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September 2012

# 74AUP1G56 TinyLogic<sup>®</sup> Low Power Universal Configurable Two-Input Logic Gate (Open Drain Output)

#### **Features**

- 0.8 V to 3.6 V V<sub>CC</sub> Supply Operation
- 3.6 V Over-Voltage Tolerant I/Os at V<sub>CC</sub> from 0.8V to 3.6 V
- Extremely High Speed tpd
  - 3.2 ns: Typical at 3.3 V
- Power-Off High-Impedance Inputs and Outputs
- Low Static Power Consumption
  - I<sub>CC</sub>=0.9 μA Maximum
- Low Dynamic Power Consumption
  - C<sub>PD</sub>=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**

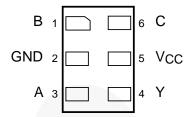


Figure 1. MicroPak™ (Top Through View)

## **Pin Definitions**

Pin#	Name	Description
1	В	Data Input
2	GND	Ground
3	А	Data Input
4	Y	Output (Open Drain)
5	V <sub>CC</sub>	Supply Voltage
6	С	Data Input

## **Function Table**

	Inputs		Y=Output
С	В	Α	
L	L	L	H <sup>(1)</sup>
L	L	Н	L
L	Н	L	H <sup>(1)</sup>
L	Н	Н	L
Н	L	L	L
Н	L	Н	L
Н	Н	L	H <sup>(1)</sup>
Н	Н	Н	H <sup>(1)</sup>

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.

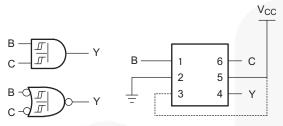


Figure 2. 2-Input AND Gate or 2-Input NOR with Both Inputs Inverted

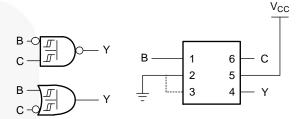


Figure 3. 2-Input NAND with Inverted B Input or 2-Input OR Gate with Inverted C Input

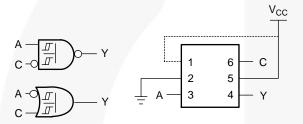


Figure 4. 2-Input NAND with Inverted C Input or 2-Input OR Gate with Inverted A Input

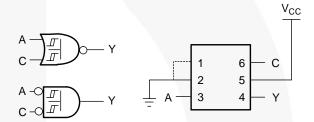


Figure 5. 2-Input NOR Gate or 2-Input AND Gate with Both Inputs Inverted

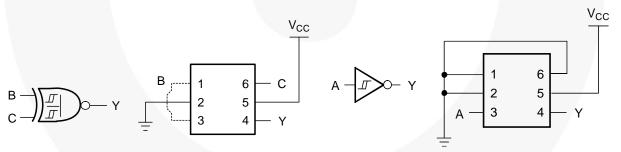


Figure 6. 2-Input XNOR Gate

Figure 7. Inverter

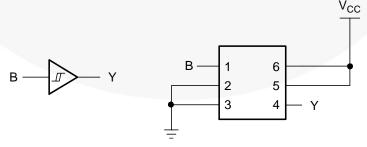


Figure 8. Non-Inverter Buffer

## **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	Para	Parameter			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 <sup>(2)</sup>		-0.5	4.6	V
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
I <sub>OL</sub>	DC Output Sink Current		+50	mA	
I <sub>CC</sub> or I <sub>GND</sub>	DC V <sub>CC</sub> or Ground Current per		±50	mA	
T <sub>STG</sub>	Storage Temperature Range		-65	+150	°C
$T_J$	Junction Temperature Under Bi	as		+150	°C
$T_L$	Junction Lead Temperature, Sc	oldering 10s		+260	°C
		MicroPak™-6		130	
P <sub>D</sub>	Power Dissipation at +85°C	MicroPak2™-6		120	mW
ESD	Human Body Model, JEDEC:JE	SD22-A114		4000	V
ESD	Charged Device Model, JEDEC	:JESD22-C101	A.	2000	V

#### Note:

2. I<sub>O</sub> absolute maximum rating must be observed.

## Recommended Operating Conditions<sup>(3)</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	Condition	Min.	Max.	Unit	
V <sub>CC</sub>	Supply Voltage		0.8	3.6	V	
$V_{IN}$	Input Voltage		0	3.6	V	
V <sub>out</sub>	Output Voltage	V <sub>CC</sub> =0 V	0	3.6	V	
		V <sub>CC</sub> =3.0 V to 3.6 V		4.0		
	Output Current	V <sub>CC</sub> =2.3 V to 2.7 V		3.1	mA	
		V <sub>CC</sub> =1.65 V to 1.95 V	4.9	1.9		
l <sub>OL</sub>		V <sub>CC</sub> =1.4 V to 1.6 V		1.7		
		V <sub>CC</sub> =1.1 V to 1.3 V		1.1		
		V <sub>CC</sub> =0.8 V		20.0	μA	
T <sub>A</sub>	Operating Temperature, Free Air		-40	+85	°C	
0	Thermal Desistance	MicroPak™-6		500	°C/W	
$\theta_{JA}$	Thermal Resistance	MicroPak2™-6		560		

#### Note:

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

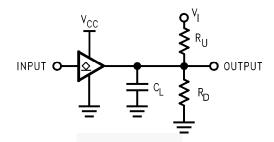
## **DC Electrical Characteristics**

Cumbal	Doromotor	V V	Condition	T <sub>A</sub> =	T <sub>A</sub> =25°C		T <sub>A</sub> =-40 to 85°C	
Symbol	Parameter	V <sub>cc</sub>	Condition	Min.	Max.	Min.	Max.	Unit
		0.80		0.30	0.60	0.30	0.60	
		1.10		0.53	0.90	0.53	0.90	
.,	Positive	1.40		0.74	1.11	0.74	1.11	1
$V_P$	Threshold Voltage	1.65		0.91	1.29	0.91	1.29	V
	Vollago	2.30		1.37	1.77	1.37	1.77	=
		3.00		1.88	2.29	1.88	2.29	-
		0.80		0.10	0.60	0.10	0.60	
		1.10		0.26	0.65	0.26	0.65	-
	Negative	1.40		0.39	0.75	0.39	0.75	
$V_N$	Threshold Voltage	1.65		0.47	0.84	0.47	0.84	V
	Voltage	2.30		0.69	1.04	0.69	1.04	-
		3.00		0.88	1.24	0.88	1.24	
-/		0.80		0.07	0.50	0.07	0.50	
		1.10		0.08	0.46	0.08	0.46	-
	Llyotoropio	1.40		0.18	0.56	0.18	0.56	
V <sub>H</sub> Hysteresis Voltage	1.65		0.27	0.66	0.27	0.66	- V	
	2.30		0.53	0.92	0.53	0.92		
		3.00		0.79	1.31	0.79	1.31	
		$0.80 \le V_{CC} \le 3.60$	Ι <sub>οι</sub> =20 μΑ		0.10		0.10	
		$1.10 \le V_{CC} \le 1.30$			0.30 x V <sub>CC</sub>		0.30 x V <sub>CC</sub>	
		1.40 ≤ V <sub>CC</sub> ≤ 1.60	I <sub>OI</sub> =1.7 mA		0.31		0.37	-
$V_{OL}$	LOW Level	1.65 ≤ V <sub>CC</sub> ≤ 1.95			0.31		0.35	V
· OL	Output Voltage	2.30 ≤ V <sub>CC</sub> ≤ 2.70			0.44		0.45	
		$2.70 \le V_{CC} \le 3.60$	I <sub>OL</sub> =4.0 mA		0.44		0.45	
I <sub>IN</sub>	Input Leakage Current	0 V to 3.6 V	$0 \le V_{IN} \le 3.6 \text{ V}$		±0.1		±0.5	μA
I <sub>OFF</sub>	Power Off Leakage Current	0 V	$0 \le (V_{IN}, V_{O}) \le 3.6 \text{ V}$		0.2		0.6	μA
$\Delta I_{OFF}$	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	μА
I <sub>cc</sub>	Quiescent	0.8V to 3.6 V	V <sub>IN</sub> - V <sub>CC</sub> or GND		0.5		0.9	μA
Δl <sub>CC</sub>	Supply Current Increase in I <sub>CC</sub> per Input	3.3 V	$V_{CC} \le V_{IN} \le 3.6 \text{ V}$ $V_{IN} = V_{CC} - 0.6 \text{ V}$		40.0		±0.9 50.0	μA

## **AC Electrical Characteristics**

Cumbal	Donomotor	V	Condition	T <sub>A</sub> =25°C			T <sub>A</sub> =-40	to 85°C	Unit
Symbol	Parameter	V <sub>cc</sub>	Condition	Min.	Тур.	Max.	Min.	Max.	Unit
		0.80			30				
		$1.10 \le V_{CC} \le 1.30$	C -15 pF	1.0	10.1	18.9	1.0	19.9	
	Propagation	$1.40 \le V_{CC} \le 1.60$	$C_L=15 \text{ pF},$ $R_U=R_D=5 \text{ K}\Omega$	1.0	6.6	11.4	1.0	12.2	no
$t_{PZL}, t_{PLZ}$	Delay	$1.65 \le V_{CC} \le 1.95$	$V_I = 2 \times (V_{CC})$	1.0	6.3	8.7	1.0	9.7	ns
		$2.30 \le V_{CC} \le 2.70$	(see Figure 9)	1.0	4.7	6.9	1.0	7.5	
		$3.00 \le V_{CC} \le 3.60$		1.0	4.6	6.8	1.0	7.4	
C <sub>IN</sub>	Input Capacitance	0			0.8				pF
C <sub>OUT</sub>	Output Capacitance	0			1.7				pF
	//	0.80			3.0				
		1.10 ≤ V <sub>CC</sub> ≤ 1.30			3.1				
	Power	$1.40 \le V_{CC} \le 1.60$	V <sub>IN</sub> =0 V or V <sub>CC</sub> ,		3.2				pF
$C_{PD}$	Dissipation Capacitance	$1.65 \le V_{CC} \le 1.95$	f=10 MHz		3.4				
		$2.30 \le V_{CC} \le 2.70$			3.8				
		$3.00 \le V_{CC} \le 3.60$			4.4				

## **AC Loadings and Waveforms**



#### Notes:

- 4. C<sub>L</sub> includes load and stray capacitance.
- 5. Input PRR = 1.0 MHz,  $t_W = 500$  ns.

Figure 9. AC Test Circuit

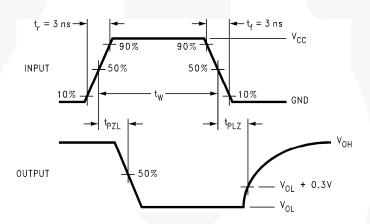
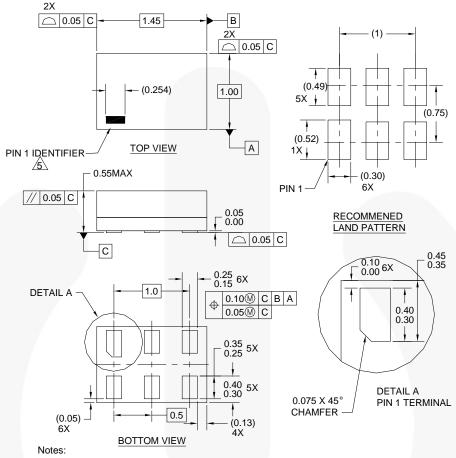


Figure 10. AC Waveforms

Symbol		V <sub>cc</sub>				
Symbol	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	V 8.0
V <sub>mi</sub>	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>CC</sub> /2
$V_x$	V <sub>OL</sub> + 0.3 V	$V_{OL}$ + 0.15 V	V <sub>OL</sub> + 0.15 V	$V_{OL}$ + 0.1 $V$	V <sub>OL</sub> + 0.1 V	$V_{OL}$ + 0.1 $V$

## **Physical Dimensions**



- 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 11. 6-Lead, MicroPak™, 1.0 mm 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.

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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	<b>Cavity Status</b>	Cover Type Status
	Leader (Start End)	125 (Typical)	Empty	Sealed
L6X	Carrier	5000	Filled	Sealed
	Trailer (Hub End)	75 (Typical)	Empty	Sealed

## **Physical Dimensions**

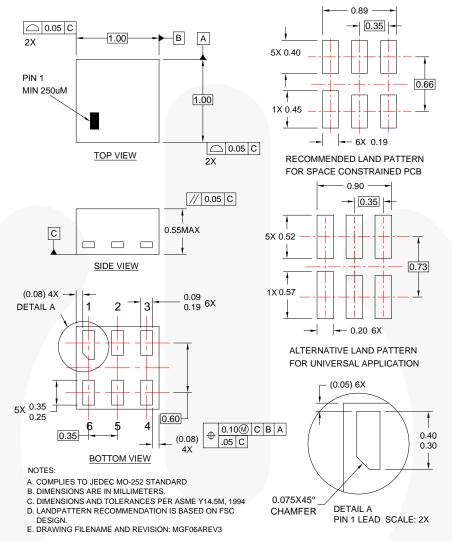


Figure 12. 6-Lead, MicroPak2™, 1x1 mm Body, .35 mm Pitch

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#### **Tape and Reel Specifications**

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Package Designator	Tape Section	Cavity Number	Cavity Status	Cover Type Status
	Leader (Start End)	125 (Typical)	Empty	Sealed
FHX	Carrier	5000	Filled	Sealed
	Trailer (Hub End)	75 (Typical)	Empty	Sealed





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 Green FPS™ e-Series™

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SUperFET®
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SuperSOT™-6
SuperSOT™-8
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SyncFET™
Sync-Lock™
System
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#### Definition of Terms

Delimition of Terms		
Datasheet Identification	Product Status	Definition
Advance Information	Formative / In Design	Datasheet contains the design specifications for product development. Specifications may change in any manner without notice.
Preliminary	First Production	Datasheet contains preliminary data; supplementary data will be published at a later date. Fairchild Semiconductor reserves the right to make changes at any time without notice to improve design.
No Identification Needed	Full Production	Datasheet contains final specifications. Fairchild Semiconductor reserves the right to make changes at any time without notice to improve the design.
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