

**SINGLE-CHANNEL
6N137
HCPL-2601
HCPL-2611**

**DUAL-CHANNEL
HCPL-2630
HCPL-2631**

DESCRIPTION

The 6N137, HCPL-2601/2611 single-channel and HCPL-2630/2631 dual-channel optocouplers consist of a 850 nm AlGaAs LED, optically coupled to a very high speed integrated photodetector logic gate with a strobable output. This output features an open collector, thereby permitting wired OR outputs. The coupled parameters are guaranteed over the temperature range of -40°C to +85°C. A maximum input signal of 5 mA will provide a minimum output sink current of 13 mA (fan out of 8).

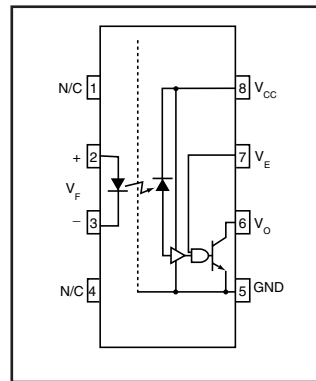
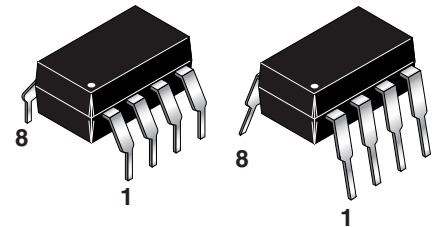
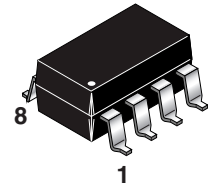
An internal noise shield provides superior common mode rejection of typically 10 kV/μs. The HCPL- 2601 and HCPL- 2631 has a minimum CMR of 5 kV/μs. The HCPL-2611 has a minimum CMR of 10 kV/μs.

FEATURES

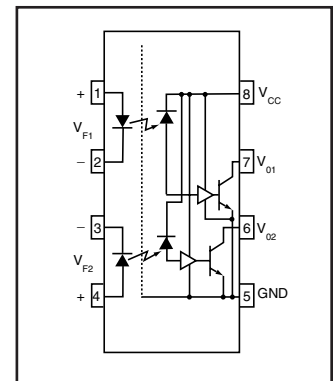
- Very high speed-10 MBit/s
- Superior CMR-10 kV/μs
- Double working voltage-480V
- Fan-out of 8 over -40°C to +85°C
- Logic gate output
- Strobable output
- Wired OR-open collector
- U.L. recognized (File # E90700)

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



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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

A 0.1 μF bypass capacitor must be connected between pins 8 and 5.
(See note 1)

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

Parameter	Symbol	Value	Units
Storage Temperature	T_{STG}	-55 to +125	°C
Operating Temperature	T_{OPR}	-40 to +85	°C
Lead Solder Temperature	T_{SOL}	260 for 10 sec	°C
EMITTER			
DC/Average Forward Current	I_F	50	mA
Input Current		30	
Enable Input Voltage	V_E	5.5	V
Not to exceed V_{CC} by more than 500 mV			
Reverse Input Voltage	V_R	5.0	V
Power Dissipation	P_I	100	mW
		45	
DETECTOR			
Supply Voltage	V_{CC} (1 minute max)	7.0	V
Output Current	I_O	50	mA
		50	
Output Voltage	V_O	7.0	V
Collector Output Power Dissipation	P_O	85	mW
		60	

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}	4.5	5.5	V
Enable Voltage, Low Level	V_{EL}	0	0.8	V
Enable Voltage, High Level	V_{EH}	2.0	V_{CC}	V
Low Level Supply Current	T_A	-40	+85	°C
Fan Out (TTL load)	N		8	

* 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

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ELECTRICAL CHARACTERISTICS ($T_A = -40^\circ\text{C}$ to $+85^\circ\text{C}$ Unless otherwise specified.)

INDIVIDUAL COMPONENT CHARACTERISTICS

Parameter	Test Conditions	Symbol	Min	Typ**	Max	Unit
EMITTER	($I_F = 10\text{ mA}$)				1.8	
Input Forward Voltage	$T_A = 25^\circ\text{C}$	V_F		1.4	1.75	V
Input Reverse Breakdown Voltage	($I_R = 10\ \mu\text{A}$)	B_{VR}	5.0			V
Input Capacitance	($V_F = 0$, $f = 1\text{ MHz}$)	C_{IN}		60		pF
Input Diode Temperature Coefficient	($I_F = 10\text{ mA}$)	$\Delta V_F/\Delta T_A$		-1.4		mV/ $^\circ\text{C}$
DETECTOR						
High Level Supply Current	Single Channel ($V_{CC} = 5.5\text{ V}$, $I_F = 0\text{ mA}$) Dual Channel ($V_E = 0.5\text{ V}$)	I_{CCH}		7	10	mA
Low Level Supply Current	Single Channel ($V_{CC} = 5.5\text{ V}$, $I_F = 10\text{ mA}$) Dual Channel ($V_E = 0.5\text{ V}$)	I_{CCL}		9	13	mA
Low Level Enable Current	($V_{CC} = 5.5\text{ V}$, $V_E = 0.5\text{ V}$)	I_{EL}		-0.8	-1.6	mA
High Level Enable Current	($V_{CC} = 5.5\text{ V}$, $V_E = 2.0\text{ V}$)	I_{EH}		-0.6	-1.6	mA
High Level Enable Voltage	($V_{CC} = 5.5\text{ V}$, $I_F = 10\text{ mA}$)	V_{EH}	2.0			V
Low Level Enable Voltage	($V_{CC} = 5.5\text{ V}$, $I_F = 10\text{ mA}$) (Note 3)	V_{EL}			0.8	V

SWITCHING CHARACTERISTICS ($T_A = -40^\circ\text{C}$ to $+85^\circ\text{C}$, $V_{CC} = 5\text{ V}$, $I_F = 7.5\text{ mA}$ Unless otherwise specified.)

AC Characteristics	Test Conditions	Symbol	Min	Typ**	Max	Unit
Propagation Delay Time to Output High Level	(Note 4) ($T_A = 25^\circ\text{C}$) ($R_L = 350\ \Omega$, $C_L = 15\text{ pF}$) (Fig. 12)	T_{PLH}	20	45	75	ns
Propagation Delay Time to Output Low Level	(Note 5) ($T_A = 25^\circ\text{C}$) ($R_L = 350\ \Omega$, $C_L = 15\text{ pF}$) (Fig. 12)	T_{PHL}	25	45	75	ns
Pulse Width Distortion	($R_L = 350\ \Omega$, $C_L = 15\text{ pF}$) (Fig. 12)	$ T_{PHL} - T_{PLH} $		3	35	ns
Output Rise Time (10-90%)	($R_L = 350\ \Omega$, $C_L = 15\text{ pF}$) (Note 6) (Fig. 12)	t_r		50		ns
Output Fall Time (90-10%)	($R_L = 350\ \Omega$, $C_L = 15\text{ pF}$) (Note 7) (Fig. 12)	t_f		12		ns
Enable Propagation Delay Time to Output High Level	($I_F = 7.5\text{ mA}$, $V_{EH} = 3.5\text{ V}$) ($R_L = 350\ \Omega$, $C_L = 15\text{ pF}$) (Note 8) (Fig. 13)	t_{ELH}		20		ns
Enable Propagation Delay Time to Output Low Level	($I_F = 7.5\text{ mA}$, $V_{EH} = 3.5\text{ V}$) ($R_L = 350\ \Omega$, $C_L = 15\text{ pF}$) (Note 9) (Fig. 13)	t_{EHL}		20		ns
Common Mode Transient Immunity (at Output High Level)	($T_A = 25^\circ\text{C}$) $ V_{CM} = 50\text{ V}$, (Peak) ($I_F = 0\text{ mA}$, $V_{OH}(\text{Min.}) = 2.0\text{ V}$) 6N137, HCPL-2630 ($R_L = 350\ \Omega$) (Note 10) HCPL-2601, HCPL-2631 (Fig. 14) HCPL-2611 $ V_{CM} = 400\text{ V}$	$ CM_H $		10,000	10,000	V/ μs
Common Mode Transient Immunity (at Output Low Level)	($R_L = 350\ \Omega$) ($I_F = 7.5\text{ mA}$, $V_{OL}(\text{Max.}) = 0.8\text{ V}$) 6N137, HCPL-2630 $ V_{CM} = 50\text{ V}$ (Peak) HCPL-2601, HCPL-2631 ($T_A = 25^\circ\text{C}$) (Note 11) (Fig. 14) HCPL-2611 ($T_A = 25^\circ\text{C}$) $ V_{CM} = 400\text{ V}$	$ CM_L $		10,000	10,000	V/ μs

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TRANSFER CHARACTERISTICS ($T_A = -40^{\circ}\text{C}$ to $+85^{\circ}\text{C}$ Unless otherwise specified.)

DC Characteristics	Test Conditions	Symbol	Min	Typ**	Max	Unit
High Level Output Current	($V_{CC} = 5.5\text{ V}$, $V_O = 5.5\text{ V}$) ($I_F = 250\ \mu\text{A}$, $V_E = 2.0\text{ V}$) (Note 2)	I_{OH}			100	μA
Low Level Output Current	($V_{CC} = 5.5\text{ V}$, $I_F = 5\text{ mA}$) ($V_E = 2.0\text{ V}$, $I_{CL} = 13\text{ mA}$) (Note 2)	V_{OL}		.35	0.6	V
Input Threshold Current	($V_{CC} = 5.5\text{ V}$, $V_O = 0.6\text{ V}$, $V_E = 2.0\text{ V}$, $I_{OL} = 13\text{ mA}$)	I_{FT}		3	5	mA

ISOLATION CHARACTERISTICS ($T_A = -40^{\circ}\text{C}$ to $+85^{\circ}\text{C}$ Unless otherwise specified.)

Characteristics	Test Conditions	Symbol	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 12)	I_{I-O}			1.0*	μA
Withstand Insulation Test Voltage	(RH < 50%, $T_A = 25^{\circ}\text{C}$) (Note 12) ($t = 1\text{ min.}$)	V_{ISO}	2500			V_{RMS}
Resistance (Input to Output)	($V_{I-O} = 500\text{ V}$) (Note 12)	R_{I-O}		10^{12}		Ω
Capacitance (Input to Output)	($f = 1\text{ MHz}$) (Note 12)	C_{I-O}		0.6		pF

 ** All typical values are at $V_{CC} = 5\text{ V}$, $T_A = 25^{\circ}\text{C}$
NOTES

- The V_{CC} supply to each optoisolator must be bypassed by a $0.1\ \mu\text{F}$ 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.
- Each channel.
- Enable Input - No pull up resistor required as the device has an internal pull up resistor.
- 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 1.5 V level on the LOW to HIGH transition of the output voltage pulse.
- 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 1.5 V level on the HIGH to LOW transition of the output voltage pulse.
- t_r - Rise time is measured from the 90% to the 10% levels on the LOW to HIGH transition of the output pulse.
- t_f - Fall time is measured from the 10% to the 90% levels on the HIGH to LOW transition of the output pulse.
- t_{ELH} - Enable input propagation delay is measured from the 1.5 V level on the HIGH to LOW transition of the input voltage pulse to the 1.5 V level on the LOW to HIGH transition of the output voltage pulse.
- t_{EHL} - Enable input propagation delay is measured from the 1.5 V level on the LOW to HIGH transition of the input voltage pulse to the 1.5 V level on the HIGH to LOW transition of the output voltage pulse.
- 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., $V_{OUT} > 2.0\text{ V}$). Measured in volts per microsecond ($\text{V}/\mu\text{s}$).
- CM_L - The maximum tolerable rate of rise of the common mode voltage to ensure the output will remain in the low output state (i.e., $V_{OUT} < 0.8\text{ V}$). Measured in volts per microsecond ($\text{V}/\mu\text{s}$).
- Device considered a two-terminal device: Pins 1,2,3 and 4 shorted together, and Pins 5,6,7 and 8 shorted together.

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TYPICAL PERFORMANCE CURVES

Fig. 1 Low Level Output Voltage vs. Ambient Temperature

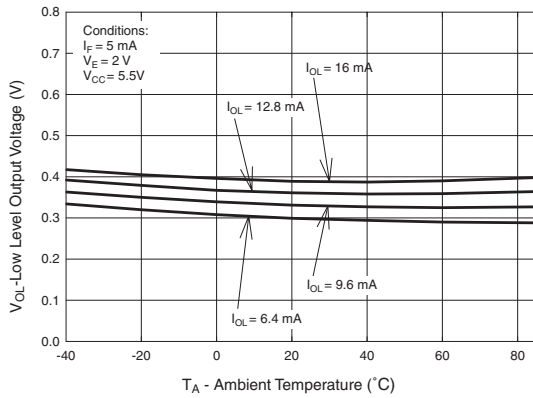


Fig. 2 Input Diode Forward Voltage vs. Forward Current

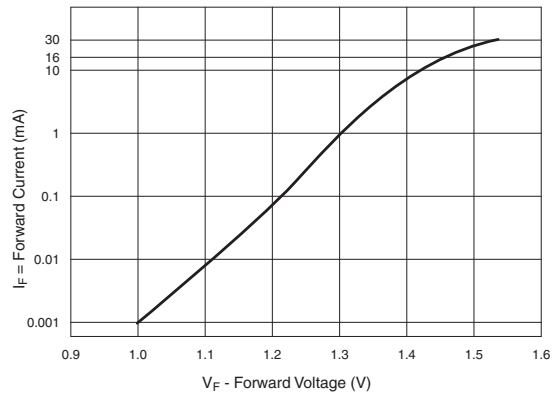


Fig. 3 Switching Time vs. Forward Current

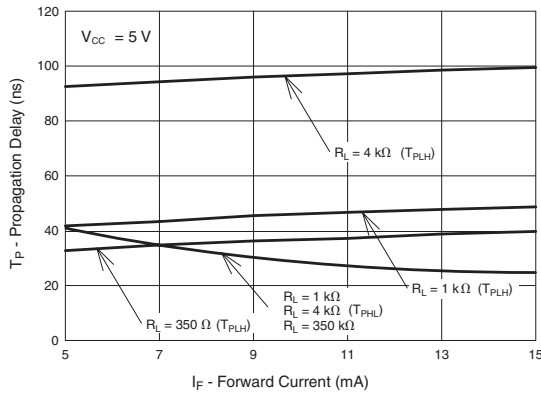


Fig. 4 Low Level Output Current vs. Ambient Temperature

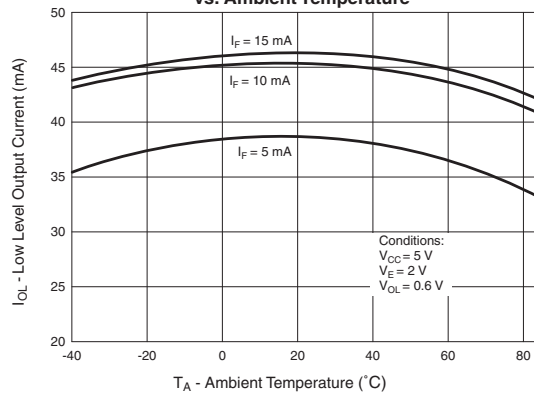


Fig. 5 Input Threshold Current vs. Ambient Temperature

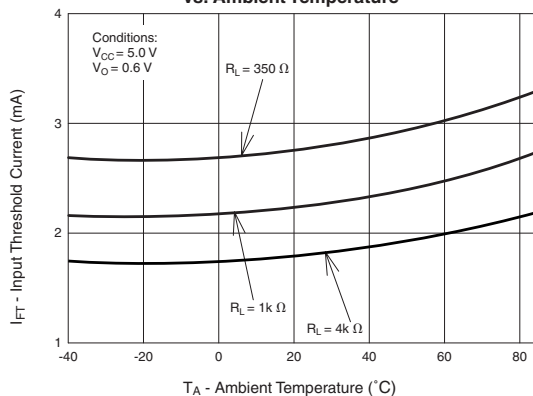
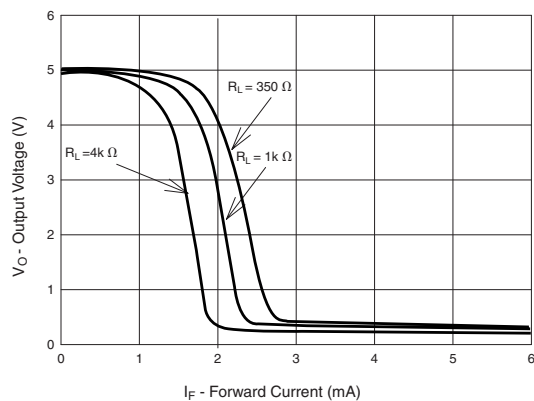


Fig. 6 Output Voltage vs. Input Forward Current



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Fig. 7 Pulse Width Distortion vs. Temperature

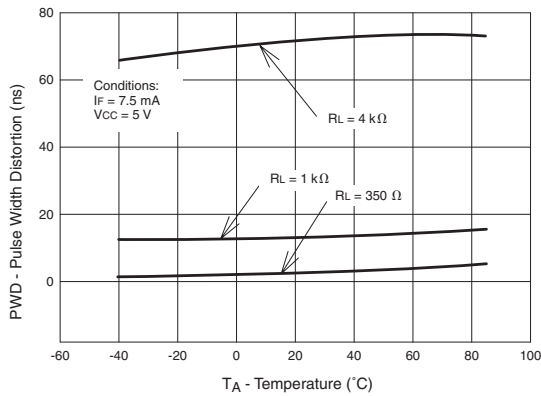


Fig. 8 Rise and Fall Time vs. Temperature

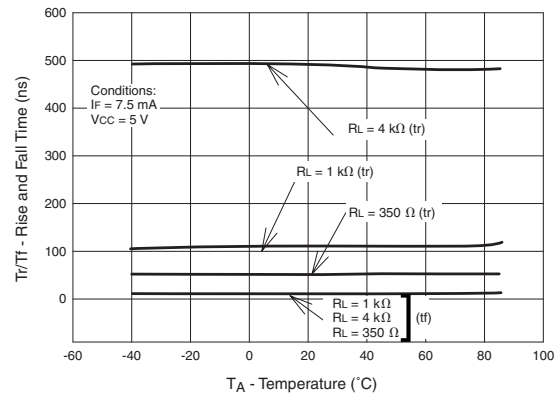


Fig. 9 Enable Propagation Delay vs. Temperature

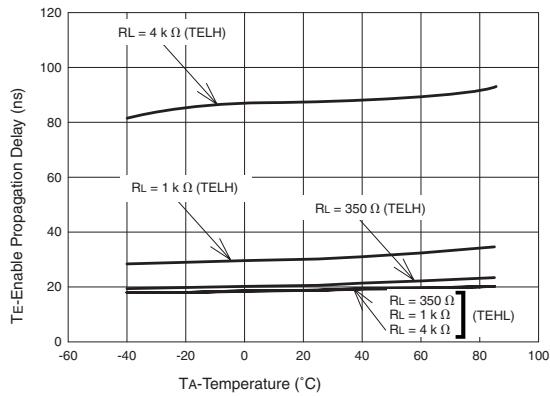


Fig. 10 Switching Time vs. Temperature

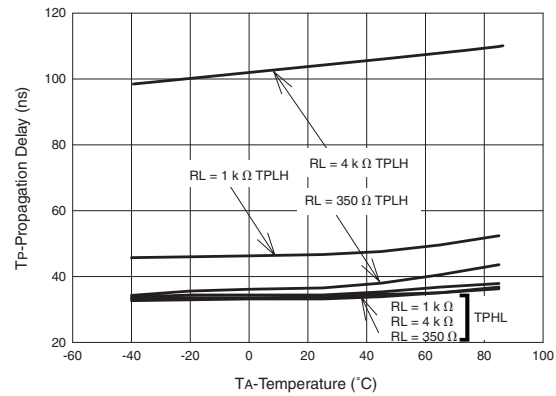
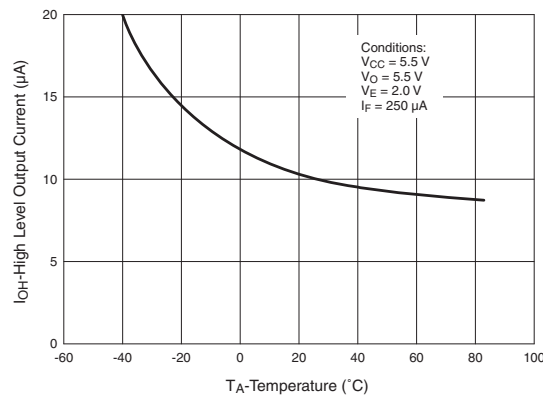


Fig. 11 High Level Output Current vs. Temperature



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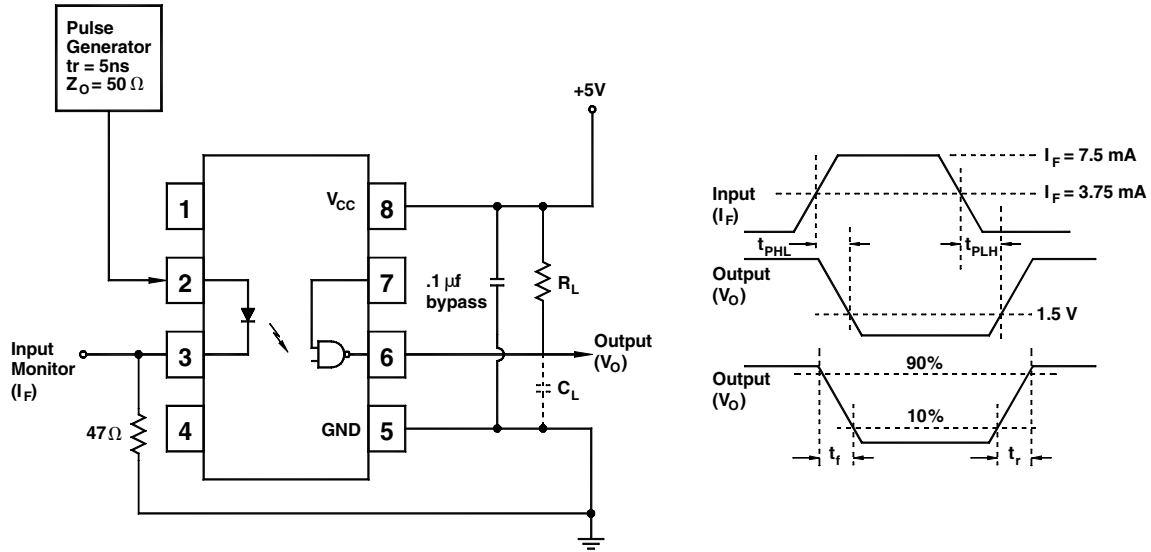


Fig. 12 Test Circuit and Waveforms for t_{PLH}, t_{PHL}, t_r and t_f.

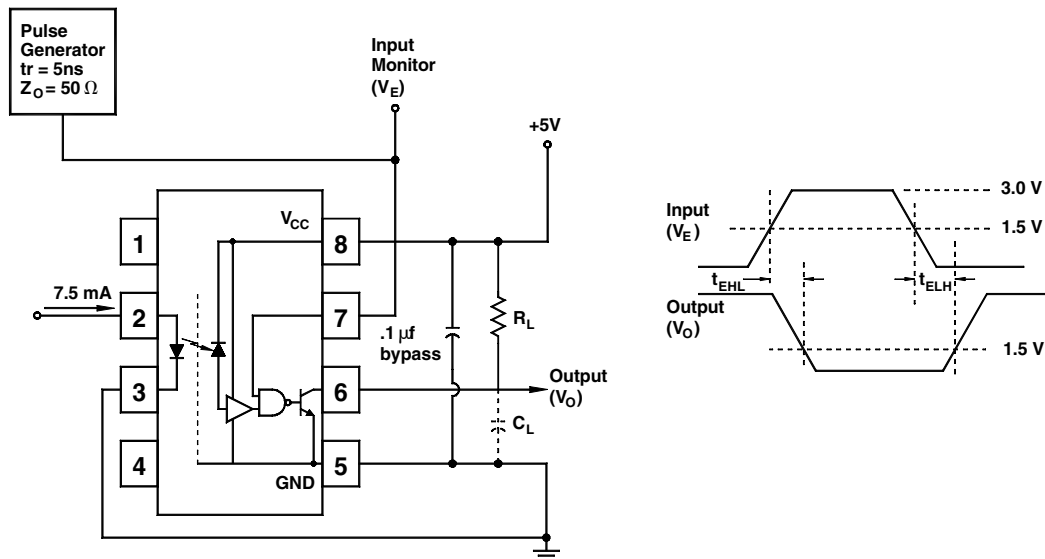


Fig. 13 Test Circuit t_{EHL} and t_{ELH}.

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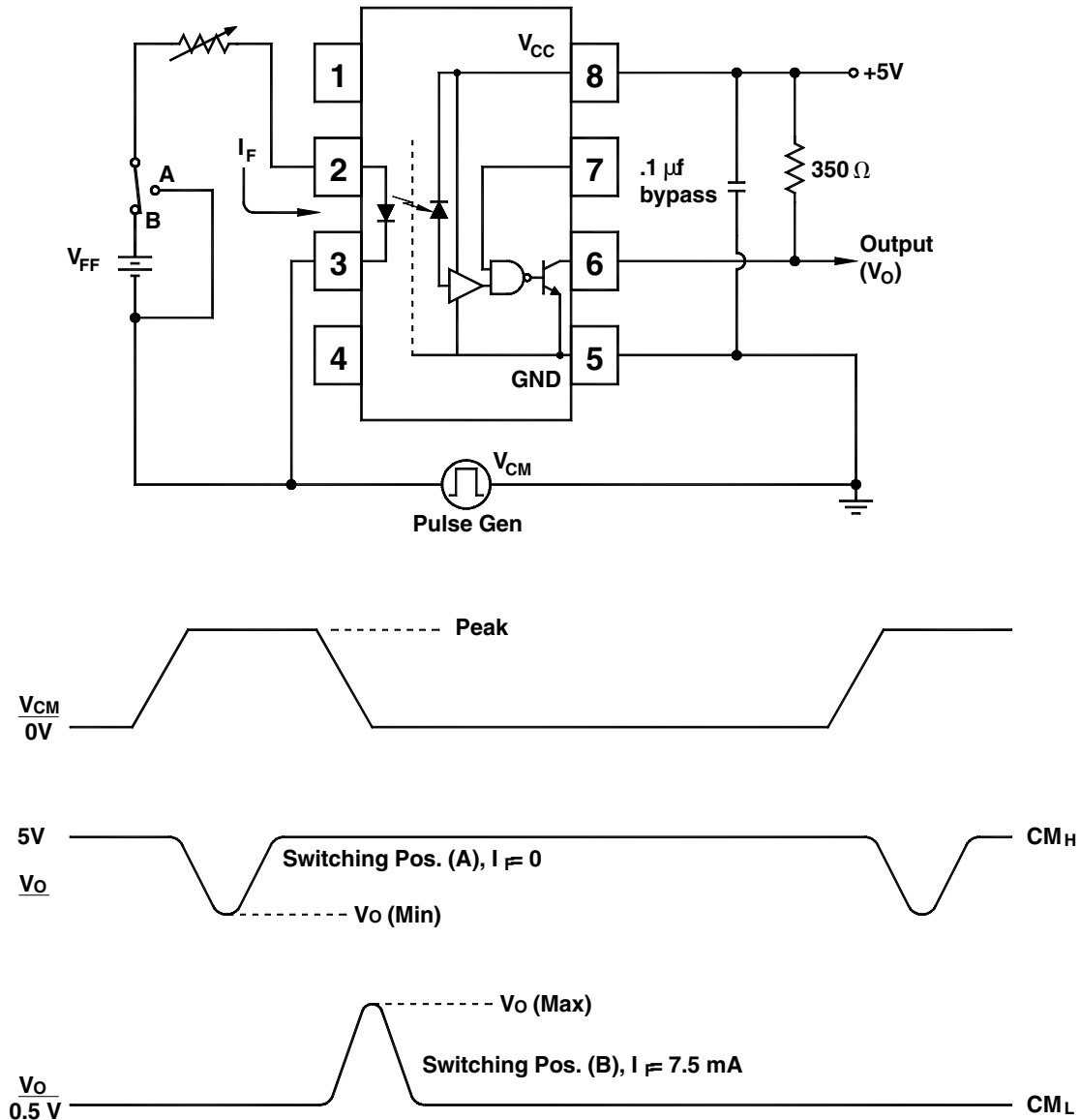
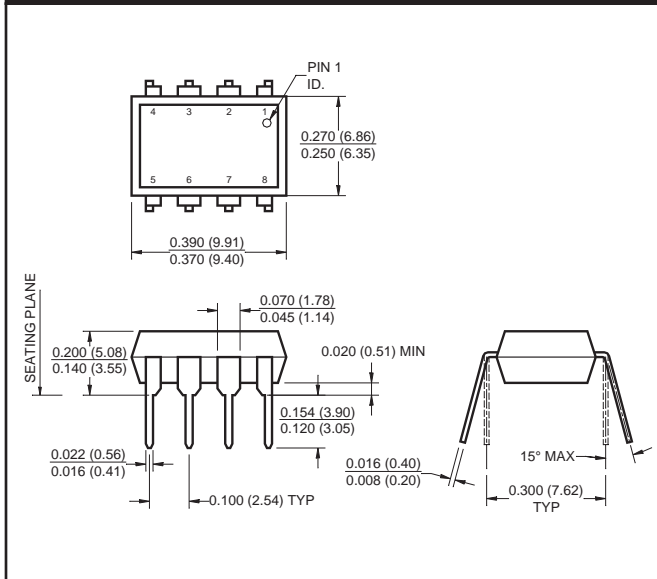


Fig. 14 Test Circuit Common Mode Transient Immunity

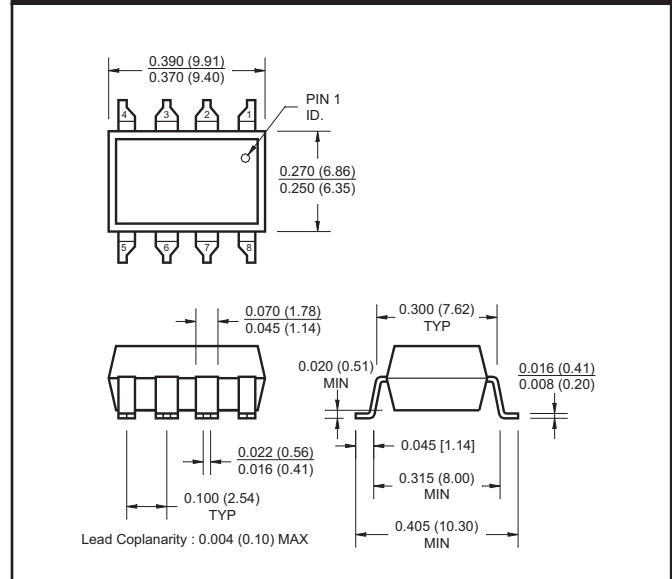
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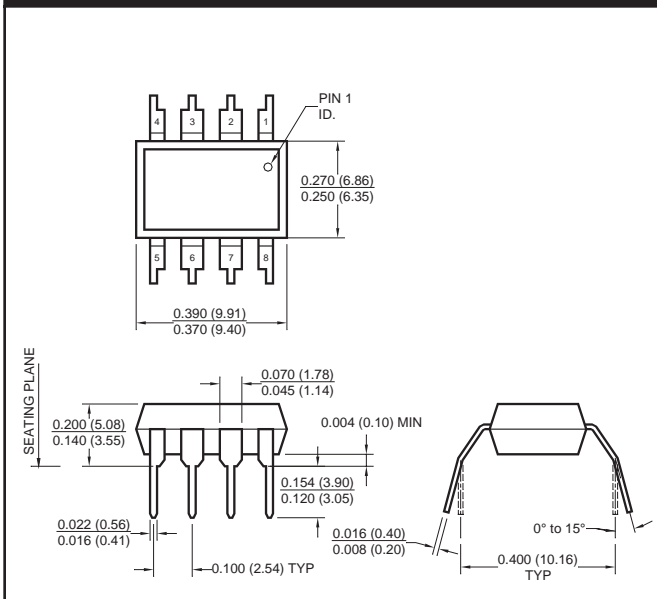
Package Dimensions (Through Hole)



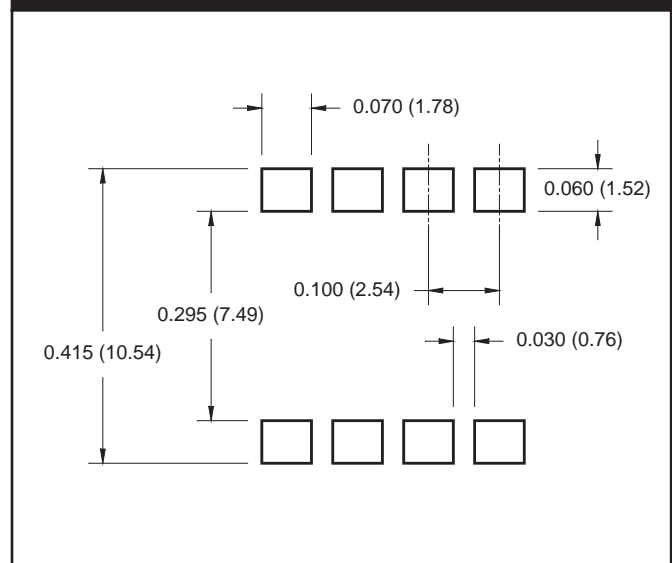
Package Dimensions (Surface Mount)



Package Dimensions (0.4" Lead Spacing)



**Recommended Pad Layout for
Surface Mount Leadform**



NOTE

All dimensions are in inches (millimeters)

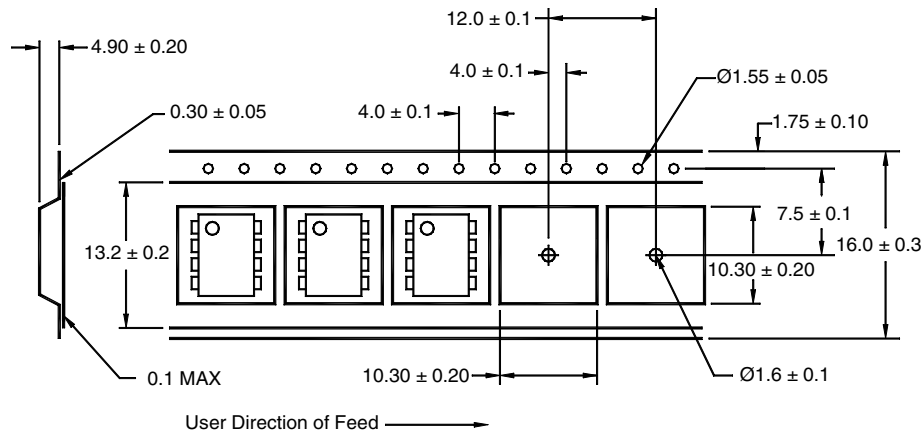
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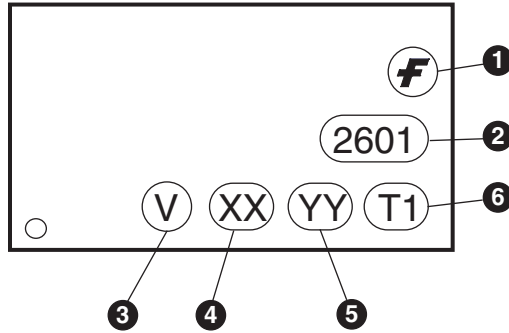
ORDERING INFORMATION

Option	Order Entry Identifier	Description
S	.S	Surface Mount Lead Bend
SD	.SD	Surface Mount; Tape and reel
W	.W	0.4" Lead Spacing

QT Carrier Tape Specifications ("D" Taping Orientation)

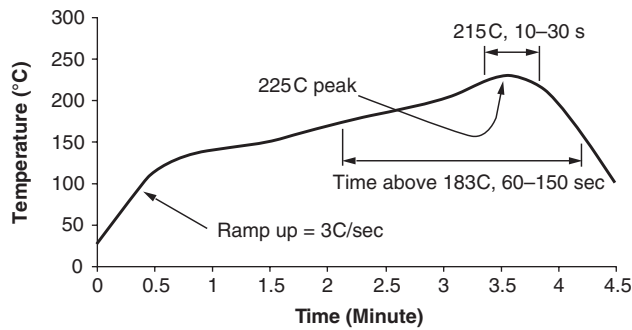


MARKING INFORMATION



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

Reflow Profile



- Peak reflow temperature: 225C (package surface temperature)
- Time of temperature higher than 183C for 60–150 seconds
- One time soldering reflow is recommended

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CROSSVOLT™	GlobalOptoisolator™	MicroPak™	QFET®	SuperSOT™-8
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EcoSPARK™	HiSeC™	MSX™	QT Optoelectronics™	TinyLogic®
E ² CMOS™	μC™	MSXPro™	Quiet Series™	TINYOPTO™
EnSigna™	i-Lo™	OCX™	RapidConfigure™	TruTranslation™
FACT™	ImpliedDisconnect™	OCXPro™	RapidConnect™	UHC™
FACT Quiet Series™		OPTOLOGIC®	μSerDes™	UltraFET®
Across the board. Around the world.™		OPTOPLANAR™	SILENT SWITCHER®	VCX™
The Power Franchise®		PACMAN™	SMART START™	
Programmable Active Droop™		POP™	SPM™	

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2. A critical component is 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.

PRODUCT STATUS DEFINITIONS

Definition of Terms

Datasheet Identification	Product Status	Definition
Advance Information	Formative or In Design	This datasheet contains the design specifications for product development. Specifications may change in any manner without notice.
Preliminary	First Production	This datasheet contains preliminary data, and supplementary data will be published at a later date. Fairchild Semiconductor reserves the right to make changes at any time without notice in order to improve design.
No Identification Needed	Full Production	This datasheet contains final specifications. Fairchild Semiconductor reserves the right to make changes at any time without notice in order to improve design.
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