

HCPL2730, HCPL2731 DUAL-CHANNEL OPTOCOUPPLERS/OPTOISOLATORS

SO05020 D3262, JUNE 1989

- Dual-Channel Optocouplers
- High Current Transfer Ratio . . . 1800% Typ at $I_F = 0.5 \text{ mA}$
- Low Input Current Requirement . . . 0.5 mA
- High-Speed Switching . . . 100 kbit/s Typ
- High Common-Mode Transient Immunity . . . 500 V/ μs Typ
- High-Voltage Electrical Insulation . . . 3000 V DC Min
- High Output Current Rating of 60 mA
- UL Recognized . . . File Number 65085

description

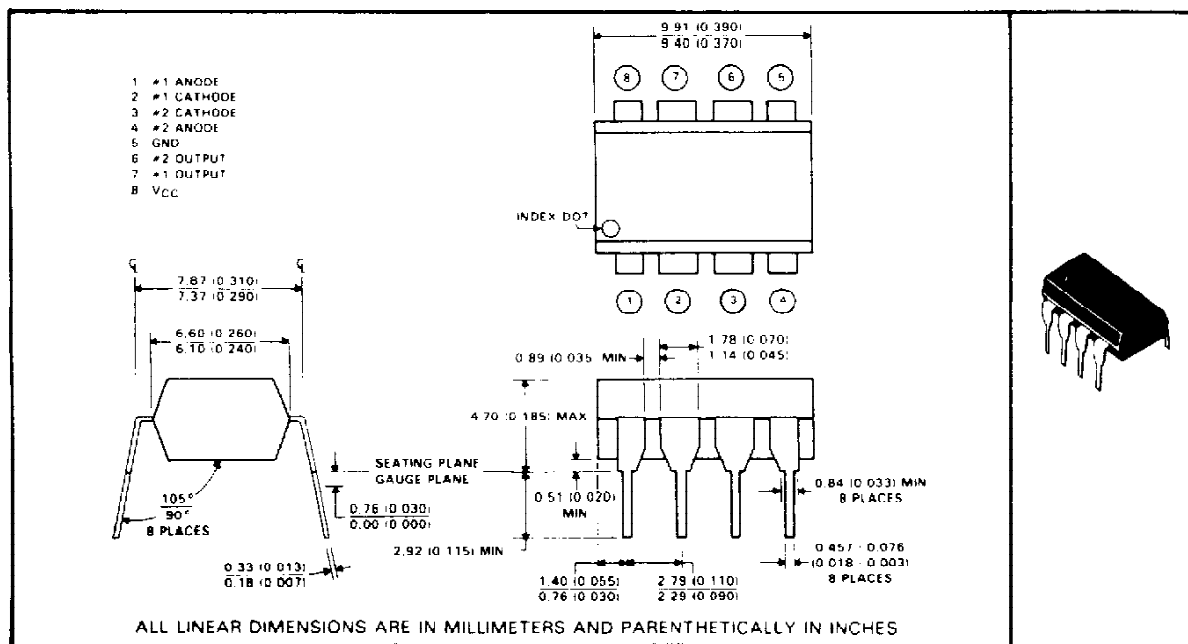
These devices are useful where large common-mode input signals exist, and in applications that require high-voltage isolation between circuits. Applications include line receivers, telephone ring detectors, power line monitors, high-voltage status indicators, and circuits that require isolation between input and output.

The HCPL2730 and HCPL2731 dual-channel high-gain optocouplers each consists of a pair of light-emitting diodes and integrated high-gain photon detectors. The V_{CC} and output terminals may be tied together to achieve conventional photodarlington operation. An integrated emitter-base bypass resistor is provided for low leakage.

The HCPL2730 is designed for use primarily in TTL applications. An LED input current of 1.6 mA and a minimum current-transfer ratio of 300% from 0°C to 70°C allow operation with one TTL-load input and one TTL-load output utilizing a 2.2-k Ω pullup resistor.

The HCPL2731 is designed for use in CMOS, LSTTL, or other low-power applications. This device has a minimum current-transfer ratio of 400% for only 0.5-mA input current over an operating temperature range of 0°C to 70°C.

mechanical data



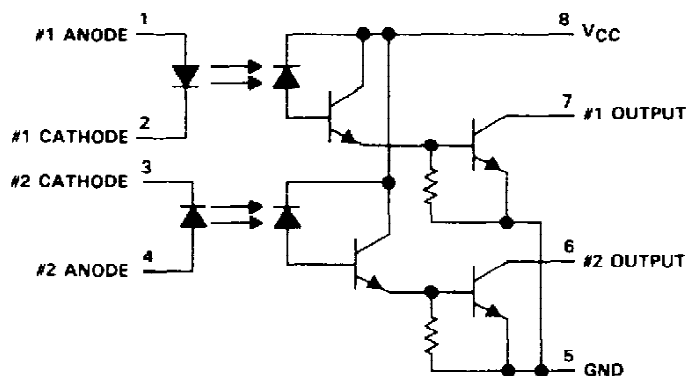
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HCPL2730, HCPL2731 **DUAL-CHANNEL OPTOCOUPPLERS/OPTOISOLATORS**

schematic



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

Supply and output voltage range, V_{CC} and V_O : HCPL2730	-0.5 V to 7 V
HCPL2731	-0.5 to 18 V
Reverse input voltage	5 V
Peak input forward current per channel (pulse duration = 1 ms, 50% duty cycle)	40 mA
Average forward input current per channel at (or below) 50°C free-air temperature (see Note 1)	20 mA
Output current per channel at (or below) 35°C free-air temperature (see Note 2)	60 mA
Input power dissipation per channel at (or below) 50°C free-air temperature (see Note 3)	35 mW
Output power dissipation per channel at (or below) 35°C free-air temperature (see Note 4)	100 mW
Operating temperature range	-40°C to 85°C
Storage temperature range	-55°C to 125°C
Lead temperature 1.6 mm (1/16 inch) from case for 10 seconds	260°C

NOTES: 1. Derate linearly above 50°C free-air temperature at a rate of 0.67 mA/°C.
2. Derate linearly above 35°C free-air temperature at a rate of 1.2 mA/°C.
3. Derate linearly above 50°C free-air temperature at a rate of 1.0 mW/°C.
4. Derate linearly above 35°C free-air temperature at a rate of 2.0 mW/°C.

HCPL2730, HCPL2731 **DUAL-CHANNEL OPTOCOUPLEDERS/OPTOISOLATORS**

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

PARAMETER	TEST CONDITIONS	HCPL2730			HCPL2731			UNIT
		MIN	TYP [†]	MAX	MIN	TYP [†]	MAX	
V _F Input forward voltage	I _F = 1.6 mA, T _A = 25°C		1.5	1.7		1.5	1.7	V
α _{VF} Temperature coefficient of forward voltage	I _F = 1.6 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 = 1.6 mA, I _{OL} = 4.8 mA, I _B = 0		0.1	0.4				V
	V _{CC} = 4.5 V, I _F = 1.6 mA, I _{OL} = 8 mA, I _B = 0					0.1	0.4	
	V _{CC} = 4.5 V, I _F = 5 mA, I _{OL} = 15 mA, I _B = 0					0.1	0.4	
	V _{CC} = 4.5 V, I _F = 12 mA, I _{OL} = 24 mA, I _B = 0					0.2	0.4	
I _{OH} High-level output current	V _{CC} = 7 V, V _O = 7 V, I _F = 0, I _B = 0		0.1	250				μA
	V _{CC} = 18 V, V _O = 18 V, I _F = 0, I _B = 0					0.05	100	
I _{CCH} Supply current, high-level output	V _{CC} = 7 V, I _O = 0, I _F = 0, I _B = 0		4					nA
	V _{CC} = 18 V, I _O = 0, I _F = 0, I _B = 0					5		
I _{CCL} Supply current, low-level output	V _{CC} = 7 V, I _O = 0, I _{F1} = 1.6 mA, I _{F2} = 1.6 mA, I _B = 0		0.4					mA
	V _{CC} = 18 V, I _O = 0, I _{F1} = 1.6 mA, I _{F2} = 1.6 mA, I _B = 0					0.6		
CTR Current transfer ratio	V _{CC} = 4.5 V, V _O = 0.4 V, I _F = 0.5 mA, I _B = 0, See Note 5					400%	1800%	
	V _{CC} = 4.5 V, V _O = 0.4 V, I _F = 1.6 mA, I _B = 0, See Note 5		300%	1000%		500%	1600%	
r _{ii} Input-input resistance	V _{ii} = 500 V		10 ¹¹			10 ¹¹		Ω
r _{io} Input-output resistance	V _{io} = 500 V, See Note 6		10 ¹²			10 ¹²		Ω
I _{ii} Input-input insulation leakage current	V _{ii} = 500 V, t = 5 s, RH = 45%		0.005			0.005		μA
I _{io} Input-output insulation leakage current	V _{io} = 3000 V, t = 5 s, T _A = 25°C, RH = 45%, See Note 6			1			1	μA
C _i Input capacitance	V _F = 0, f = 1 MHz		60			60		pF
C _{ii} Input-input capacitance	f = 1 MHz		0.25			0.25		pF
C _{io} Input-output capacitance	f = 1 MHz, See Note 6		0.6			0.6		pF

[†]All typical values are at V_{CC} = 5 V, T_A = 25°C, unless otherwise noted.

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.

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switching characteristics at $V_{CC} = 5\text{ V}$, $T_A = 25^\circ\text{C}$

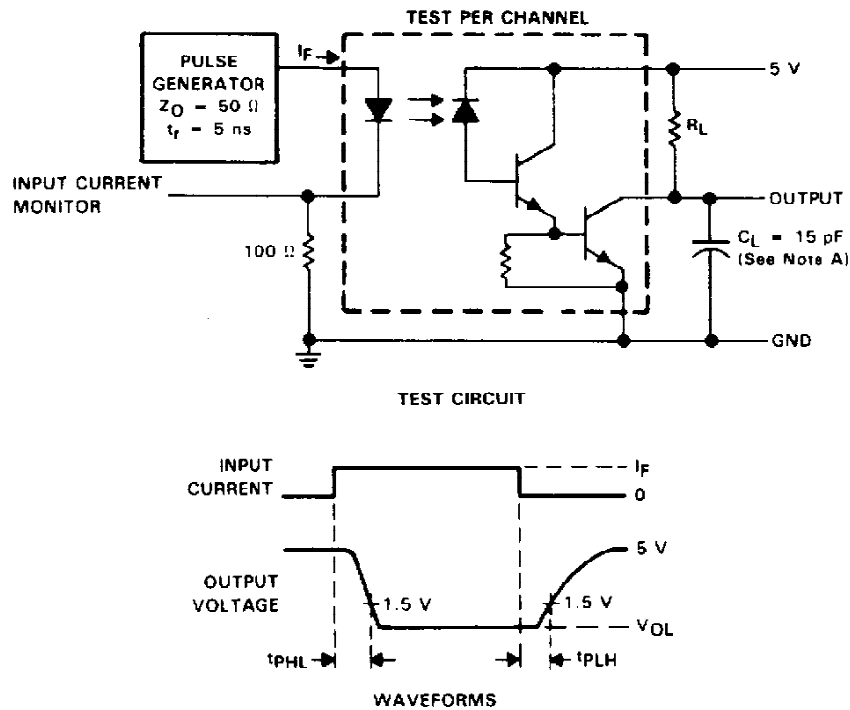
PARAMETER	TEST CONDITIONS	HCPL2730			HCPL2731			UNIT
		MIN	TYP	MAX	MIN	TYP	MAX	
t_{PHL} Propagation delay time, high-to-low level output	$I_F = 1.6\text{ mA}$, $R_L = 2.2\text{ k}\Omega$, See Figure 1		2	20		2	20	μs
	$I_F = 0.5\text{ mA}$, $R_L = 4.7\text{ k}\Omega$, See Figure 1					7	100	
	$I_F = 12\text{ mA}$, $R_L = 270\ \Omega$, See Figure 1		0.4	2		0.4	2	
t_{PLH} Propagation delay time, low-to-high-level output	$I_F = 1.6\text{ mA}$, $R_L = 2.2\text{ k}\Omega$, See Figure 1		4	35		5	35	μs
	$I_F = 0.5\text{ mA}$, $R_L = 4.7\text{ k}\Omega$, See Figure 1					6	60	
	$I_F = 12\text{ mA}$, $R_L = 270\ \Omega$, See Figure 1		3	10		2	10	
$\frac{dV_{CM}}{dt}$ (H) Common-mode input transient immunity, high-level output	$V_{CM} = 10\text{ Vp-p}$, $I_F = 0$, $R_L = 2.2\text{ k}\Omega$, See Notes 7 and 8, See Figure 2		500			500		$\text{V}/\mu\text{s}$
$\frac{dV_{CM}}{dt}$ (L) Common-mode input transient immunity, low-level output	$V_{CM} = 10\text{ Vp-p}$, $I_F = 1.6\text{ mA}$, $R_L = 2.2\text{ k}\Omega$, See Figure 2 See Notes 7 and 8		-500			-500		$\text{V}/\mu\text{s}$

- NOTES: 7. 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.
8. In applications where dV/dt may exceed 50,000 $\text{V}/\mu\text{s}$ (such as static discharge) a series resistor, R_{CC} , should be included to protect the detector IC from destructively high surge currents. The recommended value is:

$$R_{CC} \approx \frac{1}{0.15 I_F (\text{mA})} \text{ k}\Omega$$

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PARAMETER MEASUREMENT INFORMATION

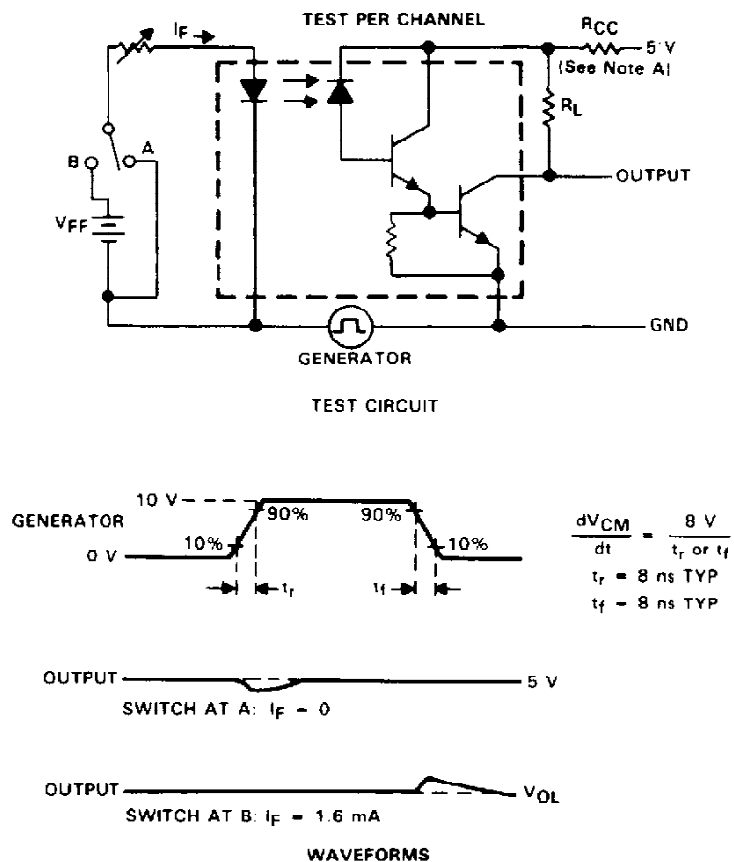


NOTE A: C_L includes probe and stray capacitances.

FIGURE 1. SWITCHING TEST CIRCUIT AND WAVEFORMS

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PARAMETER MEASUREMENT INFORMATION



NOTE A: In applications where dV/dt may exceed $50,000 \text{ V}/\mu\text{s}$ (such as static discharge) a series resistor, R_{CC} , should be included to protect the detector IC from destructively high surge currents. The recommended value is:

$$R_{CC} = \frac{1}{0.15 I_F (\text{mA})} \text{ k}\Omega$$

FIGURE 2. TRANSIENT IMMUNITY TEST CIRCUIT AND WAVEFORMS

HCPL2730, HCPL2731 DUAL-CHANNEL OPTOCOUPLEDERS/OPTOISOLATORS

TYPICAL CHARACTERISTICS

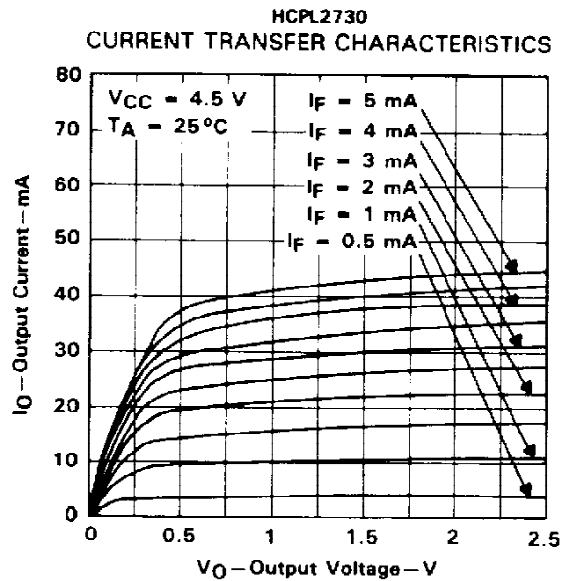


FIGURE 3

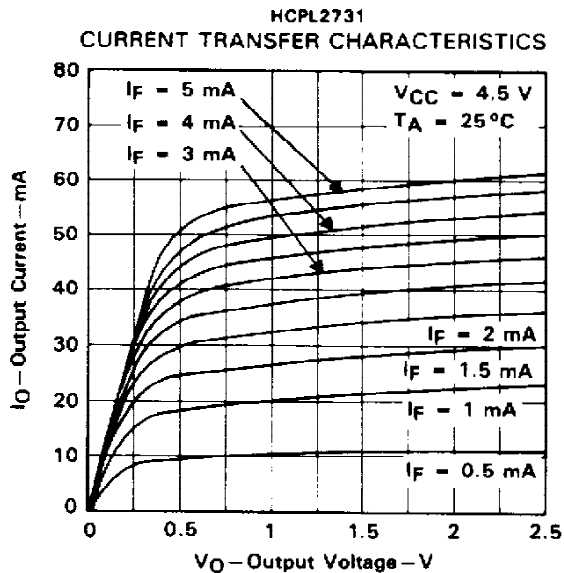


FIGURE 4

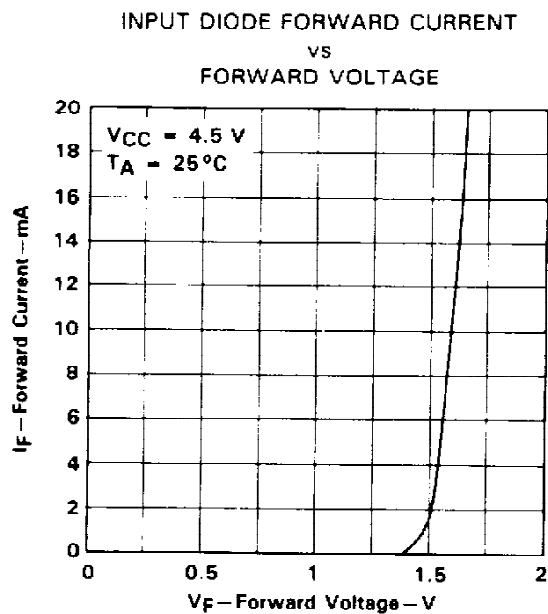


FIGURE 5

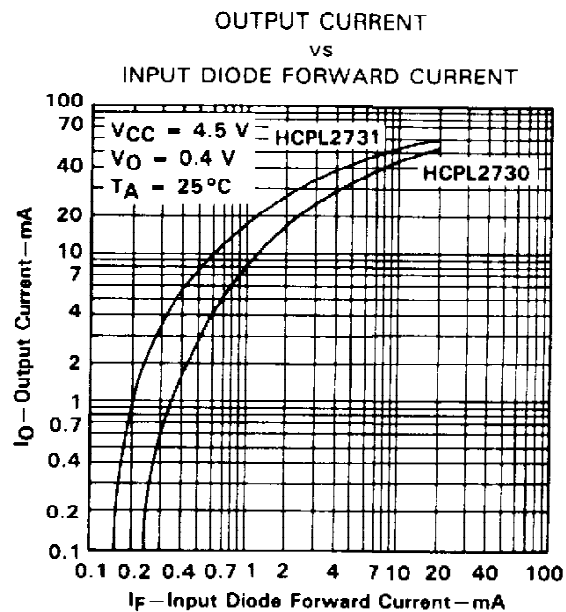


FIGURE 6

HCPL2730, HCPL2731 DUAL-CHANNEL OPTOCOUPLEDERS/OPTOISOLATORS

TYPICAL CHARACTERISTICS

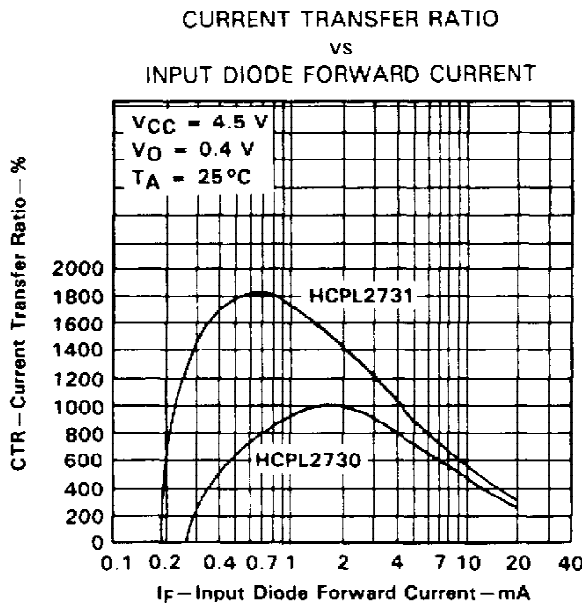


FIGURE 7

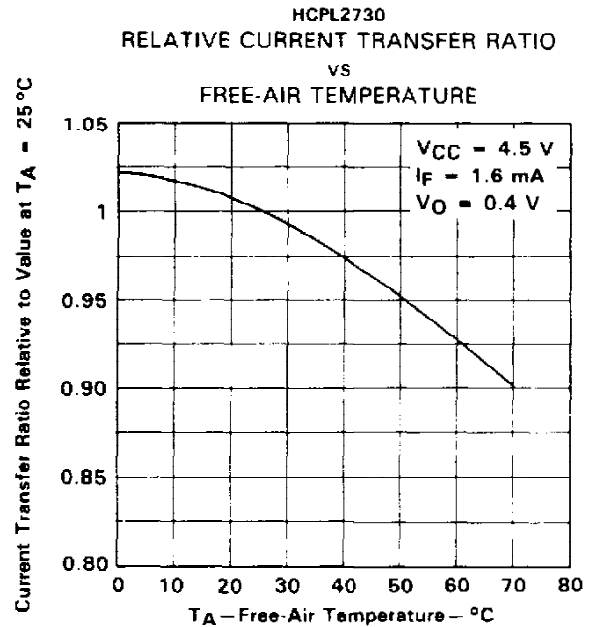


FIGURE 8

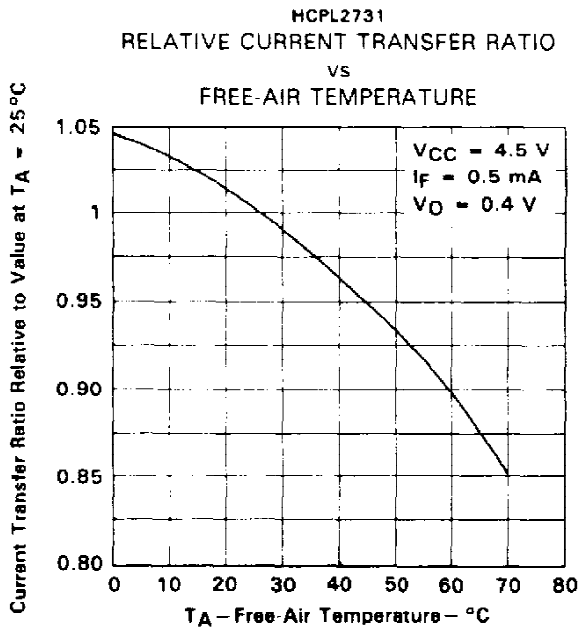


FIGURE 9

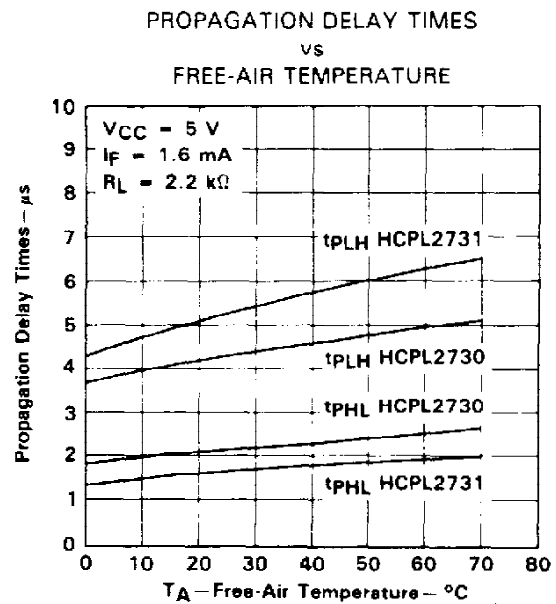


FIGURE 10

HCPL2730, HCPL2731
DUAL-CHANNEL OPTOCOUPPLERS/OPTOISOLATORS

TYPICAL CHARACTERISTICS

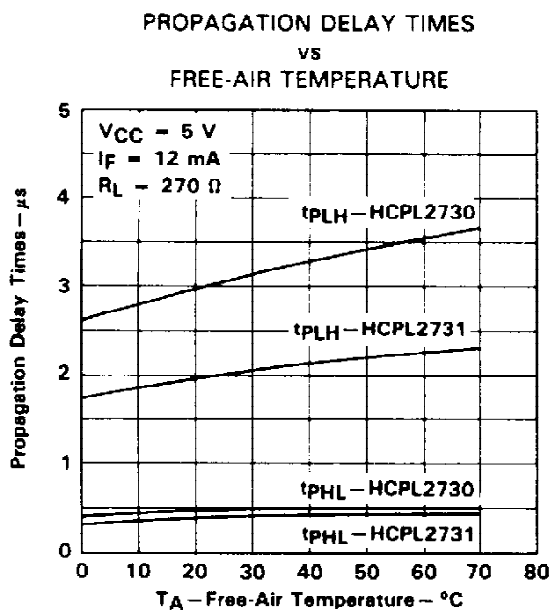


FIGURE 11

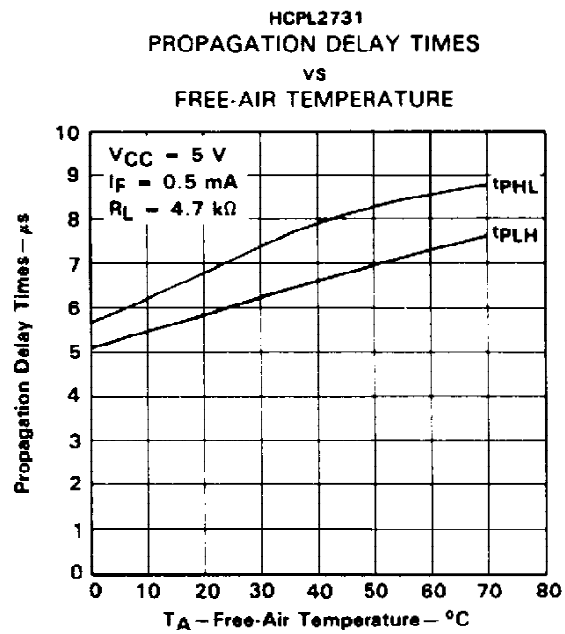


FIGURE 12

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