

# 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
- Guaranteed Reverse Avalanche
- Epoxy Meets UL94, VO at 1/8"

### Mechanical Characteristics:

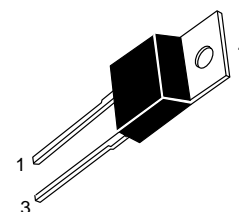
- Case: Epoxy, Molded
- Weight: 1.9 grams (approximately)
- Finish: All External Surfaces Corrosion Resistant and Terminal Leads are Readily Solderable
- Lead Temperature for Soldering Purposes: 260°C Max. for 10 Seconds
- Shipped 50 units per plastic tube
- Marking: B1035, B1045



**MBR1035**  
**MBR1045**

MBR1045 is a  
Motorola Preferred Device

**SCHOTTKY BARRIER  
RECTIFIERS**  
**10 AMPERES**  
**20 to 45 VOLTS**



**CASE 221B-03**  
**TO-220AC**  
**PLASTIC**

### MAXIMUM RATINGS

Rating	Symbol	MBR1035	MBR1045	Unit
Peak Repetitive Reverse Voltage Working Peak Reverse Voltage DC Blocking Voltage	$V_{RRM}$ $V_{RWM}$ $V_R$	35	45	Volts
Average Rectified Forward Current (Rated $V_R$ ) $T_C = 135^\circ\text{C}$	$I_{F(AV)}$	10	10	Amps
Peak Repetitive Forward Current (Rated $V_R$ , Square Wave, 20 kHz) $T_C = 135^\circ\text{C}$	$I_{FRM}$	20	20	Amps
Nonrepetitive Peak Surge Current (Surge applied at rated load conditions halfwave, single phase, 60 Hz)	$I_{FSM}$	150	150	Amps
Peak Repetitive Reverse Surge Current (2.0 $\mu\text{s}$ , 1.0 kHz) See Figure 12	$I_{RRM}$	1.0	1.0	Amp
Operating Junction Temperature	$T_J$	-65 to +150	-65 to +150	$^\circ\text{C}$
Storage Temperature	$T_{stg}$	-65 to +175	-65 to +175	$^\circ\text{C}$
Voltage Rate of Change (Rated $V_R$ )	$dv/dt$	1000	10000	$\text{V}/\mu\text{s}$

### THERMAL CHARACTERISTICS

Maximum Thermal Resistance, Junction to Case	$R_{\theta JC}$	2.0	2.0	$^\circ\text{C}/\text{W}$
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### ELECTRICAL CHARACTERISTICS

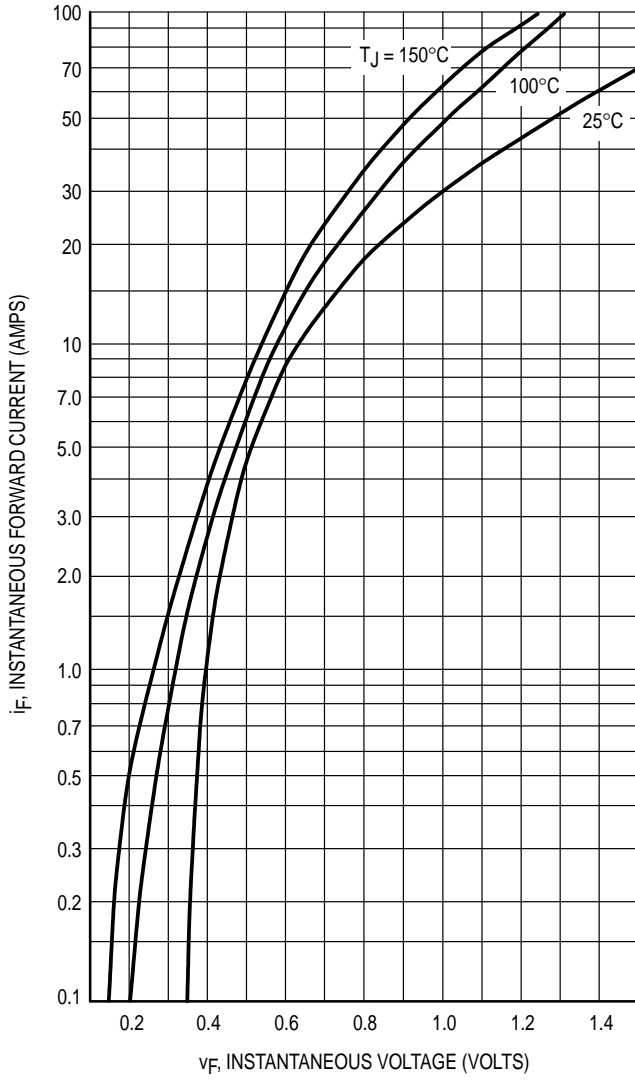
Maximum Instantaneous Forward Voltage (1) ( $i_F = 10$ Amps, $T_C = 125^\circ\text{C}$ ) ( $i_F = 20$ Amps, $T_C = 125^\circ\text{C}$ ) ( $i_F = 20$ Amps, $T_C = 25^\circ\text{C}$ )	$v_F$	0.57 0.72 0.84	0.57 0.72 0.84	Volts
Maximum Instantaneous Reverse Current (1) (Rated dc Voltage, $T_C = 125^\circ\text{C}$ ) (Rated dc Voltage, $T_C = 25^\circ\text{C}$ )	$i_R$	15 0.1	15 0.1	mA

(1) Pulse Test: Pulse Width = 300  $\mu\text{s}$ , Duty Cycle  $\leq 2.0\%$ .

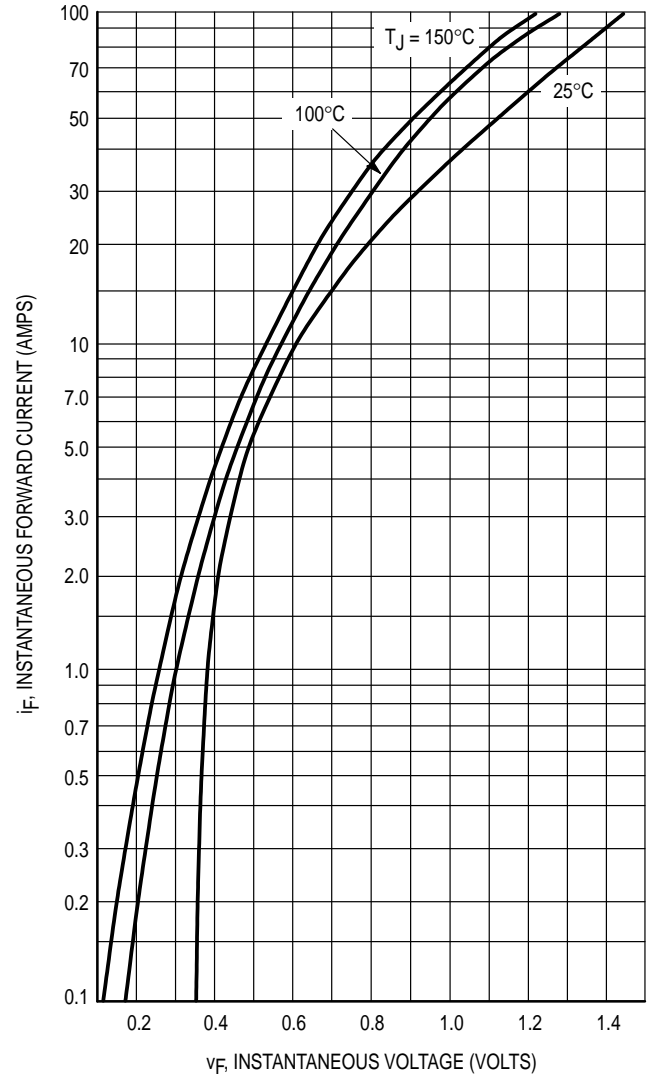
SWITCHMODE is a trademark of Motorola, Inc.

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

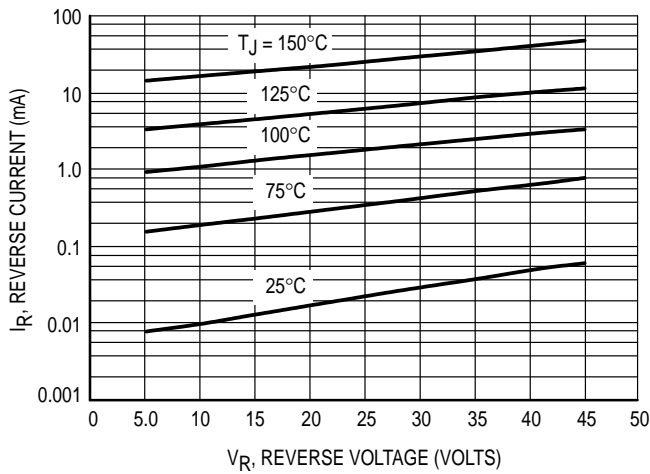
**MBR1035 MBR1045**



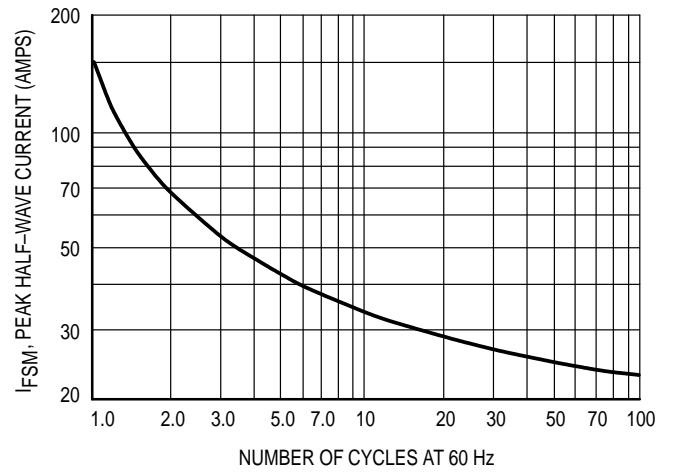
**Figure 1. Maximum Forward Voltage**



**Figure 2. Typical Forward Voltage**



**Figure 3. Maximum Reverse Current**



**Figure 4. Maximum Surge Capability**

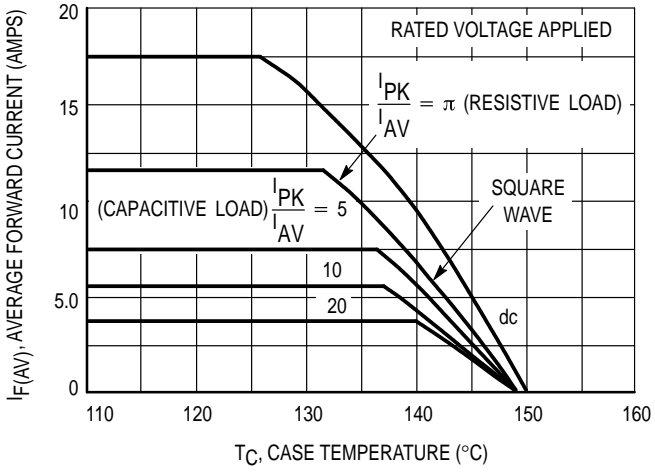


Figure 5. Current Derating, Infinite Heatsink

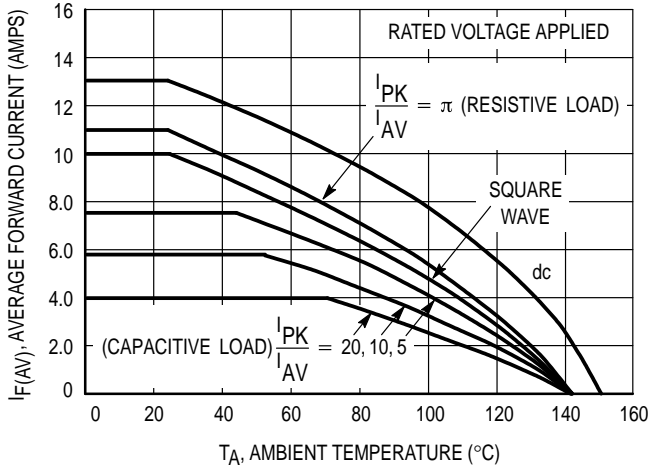


Figure 6. Current Derating,  $R_{\theta JA} = 16^{\circ}\text{C/W}$

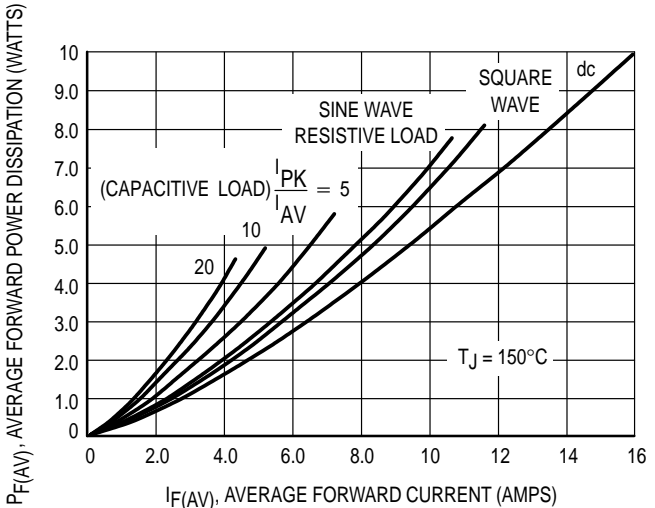


Figure 7. Forward Power Dissipation

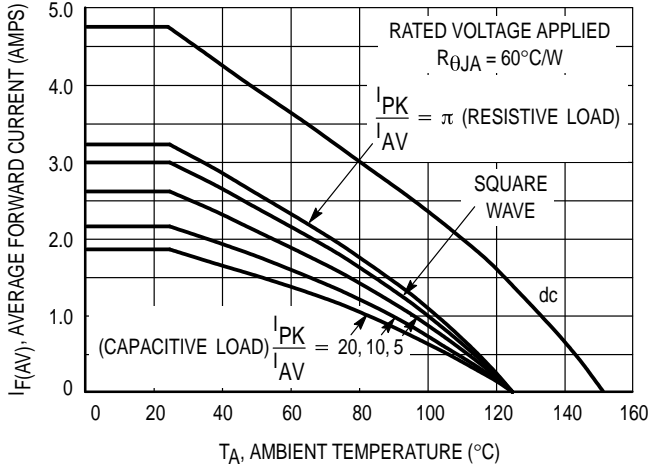


Figure 8. Current Derating, Free Air

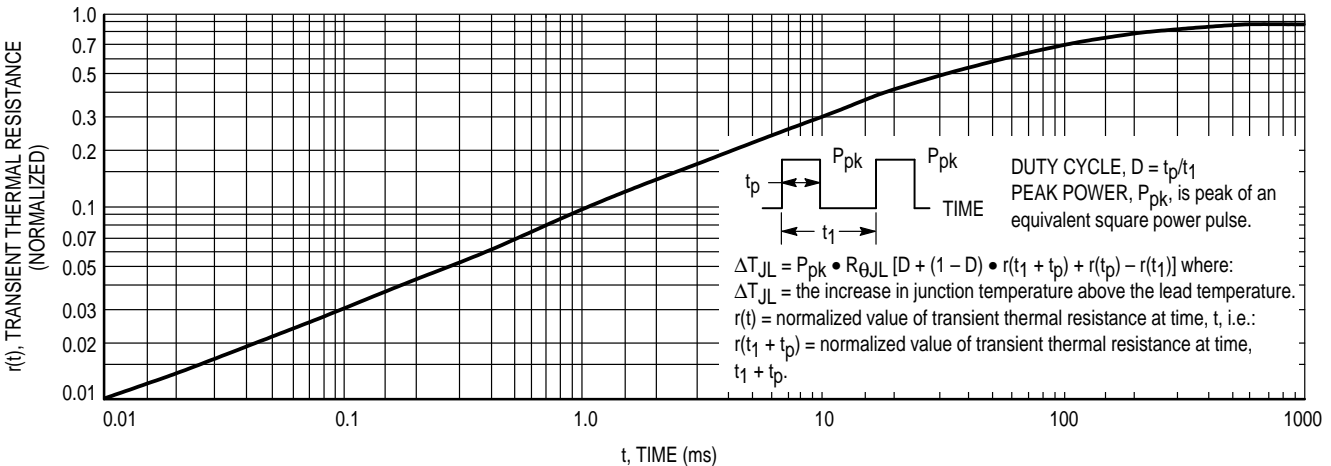
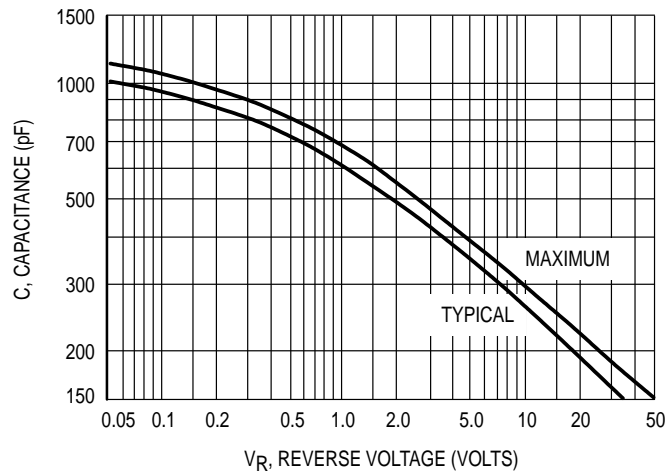


Figure 9. Thermal Response

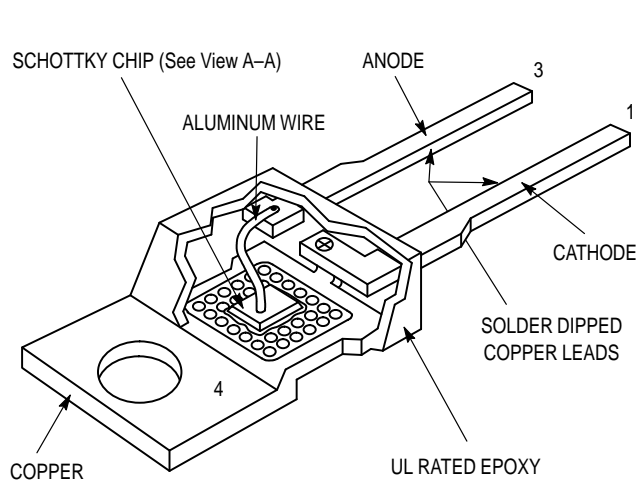
**HIGH FREQUENCY OPERATION**

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.)

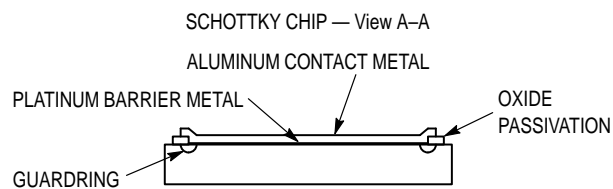
Rectification efficiency measurements show that operation will be satisfactory up to several megahertz. For example, relative waveform rectification efficiency is approximately 70 percent at 2.0 MHz, e.g., the ratio of dc power to RMS power in the load is 0.28 at this frequency, whereas perfect rectification 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**



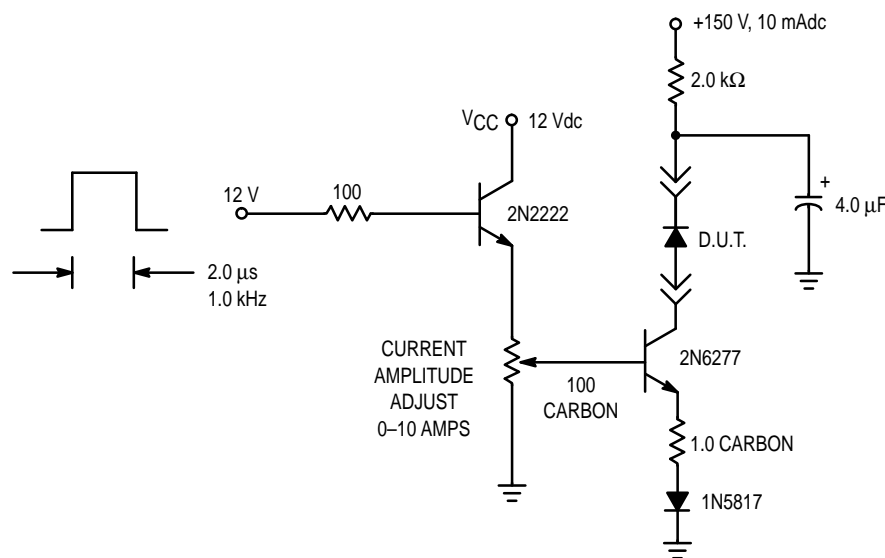
**Figure 11. Schottky Rectifier**



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.

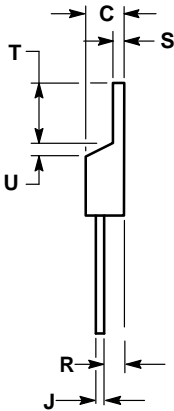
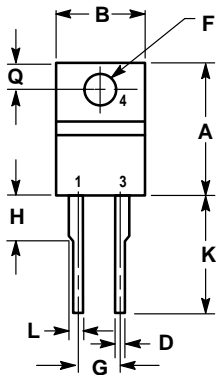
Second is the package. The Schottky chip is bonded to the copper heat sink using a specially formulated solder. This gives the unit the capability of passing 10,000 operating thermal-fatigue cycles having a  $\Delta T_J$  of 100°C. The epoxy molding compound is rated per UL 94, V0 @ 1/8". Wire bonds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

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



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


PACKAGE DIMENSIONS



- NOTES:  
 1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.  
 2. CONTROLLING DIMENSION: INCH.

DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	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	0.000	1.27

CASE 221B-03  
 (TO-220AC)  
 ISSUE B

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