

## Description

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

The 74AUP2G04 is composed of two inverters with standard 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<sub>OFF</sub>. The I<sub>OFF</sub> circuitry disables the output preventing damaging current backflow when the device is powered down. The gates perform the positive Boolean function:

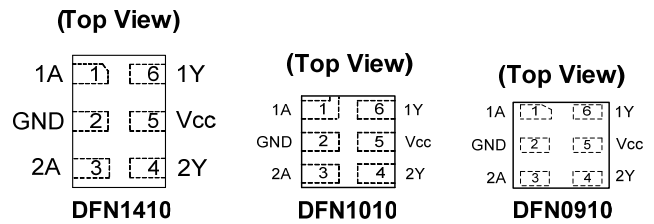
$$Y = \bar{A}$$

## 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<sub>CC</sub> < 0.9µA
- Low Dynamic Power Consumption
- C<sub>PD</sub> = 4pF Typical at 3.6V
- Schmitt Trigger Action at All Inputs Make the Circuit Tolerant for Slower Input Rise and Fall Time. The hysteresis is typically 250mV at V<sub>CC</sub> = 3.0V
- I<sub>OFF</sub> Supports Partial-Power-Down Mode Operation
- ESD Protection per JESD 22
  - Exceeds 200-V Machine Model (A115)
  - Exceeds 2000-V Human Body Model (A114)
  - Exceeds 1000-V Charged Device Model (C101)
- Latch-Up Exceeds 100 mA per JESD 78, Class I
- Leadless packages per JESD30E
  - DFN1410 denoted as X2-DFN1410-6
  - DFN1010 denoted as X2-DFN1010-6
  - DFN0910 denoted as X2-DFN0910-6
- **Totally Lead-Free & Fully RoHS Compliant (Notes 1 & 2)**
- **Halogen and Antimony Free. "Green" Device (Note 3)**

- 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](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.

## Pin Assignments



## Applications

- Suited for battery and low power needs
- Wide array of products such as:
  - PCs, networking, notebooks, netbooks, PDAs
  - Tablet Computers, E-readers
  - Computer peripherals, hard drives, CD/DVD ROM
  - TV, DVD, DVR, set top box
  - Cell Phones, Personal Navigation / GPS
  - MP3 players, Cameras, Video Recorders

[Click here for ordering information, located at the end of datasheet](#)

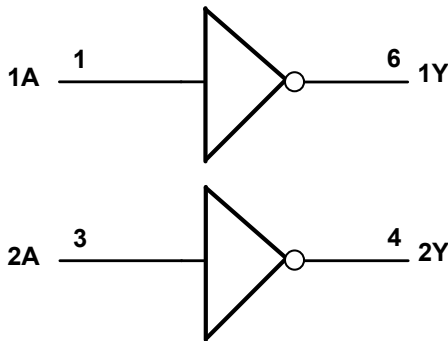
## Pin Descriptions

Pin Name	Pin NO	Function
1A	1	Data Input
GND	2	Ground
2A	3	Data Input
2Y	4	Data Output
V <sub>CC</sub>	5	Supply Voltage
1Y	6	Data Output

## Function Table

Inputs	Output
nA	nY
H	L
L	H

## Logic Diagram



## Absolute Maximum Ratings (Note 4) (@T<sub>A</sub> = +25°C, unless otherwise specified.)

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 <sub>CC</sub>	Supply Voltage Range	-0.5 to +4.6	V
V <sub>I</sub>	Input Voltage Range	-0.5 to +4.6	V
V <sub>O</sub>	Voltage applied to output in high or low state	-0.5 to V <sub>CC</sub> +0.5	V
I <sub>IK</sub>	Input Clamp Current (V <sub>I</sub> < 0)	50	mA
I <sub>OK</sub>	Output Clamp Current (V <sub>O</sub> < 0)	-50	mA
I <sub>O</sub>	Continuous Output Current (V <sub>O</sub> = 0 to V <sub>CC</sub> )	±20	mA
I <sub>CC</sub>	Continuous Current through V <sub>CC</sub>	50	mA
I <sub>GND</sub>	Continuous Current through GND	-50	mA
T <sub>J</sub>	Operating Junction Temperature	-40 to +150	°C
T <sub>STG</sub>	Storage Temperature	-65 to +150	°C

Note: 4. Stresses beyond the absolute maximum may result in immediate failure or reduced reliability. These are stress values and device operation should be within recommend values.

**Recommended Operating Conditions** (Note 5) (@ $T_A = +25^\circ\text{C}$ , unless otherwise specified.)

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	$V_{CC} = 0.8\text{V}$		-20	$\mu\text{A}$
		$V_{CC} = 1.1\text{V}$		-1.1	mA
		$V_{CC} = 1.4\text{V}$		-1.7	
		$V_{CC} = 1.65\text{V}$		-1.9	
		$V_{CC} = 2.3\text{V}$		-3.1	
		$V_{CC} = 3.0\text{V}$		-4	
$I_{OL}$	Low-Level Output Current	$V_{CC} = 0.8\text{V}$		20	$\mu\text{A}$
		$V_{CC} = 1.1\text{V}$		1.1	mA
		$V_{CC} = 1.4\text{V}$		1.7	
		$V_{CC} = 1.65\text{V}$		1.9	
		$V_{CC} = 2.3\text{V}$		3.1	
		$V_{CC} = 3.0\text{V}$		4	
$\Delta t/\Delta V$	Input Transition Rise or Fall Rate	$V_{CC} = 0.8\text{V to } 3.6\text{V}$		200	ns/V
$T_A$	Operating Free-Air Temperature		-40	125	$^\circ\text{C}$

Note: 5. Unused inputs should be held at  $V_{CC}$  or Ground.

**Electrical Characteristics** (@ $T_A = +25^\circ\text{C}$ , unless otherwise specified.)

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

**Electrical Characteristics** (cont.) (@T<sub>A</sub> = +25°C, unless otherwise specified.)

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

**Operating and Package Characteristics** (@T<sub>A</sub> = +25°C, unless otherwise specified.)

Parameter		Test Conditions	V <sub>CC</sub>	Typ	Unit
C <sub>pd</sub>	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 <sub>I</sub>	Input Capacitance	V <sub>I</sub> = V <sub>CC</sub> or GND	0V or 3.3V	2.0	pF
C <sub>O</sub>	Output Capacitance	V <sub>O</sub> = V <sub>CC</sub> or GND	0V	3.5	pF

## Switching Characteristics

 $C_L = 5\text{pF}$  see Figure 1

Parameter	From Input	TO OUTPUT	$V_{CC}$	$T_A = +25^\circ\text{C}$			$T_A = -40^\circ\text{C to } +85^\circ\text{C}$		$T_A = -40^\circ\text{C to } +125^\circ\text{C}$		Unit
				Min	Typ	Max	Min	Max	Min	Max	
$t_{pd}$	A	Y	0.8V		19.2						ns
			$1.2\text{V} \pm 0.1\text{V}$	2.6	5.5	11.3	2.3	12.5	2.3	13.9	
			$1.5\text{V} \pm 0.1\text{V}$	1.8	3.6	6.4	1.6	7.4	1.6	8.2	
			$1.8\text{V} \pm 0.15\text{V}$	1.5	2.9	5.0	1.4	5.9	1.4	6.5	
			$2.5\text{V} \pm 0.2\text{V}$	1.2	2.4	3.9	1.1	4.5	1.1	5.0	
			$3.3\text{V} \pm 0.3\text{V}$	0.9	1.9	3.2	0.8	3.9	0.8	4.3	

 $C_L = 10\text{pF}$  see Figure 1

Parameter	From Input	TO OUTPUT	$V_{CC}$	$T_A = +25^\circ\text{C}$			$T_A = -40^\circ\text{C to } +85^\circ\text{C}$		$T_A = -40^\circ\text{C to } +125^\circ\text{C}$		Unit
				Min	Typ	Max	Min	Max	Min	Max	
$t_{pd}$	A	Y	0.8V		23.8						ns
			$1.2\text{V} \pm 0.1\text{V}$	3.1	6.5	13.4	2.9	15.1	2.9	16.6	
			$1.5\text{V} \pm 0.1\text{V}$	2.3	4.2	7.5	2.1	8.7	2.1	9.6	
			$1.8\text{V} \pm 0.15\text{V}$	2.0	3.5	5.9	1.8	7.0	1.8	7.7	
			$2.5\text{V} \pm 0.2\text{V}$	1.6	2.9	4.6	1.5	5.4	1.5	6.0	
			$3.3\text{V} \pm 0.3\text{V}$	1.2	2.4	3.8	1.1	4.5	1.1	5.0	

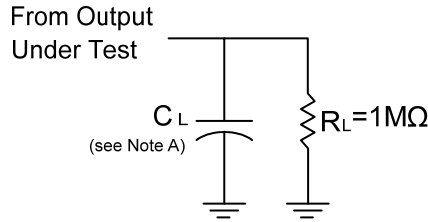
 $C_L = 15\text{pF}$  see Figure 1

Parameter	From Input	TO OUTPUT	$V_{CC}$	$T_A = +25^\circ\text{C}$			$T_A = -40^\circ\text{C to } +85^\circ\text{C}$		$T_A = -40^\circ\text{C to } +125^\circ\text{C}$		Unit
				Min	Typ	Max	Min	Max	Min	Max	
$t_{pd}$	A	Y	0.8V		28.0						ns
			$1.2\text{V} \pm 0.1\text{V}$	3.5	7.4	14.3	3.3	17.4	3.3	19.1	
			$1.5\text{V} \pm 0.1\text{V}$	2.6	4.7	8.6	2.4	10.0	2.4	11.0	
			$1.8\text{V} \pm 0.15\text{V}$	2.3	4.0	6.7	2.1	8.0	2.1	8.8	
			$2.5\text{V} \pm 0.2\text{V}$	2.1	3.3	5.1	1.8	6.1	1.8	6.8	
			$3.3\text{V} \pm 0.3\text{V}$	1.6	2.8	4.2	1.4	5.0	1.4	5.5	

 $C_L = 30\text{pF}$  see Figure 1

Parameter	From Input	TO OUTPUT	$V_{CC}$	$T_A = +25^\circ\text{C}$			$T_A = -40^\circ\text{C to } +85^\circ\text{C}$		$T_A = -40^\circ\text{C to } +125^\circ\text{C}$		Unit
				Min	Typ	Max	Min	Max	Min	Max	
$t_{pd}$	A	Y	0.8V		40.3						ns
			$1.2\text{V} \pm 0.1\text{V}$	4.8	9.8	17.6	4.4	20.9	4.4	23.0	
			$1.5\text{V} \pm 0.1\text{V}$	3.6	6.3	10.8	3.2	12.9	3.2	14.2	
			$1.8\text{V} \pm 0.15\text{V}$	3.2	5.3	9.0	2.9	10.5	2.9	11.6	
			$2.5\text{V} \pm 0.2\text{V}$	2.4	4.5	6.5	2.6	7.6	2.6	8.4	
			$3.3\text{V} \pm 0.3\text{V}$	1.8	3.8	5.4	2.1	6.2	2.1	6.9	

**Parameter Measurement Information**



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

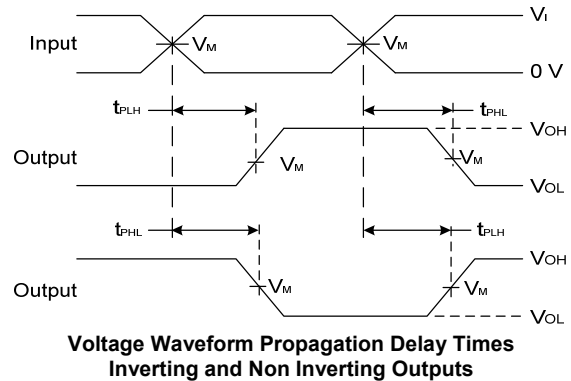
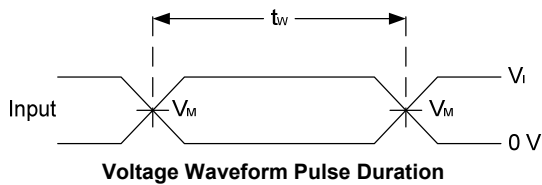
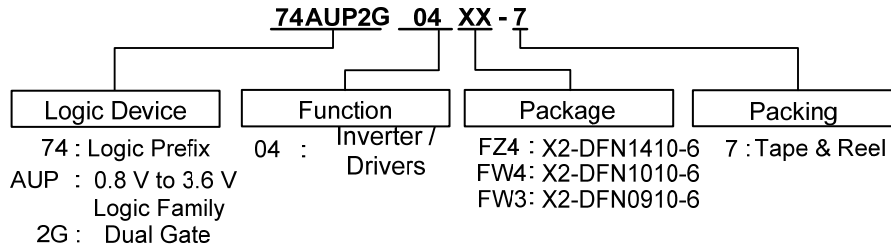


Figure 1. Load Circuit and Voltage Waveforms

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

## Ordering Information



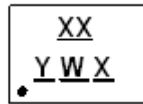
Device	Package Code	Packaging	7" Tape and Reel (Note 6)	
			Quantity	Part Number Suffix
74AUP2G04FZ4-7	FZ4	X2-DFN1410-6	5000/Tape & Reel	-7
74AUP2G04FW4-7	FW4	X2-DFN1010-6	5000/Tape & Reel	-7
74AUP2G04FW3-7	FW3	X2-DFN0910-6	5000/Tape & Reel	-7

Note: 6. The taping orientation is located on our website at <http://www.diodes.com/datasheets/ap02007.pdf>

## Marking Information

(1) X2-DFN1410-6, X2-DFN1010-6, X2-DFN0910-6

(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 : A~Z : Internal code

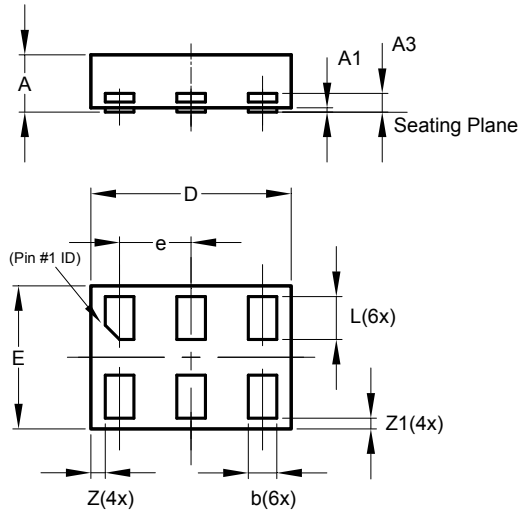
Part Number	Package	Identification Code
74AUP2G04FZ4	X2-DFN1410-6	RM
74AUP2G04FW4	X2-DFN1010-6	SM
74AUP2G04FW3	X2-DFN0910-6	MM



**Package Outline Dimensions** (All dimensions in mm.)

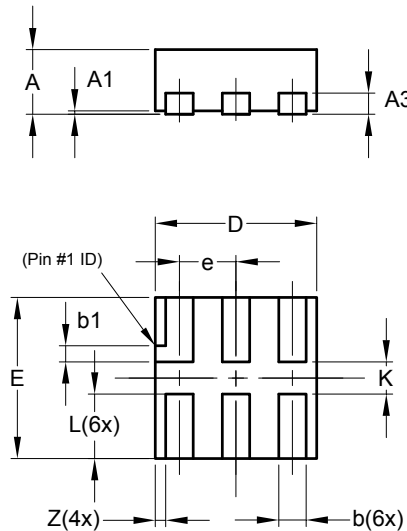
Please see AP02002 at <http://www.diodes.com/datasheets/ap02002.pdf> for latest version.

(1) Package Type X2-DFN1410-6



X2-DFN1410-6			
Dim	Min	Max	Typ
A	—	0.40	0.39
A1	0.00	0.05	0.02
A3	—	—	0.13
b	0.15	0.25	0.20
D	1.35	1.45	1.40
E	0.95	1.05	1.00
e	—	—	0.50
L	0.25	0.35	0.30
Z	—	—	0.10
Z1	0.045	0.105	0.075
All Dimensions in mm			

(2) Package Type: X2-DFN1010-6

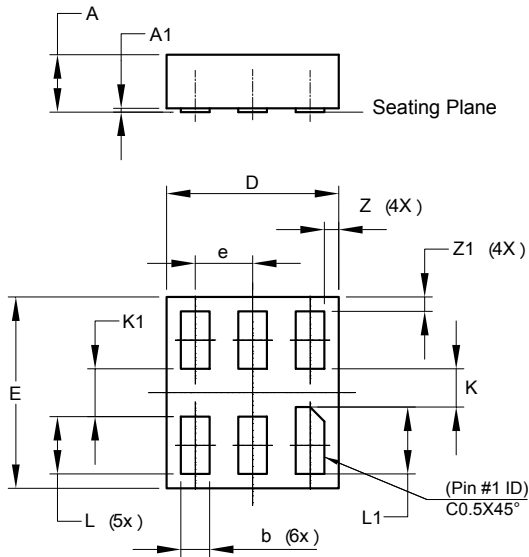


X2-DFN1010-6			
Dim	Min	Max	Typ
A	—	0.40	0.39
A1	0.00	0.05	0.02
A3	—	—	0.13
b	0.14	0.20	0.17
b1	0.05	0.15	0.10
D	0.95	1.05	1.00
E	0.95	1.05	1.00
e	—	—	0.35
L	0.35	0.45	0.40
K	0.15	—	—
Z	—	—	0.065
All Dimensions in mm			

**Package Outline Dimensions** (cont.) (All dimensions in mm.)

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

**(3) Package Type: X2-DFN0910-6**

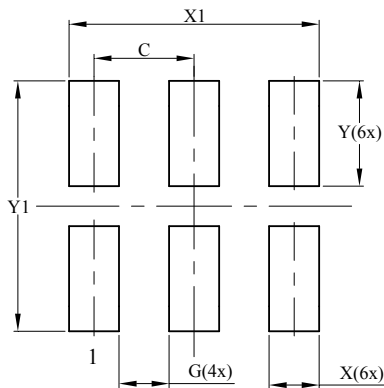


X2-DFN0910-6			
Dim	Min	Max	Typ
A	-	0.35	0.30
A1	0	0.03	0.02
b	0.10	0.20	0.15
D	0.85	0.95	0.90
E	0.95	1.05	1.00
e	-	-	0.30
K	0.20	-	-
K1	0.25	-	-
L	0.25	0.35	0.30
L1	0.30	0.40	0.35
Z	-	-	0.075
Z1	-	-	0.075
All Dimensions in mm			

**Suggested Pad Layout**

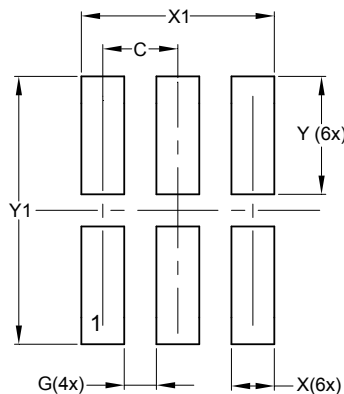
Please see AP02001 at <http://www.diodes.com/datasheets/ap02001.pdf> for the latest version.

**(1) Package Type X2-DFN1410-6**



Dimensions	Value (in mm)
C	0.500
G	0.250
X	0.250
X1	1.250
Y	0.525
Y1	1.250

**(2) Package Type: X2-DFN1010-6**

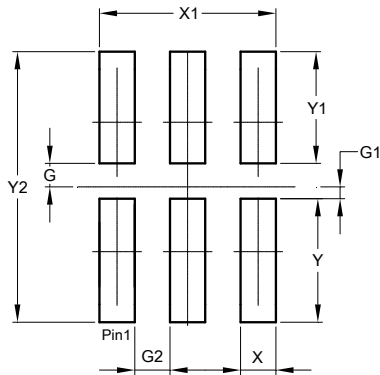


Dimensions	Value (in mm)
C	0.350
G	0.150
X	0.200
X1	0.900
Y	0.550
Y1	1.250

## Suggested Pad Layout

Please see AP02001 at <http://www.diodes.com/datasheets/ap02001.pdf> for the latest version.

### (3) Package Type: X2-DFN0910-6



Dimensions	Value (in mm)
G	0.100
G1	0.050
G2	0.150
X	0.150
X1	0.750
Y	0.525
Y1	0.475
Y2	1.150

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