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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

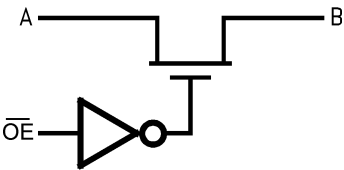
Ordering Code:

| 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.

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Logic Symbol



Pin Descriptions

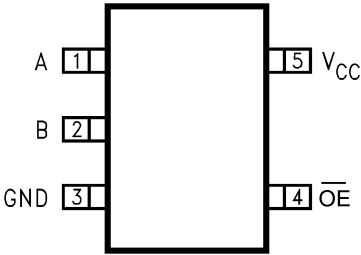
| Pin Name | Description |
|-----------------|-------------------|
| \overline{OE} | Bus Switch Enable |
| A | Bus A |
| B | Bus B |
| NC | No Connect |

Function Table

| OE | B _O | Function |
|----|----------------|------------|
| L | A _O | Connect |
| H | HIGH-Z State | Disconnect |

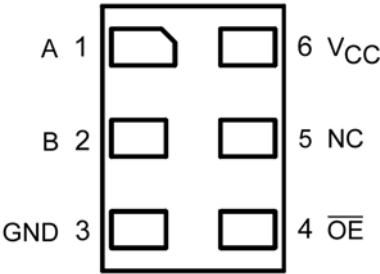
Connection Diagrams

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) | ± 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) (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 (θ_{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} (V) | $T_A = -40^\circ\text{C to } +85^\circ\text{C}$ | | | Units | Conditions |
|-----------------|---|-----------------|---|-----------------|------------|---------------|--|
| | | | Min | Typ (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 | | | ± 1.0 | μA | $0 \leq V_{IN} \leq 5.5V$ |
| I_{OFF} | "OFF" Leakage Current | 5.5 | | | ± 10.0 | μA | $0 \leq A, B, \leq V_{CC}$ |
| R_{ON} | Switch On Resistance (Note 5) | 4.5 | | 5.0 | 7.0 | Ω | $V_{IN} = 0V, I_I = 64$ mA |
| | | | | 5.0 | 7.0 | Ω | $V_{IN} = 0V, I_I = 30$ mA |
| | | | | 35.0 | 50.0 | Ω | $V_{IN} = 2.4V, I_I = 15$ 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 | μA | $\overline{OE} = V_{CC}$ |
| ΔI_{CC} | Increase in I_{CC} per Input (Note 6) | 5.5 | | 0.8 | 2.5 | mA | $\overline{OE} = 3.4V, I_O = 0$, 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 _{CC} (V) | T _A = -40°C to +85°C C _L = 50 pF, R _U = R _D = 500Ω | | | Units | Conditions | Figure Number |
|--|--|------------------------|---|-----------------|------|-------|--|------------------|
| | | | Min | Typ (Note 7) | Max | | | |
| t _{PHL} , t _{PLH} | Propagation Delay Bus-to-Bus (Note 8) | 4.5–5.5 | | | 0.25 | ns | V _I = OPEN | Figures 1, 2 |
| t _{PZL} , t _{PZH} | Output Enable Time | 4.5–5.5 | 1.5 | | 7.5 | ns | V _I = 7V for t _{PZL} V _I = OPEN for t _{PZH} | Figures 1, 2 |
| t _{PLZ} , t _{PHZ} | Output Disable Time | 4.5–5.5 | 1.0 | | 6.0 | ns | V _I = 7V for t _{PLZ} V _I = OPEN for t _{PHZ} | Figures 1, 2 |

Note 7: All typical values are V_{CC} = 5.0V, T_A = 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 _{IN} | Control Pin Input Capacitance | 2 | 5 | pF | V _{CC} = 5.0V |
| C _{I/O} | Input/Output Capacitance | 4.5 | 10 | pF | V _{CC} = 5.0V |

Note 9: T_A = 25°C f = 1MHz

AC Loading and Waveforms

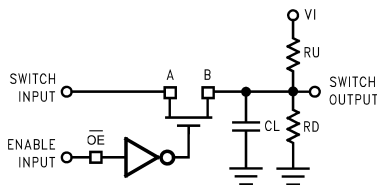


FIGURE 1. AC Test Circuit

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

C_L includes load and stray capacitance.

Input PRR = 1.0 MHz t_w = 500 ns.

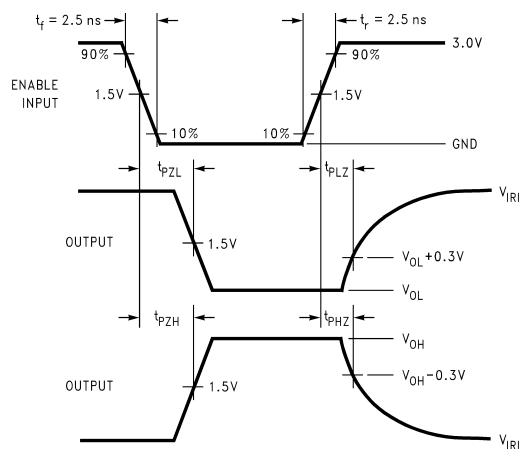
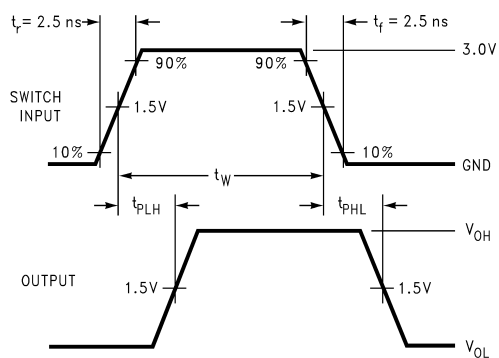


FIGURE 2. AC Waveforms

DC Characteristics

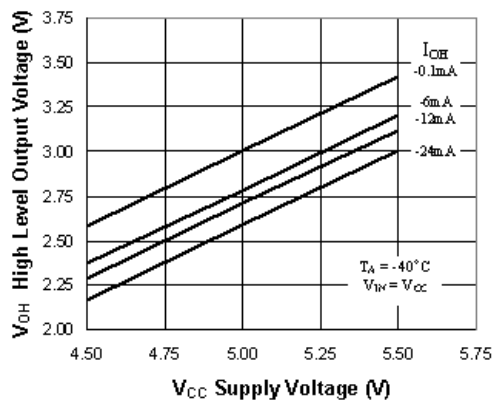
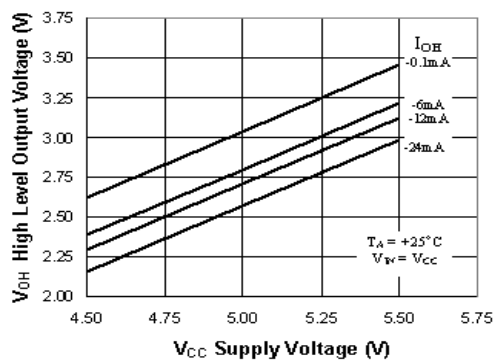
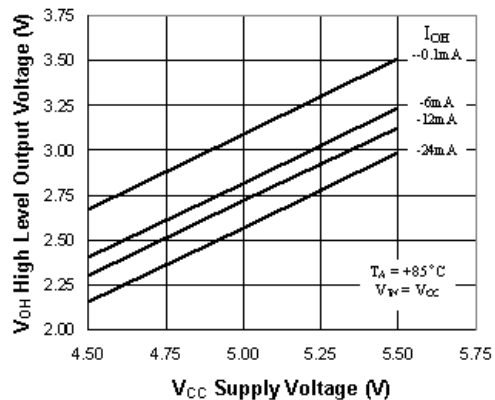


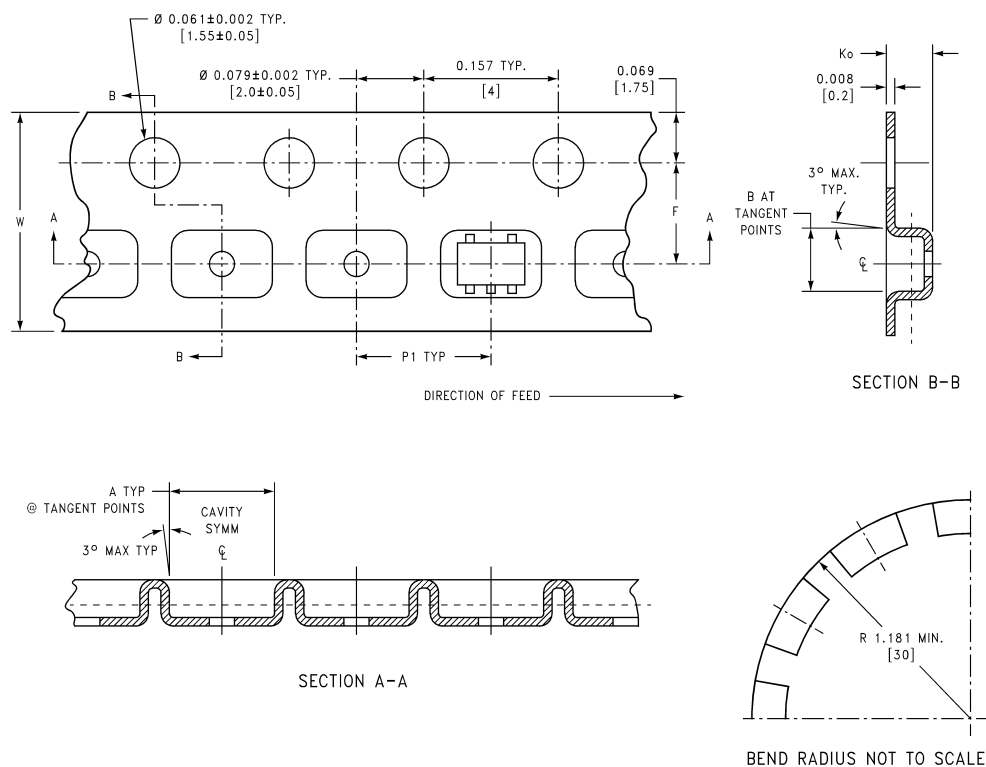
FIGURE 3. Typical High Level Output Voltage vs. Supply Voltage

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 |

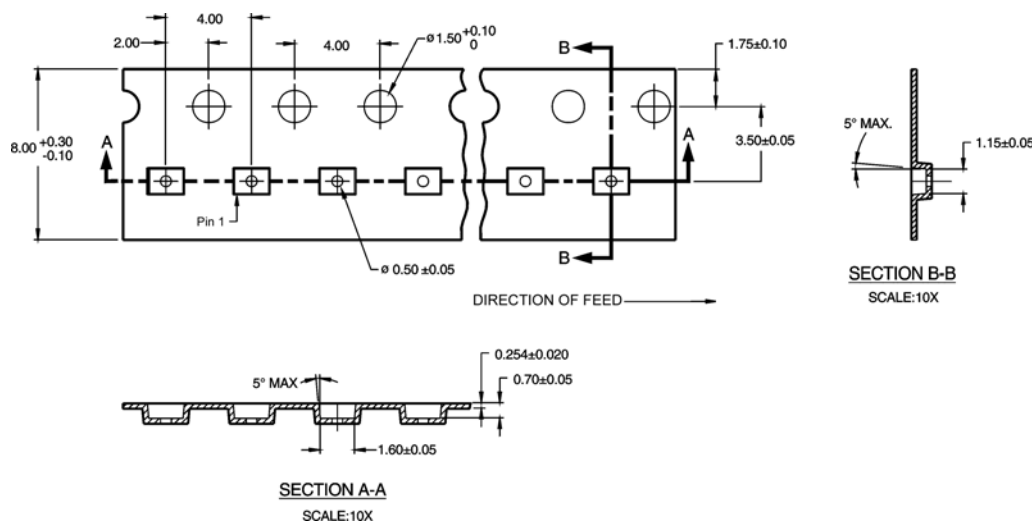
TAPE DIMENSIONS inches (millimeters)



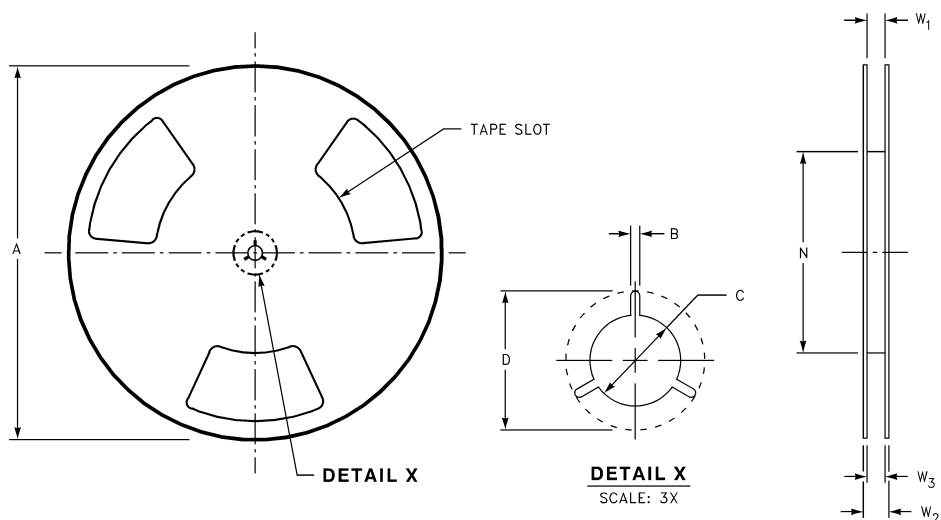
| Package | Tape Size | DIM A | DIM B | DIM F | DIM K_0 | DIM P1 | DIM W |
|---------|-----------|-----------------|-----------------|---|--|--------------|--------------------------------------|
| SC70-5 | 8 mm | 0.093 (2.35) | 0.096 (2.45) | 0.138 ± 0.004 (3.5 ± 0.10) | 0.053 ± 0.004 (1.35 ± 0.10) | 0.157 (4) | 0.315 ± 0.004 (8 ± 0.1) |
| SOT23-5 | 8 mm | 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 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 |

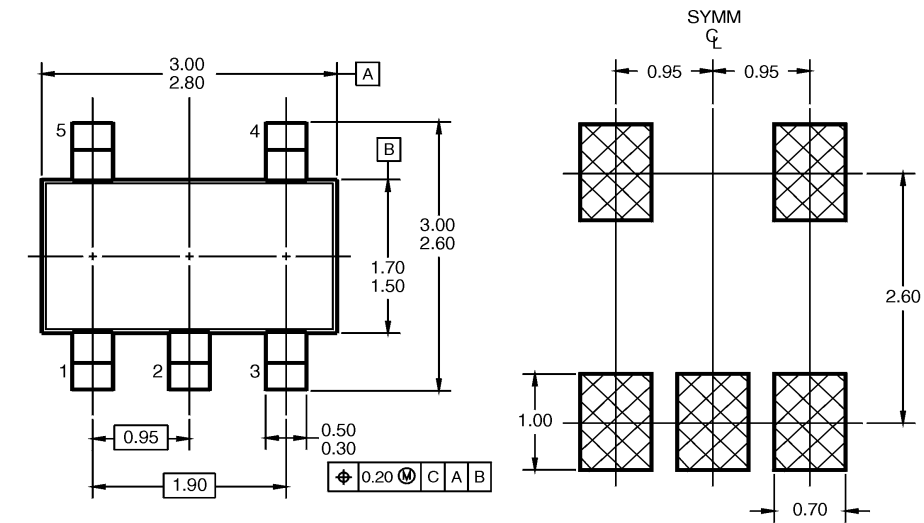


REEL DIMENSIONS inches (millimeters)

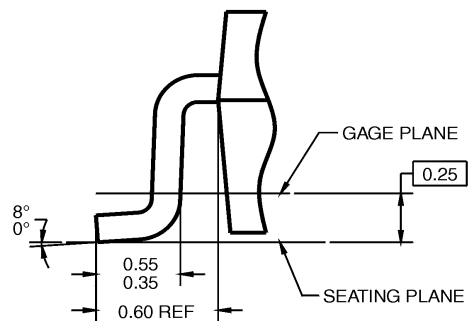
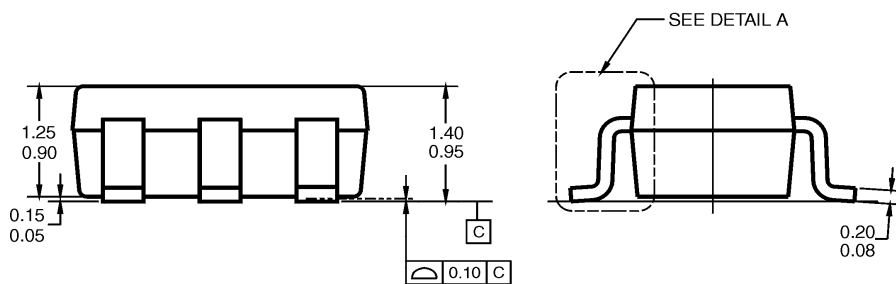


| Tape Size | A | B | C | D | N | W1 | W2 | W3 |
|-----------|----------------|-----------------|------------------|------------------|------------------|---|------------------|--|
| 8 mm | 7.0 (177.8) | 0.059 (1.50) | 0.512 (13.00) | 0.795 (20.20) | 2.165 (55.00) | 0.331 + 0.059/-0.000 (8.40 + 1.50/-0.00)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

Physical Dimensions inches (millimeters) unless otherwise noted



LAND PATTERN RECOMMENDATION



NOTES: UNLESS OTHERWISE SPECIFIED

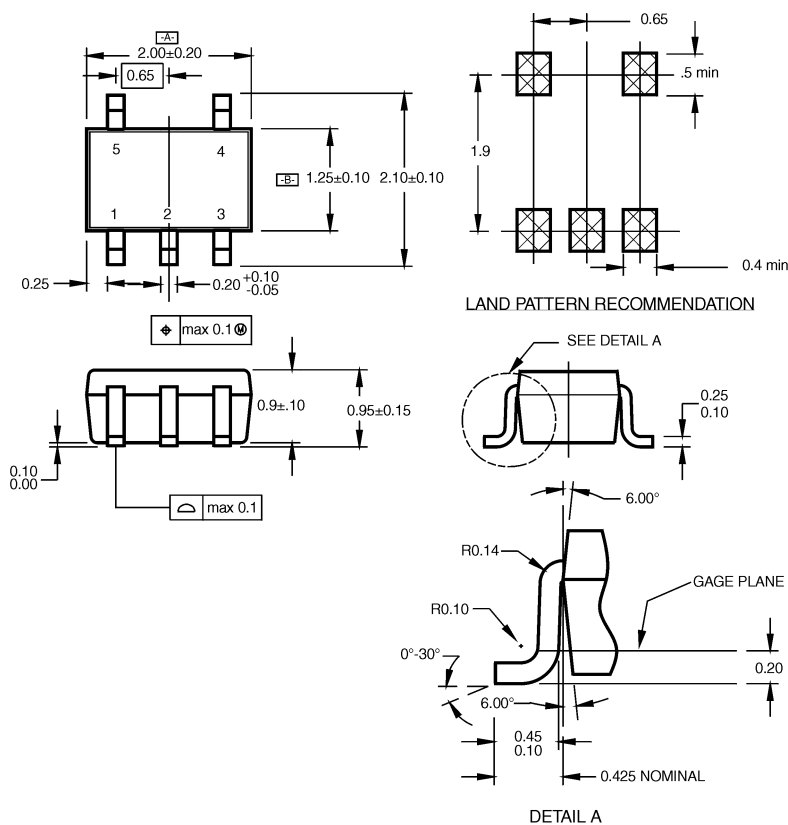
- A) THIS PACKAGE CONFORMS TO JEDEC MO-178, ISSUE B, VARIATION AA, DATED JANUARY 1999.
- B) ALL DIMENSIONS ARE IN MILLIMETERS.

MA05BRevC

DETAIL A

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**

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