

HCPL2530, HCPL2531 OPTOCOUPERS/OPTOISOLATORS

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/ μ s Typ
- High-Voltage Electrical Insulation . . . 3000 V DC Min
- Open-Collector Output
- UL Recognized . . . File Number 65085

description

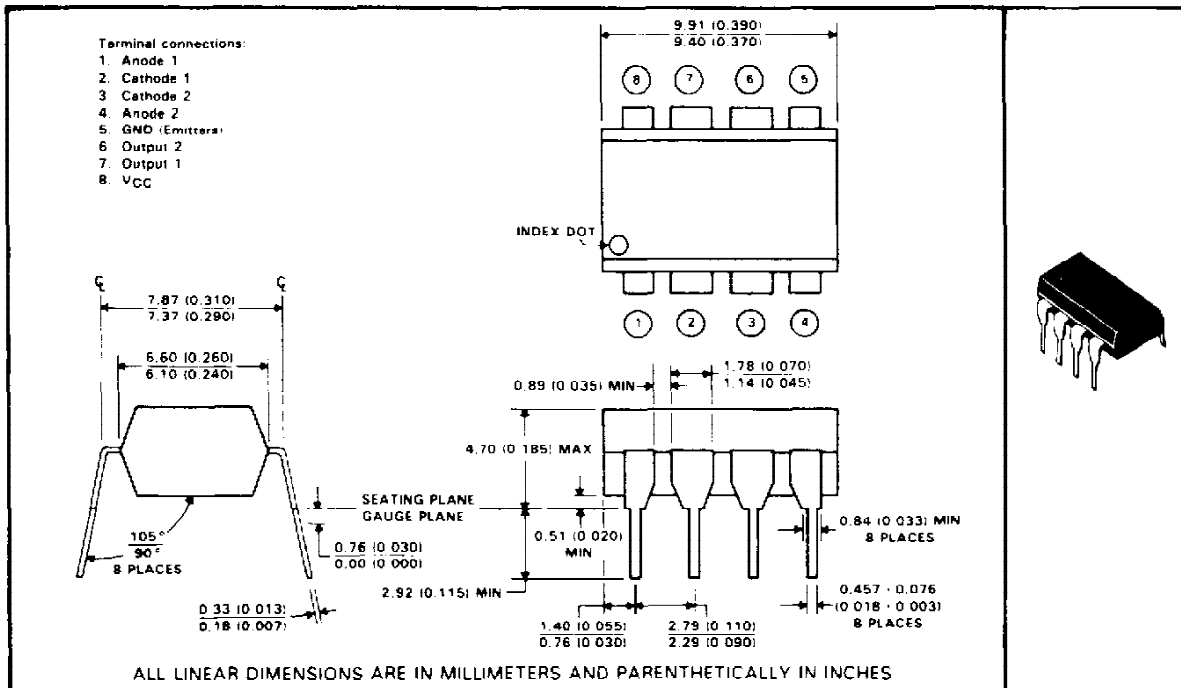
These high-speed optocouplers are designed for use in analog or digital interface applications that require high-voltage isolation between the input and output. Applications include line receivers that require high common-mode transient immunity, and analog or logic circuits that require input-to-output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

Each HCPL2530 and HCPL2531 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



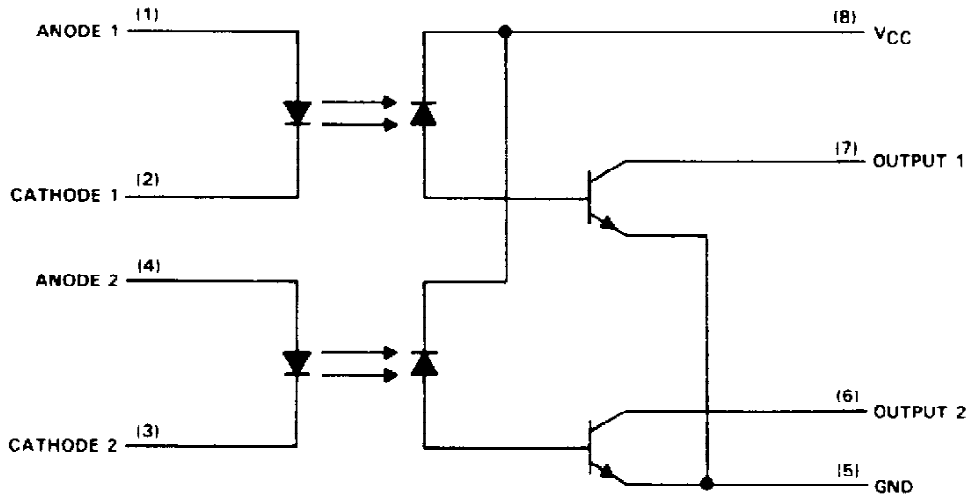
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**HCPL2530, HCPL2531
OPTOCOUPLEDERS/OPTOISOLATORS**

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 μ s, 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.

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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
V _F	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%	
		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 s, RH = 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.

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operating characteristics at $V_{CC} = 5\text{ V}$, $I_F = 16\text{ mA}$, $T_A = 25^\circ\text{C}$

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

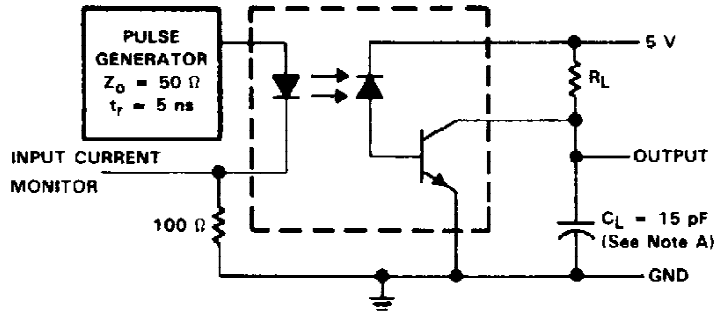
NOTE 7: Bandwidth is the range of frequencies within which the ac output voltage is not more than 3 dB below the low-frequency value.

switching characteristics at $V_{CC} = 5\text{ V}$, $I_F = 16\text{ mA}$, $T_A = 25^\circ\text{C}$ (unless otherwise noted)

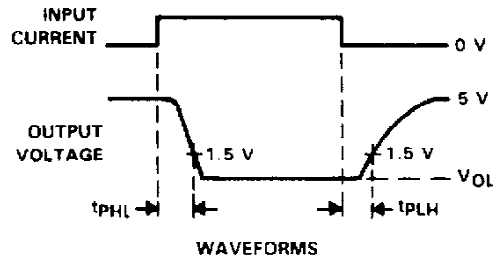
PARAMETER	TEST CONDITIONS	HCPL2530			HCPL2531			UNIT
		MIN	TYP	MAX	MIN	TYP	MAX	
t_{PLH}	Propagation delay time, low-to-high-level output	$R_L = 4.1\text{ k}\Omega$, See Note 9, See Figure 1		1.0	1.5			μs
		$R_L = 1.9\text{ k}\Omega$, See Note 10, See Figure 1				0.6	0.8	
t_{PHL}	Propagation delay time,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

- NOTES: 9. The 4.1-k Ω load represents one LSTTL unit load of 0.36 mA and a 6.1-k Ω pullup resistor.
 10. The 1.9-k Ω load represents one TTL unit load of 1.6 mA and a 5.6-k Ω 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

**HCPL2530, HCPL2531
OPTOCOUPLEDERS/OPTOISOLATORS**

PARAMETER MEASUREMENT INFORMATION

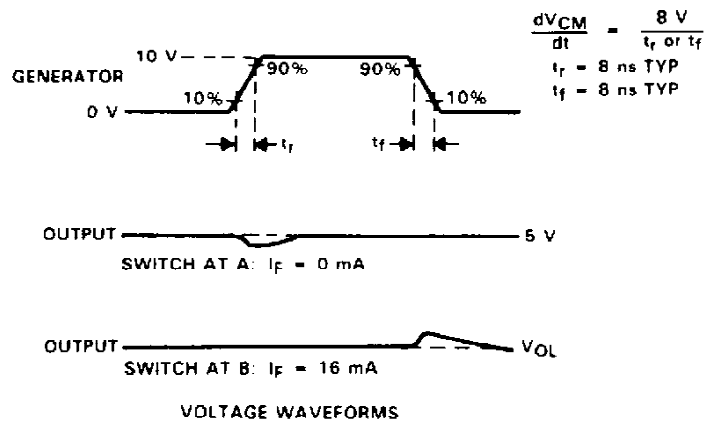
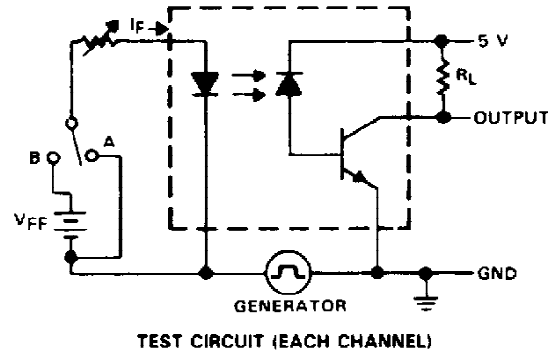


FIGURE 2. TRANSIENT IMMUNITY TEST CIRCUIT AND WAVEFORMS

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INPUT DIODE FORWARD CURRENT
vs
FORWARD VOLTAGE

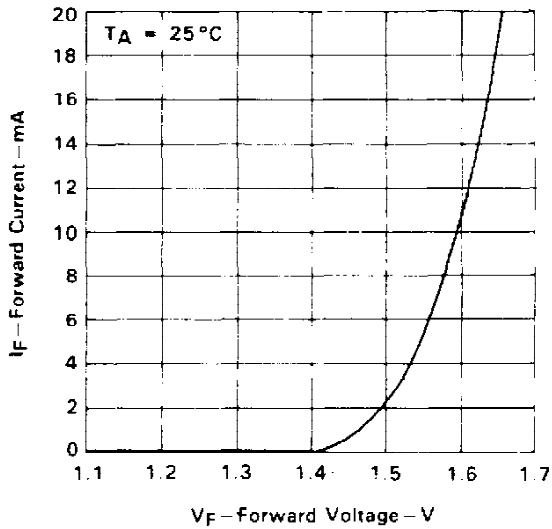


FIGURE 3

HCPL2530
CURRENT TRANSFER CHARACTERISTICS

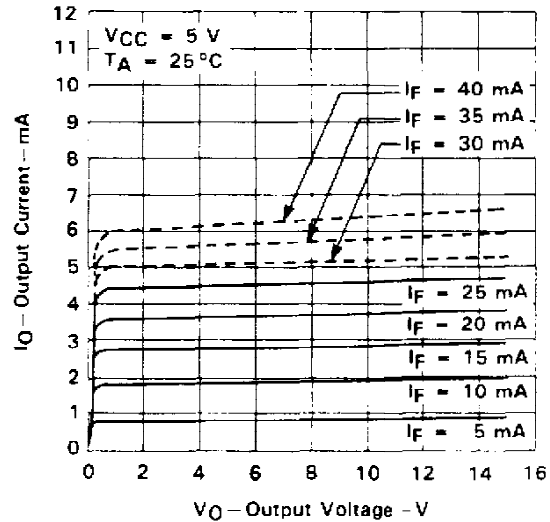


FIGURE 4

NORMALIZED CURRENT TRANSFER RATIO
vs
INPUT DIODE FORWARD CURRENT

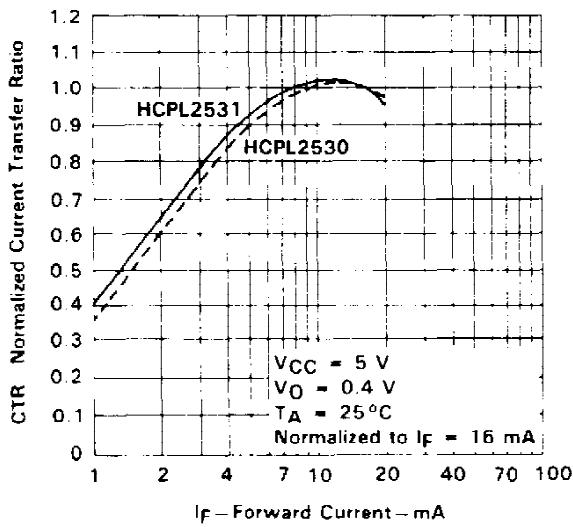


FIGURE 5

NORMALIZED CURRENT TRANSFER RATIO
vs
FREE AIR TEMPERATURE

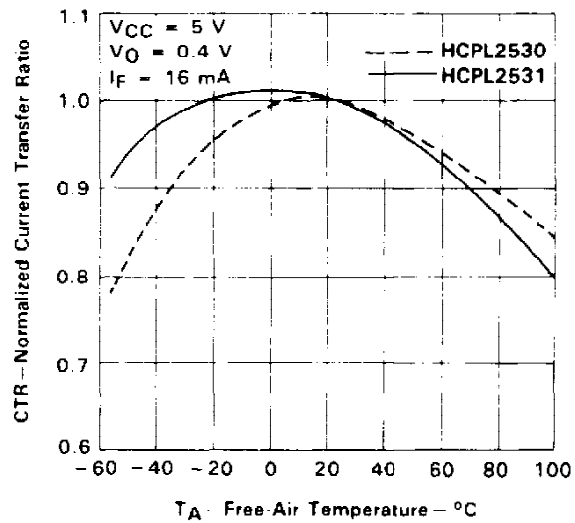


FIGURE 6

HCPL2530, HCPL2531
OPTOCOUPERS/OPTOISOLATORS

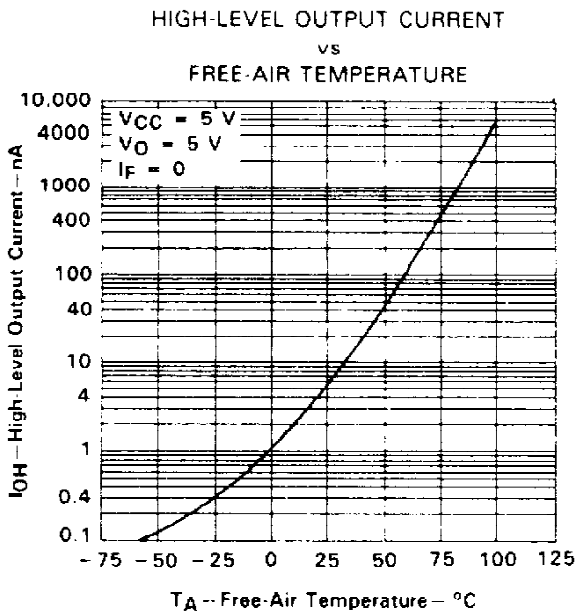


FIGURE 7

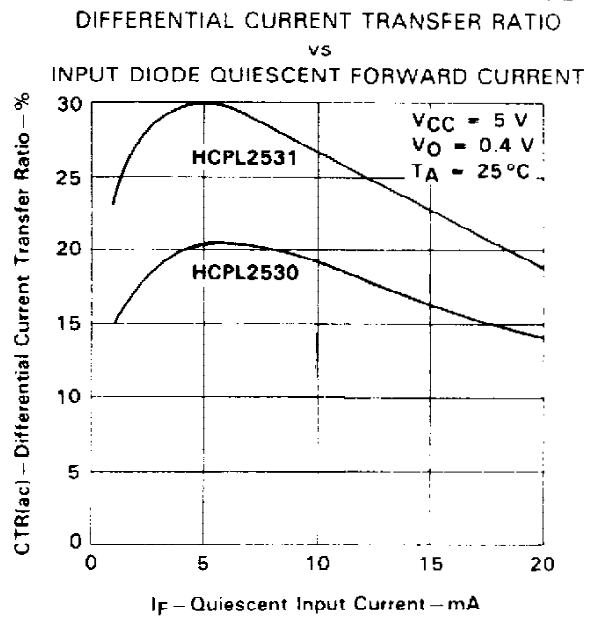


FIGURE 8

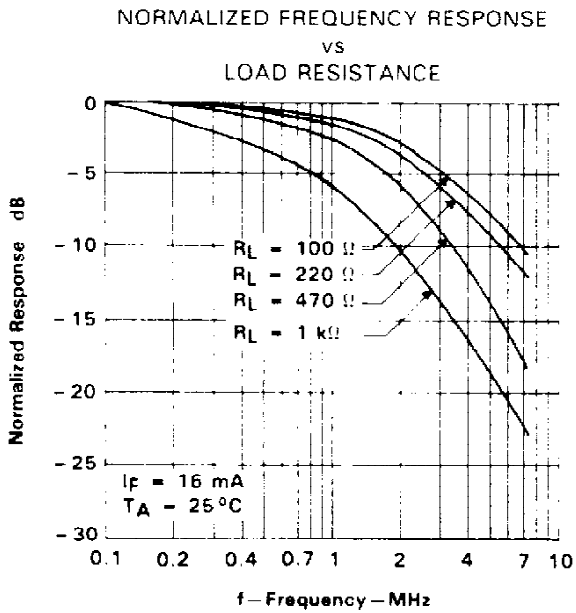


FIGURE 9

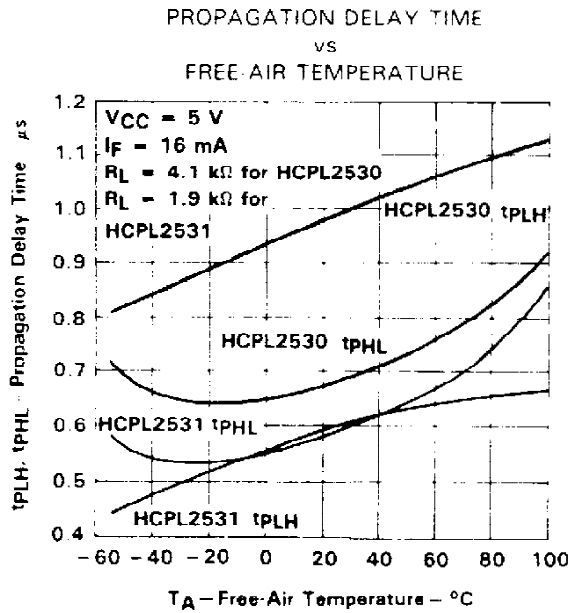


FIGURE 10

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Orderable Device	Status ⁽¹⁾	Package Type	Package Drawing	Pins	Package Qty	Eco Plan ⁽²⁾	Lead/Ball Finish	MSL Peak Temp ⁽³⁾
HCPL2530	OBSOLETE	PDIP	N	8		TBD	Call TI	Call TI
HCPL2531	OBSOLETE	PDIP	N	8		TBD	Call TI	Call TI

⁽¹⁾ The marketing status values are defined as follows:

ACTIVE: Product device recommended for new designs.

LIFEBUY: TI has announced that the device will be discontinued, and a lifetime-buy period is in effect.

NRND: Not recommended for new designs. Device is in production to support existing customers, but TI does not recommend using this part in a new design.

PREVIEW: Device has been announced but is not in production. Samples may or may not be available.

OBSOLETE: TI has discontinued the production of the device.

⁽²⁾ Eco Plan - The planned eco-friendly classification: Pb-Free (RoHS) or Green (RoHS & no Sb/Br) - please check <http://www.ti.com/productcontent> for the latest availability information and additional product content details.

TBD: The Pb-Free/Green conversion plan has not been defined.

Pb-Free (RoHS): TI's terms "Lead-Free" or "Pb-Free" mean semiconductor products that are compatible with the current RoHS requirements for all 6 substances, including the requirement that lead not exceed 0.1% by weight in homogeneous materials. Where designed to be soldered at high temperatures, TI Pb-Free products are suitable for use in specified lead-free processes.

Green (RoHS & no Sb/Br): TI defines "Green" to mean Pb-Free (RoHS compatible), and free of Bromine (Br) and Antimony (Sb) based flame retardants (Br or Sb do not exceed 0.1% by weight in homogeneous material)

⁽³⁾ MSL, Peak Temp. -- The Moisture Sensitivity Level rating according to the JEDEC industry standard classifications, and peak solder temperature.

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