New Jersey Semi-Conductor Products, Inc.

20 STERN AVE.
SPRINGFIELD, NEW JERSEY 07081
U.S.A.

TELEPHONE: (973) 376-2922
(212) 227-6005
FAX: (973) 376-8960

MR501, MR502, MR504
MR506, MR508, MR510

Designers Data Sheet

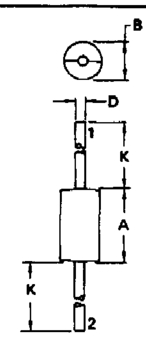
MINIATURE SIZE, AXIAL LEAD MOUNTED STANDARD RECOVERY POWER RECTIFIERS

. . . 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

STANDARD RECOVERY POWER RECTIFIERS

100-1000 VOLTS
3 AMPERE



STYLE 1:
PIN 1. CATHODE
2. ANODE

DIM	MILLIMETERS MIN	MILLIMETERS MAX	INCHES MIN	INCHES MAX
A	9.40	9.65	0.370	0.380
B	4.83	5.33	0.190	0.210
D	1.22	1.32	0.048	0.052
K	26.97	27.23	1.062	1.072

CASE 267-01

Designer's Data for "Worst Case" Conditions

The Designers Data sheets permit the design of most circuits entirely from the information presented. Limit curves — representing boundaries on device characteristics — are given to facilitate "worst case" design.

MAXIMUM RATINGS

Rating	Symbol	MR 501	MR 502	MR 504	MR 506	MR 508	MR 510	Unit
Peak Repetitive Reverse Voltage Working Peak Reverse Voltage DC Blocking Voltage	V_{RRM} V_{RWM} V_R	100	200	400	600	800	1000	Volts
Non-Repetitive Peak Reverse Voltage	V_{RSM}	150	250	450	650	850	1050	Volts
Average Rectified Forward Current (Single phase resistive load, T_A = 95°C, PC Board Mounting) (1) (EIA Standard Conditions L = 1/32", T_L = 85°C)	I_O	3.0 8.0						Amp
Non-Repetitive Peak Surge Current (surge applied at rated load conditions)	I_{FSM}	100 (one cycle)						Amp
Operating and Storage Junction Temperature Range (2)	T_J, T_{stg}	−65 to +175						°C

THERMAL CHARACTERISTICS

Characteristic	Symbol	Max	Unit
Thermal Resistance, Junction to Ambient (Recommended Printed Circuit Board Mounting, See Note 2 on Page 4).	$R_{\theta JA}$	28	°C/W

ELECTRICAL CHARACTERISTICS

Characteristic	Symbol	Min	Typ	Max	Unit
Instantaneous Forward Voltage (3) (i_F = 9.4 Amp, T_J = 175°C) (i_F = 9.4 Amp, T_J = 25°C)	v_F	 – –	 0.9 1.04	 1.0 1.1	Volts
Reverse Current (rated dc voltage) (3) T_J = 25°C T_J = 100°C	I_R	 – –	 0.1 2.8	 5.0 25	μA

(1) Derate for reverse power dissipation. See Note on Page 2.
(2) Derate as shown in Figure 1.
(3) Pulse Test: Pulse Width = 300 μs, Duty Cycle = 2.0%.

MECHANICAL CHARACTERISTICS

Case: Void Free, Transfer Molded
Finish: External Leads are Plated, Leads are readily Solderable
Polarity: Indicated by Cathode Band
Weight: 1.1 Grams (Approximately)
Maximum Lead Temperature for Soldering Purposes:
300°C, 1/8" from case for 10 s at 5.0 lb. tension

NOTE 1: DETERMINING MAXIMUM RATINGS

Reverse power dissipation and the possibility of thermal runaway must be considered when operating this rectifier at reverse voltages above 200 volts. *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 (175°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

Figure 1 permits easier use of equation (1) by taking reverse power dissipation and thermal runaway into consideration. The figure solves 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 = 175°C, when forward power is zero. The transition from one boundary condition to the other is evident on the curves of Figure 1 as a *difference in the rate of change of the slope in the vicinity of 165°C.* The data of Figure 1 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; i.e.:

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

The Factor F is derived by considering the properties of the various rectifier circuits and the rectifiers reverse characteristics.

Example: Find $T_{A(max)}$ for MR510 operated in a 400 Volt dc supply using a full wave center-tapped circuit with capacitive filter such that I_{DC} = 6.0 A, ($I_{F(AV)}$ = 3.0 A), $I_{(PK)}/I_{(AV)}$ = 10, Input Voltage = 283 V(rms) (line to center tap), $R_{\theta JA}$ = 28°C/W.

Step 1: Find $V_{R(equiv)}$. Read F = 1.11 from Table 1 ∴ $V_{R(equiv)}$ = 1.41)(283)(1.11) = 444 V

Step 2: Find T_R from Figure 1. Read T_R = 167°C @ V_R = 444 V & $R_{\theta JA}$ = 28°C/W.

Step 3: Find $P_{F(AV)}$ from Figure 8. Read $P_{F(AV)}$ = 4 W @ $\frac{I_{PK}}{I_{AV}}$ = 10 & $I_{F(AV)}$ = 3.0 A

Step 4: Find $T_{A(max)}$ from equation (3). $T_{A(max)}$ = 167-(28)(4) = 55°C.

TABLE I — VALUES FOR FACTOR F

Circuit	Half Wave		Full Wave, Bridge		Full Wave Center-Tapped*†	
Load	Resistive	Capacitive*	Resistive	Capacitive	Resistive	Capacitive
Sine Wave	0.45	1.11	0.45	0.55	0.90	1.11
Square Wave	0.61	1.22	0.61	0.61	1.22	1.22

*Note that $V_{R(PK)} \approx 2\,V_{in(PK)}$ †Use line to center tap voltage for V_{in}.

FIGURE 1 — MAXIMUM REFERENCE TEMPERATURE

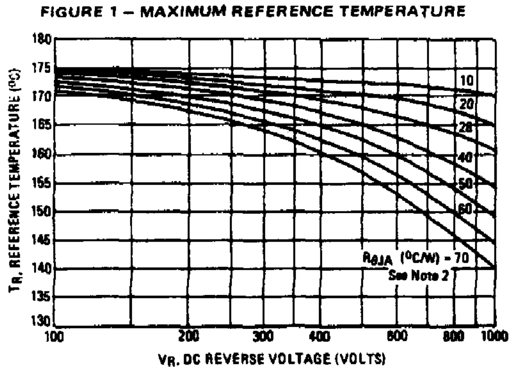


FIGURE 2 — FORWARD POWER DISSIPATION