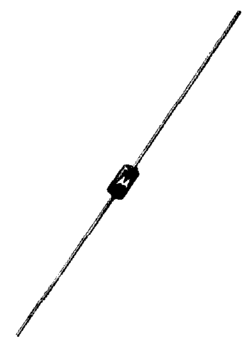
BY126
BY127

"SURMETIC" RECTIFIERS

. . . subminiature size, axial lead mounted rectifiers for general purpose low-power applications.

LEAD MOUNTED SILICON RECTIFIERS

DIFFUSED JUNCTION

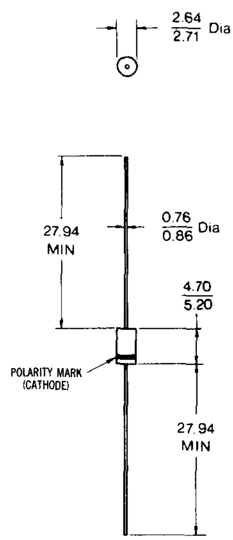


MAXIMUM RATINGS

Characteristic	Symbol	BY126	BY127	Unit
Peak Repetitive Reverse Voltage Working Peak Reverse Voltage DC Blocking Voltage	$V_{RM(rep)}$ $V_{RM(wkg)}$ V_R	450	800	Volts
Non-Repetitive Peak Reverse Voltage (halfwave, single phase, 60 Hz peak)	$V_{RM(non-rep)}$	650	1250	Volts
RMS Reverse Voltage	V_r	315	560	Volts
Average Rectified Forward Current (single phase, resistive load, 60 Hz, see Figure 6, T_A = 75°C)	I_O	1.0		Amp
Non-Repetitive Peak Surge Current (surge applied at rated load conditions, see Figure 2)	$I_{FM(surge)}$	40 (for 1 cycle)		Amp
Operating and Storage Junction Temperature Range	T_J, T_{stg}	-65 to +175		°C

ELECTRICAL CHARACTERISTICS

Characteristic and Conditions	Symbol	Max	Unit
Maximum Instantaneous Forward Voltage Drop (i_F = 1.0 Amp, T_J = 25°C) Figure 1	V_F	1.1	Volts
Maximum Full-Cycle Average Forward Voltage Drop (I_O = 1.0 Amp, T_L = 75°C, 1 inch leads)	$V_{F(AV)}$	0.8	Volts
Maximum Reverse Current (rated dc voltage) T_J = 25°C	I_R	0.01	mA
Maximum Full-Cycle Average Reverse Current (I_O = 1.0 Amp, T_L = 75°C, 1 inch leads)	$I_{R(AV)}$	0.03	mA



CASE 59

Dimensions in millimeters

MECHANICAL CHARACTERISTICS

CASE: Void free, Transfer Molded

MAXIMUM LEAD TEMPERATURE FOR SOLDERING PURPOSES: 350°C, 3/8" from case for 10 seconds at 5 lbs. tension

FINISH: All external surfaces are corrosion-resistant, leads are readily solderable

POLARITY: Cathode indicated by color band

WEIGHT: 0.40 Grams (approximately)

CURRENT DERATING DATA

FIGURE 5 — LEAD TEMPERATURE DERATING (DC ONLY)

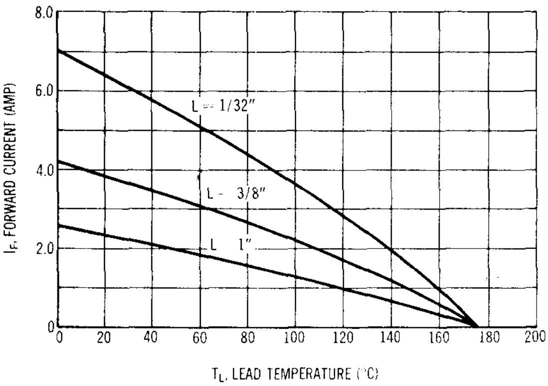


FIGURE 6 — RESISTIVE,INDUCTIVE LOADS

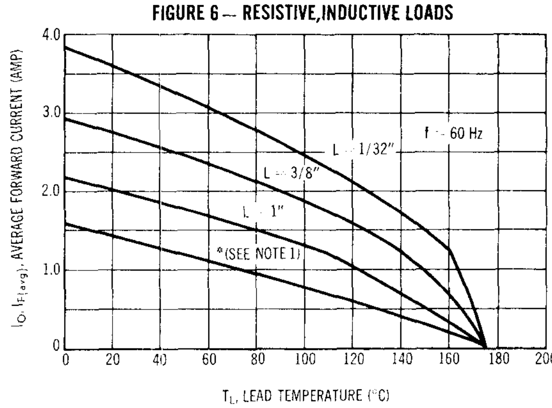


FIGURE 7 — CAPACITIVE LOADS

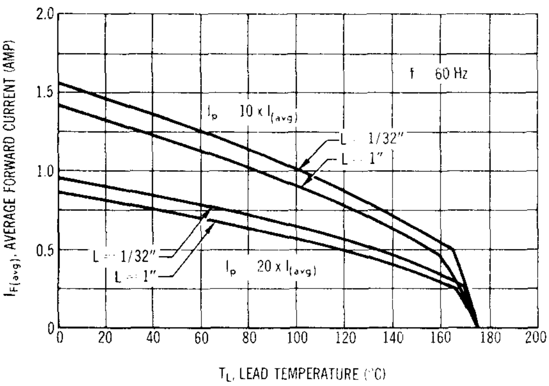
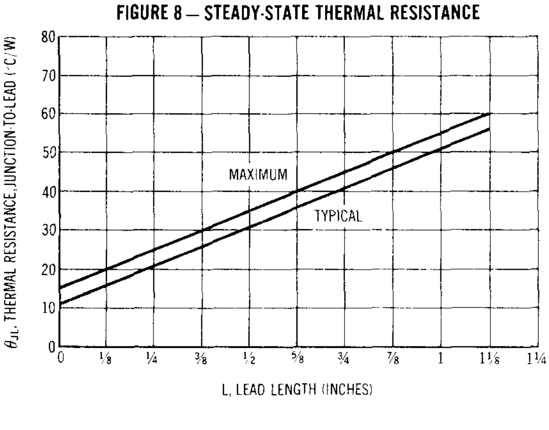


FIGURE 8 — STEADY-STATE THERMAL RESISTANCE

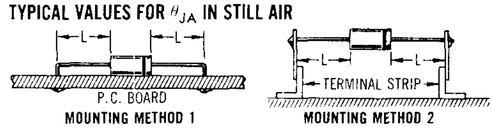


NOTES

NOTE 1

Data shown for thermal resistance junction-to-ambient (θ_{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.

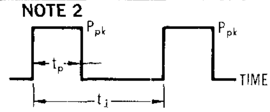
TYPICAL VALUES FOR θ_{JA} IN STILL AIR



MOUNTING METHOD	LEAD LENGTH, L (IN.)			θ_{JA}
	1/32	3/8	1	
1	—	75	85	°C/W
2	55	72	85	°C/W

*Using Mounting Method 1 or 2 with L = 1" the curve marked * in Figure 6 can be used for 60 Hz half-wave resistive/inductive load (Rating vs. Ambient Temperature). The abscissa of Figure 6 then indicates T_A in °C.

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 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:

$$\Delta T_{JL} = P_{pk}\left[\theta_{JL(\infty)} \cdot D + (1 - D) \cdot \theta_{JL(t_1+t_p)} + \theta_{JL(t_p)} - \theta_{JL(t_1)}\right]$$

where $\theta_{JL(t)}$ = value of transient thermal resistance at time t, i.e.:

$\theta_{JL(t_1+t_p)}$ = value of $\theta_{JL(t)}$ at time t_1+t_p

$\theta_{JL(t_p)}$ = value of $\theta_{JL(t)}$ at end of pulse width t_p

$\theta_{JL(t_1)}$ = value of $\theta_{JL(t)}$ at time t_1

FIGURE 1 — FORWARD VOLTAGE

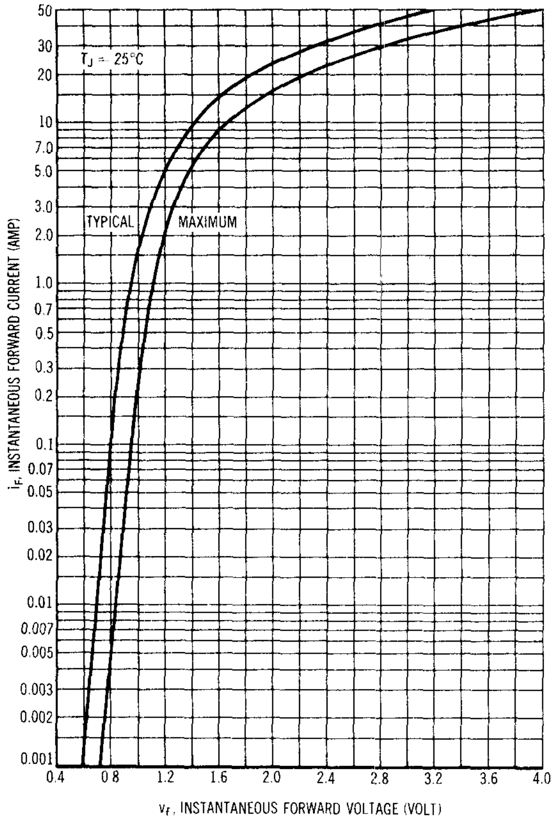


FIGURE 2 — MAXIMUM SURGE CAPABILITY

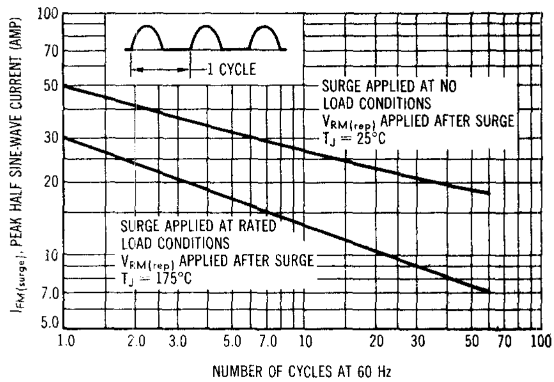


FIGURE 3 — FORWARD VOLTAGE TEMPERATURE COEFFICIENT

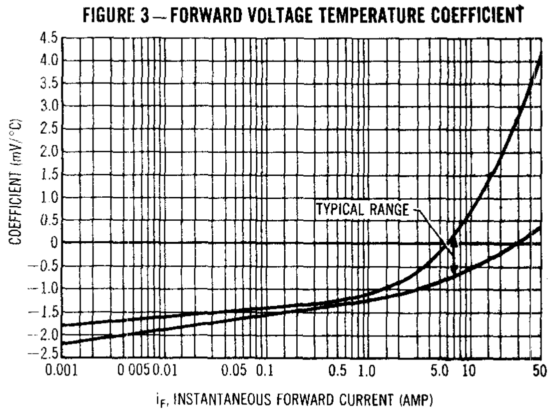
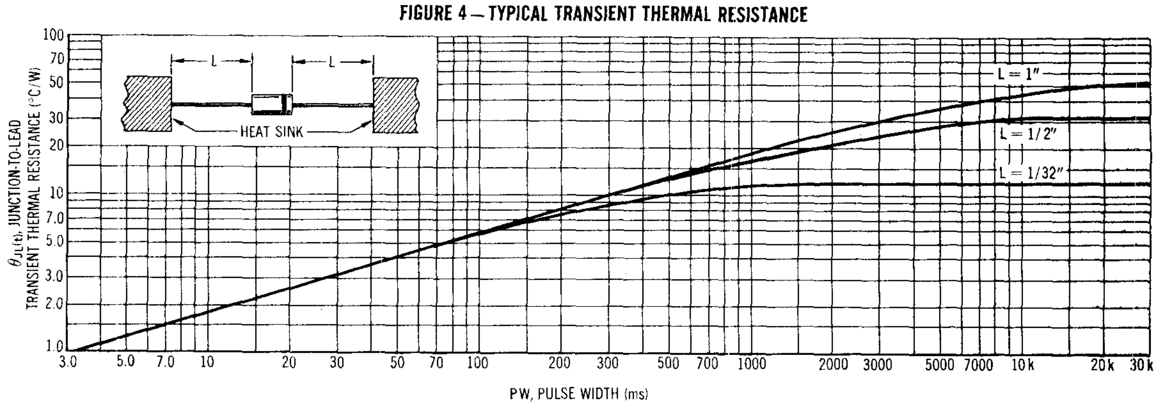


FIGURE 4 — TYPICAL TRANSIENT THERMAL RESISTANCE



FOR $\theta_{JL(t)}$ VALUES AT PULSE WIDTHS LESS THAN 3.0 ms, THE ABOVE CURVE CAN BE EXTRAPOLATED DOWN TO 10 μs AT A CONTINUING SLOPE OF 1/2

TYPICAL DYNAMIC CHARACTERISTICS

FIGURE 9 — FORWARD RECOVERY TIME

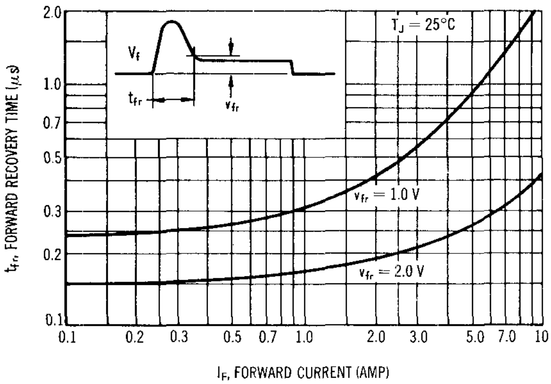


FIGURE 10 — REVERSE RECOVERY TIME

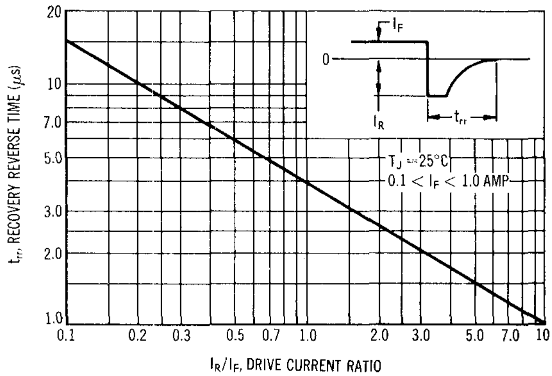


FIGURE 11 — RECTIFICATION WAVEFORM EFFICIENCY

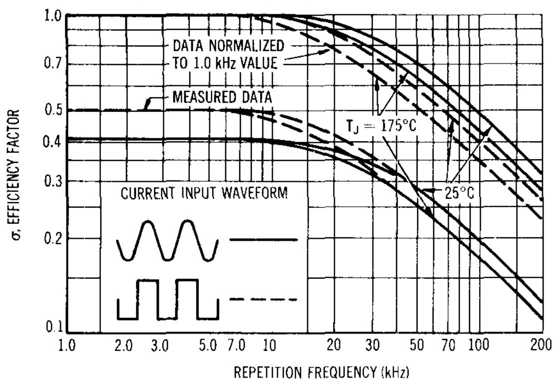
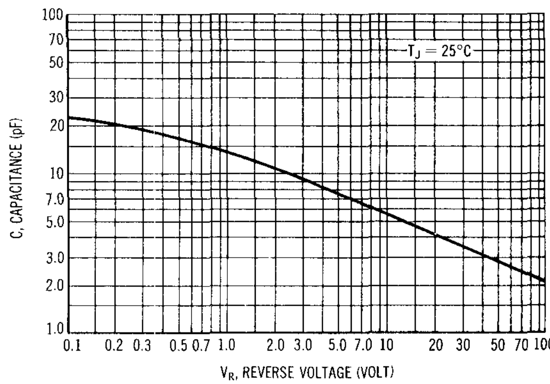
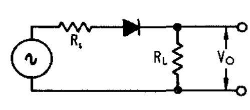


FIGURE 12 — JUNCTION CAPACITANCE



RECTIFIER EFFICIENCY NOTE

FIGURE 13 — SINGLE-PHASE HALF-WAVE RECTIFIER CIRCUIT



The rectification efficiency factor σ shown in Figure 11 was calculated using the formula:

$$\sigma = \frac{P_{dc}}{P_{rms}} = \frac{\frac{V^2_O(dc)}{R_L}}{\frac{V^2_O(rms)}{R_L}} \cdot 100\% = \frac{V^2_O(dc)}{V^2_O(ac) + V^2_O(dc)} \cdot 100\% \quad (1)$$

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

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

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

$$\sigma_{(square)} = \frac{\frac{V^2_m}{2R_L}}{\frac{V^2_m}{R_L}} \cdot 100\% = 50\% \quad (3)$$

(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 10) 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 on Figure 11.

It should be emphasized that **Figure 11 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 11.