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# NC7SVL32

## TinyLogic® Low-I<sub>CC</sub> Two-Input OR Gate

### Features

- 0.9V to 3.6V V<sub>CC</sub> Supply Operation
- 3.6V Over-Voltage Tolerant I/Os at V<sub>CC</sub> from 0.9V to 3.6V
- Power-Off High-Impedance Inputs and Outputs
- Proprietary Quiet Series™ Noise / EMI Reduction Circuitry
- Ultra-Small MicroPak™ Packages
- Ultra-Low Dynamic Power

### Description

The NC7SVL32 is a single two-input OR gate with a Low-I<sub>CC</sub> input design from Fairchild's Ultra-Low Power (ULP-A) series of TinyLogic®. The NC7SVL32 features very low quiescent current, even when the input voltage is lower than the V<sub>CC</sub> supply. This feature services mobile handset applications very well, allowing for direct interface with baseband processor general-purpose I/Os. Since mobile devices rely on a battery supply, the NC7SVL32 facilitates lower power consumption in mixed-voltage rail environments.

This product is designed on an advanced CMOS technology for a wide low-voltage operating range (0.9V to 3.6V V<sub>CC</sub>), high drive needs (up to 24mA), and speed (maximum propagation delay of 3.5ns, V<sub>CC</sub>=3.3V). It achieves this performance while maintaining low CMOS power dissipation.

### Ordering Information

| Part Number | Top Mark | Package                                     | Packing Method            |
|-------------|----------|---------------------------------------------|---------------------------|
| NC7SVL32P5X | L32      | 5-Lead SC70, EIAJ SC-88a, 1.25mm Wide       | 3000 Units on Tape & Reel |
| NC7SVL32L6X | CF       | 6-Lead MicroPak™, 1.00mm Wide               | 5000 Units on Tape & Reel |
| NC7SVL32FHX | CF       | 6-Lead, MicroPak2™, 1x1mm Body, .35mm Pitch | 5000 Units on Tape & Reel |

## Connection Diagram



Figure 1. Logic Symbol

## Pin Configurations

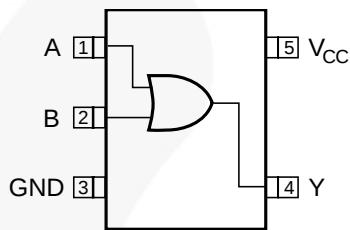


Figure 2. SC70 (Top View)

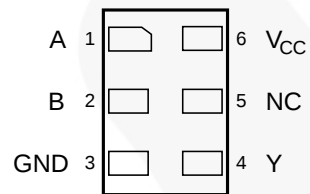


Figure 3. MicroPak™ (Top Through View)

## Pin Definitions

| Pin # SC70 | Pin # MicroPak™ | Name            | Description    |
|------------|-----------------|-----------------|----------------|
| 1          | 1               | A               | Input          |
| 2          | 2               | B               | Input          |
| 3          | 3               | GND             | Ground         |
| 4          | 4               | Y               | Output         |
|            | 5               | NC              | No Connect     |
| 5          | 6               | V <sub>CC</sub> | Supply Voltage |

## Function Table

$$Y = A + B$$

| Inputs |   | Output |
|--------|---|--------|
| A      | B | Y      |
| L      | L | L      |
| L      | H | H      |
| H      | L | H      |
| 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                                           | Min.                               | Max.                  | Unit |
|-------------------------------------|-----------------------------------------------------|------------------------------------|-----------------------|------|
| V <sub>CC</sub>                     | Supply Voltage                                      | -0.5                               | 4.6                   | V    |
| V <sub>IN</sub>                     | DC Input Voltage                                    | -0.5                               | 4.6                   | V    |
| V <sub>OUT</sub>                    | DC Output Voltage                                   | HIGH or LOW State <sup>(1)</sup>   | V <sub>CC</sub> + 0.5 | V    |
|                                     |                                                     | V <sub>CC</sub> = 0V               | 4.6                   |      |
| I <sub>IK</sub>                     | DC Input Diode Current                              | V <sub>IN</sub> < 0V               | -50                   | mA   |
| I <sub>OK</sub>                     | DC Output Diode Current                             | V <sub>OUT</sub> < 0V              | -50                   | mA   |
|                                     |                                                     | V <sub>OUT</sub> > V <sub>CC</sub> | +50                   |      |
| I <sub>OH</sub> / I <sub>OL</sub>   | DC Output Source/Sink Current                       |                                    | ±50                   | mA   |
| I <sub>CC</sub> or I <sub>GND</sub> | DC V <sub>CC</sub> or Ground Current per Supply Pin |                                    | ±50                   | mA   |
| T <sub>STG</sub>                    | Storage Temperature Range                           | -65                                | +150                  | °C   |
| T <sub>J</sub>                      | Junction Temperature Under Bias                     |                                    | +150                  | °C   |
| T <sub>L</sub>                      | Junction Lead Temperature, Soldering 10 Seconds     |                                    | +260                  | °C   |
| P <sub>D</sub>                      | Power Dissipation at +85°C                          | SC70-5                             | 150                   | mW   |
|                                     |                                                     | MicroPak™-6                        | 130                   |      |
|                                     |                                                     | MicroPak2™-6                       | 120                   |      |
| ESD                                 | Human Body Model, JEDEC:JESD22-A114                 |                                    | 4000                  | V    |
|                                     | Charge Device Model, JEDEC:JESD22-C101              |                                    | 2000                  |      |

### Note:

1. I<sub>O</sub> absolute maximum ratings 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. | Max.            | Unit |
|----------------------------------|----------------------------------------------------|-----------------------------------------------------|------|-----------------|------|
| V <sub>CC</sub>                  | Supply Voltage                                     |                                                     | 0.9  | 3.6             | V    |
| V <sub>IN</sub>                  | Input Voltage                                      |                                                     | 0    | 3.6             | V    |
| V <sub>OUT</sub>                 | Output Voltage                                     | V <sub>CC</sub> =0V                                 | 0    | 3.6             | V    |
|                                  |                                                    | HIGH or LOW State                                   | 0    | V <sub>CC</sub> |      |
| I <sub>OH</sub> /I <sub>OL</sub> | Output Current in I <sub>OH</sub> /I <sub>OL</sub> | V <sub>CC</sub> =3.0V to 3.6V                       |      | ±24.0           | mA   |
|                                  |                                                    | V <sub>CC</sub> =2.3V to 2.7V                       |      | ±18.0           |      |
|                                  |                                                    | V <sub>CC</sub> =1.65V to 1.95V                     |      | ±6.0            |      |
|                                  |                                                    | V <sub>CC</sub> =1.4V to 1.6V                       |      | ±4.0            |      |
|                                  |                                                    | V <sub>CC</sub> =1.1V to 1.3V                       |      | ±2.0            |      |
|                                  |                                                    | V <sub>CC</sub> =0.9V                               |      | ±0.1            |      |
| T <sub>A</sub>                   | Operating Temperature, Free Air                    |                                                     | -40  | +85             | °C   |
| Δt/ΔV                            | Minimum Input Edge Rate                            | V <sub>IN</sub> =0.8V to 2.0, V <sub>CC</sub> =3.0V |      | 10              | ns/V |
| θ <sub>JA</sub>                  | Thermal Resistance                                 | SC70-5                                              |      | 425             | °C/W |
|                                  |                                                    | MicroPak™-6                                         |      | 500             |      |
|                                  |                                                    | MicroPak2™-6                                        |      | 560             |      |

### Note:

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

## DC Electrical Characteristics

| Symbol          | Parameter                 | V <sub>CC</sub>               | Conditions              | T <sub>A</sub> =25°C  |                       | T <sub>A</sub> =-40 to +85°C |                       | Units |
|-----------------|---------------------------|-------------------------------|-------------------------|-----------------------|-----------------------|------------------------------|-----------------------|-------|
|                 |                           |                               |                         | Min.                  | Max.                  | Min.                         | Max.                  |       |
| V <sub>IH</sub> | HIGH Level Input Voltage  | 0.90                          |                         | .65 x V <sub>CC</sub> |                       | .65 x V <sub>CC</sub>        |                       | V     |
|                 |                           | 1.10 ≤ V <sub>CC</sub> ≤ 1.30 |                         | .65 x V <sub>CC</sub> |                       | .65 x V <sub>CC</sub>        |                       |       |
|                 |                           | 1.40 ≤ V <sub>CC</sub> ≤ 1.60 |                         | .65 x V <sub>CC</sub> |                       | .65 x V <sub>CC</sub>        |                       |       |
|                 |                           | 1.65 ≤ V <sub>CC</sub> ≤ 1.95 |                         | 0.90                  |                       | 0.90                         |                       |       |
|                 |                           | 2.30 ≤ V <sub>CC</sub> ≤ 2.70 |                         | 1.50                  |                       | 1.50                         |                       |       |
|                 |                           | 2.70 ≤ V <sub>CC</sub> ≤ 3.60 |                         | 1.50                  |                       | 1.50                         |                       |       |
| V <sub>IL</sub> | LOW Level Input Voltage   | 0.90                          |                         |                       | .25 x V <sub>CC</sub> |                              | .25 x V <sub>CC</sub> | V     |
|                 |                           | 1.10 ≤ V <sub>CC</sub> ≤ 1.30 |                         |                       | .25 x V <sub>CC</sub> |                              | .25 x V <sub>CC</sub> |       |
|                 |                           | 1.40 ≤ V <sub>CC</sub> ≤ 1.60 |                         |                       | .25 x V <sub>CC</sub> |                              | .25 x V <sub>CC</sub> |       |
|                 |                           | 1.65 ≤ V <sub>CC</sub> ≤ 1.95 |                         |                       | .25 x V <sub>CC</sub> |                              | .25 x V <sub>CC</sub> |       |
|                 |                           | 2.30 ≤ V <sub>CC</sub> ≤ 2.70 |                         |                       | 0.70                  |                              | 0.70                  |       |
|                 |                           | 2.70 ≤ V <sub>CC</sub> ≤ 3.60 |                         |                       | 0.80                  |                              | 0.80                  |       |
| V <sub>OH</sub> | HIGH Level Output Voltage | 0.90                          | I <sub>OH</sub> =-100μA | V <sub>CC</sub> -0.10 |                       | V <sub>CC</sub> -0.10        |                       | V     |
|                 |                           | 1.10 ≤ V <sub>CC</sub> ≤ 1.30 |                         | V <sub>CC</sub> -0.10 |                       | V <sub>CC</sub> -0.10        |                       |       |
|                 |                           | 1.40 ≤ V <sub>CC</sub> ≤ 1.60 |                         | V <sub>CC</sub> -0.20 |                       | V <sub>CC</sub> -0.20        |                       |       |
|                 |                           | 1.65 ≤ V <sub>CC</sub> ≤ 1.95 |                         | V <sub>CC</sub> -0.20 |                       | V <sub>CC</sub> -0.20        |                       |       |
|                 |                           | 2.30 ≤ V <sub>CC</sub> ≤ 2.70 |                         | V <sub>CC</sub> -0.20 |                       | V <sub>CC</sub> -0.20        |                       |       |
|                 |                           | 2.70 ≤ V <sub>CC</sub> ≤ 3.60 |                         | V <sub>CC</sub> -0.20 |                       | V <sub>CC</sub> -0.20        |                       |       |
|                 |                           | 1.10 ≤ V <sub>CC</sub> ≤ 1.30 | I <sub>OH</sub> =-2mA   | .75 x V <sub>CC</sub> |                       | .75 x V <sub>CC</sub>        |                       |       |
|                 |                           | 1.40 ≤ V <sub>CC</sub> ≤ 1.60 | I <sub>OH</sub> =-4mA   | .75 x V <sub>CC</sub> |                       | .75 x V <sub>CC</sub>        |                       |       |
|                 |                           | 1.65 ≤ V <sub>CC</sub> ≤ 1.95 | I <sub>OH</sub> =-6mA   | 1.25                  |                       | 1.25                         |                       |       |
|                 |                           | 2.30 ≤ V <sub>CC</sub> ≤ 2.70 |                         | 2.00                  |                       | 2.00                         |                       |       |
|                 |                           | 2.30 ≤ V <sub>CC</sub> ≤ 2.70 | I <sub>OH</sub> =-12mA  | 1.80                  |                       | 1.80                         |                       |       |
|                 |                           | 2.70 ≤ V <sub>CC</sub> ≤ 3.60 |                         | 2.20                  |                       | 2.20                         |                       |       |
|                 |                           | 2.30 ≤ V <sub>CC</sub> ≤ 2.70 | I <sub>OH</sub> =-18mA  | 1.70                  |                       | 1.70                         |                       |       |
|                 |                           | 2.70 ≤ V <sub>CC</sub> ≤ 3.60 |                         | 2.40                  |                       | 2.40                         |                       |       |
|                 |                           | 2.70 ≤ V <sub>CC</sub> ≤ 3.60 | I <sub>OH</sub> =-24mA  | 2.20                  |                       | 2.20                         |                       |       |

Continued on the following page...

## DC Electrical Characteristics (Continued)

| Symbol            | Parameter                             | V <sub>CC</sub>               | Conditions                                      | T <sub>A</sub> =25°C |                        | T <sub>A</sub> =-40 to +85°C |                        | Units |
|-------------------|---------------------------------------|-------------------------------|-------------------------------------------------|----------------------|------------------------|------------------------------|------------------------|-------|
|                   |                                       |                               |                                                 | Min.                 | Max.                   | Min.                         | Max.                   |       |
| V <sub>OL</sub>   | LOW Level Output Voltage              | 0.90                          | I <sub>OL</sub> =100μA                          |                      | 0.1                    |                              | 0.1                    | V     |
|                   |                                       | 1.10 ≤ V <sub>CC</sub> ≤ 1.30 |                                                 |                      | 0.1                    |                              | 0.1                    |       |
|                   |                                       | 1.40 ≤ V <sub>CC</sub> ≤ 1.60 |                                                 |                      | 0.2                    |                              | 0.2                    |       |
|                   |                                       | 1.65 ≤ V <sub>CC</sub> ≤ 1.95 |                                                 |                      | 0.2                    |                              | 0.2                    |       |
|                   |                                       | 2.30 ≤ V <sub>CC</sub> ≤ 2.70 |                                                 |                      | 0.2                    |                              | 0.2                    |       |
|                   |                                       | 2.70 ≤ V <sub>CC</sub> ≤ 3.60 |                                                 |                      | 0.2                    |                              | 0.2                    |       |
|                   |                                       | 1.10 ≤ V <sub>CC</sub> ≤ 1.30 | I <sub>OL</sub> =2mA                            |                      | 0.25 x V <sub>CC</sub> |                              | 0.25 x V <sub>CC</sub> |       |
|                   |                                       | 1.40 ≤ V <sub>CC</sub> ≤ 1.60 | I <sub>OL</sub> =4mA                            |                      | 0.25 x V <sub>CC</sub> |                              | 0.25 x V <sub>CC</sub> |       |
|                   |                                       | 1.65 ≤ V <sub>CC</sub> ≤ 1.95 | I <sub>OL</sub> =6mA                            |                      | 0.30                   |                              | 0.3                    |       |
|                   |                                       | 2.30 ≤ V <sub>CC</sub> ≤ 2.70 | I <sub>OL</sub> =12mA                           |                      | 0.40                   |                              | 0.40                   |       |
|                   |                                       | 2.70 ≤ V <sub>CC</sub> ≤ 3.60 |                                                 |                      | 0.40                   |                              | 0.40                   |       |
|                   |                                       | 2.30 ≤ V <sub>CC</sub> ≤ 2.70 | I <sub>OL</sub> =18mA                           |                      | 0.60                   |                              | 0.60                   |       |
|                   |                                       | 2.70 ≤ V <sub>CC</sub> ≤ 3.60 |                                                 |                      | 0.40                   |                              | 0.40                   |       |
|                   |                                       | 2.70 ≤ V <sub>CC</sub> ≤ 3.60 | I <sub>OL</sub> =24mA                           |                      | 0.55                   |                              | 0.55                   |       |
| I <sub>IN</sub>   | Input Leakage Current                 | 0.90 to 3.60                  | 0 ≤ V <sub>IN</sub> ≤ 3.60V                     |                      | ±0.1                   |                              | ±0.5                   | μA    |
| I <sub>OFF</sub>  | Power Off Leakage Current             | 0                             | 0 ≤ (V <sub>IN</sub> , V <sub>O</sub> ) ≤ 3.60V |                      | 0.5                    |                              | 0.5                    | μA    |
| I <sub>CC</sub>   | Quiescent Supply Current              | 0.90 to 3.60                  | V <sub>IN</sub> =V <sub>CC</sub> , or GND       |                      | 0.9                    |                              | 0.9                    | μA    |
|                   |                                       |                               | V <sub>CC</sub> ≤ V <sub>IN</sub> ≤ 3.60V       |                      |                        |                              | ±0.9                   |       |
| I <sub>CC</sub> T | Increase in I <sub>CC</sub> per Input | 1.95                          | V <sub>IN</sub> =0.9V                           |                      | 6                      |                              | 8                      | μA    |
|                   |                                       | 3.60                          | V <sub>IN</sub> =1.5V                           |                      | 6                      |                              | 8                      |       |

## AC Electrical Characteristics

| Symbol                              | Parameter                     | V <sub>CC</sub>               | Conditions                                          | T <sub>A</sub> =25°C |      |      | T <sub>A</sub> =-40 to 85°C |      | Units | Figure               |
|-------------------------------------|-------------------------------|-------------------------------|-----------------------------------------------------|----------------------|------|------|-----------------------------|------|-------|----------------------|
|                                     |                               |                               |                                                     | Min.                 | Typ. | Max. | Min.                        | Max. |       |                      |
| t <sub>PHL</sub> , t <sub>PLH</sub> | Propagation Delay             | 0.90                          | C <sub>L</sub> =15pF, R <sub>L</sub> =1MΩ           |                      | 42.0 |      |                             |      | ns    | Figure 4<br>Figure 5 |
|                                     |                               | 1.10 ≤ V <sub>CC</sub> ≤ 1.30 | C <sub>L</sub> =15pF, R <sub>L</sub> =2kΩ           | 3.5                  | 8.2  | 17.0 | 3.0                         | 30.5 |       |                      |
|                                     |                               | 1.40 ≤ V <sub>CC</sub> ≤ 1.60 |                                                     | 1.5                  | 4.0  | 7.0  | 1.5                         | 7.5  |       |                      |
|                                     |                               | 1.65 ≤ V <sub>CC</sub> ≤ 1.95 | C <sub>L</sub> =30pF, R <sub>L</sub> =500Ω          | 1.1                  | 3.2  | 5.5  | 1.0                         | 6.0  |       |                      |
|                                     |                               | 2.30 ≤ V <sub>CC</sub> ≤ 2.70 |                                                     | 0.6                  | 2.3  | 4.0  | 0.6                         | 4.5  |       |                      |
|                                     |                               | 2.70 ≤ V <sub>CC</sub> ≤ 3.60 |                                                     | 0.5                  | 1.9  | 3.5  | 0.5                         | 4.0  |       |                      |
| C <sub>IN</sub>                     | Input Capacitance             | 0                             |                                                     |                      | 3    |      |                             |      | pF    |                      |
| C <sub>PD</sub>                     | Power Dissipation Capacitance | 0.90 to 3.60                  | V <sub>IN</sub> =0V or V <sub>CC</sub> ,<br>f=10MHz |                      | 5    |      |                             |      | pF    |                      |

# AC Loadings and Waveforms

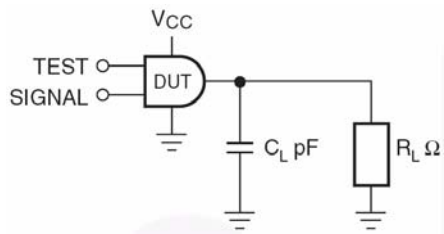


Figure 4. AC Test Circuit

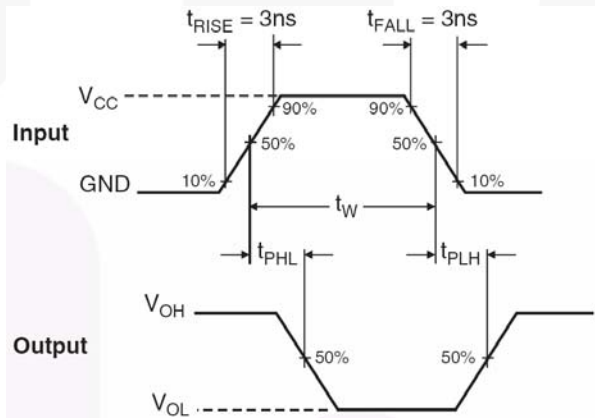
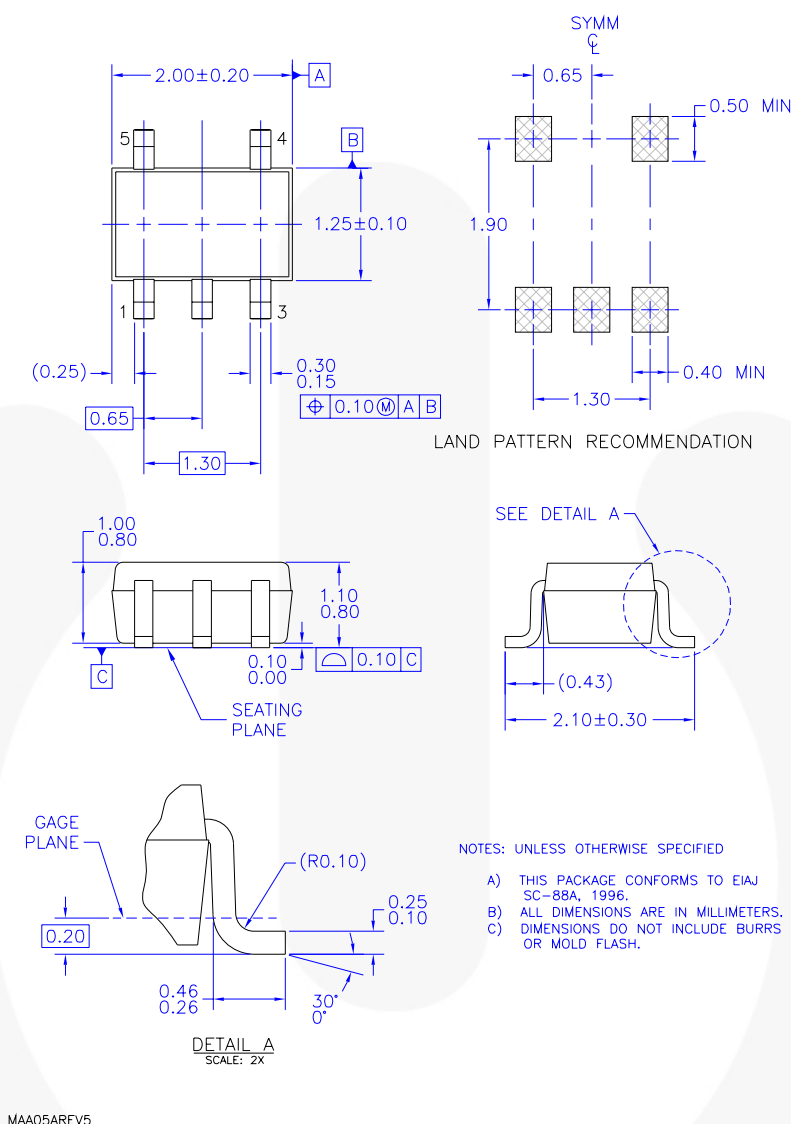


Figure 5. AC Waveforms

| Symbol          | V <sub>CC</sub> |                    |                    |                    |                    |                    |
|-----------------|-----------------|--------------------|--------------------|--------------------|--------------------|--------------------|
|                 | 3.3V ± 0.3V     | 2.5V ± 0.2V        | 1.8V ± 0.15V       | 1.5V ± 0.1V        | 1.2V ± 0.1V        | 0.9V               |
| V <sub>mi</sub> | 1.5V            | V <sub>CC</sub> /2 | V <sub>CC</sub> /2 | V <sub>CC</sub> /2 | V <sub>CC</sub> /2 | V <sub>CC</sub> /2 |
| V <sub>mo</sub> | 1.5V            | V <sub>CC</sub> /2 | V <sub>CC</sub> /2 | V <sub>CC</sub> /2 | V <sub>CC</sub> /2 | V <sub>CC</sub> /2 |

## Physical Dimensions



Package drawings are provided as a service to customers considering Fairchild components. Drawings may change in any manner without notice. Please note the revision and/or date on the drawing and contact a Fairchild Semiconductor representative to verify or obtain the most recent revision. Package specifications do not expand the terms of Fairchild's worldwide terms and conditions, specifically the warranty therein, which covers Fairchild products.

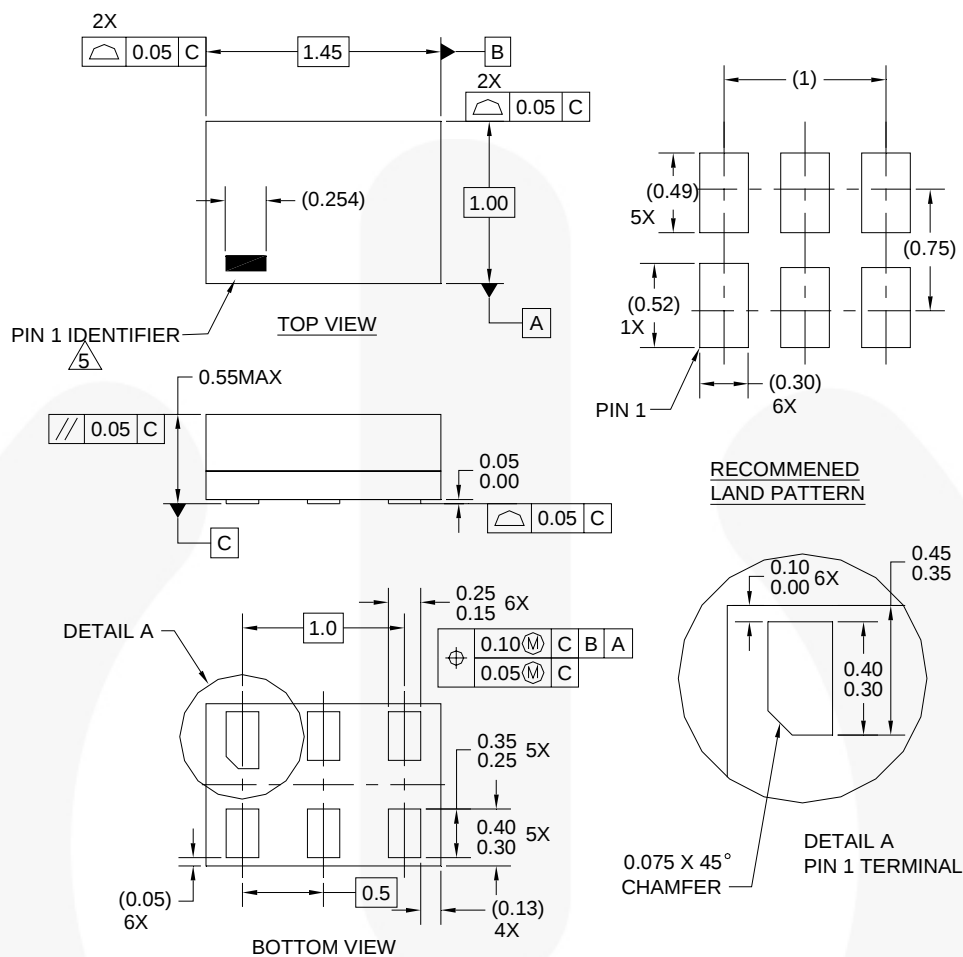
Always visit Fairchild Semiconductor's online packaging area for the most recent package drawings:  
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## Tape and Reel Specifications

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](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 7. 6-Lead, MicroPak™, 1.0mm Wide**

*Package drawings are provided as a service to customers considering Fairchild components. Drawings may change in any manner without notice. Please note the revision and/or date on the drawing and contact a Fairchild Semiconductor representative to verify or obtain the most recent revision. Package specifications do not expand the terms of Fairchild's worldwide terms and conditions, specifically the warranty therein, which covers Fairchild products.*

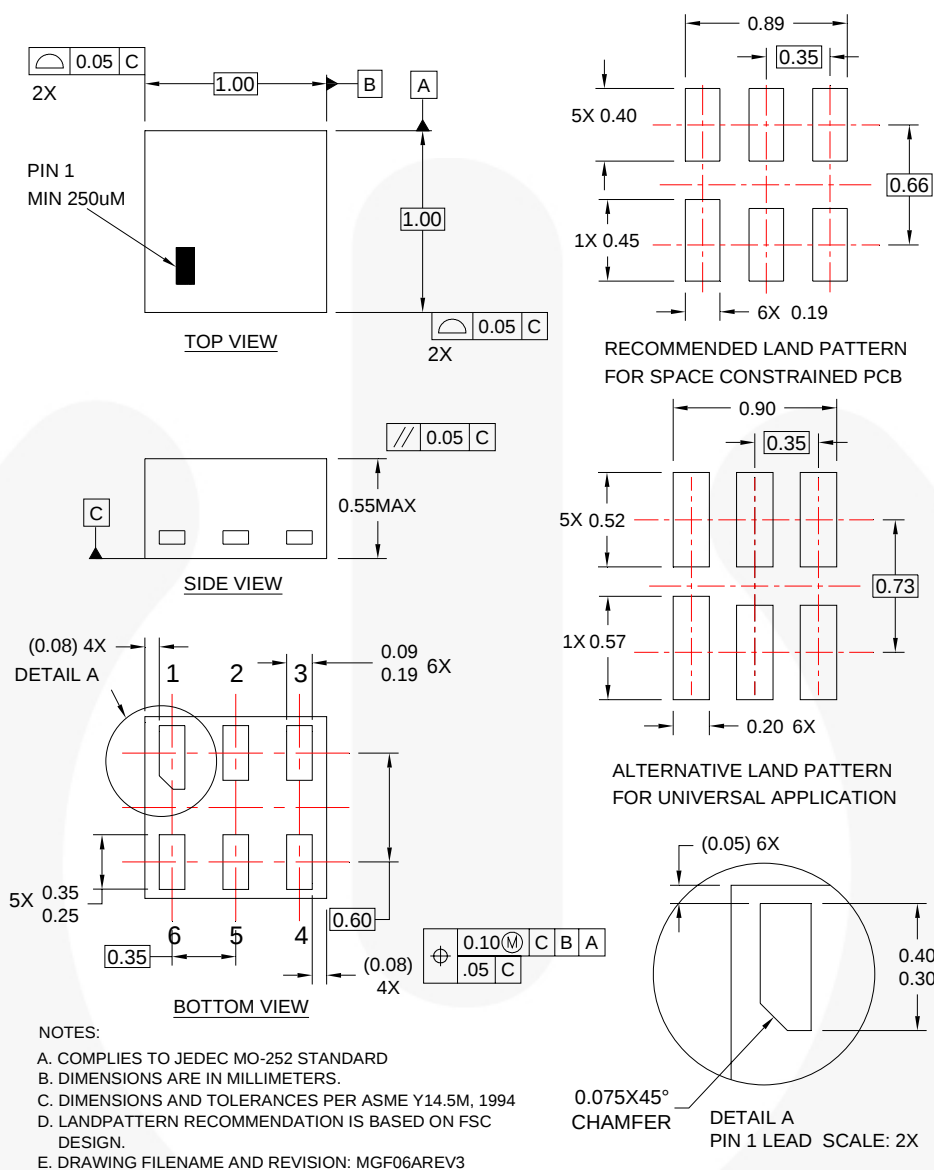
Always visit Fairchild Semiconductor's online packaging area for the most recent package drawings:  
<http://www.fairchildsemi.com/packaging/>.

## Tape and Reel Specifications

Please visit Fairchild Semiconductor's online packaging area for the most recent tape and reel specifications:  
[http://www.fairchildsemi.com/products/logic/pdf/micropak\\_tr.pdf](http://www.fairchildsemi.com/products/logic/pdf/micropak_tr.pdf)

| 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            |

## Physical Dimensions



**Figure 8. 6-Lead, MicroPak2™, 1x1mm Body, .35mm Pitch**

Package drawings are provided as a service to customers considering Fairchild components. Drawings may change in any manner without notice. Please note the revision and/or date on the drawing and contact a Fairchild Semiconductor representative to verify or obtain the most recent revision. Package specifications do not expand the terms of Fairchild's worldwide terms and conditions, specifically the warranty therein, which covers Fairchild products.

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## Tape and Reel Specifications

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| 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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| CorePOWER™               | Green FPS™ e-Series™                                                                       | QS™                                                                                                                     | TinyBuck™                                                                                   |
| CROSSVOL7™               | Gmax™                                                                                      | Quiet Series™                                                                                                           | TinyCalc™                                                                                   |
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| EcoSPARK®                | MICROCOUPLER™                                                                              | SMART START™                                                                                                            | TinyWire™                                                                                   |
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