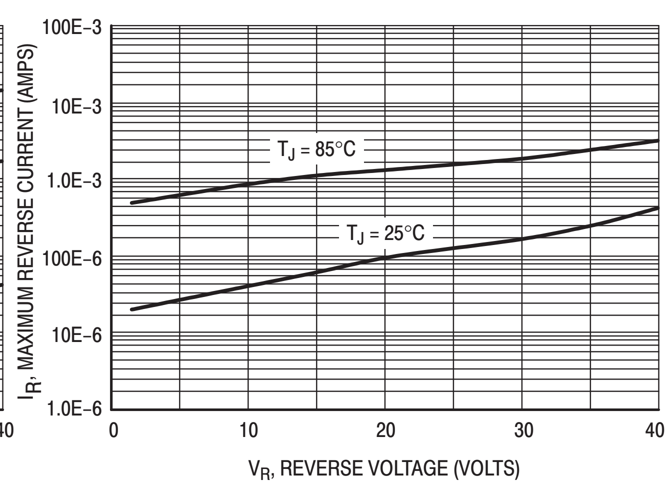

Figure 4. Maximum Reverse Current

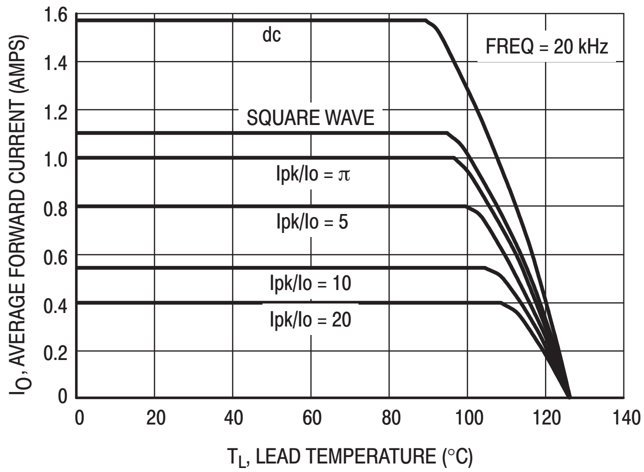

Figure 5. Current Derating

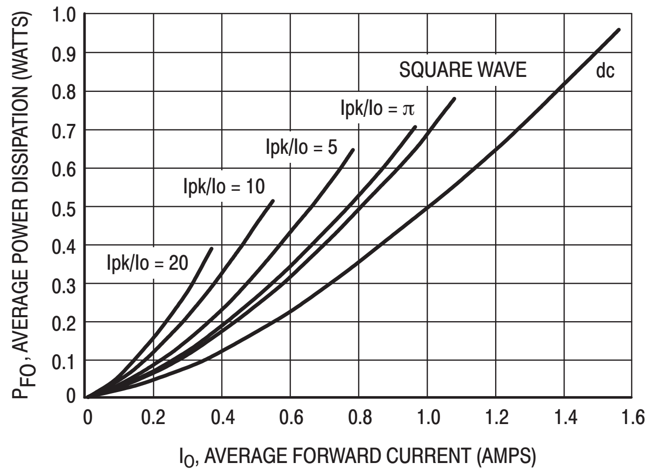

Figure 6. Forward Power Dissipation

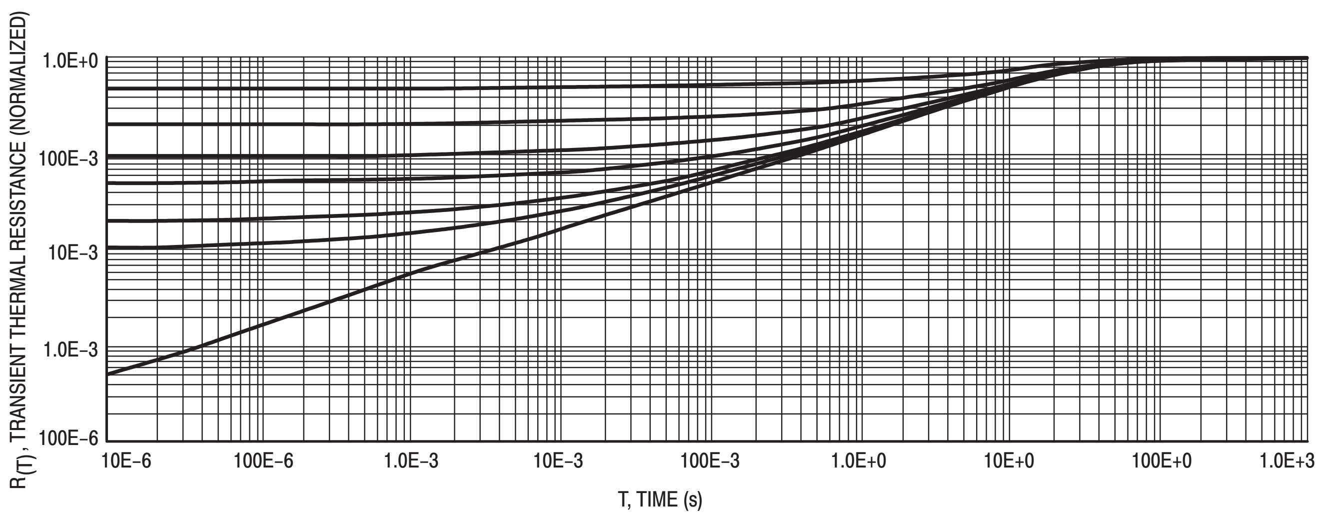

Figure 7. Thermal Response

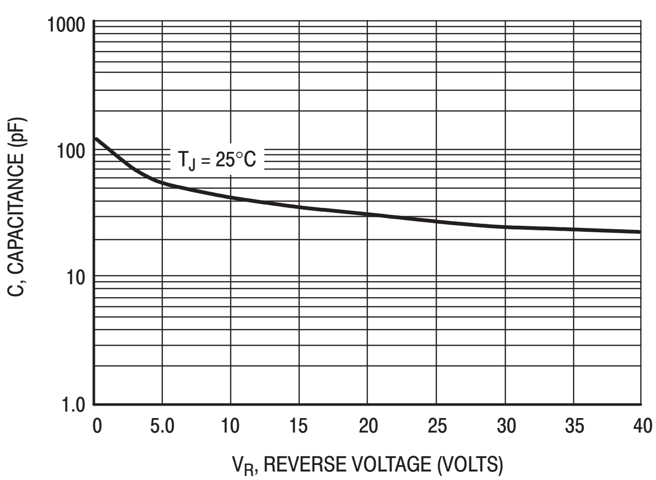

Figure 8. Capacitance

MBRS120T3

Preferred Device

Surface Mount Schottky Power Rectifier

. . . employing the Schottky Barrier principle in a large area metal–to–silicon power diode. State–of–the–art geometry features epitaxial construction with oxide passivation and metal overlay contact. Ideally suited for low voltage, high frequency rectification, or as free wheeling and polarity protection diodes in surface mount applications where compact size and weight are critical to the system.

- Small Compact Surface Mountable Package with J–Bend Leads
- Rectangular Package for Automated Handling
- Highly Stable Oxide Passivated Junction
- Very Low Forward Voltage Drop (0.55 Volts Max @ 1.0 A, T_J = 25°C)
- Excellent Ability to Withstand Reverse Avalanche Energy Transients
- Guardring for Stress Protection

Mechanical Characteristics

- Case: Epoxy, Molded
- Weight: 95 mg (approximately)
- Finish: All External Surfaces Corrosion Resistant and Terminal Leads are Readily Solderable
- Lead and Mounting Surface Temperature for Soldering Purposes: 260°C Max. for 10 Seconds
- Shipped in 12 mm Tape and Reel, 2500 units per reel
- Cathode Polarity Band
- Marking: B12

MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Peak Repetitive Reverse Voltage Working Peak Reverse Voltage DC Blocking Voltage	V_{RRM} V_{RWM} V_R	20	V
Average Rectified Forward Current (T_L = 115°C)	$I_{F(AV)}$	1.0	A
Non–Repetitive Peak Surge Current (Surge Applied at Rated Load Conditions Halfwave, Single Phase, 60 Hz)	I_{FSM}	40	A
Operating Junction Temperature	T_J	–65 to +125	°C

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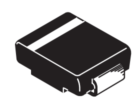
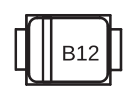
SCHOTTKY BARRIER RECTIFIER 1.0 AMPERE 20 VOLTS



SMB
CASE 403A
PLASTIC

MARKING DIAGRAM



B12 = Device Code

ORDERING INFORMATION

Device	Package	Shipping
MBRS120T3	SMB	2500/Tape & Reel

Preferred devices are recommended choices for future use and best overall value.

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THERMAL CHARACTERISTICS

Characteristic	Symbol	Value	Unit
Thermal Resistance — Junction to Lead (T_L = 25°C)	$R_{\theta JL}$	12	°C/W

ELECTRICAL CHARACTERISTICS

Maximum Instantaneous Forward Voltage (Note 1.) (i_F = 1.0 A, T_J = 25°C)	V_F	0.6	Volts
Maximum Instantaneous Reverse Current (Note 1.) (Rated dc Voltage, T_J = 25°C) (Rated dc Voltage, T_J = 100°C)	i_R	 1.0 10	mA

1. Pulse Test: Pulse Width = 300 μs, Duty Cycle ≤ 2.0%.

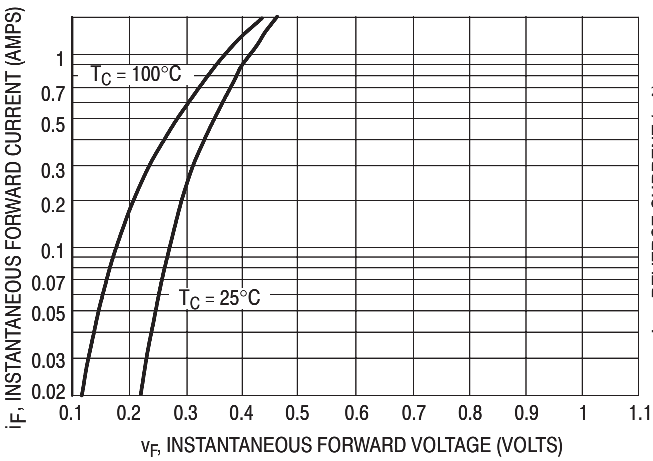

Figure 1. Typical Forward Voltage

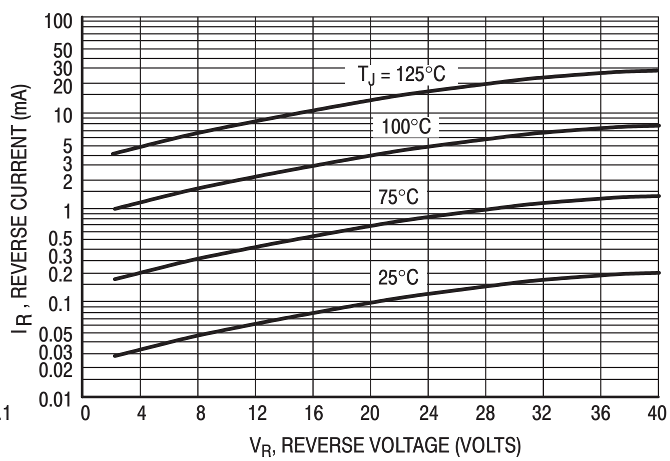

Figure 2. Typical Reverse Current

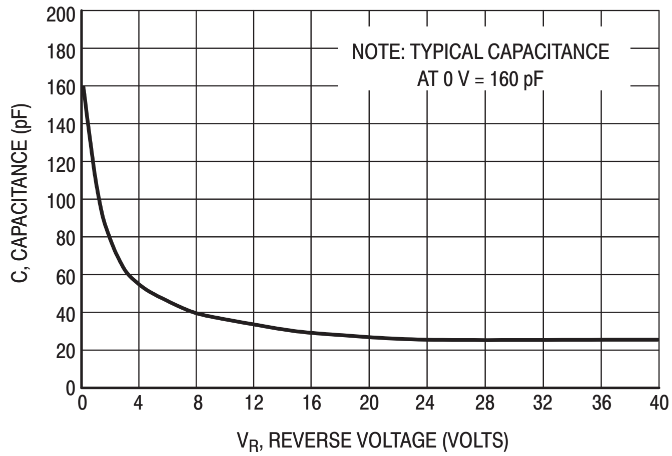

Figure 3. Typical Capacitance

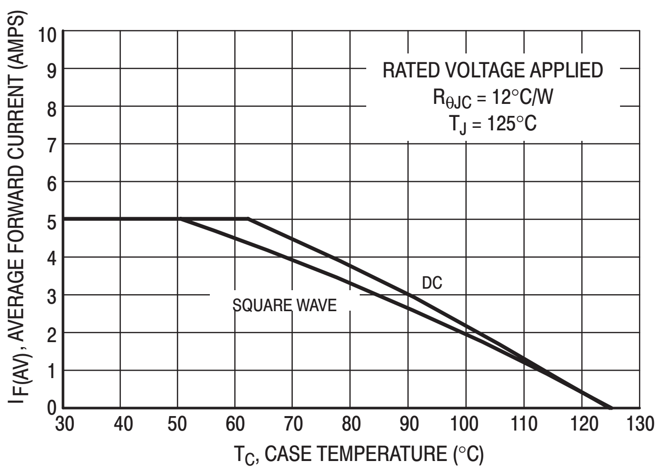

Figure 4. Current Derating (Case)

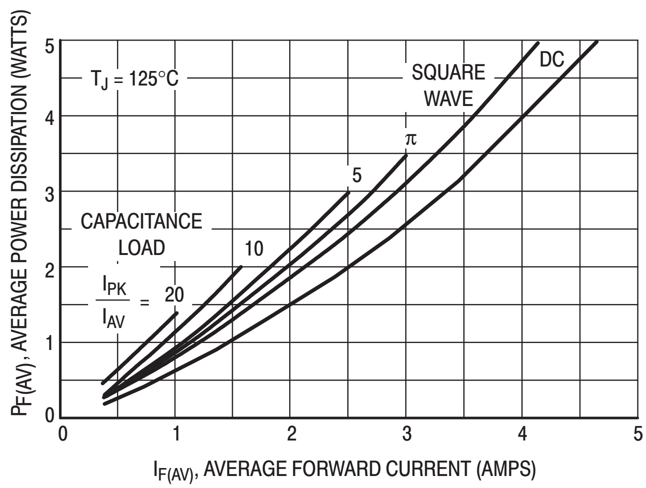

Figure 5. Power Dissipation

MBRS130LT3

Preferred Device

Schottky Power Rectifier

Surface Mount Power Package

. . . Employs the Schottky Barrier principle in a large area metal–to–silicon power diode. State–of–the–art geometry features epitaxial construction with oxide passivation and metal overlay contact. Ideally suited for low voltage, high frequency rectification, or as free wheeling and polarity protection diodes, in surface mount applications where compact size and weight are critical to the system.

- Very Low Forward Voltage Drop (0.395 Volts Max @ 1.0 A, T_J = 25°C)
- Small Compact Surface Mountable Package with J–Bend Leads
- Highly Stable Oxide Passivated Junction
- Guardring for Stress Protection

Mechanical Characteristics

- Case: Epoxy, Molded
- Weight: 95 mg (approximately)
- Finish: All External Surfaces Corrosion Resistant and Terminal Leads are Readily Solderable
- Lead and Mounting Surface Temperature for Soldering Purposes: 260°C Max. for 10 Seconds
- Shipped in 12 mm Tape and Reel, 2500 units per reel
- Cathode Polarity Band
- Marking: 1BL3

MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Peak Repetitive Reverse Voltage Working Peak Reverse Voltage DC Blocking Voltage	V_{RRM} V_{RWM} V_R	30	V
Average Rectified Forward Current T_L = 120°C T_L = 110°C	$I_{F(AV)}$	 1.0 2.0	A
Non–Repetitive Peak Surge Current (Surge Applied at Rated Load Conditions Halfwave, Single Phase, 60 Hz)	I_{FSM}	40	A
Operating Junction Temperature	T_J	–65 to +125	°C

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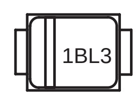
SCHOTTKY BARRIER RECTIFIER
1.0 AMPERE
30 VOLTS

SMB
CASE 403A
PLASTIC

MARKING DIAGRAM



1BL3 = Device Code

ORDERING INFORMATION

Device	Package	Shipping
MBRS130LT3	SMB	2500/Tape & Reel

Preferred devices are recommended choices for future use and best overall value.

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THERMAL CHARACTERISTICS

Rating	Symbol	Value	Unit
Thermal Resistance — Junction to Lead (T_L = 25°C)	$R_{\theta JL}$	12	°C/W

ELECTRICAL CHARACTERISTICS

Maximum Instantaneous Forward Voltage (Note 1.) (i_F = 1.0 A, T_J = 25°C) (i_F = 2.0 A, T_J = 25°C)	V_F	 0.395 0.445	Volts
Maximum Instantaneous Reverse Current (Note 1.) (Rated dc Voltage, T_J = 25°C) (Rated dc Voltage, T_J = 100°C)	I_R	 1.0 10	mA

1. Pulse Test: Pulse Width = 300 μs, Duty Cycle ≤ 2%.

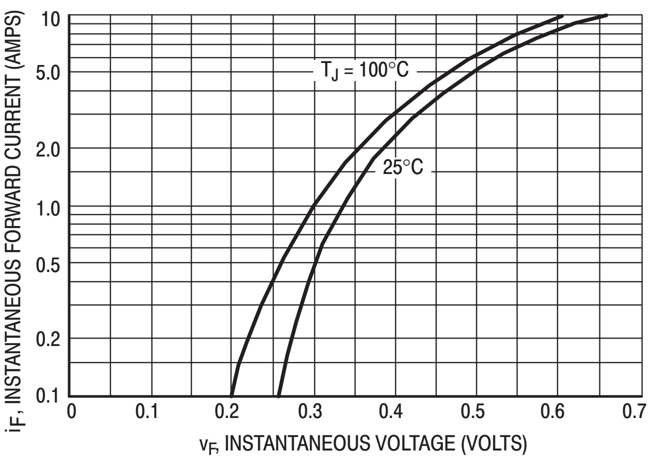

Figure 1. Typical Forward Voltage

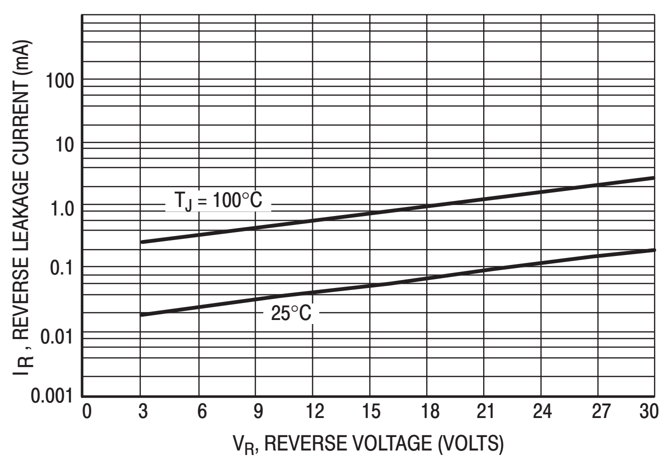

Figure 2. Typical Reverse Leakage Current

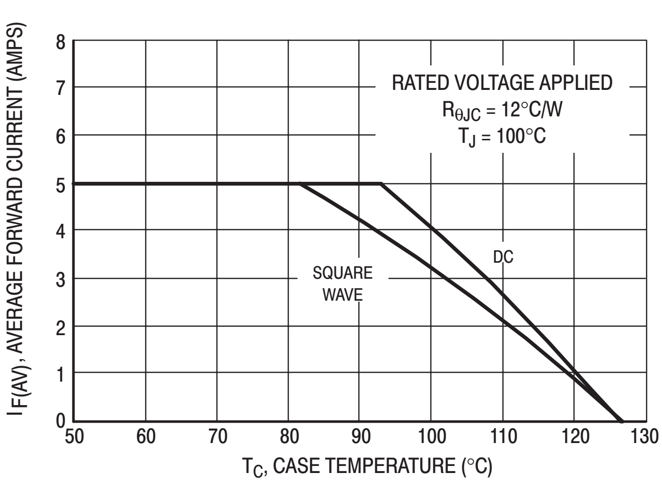

Figure 3. Current Derating (Case)

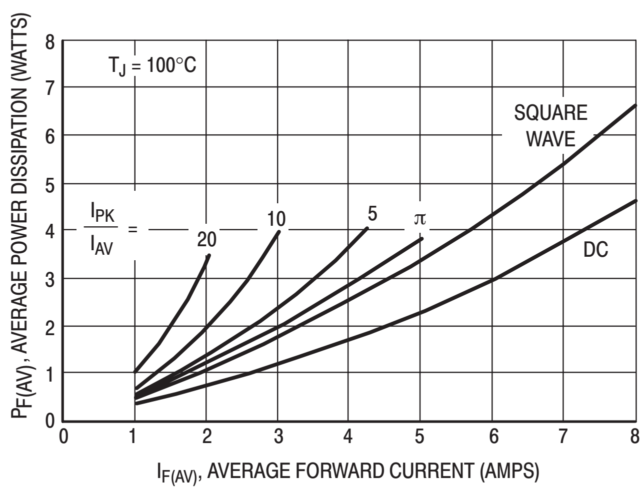

Figure 4. Typical Power Dissipation

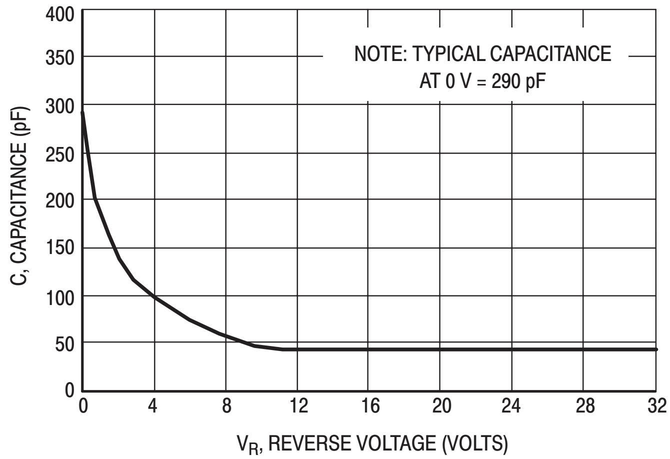

Figure 5. Typical Capacitance

MBRS130T3

Preferred Device

Surface Mount Schottky Power Rectifier

. . . employing the Schottky Barrier principle in a large area metal–to–silicon power diode. State–of–the–art geometry features epitaxial construction with oxide passivation and metal overlay contact. Ideally suited for low voltage, high frequency rectification, or as free wheeling and polarity protection diodes in surface mount applications where compact size and weight are critical to the system.

- Small Compact Surface Mountable Package with J–Bend Leads
- Rectangular Package for Automated Handling
- Highly Stable Oxide Passivated Junction
- Very Low Forward Voltage Drop (0.55 Volts Max @ 1.0 A, T_J = 25°C)
- Excellent Ability to Withstand Reverse Avalanche Energy Transients
- Guardring for Stress Protection

Mechanical Characteristics

- Case: Epoxy, Molded
- Weight: 95 mg (approximately)
- Finish: All External Surfaces Corrosion Resistant and Terminal Leads are Readily Solderable
- Lead and Mounting Surface Temperature for Soldering Purposes: 260°C Max. for 10 Seconds
- Shipped in 12 mm Tape and Reel, 2500 units per reel
- Cathode Polarity Band
- Marking: B13

MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Peak Repetitive Reverse Voltage Working Peak Reverse Voltage DC Blocking Voltage	V_{RRM} V_{RWM} V_R	30	V
Average Rectified Forward Current (T_L = 115°C)	$I_{F(AV)}$	1.0	A
Non–Repetitive Peak Surge Current (Surge Applied at Rated Load Conditions Halfwave, Single Phase, 60 Hz)	I_{FSM}	40	A
Operating Junction Temperature	T_J	–65 to +125	°C

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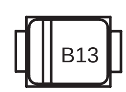
SCHOTTKY BARRIER RECTIFIER 1.0 AMPERE 30 VOLTS

SMB
CASE 403A
PLASTIC

MARKING DIAGRAM



B13 = Device Code

ORDERING INFORMATION

Device	Package	Shipping
MBRS130T3	SMB	2500/Tape & Reel

Preferred devices are recommended choices for future use and best overall value.

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THERMAL CHARACTERISTICS

Characteristic	Symbol	Value	Unit
Thermal Resistance — Junction to Lead (T_L = 25°C)	$R_{\theta JL}$	12	°C/W

ELECTRICAL CHARACTERISTICS

Maximum Instantaneous Forward Voltage (Note 1.) (i_F = 1.0 A, T_J = 25°C)	V_F	0.6	Volts
Maximum Instantaneous Reverse Current (Note 1.) (Rated dc Voltage, T_J = 25°C) (Rated dc Voltage, T_J = 100°C)	i_R	1.0 10	mA

1. Pulse Test: Pulse Width = 300 μs, Duty Cycle ≤ 2.0%.

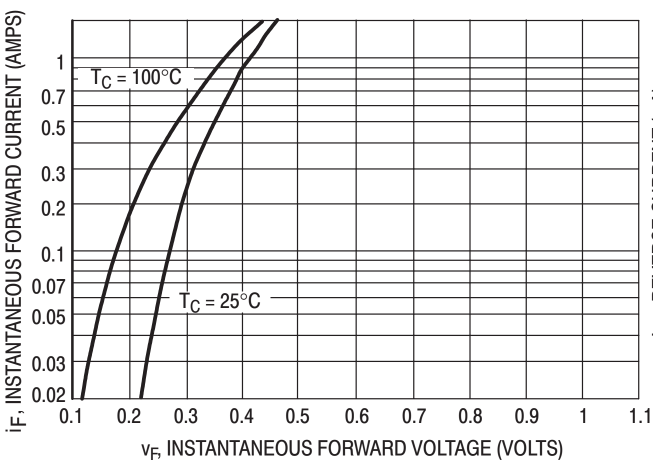

Figure 1. Typical Forward Voltage

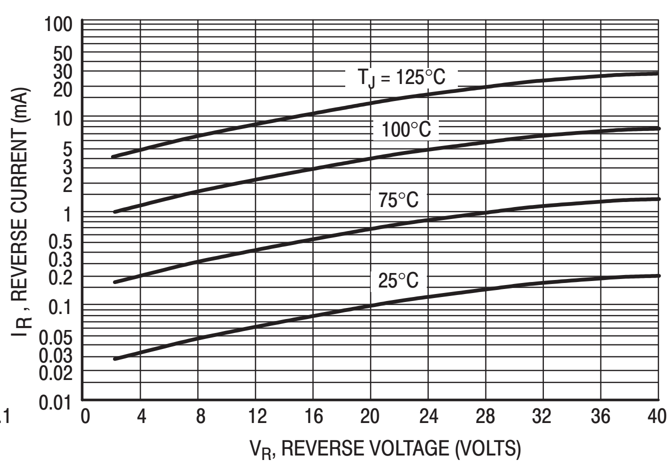

Figure 2. Typical Reverse Current

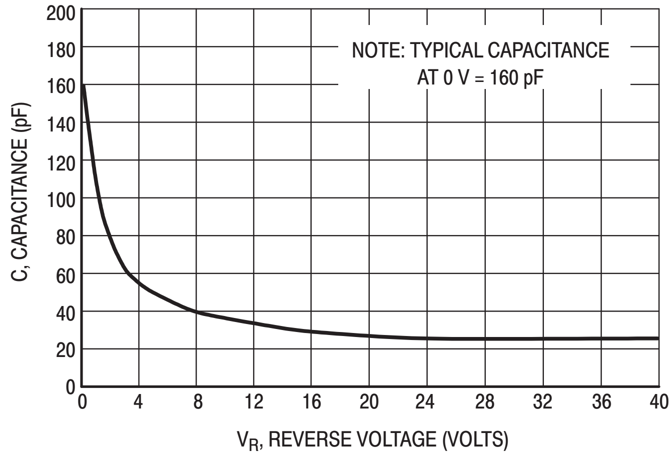

Figure 3. Typical Capacitance

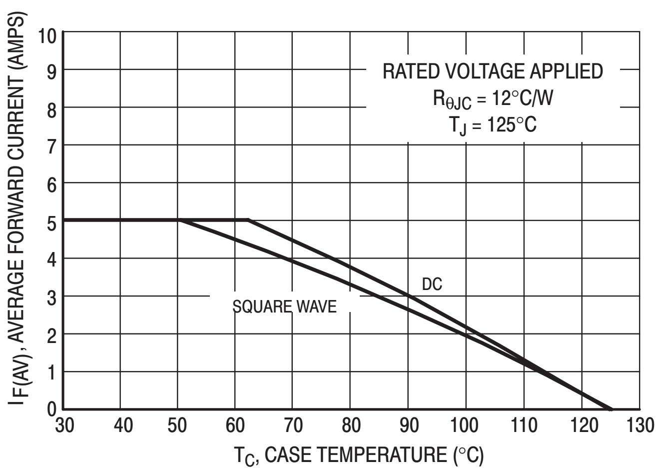

Figure 4. Current Derating (Case)

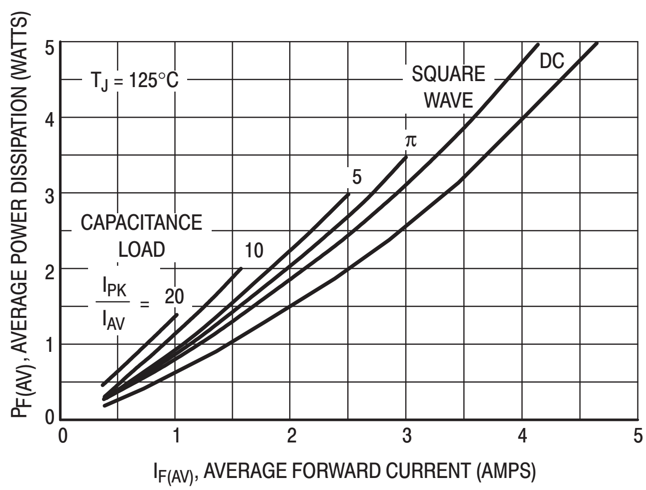

Figure 5. Power Dissipation

MBRS140T3

Preferred Device

Surface Mount Schottky Power Rectifier

. . . employing the Schottky Barrier principle in a large area metal–to–silicon power diode. State–of–the–art geometry features epitaxial construction with oxide passivation and metal overlay contact. Ideally suited for low voltage, high frequency rectification, or as free wheeling and polarity protection diodes in surface mount applications where compact size and weight are critical to the system.

- Small Compact Surface Mountable Package with J–Bend Leads
- Rectangular Package for Automated Handling
- Highly Stable Oxide Passivated Junction
- Very Low Forward Voltage Drop (0.55 Volts Max @ 1.0 A, T_J = 25°C)
- Excellent Ability to Withstand Reverse Avalanche Energy Transients
- Guardring for Stress Protection

Mechanical Characteristics

- Case: Epoxy, Molded
- Weight: 95 mg (approximately)
- Finish: All External Surfaces Corrosion Resistant and Terminal Leads are Readily Solderable
- Lead and Mounting Surface Temperature for Soldering Purposes: 260°C Max. for 10 Seconds
- Shipped in 12 mm Tape and Reel, 2500 units per reel
- Cathode Polarity Band
- Marking: B14

MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Peak Repetitive Reverse Voltage Working Peak Reverse Voltage DC Blocking Voltage	V_{RRM} V_{RWM} V_R	40	V
Average Rectified Forward Current (T_L = 115°C)	$I_{F(AV)}$	1.0	A
Non–Repetitive Peak Surge Current (Surge Applied at Rated Load Conditions Halfwave, Single Phase, 60 Hz)	I_{FSM}	40	A
Operating Junction Temperature	T_J	–65 to +125	°C

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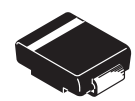
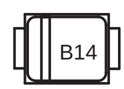
SCHOTTKY BARRIER RECTIFIER 1.0 AMPERE 40 VOLTS



SMB
CASE 403A
PLASTIC

MARKING DIAGRAM



B14 = Device Code

ORDERING INFORMATION

Device	Package	Shipping
MBRS140T3	SMB	2500/Tape & Reel

Preferred devices are recommended choices for future use and best overall value.

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THERMAL CHARACTERISTICS

Characteristic	Symbol	Value	Unit
Thermal Resistance — Junction to Lead (T_L = 25°C)	$R_{\theta JL}$	12	°C/W

ELECTRICAL CHARACTERISTICS

Maximum Instantaneous Forward Voltage (Note 1.) (i_F = 1.0 A, T_J = 25°C)	V_F	0.6	Volts
Maximum Instantaneous Reverse Current (Note 1.) (Rated dc Voltage, T_J = 25°C) (Rated dc Voltage, T_J = 100°C)	i_R	1.0 10	mA

1. Pulse Test: Pulse Width = 300 μs, Duty Cycle ≤ 2.0%.

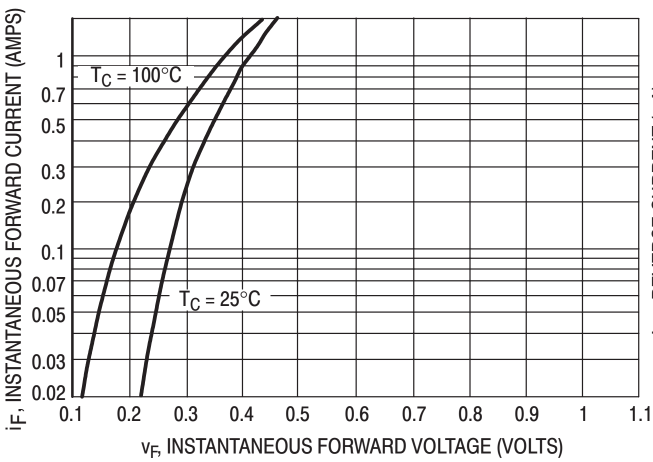

Figure 1. Typical Forward Voltage

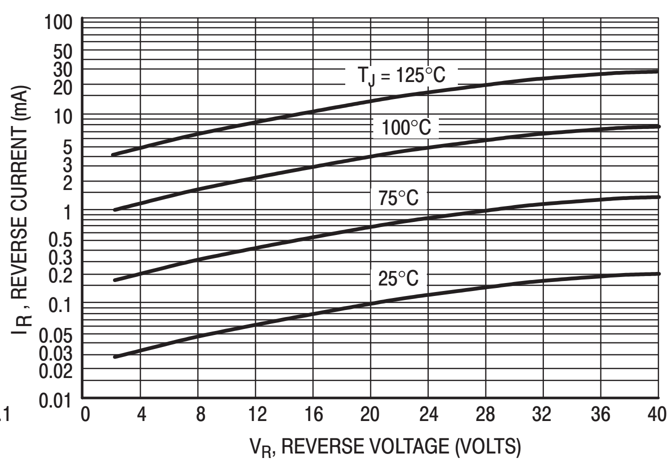

Figure 2. Typical Reverse Current

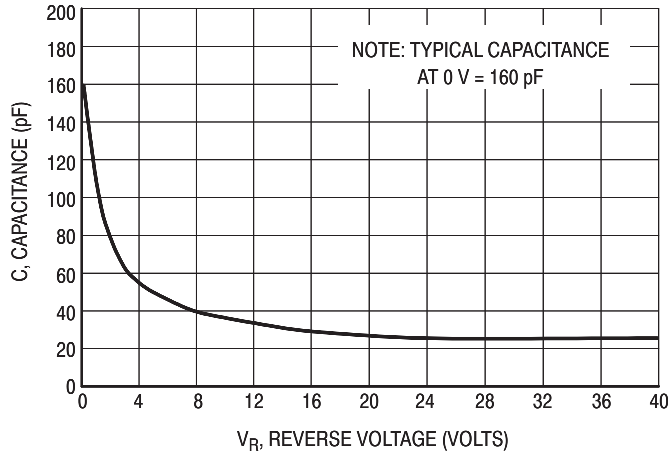

Figure 3. Typical Capacitance

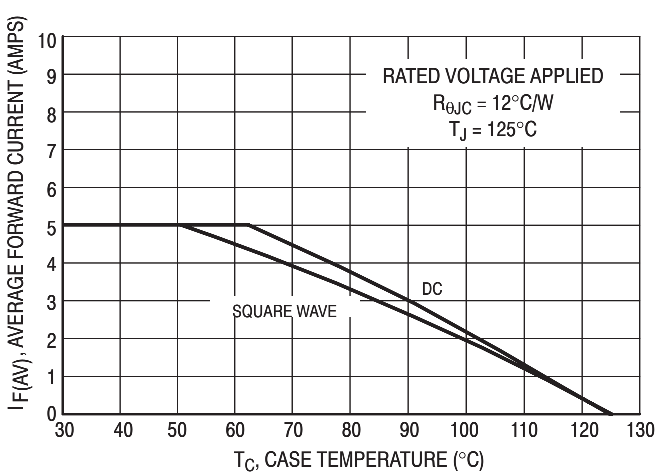

Figure 4. Current Derating (Case)

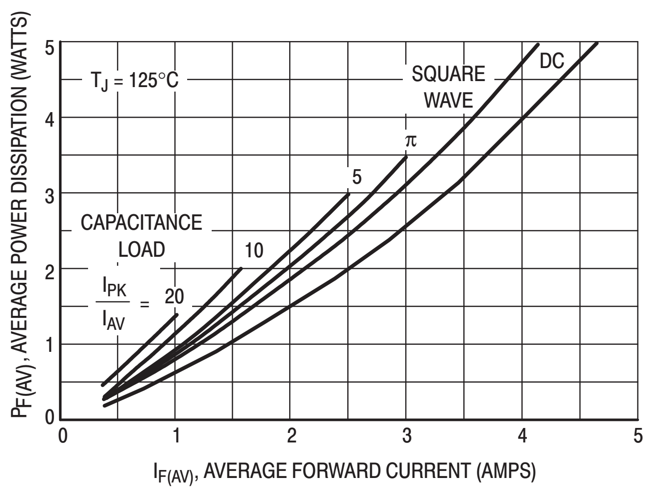

Figure 5. Power Dissipation

MBRS140LT3

Surface Mount Schottky Power Rectifier

SMB Power Surface Mount Package

. . . employing the Schottky Barrier principle in a metal–to–silicon power rectifier. Features epitaxial construction with oxide passivation and metal overlay contact. Ideally suited for low voltage, high frequency switching power supplies; free wheeling diodes and polarity protection diodes.

- Compact Package with J–Bend Leads Ideal for Automated Handling
- Highly Stable Oxide Passivated Junction
- Guardring for Over–Voltage Protection
- Low Forward Voltage Drop

Mechanical Characteristics:

- Case: Molded Epoxy
- Epoxy Meets UL94, VO at 1/8″
- Weight: 95 mg (approximately)
- Cathode Polarity Band
- Lead and Mounting Surface Temperature for Soldering Purposes: 260°C Max. for 10 Seconds
- Available in 12 mm Tape, 2500 Units per 13″ Reel, Add “T3” Suffix to Part Number
- Finish: All External Surfaces Corrosion Resistant and Terminal Leads are Readily Solderable
- Marking: B14L

MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Peak Repetitive Reverse Voltage Working Peak Reverse Voltage DC Blocking Voltage	V_{RRM} V_{RWM} V_R	40	V
Average Rectified Forward Current (At Rated V_R, T_C = 110°C)	I_O	1.0	A
Peak Repetitive Forward Current (At Rated V_R, Square Wave, 100 kHz, T_C = 110°C)	I_{FRM}	2.0	A
Non–Repetitive Peak Surge Current (Surge Applied at Rated Load Conditions Halfwave, Single Phase, 60 Hz)	I_{FSM}	40	A
Storage/Operating Case Temperature	T_{stg}, T_C	–55 to +150	°C
Operating Junction Temperature	T_J	–55 to +125	°C
Voltage Rate of Change (Rated V_R, T_J = 25°C)	dv/dt	10,000	V/μs

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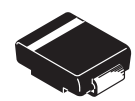
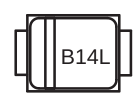
SCHOTTKY BARRIER RECTIFIER 1.0 AMPERE 40 VOLTS



SMB
CASE 403A
PLASTIC

MARKING DIAGRAM



B14L = Device Code

ORDERING INFORMATION

Device	Package	Shipping
MBRS140LT3	SMB	2500/Tape & Reel

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THERMAL CHARACTERISTICS

Characteristic	Symbol	Max	Unit
Thermal Resistance — Junction–to–Lead (Note 1.) Thermal Resistance — Junction–to–Ambient (Note 2.)	$R_{\theta JL}$ $R_{\theta JA}$	24 80	°C/W

ELECTRICAL CHARACTERISTICS

Characteristic	Symbol	T_J = 25°C	T_J = 125°C	Unit
Maximum Instantaneous Forward Voltage (Note 3.) see Figure 2 (i_F = 1.0 A) (i_F = 2.0 A)	v_F	0.5 0.6	0.425 0.58	Volts
		T_J = 25°C	**T_J = 100°C**	
Maximum Instantaneous Reverse Current (Note 3.) see Figure 4 (V_R = 40 V) (V_R = 20 V)	I_R	0.4 0.02	10 5.0	mA

1. Mounted with minimum recommended pad size, PC Board FR4.
2. 1 inch square pad size (1 x 0.5 inch for each lead) on FR4 board.
3. Pulse Test: Pulse Width ≤ 250 μs, Duty Cycle ≤ 2.0%.

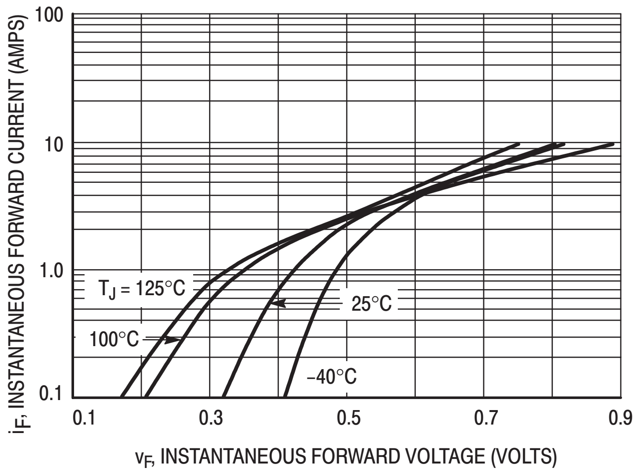

Figure 1. Typical Forward Voltage

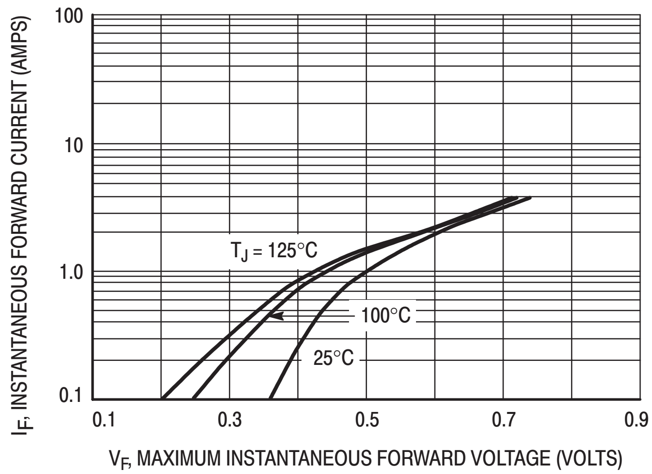

Figure 2. Maximum Forward Voltage

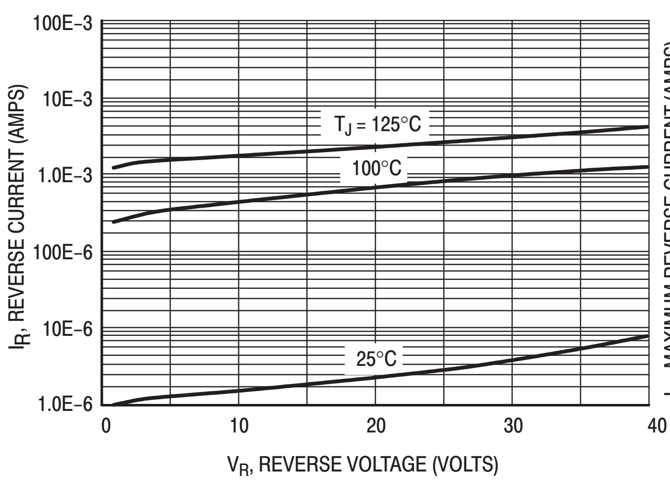

Figure 3. Typical Reverse Current

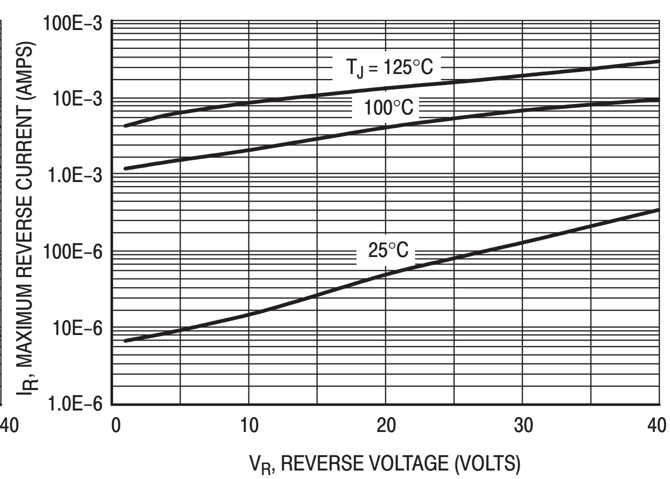

Figure 4. Maximum Reverse Current

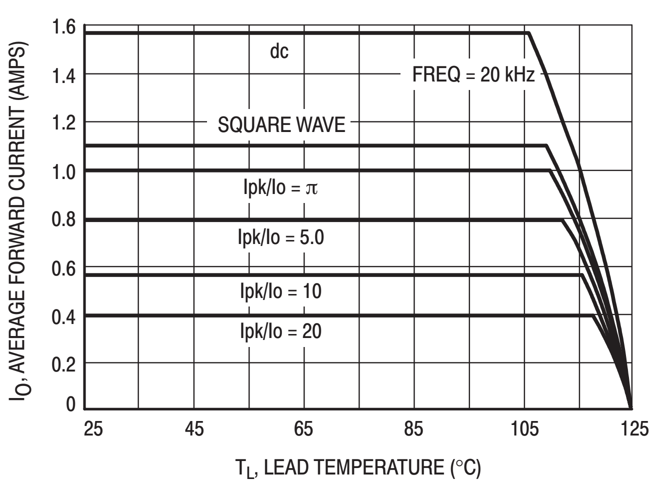

Figure 5. Current Derating

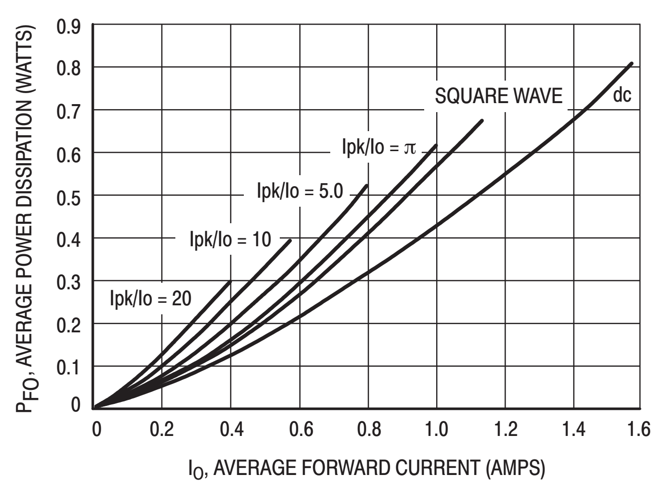

Figure 6. Forward Power Dissipation

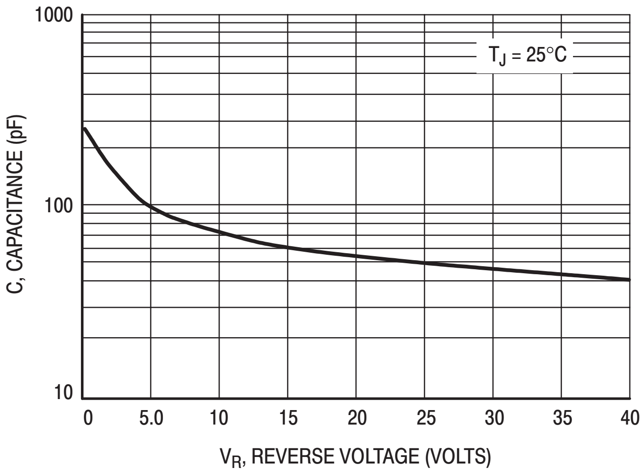

Figure 7. Capacitance

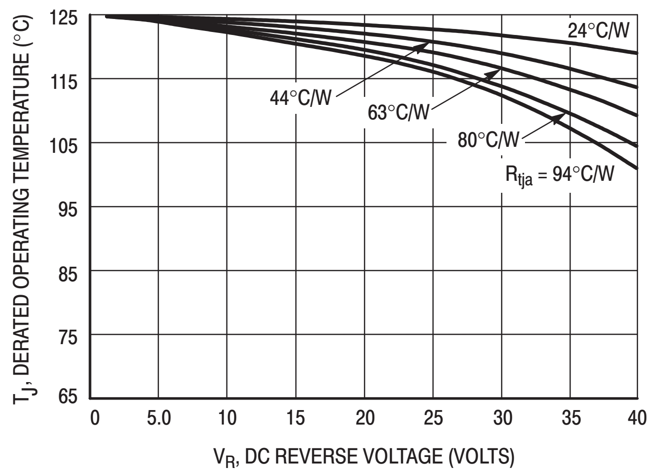

Figure 8. Typical Operating Temperature Derating*

* Reverse power dissipation and the possibility of thermal runaway must be considered when operating this device under any reverse voltage conditions. Calculations of T_J therefore must include forward and reverse power effects. The allowable operating T_J may be calculated from the equation: $T_J = T_{Jmax} - r(t)(Pf + Pr)$ where

r(t) = thermal impedance under given conditions,

Pf = forward power dissipation, and

Pr = reverse power dissipation

This graph displays the derated allowable T_J due to reverse bias under DC conditions only and is calculated as $T_J = T_{Jmax} - r(t)Pr$, where r(t) = Rthja. For other power applications further calculations must be performed.

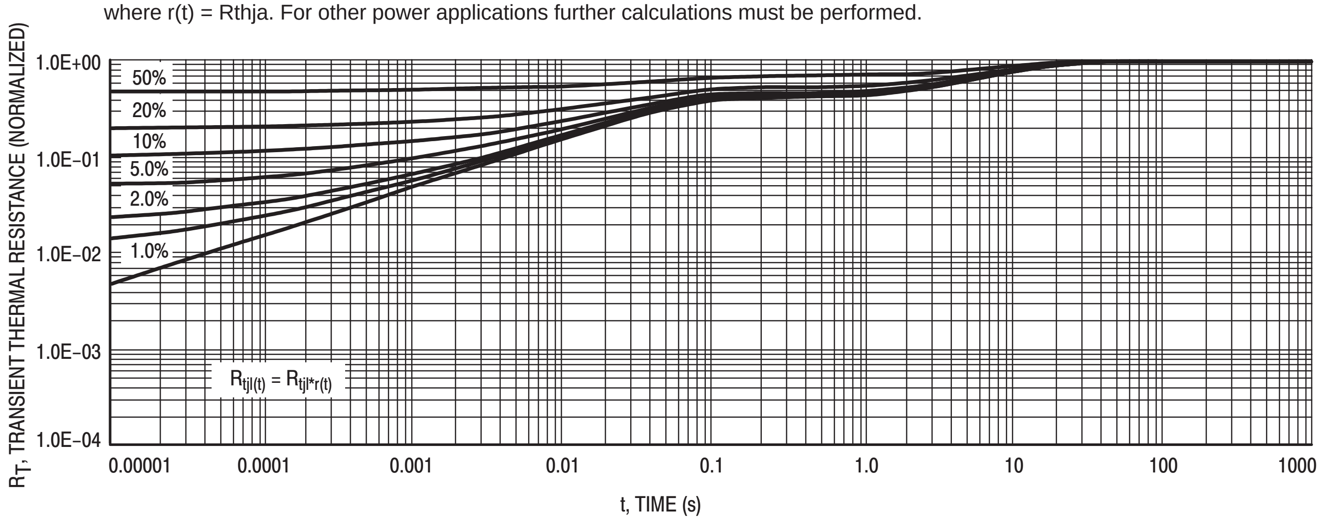

Figure 9. Thermal Response — Junction to Lead

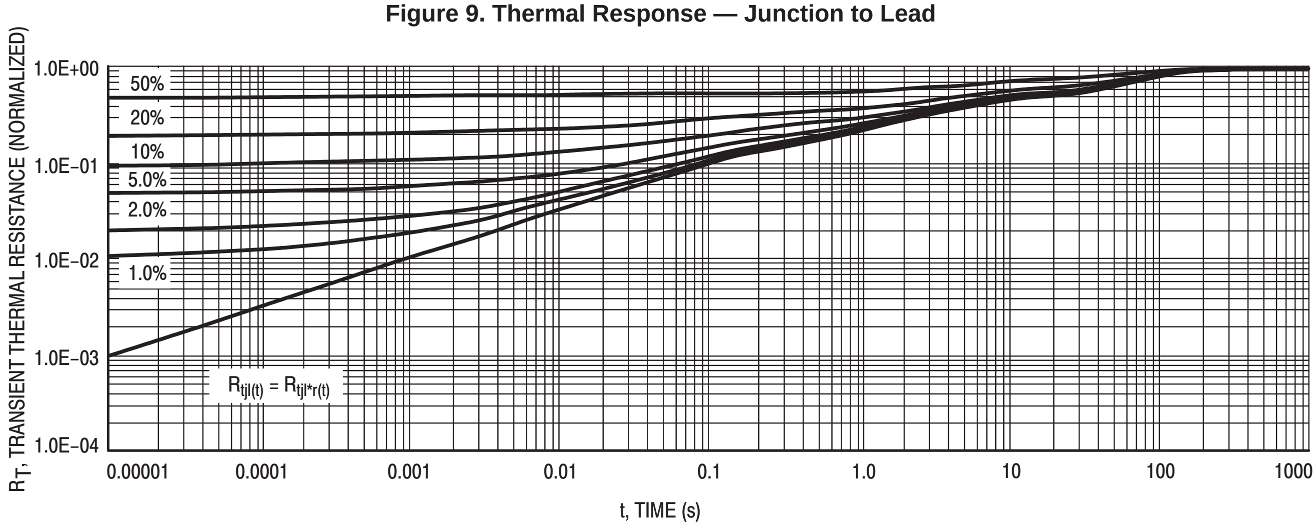

Figure 10. Thermal Response — Junction to Ambient

MBRS1100T3, MBRS190T3

Preferred Devices

Schottky Power Rectifier

Surface Mount Power Package

Schottky Power Rectifiers employ the use of the Schottky Barrier principle in a large area metal-to-silicon power diode. State-of-the-art geometry features epitaxial construction with oxide passivation and metal overlay contact. Ideally suited for low voltage, high frequency rectification, or as free wheeling and polarity protection diodes, in surface mount applications where compact size and weight are critical to the system. These state-of-the-art devices have the following features:

- Small Compact Surface Mountable Package with J-Bend Leads
- Rectangular Package for Automated Handling
- Highly Stable Oxide Passivated Junction
- High Blocking Voltage — 100 Volts
- 150°C Operating Junction Temperature
- Guardring for Stress Protection

Mechanical Characteristics

- Case: Epoxy, Molded
- Weight: 95 mg (approximately)
- Finish: All External Surfaces Corrosion Resistant and Terminal Leads are Readily Solderable
- Lead and Mounting Surface Temperature for Soldering Purposes: 260°C Max. for 10 Seconds
- Shipped in 12 mm Tape and Reel, 2500 units per reel
- Cathode Polarity Band
- Markings; MBRS190T3: B19
  MBRS1100T3: B1C

MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Peak Repetitive Reverse Voltage Working Peak Reverse Voltage DC Blocking Voltage MBRS190T3 MBRS1100T3	V_{RRM} V_{RWM} V_R	 90 100	V
Average Rectified Forward Current $T_L = 120°C$ $T_L = 100°C$	$I_{F(AV)}$	 1.0 2.0	A
Non–Repetitive Peak Surge Current (Surge Applied at Rated Load Conditions Halfwave, Single Phase, 60 Hz)	I_{FSM}	50	A
Operating Junction Temperature	T_J	–65 to +150	°C
Voltage Rate of Change	dv/dt	10	V/ns

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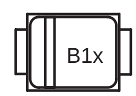
SCHOTTKY BARRIER RECTIFIER
1.0 AMPERE
90, 100 VOLTS

SMB
CASE 403A
PLASTIC

MARKING DIAGRAM



B1x = Device Code
x = 9 or C

ORDERING INFORMATION

Device	Package	Shipping
MBRS1100T3	SMB	2500/Tape & Reel
MBRS190T3	SMB	2500/Tape & Reel

Preferred devices are recommended choices for future use and best overall value.

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THERMAL CHARACTERISTICS

Rating	Symbol	Value	Unit
Thermal Resistance — Junction to Lead (T_L = 25°C)	$R_{\theta JL}$	22	°C/W

ELECTRICAL CHARACTERISTICS

Maximum Instantaneous Forward Voltage (Note 1.) (i_F = 1.0 A, T_J = 25°C)	V_F	0.75	Volts
Maximum Instantaneous Reverse Current (Note 1.) (Rated dc Voltage, TJ = 25°C) (Rated dc Voltage, T_J = 100°C)	I_R	 0.5 5.0	mA

1. Pulse Test: Pulse Width = 300 μs, Duty Cycle ≤ 2.0%.

TYPICAL ELECTRICAL CHARACTERISTICS

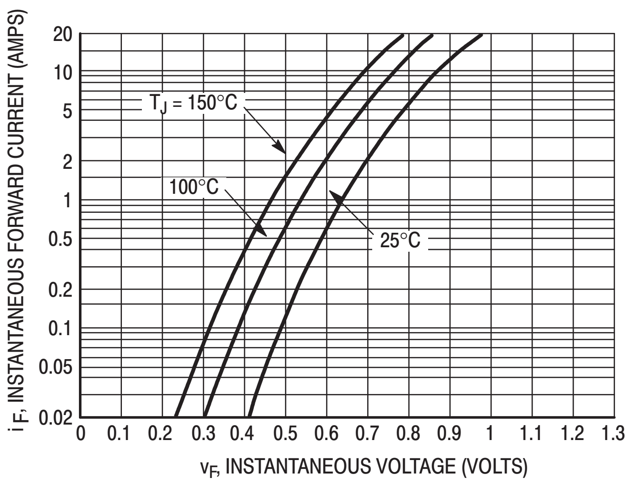

Figure 1. Typical Forward Voltage

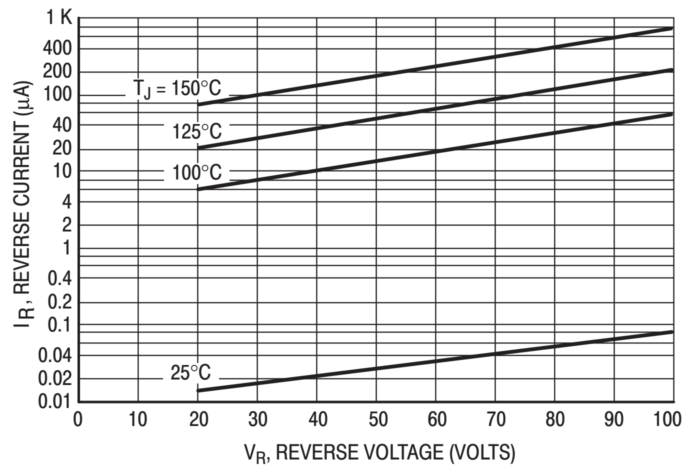

Figure 2. Typical Reverse Current*

*The curves shown are typical for the highest voltage device in the voltage grouping. Typical reverse current for lower voltage selections can be estimated from these curves if V_R is sufficient below rated V_R.

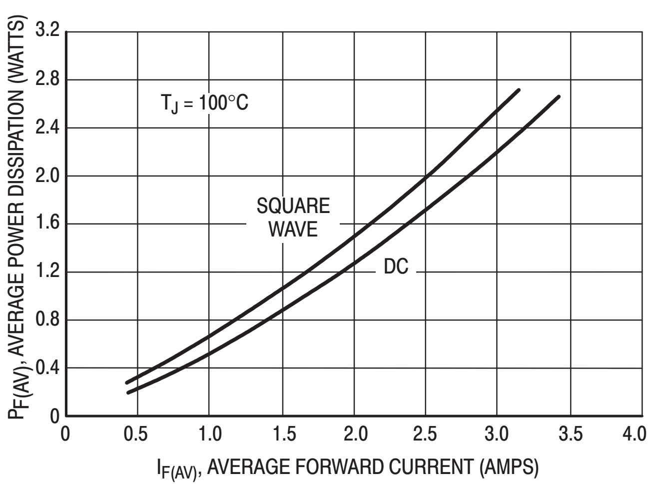

Figure 3. Power Dissipation

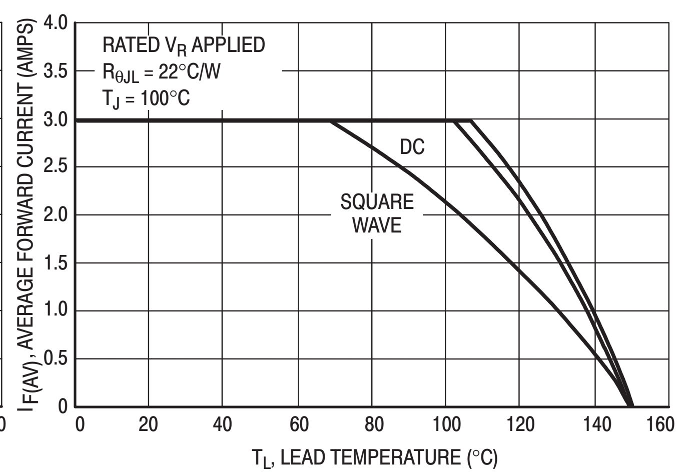

Figure 4. Current Derating, Lead

TYPICAL ELECTRICAL CHARACTERISTICS

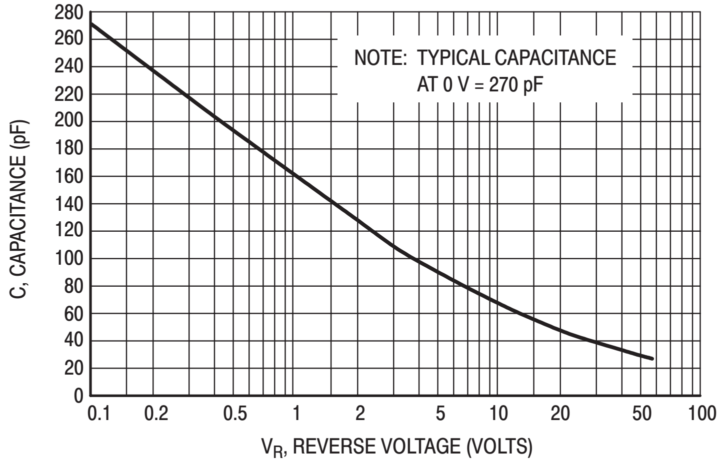

Figure 5. Typical Capacitance

MBRS1540T3

Surface Mount Schottky Power Rectifier

SMB Power Surface Mount Package

. . . employing the Schottky Barrier principle in a metal–to–silicon power rectifier. Features epitaxial construction with oxide passivation and metal overlay contact. Ideally suited for low voltage, high frequency switching power supplies; free wheeling diodes and polarity protection diodes.

- Compact Package with J–Bend Leads Ideal for Automated Handling
- Highly Stable Oxide Passivated Junction
- Guardring for Over–Voltage Protection
- Low Forward Voltage Drop

Mechanical Characteristics:

- Case: Molded Epoxy
- Epoxy Meets UL94, VO at 1/8″
- Weight: 95 mg (approximately)
- Cathode Polarity Band
- Lead and Mounting Surface Temperature for Soldering Purposes: 260°C Max. for 10 Seconds
- Available in 12 mm Tape, 2500 Units per 13″ Reel, Add “T3” Suffix to Part Number
- Finish: All External Surfaces Corrosion Resistant and Terminal Leads are Readily Solderable
- Marking: BGJ

MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Peak Repetitive Reverse Voltage Working Peak Reverse Voltage DC Blocking Voltage	V_{RRM} V_{RWM} V_R	40	V
Average Rectified Forward Current (At Rated V_R, T_C = 100°C)	I_O	1.5	A
Peak Repetitive Forward Current (At Rated V_R, Square Wave, 100 kHz, T_C = 105°C)	I_{FRM}	3.0	A
Non–Repetitive Peak Surge Current (Surge Applied at Rated Load Conditions Halfwave, Single Phase, 60 Hz)	I_{FSM}	40	A
Storage/Operating Case Temperature	T_{stg}, T_C	–55 to +150	°C
Operating Junction Temperature	T_J	–55 to +125	°C
Voltage Rate of Change (Rated V_R, T_J = 25°C)	dv/dt	10,000	V/μs

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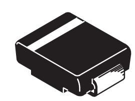
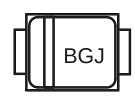
SCHOTTKY BARRIER RECTIFIER
1.5 AMPERES
40 VOLTS



SMB
CASE 403A
PLASTIC

MARKING DIAGRAM



BGJ = Device Code

ORDERING INFORMATION

Device	Package	Shipping
MBRS1540T3	SMB	2500/Tape & Reel

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THERMAL CHARACTERISTICS

Characteristic	Symbol	Value	Unit
Thermal Resistance — Junction–to–Lead (Note 1.) Thermal Resistance — Junction–to–Ambient (Note 2.)	$R_{\theta JL}$ $R_{\theta JA}$	24 80	°C/W

ELECTRICAL CHARACTERISTICS

Characteristic	Symbol	T_J = 25°C	T_J = 125°C / 100°C	Unit
Maximum Instantaneous Forward Voltage (Note 3.)	v_F	**T_J = 25°C**	**T_J = 125°C**	Volts
(i_F = 1.5 A)		0.46	0.39	
see Figure 2 (i_F = 3.0 A)		0.54	0.54	
Maximum Instantaneous Reverse Current (Note 3.)	I_R	**T_J = 25°C**	**T_J = 100°C**	mA
(V_R = 40 V)		0.8	5.7	
see Figure 4 (V_R = 20 V)		0.1	1.6	

1. Mounted with minimum recommended pad size, PC Board FR4.
2. 1 inch square pad size (1 x 0.5 inch for each lead) on FR4 board.
3. Pulse Test: Pulse Width ≤ 250 µs, Duty Cycle ≤ 2.0%.

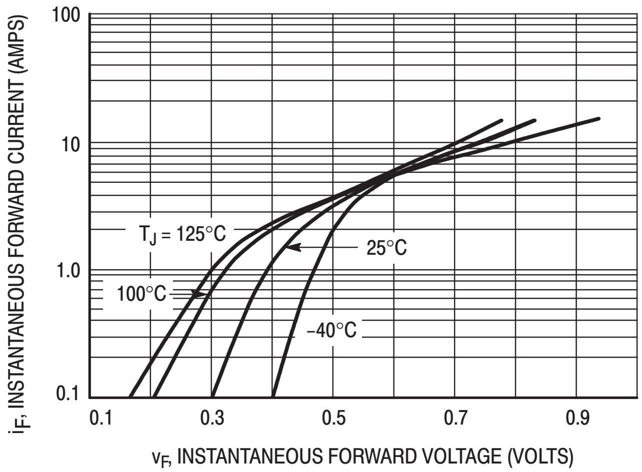

Figure 1. Typical Forward Voltage

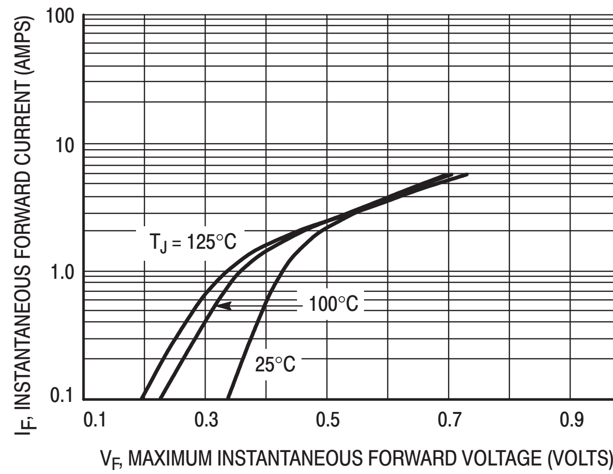

Figure 2. Maximum Forward Voltage

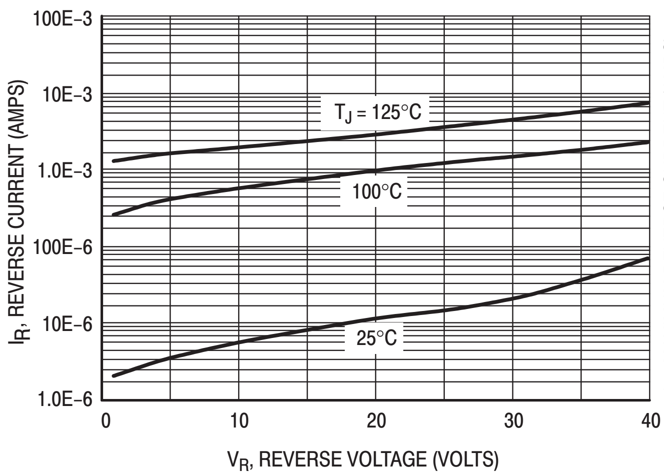

Figure 3. Typical Reverse Current

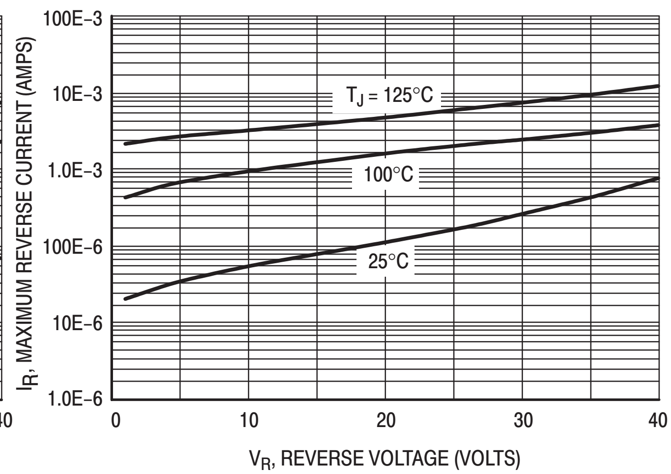

Figure 4. Maximum Reverse Current

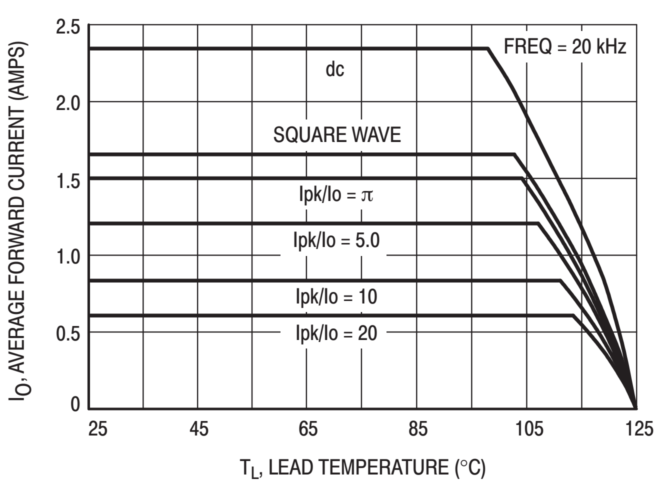

Figure 5. Current Derating

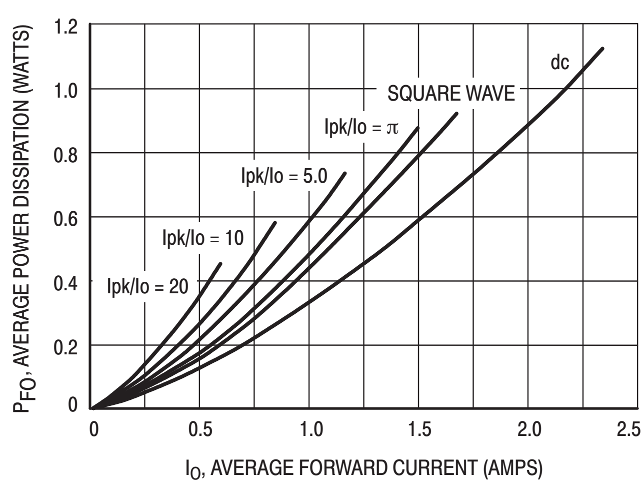

Figure 6. Forward Power Dissipation

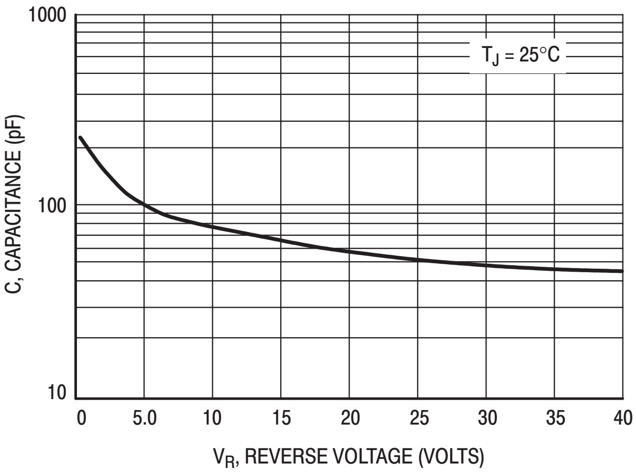

Figure 7. Capacitance

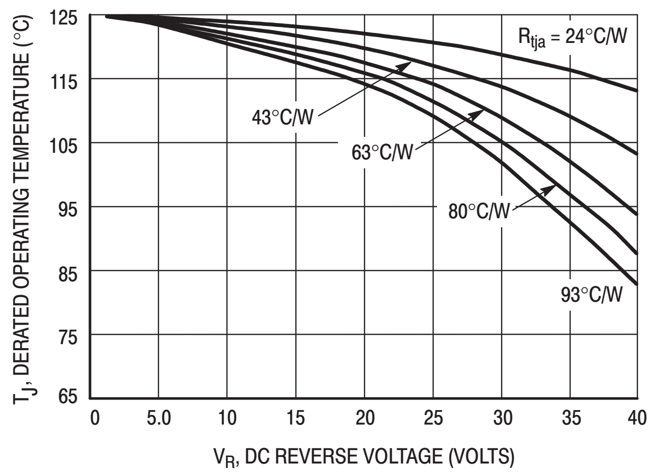

Figure 8. Typical Operating Temperature Derating*

* Reverse power dissipation and the possibility of thermal runaway must be considered when operating this device under any reverse voltage conditions. Calculations of T_J therefore must include forward and reverse power effects. The allowable operating T_J may be calculated from the equation: $T_J = T_{Jmax} - r(t)(Pf + Pr)$ where

r(t) = thermal impedance under given conditions,

Pf = forward power dissipation, and

Pr = reverse power dissipation

This graph displays the derated allowable T_J due to reverse bias under DC conditions only and is calculated as $T_J = T_{Jmax} - r(t)Pr$, where r(t) = Rthja. For other power applications further calculations must be performed.

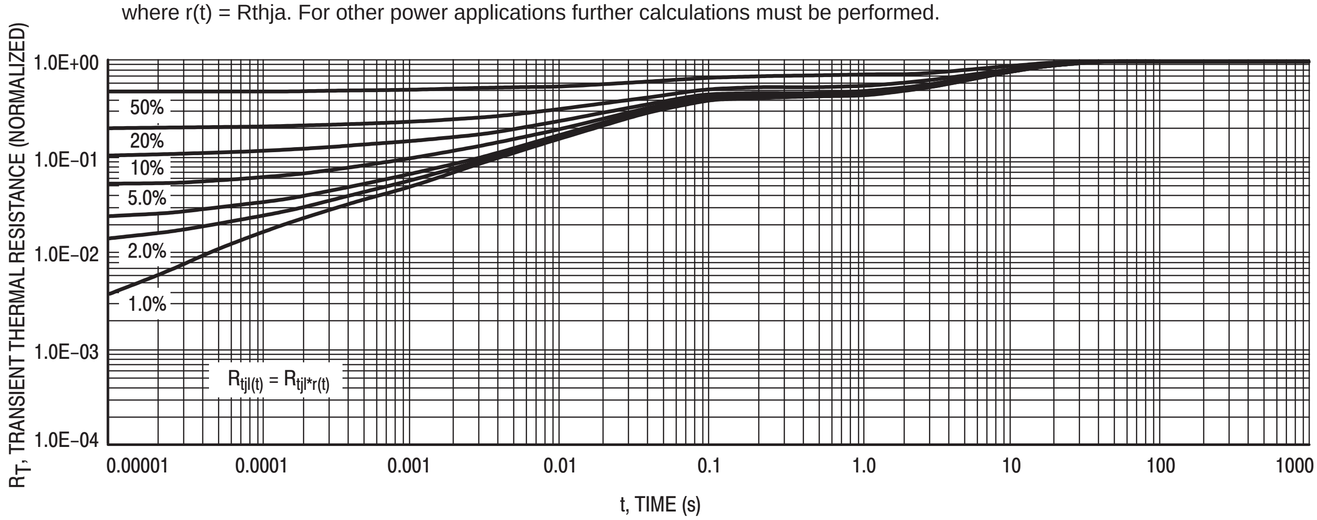

Figure 9. Thermal Response — Junction to Case

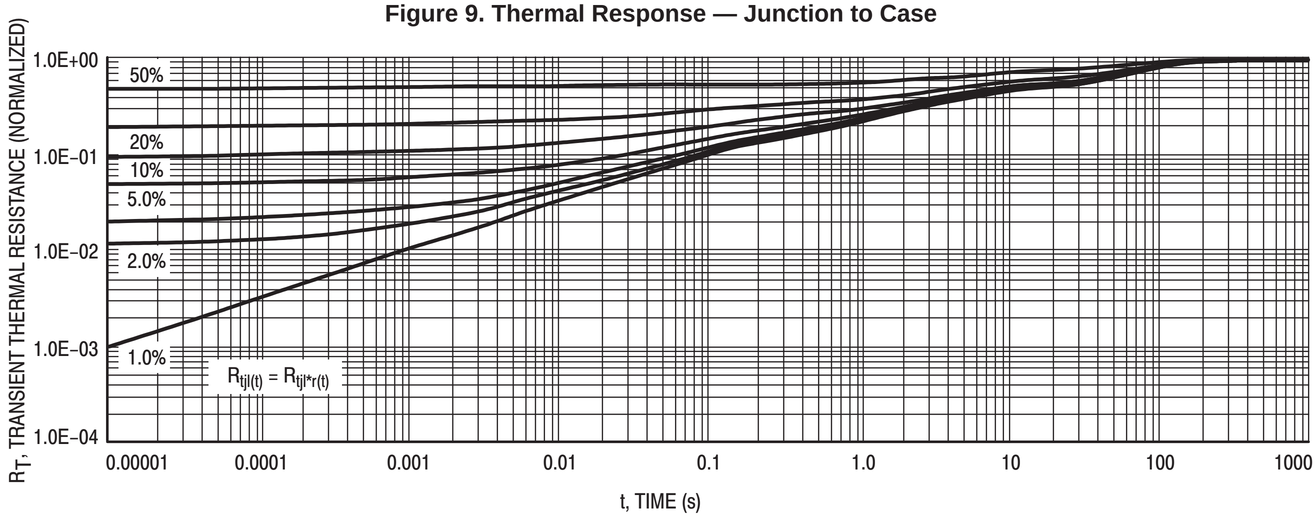

Figure 10. Thermal Response — Junction to Ambient

MBRS240LT3

Surface Mount Schottky Power Rectifier

SMB Power Surface Mount Package

. . . employing the Schottky Barrier principle in a metal–to–silicon power rectifier. Features epitaxial construction with oxide passivation and metal overlay contact. Ideally suited for low voltage, high frequency switching power supplies; free wheeling diodes and polarity protection diodes.

- Compact Package with J–Bend Leads Ideal for Automated Handling
- Highly Stable Oxide Passivated Junction
- Guardring for Over–Voltage Protection
- Low Forward Voltage Drop

Mechanical Characteristics:

- Case: Molded Epoxy
- Epoxy Meets UL94, VO at 1/8″
- Weight: 95 mg (approximately)
- Cathode Polarity Band
- Maximum Temperature of 260°C/10 Seconds for Soldering
- Available in 12 mm Tape, 2500 Units per 13″ Reel, Add “T3” Suffix to Part Number
- Finish: All External Surfaces Corrosion Resistant and Terminal Leads are Readily Solderable
- Marking: 2BL4

MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Peak Repetitive Reverse Voltage Working Peak Reverse Voltage DC Blocking Voltage	V_{RRM} V_{RWM} V_R	40	V
Average Rectified Forward Current (At Rated V_R, T_C = 100°C)	I_O	2.0	A
Peak Repetitive Forward Current (At Rated V_R, Square Wave, 20 kHz, T_C = 105°C)	I_{FRM}	4.0	A
Non–Repetitive Peak Surge Current (Surge Applied at Rated Load Conditions Halfwave, Single Phase, 60 Hz)	I_{FSM}	25	A
Storage/Operating Case Temperature	T_{stg}, T_C	–55 to +150	°C
Operating Junction Temperature	T_J	–55 to +125	°C
Voltage Rate of Change (Rated V_R, T_J = 25°C)	dv/dt	10,000	V/μs

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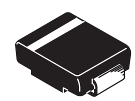
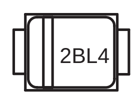
SCHOTTKY BARRIER RECTIFIER
2.0 AMPERES
40 VOLTS



SMB
CASE 403A
PLASTIC

MARKING DIAGRAM



2BL4 = Device Code

ORDERING INFORMATION

Device	Package	Shipping
MBRS240LT3	SMB	2500/Tape & Reel

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THERMAL CHARACTERISTICS

Characteristic	Symbol	Value	Unit
Thermal Resistance — Junction–to–Lead (Note 1.) Thermal Resistance — Junction–to–Ambient (Note 3.)	$R_{\theta JL}$ $R_{\theta JA}$	18 78	°C/W

ELECTRICAL CHARACTERISTICS

Maximum Instantaneous Forward Voltage (Note 2.)	V_F	**T_J = 25°C**	**T_J = 125°C**	Volts
(I_F = 2.0 A) see Figure 2 (I_F = 4.0 A)		0.43 0.54	0.375 0.55	
Maximum Instantaneous Reverse Current (Note 2.)	I_R	**T_J = 25°C**	**T_J = 100°C**	mA
(V_R = 40 V) see Figure 4 (V_R = 20 V)		2.0 0.5	60 40	

1. Mounted with minimum recommended pad size, PC Board FR4.
2. Pulse Test: Pulse Width ≤ 250 µs, Duty Cycle ≤ 2.0%.
3. 1 inch square pad size (1 x 0.5 inch for each lead) on FR4 board.

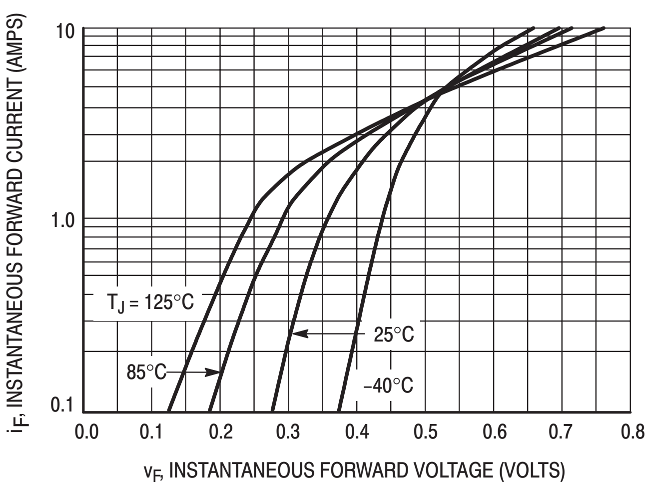

Figure 1. Typical Forward Voltage

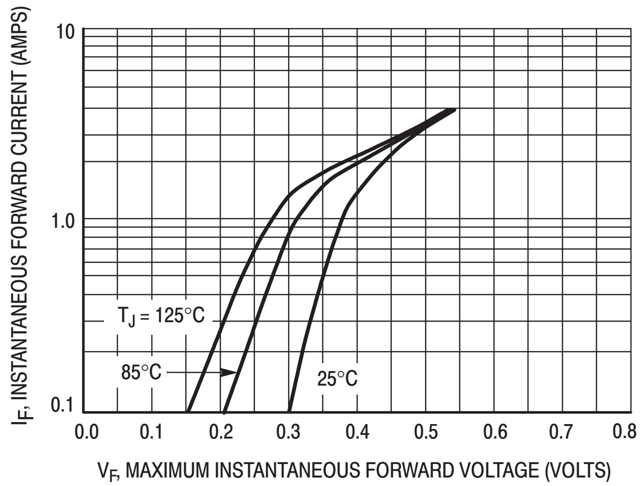

Figure 2. Maximum Forward Voltage

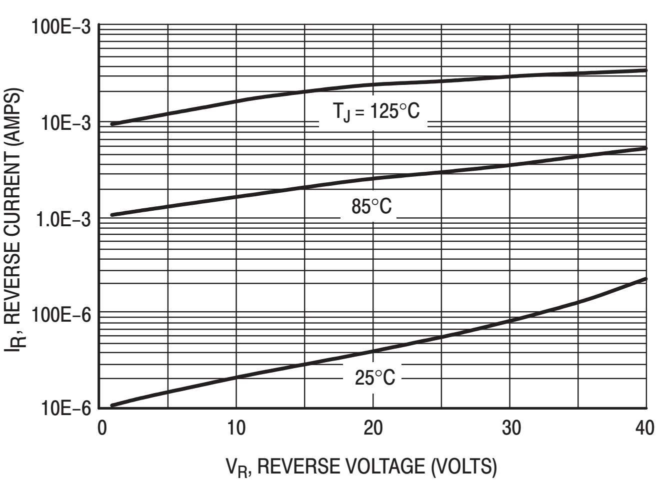

Figure 3. Typical Reverse Current

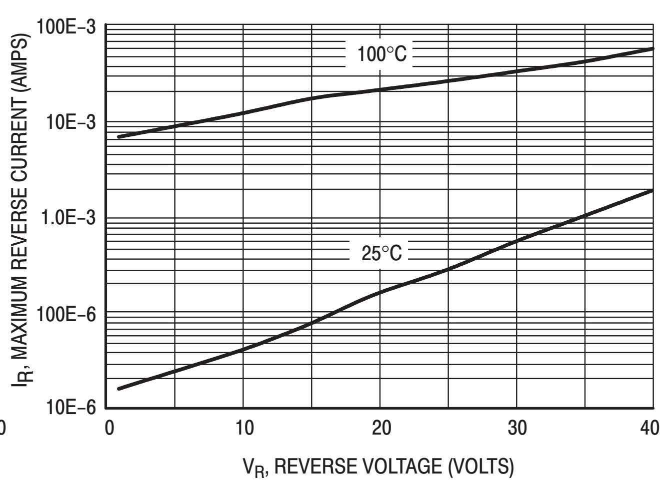

Figure 4. Maximum Reverse Current

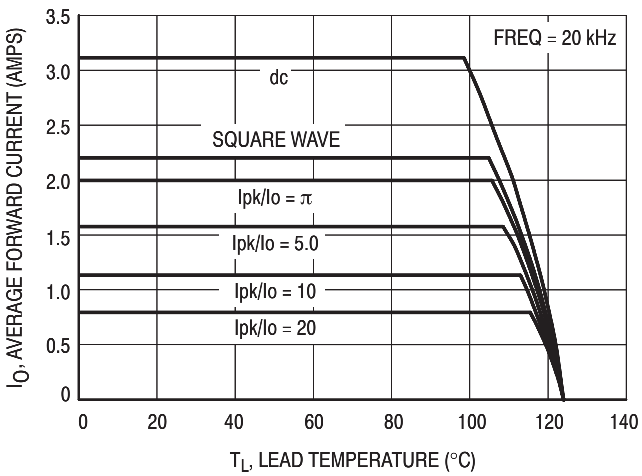

Figure 5. Current Derating

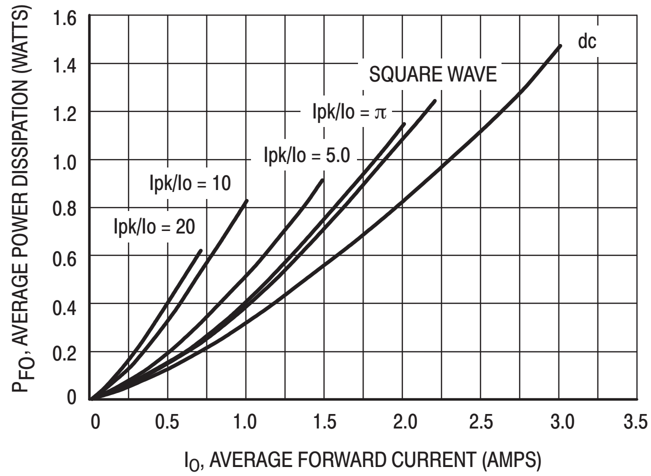

Figure 6. Forward Power Dissipation

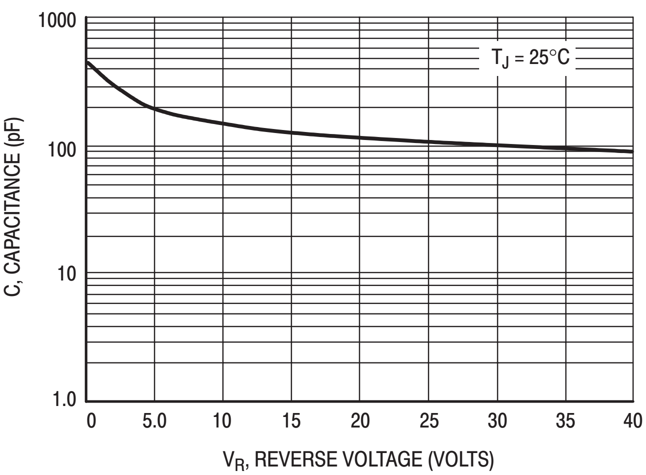

Figure 7. Capacitance

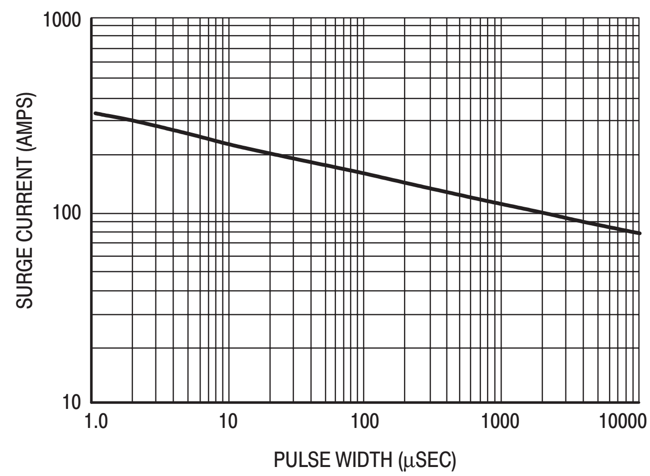

Figure 8. Maximum Non–Repetitive Forward Surge Current

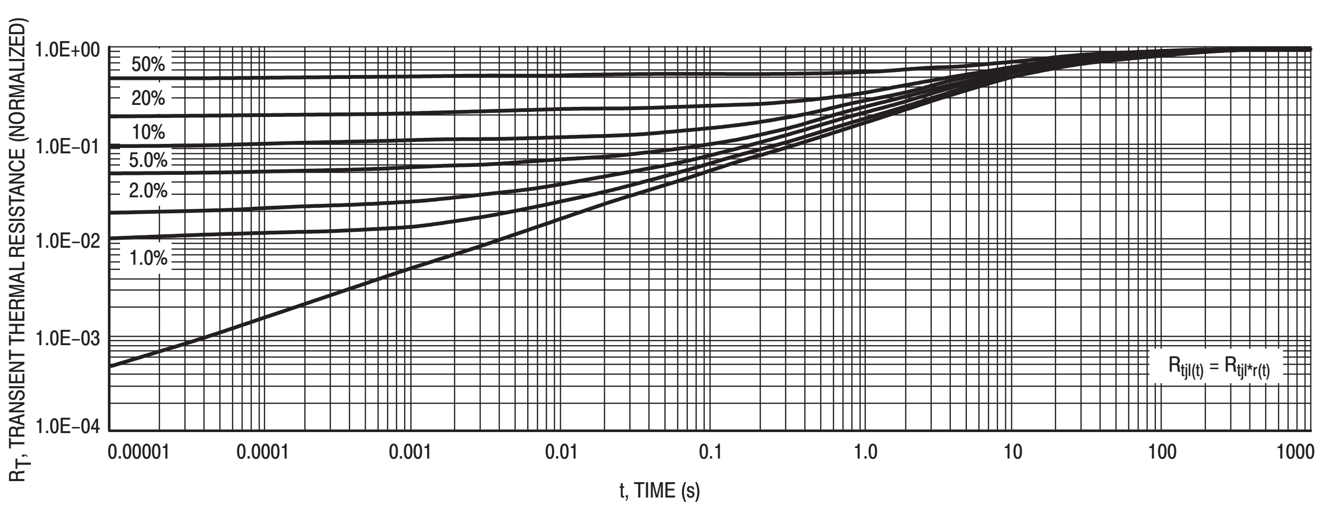

Figure 9. Thermal Response

MBRS2040LT3

Surface Mount Schottky Power Rectifier

SMB Power Surface Mount Package

. . . employing the Schottky Barrier principle in a metal–to–silicon power rectifier. Features epitaxial construction with oxide passivation and metal overlay contact. Ideally suited for low voltage, high frequency switching power supplies; free wheeling diodes and polarity protection diodes.

- Compact Package with J–Bend Leads Ideal for Automated Handling
- Highly Stable Oxide Passivated Junction
- Guardring for Over–Voltage Protection
- Low Forward Voltage Drop

Mechanical Characteristics:

- Case: Molded Epoxy
- Epoxy Meets UL94, VO at 1/8″
- Weight: 95 mg (approximately)
- Maximum Temperature of 260°C / 10 Seconds for Soldering
- Cathode Polarity Band
- Available in 12 mm Tape, 2500 Units per 13 inch Reel, Add “T3” Suffix to Part Number
- Finish: All External Surfaces Corrosion Resistant and Terminal Leads are Readily Solderable
- Marking: BKJL

MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Peak Repetitive Reverse Voltage Working Peak Reverse Voltage DC Blocking Voltage	V_{RRM} V_{RWM} V_R	40	V
Average Rectified Forward Current (At Rated V_R, T_C = 103°C)	I_O	2.0	A
Peak Repetitive Forward Current (At Rated V_R, Square Wave, 20 kHz, T_C = 104°C)	I_{FRM}	4.0	A
Non–Repetitive Peak Surge Current (Surge Applied at Rated Load Conditions Halfwave, Single Phase, 60 Hz)	I_{FSM}	70	A
Storage/Operating Case Temperature	T_{stg}, T_C	–55 to +150	°C
Operating Junction Temperature	T_J	–55 to +125	°C
Voltage Rate of Change (Rated V_R, T_J = 25°C)	dv/dt	10,000	V/μs

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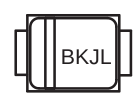
SCHOTTKY BARRIER RECTIFIER
2.0 AMPERES
40 VOLTS

SMB
CASE 403A
PLASTIC

MARKING DIAGRAM



BKJL = Device Code

ORDERING INFORMATION

Device	Package	Shipping
MBRS2040LT3	SMB	2500/Tape & Reel

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THERMAL CHARACTERISTICS

Characteristic	Symbol	Value	Unit
Thermal Resistance — Junction–to–Lead (Note 1.) Thermal Resistance — Junction–to–Ambient (Note 2.)	$R_{\theta JL}$ $R_{\theta JA}$	22.5 78	°C/W

ELECTRICAL CHARACTERISTICS

Maximum Instantaneous Forward Voltage (Note 3.)	V_F	**T_J = 25°C**	**T_J = 125°C**	Volts
(I_F = 2.0 A) see Figure 2 (I_F = 4.0 A)		0.43 0.50	0.34 0.45	
Maximum Instantaneous Reverse Current (Note 3.)	I_R	**T_J = 25°C**	**T_J = 100°C**	mA
(V_R = 40 V) see Figure 4 (V_R = 20 V)		0.8 0.1	20 6.0	

1. Minimum pad size (0.108 X 0.085 inch) for each lead on FR4 board.
2. 1 inch square pad size (1 x 0.5 inch for each lead) on FR4 board.
3. Pulse Test: Pulse Width ≤ 250 μs, Duty Cycle ≤ 2.0%.

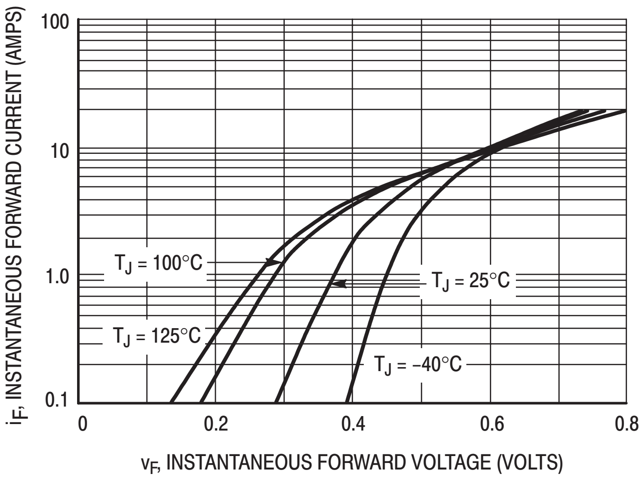

Figure 1. Typical Forward Voltage

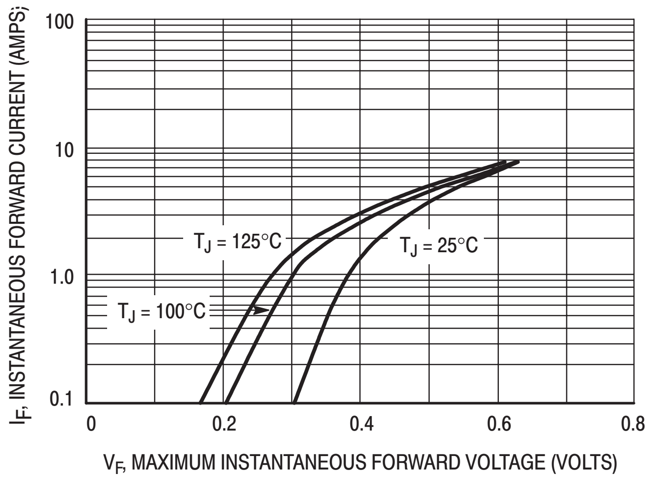

Figure 2. Maximum Forward Voltage

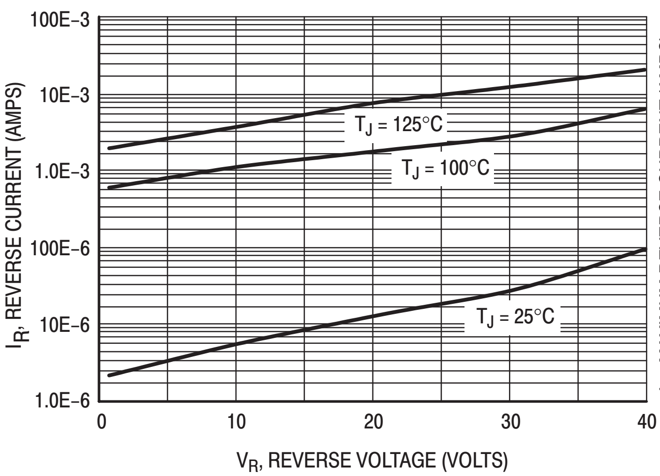

Figure 3. Typical Reverse Current

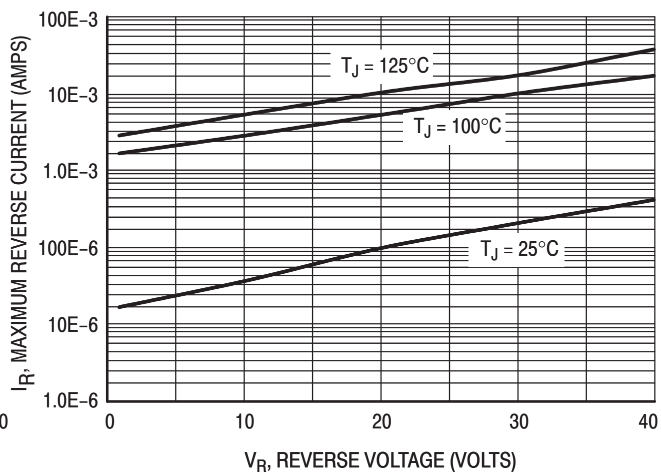

Figure 4. Maximum Reverse Current

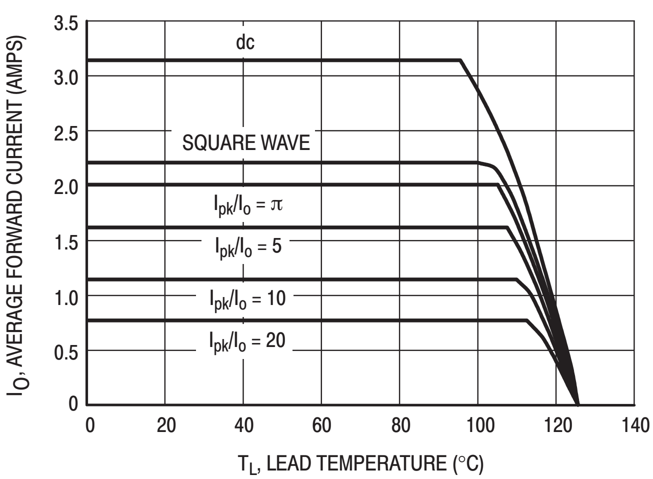

Figure 5. Current Derating

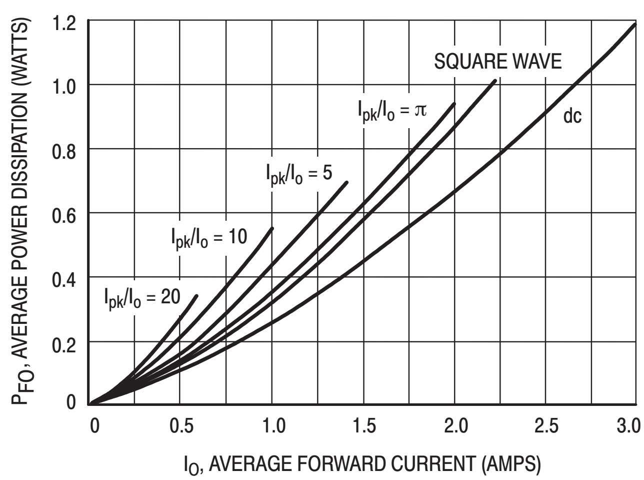

Figure 6. Forward Power Dissipation

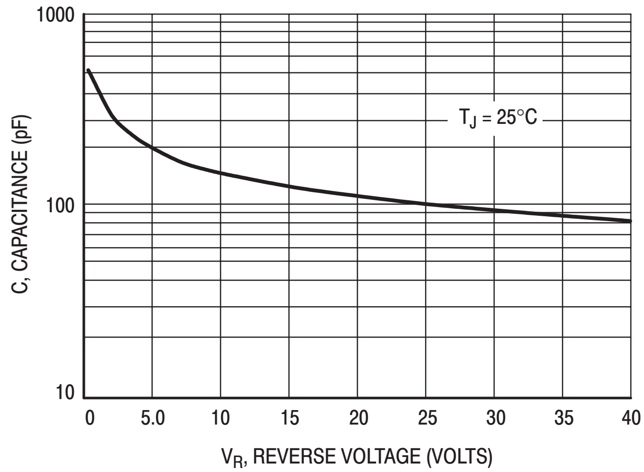

Figure 7. Capacitance

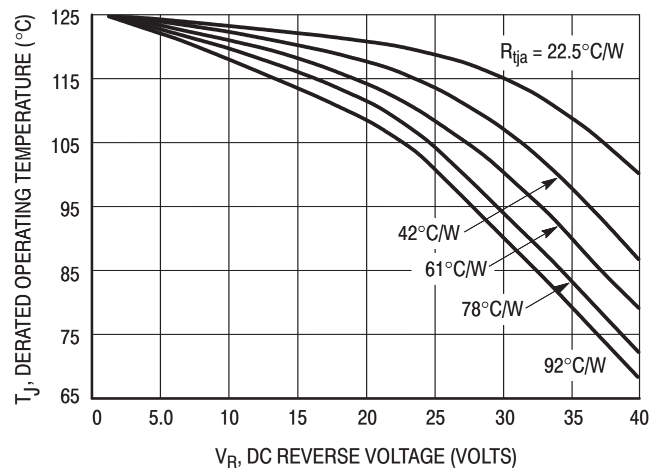

Figure 8. Typical Operating Temperature Derating*

* Reverse power dissipation and the possibility of thermal runaway must be considered when operating this device under any reverse voltage conditions. Calculations of T_J therefore must include forward and reverse power effects. The allowable operating T_J may be calculated from the equation: $T_J = T_{Jmax} - r(t)(Pf + Pr)$ where
r(t) = thermal impedance under given conditions,
Pf = forward power dissipation, and
Pr = reverse power dissipation

This graph displays the derated allowable T_J due to reverse bias under DC conditions only and is calculated as $T_J = T_{Jmax} - r(t)Pr$, where r(t) = Rthja. For other power applications further calculations must be performed.

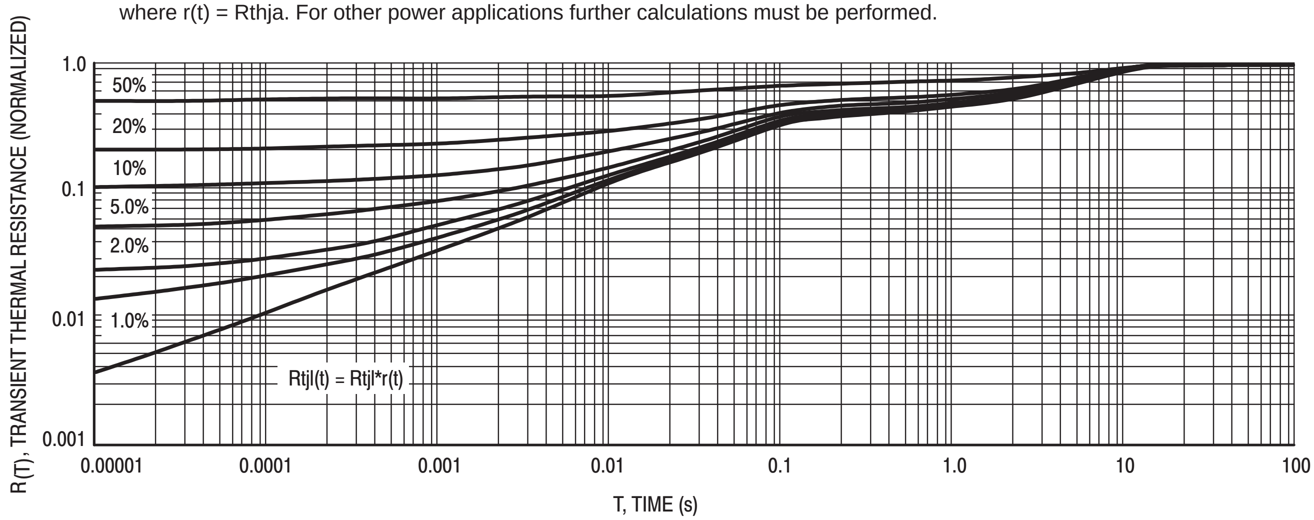

Figure 9. Thermal Response Junction to Lead

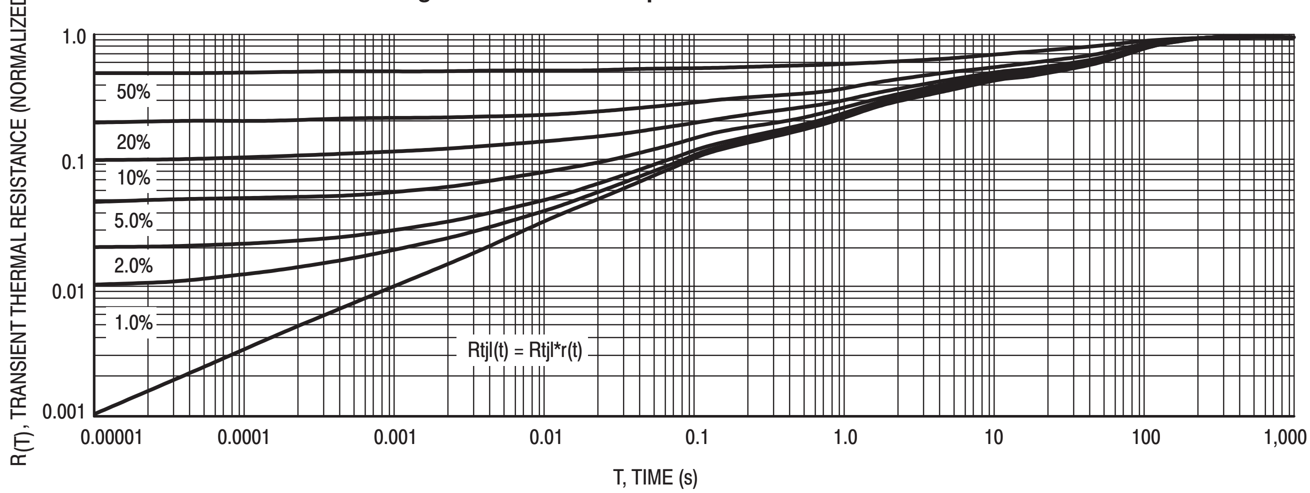

Figure 10. Thermal Response Junction to Ambient

MBRS320T3, MBRS330T3, MBRS340T3, MBRS360T3

Preferred Devices

Surface Mount Schottky Power Rectifier

. . . employing the Schottky Barrier principle in a large area metal–to–silicon power diode. State–of–the–art geometry features epitaxial construction with oxide passivation and metal overlay contact. Ideally suited for low voltage, high frequency rectification, or as free wheeling and polarity protection diodes, in surface mount applications where compact size and weight are critical to the system.

- Small Compact Surface Mountable Package with J–Bend Leads
- Rectangular Package for Automated Handling
- Highly Stable Oxide Passivated Junction
- Very Low Forward Voltage Drop (0.5 Volts Max @ 3.0 A, T_J = 25°C)
- Excellent Ability to Withstand Reverse Avalanche Energy Transients
- Guardring for Stress Protection

Mechanical Characteristics:

- Case: Epoxy, Molded
- Weight: 217 mg (approximately)
- Finish: All External Surfaces Corrosion Resistant and Terminal Leads are Readily Solderable
- Lead and Mounting Surface Temperature for Soldering Purposes: 260°C Max. for 10 Seconds
- Shipped in 16 mm Tape and Reel, 2500 units per reel
- Polarity: Notch in Plastic Body Indicates Cathode Lead
- Marking: B32, B33, B34, B36

MAXIMUM RATINGS

Please See the Table on the Following Page

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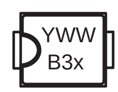
SCHOTTKY BARRIER RECTIFIERS 3.0 AMPERES 20, 30, 40, 60 VOLTS

SMC CASE 403 PLASTIC

MARKING DIAGRAM



B3x = Device Code
x = 2, 3, 4 or 6
Y = Year
W = Work Week

ORDERING INFORMATION

Device	Package	Shipping
MBRS320T3	SMC	2500/Tape & Reel
MBRS330T3	SMC	2500/Tape & Reel
MBRS340T3	SMC	2500/Tape & Reel
MBRS360T3	SMC	2500/Tape & Reel

Preferred devices are recommended choices for future use and best overall value.

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MAXIMUM RATINGS

Rating	Symbol	MBRS320T3	MBRS330T3	MBRS340T3	MBRS360T3	Unit
Peak Repetitive Reverse Voltage Working Peak Reverse Voltage DC Blocking Voltage	V_{RRM} V_{RWM} V_R	20	30	40	60	Volts
Average Rectified Forward Current	$I_{F(AV)}$	3.0 @ T_L = 100°C 4.0 @ T_L = 90°C				Amps
Nonrepetitive Peak Surge Current (Surge applied at rated load conditions halfwave, single phase, 60 Hz)	I_{FSM}	80	80	80	80	Amps
Operating Junction Temperature	T_J	– 65 to +125	– 65 to +125	– 65 to +125		°C

THERMAL CHARACTERISTICS

Thermal Resistance — Junction to Lead	$R_{\theta JL}$	11	11	11	11	°C/W

ELECTRICAL CHARACTERISTICS

Maximum Instantaneous Forward Voltage (Note 1.) (i_F = 3.0 A, T_J = 25°C)	V_F	0.50	0.50	0.525	0.740	Volts
Maximum Instantaneous Reverse Current (Note 1.) (Rated dc Voltage, T_J = 25°C) (Rated dc Voltage, T_J = 100°C)	i_R	 2.0 20	 2.0 20	 2.0 20	 0.5 20	mA

1. Pulse Test: Pulse Width = 300 µs, Duty Cycle ≤ 2.0%.

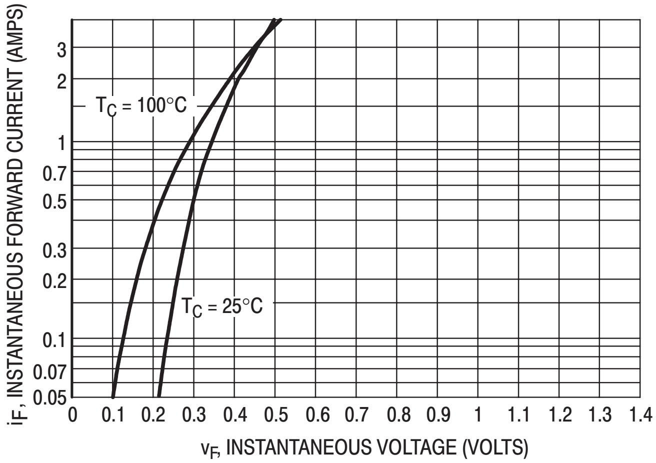

Figure 1. Typical Forward Voltage

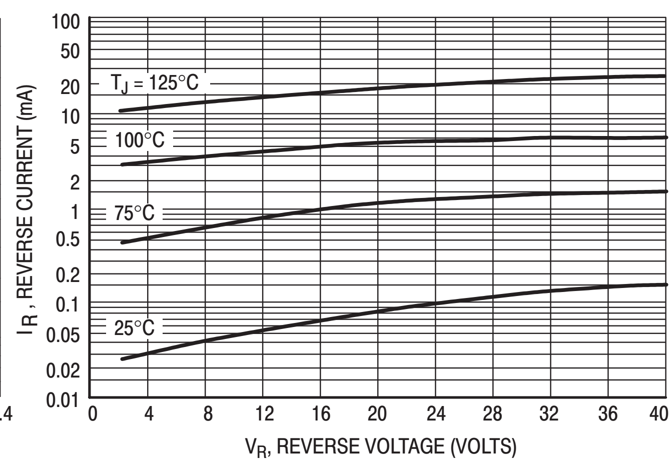

Figure 2. Typical Reverse Current

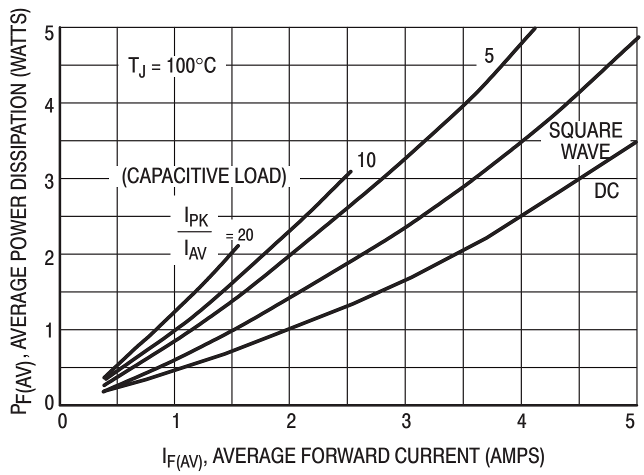

Figure 3. Power Dissipation

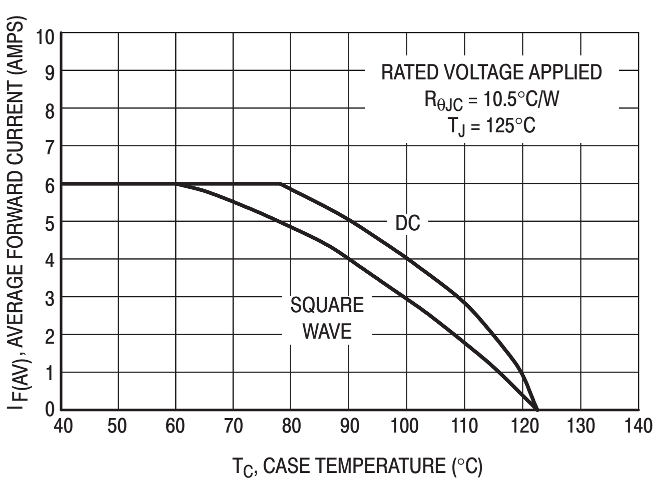

Figure 4. Current Derating (Case)

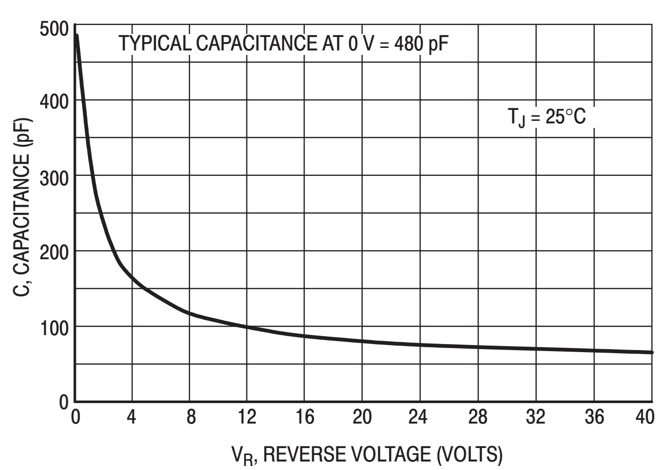

Figure 5. Typical Capacitance

MBRD320, MBRD330, MBRD340, MBRD350, MBRD360

MBRD320, MBRD340 and MBRD360 are Preferred Devices

SWITCHMODE™ Power Rectifiers

DPAK Surface Mount Package

. . . designed for use as output rectifiers, free wheeling, protection and steering diodes in switching power supplies, inverters and other inductive switching circuits. These state–of–the–art devices have the following features:

- Extremely Fast Switching
- Extremely Low Forward Drop
- Platinum Barrier with Avalanche Guardrings

Mechanical Characteristics:

- Case: Epoxy, Molded
- Weight: 0.4 gram (approximately)
- Finish: All External Surfaces Corrosion Resistant and Terminal Leads are Readily Solderable
- Lead and Mounting Surface Temperature for Soldering Purposes: 260°C Max. for 10 Seconds
- Shipped 75 units per plastic tube
- Available in 16 mm Tape and Reel, 2500 units per reel, by adding a "T4'' suffix to the part number
- Marking: B320, B330, B340, B350, B360

MAXIMUM RATINGS

Please See the Table on the Following Page

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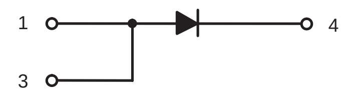
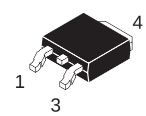
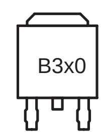
SCHOTTKY BARRIER RECTIFIERS 3.0 AMPERES 20 TO 60 VOLTS





DPAK CASE 369A PLASTIC

MARKING DIAGRAM



B3x0 = Device Code
x = 2, 3, 4, 5 or 6

ORDERING INFORMATION

Device	Package	Shipping
MBRD320	DPAK	75 Units/Rail
MBRD320RL	DPAK	1800/Tape & Reel
MBRD320T4	DPAK	2500/Tape & Reel
MBRD330	DPAK	75 Units/Rail
MBRD330RL	DPAK	1800/Tape & Reel
MBRD330T4	DPAK	2500/Tape & Reel
MBRD340	DPAK	75 Units/Rail
MBRD340RL	DPAK	1800/Tape & Reel
MBRD340T4	DPAK	2500/Tape & Reel
MBRD350	DPAK	75 Units/Rail
MBRD350RL	DPAK	1800/Tape & Reel
MBRD350T4	DPAK	2500/Tape & Reel
MBRD360	DPAK	75 Units/Rail
MBRD360RL	DPAK	1800/Tape & Reel
MBRD360T4	DPAK	2500/Tape & Reel

Preferred devices are recommended choices for future use and best overall value.

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MAXIMUM RATINGS

Rating	Symbol	MBRD					Unit
		320	330	340	350	360	
Peak Repetitive Reverse Voltage Working Peak Reverse Voltage DC Blocking Voltage	V_{RRM} V_{RWM} V_R	20	30	40	50	60	Volts
Average Rectified Forward Current (T_C = +125°C, Rated V_R)	$I_{F(AV)}$	3					Amps
Peak Repetitive Forward Current, T_C = +125°C (Rated V_R, Square Wave, 20 kHz)	I_{FRM}	6					Amps
Nonrepetitive Peak Surge Current (Surge applied at rated load conditions halfwave, single phase, 60 Hz)	I_{FSM}	75					Amps
Peak Repetitive Reverse Surge Current (2 μs, 1 kHz)	I_{RRM}	1					Amp
Operating Junction Temperature Range	T_J	–65 to +150					°C
Storage Temperature Range	T_{stg}	–65 to +175					°C
Voltage Rate of Change (Rated V_R)	dv/dt	10,000					V/μs

THERMAL CHARACTERISTICS

Maximum Thermal Resistance, Junction to Case	$R_{\theta JC}$	6	°C/W
Maximum Thermal Resistance, Junction to Ambient (Note 1.)	$R_{\theta JA}$	80	°C/W

ELECTRICAL CHARACTERISTICS

Maximum Instantaneous Forward Voltage (Note 2.) i_F = 3 Amps, T_C = +25°C i_F = 3 Amps, T_C = +125°C i_F = 6 Amps, T_C = +25°C i_F = 6 Amps, T_C = +125°C	V_F	 0.6 0.45 0.7 0.625	Volts
Maximum Instantaneous Reverse Current (Note 2.) (Rated dc Voltage, T_C = +25°C) (Rated dc Voltage, T_C = +125°C)	i_R	 0.2 20	mA

1. Rating applies when surface mounted on the minimum pad size recommended.
2. Pulse Test: Pulse Width = 300 μs, Duty Cycle ≤ 2.0%.

TYPICAL CHARACTERISTICS

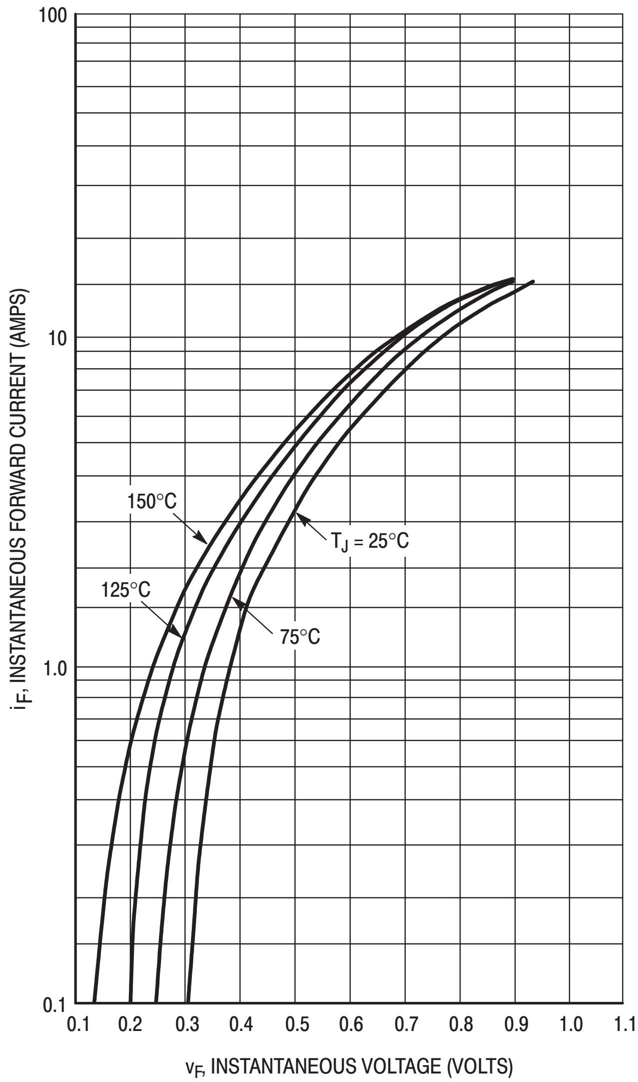
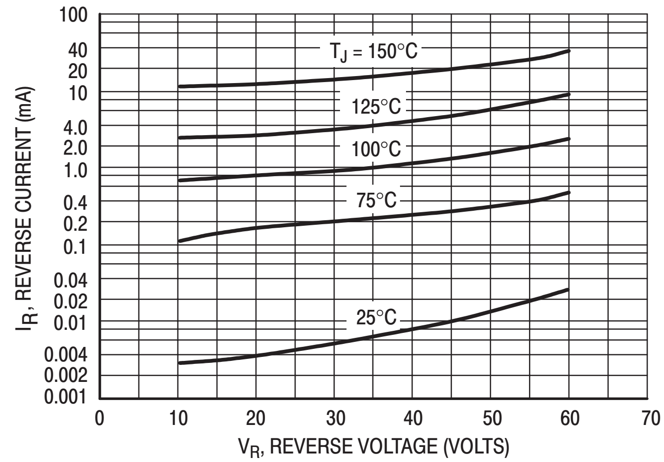


Figure 1. Typical Forward Voltage



*The curves shown are typical for the highest voltage device in the voltage grouping. Typical reverse current for lower voltage selections can be estimated from these curves if V_R is sufficient below rated V_R.

Figure 2. Typical Reverse Current

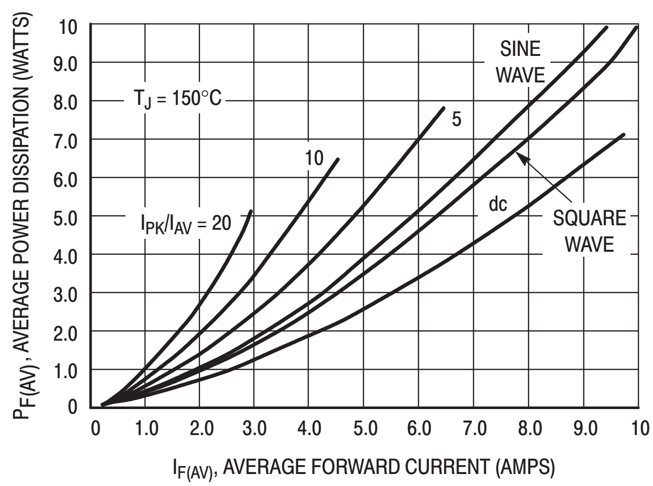


Figure 3. Average Power Dissipation

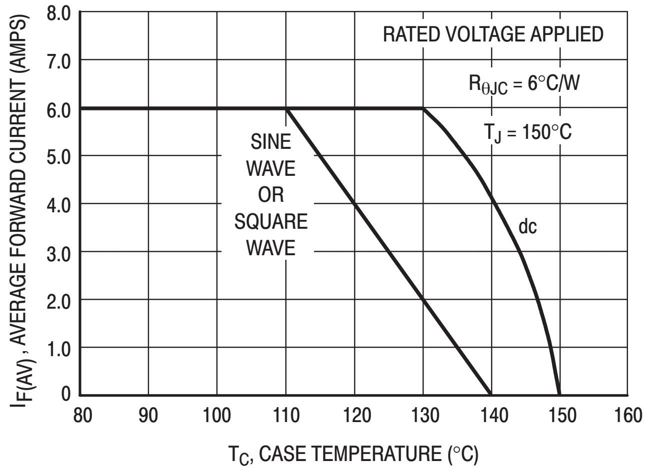


Figure 4. Current Derating, Case

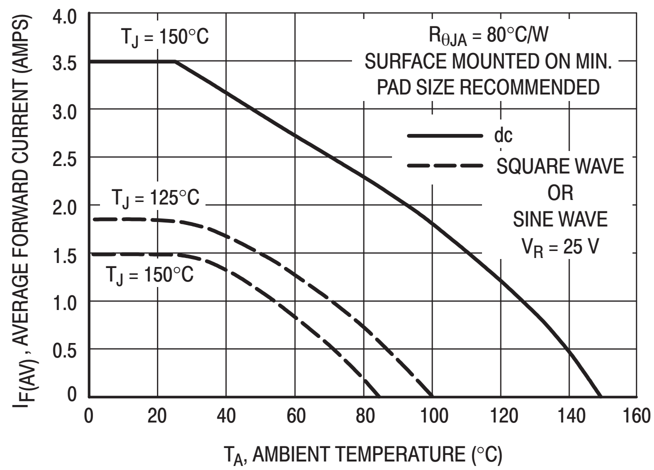


Figure 5. Current Derating, Ambient

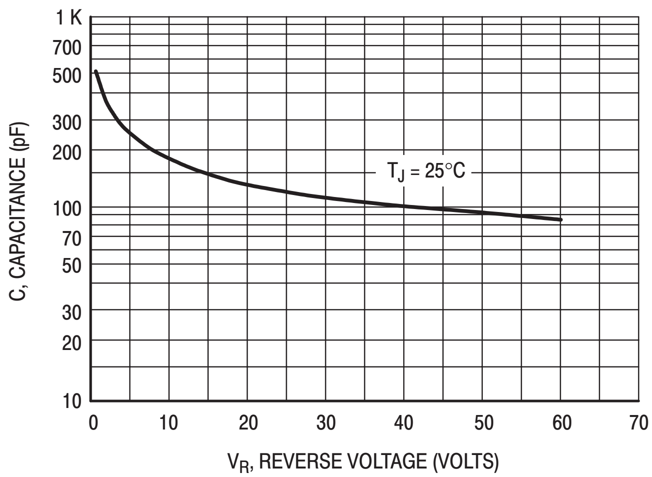


Figure 6. Typical Capacitance

MBRD620CT, MBRD630CT, MBRD640CT, MBRD650CT, MBRD660CT

MBRD620CT, MBRD640CT and MBRD660CT are Preferred Devices

SWITCHMODE™ Power Rectifiers

DPAK Surface Mount Package

. . . in switching power supplies, inverters and as free wheeling diodes, these state–of–the–art devices have the following features:

- Extremely Fast Switching
- Extremely Low Forward Drop
- Platinum Barrier with Avalanche Guardrings

Mechanical Characteristics:

- Case: Epoxy, Molded
- Weight: 0.4 gram (approximately)
- Finish: All External Surfaces Corrosion Resistant and Terminal Leads are Readily Solderable
- Lead and Mounting Surface Temperature for Soldering Purposes: 260°C Max. for 10 Seconds
- Shipped 75 units per plastic tube
- Available in 16 mm Tape and Reel, 2500 units per reel, by adding a “T4’’ suffix to the part number
- Marking: B620T, B630T, B640T, B650T, B660T

MAXIMUM RATINGS

Please See the Table on the Following Page

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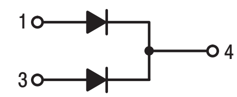
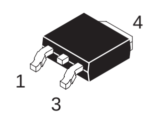
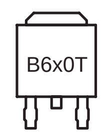
SCHOTTKY BARRIER RECTIFIERS 6.0 AMPERES 20 TO 60 VOLTS





DPAK CASE 369A PLASTIC

MARKING DIAGRAM



B6x0T = Device Code
x = 2, 3, 4, 5 or 6

ORDERING INFORMATION

Device	Package	Shipping
MBRD620CTT4	DPAK	2500/Tape & Reel
MBRD630CTT4	DPAK	2500/Tape & Reel
MBRD640CTT4	DPAK	2500/Tape & Reel
MBRD650CT	DPAK	75 Units/Rail
MBRD650CTT4	DPAK	2500/Tape & Reel
MBRD660CT	DPAK	75 Units/Rail
MBRD660CTRL	DPAK	1800/Tape & Reel
MBRD660CTT4	DPAK	2500/Tape & Reel

Preferred devices are recommended choices for future use and best overall value.

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MAXIMUM RATINGS

Rating	Symbol	MBRD					Unit
		620CT	630CT	640CT	650CT	660CT	
Peak Repetitive Reverse Voltage Working Peak Reverse Voltage DC Blocking Voltage	V_{RRM} V_{RWM} V_R	20	30	40	50	60	Volts
Average Rectified Forward Current Per Diode T_C = 130°C (Rated V_R) Per Device	$I_{F(AV)}$	3 6					Amps
Peak Repetitive Forward Current, T_C = 130°C (Rated V_R, Square Wave, 20 kHz) Per Diode	I_{FRM}	6					Amps
Nonrepetitive Peak Surge Current (Surge applied at rated load conditions halfwave, single phase, 60 Hz)	I_{FSM}	75					Amps
Peak Repetitive Reverse Surge Current (2 μs, 1 kHz)	I_{RRM}	1					Amp
Operating Junction Temperature	T_J	–65 to +150					°C
Storage Temperature	T_{stg}	–65 to +175					°C
Voltage Rate of Change (Rated V_R)	dv/dt	10,000					V/μs

THERMAL CHARACTERISTICS PER DIODE

Maximum Thermal Resistance, Junction to Case	$R_{\theta JC}$	6	°C/W
Maximum Thermal Resistance, Junction to Ambient (Note 1.)	$R_{\theta JA}$	80	°C/W

ELECTRICAL CHARACTERISTICS PER DIODE

Maximum Instantaneous Forward Voltage (Note 2.) i_F = 3 Amps, T_C = 25°C i_F = 3 Amps, T_C = 125°C i_F = 6 Amps, T_C = 25°C i_F = 6 Amps, T_C = 125°C	V_F	 0.7 0.65 0.9 0.85	Volts
Maximum Instantaneous Reverse Current (Note 2.) (Rated dc Voltage, T_C = 25°C) (Rated dc Voltage, T_C = 125°C)	i_R	 0.1 15	mA

1. Rating applies when surface mounted on the minimum pad size recommended.
2. Pulse Test: Pulse Width = 300 μs, Duty Cycle ≤ 2.0%.

TYPICAL CHARACTERISTICS

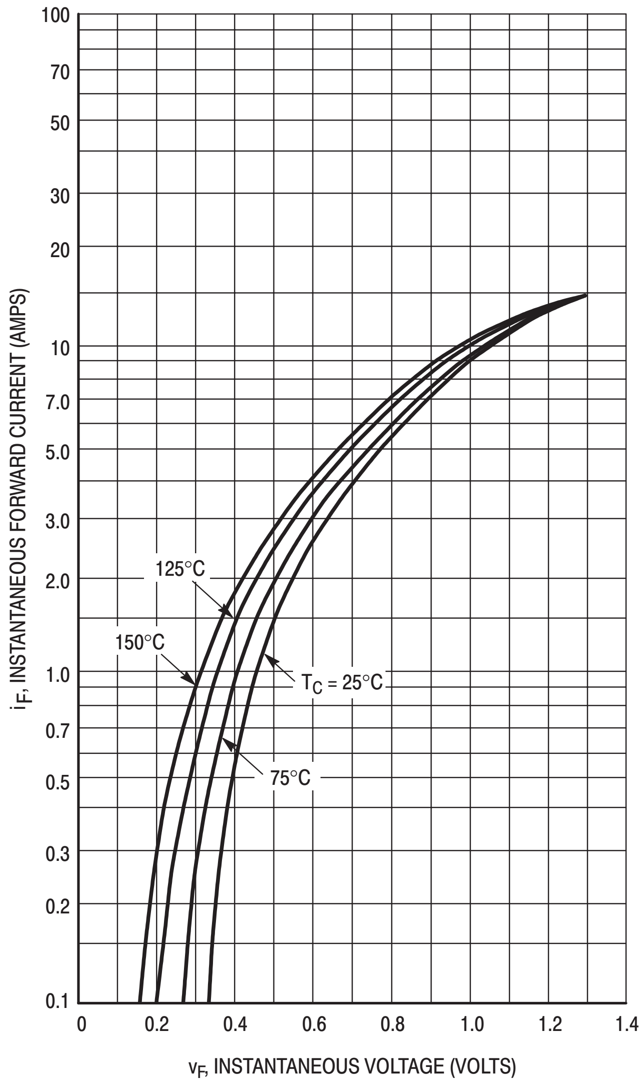
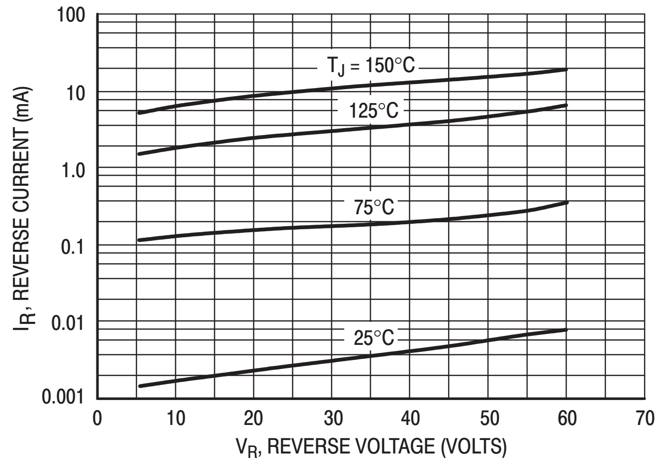


Figure 1. Typical Forward Voltage, Per Leg



*The curves shown are typical for the highest voltage device in the voltage grouping. Typical reverse current for lower voltage selections can be estimated from these curves if V_R is sufficient below rated V_R.

Figure 2. Typical Reverse Current,* Per Leg

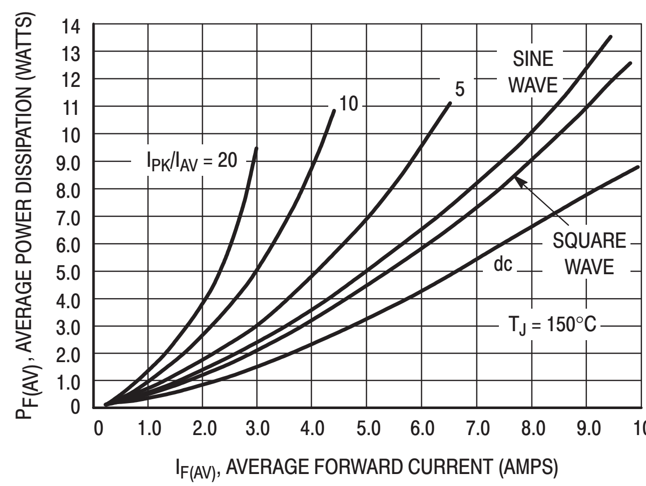


Figure 3. Average Power Dissipation, Per Leg

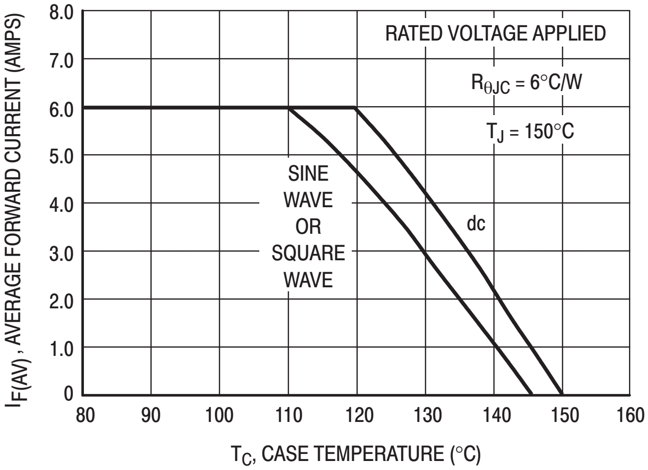


Figure 4. Current Derating, Case, Per Leg

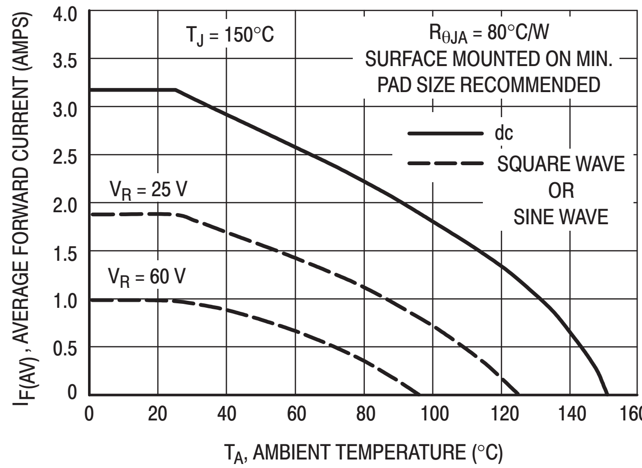


Figure 5. Current Derating, Ambient, Per Leg

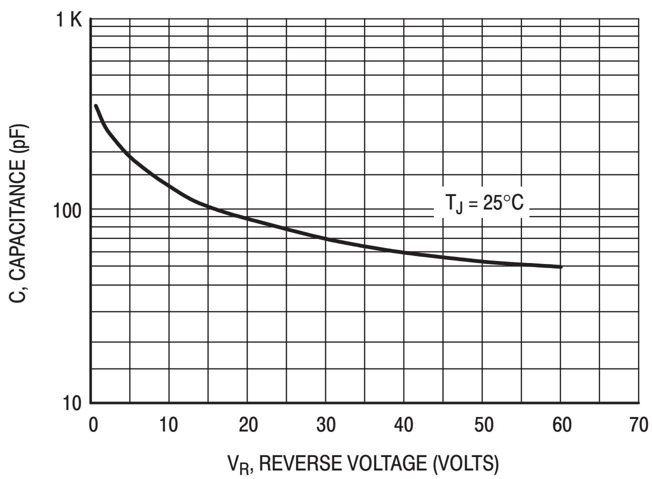


Figure 6. Typical Capacitance, Per Leg

MBRD835L

Preferred Device

SWITCHMODE™ Power Rectifier

DPAK Surface Mount Package

This SWITCHMODE power rectifier which uses the Schottky Barrier principle with a proprietary barrier metal, is designed for use as output rectifiers, free wheeling, protection and steering diodes in switching power supplies, inverters and other inductive switching circuits. This state of the art device has the following features:

- Low Forward Voltage
- 125°C Operating Junction Temperature
- Epoxy Meets UL94, VO at 1/8″
- Compact Size
- Lead Formed for Surface Mount

Mechanical Characteristics

- Case: Epoxy, Molded
- Weight: 0.4 gram (approximately)
- Finish: All External Surfaces Corrosion Resistant and Terminal Leads are Readily Solderable
- Lead and Mounting Surface Temperature for Soldering Purposes: 260°C Max. for 10 Seconds
- Shipped 75 units per plastic tube
- Available in 16 mm Tape and Reel, 2500 units per 13″ reel, by adding a “T4” suffix to the part number
- Marking: B835L

MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Peak Repetitive Reverse Voltage Working Peak Reverse Voltage DC Blocking Voltage	V_{RRM} V_{RWM} V_R	35	V
Average Rectified Forward Current (At Rated V_R, T_C = 88°C)	$I_{F(AV)}$	8.0	A
Peak Repetitive Forward Current (At Rated V_R, Square Wave, 20 kHz, T_C = 80°C)	I_{FRM}	16	A
Non–Repetitive Peak Surge Current (Surge Applied at Rated Load Conditions Halfwave, Single Phase, 60 Hz)	I_{FSM}	75	A
Repetitive Avalanche Current (Current Decaying Linearly to Zero in 1 μs, Frequency Limited by T_{Jmax})	I_{AR}	2.0	A
Storage Temperature Range	T_{stg}	–65 to +150	°C
Operating Junction Temperature	T_J	–65 to +125	°C
Voltage Rate of Change (Rated V_R)	dv/dt	10,000	V/μs

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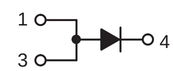
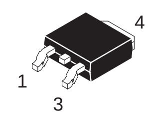
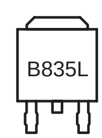
SCHOTTKY BARRIER RECTIFIER
8.0 AMPERES
35 VOLTS





DPAK
CASE 369A
STYLE 3

MARKING DIAGRAM



B835L = Device Code

ORDERING INFORMATION

Device	Package	Shipping
MBRD835L	DPAK	75 Units/Rail
MBRD835LT4	DPAK	2500/Tape & Reel

Preferred devices are recommended choices for future use and best overall value.

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THERMAL CHARACTERISTICS

Rating	Symbol	Value	Unit
Thermal Resistance — Junction to Case	$R_{\theta JC}$	6	°C/W
Thermal Resistance — Junction to Ambient (Note 1.)	$R_{\theta JA}$	80	°C/W

ELECTRICAL CHARACTERISTICS

Maximum Instantaneous Forward Voltage (Note 2.) (i_F = 8 Amps, T_C = +25°C) (i_F = 8 Amps, T_C = +125°C)	V_F	0.51 0.41	Volts
Maximum Instantaneous Reverse Current (Note 2.) (Rated dc Voltage, T_C = +25°C) (Rated dc Voltage, T_C = +100°C)	I_R	1.4 35	mA

1. Rating applies when surface mounted on the minimum pad size recommended.
2. Pulse Test: Pulse Width = 300 μs, Duty Cycle ≤ 2%.

TYPICAL CHARACTERISTICS

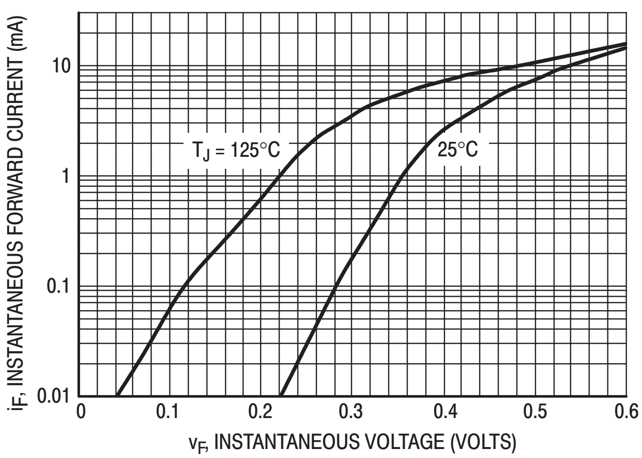

Figure 1. Maximum Forward Voltage

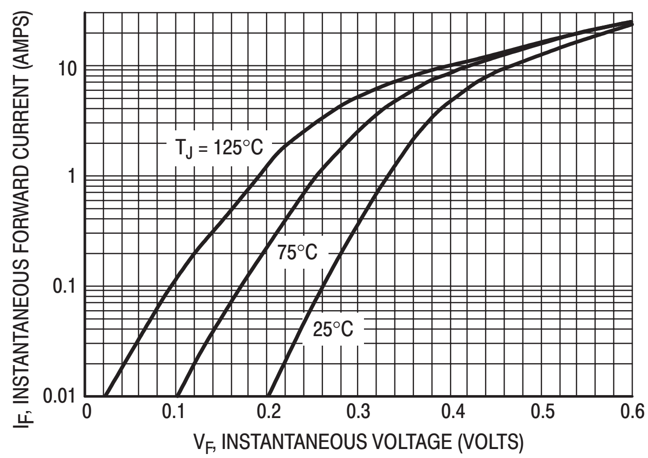

Figure 2. Typical Forward Voltage

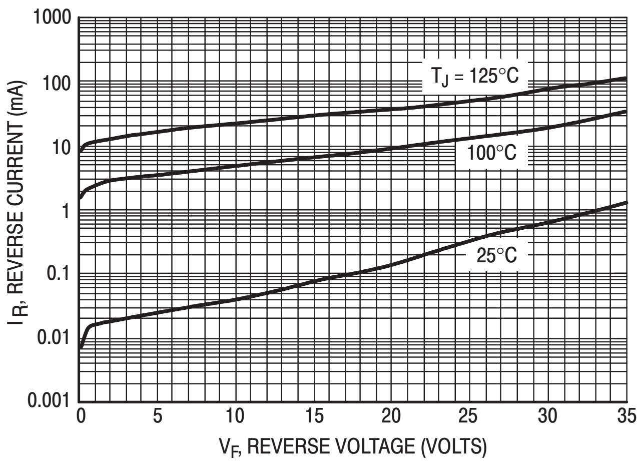

Figure 3. Maximum Reverse Current

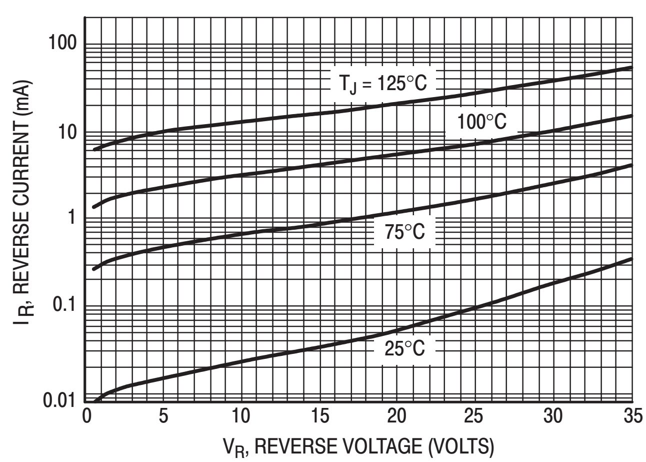

Figure 4. Typical Reverse Current

TYPICAL CHARACTERISTICS

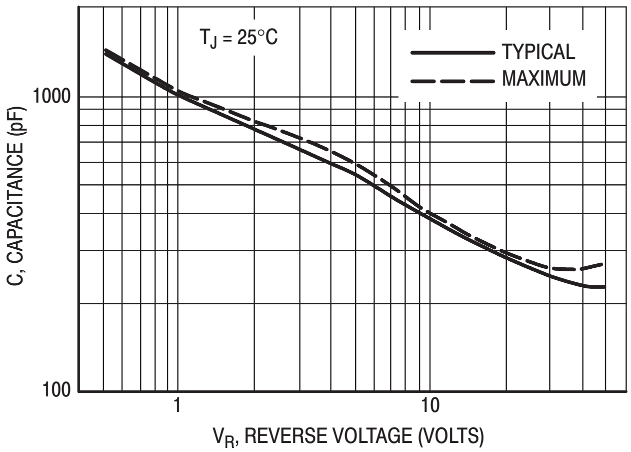

Figure 5. Maximum and Typical Capacitance

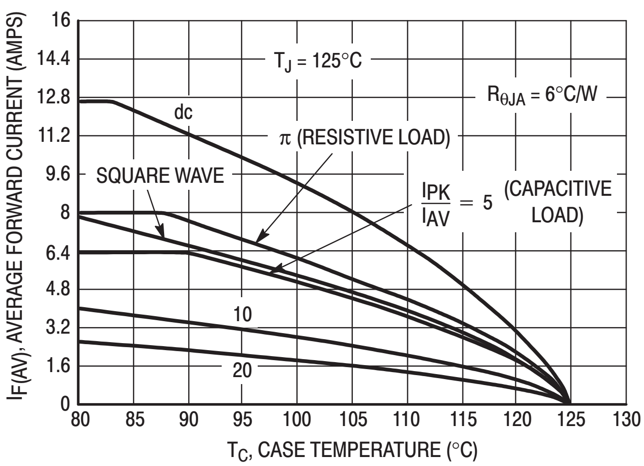

Figure 6. Current Derating, Infinite Heatsink

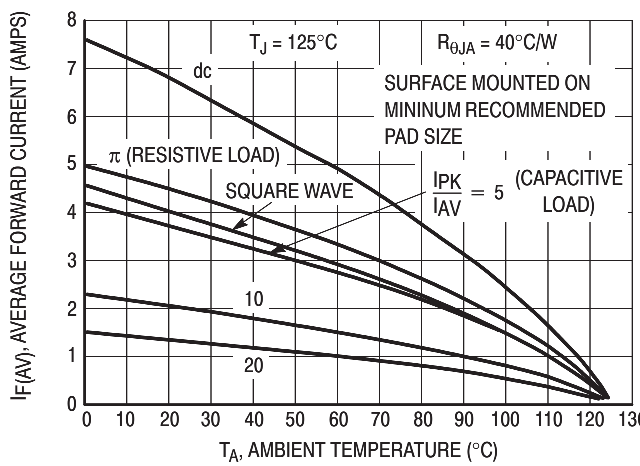

Figure 7. Current Derating

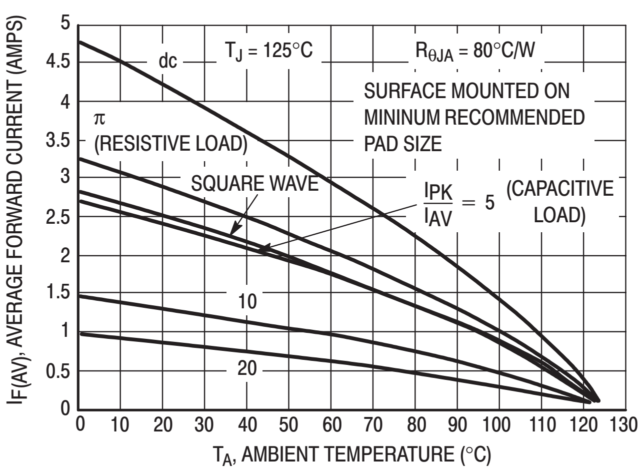

Figure 8. Current Derating, Free Air

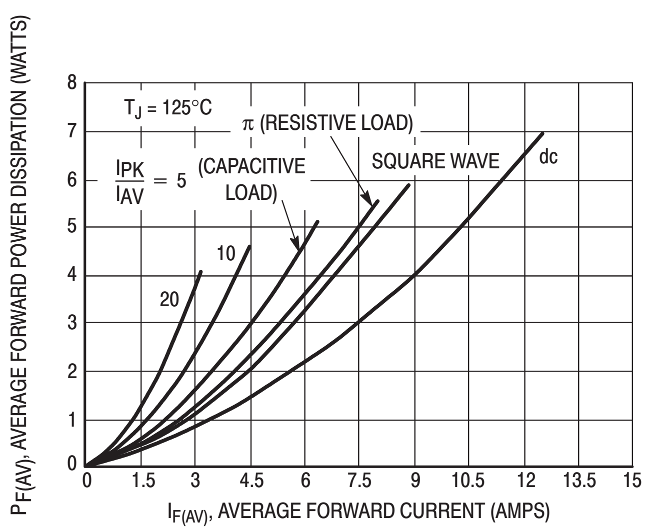

Figure 9. Forward Power Dissipation

MBRD1035CTL

SWITCHMODE™ Schottky Power Rectifier

DPAK Power Surface Mount Package

. . . employing the Schottky Barrier principle in a large area metal–to–silicon power diode. State of the art geometry features epitaxial construction with oxide passivation and metal overlay contact. Ideally suited for low voltage, high frequency switching power supplies, free wheeling diode and polarity protection diodes.

- Highly Stable Oxide Passivated Junction
- Guardring for Stress Protection
- Matched Dual Die Construction – May be Paralleled for High Current Output
- High dv/dt Capability
- Short Heat Sink Tap Manufactured – Not Sheared
- Very Low Forward Voltage Drop
- Epoxy Meets UL94, VO at 1/8”

Mechanical Characteristics:

- Case: Epoxy, Molded
- Weight: 0.4 gram (approximately)
- Finish: All External Surfaces Corrosion Resistant and Terminal Leads are Readily Solderable
- Lead and Mounting Surface Temperature for Soldering Purposes: 260°C Max. for 10 Seconds
- Shipped in 75 units per plastic tube
- Available in 16 mm Tape and Reel, 2500 units per Reel, Add “T4’’ to Suffix part #
- Marking: B1035CL

MAXIMUM RATINGS

Please See the Table on the Following Page

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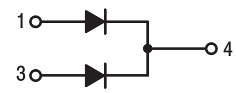
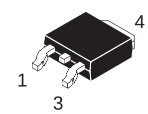
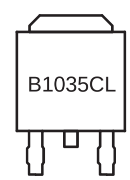
SCHOTTKY BARRIER RECTIFIER
10 AMPERES
35 VOLTS





DPAK
CASE 369A
PLASTIC

MARKING DIAGRAM



B1035CL = Device Code

ORDERING INFORMATION

Device	Package	Shipping
MBRD1035CTL	DPAK	75 Units/Rail
MBRD1035CTLT4	DPAK	2500/Tape & Reel

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MAXIMUM RATINGS

Rating		Symbol	Value	Unit
Peak Repetitive Reverse Voltage Working Peak Reverse Voltage DC Blocking Voltage		V_{RRM} V_{RWM} V_R	35	Volts
Average Rectified Forward Current (At Rated V_R, T_C = 115°C)	Per Leg Per Package	I_O	5.0 10	Amps
Peak Repetitive Forward Current (At Rated V_R, Square Wave, 20 kHz, T_C = 115°C)	Per Leg	I_{FRM}	10	Amps
Non–Repetitive Peak Surge Current (Surge applied at rated load conditions, halfwave, single phase, 60 Hz)	Per Package	I_{FSM}	50	Amps
Storage / Operating Case Temperature		T_{stg}, T_c	–55 to +125	°C
Operating Junction Temperature		T_J	–55 to +125	°C
Voltage Rate of Change (Rated V_R, T_J = 25°C)		dv/dt	10,000	V/μs

THERMAL CHARACTERISTICS

Thermal Resistance – Junction to Case	Per Leg	$R_{\theta JC}$	2.43	°C/W
Thermal Resistance – Junction to Ambient (Note 1.)	Per Leg	$R_{\theta JA}$	68	°C/W

ELECTRICAL CHARACTERISTICS

Maximum Instantaneous Forward Voltage (Note 2.) see Figure 2 I_F = 5 Amps, T_J = 25°C I_F = 5 Amps, T_J = 100°C I_F = 10 Amps, T_J = 25°C I_F = 10 Amps, T_J = 100°C	Per Leg	V_F	0.47 0.41 0.56 0.55	Volts
Maximum Instantaneous Reverse Current (Note 2.) see Figure 4 (V_R = 35 V, T_J = 25°C) (V_R = 35 V, T_J = 100°C) (V_R = 17.5 V, T_J = 25°C) (V_R = 17.5 V, T_J = 100°C)	Per Leg	I_R	2.0 30 0.20 5.0	mA

1. Rating applies when using minimum pad size, FR4 PC Board
2. Pulse Test: Pulse Width ≤ 250 μs, Duty Cycle ≤ 2.0%.

TYPICAL CHARACTERISTICS

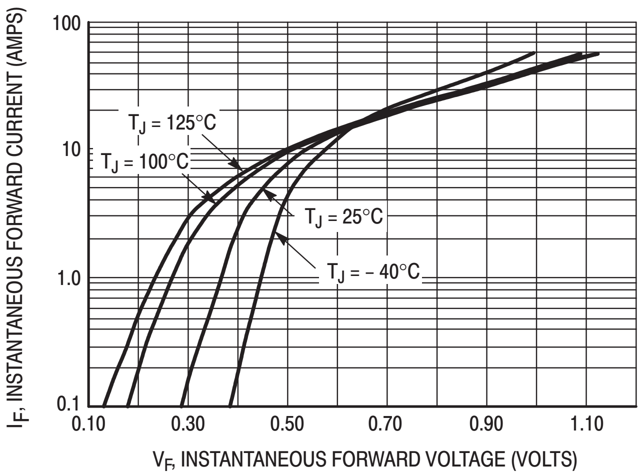

Figure 1. Typical Forward Voltage Per Leg

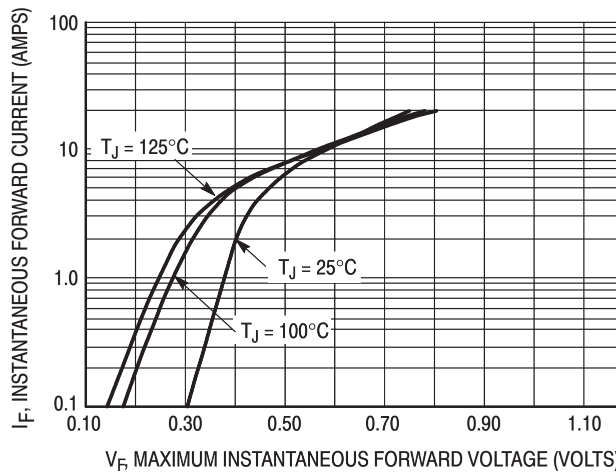

Figure 2. Maximum Forward Voltage Per Leg

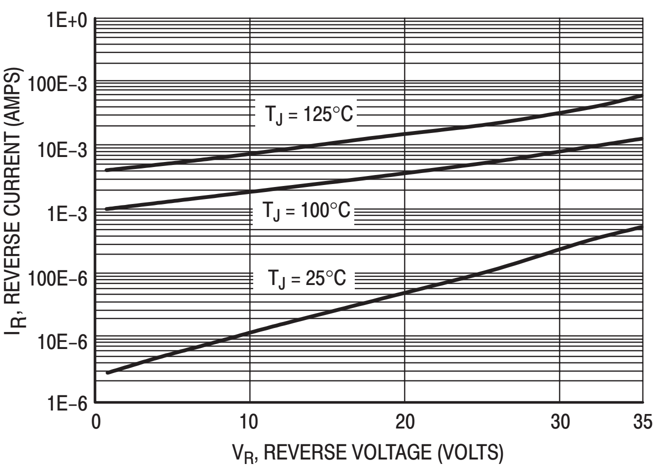

Figure 3. Typical Reverse Current Per Leg

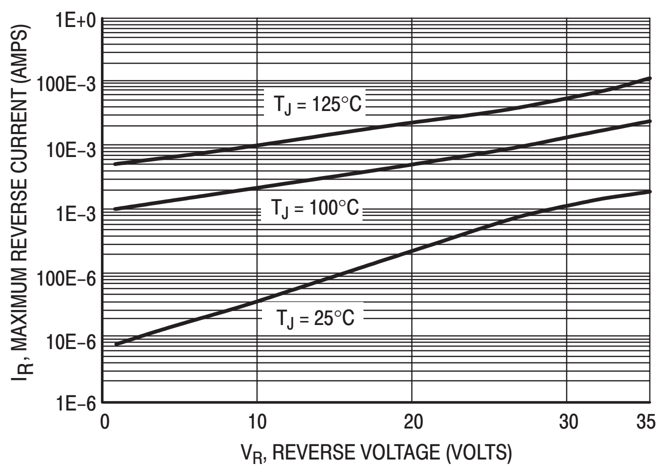

Figure 4. Maximum Reverse Current Per Leg

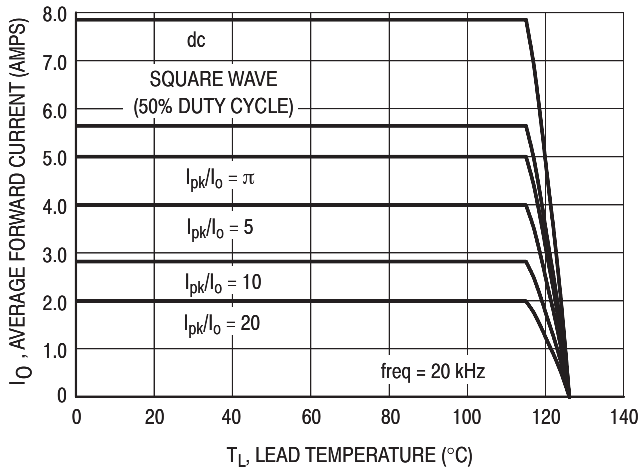

Figure 5. Current Derating Per Leg

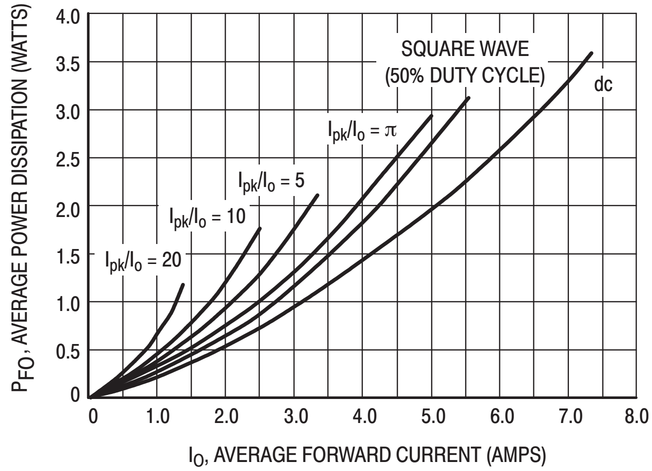

Figure 6. Forward Power Dissipation Per Leg

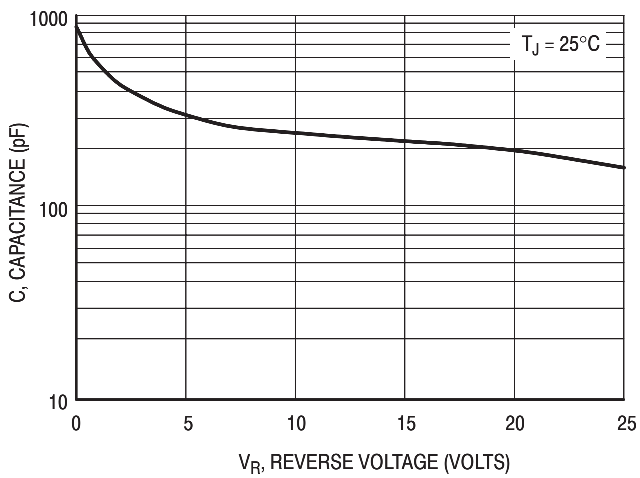

Figure 7. Capacitance Per Leg

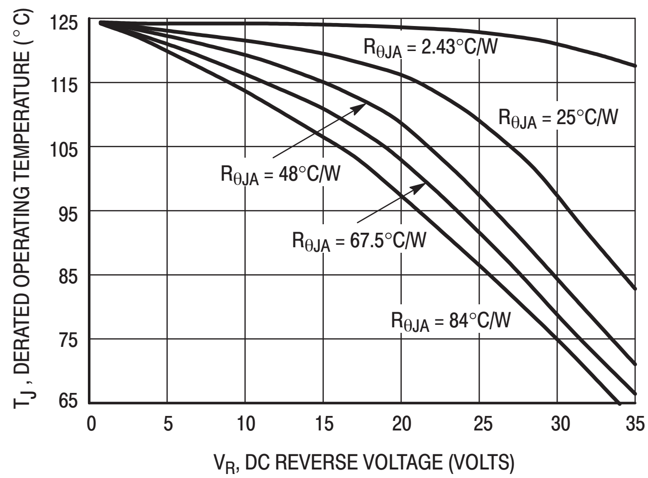

Figure 8. Typical Operating Temperature Derating Per Leg *

* Reverse power dissipation and the possibility of thermal runaway must be considered when operating this device under any reverse voltage conditions. Calculations of T_J therefore must include forward and reverse power effects. The allowable operating T_J may be calculated from the equation: $T_J = T_{Jmax} – r(t)(Pf + Pr)$ where
r(t) = thermal impedance under given conditions,
Pf = forward power dissipation, and
Pr = reverse power dissipation

This graph displays the derated allowable T_J due to reverse bias under DC conditions only and is calculated as $T_J = T_{Jmax} – r(t)Pr$, where r(t) = Rthja. For other power applications further calculations must be performed.

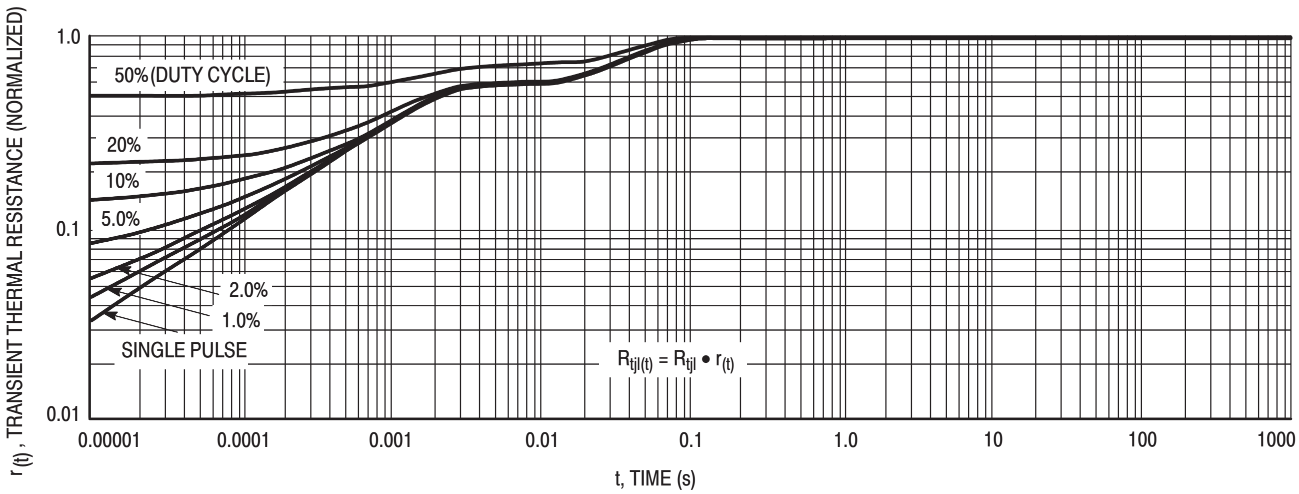

Figure 9. Thermal Response Junction to Case (Per Leg)

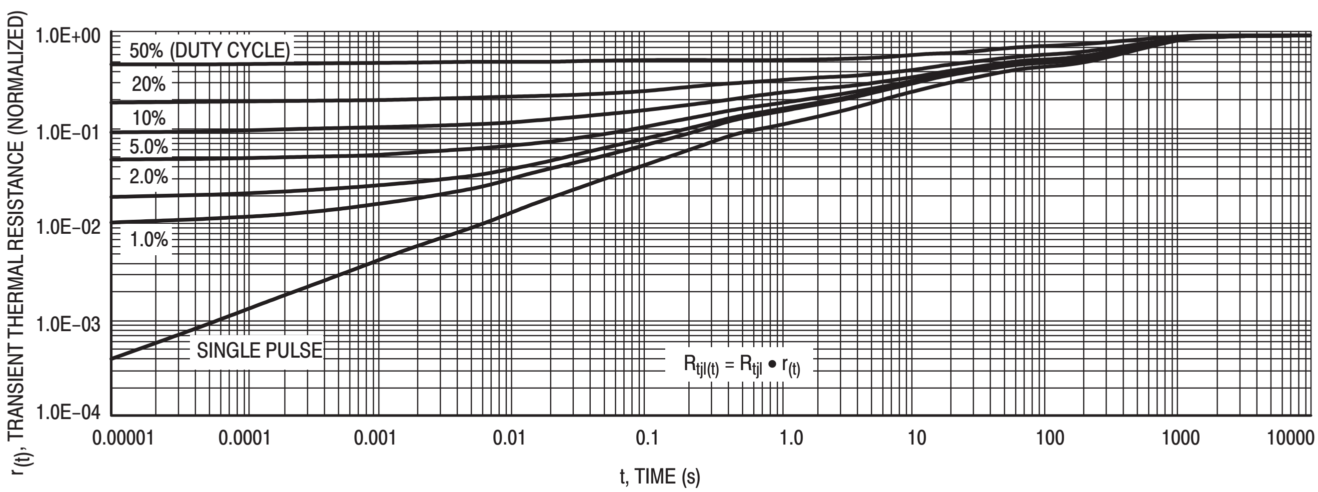

Figure 10. Thermal Response Junction to Ambient (Per Leg)

MBRB1045

Preferred Device

SWITCHMODE™ Power Rectifier

D²PAK Surface Mount Power Package

The D²PAK Power Rectifier employs the Schottky Barrier principle in a large metal–to–silicon power diode. State–of–the–art geometry features epitaxial construction with oxide passivation and metal overlay contact. Ideally suited for use in low voltage, high frequency switching power supplies, free wheeling diodes, and polarity protection diodes. These state–of–the–art devices have the following features:

- Guardring for Stress Protection
- Low Forward Voltage
- 150°C Operating Junction Temperature
- Epoxy Meets UL94, VO at 1/8″
- Short Heat Sink Tab Manufactured — Not Sheared!
- Similar in Size to the Industry Standard TO–220 Package

Mechanical Characteristics

- Case: Epoxy, Molded
- Weight: 1.7 grams (approximately)
- Finish: All External Surfaces Corrosion Resistant and Terminal Leads are Readily Solderable
- Lead and Mounting Surface Temperature for Soldering Purposes: 260°C Max. for 10 Seconds
- Shipped 50 units per plastic tube
- Available in 24 mm Tape and Reel, 800 units per 13″ reel by adding a “T4” suffix to the part number
- Marking: MBRB1045

MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Peak Repetitive Reverse Voltage Working Peak Reverse Voltage DC Blocking Voltage	V_{RRM} V_{RWM} V_R	45	Volts
Average Rectified Forward Current (Rated V_R) T_C = 135°C	$I_{F(AV)}$	10	Amps
Peak Repetitive Forward Current (Rated V_R, Square Wave, 20 kHz) T_C = 135°C	I_{FRM}	20	Amps
Nonrepetitive Peak Surge Current (Surge applied at rated load conditions halfwave, single phase, 60 Hz)	I_{FSM}	150	Amps
Operating Junction and Storage Temperature Range	T_J, T_{stg}	–65 to +150	°C
Voltage Rate of Change (Rated V_R)	dv/dt	10000	V/μs

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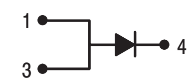
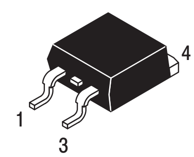
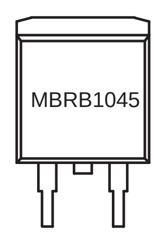
SCHOTTKY BARRIER RECTIFIER 10 AMPERES 45 VOLTS





D²PAK CASE 418B PLASTIC

MARKING DIAGRAM



MBRB1045 = Device Code

ORDERING INFORMATION

Device	Package	Shipping
MBRB1045	D²PAK	50 Units/Tube
MBRB1045T4	D²PAK	800/Tape & Reel

Preferred devices are recommended choices for future use and best overall value.

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THERMAL CHARACTERISTICS

Characteristic	Symbol	Value	Unit
Thermal Resistance — Junction to Case (Note 1.) — Junction to Ambient (Note 1.)	$R_{\theta JC}$ $R_{\theta JA}$	1.0 34	°C/W

ELECTRICAL CHARACTERISTICS

Maximum Instantaneous Forward Voltage (Note 2.) (I_F = 10 Amps, T_J = 125°C) (I_F = 20 Amps, T_J = 125°C) (I_F = 20 Amps, T_J = 25°C)	V_F	 0.57 0.72 0.84	Volts
Maximum Instantaneous Reverse Current (Note 2.) (Rated dc Voltage, TJ = 125°C) (Rated dc Voltage, T_J = 25°C)	I_R	 15 0.1	mA

1. When mounted using minimum recommended pad size on FR–4 board.
2. Pulse Test: Pulse Width = 300 μs, Duty Cycle ≤ 2.0%

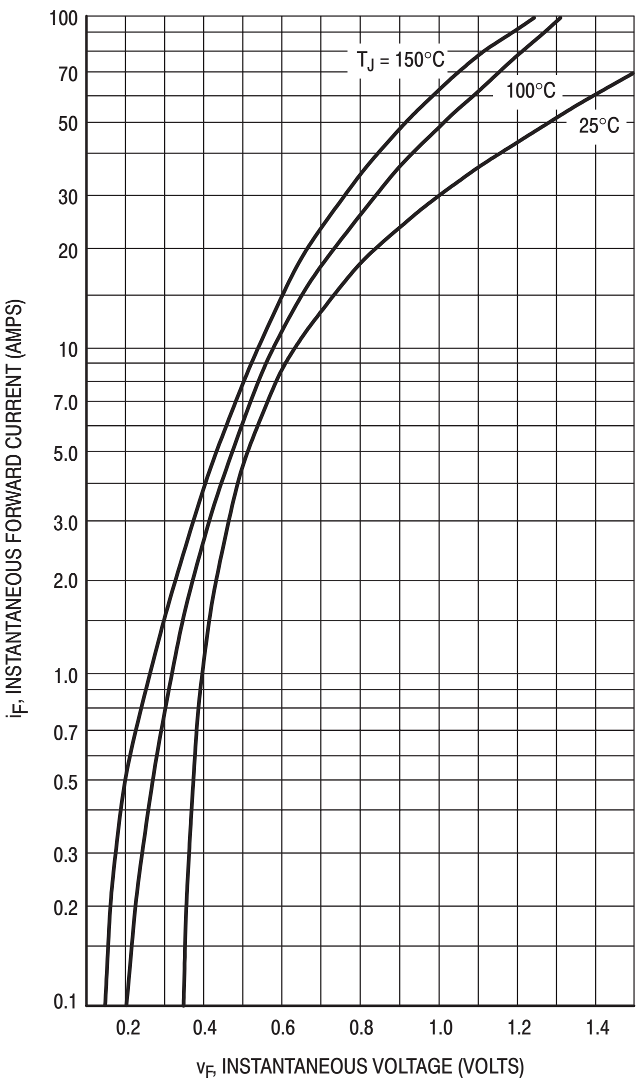

Figure 1. Maximum Forward Voltage

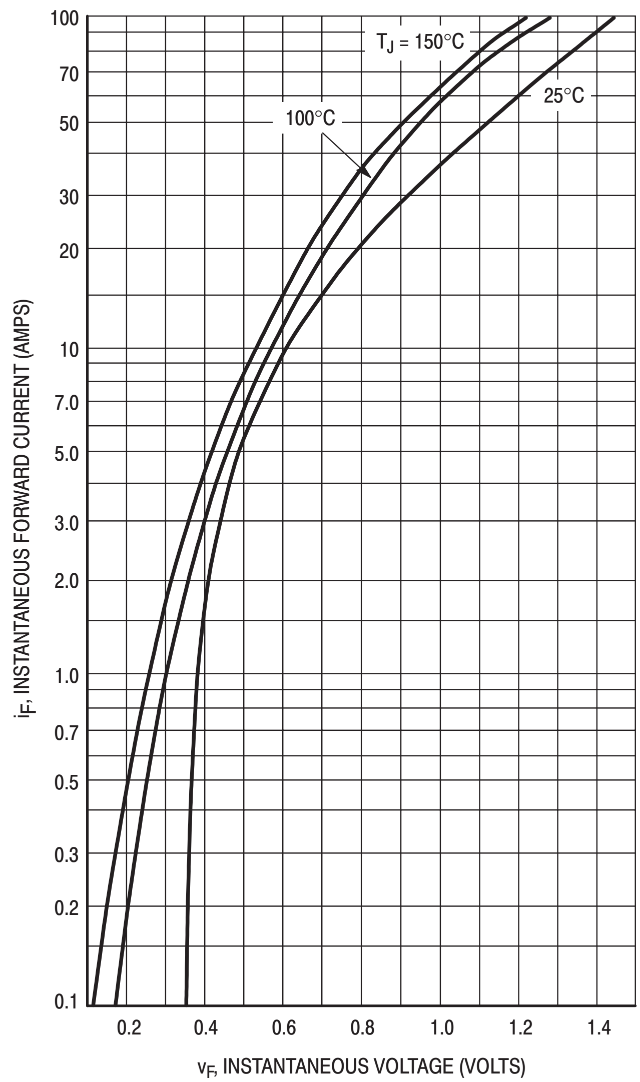

Figure 2. Typical Forward Voltage

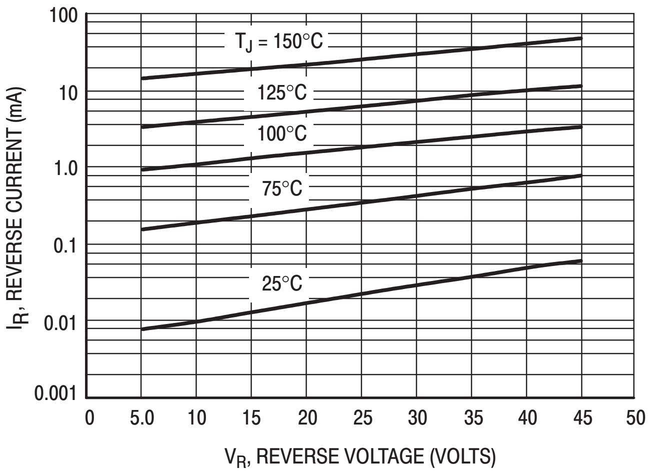

Figure 3. Maximum Reverse Current

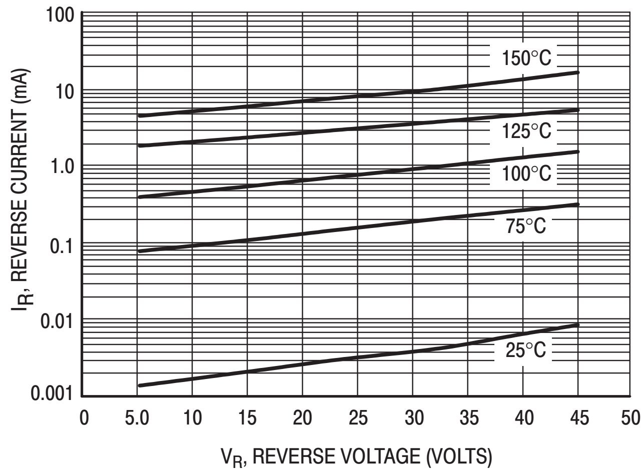

Figure 4. Typical Reverse Current

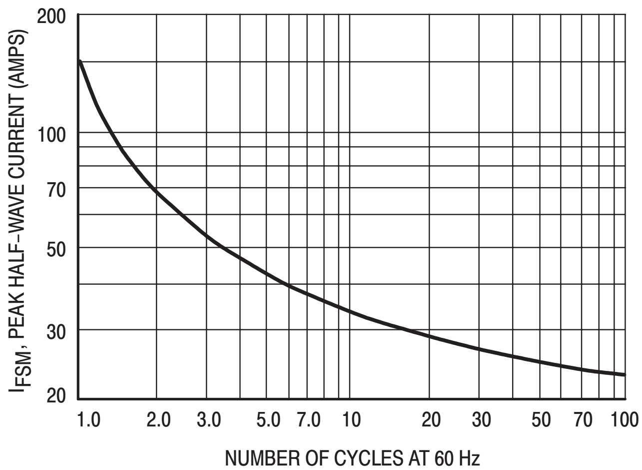

Figure 8. Maximum Surge Capability

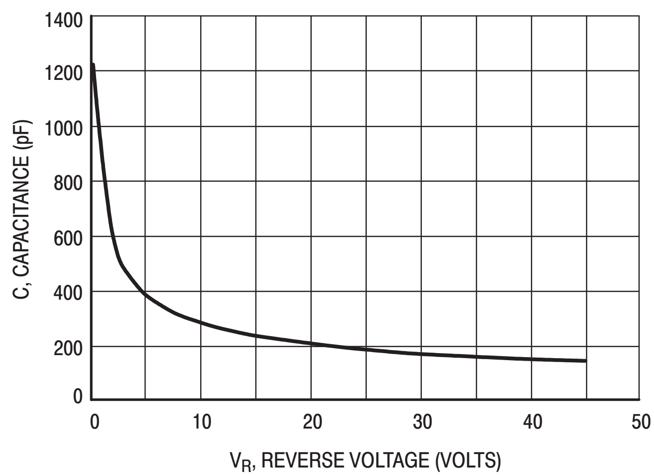

Figure 5. Typical Capacitance

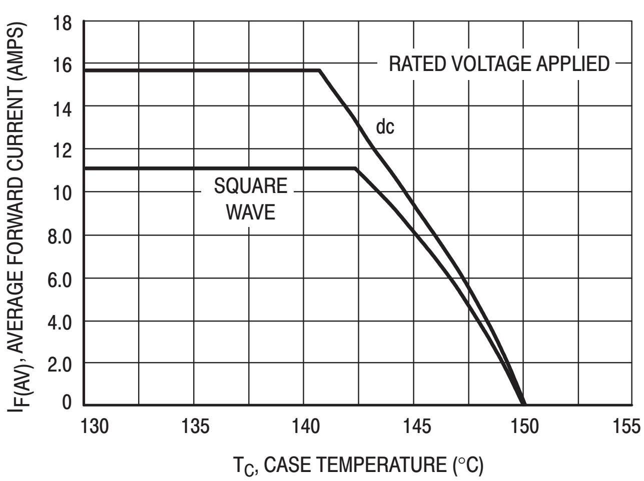

Figure 6. Current Derating, Case, $R_{\theta JC}$ = 1.0 °C/W

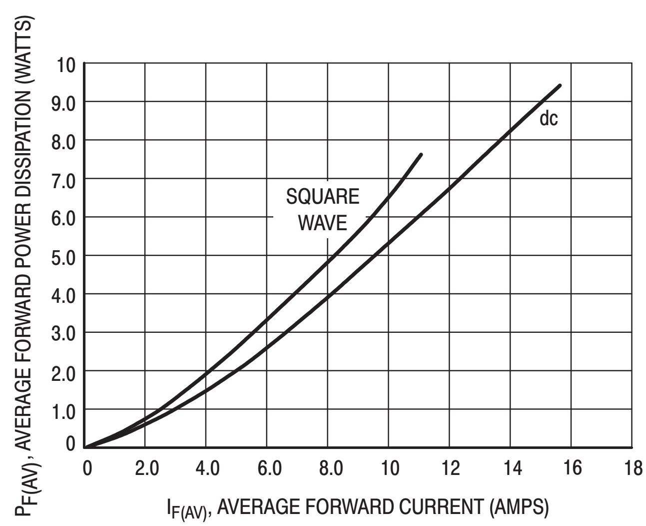

Figure 7. Forward Power Dissipation

MBRB1545CT

Preferred Device

SWITCHMODE™ Power Rectifier

D^2PAK Surface Mount Power Package

The D^2PAK Power Rectifier employs the Schottky Barrier principle with a platinum barrier metal. These state-of-the-art devices have the following features:

- Center-Tap Configuration
- Guardring for Stress Protection
- Low Forward Voltage
- 150°C Operating Junction Temperature
- Epoxy Meets UL94, VO at 1/8″
- Short Heat Sink Tab Manufactured — Not Sheared!
- Similar in Size to the Industry Standard TO-220 Package

Mechanical Characteristics

- Case: Epoxy, Molded
- Weight: 1.7 grams (approximately)
- Finish: All External Surfaces Corrosion Resistant and Terminal Leads are Readily Solderable
- Lead and Mounting Surface Temperature for Soldering Purposes: 260°C Max. for 10 Seconds
- Shipped 50 units per plastic tube
- Available in 24 mm Tape and Reel, 800 units per 13″ reel by adding a “T4” suffix to the part number
- Marking: B1545T

MAXIMUM RATINGS (Per Leg)

Rating	Symbol	Value	Unit
Peak Repetitive Reverse Voltage Working Peak Reverse Voltage DC Blocking Voltage	V_{RRM} V_{RWM} V_R	45	V
Average Rectified Forward Current (Rated V_R, T_C = 105°C) Total Device	$I_{F(AV)}$	7.5 15	A
Peak Repetitive Forward Current (Rated V_R, Square Wave, 20 kHz, T_C = 105°C)	I_{FRM}	15	A
Non–Repetitive Peak Surge Current (Surge Applied at Rated Load Conditions Halfwave, Single Phase, 60 Hz)	I_{FSM}	150	A
Peak Repetitive Reverse Surge Current (2.0 μs, 1.0 kHz)	I_{RRM}	1.0	A
Storage Temperature Range	T_{stg}	–65 to +175	°C
Operating Junction Temperature	T_J	–65 to +150	°C
Voltage Rate of Change (Rated V_R)	dv/dt	10,000	V/μs

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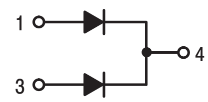
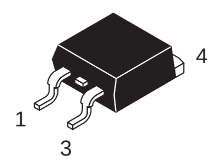
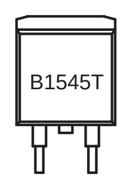
SCHOTTKY BARRIER RECTIFIER
15 AMPERES
45 VOLTS





D^2PAK
CASE 418B
STYLE 3

MARKING DIAGRAM



B1545T = Device Code

ORDERING INFORMATION

Device	Package	Shipping
MBRB1545CT	D^2PAK	50/Rail
MBRB1545CTT4	D^2PAK	800/Tape & Reel

Preferred devices are recommended choices for future use and best overall value.

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THERMAL CHARACTERISTICS (Per Leg)

Characteristic	Symbol	Value	Unit
Thermal Resistance — Junction to Case — Junction to Ambient (Note 1.)	$R_{\theta JC}$ $R_{\theta JA}$	2.0 50	°C/W

ELECTRICAL CHARACTERISTICS (Per Leg)

Characteristic	Symbol	Value	Unit
Maximum Instantaneous Forward Voltage (Note 2.) (i_F = 7.5 Amps, T_J = 125°C) (i_F = 15 Amps, T_J = 125°C) (i_F = 15 Amps, T_J = 25°C)	V_F	 0.57 0.72 0.84	Volts
Maximum Instantaneous Reverse Current (Note 2.) (Rated dc Voltage, T_J = 125°C) (Rated dc Voltage, T_J = 25°C)	i_R	 15 0.1	mA

1. When mounted using minimum recommended pad size on FR–4 board.
2. Pulse Test: Pulse Width = 300 µs, Duty Cycle ≤ 2.0%.

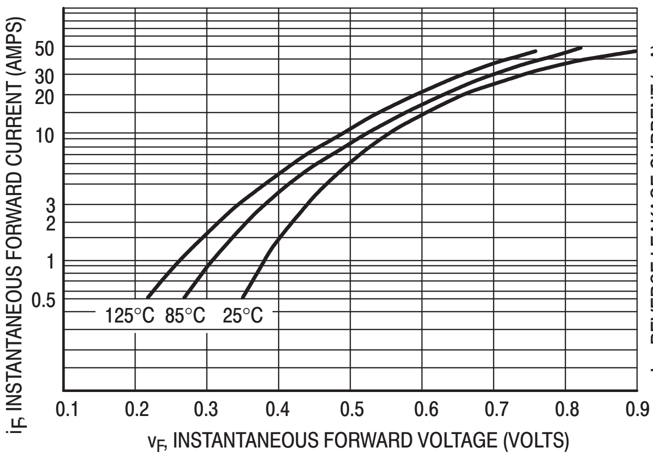

Figure 1. Typical Forward Voltage, Per Leg

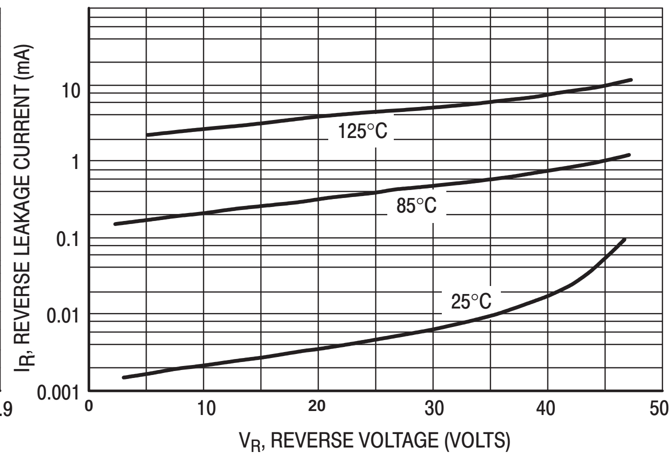

Figure 2. Typical Reverse Current, Per Leg

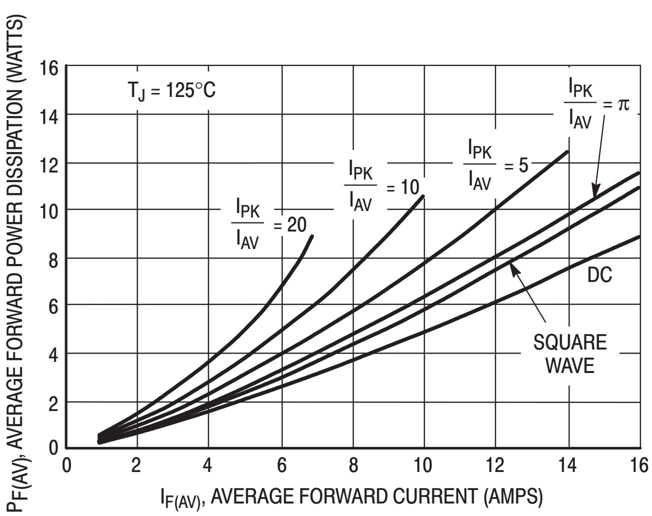

Figure 3. Typical Forward Power Dissipation

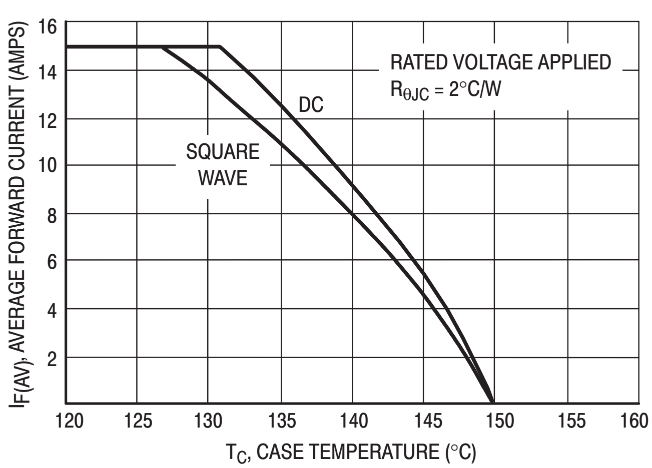

Figure 4. Current Derating, Case

MBRB2060CT

Preferred Device

SWITCHMODE™ Power Rectifier

D^2PAK Surface Mount Power Package

Employs the use of the Schottky Barrier principle with a platinum barrier metal. These state–of–the–art devices have the following features:

- Package Designed for Power Surface Mount Applications
- Center–Tap Configuration
- Guardring for Stress Protection
- Low Forward Voltage
- 150°C Operating Junction Temperature
- Epoxy Meets UL94, V_O at 1/8″
- Short Heat Sink Tab Manufactured — Not Sheared!
- Similar in Size to Industry Standard TO–220 Package

Mechanical Characteristics

- Case: Epoxy, Molded
- Weight: 1.7 grams (approximately)
- Finish: All External Surfaces Corrosion Resistant and Terminal Leads are Readily Solderable
- Lead and Mounting Surface Temperature for Soldering Purposes: 260°C Max. for 10 Seconds
- Shipped 50 units per plastic tube
- Available in 24 mm Tape and Reel, 800 units per 13″ reel by adding a “T4” suffix to the part number
- Marking: B2060T

MAXIMUM RATINGS (Per Leg)

Rating	Symbol	Value	Unit
Peak Repetitive Reverse Voltage Working Peak Reverse Voltage DC Blocking Voltage	V_{RRM} V_{RWM} V_R	60	V
Average Rectified Forward Current (Rated V_R, T_C = 110°C) Total Device	$I_{F(AV)}$	10 20	A
Peak Repetitive Forward Current (Rated V_R, Square Wave, 20 kHz, T_C = 100°C)	I_{FRM}	20	A
Non–Repetitive Peak Surge Current (Surge Applied at Rated Load Conditions Halfwave, Single Phase, 60 Hz)	I_{FSM}	150	A
Peak Repetitive Reverse Surge Current (2.0 μs, 1.0 kHz)	I_{RRM}	0.5	A
Storage Temperature Range	T_{stg}	–65 to +175	°C
Operating Junction Temperature	T_J	–65 to +150	°C
Voltage Rate of Change (Rated V_R)	dv/dt	10,000	V/μs

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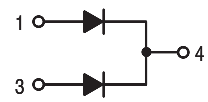
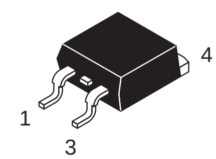
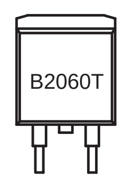
SCHOTTKY BARRIER RECTIFIER 20 AMPERES 60 VOLTS





D^2PAK
CASE 418B
STYLE 3

MARKING DIAGRAM



B2060T = Device Code

ORDERING INFORMATION

Device	Package	Shipping
MBRB2060CT	D^2PAK	50/Rail
MBRB2060CTT4	D^2PAK	800/Tape & Reel

Preferred devices are recommended choices for future use and best overall value.

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THERMAL CHARACTERISTICS (Per Leg)

Characteristic	Symbol	Value	Unit
Thermal Resistance — Junction to Case — Junction to Ambient (Note 1.)	$R_{\theta JC}$ $R_{\theta JA}$	2.0 50	°C/W

ELECTRICAL CHARACTERISTICS (Per Leg)

Maximum Instantaneous Forward Voltage (Note 2.) (i_F = 20 Amps, T_J = 125°C) (i_F = 20 Amps, T_J = 25°C)	v_F	 0.85 0.95	Volts
Maximum Instantaneous Reverse Current (Note 2.) (Rated dc Voltage, T_J = 125°C) (Rated dc Voltage, T_J = 25°C)	i_R	 150 0.15	mA

1. When mounted using minimum recommended pad size on FR–4 board.
2. Pulse Test: Pulse Width = 300 μs, Duty Cycle ≤ 2.0%.

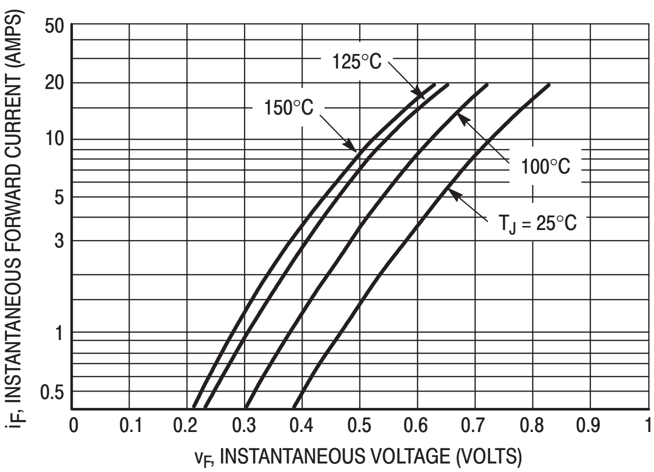

Figure 1. Typical Forward Voltage Per Diode

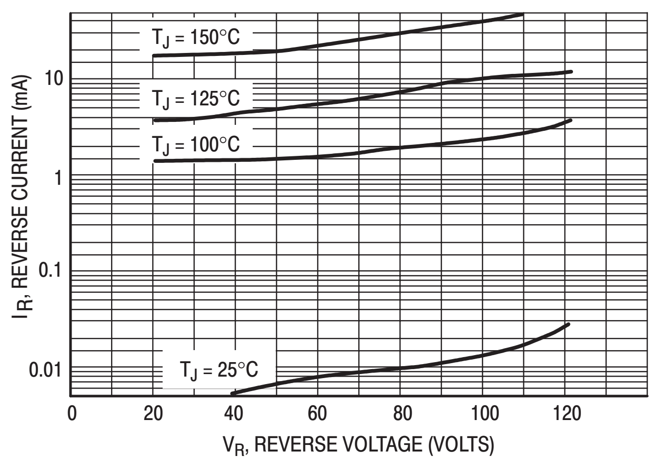

Figure 2. Typical Reverse Current Per Diode

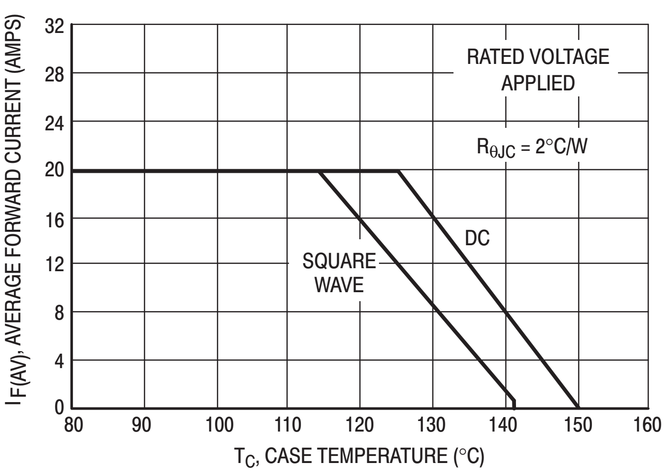

Figure 3. Typical Current Derating, Case, Per Leg

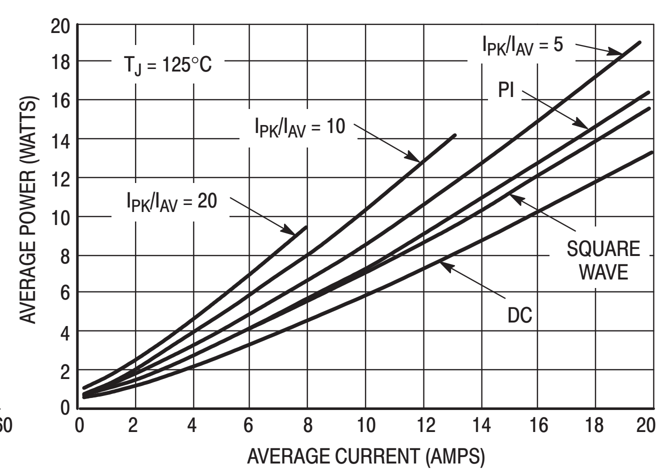

Figure 4. Average Power Dissipation and Average Current

MBRB20100CT

Preferred Device

SWITCHMODE™ Power Rectifier

D²PAK Surface Mount Power Package

The D²PAK Power Rectifier employs the use of the Schottky Barrier principle with a platinum barrier metal. These state–of–the–art devices have the following features:

- Package Designed for Power Surface Mount Applications
- Center–Tap Configuration
- Guardring for Stress Protection
- Low Forward Voltage
- 150°C Operating Junction Temperature
- Epoxy Meets UL94, V_O at 1/8″
- Short Heat Sink Tab Manufactured — Not Sheared!
- Similar in Size to Industry Standard TO–220 Package

Mechanical Characteristics

- Case: Epoxy, Molded
- Weight: 1.7 grams (approximately)
- Finish: All External Surfaces Corrosion Resistant and Terminal Leads are Readily Solderable
- Lead and Mounting Surface Temperature for Soldering Purposes: 260°C Max. for 10 Seconds
- Shipped 50 units per plastic tube
- Available in 24 mm Tape and Reel, 800 units per 13″ reel by adding a “T4” suffix to the part number
- Marking: B20100

MAXIMUM RATINGS (Per Leg)

Rating	Symbol	Value	Unit
Peak Repetitive Reverse Voltage Working Peak Reverse Voltage DC Blocking Voltage	V_{RRM} V_{RWM} V_R	100	V
Average Rectified Forward Current (Rated V_R, T_C = 110°C) Total Device	$I_{F(AV)}$	10 20	A
Peak Repetitive Forward Current (Rated V_R, Square Wave, 20 kHz, T_C = 100°C)	I_{FRM}	20	A
Non–Repetitive Peak Surge Current (Surge Applied at Rated Load Conditions Halfwave, Single Phase, 60 Hz)	I_{FSM}	150	A
Peak Repetitive Reverse Surge Current (2.0 μs, 1.0 kHz)	I_{RRM}	0.5	A
Storage Temperature Range	T_{stg}	–65 to +175	°C
Operating Junction Temperature	T_J	–65 to +150	°C
Voltage Rate of Change (Rated V_R)	dv/dt	10,000	V/μs

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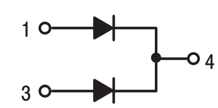
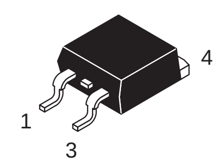
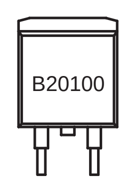
SCHOTTKY BARRIER RECTIFIER
20 AMPERES
100 VOLTS





D²PAK
CASE 418B
STYLE 3

MARKING DIAGRAM



B20100 = Device Code

ORDERING INFORMATION

Device	Package	Shipping
MBRB20100CT	D²PAK	50/Rail
MBRB20100CTT4	D²PAK	800/Tape & Reel

Preferred devices are recommended choices for future use and best overall value.

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THERMAL CHARACTERISTICS (Per Leg)

Characteristic	Symbol	Value	Unit
Thermal Resistance — Junction to Case — Junction to Ambient (Note 1.)	$R_{\theta JC}$ $R_{\theta JA}$	2.0 50	°C/W

ELECTRICAL CHARACTERISTICS (Per Leg)

Characteristic	Symbol	Value	Unit
Maximum Instantaneous Forward Voltage (Note 2.) (i_F = 10 Amp, T_C = 125°C) (i_F = 10 Amp, T_C = 25°C) (i_F = 20 Amp, T_C = 125°C) (i_F = 20 Amp, T_C = 25°C)	v_F	 0.75 0.85 0.85 0.95	Volts
Maximum Instantaneous Reverse Current (Note 2.) (Rated dc Voltage, T_J = 125°C) (Rated dc Voltage, T_J = 25°C)	i_R	 6.0 0.1	mA

1. When mounted using minimum recommended pad size on FR–4 board.
2. Pulse Test: Pulse Width = 300 μs, Duty Cycle ≤ 2.0%.

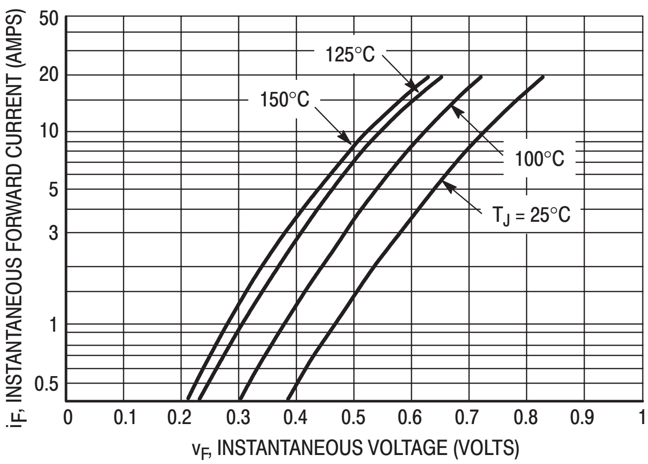

Figure 1. Typical Forward Voltage Per Diode

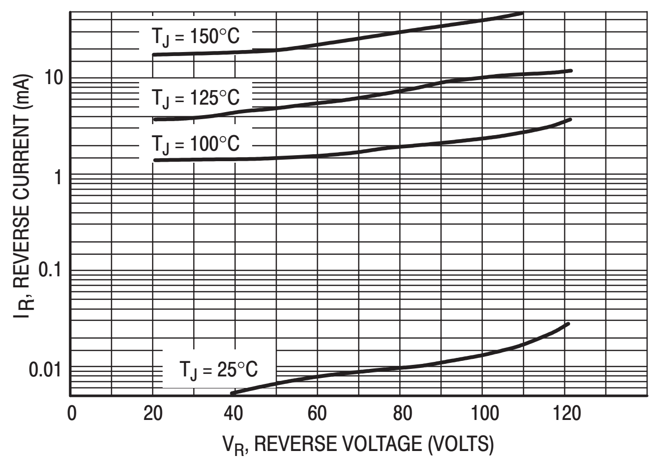

Figure 2. Typical Reverse Current Per Diode

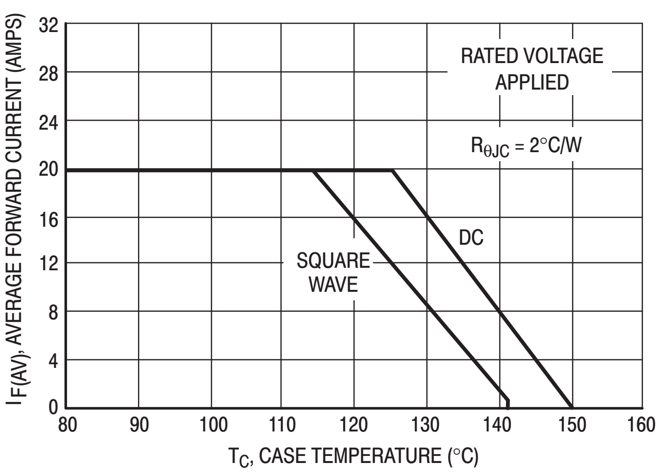

Figure 3. Typical Current Derating, Case, Per Leg

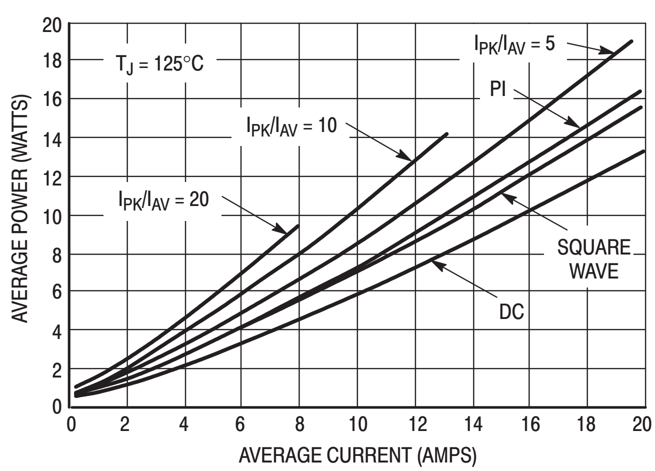

Figure 4. Average Power Dissipation and Average Current

MBRB20200CT

Preferred Device

SWITCHMODE™ Power Rectifier

Dual Schottky Rectifier

. . . using Schottky Barrier technology with a platinum barrier metal. This state–of–the–art device is designed for use in high frequency switching power supplies and converters with up to 48 volt outputs. They block up to 200 volts and offer improved Schottky performance at frequencies from 250 kHz to 5.0 MHz.

- **200 Volt Blocking Voltage**
- Low Forward Voltage Drop
- Guardring for Stress Protection and High dv/dt Capability (10,000 V/μs)
- Dual Diode Construction — Terminals 1 and 3 Must be Connected for Parallel Operation at Full Rating

Mechanical Characteristics

- Case: Epoxy, Molded
- Weight: 1.7 grams (approximately)
- Finish: All External Surfaces Corrosion Resistant and Terminal Leads are Readily Solderable
- Lead and Mounting Surface Temperature for Soldering Purposes: 260°C Max. for 10 Seconds
- Shipped 50 units per plastic tube
- Available in 24 mm Tape and Reel, 800 units per 13″ reel by adding a “T4” suffix to the part number
- Marking: B20200

MAXIMUM RATINGS (Per Leg)

Rating	Symbol	Value	Unit
Peak Repetitive Reverse Voltage Working Peak Reverse Voltage DC Blocking Voltage	V_{RRM} V_{RWM} V_R	200	V
Average Rectified Forward Current (At Rated V_R, T_C = 134°C) Per Device Per Leg	$I_{F(AV)}$	 10 20	A
Peak Repetitive Forward Current (At Rated V_R, Square Wave, 20 kHz, T_C = +137°C) Per Leg	I_{FRM}	20	A
Non–Repetitive Peak Surge Current (Surge Applied at Rated Load Conditions Halfwave, Single Phase, 60 Hz)	I_{FSM}	150	A
Peak Repetitive Reverse Surge Current (2.0 μs, 1.0 kHz)	I_{RRM}	1.0	A
Storage Temperature Range	T_{stg}	–65 to +175	°C
Operating Junction Temperature	T_J	–65 to +150	°C
Voltage Rate of Change (Rated V_R)	dv/dt	10,000	V/μs

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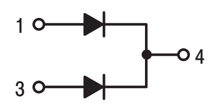
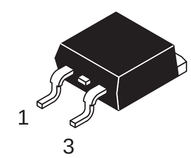
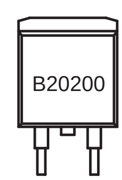
SCHOTTKY BARRIER RECTIFIER
20 AMPERES
200 VOLTS





D²PAK
CASE 418B
STYLE 3

MARKING DIAGRAM



B20200 = Device Code

ORDERING INFORMATION

Device	Package	Shipping
MBRB20200CT	D²PAK	50/Rail
MBRB20200CTT4	D²PAK	800/Tape & Reel

Preferred devices are recommended choices for future use and best overall value.

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THERMAL CHARACTERISTICS (Per Leg)

Characteristic	Symbol	Value	Unit
Thermal Resistance — Junction to Case	$R_{\theta JC}$	2.0	°C/W

ELECTRICAL CHARACTERISTICS (Per Leg)

Maximum Instantaneous Forward Voltage (Note 1.) (I_F = 10 Amps, T_C = 25°C) (I_F = 10 Amps, T_C = 125°C) (I_F = 20 Amps, T_C = 25°C) (I_F = 20 Amps, T_C = 125°C)	V_F	 0.9 0.8 1.0 0.9	Volts
Maximum Instantaneous Reverse Current (Note 1.) (Rated dc Voltage, T_C = 25°C) (Rated dc Voltage, T_C = 125°C)	I_R	 1.0 50	mA

DYNAMIC CHARACTERISTICS (Per Leg)

Capacitance (V_R = –5.0 V, T_C = 25°C, Frequency = 1.0 MHz)	C_T	500	pF

1. Pulse Test: Pulse Width = 300 μs, Duty Cycle ≤ 2.0%.

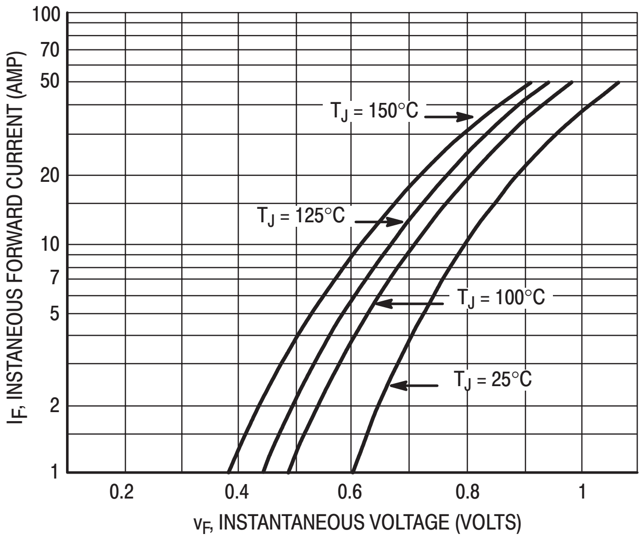

Figure 1. Typical Forward Voltage (Per Leg)

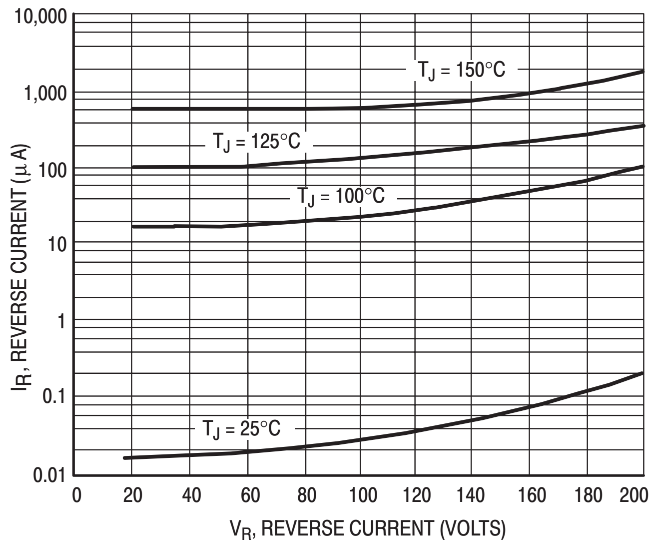

Figure 2. Typical Reverse Current (Per Leg)

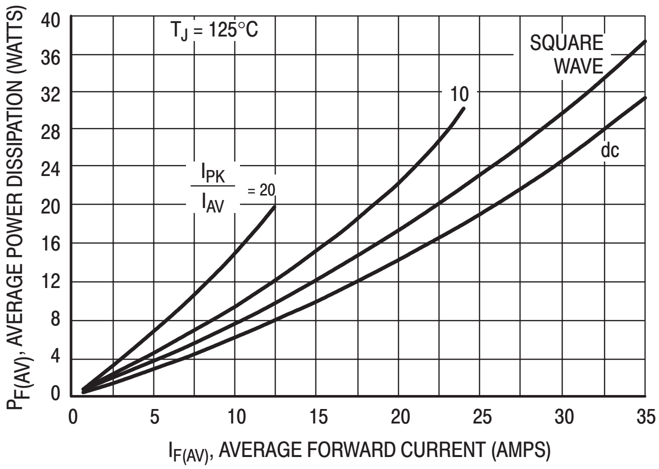

Figure 3. Forward Power Dissipation

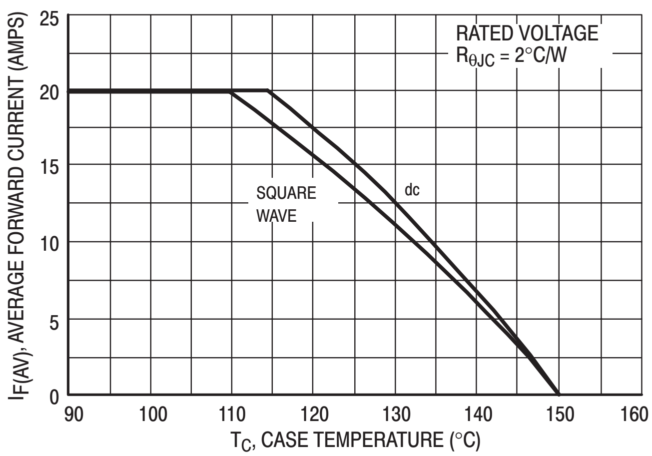

Figure 4. Current Derating, Case

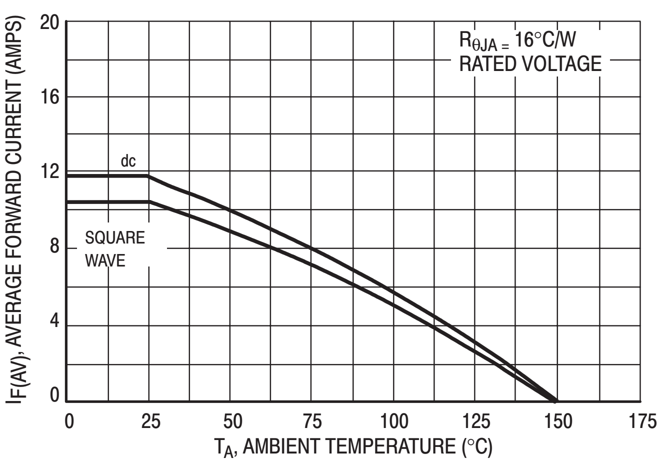

Figure 5. Current Derating, Ambient

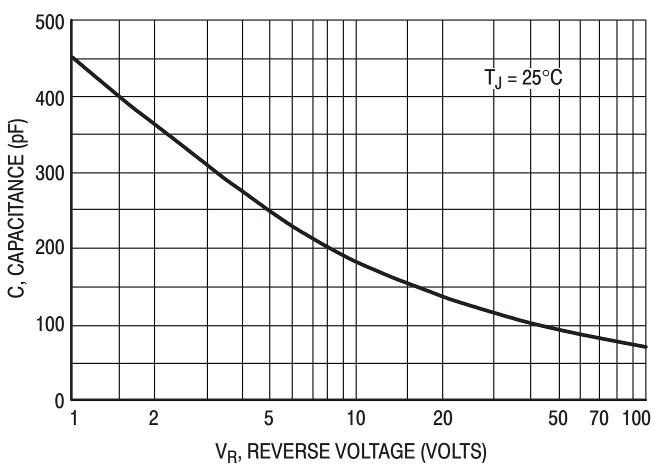

Figure 6. Typical Capacitance (Per Leg)

MBRB2515L

Preferred Device

SWITCHMODE™ Power Rectifier OR’ing Function Diode

D^2PAK Surface Mount Power Package

The D^2PAK Power Rectifier employs the Schottky Barrier principle in a large metal–to–silicon power diode. State–of–the–art geometry features epitaxial construction with oxide passivation and metal overlay contact. Ideally suited for use in low voltage, high frequency switching power supplies, free wheeling diodes, and polarity protection diodes. These state–of–the–art devices have the following features:

- Guardring for Stress Protection
- Low Forward Voltage
- 100°C Operating Junction Temperature
- Epoxy Meets UL94, VO at 1/8″
- Short Heat Sink Tab Manufactured — Not Sheared!
- Similar in Size to the Industry Standard TO–220 Package

Mechanical Characteristics

- Case: Epoxy, Molded
- Weight: 1.7 grams (approximately)
- Finish: All External Surfaces Corrosion Resistant and Terminal Leads are Readily Solderable
- Lead and Mounting Surface Temperature for Soldering Purposes: 260°C Max. for 10 Seconds
- Shipped 50 units per plastic tube
- Available in 24 mm Tape and Reel, 800 units per 13″ reel by adding a “T4” suffix to the part number
- Marking: B2515L

MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Peak Repetitive Reverse Voltage Working Peak Reverse Voltage DC Blocking Voltage	V_{RRM} V_{RWM} V_R	15	V
Average Rectified Forward Current (Rated V_R, T_C = 90°C)	$I_{F(AV)}$	25	A
Peak Repetitive Forward Current (Rated V_R, Square Wave, 20 kHz, T_C = 100°C)	I_{FRM}	30	A
Non–Repetitive Peak Surge Current (Surge Applied at Rated Load Conditions Halfwave, Single Phase, 60 Hz)	I_{FSM}	150	A
Storage Temperature Range	T_{stg}	–65 to +150	°C
Operating Junction Temperature	T_J	100	°C
Voltage Rate of Change (Rated V_R)	dv/dt	10,000	V/μs

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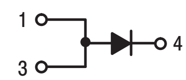
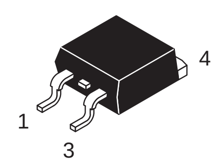
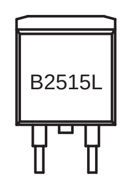
SCHOTTKY BARRIER RECTIFIER
25 AMPERES
15 VOLTS





D^2PAK
CASE 418B
STYLE 3

MARKING DIAGRAM



B2515L = Device Code

ORDERING INFORMATION

Device	Package	Shipping
MBRB2515L	D^2PAK	50/Rail
MBRB2515LT4	D^2PAK	800/Tape & Reel

Preferred devices are recommended choices for future use and best overall value.

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THERMAL CHARACTERISTICS

Characteristic	Symbol	Value	Unit
Thermal Resistance — Junction to Case — Junction to Ambient (Note 1.)	$R_{\theta JC}$ $R_{\theta JA}$	1.0 50	°C/W

ELECTRICAL CHARACTERISTICS

Maximum Instantaneous Forward Voltage (Note 2.) (i_F = 19 Amps, T_J = 70°C) (i_F = 25 Amps, T_J = 70°C) (i_F = 25 Amps, T_J = 25°C)	v_F	 0.28 0.42 0.45	Volts
Maximum Instantaneous Reverse Current (Note 2.) (Rated dc Voltage, T_J = 70°C) (Rated dc Voltage, T_J = 25°C)	I_R	 200 15	mA

1. When mounted using minimum recommended pad size on FR–4 board.
2. Pulse Test: Pulse Width = 300 μs, Duty Cycle ≤ 2.0%.

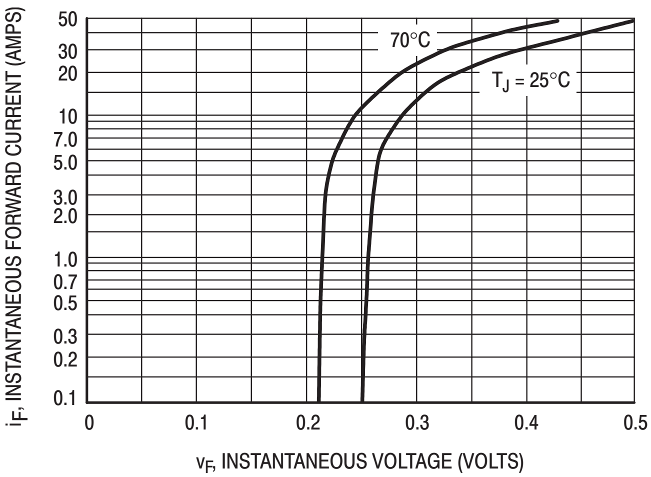

Figure 1. Typical Forward Voltage

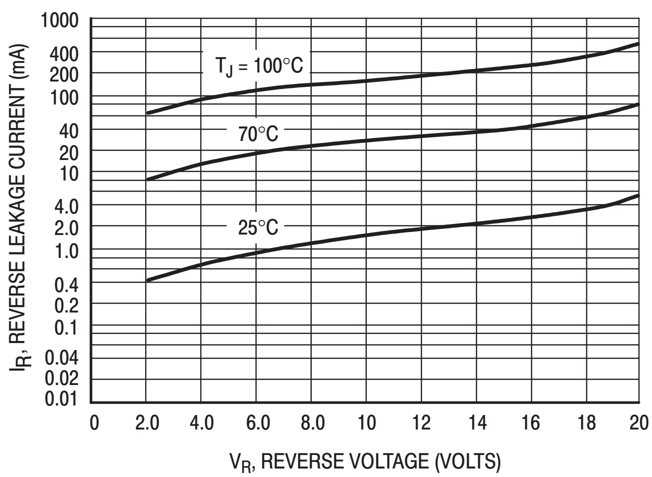

Figure 2. Typical Reverse Leakage Current

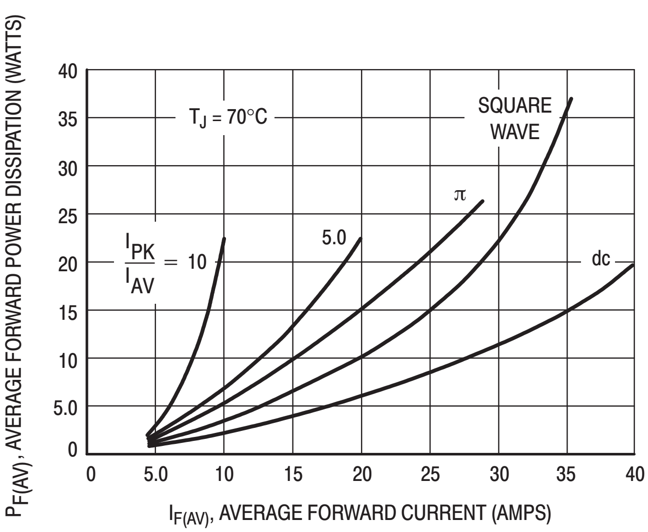

Figure 3. Typical Forward Power Dissipation

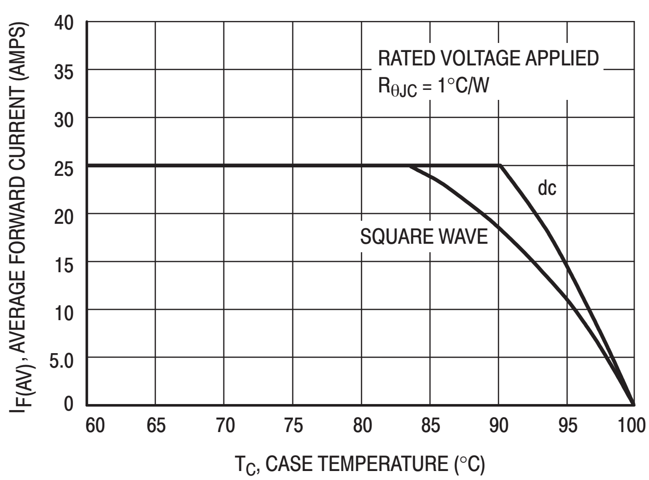

Figure 4. Current Derating, Case

MBRB2535CTL

Preferred Device

SWITCHMODE™ Power Rectifier

D^2PAK Surface Mount Power Package

The D^2PAK Power Rectifier employs the Schottky Barrier principle in a large metal–to–silicon power diode. State–of–the–art geometry features epitaxial construction with oxide passivation and metal overlay contact. Ideally suited for use in low voltage, high frequency switching power supplies, free wheeling diodes, and polarity protection diodes. These state–of–the–art devices have the following features:

- Center–Tap Configuration
- Guardring for Stress Protection
- Low Forward Voltage
- 125°C Operating Junction Temperature
- Epoxy Meets UL94, VO at 1/8″
- Short Heat Sink Tab Manufactured — Not Sheared!
- Similar in Size to the Industry Standard TO–220 Package

Mechanical Characteristics

- Case: Epoxy, Molded
- Weight: 1.7 grams (approximately)
- Finish: All External Surfaces Corrosion Resistant and Terminal Leads are Readily Solderable
- Lead and Mounting Surface Temperature for Soldering Purposes: 260°C Max. for 10 Seconds
- Shipped 50 units per plastic tube
- Available in 24 mm Tape and Reel, 800 units per 13″ reel by adding a “T4” suffix to the part number
- Marking: B2535L

MAXIMUM RATINGS

Please See the Table on the Following Page

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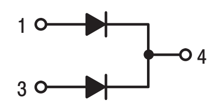
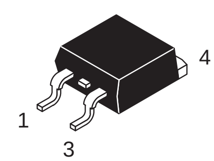
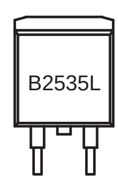
SCHOTTKY BARRIER RECTIFIER
25 AMPERES
35 VOLTS





D^2PAK
CASE 418B
STYLE 3

MARKING DIAGRAM



B2535L = Device Code

ORDERING INFORMATION

Device	Package	Shipping
MBRB2535CTL	D^2PAK	50/Rail
MBRB2535CTLT4	D^2PAK	800/Tape & Reel

Preferred devices are recommended choices for future use and best overall value.

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MAXIMUM RATINGS (Per Leg)

Rating	Symbol	Value	Unit
Peak Repetitive Reverse Voltage Working Peak Reverse Voltage DC Blocking Voltage	V_{RRM} V_{RWM} V_R	35	V
Average Rectified Forward Current (Rated V_R, T_C = 110°C)	$I_{F(AV)}$	12.5	A
Peak Repetitive Forward Current (Rated V_R, Square Wave, 20 kHz, T_C = 90°C)	I_{FRM}	25	A
Non–Repetitive Peak Surge Current (Surge Applied at Rated Load Conditions Halfwave, Single Phase, 60 Hz)	I_{FSM}	150	A
Peak Repetitive Reverse Surge Current (2.0 μs, 1.0 kHz)	I_{RRM}	1.0	A
Storage Temperature Range	T_{stg}	–65 to +150	°C
Operating Junction Temperature	T_J	–65 to +125	°C
Voltage Rate of Change (Rated V_R)	dv/dt	10,000	V/μs

THERMAL CHARACTERISTICS (Per Leg)

Characteristic	Symbol	Value	Unit
Thermal Resistance — Junction to Case — Junction to Ambient (Note 1.)	$R_{\theta JC}$ $R_{\theta JA}$	2.0 50	°C/W

ELECTRICAL CHARACTERISTICS (Per Leg)

Maximum Instantaneous Forward Voltage (Note 2.) (i_F = 25 Amps, T_J = 25°C) (i_F = 12.5 Amps, T_J = 125°C) (i_F = 12.5 Amps, T_J = 25°C)	v_F	 0.55 0.41 0.47	Volts
Maximum Instantaneous Reverse Current (Note 2.) (Rated dc Voltage, T_J = 125°C) (Rated dc Voltage, T_J = 25°C)	I_R	 500 10	mA

1. When mounted using minimum recommended pad size on FR–4 board.
2. Pulse Test: Pulse Width = 300 μs, Duty Cycle ≤ 2.0%.

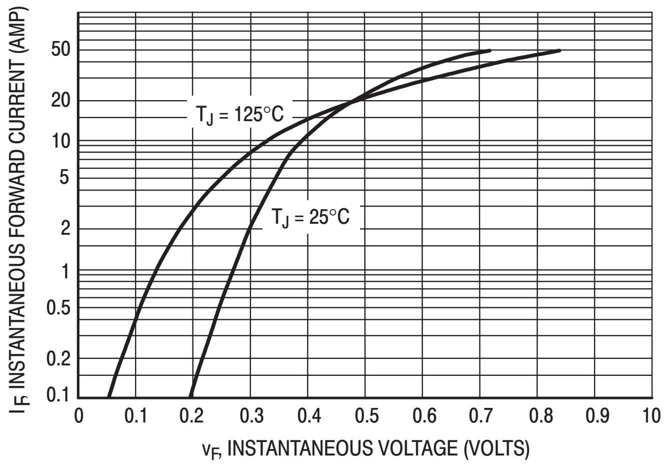

Figure 1. Typical Forward Voltage, Per Leg

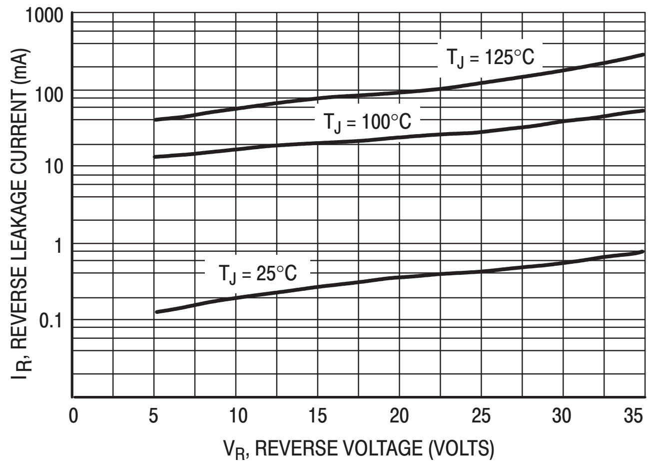

Figure 2. Typical Reverse Current, Per Leg

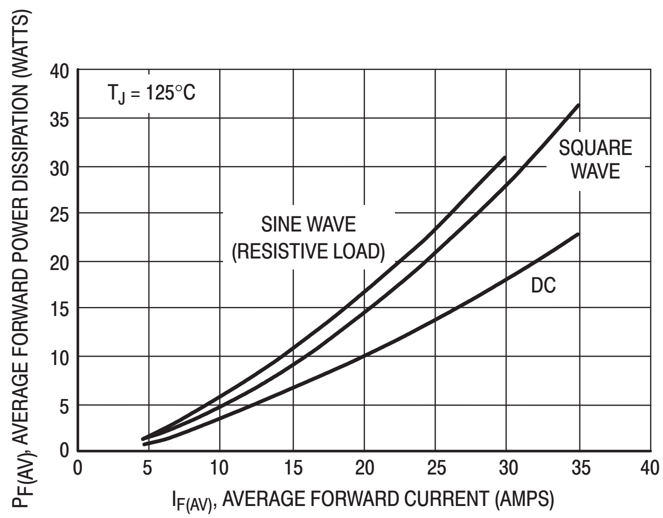

Figure 3. Typical Forward Power Dissipation

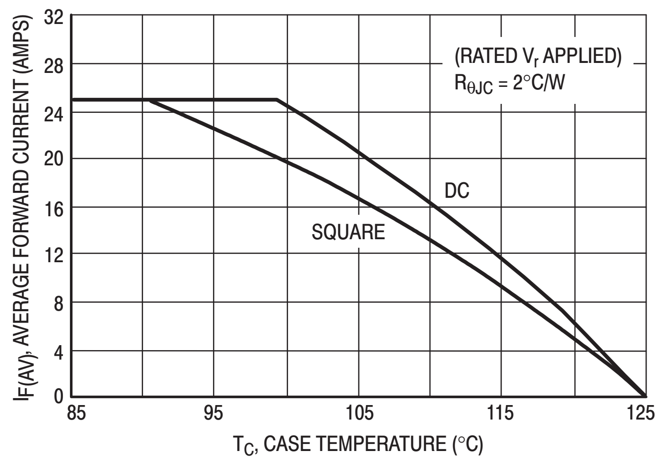

Figure 4. Current Derating, Case

MBRB2545CT

Preferred Device

SWITCHMODE™ Power Rectifier

D²PAK Surface Mount Power Package

The D²PAK Power Rectifier employs the Schottky Barrier principle with a platinum barrier metal. These state–of–the–art devices have the following features:

- Center–Tap Configuration
- Guardring for Stress Protection
- Low Forward Voltage
- 150°C Operating Junction Temperature
- Epoxy Meets UL94, VO at 1/8″
- Short Heat Sink Tab Manufactured — Not Sheared!
- Similar in Size to the Industry Standard TO–220 Package

Mechanical Characteristics

- Case: Epoxy, Molded
- Weight: 1.7 grams (approximately)
- Finish: All External Surfaces Corrosion Resistant and Terminal Leads are Readily Solderable
- Lead and Mounting Surface Temperature for Soldering Purposes: 260°C Max. for 10 Seconds
- Shipped 50 units per plastic tube
- Available in 24 mm Tape and Reel, 800 units per 13″ reel by adding a “T4” suffix to the part number
- Marking: B2545T

MAXIMUM RATINGS (Per Leg)

Rating	Symbol	Value	Unit
Peak Repetitive Reverse Voltage Working Peak Reverse Voltage DC Blocking Voltage	V_{RRM} V_{RWM} V_R	45	V
Average Rectified Forward Current (Rated V_R, T_C = 130°C) Total Device	$I_{F(AV)}$	15 30	A
Peak Repetitive Forward Current (Rated V_R, Square Wave, 20 kHz, T_C = 130°C)	I_{FRM}	30	A
Non–Repetitive Peak Surge Current (Surge Applied at Rated Load Conditions Halfwave, Single Phase, 60 Hz)	I_{FSM}	150	A
Peak Repetitive Reverse Surge Current (2.0 μs, 1.0 kHz)	I_{RRM}	1.0	A
Storage Temperature Range	T_{stg}	–65 to +175	°C
Operating Junction Temperature	T_J	–65 to +150	°C
Voltage Rate of Change (Rated V_R)	dv/dt	10,000	V/μs

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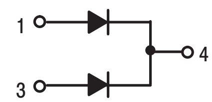
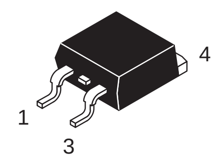
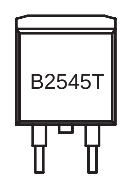
SCHOTTKY BARRIER RECTIFIER
30 AMPERES
45 VOLTS





D²PAK
CASE 418B
STYLE 3

MARKING DIAGRAM



B2545T = Device Code

ORDERING INFORMATION

Device	Package	Shipping
MBRB2545CT	D²PAK	50/Rail
MBRB2545CTT4	D²PAK	800/Tape & Reel

Preferred devices are recommended choices for future use and best overall value.

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THERMAL CHARACTERISTICS (Per Leg)

Characteristic	Symbol	Value	Unit
Thermal Resistance — Junction to Case — Junction to Ambient (Note 1.)	$R_{\theta JC}$ $R_{\theta JA}$	1.5 50	°C/W

ELECTRICAL CHARACTERISTICS (Per Leg)

Maximum Instantaneous Forward Voltage (Note 2.) (i_F = 30 Amps, T_J = 125°C) (i_F = 30 Amps, T_J = 25°C)	v_F	 0.73 0.82	Volts
Maximum Instantaneous Reverse Current (Note 2.) (Rated dc Voltage, T_J = 125°C) (Rated dc Voltage, T_J = 25°C)	i_R	 40 0.2	mA

1. When mounted using minimum recommended pad size on FR–4 board.
2. Pulse Test: Pulse Width = 300 μs, Duty Cycle ≤ 2.0%.

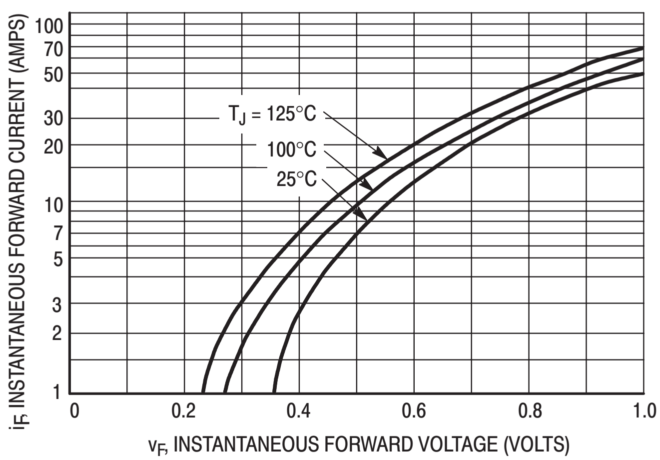

Figure 1. Typical Forward Voltage, Per Leg

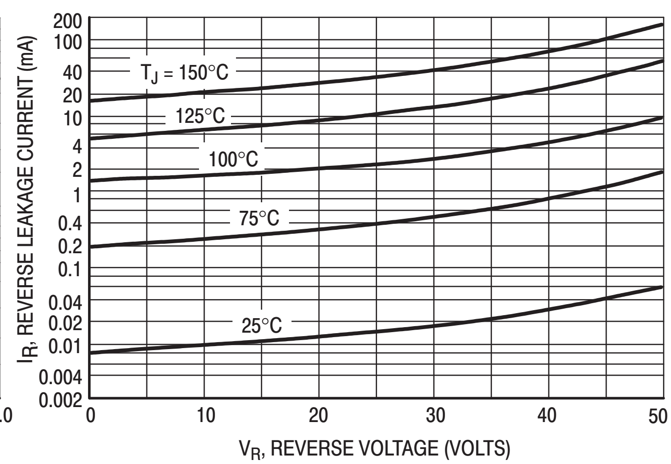

Figure 2. Typical Reverse Current, Per Leg

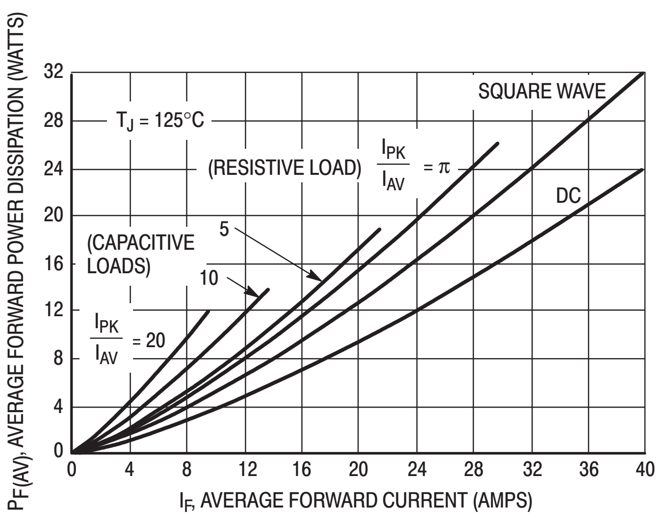

Figure 3. Typical Forward Power Dissipation

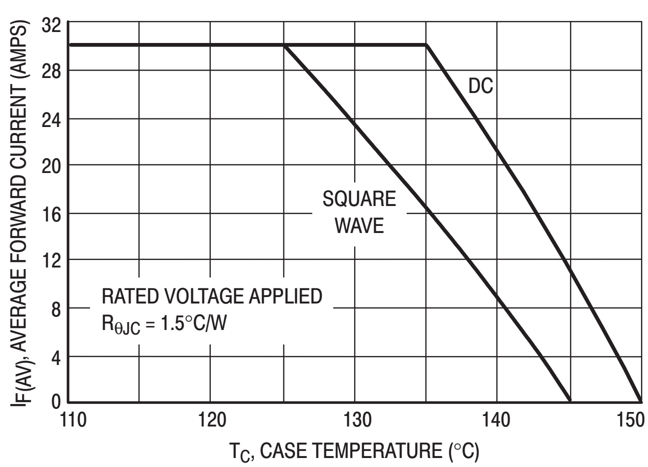

Figure 4. Current Derating, Case

MBRB3030CT

Preferred Device

SWITCHMODE™ Power Rectifier

Using the Schottky Barrier principle with a proprietary barrier metal. These state–of–the–art devices have the following features:

- Guardring for Stress Protection
- Maximum Die Size
- 150°C Operating Junction Temperature
- Short Heat Sink Tab Manufactured – Not Sheared

Mechanical Characteristics:

- Case: Epoxy, Molded
- Weight: 1.7 grams (approximately)
- Finish: All External Surfaces Corrosion Resistant and Terminal Leads are Readily Solderable
- Lead and Mounting Surface Temperature for Soldering Purposes: 260°C Max. for 10 Seconds
- Shipped 50 Units per Plastic Tube
- Available in 24 mm Tape and Reel, 800 Units per 13” Reel by Adding a “T4” Suffix to the Part Number
- Marking: B3030

MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Peak Repetitive Reverse Voltage Working Peak Reverse Voltage DC Blocking Voltage	V_{RRM} V_{RWM} V_R	30	V
Average Rectified Forward Current (At Rated V_R, T_C = 134°C) Per Device Per Leg	$I_{F(AV)}$	 30 15	A
Peak Repetitive Forward Current (At Rated V_R, Square Wave, 20 kHz, T_C = +137°C) Per Leg	I_{FRM}	30	A
Non–Repetitive Peak Surge Current (Surge Applied at Rated Load Conditions, Halfwave, Single Phase, 60 Hz)	I_{FSM}	200	A
Peak Repetitive Reverse Surge Current (2.0 μs, 1.0 kHz)	I_{RRM}	2.0	A
Storage Temperature Range	T_{stg}	–55 to +150	°C
Operating Junction Temperature	T_J	–55 to +150	°C
Voltage Rate of Change (Rated V_R)	dv/dt	10,000	V/μs
Reverse Energy (Unclamped Inductive Surge) (Inductance = 3 mH, T_C = 25°C)	W	100	mJ

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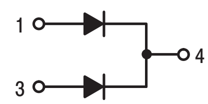
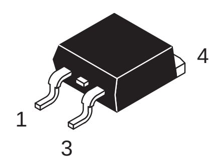
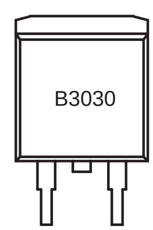
SCHOTTKY BARRIER RECTIFIER
30 AMPERES
30 VOLTS





D²PAK
CASE 418B
STYLE 3

MARKING DIAGRAM



B3030 = Device Code

ORDERING INFORMATION

Device	Package	Shipping
MBRB3030CT	D²PAK	50/Rail
MBRB3030CTT4	D²PAK	800/Tape & Reel

Preferred devices are recommended choices for future use and best overall value.

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THERMAL CHARACTERISTICS (Per Leg)

Characteristic	Symbol	Value	Unit
Thermal Resistance — Junction to Case — Junction to Ambient (Note 1.)	$R_{\theta JC}$ $R_{\theta JA}$	1.0 50	°C/W

ELECTRICAL CHARACTERISTICS (Per Leg)

Maximum Instantaneous Forward Voltage (Note 2.), Per Leg (I_F = 15 Amps, T_C = +25°C) (I_F = 15 Amps, T_C = +150°C) (I_F = 30 Amps, T_C = +25°C) (I_F = 30 Amps, T_C = +150°C)	V_F	 0.54 0.47 0.67 0.66	Volts
Maximum Instantaneous Reverse Current (Note 2.), Per Leg (Rated dc Voltage, T_C = +25°C) (Reverse Voltage = 10 V, T_C = +150°C) (Rated dc Voltage, T_C = +150°C)	I_R	 0.6 46 145	mA

1. When mounted using minimum recommended pad size on FR–4 board.
2. Pulse Test: Pulse Width = 300 μs, Duty Cycle ≤ 2.0%.

ELECTRICAL CHARACTERISTICS

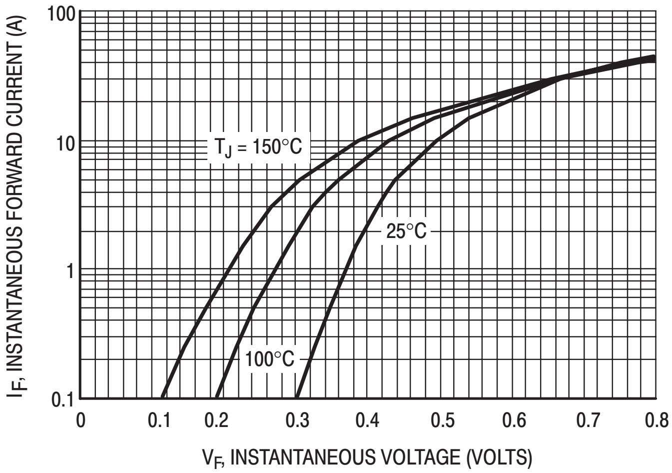

Figure 1. Maximum Forward Voltage, Per Leg

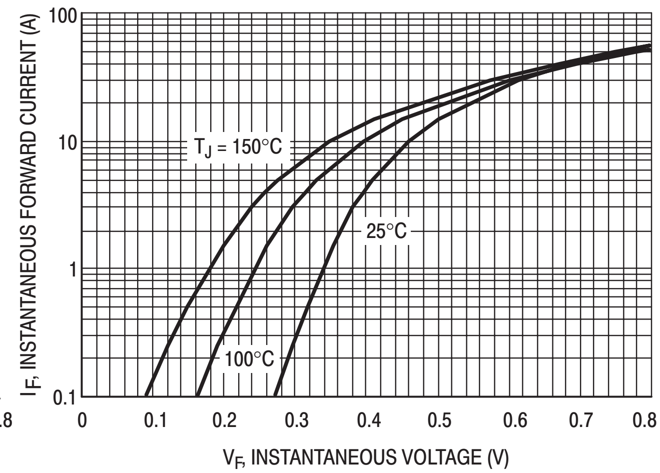

Figure 2. Typical Forward Voltage, Per Leg

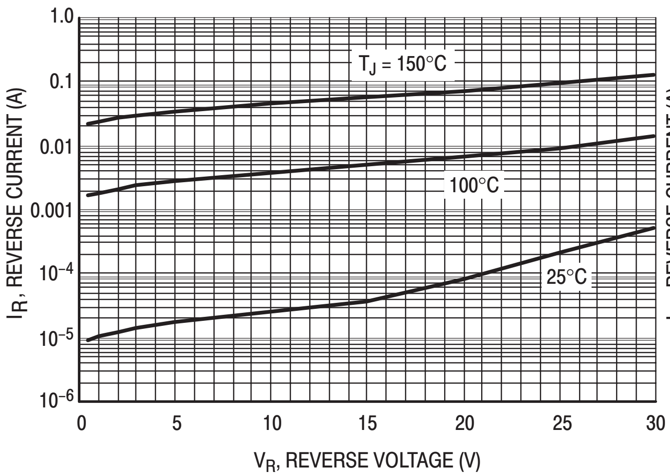

Figure 3. Maximum Reverse Current, Per Leg

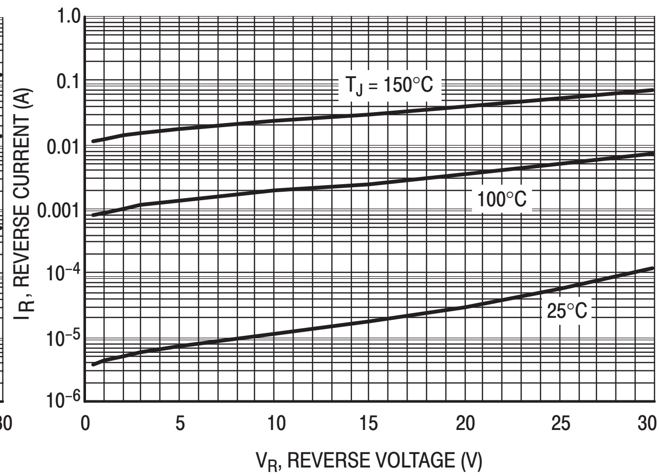

Figure 4. Typical Reverse Current, Per Leg

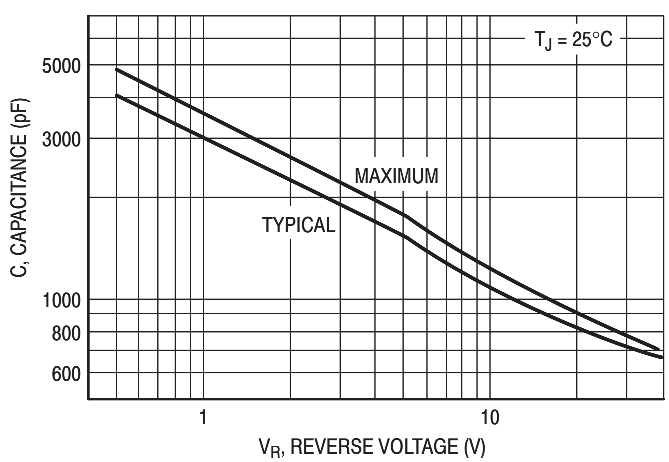

Figure 5. Capacitance

TYPICAL CHARACTERISTICS

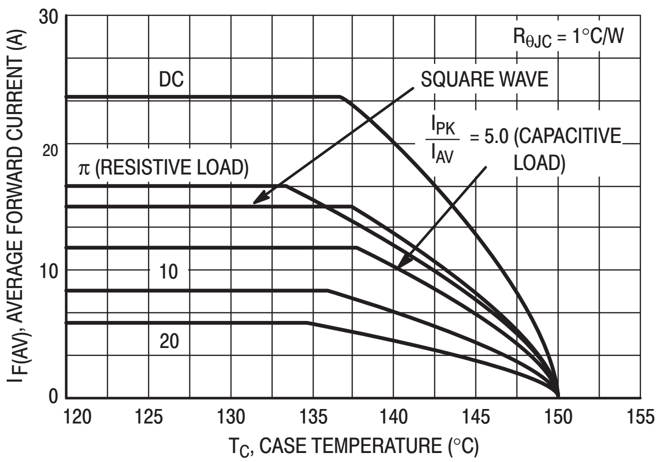

Figure 6. Current Derating, Infinite Heatsink

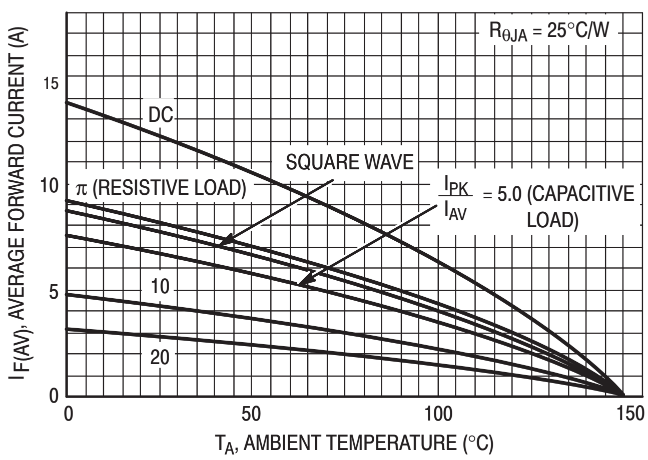

Figure 7. Current Derating

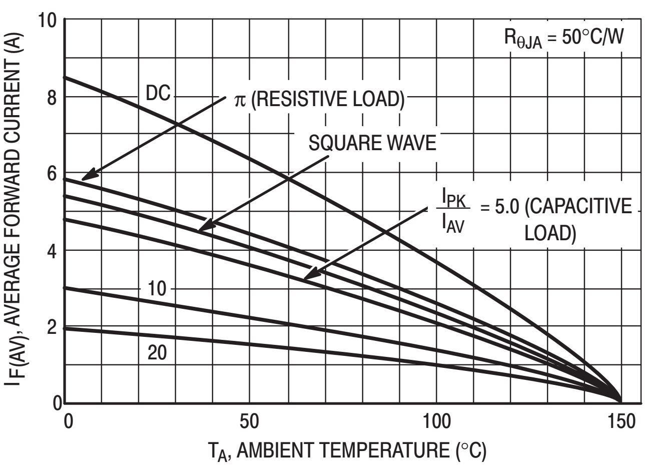

Figure 8. Current Derating, Free Air

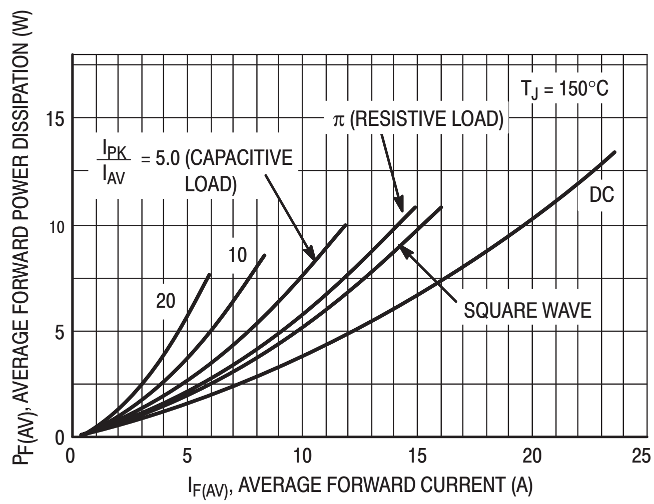

Figure 9. Forward Power Dissipation

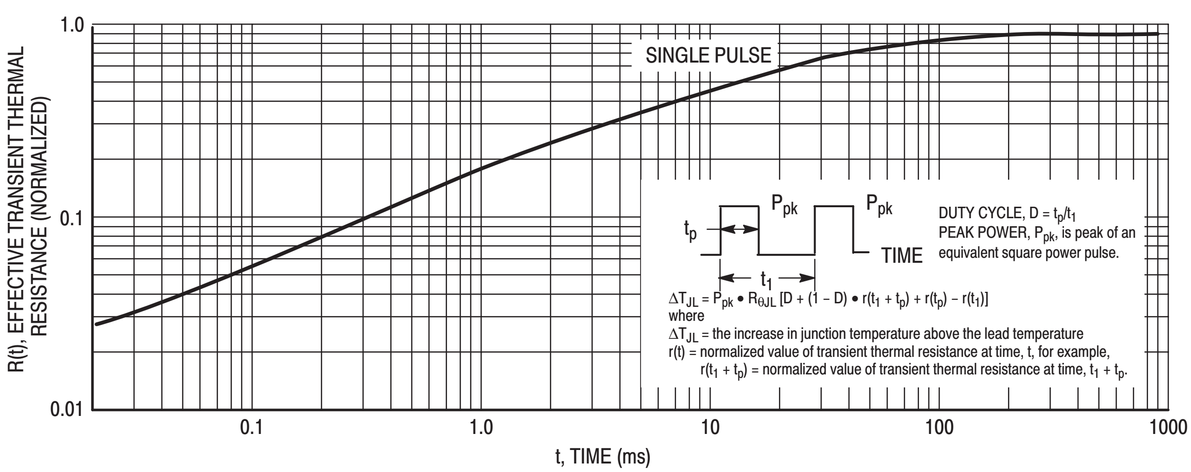

Figure 10. Thermal Response

MBRB3030CTL

Advance Information

SWITCHMODE™ Power Rectifier

. . . using the Schottky Barrier principle with a proprietary barrier metal. These state–of–the–art devices have the following features:

Features:

- Dual Diode Construction — May be Paralleled for Higher Current Output
- Guardring for Stress Protection
- Low Forward Voltage Drop
- 125°C Operating Junction Temperature
- Maximum Die Size
- Short Heat Sink Tab Manufactured — Not Sheared!

MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Peak Repetitive Reverse Voltage Working Peak Reverse Voltage DC Blocking Voltage	V_{RRM} V_{RWM} V_R	30	V
Average Rectified Forward Current (At Rated V_R, T_C = 115°C) Per Device	I_O	15 30	A
Peak Repetitive Forward Current (At Rated V_R, Square Wave, 20 kHz, T_C = 115°C)	I_{FRM}	30	A
Non–Repetitive Peak Surge Current (Surge Applied at Rated Load Conditions Halfwave, Single Phase, 60 Hz)	I_{FSM}	300	A
Peak Repetitive Reverse Surge Current (1.0 μs, 1.0 kHz)	I_{RRM}	2.0	A
Storage Temperature Range	T_{stg}	–55 to +150	°C
Operating Junction Temperature Range	T_J	–55 to +125	°C
Voltage Rate of Change (Rated V_R, T_J = 25°C)	dv/dt	10,000	V/μs
Reverse Energy, Unclamped Inductive Surge (T_J = 25°C, L = 3.0 mH)	E_{AS}	224.5	mJ

This document contains information on a new product. Specifications and information herein are subject to change without notice.

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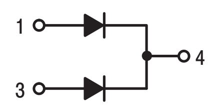
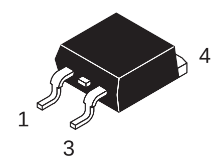
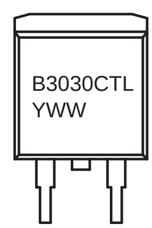
SCHOTTKY BARRIER RECTIFIER
30 AMPERES
30 VOLTS





D²PAK
CASE 418B
PLASTIC

MARKING DIAGRAM



B3030CTL = Device Code
Y = Year
WW = Work Week

ORDERING INFORMATION

Device	Package	Shipping
MBRB3030CTL	D²PAK	50/Rail
MBRB3030CTLT4	D²PAK	800/Tape & Reel

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THERMAL CHARACTERISTICS

Characteristic	Symbol	Value	Unit
Thermal Resistance, Junction to Ambient (Note 1.)	$R_{\theta JA}$	50	°C/W
Thermal Resistance, Junction to Case	$R_{\theta JC}$	1.0	°C/W

ELECTRICAL CHARACTERISTICS

Maximum Instantaneous Forward Voltage (Note 2.) (I_F = 15 A, T_J = 25°C) (I_F = 30 A, T_J = 25°C)	V_F	 0.44 0.51	V
Maximum Instantaneous Reverse Current (Note 2.) (Rated V_R, T_J = 25°C) (Rated V_R, T_J = 125°C)	I_R	 2.0 195	mA

1. Mounted using minimum recommended pad size on FR–4 board.
2. Pulse Test: Pulse Width = 250 µs, Duty Cycle ≤ 2.0%.

All device data is “Per Leg” except where noted.

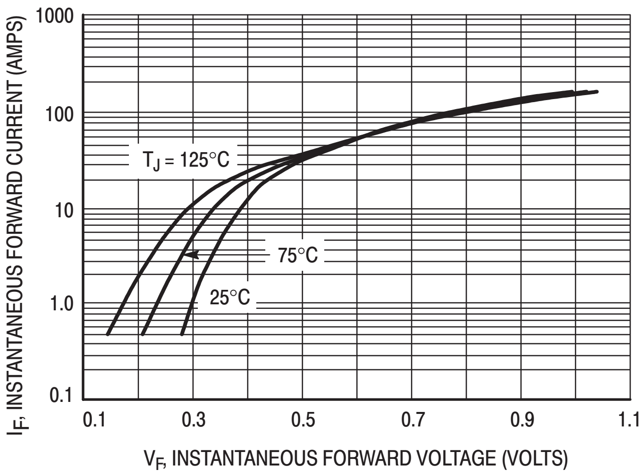


Figure 1. Typical Forward Voltage

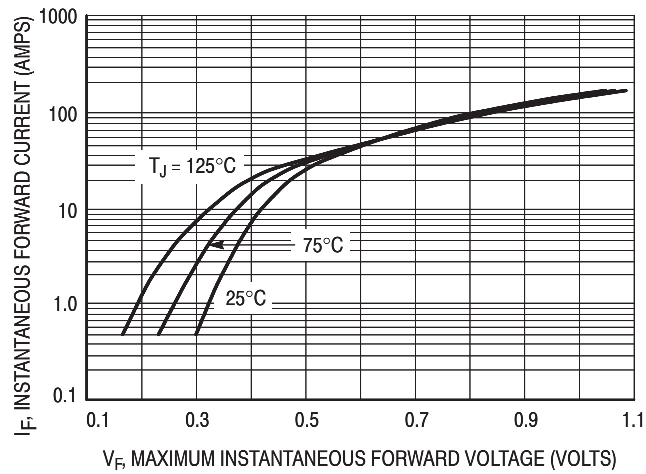


Figure 2. Maximum Forward Voltage

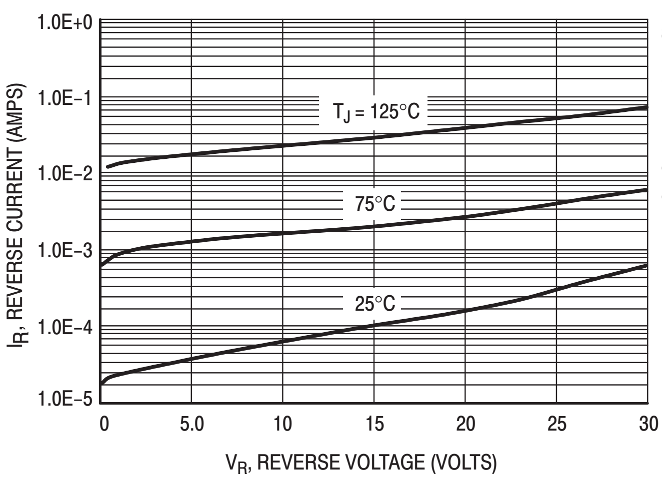


Figure 3. Typical Reverse Current

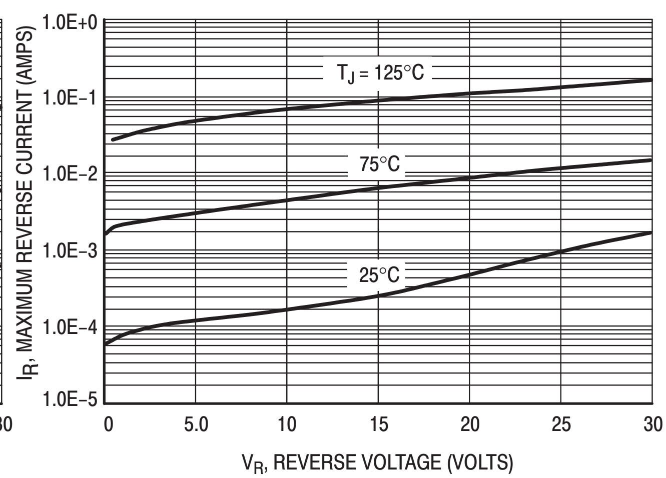


Figure 4. Maximum Reverse Current

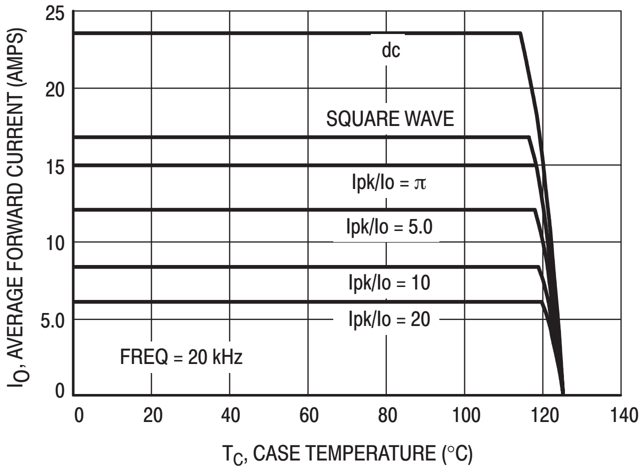


Figure 5. Current Derating

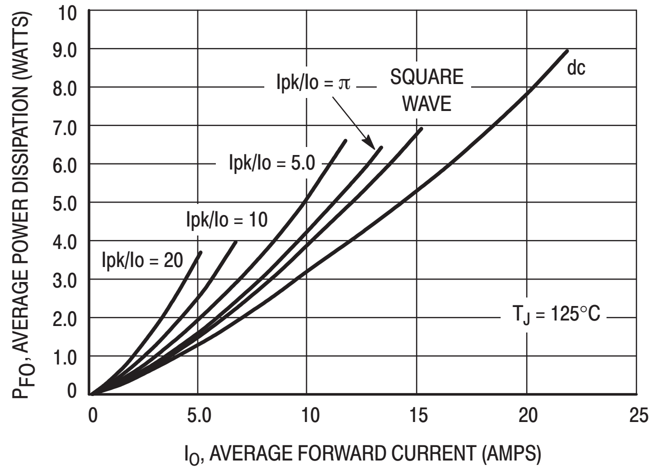


Figure 6. Forward Power Dissipation

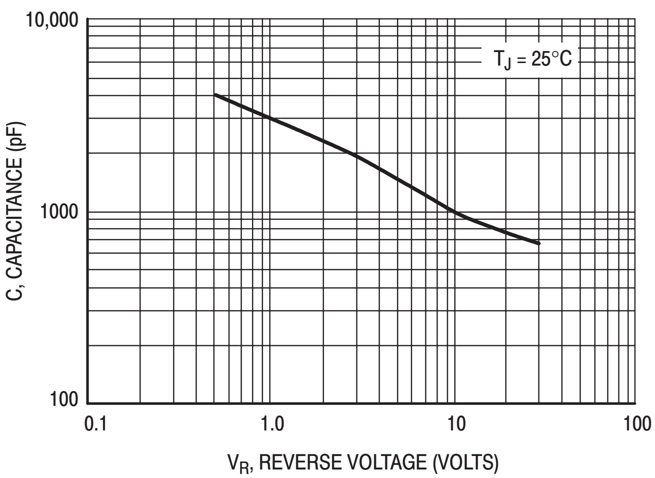


Figure 7. Typical Capacitance

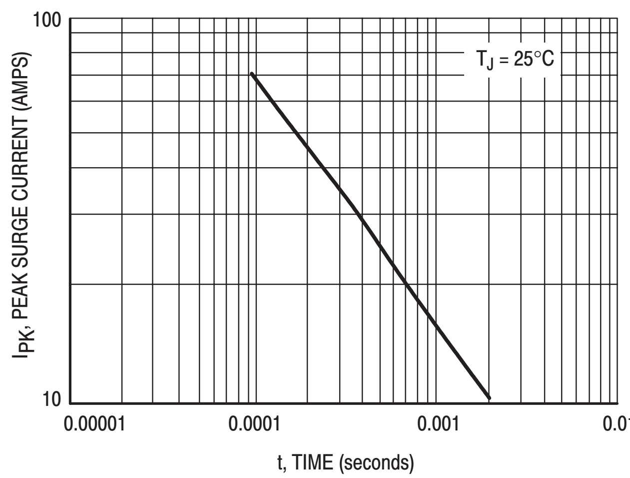


Figure 8. Typical Unclamped Inductive Surge

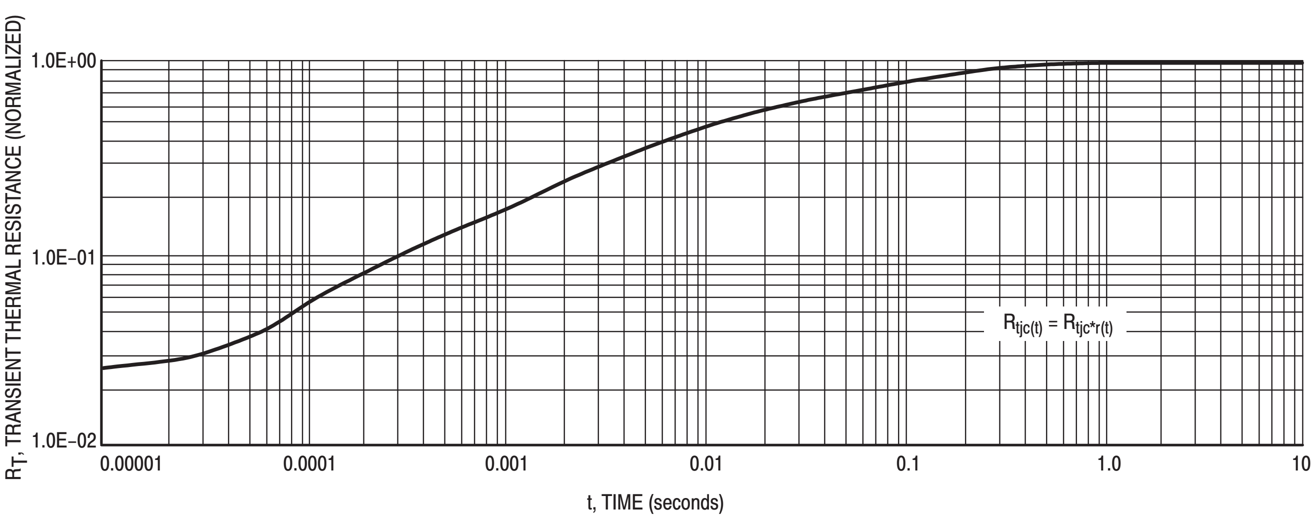


Figure 9. Typical Thermal Response

Modeling Reverse Energy Characteristics of Power Rectifiers

Prepared by: David Shumate & Larry Walker
Motorola Semiconductor Products Sector

ABSTRACT

Power semiconductor rectifiers are used in a variety of applications where the reverse energy requirements often vary dramatically based on the operating conditions of the application circuit. A characterization method was devised using the Unclamped Inductive Surge (UIS) test technique. By testing at only a few different operating conditions (i.e. different inductor sizes) a safe operating range can be established for a device. A relationship between peak avalanche current and inductor discharge time was established. Using this relationship and circuit parameters, the part applicability can be determined. This technique offers a power supply designer the total operating conditions for a device as opposed to the present single–data–point approach.

INTRODUCTION

In today's modern power supplies, converters and other switching circuitry, large voltage spikes due to parasitic inductance can propagate throughout the circuit, resulting in catastrophic device failures. Concurrent with this, in an effort to provide low–loss power rectifiers, i.e. devices with lower forward voltage drops, schottky technology is being applied to devices used in this switching power circuitry. This technology lends itself to lower reverse breakdown voltages. This combination of high voltage spikes and low reverse breakdown voltage devices can lead to reverse energy destruction of power rectifiers in their applications. This phenomena, however, is not limited to just schottky technology.

In order to meet the challenges of these situations, power semiconductor manufacturers attempt to characterize their devices with respect to reverse energy robustness. The typical reverse energy specification, if provided at all, is usually given as energy–to–failure (mJ) with a particular inductor specified for the UIS test circuit. Sometimes, the peak reverse test current is also specified. Practically all reverse energy characterizations are performed using the UIS test circuit shown in Figure 10. Typical UIS voltage and current waveforms are shown in Figure 11.

In order to provide the designer with a more extensive characterization than the above mentioned one–point approach, a more comprehensive method for characterizing these devices was developed. A designer can use the given information to determine the appropriateness and safe operating area (SOA) of the selected device.

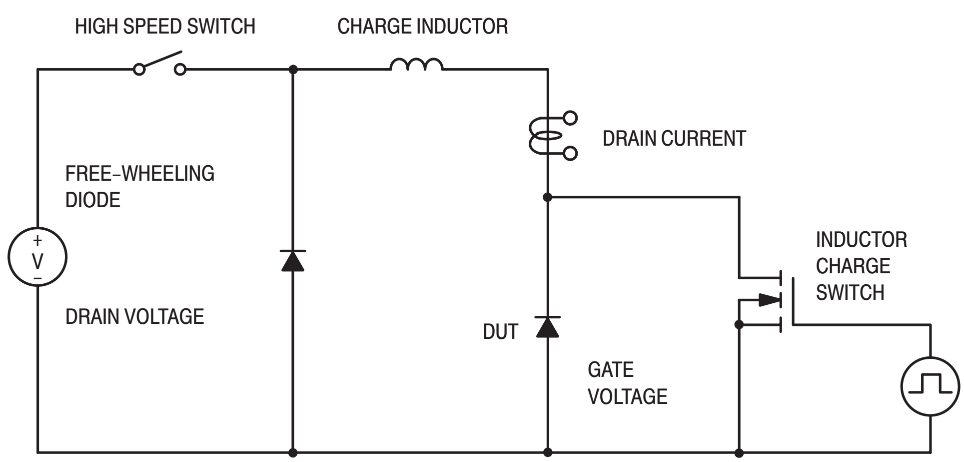


Figure 10. Simplified UIS Test Circuit

Suggested Method of Characterization

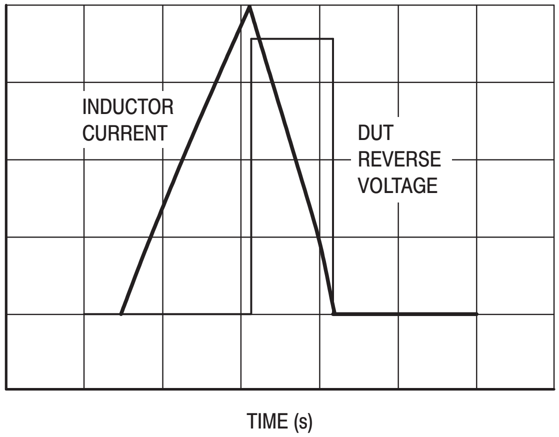


Figure 11. Typical Voltage and Current UIS Waveforms

Utilizing the UIS test circuit in Figure 10, devices are tested to failure using inductors ranging in value from 0.01 to 159 mH. The reverse voltage and current waveforms are acquired to determine the exact energy seen by the device and the inductive current decay time. At least 4 distinct inductors and 5 to 10 devices per inductor are used to generate the characteristic current versus time relationship. This relationship when coupled with the application circuit conditions, defines the SOA of the device uniquely for this application.

Example Application

The device used for this example was an MBR3035CT, which is a 30 A (15 A per side) forward current, 35 V reverse breakdown voltage rectifier. All parts were tested to destruction at 25°C. The inductors used for the characterization were 10, 3.0, 1.0 and 0.3 mH. The data recorded from the testing were peak reverse current (Ip), peak reverse breakdown voltage (BVR), maximum withstand energy, inductance and inductor discharge time (see Table 1). A plot of the Peak Reverse Current versus Time at device destruction, as shown in Figure 12, was generated. The area under the curve is the region of lower reverse energy or lower stress on the device. This area is known as the safe operating area or SOA.

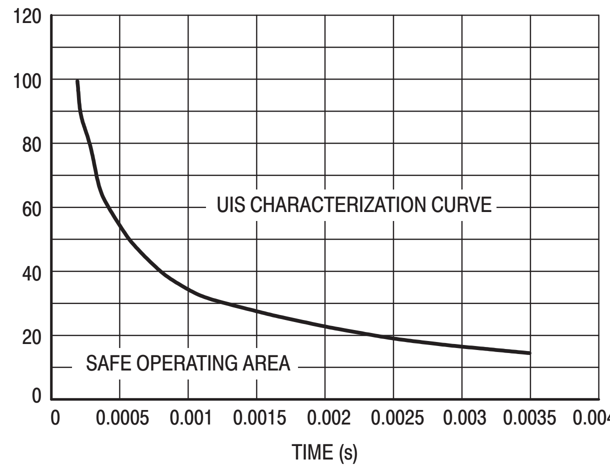


Figure 12. Peak Reverse Current versus Time for DUT

Table 1. UIS Test Data

PART NO.	I_P (A)	B_{VR} (V)	ENERGY (mJ)	L (mH)	TIME (μs)
1	46.6	65.2	998.3	1	715
2	41.7	63.4	870.2	1	657
3	46.0	66.0	1038.9	1	697
4	42.7	64.8	904.2	1	659
5	44.9	64.8	997.3	1	693
6	44.1	64.1	865.0	1	687
7	26.5	63.1	1022.6	3	1261
8	26.4	62.8	1024.9	3	1262
9	24.4	62.2	872.0	3	1178
10	27.6	62.9	1091.0	3	1316
11	27.7	63.2	1102.4	3	1314
12	17.9	62.6	1428.6	10	2851
13	18.9	62.1	1547.4	10	3038
14	18.8	60.7	1521.1	10	3092
15	19.0	62.6	1566.2	10	3037
16	74.2	69.1	768.4	0.3	322
17	77.3	69.6	815.4	0.3	333
18	75.2	68.9	791.7	0.3	328
19	77.3	69.6	842.6	0.3	333
20	73.8	69.1	752.4	0.3	321
21	75.6	69.2	823.2	0.3	328
22	74.7	68.6	747.5	0.3	327
23	78.4	70.3	834.0	0.3	335
24	70.5	66.6	678.4	0.3	317
25	78.3	69.4	817.3	0.3	339

The procedure to determine if a rectifier is appropriate, from a reverse energy standpoint, to be used in the application circuit is as follows:

a. Obtain "Peak Reverse Current versus Time" curve from data book.
b. Determine steady state operating voltage (OV) of circuit.
c. Determine parasitic inductance (L) of circuit section of interest.
d. Obtain rated breakdown voltage (BVR) of rectifier from data book.
e. From the following relationships,

$$V = L \cdot \frac{d}{dt} i(t) \qquad I = \frac{(BVR - OV) \cdot t}{L}$$

a "designer" l versus t curve is plotted alongside the device characteristic plot.

f. The point where the two curves intersect is the current level where the devices will start to fail. A peak inductor current below this intersection should be chosen for safe operating.

As an example, the values were chosen as L = 200 μH, OV = 12 V and BVR = 35 V.

Figure 13 illustrates the example. Note the UIS characterization curve, the parasitic inductor current curve and the safe operating region as indicated.

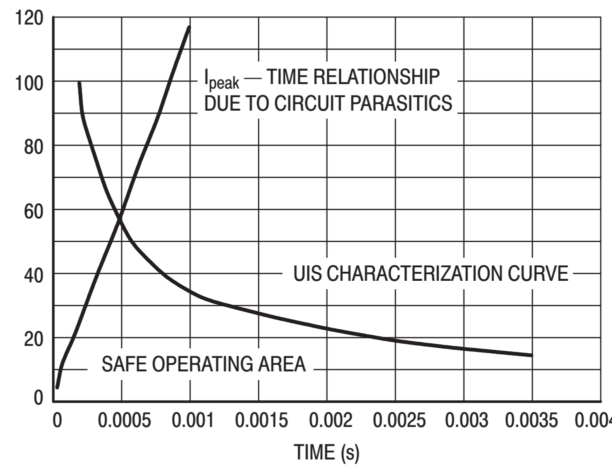


Figure 13. DUT Peak Reverse and Circuit Parasitic Inductance Current versus Time

SUMMARY

Traditionally, power rectifier users have been supplied with single–data–point reverse–energy characteristics by the supplier's device data sheet; however, as has been shown here and in previous work, the reverse withstand energy can vary significantly depending on the application. What was done in this work was to create a characterization scheme by which the designer can overlay or map their particular requirements onto the part capability and determine quite accurately if the chosen device is applicable. This characterization technique is very robust due to its statistical approach, and with proper guardbanding (6σ) can be used to give worst–case device performance for the entire product line. A "typical" characteristic curve is probably the most applicable for designers allowing them to design in their own margins.

References

1. Borras, R., Aliosi, P., Shumate, D., 1993, "Avalanche Capability of Today's Power Semiconductors, "Proceedings, European Power Electronic Conference," 1993, Brighton, England

2. Pshaenich, A., 1985, "Characterizing Overvoltage Transient Suppressors," Powerconversion International, June/July

MBRB4030

Preferred Device

SWITCHMODE™ Power Rectifier

Using the Schottky Barrier principle with a proprietary barrier metal. These state–of–the–art devices have the following features:

- Guardring for Stress Protection
- Maximum Die Size
- 150°C Operating Junction Temperature
- Short Heat Sink Tab Manufactured – Not Sheared

Mechanical Characteristics

- Case: Epoxy, Molded
- Weight: 1.7 Grams (approximately)
- Finish: All External Surfaces Corrosion Resistant and Terminal Leads Readily Solderable
- Shipped 50 Units per Plastic Tube
- Available in 24 mm Tape and Reel, 800 Units per 13″ Reel by Adding a “T4” Suffix to the Part Number
- Marking: B4030

MAXIMUM RATINGS

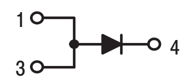
Rating	Symbol	Value	Unit
Peak Repetitive Reverse Voltage Working Peak Reverse Voltage DC Blocking Voltage	V_{RRM} V_{RWM} V_R	30	V
Average Rectified Forward Current (At Rated V_R) T_C = +115°C (Note 1.)	$I_{F(AV)}$	40	A
Peak Repetitive Forward Current (At Rated V_R, Square Wave, 20 kHz) T_C = +112°C	I_{FRM}	80	A
Non–Repetitive Peak Surge Current (Surge Applied at Rated Load Conditions Halfwave, Single Phase, 60 Hz)	I_{FSM}	300	A
Peak Repetitive Reverse Surge Current (2.0 µs, 1.0 kHz)	I_{RRM}	2.0	A
Storage Temperature Range	T_{stg}	–65 to +150	°C
Operating Junction Temperature Range	T_J	–65 to +150	°C
Voltage Rate of Change (Rated V_R)	dv/dt	10,000	V/µs
Reverse Energy (Unclamped Inductive Surge) (T_C = 25°C, L = 3.0 mH)	W	600	mJ

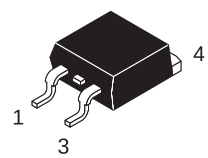
1. Rating applies when pins 1 and 3 are connected.

ON Semiconductor™

http://onsemi.com

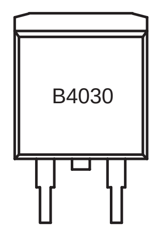
SCHOTTKY BARRIER RECTIFIER
40 AMPERES
30 VOLTS





D^2PAK
CASE 418B
STYLE 3

MARKING DIAGRAM



B4030 = Device Code

ORDERING INFORMATION

Device	Package	Shipping
MBRB4030	D^2PAK	50/Rail
MBRB4030T4	D^2PAK	800/Tape & Reel

Preferred devices are recommended choices for future use and best overall value.

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THERMAL CHARACTERISTICS

Characteristic	Symbol	Value	Unit
Thermal Resistance – Junction to Case	$R_{\theta JC}$	1.0	°C/W
Thermal Resistance – Junction to Ambient (Note 3.)	$R_{\theta JA}$	50	°C/W

ELECTRICAL CHARACTERISTICS

Maximum Instantaneous Forward Voltage (Notes 2. and 4.), per Device (I_F = 20 A, T_C = + 25°C) (I_F = 20 A, T_C = +150°C) (I_F = 40 A, T_C = + 25°C) (I_F = 40 A, T_C = +150°C)	V_F	 0.46 0.34 0.55 0.45	V
Maximum Instantaneous Reverse Current (Note 4.), per Device (Rated DC Voltage, T_C = + 25°C) (Rated DC Voltage, T_C = +125°C)	I_R	 0.35 150	mA

2. Rating applies when pins 1 and 3 are connected.
3. Rating applies when surface mounted on the miniumum pad size recommended.
4. Pulse Test: Pulse Width = 300 µs, Duty Cycle ≤ 2.0%

ELECTRICAL CHARACTERISTICS

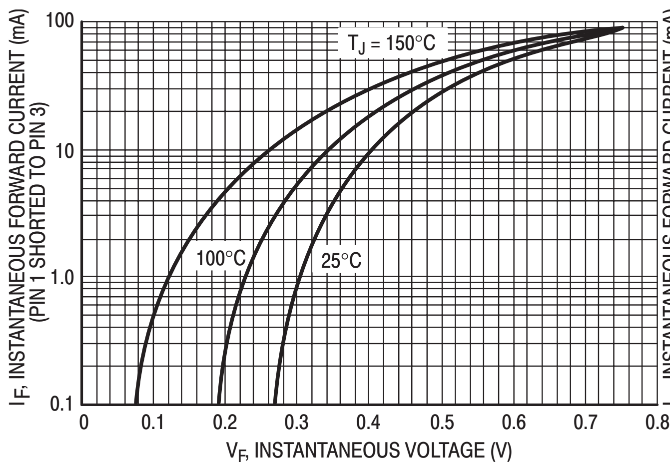


Figure 1. Maximum Forward Voltage

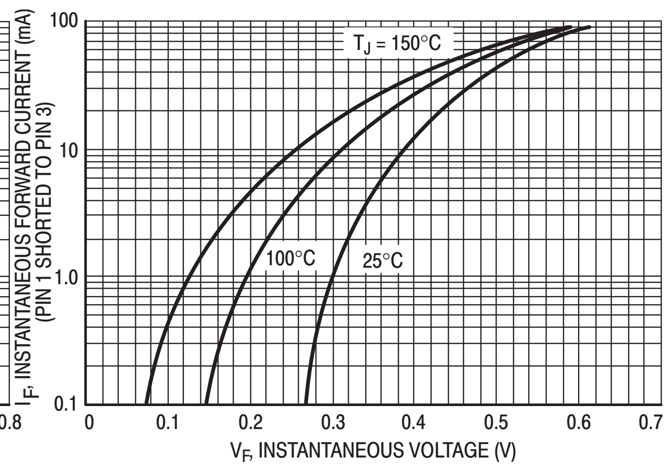


Figure 2. Typical Forward Voltage

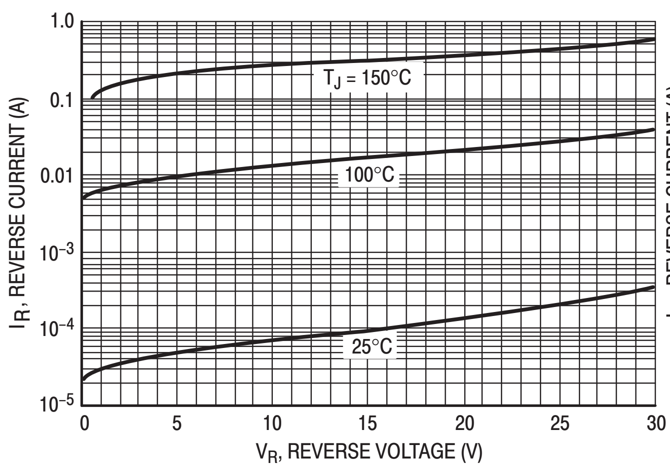


Figure 3. Maximum Reverse Current

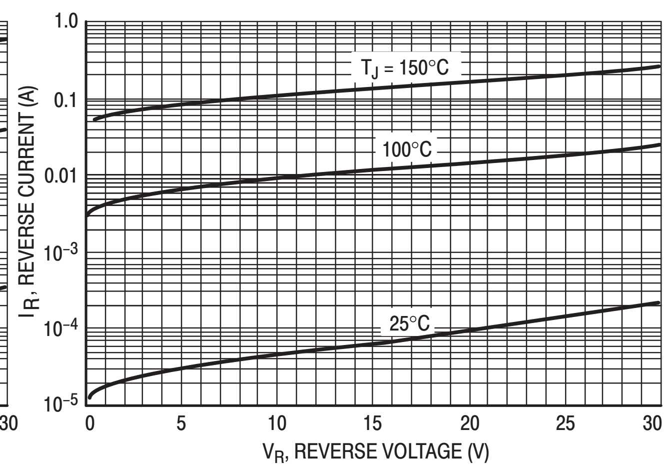


Figure 4. Typical Reverse Current

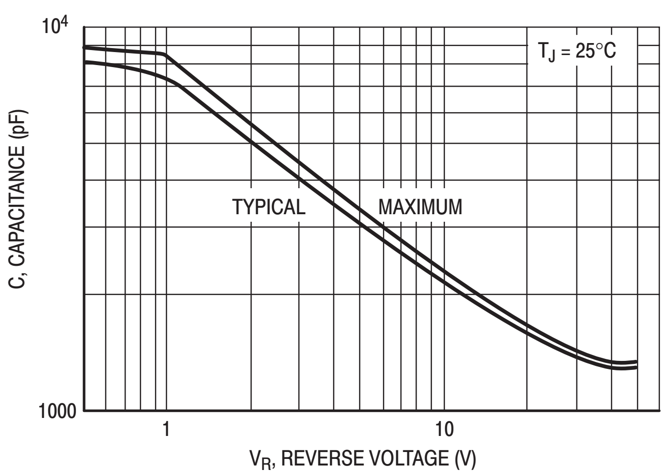


Figure 5. Maximum and Typical Capacitance

ELECTRICAL CHARACTERISTICS

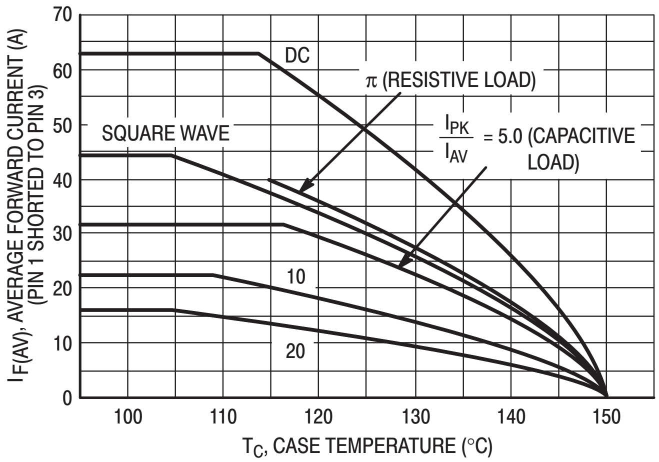


Figure 6. Current Derating, Infinite Heatsink

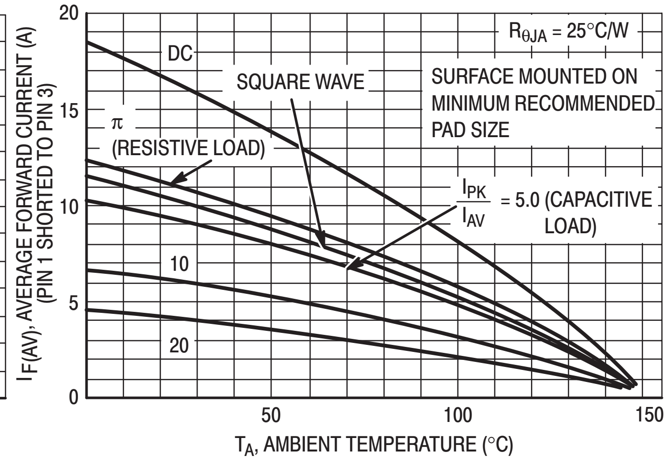


Figure 7. Current Derating

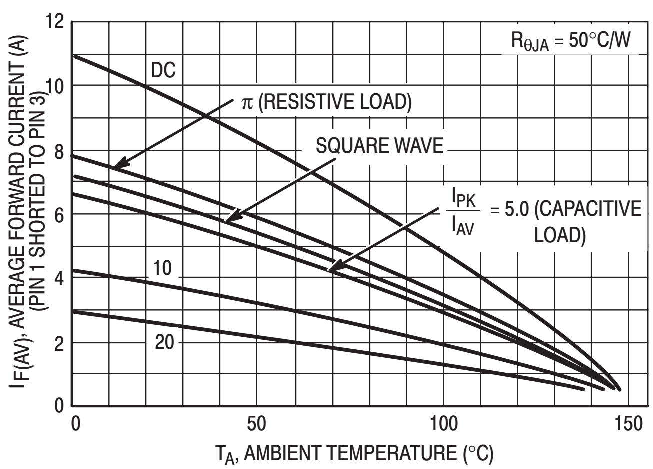


Figure 8. Current Derating, Free Air

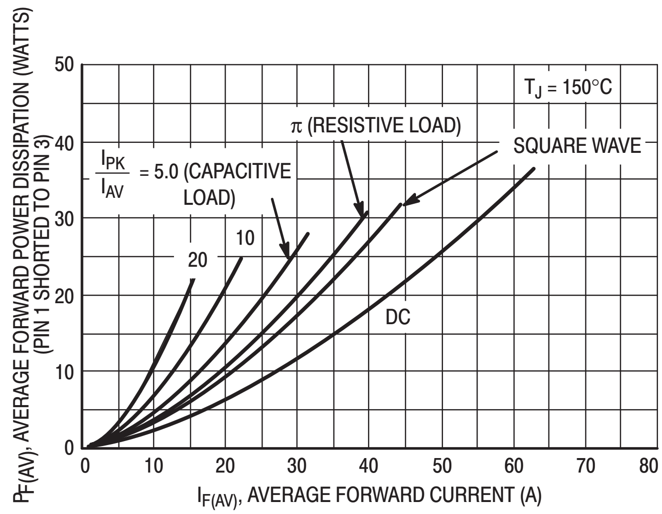


Figure 9. Forward Power Dissipation

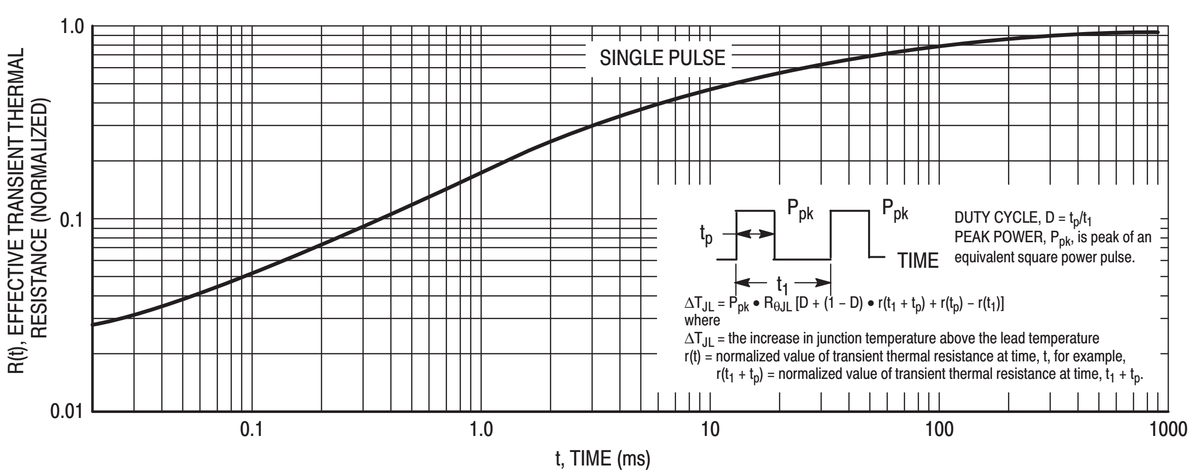


Figure 10. Thermal Response

1N5817, 1N5818, 1N5819

1N5817 and 1N5819 are Preferred Devices

Axial Lead Rectifiers

. . . employing the Schottky Barrier principle in a large area metal–to–silicon power diode. State–of–the–art geometry features chrome barrier metal, epitaxial construction with oxide passivation and metal overlap contact. Ideally suited for use as rectifiers in low–voltage, high–frequency inverters, free wheeling diodes, and polarity protection diodes.

- Extremely Low V_F
- Low Stored Charge, Majority Carrier Conduction
- Low Power Loss/High Efficiency

Mechanical Characteristics

- Case: Epoxy, Molded
- Weight: 0.4 gram (approximately)
- Finish: All External Surfaces Corrosion Resistant and Terminal Leads are Readily Solderable
- Lead and Mounting Surface Temperature for Soldering Purposes: 220°C Max. for 10 Seconds, 1/16″ from case
- Shipped in plastic bags, 1000 per bag.
- Available Tape and Reeled, 5000 per reel, by adding a “RL” suffix to the part number
- Polarity: Cathode Indicated by Polarity Band
- Marking: 1N5817, 1N5818, 1N5819

MAXIMUM RATINGS

Please See the Table on the Following Page

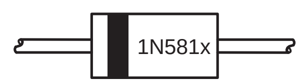
ON Semiconductor™

http://onsemi.com

SCHOTTKY BARRIER RECTIFIERS 1.0 AMPERE 20, 30 and 40 VOLTS

AXIAL LEAD
CASE 59–04
PLASTIC

MARKING DIAGRAM



1N581x = Device Code
x = 7, 8 or 9

ORDERING INFORMATION

Device	Package	Shipping
1N5817	Axial Lead	1000 Units/Bag
1N5817RL	Axial Lead	5000/Tape & Reel
1N5818	Axial Lead	1000 Units/Bag
1N5818RL	Axial Lead	5000/Tape & Reel
1N5819	Axial Lead	1000 Units/Bag
1N5819RL	Axial Lead	5000/Tape & Reel

Preferred devices are recommended choices for future use and best overall value.

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MAXIMUM RATINGS

Rating	Symbol	1N5817	1N5818	1N5819	Unit
Peak Repetitive Reverse Voltage Working Peak Reverse Voltage DC Blocking Voltage	V_{RRM} V_{RWM} V_R	20	30	40	V
Non–Repetitive Peak Reverse Voltage	V_{RSM}	24	36	48	V
RMS Reverse Voltage	$V_{R(RMS)}$	14	21	28	V
Average Rectified Forward Current (Note 5.) ($V_{R(equiv)} \leq 0.2\ V_R$(dc), $T_L = 90°C$, $R_{\theta JA} = 80°C/W$, P.C. Board Mounting, see Note 8., $T_A = 55°C$)	I_O	1.0			A
Ambient Temperature (Rated V_R(dc), $P_{F(AV)} = 0$, $R_{\theta JA} = 80°C/W$)	T_A	85	80	75	°C
Non–Repetitive Peak Surge Current (Surge applied at rated load conditions, half–wave, single phase 60 Hz, $T_L = 70°C$)	I_{FSM}	25 (for one cycle)			A
Operating and Storage Junction Temperature Range (Reverse Voltage applied)	T_J, T_{stg}	–65 to +125			°C
Peak Operating Junction Temperature (Forward Current applied)	$T_{J(pk)}$	150			°C

THERMAL CHARACTERISTICS (Note 5.)

Characteristic	Symbol	Max	Unit
Thermal Resistance, Junction to Ambient	$R_{\theta JA}$	80	°C/W

ELECTRICAL CHARACTERISTICS (T_L = 25°C unless otherwise noted) (Note 5.)

Characteristic	Symbol	1N5817	1N5818	1N5819	Unit
Maximum Instantaneous Forward Voltage (Note 6.) (i_F = 0.1 A) (i_F = 1.0 A) (i_F = 3.0 A)	v_F	0.32 0.45 0.75	0.33 0.55 0.875	0.34 0.6 0.9	V
Maximum Instantaneous Reverse Current @ Rated dc Voltage (Note 6.) (T_L = 25°C) (T_L = 100°C)	I_R	 1.0 10	 1.0 10	 1.0 10	mA

5. Lead Temperature reference is cathode lead 1/32″ from case.
6. Pulse Test: Pulse Width = 300 μs, Duty Cycle = 2.0%.

NOTE 7. — DETERMINING MAXIMUM RATINGS

Reverse power dissipation and the possibility of thermal runaway must be considered when operating this rectifier at reverse voltages above 0.1 V_{RWM}. Proper derating may be accomplished by use of equation (1).

$$T_{A(max)} = T_{J(max)} - R_{\theta JA}P_{F(AV)} - R_{\theta JA}P_{R(AV)} \quad (1)$$

where $T_{A(max)}$ = Maximum allowable ambient temperature
$T_{J(max)}$ = Maximum allowable junction temperature (125°C or the temperature at which thermal runaway occurs, whichever is lowest)
$P_{F(AV)}$ = Average forward power dissipation
$P_{R(AV)}$ = Average reverse power dissipation
$R_{\theta JA}$ = Junction–to–ambient thermal resistance

Figures 1, 2, and 3 permit easier use of equation (1) by taking reverse power dissipation and thermal runaway into consideration. The figures solve for a reference temperature as determined by equation (2).

$$T_R = T_{J(max)} - R_{\theta JA}P_{R(AV)} \quad (2)$$

Substituting equation (2) into equation (1) yields:

$$T_{A(max)} = T_R - R_{\theta JA}P_{F(AV)} \quad (3)$$

Inspection of equations (2) and (3) reveals that T_R is the ambient temperature at which thermal runaway occurs or where T_J = 125°C, when forward power is zero. The transition from one boundary condition to the other is evident on the curves of Figures 1, 2, and 3 as a difference in the rate of change of the slope in the vicinity of 115°C. The data of Figures 1, 2, and 3 is based upon dc conditions. For use in common rectifier circuits, Table 1 indicates suggested factors for an equivalent dc voltage to use for conservative design, that is:

$$V_{R(equiv)} = V_{in(PK)} \times F \quad (4)$$

The factor F is derived by considering the properties of the various rectifier circuits and the reverse characteristics of Schottky diodes.

EXAMPLE: Find $T_{A(max)}$ for 1N5818 operated in a 12–volt dc supply using a bridge circuit with capacitive filter such that I_{DC} = 0.4 A ($I_{F(AV)}$ = 0.5 A), $I_{(FM)}/I_{(AV)}$ = 10, Input Voltage = 10 $V_{(rms)}$, $R_{\theta JA}$ = 80°C/W.

Step 1. Find $V_{R(equiv)}$. Read F = 0.65 from Table 1,
$\therefore V_{R(equiv)} = (1.41)(10)(0.65) = 9.2$ V.
Step 2. Find T_R from Figure 2. Read T_R = 109°C
@ V_R = 9.2 V and $R_{\theta JA}$ = 80°C/W.
Step 3. Find $P_{F(AV)}$ from Figure 4. **Read $P_{F(AV)}$ = 0.5 W
@ $\frac{I_{(FM)}}{I_{(AV)}}$ = 10 and IF(AV) = 0.5 A.
Step 4. Find $T_{A(max)}$ from equation (3).
$T_{A(max)}$ = 109 – (80) (0.5) = 69°C.

**Values given are for the 1N5818. Power is slightly lower for the 1N5817 because of its lower forward voltage, and higher for the 1N5819.

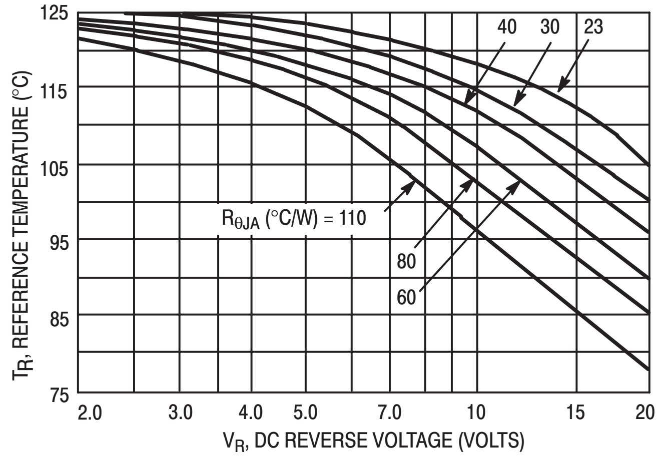


Figure 1. Maximum Reference Temperature 1N5817

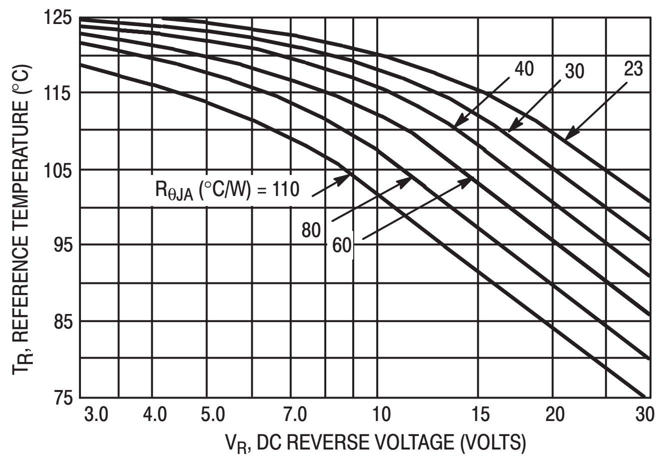


Figure 2. Maximum Reference Temperature 1N5818

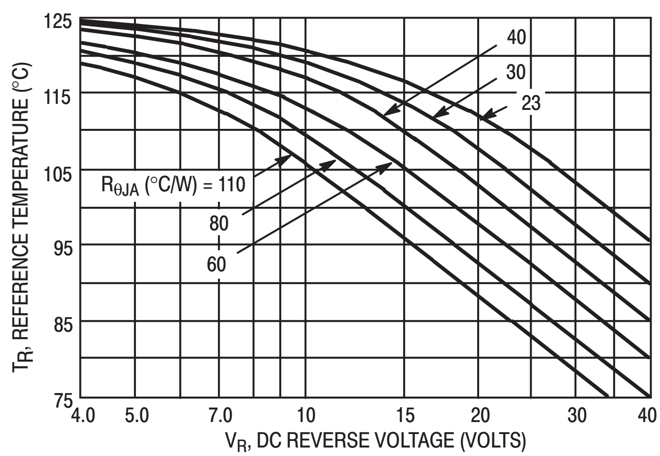


Figure 3. Maximum Reference Temperature 1N5819

Table 1. Values for Factor F

Circuit	Half Wave		Full Wave, Bridge		Full Wave, Center Tapped*†	
Load	**Resistive**	**Capacitive***	**Resistive**	**Capacitive**	**Resistive**	**Capacitive**
Sine Wave	0.5	1.3	0.5	0.65	1.0	1.3
Square Wave	0.75	1.5	0.75	0.75	1.5	1.5

*Note that $V_{R(PK)} \approx 2.0\ V_{in(PK)}$. †Use line to center tap voltage for V_{in}.

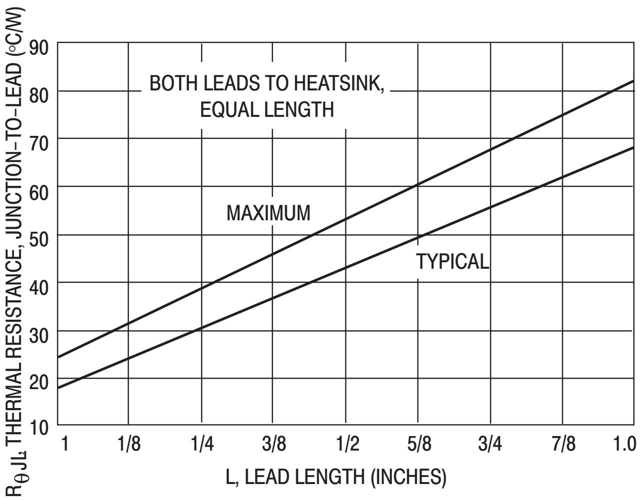


Figure 4. Steady–State Thermal Resistance

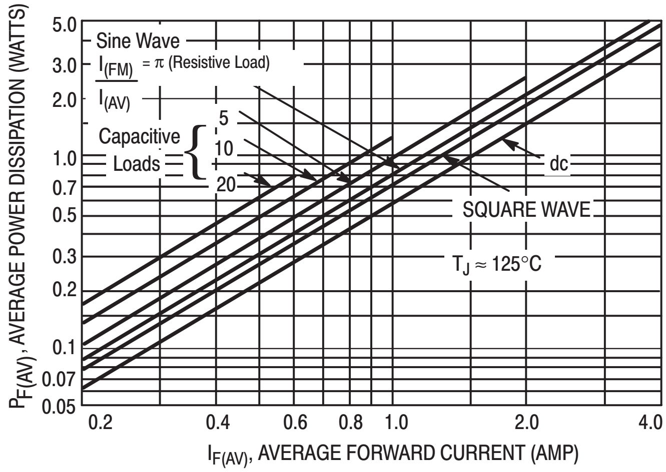


Figure 5. Forward Power Dissipation 1N5817–19

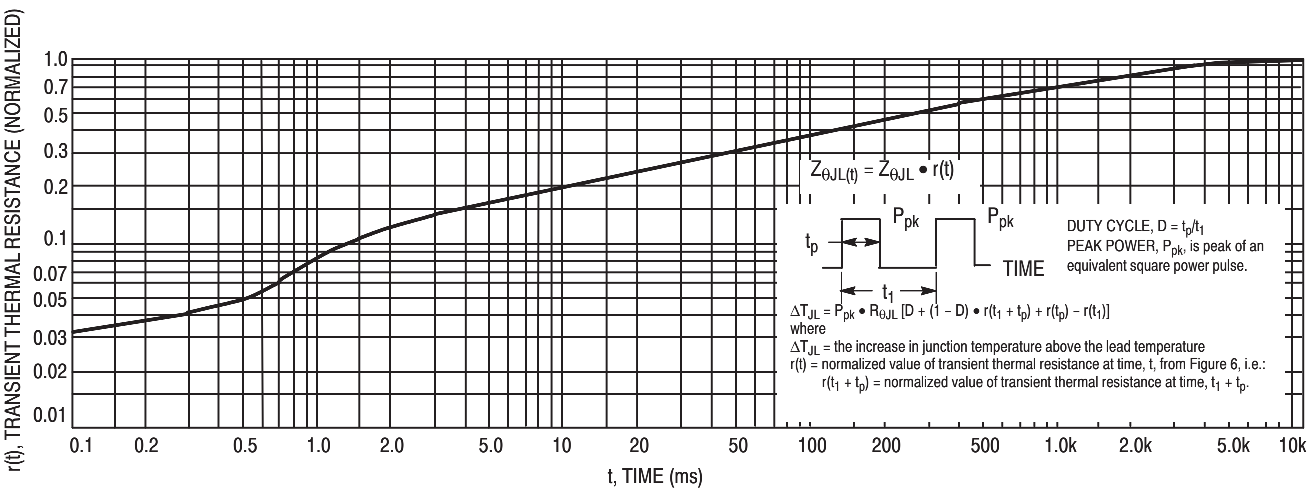


Figure 6. Thermal Response

NOTE 8. — MOUNTING DATA

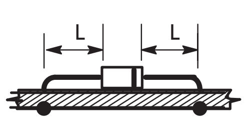
Data shown for thermal resistance junction–to–ambient ($R_{\theta JA}$) for the mountings shown is to be used as typical guideline values for preliminary engineering, or in case the tie point temperature cannot be measured.

TYPICAL VALUES FOR $R_{\theta JA}$ IN STILL AIR

Mounting Method	Lead Length, L (in)				$R_{\theta JA}$
	1/8	1/4	1/2	3/4	
1	52	65	72	85	°C/W
2	67	80	87	100	°C/W
3	50				°C/W

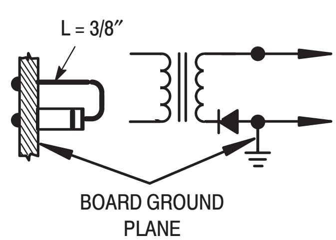
Mounting Method 1

P.C. Board with 1–1/2″ x 1–1/2″ copper surface.

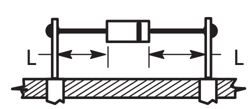


Mounting Method 3

P.C. Board with 1–1/2″ x 1–1/2″ copper surface.

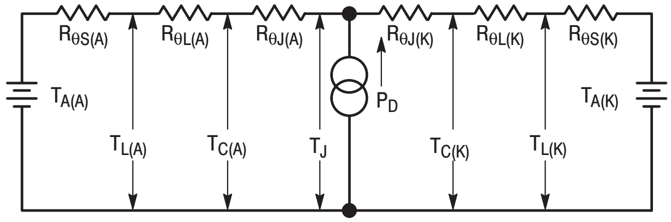


Mounting Method 2



VECTOR PIN MOUNTING

NOTE 9. — THERMAL CIRCUIT MODEL
(For heat conduction through the leads)



Use of the above model permits junction to lead thermal resistance for any mounting configuration to be found. For a given total lead length, lowest values occur when one side of the rectifier is brought as close as possible to the heatsink. Terms in the model signify:

T_A = Ambient Temperature T_C = Case Temperature
T_L = Lead Temperature T_J = Junction Temperature
$R_{\theta S}$ = Thermal Resistance, Heatsink to Ambient
$R_{\theta L}$ = Thermal Resistance, Lead to Heatsink
$R_{\theta J}$ = Thermal Resistance, Junction to Case
P_D = Power Dissipation

(Subscripts A and K refer to anode and cathode sides, respectively.) Values for thermal resistance components are:

$R_{\theta L}$ = 100°C/W/in typically and 120°C/W/in maximum
$R_{\theta J}$ = 36°C/W typically and 46°C/W maximum.

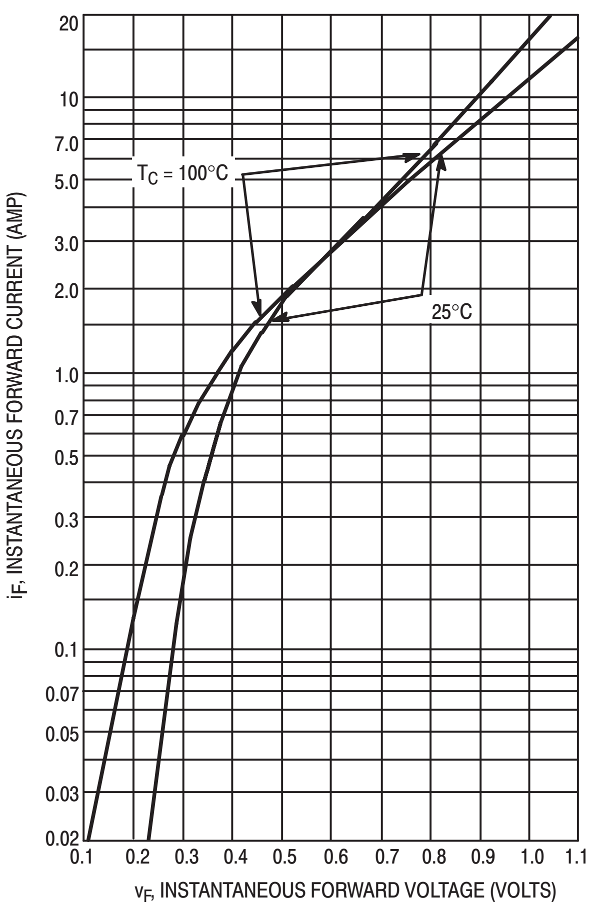


Figure 7. Typical Forward Voltage

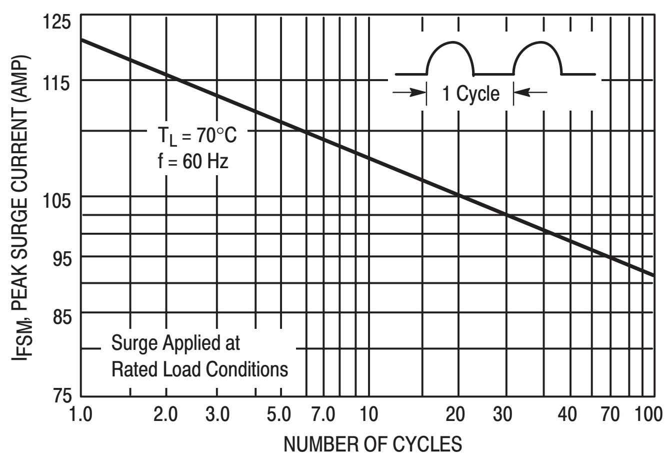


Figure 8. Maximum Non–Repetitive Surge Current

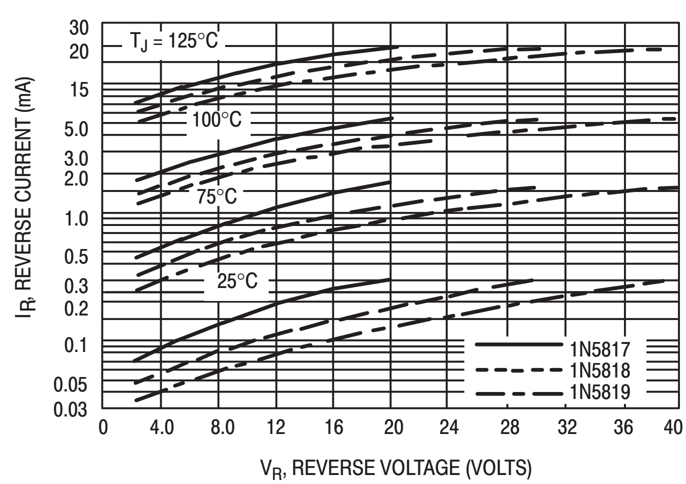


Figure 9. Typical Reverse Current

NOTE 10. — HIGH FREQUENCY OPERATION

Since current flow in a Schottky rectifier is the result of majority carrier conduction, it is not subject to junction diode forward and reverse recovery transients due to minority carrier injection and stored charge. Satisfactory circuit analysis work may be performed by using a model consisting of an ideal diode in parallel with a variable capacitance. (See Figure 10.)

Rectification efficiency measurements show that operation will be satisfactory up to several megahertz. For example, relative waveform rectification efficiency is approximately 70 percent at 2.0 MHz, e.g., the ratio of dc power to RMS power in the load is 0.28 at this frequency, whereas perfect rectification would yield 0.406 for sine wave inputs. However, in contrast to ordinary junction diodes, the loss in waveform efficiency is not indicative of power loss: it is simply a result of reverse current flow through the diode capacitance, which lowers the dc output voltage.

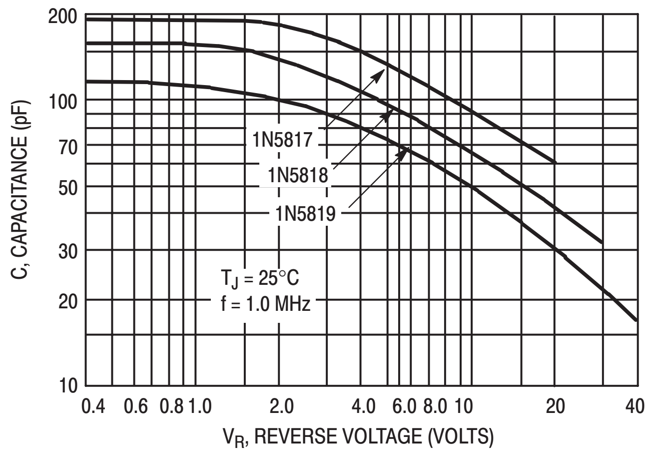


Figure 10. Typical Capacitance

MBR150, MBR160

MBR160 is a Preferred Device

Axial Lead Rectifiers

. . . employing the Schottky Barrier principle in a large area metal–to–silicon power diode. State–of–the–art geometry features epitaxial construction with oxide passivation and metal overlap contact. Ideally suited for use as rectifiers in low–voltage, high–frequency inverters, free wheeling diodes, and polarity protection diodes.

- Low Reverse Current
- Low Stored Charge, Majority Carrier Conduction
- Low Power Loss/High Efficiency
- Highly Stable Oxide Passivated Junction

Mechanical Characteristics:

- Case: Epoxy, Molded
- Weight: 0.4 gram (approximately)
- Finish: All External Surfaces Corrosion Resistant and Terminal Leads are Readily Solderable
- Lead and Mounting Surface Temperature for Soldering Purposes: 220°C Max. for 10 Seconds, 1/16″ from case
- Shipped in plastic bags, 1000 per bag
- Available Tape and Reeled, 5000 per reel, by adding a “RL’’ suffix to the part number
- Polarity: Cathode Indicated by Polarity Band
- Marking: B150, B160

MAXIMUM RATINGS

Please See the Table on the Following Page

ON Semiconductor™

http://onsemi.com

SCHOTTKY BARRIER RECTIFIERS 1.0 AMPERE 50, 60 VOLTS

AXIAL LEAD
CASE 59–04
PLASTIC

MARKING DIAGRAM

B1x0 = Device Code
x = 5 or 6

ORDERING INFORMATION

Device	Package	Shipping
MBR150	Axial Lead	1000 Units/Bag
MBR150RL	Axial Lead	5000/Tape & Reel
MBR160	Axial Lead	1000 Units/Bag
MBR160RL	Axial Lead	5000/Tape & Reel

Preferred devices are recommended choices for future use and best overall value.

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MAXIMUM RATINGS

Rating	Symbol	MBR150	MBR160	Unit
Peak Repetitive Reverse Voltage Working Peak Reverse Voltage DC Blocking Voltage	V_{RRM} V_{RWM} V_R	50	60	Volts
RMS Reverse Voltage	$V_{R(RMS)}$	35	42	Volts
Average Rectified Forward Current (Note 1.) ($V_{R(equiv)} \leq 0.2\ V_R$(dc), T_L = 90°C, $R_{\theta JA}$ = 80°C/W, P.C. Board Mounting, see Note 3., T_A = 55°C)	I_O	1.0		Amp
Nonrepetitive Peak Surge Current (Surge applied at rated load conditions, halfwave, single phase, 60 Hz, T_L = 70°C)	I_{FSM}	25 (for one cycle)		Amps
Operating and Storage Junction Temperature Range (Reverse Voltage Applied)	T_J, T_{stg}	– 65 to +150		°C
Peak Operating Junction Temperature (Forward Current Applied)	$T_{J(pk)}$	150		°C

THERMAL CHARACTERISTICS (Notes 3. and 4.)

Characteristic	Symbol	Max	Unit
Thermal Resistance, Junction to Ambient	$R_{\theta JA}$	80	°C/W

ELECTRICAL CHARACTERISTICS (T_L = 25°C unless otherwise noted) (Note 1.)

Characteristic	Symbol	Max	Unit
Maximum Instantaneous Forward Voltage (Note 2.) (i_F = 0.1 A) (i_F = 1.0 A) (i_F = 3.0 A)	v_F	 0.550 0.750 1.000	Volt
Maximum Instantaneous Reverse Current @ Rated dc Voltage (Note 2.) (T_L = 25°C) (T_L = 100°C)	i_R	 0.5 5.0	mA

1. Lead Temperature reference is cathode lead 1/32″ from case.
2. Pulse Test: Pulse Width = 300 μs, Duty Cycle ≤ 2.0%.

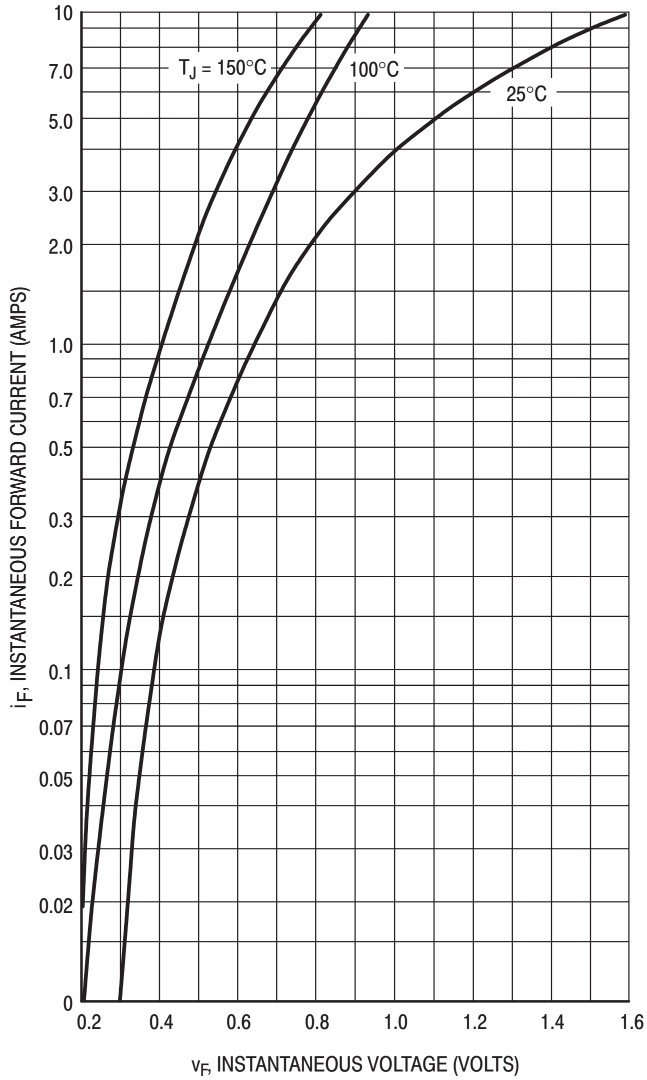


Figure 1. Typical Forward Voltage

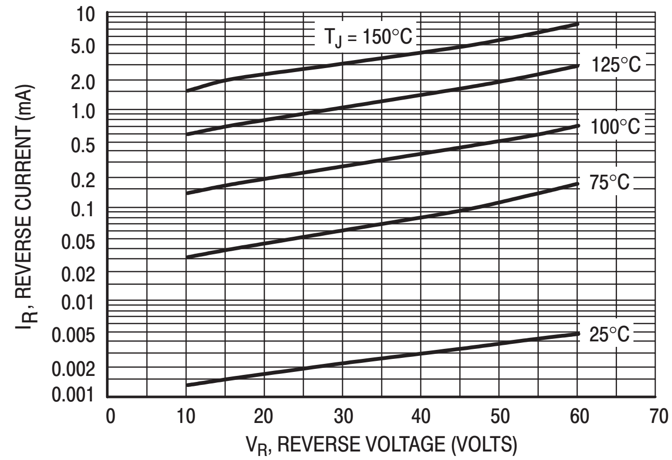


Figure 2. Typical Reverse Current*

*The curves shown are typical for the highest voltage device in the voltage grouping. Typical reverse current for lower voltage selections can be estimated from these same curves if V_R is sufficiently below rated V_R.

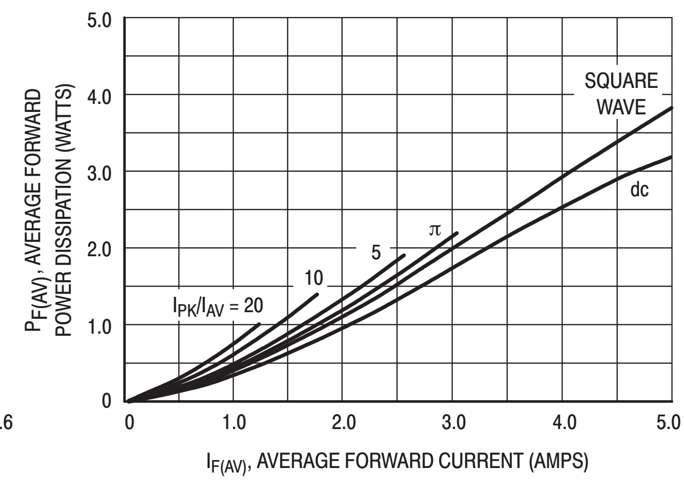


Figure 3. Forward Power Dissipation

THERMAL CHARACTERISTICS

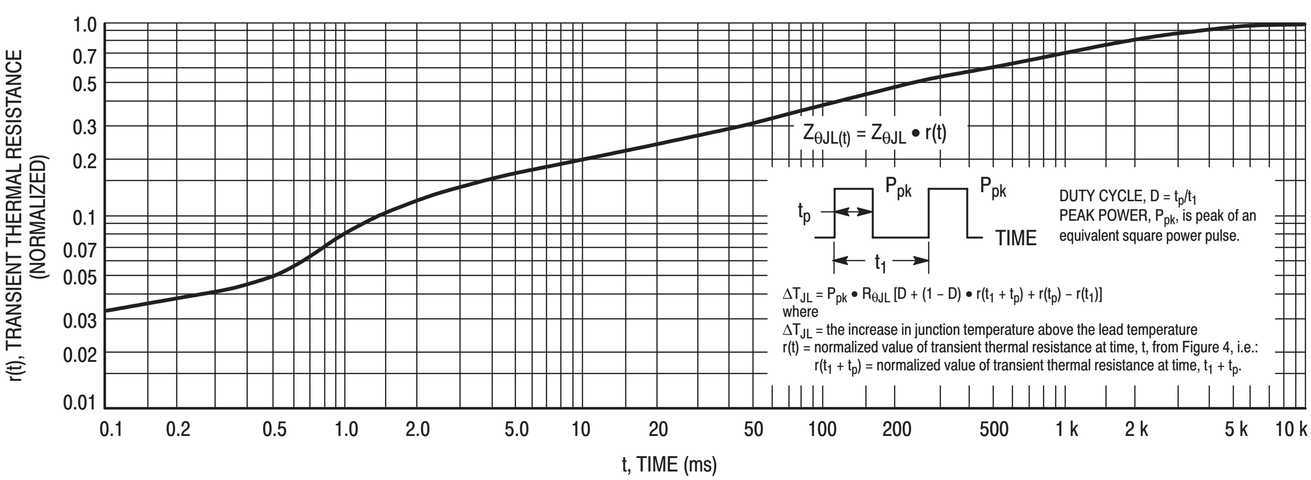


Figure 4. Thermal Response

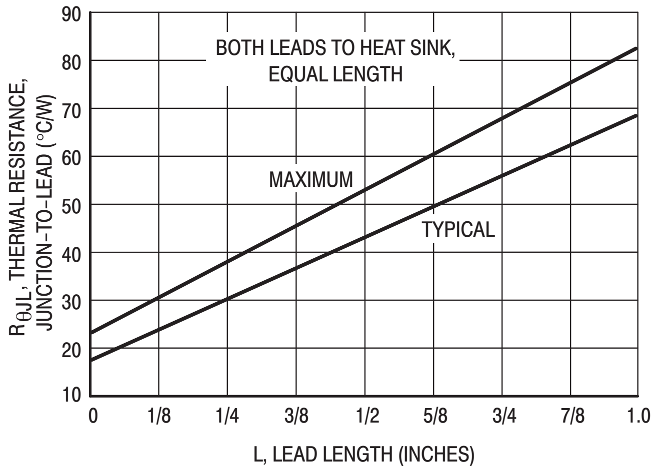


Figure 5. Steady–State Thermal Resistance

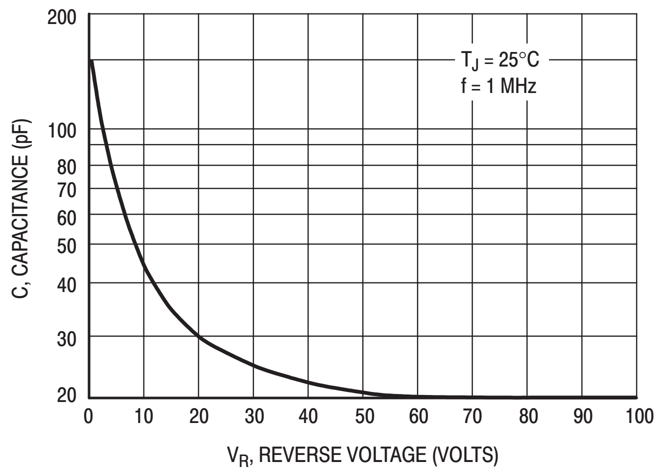


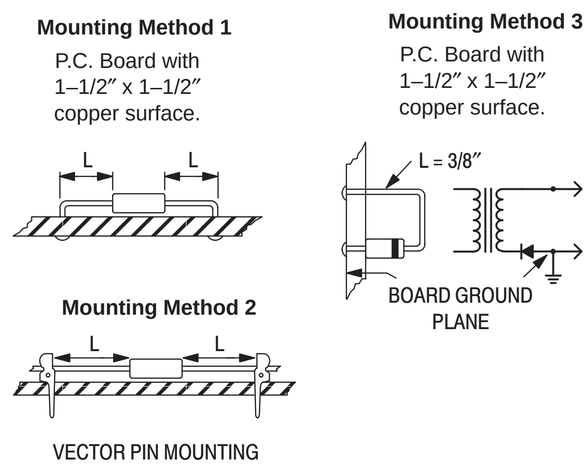
Figure 6. Typical Capacitance

NOTE 3. — MOUNTING DATA:

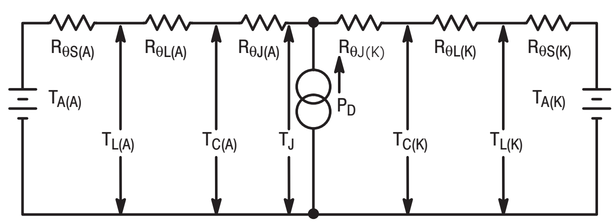
Data shown for thermal resistance junction–to–ambient ($R_{\theta JA}$) for the mounting shown is to be used as a typical guideline values for preliminary engineering or in case the tie point temperature cannot be measured.

Typical Values for $R_{\theta JA}$ in Still Air

Mounting Method	Lead Length, L (in)				$R_{\theta JA}$
	1/8	1/4	1/2	3/4	
1	52	65	72	85	°C/W
2	67	80	87	100	°C/W
3	—	50			°C/W



NOTE 4. — THERMAL CIRCUIT MODEL:
(For heat conduction through the leads)



Use of the above model permits junction to lead thermal resistance for any mounting configuration to be found. For a given total lead length, lowest values occur when one side of the rectifier is brought as close as possible to the heat sink. Terms in the model signify:

T_A = Ambient Temperature T_C = Case Temperature
T_L = Lead Temperature T_J = Junction Temperature
$R_{\theta S}$ = Thermal Resistance, Heat Sink to Ambient
$R_{\theta L}$ = Thermal Resistance, Lead to Heat Sink
$R_{\theta J}$ = Thermal Resistance, Junction to Case
P_D = Power Dissipation

(Subscripts A and K refer to anode and cathode sides, respectively.) Values for thermal resistance components are:
$R_{\theta L}$ = 100°C/W/in typically and 120°C/W/in maximum.
$R_{\theta J}$ = 36°C/W typically and 46°C/W maximum.

NOTE 5. — HIGH FREQUENCY OPERATION:

Since current flow in a Schottky rectifier is the result of majority carrier conduction, it is not subject to junction diode forward and reverse recovery transients due to minority carrier injection and stored charge. Satisfactory circuit analysis work may be performed by using a model consisting of an ideal diode in parallel with a variable capacitance. (See Figure 6.)

Rectification efficiency measurements show that operation will be satisfactory up to several megahertz. For example, relative waveform rectification efficiency is approximately 70 percent at 2 MHz, e.g., the ratio of dc power to RMS power in the load is 0.28 at this frequency, whereas perfect rectification would yield 0.406 for sine wave inputs. However, in contrast to ordinary junction diodes, the loss in waveform efficiency is not indicative of power loss: it is simply a result of reverse current flow through the diode capacitance, which lowers the dc output voltage.

MBR1100

Preferred Device

Axial Lead Rectifier

. . . employing the Schottky Barrier principle in a large area metal–to–silicon power diode. State–of–the–art geometry features epitaxial construction with oxide passivation and metal overlap contact. Ideally suited for use as rectifiers in low–voltage, high–frequency inverters, free wheeling diodes, and polarity protection diodes.

- Low Reverse Current
- Low Stored Charge, Majority Carrier Conduction
- Low Power Loss/High Efficiency
- Highly Stable Oxide Passivated Junction
- Guard–Ring for Stress Protection
- Low Forward Voltage
- 150°C Operating Junction Temperature
- High Surge Capacity

Mechanical Characteristics:
- Case: Epoxy, Molded
- Weight: 0.4 gram (approximately)
- Finish: All External Surfaces Corrosion Resistant and Terminal Leads are Readily Solderable
- Lead and Mounting Surface Temperature for Soldering Purposes: 220°C Max. for 10 Seconds, 1/16″ from case
- Shipped in plastic bags, 1000 per bag
- Available Tape and Reeled, 5000 per reel, by adding a “RL’’ suffix to the part number
- Polarity: Cathode Indicated by Polarity Band
- Marking: B1100

MAXIMUM RATINGS

Rating	Symbol	Max	Unit
Peak Repetitive Reverse Voltage Working Peak Reverse Voltage DC Blocking Voltage	V_{RRM} V_{RWM} V_R	100	V
Average Rectified Forward Current ($V_{R(equiv)} \leq 0.2\ V_R$(dc), $R_{\theta JA}$ = 50°C/W, P.C. Board Mounting, see Note 1., T_A = 120°C)	I_O	1.0	A
Non–Repetitive Peak Surge Current (Surge Applied at Rated Load Conditions Halfwave, Single Phase, 60 Hz)	I_{FSM}	50	A
Operating and Storage Junction Temperature Range	T_J, T_{stg}	–65 to +150	°C
Voltage Rate of Change (Rated V_R)	dv/dt	10	V/ns

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SCHOTTKY BARRIER RECTIFIER
1.0 AMPERE
100 VOLTS

AXIAL LEAD
CASE 59–04
PLASTIC

MARKING DIAGRAM

B1100 = Device Code

ORDERING INFORMATION

Device	Package	Shipping
MBR1100	Axial Lead	1000 Units/Bag
MBR1100RL	Axial Lead	5000/Tape & Reel

Preferred devices are recommended choices for future use and best overall value.

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THERMAL CHARACTERISTICS (See Note 2.)

Characteristic	Symbol	Max	Unit
Thermal Resistance, Junction to Ambient	$R_{\theta JA}$	See Note 1.	°C/W

ELECTRICAL CHARACTERISTICS (T_L = 25°C unless otherwise noted)

Characteristic	Symbol	Max	Unit
Maximum Instantaneous Forward Voltage * (i_F = 1 A, T_L = 25°C) (i_F = 1 A, T_L = 100°C)	V_F	 0.79 0.69	Volt
Maximum Instantaneous Reverse Current @ Rated dc Voltage * (T_L = 25°C) (T_L = 100°C)	i_R	 0.5 5.0	mA

* Pulse Test: Pulse Width = 300 µs, Duty Cycle ≤ 2.0%.

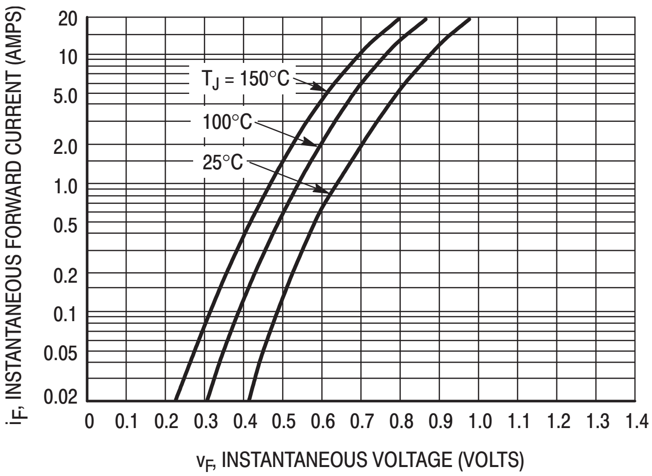


Figure 1. Typical Forward Voltage

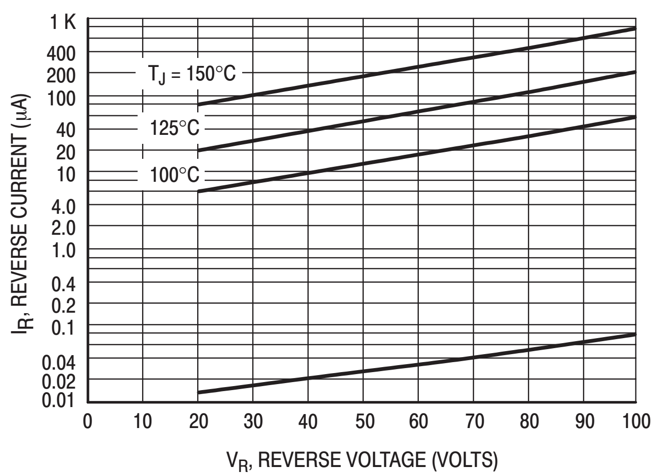


Figure 2. Typical Reverse Current †

† The curves shown are typical for the highest voltage device in the voltage grouping. Typical reverse current for lower voltage selections can be estimated from these same curves if V_R is sufficiently below rated V_R.

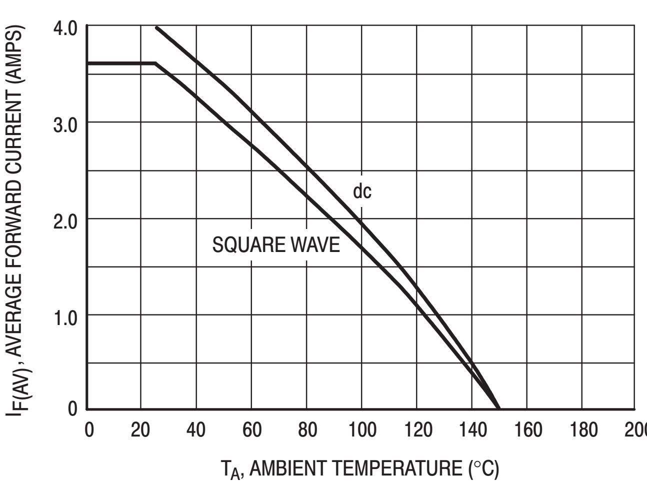


Figure 3. Current Derating (Mounting Method 3 per Note 1.)

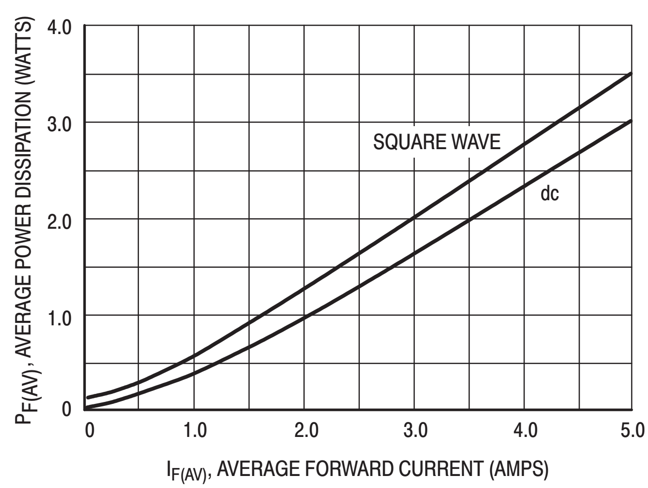


Figure 4. Power Dissipation

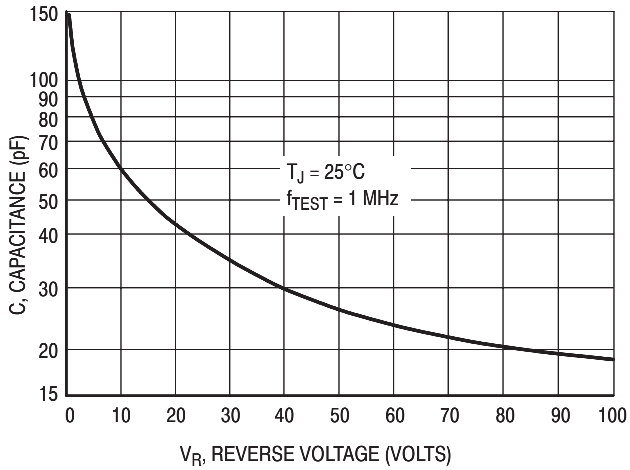


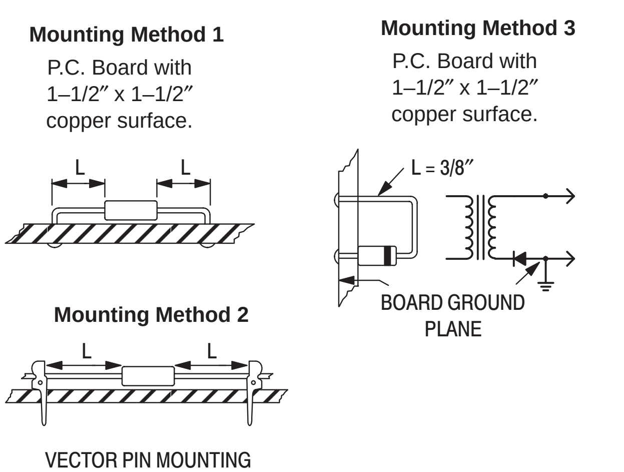
Figure 5. Typical Capacitance

NOTE 1. — MOUNTING DATA:

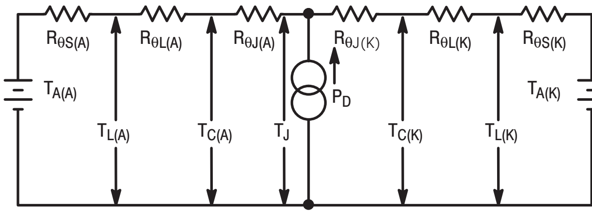
Data shown for thermal resistance junction–to–ambient ($R_{\theta JA}$) for the mounting shown is to be used as a typical guideline values for preliminary engineering or in case the tie point temperature cannot be measured.

Typical Values for $R_{\theta JA}$ in Still Air

Mounting Method	Lead Length, L (in)				$R_{\theta JA}$
	1/8	1/4	1/2	3/4	
1	52	65	72	85	°C/W
2	67	80	87	100	°C/W
3	—	50			°C/W



NOTE 2. — THERMAL CIRCUIT MODEL:
(For heat conduction through the leads)



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T_A = Ambient Temperature T_C = Case Temperature
T_L = Lead Temperature T_J = Junction Temperature
$R_{\theta S}$ = Thermal Resistance, Heat Sink to Ambient
$R_{\theta L}$ = Thermal Resistance, Lead to Heat Sink
$R_{\theta J}$ = Thermal Resistance, Junction to Case
P_D = Power Dissipation

(Subscripts A and K refer to anode and cathode sides, respectively.) Values for thermal resistance components are:
$R_{\theta L}$ = 100°C/W/in typically and 120°C/W/in maximum.
$R_{\theta J}$ = 36°C/W typically and 46°C/W maximum.

NOTE 3. — HIGH FREQUENCY OPERATION:

Since current flow in a Schottky rectifier is the result of majority carrier conduction, it is not subject to junction diode forward and reverse recovery transients due to minority carrier injection and stored charge. Satisfactory circuit analysis work may be performed by using a model consisting of an ideal diode in parallel with a variable capacitance. (See Figure 5)

Rectification efficiency measurements show that operation will be satisfactory up to several megahertz. For example, relative waveform rectification efficiency is approximately 70 percent at 2 MHz, e.g., the ratio of dc power to RMS power in the load is 0.28 at this frequency, whereas perfect rectification would yield 0.406 for sine wave inputs. However, in contrast to ordinary junction diodes, the loss in waveform efficiency is not indicative of power loss: it is simply a result of reverse current flow through the diode capacitance, which lowers the dc output voltage.

1N5820, 1N5821, 1N5822

1N5820 and 1N5822 are Preferred Devices

Axial Lead Rectifiers

. . . employing the Schottky Barrier principle in a large area metal–to–silicon power diode. State–of–the–art geometry features chrome barrier metal, epitaxial construction with oxide passivation and metal overlap contact. Ideally suited for use as rectifiers in low–voltage, high–frequency inverters, free wheeling diodes, and polarity protection diodes.

- Extremely Low V_F
- Low Power Loss/High Efficiency
- Low Stored Charge, Majority Carrier Conduction

Mechanical Characteristics:

- Case: Epoxy, Molded
- Weight: 1.1 gram (approximately)
- Finish: All External Surfaces Corrosion Resistant and Terminal Leads are Readily Solderable
- Lead and Mounting Surface Temperature for Soldering Purposes: 220°C Max. for 10 Seconds, 1/16″ from case
- Shipped in plastic bags, 500 per bag
- Available Tape and Reeled, 1500 per reel, by adding a "RL'' suffix to the part number
- Polarity: Cathode indicated by Polarity Band
- Marking: 1N5820, 1N5821, 1N5822

MAXIMUM RATINGS

Please See the Table on the Following Page

ON Semiconductor™

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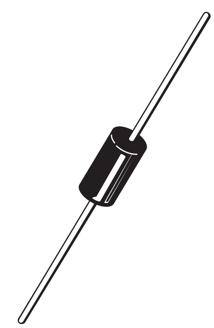
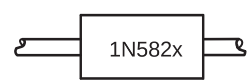
SCHOTTKY BARRIER RECTIFIERS 3.0 AMPERES 20, 30, 40 VOLTS



AXIAL LEAD
CASE 267–03
STYLE 1

MARKING DIAGRAM



1N582x = Device Code
x = 0, 1 or 2

ORDERING INFORMATION

Device	Package	Shipping
1N5820	Axial Lead	500 Units/Bag
1N5820RL	Axial Lead	1500/Tape & Reel
1N5821	Axial Lead	500 Units/Bag
1N5821RL	Axial Lead	1500/Tape & Reel
1N5822	Axial Lead	500 Units/Bag
1N5822RL	Axial Lead	1500/Tape & Reel

Preferred devices are recommended choices for future use and best overall value.

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MAXIMUM RATINGS

Rating	Symbol	1N5820	1N5821	1N5822	Unit
Peak Repetitive Reverse Voltage Working Peak Reverse Voltage DC Blocking Voltage	V_{RRM} V_{RWM} V_R	20	30	40	V
Non–Repetitive Peak Reverse Voltage	V_{RSM}	24	36	48	V
RMS Reverse Voltage	$V_{R(RMS)}$	14	21	28	V
Average Rectified Forward Current (Note 1.) $V_{R(equiv)} \leq 0.2\ V_{R(dc)}$, $T_L = 95°C$ ($R_{\theta JA}$ = 28°C/W, P.C. Board Mounting, see Note 5.)	I_O	← 3.0 →			A
Ambient Temperature Rated $V_{R(dc)}$, $P_{F(AV)} = 0$ $R_{\theta JA}$ = 28°C/W	T_A	90	85	80	°C
Non–Repetitive Peak Surge Current (Surge applied at rated load conditions, half wave, single phase 60 Hz, T_L = 75°C)	I_{FSM}	← 80 (for one cycle) →			A
Operating and Storage Junction Temperature Range (Reverse Voltage applied)	T_J, T_{stg}	← – 65 to +125 →			°C
Peak Operating Junction Temperature (Forward Current applied)	$T_{J(pk)}$	← 150 →			°C

***THERMAL CHARACTERISTICS** (Note 5.)

Characteristic	Symbol	Max	Unit
Thermal Resistance, Junction to Ambient	$R_{\theta JA}$	28	°C/W

***ELECTRICAL CHARACTERISTICS** (T_L = 25°C unless otherwise noted) (Note 1.)

Characteristic	Symbol	1N5820	1N5821	1N5822	Unit
Maximum Instantaneous Forward Voltage (Note 2.)	V_F				V
(i_F = 1.0 Amp)		0.370	0.380	0.390	
(i_F = 3.0 Amp)		0.475	0.500	0.525	
(i_F = 9.4 Amp)		0.850	0.900	0.950	
Maximum Instantaneous Reverse Current @ Rated dc Voltage (Note 2.)	i_R				mA
T_L = 25°C		2.0	2.0	2.0	
T_L = 100°C		20	20	20	

1. Lead Temperature reference is cathode lead 1/32″ from case.
2. Pulse Test: Pulse Width = 300 μs, Duty Cycle = 2.0%.

*Indicates JEDEC Registered Data for 1N5820–22.

NOTE 3. — DETERMINING MAXIMUM RATINGS

Reverse power dissipation and the possibility of thermal runaway must be considered when operating this rectifier at reverse voltages above 0.1 V_{RWM}. Proper derating may be accomplished by use of equation (1).

$$T_{A(max)} = T_{J(max)} - R_{\theta JA}P_{F(AV)} - R_{\theta JA}P_{R(AV)} \quad (1)$$

where $T_{A(max)}$ = Maximum allowable ambient temperature

$T_{J(max)}$ = Maximum allowable junction temperature (125°C or the temperature at which thermal runaway occurs, whichever is lowest)

$P_{F(AV)}$ = Average forward power dissipation

$P_{R(AV)}$ = Average reverse power dissipation

$R_{\theta JA}$ = Junction–to–ambient thermal resistance

Figures 1, 2, and 3 permit easier use of equation (1) by taking reverse power dissipation and thermal runaway into consideration. The figures solve for a reference temperature as determined by equation (2).

$$T_R = T_{J(max)} - R_{\theta JA}P_{R(AV)} \quad (2)$$

Substituting equation (2) into equation (1) yields:

$$T_{A(max)} = T_R - R_{\theta JA}P_{F(AV)} \quad (3)$$

Inspection of equations (2) and (3) reveals that T_R is the ambient temperature at which thermal runaway occurs or where T_J = 125°C, when forward power is zero. The transition from one boundary condition to the other is evident on the curves of Figures 1, 2, and 3 as a difference in the rate of change of the slope in the vicinity of 115°C. The data of Figures 1, 2, and 3 is based upon dc conditions. For use in common rectifier circuits, Table 1. indicates suggested factors for an equivalent dc voltage to use for conservative design, that is:

$$V_{R(equiv)} = V_{(FM)} \times F \quad (4)$$

The factor F is derived by considering the properties of the various rectifier circuits and the reverse characteristics of Schottky diodes.

EXAMPLE: Find $T_{A(max)}$ for 1N5821 operated in a 12–volt dc supply using a bridge circuit with capacitive filter such that I_{DC} = 2.0 A ($I_{F(AV)}$ = 1.0 A), $I_{(FM)}/I_{(AV)}$ = 10, Input Voltage = 10 $V_{(rms)}$, $R_{\theta JA}$ = 40°C/W.

Step 1. Find $V_{R(equiv)}$. Read F = 0.65 from Table 1. ,

$\therefore V_{R(equiv)}$ = (1.41) (10) (0.65) = 9.2 V.

Step 2. Find T_R from Figure 2. Read T_R = 108°C

@ V_R = 9.2 V and $R_{\theta JA}$ = 40°C/W.

Step 3. Find $P_{F(AV)}$ from Figure 6. **Read $P_{F(AV)}$ = 0.85 W

$$@\frac{I_{(FM)}}{I_{(AV)}} = 10 \text{ and } I_{F(AV)} = 1.0 \text{ A.}$$

Step 4. Find $T_{A(max)}$ from equation (3).

$T_{A(max)}$ = 108 − (0.85) (40) = 74°C.

**Values given are for the 1N5821. Power is slightly lower for the 1N5820 because of its lower forward voltage, and higher for the 1N5822. Variations will be similar for the MBR–prefix devices, using $P_{F(AV)}$ from Figure 6.

Table 1. Values for Factor F

Circuit	Half Wave		Full Wave, Bridge		Full Wave, Center Tapped*†	
Load	**Resistive**	**Capacitive***	**Resistive**	**Capacitive**	**Resistive**	**Capacitive**
Sine Wave	0.5	1.3	0.5	0.65	1.0	1.3
Square Wave	0.75	1.5	0.75	0.75	1.5	1.5

*Note that $V_{R(PK)} \approx 2.0\ V_{in(PK)}$. †Use line to center tap voltage for V_{in}.

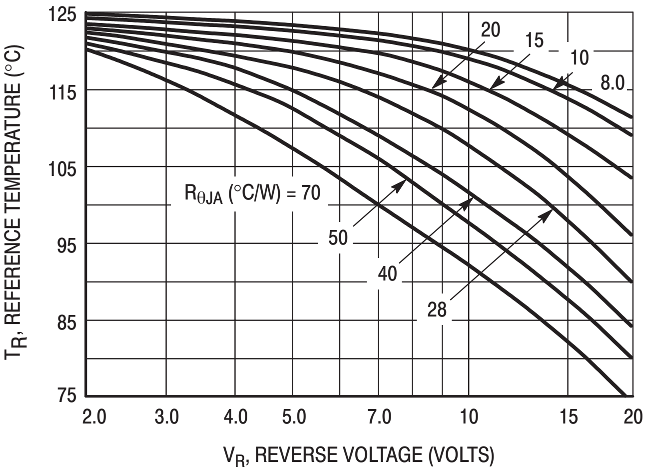


Figure 1. Maximum Reference Temperature 1N5820

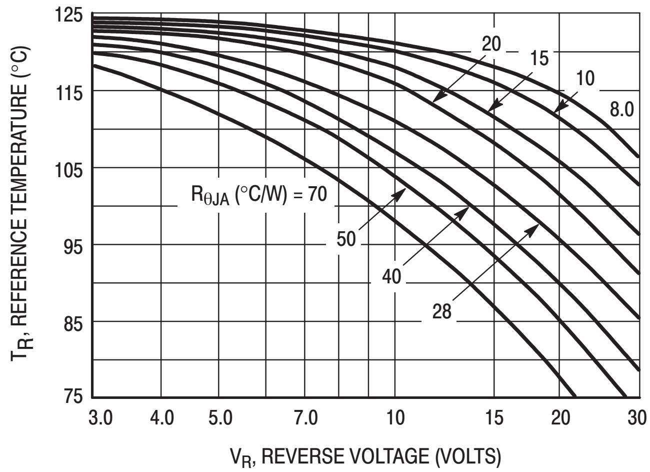


Figure 2. Maximum Reference Temperature 1N5821

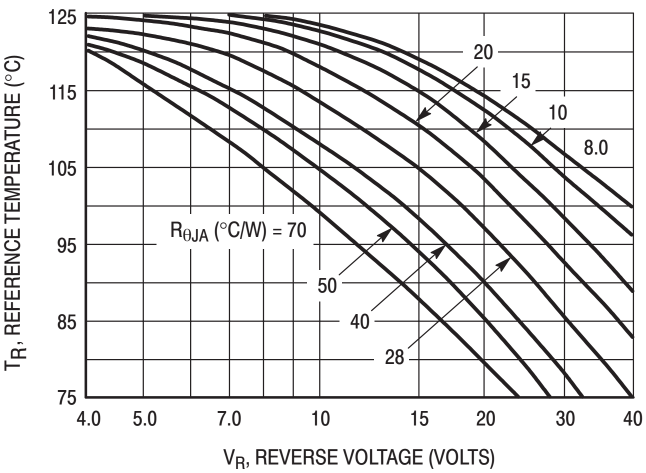


Figure 3. Maximum Reference Temperature 1N5822

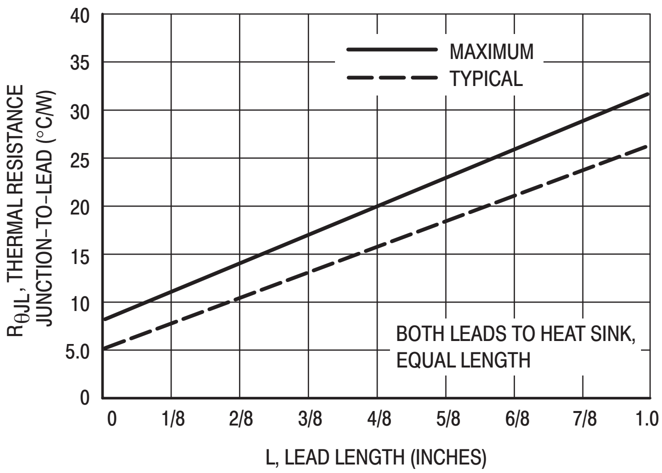


Figure 4. Steady–State Thermal Resistance

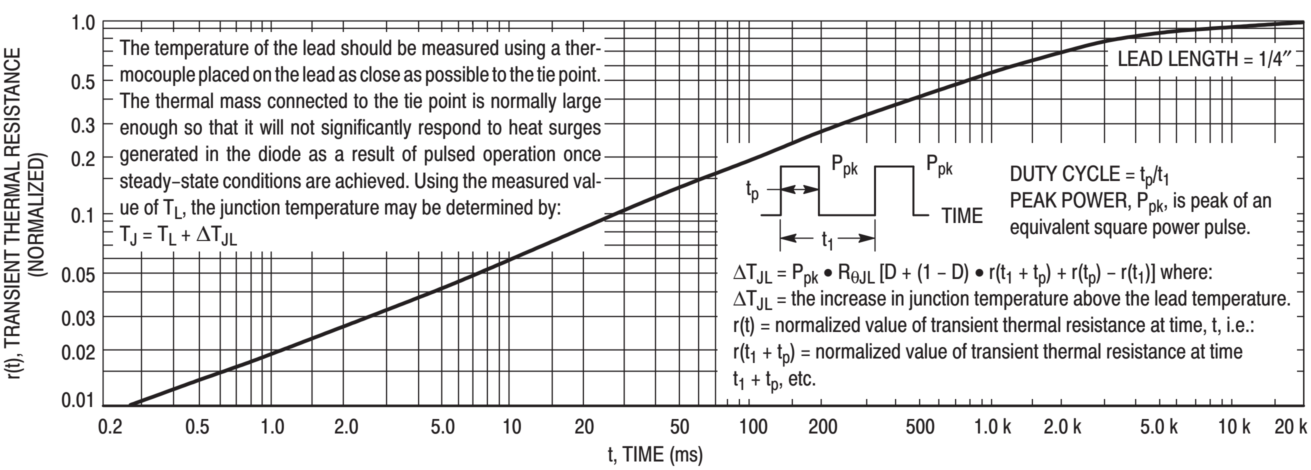


Figure 5. Thermal Response

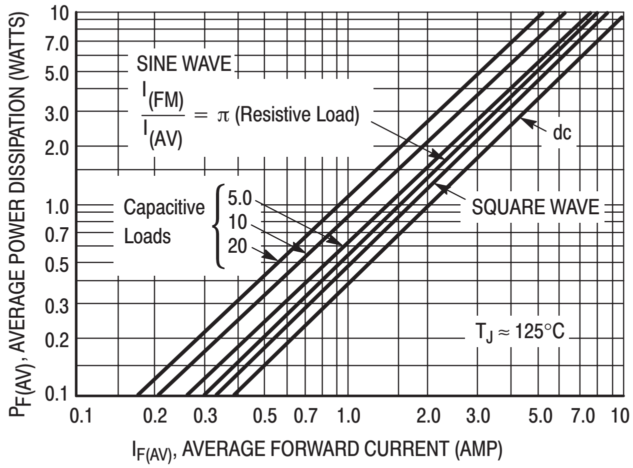
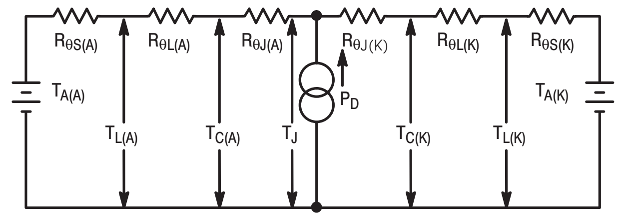


Figure 6. Forward Power Dissipation 1N5820–22

NOTE 4. – APPROXIMATE THERMAL CIRCUIT MODEL



Use of the above model permits junction to lead thermal resistance for any mounting configuration to be found. For a given total lead length, lowest values occur when one side of the rectifier is brought as close as possible to the heat sink. Terms in the model signify:

T_A = Ambient Temperature T_C = Case Temperature
T_L = Lead Temperature T_J = Junction Temperature
$R_{\theta S}$ = Thermal Resistance, Heat Sink to Ambient
$R_{\theta L}$ = Thermal Resistance, Lead to Heat Sink
$R_{\theta J}$ = Thermal Resistance, Junction to Case
P_D = Total Power Dissipation = $P_F + P_R$
P_F = Forward Power Dissipation
P_R = Reverse Power Dissipation
(Subscripts (A) and (K) refer to anode and cathode sides, respectively.) Values for thermal resistance components are:
$R_{\theta L}$ = 42°C/W/in typically and 48°C/W/in maximum
$R_{\theta J}$ = 10°C/W typically and 16°C/W maximum
The maximum lead temperature may be found as follows:
$T_L = T_{J(max)} - \Delta T_{JL}$
where $\Delta T_{JL} \approx R_{\theta JL} \cdot P_D$

NOTE 5. — MOUNTING DATA

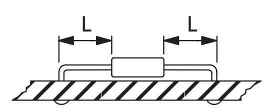
Data shown for thermal resistance junction–to–ambient ($R_{\theta JA}$) for the mountings shown is to be used as typical guideline values for preliminary engineering, or in case the tie point temperature cannot be measured.

TYPICAL VALUES FOR $R_{\theta JA}$ IN STILL AIR

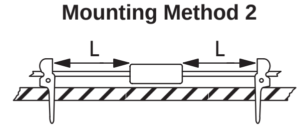
Mounting Method	Lead Length, L (in)				$R_{\theta JA}$
	1/8	1/4	1/2	3/4	
1	50	51	53	55	°C/W
2	58	59	61	63	°C/W
3	28				°C/W

Mounting Method 1

P.C. Board where available copper surface is small.



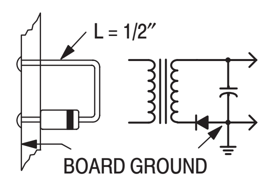
Mounting Method 2



VECTOR PUSH–IN TERMINALS T–28

Mounting Method 3

P.C. Board with 2–1/2″ x 2–1/2″ copper surface.



BOARD GROUND PLANE

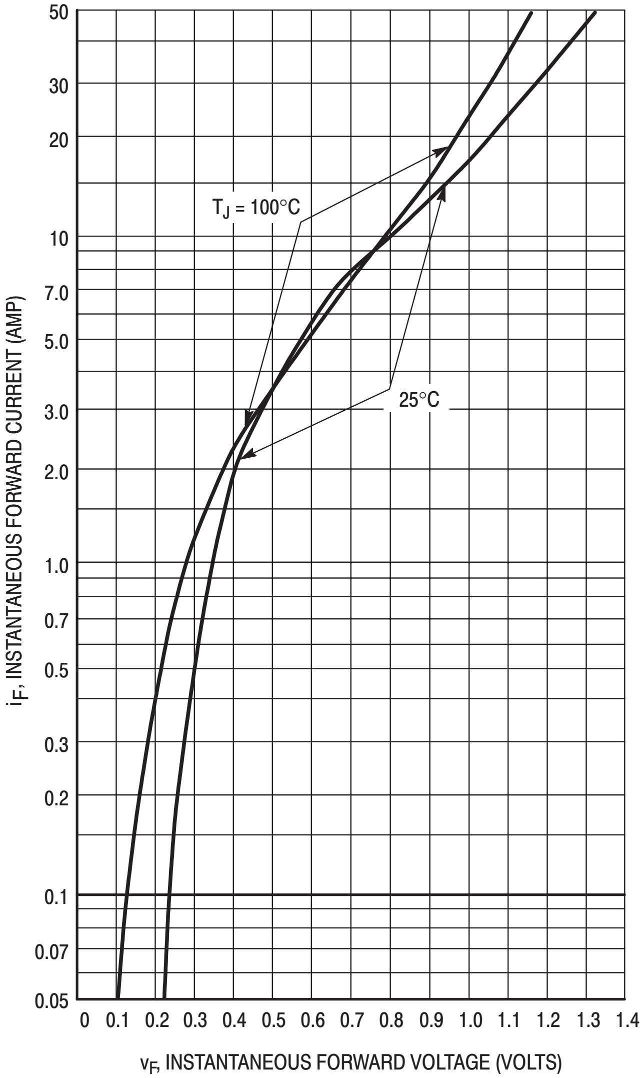


Figure 7. Typical Forward Voltage

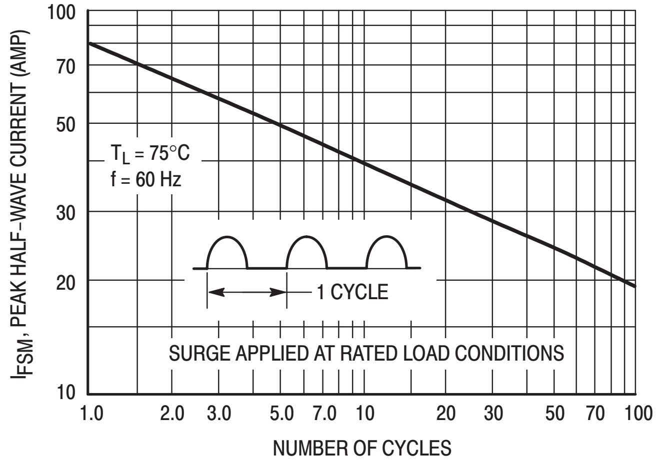


Figure 8. Maximum Non–Repetitive Surge Current

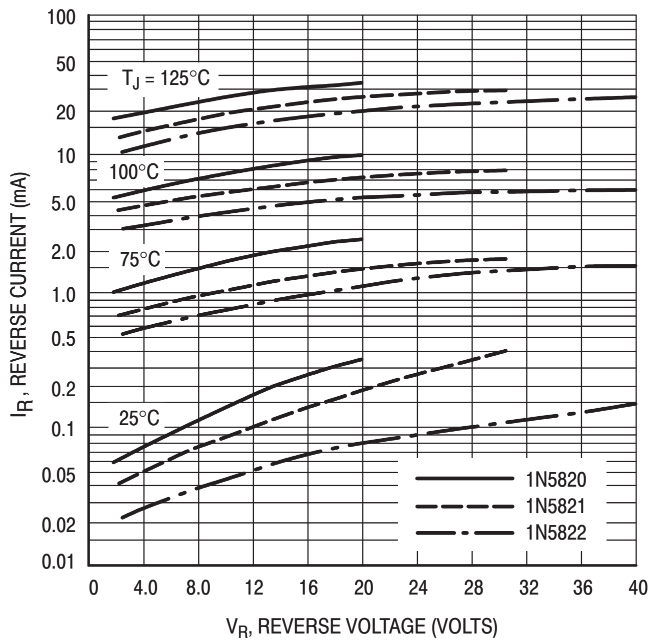


Figure 9. Typical Reverse Current

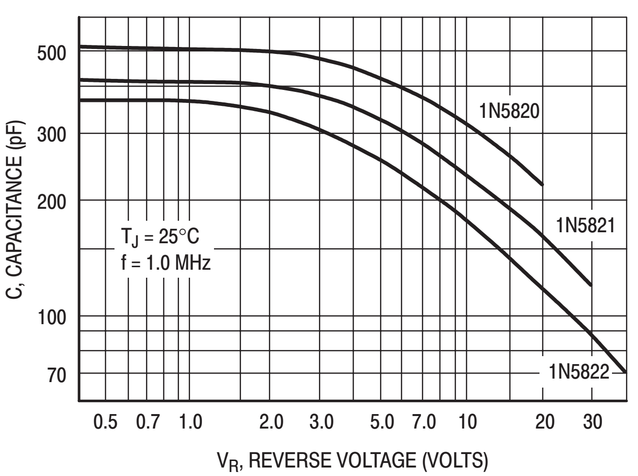


Figure 10. Typical Capacitance

NOTE 6. — HIGH FREQUENCY OPERATION

Since current flow in a Schottky rectifier is the result of majority carrier conduction, it is not subject to junction diode forward and reverse recovery transients due to minority carrier injection and stored charge. Satisfactory circuit analysis work may be performed by using a model consisting of an ideal diode in parallel with a variable capacitance. (See Figure 10.)

MBR340

Preferred Device

Axial Lead Rectifier

. . . employing the Schottky Barrier principle in a large area metal–to–silicon power diode. State–of–the–art geometry features epitaxial construction with oxide passivation and metal overlap contact. Ideally suited for use as rectifiers in low–voltage, high–frequency inverters, free wheeling diodes, and polarity protection diodes.

- Extremely Low V_F
- Low Power Loss/High Efficiency
- Highly Stable Oxide Passivated Junction
- Low Stored Charge, Majority Carrier Conduction

Mechanical Characteristics:

- Case: Epoxy, Molded
- Weight: 1.1 gram (approximately)
- Finish: All External Surfaces Corrosion Resistant and Terminal Leads are Readily Solderable
- Lead and Mounting Surface Temperature for Soldering Purposes: 220°C Max. for 10 Seconds, 1/16″ from case
- Shipped in plastic bags, 500 per bag
- Available Tape and Reeled, 1500 per reel, by adding a “RL’’ suffix to the part number
- Polarity: Cathode indicated by Polarity Band
- Marking: B340

MAXIMUM RATINGS

Rating	Symbol	Max	Unit
Peak Repetitive Reverse Voltage Working Peak Reverse Voltage DC Blocking Voltage	V_{RRM} V_{RWM} V_R	40	V
Average Rectified Forward Current T_A = 65°C ($R_{\theta JA}$ = 28°C/W, P.C. Board Mounting)	I_O	3.0	A
Non–Repetitive Peak Surge Current (Note 1.) (Surge Applied at Rated Load Conditions Halfwave, Single Phase, 60 Hz, T_L = 75°C)	I_{FSM}	80	A
Operating and Storage Junction Temperature Range (Reverse Voltage Applied)	T_J, T_{stg}	–65 to +150	°C
Peak Operating Junction Temperature (Forward Current Applied)	$T_{J(pk)}$	150	°C

1. Lead Temperature reference is cathode lead 1/32″ from case.

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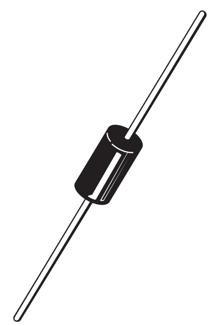
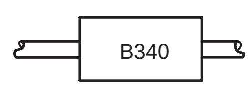
SCHOTTKY BARRIER RECTIFIER
3.0 AMPERES
40 VOLTS



AXIAL LEAD
CASE 267–03
STYLE 1

MARKING DIAGRAM



B340 = Device Code

ORDERING INFORMATION

Device	Package	Shipping
MBR340	Axial Lead	500 Units/Bag
MBR340P	Axial Lead	500 Units/Bag
MBR340PRL	Axial Lead	1500/Tape & Reel
MBR340RL	Axial Lead	1500/Tape & Reel

Preferred devices are recommended choices for future use and best overall value.

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THERMAL CHARACTERISTICS

Characteristic	Symbol	Max	Unit
Thermal Resistance, Junction to Ambient (see Note 3., Mounting Method 3)	$R_{\theta JA}$	28	°C/W

ELECTRICAL CHARACTERISTICS (T_L = 25°C unless otherwise noted) (Note 1.)

Characteristic	Symbol	Max	Unit
Maximum Instantaneous Forward Voltage (Note 2.)	v_F		V
(i_F = 1.0 Amp)		0.500	
(i_F = 3.0 Amp)		0.600	
(i_F = 9.4 Amp)		0.850	
Maximum Instantaneous Reverse Current @ Rated dc Voltage (Note 2.)	i_R		mA
T_L = 25°C		0.60	
T_L = 100°C		20	

1. Lead Temperature reference is cathode lead 1/32″ from case.
2. Pulse Test: Pulse Width = 300 µs, Duty Cycle = 2.0%.

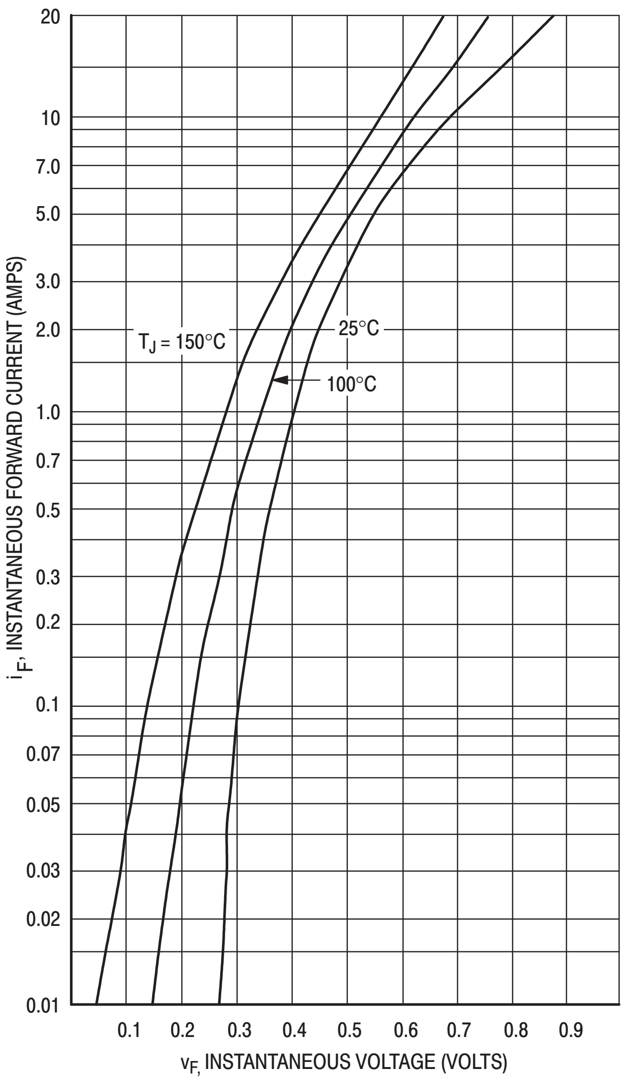


Figure 1. Typical Forward Voltage

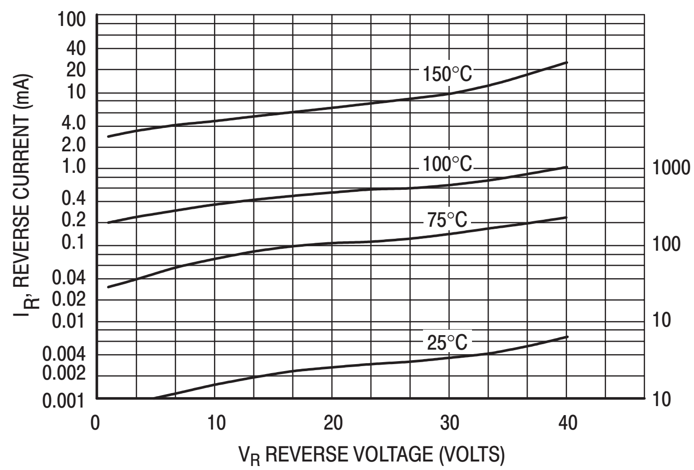


Figure 2. Typical Reverse Current*

*The curves shown are typical for the highest voltage device in the voltage grouping. Typical reverse current for lower voltage selections can be estimated from these same curves if V_R is sufficiently below rated V_R.

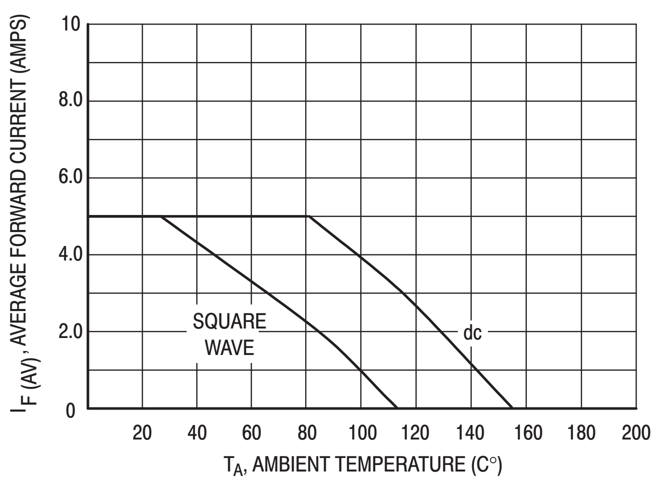


Figure 3. Current Derating (Mounting Method #3 per Note 3.)

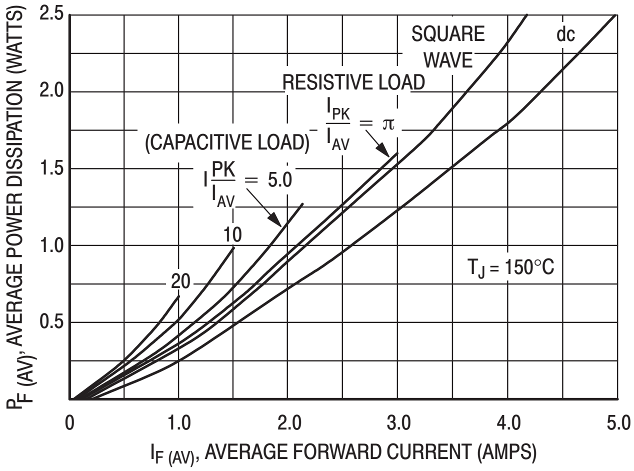


Figure 4. Power Dissipation

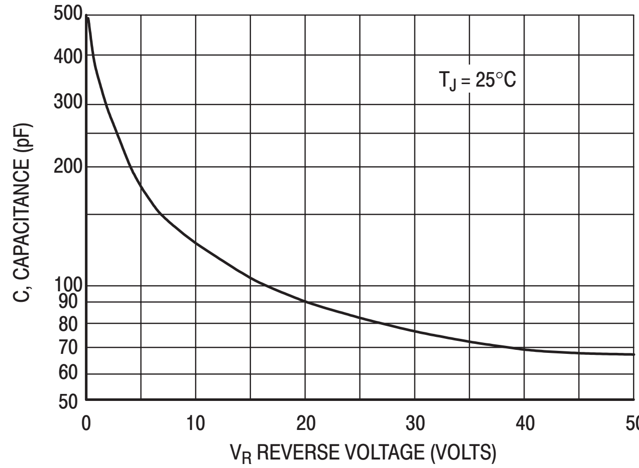


Figure 5. Typical Capacitance

NOTE 3. — MOUNTING DATA

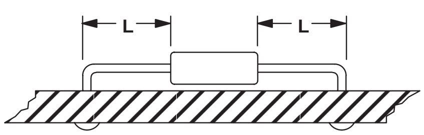
Data shown for thermal resistance junction–to–ambient ($R_{\theta JA}$) for the mountings shown is to be used as typical guideline values for preliminary engineering, or in case the tie point temperature cannot be measured.

TYPICAL VALUES FOR $R_{\theta JA}$ IN STILL AIR

Mounting Method	Lead Length, L (in)				$R_{\theta JA}$
	1/8	1/4	1/2	3/4	
1	50	51	53	55	°C/W
2	58	59	61	63	°C/W
3	28				°C/W

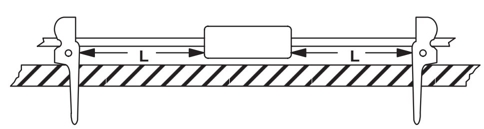
Mounting Method 1

P.C. Board where available copper surface is small.



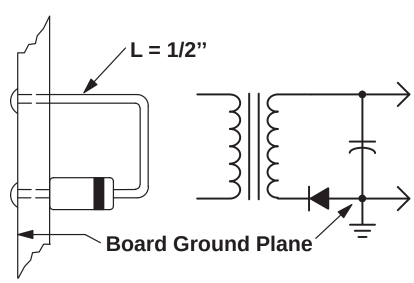
Mounting Method 2

Vector Push–In Terminals T–28



Mounting Method 3

P.C. Board with 2–1/2″ X 2–1/2″ copper surface.



MBR350, MBR360

MBR360 is a Preferred Device

Axial Lead Rectifiers

. . . employing the Schottky Barrier principle in a large area metal–to–silicon power diode. State–of–the–art geometry features epitaxial construction with oxide passivation and metal overlap contact. Ideally suited for use as rectifiers in low–voltage, high–frequency inverters, free wheeling diodes, and polarity protection diodes.

- Extremely Low v_F
- Low Power Loss/High Efficiency
- Highly Stable Oxide Passivated Junction
- Low Stored Charge, Majority Carrier Conduction

Mechanical Characteristics:

- Case: Epoxy, Molded
- Weight: 1.1 gram (approximately)
- Finish: All External Surfaces Corrosion Resistant and Terminal Leads are Readily Solderable
- Lead and Mounting Surface Temperature for Soldering Purposes: 220°C Max. for 10 Seconds, 1/16″ from case
- Shipped in plastic bags, 500 per bag
- Available Tape and Reeled, 1500 per reel, by adding a “RL’’ suffix to the part number
- Polarity: Cathode indicated by Polarity Band
- Marking: B350, B360

MAXIMUM RATINGS

Rating	Symbol	Max	Unit
Peak Repetitive Reverse Voltage Working Peak Reverse Voltage DC Blocking Voltage MBR350 MBR360	V_{RRM} V_{RWM} V_R	 50 60	V
Average Rectified Forward Current T_A = 65°C ($R_{\theta JA}$ = 28°C/W, P.C. Board Mounting)	I_O	3.0	A
Non–Repetitive Peak Surge Current (Note 1.) (Surge Applied at Rated Load Conditions Halfwave, Single Phase, 60 Hz, T_L = 75°C)	I_{FSM}	80	A
Operating and Storage Junction Temperature Range (Reverse Voltage Applied)	T_J, T_{stg}	–65 to +150	°C
Peak Operating Junction Temperature (Forward Current Applied)	$T_{J(pk)}$	150	°C

1. Lead Temperature reference is cathode lead 1/32″ from case.

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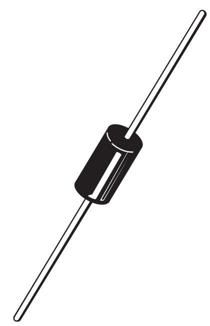
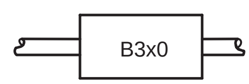
SCHOTTKY BARRIER RECTIFIERS
3.0 AMPERES
50, 60 VOLTS



AXIAL LEAD
CASE 267–03
STYLE 1

MARKING DIAGRAM



B3x0 = Device Code
x = 5 or 6

ORDERING INFORMATION

Device	Package	Shipping
MBR350	Axial Lead	500 Units/Bag
MBR350RL	Axial Lead	1500/Tape & Reel
MBR360	Axial Lead	500 Units/Bag
MBR360RL	Axial Lead	1500/Tape & Reel

Preferred devices are recommended choices for future use and best overall value.

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THERMAL CHARACTERISTICS

Characteristic	Symbol	Max	Unit
Thermal Resistance, Junction to Ambient (see Note 3., Mounting Method 3)	$R_{\theta JA}$	28	°C/W

ELECTRICAL CHARACTERISTICS (T_L = 25°C unless otherwise noted) (Note 1.)

Characteristic	Symbol	Max	Unit
Maximum Instantaneous Forward Voltage (Note 2.)	v_F		V
(i_F = 1.0 Amp)		0.600	
(i_F = 3.0 Amp)		0.740	
(i_F = 9.4 Amp)		1.080	
Maximum Instantaneous Reverse Current @ Rated dc Voltage (Note 2.)	i_R		mA
T_L = 25°C		0.60	
T_L = 100°C		20	

1. Lead Temperature reference is cathode lead 1/32″ from case.
2. Pulse Test: Pulse Width = 300 µs, Duty Cycle = 2.0%.

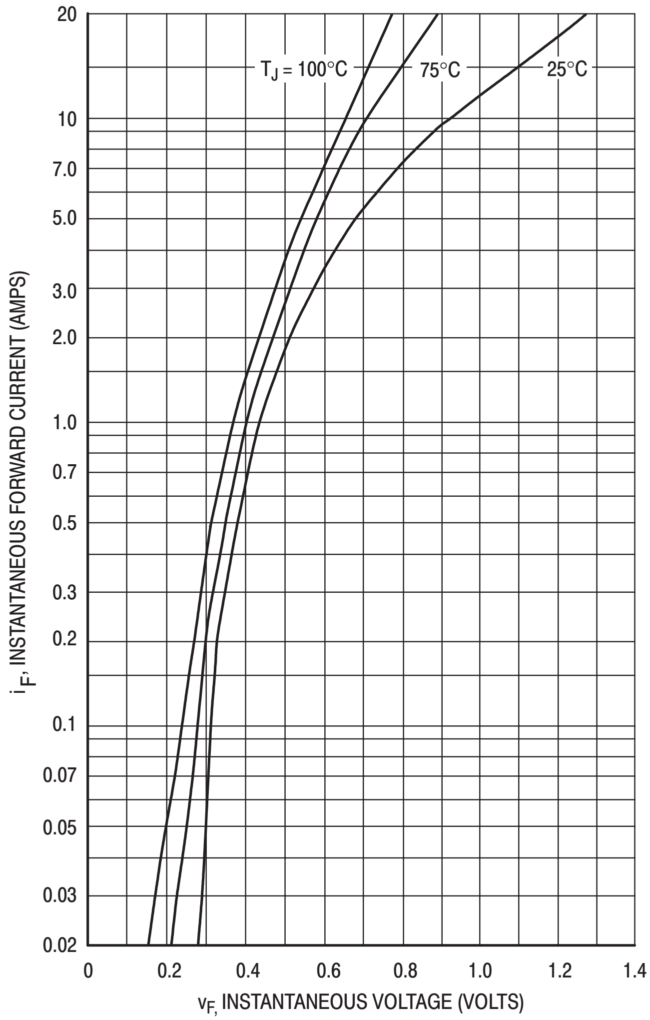


Figure 1. Typical Forward Voltage

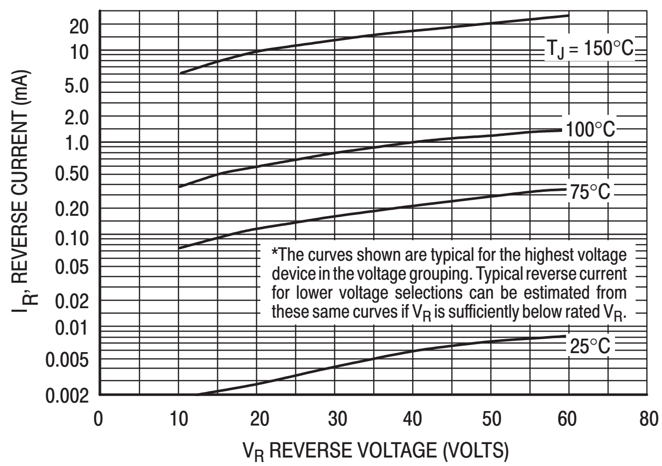


Figure 2. Typical Reverse Current*

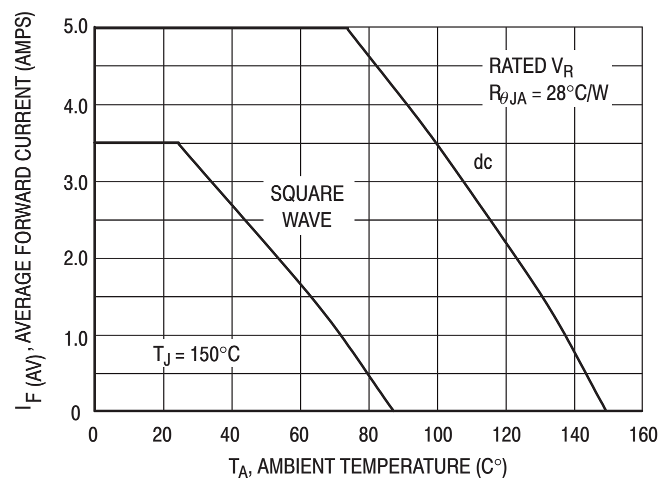


Figure 3. Current Derating Ambient (Mounting Method #3 per Note 3.)

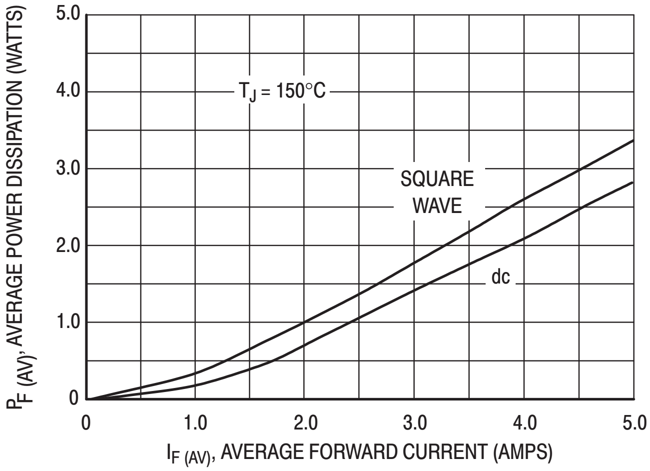


Figure 4. Power Dissipation

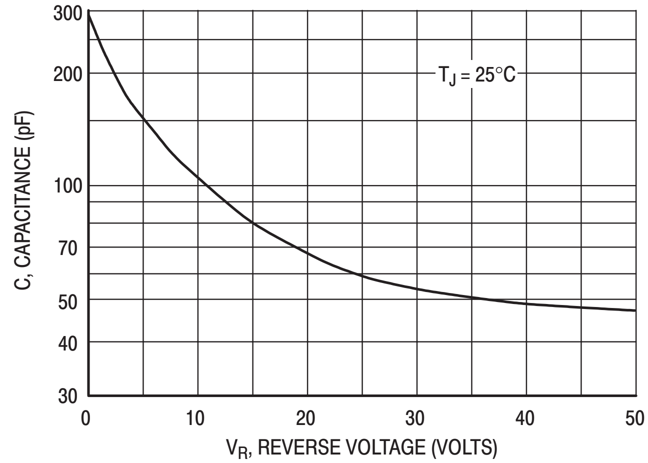


Figure 5. Typical Capacitance

NOTE 3. — MOUNTING DATA

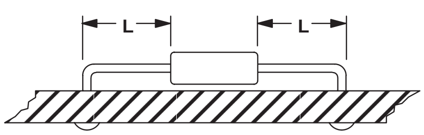
Data shown for thermal resistance junction–to–ambient ($R_{\theta JA}$) for the mountings shown is to be used as typical guideline values for preliminary engineering, or in case the tie point temperature cannot be measured.

TYPICAL VALUES FOR $R_{\theta JA}$ IN STILL AIR

Mounting Method	Lead Length, L (in)				$R_{\theta JA}$
	1/8	1/4	1/2	3/4	
1	50	51	53	55	°C/W
2	58	59	61	63	°C/W
3	28				°C/W

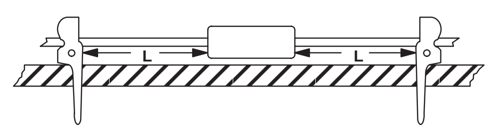
Mounting Method 1

P.C. Board where available copper surface is small.



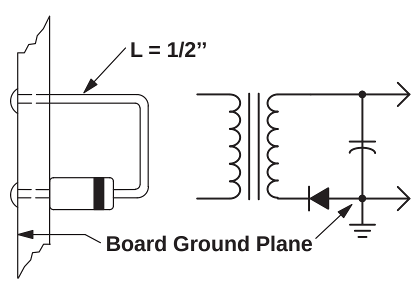
Mounting Method 2

Vector Push–In Terminals T–28



Mounting Method 3

P.C. Board with 2–1/2″ X 2–1/2″ copper surface.



MBR3100

Preferred Device

Axial Lead Rectifier

. . . employing the Schottky Barrier principle in a large area metal–to–silicon power diode. State–of–the–art geometry features epitaxial construction with oxide passivation and metal overlap contact. Ideally suited for use as rectifiers in low–voltage, high–frequency inverters, free wheeling diodes, and polarity protection diodes.

- Low Reverse Current
- Low Stored Charge, Majority Carrier Conduction
- Low Power Loss/High Efficiency
- Highly Stable Oxide Passivated Junction
- Guard–Ring for Stress Protection
- Low Forward Voltage
- 150°C Operating Junction Temperature
- High Surge Capacity

Mechanical Characteristics:

- Case: Epoxy, Molded
- Weight: 1.1 gram (approximately)
- Finish: All External Surfaces Corrosion Resistant and Terminal Leads are Readily Solderable
- Lead and Mounting Surface Temperature for Soldering Purposes: 220°C Max. for 10 Seconds, 1/16″ from case
- Shipped in plastic bags, 500 per bag
- Available Tape and Reeled, 1500 per reel, by adding a "RL'' suffix to the part number
- Polarity: Cathode indicated by Polarity Band
- Marking: B3100

MAXIMUM RATINGS

Rating	Symbol	Max	Unit
Peak Repetitive Reverse Voltage Working Peak Reverse Voltage DC Blocking Voltage	V_{RRM} V_{RWM} V_R	100	V
Average Rectified Forward Current T_A = 100°C ($R_{\theta JA}$ = 28°C/W, P.C. Board Mounting, see Note 2.)	I_O	3.0	A
Non–Repetitive Peak Surge Current (Surge Applied at Rated Load Conditions Halfwave, Single Phase, 60 Hz)	I_{FSM}	150	A
Operating and Storage Junction Temperature Range (Reverse Voltage Applied)	T_J, T_{stg}	–65 to +150	°C
Voltage Rate of Change (Rated V_R)	dv/dt	10	V/ns

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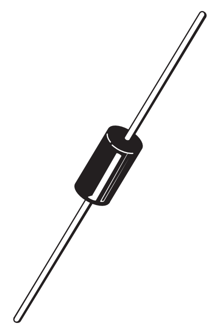
SCHOTTKY BARRIER RECTIFIER
3.0 AMPERES
100 VOLTS



AXIAL LEAD
CASE 267–03
STYLE 1

MARKING DIAGRAM

B3100 = Device Code

ORDERING INFORMATION

Device	Package	Shipping
MBR3100	Axial Lead	500 Units/Bag
MBR3100RL	Axial Lead	1500/Tape & Reel

Preferred devices are recommended choices for future use and best overall value.

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THERMAL CHARACTERISTICS

Characteristic	Symbol	Max	Unit
Thermal Resistance, Junction to Ambient (see Note 2., Mounting Method 3)	$R_{\theta JA}$	28	°C/W

ELECTRICAL CHARACTERISTICS (T_L = 25°C unless otherwise noted)

Characteristic	Symbol	Max	Unit
Maximum Instantaneous Forward Voltage (Note 1.) (i_F = 3.0 Amps, T_L = 25°C) (i_F = 3.0 Amps, T_L = 100°C)	v_F	 0.79 0.69	V
Maximum Instantaneous Reverse Current @ Rated dc Voltage (Note 1.) T_L = 25°C T_L = 100°C	i_R	 0.6 20	mA

1. Pulse Test: Pulse Width = 300 μs, Duty Cycle = 2.0%.

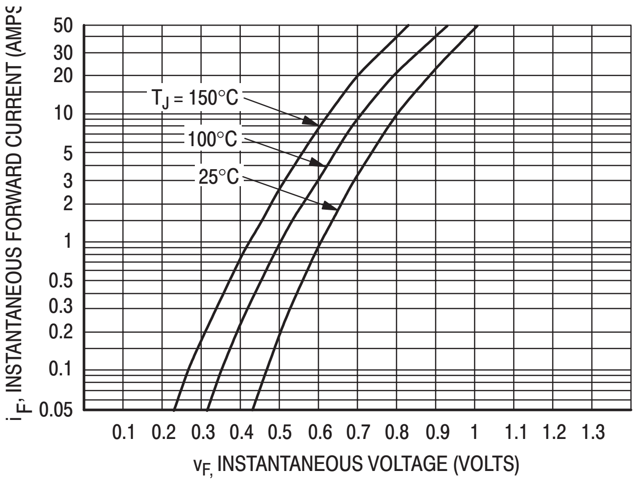


Figure 1. Typical Forward Voltage

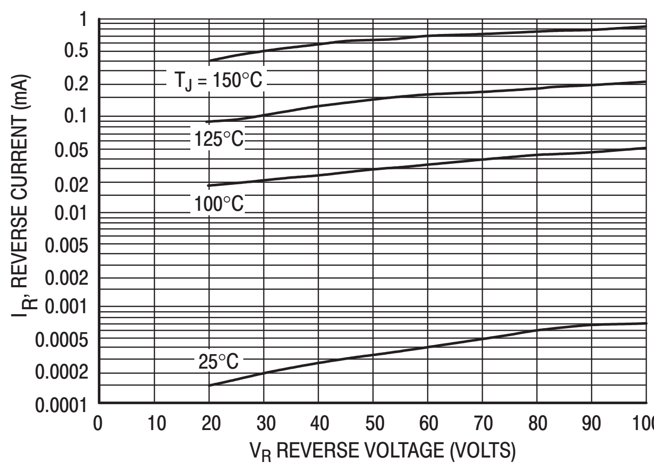


Figure 2. Typical Reverse Current*

*The curves shown are typical for the highest voltage device in the voltage grouping. Typical reverse current for lower voltage selections can be estimated from these curves if V_R is sufficient below rated V_R.

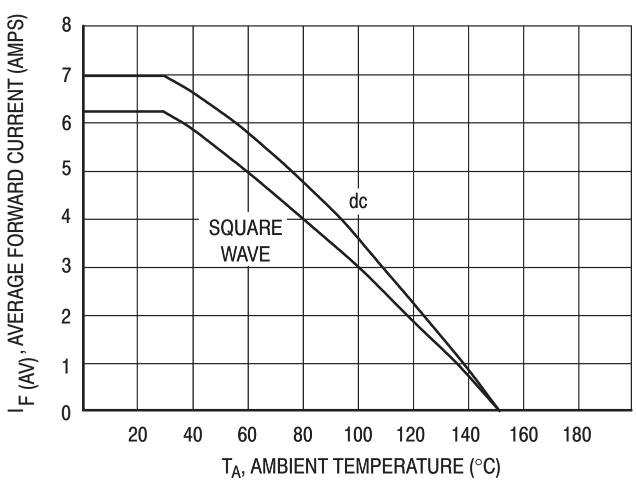


Figure 3. Current Derating (Mounting Method #3 per Note 2.)

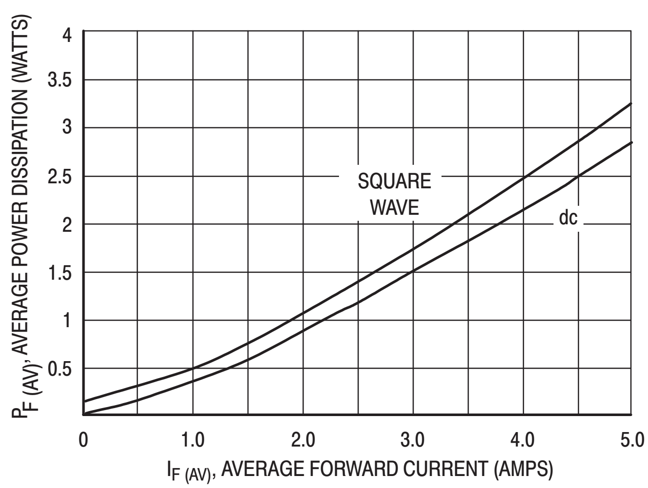


Figure 4. Power Dissipation

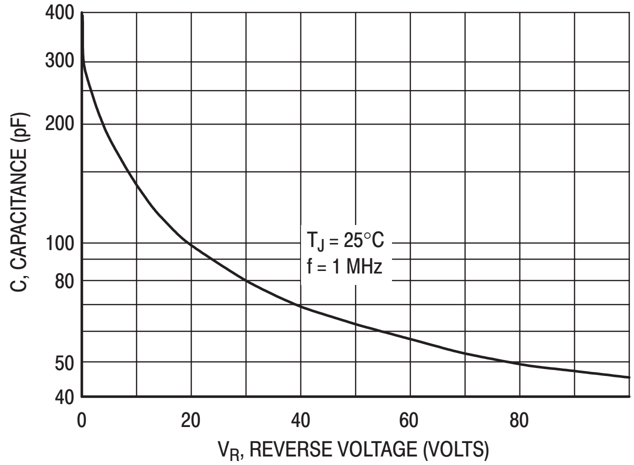


Figure 5. Typical Capacitance

NOTE 2. — MOUNTING DATA

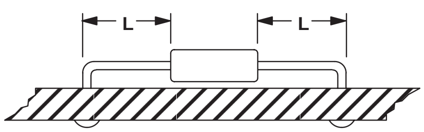
Data shown for thermal resistance junction–to–ambient ($R_{\theta JA}$) for the mountings shown is to be used as typical guideline values for preliminary engineering, or in case the tie point temperature cannot be measured.

TYPICAL VALUES FOR $R_{\theta JA}$ IN STILL AIR

Mounting Method	Lead Length, L (in)				$R_{\theta JA}$
	1/8	1/4	1/2	3/4	
1	50	51	53	55	°C/W
2	58	59	61	63	°C/W
3	28				°C/W

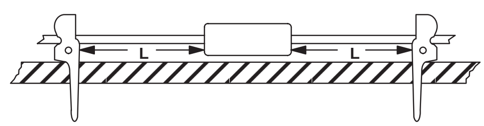
Mounting Method 1

P.C. Board where available copper surface is small.



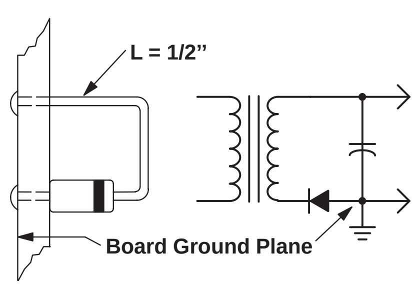
Mounting Method 2

Vector Push–In Terminals T–28



Mounting Method 3

P.C. Board with 2–1/2″ X 2–1/2″ copper surface.



MBR1535CT, MBR1545CT

MBR1545CT is a Preferred Device

SWITCHMODE™ Power Rectifier

. . . using the Schottky Barrier principle with a platinum barrier metal. These state–of–the–art devices have the following features:

- Center–Tap Configuration
- Guardring for Stress Protection
- Low Forward Voltage
- 150°C Operating Junction Temperature
- Epoxy Meets UL94, VO at 1/8″

Mechanical Characteristics:

- Case: Epoxy, Molded
- Weight: 1.9 grams (approximately)
- Finish: All External Surfaces Corrosion Resistant and Terminal Leads are Readily Solderable
- Lead Temperature for Soldering Purposes: 260°C Max. for 10 Seconds
- Shipped 50 units per plastic tube
- Marking: B1535, B1545

MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Peak Repetitive Reverse Voltage Working Peak Reverse Voltage DC Blocking Volta MBR1535CT MBR1545CT	V_{RRM} V_{RWM} V_R	 35 45	V
Average Rectified Forward Current (Rated V_R, T_C = 105°C) Per Diode Per Device	$I_{F(AV)}$	7.5 15	A
Peak Repetitive Forward Current (Rated V_R, Square Wave, 20 kHz, T_C = 105°C) Per Diode	I_{FRM}	15	A
Non–Repetitive Peak Surge Current (Surge Applied at Rated Load Conditions Halfwave, Single Phase, 60 Hz)	I_{FSM}	150	A
Peak Repetitive Reverse Surge Current (2.0 µs, 1.0 kHz)	I_{RRM}	1.0	A
Storage Temperature Range	T_{stg}	–65 to +175	°C
Operating Junction Temperature	T_J	–65 to +150	°C
Voltage Rate of Change (Rated V_R)	dv/dt	1000	V/µs

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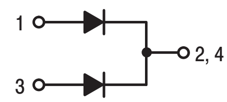
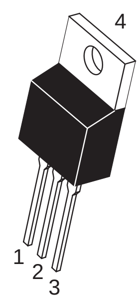
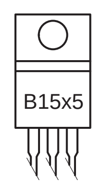
SCHOTTKY BARRIER RECTIFIERS
15 AMPERES
35 and 45 VOLTS





TO–220AB
CASE 221A
PLASTIC

MARKING DIAGRAM



B15x5 = Device Code
x = 3 or 4

ORDERING INFORMATION

Device	Package	Shipping
MBR1535CT	TO–220	50 Units/Rail
MBR1545CT	TO–220	50 Units/Rail

Preferred devices are recommended choices for future use and best overall value.

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THERMAL CHARACTERISTICS PER DIODE

Characteristic	Symbol	Value	Unit
Maximum Thermal Resistance, Junction to Case	$R_{\theta JC}$	3.0	°C/W
Maximum Thermal Resistance, Junction to Ambient	$R_{\theta JA}$	60	°C/W

ELECTRICAL CHARACTERISTICS PER DIODE

Maximum Instantaneous Forward Voltage (Note 1.) (i_F = 7.5 Amps, T_C = 125°C) (i_F = 15 Amps, T_C = 125°C) (i_F = 15 Amps, T_C = 25°C)	V_F	 0.57 0.72 0.84	Volts
Maximum Instantaneous Reverse Current (Note 1.) (Rated dc Voltage, T_C = 125°C) (Rated dc Voltage, T_C = 25°C)	i_R	 15 0.1	mA

1. Pulse Test: Pulse Width = 300 μs, Duty Cycle ≤ 2.0%

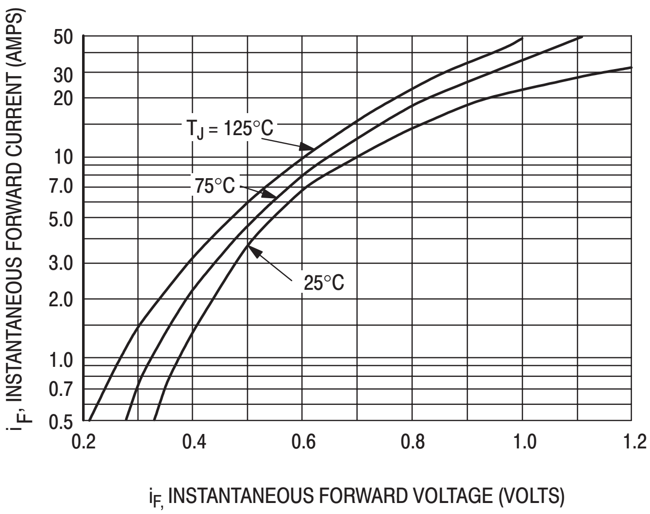

Figure 6. Typical Forward Voltage

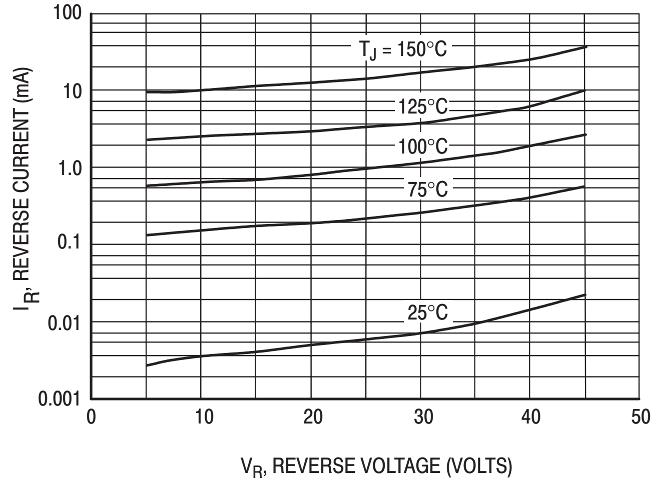

Figure 7. Typical Reverse Current

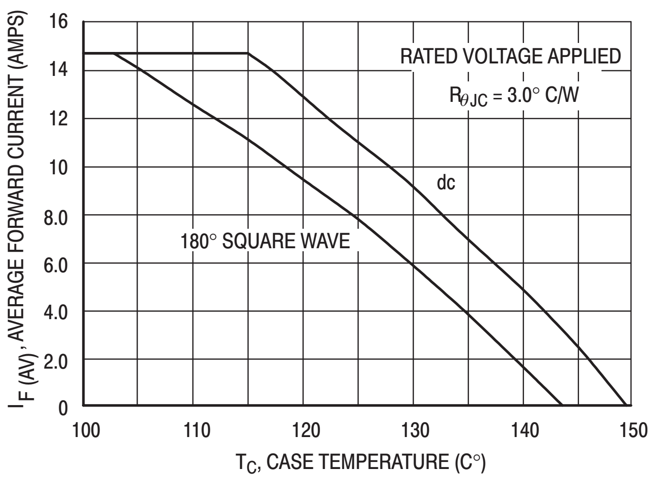

Figure 8. Current Derating, Case

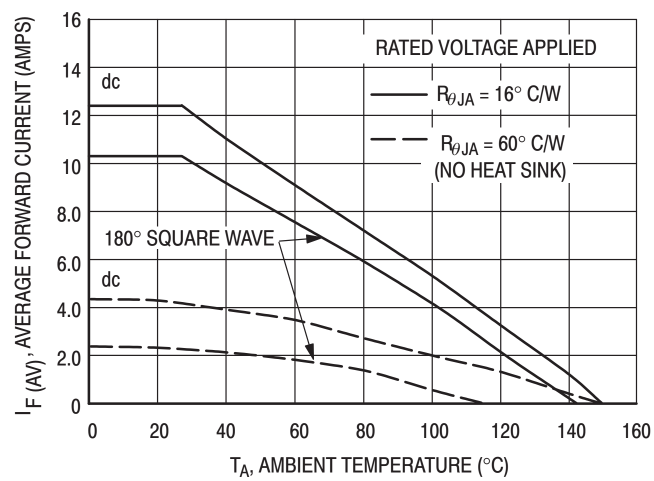

Figure 9. Current Derating, Ambient

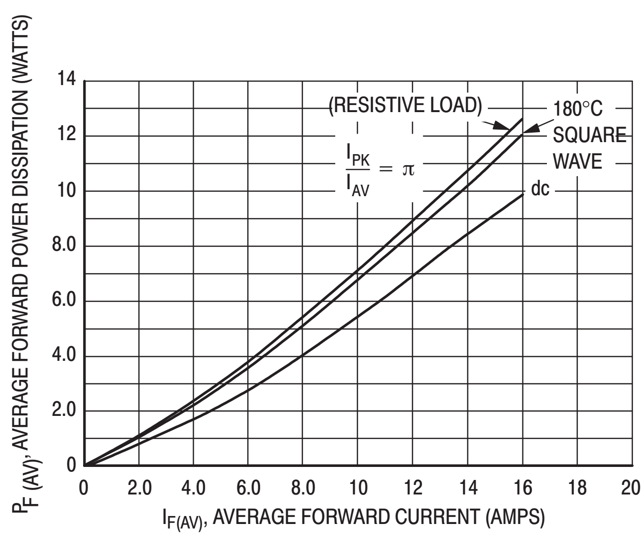

Figure 10. Power Dissipation

MBR16100CT

SWITCHMODE™ Power Rectifier

. . . using the Schottky Barrier principle with a platinum barrier metal. These state–of–the–art devices have the following features:

- 16 Amps Total (8.0 Amps Per Diode Leg)
- Guard–Ring for Stress Protection
- Low Forward Voltage
- 175°C Operating Junction Temperature
- Epoxy Meets UL94, VO at 1/8″
- Low Power Loss/High Efficiency
- High Surge Capacity
- Low Stored Charge Majority Carrier Conduction

Mechanical Characteristics:

- Case: Epoxy, Molded
- Weight: 1.9 grams (approximately)
- Finish: All External Surfaces Corrosion Resistant and Terminal Leads are Readily Solderable
- Lead Temperature for Soldering Purposes: 260°C Max. for 10 Seconds
- Shipped 50 units per plastic tube
- Marking: B16100

MAXIMUM RATINGS (Per Diode Leg)

Rating	Symbol	Value	Unit
Peak Repetitive Reverse Voltage Working Peak Reverse Voltage DC Blocking Voltage	V_{RRM} V_{RWM} V_R	100	V
Average Rectified Forward Current (Rated V_R) T_C = 133°C	$I_{F(AV)}$	8.0	A
Peak Repetitive Forward Current (Rated V_R, Square Wave, 20 kHz) T_C = 133°C	I_{FRM}	16	A
Nonrepetitive Peak Surge Current (Surge applied at rated load conditions halfwave, single phase, 60 Hz)	I_{FSM}	150	A
Peak Repetitive Reverse Surge Current (2.0 μs, 1.0 kHz)	I_{RRM}	0.5	A
Operating Junction Temperature	T_J	– 65 to +175	°C
Storage Temperature	T_{stg}	– 65 to +175	°C
Voltage Rate of Change (Rated V_R)	dv/dt	10,000	V/μs

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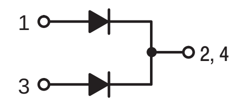
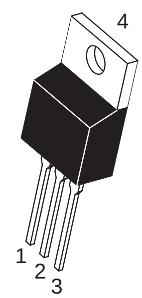
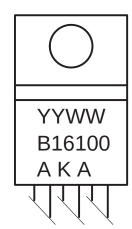
SCHOTTKY BARRIER RECTIFIER
16 AMPERES
100 VOLTS





TO–220AB
CASE 221A
PLASTIC

MARKING DIAGRAM



YY = Year
WW = Work Week
B16100 = Device Code
AKA = Polarity Designator

ORDERING INFORMATION

Device	Package	Shipping
MBR16100CT	TO–220	50 Units/Rail

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THERMAL CHARACTERISTICS

Characteristic	Symbol	Value	Unit
Maximum Thermal Resistance – Junction to Case – Junction to Ambient	$R_{\theta JC}$ $R_{\theta JA}$	2.0 60	°C/W

ELECTRICAL CHARACTERISTICS (Per Diode Leg)

Characteristic	Symbol	Value	Unit
Maximum Instantaneous Forward Voltage (Note 1.) (i_F = 8.0 Amps, T_C = 125°C) (i_F = 8.0 Amps, T_C = 25°C) (i_F = 16 Amps, T_C = 125°C) (i_F = 16 Amps, T_C = 25°C)	v_F	 0.6 0.74 0.69 0.84	Volts
Maximum Instantaneous Reverse Current (Note 1.) (Rated dc Voltage, T_C = 125°C) (Rated dc Voltage, T_C = 25°C)	i_R	 5.0 0.1	mA

1. Pulse Test: Pulse Width = 300 μs, Duty Cycle ≤ 2%.

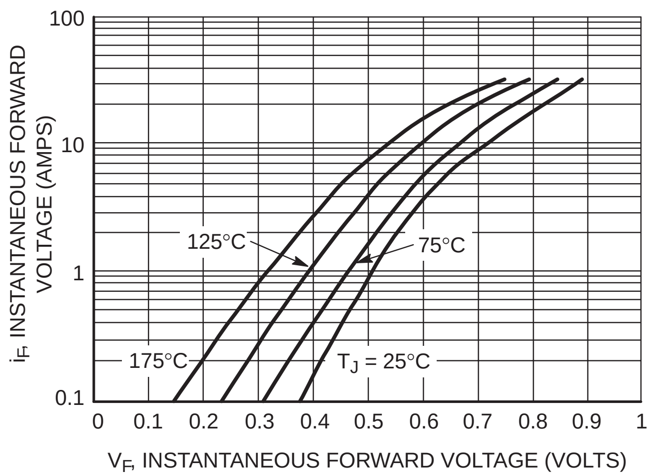

Figure 1. Typical Forward Voltage Per Diode

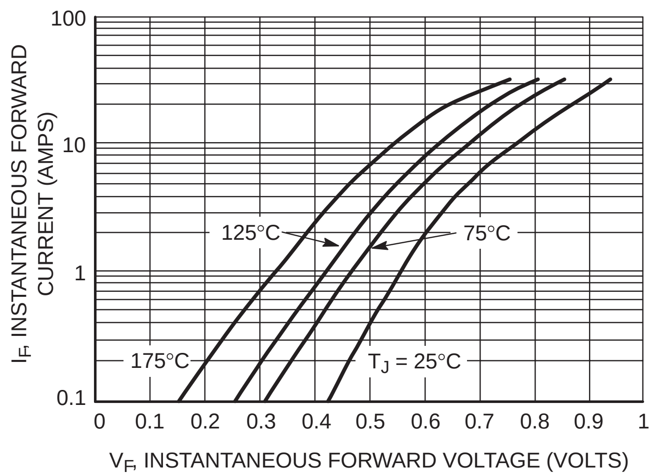

Figure 2. Maximum Forward Voltage Per Diode

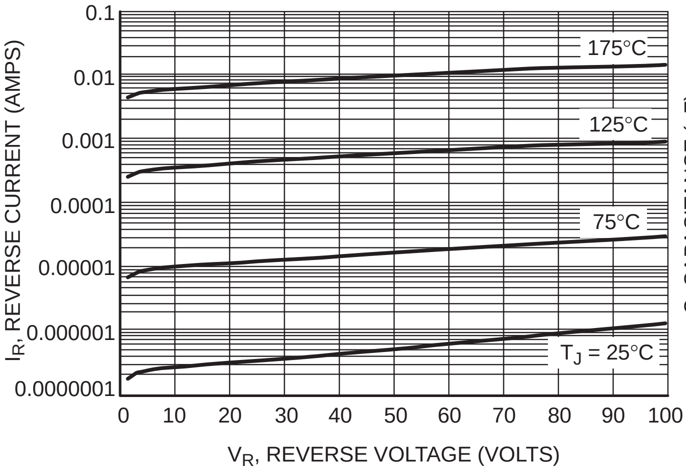

Figure 3. Typical Reverse Current Per Diode

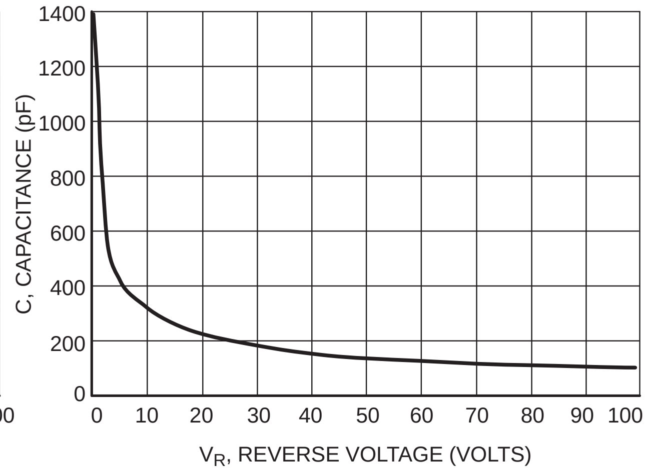

Figure 4. Typical Capacitance Per Diode

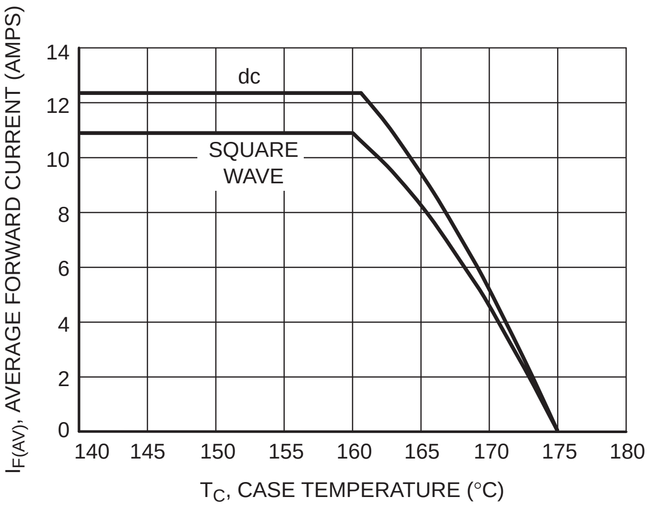

Figure 5. Current Derating (Per Diode), Case

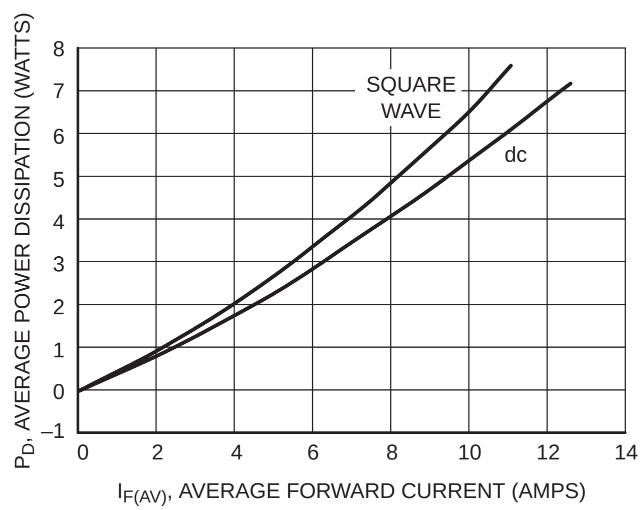

Figure 6. Average Power Dissipation

MBR2030CTL

Preferred Device

SWITCHMODE™ Dual Schottky Power Rectifier

. . . employing the Schottky Barrier principle in a large area metal–to–silicon power diode. State–of–the–art geometry features epitaxial construction with oxide passivation and metal overlay contact. Ideally suited for use as rectifiers in very low–voltage, high–frequency switching power supplies, free wheeling diodes and polarity protection diodes.

- Highly Stable Oxide Passivated Junction
- Very Low Forward Voltage Drop (0.4 Max @ 10 A, T_C = 150°C)
- 150°C Operating Junction Temperature
- Matched Dual Die Construction (10 A per Leg or 20 A per Package)
- High Junction Temperature Capability
- High dv/dt Capability
- Excellent Ability to Withstand Reverse Avalanche Energy Transients
- Guardring for Stress Protection
- Epoxy Meets UL94, VO at 1/8″

Mechanical Characteristics:

- Case: Epoxy, Molded
- Weight: 1.9 grams (approximately)
- Finish: All External Surfaces Corrosion Resistant and Terminal Leads are Readily Solderable
- Lead Temperature for Soldering Purposes: 260°C Max. for 10 Seconds
- Shipped 50 units per plastic tube
- Marking: B2030

MAXIMUM RATINGS

Please See the Table on the Following Page

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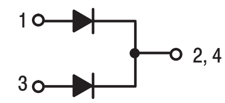
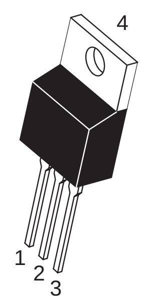
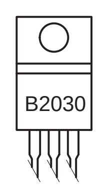
SCHOTTKY BARRIER RECTIFIER
20 AMPERES
30 VOLTS





TO–220AB
CASE 221A
PLASTIC

MARKING DIAGRAM



B2030 = Device Code

ORDERING INFORMATION

Device	Package	Shipping
MBR2030CTL	TO–220	50 Units/Tube

Preferred devices are recommended choices for future use and best overall value.

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MAXIMUM RATINGS (Per Leg)

Rating	Symbol	Value	Unit
Peak Repetitive Reverse Voltage Working Peak Reverse Voltage DC Blocking Voltage	V_{RRM} V_{RWM} V_R	30	Volts
Average Rectified Forward Current	$I_{F(AV)}$	10	Amps
Nonrepetitive Peak Surge Current (Surge applied at rated load conditions halfwave, single phase, 60 Hz)	I_{FSM}	150	Amps
Peak Repetitive Reverse Surge Current (2.0 µs, 1.0 kHz)	I_{RRM}	1.0	Amp
Operating Junction Temperature	T_J	– 65 to +150	°C
Storage Temperature	T_{stg}	– 65 to +175	°C
Voltage Rate of Change (Rated V_R)	dv/dt	1000	V/µs

THERMAL CHARACTERISTICS (Per Leg)

Thermal Resistance, Junction to Case	$R_{\theta JC}$	2.0	°C/W

ELECTRICAL CHARACTERISTICS (Per Leg)

Maximum Instantaneous Forward Voltage (Note 1.) (i_F = 10 Amps, T_C = 25°C) (i_F = 10 Amps, T_C = 150°C) (i_F = 20 Amps, T_C = 25°C) (i_F = 20 Amps, T_C = 150°C)	v_F	 0.52 0.40 0.58 0.48	Volts
Maximum Instantaneous Reverse Current (Note 1.) (Rated DC Voltage, T_C = 25°C) (Rated DC Voltage, T_C = 100°C) (Rated DC Voltage, T_C = 125°C)	i_R	 5.0 40 75	mA

1. Pulse Test: Pulse Width = 5.0 ms, Duty Cycle ≤ 10%.

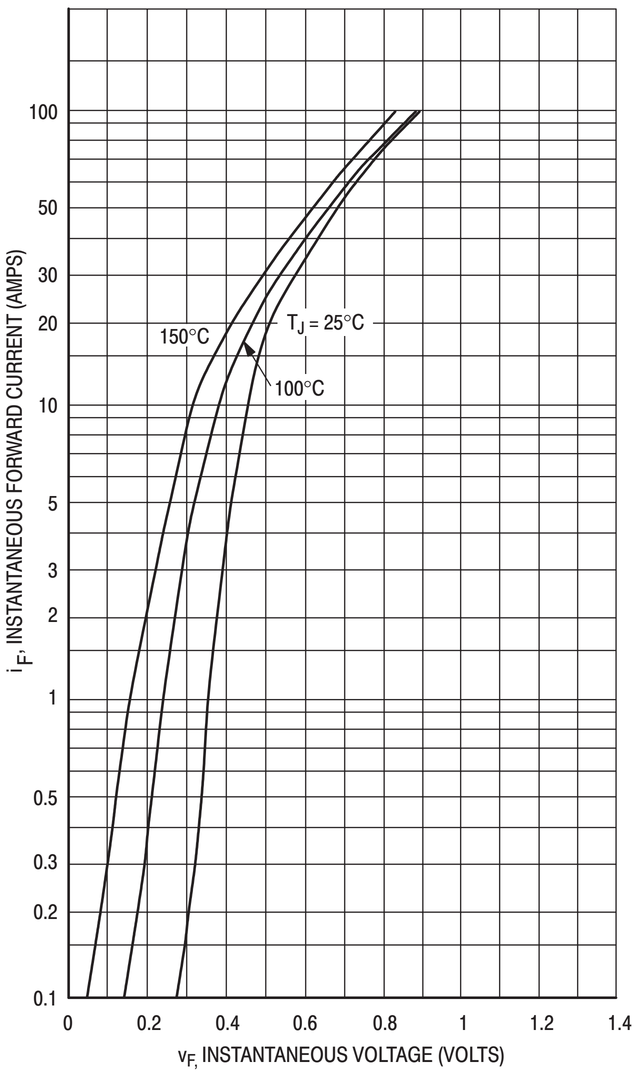

Figure 1. Typical Forward Voltage (Per Leg)

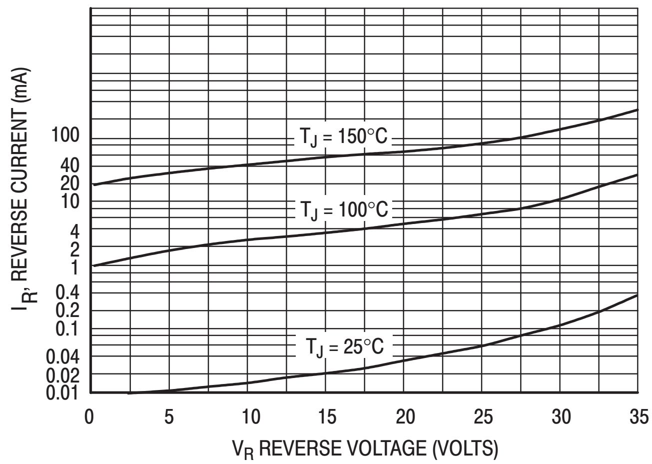

Figure 2. Typical Reverse Current (Per Leg)

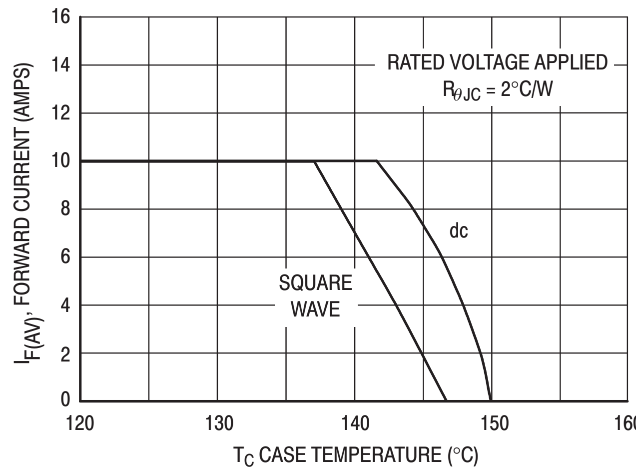

Figure 3. Current Derating, Case

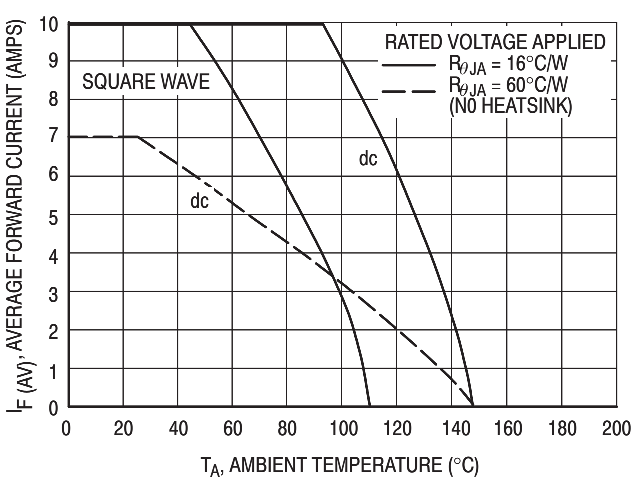

Figure 4. Current Derating, Ambient

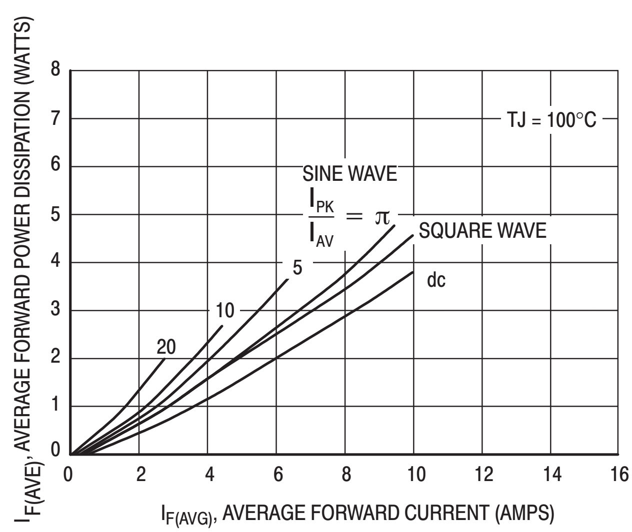

Figure 5. Forward Power Dissipation

HIGH FREQUENCY OPERATION

Since current flow in a Schottky rectifier is the result of majority carrier conduction, it is not subject to junction diode forward and reverse recovery transients due to minority carrier injection and stored charge. Satisfactory circuit analysis work may be performed by using a model consisting of an ideal diode in parallel with a variable capacitance. (See Figure 6.)

Rectification efficiency measurements show that operation will be satisfactory up to several megahertz. For example, relative waveform rectification efficiency is approximately 70 percent at 2.0 MHz, e.g., the ratio of dc power to RMS power in the load is 0.28 at this frequency, whereas perfect rectification would yield 0.406 for sine wave inputs. However, in contrast to ordinary junction diodes, the loss in waveform efficiency is not indicative of power loss; it is simply a result of reverse current flow through the diode capacitance, which lowers the dc output voltage.

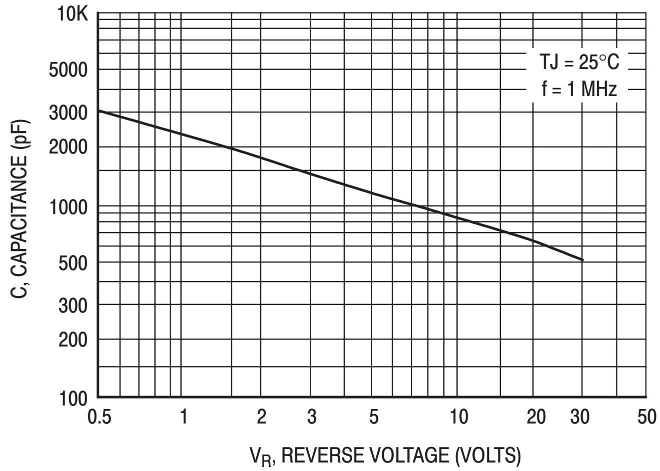

Figure 6. Typical Capacitance

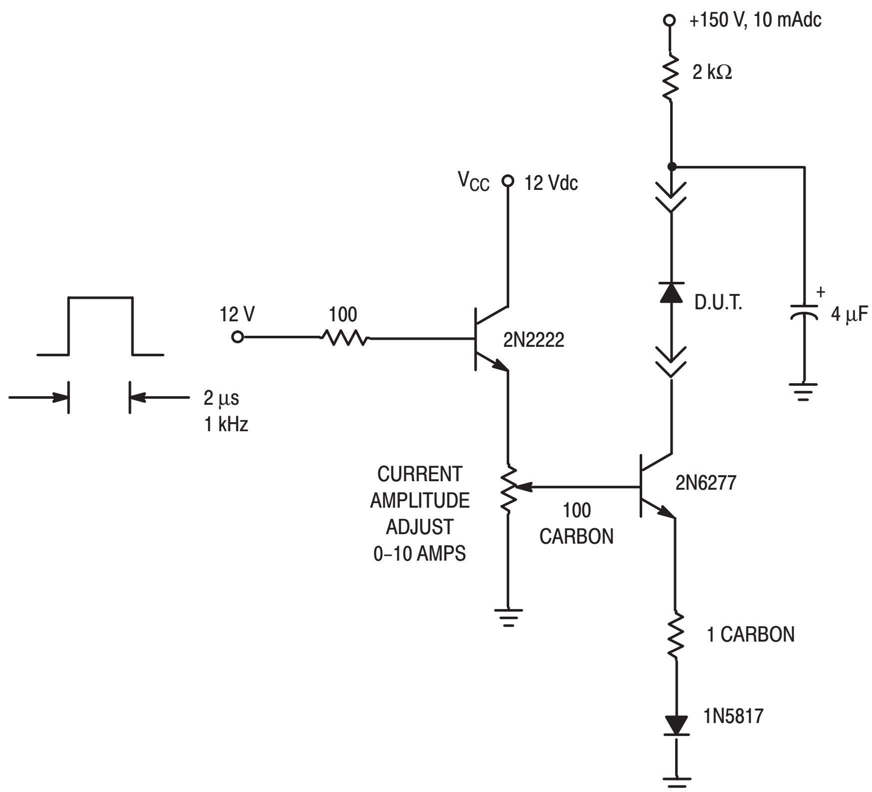

Figure 7. Test Circuit for dv/dt and Reverse Surge Current

MBR2045CT

Preferred Device

SWITCHMODE™ Power Rectifier

. . . using the Schottky Barrier principle with a platinum barrier metal. These state–of–the–art devices have the following features:

- Guardring for Stress Protection
- Low Forward Voltage
- 150°C Operating Junction Temperature
- Epoxy Meets UL94, VO at 1/8″

Mechanical Characteristics:

- Case: Epoxy, Molded
- Weight: 1.9 grams (approximately)
- Finish: All External Surfaces Corrosion Resistant and Terminal Leads are Readily Solderable
- Lead Temperature for Soldering Purposes: 260°C Max. for 10 Seconds
- Shipped 50 units per plastic tube
- Marking: B2045

MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Peak Repetitive Reverse Voltage Working Peak Reverse Voltage DC Blocking Voltage	V_{RRM} V_{RWM} V_R	45	V
Average Rectified Forward Current (Rated V_R, T_C = 135°C)	$I_{F(AV)}$	20	A
Peak Repetitive Forward Current per Diode Leg (Rated V_R, Square Wave, 20 kHz, T_C = 135°C)	I_{FRM}	20	A
Non–Repetitive Peak Surge Current (Surge Applied at Rated Load Conditions Halfwave, Single Phase, 60 Hz)	I_{FSM}	150	A
Peak Repetitive Reverse Surge Current (2.0 μs, 1.0 kHz) See Figure 11	I_{RRM}	1.0	A
Storage Temperature Range	T_{stg}	–65 to +175	°C
Operating Junction Temperature	T_J	–65 to +150	°C
Voltage Rate of Change (Rated V_R)	dv/dt	1000	V/μs

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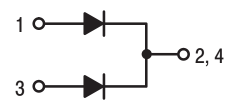
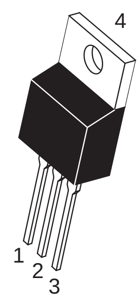
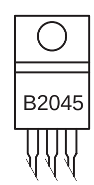
SCHOTTKY BARRIER RECTIFIER
20 AMPERES
45 VOLTS





TO–220AB
CASE 221A
PLASTIC

MARKING DIAGRAM



B2045 = Device Code

ORDERING INFORMATION

Device	Package	Shipping
MBR2045CT	TO–220	50 Units/Rail

Preferred devices are recommended choices for future use and best overall value.

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THERMAL CHARACTERISTICS

Characteristic	Symbol	Max	Unit
Maximum Thermal Resistance, Junction to Case	$R_{\theta JC}$	2.0	°C/W

ELECTRICAL CHARACTERISTICS

Maximum Instantaneous Forward Voltage (Note 1.)	v_F		Volts
(i_F = 10 Amps, T_C = 125°C)		0.57	
(i_F = 20 Amps, T_C = 125°C)		0.72	
(i_F = 20 Amps, T_C = 25°C)		0.84	
Maximum Instantaneous Reverse Current (Note 1.)	i_R		mA
(Rated dc Voltage, T_C = 125°C)		15	
(Rated dc Voltage, T_C = 25°C)		0.1	

1. Pulse Test: Pulse Width = 300 μs, Duty Cycle ≤ 2.0%.

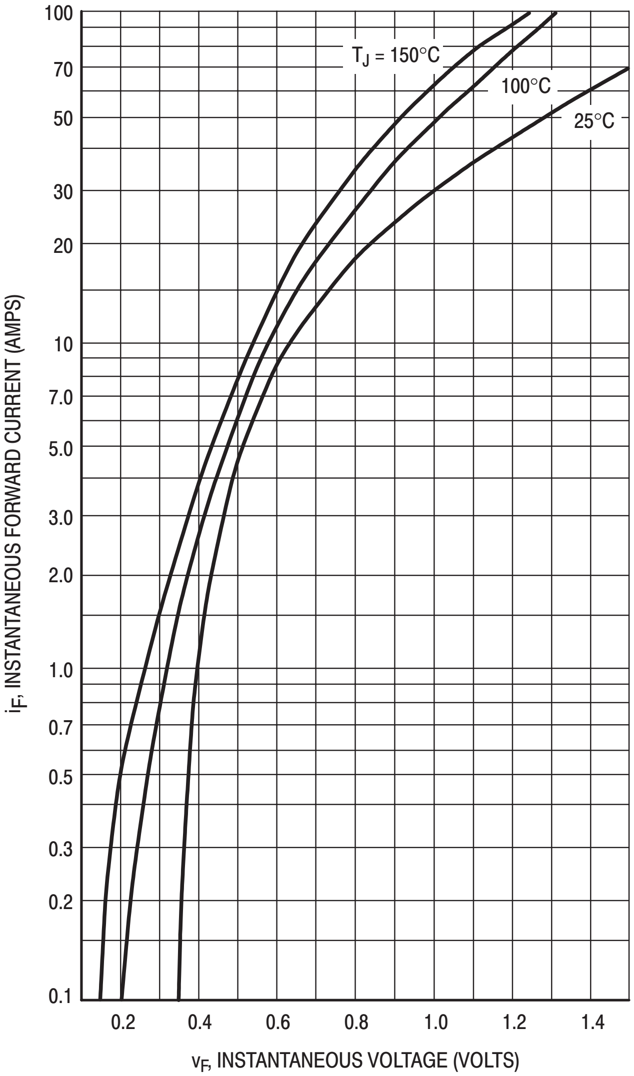

Figure 1. Maximum Forward Voltage

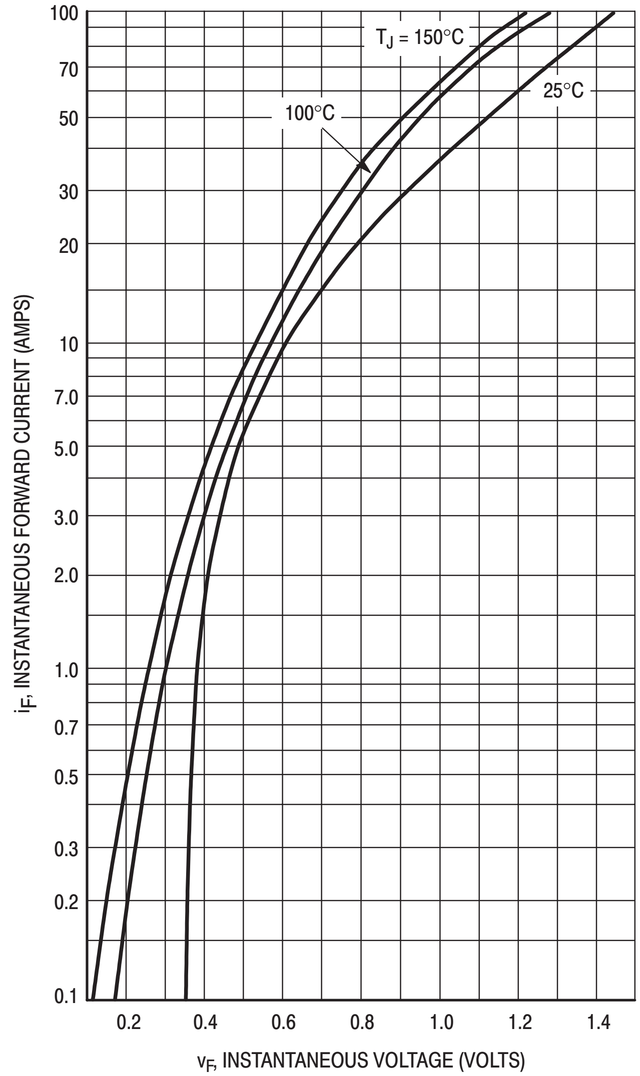

Figure 2. Typical Forward Voltage

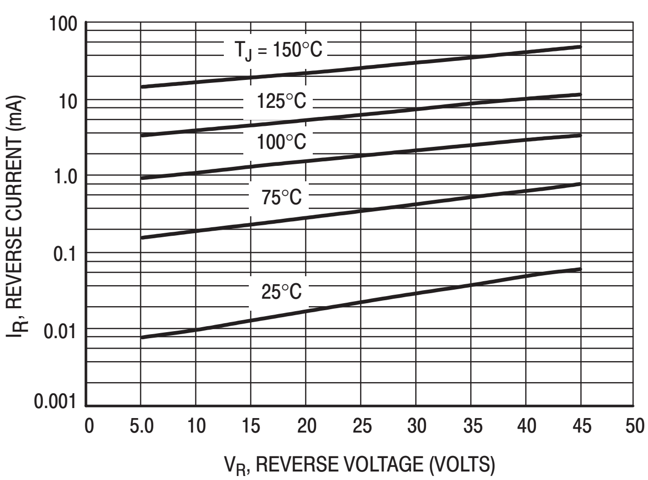

Figure 3. Maximum Reverse Current

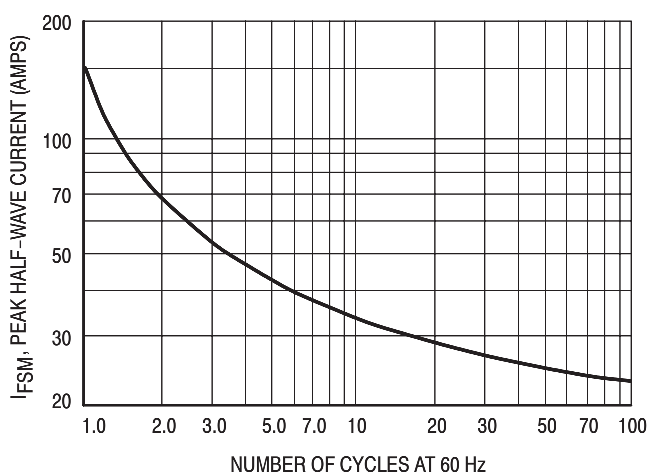

Figure 4. Maximum Surge Capability

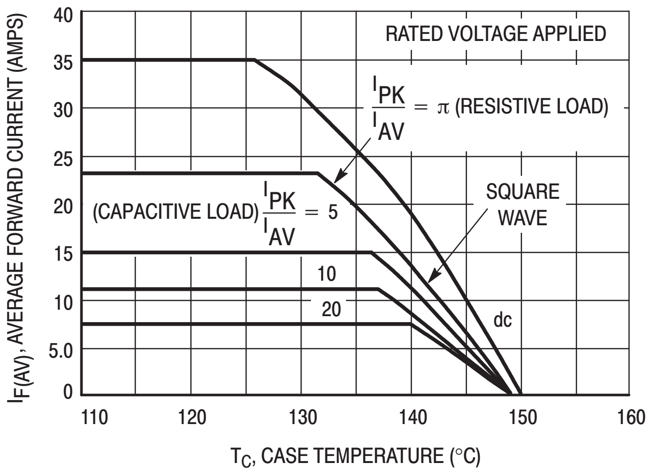

Figure 5. Current Derating, Infinite Heatsink

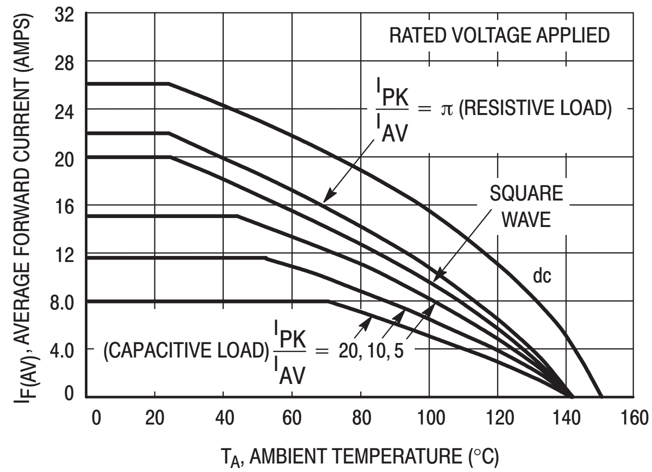

Figure 6. Current Derating, $R_{\theta JA}$ = 16°C/W

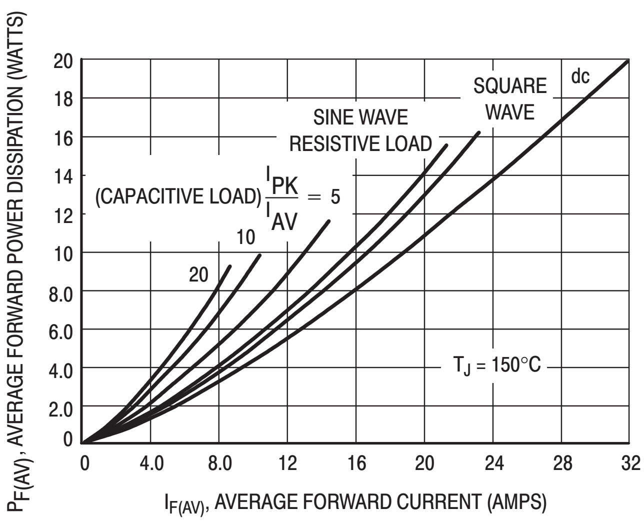

Figure 7. Forward Power Dissipation

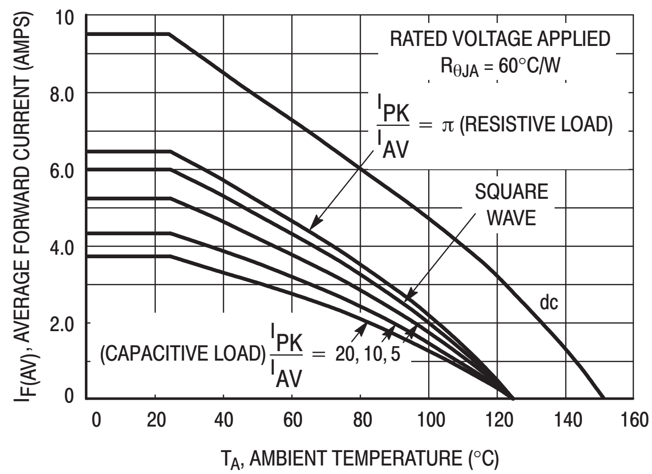

Figure 8. Current Derating, Free Air

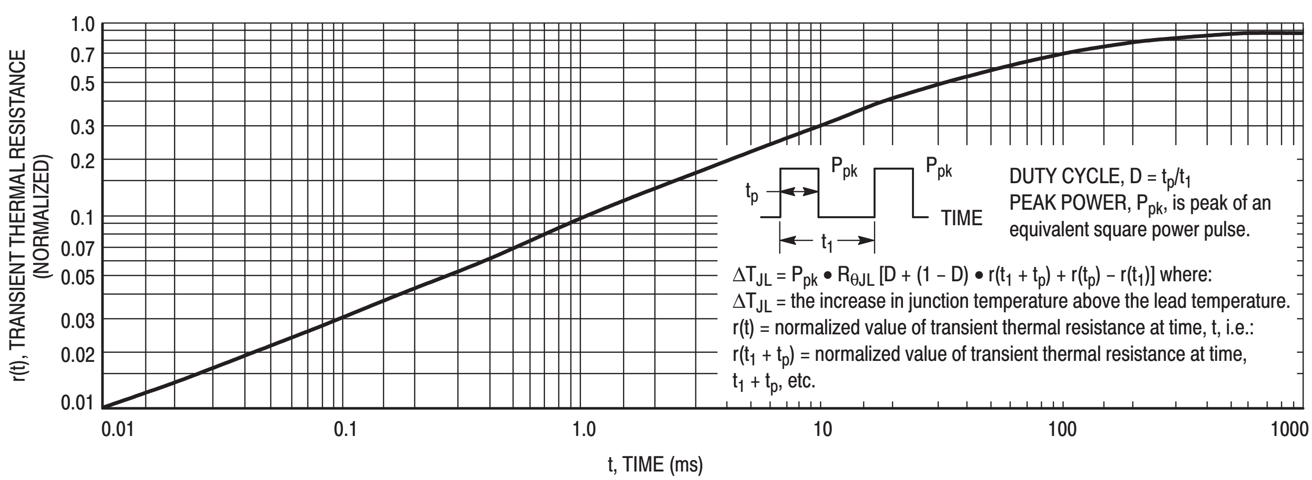

Figure 9. Thermal Response

HIGH FREQUENCY OPERATION

Since current flow in a Schottky rectifier is the result of majority carrier conduction, it is not subject to junction diode forward and reverse recovery transients due to minority carrier injection and stored charge. Satisfactory circuit analysis work may be performed by using a model consisting of an ideal diode in parallel with a variable capacitance. (See Figure 10.)

Rectification efficiency measurements show that operation will be satisfactory up to several megahertz. For example, relative waveform rectification efficiency is approximately 70 percent at 2.0 MHz, e.g., the ratio of dc power to RMS power in the load is 0.28 at this frequency, whereas perfect rectification would yield 0.406 for sine wave inputs. However, in contrast to ordinary junction diodes, the loss in waveform efficiency is not indicative of power loss; it is simply a result of reverse current flow through the diode capacitance, which lowers the dc output voltage.

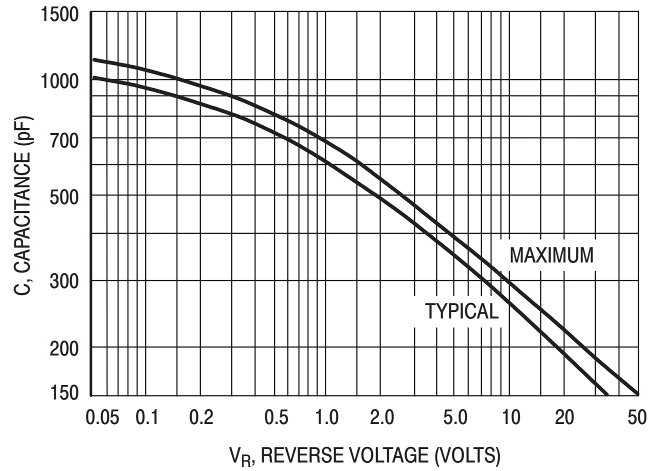

Figure 10. Capacitance

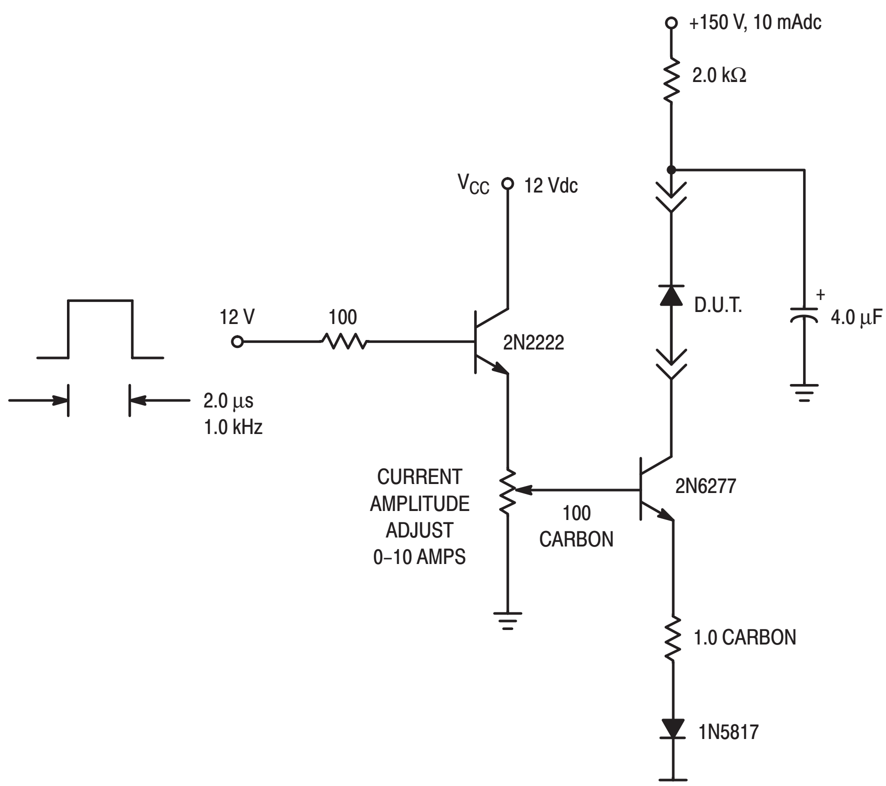

Figure 11. Test Circuit for dv/dt and Reverse Surge Current

MBR2060CT, MBR2080CT, MBR2090CT, MBR20100CT

MBR2060CT and MBR20100CT are Preferred Devices

SWITCHMODE™ Power Rectifiers

. . . using the Schottky Barrier principle with a platinum barrier metal. These state–of–the–art devices have the following features:

- 20 Amps Total (10 Amps Per Diode Leg)
- Guard–Ring for Stress Protection
- Low Forward Voltage
- 150°C Operating Junction Temperature
- Epoxy Meets UL94, VO at 1/8″
- Low Power Loss/High Efficiency
- High Surge Capacity
- Low Stored Charge Majority Carrier Conduction

Mechanical Characteristics:

- Case: Epoxy, Molded
- Weight: 1.9 grams (approximately)
- Finish: All External Surfaces Corrosion Resistant and Terminal Leads are Readily Solderable
- Lead Temperature for Soldering Purposes: 260°C Max. for 10 Seconds
- Shipped 50 units per plastic tube
- Marking: B2060, B2080, B2090, B20100

MAXIMUM RATINGS

Please See the Table on the Following Page

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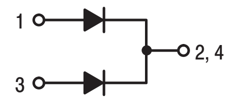
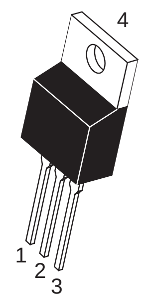
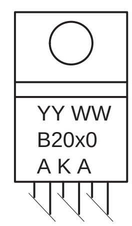
SCHOTTKY BARRIER RECTIFIERS 20 AMPERES 60–100 VOLTS





TO–220AB CASE 221A PLASTIC

MARKING DIAGRAM



YY	=	Year
WW	=	Work Week
B20x0	=	Device Code
x	=	6, 8, 9 or 10
AKA	=	Polarity Designator

ORDERING INFORMATION

Device	Package	Shipping
MBR2060CT	TO–220	50 Units/Rail
MBR2080CT	TO–220	50 Units/Rail
MBR2090CT	TO–220	50 Units/Rail
MBR20100CT	TO–220	50 Units/Rail

Preferred devices are recommended choices for future use and best overall value.

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MAXIMUM RATINGS (Per Diode Leg)

Rating	Symbol	MBR 2060CT	MBR 2080CT	MBR 2090CT	MBR 20100CT	Unit
Peak Repetitive Reverse Voltage Working Peak Reverse Voltage DC Blocking Voltage	V_{RRM} V_{RWM} V_R	60	80	90	100	Volts
Average Rectified Forward Current (Rated V_R) T_C = 133°C	$I_{F(AV)}$	10				Amps
Peak Repetitive Forward Current (Rated V_R, Square Wave, 20 kHz) T_C = 133°C	I_{FRM}	20				Amps
Nonrepetitive Peak Surge Current (Surge applied at rated load conditions halfwave, single phase, 60 Hz)	I_{FSM}	150				Amps
Peak Repetitive Reverse Surge Current (2.0 µs, 1.0 kHz)	I_{RRM}	0.5				Amp
Operating Junction Temperature	T_J	– 65 to +150				°C
Storage Temperature	T_{stg}	– 65 to +175				°C
Voltage Rate of Change (Rated V_R)	dv/dt	10,000				V/µs

THERMAL CHARACTERISTICS

Maximum Thermal Resistance — Junction to Case — Junction to Ambient	$R_{\theta JC}$ $R_{\theta JA}$	2.0 60	°C/W

ELECTRICAL CHARACTERISTICS (Per Diode Leg)

Maximum Instantaneous Forward Voltage (Note 1.) (i_F = 10 Amps, T_C = 125°C) (i_F = 10 Amps, T_C = 25°C) (i_F = 20 Amps, T_C = 125°C) (i_F = 20 Amps, T_C = 25°C)	v_F	 0.75 0.85 0.85 0.95	Volts
Maximum Instantaneous Reverse Current (Note 1.) (Rated dc Voltage, T_C = 125°C) (Rated dc Voltage, T_C = 25°C)	i_R	 6.0 0.1	mA

1. Pulse Test: Pulse Width = 300 µs, Duty Cycle ≤ 2.0%.

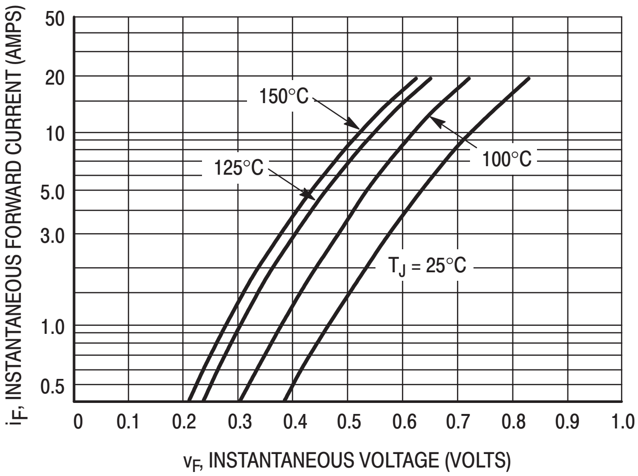

Figure 1. Typical Forward Voltage Per Diode

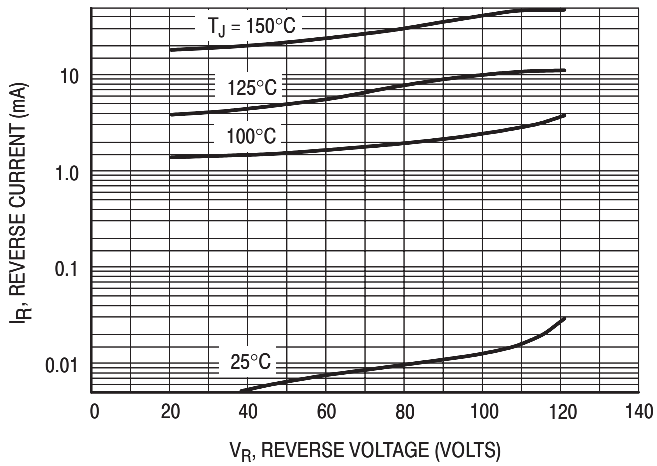

Figure 2. Typical Reverse Current Per Diode

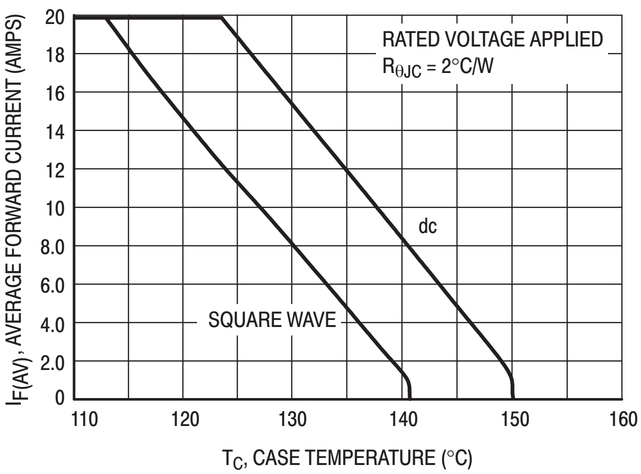

Figure 3. Current Derating, Case

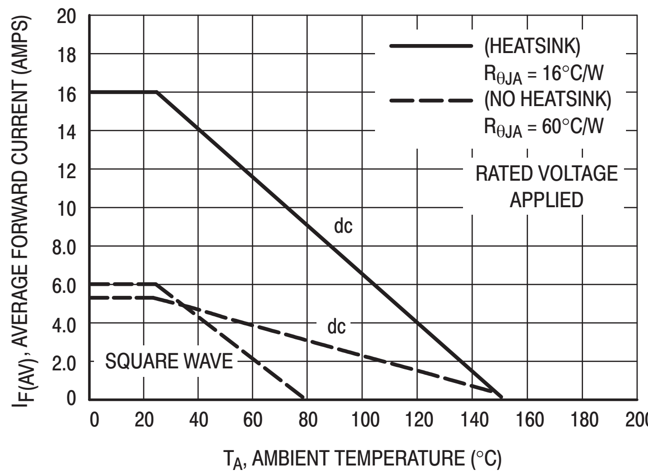

Figure 4. Current Derating, Ambient

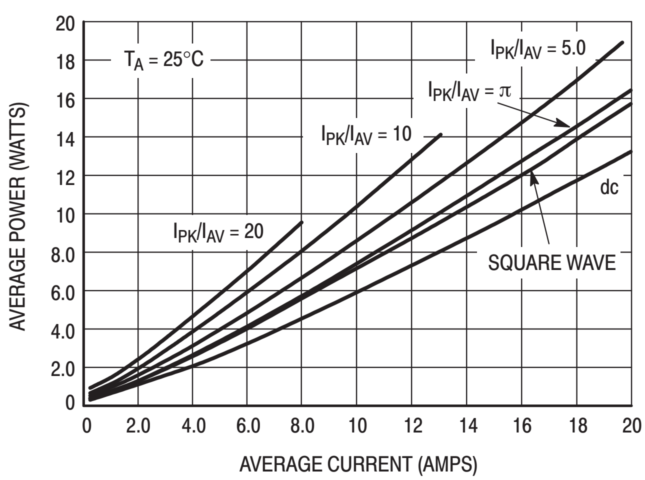

Figure 5. Average Power Dissipation and Average Current

MBR20200CT

SWITCHMODE™ Power

Dual Schottky Rectifier

. . . using Schottky Barrier technology with a platinum barrier metal. This state–of–the–art device is designed for use in high frequency switching power supplies and converters with up to 48 volt outputs. They block up to 200 volts and offer improved Schottky performance at frequencies from 250 kHz to 5.0 MHz.

- **200 Volt Blocking Voltage**
- Low Forward Voltage Drop
- Guardring for Stress Protection and High dv/dt Capability (10,000 V/µs)
- Dual Diode Construction — Terminals 1 and 3 Must be Connected for Parallel Operation at Full Rating

Mechanical Characteristics

- Case: Epoxy, Molded
- Weight: 1.9 grams (approximately)
- Finish: All External Surfaces Corrosion Resistant and Terminal Leads are Readily Solderable
- Lead Temperature for Soldering Purposes: 260°C Max. for 10 Seconds
- Shipped 50 units per plastic tube
- Marking: B20200

MAXIMUM RATINGS (Per Leg)

Rating	Symbol	Value	Unit
Peak Repetitive Reverse Voltage Working Peak Reverse Voltage DC Blocking Voltage	V_{RRM} V_{RWM} V_R	200	V
Average Rectified Forward Current (Rated V_R, T_C = 125°C) Per Leg Per Package	$I_{F(AV)}$	 10 20	A
Peak Repetitive Forward Current per Leg (Rated V_R, Square Wave, 20 kHz, T_C = 90°C)	I_{FRM}	20	A
Non–Repetitive Peak Surge Current (Surge Applied at Rated Load Conditions Halfwave, Single Phase, 60 Hz)	I_{FSM}	150	A
Peak Repetitive Reverse Surge Current (2.0 µs, 1.0 kHz)	I_{RRM}	1.0	A
Storage Temperature Range	T_{stg}	–65 to +175	°C
Operating Junction Temperature	T_J	–65 to +150	°C
Voltage Rate of Change (Rated V_R)	dv/dt	10,000	V/µs

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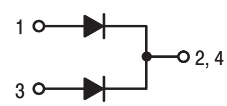
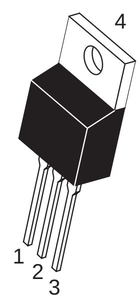
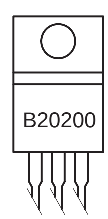
SCHOTTKY BARRIER RECTIFIER
20 AMPERES
200 VOLTS





TO–220AB
CASE 221A
PLASTIC

MARKING DIAGRAM



B20200 = Device Code

ORDERING INFORMATION

Device	Package	Shipping
MBR20200CT	TO–220	50 Units/Rail

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THERMAL CHARACTERISTICS (Per Leg)

Characteristic	Symbol	Value	Unit
Thermal Resistance — Junction to Case	$R_{\theta JC}$	2.0	°C/W

ELECTRICAL CHARACTERISTICS (Per Leg)

Characteristic	Symbol	Value	Unit
Maximum Instantaneous Forward Voltage (Note 1.) (I_F = 10 Amps, T_C = 25°C) (I_F = 10 Amps, T_C = 125°C) (I_F = 20 Amps, T_C = 25°C) (I_F = 20 Amps, T_C = 125°C)	V_F	0.9 0.8 1.0 0.9	Volts
Maximum Instantaneous Reverse Current (Note 1.) (Rated dc Voltage, T_C = 25°C) (Rated dc Voltage, T_C = 125°C)	I_R	1.0 50	mA

DYNAMIC CHARACTERISTICS (Per Leg)

Characteristic	Symbol	Value	Unit
Capacitance (V_R = –5.0 V, T_C = 25°C, Frequency = 1.0 MHz)	C_T	500	pF

1. Pulse Test: Pulse Width = 300 μs, Duty Cycle ≤ 2.0%.

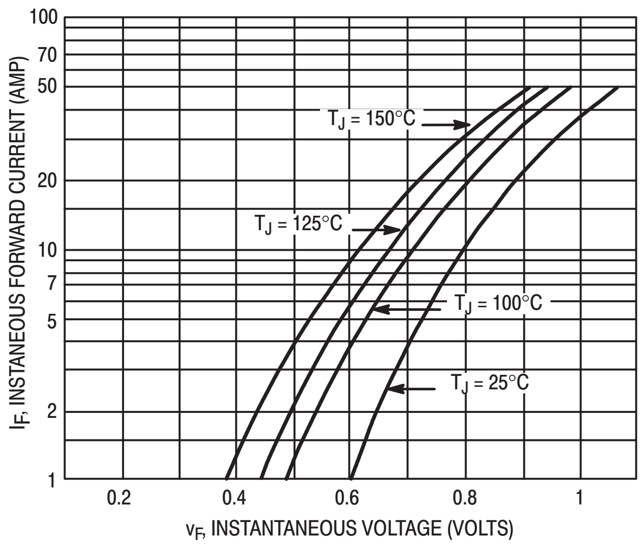

Figure 1. Typical Forward Voltage (Per Leg)

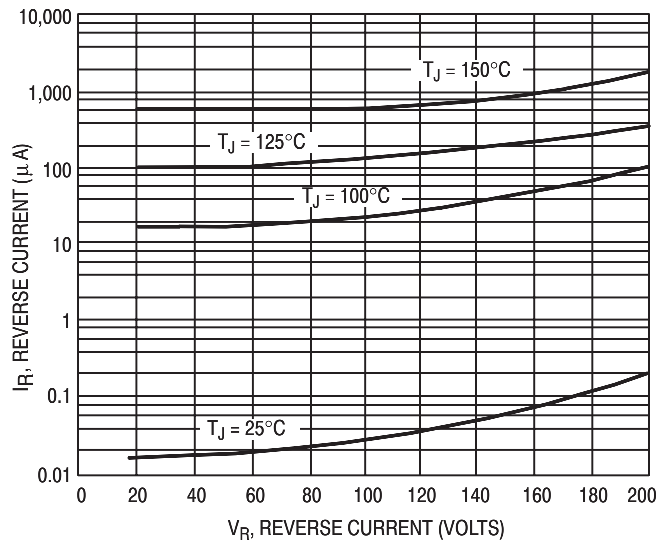

Figure 2. Typical Reverse Current (Per Leg)

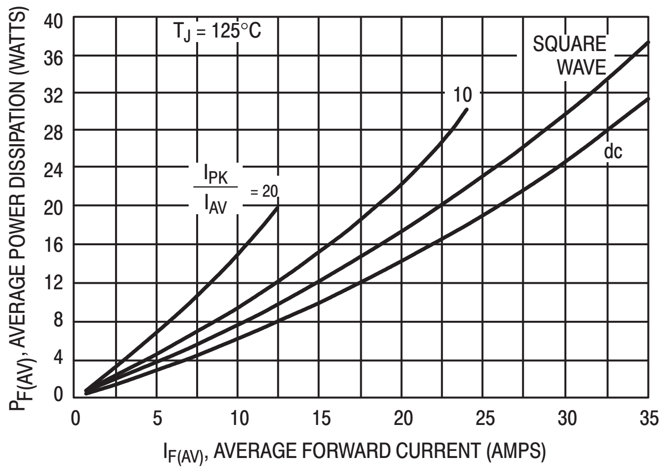

Figure 3. Forward Power Dissipation

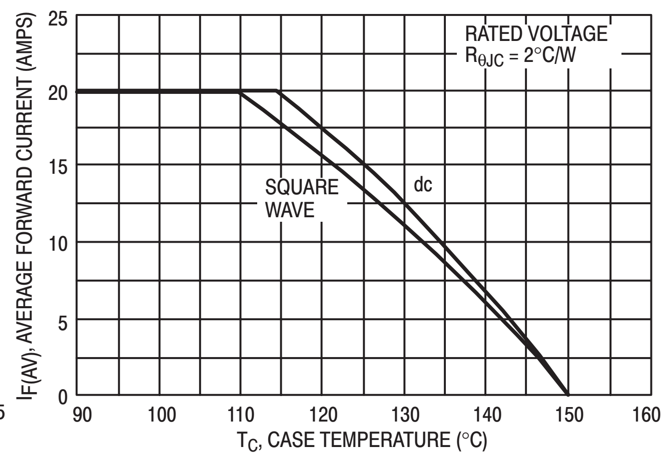

Figure 4. Current Derating, Case

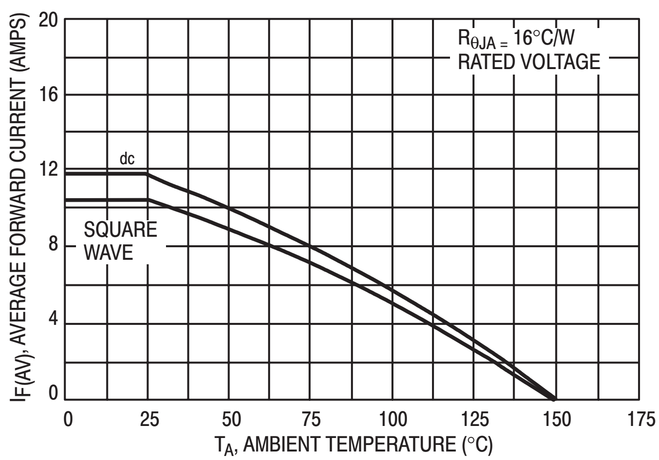

Figure 5. Current Derating, Ambient

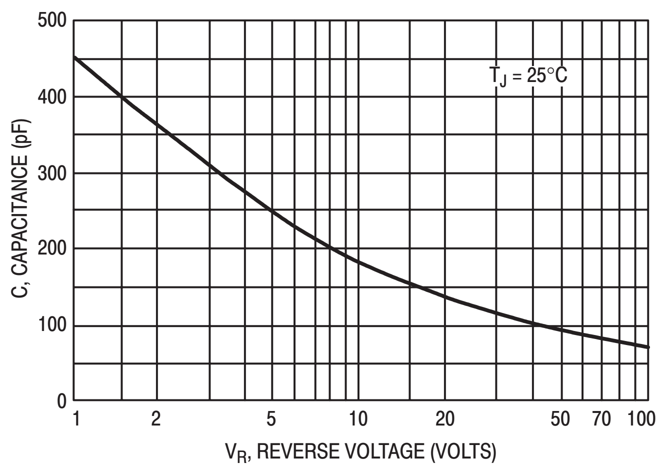

Figure 6. Typical Capacitance (Per Leg)

MBR2535CTL

SWITCHMODE™ Power Rectifier

. . . employing the Schottky Barrier principle in a large metal–to–silicon power diode. State–of–the–art geometry features epitaxial construction with oxide passivation and metal overlay contact. Ideally suited for use in low voltage, high frequency switching power supplies, free wheeling diodes, and polarity protection diodes.

- Very Low Forward Voltage (0.55 V Maximum @ 25 Amps)
- Matched Dual Die Construction (12.5 A per Leg or 25 A per Package)
- Guardring for Stress Protection
- Highly Stable Oxide Passivated Junction (125°C Operating Junction Temperature)
- Epoxy Meets UL94, VO at 1/8″

Mechanical Characteristics

- Case: Epoxy, Molded
- Weight: 1.9 grams (approximately)
- Finish: All External Surfaces Corrosion Resistant and Terminal Leads are Readily Solderable
- Lead Temperature for Soldering Purposes: 260°C Max. for 10 Seconds
- Shipped 50 units per plastic tube
- Marking: B2535L

MAXIMUM RATINGS (Per Leg)

Rating	Symbol	Value	Unit
Peak Repetitive Reverse Voltage Working Peak Reverse Voltage DC Blocking Voltage	V_{RRM} V_{RWM} V_R	35	V
Average Rectified Forward Current (Rated V_R, T_C = 110°C)	$I_{F(AV)}$	12.5	A
Peak Repetitive Forward Current, per Leg (Rated V_R, Square Wave, 20 kHz, T_C = 95°C)	I_{FRM}	25	A
Non–Repetitive Peak Surge Current (Surge Applied at Rated Load Conditions, Halfwave, Single Phase, 60 Hz)	I_{FSM}	150	A
Peak Repetitive Reverse Surge Current (2.0 μs, 1.0 kHz)	I_{RRM}	1.0	A
Storage Temperature Range	T_{stg}	–65 to +150	°C
Operating Junction Temperature	T_J	–65 to +125	°C
Voltage Rate of Change (Rated V_R)	dv/dt	10,000	V/μs
Controlled Avalanche Energy	W_{aval}	20	mJ

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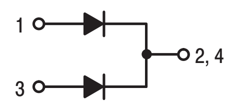
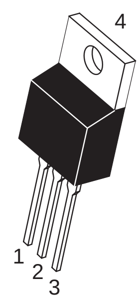
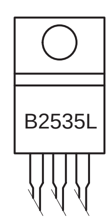
SCHOTTKY BARRIER RECTIFIER 25 AMPERES 35 VOLTS





TO–220AB CASE 221A PLASTIC

MARKING DIAGRAM



B2535L = Device Code

ORDERING INFORMATION

Device	Package	Shipping
MBR2535CTL	TO–220	50 Units/Rail

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THERMAL CHARACTERISTICS

Characteristic	Symbol	Max	Unit
Thermal Resistance — Junction to Case	$R_{\theta JC}$	2.0	°C/W

ELECTRICAL CHARACTERISTICS (Per Leg)

Characteristic	Symbol	Max	Unit
Maximum Instantaneous Forward Voltage (Note 1.) (I_F = 25 Amps, T_J = 25°C) (I_F = 12.5 Amps, T_J = 25°C) (I_F = 12.5 Amps, T_J = 125°C)	V_F	 0.55 0.47 0.41	Volts
Maximum Instantaneous Reverse Current (Note 1.) (Rated dc Voltage, T_J = 25°C) (Rated dc Voltage, T_J = 125°C)	I_R	 5.0 500	mA

1. Pulse Test: Pulse Width = 300 μs, Duty Cycle ≤ 2.0%.

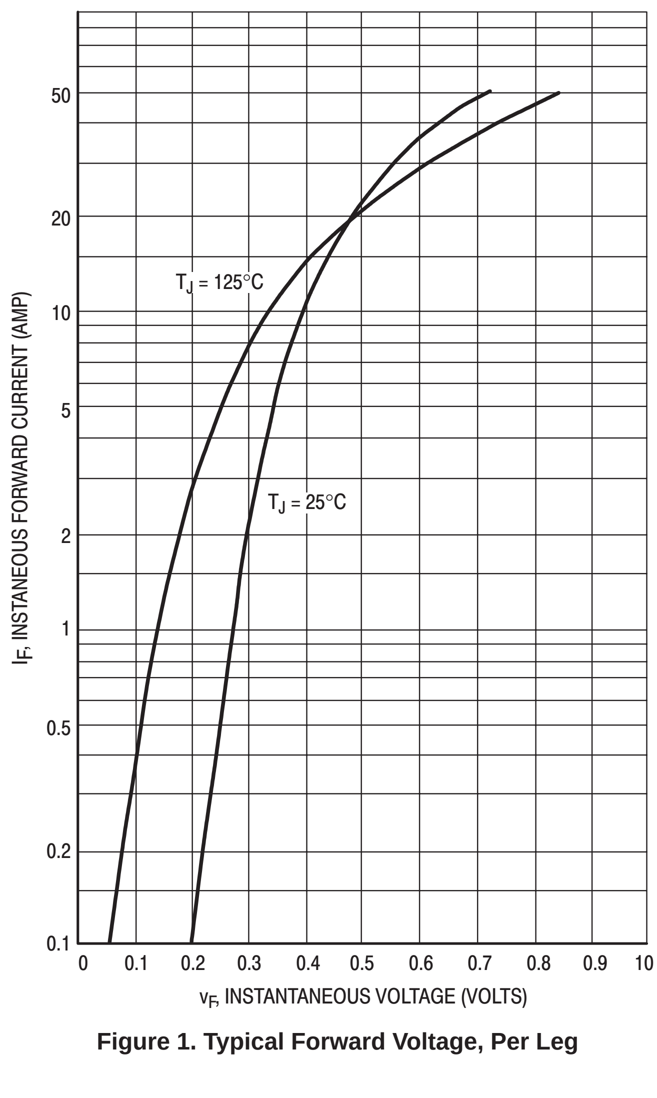

Figure 1. Typical Forward Voltage, Per Leg

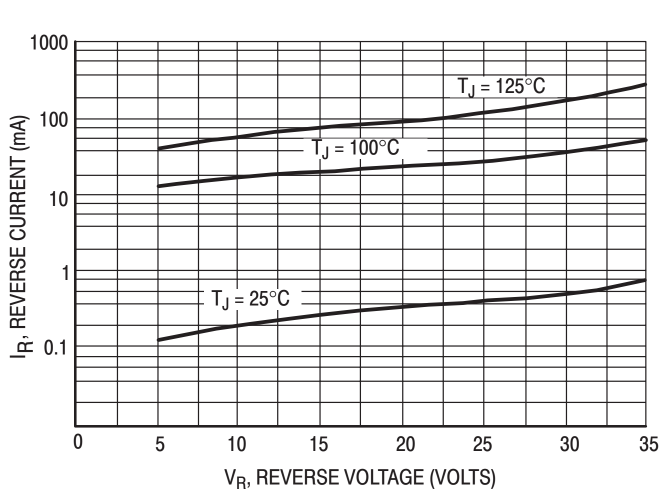

Figure 2. Typical Reverse Current, Per Leg

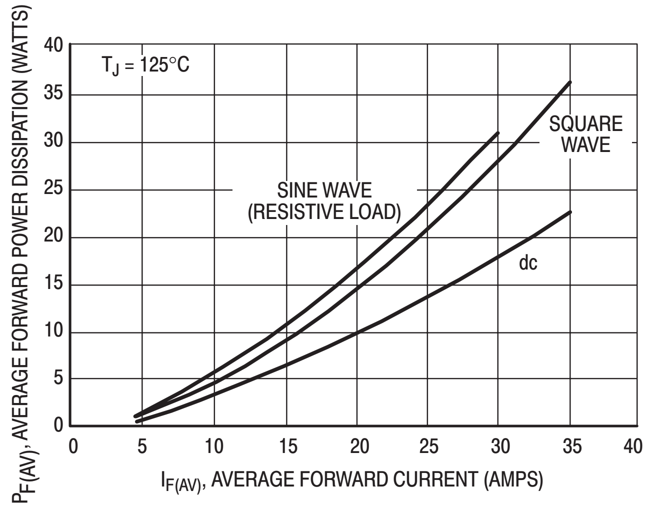

Figure 3. Forward Power Dissipation, Per Leg

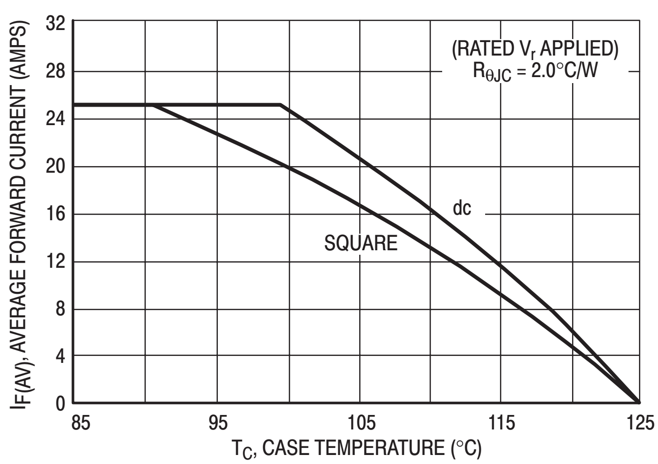

Figure 4. Current Derating

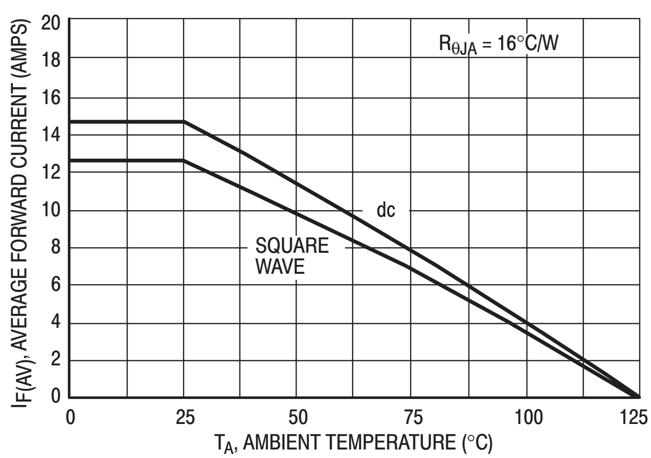

Figure 5. Current Derating Ambient, Per Leg

MBR2535CT, MBR2545CT

MBR2545CT is a Preferred Device

SWITCHMODE™ Power Rectifiers

. . . using the Schottky Barrier principle with a platinum barrier metal. These state–of–the–art devices have the following features:

- Guardring for Stress Protection
- Low Forward Voltage
- 150°C Operating Junction Temperature

Mechanical Characteristics:

- Case: Epoxy, Molded
- Weight: 1.9 grams (approximately)
- Finish: All External Surfaces Corrosion Resistant and Terminal Leads are Readily Solderable
- Lead Temperature for Soldering Purposes: 260°C Max. for 10 Seconds
- Shipped 50 units per plastic tube
- Marking: B2535, B2545

MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Peak Repetitive Reverse Voltage Working Peak Reverse Voltage DC Blocking Voltage MBR2535CT MBR2545CT	V_{RRM} V_{RWM} V_R	 35 45	V
Average Rectified Forward Current (Rated V_R, T_C = 130°C)	$I_{F(AV)}$	30	A
Peak Repetitive Forward Current, per Diode Leg (Rated V_R, Square Wave, 20 kHz, T_C = 130°C)	I_{FRM}	30	A
Non–Repetitive Peak Surge Current per Diode Leg (Surge Applied at Rated Load Conditions, Halfwave, Single Phase, 60 Hz)	I_{FSM}	150	A
Peak Repetitive Reverse Surge Current (2.0 μs, 1.0 kHz)	I_{RRM}	1.0	A
Storage Temperature Range	T_{stg}	–65 to +175	°C
Operating Junction Temperature	T_J	–65 to +150	°C
Voltage Rate of Change (Rated V_R)	dv/dt	1000	V/μs

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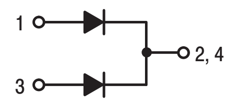
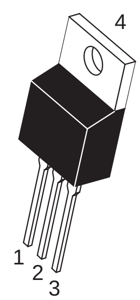
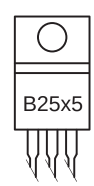
SCHOTTKY BARRIER RECTIFIERS 25 AMPERES 35 and 45 VOLTS





TO–220AB CASE 221A PLASTIC

MARKING DIAGRAM



B25x5 = Device Code
x = 3 or 4

ORDERING INFORMATION

Device	Package	Shipping
MBR2535CT	TO–220	50 Units/Rail
MBR2545CT	TO–220	50 Units/Rail

Preferred devices are recommended choices for future use and best overall value.

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THERMAL CHARACTERISTICS (Per Diode Leg)

Characteristic	Symbol	MBR2535CT	MBR2545CT	Unit
Maximum Thermal Resistance, Junction to Case	$R_{\theta JC}$	1.5	1.5	°C/W

ELECTRICAL CHARACTERISTICS (Per Diode Leg)

Characteristic	Symbol	MBR2535CT	MBR2545CT	Unit
Maximum Instantaneous Forward Voltage (Note 1.) (i_F = 30 Amps, T_C = 125°C) (i_F = 30 Amps, T_C = 25°C)	v_F	 0.73 0.82	 0.73 0.82	Volts
Maximum Instantaneous Reverse Current (Note 1.) (Rated dc Voltage, T_C = 125°C) (Rated dc Voltage, T_C = 25°C)	i_R	 40 0.2	 40 0.2	mA

1. Pulse Test: Pulse Width = 300 μs, Duty Cycle ≤ 2.0%.

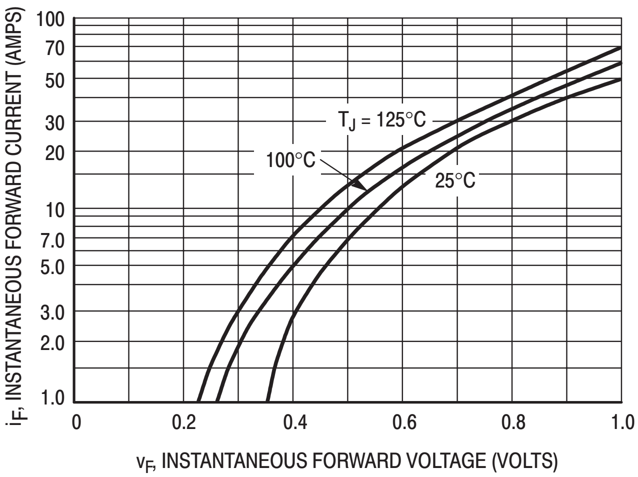

Figure 1. Typical Forward Voltage

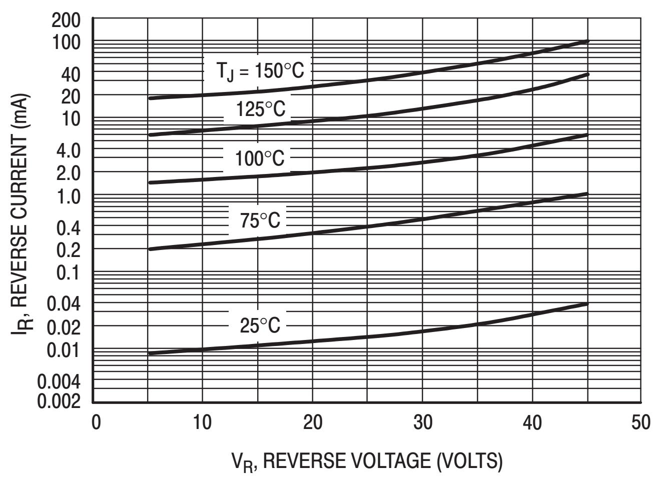

Figure 2. Typical Reverse Current

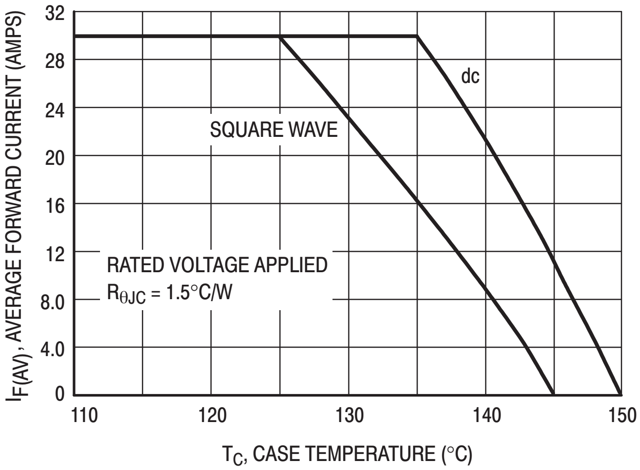

Figure 3. Current Derating, Case

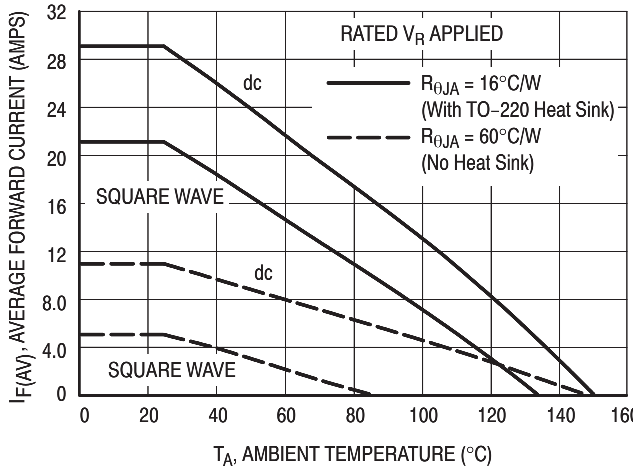

Figure 4. Current Derating, Ambient

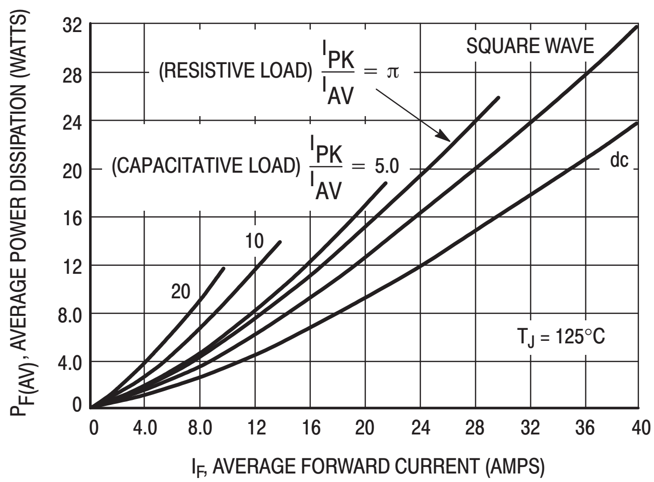

Figure 5. Forward Power Dissipation

MBR3045ST

Preferred Device

SWITCHMODE™ Power Rectifier

. . . using the Schottky Barrier principle with a platinum barrier metal. This state–of–the–art device has the following features:

- Dual Diode Construction — Terminals 1 and 3 May Be Connected for Parallel Operation at Full Rating
- 45 V Blocking Voltage
- Low Forward Voltage Drop
- Guardring for Stress Protection
- 150°C Operating Junction Temperature

Mechanical Characteristics

- Case: Epoxy, Molded
- Weight: 1.9 grams (approximately)
- Finish: All External Surfaces Corrosion Resistant and Terminal Leads are Readily Solderable
- Lead Temperature for Soldering Purposes: 260°C Max. for 10 Seconds
- Shipped 50 Units Per Plastic Tube
- Marking: B3045

MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Peak Repetitive Reverse Voltage Working Peak Reverse Voltage DC Blocking Voltage	V_{RRM} V_{RWM} V_R	45	V
Average Rectified Current Per Device (T_C = 130°C) Per Diode	$I_{F(AV)}$	 30 15	A
Peak Repetitive Forward Current, per Diode (Square Wave, V_R = 45 V, 20 kHz)	I_{FRM}	30	A
Non–Repetitive Peak Surge Current (Surge Applied at Rated Load Conditions, Halfwave, Single Phase, 60 Hz)	I_{FSM}	150	A
Peak Repetitive Reverse Current, per Diode (2.0 μs, 1.0 kHz)	I_{RRM}	2.0	A
Storage Temperature Range	T_{stg}	–65 to +175	°C
Operating Junction Temperature	T_J	–65 to +150	°C
Peak Surge Junction Temperature (Forward Current Applied)	$T_{J(pk)}$	175	°C
Voltage Rate of Change (Rated V_R)	dv/dt	10,000	V/μs

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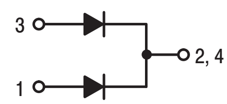
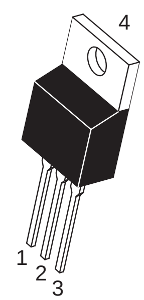
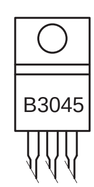
SCHOTTKY BARRIER RECTIFIER
30 AMPERES
45 VOLTS





TO–220AB
CASE 221A
STYLE 6

MARKING DIAGRAM



B3045 = Device Code

ORDERING INFORMATION

Device	Package	Shipping
MBR3045ST	TO–220	50 Units/Rail

Preferred devices are recommended choices for future use and best overall value.

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THERMAL CHARACTERISTICS (Per Diode)

Characteristic	Symbol	Value	Unit
Thermal Resistance, Junction to Case	$R_{\theta JC}$	1.5	°C/W

ELECTRICAL CHARACTERISTICS (Per Diode)

Characteristic	Symbol	Value	Unit
Instantaneous Forward Voltage (Note 1.) (i_F = 30 Amp, T_C = 25°C) (i_F = 30 Amp, T_C = 125°C) (i_F = 20 Amp, T_C = 125°C)	v_F	0.76 0.72 0.60	Volts
Instantaneous Reverse Current (Note 1.) (V_R = 45 Volts, T_C = 25°C) (V_R = 45 Volts, T_C = 125°C)	I_R	0.2 40	mA

1. Pulse Test: Pulse Width = 300 μs, Duty Cycle ≤ 2.0%

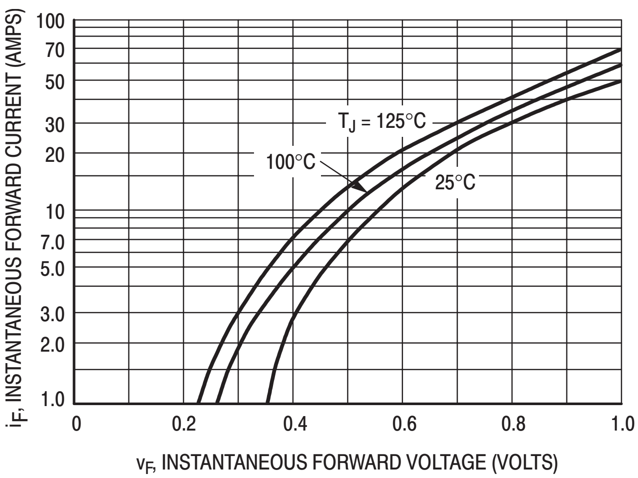

Figure 1. Typical Forward Voltage

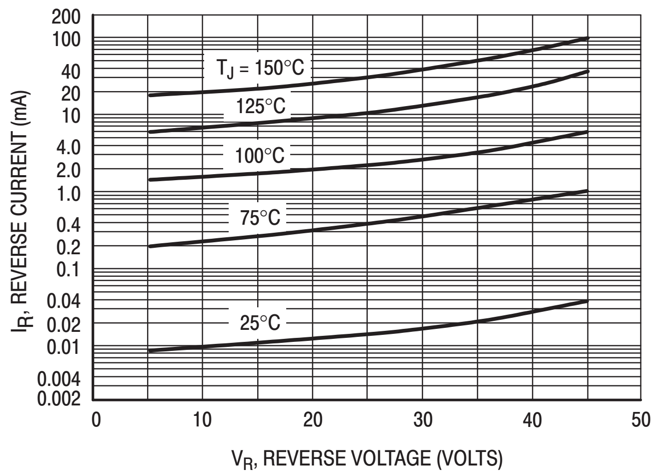

Figure 2. Typical Reverse Current

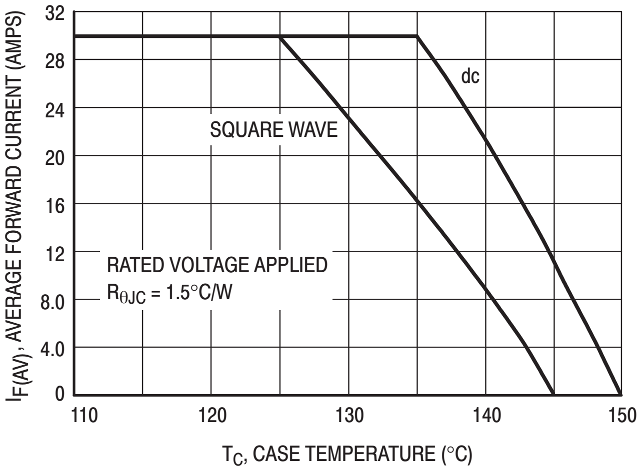

Figure 3. Current Derating, Case

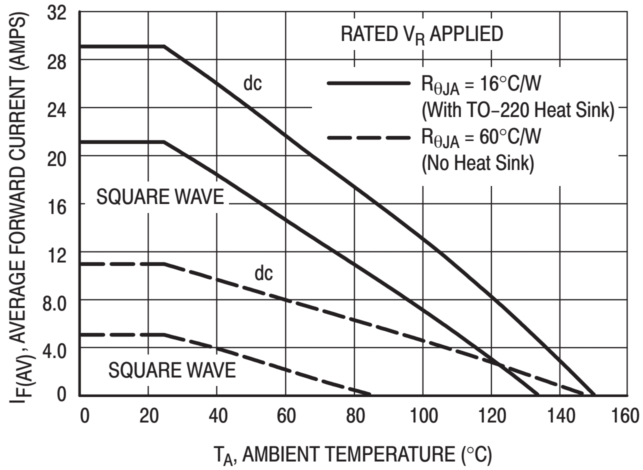

Figure 4. Current Derating, Ambient

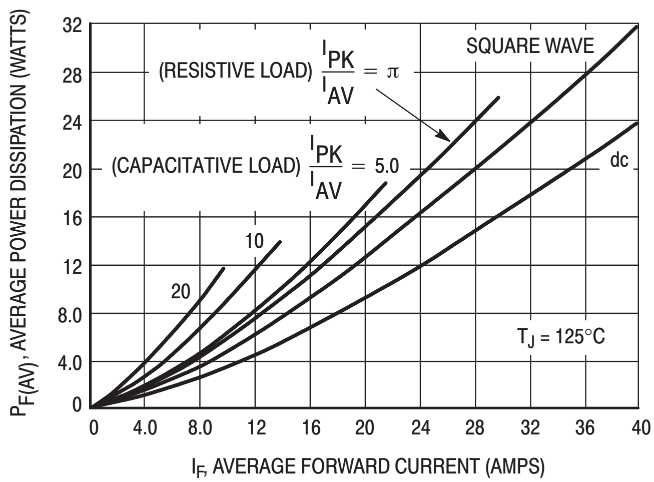

Figure 5. Forward Power Dissipation

MBR735, MBR745

MBR745 is a Preferred Device

SWITCHMODE™ Power Rectifiers

. . . using the Schottky Barrier principle with a platinum barrier metal. These state–of–the–art devices have the following features:

- Guardring for Stress Protection
- Low Forward Voltage
- 150°C Operating Junction Temperature
- Epoxy Meets UL94, VO at 1/8″

Mechanical Characteristics:

- Case: Epoxy, Molded
- Weight: 1.9 grams (approximately)
- Finish: All External Surfaces Corrosion Resistant and Terminal Leads are Readily Solderable
- Lead Temperature for Soldering Purposes: 260°C Max. for 10 Seconds
- Shipped 50 units per plastic tube
- Marking: B735, B745

MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Peak Repetitive Reverse Voltage Working Peak Reverse Voltage DC Blocking Voltage MBR735 MBR745	V_{RRM} V_{RWM} V_R	 35 45	V
Average Rectified Forward Current (Rated V_R, T_C = 105°C)	$I_{F(AV)}$	7.5	A
Peak Repetitive Forward Current, (Rated V_R, Square Wave, 20 kHz, T_C = 105°C)	I_{FRM}	15	A
Non–Repetitive Peak Surge Current (Surge Applied at Rated Load Conditions Halfwave, Single Phase, 60 Hz)	I_{FSM}	150	A
Peak Repetitive Reverse Surge Current (2.0 μs, 1.0 kHz)	I_{RRM}	1.0	A
Storage Temperature Range	T_{stg}	–65 to +175	°C
Operating Junction Temperature	T_J	–65 to +150	°C
Voltage Rate of Change (Rated V_R)	dv/dt	10,000	V/μs

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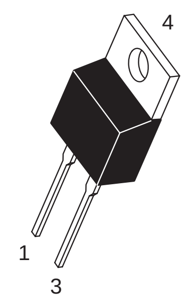
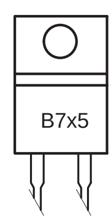
SCHOTTKY BARRIER RECTIFIERS
7.5 AMPERES
35 and 45 VOLTS



TO–220AC
CASE 221B
PLASTIC

MARKING DIAGRAM



B7x5 = Device Code
x = 3 or 4

ORDERING INFORMATION

Device	Package	Shipping
MBR735	TO–220	50 Units/Rail
MBR745	TO–220	50 Units/Rail

Preferred devices are recommended choices for future use and best overall value.

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THERMAL CHARACTERISTICS

Characteristic	Symbol	Value	Unit
Maximum Thermal Resistance, Junction to Case	$R_{\theta JC}$	3.0	°C/W
Maximum Thermal Resistance, Junction to Ambient	$R_{\theta JA}$	60	°C/W

ELECTRICAL CHARACTERISTICS

Maximum Instantaneous Forward Voltage (Note 1.) (i_F = 7.5 Amps, T_C = 125°C) (i_F = 15 Amps, T_C = 125°C) (i_F = 15 Amps, T_C = 25°C)	v_F	 0.57 0.72 0.84	Volts
Maximum Instantaneous Reverse Current (Note 1.) (Rated dc Voltage, T_C = 125°C) (Rated dc Voltage, T_C = 25°C)	i_R	 15 0.1	mA

1. Pulse Test: Pulse Width = 300 μs, Duty Cycle ≤ 2.0%.

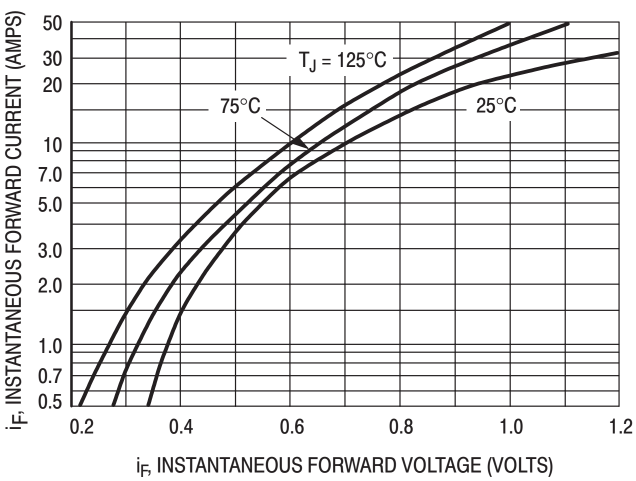

Figure 1. Typical Forward Voltage

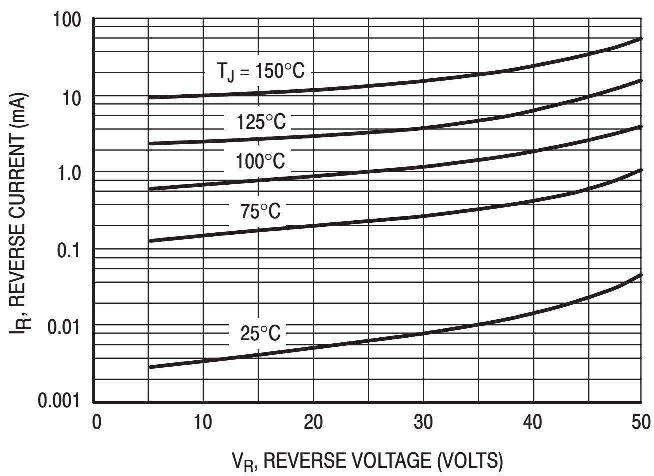

Figure 2. Typical Reverse Current

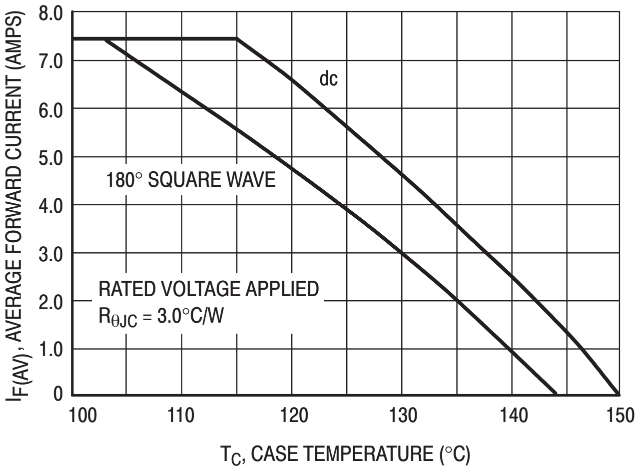

Figure 3. Current Derating, Case

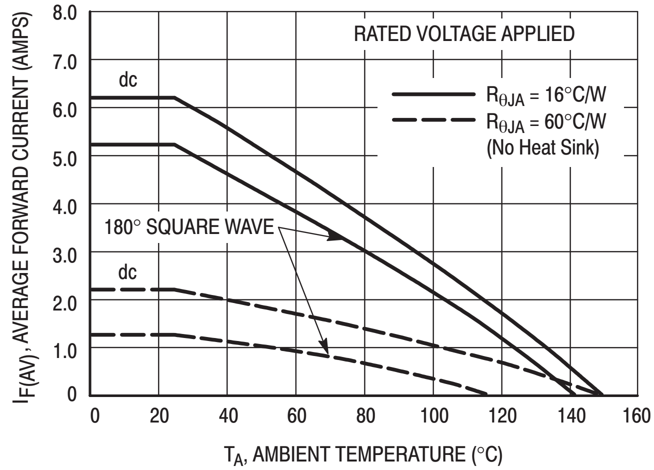

Figure 4. Current Derating, Ambient

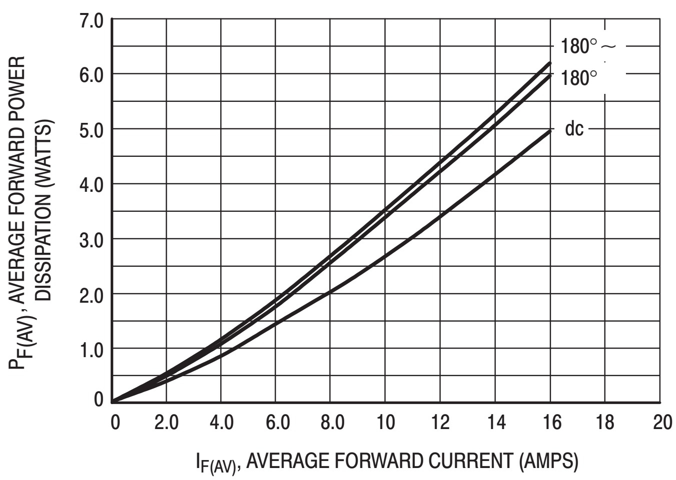

Figure 5. Power Dissipation

MBR1035, MBR1045

MBR1045 is a Preferred Device

SWITCHMODE™ Power Rectifiers

. . . using the Schottky Barrier principle with a platinum barrier metal. These state–of–the–art devices have the following features:

- Guardring for Stress Protection
- Low Forward Voltage
- 150°C Operating Junction Temperature
- Epoxy Meets UL94, VO at 1/8″

Mechanical Characteristics:

- Case: Epoxy, Molded
- Weight: 1.9 grams (approximately)
- Finish: All External Surfaces Corrosion Resistant and Terminal Leads are Readily Solderable
- Lead Temperature for Soldering Purposes: 260°C Max. for 10 Seconds
- Shipped 50 units per plastic tube
- Marking: B1035, B1045

MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Peak Repetitive Reverse Voltage Working Peak Reverse Voltage DC Blocking Voltage MBR1035 MBR1045	V_{RRM} V_{RWM} V_R	 35 45	V
Average Rectified Forward Current (Rated V_R, T_C = 135°C)	$I_{F(AV)}$	10	A
Peak Repetitive Forward Current, (Rated V_R, Square Wave, 20 kHz, T_C = 135°C)	I_{FRM}	20	A
Non–Repetitive Peak Surge Current (Surge Applied at Rated Load Conditions Halfwave, Single Phase, 60 Hz)	I_{FSM}	150	A
Peak Repetitive Reverse Surge Current (2.0 μs, 1.0 kHz) See Figure 12.	I_{RRM}	1.0	A
Storage Temperature Range	T_{stg}	–65 to +175	°C
Operating Junction Temperature	T_J	–65 to +150	°C
Voltage Rate of Change (Rated V_R)	dv/dt	10,000	V/μs

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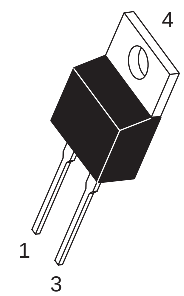
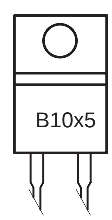
SCHOTTKY BARRIER RECTIFIERS
10 AMPERES
35 to 45 VOLTS



TO–220AC
CASE 221B
PLASTIC

MARKING DIAGRAM



B10x5 = Device Code
x = 3 or 4

ORDERING INFORMATION

Device	Package	Shipping
MBR1035	TO–220	50 Units/Rail
MBR1045	TO–220	50 Units/Rail

Preferred devices are recommended choices for future use and best overall value.

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THERMAL CHARACTERISTICS

Characteristic	Symbol	Value	Unit
Maximum Thermal Resistance, Junction to Case	$R_{\theta JC}$	2.0	°C/W

ELECTRICAL CHARACTERISTICS

Maximum Instantaneous Forward Voltage (Note 1.) (i_F = 10 Amps, TC = 125°C) (i_F = 20 Amps, T_C = 125°C) (i_F = 20 Amps, T_C = 25°C)	v_F	 0.57 0.72 0.84	Volts
Maximum Instantaneous Reverse Current (Note 1.) (Rated dc Voltage, T_C = 125°C) (Rated dc Voltage, T_C = 25°C)	i_R	 15 0.1	mA

1. Pulse Test: Pulse Width = 300 μs, Duty Cycle ≤ 2.0%.

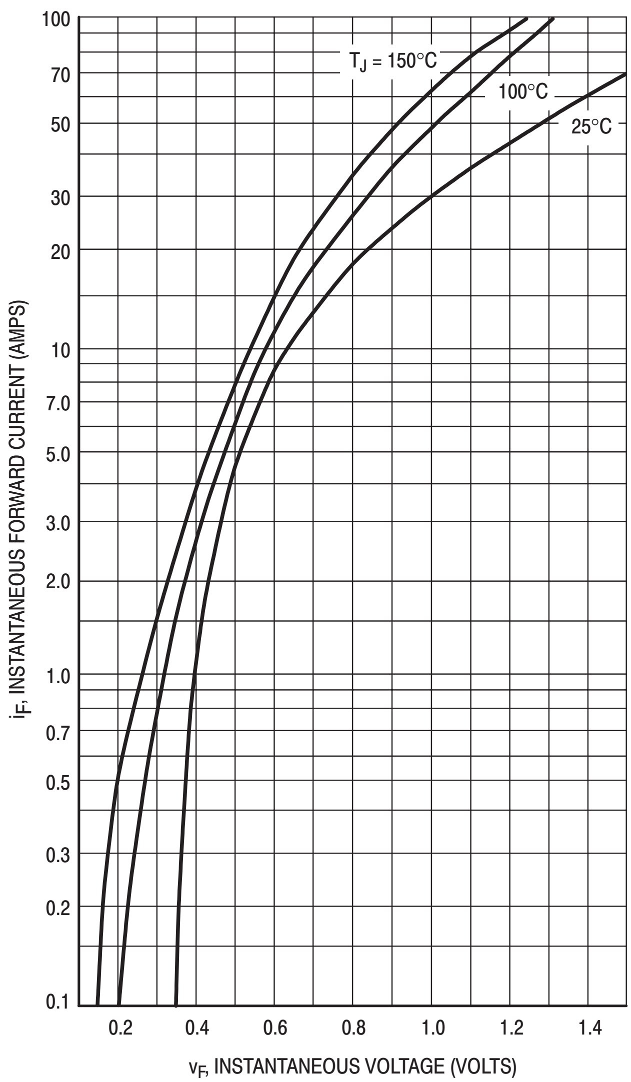


Figure 1. Maximum Forward Voltage

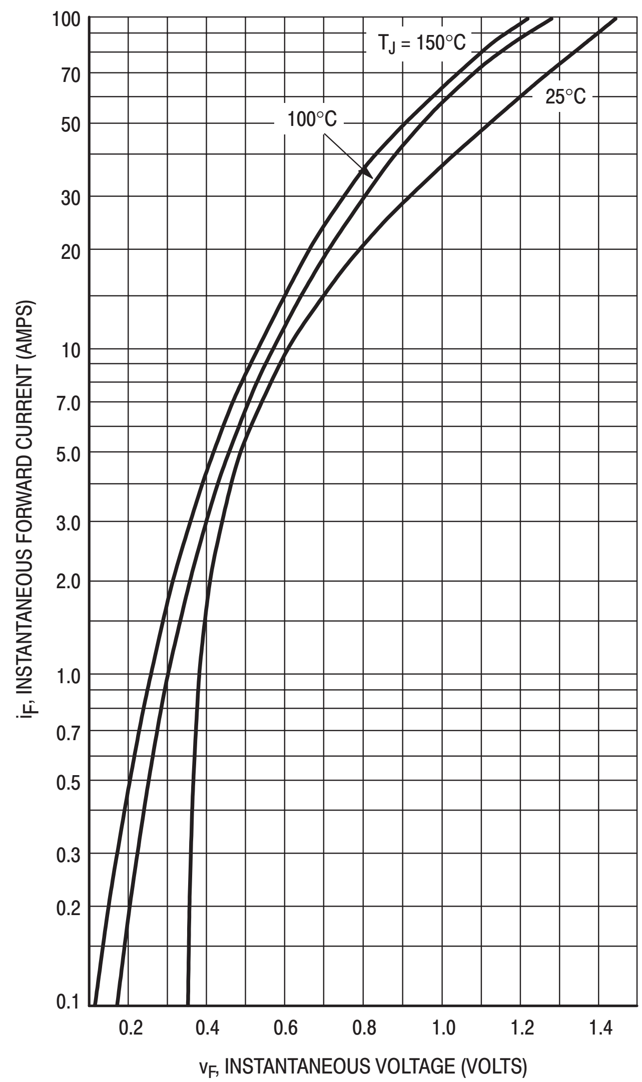


Figure 2. Typical Forward Voltage

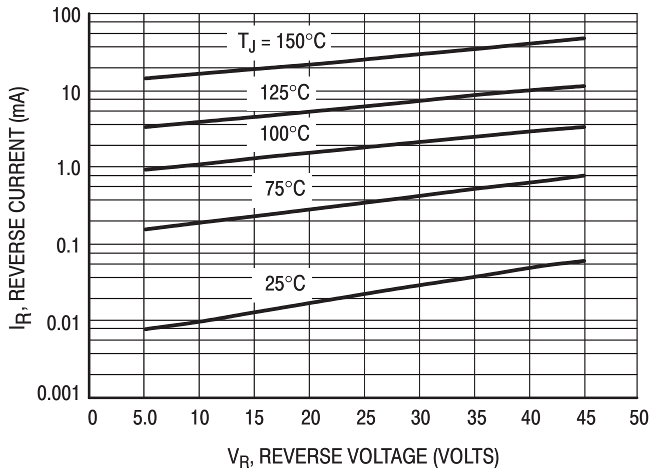


Figure 3. Maximum Reverse Current

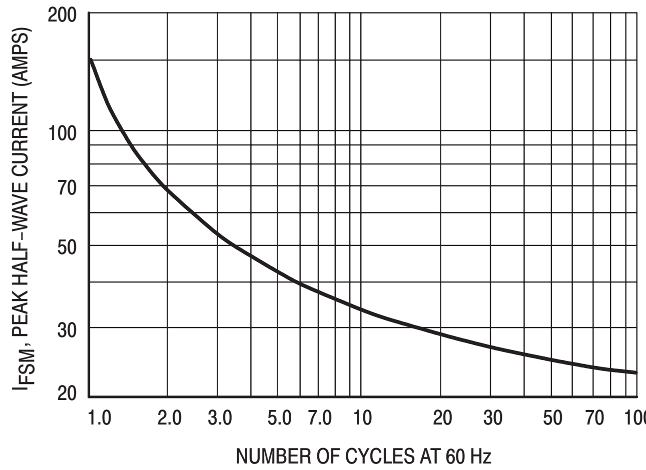


Figure 4. Maximum Surge Capability

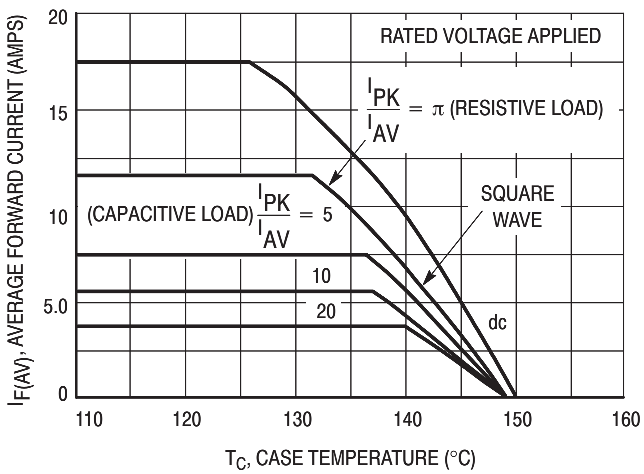


Figure 5. Current Derating, Infinite Heatsink

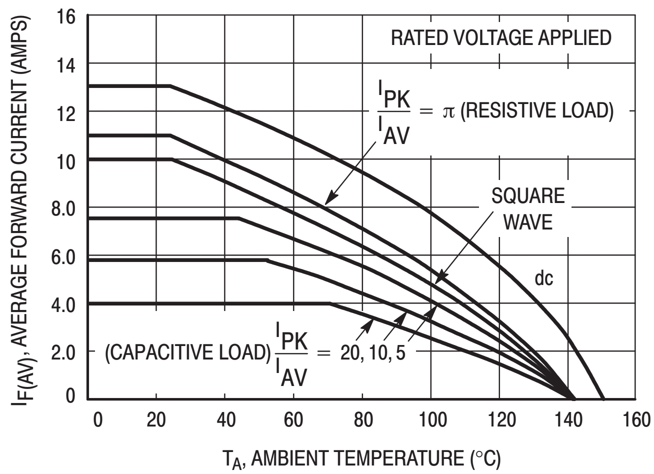


Figure 6. Current Derating, $R_{\theta JA}$ = 16°C/W

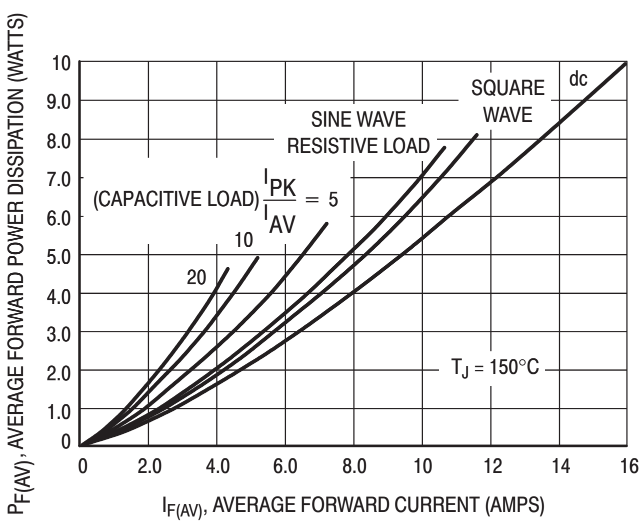


Figure 7. Forward Power Dissipation

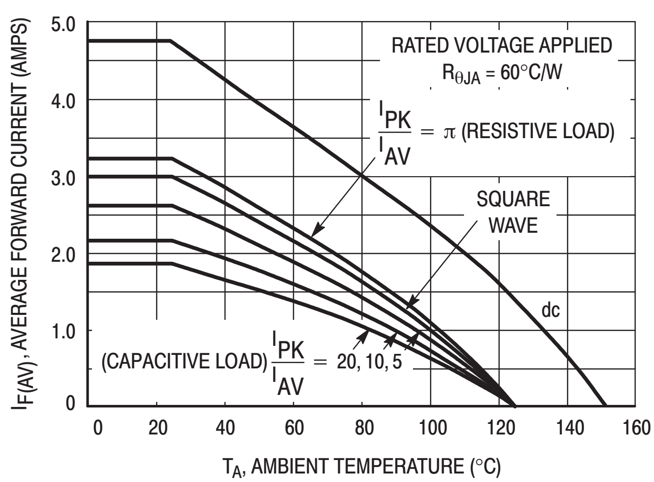


Figure 8. Current Derating, Free Air

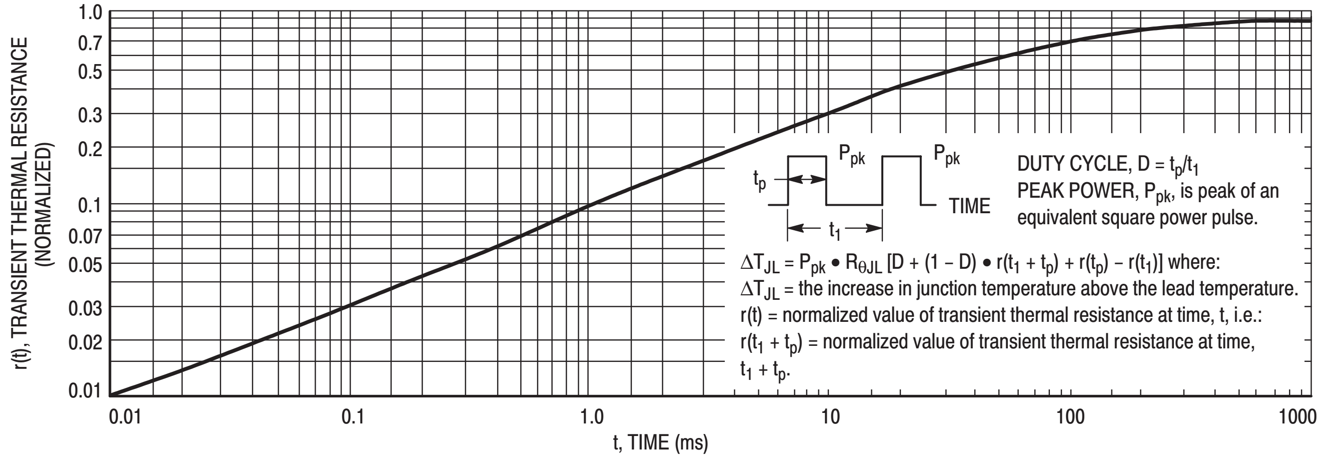


Figure 9. Thermal Response

HIGH FREQUENCY OPERATION

Since current flow in a Schottky rectifier is the result of majority carrier conduction, it is not subject to junction diode forward and reverse recovery transients due to minority carrier injection and stored charge. Satisfactory circuit analysis work may be performed by using a model consisting of an ideal diode in parallel with a variable capacitance. (See Figure 10.)

Rectification efficiency measurements show that operation will be satisfactory up to several megahertz. For example, relative waveform rectification efficiency is approximately 70 percent at 2.0 MHz, e.g., the ratio of dc power to RMS power in the load is 0.28 at this frequency, whereas perfect rectification would yield 0.406 for sine wave inputs. However, in contrast to ordinary junction diodes, the loss in waveform efficiency is not indicative of power loss; it is simply a result of reverse current flow through the diode capacitance, which lowers the dc output voltage.

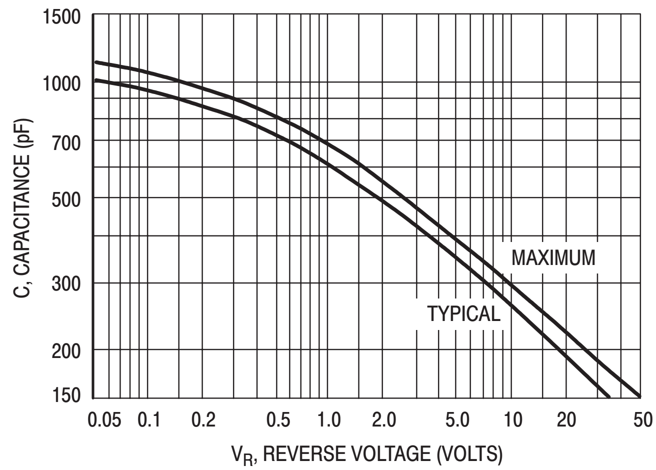


Figure 10. Capacitance

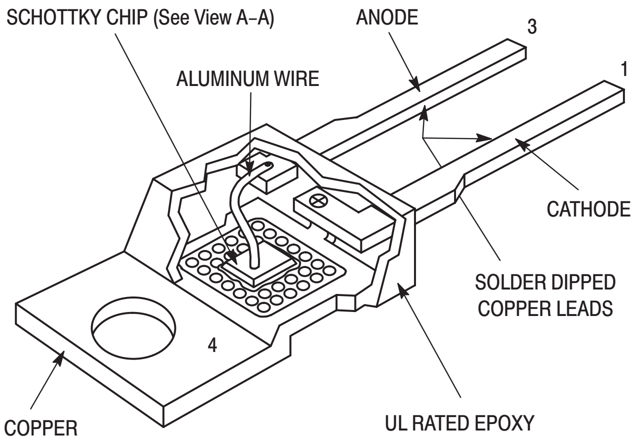
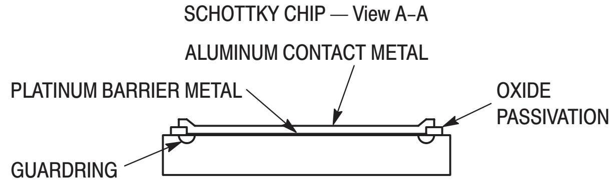


Figure 11. Schottky Rectifier



Motorola builds quality and reliability into its Schottky Rectifiers.

First is the chip, which has an interface metal between the barrier metal and aluminum–contact metal to eliminate any possible interaction between the two. The indicated guardring prevents dv/dt problems, so snubbers are not mandatory. The guardring also operates like a zener to absorb over–voltage transients.

Second is the package. The Schottky chip is bonded to the copper heat sink using a specially formulated solder. This gives the unit the capability of passing 10,000 operating thermal–fatigue cycles having a ΔT_J of 100°C. The epoxy molding compound is rated per UL 94, V0 @ 1/8″. Wire bonds are 100% tested in assembly as they are made.

Third is the electrical testing, which includes 100% dv/dt at 1600 V/μs and reverse avalanche as part of device characterization.

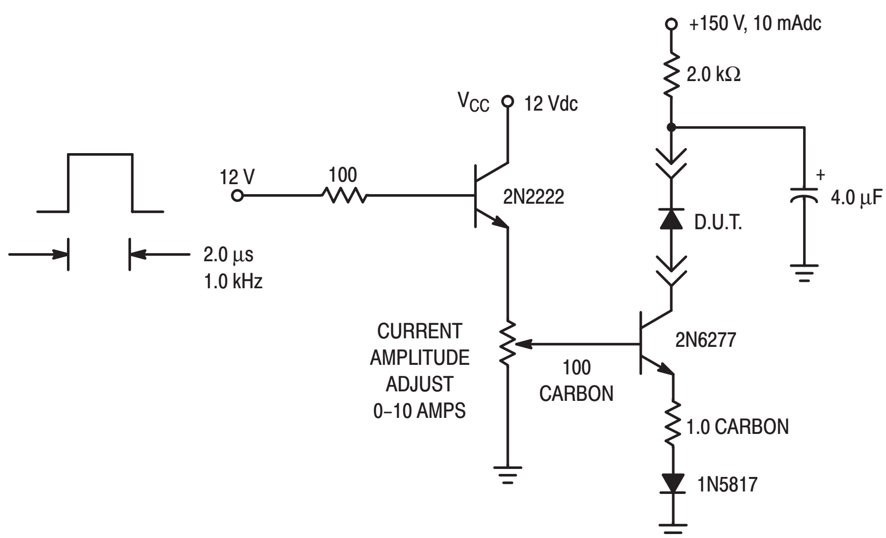


Figure 12. Test Circuit for dv/dt and Reverse Surge Current

MBR1060, MBR1080, MBR1090, MBR10100

MBR1060 and MBR10100 are Preferred Devices

SWITCHMODE™ Power Rectifiers

. . . using the Schottky Barrier principle with a platinum barrier metal. These state–of–the–art devices have the following features:

- Guard–Ring for Stress Protection
- Low Forward Voltage
- 150°C Operating Junction Temperature
- Epoxy Meets UL94, VO at 1/8″
- Low Power Loss/High Efficiency
- High Surge Capacity
- Low Stored Charge Majority Carrier Conduction

Mechanical Characteristics:

- Case: Epoxy, Molded
- Weight: 1.9 grams (approximately)
- Finish: All External Surfaces Corrosion Resistant and Terminal Leads are Readily Solderable
- Lead Temperature for Soldering Purposes: 260°C Max. for 10 Seconds
- Shipped 50 units per plastic tube
- Marking: B1060, B1080, B1090, B10100

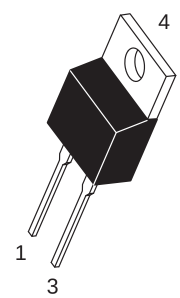
MAXIMUM RATINGS

Please See the Table on the Following Page

ON Semiconductor™

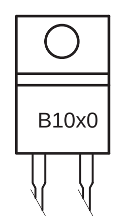
http://onsemi.com

SCHOTTKY BARRIER RECTIFIERS
10 AMPERES
60 to 100 VOLTS



TO–220AC
CASE 221B
PLASTIC

MARKING DIAGRAM



B10x0 = Device Code
x = 6, 8, 9 or 10

ORDERING INFORMATION

Device	Package	Shipping
MBR1060	TO–220	50 Units/Rail
MBR1080	TO–220	50 Units/Rail
MBR1090	TO–220	50 Units/Rail
MBR10100	TO–220	50 Units/Rail

Preferred devices are recommended choices for future use and best overall value.

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MAXIMUM RATINGS

Rating	Symbol	MBR				Unit
		1060	1080	1090	10100	
Peak Repetitive Reverse Voltage Working Peak Reverse Voltage DC Blocking Voltage	V_{RRM} V_{RWM} V_R	60	80	90	100	Volts
Average Rectified Forward Current (Rated V_R) T_C = 133°C	$I_{F(AV)}$	10				Amps
Peak Repetitive Forward Current (Rated V_R, Square Wave, 20 kHz) T_C = 133°C	I_{FRM}	20				Amps
Nonrepetitive Peak Surge Current (Surge applied at rated load conditions halfwave, single phase, 60 Hz)	I_{FSM}	150				Amps
Peak Repetitive Reverse Surge Current (2.0 µs, 1.0 kHz)	I_{RRM}	0.5				Amp
Operating Junction Temperature	T_J	– 65 to +150				°C
Storage Temperature	T_{stg}	– 65 to +175				°C
Voltage Rate of Change (Rated V_R)	dv/dt	10,000				V/µs

THERMAL CHARACTERISTICS

Maximum Thermal Resistance — Junction to Case — Junction to Ambient	$R_{\theta JC}$ $R_{\theta JA}$	2.0 60	°C/W

ELECTRICAL CHARACTERISTICS

Maximum Instantaneous Forward Voltage (Note 1.) (i_F = 10 Amps, T_C = 125°C) (i_F = 10 Amps, T_C = 25°C) (i_F = 20 Amps, T_C = 125°C) (i_F = 20 Amps, T_C = 25°C)	v_F	 0.7 0.8 0.85 0.95	Volts
Maximum Instantaneous Reverse Current (Note 1.) (Rated dc Voltage, T_C = 125°C) (Rated dc Voltage, T_C = 25°C)	i_R	 6.0 0.10	mA

1. Pulse Test: Pulse Width = 300 µs, Duty Cycle ≤ 2.0%.

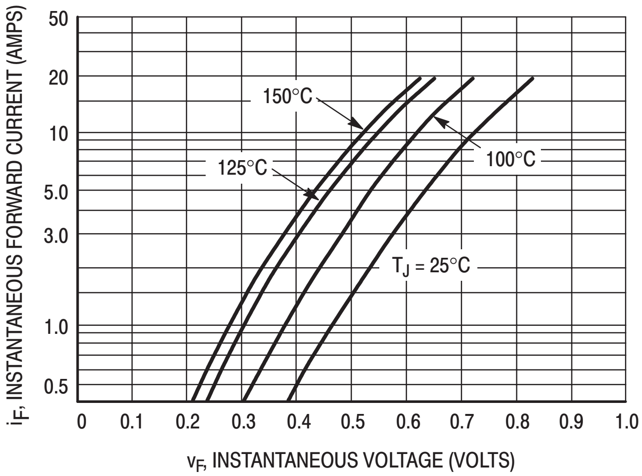

Figure 1. Typical Forward Voltage

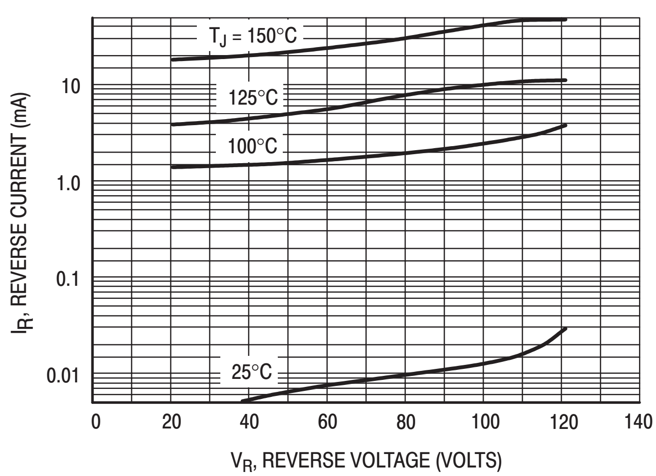

Figure 2. Typical Reverse Current

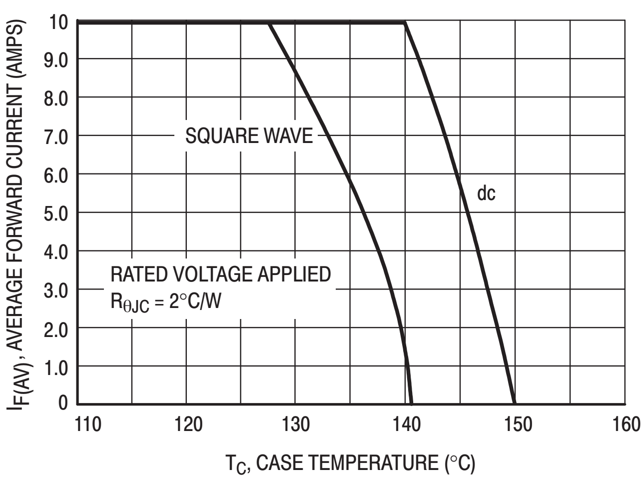

Figure 3. Current Derating, Case

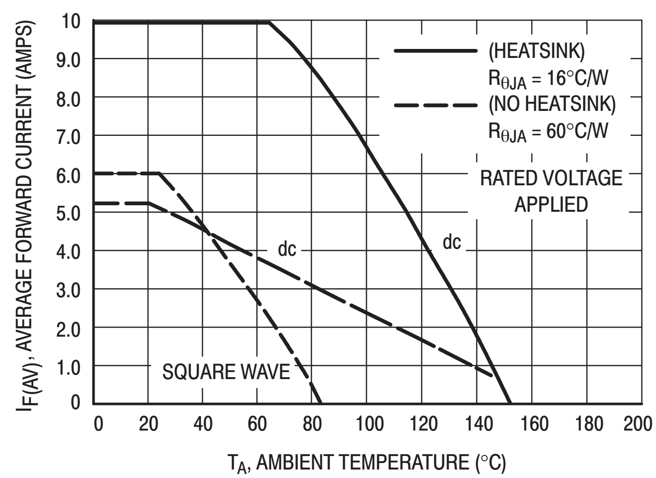

Figure 4. Current Derating, Ambient

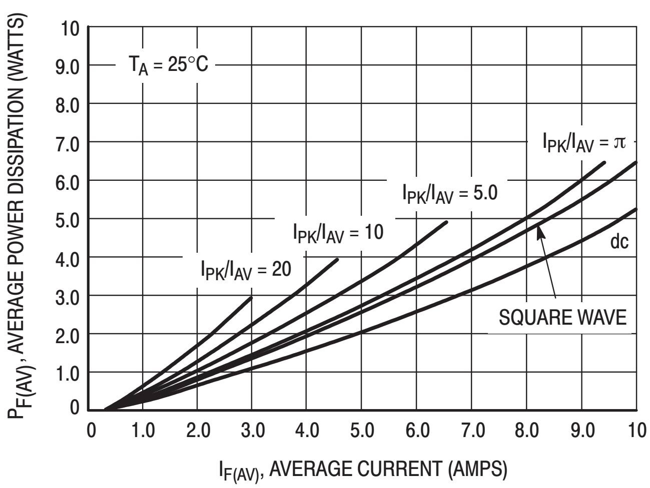

Figure 5. Forward Power Dissipation

MBR1635, MBR1645

MBR1645 is a Preferred Device

SWITCHMODE™ Power Rectifiers

. . . using the Schottky Barrier principle with a platinum barrier metal. These state–of–the–art devices have the following features:

- Guardring for Stress Protection
- Low Forward Voltage
- 150°C Operating Junction Temperature

Mechanical Characteristics:

- Case: Epoxy, Molded
- Weight: 1.9 grams (approximately)
- Finish: All External Surfaces Corrosion Resistant and Terminal Leads are Readily Solderable
- Lead Temperature for Soldering Purposes: 260°C Max. for 10 Seconds
- Shipped 50 units per plastic tube
- Marking: B1635, B1645

MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Peak Repetitive Reverse Voltage Working Peak Reverse Voltage DC Blocking Voltage MBR1635 MBR1645	V_{RRM} V_{RWM} V_R	 35 45	V
Average Rectified Forward Current (Rated V_R, T_C = 125°C)	$I_{F(AV)}$	16	A
Peak Repetitive Forward Current, (Rated V_R, Square Wave, 20 kHz, T_C = 125°C)	I_{FRM}	32	A
Non–Repetitive Peak Surge Current (Surge Applied at Rated Load Conditions Halfwave, Single Phase, 60 Hz)	I_{FSM}	150	A
Peak Repetitive Reverse Surge Current (2.0 μs, 1.0 kHz)	I_{RRM}	1.0	A
Storage Temperature Range	T_{stg}	–65 to +175	°C
Operating Junction Temperature	T_J	–65 to +150	°C
Voltage Rate of Change (Rated V_R)	dv/dt	10,000	V/μs

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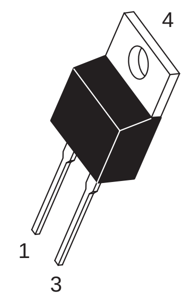
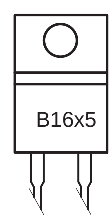
SCHOTTKY BARRIER RECTIFIERS 16 AMPERES 35 and 45 VOLTS



TO–220AC CASE 221B PLASTIC

MARKING DIAGRAM



B16x5 = Device Code
x = 3 or 4

ORDERING INFORMATION

Device	Package	Shipping
MBR1635	TO–220	50 Units/Rail
MBR1645	TO–220	50 Units/Rail

Preferred devices are recommended choices for future use and best overall value.

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THERMAL CHARACTERISTICS

Characteristic	Symbol	Value	Unit
Maximum Thermal Resistance, Junction to Case	$R_{\theta JC}$	1.5	°C/W

ELECTRICAL CHARACTERISTICS

Maximum Instantaneous Forward Voltage (Note 1.) (i_F = 16 Amps, T_C = 125°C) (i_F = 16 Amps, T_C = 25°C)	v_F	 0.57 0.63	Volts
Maximum Instantaneous Reverse Current (Note 1.) (Rated dc Voltage, T_C = 125°C) (Rated dc Voltage, T_C = 25°C)	i_R	 40 0.2	mA

1. Pulse Test: Pulse Width = 300 μs, Duty Cycle ≤ 2.0%.

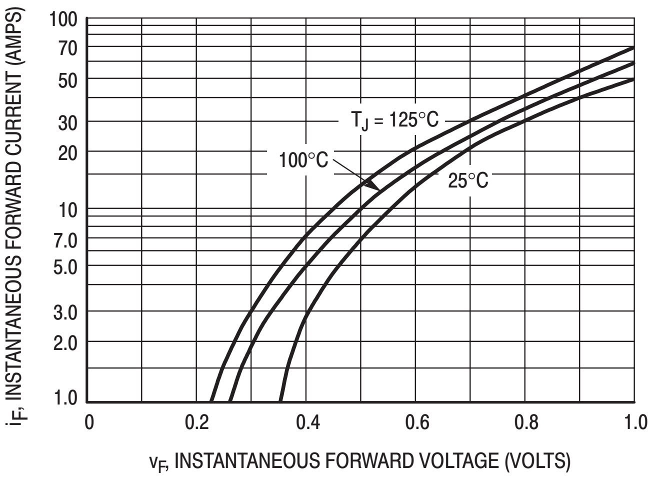

Figure 1. Typical Forward Voltage

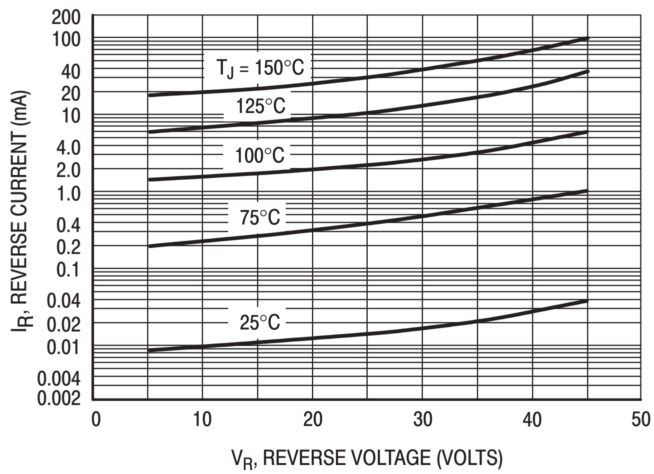

Figure 2. Typical Reverse Current

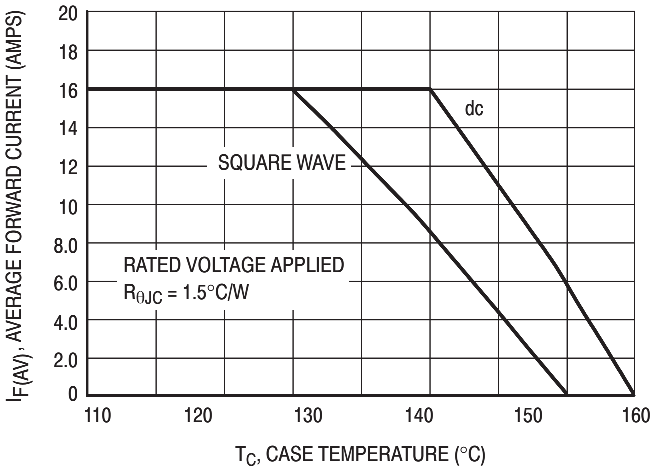

Figure 3. Current Derating, Case

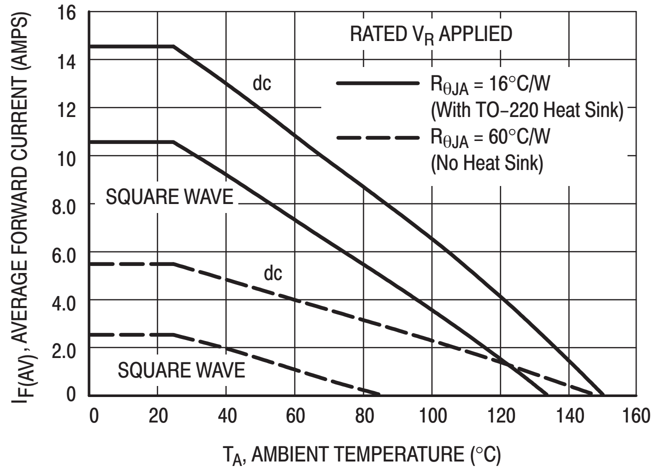

Figure 4. Current Derating, Ambient

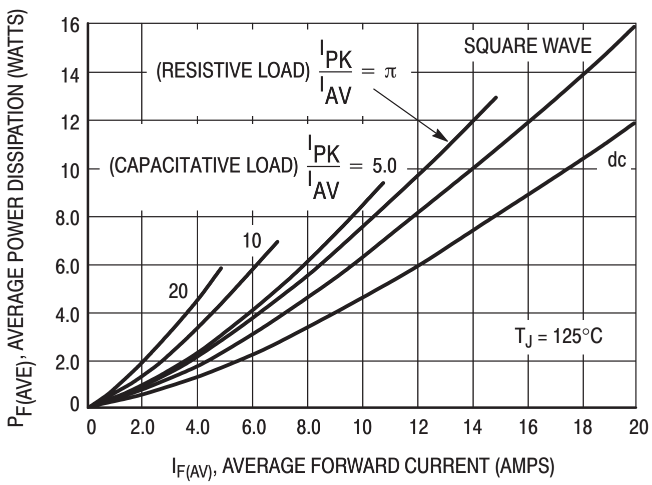

Figure 5. Forward Power Dissipation

MBR2515L

SWITCHMODE™ Power Rectifier

. . . employing the Schottky Barrier principle in a large metal–to–silicon power diode. State–of–the–art geometry features epitaxial construction with oxide passivation and metal overlay contact. Ideally suited for use in low voltage, high frequency switching power supplies, low voltage converters, OR'ing diodes, and polarity protection devices.

- Very Low Forward Voltage (0.28 V Maximum @ 19 Amps, 70°C)
- Guardring for Stress Protection
- Highly Stable Oxide Passivated Junction (100°C Operating Junction Temperature)
- Epoxy Meets UL94, VO at 1/8″

Mechanical Characteristics

- Case: Epoxy, Molded
- Weight: 1.9 grams (approximately)
- Finish: All External Surfaces Corrosion Resistant and Terminal Leads are Readily Solderable
- Lead Temperature for Soldering Purposes: 260°C Max. for 10 Seconds
- Shipped 50 Units Per Plastic Tube
- Marking: B2515L

MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Peak Repetitive Reverse Voltage Working Peak Reverse Voltage DC Blocking Voltage	V_{RRM} V_{RWM} V_R	15	V
Average Rectified Forward Current (Rated V_R, T_C = 90°C)	$I_{F(AV)}$	25	A
Peak Repetitive Forward Current, per Leg (Rated V_R, Square Wave, 20 kHz, T_C = 90°C)	I_{FRM}	30	A
Non–Repetitive Peak Surge Current (Surge Applied at Rated Load Conditions Halfwave, Single Phase, 60 Hz)	I_{FSM}	150	A
Peak Repetitive Reverse Surge Current (2.0 μs, 1.0 kHz)	I_{RRM}	1.0	A
Storage Temperature Range	T_{stg}	–65 to +125	°C
Operating Junction Temperature	T_J	–65 to +100	°C

THERMAL CHARACTERISTICS

Thermal Resistance — Junction to Case	$R_{\theta JC}$	2.0	°C/W

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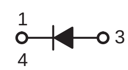
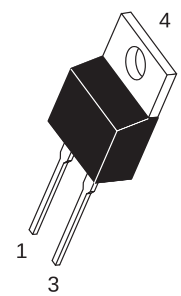
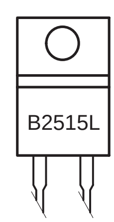
SCHOTTKY BARRIER RECTIFIER
25 AMPERES
15 VOLTS





TO–220AC
CASE 221B
STYLE 1

MARKING DIAGRAM



B2515L = Device Code

ORDERING INFORMATION

Device	Package	Shipping
MBR2515L	TO–220	50 Units/Rail

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ELECTRICAL CHARACTERISTICS

Characteristic	Symbol	Value	Unit
Maximum Instantaneous Forward Voltage (Note 1.) (i_F = 25 Amps, T_J = 25°C) (i_F = 25 Amps, T_J = 70°C) (i_F = 19 Amps, T_J = 70°C)	v_F	 0.45 0.42 0.28	Volts
Maximum Instantaneous Reverse Current (Note 1.) (Rated DC Voltage, T_J = 25°C) (Rated DC Voltage, T_J = 70°C)	I_R	 15 200	mA

1. Pulse Test: Pulse Width = 300 μs, Duty Cycle ≤ 2.0%.

MBRF2060CT

Preferred Device

SWITCHMODE™ Schottky Power Rectifier

The SWITCHMODE Power Rectifier employs the Schottky Barrier principle in a large area metal–to–silicon power diode. State–of–the–art geometry features epitaxial construction with oxide passivation and metal overlay contact. Ideally suited for use as rectifiers in very low–voltage, high–frequency switching power supplies, free wheeling diodes and polarity protection diodes.

- Highly Stable Oxide Passivated Junction
- Very Low Forward Voltage Drop
- Matched Dual Die Construction
- High Junction Temperature Capability
- High dv/dt Capability
- Excellent Ability to Withstand Reverse Avalanche Energy Transients
- Guardring for Stress Protection
- Epoxy Meets UL94, V_O at 1/8″
- Electrically Isolated. No Isolation Hardware Required.
- UL Recognized File #E69369 (Note 1.)

Mechanical Characteristics

- Case: Epoxy, Molded
- Weight: 1.9 grams (approximately)
- Finish: All External Surfaces Corrosion Resistant and Terminal Leads are Readily Solderable
- Lead Temperature for Soldering Purposes: 260°C Max. for 10 Seconds
- Shipped 50 units per plastic tube
- Marking: B2060

MAXIMUM RATINGS

Please See the Table on the Following Page

1. UL Recognized mounting method is per Figure 4.

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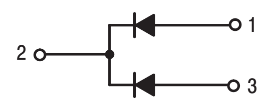
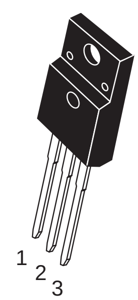
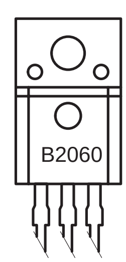
SCHOTTKY BARRIER RECTIFIER 20 AMPERES 60 VOLTS





ISOLATED TO–220
CASE 221D
STYLE 3

MARKING DIAGRAM



B2060 = Device Code

ORDERING INFORMATION

Device	Package	Shipping
MBRF2060CT	TO–220	50 Units/Rail

Preferred devices are recommended choices for future use and best overall value.

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MAXIMUM RATINGS (Per Leg)

Rating	Symbol	Value	Unit
Peak Repetitive Reverse Voltage Working Peak Reverse Voltage DC Blocking Voltage	V_{RRM} V_{RWM} V_R	60	Volts
Average Rectified Forward Current (Rated V_R), T_C = 133°C Total Device	$I_{F(AV)}$	10 20	Amps
Peak Repetitive Forward Current (Rated V_R, Square Wave, 20 kHz), T_C = 133°C	I_{FRM}	20	Amps
Nonrepetitive Peak Surge Current (Surge applied at rated load conditions halfwave, single phase, 60 Hz)	I_{FSM}	150	Amps
Peak Repetitive Reverse Surge Current (2.0 μs, 1.0 kHz)	I_{RRM}	0.5	Amp
Operating Junction and Storage Temperature Range	T_J, T_{stg}	– 65 to +150	°C
Voltage Rate of Change (Rated V_R)	dv/dt	10000	V/μs
RMS Isolation Voltage (t = 1.0 second, R.H. ≤ 30%, T_A = 25°C) (Note 2.) Per Figure 3. Per Figure 4. (Note 1.) Per Figure 5.	V_{iso1} V_{iso2} V_{iso3}	4500 3500 1500	Volts

THERMAL CHARACTERISTICS (Per Leg)

Maximum Thermal Resistance, Junction to Case	$R_{\theta JC}$	4.0	°C/W
Lead Temperature for Soldering Purposes: 1/8″ from Case for 5 Seconds	T_L	260	°C

ELECTRICAL CHARACTERISTICS (Per Leg)

Characteristic	Symbol	Max	Unit
Maximum Instantaneous Forward Voltage (Note 3.) (i_F = 10 Amp, T_C = 25°C) (i_F = 10 Amp, T_C = 125°C) (i_F = 20 Amp, T_C = 25°C) (i_F = 20 Amp, T_C = 125°C)	v_F	 0.85 0.75 0.95 0.85	Volts
Maximum Instantaneous Reverse Current (Note 3.) (Rated DC Voltage, T_C = 25°C) (Rated DC Voltage, T_C = 125°C)	i_R	 0.15 150	mA

1. UL Recognized mounting method is per Figure 4.
2. Proper strike and creepage distance must be provided.
3. Pulse Test: Pulse Width = 300 μs, Duty Cycle ≤ 2.0%

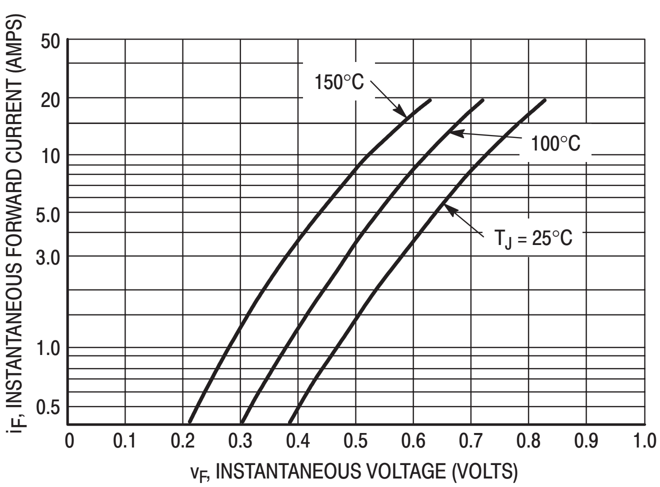


Figure 1. Typical Forward Voltage Per Diode

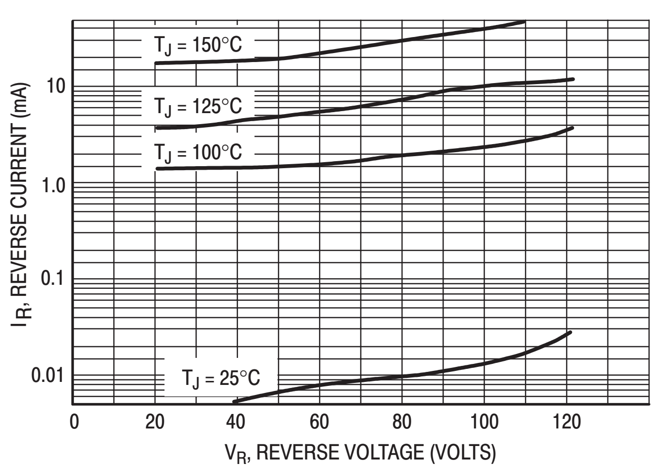


Figure 2. Typical Reverse Current Per Diode

TEST CONDITIONS FOR ISOLATION TESTS*

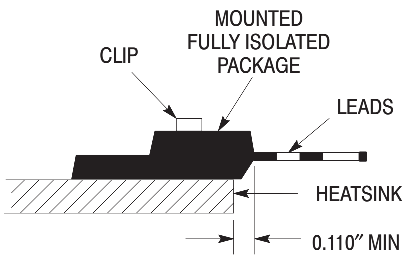


Figure 3. Clip Mounting Position for Isolation Test Number 1

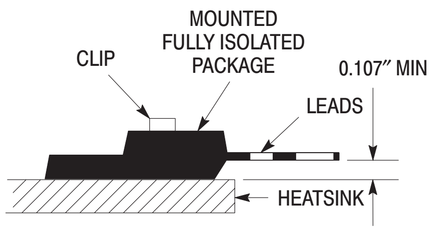


Figure 4. Clip Mounting Position for Isolation Test Number 2

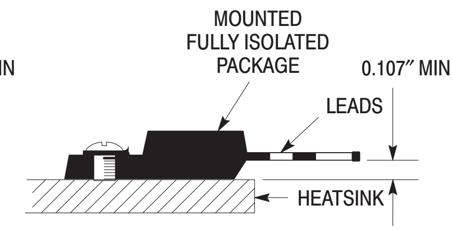
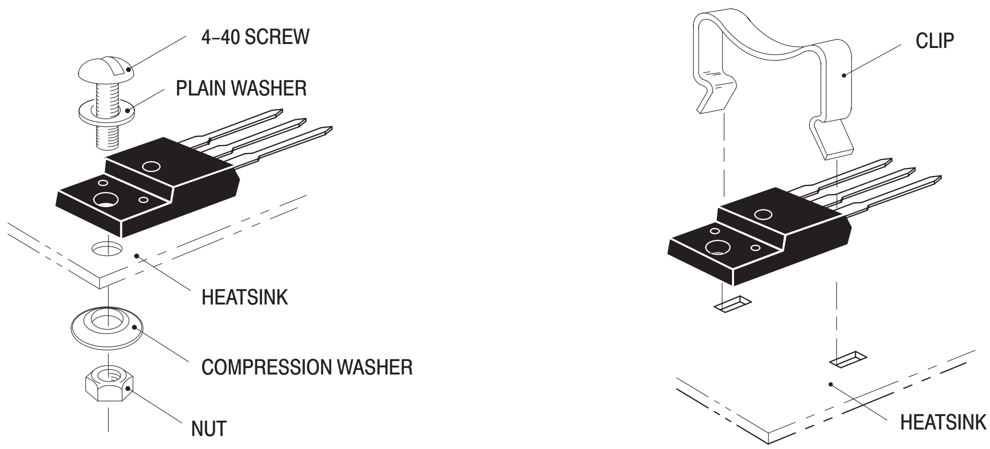


Figure 5. Screw Mounting Position for Isolation Test Number 3

* Measurement made between leads and heatsink with all leads shorted together.

MOUNTING INFORMATION**



6a. Screw–Mounted **6b. Clip–Mounted**

Figure 6. Typical Mounting Techniques

Laboratory tests on a limited number of samples indicate, when using the screw and compression washer mounting technique, a screw torque of 6 to 8 in · lbs is sufficient to provide maximum power dissipation capability. The compression washer helps to maintain a constant pressure on the package over time and during large temperature excursions.

Destructive laboratory tests show that using a hex head 4–40 screw, without washers, and applying a torque in excess of 20 in · lbs will cause the plastic to crack around the mounting hole, resulting in a loss of isolation capability.

Additional tests on slotted 4–40 screws indicate that the screw slot fails between 15 to 20 in · lbs without adversely affecting the package. However, in order to positively ensure the package integrity of the fully isolated device, ON Semiconductor does not recommend exceeding 10 in · lbs of mounting torque under any mounting conditions.

**For more information about mounting power semiconductors see Application Note AN1040.

MBRF20100CT

Preferred Device

SWITCHMODE™ Schottky Power Rectifier

The SWITCHMODE Power Rectifier employs the Schottky Barrier principle in a large area metal–to–silicon power diode. State–of–the–art geometry features epitaxial construction with oxide passivation and metal overlay contact. Ideally suited for use as rectifiers in very low–voltage, high–frequency switching power supplies, free wheeling diodes and polarity protection diodes.

- Highly Stable Oxide Passivated Junction
- Very Low Forward Voltage Drop
- Matched Dual Die Construction
- High Junction Temperature Capability
- High dv/dt Capability
- Excellent Ability to Withstand Reverse Avalanche Energy Transients
- Guardring for Stress Protection
- Epoxy Meets UL94, V_O at 1/8″
- Electrically Isolated. No Isolation Hardware Required.
- UL Recognized File #E69369 (Note 1.)

Mechanical Characteristics

- Case: Epoxy, Molded
- Weight: 1.9 grams (approximately)
- Finish: All External Surfaces Corrosion Resistant and Terminal Leads are Readily Solderable
- Lead Temperature for Soldering Purposes: 260°C Max. for 10 Seconds
- Shipped 50 units per plastic tube
- Marking: B20100

MAXIMUM RATINGS

Please See the Table on the Following Page

1. UL Recognized mounting method is per Figure 4.

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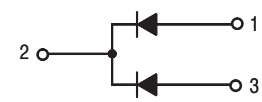
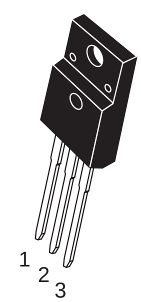
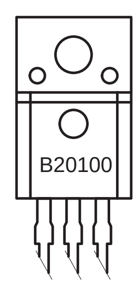
SCHOTTKY BARRIER RECTIFIER 20 AMPERES 100 VOLTS





ISOLATED TO–220
CASE 221D
STYLE 3

MARKING DIAGRAM



B20100 = Device Code

ORDERING INFORMATION

Device	Package	Shipping
MBRF20100CT	TO–220	50 Units/Rail

Preferred devices are recommended choices for future use and best overall value.

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MAXIMUM RATINGS (Per Leg)

Rating	Symbol	Value	Unit
Peak Repetitive Reverse Voltage Working Peak Reverse Voltage DC Blocking Voltage	V_{RRM} V_{RWM} V_R	100	Volts
Average Rectified Forward Current (Rated V_R), T_C = 133°C Total Device	$I_{F(AV)}$	10 20	Amps
Peak Repetitive Forward Current (Rated V_R, Square Wave, 20 kHz), T_C = 133°C	I_{FRM}	20	Amps
Non–repetitive Peak Surge Current (Surge applied at rated load conditions halfwave, single phase, 60 Hz)	I_{FSM}	150	Amps
Peak Repetitive Reverse Surge Current (2.0 µs, 1.0 kHz)	I_{RRM}	0.5	Amp
Operating Junction and Storage Temperature Range	T_J, T_{stg}	– 65 to +150	°C
Voltage Rate of Change (Rated V_R)	dv/dt	10000	V/µs
RMS Isolation Voltage (t = 1.0 second, R.H. ≤ 30%, T_A = 25°C) (Note 2.) Per Figure 3. Per Figure 4. (Note 1.) Per Figure 5.	V_{iso1} V_{iso2} V_{iso3}	4500 3500 1500	Volts

THERMAL CHARACTERISTICS (Per Leg)

Maximum Thermal Resistance, Junction to Case	$R_{\theta JC}$	3.5	°C/W
Lead Temperature for Soldering Purposes: 1/8″ from Case for 5 Seconds	T_L	260	°C

ELECTRICAL CHARACTERISTICS (Per Leg)

Characteristic	Symbol	Max	Unit
Maximum Instantaneous Forward Voltage (Note 3.) (i_F = 10 Amp, T_C = 25°C) (i_F = 10 Amp, T_C = 125°C) (i_F = 20 Amp, T_C = 25°C) (i_F = 20 Amp, T_C = 125°C)	v_F	 0.85 0.75 0.95 0.85	Volts
Maximum Instantaneous Reverse Current (Note 3.) (Rated DC Voltage, T_C = 25°C) (Rated DC Voltage, T_C = 125°C)	i_R	 0.15 150	mA

1. UL Recognized mounting method is per Figure 4.
2. Proper strike and creepage distance must be provided.
3. Pulse Test: Pulse Width = 300 µs, Duty Cycle ≤ 2.0%

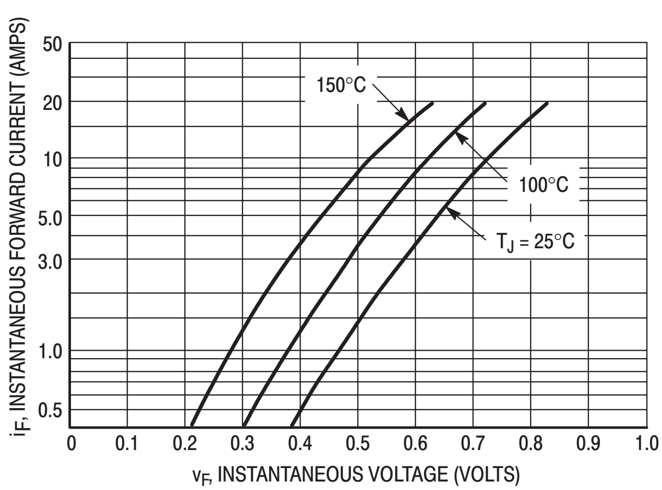


Figure 1. Typical Forward Voltage Per Diode

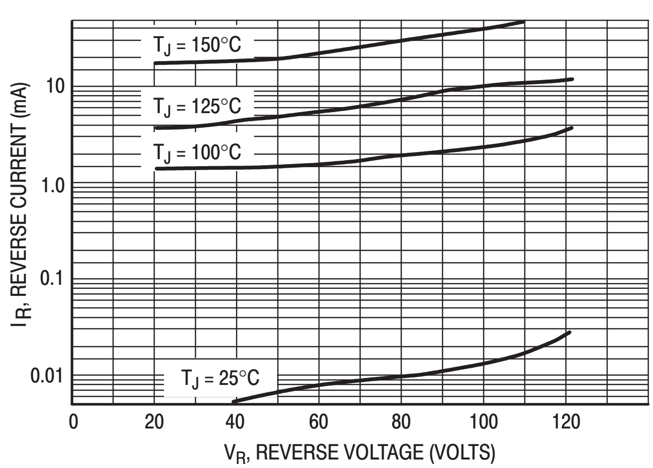


Figure 2. Typical Reverse Current Per Diode

TEST CONDITIONS FOR ISOLATION TESTS*

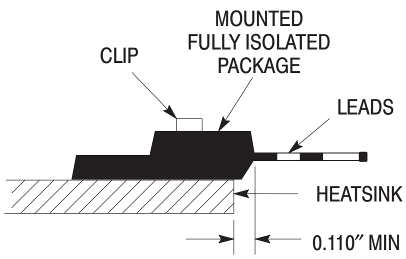


Figure 3. Clip Mounting Position for Isolation Test Number 1

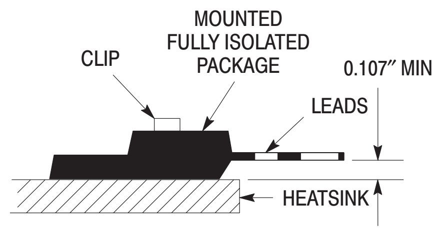


Figure 4. Clip Mounting Position for Isolation Test Number 2

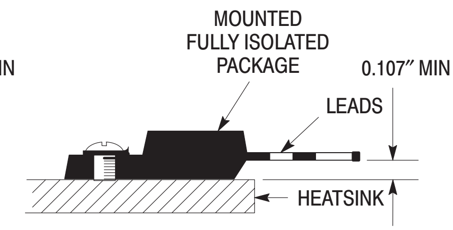
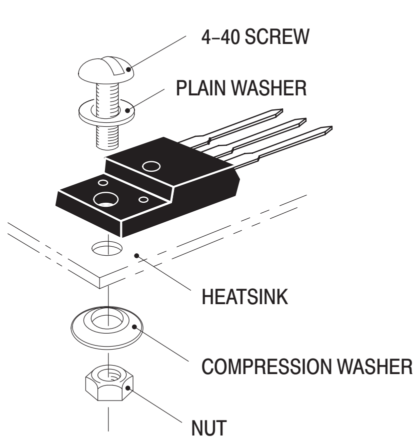


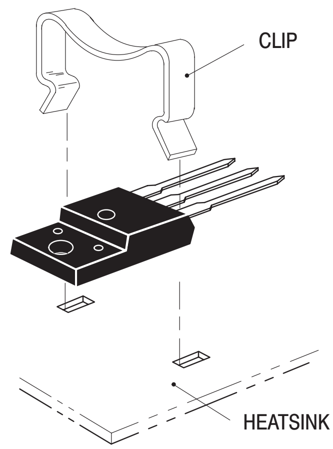
Figure 5. Screw Mounting Position for Isolation Test Number 3

* Measurement made between leads and heatsink with all leads shorted together.

MOUNTING INFORMATION**



6a. Screw–Mounted



6b. Clip–Mounted

Figure 6. Typical Mounting Techniques

Laboratory tests on a limited number of samples indicate, when using the screw and compression washer mounting technique, a screw torque of 6 to 8 in · lbs is sufficient to provide maximum power dissipation capability. The compression washer helps to maintain a constant pressure on the package over time and during large temperature excursions.

Destructive laboratory tests show that using a hex head 4–40 screw, without washers, and applying a torque in excess of 20 in · lbs will cause the plastic to crack around the mounting hole, resulting in a loss of isolation capability.

Additional tests on slotted 4–40 screws indicate that the screw slot fails between 15 to 20 in · lbs without adversely affecting the package. However, in order to positively ensure the package integrity of the fully isolated device, ON Semiconductor does not recommend exceeding 10 in · lbs of mounting torque under any mounting conditions.

**For more information about mounting power semiconductors see Application Note AN1040.

MBRF20200CT

Preferred Device

SWITCHMODE™ Schottky Power Rectifier

The SWITCHMODE Power Rectifier employs the Schottky Barrier principle in a large area metal–to–silicon power diode. State–of–the–art geometry features epitaxial construction with oxide passivation and metal overlay contact. Ideally suited for use as rectifiers in very low–voltage, high–frequency switching power supplies, free wheeling diodes and polarity protection diodes.

- Highly Stable Oxide Passivated Junction
- Very Low Forward Voltage Drop
- Matched Dual Die Construction
- High Junction Temperature Capability
- High dv/dt Capability
- Excellent Ability to Withstand Reverse Avalanche Energy Transients
- Guardring for Stress Protection
- Epoxy Meets UL94, V_O at 1/8″
- Electrically Isolated. No Isolation Hardware Required.
- UL Recognized File #E69369

Mechanical Characteristics

- Case: Epoxy, Molded
- Weight: 1.9 grams (approximately)
- Finish: All External Surfaces Corrosion Resistant and Terminal Leads are Readily Solderable
- Lead Temperature for Soldering Purposes: 260°C Max. for 10 Seconds
- Shipped 50 units per plastic tube
- Marking: B20200

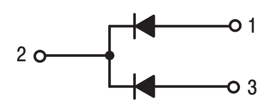
MAXIMUM RATINGS

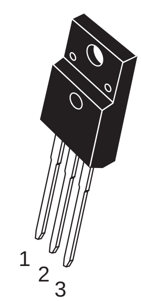
Please See the Table on the Following Page

ON Semiconductor™

http://onsemi.com

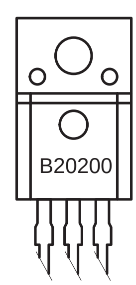
SCHOTTKY BARRIER RECTIFIER 20 AMPERES 200 VOLTS





ISOLATED TO–220 CASE 221D STYLE 3

MARKING DIAGRAM



B20200 = Device Code

ORDERING INFORMATION

Device	Package	Shipping
MBRF20200CT	TO–220	50 Units/Rail

Preferred devices are recommended choices for future use and best overall value.

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MAXIMUM RATINGS (Per Leg)

Rating		Symbol	Value	Unit
Peak Repetitive Reverse Voltage Working Peak Reverse Voltage DC Blocking Voltage		V_{RRM} V_{RWM} V_R	200	Volts
Average Rectified Forward Current (Rated V_R) T_C = 125°C	Per Leg Per Package	$I_{F(AV)}$	10 20	Amps
Peak Repetitive Forward Current, Per Leg (Rated V_R, Square Wave, 20 kHz) T_C = 90°C		I_{FRM}	20	Amps
Nonrepetitive Peak Surge Current (Surge applied at rated load conditions halfwave, single phase, 60 Hz)		I_{FSM}	150	Amps
Peak Repetitive Reverse Surge Current (2.0 μs, 1.0 kHz)		I_{RRM}	1.0	Amp
Operating Junction Temperature and Storage Temperature		T_J, T_{stg}	–65 to +150	°C
Voltage Rate of Change (Rated V_R)		dv/dt	10,000	V/μs

THERMAL CHARACTERISTICS (Per Leg)

Thermal Resistance — Junction to Case	$R_{\theta JC}$	3.5	°C/W

ELECTRICAL CHARACTERISTICS (Per Leg)

Rating	Symbol	Max	Unit
Maximum Instantaneous Forward Voltage (Note 1.) (i_F = 10 Amp, T_C = 25°C) (i_F = 10 Amp, T_C = 125°C) (i_F = 20 Amp, T_C = 25°C) (i_F = 20 Amp, T_C = 125°C)	v_F	 0.9 0.8 1.0 0.9	Volts
Maximum Instantaneous Reverse Current (Note 1.) (Rated dc Voltage, T_C = 25°C) (Rated dc Voltage, T_C = 125°C)	i_R	 1.0 50	mA

DYNAMIC CHARACTERISTICS (Per Leg)

Capacitance (V_R = –5.0 V, T_C = 25°C, Freq. = 1.0 MHz)	C_T	500	pF

1. Pulse Test: Pulse Width = 300 μs, Duty Cycle ≤ 2.0%

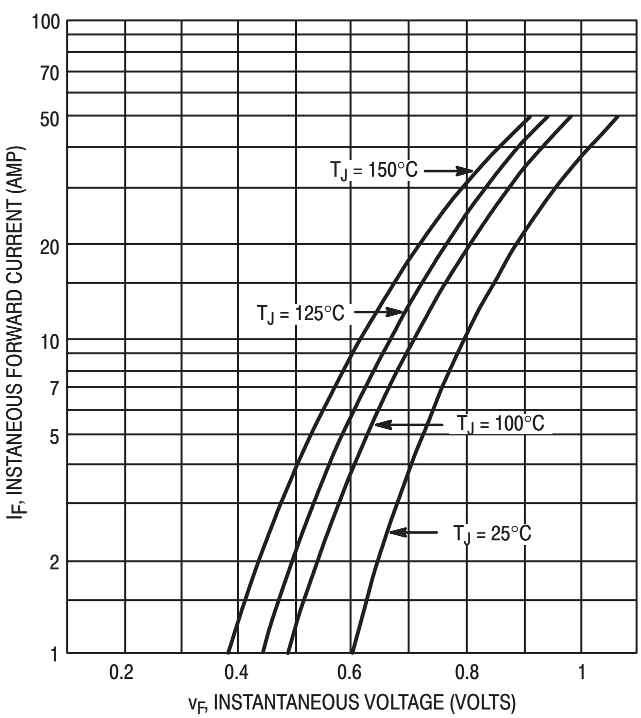


Figure 1. Typical Forward Voltage (Per Leg)

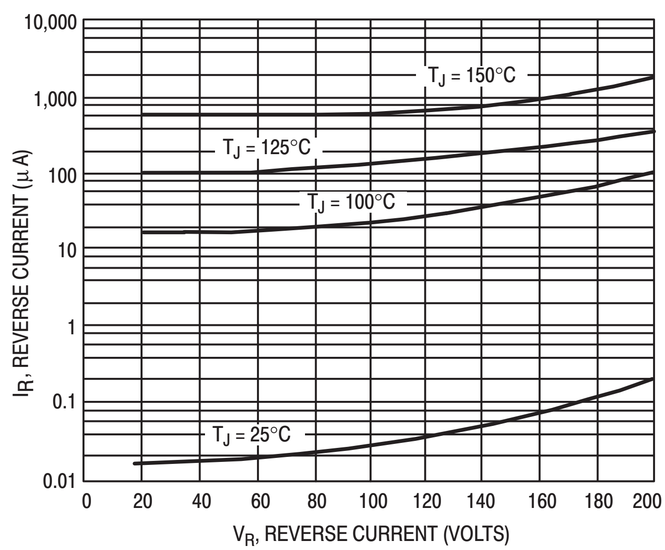


Figure 2. Typical Reverse Current (Per Leg)

TEST CONDITIONS FOR ISOLATION TESTS*

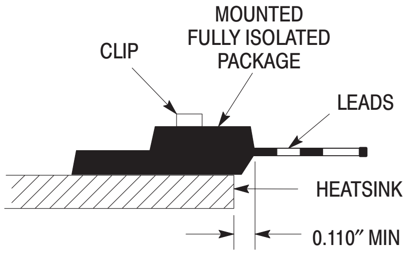


Figure 3. Clip Mounting Position for Isolation Test Number 1

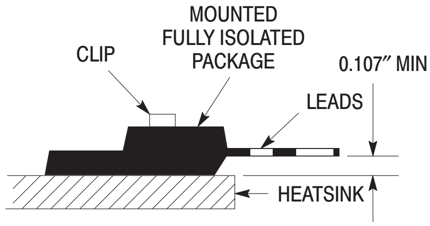


Figure 4. Clip Mounting Position for Isolation Test Number 2

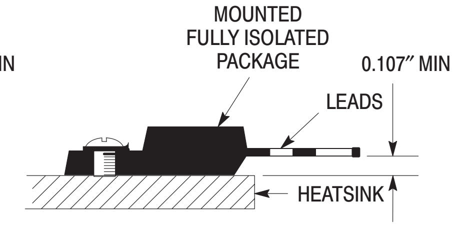
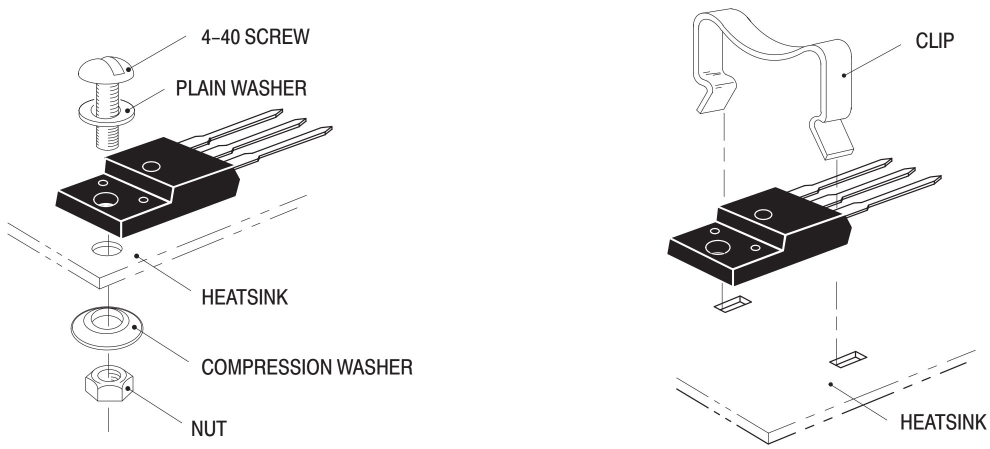


Figure 5. Screw Mounting Position for Isolation Test Number 3

* Measurement made between leads and heatsink with all leads shorted together.

MOUNTING INFORMATION**



6a. Screw–Mounted **6b. Clip–Mounted**

Figure 6. Typical Mounting Techniques

Laboratory tests on a limited number of samples indicate, when using the screw and compression washer mounting technique, a screw torque of 6 to 8 in · lbs is sufficient to provide maximum power dissipation capability. The compression washer helps to maintain a constant pressure on the package over time and during large temperature excursions.

Destructive laboratory tests show that using a hex head 4–40 screw, without washers, and applying a torque in excess of 20 in · lbs will cause the plastic to crack around the mounting hole, resulting in a loss of isolation capability.

Additional tests on slotted 4–40 screws indicate that the screw slot fails between 15 to 20 in · lbs without adversely affecting the package. However, in order to positively ensure the package integrity of the fully isolated device, ON Semiconductor does not recommend exceeding 10 in · lbs of mounting torque under any mounting conditions.

**For more information about mounting power semiconductors see Application Note AN1040.

MBRF2545CT

Preferred Device

SWITCHMODE™ Schottky Power Rectifier

The SWITCHMODE Power Rectifier employs the Schottky Barrier principle in a large area metal–to–silicon power diode. State–of–the–art geometry features epitaxial construction with oxide passivation and metal overlay contact. Ideally suited for use as rectifiers in very low–voltage, high–frequency switching power supplies, free wheeling diodes and polarity protection diodes.

- Highly Stable Oxide Passivated Junction
- Very Low Forward Voltage Drop
- Matched Dual Die Construction
- High Junction Temperature Capability
- High dv/dt Capability
- Excellent Ability to Withstand Reverse Avalanche Energy Transients
- Guardring for Stress Protection
- Epoxy Meets UL94, V_O at 1/8″
- Electrically Isolated. No Isolation Hardware Required.
- UL Recognized File #E69369 (Note 1.)

Mechanical Characteristics

- Case: Epoxy, Molded
- Weight: 1.9 grams (approximately)
- Finish: All External Surfaces Corrosion Resistant and Terminal Leads are Readily Solderable
- Lead Temperature for Soldering Purposes: 260°C Max. for 10 Seconds
- Shipped 50 units per plastic tube
- Marking: B2545

MAXIMUM RATINGS

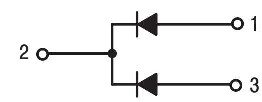
Please See the Table on the Following Page

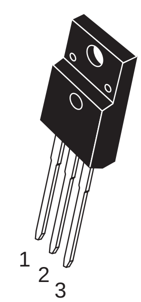
1. UL Recognized mounting method is per Figure 4.

ON Semiconductor™

http://onsemi.com

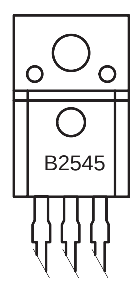
SCHOTTKY BARRIER RECTIFIER 25 AMPERES 45 VOLTS





ISOLATED TO–220
CASE 221D
STYLE 3

MARKING DIAGRAM



B2545 = Device Code

ORDERING INFORMATION

Device	Package	Shipping
MBRF2545CT	TO–220	50 Units/Rail

Preferred devices are recommended choices for future use and best overall value.

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MAXIMUM RATINGS (Per Leg)

Rating	Symbol	Value	Unit
Peak Repetitive Reverse Voltage Working Peak Reverse Voltage DC Blocking Voltage	V_{RRM} V_{RWM} V_R	45	Volts
Average Rectified Forward Current (Rated V_R), T_C = 125°C Total Device	$I_{F(AV)}$	12.5 25	Amps
Peak Repetitive Forward Current (Rated V_R, Square Wave, 20 kHz), T_C = 125°C	I_{FRM}	25	Amps
Non–repetitive Peak Surge Current (Surge applied at rated load conditions halfwave, single phase, 60 Hz)	I_{FSM}	150	Amps
Peak Repetitive Reverse Surge Current (2.0 μs, 1.0 kHz)	I_{RRM}	1.0	Amp
Operating Junction and Storage Temperature	T_J, T_{stg}	– 65 to +150	°C
Voltage Rate of Change (Rated V_R)	dv/dt	10000	V/μs
RMS Isolation Voltage (t = 1.0 second, R.H. ≤ 30%, T_A = 25°C) (Note 2.) Per Figure 3. Per Figure 4. (Note 1.) Per Figure 5.	V_{iso1} V_{iso2} V_{iso3}	4500 3500 1500	Volts

THERMAL CHARACTERISTICS (Per Leg)

Maximum Thermal Resistance, Junction to Case	$R_{\theta JC}$	3.5	°C/W
Maximum Lead Temperature for Soldering Purposes: 1/8″ from Case for 5 Seconds	T_L	260	°C

ELECTRICAL CHARACTERISTICS (Per Leg)

Characteristic	Symbol	Max	Unit
Maximum Instantaneous Forward Voltage (Note 3.) (i_F = 12.5 Amps, T_C = 25°C) (i_F = 12.5 Amps, T_C = 125°C)	v_F	0.7 0.62	Volts
Maximum Instantaneous Reverse Current (Note 3.) (Rated DC Voltage, T_C = 25°C) (Rated DC Voltage, T_C = 125°C)	i_R	0.2 40	mA

1. UL Recognized mounting method is per Figure 4.
2. Proper strike and creepage distance must be provided.
3. Pulse Test: Pulse Width = 300 μs, Duty Cycle ≤ 2.0%

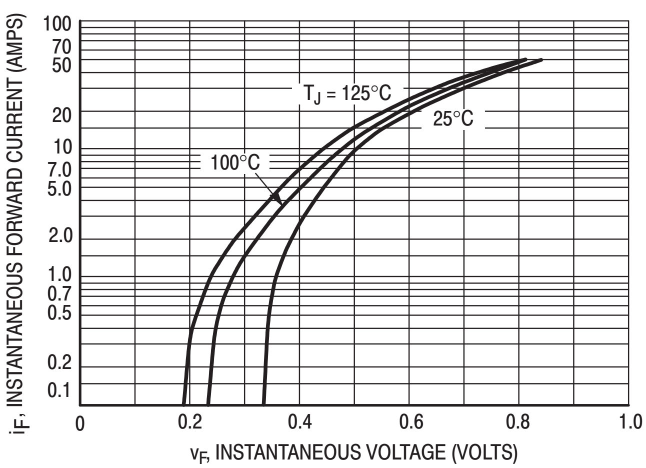


Figure 1. Typical Forward Voltage, Per Leg

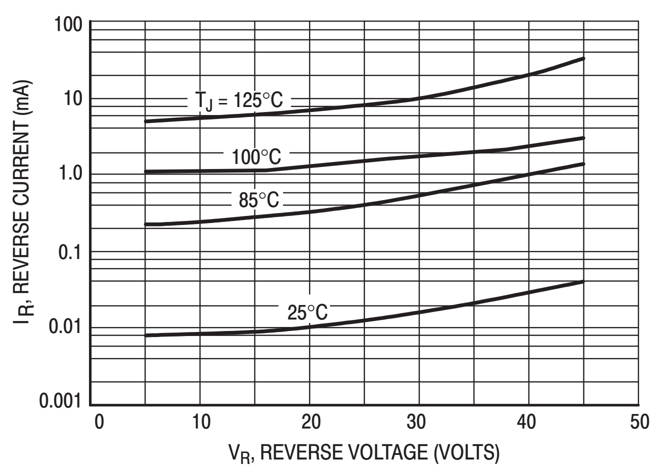


Figure 2. Typical Reverse Current, Per Leg

TEST CONDITIONS FOR ISOLATION TESTS*

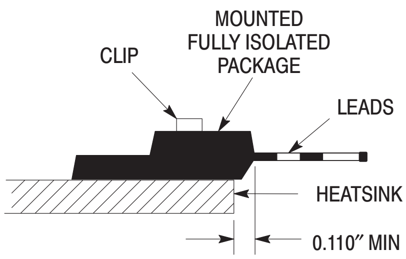


Figure 3. Clip Mounting Position for Isolation Test Number 1

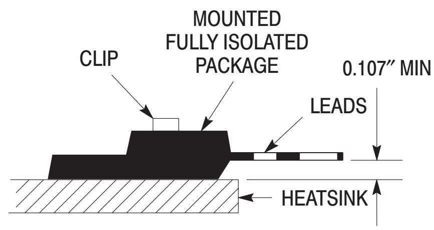


Figure 4. Clip Mounting Position for Isolation Test Number 2

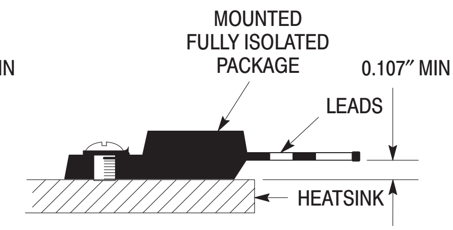
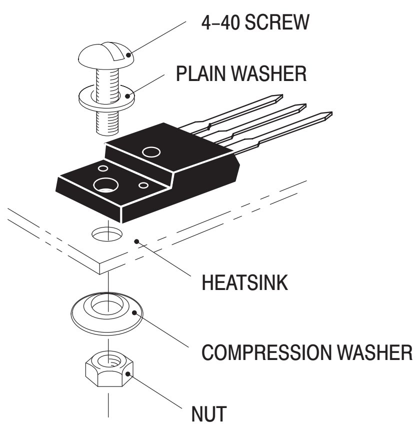


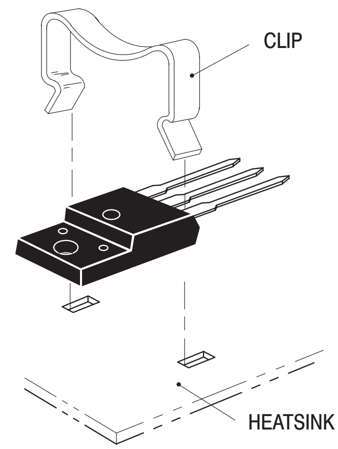
Figure 5. Screw Mounting Position for Isolation Test Number 3

* Measurement made between leads and heatsink with all leads shorted together.

MOUNTING INFORMATION**



6a. Screw–Mounted



6b. Clip–Mounted

Figure 6. Typical Mounting Techniques

Laboratory tests on a limited number of samples indicate, when using the screw and compression washer mounting technique, a screw torque of 6 to 8 in · lbs is sufficient to provide maximum power dissipation capability. The compression washer helps to maintain a constant pressure on the package over time and during large temperature excursions.

Destructive laboratory tests show that using a hex head 4–40 screw, without washers, and applying a torque in excess of 20 in · lbs will cause the plastic to crack around the mounting hole, resulting in a loss of isolation capability.

Additional tests on slotted 4–40 screws indicate that the screw slot fails between 15 to 20 in · lbs without adversely affecting the package. However, in order to positively ensure the package integrity of the fully isolated device, ON Semiconductor does not recommend exceeding 10 in · lbs of mounting torque under any mounting conditions.

**For more information about mounting power semiconductors see Application Note AN1040.

MBR3045PT

Preferred Device

SWITCHMODE™ Power Rectifier

. . . using the Schottky Barrier principle with a platinum barrier metal. These state–of–the–art devices have the following features:

- Dual Diode Construction — Terminals 1 and 3 may be Connected for Parallel Operation at Full Rating
- Guardring for Stress Protection
- Low Forward Voltage
- 150°C Operating Junction Temperature

Mechanical Characteristics:

- Case: Epoxy, Molded
- Weight: 4.3 grams (approximately)
- Finish: All External Surfaces Corrosion Resistant and Terminal Leads are Readily Solderable
- Lead Temperature for Soldering Purposes: 260°C Max. for 10 Seconds
- Shipped 30 units per plastic tube
- Marking: B3045

MAXIMUM RATINGS

Rating	Symbol	Max	Unit
Peak Repetitive Reverse Voltage Working Peak Reverse Voltage DC Blocking Voltage	V_{RRM} V_{RWM} V_R	45	V
Average Rectified Forward Current (Rated V_R, T_C = 105°C) Per Device Per Diode	$I_{F(AV)}$	30 15	A
Peak Repetitive Forward Current, (Rated V_R, Square Wave, 20 kHz) Per Diode	I_{FRM}	30	A
Non–Repetitive Peak Surge Current (Surge Applied at Rated Load Conditions Halfwave, Single Phase, 60 Hz)	I_{FSM}	200	A
Peak Repetitive Reverse Current (2.0 μs, 1.0 kHz) Per Diode See Figure 6.	I_{RRM}	2.0	A
Storage Temperature Range	T_{stg}	–65 to +175	°C
Operating Junction Temperature	T_J	–65 to +150	°C
Peak Surge Junction Temperature (Forward Current Applied)	$T_{J(pk)}$	175	°C
Voltage Rate of Change (Rated V_R)	dv/dt	10,000	V/μs

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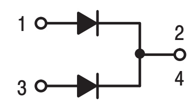
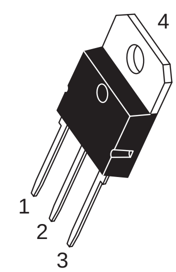
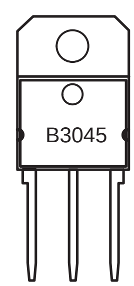
SCHOTTKY BARRIER RECTIFIER
30 AMPERES
45 VOLTS





SOT–93
CASE 340D
PLASTIC

MARKING DIAGRAM



B3045 = Device Code

ORDERING INFORMATION

Device	Package	Shipping
MBR3045PT	SOT–93	30 Units/Rail

Preferred devices are recommended choices for future use and best overall value.

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THERMAL CHARACTERISTICS PER DIODE

Rating	Symbol	Max	Unit
Thermal Resistance, Junction to Case	$R_{\theta JC}$	1.4	°C/W
Thermal Resistance, Junction to Ambient	$R_{\theta JA}$	40	°C/W

ELECTRICAL CHARACTERISTICS PER DIODE

Instantaneous Forward Voltage (Note 1.) (i_F = 20 Amps, T_C = 125°C) (i_F = 30 Amps, T_C = 125°C) (i_F = 30 Amps, T_C = 25°C)	v_F	 0.60 0.72 0.76	Volts
Instantaneous Reverse Current (Note 1.) (Rated dc Voltage, T_C = 125°C) (Rated dc Voltage, T_C = 25°C)	i_R	 100 1.0	mA

1. Pulse Test: Pulse Width = 300 μs, Duty Cycle ≤ 2.0%.

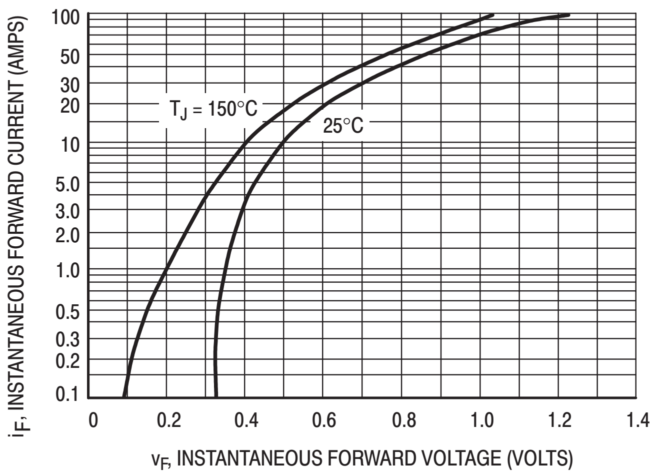


Figure 1. Typical Forward Voltage

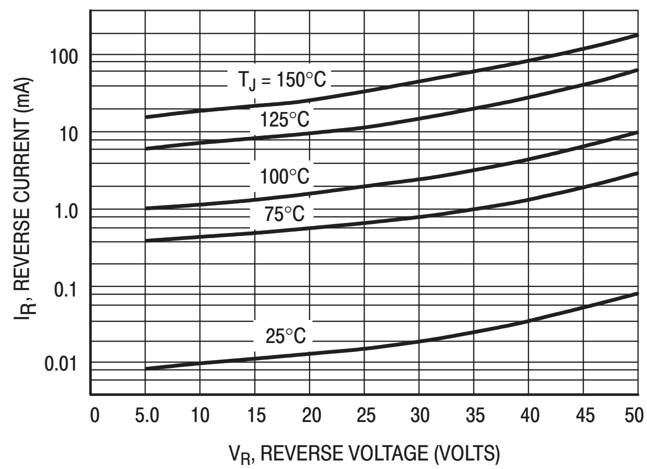


Figure 2. Typical Reverse Current

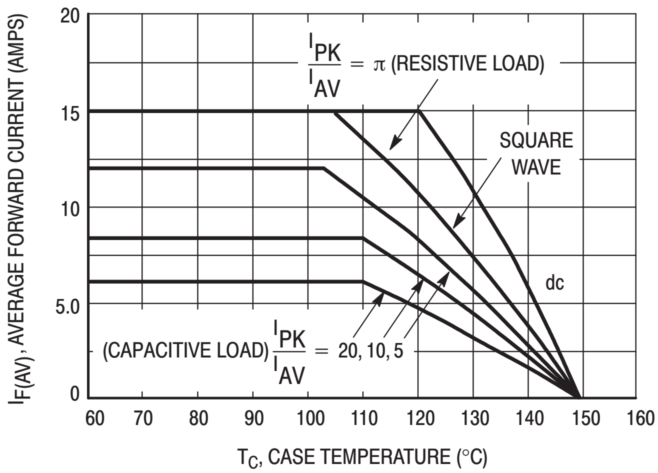


Figure 3. Current Derating (Per Leg)

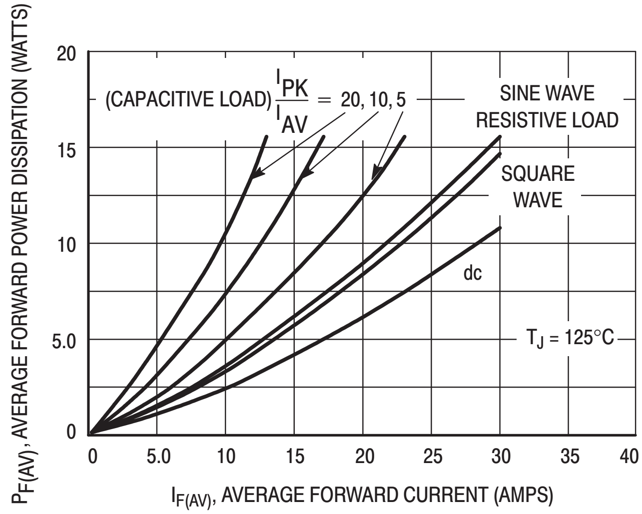


Figure 4. Forward Power Dissipation (Per Leg)

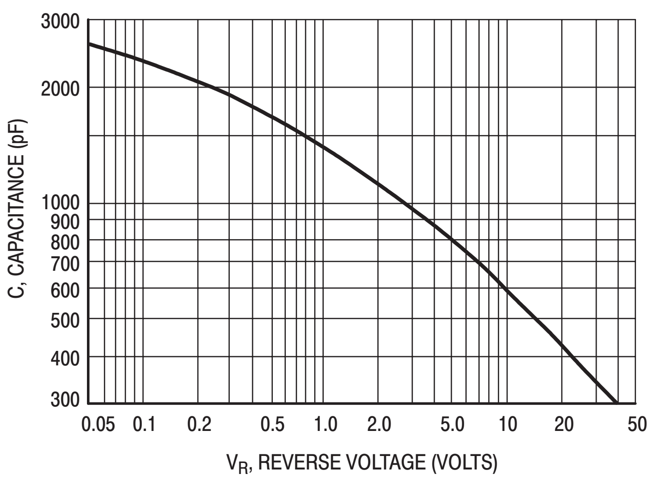


Figure 5. Capacitance

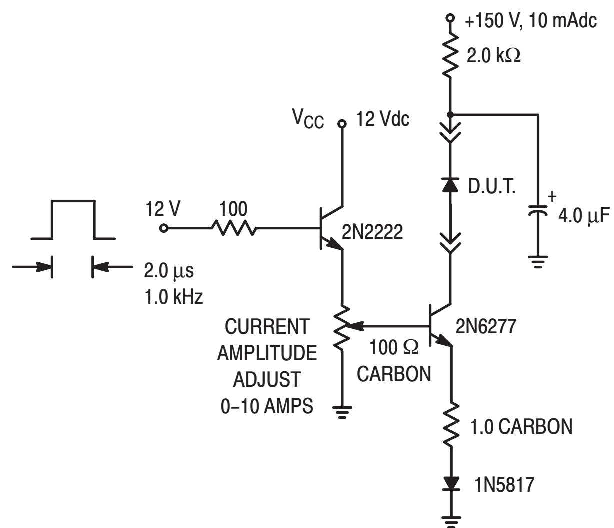


Figure 6. Test Circuit for Repetitive Reverse Current

MBR4045PT

SWITCHMODE™ Power Rectifier

The SWITCHMODE power rectifier employs the use of the Schottky Barrier principle with a Platinum barrier metal. This state-of-the-art device has the following features:

- Dual Diode Construction — Terminals 1 and 3 May Be Connected for Parallel Operation at Full Rating
- 45 Volt Blocking Voltage
- Low Forward Voltage Drop
- Guardring for Stress Protection and High dv/dt Capability (> 10 V/ns)
- 150°C Operating Junction Temperature

Mechanical Characteristics

- Case: Epoxy, Molded
- Weight: 4.3 grams (approximately)
- Finish: All External Surfaces Corrosion Resistant and Terminal Leads are Readily Solderable
- Lead Temperature for Soldering Purposes: 260°C Max. for 10 Seconds
- Shipped 30 Units Per Plastic Tube
- Marking: B4045

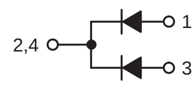
MAXIMUM RATINGS

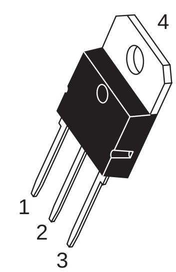
Rating	Symbol	Max	Unit
Peak Repetitive Reverse Voltage Working Peak Reverse Voltage DC Blocking Voltage	V_{RRM} V_{RWM} V_R	45	V
Average Rectified Forward Current (Rated V_R, T_C = 125°C) Per Diode Per Device	$I_{F(AV)}$	 20 40	A
Peak Repetitive Forward Current, (Rated V_R, Square Wave, 20 kHz @ T_C = 90°C) Per Diode	I_{FRM}	40	A
Non–Repetitive Peak Surge Current (Surge Applied at Rated Load Conditions Halfwave, Single Phase, 60 Hz)	I_{FSM}	400	A
Peak Repetitive Reverse Current (2.0 μs, 1.0 kHz)	I_{RRM}	2.0	A
Storage Temperature Range	T_{stg}	–65 to +175	°C
Operating Junction Temperature	T_J	–65 to +150	°C
Peak Surge Junction Temperature (Forward Current Applied)	$T_{J(pk)}$	175	°C
Voltage Rate of Change	dv/dt	10,000	V/μs

ON Semiconductor™

http://onsemi.com

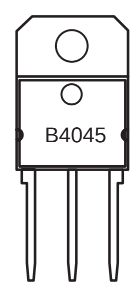
SCHOTTKY BARRIER RECTIFIER
40 AMPERES
45 VOLTS





SOT–93
CASE 340D
STYLE 2

MARKING DIAGRAM



B4045 = Device Code

ORDERING INFORMATION

Device	Package	Shipping
MBR4045PT	SOT–93	30 Units/Rail

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THERMAL CHARACTERISTICS

Rating	Symbol	Max	Unit
Thermal Resistance — Junction to Case	$R_{\theta JC}$	1.4	°C/W

ELECTRICAL CHARACTERISTICS

Instantaneous Forward Voltage (Note 1.) @ I_F = 20 Amps, T_C = 25°C @ I_F = 20 Amps, T_C = 125°C @ I_F = 40 Amps, T_C = 25°C @ I_F = 40 Amps, T_C = 125°C	V_F	 0.70 0.60 0.80 0.75	Volts
Instantaneous Reverse Current (Note 1.) @ Rated DC Voltage, T_C = 25°C @ Rated DC Voltage, T_C = 100°C	I_R	 1.0 50	mA

1. Pulse Test: Pulse Width = 300 μs, Duty Cycle ≤ 2.0%

TYPICAL ELECTRICAL CHARACTERISTICS

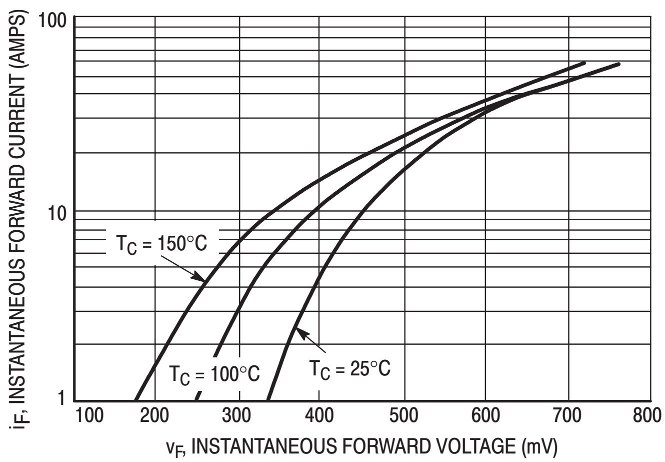

Figure 1. Typical Forward Voltage

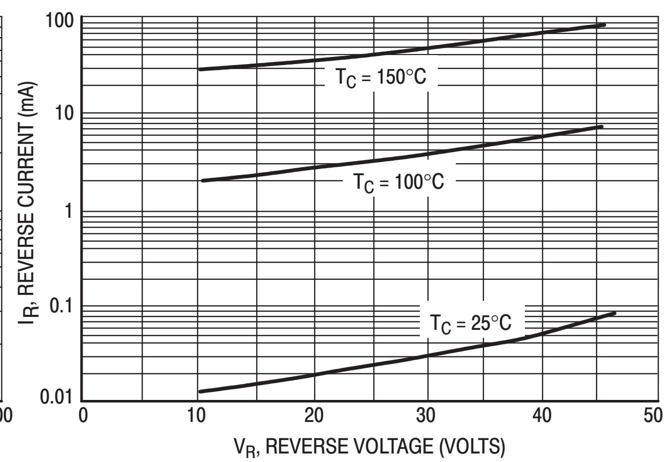

Figure 2. Typical Reverse Current

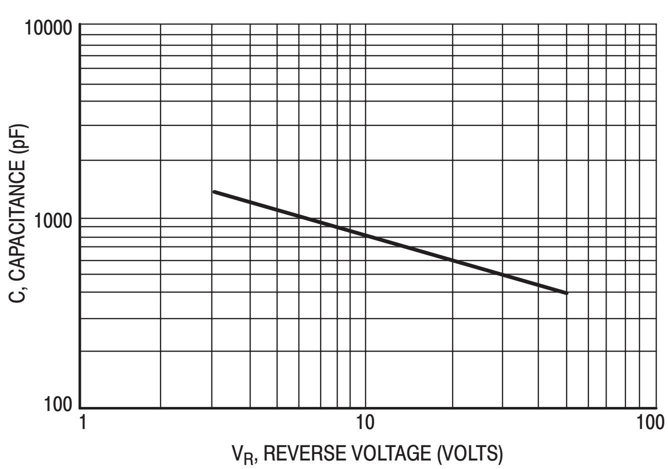

Figure 3. Typical Capacitance Per Leg

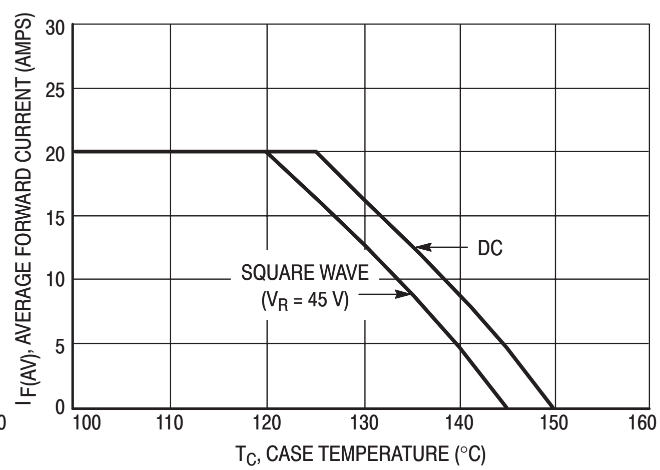

Figure 4. Current Derating Per Leg

MBR6045PT

SWITCHMODE™ Power Rectifier

The SWITCHMODE power rectifier employs the use of the Schottky Barrier principle with a Platinum barrier metal. This state-of-the-art device has the following features:

- Dual Diode Construction — Terminals 1 and 3 May Be Connected for Parallel Operation at Full Rating
- 45 Volt Blocking Voltage
- Low Forward Voltage Drop
- Guardring for Stress Protection and High dv/dt Capability (> 10 V/ns)
- 150°C Operating Junction Temperature

Mechanical Characteristics

- Case: Epoxy, Molded
- Weight: 4.3 grams (approximately)
- Finish: All External Surfaces Corrosion Resistant and Terminal Leads are Readily Solderable
- Lead Temperature for Soldering Purposes: 260°C Max. for 10 Seconds
- Shipped 30 Units Per Plastic Tube
- Marking: B6045

MAXIMUM RATINGS

Rating	Symbol	Max	Unit
Peak Repetitive Reverse Voltage Working Peak Reverse Voltage DC Blocking Voltage	V_{RRM} V_{RWM} V_R	45	V
Average Rectified Forward Current (Rated V_R, T_C = 125°C) Per Diode Per Device	$I_{F(AV)}$	 30 60	A
Peak Repetitive Forward Current, (Rated V_R, Square Wave, 20 kHz @ T_C = 90°C) Per Diode	I_{FRM}	60	A
Non–Repetitive Peak Surge Current (Surge Applied at Rated Load Conditions Halfwave, Single Phase, 60 Hz)	I_{FSM}	500	A
Peak Repetitive Reverse Current (2.0 μs, 1.0 kHz)	I_{RRM}	2.0	A
Storage Temperature Range	T_{stg}	–65 to +175	°C
Operating Junction Temperature	T_J	–65 to +150	°C
Peak Surge Junction Temperature (Forward Current Applied)	$T_{J(pk)}$	175	°C
Voltage Rate of Change	dv/dt	10,000	V/μs

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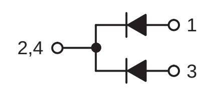
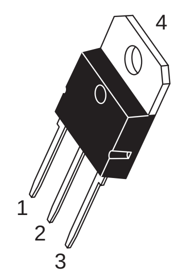
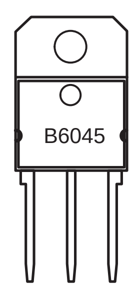
SCHOTTKY BARRIER RECTIFIER
60 AMPERES
45 VOLTS





SOT–93
CASE 340D
STYLE 2

MARKING DIAGRAM



B6045 = Device Code

ORDERING INFORMATION

Device	Package	Shipping
MBR6045PT	SOT–93	30 Units/Rail

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THERMAL CHARACTERISTICS

Rating	Symbol	Max	Unit
Thermal Resistance — Junction to Case	$R_{\theta JC}$	1.0	°C/W

ELECTRICAL CHARACTERISTICS

Instantaneous Forward Voltage (Note 1.) @ I_F = 30 Amps, T_C = 25°C @ I_F = 30 Amps, T_C = 125°C @ I_F = 60 Amps, T_C = 25°C	V_F	 0.62 0.55 0.75	Volts
Instantaneous Reverse Current (Note 1.) @ Rated DC Voltage, T_C = 25°C @ Rated DC Voltage, T_C = 100°C	I_R	 1.0 50	mA

1. Pulse Test: Pulse Width = 300 μs, Duty Cycle ≤ 2.0%

TYPICAL ELECTRICAL CHARACTERISTICS

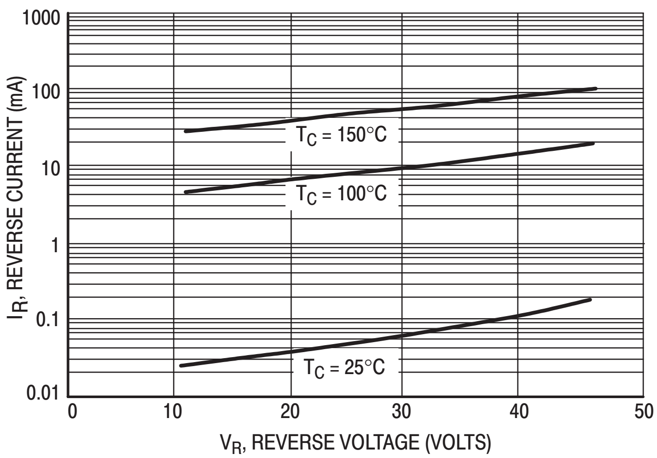

Figure 1. Typical Reverse Current

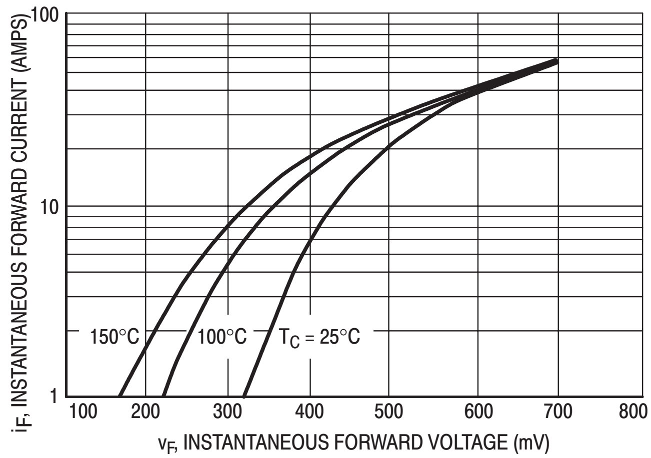

Figure 2. Typical Forward Voltage

MBR5025L

Preferred Device

SWITCHMODE™ Power Rectifier

The SWITCHMODE power rectifier employs the use of the Schottky Barrier principle with a Platinum barrier metal. This state-of-the-art device has the following features:

- Very Low Forward Voltage Drop (Max 0.58 V @ 100°C)
- Guardring for Stress Protection and High dv/dt Capability (> 10 V/ns)
- 150°C Operating Junction Temperature
- Specially Designed for SWITCHMODE Power Supplies with Operating Frequency up to 300 kHz

Mechanical Characteristics

- Case: Epoxy, Molded
- Weight: 4.3 grams (approximately)
- Finish: All External Surfaces Corrosion Resistant and Terminal Leads are Readily Solderable
- Lead Temperature for Soldering Purposes: 260°C Max. for 10 Seconds
- Shipped 30 Units Per Plastic Tube
- Marking: B5025L

MAXIMUM RATINGS

Rating	Symbol	Max	Unit
Peak Repetitive Reverse Voltage Working Peak Reverse Voltage DC Blocking Voltage	V_{RRM} V_{RWM} V_R	25	V
Average Rectified Forward Current T_C = 125°C	$I_{F(AV)}$	50	A
Peak Repetitive Forward Current, (Rated V_R, Square Wave, 20 kHz @ T_C = 90°C) Per Diode	I_{FRM}	150	A
Non–Repetitive Peak Surge Current (Surge Applied at Rated Load Conditions Halfwave, Single Phase, 60 Hz)	I_{FSM}	300	A
Peak Repetitive Reverse Current (2.0 µs, 1.0 kHz)	I_{RRM}	2.0	A
Storage Temperature Range	T_{stg}	–65 to +175	°C
Operating Junction Temperature	T_J	–65 to +150	°C
Peak Surge Junction Temperature (Forward Current Applied)	$T_{J(pk)}$	175	°C
Voltage Rate of Change	dv/dt	10,000	V/µs

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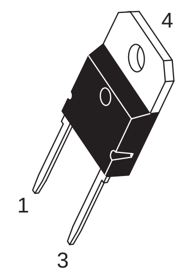
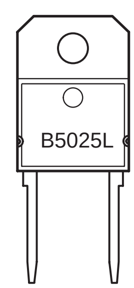
SCHOTTKY BARRIER RECTIFIER
LOW V_F
50 AMPERES
25 VOLTS



TO–218
CASE 340E
STYLE 1

MARKING DIAGRAM



B5025L = Device Code

ORDERING INFORMATION

Device	Package	Shipping
MBR5025L	TO–218	30 Units/Rail

Preferred devices are recommended choices for future use and best overall value.

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THERMAL CHARACTERISTICS

Rating	Symbol	Max	Unit
Thermal Resistance — Junction to Case	$R_{\theta JC}$	0.75	°C/W

ELECTRICAL CHARACTERISTICS

Instantaneous Forward Voltage (Note 1.) @ I_F = 50 Amps, T_C = 25°C @ I_F = 50 Amps, T_C = 125°C @ I_F = 30 Amps, T_C = 25°C	V_F	 0.62 0.58 0.54	Volts
Instantaneous Reverse Current (Note 1.) @ Rated DC Voltage, T_C = 25°C @ Rated DC Voltage, T_C = 100°C	I_R	 0.5 60	mA

1. Pulse Test: Pulse Width = 300 μs, Duty Cycle ≤ 2.0%

TYPICAL ELECTRICAL CHARACTERISTICS

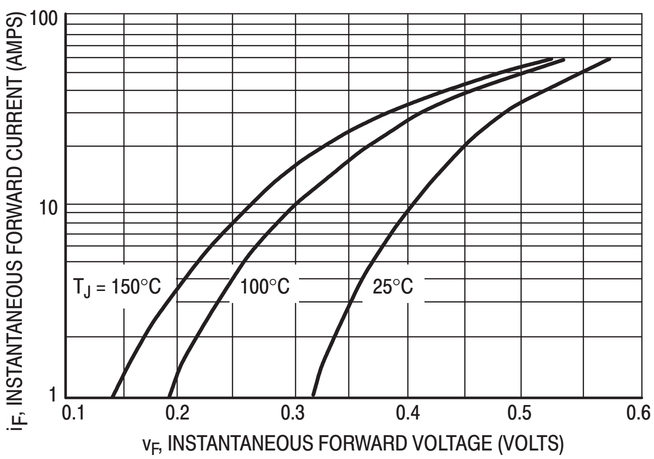

Figure 1. Typical Forward Voltage

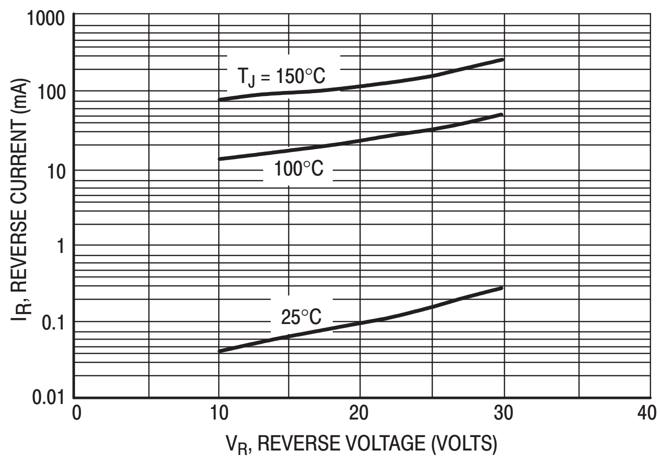

Figure 2. Typical Reverse Current

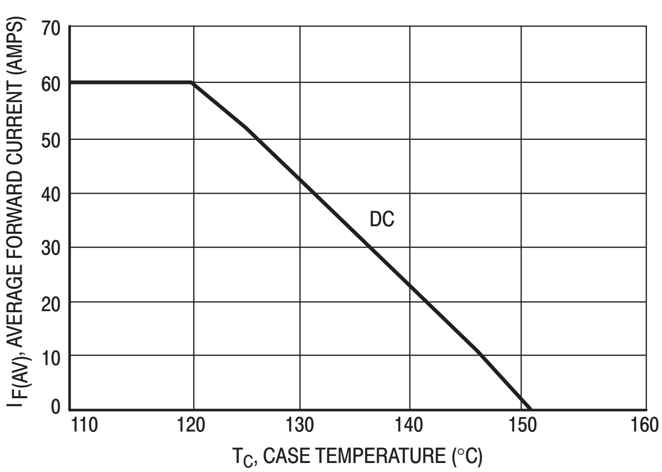

Figure 3. Current Derating, Case

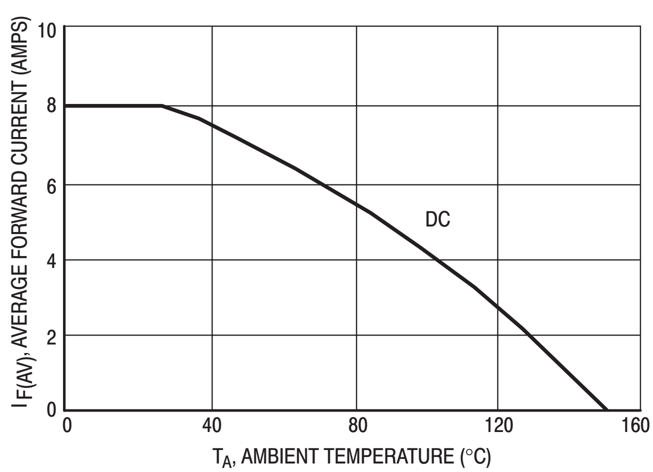

Figure 4. Current Derating, Ambient

MBR3045WT

Preferred Device

SWITCHMODE™ Power Rectifier

. . . using the Schottky Barrier principle with a platinum barrier metal. These state–of–the–art devices have the following features:

- Dual Diode Construction — Terminals 1 and 3 may be Connected for Parallel Operation at Full Rating
- Guardring for Stress Protection
- Low Forward Voltage
- 150°C Operating Junction Temperature
- Popular TO–247 Package

Mechanical Characteristics:
- Case: Epoxy, Molded
- Weight: 4.3 grams (approximately)
- Finish: All External Surfaces Corrosion Resistant and Terminal Leads are Readily Solderable
- Lead Temperature for Soldering Purposes: 260°C Max. for 10 Seconds
- Shipped 30 units per plastic tube
- Marking: B3045

MAXIMUM RATINGS

Rating	Symbol	Max	Unit
Peak Repetitive Reverse Voltage Working Peak Reverse Voltage DC Blocking Voltage	V_{RRM} V_{RWM} V_R	45	V
Average Rectified Forward Current (Rated V_R, T_C = 105°C) Per Device Per Diode	$I_{F(AV)}$	 30 15	A
Peak Repetitive Forward Current, (Rated V_R, Square Wave, 20 kHz) Per Diode	I_{FRM}	30	A
Non–Repetitive Peak Surge Current (Surge Applied at Rated Load Conditions Halfwave, Single Phase, 60 Hz)	I_{FSM}	200	A
Peak Repetitive Reverse Current (2.0 μs, 1.0 kHz) Per Diode See Figure 6.	I_{RRM}	2.0	A
Storage Temperature Range	T_{stg}	–65 to +175	°C
Operating Junction Temperature	T_J	–65 to +150	°C
Peak Surge Junction Temperature (Forward Current Applied)	$T_{J(pk)}$	175	°C
Voltage Rate of Change (Rated V_R)	dv/dt	10,000	V/μs

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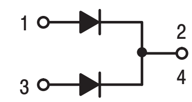
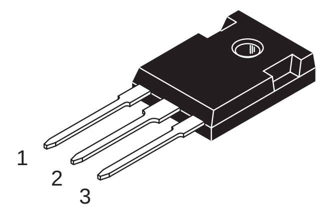
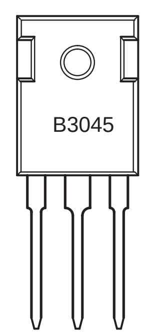
SCHOTTKY BARRIER RECTIFIER
30 AMPERES
45 VOLTS





TO–247
CASE 340L
PLASTIC

MARKING DIAGRAM



B3045 = Device Code

ORDERING INFORMATION

Device	Package	Shipping
MBR3045WT	TO–247	30 Units/Rail

Preferred devices are recommended choices for future use and best overall value.

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THERMAL CHARACTERISTICS (Per Diode)

Rating	Symbol	Max	Unit
Thermal Resistance — Junction to Case — Junction to Ambient	$R_{\theta JC}$ $R_{\theta JA}$	1.4 40	°C/W

ELECTRICAL CHARACTERISTICS (Per Diode)

Instantaneous Forward Voltage (Note 1.) (i_F = 20 Amps, T_C = 125°C) (i_F = 30 Amps, T_C = 125°C) (i_F = 30 Amps, T_C = 25°C)	v_F	 0.6 0.72 0.76	Volts
Instantaneous Reverse Current (Note 1.) (Rated dc Voltage, T_C = 125°C) (Rated dc Voltage, T_C = 25°C)	i_R	 100 1.0	mA

1. Pulse Test: Pulse Width = 300 μs, Duty Cycle ≤ 2.0%.

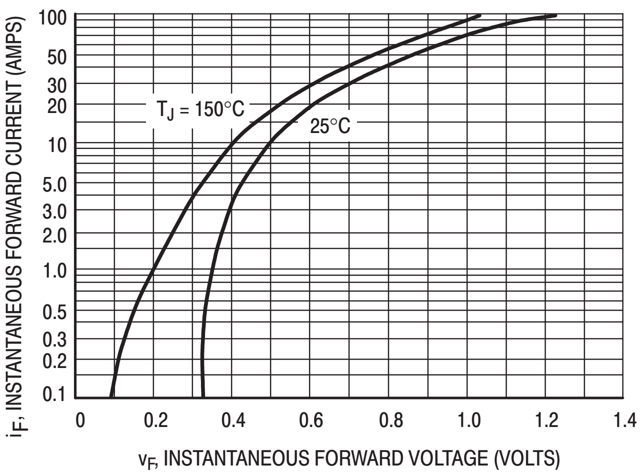

Figure 1. Typical Forward Voltage

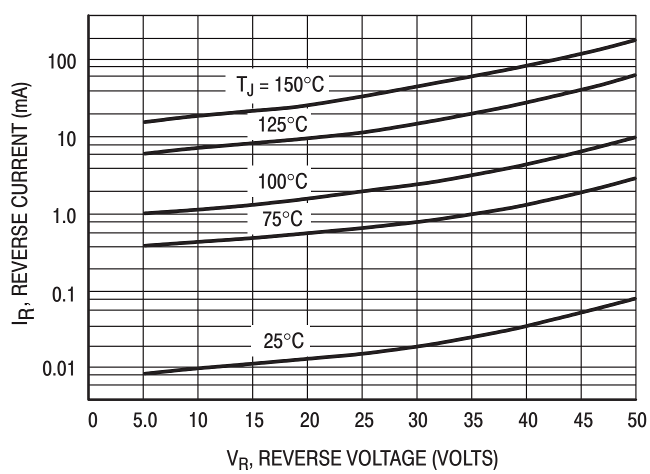

Figure 2. Typical Reverse Current

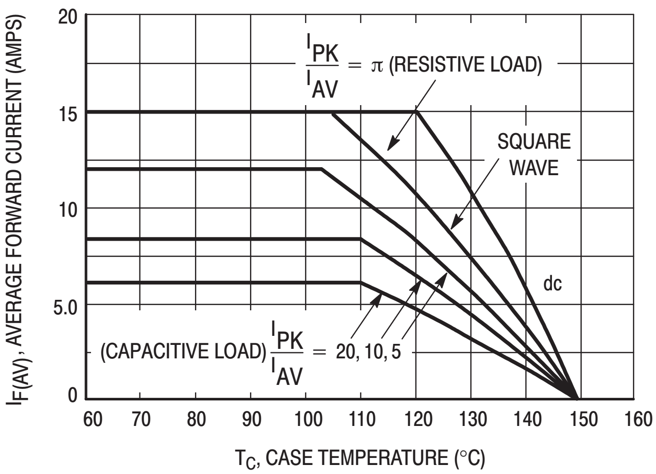

Figure 3. Current Derating (Per Leg)

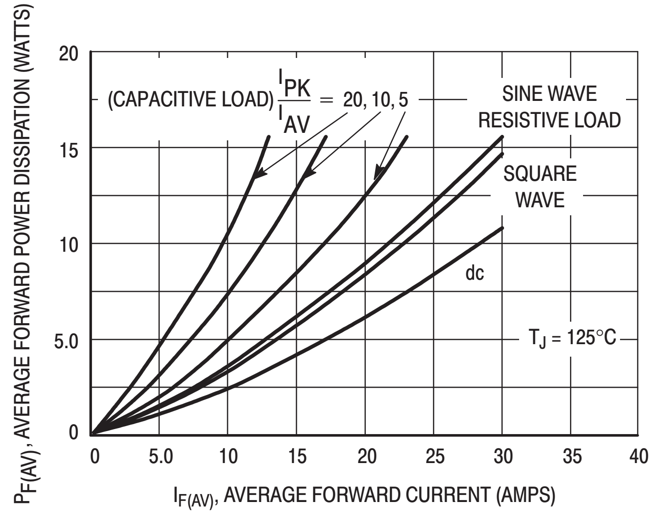

Figure 4. Forward Power Dissipation (Per Leg)

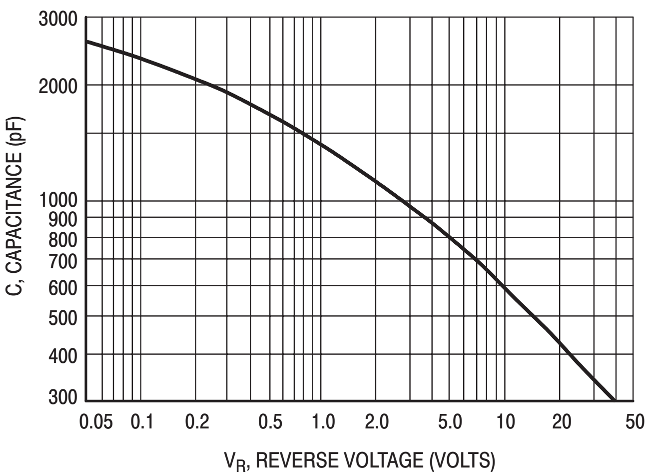

Figure 5. Capacitance

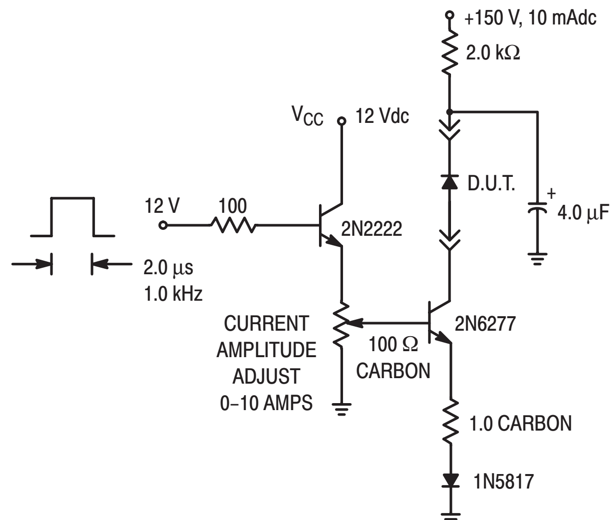

Figure 6. Test Circuit for Repetitive Reverse Current

MBR4015LWT

SWITCHMODE™ Schottky Power Rectifier

TO247 Power Package

. . . employing the Schottky Barrier principle in a large area metal–to–silicon power rectifier. Features epitaxial construction with oxide passivation and metal overlay contact. Ideally suited for low voltage, high frequency switching power supplies; free wheeling diodes and polarity protection diodes.

- Highly Stable Oxide Passivated Junction
- Guardring for Over–Voltage Protection
- Low Forward Voltage Drop
- Monolithic Dual Die Construction. May Be Paralleled for High Current Output.
- Full Electrical Isolation without Additional Hardware

Mechanical Characteristics:

- Case: Molded Epoxy
- Epoxy Meets UL94, V_O at 1/8″
- Weight: 4.3 grams (approximately)
- Finish: All External Surfaces Corrosion Resistant and Terminal Leads are Readily Solderable
- Lead and Mounting Surface Temperature for Soldering Purposes: 260°C Max. for 10 Seconds
- Shipped in 30 Units Per Plastic Tube
- Marking: B4015L

MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Peak Repetitive Reverse Voltage Working Peak Reverse Voltage DC Blocking Voltage	V_{RRM} V_{RWM} V_R	15	V
Average Rectified Forward Current (At Rated V_R, T_C = 95°C) Per Leg Per Package	I_O	20 40	A
Peak Repetitive Forward Current, (At Rated V_R, Square Wave, 20 kHz, T_C = 95°C) Per Leg	I_{FRM}	40	A
Non–Repetitive Peak Surge Current (Surge Applied at Rated Load Conditions Halfwave, Single Phase, 60 Hz) Per Package	I_{FSM}	120	A
Storage/Operating Case Temperature	T_{stg}, T_C	–55 to +100	°C
Operating Junction Temperature	T_J	–55 to +100	°C
Voltage Rate of Change (Rated V_R, T_J = 25°C)	dv/dt	10,000	V/μs

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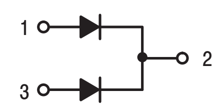
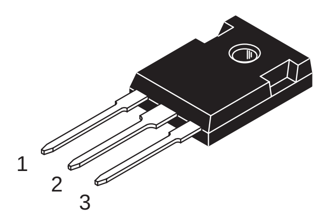
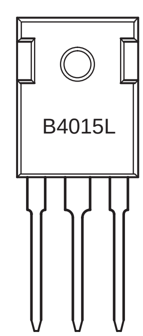
SCHOTTKY BARRIER RECTIFIER
40 AMPERES
15 VOLTS





TO–247
CASE 340L
STYLE 2

MARKING DIAGRAM



B4015L = Device Code

ORDERING INFORMATION

Device	Package	Shipping
MBR4015LWT	TO–247	30 Units/Rail

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THERMAL CHARACTERISTICS

Rating		Symbol	Value	Unit
Thermal Resistance — Junction–to–Case	Per Leg	$R_{\theta JC}$	0.57	°C/W
— Junction–to–Ambient	Per Leg	$R_{\theta JA}$	55	

ELECTRICAL CHARACTERISTICS

Maximum Instantaneous Forward Voltage (Note 1.), See Figure 2.	Per Leg	V_F	**T_J = 25°C**	**T_J = 100°C**	V
(I_F = 20 A)			0.42	0.36	
(I_F = 40 A)			0.50	0.48	
Maximum Instantaneous Reverse Current (Note 1.), See Figure 4.	Per Leg	I_R	**T_J = 25°C**	**T_J = 100°C**	mA
(V_R = 15 V)			5.0	530	
(V_R = 7.5 V)			2.7	370	

1. Pulse Test: Pulse Width ≤ 250 μs, Duty Cycle ≤ 2%.

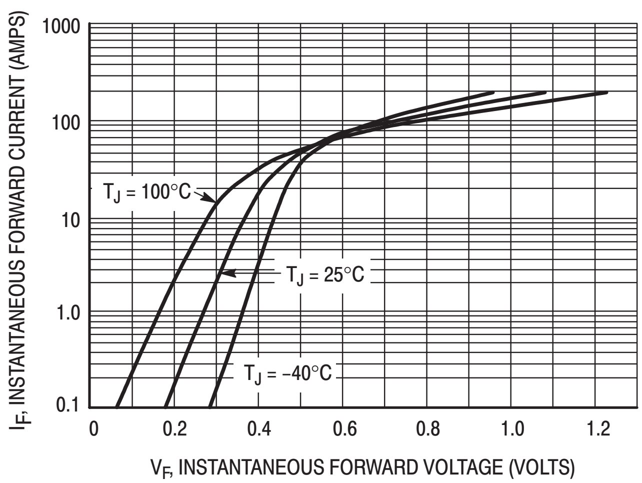

Figure 1. Typical Forward Voltage Per Leg

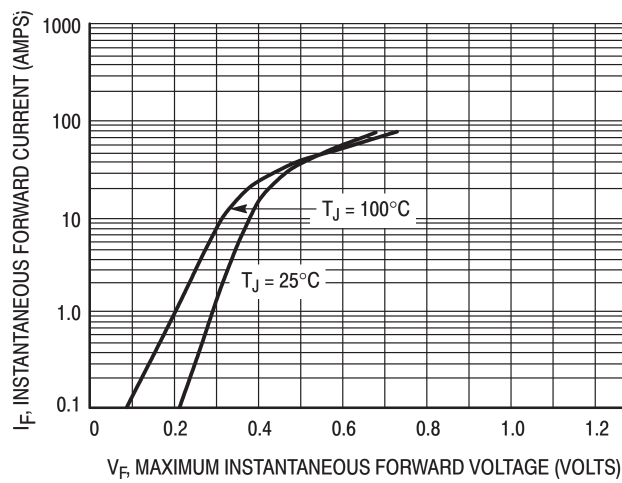

Figure 2. Maximum Forward Voltage Per Leg

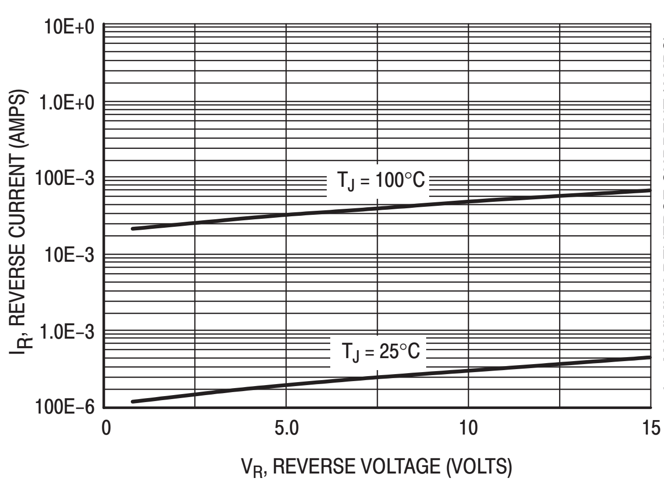

Figure 3. Typical Reverse Current Per Leg

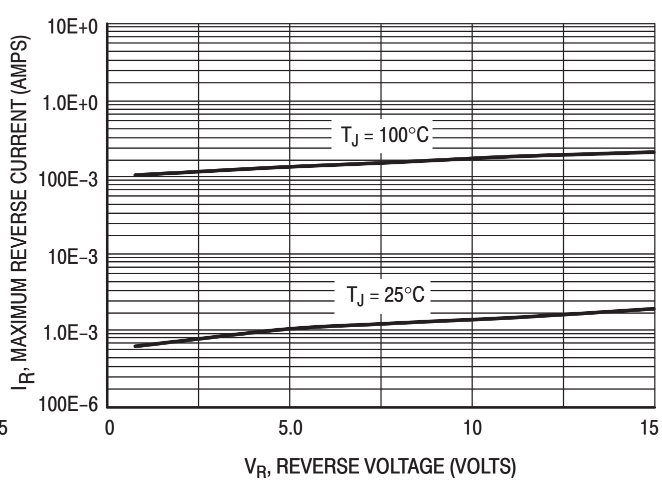

Figure 4. Maximum Reverse Current Per Leg

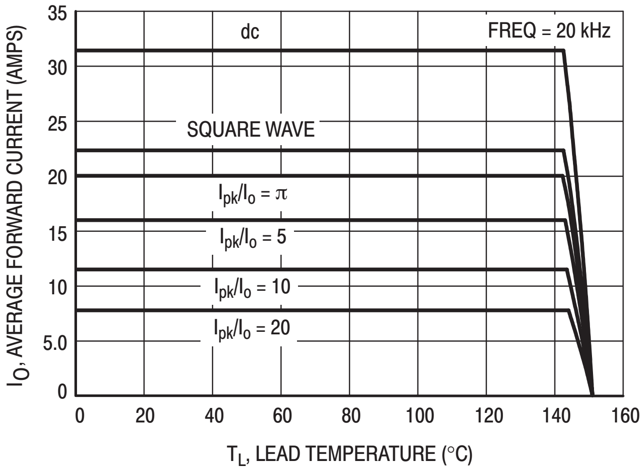

Figure 5. Current Derating Per Leg

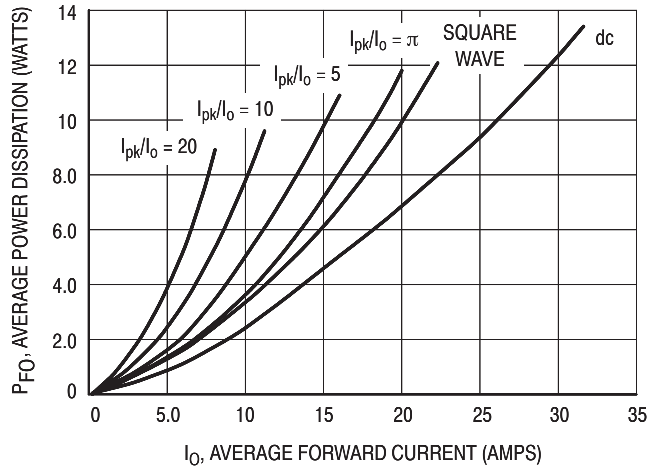

Figure 6. Forward Power Dissipation Per Leg

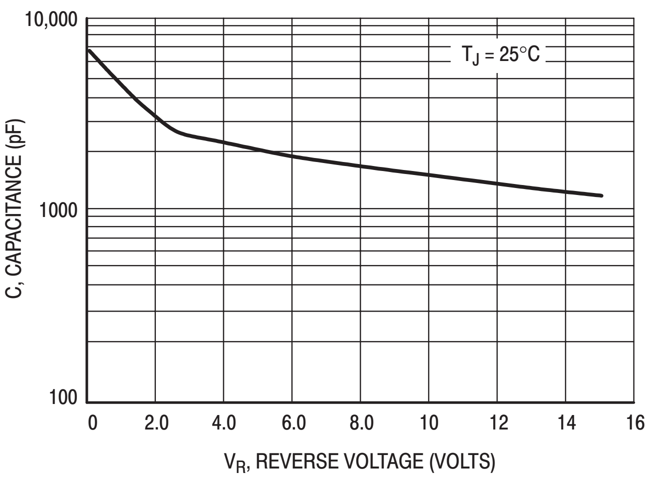

Figure 7. Capacitance Per Leg

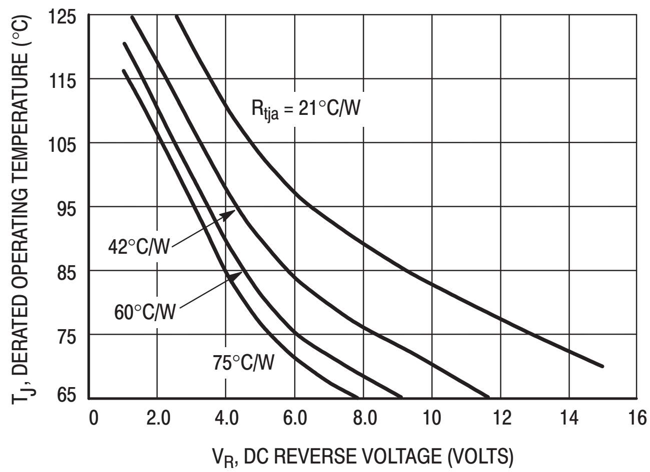

Figure 8. Typical Operating Temperature Derating Per Leg*

* Reverse power dissipation and the possibility of thermal runaway must be considered when operating this device under any reverse voltage conditions. Calculations of T_J therefore must include forward and reverse power effects. The allowable operating T_J may be calculated from the equation: $T_J = T_{Jmax} - r(t)(Pf + Pr)$ where
r(t) = thermal impedance under given conditions,
Pf = forward power dissipation, and
Pr = reverse power dissipation

This graph displays the derated allowable T_J due to reverse bias under DC conditions only and is calculated as $T_J = T_{Jmax} - r(t)Pr$, where r(t) = Rthja. For other power applications further calculations must be performed.

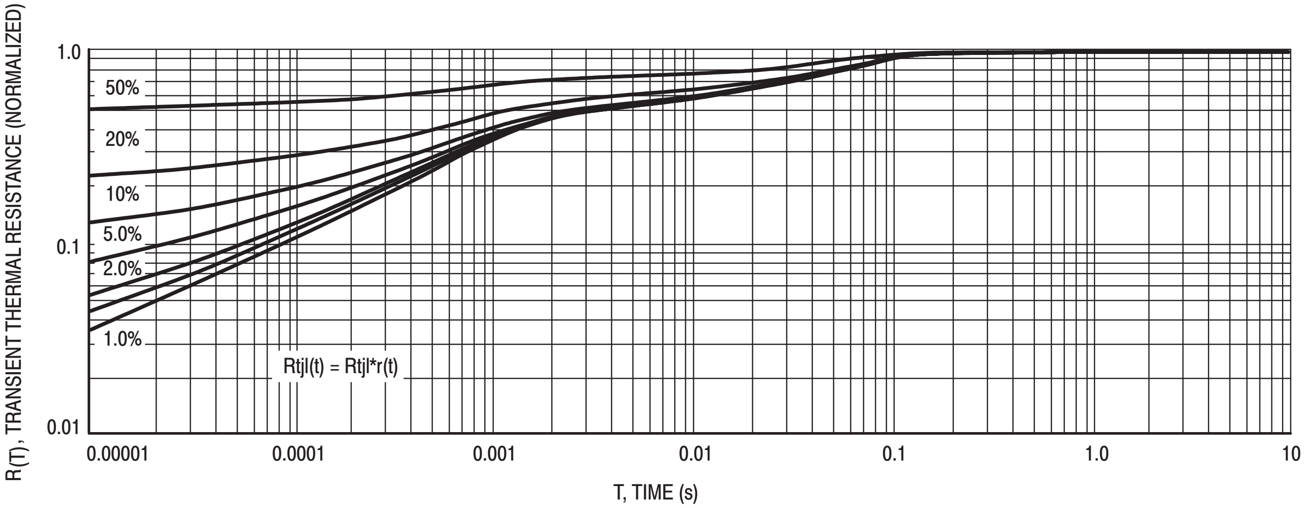

Figure 9. Thermal Response Junction to Lead (Per Leg)

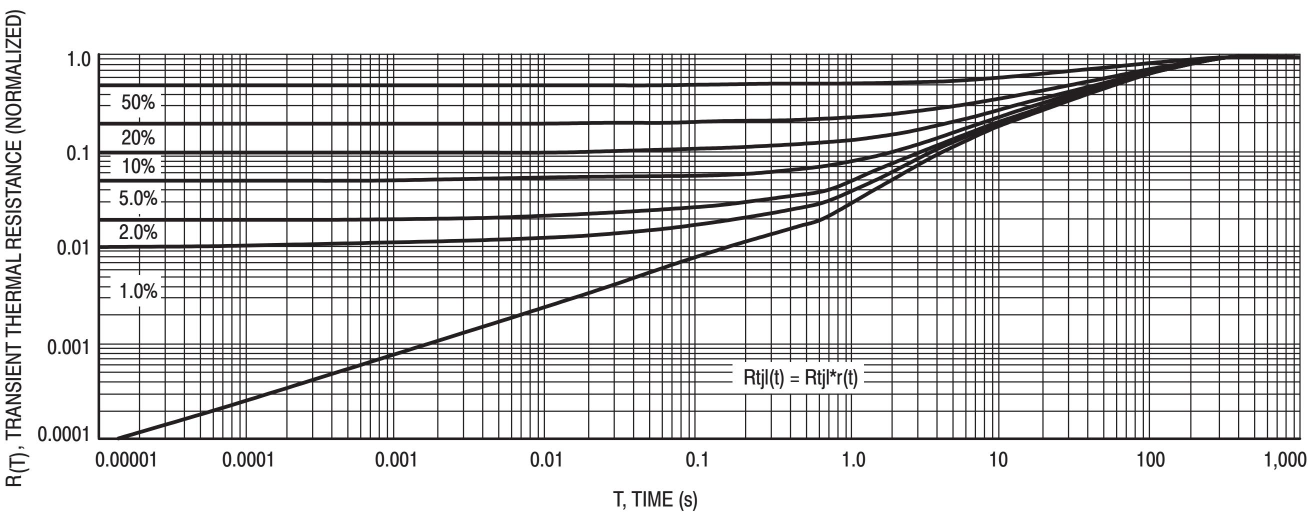

Figure 10. Thermal Response Junction to Ambient (Per Leg)

MBR4045WT

SWITCHMODE™ Power Rectifier

The SWITCHMODE power rectifier employs the use of the Schottky Barrier principle with a Platinum barrier metal. This state-of-the-art device has the following features:

- Dual Diode Construction — Terminals 1 and 3 May Be Connected for Parallel Operation at Full Rating
- 45 Volt Blocking Voltage
- Low Forward Voltage Drop
- Guardring for Stress Protection and High dv/dt Capability (> 10 V/ns)
- 150°C Operating Junction Temperature

Mechanical Characteristics

- Case: Epoxy, Molded
- Weight: 4.3 grams (approximately)
- Finish: All External Surfaces Corrosion Resistant and Terminal Leads are Readily Solderable
- Lead Temperature for Soldering Purposes: 260°C Max. for 10 Seconds
- Shipped 30 Units Per Plastic Tube
- Marking: B4045

MAXIMUM RATINGS

Rating	Symbol	Max	Unit
Peak Repetitive Reverse Voltage Working Peak Reverse Voltage DC Blocking Voltage	V_{RRM} V_{RWM} V_R	45	V
Average Rectified Forward Current (Rated V_R, T_C = 125°C) Per Diode Per Device	$I_{F(AV)}$	 20 40	A
Peak Repetitive Forward Current, (Rated V_R, Square Wave, 20 kHz, T_C = 90°C) Per Diode	I_{FRM}	40	A
Non–Repetitive Peak Surge Current (Surge Applied at Rated Load Conditions Halfwave, Single Phase, 60 Hz)	I_{FSM}	400	A
Peak Repetitive Reverse Current (2.0 μs, 1.0 kHz)	I_{RRM}	2.0	A
Storage Temperature Range	T_{stg}	–65 to +175	°C
Operating Junction Temperature	T_J	–65 to +150	°C
Peak Surge Junction Temperature (Forward Current Applied)	$T_{J(pk)}$	175	°C
Voltage Rate of Change	dv/dt	10,000	V/μs

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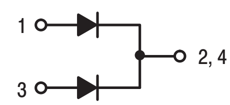
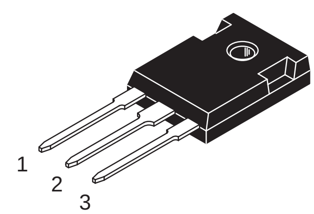
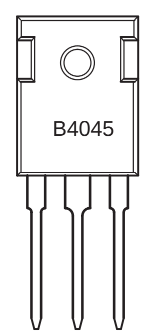
SCHOTTKY BARRIER RECTIFIER
40 AMPERES
45 VOLTS





TO–247AC
CASE 340L
STYLE 2

MARKING DIAGRAM



B4045 = Device Code

ORDERING INFORMATION

Device	Package	Shipping
MBR4045WT	TO–247	30 Units/Rail

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THERMAL CHARACTERISTICS (Per Diode)

Rating	Symbol	Max	Unit
Thermal Resistance — Junction to Case	$R_{\theta JC}$	1.4	°C/W

ELECTRICAL CHARACTERISTICS (Per Diode)

Instantaneous Forward Voltage (Note 1.) @ I_F = 20 Amps, T_C = 25°C @ I_F = 20 Amps, T_C = 125°C @ I_F = 40 Amps, T_C = 25°C @ I_F = 40 Amps, T_C = 125°C	V_F	 0.70 0.60 0.80 0.75	Volts
Instantaneous Reverse Current (Note 1.) @ Rated DC Voltage, T_C = 25°C @ Rated DC Voltage, T_C = 100°C	I_R	 1.0 50	mA

1. Pulse Test: Pulse Width = 300 μs, Duty Cycle < 2.0%

TYPICAL ELECTRICAL CHARACTERISTICS

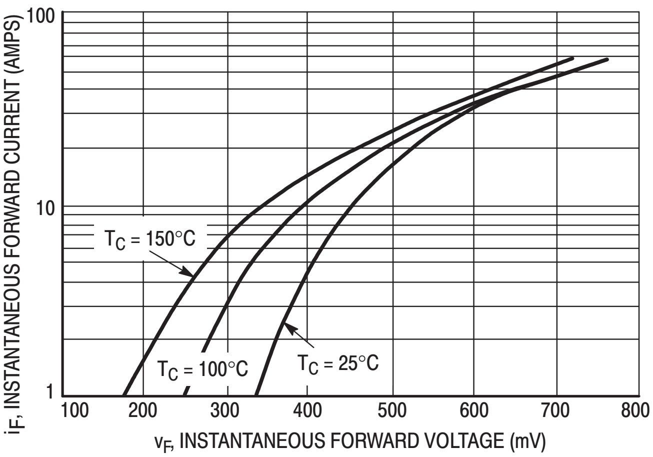

Figure 1. Typical Forward Voltage

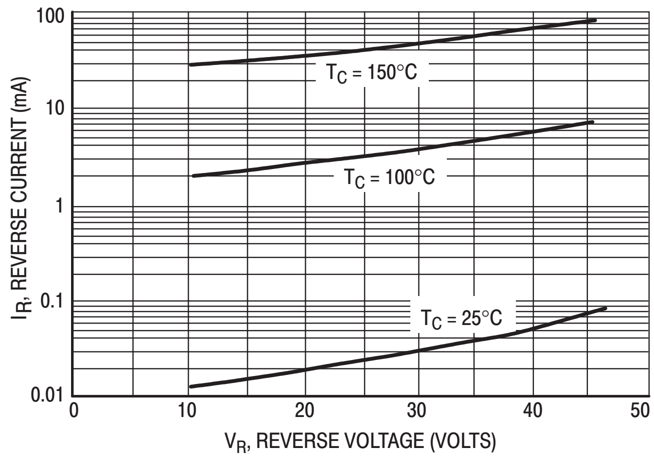

Figure 2. Typical Reverse Current

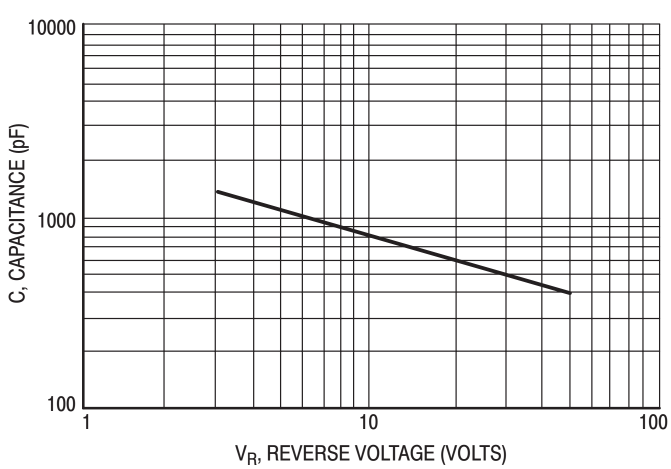

Figure 3. Typical Capacitance Per Leg

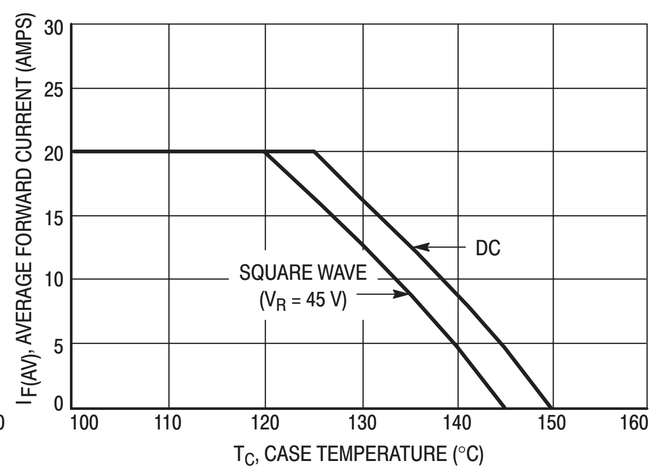

Figure 4. Current Derating Per Leg

MBR6045WT

SWITCHMODE™ Power Rectifier

The SWITCHMODE power rectifier employs the use of the Schottky Barrier principle with a Platinum barrier metal. This state-of-the-art device has the following features:

- Dual Diode Construction — Terminals 1 and 3 May Be Connected for Parallel Operation at Full Rating
- 45 Volt Blocking Voltage
- Low Forward Voltage Drop
- Guardring for Stress Protection and High dv/dt Capability (> 10 V/ns)
- 150°C Operating Junction Temperature

Mechanical Characteristics

- Case: Epoxy, Molded
- Weight: 4.3 grams (approximately)
- Finish: All External Surfaces Corrosion Resistant and Terminal Leads are Readily Solderable
- Lead Temperature for Soldering Purposes: 260°C Max. for 10 Seconds
- Shipped 30 Units Per Plastic Tube
- Marking: B6045

MAXIMUM RATINGS

Rating	Symbol	Max	Unit
Peak Repetitive Reverse Voltage Working Peak Reverse Voltage DC Blocking Voltage	V_{RRM} V_{RWM} V_R	45	V
Average Rectified Forward Current (Rated V_R, T_C = 125°C) Per Diode Per Device	$I_{F(AV)}$	 30 60	A
Peak Repetitive Forward Current, (Rated V_R, Square Wave, 20 kHz, T_C = 90°C) Per Diode	I_{FRM}	60	A
Non–Repetitive Peak Surge Current (Surge Applied at Rated Load Conditions Halfwave, Single Phase, 60 Hz)	I_{FSM}	500	A
Peak Repetitive Reverse Current (2.0 μs, 1.0 kHz)	I_{RRM}	2.0	A
Storage Temperature Range	T_{stg}	–65 to +175	°C
Operating Junction Temperature	T_J	–65 to +150	°C
Peak Surge Junction Temperature (Forward Current Applied)	$T_{J(pk)}$	175	°C
Voltage Rate of Change	dv/dt	10,000	V/μs

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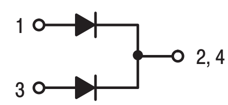
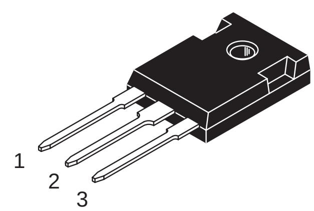
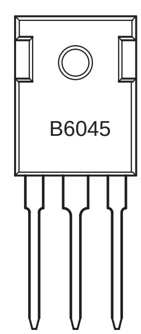
SCHOTTKY BARRIER RECTIFIER
60 AMPERES
45 VOLTS





TO–247AC
CASE 340L
STYLE 2

MARKING DIAGRAM



B6045 = Device Code

ORDERING INFORMATION

Device	Package	Shipping
MBR6045WT	TO–247	30 Units/Rail

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THERMAL CHARACTERISTICS (Per Diode)

Rating	Symbol	Max	Unit
Thermal Resistance — Junction to Case	$R_{\theta JC}$	1.0	°C/W

ELECTRICAL CHARACTERISTICS (Per Diode)

Instantaneous Forward Voltage (Note 1.) @ I_F = 30 Amps, T_C = 25°C @ I_F = 30 Amps, T_C = 125°C @ I_F = 60 Amps, T_C = 25°C	V_F	 0.62 0.55 0.75	Volts
Instantaneous Reverse Current (Note 1.) @ Rated DC Voltage, T_C = 25°C @ Rated DC Voltage, T_C = 100°C	I_R	 1.0 50	mA

1. Pulse Test: Pulse Width = 300 µs, Duty Cycle < 2.0%

TYPICAL ELECTRICAL CHARACTERISTICS

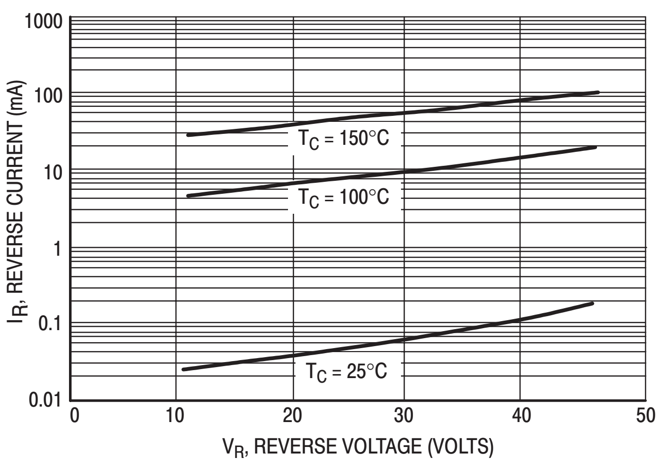

Figure 1. Typical Reverse Current

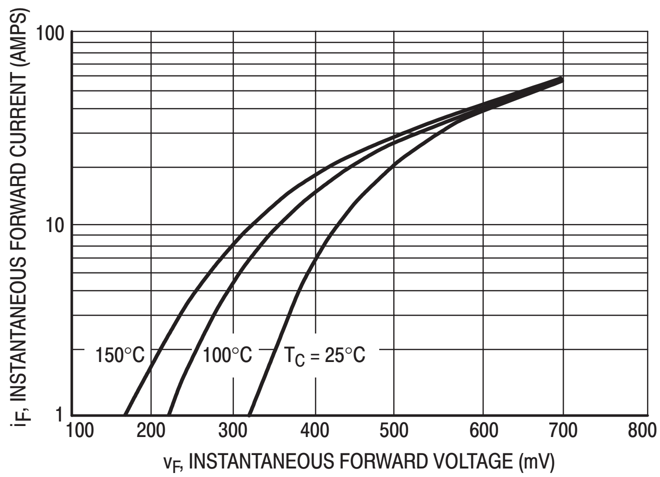

Figure 2. Typical Forward Voltage

MBRP20030CTL

Preferred Device

POWERTAP™ II SWITCHMODE™ Power Rectifier

The SWITCHMODE Power Rectifier uses the Schottky Barrier principle with a platinum barrier metal. This state–of–the–art device has the following features:

- Dual Diode Construction — May Be Paralleled for Higher Current Output
- Guardring for Stress Protection
- Low Forward Voltage Drop
- 150°C Operating Junction Temperature
- Recyclable Epoxy
- Guaranteed Reverse Avalanche Energy Capability
- Improved Mechanical Ratings

Mechanical Characteristics

- Case: Epoxy, Molded with metal heatsink base
- Weight: 80 grams (approximately)
- Finish: All External Surfaces Corrosion Resistant
- Top Terminal Torque: 25–40 lb–in max
- Base Plate Torques: See procedure given in the Package Outline Section
- Shipped 25 units per foam
- Marking: B20030L

MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Peak Repetitive Reverse Voltage Working Peak Reverse Voltage DC Blocking Voltage	V_{RRM} V_{RWM} V_R	30	V
Average Rectified Forward Current (At Rated V_R, T_C = 125°C) Per Leg Per Device	$I_{F(AV)}$	100 200	A
Peak Repetitive Forward Current, (At Rated V_R, Square Wave, 20 kHz, T_C = 100°C)	I_{FRM}	200	A
Non–Repetitive Peak Surge Current (Surge Applied at Rated Load Conditions Halfwave, Single Phase, 60 Hz)	I_{FSM}	1500	A
Peak Repetitive Reverse Surge Current (2.0 μs, 1.0 kHz)	I_{RRM}	2.0	A
Storage Temperature Range	T_{stg}	–55 to +150	°C
Operating Junction Temperature	T_J	–55 to +150	°C
Voltage Rate of Change (Rated V_R)	dv/dt	10,000	V/μs

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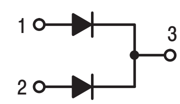
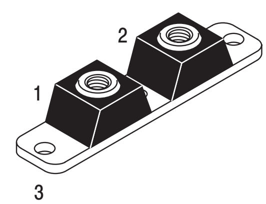
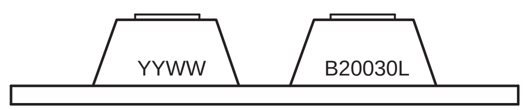
LOW V_F SCHOTTKY BARRIER RECTIFIER 200 AMPERES 30 VOLTS





POWERTAP II
CASE 357C
PLASTIC

MARKING DIAGRAM



B20030L = Device Code
YY = Year
WW = Work Week

ORDERING INFORMATION

Device	Package	Shipping
MBRP20030CTL	POWERTAP II	25 Units/Tray

Preferred devices are recommended choices for future use and best overall value.

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THERMAL CHARACTERISTICS

Rating	Symbol	Value	Unit
Thermal Resistance — Junction to Case	$R_{\theta JC}$	0.45	°C/W

ELECTRICAL CHARACTERISTICS

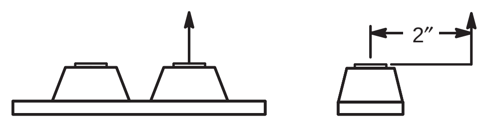
Maximum Instantaneous Forward Voltage (Note 1.) (I_F = 200 Amps, T_C = +125°C) (I_F = 200 Amps, T_C = +25°C)	V_F	 0.52 0.60	Volts
Maximum Instantaneous Reverse Current (Note 1.) (Rated dc Voltage, T_C = +25°C)	I_R	5.0	mA

1. Pulse Test: Pulse Width = 300 μs, Duty Cycle ≤ 2%.

MAXIMUM MECHANICAL RATINGS

Terminal Penetration:	0.235 max
Terminal Torque:	25–40 in-lb max
Mounting Torque — Outside Holes:	30–40 in-lb max
Mounting Torque — Center Hole:	8–10 in-lb max
Seating Plane Flatness	1 mil per in. (between mounting holes)

POWERTAP MECHANICAL DATA APPLIES OVER OPERATING TEMPERATURE



Vertical Pull
250 lbs. max

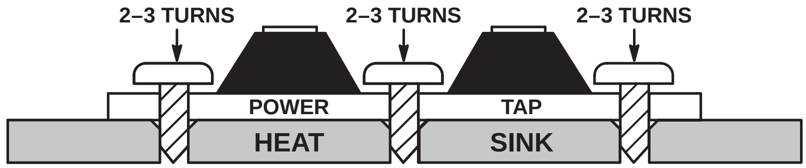
2 in. Lever Pull
50 lbs. max

Note: While the POWERTAP is capable of sustaining these vertical and levered tensions, the intimate contact between POWERTAP and heat sink may be lost. This could lead to thermal runaway. The use of very flexible leads is recommended for the anode connections. Use of thermal grease is highly recommended.

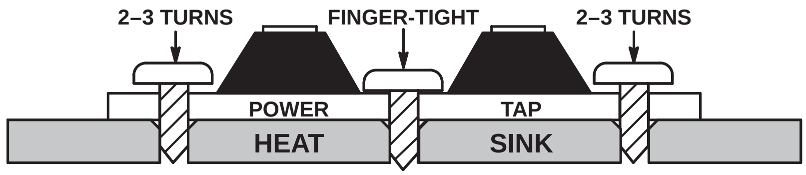
MOUNTING PROCEDURE

The POWERTAP package requires special mounting considerations because of the long longitudinal axis of the copper heat sink. It is important to follow the proper tightening sequence to avoid warping the heat sink, which can reduce thermal contact between the POWERTAP and heat sink.

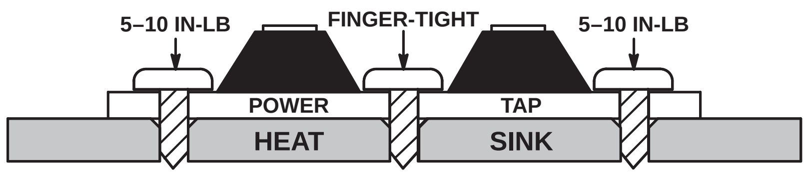
STEP 1:
Locate the POWERTAP on the heat sink and start mounting bolts into the threads by hand (2 or 3 turns).



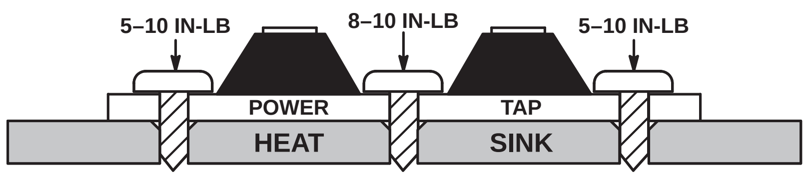
STEP 2:
Finger tighten the center bolt. The bolt may catch on the threads of the heat sink so it is important to make sure the face of the bolt or washer is in contact with the surface of the POWERTAP.



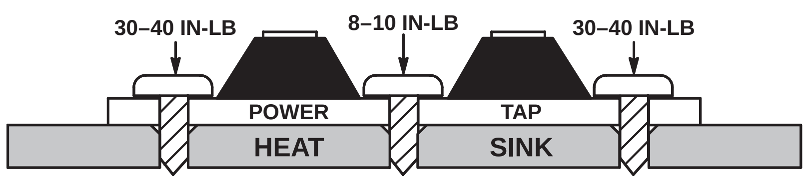
STEP 3:
Tighten each of the end bolts between 5 to 10 in-lb.



STEP 4:
Tighten the center bolt between 8 to 10 in-lb.



STEP 5:
Finally, tighten the end bolts between 30 to 40 in-lb.



MBRP40030CTL

Preferred Device

POWERTAP™ II SWITCHMODE™ Power Rectifier

The SWITCHMODE Power Rectifier uses the Schottky Barrier principle with a platinum barrier metal. This state-of-the-art device has the following features:

- Dual Diode Construction – May Be Paralleled for Higher Current Output
- Guardring for Stress Protection
- Low Forward Voltage Drop
- 150°C Operating Junction Temperature
- Recyclable Epoxy
- Improved Mechanical Ratings

Mechanical Characteristics

- Case: Epoxy, Molded with metal heatsink base
- Weight: 80 grams (approximately)
- Finish: All External Surfaces Corrosion Resistant
- Top Terminal Torque: 25–40 lb–in max
- Base Plate Torques: See procedure given in the Package Outline Section
- Shipped 25 units per foam
- Marking: B40030L

MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Peak Repetitive Reverse Voltage Working Peak Reverse Voltage DC Blocking Voltage	V_{RRM} V_{RWM} V_R	30	V
Average Rectified Forward Current (At Rated V_R, T_C = 100°C) Per Leg Per Device	$I_{F(AV)}$	200 400	A
Peak Repetitive Forward Current, (At Rated V_R, Square Wave, 20 kHz, T_C = 100°C)	I_{FRM}	200	A
Non–Repetitive Peak Surge Current (Surge Applied at Rated Load Conditions Halfwave, Single Phase, 60 Hz)	I_{FSM}	1500	A
Peak Repetitive Reverse Surge Current (2.0 μs, 1.0 kHz)	I_{RRM}	2.0	A
Storage Temperature Range	T_{stg}	–55 to +150	°C
Operating Junction Temperature	T_J	–55 to +150	°C
Voltage Rate of Change (Rated V_R)	dv/dt	10,000	V/μs

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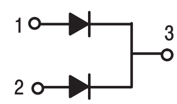
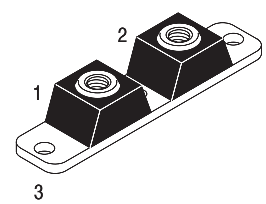
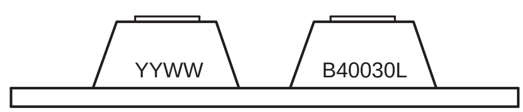
LOW V_F SCHOTTKY BARRIER RECTIFIER 400 AMPERES 30 VOLTS





POWERTAP II CASE 357C PLASTIC

MARKING DIAGRAM



B40030L = Device Code
YY = Year
WW = Work Week

ORDERING INFORMATION

Device	Package	Shipping
MBRP40030CTL	POWERTAP II	25 Units/Tray

Preferred devices are recommended choices for future use and best overall value.

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THERMAL CHARACTERISTICS

Characteristic	Symbol	Value	Unit
Thermal Resistance – Junction to Case (Note 1.)	$R_{\theta JC}$	0.4	°C/W

ELECTRICAL CHARACTERISTICS

Characteristic	Symbol	Value	Unit
Maximum Instantaneous Forward Voltage (Note 2.) (i_F = 200 Amps, T_C = +25°C) (i_F = 200 Amps, T_C = +100°C)	V_F	 0.5 0.41	Volts
Maximum Instantaneous Reverse Current (Note 2.) (Rated dc Voltage, T_C = +25°C) (Rated dc Voltage, T_C = +100°C)	I_R	 20 1000	mA

1. Rating applies when surface mounted on the minimum pad size recommended.
2. Pulse Test: Pulse Width = 300 μs, Duty Cycle ≤ 2%.

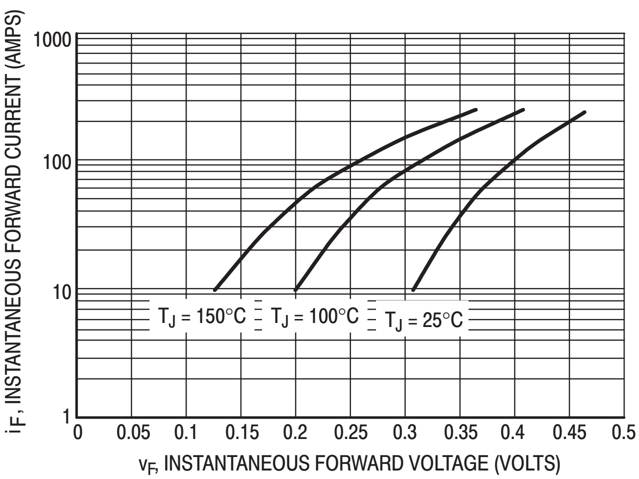


Figure 1. Typical Instantaneous Forward Voltage

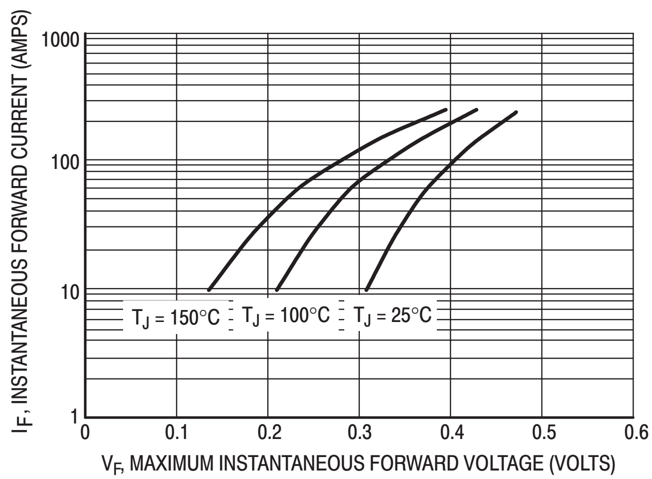


Figure 2. Maximum Instantaneous Forward Voltage

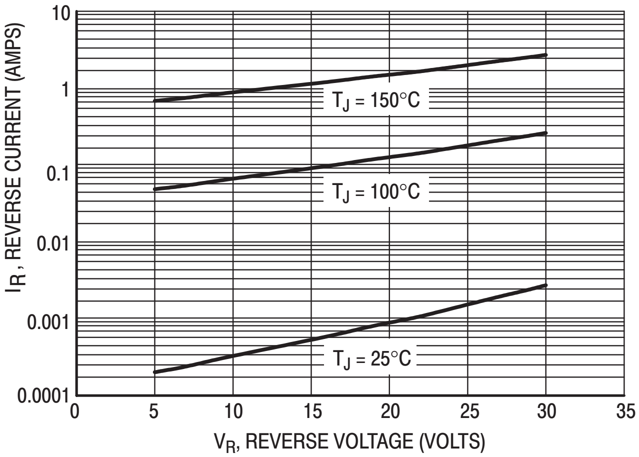


Figure 3. Typical Reverse Current

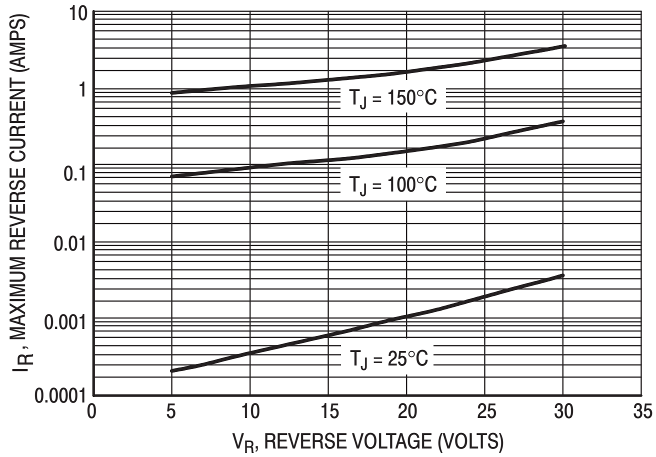


Figure 4. Maximum Reverse Current

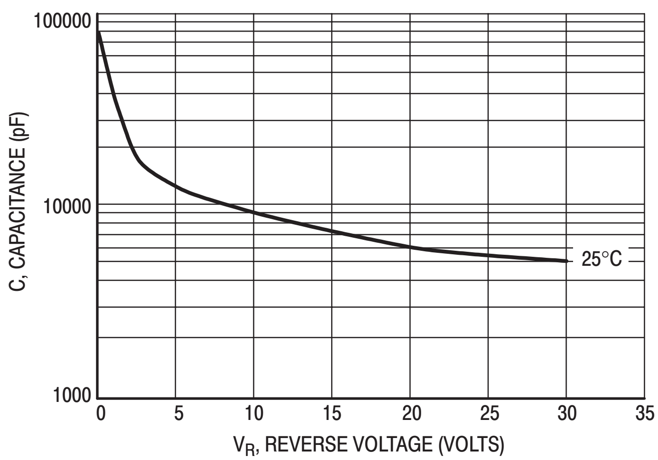
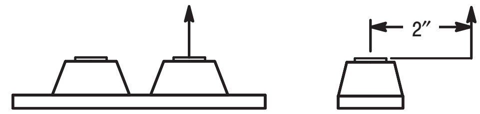


Figure 5. Typical Capacitance

MAXIMUM MECHANICAL RATINGS

Terminal Penetration:	0.235 max
Terminal Torque:	25–40 in-lb max
Mounting Torque – Outside Holes:	30–40 in-lb max
Mounting Torque – Center Hole:	8–10 in-lb max
Seating Plane Flatness	1 mil per in. (between mounting holes)

POWERTAP MECHANICAL DATA APPLIES OVER OPERATING TEMPERATURE



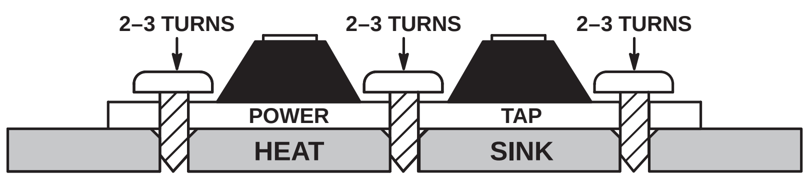
Vertical Pull 250 lbs. max **2 in. Lever Pull 50 lbs. max**

Note: While the POWERTAP is capable of sustaining these vertical and levered tensions, the intimate contact between POWERTAP and heat sink may be lost. This could lead to thermal runaway. The use of very flexible leads is recommended for the anode connections. Use of thermal grease is highly recommended.

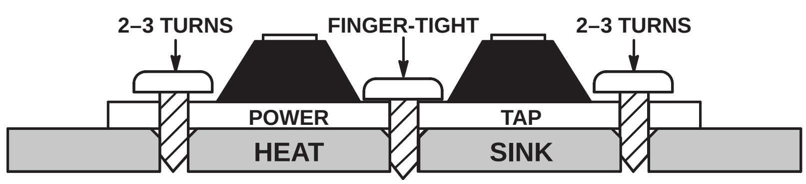
MOUNTING PROCEDURE

The POWERTAP package requires special mounting considerations because of the long longitudinal axis of the copper heat sink. It is important to follow the proper tightening sequence to avoid warping the heat sink, which can reduce thermal contact between the POWERTAP and heat sink.

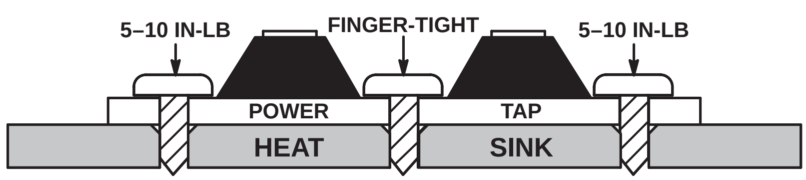
STEP 1:
Locate the POWERTAP on the heat sink and start mounting bolts into the threads by hand (2 or 3 turns).



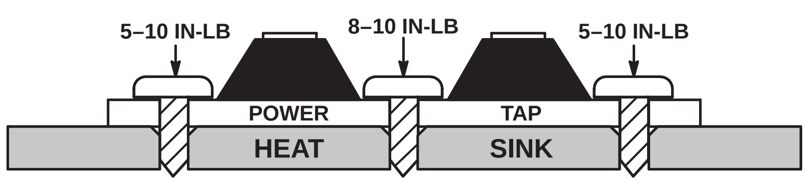
STEP 2:
Finger tighten the center bolt. The bolt may catch on the threads of the heat sink so it is important to make sure the face of the bolt or washer is in contact with the surface of the POWERTAP.



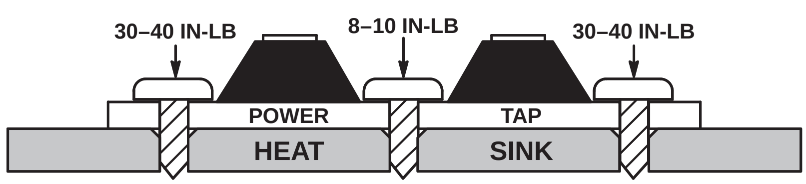
STEP 3:
Tighten each of the end bolts between 5 to 10 in-lb.



STEP 4:
Tighten the center bolt between 8 to 10 in-lb.



STEP 5:
Finally, tighten the end bolts between 30 to 40 in-lb.



MBRP60035CTL

Preferred Device

POWERTAP™ II SWITCHMODE™ Power Rectifier

The SWITCHMODE Power Rectifier uses the Schottky Barrier principle with a platinum barrier metal. This state-of-the-art device has the following features:

- Dual Diode Construction — May Be Paralleled for Higher Current Output
- Guardring for Stress Protection
- Low Forward Voltage Drop
- 150°C Operating Junction Temperature
- Recyclable Epoxy
- Guaranteed Reverse Avalanche Energy Capability
- Improved Mechanical Ratings

Mechanical Characteristics

- Case: Epoxy, Molded with metal heatsink base
- Weight: 80 grams (approximately)
- Finish: All External Surfaces Corrosion Resistant
- Top Terminal Torque: 25–40 lb–in max
- Base Plate Torques: See procedure given in the Package Outline Section
- Shipped 25 units per foam
- Marking: B60035L

MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Peak Repetitive Reverse Voltage Working Peak Reverse Voltage DC Blocking Voltage	V_{RRM} V_{RWM} V_R	35	V
Average Rectified Forward Current (At Rated V_R, T_C = 100°C) Per Leg Per Device	$I_{F(AV)}$	300 600	A
Peak Repetitive Forward Current, (At Rated V_R, Square Wave, 20 kHz, T_C = 100°C)	I_{FRM}	300	A
Non–Repetitive Peak Surge Current (Surge Applied at Rated Load Conditions Halfwave, Single Phase, 60 Hz)	I_{FSM}	4000	A
Peak Repetitive Reverse Surge Current (2.0 μs, 1.0 kHz)	I_{RRM}	2.0	A
Storage Temperature Range	T_{stg}	–55 to +150	°C
Operating Junction Temperature	T_J	–55 to +150	°C
Voltage Rate of Change (Rated V_R)	dv/dt	10,000	V/μs

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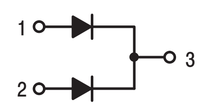
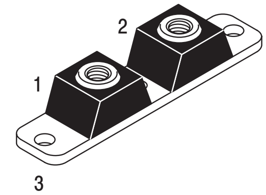
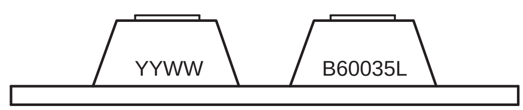
LOW V_F SCHOTTKY BARRIER RECTIFIER 600 AMPERES 35 VOLTS





POWERTAP II CASE 357C PLASTIC

MARKING DIAGRAM



B60035L = Device Code
YY = Year
WW = Work Week

ORDERING INFORMATION

Device	Package	Shipping
MBRP60035CTL	POWERTAP II	25 Units/Tray

Preferred devices are recommended choices for future use and best overall value.

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THERMAL CHARACTERISTICS

Rating	Symbol	Value	Unit
Thermal Resistance — Junction to Case	$R_{\theta JC}$	0.4	°C/W

ELECTRICAL CHARACTERISTICS

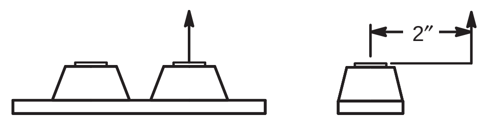
Maximum Instantaneous Forward Voltage (Note 1.) (i_F = 300 Amps, T_C = +25°C) (i_F = 300 Amps, T_C = +100°C)	V_F	 0.57 0.50	Volts
Maximum Instantaneous Reverse Current (Note 1.) (Rated dc Voltage, T_C = +25°C) (Rated dc Voltage, T_C = +100°C)	I_R	 10 250	mA

1. Pulse Test: Pulse Width = 300 μs, Duty Cycle ≤ 2%.

MAXIMUM MECHANICAL RATINGS

Terminal Penetration:	0.235 max
Terminal Torque:	25–40 in-lb max
Mounting Torque — Outside Holes:	30–40 in-lb max
Mounting Torque — Center Hole:	8–10 in-lb max
Seating Plane Flatness	1 mil per in. (between mounting holes)

POWERTAP MECHANICAL DATA APPLIES OVER OPERATING TEMPERATURE



Vertical Pull 250 lbs. max

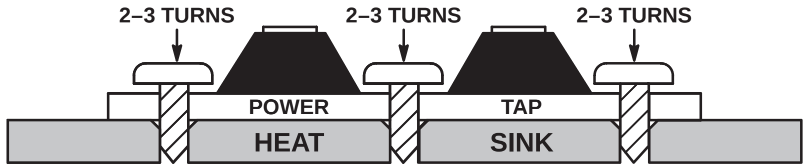
2 in. Lever Pull 50 lbs. max

Note: While the POWERTAP is capable of sustaining these vertical and levered tensions, the intimate contact between POWERTAP and heat sink may be lost. This could lead to thermal runaway. The use of very flexible leads is recommended for the anode connections. Use of thermal grease is highly recommended.

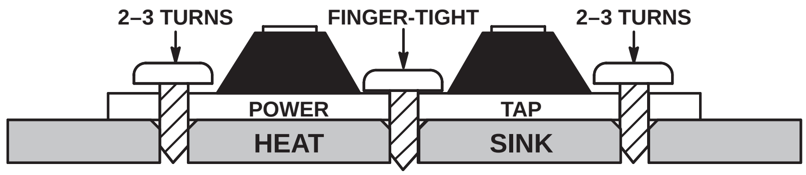
MOUNTING PROCEDURE

The POWERTAP package requires special mounting considerations because of the long longitudinal axis of the copper heat sink. It is important to follow the proper tightening sequence to avoid warping the heat sink, which can reduce thermal contact between the POWERTAP and heat sink.

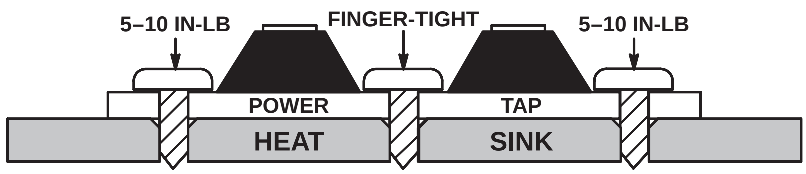
STEP 1:
Locate the POWERTAP on the heat sink and start mounting bolts into the threads by hand (2 or 3 turns).



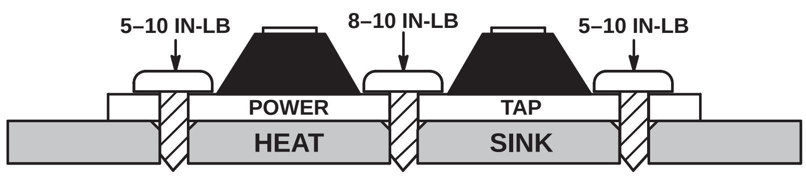
STEP 2:
Finger tighten the center bolt. The bolt may catch on the threads of the heat sink so it is important to make sure the face of the bolt or washer is in contact with the surface of the POWERTAP.



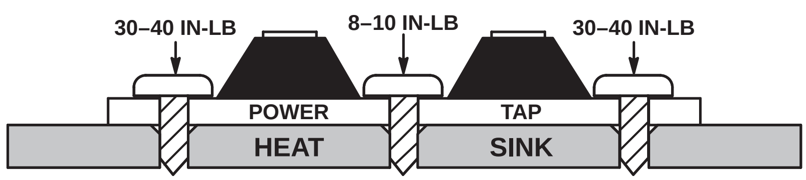
STEP 3:
Tighten each of the end bolts between 5 to 10 in-lb.



STEP 4:
Tighten the center bolt between 8 to 10 in-lb.



STEP 5:
Finally, tighten the end bolts between 30 to 40 in-lb.



MBRP20045CT

Preferred Device

POWERTAP™ II SWITCHMODE™ Power Rectifier

. . . using the Schottky Barrier principle with a platinum barrier metal. These state–of–the–art devices have the following features:

- Dual Diode Construction — May Be Paralleled for Higher Current Output
- Guardring for Stress Protection
- Low Forward Voltage
- 175°C Operating Junction Temperature
- Guaranteed Reverse Avalanche

Mechanical Characteristics:

- Case: Epoxy, Molded with metal heatsink base
- Weight: 80 grams (approximately)
- Finish: All External Surfaces Corrosion Resistant
- Top Terminal Torque: 25–40 lb–in max
- Base Plate Torques: See procedure given in the Package Outline Section
- Shipped 25 units per foam
- Marking: B20045T

MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Peak Repetitive Reverse Voltage Working Peak Reverse Voltage DC Blocking Voltage	V_{RRM} V_{RWM} V_R	45	V
Average Rectified Forward Current (Rated V_R, T_C = 140°C) Per Leg Per Device	$I_{F(AV)}$	 100 200	A
Peak Repetitive Forward Current, (Rated V_R, Square Wave, 20 kHz, T_C = 140°C) Per Leg	I_{FRM}	 200	A
Non–Repetitive Peak Surge Current (Surge Applied at Rated Load Conditions Halfwave, Single Phase, 60 Hz)	I_{FSM}	1500	A
Peak Repetitive Reverse Current (2.0 μs, 1.0 kHz) Per Leg	I_{RRM}	 2.0	A
Storage Temperature Range	T_{stg}	–55 to +150	°C
Operating Junction Temperature	T_J	–55 to +150	°C
Voltage Rate of Change (Rated V_R)	dv/dt	10,000	V/μs

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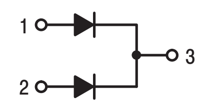
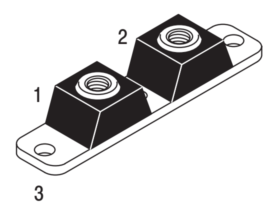
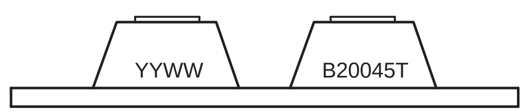
SCHOTTKY BARRIER RECTIFIER 200 AMPERES 45 VOLTS





POWERTAP II CASE 357C PLASTIC

MARKING DIAGRAM



B20045T = Device Code
YY = Year
WW = Work Week

ORDERING INFORMATION

Device	Package	Shipping
MBRP20045CT	POWERTAP II	25 Units/Tray

Preferred devices are recommended choices for future use and best overall value.

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THERMAL CHARACTERISTICS (Per Leg)

Rating	Symbol	Value	Unit
Thermal Resistance, Junction to Case	$R_{\theta JC}$	0.6	°C/W

ELECTRICAL CHARACTERISTICS (Per Leg)

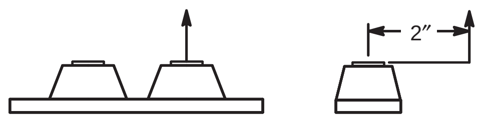
Rating	Symbol	Value	Unit
Instantaneous Forward Voltage (Note 1.) (i_F = 200 Amps, T_J = 25°C) (i_F = 200 Amps, T_J = 125°C)	v_F	 0.89 0.78	Volts
Instantaneous Reverse Current (Note 1.) (Rated dc Voltage, T_J = 125°C) (Rated dc Voltage, T_J = 25°C)	i_R	 50 0.5	mA

1. Pulse Test: Pulse Width = 300 μs, Duty Cycle ≤ 2.0%.

MAXIMUM MECHANICAL RATINGS

Terminal Penetration:	0.235 max
Terminal Torque:	25–40 in-lb max
Mounting Torque — Outside Holes:	30–40 in-lb max
Mounting Torque — Center Hole:	8–10 in-lb max
Seating Plane Flatness	1 mil per in. (between mounting holes)

POWERTAP MECHANICAL DATA APPLIES OVER OPERATING TEMPERATURE



Vertical Pull 250 lbs. max

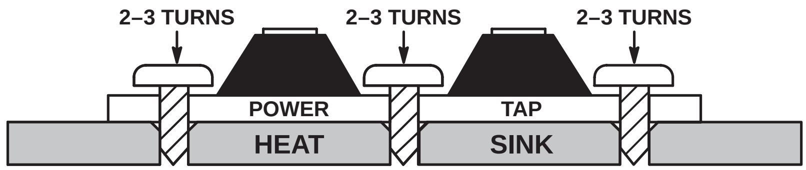
2 in. Lever Pull 50 lbs. max

Note: While the POWERTAP is capable of sustaining these vertical and levered tensions, the intimate contact between POWERTAP and heat sink may be lost. This could lead to thermal runaway. The use of very flexible leads is recommended for the anode connections. Use of thermal grease is highly recommended.

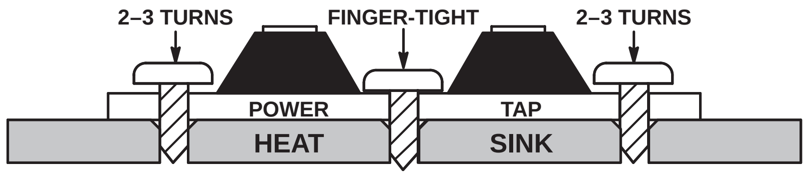
MOUNTING PROCEDURE

The POWERTAP package requires special mounting considerations because of the long longitudinal axis of the copper heat sink. It is important to follow the proper tightening sequence to avoid warping the heat sink, which can reduce thermal contact between the POWERTAP and heat sink.

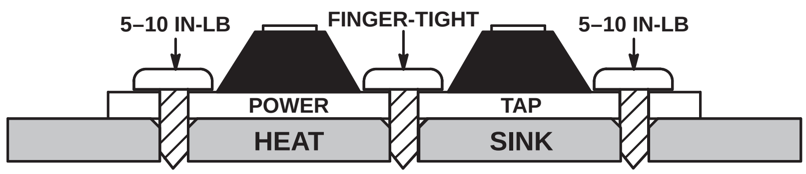
STEP 1:
Locate the POWERTAP on the heat sink and start mounting bolts into the threads by hand (2 or 3 turns).



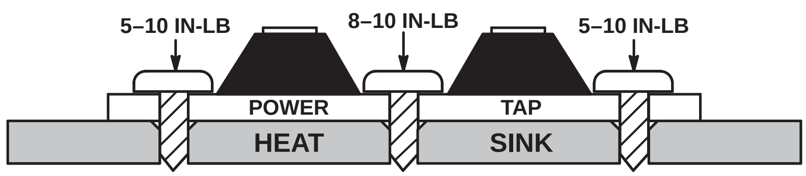
STEP 2:
Finger tighten the center bolt. The bolt may catch on the threads of the heat sink so it is important to make sure the face of the bolt or washer is in contact with the surface of the POWERTAP.



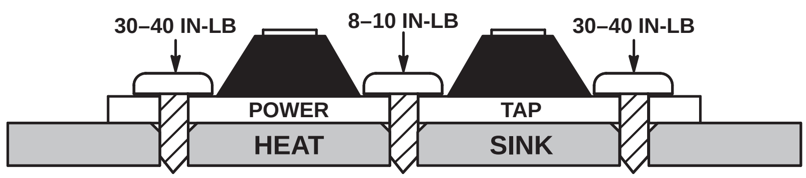
STEP 3:
Tighten each of the end bolts between 5 to 10 in-lb.



STEP 4:
Tighten the center bolt between 8 to 10 in-lb.



STEP 5:
Finally, tighten the end bolts between 30 to 40 in-lb.



MBRP30045CT

Preferred Device

POWERTAP™ II SWITCHMODE™ Power Rectifier

. . . using the Schottky Barrier principle with a platinum barrier metal. These state–of–the–art devices have the following features:

- Dual Diode Construction — May Be Paralleled for Higher Current Output
- Guardring for Stress Protection
- Low Forward Voltage
- 175°C Operating Junction Temperature
- Guaranteed Reverse Avalanche

Mechanical Characteristics:

- Case: Epoxy, Molded with metal heatsink base
- Weight: 80 grams (approximately)
- Finish: All External Surfaces Corrosion Resistant
- Top Terminal Torque: 25–40 lb–in max
- Base Plate Torques: See procedure given in the Package Outline Section
- Shipped 25 units per foam
- Marking: B30045T

MAXIMUM RATINGS

Rating	Symbol	Max	Unit
Peak Repetitive Reverse Voltage Working Peak Reverse Voltage DC Blocking Voltage	V_{RRM} V_{RWM} V_R	45	V
Average Rectified Forward Current (Rated V_R, T_C = 140°C) Per Leg Per Device	$I_{F(AV)}$	150 300	A
Peak Repetitive Forward Current, (Rated V_R, Square Wave, 20 kHz, T_C = 140°C) Per Leg	I_{FRM}	300	A
Non–Repetitive Peak Surge Current (Surge Applied at Rated Load Conditions Halfwave, Single Phase, 60 Hz) Per Leg	I_{FSM}	2500	A
Peak Repetitive Reverse Current (2.0 μs, 1.0 kHz) Per Leg	I_{RRM}	2.0	A
Storage Temperature Range	T_{stg}	–55 to +150	°C
Operating Junction Temperature	T_J	–55 to +150	°C
Voltage Rate of Change (Rated V_R)	dv/dt	10,000	V/μs

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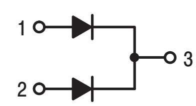
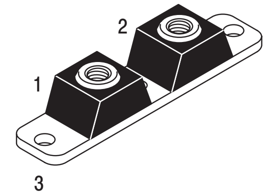
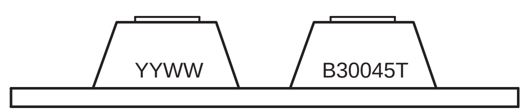
SCHOTTKY BARRIER RECTIFIER 300 AMPERES 45 VOLTS





POWERTAP II CASE 357C PLASTIC

MARKING DIAGRAM



B30045T = Device Code
YY = Year
WW = Work Week

ORDERING INFORMATION

Device	Package	Shipping
MBRP30045CT	POWERTAP II	25 Units/Tray

Preferred devices are recommended choices for future use and best overall value.

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THERMAL CHARACTERISTICS (Per Leg)

Rating	Symbol	Value	Unit
Thermal Resistance, Junction to Case	$R_{\theta JC}$	0.45	°C/W

ELECTRICAL CHARACTERISTICS (Per Leg)

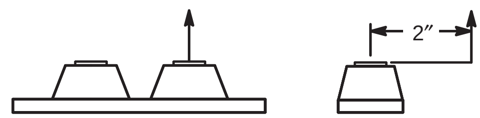
Instantaneous Forward Voltage (Note 1.) (i_F = 150 Amps, T_J = 25°C) (i_F = 300 Amps, T_J = 25°C)	v_F	 0.70 0.82	Volts
Instantaneous Reverse Current (Note 1.) (Rated dc Voltage, T_J = 125°C) (Rated dc Voltage, T_J = 25°C)	i_R	 75 0.8	mA

1. Pulse Test: Pulse Width = 300 μs, Duty Cycle ≤ 2.0%.

MAXIMUM MECHANICAL RATINGS

Terminal Penetration:	0.235 max
Terminal Torque:	25–40 in-lb max
Mounting Torque — Outside Holes:	30–40 in-lb max
Mounting Torque — Center Hole:	8–10 in-lb max
Seating Plane Flatness	1 mil per in. (between mounting holes)

POWERTAP MECHANICAL DATA APPLIES OVER OPERATING TEMPERATURE



Vertical Pull 250 lbs. max

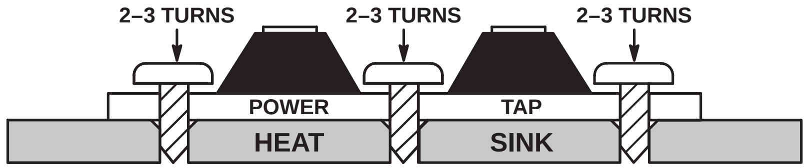
2 in. Lever Pull 50 lbs. max

Note: While the POWERTAP is capable of sustaining these vertical and levered tensions, the intimate contact between POWERTAP and heat sink may be lost. This could lead to thermal runaway. The use of very flexible leads is recommended for the anode connections. Use of thermal grease is highly recommended.

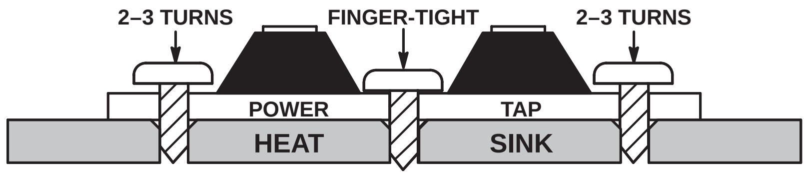
MOUNTING PROCEDURE

The POWERTAP package requires special mounting considerations because of the long longitudinal axis of the copper heat sink. It is important to follow the proper tightening sequence to avoid warping the heat sink, which can reduce thermal contact between the POWERTAP and heat sink.

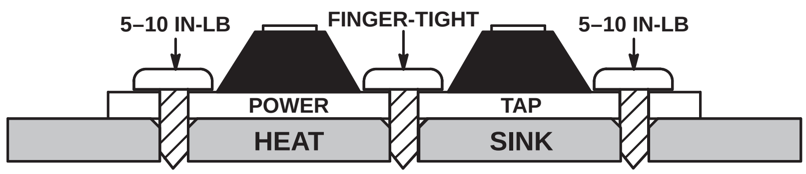
STEP 1:
Locate the POWERTAP on the heat sink and start mounting bolts into the threads by hand (2 or 3 turns).



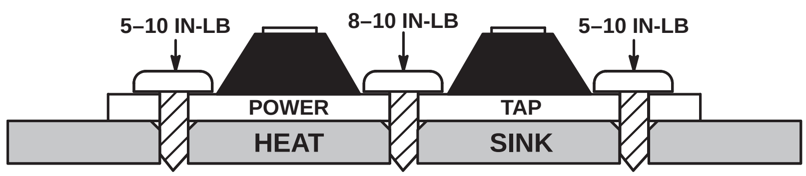
STEP 2:
Finger tighten the center bolt. The bolt may catch on the threads of the heat sink so it is important to make sure the face of the bolt or washer is in contact with the surface of the POWERTAP.



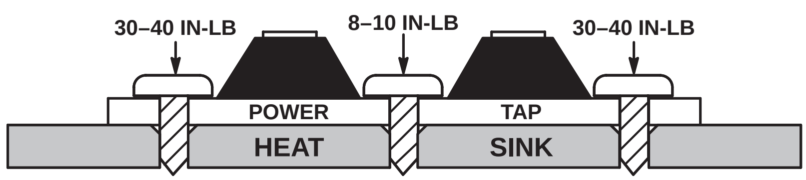
STEP 3:
Tighten each of the end bolts between 5 to 10 in-lb.



STEP 4:
Tighten the center bolt between 8 to 10 in-lb.



STEP 5:
Finally, tighten the end bolts between 30 to 40 in-lb.



MBRP40045CTL

POWERTAP™ II SWITCHMODE™ Power Rectifier

. . . using the Schottky Barrier principle with a platinum barrier metal. These state–of–the–art devices have the following features:

Features:

- Dual Diode Construction — May be Paralleled for Higher Current Output
- Guardring for Stress Protection
- Low Forward Voltage Drop
- 150°C Operating Junction Temperature
- Recyclable Epoxy
- Guaranteed Reverse Avalanche Energy Capability
- Improved Mechanical Ratings

MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Peak Repetitive Reverse Voltage Working Peak Reverse Voltage DC Blocking Voltage	V_{RRM} V_{RWM} V_R	45	V
Average Rectified Forward Current (At Rated V_R, T_C = 100°C) Per Leg Per Device	$I_{F(AV)}$	 200 400	A
Peak Repetitive Forward Current (At Rated V_R, Square Wave, 20 kHz, T_C = 100°C)	I_{FRM}	400	A
Non–Repetitive Peak Surge Current (Surge Applied at Rated Load Conditions Halfwave, Single Phase, 60 Hz)	I_{FSM}	2500	A
Peak Repetitive Reverse Current (2.0 μs, 1.0 kHz)	I_{RRM}	2.0	A
Storage and Operating Case Temperature Range	T_{stg}, T_C	–55 to +150	°C
Operating Junction Temperature	T_J	–55 to +150	°C
Voltage Rate of Change (Rated V_R)	dv/dt	1000	V/μs

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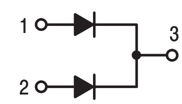
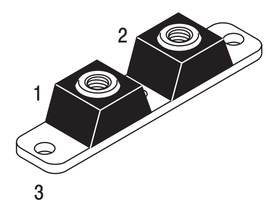
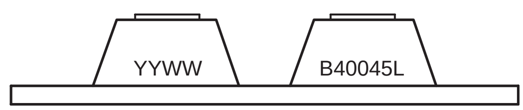
SCHOTTKY BARRIER RECTIFIER 400 AMPERES 45 VOLTS





POWERTAP II CASE 357C PLASTIC

MARKING DIAGRAM



B40045L = Device Code
YY = Year
WW = Work Week

ORDERING INFORMATION

Device	Package	Shipping
MBRP40045CTL	POWERTAP II	25 Units/Tray

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THERMAL CHARACTERISTICS

Rating		Symbol	Value	Unit
Thermal Resistance — Junction–to–Case	Per Leg	$R_{\theta JC}$	0.45	°C/W

ELECTRICAL CHARACTERISTICS

Rating		Symbol	Value		Unit
Maximum Instantaneous Forward Voltage (Note 1.)	Per Leg	V_F	**T_C = 25°C**	**T_C = 125°C**	V
(I_F = 200 A) (I_F = 400 A)			0.57 0.73	0.52 0.68	
Maximum Instantaneous Reverse Current (Note 1.)	Per Leg	I_R	**T_C = 25°C**	**T_C = 125°C**	mA
(Rated DC Voltage)			10	400	

1. Pulse Test: Pulse Width = 380 μs, Duty Cycle ≤ 2%.

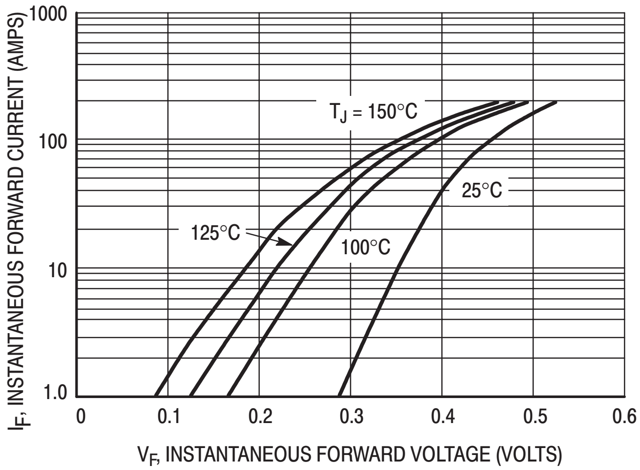

Figure 1. Typical Forward Voltage

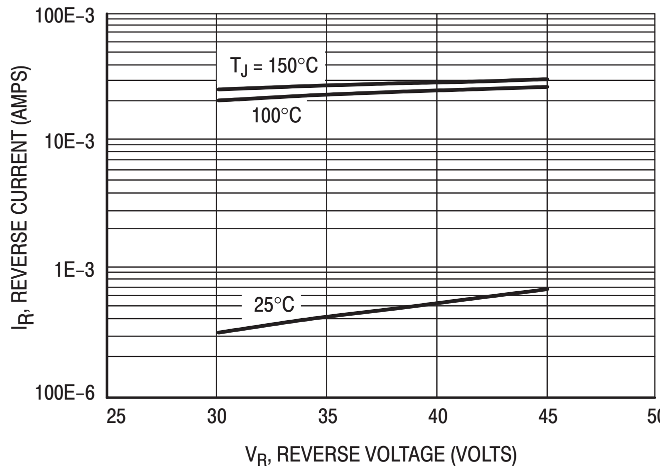

Figure 2. Typical Reverse Current

MBRP20060CT

Preferred Device

POWERTAP™ II SWITCHMODE™ Power Rectifier

. . . using the Schottky Barrier principle with a platinum barrier metal. These state–of–the–art devices have the following features:

- Dual Diode Construction — May Be Paralleled for Higher Current Output
- Guardring for Stress Protection
- Low Forward Voltage
- 175°C Operating Junction Temperature

Mechanical Characteristics:

- Case: Epoxy, Molded with metal heatsink base
- Weight: 80 grams (approximately)
- Finish: All External Surfaces Corrosion Resistant
- Top Terminal Torque: 25–40 lb–in max
- Base Plate Torques: See procedure given in the Package Outline Section
- Shipped 25 units per foam
- Marking: B20060T

MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Peak Repetitive Reverse Voltage Working Peak Reverse Voltage DC Blocking Voltage	V_{RRM} V_{RWM} V_R	60	V
Average Rectified Forward Current (Rated V_R, T_C = 140°C) Per Leg Per Device	$I_{F(AV)}$	 100 200	A
Peak Repetitive Forward Current, (Rated V_R, Square Wave, 20 kHz, T_C = 140°C) Per Leg	I_{FRM}	 200	A
Non–Repetitive Peak Surge Current (Surge Applied at Rated Load Conditions Halfwave, Single Phase, 60 Hz)	I_{FSM}	1500	A
Peak Repetitive Reverse Current (2.0 μs, 1.0 kHz) Per Leg	I_{RRM}	 2.0	A
Storage Temperature Range	T_{stg}	–55 to +150	°C
Operating Junction Temperature	T_J	–55 to +150	°C
Voltage Rate of Change (Rated V_R)	dv/dt	10,000	V/μs

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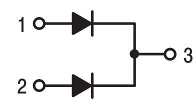
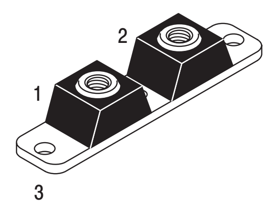
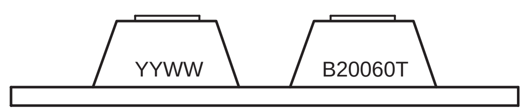
SCHOTTKY BARRIER RECTIFIER 200 AMPERES 60 VOLTS





POWERTAP II
CASE 357C
PLASTIC

MARKING DIAGRAM



B20060T = Device Code
YY = Year
WW = Work Week

ORDERING INFORMATION

Device	Package	Shipping
MBRP20060CT	POWERTAP II	25 Units/Tray

Preferred devices are recommended choices for future use and best overall value.

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THERMAL CHARACTERISTICS (Per Leg)

Rating	Symbol	Value	Unit
Thermal Resistance, Junction to Case	$R_{\theta JC}$	0.6	°C/W

ELECTRICAL CHARACTERISTICS (Per Leg)

Instantaneous Forward Voltage (Note 1.) (i_F = 200 Amps, T_J = 25°C) (i_F = 200 Amps, T_J = 100°C)	v_F	 0.91 0.80	Volts
Instantaneous Reverse Current (Note 1.) (Rated dc Voltage, T_J = 125°C) (Rated dc Voltage, T_J = 25°C)	i_R	 50 0.5	mA

1. Pulse Test: Pulse Width = 300 μs, Duty Cycle ≤ 2.0%.

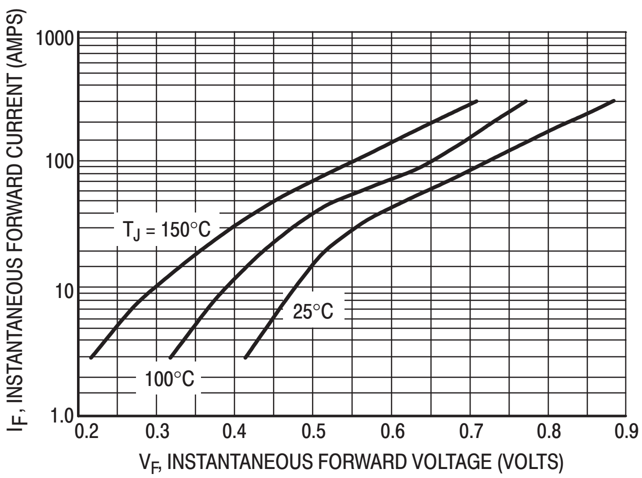


Figure 1. Typical Forward Voltage

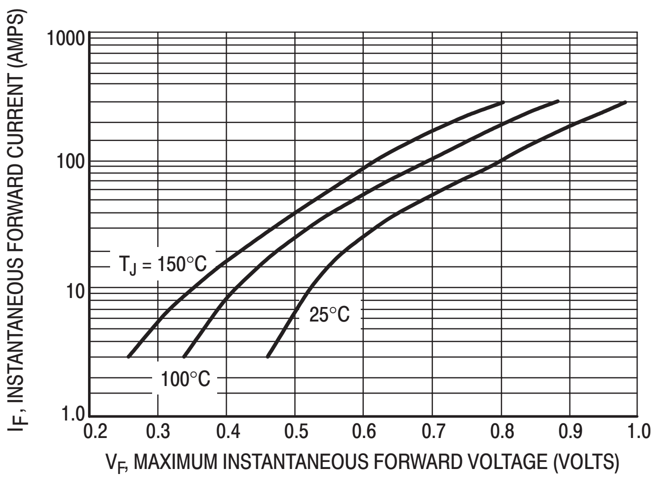


Figure 2. Maximum Forward Voltage

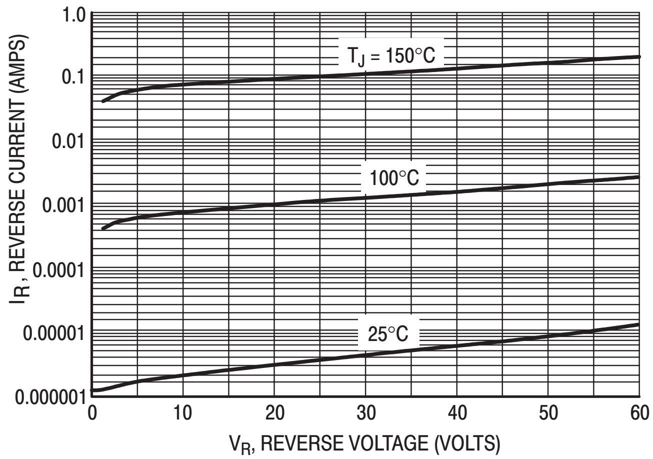


Figure 3. Typical Reverse Current

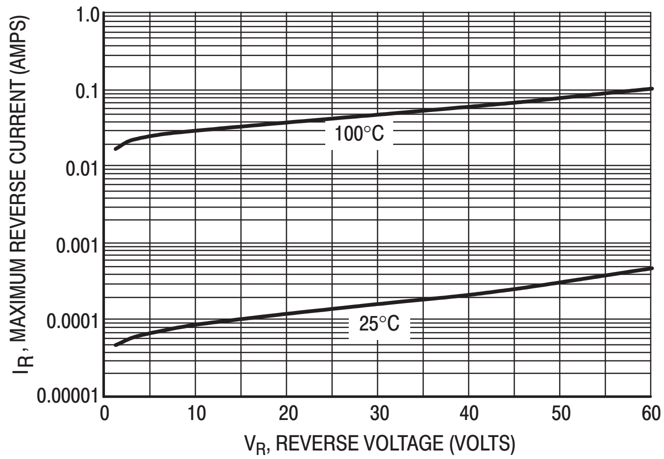


Figure 4. Maximum Reverse Current

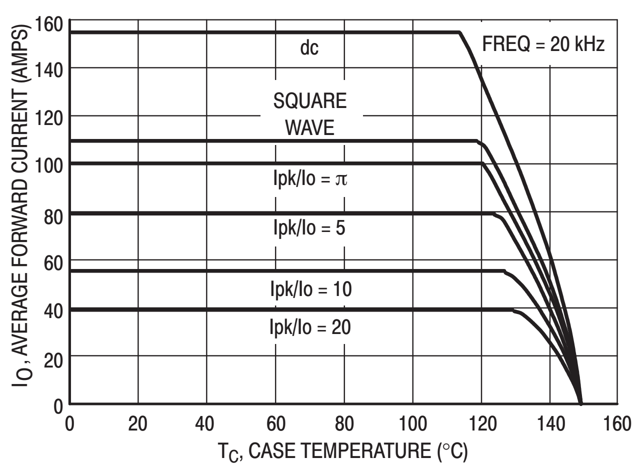


Figure 5. Current Derating
(PER LEG)

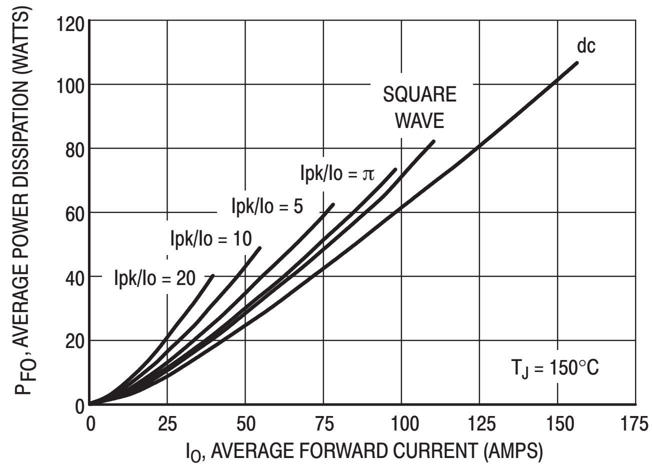


Figure 6. Forward Power Dissipation
(PER LEG)

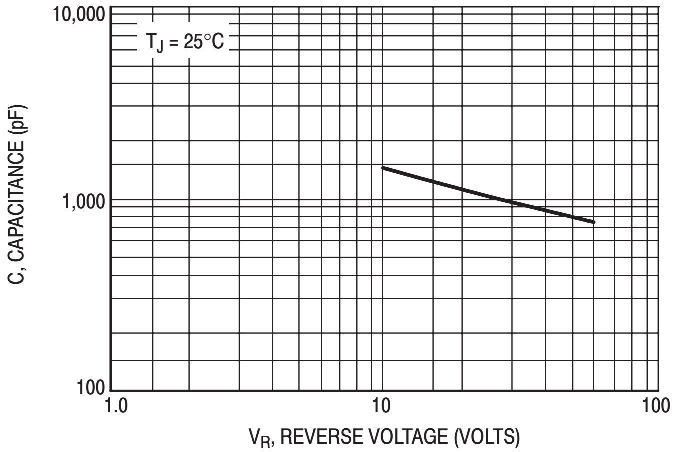


Figure 7. Capacitance

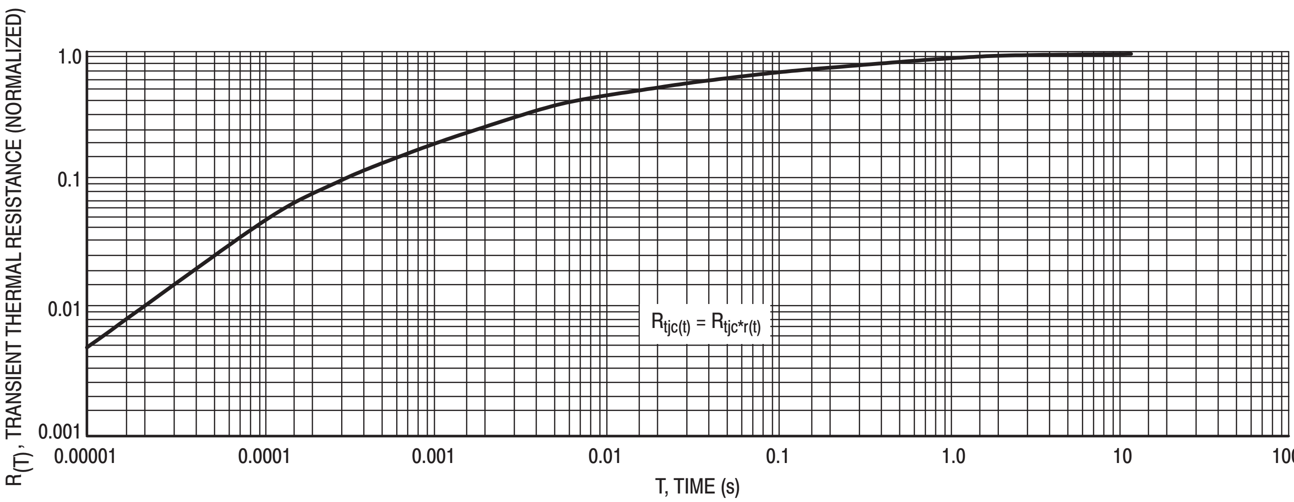


Figure 8. Thermal Response

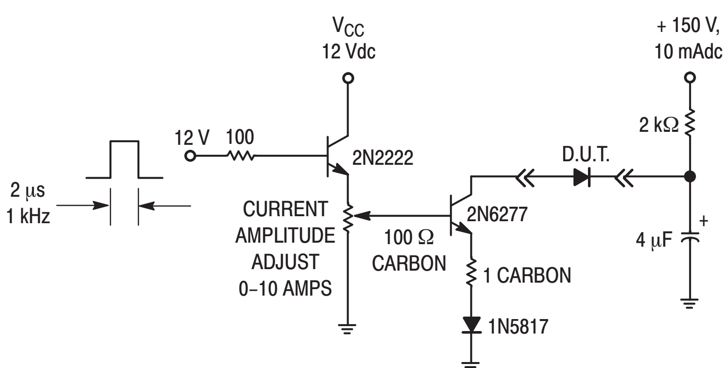
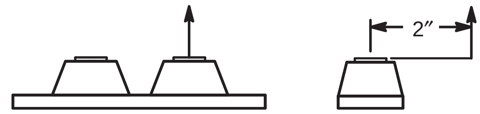


Figure 9. Test Circuit for Repetitive Reverse Current

MAXIMUM MECHANICAL RATINGS

Terminal Penetration:	0.235 max
Terminal Torque:	25–40 in-lb max
Mounting Torque — Outside Holes:	30–40 in-lb max
Mounting Torque — Center Hole:	8–10 in-lb max
Seating Plane Flatness	1 mil per in. (between mounting holes)

POWERTAP MECHANICAL DATA APPLIES OVER OPERATING TEMPERATURE



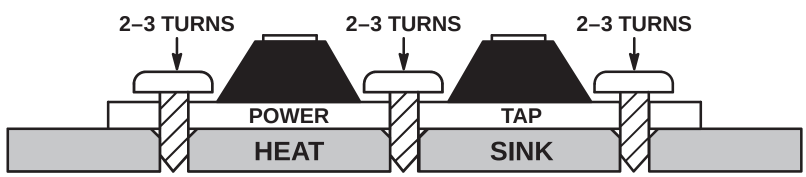
Vertical Pull 250 lbs. max | **2 in. Lever Pull 50 lbs. max**

Note: While the POWERTAP is capable of sustaining these vertical and levered tensions, the intimate contact between POWERTAP and heat sink may be lost. This could lead to thermal runaway. The use of very flexible leads is recommended for the anode connections. Use of thermal grease is highly recommended.

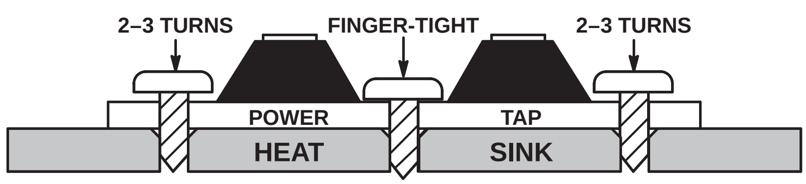
MOUNTING PROCEDURE

The POWERTAP package requires special mounting considerations because of the long longitudinal axis of the copper heat sink. It is important to follow the proper tightening sequence to avoid warping the heat sink, which can reduce thermal contact between the POWERTAP and heat sink.

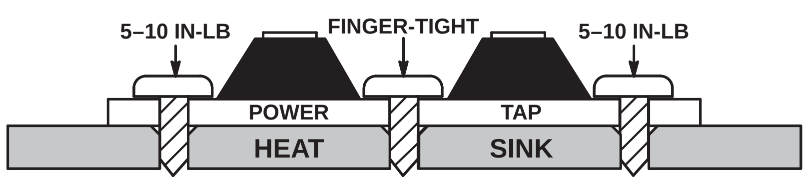
STEP 1:
Locate the POWERTAP on the heat sink and start mounting bolts into the threads by hand (2 or 3 turns).



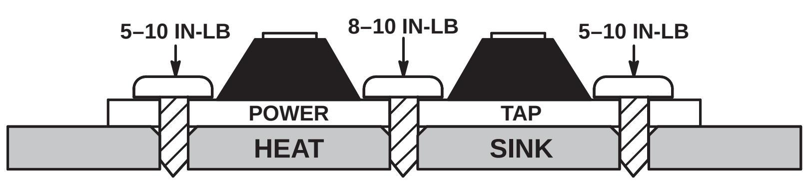
STEP 2:
Finger tighten the center bolt. The bolt may catch on the threads of the heat sink so it is important to make sure the face of the bolt or washer is in contact with the surface of the POWERTAP.



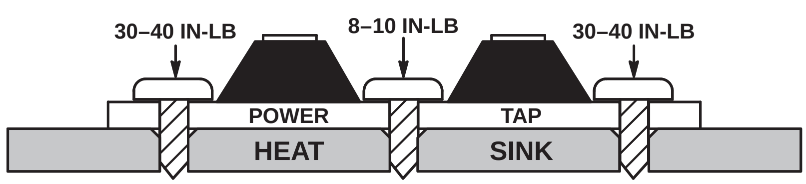
STEP 3:
Tighten each of the end bolts between 5 to 10 in-lb.



STEP 4:
Tighten the center bolt between 8 to 10 in-lb.



STEP 5:
Finally, tighten the end bolts between 30 to 40 in-lb.



MBRP30060CT

Preferred Device

POWERTAP™ II SWITCHMODE™ Power Rectifier

. . . using the Schottky Barrier principle with a platinum barrier metal. These state–of–the–art devices have the following features:

- Dual Diode Construction — May Be Paralleled for Higher Current Output
- Guardring for Stress Protection
- Low Forward Voltage
- 175°C Operating Junction Temperature

Mechanical Characteristics:

- Case: Epoxy, Molded with metal heatsink base
- Weight: 80 grams (approximately)
- Finish: All External Surfaces Corrosion Resistant
- Top Terminal Torque: 25–40 lb–in max
- Base Plate Torques: See procedure given in the Package Outline Section
- Shipped 25 units per foam
- Marking: B30060T

MAXIMUM RATINGS

Rating	Symbol	Max	Unit
Peak Repetitive Reverse Voltage Working Peak Reverse Voltage DC Blocking Voltage	V_{RRM} V_{RWM} V_R	60	V
Average Rectified Forward Current (Rated V_R, T_C = 140°C) Per Leg Per Device	$I_{F(AV)}$	150 300	A
Peak Repetitive Forward Current, (Rated V_R, Square Wave, 20 kHz, T_C = 140°C) Per Leg	I_{FRM}	300	A
Non–Repetitive Peak Surge Current (Surge Applied at Rated Load Conditions Halfwave, Single Phase, 60 Hz) Per Leg	I_{FSM}	2500	A
Peak Repetitive Reverse Current (2.0 µs, 1.0 kHz) Per Leg	I_{RRM}	2.0	A
Storage Temperature Range	T_{stg}	–55 to +150	°C
Operating Junction Temperature	T_J	–55 to +150	°C
Voltage Rate of Change (Rated V_R)	dv/dt	10,000	V/µs

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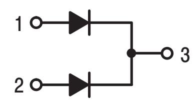
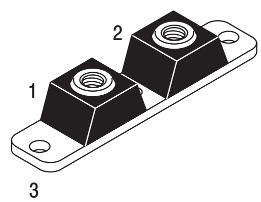
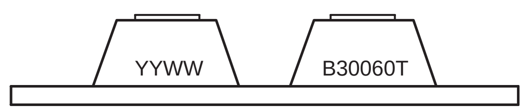
SCHOTTKY BARRIER RECTIFIER 300 AMPERES 60 VOLTS





POWERTAP II CASE 357C PLASTIC

MARKING DIAGRAM



B30060T = Device Code
YY = Year
WW = Work Week

ORDERING INFORMATION

Device	Package	Shipping
MBRP30060CT	POWERTAP II	25 Units/Tray

Preferred devices are recommended choices for future use and best overall value.

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THERMAL CHARACTERISTICS (Per Leg)

Rating	Symbol	Value	Unit
Thermal Resistance, Junction to Case	$R_{\theta JC}$	0.45	°C/W

ELECTRICAL CHARACTERISTICS (Per Leg)

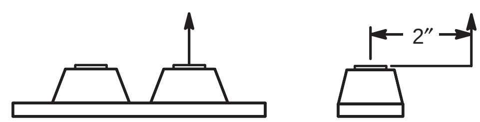
Rating	Symbol	Value	Unit
Instantaneous Forward Voltage (Note 1.) (i_F = 150 Amps, T_J = 25°C) (i_F = 300 Amps, T_J = 25°C)	v_F	 0.79 0.89	Volts
Instantaneous Reverse Current (Note 1.) (Rated dc Voltage, T_J = 125°C) (Rated dc Voltage, T_J = 25°C)	i_R	 75 0.8	mA

1. Pulse Test: Pulse Width = 300 μs, Duty Cycle $\leq$ 2.0%.

MAXIMUM MECHANICAL RATINGS

Terminal Penetration:	0.235 max
Terminal Torque:	25–40 in-lb max
Mounting Torque — Outside Holes:	30–40 in-lb max
Mounting Torque — Center Hole:	8–10 in-lb max
Seating Plane Flatness	1 mil per in. (between mounting holes)

POWERTAP MECHANICAL DATA
APPLIES OVER OPERATING TEMPERATURE



Vertical Pull
250 lbs. max

2 in. Lever Pull
50 lbs. max

Note: While the POWERTAP is capable of sustaining these vertical and levered tensions, the intimate contact between POWERTAP and heat sink may be lost. This could lead to thermal runaway. The use of very flexible leads is recommended for the anode connections. Use of thermal grease is highly recommended.

MOUNTING PROCEDURE

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STEP 1:
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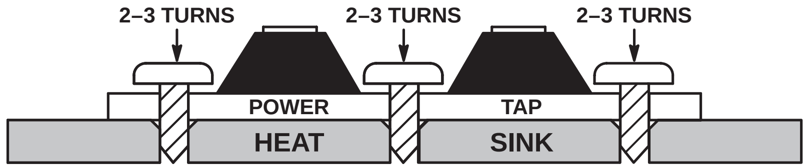
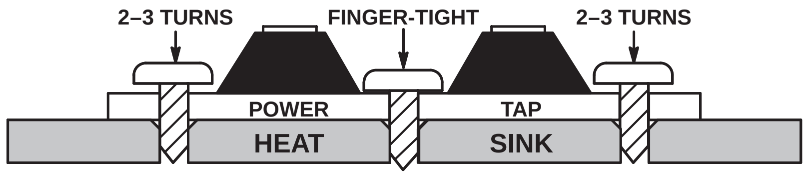
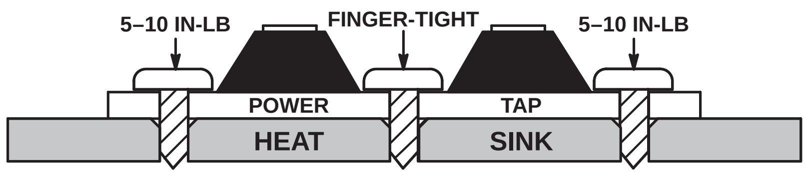


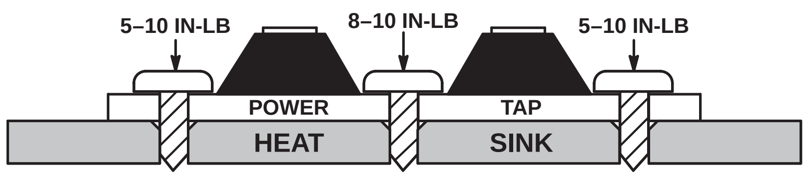
STEP 2:
Finger tighten the center bolt. The bolt may catch on the threads of the heat sink so it is important to make sure the face of the bolt or washer is in contact with the surface of the POWERTAP.



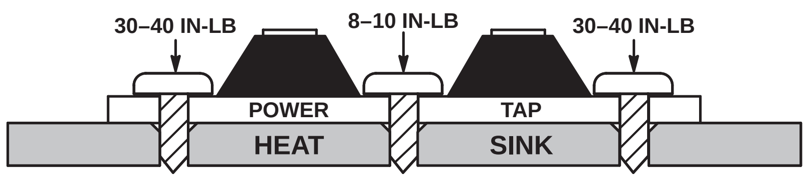
STEP 3:
Tighten each of the end bolts between 5 to 10 in-lb.



STEP 4:
Tighten the center bolt between 8 to 10 in-lb.



STEP 5:
Finally, tighten the end bolts between 30 to 40 in-lb.



MBRP400100CTL

POWERTAP™ II SWITCHMODE™ Power Rectifier

. . . using the Schottky Barrier principle with a platinum barrier metal. These state–of–the–art devices have the following features:

Features:

- Dual Diode Construction — May be Paralleled for Higher Current Output
- Guardring for Stress Protection
- Low Forward Voltage Drop
- 150°C Operating Junction Temperature
- Recyclable Epoxy
- Guaranteed Reverse Avalanche Energy Capability
- Improved Mechanical Ratings

MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Peak Repetitive Reverse Voltage Working Peak Reverse Voltage DC Blocking Voltage	V_{RRM} V_{RWM} V_R	100	V
Average Rectified Forward Current (At Rated V_R, T_C = 100°C) Per Leg Per Device	$I_{F(AV)}$	200 400	A
Peak Repetitive Forward Current (At Rated V_R, Square Wave, 20 kHz, T_C = 100°C)	I_{FRM}	400	A
Non–Repetitive Peak Surge Current (Surge Applied at Rated Load Conditions Halfwave, Single Phase, 60 Hz)	I_{FSM}	2500	A
Peak Repetitive Reverse Current (2.0 μs, 1.0 kHz)	I_{RRM}	2.0	A
Storage and Operating Case Temperature Range	T_{stg}, T_C	–55 to +150	°C
Operating Junction Temperature	T_J	–55 to +150	°C
Voltage Rate of Change (Rated V_R)	dv/dt	1000	V/μs

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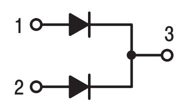
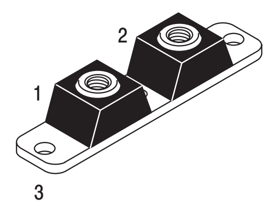
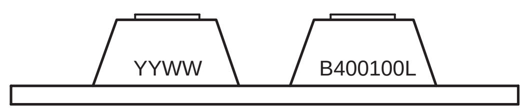
SCHOTTKY BARRIER RECTIFIER 400 AMPERES 100 VOLTS





POWERTAP II CASE 357C PLASTIC

MARKING DIAGRAM



B400100L = Device Code
YY = Year
WW = Work Week

ORDERING INFORMATION

Device	Package	Shipping
MBRP400100CTL	POWERTAP II	25 Units/Tray

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THERMAL CHARACTERISTICS

Rating		Symbol	Value	Unit
Thermal Resistance — Junction–to–Case	Per Leg	$R_{\theta JC}$	0.45	°C/W

ELECTRICAL CHARACTERISTICS

Rating		Symbol	Value		Unit
Maximum Instantaneous Forward Voltage (Note 1.)	Per Leg	V_F	T_C = 25°C	T_C = 125°C	V
(I_F = 200 A) (I_F = 400 A)			0.83 0.97	0.69 0.82	
Maximum Instantaneous Reverse Current (Note 1.)	Per Leg	I_R	T_C = 25°C	T_C = 125°C	mA
(Rated DC Voltage)			6.0	80	

1. Pulse Test: Pulse Width = 380 μs, Duty Cycle ≤ 2%.

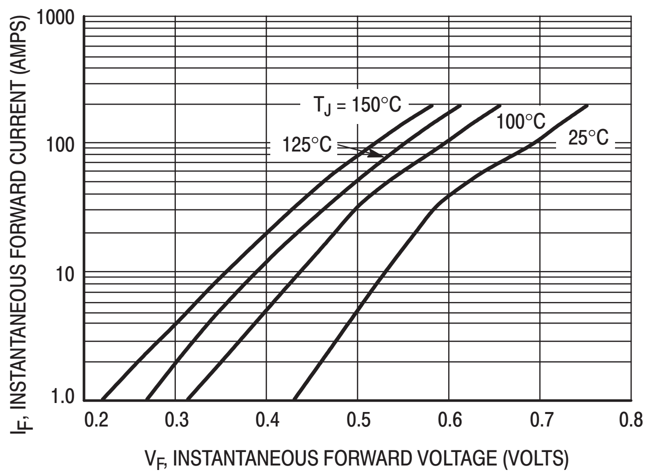

Figure 1. Typical Forward Voltage

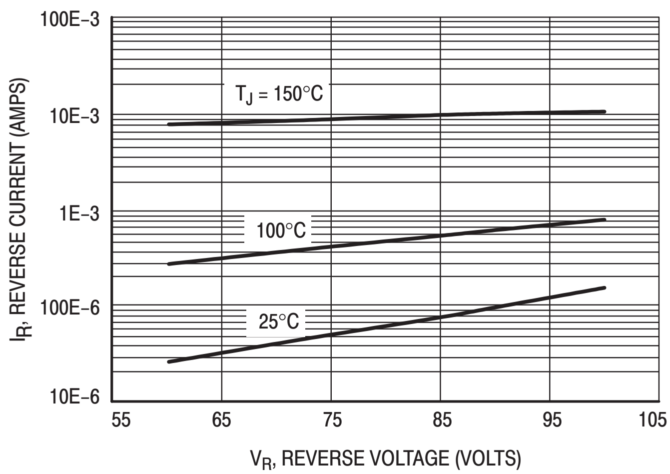

Figure 2. Typical Reverse Current

MBRP20035L

SWITCHMODE™ Schottky Power Rectifier

POWERTAP™ III Package

. . . employing the Schottky Barrier principle in a large area metal–to–silicon power diode. State of the art geometry features epitaxial construction with oxide passivation and metal overlay contact. Ideally suited for low voltage, high frequency switching power supplies, free wheeling diode and polarity protection diodes.

- Very Low Forward Voltage Drop
- Highly Stable Oxide Passivated Junction
- Guardring for Stress Protection
- High dv/dt Capability

Mechanical Characteristics:

- Dual Die Construction
- Case: Epoxy, Molded with Plated Copper Heatsink Base
- Weight: 40 grams (approximately)
- Finish: All External Surfaces Corrosion Resistant
- Base Plate Torques: See procedure given in the Package Outline Section
- Top Terminal Torque: 25–40 lb–in max.
- Shipped 50 units per foam
- Marking: MBRP20035L

MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Peak Repetitive Reverse Voltage Working Peak Reverse Voltage DC Blocking Voltage	V_{RRM} V_{RWM} V_R	35	V
Average Rectified Forward Current (At Rated V_R, T_C = 100°C)	I_O	200	A
Peak Repetitive Forward Current (At Rated V_R, Square Wave, 20 kHz, T_C = 100°C)	I_{FRM}	400	A
Non–Repetitive Peak Surge Current (Surge applied at rated load conditions, halfwave, single phase, 60 Hz)	I_{FSM}	2000	A
Peak Repetitive Reverse Surge Current (2.0 µs, 1.0 kHz)	I_{RRM}	2.0	A
Storage/Operating Case Temperature Range	T_{stg}, T_C	– 55 to +150	°C
Operating Junction Temperature	T_J	– 55 to +150	°C
Voltage Rate of Change (Rated V_R, T_J = 25°C)	dv/dt	10,000	V/µs

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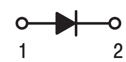
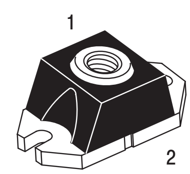
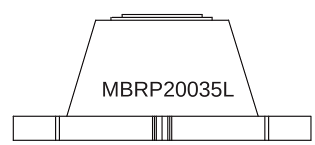
SCHOTTKY BARRIER RECTIFIER 200 AMPERES 35 VOLTS





POWERTAP III CASE 357D PLASTIC

MARKING DIAGRAM



MBRP20035L = Device Code

ORDERING INFORMATION

Device	Package	Shipping
MBRP20035L	POWERTAP III	50 Units/Foam

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THERMAL CHARACTERISTICS

Characteristic	Symbol	Value	Unit
Thermal Resistance — Junction–to–Case	$R_{\theta JC}$	0.45	°C/W

ELECTRICAL CHARACTERISTICS

Maximum Instantaneous Forward Voltage (Note 1.) (I_F = 200 A)	V_F	**T_J = 25°C**	**T_J = 100°C**	Volts
		0.57	0.5	
Maximum Instantaneous Reverse Current (V_R = 35 V)	I_R	**T_J = 25°C**	**T_J = 100°C**	mA
		10	250	

1. Pulse Test: Pulse Width $\leq$ 380 μs, Duty Cycle $\leq$ 2%.

MBRP30035L

SWITCHMODE™ Schottky Power Rectifier

POWERTAP™ III Package

. . . employing the Schottky Barrier principle in a large area metal–to–silicon power diode. State of the art geometry features epitaxial construction with oxide passivation and metal overlay contact. Ideally suited for low voltage, high frequency switching power supplies, free wheeling diode and polarity protection diodes.

- Very Low Forward Voltage Drop
- Highly Stable Oxide Passivated Junction
- Guardring for Stress Protection
- High dv/dt Capability

Mechanical Characteristics:

- Dual Die Construction
- Case: Epoxy, Molded with Plated Copper Heatsink Base
- Weight: 40 grams (approximately)
- Finish: All External Surfaces Corrosion Resistant
- Base Plate Torques: See procedure given in the Package Outline Section
- Top Terminal Torque: 25–40 lb–in max.
- Shipped 50 units per foam
- Marking: MBRP30035L

MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Peak Repetitive Reverse Voltage Working Peak Reverse Voltage DC Blocking Voltage	V_{RRM} V_{RWM} V_R	35	V
Average Rectified Forward Current (At Rated V_R, T_C = 100°C)	I_O	300	A
Peak Repetitive Forward Current (At Rated V_R, Square Wave, 20 kHz, T_C = 100°C)	I_{FRM}	600	A
Non–Repetitive Peak Surge Current (Surge applied at rated load conditions, halfwave, single phase, 60 Hz)	I_{FSM}	3000	A
Peak Repetitive Reverse Surge Current (2.0 µs, 1.0 kHz)	I_{RRM}	2.0	A
Storage/Operating Case Temperature Range	T_{stg}, T_C	– 55 to +150	°C
Operating Junction Temperature	T_J	– 55 to +150	°C
Voltage Rate of Change (Rated V_R, T_J = 25°C)	dv/dt	10,000	V/µs

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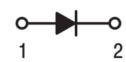
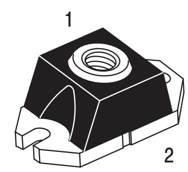
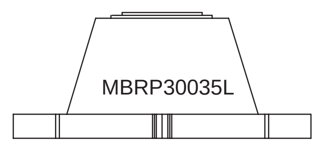
SCHOTTKY BARRIER RECTIFIER 300 AMPERES 35 VOLTS





**POWERTAP III
CASE 357D
PLASTIC**

MARKING DIAGRAM



MBRP30035L = Device Code

ORDERING INFORMATION

Device	Package	Shipping
MBRP30035L	POWERTAP III	50 Units/Foam

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THERMAL CHARACTERISTICS

Characteristic	Symbol	Value	Unit
Thermal Resistance — Junction–to–Case	$R_{\theta JC}$	0.4	°C/W

ELECTRICAL CHARACTERISTICS

Maximum Instantaneous Forward Voltage (Note 1.) (I_F = 300 A)	V_F	**T_J = 25°C**	**T_J = 100°C**	Volts
		0.57	0.5	
Maximum Instantaneous Reverse Current (V_R = 35 V)	I_R	**T_J = 25°C**	**T_J = 100°C**	mA
		10	250	

1. Pulse Test: Pulse Width $\leq$ 380 μs, Duty Cycle $\leq$ 2%.

CHAPTER 4
Ultrafast Data Sheets

MURS120T3 Series

Preferred Devices

Surface Mount Ultrafast Power Rectifiers

MURS105T3, MURS110T3, MURS115T3, MURS120T3, MURS140T3, MURS160T3

Ideally suited for high voltage, high frequency rectification, or as free wheeling and protection diodes in surface mount applications where compact size and weight are critical to the system.

- Small Compact Surface Mountable Package with J–Bend Leads
- Rectangular Package for Automated Handling
- High Temperature Glass Passivated Junction
- Low Forward Voltage Drop (0.71 to 1.05 Volts Max @ 1.0 A, T_J = 150°C)

Mechanical Characteristics:

- Case: Epoxy, Molded
- Weight: 95 mg (approximately)
- Finish: All External Surfaces Corrosion Resistant and Terminal Leads are Readily Solderable
- Lead and Mounting Surface Temperature for Soldering Purposes: 260°C Max. for 10 Seconds
- Shipped in 12 mm Tape and Reel, 2500 units per reel
- Polarity: Polarity Band Indicates Cathode Lead
- Marking: U1A, U1B, U1C, U1D, U1G, U1J

MAXIMUM RATINGS

Please See the Table on the Following Page

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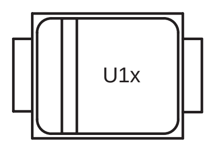
ULTRAFAST RECTIFIERS
1.0 AMPERE
50–600 VOLTS

SMB
CASE 403A

MARKING DIAGRAM



U1x= Device Code
x = Specific Device Code
A, B, C, D, G or J

ORDERING INFORMATION

See detailed ordering and shipping information in the table on page 287 of this data sheet.

DEVICE MARKING INFORMATION

See general marking information in the device marking table on page 287 of this data sheet.

Preferred devices are recommended choices for future use and best overall value.

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MAXIMUM RATINGS

Rating	Symbol	MURS 105T3	110T3	115T3	120T3	140T3	160T3	Unit
Peak Repetitive Reverse Voltage Working Peak Reverse Voltage DC Blocking Voltage	V_{RRM} V_{RWM} V_R	50	100	150	200	400	600	Volts
Average Rectified Forward Current	$I_{F(AV)}$	1.0 @ T_L = 155°C 2.0 @ T_L = 145°C				1.0 @ T_L = 150°C 2.0 @ T_L = 125°C		Amps
Non–Repetitive Peak Surge Current (Surge applied at rated load conditions halfwave, single phase, 60 Hz)	I_{FSM}	40				35		Amps
Operating Junction Temperature	T_J	– 65 to +175						°C

THERMAL CHARACTERISTICS

Thermal Resistance, Junction to Lead (T_L = 25°C)	$R_{\theta JL}$	13	°C/W

ELECTRICAL CHARACTERISTICS

Maximum Instantaneous Forward Voltage (Note 1.) (i_F = 1.0 A, T_J = 25°C) (i_F = 1.0 A, T_J = 150°C)	v_F	0.875 0.71	1.25 1.05	Volts
Maximum Instantaneous Reverse Current (Note 1.) (Rated dc Voltage, T_J = 25°C) (Rated dc Voltage, T_J = 150°C)	i_R	2.0 50	5.0 150	µA
Maximum Reverse Recovery Time (i_F = 1.0 A, di/dt = 50 A/µs) (i_F = 0.5 A, i_R = 1.0 A, I_R to 0.25 A)	t_{rr}	35 25	75 50	ns
Maximum Forward Recovery Time (i_F = 1.0 A, di/dt = 100 A/µs, Rec. to 1.0 V)	t_{fr}	25	50	ns

1. Pulse Test: Pulse Width = 300 µs, Duty Cycle ≤ 2.0%.

DEVICE MARKING AND ORDERING INFORMATION

Device	Marking	Package	Shipping
MURS105T3	U1A	SMB	2500 Units/Tape & Reel
MURS110T3	U1B	SMB	2500 Units/Tape & Reel
MURS115T3	U1C	SMB	2500 Units/Tape & Reel
MURS120T3	U1D	SMB	2500 Units/Tape & Reel
MURS140T3	U1G	SMB	2500 Units/Tape & Reel
MURS160T3	U1J	SMB	2500 Units/Tape & Reel

MURS105T3, MURS110T3, MURS115T3, MURS120T3

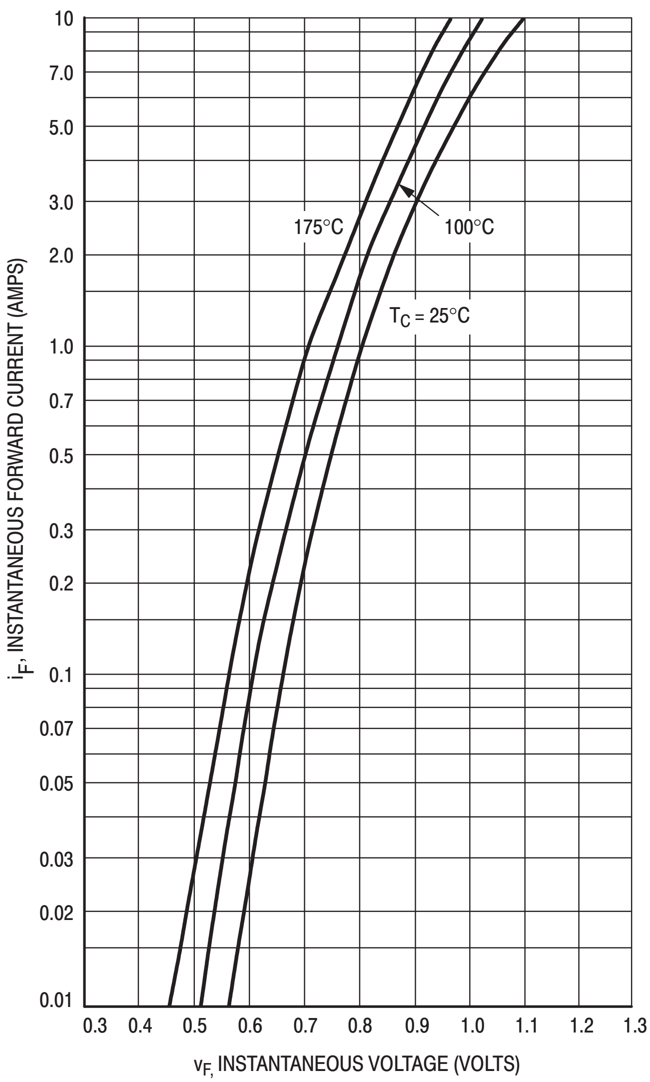

Figure 1. Typical Forward Voltage

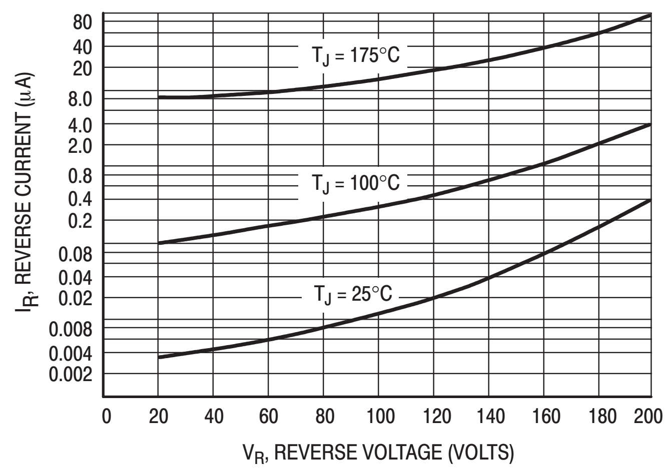

Figure 2. Typical Reverse Current*

* The curves shown are typical for the highest voltage device in the voltage grouping. Typical reverse current for lower voltage selections can be estimated from these same curves if applied V_R is sufficiently below rated V_R.

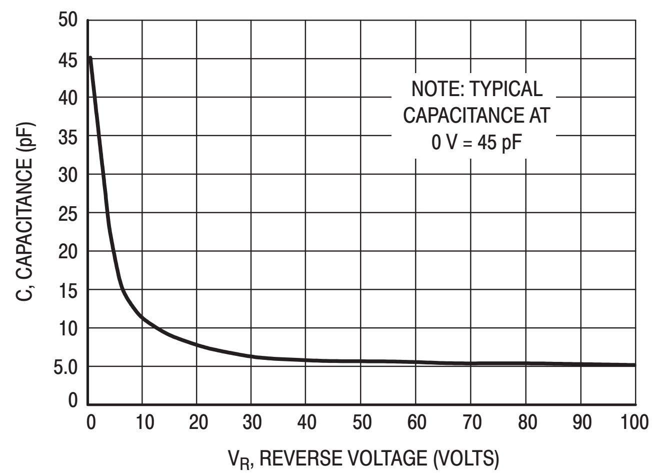

Figure 3. Typical Capacitance

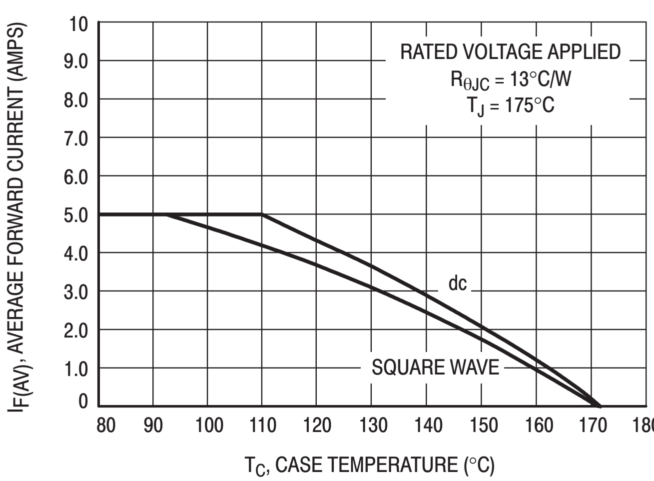

Figure 4. Current Derating, Case

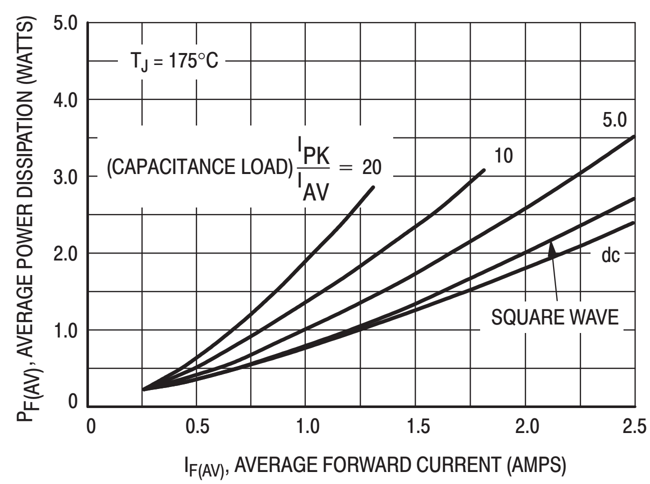

Figure 5. Power Dissipation

MURS140T3, MURS160T3

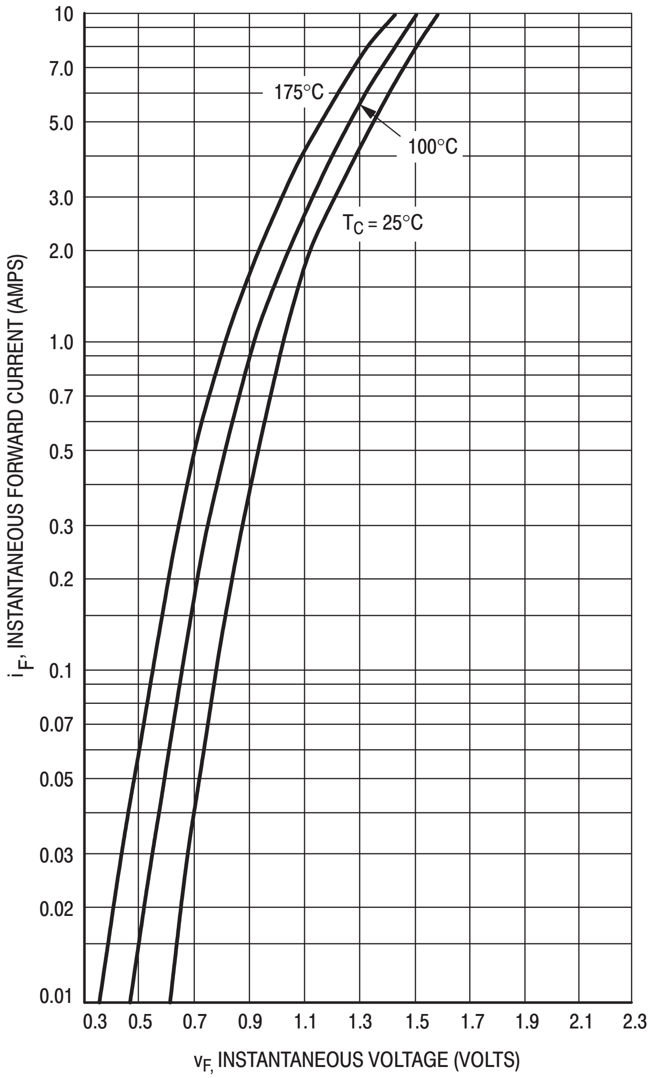

Figure 6. Typical Forward Voltage

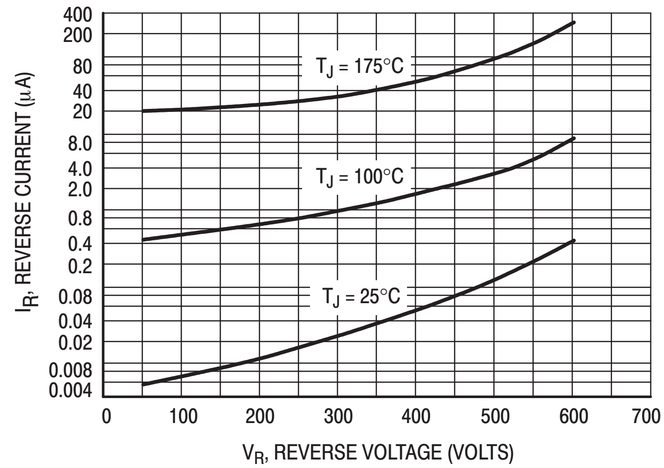

Figure 7. Typical Reverse Current*

* The curves shown are typical for the highest voltage device in the voltage grouping. Typical reverse current for lower voltage selections can be estimated from these same curves if applied V_R is sufficiently below rated V_R.

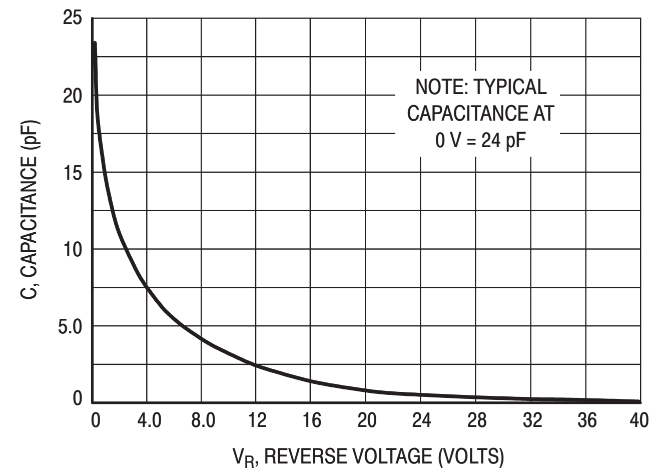

Figure 8. Typical Capacitance

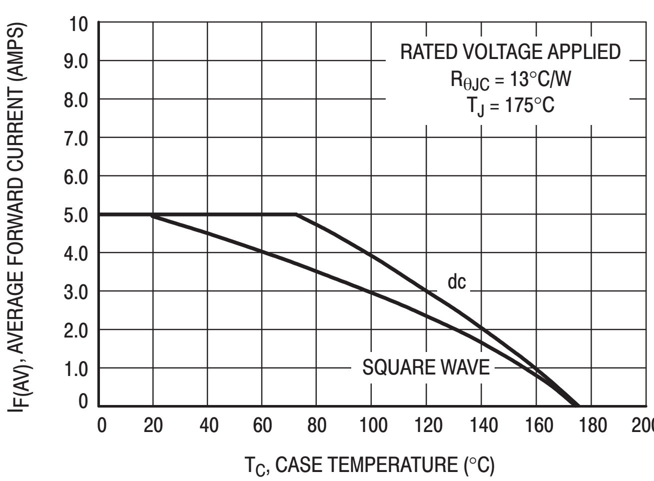

Figure 9. Current Derating, Case

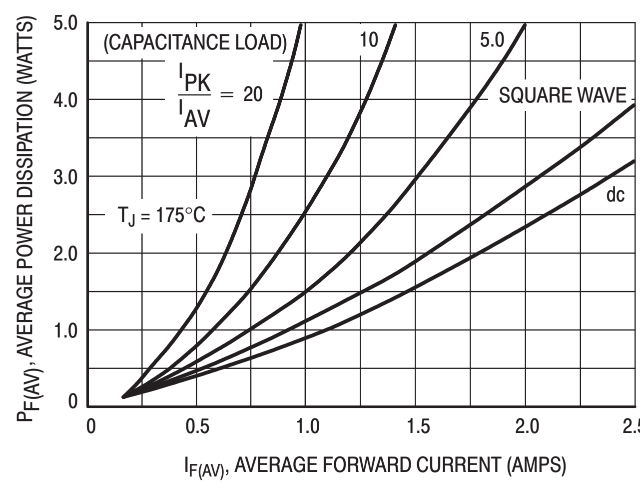

Figure 10. Power Dissipation

MURS220T3

Preferred Device

Surface Mount Ultrafast Power Rectifiers

Ideally suited for high voltage, high frequency rectification, or as free wheeling and protection diodes in surface mount applications where compact size and weight are critical to the system.

- Small Compact Surface Mountable Package with J–Bend Leads
- Rectangular Package for Automated Handling
- High Temperature Glass Passivated Junction
- Low Forward Voltage Drop (0.77 Volts Max @ 2.0 A, T_J = 150°C)

Mechanical Characteristics:

- Case: Epoxy, Molded
- Weight: 95 mg (approximately)
- Finish: All External Surfaces Corrosion Resistant and Terminal Leads are Readily Solderable
- Lead and Mounting Surface Temperature for Soldering Purposes: 260°C Max. for 10 Seconds
- Shipped in 12 mm Tape and Reel, 2500 units per reel
- Polarity: Polarity Band Indicates Cathode Lead
- Marking: U2D

MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Peak Repetitive Reverse Voltage Working Peak Reverse Voltage DC Blocking Voltage	V_{RRM} V_{RWM} V_R	200	V
Average Rectified Forward Current	$I_{F(AV)}$	2.0 @ T_L = 145°C	A
Non–Repetitive Peak Surge Current (Surge applied at rated load conditions halfwave, single phase, 60 Hz)	I_{FSM}	40	A
Operating Junction Temperature Range	T_J	–65 to +175	°C

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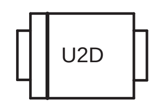
http://onsemi.com

ULTRAFAST RECTIFIERS
2 AMPERES
200 VOLTS

SMB
CASE 403A

MARKING DIAGRAM



U2D = Specific Device Code

ORDERING INFORMATION

Device	Package	Shipping
MURS220T3	SMB	2500/Tape & Reel

Preferred devices are recommended choices for future use and best overall value.

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THERMAL CHARACTERISTICS

Characteristic	Symbol	Value	Unit
Thermal Resistance, Junction to Lead (T_L = 25°C)	$R_{\theta JL}$	13	°C/W

ELECTRICAL CHARACTERISTICS

Characteristic	Symbol	Value	Unit
Maximum Instantaneous Forward Voltage (Note 1.)	v_F		Volts
(i_F = 2.0 A, T_J = 25°C)		0.95	
(i_F = 2.0 A, T_J = 150°C)		0.77	
Maximum Instantaneous Reverse Current (Note 1.)	i_R		μA
(Rated dc Voltage, T_J = 25°C)		2.0	
(Rated dc Voltage, T_J = 150°C)		50	
Maximum Reverse Recovery Time	t_{rr}		ns
(i_F = 1.0 A, di/dt = 50 A/μs)		35	
(i_F = 0.5 A, i_R = 1.0 A, I_R to 0.25 A)		25	
Maximum Forward Recovery Time (i_F = 1.0 A, di/dt = 100 A/μs, Rec. to 1.0 V)	t_{fr}	25	ns

1. Pulse Test: Pulse Width = 300 μs, Duty Cycle ≤ 2.0%.

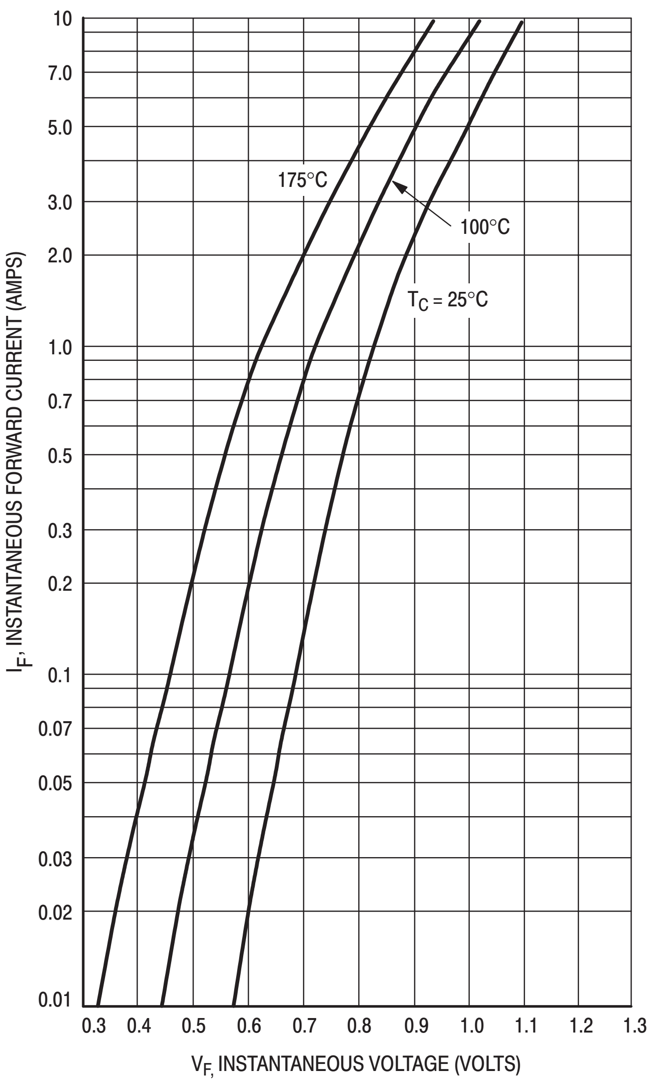

Figure 1. Typical Forward Voltage

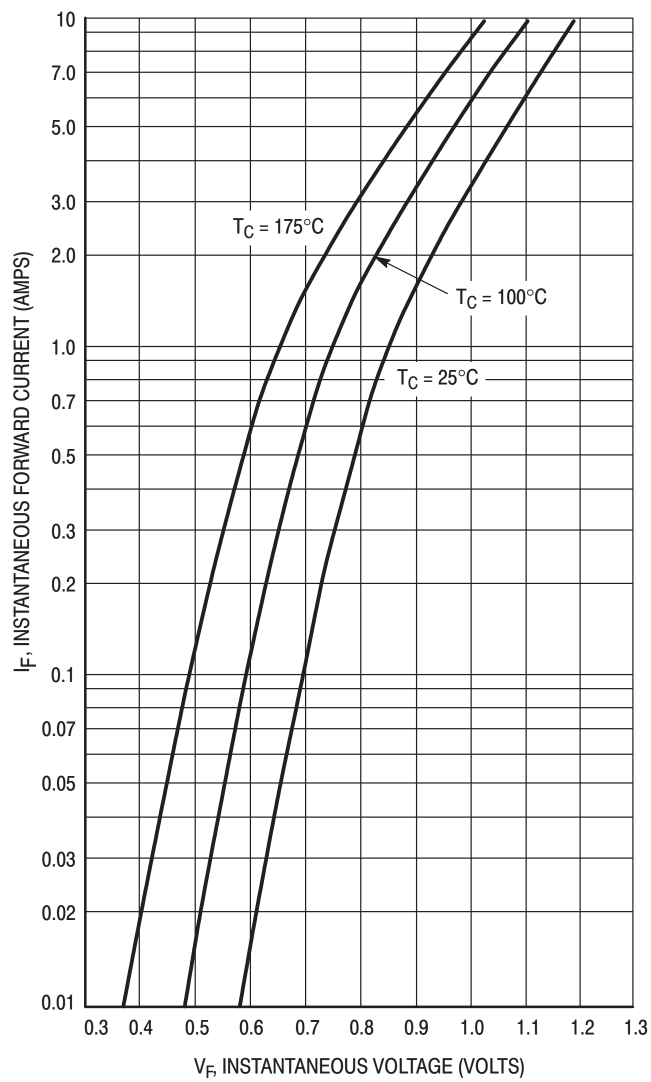

Figure 2. Maximum Forward Voltage

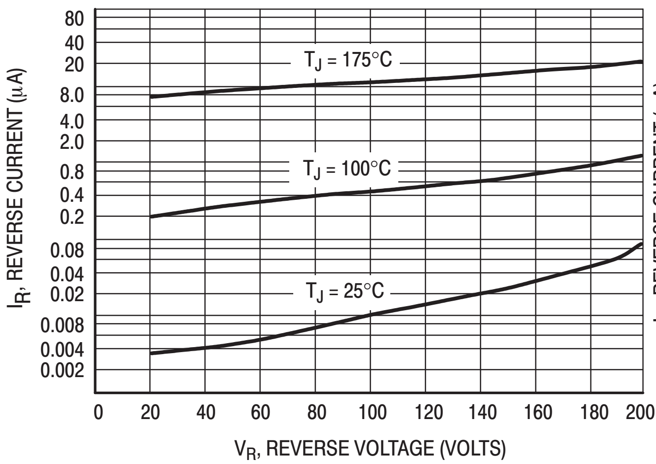

Figure 3. Typical Reverse Current*

* The curves shown are typical for the highest voltage device in the voltage grouping. Typical reverse current for lower voltage selections can be estimated from these same curves if applied V_R is sufficiently below rated V_R.

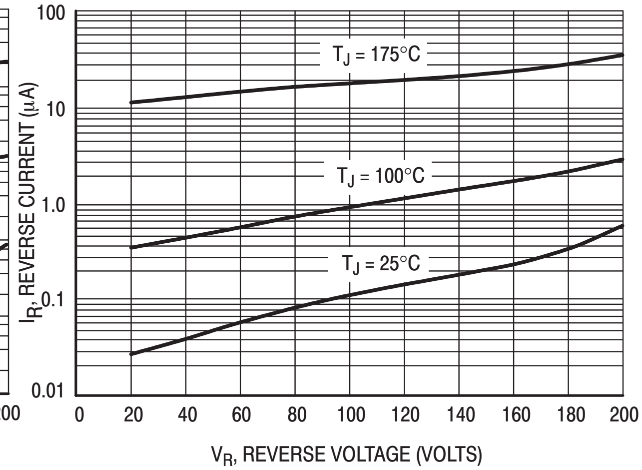

Figure 4. Maximum Reverse Current

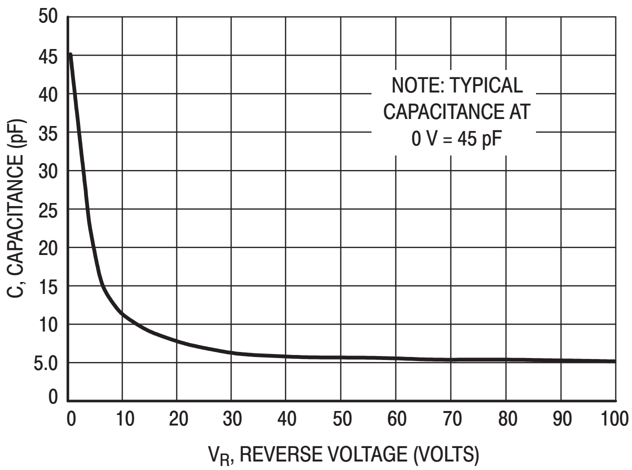

Figure 5. Typical Capacitance

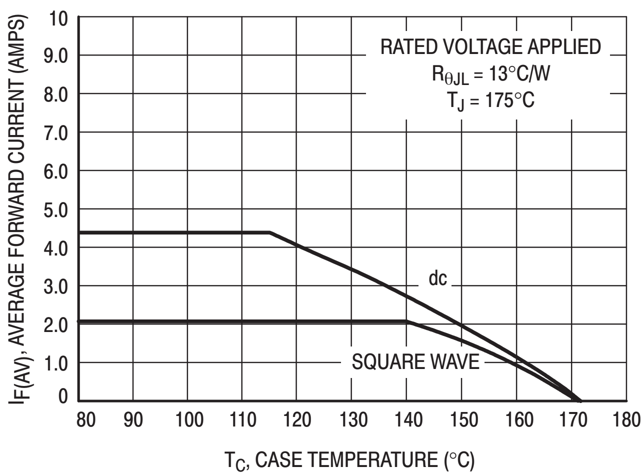

Figure 6. Current Derating, Case

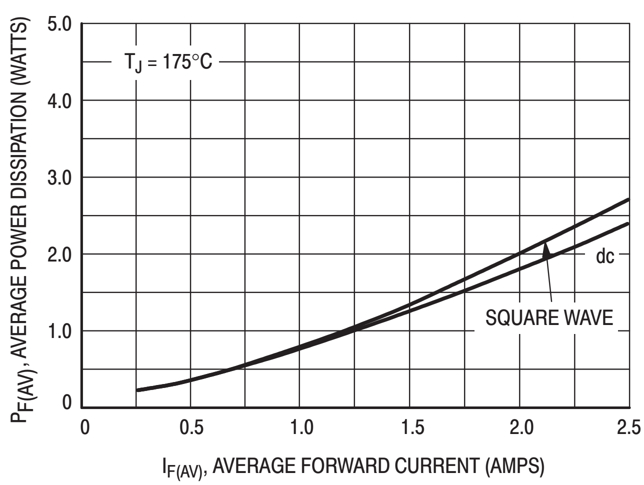

Figure 7. Power Dissipation

MURS230T3, MURS240T3

Preferred Device

Surface Mount Ultrafast Power Rectifiers

Ideally suited for high voltage, high frequency rectification, or as free wheeling and protection diodes in surface mount applications where compact size and weight are critical to the system.

- Small Compact Surface Mountable Package with J–Bend Leads
- Rectangular Package for Automated Handling
- High Temperature Glass Passivated Junction
- Low Forward Voltage Drop (0.95 Volts Max @ 2.0 A, T_J = 150°C)

Mechanical Characteristics:

- Case: Epoxy, Molded
- Weight: 95 mg (approximately)
- Finish: All External Surfaces Corrosion Resistant and Terminal Leads are Readily Solderable
- Lead and Mounting Surface Temperature for Soldering Purposes: 260°C Max. for 10 Seconds
- Shipped in 12 mm Tape and Reel, 2500 units per reel
- Polarity: Polarity Band Indicates Cathode Lead
- Marking: U2F, U2G

MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Peak Repetitive Reverse Voltage Working Peak Reverse Voltage DC Blocking Voltage MURS230T3 MURS240T3	V_{RRM} V_{RWM} V_R	 300 400	V
Average Rectified Forward Current	$I_{F(AV)}$	1.0 @ T_L = 150°C 2.0 @ T_L = 125°C	A
Non–Repetitive Peak Surge Current (Surge applied at rated load conditions halfwave, single phase, 60 Hz)	I_{FSM}	35	A
Operating Junction Temperature Range	T_J	–65 to +175	°C

ON Semiconductor™

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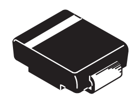
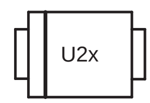
ULTRAFAST RECTIFIERS
2 AMPERES
300–400 VOLTS



SMB
CASE 403A

MARKING DIAGRAM



x = F (230T3)
G (240T3)

ORDERING INFORMATION

Device	Package	Shipping
MURS230T3	SMB	2500/Tape & Reel
MURS240T3	SMB	2500/Tape & Reel

Preferred devices are recommended choices for future use and best overall value.

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October, 2000 – Rev. 3
Publication Order Number:
MURS230T3/D

THERMAL CHARACTERISTICS

Rating	Symbol	Value	Unit
Thermal Resistance, Junction to Lead (T_L = 25°C)	$R_{\theta JL}$	13	°C/W

ELECTRICAL CHARACTERISTICS

Maximum Instantaneous Forward Voltage (Note 1.) (i_F = 2.0 A, T_J = 25°C) (i_F = 2.0 A, T_J = 150°C)	v_F	 1.15 0.95	Volts
Maximum Instantaneous Reverse Current (Note 1.) (Rated dc Voltage, T_J = 25°C) (Rated dc Voltage, T_J = 150°C)	i_R	 5.0 150	μA
Maximum Reverse Recovery Time (i_F = 1.0 A, di/dt = 50 A/μs) (i_F = 0.5 A, i_R = 1.0 A, I_R to 0.25 A)	t_{rr}	 65 50	ns
Maximum Forward Recovery Time (i_F = 1.0 A, di/dt = 100 A/μs, Rec. to 1.0 V)	t_{fr}	50	ns

1. Pulse Test: Pulse Width = 300 μs, Duty Cycle ≤ 2.0%.

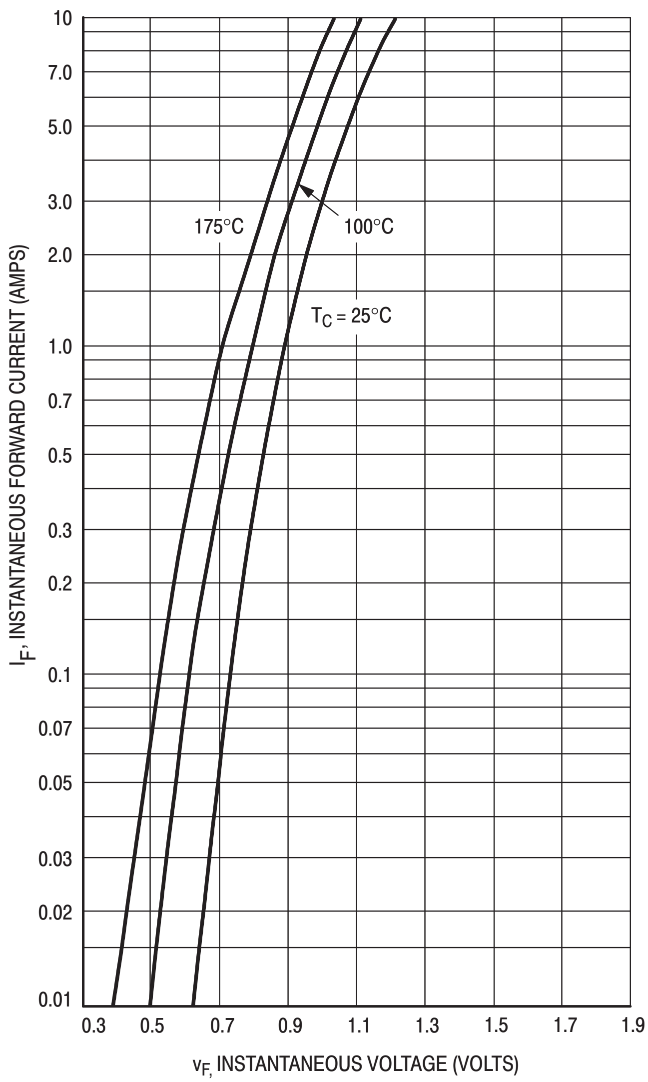

Figure 1. Typical Forward Voltage

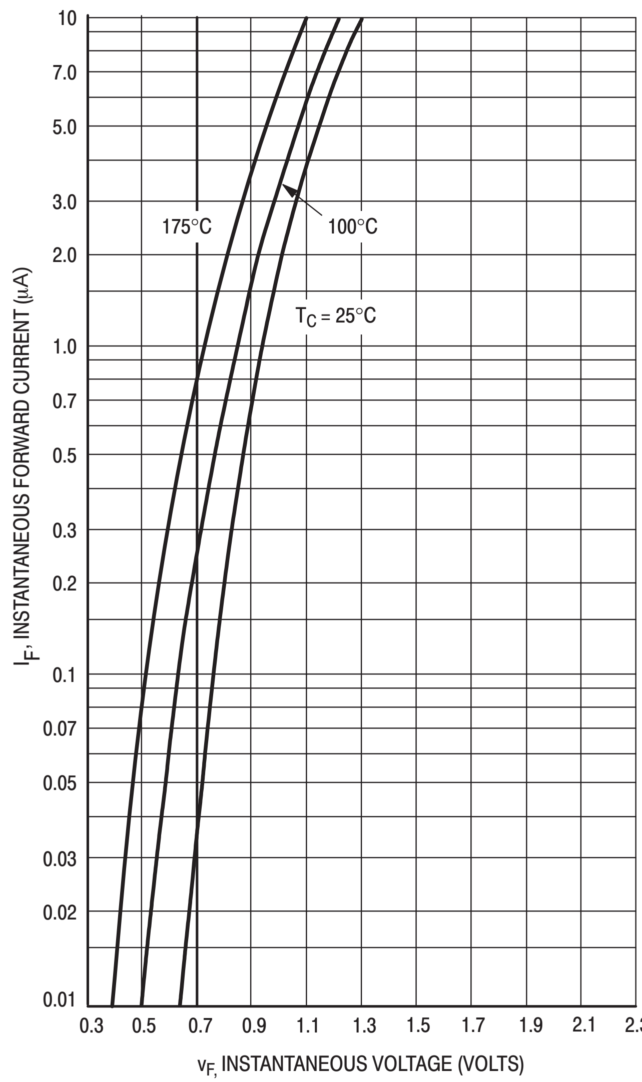

Figure 2. Maximum Forward Voltage

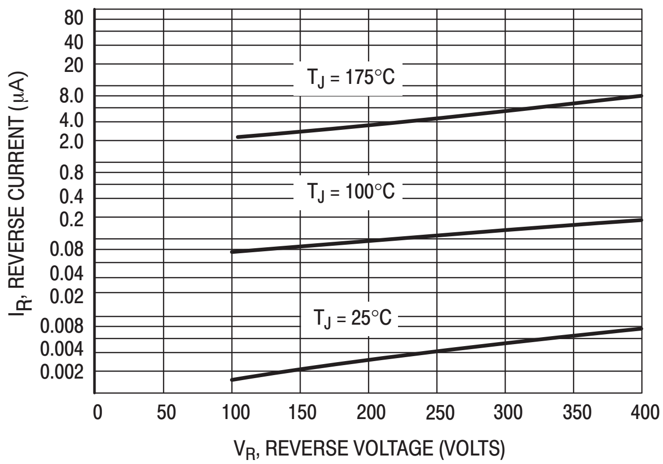

Figure 3. Typical Reverse Current*

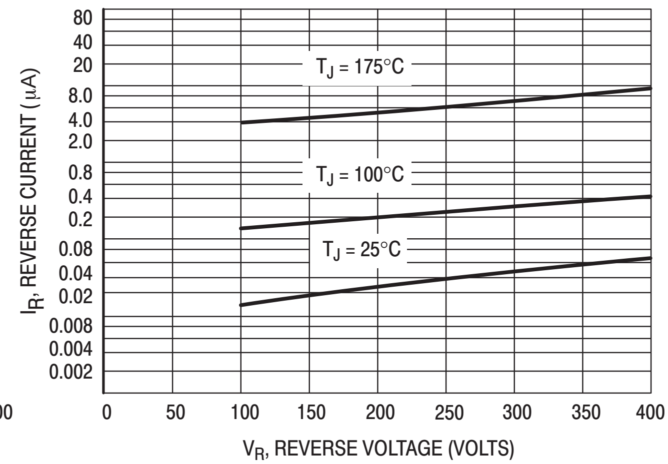

Figure 4. Maximum Reverse Current*

* The curves shown are typical for the highest voltage device in the voltage grouping. Typical reverse current for lower voltage selections can be estimated from these same curves if applied V_R is sufficiently below rated V_R.

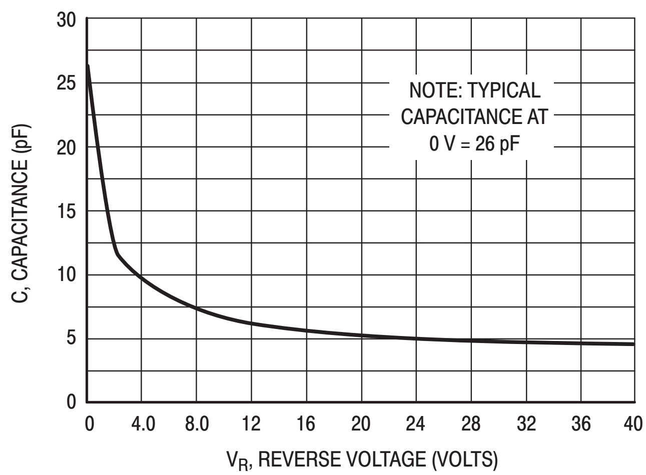

Figure 5. Typical Capacitance

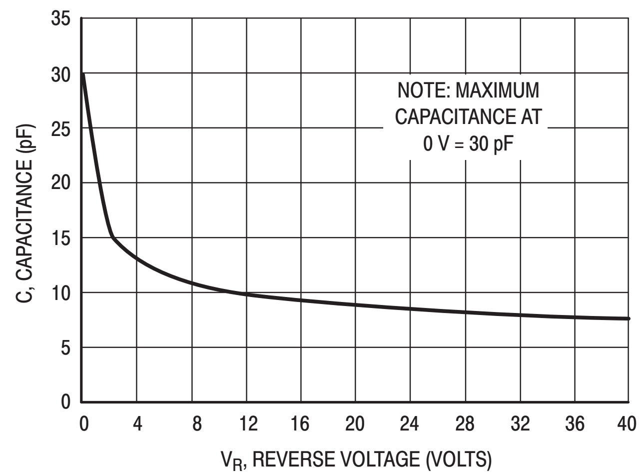

Figure 6. Maximum Capacitance

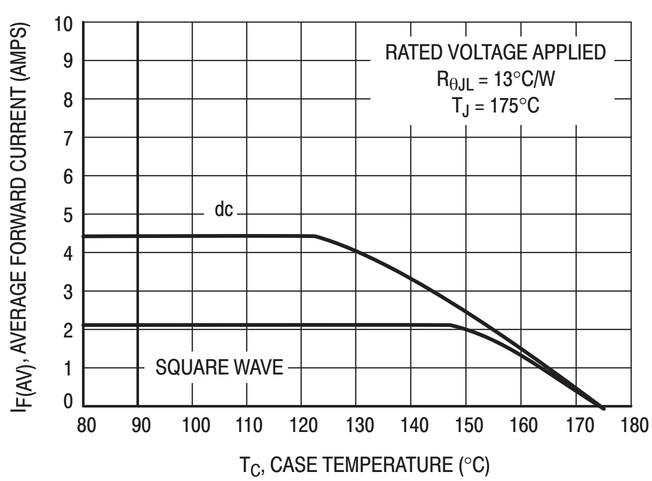

Figure 7. Current Derating, Case

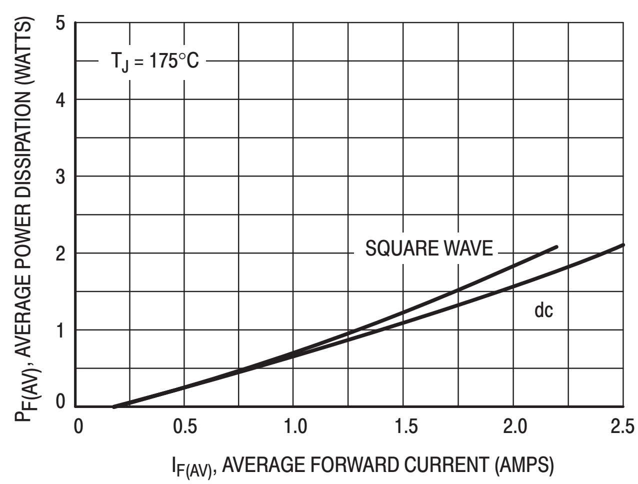

Figure 8. Power Dissipation

MURS260T3

Preferred Device

Surface Mount Ultrafast Power Rectifiers

Ideally suited for high voltage, high frequency rectification, or as free wheeling and protection diodes in surface mount applications where compact size and weight are critical to the system.

- Small Compact Surface Mountable Package with J–Bend Leads
- Rectangular Package for Automated Handling
- High Temperature Glass Passivated Junction
- Low Forward Voltage Drop (1.20 Volts Max @ 2.0 A, T_J = 150°C)

Mechanical Characteristics:

- Case: Epoxy, Molded
- Weight: 95 mg (approximately)
- Finish: All External Surfaces Corrosion Resistant and Terminal Leads are Readily Solderable
- Lead and Mounting Surface Temperature for Soldering Purposes: 260°C Max. for 10 Seconds
- Shipped in 12 mm Tape and Reel, 2500 units per reel
- Polarity: Polarity Band Indicates Cathode Lead
- Marking: U2J

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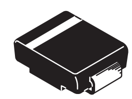
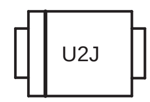
ULTRAFAST RECTIFIERS
2 AMPERES
600 VOLTS



SMB
CASE 403A

MARKING DIAGRAM



U2J = Specific Device Code

MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Peak Repetitive Reverse Voltage Working Peak Reverse Voltage DC Blocking Voltage	V_{RRM} V_{RWM} V_R	600	Volts
Average Rectified Forward Current	$I_{F(AV)}$	2.0 @ T_L = 125°C	Amps
Non–Repetitive Peak Surge Current (Surge applied at rated load conditions halfwave, single phase, 60 Hz)	I_{FSM}	35	Amps
Operating Junction Temperature	T_J	– 65 to +175	°C

ORDERING INFORMATION

Device	Package	Shipping
MURS260T3	SMB	2500/Tape & Reel

Preferred devices are recommended choices for future use and best overall value.

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THERMAL CHARACTERISTICS

Characteristic	Symbol	Value	Unit
Thermal Resistance, Junction to Lead (T_L = 25°C)	$R_{\theta JL}$	13	°C/W

ELECTRICAL CHARACTERISTICS

Characteristic	Symbol	Value	Unit
Maximum Instantaneous Forward Voltage (Note 1.) (i_F = 2.0 A, T_J = 25°C) (i_F = 2.0 A, T_J = 150°C)	v_F	 1.45 1.20	Volts
Maximum Instantaneous Reverse Current (Note 1.) (Rated dc Voltage, T_J = 25°C) (Rated dc Voltage, T_J = 150°C)	i_R	 5.0 150	μA
Maximum Reverse Recovery Time (i_F = 1.0 A, di/dt = 50 A/μs) (i_F = 0.5 A, i_R = 1.0 A, I_R to 0.25 A)	t_{rr}	 75 50	ns
Maximum Forward Recovery Time (i_F = 1.0 A, di/dt = 100 A/μs, Rec. to 1.0 V)	t_{fr}	50	ns

1. Pulse Test: Pulse Width = 300 μs, Duty Cycle ≤ 2.0%.

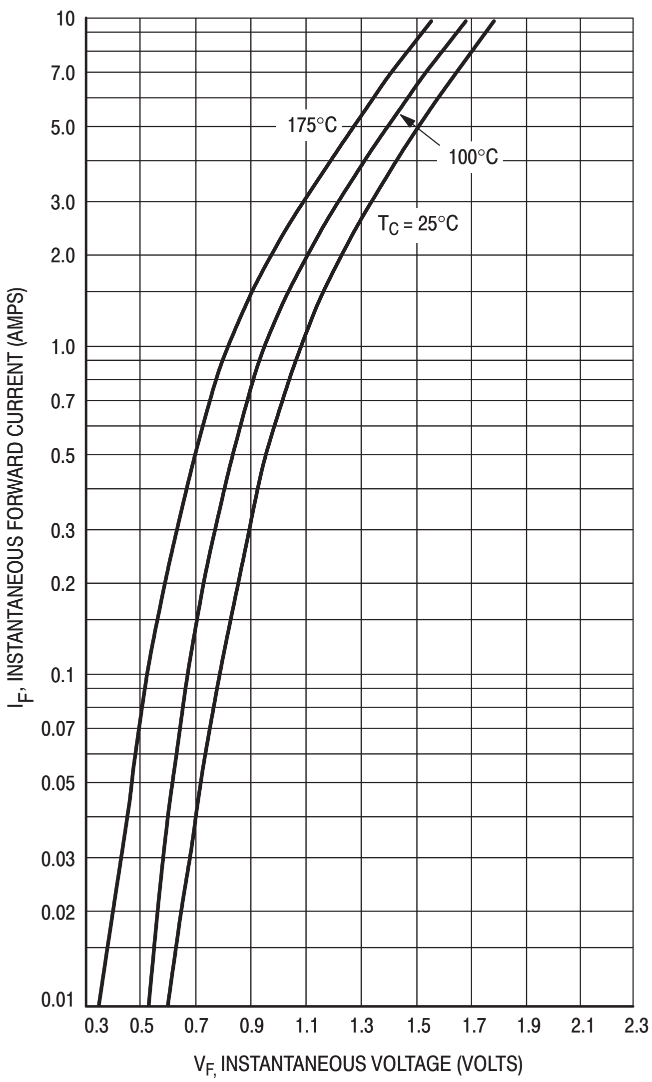

Figure 1. Typical Forward Voltage

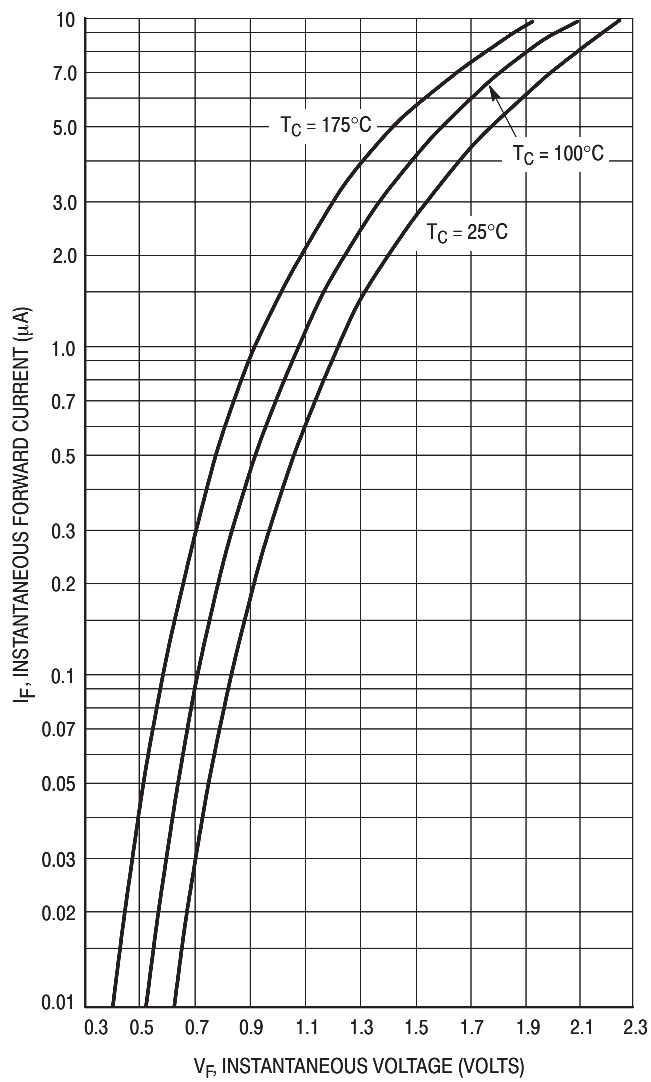

Figure 2. Maximum Forward Voltage

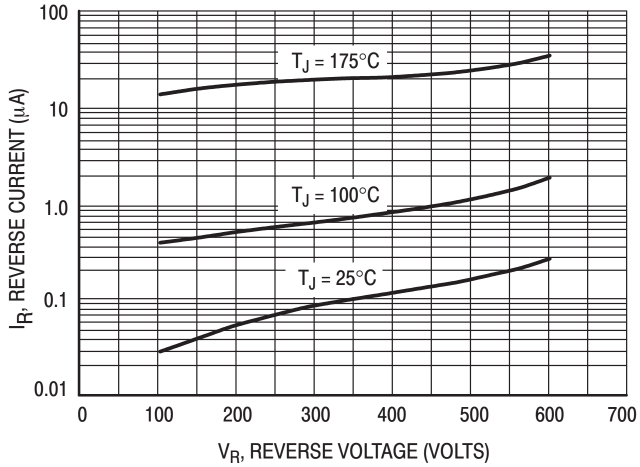

Figure 3. Typical Reverse Current*

* The curves shown are typical for the highest voltage device in the voltage grouping. Typical reverse current for lower voltage selections can be estimated from these same curves if applied V_R is sufficiently below rated V_R.

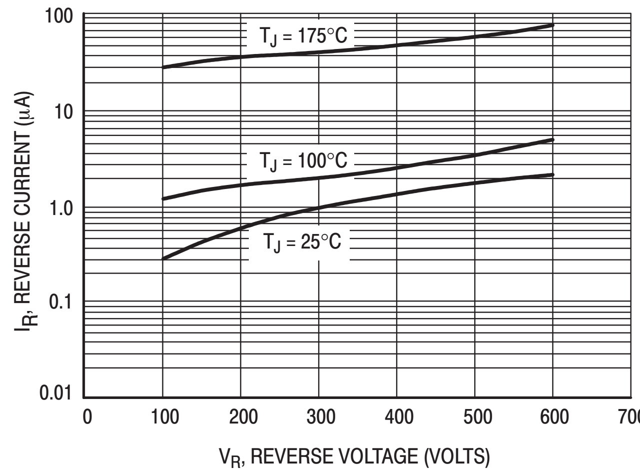

Figure 4. Maximum Reverse Current

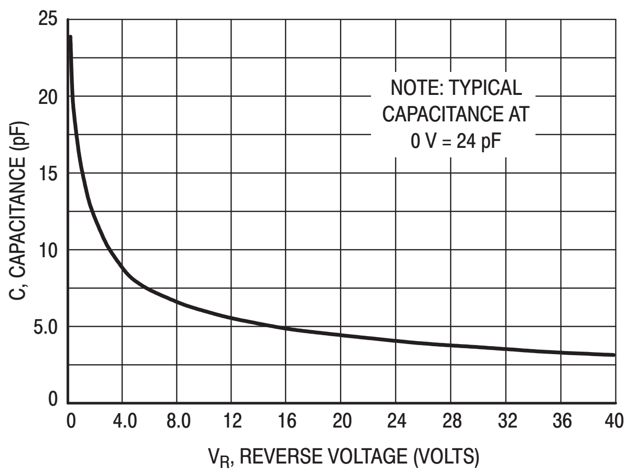

Figure 5. Typical Capacitance

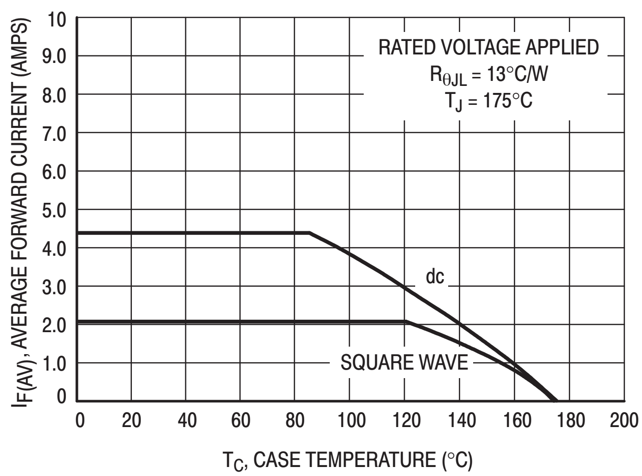

Figure 6. Current Derating, Case

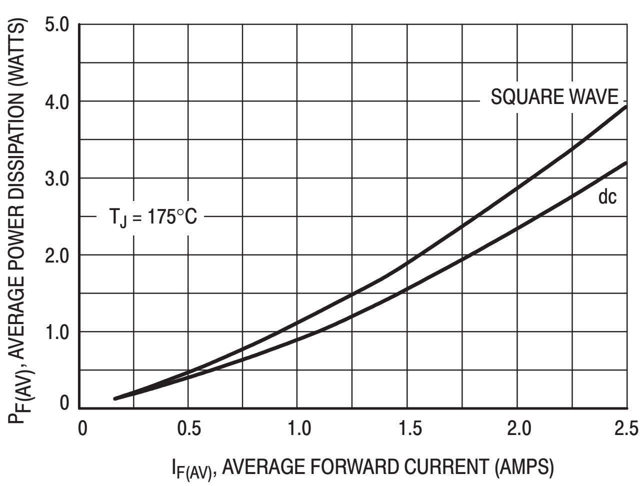

Figure 7. Power Dissipation

MURS320T3, MURS340T3, MURS360T3

Preferred Devices

Surface Mount Ultrafast Power Rectifiers

. . . employing state–of–the–art epitaxial construction with oxide passivation and metal overlay contact. Ideally suited for high voltage, high frequency rectification, or as free wheeling and protection diodes, in surface mount applications where compact size and weight are critical to the system.

- Small Compact Surface Mountable Package with J–Bend Leads
- Rectangular Package for Automated Handling
- Highly Stable Oxide Passivated Junction
- Low Forward Voltage Drop
  (0.71 to 1.05 Volts Max @ 3.0 A, T_J = 150°C)

Mechanical Characteristics:

- Case: Epoxy, Molded
- Weight: 217 mg (approximately)
- Finish: All External Surfaces Corrosion Resistant and Terminal Leads are Readily Solderable
- Lead and Mounting Surface Temperature for Soldering Purposes: 260°C Max. for 10 Seconds
- Shipped in 16 mm Tape and Reel, 2500 units per reel
- Polarity: Notch in Plastic Body Indicates Cathode Lead
- Marking: U3D, U3G, U3J

MAXIMUM RATINGS

Please See the Table on the Following Page

ON Semiconductor™

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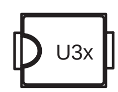
ULTRAFAST RECTIFIERS 3.0 AMPERES 200–600 VOLTS

SMC CASE 403 PLASTIC

MARKING DIAGRAM



U3x = Device Code
x = D, G , or J

ORDERING INFORMATION

Device	Package	Shipping
MURS320T3	SMC	2500/Tape & Reel
MURS340T3	SMC	2500/Tape & Reel
MURS360T3	SMC	2500/Tape & Reel

Preferred devices are recommended choices for future use and best overall value.

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MAXIMUM RATINGS

Rating	Symbol	MURS320T3	MURS340T3	MURS360T3	Unit
Peak Repetitive Reverse Voltage Working Peak Reverse Voltage DC Blocking Voltage	V_{RRM} V_{RWM} V_R	200	400	600	Volts
Average Rectified Forward Current	$I_{F(AV)}$	3.0 @ T_L = 140°C 4.0 @ T_L = 130°C	3.0 @ T_L = 130°C 4.0 @ T_L = 115°C	3.0 @ T_L = 130°C 4.0 @ T_L = 115°C	Amps
Non–Repetitive Peak Surge Current (Surge applied at rated load conditions halfwave, single phase, 60 Hz)	I_{FSM}	75			Amps
Operating Junction Temperature	T_J	– 65 to +175			°C

THERMAL CHARACTERISTICS

Thermal Resistance, Junction to Lead	$R_{\theta JL}$	11			°C/W

ELECTRICAL CHARACTERISTICS

Maximum Instantaneous Forward Voltage (Note 1.) (i_F = 3.0 A, T_J = 25°C) (i_F = 4.0 A, T_J = 25°C) (i_F = 3.0 A, T_J = 150°C)	v_F	 0.875 0.89 0.71	 1.25 1.28 1.05	 1.25 1.28 1.05	Volts
Maximum Instantaneous Reverse Current (Note 1.) (Rated dc Voltage, T_J = 25°C) (Rated dc Voltage, T_J = 150°C)	i_R	 5.0 15	 10 250	 10 250	µA
Maximum Reverse Recovery Time (i_F = 1.0 A, di/dt = 50 A/µs) (i_F = 0.5 A, i_R = 1.0 A, I_{REC} to 0.25 A)	t_{rr}	 35 25	 75 50	 75 50	ns
Maximum Forward Recovery Time (i_F = 1.0 A, di/dt = 100 A/µs, Recovery to 1.0 V)	t_{fr}	25	50	50	ns

1. Pulse Test: Pulse Width = 300 µs, Duty Cycle ≤ 2.0%.

MURS320T3

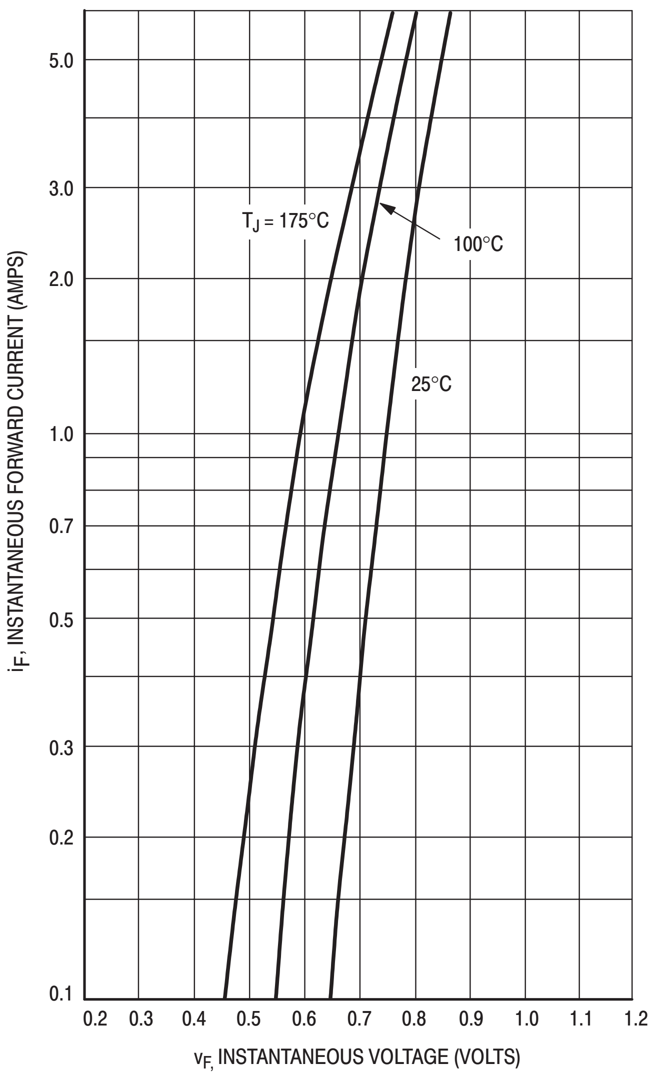

Figure 1. Typical Forward Voltage

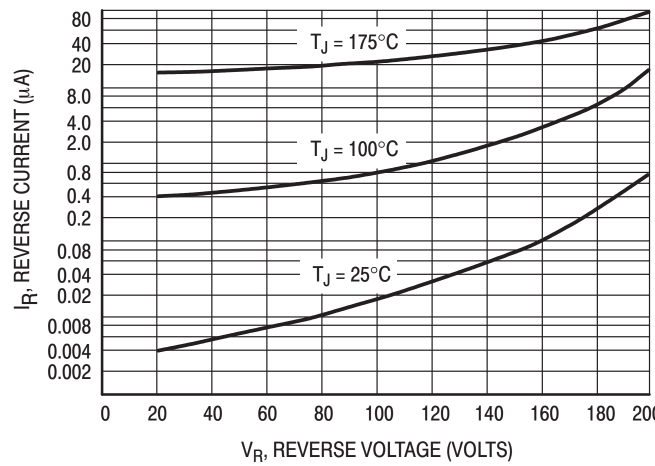

Figure 2. Typical Reverse Current*

* The curves shown are typical for the highest voltage device in the voltage grouping. Typical reverse current for lower voltage selections can be estimated from these same curves if V_R is sufficiently below rated V_R.

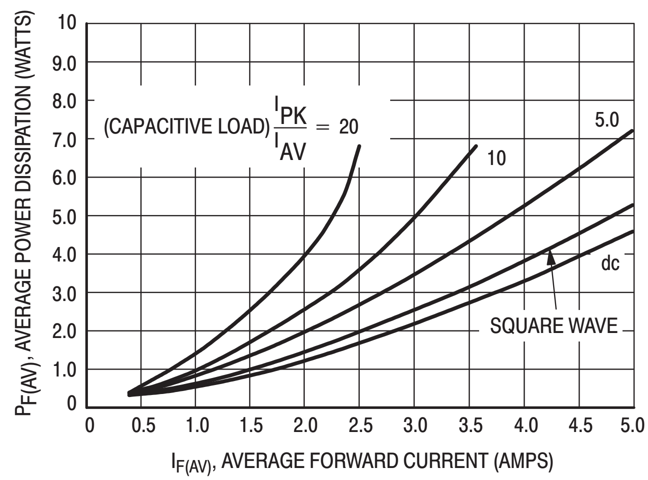

Figure 3. Power Dissipation

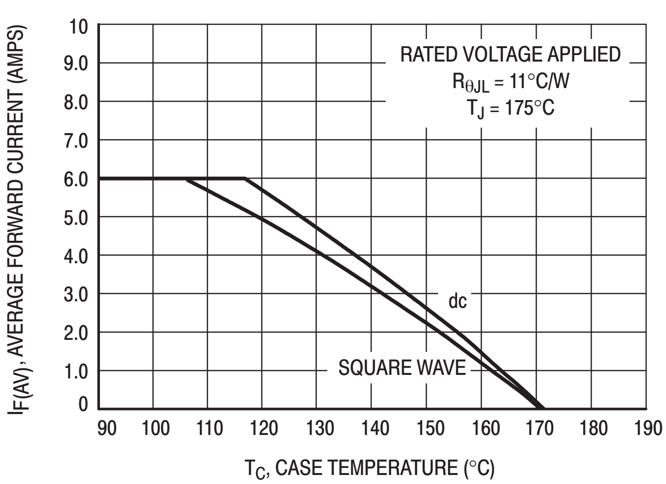

Figure 4. Current Derating, Case

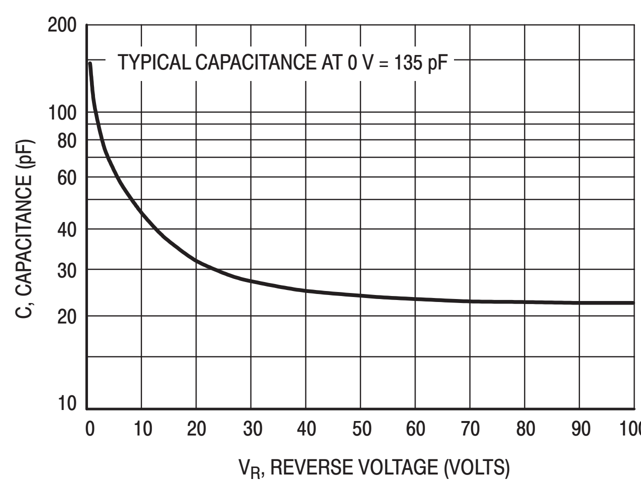

Figure 5. Typical Capacitance

MURS340T3, MURS360T3

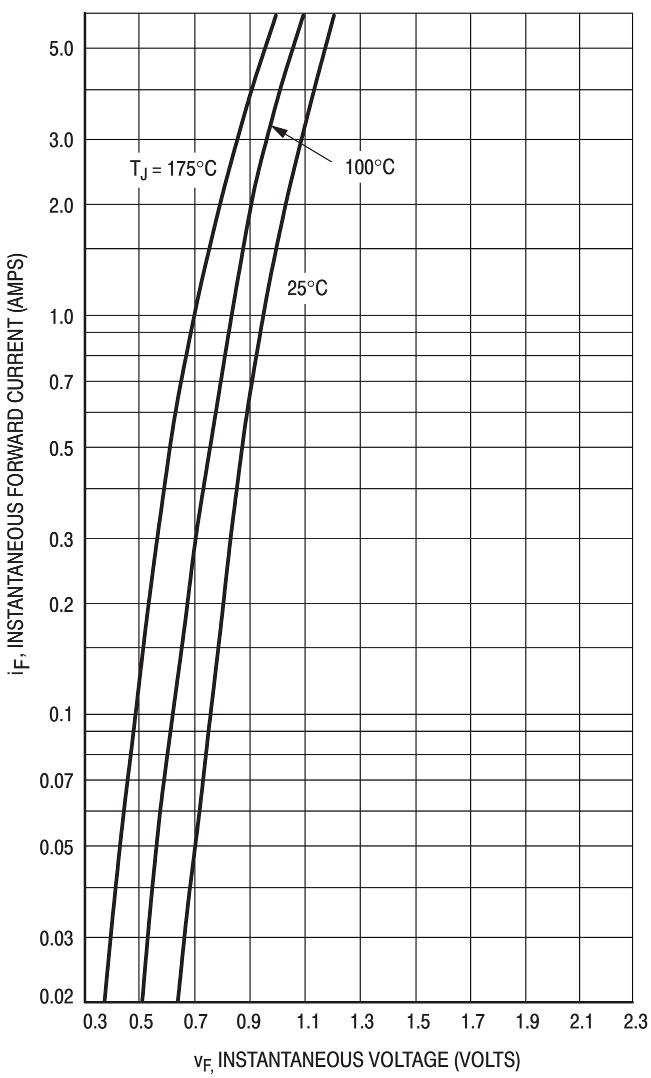

Figure 6. Typical Forward Voltage

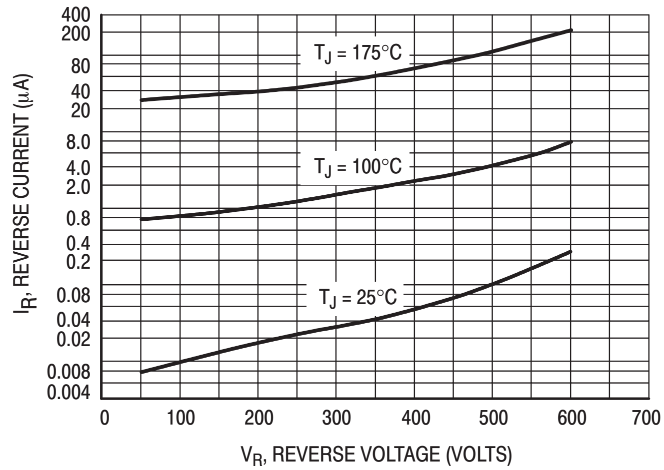

Figure 7. Typical Reverse Current*

* The curves shown are typical for the highest voltage device in the voltage grouping. Typical reverse current for lower voltage selections can be estimated from these same curves if V_R is sufficiently below rated V_R.

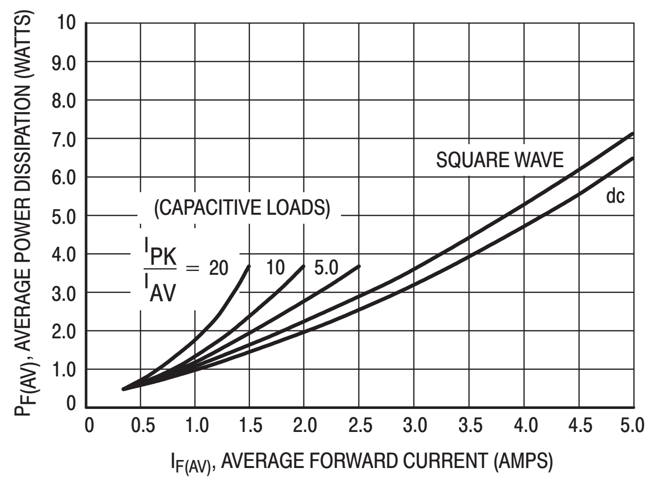

Figure 8. Power Dissipation

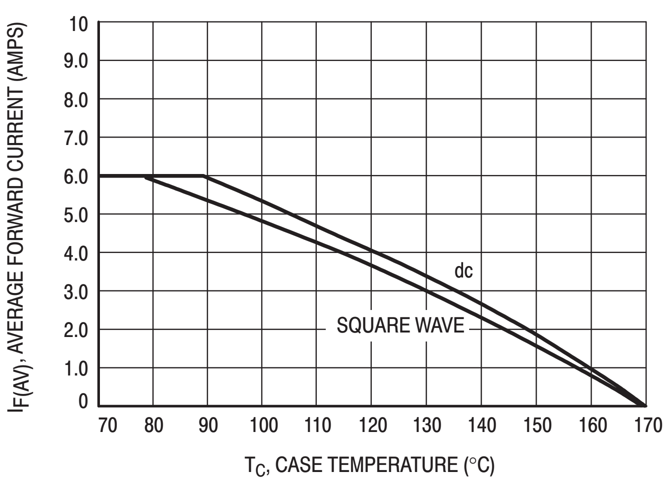

Figure 9. Current Derating, Case

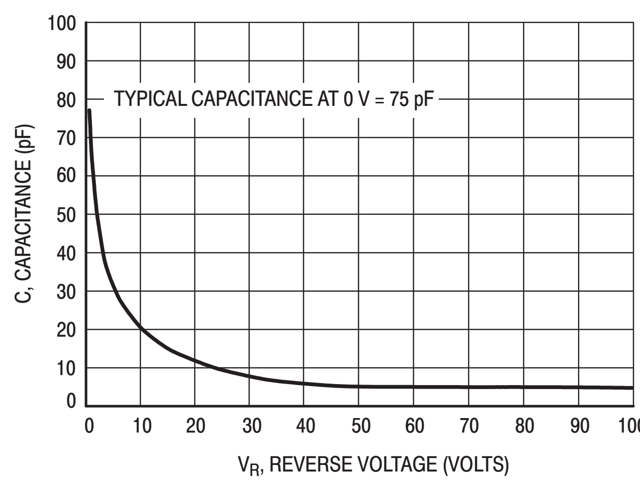

Figure 10. Typical Capacitance

MURD320

Preferred Device

SWITCHMODE™ Power Rectifier

DPAK Surface Mount Package

. . . designed for use in switching power supplies, inverters and as free wheeling diodes, these state–of–the–art devices have the following features:

- Ultrafast 35 Nanosecond Recovery Time
- Low Forward Voltage Drop
- Low Leakage

Mechanical Characteristics:

- Case: Epoxy, Molded
- Weight: 0.4 gram (approximately)
- Finish: All External Surfaces Corrosion Resistant and Terminal Leads are Readily Solderable
- Lead and Mounting Surface Temperature for Soldering Purposes: 260°C Max. for 10 Seconds
- Shipped 75 units per plastic tube
- Available in 16 mm Tape and Reel, 2500 units per reel, by adding a “T4’’ suffix to the part number
- Marking: U320

MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Peak Repetitive Reverse Voltage Working Peak Reverse Voltage DC Blocking Voltage	V_{RRM} V_{RWM} V_R	200	V
Average Rectified Forward Current (Rated V_R, T_C = 158°C)	$I_{F(AV)}$	3.0	A
Peak Repetitive Forward Current (Rated V_R, Square Wave, 20 kHz, T_C = 158°C)	I_{FRM}	6.0	A
Non–Repetitive Peak Surge Current (Surge Applied at Rated Load Conditions Halfwave, 60 Hz)	I_{FSM}	75	A
Operating Junction and Storage Temperature Range	T_J, T_{stg}	–65 to +175	°C

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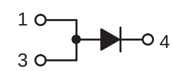
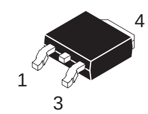
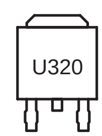
ULTRAFAST RECTIFIER 3.0 AMPERES 200 VOLTS





DPAK CASE 369A PLASTIC

MARKING DIAGRAM



U320 = Device Code

ORDERING INFORMATION

Device	Package	Shipping
MURD320	DPAK	75 Units/Rail
MURD320T4	DPAK	2500/Tape & Reel

Preferred devices are recommended choices for future use and best overall value.

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THERMAL CHARACTERISTICS

Rating	Symbol	Value	Unit
Thermal Resistance, Junction to Case Junction to Ambient (Note 1.)	$R_{\theta JC}$ $R_{\theta JA}$	6 80	°C/W

ELECTRICAL CHARACTERISTICS

Maximum Instantaneous Forward Voltage Drop (Note 2.) (i_F = 3 Amps, T_J = 25°C) (i_F = 3 Amps, T_J = 125°C)	v_F	 0.95 0.75	Volts
Maximum Instantaneous Reverse Current (Note 2.) (T_J = 25°C, Rated dc Voltage) (T_J = 125°C, Rated dc Voltage)	i_R	 5 500	μA
Maximum Reverse Recovery Time (I_F = 1 Amp, di/dt = 50 Amps/μs, V_R = 30 V, T_J = 25°C) (I_F = 0.5 Amp, i_R = 1 Amp, I_{REC} = 0.25 A, V_R = 30 V, T_J = 25°C)	t_{rr}	 35 25	ns

1. Rating applies when surface mounted on the minimum pad sizes recommended.
2. Pulse Test: Pulse Width = 300 μs, Duty Cycle ≤ 2.0%.

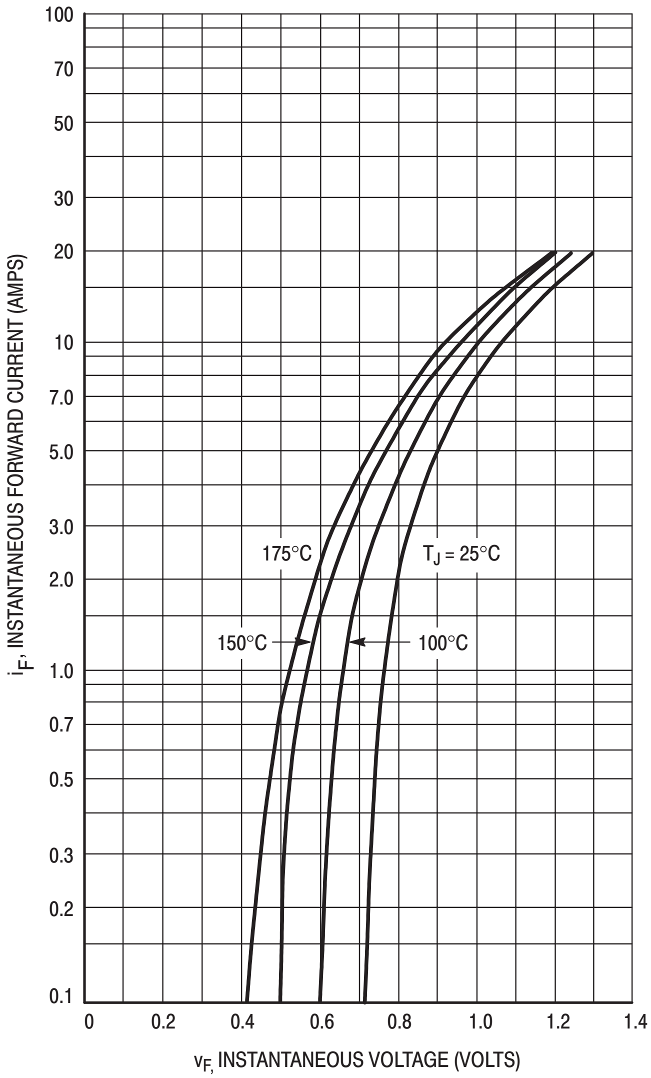

Figure 1. Typical Forward Voltage

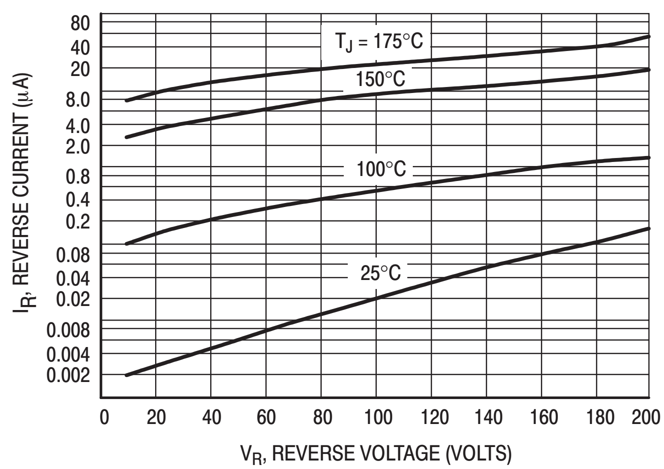

Figure 2. Typical Reverse Current*

* The curves shown are typical for the highest voltage device in the voltage grouping. Typical reverse current for lower voltage selections can be estimated from these curves if V_R is sufficiently below rated V_R.

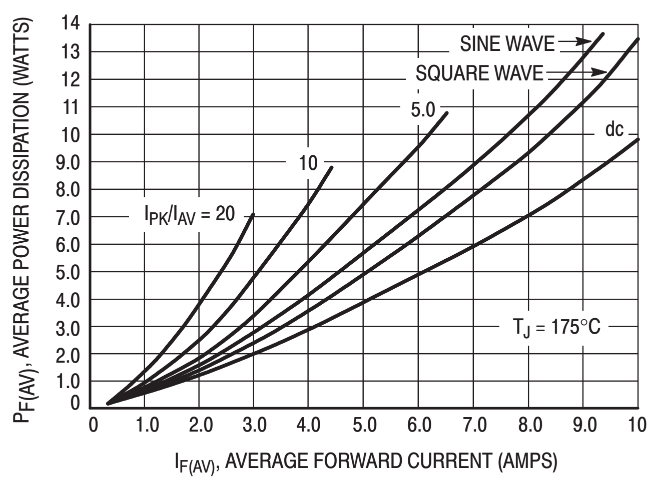

Figure 3. Average Power Dissipation

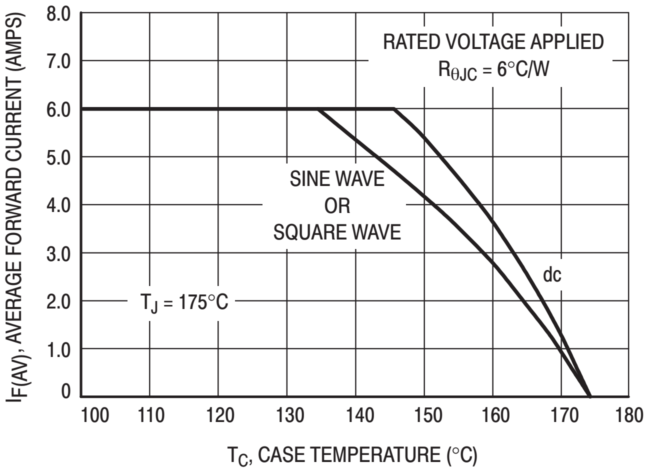

Figure 4. Current Derating, Case

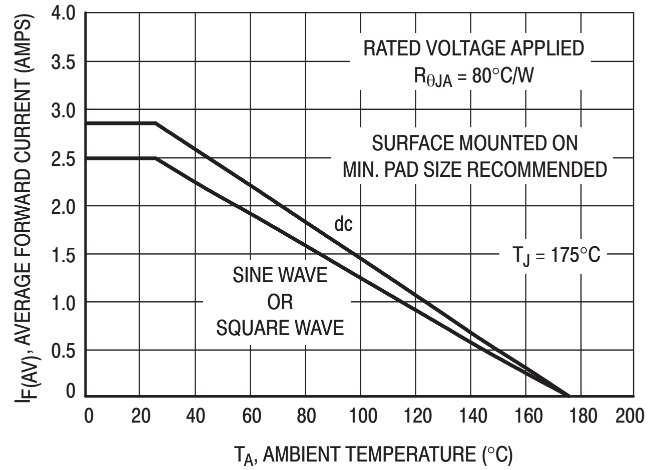

Figure 5. Current Derating, Ambient

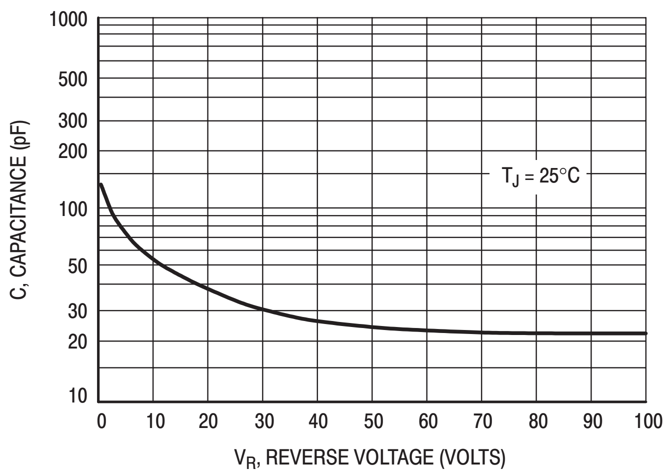

Figure 6. Typical Capacitance

MURD620CT

Preferred Device

SWITCHMODE™ Power Rectifier

DPAK Surface Mount Package

. . . designed for use in switching power supplies, inverters and as free wheeling diodes, these state–of–the–art devices have the following features:

- Ultrafast 35 Nanosecond Recovery Time
- Low Forward Voltage Drop
- Low Leakage

Mechanical Characteristics:

- Case: Epoxy, Molded
- Weight: 0.4 gram (approximately)
- Finish: All External Surfaces Corrosion Resistant and Terminal Leads are Readily Solderable
- Lead and Mounting Surface Temperature for Soldering Purposes: 260°C Max. for 10 Seconds
- Shipped 75 units per plastic tube
- Available in 16 mm Tape and Reel, 2500 units per reel, by adding a "T4'' suffix to the part number
- Marking: U620T

MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Peak Repetitive Reverse Voltage Working Peak Reverse Voltage DC Blocking Voltage	V_{RRM} V_{RWM} V_R	200	V
Average Rectified Forward Current (Rated V_R, T_C = 140°C) Per Diode Per Device	$I_{F(AV)}$	 3.0 6.0	A
Peak Repetitive Forward Current (Rated V_R, Square Wave, 20 kHz, T_C = 145°C) Per Diode	I_F	6.0	A
Non–Repetitive Peak Surge Current (Surge Applied at Rated Load Conditions Halfwave, 60 Hz)	I_{FSM}	50	A
Operating Junction and Storage Temperature Range	T_J, T_{stg}	–65 to +175	°C

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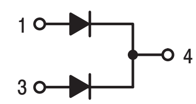
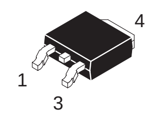
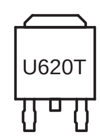
ULTRAFAST RECTIFIER 6.0 AMPERES 200 VOLTS





DPAK CASE 369A PLASTIC

MARKING DIAGRAM



U620T = Device Code

ORDERING INFORMATION

Device	Package	Shipping
MURD620CT	DPAK	75 Units/Rail
MURD620CTT4	DPAK	2500/Tape & Reel

Preferred devices are recommended choices for future use and best overall value.

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THERMAL CHARACTERISTICS (Per Diode)

Rating	Symbol	Value	Unit
Thermal Resistance, Junction to Case Junction to Ambient (Note 1.)	$R_{\theta JC}$ $R_{\theta JA}$	9 80	°C/W

ELECTRICAL CHARACTERISTICS (Per Diode)

Maximum Instantaneous Forward Voltage Drop (Note 2.) (i_F = 3 Amps, T_C = 25°C) (i_F = 3 Amps, T_C = 125°C) (i_F = 6 Amps, T_C = 25°C) (i_F = 6 Amps, T_C = 125°C)	v_F	 1 0.96 1.2 1.13	Volts
Maximum Instantaneous Reverse Current (Note 2.) (T_J = 25°C, Rated dc Voltage) (T_J = 125°C, Rated dc Voltage)	i_R	 5 250	μA
Maximum Reverse Recovery Time (I_F = 1 Amp, di/dt = 50 Amps/μs, V_R = 30 V, T_J = 25°C) (I_F = 0.5 Amp, i_R = 1 Amp, I_{REC} = 0.25 A, V_R = 30 V, T_J = 25°C)	t_{rr}	 35 25	ns

1. Rating applies when surface mounted on the minimum pad sizes recommended.
2. Pulse Test: Pulse Width = 300 μs, Duty Cycle ≤ 2.0%.

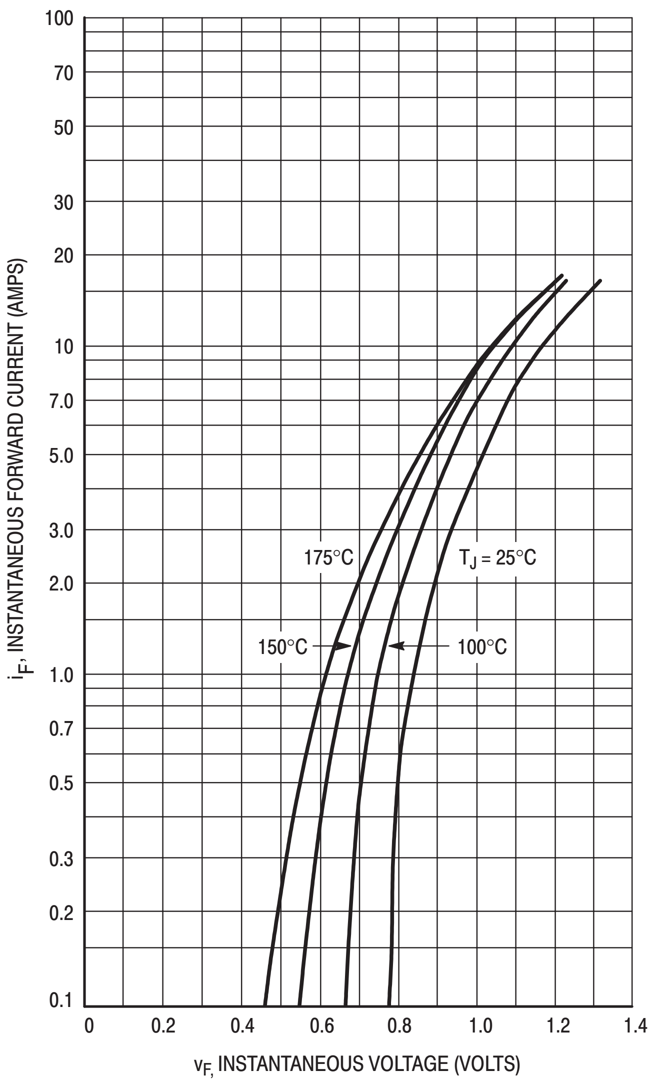

Figure 1. Typical Forward Voltage (Per Leg)

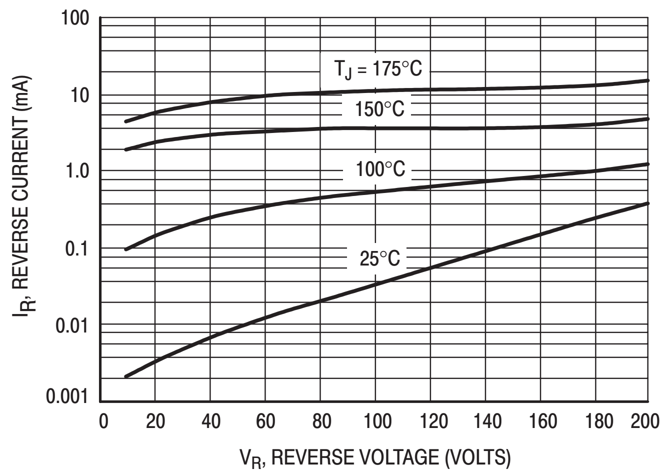

Figure 2. Typical Leakage Current* (Per Leg)

* The curves shown are typical for the highest voltage device in the voltage grouping. Typical reverse current for lower voltage selections can be estimated from these curves if V_R is sufficiently below rated V_R.

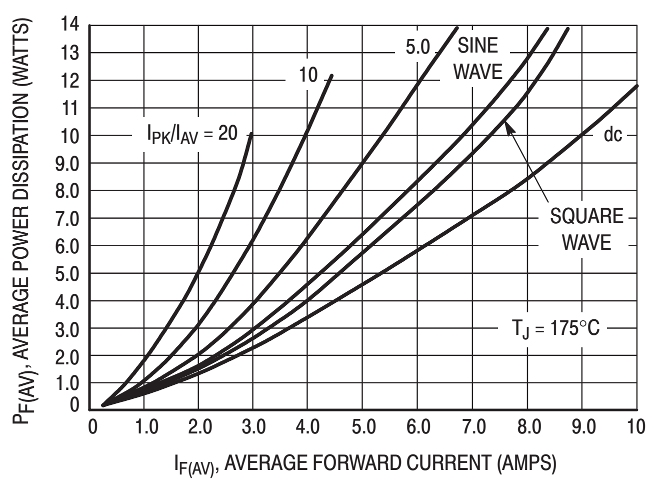

Figure 3. Average Power Dissipation (Per Leg)

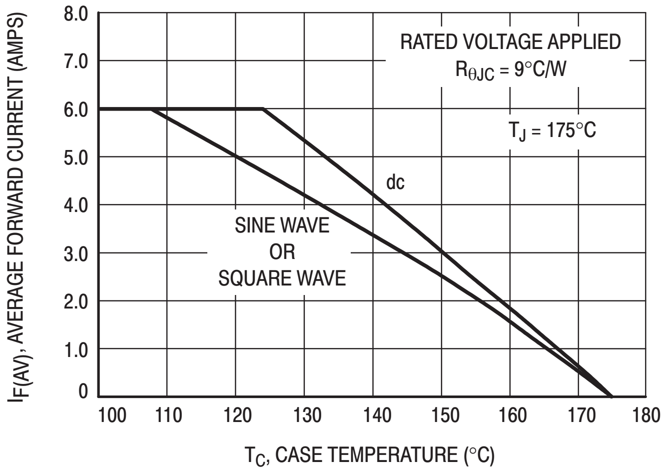

Figure 4. Current Derating, Case (Per Leg)

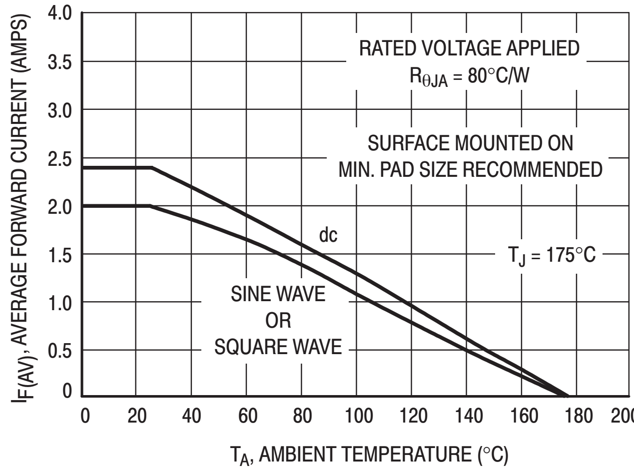

Figure 5. Current Derating, Ambient (Per Leg)

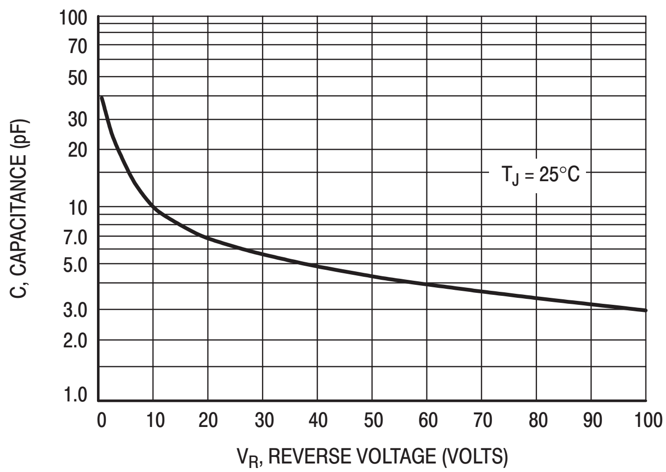

Figure 6. Typical Capacitance (Per Leg)

MSRD620CT

SWITCHMODE™ Soft Ultrafast Recovery Power Rectifier

Plastic DPAK Package

State of the art geometry features epitaxial construction with glass passivation and metal overlay contact. Ideally suited for low voltage, high frequency switching power supplies, free wheeling diode and polarity protection diodes.

- Soft Ultrafast Recovery (35 ns typ.)
- Highly Stable Oxide Passivated Junction
- Matched Dual Die Construction — May Be Paralleled for High Current Output
- Short Heat Sink Tab Manufactured — Not Sheared
- Epoxy Meets UL94, V_O at 1/8″

Mechanical Characteristics:
- Case: Epoxy, Molded
- Weight: 0.4 grams (approximately)
- Finish: All External Surfaces Corrosion Resistant and Terminal Leads are Readily Solderable
- Lead and Mounting Surface Temperature for Soldering Purposes: 260°C Max. for 10 Seconds
- Shipped in 75 units per plastic tube
- Available in 16 mm Tape and Reel, 2500 units per Reel, Add “T4’’ to Suffix part number
- Marking: S620T

MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Peak Repetitive Reverse Voltage Working Peak Reverse Voltage DC Blocking Voltage	V_{RRM} V_{RWM} V_R	200	V
Average Rectified Forward Current (At Rated V_R, T_C = 137°C) Per Leg Per Package	I_O	 3.0 6.0	A
Peak Repetitive Forward Current (At Rated V_R, Square Wave, 20 kHz, T_C = 138°C) Per Leg	I_{FRM}	6.0	A
Non–Repetitive Peak Surge Current (Surge Applied at Rated Load Conditions Halfwave, Single Phase, 60 Hz) Per Package	I_{FSM}	50	A
Storage/Operating Case Temperature Range	T_{stg}, T_C	–55 to +175	°C
Operating Junction Temperature Range	T_J	–55 to +175	°C

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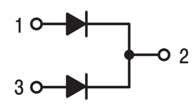
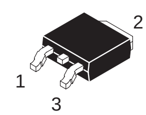
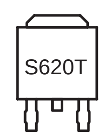
SOFT ULTRAFAST RECTIFIER
6.0 AMPERES
200 VOLTS





DPAK
CASE 369A
PLASTIC

MARKING DIAGRAM



S620T = Device Code

ORDERING INFORMATION

Device	Package	Shipping
MSRD620CT	DPAK	75 Units/Rail
MSRD620CTT4	DPAK	2500/Tape & Reel

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THERMAL CHARACTERISTICS

Rating		Symbol	Value	Unit
Thermal Resistance – Junction to Case	Per Leg	$R_{\theta JC}$	9.0	°C/W
– Junction to Ambient	Per Leg	$R_{\theta JA}$	80	

ELECTRICAL CHARACTERISTICS

Rating		Symbol	Value		Unit
Maximum Instantaneous Forward Voltage (Note 1.), see Figure 2.	Per Leg	V_F	**T_J = 25°C**	**T_J = 150°C**	V
(I_F = 3.0 A)			1.15	1.05	
(I_F = 6.0 A)			1.35	1.30	
Maximum Instantaneous Reverse Current, see Figure 4.	Per Leg	I_R	**T_J = 25°C**	**T_J = 150°C**	μA
(V_R = 200 V)			5.0	200	
(V_R = 100 V)			2.0	100	
Maximum Reverse Recovery Time (Note 2.)	Per Leg	t_{rr}			ns
(V_R = 30 V, I_F = 1.0 A, di/dt = 50 A/μs)			45		
(V_R = 30 V, I_F = 3.0 A, di/dt = 50 A/μs)			55		
Maximum Peak Reverse Recovery Current	Per Leg	I_{RM}			A
(V_R = 30 V, I_F = 1.0 A, di/dt = 50 A/μs)			2.0		
(V_R = 30 V, I_F = 3.0 A, di/dt = 50 A/μs)			3.0		

1. Pulse Test: Pulse Width ≤ 250 μs, Duty Cycle ≤ 2%.
2. t_{rr} measured projecting from 25% of I_{RM} to ground.

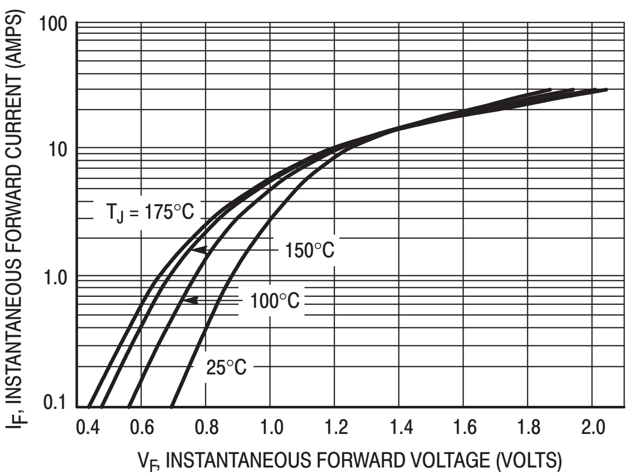

Figure 1. Typical Forward Voltage, Per Leg

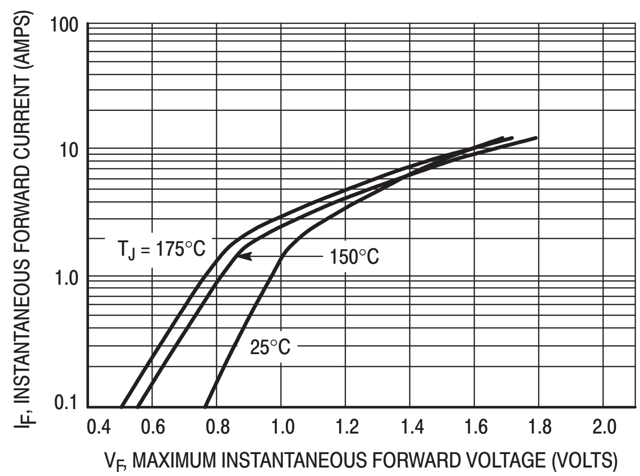

Figure 2. Maximum Forward Voltage, Per Leg

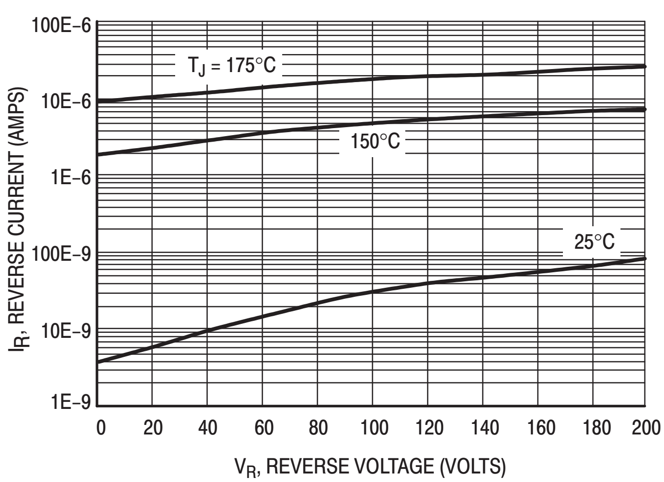

Figure 3. Typical Reverse Current, Per Leg

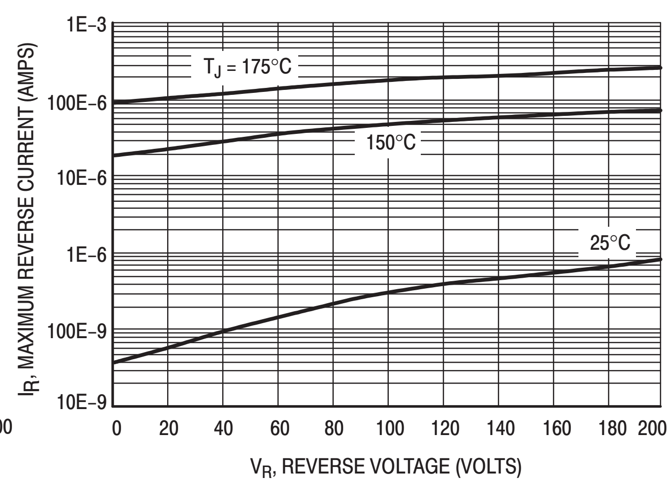

Figure 4. Maximum Reverse Current, Per Leg

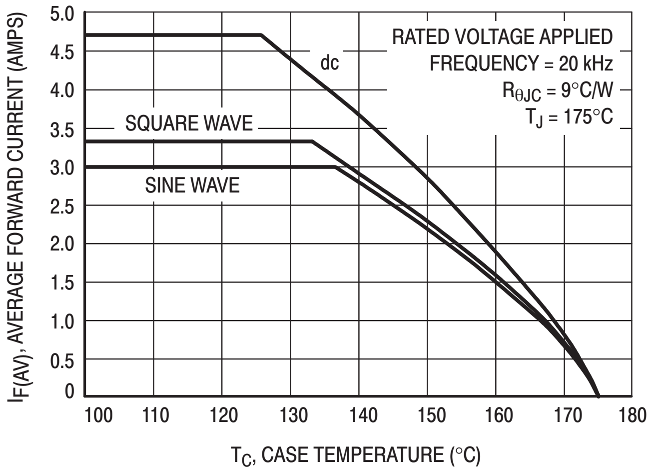

Figure 5. Current Derating, Case (Per Leg)

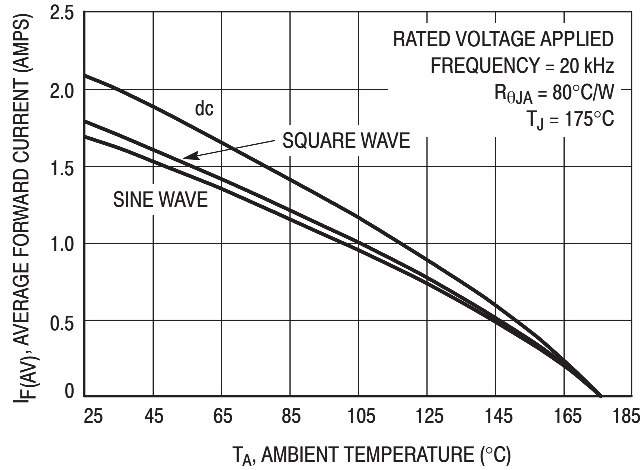

Figure 6. Current Derating, Ambient (Per Leg)

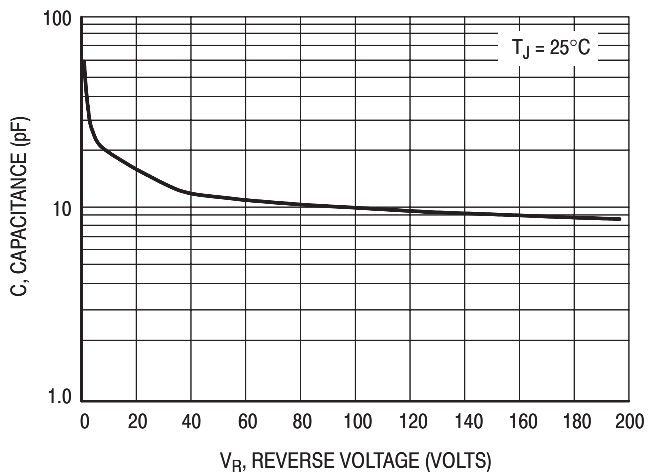

Figure 7. Typical Capacitance (Per Leg)

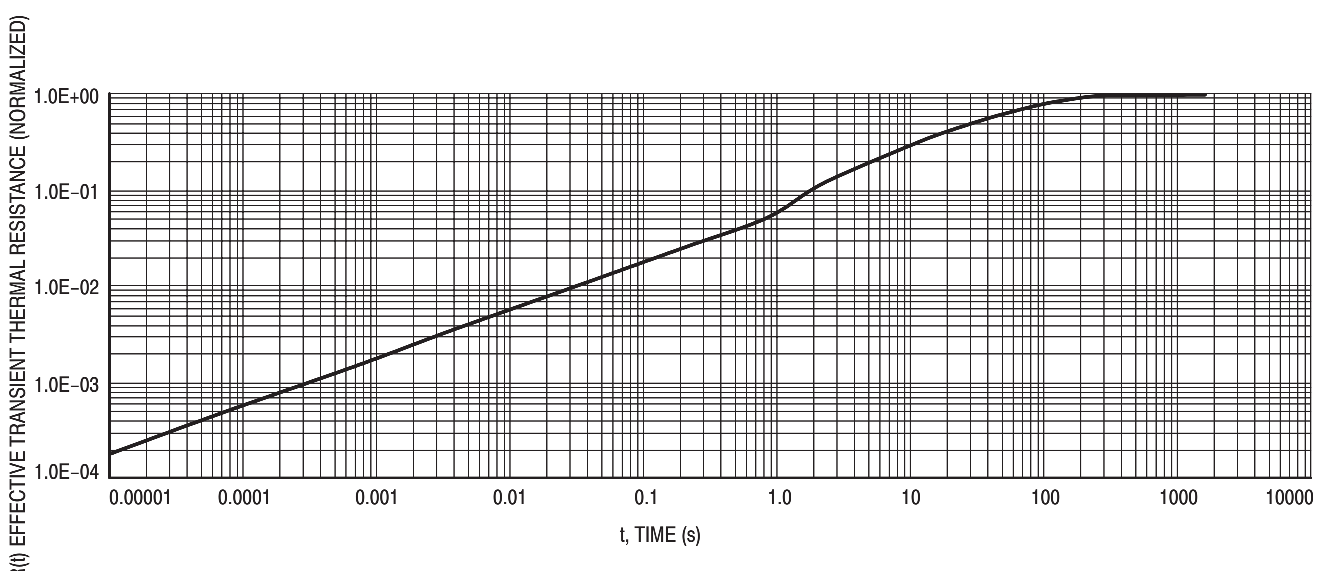

Figure 8. Transient Thermal Response ($R_{\theta JA}$)

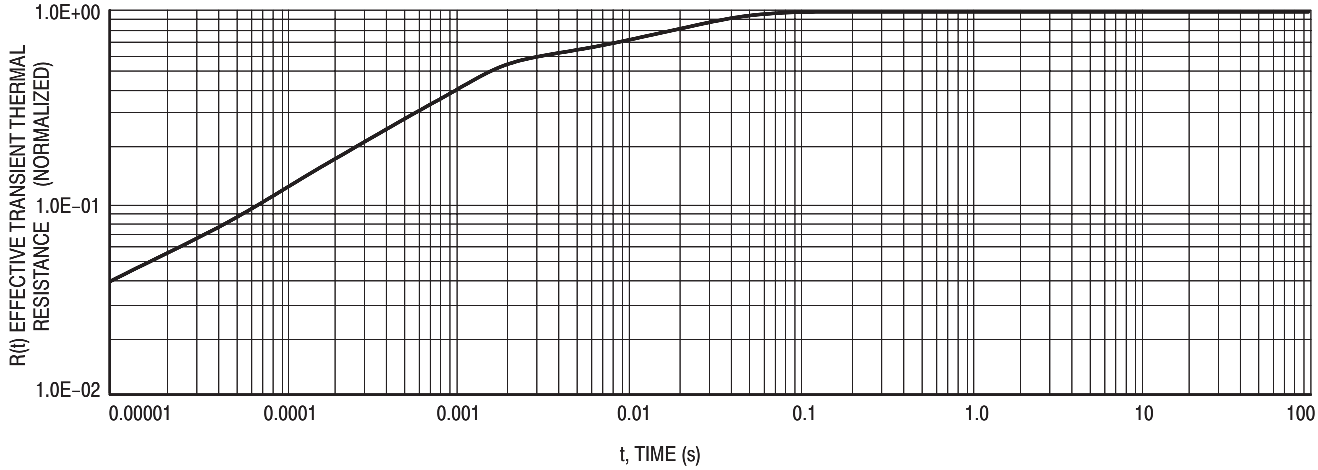

Figure 9. Transient Thermal Response ($R_{\theta JC}$)

MURB1620CT

Preferred Device

SWITCHMODE™ Power Rectifier

D²PAK Power Surface Mount Package

Designed for use in switching power supplies, inverters and as free wheeling diodes, these state–of–the–art devices have the following features:

- Package Designed for Power Surface Mount Applications
- Ultrafast 35 Nanosecond Recovery Times
- 175°C Operating Junction Temperature
- Epoxy Meets UL94, V_O @ 1/8″
- High Temperature Glass Passivated Junction
- Low Leakage Specified @ 150°C Case Temperature
- Short Heat Sink Tab Manufactured — Not Sheared!
- Similar in Size to Industrial Standard TO–220 Package

Mechanical Characteristics

- Case: Epoxy, Molded
- Weight: 1.7 grams (approximately)
- Finish: All External Surfaces Corrosion Resistant and Terminal Leads are Readily Solderable
- Lead and Mounting Surface Temperature for Soldering Purposes: 260°C Max. for 10 Seconds
- Shipped 50 units per plastic tube
- Available in 24 mm Tape and Reel, 800 units per reel by adding a “T4” suffix to the part number
- Marking: U1620T

MAXIMUM RATINGS (Per Leg)

Rating	Symbol	Value	Unit
Peak Repetitive Reverse Voltage Working Peak Reverse Voltage DC Blocking Voltage	V_{RRM} V_{RWM} V_R	200	V
Average Rectified Forward Current (Rated V_R, T_C = 150°C) Total Device	$I_{F(AV)}$	8.0 16	A
Peak Repetitive Forward Current (Rated V_R, Square Wave, 20 kHz, T_C = 150°C)	I_{FM}	16	A
Non–Repetitive Peak Surge Current (Surge Applied at Rated Load Conditions Halfwave, Single Phase, 60 Hz)	I_{FSM}	100	A
Operating Junction and Storage Temperature Range	T_J, T_{stg}	–65 to +175	°C

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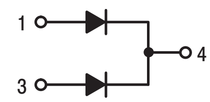
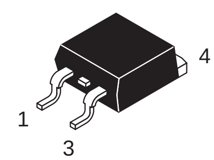
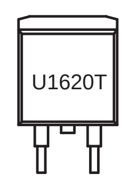
ULTRAFAST RECTIFIER
16 AMPERES
200 VOLTS





D²PAK
CASE 418B
STYLE 3

MARKING DIAGRAM



U1620T = Device Code

ORDERING INFORMATION

Device	Package	Shipping
MURB1620CT	D²PAK	50 Units/Rail
MURB1620CTT4	D²PAK	800/Tape & Reel

Preferred devices are recommended choices for future use and best overall value.

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THERMAL CHARACTERISTICS (Per Leg)

Rating	Symbol	Value	Unit
Maximum Thermal Resistance, Junction to Case	$R_{\theta JC}$	3	°C/W
Maximum Thermal Resistance, Junction to Ambient (Note 1.)	$R_{\theta JA}$	50	°C/W
Temperature for Soldering Purposes: 1/8″ from Case for 5 Seconds	T_L	260	°C

ELECTRICAL CHARACTERISTICS (Per Leg)

Characteristic	Symbol	Max	Unit
Maximum Instantaneous Forward Voltage (Note 2.) (i_F = 8 Amp, T_C = 150°C) (i_F = 8 Amp, T_C = 25°C)	v_F	 0.895 0.975	Volts
Maximum Instantaneous Reverse Current (Note 2.) (Rated dc Voltage, T_C = 150°C) (Rated dc Voltage, T_C = 25°C)	i_R	 250 5	μA
Maximum Reverse Recovery Time (I_F = 1 Amp, di/dt = 50 Amp/μs) (I_F = 0.5 Amp, i_R = 1 Amp, I_{REC} = 0.25 Amp)	t_{rr}	 35 25	ns

1. See Chapter 7 for mounting conditions
2. Pulse Test: Pulse Width = 300 μs, Duty Cycle ≤2.0%

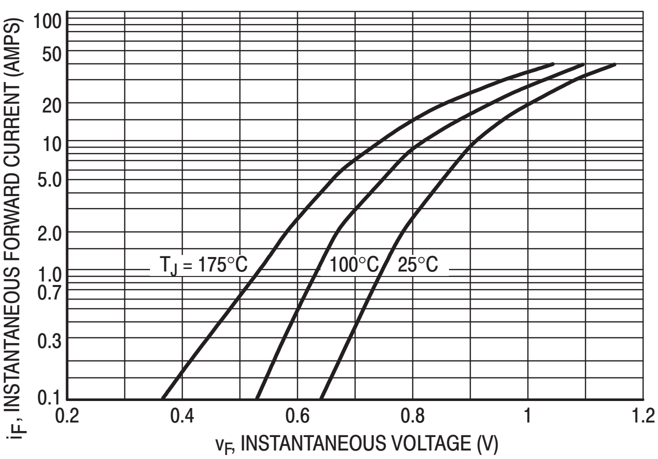

Figure 1. Typical Forward Voltage, Per Leg

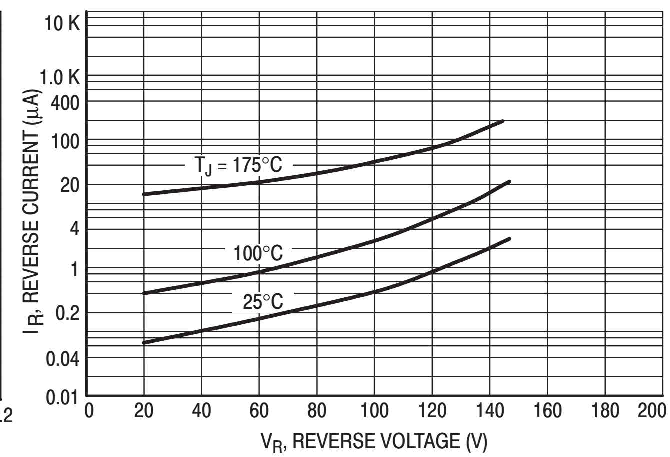

Figure 2. Typical Reverse Current, Per Leg*

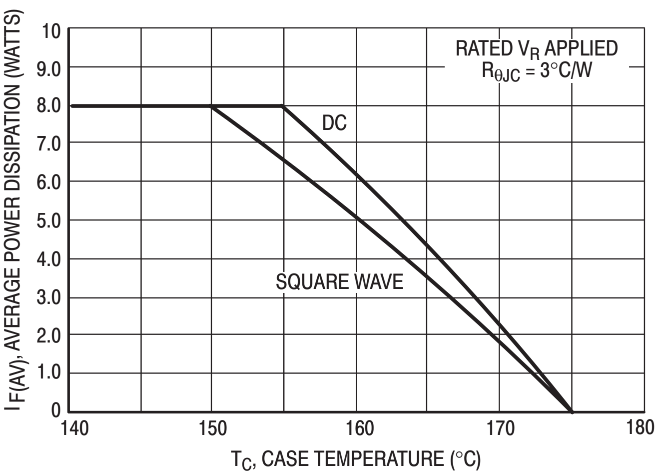

Figure 3. Current Derating Case, Per Leg

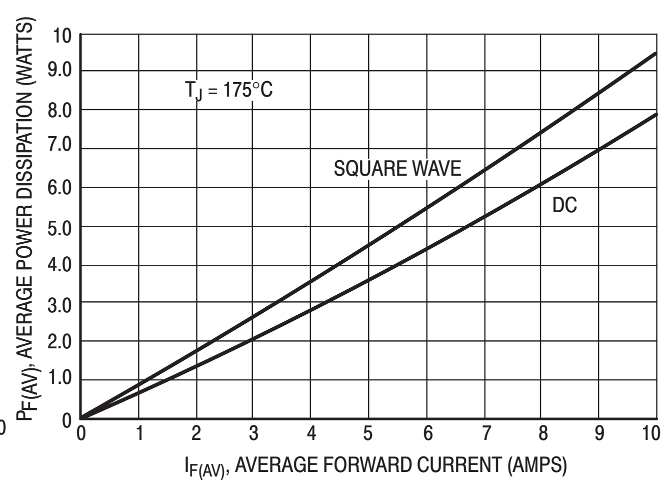

Figure 4. Power Dissipation, Per Leg

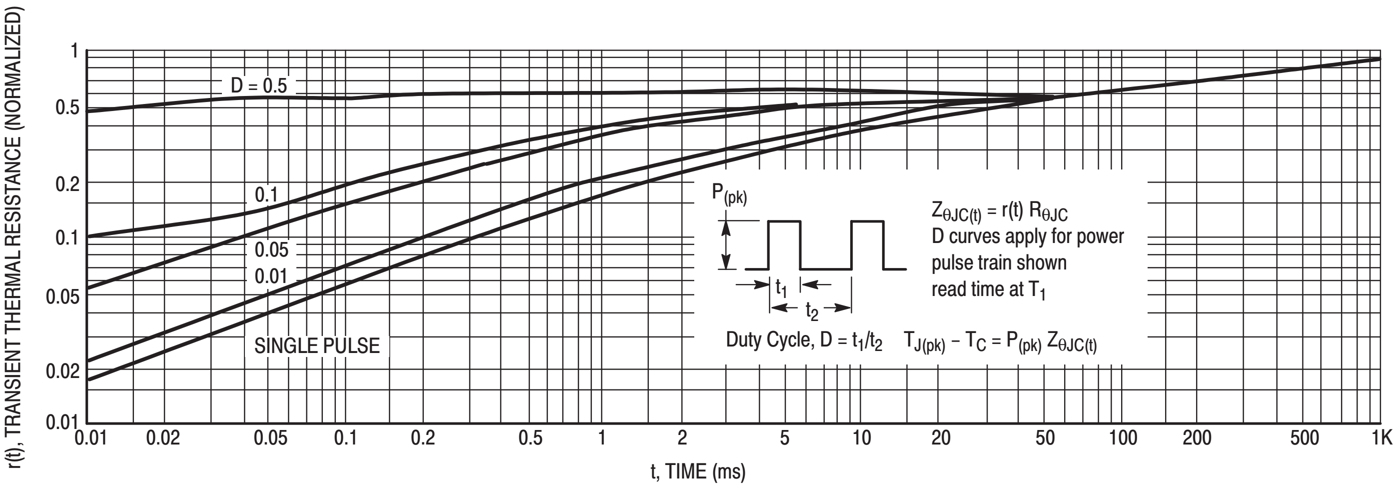

Figure 5. Thermal Response

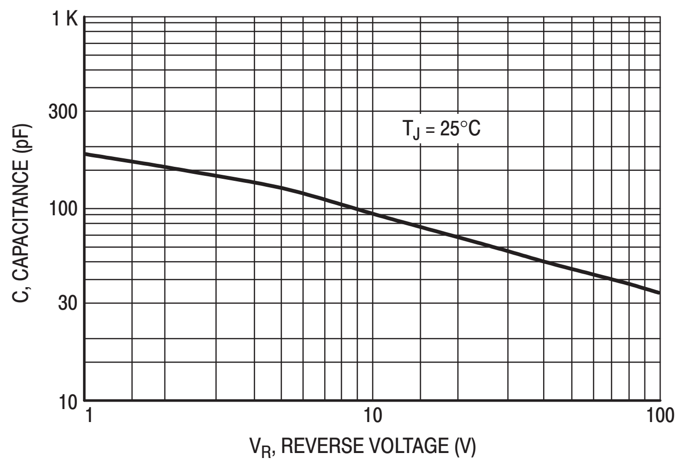

Figure 6. Typical Capacitance, Per Leg

MURB1660CT

Preferred Device

SWITCHMODE™ Power Rectifier

D^2PAK Power Surface Mount Package

Designed for use in switching power supplies, inverters and as free wheeling diodes, these state–of–the–art devices have the following features:

- Package Designed for Power Surface Mount Applications
- Ultrafast 60 Nanosecond Recovery Times
- 175°C Operating Junction Temperature
- Epoxy Meets UL94, V_O @ 1/8″
- High Temperature Glass Passivated Junction
- High Voltage Capability to 600 V
- Low Leakage Specified @ 150°C Case Temperature
- Short Heat Sink Tab Manufactured – Not Sheared!
- Similar in Size to Industrial Standard TO–220 Package

Mechanical Characteristics

- Case: Epoxy, Molded
- Weight: 1.7 grams (approximately)
- Finish: All External Surfaces Corrosion Resistant and Terminal Leads are Readily Solderable
- Lead and Mounting Surface Temperature for Soldering Purposes: 260°C Max. for 10 Seconds
- Shipped 50 units per plastic tube
- Available in 24 mm Tape and Reel, 800 units per reel by adding a “T4” suffix to the part number
- Marking: U1660T

MAXIMUM RATINGS (Per Leg)

Rating	Symbol	Value	Unit
Peak Repetitive Reverse Voltage Working Peak Reverse Voltage DC Blocking Voltage	V_{RRM} V_{RWM} V_R	600	V
Average Rectified Forward Current (Rated V_R, T_C = 150°C) Total Device	$I_{F(AV)}$	8.0 16	A
Peak Repetitive Forward Current (Rated V_R, Square Wave, 20 kHz, T_C = 150°C)	I_{FM}	16	A
Non–Repetitive Peak Surge Current (Surge Applied at Rated Load Conditions Halfwave, Single Phase, 60 Hz)	I_{FSM}	100	A
Operating Junction and Storage Temperature Range	T_J, T_{stg}	–65 to +175	°C

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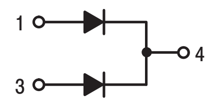
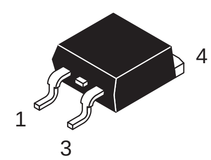
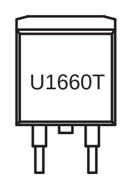
ULTRAFAST RECTIFIER 16 AMPERES 600 VOLTS





D^2PAK
CASE 418B
STYLE 3

MARKING DIAGRAM



U1660T = Device Code

ORDERING INFORMATION

Device	Package	Shipping
MURB1660CT	D^2PAK	50 Units/Rail
MURB1660CTT4	D^2PAK	800/Tape & Reel

Preferred devices are recommended choices for future use and best overall value.

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THERMAL CHARACTERISTICS (Per Leg)

Rating	Symbol	Value	Unit
Maximum Thermal Resistance, Junction to Case	$R_{\theta JC}$	2	°C/W
Maximum Thermal Resistance, Junction to Ambient (Note 1.)	$R_{\theta JA}$	50	°C/W
Temperature for Soldering Purposes: 1/8″ from Case for 5 Seconds	T_L	260	°C

ELECTRICAL CHARACTERISTICS (Per Leg)

Characteristic	Symbol	Max	Unit
Maximum Instantaneous Forward Voltage (Note 2.) (i_F = 8 Amp, T_C = 150°C) (i_F = 8 Amp, T_C = 25°C)	v_F	 1.20 1.50	Volts
Maximum Instantaneous Reverse Current (Note 2.) (Rated dc Voltage, T_C = 150°C) (Rated dc Voltage, T_C = 25°C)	i_R	 500 10	μA
Maximum Reverse Recovery Time (I_F = 1 Amp, di/dt = 50 Amp/μs) (I_F = 0.5 Amp, i_R = 1 Amp, I_{REC} = 0.25 Amp)	t_{rr}	 60 50	ns

1. See Chapter 7 for mounting conditions
2. Pulse Test: Pulse Width = 300 μs, Duty Cycle ≤2.0%

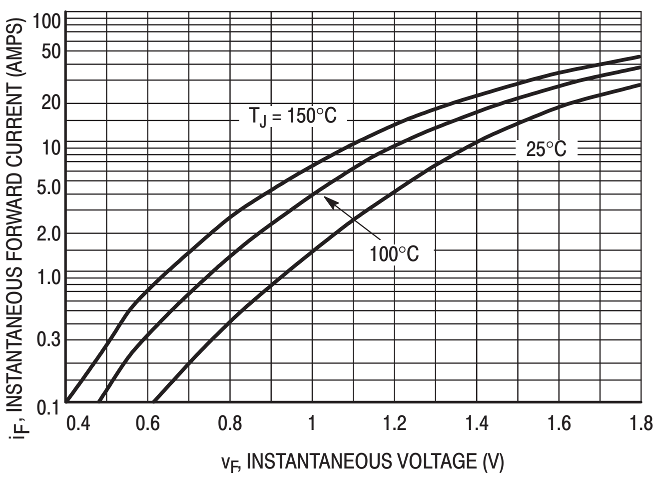

Figure 1. Typical Forward Voltage, Per Leg

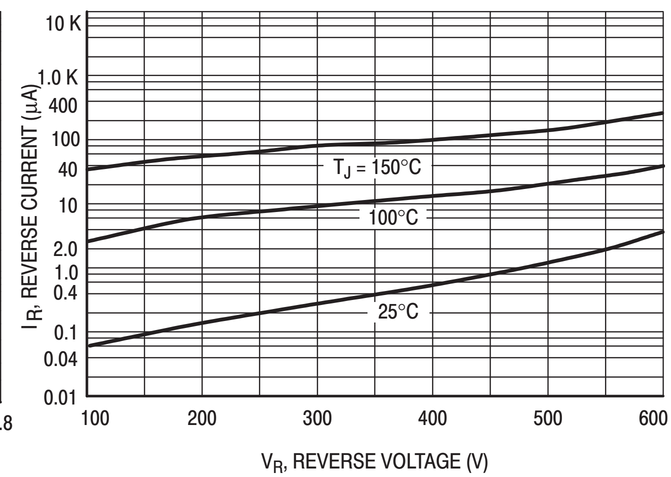

Figure 2. Typical Reverse Current, Per Leg

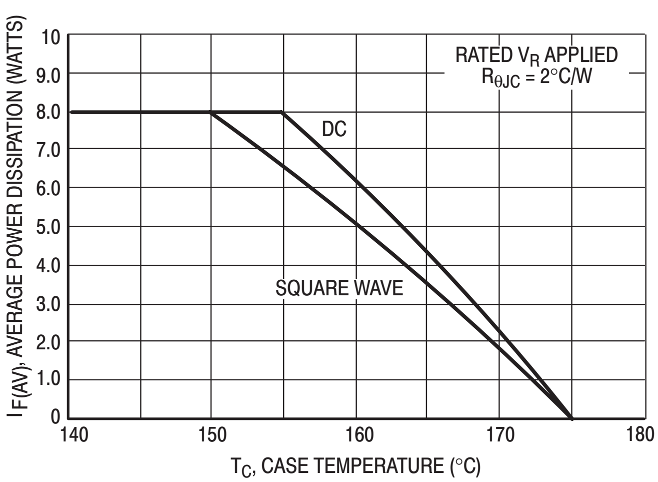

Figure 3. Current Derating, Case, Per Leg

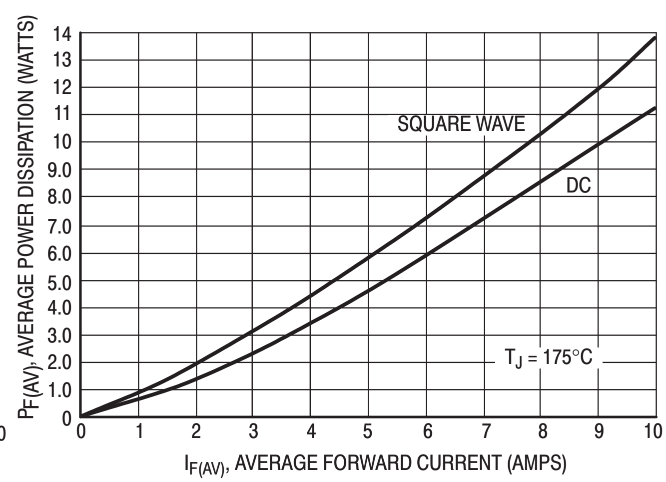

Figure 4. Power Dissipation, Per Leg

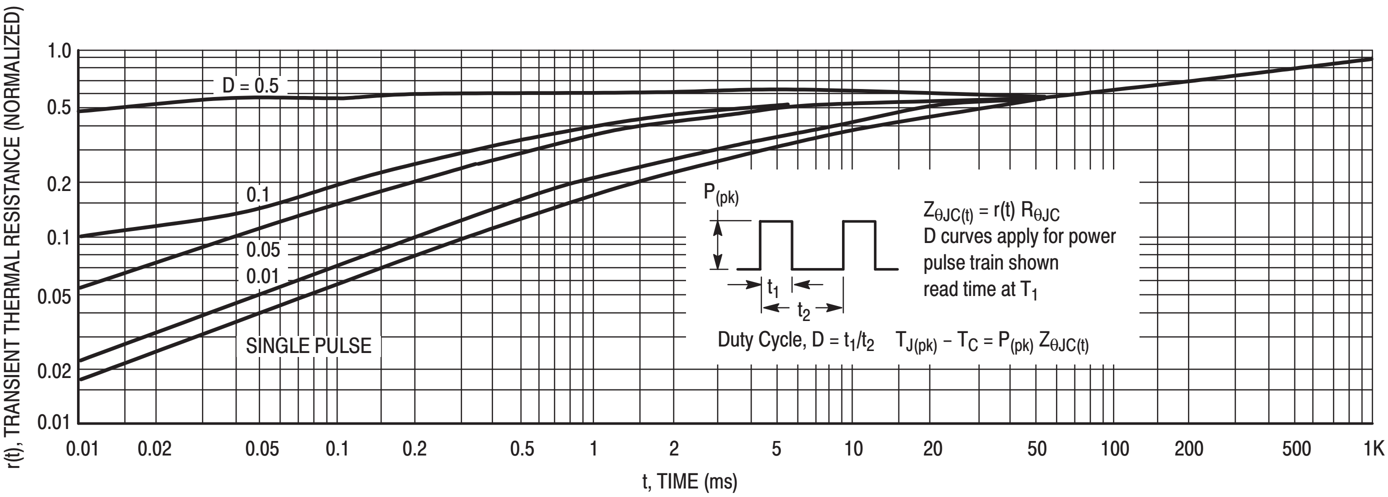

Figure 5. Thermal Response

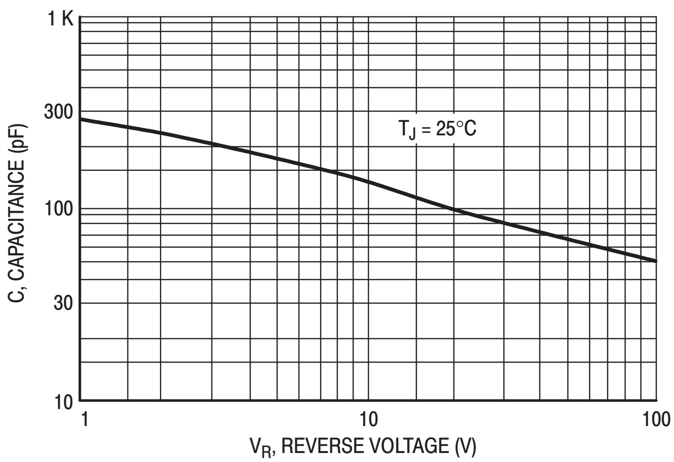

Figure 6. Typical Capacitance, Per Leg

MURHB840CT

Preferred Device

MEGAHERTZ™ Power Rectifier

D²PAK Power Surface Mount Package

Designed for use in switching power supplies, inverters and as free wheeling diodes, these state–of–the–art devices have the following features:

- Package Designed for Power Surface Mount Applications
- Ultrafast 28 Nanosecond Recovery Times
- 175°C Operating Junction Temperature
- Epoxy Meets UL94, V_O @ 1/8″
- High Temperature Glass Passivated Junction
- High Voltage Capability
- Low Leakage Specified @ 150°C Case Temperature
- Short Heat Sink Tab Manufactured – Not Sheared!
- Similar in Size to Industrial Standard TO–220 Package

Mechanical Characteristics

- Case: Epoxy, Molded
- Weight: 1.7 grams (approximately)
- Finish: All External Surfaces Corrosion Resistant and Terminal Leads are Readily Solderable
- Lead and Mounting Surface Temperature for Soldering Purposes: 260°C Max. for 10 Seconds
- Shipped 50 units per plastic tube
- Available in 24 mm Tape and Reel, 800 units per reel by adding a “T4” suffix to the part number
- Marking: UH840

MAXIMUM RATINGS (Per Leg)

Rating	Symbol	Value	Unit
Peak Repetitive Reverse Voltage Working Peak Reverse Voltage DC Blocking Voltage	V_{RRM} V_{RWM} V_R	400	V
Average Rectified Forward Current (Rated V_R, T_C = 120°C) Total Device	$I_{F(AV)}$	4.0 8.0	A
Peak Repetitive Forward Current (Rated V_R, Square Wave, 20 kHz, T_C = 120°C)	I_{FM}	8.0	A
Non–Repetitive Peak Surge Current (Surge Applied at Rated Load Conditions Halfwave, Single Phase, 60 Hz)	I_{FSM}	100	A
Controlled Avalanche Energy	W_{AVAL}	20	mJ
Operating Junction and Storage Temperature Range	T_J, T_{stg}	–65 to +175	°C

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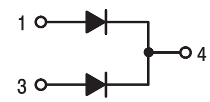
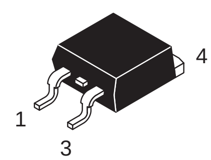
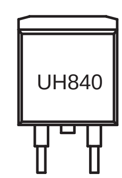
ULTRAFAST RECTIFIER 8.0 AMPERES 400 VOLTS





D²PAK
CASE 418B
STYLE 3

MARKING DIAGRAM



UH840 = Device Code

ORDERING INFORMATION

Device	Package	Shipping
MURHB840CT	D²PAK	50 Units/Rail
MURHB840CTT4	D²PAK	800/Tape & Reel

Preferred devices are recommended choices for future use and best overall value.

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THERMAL CHARACTERISTICS (Per Leg)

Rating	Symbol	Value	Unit
Maximum Thermal Resistance, Junction to Case	$R_{\theta JC}$	3.0	°C/W
Maximum Thermal Resistance, Junction to Ambient (Note 1.)	$R_{\theta JA}$	50	°C/W

ELECTRICAL CHARACTERISTICS (Per Leg)

Characteristic	Symbol	Max	Unit
Maximum Instantaneous Forward Voltage (Note 2.) (i_F = 4.0 Amps, T_C = 150°C) (i_F = 4.0 Amps, T_C = 25°C)	v_F	1.9 2.2	Volts
Maximum Instantaneous Reverse Current (Note 2.) (Rated dc Voltage, T_C = 150°C) (Rated dc Voltage, T_C = 25°C)	i_R	500 10	μA
Maximum Reverse Recovery Time (I_F = 1.0 Amp, di/dt = 50 Amps/μs)	t_{rr}	28	ns

1. See Chapter 7 for mounting conditions
2. Pulse Test: Pulse Width = 300 μs, Duty Cycle ≤2.0%

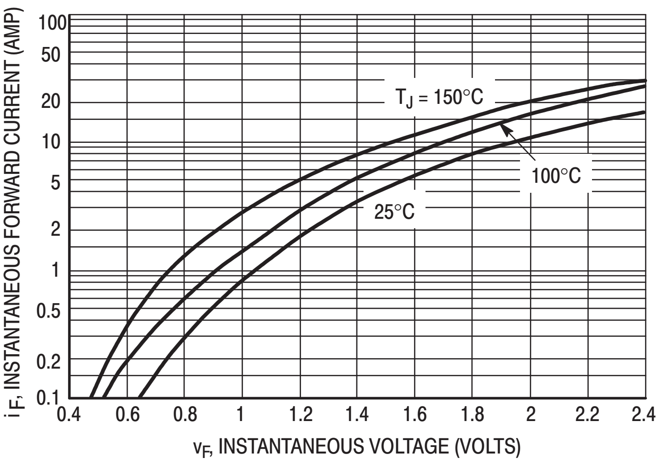

Figure 1. Typical Forward Voltage

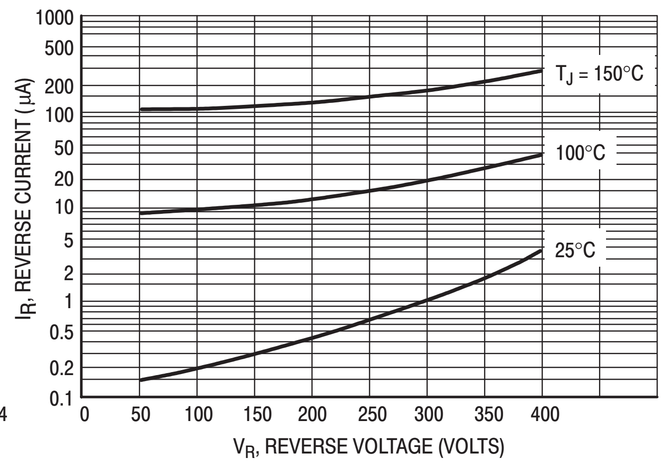

Figure 2. Typical Reverse Current, Per Leg

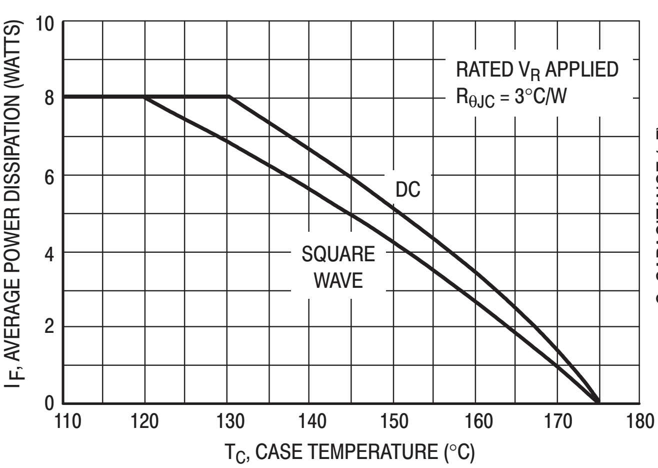

Figure 3. Current Derating, Case

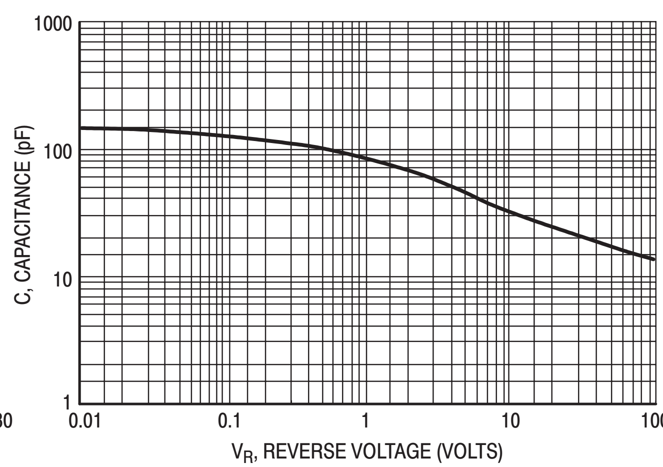

Figure 4. Typical Capacitance, Per Leg

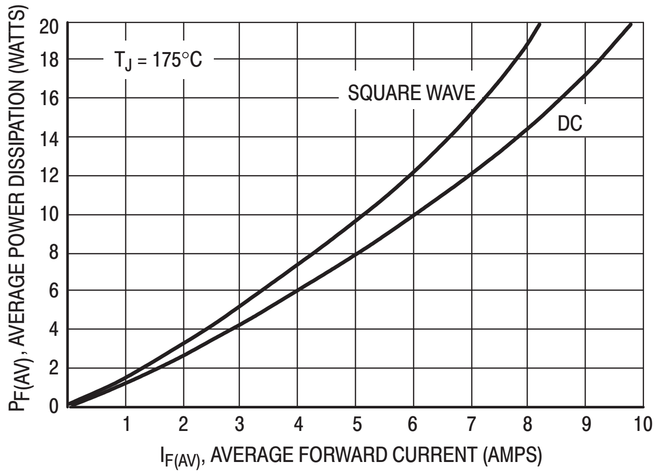

Figure 5. Forward Power Dissipation, Per Leg

MURHB860CT

Preferred Device

MEGAHERTZ™ Power Rectifier

D^{2}PAK Power Surface Mount Package

Designed for use in switching power supplies, inverters and as free wheeling diodes, these state–of–the–art devices have the following features:

- Package Designed for Power Surface Mount Applications
- Ultrafast 35 Nanosecond Recovery Times
- 175°C Operating Junction Temperature
- Epoxy Meets UL94, V_O @ 1/8″
- High Temperature Glass Passivated Junction
- High Voltage Capability to 600 Volts
- Low Leakage Specified @ 150°C Case Temperature
- Short Heat Sink Tab Manufactured — Not Sheared!
- Similar in Size to Industry Standard TO–220 Package

Mechanical Characteristics

- Case: Epoxy, Molded
- Weight: 1.7 grams (approximately)
- Finish: All External Surfaces Corrosion Resistant and Terminal Leads are Readily Solderable
- Lead and Mounting Surface Temperature for Soldering Purposes: 260°C Max. for 10 Seconds
- Shipped 50 units per plastic tube
- Available in 24 mm Tape and Reel, 800 units per reel by adding a “T4” suffix to the part number
- Marking: UH860

MAXIMUM RATINGS (Per Leg)

Rating	Symbol	Value	Unit
Peak Repetitive Reverse Voltage Working Peak Reverse Voltage DC Blocking Voltage	V_{RRM} V_{RWM} V_R	600	V
Average Rectified Forward Current (Rated V_R, T_C = 120°C) Total Device	$I_{F(AV)}$	4.0 8.0	A
Peak Repetitive Forward Current (Rated V_R, Square Wave, 20 kHz, T_C = 120°C)	I_{FM}	8.0	A
Non–Repetitive Peak Surge Current (Surge Applied at Rated Load Conditions Halfwave, Single Phase, 60 Hz)	I_{FSM}	100	A
Operating Junction and Storage Temperature Range	T_J, T_{stg}	–65 to +175	°C

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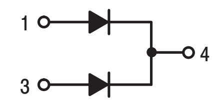
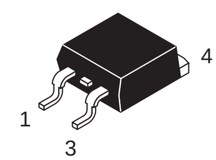
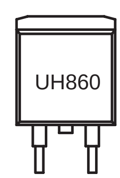
ULTRAFAST RECTIFIER
8.0 AMPERES
600 VOLTS





D^{2}PAK
CASE 418B
STYLE 3

MARKING DIAGRAM



UH860 = Device Code

ORDERING INFORMATION

Device	Package	Shipping
MURHB860CT	D^{2}PAK	50 Units/Rail
MURHB860CTT4	D^{2}PAK	800/Tape & Reel

Preferred devices are recommended choices for future use and best overall value.

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THERMAL CHARACTERISTICS (Per Leg)

Rating	Symbol	Value	Unit
Maximum Thermal Resistance, Junction to Case	$R_{\theta JC}$	3.0	°C/W
Maximum Thermal Resistance, Junction to Ambient	$R_{\theta JA}$	50	°C/W

ELECTRICAL CHARACTERISTICS (Per Leg)

Characteristic	Symbol	Max	Unit
Maximum Instantaneous Forward Voltage (Note 1.) (i_F = 4.0 Amps, T_C = 150°C) (i_F = 4.0 Amps, T_C = 25°C)	v_F	2.5 2.8	Volts
Maximum Instantaneous Reverse Current (Note 1.) (Rated dc Voltage, T_C = 150°C) (Rated dc Voltage, T_C = 25°C)	i_R	500 10	μA
Maximum Reverse Recovery Time (I_F = 1.0 Amp, di/dt = 50 Amps/μs)	t_{rr}	35	ns

1. Pulse Test: Pulse Width = 300 μs, Duty Cycle ≤2.0%

MUR120 Series

Preferred Devices

SWITCHMODE™ Power Rectifiers

MUR105, MUR110, MUR115, MUR120, MUR130, MUR140, MUR160

. . . designed for use in switching power supplies, inverters and as free wheeling diodes, these state–of–the–art devices have the following features:

- Ultrafast 25, 50 and 75 Nanosecond Recovery Times
- 175°C Operating Junction Temperature
- Low Forward Voltage
- Low Leakage Current
- High Temperature Glass Passivated Junction
- Reverse Voltage to 600 Volts

Mechanical Characteristics:

- Case: Epoxy, Molded
- Weight: 0.4 gram (approximately)
- Finish: All External Surfaces Corrosion Resistant and Terminal Leads are Readily Solderable
- Lead and Mounting Surface Temperature for Soldering Purposes: 220°C Max. for 10 Seconds, 1/16″ from case
- Shipped in plastic bags, 1000 per bag
- Available Tape and Reeled, 5000 per reel, by adding a “RL’’ suffix to the part number
- Polarity: Cathode Indicated by Polarity Band
- Marking: MUR105, MUR110, MUR115, MUR120, MUR130, MUR140, MUR160

MAXIMUM RATINGS

Please See the Table on the Following Page

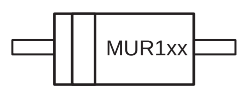
ON Semiconductor™

http://onsemi.com

ULTRAFAST RECTIFIERS
1.0 AMPERE
50–600 VOLTS

AXIAL LEAD
CASE 59–04
PLASTIC

MARKING DIAGRAM



MUR1 = Device Code
xx = Specific Device Code

ORDERING INFORMATION

See detailed ordering and shipping information in the package dimensions section on page 325 of this data sheet.

Preferred devices are recommended choices for future use and best overall value.

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MAXIMUM RATINGS

Rating	Symbol	MUR 105	110	115	120	130	140	160	Unit
Peak Repetitive Reverse Voltage Working Peak Reverse Voltage DC Blocking Voltage	V_{RRM} V_{RWM} V_R	50	100	150	200	300	400	600	Volts
Average Rectified Forward Current (Square Wave Mounting Method #3 Per Note 2.)	$I_{F(AV)}$	1.0 @ T_A = 130°C				1.0 @ T_A = 120°C			Amps
Nonrepetitive Peak Surge Current (Surge applied at rated load conditions, halfwave, single phase, 60 Hz)	I_{FSM}	35							Amps
Operating Junction Temperature and Storage Temperature	T_J, T_{stg}	– 65 to +175							°C

THERMAL CHARACTERISTICS

Maximum Thermal Resistance, Junction to Ambient	$R_{\theta JA}$	See Note 2.	°C/W

ELECTRICAL CHARACTERISTICS

		MUR105–120	MUR130–160	
Maximum Instantaneous Forward Voltage (Note 1.) (i_F = 1.0 Amp, T_J = 150°C) (i_F = 1.0 Amp, T_J = 25°C)	v_F	 0.710 0.875	 1.05 1.25	Volts
Maximum Instantaneous Reverse Current (Note 1.) (Rated dc Voltage, T_J = 150°C) (Rated dc Voltage, T_J = 25°C)	i_R	 50 2.0	 150 5.0	μA
Maximum Reverse Recovery Time (I_F = 1.0 Amp, di/dt = 50 Amp/μs) (I_F = 0.5 Amp, i_R = 1.0 Amp, I_{REC} = 0.25 A)	t_{rr}	 35 25	 75 50	ns
Maximum Forward Recovery Time (I_F = 1.0 A, di/dt = 100 A/μs, I_{REC} to 1.0 V)	t_{fr}	25	50	ns

1. Pulse Test: Pulse Width = 300 μs, Duty Cycle ≤ 2.0%.

ORDERING INFORMATION

Device	Marking	Package	Shipping
MUR105	MUR105	Axial Lead	1000 Units/Bag
MUR105RL	MUR105	Axial Lead	5000 Units/Tape & Reel
MUR110	MUR110	Axial Lead	1000 Units/Bag
MUR110RL	MUR110	Axial Lead	5000 Units/Tape & Reel
MUR115	MUR115	Axial Lead	1000 Units/Bag
MUR115RL	MUR115	Axial Lead	5000 Units/Tape & Reel
MUR120	MUR120	Axial Lead	1000 Units/Bag
MUR120RL	MUR120	Axial Lead	5000 Units/Tape & Reel
MUR130	MUR130	Axial Lead	1000 Units/Bag
MUR130RL	MUR130	Axial Lead	5000 Units/Tape & Reel
MUR140	MUR140	Axial Lead	1000 Units/Bag
MUR140RL	MUR140	Axial Lead	5000 Units/Tape & Reel
MUR160	MUR160	Axial Lead	1000 Units/Bag
MUR160RL	MUR160	Axial Lead	5000 Units/Tape & Reel

MUR105, MUR110, MUR115, MUR120

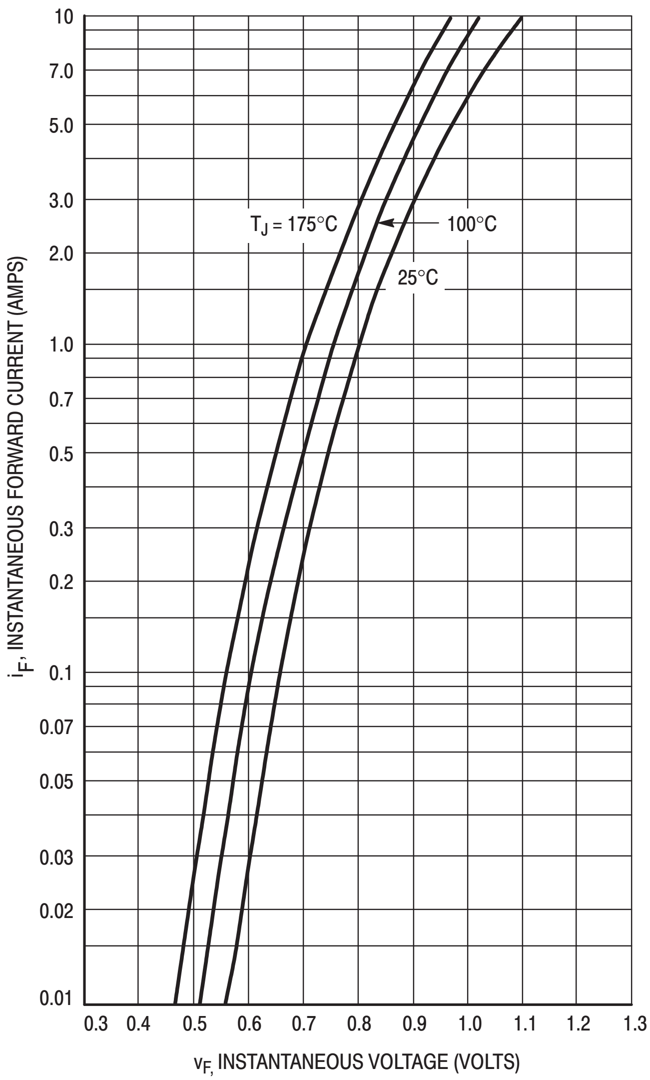


Figure 1. Typical Forward Voltage

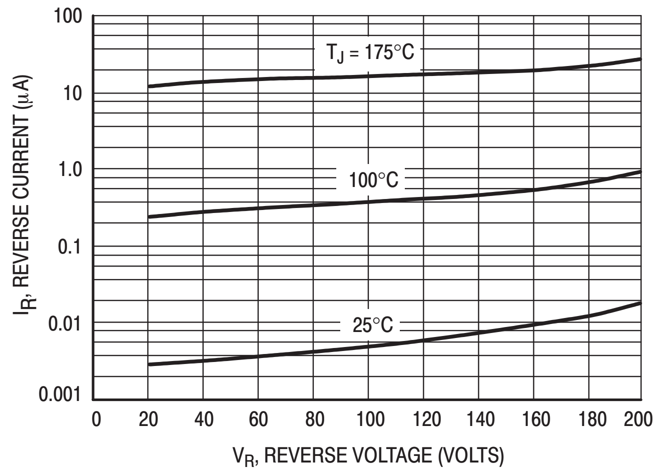


Figure 2. Typical Reverse Current*

* The curves shown are typical for the highest voltage device in the voltage grouping. Typical reverse current for lower voltage selections can be estimated from these same curves if V_R is sufficiently below rated V_R.

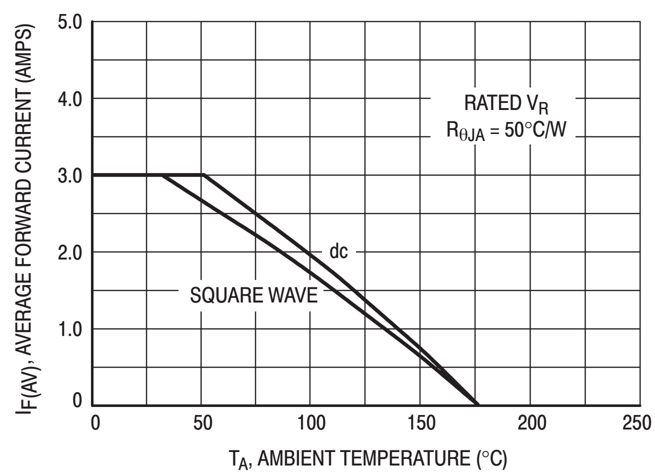


Figure 3. Current Derating (Mounting Method #3 Per Note 1)

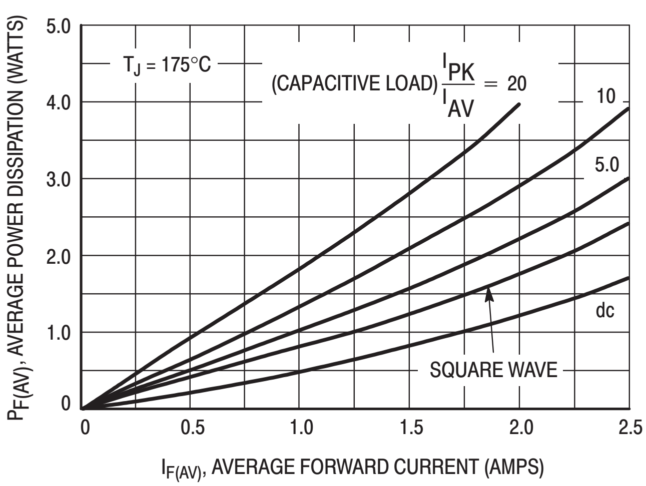


Figure 4. Power Dissipation

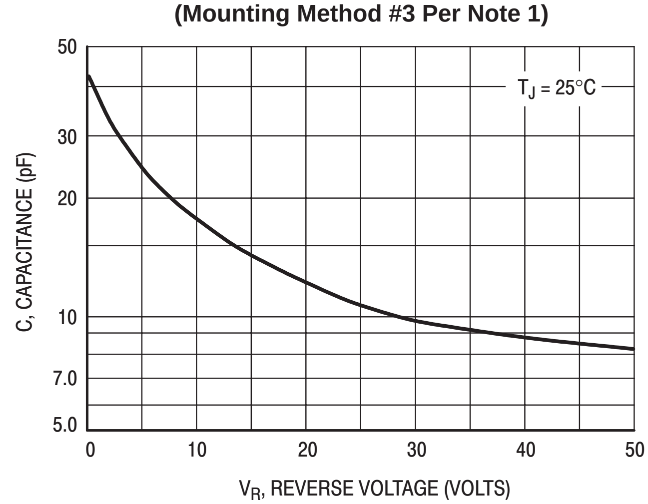


Figure 5. Typical Capacitance

MUR130, MUR140, MUR160

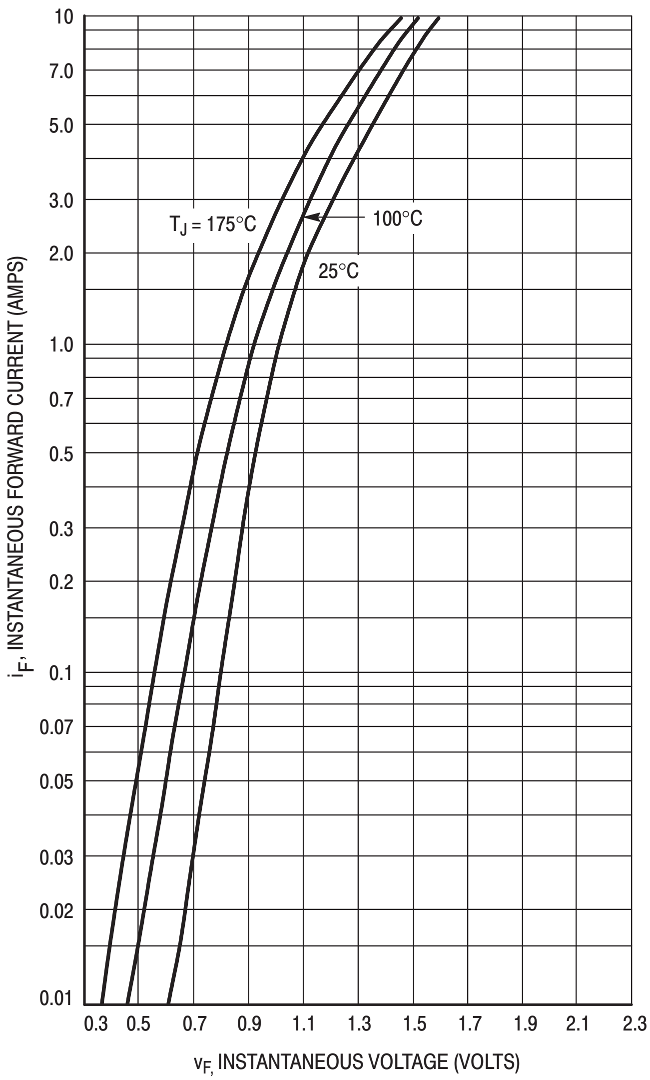


Figure 6. Typical Forward Voltage

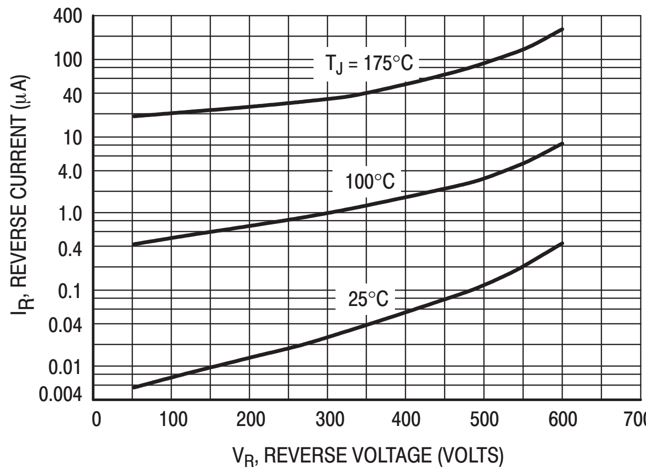


Figure 7. Typical Reverse Current*

* The curves shown are typical for the highest voltage device in the voltage grouping. Typical reverse current for lower voltage selections can be estimated from these same curves if V_R is sufficiently below rated V_R.

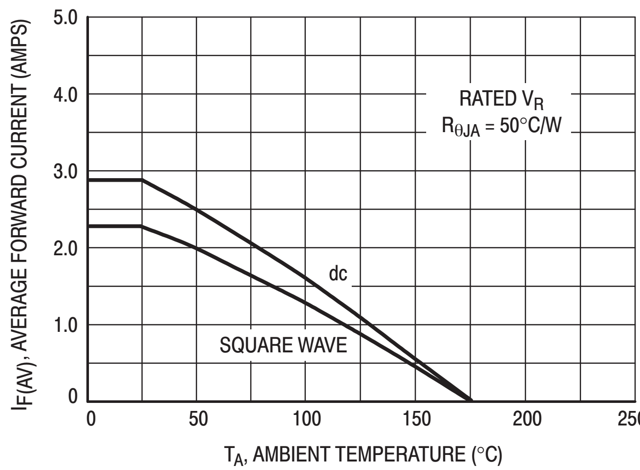


Figure 8. Current Derating (Mounting Method #3 Per Note 1)

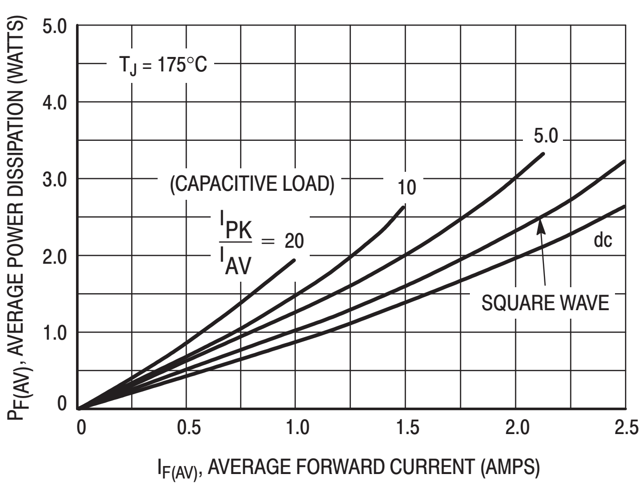


Figure 9. Power Dissipation

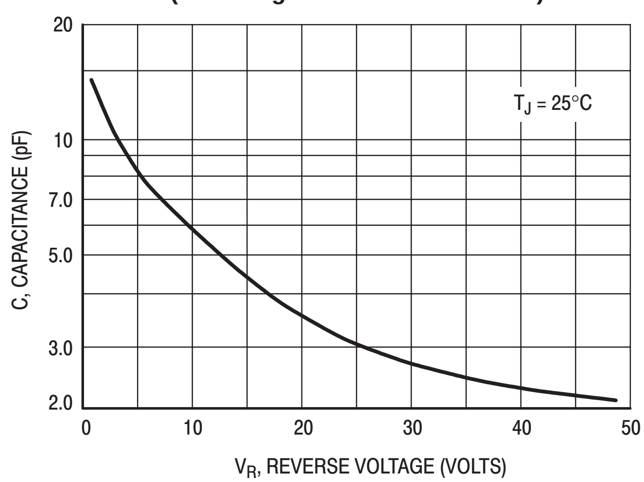


Figure 10. Typical Capacitance

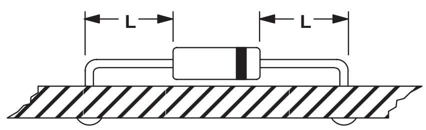
NOTE 2. — AMBIENT MOUNTING DATA

Data shown for thermal resistance junction to ambient ($R_{\theta JA}$) for the mountings shown is to be used as typical guideline values for preliminary engineering or in case the tie point temperature cannot be measured.

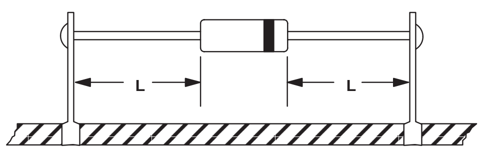
TYPICAL VALUES FOR $R_{\theta JA}$ IN STILL AIR

Mounting Method		Lead Length, L			Units
		1/8	1/4	1/2	
1	$R_{\theta JA}$	52	65	72	°C/W
2	$R_{\theta JA}$	67	80	87	°C/W
3	$R_{\theta JA}$	50			°C/W

MOUNTING METHOD 1

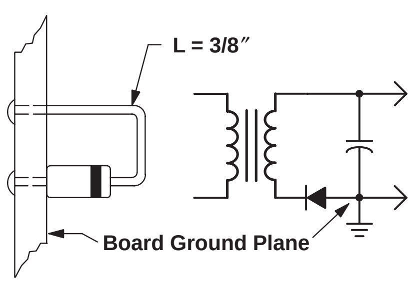


MOUNTING METHOD 2



Vector Pin Mounting

MOUNTING METHOD 3



P.C. Board with
1–1/2″ X 1–1/2″ Copper Surface

MUR180E, MUR1100E

MUR1100E is a Preferred Device

SWITCHMODE™ Power Rectifiers

Ultrafast "E" Series with High Reverse Energy Capability

. . . designed for use in switching power supplies, inverters and as free wheeling diodes, these state–of–the–art devices have the following features:

- 10 mjoules Avalanche Energy Guaranteed
- Excellent Protection Against Voltage Transients in Switching Inductive Load Circuits
- Ultrafast 75 Nanosecond Recovery Time
- 175°C Operating Junction Temperature
- Low Forward Voltage
- Low Leakage Current
- High Temperature Glass Passivated Junction
- Reverse Voltage to 1000 Volts

Mechanical Characteristics:

- Case: Epoxy, Molded
- Weight: 0.4 gram (approximately)
- Finish: All External Surfaces Corrosion Resistant and Terminal Leads are Readily Solderable
- Lead and Mounting Surface Temperature for Soldering Purposes: 220°C Max. for 10 Seconds, 1/16″ from case
- Shipped in plastic bags, 1000 per bag
- Available Tape and Reeled, 5000 per reel, by adding a "RL" suffix to the part number
- Polarity: Cathode Indicated by Polarity Band
- Marking: MUR180E, MUR1100E

MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Peak Repetitive Reverse Voltage Working Peak Reverse Voltage DC Blocking Voltage MUR180E MUR1100E	V_{RRM} V_{RWM} V_R	 800 1000	V
Average Rectified Forward Current (Note 1.) (Square Wave Mounting Method #3 Per Note 3.)	$I_{F(AV)}$	1.0 @ T_A = 95°C	A
Non-Repetitive Peak Surge Current (Surge applied at rated load conditions, halfwave, single phase, 60 Hz)	I_{FSM}	35	A
Operating Junction Temperature and Storage Temperature Range	T_J, T_{stg}	–65 to +175	°C

1. Pulse Test: Pulse Width = 300 μs, Duty Cycle ≤ 2.0%.

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ULTRAFAST RECTIFIERS 1.0 AMPERES 800–1000 VOLTS

AXIAL LEAD CASE 059–04 PLASTIC

MARKING DIAGRAM

MUR1x0E = Device Code
x = 8 or 10

ORDERING INFORMATION

Device	Package	Shipping
MUR180E	Axial Lead	1000 Units/Bag
MUR180ERL	Axial Lead	5000/Tape & Reel
MUR1100E	Axial Lead	1000 Units/Bag
MUR1100ERL	Axial Lead	5000/Tape & Reel

Preferred devices are recommended choices for future use and best overall value.

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THERMAL CHARACTERISTICS

Rating	Symbol	Value	Unit
Maximum Thermal Resistance, Junction to Ambient	$R_{\theta JA}$	See Note 3.	°C/W

ELECTRICAL CHARACTERISTICS

Maximum Instantaneous Forward Voltage (Note 2.) (i_F = 1.0 Amp, T_J = 150°C) (i_F = 1.0 Amp, T_J = 25°C)	v_F	 1.50 1.75	Volts
Maximum Instantaneous Reverse Current (Note 2.) (Rated dc Voltage, T_J = 100°C) (Rated dc Voltage, T_J = 25°C)	i_R	 600 10	μA
Maximum Reverse Recovery Time (I_F = 1.0 Amp, di/dt = 50 Amp/μs) (I_F = 0.5 Amp, i_R = 1.0 Amp, I_{REC} = 0.25 Amp)	t_{rr}	 100 75	ns
Maximum Forward Recovery Time (I_F = 1.0 Amp, di/dt = 100 Amp/μs, Recovery to 1.0 V)	t_{fr}	75	ns
Controlled Avalanche Energy (See Test Circuit in Figure 6)	W_{AVAL}	10	mJ

2. Pulse Test: Pulse Width = 300 μs, Duty Cycle ≤ 2.0%.

ELECTRICAL CHARACTERISTICS

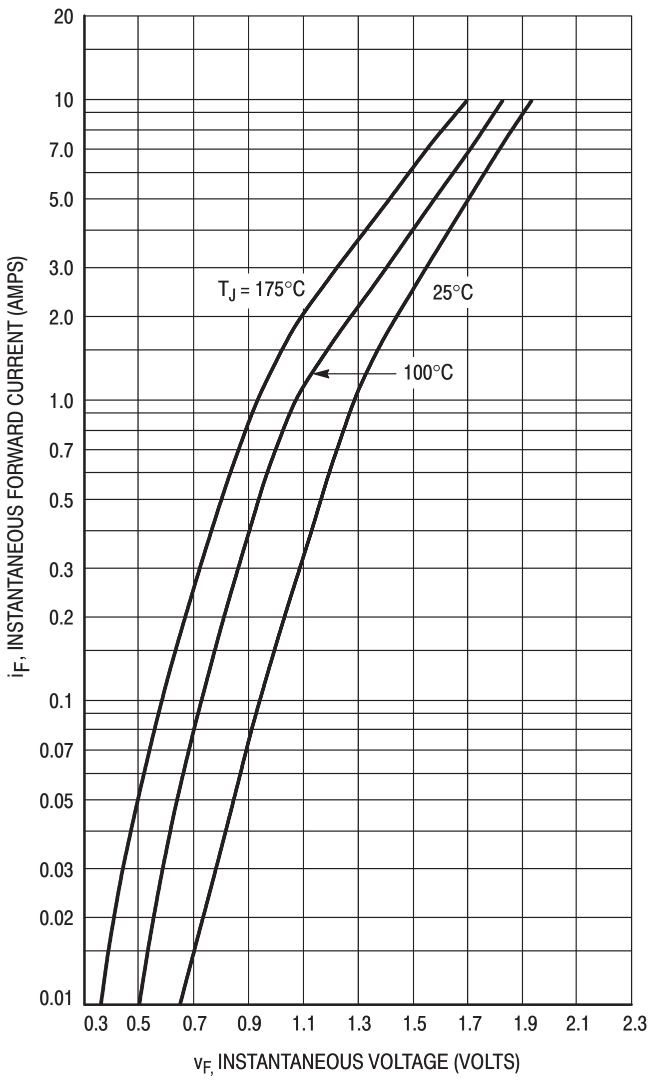


Figure 1. Typical Forward Voltage

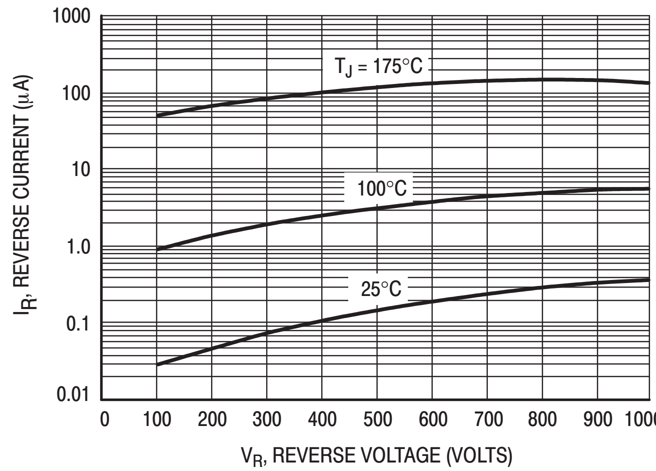


Figure 2. Typical Reverse Current*

* The curves shown are typical for the highest voltage device in the grouping. Typical reverse current for lower voltage selections can be estimated from these same curves if V_R is sufficiently below rated V_R.

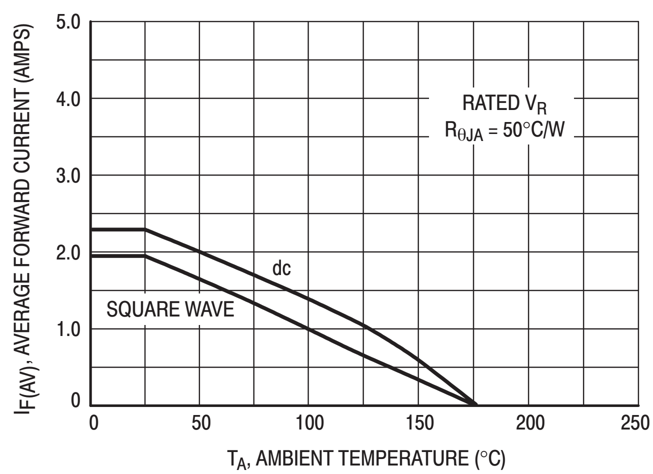


Figure 3. Current Derating (Mounting Method #3 Per Note 1)

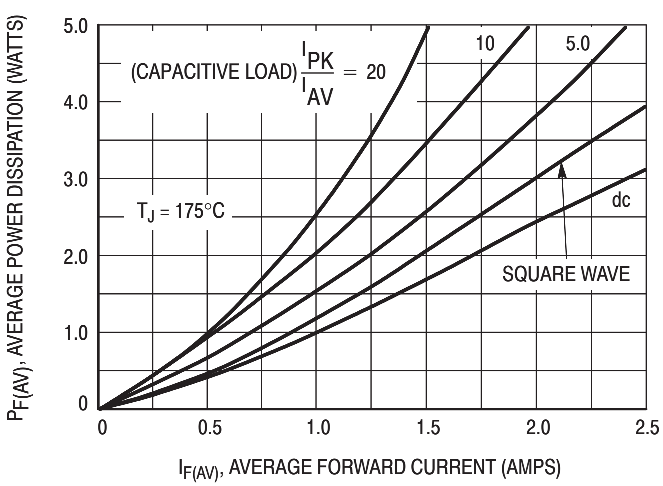


Figure 4. Power Dissipation

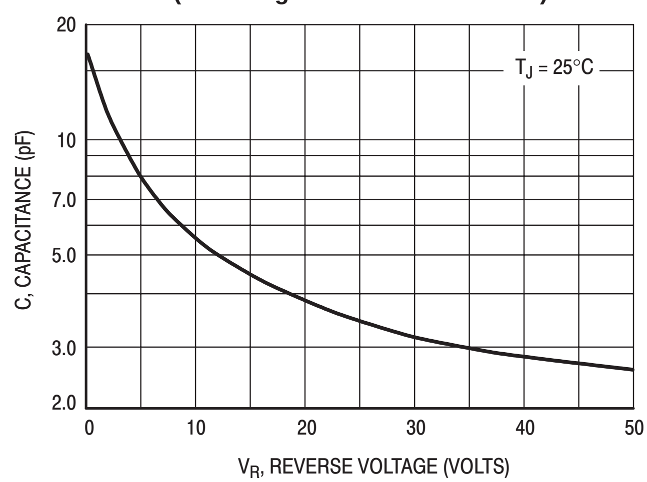


Figure 5. Typical Capacitance

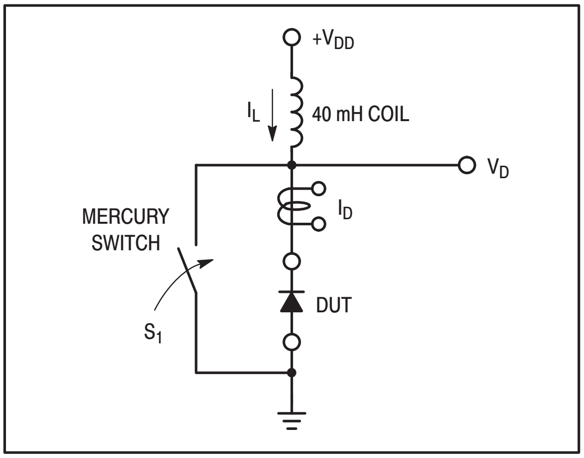


Figure 6. Test Circuit

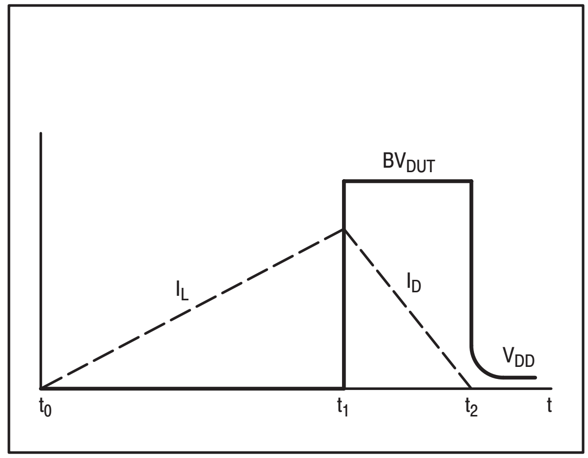


Figure 7. Current–Voltage Waveforms

The unclamped inductive switching circuit shown in Figure 6 was used to demonstrate the controlled avalanche capability of the new "E'' series Ultrafast rectifiers. A mercury switch was used instead of an electronic switch to simulate a noisy environment when the switch was being opened.

When S_1 is closed at t_0 the current in the inductor I_L ramps up linearly; and energy is stored in the coil. At t_1 the switch is opened and the voltage across the diode under test begins to rise rapidly, due to di/dt effects, when this induced voltage reaches the breakdown voltage of the diode, it is clamped at BV_{DUT} and the diode begins to conduct the full load current which now starts to decay linearly through the diode, and goes to zero at t_2.

By solving the loop equation at the point in time when S_1 is opened; and calculating the energy that is transferred to the diode it can be shown that the total energy transferred is equal to the energy stored in the inductor plus a finite amount of energy from the V_{DD} power supply while the diode is in breakdown (from t_1 to t_2) minus any losses due to finite component resistances. Assuming the component resistive elements are small Equation (1) approximates the total energy transferred to the diode. It can be seen from this equation that if the V_{DD} voltage is low compared to the breakdown voltage of the device, the amount of energy contributed by the supply during breakdown is small and the total energy can be assumed to be nearly equal to the energy stored in the coil during the time when S_1 was closed, Equation (2).

The oscilloscope picture in Figure 8, shows the information obtained for the MUR8100E (similar die construction as the MUR1100E Series) in this test circuit conducting a peak current of one ampere at a breakdown voltage of 1300 volts, and using Equation (2) the energy absorbed by the MUR8100E is approximately 20 mjoules.

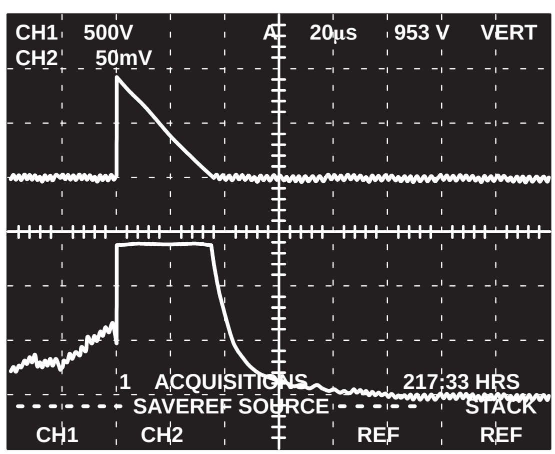
Although it is not recommended to design for this condition, the new "E'' series provides added protection against those unforeseen transient viruses that can produce unexplained random failures in unfriendly environments.

EQUATION (1):

$$W_{AVAL} \approx \frac{1}{2} L I_{LPK}^2 \left(\frac{BV_{DUT}}{BV_{DUT} - V_{DD}} \right)$$

EQUATION (2):

$$W_{AVAL} \approx \frac{1}{2} L I_{LPK}^2$$



CHANNEL 2:
I_L
0.5 AMPS/DIV.

CHANNEL 1:
V_{DUT}
500 VOLTS/DIV.

TIME BASE:
20 µs/DIV.

Figure 8. Current–Voltage Waveforms

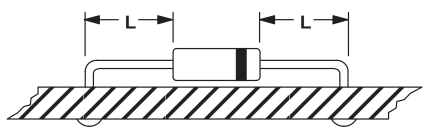
NOTE 3. — AMBIENT MOUNTING DATA

Data shown for thermal resistance junction to ambient ($R_{\theta JA}$) for the mountings shown is to be used as typical guideline values for preliminary engineering or in case the tie point temperature cannot be measured.

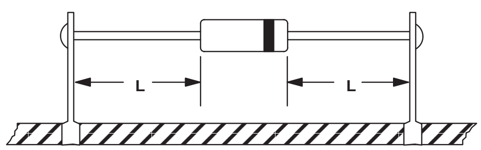
TYPICAL VALUES FOR $R_{\theta JA}$ IN STILL AIR

Mounting Method		Lead Length, L			Units
		1/8	1/4	1/2	
1	$R_{\theta JA}$	52	65	72	°C/W
2	$R_{\theta JA}$	67	80	87	°C/W
3	$R_{\theta JA}$		50		°C/W

MOUNTING METHOD 1

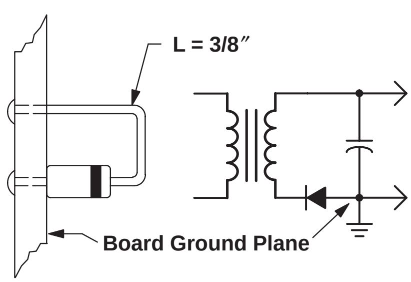


MOUNTING METHOD 2



Vector Pin Mounting

MOUNTING METHOD 3



P.C. Board with
1–1/2″ X 1–1/2″ Copper Surface

MUR220

Preferred Device

SWITCHMODE™ Power Rectifier

. . . designed for use in switching power supplies, inverters and as free wheeling diodes, these state–of–the–art devices have the following features:

- Ultrafast 25 Nanosecond Recovery Times
- 175°C Operating Junction Temperature
- Low Forward Voltage
- Low Leakage Current
- High Temperature Glass Passivated Junction

Mechanical Characteristics

- Case: Epoxy, Molded
- Weight: 0.4 gram (approximately)
- Finish: All External Surfaces Corrosion Resistant and Terminal Leads are Readily Solderable
- Lead and Mounting Surface Temperature for Soldering Purposes: 220°C Max. for 10 Seconds, 1/16″ from case
- Shipped in plastic bags, 1000 per bag
- Available Tape and Reeled, 5000 per reel, by adding a "RL'' suffix to the part number
- Polarity: Cathode Indicated by Polarity Band
- Marking: MUR220

MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Peak Repetitive Reverse Voltage Working Peak Reverse Voltage DC Blocking Voltage	V_{RRM} V_{RWM} V_R	200 —	Volts
Average Rectified Forward Current (Note 1.) (Square Wave Mounting Method #3 Per Note 3.)	$I_{F(AV)}$	2.0 @ T_A = 90°C	Amps
Non-Repetitive Peak Surge Current (Surge applied at rated load conditions, halfwave, single phase, 60 Hz)	I_{FSM}	35	Amps
Operating Junction Temperature and Storage Temperature Range	T_J, T_{stg}	–65 to +175	°C

1. Pulse Test: Pulse Width = 300 μs, Duty Cycle ≤ 2.0%.

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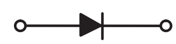
ULTRAFAST RECTIFIER
2 AMPERES
200 VOLTS



AXIAL LEAD
CASE 059–04
PLASTIC

MARKING DIAGRAM

MUR220 = Device Code

ORDERING INFORMATION

Device	Package	Shipping
MUR220	Axial Lead	1000 Units/Bag
MUR220RL	Axial Lead	5000/Tape & Reel

Preferred devices are recommended choices for future use and best overall value.

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THERMAL CHARACTERISTICS

Characteristic	Symbol	Value	Unit
Maximum Thermal Resistance, Junction to Ambient	$R_{\theta JA}$	See Note 3.	°C/W

ELECTRICAL CHARACTERISTICS

Maximum Instantaneous Forward Voltage (Note 2.) (I_F = 2.0 Amp, T_J = 150°C) (I_F = 2.0 Amp, T_J = 25°C)	v_F	 0.75 0.95	Volts
Maximum Instantaneous Reverse Current (Note 2.) (Rated dc Voltage, T_J = 150°C) (Rated dc Voltage, T_J = 25°C)	i_R	 50 2.0	μA
Maximum Reverse Recovery Time (I_F = 1.0 Amp, di/dt = 50 Amp/μs) (I_F = 0.5 Amp, I_R = 1.0 Amp, I_{REC} = 0.25 A)	t_{rr}	 35 25	ns
Maximum Forward Recovery Time (I_F = 1.0 A, di/dt = 100 A/μs, I_{REC} to 1.0 V)	t_{fr}	25	ns

2. Pulse Test: Pulse Width = 300 μs, Duty Cycle ≤ 2.0%.

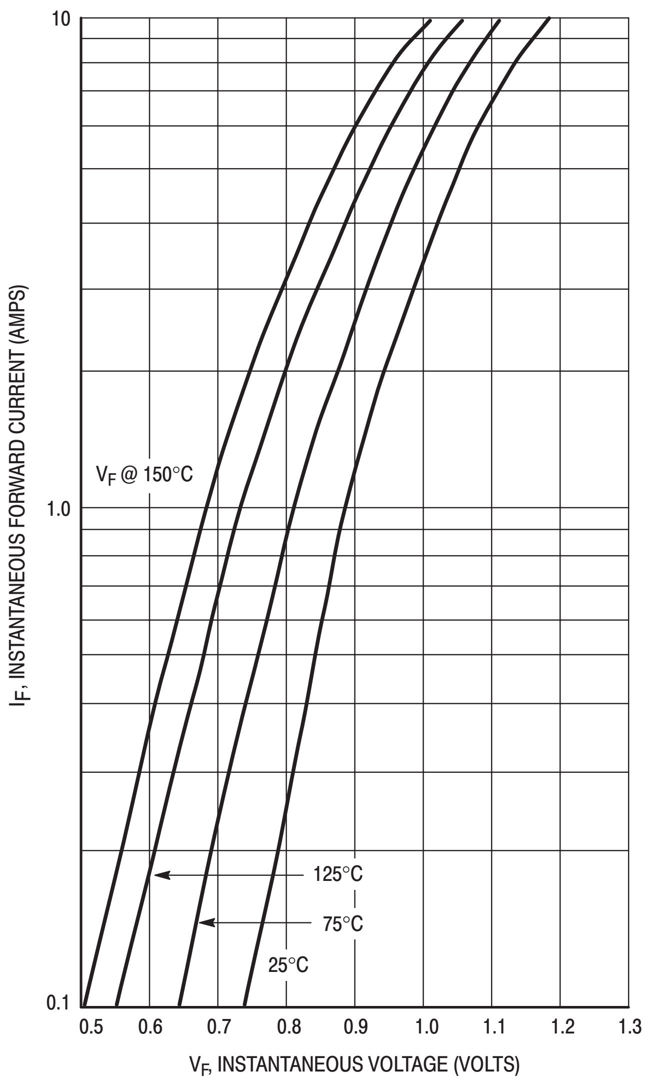


Figure 1. Maximum Forward Voltage

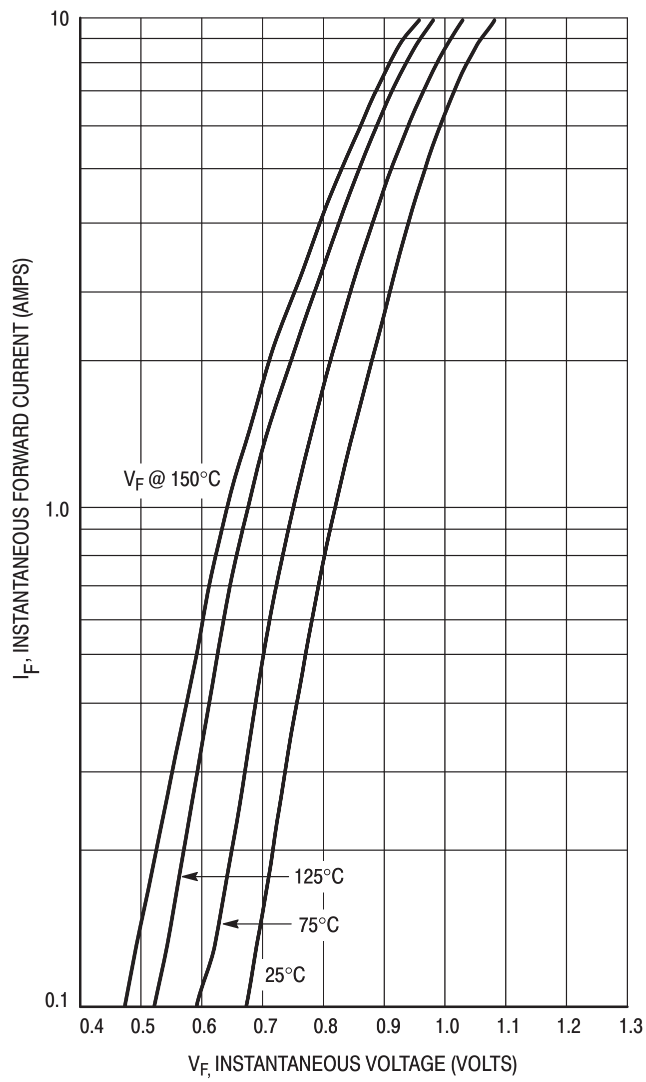


Figure 2. Typical Forward Voltage

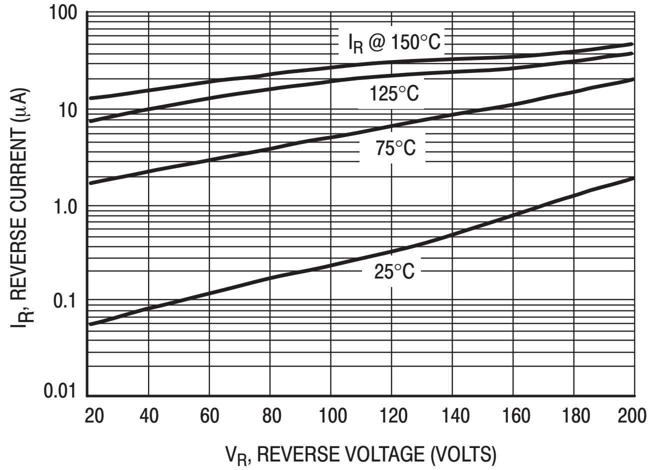


Figure 3. Maximum Reverse Current

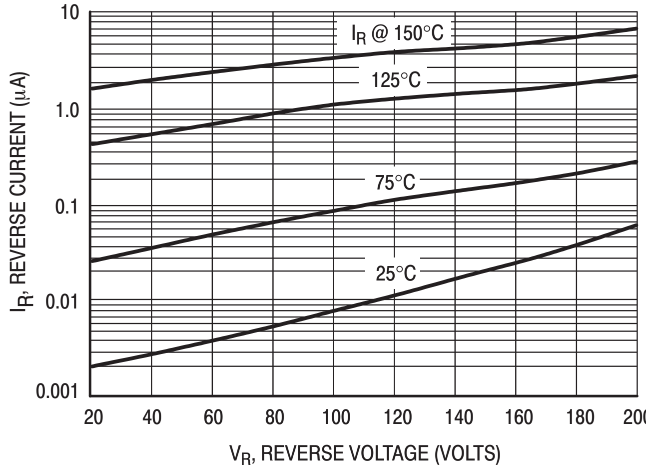


Figure 4. Typical Reverse Current

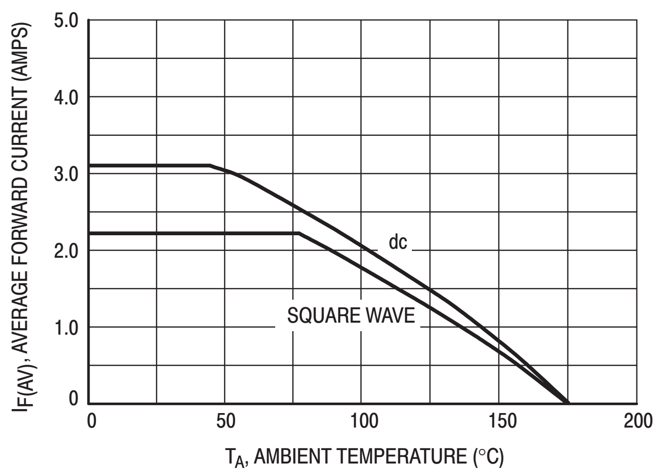


Figure 5. Current Derating

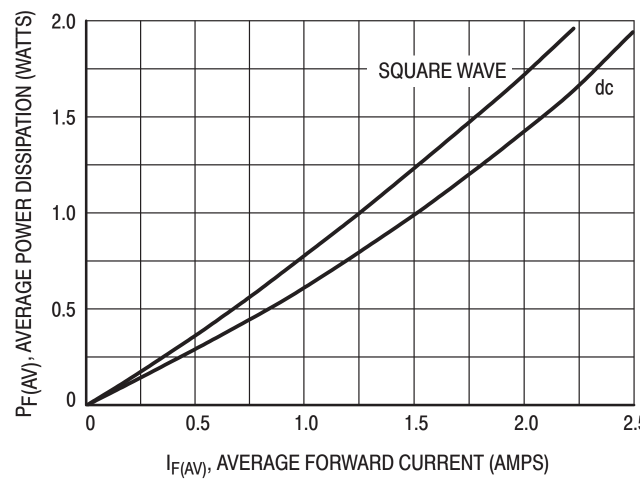


Figure 6. Power Dissipation

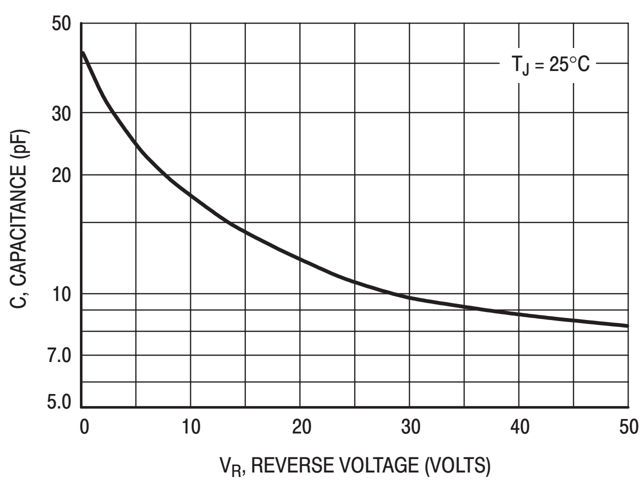


Figure 7. Typical Capacitance

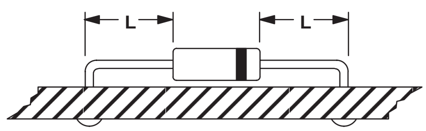
NOTE 3. – AMBIENT MOUNTING DATA

Data shown for thermal resistance junction to ambient ($R_{\theta JA}$) for the mountings shown is to be used as typical guideline values for preliminary engineering or in case the tie point temperature cannot be measured.

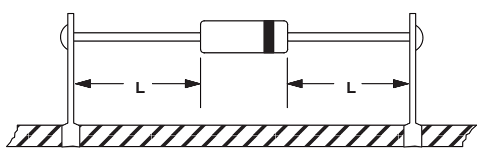
TYPICAL VALUES FOR $R_{\theta JA}$ IN STILL AIR

Mounting Method		Lead Length, L 1/8	1/4	1/2	Units
1	$R_{\theta JA}$	52	65	72	°C/W
2	$R_{\theta JA}$	67	80	87	°C/W
3	$R_{\theta JA}$	50			°C/W

MOUNTING METHOD 1

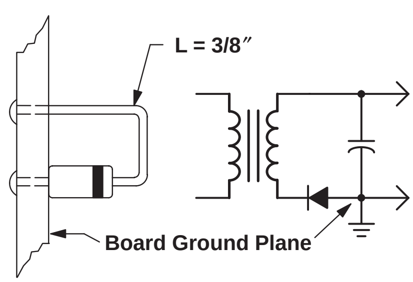


MOUNTING METHOD 2



Vector Pin Mounting

MOUNTING METHOD 3



P.C. Board with
1–1/2″ X 1–1/2″ Copper Surface

MUR240

Preferred Device

SWITCHMODE™ Power Rectifier

. . . designed for use in switching power supplies, inverters and as free wheeling diodes, these state–of–the–art devices have the following features:

- Ultrafast Recovery Times
- 175°C Operating Junction Temperature
- Low Forward Voltage
- Low Leakage Current
- High Temperature Glass Passivated Junction

Mechanical Characteristics

- Case: Epoxy, Molded
- Weight: 0.4 gram (approximately)
- Finish: All External Surfaces Corrosion Resistant and Terminal Leads are Readily Solderable
- Lead and Mounting Surface Temperature for Soldering Purposes: 220°C Max. for 10 Seconds, 1/16″ from case
- Shipped in plastic bags, 1000 per bag
- Available Tape and Reeled, 5000 per reel, by adding a "RL" suffix to the part number
- Polarity: Cathode Indicated by Polarity Band
- Marking: MUR240

MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Peak Repetitive Reverse Voltage Working Peak Reverse Voltage DC Blocking Voltage	V_{RRM} V_{RWM} V_R	400 –	V
Average Rectified Forward Current (Note 1.) (Square Wave Mounting Method #3 Per Note 3.)	$I_{F(AV)}$	2.0 @ $T_A = 85°C$	A
Non-Repetitive Peak Surge Current (Surge applied at rated load conditions, halfwave, single phase, 60 Hz)	I_{FSM}	35	A
Operating Junction Temperature and Storage Temperature Range	T_J, T_{stg}	–65 to +175	°C

1. Pulse Test: Pulse Width = 300 μs, Duty Cycle ≤ 2.0%.

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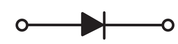
ULTRAFAST RECTIFIER 2 AMPERES 400 VOLTS



AXIAL LEAD
CASE 059–04
PLASTIC

MARKING DIAGRAM

MUR240 = Device Code

ORDERING INFORMATION

Device	Package	Shipping
MUR240	Axial Lead	1000 Units/Bag
MUR240RL	Axial Lead	5000/Tape & Reel

Preferred devices are recommended choices for future use and best overall value.

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THERMAL CHARACTERISTICS

Characteristic	Symbol	Value	Unit
Maximum Thermal Resistance, Junction to Ambient	$R_{\theta JA}$	See Note 3.	°C/W

ELECTRICAL CHARACTERISTICS

Maximum Instantaneous Forward Voltage (Note 2.) (I_F = 2.0 Amp, T_J = 150°C) (I_F = 2.0 Amp, T_J = 25°C)	V_F	 0.95 1.15	Volts
Maximum Instantaneous Reverse Current (Note 2.) (Rated dc Voltage, T_J = 150°C) (Rated dc Voltage, T_J = 25°C)	I_R	 150 5.0	μA
Maximum Reverse Recovery Time (I_F = 1.0 Amp, di/dt = 50 Amp/μs)	t_{rr}	 65	ns
Maximum Forward Recovery Time (I_F = 1.0 A, di/dt = 100 A/μs)	t_{rr}	50	ns

2. Pulse Test: Pulse Width = 300 μs, Duty Cycle ≤ 2.0%.

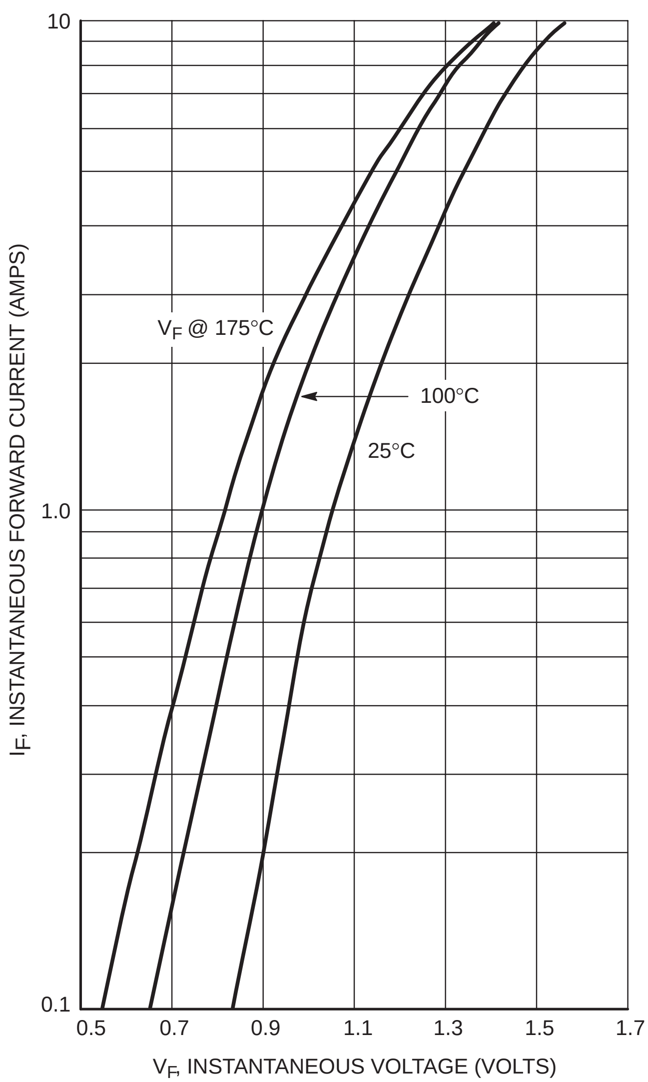


Figure 1. Maximum Forward Current

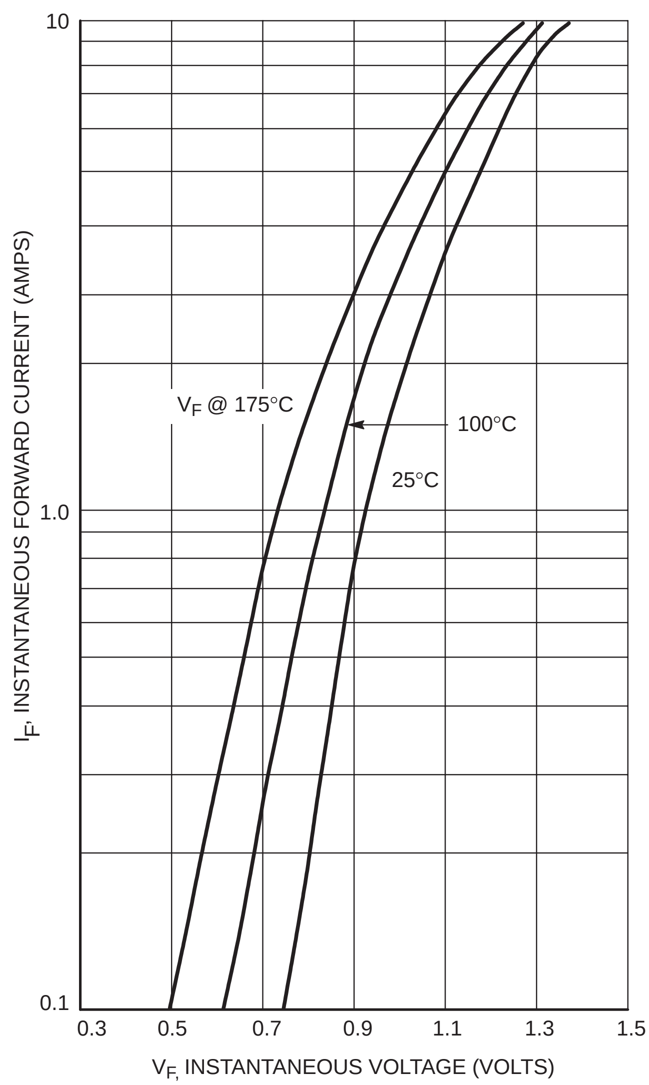


Figure 2. Typical Forward Current

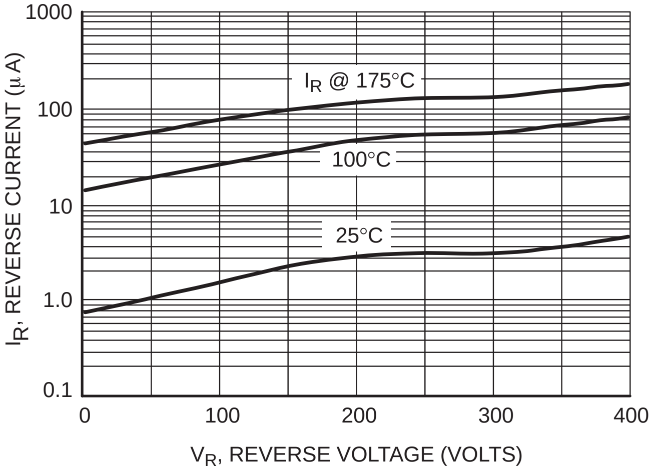


Figure 3. Maximum Reverse Current

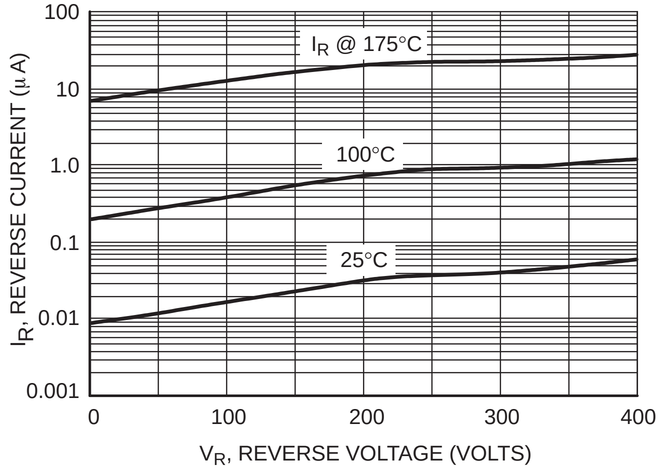


Figure 4. Typical Reverse Current

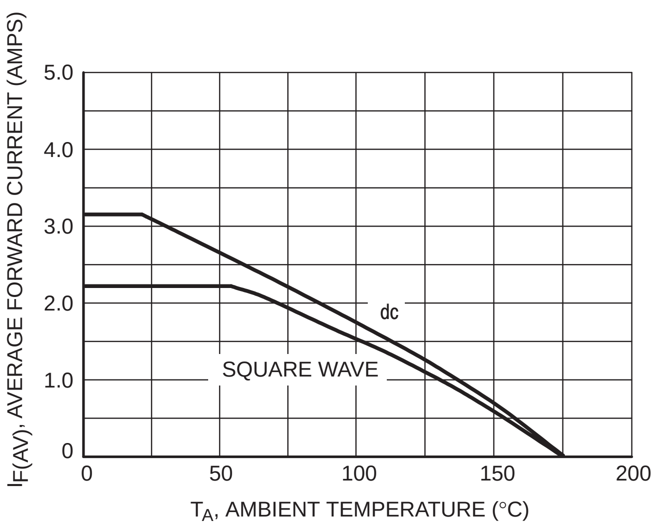


Figure 5. Current Derating

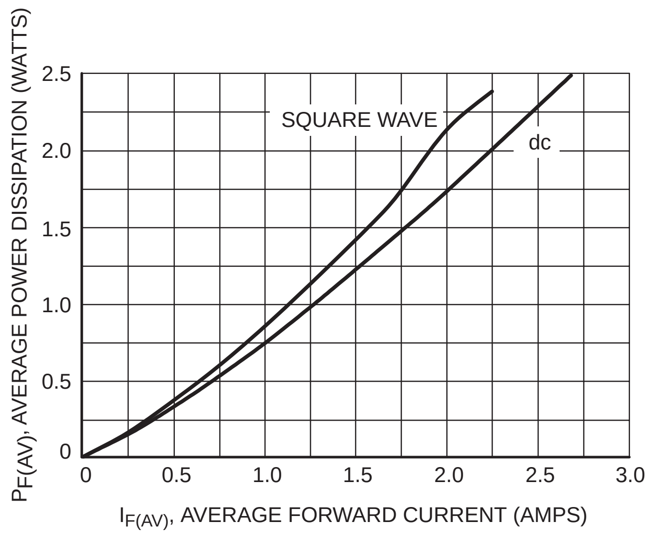


Figure 6. Power Dissipation

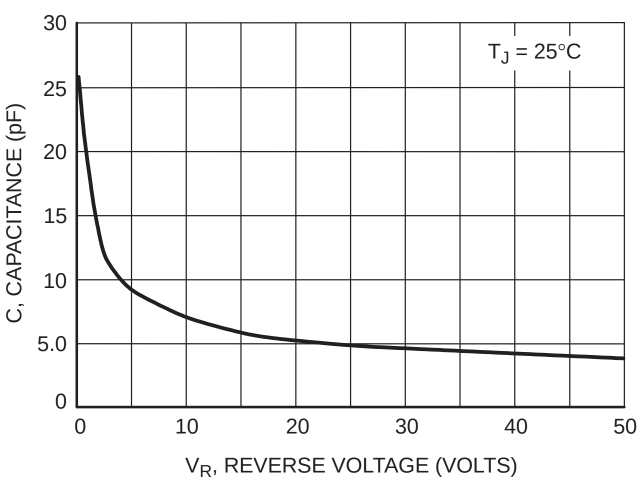


Figure 7. Typical Capacitance

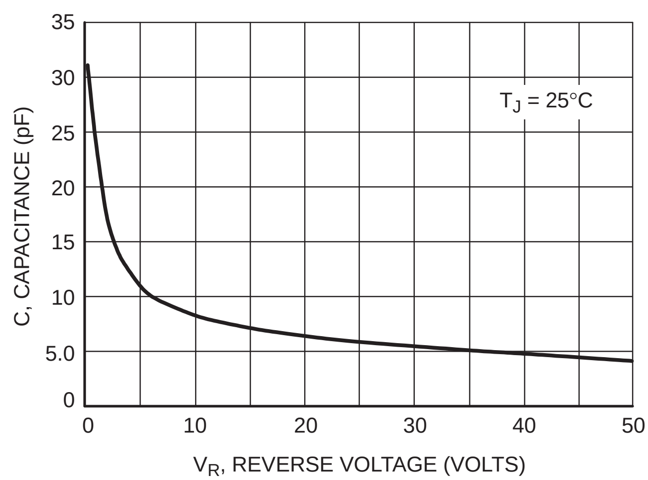


Figure 8. Maximum Capacitance

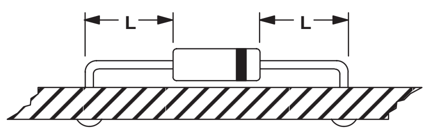
NOTE 3. – AMBIENT MOUNTING DATA

Data shown for thermal resistance junction to ambient ($R_{\theta JA}$) for the mountings shown is to be used as typical guideline values for preliminary engineering or in case the tie point temperature cannot be measured.

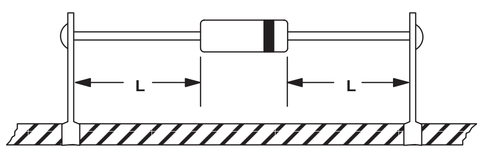
TYPICAL VALUES FOR $R_{\theta JA}$ IN STILL AIR

Mounting Method		Lead Length, L			Units
		1/8	1/4	1/2	
1	$R_{\theta JA}$	52	65	72	°C/W
2	$R_{\theta JA}$	67	80	87	°C/W
3	$R_{\theta JA}$	50			°C/W

MOUNTING METHOD 1

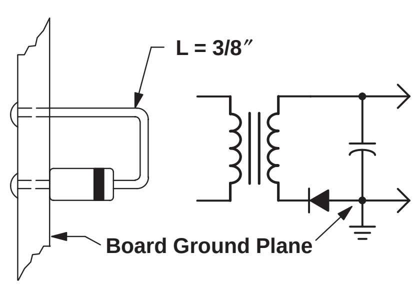


MOUNTING METHOD 2



Vector Pin Mounting

MOUNTING METHOD 3



P.C. Board with
1–1/2″ X 1–1/2″ Copper Surface

MUR260

Preferred Device

SWITCHMODE™ Power Rectifier

. . . designed for use in switching power supplies, inverters and as free wheeling diodes, these state–of–the–art devices have the following features:

- Ultrafast 50 Nanosecond Recovery Times
- 175°C Operating Junction Temperature
- Low Forward Voltage
- Low Leakage Current
- High Temperature Glass Passivated Junction

Mechanical Characteristics

- Case: Epoxy, Molded
- Weight: 0.4 gram (approximately)
- Finish: All External Surfaces Corrosion Resistant and Terminal Leads are Readily Solderable
- Lead and Mounting Surface Temperature for Soldering Purposes: 220°C Max. for 10 Seconds, 1/16″ from case
- Shipped in plastic bags, 1000 per bag
- Available Tape and Reeled, 5000 per reel, by adding a "RL" suffix to the part number
- Polarity: Cathode Indicated by Polarity Band
- Marking: MUR260

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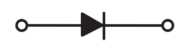
ULTRAFAST RECTIFIER 2 AMPERES 600 VOLTS



AXIAL LEAD
CASE 059–04
PLASTIC

MARKING DIAGRAM

MUR260 = Device Code

MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Peak Repetitive Reverse Voltage Working Peak Reverse Voltage DC Blocking Voltage	V_{RRM} V_{RWM} V_R	600 –	Volts
Average Rectified Forward Current (Note 1.) (Square Wave Mounting Method #3 Per Note 3.)	$I_{F(AV)}$	2.0 @ T_A = 60°C	Amps
Non-Repetitive Peak Surge Current (Surge applied at rated load conditions, halfwave, single phase, 60 Hz)	I_{FSM}	35	Amps
Operating Junction Temperature and Storage Temperature Range	T_J, T_{stg}	–65 to +175	°C

1. Pulse Test: Pulse Width = 300 μs, Duty Cycle ≤ 2.0%.

ORDERING INFORMATION

Device	Package	Shipping
MUR260	Axial Lead	1000 Units/Bag
MUR260RL	Axial Lead	5000/Tape & Reel

Preferred devices are recommended choices for future use and best overall value.

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THERMAL CHARACTERISTICS

Characteristic	Symbol	Value	Unit
Maximum Thermal Resistance, Junction to Ambient	$R_{\theta JA}$	See Note 3.	°C/W

ELECTRICAL CHARACTERISTICS

Maximum Instantaneous Forward Voltage (Note 2.) (I_F = 2.0 Amp, T_J = 150°C) (I_F = 2.0 Amp, T_J = 25°C)	v_F	 1.15 1.35	Volts
Maximum Instantaneous Reverse Current (Note 2.) (Rated dc Voltage, T_J = 150°C) (Rated dc Voltage, T_J = 25°C)	i_R	 150 5.0	μA
Maximum Reverse Recovery Time (I_F = 1.0 Amp, di/dt = 50 Amp/μs) (I_F = 0.5 Amp, I_R = 1.0 Amp, I_{REC} = 0.25 A)	t_{rr}	 75 50	ns
Maximum Forward Recovery Time (I_F = 1.0 A, di/dt = 100 A/μs, I_{REC} to 1.0 V)	t_{fr}	50	ns

2. Pulse Test: Pulse Width = 300 μs, Duty Cycle ≤ 2.0%.

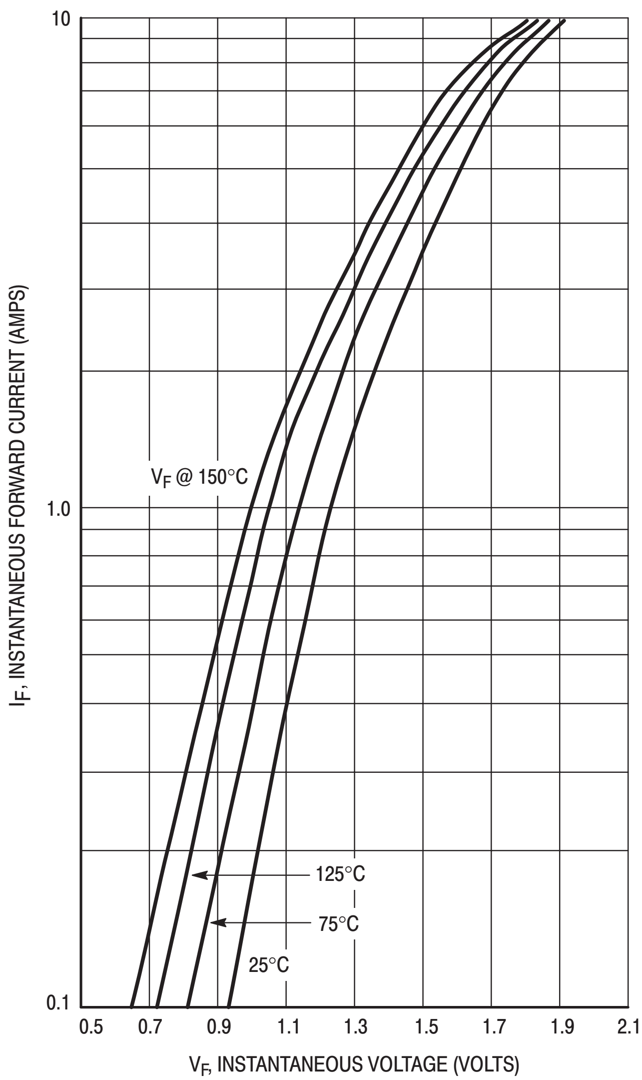


Figure 1. Maximum Forward Voltage

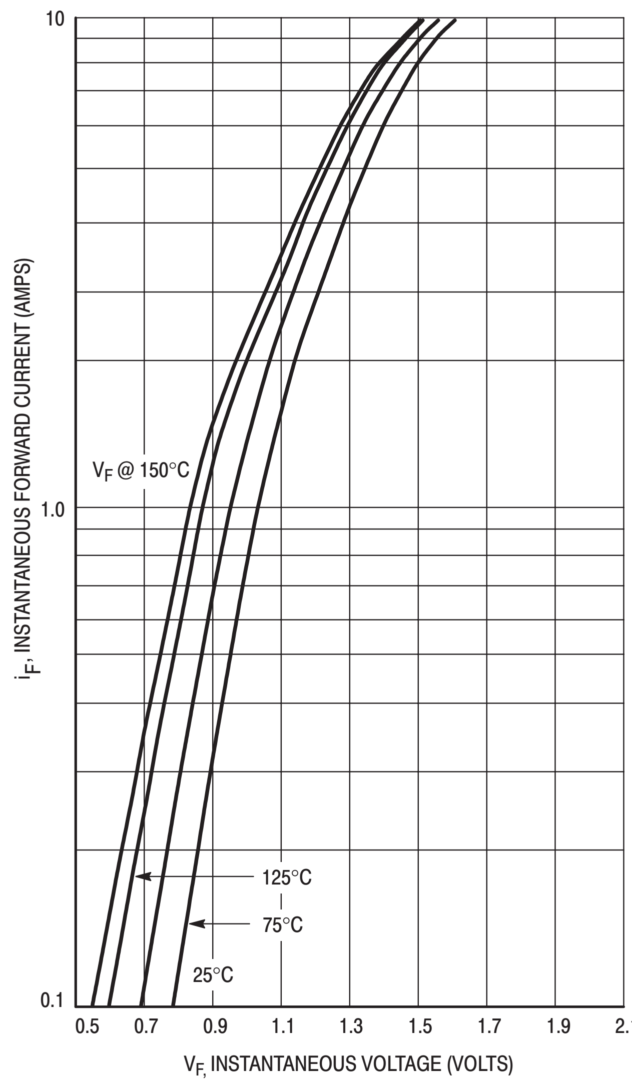


Figure 2. Typical Forward Voltage

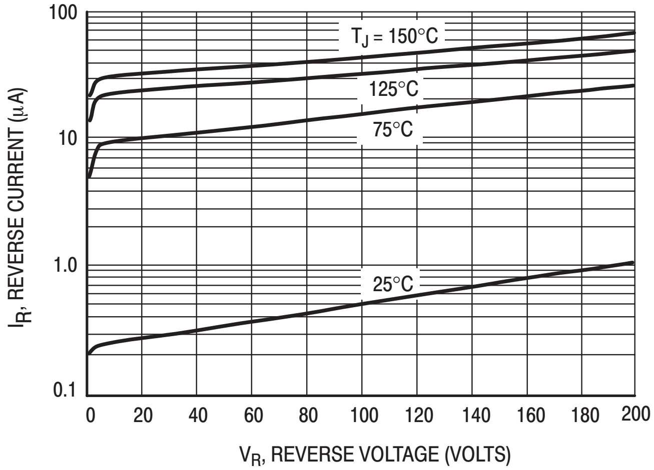


Figure 3. Maximum Reverse Current

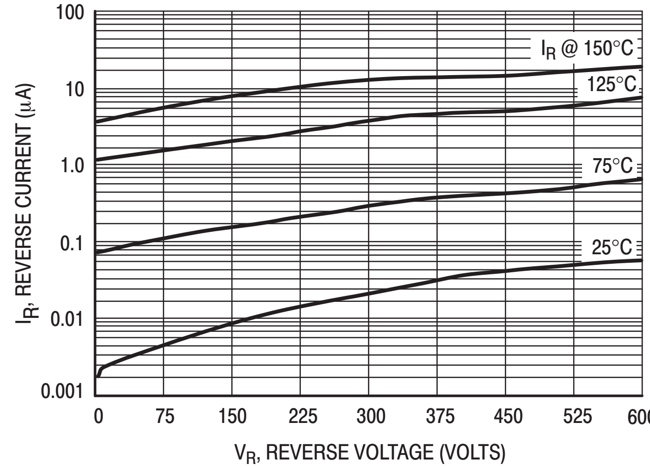


Figure 4. Typical Reverse Current

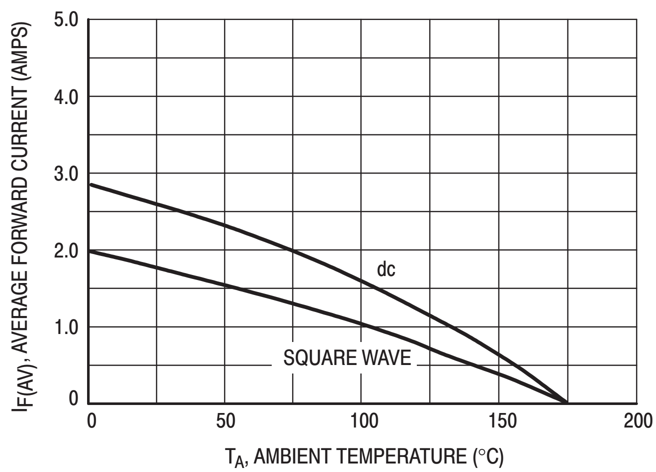


Figure 5. Current Derating

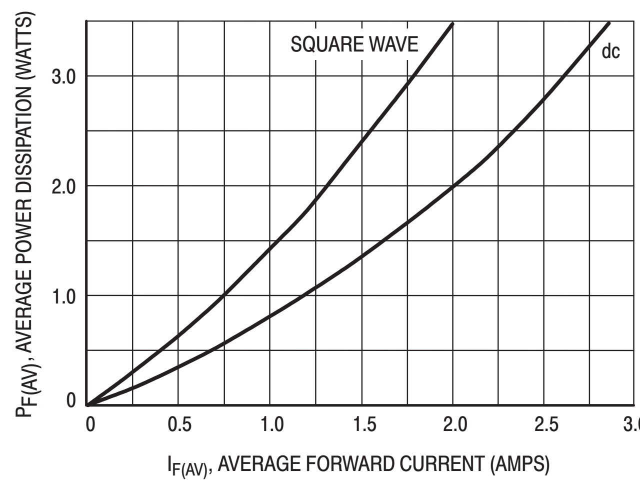


Figure 6. Power Dissipation

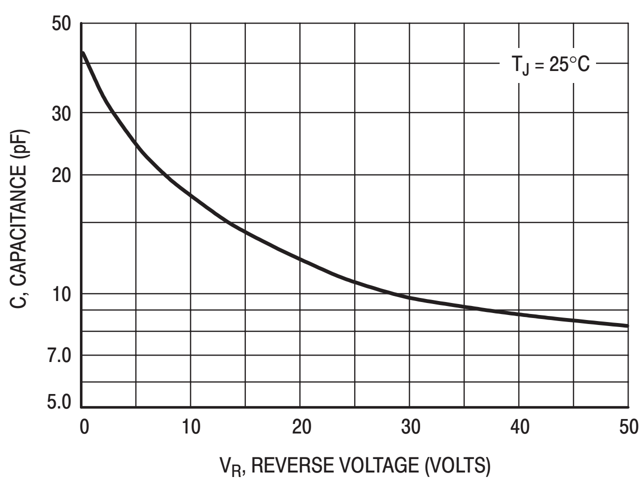


Figure 7. Typical Capacitance

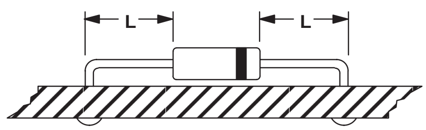
NOTE 3. — AMBIENT MOUNTING DATA

Data shown for thermal resistance junction to ambient ($R_{\theta JA}$) for the mountings shown is to be used as typical guideline values for preliminary engineering or in case the tie point temperature cannot be measured.

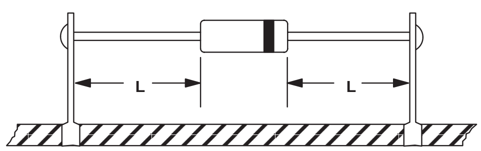
TYPICAL VALUES FOR $R_{\theta JA}$ IN STILL AIR

Mounting Method		Lead Length, L 1/8	Lead Length, L 1/4	Lead Length, L 1/2	Units
1	$R_{\theta JA}$	52	65	72	°C/W
2	$R_{\theta JA}$	67	80	87	°C/W
3	$R_{\theta JA}$	50			°C/W

MOUNTING METHOD 1

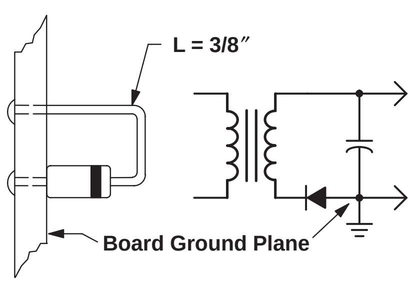


MOUNTING METHOD 2



Vector Pin Mounting

MOUNTING METHOD 3



P.C. Board with
1–1/2″ X 1–1/2″ Copper Surface

MUR2100E

Preferred Device

SWITCHMODE™ Power Rectifier

Ultrafast “E” Series with High Reverse Energy Capability

. . . designed for use in switching power supplies, inverters and as free wheeling diodes, these state–of–the–art devices have the following features:

- 20 mjoules Avalanche Energy Guaranteed
- Excellent Protection Against Voltage Transients in Switching Inductive Load Circuits
- Ultrafast 75 Nanosecond Recovery Time
- 175°C Operating Junction Temperature
- Low Forward Voltage
- Low Leakage Current
- High Temperature Glass Passivated Junction

Mechanical Characteristics

- Case: Epoxy, Molded
- Weight: 0.4 gram (approximately)
- Finish: All External Surfaces Corrosion Resistant and Terminal Leads are Readily Solderable
- Lead and Mounting Surface Temperature for Soldering Purposes: 220°C Max. for 10 Seconds, 1/16″ from case
- Shipped in plastic bags, 1000 per bag
- Available Tape and Reeled, 5000 per reel, by adding a “RL’’ suffix to the part number
- Polarity: Cathode Indicated by Polarity Band
- Marking: MUR2100E

MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Peak Repetitive Reverse Voltage Working Peak Reverse Voltage DC Blocking Voltage	V_{RRM} V_{RWM} V_R	1000	Volts
Average Rectified Forward Current (Note 1.) (Square Wave Mounting Method #3 Per Note 3.)	$I_{F(AV)}$	2.0 @ T_A = 35°C	Amps
Non-Repetitive Peak Surge Current (Surge applied at rated load conditions, halfwave, single phase, 60 Hz)	I_{FSM}	35	Amps
Operating Junction Temperature and Storage Temperature Range	T_J, T_{stg}	–65 to +175	°C

1. Pulse Test: Pulse Width = 300 μs, Duty Cycle ≤ 2.0%.

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ULTRAFAST RECTIFIER 2 AMPERES 1000 VOLTS

AXIAL LEAD CASE 059–04 PLASTIC

MARKING DIAGRAM

MUR2100E = Device Code

ORDERING INFORMATION

Device	Package	Shipping
MUR2100E	Axial Lead	1000 Units/Bag
MUR2100ERL	Axial Lead	5000/Tape & Reel

Preferred devices are recommended choices for future use and best overall value.

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THERMAL CHARACTERISTICS

Characteristic	Symbol	Value	Unit
Maximum Thermal Resistance, Junction to Ambient	$R_{\theta JA}$	See Note 3.	°C/W

ELECTRICAL CHARACTERISTICS

Maximum Instantaneous Forward Voltage (Note 2.) (I_F = 2.0 Amp, T_J = 150°C) (I_F = 2.0 Amp, T_J = 25°C)	v_F	 1.75 2.20	Volts
Maximum Instantaneous Reverse Current (Note 2.) (Rated dc Voltage, T_J = 100°C) (Rated dc Voltage, T_J = 25°C)	i_R	 600 10	µA
Maximum Reverse Recovery Time (I_F = 1.0 Amp, di/dt = 50 Amp/µs) (I_F = 0.5 Amp, I_R = 1.0 Amp, I_{REC} = 0.25 A)	t_{rr}	 100 75	ns
Maximum Forward Recovery Time (I_F = 1.0 A, di/dt = 100 A/µs, I_{REC} to 1.0 V)	t_{fr}	75	ns
Controlled Avalanche Energy (See Test Circuit in Figure 6)	W_{AVAL}	10	mJ

2. Pulse Test: Pulse Width = 300 µs, Duty Cycle ≤ 2.0%.

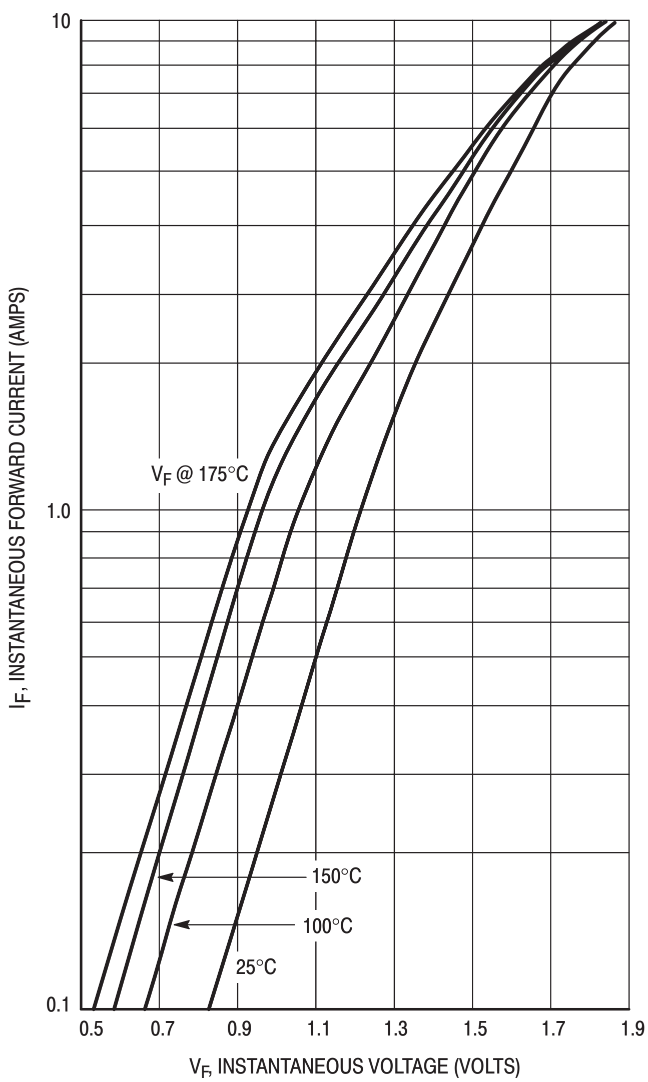

Figure 1. Maximum Forward Voltage

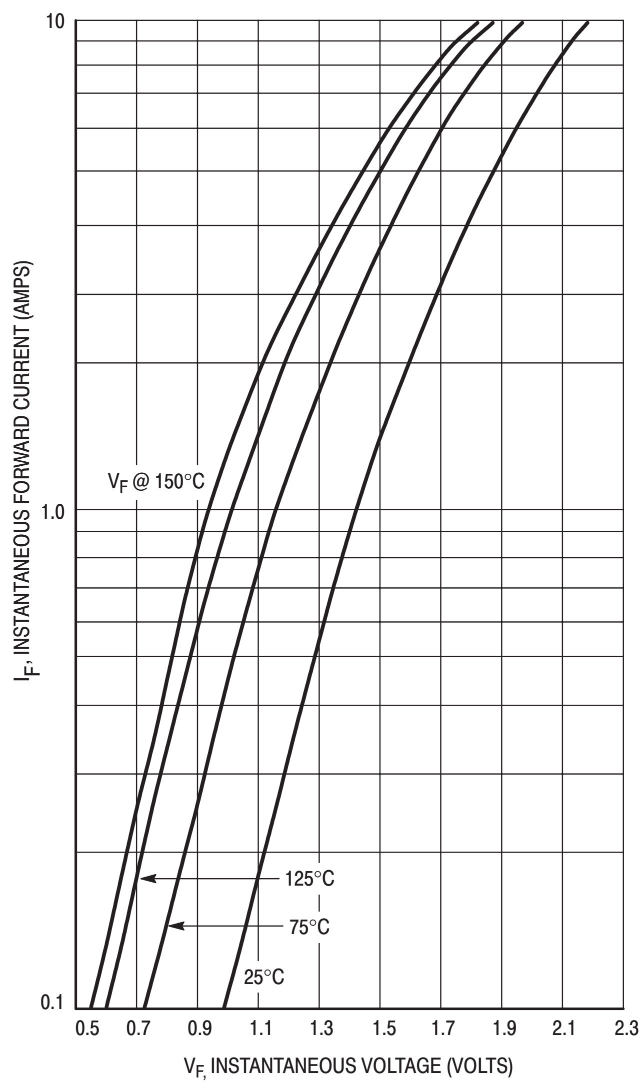

Figure 2. Typical Forward Voltage

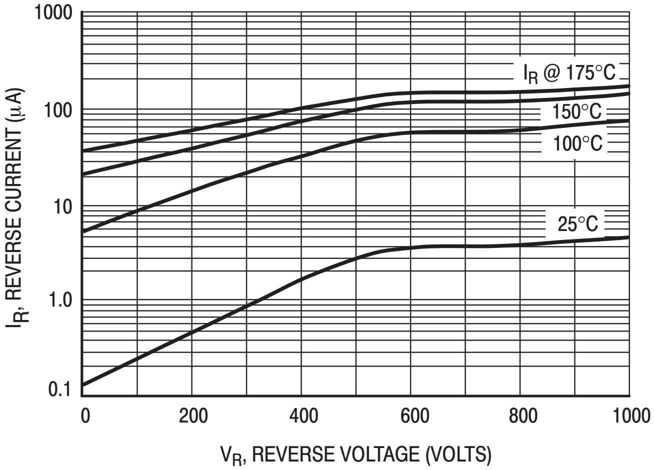

Figure 3. Maximum Reverse Current

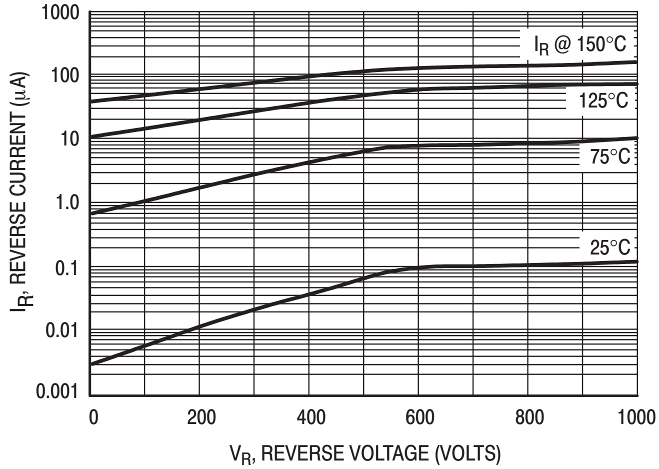

Figure 4. Typical Reverse Current

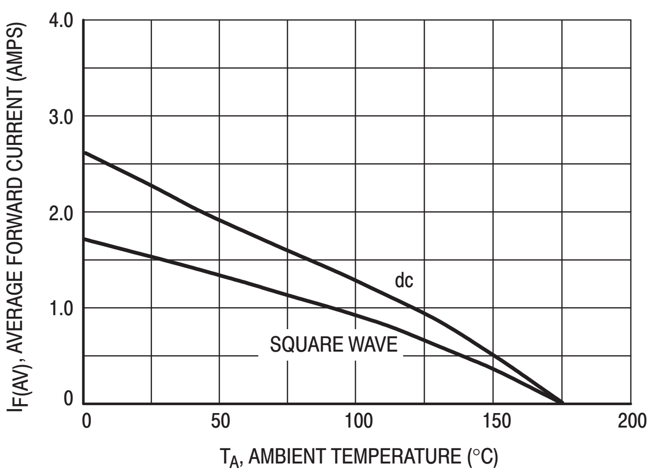

Figure 5. Current Derating

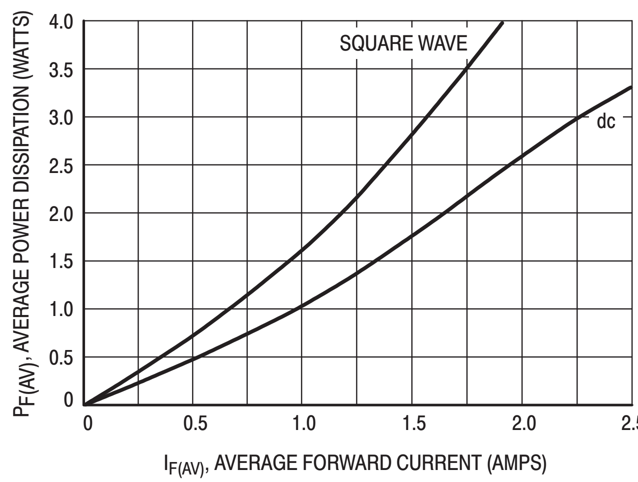

Figure 6. Power Dissipation

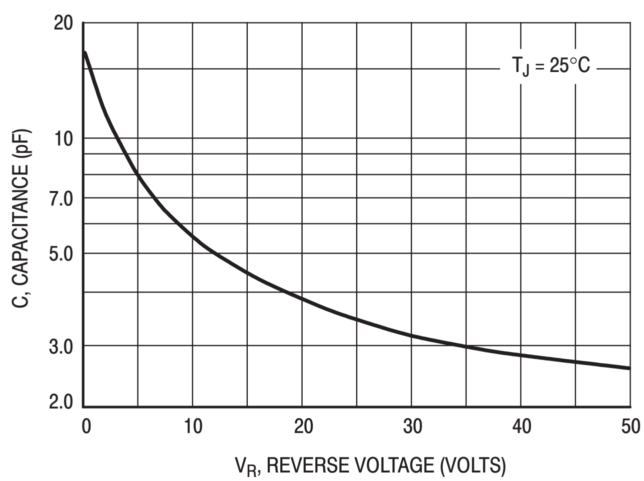

Figure 7. Typical Capacitance

NOTE 3. — AMBIENT MOUNTING DATA

Data shown for thermal resistance junction to ambient ($R_{\theta JA}$) for the mountings shown is to be used as typical guideline values for preliminary engineering or in case the tie point temperature cannot be measured.

TYPICAL VALUES FOR $R_{\theta JA}$ IN STILL AIR

<table>
<tr><th colspan="2" rowspan="2">Mounting Method</th><th colspan="3">Lead Length, L</th><th rowspan="2">Units</th></tr>
<tr><th>1/8</th><th>1/4</th><th>1/2</th></tr>
<tr><td>1</td><td rowspan="3">$R_{\theta JA}$</td><td>52</td><td>65</td><td>72</td><td>°C/W</td></tr>
<tr><td>2</td><td>67</td><td>80</td><td>87</td><td>°C/W</td></tr>
<tr><td>3</td><td colspan="3">50</td><td>°C/W</td></tr>
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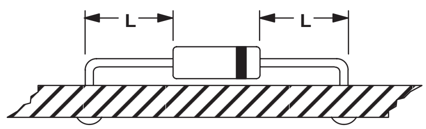
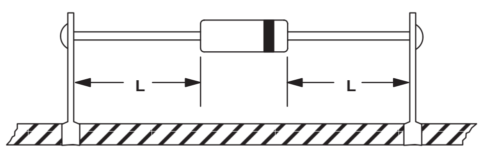
MOUNTING METHOD 1

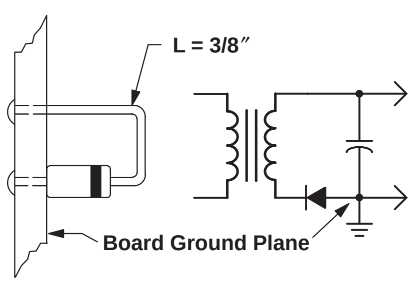


MOUNTING METHOD 2



Vector Pin Mounting

MOUNTING METHOD 3



P.C. Board with
1–1/2″ X 1–1/2″ Copper Surface

MUR405, MUR410, MUR415, MUR420, MUR440, MUR460

MUR420 and MUR460 are Preferred Devices

Switchmode™ Power Rectifiers

. . . designed for use in switching power supplies, inverters and as free wheeling diodes, these state–of–the–art devices have the following features:

- Ultrafast 25, 50 and 75 Nanosecond Recovery Times
- 175°C Operating Junction Temperature
- Low Forward Voltage
- Low Leakage Current
- High Temperature Glass Passivated Junction
- Reverse Voltage to 600 Volts

Mechanical Characteristics:

- Case: Epoxy, Molded
- Weight: 1.1 gram (approximately)
- Finish: All External Surfaces Corrosion Resistant and Terminal Leads are Readily Solderable
- Lead and Mounting Surface Temperature for Soldering Purposes: 220°C Max. for 10 Seconds, 1/16″ from case
- Shipped in plastic bags, 5,000 per bag
- Available Tape and Reeled, 1500 per reel, by adding a “RL’’ suffix to the part number
- Polarity: Cathode indicated by Polarity Band
- Marking: MUR405, MUR410, MUR415, MUR420, MUR440, MUR460

MAXIMUM RATINGS

Please See the Table on the Following Page

ON Semiconductor™

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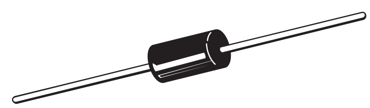
ULTRAFAST RECTIFIERS
4.0 AMPERES
50–600 VOLTS



AXIAL LEAD
CASE 267–03
STYLE 1

MARKING DIAGRAM

MUR4xx = Device Code
xx = 05, 10, 15, 20, 40, 60

ORDERING INFORMATION

Device	Package	Shipping
MUR405	Axial Lead	5000 Units/Bag
MUR405RL	Axial Lead	1500/Tape & Reel
MUR410	Axial Lead	5000 Units/Bag
MUR410RL	Axial Lead	1500/Tape & Reel
MUR415	Axial Lead	5000 Units/Bag
MUR415RL	Axial Lead	1500/Tape & Reel
MUR420	Axial Lead	5000 Units/Bag
MUR420RL	Axial Lead	1500/Tape & Reel
MUR440	Axial Lead	5000 Units/Bag
MUR440RL	Axial Lead	1500/Tape & Reel
MUR460	Axial Lead	5000 Units/Bag
MUR460RL	Axial Lead	1500/Tape & Reel

Preferred devices are recommended choices for future use and best overall value.

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MAXIMUM RATINGS

Rating	Symbol	MUR 405	410	415	420	440	460	Unit
Peak Repetitive Reverse Voltage Working Peak Reverse Voltage DC Blocking Voltage	V_{RRM} V_{RWM} V_R	50	100	150	200	400	600	Volts
Average Rectified Forward Current (Square Wave) (Mounting Method #3 Per Note 2.)	$I_{F(AV)}$	4.0 @ T_A = 80°C				4.0 @ T_A = 40°C		Amps
Nonrepetitive Peak Surge Current (Surge applied at rated load conditions, half wave, single phase, 60 Hz)	I_{FSM}	125				70		Amps
Operating Junction Temperature & Storage Temperature	T_J, T_{stg}	– 65 to +175						°C

THERMAL CHARACTERISTICS

Maximum Thermal Resistance, Junction to Ambient	$R_{\theta JA}$	See Note 2.	°C/W

ELECTRICAL CHARACTERISTICS

Characteristic	Symbol	MUR405–MUR420	MUR440–MUR460	Unit
Maximum Instantaneous Forward Voltage (Note 1.) (i_F = 3.0 Amps, T_J = 150°C) (i_F = 3.0 Amps, T_J = 25°C) (i_F = 4.0 Amps, T_J = 25°C)	v_F	 0.710 0.875 0.890	 1.05 1.25 1.28	Volts
Maximum Instantaneous Reverse Current (Note 1.) (Rated dc Voltage, T_J = 150°C) (Rated dc Voltage, T_J = 25°C)	i_R	 150 5.0	 250 10	µA
Maximum Reverse Recovery Time (I_F = 1.0 Amp, di/dt = 50 Amp/µs) (I_F = 0.5 Amp, i_R = 1.0 Amp, I_{REC} = 0.25 Amp)	t_{rr}	 35 25	 75 50	ns
Maximum Forward Recovery Time (I_F = 1.0 A, di/dt = 100 A/µs, Recovery to 1.0 V)	t_{fr}	25	50	ns

1. Pulse Test: Pulse Width = 300 µs, Duty Cycle ≤ 2.0%.

MUR405, MUR410, MUR415, MUR420

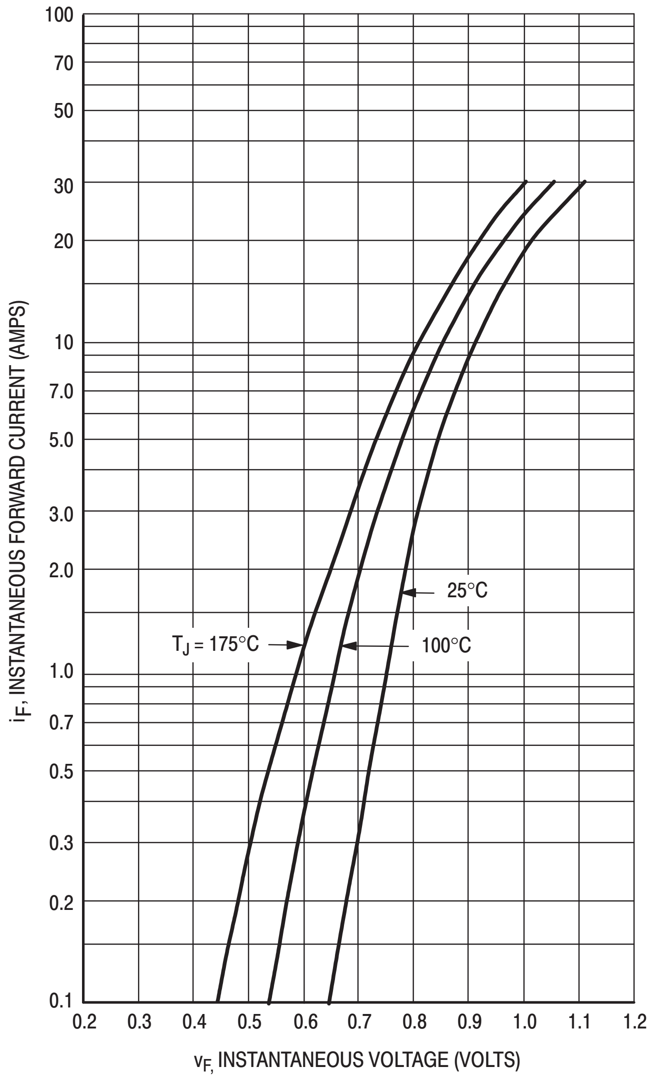


Figure 1. Typical Forward Voltage

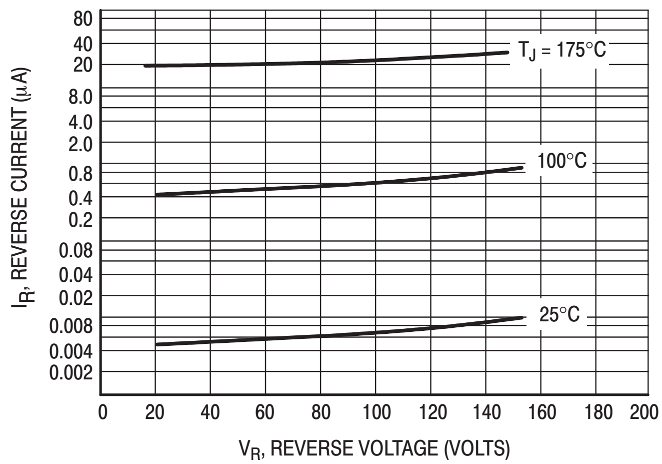


Figure 2. Typical Reverse Current

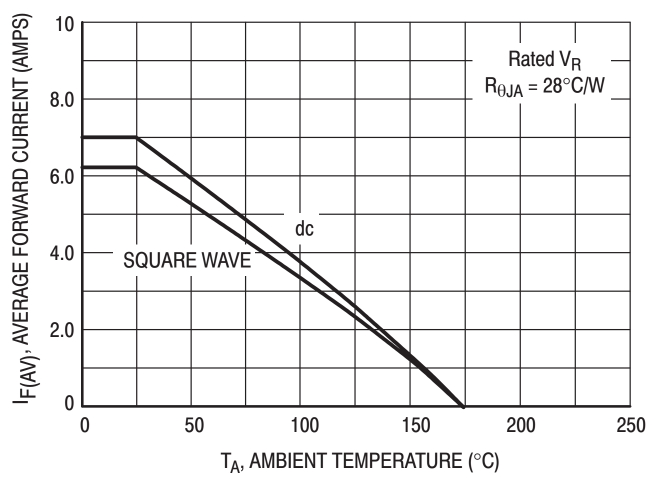


Figure 3. Current Derating (Mounting Method #3 Per Note 1)

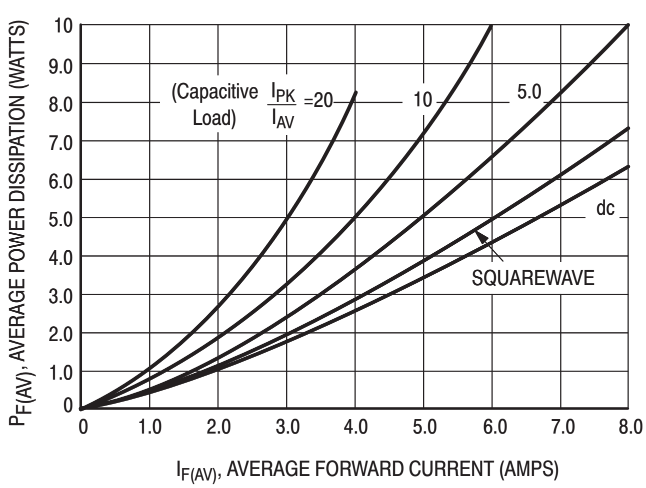


Figure 4. Power Dissipation

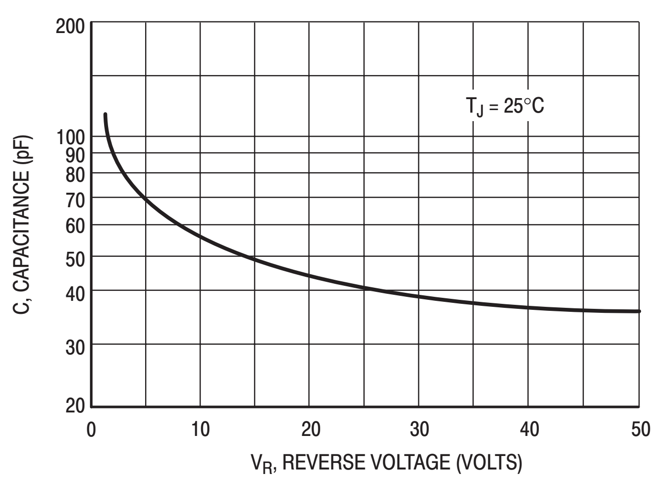


Figure 5. Typical Capacitance

MUR440, MUR460

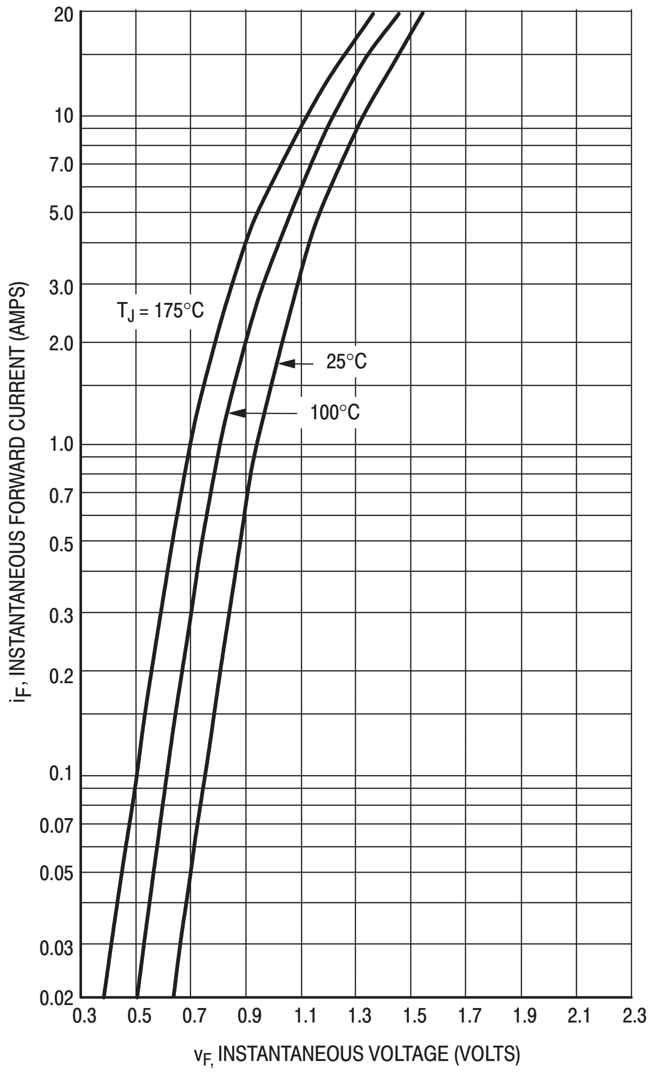


Figure 6. Typical Forward Voltage

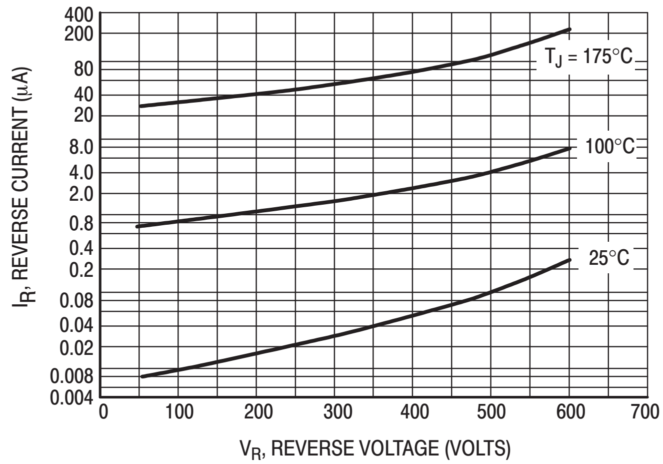


Figure 7. Typical Reverse Current

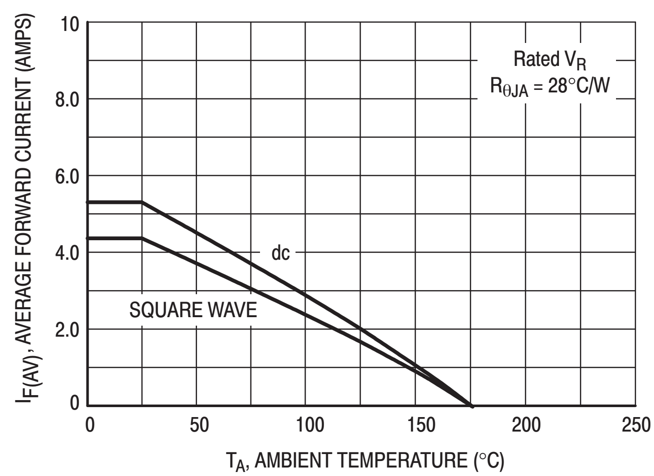


Figure 8. Current Derating (Mounting Method #3 Per Note 1)

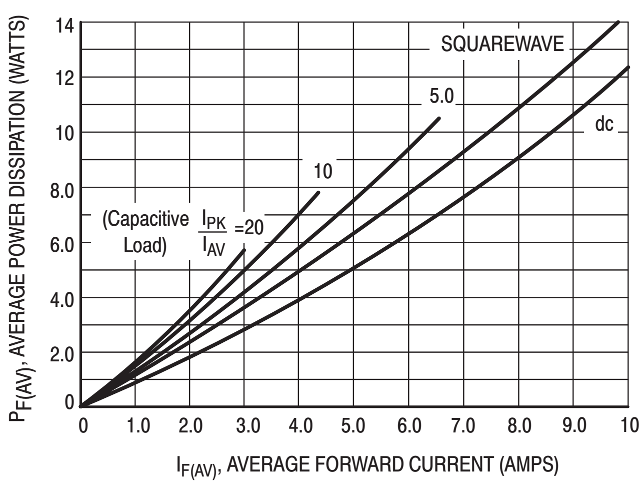


Figure 9. Power Dissipation

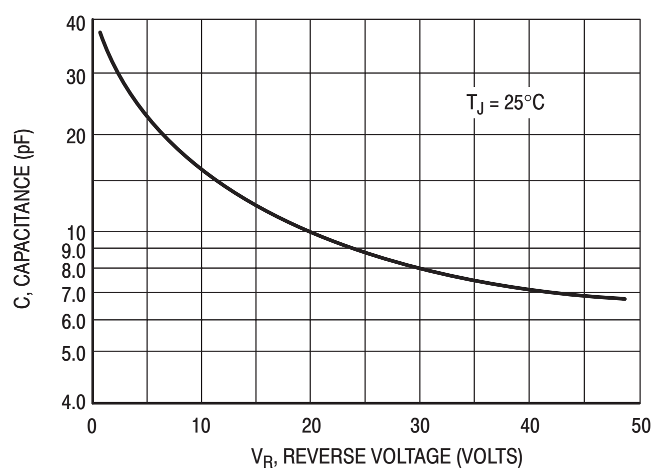


Figure 10. Typical Capacitance

NOTE 2. — AMBIENT MOUNTING DATA

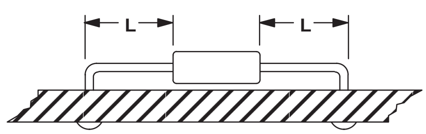
Data shown for thermal resistance junction–to–ambient ($R_{\theta JA}$) for the mountings shown is to be used as typical guideline values for preliminary engineering or in case the tie point temperature cannot be measured.

TYPICAL VALUES FOR $R_{\theta JA}$ IN STILL AIR

Mounting Method		Lead Length, L (IN)				Units
		1/8	1/4	1/2	3/4	
1	$R_{\theta JA}$	50	51	53	55	°C/W
2	$R_{\theta JA}$	58	59	61	63	°C/W
3	$R_{\theta JA}$	28				°C/W

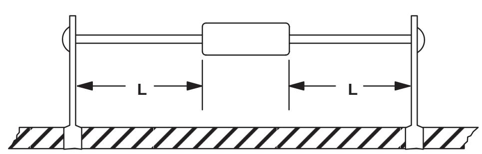
MOUNTING METHOD 1

P.C. Board Where Available Copper Surface area is small.



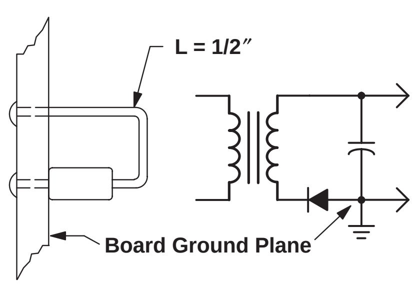
MOUNTING METHOD 2

Vector Push–In Terminals T–28



MOUNTING METHOD 3

P.C. Board with 1–1/2″ x 1–1/2″ Copper Surface



MUR480E, MUR4100E

SWITCHMODE™ Power Rectifiers

Ultrafast "E" Series with High Reverse Energy Capability

. . . designed for use in switching power supplies, inverters and as free wheeling diodes, these state–of–the–art devices have the following features:

- 20 mJ Avalanche Energy Guaranteed
- Excellent Protection Against Voltage Transients in Switching Inductive Load Circuits
- Ultrafast 75 Nanosecond Recovery Time
- 175°C Operating Junction Temperature
- Low Forward Voltage
- Low Leakage Current
- High Temperature Glass Passivated Junction
- Reverse Voltage to 1000 Volts

Mechanical Characteristics:

- Case: Epoxy, Molded
- Weight: 1.1 gram (approximately)
- Finish: All External Surfaces Corrosion Resistant and Terminal Leads are Readily Solderable
- Lead and Mounting Surface Temperature for Soldering Purposes: 220°C Max. for 10 Seconds, 1/16″ from case
- Shipped in plastic bags, 5,000 per bag
- Available Tape and Reeled, 1500 per reel, by adding a "RL" suffix to the part number
- Polarity: Cathode indicated by Polarity Band
- Marking: MUR480E, MUR4100E

MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Peak Repetitive Reverse Voltage Working Peak Reverse Voltage DC Blocking Voltage MUR480E MUR4100E	V_{RRM} V_{RWM} V_R	 800 1000	V
Average Rectified Forward Current (Square Wave) (Mounting Method #3 Per Note 2.)	$I_{F(AV)}$	4.0 @ T_A = 35°C	A
Non–Repetitive Peak Surge Current (Surge Applied at Rated Load Conditions Halfwave, Single Phase, 60 Hz)	I_{FSM}	70	A
Operating Junction and Storage Temperature Range	T_J, T_{stg}	–65 to +175	°C

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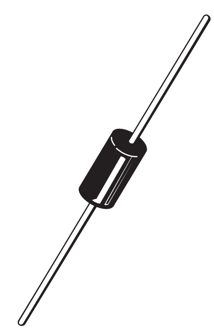
ULTRAFAST RECTIFIER 4.0 AMPERES 800–1000 VOLTS



AXIAL LEAD
CASE 267–03
STYLE 1

MARKING DIAGRAM

MUR4x0E = Device Code
x = 8 or 10

ORDERING INFORMATION

Device	Package	Shipping
MUR480E	Axial Lead	5000 Units/Bag
MUR480ERL	Axial Lead	1500/Tape & Reel
MUR4100E	Axial Lead	5000 Units/Bag
MUR4100ERL	Axial Lead	1500/Tape & Reel

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THERMAL CHARACTERISTICS

Rating	Symbol	Value	Unit
Maximum Thermal Resistance, Junction to Case	$R_{\theta JC}$	See Note 2.	°C/W

ELECTRICAL CHARACTERISTICS

Characteristic	Symbol	Max	Unit
Maximum Instantaneous Forward Voltage (Note 1.) (i_F = 3.0 Amps, T_J = 150°C) (i_F = 3.0 Amps, T_J = 25°C) (i_F = 4.0 Amps, T_J = 25°C)	v_F	 1.53 1.75 1.85	Volts
Maximum Instantaneous Reverse Current (Note 1.) (Rated dc Voltage, T_J = 100°C) (Rated dc Voltage, T_J = 25°C)	i_R	 900 25	μA
Maximum Reverse Recovery Time (I_F = 1.0 Amp, di/dt = 50 Amp/μs) (I_F = 0.5 Amp, i_R = 1.0 Amp, I_{REC} = 0.25 Amp)	t_{rr}	 100 75	ns
Maximum Forward Recovery Time (I_F = 1.0 Amp, di/dt = 100 Amp/μs, Recovery to 1.0 V)	t_{fr}	75	ns
Controlled Avalanche Energy (See Test Circuit in Figure 6.)	W_{AVAL}	20	mJ

1. Pulse Test: Pulse Width = 300 μs, Duty Cycle ≤ 2.0%.

MUR480E, MUR4100E

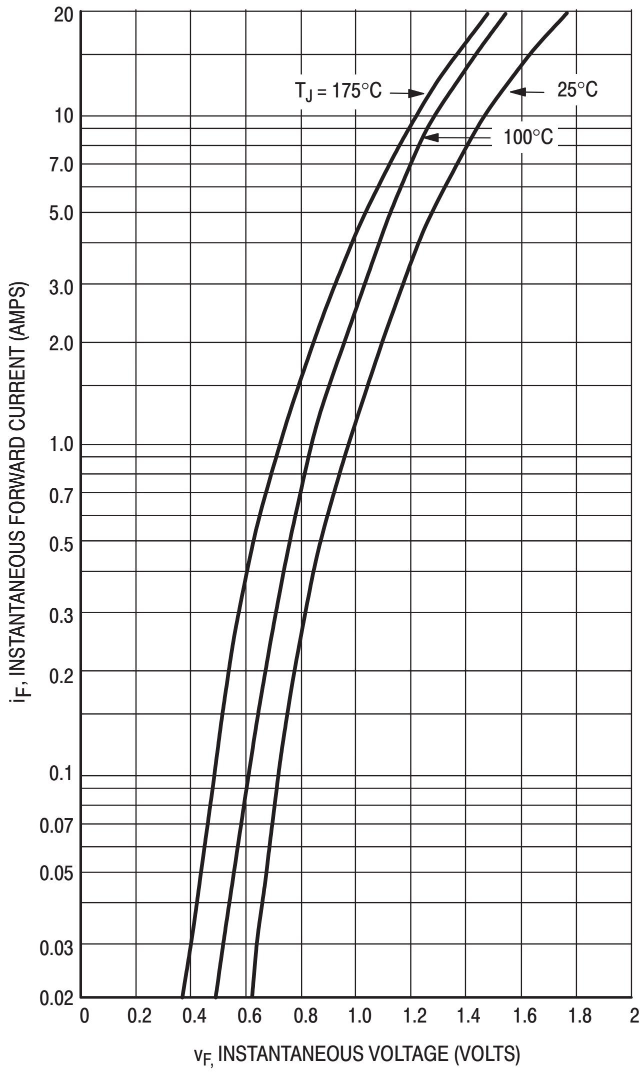


Figure 1. Typical Forward Voltage

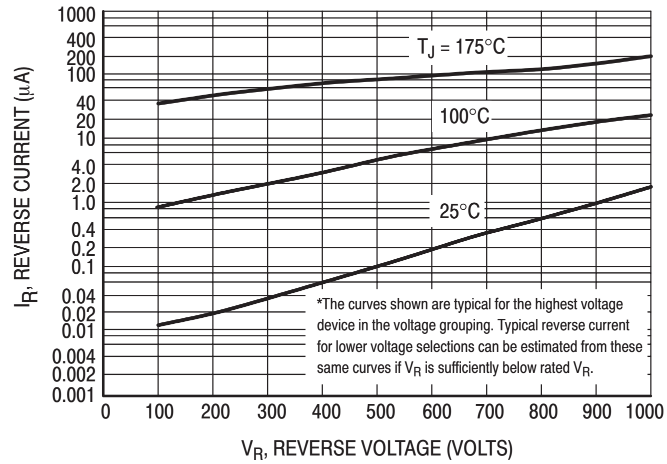


Figure 2. Typical Reverse Current*

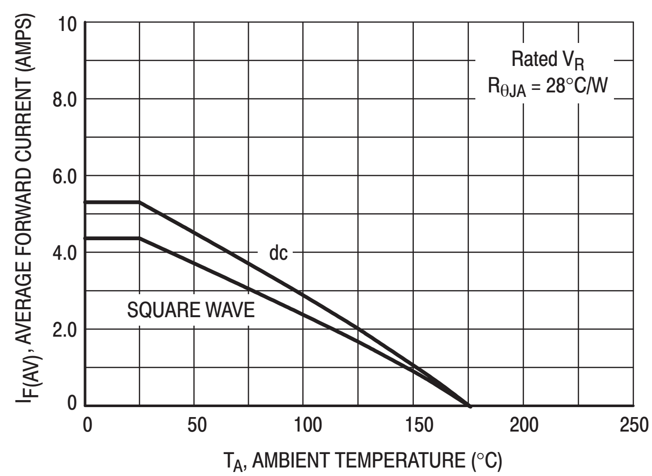


Figure 3. Current Derating
(Mounting Method #3 Per Note 1)

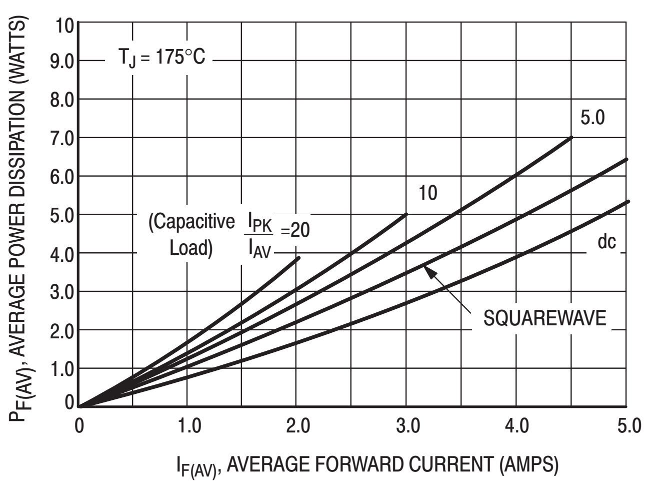


Figure 4. Power Dissipation

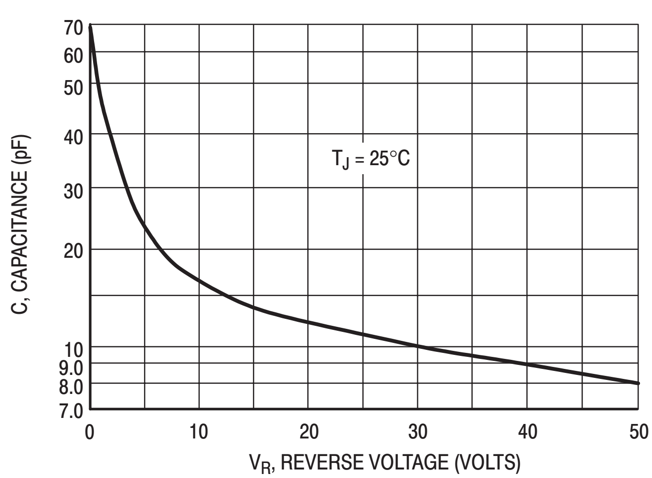


Figure 5. Typical Capacitance

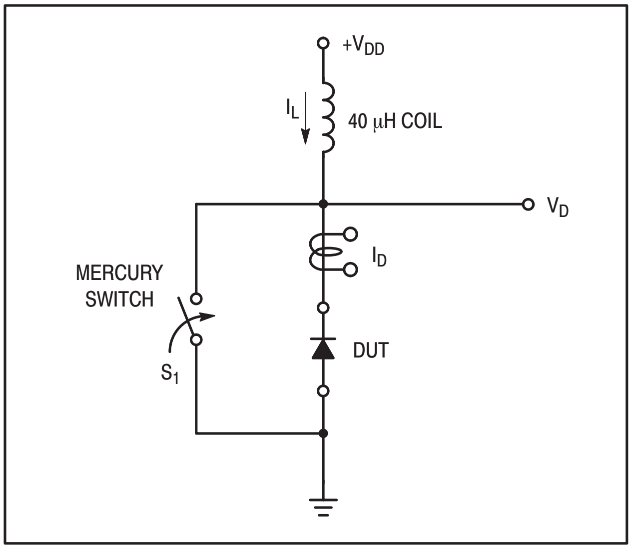


Figure 6. Test Circuit

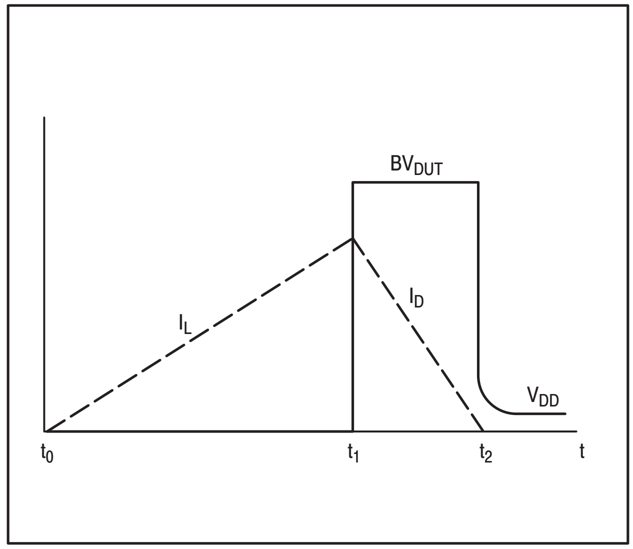


Figure 7. Current–Voltage Waveforms

The unclamped inductive switching circuit shown in Figure 6. was used to demonstrate the controlled avalanche capability of the new “E’’ series Ultrafast rectifiers. A mercury switch was used instead of an electronic switch to simulate a noisy environment when the switch was being opened.

When S_1 is closed at t_0 the current in the inductor I_L ramps up linearly; and energy is stored in the coil. At t_1 the switch is opened and the voltage across the diode under test begins to rise rapidly, due to di/dt effects, when this induced voltage reaches the breakdown voltage of the diode, it is clamped at BV_{DUT} and the diode begins to conduct the full load current which now starts to decay linearly through the diode, and goes to zero at t_2.

By solving the loop equation at the point in time when S_1 is opened; and calculating the energy that is transferred to the diode it can be shown that the total energy transferred is equal to the energy stored in the inductor plus a finite amount of energy from the V_{DD} power supply while the diode is in breakdown (from t_1 to t_2) minus any losses due to finite component resistances. Assuming the component resistive elements are small Equation (1) approximates the total energy transferred to the diode. It can be seen from this equation that if the V_{DD} voltage is low compared to the breakdown voltage of the device, the amount of energy contributed by the supply during breakdown is small and the total energy can be assumed to be nearly equal to the energy stored in the coil during the time when S_1 was closed, Equation (2).

The oscilloscope picture in Figure 8. , shows the information obtained for the MUR8100E (similar die construction as the MUR4100E Series) in this test circuit conducting a peak current of one ampere at a breakdown voltage of 1300 volts, and using Equation (2) the energy absorbed by the MUR8100E is approximately 20 mjoules.

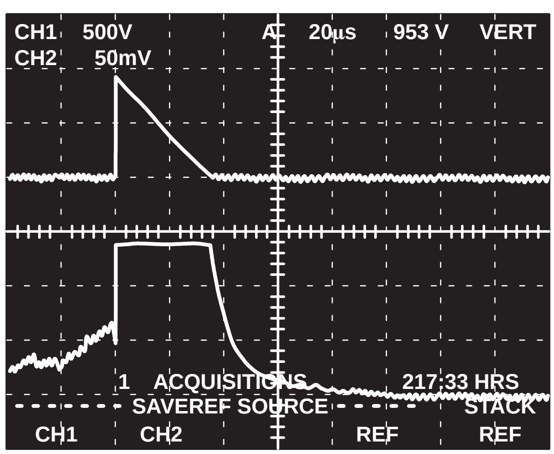
Although it is not recommended to design for this condition, the new “E’’ series provides added protection against those unforeseen transient viruses that can produce unexplained random failures in unfriendly environments.

EQUATION (1):

$$W_{AVAL} \approx \frac{1}{2} L I_{LPK}^{2} \left(\frac{BV_{DUT}}{BV_{DUT} - V_{DD}} \right)$$

EQUATION (2):

$$W_{AVAL} \approx \frac{1}{2} L I_{LPK}^{2}$$



CHANNEL 2:
I_L
0.5 AMPS/DIV.

CHANNEL 1:
V_{DUT}
500 VOLTS/DIV.

TIME BASE:
20 µs/DIV.

Figure 8. Current–Voltage Waveforms

NOTE 2. – AMBIENT MOUNTING DATA

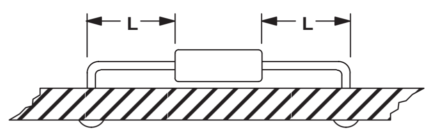
Data shown for thermal resistance junction–to–ambient ($R_{\theta JA}$) for the mountings shown is to be used as typical guideline values for preliminary engineering or in case the tie point temperature cannot be measured.

TYPICAL VALUES FOR $R_{\theta JA}$ IN STILL AIR

Mounting Method		Lead Length, L (IN)				Units
		1/8	1/4	1/2	3/4	
1	$R_{\theta JA}$	50	51	53	55	°C/W
2	$R_{\theta JA}$	58	59	61	63	°C/W
3	$R_{\theta JA}$	28				°C/W

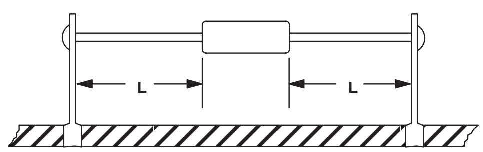
MOUNTING METHOD 1

P.C. Board Where Available Copper Surface area is small.



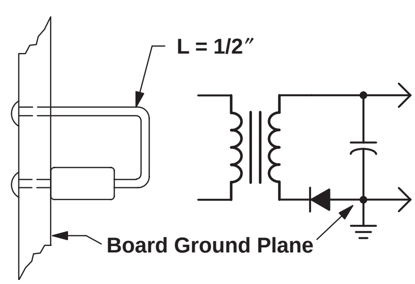
MOUNTING METHOD 2

Vector Push–In Terminals T–28



MOUNTING METHOD 3

P.C. Board with 1–1/2″ x 1–1/2″ Copper Surface



MUR5150E

Preferred Device

SCANSWITCH™ Power Rectifier

For Use As A Damper Diode In High and Very High Resolution Monitors

The MUR5150E is a state-of-the-art Ultrafast Power Rectifier specifically designed for use as a damper diode in horizontal deflection circuits for high and very high resolution monitors. In these applications, the outstanding performance of the MUR5150E is fully realized when paired with the appropriate 1500 V SCANSWITCH Bipolar Power Transistor.

- 1500 V Blocking Voltage
- 20 mjoules Avalanche Energy Guaranteed
- Peak Transient Overshoot Voltage Specified, 17 Volts (typical)
- Forward Recovery Time Specified, 175 ns (typical)
- Epoxy Meets UL94, V_O at 1/8″

Mechanical Characteristics

- Case: Epoxy, Molded
- Weight: 1.9 grams (approximately)
- Finish: All External Surfaces Corrosion Resistant and Terminal Leads are Readily Solderable
- Lead Temperature for Soldering Purposes: 260°C Max. for 10 Seconds
- Shipped 50 units per plastic tube
- Marking: U5150E

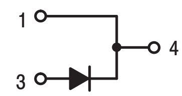
MAXIMUM RATINGS

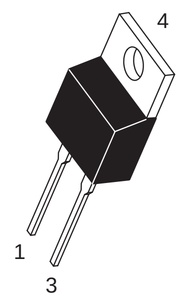
Rating	Symbol	Value	Unit
Peak Repetitive Reverse Voltage Working Peak Reverse Voltage DC Blocking Voltage	V_{RRM} V_{RWM} V_R	1500	V
Average Rectified Forward Current (Rated V_R, T_C = 100°C)	$I_{F(AV)}$	5.0	A
Peak Repetitive Forward Current (Rated V_R, Square Wave, 20 kHz, T_C = 100°C) Per Leg	I_{FRM}	10	A
Non–Repetitive Peak Surge Current (Surge Applied at Rated Load Conditions Halfwave, Single Phase, 60 Hz)	I_{FSM}	100	A
Operating Junction and Storage Temperature Range	T_J, T_{stg}	–65 to +125	°C
Controlled Avalanche Energy	W_{AVAL}	20	mJ

ON Semiconductor™

http://onsemi.com

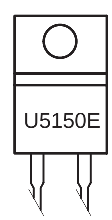
SCANSWITCH RECTIFIER 5.0 AMPERES 1500 VOLTS





TO–220AC CASE 221B STYLE 1

MARKING DIAGRAM



U5150E = Device Code

ORDERING INFORMATION

Device	Package	Shipping
MUR5150E	TO–220	50 Units/Rail

Preferred devices are recommended choices for future use and best overall value.

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THERMAL CHARACTERISTICS

Characteristic	Symbol	Value	Unit
Thermal Resistance — Junction to Case	$R_{\theta JC}$	2.0	°C/W

ELECTRICAL CHARACTERISTICS

Characteristic	Symbol	Typ	Max	Unit
Maximum Instantaneous Forward Voltage (Note 1.) (i_F = 2.0 Amps, T_J = 25°C) (i_F = 5.0 Amps, T_J = 25°C)	v_F	 1.7 2.0	 2.0 2.4	Volts
Maximum Instantaneous Reverse Current (Note 1.) (Rated dc Voltage, T_J = 125°C) (Rated dc Voltage, T_J = 25°C)	i_R	 100 10	 500 50	μA
Maximum Reverse Recovery Time (I_F = 1.0 Amps, di/dt = 50 Amps/μs)	t_{rr}	130	175	ns
Maximum Forward Recovery Time (I_F = 6.5 Amps, di/dt = 12 Amps/μs)	t_{fr}	175	225	ns
Peak Transient Overshoot Voltage	V_{RFM}	17	20	Volts

1. Pulse Test: Pulse Width = 300 μs, Duty Cycle ≤ 2.0%

TYPICAL ELECTRICAL CHARACTERISTICS

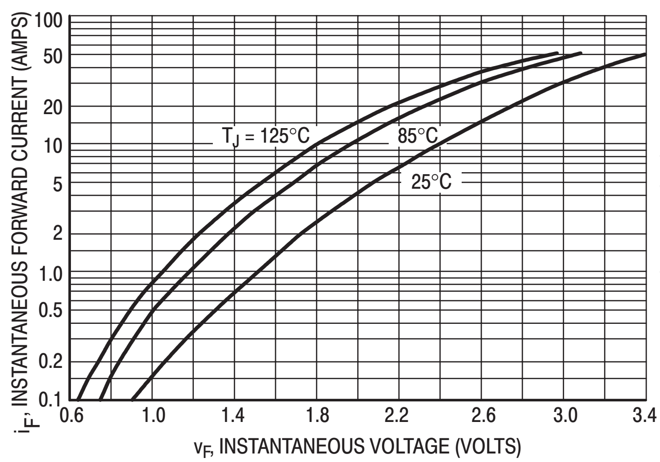

Figure 1. Typical Forward Voltage

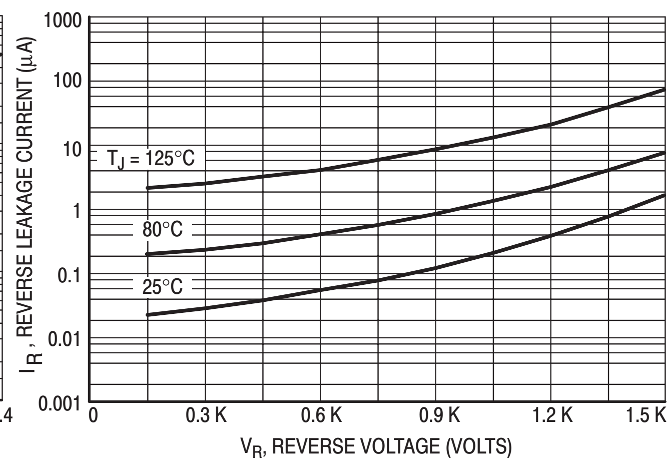

Figure 2. Typical Reverse Leakage Current

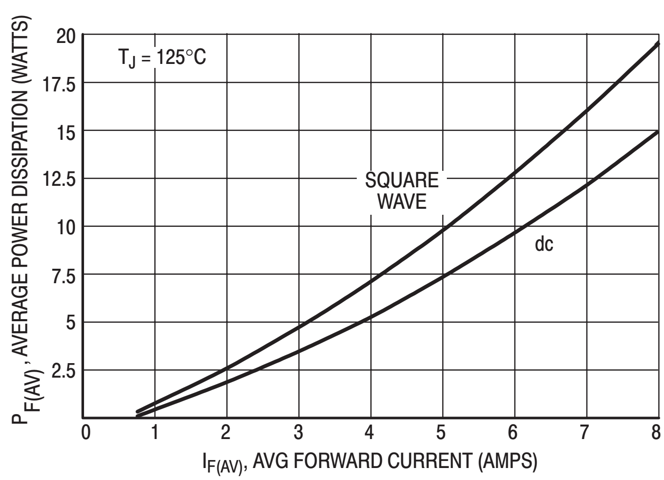

Figure 3. Forward Power Dissipation

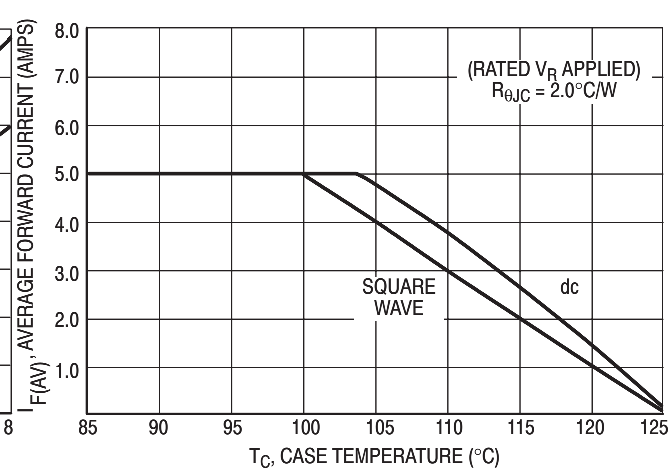

Figure 4. Current Derating Case

TYPICAL ELECTRICAL CHARACTERISTICS

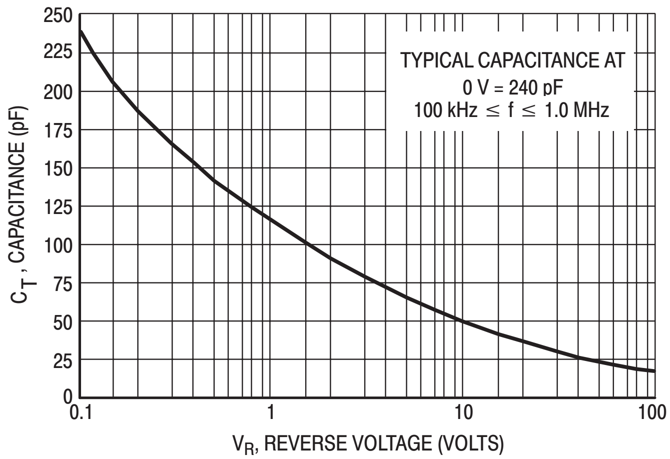

Figure 5. Typical Capacitance

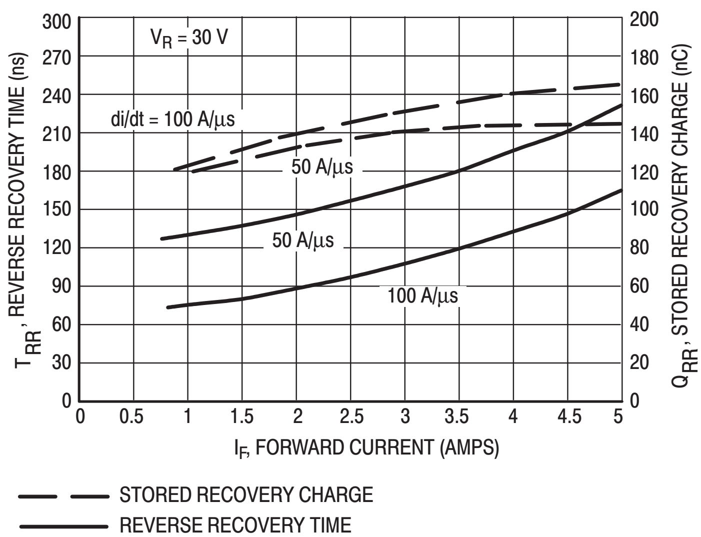

Figure 6. Typical Reverse Switching Characteristics

MUR620CT

Preferred Device

SWITCHMODE™ Power Rectifier

. . . designed for use in switching power supplies, inverters and as free wheeling diodes, these state–of–the–art devices have the following features:

- Ultrafast 35 Nanosecond Recovery Time
- 175°C Operating Junction Temperature
- Popular TO–220 Package

Mechanical Characteristics:

- Case: Epoxy, Molded
- Weight: 1.9 grams (approximately)
- Finish: All External Surfaces Corrosion Resistant and Terminal Leads are Readily Solderable
- Lead Temperature for Soldering Purposes: 260°C Max. for 10 Seconds
- Shipped 50 units per plastic tube
- Marking: U620

MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Peak Repetitive Reverse Voltage Working Peak Reverse Voltage DC Blocking Voltage	V_{RRM} V_{RWM} V_R	200	V
Average Rectified Forward Voltage (Rated V_R, T_C = 130°C) Per Diode Total Device	$I_{F(AV)}$	 3.0 6.0	A
Peak Repetitive Forward Current per Diode Leg (Rated V_R, Square Wave, 20 kHz, T_C = 130°C)	I_{FRM}	6.0	A
Non–Repetitive Peak Surge Current (Surge Applied at Rated Load Conditions Halfwave, Single Phase, 60 Hz)	I_{FSM}	75	A
Operating Junction and Storage Temperature Range	T_J, T_{stg}	–65 to +175	°C

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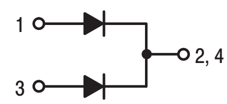
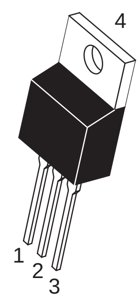
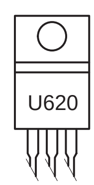
ULTRAFAST RECTIFIER
6.0 AMPERES
200 VOLTS





TO–220AB
CASE 221A
PLASTIC

MARKING DIAGRAM



U620 = Device Code

ORDERING INFORMATION

Device	Package	Shipping
MUR620CT	TO–220	50 Units/Rail

Preferred devices are recommended choices for future use and best overall value.

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THERMAL CHARACTERISTICS (Per Diode Leg)

Rating	Symbol	Typical	Maximum	Unit
Thermal Resistance, Junction to Case	$R_{\theta JC}$	5.0–6.0	7.0	°C/W

ELECTRICAL CHARACTERISTICS (Per Diode Leg)

Rating	Symbol	Typical	Maximum	Unit
Instantaneous Forward Voltage (Note 1.) (i_F = 3.0 Amps, T_C = 150°C) (i_F = 3.0 Amps, T_C = 25°C)	v_F	 0.80 0.94	 0.895 0.975	Volts
Instantaneous Reverse Current (Note 1.) (Rated dc Voltage, T_C = 150°C) (Rated dc Voltage, T_C = 25°C)	i_R	 2.0–10 0.01–3.0	 250 5.0	µA
Reverse Recovery Time (I_F = 1.0 Amp, di/dt = 50 Amps/µs)	t_{rr}	20–30	35	ns

1. Pulse Test: Pulse Width = 300 µs, Duty Cycle ≤ 2.0%.

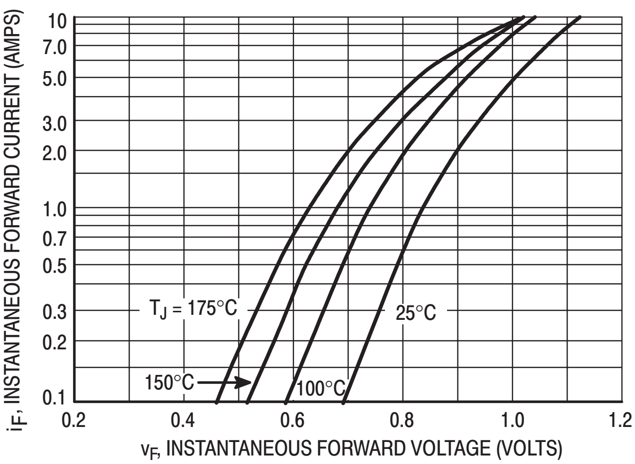

Figure 1. Typical Forward Voltage

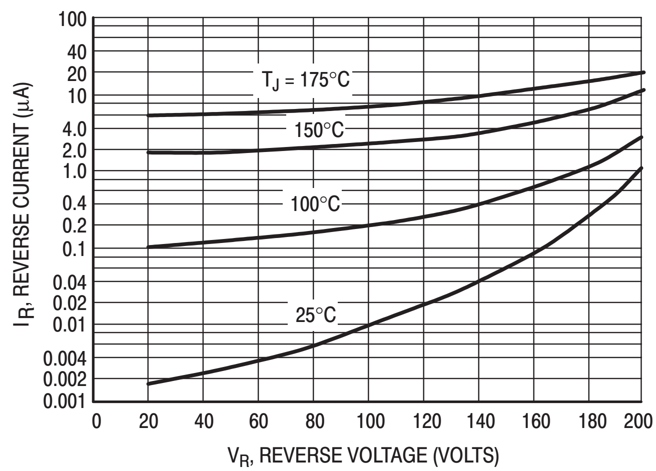

Figure 2. Typical Reverse Current

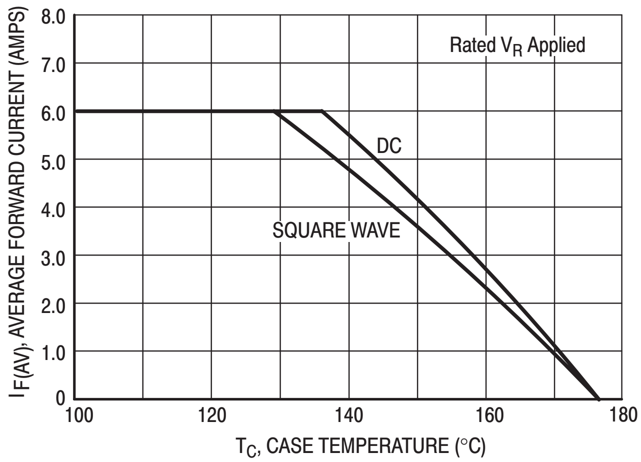

Figure 3. Total Device Current Derating, Case

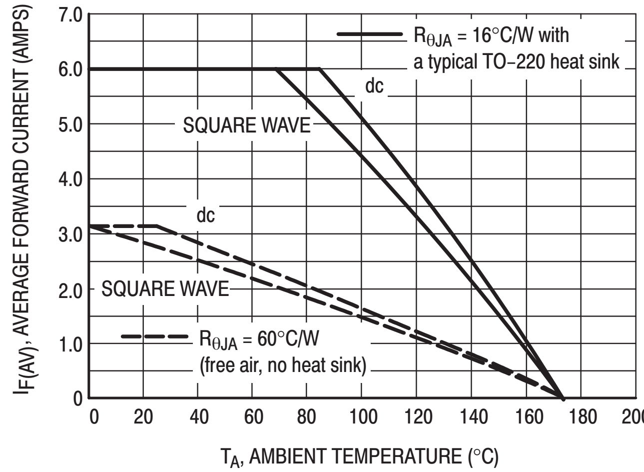

Figure 4. Total Device Current Derating, Ambient

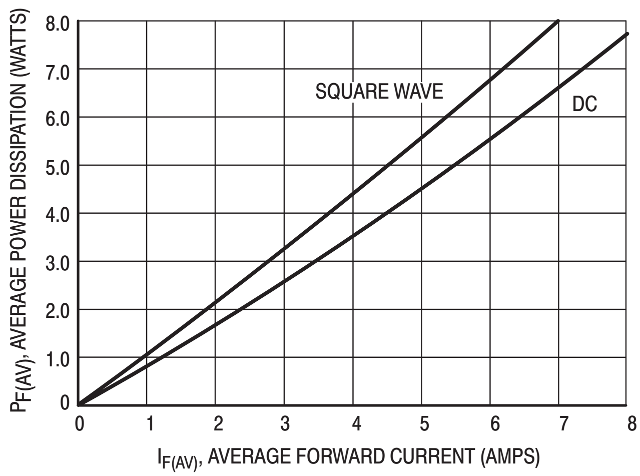

Figure 5. Power Dissipation

MSR860

SWITCHMODE™ Soft Recovery Power Rectifier

Plastic TO–220 Package

Designed for use as free wheeling diodes in variable speed motor control applications and switching power supplies. These state–of–the–art devices have the following features:

- Soft Recovery with Guaranteed Low Reverse Recovery Charge (Q_{RR}) and Peak Reverse Recovery Current (I_{RRM})
- 150°C Operating Junction Temperature
- Popular TO–220 Package
- Epoxy meets UL94, V_O @ 1/8″
- Low Forward Voltage
- Low Leakage Current
- High Temperature Glass Passivated Junction

Mechanical Characteristics:

- Case: Molded Epoxy
- Weight: 1.9 Grams (approximately)
- Finish: All External Surfaces Corrosion Resistant and Terminal Leads Readily Solderable
- Lead Temperature for Soldering Purposes: 260°C Max. for 10 Seconds
- Shipped in 50 Units per Plastic Tube
- Marking: MSR860

MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Peak Repetitive Reverse Voltage Working Peak Reverse Voltage DC Blocking Voltage	V_{RRM} V_{RWM} V_R	600	V
Average Rectified Forward Current (At Rated V_R, T_C = 125°C)	I_O	8.0	A
Peak Repetitive Forward Current (At Rated V_R, Square Wave, 20 kHz, T_C = 125°C)	I_{FRM}	16	A
Non–Repetitive Peak Surge Current (Surge Applied at Rated Load Conditions Halfwave, Single Phase, 60 Hz)	I_{FSM}	100	A
Storage/Operating Case Temperature Range	T_{stg}, T_C	–65 to +150	°C
Operating Junction Temperature Range	T_J	–65 to +150	°C

THERMAL CHARACTERISTICS

Rating	Symbol	Value	Unit
Thermal Resistance – Junction–to–Case Thermal Resistance – Junction–to–Ambient	$R_{\theta JC}$ $R_{\theta JA}$	1.6 72.8	°C/W

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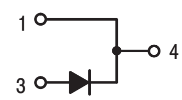
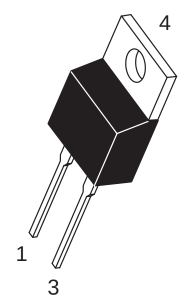
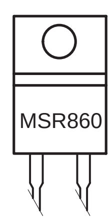
SOFT RECOVERY POWER RECTIFIER 8.0 AMPERES 600 VOLTS





TO–220AC CASE 221B STYLE 1

MARKING DIAGRAM



MSR860 = Device Code

ORDERING INFORMATION

Device	Package	Shipping
MSR860	TO–220	50 Units/Rail

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ELECTRICAL CHARACTERISTICS

Characteristic	Symbol	Value		Unit
Maximum Instantaneous Forward Voltage (Note 1.) (I_F = 8.0 A) *Typical*	V_F	**T_J = 25°C**	**T_J = 150°C**	V
		1.7 *1.4*	1.3 *1.1*	
Maximum Instantaneous Reverse Current (V_R = 600 V) *Typical*	I_R	**T_J = 25°C**	**T_J = 150°C**	μA
		10 *2.0*	1000 *80*	
Maximum Reverse Recovery Time (Note 2.) (V_R = 400 V, I_F = 8.0 A, di/dt = 200 A/μs) *Typical*	t_{rr}	**T_J = 25°C**	**T_J = 125°C**	ns
		120 *95*	190 *125*	
Typical Recovery Softness Factor (V_R = 400 V, I_F = 8.0 A, di/dt = 200 A/μs)	$s = t_b/t_a$	*2.5*	*3.0*	
Maximum Peak Reverse Recovery Current (V_R = 400 V, I_F = 8.0 A, di/dt = 200 A/μs)	I_{RRM}	5.8	8.3	A
Maximum Reverse Recovery Charge (V_R = 400 V, I_F = 8.0 A, di/dt = 200 A/μs)	Q_{RR}	350	700	nC

1. Pulse Test: Pulse Width ≤ 380 μs, Duty Cycle ≤ 2%
2. T_{RR} measured projecting from 25% of I_{RRM} to zero current

TYPICAL ELECTRICAL CHARACTERISTICS

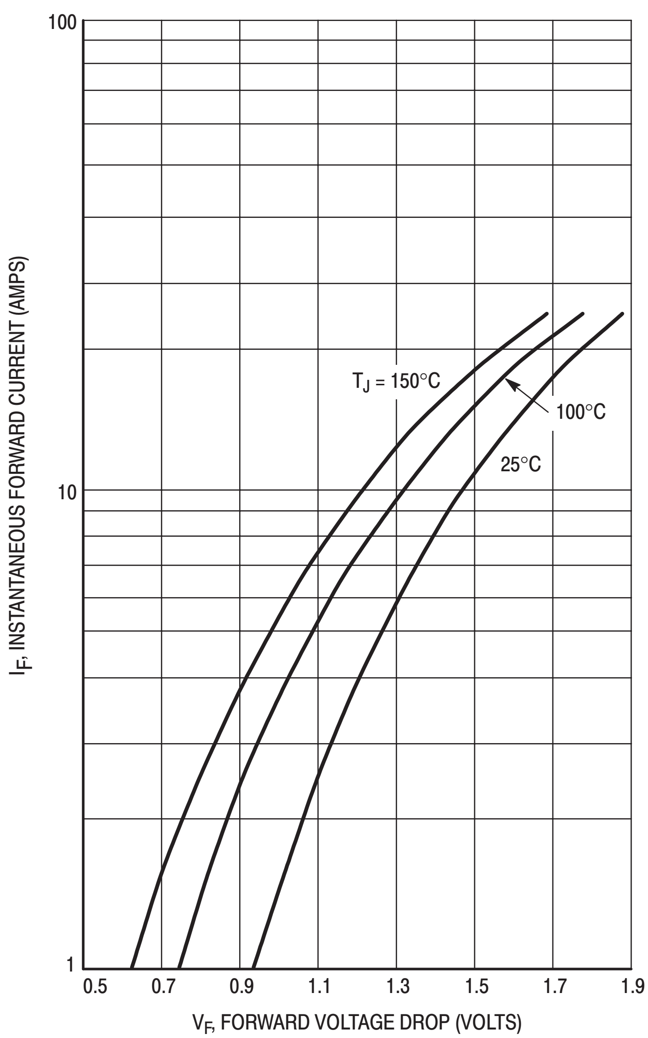

Figure 1. Typical Forward Voltage

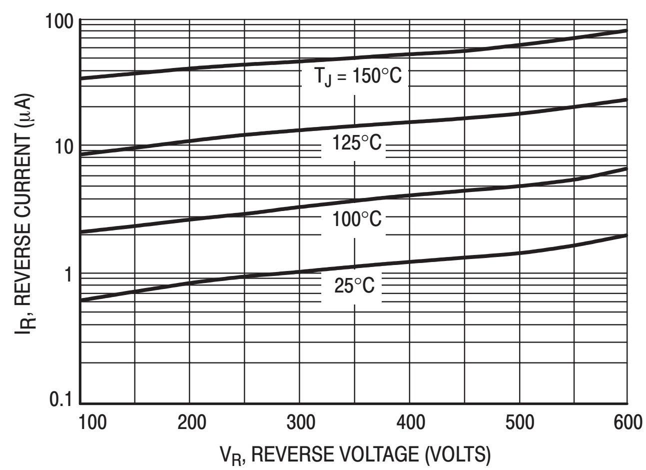

Figure 2. Typical Reverse Current

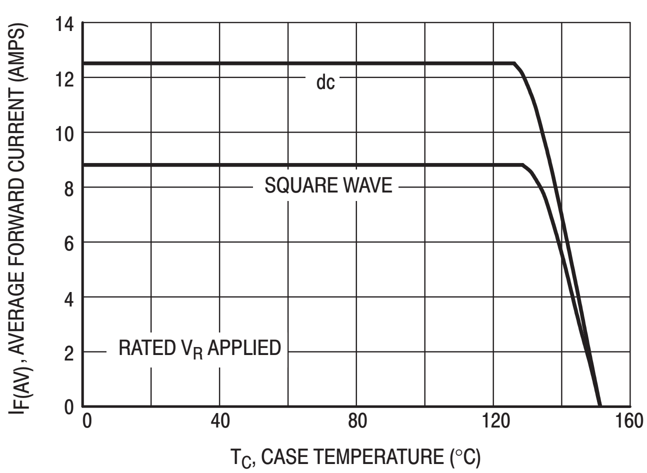

Figure 3. Current Derating, Case

TYPICAL ELECTRICAL CHARACTERISTICS

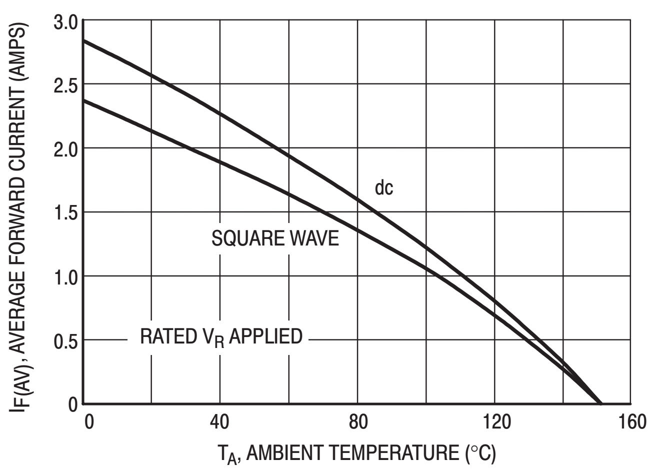

Figure 4. Current Derating, Ambient

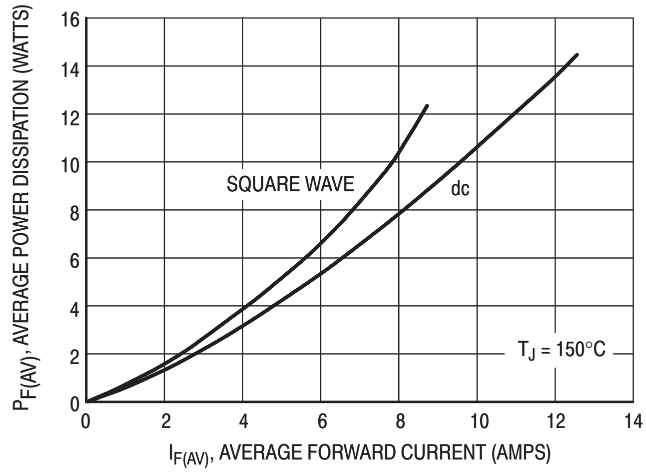

Figure 5. Power Dissipation

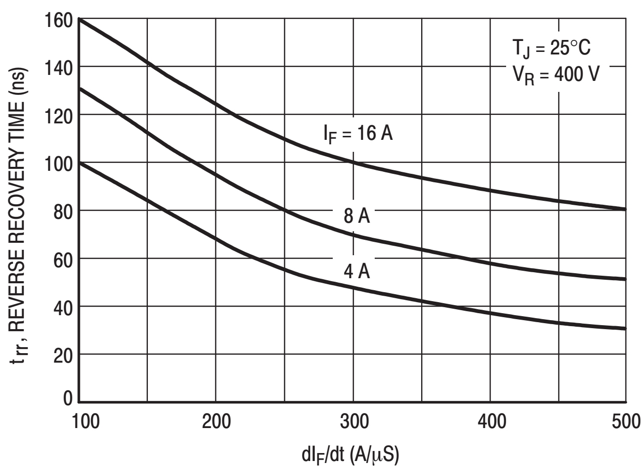

Figure 6. Typical Reverse Recovery Time

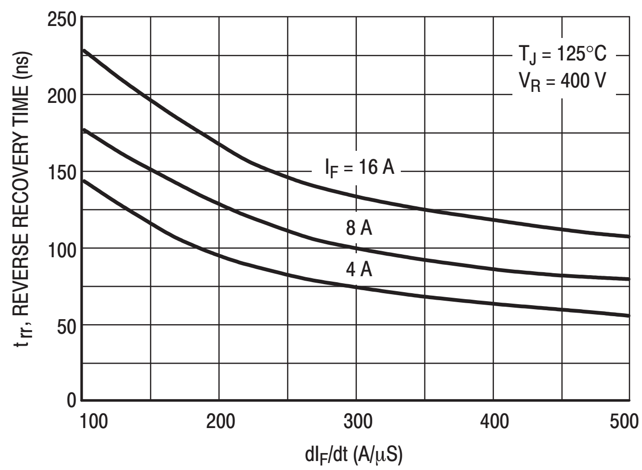

Figure 7. Typical Reverse Recovery Time

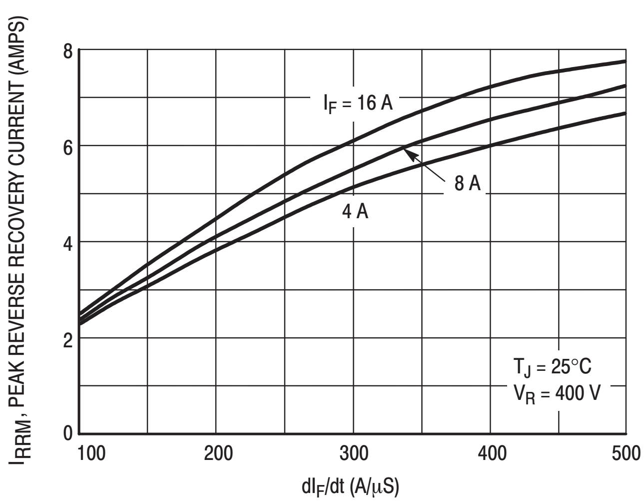

Figure 8. Typical Peak Reverse Recovery Current

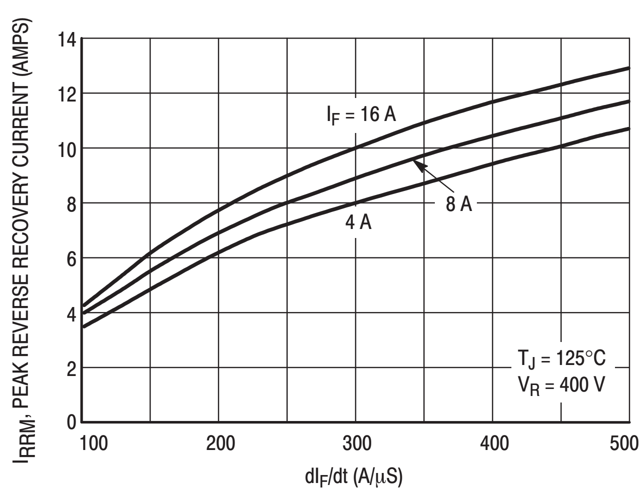

Figure 9. Typical Peak Reverse Recovery Current

TYPICAL ELECTRICAL CHARACTERISTICS

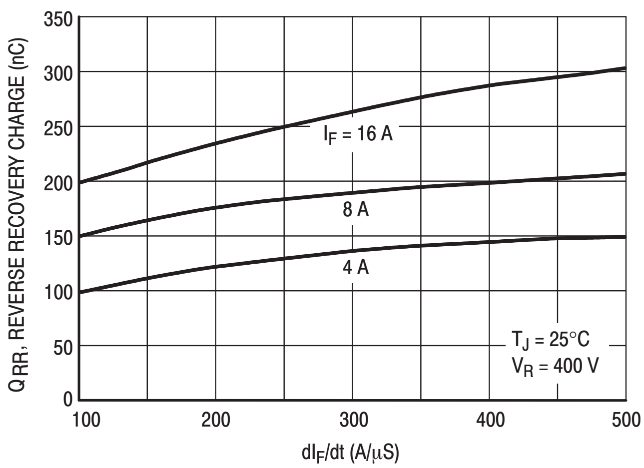

Figure 10. Typical Reverse Recovery Charge

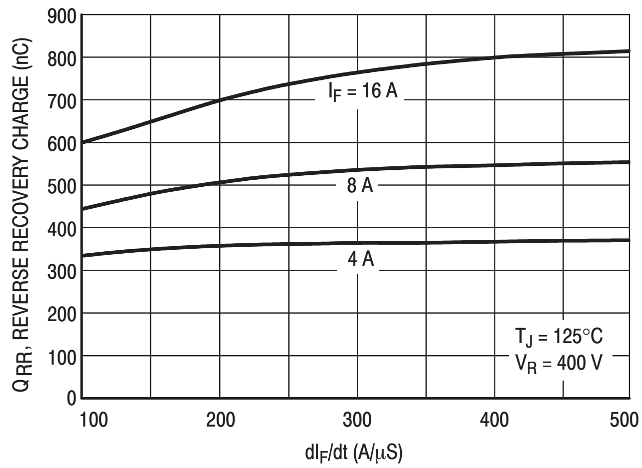

Figure 11. Typical Reverse Recovery Charge

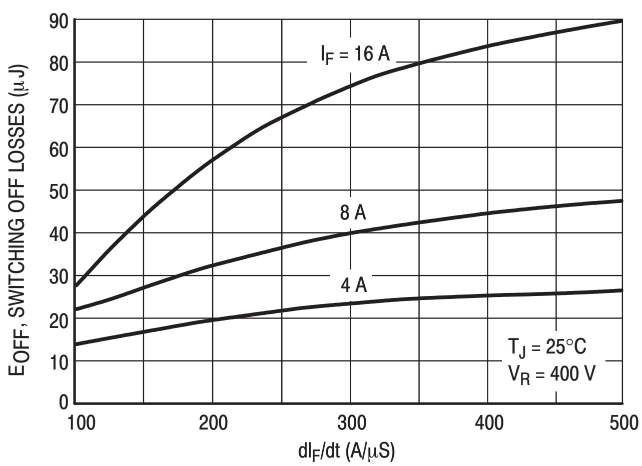

Figure 12. Typical Switching Off Losses

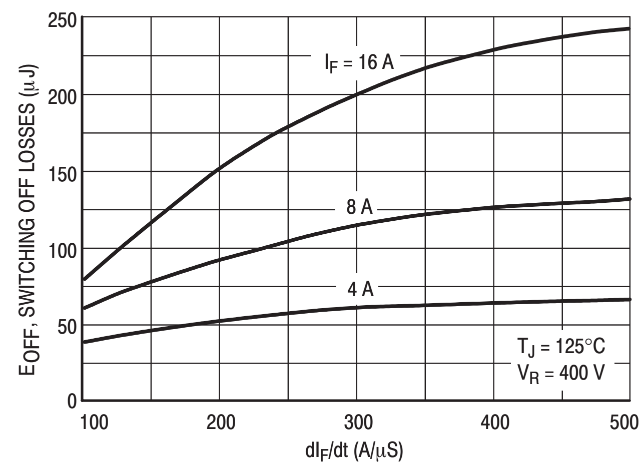

Figure 13. Typical Switching Off Losses

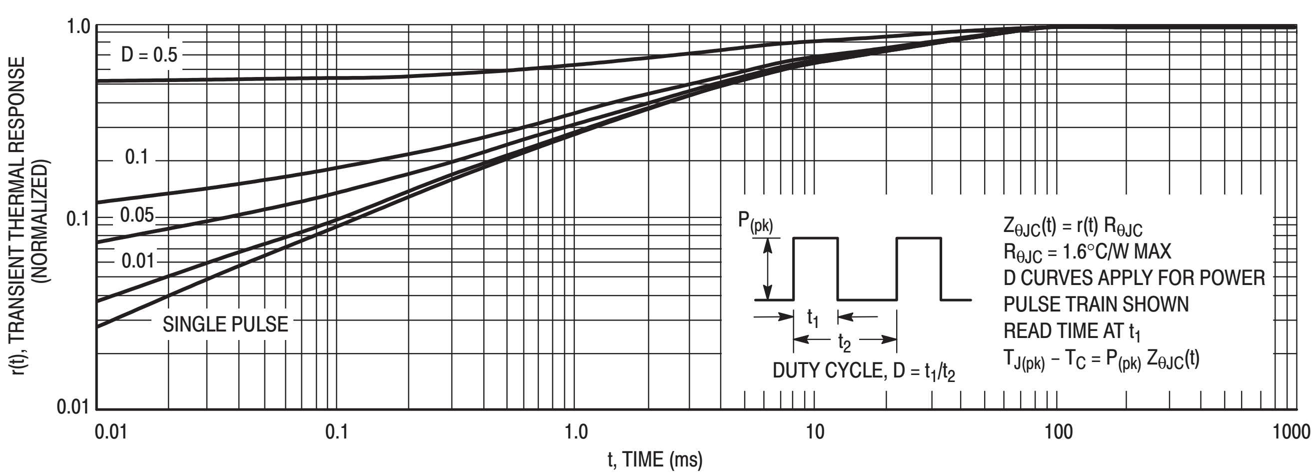

Figure 14. Thermal Response

MUR805, MUR810, MUR815, MUR820, MUR840, MUR860

Preferred Devices

SWITCHMODE™ Power Rectifiers

. . . designed for use in switching power supplies, inverters and as free wheeling diodes, these state–of–the–art devices have the following features:

- Ultrafast 25, 50 and 75 Nanosecond Recovery Time
- 175°C Operating Junction Temperature
- Popular TO–220 Package
- Epoxy Meets UL94, V_O @ 1/8″
- Low Forward Voltage
- Low Leakage Current
- High Temperature Glass Passivated Junction
- Reverse Voltage to 600 Volts

Mechanical Characteristics:

- Case: Epoxy, Molded
- Weight: 1.9 grams (approximately)
- Finish: All External Surfaces Corrosion Resistant and Terminal Leads are Readily Solderable
- Lead Temperature for Soldering Purposes: 260°C Max. for 10 Seconds
- Shipped 50 units per plastic tube
- Marking: U805, U810, U815, U820, U840, U860

MAXIMUM RATINGS

Please See the Table on the Following Page

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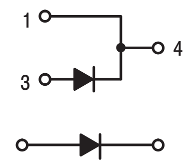
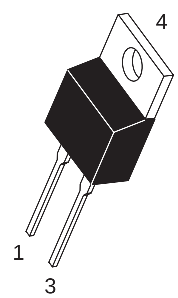
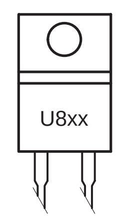
ULTRAFAST RECTIFIERS
8.0 AMPERES
50–600 VOLTS





CASE 221B
TO–220AC
PLASTIC

MARKING DIAGRAM



U8xx = Device Code
xx = 05, 10, 15, 20, 40 or 60

ORDERING INFORMATION

Device	Package	Shipping
MUR805	TO–220	50 Units/Rail
MUR810	TO–220	50 Units/Rail
MUR815	TO–220	50 Units/Rail
MUR820	TO–220	50 Units/Rail
MUR840	TO–220	50 Units/Rail
MUR860	TO–220	50 Units/Rail

Preferred devices are recommended choices for future use and best overall value.

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MAXIMUM RATINGS

Rating	Symbol	MUR 805	MUR 810	MUR 815	MUR 820	MUR 840	MUR 860	Unit
Peak Repetitive Reverse Voltage Working Peak Reverse Voltage DC Blocking Voltage	V_{RRM} V_{RWM} V_R	50	100	150	200	400	600	Volts
Average Rectified Forward Current Total Device, (Rated V_R), T_C = 150°C	$I_{F(AV)}$	8.0						Amps
Peak Repetitive Forward Current (Rated V_R, Square Wave, 20 kHz), T_C = 150°C	I_{FM}	16						Amps
Nonrepetitive Peak Surge Current (Surge applied at rated load conditions halfwave, single phase, 60 Hz)	I_{FSM}	100						Amps
Operating Junction Temperature and Storage Temperature Range	T_J, T_{stg}	–65 to +175						°C

THERMAL CHARACTERISTICS

Rating	Symbol	MUR 805–820	MUR 840–860	Unit
Maximum Thermal Resistance, Junction to Case	$R_{\theta JC}$	3.0	2.0	°C/W

ELECTRICAL CHARACTERISTICS

Characteristic	Symbol	MUR 805–820	MUR 840	MUR 860	Unit
Maximum Instantaneous Forward Voltage (Note 1.) (i_F = 8.0 Amps, T_C = 150°C) (i_F = 8.0 Amps, T_C = 25°C)	v_F	 0.895 0.975	 1.00 1.30	 1.20 1.50	Volts
Maximum Instantaneous Reverse Current (Note 1.) (Rated dc Voltage, T_J = 150°C) (Rated dc Voltage, T_J = 25°C)	i_R	 250 5.0	 500 10		μA
Maximum Reverse Recovery Time (I_F = 1.0 Amp, di/dt = 50 Amps/μs) (I_F = 0.5 Amp, i_R = 1.0 Amp, I_{REC} = 0.25 Amp)	t_{rr}	 35 25	 60 50		ns

1. Pulse Test: Pulse Width = 300 μs, Duty Cycle ≤ 2.0%.

MUR805, MUR810, MUR815, MUR820

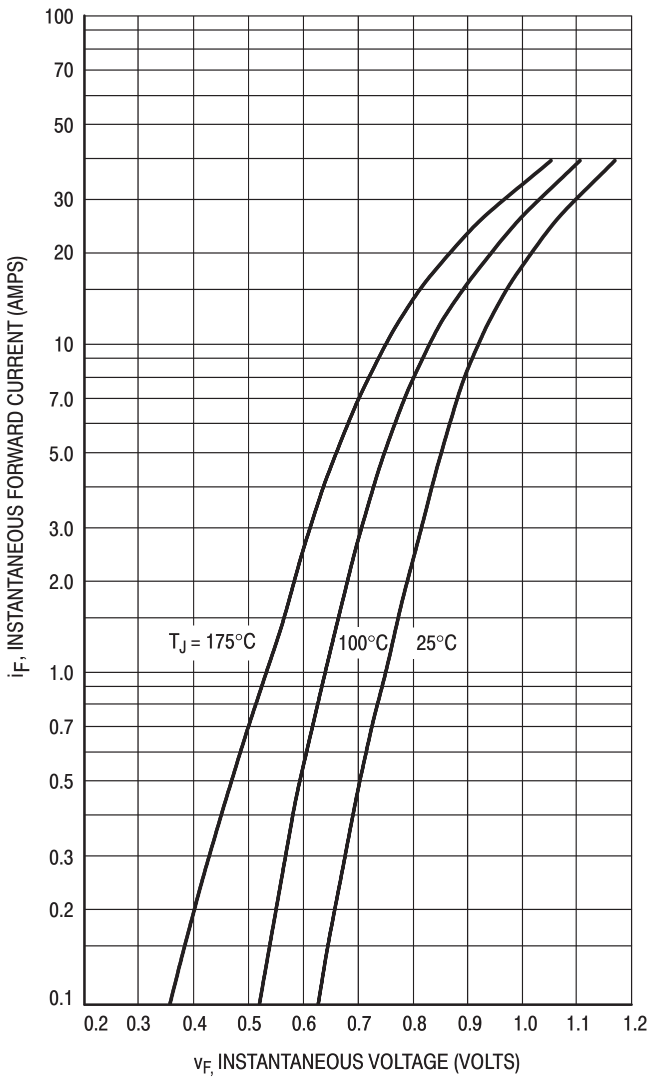

Figure 1. Typical Forward Voltage

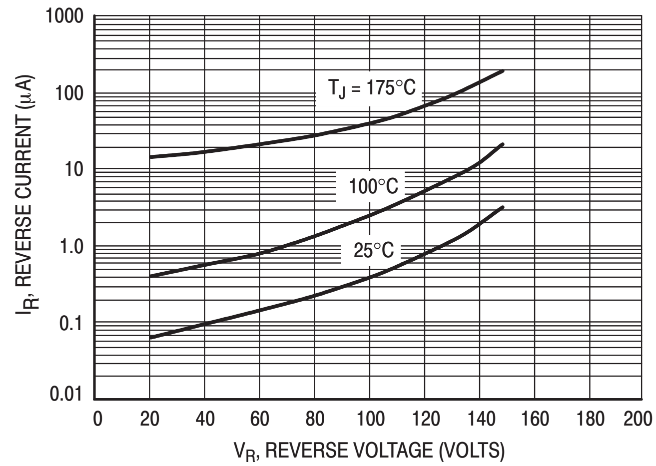

Figure 2. Typical Reverse Current*

* The curves shown are typical for the highest voltage device in the grouping. Typical reverse current for lower voltage selections can be estimated from these same curves if V_R is sufficiently below rated V_R.

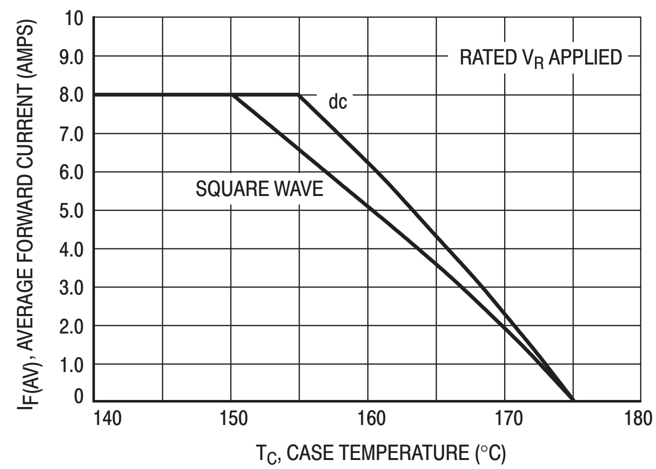

Figure 3. Current Derating, Case

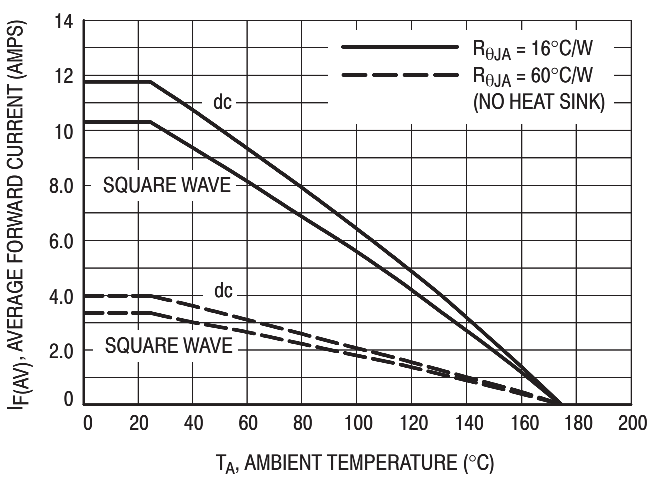

Figure 4. Current Derating, Ambient

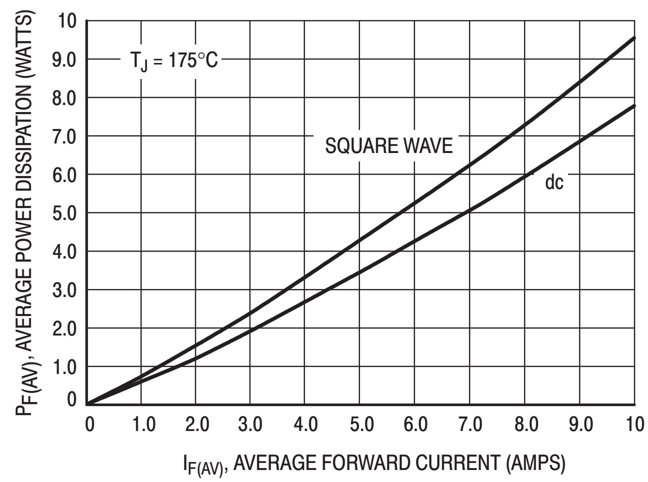

Figure 5. Power Dissipation

MUR840

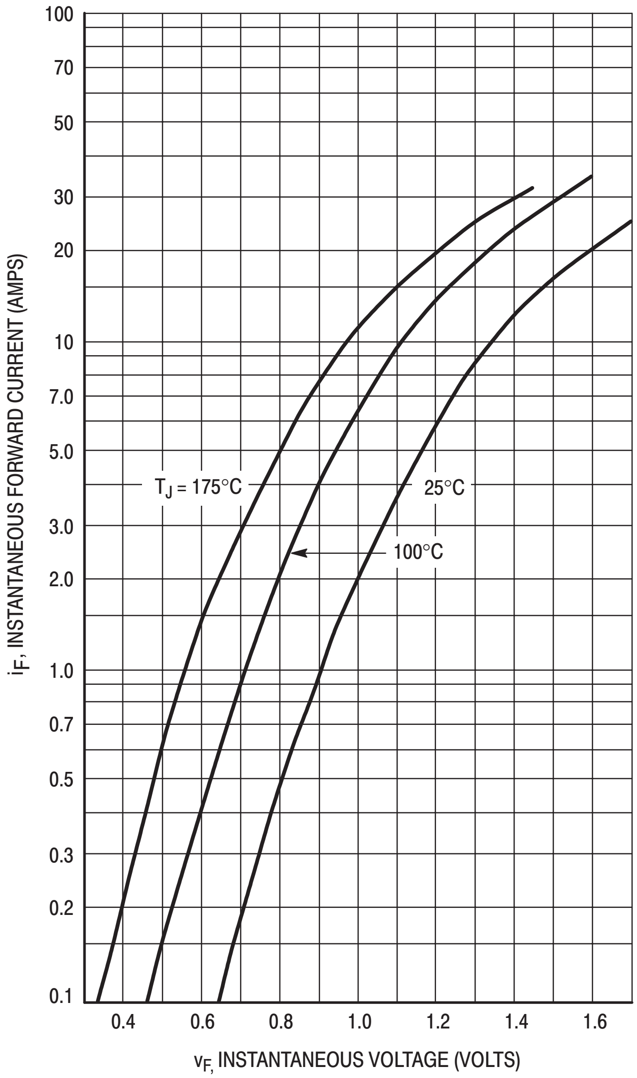

Figure 6. Typical Forward Voltage

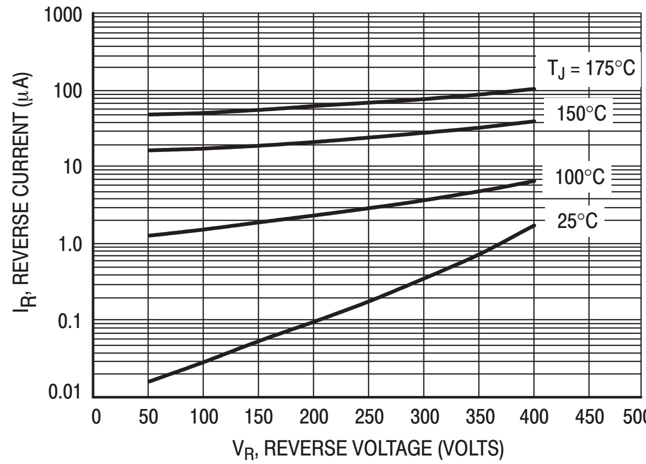

Figure 7. Typical Reverse Current*

* The curves shown are typical for the highest voltage device in the grouping. Typical reverse current for lower voltage selections can be estimated from these same curves if V_R is sufficiently below rated V_R.

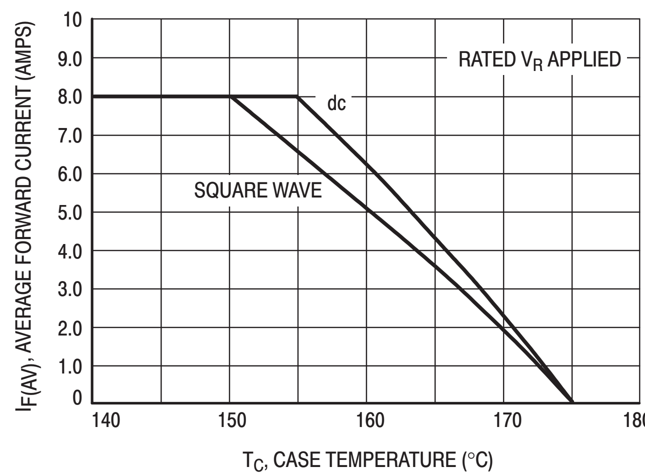

Figure 8. Current Derating, Case

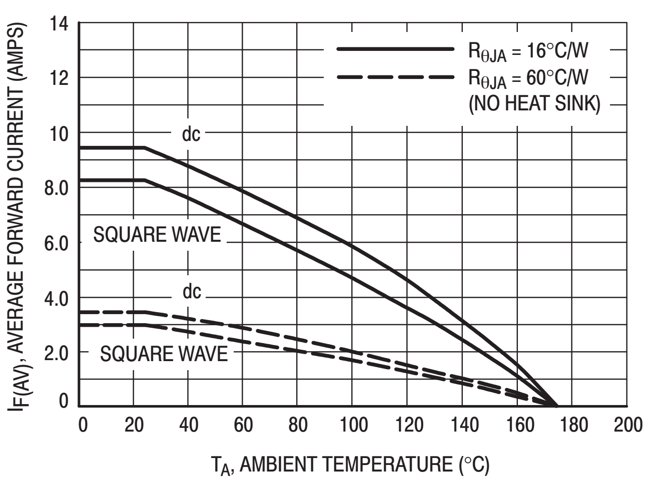

Figure 9. Current Derating, Ambient

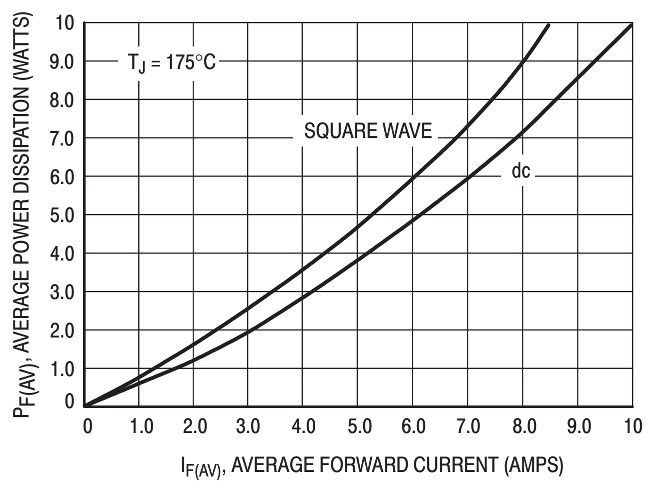

Figure 10. Power Dissipation

MUR860

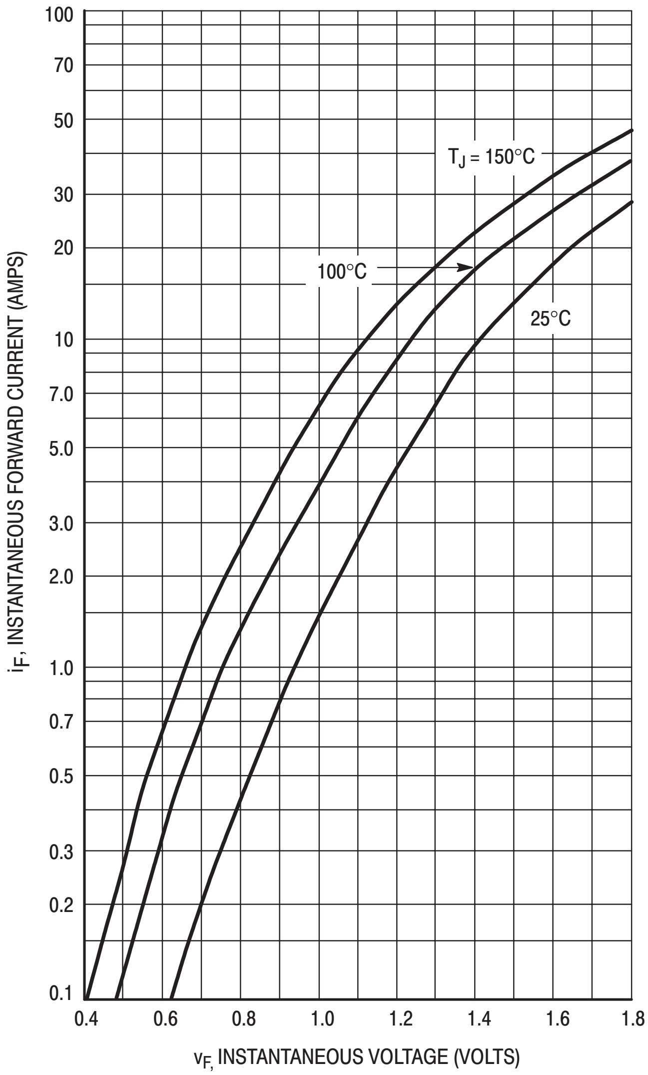

Figure 11. Typical Forward Voltage

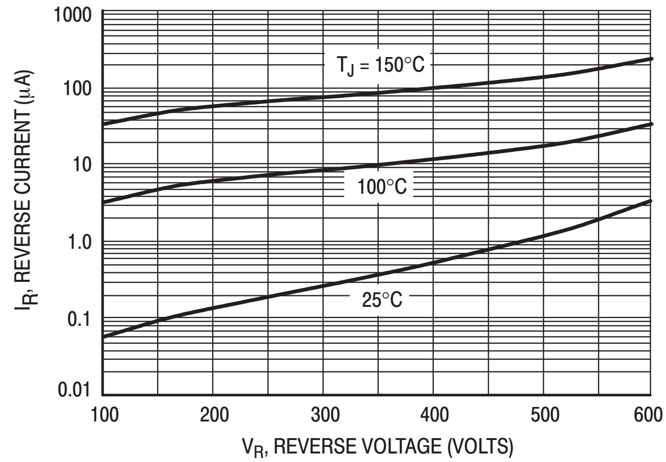

Figure 12. Typical Reverse Current*

* The curves shown are typical for the highest voltage device in the grouping. Typical reverse current for lower voltage selections can be estimated from these same curves if V_R is sufficiently below rated V_R.

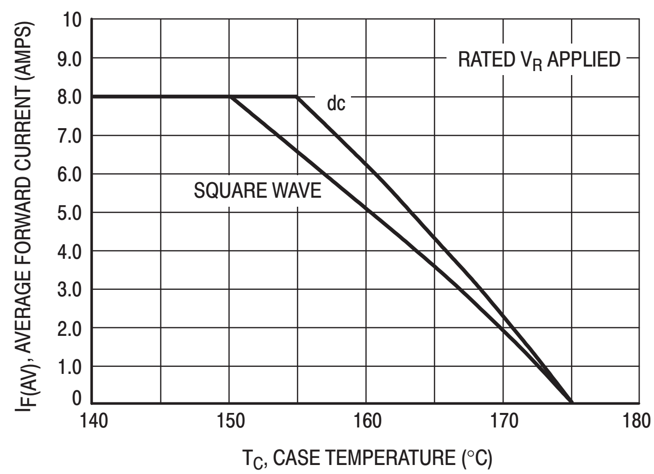

Figure 13. Current Derating, Case

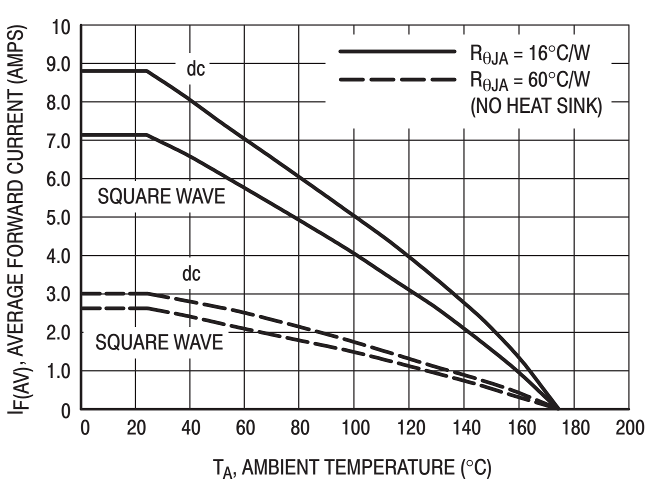

Figure 14. Current Derating, Ambient

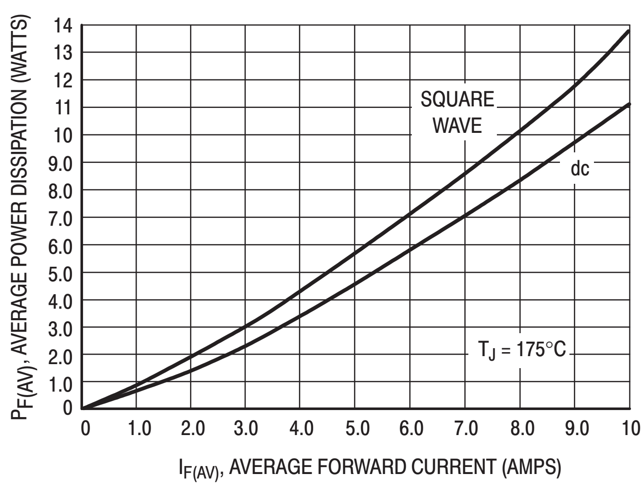

Figure 15. Power Dissipation

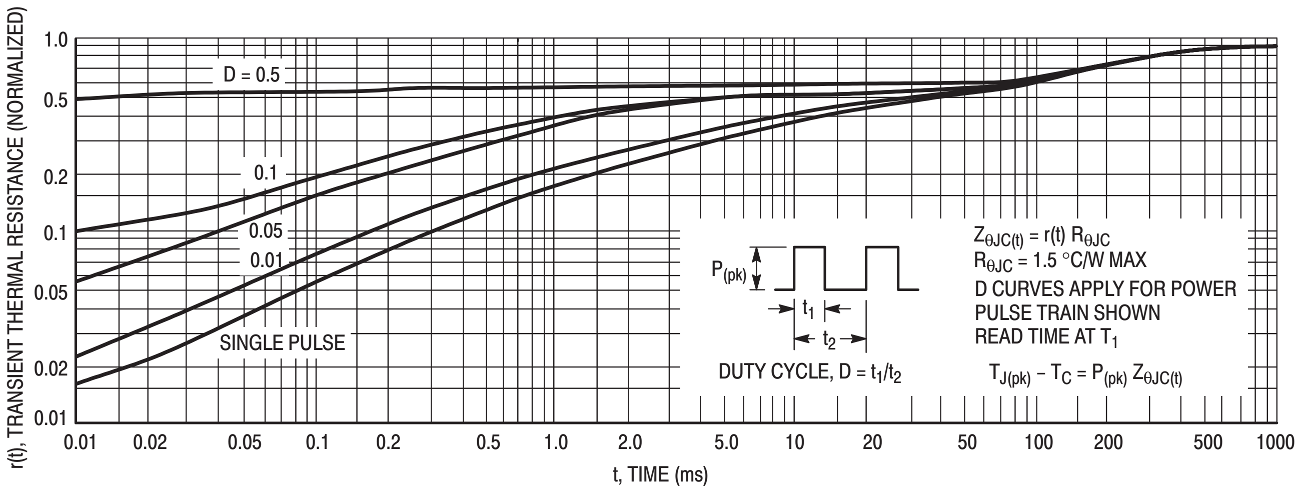

Figure 16. Thermal Response

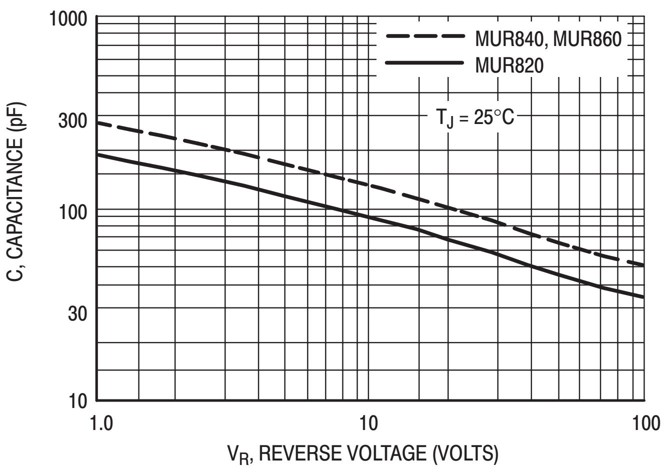

Figure 17. Typical Capacitance

MUR8100E, MUR880E

MUR8100E is a Preferred Device

SWITCHMODE™ Power Rectifiers

Ultrafast "E" Series with High Reverse Energy Capability

. . . designed for use in switching power supplies, inverters and as free wheeling diodes, these state–of–the–art devices have the following features:

- 20 mjoules Avalanche Energy Guaranteed
- Excellent Protection Against Voltage Transients in Switching Inductive Load Circuits
- Ultrafast 75 Nanosecond Recovery Time
- 175°C Operating Junction Temperature
- Popular TO–220 Package
- Epoxy Meets UL94, V_O @ 1/8″
- Low Forward Voltage
- Low Leakage Current
- High Temperature Glass Passivated Junction
- Reverse Voltage to 1000 Volts

Mechanical Characteristics:
- Case: Epoxy, Molded
- Weight: 1.9 grams (approximately)
- Finish: All External Surfaces Corrosion Resistant and Terminal Leads are Readily Solderable
- Lead Temperature for Soldering Purposes: 260°C Max. for 10 Seconds
- Shipped 50 units per plastic tube
- Marking: U880E, U8100E

MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Peak Repetitive Reverse Voltage Working Peak Reverse Voltage DC Blocking Voltage MUR880E MUR8100E	V_{RRM} V_{RWM} V_R	 800 1000	V
Average Rectified Forward Current (Rated V_R, T_C = 150°C) Total Device	$I_{F(AV)}$	8.0	A
Peak Repetitive Forward Current (Rated V_R, Square Wave, 20 kHz, T_C = 150°C)	I_{FM}	16	A
Non–Repetitive Peak Surge Current (Surge Applied at Rated Load Conditions Halfwave, Single Phase, 60 Hz)	I_{FSM}	100	A
Operating Junction and Storage Temperature Range	T_J, T_{stg}	–65 to +175	°C

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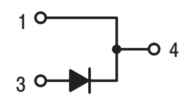
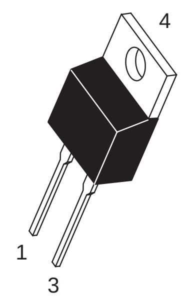
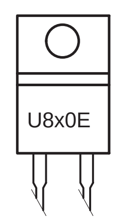
ULTRAFAST RECTIFIERS
8.0 AMPERES
800–1000 VOLTS





TO–220AC
CASE 221B
PLASTIC

MARKING DIAGRAM



U8x0E = Device Code
x = 8 or 10

ORDERING INFORMATION

Device	Package	Shipping
MUR8100E	TO–220	50 Units/Rail
MUR880E	TO–220	50 Units/Rail

Preferred devices are recommended choices for future use and best overall value.

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THERMAL CHARACTERISTICS

Characteristic	Symbol	Value	Unit
Maximum Thermal Resistance, Junction to Case	$R_{\theta JC}$	2.0	°C/W

ELECTRICAL CHARACTERISTICS

Characteristic	Symbol	MUR880E	MUR8100E	Unit
Maximum Instantaneous Forward Voltage (Note 1.) (i_F = 8.0 Amps, T_C = 150°C) (i_F = 8.0 Amps, T_C = 25°C)	v_F	 1.5 1.8		Volts
Maximum Instantaneous Reverse Current (Note 1.) (Rated dc Voltage, T_C = 100°C) (Rated dc Voltage, T_C = 25°C)	i_R	 500 25		µA
Maximum Reverse Recovery Time (I_F = 1.0 Amp, di/dt = 50 Amps/µs) (I_F = 0.5 Amp, i_R = 1.0 Amp, I_{REC} = 0.25 Amp)	t_{rr}	 100 75		ns
Controlled Avalanche Energy (See Test Circuit in Figure 6.)	W_{AVAL}	20		mJ

1. Pulse Test: Pulse Width = 300 µs, Duty Cycle ≤ 2.0%.

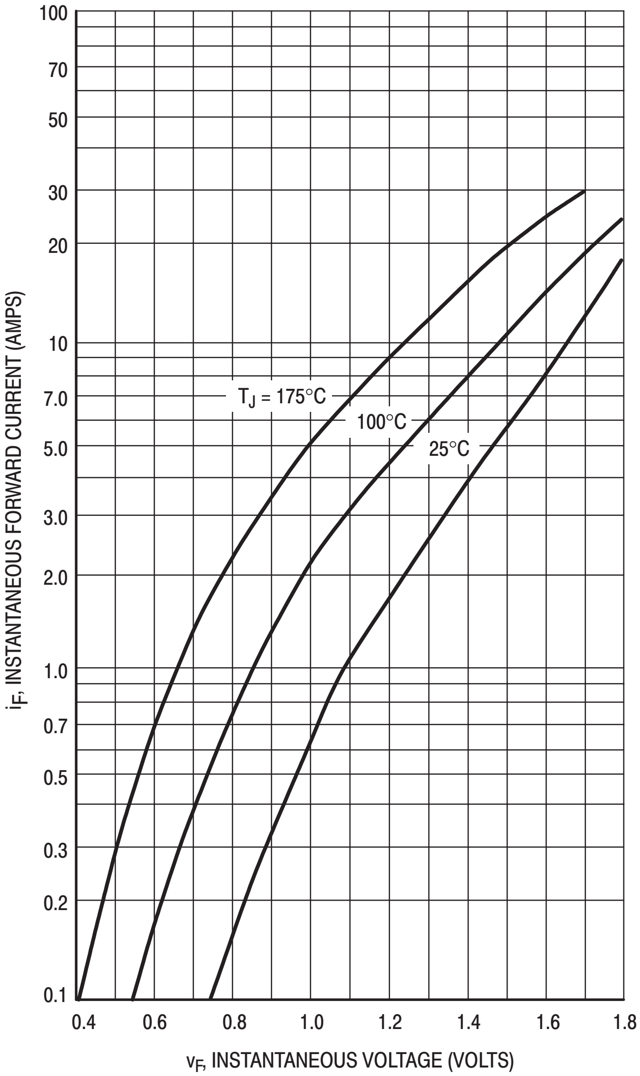


Figure 1. Typical Forward Voltage

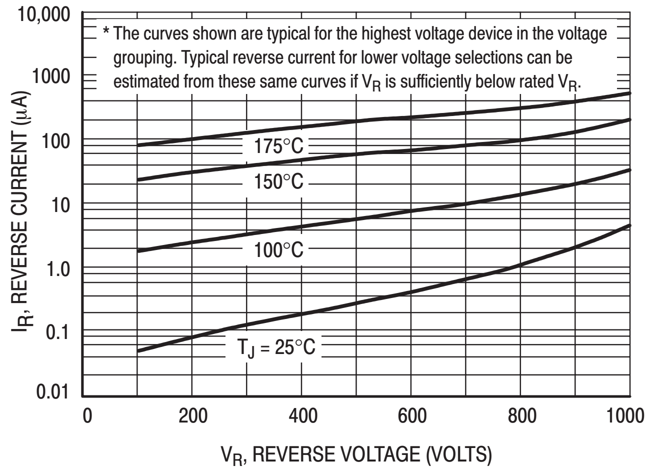


Figure 2. Typical Reverse Current*

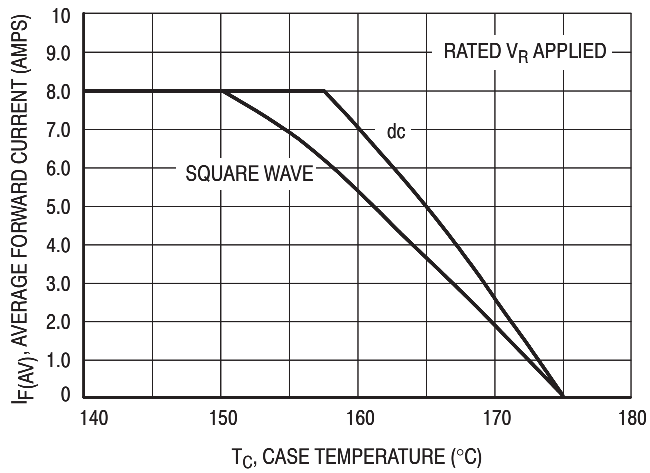


Figure 3. Current Derating, Case

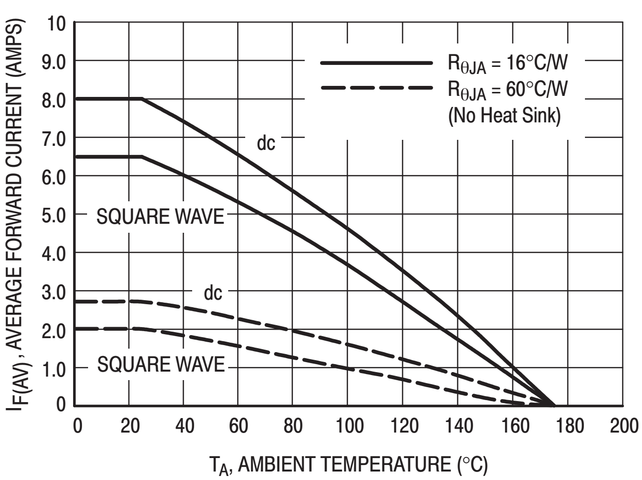


Figure 4. Current Derating, Ambient

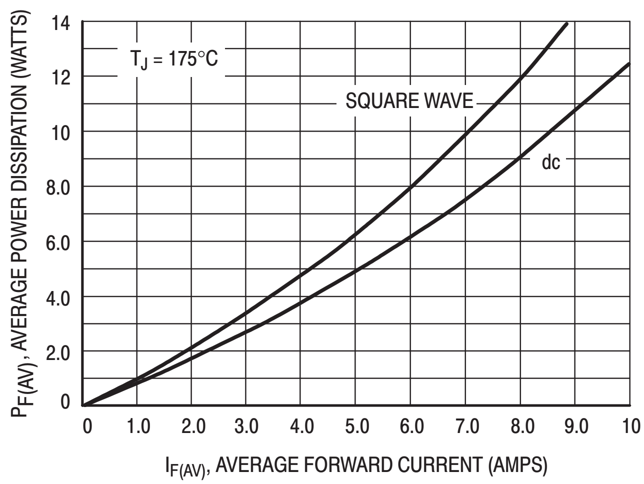


Figure 5. Power Dissipation

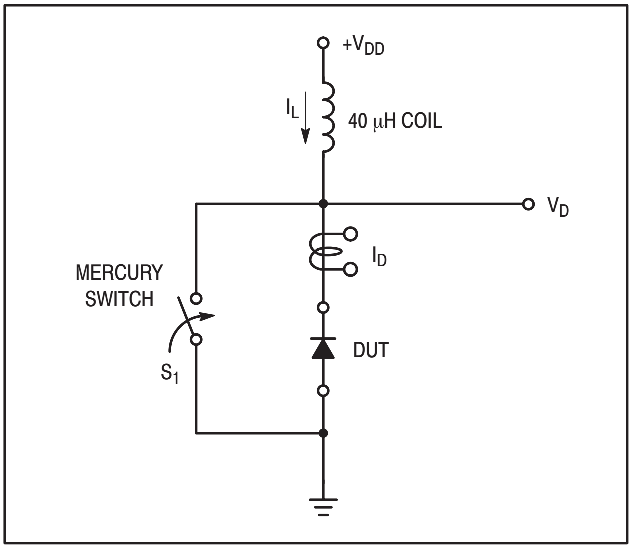


Figure 6. Test Circuit

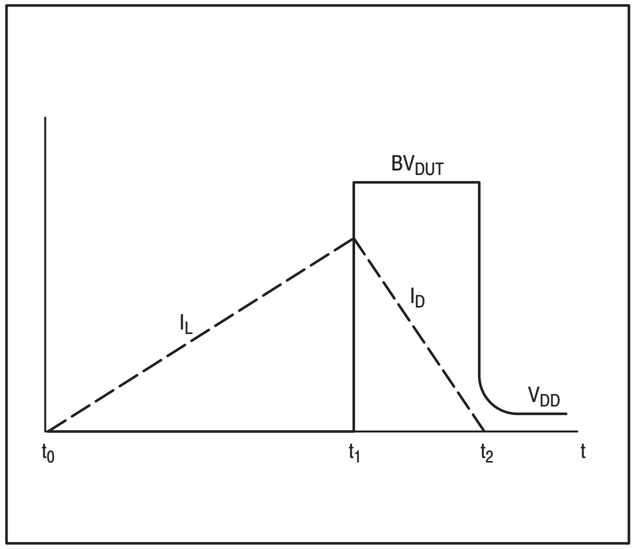


Figure 7. Current–Voltage Waveforms

The unclamped inductive switching circuit shown in Figure 6. was used to demonstrate the controlled avalanche capability of the new “E’’ series Ultrafast rectifiers. A mercury switch was used instead of an electronic switch to simulate a noisy environment when the switch was being opened.

When S_1 is closed at t_0 the current in the inductor I_L ramps up linearly; and energy is stored in the coil. At t_1 the switch is opened and the voltage across the diode under test begins to rise rapidly, due to di/dt effects, when this induced voltage reaches the breakdown voltage of the diode, it is clamped at BV_{DUT} and the diode begins to conduct the full load current which now starts to decay linearly through the diode, and goes to zero at t_2.

By solving the loop equation at the point in time when S_1 is opened; and calculating the energy that is transferred to the diode it can be shown that the total energy transferred is equal to the energy stored in the inductor plus a finite amount of energy from the V_{DD} power supply while the diode is in breakdown (from t_1 to t_2) minus any losses due to finite component resistances. Assuming the component resistive elements are small Equation (1) approximates the total energy transferred to the diode. It can be seen from this equation that if the V_{DD} voltage is low compared to the breakdown voltage of the device, the amount of energy contributed by the supply during breakdown is small and the total energy can be assumed to be nearly equal to the energy stored in the coil during the time when S_1 was closed, Equation (2).

The oscilloscope picture in Figure 8. , shows the MUR8100E in this test circuit conducting a peak current of one ampere at a breakdown voltage of 1300 volts, and using Equation (2) the energy absorbed by the MUR8100E is approximately 20 mjoules.

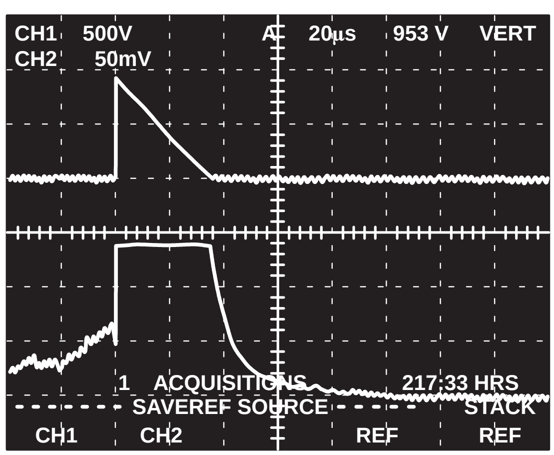
Although it is not recommended to design for this condition, the new “E’’ series provides added protection against those unforeseen transient viruses that can produce unexplained random failures in unfriendly environments.

EQUATION (1):

$$W_{AVAL} \approx \frac{1}{2} L I_{LPK}^2 \left(\frac{BV_{DUT}}{BV_{DUT} - V_{DD}} \right)$$

EQUATION (2):

$$W_{AVAL} \approx \frac{1}{2} L I_{LPK}^2$$



CHANNEL 2:
I_L
0.5 AMPS/DIV.

CHANNEL 1:
V_{DUT}
500 VOLTS/DIV.

TIME BASE:
20 μs/DIV.

Figure 8. Current–Voltage Waveforms

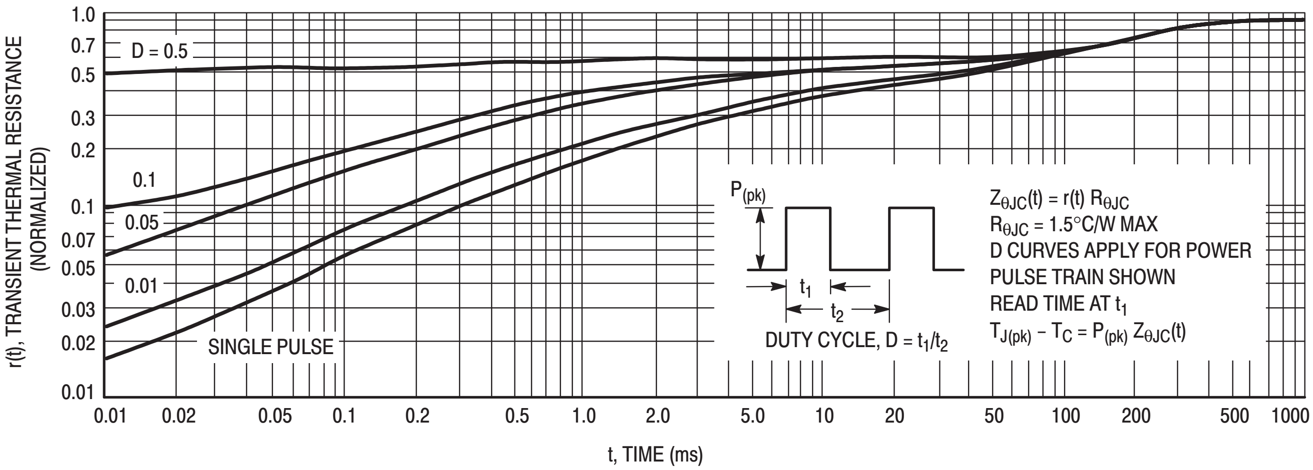


Figure 9. Thermal Response

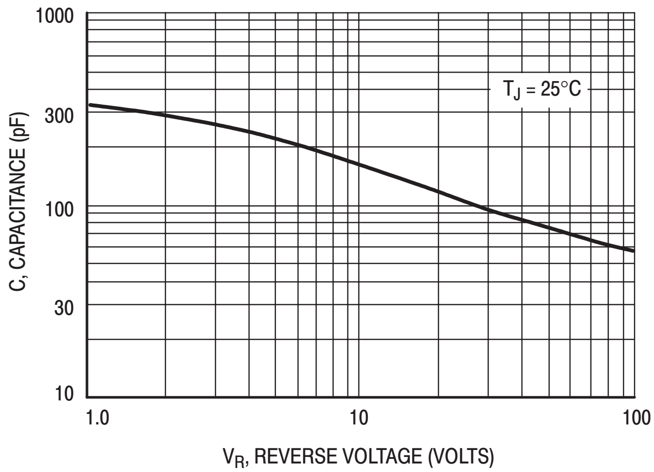


Figure 10. Typical Capacitance

MURH840CT

Preferred Device

MEGAHERTZ™ Power Rectifier

. . . designed for use in switching power supplies, inverters and as free wheeling diodes, these state–of–the–art devices have the following features:

- Ultrafast 28 Nanosecond Recovery Time
- 175°C Operating Junction Temperature
- Popular TO–220 Package
- Epoxy Meets UL94, V_O @ 1/8″
- High Temperature Glass Passivated Junction
- High Voltage Capability to 400 Volts
- Low Leakage Specified @ 150°C Case Temperature
- Current Derating @ Both Case and Ambient Temperatures

Mechanical Characteristics:

- Case: Epoxy, Molded
- Weight: 1.9 grams (approximately)
- Finish: All External Surfaces Corrosion Resistant and Terminal Leads are Readily Solderable
- Lead Temperature for Soldering Purposes: 260°C Max. for 10 Seconds
- Shipped 50 units per plastic tube
- Marking: UH840

MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Peak Repetitive Reverse Voltage Working Peak Reverse Voltage DC Blocking Voltage	V_{RRM} V_{RWM} V_R	400	V
Average Rectified Forward Current (Rated V_R, T_C = 120°C) Per Leg Total Device	$I_{F(AV)}$	 4.0 8.0	A
Peak Repetitive Forward Current per Diode Leg (Rated V_R, Square Wave, 20 kHz, T_C = 120°C)	I_{FM}	16	A
Non–Repetitive Peak Surge Current (Surge Applied at Rated Load Conditions Halfwave, Single Phase, 60 Hz)	I_{FSM}	100	A
Controlled Avalanche Energy	W_{AVAL}	20	mJ
Operating Junction and Storage Temperature Range	T_J, T_{stg}	–65 to +175	°C

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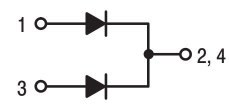
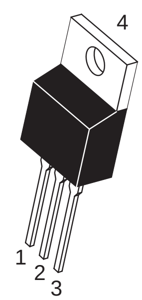
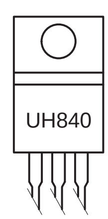
ULTRAFAST RECTIFIER 8.0 AMPERES 400 VOLTS





TO–220AB CASE 221A PLASTIC

MARKING DIAGRAM



UH840 = Device Code

ORDERING INFORMATION

Device	Package	Shipping
MURH840CT	TO–220	50 Units/Rail

Preferred devices are recommended choices for future use and best overall value.

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THERMAL CHARACTERISTICS (Per Diode Leg)

Rating	Symbol	Value	Unit
Maximum Thermal Resistance, Junction to Case	$R_{\theta JC}$	3.0	°C/W

ELECTRICAL CHARACTERISTICS (Per Diode Leg)

Maximum Instantaneous Forward Voltage (Note 1.) (i_F = 4.0 Amps, T_C = 150°C) (i_F = 4.0 Amps, T_C = 25°C)	v_F	 1.9 2.2	Volts
Maximum Instantaneous Reverse Current (Note 1.) (Rated dc Voltage, T_C = 150°C) (Rated dc Voltage, T_C = 25°C)	i_R	 500 10	μA
Maximum Reverse Recovery Time (I_F = 1.0 Amp, di/dt = 50 Amps/μs)	t_{rr}	28	ns

1. Pulse Test: Pulse Width = 300 μs, Duty Cycle ≤ 2.0%.

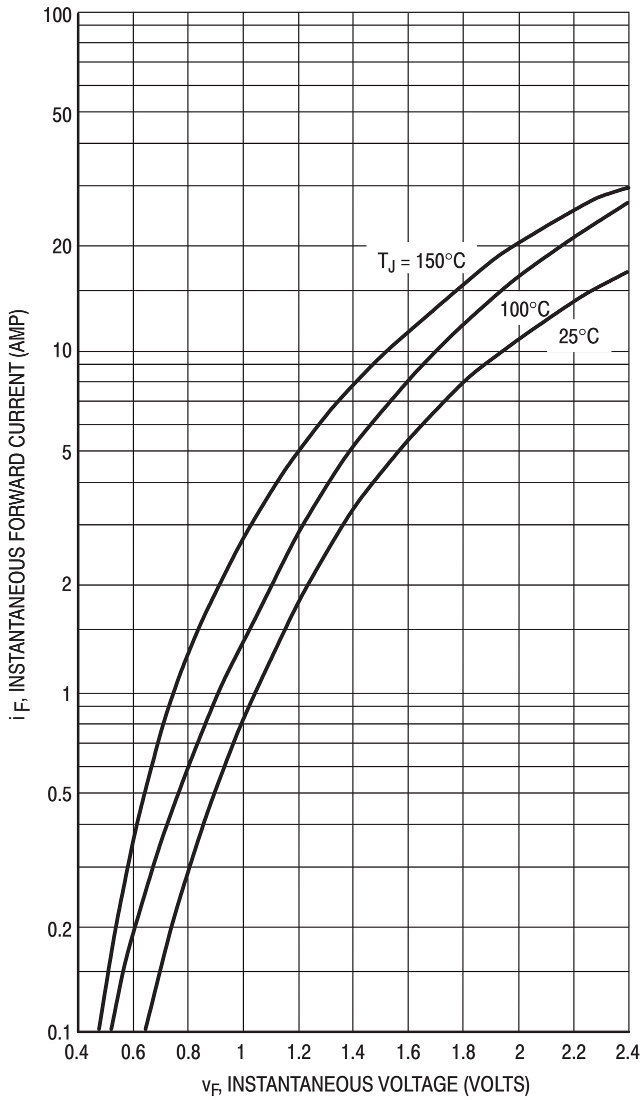

Figure 1. Typical Forward Voltage

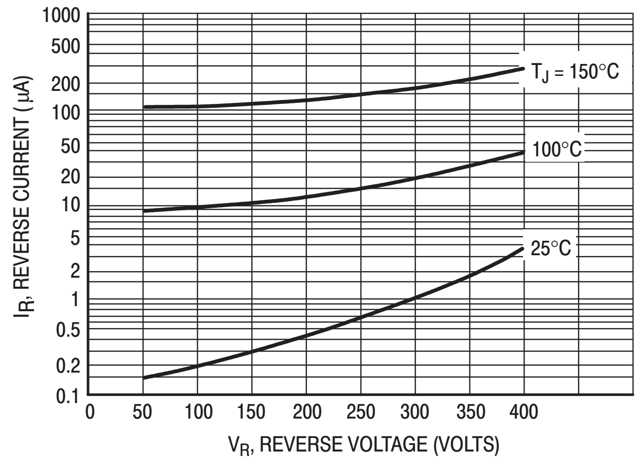

Figure 2. Typical Reverse Current, Per Leg

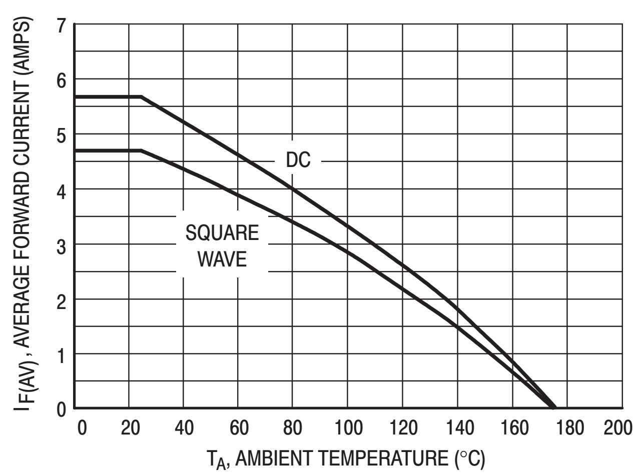

Figure 3. Forward Current Derating, Ambient, Per Leg

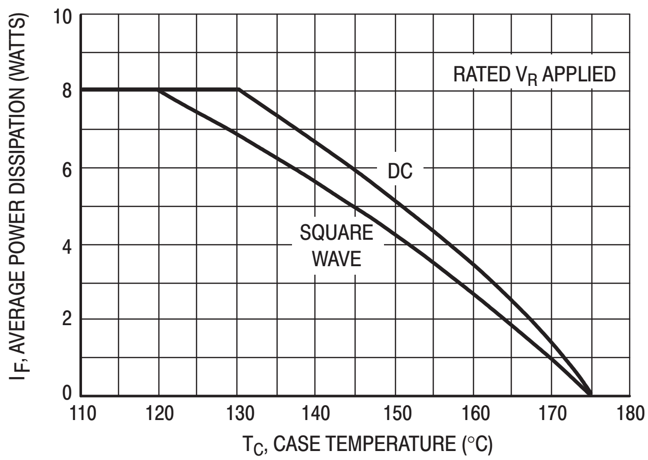

Figure 4. Current Derating, Case, Per Leg

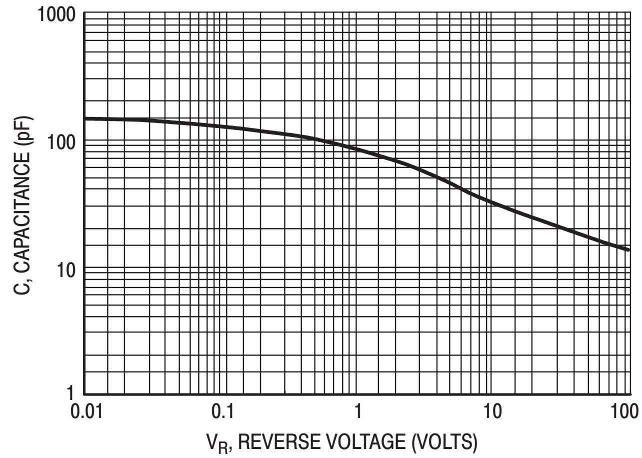

Figure 5. Typical Capacitance, Per Leg

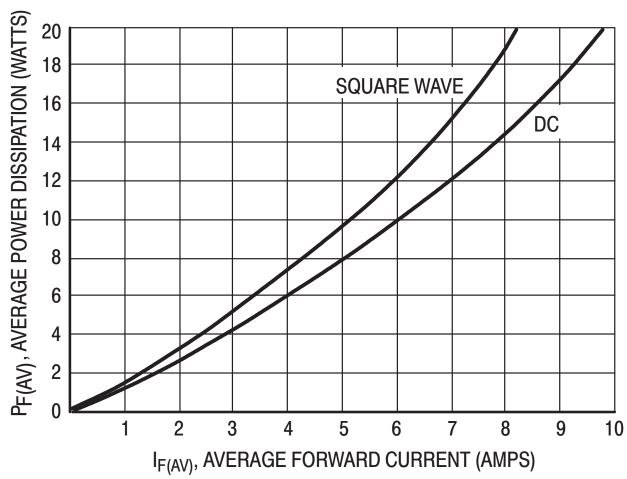

Figure 6. Forward Power Dissipation, Per Leg

MURH860CT

Preferred Device

MEGAHERTZ™ Power Rectifier

. . . designed for use in switching power supplies, inverters and as free wheeling diodes, these state-of-the-art devices have the following features:

- Ultrafast 35 Nanosecond Recovery Times
- 175°C Operating Junction Temperature
- Popular TO-220 Package
- Epoxy Meets UL94, V_O @ 1/8″
- High Temperature Glass Passivated Junction
- High Voltage Capability to 600 Volts
- Low Leakage Specified @ 150°C Case Temperature
- Current Derating @ Both Case and Ambient Temperatures

Mechanical Characteristics

- Case: Epoxy, Molded
- Weight: 1.9 grams (approximately)
- Finish: All External Surfaces Corrosion Resistant and Terminal Leads are Readily Solderable
- Lead Temperature for Soldering Purposes: 260°C Max. for 10 Seconds
- Shipped 50 units per plastic tube
- Marking: UH860

MAXIMUM RATINGS (Per Leg)

Rating	Symbol	Value	Unit
Peak Repetitive Reverse Voltage Working Peak Reverse Voltage DC Blocking Voltage	V_{RRM} V_{RWM} V_R	600	V
Average Rectified Forward Current (Rated V_R, T_C = 120°C) Total Device	$I_{F(AV)}$	 4.0 8.0	A
Peak Repetitive Forward Current (Rated V_R, Square Wave, 20 kHz, T_C = 120°C)	I_{FM}	16	A
Non–Repetitive Peak Surge Current (Surge Applied at Rated Load Conditions Halfwave, Single Phase, 60 Hz)	I_{FSM}	100	A
Operating Junction and Storage Temperature Range	T_J, T_{stg}	–65 to +175	°C

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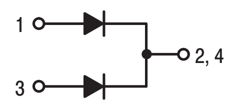
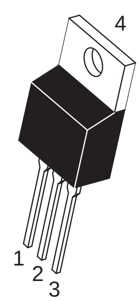
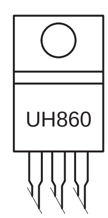
ULTRAFAST RECTIFIER 8.0 AMPERES 600 VOLTS





TO–220AB CASE 221A PLASTIC

MARKING DIAGRAM



UH860 = Device Code

ORDERING INFORMATION

Device	Package	Shipping
MURH860CT	TO–220	50 Units/Rail

Preferred devices are recommended choices for future use and best overall value.

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THERMAL CHARACTERISTICS (Per Leg)

Rating	Symbol	Value	Unit
Maximum Thermal Resistance, Junction to Case	$R_{\theta JC}$	3.0	°C/W

ELECTRICAL CHARACTERISTICS (Per Leg)

Maximum Instantaneous Forward Voltage (Note 1.) (i_F = 4.0 Amps, T_C = 150°C) (i_F = 4.0 Amps, T_C = 25°C)	v_F	 2.5 2.8	Volts
Maximum Instantaneous Reverse Current (Note 1.) (Rated dc Voltage, T_C = 150°C) (Rated dc Voltage, T_C = 25°C)	i_R	 500 10	μA
Maximum Reverse Recovery Time (I_F = 1.0 Amp, di/dt = 50 Amps/μs)	t_{rr}	35	ns

1. Pulse Test: Pulse Width = 300 μs, Duty Cycle ≤ 2.0%

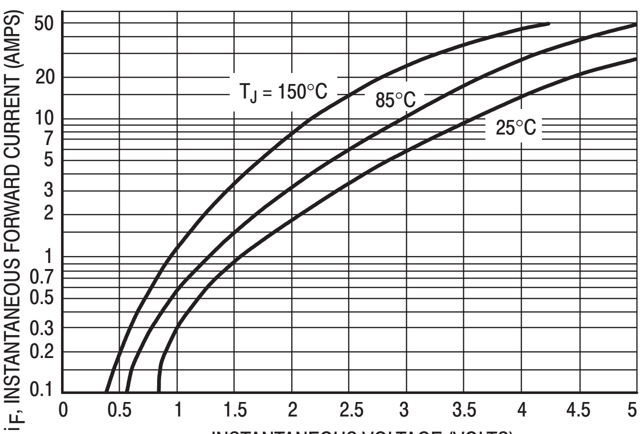

Figure 1. Typical Forward Voltage, Per Leg

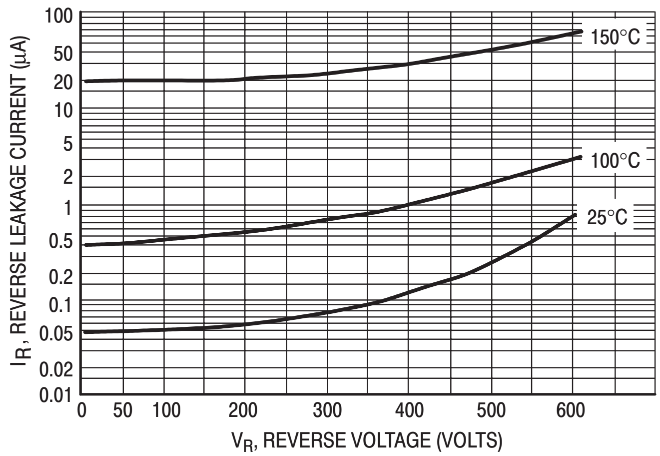

Figure 2. Typical Reverse Leakage Current, Per Leg

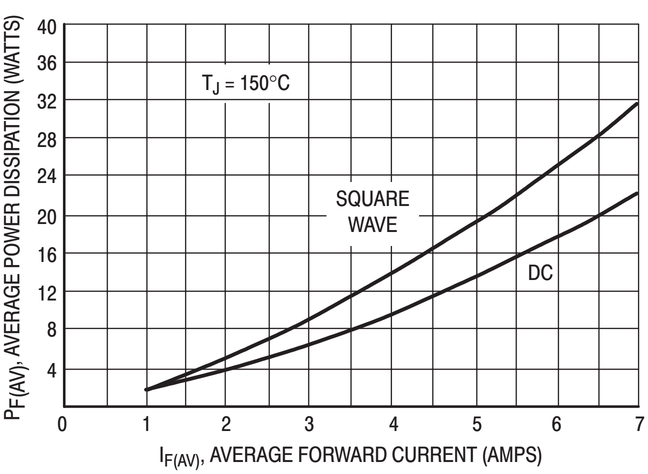

Figure 3. Typical Forward Dissipation, Per Leg

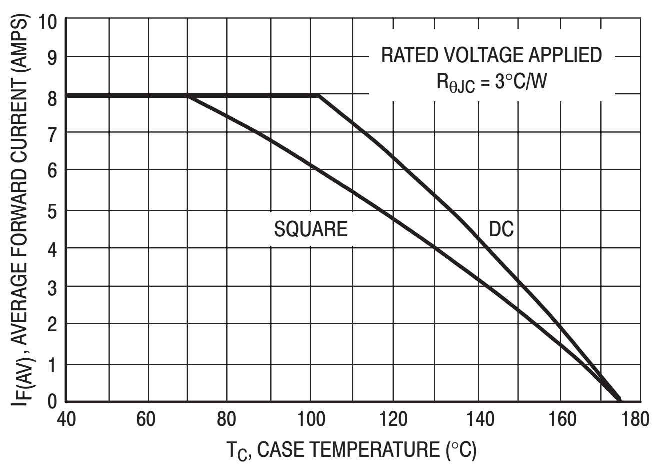

Figure 4. Typical Current Derating, Case, Per Leg

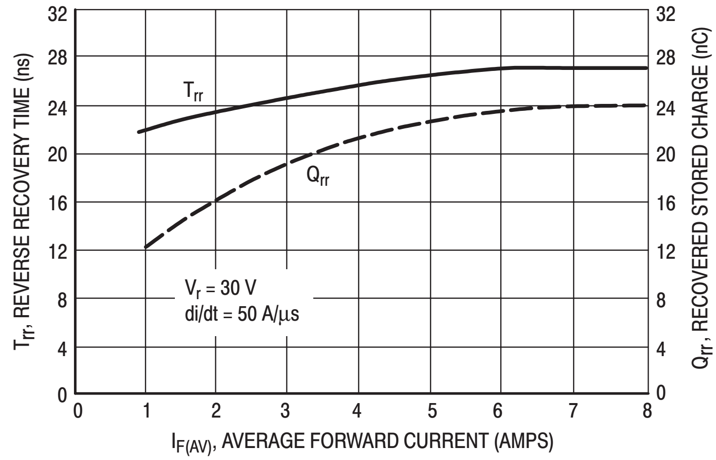

Figure 5. Typical Recovery Characteristics

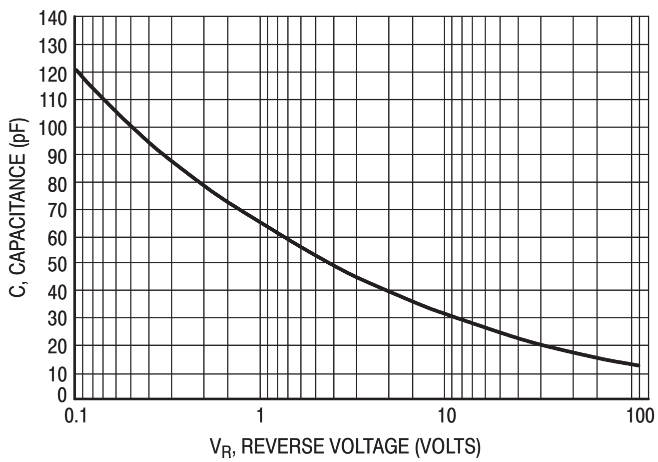

Figure 6. Typical Capacitance, Per Leg

MUR10120E

Preferred Device

SCANSWITCH™ Power Rectifier

For High and Very High Resolution Monitors

This state–of–the–art power rectifier is specifically designed for use as a damper diode in horizontal deflection circuits for high and very high resolution monitors.

- 1200 Volt Blocking Voltage
- 20 mJ Avalanche Energy (Guaranteed)
- 12 Volt (Typical) Peak Transient Overshoot Voltage
- 135 ns (Typical) Forward Recovery Time

Mechanical Characteristics:

- Case: Epoxy, Molded
- Weight: 1.9 grams (approximately)
- Finish: All External Surfaces Corrosion Resistant and Terminal Leads are Readily Solderable
- Lead Temperature for Soldering Purposes: 260°C Max. for 10 Seconds
- Shipped 50 units per plastic tube
- Marking: U10120E

MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Peak Repetitive Reverse Voltage Working Peak Reverse Voltage DC Blocking Voltage	V_{RRM} V_{RWM} V_R	1200	V
Average Rectified Forward Current (Rated V_R, T_C = 125°C)	$I_{F(AV)}$	10	A
Peak Repetitive Forward Current (Rated V_R, Square Wave, 20 kHz, T_C = 125°C) Per Leg	I_{FRM}	20	A
Non–Repetitive Peak Surge Current (Surge Applied at Rated Load Conditions Halfwave, Single Phase, 60 Hz)	I_{FSM}	100	A
Operating Junction Temperature Range	T_J	–65 to +125	°C
Controlled Avalanche Energy	W_{AVAL}	20	mJ

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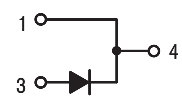
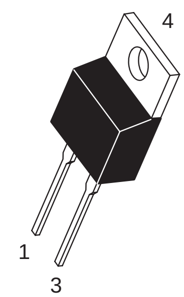
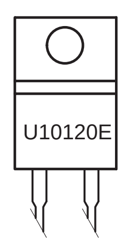
SCANSWITCH
RECTIFIER
10 AMPERES
1200 VOLTS





TO–220AC
CASE 221B
STYLE 1

MARKING DIAGRAM



U10120E = Device Code

ORDERING INFORMATION

Device	Package	Shipping
MUR10120E	TO–220	50 Units/Rail

Preferred devices are recommended choices for future use and best overall value.

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THERMAL CHARACTERISTICS

Rating	Symbol	Value	Unit
Thermal Resistance — Junction to Case	$R_{\theta JC}$	2.0	°C/W

ELECTRICAL CHARACTERISTICS

Characteristic	Symbol	Typ	Max	Unit
Maximum Instantaneous Forward Voltage (Note 1.) (i_F = 6.5 Amps, T_J = 125°C) (i_F = 6.5 Amps, T_J = 25°C)	v_F	 1.7 1.9	 2.0 2.2	Volts
Maximum Instantaneous Reverse Current (Note 1.) (Rated dc Voltage, T_J = 25°C) (Rated dc Voltage, T_J = 125°C)	i_R	 25 750	 100 1000	μA
Maximum Reverse Recovery Time (I_F = 1.0 A, di/dt = 50 Amps/μs)	t_{rr}	150	175	ns
Maximum Forward Recovery Time I_F = 6.5 Amps, di/dt = 12 Amps/μs (As Measured on a Deflection Circuit)	t_{fr}	135	175	ns
Peak Transient Overshoot Voltage	V_{RFM}	12	14	Volts

1. Pulse Test: Pulse Width = 300 μs, Duty Cycle ≤ 2.0%.

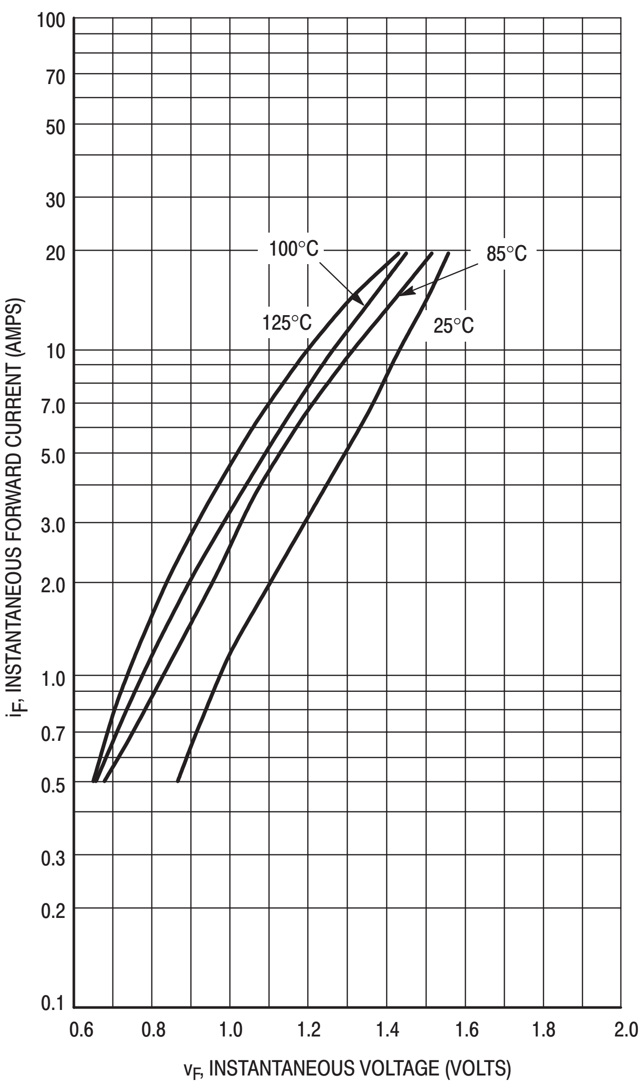

Figure 1. Typical Forward Voltage

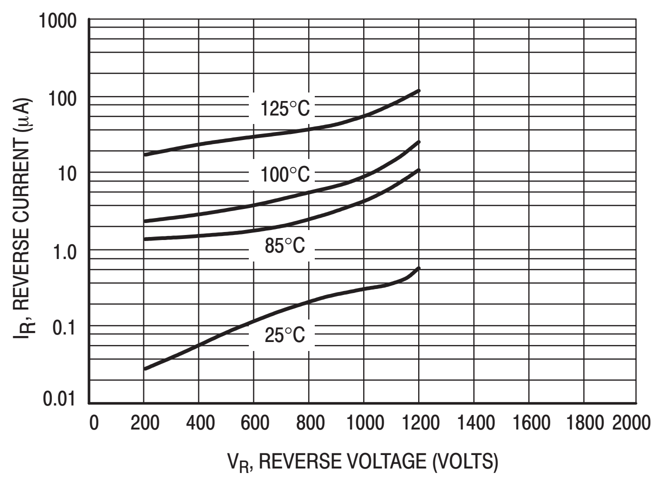

Figure 2. Typical Reverse Current

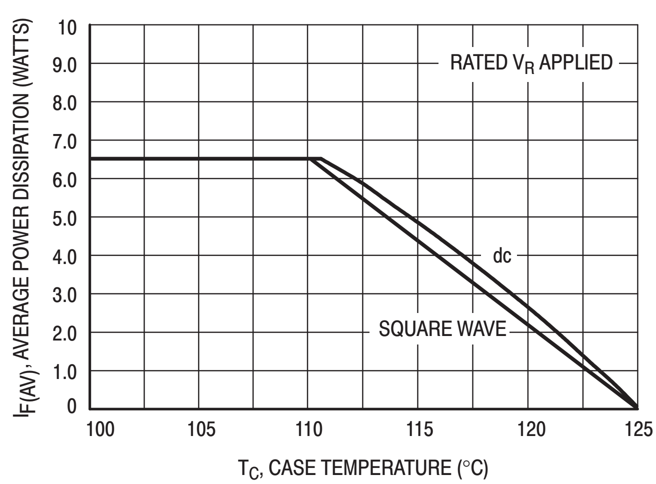

Figure 3. Current Derating, Case

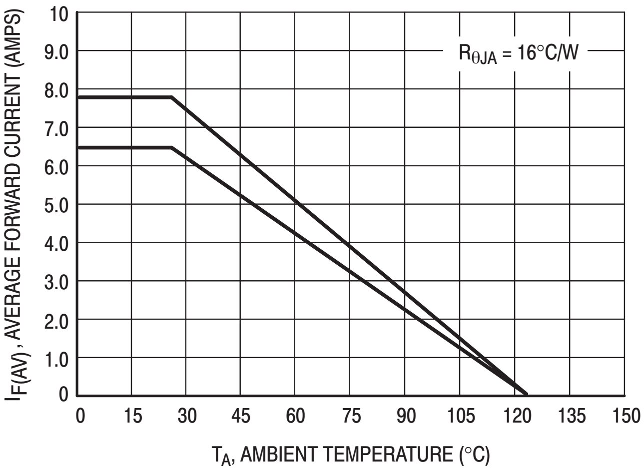

Figure 4. Current Derating, Ambient

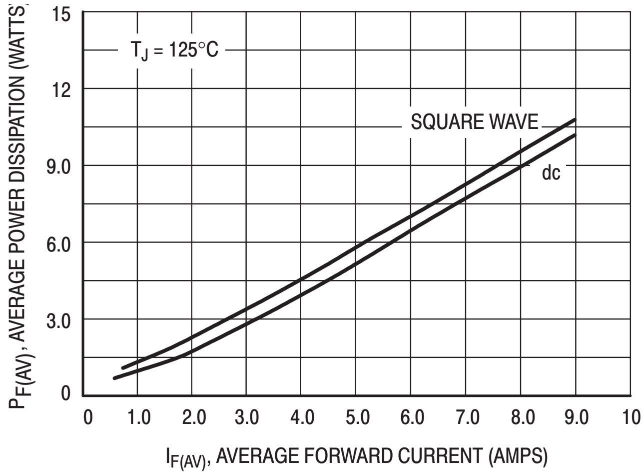

Figure 5. Power Dissipation

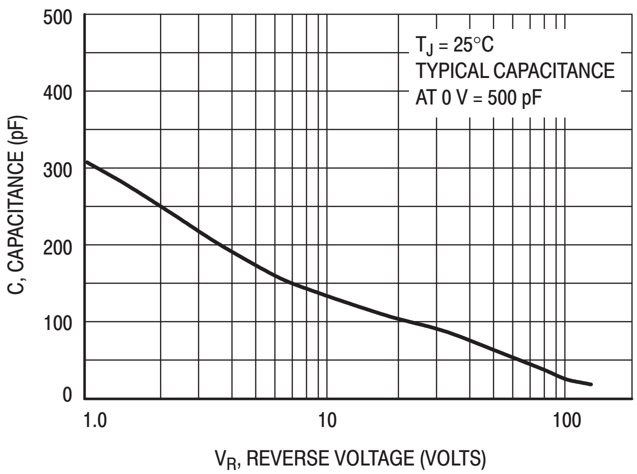

Figure 6. Typical Capacitance

MUR10150E

Preferred Device

SCANSWITCH™ Power Rectifier

For Use As A Damper Diode In High and Very High Resolution Monitors

The MUR10150E is a state-of-the-art Power Rectifier specifically designed for use as a damper diode in horizontal deflection circuits for high and very high resolution monitors.

- 1500 V Blocking Voltage
- 20 mJ Avalanche Energy Guaranteed
- Peak Transient Overshoot Voltage Specified, 14 Volts (typical)
- Forward Recovery Time Specified, 135 ns (typical)
- Epoxy Meets UL94, V_O at 1/8″

Mechanical Characteristics

- Case: Epoxy, Molded
- Weight: 1.9 grams (approximately)
- Finish: All External Surfaces Corrosion Resistant and Terminal Leads are Readily Solderable
- Lead Temperature for Soldering Purposes: 260°C Max. for 10 Seconds
- Shipped 50 units per plastic tube
- Marking: U10150E

MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Peak Repetitive Reverse Voltage Working Peak Reverse Voltage DC Blocking Voltage	V_{RRM} V_{RWM} V_R	1500	V
Average Rectified Forward Current (Rated V_R, T_C = 125°C)	$I_{F(AV)}$	10	A
Peak Repetitive Forward Current (Rated V_R, Square Wave, 20 kHz, T_C = 125°C) Per Leg	I_{FRM}	20	A
Non–Repetitive Peak Surge Current (Surge Applied at Rated Load Conditions Halfwave, Single Phase, 60 Hz)	I_{FSM}	100	A
Operating Junction and Storage Temperature Range	T_J, T_{stg}	–65 to +125	°C
Controlled Avalanche Energy	W_{AVAL}	20	mJ

ON Semiconductor™

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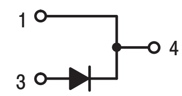
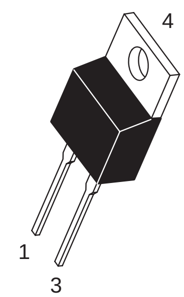
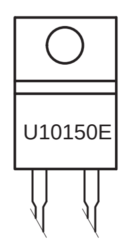
SCANSWITCH RECTIFIER 10 AMPERES 1500 VOLTS





TO–220AC
CASE 221B
STYLE 1

MARKING DIAGRAM



U10150E = Device Code

ORDERING INFORMATION

Device	Package	Shipping
MUR10150E	TO–220	50 Units/Rail

Preferred devices are recommended choices for future use and best overall value.

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THERMAL CHARACTERISTICS

Rating	Symbol	Value	Unit
Thermal Resistance — Junction to Case	$R_{\theta JC}$	2.0	°C/W

ELECTRICAL CHARACTERISTICS

Characteristic	Symbol	Typ	Max	Unit
Maximum Instantaneous Forward Voltage (Note 1.) (i_F = 6.5 Amps, T_J = 125°C) (i_F = 6.5 Amps, T_J = 25°C)	v_F	 1.7 1.9	 2.2 2.4	Volts
Maximum Instantaneous Reverse Current (Note 1.) (Rated dc Voltage, T_J = 125°C) (Rated dc Voltage, T_J = 25°C)	i_R	 750 25	 1000 100	μA
Maximum Reverse Recovery Time (I_F = 1.0 Amp, di/dt = 50 Amps/μs)	t_{rr}	150	175	ns
Maximum Forward Recovery Time (I_F = 6.5 Amps, di/dt = 12 Amps/μs)	t_{fr}	135	175	ns
Peak Transient Overshoot Voltage	V_{RFM}	14	16	Volts

1. Pulse Test: Pulse Width = 300 μs, Duty Cycle ≤ 2.0%

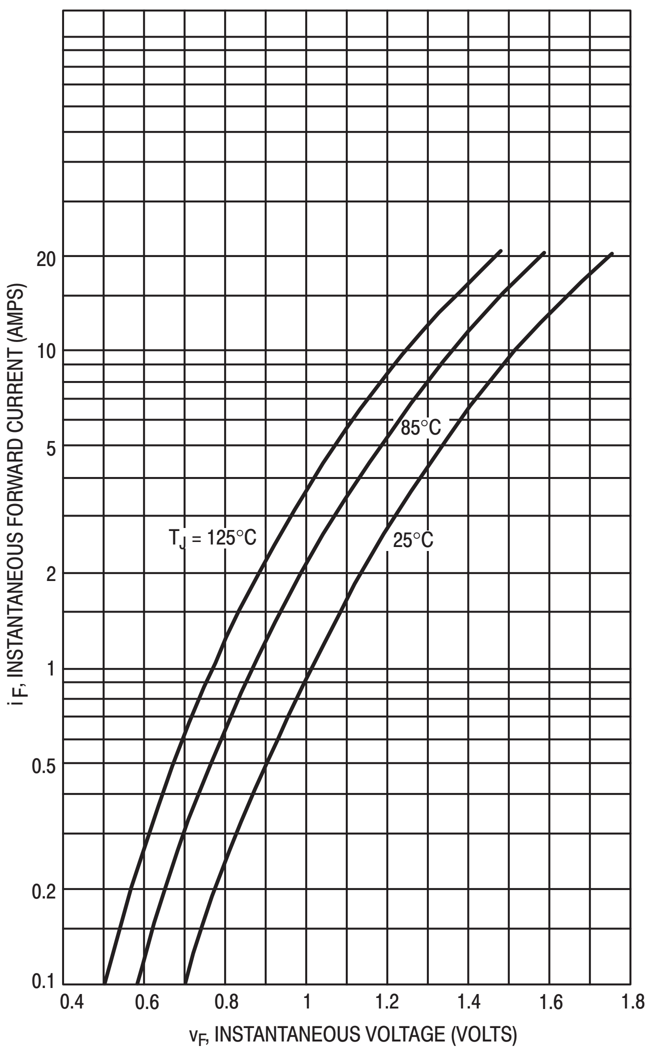

Figure 1. Typical Forward Voltage

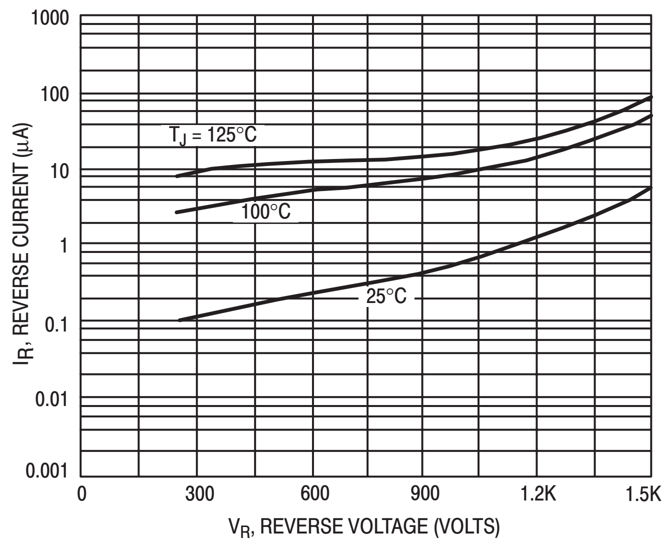

Figure 2. Typical Reverse Current

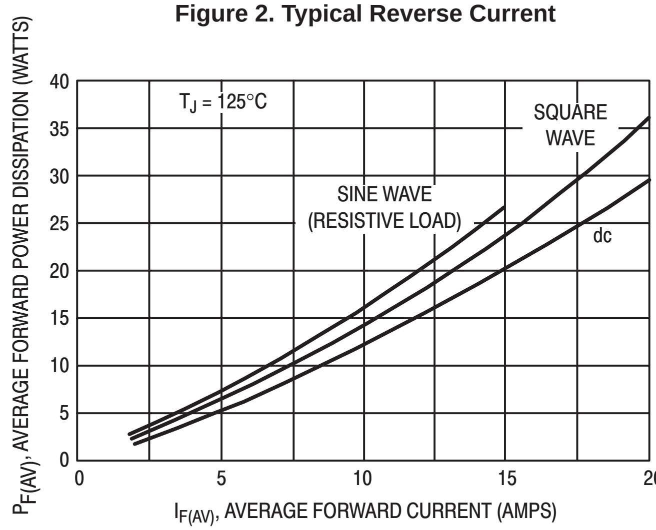

Figure 3. Forward Power Dissipation

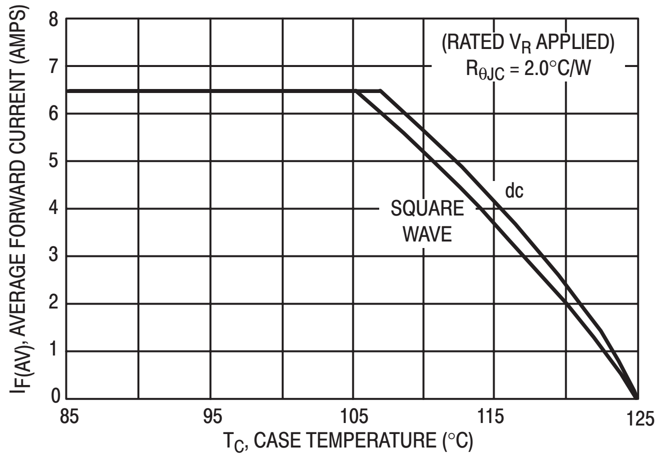

Figure 4. Current Derating Case

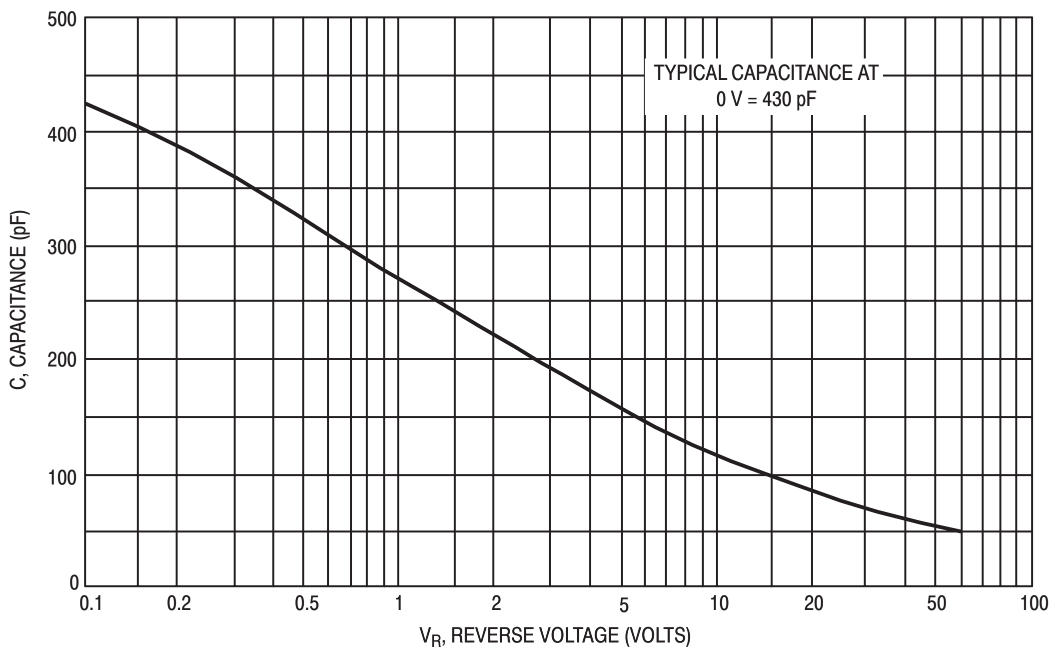

Figure 5. Typical Capacitance

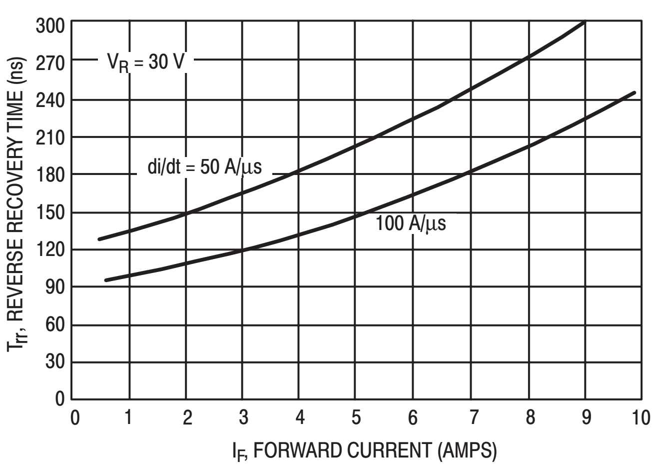

Figure 6. Typical Reverse Recovery Time

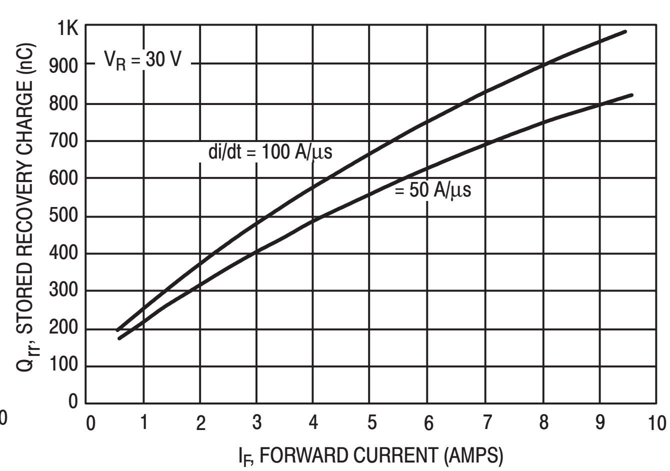

Figure 7. Typical Stored Recovery Charge

MUR1510, MUR1515, MUR1520, MUR1540, MUR1560

Preferred Devices

SWITCHMODE™ Power Rectifiers

. . . designed for use in switching power supplies, inverters and as free wheeling diodes, these state–of–the–art devices have the following features:

- Ultrafast 35 and 60 Nanosecond Recovery Time
- 175°C Operating Junction Temperature
- Popular TO–220 Package
- High Voltage Capability to 600 Volts
- Low Forward Drop
- Low Leakage Specified @ 150°C Case Temperature
- Current Derating Specified @ Both Case and Ambient Temperatures

Mechanical Characteristics:

- Case: Epoxy, Molded
- Weight: 1.9 grams (approximately)
- Finish: All External Surfaces Corrosion Resistant and Terminal Leads are Readily Solderable
- Lead Temperature for Soldering Purposes: 260°C Max. for 10 Seconds
- Shipped 50 units per plastic tube
- Marking: U1510, U1515, U1520, U1540, U1560

MAXIMUM RATINGS

Please See the Table on the Following Page

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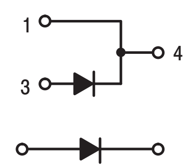
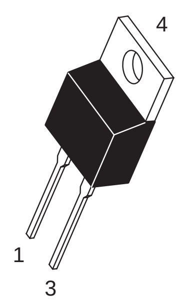
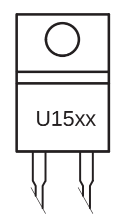
ULTRAFAST RECTIFIERS
15 AMPERES
100–600 VOLTS





TO–220AC
CASE 221B
PLASTIC

MARKING DIAGRAM



U15xx = Device Code
xx = 10, 15, 20, 40 or 60

ORDERING INFORMATION

Device	Package	Shipping
MUR1510	TO–220	50 Units/Rail
MUR1515	TO–220	50 Units/Rail
MUR1520	TO–220	50 Units/Rail
MUR1540	TO–220	50 Units/Rail
MUR1560	TO–220	50 Units/Rail

Preferred devices are recommended choices for future use and best overall value.

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MAXIMUM RATINGS

Rating	Symbol	MUR 1510	MUR 1515	MUR 1520	MUR 1540	MUR 1560	Unit
Peak Repetitive Reverse Voltage Working Peak Reverse Voltage DC Blocking Voltage	V_{RRM} V_{RWM} V_R	100	150	200	400	600	Volts
Average Rectified Forward Current (Rated V_R)	$I_{F(AV)}$	15 @ T_C = 150°C				15 @ T_C = 145°C	Amps
Peak Rectified Forward Current (Rated V_R, Square Wave, 20 kHz)	I_{FRM}	30 @ T_C = 150°C				30 @ T_C = 145°C	Amps
Nonrepetitive Peak Surge Current (Surge applied at rated load conditions halfwave, single phase, 60 Hz)	I_{FSM}	200			150		Amps
Operating Junction Temperature and Storage Temperature Range	T_J, T_{stg}	–65 to +175					°C

THERMAL CHARACTERISTICS

Maximum Thermal Resistance, Junction to Case	$R_{\theta JC}$	1.5	°C/W

ELECTRICAL CHARACTERISTICS

		MUR1510 / 1515 / 1520	MUR1540	MUR1560	Unit
Maximum Instantaneous Forward Voltage (Note 1.)	v_F				Volts
(i_F = 15 Amps, T_C = 150°C)		0.85	1.12	1.20	
(i_F = 15 Amps, T_C = 25°C)		1.05	1.25	1.50	
Maximum Instantaneous Reverse Current (Note 1.)	i_R				μA
(Rated dc Voltage, T_C = 150°C)		500	500	1000	
(Rated dc Voltage, T_C = 25°C)		10	10	10	
Maximum Reverse Recovery Time (I_F = 1.0 Amp, di/dt = 50 Amps/μs)	t_{rr}	35	60		ns

1. Pulse Test: Pulse Width = 300 μs, Duty Cycle ≤ 2.0%.

MUR1510, MUR1515, MUR1520

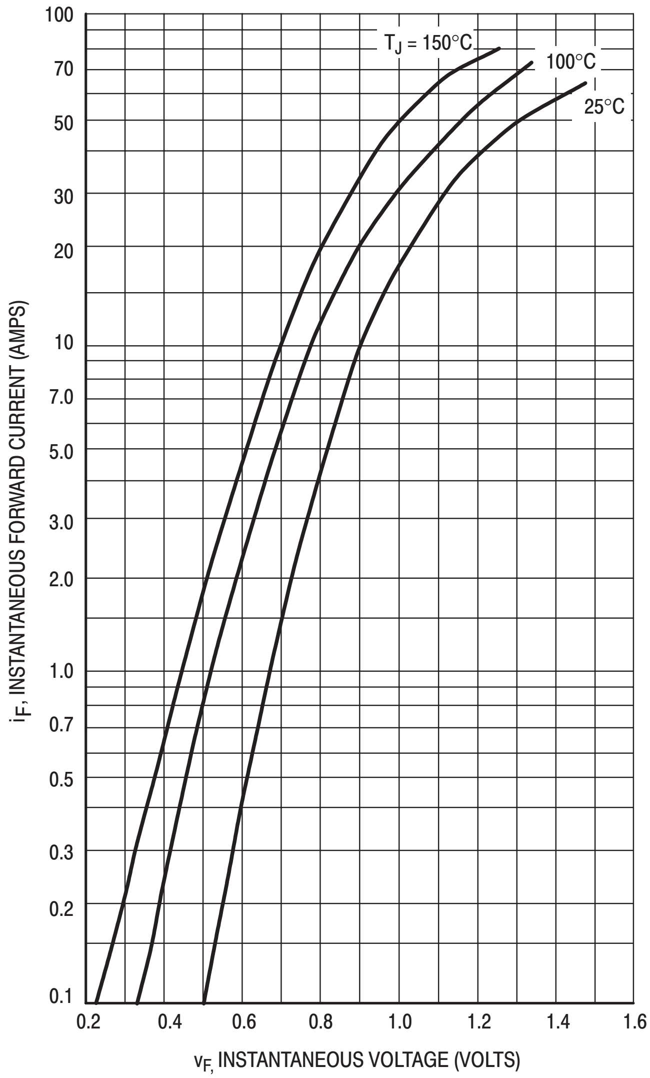


Figure 1. Typical Forward Voltage

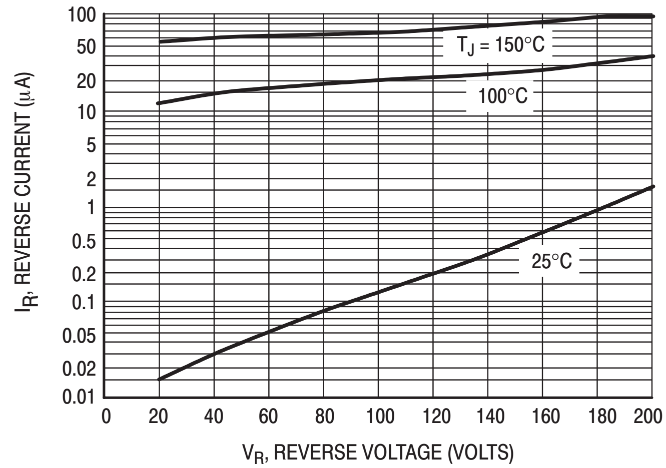


Figure 2. Typical Reverse Current

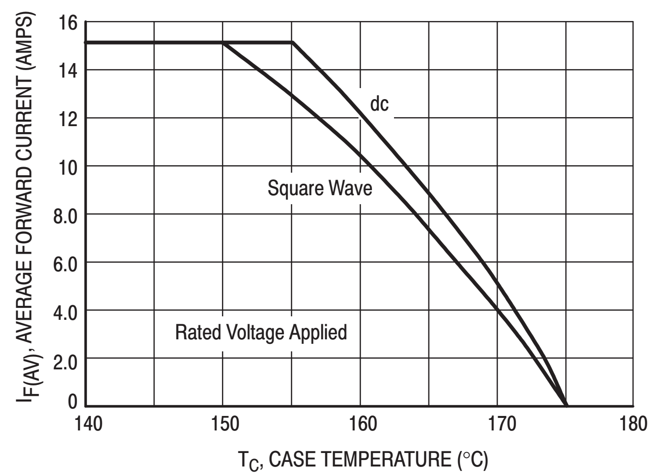


Figure 3. Current Derating, Case

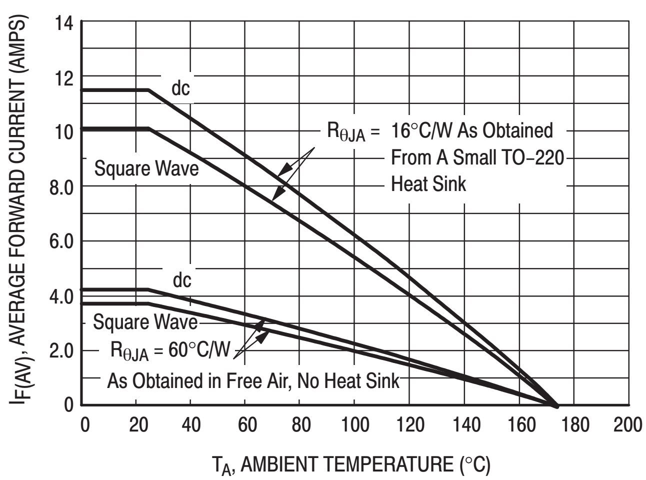


Figure 4. Current Derating, Ambient

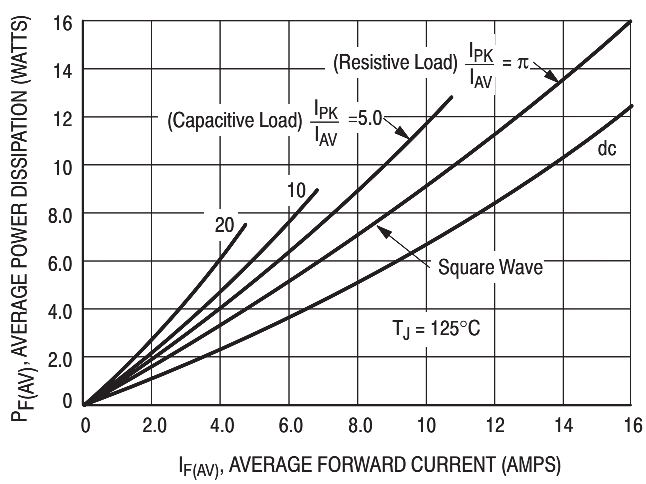


Figure 5. Power Dissipation

MUR1540

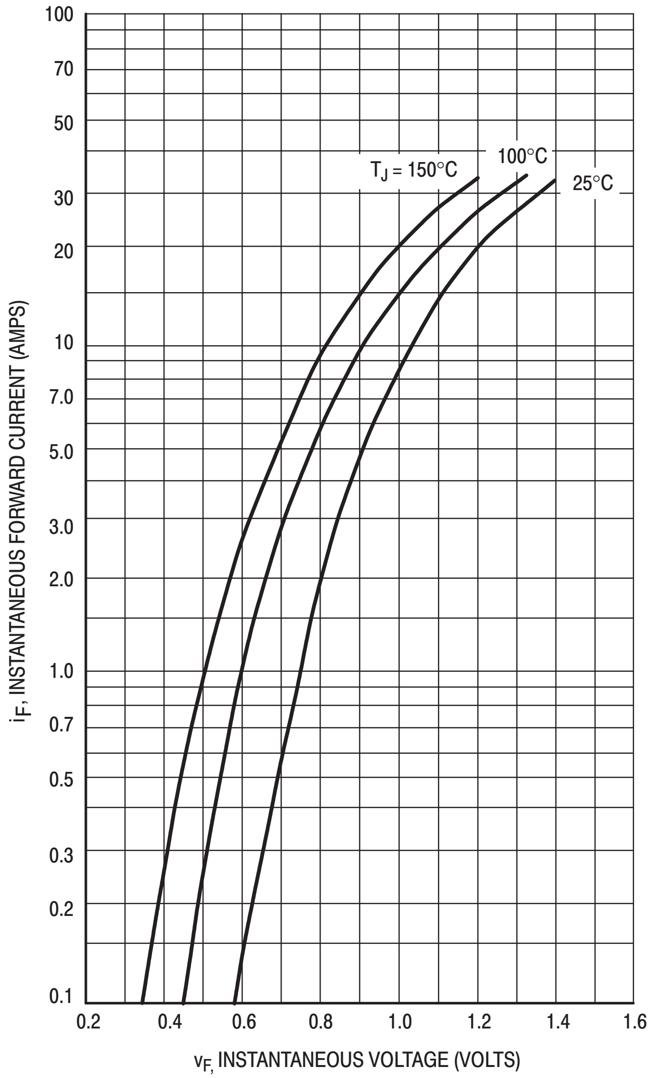


Figure 6. Typical Forward Voltage

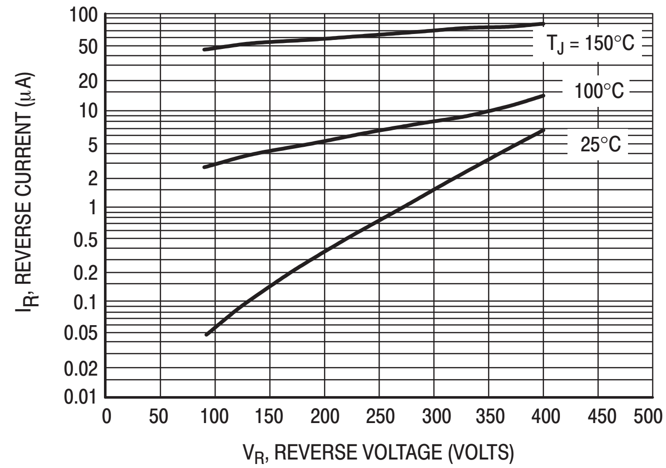


Figure 7. Typical Reverse Current

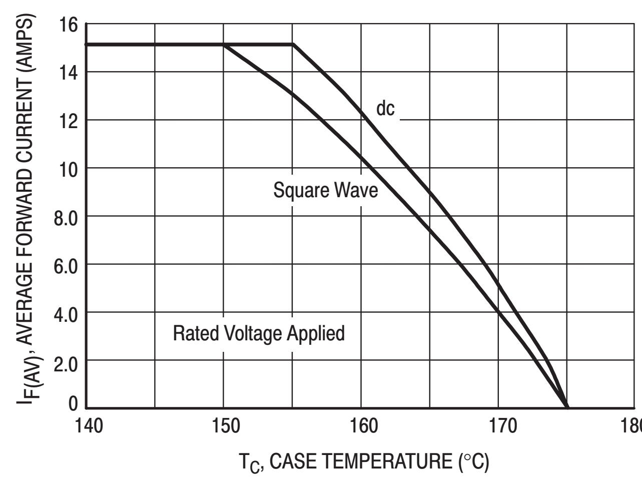


Figure 8. Current Derating, Case

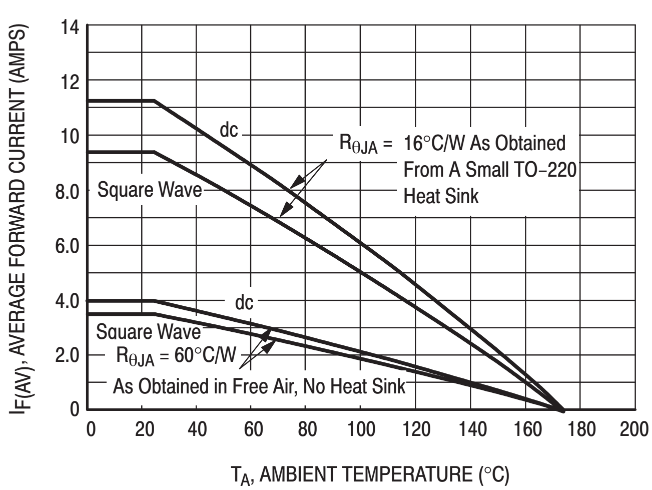


Figure 9. Current Derating, Ambient

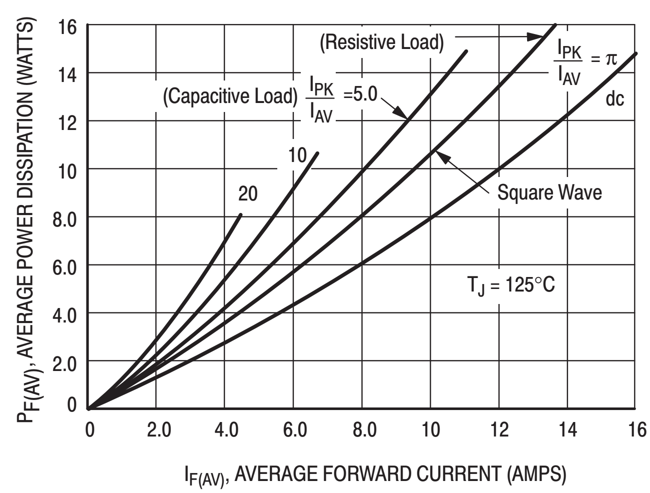


Figure 10. Power Dissipation

MUR1560

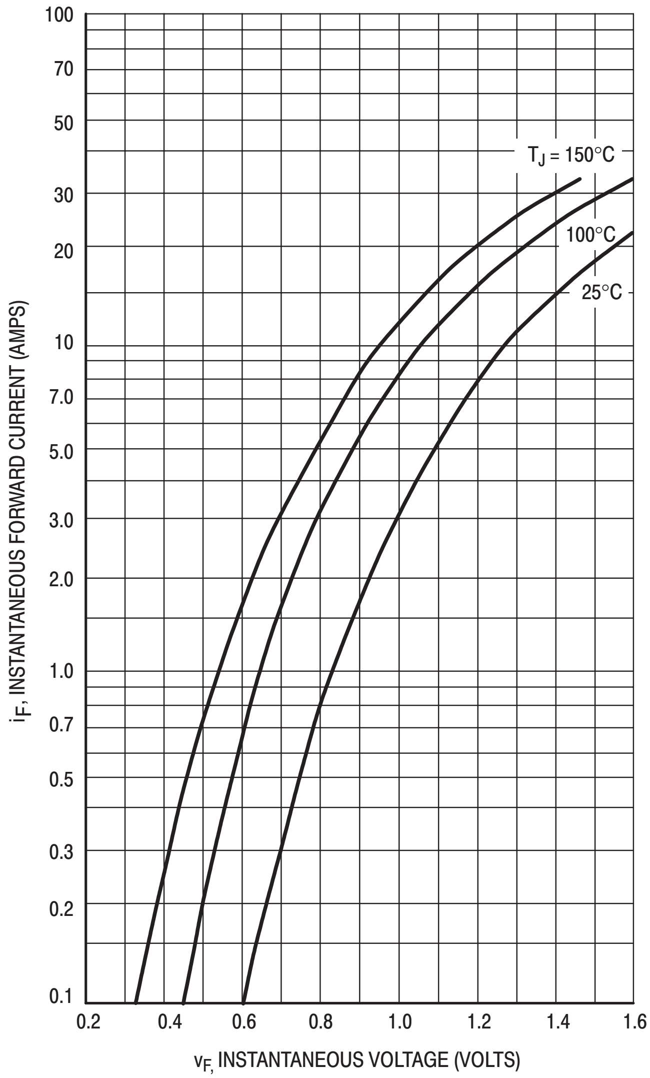


Figure 11. Typical Forward Voltage

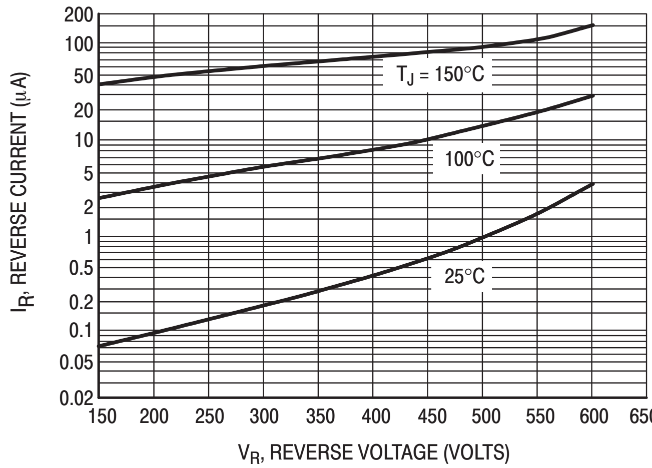


Figure 12. Typical Reverse Current

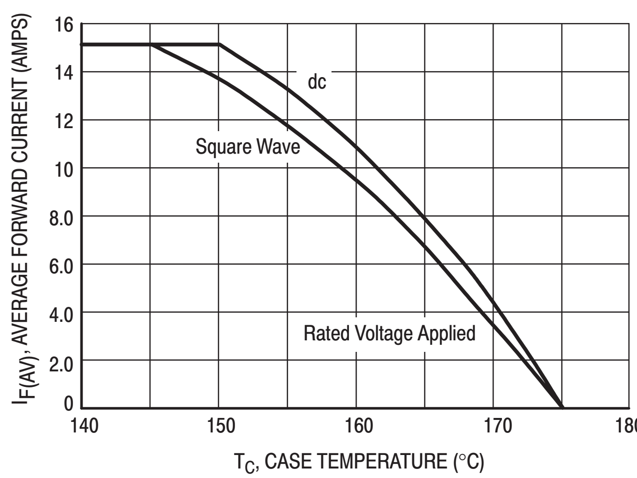


Figure 13. Current Derating, Case

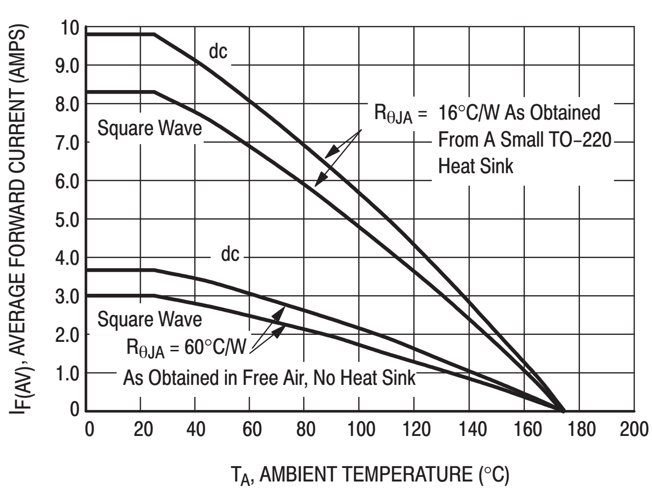


Figure 14. Current Derating, Ambient

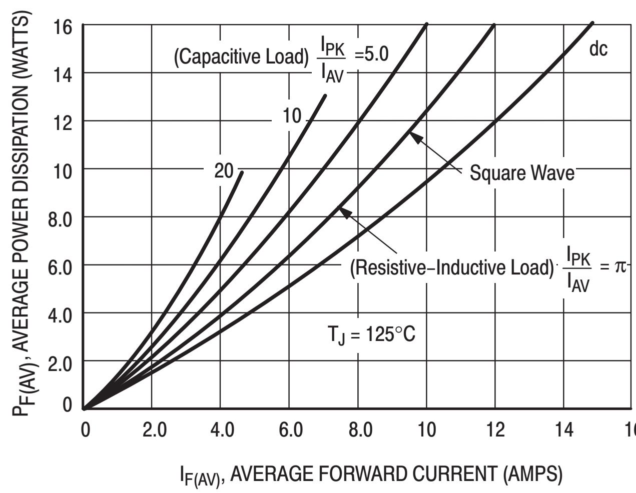


Figure 15. Power Dissipation

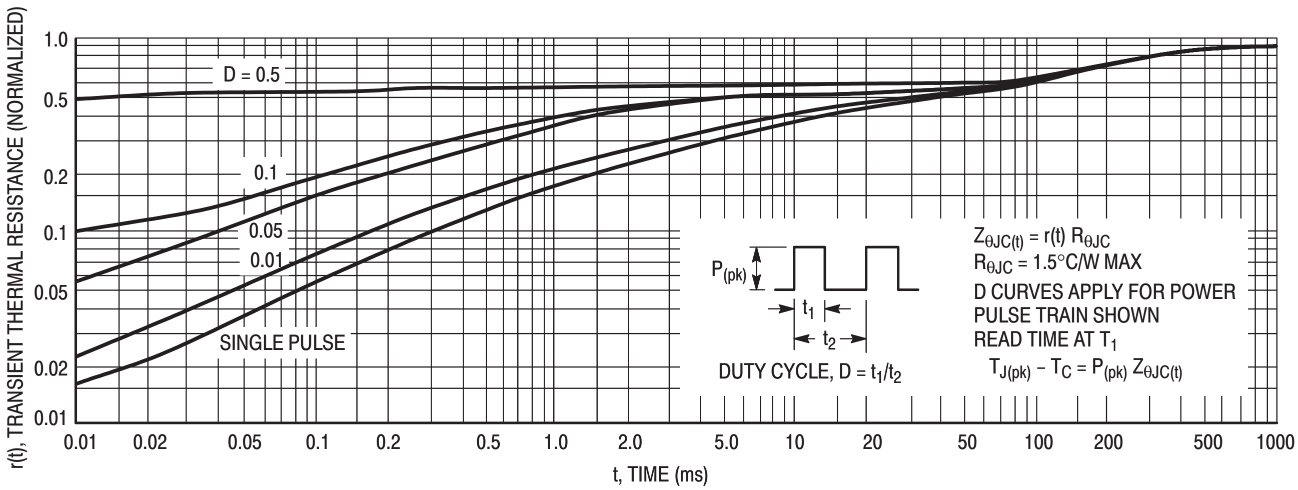


Figure 16. Thermal Response

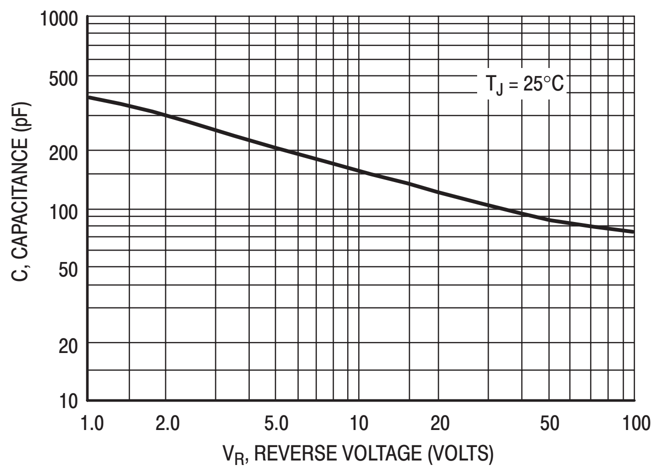


Figure 17. Typical Capacitance

MUR2020R

Preferred Device

SWITCHMODE™ Ultrafast Power Rectifier

. . . designed for use in negative switching power supplies, inverters and as free wheeling diode. Also, used in conjunction with a standard cathode dual Ultrafast Rectifier, makes a single phase full–wave bridge. These state–of–the–art devices have the following features:

- Reverse Polarity Rectifier
- Ultrafast 95 Nanosecond Reverse Recovery Times
- Exhibits Soft Recovery Characteristics
- High Temperature Glass Passivated Junction
- Low Leakage Specified @ 150°C Case Temperature
- Current Derating @ Case Temperature
- Epoxy Meets UL94, V_O @ 1/8″

Mechanical Characteristics:
- Case: Epoxy, Molded
- Weight: 1.9 grams (approximately)
- Finish: All External Surfaces Corrosion Resistant and Terminal Leads are Readily Solderable
- Lead Temperature for Soldering Purposes: 260°C Max. for 10 Seconds
- Shipped 50 units per plastic tube
- Marking: U2020R

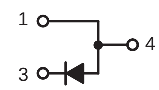
MAXIMUM RATINGS (Per Leg)

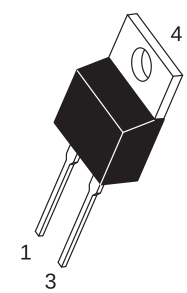
Rating	Symbol	Value	Unit
Peak Repetitive Reverse Voltage Working Peak Reverse Voltage DC Blocking Voltage	V_{RRM} V_{RWM} V_R	200	Volts
Average Rectified Forward Voltage, (Rated V_R), T_C = 125°C	$I_{F(AV)}$	20	Amps
Peak Repetitive Forward Current (Rated V_R), T_C = 125°C	I_{FRM}	40	Amps
Nonrepetitive Peak Surge Current (Surge applied at rated load conditions halfwave, single phase, 60 Hz)	I_{FSM}	250	Amps
Operating Junction Temperature and Storage Temperature Range	T_J, T_{stg}	–65 to +175	°C

ON Semiconductor™

http://onsemi.com

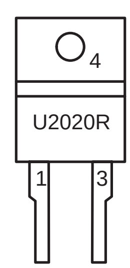
ULTRAFAST RECTIFIER
20 AMPERES
200 VOLTS





TO–220AC
CASE 221B
PLASTIC

MARKING DIAGRAM



ORDERING INFORMATION

Device	Package	Shipping
MUR2020R	TO–220AC	50 Units/Rail

Preferred devices are recommended choices for future use and best overall value.

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THERMAL CHARACTERISTICS (Per Leg)

Characteristic	Symbol	Value	Unit
Thermal Resistance – Junction to Case	$R_{\theta JC}$	2.0	°C/W

ELECTRICAL CHARACTERISTICS (Per Leg)

Characteristic	Symbol	Value	Unit
Maximum Instantaneous Forward Voltage (Note 1.)	V_F		Volts
(I_F = 20 Amps, T_C = 25°C)		1.1	
(I_F = 20 Amps, T_C = 150°C)		1.0	
Maximum Instantaneous Reverse Current (Note 1.)	I_R		
(Rated dc Voltage, T_C = 25°C)		50	µA
(Rated dc Voltage, T_C = 150°C)		1	mA
Maximum Reverse Recovery Time	t_{rr}		ns
(I_F = 1.0 Amp, di/dt = 50 Amps/µs)		95	
(I_F = 1.0 Amp, di/dt = 100 Amps/µs)		75	

1. Pulse Test: Pulse Width = 5.0 ms, Duty Cycle ≤ 10%.

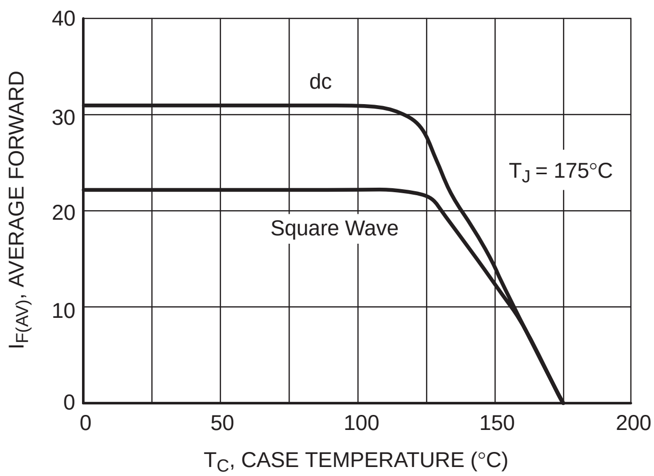

Figure 7. Current Derating

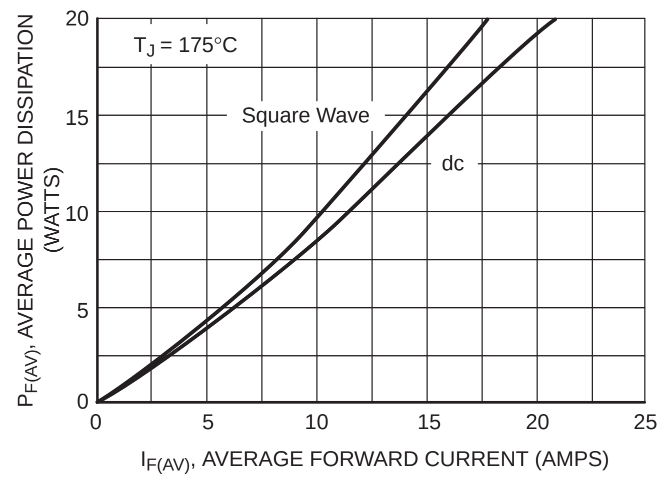

Figure 8. Power Dissipation

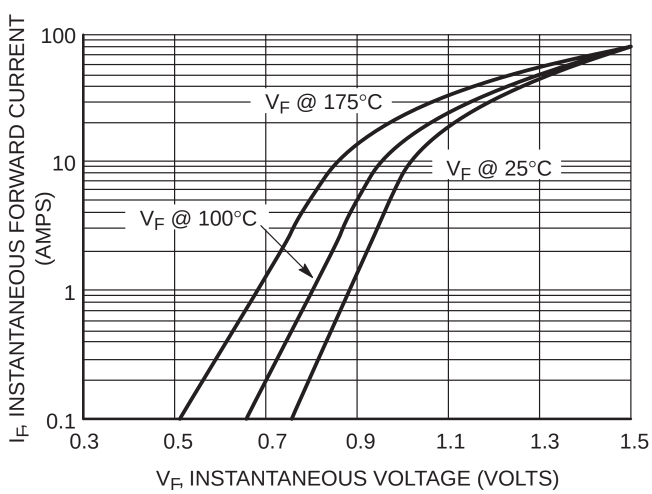

Figure 9. Maximum Forward Voltage

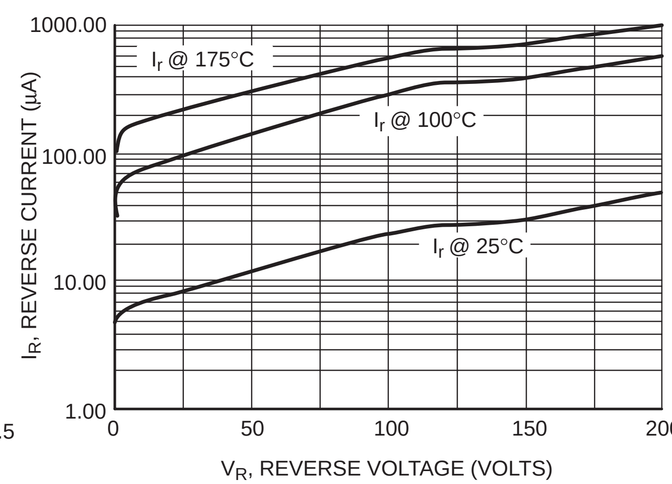

Figure 10. Maximum Reverse Current

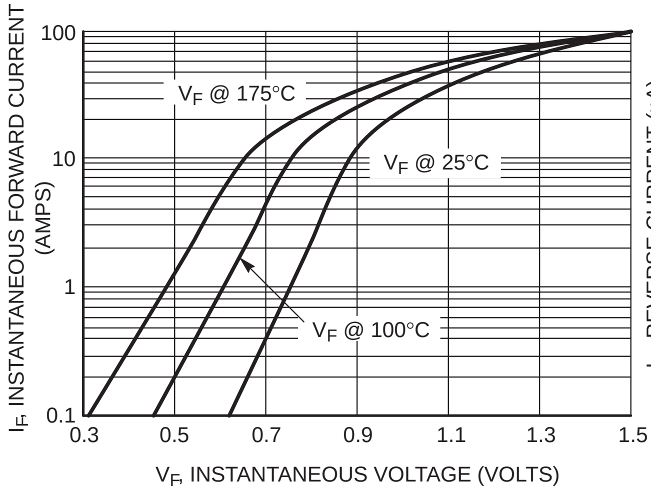

Figure 11. Typical Forward Voltage

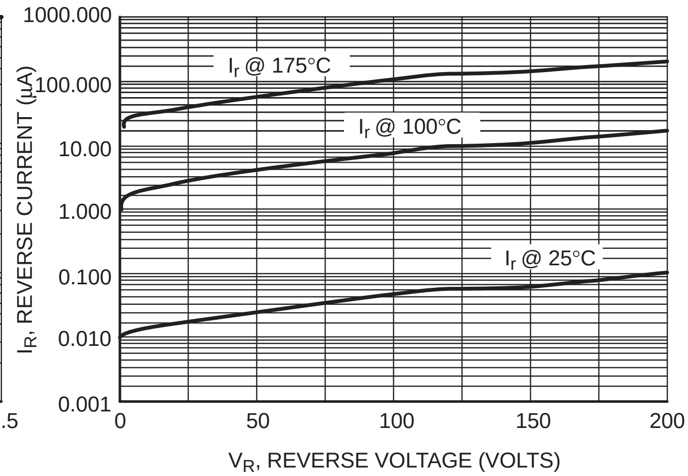

Figure 12. Typical Reverse Current

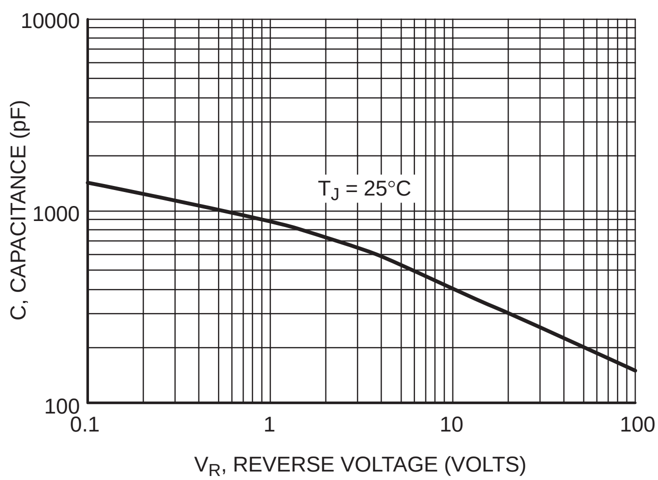

Figure 14. Maximum Capacitance

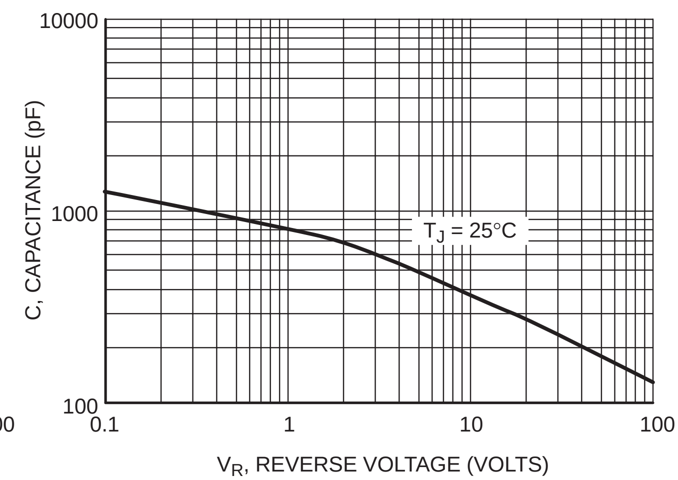

Figure 15. Typical Capacitance

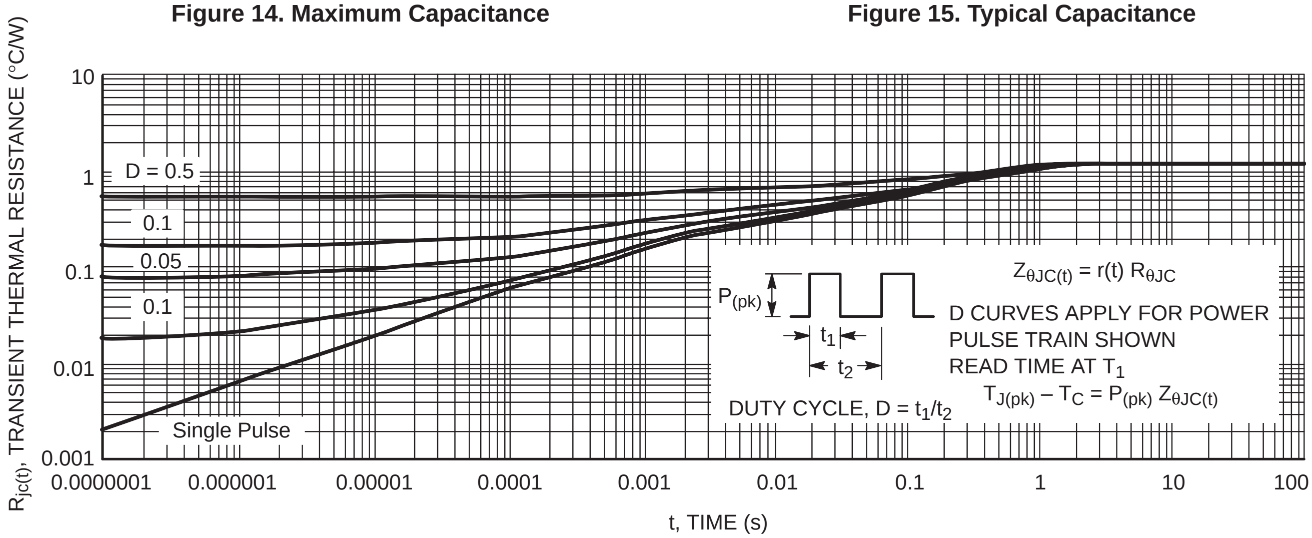

Figure 13. Thermal Response

MUR1610CT, MUR1615CT, MUR1620CT, MUR1640CT, MUR1660CT

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SWITCHMODE™ Power Rectifiers

. . . designed for use in switching power supplies, inverters and as free wheeling diodes, these state–of–the–art devices have the following features:

- Ultrafast 35 and 60 Nanosecond Recovery Times
- 175°C Operating Junction Temperature
- Popular TO–220 Package
- Epoxy Meets UL94, V_O @ 1/8″
- High Temperature Glass Passivated Junction
- High Voltage Capability to 600 Volts
- Low Leakage Specified @ 150°C Case Temperature
- Current Derating @ Both Case and Ambient Temperatures

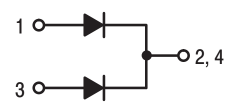
Mechanical Characteristics:

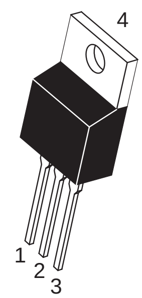
- Case: Epoxy, Molded
- Weight: 1.9 grams (approximately)
- Finish: All External Surfaces Corrosion Resistant and Terminal Leads are Readily Solderable
- Lead Temperature for Soldering Purposes: 260°C Max. for 10 Seconds
- Shipped 50 units per plastic tube
- Marking: U1610, U1615, U1620, U1640, U1660

MAXIMUM RATINGS

Please See the Table on the Following Page

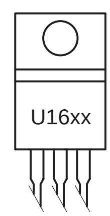
ULTRAFAST RECTIFIERS
8.0 AMPERES
100–600 VOLTS





TO–220AB
CASE 221A
PLASTIC

MARKING DIAGRAM



U16xx = Device Code
xx = 10, 15, 20, 40 or 60

ORDERING INFORMATION

Device	Package	Shipping
MUR1610CT	TO–220	50 Units/Rail
MUR1615CT	TO–220	50 Units/Rail
MUR1620CT	TO–220	50 Units/Rail
MUR1640CT	TO–220	50 Units/Rail
MUR1660CT	TO–220	50 Units/Rail

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MAXIMUM RATINGS

Rating	Symbol	MUR16					Unit
		10CT	15CT	20CT	40CT	60CT	
Peak Repetitive Reverse Voltage Working Peak Reverse Voltage DC Blocking Voltage	V_{RRM} V_{RWM} V_R	100	150	200	400	600	Volts
Average Rectified Forward Current — Per Leg Total Device, (Rated V_R), T_C = 150°C — Total Device	$I_{F(AV)}$	8.0 16					Amps
Peak Rectified Forward Current — Per Diode Leg (Rated V_R, Square Wave, 20 kHz), T_C = 150°C	I_{FM}	16					Amps
Nonrepetitive Peak Surge Current (Surge applied at rated load conditions halfwave, single phase, 60 Hz)	I_{FSM}	100					Amps
Operating Junction Temperature and Storage Temperature	T_J, T_{stg}	– 65 to +175					°C

THERMAL CHARACTERISTICS (Per Diode Leg)

Maximum Thermal Resistance, Junction to Case	$R_{\theta JC}$	3.0			2.0		°C/W

ELECTRICAL CHARACTERISTICS (Per Diode Leg)

Maximum Instantaneous Forward Voltage (Note 1.) (i_F = 8.0 Amps, T_C = 150°C) (i_F = 8.0 Amps, T_C = 25°C)	v_F	 0.895 0.975			 1.00 1.30	 1.20 1.50	Volts
Maximum Instantaneous Reverse Current (Note 1.) (Rated dc Voltage, T_C = 150°C) (Rated dc Voltage, T_C = 25°C)	i_R	 250 5.0			 500 10		μA
Maximum Reverse Recovery Time (I_F = 1.0 Amp, di/dt = 50 Amps/μs) (I_F = 0.5 Amp, I_R = 1.0 Amp, I_{REC} = 0.25 Amp)	t_{rr}	 35 25			 60 50		ns

1. Pulse Test: Pulse Width = 300 μs, Duty Cycle ≤ 2.0%

MUR1610CT, MUR1615CT, MUR1620CT

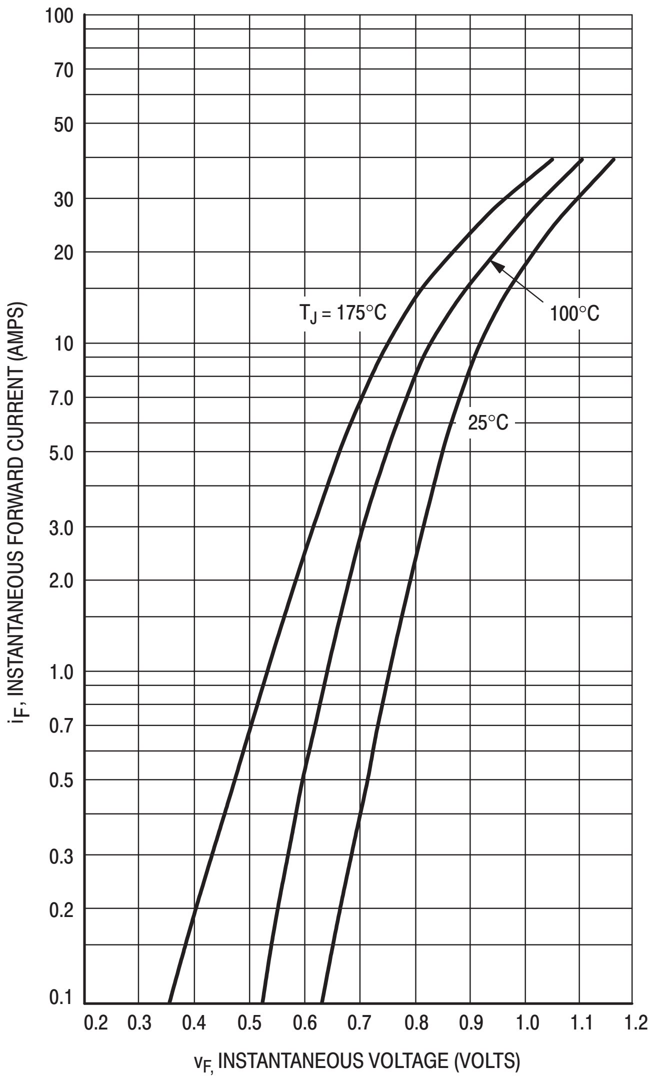

Figure 1. Typical Forward Voltage, Per Leg

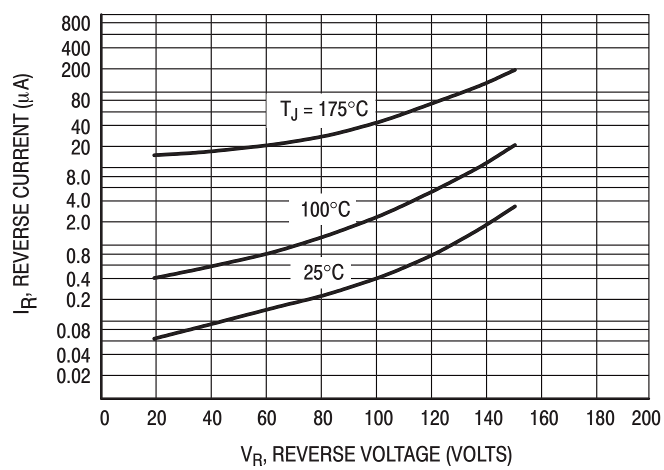

Figure 2. Typical Reverse Current, Per Leg*

* The curves shown are typical for the highest voltage device in the voltage grouping. Typical reverse current for lower voltage selections can be estimated from these same curves if V_R is sufficiently below rated V_R.

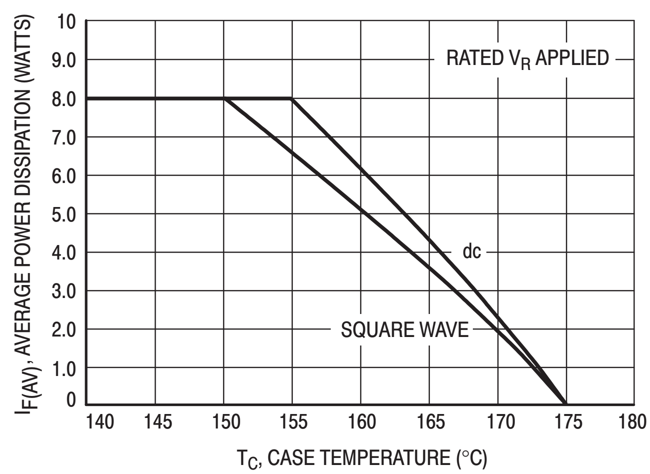

Figure 3. Current Derating, Case, Per Leg

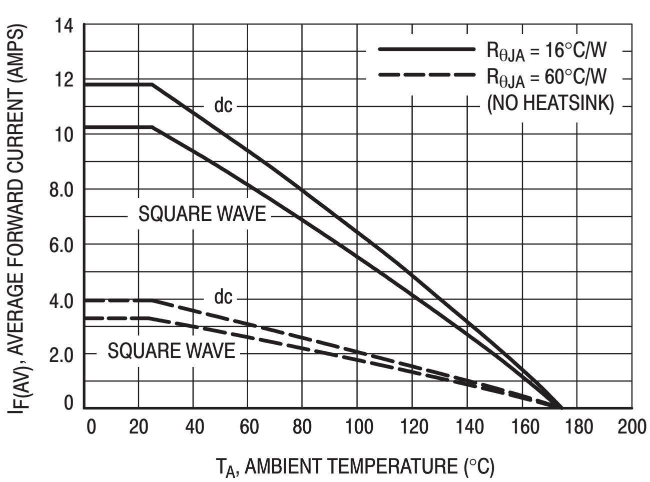

Figure 4. Current Derating, Ambient, Per Leg

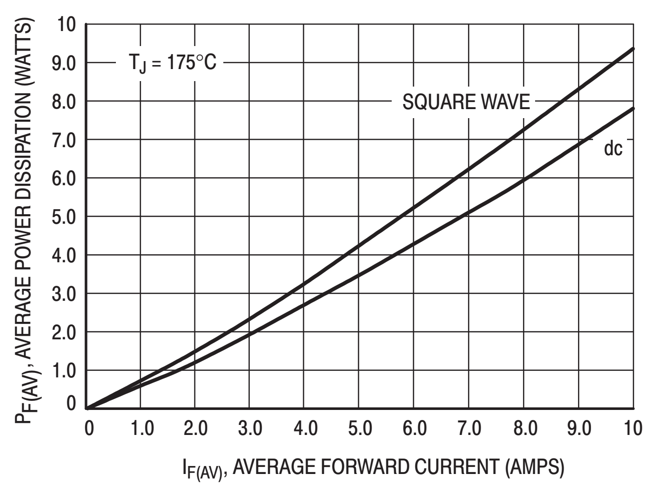

Figure 5. Power Dissipation, Per Leg

MUR1640CT

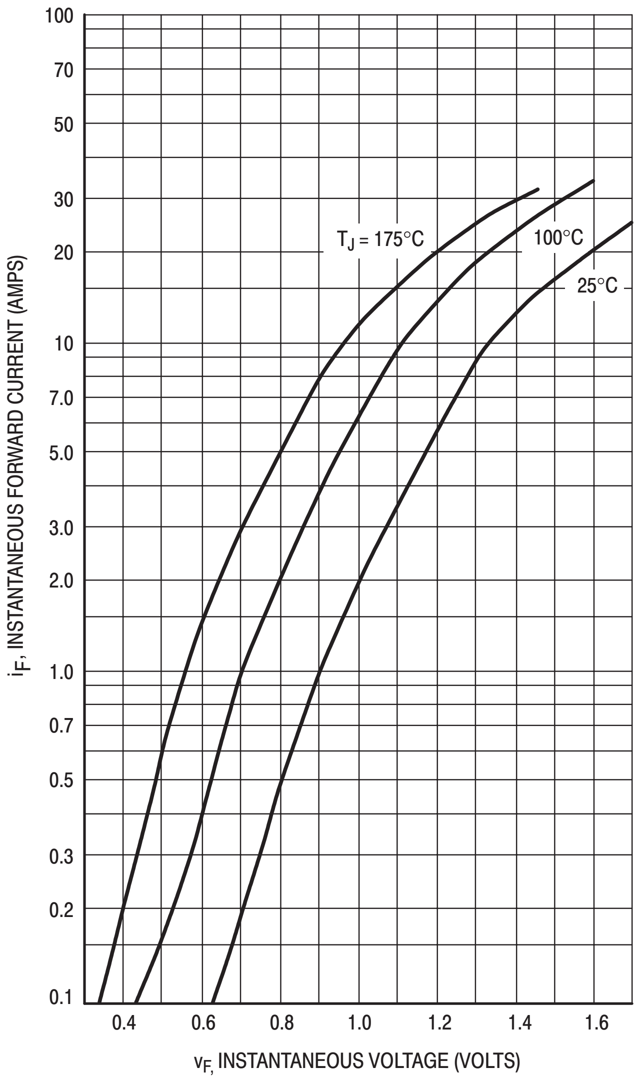

Figure 6. Typical Forward Voltage, Per Leg

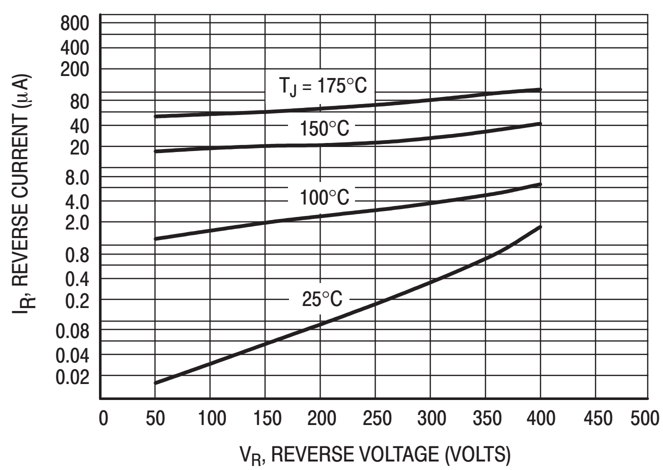

Figure 7. Typical Reverse Current, Per Leg*

* The curves shown are typical for the highest voltage device in the voltage grouping. Typical reverse current for lower voltage selections can be estimated from these curves if V_R is sufficiently below rated V_R.

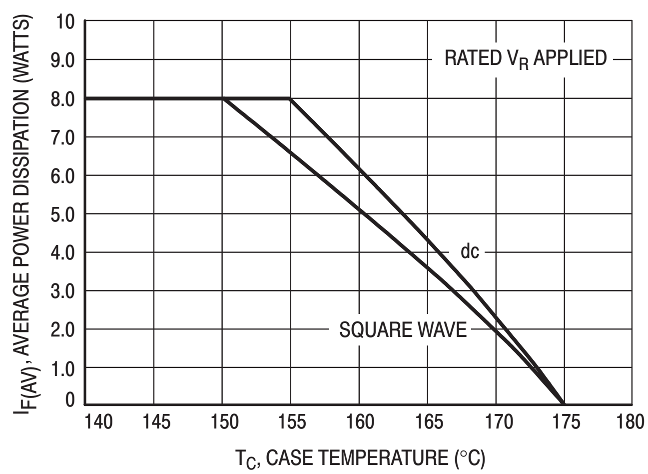

Figure 8. Current Derating, Case, Per Leg

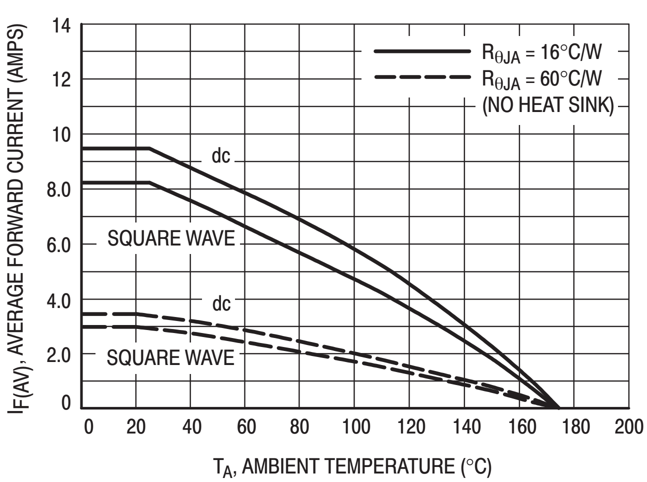

Figure 9. Current Derating, Ambient, Per Leg

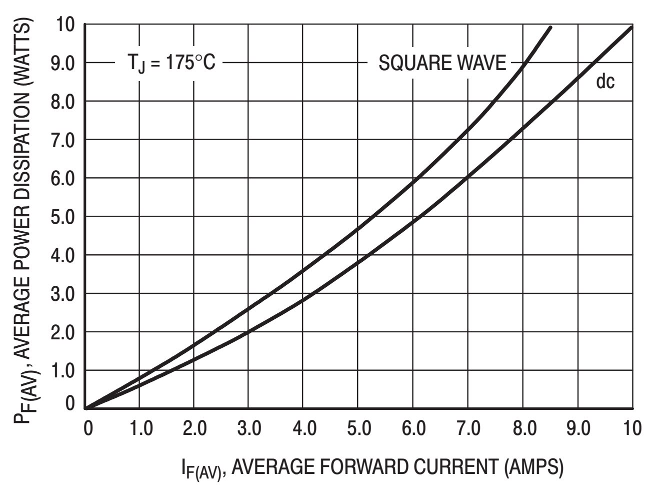

Figure 10. Power Dissipation, Per Leg

MUR1660CT

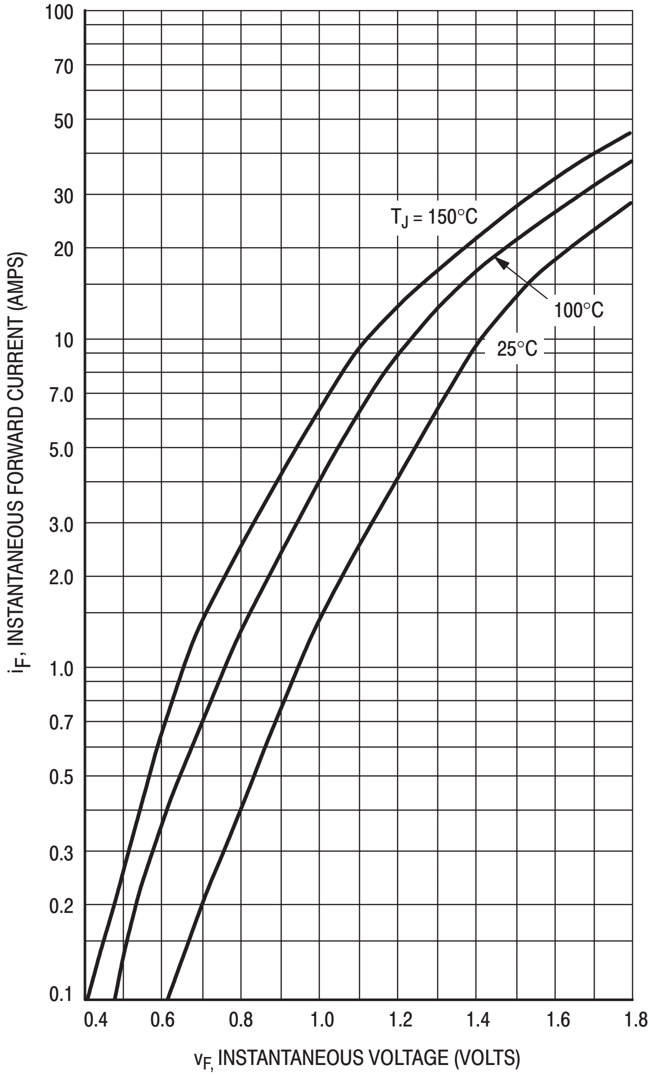

Figure 11. Typical Forward Voltage, Per Leg

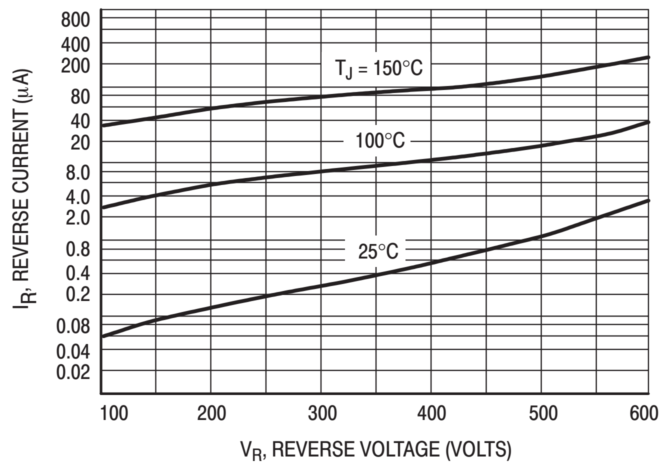

Figure 12. Typical Reverse Current, Per Leg*

* The curves shown are typical for the highest voltage device in the voltage grouping. Typical reverse current for lower voltage selections can be estimated from these same curves if V_R is sufficiently below rated V_R.

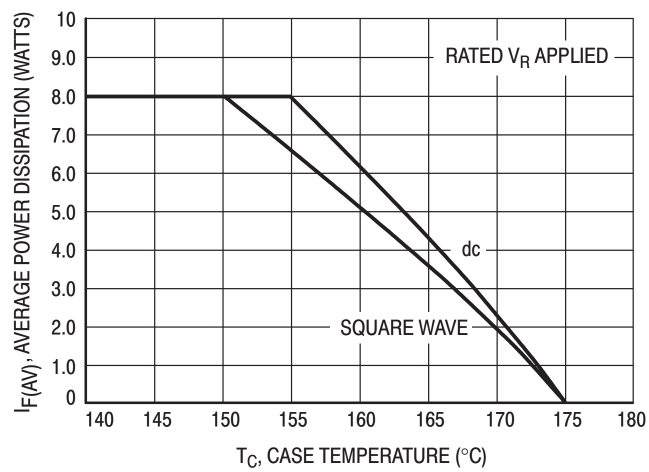

Figure 13. Current Derating, Case, Per Leg

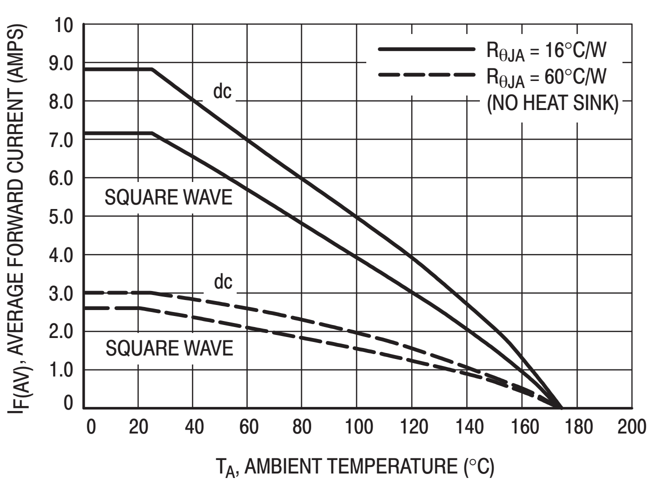

Figure 14. Current Derating, Ambient, Per Leg

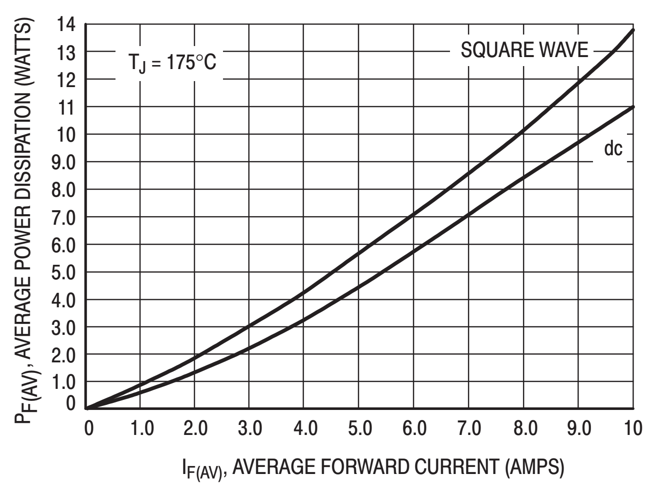

Figure 15. Power Dissipation, Per Leg

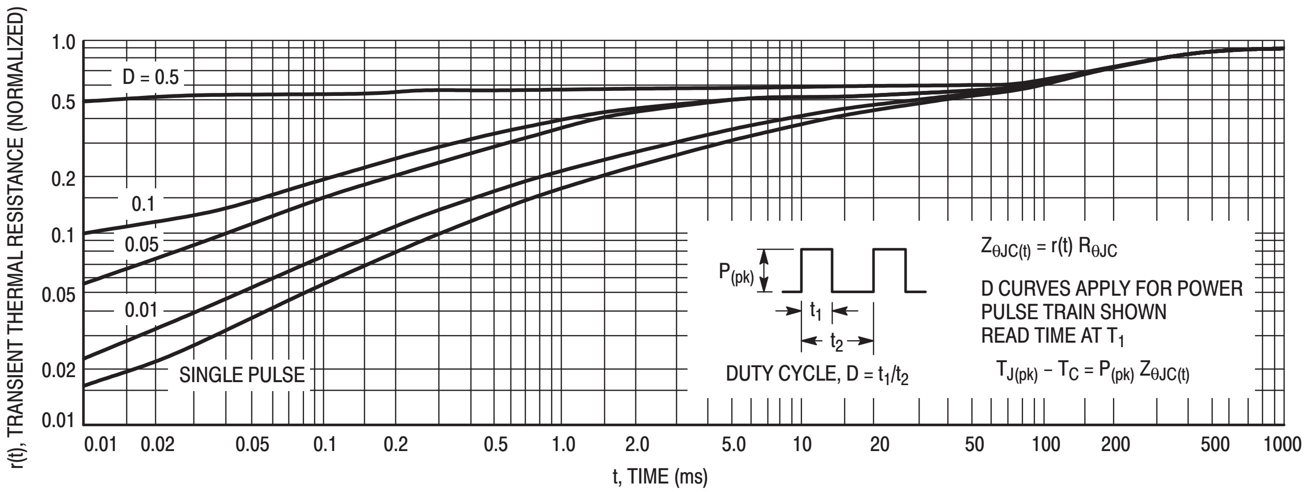

Figure 16. Thermal Response

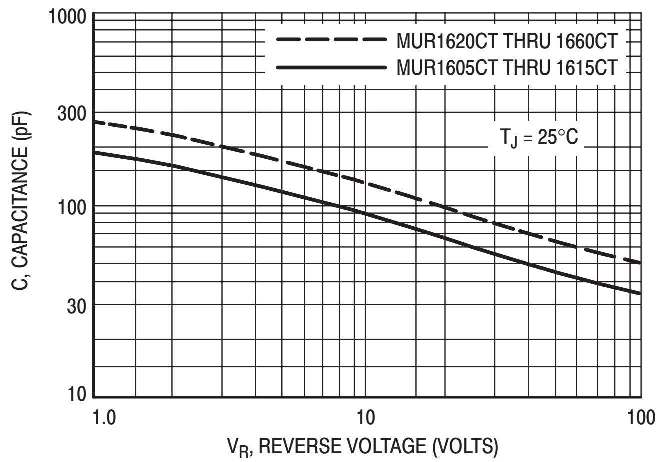

Figure 17. Typical Capacitance, Per Leg

MUR1620CTR

Preferred Device

SWITCHMODE™ Dual Ultrafast Power Rectifier

. . . designed for use in negative switching power supplies, inverters and as free wheeling diodes. Also, used in conjunction with common cathode dual Ultrafast Rectifiers, makes a single phase full–wave bridge. These state–of–the–art devices have the following features:

- Common Anode Dual Rectifier (8.0 A per Leg or 16 A per Package)
- Ultrafast 35 Nanosecond Reverse Recovery Times
- Exhibits Soft Recovery Characteristics
- High Temperature Glass Passivated Junction
- Low Leakage Specified @ 150°C Case Temperature
- Current Derating @ Both Case and Ambient Temperatures
- Epoxy Meets UL94, V_O @ 1/8″
- Complement to MUR1620CT Common Cathode Device

Mechanical Characteristics:

- Case: Epoxy, Molded
- Weight: 1.9 grams (approximately)
- Finish: All External Surfaces Corrosion Resistant and Terminal Leads are Readily Solderable
- Lead Temperature for Soldering Purposes: 260°C Max. for 10 Seconds
- Shipped 50 units per plastic tube
- Marking: U1620R

MAXIMUM RATINGS (Per Leg)

Rating	Symbol	Value	Unit
Peak Repetitive Reverse Voltage Working Peak Reverse Voltage DC Blocking Voltage	V_{RRM} V_{RWM} V_R	200	V
Average Rectified Forward Voltage (Rated V_R, T_C = 160°C) Per Leg Per Total Device	$I_{F(AV)}$	 8.0 16	A
Peak Repetitive Surge Current (Rated V_R, Square Wave, 20 kHz, T_C = 140°C) Per Diode	I_{FM}	16	A
Non–Repetitive Peak Surge Current (Surge Applied at Rated Load Conditions Halfwave, Single Phase, 60 Hz)	I_{FSM}	100	A
Operating Junction and Storage Temperature Range	T_J, T_{stg}	–65 to +175	°C

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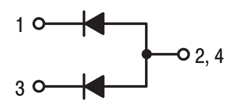
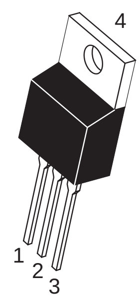
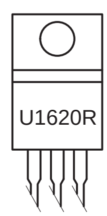
ULTRAFAST RECTIFIER 16 AMPERES 200 VOLTS





TO–220AB CASE 221A STYLE 7

MARKING DIAGRAM



U1620R = Device Code

ORDERING INFORMATION

Device	Package	Shipping
MUR1620CTR	TO–220	50 Units/Rail

Preferred devices are recommended choices for future use and best overall value.

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THERMAL CHARACTERISTICS (Per Leg)

Rating	Symbol	Value	Unit
Thermal Resistance — Junction to Case	$R_{\theta JC}$	2.0	°C/W

ELECTRICAL CHARACTERISTICS (Per Leg)

Maximum Instantaneous Forward Voltage (Note 1.) (i_F = 8.0 Amps, T_C = 25°C) (i_F = 8.0 Amps, T_C = 150°C)	v_F	 1.2 1.1	Volts
Maximum Instantaneous Reverse Current (Note 1.) (Rated dc Voltage, T_C = 25°C) (Rated dc Voltage, T_C = 150°C)	i_R	 5.0 500	µA
Maximum Reverse Recovery Time (I_F = 1.0 Amp, di/dt = 50 Amps/µs) (I_F = 0.5 Amp, di/dt = 100 Amps/µs)	t_{rr}	 85 35	ns

1. Pulse Test: Pulse Width = 5.0 ms, Duty Cycle ≤ 10%.

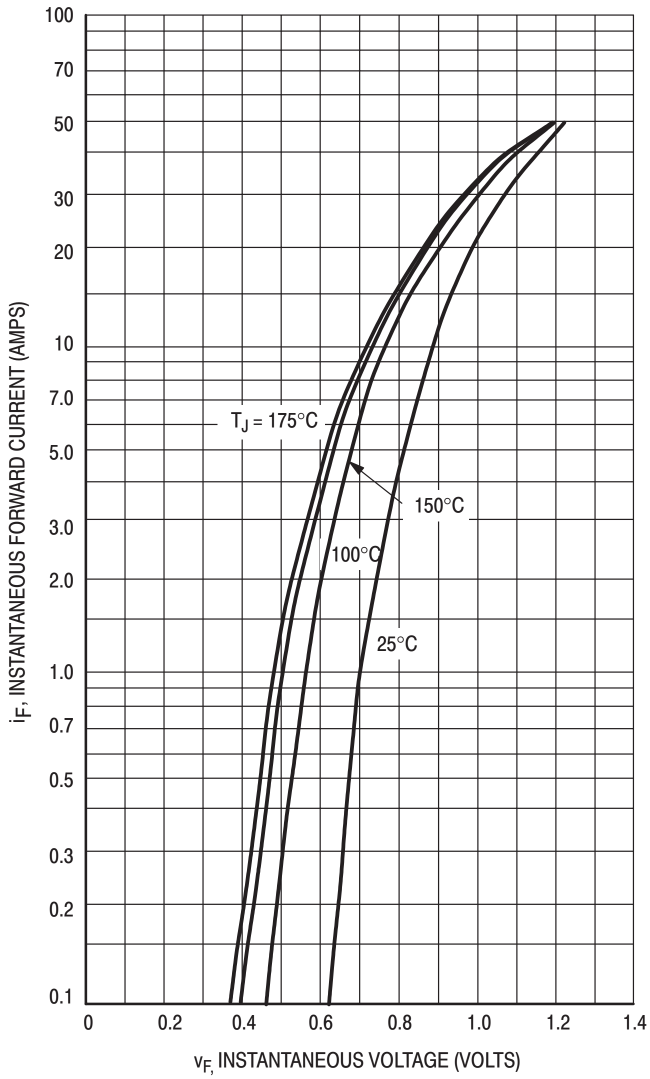

Figure 1. Typical Forward Voltage (Per Leg)

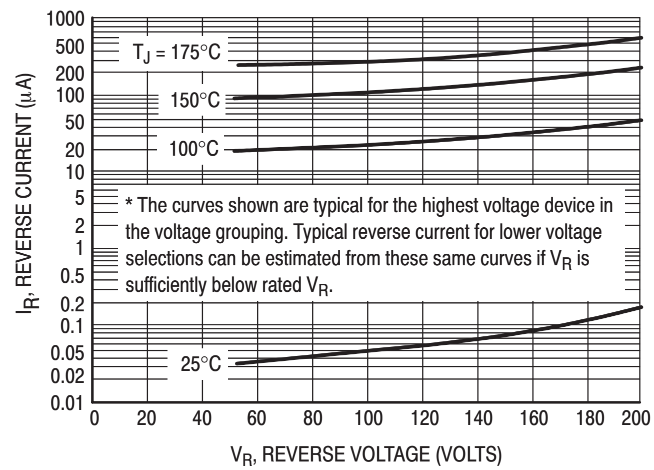

Figure 2. Typical Reverse Current* (Per Leg)

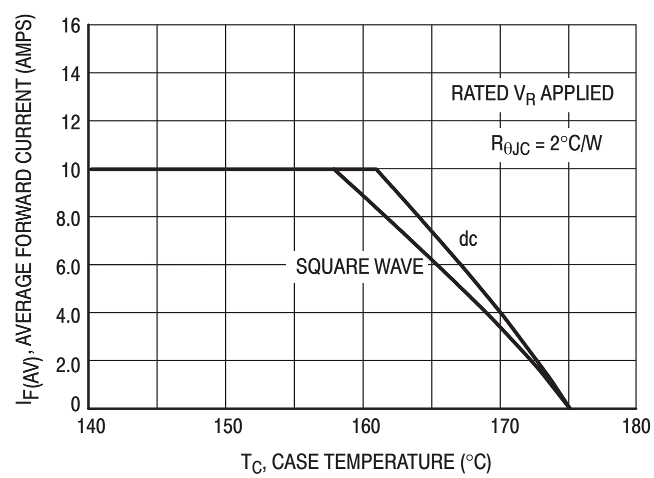

Figure 3. Current Derating, Case (Per Leg)

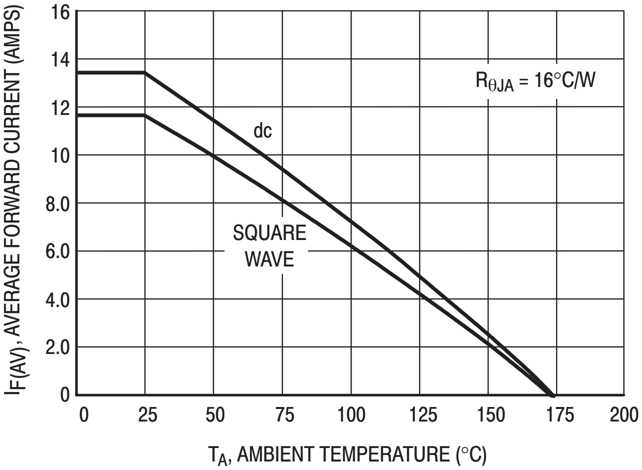

Figure 4. Current Derating, Ambient (Per Leg)

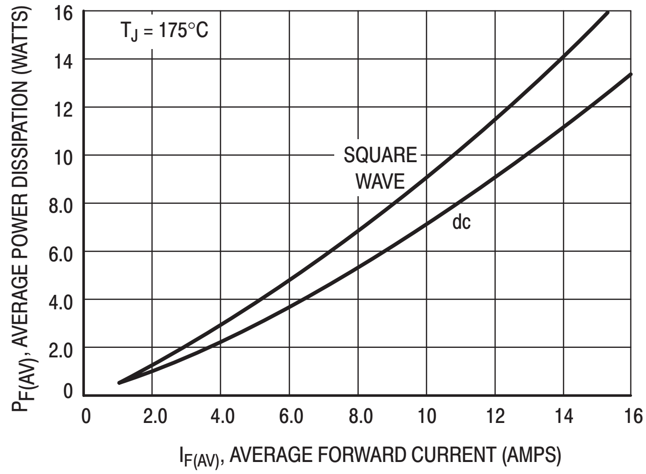

Figure 5. Power Dissipation (Per Leg)

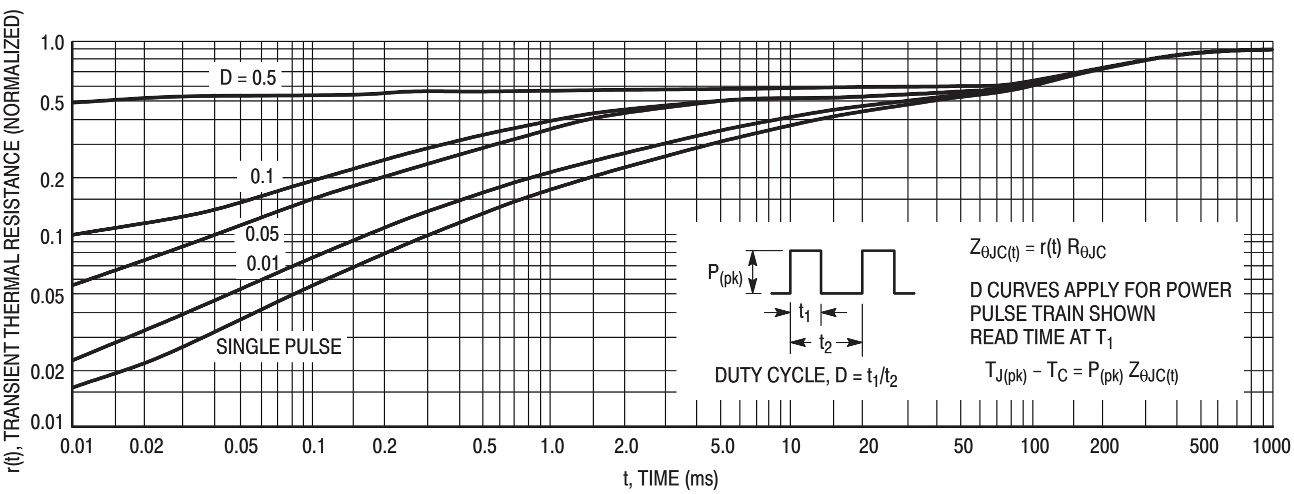

Figure 6. Thermal Response

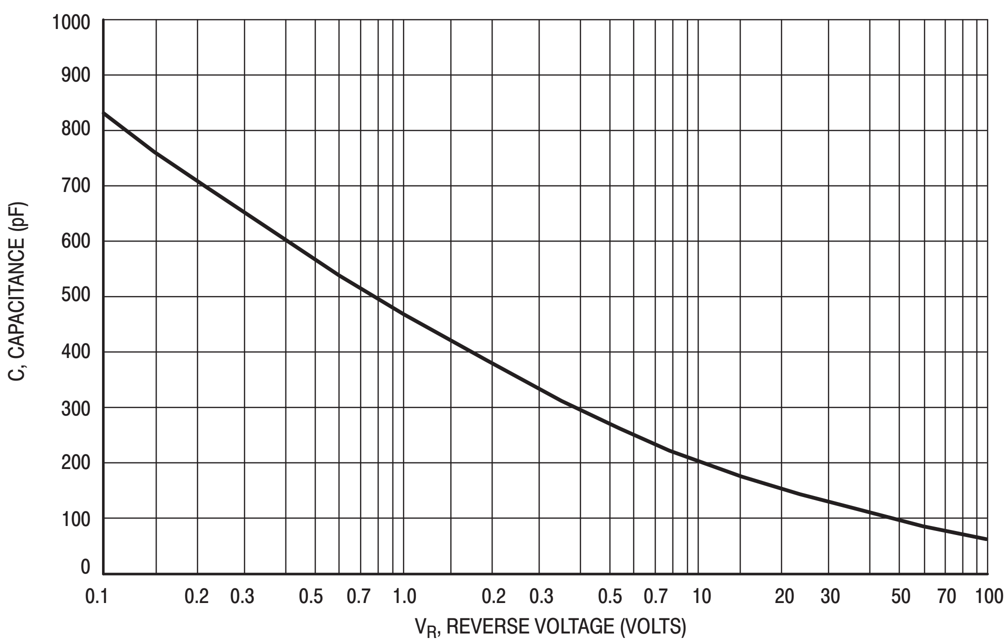

Figure 7. Typical Capacitance (Per Leg)

MURF1620CT

Preferred Device

SWITCHMODE™ Power Rectifier

Designed for use in switching power supplies, inverters and as free wheeling diodes, these state–of–the–art devices have the following features:

- Ultrafast 35 Nanosecond Recovery Times
- 150°C Operating Junction Temperature
- Epoxy Meets UL94, V_O @ 1/8″
- High Temperature Glass Passivated Junction
- Low Leakage Specified @ 150°C Case Temperature
- Current Derating @ Both Case and Ambient Temperatures
- Electrically Isolated. No Isolation Hardware Required.
- UL Recognized File #E69369 (Note 1.)

Mechanical Characteristics

- Case: Epoxy, Molded
- Weight: 1.9 grams (approximately)
- Finish: All External Surfaces Corrosion Resistant and Terminal Leads are Readily Solderable
- Lead Temperature for Soldering Purposes: 260°C Max. for 10 Seconds
- Shipped 50 units per plastic tube
- Marking: U1620

MAXIMUM RATINGS

Please See the Table on the Following Page

1. UL Recognized mounting method is per Figure 4.

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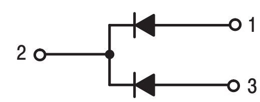
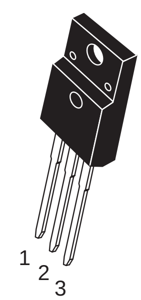
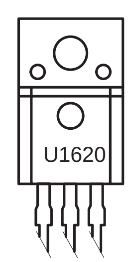
ULTRAFAST RECTIFIER 16 AMPERES 200 VOLTS





ISOLATED TO–220
CASE 221D
STYLE 3

MARKING DIAGRAM



U1620 = Device Code

ORDERING INFORMATION

Device	Package	Shipping
MURF1620CT	TO–220	50 Units/Rail

Preferred devices are recommended choices for future use and best overall value.

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MAXIMUM RATINGS (Per Leg)

Rating	Symbol	Value	Unit
Peak Repetitive Reverse Voltage Working Peak Reverse Voltage DC Blocking Voltage	V_{RRM} V_{RWM} V_R	200	Volts
Average Rectified Forward Current Total Device, (Rated V_R), T_C = 150°C Total Device	$I_{F(AV)}$	8 16	Amps
Peak Repetitive Forward Current (Rated V_R, Square Wave, 20 kHz), T_C = 150°C	I_{FM}	16	Amps
Non–repetitive Peak Surge Current (Surge applied at rated load conditions halfwave, single phase, 60 Hz)	I_{FSM}	100	Amps
Operating Junction and Storage Temperature	T_J, T_{stg}	– 65 to +150	°C
RMS Isolation Voltage (t = 1 second, R.H. ≤ 30%, T_A = 25°C) (Note 3.) Per Figure 3. Per Figure 4. (Note 2.) Per Figure 5.	V_{iso1} V_{iso2} V_{iso3}	4500 3500 1500	Volts

THERMAL CHARACTERISTICS (Per Leg)

Maximum Thermal Resistance, Junction to Case	$R_{\theta JC}$	4.2	°C/W
Lead Temperature for Soldering Purposes: 1/8″ from the Case for 5 seconds	T_L	260	°C

ELECTRICAL CHARACTERISTICS (Per Leg)

Characteristic	Symbol	Value	Unit
Maximum Instantaneous Forward Voltage (Note 4.) (i_F = 8.0 Amp, T_C = 150°C) (i_F = 8.0 Amp, T_C = 25°C)	v_F	 0.895 0.975	Volts
Maximum Instantaneous Reverse Current (Note 4.) (Rated dc Voltage, T_C = 150°C) (Rated dc Voltage, T_C = 25°C)	i_R	 250 5.0	µA
Maximum Reverse Recovery Time (I_F = 1.0 Amp, di/dt = 50 Amp/µs) (I_F = 0.5 Amp, i_R = 1.0 Amp, I_{REC} = 0.25 Amp)	t_{rr}	 35 25	ns

2. UL Recognized mounting method is per Figure 4.
3. Proper strike and creepage distance must be provided.
4. Pulse Test: Pulse Width = 300 µs, Duty Cycle ≤ 2.0%.

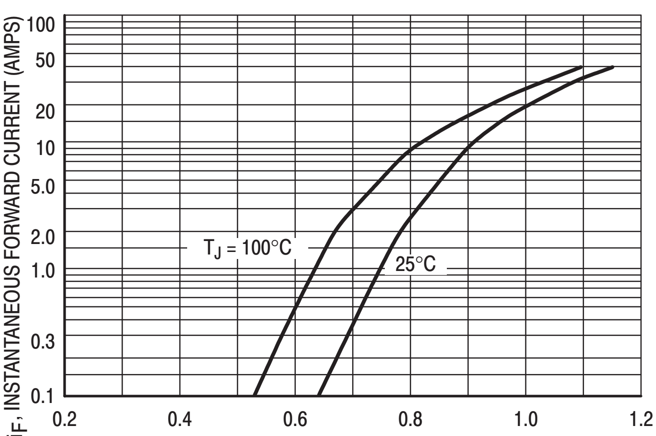


Figure 1. Typical Forward Voltage, Per Leg

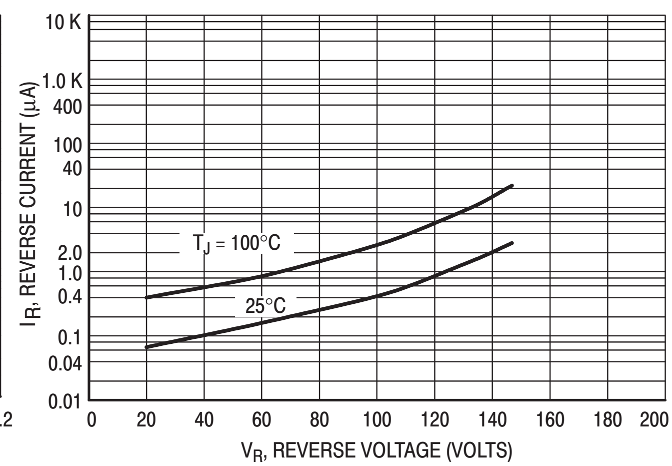


Figure 2. Typical Reverse Current, Per Leg*

TEST CONDITIONS FOR ISOLATION TESTS*

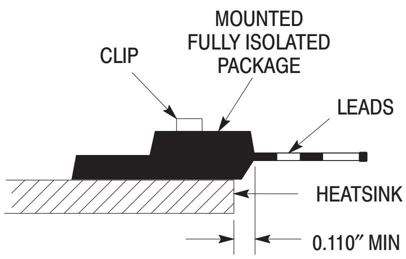


Figure 3. Clip Mounting Position for Isolation Test Number 1

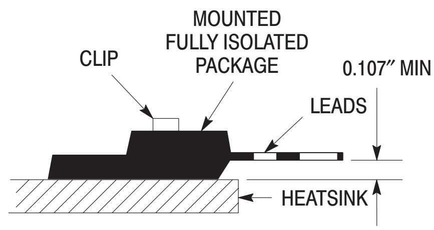


Figure 4. Clip Mounting Position for Isolation Test Number 2

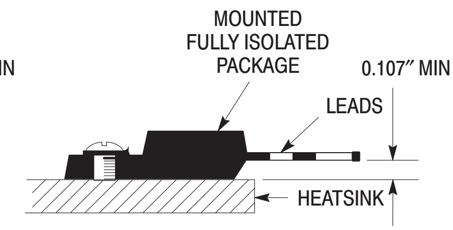
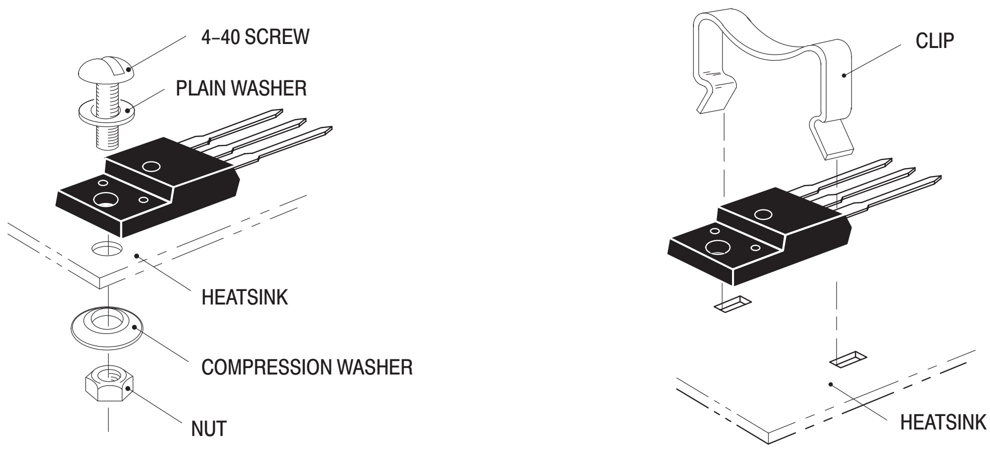


Figure 5. Screw Mounting Position for Isolation Test Number 3

* Measurement made between leads and heatsink with all leads shorted together.

MOUNTING INFORMATION**



6a. Screw–Mounted **6b. Clip–Mounted**

Figure 6. Typical Mounting Techniques

Laboratory tests on a limited number of samples indicate, when using the screw and compression washer mounting technique, a screw torque of 6 to 8 in · lbs is sufficient to provide maximum power dissipation capability. The compression washer helps to maintain a constant pressure on the package over time and during large temperature excursions.

Destructive laboratory tests show that using a hex head 4–40 screw, without washers, and applying a torque in excess of 20 in · lbs will cause the plastic to crack around the mounting hole, resulting in a loss of isolation capability.

Additional tests on slotted 4–40 screws indicate that the screw slot fails between 15 to 20 in · lbs without adversely affecting the package. However, in order to positively ensure the package integrity of the fully isolated device, ON Semiconductor does not recommend exceeding 10 in · lbs of mounting torque under any mounting conditions.

**For more information about mounting power semiconductors see Application Note AN1040.

MURHF860CT

Preferred Device

SWITCHMODE™ Power Rectifier

. . . designed for use in switching power supplies, inverters and as free wheeling diodes, these state-of-the-art devices have the following features:

- Ultrafast 35 Nanosecond Recovery Times
- 175°C Operating Junction Temperature
- Electrically Isolated. No Isolation Hardware Required.
- Epoxy Meets UL94, V_O @ 1/8″
- High Temperature Glass Passivated Junction
- High Voltage Capability to 600 Volts
- Low Leakage Specified @ 150°C Case Temperature

Mechanical Characteristics

- Case: Epoxy, Molded
- Weight: 1.9 grams (approximately)
- Finish: All External Surfaces Corrosion Resistant and Terminal Leads are Readily Solderable
- Lead Temperature for Soldering Purposes: 260°C Max. for 10 Seconds
- Shipped 50 units per plastic tube
- Marking: UH860

MAXIMUM RATINGS (Per Leg)

Rating	Symbol	Value	Unit
Peak Repetitive Reverse Voltage Working Peak Reverse Voltage DC Blocking Voltage	V_{RRM} V_{RWM} V_R	600	V
Average Rectified Forward Current (Rated V_R, T_C = 120°C) Total Device	$I_{F(AV)}$	4.0 8.0	A
Peak Repetitive Forward Current (Rated V_R, Square Wave, 20 kHz, T_C = 120°C)	I_{FM}	16	A
Non–Repetitive Peak Surge Current (Surge Applied at Rated Load Conditions Halfwave, Single Phase, 60 Hz)	I_{FSM}	100	A
Operating Junction and Storage Temperature Range	T_J, T_{stg}	–65 to +150	°C

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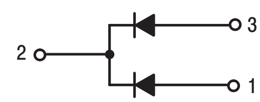
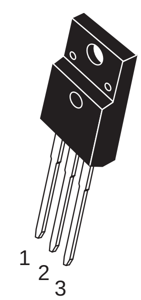
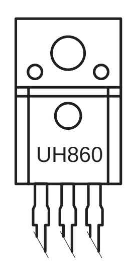
ULTRAFAST RECTIFIER 8.0 AMPERES 600 VOLTS





ISOLATED TO–220
CASE 221D
STYLE 4

MARKING DIAGRAM



UH860 = Device Code

ORDERING INFORMATION

Device	Package	Shipping
MURHF860CT	TO–220	50 Units/Rail

Preferred devices are recommended choices for future use and best overall value.

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THERMAL CHARACTERISTICS (Per Leg)

Characteristic	Symbol	Value	Unit
Maximum Thermal Resistance, Junction to Case	$R_{\theta JC}$	4.1	°C/W

ELECTRICAL CHARACTERISTICS (Per Leg)

Maximum Instantaneous Forward Voltage (Note 1.) (i_F = 4.0 Amps, T_C = 150°C) (i_F = 4.0 Amps, T_C = 25°C)	v_F	 2.5 2.8	Volts
Maximum Instantaneous Reverse Current (Note 1.) (Rated dc Voltage, T_C = 150°C) (Rated dc Voltage, T_C = 25°C)	i_R	 500 10	μA
Maximum Reverse Recovery Time (I_F = 1.0 Amp, di/dt = 50 Amps/μs)	t_{rr}	35	ns

1. Pulse Test: Pulse Width = 300 μs, Duty Cycle ≤ 2.0%

MURF1660CT

Preferred Device

SWITCHMODE™ Power Rectifier

Designed for use in switching power supplies, inverters and as free wheeling diodes, these state–of–the–art devices have the following features:

- Ultrafast 60 Nanosecond Recovery Times
- 150°C Operating Junction Temperature
- Epoxy Meets UL94, V_O @ 1/8″
- High Temperature Glass Passivated Junction
- Low Leakage Specified @ 150°C Case Temperature
- Current Derating @ Both Case and Ambient Temperatures
- Electrically Isolated. No Isolation Hardware Required.
- UL Recognized File #E69369 (Note 1.)

Mechanical Characteristics

- Case: Epoxy, Molded
- Weight: 1.9 grams (approximately)
- Finish: All External Surfaces Corrosion Resistant and Terminal Leads are Readily Solderable
- Lead Temperature for Soldering Purposes: 260°C Max. for 10 Seconds
- Shipped 50 units per plastic tube
- Marking: U1660

MAXIMUM RATINGS

Please See the Table on the Following Page

1. UL Recognized mounting method is per Figure 4.

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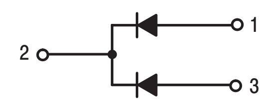
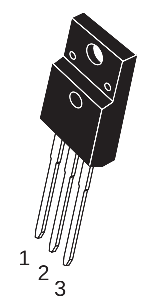
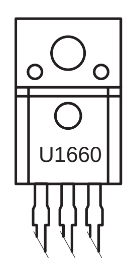
ULTRAFAST RECTIFIER 16 AMPERES 600 VOLTS





ISOLATED TO–220
CASE 221D
STYLE 3

MARKING DIAGRAM



U1660 = Device Code

ORDERING INFORMATION

Device	Package	Shipping
MURF1660CT	TO–220	50 Units/Rail

Preferred devices are recommended choices for future use and best overall value.

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MAXIMUM RATINGS (Per Leg)

Rating	Symbol	Value	Unit
Peak Repetitive Reverse Voltage Working Peak Reverse Voltage DC Blocking Voltage	V_{RRM} V_{RWM} V_R	600	Volts
Average Rectified Forward Current Per Diode Total Device, (Rated V_R), T_C = 150°C Per Device	$I_{F(AV)}$	8 16	Amps
Peak Repetitive Forward Current (Rated V_R, Square Wave, 20 kHz), T_C = 150°C	I_{FM}	16	Amps
Non–repetitive Peak Surge Current (Surge applied at rated load conditions halfwave, single phase, 60 Hz)	I_{FSM}	100	Amps
Operating Junction and Storage Temperature	T_J, T_{stg}	– 65 to +150	°C
RMS Isolation Voltage (t = 1 second, R.H. ≤ 30%, T_A = 25°C) (Note 3.) Per Figure 3. Per Figure 4. (Note 2.) Per Figure 5.	V_{iso1} V_{iso2} V_{iso3}	4500 3500 1500	Volts

THERMAL CHARACTERISTICS (Per Leg)

Maximum Thermal Resistance, Junction to Case	$R_{\theta JC}$	3.0	°C/W
Lead Temperature for Soldering Purposes: 1/8″ from Case for 5 Seconds	T_L	260	°C

ELECTRICAL CHARACTERISTICS (Per Leg)

Characteristic	Symbol	Value	Unit
Maximum Instantaneous Forward Voltage (Note 4.) (i_F = 8.0 Amp, T_C = 150°C) (i_F = 8.0 Amp, T_C = 25°C)	v_F	 1.20 1.50	Volts
Maximum Instantaneous Reverse Current (Note 4.) (Rated dc Voltage, T_C = 150°C) (Rated dc Voltage, T_C = 25°C)	i_R	 500 10	µA
Maximum Reverse Recovery Time (I_F = 1.0 Amp, di/dt = 50 Amp/µs) (I_F = 0.5 Amp, i_R = 1.0 Amp, I_{REC} = 0.25 Amp)	t_{rr}	 60 50	ns

2. UL Recognized mounting method is per Figure 4.
3. Proper strike and creepage distance must be provided.
4. Pulse Test: Pulse Width = 300 µs, Duty Cycle ≤ 2.0%.

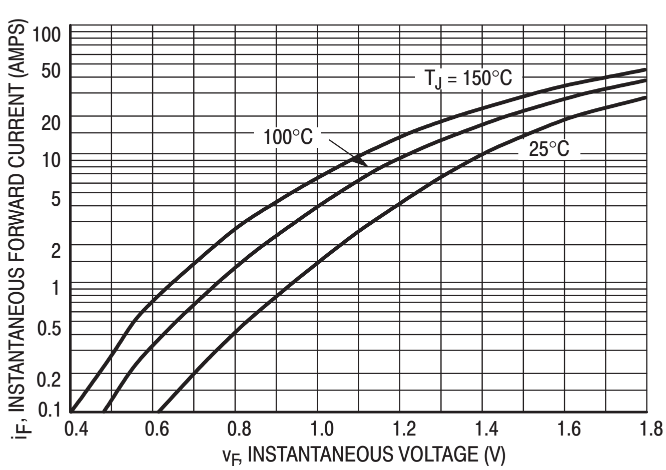


Figure 1. Typical Forward Voltage, Per Leg

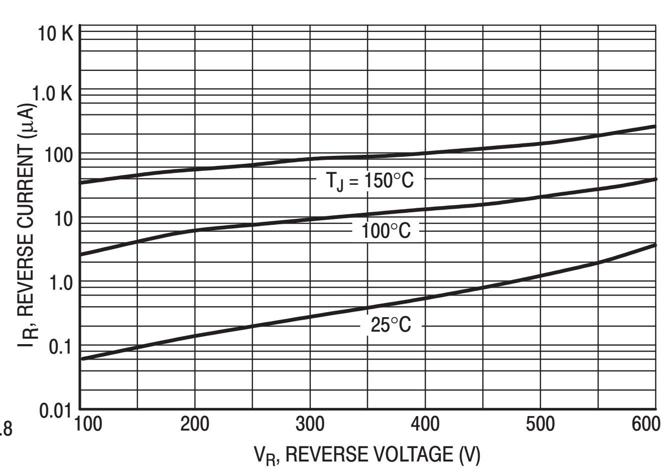


Figure 2. Typical Reverse Current, Per Leg*

TEST CONDITIONS FOR ISOLATION TESTS*

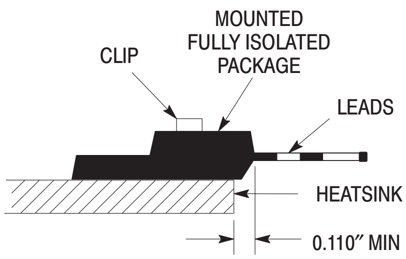


Figure 3. Clip Mounting Position for Isolation Test Number 1

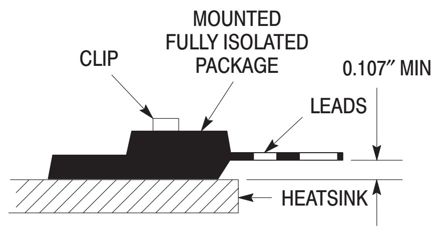


Figure 4. Clip Mounting Position for Isolation Test Number 2

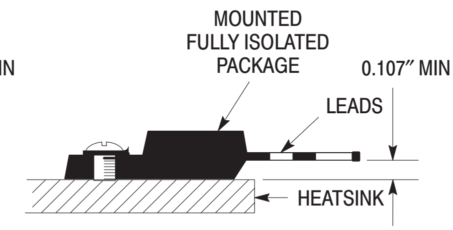
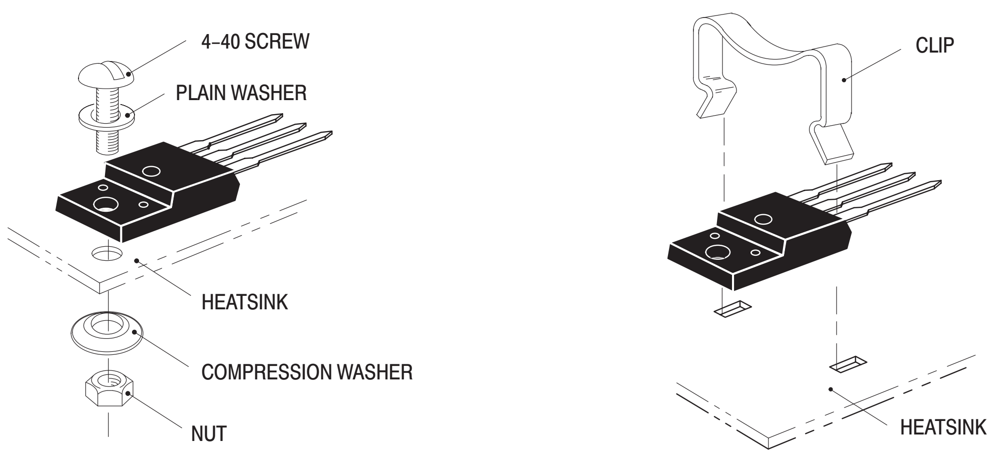


Figure 5. Screw Mounting Position for Isolation Test Number 3

* Measurement made between leads and heatsink with all leads shorted together.

MOUNTING INFORMATION**



6a. Screw–Mounted **6b. Clip–Mounted**

Figure 6. Typical Mounting Techniques

Laboratory tests on a limited number of samples indicate, when using the screw and compression washer mounting technique, a screw torque of 6 to 8 in · lbs is sufficient to provide maximum power dissipation capability. The compression washer helps to maintain a constant pressure on the package over time and during large temperature excursions.

Destructive laboratory tests show that using a hex head 4–40 screw, without washers, and applying a torque in excess of 20 in · lbs will cause the plastic to crack around the mounting hole, resulting in a loss of isolation capability.

Additional tests on slotted 4–40 screws indicate that the screw slot fails between 15 to 20 in · lbs without adversely affecting the package. However, in order to positively ensure the package integrity of the fully isolated device, ON Semiconductor does not recommend exceeding 10 in · lbs of mounting torque under any mounting conditions.

**For more information about mounting power semiconductors see Application Note AN1040.

MUR3040

Preferred Device

SWITCHMODE™ Power Rectifier

. . . designed for use in switching power supplies, inverters and as free wheeling diodes, these state–of–the–art devices have the following features:

- Ultrafast 100 Nanosecond Recovery Time
- 175°C Operating Junction Temperature
- High Voltage Capability to 400 Volts
- Low Forward Voltage Drop
- High Temperature Glass Passivated Junction

Mechanical Characteristics

- Case: Epoxy, Molded
- Weight: 4.3 grams (approximately)
- Finish: All External Surfaces Corrosion Resistant and Terminal Leads are Readily Solderable
- Lead Temperature for Soldering Purposes: 260°C Max. for 10 Seconds
- Shipped 30 Units Per Plastic Tube
- Marking: U3040

MAXIMUM RATINGS

Rating	Symbol	Max	Unit
Peak Repetitive Reverse Voltage Working Peak Reverse Voltage DC Blocking Voltage	V_{RRM} V_{RWM} V_R	400	V
Average Rectified Forward Current T_C = 70°C	$I_{F(AV)}$	30	A
Peak Repetitive Forward Current (Rated V_R, Square Wave, 20 kHz, T_C = 150°C)	I_{FRM}	30	A
Non–Repetitive Peak Surge Current (Surge Applied at Rated Load Conditions Halfwave, Single Phase, 60 Hz)	I_{FSM}	300	A
Operating Junction and Storage Temperature Range	T_J, T_{stg}	–65 to +175	°C

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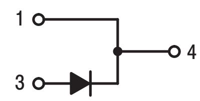
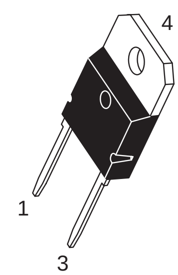
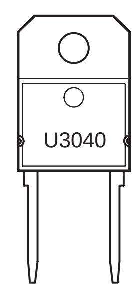
ULTRAFAST
RECTIFIER
30 AMPERES
400 VOLTS





TO–218
CASE 340E
STYLE 1

MARKING DIAGRAM



U3040 = Device Code

ORDERING INFORMATION

Device	Package	Shipping
MUR3040	TO–218	30 Units/Rail

Preferred devices are recommended choices for future use and best overall value.

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THERMAL CHARACTERISTICS

Rating	Symbol	Max	Unit
Thermal Resistance, Junction to Case	$R_{\theta JC}$	1.0	°C/W

ELECTRICAL CHARACTERISTICS

Instantaneous Forward Voltage (Note 1.) @ I_F = 30 Amps, T_C = 100°C @ I_F = 30 Amps, T_C = 25°C	V_F	 1.4 1.5	Volts
Instantaneous Reverse Current (Note 1.) @ Rated dc Voltage, T_C = 100°C @ Rated dc Voltage, T_C = 25°C	I_R	 6.0 35	 mA µA
Reverse Recovery Time I_F = 1.0 Amp, dI/dt = 15 Amp/µs	t_{RR}	100	ns

1. Pulse Test: Pulse Width = 300 µs, Duty Cycle ≤ 2.0%

TYPICAL ELECTRICAL CHARACTERISTICS

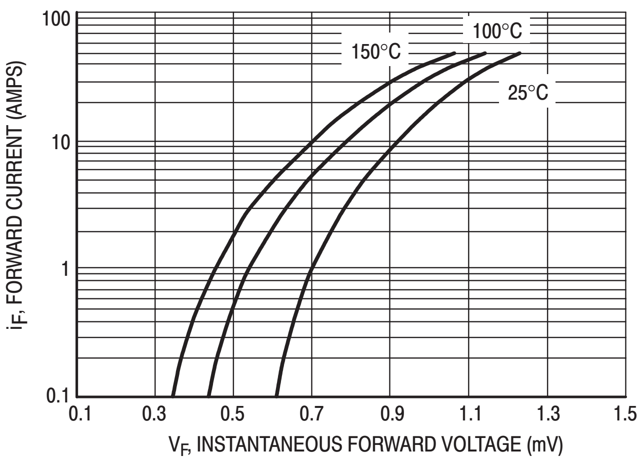

Figure 1. Typical Forward Voltage

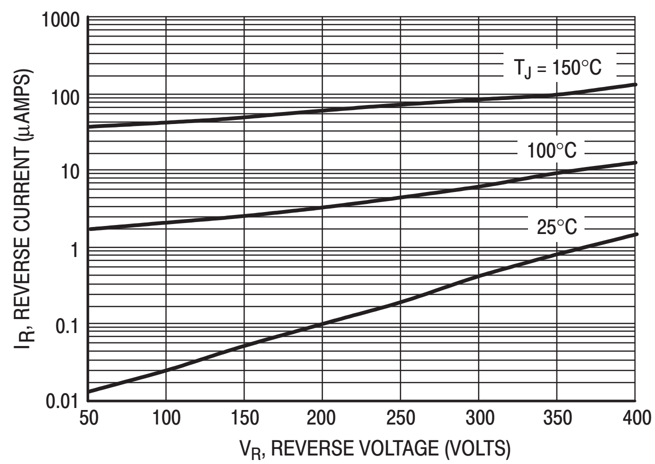

Figure 2. Typical Reverse Current

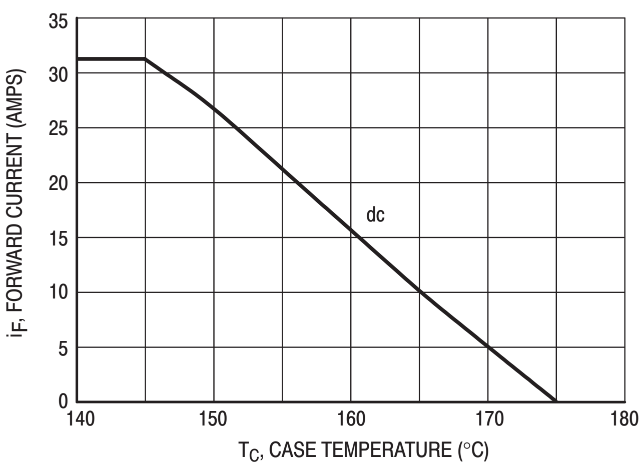

Figure 3. Current Derating, Case

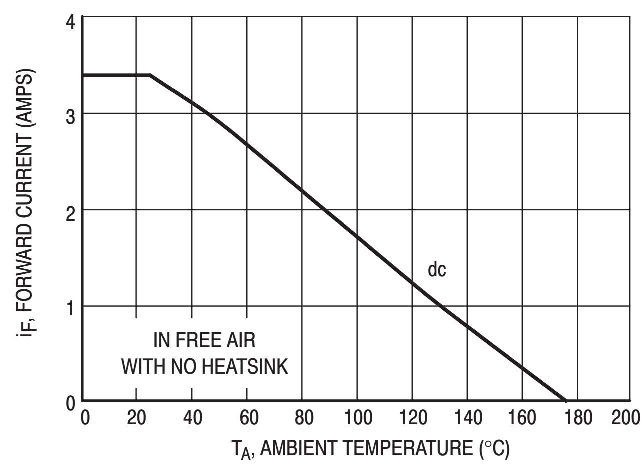

Figure 4. Current Derating, Ambient

MUR3080

Preferred Device

SWITCHMODE™ Power Rectifier

. . . designed for use in switching power supplies, inverters and as free wheeling diodes, these state–of–the–art devices have the following features:

- Ultrafast 75 ns (Typ) Soft Recovery Time
- 175°C Operating Junction Temperature
- High Voltage Capability to 800 Volts
- Low Forward Voltage Drop
- High Temperature Glass Passivated Junction

Mechanical Characteristics

- Case: Epoxy, Molded
- Weight: 4.3 grams (approximately)
- Finish: All External Surfaces Corrosion Resistant and Terminal Leads are Readily Solderable
- Lead Temperature for Soldering Purposes: 260°C Max. for 10 Seconds
- Shipped 30 Units Per Plastic Tube
- Marking: U3080

MAXIMUM RATINGS

Rating	Symbol	Max	Unit
Peak Repetitive Reverse Voltage Working Peak Reverse Voltage DC Blocking Voltage	V_{RRM} V_{RWM} V_R	800	V
Average Rectified Forward Current (Rated V_R, T_C = 70°C)	$I_{F(AV)}$	30	A
Peak Repetitive Forward Current (Rated V_R, Square Wave, 20 kHz, T_C = 150°C)	I_{FRM}	30	A
Non–Repetitive Peak Surge Current (Surge Applied at Rated Load Conditions Halfwave, Single Phase, 60 Hz)	I_{FSM}	300	A
Operating Junction and Storage Temperature Range	T_J, T_{stg}	–65 to +175	°C

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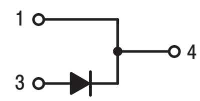
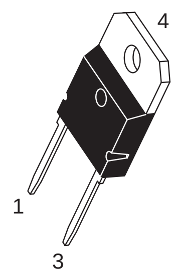
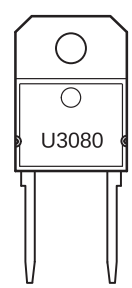
ULTRAFAST RECTIFIER 30 AMPERES 800 VOLTS





TO–218
CASE 340E
STYLE 1

MARKING DIAGRAM



U3080 = Device Code

ORDERING INFORMATION

Device	Package	Shipping
MUR3080	TO–218	30 Units/Rail

Preferred devices are recommended choices for future use and best overall value.

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THERMAL CHARACTERISTICS

Rating	Symbol	Max	Unit
Thermal Resistance, Junction to Case	$R_{\theta JC}$	1.0	°C/W

ELECTRICAL CHARACTERISTICS (Typical Data)

Instantaneous Forward Voltage (Note 1.) @ I_F = 30 Amps, T_C = 25°C @ I_F = 30 Amps, T_C = 100°C	V_F	 1.9 1.8	Volts
Instantaneous Reverse Current (Note 1.) @ Rated DC Voltage, T_C = 25°C @ Rated DC Voltage, T_C = 100°C	I_R	 100 5.0	 μA mA
Reverse Recovery Time I_F = 1.0 Amp, V_R = 30 V, dI/dt = 50 A/μs	t_{RR}	110	ns

1. Pulse Test: Pulse Width = 300 μs, Duty Cycle ≤ 2.0%.

MUR6040

Preferred Device

SWITCHMODE™ Power Rectifier

. . . designed for use in switching power supplies, inverters and as free wheeling diodes, these state–of–the–art devices have the following features:

- Ultrafast 100 Nanosecond Recovery Time
- 175°C Operating Junction Temperature
- High Voltage Capability to 400 Volts
- Low Forward Voltage Drop
- High Temperature Glass Passivated Junction

Mechanical Characteristics:

- Case: Epoxy, Molded
- Weight: 4.3 grams (approximately)
- Finish: All External Surfaces Corrosion Resistant and Terminal Leads are Readily Solderable
- Lead Temperature for Soldering Purposes: 260°C Max. for 10 Seconds
- Shipped 30 Units Per Plastic Tube
- Marking: U6040

MAXIMUM RATINGS

Rating	Symbol	Max	Unit
Peak Repetitive Reverse Voltage Working Peak Reverse Voltage DC Blocking Voltage	V_{RRM} V_{RWM} V_R	400	V
Average Rectified Forward Current T_C = 70°C	$I_{F(AV)}$	60	A
Peak Repetitive Forward Current (Rated V_R, Square Wave, 20 kHz, T_C = 150°C)	I_{FRM}	60	A
Non–Repetitive Peak Surge Current (Surge Applied at Rated Load Conditions Halfwave, Single Phase, 60 Hz)	I_{FSM}	600	A
Operating Junction and Storage Temperature Range	T_J, T_{stg}	–65 to +175	°C

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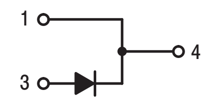
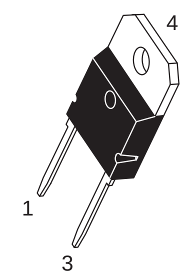
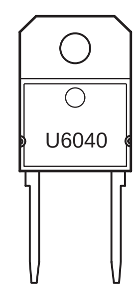
ULTRAFAST RECTIFIER 60 AMPERES 400 VOLTS





TO–218
CASE 340E
STYLE 1

MARKING DIAGRAM



U6040 = Device Code

ORDERING INFORMATION

Device	Package	Shipping
MUR6040	TO–218	30 Units/Rail

Preferred devices are recommended choices for future use and best overall value.

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THERMAL CHARACTERISTICS

Rating	Symbol	Max	Unit
Thermal Resistance, Junction to Case	$R_{\theta JC}$	0.8	°C/W

ELECTRICAL CHARACTERISTICS

Instantaneous Forward Voltage (Note 1.) @ I_F = 60 Amps, T_C = 100°C @ I_F = 60 Amps, T_C = 25°C	V_F	 1.4 1.5	Volts
Instantaneous Reverse Current (Note 1.) @ Rated dc Voltage, T_C = 100°C @ Rated dc Voltage, T_C = 25°C	I_R	 10 60	 mA µA
Reverse Recovery Time I_F = 1.0 Amp, dI/dt = 15 Amp/µs	t_{RR}	100	ns

1. Pulse Test: Pulse Width = 300 µs, Duty Cycle ≤ 2.0%

TYPICAL ELECTRICAL CHARACTERISTICS

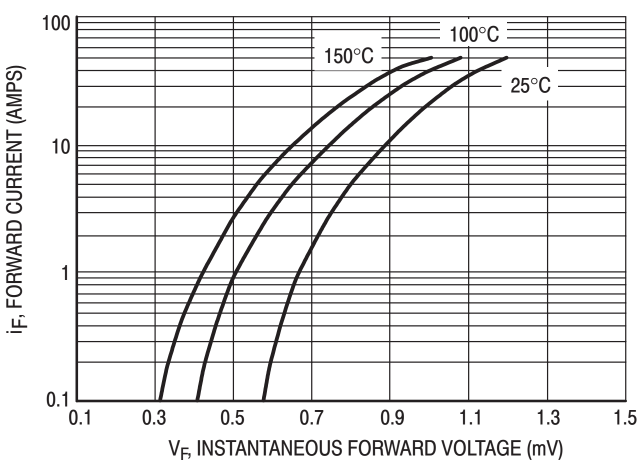


Figure 1. Typical Forward Voltage

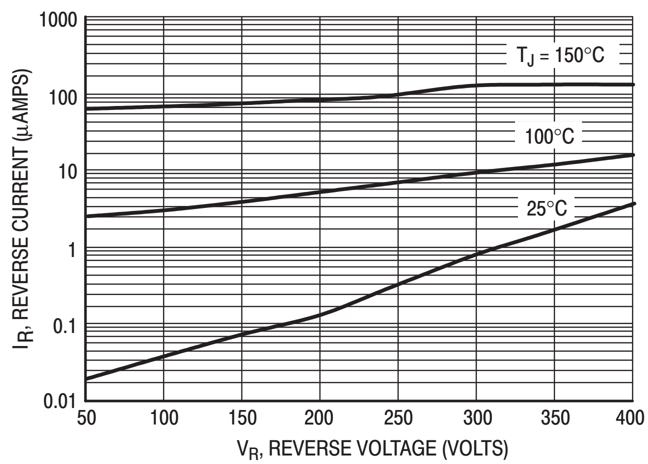


Figure 2. Typical Reverse Current

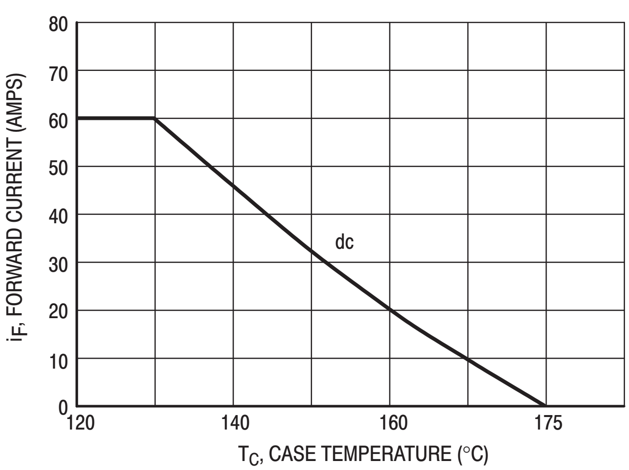


Figure 3. Current Derating, Case

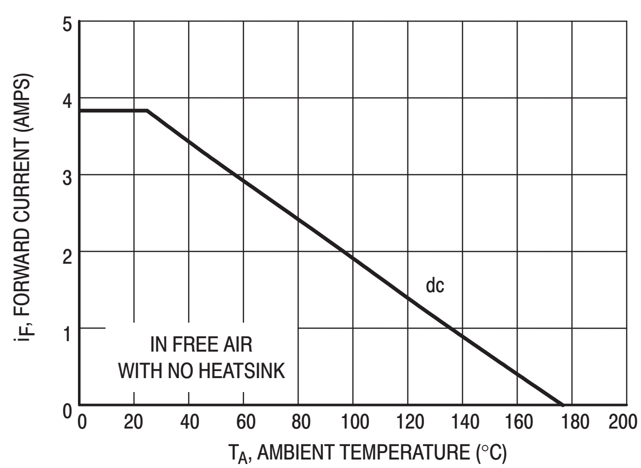


Figure 4. Current Derating, Ambient

MUR3020PT, MUR3040PT, MUR3060PT

SWITCHMODE™ Power Rectifiers

. . . designed for use in switching power supplies, inverters and as free wheeling diodes, these state–of–the–art devices have the following features:

- Ultrafast 35 and 60 Nanosecond Recovery Time
- 175°C Operating Junction Temperature
- High Voltage Capability to 600 Volts
- Low Forward Drop
- Low Leakage Specified @ 150°C Case Temperature
- Current Derating Specified @ Both Case and Ambient Temperatures
- Epoxy Meets UL94, V_O @ 1/8″
- High Temperature Glass Passivated Junction

Mechanical Characteristics:

- Case: Epoxy, Molded
- Weight: 4.3 grams (approximately)
- Finish: All External Surfaces Corrosion Resistant and Terminal Leads are Readily Solderable
- Lead Temperature for Soldering Purposes: 260°C Max. for 10 Seconds
- Shipped 30 units per plastic tube
- Marking: U3020, U3040, U3060

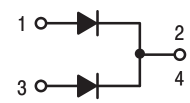
MAXIMUM RATINGS

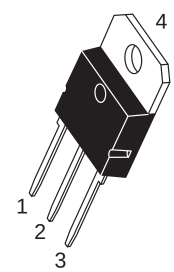
Please See the Table on the Following Page

ON Semiconductor™

http://onsemi.com

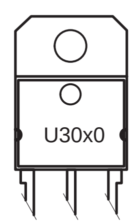
ULTRAFAST RECTIFIERS 30 AMPERES 200–600 VOLTS





TO–218AC
CASE 340D
STYLE 2

MARKING DIAGRAM



U30x0 = Device Code
x = 2, 4 or 6

ORDERING INFORMATION

Device	Package	Shipping
MUR3020PT	SOT–93	30 Units/Rail
MUR3040PT	SOT–93	30 Units/Rail
MUR3060PT	SOT–93	30 Units/Rail

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MAXIMUM RATINGS (Per Leg)

Rating	Symbol	MUR3020PT	MUR3040PT	MUR3060PT	Unit
Peak Repetitive Reverse Voltage Working Peak Reverse Voltage DC Blocking Voltage	V_{RRM} V_{RWM} V_R	200	400	600	Volts
Average Rectified Forward Current (Rated V_R) Per Leg Per Device	$I_{F(AV)}$	15 @ T_C = 150°C 30 @ T_C = 150°C		15 @ T_C = 30 145°C	Amps
Peak Rectified Forward Current, Per Leg (Rated V_R, Square Wave, 20 kHz, T_C = 150°C)	I_{FRM}	30 @ T_C = 150°C		30 @ T_C =145°C	Amps
Nonrepetitive Peak Surge Current (Surge applied at rated load conditions, halfwave, single phase, 60 Hz) Per Leg	I_{FSM}	200	150		Amps
Operating Junction and Storage Temperature	T_J, T_{stg}	– 65 to +175			°C

THERMAL CHARACTERISTICS (Per Diode Leg)

Rating	Symbol	Value	Unit
Maximum Thermal Resistance — Junction to Case — Junction to Ambient	$R_{\theta JC}$ $R_{\theta JA}$	1.5 40	°C/W

ELECTRICAL CHARACTERISTICS (Per Diode Leg)

Characteristic	Symbol	MUR3020PT	MUR3040PT	MUR3060PT	Unit
Maximum Instantaneous Forward Voltage (Note 1.) (I_F = 15 Amp, T_C = 150°C) (I_F = 15 Amp, T_C = 25°C)	V_F	0.85 1.05	1.12 1.25	1.2 1.5	Volts
Maximum Instantaneous Reverse Current (Note 1.) (Rated DC Voltage, T_J = 150°C) (Rated DC Voltage, T_J = 25°C)	i_R	500 10		1000 10	μA
Maximum Reverse Recovery Time (i_F = 1.0 Amp, di/dt = 50 Amps/μs)	t_{rr}	35	60		ns

1. Pulse Test: Pulse Width = 300 μs, Duty Cycle ≤ 2.0%.

MUR3020PT

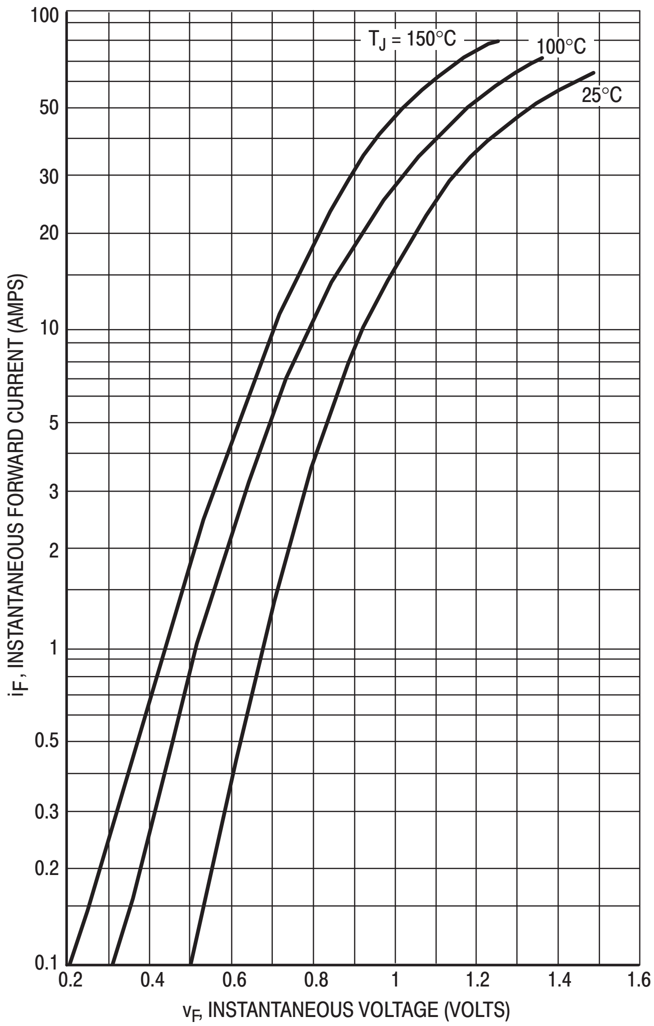


Figure 1. Typical Forward Voltage (Per Leg)

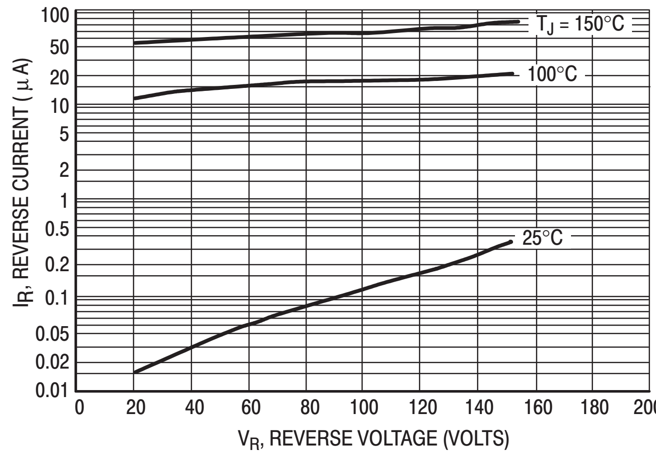


Figure 2. Typical Reverse Current (Per Leg)

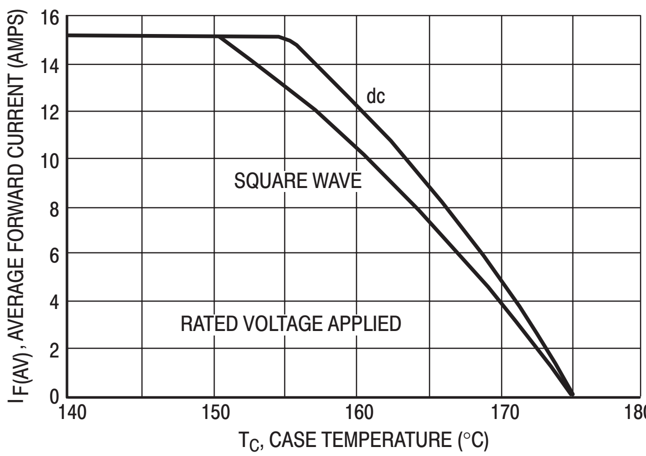


Figure 3. Current Derating, Case (Per Leg)

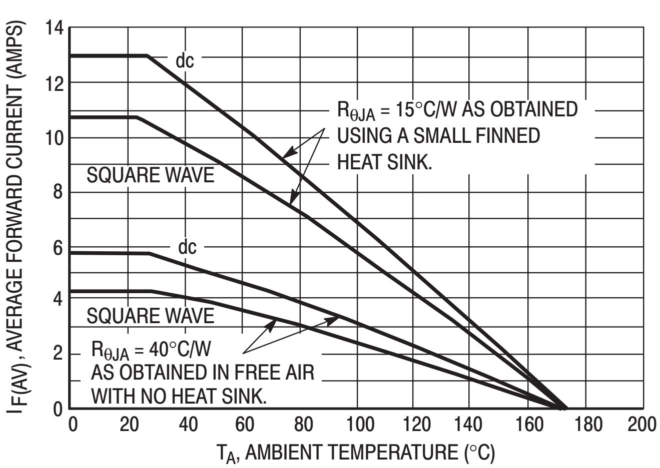


Figure 4. Current Derating, Ambient (Per Leg)

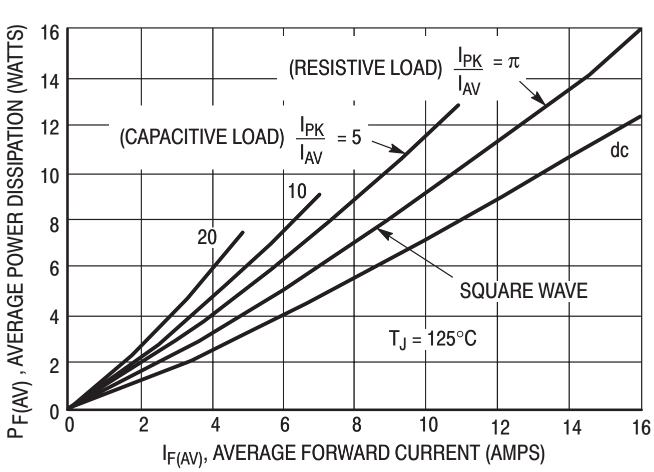


Figure 5. Power Dissipation (Per Leg)

MUR3040PT

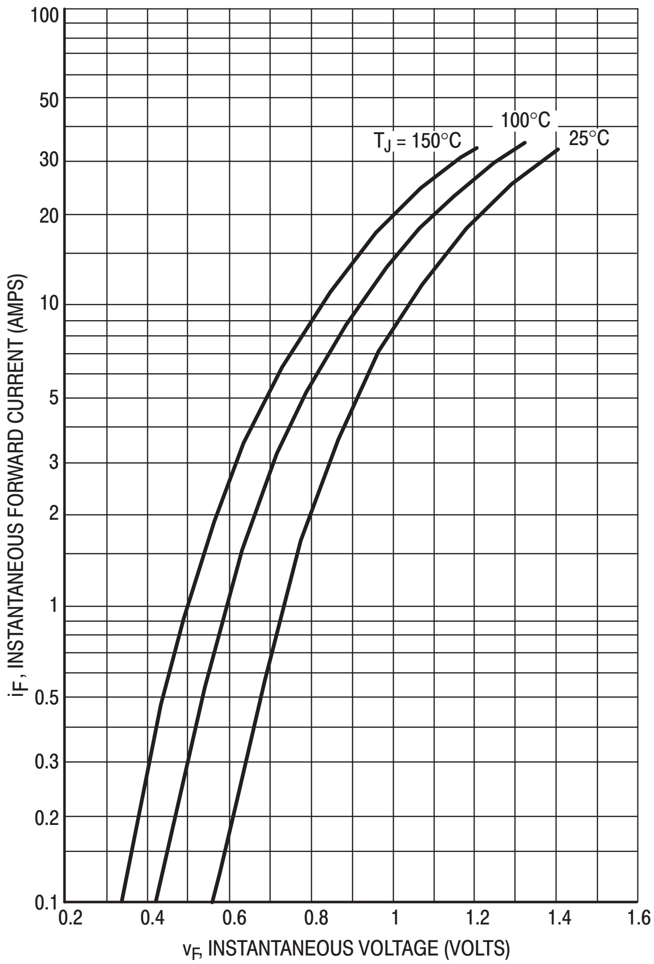


Figure 6. Typical Forward Voltage (Per Leg)

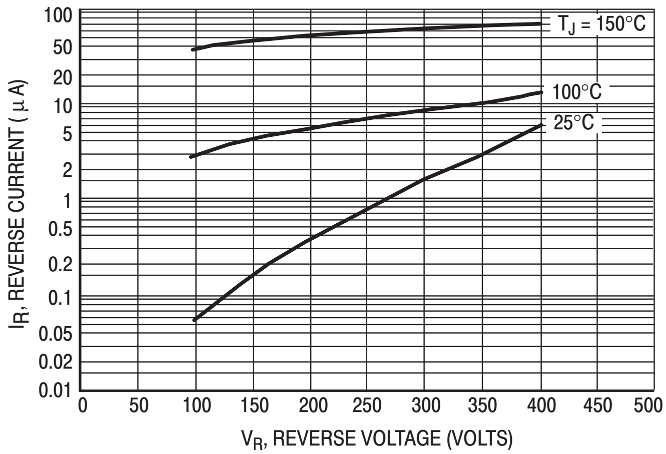


Figure 7. Typical Reverse Current (Per Leg)

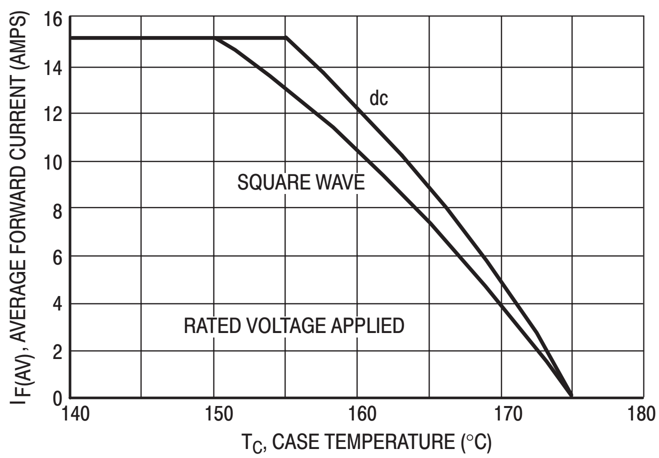


Figure 8. Current Derating, Case (Per Leg)

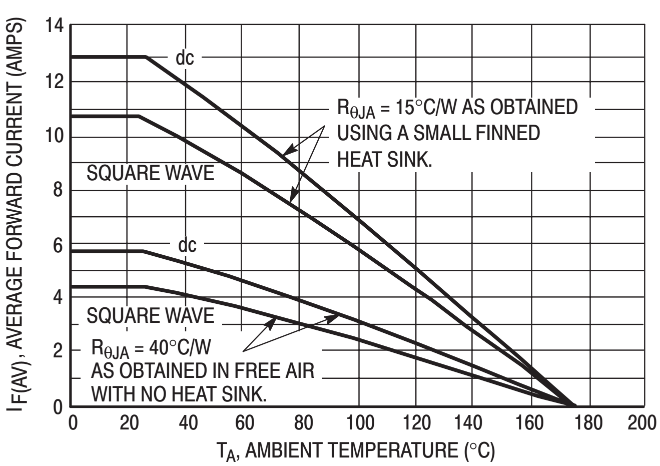


Figure 9. Current Derating, Ambient (Per Leg)

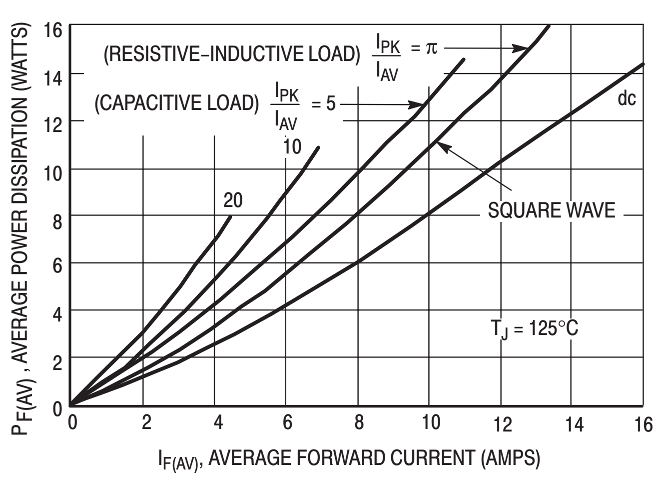


Figure 10. Power Dissipation (Per Leg)

MUR3060PT

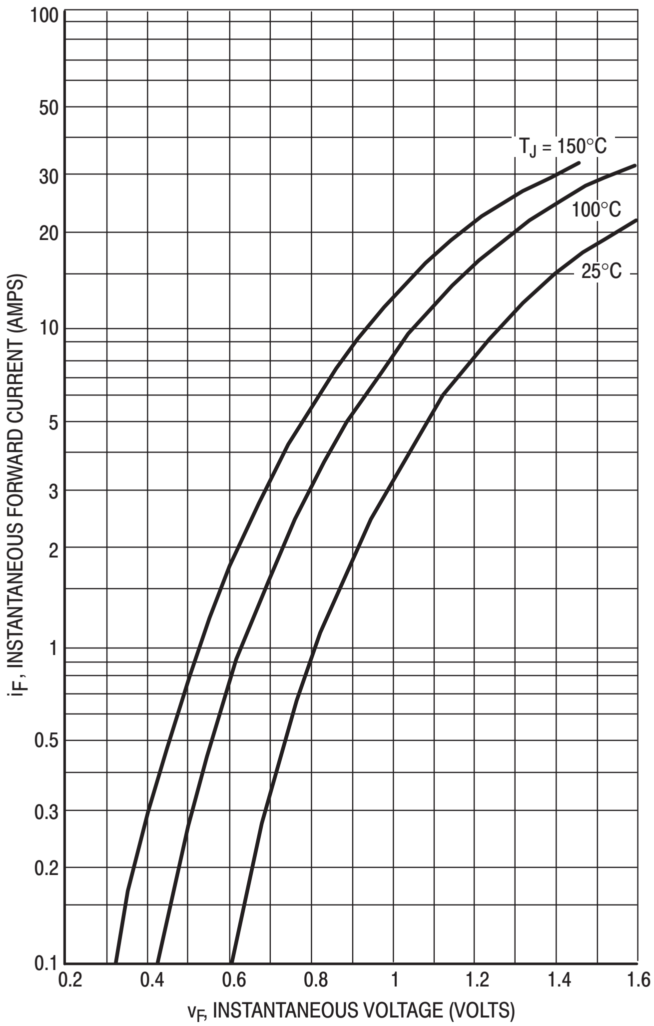


Figure 11. Typical Forward Voltage (Per Leg)

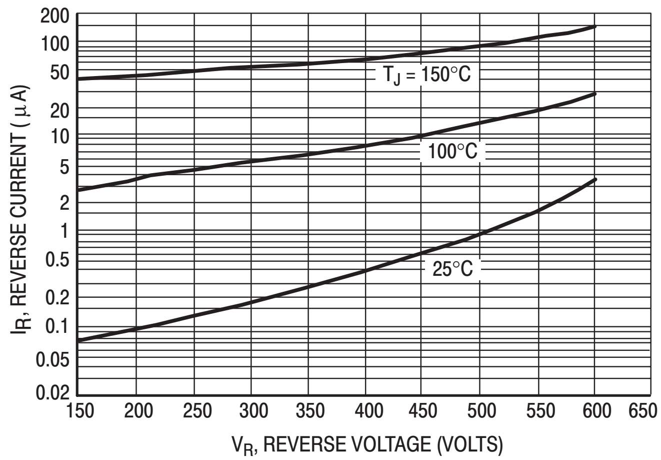


Figure 12. Typical Reverse Current (Per Leg)

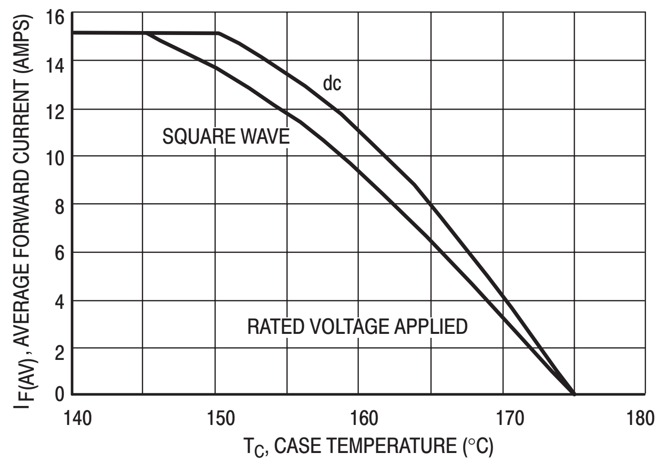


Figure 13. Current Derating, Case (Per Leg)

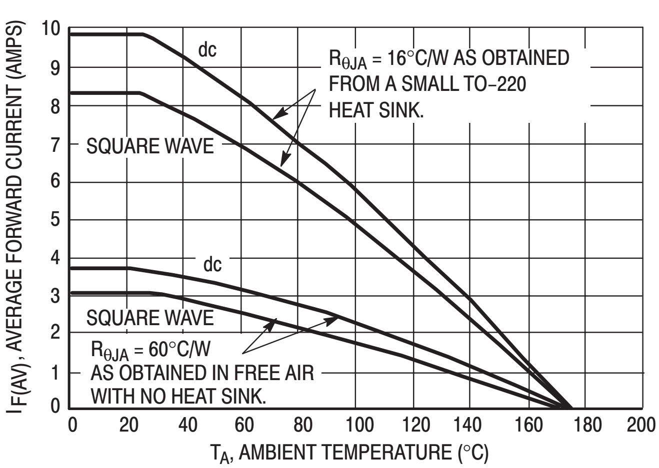


Figure 14. Current Derating, Ambient (Per Leg)

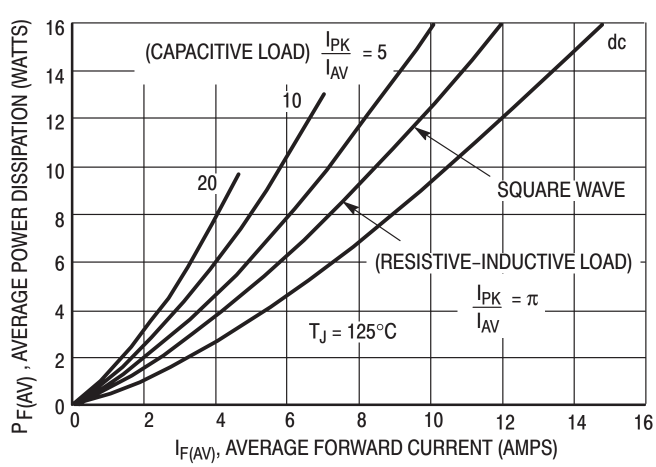


Figure 15. Power Dissipation (Per Leg)

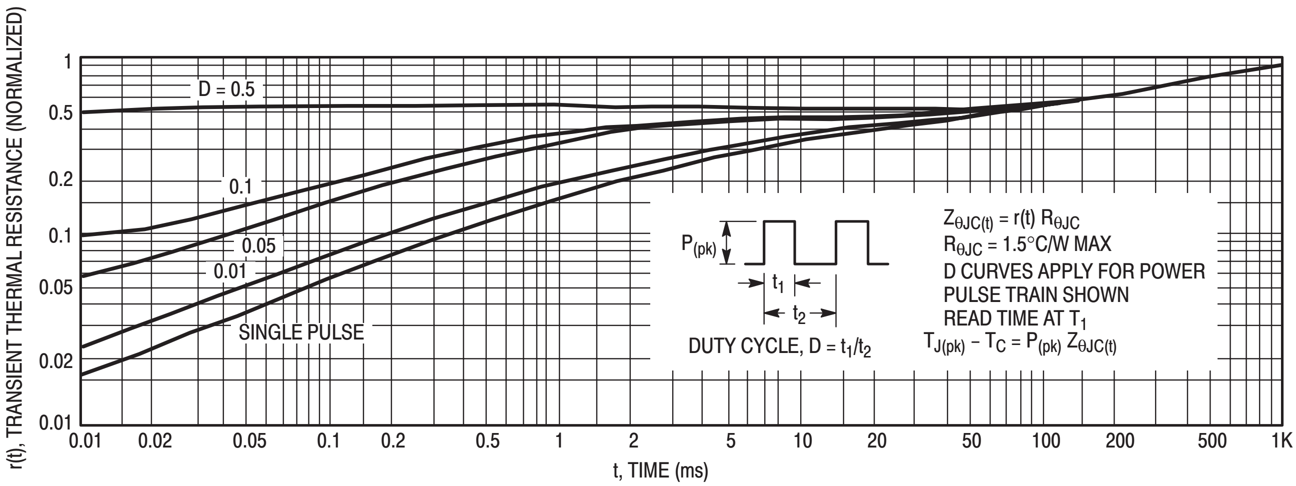


Figure 16. Thermal Response

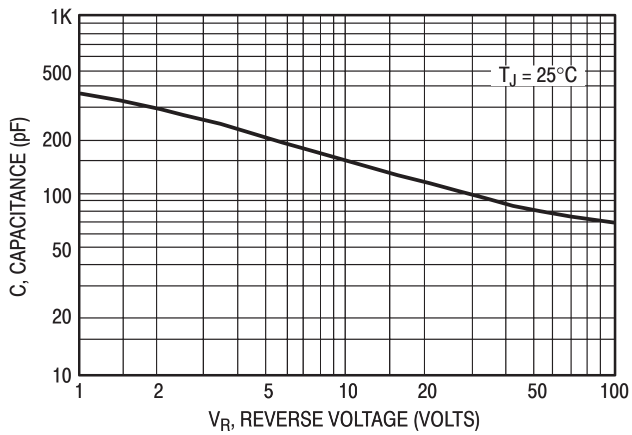


Figure 17. Typical Capacitance (Per Leg)

MUR3020WT, MUR3060WT

Preferred Devices

SWITCHMODE™ Power Rectifiers

. . . designed for use in switching power supplies, inverters and as free wheeling diodes, these state–of–the–art devices have the following features:

- Ultrafast 35 and 60 Nanosecond Recovery Time
- 175°C Operating Junction Temperature
- Popular TO–247 Package
- High Voltage Capability to 600 Volts
- Low Forward Drop
- Low Leakage Specified @ 150°C Case Temperature
- Current Derating Specified @ Both Case and Ambient Temperatures
- Epoxy Meets UL94, V_O @ 1/8″
- High Temperature Glass Passivated Junction

Mechanical Characteristics

- Case: Epoxy, Molded
- Weight: 4.3 grams (approximately)
- Finish: All External Surfaces Corrosion Resistant and Terminal Leads are Readily Solderable
- Lead Temperature for Soldering Purposes: 260°C Max. for 10 Seconds
- Shipped 30 units per plastic tube
- Marking: U3020, U3060

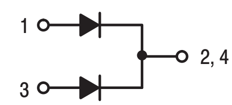
MAXIMUM RATINGS

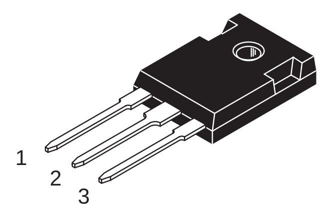
Please See the Table on the Following Page

ON Semiconductor™

http://onsemi.com

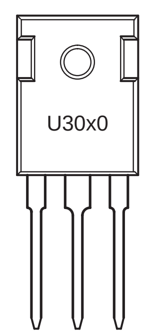
ULTRAFAST RECTIFIERS 30 AMPERES 200–600 VOLTS





TO–247 PSI CASE 340L PLASTIC

MARKING DIAGRAM



U30x0 = Device Code
x = 2 or 6

ORDERING INFORMATION

Device	Package	Shipping
MUR3020WT	TO–247	30 Units/Rail
MUR3060WT	TO–247	30 Units/Rail

Preferred devices are recommended choices for future use and best overall value.

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MAXIMUM RATINGS (Per Leg)

Rating	Symbol	MUR3020WT	MUR3060WT	Unit
Peak Repetitive Reverse Voltage Working Peak Reverse Voltage DC Blocking Voltage	V_{RRM} V_{RWM} V_R	200	600	Volts
Average Rectified Forward Current @ 145°C Total Device	$I_{F(AV)}$	15 30		Amps
Peak Repetitive Surge Current (Rated V_R, Square Wave, 20 kHz, T_C = 145°C)	I_{FM}	30		Amps
Nonrepetitive Peak Surge Current (Surge applied at rated load conditions, halfwave, single phase, 60 Hz)	I_{FSM}	200	150	Amps
Operating Junction and Storage Temperature	T_J, T_{stg}	– 65 to +175		°C

THERMAL CHARACTERISTICS (Per Leg)

Maximum Thermal Resistance — Junction to Case — Junction to Ambient	$R_{\theta JC}$ $R_{\theta JA}$	1.5 40		°C/W

ELECTRICAL CHARACTERISTICS (Per Leg)

Maximum Instantaneous Forward Voltage (Note 1.) (I_F = 15 Amp, T_C = 150°C) (I_F = 15 Amp, T_C = 25°C)	V_F	 0.85 1.05	 1.4 1.7	Volts
Maximum Instantaneous Reverse Current (Note 1.) (Rated DC Voltage, T_J = 150°C) (Rated DC Voltage, T_J = 25°C)	i_R	 500 10	 1000 10	µA
Maximum Reverse Recovery Time (i_F = 1.0 A, di/dt = 50 Amps/µs)	t_{rr}	35	60	ns

1. Pulse Test: Pulse Width = 300 µs, Duty Cycle ≤ 2.0%.

MUR3020WT

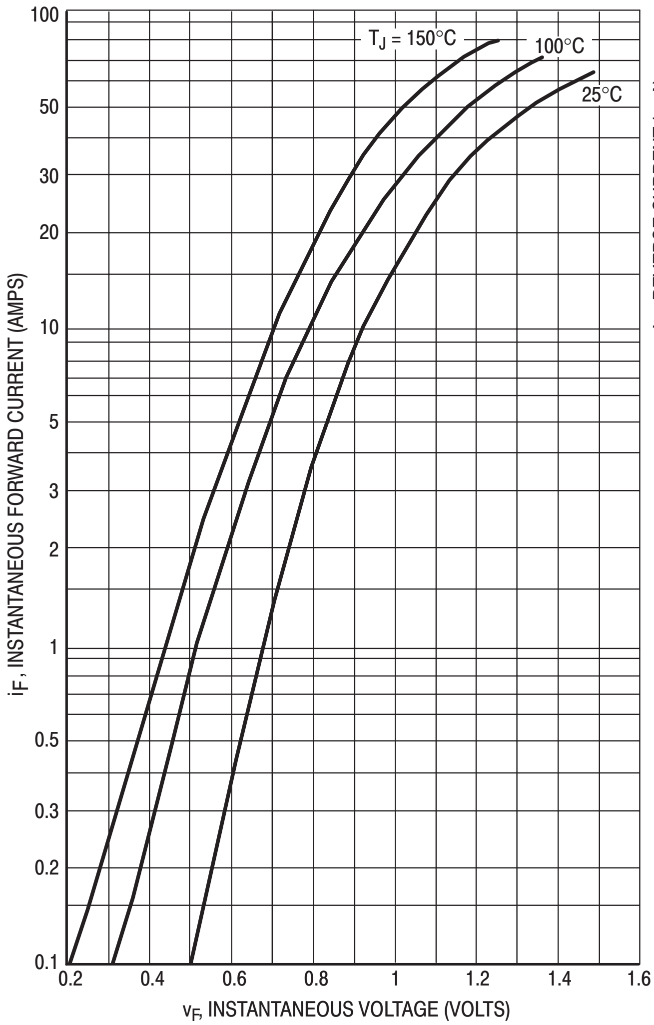
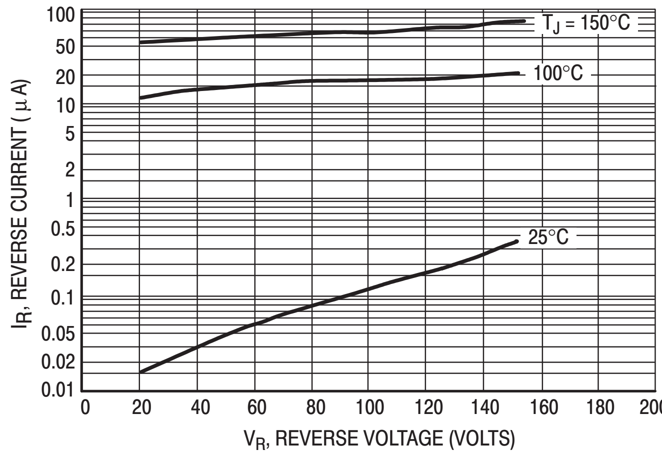


Figure 1. Typical Forward Voltage (Per Leg)



*The curves shown are typical for the highest voltage device in the voltage grouping. Typical reverse current for lower voltage selections can be estimated from these same curves if V_R is sufficiently below rated V_R.

Figure 2. Typical Reverse Current (Per Leg)*

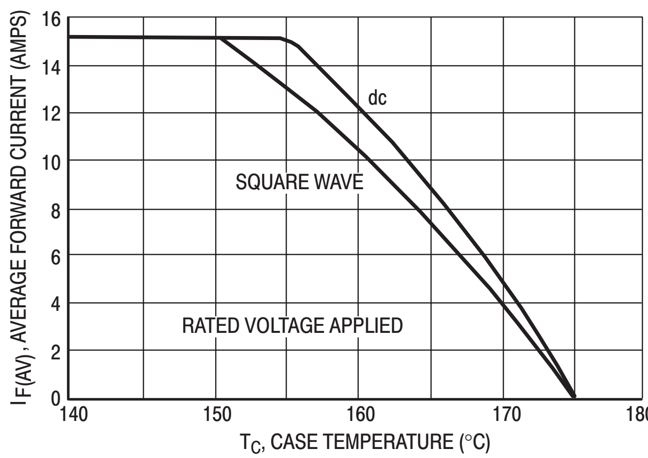


Figure 3. Current Derating, Case (Per Leg)

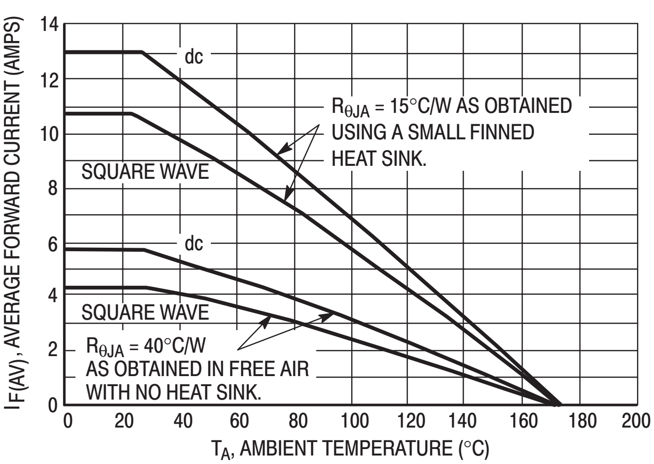


Figure 4. Current Derating, Ambient (Per Leg)

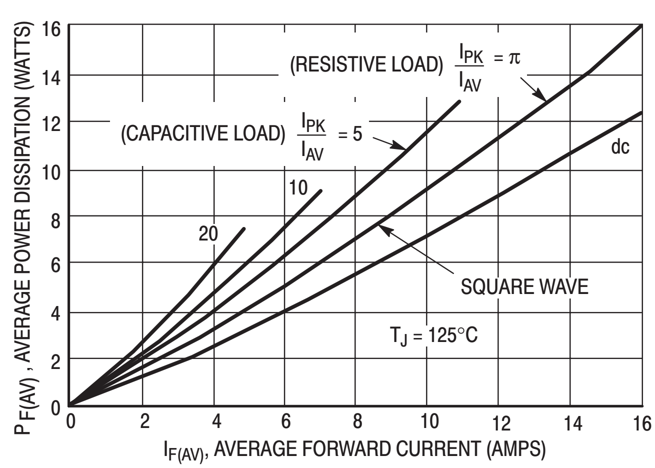


Figure 5. Power Dissipation (Per Leg)

MUR3060WT

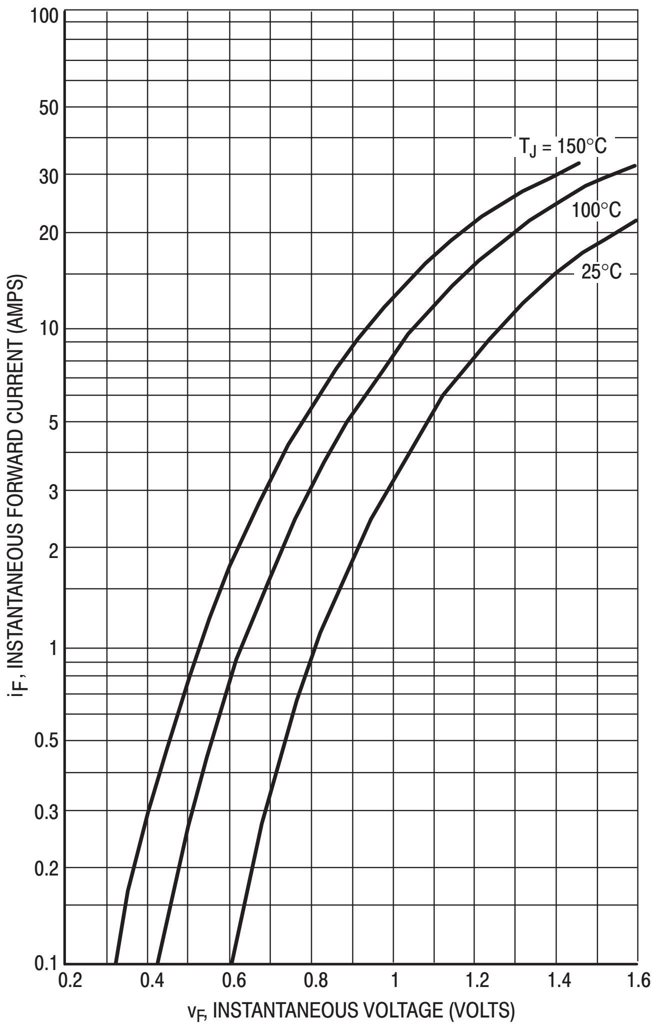
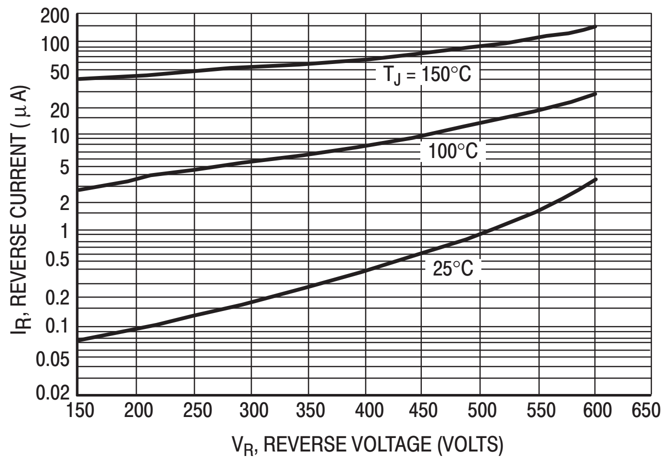


Figure 6. Typical Forward Voltage (Per Leg)



*The curves shown are typical for the highest voltage device in the voltage grouping. Typical reverse current for lower voltage selections can be estimated from these same curves if V_R is sufficiently below rated V_R.

Figure 7. Typical Reverse Current (Per Leg)*

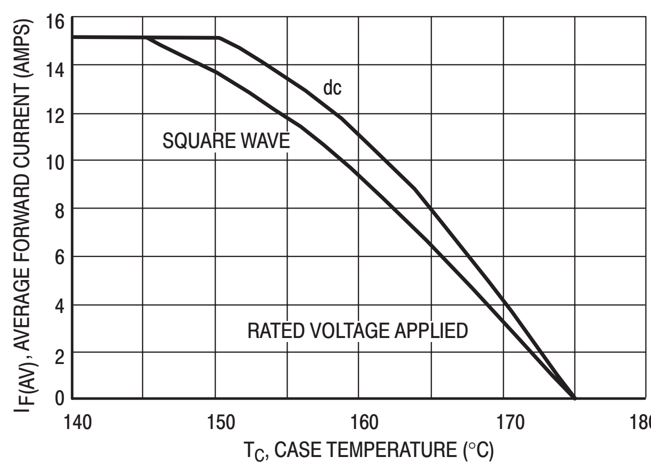


Figure 8. Current Derating, Case (Per Leg)

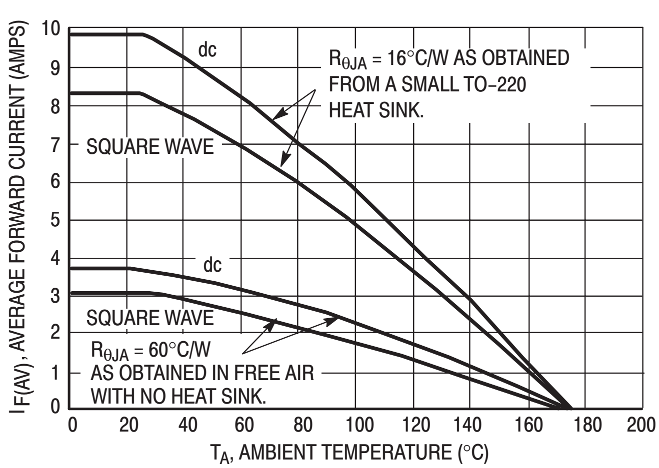


Figure 9. Current Derating, Ambient (Per Leg)

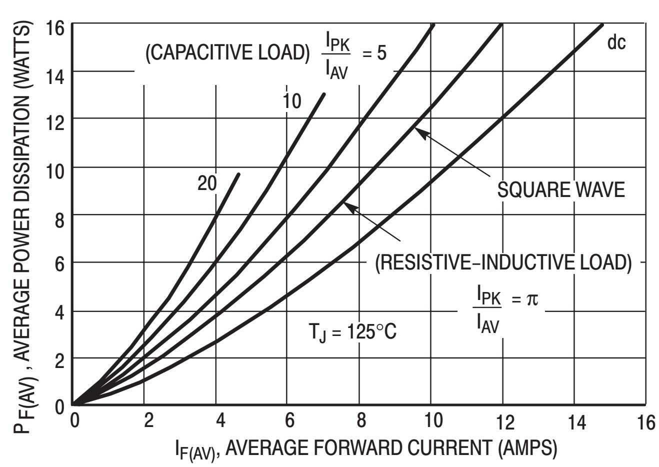


Figure 10. Power Dissipation (Per Leg)

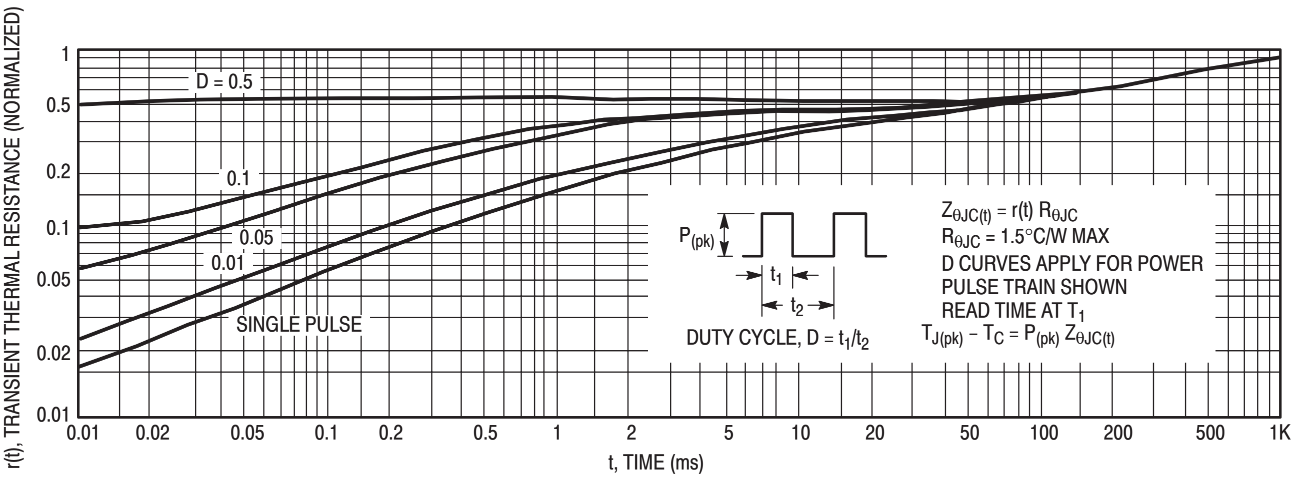


Figure 11. Thermal Response

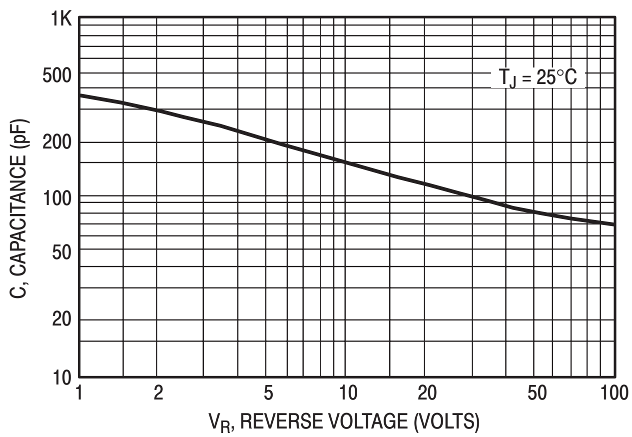


Figure 12. Typical Capacitance (Per Leg)

MURP20020CT, MURP20040CT

Preferred Devices

POWERTAP™ II Ultrafast SWITCHMODE™ Power Rectifiers

. . . designed for use in switching power supplies, inverters, and as free wheeling diodes. These state–of–the–art devices have the following features:

- Dual Diode Construction
- Low Leakage Current
- Low Forward Voltage
- 175°C Operating Junction Temperature
- Labor Saving POWERTAP Package

Mechanical Characteristics:

- Case: Epoxy, Molded with metal heatsink base
- Weight: 80 grams (approximately)
- Finish: All External Surfaces Corrosion Resistant
- Top Terminal Torque: 25–40 lb–in max
- Base Plate Torques: See procedure given in the Package Outline Section
- Shipped 25 units per foam
- Marking: UP20020, UP20040

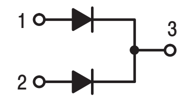
MAXIMUM RATINGS

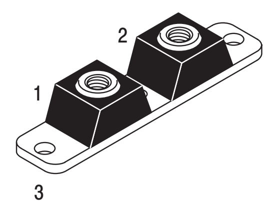
Please See the Table on the Following Page

ON Semiconductor™

http://onsemi.com

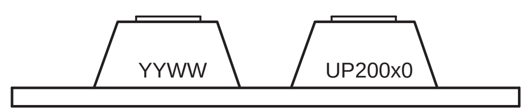
ULTRAFAST RECTIFIERS 200 AMPERES 200–400 VOLTS





PLASTIC CASE 357C POWERTAP II

MARKING DIAGRAM



UP200x0 = Device Code
x = 2 or 4
YY = Year
WW = Work Week

ORDERING INFORMATION

Device	Package	Shipping
MURP20020CT	POWERTAP II	25 Units/Tray
MURP20040CT	POWERTAP II	25 Units/Tray

Preferred devices are recommended choices for future use and best overall value.

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MAXIMUM RATINGS

Rating		Symbol	MURP20020CT	MURP20040CT	Unit
Peak Repetitive Reverse Voltage Working Peak Reverse Voltage DC Blocking Voltage		V_{RRM} V_{RWM} V_R	200	400	Volts
Average Rectified Forward Current (Rated V_R)	Per Device Per Leg	$I_{F(AV)}$	200 (T_C = 130°C) 100 (T_C = 130°C)	200 (T_C = 100°C) 100 (T_C = 100°C)	Amps
Peak Repetitive Forward Current, Per Leg (Rated V_R, Square Wave, 20 kHz), T_C = 95°C		I_{FRM}	200	200	Amps
Nonrepetitive Peak Surge Current Per Leg (Surge applied at rated load conditions halfwave, single phase, 60 Hz)		I_{FSM}	800	800	Amps
Operating Junction Temperature		T_J	– 55 to +175	– 55 to +175	°C
Storage Temperature		T_{stg}	– 55 to +150	– 55 to +150	°C

THERMAL CHARACTERISTICS (Per Leg)

Rating	Symbol	Max		Unit
Thermal Resistance, Junction to Case	$R_{\theta JC}$	0.45	0.45	°C/W

ELECTRICAL CHARACTERISTICS (Per Leg)

Instantaneous Forward Voltage (Note 1.) (i_F = 100 Amps, T_C = +25°C) (i_F = 200 Amps, T_C = 25°C) (i_F = 100 Amps, T_C = 125°C)	v_F	 1.00 1.10 0.95	 1.30 1.75 1.15	Volts
Instantaneous Reverse Current (Note 1.) (Rated dc Voltage, T_C = 125°C) (Rated dc Voltage, T_C = 25°C)	i_R	 1000 150	 500 50	µA
Maximum Reverse Recovery Time (I_F = 1.0 Amp, di/dt = 50 Amps/µs)	t_{rr}	50	75	ns

1. Pulse Test: Pulse Width = 300 µs, Duty Cycle ≤ 2.0%.

MSRP10040

SWITCHMODE™ Soft Recovery Power Rectifier

POWERTAP™ III Package

State of the art geometry features epitaxial construction with glass passivation and metal overlay contact. Ideally suited for low voltage, high frequency switching power supplies, free wheeling diode and polarity protection diodes.

- Soft Recovery Rectifier
- Low I_{RRM} Losses
- Highly Stable Glass Passivated Junction

Mechanical Characteristics:

- Dual Die Construction
- Case: Epoxy, Molded with Plated Copper Heatsink Base
- Weight: 40 Grams (approximately)
- Finish: All External Surfaces Corrosion Resistant
- Top Terminal Torque: 25 – 40 lb–in max.
- Shipped 50 Units per Foam
- Marking: MSRP10040

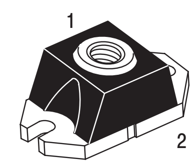
MAXIMUM RATINGS

Rating	Symbol	Max	Unit
Peak Repetitive Reverse Voltage Working Peak Reverse Voltage DC Blocking Voltage	V_{RRM} V_{RWM} V_R	400	V
Average Rectified Forward Current (At Rated V_R, T_C = 100°C)	I_O	100	A
Peak Repetitive Forward Current (At Rated V_R, Square Wave, 100 kHz, T_C = TBD°C)	I_{FRM}	200	A
Non–Repetitive Peak Surge Current (Surge Applied at Rated Load Conditions Halfwave, Single Phase, 60 Hz)	I_{FSM}	800	A
Storage/Operating Case Temperature Range	T_{stg}, T_C	–55 to +150	°C
Operating Junction Temperature Range	T_J	–55 to +150	°C

ON Semiconductor™

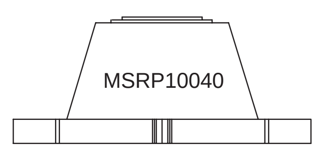
http://onsemi.com

SOFT RECOVERY RECTIFIER 100 AMPERES 400 VOLTS



POWERTAP III CASE 357D PLASTIC

MARKING DIAGRAM



MSRP10040 = Device Code

ORDERING INFORMATION

Device	Package	Shipping
MSRP10040	POWERTAP III	50 Units/Tray

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THERMAL CHARACTERISTICS

Rating	Symbol	Value	Unit
Thermal Resistance — Junction–to–Case	$R_{\theta JC}$	0.5	°C/W

ELECTRICAL CHARACTERISTICS

Typical Instantaneous Forward Voltage (Note 1.)	V_F	**T_J = 25°C**	**T_J = 100°C**	Volts
(I_F = 100 A) (I_F = 200 A)		1.75 2.00	1.25 1.50	
Typical Instantaneous Reverse Current	I_R	**T_J = 25°C**	**T_J = 100°C**	μA
(V_R = 400 V) (V_R = 200 V)		100 50	500 250	
Typical Reverse Recovery Time (Note 2.) (V_R = 30 V, I_F = 10 A, di/dt = 200 A/μs)	t_{rr}	75		ns
Typical Peak Reverse Recovery Current (V_R = 30 V, I_F = 10 A, di/dt = 200 A/μs)	I_{rm}	7.0		Amps

1. Pulse Test: Pulse Width ≤ 250 μs, Duty Cycle ≤ 2%.
2. t_{rr} measured projecting from 25% of IRM to zero.

MSR1560

SWITCHMODE™ Soft Recovery Power Rectifier

Designed for boost converter or hard–switched converter applications, especially for Power Factor Correction application. It could also be used as a free wheeling diode in variable speed motor control applications and switching mode power supplies. These state–of–the–art devices have the following features:

- Soft Recovery with Low Reverse Recovery Charge (Q_{RR}) and Peak Reverse Recovery Current (I_{RRM})
- 150°C Operating Junction Temperature
- Popular TO–220 Package
- Epoxy meets UL94, V_O @ 1/8″
- Low Forward Voltage
- Low Leakage Current
- High Temperature Glass Passivated Junction

Mechanical Characteristics:

- Case: Molded Epoxy
- Weight: 1.9 Grams (approximately)
- Finish: All External Surfaces Corrosion Resistant and Terminal Leads Readily Solderable
- Lead Temperature for Soldering Purposes: 260°C Max. for 10 Seconds
- Shipped in 50 Units per Plastic Tube
- Marking: MSR1560

MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Peak Repetitive Reverse Voltage Working Peak Reverse Voltage DC Blocking Voltage	V_{RRM} V_{RWM} V_R	600	V
Average Rectified Forward Current (At Rated V_R, T_C = 125°C)	I_O	15	A
Peak Repetitive Forward Current (At Rated V_R, Square Wave, 20 kHz, T_C = 125°C)	I_{FRM}	30	A
Non–Repetitive Peak Surge Current (Surge applied at rated load conditions, halfwave, single phase, 60 Hz)	I_{FSM}	100	A
Storage/Operating Case Temperature	T_{stg}, T_C	–65 to +150	°C
Operating Junction Temperature	T_J	–65 to +150	°C

THERMAL CHARACTERISTICS

Parameter	Symbol	Value	Unit
Thermal Resistance – Junction–to–Case	$R_{\theta JC}$	1.6	°C/W
Thermal Resistance – Junction–to–Ambient	$R_{\theta JA}$	72.8	

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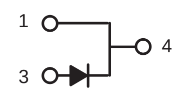
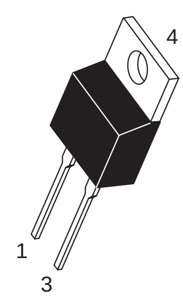
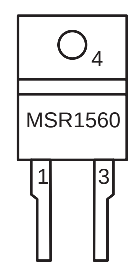
SOFT RECOVERY POWER RECTIFIER
15 AMPERES
600 VOLTS





TO–220
CASE 221B
PLASTIC

MARKING DIAGRAM



ORDERING INFORMATION

Device	Package	Shipping
MSR1560	TO–220	50 Units/Rail

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ELECTRICAL CHARACTERISTICS

Maximum Instantaneous Forward Voltage (Note 1.) (I_F = 15 A)	V_F	**T_J = 25°C**	**T_J = 150°C**	V
		1.8	1.4	
Typical		*1.5*	*1.2*	
Maximum Instantaneous Reverse Current (V_R = 600 V)	I_R	**T_J = 25°C**	**T_J = 150°C**	μA
		15	5000	
Typical		*0.4*	*100*	
Maximum Reverse Recovery Time (Note 2.) (V_R = 30 V, I_F = 1 A, di/dt = 100 A/μs)	t_{rr}	**T_J = 25°C**	**T_J = 100°C**	ns
		45	65	
Typical		*35*	*54*	
Typical Recovery Softness Factor (V_R = 30 V, I_F = 1 A, di/dt = 100 A/μs)	s = t_b/t_a	*.67*	*.74*	
Typical Peak Reverse Recovery Current (V_R = 30 V, I_F = 1 A, di/dt = 100 A/μs)	I_{RRM}	2.3	3.2	A
Typical Reverse Recovery Charge (V_R = 30 V, I_F = 1 A, di/dt = 100 A/μs)	Q_{RR}	31	78	nC

1. Pulse Test: Pulse Width ≤ 380 μs, Duty Cycle ≤ 2%
2. T_{RR} measured projecting from 25% of I_{RRM} to zero current

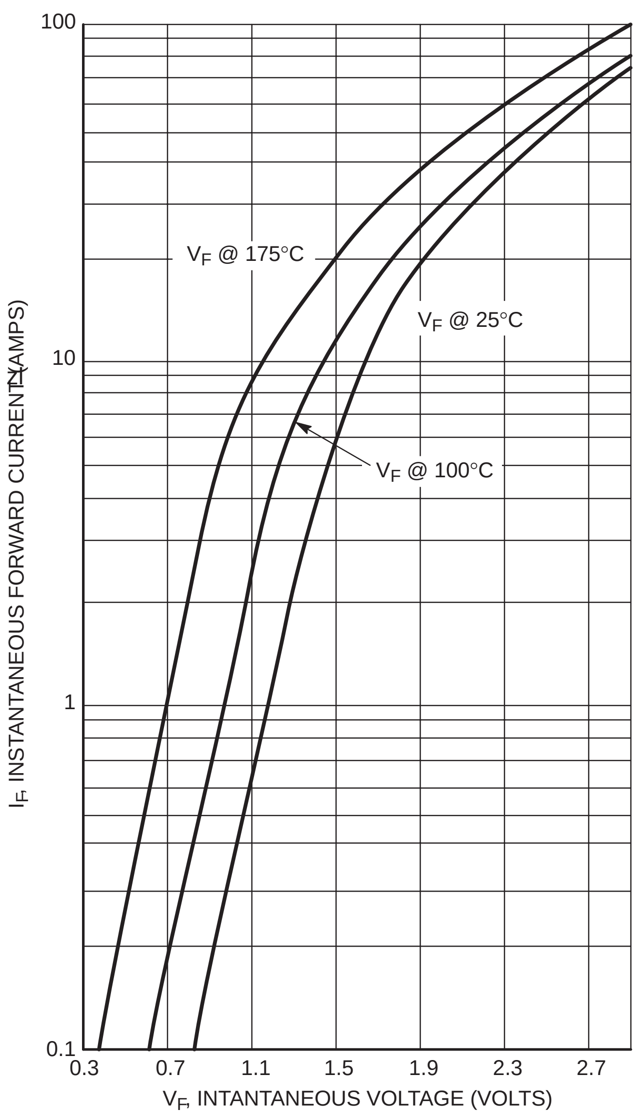

Figure 1. Maximum Forward Voltage

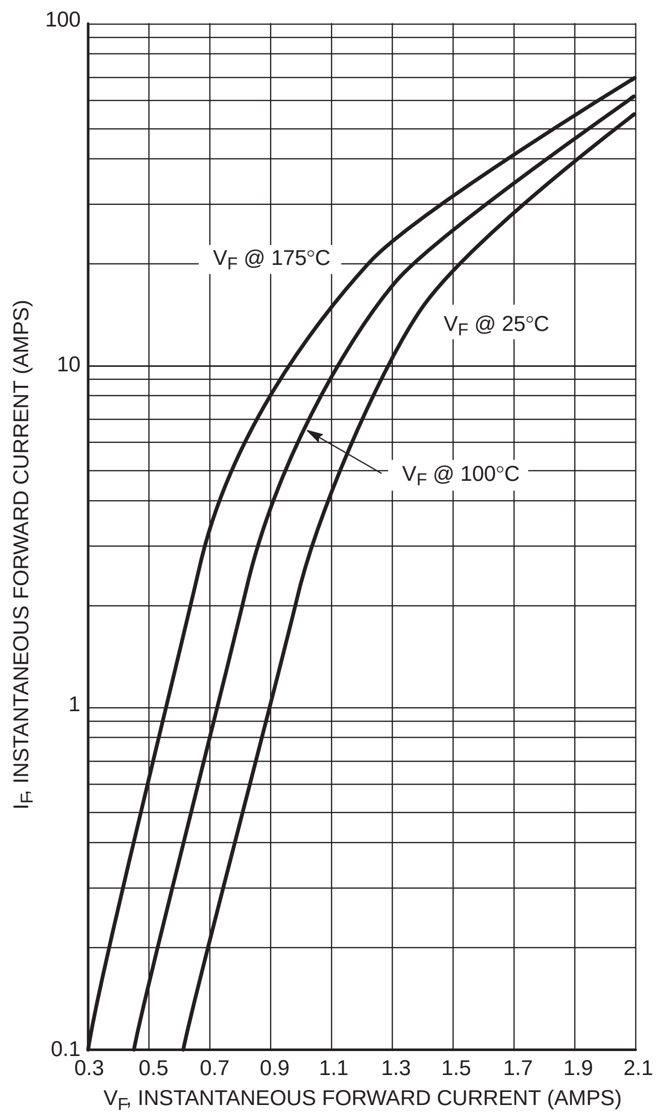

Figure 2. Typical Forward Voltage

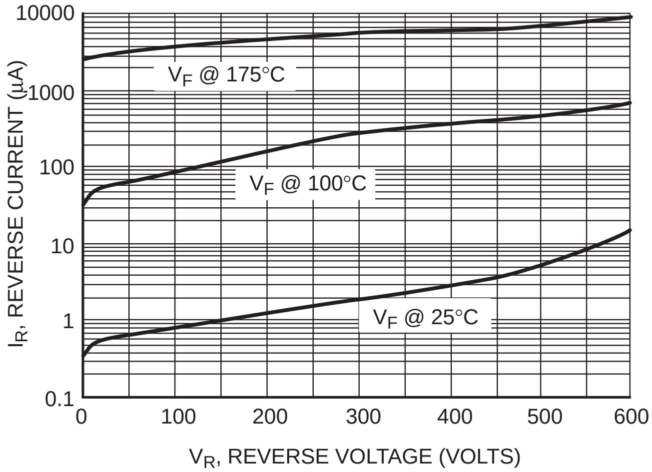

Figure 3. Maximum Reverse Current

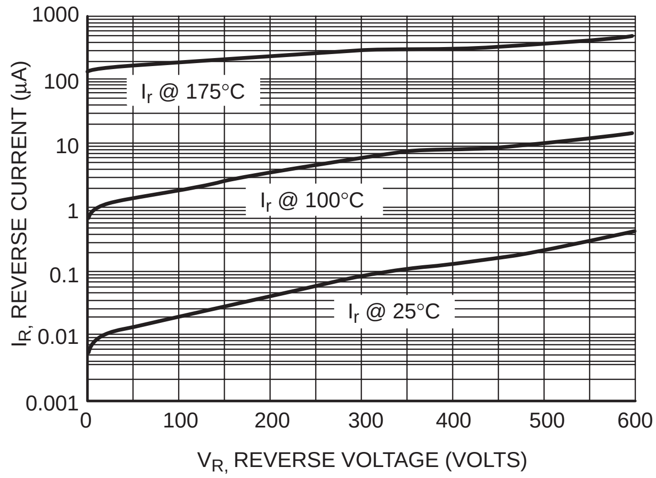

Figure 4. Typical Reverse Current

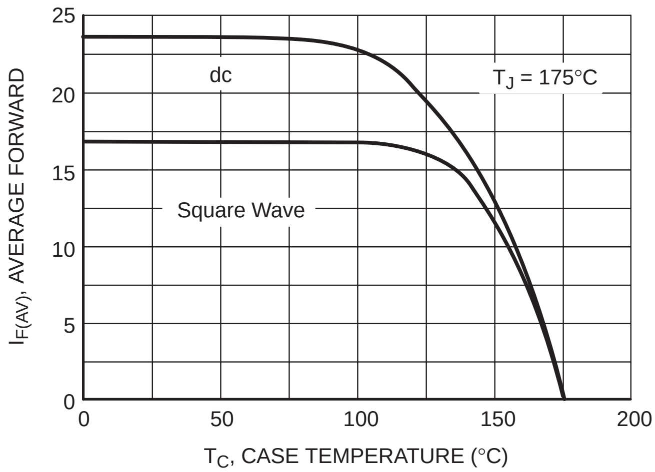

Figure 5. Current Derating

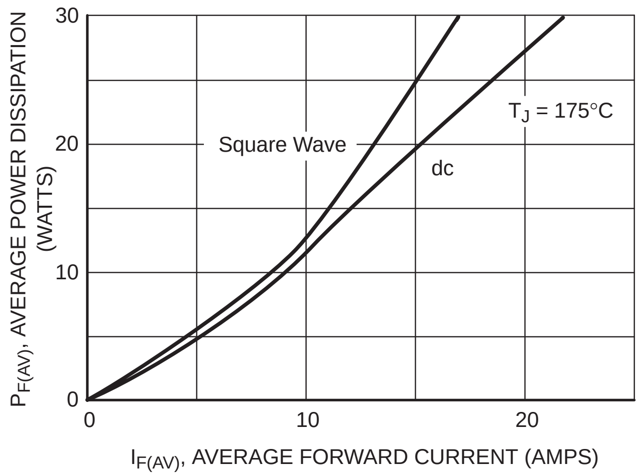

Figure 6. Power Dissipation

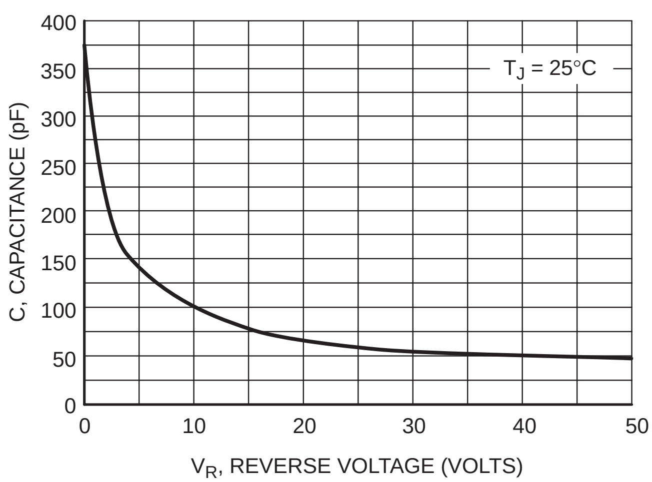

Figure 7. Maximum Capacitance

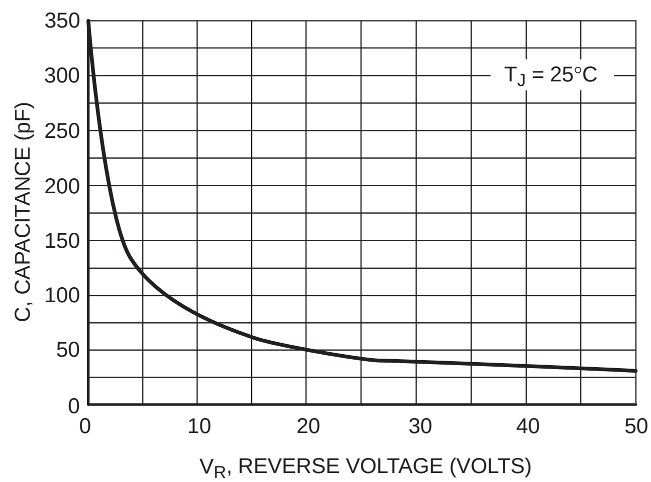

Figure 8. Typical Capacitance

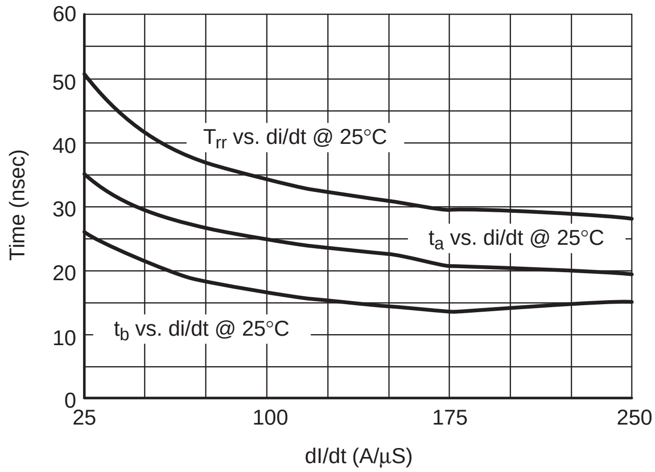

Figure 9. Typical Trr vs. di/dt

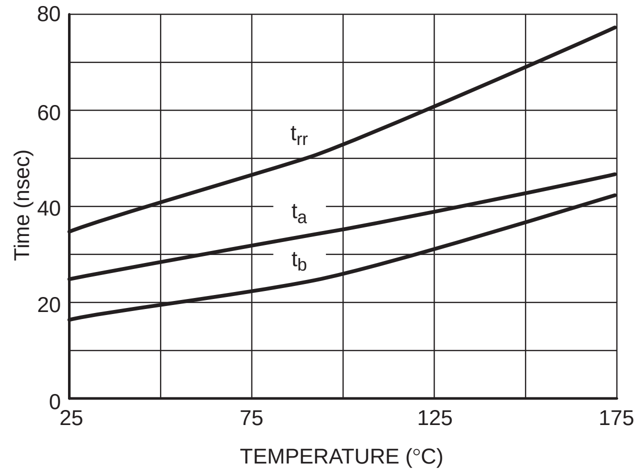

Figure 10. Typical Trr vs. Temperature

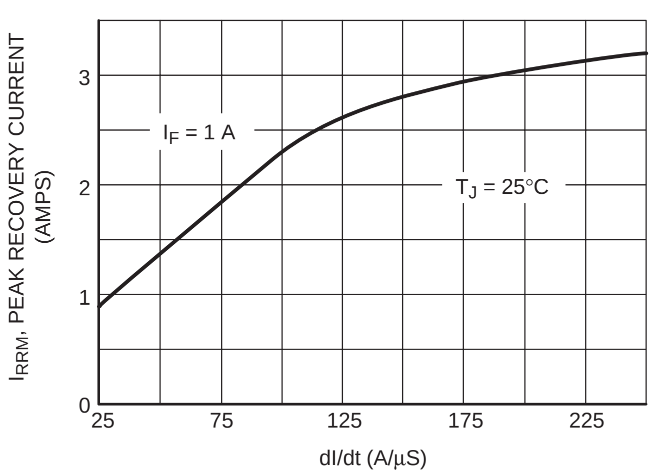

Figure 11. Typical Peak Reverse Recovery Current

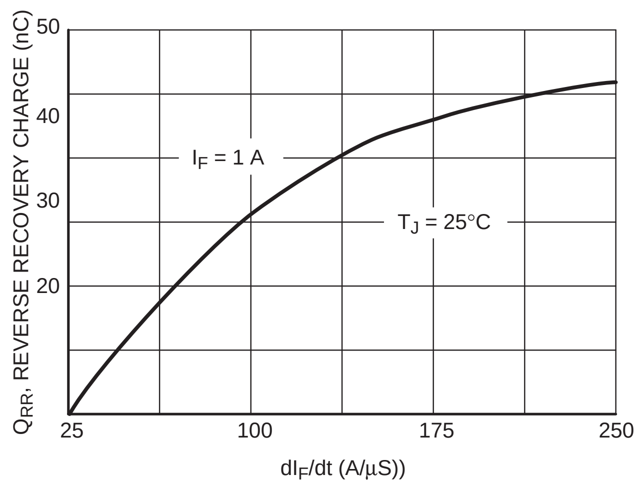

Figure 12. Typical Reverse Recovery Charge

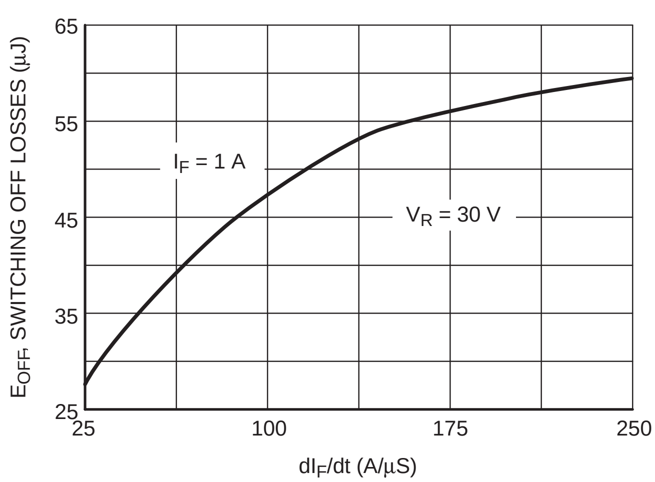

Figure 13. Typical Switching Off Losses

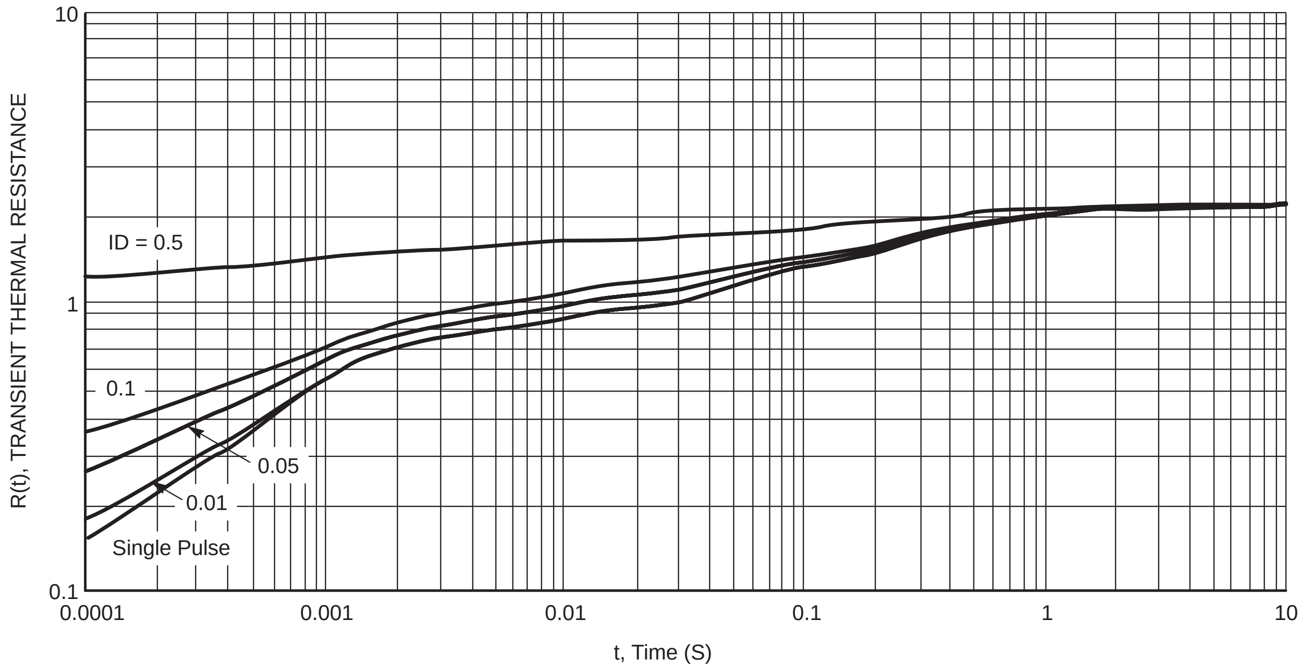

Figure 14. Transient Thermal Response

CHAPTER 5
Standard and Fast Recovery Data Sheets

1N4001, 1N4002, 1N4003, 1N4004, 1N4005, 1N4006, 1N4007

1N4004 and 1N4007 are Preferred Devices

Axial Lead Standard Recovery Rectifiers

This data sheet provides information on subminiature size, axial lead mounted rectifiers for general–purpose low–power applications.

Mechanical Characteristics

- Case: Epoxy, Molded
- Weight: 0.4 gram (approximately)
- Finish: All External Surfaces Corrosion Resistant and Terminal Leads are Readily Solderable
- Lead and Mounting Surface Temperature for Soldering Purposes: 220°C Max. for 10 Seconds, 1/16″ from case
- Shipped in plastic bags, 1000 per bag.
- Available Tape and Reeled, 5000 per reel, by adding a “RL” suffix to the part number
- Available in Fan–Fold Packaging, 3000 per box, by adding a “FF” suffix to the part number
- Polarity: Cathode Indicated by Polarity Band
- Marking: 1N4001, 1N4002, 1N4003, 1N4004, 1N4005, 1N4006, 1N4007

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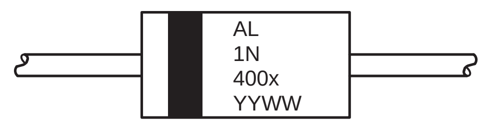
LEAD MOUNTED RECTIFIERS
50–1000 VOLTS
DIFFUSED JUNCTION

CASE 59
AXIAL LEAD
PLASTIC

MARKING DIAGRAM



AL = Assembly Location
1N400x = Device Number
x = 1, 2, 3, 4, 5, 6 or 7
YY = Year
WW = Work Week

MAXIMUM RATINGS

Rating	Symbol	1N4001	1N4002	1N4003	1N4004	1N4005	1N4006	1N4007	Unit
*Peak Repetitive Reverse Voltage Working Peak Reverse Voltage DC Blocking Voltage	V_{RRM} V_{RWM} V_R	50	100	200	400	600	800	1000	Volts
*Non–Repetitive Peak Reverse Voltage (halfwave, single phase, 60 Hz)	V_{RSM}	60	120	240	480	720	1000	1200	Volts
*RMS Reverse Voltage	$V_{R(RMS)}$	35	70	140	280	420	560	700	Volts
*Average Rectified Forward Current (single phase, resistive load, 60 Hz, T_A = 75°C)	I_O	1.0							Amp
*Non–Repetitive Peak Surge Current (surge applied at rated load conditions)	I_{FSM}	30 (for 1 cycle)							Amp
Operating and Storage Junction Temperature Range	T_J T_{stg}	–65 to +175							°C

*Indicates JEDEC Registered Data

ORDERING INFORMATION

See detailed ordering and shipping information on page 448 of this data sheet.

Preferred devices are recommended choices for future use and best overall value.

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ELECTRICAL CHARACTERISTICS*

Rating	Symbol	Typ	Max	Unit
Maximum Instantaneous Forward Voltage Drop (i_F = 1.0 Amp, T_J = 25°C)	v_F	0.93	1.1	Volts
Maximum Full–Cycle Average Forward Voltage Drop (I_O = 1.0 Amp, T_L = 75°C, 1 inch leads)	$V_{F(AV)}$	–	0.8	Volts
Maximum Reverse Current (rated dc voltage) (T_J = 25°C) (T_J = 100°C)	I_R	 0.05 1.0	 10 50	μA
Maximum Full–Cycle Average Reverse Current (I_O = 1.0 Amp, T_L = 75°C, 1 inch leads)	$I_{R(AV)}$	–	30	μA

*Indicates JEDEC Registered Data

ORDERING & SHIPPING INFORMATION

Device	Package	Shipping
1N4001	Axial Lead	1000 Units/Bag
1N4001FF	Axial Lead	3000 Units/Box
1N4001RL	Axial Lead	5000/Tape & Reel
1N4002	Axial Lead	1000 Units/Bag
1N4002FF	Axial Lead	3000 Units/Box
1N4002RL	Axial Lead	5000/Tape & Reel
1N4003	Axial Lead	1000 Units/Bag
1N4003FF	Axial Lead	3000 Units/Box
1N4003RL	Axial Lead	5000/Tape & Reel
1N4004	Axial Lead	1000 Units/Bag
1N4004FF	Axial Lead	3000 Units/Box
1N4004RL	Axial Lead	5000/Tape & Reel
1N4005	Axial Lead	1000 Units/Bag
1N4005FF	Axial Lead	3000 Units/Box
1N4005RL	Axial Lead	5000/Tape & Reel
1N4006	Axial Lead	1000 Units/Bag
1N4006FF	Axial Lead	3000 Units/Box
1N4006RL	Axial Lead	5000/Tape & Reel
1N4007	Axial Lead	1000 Units/Bag
1N4007FF	Axial Lead	3000 Units/Box
1N4007RL	Axial Lead	5000/Tape & Reel

1N5400 thru 1N5408

1N5404 and 1N5406 are Preferred Devices

Axial-Lead Standard Recovery Rectifiers

Lead mounted standard recovery rectifiers are designed for use in power supplies and other applications having need of a device with the following features:

- High Current to Small Size
- High Surge Current Capability
- Low Forward Voltage Drop
- Void–Free Economical Plastic Package
- Available in Volume Quantities
- Plastic Meets UL 94V–0 for Flammability

Mechanical Characteristics

- Case: Epoxy, Molded
- Weight: 1.1 gram (approximately)
- Finish: All External Surfaces Corrosion Resistant and Terminal Leads are Readily Solderable
- Lead and Mounting Surface Temperature for Soldering Purposes: 220°C Max. for 10 Seconds, 1/16″ from case
- Polarity: Cathode Indicated by Polarity Band
- Marking: 1N5400, 1N5401, 1N5402, 1N5404, 1N5406, 1N5407, 1N5408

MAXIMUM RATINGS

Please See the Table on the Following Page

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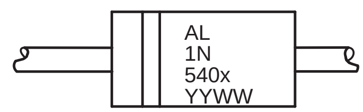
STANDARD RECOVERY RECTIFIERS
50–1000 VOLTS
3.0 AMPERES

AXIAL LEAD
CASE 267–05
STYLE 1

MARKING DIAGRAM



AL = Assembly Location
1N540x = Device Number
x = 0, 1, 2, 4, 6, 7 or 8
YY = Year
WW = Work Week

ORDERING INFORMATION

Device	Package	Shipping
1N5400	Axial Lead	500 Units/Box
1N5400RL	Axial Lead	1200/Tape & Reel
1N5401	Axial Lead	500 Units/Box
1N5401RL	Axial Lead	1200/Tape & Reel
1N5402	Axial Lead	500 Units/Box
1N5402RL	Axial Lead	1200/Tape & Reel
1N5404	Axial Lead	500 Units/Box
1N5404RL	Axial Lead	1200/Tape & Reel
1N5406	Axial Lead	500 Units/Box
1N5406RL	Axial Lead	1200/Tape & Reel
1N5407	Axial Lead	500 Units/Box
1N5407RL	Axial Lead	1200/Tape & Reel
1N5408	Axial Lead	500 Units/Box
1N5408RL	Axial Lead	1200/Tape & Reel

Preferred devices are recommended choices for future use and best overall value.

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October, 2000 – Rev. 4

Publication Order Number:
1N5400/D

MAXIMUM RATINGS

Rating	Symbol	1N5400	1N5401	1N5402	1N5404	1N5406	1N5407	1N5408	Unit
Peak Repetitive Reverse Voltage Working Peak Reverse Voltage DC Blocking Voltage	V_{RRM} V_{RWM} V_R	50	100	200	400	600	800	1000	Volts
Non–repetitive Peak Reverse Voltage	V_{RSM}	100	200	300	525	800	1000	1200	Volts
Average Rectified Forward Current (Single Phase Resistive Load, 1/2″ Leads, T_L = 105°C)	I_O	3.0							Amp
Non–repetitive Peak Surge Current (Surge Applied at Rated Load Conditions)	I_{FSM}	200 (one cycle)							Amp
Operating and Storage Junction Temperature Range	T_J T_{stg}	– 65 to +170 – 65 to +175							°C

THERMAL CHARACTERISTICS

Characteristic	Symbol	Typ	Unit
Thermal Resistance, Junction to Ambient (PC Board Mount, 1/2″ Leads)	$R_{\theta JA}$	53	°C/W

ELECTRICAL CHARACTERISTICS

Characteristic	Symbol	Min	Typ	Max	Unit
Forward Voltage (I_F = 3.0 Amp, T_A = 25°C)	v_F	–	–	1.0	Volts
Reverse Current (Rated dc Voltage)	I_R				µA
T_A = 25°C		–	–	10	
T_A = 150°C		–	–	100	

Ratings at 25°C ambient temperature unless otherwise specified.
60 Hz resistive or inductive loads.
For capacitive load, derate current by 20%.

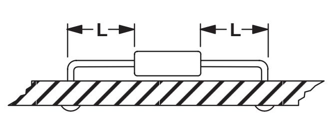
NOTE 1 — AMBIENT MOUNTING DATA

Data shown for thermal resistance junction–to–ambient ($R_{\theta JA}$) for the mountings shown is to be used as typical guideline values for preliminary engineering or in case the tie point temperature cannot be measured.

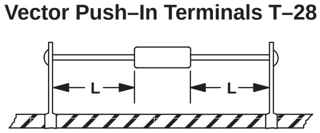
TYPICAL VALUES FOR $R_{\theta JA}$ IN STILL AIR

Mounting Method	Lead Length, L (IN)				$R_{\theta JA}$
	1/8	1/4	1/2	3/4	
1	50	51	53	55	°C/W
2	58	59	61	63	°C/W
3	28				°C/W

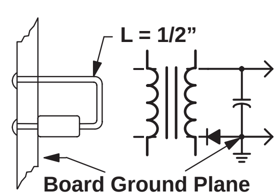
MOUNTING METHOD 1
P.C. Board Where Available Copper Surface area is small



MOUNTING METHOD 2
Vector Push–In Terminals T–28



MOUNTING METHOD 3
P.C. Board with 1–1/2” x 1–1/2” Copper Surface



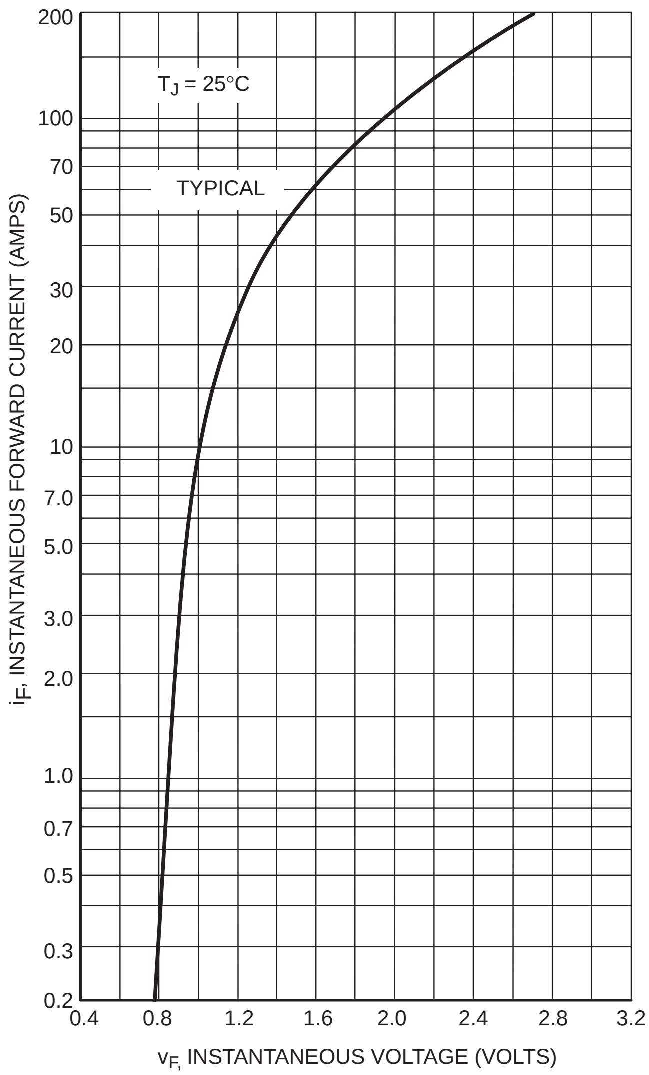


Figure 1. Forward Voltage

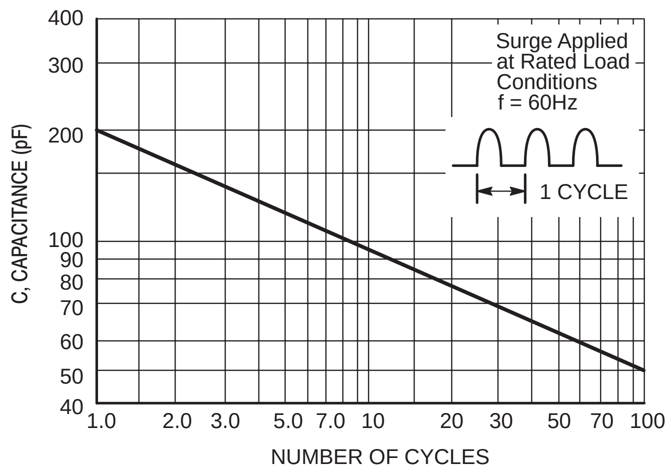


Figure 2. Maximum Nonrepetitive Surge Current

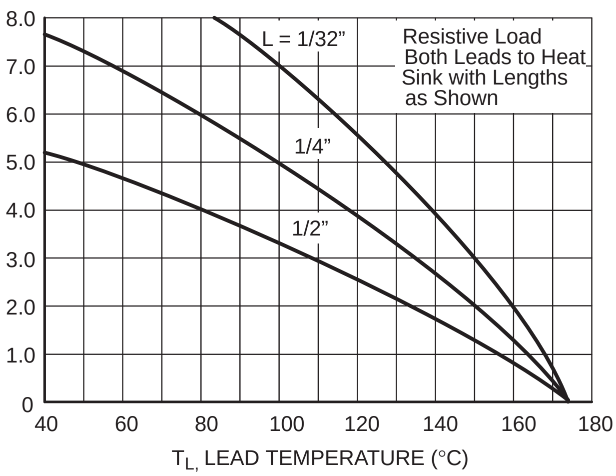


Figure 3. Current Derating Various Lead Lengths

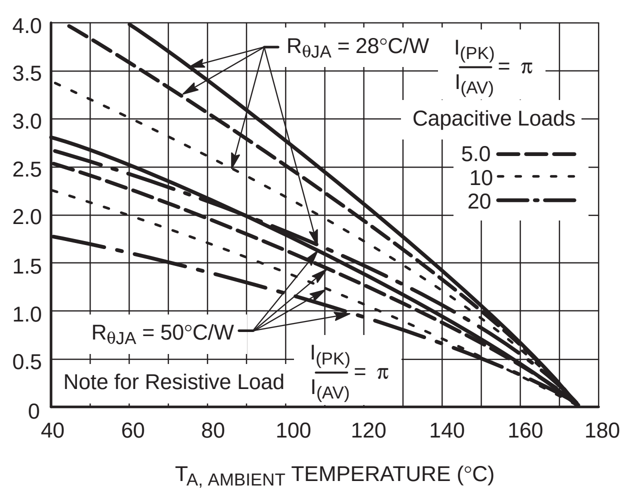


Figure 4. Current Derating PC Board Mounting

1N4933, 1N4934, 1N4935, 1N4936, 1N4937

1N4935 and 1N4937 are Preferred Devices

Axial-Lead Fast-Recovery Rectifiers

Axial–lead, fast–recovery rectifiers are designed for special applications such as dc power supplies, inverters, converters, ultrasonic systems, choppers, low RF interference and free wheeling diodes. A complete line of fast recovery rectifiers having typical recovery time of 150 nanoseconds providing high efficiency at frequencies to 250 kHz.

Mechanical Characteristics

- Case: Epoxy, Molded
- Weight: 0.4 gram (approximately)
- Finish: All External Surfaces Corrosion Resistant and Terminal Leads are Readily Solderable
- Lead and Mounting Surface Temperature for Soldering Purposes: 220°C Max. for 10 Seconds, 1/16″ from case
- Shipped in plastic bags, 1000 per bag.
- Available Tape and Reeled, 5000 per reel, by adding a “RL” suffix to the part number
- Polarity: Cathode Indicated by Polarity Band
- Marking: 1N4933, 1N4934, 1N4935, 1N4936, 1N4937

MAXIMUM RATINGS

Please See the Table on the Following Page

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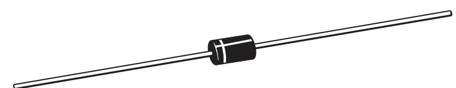
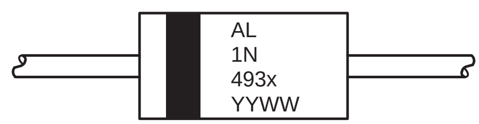
FAST RECOVERY RECTIFIERS 1.0 AMPERE 50–600 VOLTS



CASE 59
AXIAL LEAD
PLASTIC

MARKING DIAGRAM



AL = Assembly Location
1N493x = Device Number
x = 3, 4, 5, 6 or 7
YY = Year
WW = Work Week

ORDERING INFORMATION

Device	Package	Shipping
1N4933	Axial Lead	1000 Units/Bag
1N4933RL	Axial Lead	5000/Tape & Reel
1N4934	Axial Lead	1000 Units/Bag
1N4934RL	Axial Lead	5000/Tape & Reel
1N4935	Axial Lead	1000 Units/Bag
1N4935RL	Axial Lead	5000/Tape & Reel
1N4936	Axial Lead	1000 Units/Bag
1N4936RL	Axial Lead	5000/Tape & Reel
1N4937	Axial Lead	1000 Units/Bag
1N4937RL	Axial Lead	5000/Tape & Reel

Preferred devices are recommended choices for future use and best overall value.

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MAXIMUM RATINGS (Note 1.)

Rating	Symbol	1N4933	1N4934	1N4935	1N4936	1N4937	Unit
*Peak Repetitive Reverse Voltage Working Peak Reverse Voltage DC Blocking Voltage	V_{RRM} V_{RWM} V_R	50	100	200	400	600	Volts
*Non–Repetitive Peak Reverse Voltage RMS Reverse Voltage	V_{RSM} $V_{R(RMS)}$	75 35	150 70	250 140	450 280	650 420	Volts
*Average Rectified Forward Current (Single phase, resistive load, T_A = 75°C) (Note 2.)	I_O	1.0					Amp
*Non–Repetitive Peak Surge Current (Surge applied at rated load conditions)	I_{FSM}	30					Amps
Operating Junction Temperature Range Storage Temperature Range	T_J T_{stg}	– 65 to +150 – 65 to +150					°C

THERMAL CHARACTERISTICS

Characteristic	Symbol	Max	Unit
Thermal Resistance, Junction to Ambient (Typical Printed Circuit Board Mounting)	$R_{\theta JC}$	65	°C/W

ELECTRICAL CHARACTERISTICS

Characteristic	Symbol	Min	Typ	Max	Unit
Instantaneous Forward Voltage (I_F = 3.14 Amp, T_J = 125°C)	v_F	–	1.0	1.2	Volts
Forward Voltage (I_F = 1.0 Amp, T_A = 25°C)	V_F	–	1.0	1.1	Volts
*Reverse Current (Rated dc Voltage) T_A = 25°C T_A = 100°C	I_R	– –	1.0 50	5.0 100	µA

***REVERSE RECOVERY CHARACTERISTICS**

Characteristic	Symbol	Min	Typ	Max	Unit
Reverse Recovery Time (I_F = 1.0 Amp to V_R = 30 Vdc) (I_{FM} = 15 Amp, di/dt = 10 A/µs)	t_{rr}	 – –	 150 175	 200 300	ns
Reverse Recovery Current (I_F = 1.0 Amp to V_R = 30 Vdc)	$I_{RM(REC)}$	–	1.0	2.0	Amp

1. Ratings at 25°C ambient temperature unless otherwise specified.
2. Derate by 20% for capacitive loads.

*Indicates JEDEC Registered Data for 1N4933 Series.

MR850, MR851, MR852, MR854, MR856

MR852 and MR856 are Preferred Devices

Axial Lead Fast Recovery Rectifiers

Axial lead mounted fast recovery power rectifiers are designed for special applications such as dc power supplies, inverters, converters, ultrasonic systems, choppers, low RF interference and free wheeling diodes. A complete line of fast recovery rectifiers having typical recovery time of 100 nanoseconds providing high efficiency at frequencies to 250 kHz.

Mechanical Characteristics

- Case: Epoxy, Molded
- Weight: 1.1 gram (approximately)
- Finish: All External Surfaces Corrosion Resistant and Terminal Leads are Readily Solderable
- Lead and Mounting Surface Temperature for Soldering Purposes: 220°C Max. for 10 Seconds, 1/16″ from case
- Shipped in plastic bags, 500 per box
- Available Tape and Reeled, 1200 per reel, by adding a “RL” suffix to the part number
- Polarity: Cathode Indicated by Polarity Band
- Marking: MR850, MR851, MR852, MR854, MR856

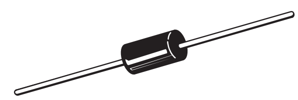
MAXIMUM RATINGS

Please See the Table on the Following Page

ON Semiconductor™

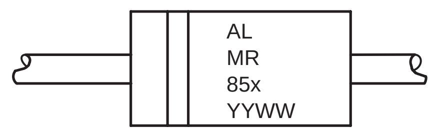
http://onsemi.com

FAST RECOVERY POWER RECTIFIERS 3.0 AMPERES 50–600 VOLTS



AXIAL LEAD
CASE 267–05
STYLE 1

MARKING DIAGRAM



AL = Assembly Location
MR85x = Device Number
x = 0, 1, 2, 4 or 6
YY = Year
WW = Work Week

ORDERING INFORMATION

Device	Package	Shipping
MR850	Axial Lead	500 Units/Box
MR850RL	Axial Lead	1200/Tape & Reel
MR851	Axial Lead	500 Units/Box
MR851RL	Axial Lead	1200/Tape & Reel
MR852	Axial Lead	500 Units/Box
MR852RL	Axial Lead	1200/Tape & Reel
MR854	Axial Lead	500 Units/Box
MR854RL	Axial Lead	1200/Tape & Reel
MR856	Axial Lead	500 Units/Box
MR856RL	Axial Lead	1200/Tape & Reel

Preferred devices are recommended choices for future use and best overall value.

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October, 2000 – Rev. 3

Publication Order Number:
MR850/D

MAXIMUM RATINGS

Rating	Symbol	MR850	MR851	MR852	MR854	MR856	Unit
Peak Repetitive Reverse Voltage Working Peak Reverse Voltage DC Blocking Voltage	V_{RRM} V_{RWM} V_R	50	100	200	400	600	Volts
Non–Repetitive Peak Reverse Voltage	V_{RSM}	75	150	250	450	650	Volts
RMS Reverse Voltage	$V_{R(RMS)}$	35	70	140	280	420	Volts
Average Rectified Forward Current (Single phase resistive load, T_A = 80°C)	I_O	3.0					Amp
Non–Repetitive Peak Surge Current (surge applied at rated load conditions)	I_{FSM}	100 (one cycle)					Amp
Operating and Storage Junction Temperature Range	T_J, T_{stg}	– 65 to +125 – 65 to +150					°C

THERMAL CHARACTERISTICS

Characteristic	Symbol	Max	Unit
Thermal Resistance, Junction to Ambient (Recommended Printed Circuit Board Mounting)	$R_{\theta JA}$	28	°C/W

ELECTRICAL CHARACTERISTICS

Characteristic	Symbol	Min	Typ	Max	Unit
Forward Voltage (I_F = 3.0 Amp, T_J = 25°C)	V_F	–	1.04	1.25	Volts
Reverse Current (rated dc voltage) T_J = 25°C	I_R	–	2.0	10	µA
T_J = 80°C MR850		–	–	150	
T_J = 80°C MR851		–	60	150	
T_J = 80°C MR852		–	–	200	
T_J = 80°C MR854		–	–	250	
T_J = 80°C MR856		–	100	300	

REVERSE RECOVERY CHARACTERISTICS

Characteristic	Symbol	Min	Typ	Max	Unit
Reverse Recovery Time (I_F = 1.0 Amp to V_R = 30 Vdc) (I_F = 15 Amp, di/dt = 10 A/µs)	t_{rr}	 – –	 100 150	 200 300	ns
Reverse Recovery Current (I_F = 1.0 Amp to V_R = 30 Vdc)	$I_{RM(REC)}$	–	–	2.0	Amp

MRA4003T3 Series

Surface Mount Standard Recovery Power Rectifier

SMA Power Surface Mount Package

Features construction with glass passivation. Ideally suited for surface mounted Automotive application.

- Compact Package with J–Bend Leads Ideal for Automated Handling
- Stable, High Temperature, Glass Passivated Junction

Mechanical Characteristics

- Case: Molded Epoxy
  Epoxy meets UL94, VO at 1/8″
- Weight: 70 mg (Approximately)
- Finish: All External Surfaces are Corrosion Resistant and Terminal Leads are Readily Solderable
- Lead and Mounting Surface Temperature for Soldering Purposes: 260°C Max. for 10 seconds in Solder Bath
- Polarity: Notch and/or Band in Plastic Body Indicates Cathode Lead
- Available in 12 mm Tape, 5000 Units per 13 inch Reel, Add “T3” Suffix to Part Number
- Marking: MRA4003T3 — R13
  MRA4004T3 — R14
  MRA4005T3 — R15
  MRA4006T3 — R16
  MRA4007T3 — R17

MAXIMUM RATINGS

Please See the Table on the Following Page

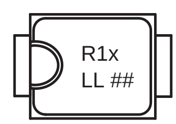
ON Semiconductor™

http://onsemi.com

STANDARD RECOVERY RECTIFIERS
1.0 AMPERES
300–1000 VOLTS

CASE 403B
SMA
PLASTIC

MARKING DIAGRAM



R1x = Device Code
x = 3, 4, 5, 6 or 7
LL = Location Code
= Date Code

ORDERING INFORMATION

Device	Package	Shipping
MRA4003T3	SMA	5000/Tape & Reel
MRA4004T3	SMA	5000/Tape & Reel
MRA4005T3	SMA	5000/Tape & Reel
MRA4006T3	SMA	5000/Tape & Reel
MRA4007T3	SMA	5000/Tape & Reel

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MAXIMUM RATINGS

Rating	Symbol	Value					Unit
		MRA4003T3	MRA4004T3	MRA4005T3	MRA4006T3	MRA4007T3	
Peak Repetitive Reverse Voltage Working Peak Reverse Voltage DC Blocking Voltage	V_{RRM} V_{RWM} V_R	300	400	600	800	1000	Volts
Avg. Rectified Forward Current (At Rated V_R, T_L = 150°C)	I_O	1					Amp
Peak Repetitive Forward Current (At Rated V_R, Square Wave, 20 kHz, T_L = 150°C)	I_{FRM}	2					Amps
Non–Repetitive Peak Surge Current (Surge applied at rated load conditions, halfwave, single phase, 60 Hz)	I_{FSM}	30					Amps
Storage/Operating Case Temperature	T_{stg}, T_C	–55 to 150					°C
Operating Junction Temperature	T_J	–55 to 175					°C

THERMAL CHARACTERISTICS

Characteristic	Symbol	Value	Unit
Thermal Resistance, Junction to Lead (Note 1.) Thermal Resistance, Junction to Ambient (Note 2.)	$R_{\theta JL}$ $R_{\theta JA}$	16.2 88.3	°C/W

ELECTRICAL CHARACTERISTICS

Characteristic	Symbol	Value		Unit
		T_J = 25°C	T_J = 100°C	
Maximum Instantaneous Forward Voltage (Note 3.) (I_F = 1 A) (I_F = 2 A)	V_F	 1.1 1.18	 1.04 1.12	Volts
Maximum Instantaneous Reverse Current (at rated DC voltage)	I_R	10	50	μA

1. Minimum Pad Size
2. 1 inch Pad Size
3. Pulse Test: Pulse Width ≤ 250 μs, Duty Cycle ≤ 2%.

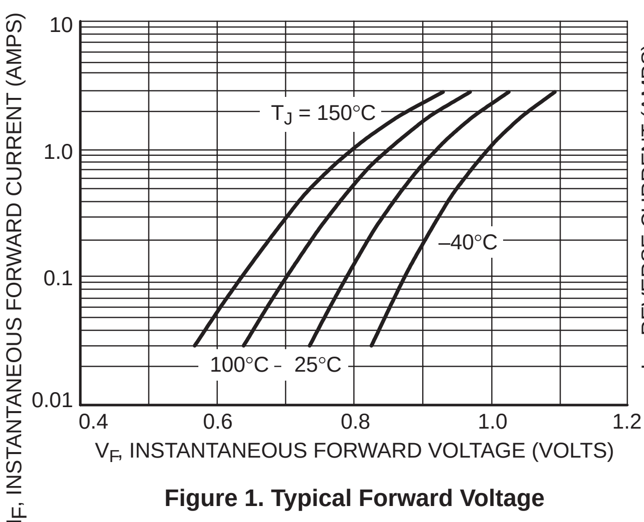

Figure 1. Typical Forward Voltage

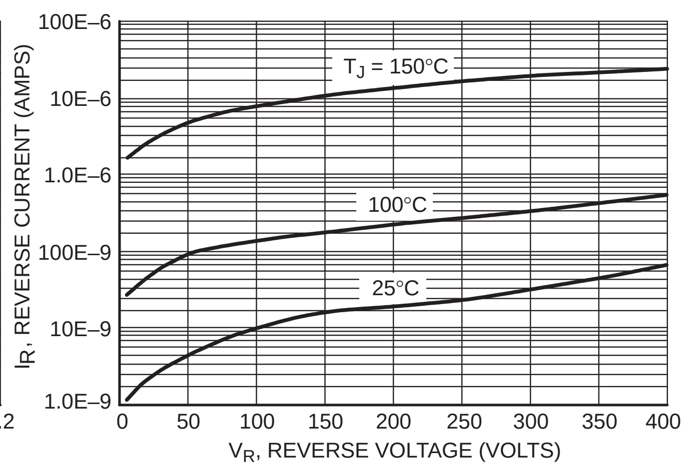

Figure 2. Typical Reverse Current

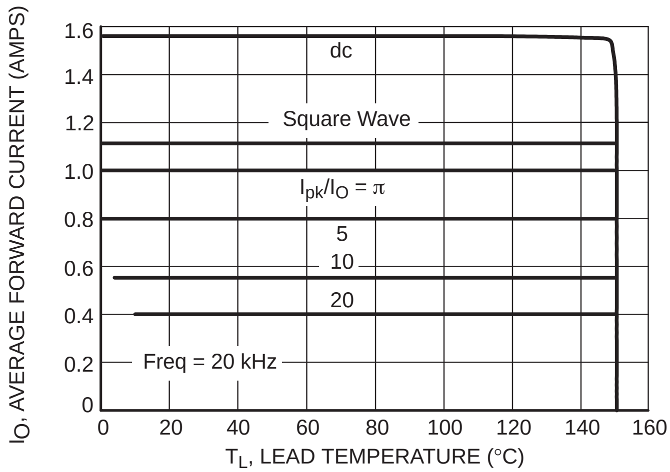

Figure 3. Current Derating per Leg

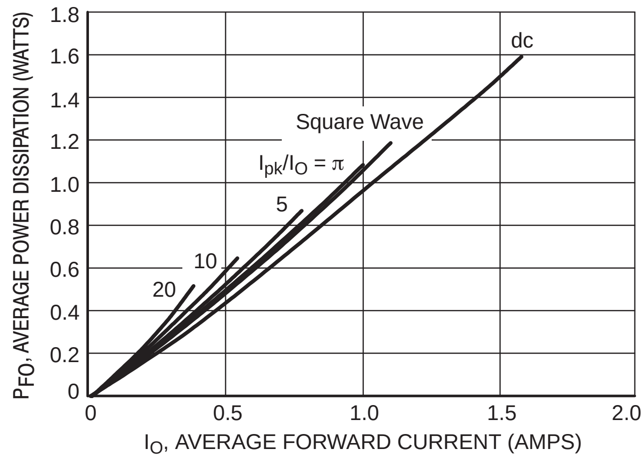

Figure 4. Forward Power Dissipation per Leg

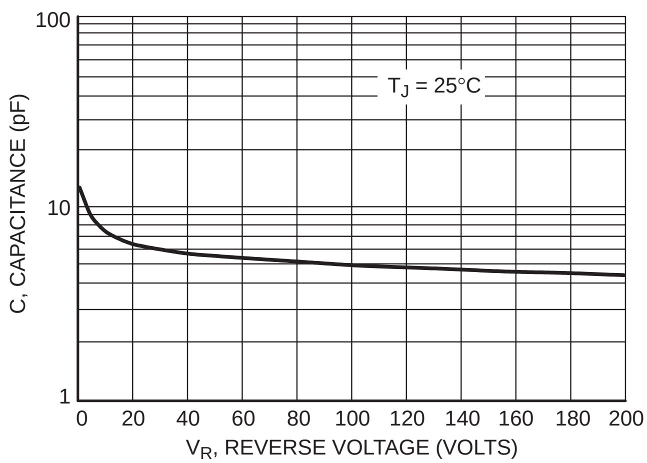

Figure 5. Capacitance

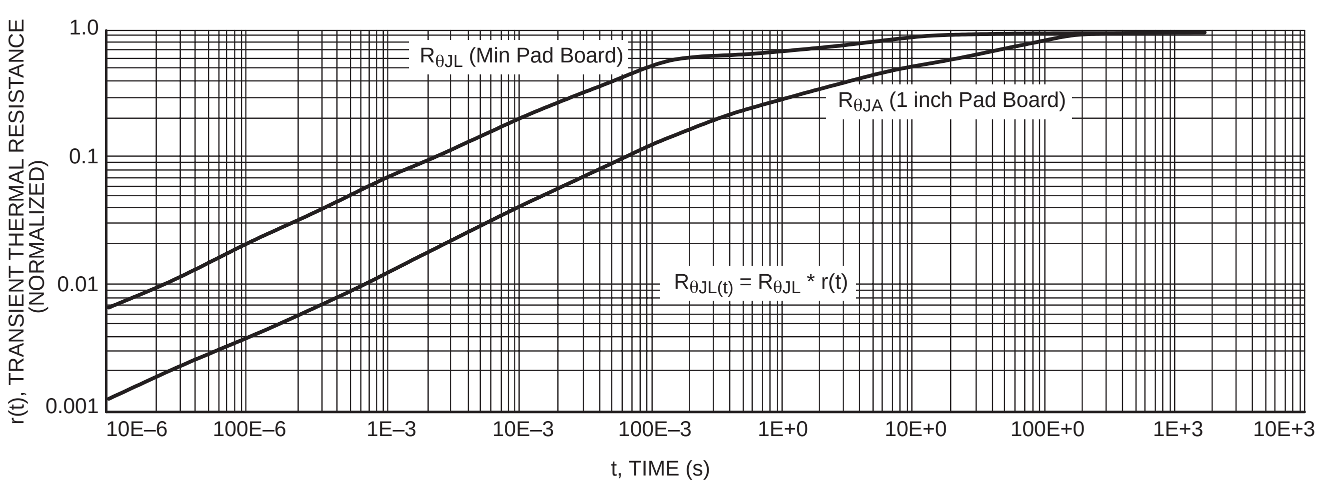

Figure 6. Thermal Response

MRS1504T3

Surface Mount Standard Recovery Power Rectifier

SMB Power Surface Mount Package

Features mesa epitaxial construction with glass passivation. Ideally suited for high frequency switching power supplies; free wheeling diodes and polarity protection diodes.

- Compact Package with J–Bend Leads Ideal for Automated Handling
- Stable, High Temperature, Glass Passivated Junction

Mechanical Characteristics:

- Case: Molded Epoxy
- Epoxy Meets UL94, VO at 1/8″
- Weight: 95 mg (approximately)
- Finish: All External Surfaces Corrosion Resistant and Terminal Leads are Readily Solderable
- Maximum Temperature of 260°C / 10 Seconds for Soldering
- Available in 12 mm Tape, 2500 Units per 13 inch Reel, Add “T3” Suffix to Part Number
- Polarity: Notch and/or band in Plastic Body Indicates Cathode Lead
- Marking: RGG

MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Peak Repetitive Reverse Voltage Working Peak Reverse Voltage DC Blocking Voltage	V_{RRM} V_{RWM} V_R	400	V
Average Rectified Forward Current (At Rated V_R, T_l = 118°C)	I_O	1.5	A
Peak Repetitive Forward Current (At Rated V_R, Square Wave, 20 kHz, T_l = 118°C)	I_{FRM}	3.0	A
Non–Repetitive Peak Surge Current (Surge applied at rated load conditions, halfwave, single phase, 60 Hz)	I_{FSM}	50	A
Storage/Operating Case Temperature Range	T_{stg}, T_C	–55 to 150	°C
Operating Junction Temperature Range	T_J	–55 to 150	°C

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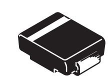
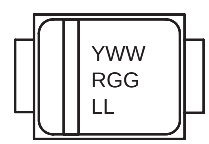
http://onsemi.com

STANDARD RECOVERY RECTIFIER
1.5 AMPERES
400 VOLTS



SMB
CASE 403A
PLASTIC

MARKING DIAGRAM



Y = Year
WW = Work Week
RGG = Device Code
LL = Location Code

ORDERING INFORMATION

Device	Package	Shipping
MRS1504T3	SMB	2500/Tape & Reel

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THERMAL CHARACTERISTICS

Rating	Symbol	Value	Unit
Thermal Resistance – Junction–to–Lead (Note 2.) Thermal Resistance – Junction–to–Ambient (on 1″ sq. Cu. PCB pattern)	R_{tjl} R_{tja}	18 79	°C/W

ELECTRICAL CHARACTERISTICS

Maximum Instantaneous Forward Voltage (Note 1.), see Figure 2	V_F	**T_J = 25°C**	**T_J = 100°C**	V
(I_F = 1.5 A) (I_F = 2.25 A)		1.04 1.10	0.96 1.02	
Maximum Instantaneous Reverse Current, see Figure 4	I_R	**T_J = 25°C**	**T_J = 100°C**	μA
(V_R = 400 V) (V_R = 200 V)		1.0 0.5	340 180	

1. Pulse Test: Pulse Width ≤ 250 μs, Duty Cycle ≤ 2.0%.
2. Minimum pad size

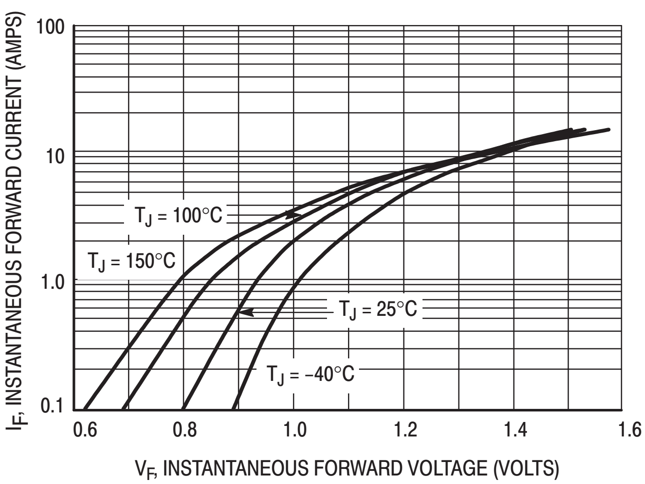


Figure 1. Typical Forward Voltage

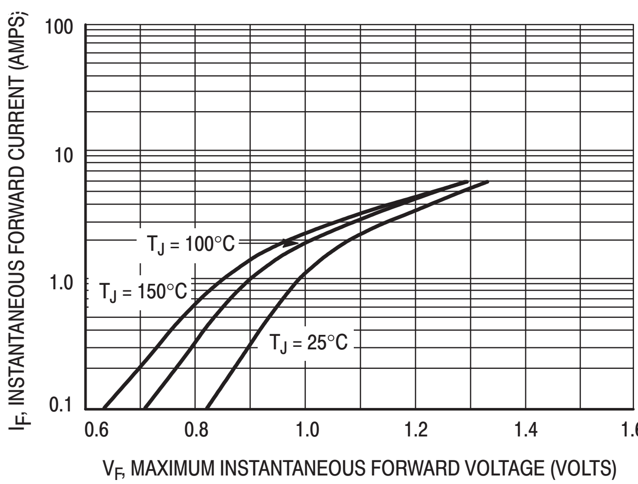


Figure 2. Maximum Forward Voltage

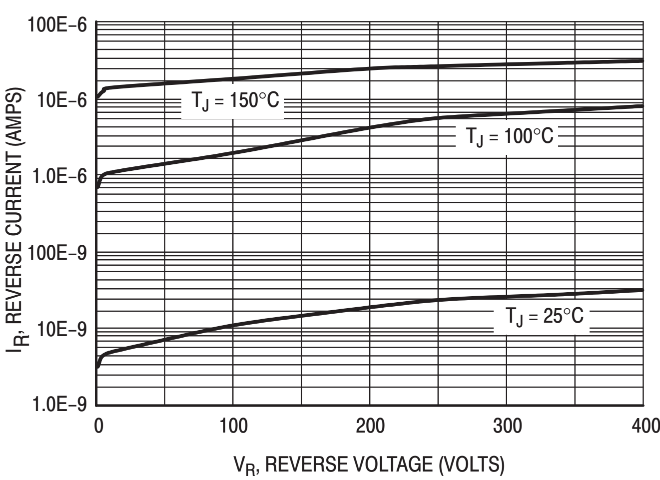


Figure 3. Typical Reverse Current

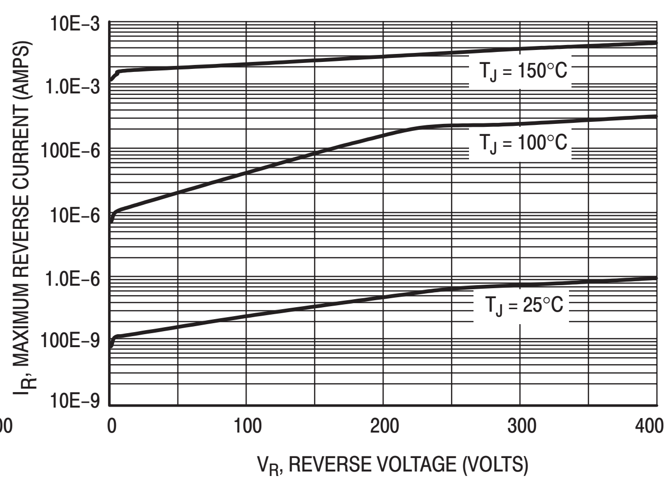


Figure 4. Maximum Reverse Current

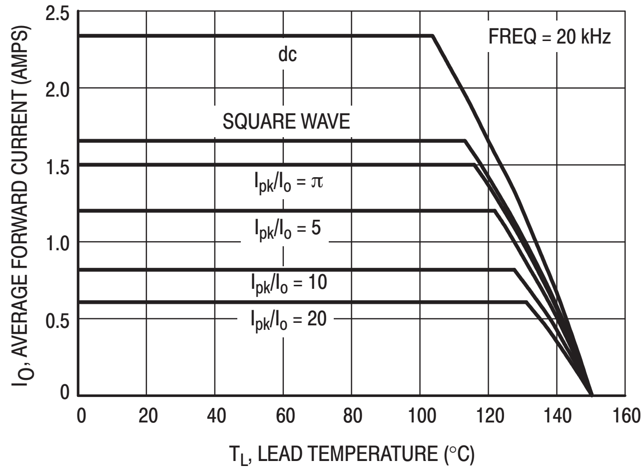


Figure 5. Current Derating

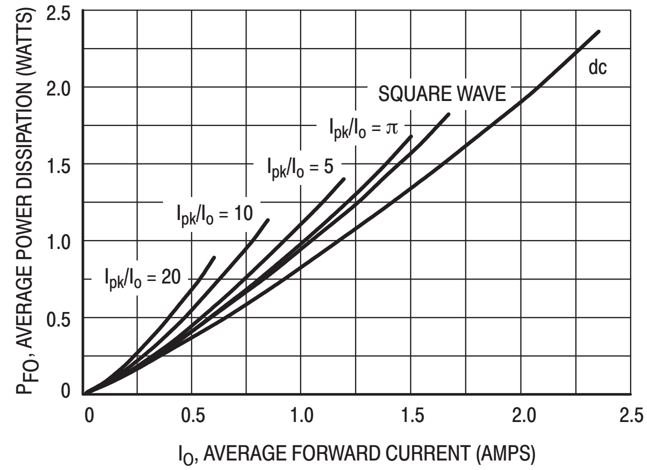


Figure 6. Forward Power Dissipation

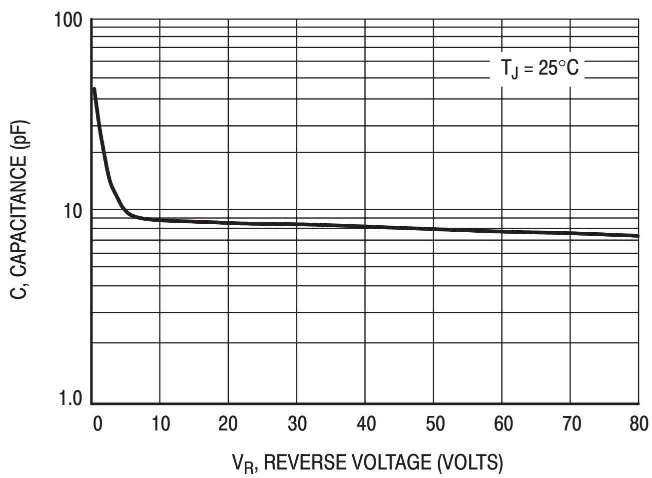


Figure 7. Capacitance

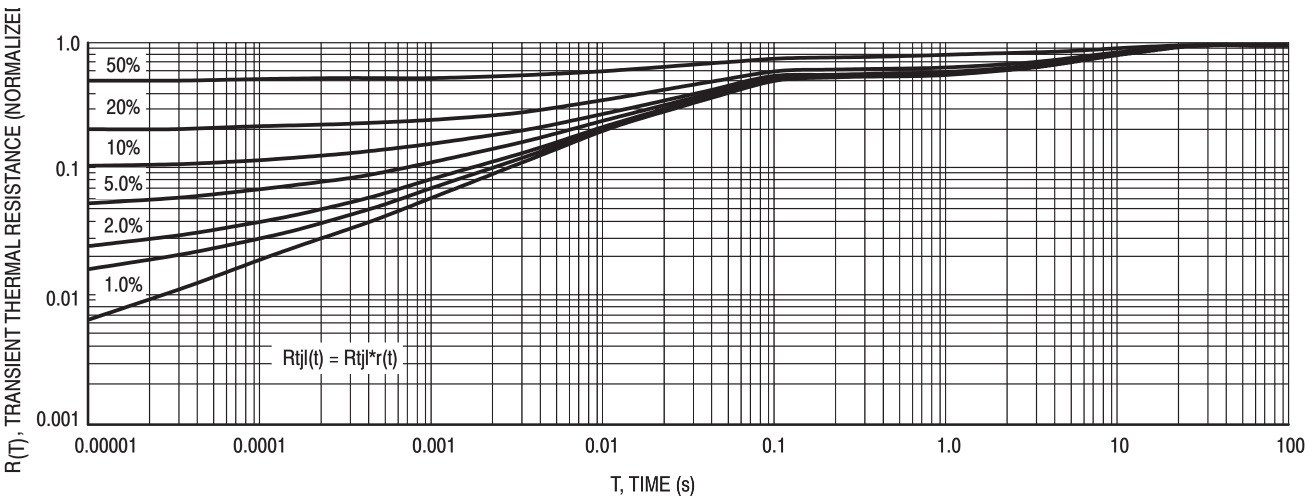


Figure 8. Thermal Response Junction to Lead

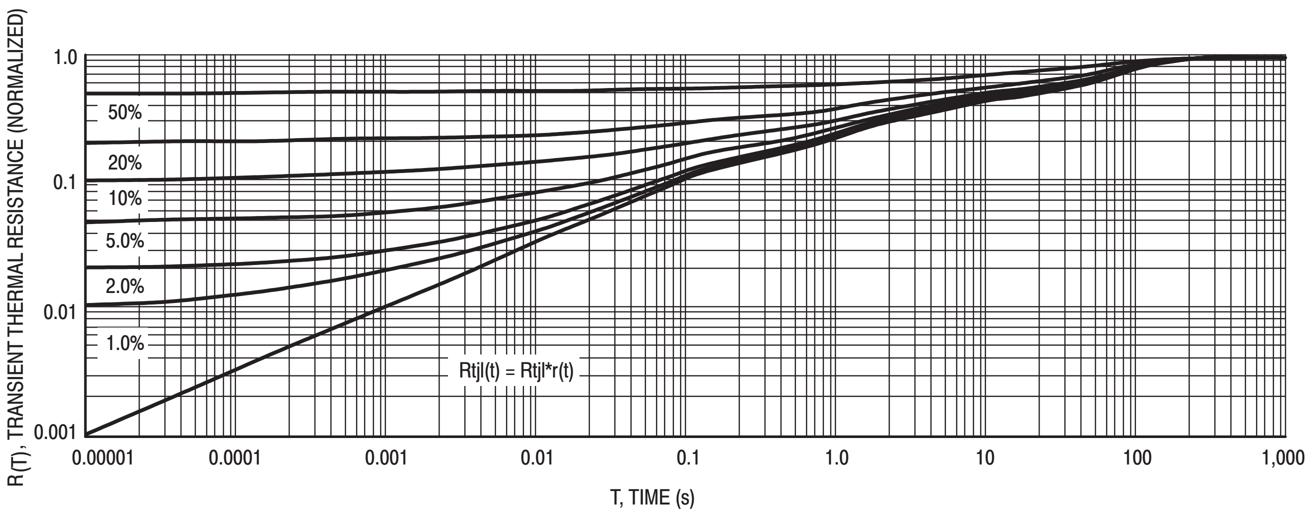


Figure 9. Thermal Response Junction to Ambient

MR2502, MR2504, MR2510

MR2504 and MR2510 are Preferred Devices

Medium-Current Silicon Rectifiers

. . . compact, highly efficient silicon rectifiers for medium–current applications requiring:

- High Current Surge — 400 Amperes @ T_J = 175°C
- Peak Performance @ Elevated Temperature — 25 Amperes @ T_C = 150°C
- Low Cost
- Compact, Molded Package — For Optimum Efficiency in a Small Case Configuration

Mechanical Characteristics:

- Case: Epoxy, Molded
- Weight: 1.8 grams (approximately)
- Finish: All External Surfaces Corrosion Resistant and Terminals are Readily Solderable
- Lead Temperature for Soldering Purposes: requires a custom temperature soldering profile
- Polarity: Cathode Polarity Band
- Shipped 5000 units per box

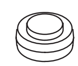
MAXIMUM RATINGS

Please See the Table on the Following Page

ON Semiconductor™

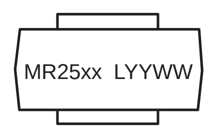
http://onsemi.com

MEDIUM–CURRENT SILICON RECTIFIERS 25 AMPERES 200–1000 VOLTS DIFFUSED JUNCTION



MICRODE BUTTON CASE 193

MARKING DIAGRAM



MR25xx	=	Device Code
xx	=	02, 04 or 10
L	=	Location Code
YY	=	Year
WW	=	Work Week

ORDERING INFORMATION

Device	Package	Shipping
MR2502	Microde Button	5000 Units/Box
MR2504	Microde Button	5000 Units/Box
MR2510	Microde Button	5000 Units/Box

Preferred devices are recommended choices for future use and best overall value.

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MAXIMUM RATINGS

Characteristic	Symbol	MR2502	MR2504	MR2510	Unit
Peak Repetitive Reverse Voltage Working Peak Reverse Voltage DC Blocking Voltage	V_{RRM} V_{RWM} V_R	200	400	1000	Volts
Non–Repetitive Peak Reverse Voltage (Halfwave, single phase, 60 Hz peak)	V_{RSM}	240	480	1200	Volts
Average Rectified Forward Current (Single phase, resistive load, 60 Hz, T_C = 150°C)	I_O	25			Amps
Non–Repetitive Peak Surge Current (Surge applied at rated load conditions, halfwave, single phase, 60 Hz)	I_{FSM}	400 (for 1 cycle)			Amps
Operating and Storage Junction Temperature Range	T_J, T_{stg}	– 65 to +175			°C

THERMAL CHARACTERISTICS

Characteristic	Symbol	Max	Unit
Thermal Resistance, Junction to Case (Single Side Cooled)	$R_{\theta JC}$	1.0	°C/W

ELECTRICAL CHARACTERISTICS

Characteristics and Conditions	Symbol	Max	Unit
Maximum Instantaneous Forward Voltage (i_F = 78.5 Amps, T_C = 25°C)	v_F	1.18	Volts
Maximum Reverse Current (rated dc voltage) T_C = 25°C T_C = 100°C	I_R	 100 500	μA

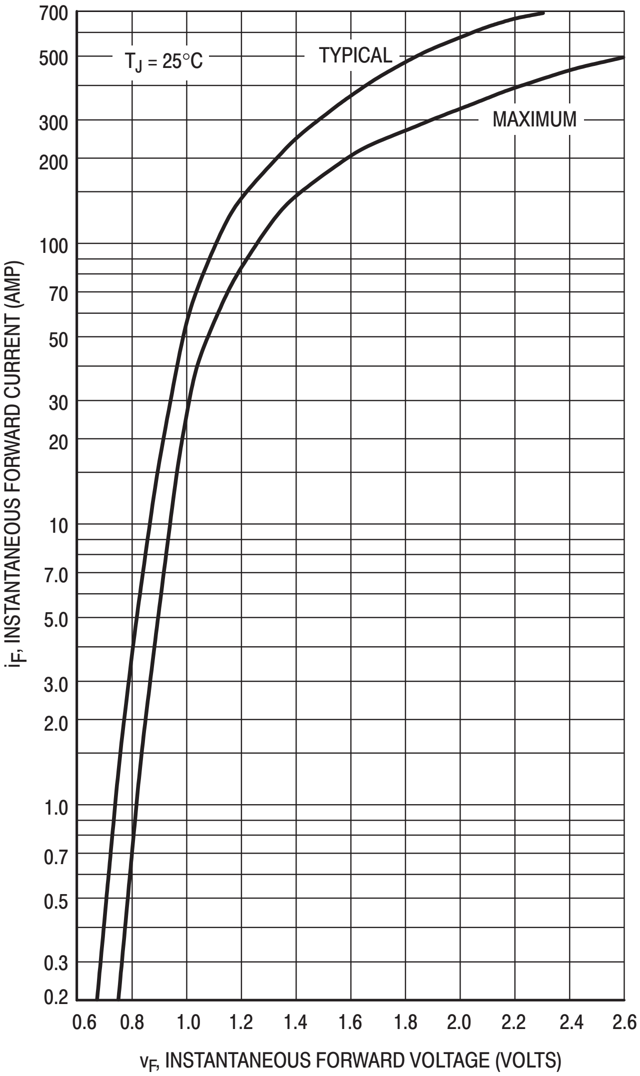


Figure 1. Forward Voltage

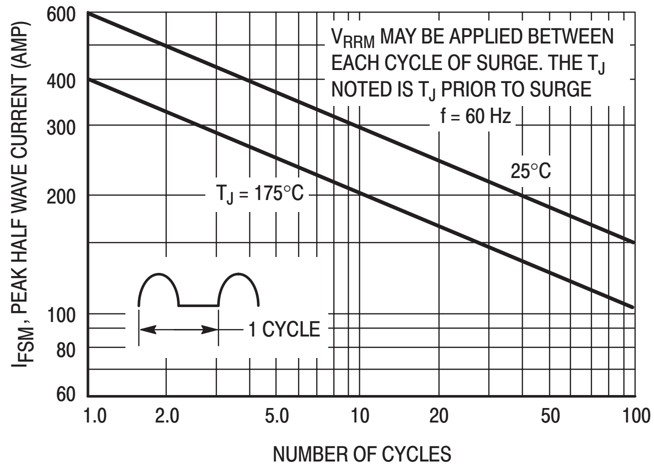


Figure 2. Non–Repetitive Surge Current

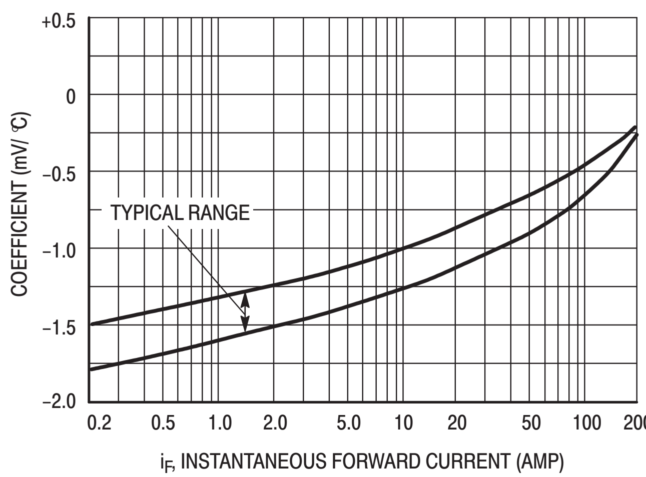


Figure 3. Forward Voltage Temperature Coefficient

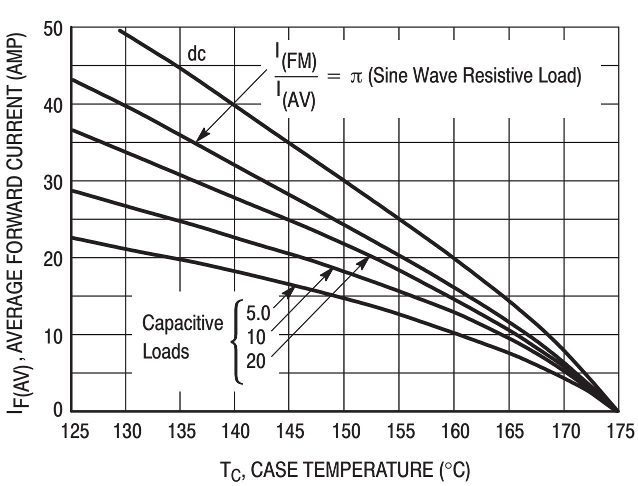


Figure 4. Current Derating

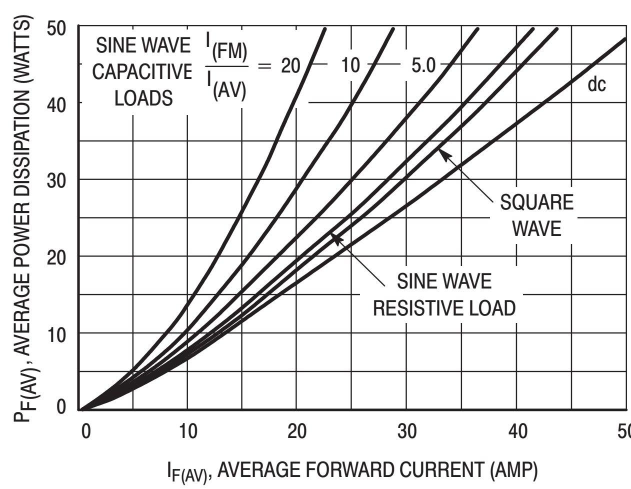


Figure 5. Forward Power Dissipation

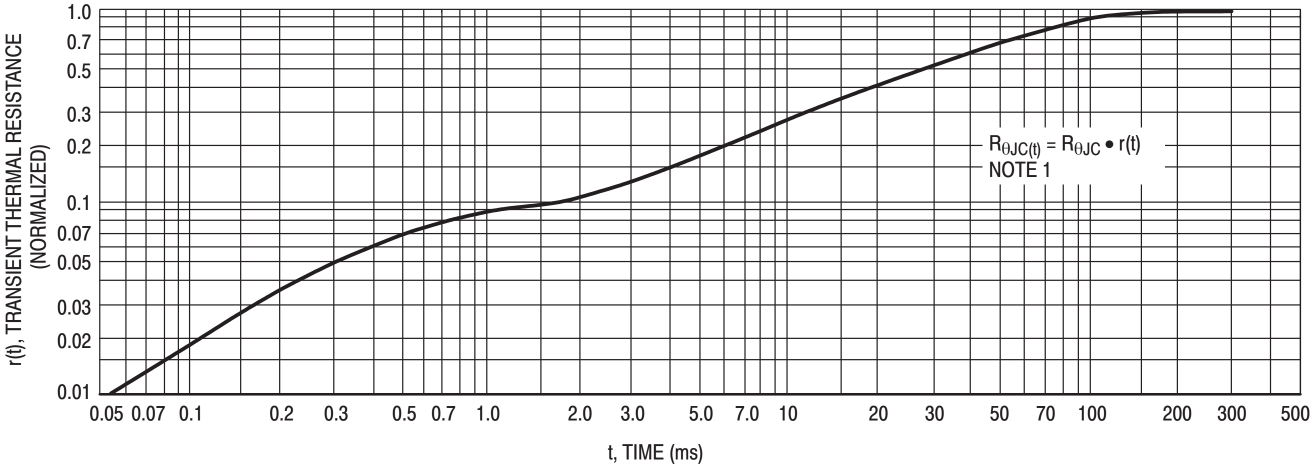
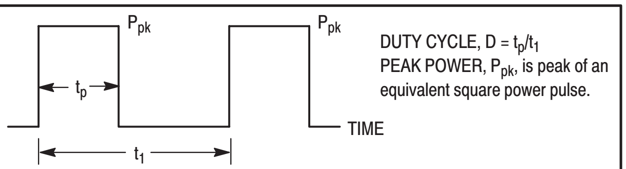


Figure 6. Thermal Response



To determine maximum junction temperature of the diode in a given situation, the following procedure is recommended:

The temperature of the case should be measured using a thermocouple placed on the case at the temperature reference point (see the outline drawing on page 1). The thermal mass connected to the case is normally large enough so that it will not significantly respond to heat surges generated in the diode as a result of pulsed operation once steady–state conditions are achieved. Using the measured value of T_C, the junction temperature may be determined by:

$$T_J = T_C + \Delta T_{JC}$$

where ΔT_{JC} is the increase in junction temperature above the case temperature, it may be determined by:

$\Delta T_{JC} = P_{pk} \cdot R_{\theta JC} [D + (1 - D) \cdot r(t_1 + t_p) + r(t_p) - r(t_1)]$ where

r(t) = normalized value of transient thermal resistance at time, t, from Figure 6, i.e.:

$r(t_1 + t_p)$ = normalized value of transient thermal resistance at time $t_1 + t_p$.

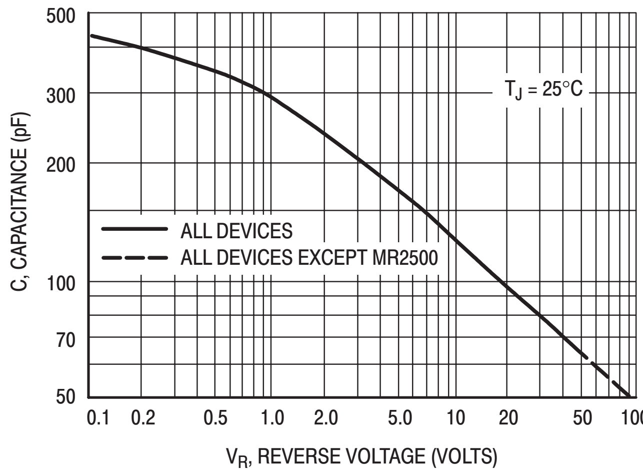


Figure 7. Capacitance

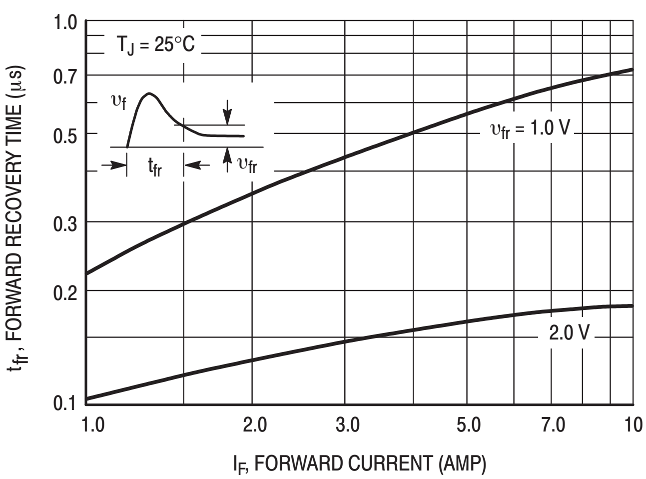


Figure 8. Forward Recovery Time

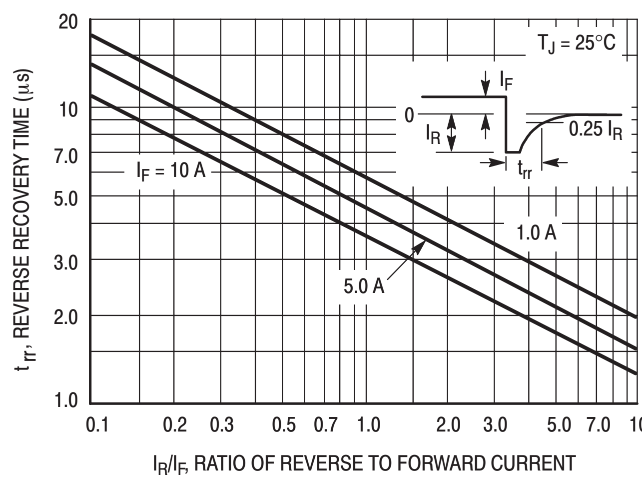


Figure 9. Reverse Recovery Time

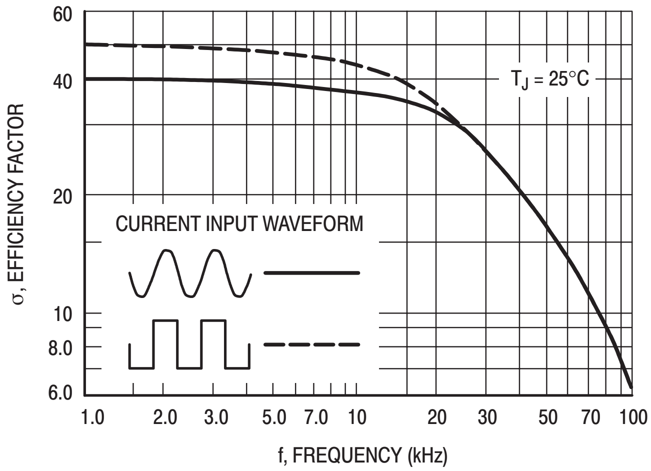


Figure 10. Rectification Waveform Efficiency

RECTIFICATION EFFICIENCY NOTE

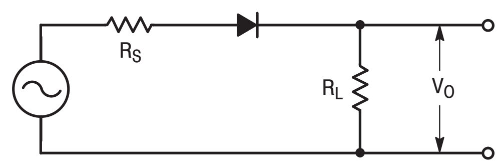


Figure 11. Single–Phase Half–Wave Rectifier Circuit

The rectification efficiency factor σ shown in Figure 10 was calculated using the formula:

$$\sigma = \frac{P_{(dc)}}{P_{(rms)}} = \frac{\frac{V^2{}_{O(dc)}}{R_L}}{\frac{V^2{}_{O(rms)}}{R_L}} \cdot 100\% = \frac{V^2{}_{O(dc)}}{V^2{}_{O(ac)} + V^2{}_{O(dc)}} \cdot 100\% \qquad (1)$$

For a sine wave input V_m sin (ωt) to the diode, assume lossless, the maximum theoretical efficiency factor becomes:

$$\sigma_{(sine)} = \frac{\frac{V^2{}_m}{\pi^2 R_L}}{\frac{V^2{}_m}{4R_L}} \cdot 100\% = \frac{4}{\pi^2} \cdot 100\% = 40.6\% \qquad (2)$$

For a square wave input of amplitude V_m, the efficiency factor becomes:

$$\sigma_{(square)} = \frac{\frac{V^2{}_m}{2R_L}}{\frac{V^2{}_m}{R_L}} \cdot 100\% = 50\% \qquad (3)$$

(A full wave circuit has twice these efficiencies)

As the frequency of the input signal is increased, the reverse recovery time of the diode (Figure 9) becomes significant, resulting in an increasing ac voltage component across R_L which is opposite in polarity to the forward current, thereby reducing the value of the efficiency factor σ, as shown on Figure 10.

It should be emphasized that Figure 10 shows waveform efficiency only; it does not provide a measure of diode losses. Data was obtained by measuring the ac component of V_O with a true rms ac voltmeter and the dc component with a dc voltmeter. The data was used in Equation 1 to obtain points for Figure 10.

ASSEMBLY AND SOLDERING INFORMATION

There are *two basic areas* of consideration for successful implementation of button rectifiers:

1. Mounting and Handling
2. Soldering

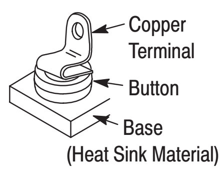
each should be carefully examined before attempting a finished assembly or mounting operation.

MOUNTING AND HANDLING

The button rectifier lends itself to a multitude of assembly arrangements but one key consideration must *always* be included:

One Side of the Connections to the Button Must Be Flexible!

Strain Relief Terminal for Button Rectifier



This stress relief to the button should also be chosen for maximum contact area to afford the best heat transfer — but not at the expense of flexibility. For an annealed copper terminal a thickness of 0.015″ is suggested.

The base heat sink may be of various materials whose shape and size are a function of the individual application and the heat transfer requirements.

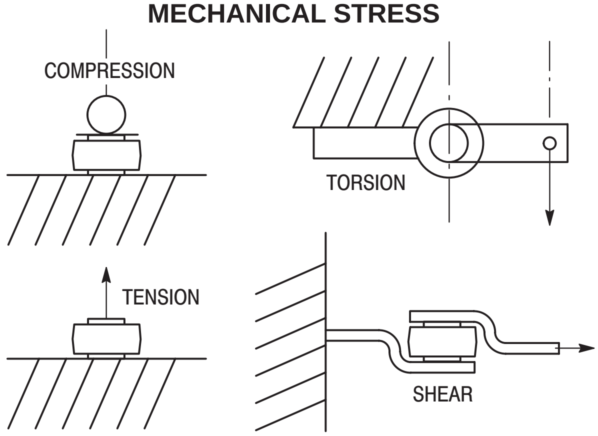
Common Materials	Advantages and Disadvantages
Steel	Low Cost; relatively low heat conductivity
Copper	High Cost; high heat conductivity
Aluminum	Medium Cost; medium heat conductivity Relatively expensive to plate and not all platers can process aluminum.

Handling of the button during assembly must be relatively gentle to minimize sharp impact shocks and avoid nicking of the plastic. Improperly designed automatic handling equipment is the worst source of unnecessary shocks. Techniques for vacuum handling and spring loading should be investigated.

The mechanical stress limits for the button diode are as follows:

Compression	32 lbs.	142.3 Newton
Tension	32 lbs.	142.3 Newton
Torsion	6–inch lbs.	0.68 Newton–meters
Shear	55 lbs.	244.7 Newton

MECHANICAL STRESS



Exceeding these recommended maximums can result in electrical degradation of the device.

SOLDERING

The button rectifier is basically a semiconductor chip bonded between two nickel–plated copper heat sinks with an encapsulating material of thermal–setting silicone. The exposed metal areas are also tin plated to enhance solderability.

In the soldering process it is important that the temperature not exceed 250°C if device damage is to be avoided. Various solder alloys can be used for this operation but two types are recommended for best results:

1. 95% Sn, 5% Sb; melting point 237°C
2. 96.5% tin, 3.5% silver; melting point 221°C
3. 63% tin, 37% lead; melting point 183°C

Solder is available as preforms or paste. The paste contains both the metal and flux and can be dispensed rapidly. The solder preform requires the application of a flux to assure good wetting of the solder. The type of flux used depends upon the degree of cleaning to be accomplished and is a function of the metals involved. These fluxes range from a mild rosin to a strong acid; e.g., Nickel plating oxides are best removed by an acid base flux while an activated rosin flux may be sufficient for tin plated parts.

Since the button is relatively light–weight, there is a tendency for it to float when the solder becomes liquid. To prevent bad joints and misalignment it is suggested that a weighting or spring loaded fixture be employed. It is also important that severe thermal shock (either heating or cooling) be avoided as it may lead to damage of the die or encapsulant of the part.

Button holding fixtures for use during soldering may be of various materials. Stainless steel has a longer use life while black anodized aluminum is less expensive and will limit heat reflection and enhance absorption. The assembly volume will influence the choice of materials. Fixture dimension tolerances for locating the button must allow for expansion during soldering as well as allowing for button clearance.

HEATING TECHNIQUES

The following four heating methods have their advantages and disadvantages depending on volume of buttons to be soldered.

1. **Belt Furnaces** readily handle large or small volumes and are adaptable to establishment of “on–line’’ assembly since a variable belt speed sets the run rate. Individual furnace zone controls make excellent temperature control possible.
2. **Flame Soldering** involves the directing of natural gas flame jets at the base of a heatsink as the heatsink is indexed to various loading–heating–cooling–unloading positions. This is the most economical labor method of soldering large volumes. Flame soldering offers good temperature control but requires sophisticated temperature monitoring systems such as infrared.

ASSEMBLY AND SOLDERING INFORMATION (continued)

3. **Ovens** are good for batch soldering and are production limited. There are handling problems because of slow cooling. Response time is load dependent, being a function of the watt rating of the oven and the mass of parts. Large ovens may not give an acceptable temperature gradient. Capital cost is low compared to belt furnaces and flame soldering.
4. **Hot Plates** are good for soldering small quantities of prototype devices. Temperature control is fair with overshoot common because of the exposed heating surface. Solder flow and positioning can be corrected during soldering since the assembly is exposed. Investment cost is very low.

Regardless of the heating method used, a soldering profile giving the time–temperature relationship of the particular method must be determined to assure proper soldering. Profiling must be performed on a scheduled basis to minimize poor soldering. The time–temperature relationship will change depending on the heating method used.

SOLDER PROCESS EVALUATION

Characteristics to look for when setting up the soldering process:

I Overtemperature is indicated by any one or all three of the following observations.

1. Remelting of the solder inside the button rectifier shows the temperature has exceeded 285°C and is noted by "islands" of shiny solder and solder dewetting when a unit is broken apart.
2. Cracked die inside the button may be observed by a moving reverse oscilloscope trace when pressure is applied to the unit.
3. Cracked plastic may be caused by thermal shock as well as overtemperature so cooling rate should also be checked.

II Cold soldering gives a grainy appearance and solder build–up without a smooth continuous solder fillet. The temperature must be adjusted until the proper solder fillet is obtained within the maximum temperature limits.

III Incomplete solder fillets result from insufficient solder or parts not making proper contact.

IV Tilted buttons can cause a void in the solder between the heatsink and button rectifier which will result in poor heat transfer during operation. An eight degree tilt is a suggested maximum value.

V Plating problems require a knowledge of plating operations for complete understanding of observed deficiencies.

1. Peeling or plating separation is generally seen when a button is broken away for solder inspection. If heatsink or terminal base metal is present the plating is poor and must be corrected.
2. Thin plating allows the solder to penetrate through to the base metal and can give a poor connection. A suggested minimum plating thickness is 300 microinches.
3. Contaminated soldering surfaces may out–gas and cause non–wetting resulting in voids in the solder connection. The exact cause is not always readily apparent and can be because of:
   (a) improper plating
   (b) mishandling of parts
   (c) improper and/or excessive storage time

SOLDER PROCESS MONITORING

Continuous monitoring of the soldering process must be established to minimize potential problems. All parts used in the soldering operation should be sampled on a lot by lot basis by assembly of a controlled sample. Evaluate the control sample by break–apart tests to view the solder connections, by physical strength tests and by dimensional characteristics for part mating.

A shear test is a suggested way of testing the solder bond strength.

POST SOLDERING OPERATION CONSIDERATIONS

After soldering, the completed assembly must be unloaded, washed and inspected.

Unloading must be done carefully to avoid unnecessary stress. Assembly fixtures should be cooled to room temperature so solder profiles are not affected.

Washing is mandatory if an acid flux is used because of its ionic and corrosive nature. Wash the assemblies in agitated hot water and detergent for three to five minutes. After washing; rinse, blow off excessive water and bake 30 minutes at 150°C to remove trapped moisture.

Inspection should be both electrical and physical. Any rejects can be reworked as required.

SUMMARY

The Button Rectifier is an excellent building block for specialized applications. The prime example of its use is the output bridge of the automative alternator where millions are used each year. Although the material presented here is not all inclusive, primary considerations for use are presented. For further information, contact the nearest ON Semiconductor Sales Office or franchised distributor.

TRA2525 MR3025

Medium-Current Silicon Rectifiers

250 Volts, 25 Amperes

Compact, highly efficient silicon rectifiers for medium–current applications requiring:

- High Current Surge — 400 Amperes @ T_J = 175°C
- Peak Performance @ Elevated Temperature — 25 Amperes
- Low Cost
- Compact, Molded Package for Optimum Efficiency in a Small Case Configuration

Mechanical Characteristics

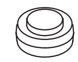
- Finish: All External Surfaces are Corrosion Resistant, and Contact Areas are Readily Solderable
- Polarity: Indicated by Cathode Band
- Weight: 1.8 Grams (Approximately)
- Maximum Temperature for Soldering Purposes: 260°C
- Marking: 2525 or MR3025

MAXIMUM RATINGS

Rating	Symbol	Value	Unit
DC Blocking Voltage	V_R	250	Volts
Non–Repetitive Peak Reverse Voltage (Halfwave, Single Phase, 60 Hz)	V_{RSM}	310	Volts
Average Forward Current (Single Phase, Resistive Load, T_C = 150°C)	I_O	25	Amps
Non–Repetitive Peak Surge Current (Halfwave, Single Phase, 60 Hz)	I_{FSM}	400	Amps
Operating Junction Temperature Range	T_J	–65 to +175	°C
Storage Temperature Range	T_{stg}	–65 to +175	°C

ON Semiconductor™

http://onsemi.com



MICRODE BUTTON
CASE 193

MARKING DIAGRAM

2525	= Device Code
L	= Location Code
YY	= Year
WW	= Work Week

MARKING DIAGRAM

MR3025	= Device Code
L	= Location Code
YY	= Year
WW	= Work Week

ORDERING INFORMATION

Device	Package	Shipping
TRA2525	Microde Button	5000 Units/Box
MR3025	Microde Button	5000 Units/Box

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THERMAL CHARACTERISTICS

Characteristic	Symbol	Value	Unit
Thermal Resistance, Junction to Case	$R_{\theta JC}$	1.0	°C/W

ELECTRICAL CHARACTERISTICS

Characteristic	Symbol	Min	Max	Unit
Instantaneous Forward Voltage (Note 1.) (I_F = 100 Amps, T_C = 25°C)	V_F	—	1.18	Volts
Reverse Current[1]	I_R			μA
(V_R = 250 V, T_C = 25°C)		—	10	
(V_R = 250 V, T_C = 100°C)		—	250	
Forward Voltage Temperature Coefficient @ I_F = 10 mA	V_{FTC}	– 2*	– 2*	mV/°C

1. Pulse Test: Pulse Width < 300 μs, Duty Cycle < 2%.

*Typical

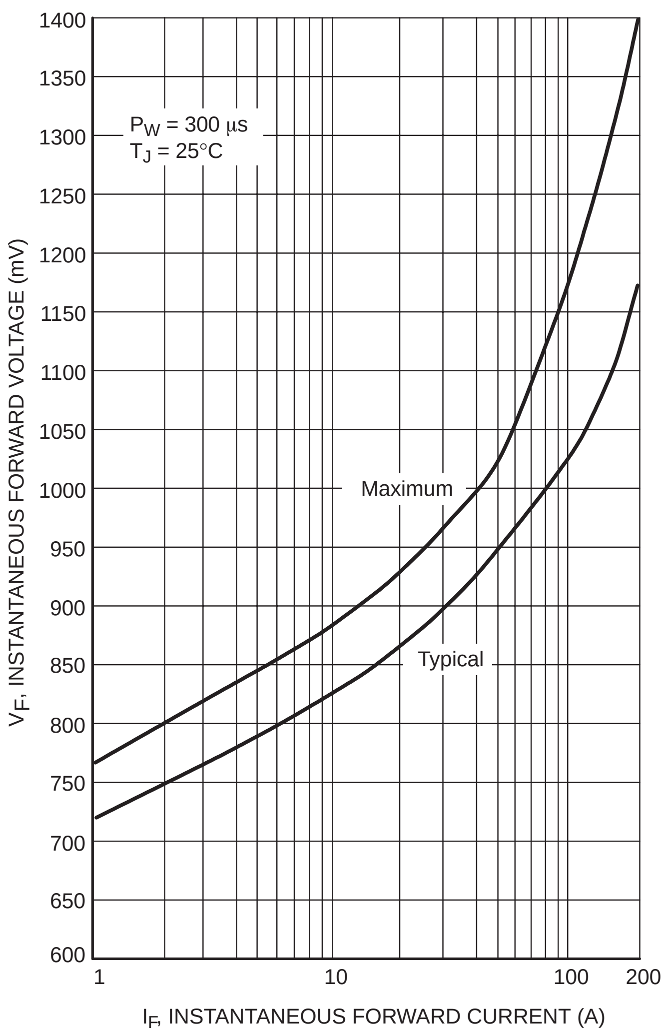


Figure 1. Forward Voltage

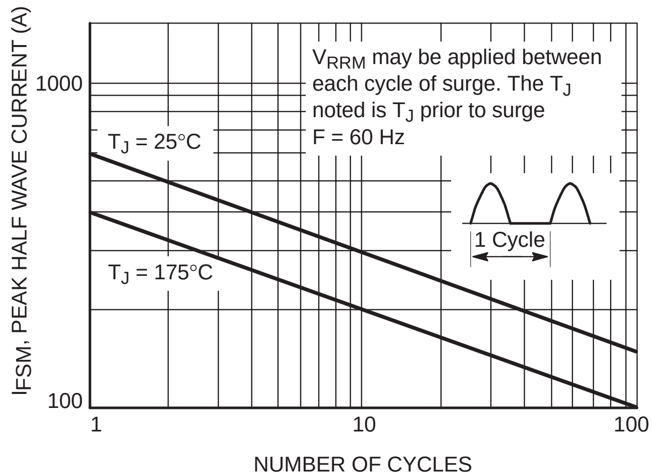


Figure 2. Non–Repetitive Surge Current

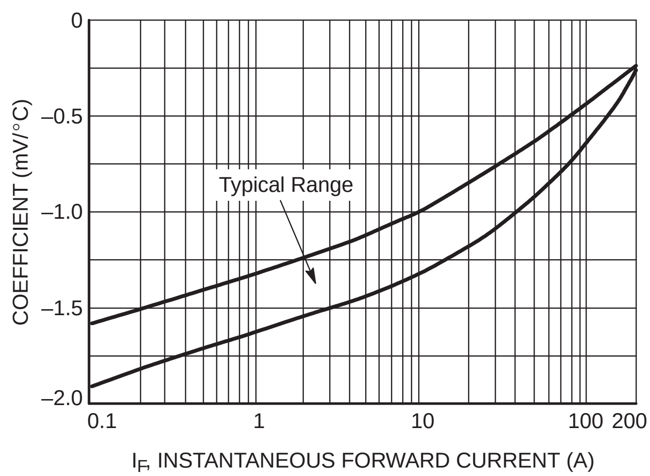


Figure 3. V_F Temperature Coefficient

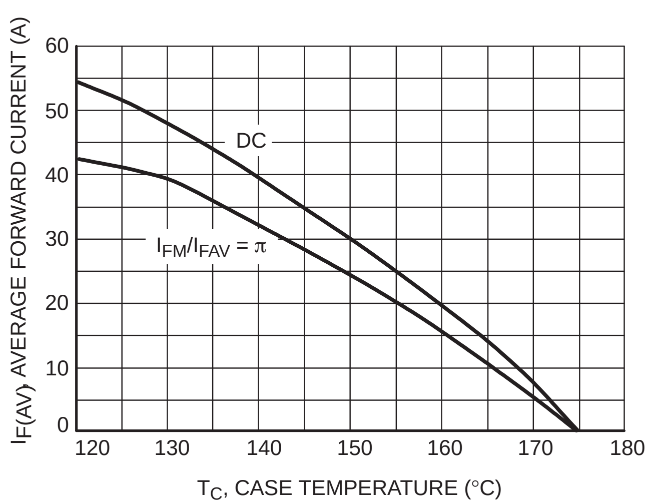


Figure 4. Current Derating

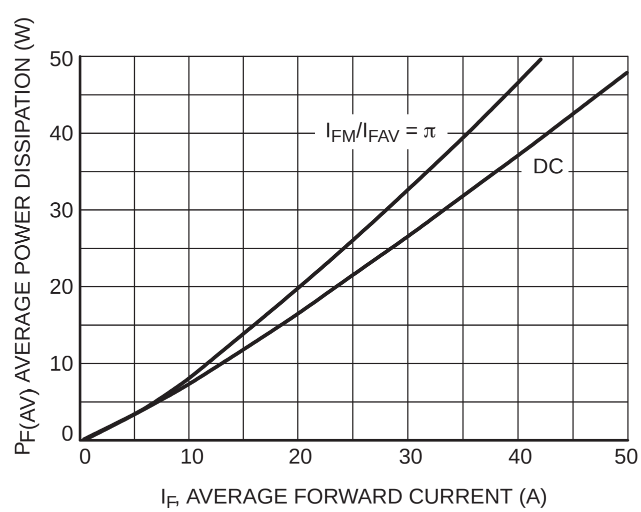


Figure 5. Forward Power Dissipation

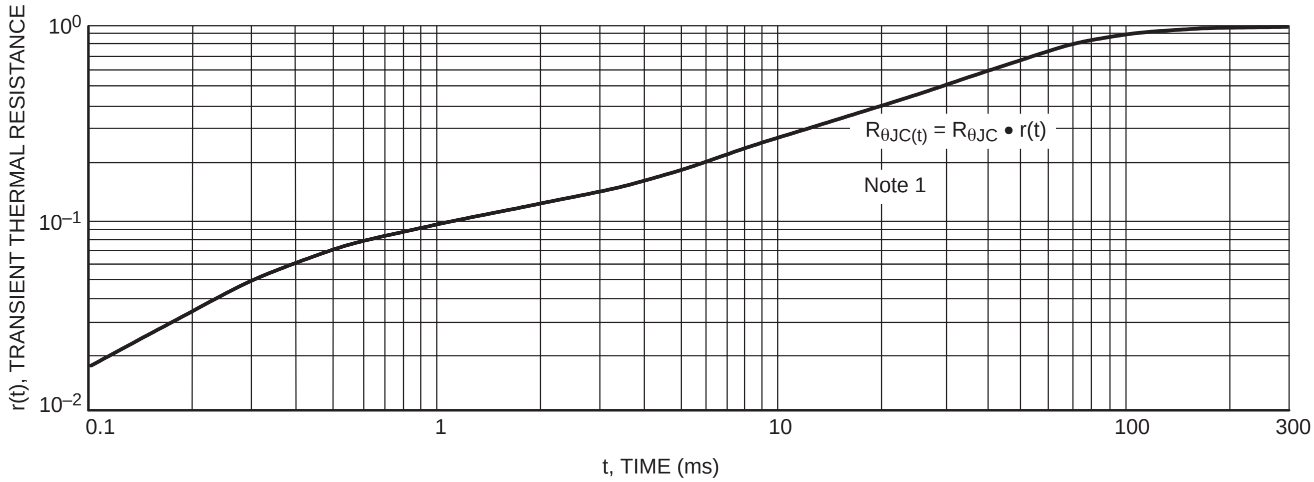
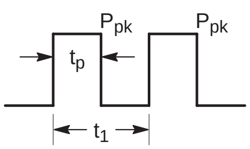


Figure 6. Thermal Response

NOTE 1



DUTY CYCLE, $D = t_p/t_1$
PEAK POWER, P_{pk} is peak of an equivalent square power pulse

To determine maximum junction temperature of the diode in a given situation, the following procedure is recommended.

The temperature of the case should be measured using a thermocouple placed on the case at the temperature reference point (see the outline drawing on page 1). The thermal mass connected to the case is normally large enough so that it will not significantly respond to heat surges generated in the diode as a result of pulse operation once steady state conditions are achieved.

Using the measured value of T_C, the junction temperature may be determined by:

$$T_J = T_C + \Delta T_{JC}$$

Where ΔT_{JC} is the increase in junction temperature above the case temperature, it may be determined by:

$$\Delta T_{JC} = P_{pk} \cdot R_{\theta JC} [D + (1 - D) \cdot r(t_1 + t_p) + r(t_p) - r(t_1)]$$

where:

$r(t)$ = normalized value of transient thermal resistance at time, t, from Figure 6, i.e.:

$r(t_1 + t_p)$ = normalized value of transient thermal resistance at time $t_1 + t_p$.

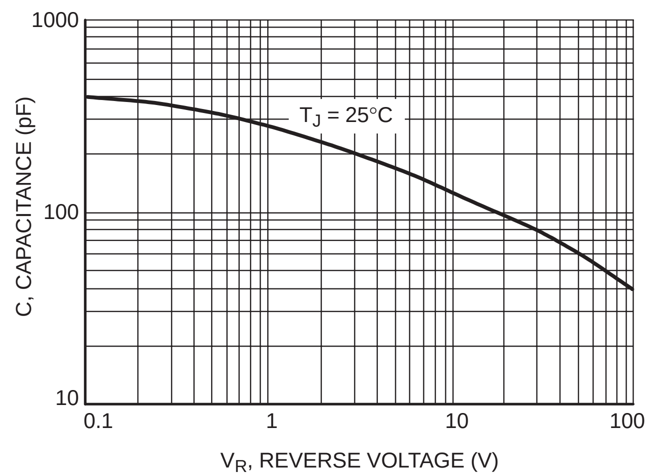


Figure 7. Typical Capacitance

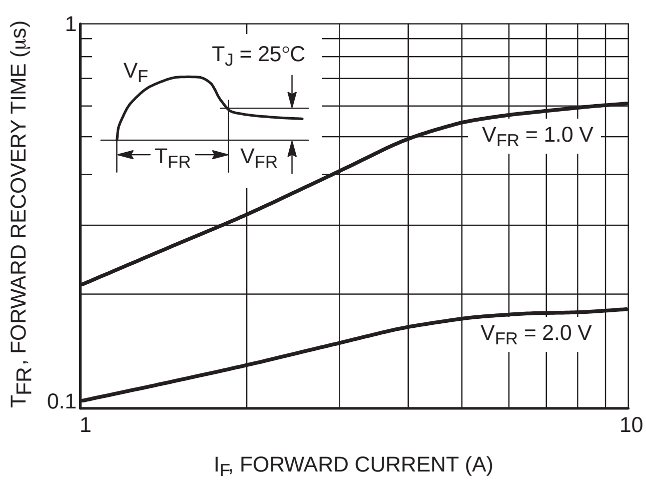


Figure 8. Forward Recovery Time

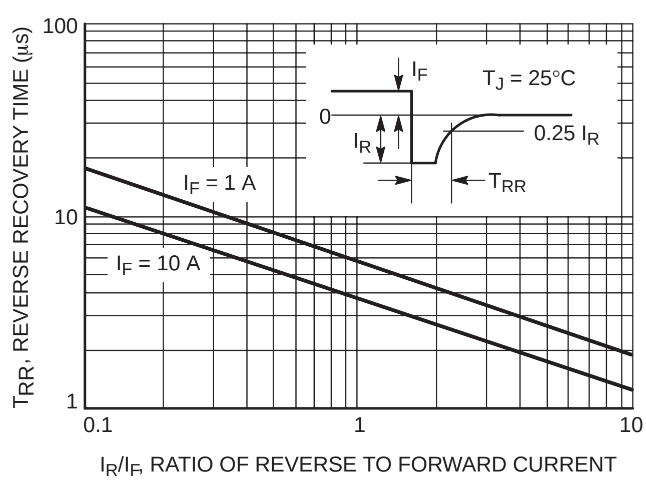


Figure 9. Reverse Recovery Time

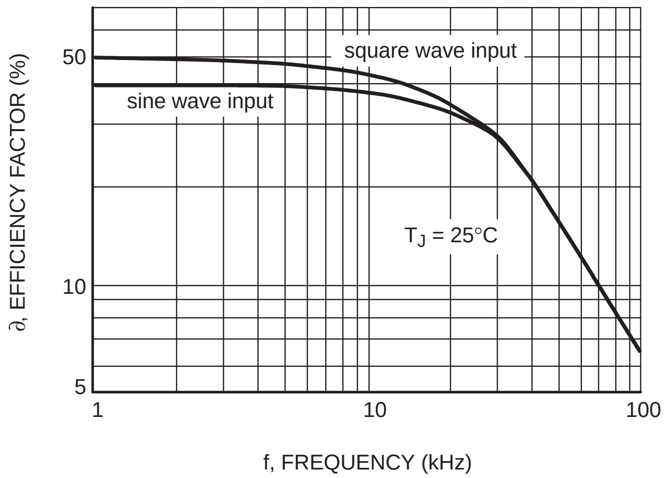


Figure 10. Rectification Waveform Efficiency

RECTIFICATION EFFICIENCY NOTE

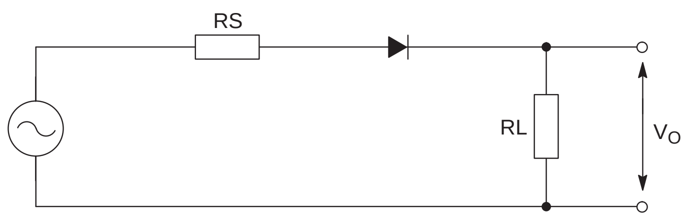


Figure 11. Single Phase Half–Wave Rectifier Circuit

The rectification efficiency factor ∂ shown in Figure 10 was calculated using the formula:

$$\partial = \frac{P_{(dc)}}{P_{(rms)}} = \frac{\frac{V^2{}_{O(dc)}}{R_L}}{\frac{V^2{}_{O(rms)}}{R_L}} \cdot 100\% = \frac{V^2{}_{O(dc)}}{V^2{}_{O(ac)} + V^2{}_{O(dc)}} \cdot 100\% \qquad (1)$$

For a sine wave input Vm sin(wt) to the diode, assume lossless, the maximum theoretical efficiency factor becomes:

$$\partial_{(sine)} = \frac{\frac{V^2{}_m}{\pi^2 R_L}}{\frac{V^2{}_m}{4R_L}} \cdot 100\% = \frac{4}{\pi^2} \cdot 100\% = 40.6\% \qquad (2)$$

For a square wave input of amplitude Vm, the efficiency factor becomes:

$$\partial_{(square)} = \frac{\frac{V^2{}_m}{2R_L}}{\frac{V^2{}_m}{R_L}} \cdot 100\% = 50\% \qquad (3)$$

(a full wave circuit has twice these efficiencies)

As the frequency of the input signal is increased, the reverse recovery time of the diode (Figure 9) becomes significant, resulting in an increase ac voltage component across RL which is opposite in polarity to the forward current, thereby reducing the value of the efficiency factor ∂, as shown on Figure 10.

It should be emphasized that Figure 10 shows waveform efficiency only; it does not provide a measure of diode losses. Data was obtained by measuring the ac component of V_O with a true rms ac voltmeter and the dc component with a dc voltmeter. The data was used in Equation 1 to obtain points for Figure 10.

Assembly and Soldering Information

There are t*wo basic areas* of consideration for successful implementation of button rectifiers:

1. Mounting and Handling
2. Soldering

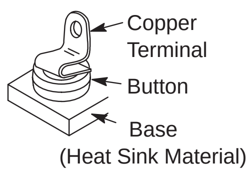
Each should be carefully examined before attempting a finished assembly or mounting operation.

Mounting and Handling

The button rectifier lends itself to a multitude of assembly arrangements, but one key consideration must *always* be included: One Side of the Connections to the Button Must be Flexible!

This stress relief to the button should also be chosen for maximum contact area to afford the best heat transfer — but not at the expense of flexibility. For an annealed copper terminal a thickness of 0.015″ is suggested.

Strain Relief Terminal
for Button Rectifier



The base heat sink may be of various materials whose shape and size are a function of the individual application and the heat transfer requirements.

Common Materials	Advantages and Disadvantages
Steel	Low Cost: relatively low heat conductivity
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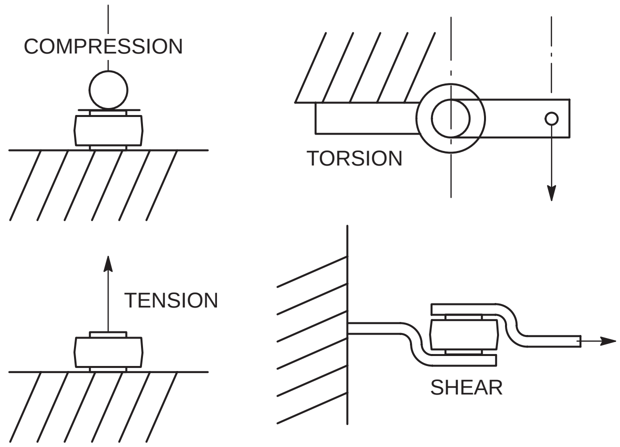
Aluminum	Medium Cost: medium heat conductivity. Relatively expensive to plate and not all platers can process aluminum.

Handling of the button during assembly must be relatively gentle to minimize sharp impact shocks and avoid nicking of the plastic. Improperly designed automatic handling equipment is the worst source of unnecessary shocks. Techniques for vacuum handling and spring loading should be investigated.

The mechanical stress limits for the button diode are as follows:

Compression	32 lbs.	142.3 Newton
Tension	32 lbs.	142.3 Newton
Torsion	6–inch lbs.	0.68 Newtons–meters
Shear	55 lbs.	244.7 Newton

MECHANICAL STRESS



Exceeding these recommended maximums can result in electrical degradation of the device.

Soldering

The button rectifier is basically a semiconductor chip bonded between two nickel–plated copper heat sinks with an encapsulating material of epoxy compound. The exposed metal areas are also tin plated to enhance solderability.

In the soldering process it is important that the temperature not exceed 260°C if device damage is to be avoided. Various solder alloys can be used for this operation but two types are recommended for best results:

1. 95% Sn, 5% Sb; melting point 237°C
2. 96.5% tin, 3.5% silver; melting point 221°C
3. 63% tin, 37% lead; melting point 183°C

Solder is available as preforms or paste. The paste contains both the metal and flux and can be dispensed rapidly. The solder preform requires the application of a flux to assure good wetting of the solder. The type of flux used depends upon the degree of cleaning to be accomplished and is a function of the metal involved. These fluxes range from a mild rosin to a strong acid; e.g., Nickel plating oxides are best removed by an acid base flux while an activated rosin flux may be sufficient for tin plated parts.

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Heating Techniques

The following four heating methods have their advantages and disadvantages depending on volume of buttons to be soldered.

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4. **Hot Plates** are good for soldering small quantities of prototype devices. Temperature control is fair with overshoot common because of the exposed heating surface. Solder flow and positioning can be corrected during soldering since the assembly is exposed. Investment cost is very low.

Regardless of the heating method used, a soldering profile giving the time–temperature relationship of the particular method must be determined to assure proper soldering. Profiling must be performed on a scheduled basis to minimize poor soldering. The time–temperature relationship will change depending on the heating method used.

TRA3225

Medium-Current Silicon Rectifier

250 Volts, 32 Amperes

Compact, highly efficient silicon rectifiers for medium–current applications requiring:

- High Current Surge – 500 Amperes @ T_J = 175°C
- Peak Performance @ Elevated Temperature – 32 Amperes
- Low Cost
- Compact, Molded Package for Optimum Efficiency in a Small Case Configuration

Mechanical Characteristics

- Finish: All External Surfaces are Corrosion Resistant, and Contact Areas are Readily Solderable
- Polarity: Indicated by Cathode Band
- Weight: 1.8 Grams (Approximately)
- Maximum Temperature for Soldering Purposes: 260°C
- Marking: 3225

MAXIMUM RATINGS

Rating	Symbol	Value	Unit
DC Blocking Voltage	V_R	250	Volts
Non–Repetitive Peak Reverse Voltage (Halfwave, Single Phase, 60 Hz)	V_{RSM}	310	Volts
Average Forward Current (Single Phase, Resistive Load, T_C = 150°C)	I_O	32	Amps
Non–Repetitive Peak Surge Current (Halfwave, Single Phase, 60 Hz)	I_{FSM}	500	Amps
Operating Junction Temperature Range	T_J	–65 to +175	°C
Storage Temperature Range	T_{stg}	–65 to +175	°C

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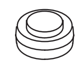
http://onsemi.com



MICRODE BUTTON
CASE 193

MARKING DIAGRAM

3225 = Device Code
L = Location Code
YY = Year
WW = Work Week

ORDERING INFORMATION

Device	Package	Shipping
TRA3225	Microde Button	5000 Units/Box

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THERMAL CHARACTERISTICS

Characteristic	Symbol	Value	Unit
Thermal Resistance, Junction to Case	$R_{\theta JC}$	0.8	°C/W

ELECTRICAL CHARACTERISTICS

Characteristic	Symbol	Min	Max	Unit
Instantaneous Forward Voltage (Note 1.) (I_F = 100 Amps, T_C = 25°C)	V_F	–	1.15	Volts
Reverse Current (Note 1.) (V_R = 250 V, T_C = 25°C) (V_R = 250 V, T_C = 100°C)	I_R	 – –	 20 250	µA
Forward Voltage Temperature Coefficient (I_F = 10 mA)	V_{FTC}	– 2*	– 2*	mV/°C

1. Pulse Test: Pulse Width < 300 µs, Duty Cycle < 2%.

*Typical

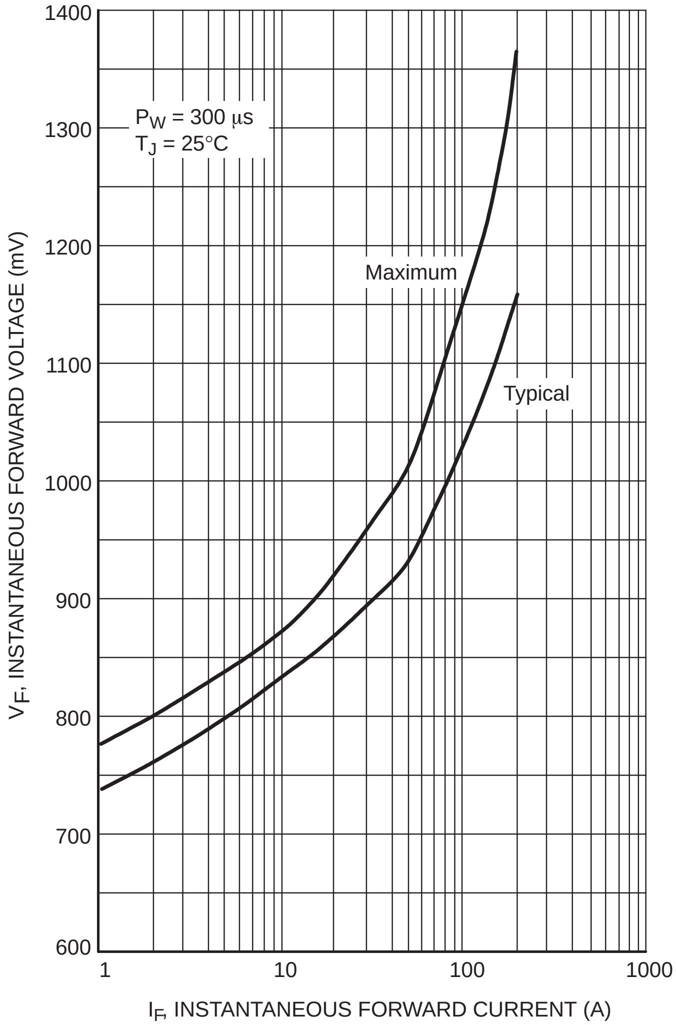


Figure 1. Forward Voltage

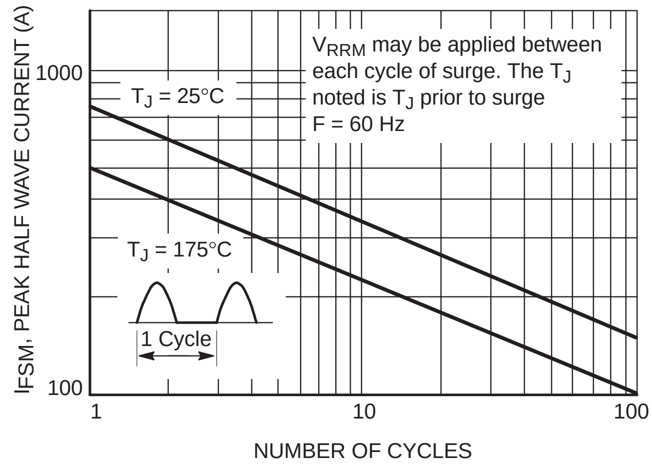


Figure 2. Non–Repetitive Surge Current

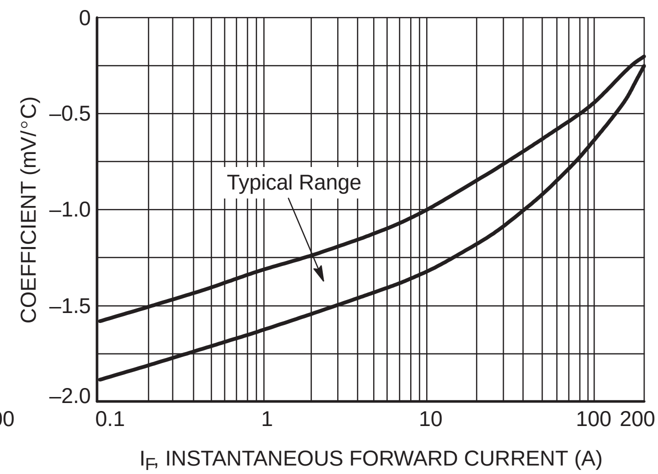


Figure 3. V_F Temperature Coefficient

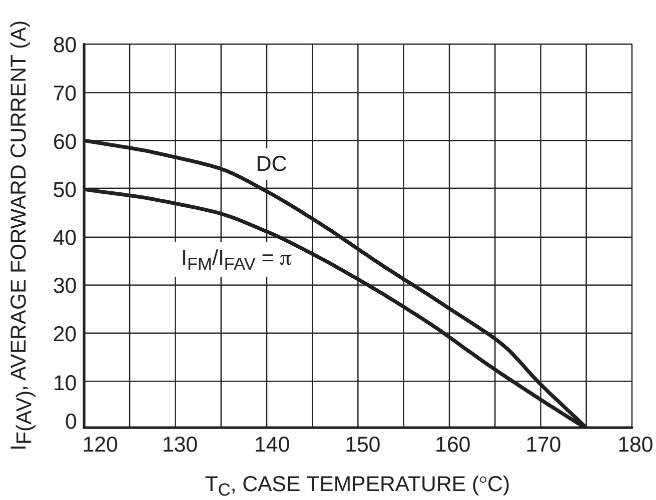


Figure 4. Current Derating

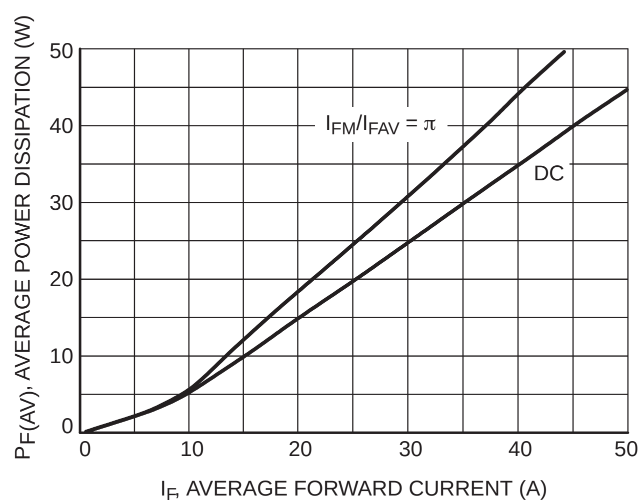


Figure 5. Forward Power Dissipation

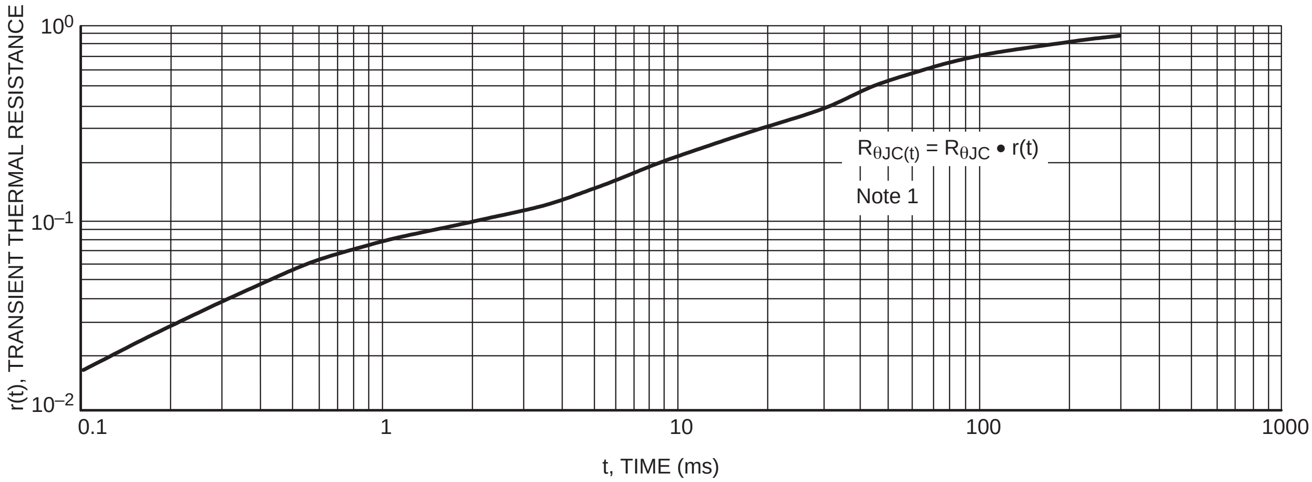
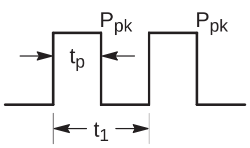


Figure 6. Thermal Response

NOTE 1



DUTY CYCLE, $D = t_p/t_1$
PEAK POWER, P_{pk} is peak of an equivalent square power pulse

To determine maximum junction temperature of the diode in a given situation, the following procedure is recommended.

The temperature of the case should be measured using a thermocouple placed on the case at the temperature reference point (see the outline drawing on page 1). The thermal mass connected to the case is normally large enough so that it will not significantly respond to heat surges generated in the diode as a result of pulse operation once steady state conditions are achieved.

Using the measured value of T_C, the junction temperature may be determined by:

$$T_J = T_C + \Delta T_{JC}$$

Where ΔT_{JC} is the increase in junction temperature above the case temperature, it may be determined by:

$$\Delta T_{JC} = P_{pk} \cdot R_{\theta JC} [D + (1 - D) \cdot r(t_1 + t_p) + r(t_p) - r(t_1)]$$

where:

$r(t)$ = normalized value of transient thermal resistance at time, t, from Figure 6, i.e.:

$r(t_1 + t_p)$ = normalized value of transient thermal resistance at time $t_1 + t_p$.

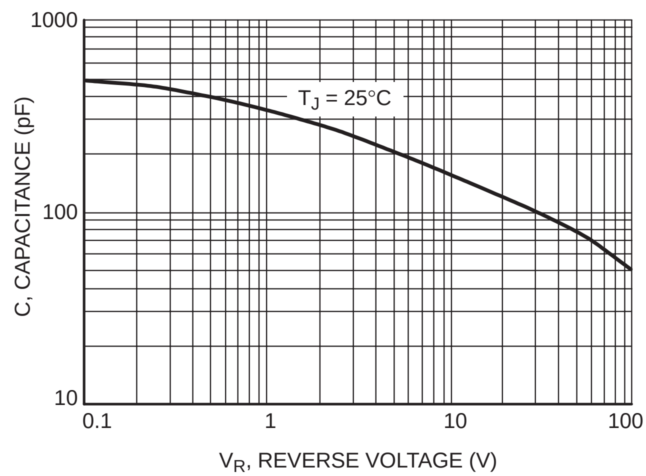


Figure 7. Typical Capacitance

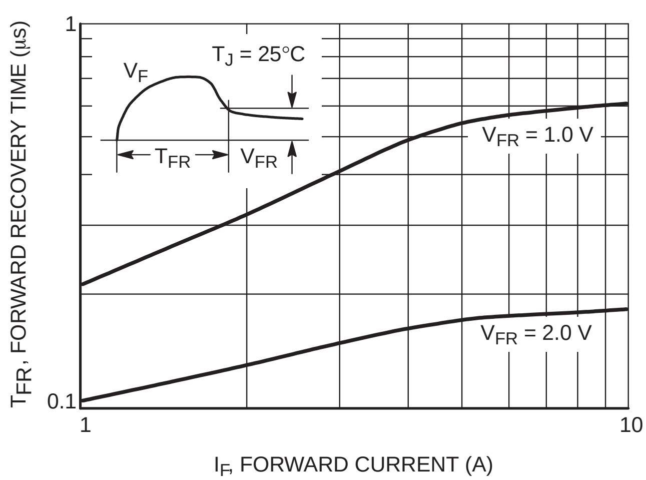


Figure 8. Forward Recovery Time

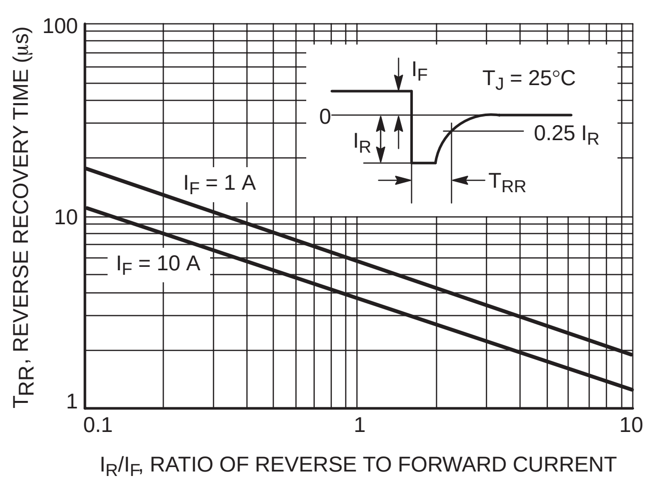


Figure 9. Reverse Recovery Time

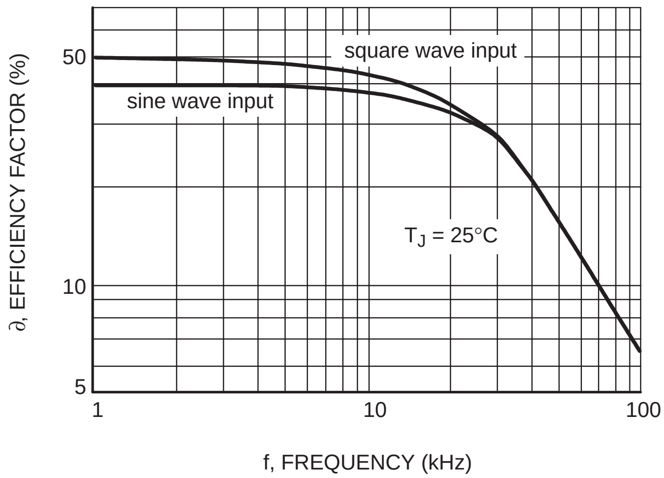


Figure 10. Rectification Waveform Efficiency

RECTIFICATION EFFICIENCY NOTE

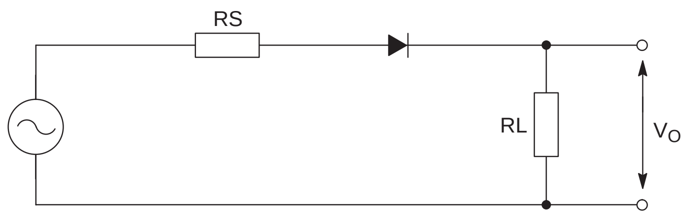


Figure 11. Single Phase Half–Wave Rectifier Circuit

The rectification efficiency factor ∂ shown in Figure 10 was calculated using the formula:

$$\partial = \frac{P_{(dc)}}{P_{(rms)}} = \frac{\frac{V^2{}_{o(dc)}}{R_L}}{\frac{V^2{}_{o(rms)}}{R_L}} \cdot 100\% = \frac{V^2{}_{o(dc)}}{V^2{}_{o(ac)} + V^2{}_{o(dc)}} \cdot 100\% \quad (1)$$

For a sine wave input Vm sin(wt) to the diode, assume lossless, the maximum theoretical efficiency factor becomes:

$$\partial_{(sine)} = \frac{\frac{V^2{}_m}{\pi^2 R_L}}{\frac{V^2{}_m}{4R_L}} \cdot 100\% = \frac{4}{\pi^2} \cdot 100\% = 40.6\% \quad (2)$$

For a square wave input of amplitude Vm, the efficiency factor becomes:

$$\partial_{(square)} = \frac{\frac{V^2{}_m}{2R_L}}{\frac{V^2{}_m}{R_L}} \cdot 100\% = 50\% \quad (3)$$

(a full wave circuit has twice these efficiencies)

As the frequency of the input signal is increased, the reverse recovery time of the diode (Figure 9) becomes significant, resulting in an increase ac voltage component across RL which is opposite in polarity to the forward current, thereby reducing the value of the efficiency factor ∂, as shown on Figure 10.

It should be emphasized that Figure 10 shows waveform efficiency only; it does not provide a measure of diode losses. Data was obtained by measuring the ac component of V_O with a true rms ac voltmeter and the dc component with a dc voltmeter. The data was used in Equation 1 to obtain points for Figure 10.

Assembly and Soldering Information

There are t*wo basic areas* of consideration for successful implementation of button rectifiers:

1. Mounting and Handling
2. Soldering

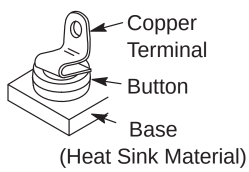
Each should be carefully examined before attempting a finished assembly or mounting operation.

Mounting and Handling

The button rectifier lends itself to a multitude of assembly arrangements, but one key consideration must *always* be included: One Side of the Connections to the Button Must be Flexible!

This stress relief to the button should also be chosen for maximum contact area to afford the best heat transfer – but not at the expense of flexibility. For an annealed copper terminal a thickness of 0.015″ is suggested.

Strain Relief Terminal
for Button Rectifier



The base heat sink may be of various materials whose shape and size are a function of the individual application and the heat transfer requirements.

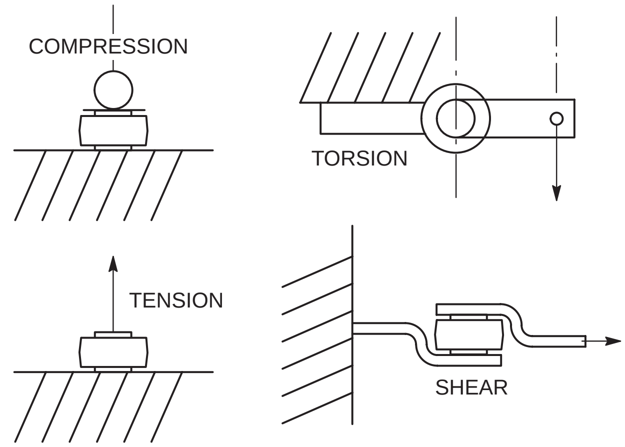
Common Materials	Advantages and Disadvantages
Steel	Low Cost: relatively low heat conductivity
Copper	High Cost: high heat conductivity
Aluminum	Medium Cost: medium heat conductivity. Relatively expensive to plate and not all platers can process aluminum.

Handling of the button during assembly must be relatively gentle to minimize sharp impact shocks and avoid nicking of the plastic. Improperly designed automatic handling equipment is the worst source of unnecessary shocks. Techniques for vacuum handling and spring loading should be investigated.

The mechanical stress limits for the button diode are as follows:

Compression	32 lbs.	142.3 Newton
Tension	32 lbs.	142.3 Newton
Torsion	6–inch lbs.	0.68 Newtons–meters
Shear	55 lbs.	244.7 Newton

MECHANICAL STRESS



Exceeding these recommended maximums can result in electrical degradation of the device.

Soldering

The button rectifier is basically a semiconductor chip bonded between two nickel–plated copper heat sinks with an encapsulating material of epoxy compound. The exposed metal areas are also tin plated to enhance solderability.

In the soldering process it is important that the temperature not exceed 260°C if device damage is to be avoided. Various solder alloys can be used for this operation but two types are recommended for best results:

1. 95% Sn, 5% Sb; melting point 237°C
2. 96.5% tin, 3.5% silver; melting point 221°C
3. 63% tin, 37% lead; melting point 183°C

Solder is available as preforms or paste. The paste contains both the metal and flux and can be dispensed rapidly. The solder preform requires the application of a flux to assure good wetting of the solder. The type of flux used depends upon the degree of cleaning to be accomplished and is a function of the metal involved. These fluxes range from a mild rosin to a strong acid; e.g., Nickel plating oxides are best removed by an acid base flux while an activated rosin flux may be sufficient for tin plated parts.

Since the button is relatively lightweight, there is a tendency for it to float when the solder becomes liquid. To prevent bad joints and misalignment, it is suggested that a weighting or spring loaded fixture be employed. It is also important that severe thermal shock (either heating or cooling) be avoided as it may lead to damage of the die or encapsulant of the part.

Button holding fixtures for use during soldering may be of various materials. Stainless steel has a longer use life while black anodized aluminum is less expensive and will limit heat reflection and enhance absorption. The assembly volume will influence the choice of materials. Fixture dimension tolerances for locating the button must allow for expansion during soldering as well as allowing for button clearance.

Heating Techniques

The following four heating methods have their advantages and disadvantages depending on volume of buttons to be soldered.

1. **Belt furnaces** readily handle large or small volumes and are adaptable to establishment of “on–line’’ assembly since a variable belt speed sets the run rate. Individual furnace zone controls make excellent temperature control possible.
2. **Flame Soldering** involves the directing of natural gas flame jets at the base of a heatsink as the heatsink is indexed to various loading–heating–cooling–unloading positions. This is the most economical labor method of soldering large volumes. Flame soldering offers good temperature control but requires sophisticated temperature monitoring systems such as infrared.
3. **Ovens** are good for batch soldering and are production limited. There are handling problems because of slow cooling. Response time is load dependent, being a function of the watt rating of the oven and the mass of parts. Large ovens may not give an acceptable temperature gradient. Capital cost is low compared to belt furnaces and flame soldering.
4. **Hot Plates** are good for soldering small quantities of prototype devices. Temperature control is fair with overshoot common because of the exposed heating surface. Solder flow and positioning can be corrected during soldering since the assembly is exposed. Investment cost is very low.

Regardless of the heating method used, a soldering profile giving the time–temperature relationship of the particular method must be determined to assure proper soldering. Profiling must be performed on a scheduled basis to minimize poor soldering. The time–temperature relationship will change depending on the heating method used.

MR750 SERIES

MR754 and MR760 are Preferred Devices

High Current Lead Mounted Rectifiers

- Current Capacity Comparable to Chassis Mounted Rectifiers
- Very High Surge Capacity
- Insulated Case

Mechanical Characteristics:

- Case: Epoxy, Molded
- Weight: 2.5 grams (approximately)
- Finish: All External Surfaces Corrosion Resistant and Terminal Lead is Readily Solderable
- Lead Temperature for Soldering Purposes: 260°C Max. for 10 Seconds
- Polarity: Cathode Polarity Band
- Shipped 1000 units per plastic bag. Available Tape and Reeled, 800 units per reel by adding a "RL" suffix to the part number

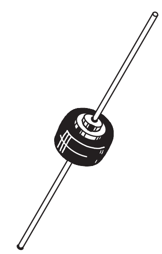
MAXIMUM RATINGS

Please See the Table on the Following Page

ON Semiconductor™

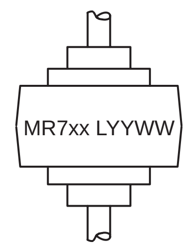
http://onsemi.com

HIGH CURRENT LEAD MOUNTED SILICON RECTIFIERS 50 – 1000 VOLTS DIFFUSED JUNCTION



AXIAL LEAD BUTTON CASE 194 STYLE 1

MARKING DIAGRAM



MR7xx	=	Device Code
xx	=	50, 51, 52, 54, 56 or 60
L	=	Location Code
YY	=	Year
WW	=	Work Week

ORDERING INFORMATION

Device	Package	Shipping
MR750	Axial Lead	1000 Units/Bag
MR750RL	Axial Lead	800/Tape & Reel
MR751	Axial Lead	1000 Units/Bag
MR751RL	Axial Lead	800/Tape & Reel
MR752	Axial Lead	1000 Units/Bag
MR752RL	Axial Lead	800/Tape & Reel
MR754	Axial Lead	1000 Units/Bag
MR754RL	Axial Lead	800/Tape & Reel
MR756	Axial Lead	1000 Units/Bag
MR756RL	Axial Lead	800/Tape & Reel
MR760	Axial Lead	1000 Units/Bag
MR760RL	Axial Lead	800/Tape & Reel

Preferred devices are recommended choices for future use and best overall value.

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MAXIMUM RATINGS

Characteristic	Symbol	MR750	MR751	MR752	MR754	MR756	MR760	Unit
Peak Repetitive Reverse Voltage Working Peak Reverse Voltage DC Blocking Voltage	V_{RRM} V_{RWM} V_R	50	100	200	400	600	1000	Volts
Non–Repetitive Peak Reverse Voltage (Halfwave, single phase, 60 Hz peak)	V_{RSM}	60	120	240	480	720	1200	Volts
RMS Reverse Voltage	$V_{R(RMS)}$	35	70	140	280	420	700	Volts
Average Rectified Forward Current (Single phase, resistive load, 60 Hz) See Figures 5 and 6	I_O	22 (T_L = 60°C, 1/8″ Lead Lengths) 6.0 (T_A = 60°C, P.C. Board mounting)						Amps
Non–Repetitive Peak Surge Current (Surge applied at rated load conditions)	I_{FSM}	400 (for 1 cycle)						Amps
Operating and Storage Junction Temperature Range	T_J, T_{stg}	– 65 to +175						°C

ELECTRICAL CHARACTERISTICS

Characteristic and Conditions	Symbol	Max	Unit
Maximum Instantaneous Forward Voltage Drop (i_F = 100 Amps, T_J = 25°C)	v_F	1.25	Volts
Maximum Forward Voltage Drop (I_F = 6.0 Amps, T_A = 25°C, 3/8″ leads)	V_F	0.90	Volts
Maximum Reverse Current T_J = 25°C (Rated dc Voltage) T_J = 100°C	I_R	25 1.0	µA mA

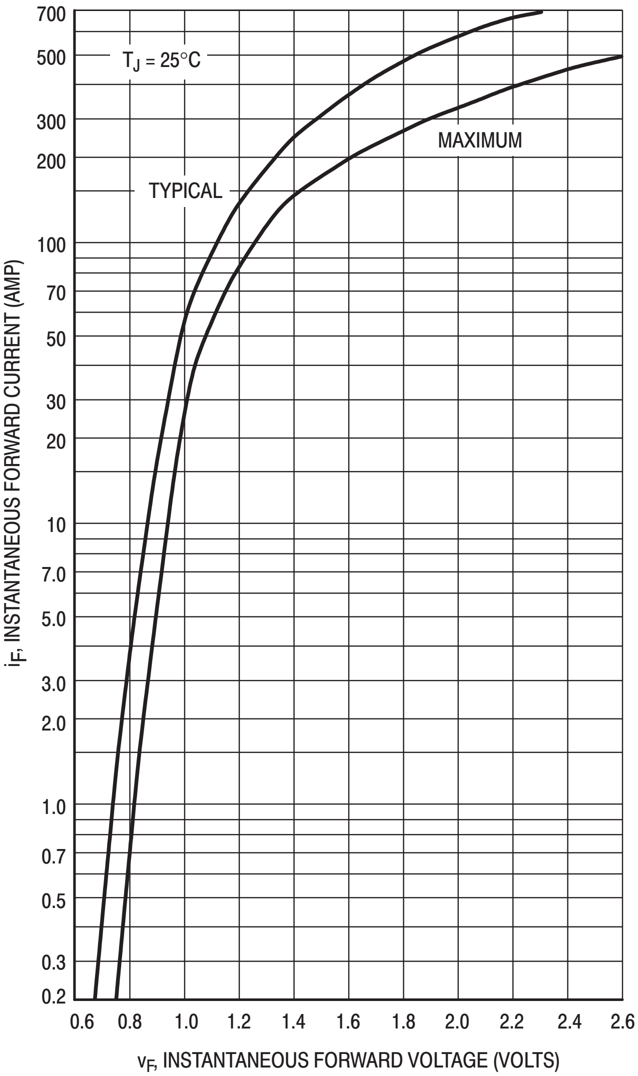


Figure 1. Forward Voltage

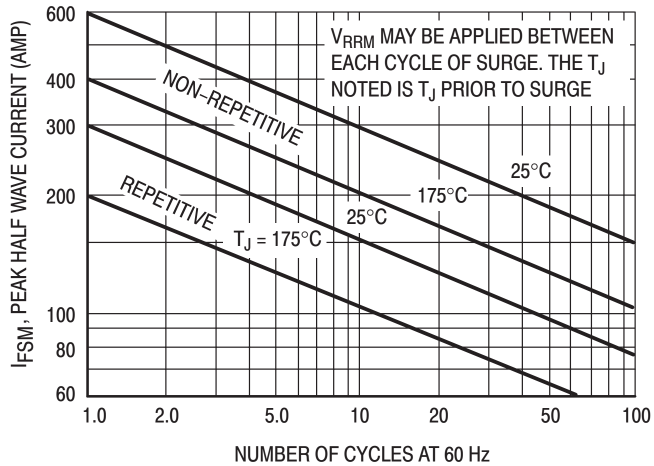


Figure 2. Maximum Surge Capability

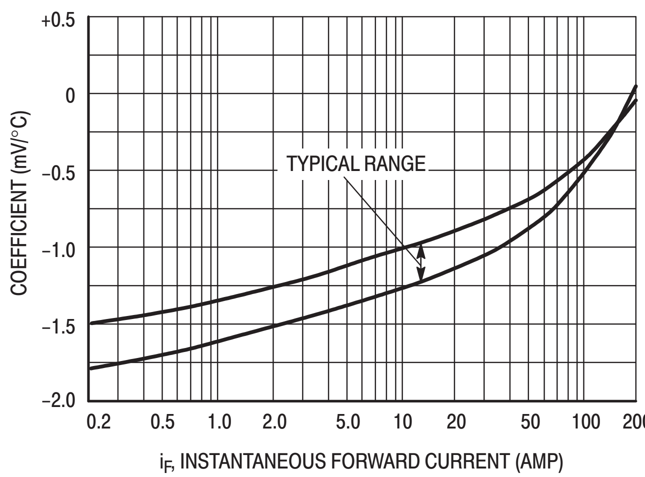


Figure 3. Forward Voltage Temperature Coefficient

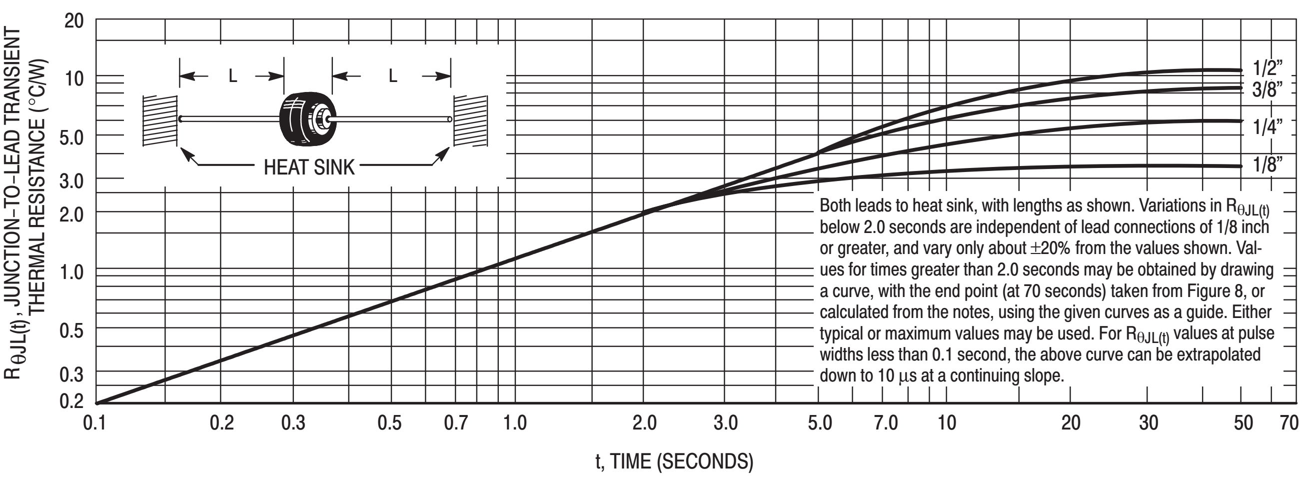


Figure 4. Typical Transient Thermal Resistance

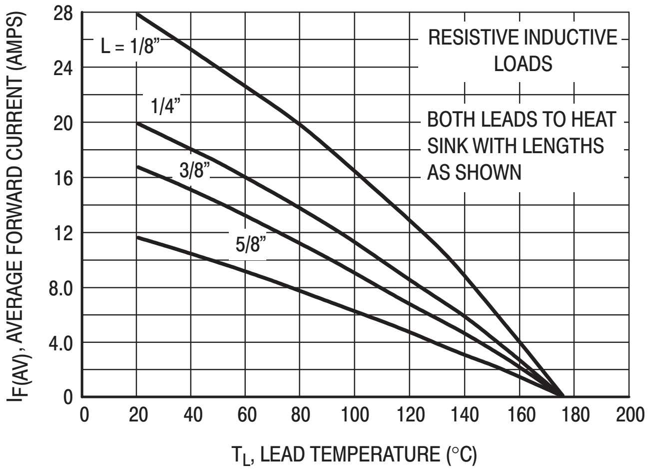


Figure 5. Maximum Current Ratings

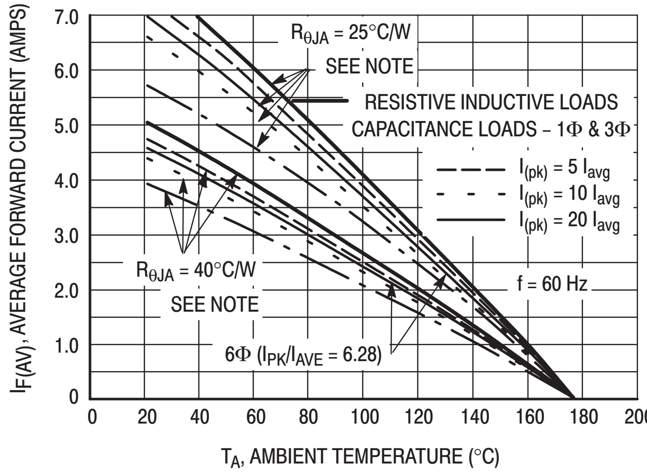


Figure 6. Maximum Current Ratings

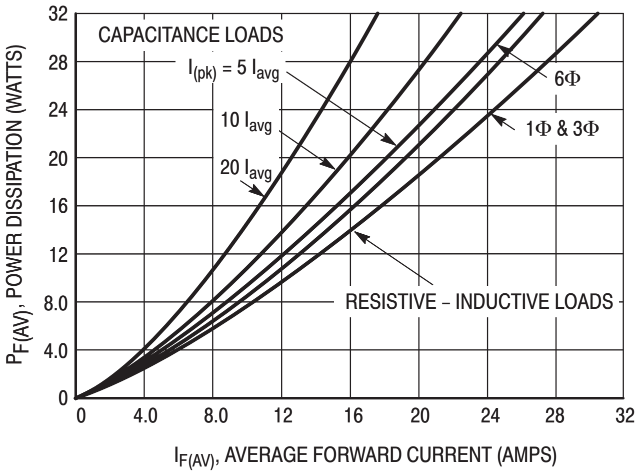


Figure 7. Power Dissipation

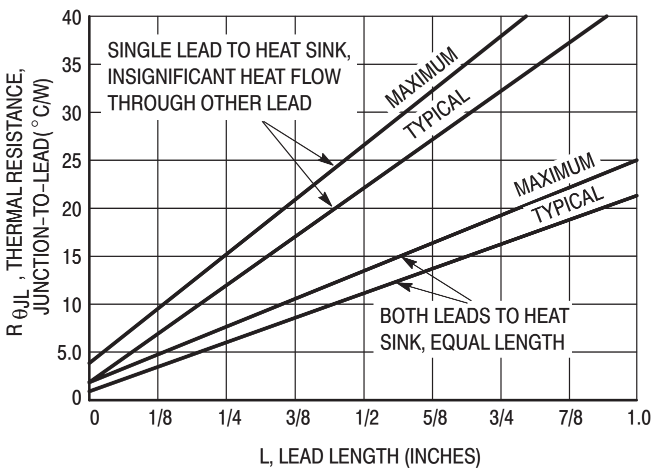
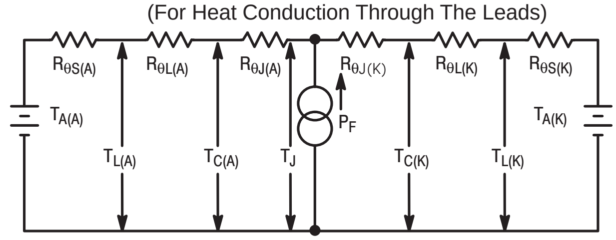


Figure 8. Steady State Thermal Resistance

NOTES

THERMAL CIRCUIT MODEL

(For Heat Conduction Through The Leads)



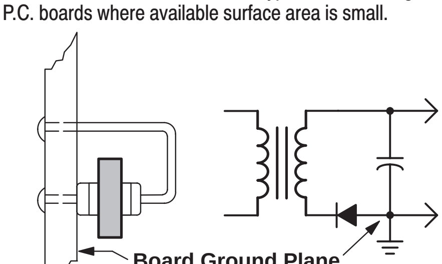
Use of the above model permits junction to lead thermal resistance for any mounting configuration to be found. Lowest values occur when one side of the rectifier is brought as close as possible to the heat sink as shown below. Terms in the model signify:

T_A = Ambient Temperature	T_C = Case Temperature
T_L = Lead Temperature	T_J = Junction Temperature

$R_{\theta S}$ = Thermal Resistance, Heat Sink to Ambient
$R_{\theta L}$ = Thermal Resistance, Lead to Heat Sink
$R_{\theta J}$ = Thermal Resistance, Junction to Case
P_F = Power Dissipation
(Subscripts A and K refer to anode and cathode sides, respectively.)
Values for thermal resistance components are:
$R_{\theta L}$ = 40°C/W/in. Typically and 44°C/W/in Maximum.
$R_{\theta J}$ = 2°C/W typically and 4°C/W Maximum.

Since $R_{\theta J}$ is so low, measurements of the case temperature, T_C, will be approximately equal to junction temperature in practical lead mounted applications. When used as a 60 Hz rectifierm the slow thermal response holds $T_{J(PK)}$ close to $T_{J(AVG)}$. Therefore maximum lead temperature may be found from: $T_L = 175° – R_{\theta JL}\ P_F$. P_F may be found from Figure 7.

The recommended method of mounting to a P.C. board is shown on the sketch, where $R_{\theta JA}$ is approximately 25°C/W for a 1–1/2” x 1–1/2” copper surface area. Values of 40°C/W are typical for mounting to terminal strips or P.C. boards where available surface area is small.



Recommended mounting for half wave circuit

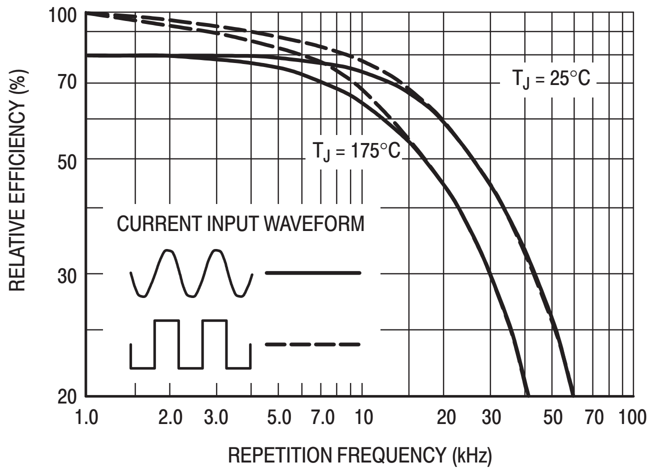


Figure 9. Rectification Efficiency

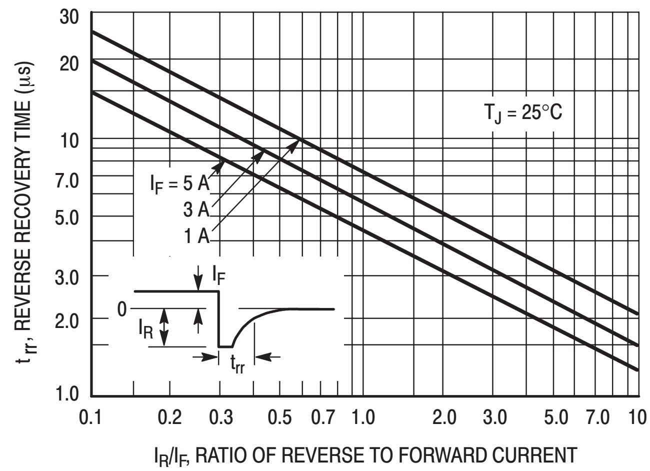


Figure 10. Reverse Recovery Time

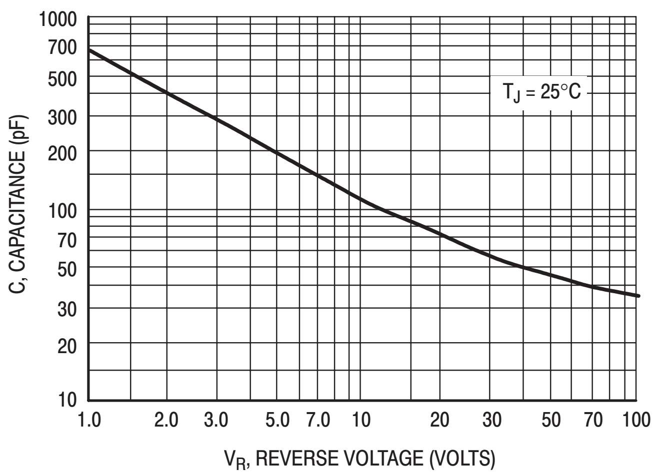


Figure 11. Junction Capacitance

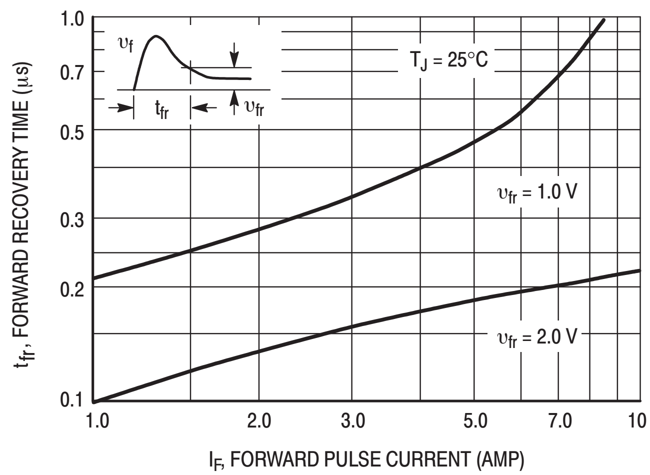


Figure 12. Forward Recovery Time

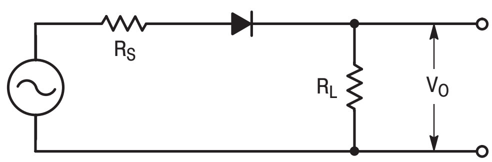


Figure 13. Single–Phase Half–Wave Rectifier Circuit

The rectification efficiency factor σ shown in Figure 9 was calculated using the formula:

$$\sigma = \frac{P_{(dc)}}{P_{(rms)}} = \frac{\frac{V^2{}_{o(dc)}}{R_L}}{\frac{V^2{}_{o(rms)}}{R_L}} \cdot 100\% = \frac{V^2{}_{o(dc)}}{V^2{}_{o(ac)} + V^2{}_{o(dc)}} \cdot 100\% \qquad (1)$$

For a sine wave input V_m sin (wt) to the diode, assumed lossless, the maximum theoretical efficiency factor becomes:

$$\sigma_{(sine)} = \frac{\frac{V^2{}_m}{\pi^2 R_L}}{\frac{V^2{}_m}{4R_L}} \cdot 100\% = \frac{4}{\pi^2} \cdot 100\% = 40.6\% \qquad (2)$$

For a square wave input of amplitude V_m, the efficiency factor becomes:

$$\sigma_{(square)} = \frac{\frac{V^2{}_m}{2R_L}}{\frac{V^2{}_m}{R_L}} \cdot 100\% = 50\% \qquad (3)$$

(A full wave circuit has twice these efficiencies)

As the frequency of the input signal is increased, the reverse recovery time of the diode (Figure 10) becomes significant, resulting in an increasing ac voltage component across R_L which is opposite in polarity to the forward current, thereby reducing the value of the efficiency factor σ, as shown on Figure 9.

It should be emphasized that Figure 9 shows waveform efficiency only; it does not provide a measure of diode losses. Data was obtained by measuring the ac component of V_o with a true rms ac voltmeter and the dc component with a dc voltmeter. The data was used in Equation 1 to obtain points for Figure 9.

TRA2532

Overvoltage Transient Suppressor

24 V–32 V

Designed for applications requiring a diode with reverse avalanche characteristics for use as reverse power transient suppressor. Developed to suppress transients in automotive system, this device operates in the forward mode as standard rectifier or reverse mode as power zener diode and will protect expensive modules such as ignition, injection, antiblocking system . . . from overvoltage conditions.

- High Power Capability
- Economical

Mechanical Characteristics

- Finish: All External Surfaces are Corrosion Resistant, and Contact Areas are Readily Solderable
- Polarity: Indicated by Cathode Band
- Weight: 1.8 Grams (Approximately)
- Maximum Temperature for Soldering Purposes: 260°C
- Marking: 2532

MAXIMUM RATINGS

Rating	Symbol	Value	Unit
DC Blocking Voltage	V_R	23	Volts
Average Forward Current (Single Phase, Resistive Load, T_C = 150°C)	I_O	32	Amps
Peak Repetitive Reverse Surge Current (Time Constant = 10 ms, T_C = 25°C)	I_{RSM}	80	Amps
Non–Repetitive Peak Surge Current (Halfwave, Single Phase, 60 Hz)	I_{FSM}	500	Amps
Operating Junction Temperature Range	T_J	–65 to +175	°C
Storage Temperature Range	T_{stg}	–65 to +150	°C

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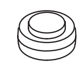
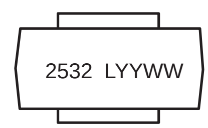


MICRODE BUTTON
CASE 193

MARKING DIAGRAM



2532 = Device Code
L = Location Code
YY = Year
WW = Work Week

ORDERING INFORMATION

Device	Package	Shipping
TRA2532	Microde Button	5000 Units/Box

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THERMAL CHARACTERISTICS

Characteristic	Symbol	Value	Unit
Thermal Resistance, Junction to Case	$R_{\theta JC}$	0.8	°C/W

ELECTRICAL CHARACTERISTICS

Characteristic	Symbol	Min	Max	Unit
Instantaneous Forward Voltage (Note 1.) (i_F = 100 Amps, T_C = 25°C)	v_F	–	1.18	Volts
Reverse Current[1] (V_R = 23 Vdc, T_C = 25°C)	I_R	–	10	µA
Breakdown Voltage[1] (I_Z = 100 mA, T_C = 25°C)	$V_{(BR)}$	24	32	Volts
Breakdown Voltage (I_Z = 80 Amps, T_C = 25°C, P_W = 80 µs)	$V_{(BR)}$	–	40	Volts
Breakdown Voltage Temperature Coefficient	$V_{(BR)TC}$	0.096*	0.096*	%/°C
Forward Voltage Temperature Coefficient @ I_F = 10 mA	V_{FTC}	– 2*	– 2*	mV/°C

1. Pulse Test: Pulse Width ≤ 300 µs, Duty Cycle ≤ 2%.

*Typical

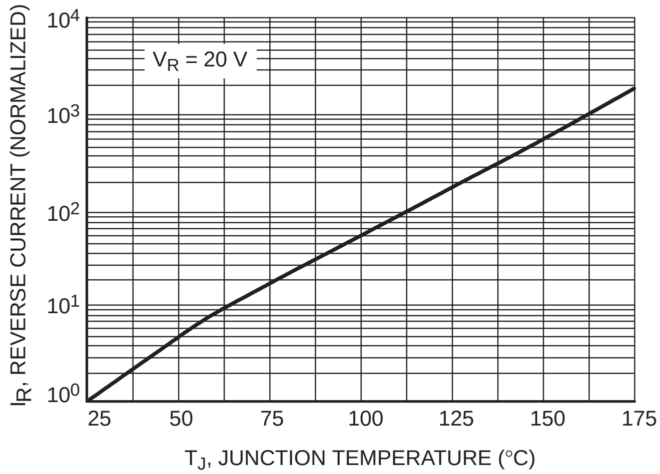


Figure 1. Normalized Reverse Current

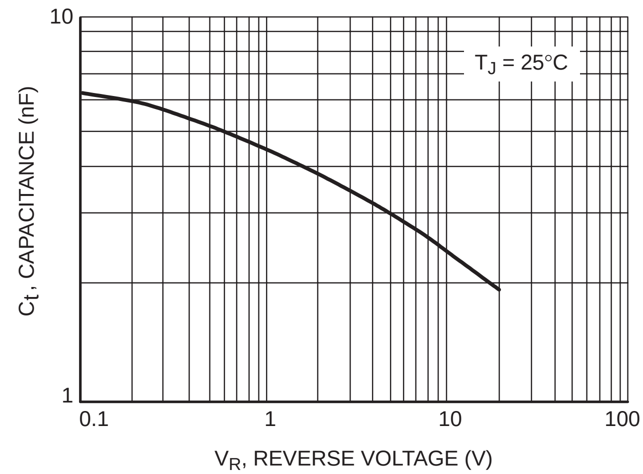


Figure 2. Typical Reverse Capacitance

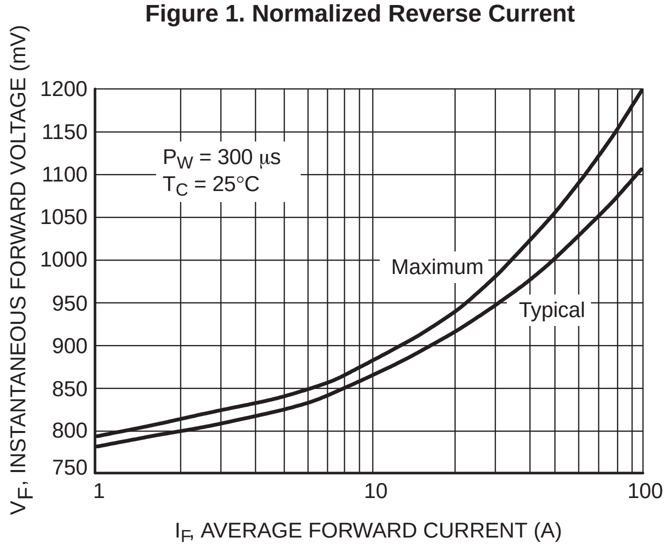


Figure 3. Forward Voltage

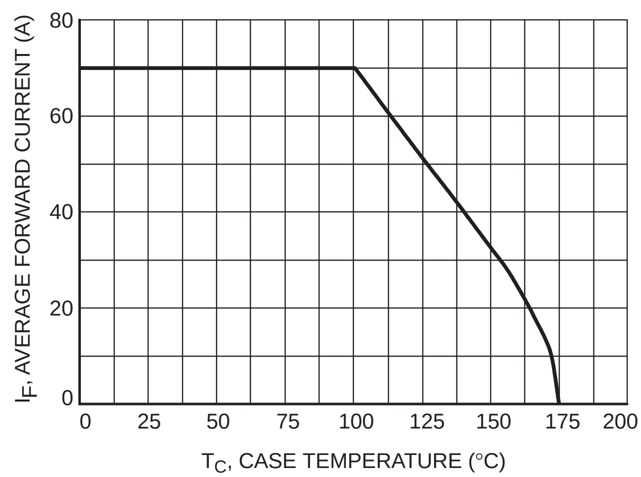


Figure 4. Maximum Current Rating

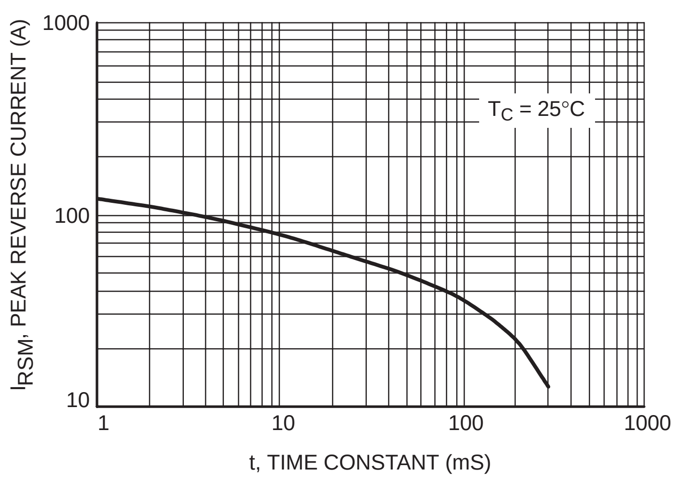


Figure 5. Maximum Peak Reverse Current

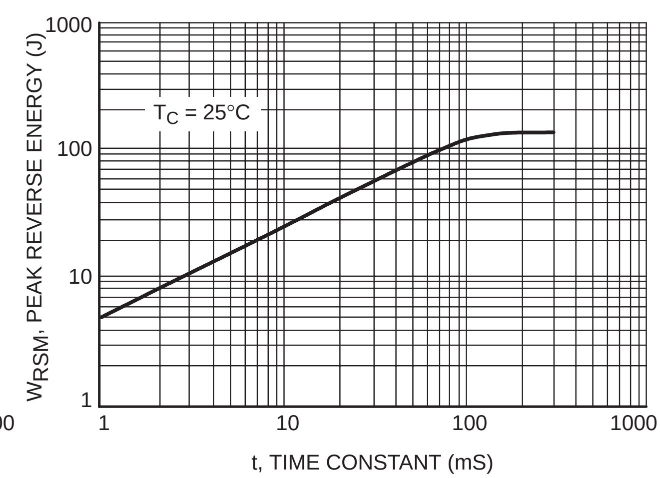


Figure 6. Maximum Reverse Energy

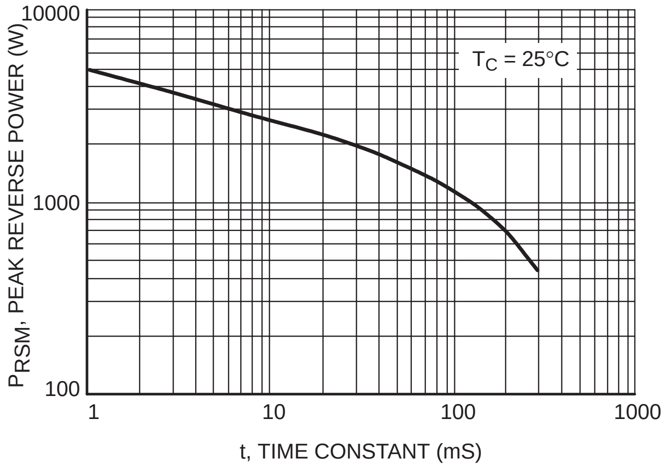


Figure 7. Maximum Peak Reverse Power

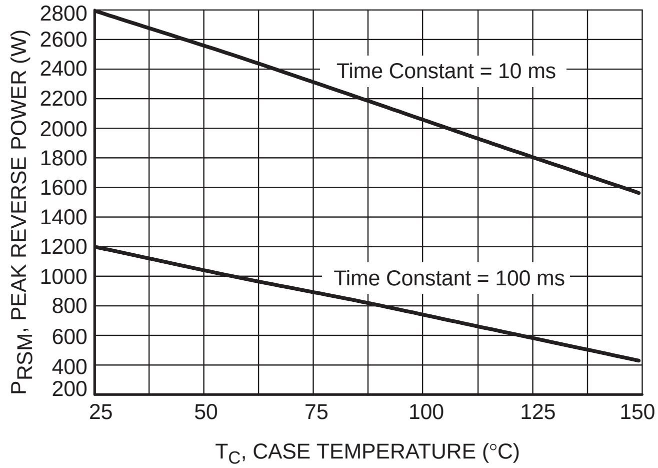


Figure 8. Reverse Power Derating

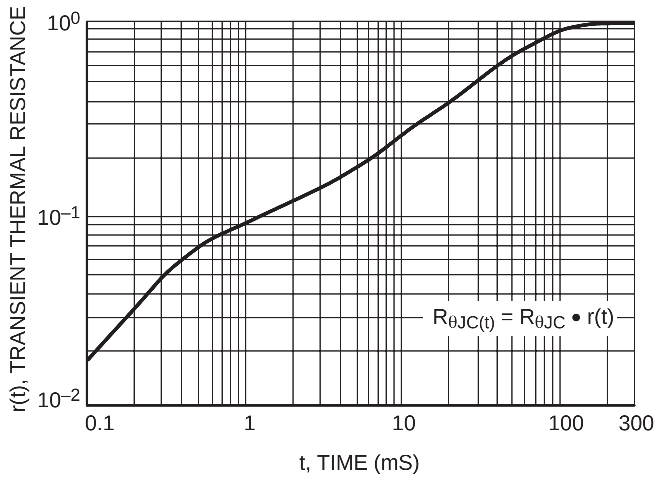


Figure 9. Thermal Response

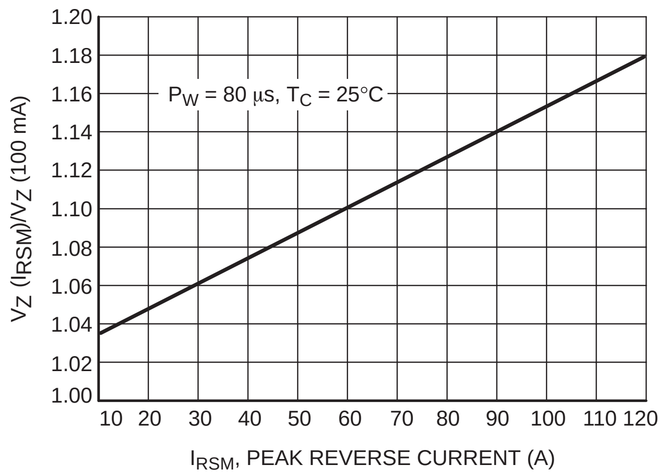


Figure 10. Typical Clamping Factor

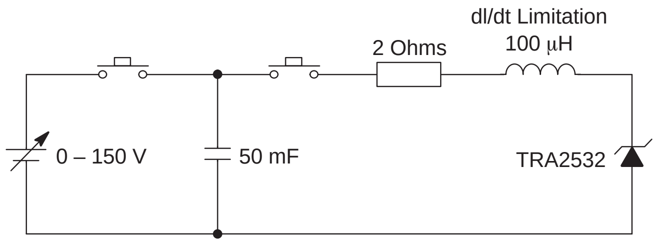


Figure 11. Load Dump Test Circuit

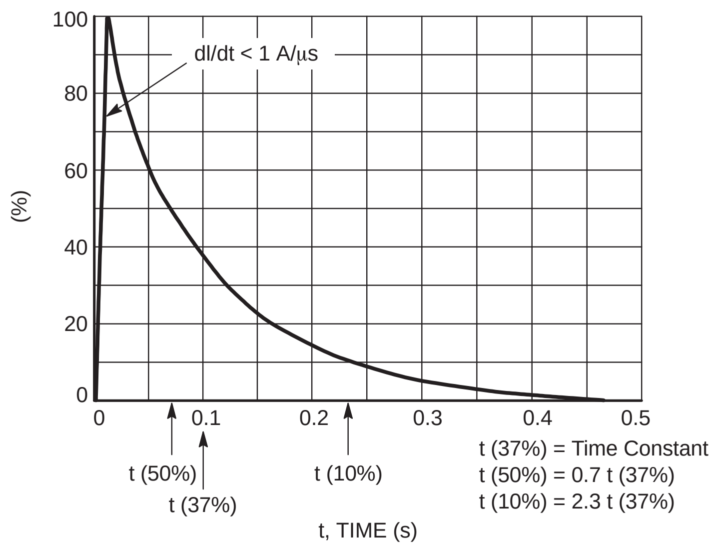


Figure 12. Load Dump Pulse Current

Assembly and Soldering Information

There are t*wo basic areas* of consideration for successful implementation of button rectifiers:

1. Mounting and Handling
2. Soldering

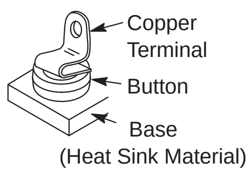
Each should be carefully examined before attempting a finished assembly or mounting operation.

Mounting and Handling

The button rectifier lends itself to a multitude of assembly arrangements, but one key consideration must *always* be included: One Side of the Connections to the Button Must be Flexible!

This stress relief to the button should also be chosen for maximum contact area to afford the best heat transfer – but not at the expense of flexibility. For an annealed copper terminal a thickness of 0.015″ is suggested.

Strain Relief Terminal
for Button Rectifier



The base heat sink may be of various materials whose shape and size are a function of the individual application and the heat transfer requirements.

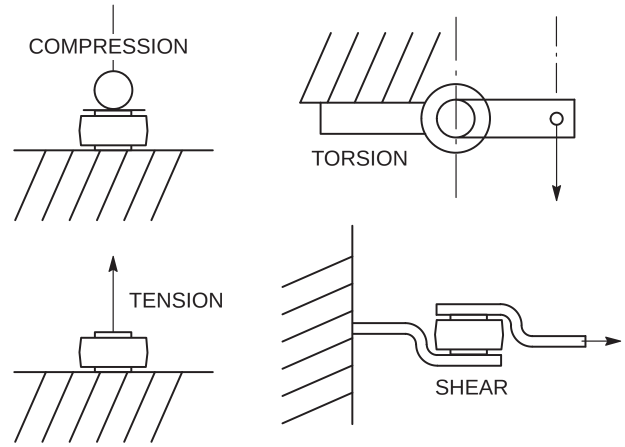
Common Materials	Advantages and Disadvantages
Steel	Low Cost: relatively low heat conductivity
Copper	High Cost: high heat conductivity
Aluminum	Medium Cost: medium heat conductivity. Relatively expensive to plate and not all platers can process aluminum.

Handling of the button during assembly must be relatively gentle to minimize sharp impact shocks and avoid nicking of the plastic. Improperly designed automatic handling equipment is the worst source of unnecessary shocks. Techniques for vacuum handling and spring loading should be investigated.

The mechanical stress limits for the button diode are as follows:

Compression	32 lbs.	142.3 Newton
Tension	32 lbs.	142.3 Newton
Torsion	6–inch lbs.	0.68 Newtons–meters
Shear	55 lbs.	244.7 Newton

MECHANICAL STRESS



Exceeding these recommended maximums can result in electrical degradation of the device.

Soldering

The button rectifier is basically a semiconductor chip bonded between two nickel–plated copper heat sinks with an encapsulating material of epoxy compound. The exposed metal areas are also tin plated to enhance solderability.

In the soldering process it is important that the temperature not exceed 260°C if device damage is to be avoided. Various solder alloys can be used for this operation but two types are recommended for best results:

1. 95% Sn, 5% Sb; melting point 237°C
2. 96.5% tin, 3.5% silver; melting point 221°C
3. 63% tin, 37% lead; melting point 183°C

Solder is available as preforms or paste. The paste contains both the metal and flux and can be dispensed rapidly. The solder preform requires the application of a flux to assure good wetting of the solder. The type of flux used depends upon the degree of cleaning to be accomplished and is a function of the metal involved. These fluxes range from a mild rosin to a strong acid; e.g., Nickel plating oxides are best removed by an acid base flux while an activated rosin flux may be sufficient for tin plated parts.

Since the button is relatively lightweight, there is a tendency for it to float when the solder becomes liquid. To prevent bad joints and misalignment, it is suggested that a weighting or spring loaded fixture be employed. It is also important that severe thermal shock (either heating or cooling) be avoided as it may lead to damage of the die or encapsulant of the part.

Button holding fixtures for use during soldering may be of various materials. Stainless steel has a longer use life while black anodized aluminum is less expensive and will limit heat reflection and enhance absorption. The assembly volume will influence the choice of materials. Fixture dimension tolerances for locating the button must allow for expansion during soldering as well as allowing for button clearance.

Heating Techniques

The following four heating methods have their advantages and disadvantages depending on volume of buttons to be soldered.

1. **Belt furnaces** readily handle large or small volumes and are adaptable to establishment of "on–line" assembly since a variable belt speed sets the run rate. Individual furnace zone controls make excellent temperature control possible.
2. **Flame Soldering** involves the directing of natural gas flame jets at the base of a heatsink as the heatsink is indexed to various loading–heating–cooling–unloading positions. This is the most economical labor method of soldering large volumes. Flame soldering offers good temperature control but requires sophisticated temperature monitoring systems such as infrared.
3. **Ovens** are good for batch soldering and are production limited. There are handling problems because of slow cooling. Response time is load dependent, being a function of the watt rating of the oven and the mass of parts. Large ovens may not give an acceptable temperature gradient. Capital cost is low compared to belt furnaces and flame soldering.
4. **Hot Plates** are good for soldering small quantities of prototype devices. Temperature control is fair with overshoot common because of the exposed heating surface. Solder flow and positioning can be corrected during soldering since the assembly is exposed. Investment cost is very low.

Regardless of the heating method used, a soldering profile giving the time–temperature relationship of the particular method must be determined to assure proper soldering. Profiling must be performed on a scheduled basis to minimize poor soldering. The time–temperature relationship will change depending on the heating method used.

MR2520L

Overvoltage Transient Suppressor

Designed for applications requiring a low voltage rectifier with reverse avalanche characteristics for use as reverse power transient suppressors. Developed to suppress transients in the automotive system, these devices operate in the forward mode as standard rectifiers or reverse mode as power avalanche rectifier and will protect electronic equipment from overvoltage conditions.

- High Power Capability
- Economical
- Increased Capacity by Parallel Operation

Mechanical Characteristics

- Case: Epoxy, Molded
- Weight: 2.5 Grams (Approximately)
- Finish: All External Surfaces Corrosion Resistant and Terminal Leads are Readily Solderable
- Maximum Lead Temperature for Soldering Purposes: 350°C 3/8″ from Case for 10 Seconds at 5 lbs. Tension
- Polarity: Indicated by Diode Symbol or Cathode Band
- Marking: MR2520L

MAXIMUM RATINGS (T_J = 25°C unless otherwise noted)

Rating	Symbol	Value	Unit
DC Peak Repetitive Reverse Voltage Working Peak Reverse Voltage DC Blocking Voltage	V_{RRM} V_{RWM} V_R	23	Volts
Repetitive Peak Reverse Surge Current (Time Constant = 10 ms, Duty Cycle ≤ 1%, T_C = 25°C)	I_{RSM}	58	Amps
Peak Reverse Power (Time Constant = 10 ms, Duty Cycle ≤ 1%, T_C = 25°C)	P_{RSM}	2500	Watts
Average Rectified Forward Current (Single Phase, Resistive Load, 60 Hz, T_C = 125°C) (See Figure 4)	I_O	6.0	Amps
Non–Repetitive Peak Surge Current Surge Supplied at Rated Load Conditions Halfwave, Single Phase	I_{FSM}	400	Amps
Operating and Storage Junction Temperature Range	T_J, T_{stg}	–65 to +175	°C

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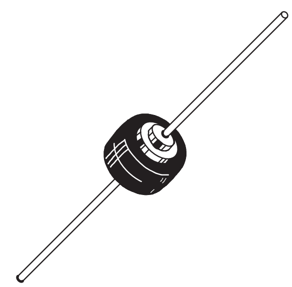
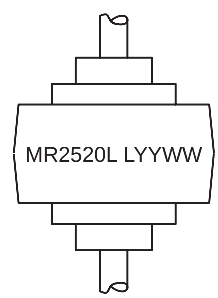
OVERVOLTAGE TRANSIENT SUPPRESSOR 24 – 32 VOLTS



AXIAL LEAD BUTTON
CASE 194
STYLE 1



MR2520L = Device Code
L = Location Code
YY = Year
WW = Work Week

ORDERING INFORMATION

Device	Package	Shipping
MR2520L	Axial Lead Button	1000/Box
MR2520LRL	Axial Lead Button	800/Reel

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THERMAL CHARACTERISTICS

Characteristic	Lead Length	Symbol	Max	Unit
Thermal Resistance, Junction to Lead, Both Leads to Heat Sink with Equal Length	6.25 mm 10 mm 15 mm	$R_{\theta JL}$	7.5 10 15	°C/W
Thermal Resistance Junction to Case	–	$R_{\theta JC}$	1.0	°C/W

*Typical

ELECTRICAL CHARACTERISTICS (T_J = 25°C unless otherwise noted)

Characteristic	Symbol	Min	Max	Unit
Instantaneous Forward Voltage (Note 1.) (I_F = 100 Amps, T_C = 25°C)	V_F	–	1.25	Volts
Instantaneous Forward Voltage (Note 1.) (I_F = 100 Amps, T_C = 25°C)	V_F	–	0.90	Volts
Reverse Current (V_R = 20 Vdc, T_C = 25°C)	I_R	–	10	nAdc
Reverse Current (V_R = 20 Vdc, T_C = 25°C)	I_R	–	300	nAdc
Breakdown Voltage (Note 1.) (I_R = 100 mAdc, T_C = 25°C)	$V_{(BR)}$	24	32	Volts
Breakdown Voltage (Note 1.) (I_R = 90 Amp, T_C = 150°C, PW = 80 μs)	$V_{(BR)}$	–	40	Volts
Dynamic Resistance (I_R = 100 mA, T_J = 25°C, f = 1.0 kHz)	R_Z	–	5.0	Ω
Dynamic Resistance (I_R = 40 mA, T_J = 25°C)	R_Z	–	0.15	Ω
Breakdown Voltage Temperature Coefficient	$V_{(BR)TC}$	–	0.09*	%/°C
Forward Voltage Temperature Coefficient @ I_F = 10 mA	V_{FTC}	–	–2*	mV/°C

1. Pulse Test: Pulse Width ≤ 300 μs, Duty Cycle ≤ 2%.

*Typical

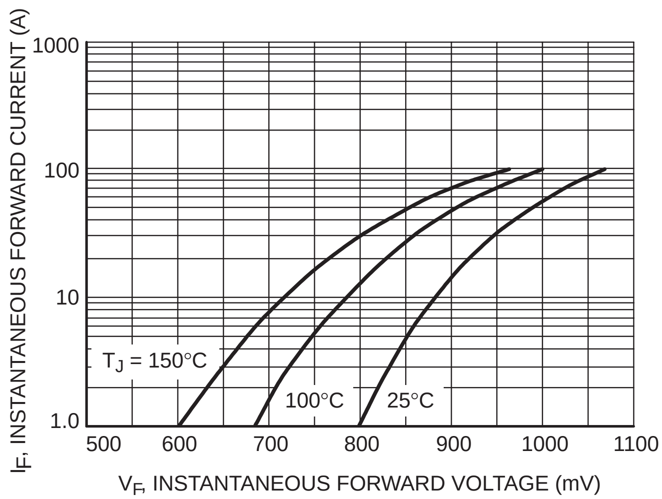

Figure 1. Forward Voltage

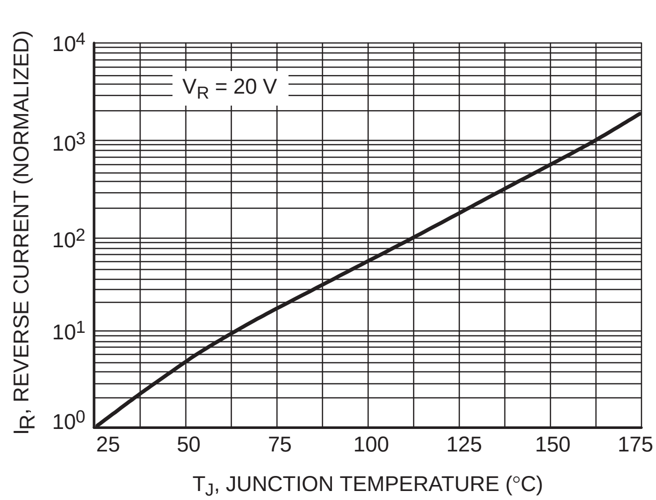

Figure 2. Normalized Reverse Current

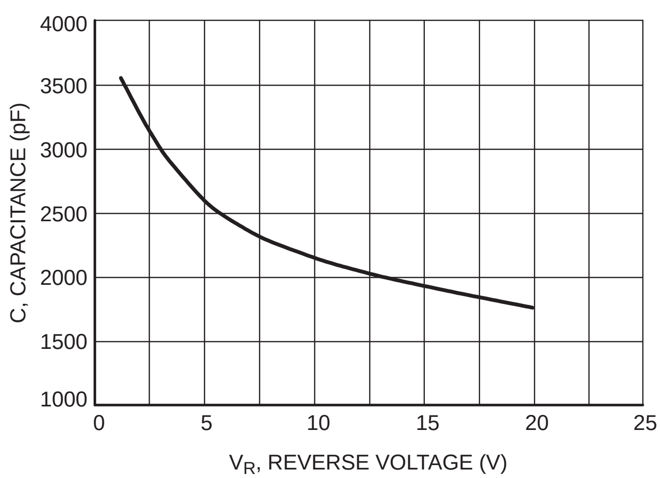

Figure 3. Typical Capacitance

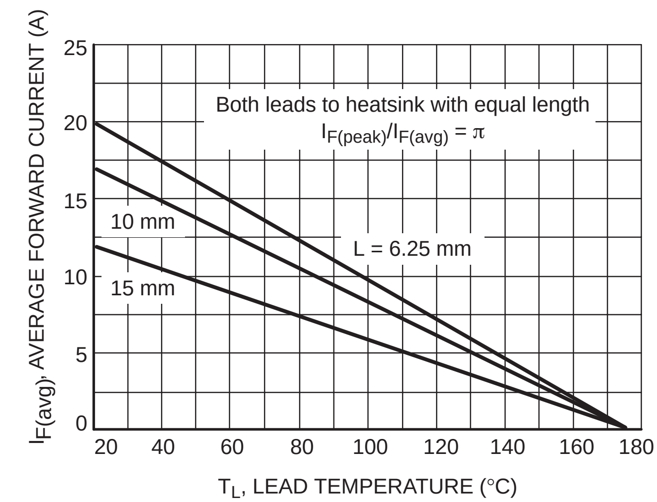

Figure 4. Maximum Current Ratings

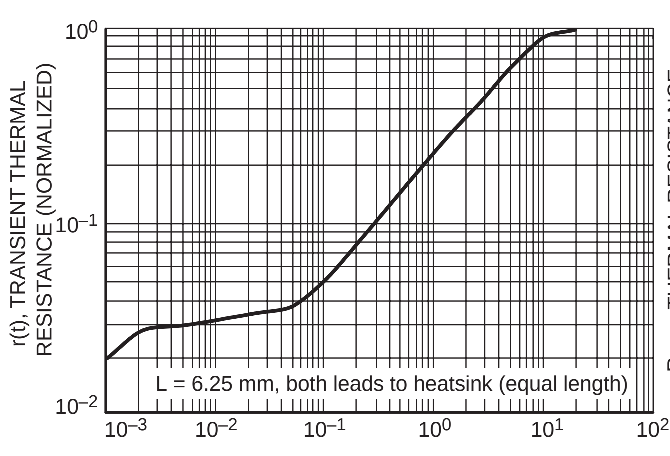

Figure 5. Thermal Response

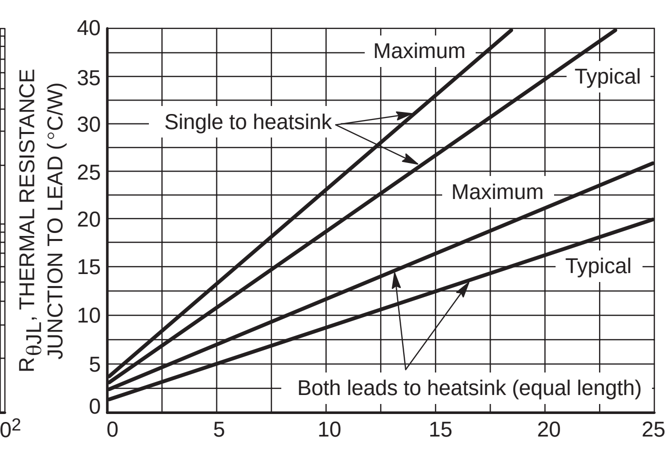

Figure 6. Steady State Thermal Resistance

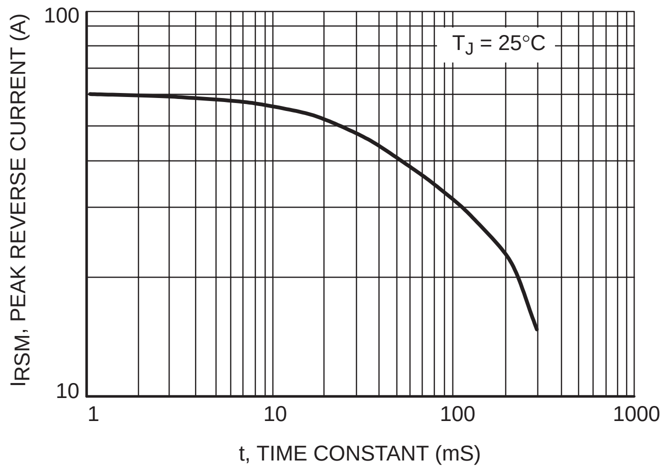

Figure 7. Maximum Peak Reverse Current

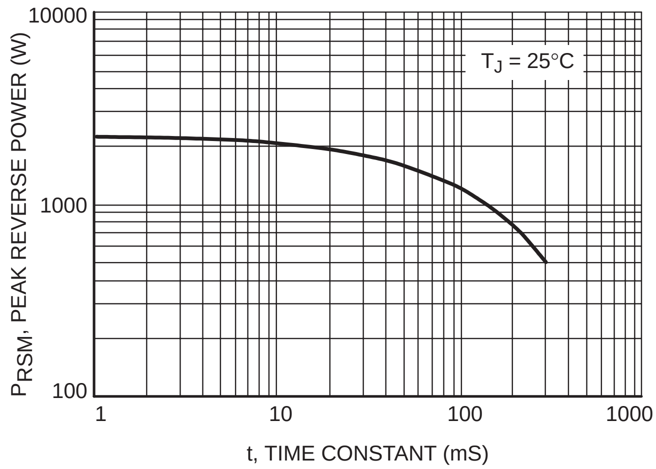

Figure 8. Maximum Peak Reverse Power

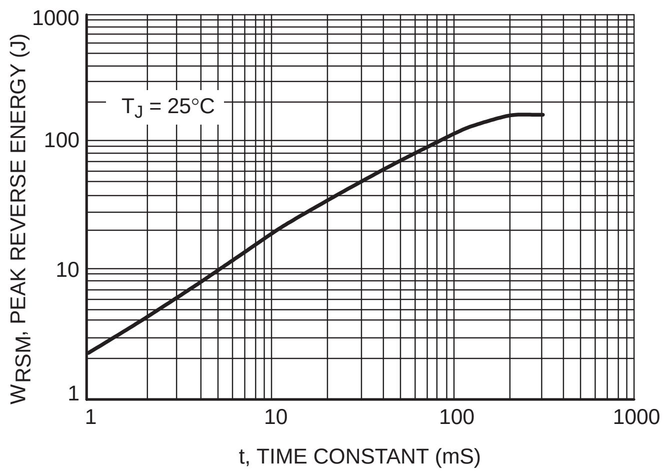

Figure 9. Maximum Reverse Energy

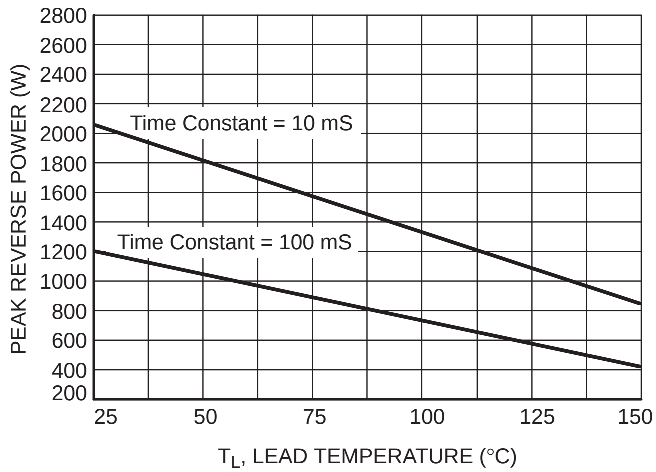

Figure 10. Reverse Power Derating

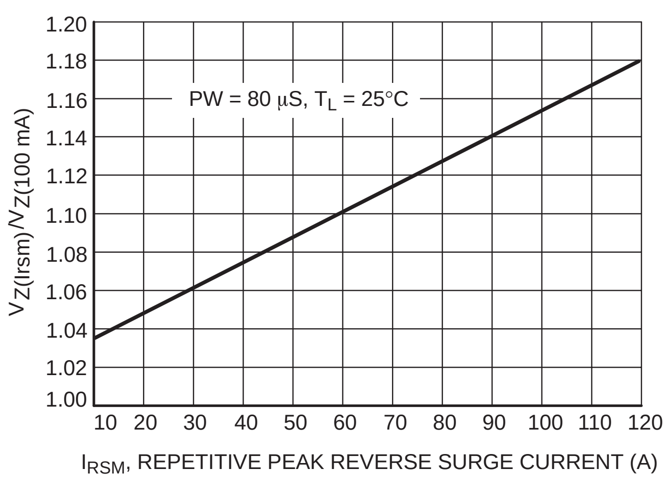

Figure 11. Typical Clamping Factor

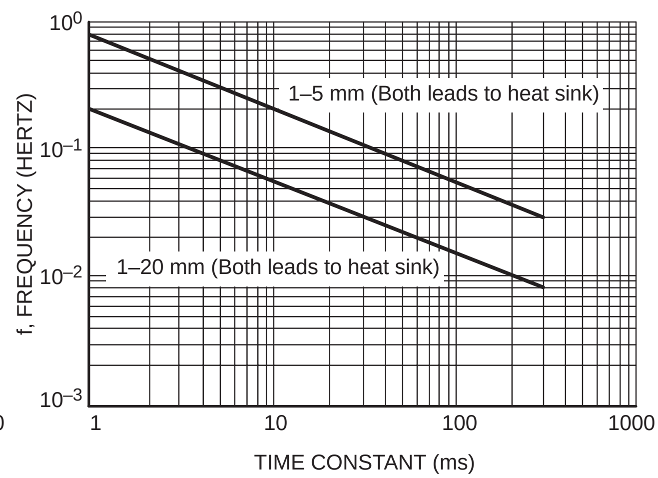

Figure 12. Maximum Load Dump Frequency

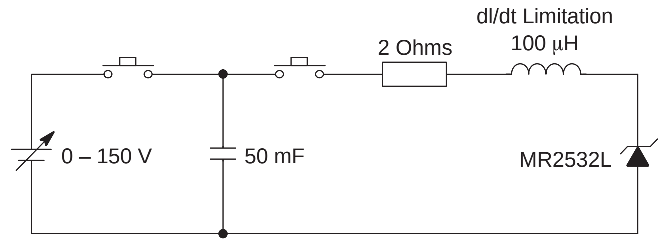

Figure 13. Load Dump Test Circuit

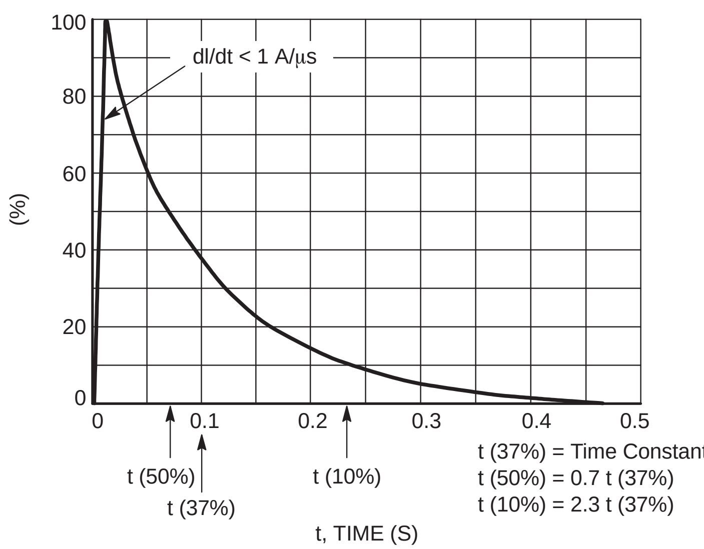

Figure 14. Load Dump Pulse Current

MR2535L

Overvoltage Transient Suppressors

Medium Current

Designed for applications requiring a low voltage rectifier with reverse avalanche characteristics for use as reverse power transient suppressors. Developed to suppress transients in the automotive system, these devices operate in the forward mode as standard rectifiers or reverse mode as power avalanche rectifier and will protect electronic equipment from overvoltage conditions.

- Avalanche Voltage 24 to 32 Volts
- High Power Capability
- Economical
- Increased Capacity by Parallel Operation

Mechanical Characteristics

- Case: Epoxy, Molded
- Weight: 2.5 Grams (Approximately)
- Finish: All External Surfaces Corrosion Resistant and Terminal Leads are Readily Solderable
- Maximum Lead Temperature for Soldering Purposes: 350°C 3/8″ from Case for 10 Seconds at 5 lbs. Tension
- Polarity: Indicated by Diode Symbol or Cathode Band
- Marking: MR2535L

MAXIMUM RATINGS (T_J = 25°C unless otherwise noted)

Rating	Symbol	Value	Unit
DC Peak Repetitive Reverse Voltage Working Peak Reverse Voltage DC Blocking Voltage	V_{RRM} V_{RWM} V_R	20	Volts
Repetitive Peak Reverse Surge Current (Time Constant = 10 ms, Duty Cycle ≤ 1%, T_C = 25°C) (See Note 1)	I_{RSM}	62	Amps
Average Rectified Forward Current (Single Phase, Resistive Load, 60 Hz, T_C = 125°C) (See Figure 4)	I_O	6.0	Amps
Non–Repetitive Peak Surge Current Surge Supplied at Rated Load Conditions Halfwave, Single Phase	I_{FSM}	600	Amps
Operating and Storage Junction Temperature Range	T_J, T_{stg}	–65 to +175	°C

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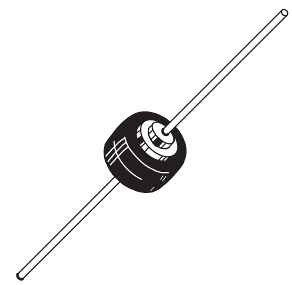
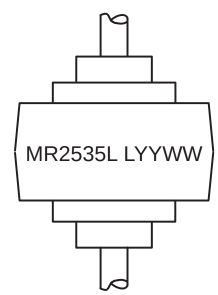


AXIAL LEAD BUTTON
CASE 194
STYLE 1

MARKING DIAGRAM



MR2535L = Device Code
L = Location Code
YY = Year
WW = Work Week

ORDERING INFORMATION

Device	Package	Shipping
MR2535L	Axial Lead Button	1000/Box
MR2535LRL	Axial Lead Button	800/Reel

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THERMAL CHARACTERISTICS

Characteristic	Lead Length	Symbol	Max	Unit
Thermal Resistance, Junction to Lead @ Both Leads to Heat Sink, Equal Length	1/4″ 3/8″ 1/2″	$R_{\theta JL}$	7.5 10 13	°C/W
Thermal Resistance Junction to Case		$R_{\theta JC}$	0.8*	°C/W

ELECTRICAL CHARACTERISTICS (T_J = 25°C unless otherwise noted)

Characteristic	Symbol	Min	Max	Unit
Instantaneous Forward Voltage (Note 1.) (i_F = 100 Amps, T_C = 25°C)	v_F	–	1.1	Volts
Reverse Current (V_R = 20 Vdc, T_C = 25°C)	I_R	–	200	nAdc
Breakdown Voltage (Note 1.) (I_R = 100 mAdc, T_C = 25°C)	$V_{(BR)}$	24	32	Volts
Breakdown Voltage (Note 1.) (I_R = 90 Amp, T_C = 150°C, PW = 80 µs)	$V_{(BR)}$	–	40	Volts
Breakdown Voltage Temperature Coefficient	$V_{(BR)TC}$	–	0.096*	%/°C
Forward Voltage Temperature Coefficient @ I_F = 10 mA	V_{FTC}	–	2*	mV/°C

1. Pulse Test: Pulse Width ≤ 300 µs, Duty Cycle ≤ 2%.

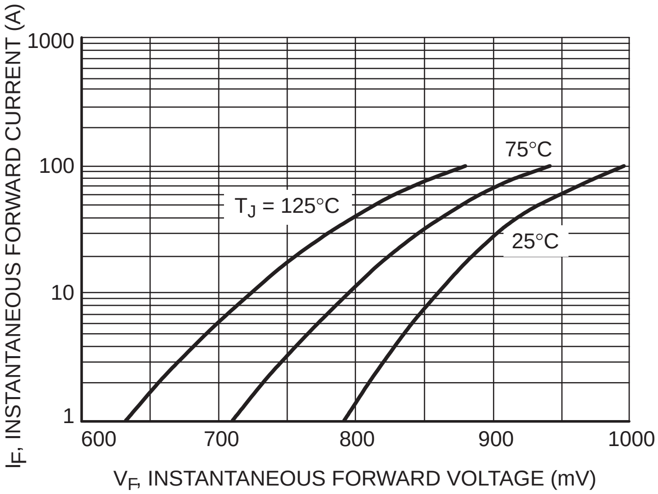

Figure 1. Typical Forward Voltage

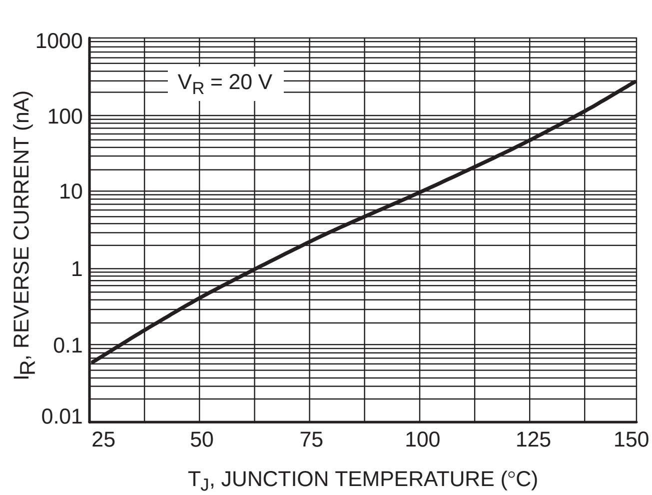

Figure 2. Typical Reverse Current versus Junction Temperature

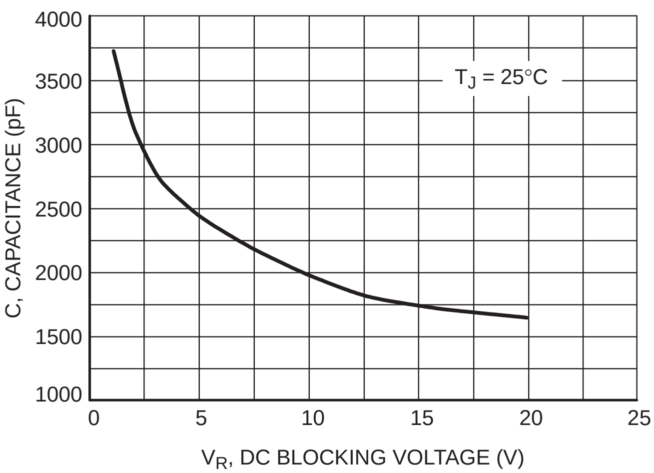

Figure 3. Typical Capacitance

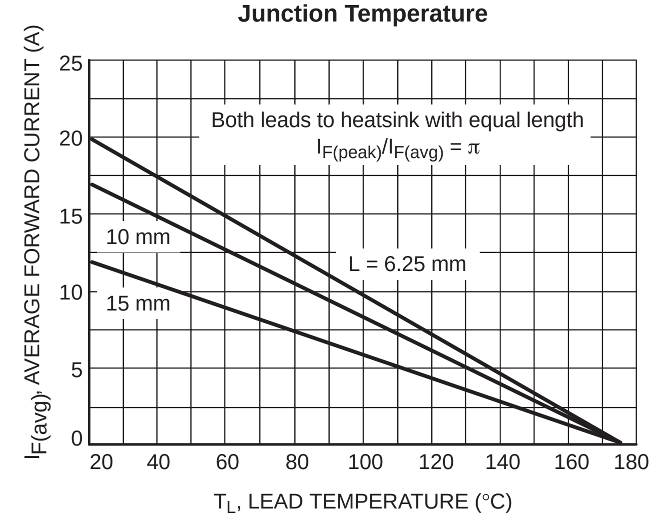

Figure 4. Maximum Current Ratings

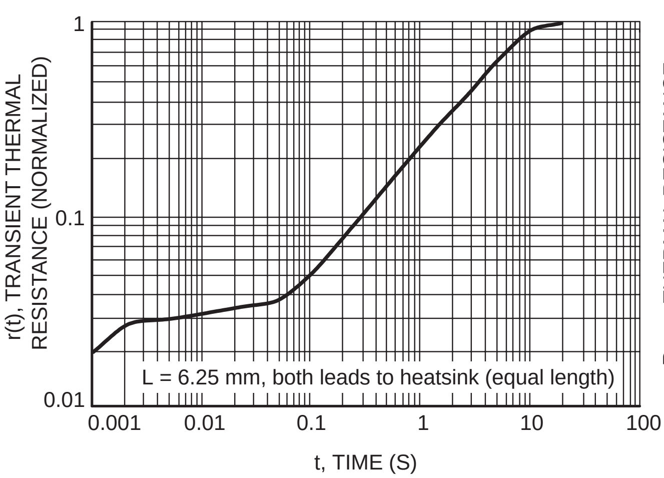

Figure 5. Thermal Response

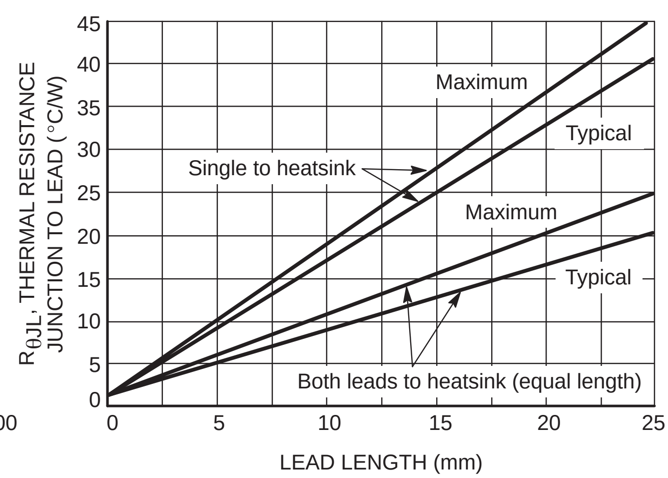

Figure 6. Steady State Thermal Resistance

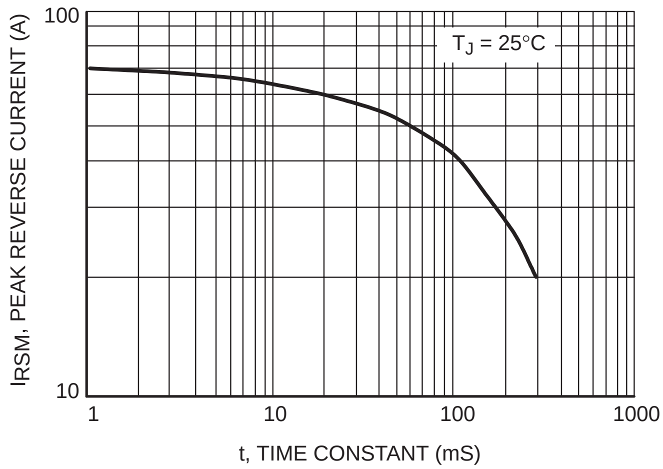

Figure 7. Maximum Peak Reverse Current

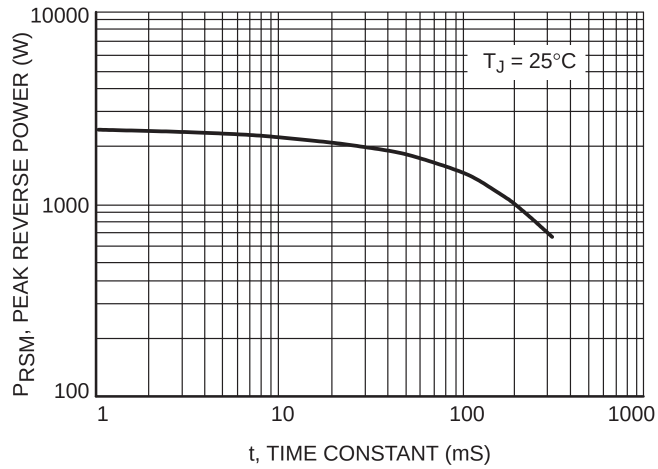

Figure 8. Maximum Peak Reverse Power

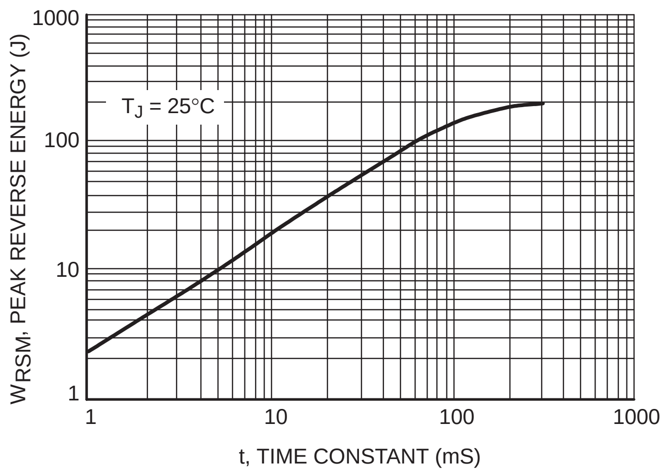

Figure 9. Maximum Reverse Energy

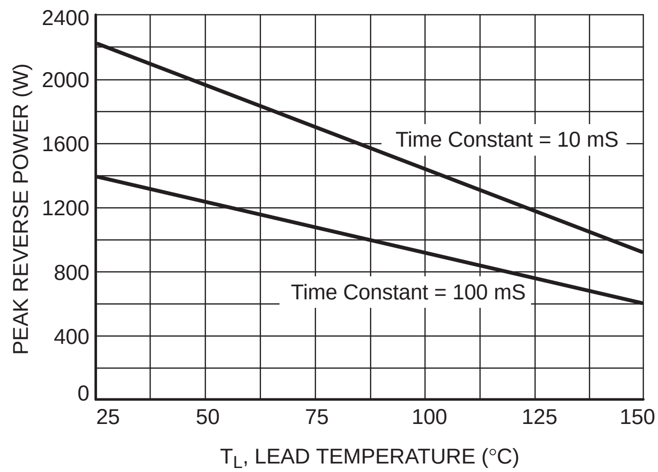

Figure 10. Reverse Power Derating

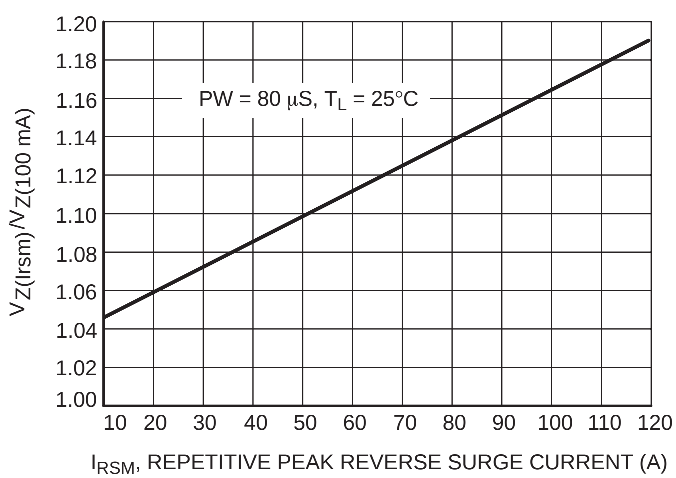

Figure 11. Typical Clamping Factor

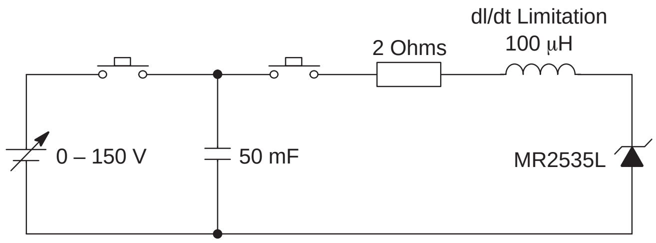

Figure 12. Load Dump Test Circuit

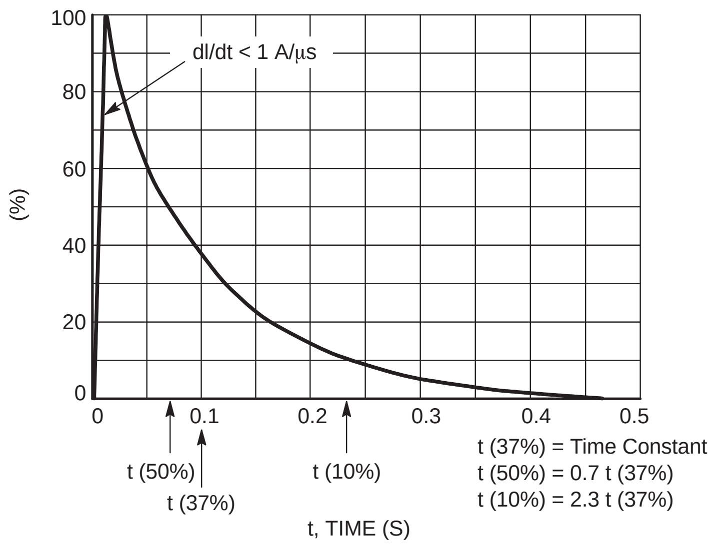

Figure 13. Load Dump Pulse Current

MR2835S

Overvoltage Transient Suppressor

...designed for applications requiring a diode with reverse avalanche characteristics for use as reverse power transient suppressor.

Developed to suppress transients in the automotive system, this device operates in reverse mode as power zener diode and will protect expensive modules such as ignition, injection and autoblocking systems from overvoltage conditions.

- High Power Capability
- Economical

Mechanical Characteristics

- Finish: All External Surfaces are Corrosion Resistant
- Polarity: Cathode to Terminal
- Weight: 1.78 Grams (Approximately)
- Maximum Temperature for Soldering Purposes: 260°C for 10 s using a Belt Furnace
- Marking: MR2835S

MAXIMUM RATINGS

Rating	Symbol	Value	Unit
DC Blocking Voltage	V_R	23	Volts
Peak Repetitive Reverse Surge Current (Time Constant = 10 ms, T_C = 25°C)	I_{RSM}	62	Amps
Non–Repetitive Peak Surge Current (Halfwave, Single Phase, 50 Hz)	I_{FSM}	400	Amps
Storage Temperature Range	T_{stg}	–40 to +150	°C
Operating Junction Temperature Range	T_J	–40 to +150	°C

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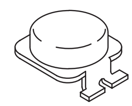
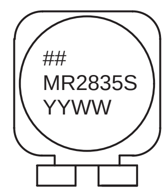


Cathode

TOP CAN
CASE 460

MARKING DIAGRAM



##	= Lot Number
MR2835S	= Specific Device Code
YY	= Year
WW	= Work Week

ORDERING INFORMATION

Device	Package	Shipping
MR2835S	Top Can	500/Tape & Reel

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THERMAL CHARACTERISTICS

Characteristic	Symbol	Value	Unit
Thermal Resistance, Junction to Case	$R_{\theta JC}$	1.0	°C/W

ELECTRICAL CHARACTERISTICS (T_C = 25°C unless otherwise noted)

Characteristic	Symbol	Min	Max	Unit
Instantaneous Forward Voltage (I_F = 100 A) (Note 1.)	V_F	–	1.1	Volts
Reverse Current (V_R = 20 V) (Note 1.)	I_R	–	5.0	μA
Breakdown Voltage (I_Z = 100 mA) (Note 1.)	$V_{(BR)}$	24	32	Volts
Breakdown Voltage (I_Z = 80 A, T_C = 85°C, PW = 80 μs)	$V_{(BR)}$	–	40	Volts
Breakdown Voltage Temperature Coefficient	$V_{(BR)TC}$	–	0.09	%/°C
Forward Voltage Temperature Coefficient (I_F = 10 mA)	V_{FTC}	–	–2.0*	mV/°C

1. Pulse Test: Pulse Width < 300 μs, Duty Cycle < 2%.

*Typical

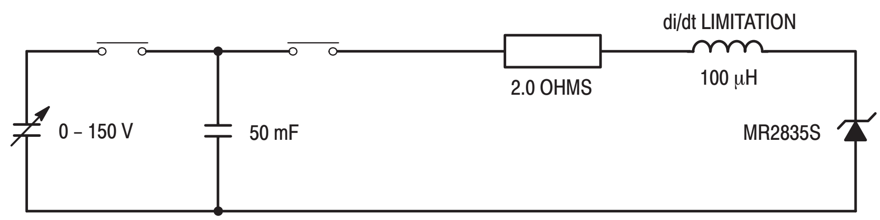


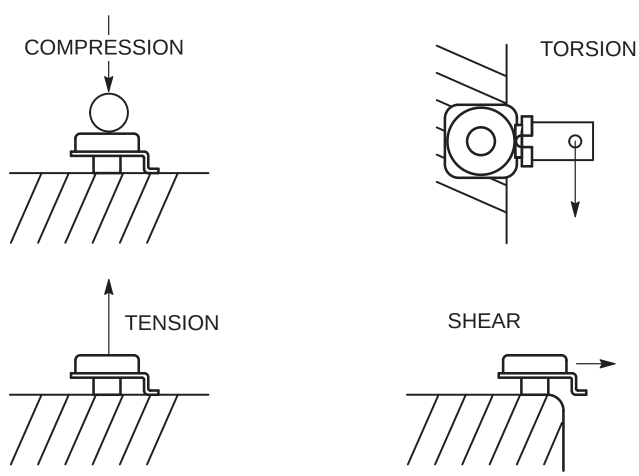
Figure 1. Load Dump Test Circuit

MOUNTING AND HANDLING

The mechanical stress limits for the Top Can diode are as follows:

Compression:	33.7 lbs	150 newtons
Tension:	33.7 lbs	150 newtons
Torsion:	6.3 inch lbs	0.7 newton meters
Shear:	56.2 lbs	250 newtons

MECHANICAL STRESS



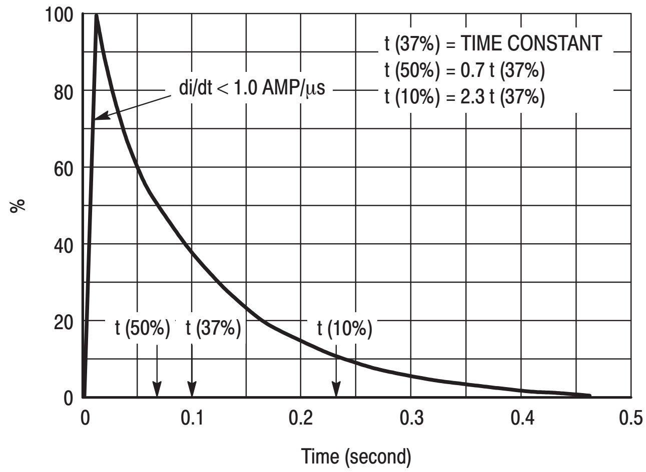


Figure 2. Load Dump Pulse Current

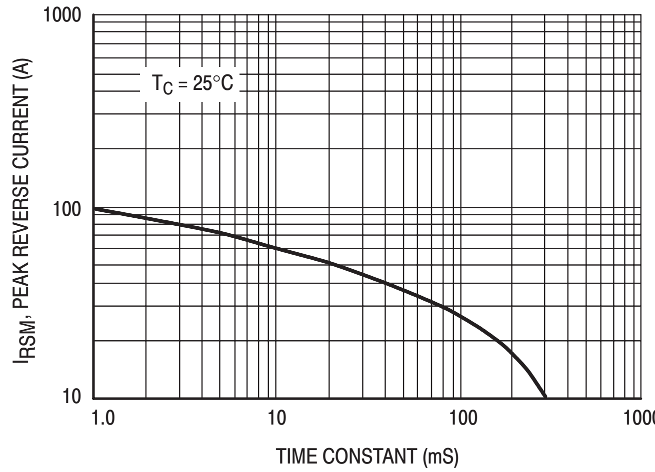


Figure 3. Maximum Peak Reverse Current

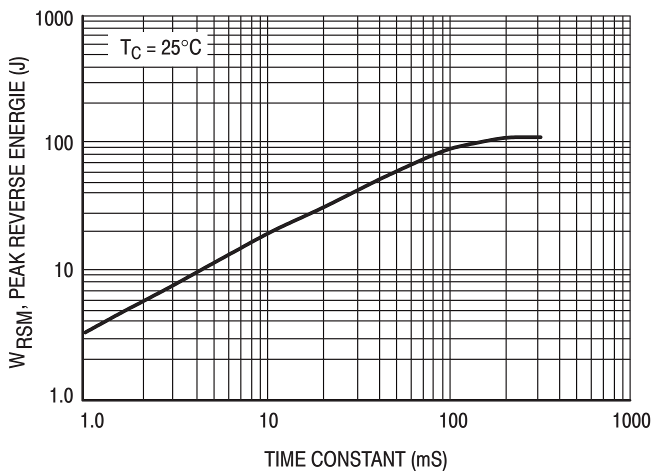


Figure 4. Maximum Reverse Energie

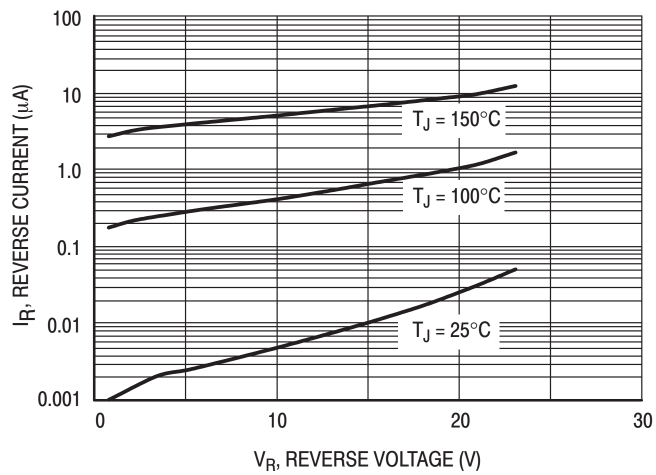


Figure 5. Typical Reverse Current

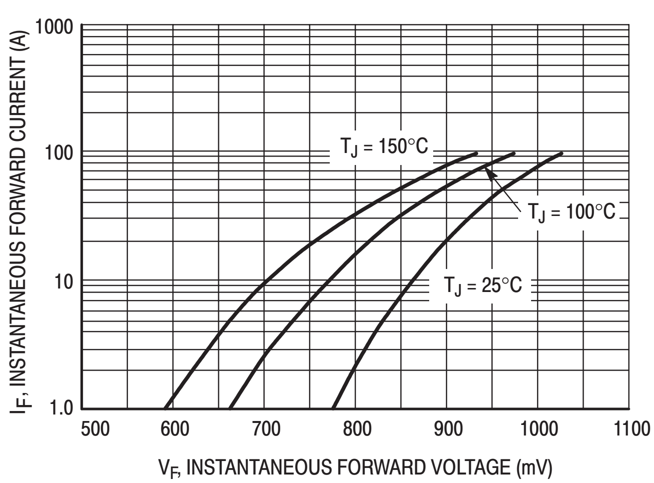


Figure 6. Typical Forward Voltage

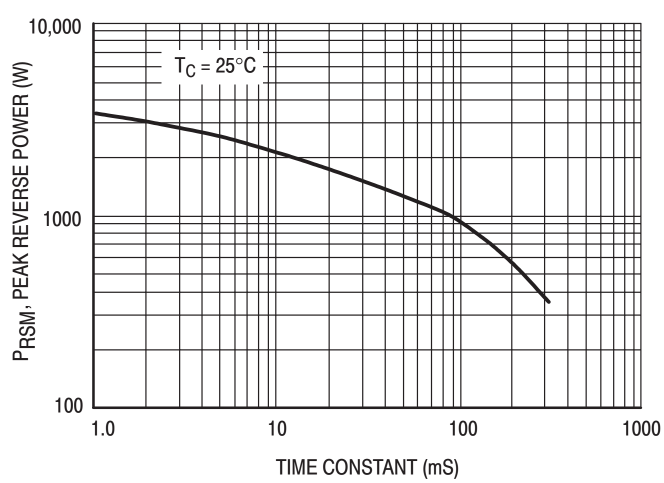


Figure 7. Maximum Peak Reverse Power

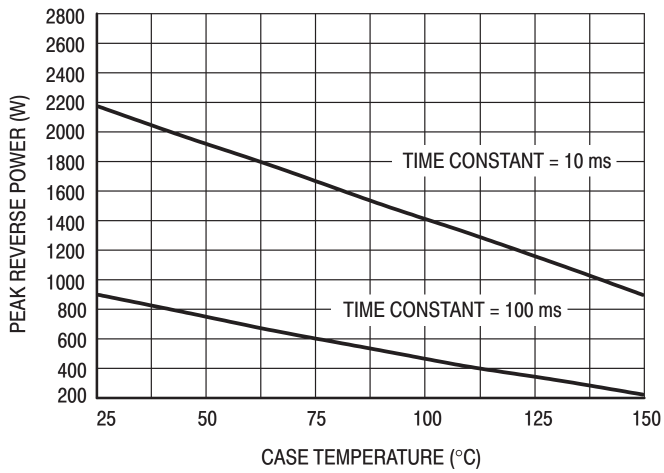


Figure 8. Reverse Power Derating

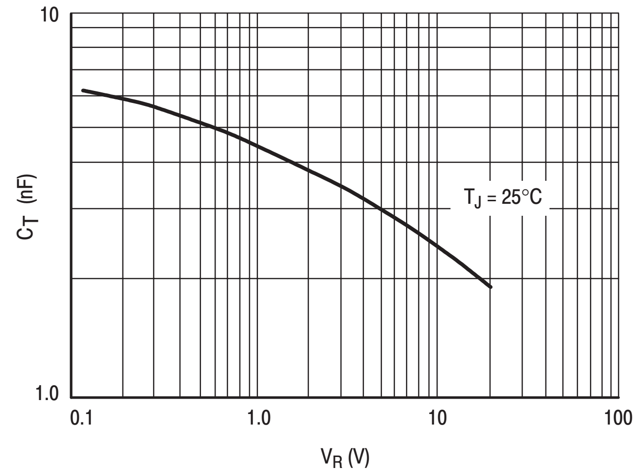
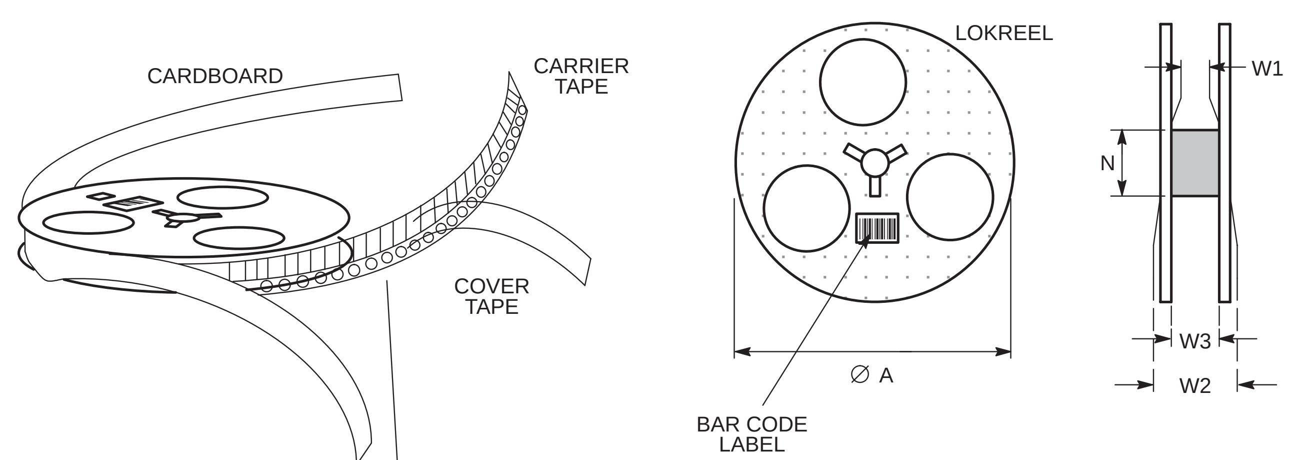
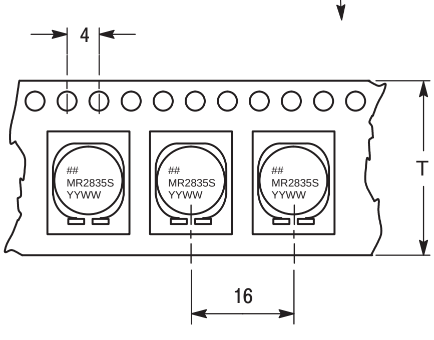


Figure 9. Typical Reverse Capacitance

Reel of 500 Units



(stuck on the opposite side of the carrier holes)



DIM	mm
T	24
A ∅	330
N∅	100
W1	24.4
W2	28.5
W3	25

DIMENSIONS: millimeter

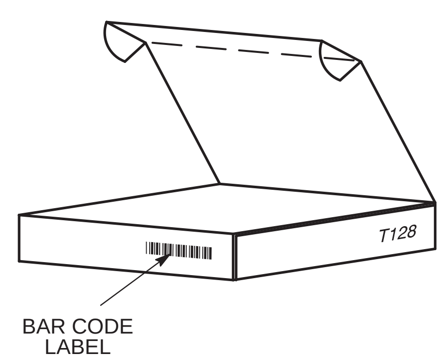


Figure 10. Reel Packing of MR2835S – Top Can

MR3227

Automotive Transient Voltage Suppressor

20 V – 27 V

Designed for Automotive Applications (Alternator) requiring Reverse Avalanche Capability for use as Transient Voltage Suppressor. Developed to suppress transients in automotive systems, this device operates in the forward mode as Standard Rectifier or in Reverse as Transient Voltage Suppressor for Centralized Protection.

For further information referring to Mounting or Operating Conditions, contact your nearest ON Semiconductor Sales Representative.

Mechanical Characteristics

- Finish: 100% Tin Plated
  All External Surfaces are Corrosion Resistant
- Weight: 2.5 Grams (Approximately)

Packaging/Labeling

- Two Sealed Bags into a Cardboard Box
- Device Number Labeled on the Bag

Marking

- The Devices are Laser Marked on the Epoxy Surface

MAXIMUM RATING

Rating	Symbol	Value	Unit
DC Blocking Voltage	V_R	18	Volts
Average Forward Current (Single Phase, Resistive Load, T_C = 185°C)	I_O	32	Amps
Peak Repetitive Reverse Surge Current (Time Constant = 10 ms, T_C = 25°C) (Time Constant = 80 ms, T_C = 25°C)	I_{RSM} I_{RSM}	90 40	Amps
Non–Repetitive Peak Surge Current (Halfwave, Single Phase, 50 Hz)	I_{FSM}	400	Amps
Storage Temperature Range	T_{stg}	–40 to +200	°C
Maximum Operating Junction Temperature	T_J	200	°C

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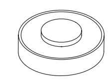
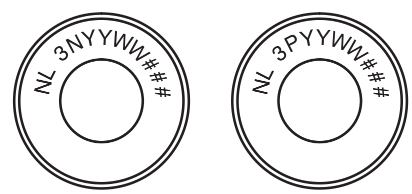


N SUFFIX
(Anode to Cup)
P SUFFIX
(Cathode to Cup)
CASE 193A

MARKING DIAGRAM



NL = Location Code
3N or 3P = Device Code and Polarity
YY = Year
WW = Work Week
= Assembly Lot Number

ORDERING INFORMATION

Device	Package	Shipping
MR3227N	Button Can	5000 Units/Box
MR3227P	Button Can	5000 Units/Box

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THERMAL CHARACTERISTICS

Characteristic	Symbol	Value	Unit
Thermal Resistance Junction to Case	$R_{\theta JC}$	0.5	°C/W

ELECTRICAL CHARACTERISTICS

Characteristic	Symbol	Min	Max	Unit
Instantaneous Forward Voltage (Note 1.) (I_F = 100 Amps, T_C = 25°C)	v_F	–	1.18	Volts
Reverse Current (Note 1.) (V_R = 16 Vdc, T_C = 25°C)	I_R	–	1.0	μA
Breakdown Voltage (Note 1.) (I_R = 100 mA, T_C = 25°C)	$V_{(BR)}$	20	27	Volts
Breakdown Voltage (I_R = 80 Amps, T_C = 25°C, PW = 80 μs) (I_R = 80 Amps, T_C = 85°C, PW = 80 μs)	$V_{(BR)}$	 – –	 35 37	Volts
Breakdown Voltage Temperature Coefficient	$V_{(BR)TC}$	0.095*		%/°C
Forward Voltage Temperature Coefficient (I_F = 10 mA)	V_{FTC}	–2*		mV/°C

1. Pulse Test: Pulse Width < 300 μs, Duty Cycle < 2%.

*Typical

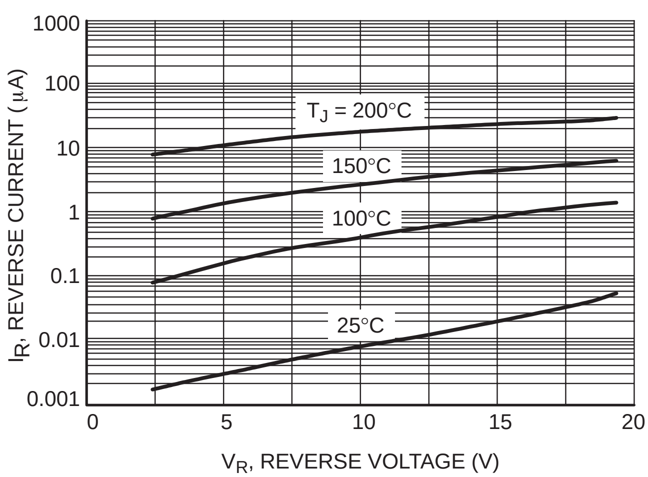

Figure 1. Typical Reverse Current

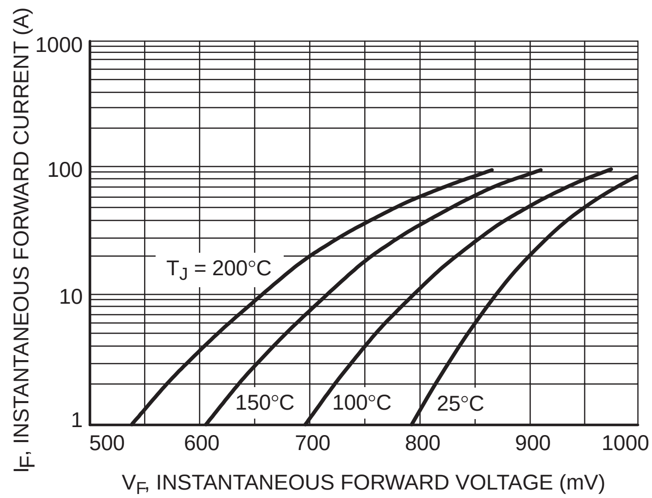

Figure 2. Typical Forward Voltage

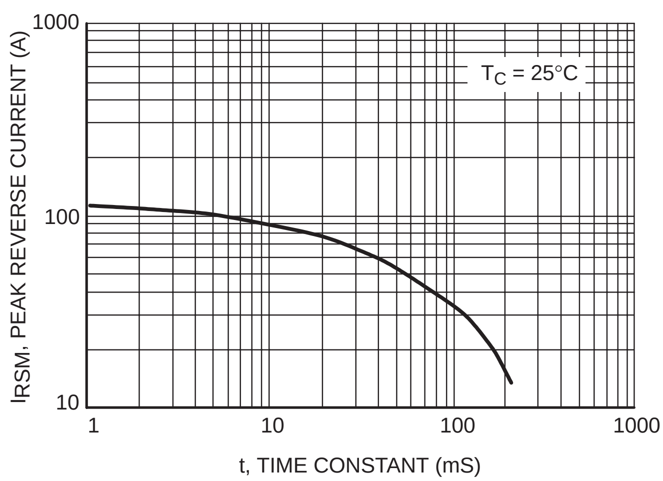

Figure 3. Maximum Peak Reverse Current

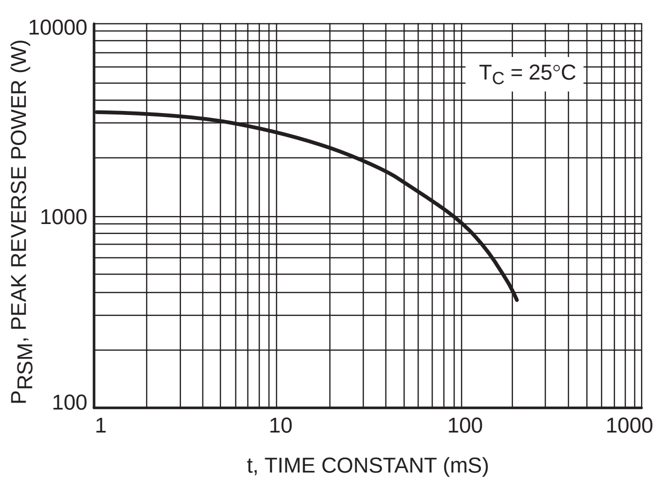

Figure 4. Maximum Peak Reverse Power

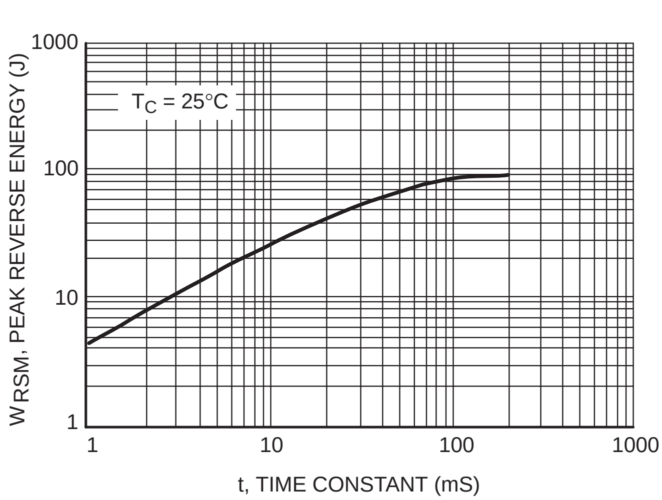

Figure 5. Maximum Reverse Energy

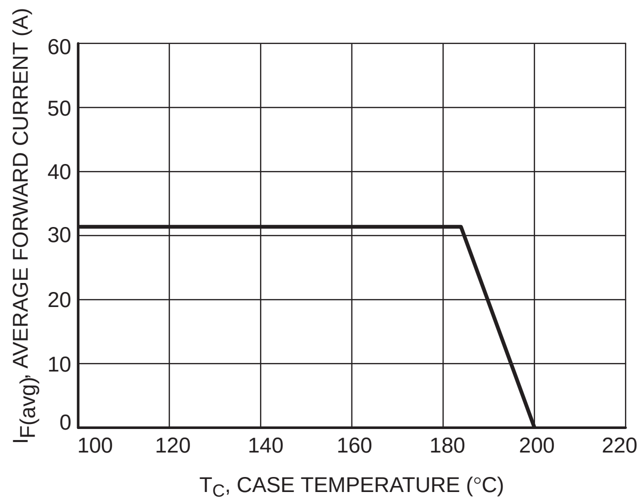

Figure 6. Maximum Current Rating

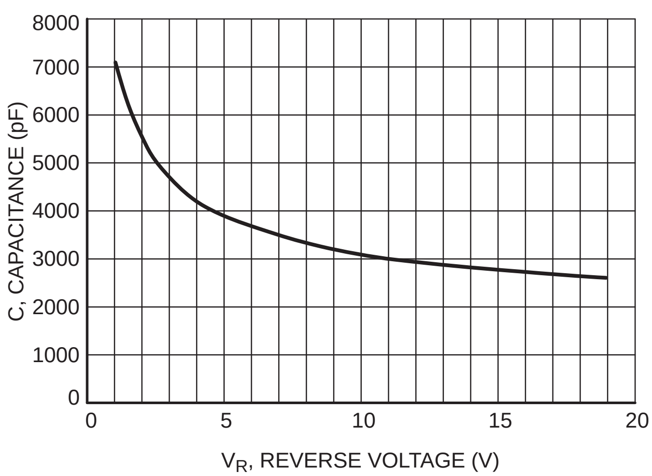

Figure 7. Typical Capacitance

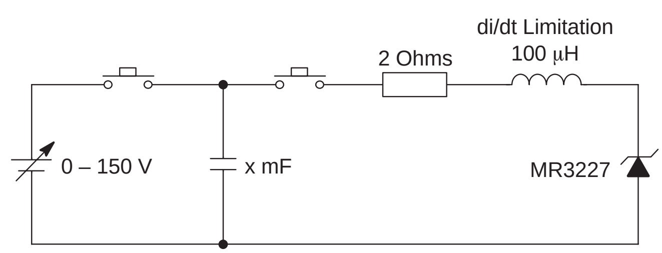

Figure 8. Load Dump Test Circuit

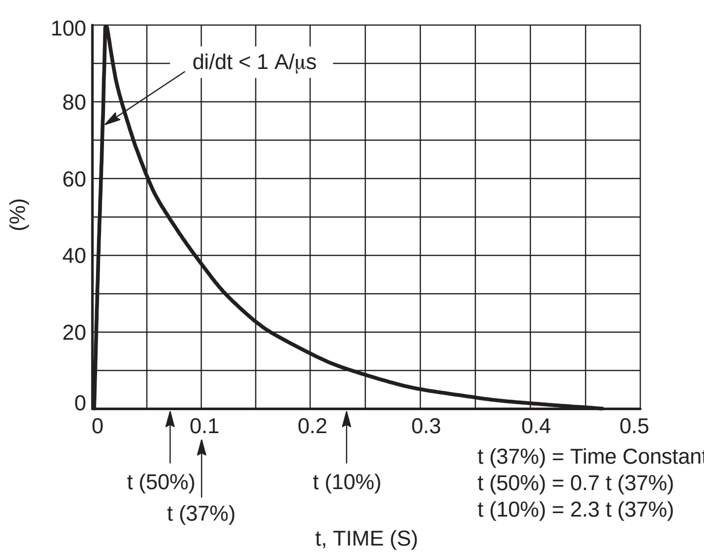

Figure 9. Load Dump Pulse Current

MR4027

Automotive Transient Voltage Suppressor

20 V – 27 V

Designed for Automotive Applications (Alternator) requiring Reverse Avalanche Capability for use as Transient Voltage Suppressor. Developed to suppress transients in automotive systems, this device operates in the forward mode as Standard Rectifier or in Reverse as Transient Voltage Suppressor for Centralized Protection.

For further information referring to Mounting or Operating Conditions, contact your nearest ON Semiconductor Sales Representative.

Mechanical Characteristics

- Finish: 100% Tin Plated
  All External Surfaces are Corrosion Resistant
- Weight: 2.6 Grams (Approximately)

Packaging/Labeling

- Two Sealed Bags into a Cardboard Box
- Device Number Labeled on the Bag

Marking

- The Devices are Laser Marked on the Epoxy Surface

MAXIMUM RATING

Rating	Symbol	Value	Unit
DC Blocking Voltage	V_R	18	Volts
Average Forward Current (Single Phase, Resistive Load, T_C = 185°C)	I_O	40	Amps
Peak Repetitive Reverse Surge Current (Time Constant = 10 ms, T_C = 25°C) (Time Constant = 80 ms, T_C = 25°C)	 I_{RSM} I_{RSM}	 110 50	Amps
Non–Repetitive Peak Surge Current (Halfwave, Single Phase, 50 Hz)	I_{FSM}	500	Amps
Storage Temperature Range	T_{stg}	–40 to +200	°C
Maximum Operating Junction Temperature	T_J	200	°C

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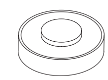
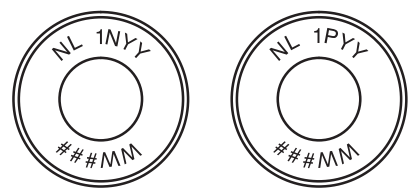


N SUFFIX
(Anode to Cup)
P SUFFIX
(Cathode to Cup)
CASE 193A

MARKING DIAGRAM



NL = Location Code
1N or 1P = Device Code and Polarity
YY = Year
WW = Work Week
= Assembly Lot Number

ORDERING INFORMATION

Device	Package	Shipping
MR4027N	Button Can	5000 Units/Box
MR4027P	Button Can	5000 Units/Box

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THERMAL CHARACTERISTICS

Characteristic	Symbol	Value	Unit
Thermal Resistance Junction to Case	$R_{\theta JC}$	0.4	°C/W

ELECTRICAL CHARACTERISTICS

Characteristic	Symbol	Min	Max	Unit
Instantaneous Forward Voltage (Note 1.) (I_F = 100 Amps, T_C = 25°C)	v_F	–	1.1	Volts
Reverse Current (Note 1.) (V_R = 16 Vdc, T_C = 25°C)	I_R	–	1.0	μA
Breakdown Voltage (Note 1.) (I_R = 100 mA, T_C = 25°C)	$V_{(BR)}$	20	27	Volts
Breakdown Voltage (I_R = 80 Amps, T_C = 25°C, PW = 80 μs) (I_R = 80 Amps, T_C = 85°C, PW = 80 μs)	$V_{(BR)}$	 – –	 35 37	Volts
Breakdown Voltage Temperature Coefficient	$V_{(BR)TC}$	0.095*		%/°C
Forward Voltage Temperature Coefficient (I_F = 10 mA)	V_{FTC}	–2*		mV/°C

1. Pulse Test: Pulse Width < 300 μs, Duty Cycle < 2%.

*Typical

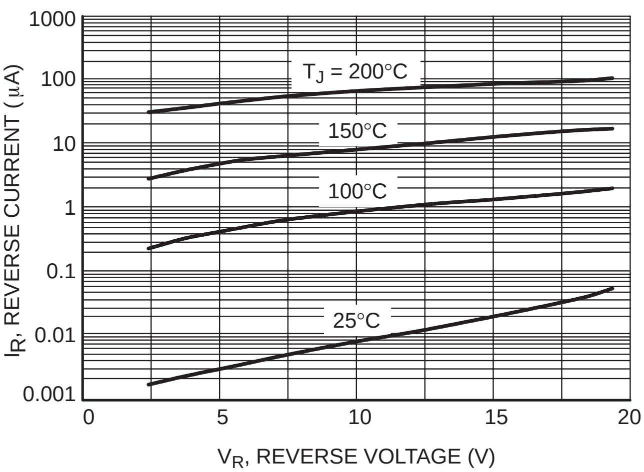

Figure 1. Typical Reverse Current

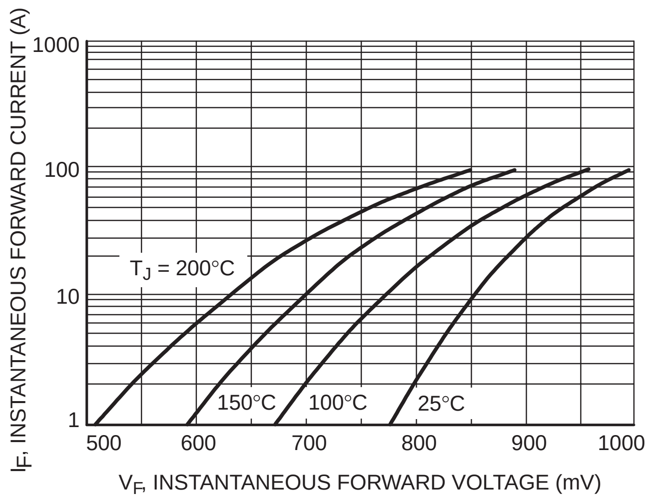

Figure 2. Typical Forward Voltage

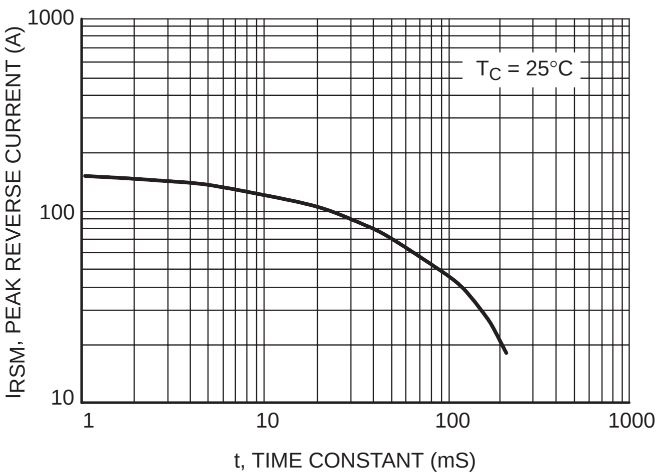

Figure 3. Maximum Peak Reverse Current

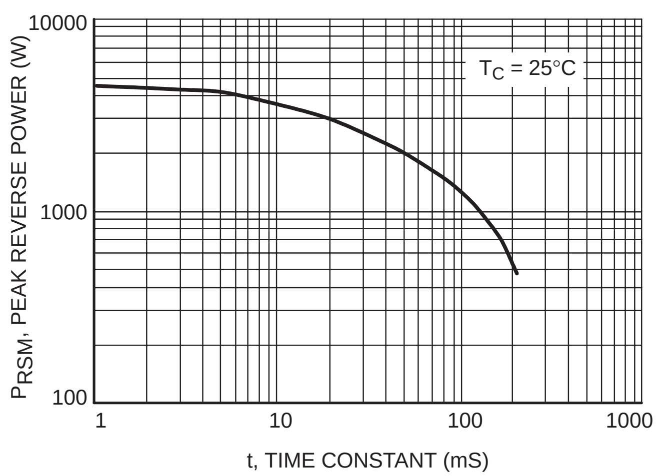

Figure 4. Maximum Peak Reverse Power

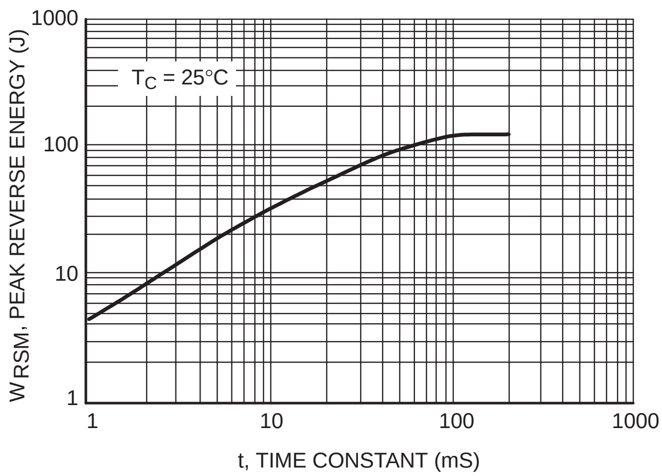

Figure 5. Maximum Reverse Energy

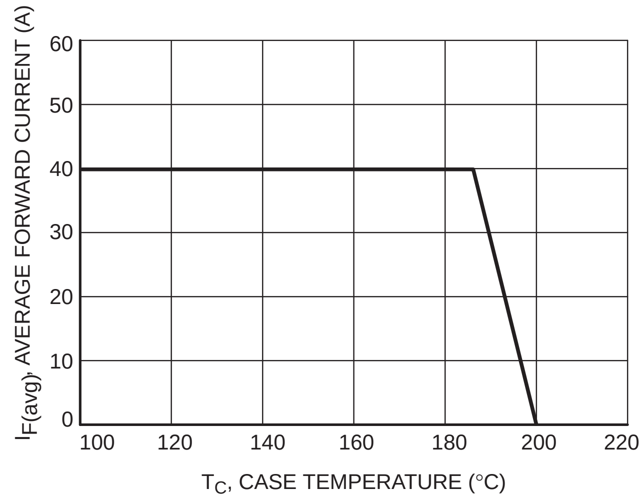

Figure 6. Maximum Current Rating

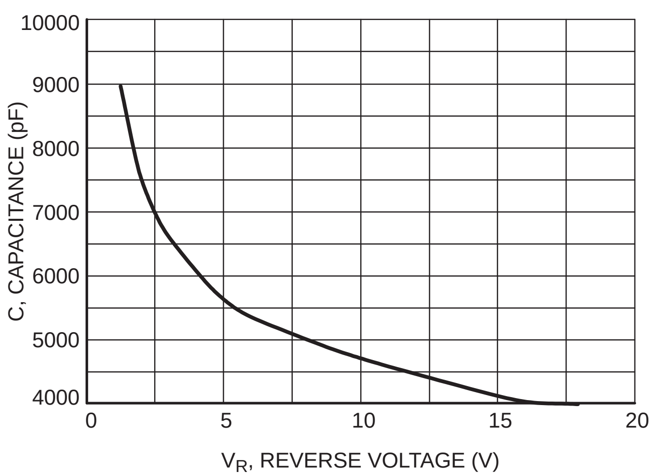

Figure 7. Typical Capacitance

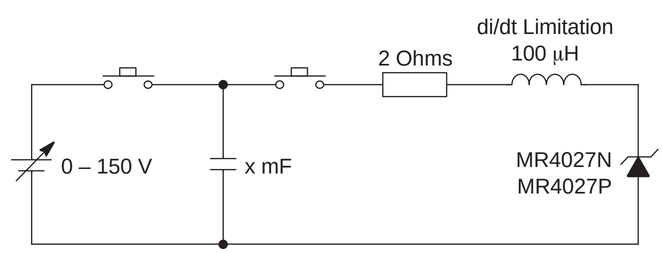

Figure 8. Load Dump Test Circuit

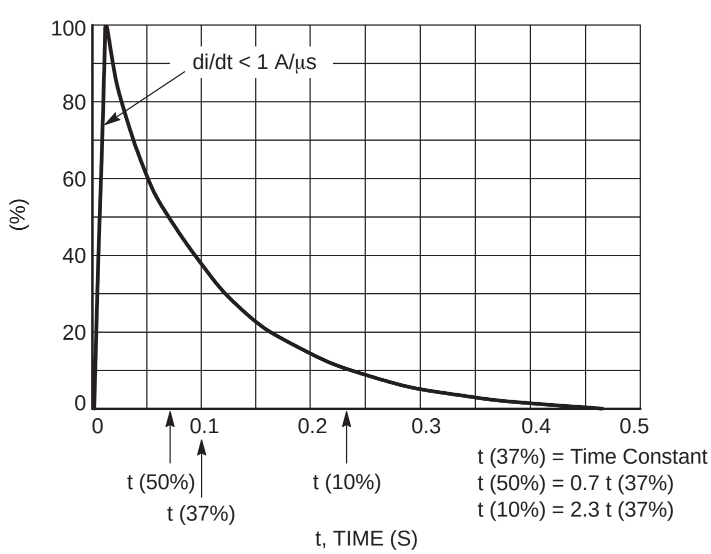

Figure 9. Load Dump Pulse Current

MR4045

Automotive Transient Voltage Suppressor

34 V – 45 V

Designed for Automotive Applications (Alternator) requiring Reverse Avalanche Capability for use as Transient Voltage Suppressor. Developed to suppress transients in automotive systems, this device operates in the forward mode as Standard Rectifier or in Reverse as Transient Voltage Suppressor for Centralized Protection.

For further information referring to Mounting or Operating Conditions, contact your nearest ON Semiconductor Sales Representative.

Mechanical Characteristics

- Finish: 100% Tin Plated
  All External Surfaces are Corrosion Resistant
- Weight: 2.6 Grams (Approximately)

Packaging/Labeling

- Two Sealed Bags into a Cardboard Box
- Device Number Labeled on the Bag

Marking

- The Devices are Laser Marked on the Epoxy Surface

MAXIMUM RATING

Rating	Symbol	Value	Unit
DC Blocking Voltage	V_R	30	Volts
Average Forward Current (Single Phase, Resistive Load, T_C = 185°C)	I_O	40	Amps
Peak Repetitive Reverse Surge Current (Time Constant = 10 ms, T_C = 25°C) (Time Constant = 80 ms, T_C = 25°C)	 I_{RSM} I_{RSM}	 55 25	Amps
Non–Repetitive Peak Surge Current (Halfwave, Single Phase, 50 Hz)	I_{FSM}	500	Amps
Storage Temperature Range	T_{stg}	–40 to +200	°C
Maximum Operating Junction Temperature	T_J	200	°C

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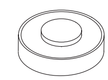
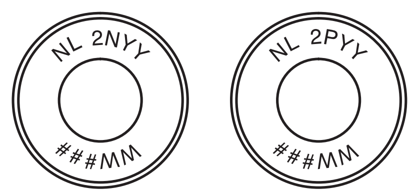


N SUFFIX
(Anode to Cup)
P SUFFIX
(Cathode to Cup)
CASE 193A

MARKING DIAGRAM



NL = Location Code
2N or 2P = Device Code and Polarity
YY = Year
WW = Work Week
= Assembly Lot Number

ORDERING INFORMATION

Device	Package	Shipping
MR4045N	Button Can	5000 Units/Box
MR4045P	Button Can	5000 Units/Box

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THERMAL CHARACTERISTICS

Characteristic	Symbol	Value	Unit
Thermal Resistance Junction to Case	$R_{\theta JC}$	0.4	°C/W

ELECTRICAL CHARACTERISTICS

Characteristic	Symbol	Min	Max	Unit
Instantaneous Forward Voltage (Note 1.) (I_F = 100 Amps, T_C = 25°C)	v_F	–	1.1	Volts
Reverse Current (Note 1.) (V_R = 28 Vdc, T_C = 25°C)	I_R	–	1.0	μA
Breakdown Voltage (Note 1.) (I_R = 100 mA, T_C = 25°C)	$V_{(BR)}$	34	45	Volts
Breakdown Voltage (I_R = 80 Amps, T_C = 25°C, PW = 80 μs) (I_R = 80 Amps, T_C = 85°C, PW = 80 μs)	$V_{(BR)}$	 – –	 53 55	Volts
Breakdown Voltage Temperature Coefficient	$V_{(BR)TC}$	0.095*		%/°C
Forward Voltage Temperature Coefficient (I_F = 10 mA)	V_{FTC}	–2*		mV/°C

1. Pulse Test: Pulse Width < 300 μs, Duty Cycle < 2%.

*Typical

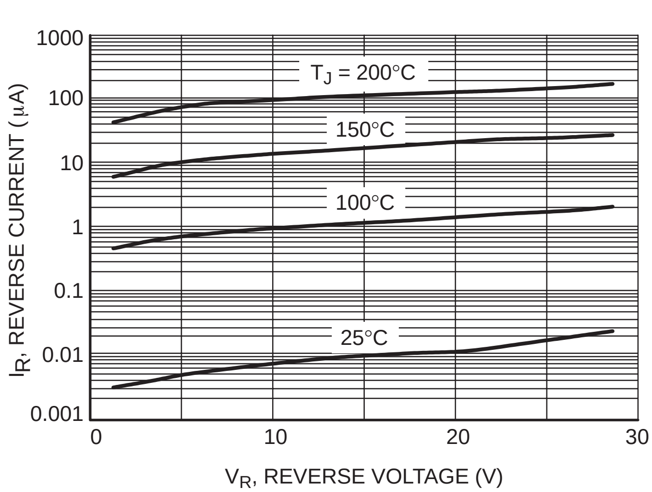


Figure 1. Typical Reverse Current

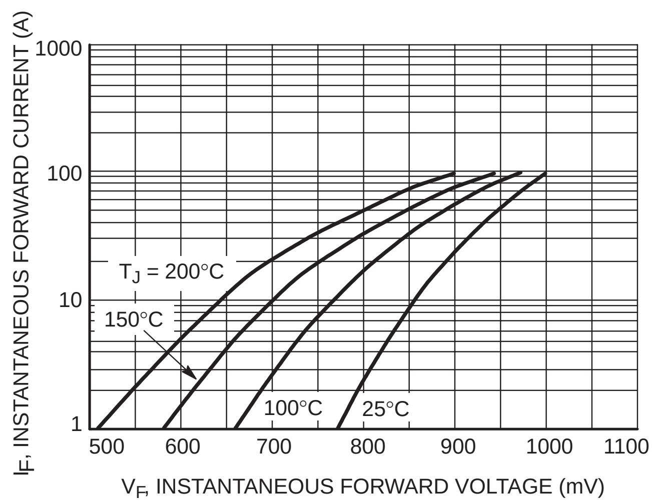


Figure 2. Typical Forward Voltage

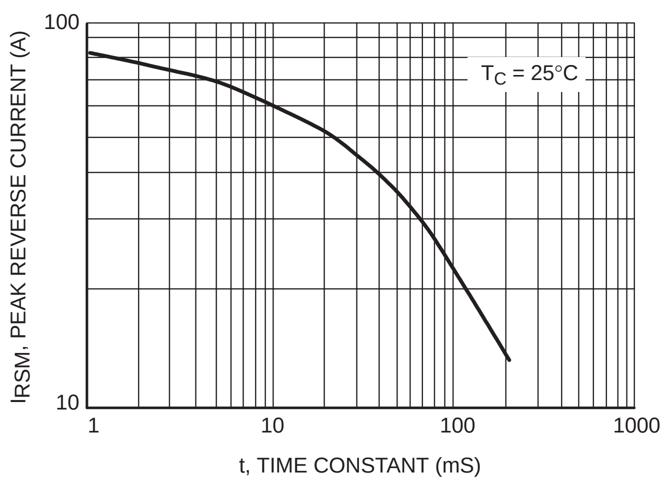


Figure 3. Maximum Peak Reverse Current

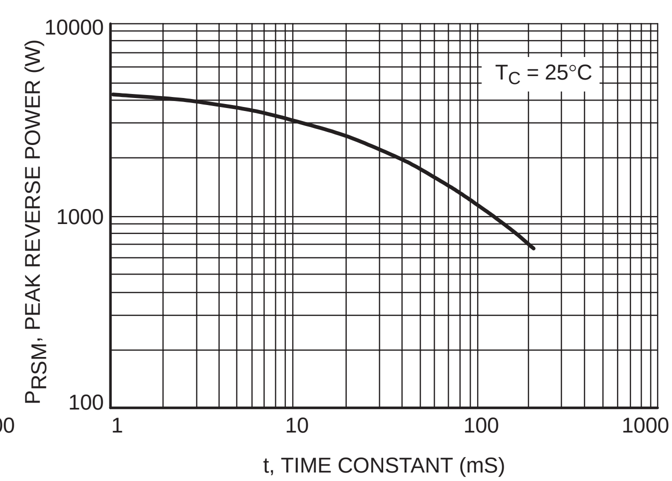


Figure 4. Maximum Peak Reverse Power

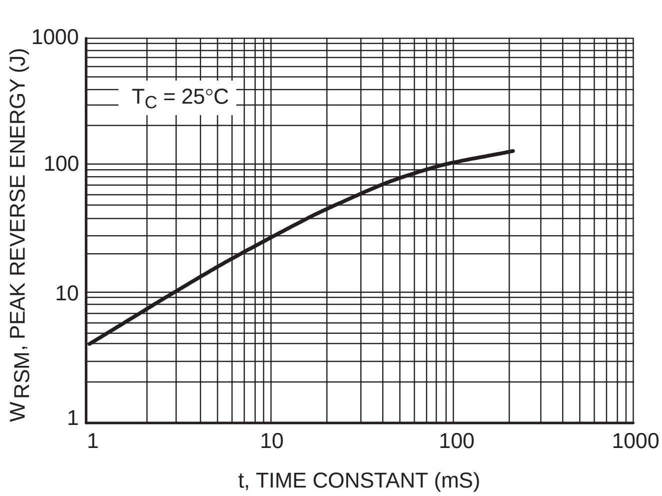


Figure 5. Maximum Reverse Energy

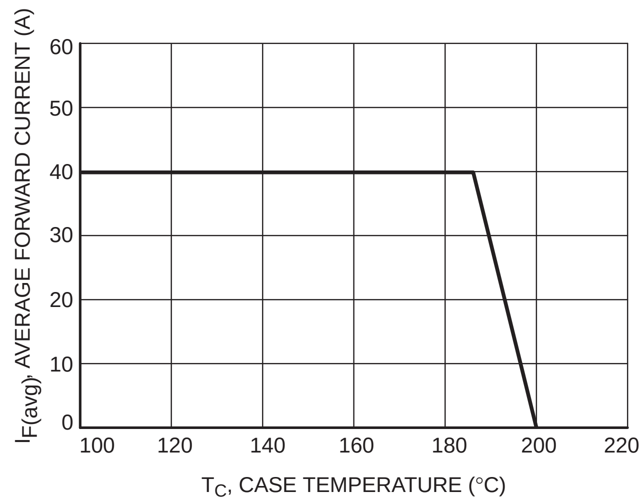


Figure 6. Maximum Current Rating

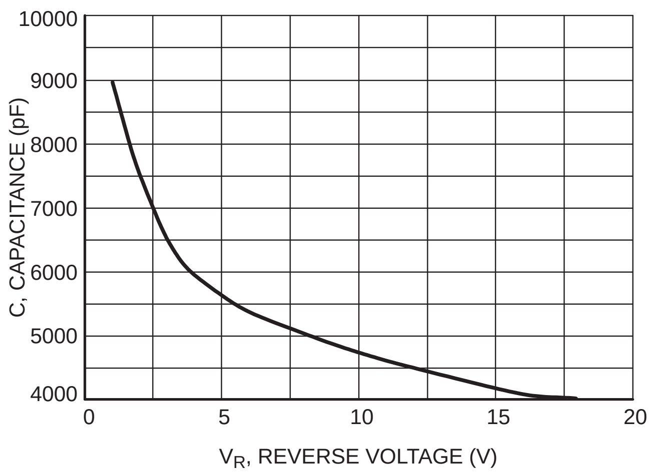


Figure 7. Typical Capacitance

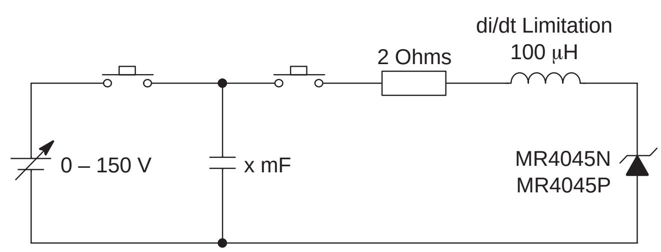


Figure 8. Load Dump Test Circuit

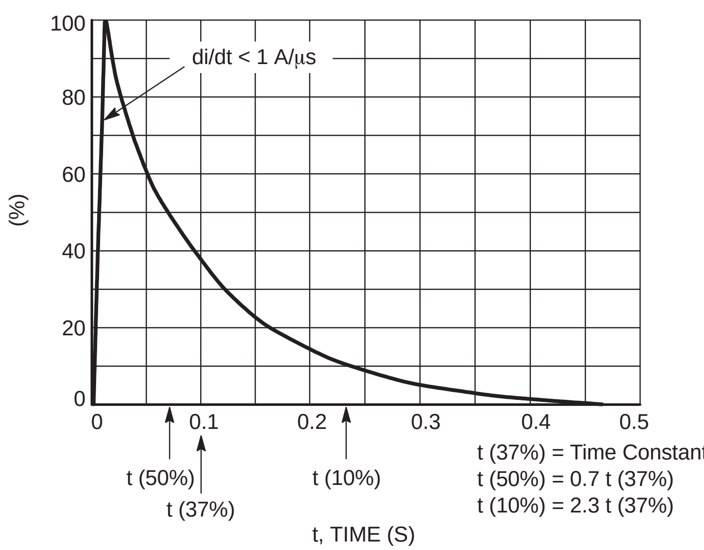


Figure 9. Load Dump Pulse Current

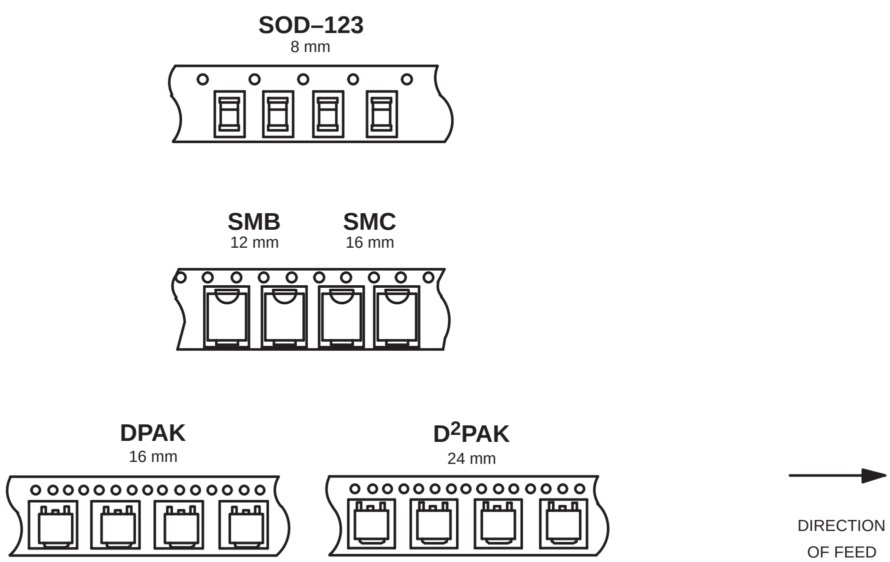
CHAPTER 6
Tape & Reel/Packaging Specifications

Tape and Reel Specifications and Packaging Specifications

Embossed Tape and Reel is used to facilitate automatic pick and place equipment feed requirements. The tape is used as the shipping container for various products and requires a minimum of handling. The antistatic/conductive tape provides a secure cavity for the product when sealed with the “peel–back” cover tape.

- Two Reel Sizes Available (7″ and 13″)
- Used for Automatic Pick and Place Feed Systems
- Minimizes Product Handling
- EIA 481, –1, –2
- SOD–123 in 8 mm Tape
- SMB in 12 mm Tape
- DPAK, SMC in 16 mm Tape
- D^2PAK in 24 mm Tape

Use the standard device title and add the required suffix as listed in the option table on the following page. Note that the individual reels have a finite number of devices depending on the type of product contained in the tape. Also note the minimum lot size is one full reel for each line item, and orders are required to be in increments of the single reel quantity.

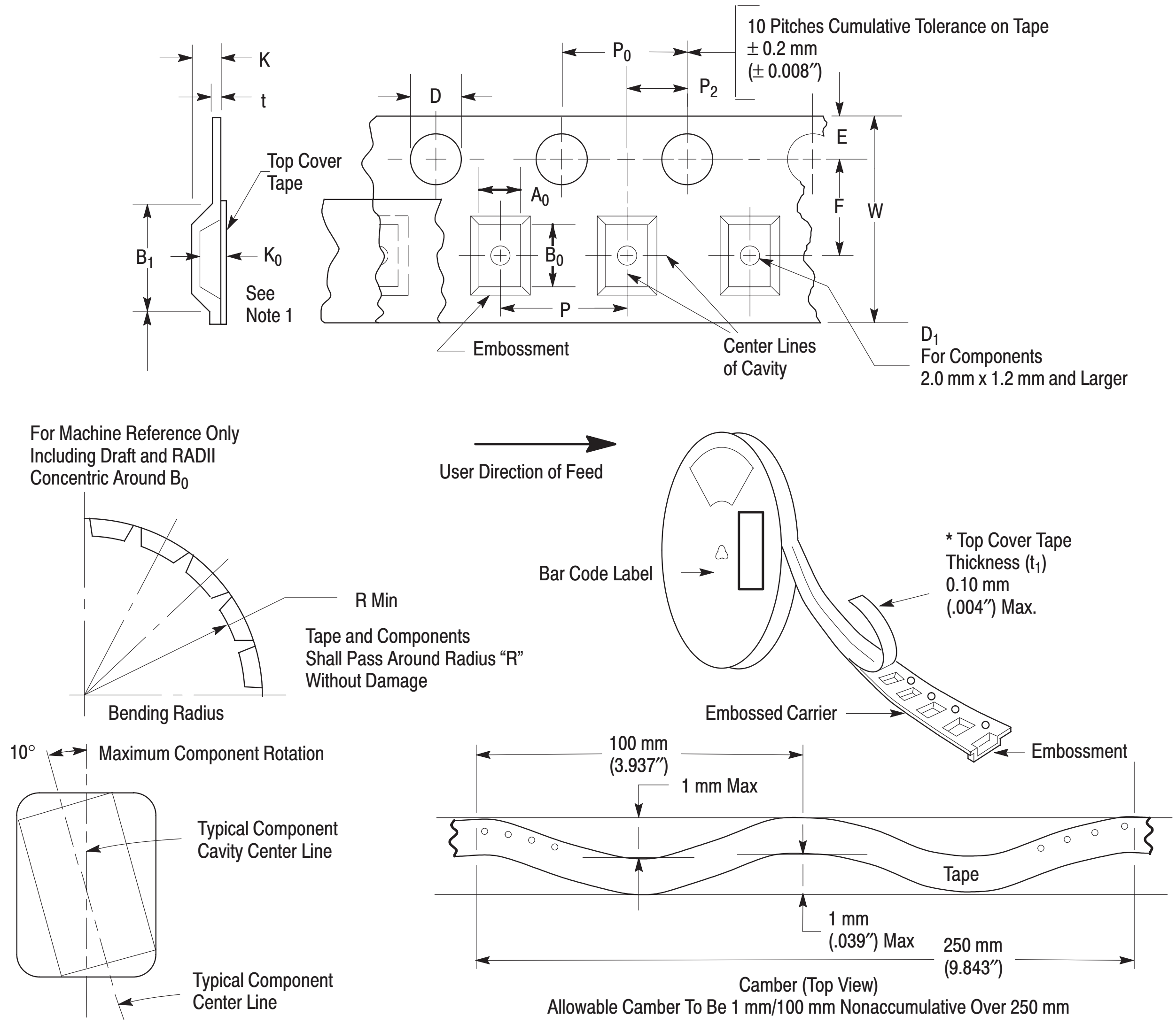


EMBOSSED TAPE AND REEL ORDERING INFORMATION

Package	Tape Width (mm)	Pitch mm (inch)	Reel Size mm (inch)	Devices Per Reel and Minimum Order Quantity	Device Suffix
DPAK	16	8.0 ± 0.1 (.315 ± .004)	330 (13)	2,500	T4
D^2PAK	24	16.0 ± 0.1 (.630 ± .004)	330 (13)	800	T4
SMB	12	8.0 ± 0.1 (.315 ± .004)	330 (13)	2,500	T3
SMC	16	8.0 ± 0.1 (.315 ± .004)	330 (13)	2,500	T3
SOD–123	8 8	4.0 ± 0.1 (.157 ± .004)	178 (7) 330 (13)	3,000 10,000	T1 T3

EMBOSSED TAPE AND REEL DATA FOR DISCRETES

CARRIER TAPE SPECIFICATIONS



DIMENSIONS

Tape Size	B_1 Max	D	D_1	E	F	K	P_0	P_2	R Min	T Max	W Max
8 mm	4.55 mm (.179″)	1.5+0.1 mm −0.0 (.059+.004″ −0.0)	1.0 Min (.039″)	1.75±0.1 mm (.069±.004″)	3.5±0.05 mm (.138±.002″)	2.4 mm Max (.094″)	4.0±0.1 mm (.157±.004″)	2.0±0.1 mm (.079±.002″)	25 mm (.98″)	0.6 mm (.024″)	8.3 mm (.327″)
12 mm	8.2 mm (.323″)		1.5 mm Min (.060″)		5.5±0.05 mm (.217±.002″)	6.4 mm Max (.252″)			30 mm (1.18″)		12±.30 mm (.470±.012″)
16 mm	12.1 mm (.476″)				7.5±0.10 mm (.295±.004″)	7.9 mm Max (.311″)					16.3 mm (.642″)
24 mm	20.1 mm (.791″)				11.5±0.1 mm (.453±.004″)	11.9 mm Max (.468″)					24.3 mm (.957″)

Metric dimensions govern — English are in parentheses for reference only.

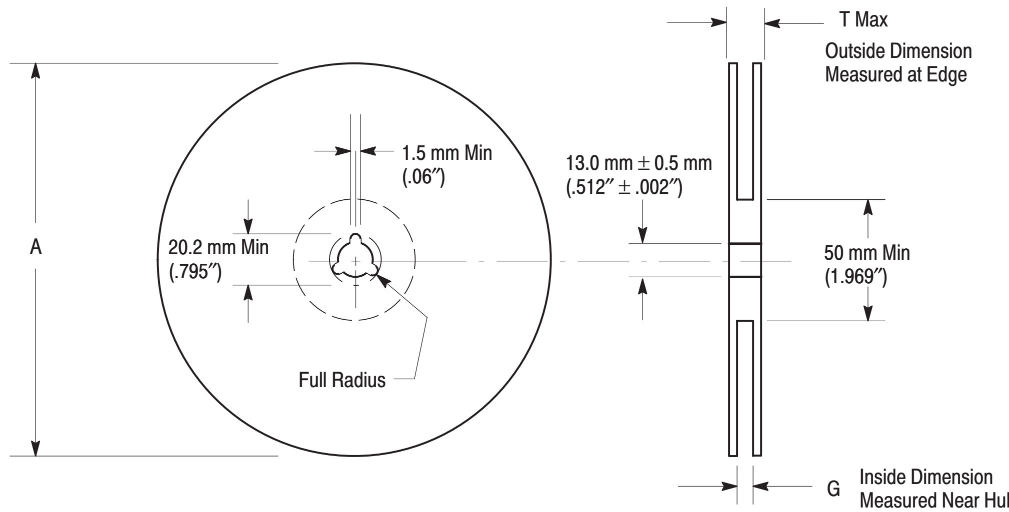
NOTE 1: A_0, B_0, and K_0 are determined by component size. The clearance between the components and the cavity must be within .05 mm min. to .50 mm max.,

the component cannot rotate more than 10° within the determined cavity.

NOTE 2: If B_1 exceeds 4.2 mm (.165) for 8 mm embossed tape, the tape may not feed through all tape feeders.

NOTE 3: Pitch information is contained in the Embossed Tape and Reel Ordering Information on pg. 6–3.

EMBOSSED TAPE AND REEL DATA FOR DISCRETES



Size	A Max	G	T Max
8 mm	330 mm (12.992″)	8.4 mm + 1.5 mm, –0.0 (.33″ + .059″, –0.00)	14.4 mm (.56″)
12 mm	330 mm (12.992″)	12.4 mm + 2.0 mm, –0.0 (.49″ + .079″, –0.00)	18.4 mm (.72″)
16 mm	360 mm (14.173″)	16.4 mm + 2.0 mm, –0.0 (.646″ + .078″, –0.00)	22.4 mm (.882″)
24 mm	360 mm (14.173″)	24.4 mm + 2.0 mm, –0.0 (.961″ + .070″, –0.00)	30.4 mm (1.197″)

Reel Dimensions

Metric Dimensions Govern — English are in parentheses for reference only

LEAD TAPE PACKAGING STANDARDS FOR AXIAL–LEAD COMPONENTS

Case Type	Product Category	Device Title Suffix	MPQ Quantity Per Reel (Item 3.3.7)	Component Spacing A Dimension	Tape Spacing B Dimension	Reel Dimension C	Reel Dimension D (Max)	Max Off Alignment E
Case 17–02	Surmetic 40 & 600 Watt TVS	RL	4000	0.2 +/– 0.015	2.062 +/– 0.059	3	14	0.047
Case 41A–02	1500 Watt TVS	RL4	1500	0.4 +/– 0.02	2.062 +/– 0.059	3	14	0.047
Case 51–02	DO–7 Glass (For Reference only)	RL	3000	0.2 +/– 0.02	2.062 +/– 0.059	3	14	0.047
Case 59–03	DO–41 Glass & DO–41 Surmetic 30	RL	6000	0.2 +/– 0.015	2.062 +/– 0.059	3	14	0.047
	Rectifier							
Case 59–04	500 Watt TVS	RL	5000	0.2 +/– 0.02	2.062 +/– 0.059	3	14	0.047
	Rectifier							
Case 194–04	110 Amp TVS (Automotive)	RL	800	0.4 +/– 0.02	1.875 +/– 0.059	3	14	0.047
	Rectifier							
Case 267–02	Rectifier	RL	1500	0.4 +/– 0.02	2.062 +/– 0.059	3	14	0.047
Case 299–02	DO–35 Glass	RL	5000	0.2 +/– 0.02	2.062 +/– 0.059	3	14	0.047

Table 1. Packaging Details (all dimensions in inches)

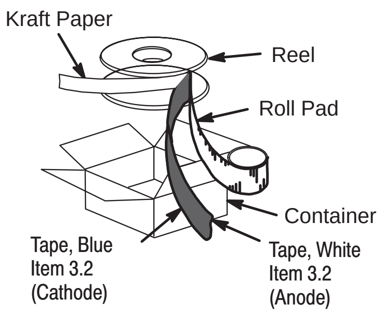


Figure 1. Reel Packing

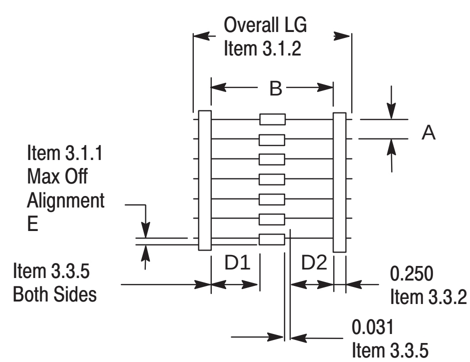


Figure 2. Component Spacing

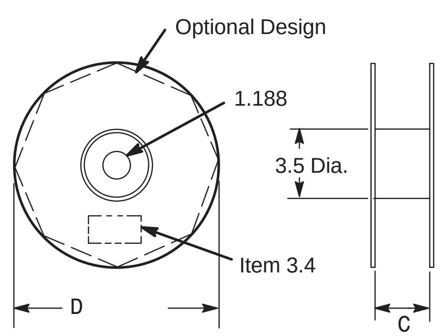


Figure 3. Reel Dimensions

CHAPTER 7
Surface Mount Information

INFORMATION FOR USING SURFACE MOUNT PACKAGES

RECOMMENDED FOOTPRINTS FOR SURFACE MOUNTED APPLICATIONS

Surface mount board layout is a critical portion of the total design. The footprint for the semiconductor packages must be the correct size to ensure proper solder connection interface between the board and the package. With the correct pad geometry, the packages will self align when subjected to a solder reflow process.

POWER DISSIPATION FOR A SURFACE MOUNT DEVICE

The power dissipation for a surface mount device is a function of the drain/collector pad size. These can vary from the minimum pad size for soldering to a pad size given for maximum power dissipation. Power dissipation for a surface mount device is determined by $T_{J(max)}$, the maximum rated junction temperature of the die, $R_{\theta JA}$, the thermal resistance from the device junction to ambient, and the operating temperature, T_A. Using the values provided on the data sheet, P_D can be calculated as follows:

$$P_D = \frac{T_{J(max)} - T_A}{R_{\theta JA}}$$

The values for the equation are found in the maximum ratings table on the data sheet. Substituting these values into the equation for an ambient temperature T_A of 25°C, one can calculate the power dissipation of the device. For example, for a SOT–223 device, P_D is calculated as follows.

$$P_D = \frac{150°C - 25°C}{156°C/W} = 800 \text{ milliwatts}$$

The 156°C/W for the SOT–223 package assumes the use of the recommended footprint on a glass epoxy printed circuit board to achieve a power dissipation of 800 milliwatts. There are other alternatives to achieving higher power dissipation from the surface mount packages. One is to increase the area of the drain/collector pad. By increasing the area of the drain/collector pad, the power dissipation can be increased. Although the power dissipation can almost be doubled with this method, area is taken up on the printed circuit board which can defeat the purpose of using surface mount technology. For example, a graph of $R_{\theta JA}$ versus drain pad area is shown in Figures 1, 2 and 3.

Another alternative would be to use a ceramic substrate or an aluminum core board such as Thermal Clad™. Using a board material such as Thermal Clad, an aluminum core board, the power dissipation can be doubled using the same footprint.

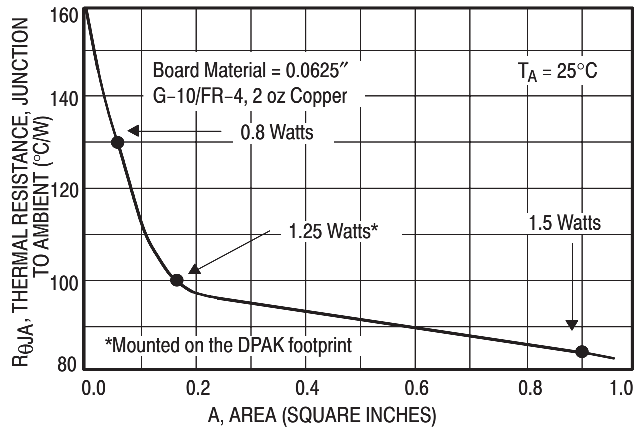


Figure 1. Thermal Resistance versus Drain Pad Area for the SOT–223 Package (Typical)

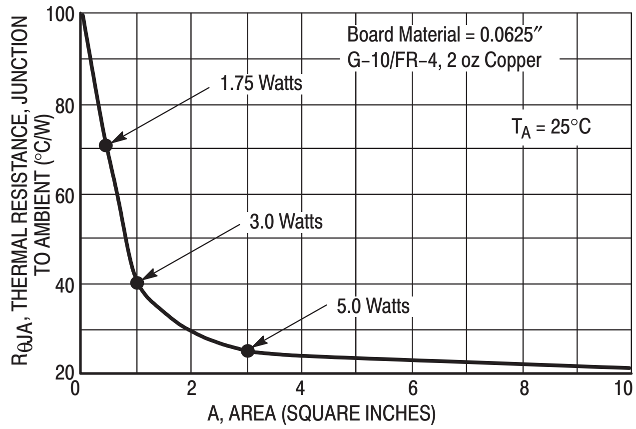


Figure 2. Thermal Resistance versus Drain Pad Area for the DPAK Package (Typical)

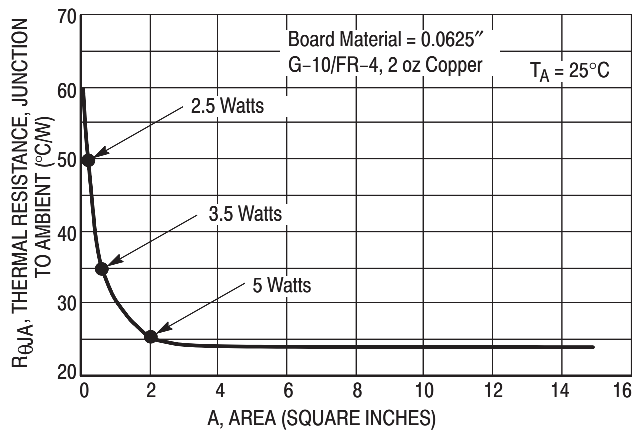


Figure 3. Thermal Resistance versus Drain Pad Area for the D²PAK Package (Typical)

SOLDER STENCIL GUIDELINES

Prior to placing surface mount components onto a printed circuit board, solder paste must be applied to the pads. Solder stencils are used to screen the optimum amount. These stencils are typically 0.008 inches thick and may be made of brass or stainless steel. For packages such as the SC–59, SC–70/SOT–323, SOD–123, SOT–23, SOT–143, SOT–223, SO–8, SO–14, SO–16, and SMB/SMC diode packages, the stencil opening should be the same as the pad size or a 1:1 registration. This is not the case with the DPAK and D^2PAK packages. If a 1:1 opening is used to screen solder onto the drain pad, misalignment and/or "tombstoning" may occur due to an excess of solder. For these two packages, the opening in the stencil for the paste should be approximately 50% of the tab area. The opening for the leads is still a 1:1 registration. Figure 4 shows a typical stencil for the DPAK and D^2PAK packages. The pattern of the opening in the stencil for the drain pad is not critical as long as it allows approximately 50% of the pad to be covered with paste.

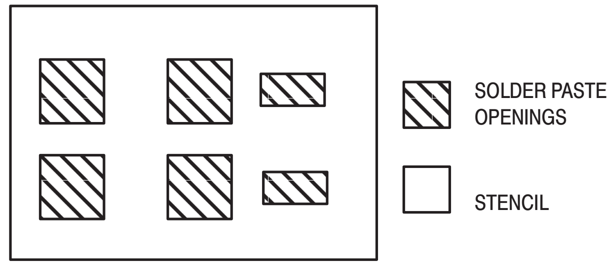


Figure 4. Typical Stencil for DPAK and D^2PAK Packages

SOLDERING PRECAUTIONS

The melting temperature of solder is higher than the rated temperature of the device. When the entire device is heated to a high temperature, failure to complete soldering within a short time could result in device failure. Therefore, the following items should always be observed in order to minimize the thermal stress to which the devices are subjected.

- Always preheat the device.
- The delta temperature between the preheat and soldering should be 100°C or less.*
- When preheating and soldering, the temperature of the leads and the case must not exceed the maximum temperature ratings as shown on the data sheet. When using infrared heating with the reflow soldering method, the difference should be a maximum of 10°C.
- The soldering temperature and time should not exceed 260°C for more than 10 seconds.
- When shifting from preheating to soldering, the maximum temperature gradient shall be 5°C or less.
- After soldering has been completed, the device should be allowed to cool naturally for at least three minutes. Gradual cooling should be used since the use of forced cooling will increase the temperature gradient and will result in latent failure due to mechanical stress.
- Mechanical stress or shock should not be applied during cooling.

* Soldering a device without preheating can cause excessive thermal shock and stress which can result in damage to the device.

* Due to shadowing and the inability to set the wave height to incorporate other surface mount components, the D^2PAK is not recommended for wave soldering.

TYPICAL SOLDER HEATING PROFILE

For any given circuit board, there will be a group of control settings that will give the desired heat pattern. The operator must set temperatures for several heating zones and a figure for belt speed. Taken together, these control settings make up a heating "profile" for that particular circuit board. On machines controlled by a computer, the computer remembers these profiles from one operating session to the next. Figure 5 shows a typical heating profile for use when soldering a surface mount device to a printed circuit board. This profile will vary among soldering systems, but it is a good starting point. Factors that can affect the profile include the type of soldering system in use, density and types of components on the board, type of solder used, and the type of board or substrate material being used. This profile shows temperature versus time. The line on the graph shows the actual temperature that might be experienced on the surface of a test board at or near a central solder joint. The two profiles are based on a high density and a low density board. The Vitronics SMD310 convection/infrared reflow soldering system was used to generate this profile. The type of solder used was 62/36/2 Tin Lead Silver with a melting point between 177–189°C. When this type of furnace is used for solder reflow work, the circuit boards and solder joints tend to heat first. The components on the board are then heated by conduction. The circuit board, because it has a large surface area, absorbs the thermal energy more efficiently, then distributes this energy to the components. Because of this effect, the main body of a component may be up to 30 degrees cooler than the adjacent solder joints.

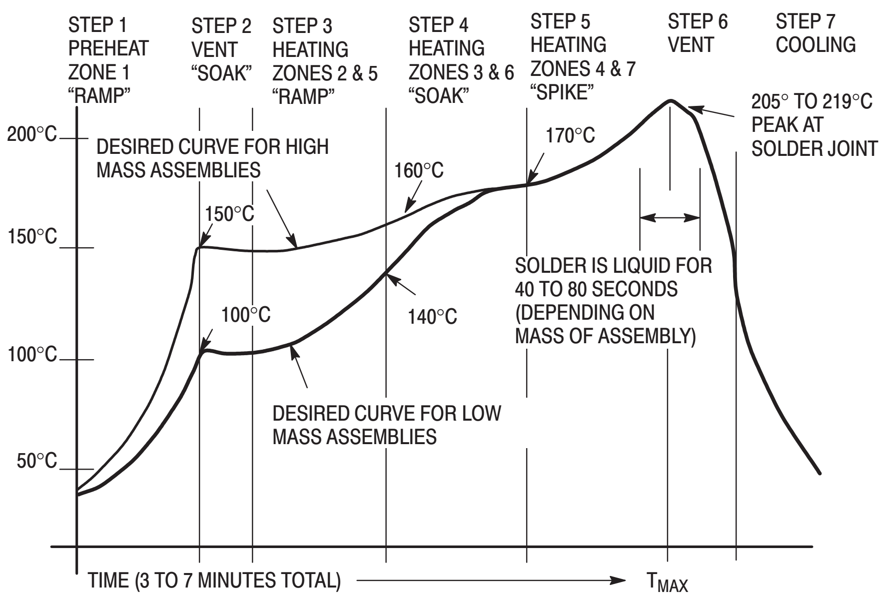
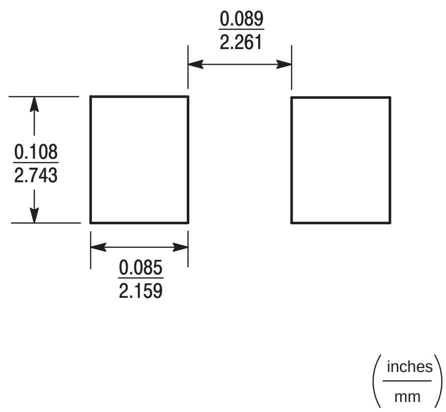
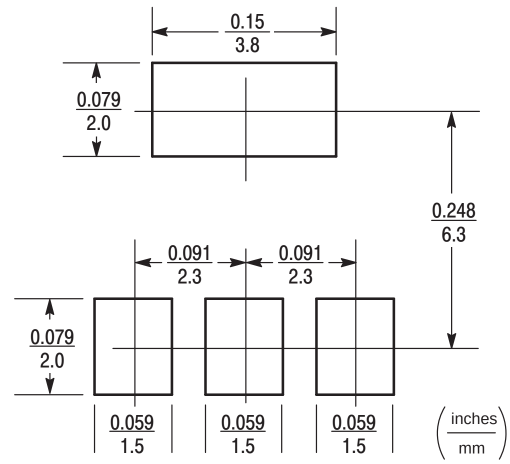


Figure 5. Typical Solder Heating Profile

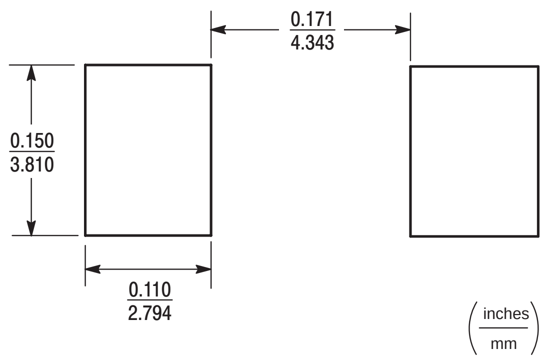
Footprints for Soldering



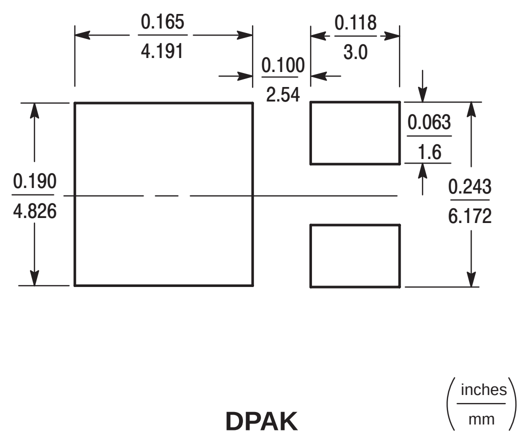
SMB



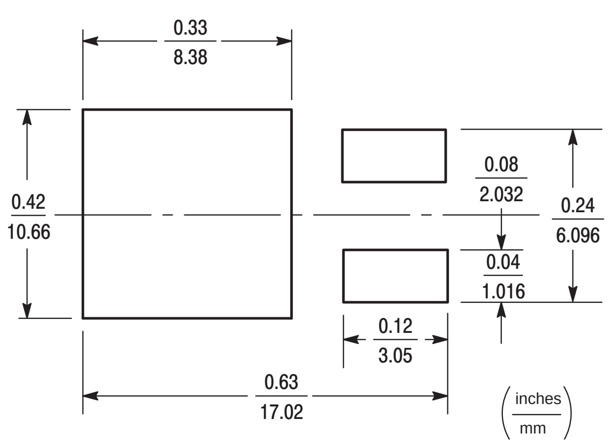
SOT–223



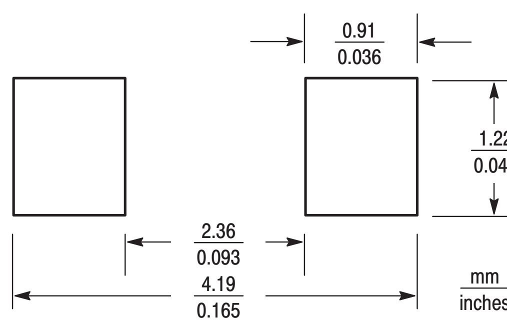
SMC



DPAK

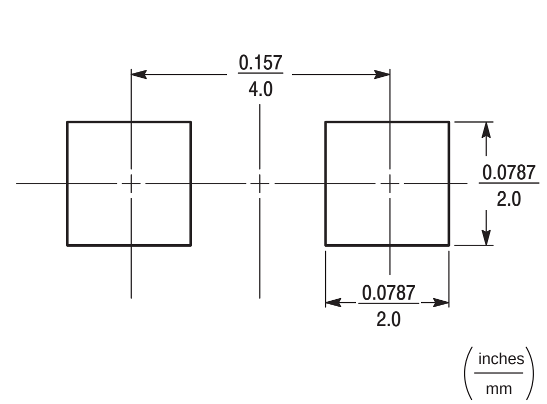


D^2PAK

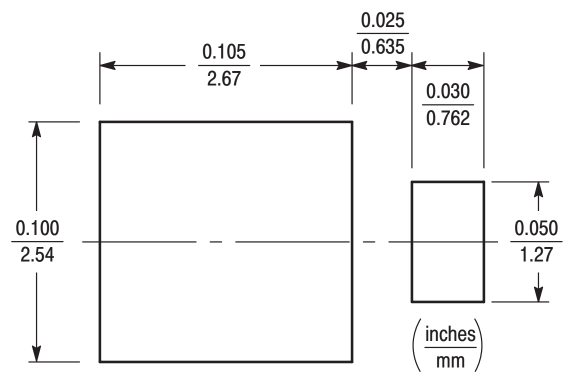


SOD–123

Footprints for Soldering



SMA



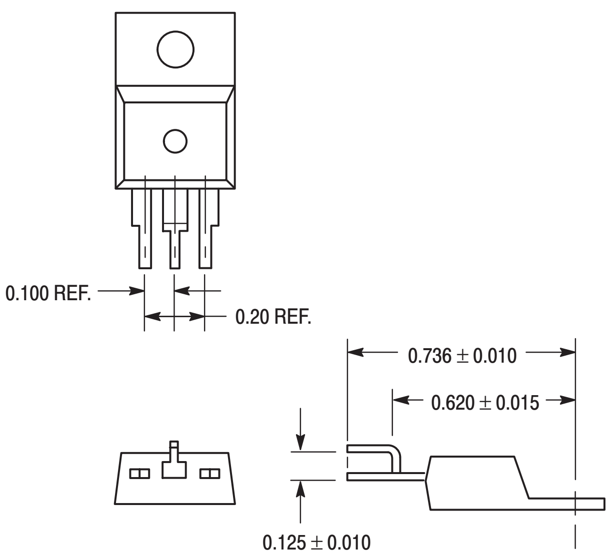
POWERMITE

CHAPTER 8
TO–220 Leadform Information

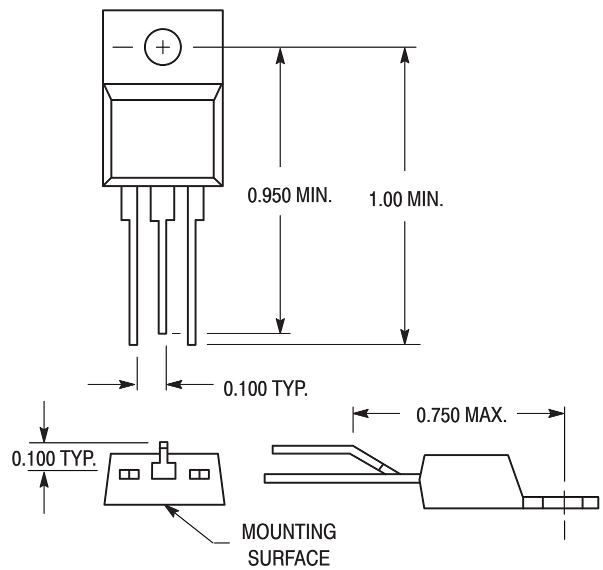
Leadform Options — TO-220 (Case 221A)

- Leadform options require assignment of a special part number before ordering.
- Contact your local ON Semiconductor representative for special part number and pricing.
- 10,000 piece minimum quantity orders are required.
- Leadform orders are non-cancellable after processing.
- Leadforms apply to both ON Semiconductor Case 221A-04 and 221A-06 except as noted.

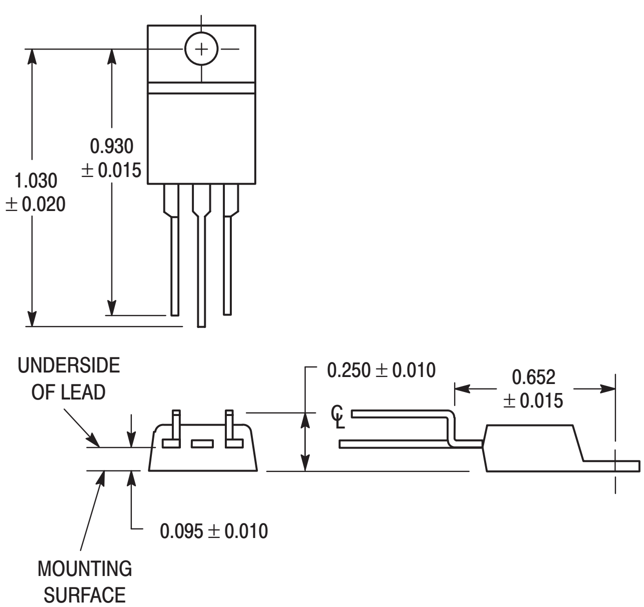
LEADFORM AS



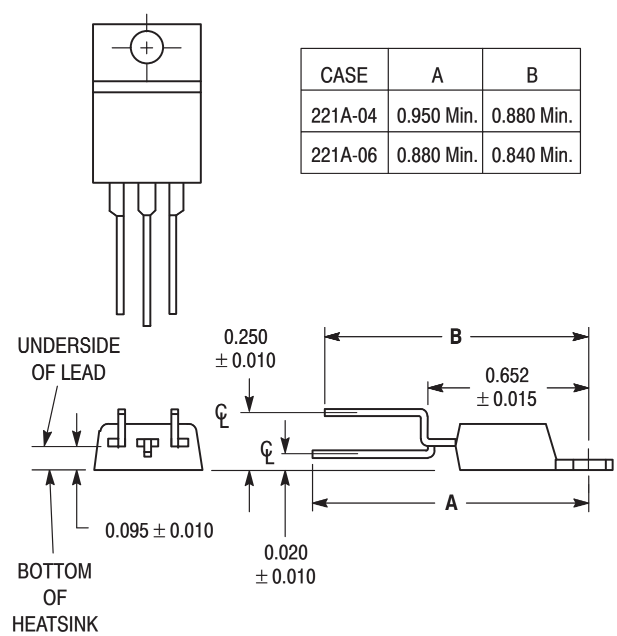
LEADFORM BC



LEADFORM AC



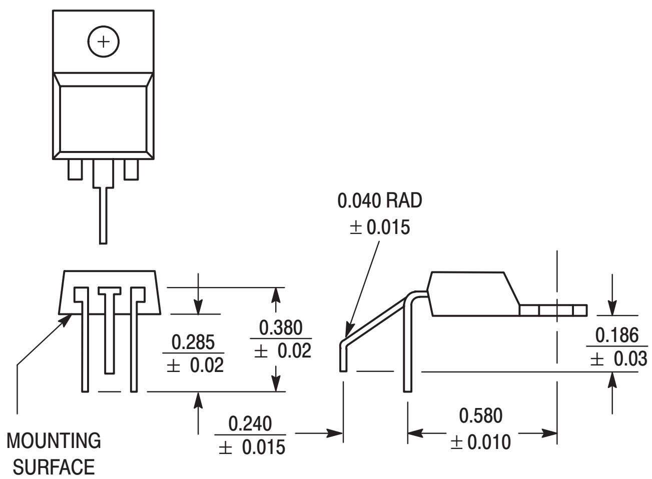
LEADFORM AD



CASE	A	B
221A-04	0.950 Min.	0.880 Min.
221A-06	0.880 Min.	0.840 Min.

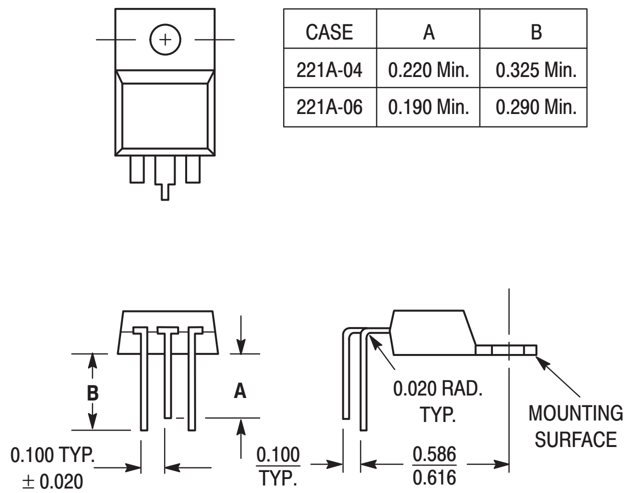
TO-220 Leadform Options (continued)

LEADFORM AN



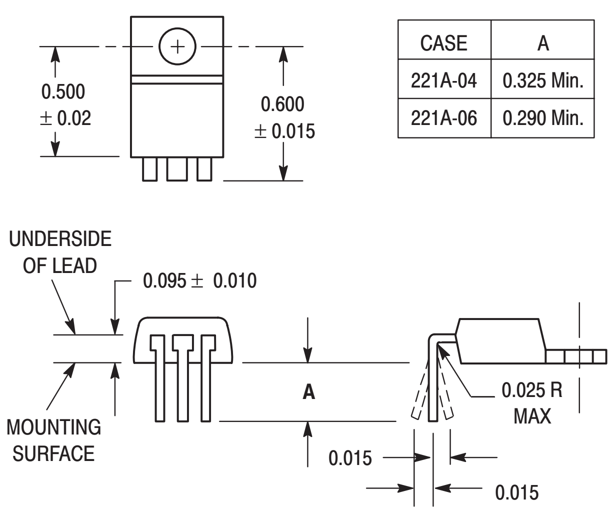
LEADFORM BA

CASE	A	B
221A-04	0.220 Min.	0.325 Min.
221A-06	0.190 Min.	0.290 Min.

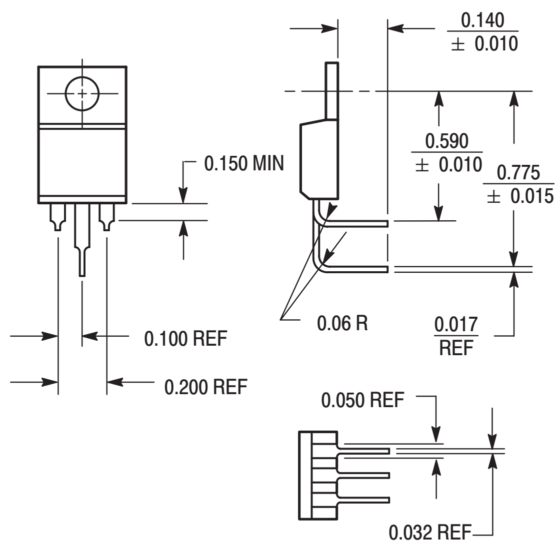


LEADFORM BL

CASE	A
221A-04	0.325 Min.
221A-06	0.290 Min.

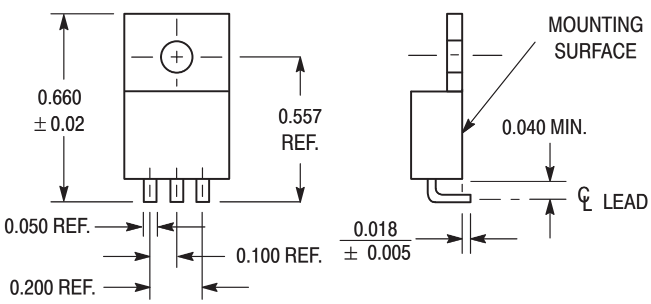


LEADFORM AK

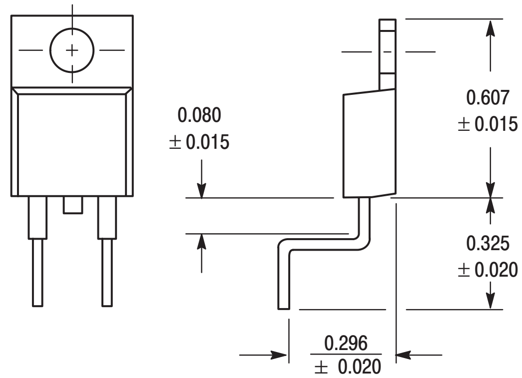


TO-220 Leadform Options (continued)

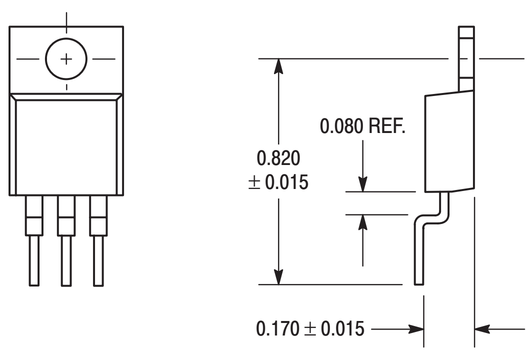
LEADFORM AF



LEADFORM BS

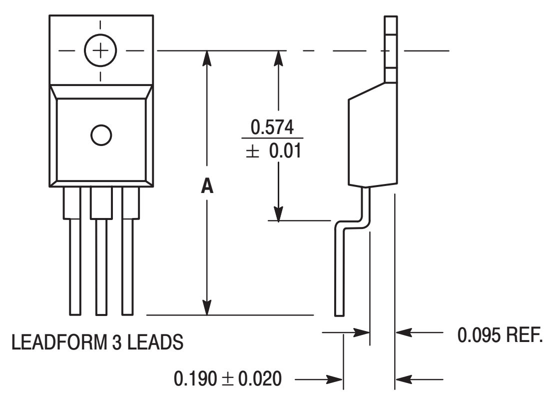


LEADFORM BR



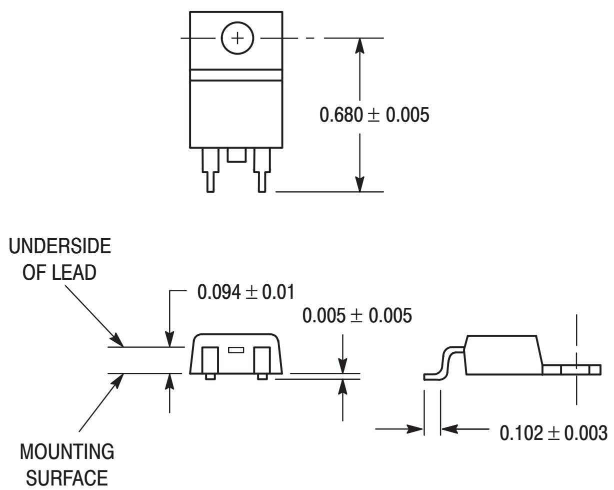
LEADFORM AU

CASE	A
221A-04	0.920 Min.
221A-06	0.885 Min.

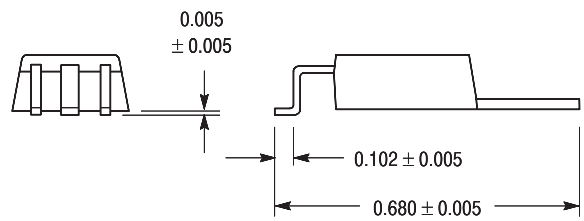


TO-220 Leadform Options (continued)

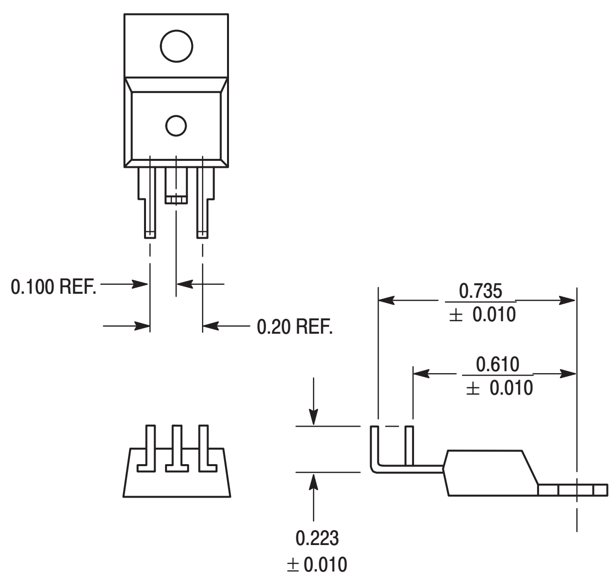
LEADFORM BU



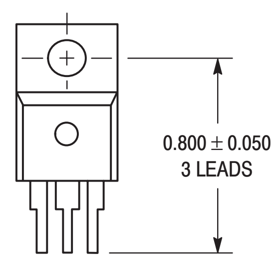
LEADFORM BV



LEADFORM BD

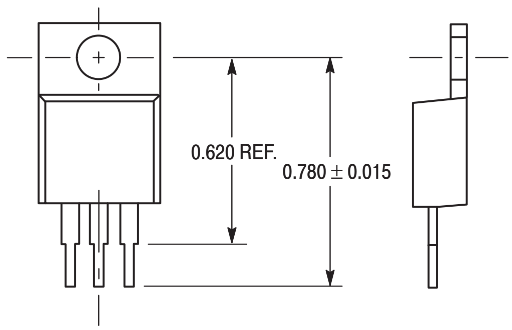


LEADFORM DW

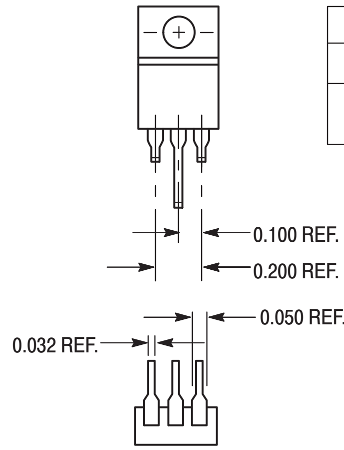


TO-220 Leadform Options (continued)

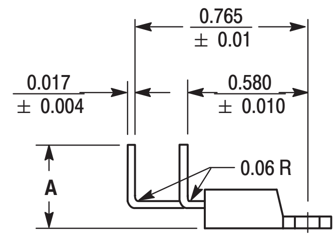
LEADFORM BG



LEADFORM AJ



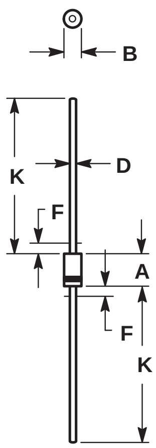
CASE	A
221A-04	0.360 ± 0.010
221A-06	Lead Not Trimmed 0.300 Min.



CHAPTER 9
Package Outline Dimensions

Package Outline Dimensions

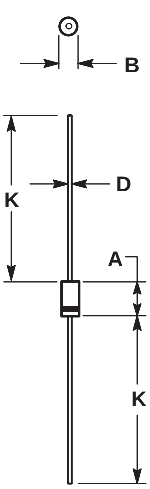
GLASS/PLASTIC
DO–41
CASE 59–03
ISSUE M



NOTES:
1. ALL RULES AND NOTES ASSOCIATED WITH JEDEC DO−41 OUTLINE SHALL APPLY.
2. POLARITY DENOTED BY CATHODE BAND.
3. LEAD DIAMETER NOT CONTROLLED WITHIN F DIMENSION.

	MILLIMETERS		INCHES	
DIM	MIN	MAX	MIN	MAX
A	4.07	5.20	0.160	0.205
B	2.04	2.71	0.080	0.107
D	0.71	0.86	0.028	0.034
F	---	1.27	---	0.050
K	27.94	---	1.100	---

MINI MOSORB
CASE 59–04
ISSUE M

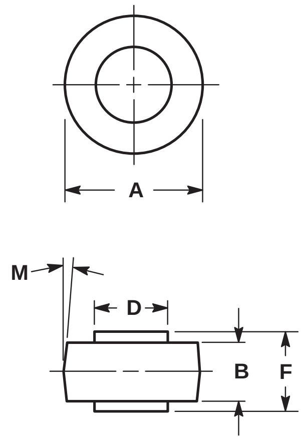


NOTES:
1. ALL RULES AND NOTES ASSOCIATED WITH JEDEC DO−41 OUTLINE SHALL APPLY.
2. POLARITY DENOTED BY CATHODE BAND.
3. LEAD DIAMETER NOT CONTROLLED WITHIN F DIMENSION.

	MILLIMETERS		INCHES	
DIM	MIN	MAX	MIN	MAX
A	5.97	6.60	0.235	0.260
B	2.79	3.05	0.110	0.120
D	0.76	0.86	0.030	0.034
K	27.94	---	1.100	---

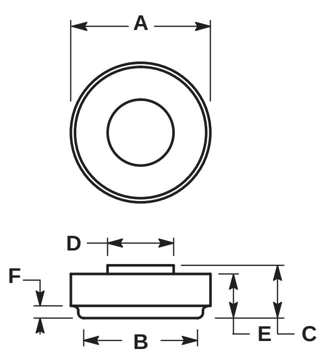
PACKAGE OUTLINE DIMENSIONS (continued)

MICRODE BUTTON
CASE 193–04
ISSUE J



DIM	MILLIMETERS MIN	MILLIMETERS MAX	INCHES MIN	INCHES MAX
A	8.43	8.69	0.332	0.342
B	4.19	4.45	0.165	0.175
D	5.54	5.64	0.218	0.222
F	5.94	6.25	0.234	0.246
M	5°NOM		5°NOM	

CAN BUTTON
CASE 193A–02
ISSUE A



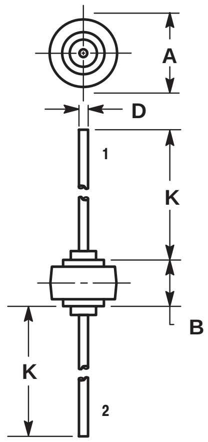
NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: MILLIMETER.

DIM	MILLIMETERS MIN	MILLIMETERS MAX	INCHES MIN	INCHES MAX
A	11.4	11.6	0.449	0.457
B	9.3	9.7	0.366	0.382
C	4.3	4.9	0.169	0.193
D	5.4	5.6	0.213	0.220
E	3.6	4.2	0.142	0.165
F	1.0	2.0	0.039	0.079

PACKAGE OUTLINE DIMENSIONS (continued)

AXIAL LEAD BUTTON

CASE 194–04
ISSUE F



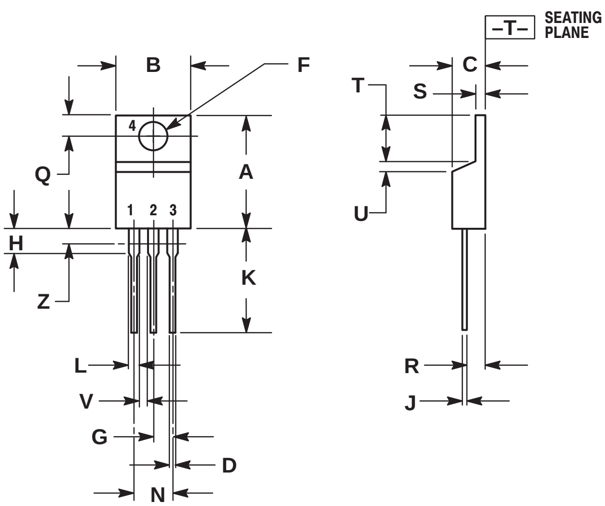
NOTES:
1. CATHODE SYMBOL ON PACKAGE.

	MILLIMETERS		INCHES	
DIM	MIN	MAX	MIN	MAX
A	8.43	8.69	0.332	0.342
B	5.94	6.25	0.234	0.246
D	1.27	1.35	0.050	0.053
K	25.15	25.65	0.990	1.010

STYLE 1:
PIN 1. CATHODE
2. ANODE

TO–220 THREE–LEAD
TO–220

CASE 221A–09
ISSUE AA



NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.
3. DIMENSION Z DEFINES A ZONE WHERE ALL BODY AND LEAD IRREGULARITIES ARE ALLOWED.

	INCHES		MILLIMETERS	
DIM	MIN	MAX	MIN	MAX
A	0.570	0.620	14.48	15.75
B	0.380	0.405	9.66	10.28
C	0.160	0.190	4.07	4.82
D	0.025	0.035	0.64	0.88
F	0.142	0.147	3.61	3.73
G	0.095	0.105	2.42	2.66
H	0.110	0.155	2.80	3.93
J	0.018	0.025	0.46	0.64
K	0.500	0.562	12.70	14.27
L	0.045	0.060	1.15	1.52
N	0.190	0.210	4.83	5.33
Q	0.100	0.120	2.54	3.04
R	0.080	0.110	2.04	2.79
S	0.045	0.055	1.15	1.39
T	0.235	0.255	5.97	6.47
U	0.000	0.050	0.00	1.27
V	0.045	---	1.15	---
Z	---	0.080	---	2.04

STYLE 1:
PIN 1. BASE
2. COLLECTOR
3. EMITTER
4. COLLECTOR

STYLE 2:
PIN 1. BASE
2. EMITTER
3. COLLECTOR
4. EMITTER

STYLE 3:
PIN 1. CATHODE
2. ANODE
3. GATE
4. ANODE

STYLE 4:
PIN 1. MAIN TERMINAL 1
2. MAIN TERMINAL 2
3. GATE
4. MAIN TERMINAL 2

STYLE 5:
PIN 1. GATE
2. DRAIN
3. SOURCE
4. DRAIN

STYLE 6:
PIN 1. ANODE
2. CATHODE
3. ANODE
4. CATHODE

STYLE 7:
PIN 1. CATHODE
2. ANODE
3. CATHODE
4. ANODE

STYLE 8:
PIN 1. CATHODE
2. ANODE
3. EXTERNAL TRIP/DELAY
4. ANODE

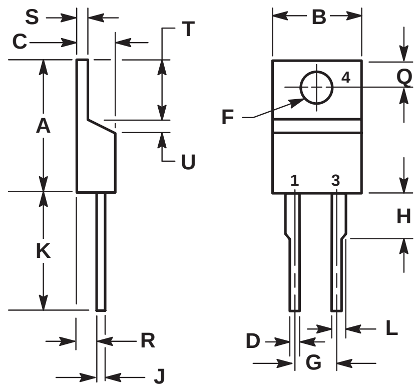
STYLE 9:
PIN 1. GATE
2. COLLECTOR
3. EMITTER
4. COLLECTOR

STYLE 10:
PIN 1. GATE
2. SOURCE
3. DRAIN
4. SOURCE

STYLE 11:
PIN 1. DRAIN
2. SOURCE
3. GATE
4. SOURCE

PACKAGE OUTLINE DIMENSIONS (continued)

TO–220 TWO–LEAD
CASE 221B–04
ISSUE D



NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.

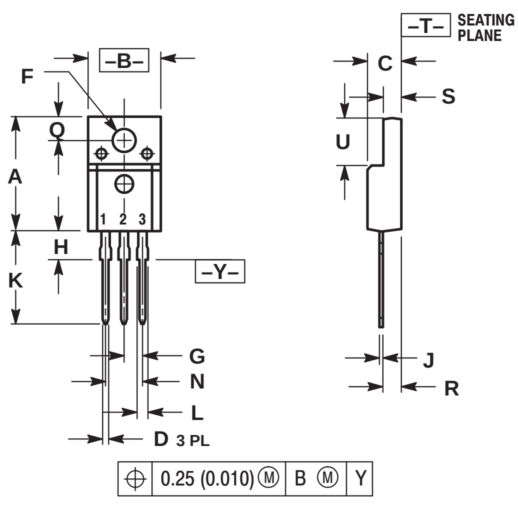
DIM	INCHES MIN	INCHES MAX	MILLIMETERS MIN	MILLIMETERS MAX
A	0.595	0.620	15.11	15.75
B	0.380	0.405	9.65	10.29
C	0.160	0.190	4.06	4.82
D	0.025	0.035	0.64	0.89
F	0.142	0.147	3.61	3.73
G	0.190	0.210	4.83	5.33
H	0.110	0.130	2.79	3.30
J	0.018	0.025	0.46	0.64
K	0.500	0.562	12.70	14.27
L	0.045	0.060	1.14	1.52
Q	0.100	0.120	2.54	3.04
R	0.080	0.110	2.04	2.79
S	0.045	0.055	1.14	1.39
T	0.235	0.255	5.97	6.48
U	0.000	0.050	0.00	1.27

STYLE 1:
PIN 1. CATHODE
2. N/A
3. ANODE
4. CATHODE

STYLE 2:
PIN 1. ANODE
2. N/A
3. CATHODE
4. ANODE

TO–220 FULLPACK TRANSISTOR
CASE 221D–02
ISSUE D

SCALE 1:1



NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.

DIM	INCHES MIN	INCHES MAX	MILLIMETERS MIN	MILLIMETERS MAX
A	0.621	0.629	15.78	15.97
B	0.394	0.402	10.01	10.21
C	0.181	0.189	4.60	4.80
D	0.026	0.034	0.67	0.86
F	0.121	0.129	3.08	3.27
G	0.100 BSC		2.54 BSC	
H	0.123	0.129	3.13	3.27
J	0.018	0.025	0.46	0.64
K	0.500	0.562	12.70	14.27
L	0.045	0.060	1.14	1.52
N	0.200 BSC		5.08 BSC	
Q	0.126	0.134	3.21	3.40
R	0.107	0.111	2.72	2.81
S	0.096	0.104	2.44	2.64
U	0.259	0.267	6.58	6.78

STYLE 1:
PIN 1. GATE
2. DRAIN
3. SOURCE

STYLE 2:
PIN 1. BASE
2. COLLECTOR
3. EMITTER

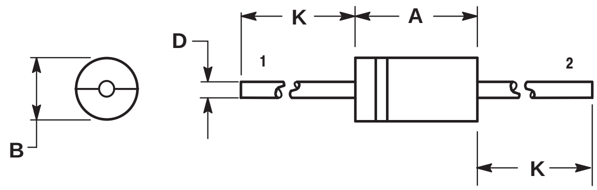
STYLE 3:
PIN 1. ANODE
2. CATHODE
3. ANODE

STYLE 4:
PIN 1. CATHODE
2. ANODE
3. CATHODE

STYLE 5:
PIN 1. CATHODE
2. ANODE
3. GATE

STYLE 6:
PIN 1. MT 1
2. MT 2
3. GATE

AXIAL LEAD
CASE 267–03
ISSUE G



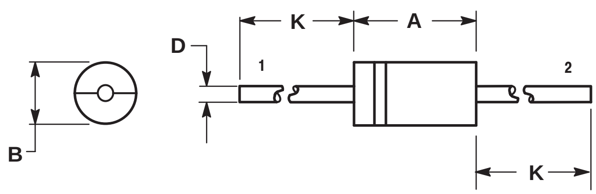
NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.

	INCHES		MILLIMETERS	
DIM	MIN	MAX	MIN	MAX
A	0.370	0.380	9.40	9.65
B	0.190	0.210	4.83	5.33
D	0.048	0.052	1.22	1.32
K	1.000	---	25.40	---

STYLE 1:
PIN 1. CATHODE (POLARITY BAND)
2. ANODE

STYLE 2:
NO POLARITY

AXIAL LEAD
CASE 267–05
ISSUE G



NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.

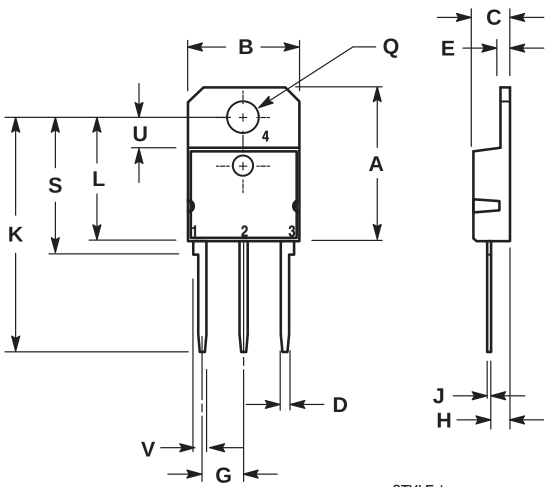
	INCHES		MILLIMETERS	
DIM	MIN	MAX	MIN	MAX
A	0.287	0.374	7.30	9.50
B	0.189	0.209	4.80	5.30
D	0.047	0.051	1.20	1.30
K	1.000	---	25.40	---

STYLE 1:
PIN 1. CATHODE (POLARITY BAND)
2. ANODE

STYLE 2:
NO POLARITY

PACKAGE OUTLINE DIMENSIONS (continued)

TO–218 THREE LEAD
TO–218
CASE 340D–02
ISSUE B



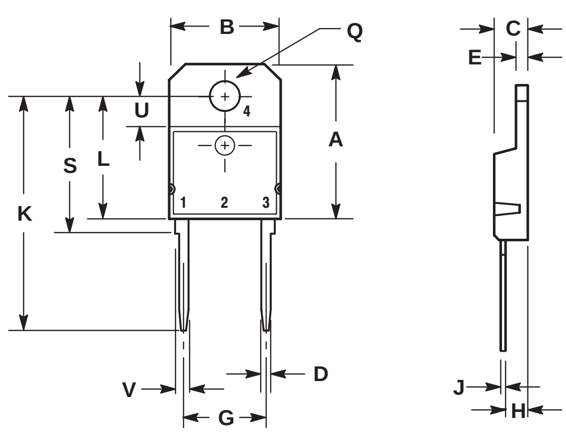
NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: MILLIMETER.

	MILLIMETERS		INCHES	
DIM	MIN	MAX	MIN	MAX
A	---	20.35	---	0.801
B	14.70	15.20	0.579	0.598
C	4.70	4.90	0.185	0.193
D	1.10	1.30	0.043	0.051
E	1.17	1.37	0.046	0.054
G	5.40	5.55	0.213	0.219
H	2.00	3.00	0.079	0.118
J	0.50	0.78	0.020	0.031
K	31.00 REF		1.220 REF	
L	---	16.20	---	0.638
Q	4.00	4.10	0.158	0.161
S	17.80	18.20	0.701	0.717
U	4.00 REF		0.157 REF	
V	1.75 REF		0.069	

STYLE 1:
PIN 1. BASE
2. COLLECTOR
3. EMITTER
4. COLLECTOR

STYLE 2:
PIN 1. ANODE
2. CATHODE
3. ANODE
4. CATHODE

TO–218 TWO LEAD
TO–218
CASE 340E–02
ISSUE A

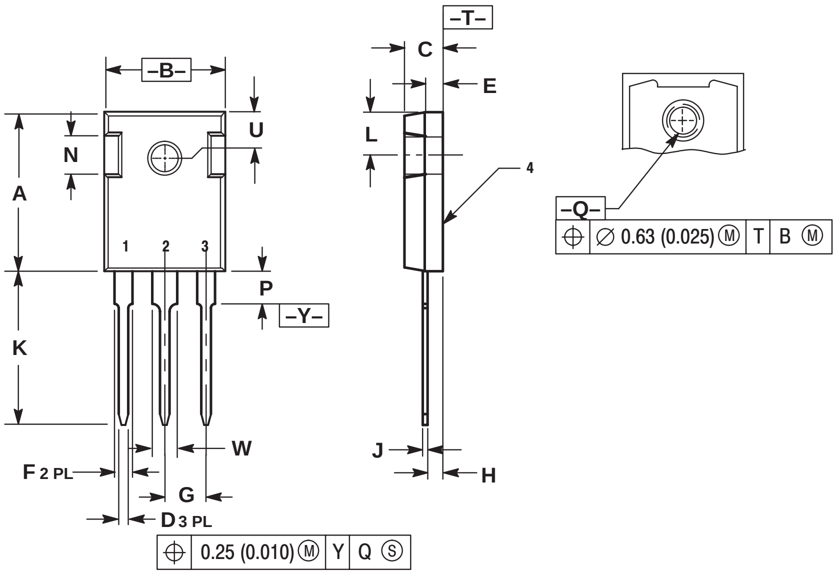


NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982
2. CONTROLLING DIMENSION: MILLIMETER.

	MILLIMETERS		INCHES	
DIM	MIN	MAX	MIN	MAX
A	---	20.35	---	0.801
B	14.70	15.20	0.579	0.598
C	4.70	4.90	0.185	0.193
D	1.10	1.30	0.043	0.051
E	1.17	1.37	0.046	0.054
G	10.80	11.10	0.425	0.437
H	2.00	3.00	0.079	0.118
J	0.50	0.78	0.020	0.031
K	31.00 REF		1.220 REF	
L	---	16.20	---	0.638
Q	4.00	4.10	0.158	0.161
S	17.80	18.20	0.701	0.717
U	4.00 REF		0.157 REF	
V	1.75 REF		0.069	

STYLE 1:
PIN 1. CATHODE
3. ANODE
4. CATHODE

TO–247
CASE 340L–02
ISSUE D



NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: MILLIMETER.

DIM	MILLIMETERS MIN	MILLIMETERS MAX	INCHES MIN	INCHES MAX
A	20.32	21.08	0.800	8.30
B	15.75	16.26	0.620	0.640
C	4.70	5.30	0.185	0.209
D	1.00	1.40	0.040	0.055
E	2.20	2.60	0.087	0.102
F	1.65	2.13	0.065	0.084
G	5.45 BSC		0.215 BSC	
H	1.50	2.49	0.059	0.098
J	0.40	0.80	0.016	0.031
K	20.06	20.83	0.790	0.820
L	5.40	6.20	0.212	0.244
N	4.32	5.49	0.170	0.216
P	---	4.50	---	0.177
Q	3.55	3.65	0.140	0.144
U	6.15 BSC		0.242 BSC	
W	2.87	3.12	0.113	0.123

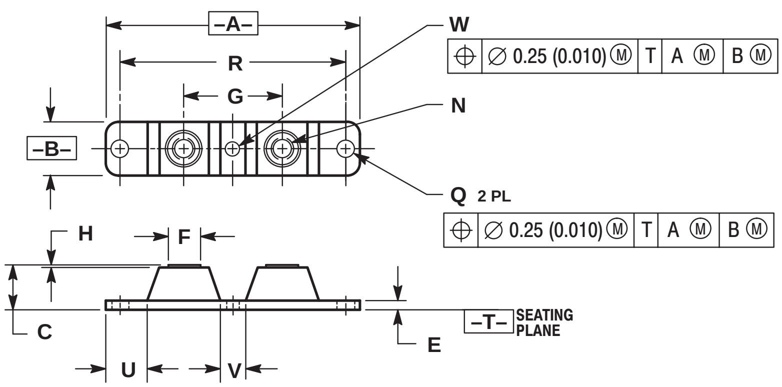
STYLE 1:
PIN 1. GATE
2. DRAIN
3. SOURCE
4. DRAIN

STYLE 2:
PIN 1. ANODE
2. CATHODE (S)
3. ANODE 2
4. CATHODES (S)

STYLE 3:
PIN 1. BASE
2. COLLECTOR
3. EMITTER
4. COLLECTOR

STYLE 4:
PIN 1. GATE
2. COLLECTOR
3. EMITTER
4. COLLECTOR

POWERTAP II
CASE 357C–03
ISSUE E

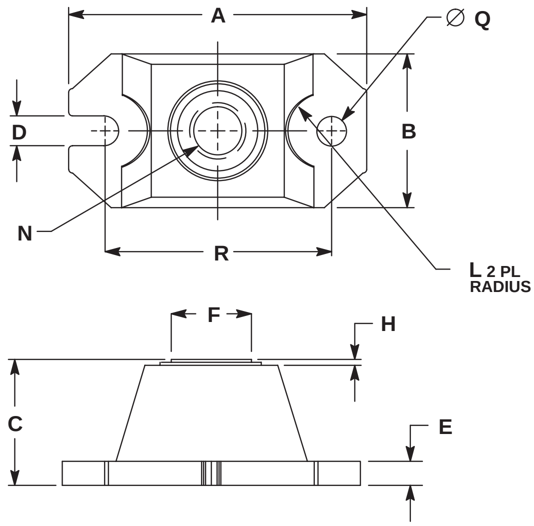


NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.
3. TERMINAL PENETRATION: 5.97 (0.235) MAXIMUM.

DIM	INCHES MIN	INCHES MAX	MILLIMETERS MIN	MILLIMETERS MAX
A	3.450	3.635	87.63	92.33
B	0.700	0.810	17.78	20.57
C	0.615	0.640	15.63	16.26
E	0.120	0.130	3.05	3.30
F	0.435	0.445	11.05	11.30
G	1.370	1.380	34.80	35.05
H	0.007	0.030	0.18	0.76
N	1/4–20UNC–2B		1/4–20UNC–2B	
Q	0.270	0.285	6.86	7.23
R	31.50 BSC		80.01 BSC	
U	0.600	0.630	15.24	16.00
V	0.330	0.375	8.39	9.52
W	0.170	0.190	4.32	4.82

PACKAGE OUTLINE DIMENSIONS (continued)

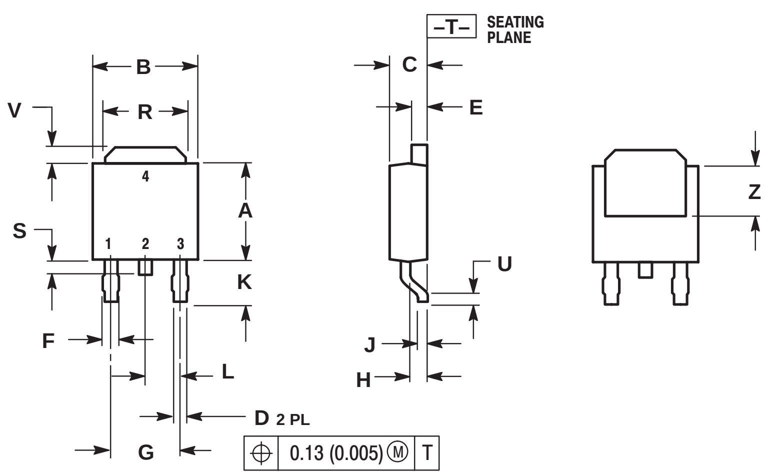
POWERTAP III
CASE 357D–01
ISSUE A



NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.
3. TERMINAL PENETRATION: 5.97 (0.235) MAXIMUM.

	INCHES		MILLIMETERS	
DIM	MIN	MAX	MIN	MAX
A	1.520	1.560	38.61	39.62
B	0.783	0.813	19.89	20.65
C	0.615	0.635	15.62	16.13
D	0.152	0.162	3.86	4.11
E	0.120	0.130	3.05	3.30
F	0.435	0.445	11.05	11.30
H	0.007	0.030	0.18	0.76
L	0.210	0.230	5.33	5.84
N	1/4–20UNC–2B		1/4–20UNC–2B	
Q	0.152	0.162	3.86	4.11
R	1.175	1.195	29.85	30.35

DPAK
CASE 369A–13
ISSUE AA



NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.

	INCHES		MILLIMETERS	
DIM	MIN	MAX	MIN	MAX
A	0.235	0.250	5.97	6.35
B	0.250	0.265	6.35	6.73
C	0.086	0.094	2.19	2.38
D	0.027	0.035	0.69	0.88
E	0.033	0.040	0.84	1.01
F	0.037	0.047	0.94	1.19
G	0.180 BSC		4.58 BSC	
H	0.034	0.040	0.87	1.01
J	0.018	0.023	0.46	0.58
K	0.102	0.114	2.60	2.89
L	0.090 BSC		2.29 BSC	
R	0.175	0.215	4.45	5.46
S	0.020	0.050	0.51	1.27
U	0.020	---	0.51	---
V	0.030	0.050	0.77	1.27
Z	0.138	---	3.51	---

STYLE 1:
PIN 1. BASE
2. COLLECTOR
3. EMITTER
4. COLLECTOR

STYLE 2:
PIN 1. GATE
2. DRAIN
3. SOURCE
4. DRAIN

STYLE 3:
PIN 1. ANODE
2. CATHODE
3. ANODE
4. CATHODE

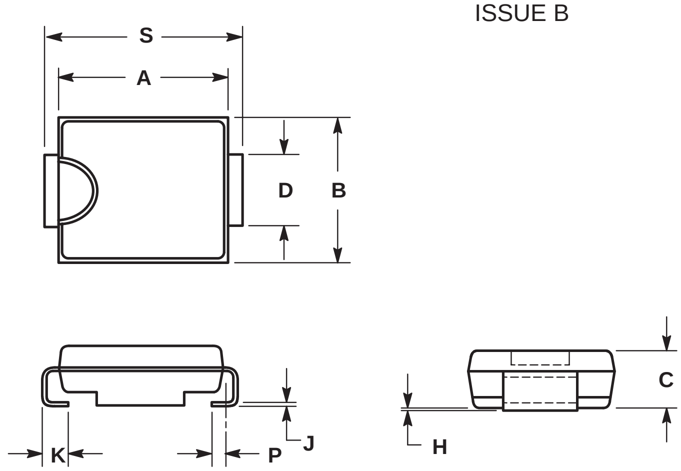
STYLE 4:
PIN 1. CATHODE
2. ANODE
3. GATE
4. ANODE

STYLE 5:
PIN 1. GATE
2. ANODE
3. CATHODE
4. ANODE

STYLE 6:
PIN 1. MT1
2. MT2
3. GATE
4. MT2

PACKAGE OUTLINE DIMENSIONS (continued)

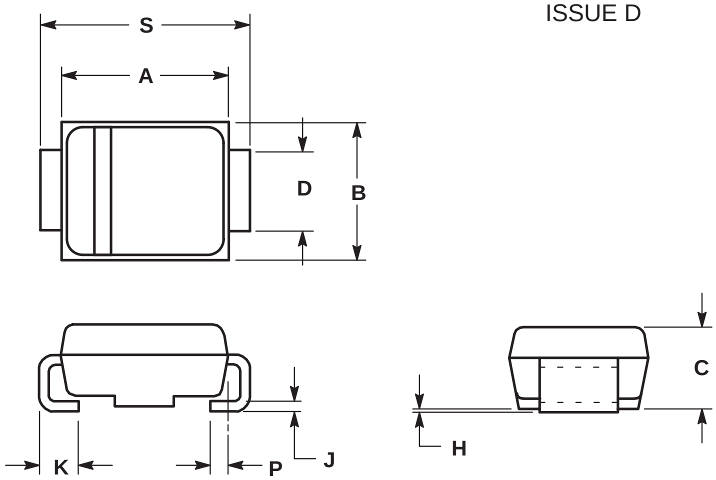
SMC
CASE 403–03
ISSUE B



NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.
3. D DIMENSION SHALL BE MEASURED WITHIN DIMENSION P.

DIM	INCHES MIN	INCHES MAX	MILLIMETERS MIN	MILLIMETERS MAX
A	0.260	0.280	6.60	7.11
B	0.220	0.240	5.59	6.10
C	0.075	0.095	1.90	2.41
D	0.115	0.121	2.92	3.07
H	0.0020	0.0060	0.051	0.152
J	0.006	0.012	0.15	0.30
K	0.030	0.050	0.76	1.27
P	0.020 REF		0.51 REF	
S	0.305	0.320	7.75	8.13

SMB
D0–214AA
CASE 403A–03
ISSUE D

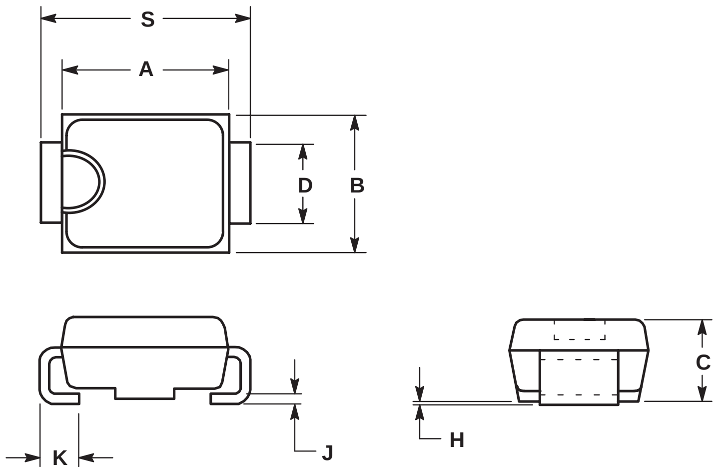


NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.
3. D DIMENSION SHALL BE MEASURED WITHIN DIMENSION P.

DIM	INCHES MIN	INCHES MAX	MILLIMETERS MIN	MILLIMETERS MAX
A	0.160	0.180	4.06	4.57
B	0.130	0.150	3.30	3.81
C	0.075	0.095	1.90	2.41
D	0.077	0.083	1.96	2.11
H	0.0020	0.0060	0.051	0.152
J	0.006	0.012	0.15	0.30
K	0.030	0.050	0.76	1.27
P	0.020 REF		0.51 REF	
S	0.205	0.220	5.21	5.59

PACKAGE OUTLINE DIMENSIONS (continued)

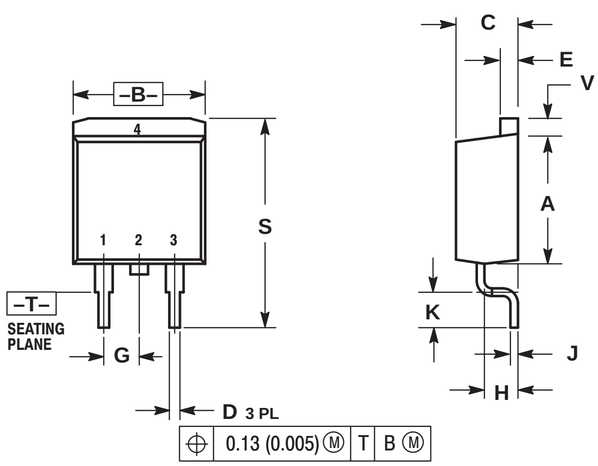
SMB
CASE 403B–01
ISSUE O



NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.

DIM	INCHES MIN	INCHES MAX	MILLIMETERS MIN	MILLIMETERS MAX
A	0.160	0.180	4.06	4.57
B	0.090	0.115	2.29	2.92
C	0.075	0.105	1.91	2.67
D	0.050	0.064	1.27	1.63
H	0.004	0.008	0.10	0.20
J	0.006	0.016	0.15	0.41
K	0.030	0.060	0.76	1.52
S	0.190	0.220	4.83	5.59

D^{2}PAK
CASE 418B–03
ISSUE D



NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.

DIM	INCHES MIN	INCHES MAX	MILLIMETERS MIN	MILLIMETERS MAX
A	0.340	0.380	8.64	9.65
B	0.380	0.405	9.65	10.29
C	0.160	0.190	4.06	4.83
D	0.020	0.035	0.51	0.89
E	0.045	0.055	1.14	1.40
G	0.100 BSC		2.54 BSC	
H	0.080	0.110	2.03	2.79
J	0.018	0.025	0.46	0.64
K	0.090	0.110	2.29	2.79
S	0.575	0.625	14.60	15.88
V	0.045	0.055	1.14	1.40

STYLE 1:
PIN 1. BASE
2. COLLECTOR
3. EMITTER
4. COLLECTOR

STYLE 2:
PIN 1. GATE
2. DRAIN
3. SOURCE
4. DRAIN

STYLE 3:
PIN 1. ANODE
2. CATHODE
3. ANODE
4. CATHODE

CHAPTER 10
AR598: Avalanche Capability of Today's Power Semiconductors

Avalanche Capability of Today's Power Semiconductors

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ARTICLE REPRINT

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ON Semiconductor, France, USA*
Paper published at the EPE Conference '93, Brighton 9/93.

Abstract. Power semiconductors are used to switch high currents in fractions of a second and therefore belong inherently to a world of voltage spikes. To avoid unnecessary breakdown voltage guardbands, new generations of semiconductors are now avalanche rugged and characterized in avalanche energy.

This characterization is often far from application conditions and thus quite useless to the designer. It is easy to verify that an energy rating is not the best approach to a ruggedness quantification because of avalanche energy fluctuations with test conditions.

A physical and thermal analysis of the failure mechanisms leads to a new characterization method generating easy–to–use data for safe designs. The short–term avalanche capability will be discussed with an insight of the different technologies developed to meet these new ruggedness requirements.

Keywords. Avalanche, breakdown, unclamped inductive switching energy, safe operating areas.

INTRODUCTION

One obvious trend for new power electronic designs is to work at very high switching frequencies in order to reduce the volume and weight of all the capacitive and inductive elements. The consequence is that most applications today require switching very high currents in fractions of a microsecond and therefore generate L x dI/dt voltage spikes due to parasitic inductance. Unfortunately these undesirable voltage levels sometimes reach the breakdown voltage of power semiconductors that are not intended to be used in avalanche.

The necessity for avalanche rugged power semiconductors has clearly been perceived by many semiconductor manufacturers who have come up with avalanche–energy rated devices.

This paper will show the limits of an energy–based characterization model. It will concentrate on three different devices: Ultra Fast recovery Rectifiers, Schottky Barrier Rectifiers and MOSFETs. It will study their main failure mechanisms and show the technological improvements that guarantee an enhanced ruggedness.

This will lead to a new characterization that will help the designer choose correctly between overall cost and reliability.

LIMITS OF AN AVALANCHE ENERGY CHARACTERIZATION

Practically all the characterizations are based on the following Unclamped Inductive Switching (UIS) test circuit (Fig 1).

The energy is first stored in inductor L by turning on transistor Q for a period of time proportional to the peak current desired in the inductor. When Q is turned off, the inductor reverses its voltage and avalanches the Device Under Test until all its energy is transferred. The DUT can be a rectifier or a MOSFET (the gate should always be shorted to the source).

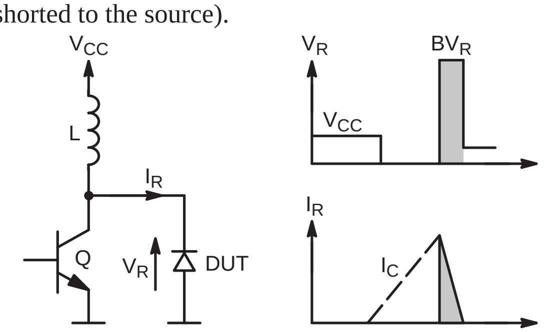

Figure 1. Standard UIS Characterization Circuit.

The standard characterization method consists in increasing the peak current in the inductor until the device fails. The energy that the device can sustain without failing becomes a figure of merit of the ruggedness to avalanche:

$$W_{aval} = 1/2\ L\ I_{peak}^2\ BV_{(DUT)} / (BV_{(DUT)} - V_{CC}) \qquad [1]$$

The main limit of this method is that the energy level that causes a failure in the DUT is not a constant but a function of L and V_{CC}. This results of the fact that the avalanche duration is function of the current decay slope $(BV_{(DUT)}–V_{CC})/L$:

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Table 1. Peak Current and Energy Causing Failures in a 1 A, 1000 V Ultra Fast Recovery Rectifier.

Inductor Value:	10 mH	50 mH	100 mH
Peak Current:	1.7 A	0.9 A	0.8 A
Energy:	14 mJ	20 mJ	32 mJ

Table 1 indicates that the failure is not caused by an energy (i.e. it is not independent of the avalanche duration) but rather by a current level that has to be derated versus time: the devices can sustain a low current for a long period of time (high energy) but at high avalanche currents they will fail after a few microseconds (low energy).

Therefore, unless the designer has a parasitic inductance of value L in his circuit, the standard characterization data will be useless, or worse, it might lead to an overestimate of the ruggedness of his application: because parasitic inductances are often an order of magnitude less than the test circuit inductance, the expected energy capability leads to excessive current levels.

The UIS test circuit is very easy to implement: the only important point is that the transistor has to have a breakdown voltage higher than the DUT. For low breakdown voltage devices, a MOSFET might be preferred to the bipolar transistor.

The advantages of using a MOSFET are multiple: it is a more rugged device, it is much easier to drive and its switching characteristics can be controlled by adding a resistor in series with the gate. It is mandatory to limit this switching speed to avoid having an avalanche energy measurement dependent on the gate drive (i.e. gate resistor and gate to source voltage values).

Anyhow, it is possible to generate very useful information with this UIS test circuit by varying the inductor value. It is also very important to present the data independently of the values of V_{CC} and L. One solution can be to plot the maximum peak current versus the avalanche duration (Fig 2):

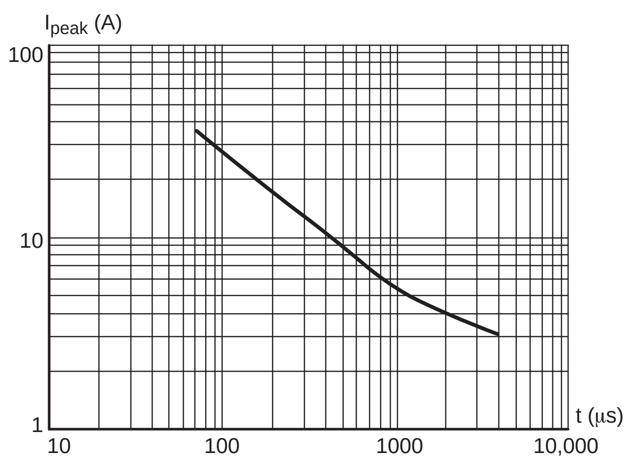

Figure 2. Maximum Peak Current versus Avalanche Duration for a 15 A, 60 V MOSFET in an UIS Test Circuit.

The advantage of this new graph is that the designer can easily calculate the safety margin of his application and he will not be mislead by an energy value that depends on too many different parameters. If he knows the value of the parasitic inductance in his circuit he will be able to determine its maximum peak current.

For instance, let us assume that the designer uses the 15 A, 60 V MOSFET characterized in Figure 2. This device sustains 500 mJ with an inductor of 75 mH according to equation [1]. Its typical breakdown voltage is 80 V.

If the supply voltage V_{DD} is 12 V and the parasitic inductance L is 250 μH, then the avalanche duration and maximum peak current are related by

$$I_{peak} = t\,(BV_{DSS} - V_{DD}) / L \qquad [2]$$

This relationship can be added to Figure 2 (see Fig 3):

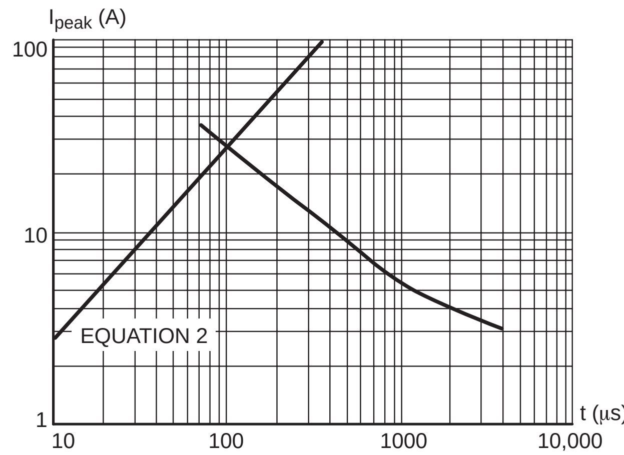

Figure 3. Figure 2 + equation [2].

Thus the maximum peak current that can flow through the parasitic inductance L is approximately 28 A instead of 58 A that would have resulted of using equation [1].

UNDERSTANDING THE FAILURE MECHANISMS

Physical Approach

The following microscope photographs show the failure locations for an Ultra Fast Recovery Rectifier (UFR), a Schottky Barrier Rectifier (SBR) and a MOSFET:

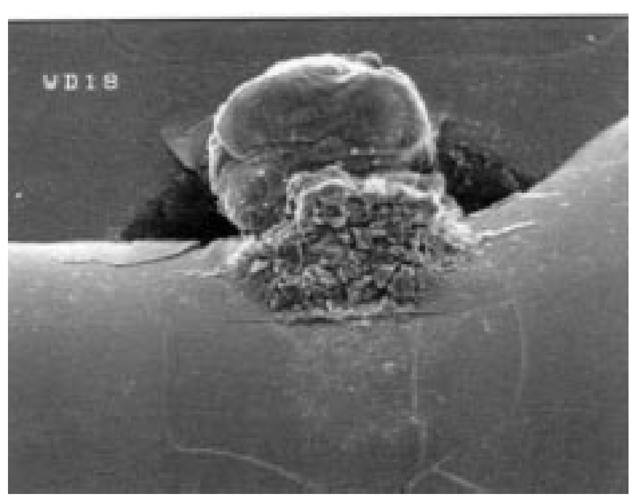

Figure 4. 4 A, 1000 V UFR Avalanche Failure.

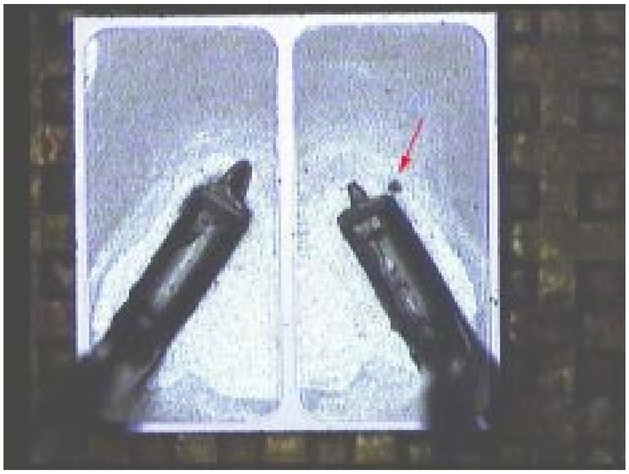

Figure 5. 25 A, 35 V SBR Avalanche Failure.

Figure 6. 20 A, 500 V MOSFET Avalanche Failure.

These photographs show that the failure is generally a punchthrough. The melt–through hole dimensions depend on the current level and avalanche duration.

A close look at the electrical characteristics of failed rectifiers on a curve tracer show three levels of degradation: low stressed diodes have a normal forward characteristic but show an unusual leakage current before entering breakdown as if they had a high–value resistor in parallel: this resistance can be explained by a small punchthrough. For medium degradation levels, the value of this pseudo–resistance decreases and becomes visible in the forward characteristic of the diode. Finally, when the punchthrough reaches considerable dimensions, the device looks very similar to a low value resistor.

The failure does not always appear in the same region of the die. For instance, high voltage UFRs have their punch-through always located in a corner, MOSFETs often fail in the corners or on the sides whereas SBRs have randomly located failures.

Thermal Approach

Transient thermal response graphs generated by a standard ΔV_{DS} method show the junction temperature evolution for forward and avalanche constant current conduction in a MOSFET. These graphs (Fig 7) prove that the silicon efficiency during avalanche and forward currents are similar.

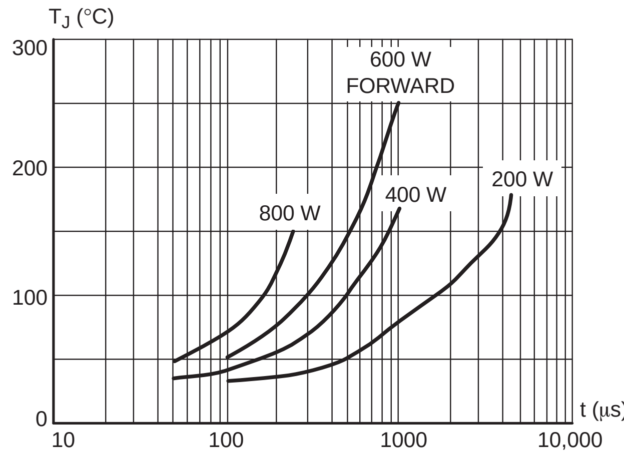

Figure 7. 15 A, 60 V MOSFET Transient Thermal Response for 800 W, 400 W, 200 W Avalanche and 600 W Forward Conduction.

Figure 7 can be used to generate a transient thermal resistance graph by plotting the temperature divided by the power: the four graphs should then normally match. Some slight differences show that the transient thermal resistance increases with the current level: i.e. the 800 W curve (10 A constant avalanche current) has a higher transient thermal resistance than the 200 W (2.5 A). Therefore the thermal efficiency in a MOSFET is not perfectly homogeneous versus the avalanche current.

A similar analysis on an UFR or an SBR shows poor thermal efficiency in avalanche. This can be shown by comparing the temperature rise after 1 ms for forward and avalanche conduction pulses of same power (400 W):

MOSFET	ΔT_{direct}=160°C	$\Delta T_{avalanche}$=180°C	ratio=0.9
UFR	ΔT_{direct}=120°C	$\Delta T_{avalanche}$=175°C	ratio=0.7
SBR	ΔT_{direct}=100°C	$\Delta T_{avalanche}$=150°C	ratio=0.7

Electrical Approach

Considering the transient thermal responses of a device, it is possible to simulate the instantaneous junction temperature for any sort of power pulse.

Conducting this simulation on the data generated by the UIS test it is possible to show that all the parts fail when they reach a "critical temperature" (Fig 8):

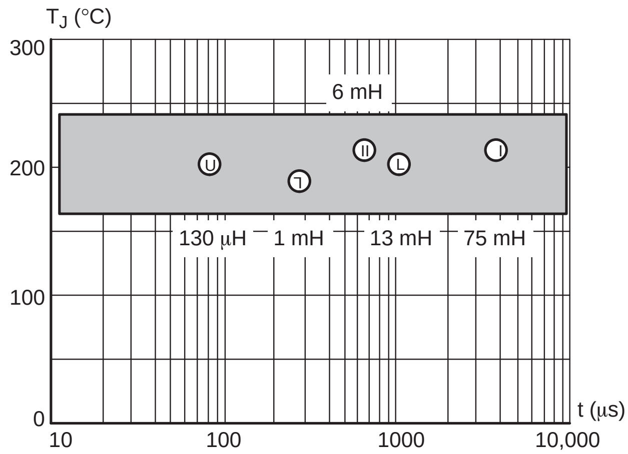

Figure 8. 15A, 60V MOSFET Failure Points and Critical Temperature for different Inductor Values.

At these critical temperatures the intrinsic carrier concentration, ni, reaches levels close to those of the doping concentrations:

$$\text{ni is proportional to} \quad T^{3/2}\, e^{-Eg/2kT} \qquad [3]$$

where T is the absolute temperature, Eg the energy bandgap and k is Boltzmann's constant.

At 200°C, ni exceeds 2 10^{14} cm^{-3} which corresponds to a 1000 V material epitaxy concentration level. This means that when the junction temperature reaches 300°C, the rectifier looks more like a resistor than a diode. A local thermal runaway then generates a hot spot and a punchthrough as can be seen in Figures 4, 5 and 6.

This failure analysis has shown that the failure mechanism is essentially thermal: the devices are heated by the BV_R x I_R power dissipation. Unfortunately, this power does not remain constant because the UIS circuit generates a linear current decay and also the breakdown voltage varies with the current level and with the junction temperature.

In order to have a complete characterization of the device it is interesting to see how it reacts to a constant avalanche current and different ambient temperatures.

NEW CHARACTERIZATION METHOD PROPOSAL

During the prototype phase, it is easier for the designer to measure the avalanche current and duration than the circuit's parasitic inductance. Therefore, the characterization should be based on easy to measure parameters. The failure analysis proves that the main cause of degradation is the inability to handle an excessive power (avalanche current I_R multiplied by breakdown voltage BV_R). A proper characterization should present the maximum power capability versus time.

As the avalanche voltage varies only slightly with the current level, the proposed method is based on avalanching a device at a constant current and presenting the maximum current capability versus time:

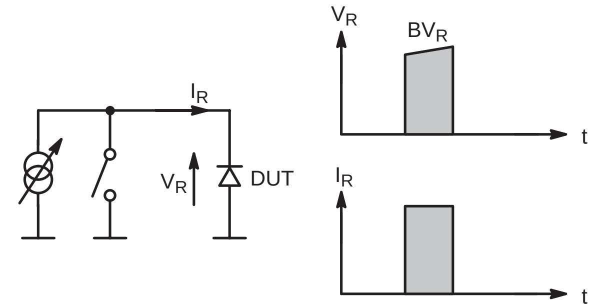

Figure 9. Constant Current Characterization Circuit.

Different test circuits similar to Figure 9 have been proposed by Gauen (1) and Pshaenich (2). Some unexpected failures in MOSFETs suggest that the DUT should always be referenced to ground. Unlike UFRs and SBRs, MOSFETs react differently whether they are tied to ground or floating around a fluctuating voltage. Many floating transistors fail at very low stress levels probably due to capacitive coupled currents that turn–on the internal parasitic transistor.

The test circuit shown in Figure 9 sets a constant avalanche current through the device until it fails, this duration can then be plotted for different current levels. This generates a graph similar to the UIS method, except that the current is constant instead of decreasing linearly.

This leads to the definition of a "Safe Avalanching Area" (Fig 10) that will guarantee a short–term reliability if the device is used within this clearly defined area.

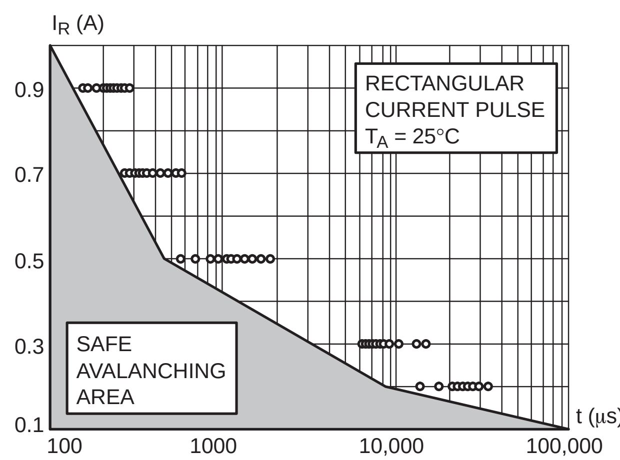

Figure 10. 1 A, 30 V SBR Save Avalanching Area.

This graph gives the maximum avalanche duration for any value of avalanche current.

The Safe Avalanching Area is generated by taking a safety margin from the failure points. Another approach would be to dynamically measure the temperature as in Figure 7 and generate an area defined by a maximum allowable junction temperature.

As the failure mechanism is related to a peak junction temperature, it is necessary to give Safe Avalanching Areas for different ambient temperatures (Fig 11):

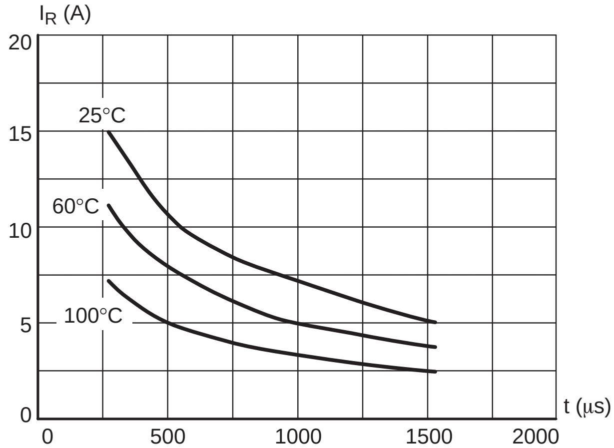

Figure 11. 25 A, 35 V SBR Safe Avalanching Areas for different ambient temperatures.

When the data in Figures 10 and 11 is plotted on log/log axes instead of lin/log or lin/lin, an interesting feature appears (Fig 12):

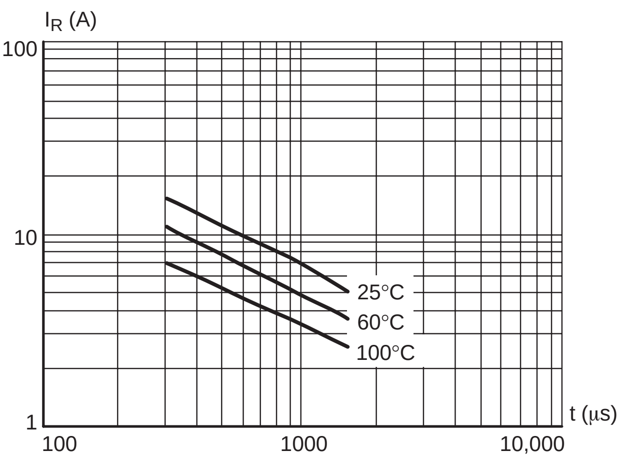

Figure 12. Figure 12 on log/log axes.

Figure 12 shows a linear relationship between current and time on a log/log plot. This means that:

$$\log(I_R) = A \log(t) + B,$$

so

$$I_R = k\,T^A \qquad [4]$$

where k is a constant function of the die size, the breakdown voltage and other parameters. Constant A can be extracted from Figure 12 and similar figures for UFRs and MOSFETs:

$$I_R = k\,T^{-0.55} \qquad [5]$$

Relation [5] is a consequence of heat propagation laws which explain that the temperature in a semiconductor rises proportionally to $t^{0.5}$ (for a constant current pulse and as long as the temperature remains within the silicon die). This can be seen in any transient thermal resistance graph.

A standard thermal calculation shows that:

$$T_J = T_A + P_D\,Rth_{JA}(t),$$

or

$$P_D = (T_J – T_A) / Rth_{JA}(t) \qquad [6]$$

where:

T_J, T_A are the junction and ambient temperatures,
P_D is the power dissipation,
$Rth_{JA}(t)$ is the transient thermal resistance.

Given a constant power pulse and for values of t less than 1 ms, [6] is equivalent to:

$$I_R\,B_{VR} = (T_J – T_A) / (k\,t^{0.5})$$

so

$$I_R = k\,t^{–0.5} \qquad [7]$$

This relation is similar to [5]. For avalanche durations of less than 500 μs the heat propagates within the silicon only. For longer durations the heat reaches the solder and the package so the propagation characteristics are modified. The devices heat faster or slower and therefore the I_R=f(t) slope changes. Empirical data shows that A in relation [4] remains within –0.5 to –0.6.

Relation [7] can also be expressed by:

$$I_R^2\,t = k \qquad \text{(k:constant)} \qquad [7bis]$$

This rule of thumb works out much better than the, unfortunately too common, 1/2 L I^2 law.

For example, when applied to the example following Figure 2 (which is UIS and not Constant Current generated) to determine the maximum peak current in a 250 μH inductor and by choosing for instance the 9 A, 500 μs point, relation [7bis] can be written:

$$9A^2\ 500\ \mu s = Ipeak^2\ 100 \mu s$$

This gives a conservative value of 20 A instead of a real value of 28 A whereas the 1/2 L I^2 method generates a catastrophic 58 A value.

TECHNOLOGY TRADEOFFS

Ultra Fast Recovery Rectifiers

The UFR devices are based on a Mesa technology (Fig 13) with a Phosphorus doped (n–type) substrate. The heavily doped N+ substrate is followed by a lighter N– epitaxial layer. The P+ is diffused into the epitaxy to form the P–N junction. The passivation follows the perimeter of the die.

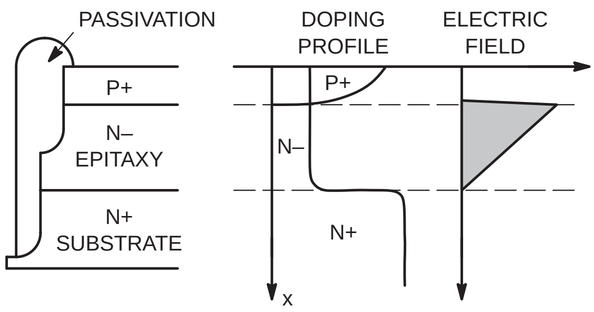

Figure 13. UFR Technology, Profile and Electric Field.

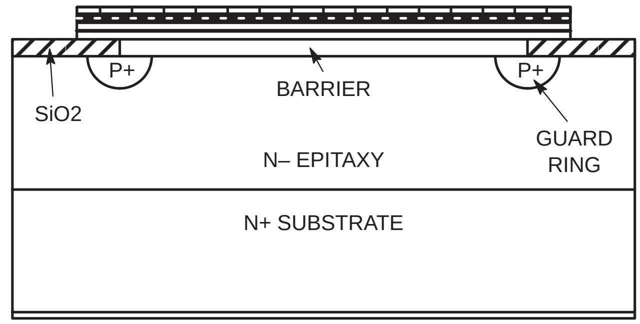

Figure 14. SBR Technology with P–N Guard Rings

The epitaxy characteristics determine the major electrical parameters of the device. A designed experiment was conducted varying the epitaxy thickness and resistivity. The output responses were the forward voltage, the breakdown voltage, the leakage current and the avalanche capability. A wide range of epitaxy materials was chosen to determine the general trends for all the effects.

Although the results were predictable for the static parameters, the avalanche capability results were not.

A key issue is the electric field extension. If it terminates before the substrate the avalanche capability increases by increasing the epitaxy resistivity. If the field extends into the N+ region (reach–through) the avalanche capability is considerably reduced.

The avalanche capability is proportional to the die size and not to the perimeter. This confirms that the avalanche current is vertical and not only a surface or passivation related phenomenon.

The failures always occur in the corners where the electric field is most critical. These failures are essentially function of the thermal characteristics of the device when conducting avalanche currents. Therefore the avalanche capability decreases when the ambient temperature increases and the failures can normally be predicted by Safe Avalanching Areas such as Figure 12.

Some unexpected defects though can radically degrade the avalanche capability. Defects in the epi such as pipes cause premature failures but can often be screened by a leakage current test that eliminates soft breakdown devices. Defects in the passivation can generate parasitic oscillations during breakdown.

Schottky Rectifiers

Due to P–N junction guard rings, SBR devices are very similar to UFRs when conducting avalanche currents. These rectifiers have very low breakdown voltages and therefore very thin epitaxy layers. This probably explains that the avalanche–related failures occur anywhere on the die surface: the thin N– region is relatively more heterogeneous with respect to avalanche capability and thermal dissipation than a thick UFR epitaxy.

MOSFETs

MOSFETs can also be compared to UFRs as long as the internal parasitic bipolar transistor (due to the P–tub) does not turn–on. The latest MOSFET generations reduce the P– resistance to avoid biasing this NPN.

While analyzing different constant current test circuits, it appeared that devices used in a floating configuration can have very poor avalanche capabilities.

Due to their cellular technology, MOSFETs conduct very efficiently avalanche currents. They can sustain avalanche power levels close to those of forward conduction ratings.

CONCLUSION

The necessity of characterizing the avalanche capability of power semiconductors has been explained. An analysis of the standard UIS test circuit has shown the limits of a characterization based on energy ratings. Throughout a discussion of the main failure mechanisms, a new thermal approach has been proposed to help designers set safety levels in their designs. This paper sets new standards for characterizing avalanche ruggedness.

Acknowledgements

The authors would like to thank Jean–Michel REYNES, design engineer at ON Semiconductor Toulouse, for his help in understanding the failure mechanisms.

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CHAPTER 11
Index and Cross Reference

Index and Cross Reference

The following table represents an index and cross reference guide for all rectifier devices which are either manufactured directly by ON Semiconductor or for which ON Semiconductor manufactures a suitable equivalent. Where the ON Semiconductor part number differs from the industry part number, the ON Semiconductor device is a form, fit and function replacement for the industry type number – however, subtle differences in characteristics and/or specifications may exist. The part numbers listed in this Cross Reference are in computer sort.

Industry Part Number	ON Semiconductor Nearest Replacement	ON Semiconductor Similar Replacement	Page
10BF10	MURS110T3		286
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FEP16CT		MUR1620CT	402
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FEP16GT		MUR1640CT	402
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FES8FT		MUR840	370
FES8GT		MUR840	370
FES8HT		MUR860	370
FES8JT		MUR860	370
FESB16AT		MURB1620CT	313
FESB16BT		MURB1620CT	313
FESB16CT		MURB1620CT	313
FESB16DT		MURB1620CT	313
FM120		MBRA130LT3	58
FM130		MBRA130LT3	58
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FM5817		MBRA130LT3	58
FM5818		MBRA130LT3	58
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FR062		1N4934	452
FR062L	1N4934		452
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FR254		MR856	454
FR255		MR856	454
FR301	MR852		454
FR302	MR852		454
FR303	MR852		454
FR304	MR856		454
FR305	MR856		454
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FRM3210CC	MUR3020PT		425
FRM3215CC	MUR3020PT		425
FRM3220CC	MUR3020PT		425
FRP1605CC	MUR1620CT		402
FRP1610CC	MUR1620CT		402
FRP1615CC	MUR1620CT		402
FRP1620CC	MUR1620CT		402
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GI1001		MUR120	324
GI1002		MUR120	324
GI1003		MUR120	324
GI1004		MUR120	324
GI1101		MUR420	350
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GI1103		MUR420	350
GI1104		MUR420	350
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GI1302		MUR420	350
GI1303		MUR420	350
GI1304		MUR420	350
GI1401	MUR820		370
GI1402	MUR820		370
GI1403	MUR820		370
GI1404	MUR820		370
GI2401	MUR1620CT		402
GI2402	MUR1620CT		402
GI2403	MUR1620CT		402
GI2404	MUR1620CT		402
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GI2501	MR2504		463
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GI500	1N5400RL		449
GI501	1N5401RL		449
GI502	1N5402RL		449
GI504	1N5404RL		449
GI506	1N5406RL		449
GI508	1N5407RL		449
GI510	1N5408RL		449
GI750		MR754	484
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GI810		1N4933RL	452
GI811		1N4934RL	452
GI812		1N4935RL	452
GI814		1N4936RL	452
GI816		1N4937RL	452
GI850	MR852		454
GI851	MR852		454
GI852	MR852		454
GI854	MR856		454
GI856	MR856		454
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GP15M		1N4007RL	447
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GP30D	1N5402RL		449
GP30G	1N5404RL		449
GP30J	1N5406RL		449
GP30K	1N5407RL		449
GP30M	1N5408RL		449
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HER103	MUR120		324
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HER105	MUR140		324
HER151		MUR120	324
HER152		MUR120	324
HER153		MUR120	324
HER154		MUR140	324
HER155		MUR140	324
HER301	MUR420		350
HER302	MUR420		350
HER303	MUR420		350
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HER802	MUR820		370
HER803	MUR820		370
HER804	MUR840		370
HER805	MUR840		370
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LT2A03		1N5402RL	449
LT2A04		1N5404RL	449
LT2A05		1N5406RL	449
LT2A06		1N5407RL	449
LT2A07		1N5408RL	449
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MBR1545CT	MBR1545CT		174
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MBR20025CTL	MBRP20030CTL		252
MBR20030CTL	MBRP20030CTL		252
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MBR2090CT	MBR2090CT		189
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MBRB1530CT		MBRB1545CT	116
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MBRB1545CT	MBRB1545CT		116
MBRB1550CT		MBRB1545CT	116
MBRB1635		MBRB1545CT	116
MBRB1645		MBRB1545CT	116
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MBRB2035CT		MBRB2535CTL	127
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MBRB2050CT		MBRB2545CT	130
MBRB2060CT	MBRB2060CT		118
MBRB2080CT		MBRB20100CT	120
MBRB2090CT		MBRB20100CT	120
MBRB2515L	MBRB2515L		125
MBRB2535CTL	MBRB2535CTL		127
MBRB2545CT	MBRB2545CT		130
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MBRD660CT	MBRD660CT		101
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MUR1660CT	MUR1660CT		402
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MUR20020CT	MURP20020CT		436
MUR20030CT	MURP20040CT		436
MUR20040CT	MURP20040CT		436
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MUR3010PT	MUR3020PT		425
MUR3015PT	MUR3020PT		425
MUR3020PT	MUR3020PT		425
MUR3020WT	MUR3020WT		431
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MUR450	MUR460		350
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P600A		MR754	484
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