

## Description

The 74LVC1G86 is a single 2-input EXCLUSIVE OR gate with a standard push-pull output. The device is designed for operation with a power supply range of 1.65V to 5.5V. The inputs are tolerant to 5.5V allowing this device to be used in a mixed voltage environment. 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.

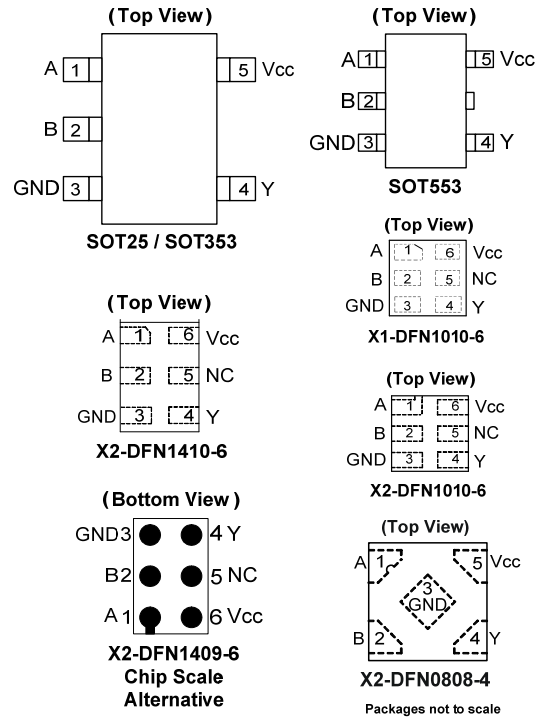
The gate performs the positive Boolean function:

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

## Features

- Wide Supply Voltage Range from 1.65 to 5.5V
- ± 24mA Output Drive at 3.3V
- CMOS Low Power Consumption
- I<sub>OFF</sub> Supports Partial-Power-Down Mode Operation
- Inputs Accept Up to 5.5V
- ESD Protection Tested 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 100mA per JESD 78, Class I
- Range of Package Options
- Direct Interface with TTL Levels
- **Totally Lead-Free & Fully RoHS Compliant (Notes 1 & 2)**
- **Halogen and Antimony Free. "Green" Device (Note 3)**

## Pin Assignments

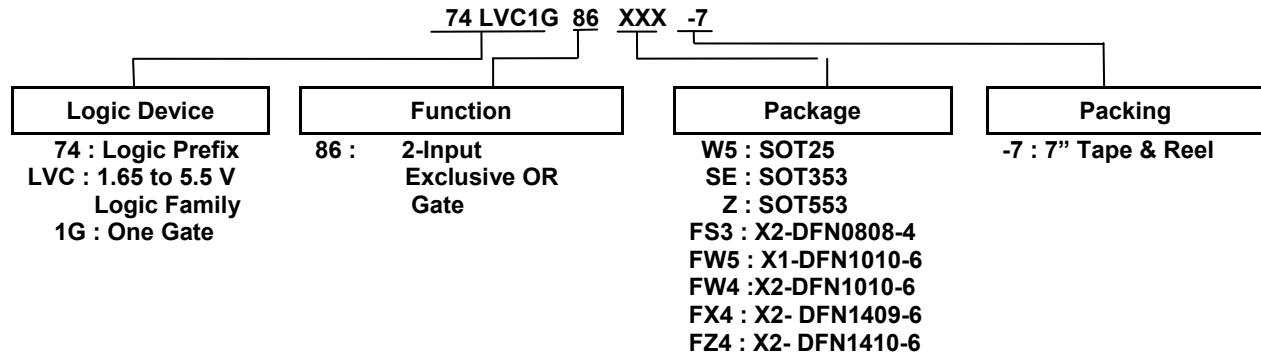


## Applications

- Voltage Level Shifting
- General Purpose Logic
- Power Down Signal Isolation
- 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

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.

## Ordering Information



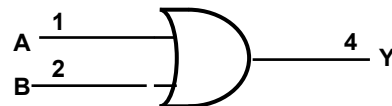
Part Number	Package Code	Package (Notes 4 & 5)	Package Size	7" Tape and Reel	
				Quantity	Part Number Suffix
74LVC1G86W5-7	W5	SOT25	3.0mm X 2.8mm X 1.2mm 0.95mm lead pitch	3000/Tape & Reel	-7
74LVC1G86SE-7	SE	SOT353	2.0mm X 2.0mm X 1.1mm 0.65mm lead pitch	3000/Tape & Reel	-7
74LVC1G86Z-7	Z	SOT553	1.6mm X 1.6 mm X 0.62mm 0.5mm lead pitch	4000/Tape & Reel	-7
74LVC1G86FS3-7	FS3	X2-DFN0808-4	0.9mm X 0.9 mm X 0.35mm 0.5mm pad pitch (diamond)	5000/Tape & Reel	-7
74LVC1G86FW5-7	FW5	X1-DFN1010-6	1.0mm X 1.0mm X 0.5mm 0.35mm pad pitch	5000/Tape & Reel	-7
74LVC1G86FW4-7	FW4	X2-DFN1010-6	1.0mm X 1.0mm X 0.4mm 0.35mm pad pitch	5000/Tape & Reel	-7
74LVC1G86FX4-7	FX4	X2-DFN1409-6 <b>(Chip scale alternative)</b>	1.4mm X 0.9mm X 0.4mm 0.5mm pad pitch	5000/Tape & Reel	-7
74LVC1G86FZ4-7	FZ4	X2-DFN1410-6	1.4mm X 1.0mm X 0.4mm 0.5mm pad pitch	5000/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	Description
A	Data Input
B	Data Input
GND	Ground
Y	Data Output
V <sub>CC</sub>	Supply Voltage
NC	No Connection

## Logic Diagram



## Function Table

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

**Absolute Maximum Ratings** (Notes 6 & 7) (@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 6.5	V
V <sub>I</sub>	Input Voltage Range	-0.5 to 6.5	V
V <sub>O</sub>	Voltage Applied to Output in High Impedance or I <sub>OFF</sub> state	-0.5 to 6.5	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	-50	mA
I <sub>O</sub>	Continuous Output Current	±50	mA
I <sub>CC</sub> , I <sub>GND</sub>	Continuous Current Through V <sub>CC</sub> or GND	±100	mA
T <sub>J</sub>	Operating Junction Temperature	-40 to +150	°C
T <sub>STG</sub>	Storage Temperature	-65 to +150	°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<sub>A</sub> = +25°C, unless otherwise specified.)

Symbol	Parameter	Min	Max	Unit	
V <sub>CC</sub>	Operating Voltage	1.65	5.5	V	
	Data Retention Only	1.5	—	V	
V <sub>IH</sub>	High-Level Input Voltage	V <sub>CC</sub> = 1.65V to 1.95V	0.65 X V <sub>CC</sub>	—	V
		V <sub>CC</sub> = 2.3V to 2.7V	1.7	—	
		V <sub>CC</sub> = 3V to 3.6V	2	—	
		V <sub>CC</sub> = 4.5V to 5.5V	0.7 X V <sub>CC</sub>	—	
V <sub>IL</sub>	Low-Level Input voltage	V <sub>CC</sub> = 1.65V to 1.95V	—	0.35 X V <sub>CC</sub>	V
		V <sub>CC</sub> = 2.3V to 2.7V	—	0.7	
		V <sub>CC</sub> = 3V to 3.6V	—	0.8	
		V <sub>CC</sub> = 4.5V to 5.5V	—	0.3 X V <sub>CC</sub>	
V <sub>I</sub>	Input Voltage	0	5.5	V	
V <sub>O</sub>	Output Voltage	0	V <sub>CC</sub>	V	
I <sub>OH</sub>	High-Level Output Current	V <sub>CC</sub> = 1.65V	—	-4	mA
		V <sub>CC</sub> = 2.3V	—	-8	
		V <sub>CC</sub> = 2.7V	—	-12	
		V <sub>CC</sub> = 3V	—	-16	
		V <sub>CC</sub> = 4.5V	—	-24	
I <sub>OL</sub>	Low-Level Output Current	V <sub>CC</sub> = 1.65V	—	4	mA
		V <sub>CC</sub> = 2.3V	—	8	
		V <sub>CC</sub> = 2.7V	—	12	
		V <sub>CC</sub> = 3V	—	16	
		V <sub>CC</sub> = 4.5V	—	24	
Δt/ΔV	Input Transition Rise or Fall Rate	V <sub>CC</sub> = 1.8V ± 0.15V, 2.5V ± 0.2V	—	20	ns/V
		V <sub>CC</sub> = 3.3V ± 0.3V	—	10	
		V <sub>CC</sub> = 5V ± 0.5V	—	5	
T <sub>A</sub>	Operating Free-Air Temperature	—	-40	+125	°C

- Note: 8. Unused inputs should be held at V<sub>CC</sub> or Ground.

**Electrical Characteristics** (All typical values are at  $V_{CC} = 3.3V$ ,  $T_A = +25^\circ C$ )

Symbol	Parameter	Test Conditions	$V_{CC}$	-40°C to +85°C			-40°C to +125°C		Unit
				Min	Typ	Max	Min	Max	
$V_{OH}$	High Level Output Voltage	$I_{OH} = -100\mu A$	1.65V to 5.5V	$V_{CC} - 0.1$	—	—	$V_{CC} - 0.1$	—	V
		$I_{OH} = -4mA$	1.65V	1.2	—	—	0.95	—	
		$I_{OH} = -8mA$	2.3V	1.9	—	—	1.7	—	
		$I_{OH} = -12mA$	2.7V	2.2	—	—	1.9	—	
		$I_{OH} = -16mA$	3V	2.4	—	—	2.2	—	
		$I_{OH} = -24mA$		2.3	—	—	2.0	—	
		$I_{OH} = -32mA$	4.5V	3.8	—	—	3.4	—	
$V_{OL}$	Low Level Output Voltage	$I_{OL} = 100\mu A$	1.65V to 5.5V	—	—	0.1	—	0.1	V
		$I_{OL} = 4mA$	1.65V	—	—	0.45	—	0.7	
		$I_{OL} = 8mA$	2.3V	—	—	0.3	—	0.45	
		$I_{OL} = 12mA$	2.7V	—	—	0.4	—	0.6	
		$I_{OL} = 16mA$	3V	—	—	0.4	—	0.6	
		$I_{OL} = 24mA$		—	—	0.55	—	0.8	
		$I_{OL} = 32mA$	4.5V	—	—	0.55	—	.8	
$I_I$	Input Current	$V_I = 5.5V$ or GND	0 to 5.5V	—	$\pm 0.1$	$\pm 5$	—	$\pm 100$	$\mu A$
$I_{OFF}$	Power Down Leakage Current	$V_I$ or $V_O = 5.5V$	0V	—	—	$\pm 10$	—	$\pm 200$	$\mu A$
$I_{CC}$	Supply Current	$V_I = 5.5V$ or GND $I_O = 0$	5.5V	—	0.1	10	—	200	$\mu A$
$\Delta I_{CC}$	Additional Supply Current	One input at $V_{CC} - 0.6V$ Other inputs at $V_{CC}$ or GND	3V to 5.5V	—	—	500	—	5000	$\mu A$
$C_i$	Input Capacitance	$V_I = V_{CC}$ or GND	3.3V	—	5	—	—	—	pF

**Package Characteristics** (All typical values are at  $V_{CC} = 3.3V$ ,  $T_A = +25^\circ C$ )

Symbol	Parameter	Test Conditions	$V_{CC}$	Min	Typ	Max	Unit
$\theta_{JA}$	Thermal Resistance Junction-to-Ambient	SOT25	(Note 9)	—	204	—	$^\circ C/W$
		SOT353		—	371	—	
		SOT553		—	231	—	
		X2-DFN0808-4		—	400	—	
		X1-DFN1010-6		—	435	—	
		X2-DFN1010-6		—	445	—	
		X2-DFN1409-6		—	470	—	
		X2-DFN1410-6		—	460	—	
$\theta_{JC}$	Thermal Resistance Junction-to-Case	SOT25	(Note 9)	—	52	—	$^\circ C/W$
		SOT353		—	143	—	
		SOT553		—	105	—	
		X2-DFN0808-4		—	225	—	
		X1-DFN1010-6		—	250	—	
		X2-DFN1010-6		—	250	—	
		X2-DFN1409-6		—	275	—	
		X2-DFN1410-6		—	265	—	

Note: 9. Test condition for each of the 8 package types: Device mounted on FR-4 substrate PC board, 2oz copper, with minimum recommended pad layout.

## Switching Characteristics

Figure 1 Typical Values at  $T_A = +25^\circ\text{C}$  and nominal voltages 1.8V, 2.5V, 2.7V, 3.3V, and 5.0V.

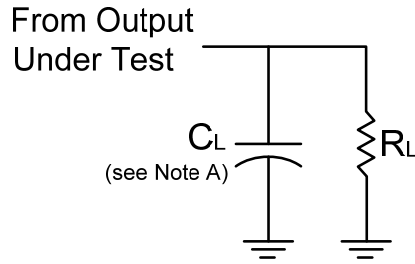
Parameter	From Input	To Output	V <sub>CC</sub>	T <sub>A</sub> = -40°C to +85°C			T <sub>A</sub> = -40°C to +125°C		Unit
				Min	Typ	Max	Min	Max	
t <sub>pd</sub>	A or B	Y	1.8V ± 0.15V	1.0	3.7	9.9	1.0	13.0	ns
			2.5V ± 0.2V	0.5	2.5	5.5	0.5	7.0	
			2.7V	0.5	2.8	5.8	0.5	7.5	
			3.3V ± 0.3V	0.5	2.3	5.0	0.5	6.5	
			5.0V ± 0.5V	0.5	1.9	4.0	0.5	5.5	

## Operating Characteristics

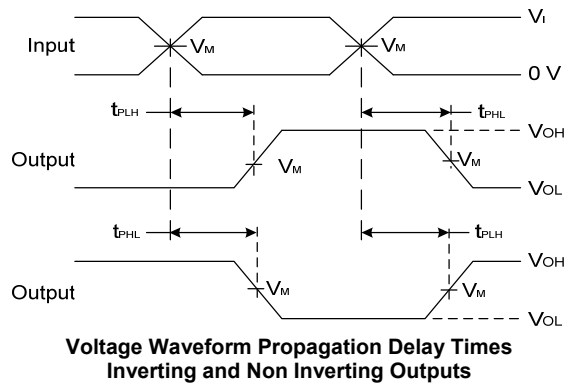
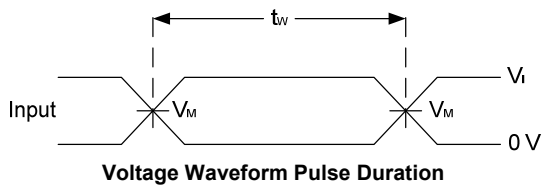
T<sub>A</sub> = +25°C

Parameter	Test Conditions	V <sub>CC</sub> = 1.8V	V <sub>CC</sub> = 2.5V	V <sub>CC</sub> = 3.3V	V <sub>CC</sub> = 5V	Unit	
		Typ	Typ	Typ	Typ		
C <sub>pd</sub>	Power Dissipation Capacitance	f = 10 MHz	14	14	14	14	pF

**Parameter Measurement Information**



V <sub>CC</sub>	Inputs		V <sub>M</sub>	C <sub>L</sub>	R <sub>L</sub>
	V <sub>I</sub>	t <sub>r</sub> /t <sub>f</sub>			
1.8V ± 0.15V	V <sub>CC</sub>	≤2ns	V <sub>CC</sub> /2	30pF	1kΩ
2.5V ± 0.2V	V <sub>CC</sub>	≤2ns	V <sub>CC</sub> /2	30pF	500Ω
2.7V	V <sub>CC</sub>	≤2.5ns	1.5V	50pF	500Ω
3.3V ± 0.3V	3.0V	≤2.5ns	1.5V	50pF	500Ω
5.0V ± 0.5V	V <sub>CC</sub>	≤2.5ns	V <sub>CC</sub> /2	50pF	500Ω

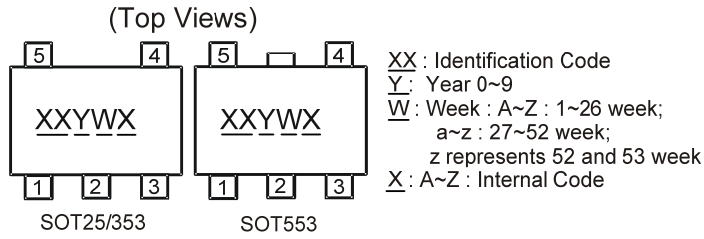


**Figure 1. Load Circuit and Voltage Waveforms**

- 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<sub>PLH</sub> and t<sub>PHL</sub> are the same as t<sub>PD</sub>.

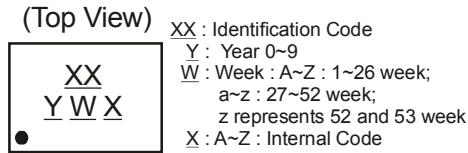
## Marking Information

### (1) SOT25, SOT353 and SOT553



Part Number	Package	Identification Code
74LVC1G86W5-7	SOT25	UX
74LVC1G86SE-7	SOT353	UX
74LVC1G86Z-7	SOT553	UX

### (2) DFN Packages

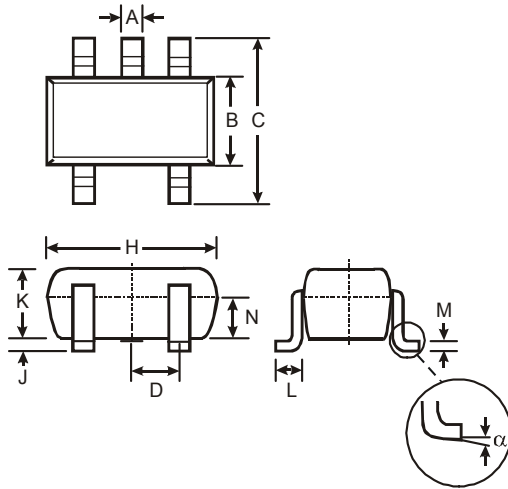


Part Number	Package	Identification Code
74LVC1G86FS3-7	X2-DFN0808-4	WX
74LVC1G86FW5-7	X1-DFN1010-6	VX
74LVC1G86FW4-7	X2-DFN1010-6	UX
74LVC1G86FX4-7	X2-DFN1409-6	MV
74LVC1G86FZ4-7	X2-DFN1410-6	UX

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

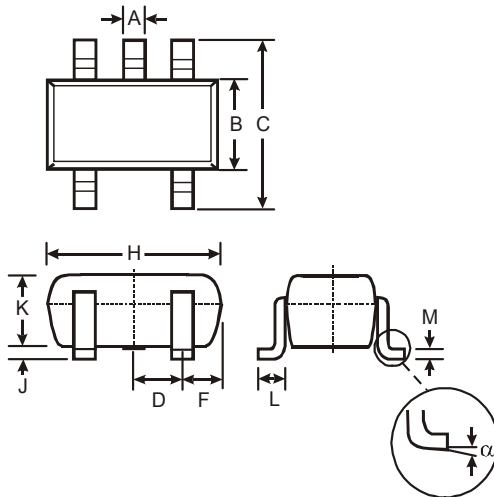
Please see AP02002 at <http://www.diodes.com/datasheets/ap02002.pdf> for latest version.

(1) SOT25



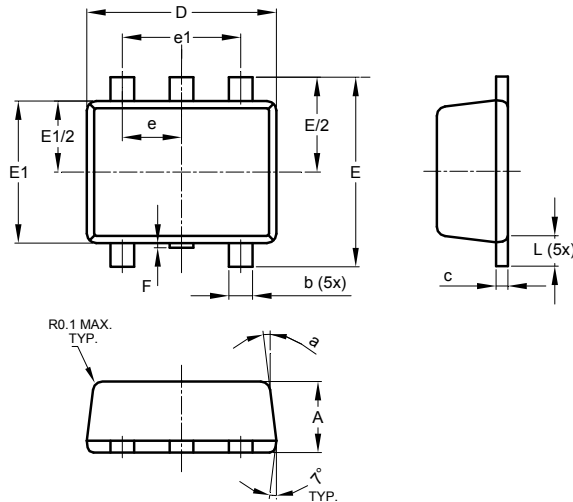
SOT25			
Dim	Min	Max	Typ
A	0.35	0.50	0.38
B	1.50	1.70	1.60
C	2.70	3.00	2.80
D	—	—	0.95
H	2.90	3.10	3.00
J	0.013	0.10	0.05
K	1.00	1.30	1.10
L	0.35	0.55	0.40
M	0.10	0.20	0.15
N	0.70	0.80	0.75
α	0°	8°	—
All Dimensions in mm			

(2) SOT353



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

(3) SOT553



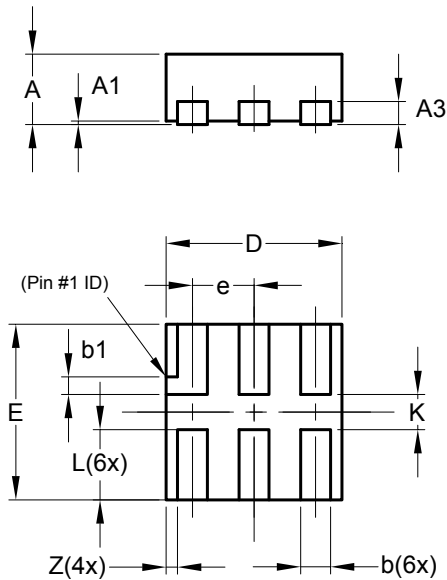
SOT553			
Dim	Min	Max	Typ
A	0.55	0.62	0.60
b	0.15	0.30	0.20
c	0.10	0.18	0.15
D	1.50	1.70	1.60
E	1.55	1.70	1.60
E1	1.10	1.25	1.20
e	0.50 BSC		
e1	1.00 BSC		
F	0.00	0.10	—
L	0.10	0.30	0.20
a	6°	8°	7°
All Dimensions in mm			



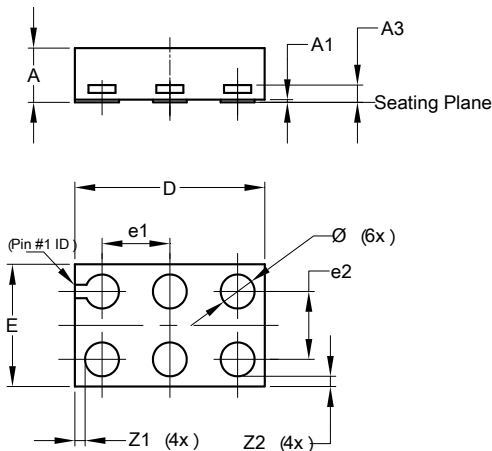


**Package Outline Dimensions** (cont.) (All dimensions in mm.)

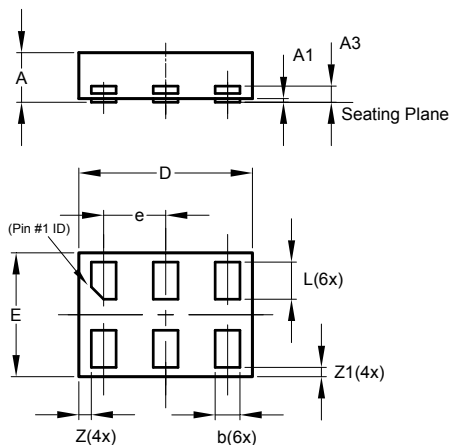
 Please see AP02002 at <http://www.diodes.com/datasheets/ap02002.pdf> for latest version.

**(6) 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			

**(7) X2-DFN1409-6 CHIP SCALE ALTERNATIVE**


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			

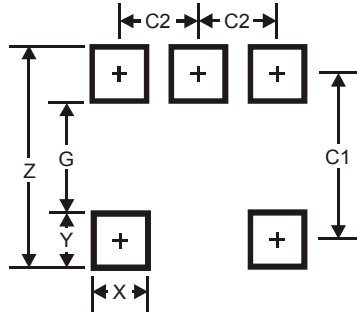
**(8) X2-DFN1410-6**


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			

## Suggested Pad Layout

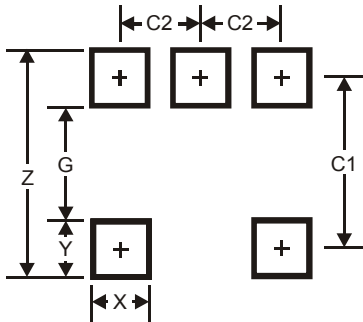
Please see AP02001 at <http://www.diodes.com/datasheets/ap02001.pdf> for the latest version.

### (1) SOT25



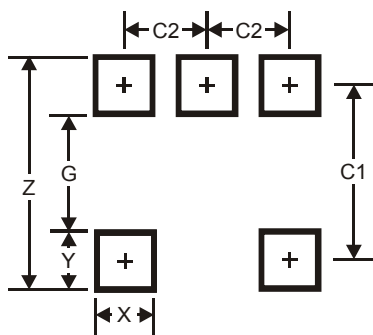
Dimensions	Value (in mm)
Z	3.20
G	1.60
X	0.55
Y	0.80
C1	2.40
C2	0.95

### (2) SOT353



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

### (3) SOT553

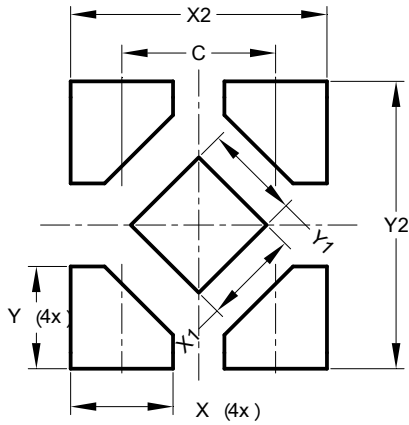


Dimensions	Value (in mm)
Z	2.2
G	1.2
X	0.375
Y	0.5
C1	1.7
C2	0.5

**Suggested Pad Layout (cont.)**

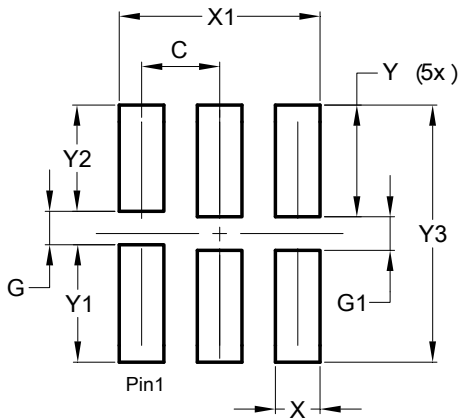
Please see AP02001 at <http://www.diodes.com/datasheets/ap02001.pdf> for the latest version.

**(4) X2-DFN0808-4**



Dimensions	Value (in mm)
C	0.480
X	0.320
X1	0.300
X2	0.800
Y	0.320
Y1	0.300
Y2	0.900

**(5) X1-DFN1010-6**

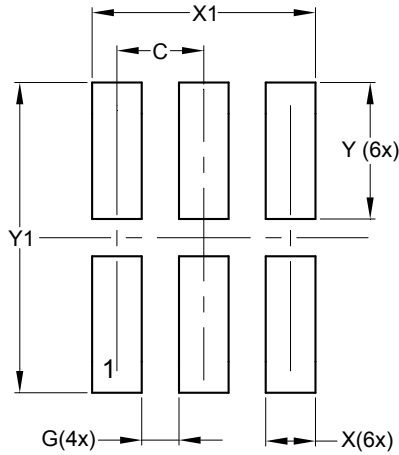


Dimensions	Value (in mm)
C	0.350
G	0.150
G1	0.150
X	0.200
X1	0.900
Y	0.500
Y1	0.525
Y2	0.475
Y3	1.150

**Suggested Pad Layout (cont.)**

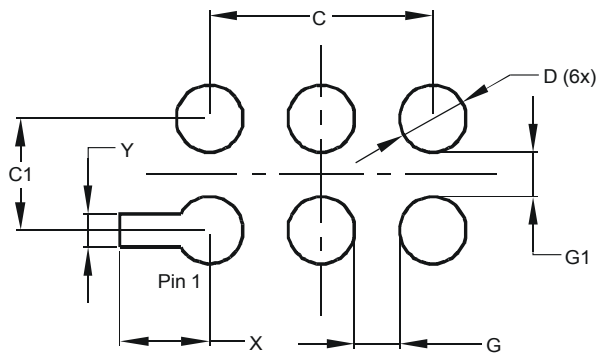
Please see AP02001 at <http://www.diodes.com/datasheets/ap02001.pdf> for the latest version.

**(6) X2-DFN1010-6**



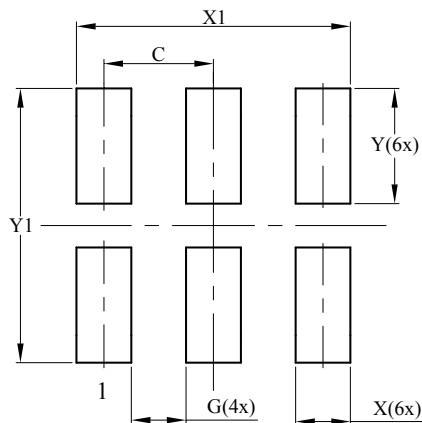
Dimensions	Value (in mm)
C	0.350
G	0.150
X	0.200
X1	0.900
Y	0.550
Y1	1.250

**(7) X2-DFN1409-6**



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

**(8) 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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