SINGLE 2 INPUT EXCLUSIVE-OR GATE

Description

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

The 74AUP1G86 is a single 2-input positive exclusive-OR gate with a standard push-pull output 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.

The gate performs the positive Boolean function:

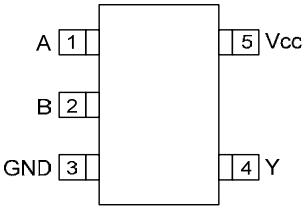
$$Y = A \oplus B \text{ or } Y = \overline{A}B + A\overline{B}$$

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} = 6.3pF (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 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-A)
  - Exceeds 1000-V Charged Device Model (C101C)
- Latch-Up Exceeds 100mA per JESD 78, Class II
- Range of Package Options SOT353, DFN1410, and DFN1010
- Leadless packages per JESD30E
  - DFN1010 denoted as X2-DFN1010-6
  - DFN1014 denoted as X2-DFN1014-6
- **Totally Lead-Free & Fully RoHS Compliant (Notes 1 & 2)**
- **Halogen and Antimony Free. "Green" Device (Note 3)**

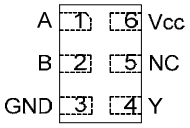
Pin Assignments

(Top View)



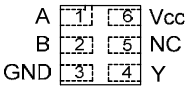
SOT353

(Top View)



DFN1410

(Top View)



DFN1010

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, 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 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.

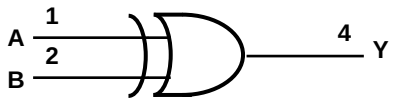
Click here for ordering information, located at the end of datasheet

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Pin Descriptions

Pin Name	Function
A	Data Input
B	Data Input
GND	Ground
Y	Data Output
Vcc	Supply Voltage

Logic Diagram



Function Table

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

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Absolute Maximum Ratings (Note 4) (@T_A = +25°C, unless otherwise specified.)

Symbol	Parameter	Rating	Unit
ESD HBM	Human Body Model ESD Protection	2	KV
ESD CDM	Charged Device Model ESD Protection	1	KV
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

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°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} = 0.8V		-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: 5. Unused inputs should be held at V_{CC} or Ground.

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Electrical Characteristics (@T_A = +25°C, unless otherwise specified.)

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}	High-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	0 to 3.6V		±0.1		±0.5	µA
I_{OFF}	Power Down Leakage Current	V_I or V_O = 0V to 3.6V	0		0.2		0.6	µA
ΔI_{OFF}	Delta Power Down Leakage Current	V_I or V_O = 0V to 3.6V	0 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

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Electrical Characteristics (cont.) (@T_A = +25°C, unless otherwise specified.)

Symbol	Parameter	Test Conditions	Vcc	T_A = -40 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 2.7 V	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} = -4 mA		2.30		
V_{OL}	High-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	0 to 3.6V		±0.75	µA
I_{OFF}	Power Down Leakage Current	V_I or V_O = 0 to 3.6V	0		±3.5	µA
ΔI_{OFF}	Delta Power Down Leakage Current	V_I or V_O = 0 to 3.6V	0 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

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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 or B	Y	0.8V		21.2						ns
			1.2V ± 0.1V	2.3	5.9	13.1	2.1	14.3	2.1	15.8	
			1.5V ± 0.1V	1.8	4.1	7.7	1.6	8.8	1.6	9.7	
			1.8V ± 0.15V	1.5	3.3	5.9	1.4	6.9	1.4	7.6	
			2.5V ± 0.2V	1.2	2.6	4.4	1.1	5.3	1.1	5.9	
			3.3V ± 0.3V	1.0	2.3	4.0	0.9	4.7	0.9	5.2	

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 or B	Y	0.8V		24.7						ns
			1.2V ± 0.1V	2.6	6.8	14.8	2.4	16.2	2.4	17.9	
			1.5V ± 0.1V	2.2	4.8	8.7	1.9	10.0	1.9	11.0	
			1.8V ± 0.15V	1.8	3.9	6.7	1.7	8.0	1.7	8.8	
			2.5V ± 0.2V	1.5	3.1	5.2	1.4	6.2	1.4	6.9	
			3.3V ± 0.3V	1.3	2.98	4.8	1.3	5.6	1.3	6.2	

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 or B	Y	0.8V		28.2						ns
			1.2V ± 0.1V	3.0	7.6	16.5	2.7	18.1	2.7	20.0	
			1.5V ± 0.1V	2.4	5.3	9.6	2.2	11.3	2.2	12.5	
			1.8V ± 0.15V	2.1	4.4	7.5	1.9	9.0	1.9	9.9	
			2.5V ± 0.2V	1.8	3.6	5.9	1.6	7.0	1.6	7.7	
			3.3V ± 0.3V	1.6	3.3	5.4	1.5	6.4	1.5	7.1	

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 or B	Y	0.8V		38.5						ns
			1.2V ± 0.1V	3.9	9.9	21.5	3.5	24.1	3.5	26.6	
			1.5V ± 0.1V	3.2	6.9	12.5	2.8	14.8	2.8	16.3	
			1.8V ± 0.15V	2.8	5.7	9.8	2.5	11.7	2.5	12.9	
			2.5V ± 0.2V	2.4	4.7	7.6	2.2	9.1	2.2	10.1	
			3.3V ± 0.3V	2.2	4.4	7.1	2.1	8.3	2.1	9.2	

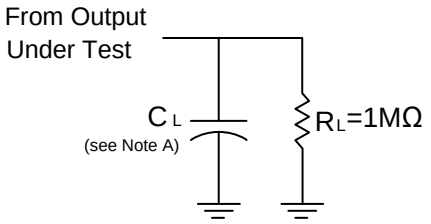
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Operating and Package Characteristics (@T_A = +25°C, unless otherwise specified.)

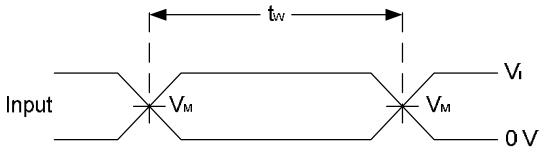
Parameter		Test Conditions		V_{CC}	Typ	Unit
C_{pd}	Power Dissipation Capacitance	f = 1MHz No Load		0.8V	6.7	pF
				1.2V ± 0.1V	6.6	
				1.5V ± 0.1V	6.5	
				1.8V ± 0.15V	6.5	
				2.5V ± 0.2V	6.4	
				3.3V ± 0.3V	6.3	
C_i	Input Capacitance	V_i = V_{CC} or GND		0 or 3.3V	1.5	pF
θ_{JA}	Thermal Resistance Junction-to-Ambient	SOT353	(Note 6)		371	°C/W
		X2-DFN1410-6			430	
		X2-DFN1010-6			445	
θ_{JC}	Thermal Resistance Junction-to-Case	SOT353	(Note 6		143	°C/W
		X2-DFN1410-6			190	
		X2-DFN1010-6			250	

Note: 6. Test condition for SOT353, X2-DFN1410-6, and X2-DFN1010-2 devices mounted on FR-4 substrate PC board, 2oz copper, with minimum recommended pad layout.

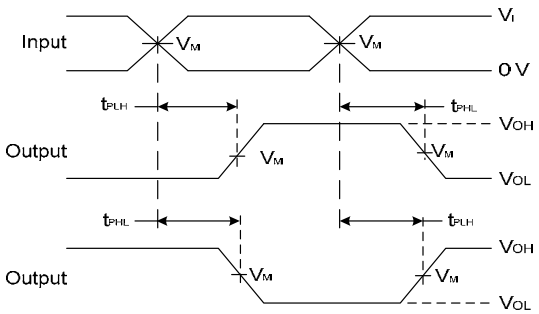
Parameter Measurement Information



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



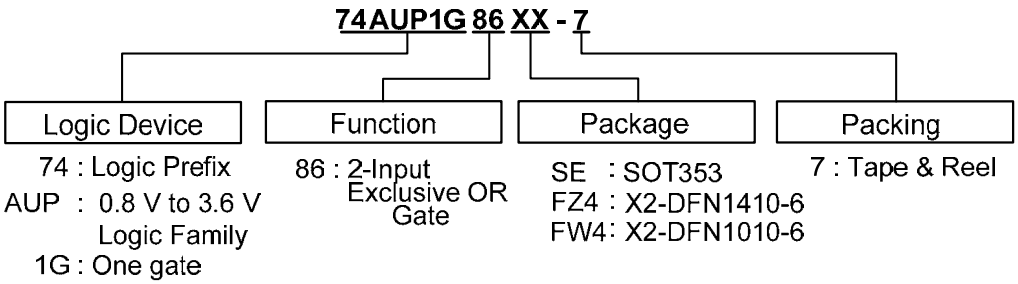
Voltage Waveform Propagation Delay Times Inverting and Non Inverting Outputs

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}.

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Ordering Information

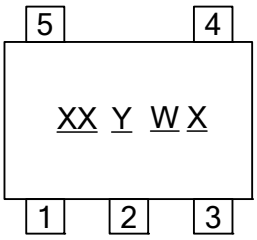


Part Number	Package Code	Packaging	7" Tape and Reel	
			Quantity	Part Number Suffix
74AUP1G86SE-7	SE	SOT353	3000/Tape & Reel	-7
74AUP1G86FZ4-7	FZ4	X2-DFN1410-6	5000/Tape & Reel	-7
74AUP1G86FW4-7	FW4	X2-DFN1010-6	5000/Tape & Reel	-7

Marking Information

(1) SOT353

(Top View)

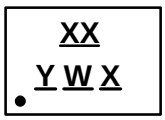


XX : Identification code
Y : Year 0~9
W : Week : A~Z : 1~26 week;
a~z : 27~52 week; z represents 52 and 53 week
X : A~Z : Internal code

Part Number	Package	Identification Code
74AUP1G86SE	SOT353	XW

(2) X2-DFN1410-6 and X2-DFN1010-6

(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

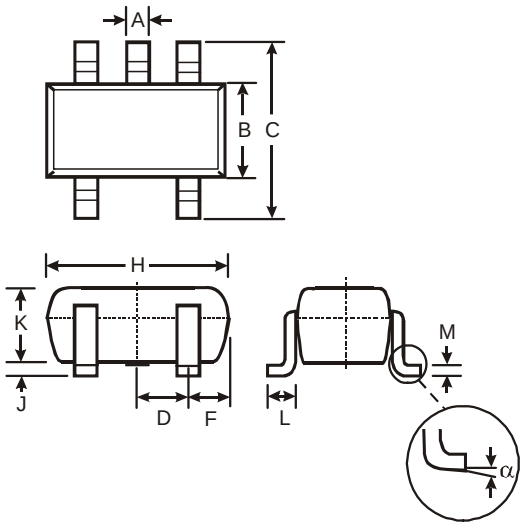
Part Number	Package	Identification Code
74AUP1G86FZ4	X2-DFN1410-6	XW
74AUP1G86FW4	X2-DFN1010-6	XW

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Package Outline Dimensions (All dimensions in mm.)

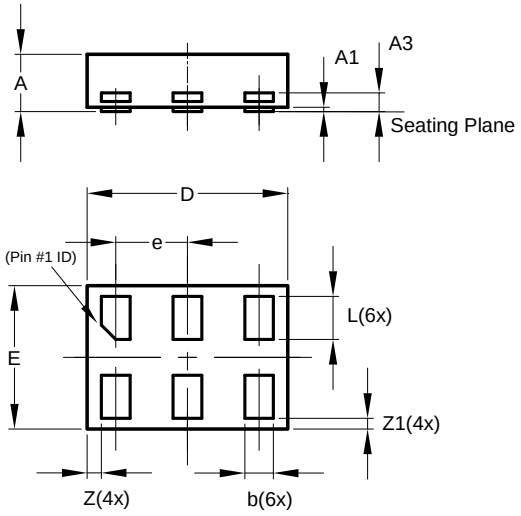
Please see AP02002 at http://www.diodes.com/datasheets/ap02002.pdf for latest version.

(1) SOT353



SOT353			
Dim	Min	Max	Typ
A	0.10	0.30	0.25
B	1.15	1.35	1.30
C	2.00	2.20	2.10
D	0.65 Typ		
F	0.40	0.45	0.425
H	1.80	2.20	2.15
J	0	0.10	0.05
K	0.90	1.00	1.00
L	0.25	0.40	0.30
M	0.10	0.22	0.11
α	0°	8°	-
All Dimensions in mm			

(2) X2-DFN1410-6



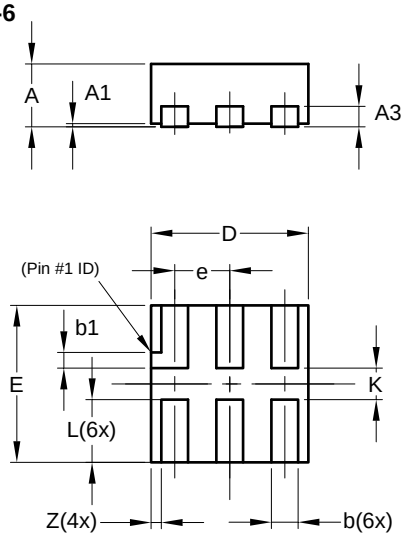
X2-DFN1410-6			
Dim	Min	Max	Typ
A	—	0.40	0.39
A1	0.00	0.05	0.02
A3	—	—	0.13
b	0.15	0.25	0.20
D	1.35	1.45	1.40
E	0.95	1.05	1.00
e	—	—	0.50
L	0.25	0.35	0.30
Z	—	—	0.10
Z1	0.045	0.105	0.075
All Dimensions in mm			

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

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

(3) X2-DFN1010-6

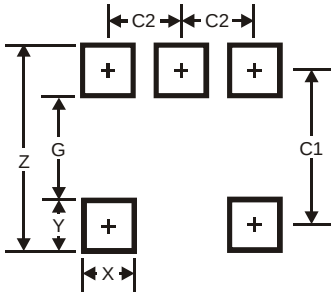


X2-DFN1010-6			
Dim	**Min**	**Max**	**Typ**
A	—	0.40	0.39
A1	0.00	0.05	0.02
A3	—	—	0.13
b	0.14	0.20	0.17
b1	0.05	0.15	0.10
D	0.95	1.05	1.00
E	0.95	1.05	1.00
e	—	—	0.35
L	0.35	0.45	0.40
K	0.15	—	—
Z	—	—	0.065
All Dimensions in mm			

Suggested Pad Layout

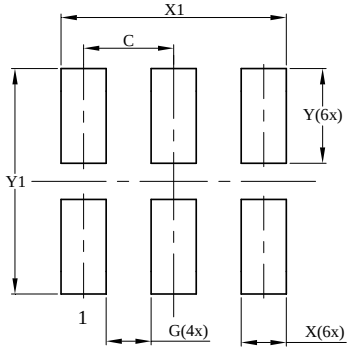
Please see AP02001 at http://www.diodes.com/datasheets/ap02001.pdf for the latest version

(1) SOT353



Dimensions	Value (in mm)
Z	2.5
G	1.3
X	0.42
Y	0.6
C1	1.9
C2	0.65

(2) X2-DFN1410-6



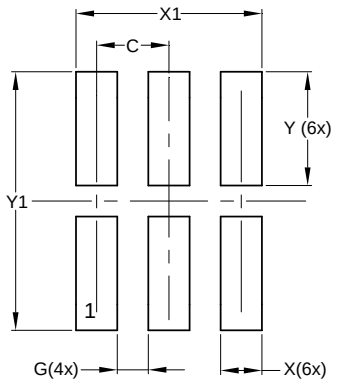
Dimensions	Value (in mm)
C	0.500
G	0.250
X	0.250
X1	1.250
Y	0.525
Y1	1.250

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Suggested Pad Layout (cont.)

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

(3) 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

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