

1N5826
1N5827
1N5828

1N5826 and 1N5828 are
 Motorola Preferred Devices

Designer's Data Sheet
Power Rectifiers

... employing the Schottky Barrier principle in a large area metal-to-silicon power diode. State-of-the-art geometry features chrome barrier metal, 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.

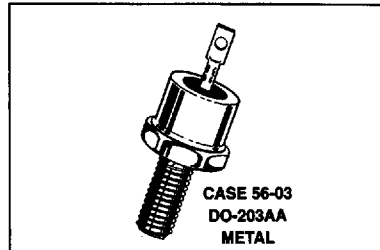
- Extremely Low v_f
- Low Power Loss/High Efficiency
- Low Stored Charge, Majority Carrier Conduction
- High Surge Capacity

Mechanical Characteristics:

- Case: Welded steel, hermetically sealed
- Weight: 45.6 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: 15 lb-in max
- Shipped 25 units per rail
- Marking: 1N5826, 1N5827, 1N5828

**SCHOTTKY
 BARRIER
 RECTIFIERS**

**15 AMPERE
 20,30,40 VOLTS**



3

Rating	Symbol	1N5826	1N5827	1N5828	Unit
Peak Repetitive Reverse Voltage	V_{RRM}				
Working Peak Reverse Voltage	V_{RWM}	20	30	40	Volts
DC Blocking Voltage	V_R				
Non-Repetitive Peak Reverse Voltage	V_{RSM}	24	36	48	Volts
Average Rectified Forward Current $V_{R(equiv)} \leq 0.2 V_R(d.c), T_C = 85^\circ C$	I_O	← 15 →			Amp
Ambient Temperature Rated $V_R(d.c), P_F(A.V) = 0,$ $R_{\theta JA} = 5.0^\circ C/W$	T_A	95	90	85	$^\circ C$
Non-Repetitive Peak Surge Current (surge applied at rated load conditions, halfwave, single phase, 60 Hz)	I_{FSM}	← 500 (for 1 cycle) →			Amp
Operating and Storage Junction Temperature Range (Reverse voltage applied)	$T_{J,Tstg}$	← -65 to +125 →			$^\circ C$
Peak Operating Junction Temperature (Forward Current Applied)	$T_{J(pk)}$	← 150 →			$^\circ C$

***THERMAL CHARACTERISTICS**

Characteristic	Symbol	Max	Unit
Thermal Resistance, Junction to Case	$R_{\theta JC}$	2.5	$^\circ C/W$

***ELECTRICAL CHARACTERISTICS** ($T_C = 25^\circ C$ unless otherwise noted.)

Characteristic	Symbol	1N5826	1N5827	1N5828	Unit
Maximum Instantaneous Forward Voltage (1) ($i_F = 8.0$ Amp) ($i_F = 15$ Amp) ($i_F = 47.1$ Amp)	v_F	0.380 0.440 0.670	0.400 0.470 0.770	0.420 0.500 0.870	Volts
Maximum Instantaneous Reverse Current @ rated dc Voltage (1) $T_C = 100^\circ C$	i_R	10 75	10 75	10 75	mA

*Indicates JEDEC Registered Data.

(1) Pulse Test: Pulse Width = 300 μs , Duty Cycle = 2.0%.

1N5826 thru 1N5828

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 $0.2 V_{RWM}$. 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 (125°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

Figures 1, 2 and 3 permit easier use of equation (1) by taking reverse power dissipation and thermal runaway into consideration. The figures solve 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 $T_J = 125^\circ\text{C}$, when forward power is zero. The transition from one boundary condition to the other is evident on the curves of Figures 1, 2 and

3 as a difference in the rate of change of the slope in the vicinity of 116°C . The data of Figures 1, 2 and 3 is based upon dc conditions. For use in common rectifier circuits, Table I 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 reverse characteristics of Schottky diodes.

Example: Find $T_{A(max)}$ for 1N5828 operated in a 12-Volt dc supply using a bridge circuit with capacitive filter such that $I_{DC} = 10 \text{ A}$ ($I_F(AV) = 5 \text{ A}$), $I_{(PK)}/I_{(AV)} = 20$, Input Voltage = 10 V(rms), $R_{\theta JA} = 5^\circ\text{C/W}$.

Step 1: Find $V_{R(equiv)}$. Read $F = 0.65$ from Table I.

$$V_{R(equiv)} = (1.41)(10)(0.65) = 9.18 \text{ V}$$

Step 2: Find T_R from Figure 3. Read $T_R = 121^\circ\text{C}$ @ $V_R = 9.18$ & $R_{\theta JA} = 5^\circ\text{C/W}$

Step 3: Find $P_F(AV)$ from Figure 4. ** Read $P_F(AV) = 10 \text{ W}$

$$\text{at } I_{(PK)} = 20 \text{ \& } I_F(AV) = 5 \text{ A}$$

Step 4: Find $T_{A(max)}$ from equation (3). $T_{A(max)} = 121 - (5)(10) = 71^\circ\text{C}$

** Value given are for the 1N5828. Power is slightly lower for the other units because of their lower forward voltage.

TABLE I - VALUES FOR FACTOR F

Circuit	Half Wave		Full Wave, Bridge		Full Wave, Center Tapped * †	
	Resistive	Capacitive *	Resistive	Capacitive	Resistive	Capacitive
Sine Wave	0.5	1.3	0.5	0.65	1.0	1.3
Square Wave	0.75	1.5	0.75	0.75	1.5	1.5

*Note that $V_{R(PK)} \approx 2 V_{in(PK)}$

* † Use line to center tap voltage for V_{in} .

FIGURE 1 - MAXIMUM REFERENCE TEMPERATURE - 1N5826

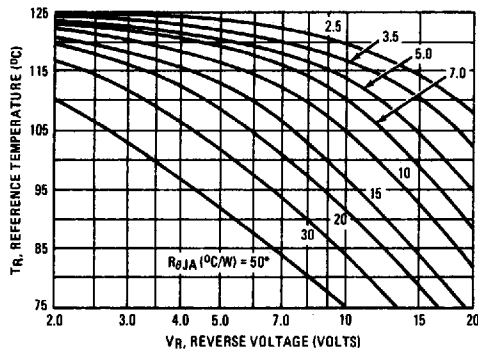


FIGURE 2 - MAXIMUM REFERENCE TEMPERATURE - 1N5827

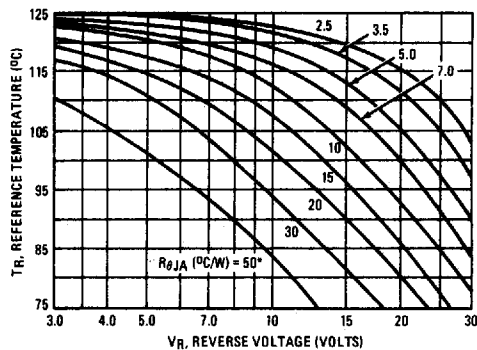


FIGURE 3 - MAXIMUM REFERENCE TEMPERATURE - 1N5828

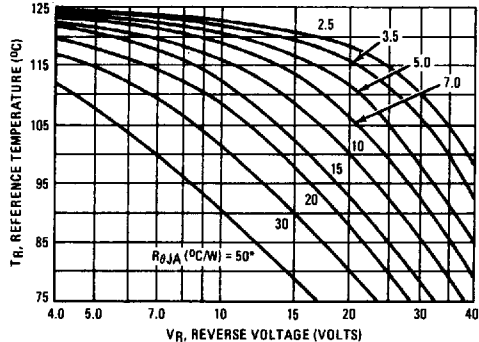
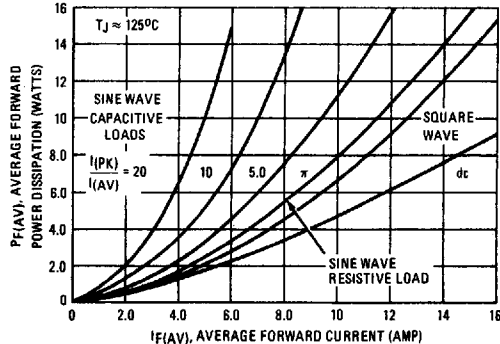


FIGURE 4 - FORWARD POWER DISSIPATION



*No external heat sink.

FIGURE 5 - TYPICAL FORWARD VOLTAGE

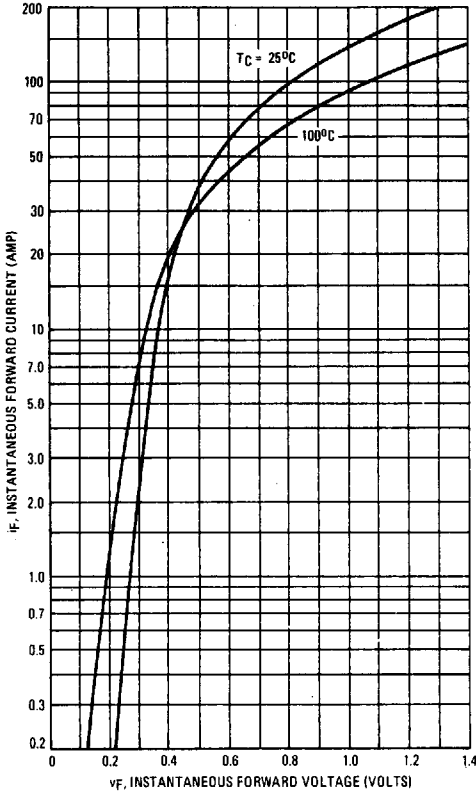


FIGURE 6 - MAXIMUM SURGE CAPABILITY

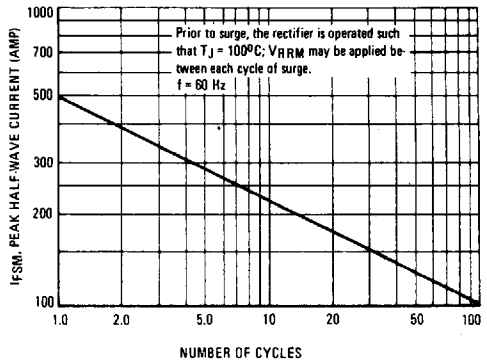


FIGURE 7 - CURRENT DERATING

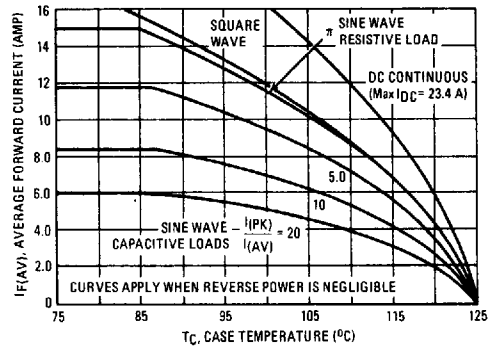


FIGURE 8 - THERMAL RESPONSE

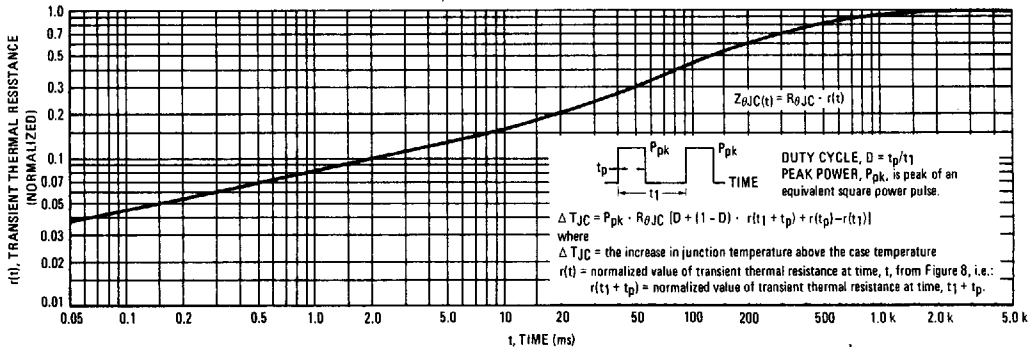


FIGURE 9 - NORMALIZED REVERSE CURRENT

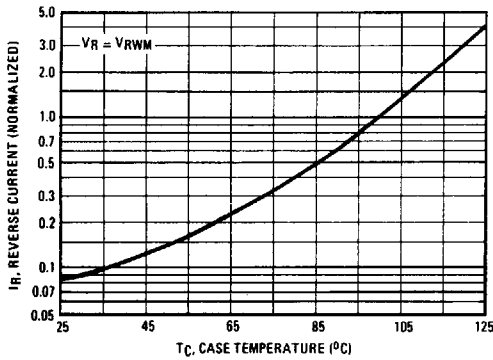


FIGURE 10 - TYPICAL REVERSE CURRENT

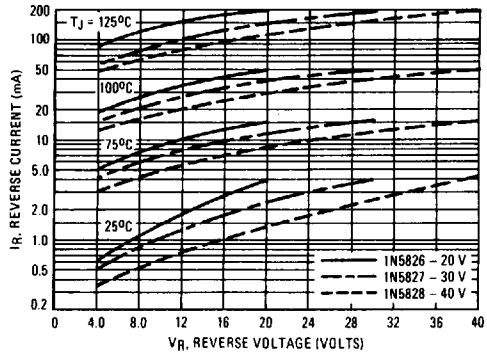
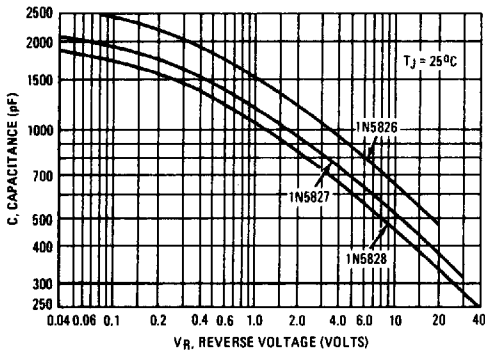


FIGURE 11 - CAPACITANCE



NOTE 2 - 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 11).

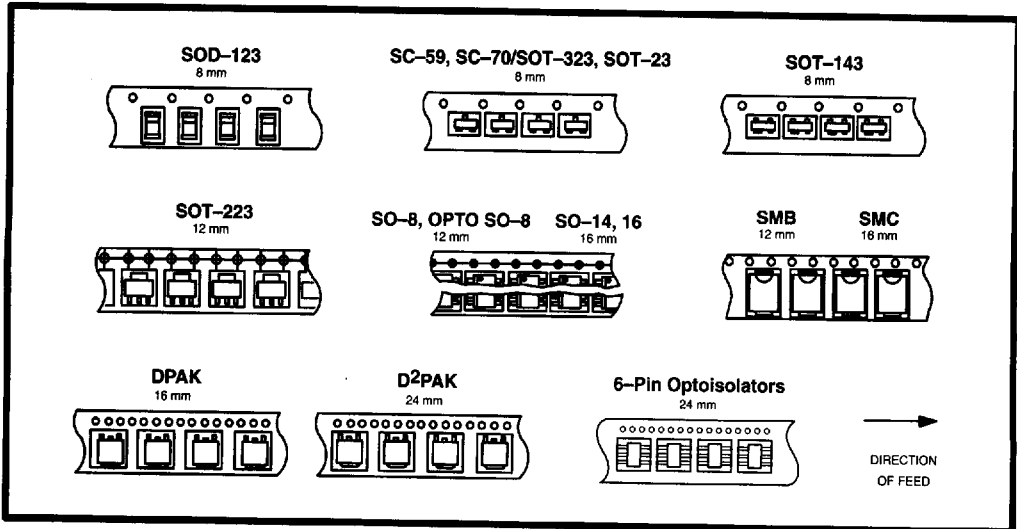
Rectification efficiency measurements show that operation will be satisfactory up to several megahertz. For example, relative waveform rectification efficiency is approximately 70 per cent at 2.0 MHz, e.g., the ratio of dc power to RMS power in the load is 0.28 at this frequency, whereas perfect rectification 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.

Tape and Reel Specifications and Packaging Specifications

Embossed Tape and Reel is used to facilitate automatic pick and place equipment feed requirements. The tape is used as the shipping container for various products and requires a minimum of handling. The antistatic/conductive tape provides a secure cavity for the product when sealed with the "peel-back" cover tape.

- Two Reel Sizes Available (7" and 13")
- Used for Automatic Pick and Place Feed Systems
- Minimizes Product Handling
- EIA 481, -1, -2
- SOD-123, SC-59, SC-70/SOT-323, SOT-23, SOT-143 in 8 mm Tape
- SO-8, OPTO SO-8, SOT-223, SMB in 12 mm Tape
- DPAK, SO-14, SO-16, SMC in 16 mm Tape
- D²PAK, 6-Pin Optoisolators in 24 mm Tape

Use the standard device title and add the required suffix as listed in the option table on the following page. Note that the individual reels have a finite number of devices depending on the type of product contained in the tape. Also note the minimum lot size is one full reel for each line item, and orders are required to be in increments of the single reel quantity.



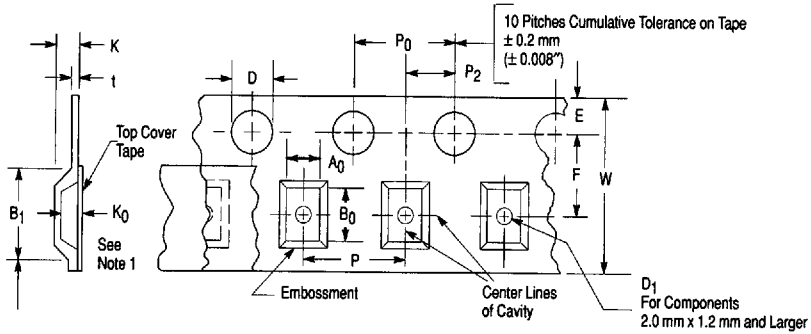
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EMBOSSED TAPE AND REEL ORDERING INFORMATION

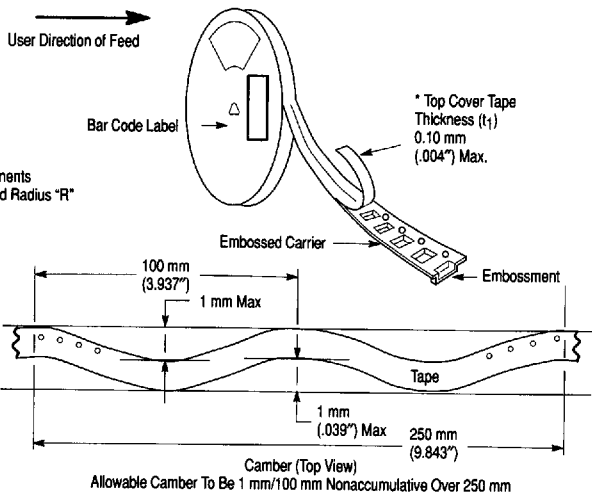
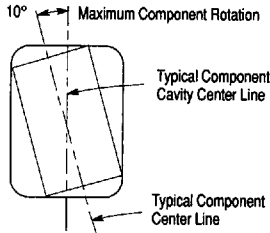
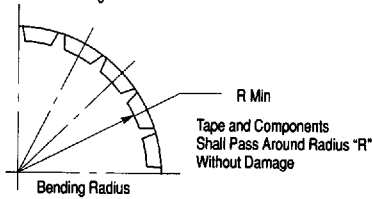
Package	Tape Width (mm)	Pitch mm (inch)	Reel Size mm (inch)	Devices Per Reel and Minimum Order Quantity	Device Suffix
DPAK	16	8.0 ± 0.1 (.315 ± .004)	330 (13)	2,500	T4
D ² PAK	24	16.0 ± 0.1 (.630 ± .004)	330 (13)	800	T4
SC-59	8	4.0 ± 0.1 (.157 ± .004)	178 (7)	3,000	T1
SC-70/SOT-323	8	4.0 ± 0.1 (.157 ± .004)	178 (7)	3,000	T1
	8		330 (13)		T3
SMB	12	8.0 ± 0.1 (.315 ± .004)	330 (13)	2,500	T3
SMC	16	8.0 ± 0.1 (.315 ± .004)	330 (13)	2,500	T3
SO-8, OPTO SO-8	12	8.0 ± 0.1 (.315 ± .004)	178 (7)	500	R1
	12		330 (13)		R2
SO-14	16	8.0 ± 0.1 (.315 ± .004)	178 (7)	500	R1
	16		330 (13)		R2
SO-16	16	8.0 ± 0.1 (.315 ± .004)	178 (7)	500	R1
	16		330 (13)		R2
SOD-123	8	4.0 ± 0.1 (.157 ± .004)	178 (7)	3,000	T1
	8		330 (13)		T3
SOT-23	8	4.0 ± 0.1 (.157 ± .004)	178 (7)	3,000	T1
	8		330 (13)		T3
SOT-143	8	4.0 ± 0.1 (.157 ± .004)	178 (7)	3,000	T1
	8		330 (13)		T3
SOT-223	12	8.0 ± 0.1 (.315 ± .004)	178 (7)	1,000	T1
	12		330 (13)		T3
6-Pin Optoisolators	24	12.0 ± 0.1 (.472 ± .004)	330 (13)	1000	R2

EMBOSSED TAPE AND REEL DATA FOR DISCRETES

CARRIER TAPE SPECIFICATIONS



For Machine Reference Only
Including Draft and RADII
Concentric Around B_0



DIMENSIONS

Tape Size	B_1 Max	D	D_1	E	F	K	P_0	P_2	R Min	T Max	W Max
8 mm	4.55 mm (.179")	1.5 ± 0.1 mm -0.0 (.059 ± .004" -0.0)	1.0 Min (.039")	1.75 ± 0.1 mm (.069 ± .004")	3.5 ± 0.05 mm (.138 ± .002")	2.4 mm Max (.094")	4.0 ± 0.1 mm (.157 ± .004")	2.0 ± 0.1 mm (.079 ± .002")	25 mm (.98")	0.6 mm (.024")	8.3 mm (.327")
12 mm	8.2 mm (.323")				5.5 ± 0.05 mm (.217 ± .002")	6.4 mm Max (.252")					12 ± 30 mm (.470 ± .012")
16 mm	12.1 mm (.476")				7.5 ± 0.10 mm (.295 ± .004")	7.9 mm Max (.311")					16.3 mm (.642")
24 mm	20.1 mm (.791")				11.5 ± 0.1 mm (.453 ± .004")	11.9 mm Max (.468")					24.3 mm (.957")

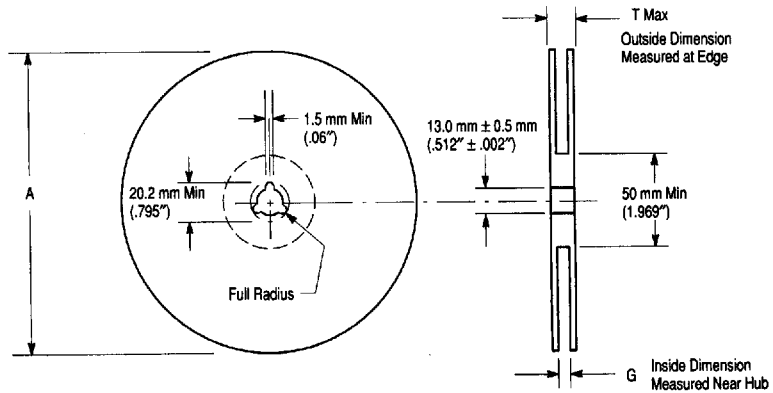
Metric dimensions govern — English are in parentheses for reference only.

NOTE 1: A_0 , B_0 , and K_0 are determined by component size. The clearance between the components and the cavity must be within .05 mm min. to .50 mm max., the component cannot rotate more than 10° within the determined cavity.

NOTE 2: If B_1 exceeds 4.2 mm (.165) for 8 mm embossed tape, the tape may not feed through all tape feeders.

NOTE 3: Pitch information is contained in the Embossed Tape and Reel Ordering Information on pg. 6-3.

EMBOSSED TAPE AND REEL DATA FOR DISCRETES



Size	A Max	G	T Max
8 mm	330 mm (12.992")	8.4 mm + 1.5 mm, -0.0 (.33" + .059", -0.00)	14.4 mm (.56")
12 mm	330 mm (12.992")	12.4 mm + 2.0 mm, -0.0 (.48" + .079", -0.00)	18.4 mm (.72")
16 mm	360 mm (14.173")	16.4 mm + 2.0 mm, -0.0 (.646" + .078", -0.00)	22.4 mm (.882")
24 mm	360 mm (14.173")	24.4 mm + 2.0 mm, -0.0 (.961" + .070", -0.00)	30.4 mm (1.197")

Reel Dimensions

Metric Dimensions Govern — English are in parentheses for reference only

LEAD TAPE PACKAGING STANDARDS FOR AXIAL-LEAD COMPONENTS

Case Type	Product Category	Device Title Suffix	MPQ Quantity Per Reel (Item 3.3.7)	Component Spacing A Dimension	Tape Spacing B Dimension	Reel Dimension C	Reel Dimension D (Max)	Max Off Alignment E
Case 17-02	Surmetic 40 & 600 Watt TVS	RL	4000	0.2 +/- 0.015	2.062 +/- 0.059	3	14	0.047
Case 41A-02	1500 Watt TVS	RL4	1500	0.4 +/- 0.02	2.062 +/- 0.059	3	14	0.047
Case 51-02	DO-7 Glass (For Reference only)	RL	3000	0.2 +/- 0.02	2.062 +/- 0.059	3	14	0.047
Case 59-03	DO-41 Glass & DO-41 Surmetic 30	RL	6000	0.2 +/- 0.015	2.062 +/- 0.059	3	14	0.047
	Rectifier							
Case 59-04	500 Watt TVS	RL	5000	0.2 +/- 0.02	2.062 +/- 0.059	3	14	0.047
	Rectifier							
Case 194-04	110 Amp TVS (Automotive)	RL	800	0.4 +/- 0.02	1.875 +/- 0.059	3	14	0.047
	Rectifier							
Case 267-02	Rectifier	RL	1500	0.4 +/- 0.02	2.062 +/- 0.059	3	14	0.047
Case 299-02	DO-35 Glass	RL	5000	0.2 +/- 0.02	2.062 +/- 0.059	3	14	0.047

Table 1. Packaging Details (all dimensions in inches)

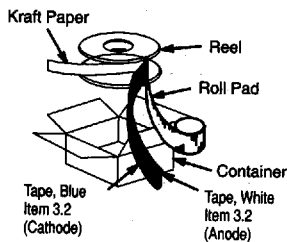


Figure 1. Reel Packing

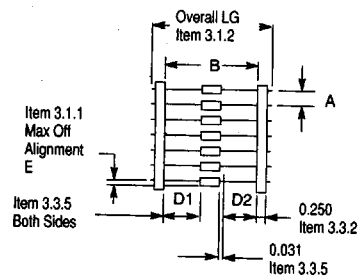


Figure 2. Component Spacing

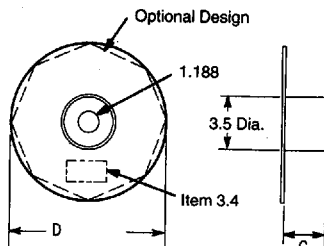


Figure 3. Reel Dimensions