

LVTTL/LVCMOS COMPATIBLE LOW INPUT CURRENT HIGH GAIN SPLIT DARLINGTON OPTOCOUPLERS

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 LVTTL requirements.

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

FEATURES

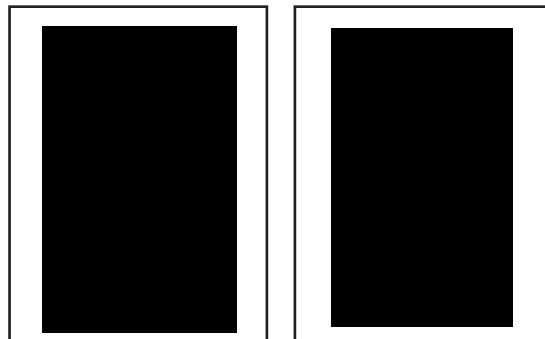
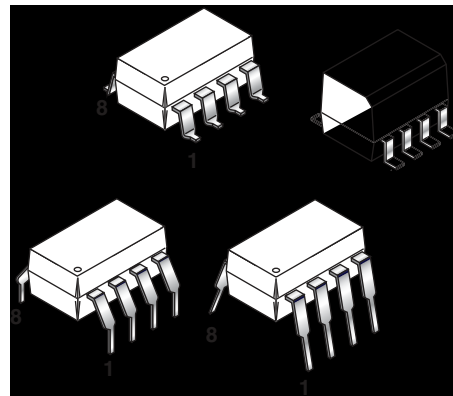
- Low power consumption
- Low input current - 0.5 mA
- Available in single channel 8-pin DIP (FOD270L), 8-pin SOIC (FOD070L) and dual channel 8-pin SOIC
- High CTR-2000%
- High CMR-10 kV/μs
- Guaranteed performance over temperature 0°C to 70°C
- U.L. recognized (File # E90700)
- LVTTL/LVCMOS Compatible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

APPLICATIONS

- Digital logic ground isolation – LVTTL/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 _O
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
EMITTER			
DC/Average Forward Input Current	Each Channel	I_F (avg)	20 mA
Peak Forward Input Current (50% duty cycle, 1 ms P.W.)	Each Channel	I_F (pk)	40 mA
Peak Transient Input Current - ($\leq 1 \mu s$ P.W., 300 pps)	Each Channel	I_F (trans)	1.0 A
Reverse Input Voltage	Each Channel	V_R	5 V
Input Power Dissipation	Each Channel	P_D	35 mW
DETECTOR			
Average Output Current	Each Channel	I_O (avg)	60 mA
Emitter-Base Reverse Voltage (FOD070L, FOD270L)	Each Channel	V_{EB}	0.5 V
Supply Voltage, Output Voltage	Each Channel	V_{CC}, V_O	-0.5 to 7 V
Output power dissipation	Each Channel	P_D	100 mW

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

INDIVIDUAL COMPONENT CHARACTERISTICS

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

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

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

Parameter	Test Conditions	Symbol	Device	Min	Typ**	Max	Unit
COUPLED Current transfer ratio (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 output voltage (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°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	$(R_L = 4.7 \text{ k}\Omega, I_F = 0.5 \text{ mA})$ (Note 2) (Fig. 17)	T_{PHL}	FOD070L		3	30	μs
			FOD270L		5		
			FOD073L				
Propagation delay time to logic high	$(R_L = 4.7 \text{ k}\Omega, I_F = 0.5 \text{ mA})$ (Note 2) (Fig. 17)	T_{PLH}	FOD070L		50	90	μs
			FOD270L		25		
			FOD073L				
Common mode transient immunity at logic high	$(I_F = 0 \text{ mA}, V_{CM} = 10 \text{ V}_{P-P})$ $T_A = 25^\circ\text{C} (R_L = 2.2 \text{ k}\Omega)$ (Note 3) (Fig. 18)	$ CM_H $	ALL	1,000	10,000		$\text{V}/\mu\text{s}$
Common mode transient immunity at logic low	$(I_F = 1.6 \text{ mA}, V_{CM} = 10 \text{ V}_{P-P})$ $R_L = 2.2 \text{ k}\Omega$ $T_A = 25^\circ\text{C}$ (Note 3) (Fig. 18)	$ CM_L $	ALL	1,000	10,000		$\text{V}/\mu\text{s}$

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

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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%) ($T_A = 25^\circ\text{C}$, $t = 5$ s) ($V_{I-O} = 3000$ VDC) (Note 4)	I_{I-O}	ALL			1.0	μA
Withstand insulation test voltage	(RH \leq 50%, $T_A = 25^\circ\text{C}$) (Note 4) ($t = 1$ min.)	V_{ISO}	FOD070L FOD073L	2500			V_{RMS}
			FOD270L	5000			
Resistance (input to output)	(Note 4) ($V_{I-O} = 500$ VDC)	R_{I-O}	ALL		10^{12}		Ω
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			μA
Input-Input Resistance	($V_{I-I} = 500$ VDC) (Note 6)	R_{I-I}	FOD073L		10^{11}		Ω
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

- Current Transfer Ratio is defined as a ratio of output collector current, I_O , to the forward LED input current, I_F times 100%.
- Pin 7 open. (FOD070L and FOD270L only)
- 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).
- 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.
- 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.
- Measured between pins 1 and 2 shorted together, and pins 3 and 4 shorted together.

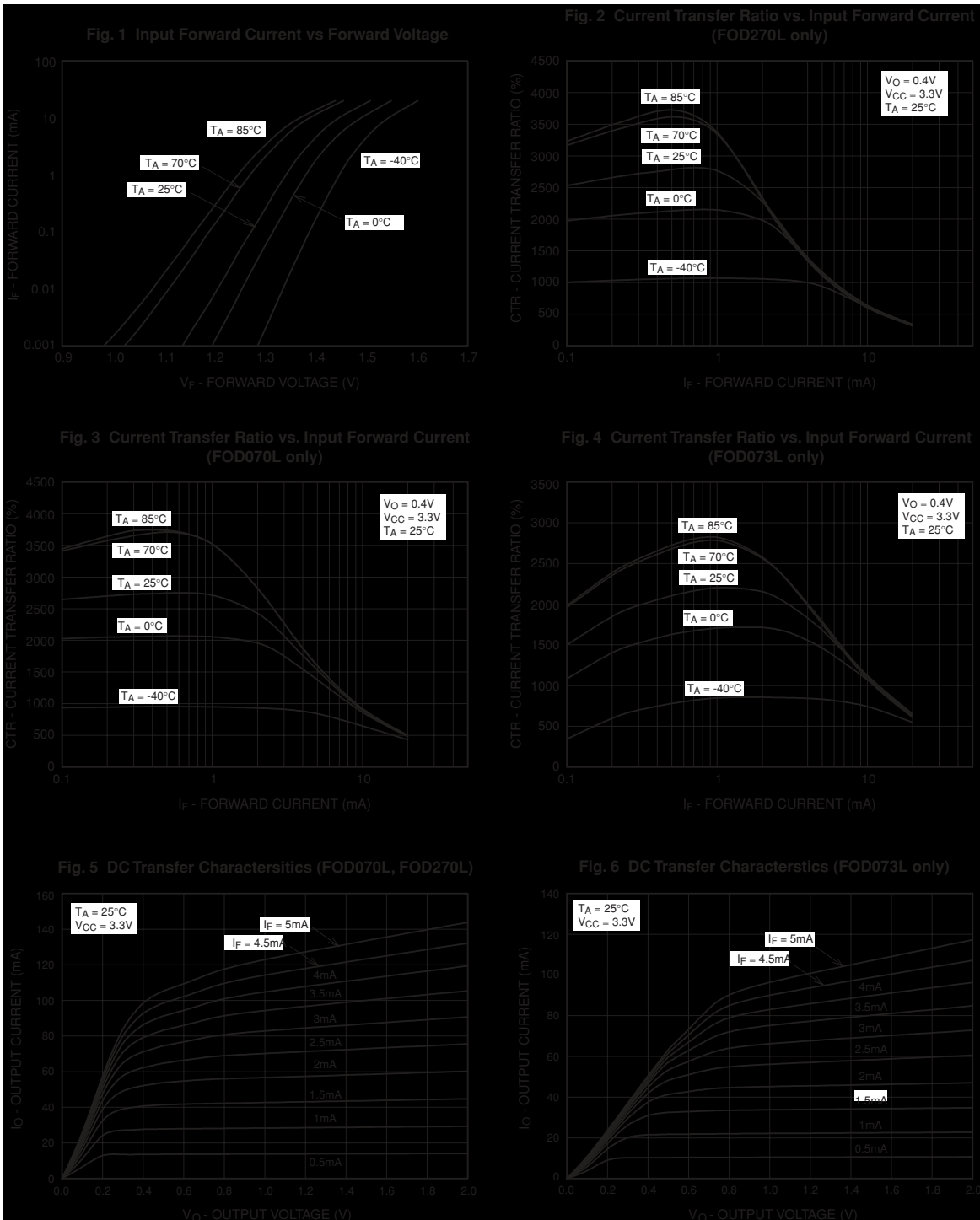
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TYPICAL PERFORMANCE CURVES



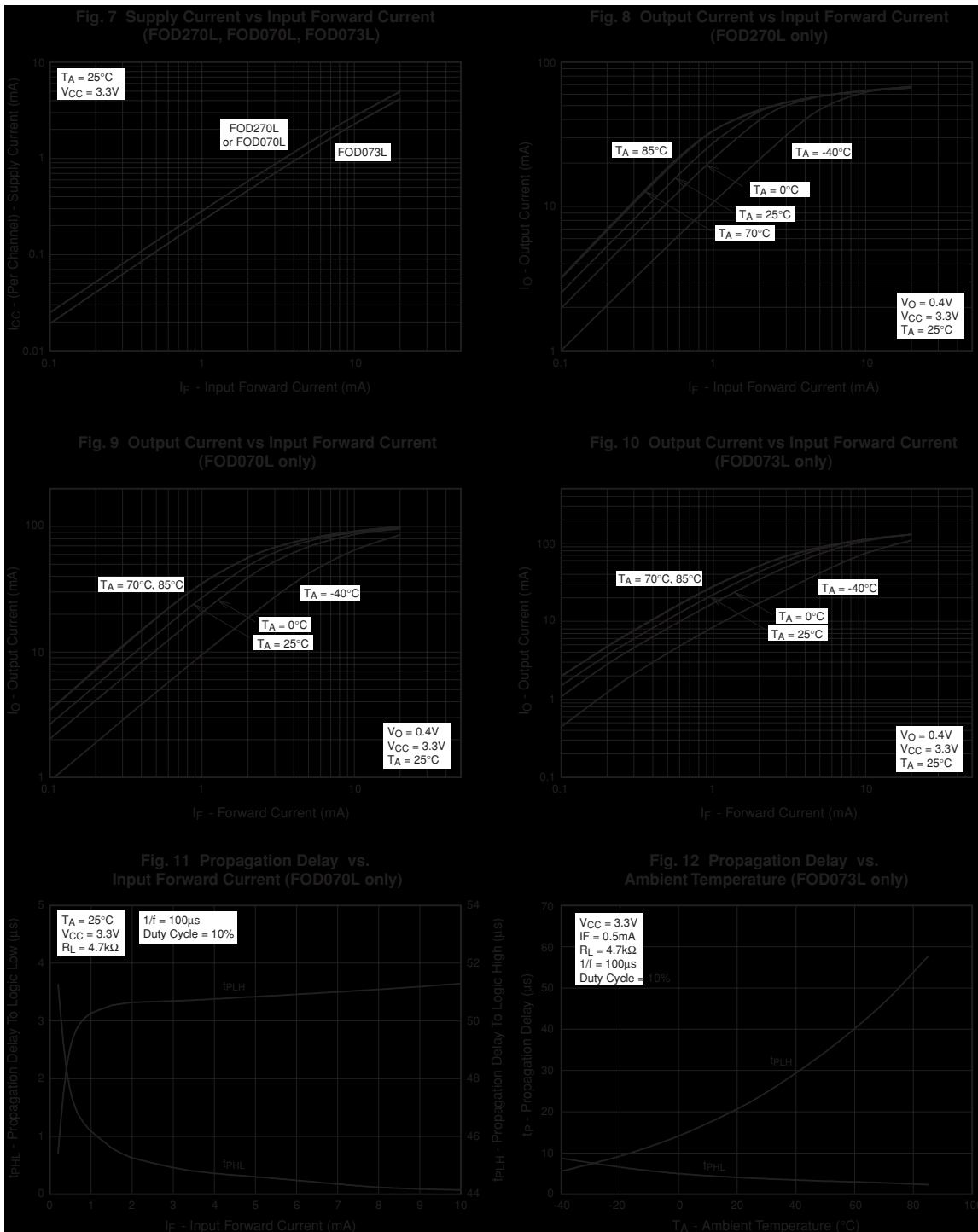
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TYPICAL PERFORMANCE CURVES



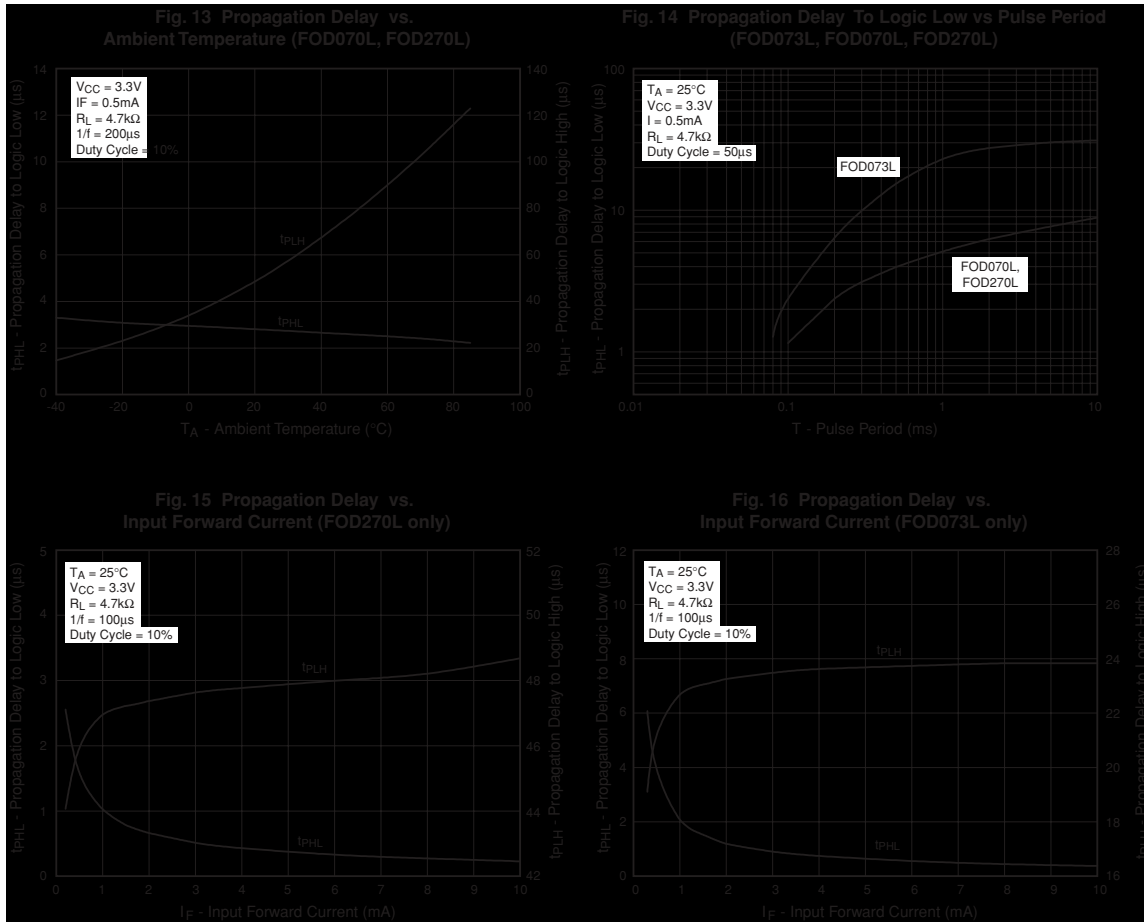
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TYPICAL PERFORMANCE CURVES



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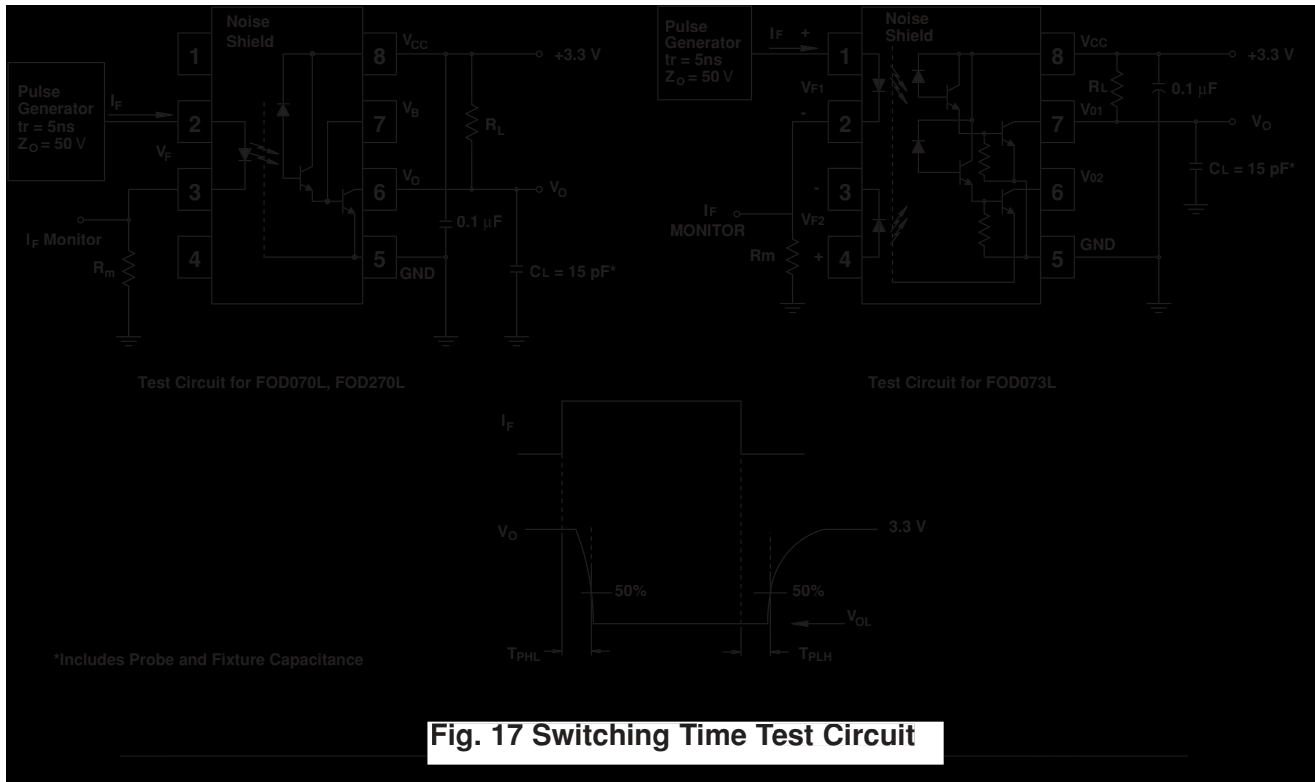


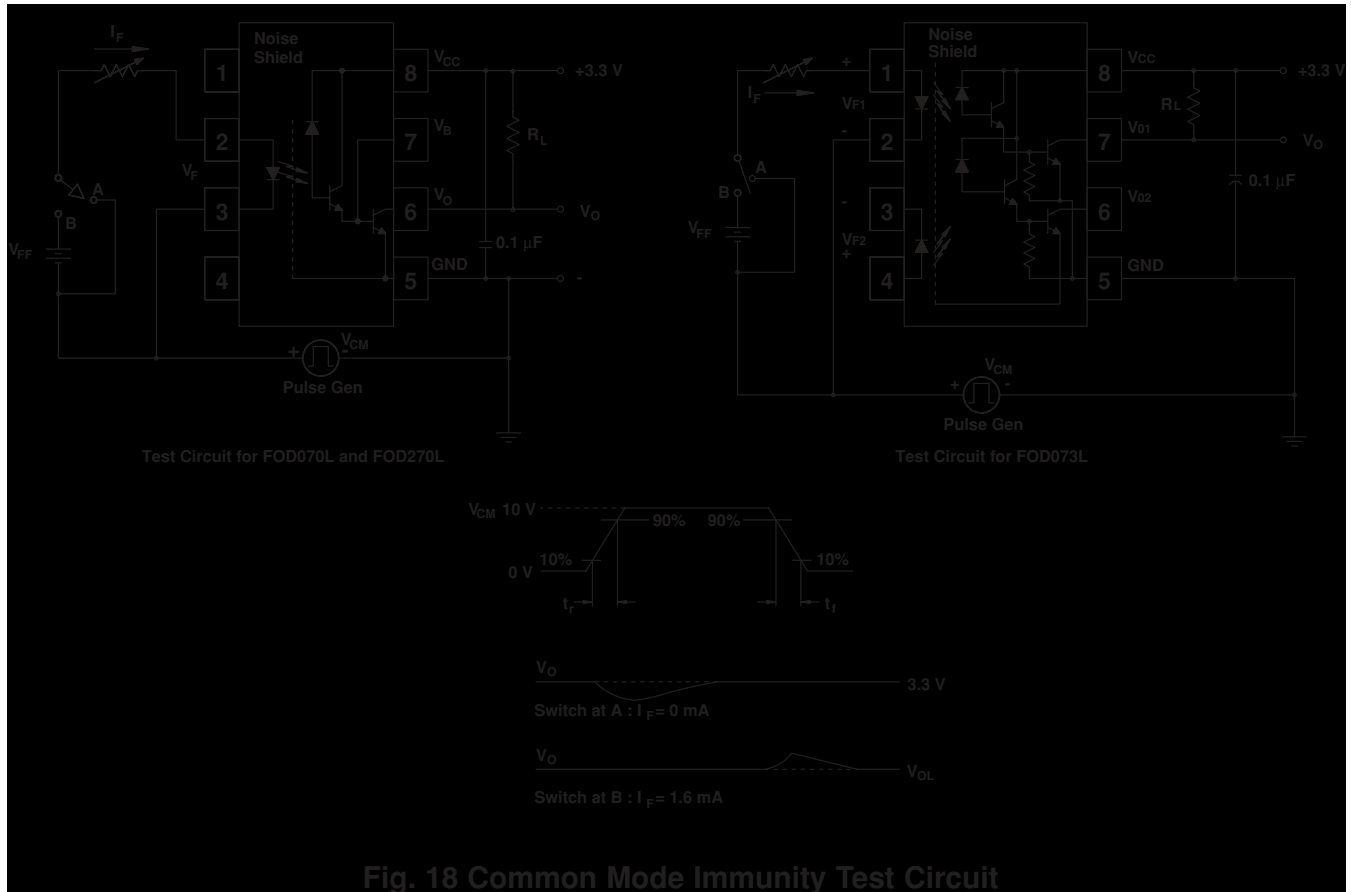
Fig. 17 Switching Time Test Circuit

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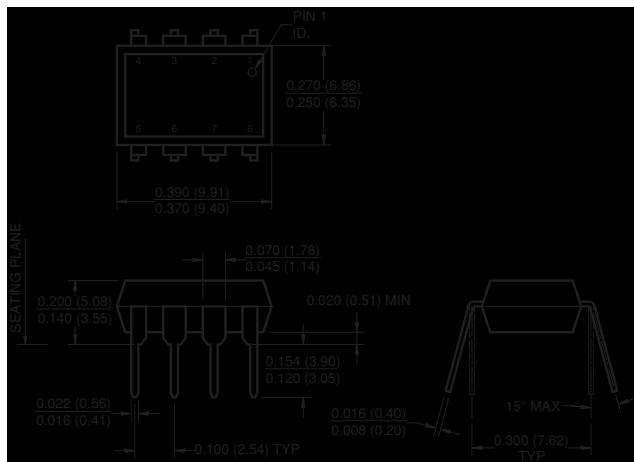
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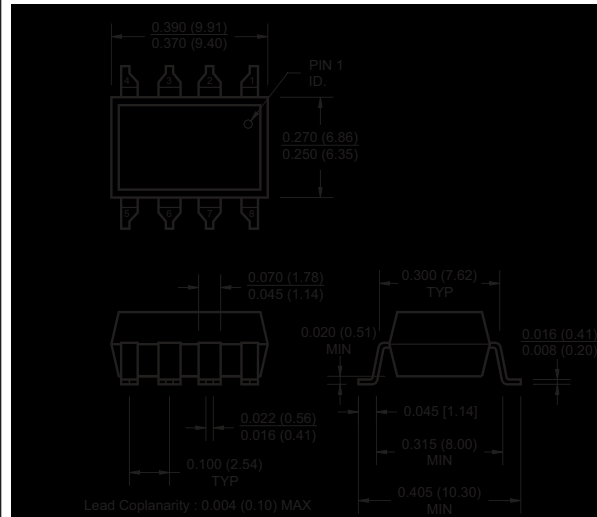
FOD270L

8-Pin DIP

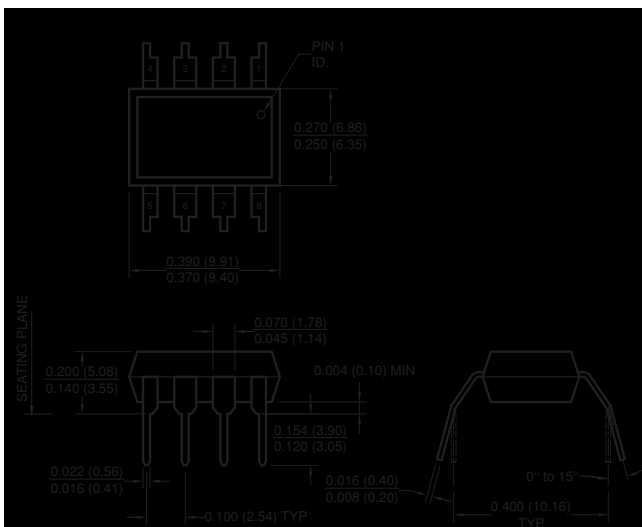
Package Dimensions (Through Hole)



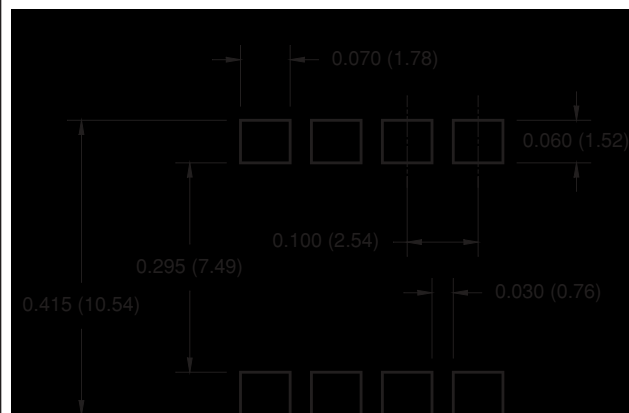
Package Dimensions (Surface Mount)



Package Dimensions (0.4" Lead Spacing)



Recommend Pad Layout for Surface Mount Leadform



NOTE

All dimensions are in inches (millimeters)

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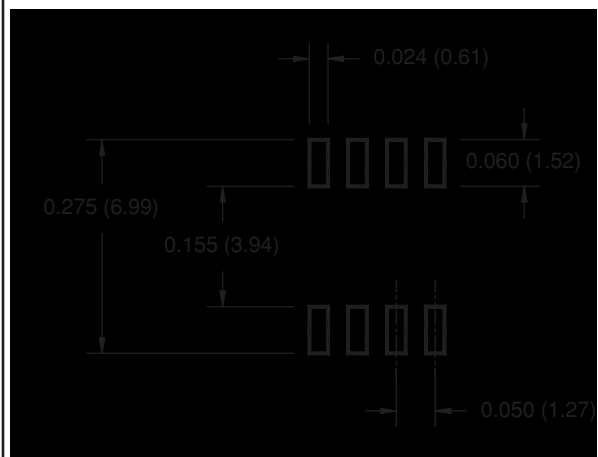
FOD270L

SOIC 8

Package Dimensions (Surface Mount)



Recommend Pad Layout



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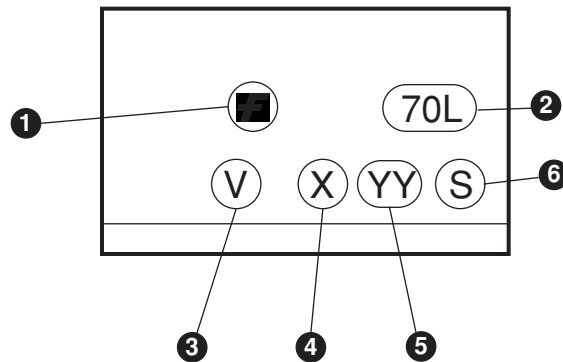
FOD070L
FOD073L

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) (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 (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

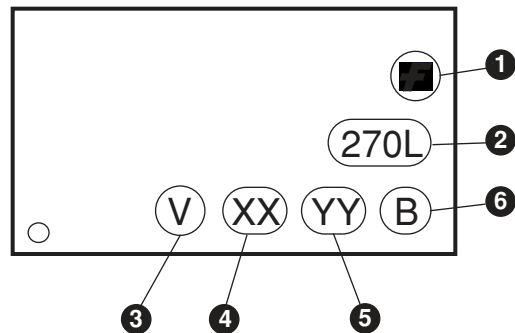
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MARKING INFORMATION (FOD270L)



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

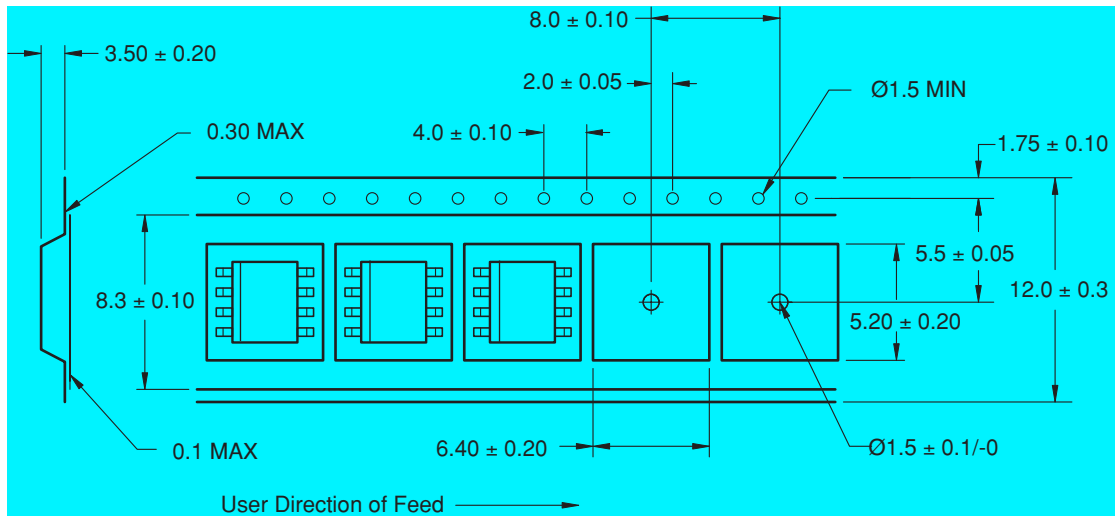
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Carrier Tape Specifications (FOD070L and FOD073L)



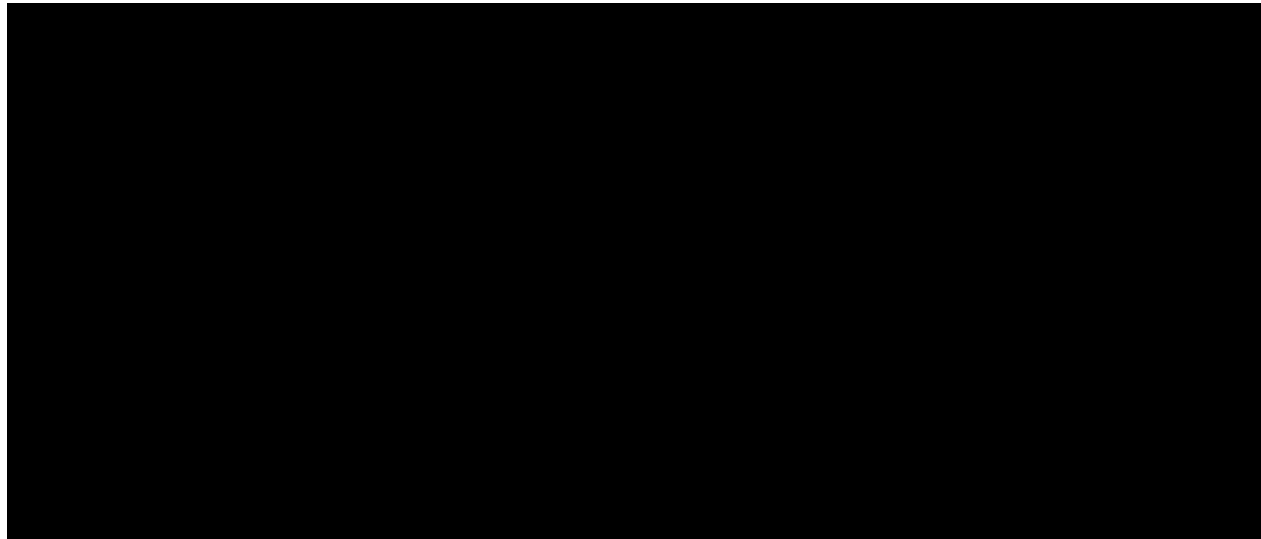
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Carrier Tape Specifications (FOD270L)



Description	Symbol	Dimension in mm
Tape Width	W	16.0 ± 0.3
Tape Thickness	t	0.30 ± 0.05
Sprocket Hole Pitch	P ₀	4.0 ± 0.1
Sprocket Hole Diameter	D ₀	1.55 ± 0.05
Sprocket Hole Location	E	1.75 ± 0.10
Pocket Location	F	7.5 ± 0.1
	P ₂	4.0 ± 0.1
Pocket Pitch	P	12.0 ± 0.1
Pocket Dimensions	A ₀	10.30 ± 0.20
	B ₀	10.30 ± 0.20
	K ₀	4.90 ± 0.20
Cover Tape Width	W ₁	1.6 ± 0.1
Cover Tape Thickness	d	0.1 max
Max. Component Rotation or Tilt		10°
Min. Bending Radius	R	30

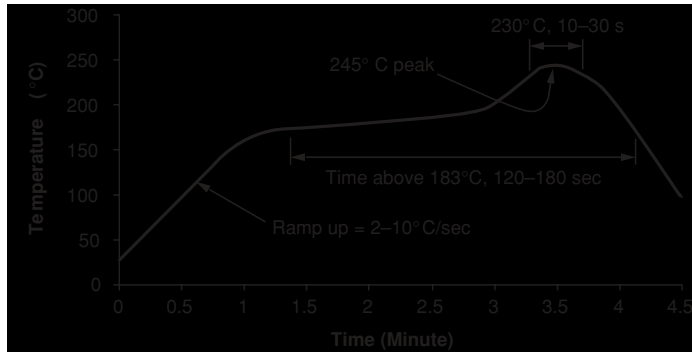
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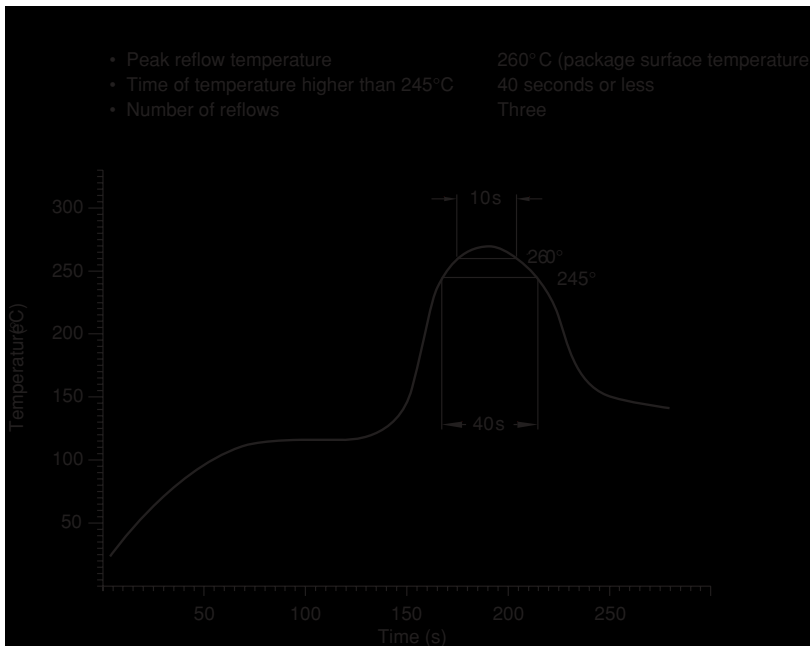
FOD270L

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)



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



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