# NL17SZ125

## Non-Inverting 3-State Buffer

The NL17SZ125 is a high performance noninverting buffer operating from a 2.3 V to 5.5 V supply.

- Extremely High Speed: $t_{PD}$ 2.6 ns (typical) at $V_{CC}$ = 5 V
- Designed for 2.3 V to 5.5 V $V_{CC}$ Operation
- Over Voltage Tolerant Inputs and Outputs
- LVTTL Compatible – Interface Capability With 5 V TTL Logic with $V_{CC}$ = 3 V
- LVCMOS Compatible
- 24 mA Balanced Output Sink and Source Capability
- Near Zero Static Supply Current Substantially Reduces System Power Requirements
- 3–State OE Input is Active–Low
- Replacement for NC7SZ125
- Chip Complexity = 36 FETs

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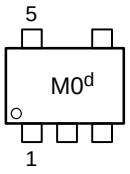
**SC70–5/SC–88A/SOT–353**
**DF SUFFIX**
**CASE 419A**

**MARKING DIAGRAM**




d = Date Code

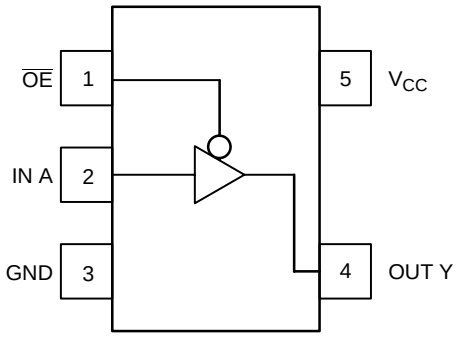



**Figure 1. Pinout** (Top View)

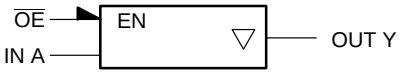



**Figure 2. Logic Symbol**

| PIN ASSIGNMENT | |
|---|---|
| 1 | $\overline{OE}$ |
| 2 | IN A |
| 3 | GND |
| 4 | OUT Y |
| 5 | $V_{CC}$ |

**FUNCTION TABLE**

| $\overline{OE}$ Input | A Input | Y Output |
|---|---|---|
| L | L | L |
| L | H | H |
| H | X | Z |

X = Don't Care

**ORDERING INFORMATION**

See detailed ordering and shipping information in the package dimensions section on page 5 of this data sheet.

**MAXIMUM RATINGS**

| Symbol | Parameter | | Value | Unit |
|---|---|---|---|---|
| $V_{CC}$ | DC Supply Voltage | | −0.5 to +7.0 | V |
| $V_{IN}$ | DC Input Voltage | | −0.5 to +7.0 | V |
| $V_{OUT}$ | DC Output Voltage | | −0.5 to +7.0 | V |
| $I_{IK}$ | DC Input Diode Current | | −50 | mA |
| $I_{OK}$ | DC Output Diode Current | | −50 | mA |
| $I_{OUT}$ | DC Output Sink Current | | ±50 | mA |
| $I_{CC}$ | DC Supply Current per Supply Pin | | ±100 | mA |
| $T_{STG}$ | Storage Temperature Range | | −65 to +150 | °C |
| $T_L$ | Lead Temperature, 1 mm from Case for 10 Seconds | | 260 | °C |
| $T_J$ | Junction Temperature Under Bias | | +150 | °C |
| $\theta_{JA}$ | Thermal Resistance (Note 1) | | 350 | °C/W |
| $P_D$ | Power Dissipation in Still Air at 85°C | | 150 | mW |
| MSL | Moisture Sensitivity | | Level 1 | |
| $F_R$ | Flammability Rating | Oxygen Index: 28 to 34 | UL 94 V–0 @ 0.125 in | |
| $V_{ESD}$ | ESD Withstand Voltage | Human Body Model (Note 2)<br>Machine Model (Note 3)<br>Charged Device Model (Note 4) | >2000<br>>200<br>N/A | V |

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.
3. Tested to EIA/JESD22–A115–A.
4. Tested to JESD22–C101–A.

**RECOMMENDED OPERATING CONDITIONS**

| Symbol | Parameter | | Min | Max | Unit |
|---|---|---|---|---|---|
| $V_{CC}$ | DC Supply Voltage | | 2.0 | 5.5 | V |
| $V_{IN}$ | DC Input Voltage | | 0 | 5.5 | V |
| $V_{OUT}$ | DC Output Voltage | | 0 | 5.5 | V |
| $T_A$ | Operating Temperature Range | | −40 | +85 | °C |
| $t_r$, $t_f$ | Input Rise and Fall Time | $V_{CC}$ = 3.0 V ±0.3 V<br>$V_{CC}$ = 5.0 V ±0.5 V | 0<br>0 | 100<br>20 | ns/V |

**DEVICE JUNCTION TEMPERATURE VERSUS TIME TO 0.1% BOND FAILURES**

| Junction Temperature °C | Time, Hours | Time, Years |
|---|---|---|
| 80 | 1,032,200 | 117.8 |
| 90 | 419,300 | 47.9 |
| 100 | 178,700 | 20.4 |
| 110 | 79,600 | 9.4 |
| 120 | 37,000 | 4.2 |
| 130 | 17,800 | 2.0 |
| 140 | 8,900 | 1.0 |

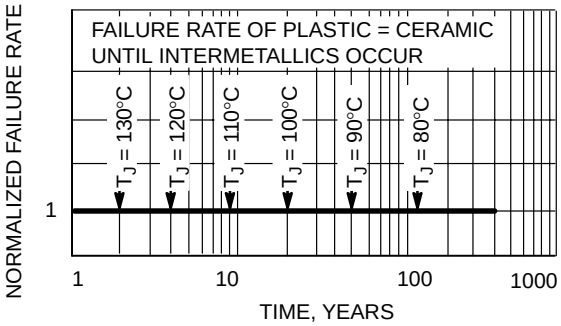



**Figure 3. Failure Rate vs. Time Junction Temperature**

## DC ELECTRICAL CHARACTERISTICS

| Symbol | Parameter | Condition | $V_{CC}$ (V) | $T_A$ = 25°C | | | −40°C ≤ $T_A$ ≤ 85°C | | Unit |
|---|---|---|---|---|---|---|---|---|---|
| | | | | Min | Typ | Max | Min | Max | |
| $V_{IH}$ | High–Level Input Voltage | | 2.3 to 5.5 | 0.7 $V_{CC}$ | | | 0.7 $V_{CC}$ | | V |
| $V_{IL}$ | Low–Level Input Voltage | | 2.3 to 5.5 | | | 0.3 $V_{CC}$ | | 0.3 $V_{CC}$ | V |
| $V_{OH}$ | High–Level Output Voltage<br>$V_{IN}$ = $V_{IL}$ or $V_{IH}$ | $I_{OH}$ = 100 μA<br>$I_{OH}$ = –8 mA<br>$I_{OH}$ = –12 mA<br>$I_{OH}$ = –16 mA<br>$I_{OH}$ = –24 mA<br>$I_{OH}$ = –32 mA | 2.3 to 5.5<br>2.3<br>2.7<br>3.0<br>3.0<br>4.5 | $V_{CC}$ – 0.1<br>1.9<br>2.2<br>2.4<br>2.3<br>3.8 | $V_{CC}$<br>2.1<br>2.4<br>2.7<br>2.5<br>4.0 | | $V_{CC}$ – 0.1<br>1.9<br>2.2<br>2.4<br>2.3<br>3.8 | | V |
| $V_{OL}$ | Low–Level Output Voltage<br>$V_{IN}$ = $V_{IL}$ | $I_{OL}$ = 100 μA<br>$I_{OL}$ = 8 mA<br>$I_{OL}$ = 12 mA<br>$I_{OL}$ = 16 mA<br>$I_{OL}$ = 24 mA<br>$I_{OL}$ = 32 mA | 2.3 to 5.5<br>2.3<br>2.7<br>3.0<br>3.0<br>4.5 | | <br>0.20<br>0.22<br>0.28<br>0.38<br>0.42 | 0.1<br>0.3<br>0.4<br>0.4<br>0.55<br>0.55 | | 0.1<br>0.3<br>0.4<br>0.4<br>0.55<br>0.55 | V |
| $I_{IN}$ | Input Leakage Current | $V_{IN}$ = $V_{CC}$ or GND | 0 to 5.5 | | | ±0.1 | | ±1.0 | μA |
| $I_{OFF}$ | Power Off–Output Leakage Current | $V_{OUT}$ = 5.5 V | 0 | | | 1 | | 10 | μA |
| $I_{CC}$ | Quiescent Supply Current | $V_{IN}$ = $V_{CC}$ or GND | 5.5 | | | 1 | | 10 | μA |
| $I_{OZ}$ | 3–State Output Leakage | $V_{IN}$ = $V_{IL}$ or $V_{IH}$<br>0 V ≤ $V_{OUT}$ ≤ 5.5 V | 2.3 to 5.5 | | | ±0.5 | | ±5 | μA |

## AC ELECTRICAL CHARACTERISTICS ($t_R$ = $t_F$ = 3.0 ns)

| Symbol | Parameter | Condition | $V_{CC}$ (V) | $T_A$ = 25°C | | | −40°C ≤ $T_A$ ≤ 85°C | | Unit |
|---|---|---|---|---|---|---|---|---|---|
| | | | | Min | Typ | Max | Min | Max | |
| $t_{PLH}$<br>$t_{PHL}$ | Propagation Delay<br>AN to YN<br>(Figures 4 and 5, Table 1) | $R_L$ = 1 MΩ $C_L$ = 15 pF | 2.5 ± 0.2 | 1.0 | | 7.5 | 1.0 | 8 | ns |
| | | $R_L$ = 1 MΩ $C_L$ = 15 pF<br>$R_L$ = 500 Ω $C_L$ = 50 pF | 3.3 ± 0.3 | 0.8<br>1.2 | | 5.2<br>5.7 | 0.8<br>1.2 | 5.5<br>6.0 | |
| | | $R_L$ = 1 MΩ $C_L$ = 15 pF<br>$R_L$ = 500 Ω $C_L$ = 50 pF | 5.0 ± 0.5 | 0.5<br>0.8 | | 4.5<br>5.0 | 0.5<br>0.8 | 4.8<br>5.3 | |
| $t_{PZH}$<br>$t_{PZL}$ | Output Enable Time<br>(Figures 6, 7and 8, Table 1) | $R_L$ = 250 Ω $C_L$ = 50 pF | 2.5 ± 0.2 | 1.8 | | 8.5 | 1.8 | 9.0 | ns |
| | | | 3.3 ± 0.3 | 1.2 | | 6.2 | 1.2 | 6.5 | |
| | | | 5.0 ± 0.5 | 0.8 | | 5.5 | 0.8 | 5.8 | |
| $t_{PHZ}$<br>$t_{PLZ}$ | Output Enable Time<br>(Figures 6, 7and 8, Table 1) | $R_L$ and $R_1$= 500 Ω $C_L$ = 50 pF | 2.5 ± 0.2 | 1.5 | | 8.0 | 1.5 | 8.5 | ns |
| | | | 3.3 ± 0.3 | 0.8 | | 5.7 | 0.8 | 6.0 | |
| | | | 5.0 ± 0.5 | 0.3 | | 4.7 | 0.3 | 5.0 | |

## CAPACITIVE CHARACTERISTICS

| Symbol | Parameter | Condition | Typical | Unit |
|---|---|---|---|---|
| $C_{IN}$ | Input Capacitance | $V_{CC}$ = 5.5 V, $V_I$ = 0 V or $V_{CC}$ | 2.5 | pF |
| $C_{OUT}$ | Output Capacitance | $V_{CC}$ = 5.5 V, $V_I$ = 0 V or $V_{CC}$ | 2.5 | pF |
| $C_{PD}$ | Power Dissipation Capacitance<br>(Note 5) | 10 MHz, $V_{CC}$ = 3.3 V, $V_I$ = 0 V or $V_{CC}$<br>10 MHz, $V_{CC}$ = 5.5 V, $V_I$ = 0 V or $V_{CC}$ | 9<br>11 | pF |

5. $C_{PD}$ 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: $I_{CC(OPR)} = C_{PD} \bullet V_{CC} \bullet f_{in} + I_{CC}$. $C_{PD}$ is used to determine the no–load dynamic power consumption; $P_D = C_{PD} \bullet V_{CC}^2 \bullet f_{in} + I_{CC} \bullet V_{CC}$.

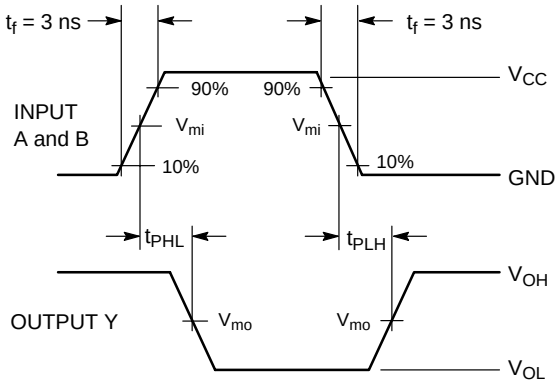
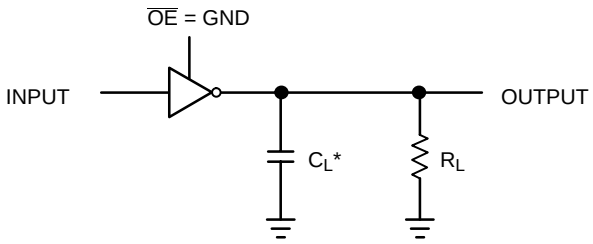
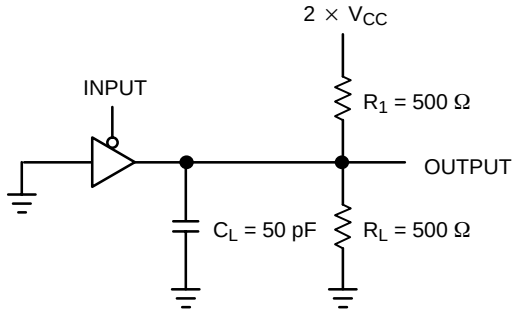



**Figure 4. Switching Waveform**



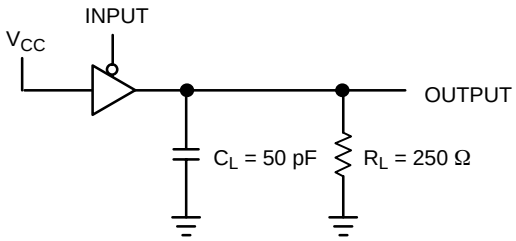

*Includes all probe and jig capacitance.
A 1 MHz square input wave is recommended for propagation delay tests.

**Figure 5. $T_{PLH}$ or $T_{PHL}$**




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

**Figure 6. $T_{PZL}$ or $T_{PL}$**




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

**Figure 7. $T_{PZH}$ or $T_{PHZ}$**

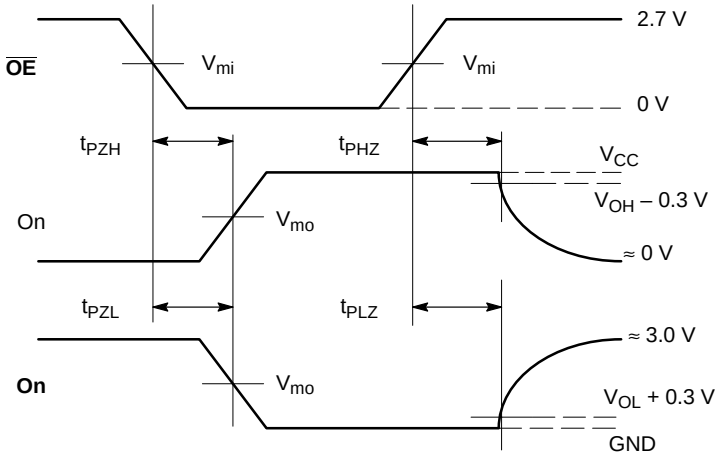



**Figure 8. AC Output Enable and Disable Waveform**

**Table 1. Output Enable and Disable Times**
$t_R = t_F$ = 2.5 ns, 10% to 90%; f = 1 MHz; $t_W$ = 500 ns

| | $V_{CC}$ | | |
|---|---|---|---|
| **Symbol** | **3.3 V ± 0.3 V** | **2.7 V** | **2.5 V ± 0.2 V** |
| $V_{mi}$ | 1.5 V | 1.5 V | $V_{CC}/2$ |
| $V_{mo}$ | 1.5 V | 1.5 V | $V_{CC}/2$ |

**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 | | |
| NL17SZ125 | NL | 1 | 7 | SZ | 125 | DF | T2 | SC70–5/SC–88A/ SOT–353 | 178 mm (7″), 3000 Units |

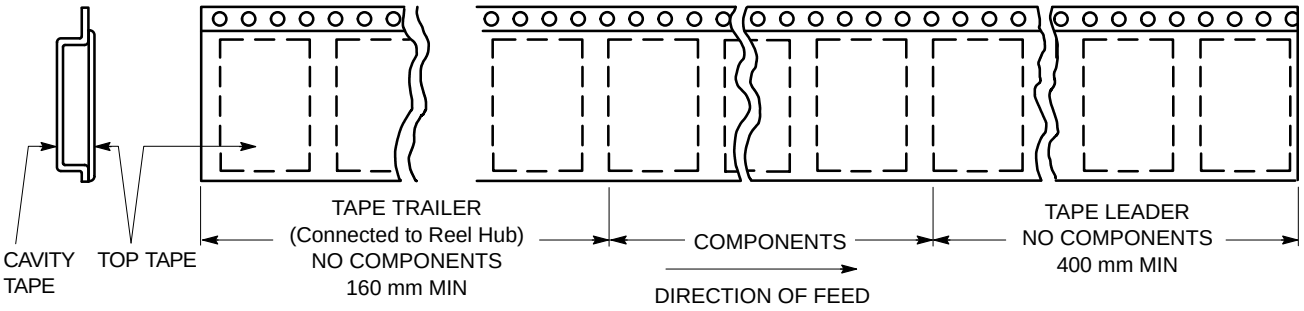



**Figure 9. Tape Ends for Finished Goods**

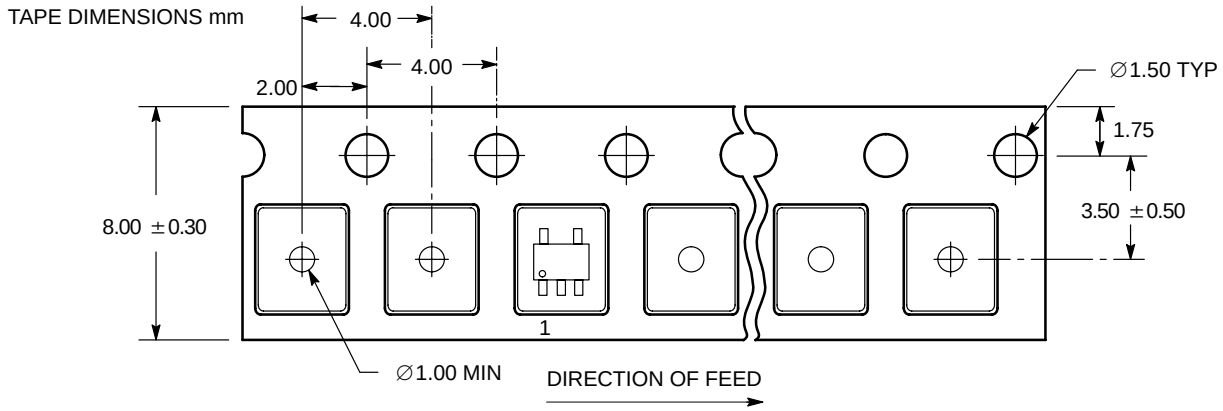



**Figure 10. SC−70/SC−88A/SOT−353 DFT2 Reel Configuration/Orientation**

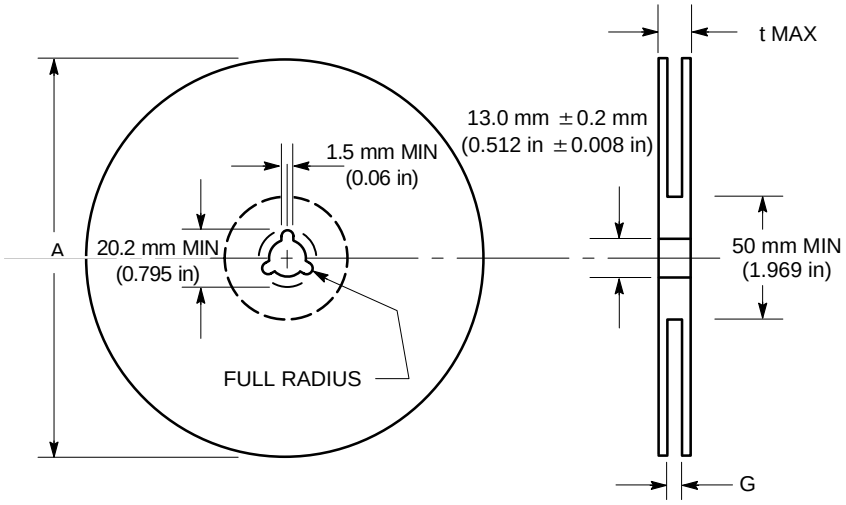



**Figure 11. Reel Dimensions**

**REEL DIMENSIONS**

| Tape Size | T and R Suffix | A Max | G | t Max |
|---|---|---|---|---|
| 8 mm | T1, 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) |

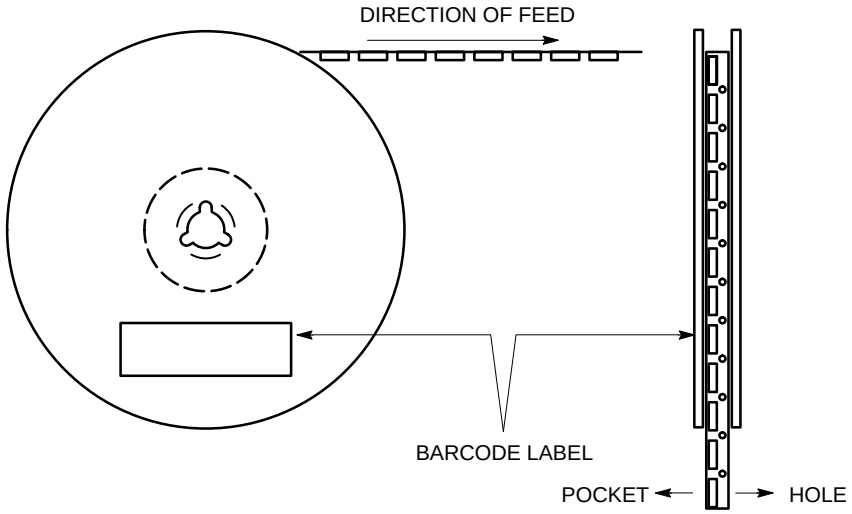
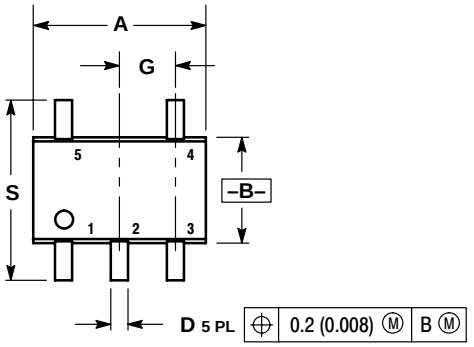



**Figure 12. Reel Winding Direction**

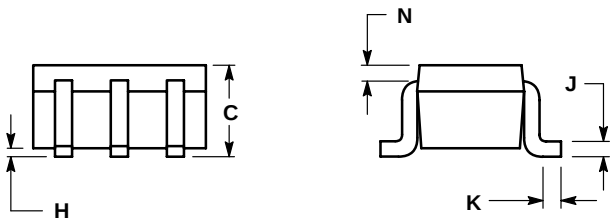
## PACKAGE DIMENSIONS

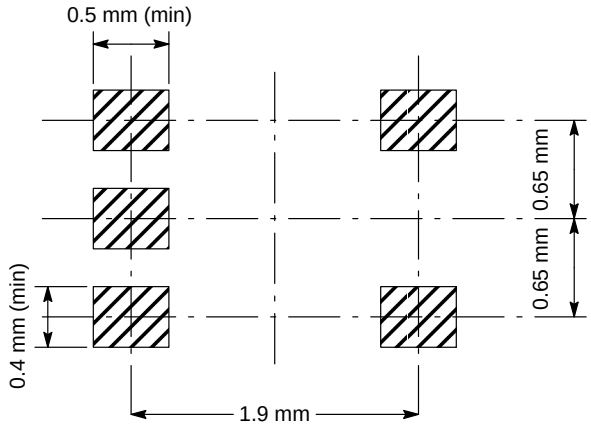
**SC70–5/SC–88A/SOT–353**
**DF SUFFIX**
5–LEAD PACKAGE
CASE 419A–02
ISSUE F




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

| | INCHES | | MILLIMETERS | |
|---|---|---|---|---|
| DIM | 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 |



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