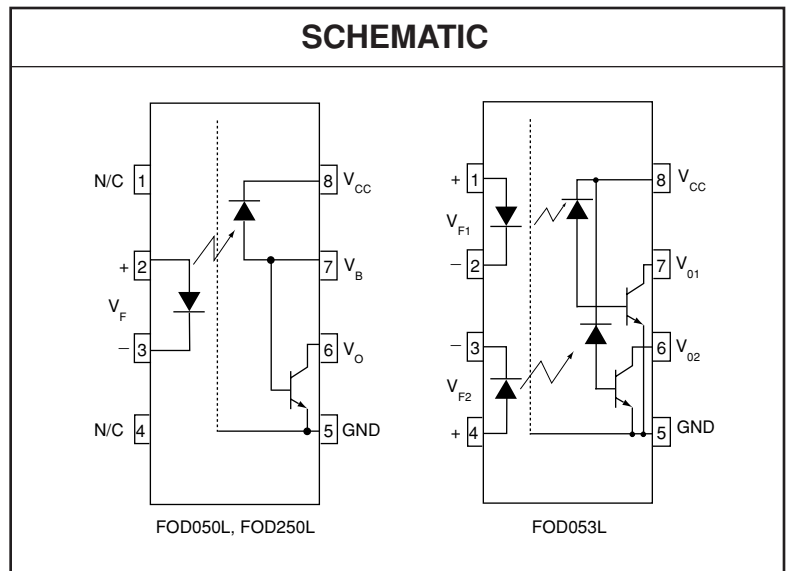
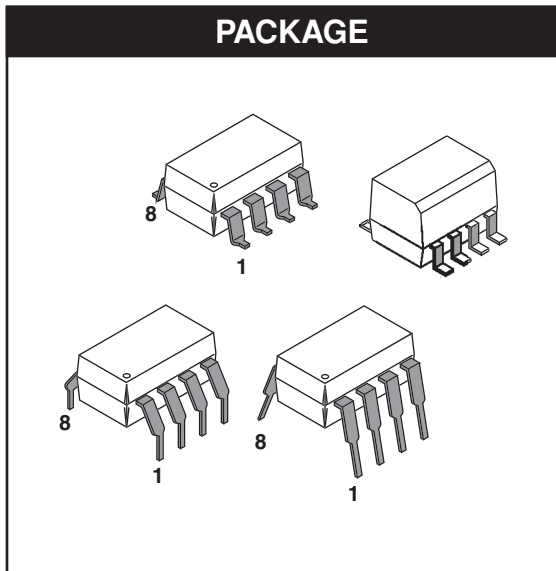


**SINGLE-CHANNEL: FOD050L  
DUAL-CHANNEL: FOD053L**

**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                      FOD250L  
DUAL-CHANNEL: FOD053L

**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  
DUAL-CHANNEL: FOD053L

FOD250L

**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><br>Input Forward Voltage | ( $I_F = 16$ mA, $T_A = 25^\circ\text{C}$ )   | $V_F$     | All                | —   | 1.45  | 1.7 | V             |
|   | ( $I_F = 16$ 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               | ( $I_F = 0$ mA, $V_O = V_{CC} = 3.3$ V)<br>( $T_A = 25^\circ\text{C}$ )                 | $I_{OH}$  | All                | —   | 0.001 | 1   | $\mu\text{A}$ |
| Logic low supply current                | ( $I_F = 16$ mA, $V_O = \text{Open}$ )<br>( $V_{CC} = 3.3$ V)                           | $I_{CCL}$ | FOD050L<br>FOD250L | —   | —     | 200 | $\mu\text{A}$ |
|   | ( $I_{F1} = I_{F2} = 16$ mA, $V_O = \text{Open}$ )<br>( $V_{CC} = 3.3$ V)               |           | FOD053L            | —   | —     | 400 |               |
| Logic high supply current               | ( $I_F = 0$ mA, $V_O = \text{Open}$ , $V_{CC} = 3.3$ V)<br>( $T_A = 25^\circ\text{C}$ ) | $I_{CCH}$ | FOD050L<br>FOD250L | —   | —     | 0.3 | $\mu\text{A}$ |
|   | ( $I_F = 0$ mA, $V_O = \text{Open}$ )<br>( $V_{CC} = 3.3$ 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><br>Current transfer ratio<br>(Note 1) | ( $I_F = 16$ mA, $V_O = 0.4$ V)<br>( $V_{CC} = 3.3$ V, $T_A = 25^\circ\text{C}$ ) | CTR      | All    | 15  | —     | 50  | %    |
| Logic low output voltage<br>output voltage           | ( $I_F = 16$ mA, $I_O = 3$ mA)<br>( $V_{CC} = 3.3$ 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 | $(I_F = 0\text{ mA}, V_{CM} = 1,000\text{ V}_{P-P}, R_L = 4.1\text{ k}\Omega)$<br>(Note 3, 4) (Fig. 11) $T_A = 25^\circ\text{C}$  | $ CM_H $  | All    | 5,000              | 50,000 | —   | $\text{V}/\mu\text{s}$ |               |
|  | $(I_F = 0\text{ mA}, V_{CM} = 1,000\text{ V}_{P-P}, T_A = 25^\circ\text{C}, R_L = 1.9\text{ k}\Omega)$<br>(Note 2, 4) (Fig. 11)   |           | All    | 5,000              | 50,000 | —   | $\text{V}/\mu\text{s}$ |               |
| Common mode transient immunity at logic low  | $(I_F = 16\text{ mA}, V_{CM} = 1,000\text{ V}_{P-P}, R_L = 4.1\text{ k}\Omega)$<br>(Note 3, 4) (Fig. 11) $T_A = 25^\circ\text{C}$ | $ CM_L $  | All    | 5,000              | 35,000 | —   | $\text{V}/\mu\text{s}$ |               |
|  | $(I_F = 16\text{ mA}, V_{CM} = 1,000\text{ V}_{P-P}, R_L = 1.9\text{ k}\Omega)$<br>(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  $70^\circ\text{C}$  Unless otherwise specified)

| Characteristics                         | Test Conditions  | Symbol    | Device             | Min       | Typ**     | Max | Unit             |
|---|--|-----------|--------------------|-----------|-----------|-----|------------------|
| Input-output insulation leakage current | (Relative humidity = 45%)<br>$(T_A = 25^\circ\text{C}, t = 5\text{ s})$<br>$(V_{I-O} = 3000\text{ VDC})$<br>(Note 5) | $I_{I-O}$ | All                | —         | —         | 1.0 | $\mu\text{A}$    |
| Withstand insulation test voltage       | $(f = 60\text{ Hz}, T_A = 25^\circ\text{C})$<br>(Note 5) ( $t = 1\text{ min.}$ )                                     | $V_{ISO}$ | FOD050L<br>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       | —   | $\text{pF}$      |

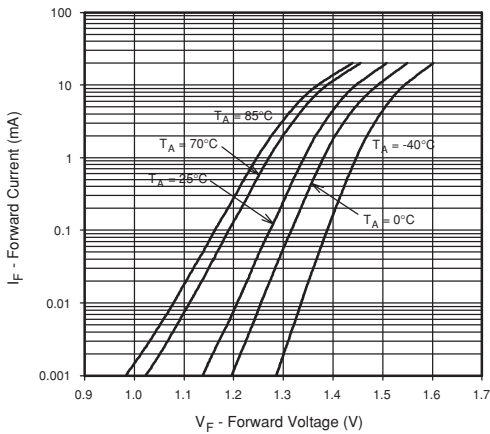
**Notes**

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.

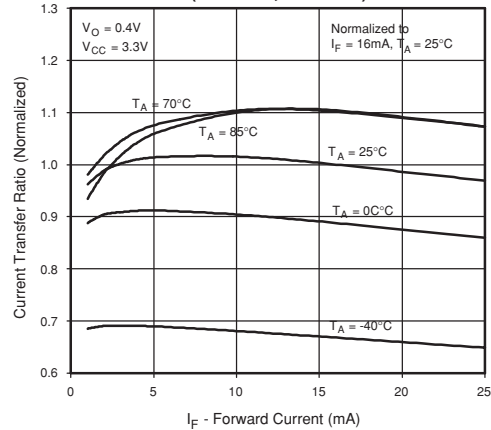
**SINGLE-CHANNEL: FOD050L  
DUAL-CHANNEL: FOD053L**

**FOD250L**

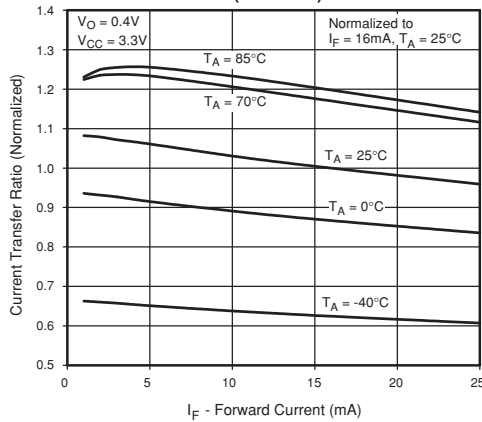
**Fig. 1 LED Forward Current vs. Forward Voltage**



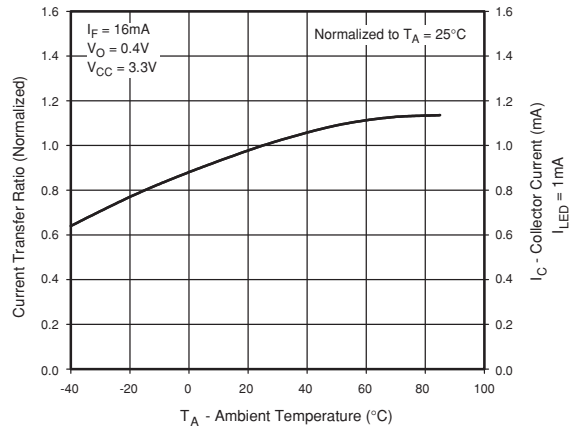
**Fig. 2 Current Transfer Ratio vs. Forward Current (FOD050L, FOD053L)**



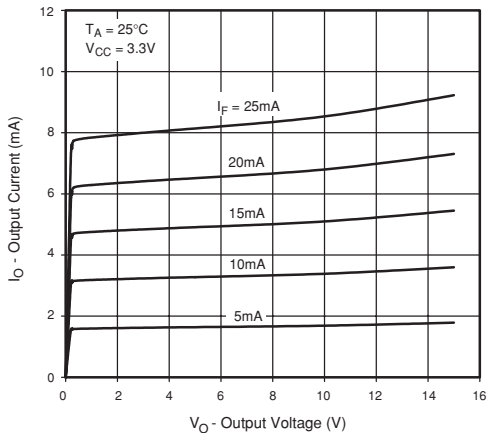
**Fig. 3 Current Transfer Ratio vs. Input Forward Current (FOD250L)**



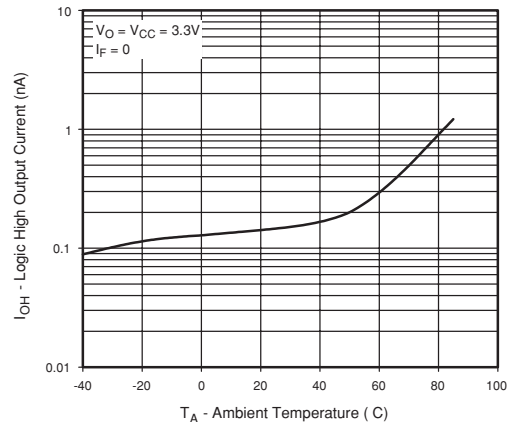
**Fig. 4 Current Transfer Ratio vs. Ambient Temperature**



**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

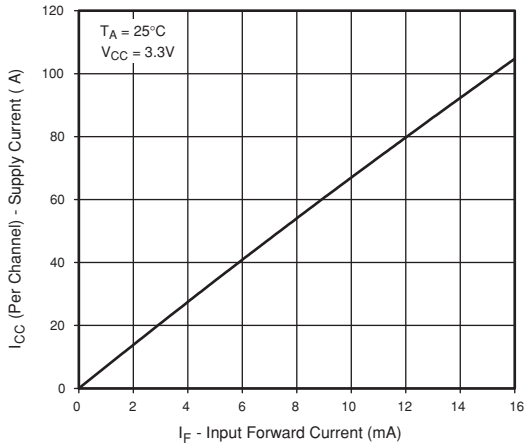


Fig. 8 Propagation Delay vs. Ambient Temperature

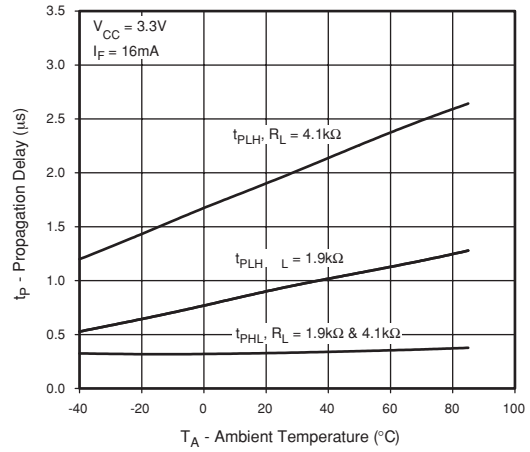
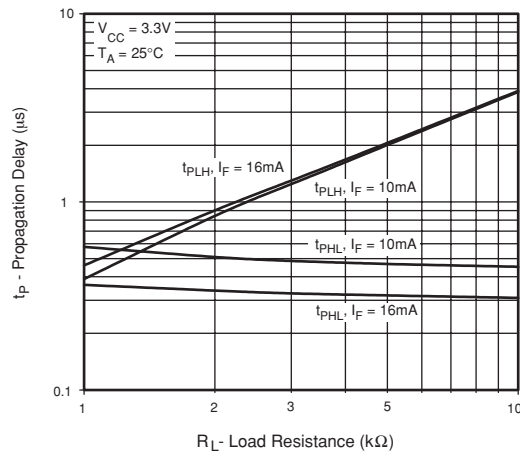
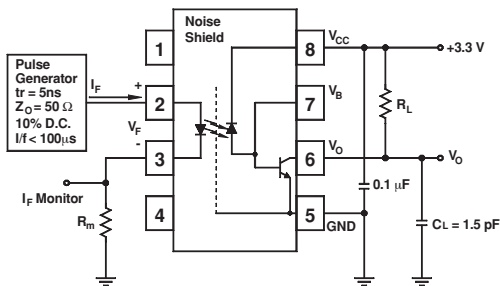


Fig. 9 Propagation Delay vs Load Resistance

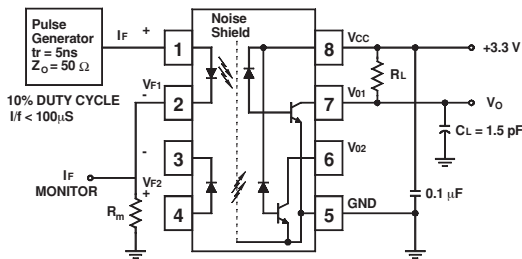


**SINGLE-CHANNEL: FOD050L  
DUAL-CHANNEL: FOD053L**

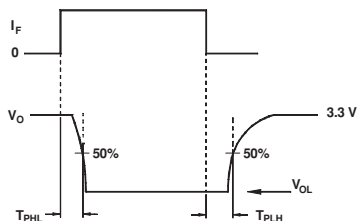
**FOD250L**



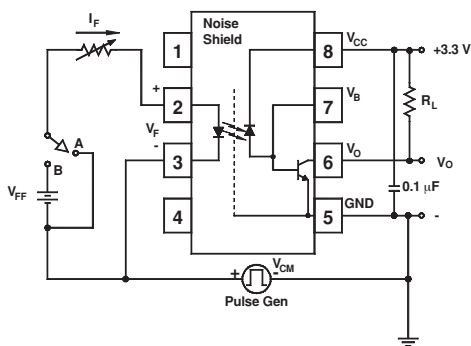
Test Circuit for FOD050L and FOD250L



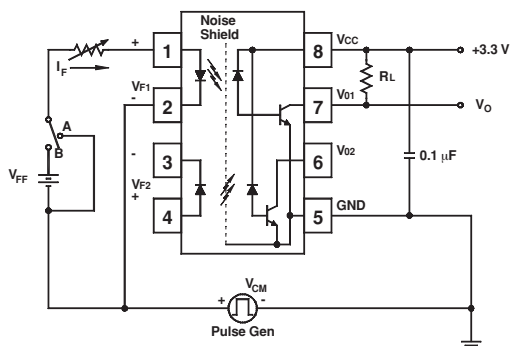
Test Circuit for FOD053L



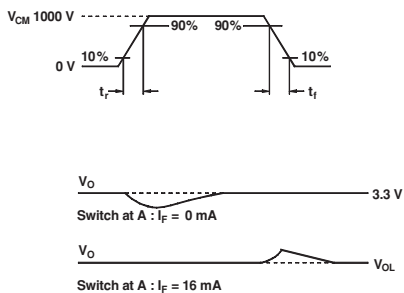
**Fig. 10 Switching Time Test Circuit**



Test Circuit for FOD050L and FOD250L



Test Circuit for FOD053L



**Fig. 11 Common Mode Immunity Test Circuit**

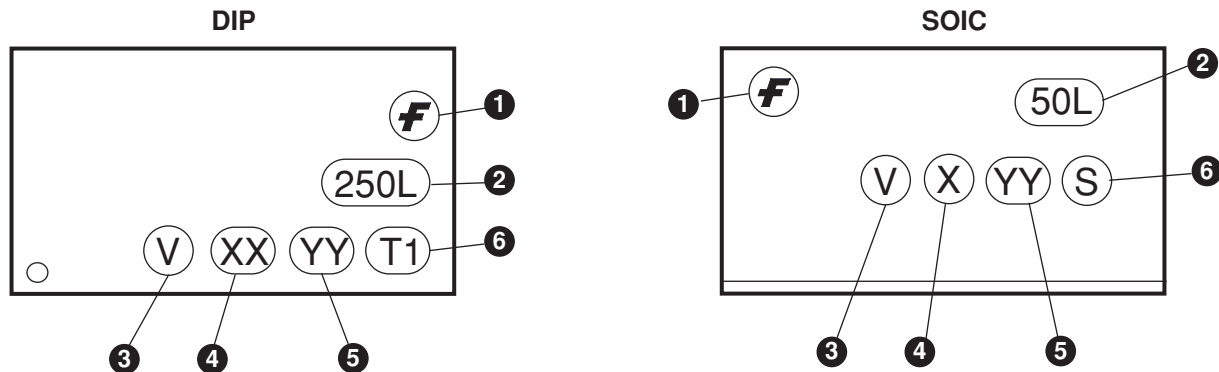
SINGLE-CHANNEL: FOD050L  
DUAL-CHANNEL: FOD053L

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  |

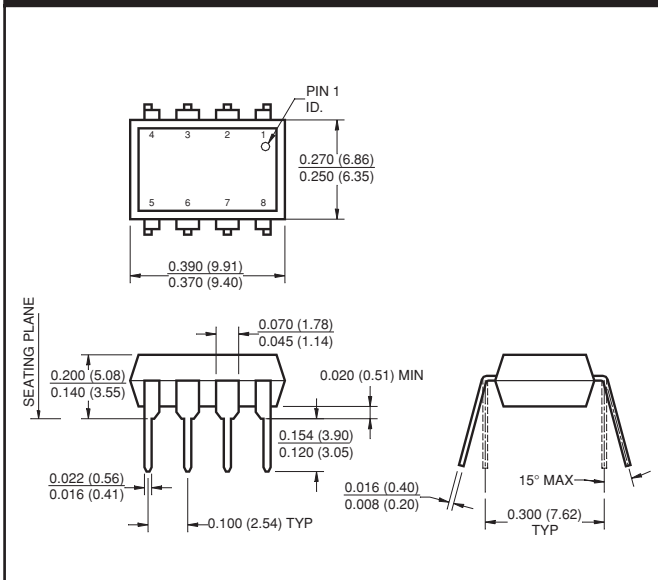


**SINGLE-CHANNEL: FOD050L  
DUAL-CHANNEL: FOD053L**

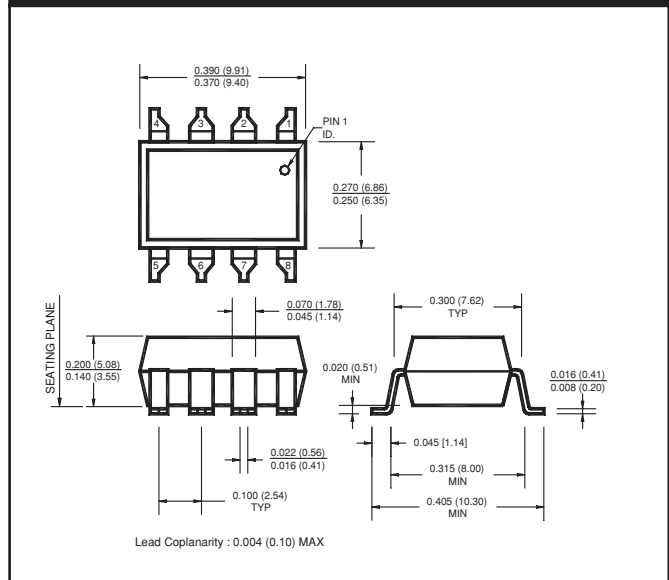
**FOD250L**

**8-PIN DIP**

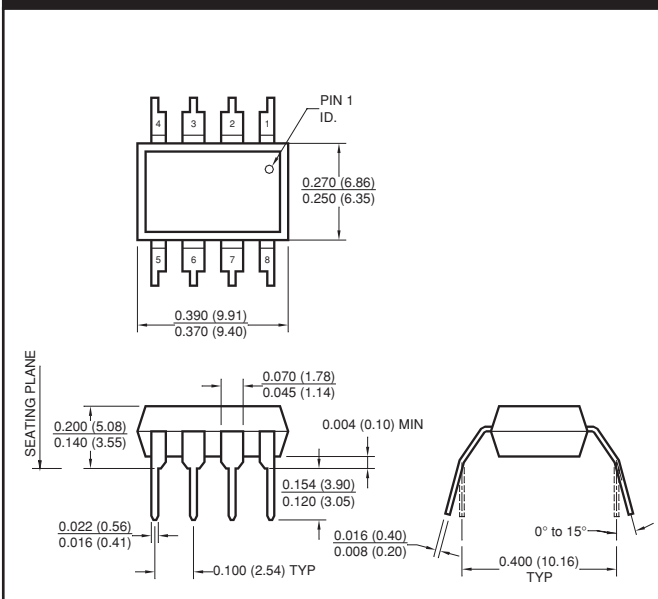
**Package Dimensions (Through Hole)**



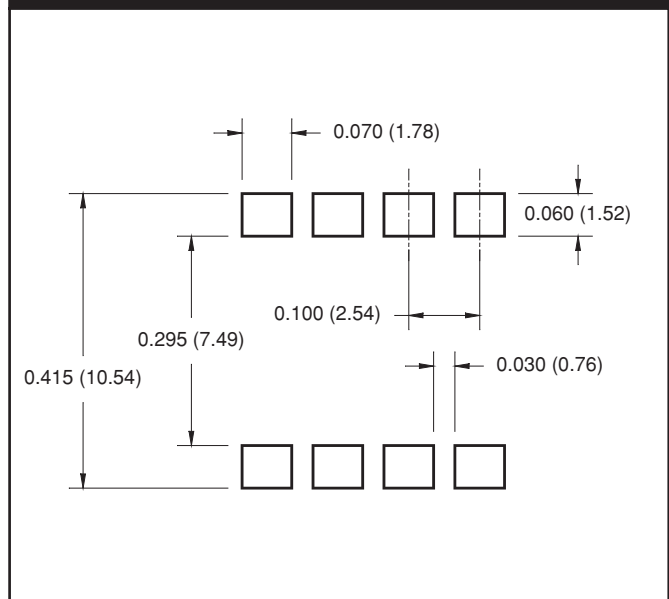
**Package Dimensions (Surface Mount)**



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



**8 - Pin Dip**



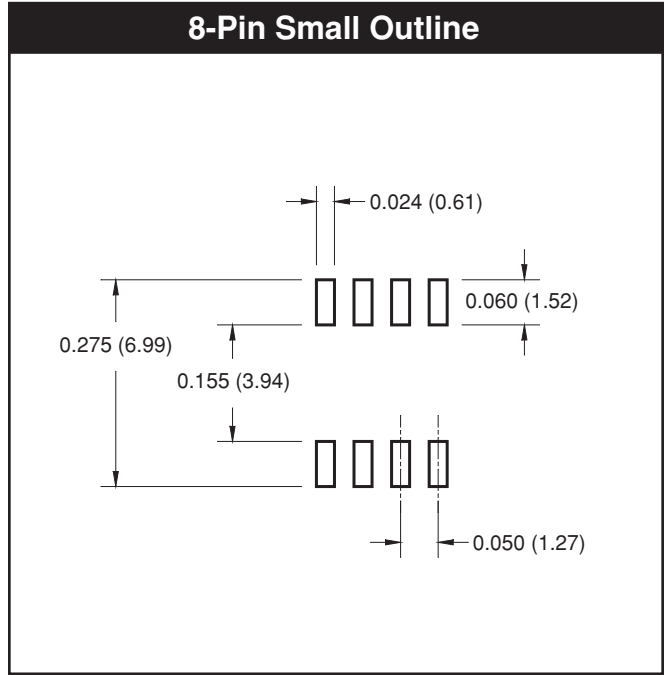
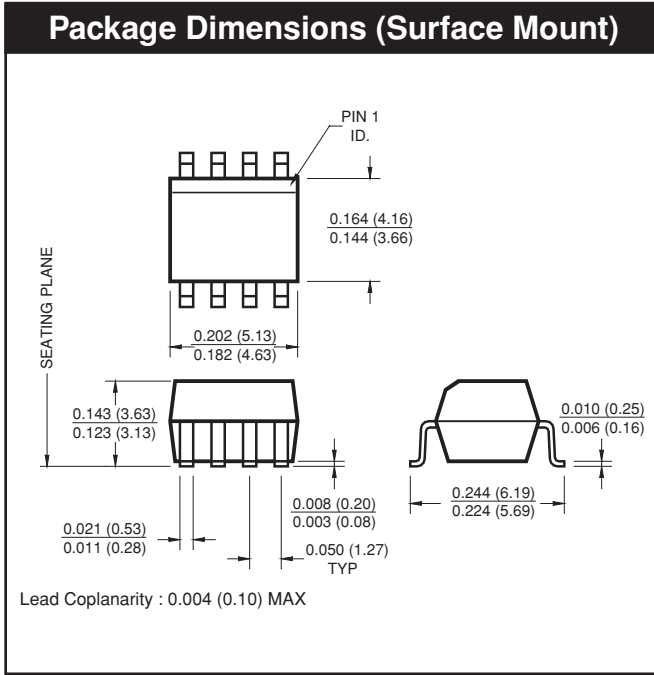
**NOTE**

All dimensions are in inches (millimeters)

SINGLE-CHANNEL: FOD050L  
DUAL-CHANNEL: FOD053L

FOD250L

**8-PIN SOIC**

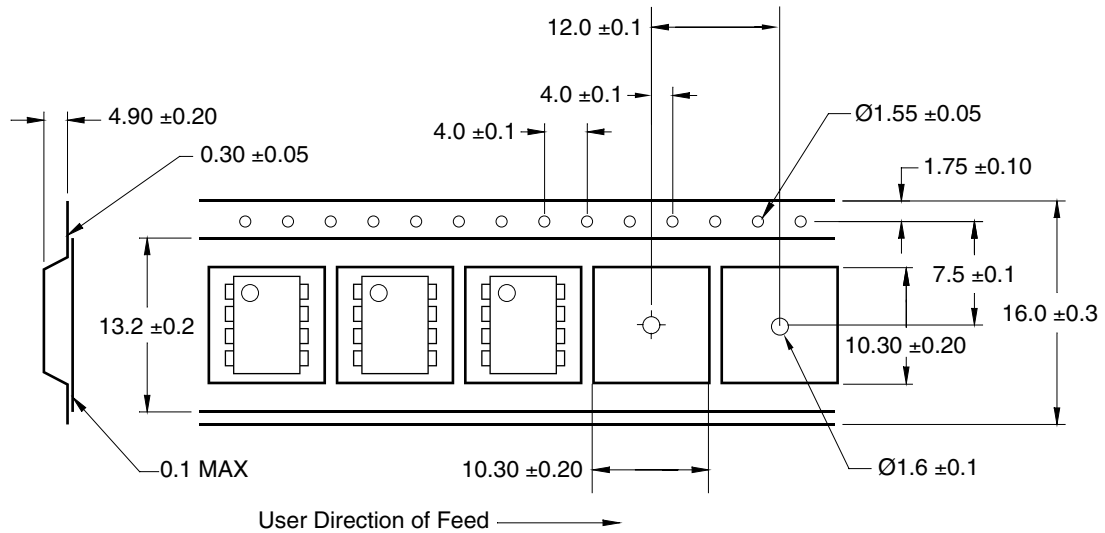


SINGLE-CHANNEL: FOD050L  
DUAL-CHANNEL: FOD053L

FOD250L

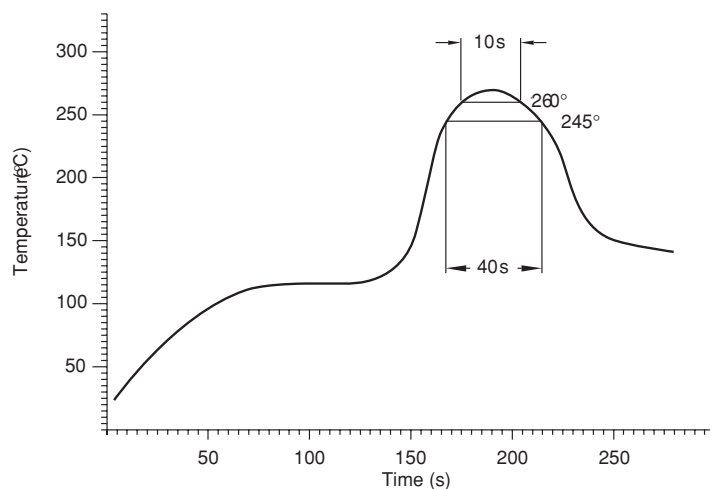
**8-PIN DIP**

**Carrier Tape Specifications**



**Reflow Profile (FOD250L)**

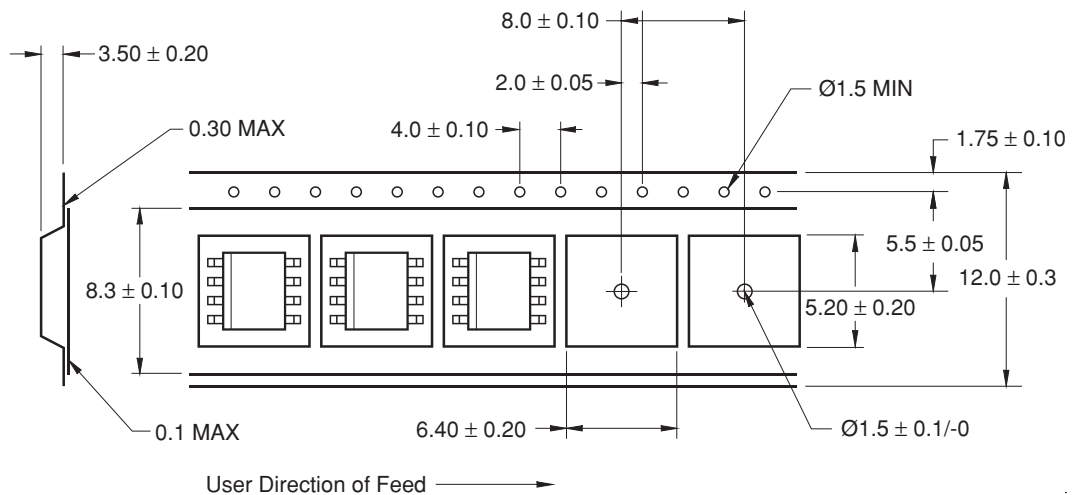
- Peak reflow temperature 260°C (package surface temperature)
- Time of temperature higher than 245°C 40 seconds or less
- Number of reflows Three



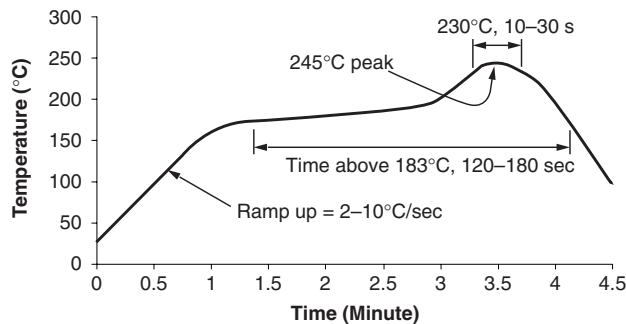
SINGLE-CHANNEL: FOD050L                      FOD250L  
DUAL-CHANNEL: FOD053L

**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**

**DISCLAIMER**

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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.