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74AUP1G58

TinyLogic® Low Power Universal Configurable Two-Input Logic Gate

Features

- 0.8V to 3.6V V_{CC} Supply Operation
- 3.6V Over-Voltage Tolerant I/Os at V_{CC} from 0.8V to 3.6V
- High Speed t_{PD}
 - 3.1ns: Typical at 3.3V
- Power-Off High-Impedance Inputs and Outputs
- Low Static Power Consumption
 - I_{CC} =0.9 μ A Maximum
- Low Dynamic Power Consumption
 - C_{PD} =2.9pF Typical at 3.3V
- Ultra-Small MicroPak™ Packages

Description

The 74AUP1G58 is a universal configurable 2-input logic gate that provides a high performance and low power solution ideal for battery-powered portable applications. This product is designed for a wide low voltage operating range (0.8V to 3.6V) and guarantees very low static and dynamic power consumption across the entire voltage range. All inputs are implemented with hysteresis to allow for slower transition input signals and better switching noise immunity.

The 74AUP1G58 provides for multiple functions as determined by various configurations of the three inputs. The potential logic functions provided are AND, OR, NOR, NAND, and XNOR, inverter and non-inverter. Refer to Figures 2 to 8.

Ordering Information

| Part Number | Top Mark | Package | Packing Method |
|--------------|----------|---|---------------------------|
| 74AUP1G58L6X | AC | 6-Lead MicroPak™, 1.0mm Wide | 5000 Units on Tape & Reel |
| 74AUP1G58FHX | AC | 6-Lead, MicroPak2™, 1x1mm Body, .35mm Pitch | 5000 Units on Tape & Reel |

Pin Configurations

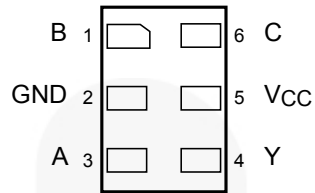


Figure 1. MicroPak™ (Top Through View)

Pin Definitions

| Pin # | Name | Description |
|-------|-----------------|----------------|
| 1 | B | Data Input |
| 2 | GND | Ground |
| 3 | A | Data Input |
| 4 | Y | Output |
| 5 | V _{CC} | Supply Voltage |
| 6 | C | Data Input |

Function Table

| Inputs | | | 74AUP1G58 |
|--------|---|---|-----------|
| C | B | A | Y=Output |
| L | L | L | L |
| L | L | H | H |
| L | H | L | L |
| L | H | H | H |
| H | L | L | H |
| H | L | H | H |
| H | H | L | L |
| H | H | H | L |

H = HIGH Logic Level

L = LOW Logic Level

Function Selection Table

| 2-Input Logic Function | Connection Configuration |
|--|--------------------------|
| 2-Input AND with Inverted Input | Figure 3, Figure 4 |
| 2-Input NAND | Figure 2 |
| 2-Input NAND with Both Inputs Inverted | Figure 5 |
| 2-Input OR | Figure 5 |
| 2-Input OR with Both Inputs Inverted | Figure 2 |
| 2-Input NOR with Inverted Inputs | Figure 3, Figure 4 |
| 2-Input XOR | Figure 6 |
| Inverter | Figure 7 |
| Buffer | Figure 8 |

74AUP1G58 Logic Configurations

Figure 2 through Figure 8 show the logical functions that can be implemented using the 74AUP1G58. 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.

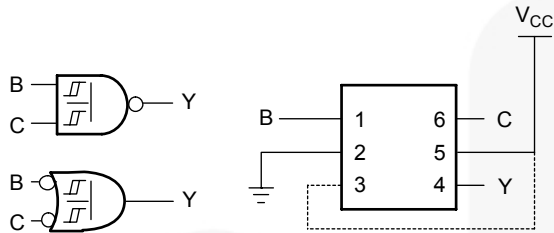


Figure 2. 2-Input NAND Gate or 2-Input OR with Both Inputs Inverted

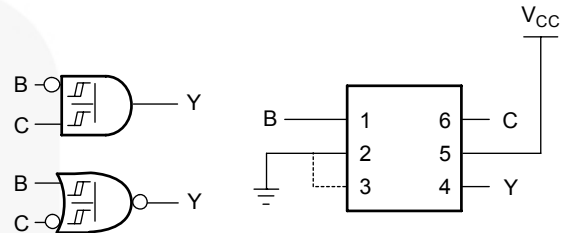


Figure 3. 2-Input AND with Inverted B Input or 2-Input NOR Gate with Inverted C Input

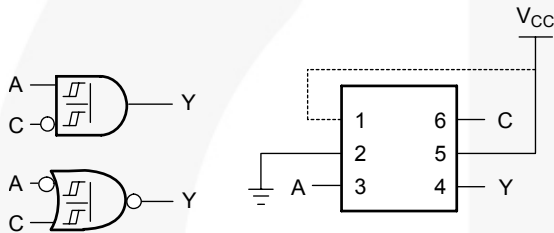


Figure 4. 2-Input AND with Inverted C Input or 2-Input NOR Gate with Inverted A Input

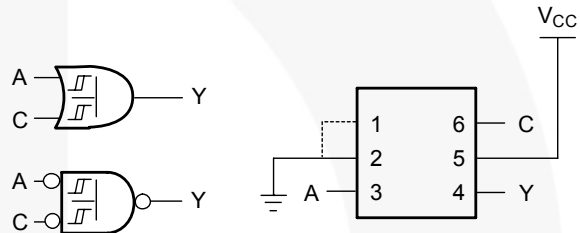


Figure 5. 2-Input OR Gate or 2-Input NAND Gate with Both Inputs Inverted

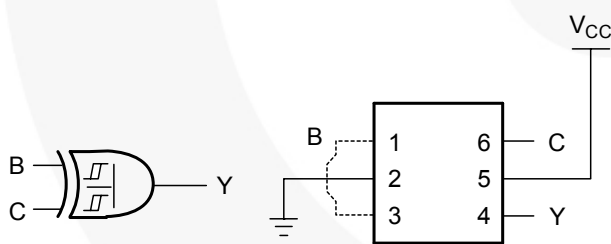


Figure 6. 2-Input XOR Gate

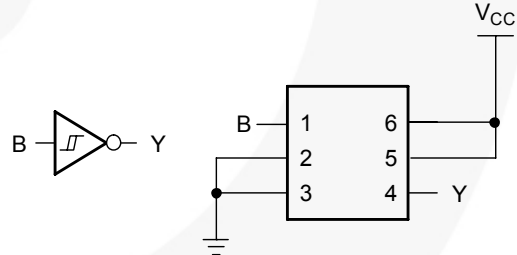


Figure 7. Inverter

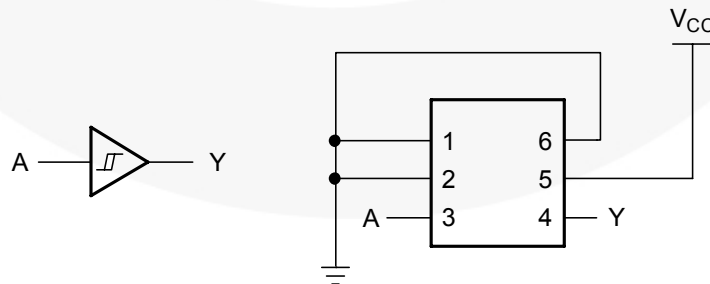


Figure 8. Buffer

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 ⁽¹⁾ | $V_{CC} + 0.5$ | 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_{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:

- I_O absolute maximum rating must be observed.

Recommended Operating Conditions⁽²⁾

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 | | 0.8 | 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 | |
| | | $V_{CC}=1.65V$ to 1.95V | | ±1.9 | |
| | | $V_{CC}=1.4V$ to 1.6V | | ±1.7 | |
| | | $V_{CC}=1.1V$ to 1.3V | | ±1.1 | |
| | | $V_{CC}=0.8V$ | | ±20.0 | µA |
| T_A | Operating Temperature, Free Air | | -40 | +85 | °C |
| θ_{JA} | Thermal Resistance | MicroPak-6 | | 500 | °C/W |
| | | MicroPak2-6 | | 560 | |

Note:

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

DC Electrical Characteristics

| Symbol | Parameter | V _{CC} | Conditions | T _A =+25°C | | T _A =-40 to +85°C | | Units |
|-------------------|---------------------------------------|-------------------------------|--|------------------------|------------------------|------------------------------|------------------------|-------|
| | | | | Min. | Max. | Min. | Max. | |
| V _P | Positive Threshold Voltage | 0.80 | | 0.30 | 0.60 | 0.30 | 0.60 | V |
| | | 1.10 | | 0.53 | 0.90 | 0.53 | 0.90 | |
| | | 1.40 | | 0.74 | 1.11 | 0.74 | 1.11 | |
| | | 1.65 | | 0.91 | 1.29 | 0.91 | 1.29 | |
| | | 2.30 | | 1.37 | 1.77 | 1.37 | 1.77 | |
| | | 3.00 | | 1.88 | 2.29 | 1.88 | 2.29 | |
| V _N | Negative Threshold Voltage | 0.80 | | 0.10 | 0.60 | 0.10 | 0.60 | V |
| | | 1.10 | | 0.26 | 0.65 | 0.26 | 0.65 | |
| | | 1.40 | | 0.39 | 0.75 | 0.39 | 0.75 | |
| | | 1.65 | | 0.47 | 0.84 | 0.47 | 0.84 | |
| | | 2.30 | | 0.69 | 1.04 | 0.69 | 1.04 | |
| | | 3.00 | | 0.88 | 1.24 | 0.88 | 1.24 | |
| V _H | Hysteresis Voltage | 0.80 | | 0.07 | 0.50 | 0.07 | 0.50 | V |
| | | 1.10 | | 0.08 | 0.46 | 0.08 | 0.46 | |
| | | 1.40 | | 0.18 | 0.56 | 0.18 | 0.56 | |
| | | 1.65 | | 0.27 | 0.66 | 0.27 | 0.66 | |
| | | 2.30 | | 0.53 | 0.92 | 0.53 | 0.92 | |
| | | 3.00 | | 0.79 | 1.31 | 0.79 | 1.31 | |
| V _{OH} | HIGH Level Output Voltage | 0.80 ≤ V _{CC} ≤ 3.60 | I _{OH} =-20μA | V _{CC} -0.1 | | V _{CC} -0.1 | | V |
| | | 1.10 ≤ V _{CC} ≤ 1.30 | I _{OH} =-1.1mA | 0.75 x V _{CC} | | 0.70 x V _{CC} | | |
| | | 1.40 ≤ V _{CC} ≤ 1.60 | I _{OH} =-1.7mA | 1.11 | | 1.03 | | |
| | | 1.65 ≤ V _{CC} ≤ 1.95 | I _{OH} =-1.9mA | 1.32 | | 1.30 | | |
| | | 2.30 ≤ V _{CC} ≤ 2.70 | I _{OH} =-2.3mA | 2.05 | | 1.97 | | |
| | | | I _{OH} =-3.1mA | 1.90 | | 1.85 | | |
| | | 3.00 ≤ V _{CC} ≤ 3.60 | I _{OH} =-2.7mA | 2.72 | | 2.67 | | |
| | | | I _{OH} =-4.0mA | 2.60 | | 2.55 | | |
| V _{OL} | LOW Level Output Voltage | 0.80 ≤ V _{CC} ≤ 3.60 | I _{OL} =20μA | | 0.10 | | 0.10 | V |
| | | 1.10 ≤ V _{CC} ≤ 1.30 | I _{OL} =1.1mA | | 0.30 x V _{CC} | | 0.30 x V _{CC} | |
| | | 1.40 ≤ V _{CC} ≤ 1.60 | I _{OL} =1.7mA | | 0.31 | | 0.37 | |
| | | 1.65 ≤ V _{CC} ≤ 1.95 | I _{OL} =1.9mA | | 0.31 | | 0.35 | |
| | | 2.30 ≤ V _{CC} ≤ 2.70 | I _{OL} =2.3mA | | 0.31 | | 0.33 | |
| | | | I _{OL} =3.1mA | | 0.44 | | 0.45 | |
| | | 2.70 ≤ V _{CC} ≤ 3.60 | I _{OL} =2.7mA | | 0.31 | | 0.33 | |
| | | | I _{OL} =4.0mA | | 0.44 | | 0.45 | |
| I _{IN} | Input Leakage Current | 0V to 3.6V | 0 ≤ V _{IN} ≤ 3.6 | | ±0.1 | | ±0.5 | μA |
| I _{OFF} | Power Off Leakage Current | 0V | 0 ≤ (V _{IN} , V _O) ≤ 3.6 | | 0.2 | | 0.6 | μA |
| ΔI _{OFF} | Additional Power Off Leakage Current | 0V to 0.2V | V _{IN} or V _O = 0V to 3.6V | | 0.2 | | 0.6 | μA |
| I _{CC} | Quiescent Supply Current | 0.8V to 3.6V | V _{IN} - V _{CC} or GND | | 0.5 | | 0.9 | μA |
| | | | V _{CC} ≤ V _{IN} ≤ 3.6 | | | | ±0.9 | |
| ΔI _{CC} | Increase in I _{CC} per Input | 3.3V | V _{IN} = V _{CC} -0.6V | | 40.0 | | 50.0 | μA |

AC Electrical Characteristics

| Symbol | Parameter | V _{CC} | Conditions | T _A =+25°C | | | T _A =-40 to +85°C | | Units | Figure | |
|-------------------------------------|-------------------------------|-------------------------------|---|-----------------------|------|------|------------------------------|------|-------|-----------------------|--|
| | | | | Min. | Typ. | Max | Min | Max | | | |
| t _{PHL} , t _{PLH} | Propagation Delay | 0.80 | C _L =5pF, R _L =1MΩ | | 22.8 | | | | ns | Figure 9 Figure 10 | |
| | | 1.10 ≤ V _{CC} ≤ 1.30 | | 2.8 | 8.9 | 12.9 | 2.6 | 13.1 | | | |
| | | 1.40 ≤ V _{CC} ≤ 1.60 | | 2.4 | 5.2 | 7.9 | 2.4 | 8.6 | | | |
| | | 1.65 ≤ V _{CC} ≤ 1.95 | | 2.0 | 4.4 | 6.5 | 2.0 | 7.2 | | | |
| | | 2.30 ≤ V _{CC} ≤ 2.70 | | 1.7 | 3.6 | 4.9 | 1.8 | 5.2 | | | |
| | | 3.00 ≤ V _{CC} ≤ 3.60 | | 1.3 | 3.1 | 4.2 | 1.6 | 4.7 | | | |
| | | 0.80 | C _L =10pF, R _L =1MΩ | | 26.4 | | | | | | |
| | | 1.10 ≤ V _{CC} ≤ 1.30 | | 3.2 | 7.4 | 14.5 | 3.0 | 14.9 | | | |
| | | 1.40 ≤ V _{CC} ≤ 1.60 | | 2.7 | 5.4 | 8.7 | 2.7 | 9.4 | | | |
| | | 1.65 ≤ V _{CC} ≤ 1.95 | | 2.3 | 4.5 | 7.1 | 2.3 | 7.9 | | | |
| | | 2.30 ≤ V _{CC} ≤ 2.70 | | 1.9 | 3.8 | 5.3 | 1.9 | 5.9 | | | |
| | | 3.00 ≤ V _{CC} ≤ 3.60 | 1.3 | 3.5 | 4.6 | 1.3 | 4.9 | | | | |
| | | 0.80 | C _L =15pF, R _L =1MΩ | | 29.9 | | | | | | |
| | | 1.10 ≤ V _{CC} ≤ 1.30 | | 3.6 | 9.9 | 16.1 | 3.3 | 16.7 | | | |
| | | 1.40 ≤ V _{CC} ≤ 1.60 | | 3.0 | 6.5 | 9.7 | 3.0 | 10.5 | | | |
| | | 1.65 ≤ V _{CC} ≤ 1.95 | | 2.8 | 5.2 | 7.9 | 2.5 | 8.7 | | | |
| | | 2.30 ≤ V _{CC} ≤ 2.70 | | 2.3 | 4.1 | 5.9 | 2.3 | 6.6 | | | |
| | | 3.00 ≤ V _{CC} ≤ 3.60 | 1.3 | 3.5 | 5.2 | 1.3 | 5.5 | | | | |
| | | 0.80 | C _L =30pF, R _L =1MΩ | | 28.8 | | | 31.4 | | | |
| | | 1.10 ≤ V _{CC} ≤ 1.30 | | 3.4 | 9.1 | 18.5 | 3.4 | 19.0 | | | |
| 1.40 ≤ V _{CC} ≤ 1.60 | 3.1 | 5.5 | | 10.5 | 3.1 | 11.0 | | | | | |
| 1.65 ≤ V _{CC} ≤ 1.95 | 2.1 | 4.4 | | 8.7 | 2.1 | 9.5 | | | | | |
| 2.30 ≤ V _{CC} ≤ 2.70 | 1.7 | 3.6 | | 6.5 | 1.7 | 7.1 | | | | | |
| 3.00 ≤ V _{CC} ≤ 3.60 | 1.3 | 3.1 | 5.6 | 1.3 | 6.3 | | | | | | |
| C _{IN} | Input Capacitance | 0 | | 0.8 | | | | pF | | | |
| C _{OUT} | Output Capacitance | 0 | | 1.7 | | | | pF | | | |
| C _{PD} | Power Dissipation Capacitance | 0.80 | V _{IN} =0V or V _{CC} , f=10MHz | | 1.8 | | | | pF | | |
| | | 1.10 ≤ V _{CC} ≤ 1.30 | | | 1.82 | | | | | | |
| | | 1.40 ≤ V _{CC} ≤ 1.60 | | | 1.85 | | | | | | |
| | | 1.65 ≤ V _{CC} ≤ 1.95 | | | 1.9 | | | | | | |
| | | 2.30 ≤ V _{CC} ≤ 2.70 | | | 2.1 | | | | | | |
| | | 3.00 ≤ V _{CC} ≤ 3.60 | | | 2.9 | | | | | | |

AC Loadings and Waveforms

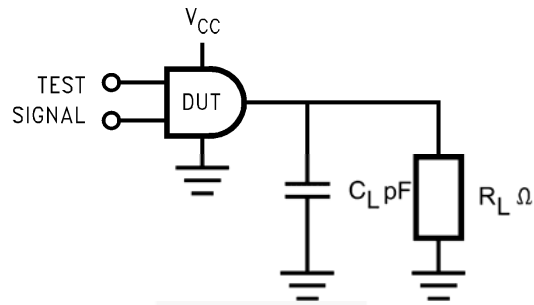


Figure 9. AC Test Circuit

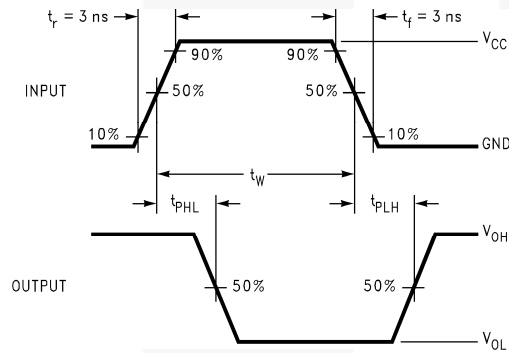


Figure 10. AC Waveforms

| Symbol | V_{CC} | | | | | |
|----------|-----------------|-----------------|------------------|------------------|------------------|------------|
| | $3.3V \pm 0.3V$ | $2.5V \pm 0.2V$ | $1.8V \pm 0.15V$ | $1.5V \pm 0.10V$ | $1.2V \pm 0.10V$ | $0.8V$ |
| V_{mi} | $V_{CC}/2$ | $V_{CC}/2$ | $V_{CC}/2$ | $V_{CC}/2$ | $V_{CC}/2$ | $V_{CC}/2$ |
| V_{mo} | $V_{CC}/2$ | $V_{CC}/2$ | $V_{CC}/2$ | $V_{CC}/2$ | $V_{CC}/2$ | $V_{CC}/2$ |

Physical Dimensions

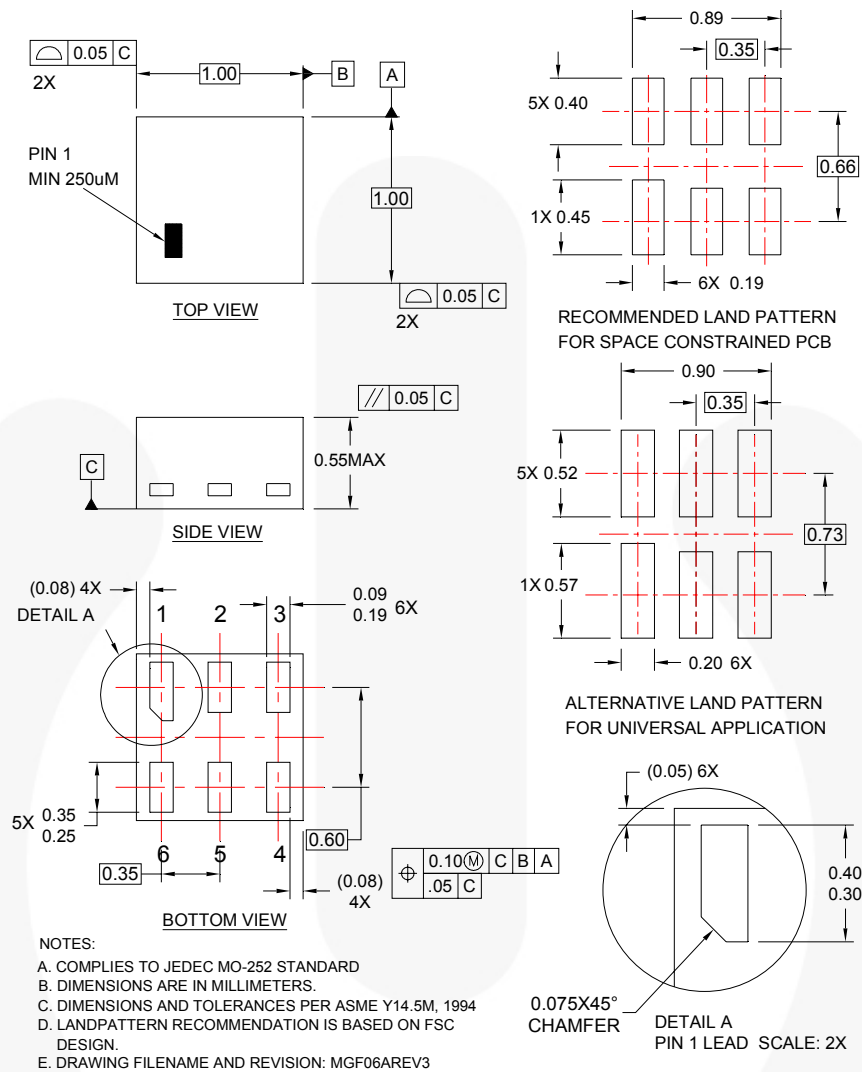


Figure 12. 6-Lead, MicroPak2™, 1x1mm Body, .35mm Pitch

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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/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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| Datasheet Identification | Product Status | Definition |
|--------------------------|-----------------------|---|
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