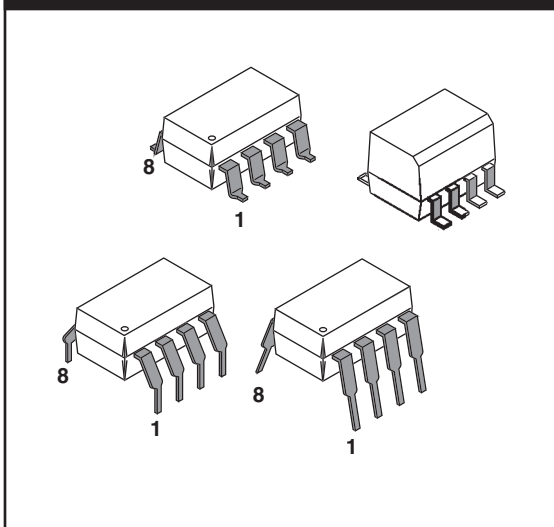


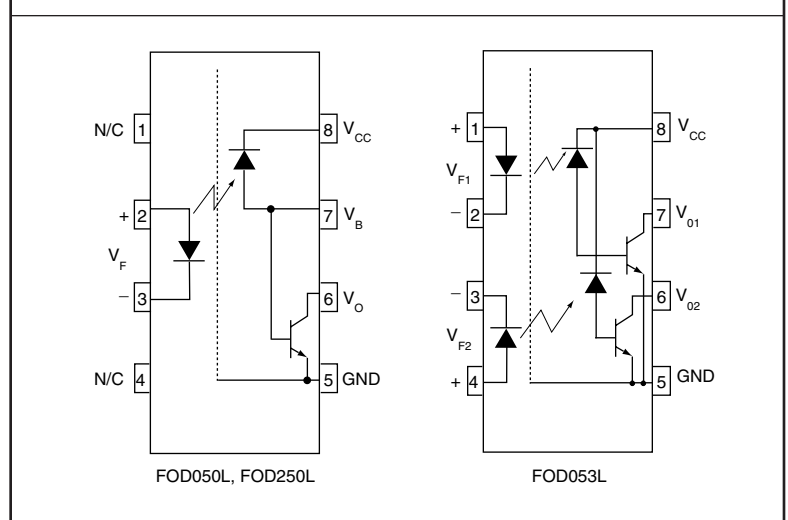
**SINGLE-CHANNEL: FOD050L
DUAL-CHANNEL: FOD053L**

FOD250L

PACKAGE



SCHEMATIC



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 $CM_H = 50\text{kV/ms}$ (typical) and $CM_L = 35\text{kV/ms}$ (typical).

Truth Table

LED	V_O
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 – $CM_H = 50\text{kV}/\mu\text{s}$ (typical) and $CM_L = 35\text{kV}/\mu\text{s}$ (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: LVTTL/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	$^\circ\text{C}$
EMITTER				
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°C)	Each Channel	P_D	45	mW
DETECTOR				
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°C)	Each Channel	P_D	100	mW

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

FOD250L

ELECTRICAL CHARACTERISTICS ($T_A = 0$ to 70°C Unless otherwise specified)

INDIVIDUAL COMPONENT CHARACTERISTICS

Parameter	Test Conditions	Symbol	Device	Min	Typ**	Max	Unit
EMITTER 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	($I_R = 10\text{ }\mu\text{A}$)	B_{VR}	All	5.0	—	—	V
DETECTOR							
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	μA
Logic low supply current	($I_F = 16\text{ mA}$, $V_O = \text{Open}$) ($V_{CC} = 3.3\text{ V}$)	I_{CCL}	FOD050L FOD250L	—	—	200	μA
	($I_{F1} = I_{F2} = 16\text{ mA}$, $V_O = \text{Open}$) ($V_{CC} = 3.3\text{ V}$)		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	μA
	($I_F = 0\text{ mA}$, $V_O = \text{Open}$) ($V_{CC} = 3.3\text{ V}$)		FOD053L	—	—	10	

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

TRANSFER CHARACTERISTICS ($T_A = 0$ to 70°C Unless otherwise specified)

Parameter	Test Conditions	Symbol	Device	Min	Typ**	Max	Unit
COUPLED							
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 Typicals at $T_A = 25^\circ\text{C}$

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

FOD250L

SWITCHING CHARACTERISTICS ($T_A = 0$ to 70°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	—	—	1.0	μs
	25°C			—	—	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	—	—	1.0	μs
	25°C			—	—	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) $T_A = 25^\circ\text{C}$	ICM_{HI}	All	5,000	50,000	—	$\text{V}/\mu\text{s}$
	$(I_F = 0\text{ mA}, V_{CM} = 1,000\text{ V}_{P-P})$ $T_A = 25^\circ\text{C}, (R_L = 1.9\text{ k}\Omega)$ (Note 2, 4) (Fig. 11)		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) $T_A = 25^\circ\text{C}$	ICM_{LI}	All	5,000	35,000	—	$\text{V}/\mu\text{s}$
	$(I_F = 16\text{ mA}, V_{CM} = 1,000\text{ V}_{P-P}) (R_L = 1.9\text{ k}\Omega)$ (Note 2, 4) (Fig. 11)		All	5,000	35,000	—	$\text{V}/\mu\text{s}$

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

ISOLATION CHARACTERISTICS ($T_A = 0$ to 70°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	μA
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	—	—	V_{RMS}
			FOD250L	5000	—	—	
Resistance (input to output)	(Note 5) ($V_{I-O} = 500\text{ VDC}$)	R_{I-O}	All	10^{11}	10^{12}	—	Ω
Capacitance (input to output)	(Note 5) ($f = 1\text{ MHz}$)	C_{I-O}	All	—	0.2	—	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 $1.9\text{ k}\Omega$ load represents 1 TTL unit load of 1.6 mA and $5.6\text{ k}\Omega$ pull-up resistor.
3. The $4.1\text{ k}\Omega$ load represents 1 LSTTL unit load of 0.36 mA and $6.1\text{ k}\Omega$ 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

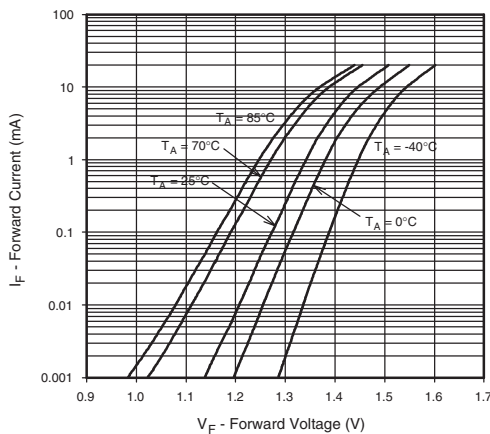


Fig. 2 Current Transfer Ratio vs. Forward Current (FOD050L, FOD053L)

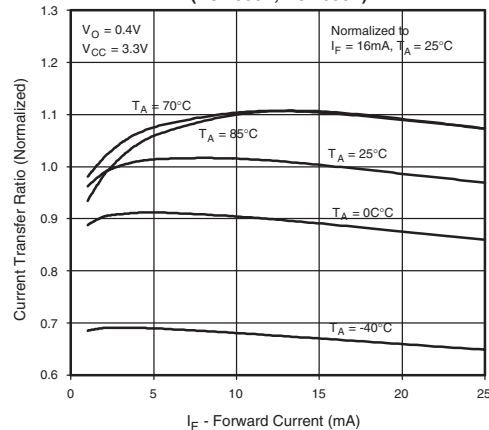


Fig. 3 Current Transfer Ratio vs. Input Forward Current (FOD250L)

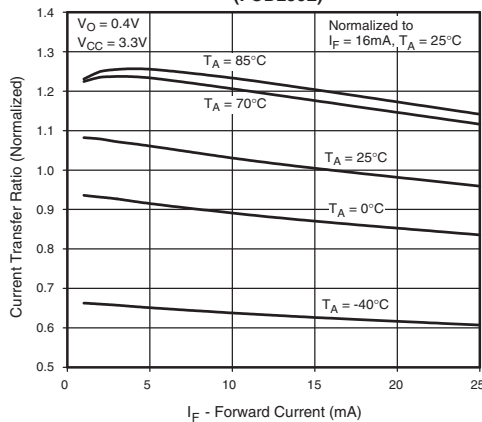


Fig. 4 Current Transfer Ratio vs. Ambient Temperature

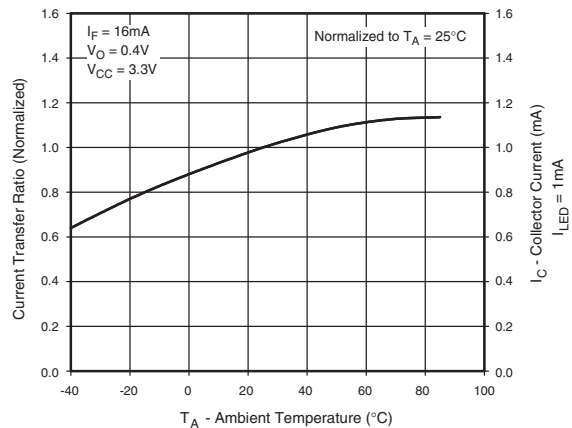


Fig. 5 Output Current vs. Output Voltage

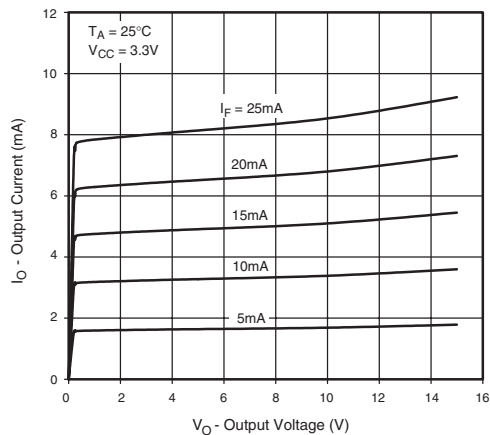
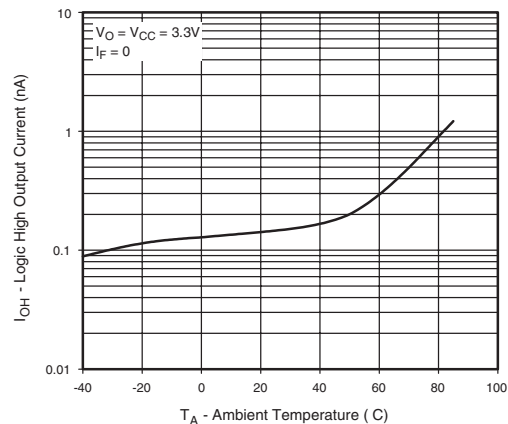


Fig. 6 Logic High Output Current vs. Ambient Temperature



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

FOD250L

Fig. 7 Supply Current vs. Input Forward Current

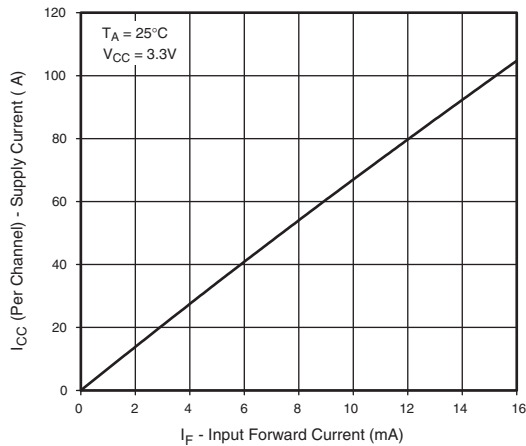


Fig. 8 Propagation Delay vs. Ambient Temperature

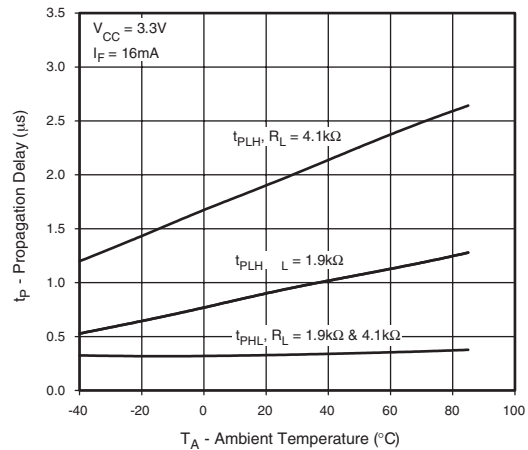
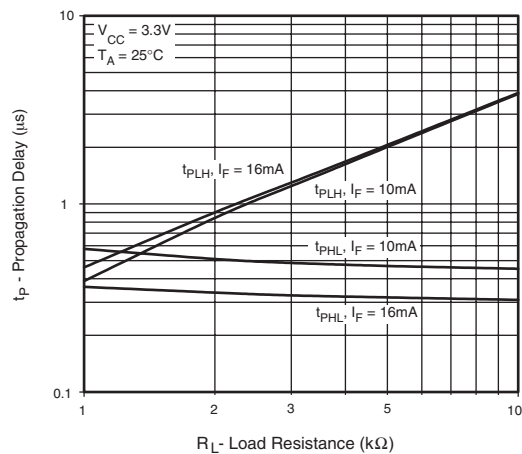
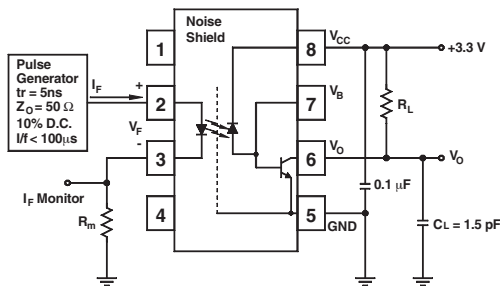


Fig. 9 Propagation Delay vs Load Resistance

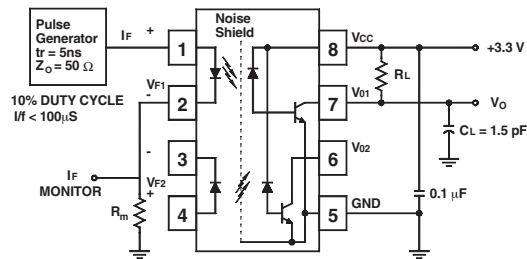


**SINGLE-CHANNEL: FOD050L
DUAL-CHANNEL: FOD053L**

FOD250L



Test Circuit for FOD050L and FOD250L



Test Circuit for FOD053L

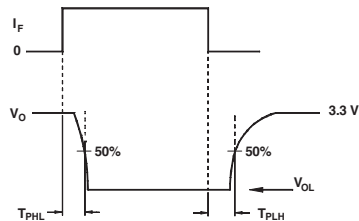
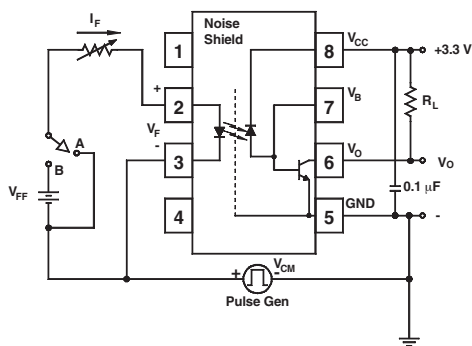
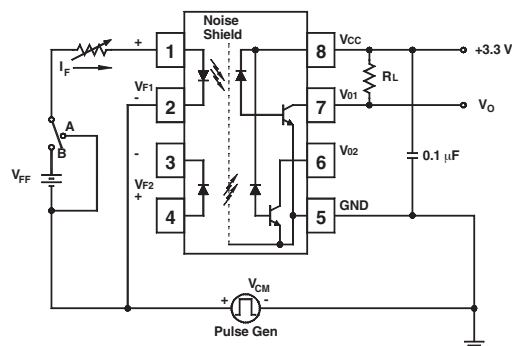


Fig. 10 Switching Time Test Circuit



Test Circuit for FOD050L and FOD250L



Test Circuit for FOD053L

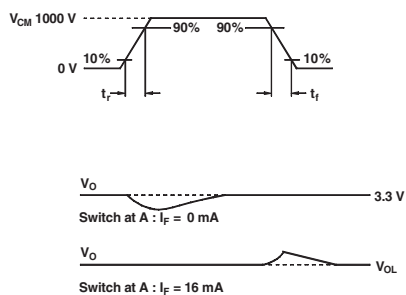


Fig. 11 Common Mode Immunity Test Circuit

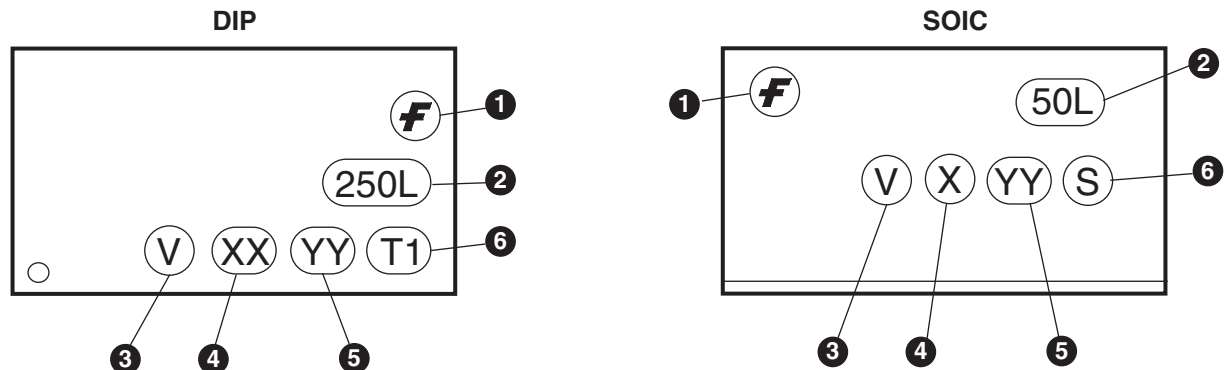
**SINGLE-CHANNEL: FOD050L
DUAL-CHANNEL: FOD053L**

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



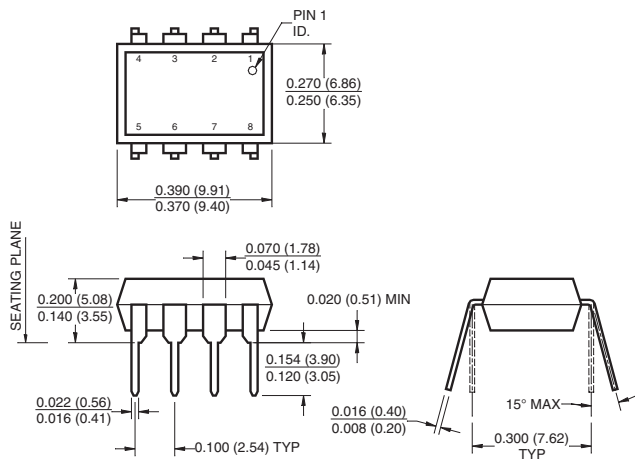
Definitions	
1	Fairchild logo
2	Device number
3	VDE mark (Note: Only appears on parts ordered with VDE option – See order entry table)
4 (DIP)	Two digit year code, e.g., '03'
4 (SOIC)	One digit year code, e.g., '3'
5	Two digit work week ranging from '01' to '53'
6	Assembly package code

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

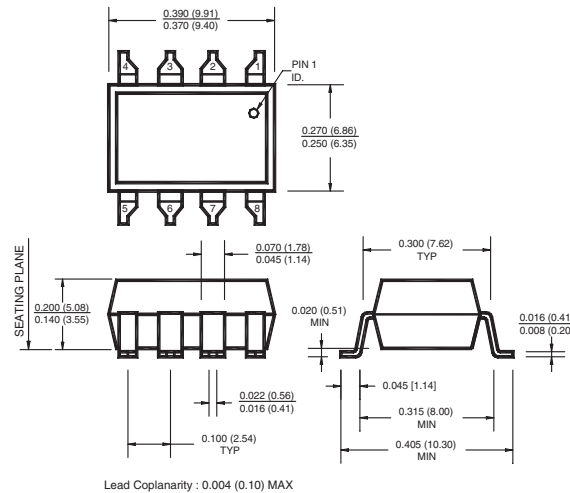
FOD250L

8-PIN DIP

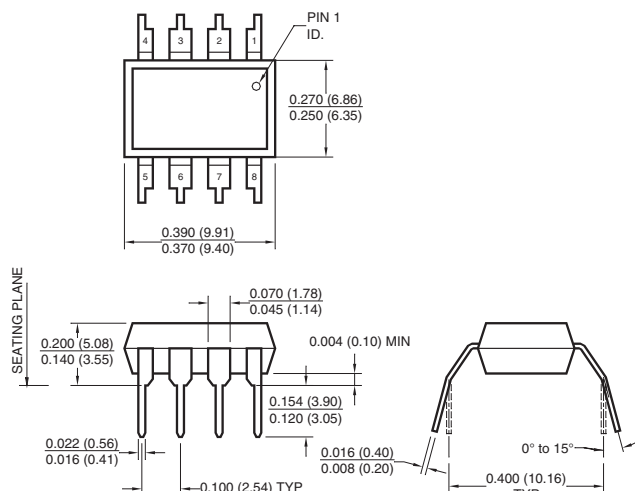
Package Dimensions (Through Hole)



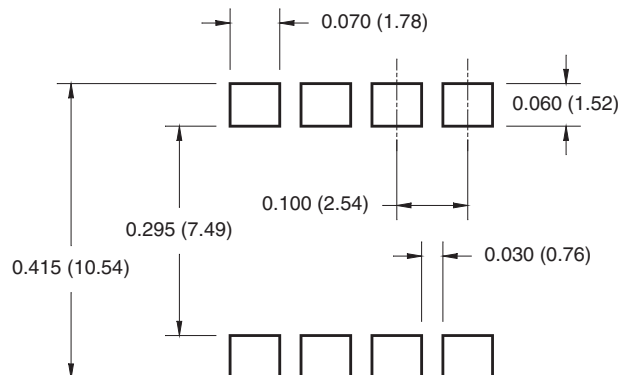
Package Dimensions (Surface Mount)



Package Dimensions (0.4"Lead Spacing)



8 - Pin Dip



NOTE

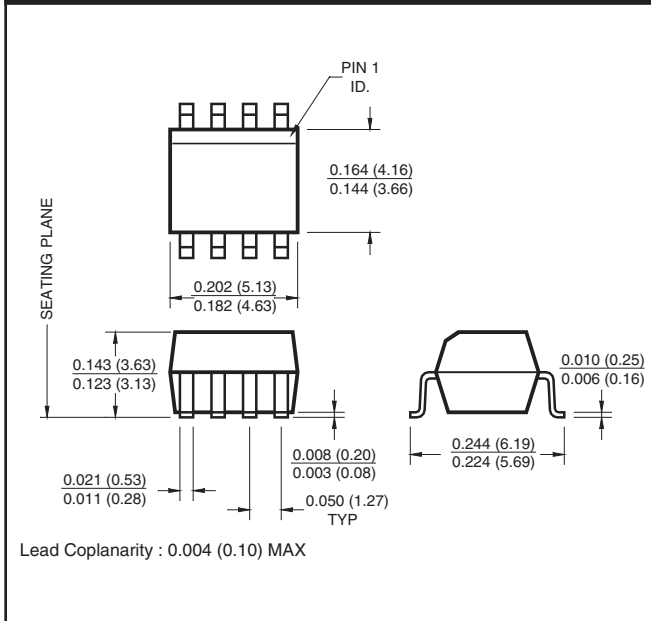
All dimensions are in inches (millimeters)

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

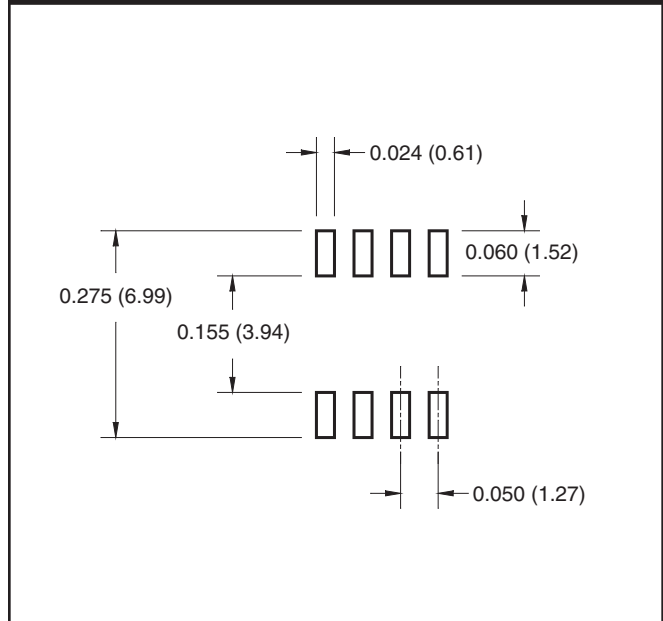
FOD250L

8-PIN SOIC

Package Dimensions (Surface Mount)



8-Pin Small Outline

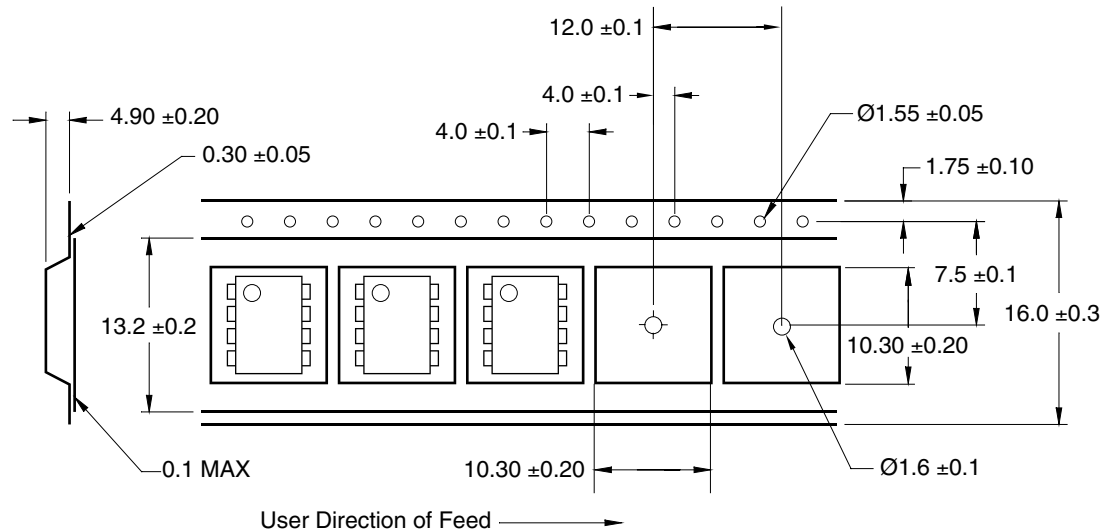


SINGLE-CHANNEL: FOD050L
DUAL-CHANNEL: FOD053L

FOD250L

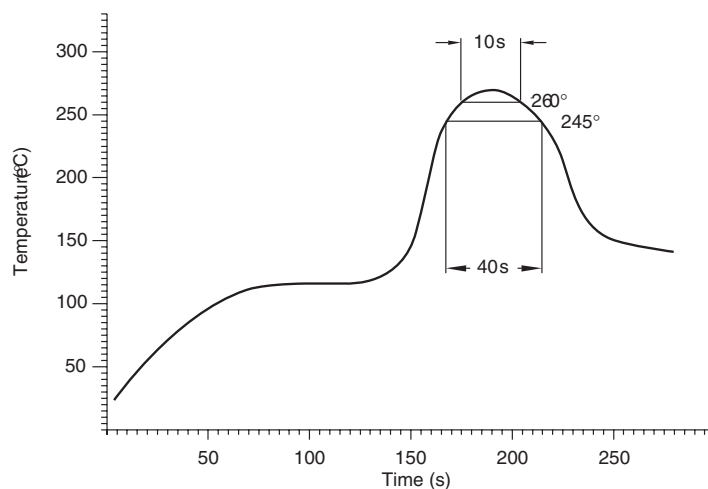
8-PIN DIP

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

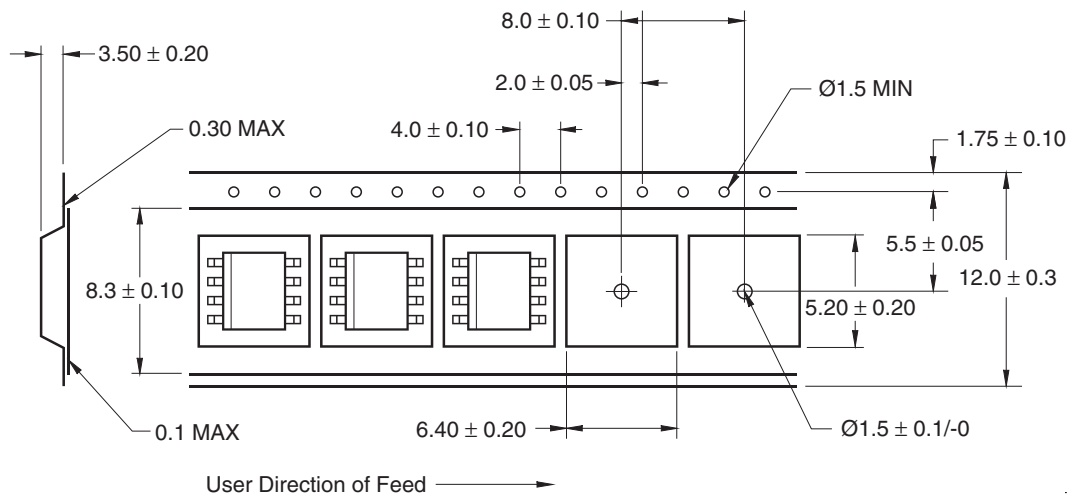


SINGLE-CHANNEL: FOD050L
DUAL-CHANNEL: FOD053L

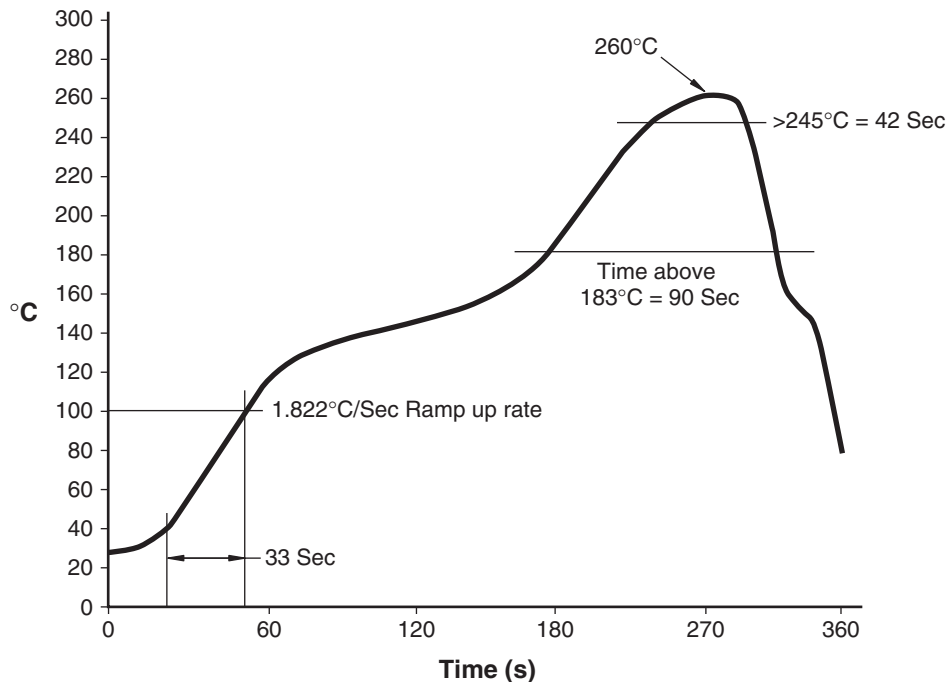
FOD250L

8-PIN SOIC

Carrier Tape Specifications (FOD050L, FOD053L)



Reflow Profile (FOD050L, FOD053L)



SINGLE-CHANNEL: FOD050L
DUAL-CHANNEL: FOD053L

FOD250L

DISCLAIMER

FAIRCHILD SEMICONDUCTOR RESERVES THE RIGHT TO MAKE CHANGES WITHOUT FURTHER NOTICE TO ANY PRODUCTS HEREIN TO IMPROVE RELIABILITY, FUNCTION OR DESIGN. FAIRCHILD DOES NOT ASSUME ANY LIABILITY ARISING OUT OF THE APPLICATION OR USE OF ANY PRODUCT OR CIRCUIT DESCRIBED HEREIN; NEITHER DOES IT CONVEY ANY LICENSE UNDER ITS PATENT RIGHTS, NOR THE RIGHTS OF OTHERS.

LIFE SUPPORT POLICY

FAIRCHILD'S PRODUCTS ARE NOT AUTHORIZED FOR USE AS CRITICAL COMPONENTS IN LIFE SUPPORT DEVICES OR SYSTEMS WITHOUT THE EXPRESS WRITTEN APPROVAL OF THE PRESIDENT OF FAIRCHILD SEMICONDUCTOR CORPORATION. As used herein:

1. Life support devices or systems are devices or systems which, (a) are intended for surgical implant into the body, or (b) support or sustain life, and (c) whose failure to perform when properly used in accordance with instructions for use provided in the labeling, can be reasonably expected to result in a significant injury of the user.
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.