

# 74AUP1T97 TinyLogic® Low Power Configurable Gate with Voltage-Level Translator

## Features

- Single Supply Voltage Translator
  - 1.8V to 3.3V Input at  $V_{CC}=3.3V$
  - 1.8V to 2.5V Input at  $V_{CC}=2.5V$
- 2.3V to 3.6V  $V_{CC}$  Supply Voltage Operation
- 3.6V Over-Voltage Tolerant I/O's at  $V_{CC}$  from 2.3V to 3.6V
- Power-Off High-Impedance Inputs and Outputs
- Low Static Power Consumption
  - $I_{CC}=0.9\mu A$  Maximum
- Low Dynamic Power Consumption
  - $C_{PD}=2.7pF$  Typical at 3.3V
- Ultra-Small MicroPak™ Packages

## Description

The 74AUP1T97 is a universal configurable 2-input logic gate that provides single supply voltage level translation. This device is designed for applications with inputs switching levels that accept 1.8V low voltage CMOS signals while operating from either a single 2.5V or 3.3V supply voltage. The 74AUP1T97 is an ideal low power solution for mixed voltage signal applications especially for battery-powered portable applications. This product guarantees very low static and dynamic power consumption across entire voltage range. All inputs are implemented with hysteresis to allow for slower transition input signals and better switching noise immunity.

The 74AUP1T97 provides for multiple functions as determined by various configurations of the three inputs. The potential logic functions provided are MUX, AND, NAND, OR, and NOR, inverter and buffer. Refer to Figures 3 to 9.

## Ordering Information

| Part Number  | Top Mark | Package                                     | Packing Method            |
|--------------|----------|---|---------------------------|
| 74AUP1T97L6X | AH       | 6-Lead MicroPak™, 1.0mm Wide                | 5000 Units on Tape & Reel |
| 74AUP1T97FHX | AH       | 6-Lead, MicroPak2™, 1x1mm Body, .35mm Pitch | 5000 Units on Tape & Reel |

### Logic Diagram

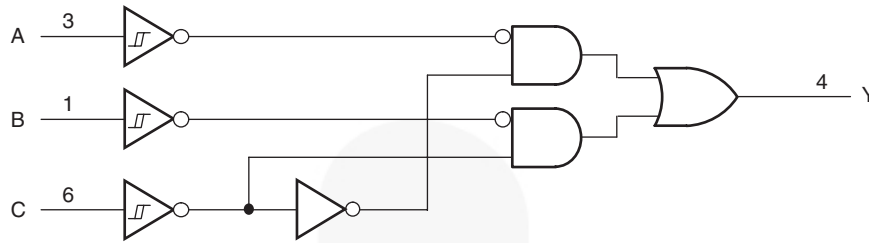


Figure 1. Logic Diagram (Positive Logic)

### Pin Configurations

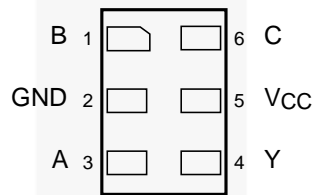


Figure 2. MicroPak™ (Top Through View)

### Pin Definitions

| Pin # | Name            | Description    |
|-------|-----------------|----------------|
| 1     | B               | Data Input     |
| 2     | GND             | Ground         |
| 3     | A               | Data Input     |
| 4     | Y               | Output         |
| 5     | V <sub>CC</sub> | Supply Voltage |
| 6     | C               | Data Input     |

**Function Table**

| Inputs |   |   | 74AUP1T97 |
|--------|---|---|-----------|
| C      | B | A | Y=Output  |
| L      | L | L | L         |
| L      | L | H | L         |
| L      | H | L | H         |
| L      | H | H | H         |
| H      | L | L | L         |
| H      | L | H | H         |
| H      | H | L | L         |
| H      | H | H | H         |

H = HIGH Logic Level

L = LOW Logic Level

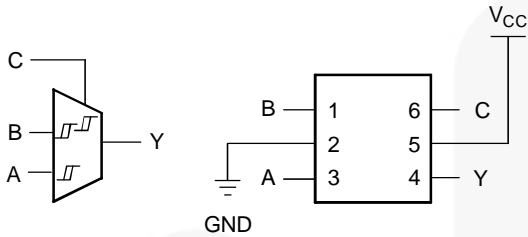
**Function Selection Table**

| Logic Function                            | Connection Configuration |
|---|--------------------------|
| 2-to-1 MUX                                | Figure 3                 |
| 2-Input AND Gate                          | Figure 4                 |
| 2-Input OR Gate with One Inverted Input   | Figure 5                 |
| 2-Input NAND Gate with One Inverted Input | Figure 5                 |
| 2-Input AND Gate with One Inverted Input  | Figure 6                 |
| 2-Input NOR Gate with One Inverted Input  | Figure 6                 |
| 2-Input OR Gate                           | Figure 7                 |
| Inverter                                  | Figure 8                 |
| Buffer                                    | Figure 9                 |

## 74AUP1T97 Logic Configurations

Figure 3 through Figure 9 show the logical functions that can be implemented using the 74AUP1T97. The diagrams show the DeMorgan's equivalent logic duals for a given two-input function. The logical

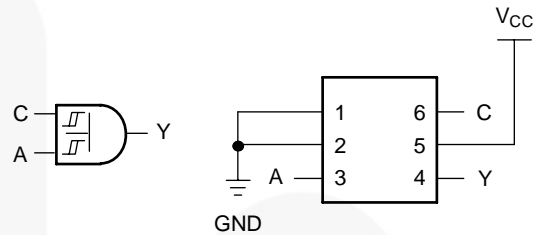
implementation is next to the board-level physical implementation of how the pins of the function should be connected.



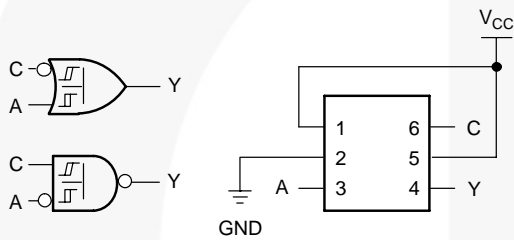
**Note:**

1. When C is L, Y=B.
2. When C is H, Y=A.

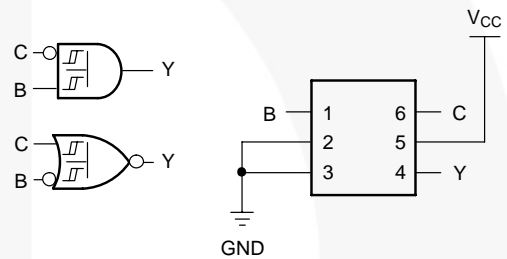
**Figure 3. 2-to-1 MUX**



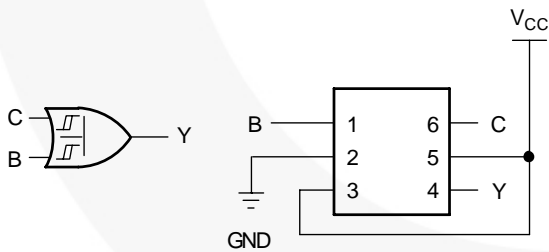
**Figure 4. 2-Input AND Gate**



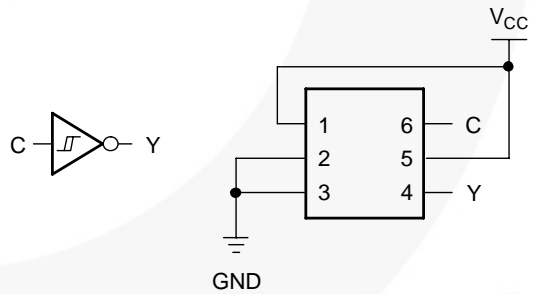
**Figure 5. Input OR Gate with One Inverted Input  
2-Input NAND Gate with One Inverted Input**



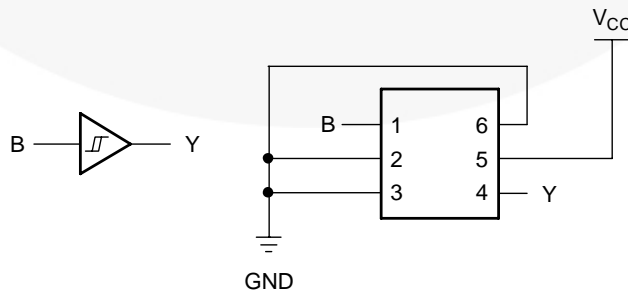
**Figure 6. 2-Input AND Gate with One Inverted Input  
2-Input NOR Gate with One Inverted Input**



**Figure 7. 2-Input OR Gate**



**Figure 8. Inverter**



**Figure 9. Buffer**

## 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 <sup>(3)</sup> | $V_{CC} + 0.5$ | V    |
|                       |  | $V_{CC}=0V$                      | 4.6            |      |
| $I_{IK}$              | DC Input Diode Current                       | $V_{IN} < 0V$                    | -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   |
| $I_o$                 | Continuous Output Current                    |                                  | ±20            | mA   |
| $I_{CC}$ or $I_{GND}$ | 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 10s     |                                  | +260           | °C   |
| $P_D$                 | Power Dissipation at +85°C                   | MicroPak-6                       | 130            | mW   |
|                       |  | MicroPak2-6                      | 120            |      |
| ESD                   | Human Body Model, JEDEC:JESD22-A114          |                                  | 5000+          | V    |
|                       | Charged Device Model, JEDEC:JESD22-C101      |                                  | 2000           |      |

### Note:

3.  $I_o$  absolute maximum rating must be observed.

## Recommended Operating Conditions<sup>(4)</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                       | Conditions              | Min. | Max.     | Unit |
|-----------------|---------------------------------|-------------------------|------|----------|------|
| $V_{CC}$        | Supply Voltage                  |                         | 2.3  | 3.6      | V    |
| $V_{IN}$        | Input Voltage                   |                         | 0    | 3.6      | V    |
| $V_{OUT}$       | Output Voltage                  | $V_{CC}=0V$             | 0    | 3.6      | V    |
|                 |                                 | HIGH or LOW State       | 0    | $V_{CC}$ |      |
| $I_{OH}/I_{OL}$ | Output Current                  | $V_{CC}=3.0V$ to $3.6V$ |      | ±4.0     | mA   |
|                 |                                 | $V_{CC}=2.3V$ to $2.7V$ |      | ±3.1     |      |
| $T_A$           | Operating Temperature, Free Air |                         | -40  | +85      | °C   |
| $\theta_{JA}$   | Thermal Resistance              | MicroPak-6              |      | 500      | °C/W |
|                 |                                 | MicroPak2-6             |      | 560      |      |

### Note:

4. 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>P</sub>         | Positive Threshold Voltage            | 2.3V to 2.7V                  |  | 0.60                  | 1.10  | 0.60                         | 1.10  | V     |
|                        |                                       | 3.0V to 3.6V                  |  | 0.75                  | 1.16  | 0.75                         | 1.19  |       |
| V <sub>N</sub>         | Negative Threshold Voltage            | 2.3V to 2.7V                  |  | 0.35                  | 0.60  | 0.35                         | 0.60  | V     |
|                        |                                       | 3.0V to 3.6V                  |  | 0.50                  | 0.85  | 0.50                         | 0.85  |       |
| V <sub>H</sub>         | Hysteresis Voltage                    | 2.3V to 2.7V                  |  | 0.23                  | 0.60  | 0.10                         | 0.60  | V     |
|                        |                                       | 3.0V to 3.6V                  |  | 0.25                  | 0.56  | 0.15                         | 0.56  |       |
| V <sub>OH</sub>        | HIGH Level Output Voltage             | 2.3V ≤ V <sub>CC</sub> ≤ 3.6V | I <sub>OH</sub> =-20μA   | V <sub>CC</sub> -0.1  |       | V <sub>CC</sub> -0.1         |       | V     |
|                        |                                       | 2.3V                          | I <sub>OH</sub> =-2.3mA  | 2.05                  |       | 1.97                         |       |       |
|                        |                                       |                               | I <sub>OH</sub> =-3.1mA  | 1.90                  |       | 1.85                         |       |       |
|                        |                                       | 3.0V                          | I <sub>OH</sub> =-2.7mA  | 2.72                  |       | 2.67                         |       |       |
| I <sub>OH</sub> =-4mA  | 2.60                                  |                               |  | 2.55                  |       |                              |       |       |
| V <sub>OL</sub>        | LOW Level Output Voltage              | 2.3V ≤ V <sub>CC</sub> ≤ 3.6V | I <sub>OL</sub> =20μA  |                       | 0.10  |                              | 0.10  | V     |
|                        |                                       | 2.3V                          | I <sub>OL</sub> =2.3mA   |                       | 0.31  |                              | 0.33  |       |
|                        |                                       |                               | I <sub>OL</sub> =3.1mA   |                       | 0.44  |                              | 0.45  |       |
|                        |                                       | 3.0V                          | I <sub>OL</sub> =2.7mA   |                       | 0.31  |                              | 0.33  |       |
| I <sub>OL</sub> =4.0mA |                                       |                               | 0.44   |                       | 0.45  |                              |       |       |
| I <sub>IN</sub>        | Input Leakage Current                 | 0V to 3.6V                    | 0 ≤ V <sub>IN</sub> ≤ 3.6  |                       | ±0.10 |                              | ±0.50 | μA    |
| I <sub>OFF</sub>       | Power Off Leakage Current             | 0V                            | 0 ≤ (V <sub>IN</sub> , V <sub>O</sub> ) ≤ 3.6                    |                       | 0.10  |                              | 0.50  | μA    |
| ΔI <sub>OFF</sub>      | Additional Power Off Leakage Current  | 0V to 0.2V                    | V <sub>IN</sub> or V <sub>O</sub> =0V to 3.6V                    |                       | 0.20  |                              | 0.60  | μA    |
| I <sub>CC</sub>        | Quiescent Supply Current              | 2.3V to 3.6V                  | V <sub>IN</sub> =V <sub>CC</sub> or GND                          |                       | 0.50  |                              | 0.90  | μA    |
|                        |                                       |                               | V <sub>CC</sub> ≤ V <sub>IN</sub> ≤ 3.6V                         |                       |       |                              | ±0.90 |       |
| ΔI <sub>CC</sub>       | Increase in I <sub>CC</sub> per Input | 2.3V to 2.7V                  | One Input at 0.3V or 1.1V, other Inputs at 0 or V <sub>CC</sub>  |                       |       |                              | 4     | μA    |
|                        |                                       | 3.0V to 3.6V                  | One Input at 0.45V or 1.2V, other Inputs at 0 or V <sub>CC</sub> |                       |       |                              | 12    |       |

### 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. | Typ.                         | Max. |       |                        |  |    |  |
| t <sub>PHL</sub> , t <sub>PLH</sub> | Propagation Delay | 2.30V ≤ V <sub>CC</sub> ≤ 2.70V, V <sub>IN</sub> =1.65V to 1.95V | C <sub>L</sub> =5pF, R <sub>L</sub> =1MΩ  | 1.1                             | 3.7  | 5.5  | 1.1                          | 6.8  | ns    | Figure 10<br>Figure 11 |  |    |  |
|                                     |                   | 2.30V ≤ V <sub>CC</sub> ≤ 2.70V, V <sub>IN</sub> =2.30V to 2.70V |   | 1.1                             | 3.8  | 6.5  | 1.1                          | 7.0  |       |                        |  |    |  |
|                                     |                   | 2.30V ≤ V <sub>CC</sub> ≤ 2.70V, V <sub>IN</sub> =3.0V to 3.60V  |   | 1.1                             | 3.9  | 6.0  | 1.1                          | 6.5  |       |                        |  |    |  |
|                                     |                   | 3.00V ≤ V <sub>CC</sub> ≤ 3.60V, V <sub>IN</sub> =1.65V to 1.95V |   | 1.0                             | 3.3  | 4.9  | 1.0                          | 8.0  |       |                        |  |    |  |
|                                     |                   | 3.00V ≤ V <sub>CC</sub> ≤ 3.60V, V <sub>IN</sub> =2.30V to 2.70V |   | 1.0                             | 3.2  | 4.6  | 1.0                          | 5.8  |       |                        |  |    |  |
|                                     |                   | 3.00V ≤ V <sub>CC</sub> ≤ 3.60V, V <sub>IN</sub> =3.00V to 3.60V |   | 1.0                             | 3.1  | 4.7  | 1.0                          | 5.5  |       |                        |  |    |  |
|                                     |                   | 2.30V ≤ V <sub>CC</sub> ≤ 2.70V, V <sub>IN</sub> =1.65V to 1.95V | C <sub>L</sub> =10pF, R <sub>L</sub> =1MΩ | 1.3                             | 4.1  | 6.5  | 1.0                          | 7.9  |       |                        |  |    |  |
|                                     |                   | 2.30V ≤ V <sub>CC</sub> ≤ 2.70V, V <sub>IN</sub> =2.30V to 2.70V |   | 1.3                             | 4.0  | 6.2  | 1.0                          | 7.1  |       |                        |  |    |  |
|                                     |                   | 2.30V ≤ V <sub>CC</sub> ≤ 2.70V, V <sub>IN</sub> =3.0V to 3.60V  |   | 1.3                             | 3.7  | 5.7  | 1.0                          | 6.5  |       |                        |  |    |  |
|                                     |                   | 3.00V ≤ V <sub>CC</sub> ≤ 3.60V, V <sub>IN</sub> =1.65V to 1.95V |   | 1.3                             | 3.5  | 5.6  | 1.0                          | 8.5  |       |                        |  |    |  |
|                                     |                   | 3.00V ≤ V <sub>CC</sub> ≤ 3.60V, V <sub>IN</sub> =2.30V to 2.70V |   | 1.3                             | 3.4  | 5.3  | 1.0                          | 6.1  |       |                        |  |    |  |
|                                     |                   | 3.00V ≤ V <sub>CC</sub> ≤ 3.60V, V <sub>IN</sub> =3.00V to 3.60V |   | 1.3                             | 3.3  | 5.2  | 1.0                          | 5.9  |       |                        |  |    |  |
|                                     |                   | 2.30V ≤ V <sub>CC</sub> ≤ 2.70V, V <sub>IN</sub> =1.65V to 1.95V | C <sub>L</sub> =15pF, R <sub>L</sub> =1MΩ | 1.5                             | 4.6  | 6.9  | 1.0                          | 8.7  |       |                        |  |    |  |
|                                     |                   | 2.30V ≤ V <sub>CC</sub> ≤ 2.70V, V <sub>IN</sub> =2.30V to 2.70V |   | 1.5                             | 4.4  | 6.8  | 1.0                          | 7.9  |       |                        |  |    |  |
|                                     |                   | 2.30V ≤ V <sub>CC</sub> ≤ 2.70V, V <sub>IN</sub> =3.0V to 3.60V  |   | 1.5                             | 4.2  | 6.3  | 1.0                          | 7.4  |       |                        |  |    |  |
|                                     |                   | 3.00V ≤ V <sub>CC</sub> ≤ 3.60V, V <sub>IN</sub> =1.65V to 1.95V |   | 1.3                             | 3.9  | 6.2  | 1.0                          | 9.1  |       |                        |  |    |  |
|                                     |                   | 3.00V ≤ V <sub>CC</sub> ≤ 3.60V, V <sub>IN</sub> =2.30V to 2.70V |   | 1.3                             | 3.8  | 5.6  | 1.0                          | 6.8  |       |                        |  |    |  |
|                                     |                   | 3.00V ≤ V <sub>CC</sub> ≤ 3.60V, V <sub>IN</sub> =3.00V to 3.60V |   | 1.3                             | 3.8  | 5.6  | 1.0                          | 6.2  |       |                        |  |    |  |
|                                     |                   | 2.30V ≤ V <sub>CC</sub> ≤ 2.70V, V <sub>IN</sub> =1.65V to 1.95V | C <sub>L</sub> =30pF, R <sub>L</sub> =1MΩ | 1.3                             | 4.2  | 7.9  | 1.3                          | 8.5  |       |                        |  |    |  |
|                                     |                   | 2.30V ≤ V <sub>CC</sub> ≤ 2.70V, V <sub>IN</sub> =2.30V to 2.70V |   | 1.3                             | 3.9  | 7.9  | 1.3                          | 8.5  |       |                        |  |    |  |
|                                     |                   | 2.30V ≤ V <sub>CC</sub> ≤ 2.70V, V <sub>IN</sub> =3.0V to 3.60V  |   | 1.0                             | 3.7  | 7.3  | 1.0                          | 8.9  |       |                        |  |    |  |
|                                     |                   | 3.00V ≤ V <sub>CC</sub> ≤ 3.60V, V <sub>IN</sub> =1.65V to 1.95V |   | 1.3                             | 3.5  | 6.1  | 1.3                          | 7.9  |       |                        |  |    |  |
|                                     |                   | 3.00V ≤ V <sub>CC</sub> ≤ 3.60V, V <sub>IN</sub> =2.30V to 2.70V |   | 1.1                             | 3.0  | 5.9  | 1.1                          | 6.8  |       |                        |  |    |  |
|                                     |                   | 3.00V ≤ V <sub>CC</sub> ≤ 3.60V, V <sub>IN</sub> =3.00V to 3.60V |   | 1.0                             | 2.7  | 5.7  | 1.0                          | 6.5  |       |                        |  |    |  |
|                                     |                   | C <sub>IN</sub>  | Input Capacitance                         | 0                               |      | 2.1  |                              |      |       |                        |  | pF |  |
|                                     |                   | C <sub>OUT</sub>   | Output Capacitance                        | 0                               |      | 3.0  |                              |      |       |                        |  | pF |  |
|                                     |                   | C <sub>PD</sub>  | Power Dissipation Capacitance             | 2.30V ≤ V <sub>CC</sub> ≤ 2.70V |      | 2.0  |                              |      |       |                        |  | pF |  |
|                                     |                   |  |   | 3.00V ≤ V <sub>CC</sub> ≤ 3.60V |      | 2.7  |                              |      |       |                        |  |    |  |

## AC Loadings and Waveforms

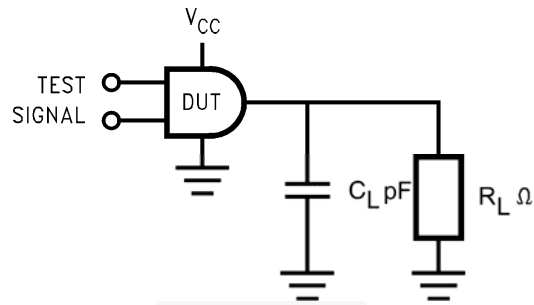


Figure 10. AC Test Circuit

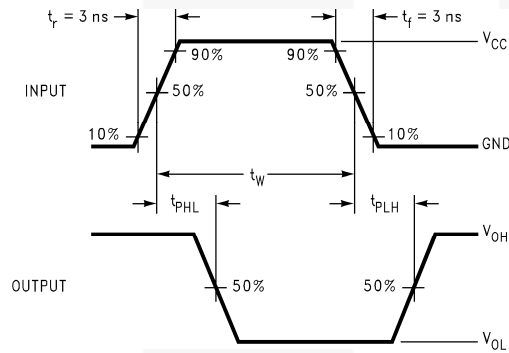
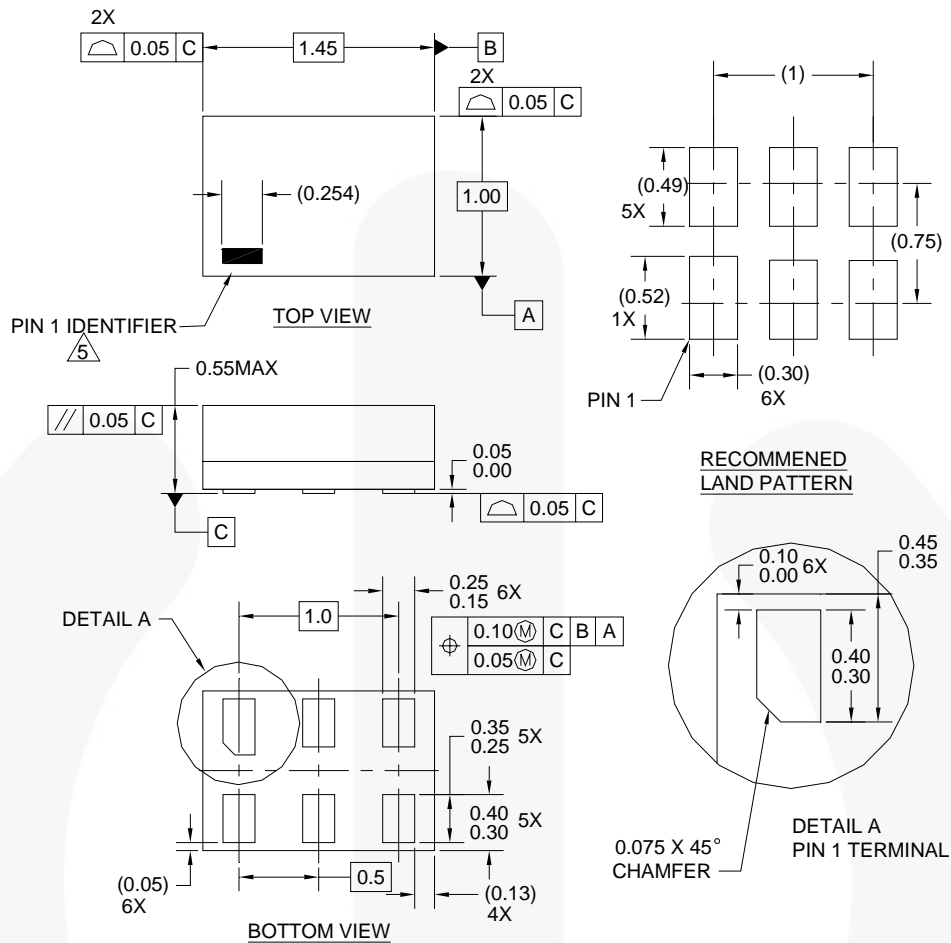


Figure 11. AC Waveforms

| Symbol   | $V_{CC}$        |                 |
|----------|-----------------|-----------------|
|          | $3.3V \pm 0.3V$ | $2.5V \pm 0.2V$ |
| $V_{mi}$ | $V_{IN}/2$      | $V_{IN}/2$      |
| $V_{mo}$ | $V_{CC}/2$      | $V_{CC}/2$      |



## 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 12. 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.

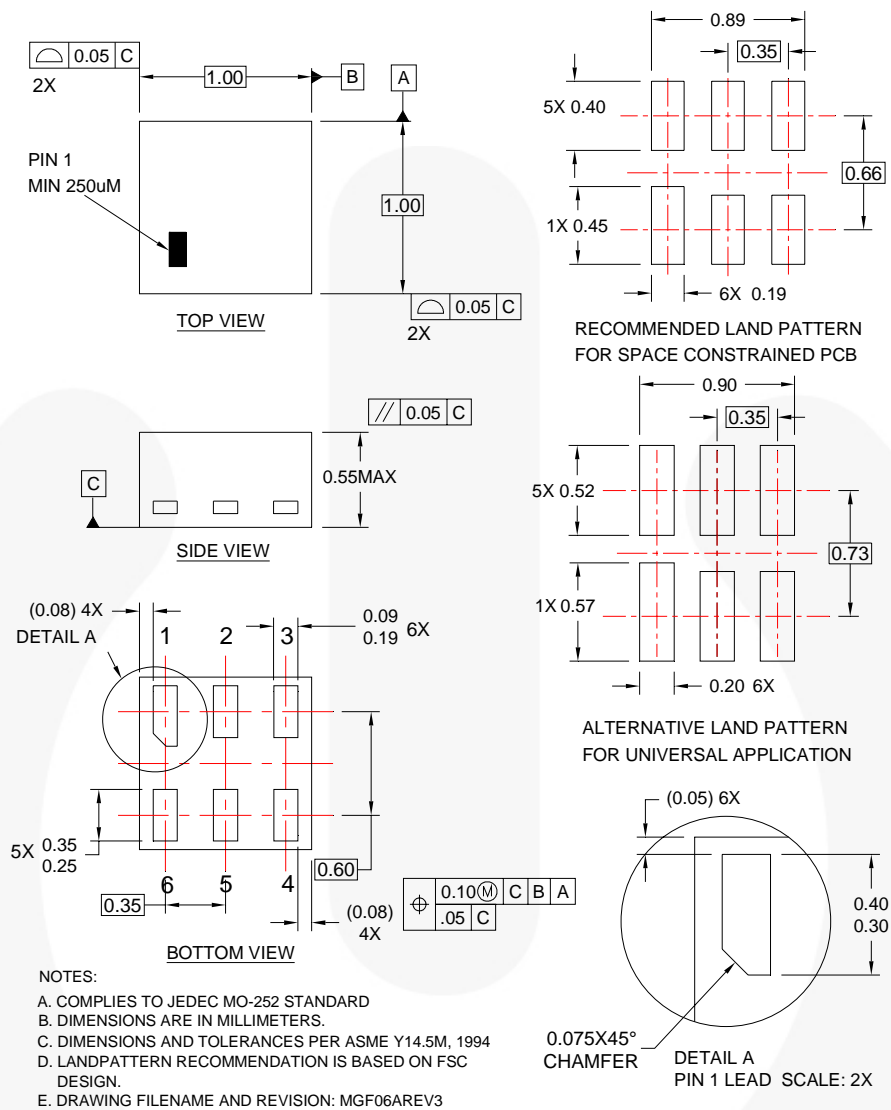
Always visit Fairchild Semiconductor's online packaging area for the most recent package drawings:  
<http://www.fairchildsemi.com/packaging/>.

## 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 13. 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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<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/packaging/MicroPAK2\\_6L\\_tr.pdf](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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|--------------------------|-----------------------|---|
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