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# NC7S08

## TinyLogic® HS 2-Input AND Gate

### Features

- Space saving SOT23 or SC70 5-lead package
- Ultra small MicroPak™ Pb-Free leadless package
- High Speed;  $t_{PD}$  3.5ns typ
- Low Quiescent Power;  $I_{CC} < 1\mu A$
- Balanced Output Drive; 2mA  $I_{OL}$ , -2mA  $I_{OH}$
- Broad  $V_{CC}$  Operating Range; 2V–6V
- Balanced Propagation Delays
- Specified for 3V operation

### General Description

The NC7S08 is a single 2-Input high performance CMOS AND Gate. Advanced Silicon Gate CMOS fabrication assures high speed and low power circuit operation over a broad  $V_{CC}$  range. ESD protection diodes inherently guard both inputs and output with respect to the  $V_{CC}$  and GND rails. Three stages of gain between inputs and outputs assures high noise immunity and reduced sensitivity to input edge rate.

### Ordering Information

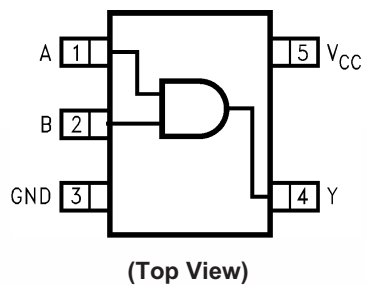
| Order Number | Package Number | Product Code Top Mark | Package Description                   | Supplied As               |
|--------------|----------------|-----------------------|---------------------------------------|---------------------------|
| NC7S08M5X    | MA05B          | 7S08                  | 5-Lead SOT23, JEDEC MO-178, 1.6mm     | 3k Units on Tape and Reel |
| NC7S08P5X    | MAA05A         | S08                   | 5-Lead SC70, EIAJ SC-88a, 1.25mm Wide | 3k Units on Tape and Reel |
| NC7S08L6X    | MAC06A         | PP                    | 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.

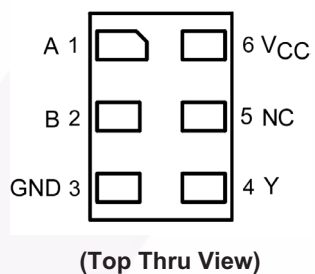
 All packages are lead free per JEDEC: J-STD-020B standard.

## Connection Diagram

Pin Assignments for SC70 and SOT23



Pad Assignments for MicroPak



## Pin Description

| Pin Names | Description |
|-----------|-------------|
| A, B      | Inputs      |
| Y         | Output      |
| NC        | No Connect  |

## Logic Symbol



## Function Table

$$Y = AB$$

| Inputs |   | Output |
|--------|---|--------|
| A      | B | Y      |
| L      | L | L      |
| L      | H | L      |
| H      | L | L      |
| H      | H | H      |

H = HIGH Logic Level

L = LOW Logic Level

## 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 +7.0V           |
| $I_{IK}$              | DC Input Diode Current<br>@ $V_{IN} \leq -0.5V$<br>@ $V_{IN} \geq V_{CC} + 0.5V$ | -20mA<br>+20mA           |
| $V_{IN}$              | DC Input Voltage   | -0.5V to $V_{CC} + 0.5V$ |
| $I_{OK}$              | DC Output Diode Current<br>@ $V_{OUT} < -0.5V$<br>@ $V_{OUT} > V_{CC} + 0.5V$    | -20mA<br>+20mA           |
| $V_{OUT}$             | DC Output Voltage  | -0.5V to $V_{CC} + 0.5V$ |
| $I_{OUT}$             | DC Output Source or Sink Current   | $\pm 12.5mA$             |
| $I_{CC}$ or $I_{GND}$ | DC $V_{CC}$ or Ground Current per Output Pin                                     | $\pm 25mA$               |
| $T_{STG}$             | Storage Temperature  | -65°C to +150°C          |
| $T_J$                 | Junction Temperature   | 150°C                    |
| $T_L$                 | Lead Temperature (Soldering, 10 seconds)   | 260°C                    |
| $P_D$                 | Power Dissipation @ +85°C<br>SOT23-5<br>SC70-5                                   | 200mW<br>150mW           |

## Recommended Operating Conditions<sup>(1)</sup>

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   | 2.0V to 6.0V  |
| $V_{IN}$      | Input Voltage  | 0V to $V_{CC}$  |
| $V_{OUT}$     | Output Voltage   | 0V to $V_{CC}$  |
| $T_A$         | Operating Temperature  | -40°C to +85°C  |
| $t_r, t_f$    | Input Rise and Fall Time<br>$V_{CC}$ @ 2.0V<br>$V_{CC}$ @ 3.0V<br>$V_{CC}$ @ 4.5V<br>$V_{CC}$ @ 6.0V | 0ns to 1000ns<br>0ns to 750ns<br>0ns to 500ns<br>0ns to 400ns |
| $\theta_{JA}$ | Thermal Resistance<br>SOT23-5<br>SC70-5  | 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 <sub>CC</sub> (V) | Conditions  | T <sub>A</sub> = +25°C |      |                       | T <sub>A</sub> = -40°C to +85°C |                       | Units |
|-----------------|---------------------------|---------------------|---|------------------------|------|-----------------------|---------------------------------|-----------------------|-------|
|                 |                           |                     |   | Min.                   | Typ. | Max.                  | Min.                            | Max.                  |       |
| V <sub>IH</sub> | HIGH Level Input Voltage  | 2.0                 |   | 1.50                   |      |                       | 1.50                            |                       | V     |
|                 |                           | 3.0-6.0             |   | 0.7 x V <sub>CC</sub>  |      |                       | 0.7 x V <sub>CC</sub>           |                       |       |
| V <sub>IL</sub> | LOW Level Input Voltage   | 2.0                 |   |                        |      | 0.50                  |                                 | 0.50                  | V     |
|                 |                           | 3.0-6.0             |   |                        |      | 0.3 x V <sub>CC</sub> |                                 | 0.3 x V <sub>CC</sub> |       |
| V <sub>OH</sub> | HIGH Level Output Voltage | 2.0                 | I <sub>OH</sub> = -20μA,<br>V <sub>IN</sub> = V <sub>IH</sub>                     | 1.90                   | 2.0  |                       | 1.90                            |                       | V     |
|                 |                           | 3.0                 |   | 2.90                   | 3.0  |                       | 2.90                            |                       |       |
|                 |                           | 4.5                 |   | 4.40                   | 4.5  |                       | 4.40                            |                       |       |
|                 |                           | 6.0                 |   | 5.90                   | 6.0  |                       | 5.90                            |                       |       |
|                 |                           | 3.0                 | V <sub>IN</sub> = V <sub>IH</sub> ,<br>I <sub>OH</sub> = -1.3mA                   | 2.68                   | 2.85 |                       | 2.63                            |                       |       |
|                 |                           | 4.5                 | V <sub>IN</sub> = V <sub>IH</sub> ,<br>I <sub>OH</sub> = -2mA                     | 4.18                   | 4.35 |                       | 4.13                            |                       |       |
|                 |                           | 6.0                 | V <sub>IN</sub> = V <sub>IH</sub> ,<br>I <sub>OH</sub> = -2.6mA                   | 5.68                   | 5.85 |                       | 5.63                            |                       |       |
| V <sub>OL</sub> | LOW Level Output Voltage  | 2.0                 | I <sub>OL</sub> = 20μA<br>V <sub>IN</sub> = V <sub>IL</sub>                       |                        | 0.0  | 0.10                  |                                 | 0.10                  | V     |
|                 |                           | 3.0                 |   |                        | 0.0  | 0.10                  |                                 | 0.10                  |       |
|                 |                           | 4.5                 |   |                        | 0.0  | 0.10                  |                                 | 0.10                  |       |
|                 |                           | 6.0                 |   |                        | 0.0  | 0.10                  |                                 | 0.10                  |       |
|                 |                           | 3.0                 | V <sub>IN</sub> = V <sub>IH</sub> or V <sub>IL</sub> ,<br>I <sub>OH</sub> = 1.3mA |                        | 0.1  | 0.26                  |                                 | 0.33                  |       |
|                 |                           | 4.5                 | V <sub>IN</sub> = V <sub>IH</sub> or V <sub>IL</sub> ,<br>I <sub>OL</sub> = 2mA   |                        | 0.1  | 0.26                  |                                 | 0.33                  |       |
|                 |                           | 6.0                 | V <sub>IN</sub> = V <sub>IH</sub> or V <sub>IL</sub> ,<br>I <sub>OL</sub> = 2.6mA |                        | 0.1  | 0.26                  |                                 | 0.33                  |       |
| I <sub>IN</sub> | Input Leakage Current     | 6.0                 | V <sub>IN</sub> = V <sub>CC</sub> , GND   |                        |      | ±0.1                  |                                 | ±1.0                  | μA    |
| I <sub>CC</sub> | Quiescent Supply Current  | 6.0                 | V <sub>IN</sub> = V <sub>CC</sub> , GND   |                        |      | 1.0                   |                                 | 10.0                  | μA    |

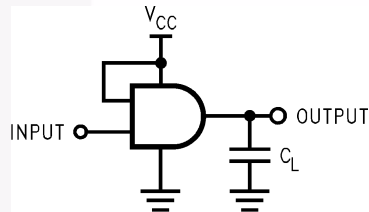
## AC Electrical Characteristics

| Symbol                              | Parameter                     | V <sub>CC</sub> (V) | Conditions            | T <sub>A</sub> = +25°C |      |      | T <sub>A</sub> = -40°C to +85°C |      | Units | Figure Number        |
|-------------------------------------|-------------------------------|---------------------|-----------------------|------------------------|------|------|---------------------------------|------|-------|----------------------|
|                                     |                               |                     |                       | Min.                   | Typ. | Max. | Min.                            | Max. |       |                      |
| t <sub>PLH</sub> , t <sub>PHL</sub> | Propagation Delay             | 5.0                 | C <sub>L</sub> = 15pF |                        | 3.5  | 15   |                                 |      | ns    | Figure 1<br>Figure 3 |
|                                     |                               | 2.0                 | C <sub>L</sub> = 50pF |                        | 20   | 100  |                                 | 125  |       |                      |
|                                     |                               | 3.0                 |                       |                        | 11   | 27   |                                 | 35   |       |                      |
|                                     |                               | 4.5                 |                       |                        | 8    | 20   |                                 | 25   |       |                      |
|                                     |                               | 6.0                 |                       |                        | 7    | 17   |                                 | 21   |       |                      |
| t <sub>TLH</sub> , t <sub>THL</sub> | Output Transition Time        | 5.0                 | C <sub>L</sub> = 15pF |                        | 3.0  | 10   |                                 |      | ns    | Figure 1<br>Figure 3 |
|                                     |                               | 2.0                 | C <sub>L</sub> = 50pF |                        | 25   | 125  |                                 | 155  |       |                      |
|                                     |                               | 3.0                 |                       |                        | 16   | 35   |                                 | 45   |       |                      |
|                                     |                               | 4.5                 |                       |                        | 11   | 25   |                                 | 31   |       |                      |
|                                     |                               | 6.0                 |                       |                        | 9    | 21   |                                 | 26   |       |                      |
| C <sub>IN</sub>                     | Input Capacitance             | Open                |                       |                        | 2    | 10   |                                 | 10   | pF    |                      |
| C <sub>PD</sub>                     | Power Dissipation Capacitance | 5.0                 | (2)                   |                        | 6    |      |                                 |      | pF    | Figure 2             |

**Note:**

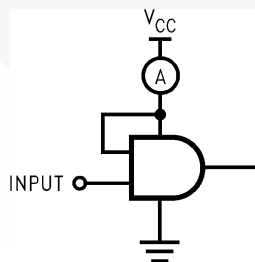
2. C<sub>PD</sub> is defined as the value of the internal equivalent capacitance which is derived from dynamic operating current consumption (I<sub>CCD</sub>) at no output loading and operating at 50% duty cycle. (See Figure 2.) C<sub>PD</sub> is related to I<sub>CCD</sub> dynamic operating current by 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



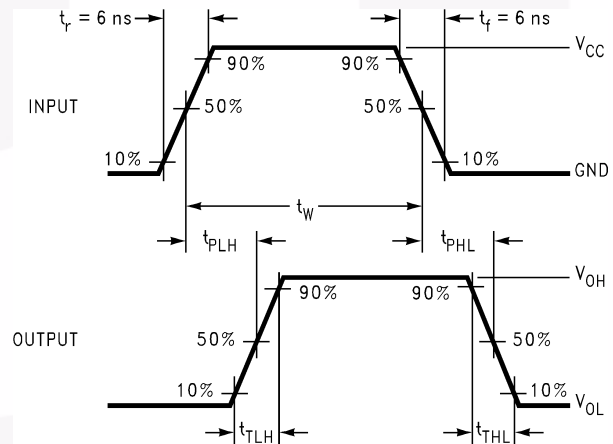
C<sub>L</sub> includes load and stray capacitance  
Input PRR = 1.0 MHz; t<sub>W</sub> = 500 ns

**Figure 1. AC Test Circuit**



Input = AC Waveform;  
PRR = variable; Duty Cycle = 50%

**Figure 2. I<sub>CCD</sub> Test Circuit**



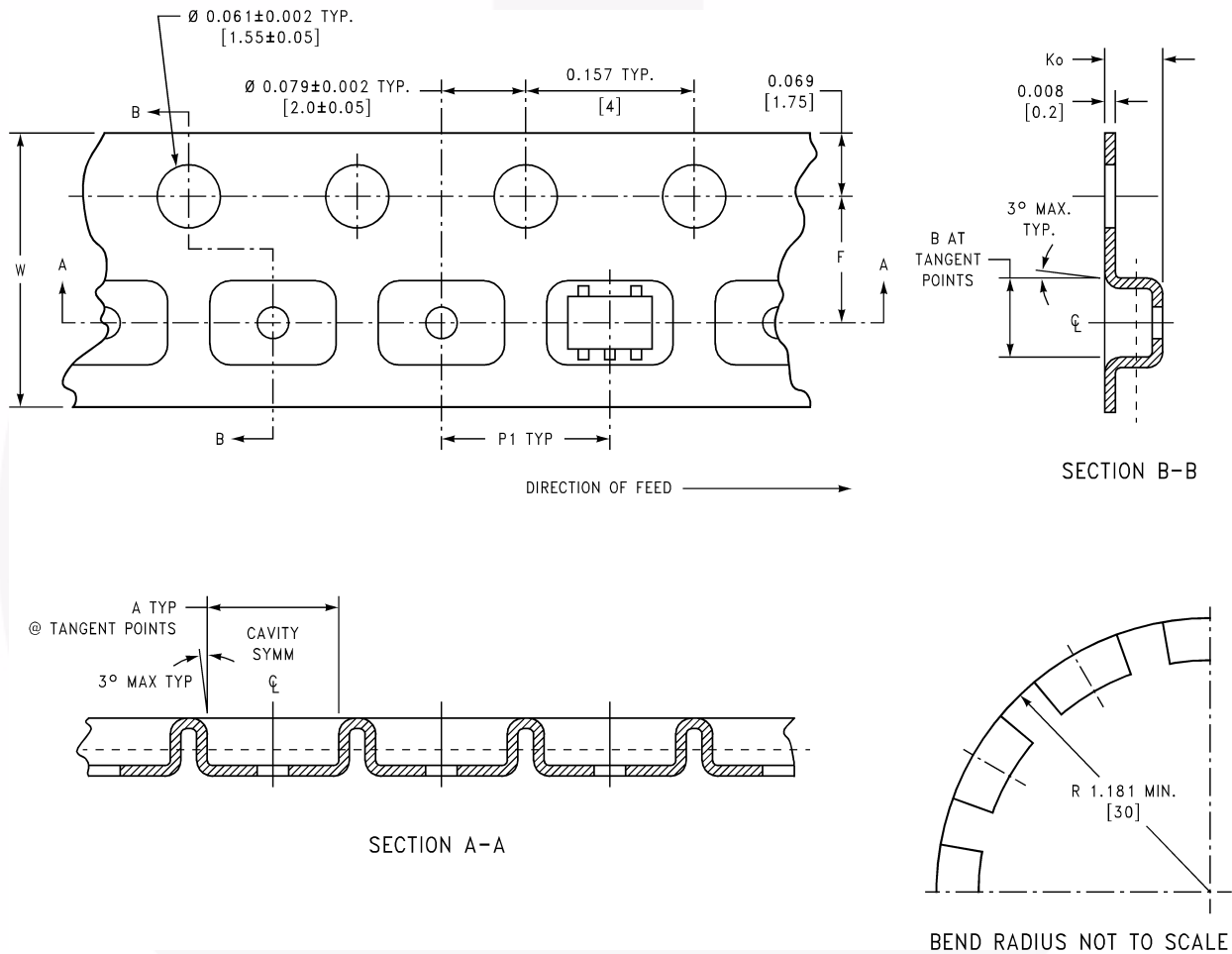
**Figure 3. AC Waveforms**

## 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)

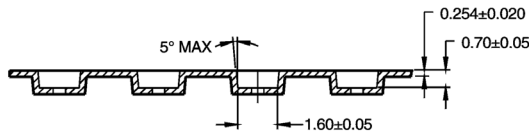
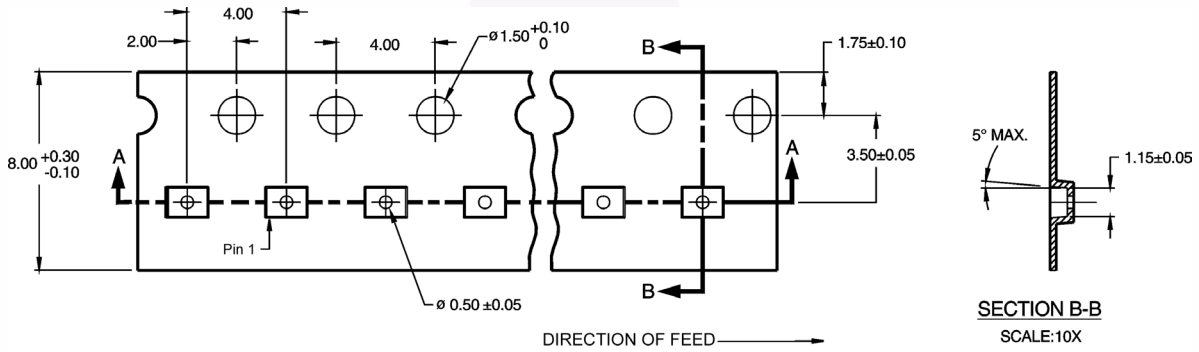


| Package | Tape Size | Dim A           | Dim B           | Dim F                         | Dim $K_o$                      | Dim P1       | Dim W                      |
|---------|-----------|-----------------|-----------------|-------------------------------|--------------------------------|--------------|----------------------------|
| SC70-5  | 8mm       | 0.093<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 | 8mm       | 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) |

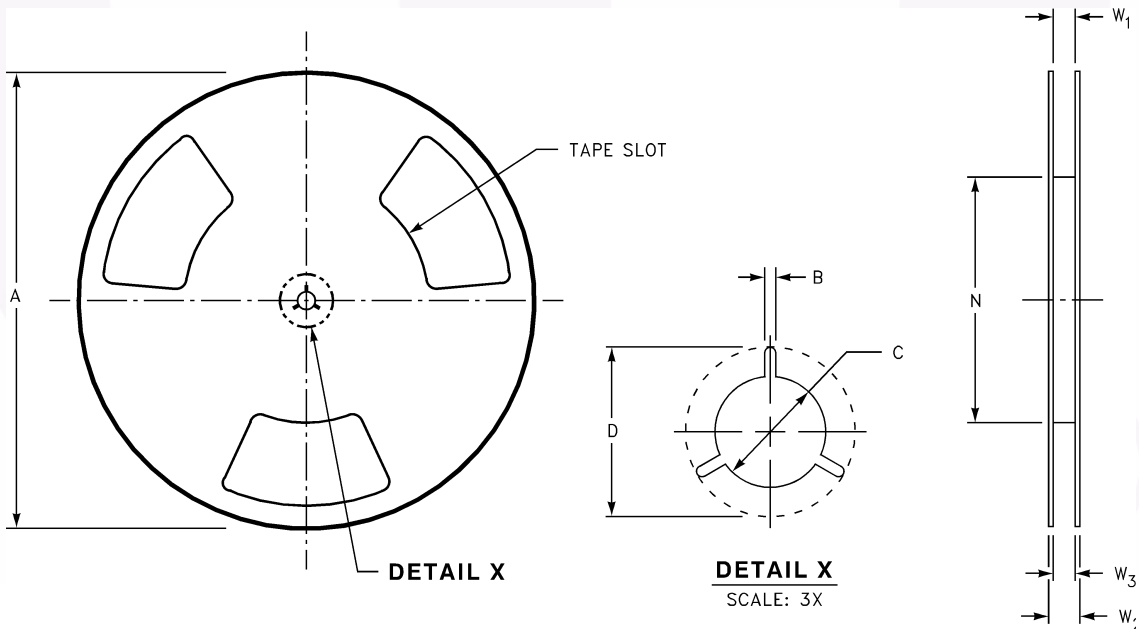
## Tape and Reel Specifications (Continued)

### 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                                     |
|-----------|----------------|-----------------|------------------|------------------|------------------|---|------------------|--|
| 8mm       | 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

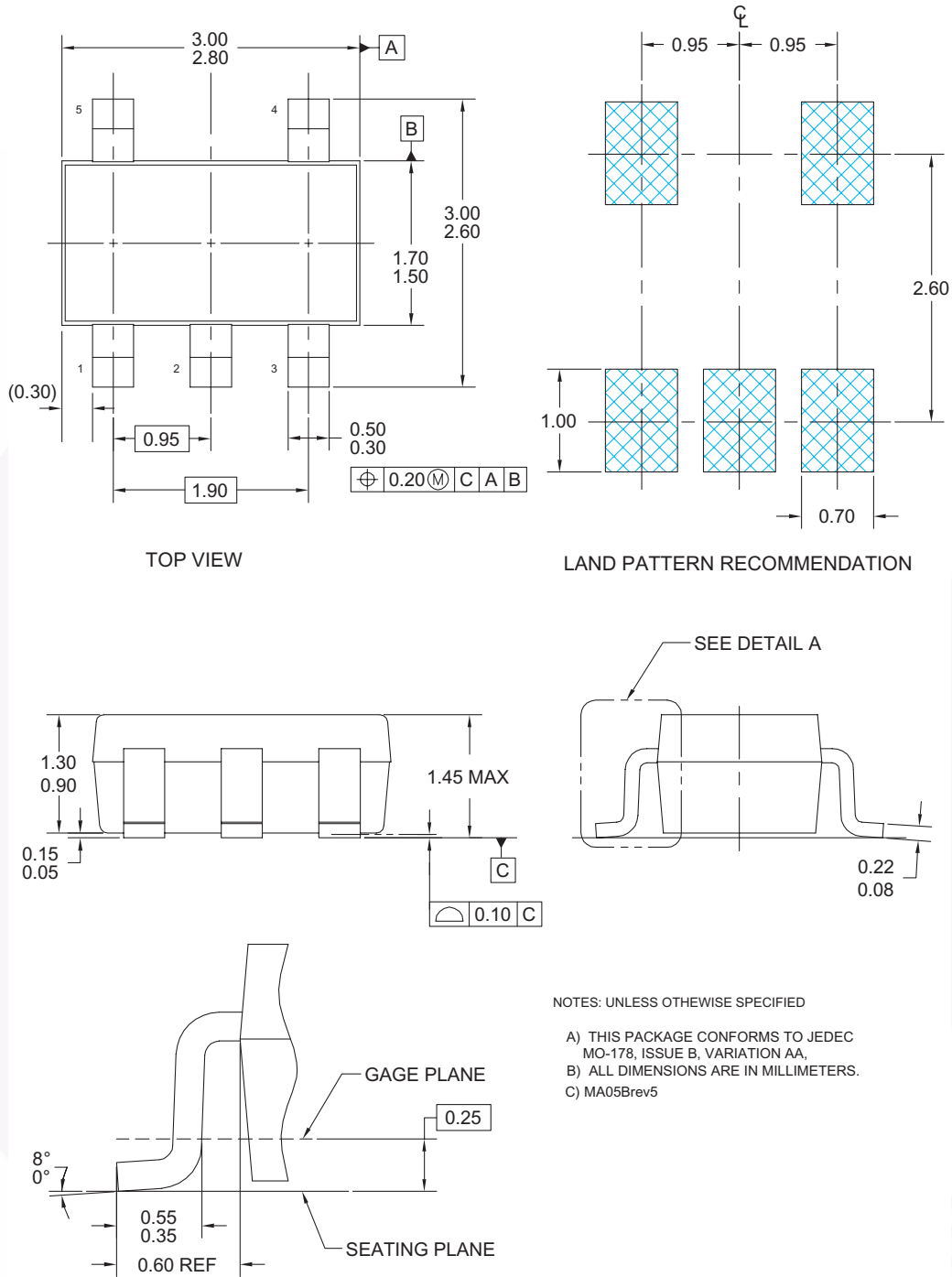


Figure 4. 5-Lead SOT23, JEDEC MO-178, 1.6mm

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Physical Dimensions (Continued)

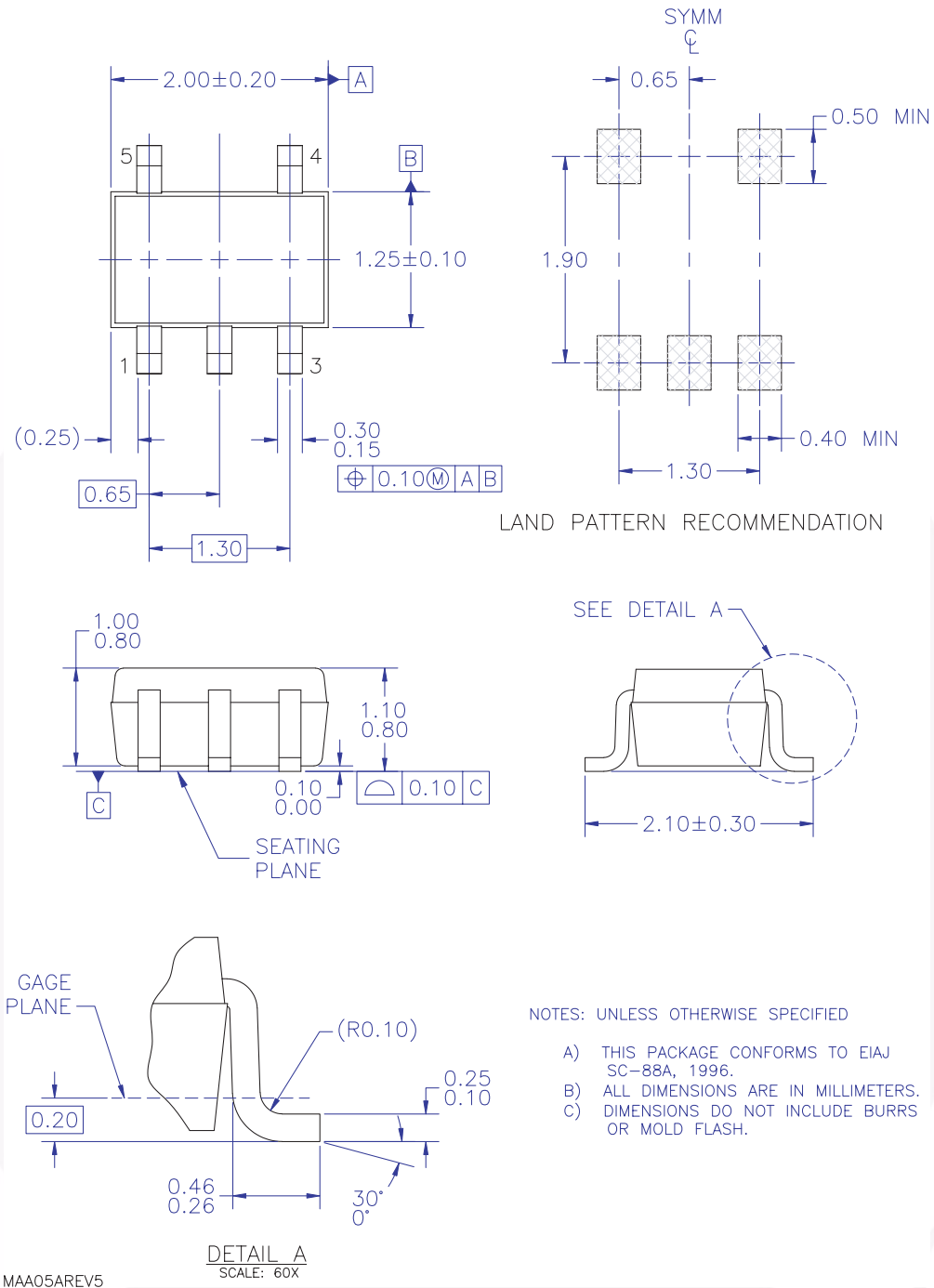
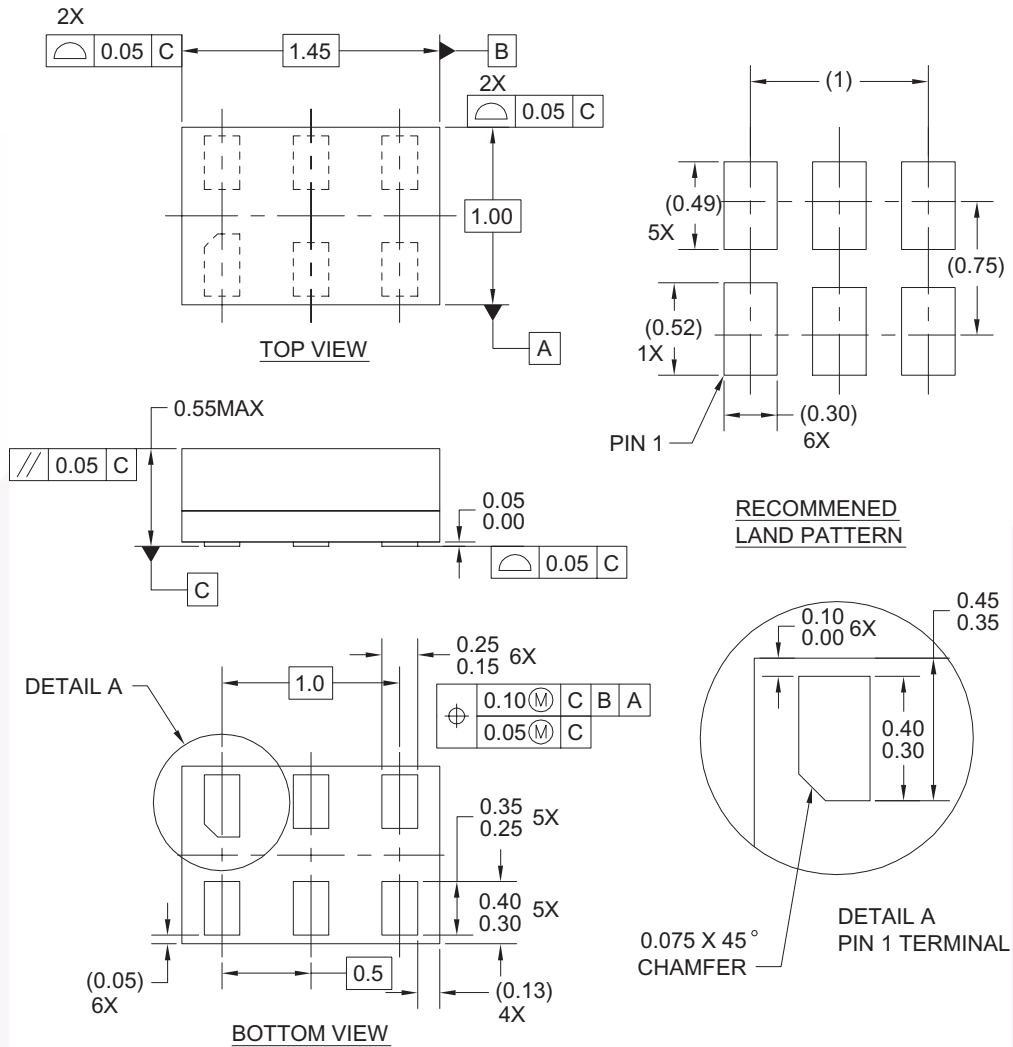


Figure 5. 5-Lead SC70, EIAJ SC-88a, 1.25mm Wide

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**Physical Dimensions** (Continued)



MAC06AREVC

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


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| CROSSVOLT™  | Green FPS™                          | Power-SPM™                 | The Power Franchise®           |
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| EcoSPARK®   | i-Lo™                               | QFET®                      | TinyBuck™                      |
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| FAST®   | Motion-SPM™                         | SuperFET™                  | Ultra FRFET™                   |
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