MR 910 SERIES

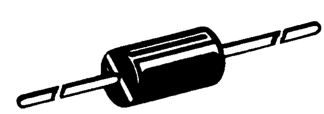
Designers Data Sheet

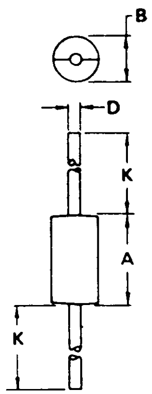
SUBMINIATURE SIZE, AXIAL LEAD MOUNTED FAST RECOVERY POWER RECTIFIERS

. . . designed for special applications such as dc power supplies, inverters, converters, ultrasonic systems, choppers, low RF interference and free wheeling diodes. A complete line of fast recovery rectifiers having typical recovery time of 500 nanoseconds providing high efficiency at frequencies to 100 kHz.

FAST RECOVERY POWER RECTIFIERS

50-1000 VOLTS
3 AMPERE





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

MAXIMUM RATINGS

Rating	Symbol	MR 910	MR 911	MR 912	MR 914	MR 916	MR 917	MR 918	Units
Peak Repetitive Reverse Voltage Working Peak Reverse Voltage DC Blocking Voltage	V_{RRM} V_{RWM} V_R	50	100	200	400	600	800	1000	Volts
Non-Repetitive Peak Reverse Voltage	V_{RSM}	100	200	300	525	800	1000	1200	Volts
Average Rectified Forward Current (Single phase resistive load, $T_A = 90^\circ C$)	I_O	← 3.0 →							Amp
Non-Repetitive Peak Surge Current (surge applied at rated load conditions)	I_{FSM}	← 100 (one cycle) →							Amp
Operating and Storage Junction Temperature Range	T_J, T_{stg}	← -65 to +175 →							°C

THERMAL CHARACTERISTICS

Characteristic	Symbol	Max	Unit
Thermal Resistance, Junction to Ambient	$R_{\theta JA}$	28	°C/W

ELECTRICAL CHARACTERISTICS

Characteristic	Symbol	Min	Typ	Max	Unit
Instantaneous Forward Voltage ($I_F = 9.4$ Amp, $T_J = 175^\circ C$)	v_F	–	0.9	1.1	Volts
Forward Voltage ($I_F = 3.0$ Amp, $T_J = 25^\circ C$)	V_F	–	1.04	1.25	Volts
Reverse Current (rated dc voltage) $T_J = 25^\circ C$	I_R	–		10	μA
$T_J = 100^\circ C$		–	–	300	μA

REVERSE RECOVERY CHARACTERISTICS

Characteristic	Symbol	Min	Typ	Max	Unit
Reverse Recovery Time ($I_F = 1.0$ Amp to $V_R = 30$ Vdc	t_{rr}	–		750	ns
Reverse Recovery Current ($I_F = 1.0$ Amp to $V_R = 30$ Vdc	$I_{RM(REC)}$	–	–	3.0	Amp

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:
240°C, 1/8" from case for 10 s at 5.0 lb. tension

STATIC CHARACTERISTICS

FIGURE 1 – FORWARD VOLTAGE

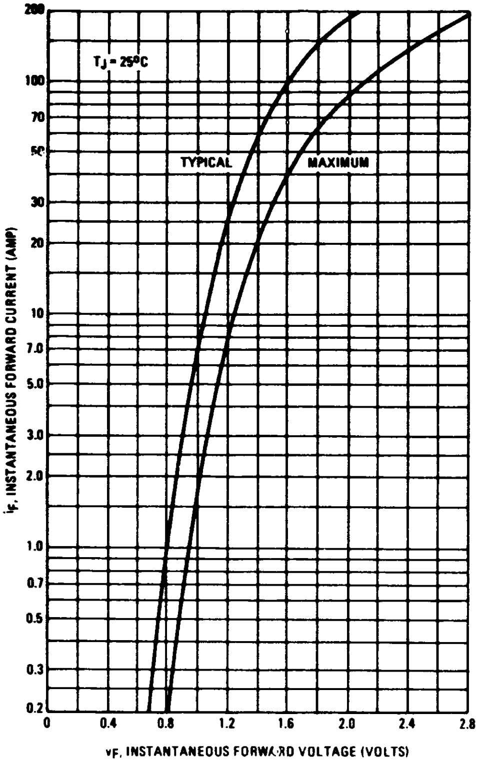


FIGURE 2 – MAXIMUM SURGE CAPABILITY

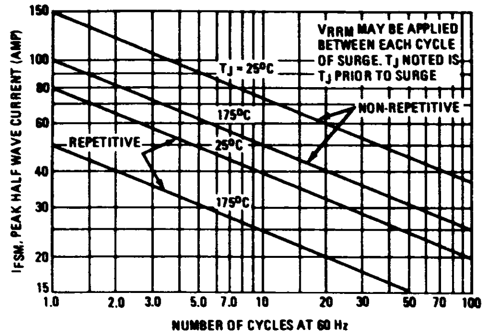
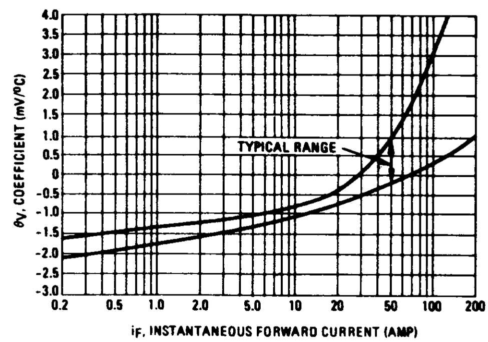
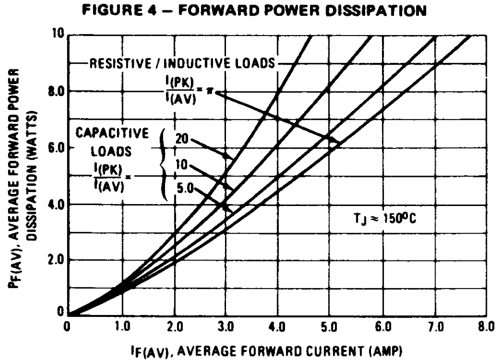


FIGURE 3 – FORWARD VOLTAGE TEMPERATURE COEFFICIENT



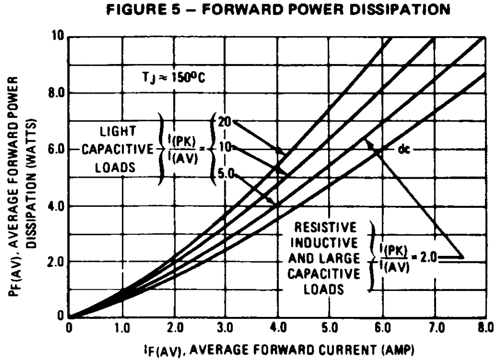
SINE WAVE INPUT

FIGURE 4 – FORWARD POWER DISSIPATION



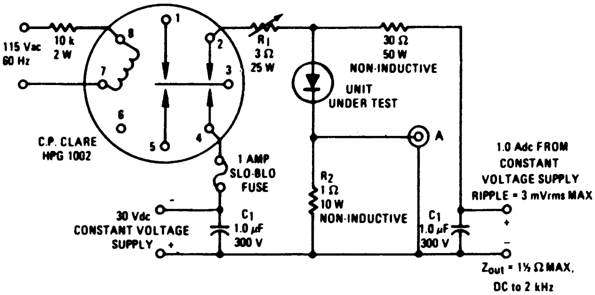
SQUARE WAVE INPUT

FIGURE 5 – FORWARD POWER DISSIPATION



DYNAMIC CHARACTERISTICS

FIGURE 6 – REVERSE RECOVERY CIRCUIT



MINIMIZE ALL LEAD LENGTHS

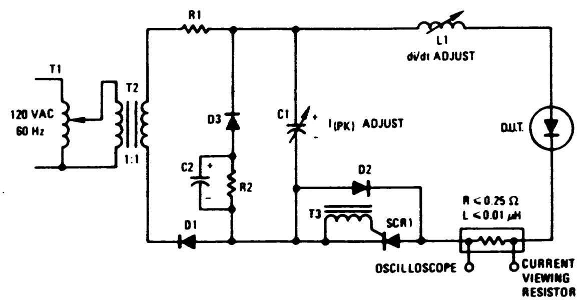
A – TEKTRONIX 545A, K PLUG IN PRE-AMP, P6000 PROBE OR EQUIVALENT

R_1 – ADJUSTED FOR 1.4 Ω BETWEEN POINT 2 OF RELAY AND RECTIFIER INDUCTANCE ≈ 38 µH

R_2 – TEN-1 W, 10 Ω, 1% CARBON CORE IN PARALLEL

$T_A = 25\ ^{+10}_{-0}$ °C FOR RECTIFIER

FIGURE 7 – JEDEC REVERSE RECOVERY CIRCUIT



R1 = 50 Ohms
R2 = 250 Ohms
D1 = 1N4723
D2 = 1N4001
D3 = 1N4934
SCR1 = MCR729-10
C1 = 0.5 to 50 µF
C2 ≈ 4000 µF
L1 = 1.0 - 27 µH
T1 = Variac Adjusts $I_{(PK)}$ and di/dt
T2 = 1:1
T3 = 1:1 (to trigger circuit)

FIGURE 8 – FORWARD RECOVERY TIME

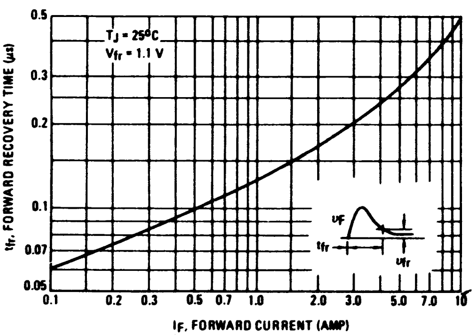


FIGURE 9 – JUNCTION CAPACITANCE

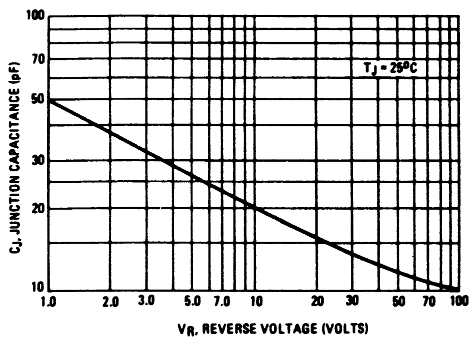


FIGURE 10 – THERMAL RESPONSE

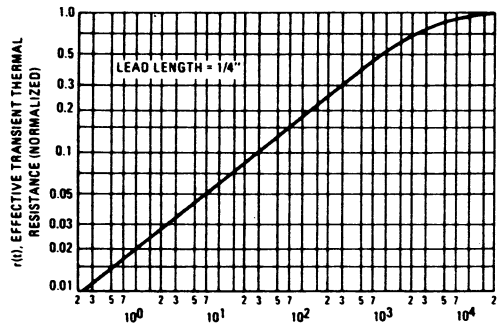
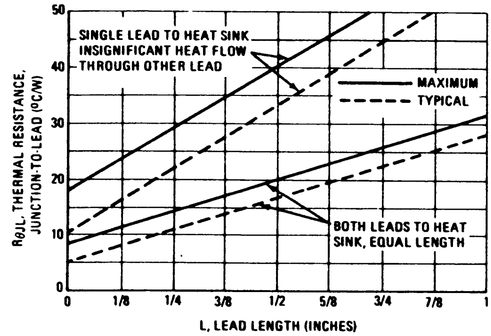


FIGURE 11 – STEADY STATE THERMAL RESISTANCE



NOTE 1

To determine maximum junction temperature of the diode in a given situation, the following procedure is recommended:

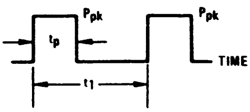
The temperature of the lead should be measured using a thermocouple placed on the lead as close as possible to the tie point. The thermal mass connected to the tie point is normally large enough so that it will not significantly respond to heat surges generated in the diode as a result of pulsed operation once steady-state conditions are achieved. Using the measured value of T_L, the junction temperature may be determined by:

$$T_J = T_L + \Delta T_{JL}$$

where ΔT_{JL} is the increase in junction temperature above the lead temperature. It may be determined by:

$$\Delta T_{JL} = P_{pk} \cdot R_{\theta JL} [D + (1 - D) \cdot r(t_1 + t_p) + r(t_p) - r(t_1)]$$

where $r(t)$ = normalized value of transient thermal resistance at time t from Figure 29, i.e.,
$r(t_1 + t_p)$ = normalized value of transient thermal resistance at time $t_1 + t_p$.



DUTY CYCLE = t_p/t_1
PEAK POWER, P_{pk}, is peak of an equivalent square power pulse.

NOTE 2

Use of the above model permits junction to lead thermal resistance for any mounting configuration to be found. For a given total lead length, lowest values occur when one side of the rectifier is brought as close as possible to the heat sink. Terms in the model signify:

T_A = Ambient Temperature
T_L = Lead Temperature
T_C = Case Temperature
T_J = Junction Temperature
$R_{\theta S}$ = Thermal Resistance, Heat Sink to Ambient
$R_{\theta L}$ = Thermal Resistance, Lead to Heat Sink
$R_{\theta J}$ = Thermal Resistance, Junction to Case
P_D = Total Power Dissipation = $P_F + P_R$
P_F = Forward Power Dissipation
P_R = Reverse Power Dissipation

(Subscripts A and K refer to anode and cathode sides respectively.)
Values for thermal resistance components are:

$R_{\theta L}$ = 46°C/W/IN. Typically and 48°C/W/IN Maximum.
$R_{\theta J}$ = 10°C/W Typically and 16°C/W Maximum.

The maximum lead temperature may be found as follows:

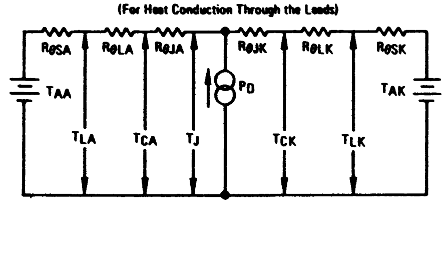
$$T_L = T_{J(max)} - \Delta T_{JL}$$

where

ΔT_{JL} can be approximated as follows:

$\Delta T_{JL} \approx R_{\theta JL} \cdot P_D$; P_D is the sum of forward and reverse power dissipation shown in Figures 2 and 4 for sine wave operation and Figures 3 and 5 for square wave operation.

THERMAL CIRCUIT MODEL
(For Heat Conduction Through the Leads)



NOTE 3

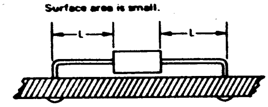
Data shown for thermal resistance junction-to-ambient ($R_{\theta JA}$) for the mountings shown is to be used as typical guideline values for preliminary engineering or in case the tie point temperature cannot be measured.

TYPICAL VALUES FOR $R_{\theta JA}$ IN STILL AIR

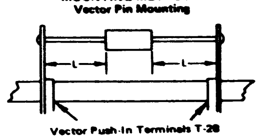
MOUNTING METHOD	LEAD LENGTH, L (IN)				$R_{\theta JA}$
	1/8	1/4	1/2	3/4	
1	50	51	53	55	°C/W
2	58	59	61	63	°C/W
3	28				°C/W

MOUNTING METHOD 1

P.C. Board Where Available Copper Surface area is small.



MOUNTING METHOD 2
Vector Pin Mounting



MOUNTING METHOD 3

P.C. Board with 1-1/2" x 1-1/2" Copper Surface