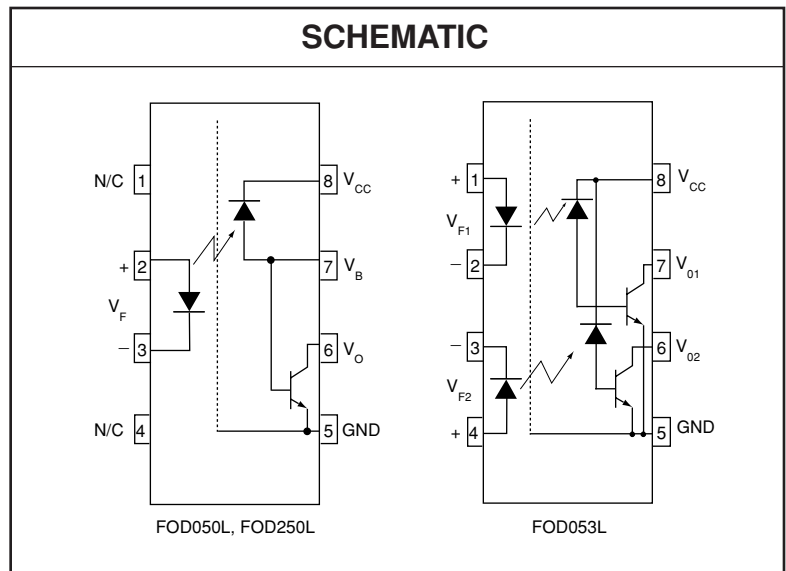
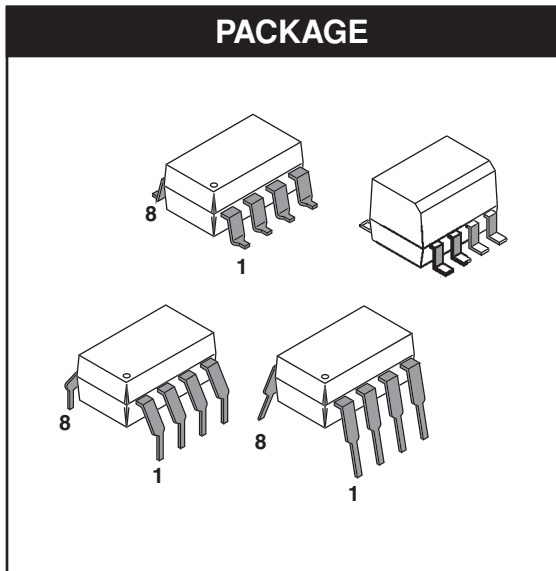


**SINGLE-CHANNEL: FOD050L  
DUAL-CHANNEL: FOD053L**

**FOD250L**



**DESCRIPTION**

The FOD250L, FOD050L and FOD053L optocouplers consist of an AlGaAs LED optically coupled to a high speed photodetector transistor. These devices are specified for operation at a 3.3V supply voltage.

A separate connection for the bias of the photodiode improves the speed by several orders of magnitude over conventional phototransistor optocouplers by reducing the base-collector capacitance of the input transistor.

An internal noise shield provides superior common mode rejection of  $CM_H = 50kV/ms$  (typical) and  $CM_L = 35kV/ms$  (typical).

**Truth Table**

LED	V <sub>O</sub>
On	LOW
Off	HIGH

**FEATURES**

- Low power consumption
- High speed
- Available in single channel 8-pin DIP (FOD250L), 8-pin SOIC (FOD050L) or dual channel 8-pin SOIC (FOD053L)
- Superior CMR –  $CM_H = 50kV/\mu s$  (typical) and  $CM_L = 35kV/\mu s$  (typical)
- Guaranteed performance over temperature: 0°C to 70°C
- U.L. recognized (File # E90700)
- VDE pending

**APPLICATIONS**

- Line receivers
- Pulse transformer replacement
- High speed logic ground isolation: LVTTTL/LVCMOS
- Wide bandwidth analog coupling

**SINGLE-CHANNEL: FOD050L  
DUAL-CHANNEL: FOD053L**

**FOD250L**

**ABSOLUTE MAXIMUM RATINGS** ( $T_A = 25^\circ\text{C}$  unless otherwise specified)

Parameter	Symbol	Value	Units
Storage Temperature	$T_{STG}$	-40 to +125	$^\circ\text{C}$
Operating Temperature	$T_{OPR}$	-40 to +85	$^\circ\text{C}$
Lead Solder Temperature (Wave solder only)	$T_{SOL}$	260 for 10 sec	$^\circ\text{C}$
<b>EMITTER</b>			
DC/Average Forward Input Current	Each Channel $I_F$ (avg)	25	mA
Peak Forward Input Current (50% duty cycle, 1 ms P.W.)	Each Channel $I_F$ (pk)	50	mA
Peak Transient Input Current - ( $\leq 1 \mu\text{s}$ P.W., 300 pps)	Each Channel $I_F$ (trans)	1.0	A
Reverse Input Voltage	Each Channel $V_R$	5	V
Input Power Dissipation (No derating required up to $85^\circ\text{C}$ )	Each Channel $P_D$	45	mW
<b>DETECTOR</b>			
Average Output Current	Each Channel $I_O$ (avg)	8	mA
Peak Output Current	Each Channel $I_O$ (pk)	16	mA
Emitter-Base Reverse Voltage	(FOD050L, FOD250L only) $V_{EBR}$	5	V
Supply Voltage	$V_{CC}$	-0.5 to 7	V
Output Voltage	$V_O$	-0.5 to 7	V
Base Current	(FOD050L, FOD250L only) $I_B$	5	mA
Output Power Dissipation (No derating required up to $85^\circ\text{C}$ )	Each Channel $P_D$	100	mW

SINGLE-CHANNEL: FOD050L                      FOD250L  
DUAL-CHANNEL: FOD053L

**ELECTRICAL CHARACTERISTICS** ( $T_A = 0$  to  $70^\circ\text{C}$  Unless otherwise specified)

**INDIVIDUAL COMPONENT CHARACTERISTICS**

Parameter	Test Conditions	Symbol	Device	Min	Typ**	Max	Unit
<b>EMITTER</b> Input Forward Voltage	( $I_F = 16\text{ mA}$ , $T_A = 25^\circ\text{C}$ )	$V_F$	All	—	1.45	1.7	V
	( $I_F = 16\text{ mA}$ )			—	—	1.8	
Input Reverse Breakdown Voltage	( $I_R = 10\ \mu\text{A}$ )	$B_{VR}$	All	5.0	—	—	V
<b>DETECTOR</b>							
Logic high output current	( $I_F = 0\text{ mA}$ , $V_O = V_{CC} = 3.3\text{ V}$ ) ( $T_A = 25^\circ\text{C}$ )	$I_{OH}$	All	—	0.001	1	$\mu\text{A}$
Logic low supply current	( $I_F = 16\text{ mA}$ , $V_O = \text{Open}$ ) ( $V_{CC} = 3.3\text{ V}$ )	$I_{CCL}$	FOD050L FOD250L	—	—	200	$\mu\text{A}$
	( $I_{F1} = I_{F2} = 16\text{ mA}$ , $V_O = \text{Open}$ ) ( $V_{CC} = 3.3\text{ V}$ )		FOD053L	—	—	400	
Logic high supply current	( $I_F = 0\text{ mA}$ , $V_O = \text{Open}$ , $V_{CC} = 3.3\text{ V}$ ) ( $T_A = 25^\circ\text{C}$ )	$I_{CCH}$	FOD050L FOD250L	—	—	0.3	$\mu\text{A}$
	( $I_F = 0\text{ mA}$ , $V_O = \text{Open}$ ) ( $V_{CC} = 3.3\text{ V}$ )		FOD053L	—	—	10	

\*\* All Typical at  $T_A = 25^\circ\text{C}$

**TRANSFER CHARACTERISTICS** ( $T_A = 0$  to  $70^\circ\text{C}$  Unless otherwise specified)

Parameter	Test Conditions	Symbol	Device	Min	Typ**	Max	Unit
<b>COUPLED</b> Current transfer ratio (Note 1)	( $I_F = 16\text{ mA}$ , $V_O = 0.4\text{ V}$ ) ( $V_{CC} = 3.3\text{ V}$ , $T_A = 25^\circ\text{C}$ )	CTR	All	15	—	50	%
Logic low output voltage output voltage	( $I_F = 16\text{ mA}$ , $I_O = 3\text{ mA}$ ) ( $V_{CC} = 3.3\text{ V}$ , $T_A = 25^\circ\text{C}$ )	$V_{OL}$	All	—	—	0.3	V

\*\* All Typical at  $T_A = 25^\circ\text{C}$

**SINGLE-CHANNEL: FOD050L  
DUAL-CHANNEL: FOD053L**

**FOD250L**

**SWITCHING CHARACTERISTICS** ( $T_A = 0$  to  $70^\circ\text{C}$  unless otherwise specified.,  $V_{CC} = 3.3\text{ V}$ )

Parameter	Test Conditions	Symbol	Device	Min	Typ**	Max	Unit	
Propagation delay time to logic low	$(R_L = 1.9\text{ k}\Omega, I_F = 16\text{ mA})$ (Note 2) (Fig. 10)	$T_{PHL}$	All	$25^\circ\text{C}$	—	—	1.0	$\mu\text{s}$
				—	—	2.0		
Propagation delay time to logic high	$(R_L = 1.9\text{ k}\Omega, I_F = 16\text{ mA})$ (Note 2) (Fig. 10)	$T_{PLH}$	All	$25^\circ\text{C}$	—	—	1.0	$\mu\text{s}$
				—	—	2.0		
Common mode transient immunity at logic high	$(I_F = 0\text{ mA}, V_{CM} = 1,000\text{ V}_{P-P}, R_L = 4.1\text{ k}\Omega)$ (Note 3, 4) (Fig. 11) $T_A = 25^\circ\text{C}$	$ CM_H $	All	5,000	50,000	—	$\text{V}/\mu\text{s}$	
			All	5,000	50,000	—	$\text{V}/\mu\text{s}$	
Common mode transient immunity at logic low	$(I_F = 16\text{ mA}, V_{CM} = 1,000\text{ V}_{P-P}, R_L = 4.1\text{ k}\Omega)$ (Note 3, 4) (Fig. 11) $T_A = 25^\circ\text{C}$	$ CM_L $	All	5,000	35,000	—	$\text{V}/\mu\text{s}$	
			All	5,000	35,000	—	$\text{V}/\mu\text{s}$	

\*\* All Typical at  $T_A = 25^\circ\text{C}$

**ISOLATION CHARACTERISTICS** ( $T_A = 0$  to  $70^\circ\text{C}$  Unless otherwise specified)

Characteristics	Test Conditions	Symbol	Device	Min	Typ**	Max	Unit
Input-output insulation leakage current	(Relative humidity = 45%) $(T_A = 25^\circ\text{C}, t = 5\text{ s})$ $(V_{I-O} = 3000\text{ VDC})$ (Note 5)	$I_{I-O}$	All	—	—	1.0	$\mu\text{A}$
Withstand insulation test voltage	$(f = 60\text{ Hz}, T_A = 25^\circ\text{C})$ (Note 5) ( $t = 1\text{ min.}$ )	$V_{ISO}$	FOD050L FOD053L	2500	—	—	$\text{V}_{RMS}$
			FOD250L	5000	—	—	
Resistance (input to output)	(Note 5) ( $V_{I-O} = 500\text{ VDC}$ )	$R_{I-O}$	All	$10^{11}$	$10^{12}$	—	$\Omega$
Capacitance (input to output)	(Note 5) ( $f = 1\text{ MHz}$ )	$C_{I-O}$	All	—	0.2	—	$\text{pF}$

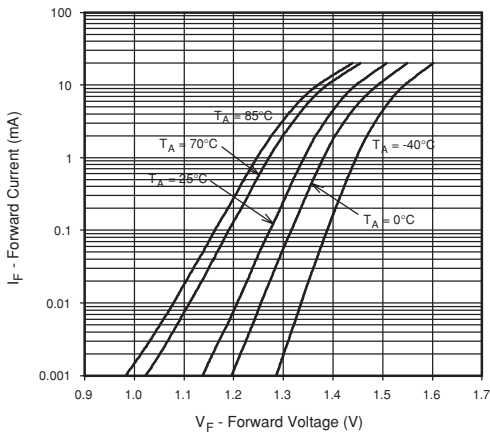
**Notes**

1. Current Transfer Ratio is defined as a ratio of output collector current,  $I_O$ , to the forward LED input current,  $I_F$ , times 100%.
2. The 1.9 k $\Omega$  load represents 1 TTL unit load of 1.6 mA and 5.6 k $\Omega$  pull-up resistor.
3. The 4.1 k $\Omega$  load represents 1 LSTTL unit load of 0.36 mA and 6.1k $\Omega$  pull-up resistor.
4. Common mode transient immunity in logic high level is the maximum tolerable (positive)  $dV_{cm}/dt$  on the leading edge of the common mode pulse signal  $V_{CM}$ , to assure that the output will remain in a logic high state (i.e.,  $V_O > 2.0\text{ V}$ ). Common mode transient immunity in logic low level is the maximum tolerable (negative)  $dV_{cm}/dt$  on the trailing edge of the common mode pulse signal,  $V_{CM}$ , to assure that the output will remain in a logic low state (i.e.,  $V_O < 0.8\text{ V}$ ).
5. Device is considered a two terminal device: Pins 1, 2, 3 and 4 are shorted together and Pins 5, 6, 7 and 8 are shorted together.

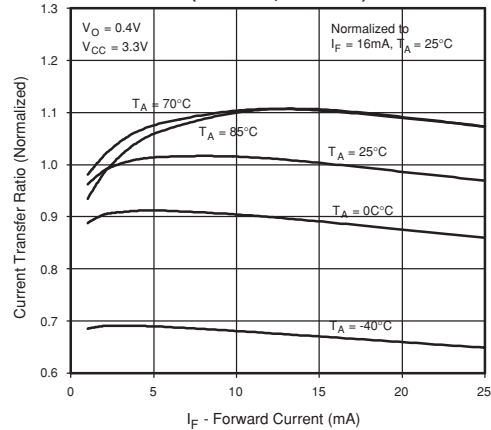
**SINGLE-CHANNEL: FOD050L  
DUAL-CHANNEL: FOD053L**

**FOD250L**

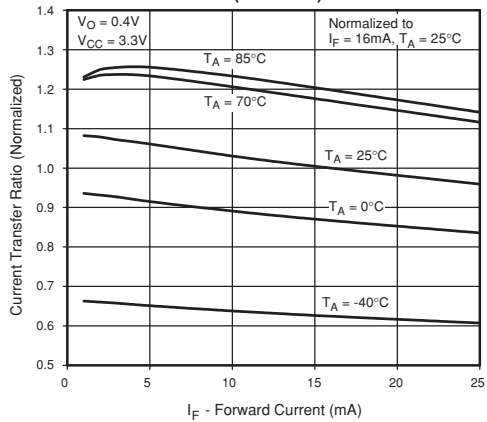
**Fig. 1 LED Forward Current vs. Forward Voltage**



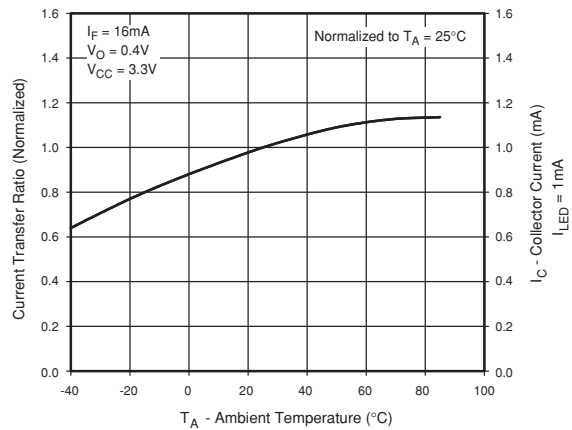
**Fig. 2 Current Transfer Ratio vs. Forward Current (FOD050L, FOD053L)**



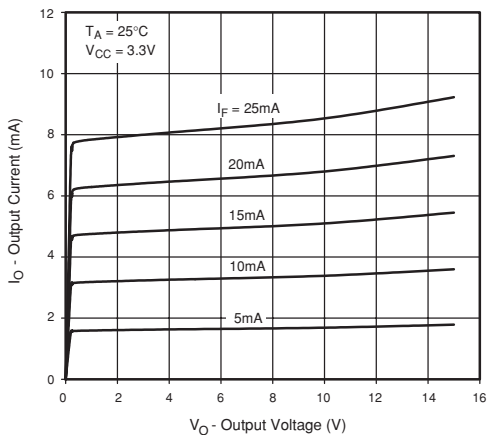
**Fig. 3 Current Transfer Ratio vs. Input Forward Current (FOD250L)**



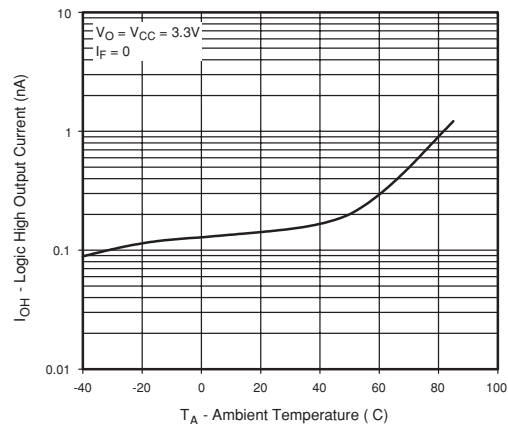
**Fig. 4 Current Transfer Ratio vs. Ambient Temperature**



**Fig. 5 Output Current vs. Output Voltage**



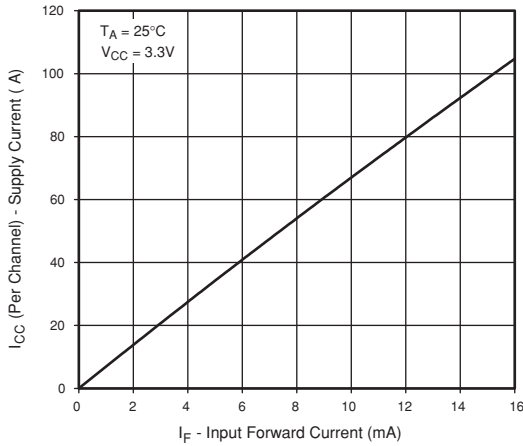
**Fig. 6 Logic High Output Current vs. Ambient Temperature**



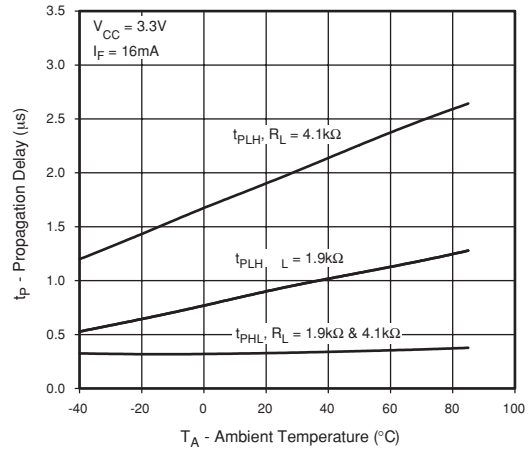
**SINGLE-CHANNEL: FOD050L  
DUAL-CHANNEL: FOD053L**

**FOD250L**

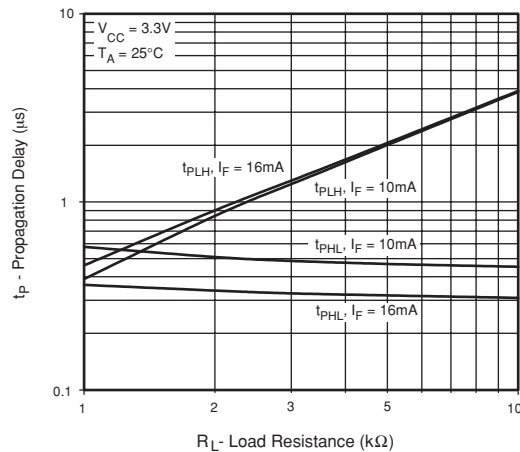
**Fig. 7 Supply Current vs. Input Forward Current**



**Fig. 8 Propagation Delay vs. Ambient Temperature**

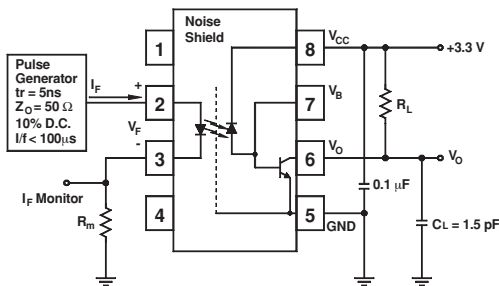


**Fig. 9 Propagation Delay vs Load Resistance**

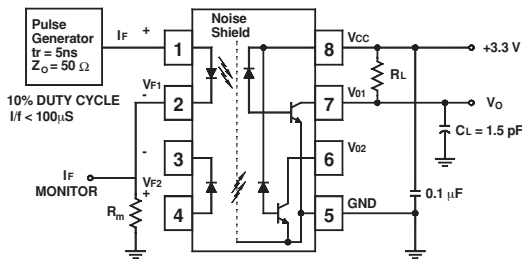


SINGLE-CHANNEL: FOD050L  
DUAL-CHANNEL: FOD053L

FOD250L



Test Circuit for FOD050L and FOD250L



Test Circuit for FOD053L

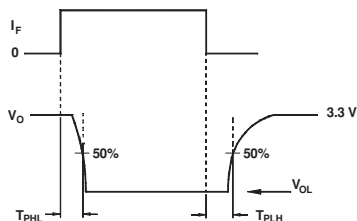
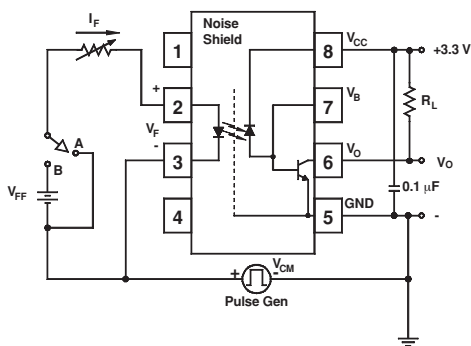
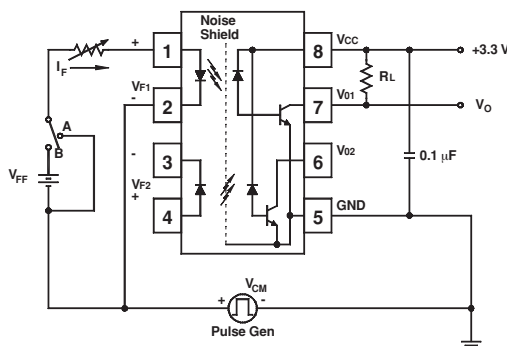


Fig. 10 Switching Time Test Circuit



Test Circuit for FOD050L and FOD250L



Test Circuit for FOD053L

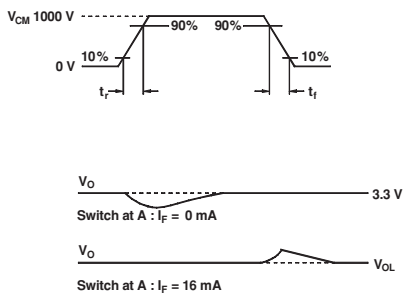


Fig. 11 Common Mode Immunity Test Circuit

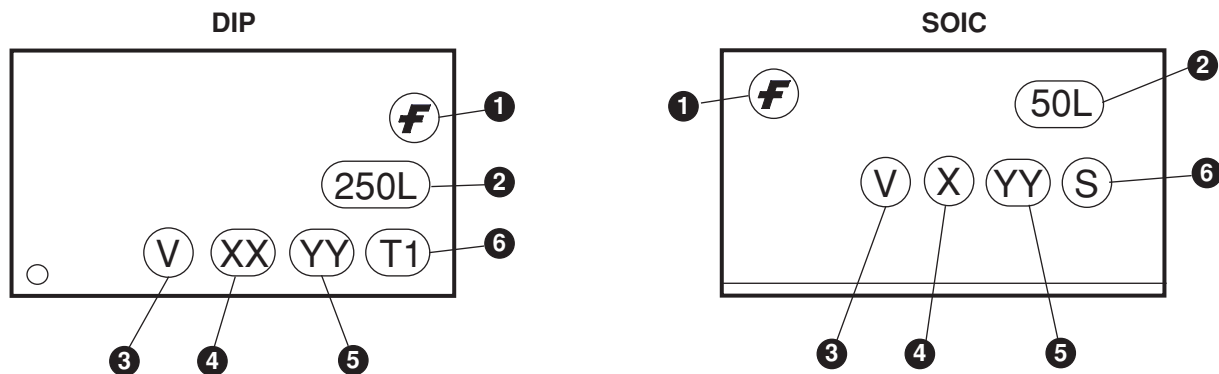
SINGLE-CHANNEL: FOD050L  
DUAL-CHANNEL: FOD053L

FOD250L

**ORDERING INFORMATION**

Option	Order Entry Identifier	Description
No Suffix	FOD250L	Through Hole (DIP package only)
	FOD050L	Surface Mount Lead Form (SOIC-8 package only)
S	FOD250LS	Surface Mount Lead Bend (DIP package only)
SD	FOD250LSD	Surface Mount; Tape and reel (DIP package only)
SV	Pending Approval	Surface Mount; VDE0884 (DIP package only)
SDV	Pending Approval	Surface Mount; Tape and reel, VDE0884 (1000 units per reel) (DIP package only)
T	FOD250LT	0.4" Lead Spacing (DIP package only)
TV	Pending Approval	0.4" Lead Spacing, VDE0884 (DIP package only)
R1	FOD050LR1	Tape and Reel (500 units per reel) (SOIC-8 package only)
R1V	Pending Approval	VDE, Tape and Reel (500 units per reel) (SOIC-8 package only)
R2	FOD050LR2	Tape and Reel (2500 units per reel) (SOIC-8 package only)
R2V	Pending Approval	VDE, Tape and Reel (2500 units per reel) (SOIC-8 package only)
V	Pending Approval	VDE (SOIC-8 package only)

**MARKING INFORMATION**



Definitions	
1	Fairchild logo
2	Device number
3	VDE mark (Note: Only appears on parts ordered with VDE option – See order entry table)
4 (DIP)	Two digit year code, e.g., '03'
4 (SOIC)	One digit year code, e.g., '3'
5	Two digit work week ranging from '01' to '53'
6	Assembly package code

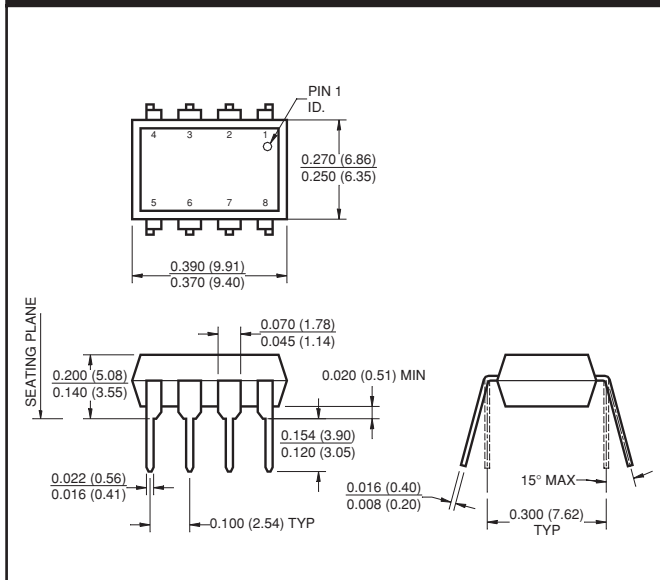


**SINGLE-CHANNEL: FOD050L  
DUAL-CHANNEL: FOD053L**

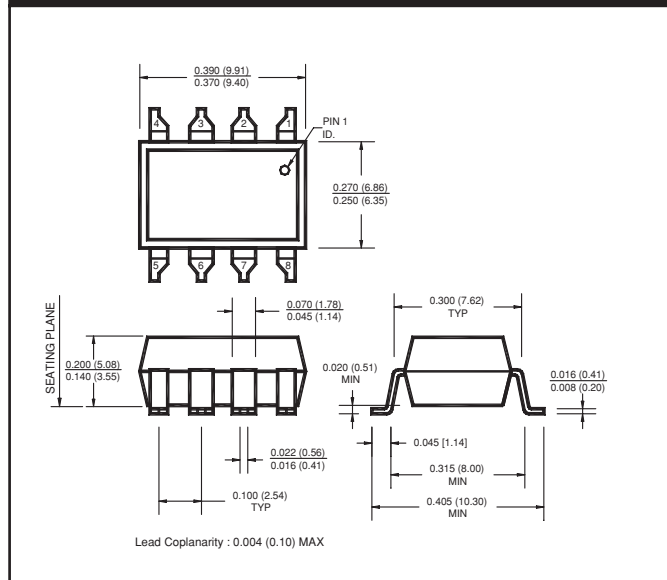
**FOD250L**

**8-PIN DIP**

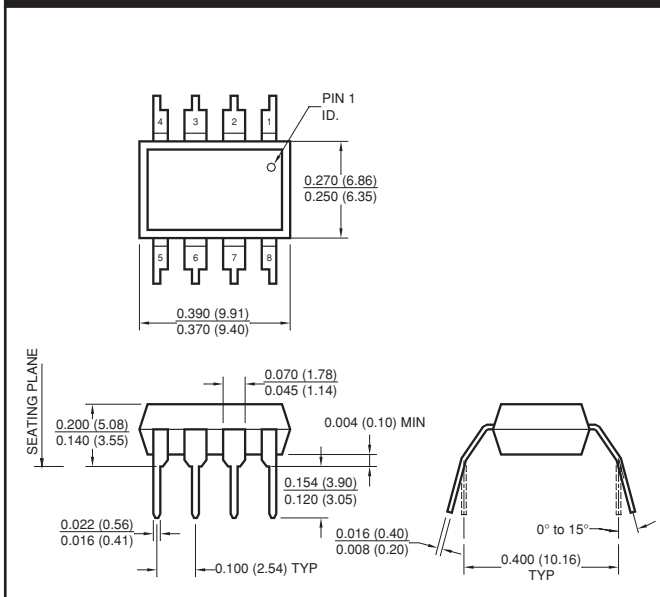
**Package Dimensions (Through Hole)**



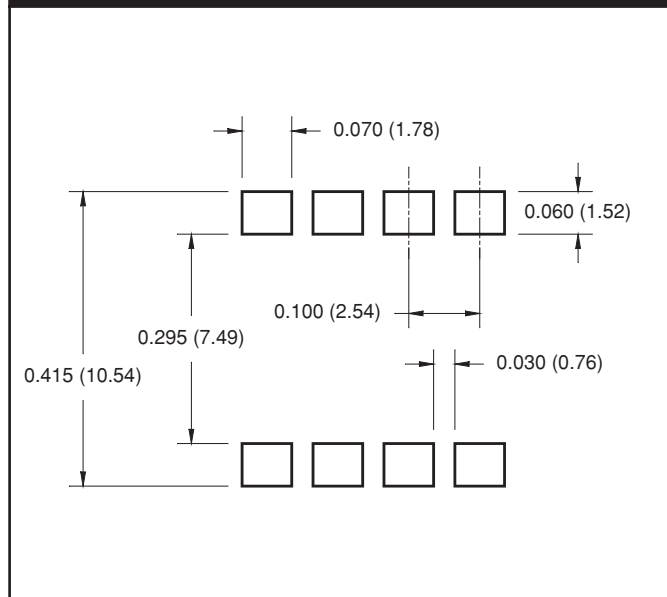
**Package Dimensions (Surface Mount)**



**Package Dimensions (0.4" Lead Spacing)**



**8 - Pin Dip**



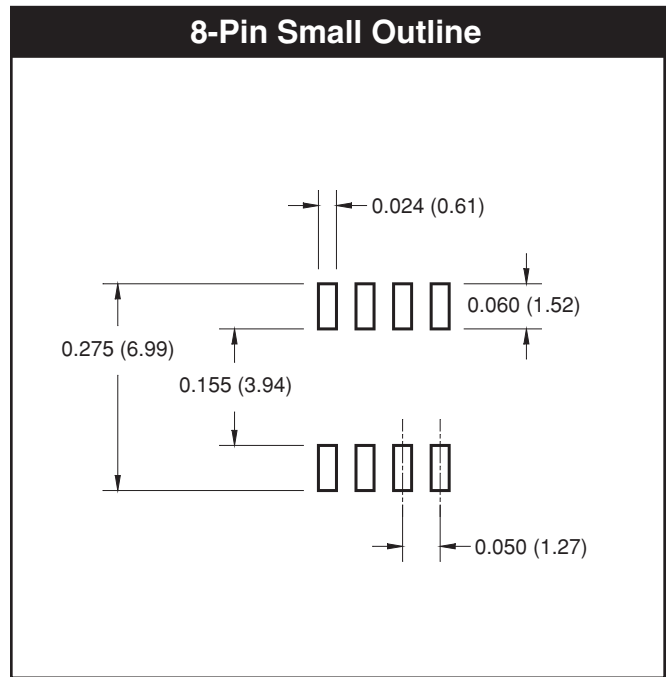
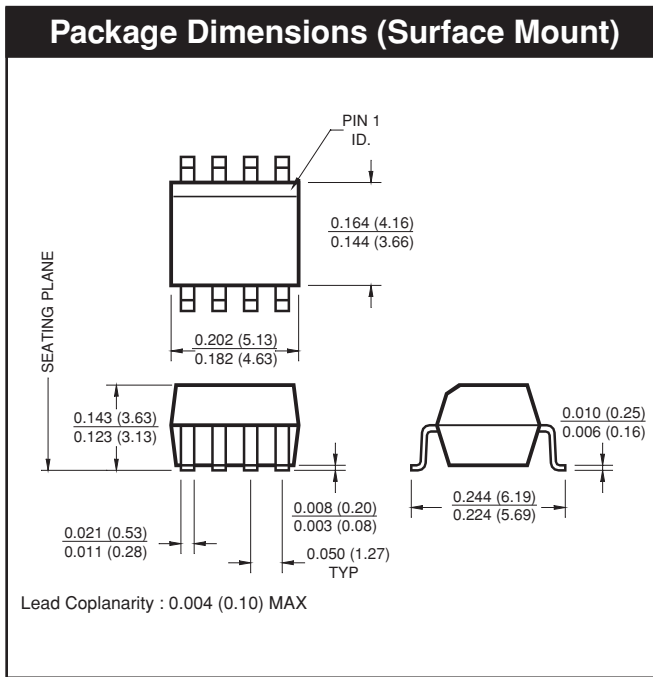
**NOTE**

All dimensions are in inches (millimeters)

SINGLE-CHANNEL: FOD050L  
DUAL-CHANNEL: FOD053L

FOD250L

**8-PIN SOIC**

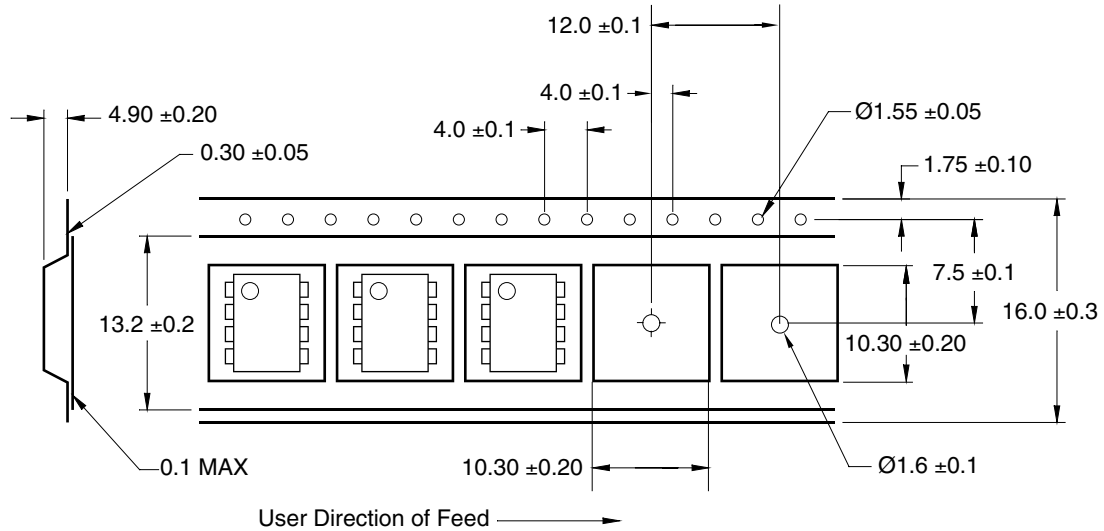


SINGLE-CHANNEL: FOD050L  
DUAL-CHANNEL: FOD053L

FOD250L

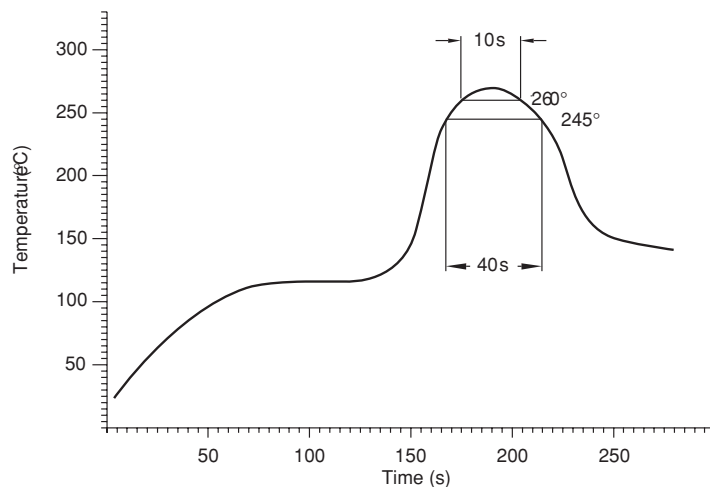
**8-PIN DIP**

**Carrier Tape Specifications**



**Reflow Profile (FOD250L)**

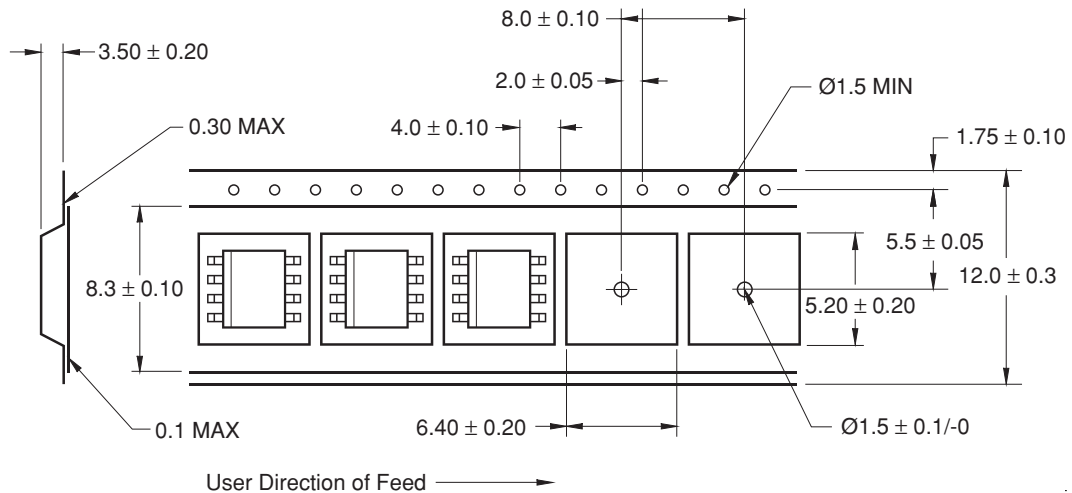
- Peak reflow temperature 260°C (package surface temperature)
- Time of temperature higher than 245°C 40 seconds or less
- Number of reflows Three



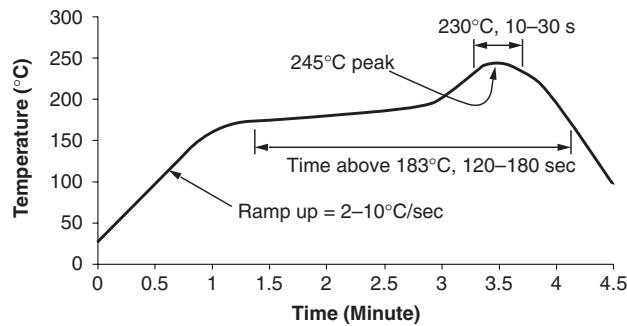
SINGLE-CHANNEL: FOD050L                      FOD250L  
DUAL-CHANNEL: FOD053L

**8-PIN SOIC**

**Carrier Tape Specifications (FOD050L, FOD053L)**



**Reflow Profile (FOD250L)**



- Peak reflow temperature: 245°C (package surface temperature)
- Time of temperature higher than 183°C for 120-180 seconds
- One time soldering reflow is recommended

**SINGLE-CHANNEL: FOD050L  
DUAL-CHANNEL: FOD053L**

**FOD250L**

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2. A critical component in any component of a life support device or system whose failure to perform can be reasonably expected to cause the failure of the life support device or system, or to affect its safety or effectiveness.