FAIRCHILD
SEMICONDUCTOR®

May 2010

FOD060L, FOD260L, FOD063L LVTTL/LVCMOS 3.3V High Speed-10 MBit/s Logic Gate Optocouplers

Single Channel: FOD060L, FOD260L
Dual Channel: FOD063L

Features

- Compact SO8 package (except FOD260L – 8-pin DIP)
- Very high speed – 10 MBit/s
- Superior CMR — 50 kV/µs at 2,000V peak
- Fan-out of 8 over -40°C to +85°C
- Logic gate output
- Strobable output (single channel devices)
- Wired OR-open collector
- U.L. recognized (File # E90700) (pending)
- UDE approval pending

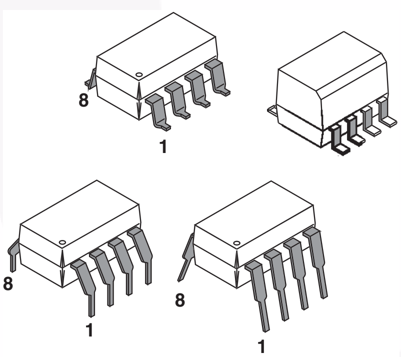
Applications

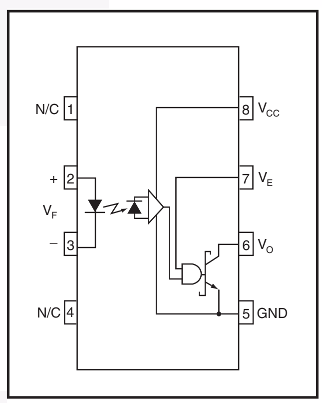
- Ground loop elimination
- LSTTL to TTL, LSTTL or 5-volt CMOS
- Line receiver, data transmission
- Data multiplexing
- Switching power supplies
- Pulse transformer replacement
- Computer-peripheral interface

Description

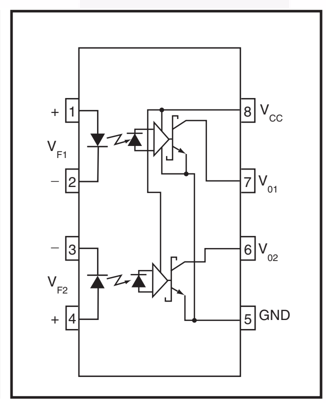
These optocouplers consist of an AlGaAS LED, optically coupled to a very high speed integrated photo-detector logic gate. Single channel devices include a strobable output. This output features an open collector, thereby permitting wired OR outputs. The output consists of bipolar transistors in a Bi-CMOS process for reduced power consumption. The coupled parameters are guaranteed over the temperature range of -40°C to +85°C. A maximum input signal of 5 mA (3 mA for the FODX6XL versions) will provide a minimum output sink current of 13 mA (fan out of 8). An internal noise shield provides superior common mode rejection of typically 50 kV/µs at 2,000V common mode.

Package





Single-channel circuit drawing (FOD060L, FOD260L)



Dual-channel circuit drawing (FOD063L)

Truth Table (Positive Logic)

Input	Enable	Output
H	H	L
L	H	H
H	L	H
L	L	H
H*	NC*	L*
L*	NC*	H*

*Dual channel devices or single channel devices with pin 7 not connected.
A 0.1 µF bypass capacitor must be connected between pins 8 and 5. (See note 1)

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
EMITTER DC/Average Forward Input Current (each channel)		I_F	50	mA
Enable Input Voltage Not to exceed VCC by more than 500 mV	Single Channel	V_E	V_{CC} + 0.5V	V
Reverse Input Voltage (each channel)		V_R	5.0	V
Power Dissipation	Single Channel	P_I	45	mW
	Dual Channel			
DETECTOR Supply Voltage		V_{CC} (1 minute max)	7.0	V
Output Current (each channel)		I_O	50	mA
Output Voltage (each channel)		V_O	7.0	V
Collector Output Power Dissipation	Single Channel	P_O	85	mW
	Dual Channel			

Recommended Operating Conditions

Parameter	Symbol	Min	Max	Units
Input Current, Low Level	I_{FL}	0	250	µA
Input Current, High Level	I_{FH}	*6.3	15	mA
Supply Voltage, Output	V_{CC}	2.7	3.3	V
Enable Voltage, Low Level (Single Channel)	V_{EL}	0	0.8	V
Enable Voltage, High Level (Single Channel)	V_{EH}	2.0	V_{CC}	V
Operating Temperature	T_A	-40	+85	°C
Fan Out (TTL load)	N		8	
Output Pull-up Resistor	R_L	330	4K	Ω

*6.3 mA is a guard banded value which allows for at least 20% CTR degradation. Initial input current threshold value is 5.0 mA or less.

Electrical Characteristics (T_A = -40°C to +85°C unless otherwise specified.)

Individual Component Characteristics

Parameter	Test Conditions	Symbol	Min	Typ**	Max	Unit
EMITTER Input Forward Voltage	(I_F = 10 mA)	V_F			1.8	V
	T_A =25°C				1.75	
Input Reverse Breakdown Voltage	(I_R = 10 µA)	B_{VR}	5.0			V
Input Capacitance	(V_F = 0, f = 1 MHz)	C_{IN}				pF
Input Diode Temperature Coefficient	(I_F = 10 mA)	ΔVF/ΔTA				mV/°C
DETECTOR High Level Supply Current	(V_E = 0.5 V) (I_F = 0 mA, V_{CC} = 3.3 V) Single Channel	I_{CCH}			7	mA
	Dual Channel				10	
Low Level Supply Current	(V_E = 0.5 V) (I_F = 10 mA, V_{CC} = 3.3 V) Single Channel	I_{CCL}			10	mA
	Dual Channel				15	
Low Level Enable Current	(V_{CC} = 3.3 V, V_E = 0.5 V) Single Channel	I_{EL}			-1.6	mA
High Level Enable Current	(V_{CC} = 3.3 V, V_E = 2.0 V) Single Channel	I_{EH}			-1.6	mA
High Level Enable Voltage	(V_{CC} = 3.3 V, I_F = 10 mA) Single Channel	V_{EH}	2.0			V
Low Level Enable Voltage	(V_{CC} = 3.3 V, I_F = 10 mA) (Note 2) Single Channel	V_{EL}			0.8	V

Switching Characteristics (T_A = -40°C to +85°C, V_{CC} = 3.3 V, I_F = 7.5 mA unless otherwise specified.)

AC Characteristics	Test Conditions	Device	Symbol	Min	Typ	Max	Unit
Propagation Delay Time to Output High Level	(Note 3) (R_L = 350Ω, C_L = 15 pF) (Fig. 9)	All	T_{PLH}			90	ns
Propagation Delay Time to Output Low Level	(Note 4) (R_L = 350Ω, C_L = 15 pF) (Fig. 9)	All	T_{PHL}			75	ns
Pulse Width Distortion	(R_L = 350Ω, C_L = 15 pF) (Fig. 9)	All	$\lvert T_{PHL}-T_{PLH}\rvert$			25	ns
Propagation Delay Skew	(R_L = 350Ω, C_L = 15 pF) (Note 5)	All	t_{PSK}			40	ns
Output Rise Time (10-90%)	(R_L = 350Ω, C_L = 15 pF) (Note 6) (Fig. 9)	All	t_r				ns
Output Fall Time (90-10%)	(R_L = 350Ω, C_L = 15 pF) (Note 7) (Fig. 12)	All	t_f				ns
Enable Propagation Delay Time to Output High Level	(V_{EH} = 3 V, R_L = 350Ω, C_L = 15 pF) (Note 8) (Fig. 10) Single Channel	All	t_{ELH}				ns
Enable Propagation Delay Time to Output Low Level	(V_{EH} = 3 V, R_L = 350Ω, C_L = 15 pF) (Note 9) (Fig. 10) Single Channel	All	t_{EHL}				ns
Common Mode Transient Immunity (at Output High Level)	(R_L = 350Ω) (T_A =25°C) (I_F = 0 mA, V_{OH} (Min.) = 2.0V) (Note 10) (Fig. 11) $\lvert V_{CM}\rvert$ = 50 V	All	$\lvert CM_H\rvert$	25,000	50,000		V/µs
Common Mode Transient Immunity (at Output Low Level)	(R_L = 350Ω) (T_A =25°C) (I_F = 7.5 mA, V_{OL} (Max.) = 0.8 V) (Note 11) (Fig. 11) $\lvert V_{CM}\rvert$ = 50 V	All	$\lvert CM_H\rvert$	25,000	50,000		V/µs

Transfer Characteristics (T_A = -40°C to +85°C Unless otherwise specified.)

DC Characteristics	Test Conditions		Symbol	Min	Typ**	Max	Unit
High Level Output Current	(I_F = 250 µA, V_{CC} = 3.3 V, V_O = 3.3 V)		I_{OH}			50	µA
	(Note 2) V_E = 2.0 V	Single Channel					
Low Level Output Voltage	(V_{CC} = 3.3 V, I_F = 5 mA, I_{OL} = 13 mA)		V_{OL}			0.6	V
	(Note 2) V_E = 2.0 V	Single Channel					
Input Threshold Current	(V_{CC} = 3.3 V, V_O = 0.6 V, I_{OL} = 13 mA)		I_{FT}			5	mA
	(Note 2) V_E = 2.0 V	Single Channel					

Isolation Characteristics (T_A = -40°C to +85°C Unless otherwise specified.)

Characteristics	Test Conditions	Device	Symbol	Min	Typ**	Max	Unit
Input-Output Insulation Leakage Current	(Relative humidity = 45%) (T_A = 25°C, t = 5 s) (V_{I-O} = 3000 VDC) (Note 12)		I_{I-O}			1.0*	µA
Withstand Insulation Test Voltage	I_{IO} ≤ 2 µA, R_H < 50%, T_A = 25°C) (Note 12) (t = 1 min.)	FOD060L FOD063L	V_{ISO}	3750			V_{RMS}
		FOD260L		5000			
Resistance (Input to Output)	(V_{I-O} = 500 V) (Note 12)		R_{I-O}		10^{12}		Ω
Capacitance (Input to Output)	(f = 1 MHz) (Note 12)		C_{I-O}		0.6		pF

** All typical values are at V_{CC} = 3.3 V, T_A = 25°C

Notes

1. The V_{CC} supply to each optoisolator must be bypassed by a 0.1µF capacitor or larger. This can be either a ceramic or solid tantalum capacitor with good high frequency characteristic and should be connected as close as possible to the package V_{CC} and GND pins of each device.
2. Enable Input – No pull up resistor required as the device has an internal pull up resistor.
3. t_{PLH} – Propagation delay is measured from the 3.75 mA level on the HIGH to LOW transition of the input current pulse to the 1.5V level on the LOW to HIGH transition of the output voltage pulse.
4. t_{PHL} – Propagation delay is measured from the 3.75 mA level on the LOW to HIGH transition of the input current pulse to the 1.5V level on the HIGH to LOW transition of the output voltage pulse.
5. t_{PSK} is the worst case difference between t_{PHL} and t_{PLH} for any devices at the stated test conditions.
6. t_r – Rise time is measured from the 90% to the 10% levels on the LOW to HIGH transition of the output pulse.
7. t_f – Fall time is measured from the 10% to the 90% levels on the HIGH to LOW transition of the output pulse.
8. t_{ELH} – Enable input propagation delay is measured from the 1.5V level on the HIGH to LOW transition of the input voltage pulse to the 1.5V level on the LOW to HIGH transition of the output voltage pulse.
9. t_{EHL} – Enable input propagation delay is measured from the 1.5V level on the LOW to HIGH transition of the input voltage pulse to the 1.5V level on the HIGH to LOW transition of the output voltage pulse.
10. CM_H – The maximum tolerable rate of rise of the common mode voltage to ensure the output will remain in the high state (i.e., V_{OUT} > 2.0 V). Measured in volts per microsecond (V/µs).
11. CM_L – The maximum tolerable rate of fall of the common mode voltage to ensure the output will remain in the low output state (i.e., V_{OUT} < 0.8 V). Measured in volts per microsecond (V/µs).
12. Device considered a two-terminal device: Pins 1,2,3 and 4 shorted together, and Pins 5,6,7 and 8 shorted together.

Typical Performance Curves

Fig. 1 Input Forward Current vs. Forward Voltage

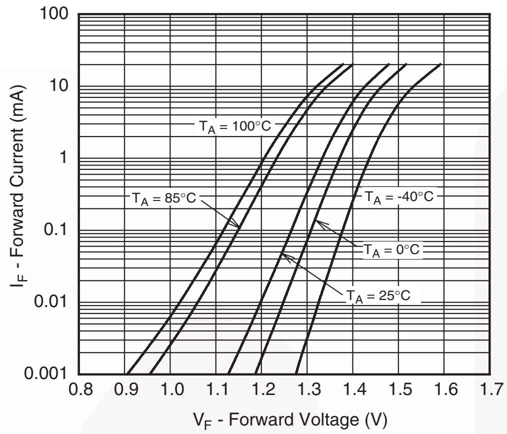


Fig. 2 Input Threshold Current vs. Ambient Temperature

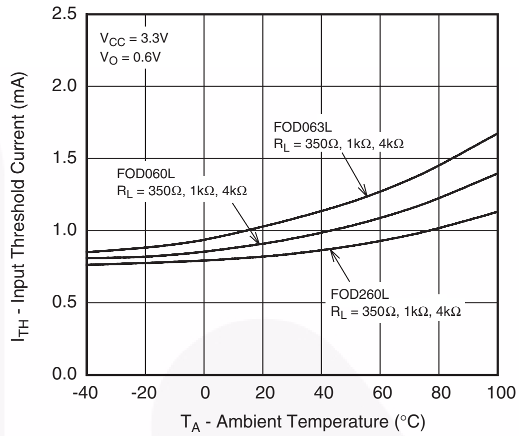


Fig. 3 Low Level Output Voltage vs. Ambient Temperature

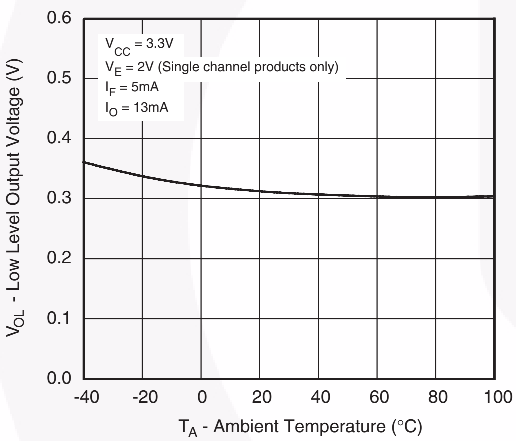


Fig. 4 High Level Output Current vs. Ambient Temperature

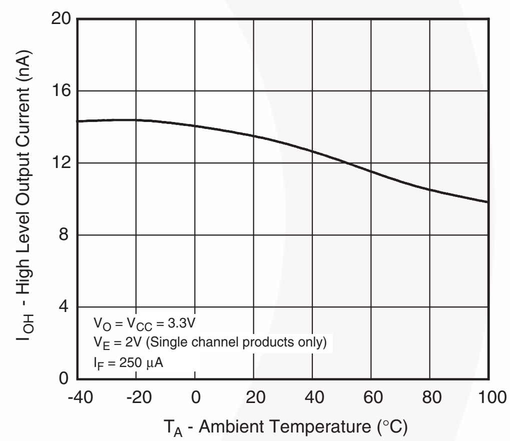


Fig. 5 Low Level Output Current vs. Ambient Temperature

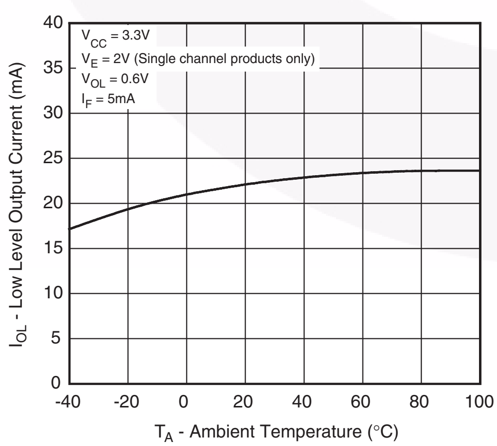
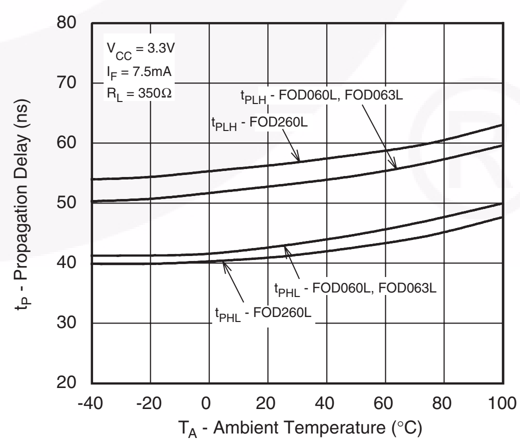


Fig. 6 Propagation Delay vs. Ambient Temperature



Typical Performance Curves

Fig. 7 Rise and Fall Times vs. Ambient Temperature

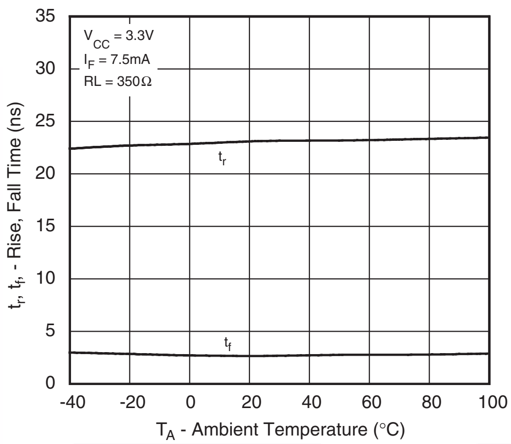
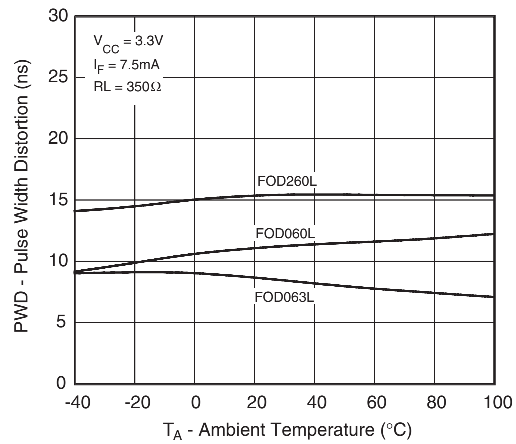


Fig. 8 Pulse Width Distortion vs. Ambient Temperature



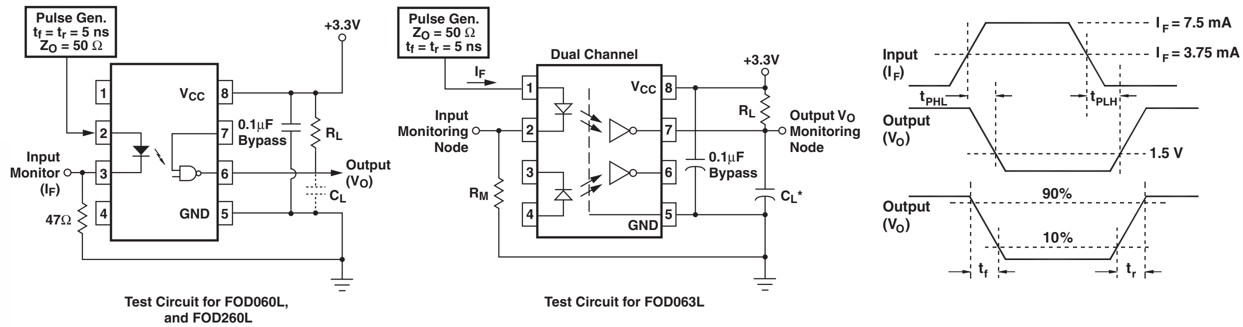


Fig. 9 Test Circuit and Waveforms for t_{PLH}, t_{PHL}, t_r and t_f.

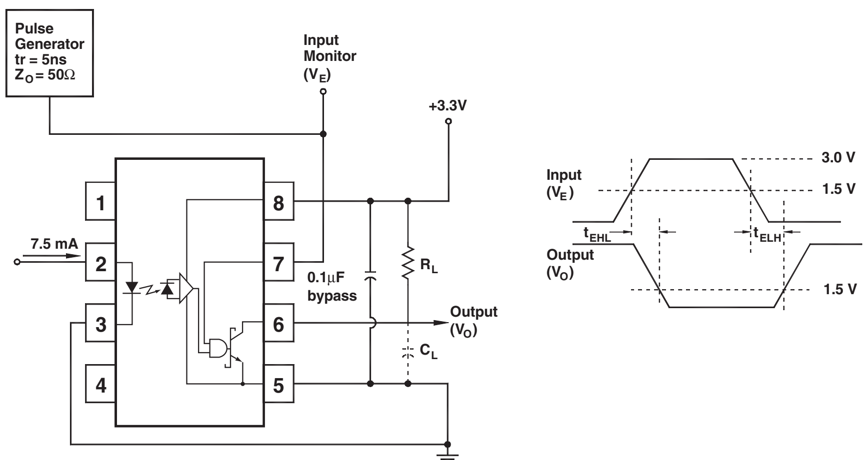
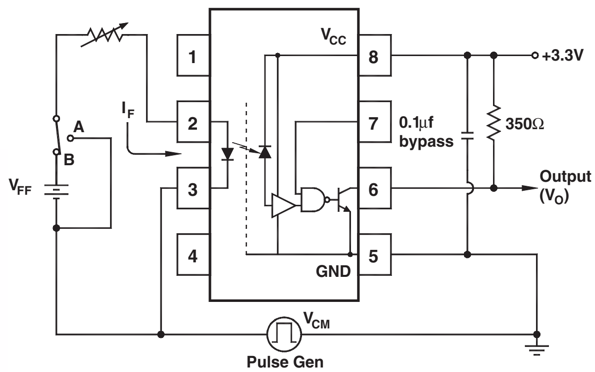
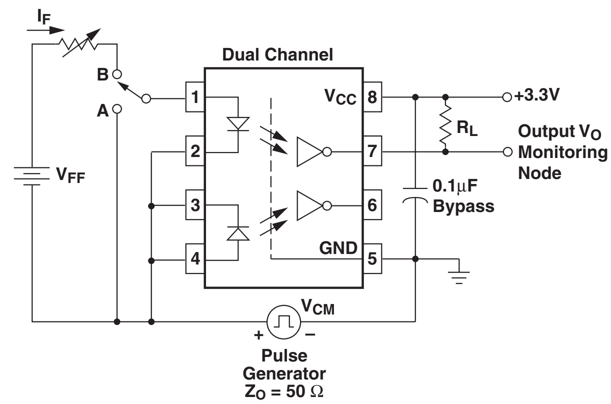


Fig. 10 Test Circuit t_{EHL} and t_{ELH}.



Test Circuit for FOD060L and FOD260L



Test Circuit for FOD063L

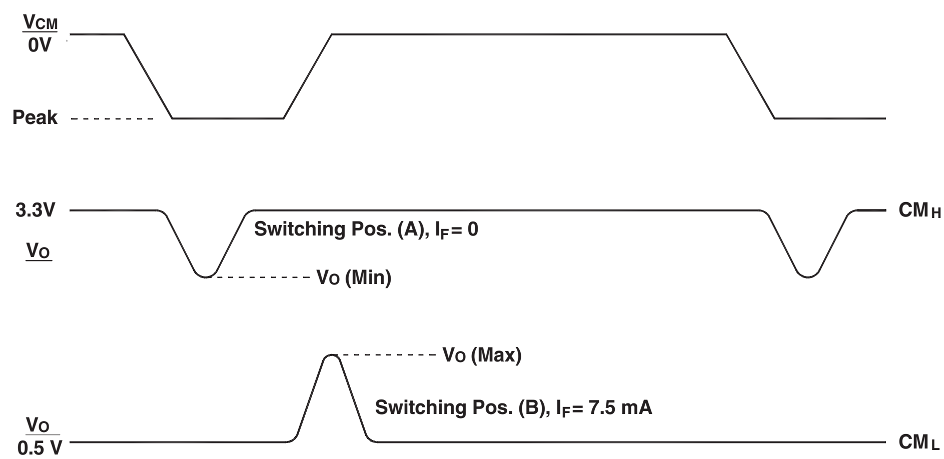
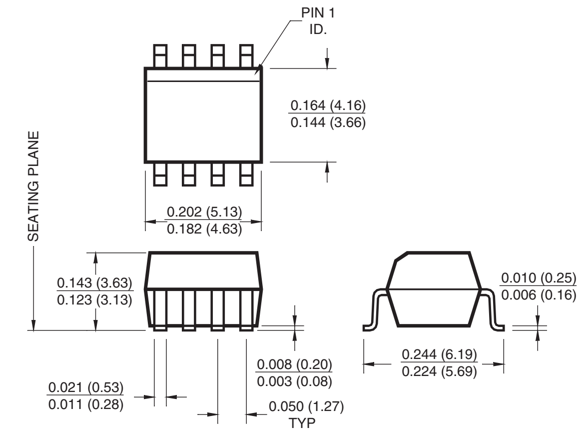


Fig. 11 Test Circuit Common Mode Transient Immunity

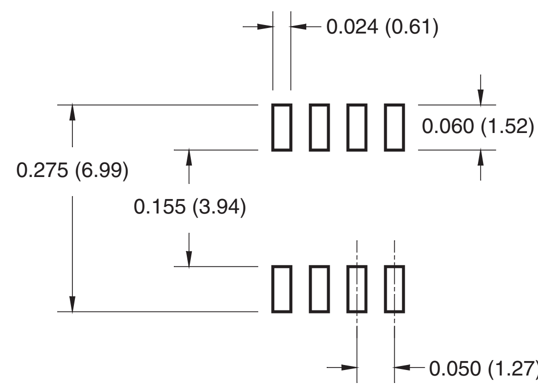
8-Pin SOIC

Package Dimensions (Surface Mount)



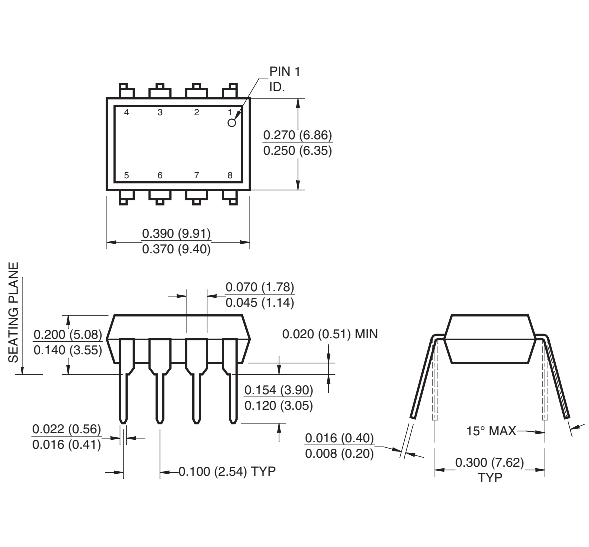
Lead Coplanarity : 0.004 (0.10) MAX

8-Pin Small Outline

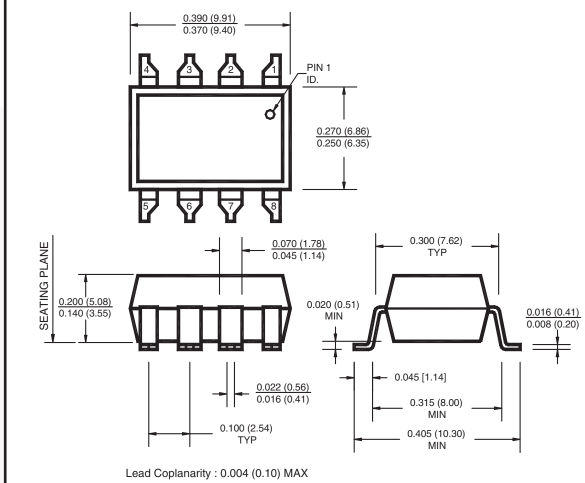


8-Pin DIP

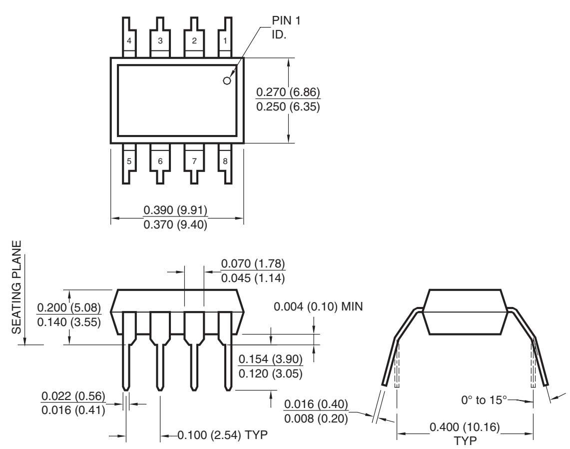
Package Dimensions (Through Hole)



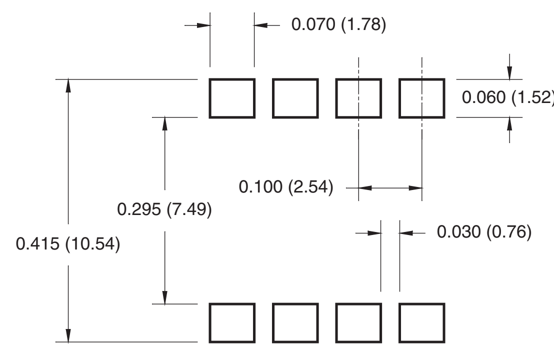
Package Dimensions (Surface Mount)



Package Dimensions (0.4" Lead Spacing)



8-Pin DIP



NOTE

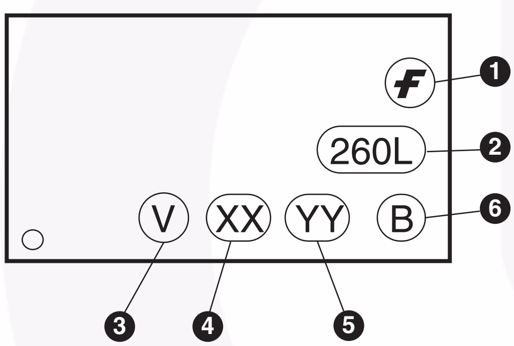
All dimensions are in inches (millimeters)

Ordering Information

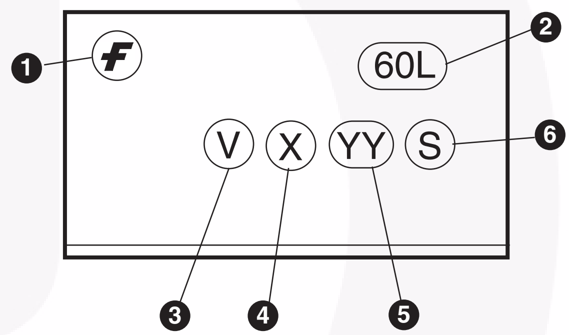
Option	Order Entry Identifier	Description
No Suffix	FOD260L	Through Hole (DIP package only)
	FOD060L	Surface Mount Lead Form (SOIC-8 package only)
S	FOD260LS	Surface Mount Lead Bend (DIP package only)
SD	FOD260LSD	Surface Mount; Tape and reel (DIP package only)
SV	Pending Approval	Surface Mount; VDE0884 (DIP package only)
SDV	Pending Approval	Surface Mount; Tape and reel, VDE0884 (1000 units per reel) (DIP package only)
T	FOD260LT	0.4" Lead Spacing (DIP package only)
TV	Pending Approval	0.4" Lead Spacing, VDE0884 (DIP package only)
R1	FOD060LR1	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	FOD060LR2	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

DIP



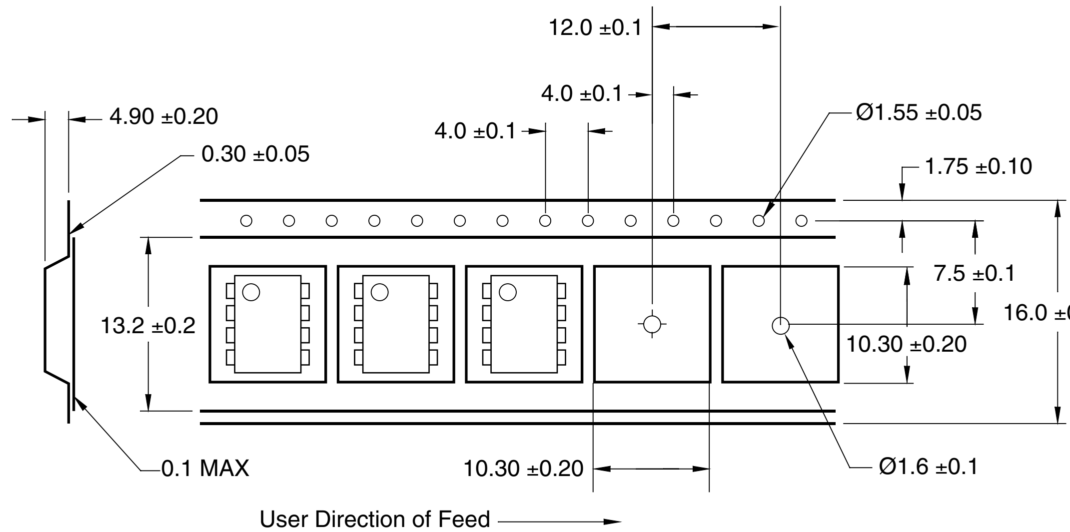
SOIC



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

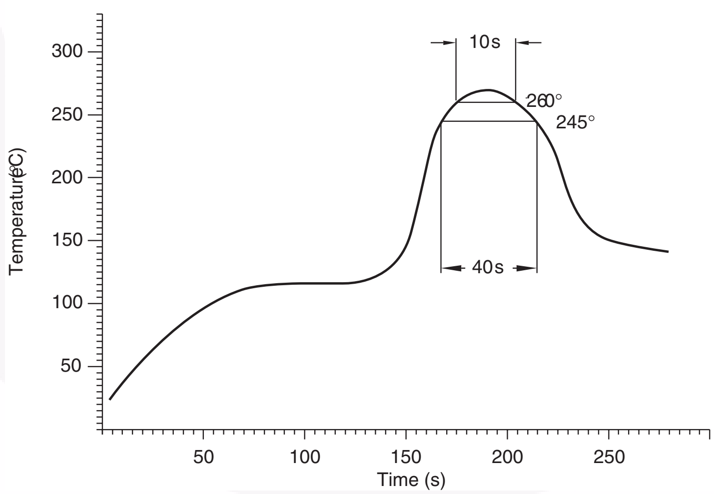
8-Pin DIP

Carrier Tape Specifications (FOD260L)



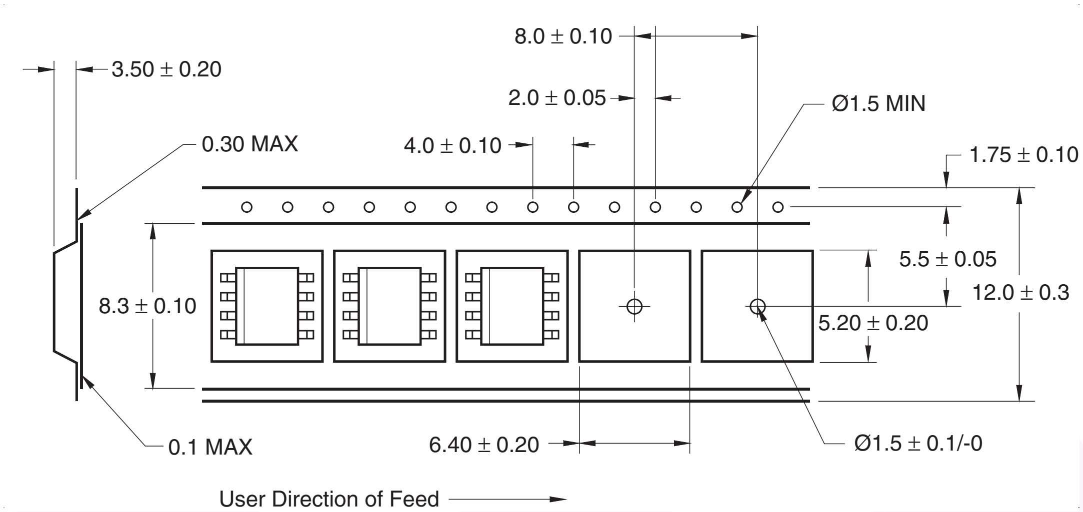
Reflow Profile (FOD260L)

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

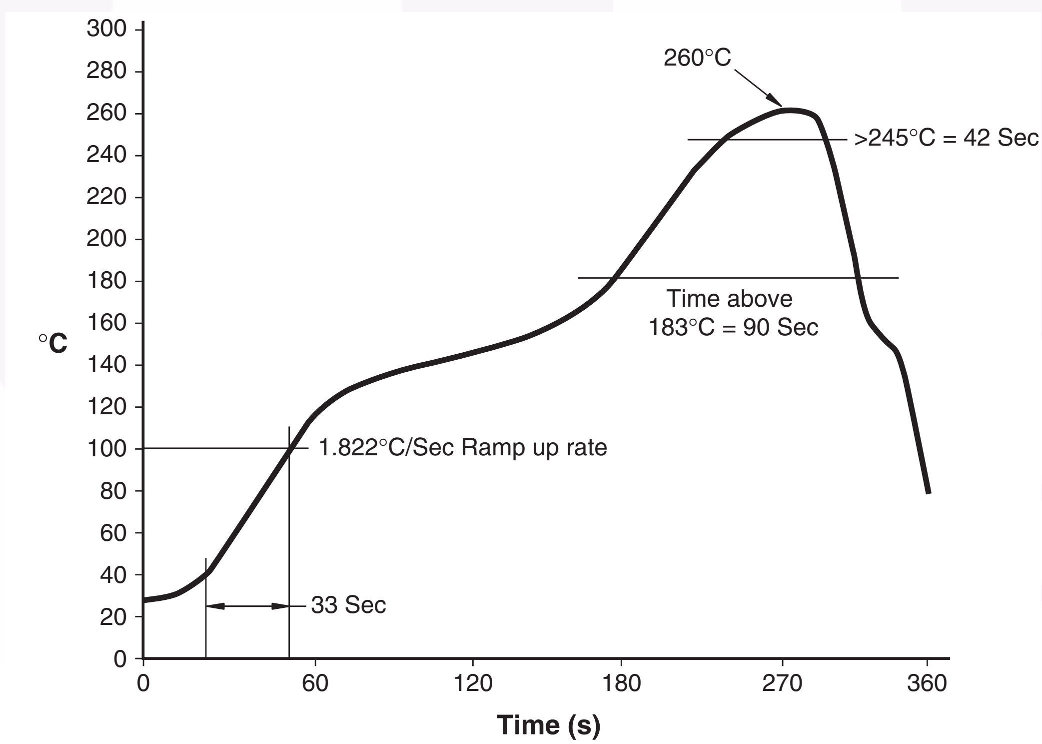


8-Pin SOIC

Carrier Tape Specifications (FOD060L, FOD063L)



Reflow Profile (FOD060L, FOD063L)



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Green FPS™ e-Series™
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MicroPak2™
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VCX™
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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.

ANTI-COUNTERFEITING POLICY

Fairchild Semiconductor Corporation's Anti-Counterfeiting Policy. Fairchild's Anti-Counterfeiting Policy is also stated on our external website, www.fairchildsemi.com, under Sales Support.

Counterfeiting of semiconductor parts is a growing problem in the industry. All manufacturers of semiconductor products are experiencing counterfeiting of their parts. Customers who inadvertently purchase counterfeit parts experience many problems such as loss of brand reputation, substandard performance, failed applications, and increased cost of production and manufacturing delays. Fairchild is taking strong measures to protect ourselves and our customers from the proliferation of counterfeit parts. Fairchild strongly encourages customers to purchase Fairchild parts either directly from Fairchild or from Authorized Fairchild Distributors who are listed by country on our web page cited above. Products customers buy either from Fairchild directly or from Authorized Fairchild Distributors are genuine parts, have full traceability, meet Fairchild's quality standards for handling and storage and provide access to Fairchild's full range of up-to-date technical and product information. Fairchild and our Authorized Distributors will stand behind all warranties and will appropriately address any warranty issues that may arise. Fairchild will not provide any warranty coverage or other assistance for parts bought from Unauthorized Sources. Fairchild is committed to combat this global problem and encourage our customers to do their part in stopping this practice by buying direct or from authorized distributors.

PRODUCT STATUS DEFINITIONS

Definition of Terms

Datasheet Identification	Product Status	Definition
Advance Information	Formative / In Design	Datasheet contains the design specifications for product development. Specifications may change in any manner without notice.
Preliminary	First Production	Datasheet contains preliminary data; supplementary data will be published at a later date. Fairchild Semiconductor reserves the right to make changes at any time without notice to improve design.
No Identification Needed	Full Production	Datasheet contains final specifications. Fairchild Semiconductor reserves the right to make changes at any time without notice to improve the design.
Obsolete	Not In Production	Datasheet contains specifications on a product that is discontinued by Fairchild Semiconductor. The datasheet is for reference information only.

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