

# NC7WZU04

## TinyLogic® UHS Dual Unbuffered Inverter

### Features


- Space saving SC70 6-lead package
- Ultra small MicroPak™ leadless package
- Unbuffered for crystal oscillator and analog applications
- Balanced output drive:  $\pm 8\text{mA}$  at  $4.5\text{V } V_{CC}$
- Broad  $V_{CC}$  operating range:  $1.65\text{V}$  to  $5.5\text{V}$
- Low quiescent power:  $I_{CC} < 1\mu\text{A}$  at  $5\text{V } V_{CC}$ ,  $T_A = 25^\circ\text{C}$

### General Description

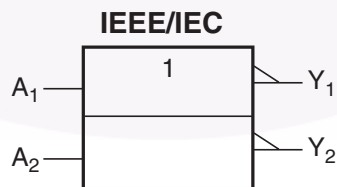
The NC7WZU04 is a dual unbuffered inverter from Fairchild's Ultra High Speed Series of TinyLogic® in the space saving SC70 6-lead package. The special purpose unbuffered circuit design is intended for crystal oscillator or analog applications. The internal circuit consists of only one-stage, the output, to allow for this part to be used in these oscillator or analog applications. 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  $1.65\text{V}$  to  $5.5\text{V } V_{CC}$  range. The inputs are high impedance when  $V_{CC}$  is  $0\text{V}$ . Inputs tolerate voltages up to  $7\text{V}$  independent of  $V_{CC}$  operating voltage.

### Ordering Information

| Order Number | Package Number | Package Code Top Mark | Package Description                 | Supplied As               |
|--------------|----------------|-----------------------|-------------------------------------|---------------------------|
| NC7WZU04P6X  | MAA06A         | ZU4                   | 6-Lead SC70, EIAJ SC88, 1.25mm Wide | 3k Units on Tape and Reel |
| NC7WZU04L6X  | MAC06A         | B5                    | 6-Lead MicroPak, 1.0mm Wide         | 5k Units on Tape and Reel |

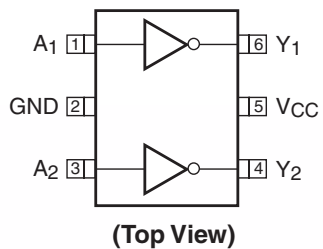
 All packages are lead free per JEDEC: J-STD-020B standard.

### Logic Symbol

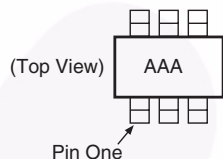


## Connection Diagrams

### Pin Assignment for SC70



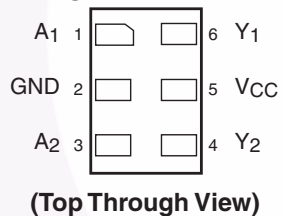
### Pin One Orientation Diagram



AAA represents Product Code Top Mark – see ordering code

**Note:** Orientation of Top Mark determines Pin One location. Read the top product code mark left to right, Pin One is the lower left pin (see diagram).

### Pad Assignments for MicroPak



## Pin Descriptions

| Pin Name                        | Description |
|---------------------------------|-------------|
| A <sub>1</sub> , A <sub>2</sub> | Data Inputs |
| Y <sub>1</sub> , Y <sub>2</sub> | Outputs     |

## Function Table

$$Y = \bar{A}$$

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

H = HIGH Logic Level  
L = LOW Logic Level



## Absolute Maximum Ratings

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.

| Symbol           | Parameter  | Rating          |
|------------------|--|-----------------|
| $V_{CC}$         | Supply Voltage   | -0.5V to +7V    |
| $V_{IN}$         | DC Input Voltage   | -0.5V to +7V    |
| $V_{OUT}$        | DC Output Voltage  | -0.5V to +7V    |
| $I_{IK}$         | DC Input Diode Current @ $V_{IN} \leq -0.5V$                                     | -50mA           |
| $I_{OK}$         | DC Output Diode Current @<br>$V_{OUT} < -0.5V$<br>$V_{OUT} > 0.5V, V_{CC} = GND$ | -50mA<br>+50mA  |
| $I_{OUT}$        | DC Output Current  | $\pm 50mA$      |
| $I_{CC}/I_{GND}$ | DC $V_{CC}/GND$ Current  | $\pm 100mA$     |
| $T_{STG}$        | Storage Temperature  | -65°C to +150°C |
| $T_J$            | Junction Temperature under Bias  | 150°C           |
| $T_L$            | Junction Lead Temperature (Soldering, 10 seconds)                                | 260°C           |
| $P_D$            | Power Dissipation @ +85°C<br>SC70-6<br>Micropak-6                                | 215mW<br>215mW  |

## 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 Operating                   | 1.8V to 5.5V       |
| $V_{CC}$      | Supply Voltage Data Retention              | 1.5V to 5.5V       |
| $V_{IN}$      | Input Voltage                              | 0V to 5.5V         |
| $V_{OUT}$     | Output Voltage                             | 0V to $V_{CC}$     |
| $T_A$         | Operating Temperature                      | -40°C to +85°C     |
| $\theta_{JA}$ | Thermal Resistance<br>SC70-6<br>Micropak-6 | 350°C/W<br>350°C/W |

**Note:**

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> =       |      |                      |                      |                      | Units |      |
|---------------------|---|---------------------|--|--------------------------|------------------------|------|----------------------|----------------------|----------------------|-------|------|
|                     |   |                     |  |                          | +25°C                  |      |                      | -40°C to +85°C       |                      |       |      |
|                     |   |                     |  |                          | Min .                  | Typ. | Max .                | Min.                 | Max.                 |       |      |
| V <sub>IH</sub>     | HIGH Level Input Voltage                | 1.8 to 2.7          |  |                          | 0.85 V <sub>CC</sub>   |      |                      | 0.85 V <sub>CC</sub> |                      | V     |      |
|                     |   | 3.0 to 5.5          |  |                          | 0.8 V <sub>CC</sub>    |      |                      | 0.8 V <sub>CC</sub>  |                      |       |      |
| V <sub>IL</sub>     | LOW Level Input Voltage                 | 1.8 to 2.7          |  |                          |                        |      | 0.15 V <sub>CC</sub> |                      | 0.15 V <sub>CC</sub> | V     |      |
|                     |   | 3.0 to 5.5          |  |                          |                        |      | 0.2 V <sub>CC</sub>  |                      | 0.2 V <sub>CC</sub>  |       |      |
| V <sub>OH</sub>     | HIGH Level Output Voltage               | 1.65                | V <sub>IN</sub> = V <sub>IL</sub>  | I <sub>OH</sub> = -100μA | 1.55                   | 1.65 |                      | 1.55                 |                      | V     |      |
|                     |   | 1.8                 |  |                          | 1.6                    | 1.79 |                      | 1.6                  |                      |       |      |
|                     |   | 2.3                 |  |                          | 2.1                    | 2.29 |                      | 2.1                  |                      |       |      |
|                     |   | 3.0                 |  |                          | 2.7                    | 2.99 |                      | 2.7                  |                      |       |      |
|                     |   | 4.5                 |  |                          | 4.0                    | 4.48 |                      | 4.0                  |                      |       |      |
|                     |   | 1.65                | V <sub>IN</sub> = GND  | I <sub>OH</sub> = -2mA   | 1.29                   | 1.52 |                      | 1.29                 |                      | V     |      |
|                     |   | 2.3                 |  |                          | I <sub>OH</sub> = -2mA | 1.9  | 2.19                 |                      | 1.9                  |       |      |
|                     |   | 3.0                 |  |                          | I <sub>OH</sub> = -4mA | 2.4  | 2.82                 |                      | 2.4                  |       |      |
|                     |   | 3.0                 |  |                          | I <sub>OH</sub> = -6mA | 2.3  | 2.73                 |                      | 2.3                  |       |      |
|                     |   | 4.5                 |  |                          | I <sub>OH</sub> = -8mA | 3.8  | 4.24                 |                      | 3.8                  |       |      |
| VOL                 | LOW Level Output Voltage                | 1.65                | V <sub>IN</sub> = V <sub>IH</sub>  | I <sub>OL</sub> = 100μA  |                        | 0.01 | 0.2                  |                      | 0.2                  | V     |      |
|                     |   | 1.8                 |  |                          |                        | 0.01 | 0.2                  |                      | 0.2                  |       |      |
|                     |   | 2.3                 |  |                          |                        | 0.01 | 0.2                  |                      | 0.2                  |       |      |
|                     |   | 3.0                 |  |                          |                        | 0.01 | 0.3                  |                      | 0.3                  |       |      |
|                     |   | 4.5                 |  |                          |                        | 0.01 | 0.5                  |                      | 0.5                  |       |      |
|                     |   | 1.65                | V <sub>IN</sub> = V <sub>CC</sub>  | I <sub>OL</sub> = 2mA    |                        | 0.10 | 0.24                 |                      | 0.24                 | V     |      |
|                     |   | 2.3                 |  |                          | I <sub>OL</sub> = 2mA  |      | 0.12                 | 0.3                  |                      |       | 0.3  |
|                     |   | 3.0                 |  |                          | I <sub>OL</sub> = 4mA  |      | 0.19                 | 0.4                  |                      |       | 0.4  |
|                     |   | 3.0                 |  |                          | I <sub>OL</sub> = 6mA  |      | 0.29                 | 0.55                 |                      |       | 0.55 |
|                     |   | 4.5                 |  |                          | I <sub>OL</sub> = 8mA  |      | 0.29                 | 0.55                 |                      |       | 0.55 |
| I <sub>IN</sub>     | Input Leakage Current                   | 0 to 5.5            | V <sub>IN</sub> = 5.5V, GND  |                          |                        |      | ±0.1                 |                      | ±1.0                 | μA    |      |
| I <sub>CC</sub>     | Quiescent Supply Current                | 1.65 to 5.5         | V <sub>IN</sub> = 5.5V, GND  |                          |                        |      | 1.0                  |                      | 10                   | μA    |      |
| I <sub>CCPEAK</sub> | Peak Supply Current in Analog Operation | 1.8                 | V <sub>OUT</sub> = Open<br>V <sub>IN</sub> = Adjust for Peak I <sub>CC</sub> Current |                          |                        | 0.2  |                      |                      |                      | mA    |      |
|                     |   | 2.5                 |  |                          |                        | 2    |                      |                      |                      |       |      |
|                     |   | 3.3                 |  |                          |                        | 5    |                      |                      |                      |       |      |
|                     |   | 5.0                 |  |                          |                        | 15   |                      |                      |                      |       |      |

## AC Electrical Characteristics

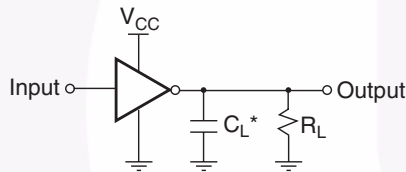
| Symbol                              | Parameter                     | V <sub>CC</sub> (V) | Conditions                                     | T <sub>A</sub> =                                |      |      |                |      | Units | Figure Number        |
|-------------------------------------|-------------------------------|---------------------|--|---|------|------|----------------|------|-------|----------------------|
|                                     |                               |                     |  | +25°C   |      |      | -40°C to +85°C |      |       |                      |
|                                     |                               |                     |  | Min.  | Typ. | Max. | Min.           | Max. |       |                      |
| t <sub>PLH</sub> , t <sub>PHL</sub> | Propagation Delay             | 1.65                | C <sub>L</sub> = 15pF,<br>R <sub>L</sub> = 1MΩ | 1.5   | 5.5  | 9.8  | 1.5            | 11.0 | ns    | Figure 1<br>Figure 3 |
|                                     |                               | 1.8                 |  | 1.5   | 4.6  | 8.1  | 1.5            | 8.9  |       |                      |
|                                     |                               | 2.5 ± 0.2           |  | 1.2   | 3.3  | 5.7  | 1.2            | 6.3  |       |                      |
|                                     |                               | 3.3 ± 0.3           |  | 0.8   | 2.7  | 4.1  | 0.8            | 4.5  |       |                      |
|                                     |                               | 5.0 ± 0.5           |  | 0.5   | 2.2  | 3.3  | 0.5            | 3.6  |       |                      |
|                                     |                               | 3.3 ± 0.3           |  | C <sub>L</sub> = 50pF,<br>R <sub>L</sub> = 500Ω | 1.2  | 4.0  | 6.4            | 1.2  |       |                      |
|                                     |                               | 5.0 ± 0.5           | 0.8  |   | 3.4  | 5.6  | 0.8            | 6.2  |       |                      |
|                                     |                               | C <sub>IN</sub>     | Input Capacitance                              | 0   |      | 3    |                |      |       | pF                   |
| C <sub>PD</sub>                     | Power Dissipation Capacitance | 3.3                 | Note 2   |   | 3.5  |      |                |      | pF    | Figure 2             |
|                                     |                               | 5.0                 |  |   | 5.5  |      |                |      |       |                      |

### 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:

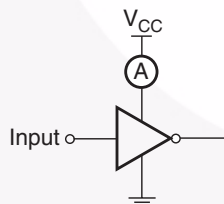
$$I_{CCD} = (C_{PD})(V_{CC})(f_{IN}) + (I_{CCstatic}).$$

## AC Loading and Waveforms



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

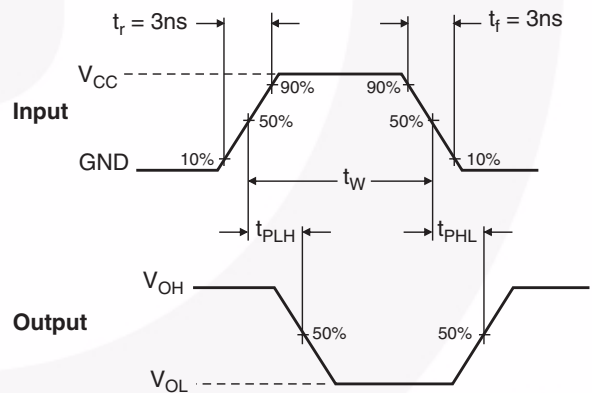
**Figure 1. AC Test Circuit**



**Application Note:** When operating the NC7WZU04's unbuffered output stage in its linear range, as in oscillator applications, care must be taken to observe maximum power rating for the device and package. The high drive nature of the design of the output stage will result in substantial simultaneous conduction currents when the stage is in the linear region. See the I<sub>CCPEAK</sub> specification on page 2.

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

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



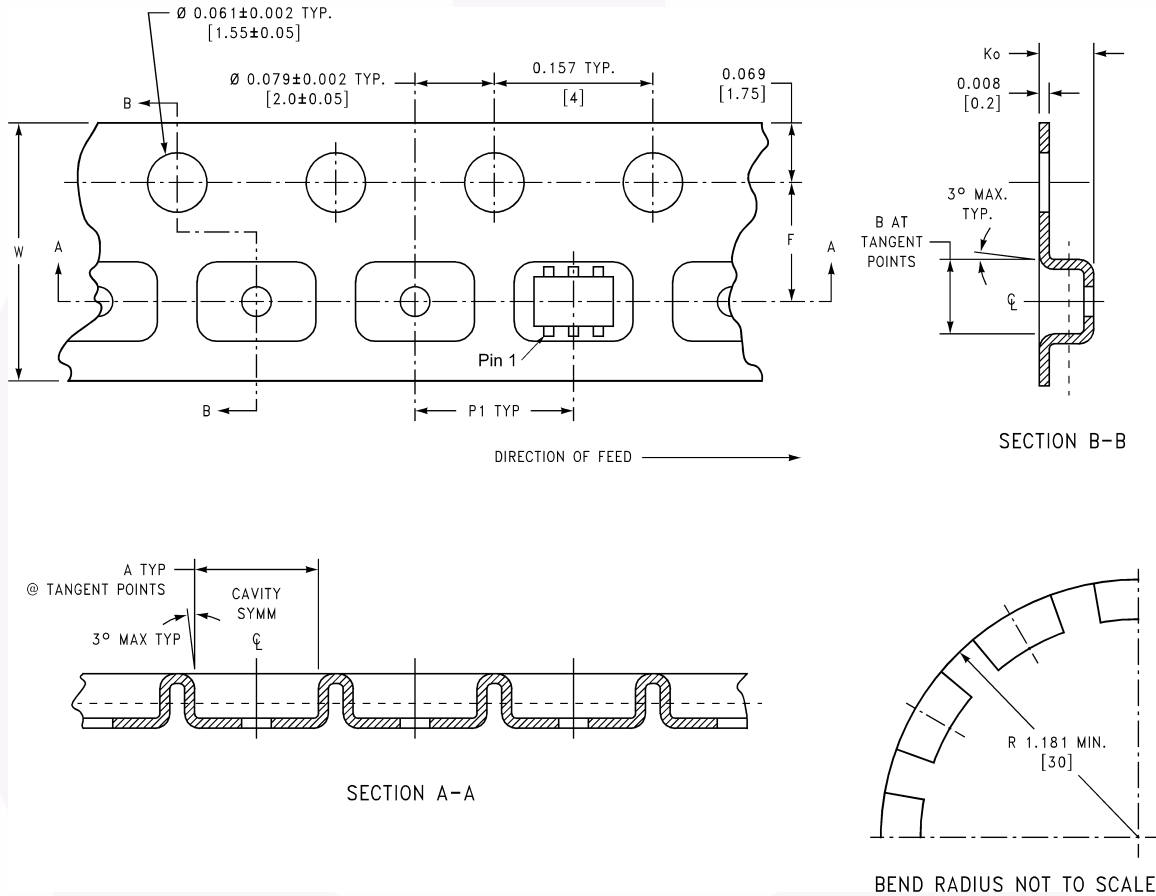
**Figure 3. AC Waveforms**

## Tape and Reel Specification

### Tape Format for SC70

| Package Designator | Tape Section       | Number Cavities | Cavity Status | Cover Tape Status |
|--------------------|--------------------|-----------------|---------------|-------------------|
| P6X                | Leader (Start End) | 125 (typ)       | Empty         | Sealed            |
|                    | Carrier            | 3000            | Filled        | Sealed            |
|                    | Trailer (Hub End)  | 75 (typ)        | Empty         | Sealed            |

### Tape Dimension inches (millimeters)



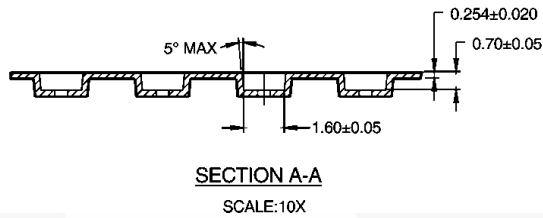
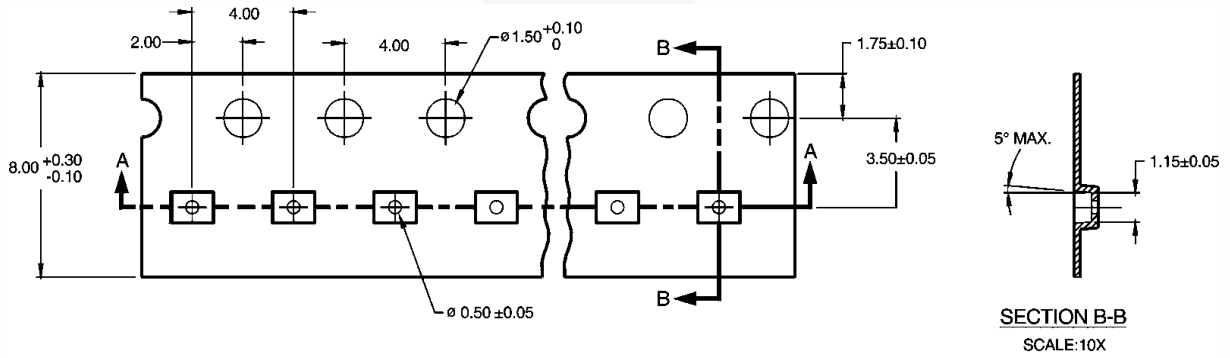
| Package | Tape Size | Dim A           | Dim B           | Dim F                         | Dim K <sub>O</sub>             | Dim P1       | Dim W                      |
|---------|-----------|-----------------|-----------------|-------------------------------|--------------------------------|--------------|----------------------------|
| SC70-6  | 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) |

## Tape and Reel Specification (Continued)

### Tape Format for MicroPak

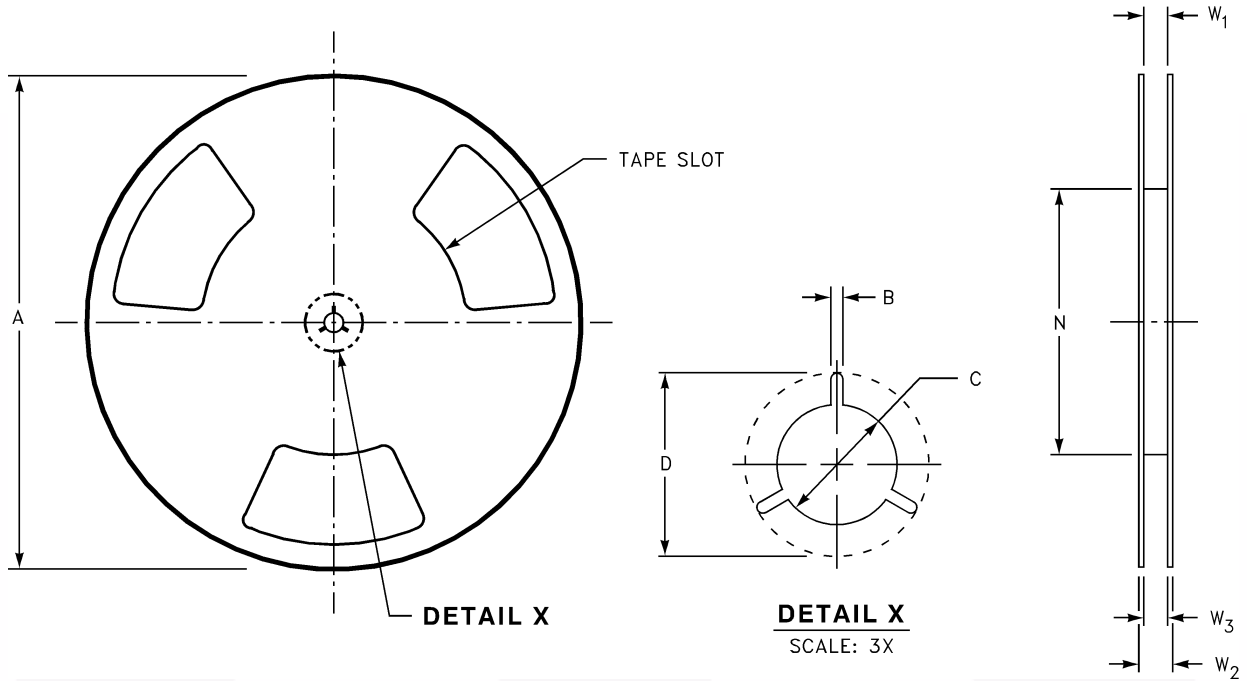
| Package Designator | Tape Section       | Number Cavities | Cavity Status | Cover Tape Status |
|--------------------|--------------------|-----------------|---------------|-------------------|
| L6X                | Leader (Start End) | 125 (typ.)      | Empty         | Sealed            |
|                    | Carrier            | 3000            | Filled        | Sealed            |
|                    | Trailer (Hub End)  | 75 (typ)        | Empty         | Sealed            |

### Tape Dimension inches (millimeters)



**Tape and Reel Specification** (Continued)

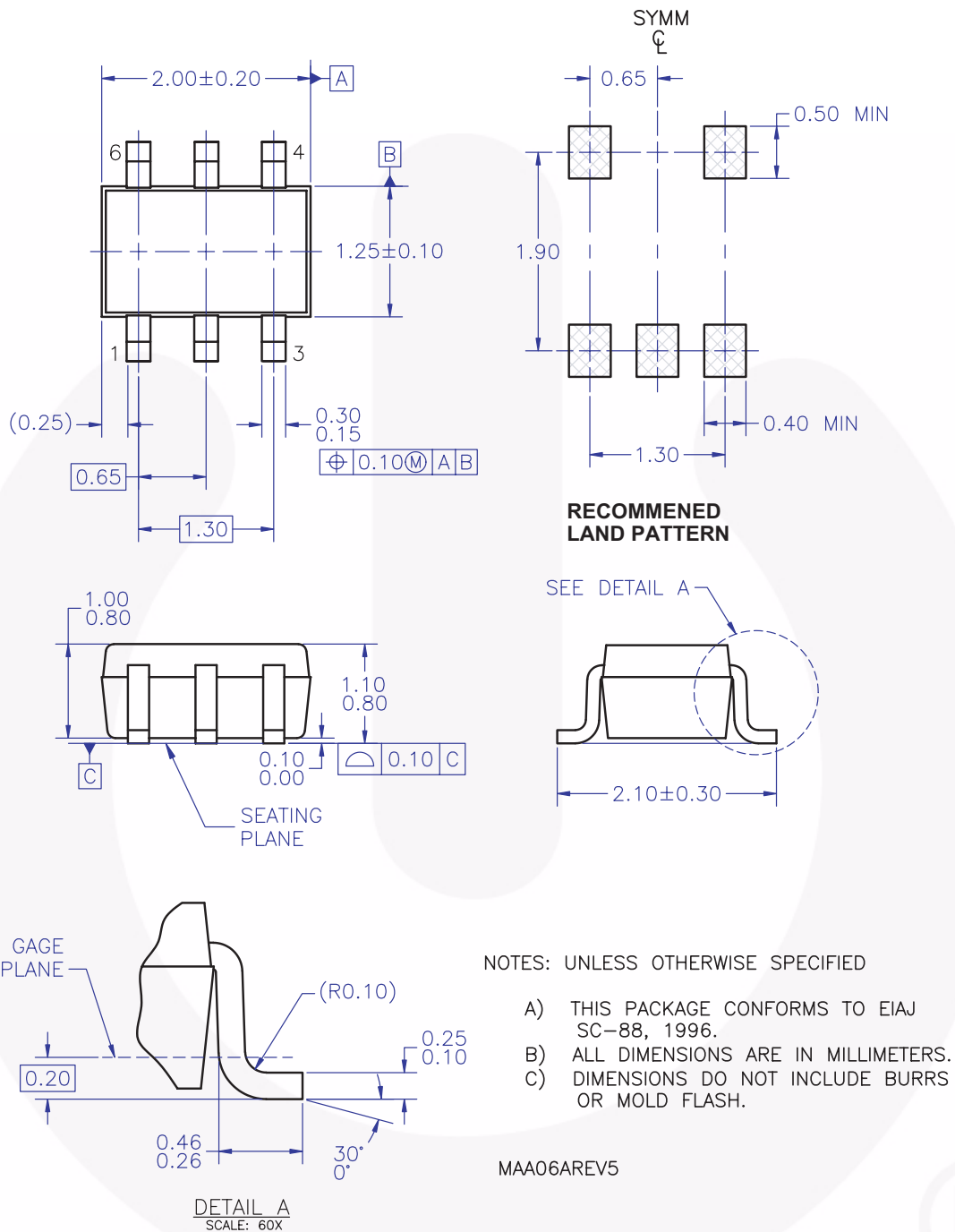
Reel Dimension for MicroPak inches (millimeters)



| 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



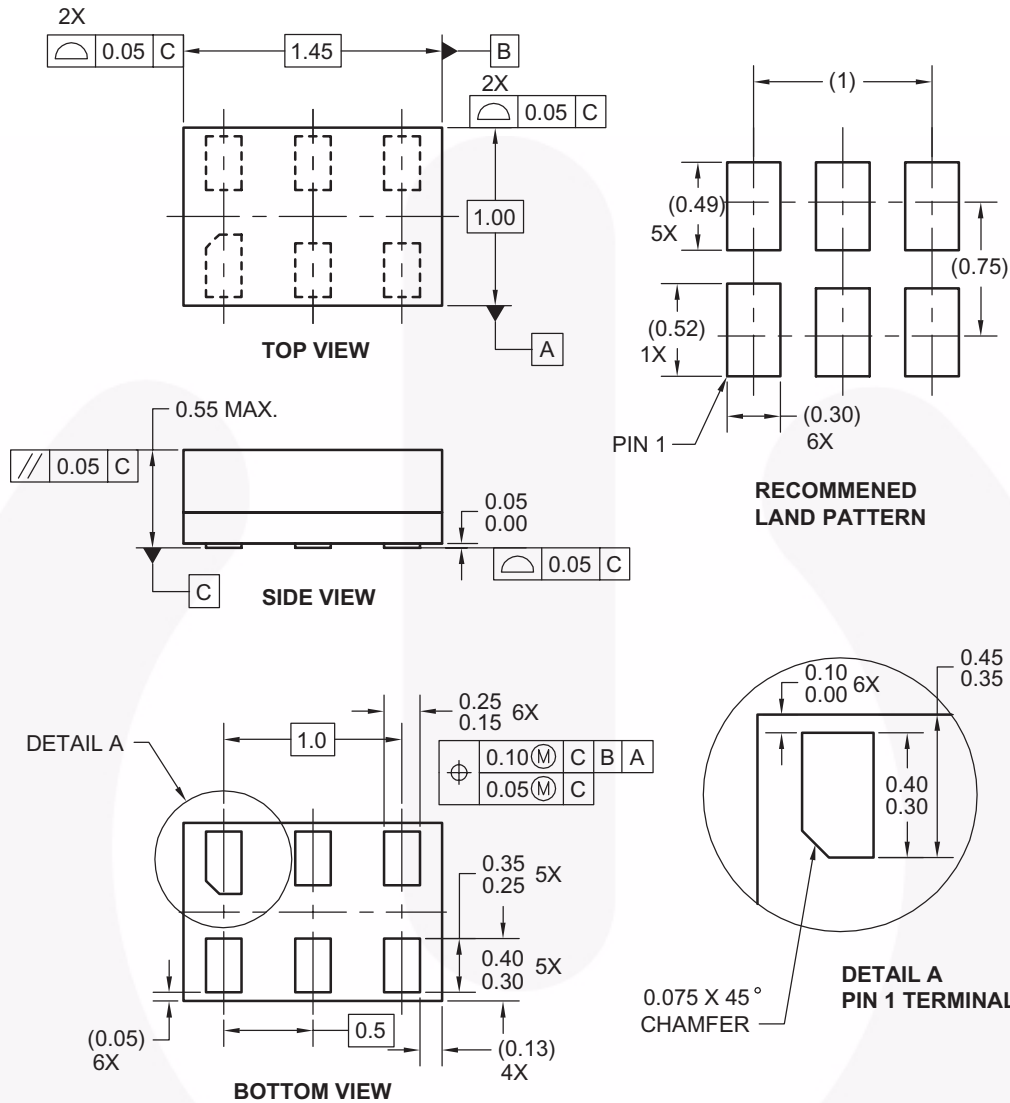
**Figure 4. 6-Lead SC70, EIAJ SC88, 1.25mm Wide**

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**Physical Dimensions** (Continued)



**Notes:**

1. CONFORMS TO JEDEC STANDARD M0-252 VARIATION UAAD
2. DIMENSIONS ARE IN MILLIMETERS
3. DRAWING CONFORMS TO ASME Y14.5M-1994

MAC06AREVC

**Figure 5. 6-Lead MicroPak, 1.0mm Wide**

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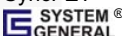
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| EfficientMax™   | ISOPLANAR™  | Saving our world, 1mW at a time™  | TinyWire™   |
| EZSWITCH™ *   | MegaBuck™   | SmartMax™   | μSerDes™  |
|  ™ | MICROCOUPLER™   | SMART START™  |  |
|  ® | MicroFET™   | SPM®  | UHC®  |
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| FAST®   | OPTOLOGIC®  | SuperSOT™-8   |   |
| FastvCore™  | OPTOPLANAR®   | SupreMOS™   |   |
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| Datasheet Identification | Product Status        | Definition   |
|--------------------------|-----------------------|--|
| Advance Information      | Formative / 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; supplementary data will be published at a later date. Fairchild Semiconductor reserves the right to make changes at any time without notice 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 to improve the design.   |
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