

# 2N6027, 2N6028

Preferred Device

## Programmable Unijunction Transistor

### Programmable Unijunction Transistor Triggers

Designed to enable the engineer to “program” unijunction characteristics such as  $R_{BB}$ ,  $\eta$ ,  $I_V$ , and  $I_P$  by merely selecting two resistor values. Application includes thyristor-trigger, oscillator, pulse and timing circuits. These devices may also be used in special thyristor applications due to the availability of an anode gate. Supplied in an inexpensive TO-92 plastic package for high-volume requirements, this package is readily adaptable for use in automatic insertion equipment.

- Programmable —  $R_{BB}$ ,  $\eta$ ,  $I_V$  and  $I_P$
- Low On-State Voltage — 1.5 Volts Maximum @  $I_F = 50$  mA
- Low Gate to Anode Leakage Current — 10 nA Maximum
- High Peak Output Voltage — 11 Volts Typical
- Low Offset Voltage — 0.35 Volt Typical ( $R_G = 10$  k ohms)
- Device Marking: Logo, Device Type, e.g., 2N6027, Date Code

#### MAXIMUM RATINGS ( $T_J = 25^\circ\text{C}$ unless otherwise noted)

| Rating                                                                                                                          | Symbol                   | Value          | Unit                       |
|---------------------------------------------------------------------------------------------------------------------------------|--------------------------|----------------|----------------------------|
| *Power Dissipation<br>Derate Above $25^\circ\text{C}$                                                                           | $P_F$<br>$1/\theta_{JA}$ | 300<br>4.0     | mW<br>mW/ $^\circ\text{C}$ |
| *DC Forward Anode Current<br>Derate Above $25^\circ\text{C}$                                                                    | $I_T$                    | 150<br>2.67    | mA<br>mA/ $^\circ\text{C}$ |
| *DC Gate Current                                                                                                                | $I_G$                    | $\pm 50$       | mA                         |
| Repetitive Peak Forward Current<br>100 $\mu\text{s}$ Pulse Width, 1% Duty Cycle<br>*20 $\mu\text{s}$ Pulse Width, 1% Duty Cycle | $I_{TRM}$                | 1.0<br>2.0     | Amps                       |
| Non-Repetitive Peak Forward Current<br>10 $\mu\text{s}$ Pulse Width                                                             | $I_{TSM}$                | 5.0            | Amps                       |
| *Gate to Cathode Forward Voltage                                                                                                | $V_{GKF}$                | 40             | Volts                      |
| *Gate to Cathode Reverse Voltage                                                                                                | $V_{GKR}$                | -5.0           | Volts                      |
| *Gate to Anode Reverse Voltage                                                                                                  | $V_{GAR}$                | 40             | Volts                      |
| *Anode to Cathode Voltage <sup>(1)</sup>                                                                                        | $V_{AK}$                 | $\pm 40$       | Volts                      |
| Operating Junction Temperature Range                                                                                            | $T_J$                    | -50 to<br>+100 | $^\circ\text{C}$           |
| *Storage Temperature Range                                                                                                      | $T_{stg}$                | -55 to<br>+150 | $^\circ\text{C}$           |

\*Indicates JEDEC Registered Data

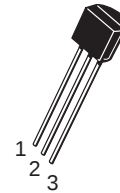
(1) Anode positive,  $R_{GA} = 1000$  ohms  
Anode negative,  $R_{GA} = \text{open}$



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PUTs  
40 VOLTS  
300 mW



TO-92 (TO-226AA)  
CASE 029  
STYLE 16

#### PIN ASSIGNMENT

|   |         |
|---|---------|
| 1 | Anode   |
| 2 | Gate    |
| 3 | Cathode |

#### ORDERING INFORMATION

See detailed ordering and shipping information in the package dimensions section on page 7 of this data sheet.

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

## 2N6027, 2N6028

### THERMAL CHARACTERISTICS

| Characteristic                                                                          | Symbol          | Max | Unit                 |
|-----------------------------------------------------------------------------------------|-----------------|-----|----------------------|
| Thermal Resistance, Junction to Case                                                    | $R_{\theta JC}$ | 75  | $^{\circ}\text{C/W}$ |
| Thermal Resistance, Junction to Ambient                                                 | $R_{\theta JA}$ | 200 | $^{\circ}\text{C/W}$ |
| Maximum Lead Temperature for Soldering Purposes<br>( $< 1/16''$ from case, 10 secs max) | $T_L$           | 260 | $^{\circ}\text{C}$   |

### ELECTRICAL CHARACTERISTICS ( $T_C = 25^{\circ}\text{C}$ unless otherwise noted.)

| Characteristic                                                                                                                                                                                                                                     | Fig. No. | Symbol    | Min                              | Typ                              | Max                          | Unit                                         |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|-----------|----------------------------------|----------------------------------|------------------------------|----------------------------------------------|
| *Peak Current<br>( $V_S = 10\text{ Vdc}$ , $R_G = 1\text{ M}\Omega$ )<br>2N6027<br>2N6028<br>( $V_S = 10\text{ Vdc}$ , $R_G = 10\text{ k ohms}$ )<br>2N6027<br>2N6028                                                                              | 2,9,11   | $I_P$     | —<br>—<br>—<br>—                 | 1.25<br>0.08<br>4.0<br>0.70      | 2.0<br>0.15<br>5.0<br>1.0    | $\mu\text{A}$                                |
| *Offset Voltage<br>( $V_S = 10\text{ Vdc}$ , $R_G = 1\text{ M}\Omega$ )<br>2N6027<br>2N6028<br>( $V_S = 10\text{ Vdc}$ , $R_G = 10\text{ k ohms}$ )<br>(Both Types)                                                                                | 1        | $V_T$     | 0.2<br>0.2<br>0.2                | 0.70<br>0.50<br>0.35             | 1.6<br>0.6<br>0.6            | Volts                                        |
| *Valley Current<br>( $V_S = 10\text{ Vdc}$ , $R_G = 1\text{ M}\Omega$ )<br>2N6027<br>2N6028<br>( $V_S = 10\text{ Vdc}$ , $R_G = 10\text{ k ohms}$ )<br>2N6027<br>2N6028<br>( $V_S = 10\text{ Vdc}$ , $R_G = 200\text{ ohms}$ )<br>2N6027<br>2N6028 | 1,4,5    | $I_V$     | —<br>—<br>70<br>25<br>1.5<br>1.0 | 18<br>18<br>150<br>150<br>—<br>— | 50<br>25<br>—<br>—<br>—<br>— | $\mu\text{A}$<br><br><br><br><br>$\text{mA}$ |
| *Gate to Anode Leakage Current<br>( $V_S = 40\text{ Vdc}$ , $T_A = 25^{\circ}\text{C}$ , Cathode Open)<br>( $V_S = 40\text{ Vdc}$ , $T_A = 75^{\circ}\text{C}$ , Cathode Open)                                                                     | —        | $I_{GAO}$ | —<br>—                           | 1.0<br>3.0                       | 10<br>—                      | nAdc                                         |
| Gate to Cathode Leakage Current<br>( $V_S = 40\text{ Vdc}$ , Anode to Cathode Shorted)                                                                                                                                                             | —        | $I_{GKS}$ | —                                | 5.0                              | 50                           | nAdc                                         |
| *Forward Voltage ( $I_F = 50\text{ mA Peak}$ )(1)                                                                                                                                                                                                  | 1,6      | $V_F$     | —                                | 0.8                              | 1.5                          | Volts                                        |
| *Peak Output Voltage<br>( $V_G = 20\text{ Vdc}$ , $C_C = 0.2\text{ }\mu\text{F}$ )                                                                                                                                                                 | 3,7      | $V_O$     | 6.0                              | 11                               | —                            | Volt                                         |
| Pulse Voltage Rise Time<br>( $V_B = 20\text{ Vdc}$ , $C_C = 0.2\text{ }\mu\text{F}$ )                                                                                                                                                              | 3        | $t_r$     | —                                | 40                               | 80                           | ns                                           |

\*Indicates JEDEC Registered Data

(1) Pulse Test: Pulse Width  $\leq 300\text{ }\mu\text{sec}$ , Duty Cycle  $\leq 2\%$ .

## 2N6027, 2N6028

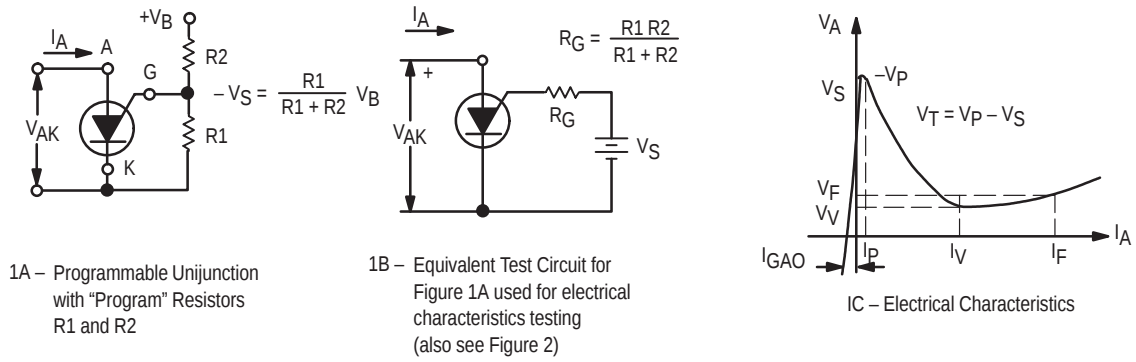


Figure 1. Electrical Characterization

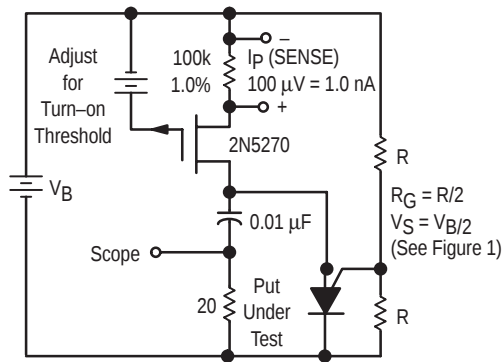


Figure 2. Peak Current ( $I_P$ ) Test Circuit

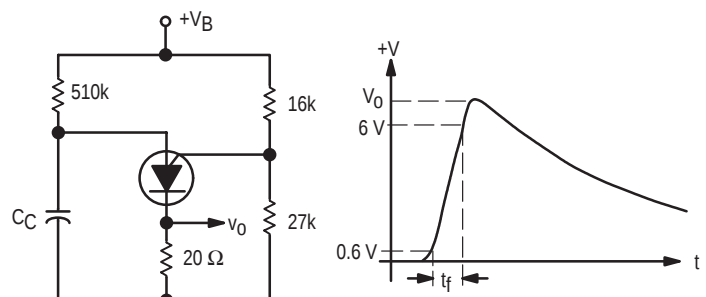


Figure 3.  $V_0$  and  $t_r$  Test Circuit

TYPICAL VALLEY CURRENT BEHAVIOR

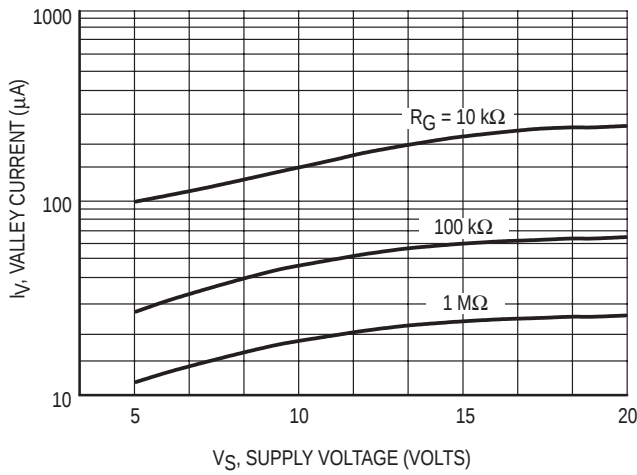


Figure 4. Effect of Supply Voltage

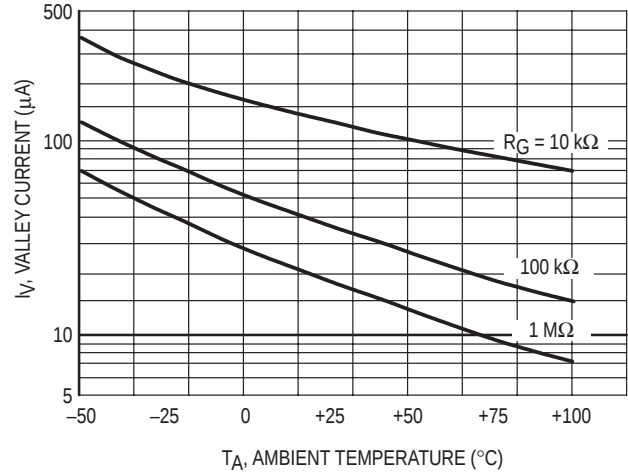


Figure 5. Effect of Temperature

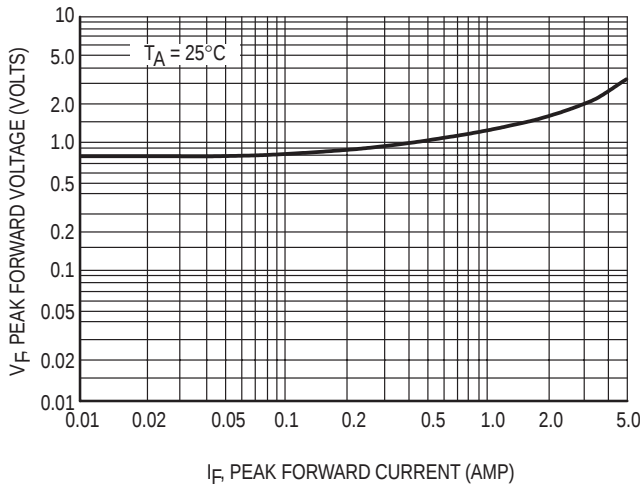


Figure 6. Forward Voltage

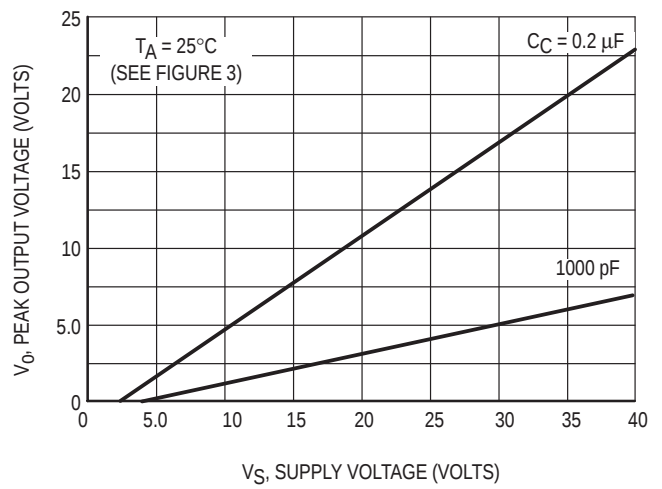


Figure 7. Peak Output Voltage

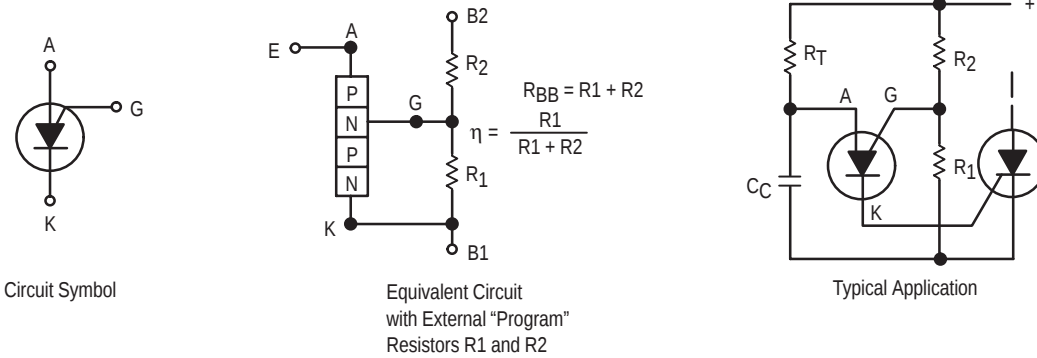


Figure 8. Programmable Unijunction

## 2N6027, 2N6028

### TYPICAL PEAK CURRENT BEHAVIOR

#### 2N6027

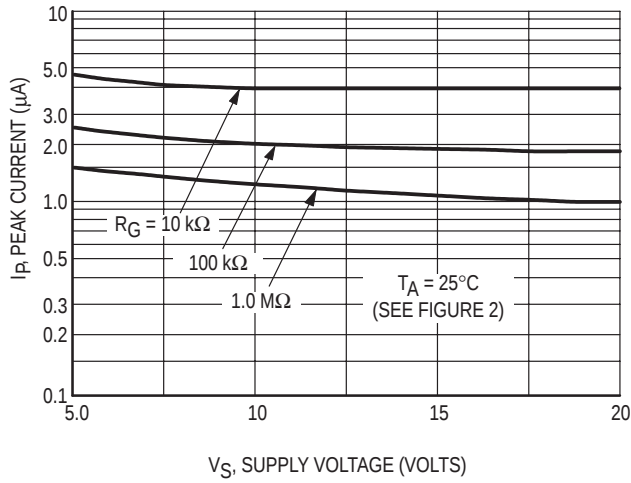


Figure 9. Effect of Supply Voltage and  $R_G$

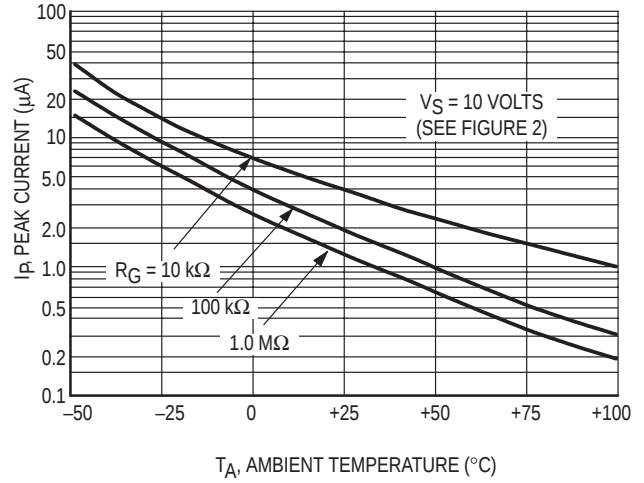


Figure 10. Effect of Temperature and  $R_G$

#### 2N6028

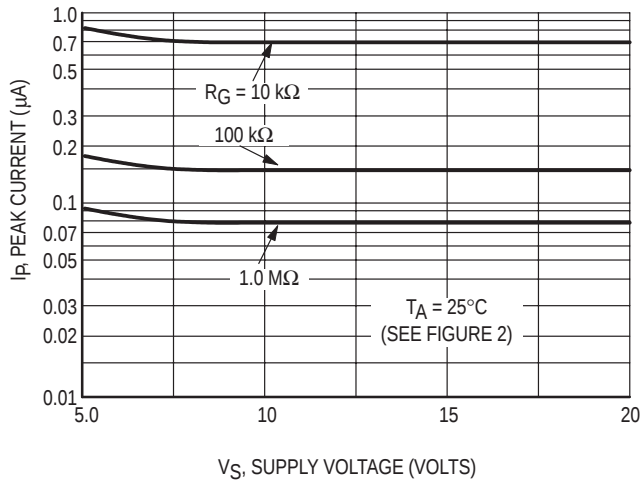


Figure 11. Effect of Supply Voltage and  $R_G$

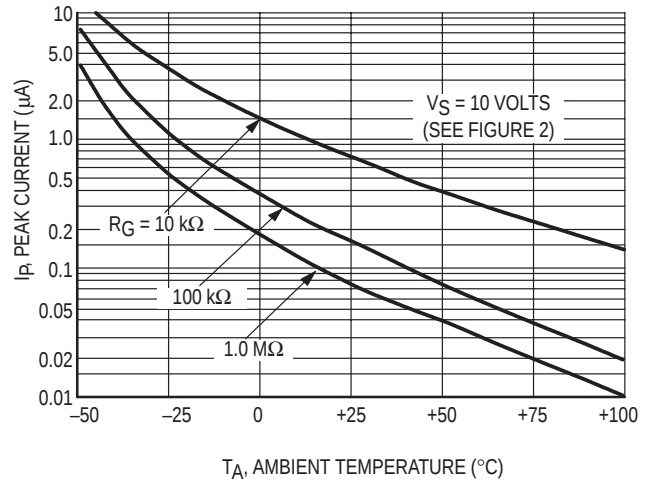


Figure 12. Effect of Temperature and  $R_G$

## TO-92 EIA RADIAL TAPE IN FAN FOLD BOX OR ON REEL

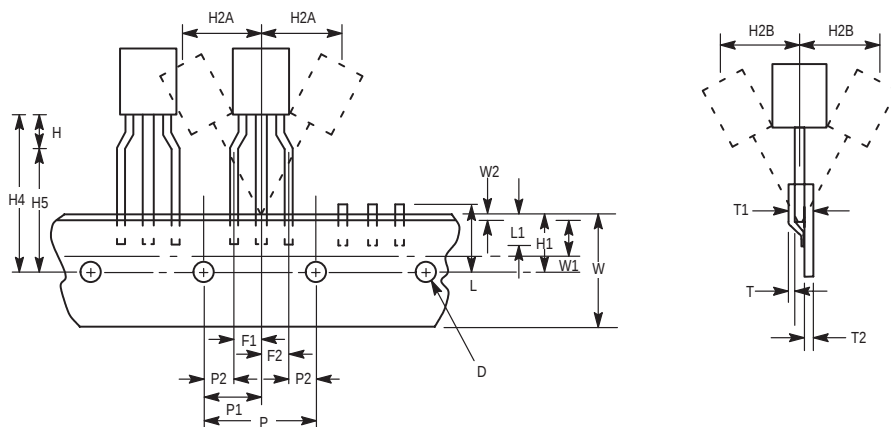


Figure 13. Device Positioning on Tape

| Symbol | Item                                 | Specification |         |            |      |
|--------|--------------------------------------|---------------|---------|------------|------|
|        |                                      | Inches        |         | Millimeter |      |
|        |                                      | Min           | Max     | Min        | Max  |
| D      | Tape Feedhole Diameter               | 0.1496        | 0.1653  | 3.8        | 4.2  |
| D2     | Component Lead Thickness Dimension   | 0.015         | 0.020   | 0.38       | 0.51 |
| F1, F2 | Component Lead Pitch                 | 0.0945        | 0.110   | 2.4        | 2.8  |
| H      | Bottom of Component to Seating Plane | .059          | .156    | 1.5        | 4.0  |
| H1     | Feedhole Location                    | 0.3346        | 0.3741  | 8.5        | 9.5  |
| H2A    | Deflection Left or Right             | 0             | 0.039   | 0          | 1.0  |
| H2B    | Deflection Front or Rear             | 0             | 0.051   | 0          | 1.0  |
| H4     | Feedhole to Bottom of Component      | 0.7086        | 0.768   | 18         | 19.5 |
| H5     | Feedhole to Seating Plane            | 0.610         | 0.649   | 15.5       | 16.5 |
| L      | Defective Unit Clipped Dimension     | 0.3346        | 0.433   | 8.5        | 11   |
| L1     | Lead Wire Enclosure                  | 0.09842       | —       | 2.5        | —    |
| P      | Feedhole Pitch                       | 0.4921        | 0.5079  | 12.5       | 12.9 |
| P1     | Feedhole Center to Center Lead       | 0.2342        | 0.2658  | 5.95       | 6.75 |
| P2     | First Lead Spacing Dimension         | 0.1397        | 0.1556  | 3.55       | 3.95 |
| T      | Adhesive Tape Thickness              | 0.06          | 0.08    | 0.15       | 0.20 |
| T1     | Overall Taped Package Thickness      | —             | 0.0567  | —          | 1.44 |
| T2     | Carrier Strip Thickness              | 0.014         | 0.027   | 0.35       | 0.65 |
| W      | Carrier Strip Width                  | 0.6889        | 0.7481  | 17.5       | 19   |
| W1     | Adhesive Tape Width                  | 0.2165        | 0.2841  | 5.5        | 6.3  |
| W2     | Adhesive Tape Position               | .0059         | 0.01968 | .15        | 0.5  |

## NOTES:

1. Maximum alignment deviation between leads not to be greater than 0.2 mm.
2. Defective components shall be clipped from the carrier tape such that the remaining protrusion (L) does not exceed a maximum of 11 mm.
3. Component lead to tape adhesion must meet the pull test requirements.
4. Maximum non-cumulative variation between tape feed holes shall not exceed 1 mm in 20 pitches.
5. Holddown tape not to extend beyond the edge(s) of carrier tape and there shall be no exposure of adhesive.
6. No more than 1 consecutive missing component is permitted.
7. A tape trailer and leader, having at least three feed holes is required before the first and after the last component.
8. Splices will not interfere with the sprocket feed holes.

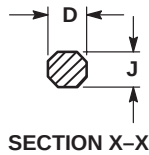
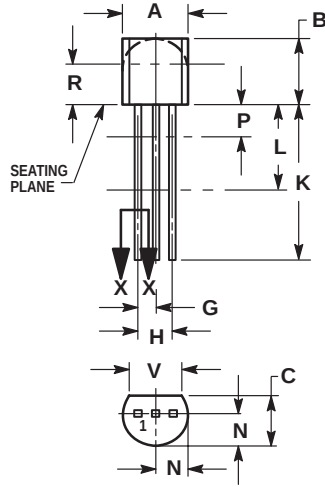
## 2N6027, 2N6028

### ORDERING & SHIPPING INFORMATION: 2N6027 and 2N6028 packaging options, Device Suffix

| U.S.                                                                 | Europe Equivalent | Shipping                                                                                                                                                                   | Description of TO92 Tape Orientation                                                                                                                                                                    |
|----------------------------------------------------------------------|-------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 2N6027, 2N6028<br>2N6027, 2N6028RLRA<br><br>2N6028RLRM<br>2N6028RLRP | 2N6027RL1         | Bulk in Box (5K/Box)<br>Radial Tape and Reel (2K/Reel)<br>Radial Tape and Reel (2K/Reel)<br>Radial Tape and Fan Fold Box (2K/Box)<br>Radial Tape and Fan Fold Box (2K/Box) | N/A, Bulk<br>Round side of TO92 and adhesive tape visible<br>Flat side of TO92 and adhesive tape visible<br>Flat side of TO92 and adhesive tape visible<br>Round side of TO92 and adhesive tape visible |

### PACKAGE DIMENSIONS

#### TO-92 (TO-226AA) CASE 029-11 ISSUE AJ



#### NOTES:

1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.
3. CONTOUR OF PACKAGE BEYOND DIMENSION R IS UNCONTROLLED.
4. LEAD DIMENSION IS UNCONTROLLED IN P AND BEYOND DIMENSION K MINIMUM.

| DIM | INCHES |       | MILLIMETERS |       |
|-----|--------|-------|-------------|-------|
|     | MIN    | MAX   | MIN         | MAX   |
| A   | 0.175  | 0.205 | 4.45        | 5.20  |
| B   | 0.170  | 0.210 | 4.32        | 5.33  |
| C   | 0.125  | 0.165 | 3.18        | 4.19  |
| D   | 0.016  | 0.021 | 0.407       | 0.533 |
| G   | 0.045  | 0.055 | 1.15        | 1.39  |
| H   | 0.095  | 0.105 | 2.42        | 2.66  |
| J   | 0.015  | 0.020 | 0.39        | 0.50  |
| K   | 0.500  | —     | 12.70       | —     |
| L   | 0.250  | —     | 6.35        | —     |
| N   | 0.080  | 0.105 | 2.04        | 2.66  |
| P   | —      | 0.100 | —           | 2.54  |
| R   | 0.115  | —     | 2.93        | —     |
| V   | 0.135  | —     | 3.43        | —     |

#### STYLE 16:

- PIN 1. ANODE
- GATE
- CATHODE

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