

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.

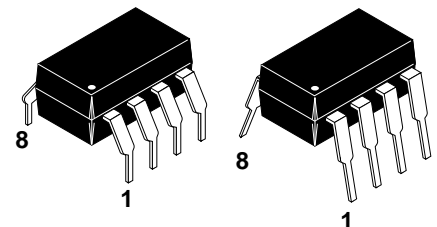
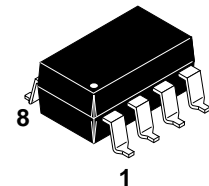
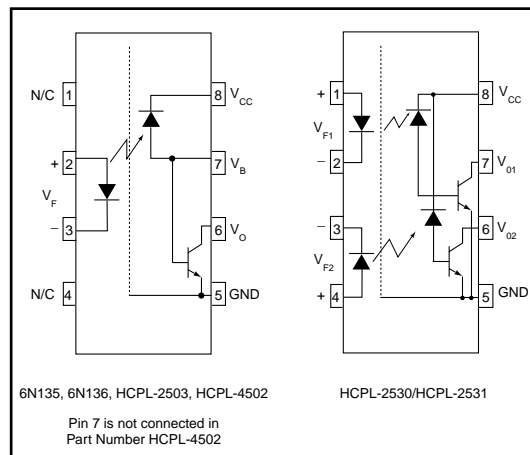
An internal noise shield provides superior common mode rejection of 10kV/μs. An improved package allows superior insulation permitting a 480 V working voltage compared to industry standard of 220 V.

FEATURES

- High speed-1 MBit/s
- Superior CMR-10 kV/μs
- 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°C unless otherwise specified)

Parameter	Symbol	Value	Units
Storage Temperature	T _{STG}	-55 to +125	°C
Operating Temperature	T _{OPR}	-55 to +100	°C
Lead Solder Temperature	T _{SOL}	260 for 10 sec	°C
EMITTER			
DC/Average Forward Input Current	I _F (avg)	25	mA
Peak Forward Input Current (50% duty cycle, 1 ms P.W.)	I _F (pk)	50	mA
Peak Transient Input Current - (≤ 1 μs P.W., 300 pps)	I _F (trans)	1.0	A
Reverse Input Voltage	V _R	5	V
Input Power Dissipation	P _D	100	mW
		45	mW
DETECTOR			
Average Output Current	I _O (avg)	8	mA
Peak Output Current	I _O (pk)	16	mA
Emitter-Base Reverse Voltage	V _{EBR}	5	V
Supply Voltage	V _{CC}	-0.5 to 30	V
Output Voltage	V _O	-0.5 to 20	V
Base Current	I _B	5	mA
Output power dissipation	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 HCPL-2530		0.18	0.4	V
					6N136 HCPL-4502 HCPL-2503		0.18	0.5	
$(I_F = 16 \text{ mA}, I_O = 3 \text{ mA})$ $(V_{CC} = 4.5 \text{ V}, T_A = 25^\circ\text{C})$	HCPL-2531			0.25	0.4				
$(I_F = 16 \text{ mA}, I_O = 0.8 \text{ mA})$ $(V_{CC} = 4.5 \text{ V})$	6N135 HCPL-2530				0.5				
$(I_F = 16 \text{ mA}, I_O = 2.4 \text{ mA})$ $(V_{CC} = 4.5 \text{ V})$	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
	$T_A = 25^\circ\text{C}$, ($R_L = 1.9\text{ k}\Omega$, $I_F = 16\text{ mA}$) (Note 7) (Fig. 7)		6N136 HCPL-4502 HCPL-2503 HCPL-2531		0.45	0.8	μs
	$T_A = 25^\circ\text{C}$, ($R_L = 4.1\text{ k}\Omega$, $I_F = 16\text{ mA}$) (Note 6) (Fig. 7)		6N135 HCPL-2530			2.0	μs
	$T_A = 25^\circ\text{C}$, ($R_L = 1.9\text{ k}\Omega$, $I_F = 16\text{ mA}$) (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
	$T_A = 25^\circ\text{C}$, ($R_L = 1.9\text{ k}\Omega$, $I_F = 16\text{ mA}$) (Note 7) (Fig. 7)		6N136 HCPL-4502 HCPL-2503 HCPL-2531		0.3	0.8	μs
	$T_A = 25^\circ\text{C}$, ($R_L = 4.1\text{ k}\Omega$, $I_F = 16\text{ mA}$) (Note 6) (Fig. 7)		6N135 HCPL-2530			2.0	μs
	$T_A = 25^\circ\text{C}$, ($R_L = 1.9\text{ k}\Omega$, $I_F = 16\text{ mA}$) (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		$\text{V}/\mu\text{s}$
	($I_F = 16\text{ mA}$, $V_{CM} = 10\text{ V}_{P-P}$) $T_A = 25^\circ\text{C}$, ($R_L = 1.9\text{ k}\Omega$) (Note 8) (Fig. 8)		6N136 HCPL-4502 HCPL-2503 HCPL-2531		10,000		$\text{V}/\mu\text{s}$

** 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

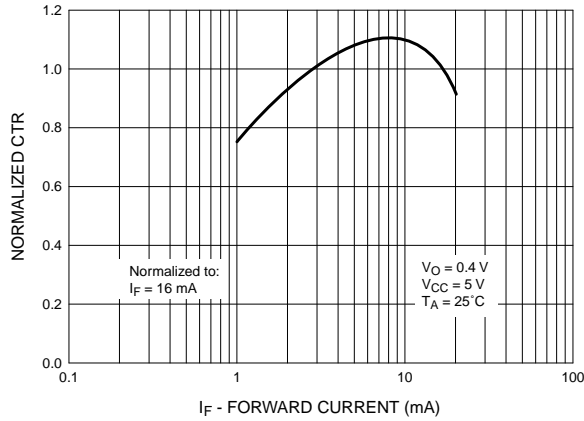


Fig. 2 Normalized CTR vs. Temperature

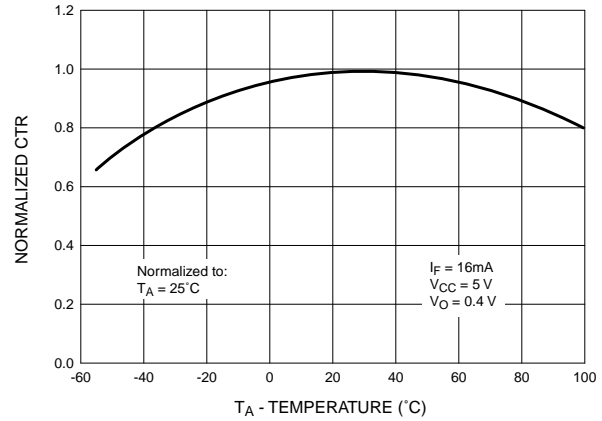


Fig. 3 Output Current vs. Output Voltage

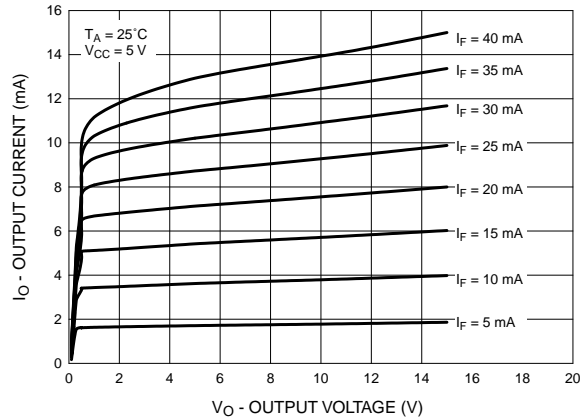


Fig. 4 Logic High Output Current vs. Temperature

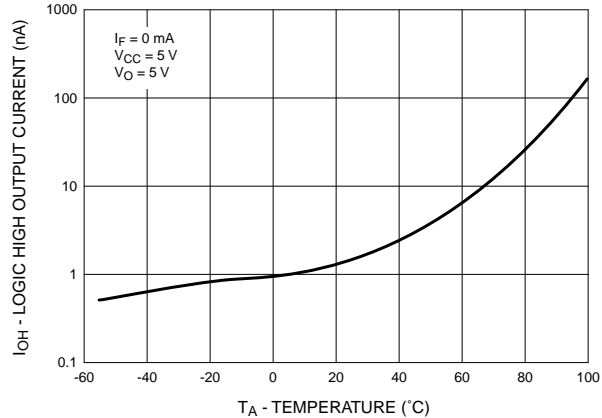


Fig. 5 Propagation Delay vs. Temperature

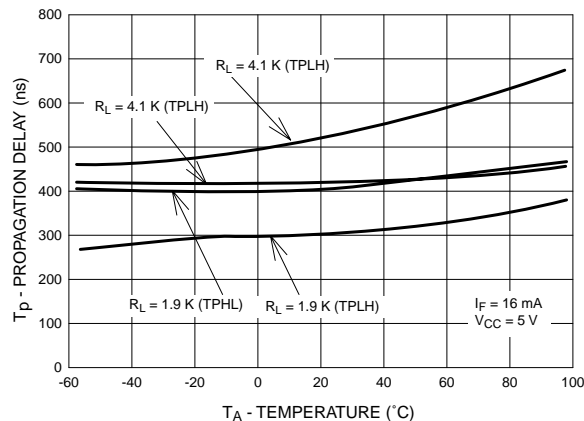
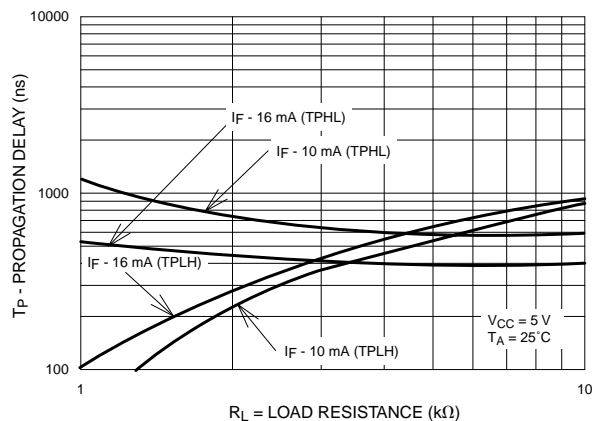
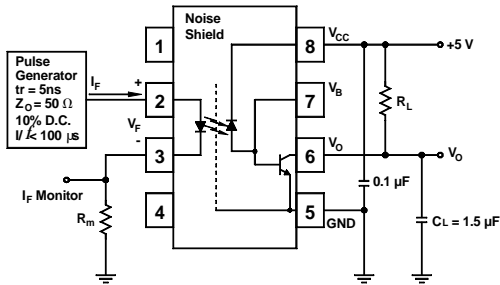


Fig. 6 Propagation Delay vs. Load Resistance

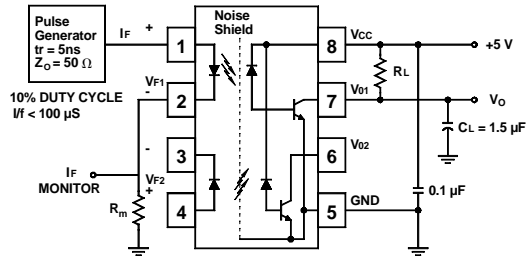


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Test Circuit for 6N135, 6N136, HCPL-2503 and HCPL-4502



Test Circuit for HCPL-2530 and HCPL-2531

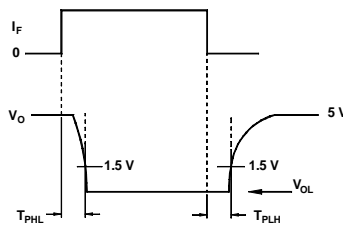
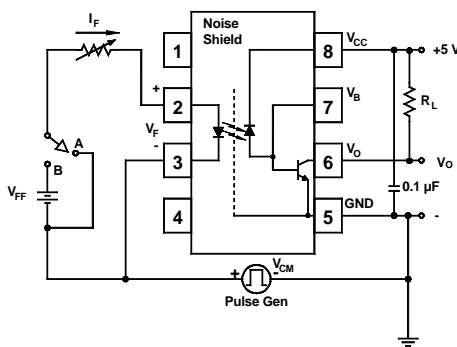
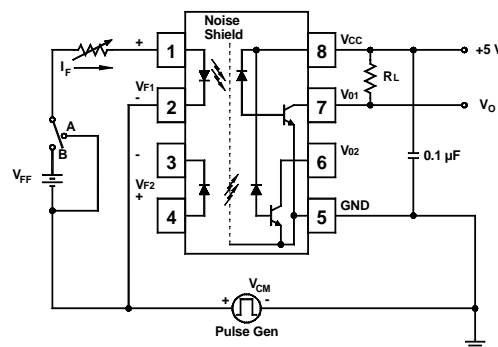


Fig. 7 Switching Time Test Circuit



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



Test Circuit for HCPL-2530 and HCPL-2531

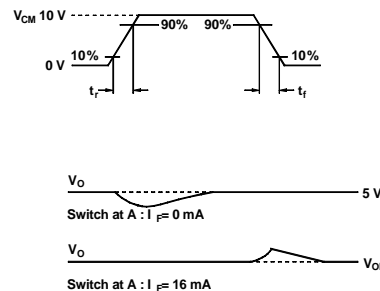
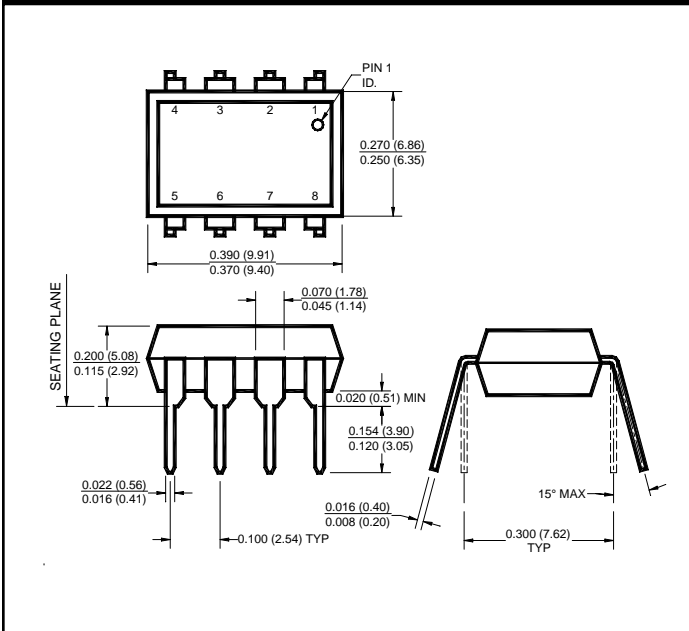


Fig. 8 Common Mode Immunity Test Circuit

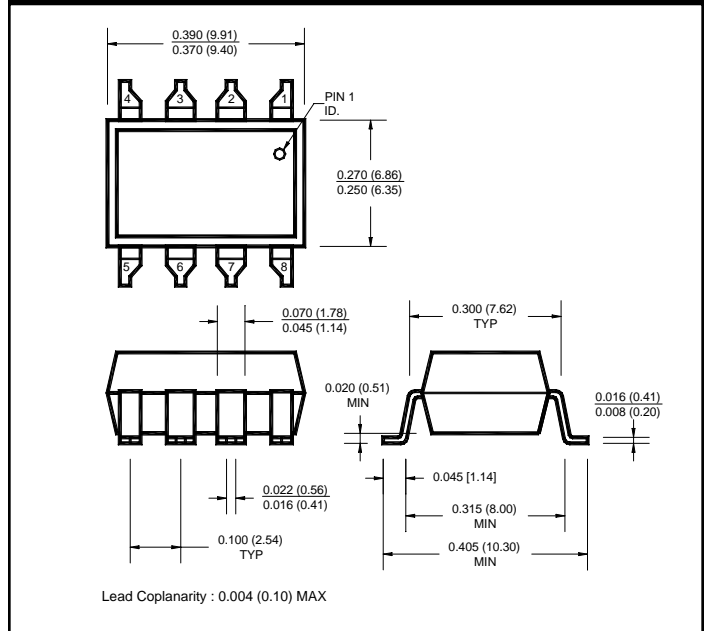
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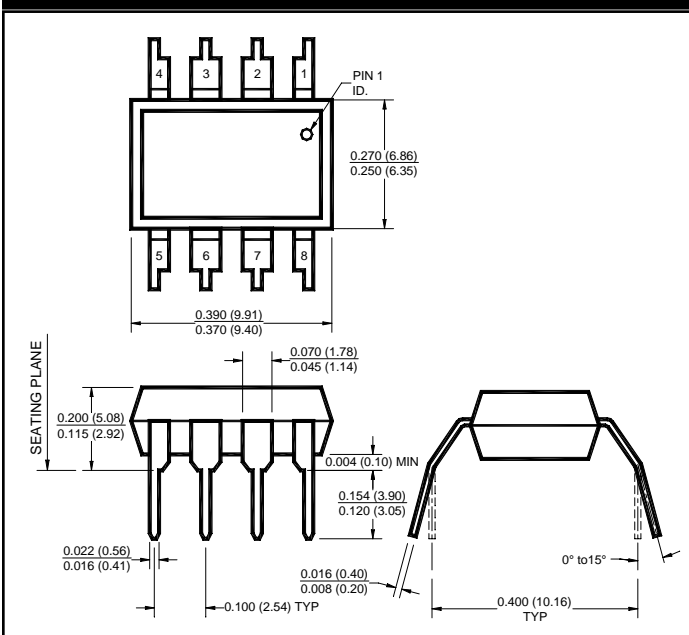
Package Dimensions (Through Hole)



Package Dimensions (Surface Mount)



Package Dimensions (0.4" Lead Spacing)



NOTE

All dimensions are in inches (millimeters)

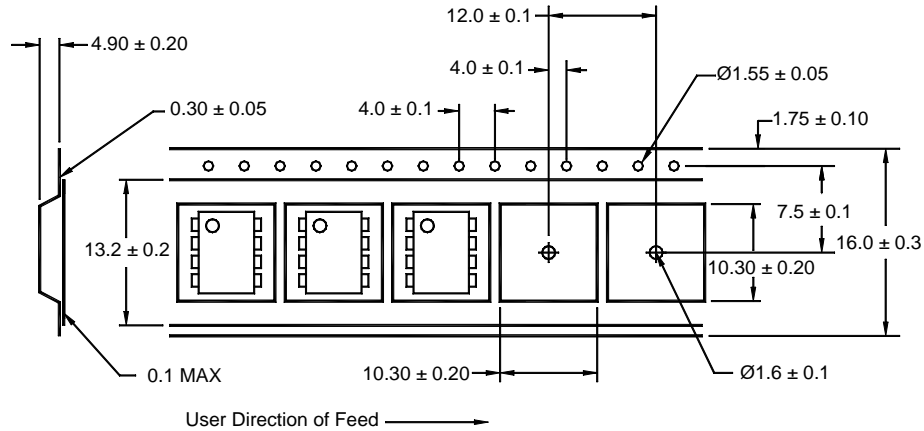
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ORDERING INFORMATION

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)



Corporate Headquarters

QT Optoelectronics
610 North Mary Avenue
Sunnyvale, CA 94086
(408) 720-1440 Phone
(408) 720-0848 Fax

North American Sales

QT Optoelectronics
16775 Addison Rd., Suite 200
Addison, TX 75001
(972) 447-1300 Phone
(972) 447-0784 Fax

European Sales

Quality Technologies Deutschland GmbH
Max-Huber-Strasse 8
D-85737 Ismaning, Germany
49 [0] 89/96.30.51 Phone
49 [0] 89/96.54.74 Fax

European Sales

QT Optoelectronics
"Le Levant"
2, rue du Nouveau Bercy
F-94277-CHARENTON-LE PONT Cedex
FRANCE
33 [0] 1.45.18.78.78 Phone
33 [0] 1.43.75.77.57 Fax

Asia/Pacific Sales

QT Optoelectronics
B613, 6th Floor
East Wing, Wisma Tractors
Jalan SS16/1, Subang Jaya
47500 Petaling Jaya
Selangor Darul Eshan, Malaysia
603/735-2417 Phone
603/736-3382 Fax

European Sales

Quality Technologies (U.K) Ltd.
10, Prebendal Court, Oxford Road
Aylesbury, Buckinghamshire
HP19-3EY United Kingdom
44 [0] 1296/30.44.99 Phone
44 [0] 1296/39.24.32 Fax

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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.