HIGH SPEED TRANSISTOR OPTOCOUPLERS

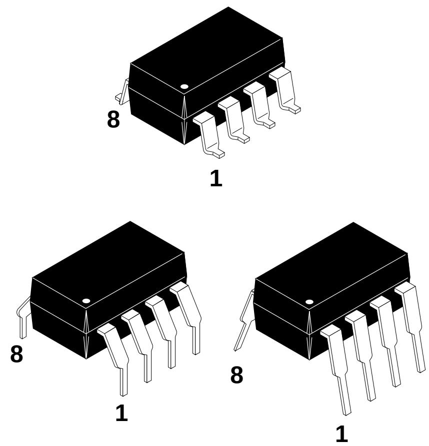
SINGLE-CHANNEL	DUAL-CHANNEL
6N135, 6N136	HCPL-2530
HCPL-2503	HCPL-2531
HCPL-4502	

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.

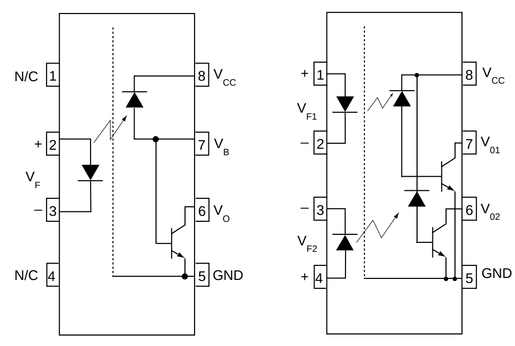


FEATURES

- 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) (HCPL-2530/2531) Each Channel (Note 3)	P_D	100 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)	P_D	100	mW
	(HCPL-2530, HCPL-2531) Each Channel		35	mW

OPTOELECTRONICS

HIGH SPEED TRANSISTOR OPTOCOUPLERS

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

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

OPTOELECTRONICS

HIGH SPEED TRANSISTOR OPTOCOUPLERS

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

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

HIGH SPEED
TRANSISTOR OPTOCOUPLERS

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

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

HIGH SPEED TRANSISTOR OPTOCOUPLERS

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

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.

HIGH SPEED TRANSISTOR OPTOCOUPLERS

OPTOELECTRONICS

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

Fig. 1 Normalized CTR vs. Forward Current

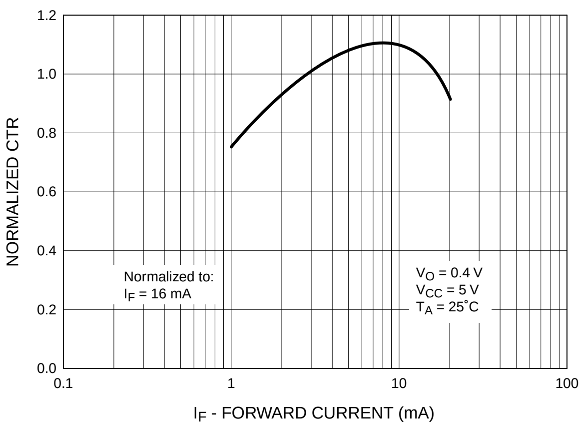


Fig. 2 Normalized CTR vs. Temperature

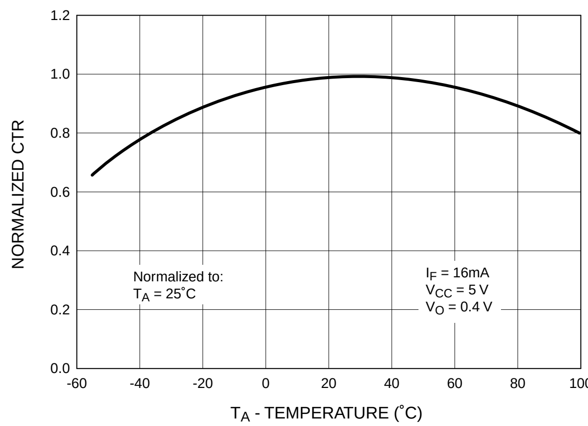


Fig. 3 Output Current vs. Output Voltage

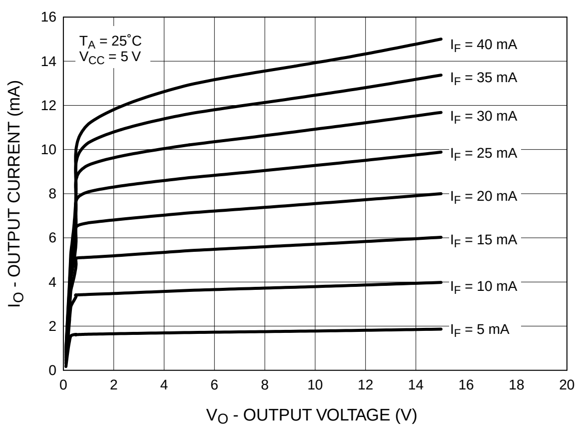


Fig. 4 Logic High Output Current vs. Temperature

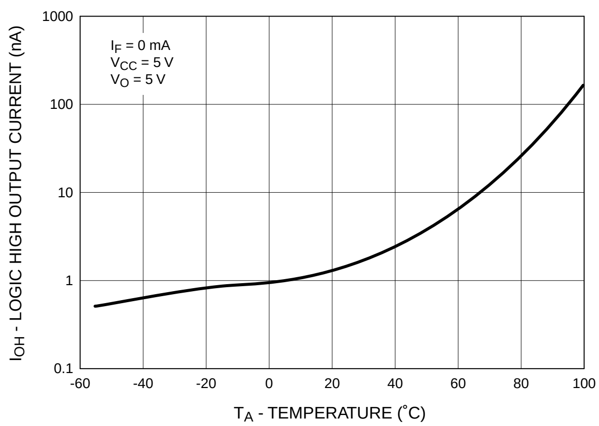


Fig. 5 Propagation Delay vs. Temperature

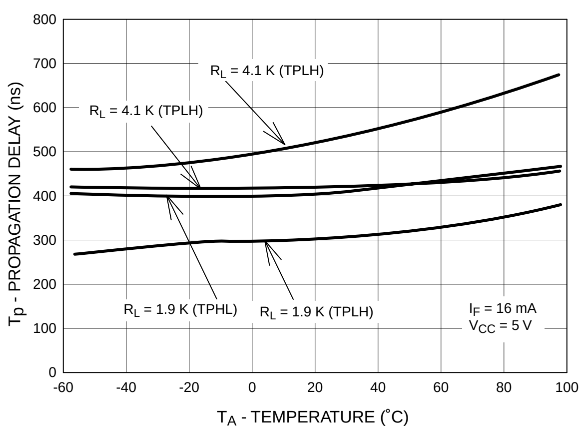
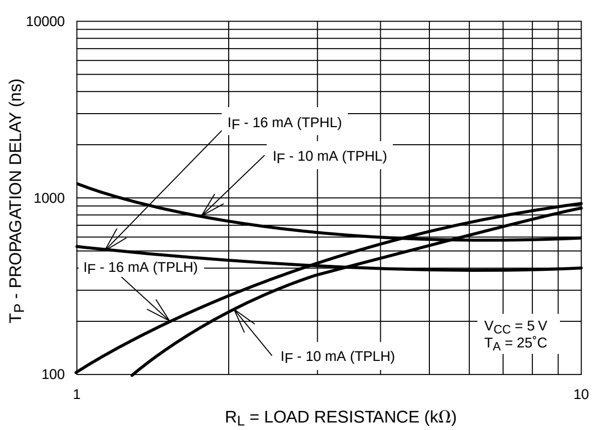
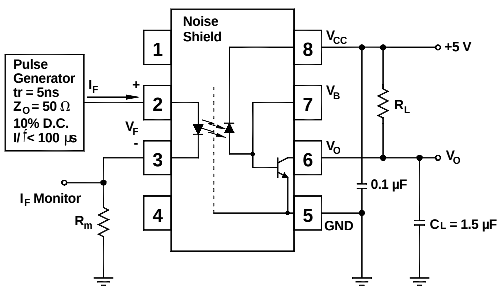


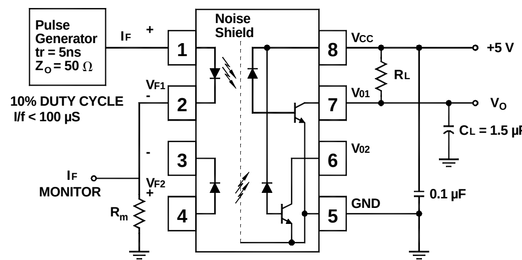
Fig. 6 Propagation Delay vs. Load Resistance



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



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



Test Circuit for HCPL-2530 and HCPL-2531

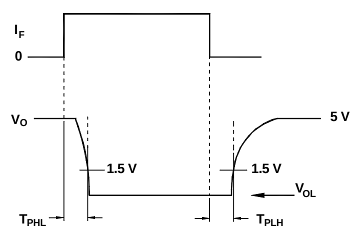
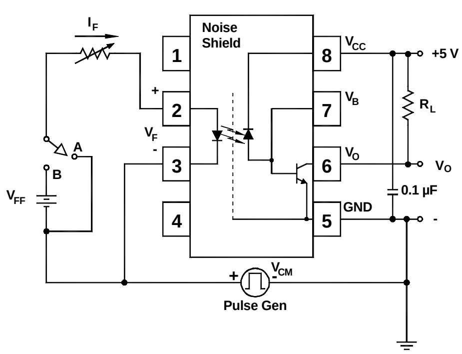
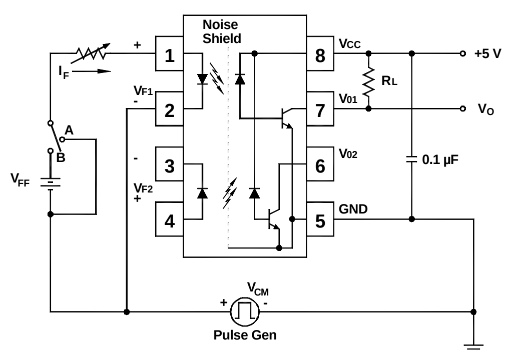


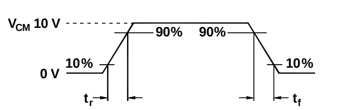
Fig. 7 Switching Time Test Circuit



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



Test Circuit for HCPL-2530 and HCPL-2531



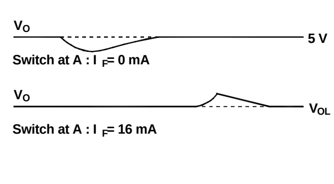
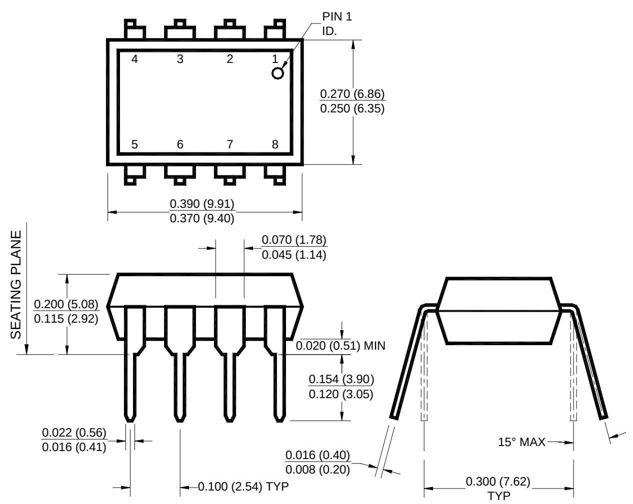


Fig. 8 Common Mode Immunity Test Circuit

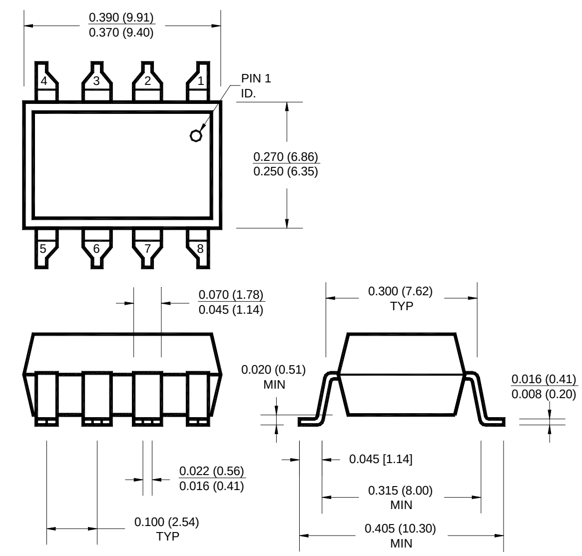
HIGH SPEED TRANSISTOR OPTOCOUPLERS

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

Package Dimensions (Through Hole)

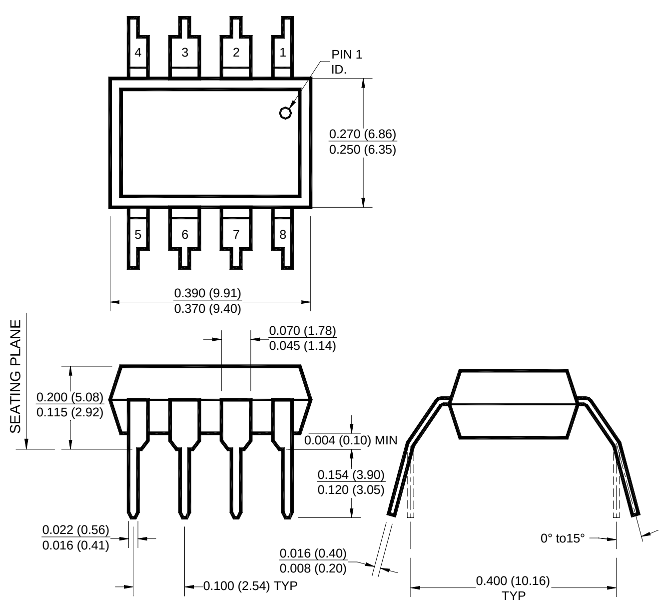


Package Dimensions (Surface Mount)



Lead Coplanarity : 0.004 (0.10) MAX

Package Dimensions (0.4"Lead Spacing)



NOTE

All dimensions are in inches (millimeters)

www.qtopto.com

Call QT Optoelectronics for more information or the phone number of your nearest distributor.

United States 800-533-6786 • France 33 [0] 1.45.18.78.78 • Germany 49 [0] 89/96.30.51 • United Kingdom 44 [0] 1296 394499 • Asia/Pacific 603-7352417

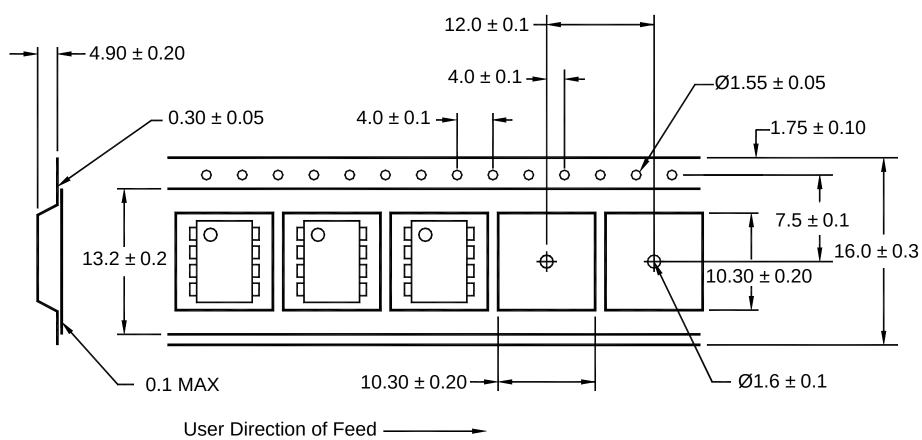
HIGH SPEED TRANSISTOR OPTOCOUPLERS

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

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

www.qtopto.com

Call QT Optoelectronics for more information or the phone number of your nearest distributor.

United States 800-533-6786 • France 33 [0] 1.45.18.78.78 • Germany 49 [0] 89/96.30.51 • United Kingdom 44 [0] 1296 394499 • Asia/Pacific 603-7352417