

## NC7SZ14

### TinyLogic™ UHS Inverter with Schmitt Trigger Input

#### General Description

The NC7SZ14 is a single Inverter with Schmitt Trigger input 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 input and output are high impedance when  $V_{CC}$  is 0V. Inputs tolerate voltages up to 6V independent of  $V_{CC}$  operating voltage.

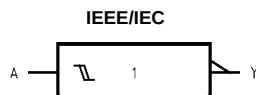
#### Features

- Space saving SOT23 or SC70 5-lead package
- Ultra High Speed;  $t_{PD}$  3.7 ns Typ into 50 pF at 5V  $V_{CC}$
- High Output Drive;  $\pm 24$  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

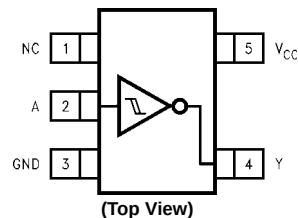
#### Ordering Code:

| Order Number | Package Number | Product Code Top Mark | Package Description                   | Supplied As                |
|--------------|----------------|-----------------------|---------------------------------------|----------------------------|
| NC7SZ14M5    | MA05B          | 7Z14                  | 5-Lead SOT23, JEDEC MO-178, 1.6mm     | 250 Units on Tape and Reel |
| NC7SZ14M5X   | MA05B          | 7Z14                  | 5-Lead SOT23, JEDEC MO-178, 1.6mm     | 3k Units on Tape and Reel  |
| NC7SZ14P5    | MAA05A         | Z14                   | 5-Lead SC70, EIAJ SC-88a, 1.25mm Wide | 250 Units on Tape and Reel |
| NC7SZ14P5X   | MAA05A         | Z14                   | 5-Lead SC70, EIAJ SC-88a, 1.25mm Wide | 3k Units on Tape and Reel  |

#### Logic Symbol



#### Connection Diagram



#### 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

TinyLogic™ is a trademark of Fairchild Semiconductor Corporation.

**Absolute Maximum Ratings**(Note 1)

|                                                            |                 |
|------------------------------------------------------------|-----------------|
| Supply Voltage ( $V_{CC}$ )                                | –0.5V to +6V    |
| DC Input Voltage ( $V_{IN}$ )                              | –0.5V to +6V    |
| DC Output Voltage ( $V_{OUT}$ )                            | –0.5V to +6V    |
| DC Input Diode Current ( $I_{IK}$ )                        |                 |
| @ $V_{IN} < -0.5V$                                         | –50 mA          |
| @ $V_{IN} > 6V$                                            | +20 mA          |
| DC Output Diode Current ( $I_{OK}$ )                       |                 |
| @ $V_{OUT} < -0.5V$                                        | –50 mA          |
| @ $V_{OUT} > 6V$ , $V_{CC} = GND$                          | +20 mA          |
| DC Output Current ( $I_{OUT}$ )                            | ±50 mA          |
| DC $V_{CC}/GND$ Current ( $I_{CC}/I_{GND}$ )               | ±50 mA          |
| Storage Temperature ( $T_{STG}$ )                          | –65°C to +150°C |
| Junction Temperature under Bias ( $T_J$ )                  | 150°C           |
| Junction Lead Temperature (T1);<br>(Soldering, 10 seconds) | 260°C           |
| Power Dissipation ( $P_D$ ) @ +85°C                        |                 |
| SOT23-5                                                    | 200 mW          |
| SC70-5                                                     | 150 mW          |

**Recommended Operating Conditions** (Note 2)

|                                            |                |
|--------------------------------------------|----------------|
| Supply Voltage Operating ( $V_{CC}$ )      | 1.65V to 5.5V  |
| Supply Voltage Data Retention ( $V_{CC}$ ) | 1.5V to 5.5V   |
| Input Voltage ( $V_{IN}$ )                 | 0V to 5.5V     |
| Output Voltage ( $V_{OUT}$ )               | 0V to $V_{CC}$ |
| Operating Temperature ( $T_A$ )            | –40°C to +85°C |
| Thermal Resistance ( $\theta_{JA}$ )       |                |
| SOT23-5                                    | 300°C/W        |
| SC70-5                                     | 425°C/W        |

**Note 1:** Absolute maximum ratings are DC values beyond which the device may be damaged or have its useful life impaired. The datasheet specification 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                  | $V_{CC}$<br>(V) | $T_A = +25^\circ\text{C}$ |      |      | $T_A = -40^\circ\text{C to } +85^\circ\text{C}$ |      | Unit | Conditions        |                                                                                                                                             |
|----------|----------------------------|-----------------|---------------------------|------|------|-------------------------------------------------|------|------|-------------------|---------------------------------------------------------------------------------------------------------------------------------------------|
|          |                            |                 | Min                       | Typ  | Max  | Min                                             | Max  |      |                   |                                                                                                                                             |
| $V_P$    | Positive Threshold Voltage | 1.65            | 0.6                       | 1.0  | 1.4  | 0.6                                             | 1.4  | V    |                   |                                                                                                                                             |
|          |                            | 1.8             | 0.7                       | 1.1  | 1.5  | 0.7                                             | 1.5  |      |                   |                                                                                                                                             |
|          |                            | 2.3             | 1.0                       | 1.4  | 1.8  | 1.0                                             | 1.8  |      |                   |                                                                                                                                             |
|          |                            | 3.0             | 1.3                       | 1.75 | 2.2  | 1.3                                             | 2.2  |      |                   |                                                                                                                                             |
|          |                            | 4.5             | 1.9                       | 2.45 | 3.1  | 1.9                                             | 3.1  |      |                   |                                                                                                                                             |
| $V_N$    | Negative Threshold Voltage | 5.5             | 2.2                       | 2.9  | 3.6  | 2.2                                             | 3.6  | V    |                   |                                                                                                                                             |
|          |                            | 1.65            | 0.2                       | 0.5  | 0.8  | 0.2                                             | 0.8  |      |                   |                                                                                                                                             |
|          |                            | 1.8             | 0.25                      | 0.55 | 0.9  | 0.25                                            | 0.9  |      |                   |                                                                                                                                             |
|          |                            | 2.3             | 0.40                      | 0.75 | 1.15 | 0.40                                            | 1.15 |      |                   |                                                                                                                                             |
|          |                            | 3.0             | 0.6                       | 1.0  | 1.5  | 0.6                                             | 1.5  |      |                   |                                                                                                                                             |
| $V_H$    | Hysteresis Voltage         | 4.5             | 1.0                       | 1.43 | 2.0  | 1.0                                             | 2.0  | V    |                   |                                                                                                                                             |
|          |                            | 5.5             | 1.2                       | 1.70 | 2.3  | 1.2                                             | 2.3  |      |                   |                                                                                                                                             |
|          |                            | 1.65            | 0.1                       | 0.48 | 0.9  | 0.1                                             | 0.9  |      |                   |                                                                                                                                             |
|          |                            | 1.8             | 0.15                      | 0.54 | 1.0  | 0.15                                            | 1.0  |      |                   |                                                                                                                                             |
|          |                            | 2.3             | 0.25                      | 0.65 | 1.1  | 0.25                                            | 1.1  |      |                   |                                                                                                                                             |
| $V_{OH}$ | HIGH Level Output Voltage  | 3.0             | 0.4                       | 0.77 | 1.2  | 0.4                                             | 1.2  | V    | $V_{IN} = V_{IL}$ | $I_{OH} = -100 \mu\text{A}$                                                                                                                 |
|          |                            | 4.5             | 0.6                       | 1.01 | 1.5  | 0.6                                             | 1.5  |      |                   |                                                                                                                                             |
|          |                            | 5.5             | 0.7                       | 1.18 | 1.7  | 0.7                                             | 1.7  |      |                   |                                                                                                                                             |
|          |                            | 1.65            | 1.55                      | 1.65 |      | 1.55                                            |      |      |                   |                                                                                                                                             |
|          |                            | 1.8             | 1.7                       | 1.8  |      | 1.7                                             |      |      |                   |                                                                                                                                             |
|          |                            | 2.3             | 2.2                       | 2.3  |      | 2.2                                             |      | V    |                   | $I_{OH} = -4 \text{ mA}$<br>$I_{OH} = -8 \text{ mA}$<br>$I_{OH} = -16 \text{ mA}$<br>$I_{OH} = -24 \text{ mA}$<br>$I_{OH} = -32 \text{ mA}$ |
|          |                            | 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                                             |      |      |                   |                                                                                                                                             |
|          |                            | 3.0             | 2.3                       | 2.68 |      | 2.3                                             |      |      |                   |                                                                                                                                             |
|          |                            | 4.5             | 3.8                       | 4.20 |      | 3.8                                             |      |      |                   |                                                                                                                                             |

## DC Electrical Characteristics (Continued)

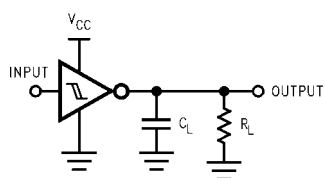
| Symbol           | Parameter                   | V <sub>CC</sub><br>(V) | T <sub>A</sub> = +25°C |      |      | T <sub>A</sub> = -40°C to +85°C |      | Unit | Conditions                                 |                          |
|------------------|-----------------------------|------------------------|------------------------|------|------|---------------------------------|------|------|--------------------------------------------|--------------------------|
|                  |                             |                        | Min                    | Typ  | Max  | Min                             | Max  |      |                                            |                          |
| V <sub>OL</sub>  | LOW Level<br>Output Voltage | 1.65                   |                        | 0.0  | 0.1  |                                 | 0.1  | V    | V <sub>IN</sub> = V <sub>IH</sub>          | I <sub>OL</sub> = 100 μA |
|                  |                             | 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                   |                        | 0.08 | 0.24 |                                 | 0.24 | V    |                                            | I <sub>OL</sub> = 4 mA   |
|                  |                             | 2.3                    |                        | 0.10 | 0.3  |                                 | 0.3  |      |                                            | I <sub>OL</sub> = 8 mA   |
|                  |                             | 3.0                    |                        | 0.15 | 0.4  |                                 | 0.4  |      |                                            | I <sub>OL</sub> = 16 mA  |
|                  |                             | 3.0                    |                        | 0.22 | 0.55 |                                 | 0.55 |      |                                            | I <sub>OL</sub> = 24 mA  |
|                  |                             | 4.5                    |                        | 0.22 | 0.55 |                                 | 0.55 |      |                                            | I <sub>OL</sub> = 32 mA  |
| I <sub>IN</sub>  | Input Leakage Current       | 0 to 5.5               |                        |      | ±1   |                                 | ±10  | μA   | V <sub>IN</sub> = 5.5V, GND                |                          |
| I <sub>OFF</sub> | Power Off Leakage Current   | 0.0                    |                        |      | 1    |                                 | 10   | μA   | V <sub>IN</sub> or V <sub>OUT</sub> = 5.5V |                          |
| I <sub>CC</sub>  | Quiescent Supply Current    | 1.65 to 5.5            |                        |      | 2.0  |                                 | 20   | μA   | V <sub>IN</sub> = 5.5V, GND                |                          |

## AC Electrical Characteristics

| Symbol                                 | Parameter                        | V <sub>CC</sub><br>(V) | T <sub>A</sub> = +25°C |          |      | T <sub>A</sub> = -40°C to +85°C |      | Unit | Conditions                                       | Fig. No.        |
|----------------------------------------|----------------------------------|------------------------|------------------------|----------|------|---------------------------------|------|------|--------------------------------------------------|-----------------|
|                                        |                                  |                        | Min                    | Typ      | Max  | Min                             | Max  |      |                                                  |                 |
| t <sub>PLH</sub> ,<br>t <sub>PHL</sub> | Propagation Delay                | 1.65                   | 2.0                    | 9.1      | 15.0 | 2.0                             | 15.6 | ns   | C <sub>L</sub> = 15 pF,<br>R <sub>L</sub> = 1 MΩ | Figures<br>1, 3 |
|                                        |                                  | 1.8                    | 2.0                    | 7.6      | 12.5 | 2.0                             | 13   |      |                                                  |                 |
|                                        |                                  | 2.5 ± 0.2              | 1.0                    | 5.0      | 9.0  | 1.0                             | 9.5  |      |                                                  |                 |
|                                        |                                  | 3.3 ± 0.3              | 1.0                    | 3.7      | 6.3  | 1.0                             | 6.5  |      |                                                  |                 |
|                                        |                                  | 5.0 ± 0.5              | 0.5                    | 3.1      | 5.2  | 0.5                             | 5.5  |      |                                                  |                 |
| t <sub>PLH</sub> ,<br>t <sub>PHL</sub> | Propagation Delay                | 3.3 ± 0.3              | 1.5                    | 4.4      | 7.2  | 1.5                             | 7.5  | ns   | C <sub>L</sub> = 50 pF,<br>R <sub>L</sub> = 500Ω | Figures<br>1, 3 |
|                                        |                                  | 5.0 ± 0.5              | 0.8                    | 3.7      | 5.9  | 0.8                             | 6.2  |      |                                                  |                 |
| C <sub>IN</sub>                        | Input Capacitance                | 0                      |                        | 4        |      |                                 |      | pF   |                                                  |                 |
| C <sub>PD</sub>                        | Power Dissipation<br>Capacitance | 3.3<br>5.0             |                        | 24<br>30 |      |                                 |      | pF   | (Note 3)                                         | Figure 2        |

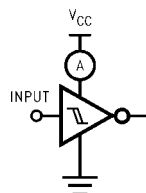
**Note 3:** C<sub>PD</sub> is defined as the value of the internal equivalent capacitance which is derived from dynamic operating current consumption (I<sub>CCD</sub>) at no output loading and operating at 50% duty cycle. (See Figure 2.) C<sub>PD</sub> is related to I<sub>CCD</sub> dynamic operating current by the expression:  
I<sub>CCD</sub> = (C<sub>PD</sub>) (V<sub>CC</sub>) (f<sub>IN</sub>) + (I<sub>CC</sub> static).

## AC Loading and Waveforms



C<sub>L</sub> includes load and stray capacitance  
Input PRR = 1.0 MHz; t<sub>w</sub> = 500 ns

FIGURE 1. AC Test Circuit



Input = AC Waveform; t<sub>r</sub> = t<sub>f</sub> = 1.8 ns  
PRR = 10 MHz; Duty Cycle = 50%

FIGURE 2. I<sub>CCD</sub> Test Circuit

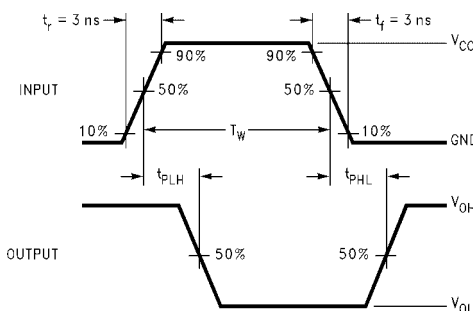


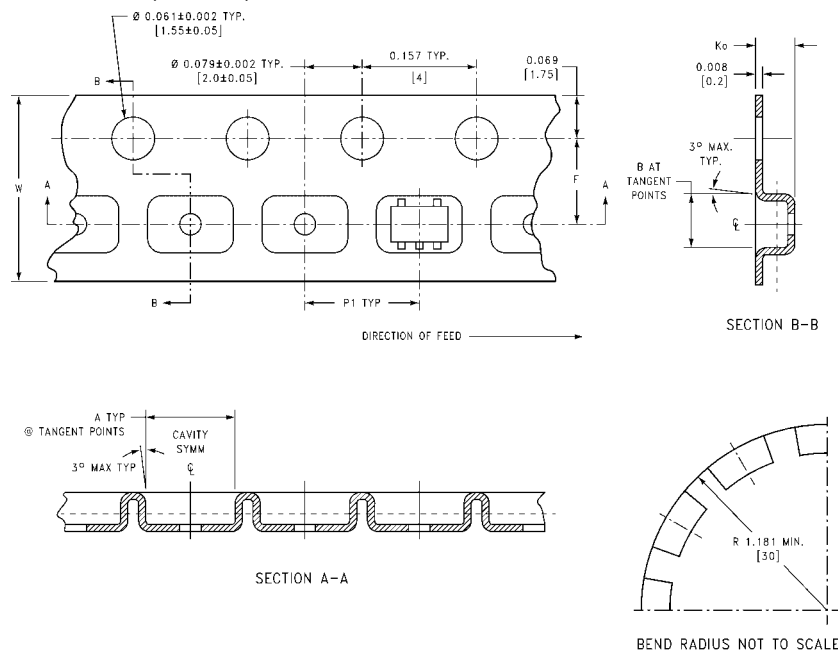
FIGURE 3. AC Waveforms

## Tape and Reel Specification

### TAPE FORMAT

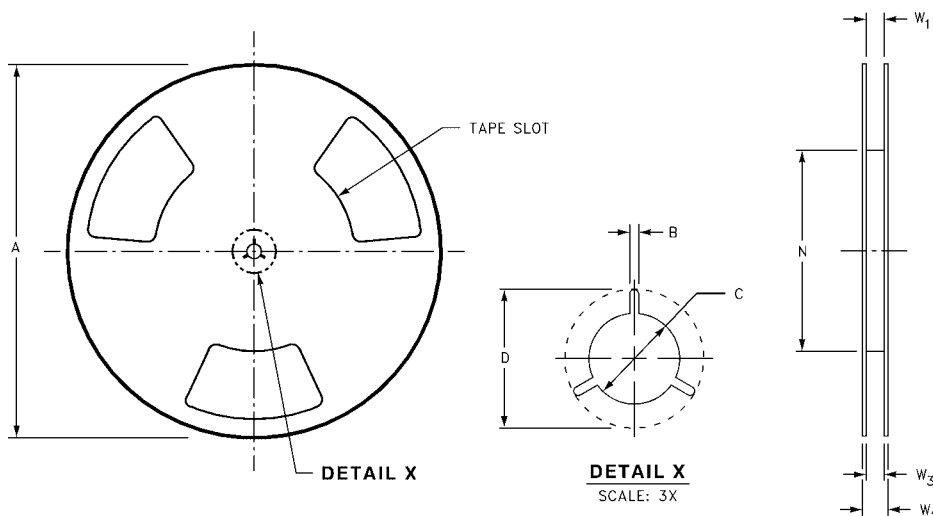
| Package Designator | Tape Section       | Number Cavities | Cavity Status | Cover Tape Status |
|--------------------|--------------------|-----------------|---------------|-------------------|
| M5, P5             | Leader (Start End) | 125 (typ)       | Empty         | Sealed            |
|                    | Carrier            | 250             | Filled        | Sealed            |
|                    | Trailer (Hub End)  | 75 (typ)        | Empty         | Sealed            |
| M5X, P5X           | Leader (Start End) | 125 (typ)       | Empty         | Sealed            |
|                    | Carrier            | 3000            | Filled        | Sealed            |
|                    | Trailer (Hub End)  | 75 (typ)        | Empty         | Sealed            |

### TAPE DIMENSIONS inches (millimeters)

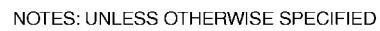


| Package | Tape Size | DIM A           | DIM B           | DIM F                         | DIM K <sub>0</sub>             | DIM P1       | DIM W                      |
|---------|-----------|-----------------|-----------------|-------------------------------|--------------------------------|--------------|----------------------------|
| 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 and Reel Specification** (Continued)  
**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) |



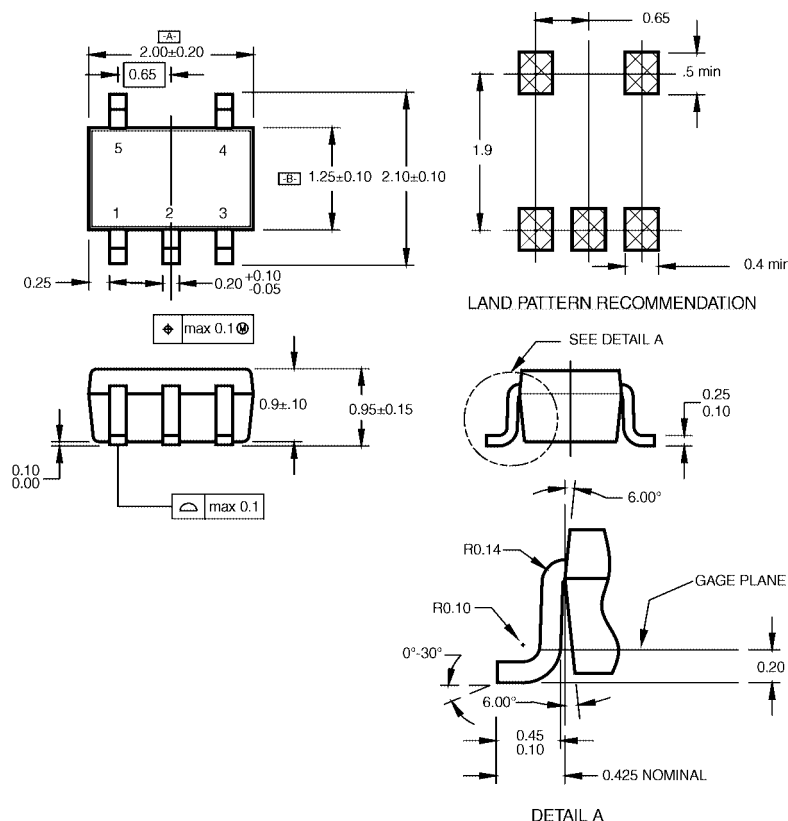
- A) THIS PACKAGE CONFORMS TO JEDEC MO-178, ISSUE B, VARIATION AA, DATED JANUARY 1999.
- B) ALL DIMENSIONS ARE IN MILLIMETERS.



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

MA05BRevC

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



**NOTES:**

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

MAA05ARevC

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

Fairchild does not assume any responsibility for use of any circuitry described, no circuit patent licenses are implied and Fairchild reserves the right at any time without notice to change said circuitry and specifications.

**LIFE SUPPORT POLICY**

FAIRCHILD'S PRODUCTS ARE NOT AUTHORIZED FOR USE AS CRITICAL COMPONENTS IN LIFE SUPPORT DEVICES OR SYSTEMS WITHOUT THE EXPRESS WRITTEN APPROVAL OF THE PRESIDENT OF FAIRCHILD SEMICONDUCTOR CORPORATION. As used herein:

- Life support devices or systems are devices or systems which, (a) are intended for surgical implant into the body, or (b) support or sustain life, and (c) whose failure to perform when properly used in accordance with instructions for use provided in the labeling, can be reasonably expected to result in a significant injury to the user.
- A critical component in 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.

[www.fairchildsemi.com](http://www.fairchildsemi.com)