HIGH SPEED TRANSISTOR OPTOCOUPLERS

OPTOELECTRONICS

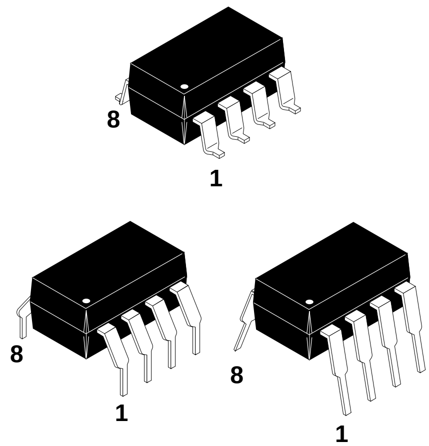
SINGLE-CHANNEL	DUAL-CHANNEL
6N135, 6N136	HCPL-2530
HCPL-2503	HCPL-2531
HCPL-4502	

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 0f 220 V.

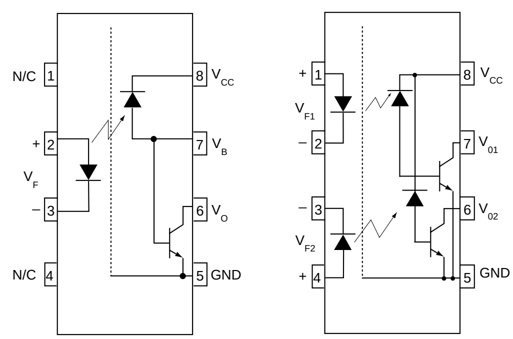


FEATURES

- 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



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

HCPL-2530/HCPL-2531

Pin 7 is not connected in Part Number HCPL-4502

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	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 - (≤ 1 µs 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)	P_D	100	mW
	(HCPL-2530/2531) Each Channel (Note 3)		45	
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)	P_D	100	mW
	(HCPL-2530, HCPL-2531) Each Channel		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°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/°C
DETECTOR Logic high output current	(I_F = 0 mA, V_O = V_{CC} = 5.5 V) (T_A =25°C)	I_{OH}	All		0.001	0.5	µA
	(I_F = 0 mA, V_O = V_{CC} = 15 V) (T_A =25°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 = Open) (V_{CC} = 15 V)	I_{CCL}	6N135 6N136 HCPL-4502 HCPL-2503		120	200	µA
	(I_{F1} = I_{F2} = 16 mA, V_O = Open) (V_{CC} = 15 V)		HCPL-2530 HCPL-2531		200	400	
Logic high supply current	(I_F = 0 mA, V_O = Open, V_{CC} = 15 V) (T_A =25°C)	I_{CCH}	6N135 6N136 HCPL-4502 HCPL-2503			1	µA
	(I_F = 0 mA, V_O = Open) (V_{CC} = 15 V)		6N135 6N136 HCPL-4502 HCPL-2503			2	
	(I_F = 0 mA, V_O = Open) (V_{CC} = 15 V)		HCPL-2530 HCPL-2531		0.02	4	

** All typicals at T_A = 25°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 mA, V_O = 0.4 V) (V_{CC} = 4.5 V, T_A =25°C)	CTR	6N135, HCPL-2530	7	18	50	%
			6N136, HCPL-4502, HCPL-2531	19	27	50	%
			HCPL-2503	12	27		%
	(I_F = 16 mA, V_O = 0.5 V) (V_{CC} = 4.5 V)		6N135, HCPL-2530	5	21		%
			6N136, HCPL-4502, HCPL-2531	15	30		%
			HCPL-2503	9	30		%
Logic low output voltage output voltage	(I_F = 16 mA, I_O = 1.1 mA) (V_{CC} = 4.5 V, T_A =25°C)	V_{OL}	6N135		0.18	0.4	V
			HCPL-2530		0.18	0.5	
	(I_F = 16 mA, I_O = 3 mA) (V_{CC} = 4.5 V, T_A =25°C)		6N136, HCPL-4502, HCPL-2503		0.25	0.4	
			HCPL-2531		0.25	0.5	
	(I_F = 16 mA, I_O = 0.8 mA) (V_{CC} = 4.5 V)		6N135, HCPL-2530			0.5	
	(I_F = 16 mA, I_O = 2.4 mA) (V_{CC} = 4.5 V)		6N136, HCPL-4502, HCPL-2503, HCPL-2531			0.5	

** All typicals at T_A = 25°C

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

Parameter	Test Conditions	Symbol	Device	Min	Typ**	Max	Unit
Propagation delay time to logic low	T_A = 25°C, (R_L = 4.1 kΩ, I_F = 16 mA) (Note 6) (Fig. 7)	T_{PHL}	6N135 HCPL-2530		0.45	1.5	µs
	(R_L = 1.9 kΩ, I_F = 16 mA) (Note 7) (Fig. 7) T_A = 25°C		6N136 HCPL-4502 HCPL-2503 HCPL-2531		0.45	0.8	µs
	(R_L = 4.1 kΩ, I_F = 16 mA) (Note 6) (Fig. 7)		6N135 HCPL-2530			2.0	µs
	(R_L = 1.9 kΩ, I_F = 16 mA) (Note 7) (Fig. 7)		6N136 HCPL-4502 HCPL-2503 HCPL-2531			1.0	µs
Propagation delay time to logic high	T_A = 25°C, (R_L = 4.1 kΩ, I_F = 16 mA) (Note 6) (Fig. 7)	T_{PLH}	6N135 HCPL-2530		0.5	1.5	µs
	(R_L = 1.9 kΩ, I_F = 16 mA) (Note 7) (Fig. 7) T_A = 25°C		6N136 HCPL-4502 HCPL-2503 HCPL-2531		0.3	0.8	µs
	(R_L = 4.1 kΩ, I_F = 16 mA) (Note 6) (Fig. 7)		6N135 HCPL-2530			2.0	µs
	(R_L = 1.9 kΩ, I_F = 16 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 mA, V_{CM} = 10 V_{P-P}, R_L = 4.1 kΩ) (Note 8) (Fig. 8) T_A = 25°C	$\|CM_H\|$	6N135 HCPL-2530		10,000		V/µs
	(I_F = 0 mA, V_{CM} = 10 V_{P-P}) T_A = 25°C, (R_L = 1.9 kΩ) (Note 8) (Fig. 8)		6N136 HCPL-4502 HCPL-2503 HCPL-2531		10,000		V/µs
Common mode transient immunity at logic low	(I_F = 16 mA, V_{CM} = 10 V_{P-P}, R_L = 4.1 kΩ) (Note 8) (Fig. 8) T_A = 25°C	$\|CM_L\|$	6N135 HCPL-2530		10,000		V/µs
	(I_F = 16 mA, V_{CM} = 10 V_{P-P}) (R_L = 1.9 kΩ) (Note 8) (Fig. 8)		6N136 HCPL-4502 HCPL-2503 HCPL-2531		10,000		V/µs

** All typicals at T_A = 25°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°C, t = 5 s) (V_{I-O} = 3000 VDC) (Note 9)	I_{I-O}			1.0	µA
Withstand insulation test voltage	(RH ≤ 50%, T_A = 25°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 ≤ 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°C

NOTES

1. Derate linearly above 70°C free-air temperature at a rate of 0.8 mA/°C.
2. Derate linearly above 70°C free-air temperature at a rate of 1.6 mA/°C.
3. Derate linearly above 70°C free-air temperature at a rate of 0.9 mW/°C.
4. Derate linearly above 70°C free-air temperature at a rate of 2.0 mW/°C.
5. Current Transfer Ratio is defined as a ratio of output collector current, I_O, to the forward LED input current, I_F, times 100%.
6. The 4.1 kΩ load represents 1 LSTTL unit load of 0.36 mA and 6.1kΩ pull-up resistor.
7. The 1.9 kΩ load represents 1 TTL unit load of 1.6 mA and 5.6 kΩ pull-up resistor.
8. 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).
9. 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.
10. 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

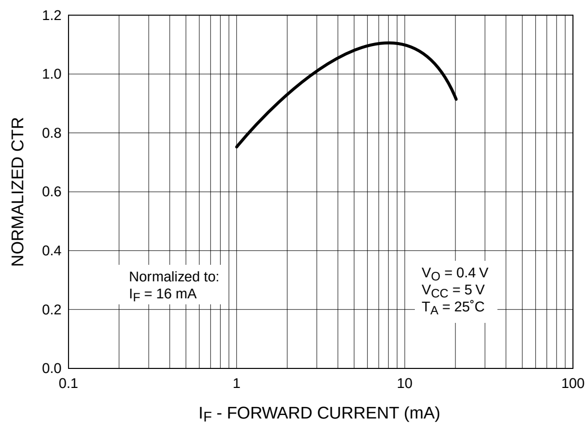


Fig. 2 Normalized CTR vs. Temperature

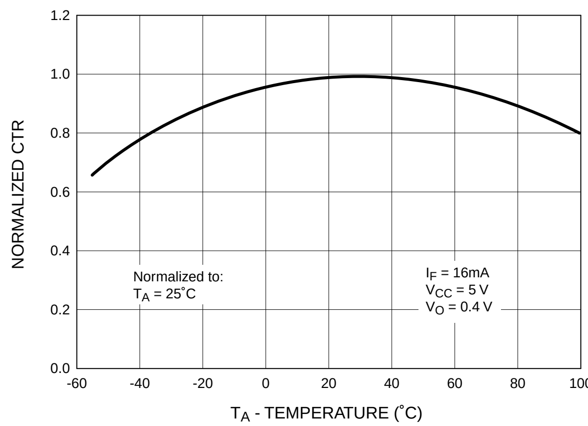


Fig. 3 Output Current vs. Output Voltage

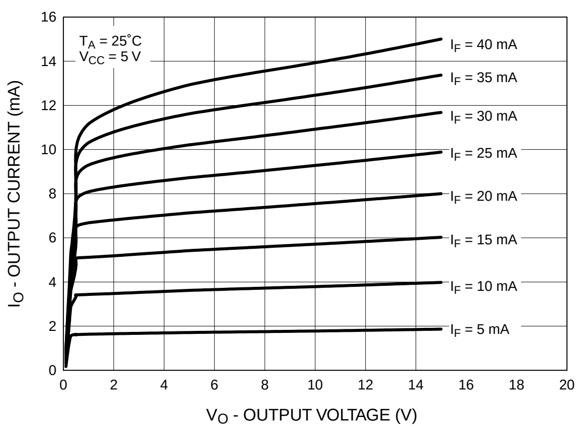


Fig. 4 Logic High Output Current vs. Temperature

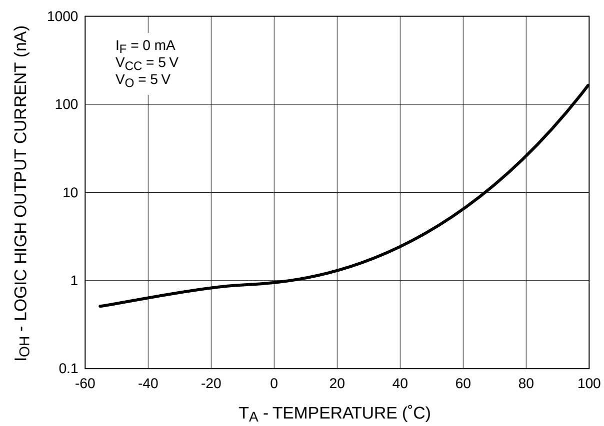


Fig. 5 Propagation Delay vs. Temperature

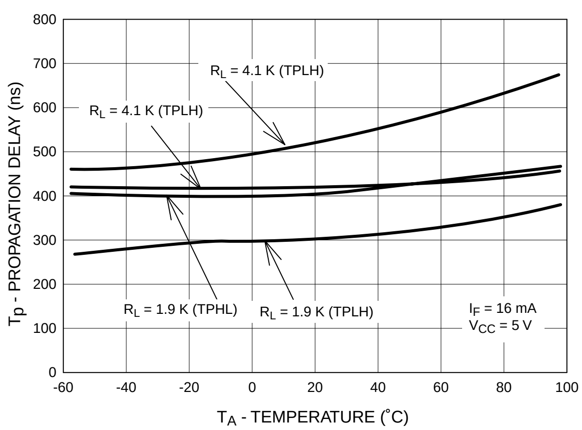
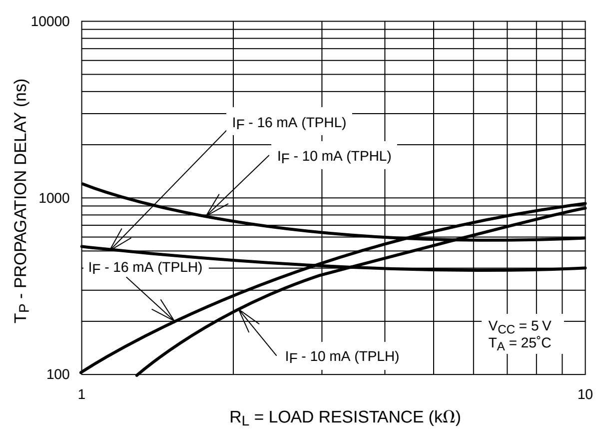


Fig. 6 Propagation Delay vs. Load Resistance



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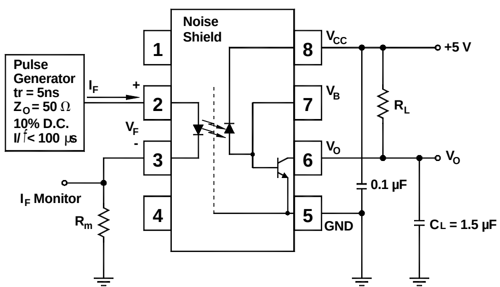
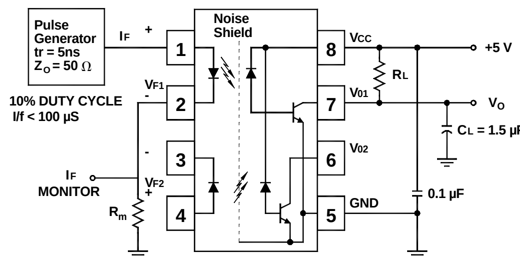
HCPL-2503	HCPL-2531
HCPL-4502	



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



Test Circuit for HCPL-2530 and HCPL-2531

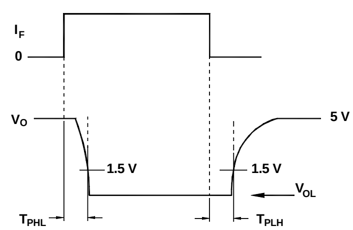
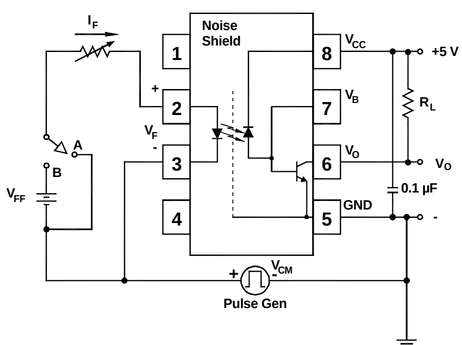
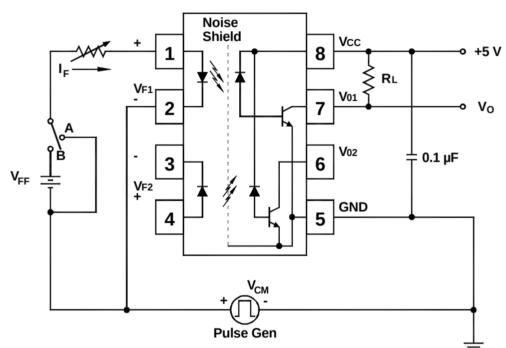


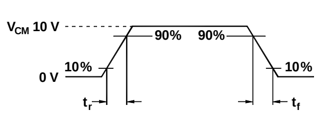
Fig. 7 Switching Time Test Circuit



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



Test Circuit for HCPL-2530 and HCPL-2531



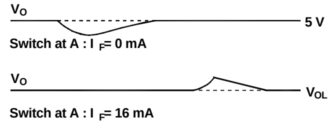


Fig. 8 Common Mode Immunity Test Circuit

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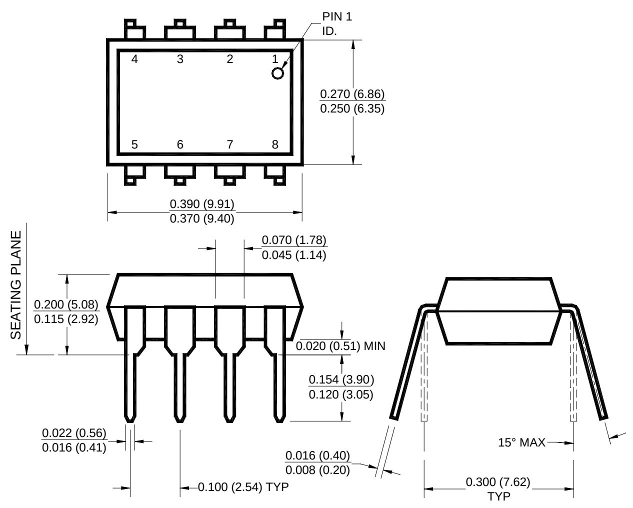
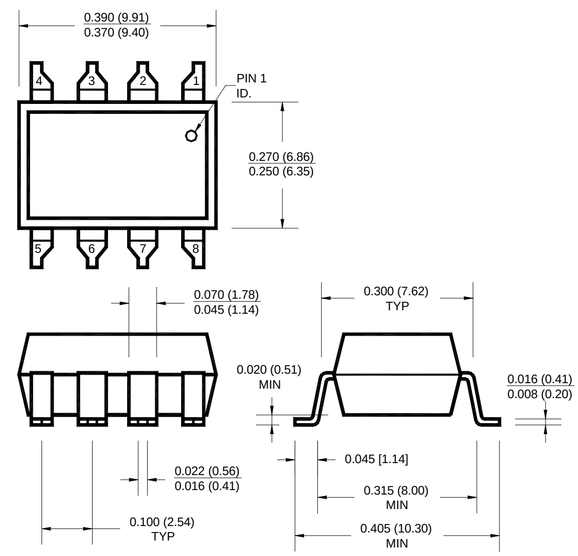
Package Dimensions (Through Hole)

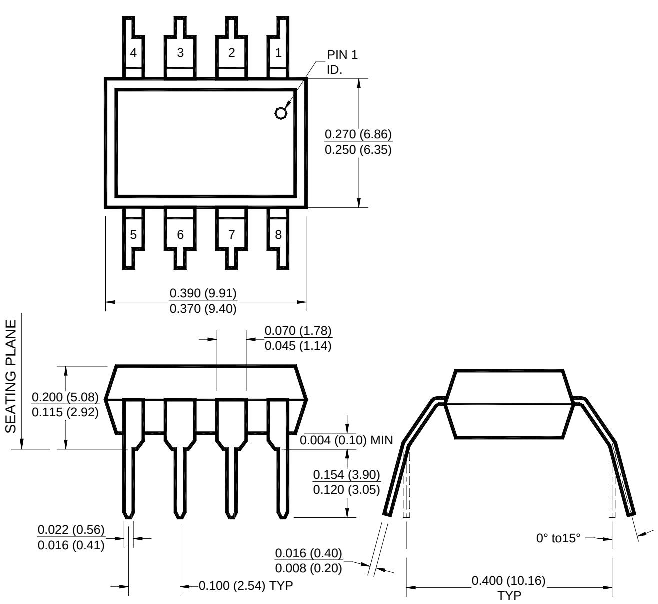


Package Dimensions (Surface Mount)



Lead Coplanarity : 0.004 (0.10) MAX

Package Dimensions (0.4”Lead Spacing)



NOTE

All dimensions are in inches (millimeters)

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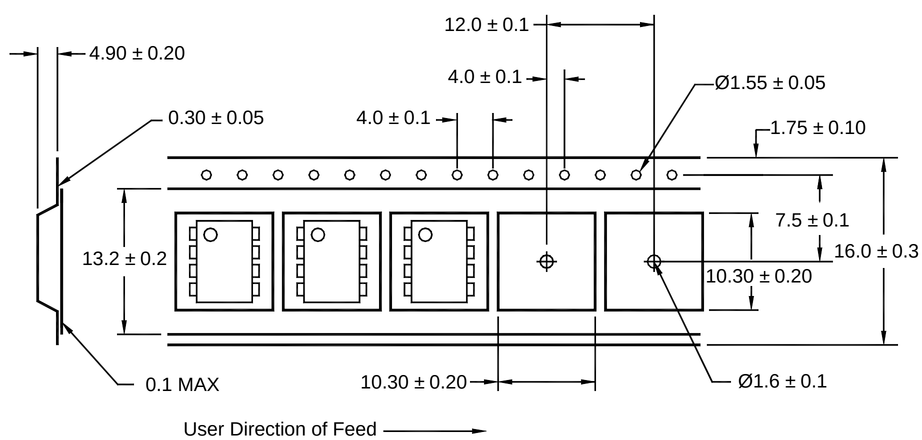
ORDERING INFORMATION

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)



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