

# NL17SZ02

## 2-Input NOR Gate

The NL17SZ02 is a single 2-input NOR Gate in two tiny footprint packages. The device performs much as LCX multi-gate products in speed and drive.

- Tiny SOT-353 and SOT-553 Packages
- 2.4 ns  $T_{PD}$  at 5 V (typ)
- Source/Sink 24 mA at 3.0 V
- Over-Voltage Tolerant Inputs
- Pin For Pin with NC7SZ02P5X, TC7SZ02FU and TC7SZ02AFE
- Chip Complexity: FETs = 20
- Designed for 1.65 V to 5.5 V  $V_{CC}$  Operation

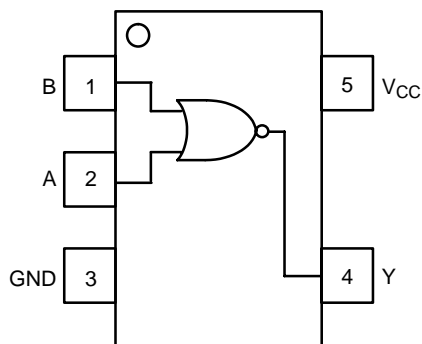


Figure 1. Pinout (Top View)

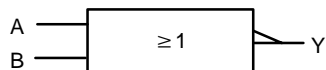


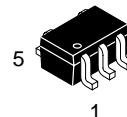
Figure 2. Logic Symbol



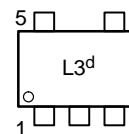
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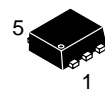
### MARKING DIAGRAMS



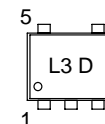
**SOT-353/SC70-5/SC-88A**  
**DF SUFFIX**  
**CASE 419A**



d = Date Code



**SOT-553**  
**XV5 SUFFIX**  
**CASE 463B**



L3 = Device Marking  
D = One Digit Date Code

### PIN ASSIGNMENT

| Pin | Function |
|-----|----------|
| 1   | A        |
| 2   | B        |
| 3   | GND      |
| 4   | Y        |
| 5   | $V_{CC}$ |

### FUNCTION TABLE

| Input |   | Output<br>$Y = \overline{A + B}$ |
|-------|---|----------------------------------|
| A     | B | Y                                |
| L     | L | H                                |
| L     | H | L                                |
| H     | L | L                                |
| H     | H | L                                |

### ORDERING INFORMATION

See detailed ordering and shipping information in the package dimensions section on page 4 of this data sheet.

## MAXIMUM RATINGS

| Symbol           | Parameter  | Value                          | Unit |
|------------------|--|--------------------------------|------|
| V <sub>CC</sub>  | DC Supply Voltage  | − 0.5 to + 7.0                 | V    |
| V <sub>IN</sub>  | DC Input Voltage   | − 0.5 to + 7.0                 | V    |
| V <sub>OUT</sub> | DC Output Voltage  | − 0.5 to V <sub>CC</sub> + 0.5 | V    |
| I <sub>IK</sub>  | DC Input Diode Current   | − 50                           | mA   |
| I <sub>OK</sub>  | DC Output Diode Current  | − 50                           | mA   |
| I <sub>OUT</sub> | DC Output Sink Current   | ± 50                           | mA   |
| I <sub>CC</sub>  | DC Supply Current per Supply Pin   | ± 100                          | mA   |
| T <sub>STG</sub> | Storage Temperature Range  | − 65 to + 150                  | °C   |
| T <sub>L</sub>   | Lead Temperature, 1 mm from Case for 10 Seconds  | 260                            | °C   |
| T <sub>J</sub>   | Junction Temperature Under Bias  | + 150                          | °C   |
| θ <sub>JA</sub>  | Thermal Resistance<br>SOT- 353 (Note 1)<br>SOT- 553  | 350<br>496                     | °C/W |
| P <sub>D</sub>   | Power Dissipation in Still Air at 85°C<br>SOT- 353<br>SOT- 553   | 186<br>135                     | mW   |
| MSL              | Moisture Sensitivity   | Level 1                        |      |
| F <sub>R</sub>   | Flammability Rating<br>Oxygen Index: 28 to 34  | UL 94 V-0 @ 0.125 in           |      |
| ESD              | ESD Classification<br>Human Body Model (Note 2)<br>Machine Model (Note 3)<br>Charged Device Model (Note 4) | Class Z<br>Class A<br>N/A      |      |

Maximum Ratings are those values beyond which damage to the device may occur. Exposure to these conditions or conditions beyond those indicated may adversely affect device reliability. Functional operation under absolute maximum-rated conditions is not implied. Functional operation should be restricted to the Recommended Operating Conditions.

1. Measured with minimum pad spacing on an FR4 board, using 10 mm-by-1 inch, 2-ounce copper trace with no air flow.
2. Tested to EIA/JESD22-A114-A, rated to EIA/JESD22-A114-B.
3. Tested to EIA/JESD22-A115-A, rated to EIA/JESD22-A115-A.
4. Tested to JESD22-C101-A.

## RECOMMENDED OPERATING CONDITIONS

| Symbol                          | Parameter                   | Min  | Max                   | Unit |
|---------------------------------|-----------------------------|--|-----------------------|------|
| V <sub>CC</sub>                 | DC Supply Voltage           | 1.65   | 5.5                   | V    |
| V <sub>IN</sub>                 | DC Input Voltage            | 0  | 5.5                   | V    |
| V <sub>OUT</sub>                | DC Output Voltage           | 0  | V <sub>CC</sub> + 0.5 | V    |
| T <sub>A</sub>                  | Operating Temperature Range | − 40   | + 85                  | °C   |
| t <sub>r</sub> , t <sub>f</sub> | Input Rise and Fall Time    | V <sub>CC</sub> = 3.0 V ± 0.3 V<br>V <sub>CC</sub> = 5.0 V ± 0.5 V | 0<br>100<br>20        | ns/V |

## DC ELECTRICAL CHARACTERISTICS

| Symbol          | Parameter   | Condition  | V <sub>CC</sub><br>(V)                                 | T <sub>A</sub> = 25°C  |  |  | -40°C ≤ T <sub>A</sub> ≤ 85°C                                    |  | Unit |
|-----------------|---|--|--|--|--|--|--|--|------|
|                 |   |  |  | Min  | Typ  | Max  | Min  | Max  |      |
| V <sub>IH</sub> | High-Level Input Voltage  |  | 1.65 to 1.95<br>2.3 to 5.5                             | 0.75 V <sub>CC</sub><br>0.7 V <sub>CC</sub>                      |  |  | 0.75 V <sub>CC</sub><br>0.7 V <sub>CC</sub>                      |  | V    |
| V <sub>IL</sub> | Low-Level Input Voltage   |  | 1.65 to 1.95<br>2.3 to 5.5                             |  |  | 0.25 V <sub>CC</sub><br>0.3 V <sub>CC</sub>      |  | 0.25 V <sub>CC</sub><br>0.3 V <sub>CC</sub>      | V    |
| V <sub>OH</sub> | High-Level Output Voltage<br>V <sub>IN</sub> = V <sub>IL</sub> or V <sub>IH</sub> | I <sub>OH</sub> = 100 μA<br>I <sub>OH</sub> = -3 mA<br>I <sub>OH</sub> = -8 mA<br>I <sub>OH</sub> = -12 mA<br>I <sub>OH</sub> = -16 mA<br>I <sub>OH</sub> = -24 mA<br>I <sub>OH</sub> = -32 mA | 1.65 to 5.5<br>1.65<br>2.3<br>2.7<br>3.0<br>3.0<br>4.5 | V <sub>CC</sub> - 0.1<br>1.29<br>1.9<br>2.2<br>2.4<br>2.3<br>3.8 | V <sub>CC</sub><br>1.52<br>2.1<br>2.4<br>2.7<br>2.5<br>4.0 |  | V <sub>CC</sub> - 0.1<br>1.29<br>1.9<br>2.2<br>2.4<br>2.3<br>3.8 |  | V    |
| V <sub>OL</sub> | Low-Level Output Voltage<br>V <sub>IN</sub> = V <sub>IH</sub> or V <sub>OH</sub>  | I <sub>OL</sub> = 100 μA<br>I <sub>OL</sub> = 3 mA<br>I <sub>OL</sub> = 8 mA<br>I <sub>OL</sub> = 12 mA<br>I <sub>OL</sub> = 16 mA<br>I <sub>OL</sub> = 24 mA<br>I <sub>OL</sub> = 32 mA       | 1.65 to 5.5<br>1.65<br>2.3<br>2.7<br>3.0<br>3.0<br>4.5 |  | 0.08<br>0.20<br>0.22<br>0.28<br>0.38<br>0.42               | 0.1<br>0.24<br>0.3<br>0.4<br>0.4<br>0.55<br>0.55 |  | 0.1<br>0.24<br>0.3<br>0.4<br>0.4<br>0.55<br>0.55 | V    |
| I <sub>IN</sub> | Input Leakage Current   | V <sub>IN</sub> = V <sub>CC</sub> or GND   | 0 to 5.5   |  |  | ±0.1   |  | ±1.0   | μA   |
| I <sub>CC</sub> | Quiescent Supply Current  | V <sub>IN</sub> = V <sub>CC</sub> or GND   | 5.5  |  |  | 1  |  | 10   | μA   |

AC ELECTRICAL CHARACTERISTICS t<sub>R</sub> = t<sub>F</sub> = 3.0 ns

| Symbol                               | Parameter                             | Condition   | V <sub>CC</sub><br>(V) | T <sub>A</sub> = 25°C |            |            | -40°C ≤ T <sub>A</sub> ≤ 85°C |            | Unit |
|--------------------------------------|---------------------------------------|---|------------------------|-----------------------|------------|------------|-------------------------------|------------|------|
|                                      |                                       |   |                        | Min                   | Typ        | Max        | Min                           | Max        |      |
| t <sub>PLH</sub><br>t <sub>PHL</sub> | Propagation Delay<br>(Figure 3 and 4) | R <sub>L</sub> = 1 MΩ, C <sub>L</sub> = 15 pF   | 1.65                   | 2.0                   | 5.3        | 11.5       | 2.0                           | 12.0       | ns   |
|                                      |                                       | R <sub>L</sub> = 1 MΩ, C <sub>L</sub> = 15 pF   | 1.8                    | 2.0                   | 4.4        | 9.5        | 2.0                           | 10.0       |      |
|                                      |                                       | R <sub>L</sub> = 1 MΩ, C <sub>L</sub> = 15 pF   | 2.5 ± 0.2              | 0.8                   | 2.9        | 6.5        | 0.8                           | 7.0        |      |
|                                      |                                       | R <sub>L</sub> = 1 MΩ, C <sub>L</sub> = 15 pF   | 3.3 ± 0.3              | 0.5                   | 2.3        | 4.5        | 0.5                           | 4.7        |      |
|                                      |                                       | R <sub>L</sub> = 500 Ω, C <sub>L</sub> = 50 pF  |                        | 1.5                   | 2.9        | 5.0        | 1.5                           | 5.2        |      |
|                                      |                                       | R <sub>L</sub> = 1 MΩ, C <sub>L</sub> = 15 pF<br>R <sub>L</sub> = 500 Ω, C <sub>L</sub> = 50 pF | 5.0 ± 0.5              | 0.5<br>0.8            | 1.9<br>2.4 | 3.9<br>4.3 | 0.5<br>0.8                    | 4.1<br>4.5 |      |

## CAPACITIVE CHARACTERISTICS

| Symbol          | Parameter                                 | Condition  | Typical  | Unit |
|-----------------|---|--|----------|------|
| C <sub>IN</sub> | Input Capacitance                         | V <sub>CC</sub> = 5.5 V, V <sub>I</sub> = 0 V or V <sub>CC</sub>   | > 4      | pF   |
| C <sub>PD</sub> | Power Dissipation Capacitance<br>(Note 5) | 10 MHz, V <sub>CC</sub> = 3.3 V, V <sub>I</sub> = 0 V or V <sub>CC</sub><br>10 MHz, V <sub>CC</sub> = 5.5 V, V <sub>I</sub> = 0 V or V <sub>CC</sub> | 25<br>30 | pF   |

5. C<sub>PD</sub> is defined as the value of the internal equivalent capacitance which is calculated from the operating current consumption without load. Average operating current can be obtained by the equation: I<sub>CC(OPR)</sub> = C<sub>PD</sub> • V<sub>CC</sub> • f<sub>in</sub> + I<sub>CC</sub>. C<sub>PD</sub> is used to determine the no-load dynamic power consumption; P<sub>D</sub> = C<sub>PD</sub> • V<sub>CC</sub><sup>2</sup> • f<sub>in</sub> + I<sub>CC</sub> • V<sub>CC</sub>.

## NL17SZ02

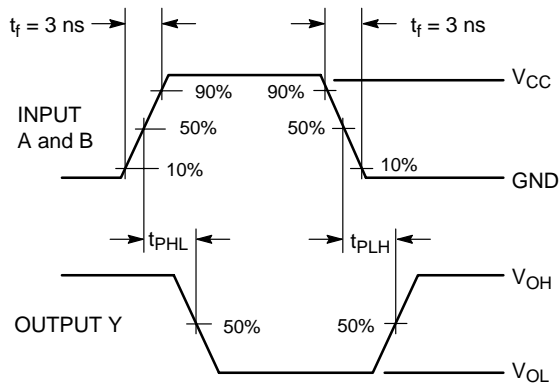
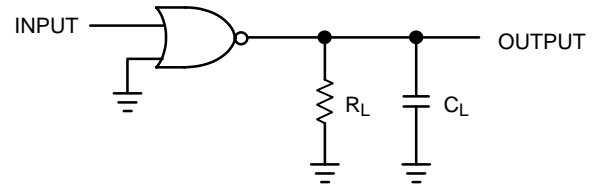


Figure 3. Switching Waveform



A 1-MHz square input wave is recommended for propagation delay tests.

Figure 4. Test Circuit

### DEVICE ORDERING INFORMATION

| Device Order Number | Device Nomenclature     |                          |                       |            |                 |                |                      | Package Type                  | Tape and Reel Size    |
|---------------------|-------------------------|--------------------------|-----------------------|------------|-----------------|----------------|----------------------|-------------------------------|-----------------------|
|                     | Logic Circuit Indicator | No. of Gates per Package | Temp Range Identifier | Technology | Device Function | Package Suffix | Tape and Reel Suffix |                               |                       |
| NL17SZ02DFT2        | NL                      | 1                        | 7                     | SZ         | 02              | DF             | T2                   | SOT-353/<br>SC70-5/<br>SC-88A | 178 mm,<br>3000 Units |
| NL17SZ02XV5T2       | NL                      | 1                        | 7                     | SZ         | 02              | XV5            | T2                   | SOT-553                       | 178 mm<br>4000 Units  |

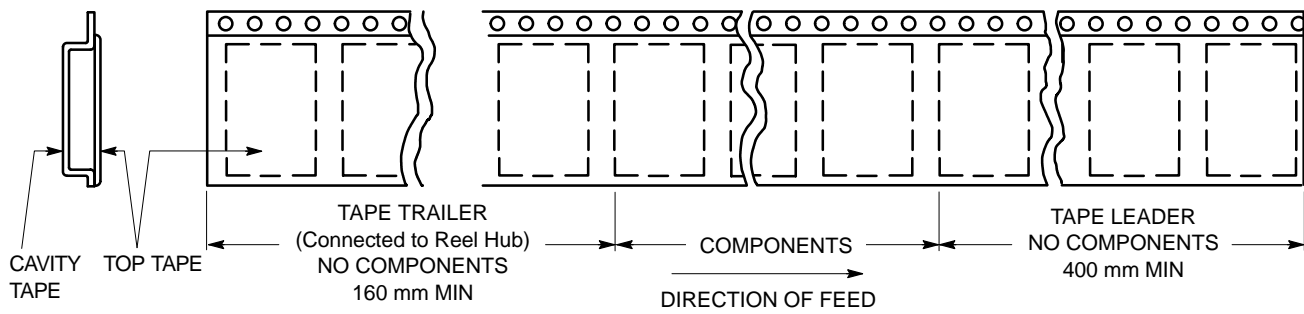
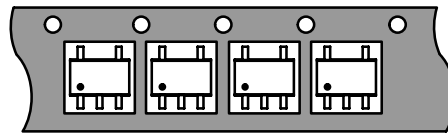
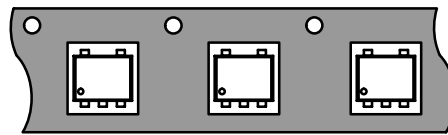


Figure 5. Tape Ends for Finished Goods



"T2" Pin One Opposing Sprocket Hole (3k Reel)

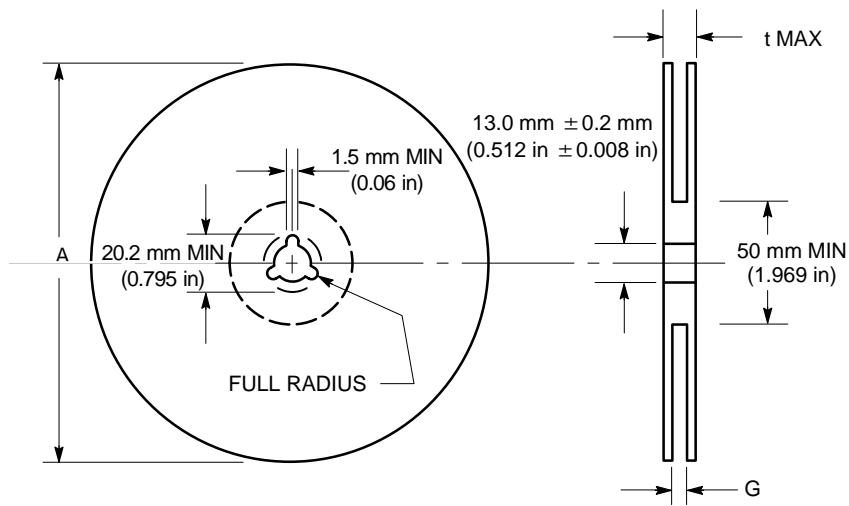
Figure 6. SOT-353/SC70-5/SC-88A Reel Configuration/Orientation



"T2" Pin One Opposing Sprocket Hole (4k Reel)

Figure 7. SOT-553 XV5T2 Reel Configuration/Orientation

# NL17SZ02

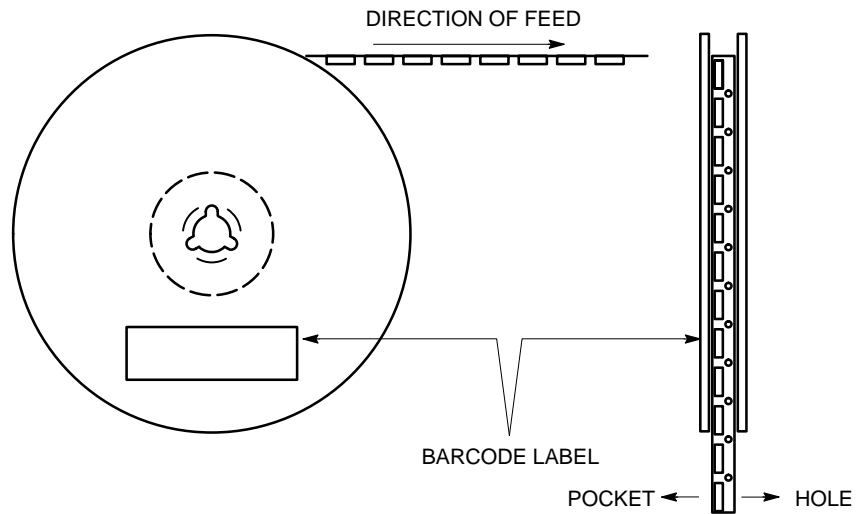


**Figure 8. Reel Dimensions**

## REEL DIMENSIONS†

| Tape Size | T and R Suffix | A Max            | G   | t Max                |
|-----------|----------------|------------------|---|----------------------|
| 8 mm      | T2             | 178 mm<br>(7 in) | 8.4 mm, + 1.5 mm, -0.0<br>(0.33 in + 0.059 in, -0.00) | 14.4 mm<br>(0.56 in) |

†For additional tape and reel information, refer to Brochure BRD8011/D.

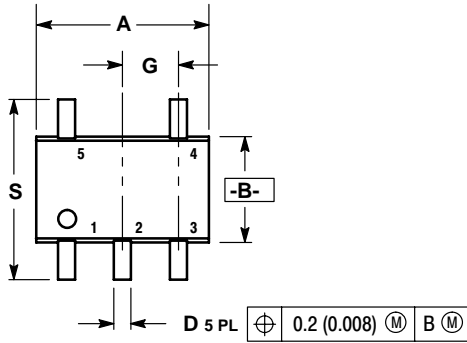


**Figure 9. Reel Winding Direction**

# NL17SZ02

## PACKAGE DIMENSIONS

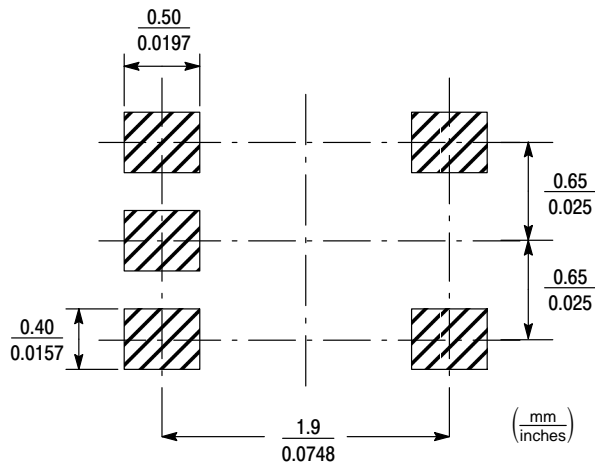
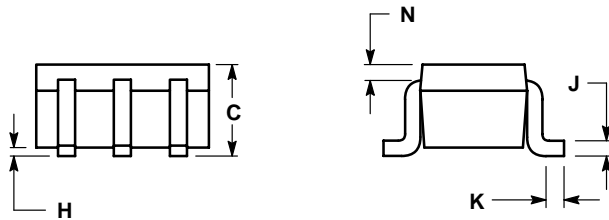
**SOT-353**  
**DF SUFFIX**  
 5-LEAD PACKAGE  
 CASE 419A-02  
 ISSUE F



### NOTES:

1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.
3. 419A-01 OBSOLETE. NEW STANDARD 419A-02.

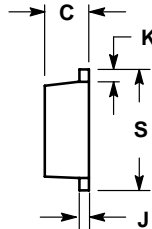
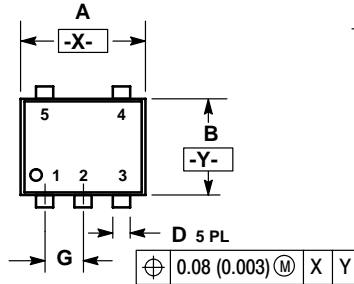
| DIM | INCHES    |       | MILLIMETERS |      |
|-----|-----------|-------|-------------|------|
|     | MIN       | MAX   | MIN         | MAX  |
| A   | 0.071     | 0.087 | 1.80        | 2.20 |
| B   | 0.045     | 0.053 | 1.15        | 1.35 |
| C   | 0.031     | 0.043 | 0.80        | 1.10 |
| D   | 0.004     | 0.012 | 0.10        | 0.30 |
| G   | 0.026 BSC |       | 0.65 BSC    |      |
| H   | ---       | 0.004 | ---         | 0.10 |
| J   | 0.004     | 0.010 | 0.10        | 0.25 |
| K   | 0.004     | 0.012 | 0.10        | 0.30 |
| N   | 0.008 REF |       | 0.20 REF    |      |
| S   | 0.079     | 0.087 | 2.00        | 2.20 |



# NL17SZ02

## PACKAGE DIMENSIONS

**SOT-553**  
**XV5 SUFFIX**  
**5-LEAD PACKAGE**  
**CASE 463B-01**  
**ISSUE O**



### NOTES:

1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: MILLIMETERS
3. MAXIMUM LEAD THICKNESS INCLUDES LEAD FINISH THICKNESS. MINIMUM LEAD THICKNESS IS THE MINIMUM THICKNESS OF BASE MATERIAL

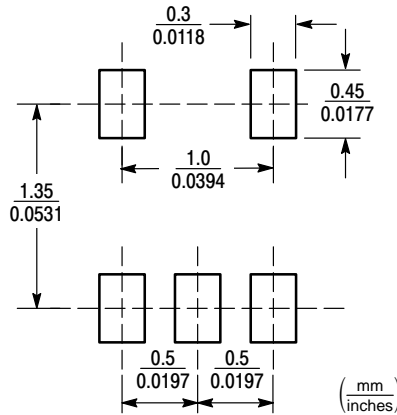
| DIM | MILLIMETERS |      | INCHES    |       |
|-----|-------------|------|-----------|-------|
|     | MIN         | MAX  | MIN       | MAX   |
| A   | 1.50        | 1.70 | 0.059     | 0.067 |
| B   | 1.10        | 1.30 | 0.043     | 0.051 |
| C   | 0.50        | 0.60 | 0.020     | 0.024 |
| D   | 0.17        | 0.27 | 0.007     | 0.011 |
| G   | 0.50 BSC    |      | 0.020 BSC |       |
| J   | 0.08        | 0.18 | 0.003     | 0.007 |
| K   | 0.10        | 0.30 | 0.004     | 0.012 |
| S   | 1.50        | 1.70 | 0.059     | 0.067 |


### STYLE 1:

- PIN 1. BASE 1
- EMITTER 1/2
- BASE 2
- COLLECTOR 2
- COLLECTOR 1

### STYLE 2:

- PIN 1. CATHODE
- ANODE
- CATHODE
- CATHODE
- CATHODE



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