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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

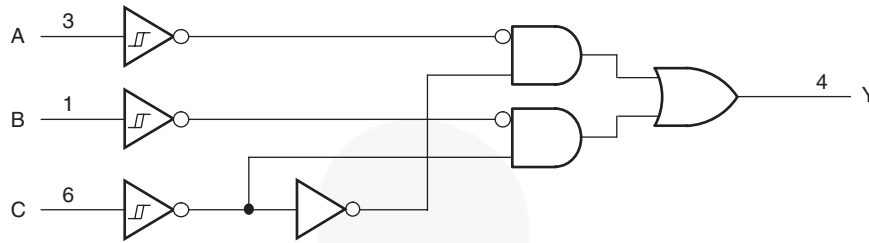


Figure 1. Logic Diagram (Positive Logic)

Pin Configurations

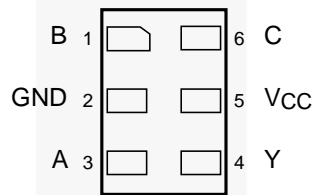


Figure 2. MicroPak™ (Top Through View)

Pin Definitions

Pin #	Name	Description
1	B	Data Input
2	GND	Ground
3	A	Data Input
4	Y	Output
5	V _{CC}	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

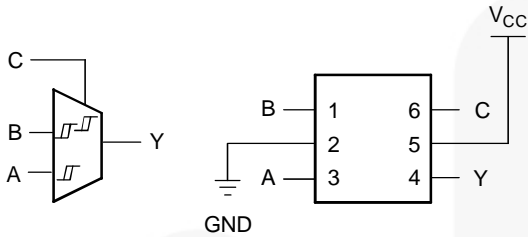
Function Selection Table

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

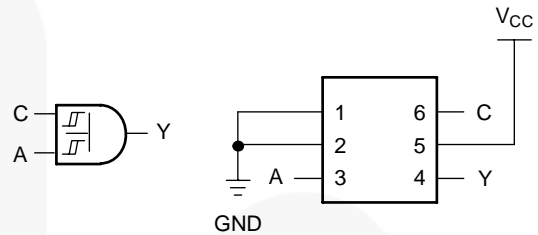
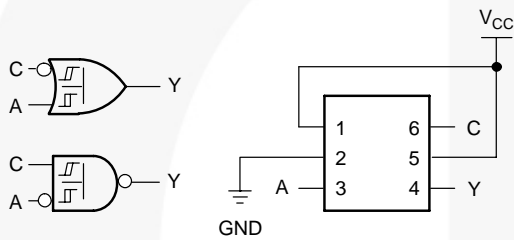
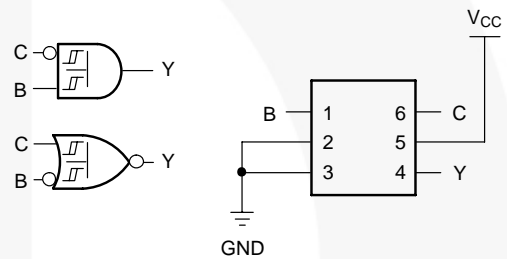


Figure 4. 2-Input AND Gate



**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**

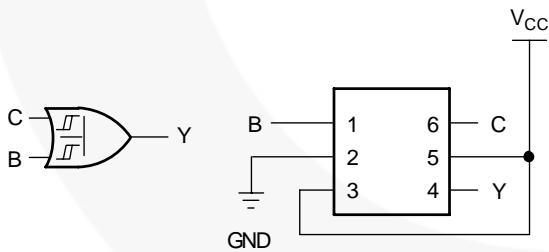


Figure 7. 2-Input OR Gate

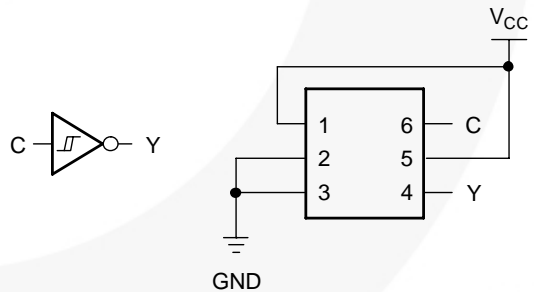


Figure 8. Inverter

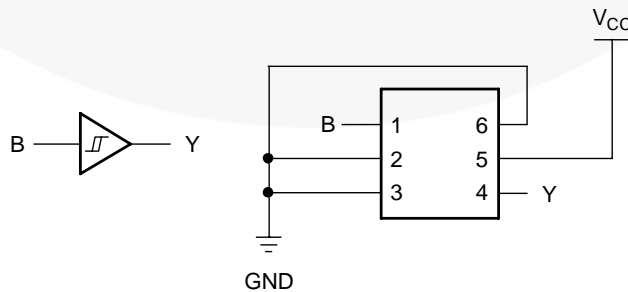


Figure 9. Buffer

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 ⁽³⁾	$V_{CC} + 0.5$	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⁽⁴⁾

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
θ_{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 _{CC}	Conditions	T _A =+25°C		T _A =-40 to +85°C		Units
				Min.	Max.	Min.	Max.	
V _P	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 _N	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 _H	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 _{OH}	HIGH Level Output Voltage	2.3V ≤ V _{CC} ≤ 3.6V	I _{OH} =-20μA	V _{CC} -0.1		V _{CC} -0.1		V
		2.3V	I _{OH} =-2.3mA	2.05		1.97		
			I _{OH} =-3.1mA	1.90		1.85		
		3.0V	I _{OH} =-2.7mA	2.72		2.67		
I _{OH} =-4mA	2.60			2.55				
V _{OL}	LOW Level Output Voltage	2.3V ≤ V _{CC} ≤ 3.6V	I _{OL} =20μA		0.10		0.10	V
		2.3V	I _{OL} =2.3mA		0.31		0.33	
			I _{OL} =3.1mA		0.44		0.45	
		3.0V	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		±0.10		±0.50	μA
I _{OFF}	Power Off Leakage Current	0V	0 ≤ (V _{IN} , V _O) ≤ 3.6		0.10		0.50	μA
ΔI _{OFF}	Additional Power Off Leakage Current	0V to 0.2V	V _{IN} or V _O =0V to 3.6V		0.20		0.60	μA
I _{CC}	Quiescent Supply Current	2.3V to 3.6V	V _{IN} =V _{CC} or GND		0.50		0.90	μA
			V _{CC} ≤ V _{IN} ≤ 3.6V				±0.90	
ΔI _{CC}	Increase in I _{CC} per Input	2.3V to 2.7V	One Input at 0.3V or 1.1V, other Inputs at 0 or V _{CC}				4	μA
		3.0V to 3.6V	One Input at 0.45V or 1.2V, other Inputs at 0 or V _{CC}				12	

AC Electrical Characteristics

Symbol	Parameter	V _{CC}	Conditions	T _A =+25°C			T _A =-40 to +85°C		Units	Figure			
				Min.	Typ.	Max.	Typ.	Max.					
t _{PHL} , t _{PLH}	Propagation Delay	2.30V ≤ V _{CC} ≤ 2.70V, V _{IN} =1.65V to 1.95V	C _L =5pF, R _L =1MΩ	1.1	3.7	5.5	1.1	6.8	ns	Figure 10 Figure 11			
		2.30V ≤ V _{CC} ≤ 2.70V, V _{IN} =2.30V to 2.70V		1.1	3.8	6.5	1.1	7.0					
		2.30V ≤ V _{CC} ≤ 2.70V, V _{IN} =3.0V to 3.60V		1.1	3.9	6.0	1.1	6.5					
		3.00V ≤ V _{CC} ≤ 3.60V, V _{IN} =1.65V to 1.95V		1.0	3.3	4.9	1.0	8.0					
		3.00V ≤ V _{CC} ≤ 3.60V, V _{IN} =2.30V to 2.70V		1.0	3.2	4.6	1.0	5.8					
		3.00V ≤ V _{CC} ≤ 3.60V, V _{IN} =3.00V to 3.60V		1.0	3.1	4.7	1.0	5.5					
		2.30V ≤ V _{CC} ≤ 2.70V, V _{IN} =1.65V to 1.95V	C _L =10pF, R _L =1MΩ	1.3	4.1	6.5	1.0	7.9					
		2.30V ≤ V _{CC} ≤ 2.70V, V _{IN} =2.30V to 2.70V		1.3	4.0	6.2	1.0	7.1					
		2.30V ≤ V _{CC} ≤ 2.70V, V _{IN} =3.0V to 3.60V		1.3	3.7	5.7	1.0	6.5					
		3.00V ≤ V _{CC} ≤ 3.60V, V _{IN} =1.65V to 1.95V		1.3	3.5	5.6	1.0	8.5					
		3.00V ≤ V _{CC} ≤ 3.60V, V _{IN} =2.30V to 2.70V		1.3	3.4	5.3	1.0	6.1					
		3.00V ≤ V _{CC} ≤ 3.60V, V _{IN} =3.00V to 3.60V		1.3	3.3	5.2	1.0	5.9					
		2.30V ≤ V _{CC} ≤ 2.70V, V _{IN} =1.65V to 1.95V	C _L =15pF, R _L =1MΩ	1.5	4.6	6.9	1.0	8.7					
		2.30V ≤ V _{CC} ≤ 2.70V, V _{IN} =2.30V to 2.70V		1.5	4.4	6.8	1.0	7.9					
		2.30V ≤ V _{CC} ≤ 2.70V, V _{IN} =3.0V to 3.60V		1.5	4.2	6.3	1.0	7.4					
		3.00V ≤ V _{CC} ≤ 3.60V, V _{IN} =1.65V to 1.95V		1.3	3.9	6.2	1.0	9.1					
		3.00V ≤ V _{CC} ≤ 3.60V, V _{IN} =2.30V to 2.70V		1.3	3.8	5.6	1.0	6.8					
		3.00V ≤ V _{CC} ≤ 3.60V, V _{IN} =3.00V to 3.60V		1.3	3.8	5.6	1.0	6.2					
		2.30V ≤ V _{CC} ≤ 2.70V, V _{IN} =1.65V to 1.95V	C _L =30pF, R _L =1MΩ	1.3	4.2	7.9	1.3	8.5					
		2.30V ≤ V _{CC} ≤ 2.70V, V _{IN} =2.30V to 2.70V		1.3	3.9	7.9	1.3	8.5					
		2.30V ≤ V _{CC} ≤ 2.70V, V _{IN} =3.0V to 3.60V		1.0	3.7	7.3	1.0	8.9					
		3.00V ≤ V _{CC} ≤ 3.60V, V _{IN} =1.65V to 1.95V		1.3	3.5	6.1	1.3	7.9					
		3.00V ≤ V _{CC} ≤ 3.60V, V _{IN} =2.30V to 2.70V		1.1	3.0	5.9	1.1	6.8					
		3.00V ≤ V _{CC} ≤ 3.60V, V _{IN} =3.00V to 3.60V		1.0	2.7	5.7	1.0	6.5					
		C _{IN}	Input Capacitance	0		2.1						pF	
		C _{OUT}	Output Capacitance	0		3.0						pF	
		C _{PD}	Power Dissipation Capacitance	2.30V ≤ V _{CC} ≤ 2.70V		2.0						pF	
				3.00V ≤ V _{CC} ≤ 3.60V		2.7							

AC Loadings and Waveforms

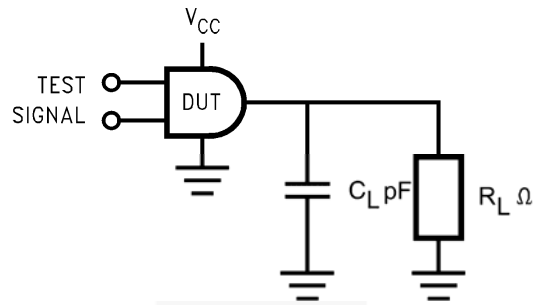


Figure 10. AC Test Circuit

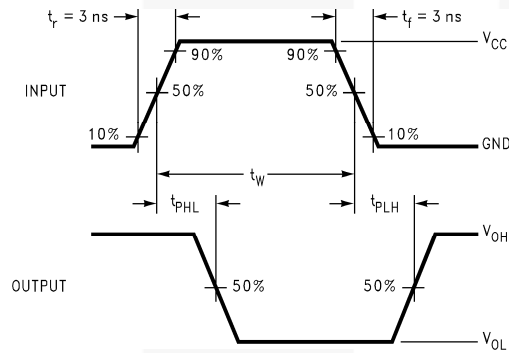


Figure 11. AC Waveforms

Symbol	V _{CC}	
	3.3V ± 0.3V	2.5V ± 0.2V
V _{mi}	V _{IN} /2	V _{IN} /2
V _{mo}	V _{CC} /2	V _{CC} /2

Physical Dimensions

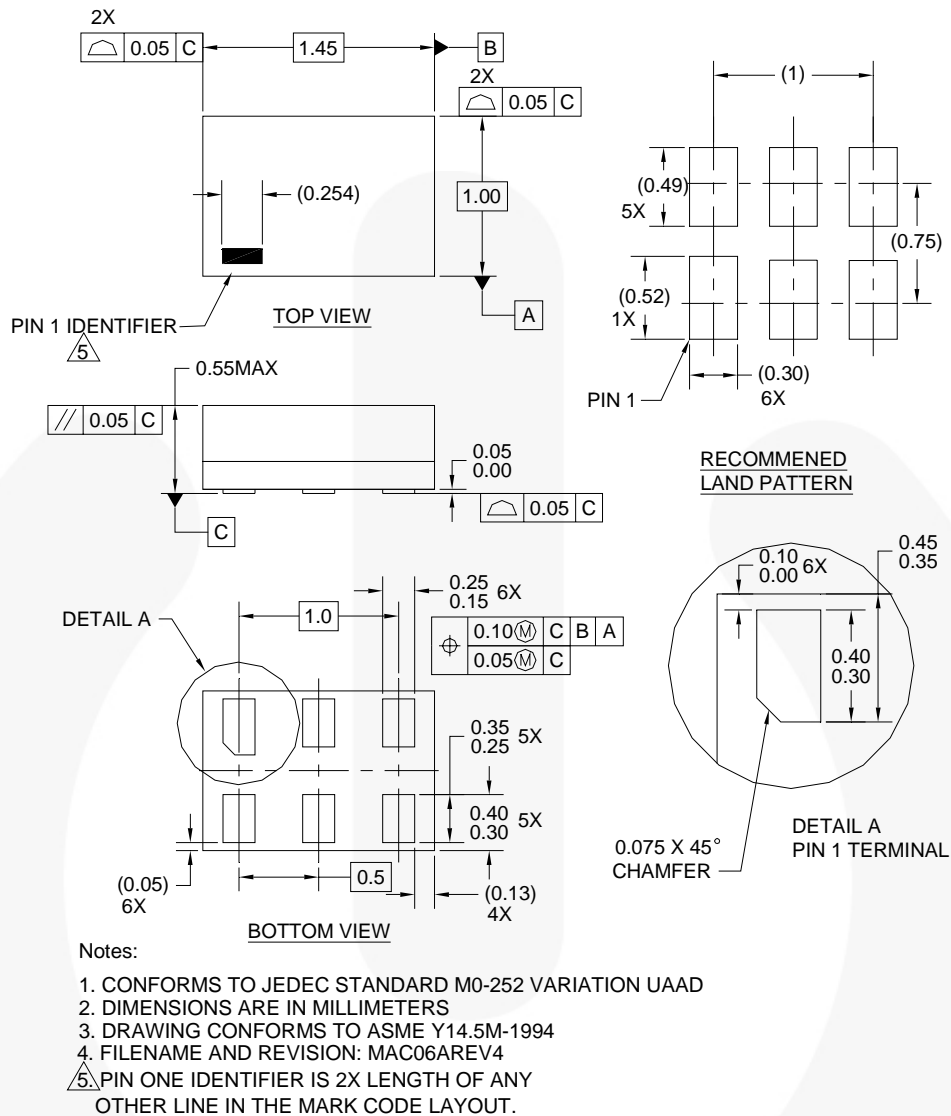


Figure 12. 6-Lead, MicroPak™, 1.0mm Wide

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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

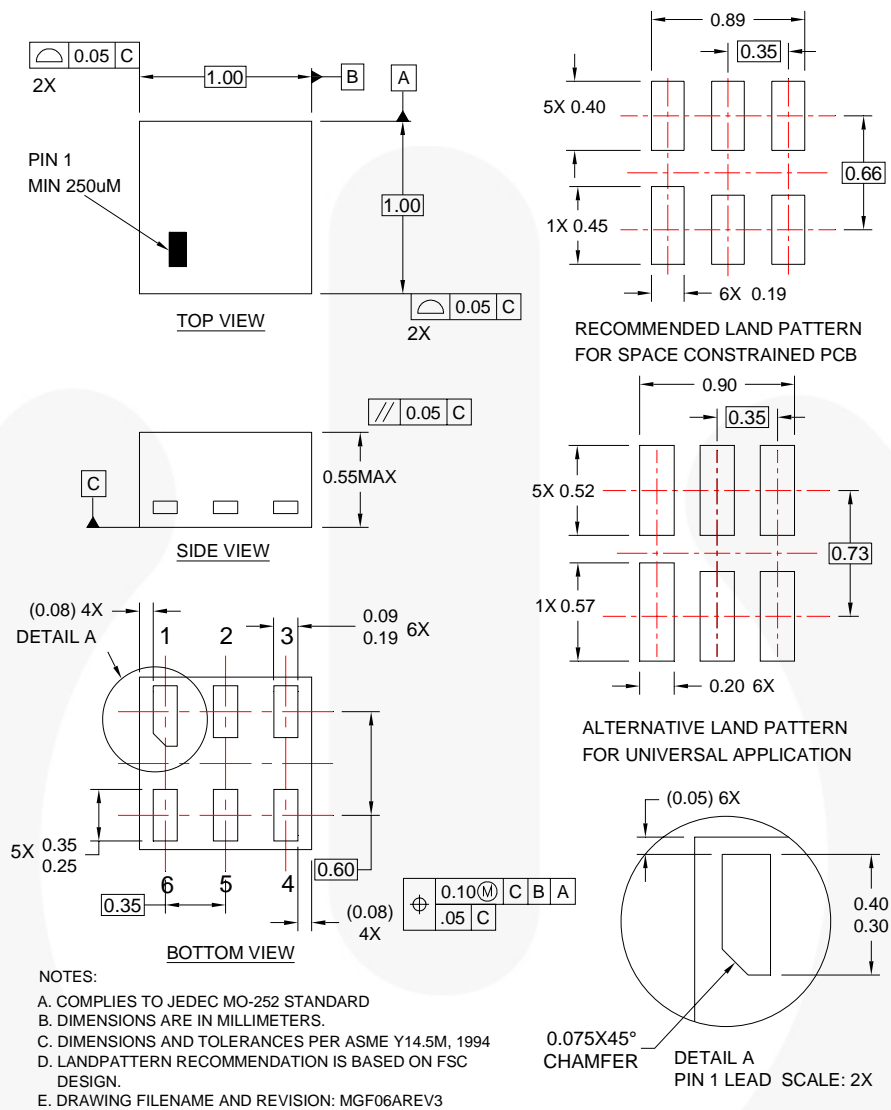


Figure 13. 6-Lead, MicroPak2™, 1x1mm Body, .35mm Pitch

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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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