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Tel: +86-755-8981 8866 Fax: +86-755-8427 6832
Email & Skype: info@chipsmall.com Web: www.chipsmall.com
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FAIRCHILD SEMICONDUCTOR®

February 2011

# NC7SP17
## TinyLogic® ULP Single Buffer with Schmitt Trigger Input

### Features

- 0.9V to 3.6V $V_{CC}$ Supply Operation
- 3.6V Over-Voltage Tolerant I/Os at $V_{CC}$ from 0.9V to 3.6V
- Propagation Delay ($t_{PD}$):
  - 4.0ns Typical for 3.0V to 3.6V $V_{CC}$
  - 5.0ns Typical for 2.3V to 2.7V $V_{CC}$
  - 6.0ns Typical for 1.65V to 1.95V $V_{CC}$
  - 7.0ns Typical for 1.40V to 1.60V $V_{CC}$
  - 11.0ns Typical for 1.10V to 1.30V $V_{CC}$
  - 27.0ns Typical for 0.90V $V_{CC}$
- Power-Off High-Impedance Inputs and Outputs
- Static Drive ($I_{OH}/I_{OL}$):
  - ± 2.6mA at 3.00V $V_{CC}$
  - ± 2.1mA at 2.30V $V_{CC}$
  - ± 1.5mA at 1.65V $V_{CC}$
  - ± 1.0mA at 1.40V $V_{CC}$
  - ± 0.5mA at 1.10V $V_{CC}$
  - ± 20µA at 0.9V $V_{CC}$
- Quiet Series™ Noise / EMI Reduction Circuitry
- Ultra Small MicroPak™ Packages
- Ultra Low Dynamic Power

### Description

The NC7SP17 is a single buffer with Schmitt trigger input from Fairchild's Ultra Low Power (ULP) series of TinyLogic®. Ideal for applications where battery life is critical, this product is designed for ultra low power consumption within the $V_{CC}$ operating range of 0.9V to 3.6V $V_{CC}$.

The internal circuit is composed of a minimum of inverter stages, including the output buffer, to enable ultra low static and dynamic power.

The NC7SP17, for lower drive requirements, is uniquely designed for optimized power and speed and is fabricated with an advanced CMOS technology to achieve best-in-class speed of operation, while maintaining extremely low CMOS power dissipation.

### Ordering Information

| Part Number | Top Mark | Package | Packing Method |
|---|---|---|---|
| NC7SP17P5X | P17 | 5-Lead SC70, EIAJ SC-88a, 1.25mm Wide | 3000 Units on Tape & Reel |
| NC7SP17L6X | K4 | 6-Lead MicroPak™, 1.00mm Wide | 5000 Units on Tape & Reel |
| NC7SP17FHX | K4 | 6-Lead, MicroPak2™, 1x1mm Body, .35mm Pitch | 5000 Units on Tape & Reel |

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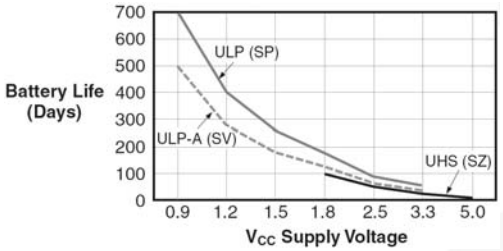


**Notes:**

1. TinyLogic ULP and ULP-A with up to 50% less power consumption can extend battery life significantly.
2. Battery Life=($V_{battery}$ x $I_{battery}$ x 0.9) / ($P_{device}$) / 24hrs/day; where, $P_{device}$=($I_{CC}$ x $V_{CC}$) + ($C_{PD}$ + $C_L$) x $V_{CC}^2$ x f.
3. Assumes ideal 3.6V Lithium Ion battery with current rating of 900mAH and derated 90% and device frequency at 10MHz, with $C_L$=15pF load.

**Figure 1. Battery Life vs. $V_{CC}$ Supply Voltage**

## Connection Diagrams


**Figure 2. Logic Symbol**

## Pin Configurations

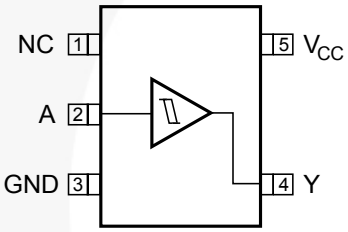


**Figure 3. SC70 (Top View)**

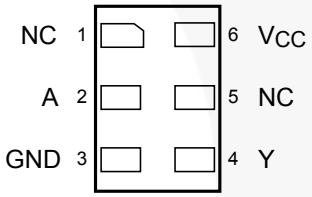


**Figure 4. MicroPak™ (Top Through View)**

## Function Table

**Y=A**

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

L = Low Logic Level
H = High Logic Level

## Pin Definitions

| Pin # SC70 | Pin # MicroPak | Name | Description |
|---|---|---|---|
| 1 | 1, 5 | NC | No Connect |
| 2 | 2 | A | Input |
| 3 | 3 | GND | Ground |
| 4 | 4 | Y | Output |
| 5 | 6 | $V_{CC}$ | Supply Voltage |

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## 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 | | Min. | Max. | Unit |
|---|---|---|---|---|---|
| $V_{CC}$ | Supply Voltage | | -0.5 | 4.6 | V |
| $V_{IN}$ | DC Input Voltage | | -0.5 | 4.6 | V |
| $V_{OUT}$ | DC Output Voltage | HIGH or LOW State(4) | -0.5 | $V_{CC}$ to +0.5 | V |
| | | $V_{CC}$=0V | -0.5 | 4.6 | V |
| $I_{IK}$ | DC Input Diode Current at $V_{IN}$ < 0V | | | -50 | mA |
| $I_{OK}$ | DC Output Diode Current | $V_{OUT}$ < 0V | | -50 | mA |
| | | $V_{OUT}$ > $V_{CC}$ | | +50 | |
| $I_{OH}$ / $I_{OL}$ | DC Output Source/Sink Current | | | ±50 | mA |
| $I_{CC}$ or Ground | DC $V_{CC}$ or Ground Current per Supply Pin | | | ±50 | mA |
| $T_{STG}$ | Storage Temperature Range | | -65 | +150 | °C |
| $T_J$ | Junction Temperature Under Bias | | | +150 | °C |
| $T_L$ | Junction Lead Temperature (Soldering, 10 Seconds) | | | +260 | °C |
| $P_D$ | Power Dissipation at +85°C | SC70-5 | | 150 | mW |
| | | MicroPak™-6 | | 130 | |
| | | MicroPak2™-6 | | 120 | |
| ESD | Human Body Model | JEDEC: JESD22-A114 | | 4000 | V |
| | Charged Device Model | JEDEC: JESD22-C101 | | 2000 | |

**Note:**
4. The $I_O$ maximum rating must be observed.

## Recommended Operating Conditions

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 | Conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| $V_{CC}$ | Supply Voltage | | 0.9 | | 3.6 | V |
| $V_{IN}$ | Input Voltage(5) | | 0 | | 3.6 | V |
| $V_{OUT}$ | Output Voltage | HIGH or LOW State | 0 | | $V_{CC}$ | V |
| | | $V_{CC}$=0V | 0 | | 3.6 | |
| $I_{OH}$ / $I_{OL}$ | Output Current in $I_{OH}$ / $I_{OL}$ | $V_{CC}$=3.0V to 3.6V | | ±2.6 | | mA |
| | | $V_{CC}$=2.3V to 2.7V | | ±2.1 | | |
| | | $V_{CC}$=1.65V to 1.95V | | ±1.5 | | |
| | | $V_{CC}$=1.40V to 1.60V | | ±1.0 | | |
| | | $V_{CC}$=1.10V to 1.30V | | ±0.5 | | |
| | | $V_{CC}$=0.9V | | 20.0 | | µA |
| $T_A$ | Free Air Operating Temperature | | -40 | | +85 | °C |
| $\Delta t / \Delta V$ | Minimum Input Edge Rate | $V_{IN}$=0.8V to 2.0V, $V_{CC}$=3.0V | | 10 | | ns/V |
| $\theta_{JA}$ | Thermal Resistance | SC70-5 | | 425 | | °C/W |
| | | MicroPak™-6 | | 500 | | |
| | | MicroPak2™-6 | | 560 | | |

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

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## DC Electrical Characteristics

| Symbol | Parameter | Conditions | $V_{CC}$ (V) | $T_A$=+25°C | | $T_A$=–40°C to +85°C | | Units |
|---|---|---|---|---|---|---|---|---|
| | | | | Min. | Max. | Min. | Max. | |
| $V_P$ | Positive Threshold Voltage | | 0.90 | 0.30 | 0.60 | 0.30 | 0.60 | V |
| | | | 1.10 | 0.40 | 1.00 | 0.40 | 1.00 | |
| | | | 1.40 | 0.50 | 1.20 | 0.50 | 1.20 | |
| | | | 1.65 | 0.70 | 1.50 | 0.70 | 1.50 | |
| | | | 2.30 | 1.00 | 1.90 | 1.00 | 1.90 | |
| | | | 3.00 | 1.50 | 2.60 | 1.50 | 2.60 | |
| $V_N$ | Negative Threshold Voltage | | 0.90 | 0.10 | 0.60 | 0.10 | 0.60 | V |
| | | | 1.10 | 0.15 | 0.70 | 0.15 | 0.70 | |
| | | | 1.40 | 0.20 | 0.80 | 0.20 | 0.80 | |
| | | | 1.65 | 0.25 | 0.90 | 0.25 | 0.90 | |
| | | | 2.30 | 0.40 | 1.15 | 0.40 | 1.15 | |
| | | | 3.00 | 0.6 | 1.50 | 0.60 | 1.50 | |
| $V_H$ | Hysteresis Voltage | | 0.90 | 0.07 | 0.50 | 0.07 | 0.50 | V |
| | | | 1.10 | 0.08 | 0.60 | 0.08 | 0.60 | |
| | | | 1.40 | 0.09 | 0.80 | 0.09 | 0.80 | |
| | | | 1.65 | 0.10 | 1.00 | 0.10 | 1.00 | |
| | | | 2.30 | 0.25 | 1.10 | 0.25 | 1.10 | |
| | | | 3.00 | 0.60 | 1.80 | 0.60 | 1.80 | |
| $V_{OH}$ | HIGH Level Output Voltage | $I_{OH}$=–20µA | 0.90 | $V_{CC}$ – 0.1 | | $V_{CC}$ – 0.1 | | V |
| | | | 1.10 ≤ $V_{CC}$ ≤ 1.30 | $V_{CC}$ – 0.1 | | $V_{CC}$ – 0.1 | | |
| | | | 1.40 ≤ $V_{CC}$ ≤ 1.60 | $V_{CC}$ – 0.1 | | $V_{CC}$ – 0.1 | | |
| | | | 1.65 ≤ $V_{CC}$ ≤ 1.95 | $V_{CC}$ – 0.1 | | $V_{CC}$ – 0.1 | | |
| | | | 2.30 ≤ $V_{CC}$ ≤ 2.70 | $V_{CC}$ – 0.1 | | $V_{CC}$ – 0.1 | | |
| | | | 3.00 ≤ $V_{CC}$ ≤ 3.60 | $V_{CC}$ – 0.1 | | $V_{CC}$ – 0.1 | | |
| | | $I_{OH}$=–0.5mA | 1.10 ≤ $V_{CC}$ ≤ 1.30 | 0.75 x $V_{CC}$ | | 0.70 x $V_{CC}$ | | |
| | | $I_{OH}$=–1mA | 1.40 ≤ $V_{CC}$ ≤ 1.60 | 1.07 | | 0.99 | | |
| | | $I_{OH}$=–1.5mA | 1.65 ≤ $V_{CC}$ ≤ 1.95 | 1.24 | | 1.22 | | |
| | | $I_{OH}$=–2.1mA | 2.30 ≤ $V_{CC}$ ≤ 2.70 | 1.95 | | 1.87 | | |
| | | $I_{OH}$=–2.6mA | 3.00 ≤ $V_{CC}$ ≤ 3.60 | 2.61 | | 2.55 | | |
| $V_{OL}$ | LOW Level Output Voltage | $I_{OL}$=20µA | 0.90 | | 0.1 | | 0.1 | V |
| | | | 1.10 ≤ $V_{CC}$ ≤ 1.30 | | 0.1 | | 0.1 | |
| | | | 1.40 ≤ $V_{CC}$ ≤ 1.60 | | 0.1 | | 0.1 | |
| | | | 1.65 ≤ $V_{CC}$ ≤ 1.95 | | 0.1 | | 0.1 | |
| | | | 2.30 ≤ $V_{CC}$ ≤ 2.70 | | 0.1 | | 0.1 | |
| | | | 3.00 ≤ $V_{CC}$ ≤ 3.60 | | 0.1 | | 0.1 | |
| | | $I_{OL}$=0.5mA | 1.10 ≤ $V_{CC}$ ≤ 1.30 | | 0.30 x $V_{CC}$ | | 0.30 x $V_{CC}$ | |
| | | $I_{OL}$=1mA | 1.40 ≤ $V_{CC}$ ≤ 1.60 | | 0.31 | | 0.37 | |
| | | $I_{OL}$=1.5mA | 1.65 ≤ $V_{CC}$ ≤ 1.95 | | 0.31 | | 0.35 | |
| | | $I_{OL}$=2.1mA | 2.30 ≤ $V_{CC}$ ≤ 2.70 | | 0.31 | | 0.33 | |
| | | $I_{OL}$=2.6mA | 3.00 ≤ $V_{CC}$ ≤ 3.60 | | 0.31 | | 0.33 | |
| $I_{IN}$ | Input Leakage Current | 0 ≤ $V_{IN}$ ≤ 3.6V | 0.90 to 3.60 | | ±0.1 | | ±0.5 | µA |
| $I_{OFF}$ | Power Off Leakage Current | 0 ≤ ($V_{IN}$, $V_O$) ≤ 3.6V | 0 | | 0.5 | | 0.5 | µA |
| $I_{CC}$ | Quiescent Supply Current | $V_{IN}$=$V_{CC}$ or GND | 0.90 to 3.60 | | 0.9 | | 0.9 | µA |

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## AC Electrical Characteristics

| Symbol | Parameter | Conditions | $V_{CC}$ | $T_A$=25°C | | | $T_A$=-40 to 85°C | | Units | Figure |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Min. | Typ. | Max. | Min. | Max. | | |
| $t_{PHL}$, $t_{PLH}$ | Propagation Delay | $C_L$=10pF, $R_L$=1MΩ | 0.90 | | 27.0 | | | | ns | Figure 5 Figure 6 |
| | | | 1.10 ≤ $V_{CC}$ ≤ 1.30 | 3.5 | 11.0 | 21.8 | 3.0 | 34.3 | | |
| | | | 1.40 ≤ $V_{CC}$ ≤ 1.60 | 2.5 | 7.0 | 14.8 | 2.0 | 15.0 | | |
| | | | 1.65 ≤ $V_{CC}$ ≤ 1.95 | 2.0 | 6.0 | 12.0 | 1.5 | 12.2 | | |
| | | | 2.30 ≤ $V_{CC}$ ≤ 2.70 | 1.5 | 5.0 | 9.4 | 1.0 | 9.9 | | |
| | | | 3.00 ≤ $V_{CC}$ ≤ 3.60 | 1.0 | 4.0 | 8.3 | 1.0 | 9.0 | | |
| | | $C_L$=15pF, $R_L$=1MΩ | 0.90 | | 30.0 | | | | | |
| | | | 1.10 ≤ $V_{CC}$ ≤ 1.30 | 4.0 | 11.0 | 22.8 | 3.5 | 37.3 | | |
| | | | 1.40 ≤ $V_{CC}$ ≤ 1.60 | 3.0 | 8.0 | 15.5 | 2.5 | 16.5 | | |
| | | | 1.65 ≤ $V_{CC}$ ≤ 1.95 | 2.5 | 6.0 | 12.6 | 2.0 | 13.6 | | |
| | | | 2.30 ≤ $V_{CC}$ ≤ 2.70 | 2.0 | 5.0 | 9.9 | 1.5 | 10.8 | | |
| | | | 3.00 ≤ $V_{CC}$ ≤ 3.60 | 1.5 | 4.0 | 8.7 | 1.0 | 9.5 | | |
| | | $C_L$=30pF, $R_L$=1MΩ | 0.90 | | 32.0 | | | | | |
| | | | 1.10 ≤ $V_{CC}$ ≤ 1.30 | 5.0 | 13.0 | 25.9 | 4.0 | 46.3 | | |
| | | | 1.40 ≤ $V_{CC}$ ≤ 1.60 | 4.0 | 9.0 | 17.8 | 3.5 | 18.2 | | |
| | | | 1.65 ≤ $V_{CC}$ ≤ 1.95 | 3.0 | 7.0 | 14.4 | 2.0 | 15.9 | | |
| | | | 2.30 ≤ $V_{CC}$ ≤ 2.70 | 2.0 | 6.0 | 11.3 | 1.5 | 12.8 | | |
| | | | 3.00 ≤ $V_{CC}$ ≤ 3.60 | 1.5 | 5.0 | 9.2 | 1.0 | 10.7 | | |
| $C_{IN}$ | Input Capacitance | | 0 | | 2 | | | | pF | |
| $C_{PD}$ | Power Dissipation Capacitance | $V_{IN}$=0V or $V_{CC}$, f=10MHz | 0.90 to 3.60 | | 8 | | | | pF | |

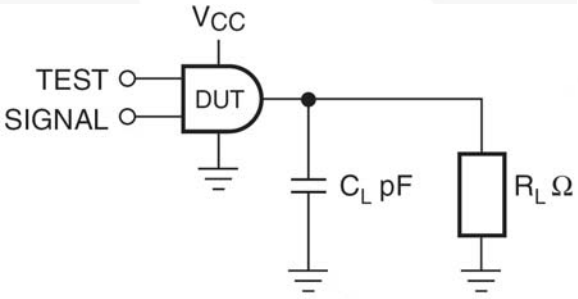


**Figure 5. AC Test Circuit**

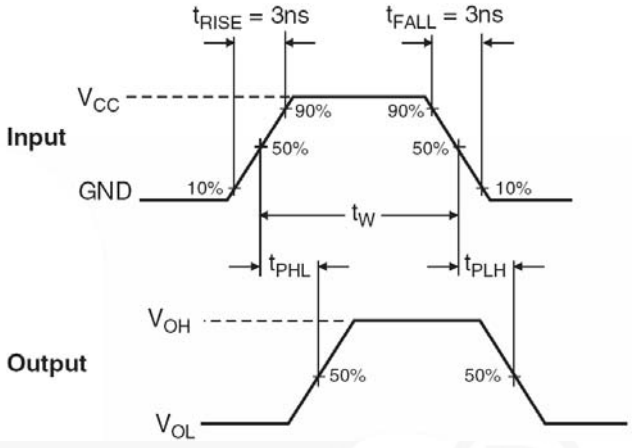


**Figure 6. AC Waveforms for Inverting and Non-Inverting Functions**

| Symbol | $V_{CC}$ | | | | | |
|---|---|---|---|---|---|---|
| | 3.3V ± 0.3V | 2.5V ± 0.2V | 1.8V ± 0.15V | 1.5V ± 0.1V | 1.2V ± 0.1V | 0.9V |
| $V_{mi}$ | 1.5V | $V_{CC}$ / 2 | $V_{CC}$ / 2 | $V_{CC}$ / 2 | $V_{CC}$ / 2 | $V_{CC}$ / 2 |
| $V_{mo}$ | 1.5V | $V_{CC}$ / 2 | $V_{CC}$ / 2 | $V_{CC}$ / 2 | $V_{CC}$ / 2 | $V_{CC}$ / 2 |

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## Physical Dimensions

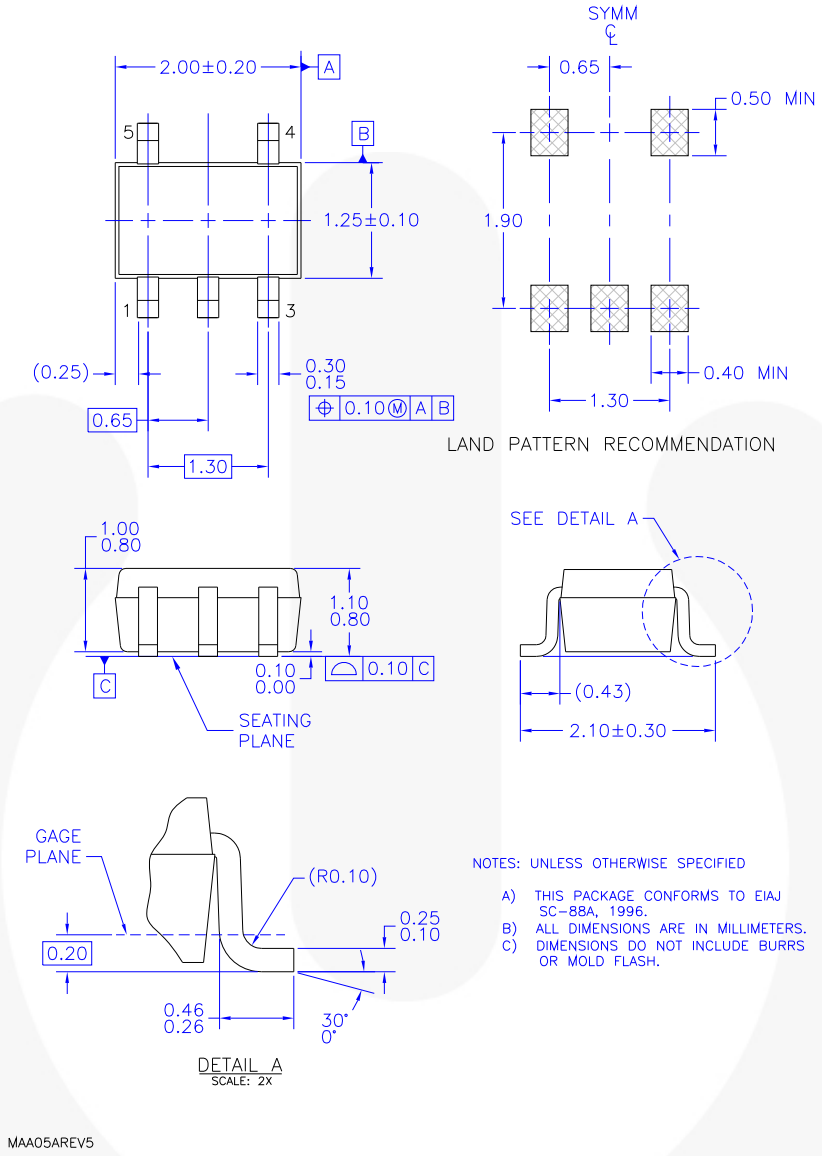


**Figure 7. 5-Lead, SC70, EIAJ SC-88a, 1.25mm Wide**

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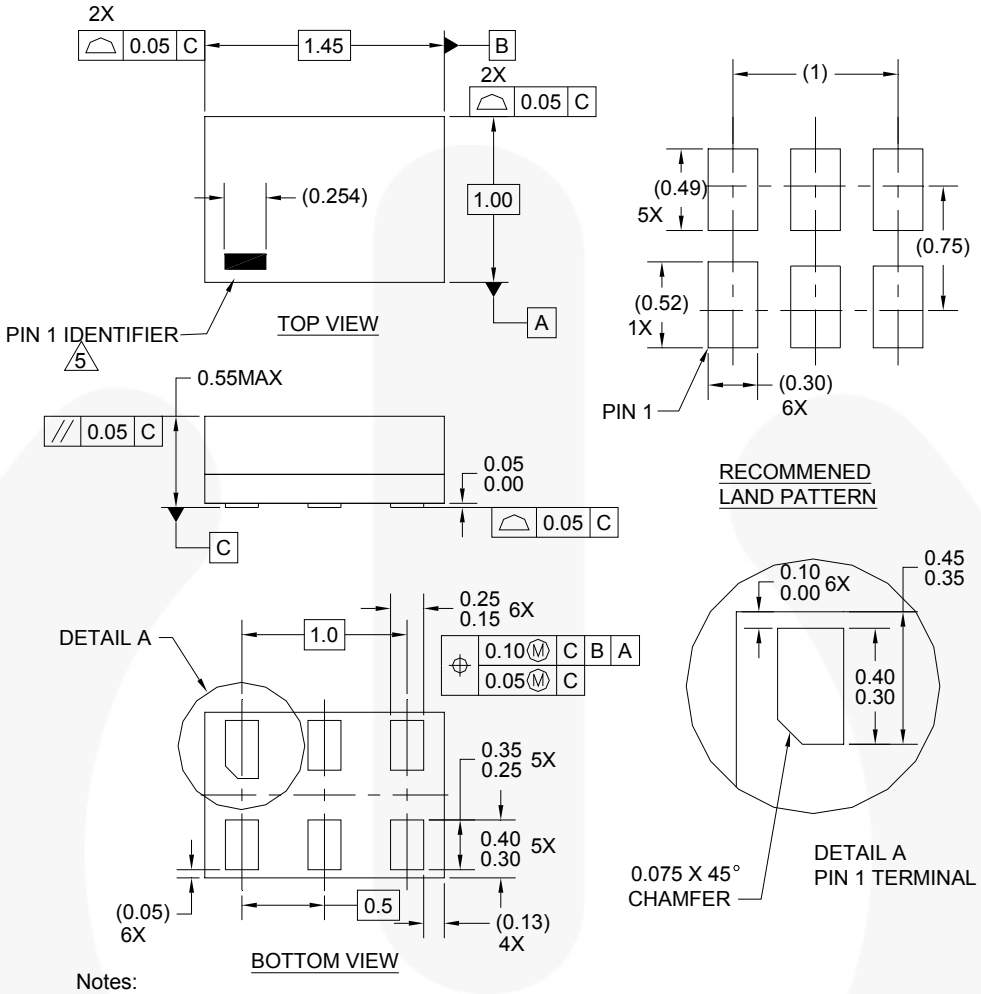
## Tape and Reel Specification

*Please visit Fairchild Semiconductor's online packaging area for the most recent tape and reel specifications:*
*http://www.fairchildsemi.com/products/analog/pdf/sc70-5_tr.pdf.*

| Package Designator | Tape Section | Cavity Number | Cavity Status | Cover Type Status |
|---|---|---|---|---|
| P5X | Leader (Start End) | 125 (Typical) | Empty | Sealed |
| | Carrier | 3000 | Filled | Sealed |
| | Trailer (Hub End) | 75 (Typical) | Empty | Sealed |

## Physical Dimensions




Notes:

1. CONFORMS TO JEDEC STANDARD M0-252 VARIATION UAAD
2. DIMENSIONS ARE IN MILLIMETERS
3. DRAWING CONFORMS TO ASME Y14.5M-1994
4. FILENAME AND REVISION: MAC06AREV4
5. PIN ONE IDENTIFIER IS 2X LENGTH OF ANY OTHER LINE IN THE MARK CODE LAYOUT.

**Figure 8. 6-Lead, MicroPak™, 1.0mm Wide**

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| Package Designator | Tape Section | Cavity Number | Cavity Status | Cover Type Status |
|---|---|---|---|---|
| L6X | Leader (Start End) | 125 (Typical) | Empty | Sealed |
| | Carrier | 5000 | Filled | Sealed |
| | Trailer (Hub End) | 75 (Typical) | Empty | Sealed |

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## Physical Dimensions

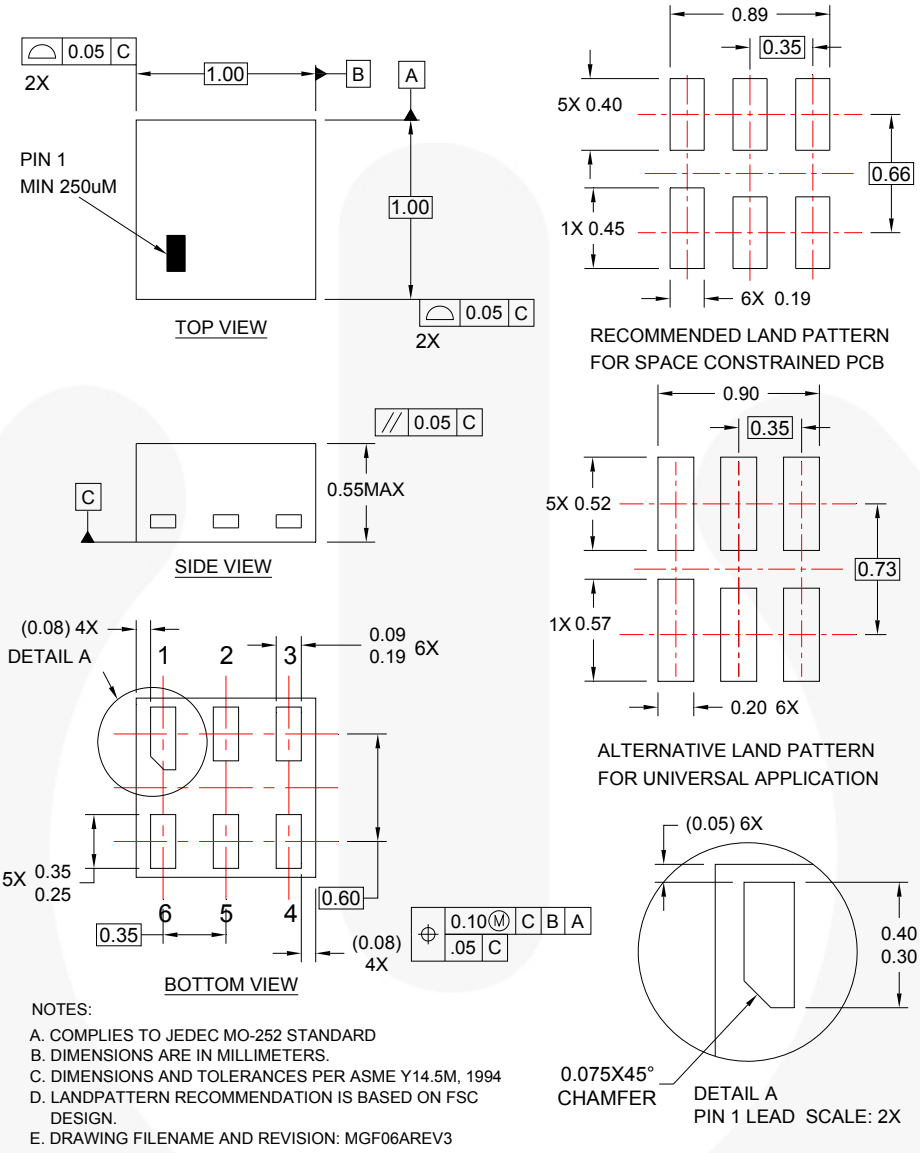


**Figure 9. 6-Lead, MicroPak2™, 1x1mm Body, .35mm Pitch**

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## Tape and Reel Specification

*Please visit Fairchild Semiconductor's online packaging area for the most recent tape and reel specifications:*
*http://www.fairchildsemi.com/packaging/MicroPAK2_6L_tr.pdf.*

| Package Designator | Tape Section | Cavity Number | Cavity Status | Cover Type Status |
|---|---|---|---|---|
| FHX | Leader (Start End) | 125 (Typical) | Empty | Sealed |
| | Carrier | 5000 | Filled | Sealed |
| | Trailer (Hub End) | 75 (Typical) | Empty | Sealed |

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