

### Description

The 74LVCE1G86 is a single 2-input positive EXCLUSIVE OR gate with a standard totem pole output. The device is designed for operation with a power supply range of 1.4V 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  $I_{OFF}$ . The  $I_{OFF}$  circuitry disables the output preventing damaging current backflow when the device is powered down.

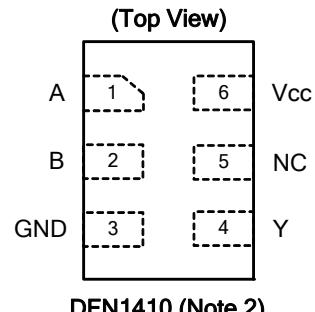
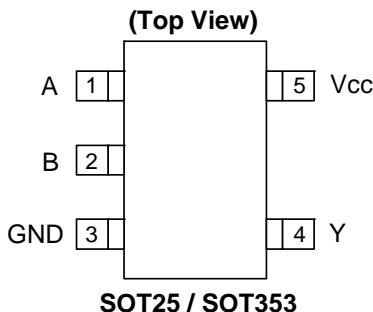
The gate performs the positive Boolean function:

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

### Features

- Extended Supply Voltage Range from 1.4 to 5.5V
- Switching speed characterized for operation at 1.5V
- Offers 30% speed improvement over LVC at 1.8V.
- $\pm 24\text{mA}$  Output Drive at 3.3V
- CMOS low power consumption
- $I_{OFF}$  Supports Partial-Power-Down Mode Operation
- Inputs accept up to 5.5V
- ESD Protection Tested per JESD 22  
Exceeds 200-V Machine Model (A115-A)  
Exceeds 2000-V Human Body Model (A114-A)
- Latch-Up Exceeds 100mA per JESD 78, Class II
- Range of Package Options
- Direct Interface with TTL Levels
- SOT25, SOT353 and DFN1410: Assembled with "Green" Molding Compound (no Br, Sb)
- Lead Free Finish/ RoHS Compliant (Note 1)

### Pin Assignments



### Applications

- Voltage Level Shifting
- Bus Driver / Repeater
- Parity Bit Generation
- Selectable signal Inverter
- Power Down Signal Isolation
- General Purpose Logic
- Wide array of products such as.
  - PCs, networking, notebooks, netbooks, PDAs
  - Computer peripherals, hard drives, CD/DVD ROM
  - TV, DVD, DVR, set top box
  - Cell Phones, Personal Navigation / GPS
  - MP3 players, Cameras, Video Recorders

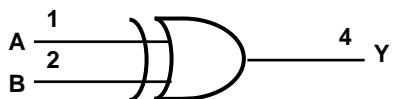
Notes: 1. EU Directive 2002/95/EC (RoHS). All applicable RoHS exemptions applied. Please visit our website at

[http://www.diodes.com/products/lead\\_free.html](http://www.diodes.com/products/lead_free.html).

2. Pin 2 and pin 5 of the DFN1410 package are internally connected.

**Pin Descriptions**

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

**Logic Diagram****Function Table**

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

**Absolute Maximum Ratings (Note 3)**

Symbol	Description	Rating	Unit
ESD HBM	Human Body Model ESD Protection	2	kV
ESD MM	Machine Model ESD Protection	200	V
$V_{CC}$	Supply Voltage Range	-0.5 to 6.5	V
$V_I$	Input Voltage Range	-0.5 to 6.5	V
$V_o$	Voltage applied to output in high impedance or $I_{OFF}$ state	-0.5 to 6.5	V
$V_o$	Voltage applied to output in high or low state	-0.3 to $V_{CC}$ +0.5	V
$I_{IK}$	Input Clamp Current $V_I < 0$	-50	mA
$I_{OK}$	Output Clamp Current	-50	mA
$I_o$	Continuous output current	$\pm 50$	mA
	Continuous current through Vdd or GND	$\pm 100$	mA
$T_J$	Operating Junction Temperature	-40 to 150	°C
$T_{STG}$	Storage Temperature	-65 to 150	°C

Note: 3. Stresses beyond the absolute maximum may result in immediate failure or reduced reliability. These are stress values and device operation should be within recommended values.

**Recommended Operating Conditions (Note 4)**

Symbol	Parameter	Min	Max	Unit	
$V_{CC}$	Operating	1.4	5.5	V	
	Data retention only	1.2		V	
$V_{IH}$	High-level Input Voltage	$V_{CC} = 1.4\text{ V to }1.95\text{ V}$	$0.65 \times V_{CC}$	V	
		$V_{CC} = 2.3\text{ V to }2.7\text{ V}$	1.7		
		$V_{CC} = 3\text{ V to }3.6\text{ V}$	2		
		$V_{CC} = 4.5\text{ V to }5.5\text{ V}$	$0.7 \times V_{CC}$		
$V_{IL}$	Low-level input voltage	$V_{CC} = 1.4\text{ V to }1.95\text{ V}$		V	
		$V_{CC} = 2.3\text{ V to }2.7\text{ V}$	0.35 $\times V_{CC}$		
		$V_{CC} = 3\text{ V to }3.6\text{ V}$	0.7		
		$V_{CC} = 4.5\text{ V to }5.5\text{ V}$	0.8		
$V_I$	Input Voltage	0	5.5	V	
$V_O$	Output Voltage	0	$V_{CC}$	V	
$I_{OH}$	High-level output current	$V_{CC} = 1.4\text{ V}$	-3	mA	
		$V_{CC} = 1.65\text{ V}$	-4		
		$V_{CC} = 2.3\text{ V}$	-8		
		$V_{CC} = 3\text{ V}$	-16		
			-24		
		$V_{CC} = 4.5\text{ V}$	-32		
$I_{OL}$	Low-level output current	$V_{CC} = 1.4\text{ V}$	3	mA	
		$V_{CC} = 1.65\text{ V}$	4		
		$V_{CC} = 2.3\text{ V}$	8		
		$V_{CC} = 3\text{ V}$	16		
			24		
		$V_{CC} = 4.5\text{ V}$	32		
$\Delta t/\Delta V$	Input transition rise or fall rate	$V_{CC} = 1.4\text{ to }3\text{ V}$	20	ns/V	
		$V_{CC} = 3.3\text{ V} \pm 0.3\text{ V}$	10		
		$V_{CC} = 5\text{ V} \pm 0.5\text{ V}$	5		
$T_A$	Operating free-air temperature		-40	85	°C

Note: 4. Unused inputs should be held at  $V_{CC}$  or Ground.

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

Over recommended free-air temperature range (unless otherwise noted)

Symbol	Parameter	Test Conditions	V <sub>CC</sub>	Min	Typ.	Max	Unit
$V_{OH}$	High Level Output Voltage	$I_{OH} = -100\mu A$	1.4 V to 5.5V	$V_{CC} - 0.1$			V
		$I_{OH} = -3mA$	1.4 V	1.05			
		$I_{OH} = -4mA$	1.65 V	1.2			
		$I_{OH} = -8mA$	2.3V	1.9			
		$I_{OH} = -16mA$	3 V	2.4			
		$I_{OH} = -24mA$		2.3			
		$I_{OH} = -32mA$	4.5 V	3.8			
$V_{OL}$	High-level Input Voltage	$I_{OL} = 100\mu A$	1.4 V to 5.5V			0.1	V
		$I_{OL} = 3mA$	1.4 V			.4	
		$I_{OL} = 4mA$	1.65 V			0.45	
		$I_{OL} = 8mA$	2.3V			0.3	
		$I_{OL} = 16mA$	3 V			0.4	
		$I_{OL} = 24mA$				0.55	
		$I_{OL} = 32mA$	4.5			0.55	
$I_I$	Input Current	$V_I = 5.5 V$ or GND	0 to 5.5 V			$\pm 5$	$\mu A$
$I_{OFF}$	Power Down Leakage Current	$V_I$ or $V_O = 5.5V$	0			$\pm 10$	$\mu A$
$I_{CC}$	Supply Current	$V_I = 5.5V$ or GND $I_O=0$	1.4 V to 5.5V			10	$\mu A$
$\Delta I_{CC}$	Additional Supply Current	One input at $V_{CC} - 0.6 V$ Other inputs at $V_{CC}$ or GND	3 V to 5.5V			500	$\mu A$
$C_i$	Input Capacitance	$V_I = V_{CC} -$ or GND	3.3		3.5		$pF$
$\theta_{JA}$	Thermal Resistance Junction-to-Ambient	SOT25	(Note 5)		204		$^\circ C/W$
		SOT353	(Note 5)		371		
		DFN1410	(Note 5)		430		
$\theta_{JC}$	Thermal Resistance Junction-to-Case	SOT25	(Note 5)		52		$^\circ C/W$
		SOT353	(Note 5)		143		
		DFN1410	(Note 5)		190		

Note: 5. Test condition for SOT25, SOT353, and DFN1410: Device mounted on FR-4 substrate PC board, 2oz copper, with minimum recommended pad layout.

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**Switching Characteristics**


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Over recommended free-air temperature range, CL = 15pF (see Figure 1)

Parameter	From (Input)	TO (OUTPUT)	Vcc = 1.5 V ± 0.1V		Vcc = 1.8 V ± 0.15V		Vcc = 2.5 V ± 0.2V		Vcc = 3.3 V ± 0.3V		Vcc = 5 V ± 0.5V		
			Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	
t <sub>pd</sub>	A or B	Y	2.1	9.1	1.4	6.3	0.8	3.6	0.6	3.2	0.7	2.9	ns

Over recommended free-air temperature range, CL = 30 or 50pF as noted (see Figure 2)

Parameter	From (Input)	TO (OUTPUT)	Vcc = 1.5 V ± 0.1V		Vcc = 1.8 V ± 0.15V		Vcc = 2.5 V ± 0.2V		Vcc = 3.3 V ± 0.3V		Vcc = 5 V ± 0.5V		
			Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	
t <sub>pd</sub>	A or B	Y	3.5	9.9	2.4	6.9	1.4	4.4	1	4.1	0.9	3.6	ns

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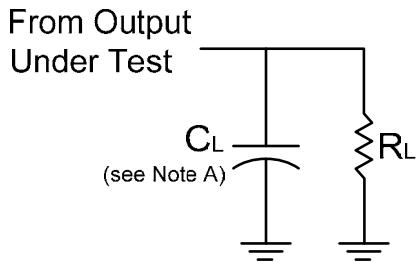
**Operating Characteristics**


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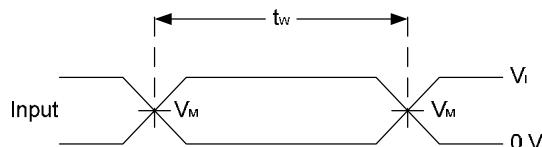
T<sub>A</sub> = 25 °C

Parameter	Test Conditions	Vcc = 1.5 V		Vcc = 1.8 V		Vcc = 2.5 V		Vcc = 3.3 V		Vcc = 5 V		Unit
		TYP	TYP	TYP	TYP	TYP	TYP	TYP	TYP	TYP	TYP	
C <sub>pd</sub>	Power dissipation capacitance	f = 10 MHz	22	22	22	22	22	22	24	24	24	pF

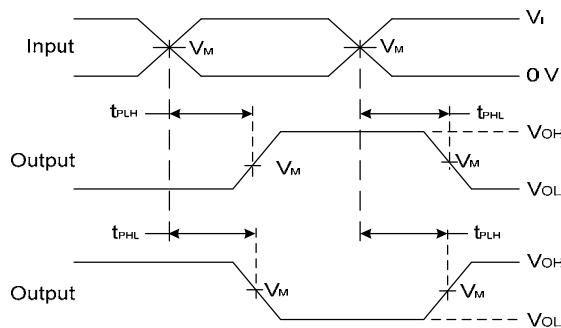
**Parameter Measurement Information**



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>			
1.5V±0.1V	V <sub>cc</sub>	≤2ns	V <sub>cc</sub> /2	15pF	1MΩ
1.8V±0.15V	V <sub>cc</sub>	≤2ns	V <sub>cc</sub> /2	15pF	1MΩ
2.5V±0.2V	V <sub>cc</sub>	≤2ns	V <sub>cc</sub> /2	15pF	1MΩ
3.3V±0.3V	3V	≤2.5ns	1.5V	15pF	1MΩ
5V±0.5V	V <sub>cc</sub>	≤2.5ns	V <sub>cc</sub> /2	15pF	1MΩ



**Voltage Waveform  
Pulse Duration**



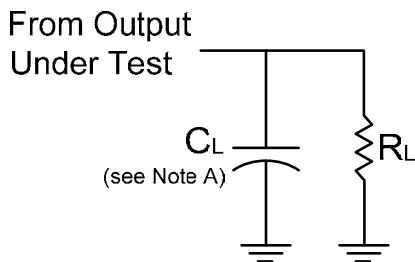
**Voltage Waveform  
Propagation Delay Times  
Inverting and Non Inverting Outputs**

Notes:

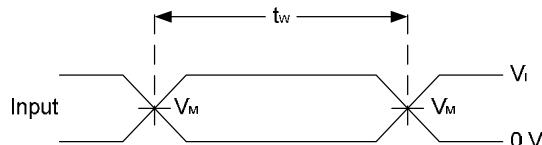
- A. Includes test lead and test apparatus capacitance.
- B. All pulses are supplied at pulse repetition rate  $\leq 10$  MHz.
- C. Inputs are measured separately one transition per measurement.
- D. t<sub>PLH</sub> and t<sub>PHL</sub> are the same as t<sub>PD</sub>.

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

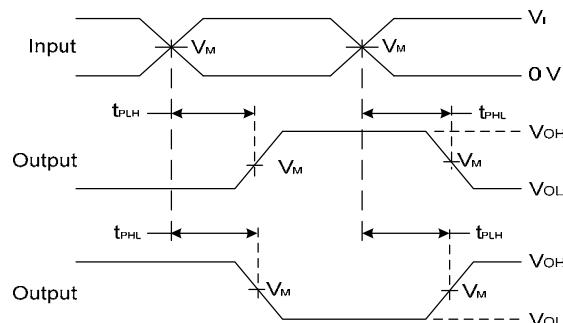
**Parameter Measurement Information (Continued)**



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>			
1.5V±0.15	V <sub>cc</sub>	≤2ns	V <sub>cc</sub> /2	30pF	1KΩ
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
3.3V±0.3V	3V	≤2.5ns	1.5V	50pF	500Ω
5V±0.5V	V <sub>cc</sub>	≤2.5ns	V <sub>cc</sub> /2	50pF	500Ω



**Voltage Waveform  
Pulse Duration**

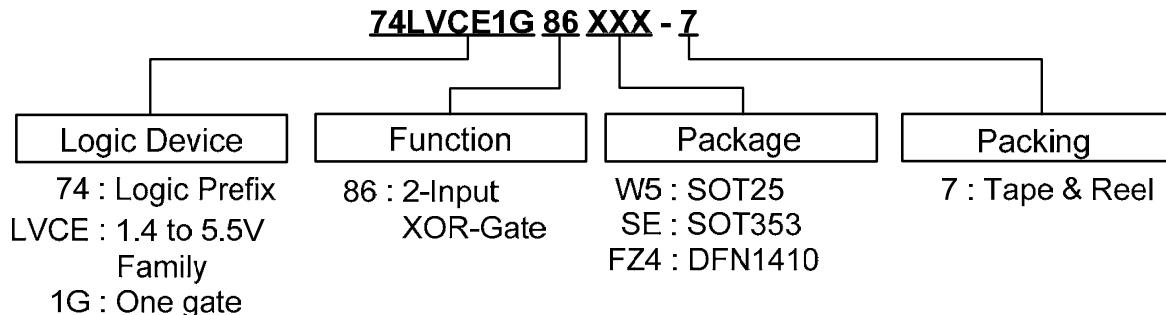


**Voltage Waveform  
Propagation Delay Times  
Inverting and Non Inverting Outputs**

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

**Figure 2. Load Circuit and Voltage Waveforms**

**Ordering Information**


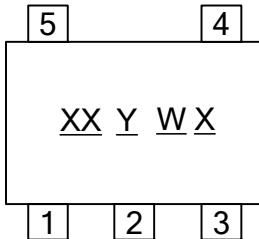
Device	Package Code	Packaging (Note 5)	7" Tape and Reel	
			Quantity	Part Number Suffix
74LVCE1G86W5-7	W6	SOT25	3000/Tape & Reel	-7
74LVCE1G86SE-7	SE	SOT353	3000/Tape & Reel	-7
74LVCE1G86FZ4-7	FZ4	DFN1410	5000/Tape & Reel	-7

Note: 6. 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>.

## Marking Information

### (1) SOT25 and SOT353

(Top View)

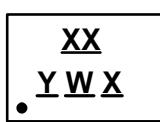


XX : Identification code  
Y : Year 0~9  
W : Week : A~Z : 1~26 week;  
 a~z : 27~52 week; z represents  
 52 and 53 week  
X : A~Z : Internal code

Part Number	Package	Identification Code
74LVCE1G86W5	SOT25	PX
74LVCE1G86SE	SOT353	PX

### (2) DFN1410

(Top View)

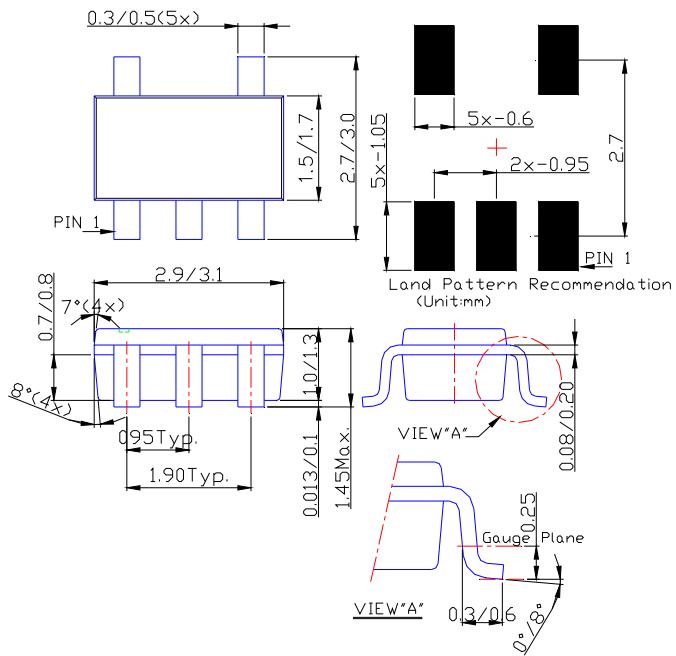


XX : Identification Code  
Y : Year : 0~9  
W : Week : A~Z : 1~26 week;  
 a~z : 27~52 week; z represents  
 52 and 53 week  
X : A~Z : Internal code

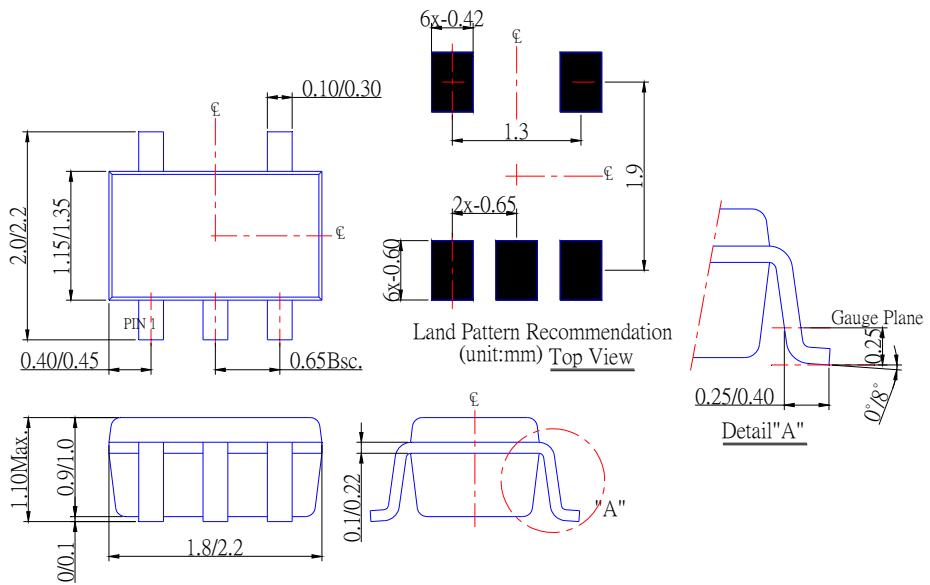
Part Number	Package	Identification Code
74LVCE1G86FZ4	DFN1410	PX

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

**(1) Package Type: SOT25**

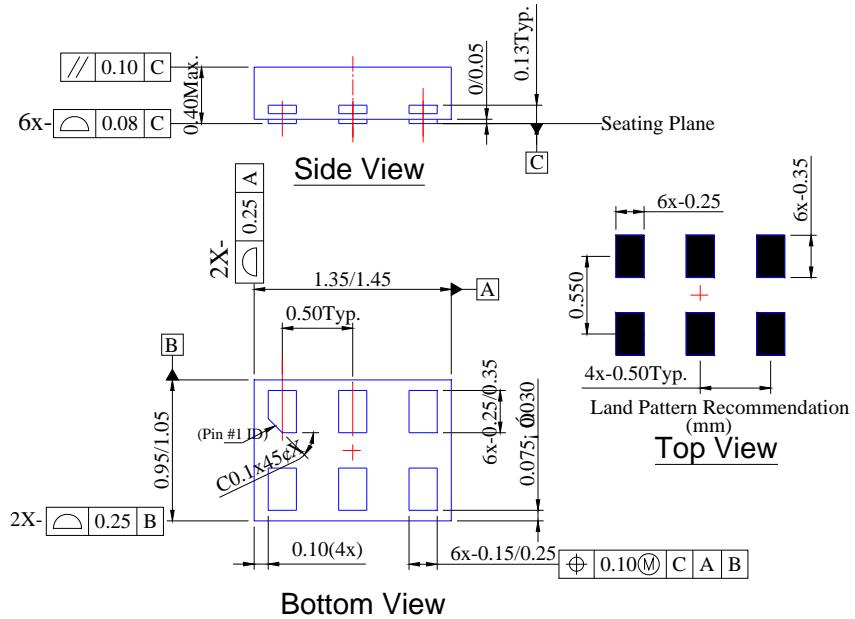


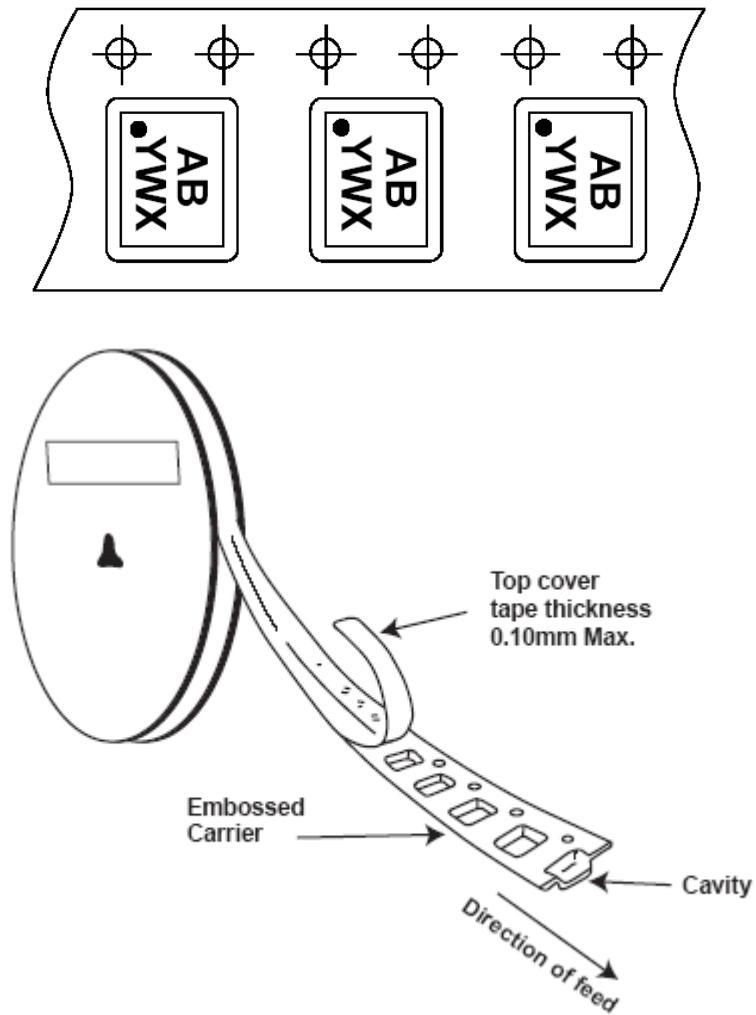
**(2) Package Type: SOT353**



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

**(3) Package Type: DFN1410**



**Taping Orientation (Note 7)****For DFN1410**

Note: 7. The taping orientation of the other package type can be found on our website at <http://www.diodes.com/datasheets/ap02007.pdf>

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