FAIRCHILD SEMICONDUCTOR®

March 2008

# NC7SZ125
# TinyLogic® UHS Buffer with 3-STATE Output

## Features

- Space saving SOT23 or SC70 5-lead package
- Ultra small MicroPak™ Pb-Free leadless package
- Ultra High Speed; $t_{PD}$ 2.6ns Typ. into 50pF at 5V $V_{CC}$
- High Output Drive; ±24mA at 3V $V_{CC}$
- Broad $V_{CC}$ Operating Range; 1.65V to 5.5V
- Matches the performance of LCX when operated at 3.3V $V_{CC}$
- Power down high impedance inputs/output
- Overvoltage Tolerant inputs facilitate 5V to 3V translation
- Patented noise/EMI reduction circuitry implemented

## General Description

The NC7SZ125 is a single buffer with 3-STATE output from Fairchild's Ultra High Speed Series of TinyLogic®. The device is fabricated with advanced CMOS technology to achieve ultra high speed with high output drive while maintaining low static power dissipation over a very broad $V_{CC}$ operating range. The device is specified to operate over the 1.65V to 5.5V range.

The inputs and output are high impedance above ground when $V_{CC}$ is 0V. Inputs tolerate voltages up to 6V independent of $V_{CC}$ operating voltage. The output tolerates voltages above $V_{CC}$ when in the 3-STATE condition.

## Ordering Information

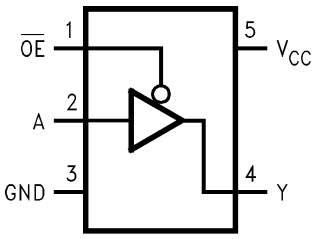
| Order Number | Package Number | Product Code Top Mark | Package Description | Supplied As |
|---|---|---|---|---|
| NC7SZ125M5X | MA05B | 7Z25 | 5-Lead SOT23, JEDEC MO-178, 1.6mm | 3k Units on Tape and Reel |
| NC7SZ125P5X | MAA05A | Z25 | 5-Lead SC70, EIAJ SC-88a, 1.25mm Wide | 3k Units on Tape and Reel |
| NC7SZ125L6X | MAC06A | DD | 6-Lead MicroPak, 1.0mm Wide | 5k Units on Tape and Reel |

Device also available in Tape and Reel. Specify by appending suffix letter “X” to the ordering number.

All packages are lead free per JEDEC: J-STD-020B standard.

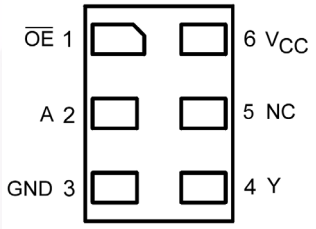
## Connection Diagram

**Pin Assignment for SC70 and SOT23**




**(Top View)**

**Pad Assignment for MicroPak**



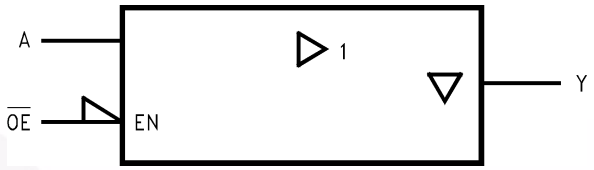

**(Top Thru View)**

## Pin Description

| Pin Names | Description |
|---|---|
| A, $\overline{OE}$ | Inputs |
| Y | Output |
| NC | No Connect |

## Logic Symbol

**IEEE/IEC**




## Function Table

| Inputs | | Output |
|---|---|---|
| $\overline{OE}$ | In A | Out Y |
| L | L | L |
| L | H | H |
| H | X | Z |

H = HIGH Logic Level

L = LOW Logic Level

X = HIGH or LOW Logic Level

Z = HIGH Impedance State

## Absolute Maximum Ratings

Stresses exceeding the absolute maximum ratings may damage the device. The device may not function or be operable above the recommended operating conditions and stressing the parts to these levels is not recommended. In addition, extended exposure to stresses above the recommended operating conditions may affect device reliability. The absolute maximum ratings are stress ratings only.

| Symbol | Parameter | Rating |
|---|---|---|
| $V_{CC}$ | Supply Voltage | –0.5V to +6V |
| $V_{IN}$ | DC Input Voltage | –0.5V to +6V |
| $V_{OUT}$ | DC Output Voltage | –0.5V to +6V |
| $I_{IK}$ | DC Input Diode Current<br>@ $V_{IN}$ < –0.5V<br>@ $V_{IN}$ > 6V | <br>–50mA<br>+20mA |
| $I_{OK}$ | DC Output Diode Current<br>@ $V_{OUT}$ < –0.5V<br>@ $V_{OUT}$ > 6V, $V_{CC}$ = GND | <br>–50mA<br>+20mA |
| $I_{OUT}$ | DC Output Current | ±50mA |
| $I_{CC}/I_{GND}$ | DC $V_{CC}$/GND Current | ±50mA |
| $T_{STG}$ | Storage Temperature | -65°C to +150°C |
| $T_J$ | Junction Temperature under Bias | 150°C |
| $T_L$ | Junction Lead Temperature (Soldering, 10 seconds) | 260°C |
| $P_D$ | Power Dissipation @ +85°C<br>SOT23-5<br>SC70-5 | <br>200mW<br>150mW |

## Recommended Operating Conditions(1)

The Recommended Operating Conditions table defines the conditions for actual device operation. Recommended operating conditions are specified to ensure optimal performance to the datasheet specifications. Fairchild does not recommend exceeding them or designing to absolute maximum ratings.

| Symbol | Parameter | Rating |
|---|---|---|
| $V_{CC}$ | Supply Voltage Operation | 1.65V to 5.5V |
| $V_{CC}$ | Supply Voltage Data Retention | 1.5V to 5.5V |
| $V_{IN}$ | Input Voltage | 0V to 5.5V |
| $V_{OUT}$ | Output Voltage<br>Active State<br>3-STATE | <br>0V to $V_{CC}$<br>0V to 5.5V |
| $T_A$ | Operating Temperature | –40°C to +85°C |
| $t_r$, $t_f$ | Input Rise and Fall Time<br>$V_{CC}$ = 1.8V, 2.5V ±0.2V<br>$V_{CC}$ = 3.3V ±0.3V<br>$V_{CC}$ = 5.0V ±0.5V | <br>0ns/V to 20ns/V<br>0ns/V to 10ns/V<br>0ns/V to 5ns/V |
| $\theta_{JA}$ | Thermal Resistance<br>SOT23-5<br>SC70-5 | <br>300°C/W<br>425°C/W |

**Notes:**

1. Unused inputs must be held HIGH or LOW. They may not float.

## DC Electrical Characteristics

| Symbol | Parameter | $V_{CC}$ (V) | Conditions | | $T_A$ = +25°C | | | $T_A$ = –40°C to +85°C | | Unit |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Min. | Typ. | Max. | Min. | Max. | |
| $V_{IH}$ | HIGH Level Input Voltage | 1.65–1.95 | | | 0.75 x $V_{CC}$ | | | 0.75 x $V_{CC}$ | | V |
| | | 2.3–5.5 | | | 0.7 x $V_{CC}$ | | | 0.7 x $V_{CC}$ | | |
| $V_{IL}$ | LOW Level Input Voltage | 1.65–1.95 | | | | | 0.25 x $V_{CC}$ | | 0.25 x $V_{CC}$ | V |
| | | 2.3–5.5 | | | | | 0.3 x $V_{CC}$ | | 0.3 x $V_{CC}$ | |
| $V_{OH}$ | HIGH Level Output Voltage | 1.65 | $V_{IN}$ = $V_{IH}$ | $I_{OH}$ = –100µA | 1.55 | 1.65 | | 1.55 | | V |
| | | 1.8 | | | 1.7 | 1.8 | | 1.7 | | |
| | | 2.3 | | | 2.2 | 2.3 | | 2.2 | | |
| | | 3.0 | | | 2.9 | 3.0 | | 2.9 | | |
| | | 4.5 | | | 4.4 | 4.5 | | 4.4 | | |
| | | 1.65 | | $I_{OH}$ = –4mA | 1.29 | 1.52 | | 1.29 | | |
| | | 2.3 | | $I_{OH}$ = –8mA | 1.9 | 2.15 | | 1.9 | | |
| | | 3.0 | | $I_{OH}$ = –16mA | 2.4 | 2.80 | | 2.4 | | |
| | | 3.0 | | $I_{OH}$ = –24mA | 2.3 | 2.68 | | 2.3 | | |
| | | 4.5 | | $I_{OH}$ = –32mA | 3.8 | 4.20 | | 3.8 | | |
| $V_{OL}$ | LOW Level Output Voltage | 1.65 | $V_{IN}$ = $V_{IL}$ | $I_{OL}$ = 100µA | | 0.0 | 0.1 | | 0.0 | V |
| | | 1.8 | | | | 0.0 | 0.1 | | 0.1 | |
| | | 2.3 | | | | 0.0 | 0.1 | | 0.1 | |
| | | 3.0 | | | | 0.0 | 0.1 | | 0.1 | |
| | | 4.5 | | | | 0.0 | 0.1 | | 0.1 | |
| | | 1.65 | | $I_{OL}$ = 4mA | | 0.08 | 0.24 | | 0.24 | |
| | | 2.3 | | $I_{OL}$ = 8mA | | 0.10 | 0.3 | | 0.3 | |
| | | 3.0 | | $I_{OL}$ = 16mA | | 0.15 | 0.4 | | 0.4 | |
| | | 3.0 | | $I_{OL}$ = 24mA | | 0.22 | 0.55 | | 0.55 | |
| | | 4.5 | | $I_{OL}$ = 32mA | | 0.22 | 0.55 | | 0.55 | |
| $I_{IN}$ | Input Leakage Current | 0–5.5 | 0 ≤ $V_{IN}$ ≤ 5.5V | | | | ±1 | | ±10 | µA |
| $I_{OZ}$ | 3-STATE Output Leakage | 0–5.5 | $V_{IN}$ = $V_{IH}$ or $V_{IL}$, 0 ≤ $V_O$ ≤ 5.5V | | | | ±1 | | ±10 | µA |
| $I_{OFF}$ | Power Off Leakage Current | 0.0 | $V_{IN}$ or $V_{OUT}$ = 5.5V | | | | 1 | | 10 | µA |
| $I_{CC}$ | Quiescent Supply Current | 1.65–5.5 | $V_{IN}$ = 5.5V, GND | | | | 2.0 | | 20 | µA |

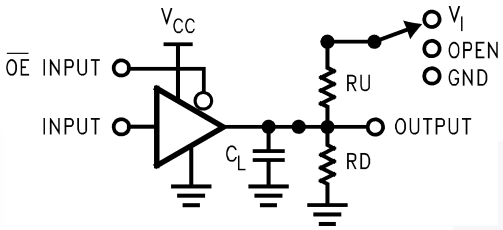
## AC Electrical Characteristics

| Symbol | Parameter | $V_{CC}$ (V) | Conditions | $T_A$ = +25°C | | | $T_A$ = –40°C to +85°C | | Units | Figure Number |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Min. | Typ. | Max. | Min. | Max. | | |
| $t_{PLH}$, $t_{PHL}$ | Propagation Delay | 1.65 | $C_L$ = 15pF, $R_D$ = 1MΩ, $S_1$ = OPEN | 2.0 | 6.4 | 13.2 | 2.0 | 13.8 | ns | Figure 1 Figure 3 |
| | | 1.8 | | 2.0 | 5.3 | 11.0 | 2.0 | 11.5 | | |
| | | 2.5 ± 0.2 | | 0.8 | 3.4 | 7.5 | 0.8 | 8.0 | | |
| | | 3.3 ± 0.3 | | 0.5 | 2.5 | 5.2 | 0.5 | 5.5 | | |
| | | 5.0 ± 0.5 | | 0.5 | 2.1 | 4.5 | 0.5 | 4.8 | | |
| $t_{PLH}$, $t_{PHL}$ | Propagation Delay | 3.3 ± 0.3 | $C_L$ = 50pF, $R_D$ = 500Ω, $S_1$ = OPEN | 1.5 | 3.2 | 5.7 | 1.5 | 6.0 | ns | Figure 1 Figure 3 |
| | | 5.0 ± 0.5 | | 0.8 | 2.6 | 5.0 | 0.8 | 5.3 | | |
| $t_{PZL}$, $t_{PZH}$ | Output Enable Time | 1.65 | $C_L$ = 50 pF, RD = 500Ω, RU = 500Ω, $S_1$ = GND for $t_{PZH}$, $S_1$ = $V_{IN}$ for $t_{PZL}$, $V_{IN}$ = 2 x $V_{CC}$ | 2.0 | 8.4 | 15.0 | 2.0 | 15.6 | ns | Figure 1 Figure 3 |
| | | 1.8 | | 2.0 | 7.0 | 12.5 | 2.0 | 13 | | |
| | | 2.5 ± 0.2 | | 1.5 | 4.6 | 8.5 | 1.5 | 9 | | |
| | | 3.3 ± 0.3 | | 1.5 | 3.5 | 6.2 | 1.5 | 6.5 | | |
| | | 5.0 ± 0.5 | | 0.8 | 2.8 | 5.5 | 0.8 | 5.8 | | |
| $t_{PLZ}$, $t_{PHZ}$ | Output Disable Time | 1.65 | $C_L$ = 50pF, RD = 500Ω, RU = 500Ω, $S_1$ = GND for $t_{PHZ}$, $S_1$ = $V_{IN}$ for $t_{PLZ}$, $V_{IN}$ = 2 x $V_{CC}$ | 2.0 | 6.5 | 13.2 | 2.0 | 14.5 | ns | Figure 1 Figure 3 |
| | | 1.8 | | 2.0 | 5.4 | 11 | 2.0 | 12 | | |
| | | 2.5 ± 0.2 | | 1.5 | 3.5 | 8 | 1.5 | 8.5 | | |
| | | 3.3 ± 0.3 | | 1.0 | 2.8 | 5.7 | 1.0 | 6 | | |
| | | 5.0 ± 0.5 | | 0.5 | 2.1 | 4.7 | 0.5 | 5.0 | | |
| $C_{IN}$ | Input Capacitance | 0 | | | 4 | | | | pF | |
| $C_{OUT}$ | Output Capacitance | 0 | | | 8 | | | | pF | |
| $C_{PD}$ | Power Dissipation Capacitance | 3.3 | (2) | | 17 | | | | pF | Figure 2 |
| | | 5.0 | | | 24 | | | | | |

**Note:**

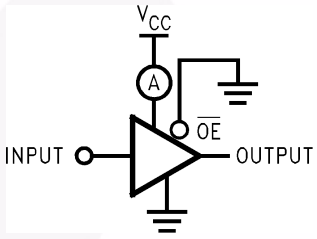
2. $C_{PD}$ is defined as the value of the internal equivalent capacitance which is derived from dynamic operating current consumption ($I_{CCD}$) at no output loading and operating at 50% duty cycle. (See Figure 2.) $C_{PD}$ is related to $I_{CCD}$ dynamic operating current by the expression: $I_{CCD}$ = ($C_{PD}$)($V_{CC}$)($f_{IN}$) + ($I_{CC}$static).

## AC Loading and Waveforms




$C_L$ includes load and stray capacitance
Input PRR = 1.0MHz; $t_W$ = 500ns

**Figure 1. AC Test Circuit**




Input = AC Waveform; $t_r = t_f$ = 1.8ns;
PRR = 10 MHz; Duty Cycle = 50%

**Figure 2. $I_{CCD}$ Test Circuit**

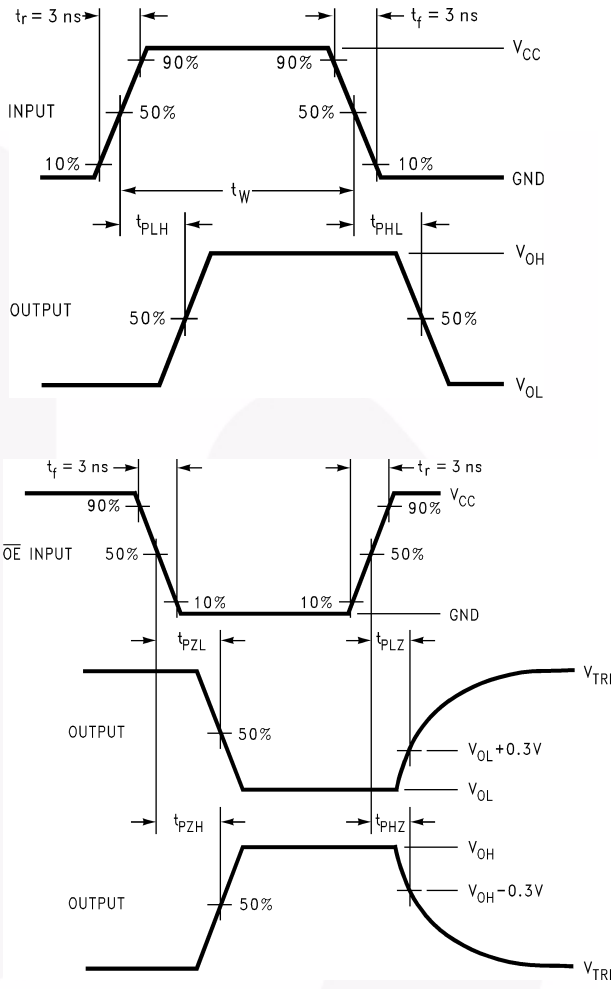


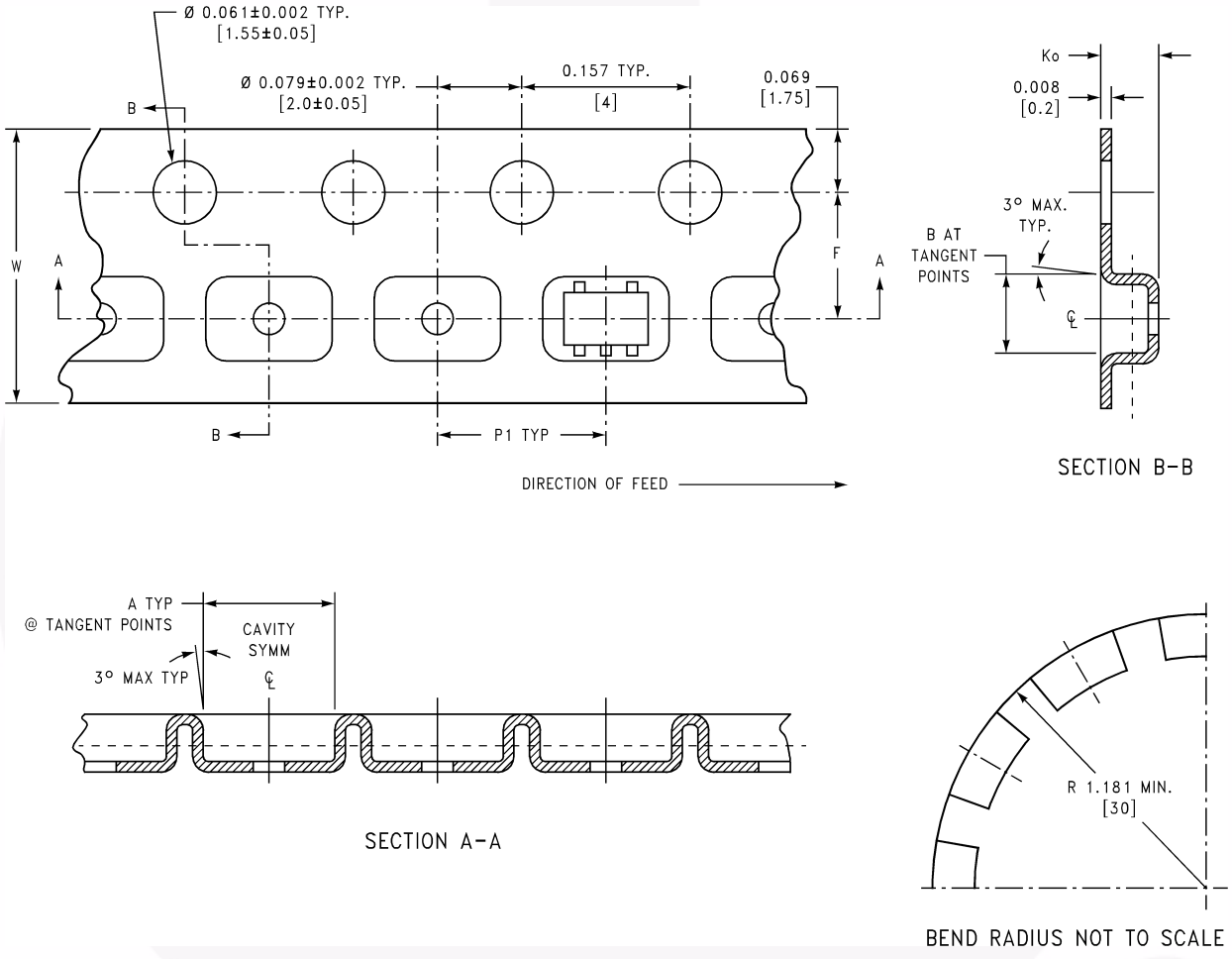

**Figure 3. AC Waveforms**

## Tape and Reel Specifications

### Tape Format for SC70 and SOT23

| Package Designator | Tape Section | Number Cavities | Cavity Status | Cover Tape Status |
|---|---|---|---|---|
| M5X, P5X | Leader (Start End) | 125 (typ.) | Empty | Sealed |
| | Carrier | 3000 | Filled | Sealed |
| | Trailer (Hub End) | 75 (typ.) | Empty | Sealed |

**Tape Dimensions** inches (millimeters)

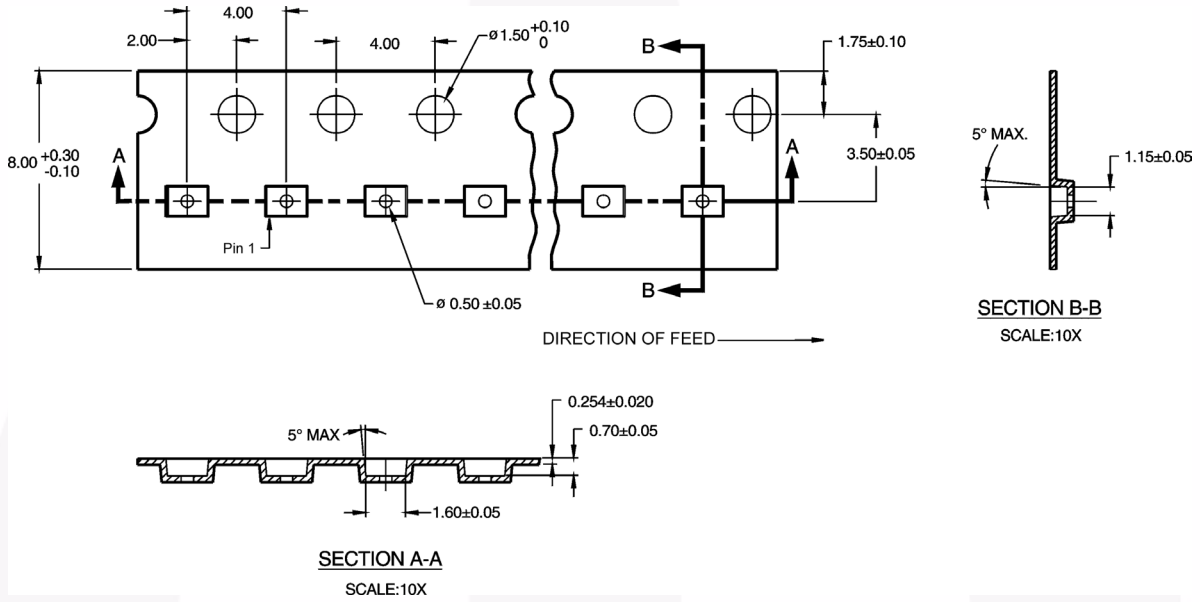



| Package | Tape Size | Dim A | Dim B | Dim F | Dim $K_o$ | Dim P1 | Dim W |
|---|---|---|---|---|---|---|---|
| SC70-5 | 8mm | 0.093 (2.35) | 0.096 (2.45) | 0.138 ± 0.004 (3.5 ± 0.10) | 0.053 ± 0.004 (1.35 ± 0.10) | 0.157 (4) | 0.315 ± 0.004 (8 ± 0.1) |
| SOT23-5 | 8mm | 0.130 (3.3) | 0.130 (3.3) | 0.138 ± 0.002 (3.5 ± 0.05) | 0.055 ± 0.004 (1.4 ± 0.11) | 0.157 (4) | 0.315 ± 0.012 (8 ± 0.3) |

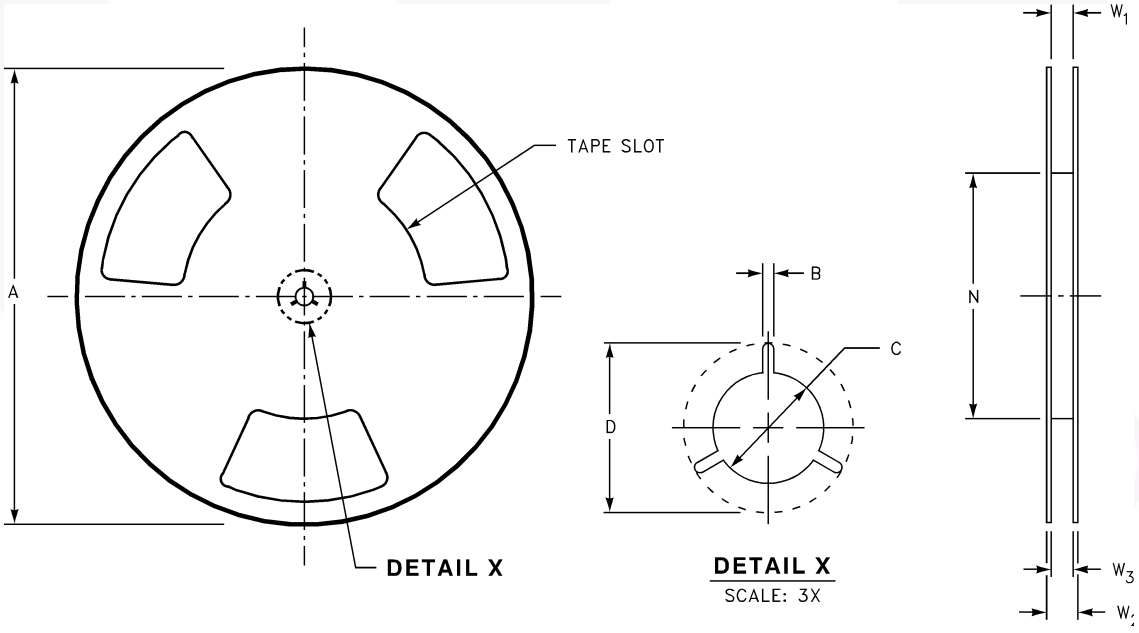
## Tape and Reel Specifications (Continued)

### Tape Format for MicroPak

| Package Designator | Tape Section | Number Cavities | Cavity Status | Cover Tape Status |
|---|---|---|---|---|
| L6X | Leader (Start End) | 125 (typ.) | Empty | Sealed |
| | Carrier | 5000 | Filled | Sealed |
| | Trailer (Hub End) | 75 (typ.) | Empty | Sealed |




## Reel Dimensions inches (millimeters)




| Tape Size | A | B | C | D | N | W1 | W2 | W3 |
|---|---|---|---|---|---|---|---|---|
| 8 mm | 7.0 (177.8) | 0.059 (1.50) | 0.512 (13.00) | 0.795 (20.20) | 2.165 (55.00) | 0.331 + 0.059/–0.000 (8.40 + 1.50/–0.00) | 0.567 (14.40) | W1 + 0.078/–0.039 (W1 + 2.00/–1.00) |

## Physical Dimensions

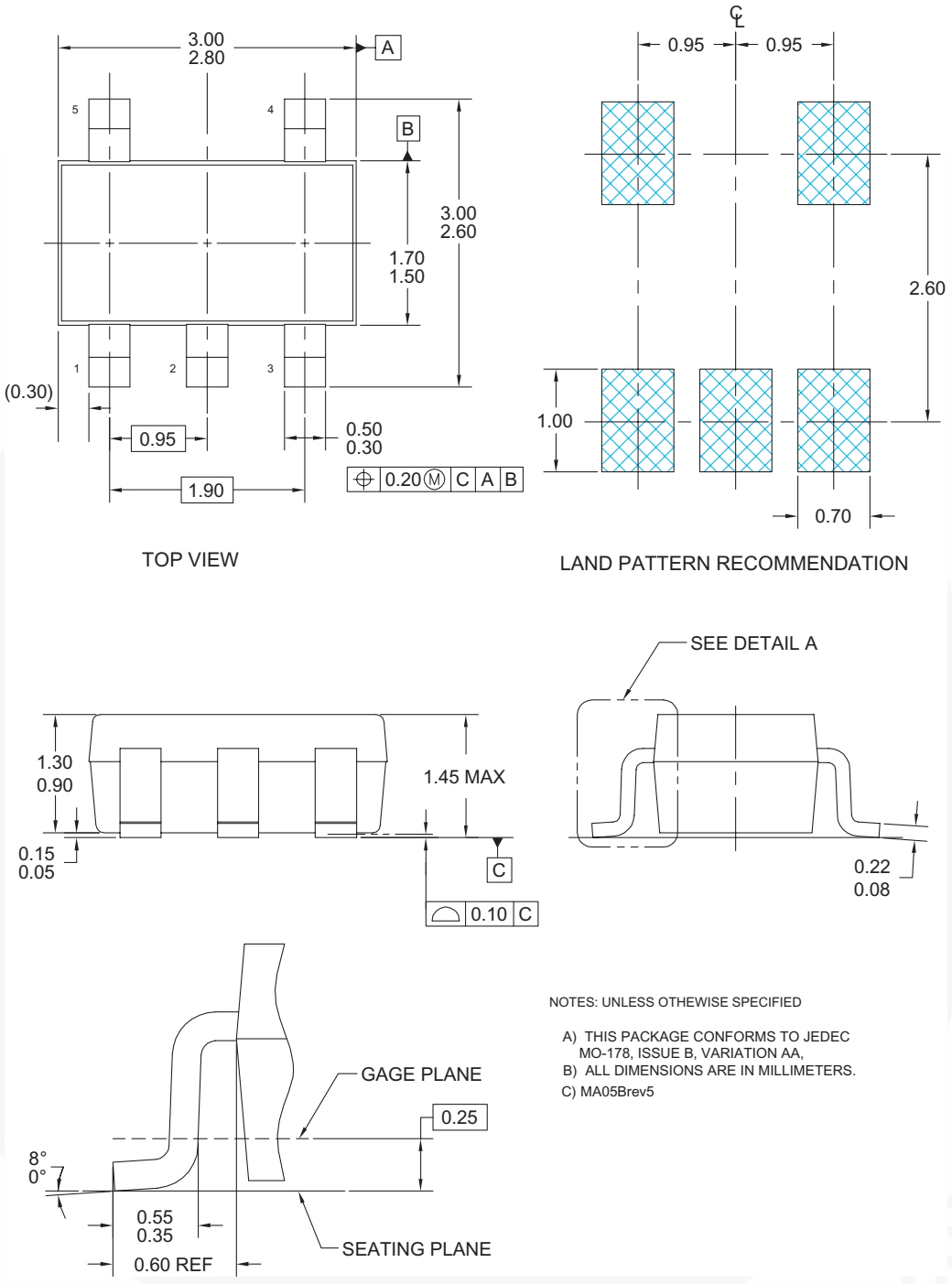



**Figure 4. 5-Lead SOT23, JEDEC MO-178, 1.6mm**

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## Physical Dimensions (Continued)

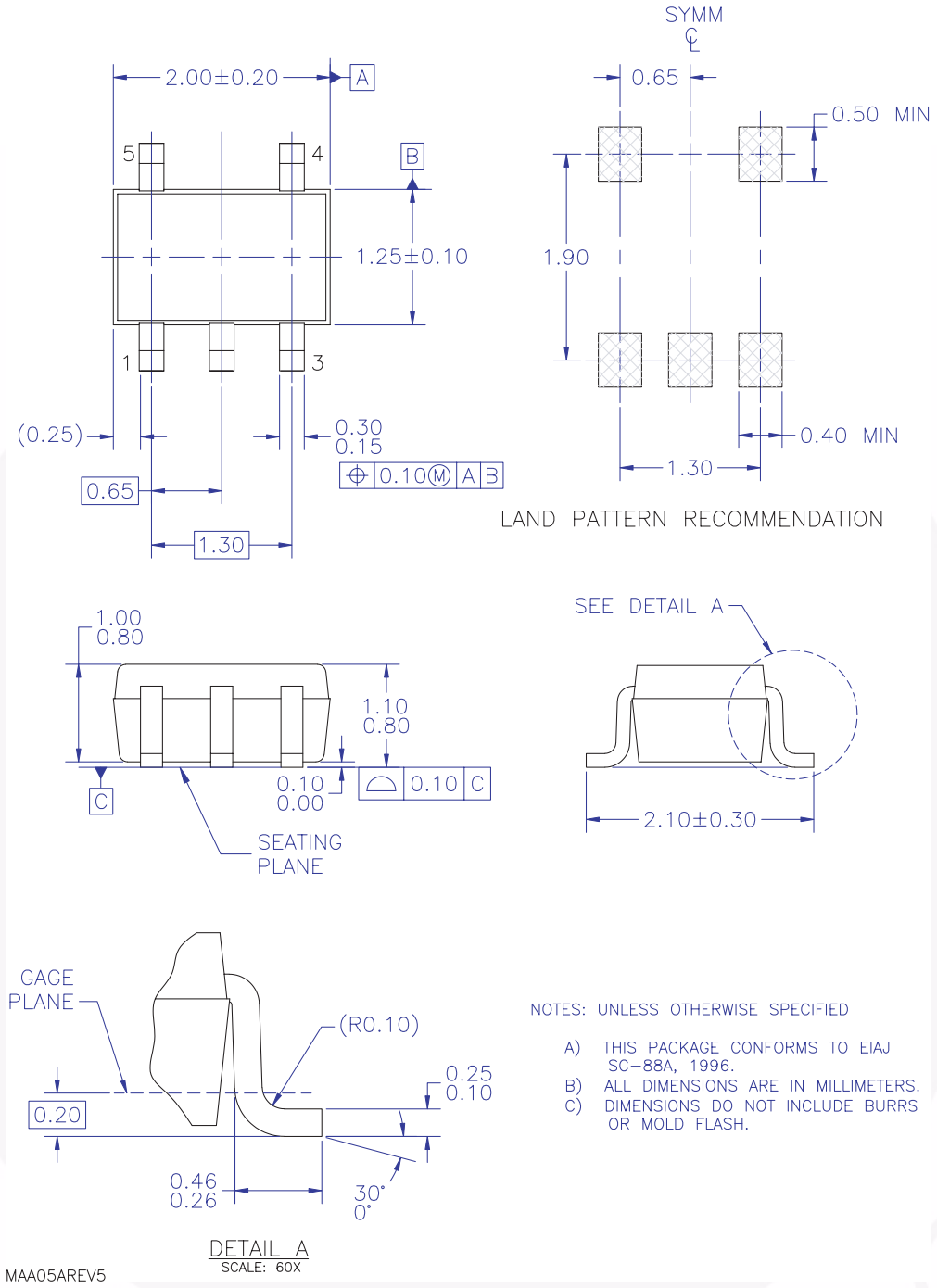


**Figure 5. 5-Lead SC70, EIAJ SC-88a, 1.25mm Wide**

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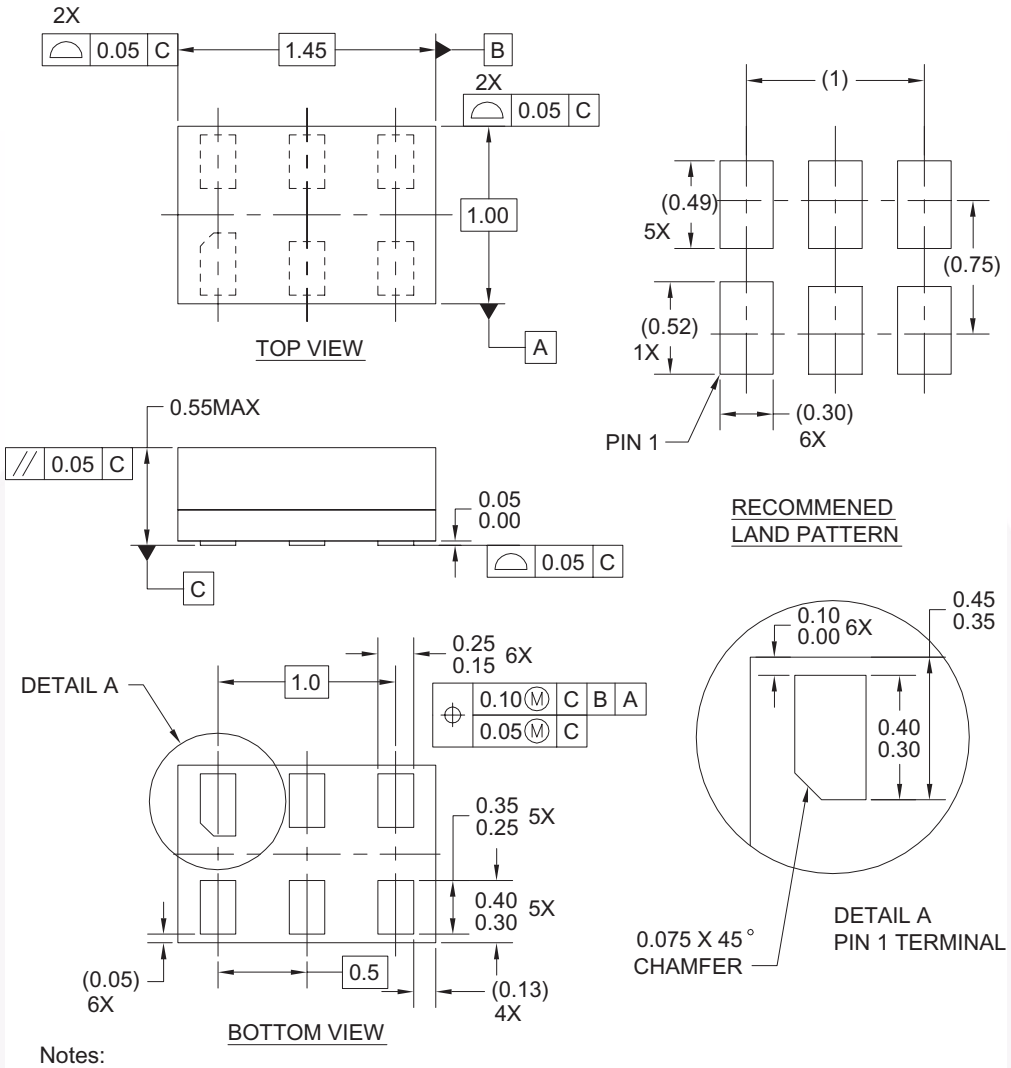
## Physical Dimensions (Continued)




Notes:

1. CONFORMS TO JEDEC STANDARD M0-252 VARIATION UAAD
2. DIMENSIONS ARE IN MILLIMETERS
3. DRAWING CONFORMS TO ASME Y14.5M-1994

MAC06AREVC

**Figure 6. 6-Lead MicroPak, 1.0mm Wide**

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