



74AUP1G56

TinyLogic® Low Power Universal Configurable Two-Input Logic Gate (Open Drain Output)

Features

- 0.8 V to 3.6 V V_{CC} Supply Operation
- 3.6 V Over-Voltage Tolerant I/Os at V_{CC} from 0.8V to 3.6 V
- Extremely High Speed t_{PD}
 - 3.2 ns: Typical at 3.3 V
- Power-Off High-Impedance Inputs and Outputs
- Low Static Power Consumption
 - I_{CC} =0.9 μ A Maximum
- Low Dynamic Power Consumption
 - C_{PD} =3.0 pF Typical at 3.3 V
- Ultra-Small MicroPak™ Packages

Description

The 74AUP1G56 is a universal, configurable, two-input logic gate with an open drain that provides a high-performance and low-power solution for battery-powered portable applications. This product is designed for a wide low-voltage operating range (0.8 V to 3.6 V) 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 74AUP1G56 provides for multiple functions, as determined by various configurations of the three inputs. The potential logic functions provided are AND, NAND, OR, NOR, XNOR, inverter, and buffer (see Figure 2 through Figure 8).

Ordering Information

| Part Number | Top Mark | Package | Packing Method |
|--------------|----------|---|---------------------------|
| 74AUP1G56L6X | AK | 6-Lead, MicroPak™, 1.0 mm Wide | 5000 Units on Tape & Reel |
| 74AUP1G56FHX | AK | 6-Lead, MicroPak2™, 1x1 mm Body, .35 mm Pitch | 5000 Units on Tape & Reel |

Pin Configuration

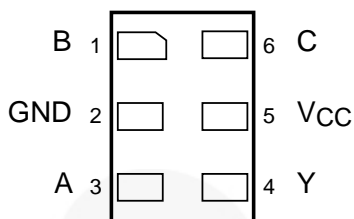


Figure 1. MicroPak™ (Top Through View)

Pin Definitions

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

Function Table

| Inputs | | | Y=Output |
|--------|---|---|------------------|
| C | B | A | |
| L | L | L | H ⁽¹⁾ |
| L | L | H | L |
| L | H | L | H ⁽¹⁾ |
| L | H | H | L |
| H | L | L | L |
| H | L | H | L |
| H | H | L | H ⁽¹⁾ |
| H | H | H | H ⁽¹⁾ |

H = HIGH Logic Level

L = LOW Logic Level

Note:

1. High impedance output state, open drain.

Function Selection Table

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

Logic Configurations

Figure 2 through Figure 8 show the logical functions that can be implemented using the 74AUP1G56. 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 should be connected.

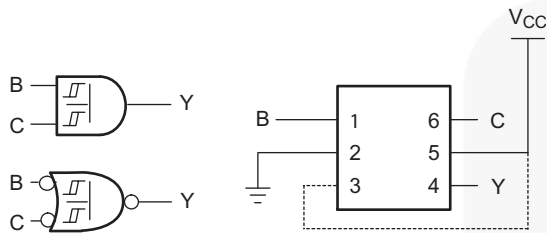


Figure 2. 2-Input AND Gate or 2-Input NOR with Both Inputs Inverted

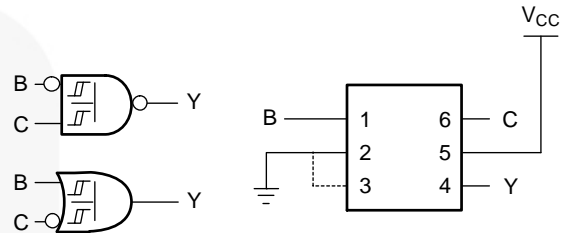


Figure 3. 2-Input NAND with Inverted B Input or 2-Input OR Gate with Inverted C Input

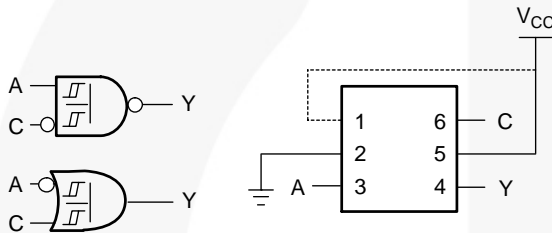


Figure 4. 2-Input NAND with Inverted C Input or 2-Input OR Gate with Inverted A Input

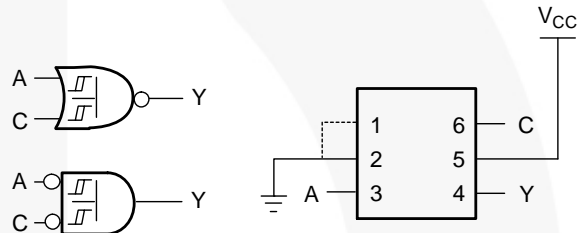


Figure 5. 2-Input NOR Gate or 2-Input AND Gate with Both Inputs Inverted

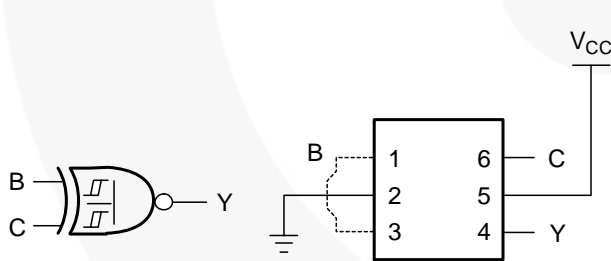


Figure 6. 2-Input XNOR Gate

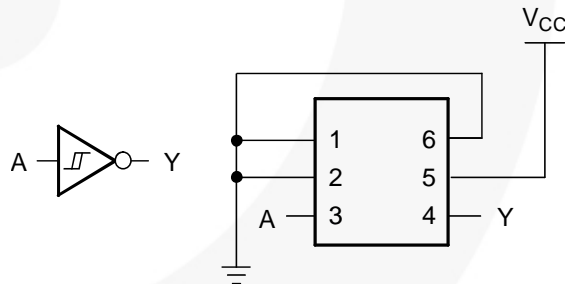


Figure 7. Inverter

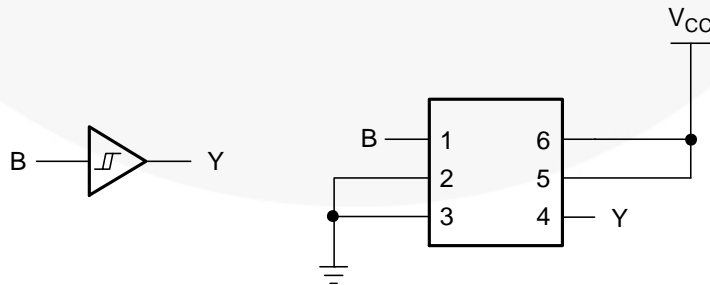


Figure 8. Non-Inverter Buffer

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 ⁽²⁾ | | -0.5 | 4.6 | V |
| I_{IK} | DC Input Diode Current | $V_{IN} < 0V$ | | -50 | mA |
| I_{OK} | DC Output Diode Current | $V_{OUT} < 0V$ | | -50 | mA |
| I_{OL} | DC Output 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 | | | 4000 | V |
| | Charged Device Model, JEDEC:JESD22-C101 | | | 2000 | |

Note:

- I_O absolute maximum rating must be observed.

Recommended Operating Conditions⁽³⁾

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 | Condition | Min. | Max. | Unit |
|---------------|---------------------------------|-----------------------------|------|------|------|
| V_{CC} | Supply Voltage | | 0.8 | 3.6 | V |
| V_{IN} | Input Voltage | | 0 | 3.6 | V |
| V_{OUT} | Output Voltage | $V_{CC}=0 V$ | 0 | 3.6 | V |
| I_{OL} | Output Current | $V_{CC}=3.0 V$ to $3.6 V$ | | 4.0 | mA |
| | | $V_{CC}=2.3 V$ to $2.7 V$ | | 3.1 | |
| | | $V_{CC}=1.65 V$ to $1.95 V$ | | 1.9 | |
| | | $V_{CC}=1.4 V$ to $1.6 V$ | | 1.7 | |
| | | $V_{CC}=1.1 V$ to $1.3 V$ | | 1.1 | |
| | | $V_{CC}=0.8 V$ | | 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.

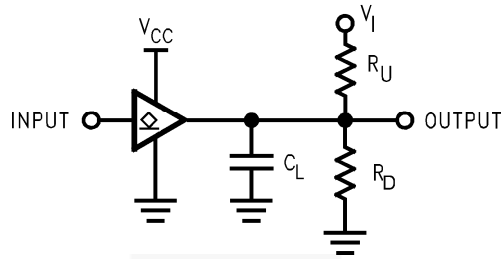
DC Electrical Characteristics

| Symbol | Parameter | V _{CC} | Condition | T _A =25°C | | T _A =-40 to 85°C | | Unit |
|-------------------|---------------------------------------|-------------------------------|--|----------------------|------------------------|-----------------------------|------------------------|------|
| | | | | 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 _{OL} | LOW Level Output Voltage | 0.80 ≤ V _{CC} ≤ 3.60 | I _{OL} =20 μA | | 0.10 | | 0.10 | V |
| | | 1.10 ≤ V _{CC} ≤ 1.30 | I _{OL} =1.1 mA | | 0.30 x V _{CC} | | 0.30 x V _{CC} | |
| | | 1.40 ≤ V _{CC} ≤ 1.60 | I _{OL} =1.7 mA | | 0.31 | | 0.37 | |
| | | 1.65 ≤ V _{CC} ≤ 1.95 | I _{OL} =1.9 mA | | 0.31 | | 0.35 | |
| | | 2.30 ≤ V _{CC} ≤ 2.70 | I _{OL} =3.1 mA | | 0.44 | | 0.45 | |
| | | 2.70 ≤ V _{CC} ≤ 3.60 | I _{OL} =4.0 mA | | 0.44 | | 0.45 | |
| I _{IN} | Input Leakage Current | 0 V to 3.6 V | 0 ≤ V _{IN} ≤ 3.6 V | | ±0.1 | | ±0.5 | μA |
| I _{OFF} | Power Off Leakage Current | 0 V | 0 ≤ (V _{IN} , V _O) ≤ 3.6 V | | 0.2 | | 0.6 | μA |
| ΔI _{OFF} | Additional Power Off Leakage Current | 0V to 0.2 V | V _{IN} or V _O = 0 V to 3.6 V | | 0.2 | | 0.6 | μA |
| I _{CC} | Quiescent Supply Current | 0.8V to 3.6 V | V _{IN} - V _{CC} or GND | | 0.5 | | 0.9 | μA |
| | | | V _{CC} ≤ V _{IN} ≤ 3.6 V | | | | ±0.9 | |
| ΔI _{CC} | Increase in I _{CC} per Input | 3.3 V | V _{IN} =V _{CC} -0.6 V | | 40.0 | | 50.0 | μA |

AC Electrical Characteristics

| Symbol | Parameter | V _{CC} | Condition | T _A =25°C | | | T _A =-40 to 85°C | | Unit |
|-------------------------------------|-------------------------------|-------------------------------|---|----------------------|------|------|-----------------------------|------|------|
| | | | | Min. | Typ. | Max. | Min. | Max. | |
| t _{PZL} , t _{PLZ} | Propagation Delay | 0.80 | C _L =15 pF, R _U =R _D =5 KΩ V _I = 2 × (V _{CC}) (see Figure 9) | | 30 | | | | ns |
| | | 1.10 ≤ V _{CC} ≤ 1.30 | | 1.0 | 10.1 | 18.9 | 1.0 | 19.9 | |
| | | 1.40 ≤ V _{CC} ≤ 1.60 | | 1.0 | 6.6 | 11.4 | 1.0 | 12.2 | |
| | | 1.65 ≤ V _{CC} ≤ 1.95 | | 1.0 | 6.3 | 8.7 | 1.0 | 9.7 | |
| | | 2.30 ≤ V _{CC} ≤ 2.70 | | 1.0 | 4.7 | 6.9 | 1.0 | 7.5 | |
| | | 3.00 ≤ V _{CC} ≤ 3.60 | | 1.0 | 4.6 | 6.8 | 1.0 | 7.4 | |
| 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} =0 V or V _{CC} , f=10 MHz | | 3.0 | | | | pF |
| | | 1.10 ≤ V _{CC} ≤ 1.30 | | | 3.1 | | | | |
| | | 1.40 ≤ V _{CC} ≤ 1.60 | | | 3.2 | | | | |
| | | 1.65 ≤ V _{CC} ≤ 1.95 | | | 3.4 | | | | |
| | | 2.30 ≤ V _{CC} ≤ 2.70 | | | 3.8 | | | | |
| | | 3.00 ≤ V _{CC} ≤ 3.60 | | | 4.4 | | | | |

AC Loadings and Waveforms



Notes:

4. C_L includes load and stray capacitance.
5. Input PRR = 1.0 MHz, $t_W = 500$ ns.

Figure 9. AC Test Circuit

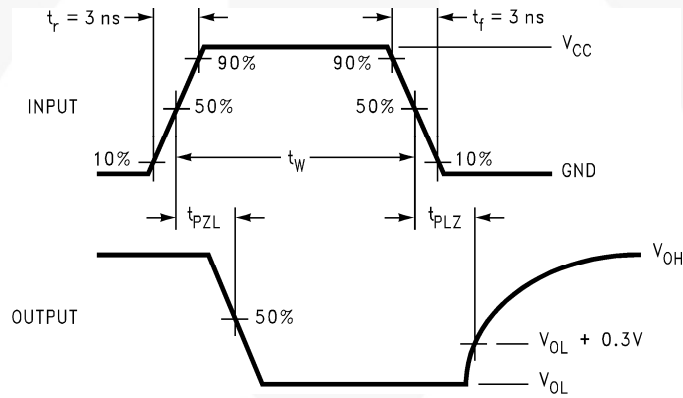


Figure 10. AC Waveforms

| Symbol | V_{CC} | | | | | |
|----------|------------------|-------------------|-------------------|------------------|------------------|------------------|
| | 3.3 V ± 0.3 V | 2.5 V ± 0.2 V | 1.8 V ± 0.15 V | 1.5 V ± 0.10 V | 1.2 V ± 0.10 V | 0.8 V |
| V_{mi} | $V_{CC}/2$ | $V_{CC}/2$ | $V_{CC}/2$ | $V_{CC}/2$ | $V_{CC}/2$ | $V_{CC}/2$ |
| V_x | $V_{OL} + 0.3$ V | $V_{OL} + 0.15$ V | $V_{OL} + 0.15$ V | $V_{OL} + 0.1$ V | $V_{OL} + 0.1$ V | $V_{OL} + 0.1$ V |

Physical Dimensions

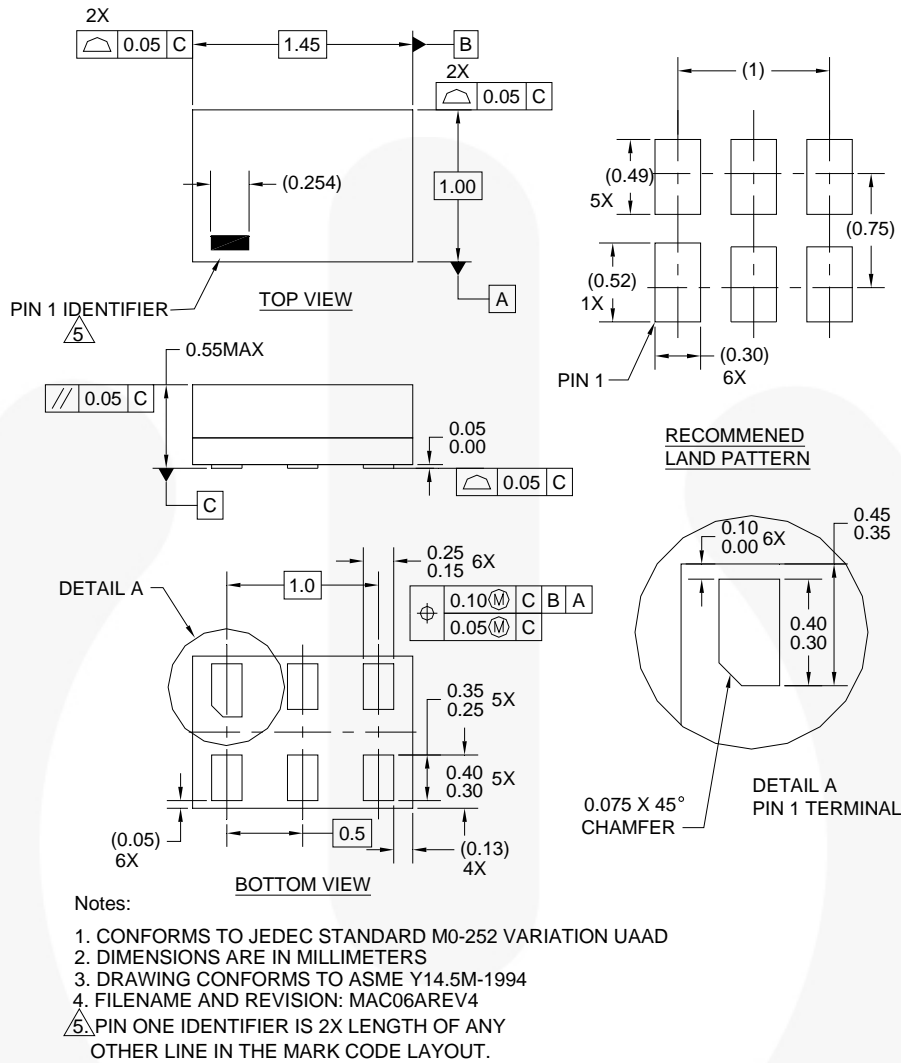


Figure 11. 6-Lead, MicroPak™, 1.0 mm Wide

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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/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

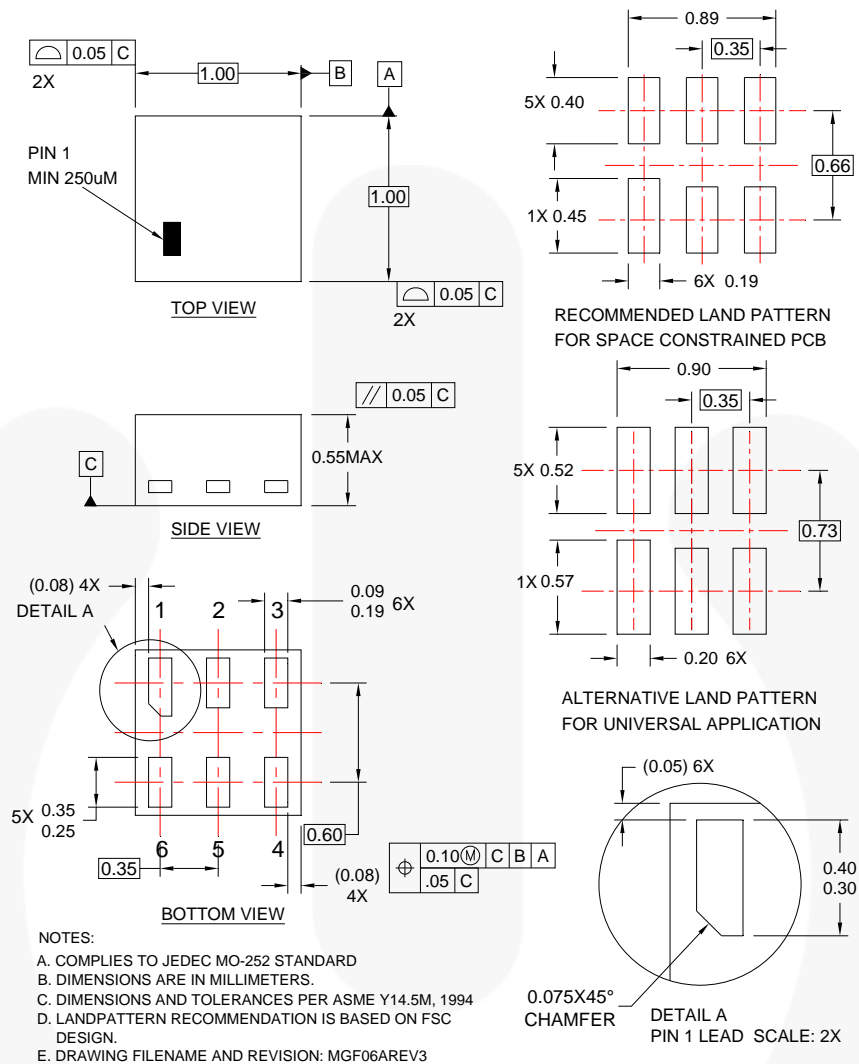


Figure 12. 6-Lead, MicroPak2™, 1x1 mm Body, .35 mm Pitch

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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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| CROSSVOLT™ | GTO™ |  ™ | TinyPower™ |
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