Single-Channel: 6N135, 6N136, HCPL-2503, HCPL-4502
Dual-Channel: HCPL-2530, HCPL-2531
High Speed Transistor Optocouplers

Features

- High speed–1MBit/s
- Superior CMR-10kV/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

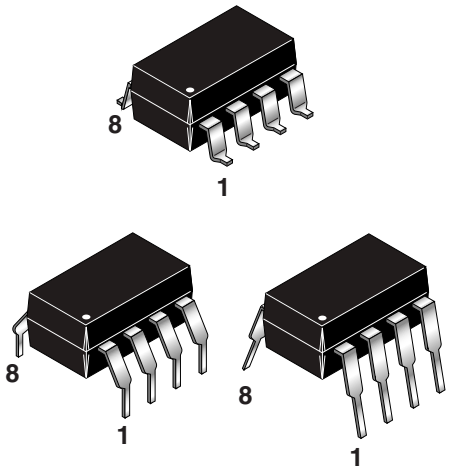
Description

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.

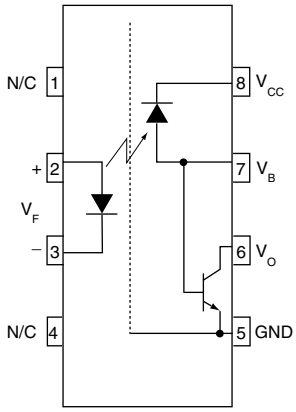
A separate connection for the bias of the photodiode improves the speed by several orders of magnitude over conventional phototransistor optocouplers by reducing the base-collector capacitance of the input transistor.

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

Package

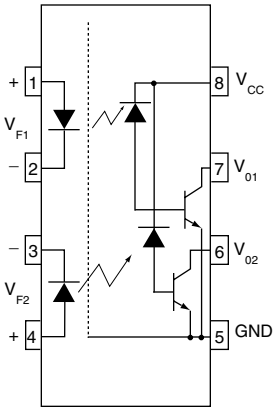


Schematic



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

Pin 7 is not connected in
Part Number HCPL-4502



HCPL-2530/HCPL-2531

Absolute Maximum Ratings (T_A = 25°C unless otherwise specified)

Symbol	Parameter	Condition	Value	Units
T_{STG}	Storage Temperature		-55 to +125	°C
T_{OPR}	Operating Temperature		-55 to +100	°C
T_{SOL}	Lead Solder Temperature		260 for 10 sec	°C
EMITTER				
I_F (avg)	DC/Average Forward Input Current Each Channel[1]		25	mA
I_F (pk)	Peak Forward Input Current Each Channel[2]	50% duty cycle, 1ms P.W.	50	mA
I_F (trans)	Peak Transient Input Current Each Channel	≤1 µs P.W., 300pps	1.0	A
V_R	Reverse Input Voltage Each Channel		5	V
P_D	Input Power Dissipation Each Channel	6N135/6N136 and HCPL-2503/4502	100	mW
		HCPL-2530/253[3]	45	
DETECTOR				
I_O (avg)	Average Output Current Each Channel		8	mA
I_O (pk)	Peak Output Current Each Channel		16	mA
V_{EBR}	Emitter-Base Reverse Voltage	6N135, 6N136 and HCPL-2503 only	5	V
V_{CC}	Supply Voltage		-0.5 to 30	V
V_O	Output Voltage		-0.5 to 20	V
I_B	Base Current	6N135, 6N136 and HCPL-2503 only	5	mA
PD	Output Power Dissipation Each Channel	6N135, 6N136, HCPL-2503, HCPL-4502[4]	100	mW
		HCPL-2530, HCPL-2531	35	mW

Notes:

1. Derate linearly above 70°C free-air temperature at a rate of 0.8mA/°C.
2. Derate linearly above 70°C free-air temperature at a rate of 1.6mA/°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.

Electrical Characteristics (T_A = 0 to 70°C Unless otherwise specified)

Individual Component Characteristics

Symbol	Parameter	Test Conditions	Device	Min.	Typ.*	Max.	Unit
EMITTER							
V_F	Input Forward Voltage	I_F = 16mA, T_A =25°C			1.45	1.7	V
		I_F = 16mA				1.8	
B_{VR}	Input Reverse Breakdown Voltage	I_R = 10 µA		5.0			V
$\Delta V_F/\Delta T_A$	Temperature Coefficient of Forward Voltage	I_F = 16mA			-1.6		mV/°C
DETECTOR							
I_{OH}	Logic High Output Current	I_F = 0mA, V_O = V_{CC} = 5.5V, T_A =25°C	All		0.001	0.5	µA
		I_F = 0mA, V_O = V_{CC} = 15V, T_A =25°C	6N135 6N136 HCPL-4502 HCPL-2503		0.005	1	
		I_F = 0mA, V_O = V_{CC} = 15V	All			50	
I_{CCL}	Logic Low Supply Current	I_F = 16mA, V_O = Open, V_{CC} = 15V	6N135 6N136 HCPL-4502 HCPL-2503		120	200	µA
		I_{F1} = I_{F2} = 16mA, V_O = Open, V_{CC} = 15V	HCPL-2530 HCPL-2531		200	400	
I_{CCH}	Logic High Supply Current	I_F = 0mA, V_O = Open, V_{CC} = 15V, T_A =25°C	6N135 6N136 HCPL-4502 HCPL-2503			1	µA
		I_F = 0mA, V_O = Open, V_{CC} = 15V	6N135 6N136 HCPL-4502 HCPL-2503			2	
		I_F = 0mA, V_O = Open, V_{CC} = 15V	HCPL-2530 HCPL-2531		0.02	4	

*All Typicals at T_A = 25°C

Transfer Characteristics (T_A = 0 to 70°C Unless otherwise specified)

Symbol	Parameter	Test Conditions		Device	Min.	Typ.*	Max.	Unit
COUPLED								
CTR	Current Transfer Ratio[5]	I_F = 16mA, V_O = 0.4 V, V_{CC} = 4.5V, T_A =25°C		6N135 HCPL-2530	7	18	50	%
				6N136 HCPL-4502 HCPL-2531	19	27	50	%
				HCPL-2503	12	27		%
		I_F = 16mA, V_{CC} = 4.5V	V_{OL} = 0.4V	6N135	5	21		%
			V_{OL} = 0.5V	HCPL-2530				
			V_{OL} = 0.4V	6N136 HCPL-4502	15	30		%
			V_{OL} = 0.5V	HCPL-2531				
			V_{OL} = 0.4V	HCPL-2503	9	30		%
V_{OL}	Logic LOW Output Voltage	I_F = 16mA, I_O = 1.1mA, V_{CC} = 4.5V, T_A =25°C		6N135		0.18	0.4	V
				HCPL-2530		0.18	0.5	
		I_F = 16mA, I_O = 3mA, V_{CC} = 4.5V, T_A =25°C		6N136 HCPL-2503		0.25	0.4	
				HCPL-2531		0.25	0.5	
		I_F = 16mA, I_O = 0.8mA, V_{CC} = 4.5V		6N135 HCPL-2530			0.5	
		I_F = 16mA, I_O = 2.4mA, V_{CC} = 4.5V		HCPL-4502 HCPL-2531			0.5	

*All Typicals at T_A = 25°C

Note:

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%.

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

Symbol	Parameter	Test Conditions	Device	Min.	Typ.*	Max.	Unit
T_{PHL}	Propagation Delay Time to Logic LOW	T_A = 25°C, R_L = 4.1kΩ, I_F = 16mA[6] (Fig. 7)	6N135 HCPL-2530		0.45	1.5	µs
		R_L = 1.9kΩ, I_F = 16mA, T_A = 25°C[7] (Fig. 7)	6N136 HCPL-4502 HCPL-2503 HCPL-2531		0.45	0.8	µs
		R_L = 4.1kΩ, I_F = 16mA[6] (Fig. 7)	6N135 HCPL-2530			2.0	µs
		R_L = 1.9kΩ, I_F = 16mA[7] (Fig. 7)	6N136 HCPL-4502 HCPL-2503 HCPL-2531			1.0	µs
T_{PLH}	Propagation Delay Time to Logic HIGH	T_A = 25°C, (R_L = 4.1kΩ, I_F = 16mA[6] (Fig. 7)	6N135 HCPL-2530		0.5	1.5	µs
		R_L = 1.9kΩ, I_F = 16mA[7] (Fig. 7) T_A = 25°C	6N136 HCPL-4502 HCPL-2503 HCPL-2531		0.3	0.8	µs
		R_L = 4.1kΩ, I_F = 16mA[6] (Fig. 7)	6N135 HCPL-2530			2.0	µs
		R_L = 1.9kΩ, I_F = 16mA[7] (Fig. 7)	6N136 HCPL-4502 HCPL-2503 HCPL-2531			1.0	µs
$\|CM_H\|$	Common Mode Transient Immunity at Logic High	I_F = 0mA, V_{CM} = 10V_{P-P}, R_L = 4.1kΩ, T_A = 25°C[8] (Fig. 8)	6N135 HCPL-2530		10,000		V/µs
		I_F = 0mA, V_{CM} = 10V_{P-P} R_L = 1.9kΩ, T_A = 25°C[8] (Fig. 8)	6N136 HCPL-4502 HCPL-2503 HCPL-2531		10,000		V/µs
$\|CM_L\|$	Common Mode Transient Immunity at Logic Low	I_F = 16mA, V_{CM} = 10 V_{P-P} R_L = 4.1kΩ, T_A = 25°C[8] (Fig. 8)	6N135 HCPL-2530		10,000		V/µs
		I_F = 16mA, V_{CM} = 10 V_{P-P} R_L = 1.9kΩ[8] (Fig. 8)	6N136 HCPL-4502 HCPL-2503 HCPL-2531		10,000		V/µs

** All Typicals at T_A = 25°C

Notes:

6. The 4.1kΩ load represents 1 LSTTL unit load of 0.36mA and 6.1kΩ pull-up resistor.
7. The 1.9kΩ load represents 1 TTL unit load of 1.6mA and 5.6kΩ 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 > 2.0V). 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 < 0.8V).

Isolation Characteristics (T_A = 0 to 70°C Unless otherwise specified)

Symbol	Characteristics	Test Conditions	Min	Typ**	Max	Unit
I_{I-O}	Input-Output Insulation Leakage Current	Relative humidity = 45%, T_A = 25°C, t = 5s, V_{I-O} = 3000 VDC[9]			1.0	µA
V_{ISO}	Withstand Insulation Test Voltage	RH ≤ 50%, T_A = 25°C, I_{I-O} ≤ 2 µA, t = 1 min.[9]	2500			V_{RMS}
R_{I-O}	Resistance (Input to Output)	V_{I-O} = 500VDC[9]		10^{12}		Ω
C_{I-O}	Capacitance (Input to Output)	f = 1 MHz[9]		0.6		pF
HFE	DC Current Gain	I_O = 3mA, V_O = 5V[9]		150		
I_{I-I}	Input-Input Insulation Leakage Current	RH ≤ 45%, V_{I-I} = 500VDC[10] t = 5 s, (HCPL-2530/2531 only)		0.005		µA
R_{I-I}	Input-Input Resistance	V_{I-I} = 500 VDC[10] (HCPL-2530/2531 only)		10^{11}		Ω
C_{I-I}	Input-Input Capacitance	f = 1MHz)[10] (HCPL-2530/2531 only)		0.03		pF

Notes:

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.

Fig. 1 Normalized CTR vs. Forward Current

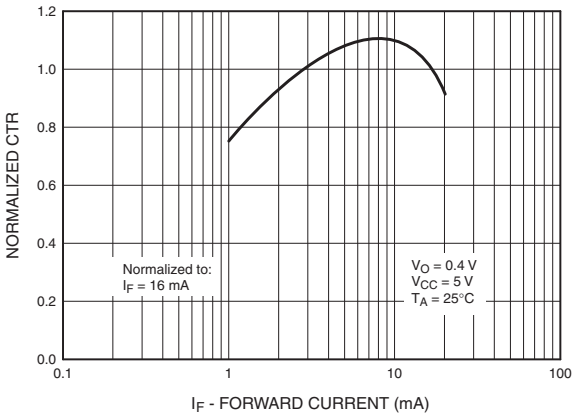


Fig. 2 Normalized CTR vs. Temperature

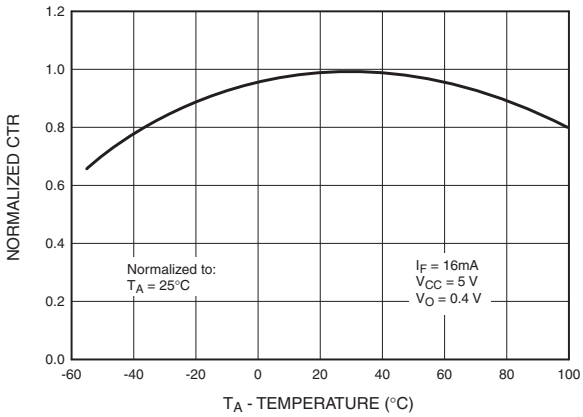


Fig. 3 Output Current vs. Output Voltage

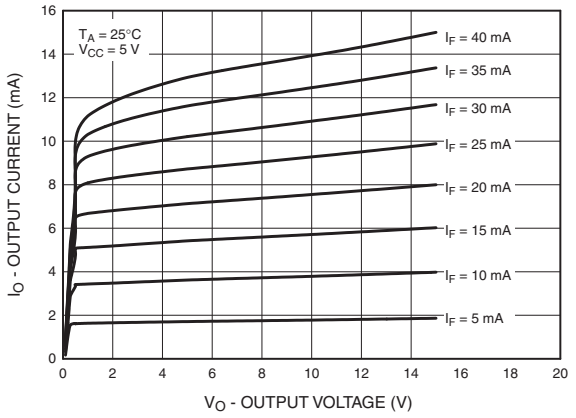


Fig. 4 Logic High Output Current vs. Temperature

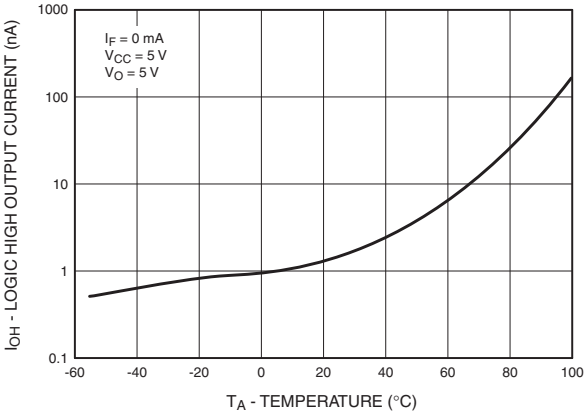


Fig. 5 Propagation Delay vs. Temperature

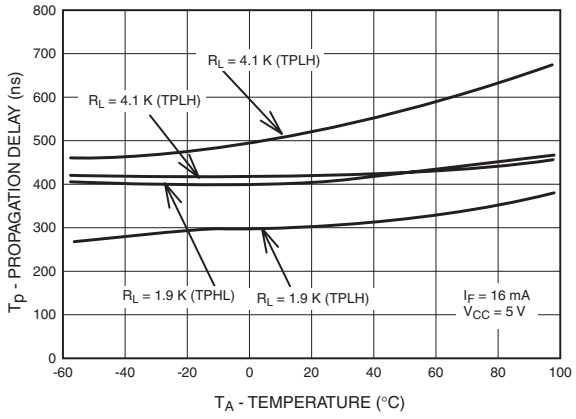
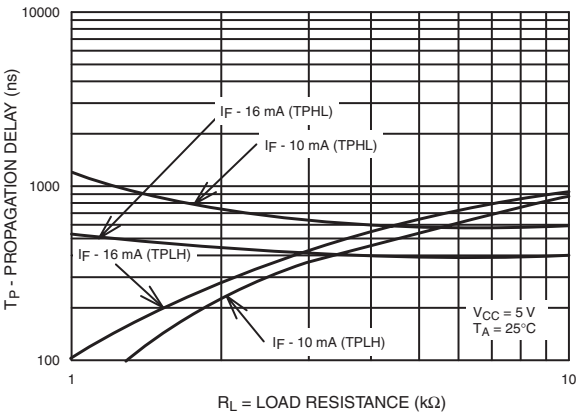


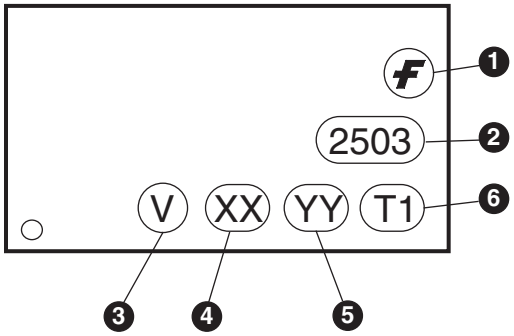
Fig. 6 Propagation Delay vs. Load Resistance



Ordering Information

Option	Example Part Number	Description
S	6N135S	Surface Mount Lead Bend
SD	6N135SD	Surface Mount; Tape and reel
W	6N135W	0.4" Lead Spacing
V	6N135V	VDE0884
WV	6N135WV	VDE0884; 0.4” lead spacing
SV	6N135SV	VDE0884; surface mount
SDV	6N135SDV	VDE0884; surface mount; tape and reel

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