DIGITRON™ Semiconductors

High-reliability discrete products
and engineering services since 1977

MR2000 SERIES

MEDIUM CURRENT SILICON RECTIFIERS

FEATURES

- Available as "HR" (high reliability) screened per MIL-PRF-19500, JANTX level. Add "HR" suffix to base part number.
- Available as non-RoHS (Sn/Pb plating), standard, and as RoHS by adding "-PBF" suffix.

MAXIMUM RATINGS

Ratings	Symbol	MR2000	MR2001	MR2002	MR2004	MR2006	MR2008	MR2010	Unit
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 (half-wave, single phase, 60Hz peak)	V_{RSM}	60	120	240	480	720	960	1200	Volts
RMS forward current	$I_{(RMS)}$	40							Amps
Average rectified forward current (single phase, resistive load, 60Hz, T_C = 150°C)	I_O	20							Amps
Non-repetitive peak surge current (surge applied @ rated load conditions, half wave, single phase, 60Hz)	I_{FSM}	400(1 cycle)							Amps
Operating and storage temperature range	T_J, T_{stg}	-65 to +175							°C
Maximum thermal resistance, junction to case	$R_{\Theta JC}$	1.3							°C/W

ELECTRICAL CHARACTERISTICS (T_A = 25°C unless otherwise specified)

Characteristic	Symbol	Maximum	Unit
Maximum instantaneous forward voltage (I_F = 63A, T_C = 25°C)	V_F	1.1	Volts
Maximum reverse current (rated dc voltage) T_C = 25°C T_C = 100°C	I_R	 100 500	µA

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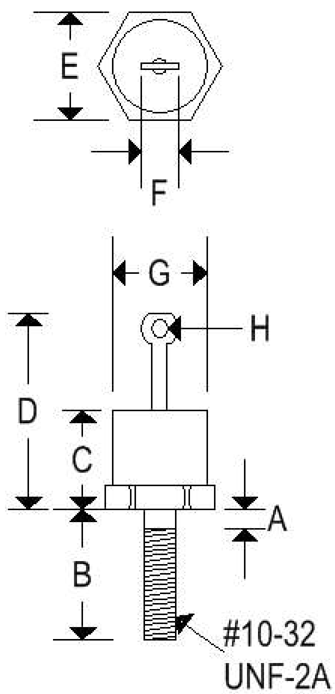
MECHANICAL CHARACTERISTICS

Case	DO-4(R)
Marking	Alpha-numeric
Normal polarity	Cathode is stud
Reverse polarity	Anode is stud (add "R" suffix)



	DO-4(R)			
	Inches		Millimeters	
	Min	Max	Min	Max
A	-	0.078	-	1.981
B	0.422	0.453	10.719	11.506
C	-	0.405	-	10.287
D	-	0.800	-	20.320
E	0.420	0.440	10.668	11.176
F	-	0.250	-	6.350
G	-	0.424	-	10.770
H	0.066	-	1.676	-

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FIGURE 1 – FORWARD VOLTAGE

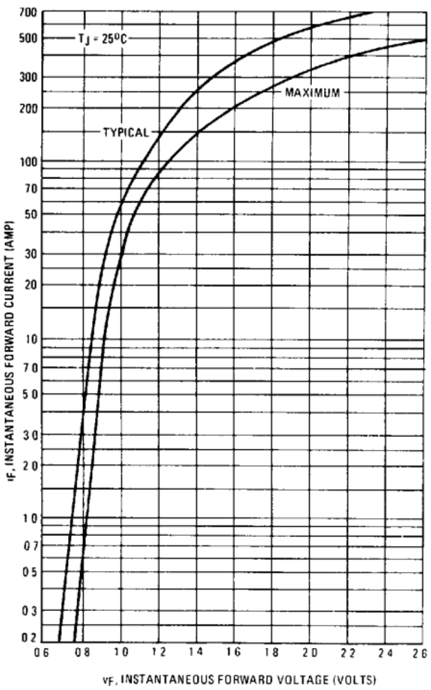

FIGURE 2 – NON-REPETITIVE SURGE CURRENT

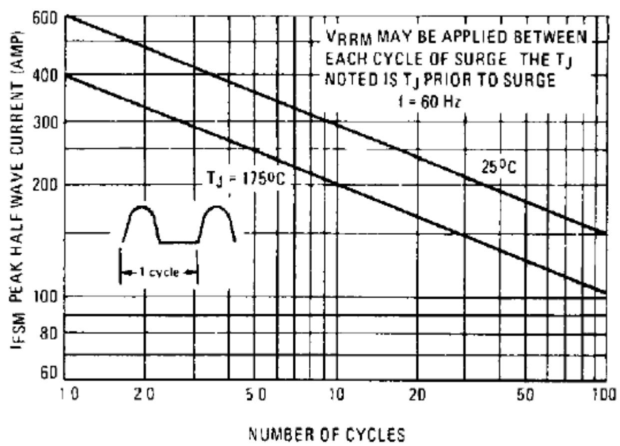

FIGURE 3 – FORWARD VOLTAGE TEMPERATURE COEFFICIENT

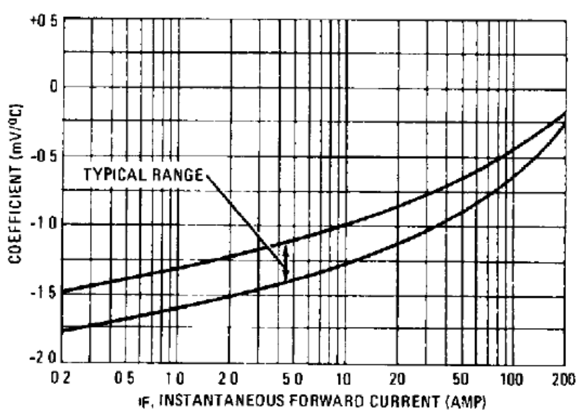

FIGURE 4 – CURRENT DERATING

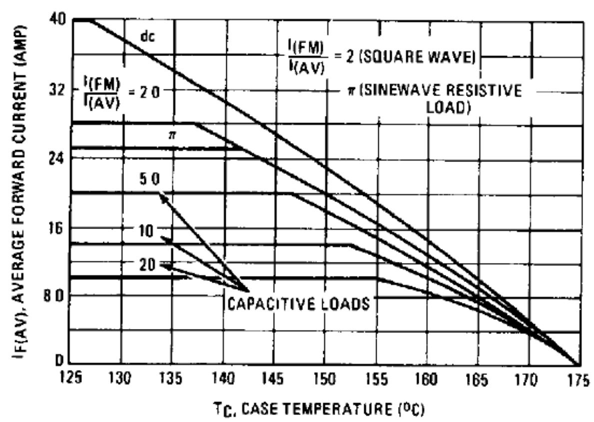

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FIGURE 5 – FORWARD POWER DISSIPATION

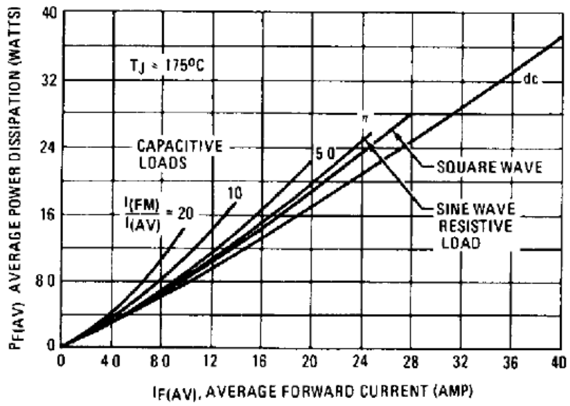
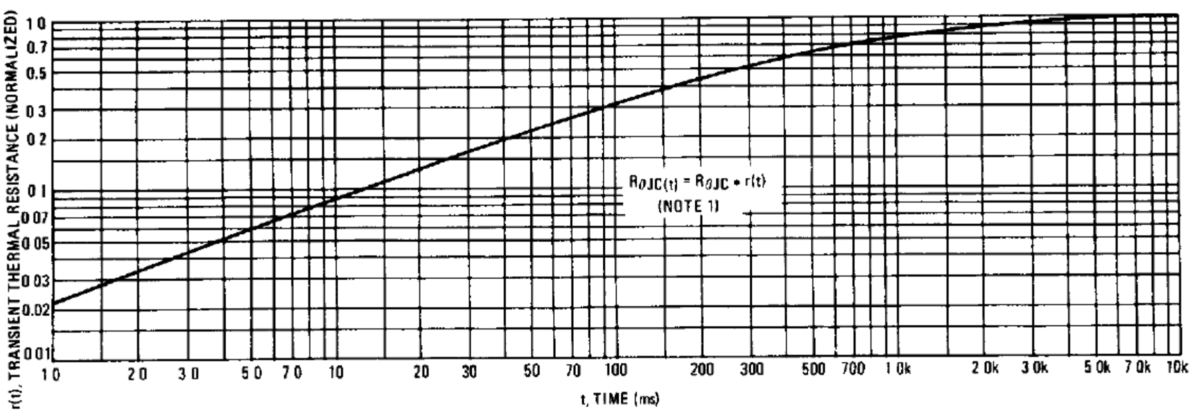
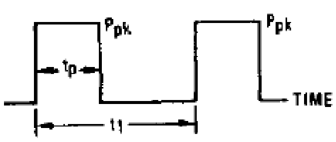


FIGURE 6 – THERMAL RESPONSE





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 at the temperature reference point. 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_{JC} is the increase in junction temperature above the case temperature.
It may be determined by $\Delta T_{JC} = P_{pk} \bullet R_{\varnothing JC} [D + (1-D) \bullet r(t_r + t_p) - r(t_1)]$ where r(t) = normalized value of transient thermal resistance at time t from figure 6, and $r(t_1+t_p)$ = normalized value of transient thermal resistance at time $t_1 + t_p$.

FIGURE 7 – CAPACITANCE

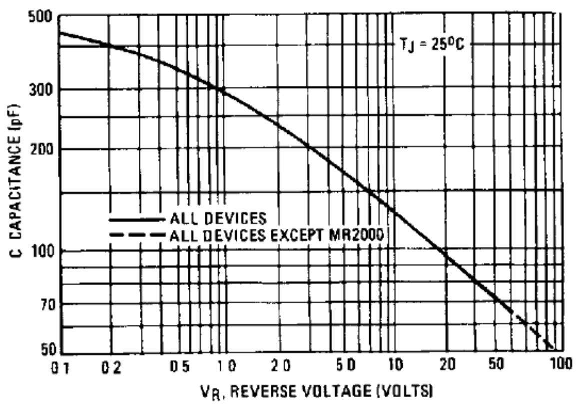


FIGURE 8 – FORWARD RECOVERY TIME

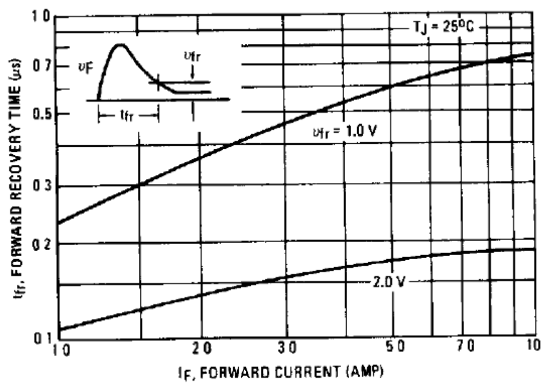


FIGURE 9 – REVERSE RECOVERY TIME

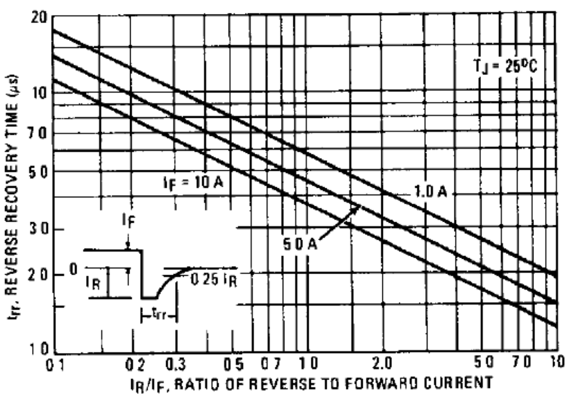


FIGURE 10 – RECTIFICATION WAVEFORM EFFICIENCY

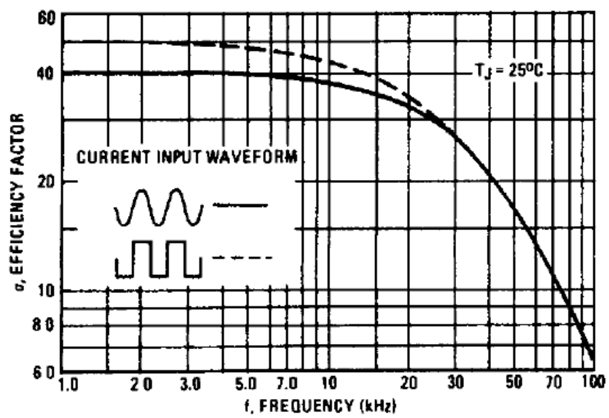


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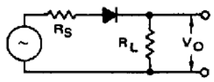
FIGURE 11 – SINGLE-PHASE HALF-WAVE RECTIFIER CIRCUIT



The rectification efficiency factor σ shown in Figure 10 was calculated using the formula:

$$\sigma = \frac{P_{dc}}{P_{rms}} = \frac{\dfrac{V^2_{O(dc)}}{R_L}}{\dfrac{V^2_{O(rms)}}{R_L}} \bullet 100\% = \frac{V^2_{O(dc)}}{V^2_{O(ac)} + V^2_{O(dc)}} \bullet 100\% \qquad (1)$$

For a sine wave input $V_m \sin(\omega t)$ to the diode, assume lossless, the maximum theoretical efficiency factor becomes

$$\sigma_{(sine)} = \frac{\dfrac{V^2_m}{\pi^2 R_L}}{\dfrac{V^2_m}{4R_L}} \bullet 100\% = \frac{4}{\pi^2} \bullet 100\% = 40.6\% \qquad (2)$$

For a square wave input of amplitude V_m, the efficiency factor becomes:

$$\sigma_{(square)} = \frac{\dfrac{V^2_m}{2R_L}}{\dfrac{V^2_m}{R_L}} \bullet 100\% = 50\% \qquad (3)$$

(A full wave circuit has twice these efficiencies)

As the frequency of the input signal is increased, the reverse recovery time of the diode (figure 9) becomes significant, resulting in an increasing ac voltage component across R_L which is opposite in polarity to the forward current, thereby reducing the value of the efficiency factor, σ, as shown in figure 10.

It should be emphasized that figure 10 shows waveform efficiency only; it does not provide a measure of diode losses. Data was obtained by measuring the ac component of V_O with a true rms ac voltmeter and the dc component with a dc voltmeter. The data was used in Equation 1 to obtain points for figure 10.