

SINGLE-CHANNEL
6N135, 6N136
HCPL-2503
HCPL-4502

DUAL-CHANNEL
HCPL-2530
HCPL-2531

DESCRIPTION

The HCPL-4502/HCPL-2503, 6N135/6 and HCPL-2530/HCPL-2531 optocouplers consist of an AlGaAs LED optically coupled to a high speed photodetector transistor.

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.

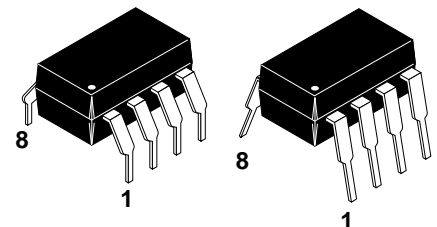
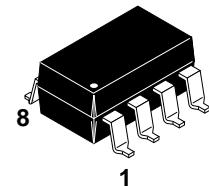
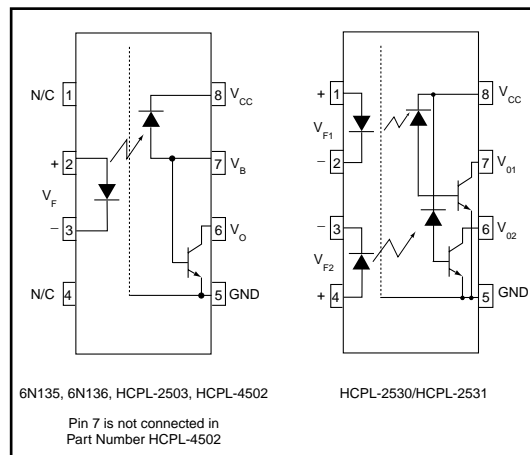
An internal noise shield provides superior common mode rejection of 10kV/ μ s. An improved package allows superior insulation permitting a 480 V working voltage compared to industry standard Of 220 V.

FEATURES

- High speed-1 MBit/s
- Superior CMR-10 kV/ μ s
- Dual-Channel
 HCPL-2530/HCPL-2531
- Double working voltage-480V RMS
- CTR guaranteed 0-70°C
- U.L. recognized (File # E90700)

APPLICATIONS

- Line receivers
- Pulse transformer replacement
- Output interface to CMOS-LSTTL-TTL
- Wide bandwidth analog coupling



ABSOLUTE MAXIMUM RATINGS ($T_A = 25^\circ\text{C}$ unless otherwise specified)

Parameter	Symbol	Value	Units
Storage Temperature	T_{STG}	-55 to +125	$^\circ\text{C}$
Operating Temperature	T_{OPR}	-55 to +100	$^\circ\text{C}$
Lead Solder Temperature	T_{SOL}	260 for 10 sec	$^\circ\text{C}$
EMITTER			
DC/Average Forward Input Current	Each Channel (Note 1)	I_F (avg)	25 mA
Peak Forward Input Current (50% duty cycle, 1 ms P.W.)	Each Channel (Note 2)	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	(6N135/6N136 and HCPL-2503/4502) (HCPL-2530/2531) Each Channel (Note 3)	P_D	100 mW 45 mW
DETECTOR			
Average Output Current	Each Channel	I_O (avg)	8 mA
Peak Output Current	Each Channel	I_O (pk)	16 mA
Emitter-Base Reverse Voltage	(6N135, 6N136 and HCPL-2503 only)	V_{EBR}	5 V
Supply Voltage		V_{CC}	-0.5 to 30 V
Output Voltage		V_O	-0.5 to 20 V
Base Current	(6N135, 6N136 and HCPL-2503 only)	I_B	5 mA
Output power dissipation	(6N135, 6N136, HCPL-2503, HCPL-4502) (Note 4) (HCPL-2530, HCPL-2531) Each Channel	P_D	100 mW 35 mW

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ELECTRICAL CHARACTERISTICS ($T_A = 0$ to 70°C Unless otherwise specified)							
INDIVIDUAL COMPONENT CHARACTERISTICS							
Parameter	Test Conditions	Symbol	Device	Min	Typ**	Max	Unit
EMITTER							
Input Forward Voltage	($I_F = 16$ mA, $T_A = 25^\circ\text{C}$)	V_F			1.45	1.7	V
	($I_F = 16$ mA)					1.8	
Input Reverse Breakdown Voltage	($I_R = 10$ μA)	B_{VR}		5.0			V
Temperature coefficient of forward voltage	($I_F = 16$ mA)	$(\Delta V_F / \Delta T_A)$			-1.6		mV/ $^\circ\text{C}$
DETECTOR							
Logic high output current	($I_F = 0$ mA, $V_O = V_{CC} = 5.5$ V) ($T_A = 25^\circ\text{C}$)	I_{OH}	All		0.001	0.5	μA
	($I_F = 0$ mA, $V_O = V_{CC} = 15$ V) ($T_A = 25^\circ\text{C}$)		6N135 6N136 HCPL-4502 HCPL-2503		0.005	1	
	($I_F = 0$ mA, $V_O = V_{CC} = 15$ V)		All			50	
Logic low supply current	($I_F = 16$ mA, $V_O = \text{Open}$) ($V_{CC} = 15$ V)	I_{CCL}	6N135 6N136 HCPL-4502 HCPL-2503		120	200	μA
	($I_{F1} = I_{F2} = 16$ mA, $V_O = \text{Open}$) ($V_{CC} = 15$ V)		HCPL-2530 HCPL-2531		200	400	
Logic high supply current	($I_F = 0$ mA, $V_O = \text{Open}$, $V_{CC} = 15$ V) ($T_A = 25^\circ\text{C}$)	I_{CCH}	6N135 6N136 HCPL-4502 HCPL-2503			1	μA
	($I_F = 0$ mA, $V_O = \text{Open}$) ($V_{CC} = 15$ V)		6N135 6N136 HCPL-4502 HCPL-2503			2	
	($I_F = 0$ mA, $V_O = \text{Open}$) ($V_{CC} = 15$ V)		HCPL-2530 HCPL-2531		0.02	4	

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

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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 (Note 5)	$(I_F = 16 \text{ mA}, V_O = 0.4 \text{ V})$ $(V_{CC} = 4.5 \text{ V}, T_A = 25^\circ\text{C})$	CTR	6N135 HCPL-2530	7	18	50	%		
			6N136 HCPL-4502 HCPL-2531	19	27	50	%		
			HCPL-2503	12	27		%		
			6N135 HCPL-2530	5	21		%		
	$(I_F = 16 \text{ mA}, V_O = 0.5 \text{ V})$ $(V_{CC} = 4.5 \text{ V})$		6N136 HCPL-4502 HCPL-2531	15	30		%		
			HCPL-2503	9	30		%		
			Logic low output voltage output voltage	$(I_F = 16 \text{ mA}, I_O = 1.1 \text{ mA})$ $(V_{CC} = 4.5 \text{ V}, T_A = 25^\circ\text{C})$	6N135		0.18	0.4	V
					HCPL-2530		0.18	0.5	
$(I_F = 16 \text{ mA}, I_O = 3 \text{ mA})$ $(V_{CC} = 4.5 \text{ V}, T_A = 25^\circ\text{C})$	6N136 HCPL-4502 HCPL-2503			0.25	0.4				
	HCPL-2531			0.25	0.5				
$(I_F = 16 \text{ mA}, I_O = 0.8 \text{ mA})$ $(V_{CC} = 4.5 \text{ V})$	6N135 HCPL-2530				0.5				
	6N136 HCPL-4502 HCPL-2503 HCPL-2531				0.5				

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

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SWITCHING CHARACTERISTICS ($T_A = 0$ to 70°C unless otherwise specified., $V_{CC} = 5\text{ V}$)

Parameter	Test Conditions	Symbol	Device	Min	Typ**	Max	Unit
Propagation delay time to logic low	$T_A = 25^\circ\text{C}$, ($R_L = 4.1\text{ k}\Omega$, $I_F = 16\text{ mA}$) (Note 6) (Fig. 7)	T_{PHL}	6N135 HCPL-2530		0.45	1.5	μs
	$(R_L = 1.9\text{ k}\Omega$, $I_F = 16\text{ mA}$) (Note 7) (Fig. 7) $T_A = 25^\circ\text{C}$		6N136 HCPL-4502 HCPL-2503 HCPL-2531		0.45	0.8	μs
	$(R_L = 4.1\text{ k}\Omega$, $I_F = 16\text{ mA}$) (Note 6) (Fig. 7)		6N135 HCPL-2530			2.0	μs
	$(R_L = 1.9\text{ k}\Omega$, $I_F = 16\text{ mA}$) (Note 7) (Fig. 7)		6N136 HCPL-4502 HCPL-2503 HCPL-2531			1.0	μs
Propagation delay time to logic high	$T_A = 25^\circ\text{C}$, ($R_L = 4.1\text{ k}\Omega$, $I_F = 16\text{ mA}$) (Note 6) (Fig. 7)	T_{PLH}	6N135 HCPL-2530		0.5	1.5	μs
	$(R_L = 1.9\text{ k}\Omega$, $I_F = 16\text{ mA}$) (Note 7) (Fig. 7) $T_A = 25^\circ\text{C}$		6N136 HCPL-4502 HCPL-2503 HCPL-2531		0.3	0.8	μs
	$(R_L = 4.1\text{ k}\Omega$, $I_F = 16\text{ mA}$) (Note 6) (Fig. 7)		6N135 HCPL-2530			2.0	μs
	$(R_L = 1.9\text{ k}\Omega$, $I_F = 16\text{ mA}$) (Note 7) (Fig. 7)		6N136 HCPL-4502 HCPL-2503 HCPL-2531			1.0	μs
Common mode transient immunity at logic high	$(I_F = 0\text{ mA}$, $V_{CM} = 10\text{ V}_{P-P}$, $R_L = 4.1\text{ k}\Omega$) (Note 8) (Fig. 8) $T_A = 25^\circ\text{C}$	$ CM_H $	6N135 HCPL-2530		10,000		$\text{V}/\mu\text{s}$
	$(I_F = 0\text{ mA}$, $V_{CM} = 10\text{ V}_{P-P}$) $T_A = 25^\circ\text{C}$, ($R_L = 1.9\text{ k}\Omega$) (Note 8) (Fig. 8)		6N136 HCPL-4502 HCPL-2503 HCPL-2531		10,000		$\text{V}/\mu\text{s}$
Common mode transient immunity at logic low	$(I_F = 16\text{ mA}$, $V_{CM} = 10\text{ V}_{P-P}$, $R_L = 4.1\text{ k}\Omega$) (Note 8) (Fig. 8) $T_A = 25^\circ\text{C}$	$ CM_L $	6N135 HCPL-2530		10,000		$\text{V}/\mu\text{s}$
	$(I_F = 16\text{ mA}$, $V_{CM} = 10\text{ V}_{P-P}$) $(R_L = 1.9\text{ k}\Omega)$ (Note 8) (Fig. 8)		6N136 HCPL-4502 HCPL-2503 HCPL-2531		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	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 9)	I_{I-O}			1.0	μA
Withstand insulation test voltage	($RH \leq 50\%$, $T_A = 25^\circ\text{C}$) (Note 9) ($t = 1$ min.)	V_{ISO}	2500			V_{RMS}
Resistance (input to output)	(Note 9) ($V_{I-O} = 500$ VDC)	R_{I-O}		10^{12}		Ω
Capacitance (input to output)	(Note 9) ($f = 1$ MHz)	C_{I-O}		0.6		pF
DC Current gain	($I_O = 3$ mA, $V_O = 5$ V)	HFE		150		
Input-Input Insulation leakage current	($RH \leq 45\%$, $V_{I-I} = 500$ VDC) (Note 10) $t = 5$ s, (HCPL-2530/2531 only)	I_{I-I}		0.005		μA
Input-Input Resistance	($V_{I-I} = 500$ VDC) (Note 10) (HCPL-2530/2531 only)	R_{I-I}		10^{11}		Ω
Input-Input Capacitance	($f = 1$ MHz) (Note 10) (HCPL-2530/2531 only)	C_{I-I}		0.03		pF

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

NOTES

- Derate linearly above 70°C free-air temperature at a rate of 0.8 mA/ $^\circ\text{C}$.
- Derate linearly above 70°C free-air temperature at a rate of 1.6 mA/ $^\circ\text{C}$.
- Derate linearly above 70°C free-air temperature at a rate of 0.9 mW/ $^\circ\text{C}$.
- Derate linearly above 70°C free-air temperature at a rate of 2.0 mW/ $^\circ\text{C}$.
- Current Transfer Ratio is defined as a ratio of output collector current, I_O , to the forward LED input current, I_F , times 100%.
- The 4.1 k Ω load represents 1 LSTTL unit load of 0.36 mA and 6.1 k Ω pull-up resistor.
- The 1.9 k Ω load represents 1 TTL unit load of 1.6 mA and 5.6 k Ω pull-up resistor.
- 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.
- Measured between pins 1 and 2 shorted together, and pins 3 and 4 shorted together.

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Fig. 1 Normalized CTR vs. Forward Current

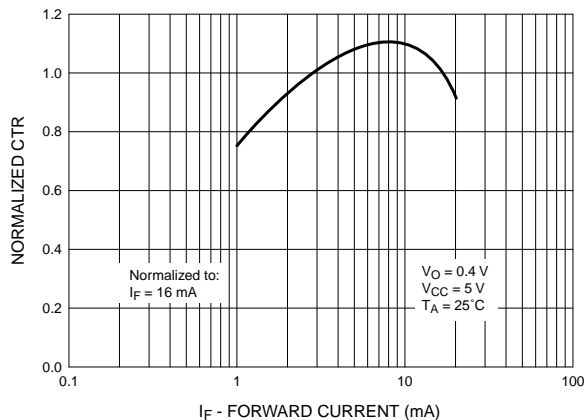


Fig. 2 Normalized CTR vs. Temperature

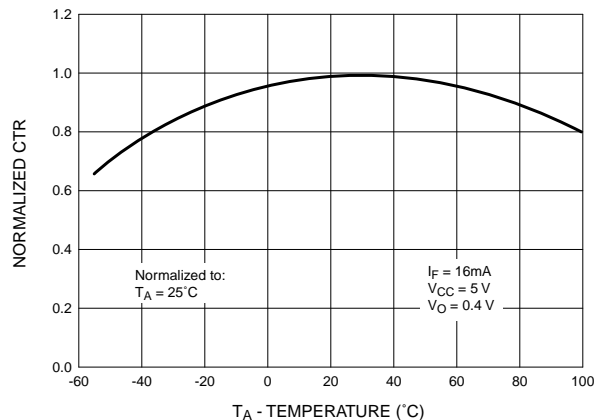


Fig. 3 Output Current vs. Output Voltage

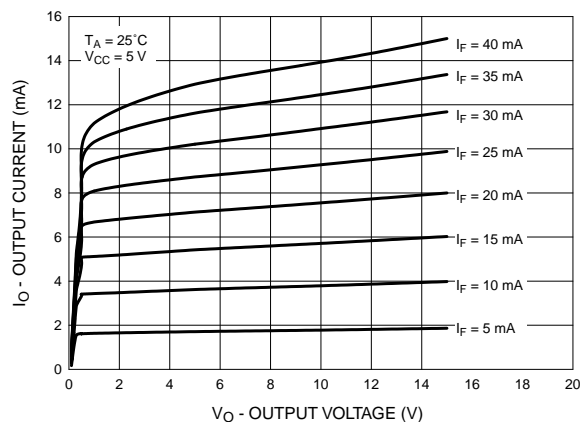


Fig. 4 Logic High Output Current vs. Temperature

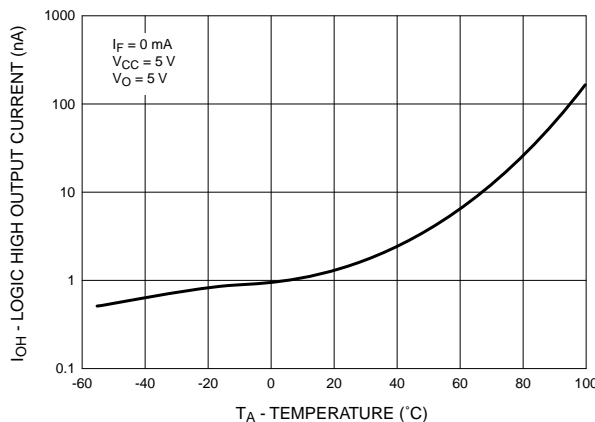


Fig. 5 Propagation Delay vs. Temperature

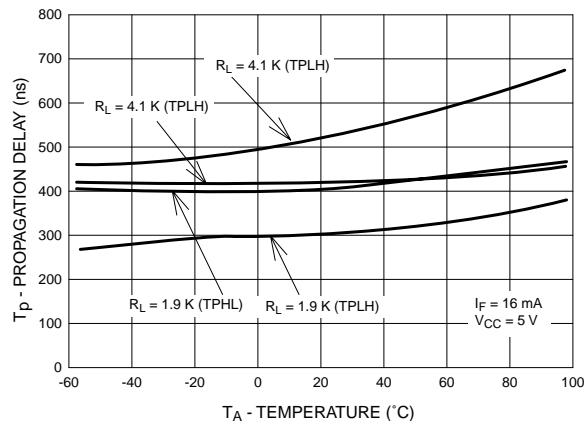
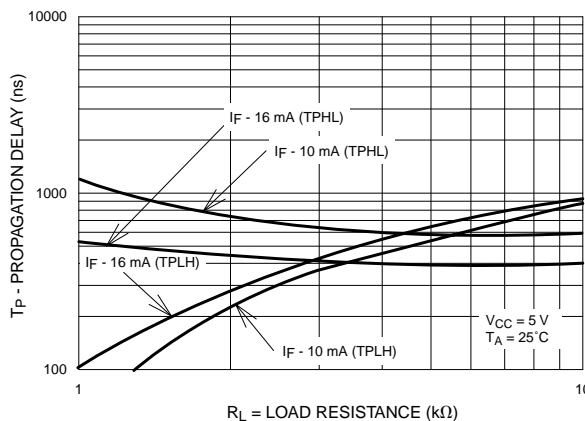
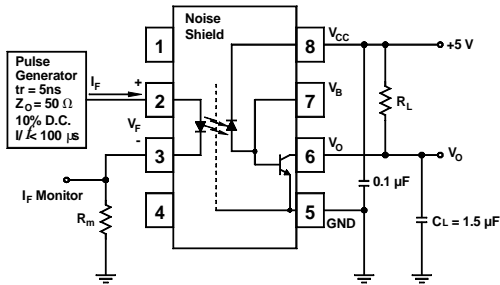


Fig. 6 Propagation Delay vs. Load Resistance

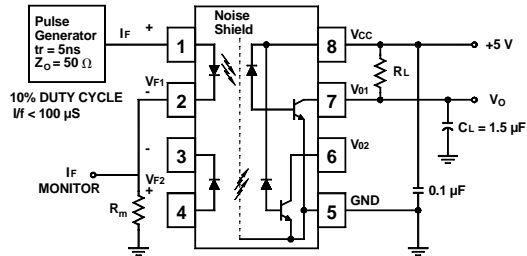


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Test Circuit for 6N135, 6N136, HCPL-2503 and HCPL-4502



Test Circuit for HCPL-2530 and HCPL-2531

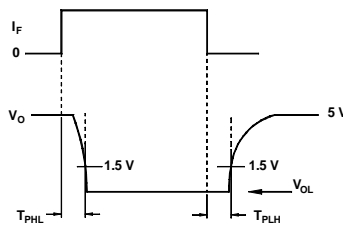
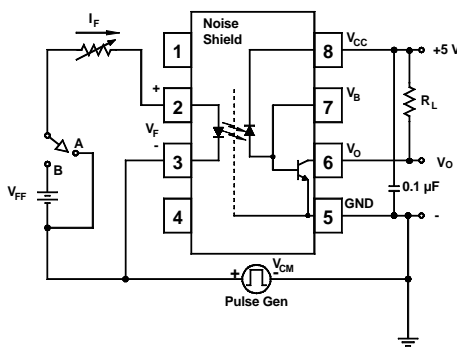
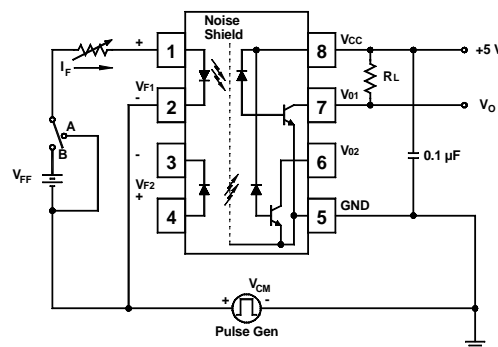


Fig. 7 Switching Time Test Circuit



Test Circuit for 6N135, 6N136, HCPL-2503 and HCPL-4502



Test Circuit for HCPL-2530 and HCPL-2531

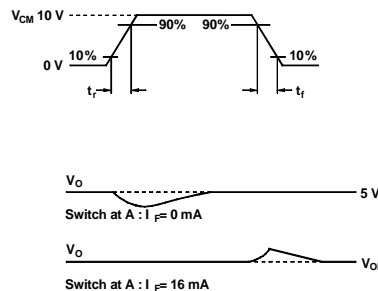
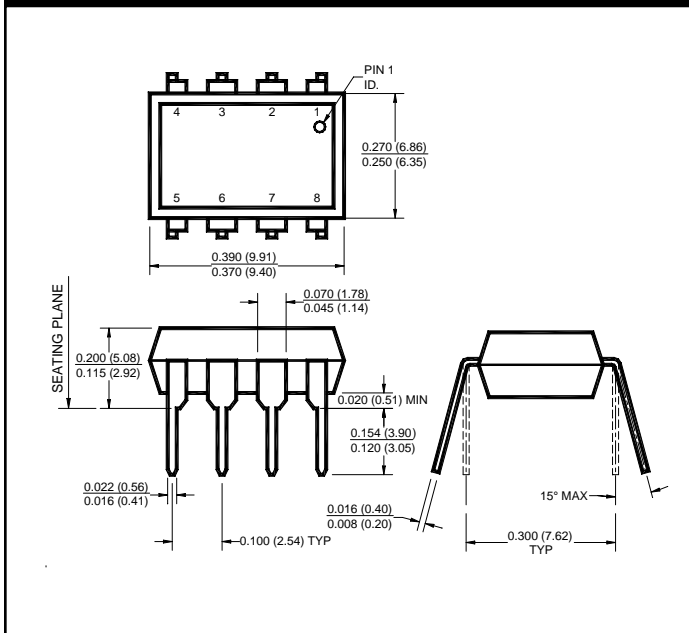


Fig. 8 Common Mode Immunity Test Circuit

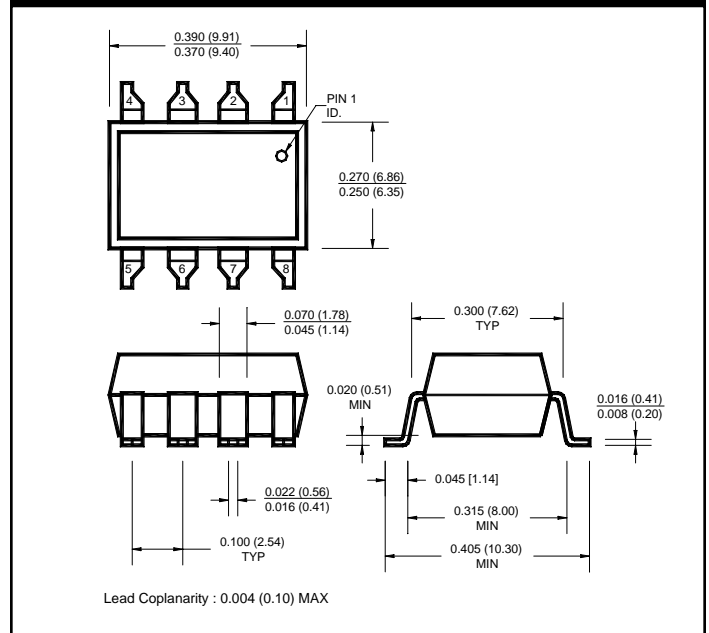
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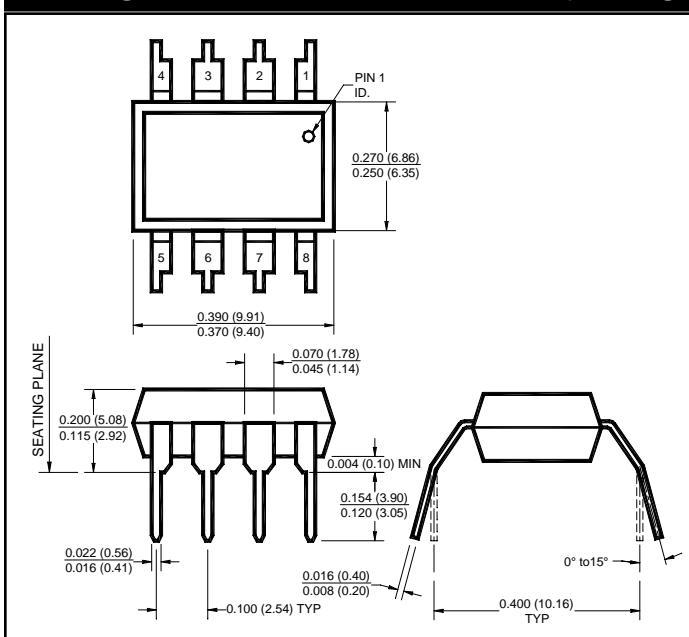
Package Dimensions (Through Hole)



Package Dimensions (Surface Mount)



Package Dimensions (0.4" Lead Spacing)



NOTE

All dimensions are in inches (millimeters)

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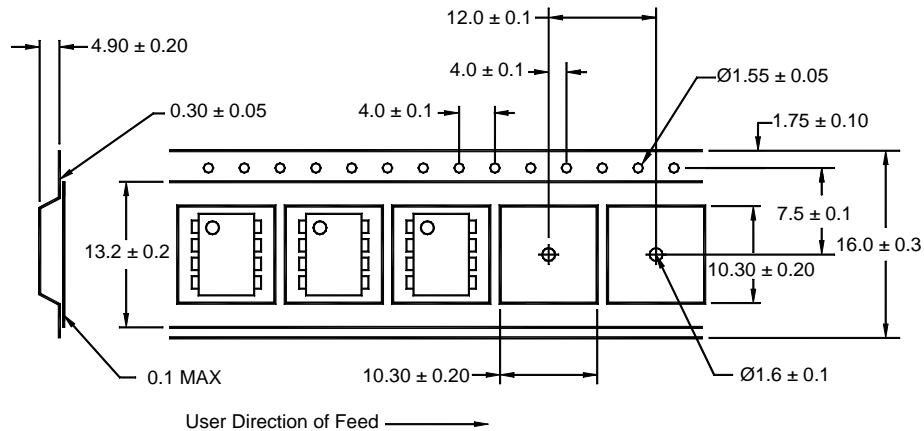
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ORDERING INFORMATION

Option	Order Entry Identifier	Description
R2	.R2	Opto Plus Reliability Conditioning
S	.S	Surface Mount Lead Bend
SD	.SD	Surface Mount; Tape and reel
SDL	.SDL	Surface Mount; Tape and reel
W	.W	0.4" Lead Spacing

QT Carrier Tape Specifications ("D" Taping Orientation)



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