

NC7SZ04 TinyLogic® UHS Inverter

General Description

The NC7SZ04 is a single inverter 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 V_{CC} range. The inputs and output are high impedance when V_{CC} is 0V. Inputs tolerate voltages up to 6V independent of V_{CC} operating voltage.

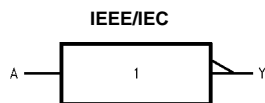
Features

- Space saving SOT23 or SC70 5-lead package
- Ultra small MicroPak™ leadless package
- Ultra High Speed; t_{PD} 2.4 ns typ into 50 pF at 5V V_{CC}
- High Output Drive; ± 24 mA 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

Ordering Code:

| Order Number | Package Number | Product Code Top Mark | Package Description | Supplied As |
|--------------|----------------|-----------------------|---------------------------------------|---------------------------|
| NC7SZ04M5X | MA05B | 7Z04 | 5-Lead SOT23, JEDEC MO-178, 1.6mm | 3k Units on Tape and Reel |
| NC7SZ04P5X | MAA05A | Z04 | 5-Lead SC70, EIAJ SC-88a, 1.25mm Wide | 3k Units on Tape and Reel |
| NC7SZ04L6X | MAC06A | CC | 6-Lead MicroPak, 1.0mm Wide | 5k Units on Tape and Reel |

Logic Symbol



Pin Descriptions

| Pin Names | Description |
|-----------|-------------|
| A | Input |
| Y | Output |
| NC | No Connect |

Function Table

$$Y = \bar{A}$$

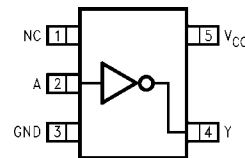
| Input | Output |
|-------|--------|
| A | Y |
| L | H |
| H | L |

H = HIGH Logic Level
L = LOW Logic Level

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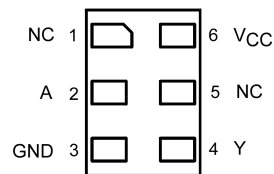
Connection Diagrams

Pin Assignments for SC70



(Top View)

Pad Assignments for MicroPak



(Top Thru View)

| Absolute Maximum Ratings (Note 1) | | Recommended Operating Conditions (Note 2) | |
|--|-----------------|--|-------------------|
| Supply Voltage (V_{CC}) | -0.5V to +6V | Supply Voltage Operating (V_{CC}) | 1.65V to 5.5V |
| DC Input Voltage (V_{IN}) | -0.5V to +6V | Supply Voltage Data Retention (V_{CC}) | 1.5V to 5.5V |
| DC Output Voltage (V_{OUT}) | -0.5V to +6V | Input Voltage (V_{IN}) | 0V to 5.5V |
| DC Input Diode Current (I_{IK}) | | Output Voltage (V_{OUT}) | 0V to V_{CC} |
| @ $V_{IN} < -0.5V$ | -50 mA | Operating Temperature (T_A) | -40°C to +85°C |
| @ $V_{IN} > 6V$ | +20 mA | Input Rise and Fall Time (t_r, t_f) | |
| DC Output Diode Current (I_{OK}) | | $V_{CC} = 1.8V, 2.5V \pm 0.2V$ | 0 ns/V to 20 ns/V |
| @ $V_{OUT} < -0.5V$ | -50 mA | $V_{CC} = 3.3V \pm 0.3V$ | 0 ns/V to 10 ns/V |
| @ $V_{OUT} > 6V, V_{CC} = GND$ | +20 mA | $V_{CC} = 5.0V \pm 0.5V$ | 0 ns/V to 5 ns/V |
| DC Output Current (I_{OUT}) | ± 50 mA | Thermal Resistance (θ_{JA}) | |
| DC V_{CC}/GND Current (I_{CC}/I_{GND}) | ± 50 mA | SOT23-5 | 300°C/W |
| Storage Temperature (T_{STG}) | -65°C to +150°C | SC70-5 | 425°C/W |
| 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 | | |
| SOT70-5 | 150 mW | | |

Note 1: Absolute maximum ratings are DC values beyond which the device may be damaged or have its useful life impaired. The datasheet specifications should be met without exception, to ensure that the system design is reliable over its power supply, temperature, and output/input loading variables. Fairchild does not recommend operation outside datasheet specifications.

Note 2: Unused inputs must be held HIGH or LOW. They may not float.

DC Electrical Characteristics

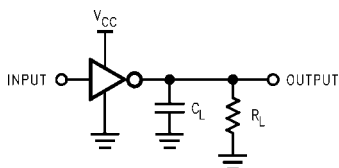
| Symbol | Parameter | V_{CC} (V) | $T_A = +25^\circ C$ | | | $T_A = -40^\circ C$ to $+85^\circ C$ | | Units | Conditions |
|-----------|---------------------------|----------------------------|-------------------------------|------|------|--------------------------------------|---------|---|--|
| |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

AC Electrical Characteristics

| Symbol | Parameter | V _{CC} (V) | T _A = +25°C | | | T _A = -40°C to +85°C | | Units | Conditions | Figure Number |
|--------------------------------------|-------------------------------|------------------------|------------------------|-----|------|---------------------------------|------|-------|---|---------------|
| | | | Min | Typ | Max | Min | Max | | | |
| t _{PLH} t _{PHL} | Propagation Delay | 1.65 | 2.0 | 5.3 | 11.4 | 2.0 | 12.0 | ns | C _L = 15 pF R _L = 1 MΩ | Figures 1, 3 |
| | | 1.8 | 2.0 | 4.4 | 9.5 | 2.0 | 10 | | | |
| | | 2.5 ± 0.2 | 0.8 | 2.9 | 6.5 | 0.8 | 7.0 | | | |
| | | 3.3 ± 0.3 | 0.5 | 2.1 | 4.5 | 0.5 | 4.7 | | | |
| | | 5.0 ± 0.5 | 0.5 | 1.8 | 3.9 | 0.5 | 4.1 | | | |
| t _{PLH} t _{PHL} | Propagation Delay | 3.3 ± 0.3 | 1.5 | 2.9 | 5.0 | 1.5 | 5.2 | ns | C _L = 50 pF R _L = 500Ω | Figures 1, 3 |
| | | 5.0 ± 0.5 | 0.8 | 2.4 | 4.3 | 0.8 | 4.5 | | | |
| C _{IN} | Input Capacitance | 0 | 4 | | | | | pF | | |
| C _{PD} | Power Dissipation Capacitance | 3.3 | 20 | | | | | pF | (Note 3) | Figure 2 |
| | | 5.0 | 26 | | | | | | | |

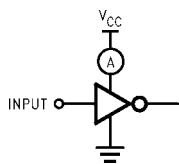
Note 3: C_{PD} is defined as the value of the internal equivalent capacitance which is derived from dynamic operating current consumption (I_{CCD}) at no output loading and operating at 50% duty cycle. (See Figure 2.) C_{PD} is related to I_{CCD} dynamic operating current by the expression:
 $I_{CCD} = (C_{PD})(V_{CC})(f_{IN}) + (I_{CC} \text{ static})$

AC Loading and Waveforms



C_L includes load and stray capacitance
 Input PRR = 1.0 MHz, t_w = 500 ns

FIGURE 1. AC Test Circuit



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

FIGURE 2. I_{CCD} Test Circuit

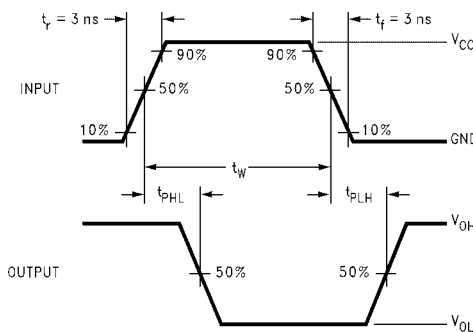


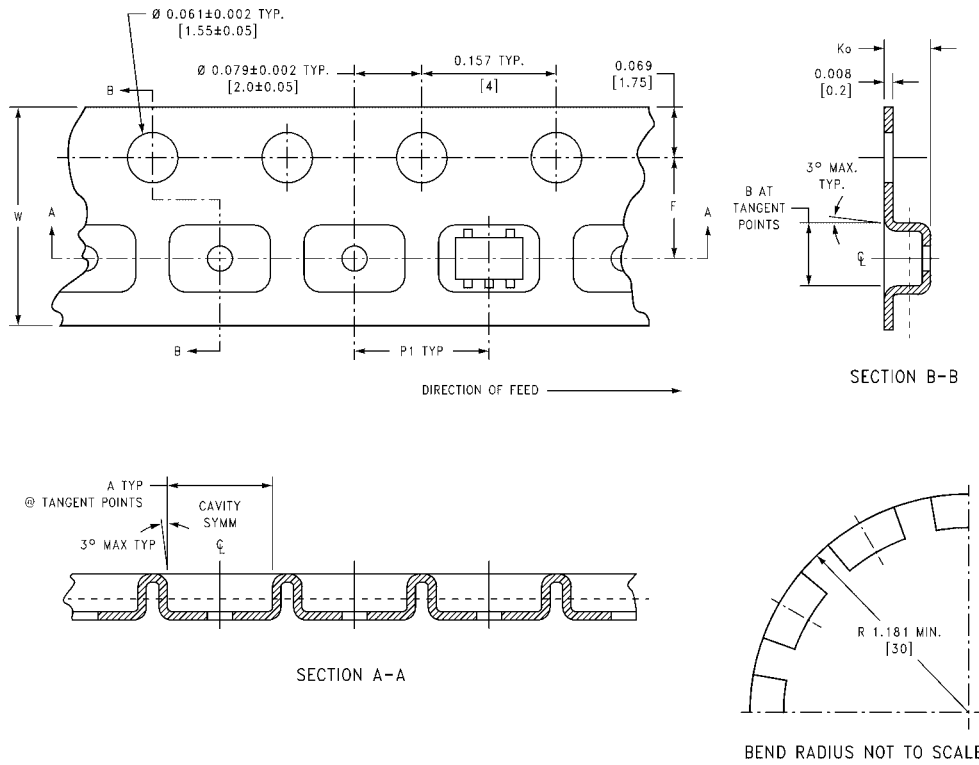
FIGURE 3. AC Waveforms

Tape and Reel Specification

TAPE FORMAT FOR SOT23, SC70

| 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)



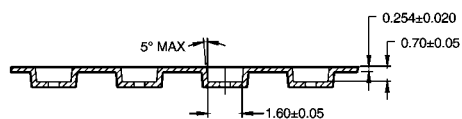
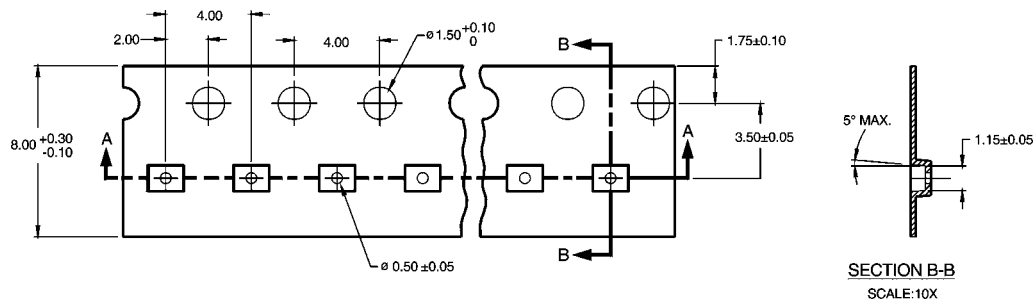
| Package | Tape Size | DIM A | DIM B | DIM F | DIM K_o | DIM P1 | DIM W |
|---------|-----------|-----------------|-----------------|-------------------------------|--------------------------------|--------------|----------------------------|
| SC70-5 | 8 mm | 0.093 (2.35) | 0.096 (2.45) | 0.138 ± 0.004 (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 and Reel Specification (Continued)

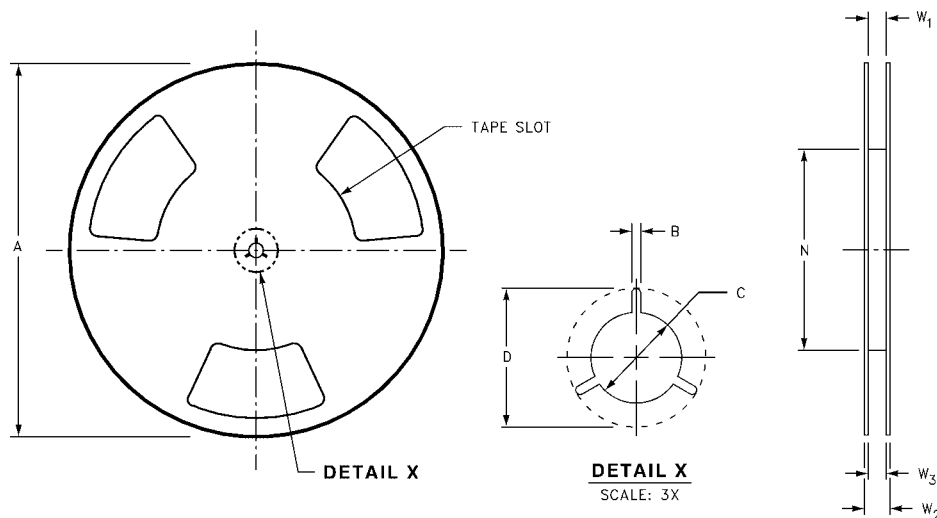
TAPE FORMAT FOR MicroPak

| 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 |

TAPE DIMENSIONS inches (millimeters)



REEL DIMENSIONS inches (millimeters)

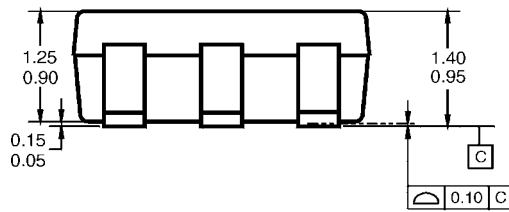


| Tape Size | A | B | C | D | N | W1 | W2 | W3 |
|-----------|----------------|-----------------|------------------|------------------|------------------|---|------------------|--|
| 8 mm | 7.0 (177.8) | 0.059 (1.50) | 0.512 (13.00) | 0.795 (20.20) | 2.165 (55.00) | 0.331 + 0.059/-0.000 (8.40 + 1.50/-0.00)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

Physical Dimensions inches (millimeters) unless otherwise noted



LAND PATTERN RECOMMENDATION



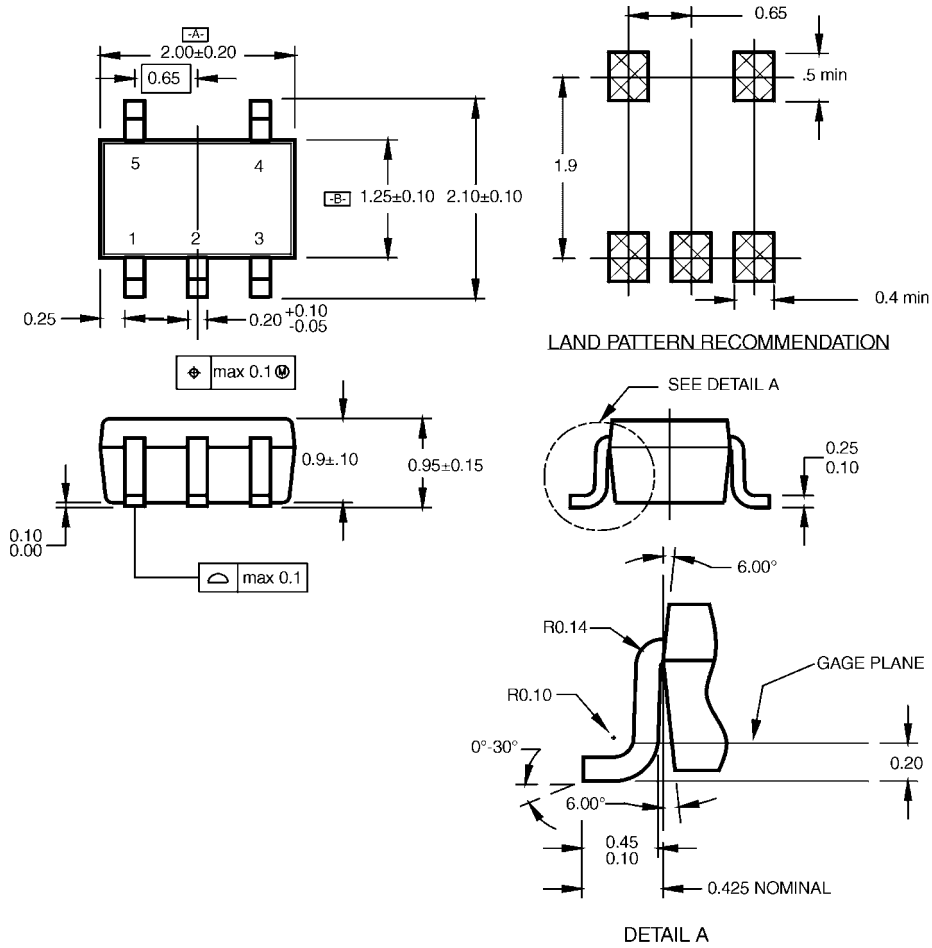
DETAIL A

- 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)



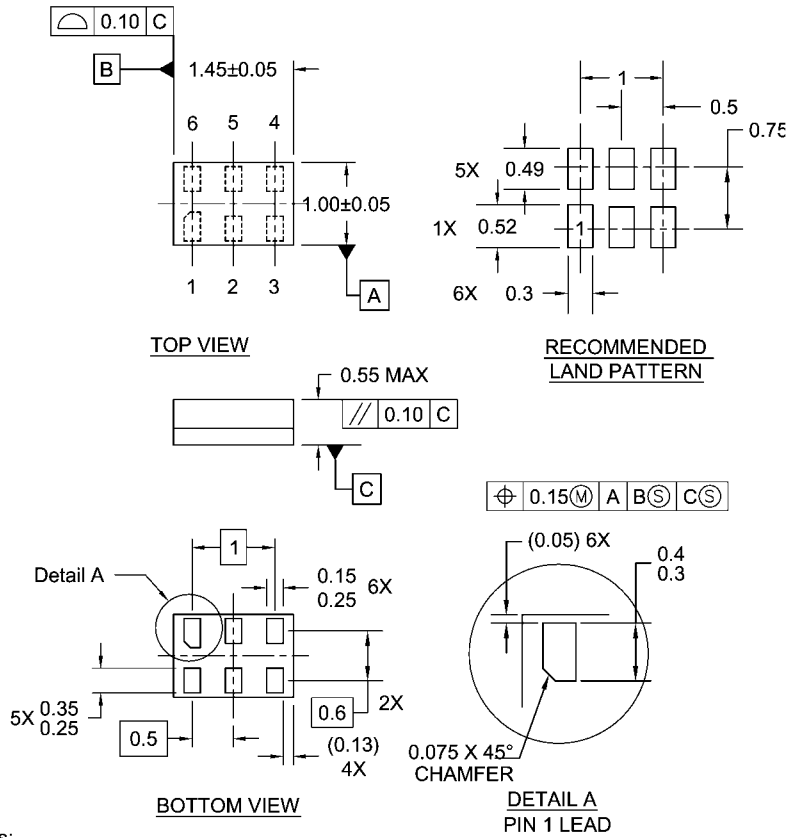
NOTES:

- 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

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

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