MOTOROLA
**SEMICONDUCTOR**
**TECHNICAL DATA**

# MBR6535
# MBR6545

MBR6545 is a Motorola Preferred Device

# 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 rectifiers in low-voltage, high-frequency inverters, free-wheeling diodes, and polarity-protection diodes.

- Guaranteed Reverse Avalanche
- Guardring for dv/dt Stress Protection
- 175°C Operating Junction Temperature
- Low Forward Voltage

**Mechanical Characteristics:**

- Case: Welded steel, hermetically sealed
- Weight: 17 grams (approximately)
- Finish: All External Surfaces Corrosion Resistant and Terminal Lead is Readily Solderable
- Solder Heat: The excellent heat transfer property of the heavy duty copper anode terminal which transmits heat away from the die requires that caution be used when attaching wires. Motorola suggests a heat sink be clamped between the eyelet and the body during any soldering operation.
- Stud Torque: 25 lb-in max
- Shipped 25 units per rail
- Marking: B6535, B6545

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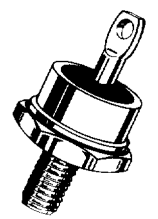
**HIGH TEMPERATURE SCHOTTKY RECTIFIERS**

**65 AMPERES**
**35 and 45 VOLTS**



**CASE 257-01**
**DO-203AB**
**METAL**

**MAXIMUM RATINGS**

| Rating | Symbol | MBR6535 | MBR6545 | Unit |
|---|---|---|---|---|
| Peak Repetitive Reverse Voltage<br>Working Peak Reverse Voltage<br>DC Blocking Voltage | $V_{RRM}$<br>$V_{RWM}$<br>$V_R$ | 35 | 45 | Volts |
| Peak Repetitive Forward Current<br>(Rated $V_R$, Square Wave, 20 kHz) $T_C = 120°C$ | $I_{FRM}$ | 130 | 130 | Amps |
| Average Rectified Forward Current<br>(Rated $V_R$) $T_C = 120°C$ | $I_O$ | 65 | 65 | Amps |
| Peak Repetitive Reverse Surge Current<br>(2.0 μs, 1.0 kHz) See Figure 7 | $I_{RRM}$ | 2 0 | 2 0 | Amps |
| Nonrepetitive Peak Surge Current<br>(Surge applied at rated load conditions halfwave, single phase, 60 Hz) | $I_{FSM}$ | 800 | 800 | Amps |
| Operating Junction Temperature and<br>Storage Temperature | $T_J$, $T_{stg}$ | −65 to +175 | −65 to +175 | °C |
| Voltage Rate of Change<br>(Rated $V_R$) | dv/dt | 1000 | 10000 | V/μs |

**THERMAL CHARACTERISTICS**

| | | | | |
|---|---|---|---|---|
| Maximum Thermal Resistance, Junction to Case | $R_{\theta JC}$ | 1.0 | 1.0 | °C/W |

**ELECTRICAL CHARACTERISTICS**

| | | | | |
|---|---|---|---|---|
| Maximum Instantaneous Forward Voltage (1)<br>($i_F$ = 65 Amp, $T_C$ = 25°C)<br>($i_F$ = 65 Amp, $T_C$ = 150°C)<br>($i_f$ = 130 Amp, $T_C$ = 150°C) | $v_F$ | <br>0.78<br>0.62<br>0.73 | <br>0.78<br>0.62<br>0.73 | Volts |
| Maximum Instantaneous Reverse Current (1)<br>(Rated Voltage, $T_C$ = 25°C)<br>(Rated Voltage, $T_C$ = 150°C) | $i_R$ | <br>0.07<br>125 | <br>0.07<br>125 | mA |
| Capacitance<br>($V_R$ = 1.0 Vdc, 100 kHz ≤ f ≤ 1.0 MHz) | $C_t$ | 3700 | 3700 | pF |

(1) Pulse Test: Pulse Width = 300 μs, Duty Cycle ≤ 2 0%

Rev 1

FIGURE 1 — TYPICAL FORWARD VOLTAGE

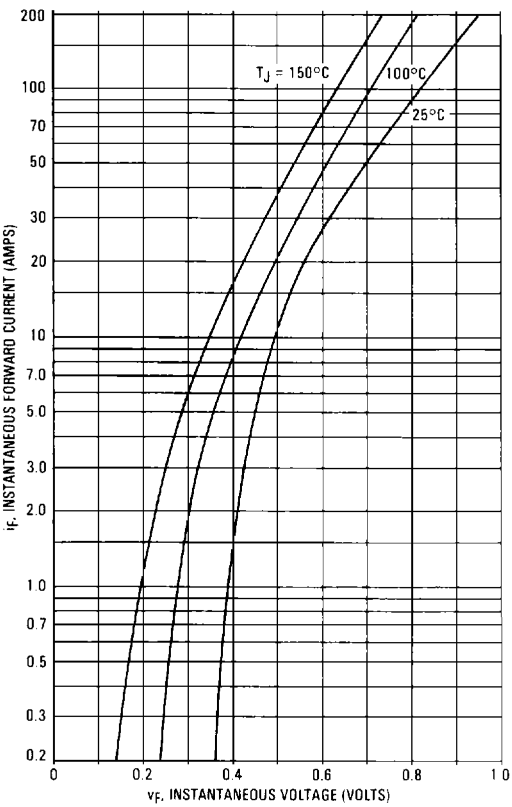



FIGURE 2 — TYPICAL REVERSE CURRENT

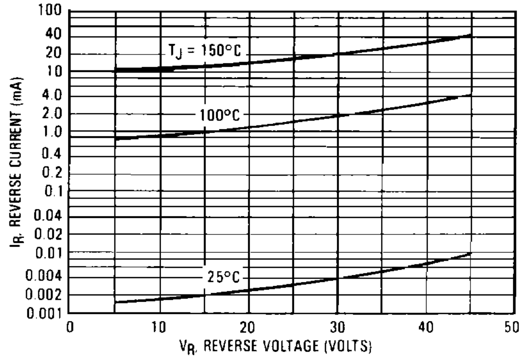
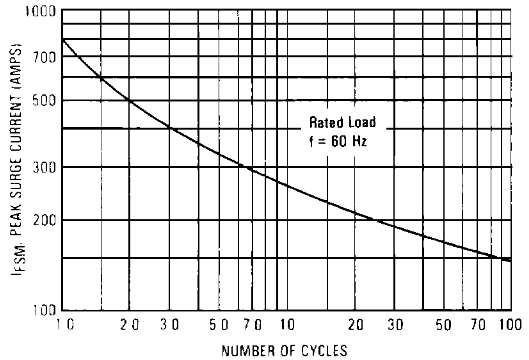





FIGURE 3 — MAXIMUM SURGE CAPABILITY




## 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 4 — CAPACITANCE

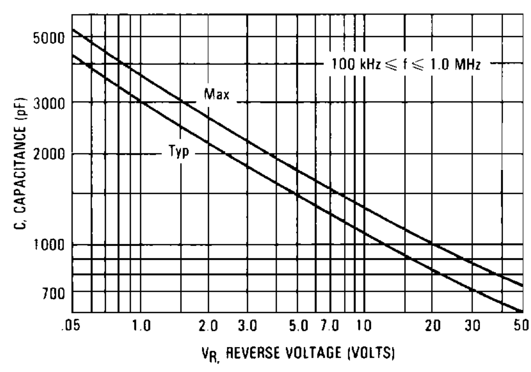


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**FIGURE 5 — FORWARD CURRENT DERATING**

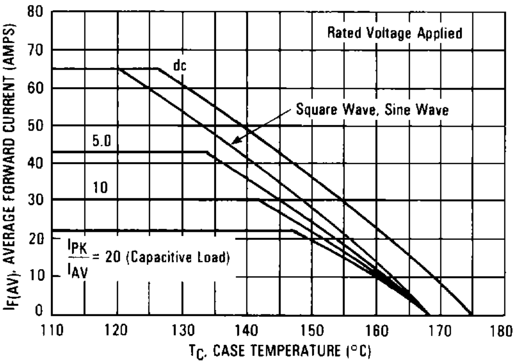
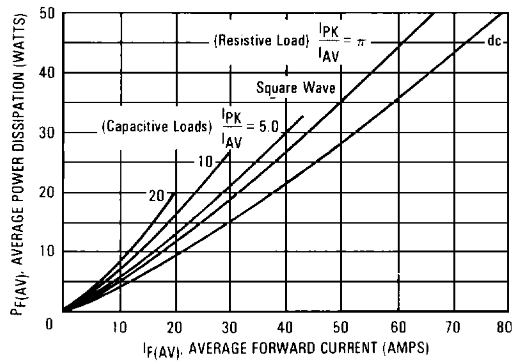
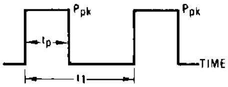



**FIGURE 6 — POWER DISSIPATION**




## 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 $\Delta T_C$ 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**

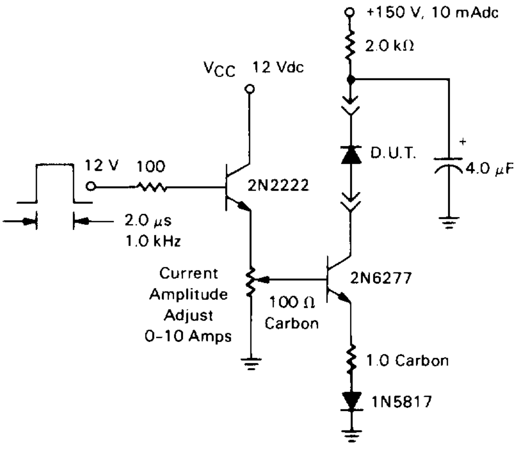



**FIGURE 8 — THERMAL RESPONSE**

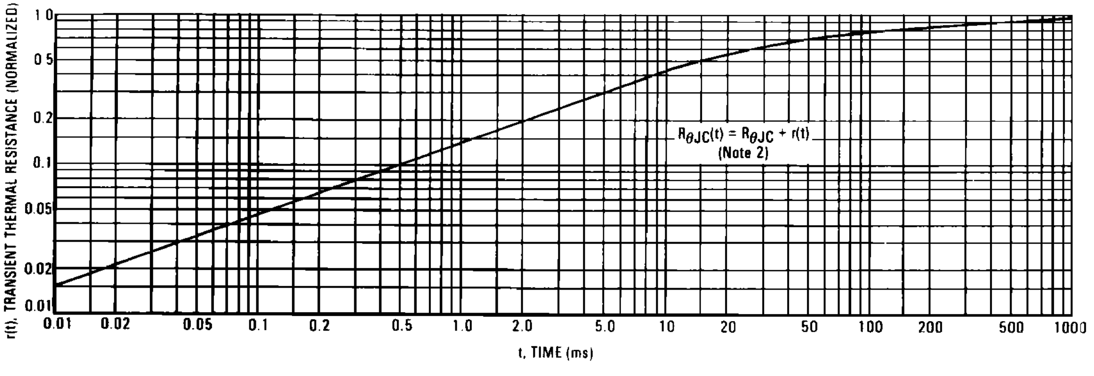
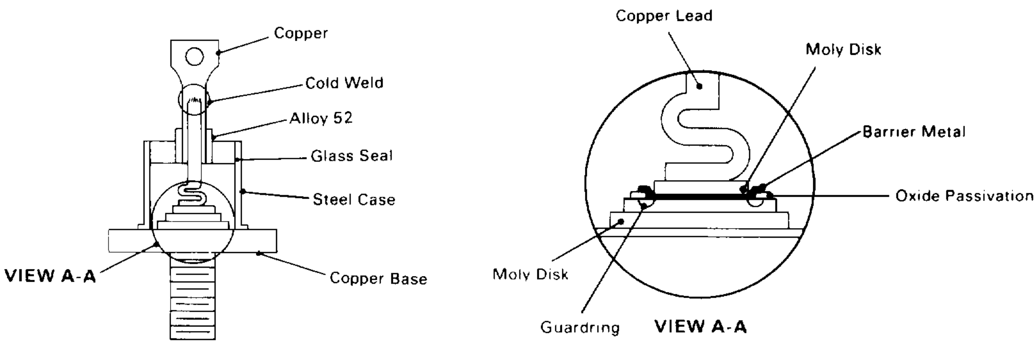


**FIGURE 9 — SCHOTTKY RECTIFIER**




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/$\mu$s and reverse avalanche.