Axial Lead Rectifiers

1N5820, 1N5821, 1N5822

1N5820 and 1N5822 are Preferred Devices

This series employs 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.

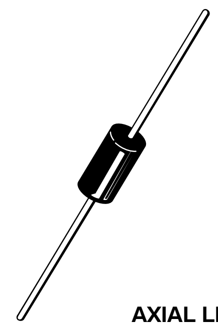
Features

- Extremely Low V_F
- Low Power Loss/High Efficiency
- Low Stored Charge, Majority Carrier Conduction
- Shipped in plastic bags, 500 per bag
- Available in Tape and Reel, 1500 per reel, by adding a "RL" suffix to the part number
- Pb−Free Packages are Available*

Mechanical Characteristics:

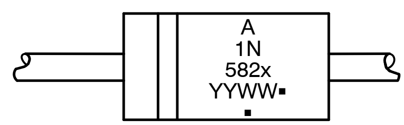
- Case: Epoxy, Molded
- Weight: 1.1 Gram (Approximately)
- Finish: All External Surfaces Corrosion Resistant and Terminal Leads are Readily Solderable
- Lead Temperature for Soldering Purposes: 260°C Max. for 10 Seconds
- Polarity: Cathode indicated by Polarity Band

SCHOTTKY BARRIER RECTIFIERS 3.0 AMPERES 20, 30, 40 VOLTS



AXIAL LEAD
CASE 267−05
(DO−201AD)
STYLE 1

MARKING DIAGRAM



A	= Assembly Location
1N582x	= Device Code
x	= 0, 1, or 2
YY	= Year
WW	= Work Week
▪	= Pb−Free Package

(Note: Microdot may be in either location)

ORDERING INFORMATION

See detailed ordering and shipping information on page 7 of this data sheet.

Preferred devices are recommended choices for future use and best overall value.

*For additional information on our Pb−Free strategy and soldering details, please download the **onsemi** Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.

November, 2023 − Rev. 11
Publication Order Number:
1N5820/D

MAXIMUM RATINGS

Rating	Symbol	1N5820	1N5821	1N5822	Unit
Peak Repetitive Reverse Voltage Working Peak Reverse Voltage DC Blocking Voltage	V_{RRM} V_{RWM} V_R	20	30	40	V
Non−Repetitive Peak Reverse Voltage	V_{RSM}	24	36	48	V
RMS Reverse Voltage	$V_{R(RMS)}$	14	21	28	V
Average Rectified Forward Current (Note 1) $V_{R(equiv)} \leq 0.2\ V_{R(dc)}$, T_L = 95°C ($R_{\theta JA}$ = 28°C/W, P.C. Board Mounting, see Note 5)	I_O	←	3.0	→	A
Ambient Temperature Rated $V_{R(dc)}$, $P_{F(AV)}$ = 0 $R_{\theta JA}$ = 28°C/W	T_A	90	85	80	°C
Non−Repetitive Peak Surge Current (Surge applied at rated load conditions, half wave, single phase 60 Hz, T_L = 75°C)	I_{FSM}		80 (for one cycle)		A
Operating and Storage Junction Temperature Range (Reverse Voltage applied)	T_J, T_{stg}		−65 to +125		°C

Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

*THERMAL CHARACTERISTICS (Note 5)

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

*ELECTRICAL CHARACTERISTICS (T_L = 25°C unless otherwise noted) (Note 1)

Characteristic	Symbol	1N5820	1N5821	1N5822	Unit
Maximum Instantaneous Forward Voltage (Note 2) (i_F = 1.0 Amp) (i_F = 3.0 Amp) (i_F = 9.4 Amp)	V_F	 0.370 0.475 0.850	 0.380 0.500 0.900	 0.390 0.525 0.950	V
Maximum Instantaneous Reverse Current @ Rated dc Voltage (Note 2) T_L = 25°C T_L = 100°C	i_R	 2.0 20	 2.0 20	 2.0 20	mA

1. Lead Temperature reference is cathode lead 1/32″ from case.
2. Pulse Test: Pulse Width = 300 μs, Duty Cycle = 2.0%.

*Indicates JEDEC Registered Data for 1N5820−22.

NOTE 3 — DETERMINING MAXIMUM RATINGS

Reverse power dissipation and the possibility of thermal runaway must be considered when operating this rectifier at reverse voltages above 0.1 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°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 115°C. The data of Figures 1, 2, and 3 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, that is:

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

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 1N5821 operated in a 12−volt dc supply using a bridge circuit with capacitive filter such that I_{DC} = 2.0 A ($I_{F(AV)}$ = 1.0 A), $I_{(FM)}/I_{(AV)}$ = 10, Input Voltage = 10 $V_{(rms)}$, $R_{\theta JA}$ = 40°C/W.

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

$$\therefore V_{R(equiv)} = (1.41)(10)(0.65) = 9.2\text{ V.}$$

Step 2. Find T_R from Figure 2. Read T_R = 108°C @ V_R = 9.2 V and $R_{\theta JA}$ = 40°C/W.

Step 3. Find $P_{F(AV)}$ from Figure 6. **Read $P_{F(AV)}$ = 0.85 W

$$@\frac{I_{(FM)}}{I_{(AV)}} = 10 \text{ and } I_{F(AV)} = 1.0\text{ A.}$$

Step 4. Find $T_{A(max)}$ from equation (3).

$$T_{A(max)} = 108 - (0.85)(40) = 74°\text{C.}$$

**Values given are for the 1N5821. Power is slightly lower for the 1N5820 because of its lower forward voltage, and higher for the 1N5822. Variations will be similar for the MBR−prefix devices, using $P_{F(AV)}$ from Figure 6.

Table 1. Values for Factor F

Circuit	Half Wave		Full Wave, Bridge		Full Wave, Center Tapped*†	
Load	**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 $V_{R(PK)} \approx 2.0\ V_{in(PK)}$.
†Use line to center tap voltage for V_{in}.

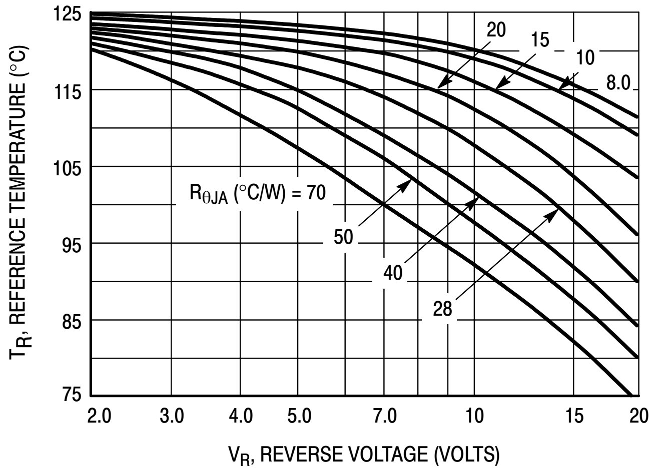


Figure 1. Maximum Reference Temperature 1N5820

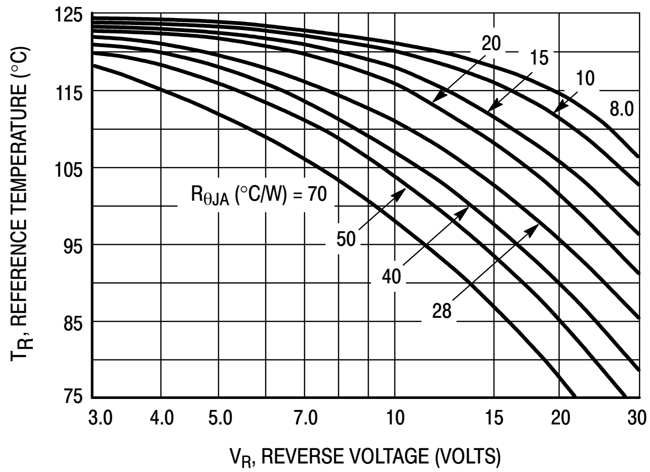


Figure 2. Maximum Reference Temperature 1N5821

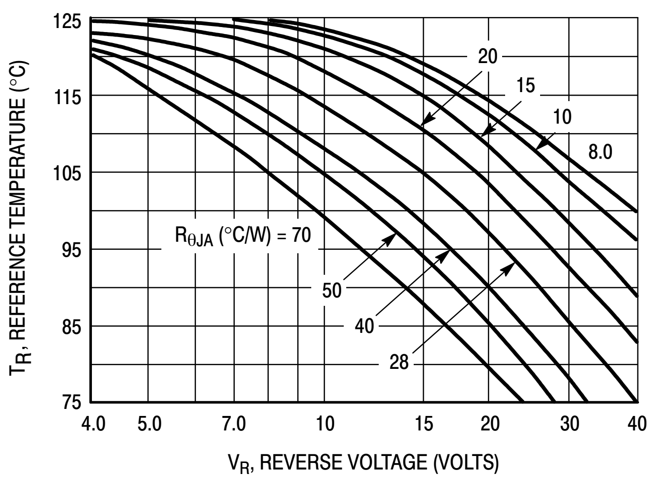


Figure 3. Maximum Reference Temperature 1N5822

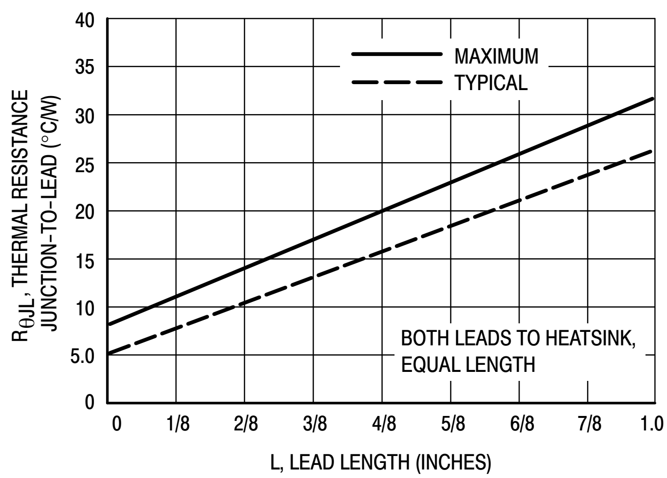


Figure 4. Steady−State Thermal Resistance

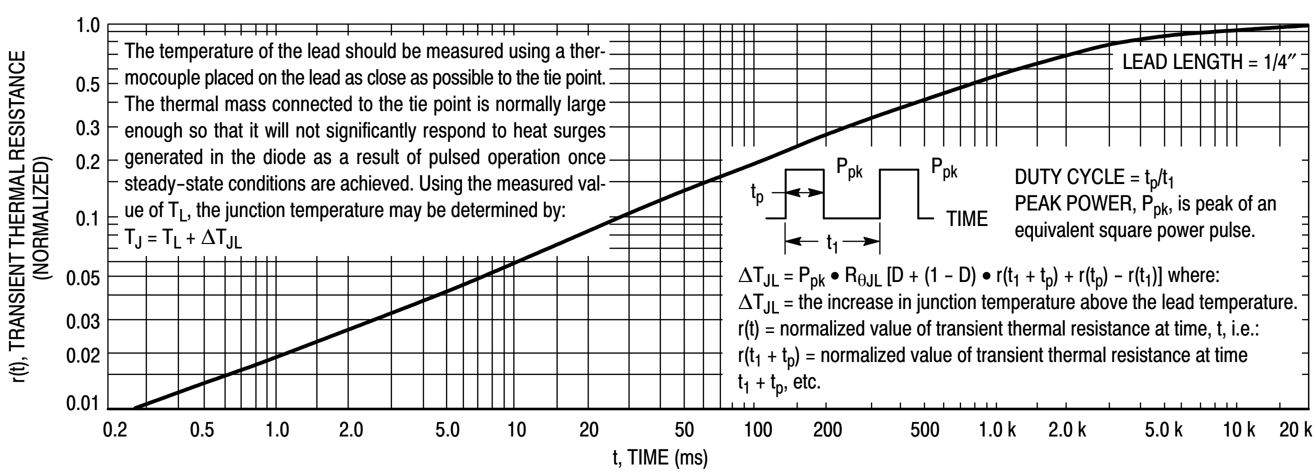


Figure 5. Thermal Response

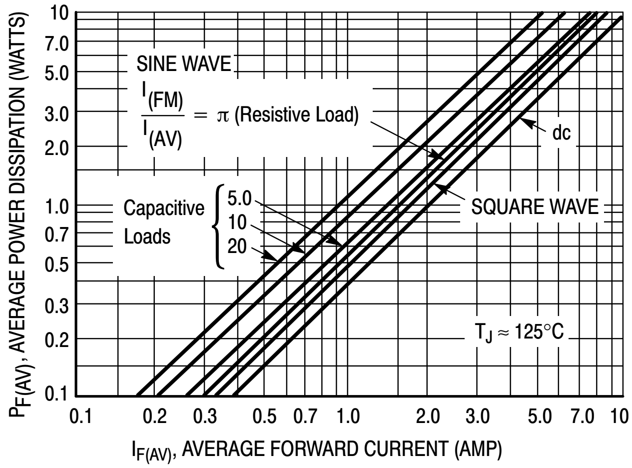
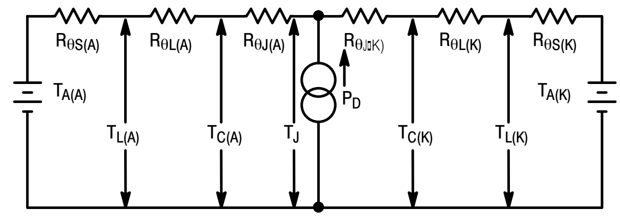


Figure 6. Forward Power Dissipation 1N5820−22

NOTE 4 − APPROXIMATE THERMAL CIRCUIT MODEL



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:

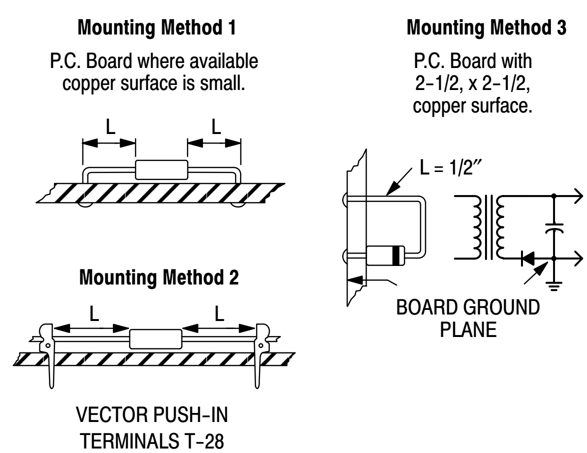
T_A = Ambient Temperature T_C = Case Temperature
T_L = Lead Temperature T_J = Junction Temperature
$R_{\theta S}$ = Thermal Resistance, Heatsink to Ambient
$R_{\theta L}$ = Thermal Resistance, Lead−to−Heatsink
$R_{\theta J}$ = Thermal Resistance, Junction−to−Case
P_D = Total Power Dissipation = $P_F + P_R$
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:
$R_{\theta L}$ = 42°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 $\Delta T_{JL} \approx R_{\theta JL} \cdot P_D$

NOTE 5 — MOUNTING DATA

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



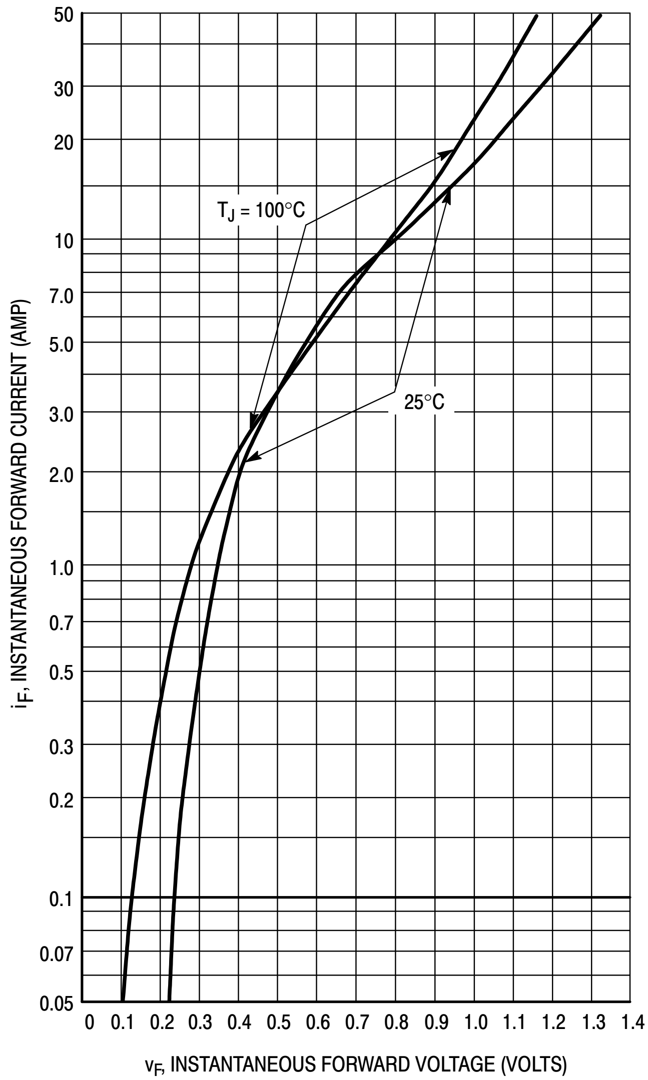


Figure 7. Typical Forward Voltage

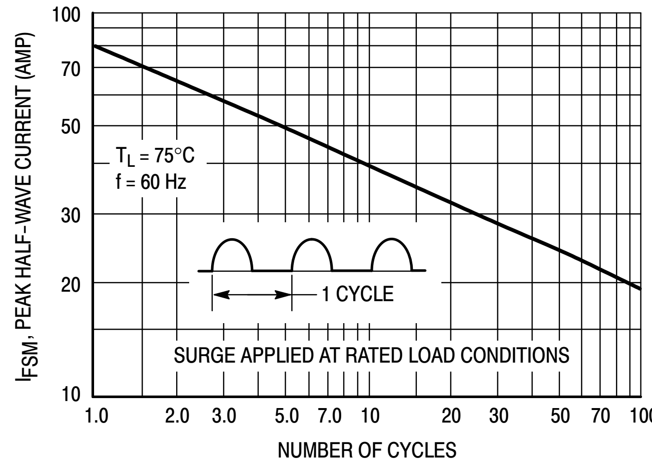


Figure 8. Maximum Non−Repetitive Surge Current

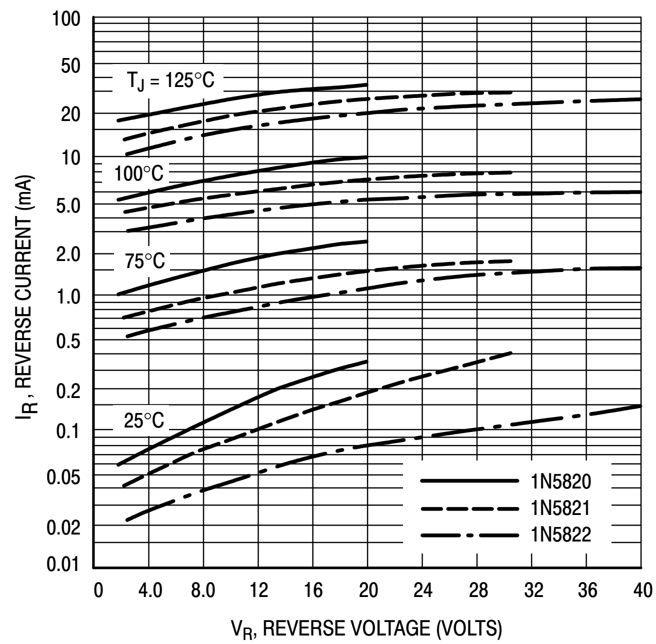


Figure 9. Typical Reverse Current

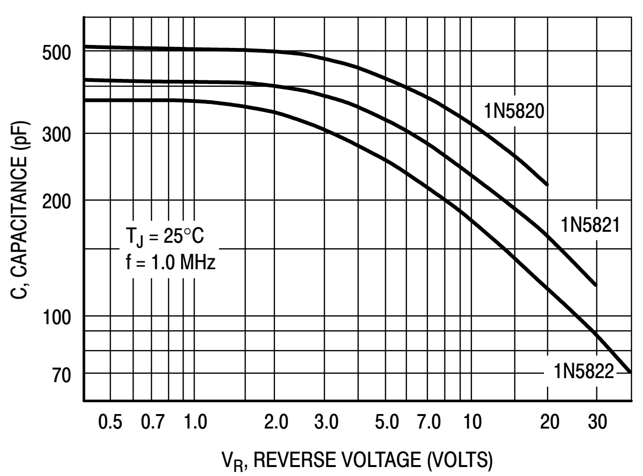


Figure 10. Typical Capacitance

NOTE 6 — 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 10.)

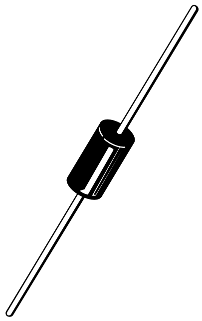
ORDERING INFORMATION

Device	Package	Shipping†
1N5820	Axial Lead	500 Units/Bag
1N5820G	Axial Lead (Pb−Free)	500 Units/Bag
1N5820RL	Axial Lead	1500/Tape & Reel
1N5820RLG	Axial Lead (Pb−Free)	1500/Tape & Reel
1N5821	Axial Lead	500 Units/Bag
1N5821G	Axial Lead (Pb−Free)	500 Units/Bag
1N5821RL	Axial Lead	1500/Tape & Reel
1N5821RLG	Axial Lead (Pb−Free)	1500/Tape & Reel
1N5822	Axial Lead	500 Units/Bag
1N5822G	Axial Lead (Pb−Free)	500 Units/Bag
1N5822RL	Axial Lead	1500/Tape & Reel
1N5822RLG	Axial Lead (Pb−Free)	1500/Tape & Reel

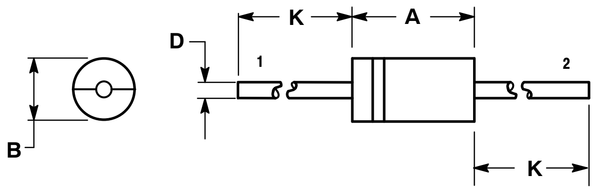
†For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, BRD8011/D.

AXIAL LEAD
CASE 267−05
ISSUE G

DATE 06/06/2000



SCALE 1:1



NOTES:
1. DIMENSIONS AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.
3. 267−04 OBSOLETE, NEW STANDARD 267−05.

	INCHES		MILLIMETERS	
DIM	MIN	MAX	MIN	MAX
A	0.287	0.374	7.30	9.50
B	0.189	0.209	4.80	5.30
D	0.047	0.051	1.20	1.30
K	1.000	---	25.40	---

STYLE 1:
PIN 1. CATHODE (POLARITY BAND)
2. ANODE

STYLE 2:
NO POLARITY

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DESCRIPTION:	AXIAL LEAD	PAGE 1 OF 1

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