

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, two-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:

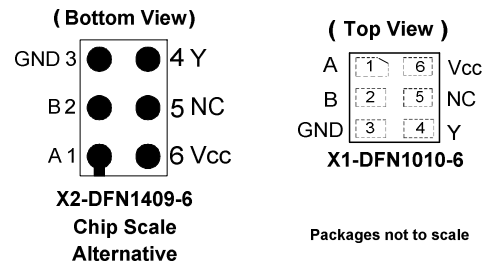
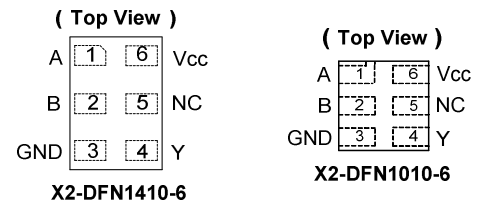
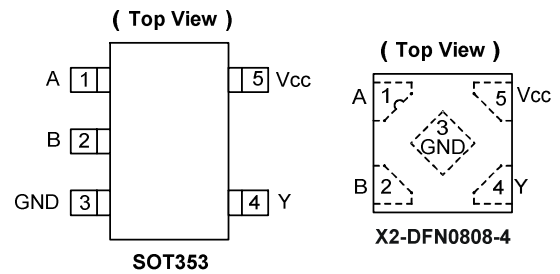
$$Y = A \oplus B \text{ or } Y = \overline{AB} + A\overline{B}$$

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 makes the circuit tolerant for slower input rise and fall time. The hysteresis is typically 250mV 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)**

- 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.

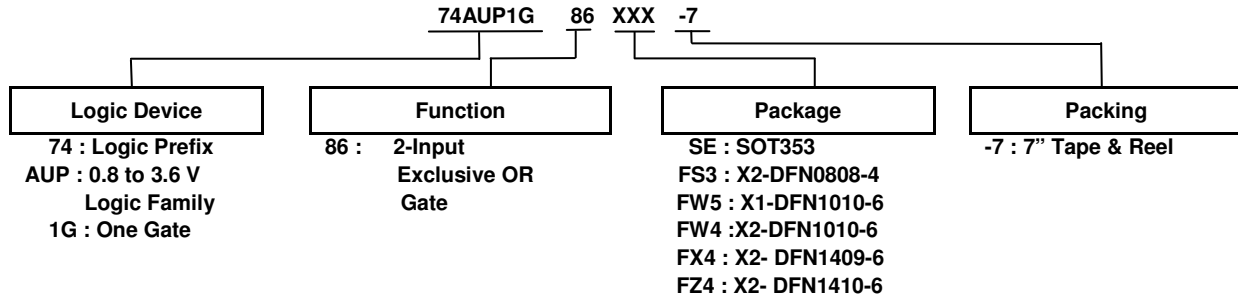
Pin Assignments



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, SSDs, Netbooks
 - Computer Peripherals, Hard Drives, CD/DVD ROMs
 - TVs, DVDs, DVRs, Set-Top Boxes

Ordering Information



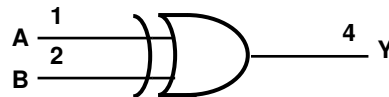
Device	Package Code	Package (Notes 4 & 5)	Package Size	7" Tape and Reel	
				Quantity	Part Number Suffix
74AUP1G86SE-7	SE	SOT353	2.0mm x 2.0mm x 1.1mm 0.65 mm lead pitch	3,000/Tape & Reel	-7
74AUP1G86FS3-7	FS3	X2-DFN0808-4	0.8mm x 0.8mm x 0.35mm 0.5 mm pad pitch (diamond)	5,000/Tape & Reel	-7
74AUP1G86FW5-7	FW5	X1-DFN1010-6	1.0mm x 1.0mm x 0.5mm 0.35 mm pad pitch	5,000/Tape & Reel	-7
74AUP1G86FW4-7	FW4	X2-DFN1010-6	1.0mm x 1.0mm x 0.4mm 0.35 mm pad pitch	5,000/Tape & Reel	-7
74AUP1G86FX4-7	FX4	X2-DFN1409-6 Chip Scale Alternative	1.4mm x 0.9mm x 0.4mm 0.5 mm pad pitch	5,000/Tape & Reel	-7
74AUP1G86FZ4-7	FZ4	X2-DFN1410-6	1.4mm x 1.0mm x 0.4mm 0.5 mm pad 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	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

Absolute Maximum Ratings (Notes 6 & 7) (@ $T_A = +25^\circ\text{C}$, 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	$^\circ\text{C}$
T_{STG}	Storage Temperature	-65 to +150	$^\circ\text{C}$

- Notes:
- 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.
 - 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) (@ $T_A = +25^\circ\text{C}$, 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	μA
		$V_{CC} = 1.1\text{V}$	—	-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	μA
		$V_{CC} = 1.1\text{V}$	—	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 3.6V	—	200	ns/V
T_A	Operating Free-Air Temperature		-40	+125	$^\circ\text{C}$

- Note: 8. 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}	Low-Level Output 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

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

Symbol	Parameter	Test Conditions	V _{CC}	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}	Low-Level Output 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

Switching Characteristics

 $C_L = 5\text{pF}$, 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	

 $C_L = 10\text{pF}$, 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	

 $C_L = 15\text{pF}$, 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	

 $C_L = 30\text{pF}$, See Figure 1

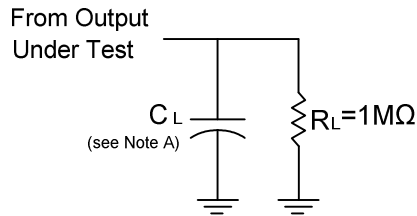
Parameter	From Input	TO OUTPUT	V _{cc}	T _A = +25°C			T _A = -40°C to +85°C		T _A = -40°C to +125°C		Unit
				Min	Typ	Max	Min	Max	Min	Max	
t _{pd}	A or B	Y	0.8V	—	38.5	—	—	—	—	—	ns
			1.2V ± 0.1V	3.9	9.9	21.5	3.5	24.1	3.5	26.6	
			1.5V ± 0.1V	3.2	6.9	12.5	2.8	14.8	2.8	16.3	
			1.8V ± 0.15V	2.8	5.7	9.8	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	

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

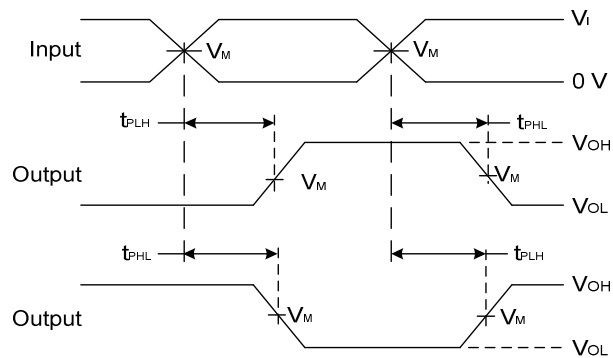
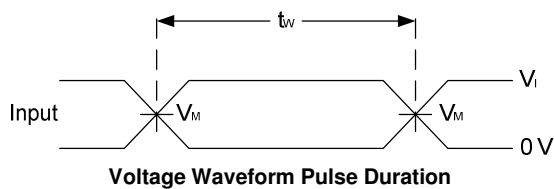
Parameter		Test Conditions		V _{CC}	Typ	Unit
C _{pd}	Power Dissipation Capacitance	f = 1MHz No Load		0.8V	6.7	pF
				1.2V ± 0.1V	6.6	
				1.5V ± 0.1V	6.5	
				1.8V ± 0.15V	6.5	
				2.5V ± 0.2V	6.4	
				3.3V ± 0.3V	6.3	
C _i	Input Capacitance	V _i = V _{CC} or GND		0V or 3.3V	1.5	pF
θ _{JA}	Thermal Resistance Junction-to-Ambient	SOT353	(Note 9)	—	371	°C/W
		X2-DFN0808-4		—	430	
		X1-DFN1010-6		—	435	
		X2-DFN1010-6		—	445	
		X2-DFN1409-6		—	470	
		X2-DFN1410-6		—	460	
θ _{JC}	Thermal Resistance Junction-to-Case	SOT353	(Note 9)	—	143	°C/W
		X2-DFN0808-4		—	240	
		X1-DFN1010-6		—	250	
		X2-DFN1010-6		—	250	
		X2-DFN1409-6		—	275	
		X2-DFN1410-6		—	265	

Note: 9. Test condition for each of the six package types: Device 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



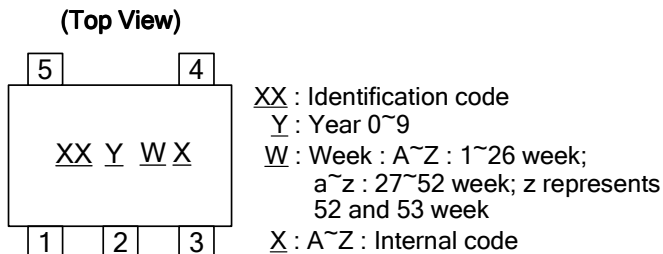
**Voltage Waveform Propagation Delay Times
Inverting and Non Inverting Outputs**

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 ≤ 10MHz.
 - C. Inputs are measured separately one transition per measurement.
 - D. t_{PLH} and t_{PHL} are the same as t_{PD}.

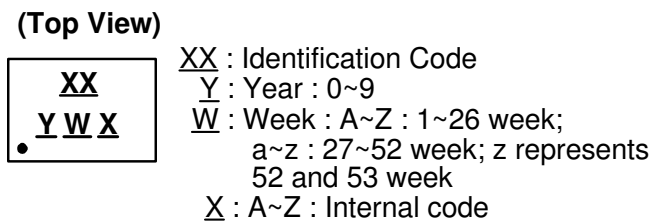
Marking Information

(1) SOT353



Part Number	Package	Identification Code
74AUP1G86SE-7	SOT353	XW

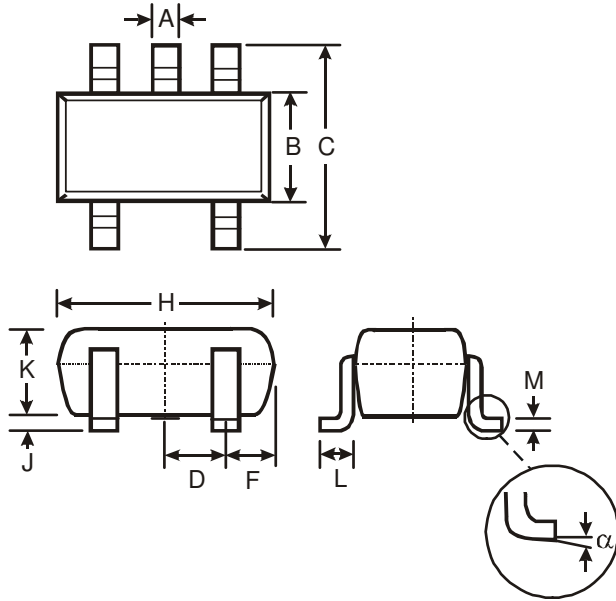
(2) X2-DFN0808-4, X1-DFN1010-6, X2-DFN1010-6, X2-DFN1409-6 and X2-DFN1410-6



Part Number	Package	Identification Code
74AUP1G86FS3-7	X2-DFN0808-4	YX
74AUP1G86FW5-7	X1-DFN1010-6	QW
74AUP1G86FW4-7	X2-DFN1010-6	XW
74AUP1G86FX4-7	X2-DFN1409-6	HN
74AUP1G86FZ4-7	X2-DFN1410-6	XW

SOT353 Package Outline Dimensions and Suggested Pad Layout

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



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°	-

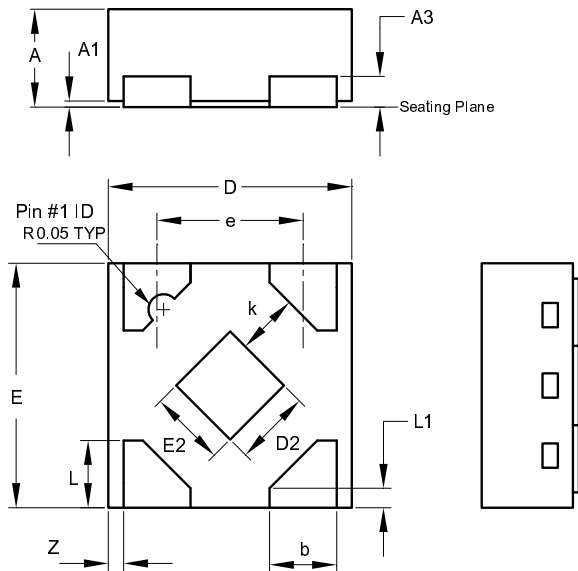
All Dimensions in mm



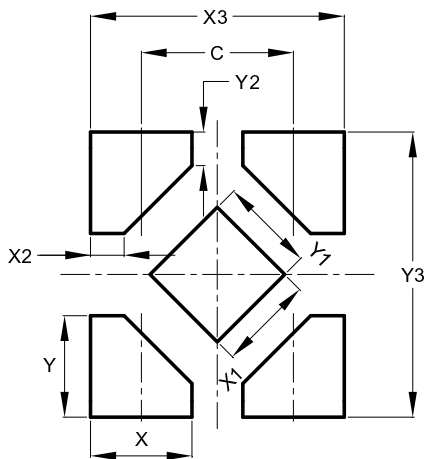
Dimensions	Value (in mm)
Z	2.5
G	1.3
X	0.42
Y	0.6
C1	1.9
C2	0.65

X2-DFN0808-4 Package Outline Dimensions and Suggested Pad Layout

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



X2-DFN0808-4			
Dim	Min	Max	Typ
A	0.25	0.35	0.30
A1	0	0.04	0.02
A3	-	-	0.13
b	0.17	0.27	0.22
D	0.75	0.85	0.80
D2	0.15	0.35	0.25
E	0.75	0.85	0.80
E2	0.15	0.35	0.25
e	-	-	0.48
K	0.20	-	-
L	0.17	0.27	0.22
L1	0.02	0.12	0.07
Z	-	-	0.05
All Dimensions in mm			



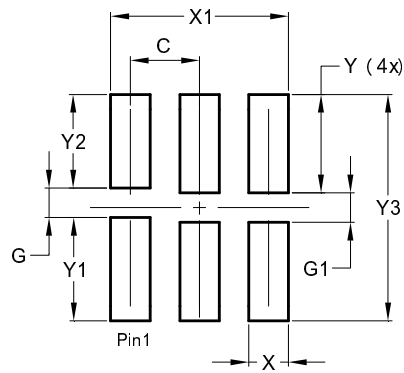
Dimensions	Value
C	0.480
X	0.320
X1	0.300
X2	0.106
X3	0.800
Y	0.320
Y1	0.300
Y2	0.106
Y3	0.900

X1-DFN1010-6 (Type B) Package Outline Dimensions and Suggested Pad Layout

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



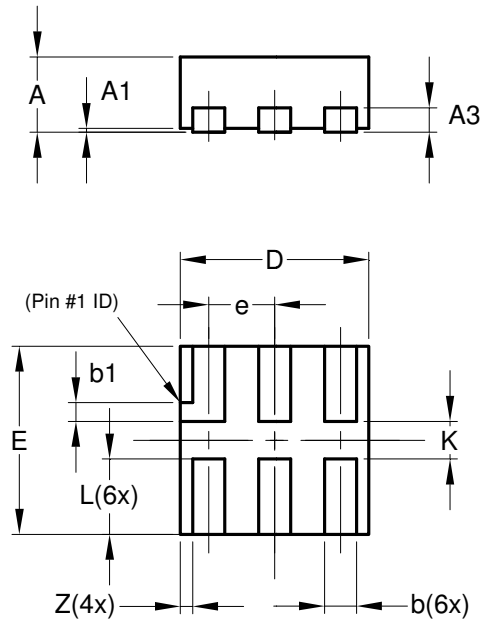
X1-DFN1010-6 (Type B)			
Dim	Min	Max	Typ
A	-	0.50	0.39
A1	-	0.04	-
b	0.12	0.20	0.15
D	0.95	1.050	1.00
E	0.95	1.050	1.00
e	0.35 BSC		
e1	0.55 BSC		
L3	0.27	0.30	0.30
L3a	0.32	0.40	0.35
All Dimensions in mm			



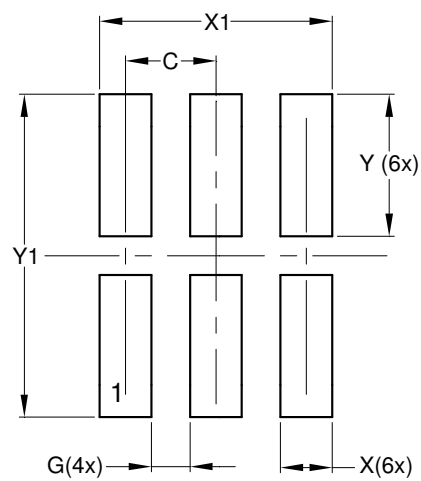
Dimensions	Value (in mm)
C	0.350
G	0.150
G1	0.150
X	0.200
X1	0.900
Y	0.500
Y1	0.525
Y2	0.475
Y3	1.150

X2-DFN1010-6 Package Outline Dimensions and Suggested Pad Layout

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



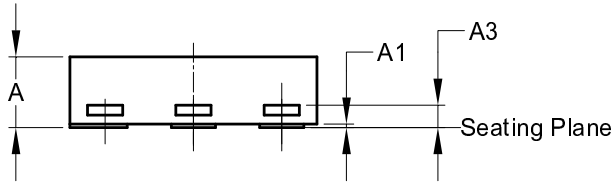
X2-DFN1010-6			
Dim	Min	Max	Typ
A	—	0.40	0.39
A1	0.00	0.05	0.02
A3	—	—	0.13
b	0.14	0.20	0.17
b1	0.05	0.15	0.10
D	0.95	1.05	1.00
E	0.95	1.05	1.00
e	—	—	0.35
L	0.35	0.45	0.40
K	0.15	—	—
Z	—	—	0.065
All Dimensions in mm			



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

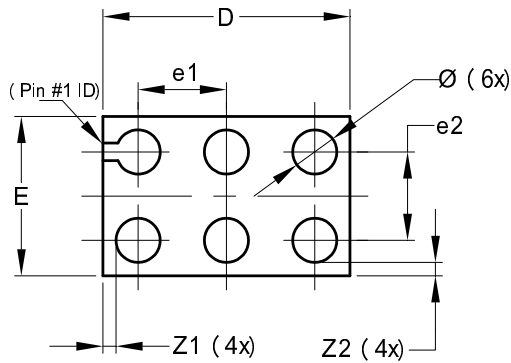
X2-DFN1409-6 Package Outline Dimensions and Suggested Pad Layout

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



X2-DFN1409-6			
Dim	Min	Max	Typ
A	-	0.40	0.39
A1	0	0.05	0.02
A3	-	-	0.13
Ø	0.20	0.30	0.25
D	1.35	1.45	1.40
E	0.85	0.95	0.90
e1	-	-	0.50
e2	-	-	0.50
Z1	-	-	0.075
Z2	-	-	0.075

All Dimensions in mm



Dimensions	Value (in mm)
C	1.000
C1	0.500
D	0.300
G	0.200
G1	0.200
X	0.400
Y	0.150

X2-DFN1410-6 Package Outline Dimensions and Suggested Pad Layout

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



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			



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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