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Designer's™ Data Sheet
Axial Lead Rectifiers

**1N5820
1N5821
1N5822**

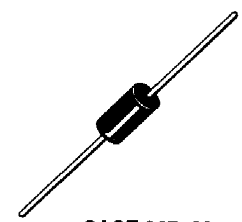
1N5820 and 1N5822 are Motorola Preferred Devices

... 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

**SCHOTTKY BARRIER RECTIFIERS
3.0 AMPERES
20, 30, 40 VOLTS**

Mechanical Characteristics:
- Case: Epoxy, Molded
- Weight: 1.1 gram (approximately)
- Finish: All External Surfaces Corrosion Resistant and Terminal Leads are Readily Solderable
- Lead and Mounting Surface Temperature for Soldering Purposes: 220°C Max. for 10 Seconds, 1/16″ from case
- Shipped in plastic bags, 5,000 per bag
- Available Tape and Reeled, 1500 per reel, by adding a "RL" suffix to the part number
- Polarity: Cathode indicated by Polarity Band
- Marking: 1N5820, 1N5821, 1N5822



**CASE 267–03
PLASTIC**

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 (2) $V_{R(equiv)} \leq 0.2\ V_{R(dc)}$, $T_L = 95°C$ ($R_{\theta JA}$ = 28°C/W, P.C. Board Mounting, see Note 2)	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
Peak Operating Junction Temperature (Forward Current applied)	$T_{J(pk)}$	← 150 →			°C

***THERMAL CHARACTERISTICS** (Note 2)

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

(1) Pulse Test: Pulse Width = 300 μs, Duty Cycle = 2.0%.
(2) Lead Temperature reference is cathode lead 1/32″ from case.
* Indicates JEDEC Registered Data for 1N5820–22.

1N5820 1N5821 1N5822

***ELECTRICAL CHARACTERISTICS** (T_L = 25°C unless otherwise noted) (2)

Characteristic	Symbol	1N5820	1N5821	1N5822	Unit
Maximum Instantaneous Forward Voltage (1) (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 (1) T_L = 25°C T_L = 100°C	i_R	 2.0 20	 2.0 20	 2.0 20	mA

(1) Pulse Test: Pulse Width = 300 μs, Duty Cycle = 2.0%.
(2) Lead Temperature reference is cathode lead 1/32″ from case.
* Indicates JEDEC Registered Data for 1N5820–22.

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 0.1 V_{RWM}. Proper derating may be accomplished by use of equation (1).

$$T_{A(max)} = T_{J(max)} - R_{\theta JA}P_{F(AV)} - R_{\theta JA}P_{R(AV)} \qquad (1)$$

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).

$$T_R = T_{J(max)} - R_{\theta JA}P_{R(AV)} \qquad (2)$$

Substituting equation (2) into equation (1) yields:

$$T_{A(max)} = T_R - R_{\theta JA}P_{F(AV)} \qquad (3)$$

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:

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

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 V.

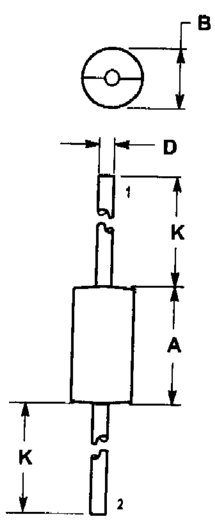
Step 2. Find T_R from Figure 2. Read T_R = 108°C
@ V_R = 9.2 V and $R_{\theta JA}$ = 40°C/W.

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°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 7.



NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.

DIM	INCHES MIN	INCHES MAX	MILLIMETERS MIN	MILLIMETERS MAX
A	0.370	0.380	9.40	9.65
B	0.190	0.210	4.83	5.33
D	0.048	0.052	1.22	1.32
K	1.000	—	25.40	—

STYLE 1:
PIN 1. CATHODE
2. ANODE