MOTOROLA
SEMICONDUCTORS
P.O. BOX 20912 • PHOENIX, ARIZONA 85036

MBR1020
MBR1035
MBR1045

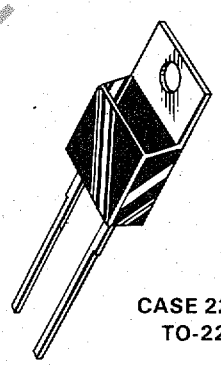
SWITCHMODE POWER RECTIFIERS

... 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, V0 at 1/8"

SCHOTTKY BARRIER RECTIFIERS

10 AMPERES
20 to 45 VOLTS



CASE 221B-01
TO-220AC

MAXIMUM RATINGS

Rating	Symbol	MBR1020	MBR1035	MBR1045	Unit
Peak Repetitive Reverse Voltage Working Peak Reverse Voltage DC Blocking Voltage	V_{RRM} V_{RWM} V_R	20	35	45	Volts
Average Rectified Forward Current (Rated V_R) T_C = 135°C	$I_{F(AV)}$	10	10	10	Amps
Peak Repetitive Forward Current (Rated V_R, Square Wave, 20 kHz) T_C = 135°C	I_{FRM}	20	20	20	Amps
Nonrepetitive Peak Surge Current (Surge applied at rated load conditions halfwave, single phase, 60 Hz)	I_{FSM}	150	150	150	Amps
Peak Repetitive Reverse Surge Current (2.0 μs, 1.0 kHz) See Figure 12	I_{RRM}	1.0	1.0	1.0	Amps
Operating Junction Temperature	T_J	−65 to + 150	−65 to + 150	−65 to + 150	°C
Storage Temperature	T_{stg}	−65 to +175	−65 to +175	−65 to +175	°C
Voltage Rate of Change (Rated V_R)	dv/dt	1000	1000	1000	V/μs

THERMAL CHARACTERISTICS

Characteristic	Symbol	MBR1020	MBR1035	MBR1045	Unit
Maximum Thermal Resistance, Junction to Case	$R_{\theta JC}$	2.0	2.0	2.0	°C/W

ELECTRICAL CHARACTERISTICS

Characteristic	Symbol	MBR1020	MBR1035	MBR1045	Unit
Maximum Instantaneous Forward Voltage (1) (i_F = 10 A, T_C = 125°C) (i_F = 20 A, T_C = 125°C) (i_F = 20 A, T_C = 25°C)	v_F	 0.57 0.72 0.84	 0.57 0.72 0.84	 0.57 0.72 0.84	Volts
Maximum Instantaneous Reverse Current (1) (Rated dc Voltage, T_C = 125°C) (Rated dc Voltage, T_C = 25°C)	i_R	 15 0.1	 25 0.1	 25 0.1	mA

(1) Pulse Test: Pulse Width = 300 μs, Duty Cycle ≤ 2.0%
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FIGURE 1 —MAXIMUM FORWARD VOLTAGE

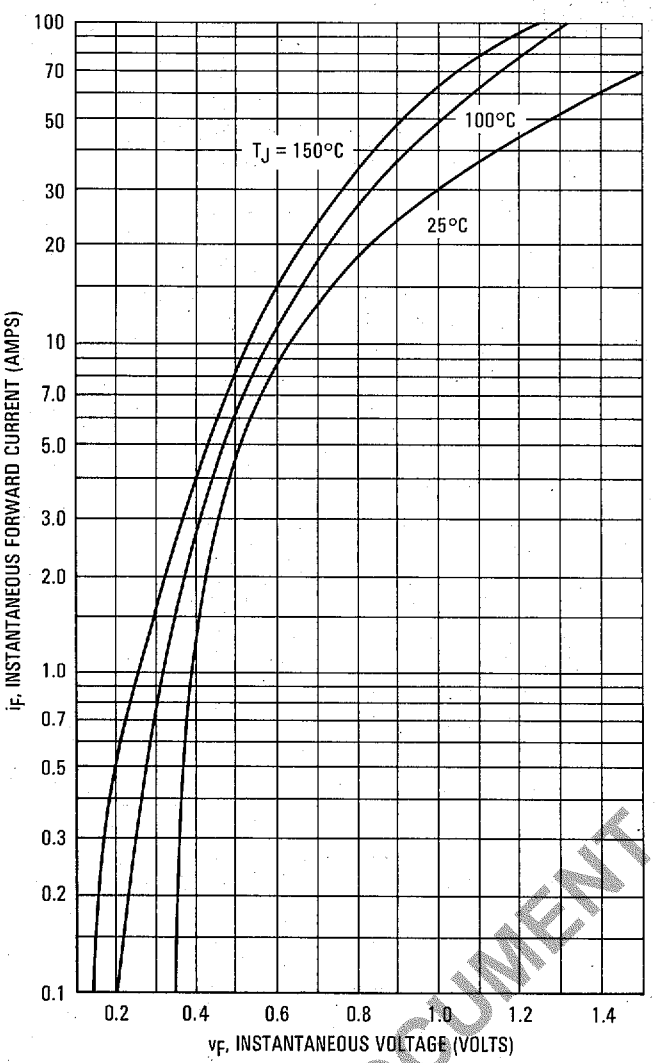


FIGURE 2 —TYPICAL FORWARD VOLTAGE

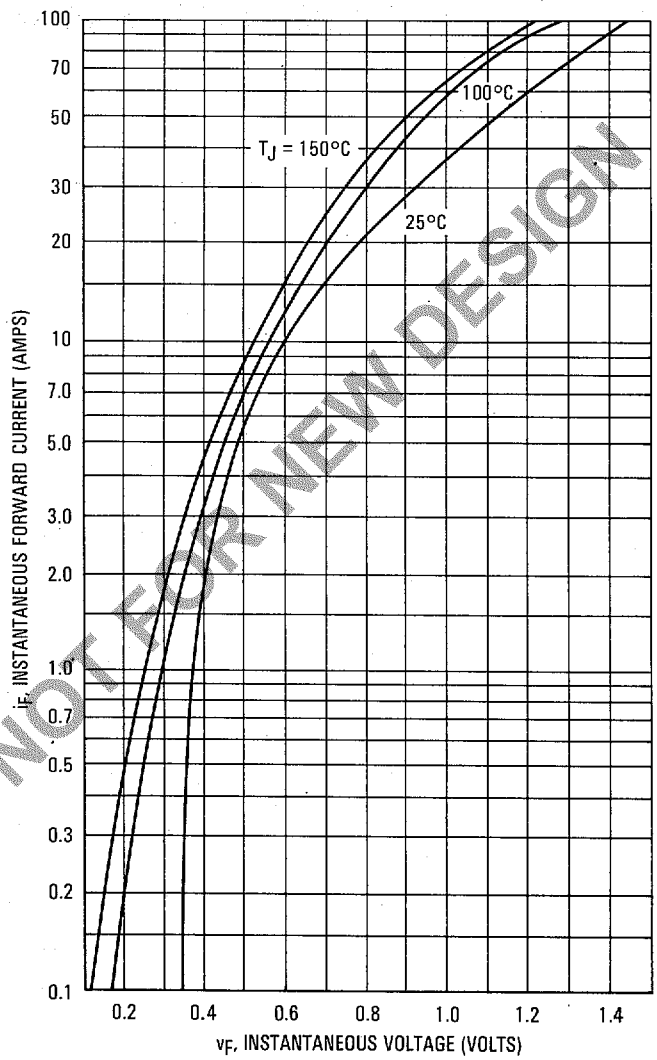


FIGURE 3 — MAXIMUM REVERSE CURRENT

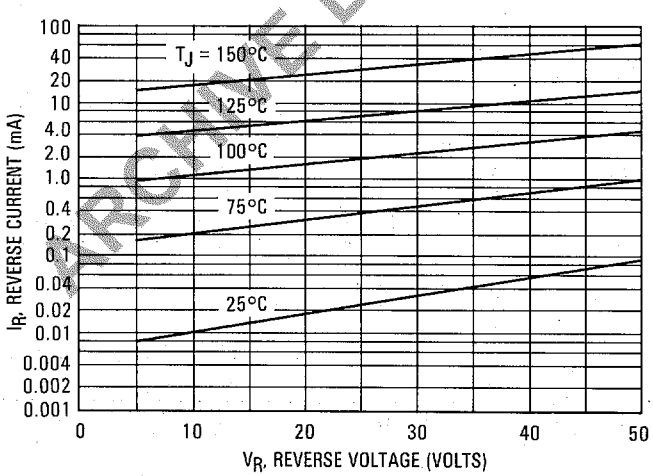


FIGURE 4 — MAXIMUM SURGE CAPABILITY

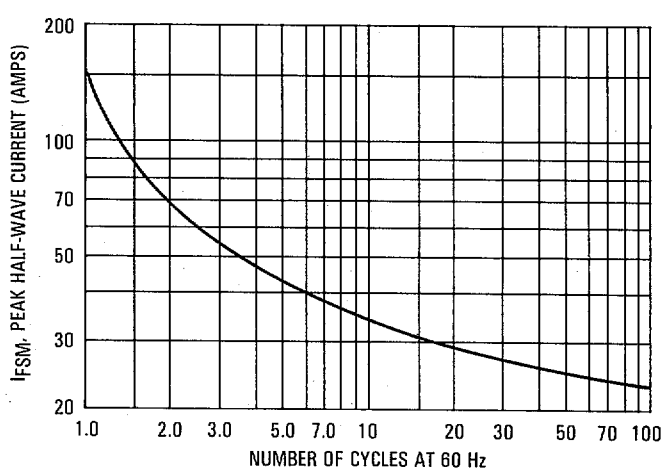


FIGURE 5 — CURRENT DERATING, INFINITE HEATSINK

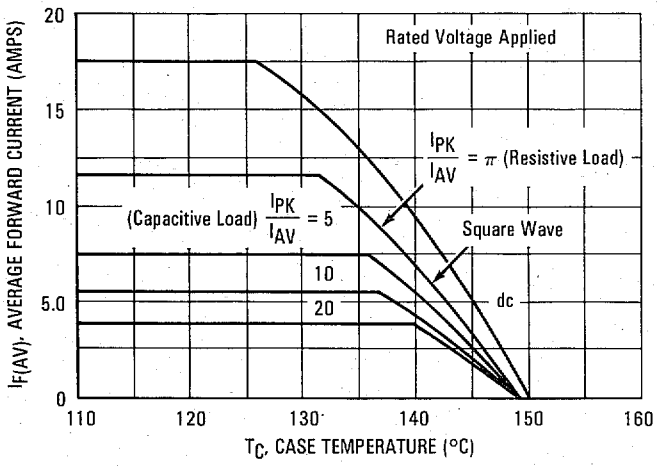


FIGURE 6 — CURRENT DERATING, $R_{\theta JA}$ = 16° C/W

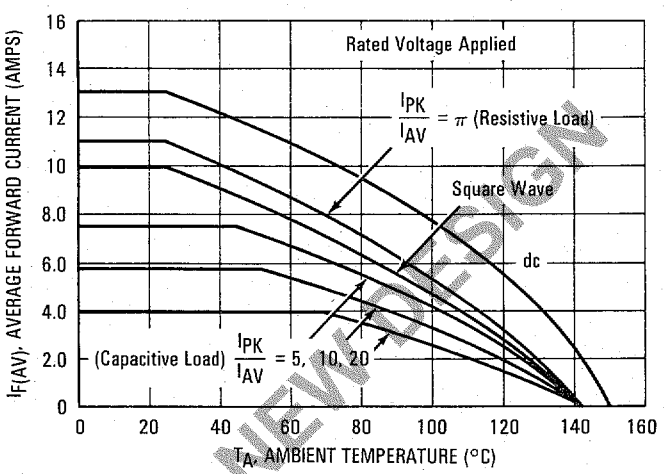


FIGURE 7 — FORWARD POWER DISSIPATION

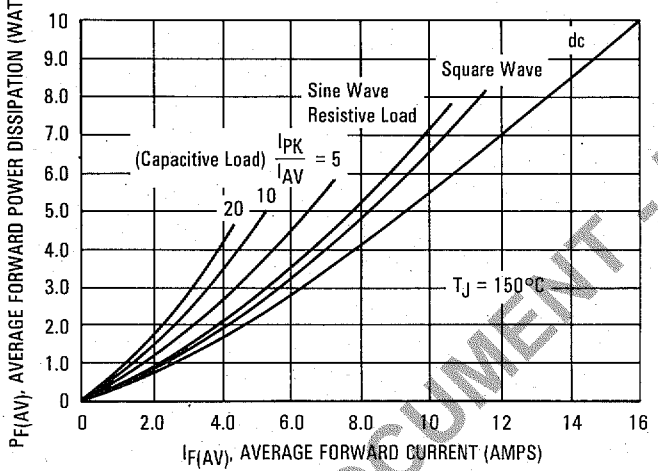


FIGURE 8 — CURRENT DERATING, FREE AIR

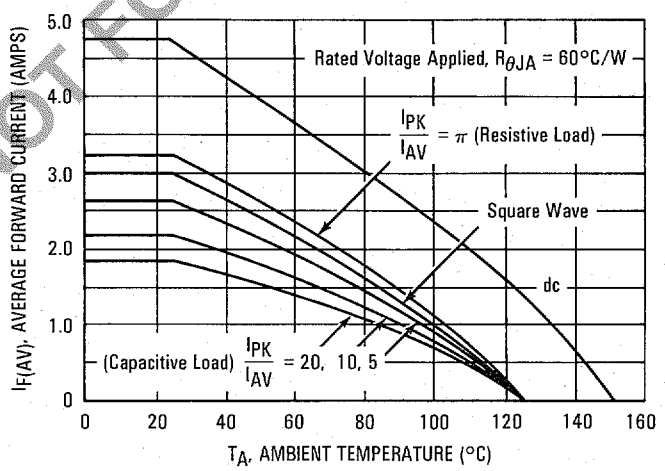
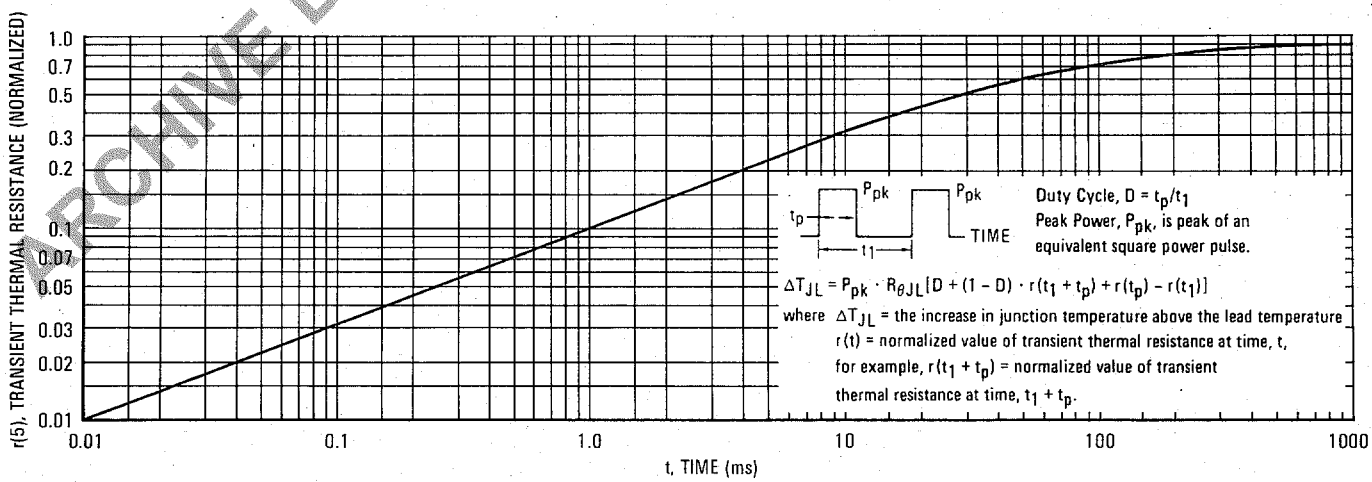


FIGURE 9 — THERMAL RESPONSE



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 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 efficieny 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

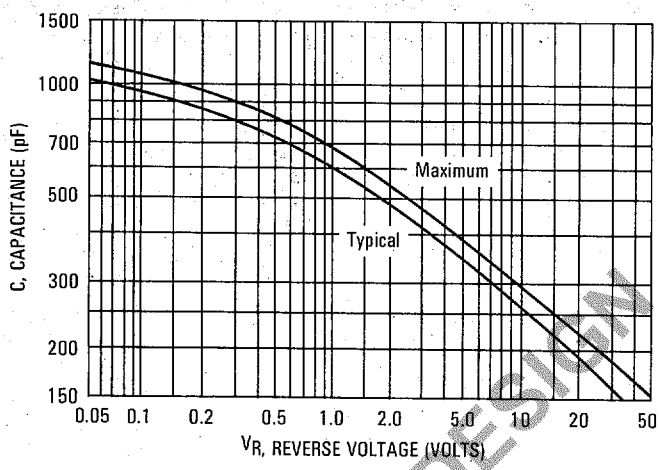
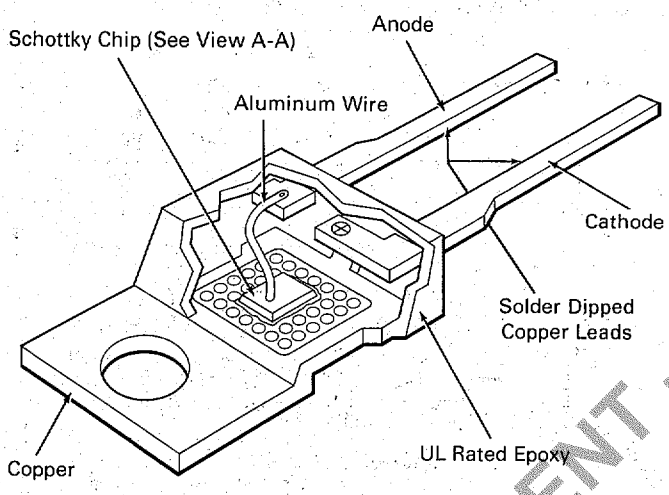
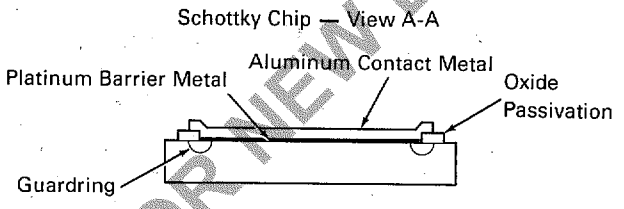


FIGURE 11 — SCHOTTKY RECTIFIER





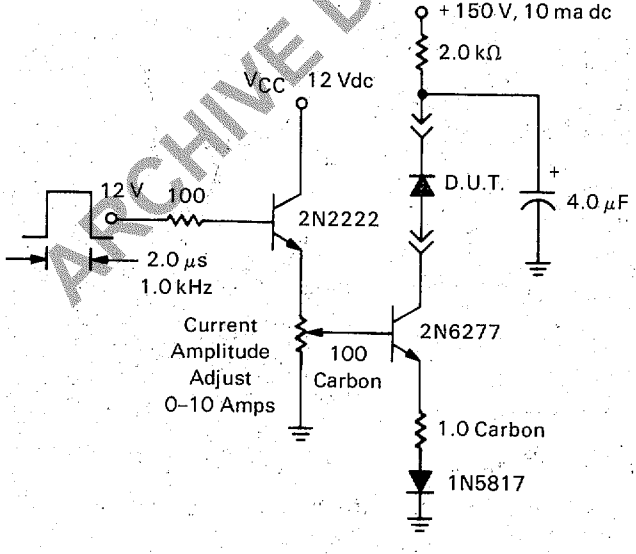
Motorola builds quality and reliability into its Schottky Rectifiers.

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.

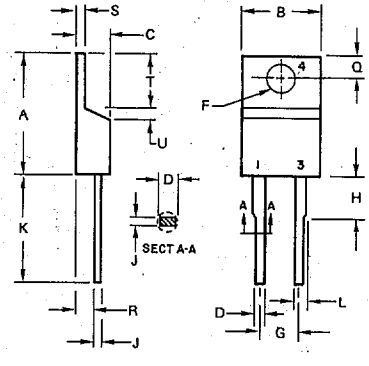
Second is the package. The Schottky chip is bonded to the copper heat sink using a specially formulated solder. This gives the unit the capability of passing 10,000 operating thermal-fatigue cycles having a ΔT_J of 100°C. The epoxy molding compound is rated per UL 94, V0 @ 1/8″. Wire bonds are 100% tested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



OUTLINE DIMENSIONS



STYLE 1:
PIN 1. CATHODE
2. N/A
3. ANODE
4. CATHODE

DIM	MILLIMETERS MIN	MILLIMETERS MAX	INCHES MIN	INCHES MAX
A	15.11	15.75	0.595	0.620
B	9.65	10.29	0.380	0.405
C	4.06	4.82	0.160	0.190
D	0.64	0.89	0.025	0.035
F	3.61	3.73	0.142	0.147
G	4.83	5.33	0.190	0.210
H	2.79	3.30	0.110	0.130
J	0.36	0.56	0.014	0.022
K	12.70	14.27	0.500	0.562
L	1.14	1.27	0.045	0.050
Q	2.54	3.04	0.100	0.120
R	2.04	2.79	0.080	0.110
S	1.14	1.39	0.045	0.055
T	5.97	6.48	0.235	0.255
U	0.76	1.27	0.030	0.050

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MOTOROLA *Semiconductor Products Inc.*

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