SOOS016 D3115, APRIL 1988

- Compatible with TTL Inputs
- High-Speed Switching . . . 1 Mbit/s Typ
- Bandwidth . . . 2 MHz Typ
- High Common-Mode Transient Immunity . . . 1000 V/μs Typ
- High-Voltage Electrical Insulation . . . 3000 V DC Min
- Open-Collector Output
- UL Recognized . . . File Number 65085

description

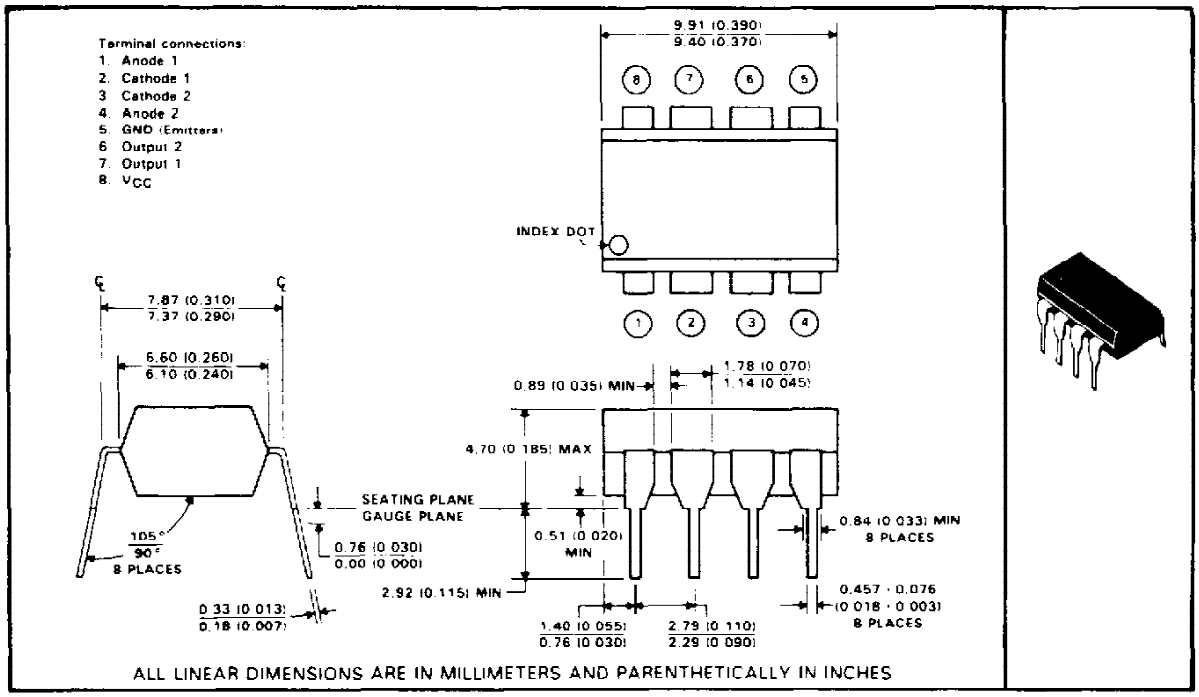
These high-speed optocouplers are designed for use in analog or digital interface applications that require high-voltage isolation between the input and output. Applications include line receivers that require high common-mode transient immunity, and analog or logic circuits that require input-to-output electrical isolation.

Each HCPL2530 and HCPL3531 optocoupler consists of two light-emitting diodes and two integrated photon detectors. Each detector is composed of a photodiode and an open-collector output transistor. Separate connections are provided for the photodiode bias and the transistor collector output. This feature, which reduces the transistor base-to-collector capacitance, results in speeds up to one hundred times that of a conventional phototransistor optocoupler.

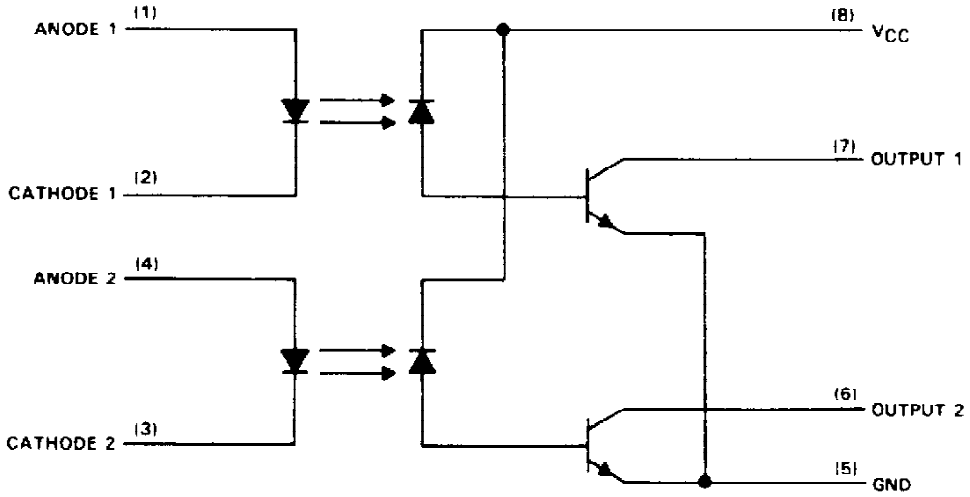
The HCPL2530 is designed for TTL/CMOS, TTL/LSTTL, and wide-band analog applications.

The HCPL2531 is designed for high-speed TTL/TTL applications.

mechanical data



schematic



absolute maximum ratings at 25 °C free-air temperature (unless otherwise noted)

Supply and output voltage range, V_{CC} and V_O	−0.5 V to 15 V
Reverse input voltage (each channel)	5 V
Peak input forward current (each channel) (pulse duration = 1 ms, 50% duty cycle, see Note 1)	50 mA
Peak transient input forward current (each channel) (pulse duration = 1 μs, f = 300 Hz)	1 A
Average forward input current (each channel) (see Note 2)	25 mA
Peak output current (each channel)	16 mA
Average output current (each channel)	8 mA
Input power dissipation at (or below) 70 °C free-air temperature (each channel) (see Note 3)	45 mW
Output power dissipation at (or below) 70 °C free-air temperature (each channel) (see Note 4)	35 mW
Storage temperature range	−55 °C to 125 °C
Operating free-air temperature range	−55 °C to 100 °C
Lead temperature 1,6 mm (1/16 inch) from case for 10 seconds	260 °C

NOTES: 1. Derate linearly above 70 °C free-air temperature at the rate of 1.67 mA/°C.
2. Derate linearly above 70 °C free-air temperature at the rate of 0.83 mA/°C.
3. Derate linearly above 70 °C free-air temperature at the rate of 1.50 mW/°C.
4. Derate linearly above 70 °C free-air temperature at the rate of 1.17 mW/°C.

electrical characteristics over operating free-air temperature range of 0 °C to 70 °C (unless otherwise noted)

PARAMETER		TEST CONDITIONS		HCPL2530			HCPL2531			UNIT
				MIN	TYP†	MAX	MIN	TYP†	MAX	
V_F	Input forward voltage	I_F = 16 mA,	T_A = 25°C		1.6	1.7		1.6	1.7	V
VF	Temperature coefficient of forward voltage	I_F = 16 mA			−1.8			−1.8		mV/°C
V_{BR}	Input breakdown voltage	I_R = 10 μA,	T_A = 25°C	5			5			V
V_{OL}	Low-level output voltage	V_{CC} = 4.5 V, I_F = 16 mA	I_{OL} = 1.1 mA		0.1	0.5				V
			I_{OL} = 2.4 mA					0.1	0.5	
I_{OH}	High-level output current	I_{F1} = I_{F2} = 0, T_A = 25°C	V_{CC} = V_{O1} = V_{O2} = 5.5 V		3	500		3	500	nA
		V_{CC} = V_{O1} = V_{O2} = 15 V, I_{F1} = I_{F2} = 0				50			50	μA
I_{CCH}	Supply current, high-level output	V_{CC} = 15 V, I_{F1} = I_{F2} = 0	I_{O1} = I_{O2} = 0,			4			4	μA
I_{CCL}	Supply current, low-level output	V_{CC} = 15 V, I_{F1} = I_{F2} = 16 mA	I_{O1} = I_{O2} = 0,		80			80		μA
CTR	Current transfer ratio	V_{CC} = 4.5 V, I_F = 16 mA, See Note 5	V_O = 0.5 V, T_A = 25°C,	7%	18%		19%	24%		
CTR	Current transfer ratio	V_{CC} = 4.5 V, I_F = 16 mA,	V_O = 0.5 V, See Note 5	5%			15%			
r_{IO}	Input-output resistance	V_{IO} = 500 V, See Note 6	T_A = 25°C,		10^{12}			10^{12}		Ω
I_{IO}	Input-output insulation leakage current	V_{IO} = 3000 V, T_A = 25°C, See Note 6	t = 5 s, RH = 45%,			1			1	μA
C_I	Input capacitance	V_F = 0,	f = 1 MHz		60			60		pF
C_{io}	Input-output capacitance	f = 1 MHz,	See Note 6		0.6			0.6		pF
r_{ii}	Input-input resistance	V_{ii} = 500 V, See Note 7	T_A = 25°C		10^{11}			10^{11}		Ω
I_{ii}	Input-input insulation leakage current	V_{ii} = 500 V, T_A = 25°C, See Note 7	t = 5 5, R_h = 45%,		0.005			0.005		μA
c_{ii}	Input-input capacitance	f = 1 MHz, See Note 7	T_A = 25°C,		0.25			0.25		pF

†All typical values are at T_A = 25°C.

NOTES: 5. Current transfer ratio is defined as the ratio of output collector current I_O to the forward LED input current I_F times 100%.
6. These parameters are measured between pins 2 and 3 shorted together and pins 5, 6, 7, and 8 shorted together.
7. These parameters are measured between pins 1 and 2 shorted together and pins 3 and 4 shorted together.

operating characteristics at V_{CC} = 5 V, I_F = 16 mA, T_A = 25°C

PARAMETER		TEST CONDITIONS	HCPL2530			HCPL2531			UNIT
			MIN	TYP	MAX	MIN	TYP	MAX	
BW	Bandwidth (−3 dB)	R_L = 100 Ω, See Note 8		2			2		MHz

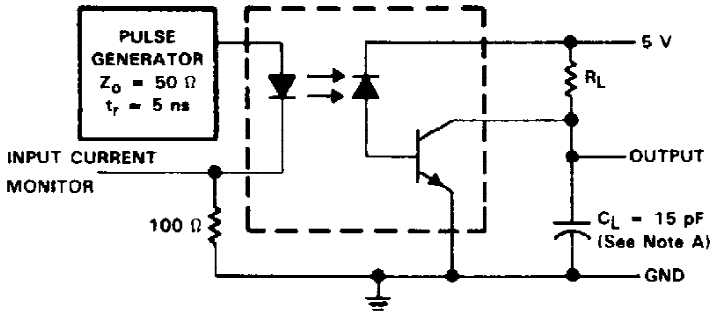
NOTE 7: Bandwidth is the range of frequencies within which the ac output voltage is not more than 3 dB below the low-frequency value.

switching characteristics at V_{CC} = 5 V, I_F = 16 mA, T_A = 25°C (unless otherwise noted)

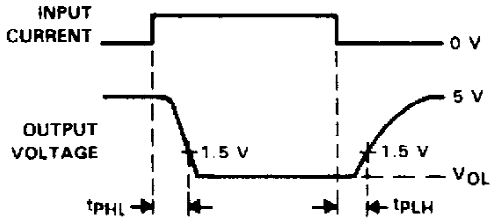
PARAMETER		TEST CONDITIONS	HCPL2530			HCPL2531			UNIT
			MIN	TYP	MAX	MIN	TYP	MAX	
t_{PLH}	Propagation delay time, low-to-high-level output	R_L = 4.1 kΩ, See Note 9, See Figure 1		1.0	1.5				µs
		R_L = 1.9 kΩ, See Note 10, See Figure 1					0.6	0.8	
t_{PHL}	Propagation delay time, high-to-low-level output	R_L = 4.1 kΩ, See Note 9, See Figure 1		0.7	1.5				µs
		R_L = 1.9 kΩ, See Note 10, See Figure 1					0.6	0.8	
$\frac{dV_{CM}}{dt}$ (H)	Common-mode input transient immunity, high-level output	ΔV_{CM} = 10 V, I_F = 0, R_L = 4.1 kΩ, See Notes 9 and 10, See Figure 2	1000						V/µs
		ΔV_{CM} = 10 V, I_F = 0, R_L = 1.9 kΩ, See Notes 10 and 11, See Figure 2				1000			
$\frac{dV_{CM}}{dt}$ (L)	Common-mode input transient immunity, low-level output	ΔV_{CM} = 10 V, R_L = 4.1 kΩ, See Figure 2, See Notes 9 and 11,	−1000						V/µs
		ΔV_{CM} = 10 V, R_L = 1.9 kΩ, See Figure 2, See Notes 10 and 11				−1000			

NOTES: 9. The 4.1-kΩ load represents one LSTTL unit load of 0.36 mA and a 6.1-kΩ pullup resistor.
10. The 1.9-kΩ load represents one TTL unit load of 1.6 mA and a 5.6-kΩ pullup resistor.
11. Common-mode transient immunity, high-level output, is the maximum rate of rise of the common-mode input voltage that does not cause the output voltage to drop below 2 V. Common-mode input transient immunity, low-level output, is the maximum rate of fall of the common-mode input voltage that does not cause the output voltage to rise above 0.8 V.

PARAMETER MEASUREMENT INFORMATION



TEST CIRCUIT (EACH CHANNEL)

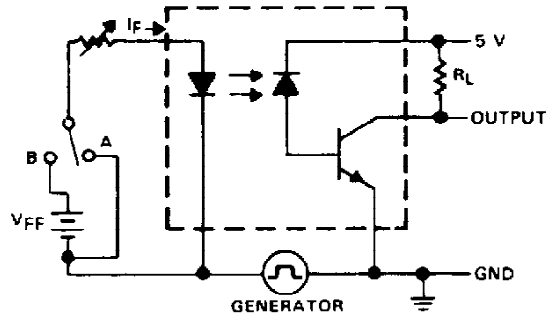


WAVEFORMS

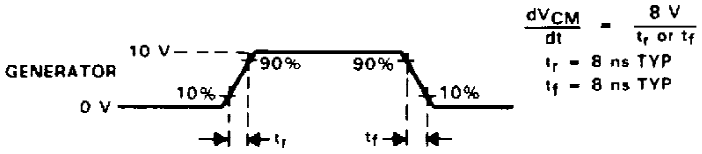
NOTE A: C_L includes probe and stray capacitance.

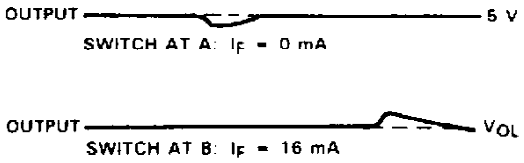
FIGURE 1. SWITCHING TEST CIRCUIT AND WAVEFORMS

PARAMETER MEASUREMENT INFORMATION



TEST CIRCUIT (EACH CHANNEL)





VOLTAGE WAVEFORMS

FIGURE 2. TRANSIENT IMMUNITY TEST CIRCUIT AND WAVEFORMS

INPUT DIODE FORWARD CURRENT
vs
FORWARD VOLTAGE

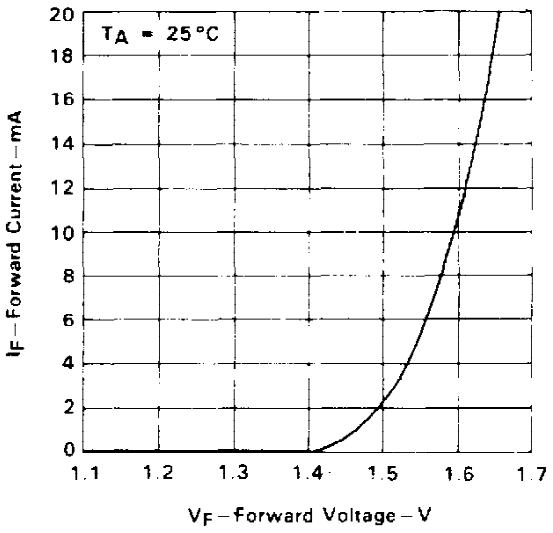


FIGURE 3

HCPL2530
CURRENT TRANSFER CHARACTERISTICS

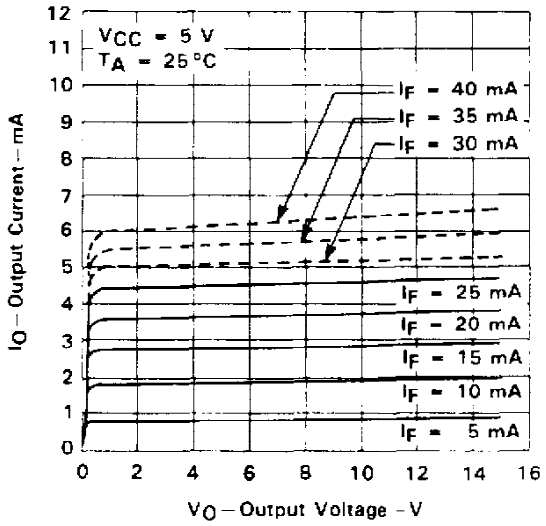


FIGURE 4

NORMALIZED CURRENT TRANSFER RATIO
vs
INPUT DIODE FORWARD CURRENT

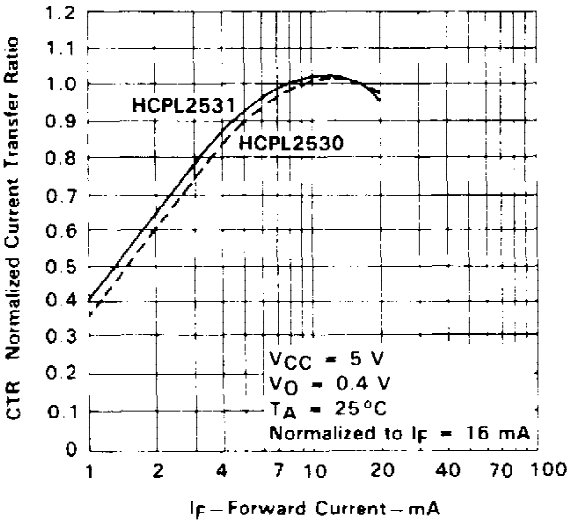


FIGURE 5

NORMALIZED CURRENT TRANSFER RATIO
vs
FREE AIR TEMPERATURE

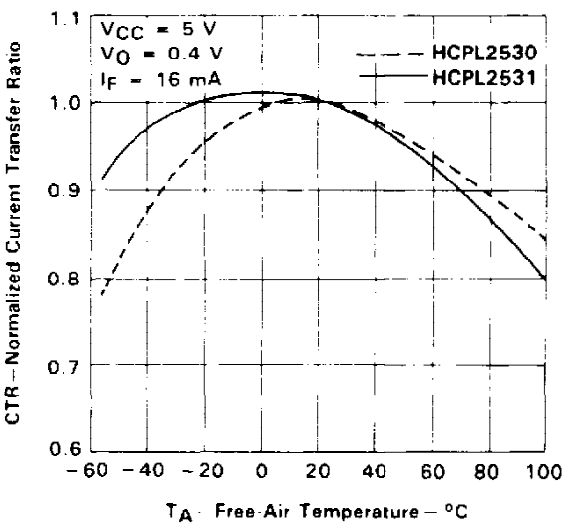


FIGURE 6

HIGH-LEVEL OUTPUT CURRENT
vs
FREE-AIR TEMPERATURE

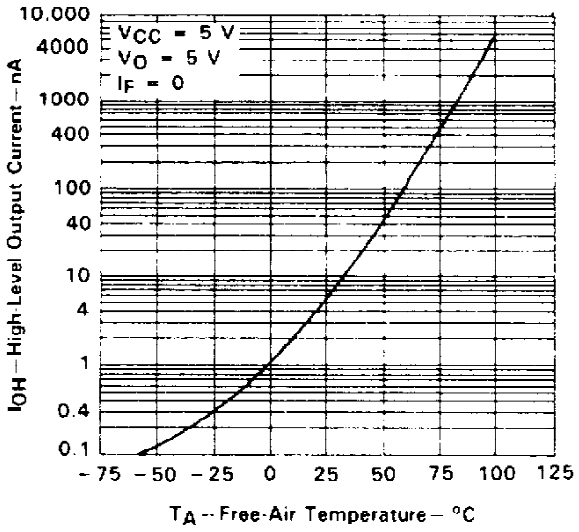


FIGURE 7

DIFFERENTIAL CURRENT TRANSFER RATIO
vs
INPUT DIODE QUIESCENT FORWARD CURRENT

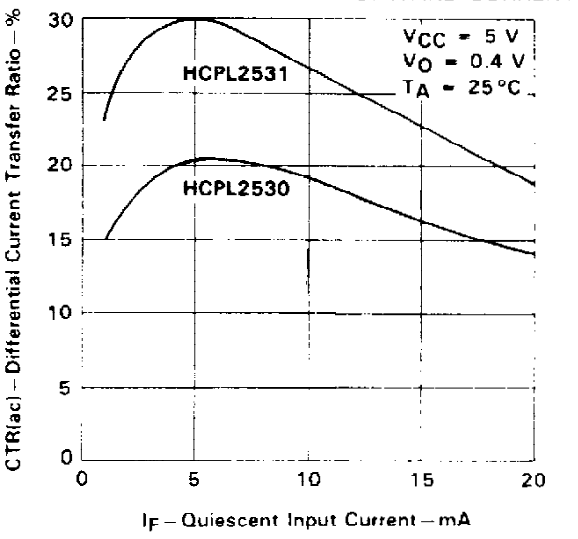


FIGURE 8

NORMALIZED FREQUENCY RESPONSE
vs
LOAD RESISTANCE

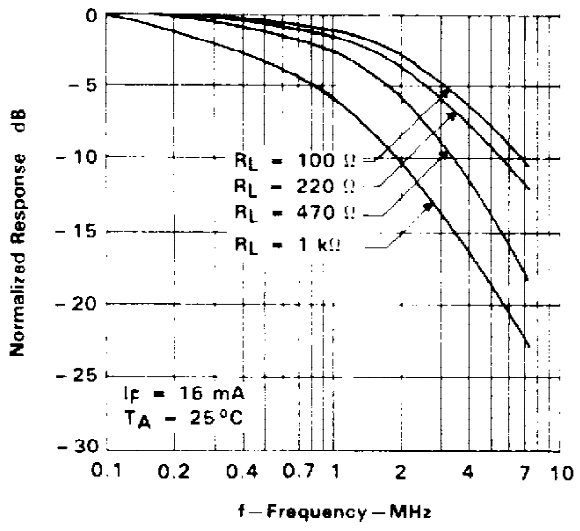


FIGURE 9

PROPAGATION DELAY TIME
vs
FREE-AIR TEMPERATURE

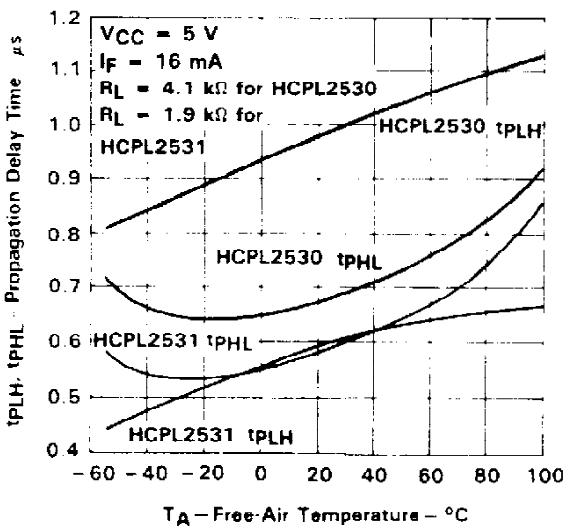


FIGURE 10

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