MBR6035PF
MBR6045PF

MOTOROLA

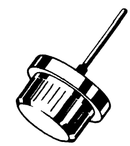
SWITCHMODE POWER RECTIFIERS

. . . using a platinum barrier metal 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 rectfiers in low-voltage, high frequency inverters, free-wheeling diodes, and polarity-protection diodes.

- Guaranteed Reverse Avalanche
- Guardring for dv/dt Stress Protection
- 150°C Operating Junction Temperature
- Low Forward Voltage

SCHOTTKY RECTIFIERS

60 AMPERES
35 and 45 VOLTS



CASE 43-02
(DO-21)

MAXIMUM RATINGS

Rating	Symbol	MBR6035PF	MBR6045PF	Unit
Peak Repetitive Reverse Voltage Working Peak Reverse Voltage DC Blocking Voltage	V_{RRM} V_{RWM} V_R	35	45	Volts
Peak Repetitive Forward Current (Rated V_R, Square Wave, 20 kHz) $T_C = 100°C$	I_{FRM}	← 120 →		Amps
Average Rectified Forward Current (Rated V_R) $T_C = 100°C$	I_O	← 60 →		Amps
Peak Repetitive Reverse Surge Current (2.0 μs, 1.0 kHz) See Figure 7	I_{RRM}	← 2.0 →		Amps
Nonrepetitive Peak Surge Current (Surge applied at rated load conditions halfwave, single phase, 60 Hz)	I_{FSM}	← 800 →		Amps
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

Characteristic	Symbol	Typ	Max	Unit
Thermal Resistance, Junction to Case	$R_{\theta JC}$	0.77	1.0	°C/W

ELECTRICAL CHARACTERISTICS

Characteristic	Symbol	Typ	Max	Unit
Instantaneous Forward Voltage (1) (i_F = 60 Amp, T_C = 25°C) (i_F = 60 Amp, T_C = 125°C) (i_F = 120 Amp, T_C = 125°C)	v_F	— 0.65 0.57 0.70	— 0.70 0.60 0.76	Volts
Instantaneous Reverse Current (1) (Rated Voltage, T_C = 25°C) (Rated Voltage, T_C = 125°C)	i_R	— 0.1 55	— 0.3 100	mA
Capacitance (V_R = 1.0 Vdc, 100 kHz ≤ 1.0 MHz)	C_t	3000	3700	pF

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

FIGURE 1 — TYPICAL FORWARD VOLTAGE

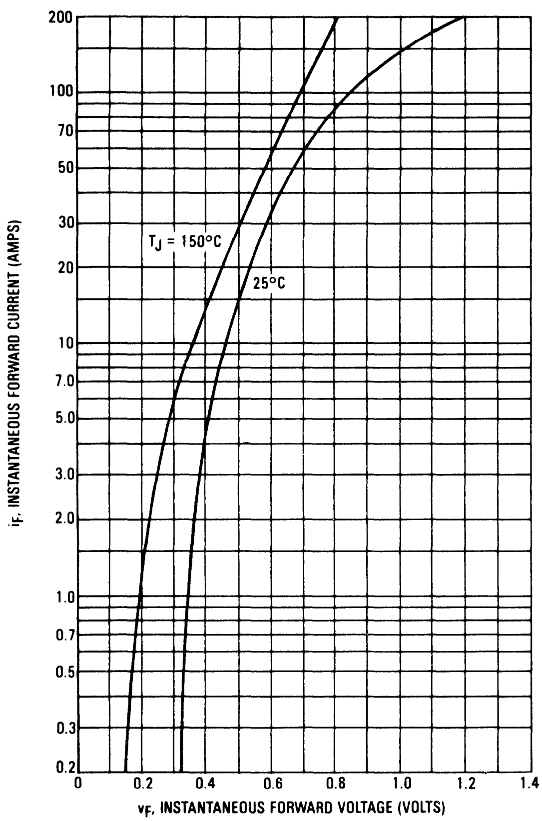


FIGURE 2 — TYPICAL REVERSE CURRENT

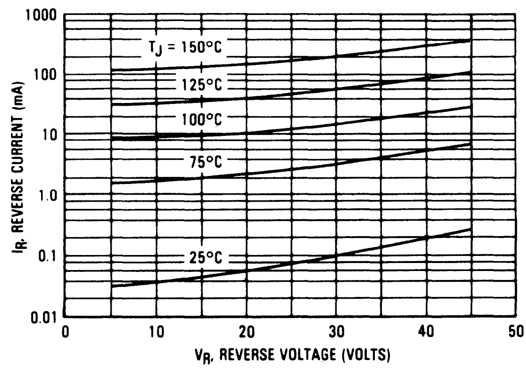


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FIGURE 3 — MAXIMUM SURGE CAPABILITY

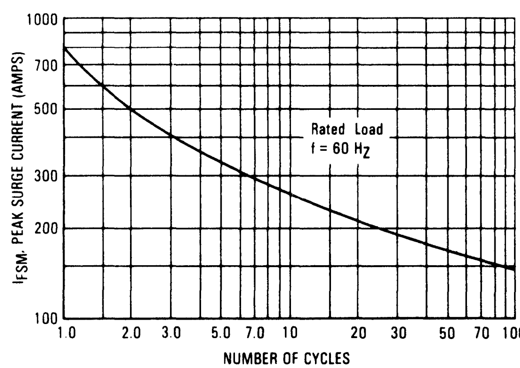
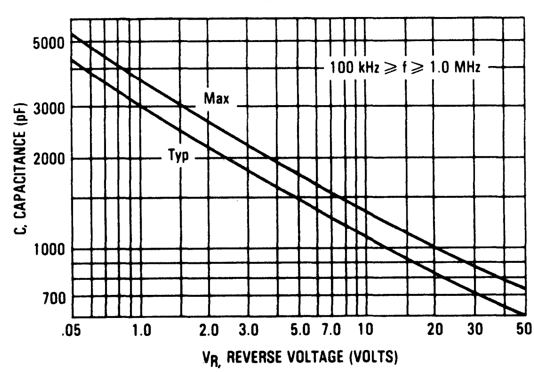


FIGURE 4 — CAPACITANCE



NOTE 1
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 4.)

Rectification efficiency measurements show that operation will be satisfactory up to several megahertz. For example, relative waveform rectification efficiency is approximately 70 per cent 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 5 — FORWARD CURRENT DERATING

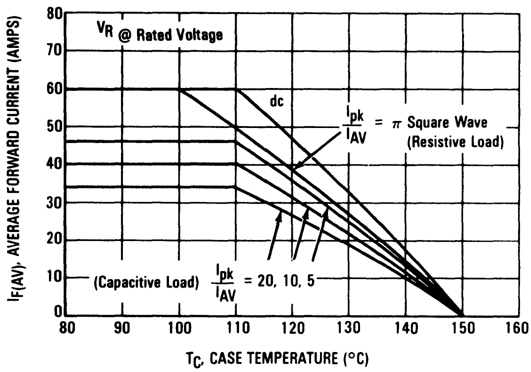
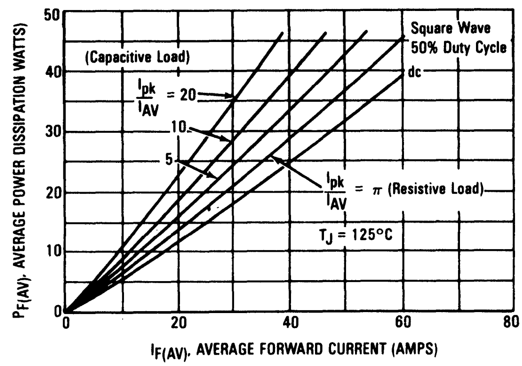


FIGURE 6 — POWER DISSIPATION



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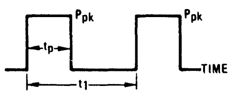
NOTE 2



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. 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_C 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 8, i.e.:

$r(t_1 + t_p)$ = normalized value of transient thermal resistance at time $t_1 + t_p$.

FIGURE 7 — TEST CIRCUIT FOR dv/dt AND REVERSE SURGE CURRENT

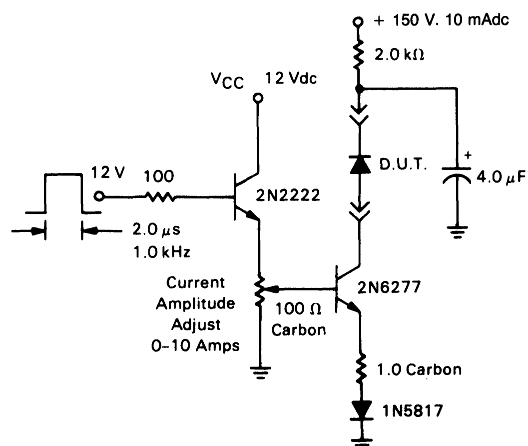


FIGURE 8 — THERMAL RESPONSE

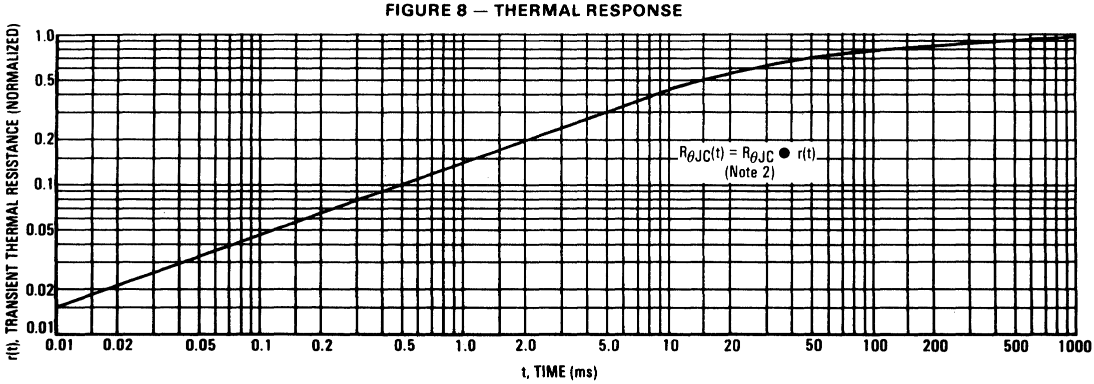
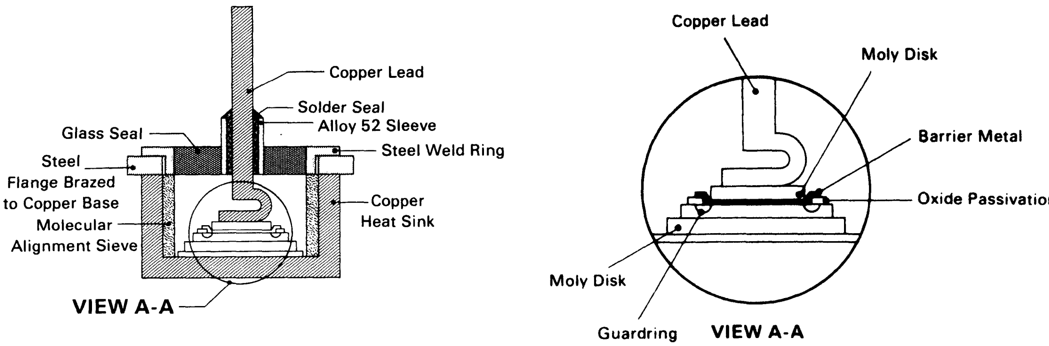


FIGURE 9 — SCHOTTKY RECTIFIER

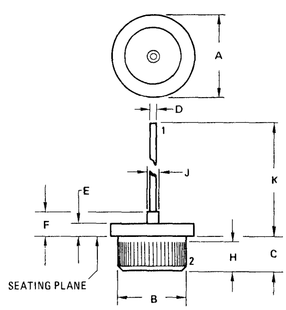


Motorola builds quality and reliability into its Schottky Rectifiers.

First is the chip, which has an interface metal between the platinum-barrier metal and nickel-gold ohmic-contact metal to eliminate any possible interaction with the barrier. The indicated guardring prevents dv/dt problems, so snubbers are not mandatory. The guardring also operates like a zener to absorb overvoltage transients.

Second is the package. There are molybdenum disks which closely match the thermal coefficient of expansion of silicon on each side of the chip. The top copper lead has a stress relief feature which protects the die during assembly. These two features give the unit the capability of passing stringent thermal fatigue tests for 5,000 cycles. The top copper lead provides a low resistance to current and therefore does not contribute to device heating; a heat sink should be used when attaching wires.

Third is the redundant electrical testing. The device is tested before assembly in "sandwich" form, with the chip between the moly disks. It is tested again after assembly. As part of the final electrical test, devices are 100% tested for dv/dt at 1,600 V/μs and reverse avalanche.



DIM	MILLIMETERS MIN	MILLIMETERS MAX	INCHES MIN	INCHES MAX
A	15.494	16.256	0.610	0.640
B	12.725	12.827	0.501	0.505
C	5.08	6.35	0.200	0.250
D	1.193	1.346	0.047	0.053
E	2.032	4.826	0.080	0.190
F	–	10.77	–	0.424
H	4.572	6.350	0.180	0.250
J	–	3.556	–	0.140
K	12.70	–	0.500	–

CASE 43-02
DO-21

MECHANICAL CHARACTERISTICS

CASE: Welded, hermetically sealed

FINISH: All external surfaces corrosion resistant and terminal lead is readily solderable.

POLARITY: Cathode to Case

MOUNTING POSITION: Any

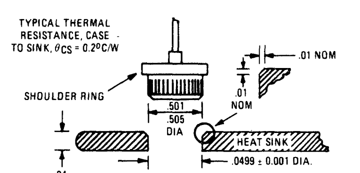
WEIGHT: 9 grams (Approximately)

MOUNTING INFORMATION

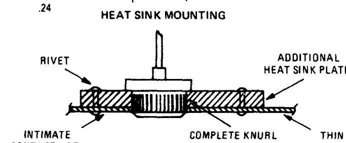
Recommended procedures for mounting are as follows:

1. Drill a hole in the heat sink 0.499 ± 0.001 inch in diameter.
2. Break the hole edge as shown to provide a guide into the hole and prevent shearing off the knurled side of the rectifier.
3. The depth and width of the break should be 0.010 inch maximum to retain maximum heat sink surface contact.
4. To prevent damage to the rectifier during press-in, the pressing force should be applied only on the shoulder ring of the rectifier case.
5. The pressing force should be applied evenly about the shoulder ring to avoid tilting or canting of the rectifier case in the hole during the press-in operation. Also, the use of a thermal lubricant such as D.C. 340 will be of considerable aid.

For more information see: Mounting Techniques for Metal Packaged Power Semiconductors, AN-599.



HEAT SINK MOUNTING



THIN-CHASSIS MOUNTING