

**SINGLE CHANNEL:  
DUAL CHANNEL:**

**FOD070L  
FOD073L**

**FOD270L**

## DESCRIPTION

The FOD070L, FOD270L and FOD073L optocouplers consist of an AlGaAs LED optically coupled to a high gain split darlington photodetector. These devices are specified to operate at a 3.3V supply voltage.

The split darlington configuration separating the input photodiode and the first stage gain from the output transistor permits lower output saturation voltage and higher speed operation than possible with conventional darlington phototransistor optocoupler. In the dual channel device FOD073L, an integrated emitter – base resistor provides superior stability over temperature.

The combination of a very low input current of 0.5 mA and a high current transfer ratio of 2000% makes this family particularly useful for input interface to MOS, CMOS, LSTTL and EIA RS232C, while output compatibility is ensured to LVCMOS as well as high fan-out LVTTTL requirements.

An internal noise shield provides exceptional common mode rejection of 10 kV/μs.

## FEATURES

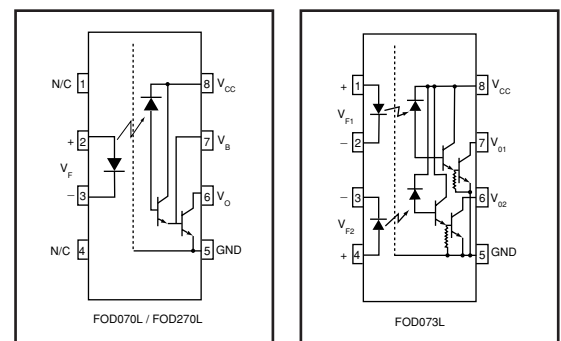
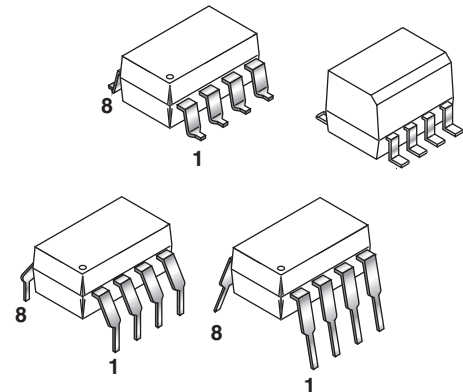
- Low power consumption
- Low input current - 0.5 mA
- Available in single channel 8-pin DIP (FOD270L), 8-pin SOIC (FOD070L) and dual channel 8-pin SOIC
- High CTR-2000%
- High CMR-10 kV/μs
- Guaranteed performance over temperature 0°C to 70°C
- U.L. recognized (File # E90700)
- LVTTTL/LVCMOS Compatible output

## APPLICATIONS

- Digital logic ground isolation – LVTTTL/LVCMOS
- Telephone ring detector
- EIA-RS-232C line receiver
- High common mode noise line receiver
- μP bus isolation
- Current loop receiver

## TRUTH TABLE

| LED | V <sub>O</sub> |
|-----|----------------|
| ON  | LOW            |
| OFF | HIGH           |



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**ABSOLUTE MAXIMUM RATINGS** (No derating required up to 85°C)

| Parameter                                                                                | Symbol        | Value          | Units |
|------------------------------------------------------------------------------------------|---------------|----------------|-------|
| Storage Temperature                                                                      | $T_{STG}$     | -40 to +125    | °C    |
| Operating Temperature                                                                    | $T_{OPR}$     | -40 to +85     | °C    |
| Lead Solder Temperature (Wave solder only. See reflow profile for surface mount devices) | $T_{SOL}$     | 260 for 10 sec | °C    |
| <b>EMITTER</b>                                                                           |               |                |       |
| DC/Average Forward Input Current                                                         | $I_F$ (avg)   | 20             | mA    |
| Peak Forward Input Current (50% duty cycle, 1 ms P.W.)                                   | $I_F$ (pk)    | 40             | mA    |
| Peak Transient Input Current - ( $\leq 1 \mu s$ P.W., 300 pps)                           | $I_F$ (trans) | 1.0            | A     |
| Reverse Input Voltage                                                                    | $V_R$         | 5              | V     |
| Input Power Dissipation                                                                  | $P_D$         | 35             | mW    |
| <b>DETECTOR</b>                                                                          |               |                |       |
| Average Output Current                                                                   | $I_O$ (avg)   | 60             | mA    |
| Emitter-Base Reverse Voltage (FOD070L, FOD270L)                                          | $V_{EB}$      | 0.5            | V     |
| Supply Voltage, Output Voltage                                                           | $V_{CC}, V_O$ | -0.5 to 7      | V     |
| Output power dissipation                                                                 | $P_D$         | 100            | mW    |

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

**INDIVIDUAL COMPONENT CHARACTERISTICS**

| Parameter                       | Test Conditions                                                                  | Symbol    | Device             | Min | Typ** | Max  | Unit    |
|---------------------------------|----------------------------------------------------------------------------------|-----------|--------------------|-----|-------|------|---------|
| <b>EMITTER</b>                  |                                                                                  |           |                    |     |       |      |         |
| Input Forward Voltage           | $T_A = 25^\circ C$                                                               | $V_F$     | All                |     | 1.35  | 1.7  | V       |
|                                 | Each Channel ( $I_F = 1.6$ mA)                                                   |           |                    |     |       | 1.75 |         |
| Input Reverse Breakdown Voltage | ( $T_A = 25^\circ C$ , $I_R = 10 \mu A$ )<br>Each Channel                        | $BV_R$    | All                | 5.0 |       |      | V       |
| <b>DETECTOR</b>                 |                                                                                  |           |                    |     |       |      |         |
| Logic high output current       | ( $I_F = 0$ mA, $V_O = V_{CC} = 3.3$ V)                                          | $I_{OH}$  | FOD070L<br>FOD270L |     | 0.05  | 25   | $\mu A$ |
|                                 | Each Channel                                                                     |           | FOD073L            |     |       |      |         |
| Logic Low Supply Current        | $I_F = 1.6$ mA, $V_O = \text{Open}$ , $V_{CC} = 3.3$ V                           | $I_{CCL}$ | FOD070L<br>FOD270L |     | 0.5   | 1.5  | mA      |
|                                 | $I_{F1} = I_{F2} = 1.6$ mA<br>$V_{O1} = V_{O2} = \text{Open}$ , $V_{CC} = 3.3$ V |           | FOD073L            |     | 0.8   | 3    |         |
| Logic High Supply Current       | $I_F = 0$ mA, $V_O = \text{Open}$ , $V_{CC} = 3.3$ V                             | $I_{CCH}$ | FOD070L<br>FOD270L |     | 0.01  | 1    | $\mu A$ |
|                                 | $I_{F1} = I_{F2} = 0$ mA<br>$V_{O1} = V_{O2} = \text{Open}$ , $V_{CC} = 3.3$ V   |           | FOD073L            |     | 0.01  | 2    |         |

\*\* All typicals at  $T_A = 25^\circ C$

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**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<br>(Notes 1,2)                  | ( $I_F = 0.5\text{ mA}$ , $V_O = 0.4\text{ V}$ , $V_{CC} = 3.3\text{ V}$ ) | CTR      | ALL    | 400 |       | 7000 | %    |
| Logic low output voltage<br>output voltage<br>(Note 2) | ( $I_F = 1.6\text{ mA}$ , $I_O = 8\text{ mA}$ , $V_{CC} = 3.3\text{ V}$ )  | $V_{OL}$ | ALL    |     | 0.07  | 0.3  | V    |
|                                                        | ( $I_F = 5\text{ mA}$ , $I_O = 15\text{ mA}$ , $V_{CC} = 3.3\text{ V}$ )   |          | ALL    |     | 0.07  | 0.4  |      |

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

**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<br>time to logic low          | (R <sub>L</sub> = 4.7 kΩ, I <sub>F</sub> = 0.5 mA)<br>(Note 2) (Fig. 17)                                                                     | T <sub>PHL</sub> | FOD070L |       | 3      | 30  | μs   |
|                                                 |                                                                                                                                              |                  | FOD270L |       |        |     |      |
|                                                 |                                                                                                                                              |                  | FOD073L |       | 5      |     |      |
| Propagation delay<br>time to logic high         | (R <sub>L</sub> = 4.7 kΩ, I <sub>F</sub> = 0.5 mA)<br>(Note 2) (Fig. 17)                                                                     | T <sub>PLH</sub> | FOD070L |       | 50     | 90  | μs   |
|                                                 |                                                                                                                                              |                  | FOD270L |       |        |     |      |
|                                                 |                                                                                                                                              |                  | FOD073L |       | 25     |     |      |
| Common mode transient<br>immunity at logic high | (I <sub>F</sub> = 0 mA,  V <sub>CM</sub>   = 10 V <sub>P-P</sub> )<br>T <sub>A</sub> = 25°C (R <sub>L</sub> = 2.2 kΩ) (Note 3) (Fig. 18)     | CM <sub>H</sub>  | ALL     | 1,000 | 10,000 |     | V/μs |
| Common mode transient<br>immunity at logic low  | (I <sub>F</sub> = 1.6 mA,  V <sub>CM</sub>   = 10 V <sub>P-P</sub> ,<br>R <sub>L</sub> = 2.2 kΩ)<br>T <sub>A</sub> = 25°C (Note 3) (Fig. 18) | CM <sub>L</sub>  | ALL     | 1,000 | 10,000 |     | V/μs |

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

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**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>( $T_A = 25^\circ\text{C}$ , $t = 5$ s)<br>( $V_{I-O} = 3000$ VDC)<br>(Note 4) | $I_{I-O}$ | ALL                |       |           | 1.0 | $\mu\text{A}$ |
| Withstand insulation test voltage       | (RH $\leq 50\%$ , $T_A = 25^\circ\text{C}$ )<br>(Note 4) ( $t = 1$ min.)                                    | $V_{ISO}$ | FOD070L<br>FOD073L | 2500  |           |     | $V_{RMS}$     |
|                                         |                                                                                                             |           | FOD270L            | 5000  |           |     |               |
| Resistance (input to output)            | (Note 4) ( $V_{I-O} = 500$ VDC)                                                                             | $R_{I-O}$ | ALL                |       | $10^{12}$ |     | $\Omega$      |
| Capacitance (input to output)           | (Note 4,5) ( $f = 1$ MHz)                                                                                   | $C_{I-O}$ | ALL                |       | 0.7       |     | pF            |
| Input-Input Insulation leakage current  | (RH $\leq 45\%$ , $V_{I-I} = 500$ VDC (Note 6))                                                             | $I_{I-I}$ | FOD073L            | 0.005 |           |     | $\mu\text{A}$ |
| Input-Input Resistance                  | ( $V_{I-I} = 500$ VDC) (Note 6)                                                                             | $R_{I-I}$ | FOD073L            |       | $10^{11}$ |     | $\Omega$      |
| Input-Input Capacitance                 | ( $f = 1$ MHz) (Note 6)                                                                                     | $C_{I-I}$ | FOD073L            |       | 0.03      |     | pF            |

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

**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. Pin 7 open. (FOD070L and FOD270L only)
3. 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.,  $V_O > 2.0$  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.,  $V_O < 0.8$  V).
4. 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.
5. For dual channel devices,  $C_{I-O}$  is measured by shorting pins 1 and 2 or pins 3 and 4 together and pins 5 through 8 shorted together.
6. Measured between pins 1 and 2 shorted together, and pins 3 and 4 shorted together.

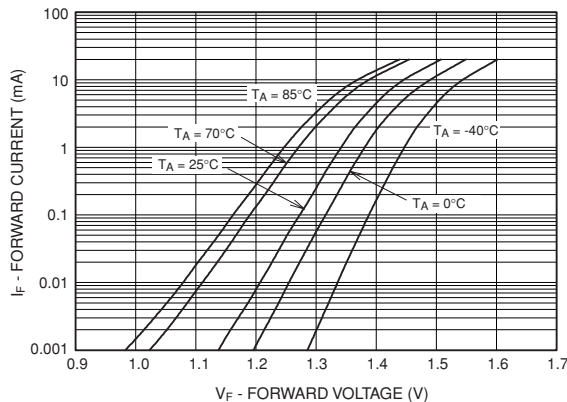
**SINGLE CHANNEL:  
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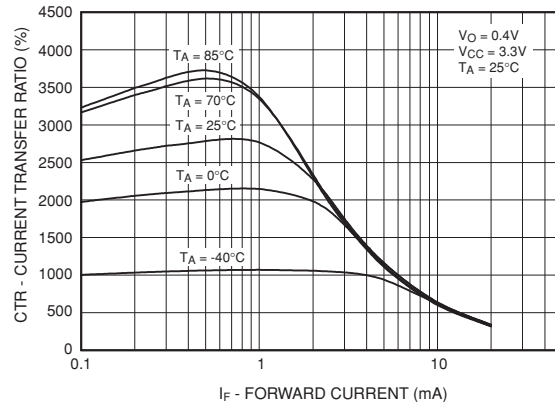
**FOD270L**

**TYPICAL PERFORMANCE CURVES**

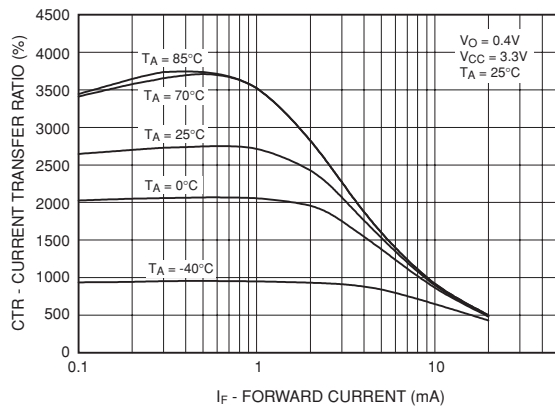
**Fig. 1 Input Forward Current vs Forward Voltage**



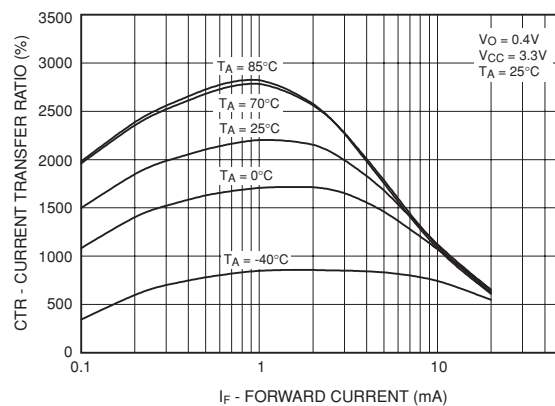
**Fig. 2 Current Transfer Ratio vs. Input Forward Current (FOD270L only)**



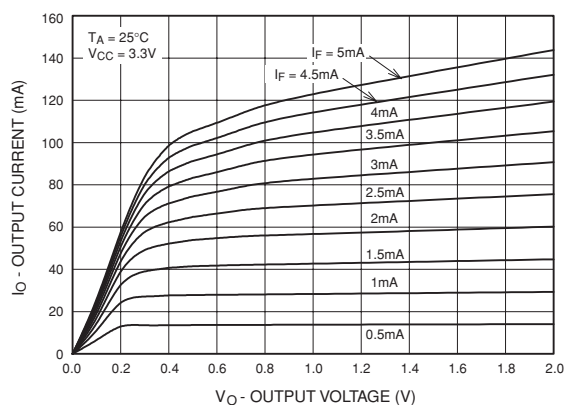
**Fig. 3 Current Transfer Ratio vs. Input Forward Current (FOD070L only)**



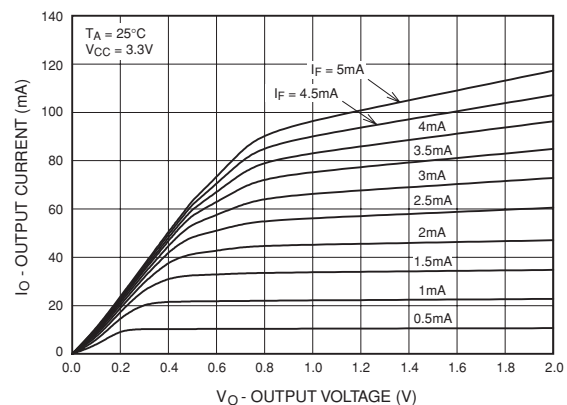
**Fig. 4 Current Transfer Ratio vs. Input Forward Current (FOD073L only)**



**Fig. 5 DC Transfer Characteristics (FOD070L, FOD270L)**



**Fig. 6 DC Transfer Characteristics (FOD073L only)**



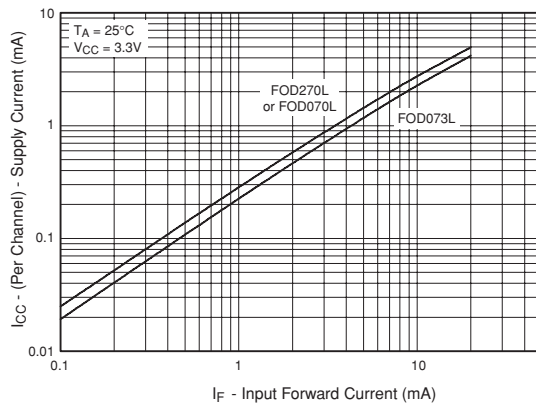
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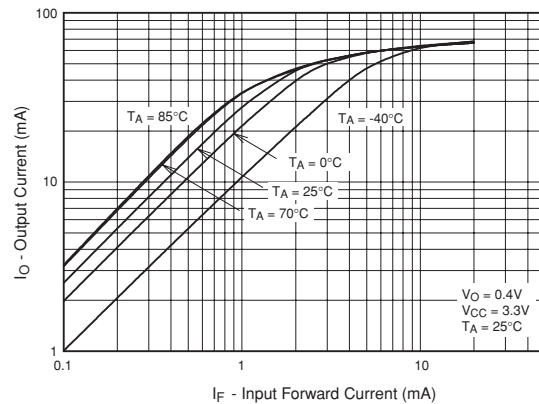
**FOD270L**

**TYPICAL PERFORMANCE CURVES**

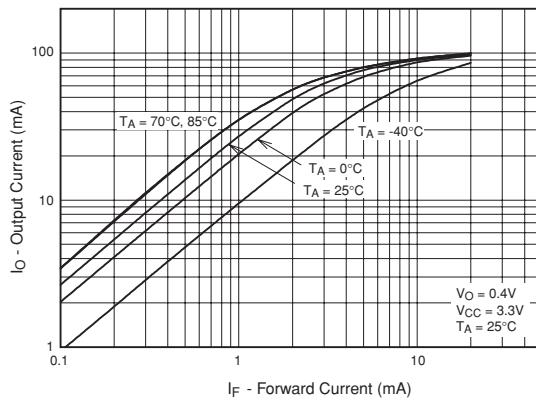
**Fig. 7 Supply Current vs Input Forward Current  
(FOD270L, FOD070L, FOD073L)**



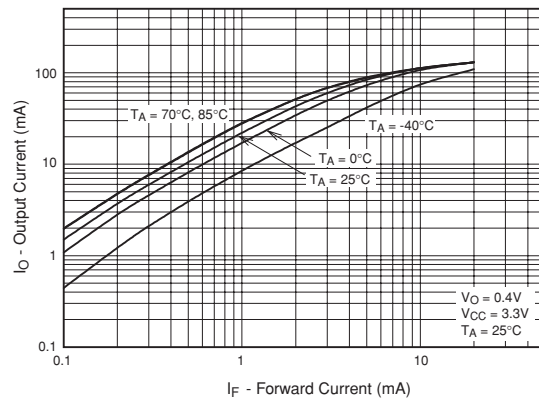
**Fig. 8 Output Current vs Input Forward Current  
(FOD270L only)**



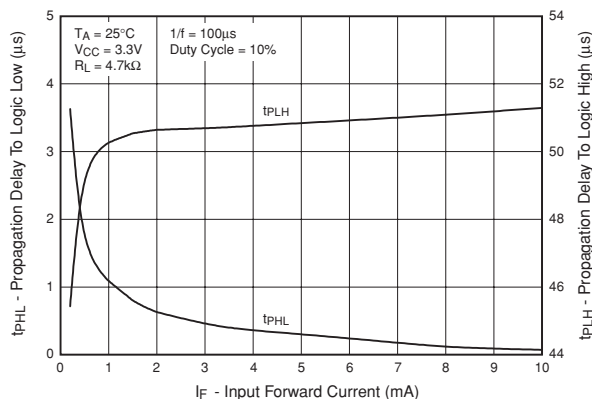
**Fig. 9 Output Current vs Input Forward Current  
(FOD070L only)**



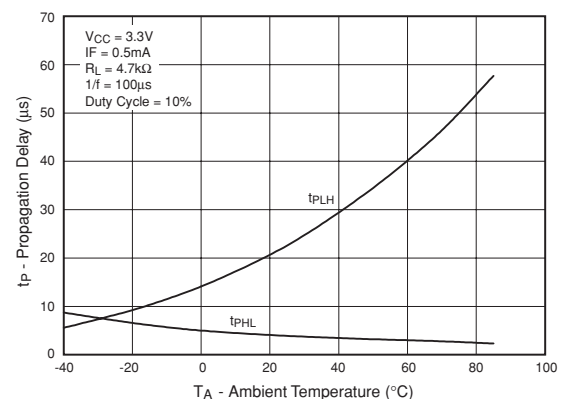
**Fig. 10 Output Current vs Input Forward Current  
(FOD073L only)**



**Fig. 11 Propagation Delay vs.  
Input Forward Current (FOD070L only)**



**Fig. 12 Propagation Delay vs.  
Ambient Temperature (FOD073L only)**



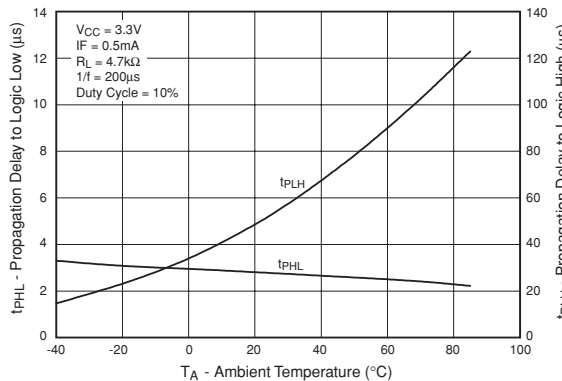
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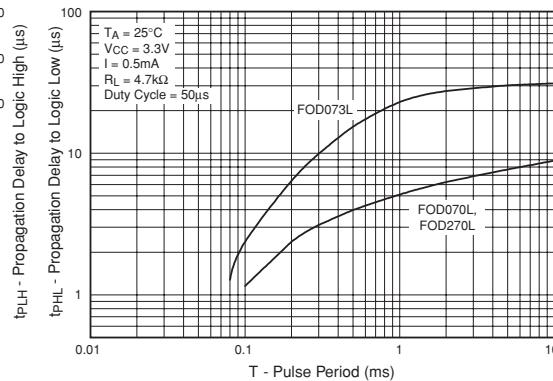
**FOD270L**

**TYPICAL PERFORMANCE CURVES**

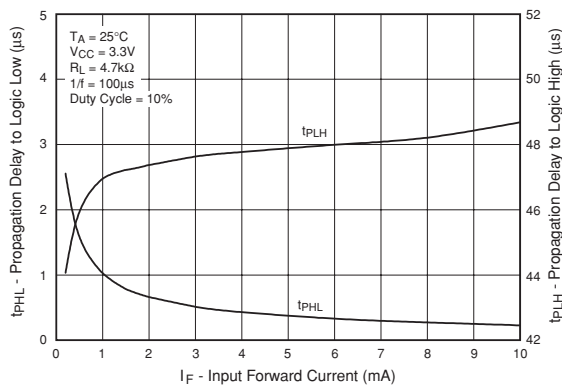
**Fig. 13 Propagation Delay vs.  
Ambient Temperature (FOD070L, FOD270L)**



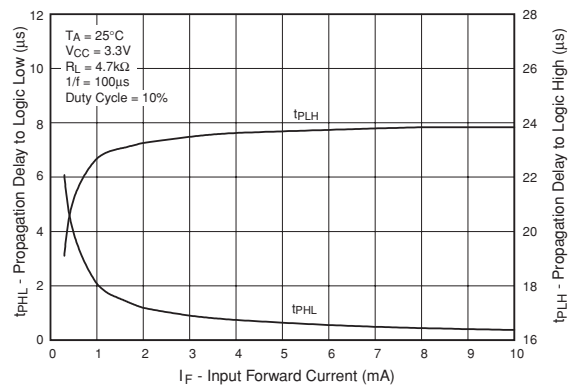
**Fig. 14 Propagation Delay To Logic Low vs Pulse Period  
(FOD073L, FOD070L, FOD270L)**



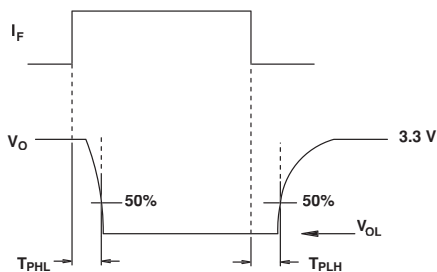
**Fig. 15 Propagation Delay vs.  
Input Forward Current (FOD270L only)**



**Fig. 16 Propagation Delay vs.  
Input Forward Current (FOD073L only)**



## FOD270L



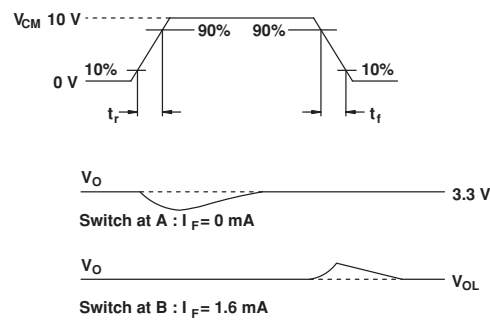
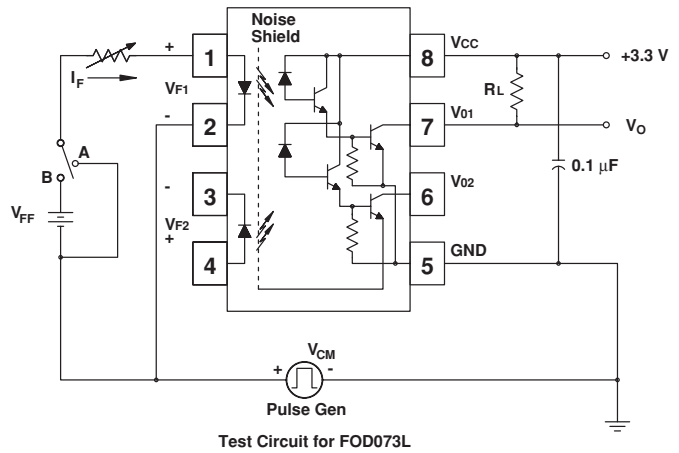
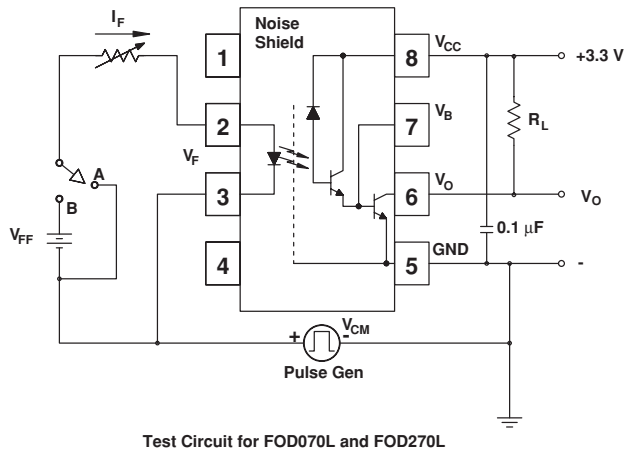
\*Includes Probe and Fixture Capacitance

### Fig. 17 Switching Time Test Circuit

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**Fig. 18 Common Mode Immunity Test Circuit**

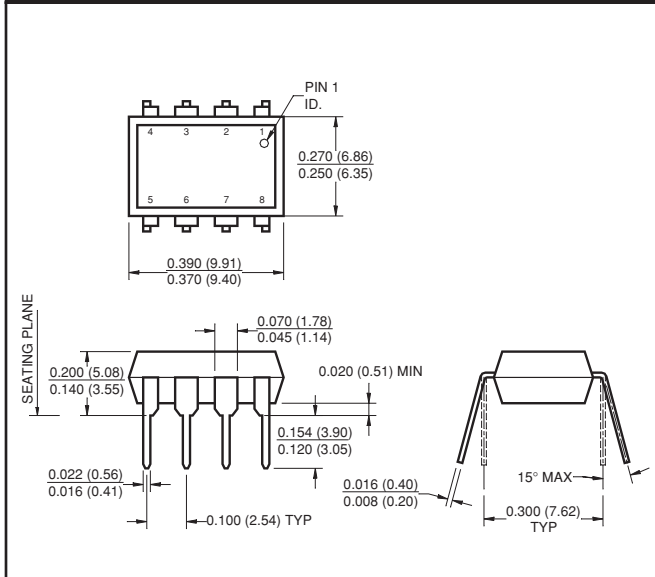
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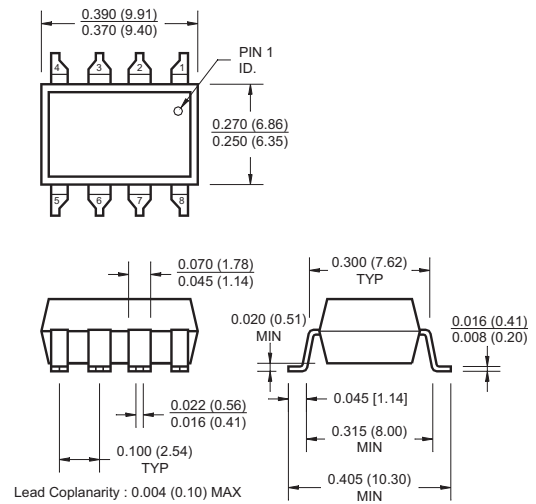
**FOD270L**

**8-Pin DIP**

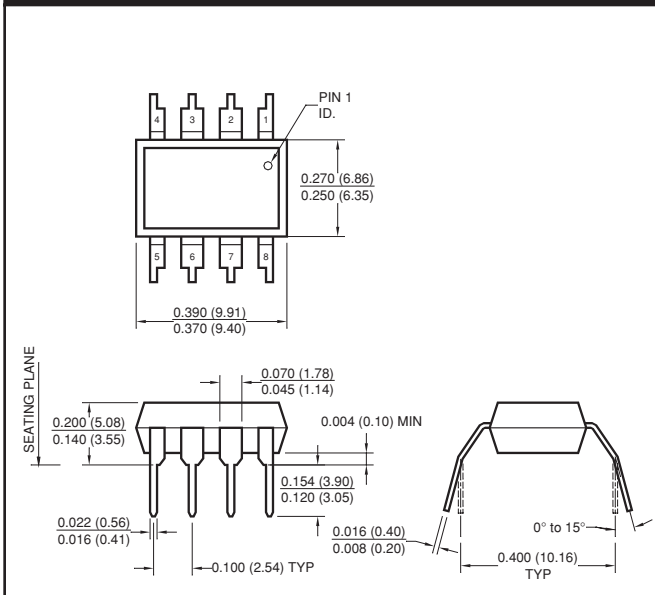
**Package Dimensions (Through Hole)**



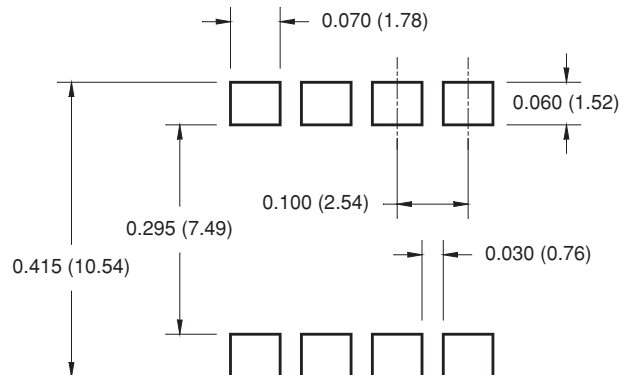
**Package Dimensions (Surface Mount)**



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



**Recommend Pad Layout for  
Surface Mount Leadform**



**NOTE**

All dimensions are in inches (millimeters)

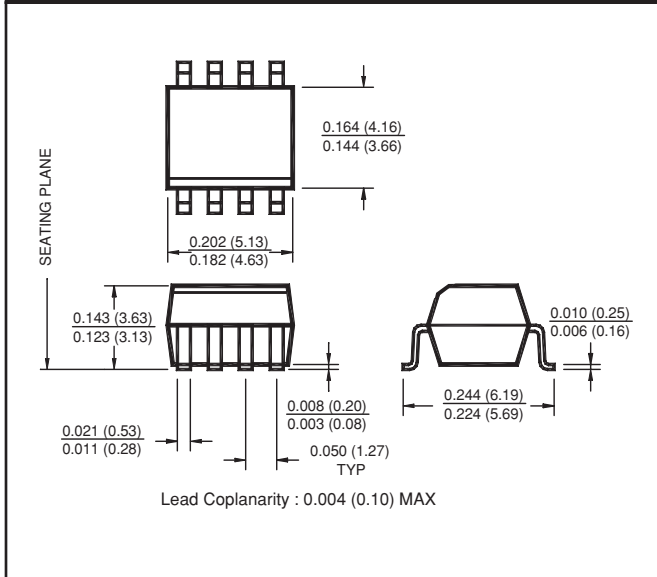
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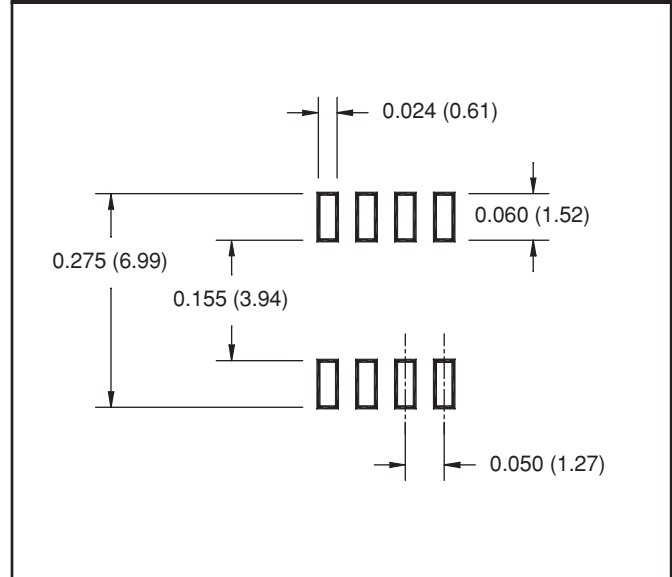
**FOD270L**

**SOIC 8**

**Package Dimensions (Surface Mount)**



**Recommend Pad Layout**



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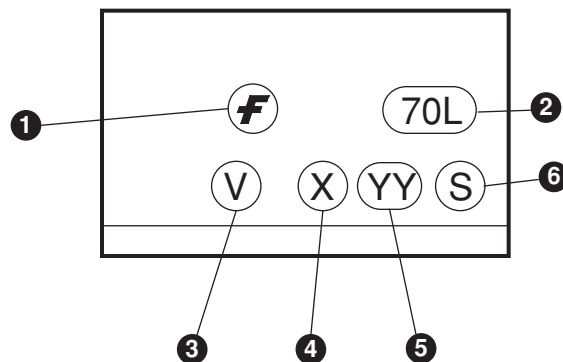
**FOD070L  
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**FOD270L**

## ORDERING INFORMATION

| Option | Order Entry Identifier | Description                                                                        |
|--------|------------------------|------------------------------------------------------------------------------------|
| S      | FOD270LS               | Surface Mount Lead Bend (DIP Package Only)                                         |
| SD     | FOD270LSD              | Surface Mount; Tape and reel (DIP Package Only)<br>(1000 units per reel)           |
| SV     | Pending approval       | Surface Mount; VDE 0884 (DIP Package Only)                                         |
| SDV    | Pending approval       | Surface Mount; Tape and reel (DIP Package Only); VDE 0884<br>(1000 units per reel) |
| T      | FOD270LT               | 0.4" lead spacing (DIP Package Only)                                               |
| TV     | Pending approval       | 0.4" lead spacing, VDE 0884 (DIP Package Only)                                     |
| R1     | FOD070LR1              | 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     | FOD070LR2              | Tape and reel (2500 units per reel) (SOIC 8 Package only)                          |
| R2V    | Pending approval       | VDE 0884, Tape and reel (2500 units per reel) (SOIC 8 Package only)                |
| V      | Pending approval       | VDE 0884                                                                           |

## MARKING INFORMATION (FOD070L, FOD073L)



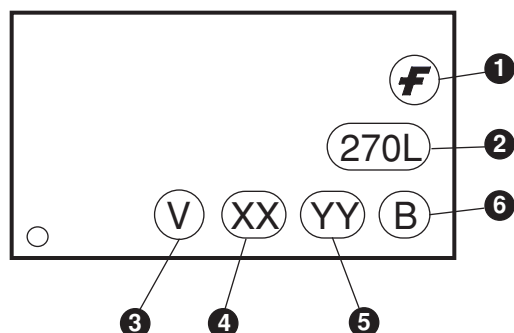
| Definitions |                                                                                        |
|-------------|----------------------------------------------------------------------------------------|
| 1           | Fairchild logo                                                            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

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**MARKING INFORMATION (FOD270L)**



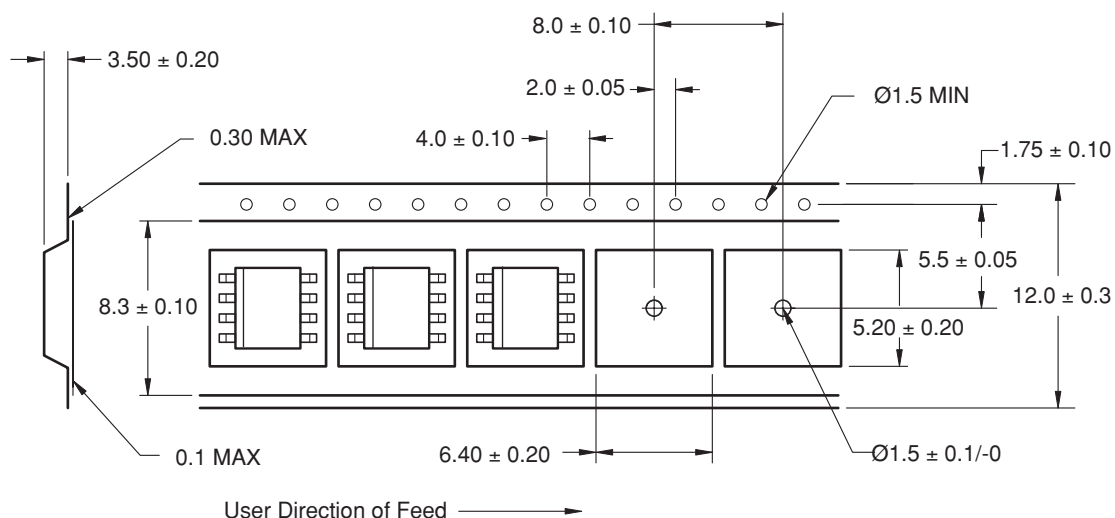
| Definitions |                                                                                        |
|-------------|----------------------------------------------------------------------------------------|
| 1           | Fairchild logo                                                            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

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**Carrier Tape Specifications (FOD070L and FOD073L)**

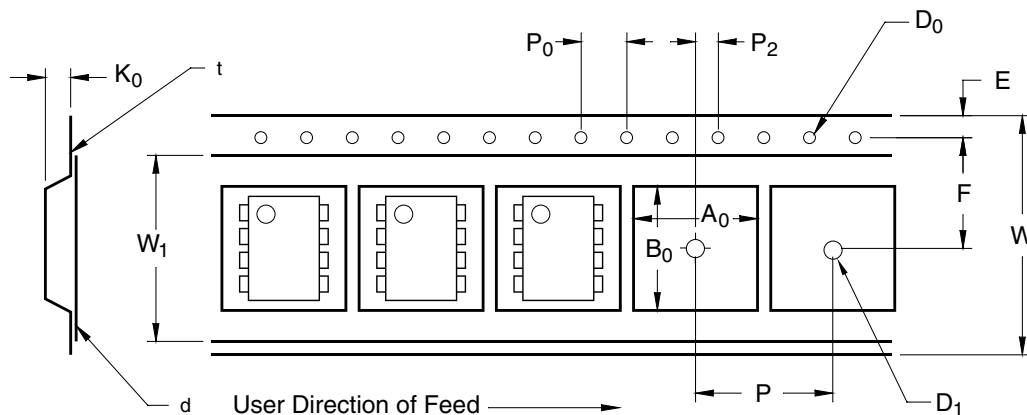


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FOD073L**

**FOD270L**

**Carrier Tape Specifications (FOD270L)**



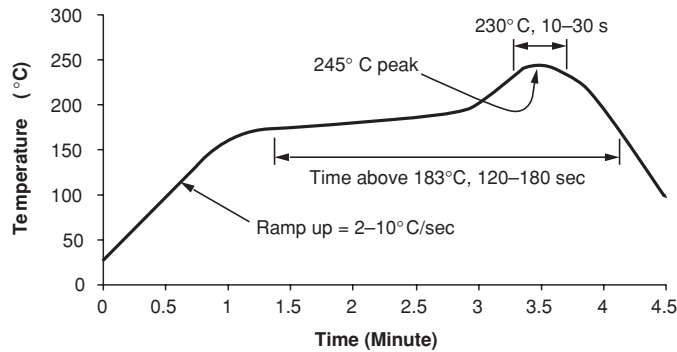
| Description                     | Symbol | Dimension in mm   |
|---------------------------------|--------|-------------------|
| Tape Width                      | $W$    | $16.0 \pm 0.3$    |
| Tape Thickness                  | $t$    | $0.30 \pm 0.05$   |
| Sprocket Hole Pitch             | $P_0$  | $4.0 \pm 0.1$     |
| Sprocket Hole Diameter          | $D_0$  | $1.55 \pm 0.05$   |
| Sprocket Hole Location          | $E$    | $1.75 \pm 0.10$   |
| Pocket Location                 | $F$    | $7.5 \pm 0.1$     |
| Pocket Pitch                    | $P$    | $12.0 \pm 0.1$    |
| Pocket Dimensions               | $A_0$  | $10.30 \pm 0.20$  |
|                                 | $B_0$  | $10.30 \pm 0.20$  |
|                                 | $K_0$  | $4.90 \pm 0.20$   |
| Cover Tape Width                | $W_1$  | $1.6 \pm 0.1$     |
| Cover Tape Thickness            | $d$    | $0.1 \text{ max}$ |
| Max. Component Rotation or Tilt |        | $10^\circ$        |
| Min. Bending Radius             | $R$    | $30$              |

**SINGLE CHANNEL:  
DUAL CHANNEL:**

**FOD070L  
FOD073L**

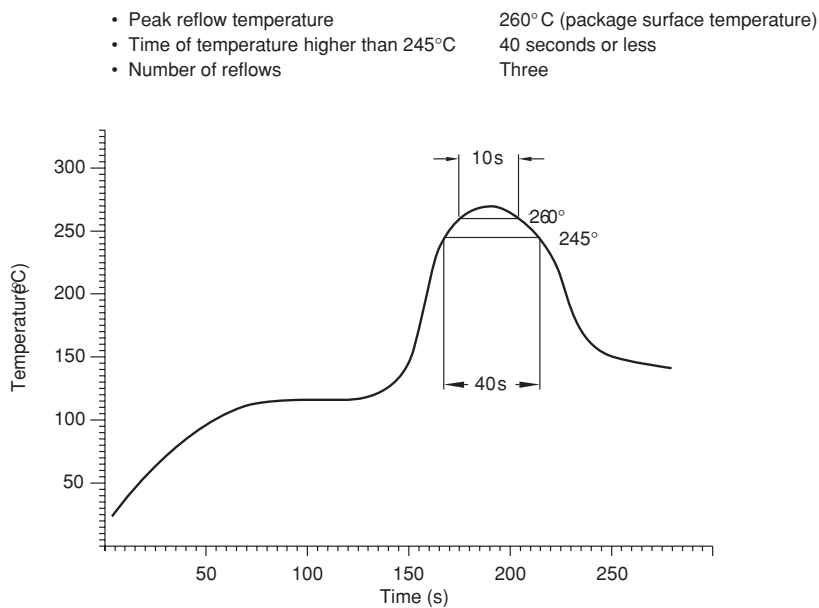
**FOD270L**

### Reflow Profile (FOD070L and FOD073L)



- 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

### Reflow Profile (FOD270L)



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**SINGLE CHANNEL:  
DUAL CHANNEL:**

**FOD070L  
FOD073L**

**FOD270L**

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