Description

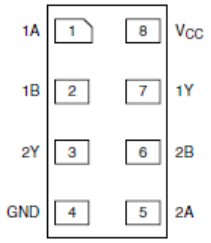
The Advanced Ultra Low Power (AUP) CMOS logic family is designed for low power and extended battery life in portable applications.

The 74AUP2G00 is a dual two input NAND gate. Both gates have push-pull outputs designed for operation over a power supply range of 0.8V to 3.6V. The device is fully specified for partial power down applications using I_{OFF}. The I_{OFF} circuitry disables the output preventing damaging current backflow when the device is powered down. Each gate performs the positive Boolean function:

$$Y = \overline{A \bullet B} \text{ or } Y = \overline{A} + \overline{B}$$

Pin Assignments

(Top View)



X2-DFN1210-8

Features

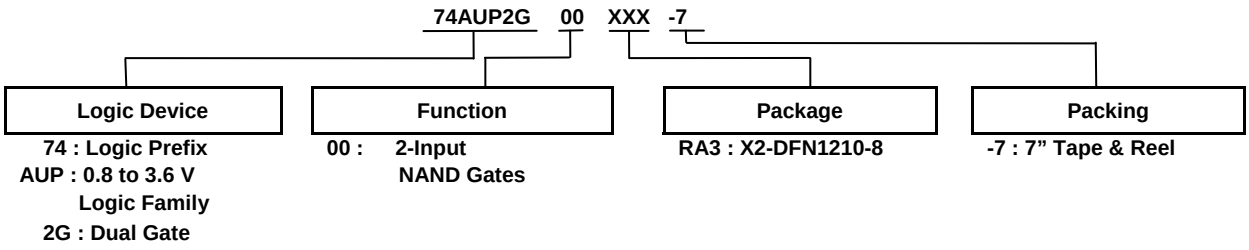
- Advanced Ultra Low Power (AUP) CMOS
- Supply Voltage Range from 0.8V to 3.6V
- ±4mA Output Drive at 3.0V
- Low Static Power Consumption
  I_{CC} < 0.9μA
- Low Dynamic Power Consumption
  C_{PD} = 6 pF (Typical at 3.6V)
- Schmitt Trigger Action at all inputs makes the circuit tolerant for slower input rise and fall time. The hysteresis is typically 250 mV at V_{CC} = 3.0V
- I_{OFF} Supports Partial-Power-Down Mode Operation
- ESD Protection Exceeds JESD 22
  2000-V Human Body Model (A114)
  Exceeds 1000-V Charged Device Model (C101)
- Latch-Up Exceeds 100mA per JESD 78, Class I
- Leadless Packages Named per JESD30E
- **Totally Lead-Free & Fully RoHS Compliant (Notes 1 & 2)**
- **Halogen and Antimony Free. "Green" Device (Note 3)**

Applications

- Suited for Battery and Low Power Needs
- Wide Array of Products Such as:
  - Tablets, E-readers
  - Cell Phones, Personal Navigation/GPS
  - MP3 Players, Cameras, Video Recorders
  - PCs, Ultrabooks, Notebooks, Netbooks
  - Computer Peripherals, Hard Drives, SSD, CD/DVD ROM
  - TV, DVD, DVR, Set-Top Box

Notes:
1. No purposely added lead. Fully EU Directive 2002/95/EC (RoHS) & 2011/65/EU (RoHS 2) compliant.
2. See http://www.diodes.com/quality/lead_free.html for more information about Diodes Incorporated's definitions of Halogen- and Antimony-free, "Green" and Lead-free.
3. Halogen- and Antimony-free "Green" products are defined as those which contain <900ppm bromine, <900ppm chlorine (<1500ppm total Br + Cl) and <1000ppm antimony compounds.

Ordering Information



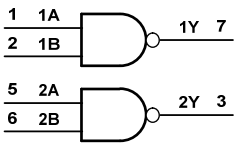
Device	Package Code	Package (Notes 4 & 5)	Package Size	7" Tape and Reel	
				Quantity	Part Number Suffix
74AUP2G00RA3-7	RA3	X2-DFN1210-8	1.2mm X 1.0mm X 0.35mm 0.3 mm lead pitch	5,000/Tape & Reel	-7

Notes: 4. Pad layout as shown on Diodes Inc. suggested pad layout document AP02001, which can be found on our website at http://www.diodes.com/datasheets/ap02001.pdf.
5. The taping orientation is located on our website at http://www.diodes.com/datasheets/ap02007.pdf.

Pin Descriptions

Pin Name	Pin No.	Function
1A	1	Data Input
1B	2	Data Input
2Y	3	Data Output
GND	4	Ground
2A	5	Data Input
2B	6	Data Input
1Y	7	Data Output
V_{CC}	8	Supply Voltage

Logic Diagram



Function Table

Inputs		Output
A	B	Y
L	L	H
L	H	H
H	L	H
H	H	L

Absolute Maximum Ratings (Note 6 & 7)

Symbol	Description	Rating	Unit
ESD HBM	Human Body Model ESD Protection	2	kV
ESD CDM	Charged Device Model ESD Protection	1	kV
ESD MM	Machine Model ESD Protection	200	V
V_{CC}	Supply Voltage Range	-0.5 to +4.6	V
V_I	Input Voltage Range	-0.5 to +4.6	V
V_o	Voltage Applied to Output in High or Low State	-0.5 to V_{CC} +0.5	V
I_{IK}	Input Clamp Current V_I<0	50	mA
I_{OK}	Output Clamp Current (V_O < 0)	50	mA
I_O	Continuous Output Current (V_O = 0 to V_{CC})	±20	mA
I_{CC}	Continuous Current Through V_{CC}	50	mA
I_{GND}	Continuous Current Through GND	-50	mA
T_J	Operating Junction Temperature	-40 to +150	°C
T_{STG}	Storage Temperature	-65 to +150	°C

Notes: 6. Stresses beyond the absolute maximum may result in immediate failure or reduced reliability. These are stress values and device operation should be within recommended values.
7. Forcing the maximum allowed voltage could cause a condition exceeding the maximum current or conversely, forcing the maximum current could cause a condition exceeding the maximum voltage. The ratings of both current and voltage must be maintained within the controlled range.

Recommended Operating Conditions (Note 8)

Symbol	Parameter		Min	Max	Unit
V_{CC}	Operating Voltage	—	0.8	3.6	V
V_I	Input Voltage		0	3.6	V
V_O	Output Voltage		0	V_{CC}	V
I_{OH}	High-Level Output Current	V_{CC} = 0.8V	—	-20	μA
		V_{CC} = 1.1V	—	-1.1	mA
		V_{CC} = 1.4V	—	-1.7	
		V_{CC} = 1.65V	—	-1.9	
		V_{CC} = 2.3V	—	-3.1	
		V_{CC} = 3.0V	—	-4	
I_{OL}	Low-Level Output Current	V_{CC} = 0.8V	—	20	μA
		V_{CC} = 1.1V	—	1.1	mA
		V_{CC} = 1.4V	—	1.7	
		V_{CC} = 1.65V	—	1.9	
		V_{CC} = 2.3V	—	3.1	
		V_{CC} = 3.0V	—	4	
Δt/ΔV	Input Transition Rise or Fall Rate	V_{CC} = 0.8V to 3.6V	—	200	ns/V
T_A	Operating Free-Air Temperature	—	-40	+125	°C

Note: 8. Unused inputs should be held at V_{CC} or Ground.

Electrical Characteristics

Symbol	Parameter	Test Conditions	V_{CC}	T_A = +25°C		T_A = -40°C to +85°C		Unit
				Min	Max	Min	Max	
V_{IH}	High-Level Input Voltage	—	0.8V to 1.65V	0.80 X V_{CC}	—	0.80 X V_{CC}	—	V
		—	1.65V to 1.95V	0.65 X V_{CC}	—	0.65 X V_{CC}	—	
		—	2.3V to 2.7V	1.6	—	1.6	—	
		—	3.0V to 3.6V	2.0	—	2.0	—	
V_{IL}	Low-Level Input Voltage	—	0.8V to 1.65V	—	0.30 X V_{CC}	—	0.30 X V_{CC}	V
		—	1.65V to 1.95V	—	0.35 X V_{CC}	—	0.35 X V_{CC}	
		—	2.3V to 2.7V	—	0.7	—	0.7	
		—	3.0V to 3.6V	—	0.9	—	0.9	
V_{OH}	High-Level Output Voltage	I_{OH} = -20µA	0.8V to 3.6V	V_{CC} – 0.1	—	V_{CC} – 0.1	—	V
		I_{OH} = -1.1mA	1.1V	0.75 X V_{CC}	—	0.7 X V_{CC}	—	
		I_{OH} = -1.7mA	1.4V	1.11	—	1.03	—	
		I_{OH} = -1.9mA	1.65V	1.32	—	1.3	—	
		I_{OH} = -2.3mA	2.3V	2.05	—	1.97	—	
		I_{OH} = -3.1mA		1.9	—	1.85	—	
		I_{OH} = -2.7mA	3V	2.72	—	2.67	—	
		I_{OH} = -4mA		2.6	—	2.55	—	
V_{OL}	Low-Level Input Voltage	I_{OL} = 20µA	0.8V to 3.6V	—	0.1	—	0.1	V
		I_{OL} = 1.1mA	1.1V	—	0.3 X V_{CC}	—	0.3 X V_{CC}	
		I_{OL} = 1.7mA	1.4V	—	0.31	—	0.37	
		I_{OL} = 1.9mA	1.65V	—	0.31	—	0.35	
		I_{OL} = 2.3mA	2.3V	—	0.31	—	0.33	
		I_{OL} = 3.1mA		—	0.44	—	0.45	
		I_{OL} = 2.7mA	3V	—	0.31	—	0.33	
		I_{OL} = 4mA		—	0.44	—	0.45	
I_I	Input Current	A or B Input V_I = GND to 3.6V	0V to 3.6V	—	± 0.1	—	± 0.5	µA
I_{OFF}	Power Down Leakage Current	V_I or V_O = 0V to 3.6V	0V	—	± 0.2	—	± 0.6	µA
ΔI_{OFF}	Delta Power Down Leakage Current	V_I or V_O = 0V to 3.6V	0V to 0.2V	—	± 0.2	—	± 0.6	µA
I_{CC}	Supply Current	V_I = GND or V_{CC}, I_O = 0	0.8V to 3.6V	—	0.5	—	0.9	µA
ΔI_{CC}	Additional Supply Current	One Input at V_{CC} –0.6V Other Inputs at V_{CC} or GND	3.3V	—	40	—	50	µA

Electrical Characteristics (continued)

Symbol	Parameter	Test Conditions	V_{CC}	T_A = -40°C to +125°C		Unit
				Min	Max	
V_{IH}	High-Level Input Voltage	—	0.8V to 1.65V	0.80 X V_{CC}	—	V
		—	1.65V to 1.95V	0.70 X V_{CC}	—	
		—	2.3V to 2.7V	1.6	—	
		—	3.0V to 3.6V	2.0	—	
V_{IL}	Low-Level Input Voltage	—	0.8V to 1.65V	—	0.25 X V_{CC}	V
		—	1.65V to 1.95V	—	0.30 X V_{CC}	
		—	2.3V to 2.7V	—	0.7	
		—	3.0V to 3.6V	—	0.9	
V_{OH}	High-Level Output Voltage	I_{OH} = -20µA	0.8V to 3.6V	V_{CC} – 0.11	—	V
		I_{OH} = -1.1mA	1.1V	0.6 X V_{CC}	—	
		I_{OH} = -1.7mA	1.4V	0.93	—	
		I_{OH} = -1.9mA	1.65V	1.17	—	
		I_{OH} = -2.3mA	2.3V	1.77	—	
		I_{OH} = -3.1mA		1.67	—	
		I_{OH} = -2.7mA	3V	2.40	—	
		I_{OH} = -4mA		2.30	—	
V_{OL}	Low-Level Input Voltage	I_{OL} = 20µA	0.8V to 3.6V	—	0.11	V
		I_{OL} = 1.1mA	1.1V	—	0.33 X V_{CC}	
		I_{OL} = 1.7mA	1.4V	—	0.41	
		I_{OL} = 1.9mA	1.65V	—	0.39	
		I_{OL} = 2.3mA	2.3V	—	0.36	
		I_{OL} = 3.1mA		—	0.50	
		I_{OL} = 2.7mA	3V	—	0.36	
		I_{OL} = 4mA		—	0.50	
I_I	Input Current	A or B Input, V_I = GND to 3.6V	0V to 3.6V	—	± 0.75	µA
I_{OFF}	Power Down Leakage Current	V_I or V_O = 0V to 3.6V	0V	—	± 1.0	µA
ΔI_{OFF}	Delta Power Down Leakage Current	V_I or V_O = 0V to 3.6V	0V to 0.2V	—	± 2.5	µA
I_{CC}	Supply Current	V_I = GND or V_{CC}, I_O = 0	0.8V to 3.6V	—	3.0	µA
ΔI_{CC}	Additional Supply Current	Input at V_{CC} –0.6V Other Inputs at V_{CC} or GND	3.3V	—	75	µA

Operating and Package Characteristics (@T_A = +25°C, unless otherwise specified.)

Parameter		Test Conditions		V_{CC}	Typ	Unit
C_{pd}	Power Dissipation Capacitance	f = 1MHz No Load		0.8V	5.1	pF
				1.2V ± 0.1V	5.2	
				1.5V ± 0.1V	5.2	
				1.8V ± 0.15V	5.5	
				2.5V ± 0.2V	5.7	
				3.3V ± 0.3V	6.0	
C_i	Input Capacitance	V_i = V_{CC} or GND		0V or 3.3V	2.0	pF
θ_{JA}	Thermal Resistance Junction-to-Ambient	X2-DFN1210-8	(Note 9)	—	395	°C/W
θ_{JC}	Thermal Resistance Junction-to-Case	X2-DFN1210-8	(Note 9)	—	236	°C/W

Note: 9. Test condition, X2-DFN1210-8 device mounted on FR-4 substrate PC board, 2oz copper, with minimum recommended pad layout.

Switching Characteristics

C_L=5pF, See Figure 1

Parameter	From Input	TO OUTPUT	V_{CC}	T_A = +25°C			T_A = -40°C to +85°C		T_A = -40°C to +125°C		Unit
				Min	Typ	Max	Min	Max	Min	Max	
t_{pd}	A	Y	0.8V	—	20.1	—	—	—	—	—	ns
			1.2V ± 0.1V	2.5	5.3	12.1	2.1	13.4	2.1	14.9	
			1.5V ± 0.1V	2.0	3.8	6.8	1.8	7.8	1.8	8.6	
			1.8V ± 0.15V	1.6	3.1	5.3	1.4	6.2	1.4	6.9	
			2.5V ± 0.2V	1.3	2.5	4.0	1.1	4.7	1.1	5.2	
			3.3V ± 0.3V	1.0	2.2	3.6	1.0	4.2	1.0	4.7	

C_L= 10pF, See Figure 1

Parameter	From Input	TO OUTPUT	V_{CC}	T_A = +25°C			T_A = -40°C to +85°C		T_A = -40°C to +125°C		Unit
				Min	Typ	Max	Min	Max	Min	Max	
t_{pd}	A	Y	0.8V	—	24.2	—	—	—	—	—	ns
			1.2V ± 0.1V	2.4	6.1	14.3	2.2	15.8	2.2	17.5	
			1.5V ± 0.1V	2.4	4.4	7.9	2.2	9.2	2.2	10.2	
			1.8V ± 0.15V	2.0	3.7	6.2	1.9	7.3	1.9	8.1	
			2.5V ± 0.2V	1.4	3.0	4.7	1.3	5.6	1.3	6.2	
			3.3V ± 0.3V	1.3	2.8	4.3	1.2	4.9	1.2	5.4	

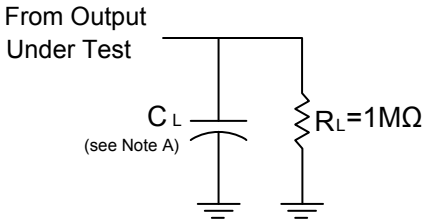
C_L = 15pF, See Figure 1

Parameter	From Input	TO OUTPUT	V_{CC}	T_A = +25°C			T_A = -40°C to +85°C		T_A = -40°C to +125°C		Unit
				Min	Typ	Max	Min	Max	Min	Max	
t_{pd}	A	Y	0.8V	—	28.2	—	—	—	—	—	ns
			1.2V ± 0.1V	3.4	6.9	16.3	3.1	20.3	3.1	20.5	
			1.5V ± 0.1V	2.8	5.0	8.9	2.5	10.5	2.5	11.6	
			1.8V ± 0.15V	2.0	4.1	7.0	2.0	8.3	2.0	9.2	
			2.5V ± 0.2V	1.7	3.5	5.3	1.5	6.4	1.5	7.1	
			3.3V ± 0.3V	1.4	3.2	4.9	1.3	5.7	1.3	6.3	

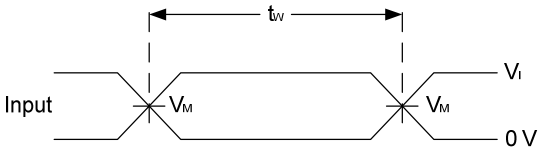
C_L = 30pF, See Figure 1

Parameter	From Input	TO OUTPUT	V_{CC}	T_A = +25°C			T_A = -40°C to +85°C		T_A = -40°C to +125°C		Unit
				Min	Typ	Min	Min	Max	Min	Max	
t_{pd}	A	Y	0.8V	—	40.0	—	—	—	—	—	ns
			1.2V ± 0.1V	4.6	9.2	22.1	4.1	27.8	4.1	28.0	
			1.5V ± 0.1V	3.0	6.5	11.8	2.9	14.0	2.9	15.4	
			1.8V ± 0.15V	2.6	5.4	9.3	2.3	11.1	2.3	12.3	
			2.5V ± 0.2V	2.4	4.6	7.1	2.1	8.5	2.1	9.4	
			3.3V ± 0.3V	2.0	4.3	6.5	1.8	7.6	1.8	8.4	

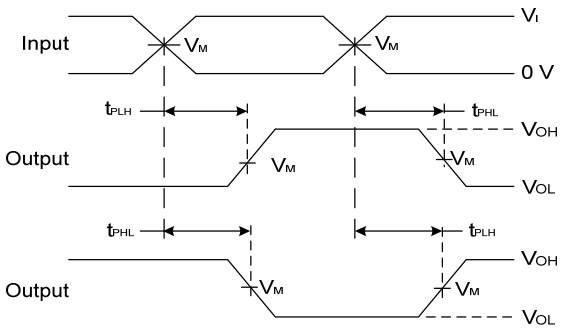
Parameter Measurement Information



V_{CC}	Inputs		V_M	C_L
	V_I	t_r/t_f		
0.8V	V_{CC}	≤3ns	$V_{CC}/2$	5, 10, 15, 30pF
1.2V ± 0.1V	V_{CC}	≤3ns	$V_{CC}/2$	5, 10, 15, 30pF
1.5V ± 0.1V	V_{CC}	≤3ns	$V_{CC}/2$	5, 10, 15, 30pF
1.8V ± 0.15V	V_{CC}	≤3ns	$V_{CC}/2$	5, 10, 15, 30pF
2.5V ± 0.2V	V_{CC}	≤3ns	$V_{CC}/2$	5, 10, 15, 30pF
3.3V ± 0.3V	V_{CC}	≤3ns	$V_{CC}/2$	5, 10, 15, 30pF



Voltage Waveform Pulse Duration



Voltage Waveform Propagation Delay Times
Inverting and Non Inverting Outputs

Figure 1 Load Circuit and Voltage Waveforms

Notes:
A. Includes test lead and test apparatus capacitance.
B. All pulses are supplied at pulse repetition rate ≤ 10 MHz.
C. Inputs are measured separately one transition per measurement.
D. t_{PLH} and t_{PHL} are the same as t_{PD}.

Marking Information

X2-DFN1210-8

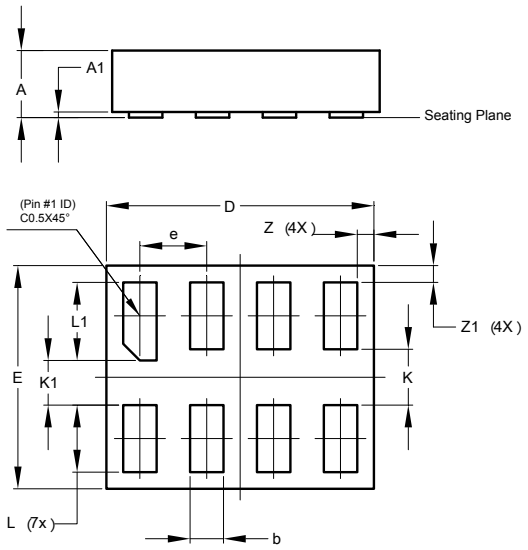
(Top View)

XX : Identification Code
Y : Year : 0~9
W : week : A~Z : 1~26 week
a~z: 27-52 week
z represents 52 and 53 week
X : week : A~Z : Internal code

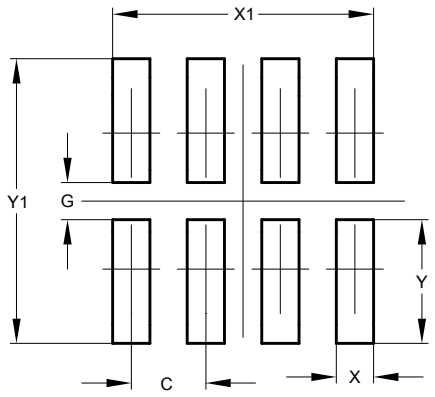
Part Number	Package	Identification Code
74AUP2G00RA3-7	X2-DFN1210-8	AT

X2-DFN1210-8 Package Outline Dimensions and Suggested Pad Layout

Please see AP02002 at http://www.diodes.com/datasheets/ap02002.pdf for the latest version.



X2-DFN1210-8			
Dim	**Min**	**Max**	**Typ**
A	-	0.35	0.30
A1	0	0.03	0.02
b	0.10	0.20	0.15
D	1.15	1.25	1.20
E	0.95	1.05	1.00
e	-	-	0.30
K	-	-	0.25
K1	-	-	0.20
L	0.25	0.35	0.30
L1	0.30	0.40	0.35
Z	0.050	0.100	0.075
Z1	0.050	0.100	0.075
All Dimensions in mm			



Dimensions	Value (in mm)
C	0.300
G	0.150
X	0.150
X1	1.050
Y	0.500
Y1	1.150

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