

Description

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

The 74AUP1G02 is a single 2-input positive NOR 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:

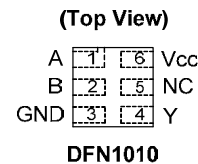
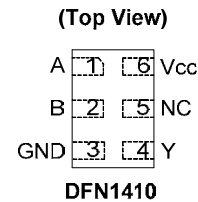
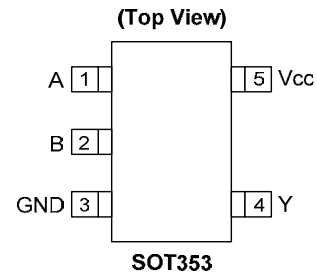
$$Y = \overline{A + B} \text{ or } Y = \overline{A} \bullet \overline{B}$$

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} = 6.4pF (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 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)**

- 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.

Pin Assignments



Applications

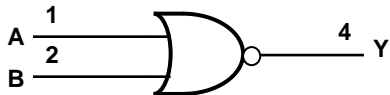
- Suited for battery and low power needs
- Wide array of products such as:
 - Tablets, E-readers
 - Cell Phones, Personal Navigation / GPS
 - MP3 players, Cameras, Video Recorders
 - PCs ultrabooks, notebooks, netbooks,
 - Computer peripherals, hard drives, CD/DVD ROM
 - TV, DVD, DVR, set top box

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

Pin Descriptions

Pin Name	Function
A	Data Input
B	Data Input
GND	Ground
Y	Data Output
V _{CC}	Supply Voltage

Logic Diagram



Function Table

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

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	uA
		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.

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} = 4 mA			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	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 (cont.) (@T_A = +25°C, unless otherwise specified.)

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} = -20 μA	0.8V to 3.6V	V _{CC} - 0.11		V
		I _{OH} = -1.1 mA	1.1V	0.6 X V _{CC}		
		I _{OH} = -1.7 mA	1.4V	0.93		
		I _{OH} = -1.9 mA	1.65V	1.17		
		I _{OH} = -2.3 mA	2.3V	1.77		
		I _{OH} = -3.1 mA		1.67		
		I _{OH} = -2.7 mA	3V	2.40		
		I _{OH} = -4 mA		2.30		
V _{OL}	High-Level Input Voltage	I _{OL} = 20 μA	0.8V to 3.6V		0.11	V
		I _{OL} = 1.1 mA	1.1V		0.33 X V _{CC}	
		I _{OL} = 1.7 mA	1.4V		0.41	
		I _{OL} = 1.9 mA	1.65V		0.39	
		I _{OL} = 2.3 mA	2.3V		0.36	
		I _{OL} = 3.1 mA			0.50	
		I _{OL} = 2.7 mA	3V		0.36	
		I _{OL} = 4 mA			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 = 0V to 3.6V	0		± 3.5	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

Switching Characteristics

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

Parameter	From Input	TO OUTPUT	Vcc	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		17.0						ns
			1.2V ± 0.1V	2.5	5.1	10.8	2.1	12.1	2.1	13.4	
			1.5V ± 0.1V	1.6	3.7	6.7	1.4	7.8	1.4	8.6	
			1.8V ± 0.15V	1.3	3.0	5.3	1.1	6.2	1.1	6.9	
			2.5V ± 0.2V	1.0	2.4	3.9	0.9	4.6	0.9	5.1	
			3.3V ± 0.3V	1.0	2.2	3.4	0.8	4.0	0.8	4.4	

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

Parameter	From Input	TO OUTPUT	Vcc	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		20.4						ns
			1.2V ± 0.1V	2.4	6.0	12.8	2.2	14.3	2.2	15.8	
			1.5V ± 0.1V	1.9	4.3	7.9	1.7	9.2	1.7	10.2	
			1.8V ± 0.15V	1.6	3.6	6.2	1.5	7.3	1.5	8.1	
			2.5V ± 0.2V	1.4	3.0	4.7	1.2	5.6	1.2	6.2	
			3.3V ± 0.3V	1.3	2.7	4.2	1.2	5.0	1.2	5.5	

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

Parameter	From Input	TO OUTPUT	Vcc	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		23.9						ns
			1.2V ± 0.1V	3.4	6.8	14.6	3.1	16.4	3.1	18.1	
			1.5V ± 0.1V	2.3	4.8	8.9	2.0	10.4	2.0	11.5	
			1.8V ± 0.15V	1.9	4.0	7.0	1.7	8.3	1.7	9.2	
			2.5V ± 0.2V	1.7	3.4	5.4	1.5	6.3	1.5	7.0	
			3.3V ± 0.3V	1.6	3.2	4.8	1.4	5.7	1.4	6.3	

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

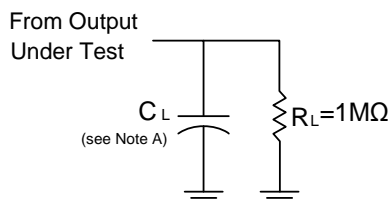
Parameter	From Input	TO OUTPUT	Vcc	T _A = +25°C			T _A = -40°C to +85°C		T _A = -40°C to +125°C		Unit
				Min	Typ	Max	Min	Max	Min	Max	
t _{pd}	A or B	Y	0.8V		34.2						ns
			1.2V ± 0.1V	4.6	19.0	22.0	4.1	22.4	4.1	24.7	
			1.5V ± 0.1V	3.4	6.4	11.8	2.9	13.9	2.9	15.3	
			1.8V ± 0.15V	2.6	5.3	9.3	2.3	11.1	2.3	12.3	
			2.5V ± 0.2V	2.4	4.5	7.1	2.1	8.5	2.1	9.4	
			3.3V ± 0.3V	2.0	2.9	6.4	2.1	7.7	2.1	8.5	

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

Parameter		Test Conditions	Vcc	Typ	Unit
C_{pd}	Power Dissipation Capacitance	f = 1MHz No Load	0.8V	6.8	pF
			1.2V ± 0.1V	6.7	
			1.5V ± 0.1V	6.6	
			1.8V ± 0.15V	6.2	
			2.5V ± 0.2V	6.5	
			3.3V ± 0.3V	6.4	
C_i	Input Capacitance	$V_i = V_{CC}$ or GND	0V or 3.3V	1.5	pF
θ_{JA}	Thermal Resistance Junction-to-Ambient	SOT353	(Note 6)	371	$^\circ\text{C/W}$
		X2-DFN1410-6		430	
		X2-DFN1010-6		445	
θ_{JC}	Thermal Resistance Junction-to-Case	SOT353	(Note 6)	143	$^\circ\text{C/W}$
		X2-DFN1410-6		190	
		X2-DFN1010-6		250	

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

Parameter Measurement Information



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

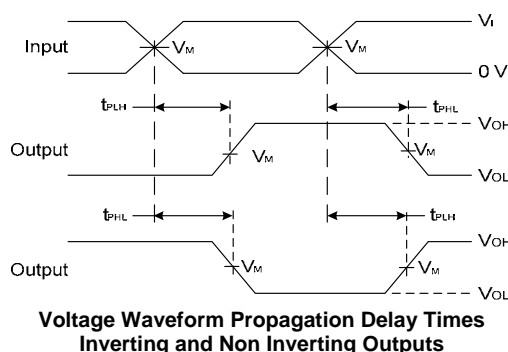
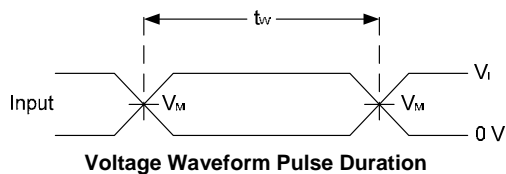
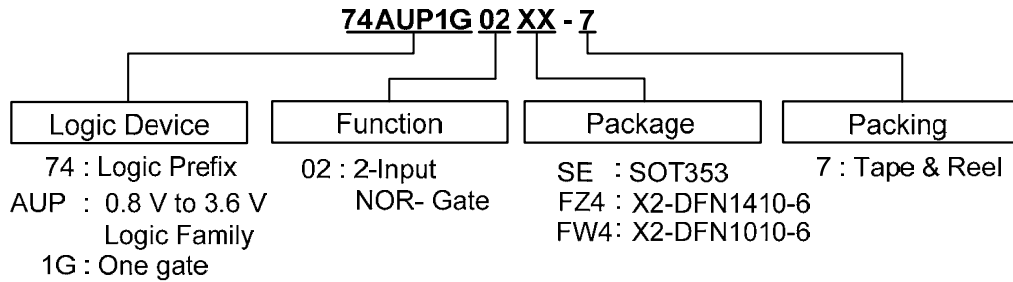


Figure 1. Load Circuit and Voltage Waveforms

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

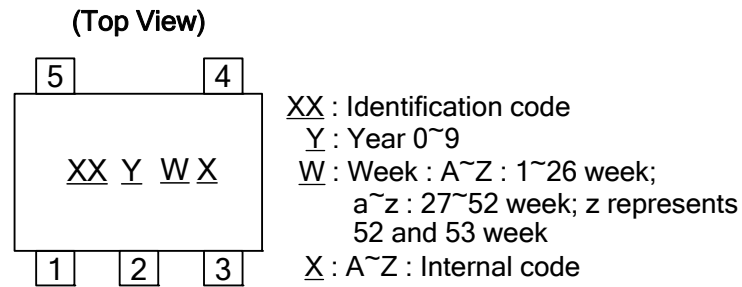
Ordering Information



Device	Package Code	Packaging	7" Tape and Reel	
			Quantity	Part Number Suffix
74AUP1G02SE-7	SE	SOT353	3000/Tape & Reel	-7
74AUP1G02FZ4-7	FZ4	X2-DFN1410-6	5000/Tape & Reel	-7
74AUP1G02FW4-7	FW4	X2-DFN1010-6	5000/Tape & Reel	-7

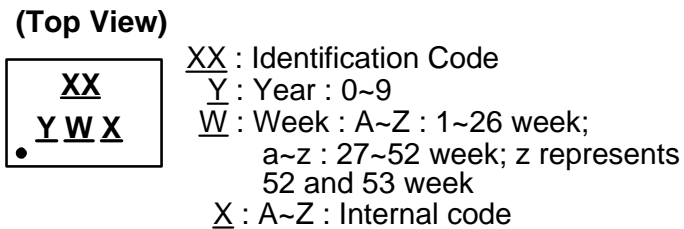
Marking Information

(1) SOT353



Part Number	Package	Identification Code
74AUP1G02SE	SOT353	XJ

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

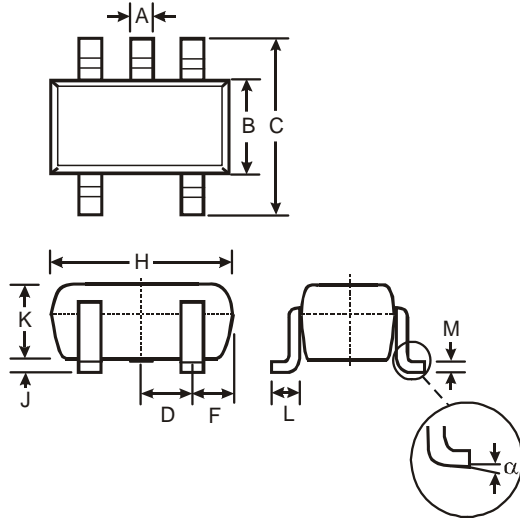


Part Number	Package	Identification Code
74AUP1G02FZ4	X2-DFN1410-6	XJ
74AUP1G02FW4	X2-DFN1010-6	XJ

Package Outline Dimensions (All dimensions in mm.)

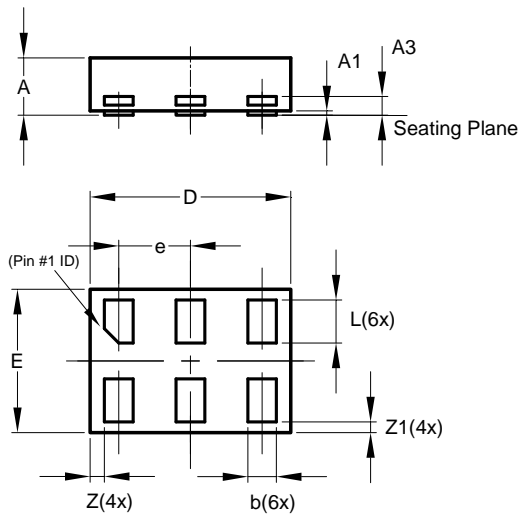
Please see AP02002 at <http://www.diodes.com/datasheets/ap02002.pdf> for latest version.

(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
	0°	8°	-
All Dimensions in mm			

(2) X2-DFN1410-6

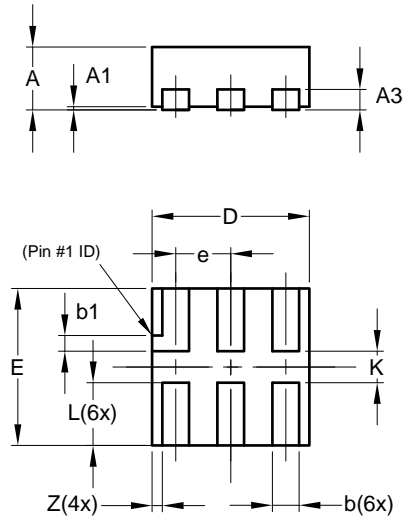


X2-DFN1410-6			
Dim	Min	Max	Typ
A	—	0.40	0.39
A1	0.00	0.05	0.02
A3	—	—	0.13
b	0.15	0.25	0.20
D	1.35	1.45	1.40
E	0.95	1.05	1.00
e	—	—	0.50
L	0.25	0.35	0.30
Z	—	—	0.10
Z1	0.045	0.105	0.075
All Dimensions in mm			

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

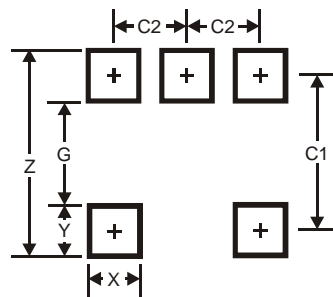


X2-DFN1010-6			
Dim	Min	Max	Typ
A	—	0.40	0.39
A1	0.00	0.05	0.02
A3	—	—	0.13
b	0.14	0.20	0.17
b1	0.05	0.15	0.10
D	0.95	1.05	1.00
E	0.95	1.05	1.00
e	—	—	0.35
L	0.35	0.45	0.40
K	0.15	—	—
Z	—	—	0.065
All Dimensions in mm			

Suggested Pad Layout

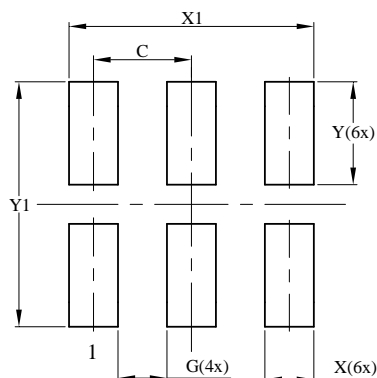
Please see AP02001 at <http://www.diodes.com/datasheets/ap02001.pdf> for the latest version

(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

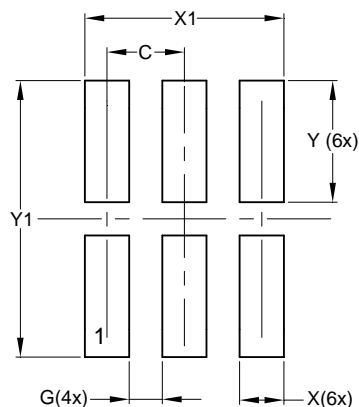


Dimensions	Value (in mm)
C	0.500
G	0.250
X	0.250
X1	1.250
Y	0.525
Y1	1.250

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

IMPORTANT NOTICE

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