

# NC7SZD384

## 1-Bit Low Power Bus Switch with Level Shifting

### General Description

The NC7SZD384 provides 1-bit of high-speed CMOS TTL-compatible bus switch. The low on resistance of the switch allows inputs to be connected to outputs with minimal propagation delay and without generating additional ground bounce noise. The device is organized as a 1-bit switch with a bus enable ( $\overline{OE}$ ) signal. When  $\overline{OE}$  is LOW, the switch is on and Port A is connected to Port B. When  $\overline{OE}$  is HIGH, the switch is open and a high-impedance state exists between the two ports. Reduced voltage drive to the gate of the FET switch permits nominal level shifting of 5V to 3.3V through the switch.

### Features

- Space saving SOT23 or SC70 5-lead package
- Ultra small MicroPak™ Pb-Free leadless package
- 5Ω switch connection between two ports
- Designed to be used in level-shifting applications
- Minimal propagation delay through the switch
- Low  $I_{CC}$
- Zero bounce in flow-through mode
- Control inputs compatible with TTL level

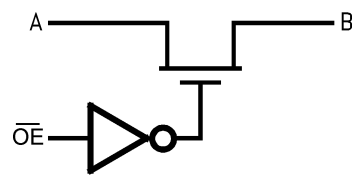
### Ordering Code:

| Order Number | Package Number | Product Code Top Mark | Package Description                   | Supplied As               |
|--------------|----------------|-----------------------|---------------------------------------|---------------------------|
| NC7SZD384M5X | MA05B          | 8Z4D                  | 5-Lead SOT23, JEDEC MO-178, 1.6mm     | 3k Units on Tape and Reel |
| NC7SZD384P5X | MAA05A         | Z4D                   | 5-Lead SC70, EIAJ SC-88a, 1.25mm Wide | 3k Units on Tape and Reel |
| NC7SZD384L6X | MAC06A         | A4                    | Pb-Free 6-Lead MicroPak, 1.0mm Wide   | 5k Units on Tape and Reel |

Pb-Free package per JEDEC J-STD-020B.

MicroPak™ is a trademark of Fairchild Semiconductor Corporation.

Logic Symbol



Pin Descriptions

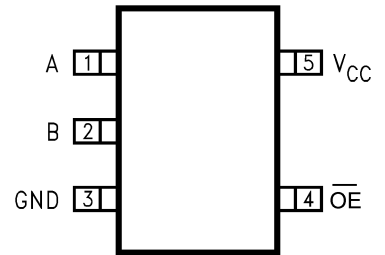
| Pin Name        | Description       |
|-----------------|-------------------|
| $\overline{OE}$ | Bus Switch Enable |
| A               | Bus A             |
| B               | Bus B             |
| NC              | No Connect        |

Function Table

| OE | B <sub>O</sub> | Function   |
|----|----------------|------------|
| L  | A <sub>O</sub> | Connect    |
| H  | HIGH-Z State   | Disconnect |

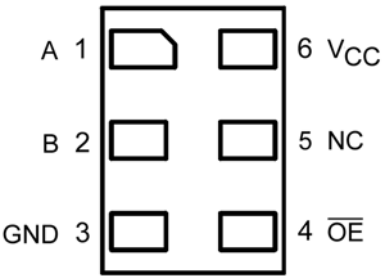
Connection Diagrams

Pin Assignments for SC70 and SOT23



(Top View)

Pad Assignments for MicroPak



(Top Through View)

**Absolute Maximum Ratings**(Note 1)

|                                                                |                 |
|----------------------------------------------------------------|-----------------|
| Supply Voltage ( $V_{CC}$ )                                    | -0.5V to +7.0V  |
| DC Switch Voltage ( $V_S$ )                                    | -0.5V to +7.0V  |
| DC Input Voltage ( $V_{IN}$ ) (Note 2)                         | -0.5V to +7.0V  |
| DC Input Diode Current ( $I_{IK}$ ) $V_{IN} < 0V$              | -50 mA          |
| DC Output ( $I_{OUT}$ ) Sink Current                           | 128 mA          |
| DC $V_{CC}$ /GND Current ( $I_{CC}/GND$ )                      | $\pm 100$ mA    |
| Storage Temperature Range ( $T_{STG}$ )                        | -65°C to +150°C |
| Junction Temperature under bias ( $T_J$ )                      | +150°C          |
| Junction Lead Temperature ( $T_L$ )<br>(Soldering, 10 seconds) | +260°C          |
| Power Dissipation ( $P_D$ ) @ +85°C                            |                 |
| SOT23-5                                                        | 200 mW          |
| SC70-5                                                         | 150 mW          |

**Recommended Operating Conditions** (Note 3)

|                                         |                |
|-----------------------------------------|----------------|
| Power Supply Operating ( $V_{CC}$ )     | 4.5V to 5.5V   |
| Input Voltage ( $V_{IN}$ )              | 0V to 5.5V     |
| Output Voltage ( $V_{OUT}$ )            | 0V to 5.5V     |
| Input Rise and Fall Time ( $t_r, t_f$ ) |                |
| Switch Control Input                    | 0 ns/V to 5 ns |
| Switch I/O                              | 0 ns/V to DC   |
| Operating Temperature ( $T_A$ )         | -40°C to +85°C |
| Thermal Resistance ( $\theta_{JA}$ )    |                |
| SOT23-5                                 | 300°C/Watt     |
| SC70-5                                  | 425°C/Watt     |

**Note 1:** The "Absolute Maximum Ratings" are those values beyond which the safety of the device cannot be guaranteed. The device should not be operated at these limits. The parametric values defined in the Electrical Characteristics tables are not guaranteed at the absolute maximum ratings. The "Recommended Operating Conditions" table will define the conditions for actual device operation.

**Note 2:** The input and output negative voltage ratings may be exceeded if the input and output diode current ratings are observed.

**Note 3:** Unused inputs must be held HIGH or LOW. They may not float.

**DC Electrical Characteristics**

| Symbol          | Parameter                               | $V_{CC}$<br>(V) | $T_A = -40^\circ\text{C to } +85^\circ\text{C}$ |                 |            | Units         | Conditions                                               |
|-----------------|-----------------------------------------|-----------------|-------------------------------------------------|-----------------|------------|---------------|----------------------------------------------------------|
|                 |                                         |                 | Min                                             | Typ<br>(Note 4) | Max        |               |                                                          |
| $V_{IK}$        | Maximum Clamp Diode Voltage             | 4.5             |                                                 |                 | -1.2       | -V            | $I_{IN} = -18$ mA                                        |
| $V_{IH}$        | HIGH Level Input Voltage                | 4.5-5.5         | 2.0                                             |                 |            | V             |                                                          |
| $V_{IL}$        | LOW Level Input Voltage                 | 4.5-5.5         |                                                 |                 | 0.8        | V             |                                                          |
| $V_{OH}$        | HIGH Level Output Voltage               | 4.5-5.5         | See Figure 3                                    |                 |            | V             | $V_{IN} = V_{CC}$                                        |
| $I_I$           | Input Leakage Current                   | 0-5.5           |                                                 |                 | $\pm 1.0$  | $\mu\text{A}$ | $0 \leq V_{IN} \leq 5.5V$                                |
| $I_{OFF}$       | "OFF" Leakage Current                   | 5.5             |                                                 |                 | $\pm 10.0$ | $\mu\text{A}$ | $0 \leq A, B, \leq V_{CC}$                               |
| $R_{ON}$        | Switch On Resistance (Note 5)           | 4.5             |                                                 | 5.0             | 7.0        | $\Omega$      | $V_{IN} = 0V, I_I = 64$ mA                               |
|                 |                                         |                 |                                                 | 5.0             | 7.0        | $\Omega$      | $V_{IN} = 0V, I_I = 30$ mA                               |
|                 |                                         |                 |                                                 | 35.0            | 50.0       | $\Omega$      | $V_{IN} = 2.4V, I_I = 15$ mA                             |
| $I_{CC}$        | Quiescent Supply Current                |                 |                                                 |                 |            |               | $V_{IN} = V_{CC}$ or GND, $I_O = 0$                      |
|                 | Switch On                               | 5.5             |                                                 | 0.8             | 1.5        | mA            | $\overline{OE} = GND$                                    |
|                 | Switch Off                              | 5.5             |                                                 |                 | 10.0       | $\mu\text{A}$ | $\overline{OE} = V_{CC}$                                 |
| $\Delta I_{CC}$ | Increase in $I_{CC}$ per Input (Note 6) | 5.5             |                                                 | 0.8             | 2.5        | mA            | $\overline{OE} = 3.4V, I_O = 0$ ,<br>Control Input only. |

**Note 4:** All typical values are at  $V_{CC} = 5.0V$ ,  $T_A = 25^\circ\text{C}$ .

**Note 5:** Measured by the voltage drop between A and B pins at the indicated current through the switch. On Resistance is determined by the lower of the voltages on the two (A or B) pins.

**Note 6:** Per TTL driven input ( $V_{IN} = 3.4V$ , control input only). A and B pins do not contribute to  $I_{CC}$ .

## AC Electrical Characteristics

| Symbol                                 | Parameter                                | V <sub>CC</sub><br>(V) | T <sub>A</sub> = -40°C to +85°C<br>C <sub>L</sub> = 50 pF, R <sub>U</sub> = R <sub>D</sub> = 500Ω |                 |      | Units | Conditions                                                                             | Figure<br>Number |
|----------------------------------------|------------------------------------------|------------------------|---------------------------------------------------------------------------------------------------|-----------------|------|-------|----------------------------------------------------------------------------------------|------------------|
|                                        |                                          |                        | Min                                                                                               | Typ<br>(Note 7) | Max  |       |                                                                                        |                  |
| t <sub>PHL</sub> ,<br>t <sub>PLH</sub> | Propagation Delay Bus-to-Bus<br>(Note 8) | 4.5–5.5                |                                                                                                   |                 | 0.25 | ns    | V <sub>I</sub> = OPEN                                                                  | Figures<br>1, 2  |
| t <sub>PZL</sub> ,<br>t <sub>PZH</sub> | Output Enable Time                       | 4.5–5.5                | 1.5                                                                                               |                 | 7.5  | ns    | V <sub>I</sub> = 7V for t <sub>PZL</sub><br>V <sub>I</sub> = OPEN for t <sub>PZH</sub> | Figures<br>1, 2  |
| t <sub>PLZ</sub> ,<br>t <sub>PHZ</sub> | Output Disable Time                      | 4.5–5.5                | 1.0                                                                                               |                 | 6.0  | ns    | V <sub>I</sub> = 7V for t <sub>PLZ</sub><br>V <sub>I</sub> = OPEN for t <sub>PHZ</sub> | Figures<br>1, 2  |

**Note 7:** All typical values are V<sub>CC</sub> = 5.0V, T<sub>A</sub> = 25°C.

**Note 8:** This parameter is guaranteed by design but is not tested. The bus switch contributes no propagation delay other than the RC delay of the typical On Resistance of the switch and the 50 pF load capacitance, when driven by an ideal voltage source (zero output impedance).

## Capacitance (Note 9)

| Symbol           | Parameter                     | Typ | Max | Units | Conditions             |
|------------------|-------------------------------|-----|-----|-------|------------------------|
| C <sub>IN</sub>  | Control Pin Input Capacitance | 2   | 5   | pF    | V <sub>CC</sub> = 5.0V |
| C <sub>I/O</sub> | Input/Output Capacitance      | 4.5 | 10  | pF    | V <sub>CC</sub> = 5.0V |

**Note 9:** T<sub>A</sub> = 25°C f = 1MHz

## AC Loading and Waveforms

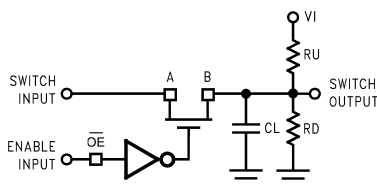


FIGURE 1. AC Test Circuit

**Note:** Input driven by 50Ω source terminated in 50Ω.

C<sub>L</sub> includes load and stray capacitance.

Input PRR = 1.0 MHz t<sub>w</sub> = 500 ns.

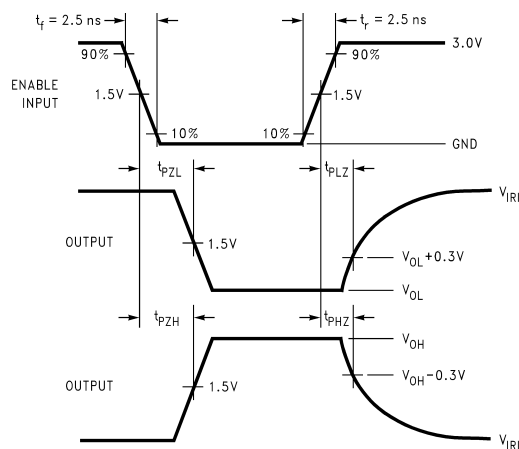
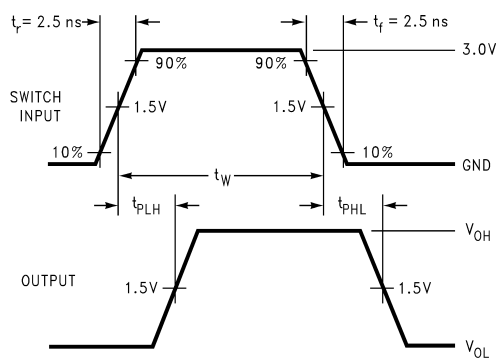


FIGURE 2. AC Waveforms

## DC Characteristics

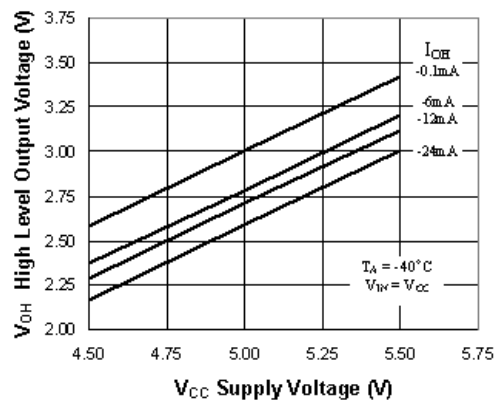
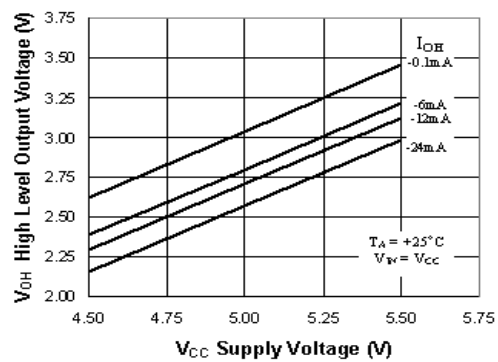
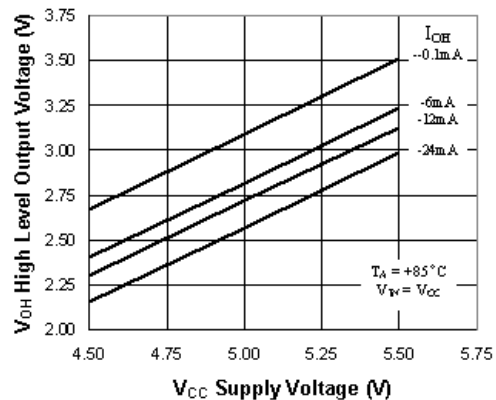


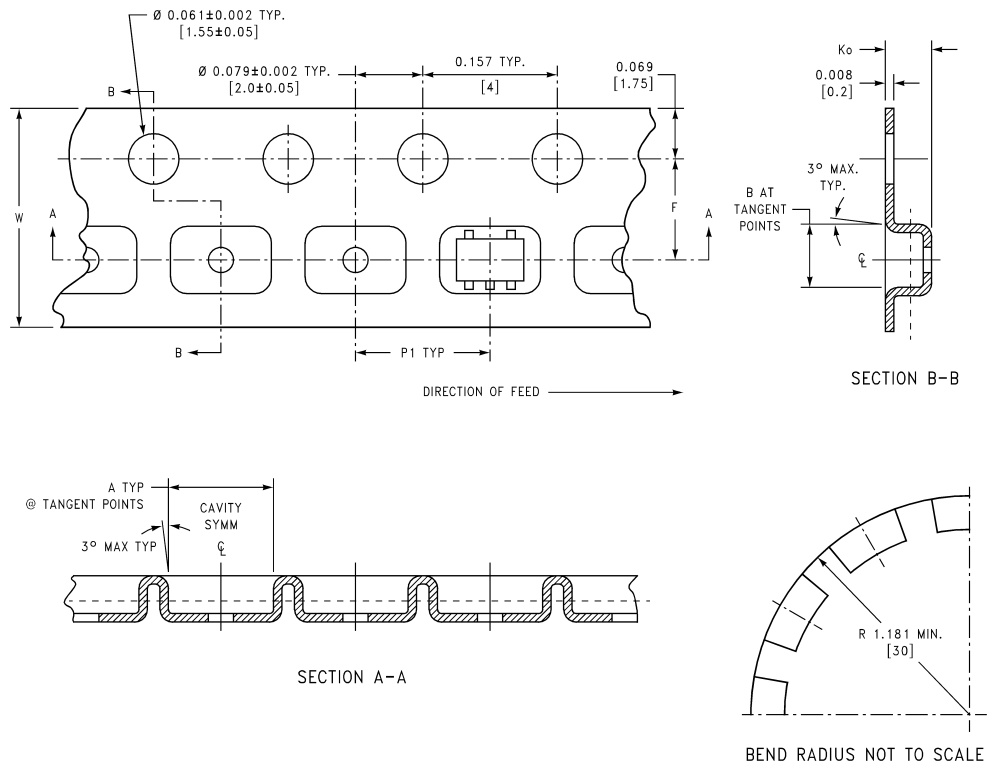
FIGURE 3. Typical High Level Output Voltage vs. Supply Voltage

## Tape and Reel Specification

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            |

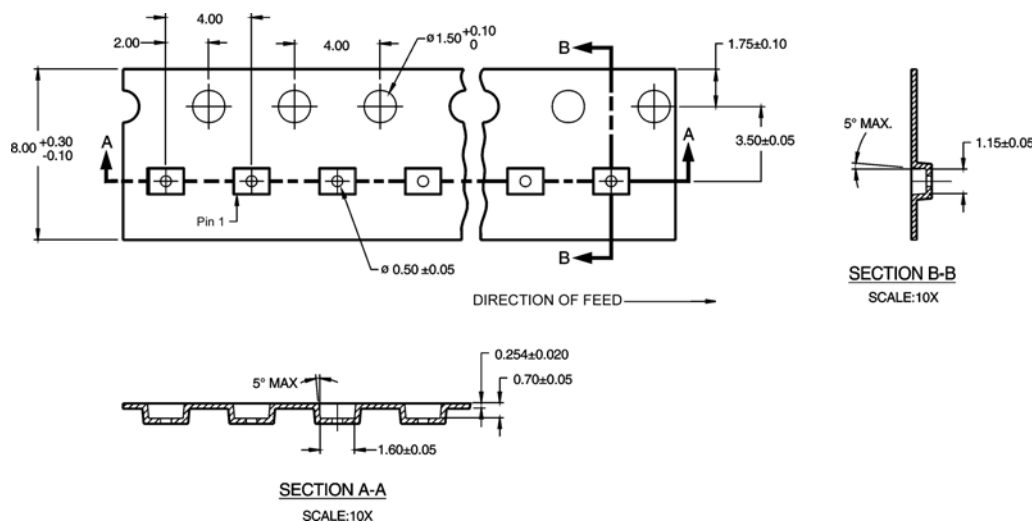
TAPE DIMENSIONS inches (millimeters)



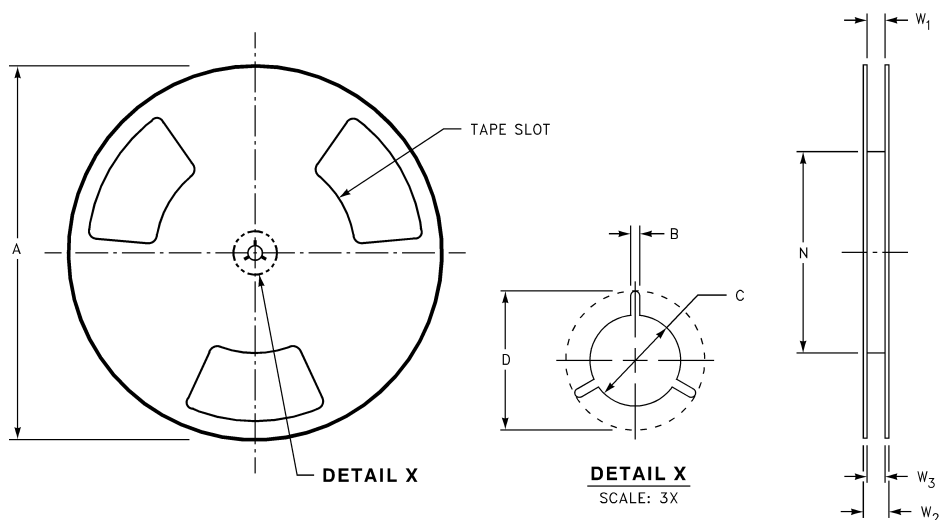
| Package | Tape Size | DIM A           | DIM B           | DIM F                         | DIM K <sub>0</sub>             | DIM P1       | DIM W                      |
|---------|-----------|-----------------|-----------------|-------------------------------|--------------------------------|--------------|----------------------------|
| SC70-5  | 8 mm      | 0.093<br>(2.35) | 0.096<br>(2.45) | 0.138 ± 0.004<br>(3.5 ± 0.10) | 0.053 ± 0.004<br>(1.35 ± 0.10) | 0.157<br>(4) | 0.315 ± 0.004<br>(8 ± 0.1) |
| SOT23-5 | 8 mm      | 0.130<br>(3.3)  | 0.130<br>(3.3)  | 0.138 ± 0.002<br>(3.5 ± 0.05) | 0.055 ± 0.004<br>(1.4 ± 0.11)  | 0.157<br>(4) | 0.315 ± 0.012<br>(8 ± 0.3) |

## 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            |

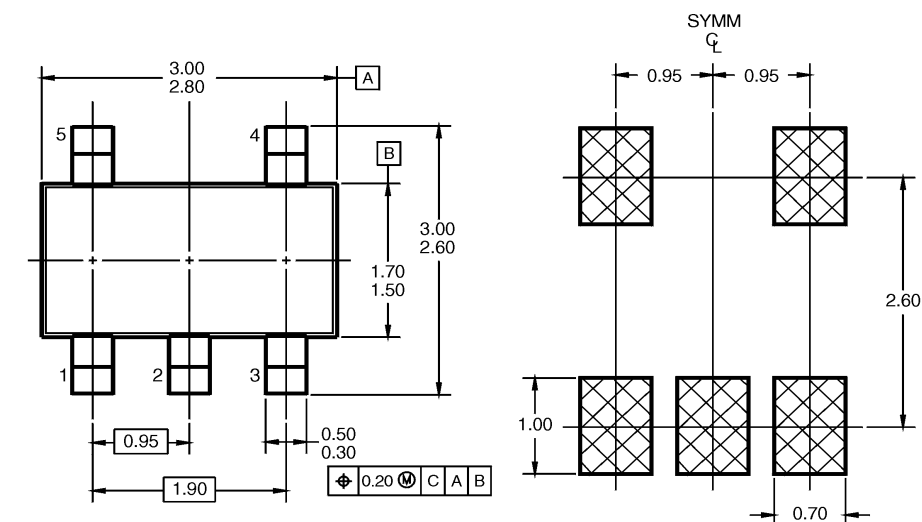


## REEL DIMENSIONS inches (millimeters)

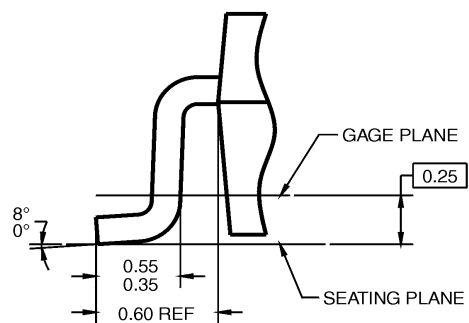
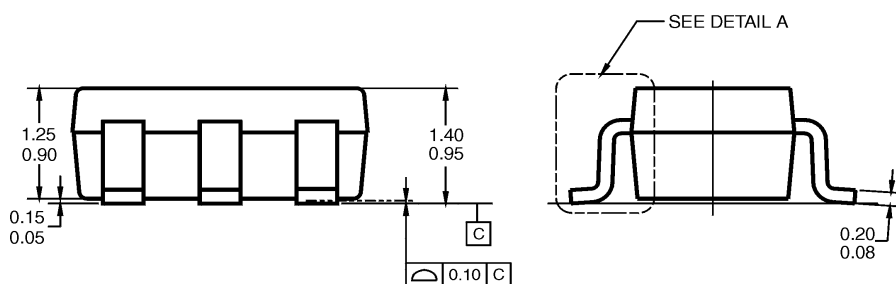


| Tape Size | A              | B               | C                | D                | N                | W1                                            | W2               | W3                                       |
|-----------|----------------|-----------------|------------------|------------------|------------------|-------------------------------------------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

**Physical Dimensions** inches (millimeters) unless otherwise noted



### LAND PATTERN RECOMMENDATION



### DETAIL A

NOTES: UNLESS OTHERWISE SPECIFIED

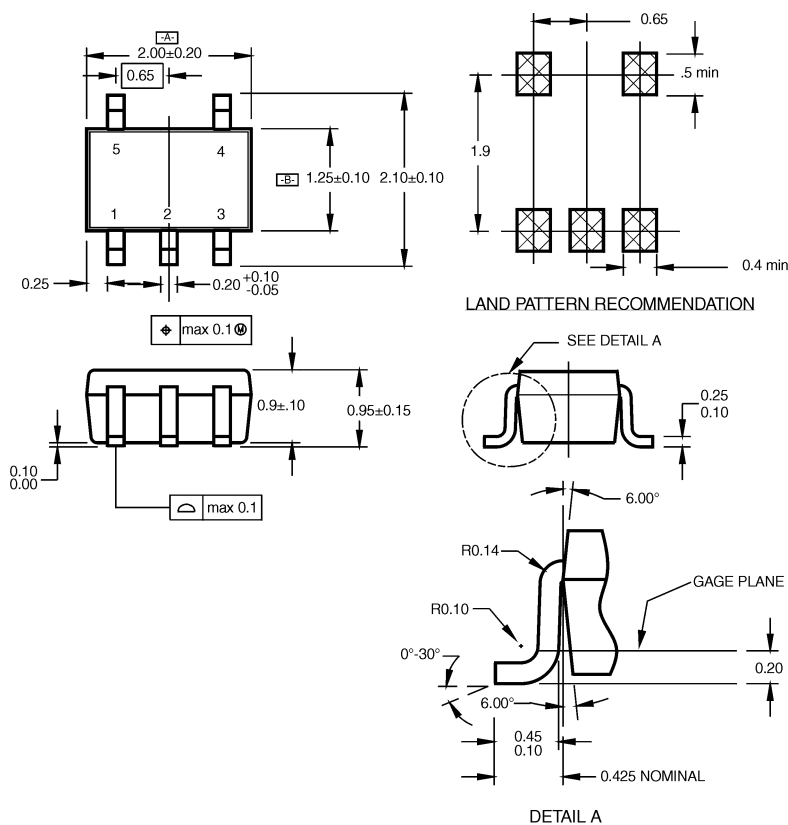
A) THIS PACKAGE CONFORMS TO JEDEC  
MO-178, ISSUE B, VARIATION AA,  
DATED JANUARY 1999.

B) ALL DIMENSIONS ARE IN MILLIMETERS.

MA05BRevC

**5-Lead SOT23, JEDEC MO-178, 1.6mm  
Package Number MA05B**

# Physical Dimensions inches (millimeters) unless otherwise noted (Continued)



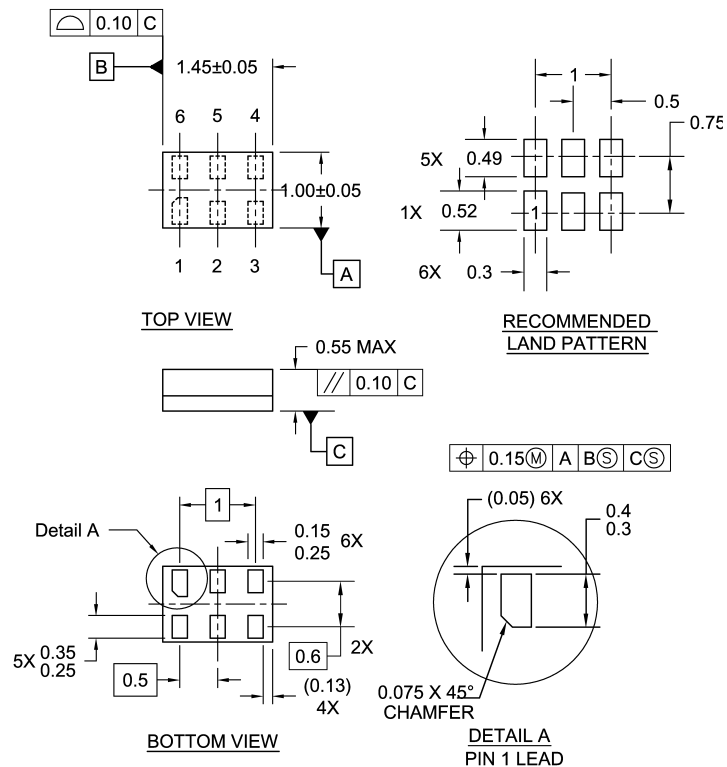
## NOTES:

- A. CONFORMS TO EIAJ REGISTERED OUTLINE DRAWING SC88A.
- B. DIMENSIONS DO NOT INCLUDE BURRS OR MOLD FLASH.
- C. DIMENSIONS ARE IN MILLIMETERS.

MAA05ARevC

**5-Lead SC70, EIAJ SC-88a, 1.25mm Wide  
Package Number MAA05A**

# Physical Dimensions inches (millimeters) unless otherwise noted (Continued)



## Notes:

1. JEDEC PACKAGE REGISTRATION IS ANTICIPATED
2. DIMENSIONS ARE IN MILLIMETERS
3. DRAWING CONFORMS TO ASME Y14.5M-1994

MAC06ARevB

**Pb-Free 6-Lead MicroPak, 1.0mm Wide  
Package Number MAC06A**

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provided in the labeling, can be reasonably expected to result in significant injury to the user.

2. A critical component is any component of a life support device or system whose failure to perform can be reasonably expected to cause the failure of the life support device or system, or to affect its safety or effectiveness.

## PRODUCT STATUS DEFINITIONS

Definition of terms

| Datasheet Identification | Product Status         | Definition                                                                                                                                                                                                            |
|--------------------------|------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Advance Information      | Formative or In Design | This datasheet contains the design specifications for product development. Specifications may change in any manner without notice.                                                                                    |
| Preliminary              | First Production       | This datasheet contains preliminary data, and supplementary data will be published at a later date. Fairchild Semiconductor reserves the right to make changes at any time without notice in order to improve design. |
| No Identification Needed | Full Production        | This datasheet contains final specifications. Fairchild Semiconductor reserves the right to make changes at any time without notice in order to improve design.                                                       |
| Obsolete                 | Not In Production      | This datasheet contains specifications on a product that has been discontinued by Fairchild Semiconductor. The datasheet is printed for reference information only.                                                   |