

HCPL2601 OPTOCOUPLER/OPTOISOLATOR

SOOS009 D2968, NOVEMBER 1986

- Gallium Arsenide Phosphide LED Optically Coupled to an Integrated Circuit Detector
- Internal Shield for Common-Mode Rejection
- Compatible with TTL and LSTTL Inputs
- Low Input Current Required to Turn Output On . . . 5 mA Max
- High-Voltage Electrical Insulation . . . 3000 V DC Min
- High-Speed Switching . . . 75 ns Max
- UL Recognized . . . File Number E65085
- Directly Interchangeable with Hewlett Packard HCPL2601

description

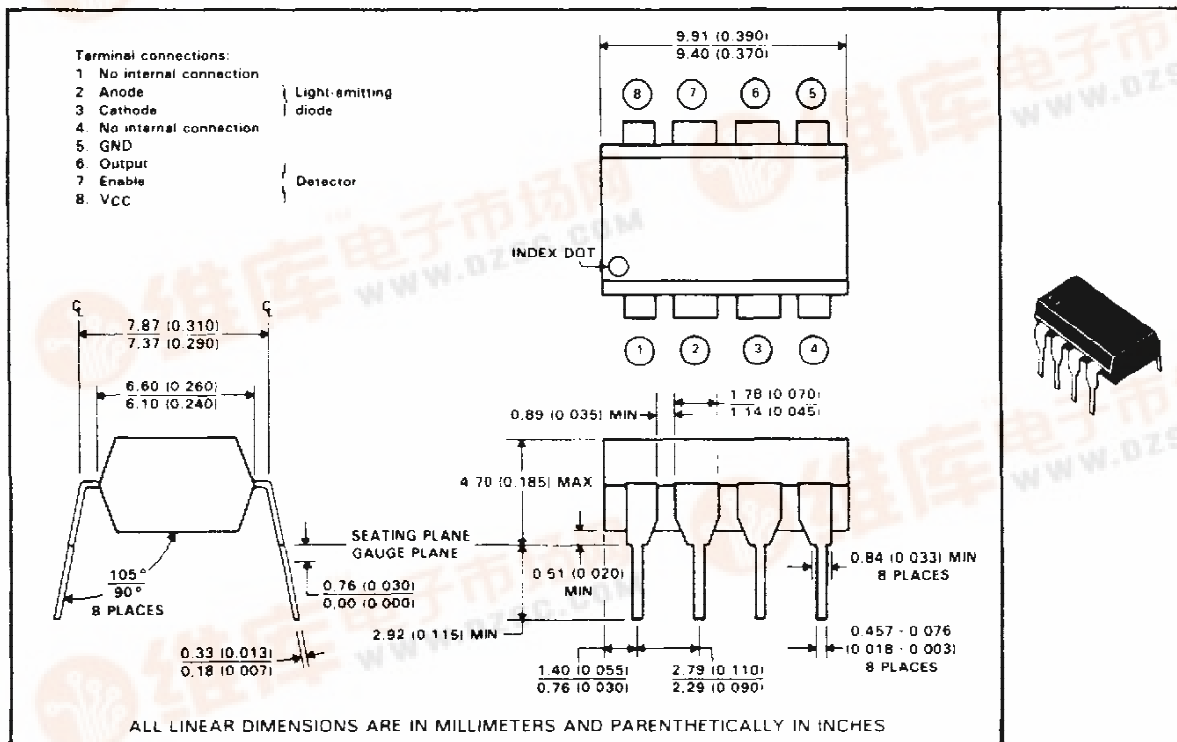
The HCPL2601 optocoupler is designed for use in high-speed digital interfacing applications that require high-voltage isolation between the input and output. It is recommended for use in extremely high ground-noise and induced-noise environments. Applications include line receivers, microprocessors or computer interface, digital programming of floating power supplies, motors, and other control systems.

The HCPL2601 high-speed optocoupler consists of a GaAsP light-emitting diode and an integrated light detector composed of a photodiode, a high-gain amplifier, and a Schottky-clamped open-collector output transistor. An input diode forward current of 5 milliamperes will switch the output transistor low, providing an on-state drive current of 13 milliamperes (eight 1.6-milliampere TTL loads). A TTL-compatible enable input is provided for applications that require output-transistor gating.

The HCPL2601 is mounted in a standard 8-pin dual-in-line plastic package.

The HCPL2601 is characterized for operation over the temperature range of 0°C to 70°C. The internal shield provides a guaranteed common-mode transient immunity of 1000 volts/microsecond minimum.

mechanical data



PRODUCTION DATA documents contain information current as of publication date. Products conform to specifications per the terms of Texas Instruments standard warranty. Production processing does not necessarily include testing of all parameters.

TEXAS
INSTRUMENTS

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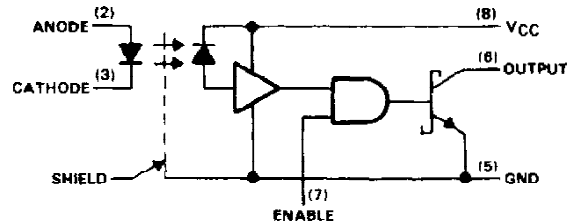


**HCPL2601
OPTOCOUPLER/OPTOISOLATOR**

FUNCTION TABLE

INPUT	ENABLE	OUTPUT
I _{F(on)}	H	L
I _{F(off)}	X	H
X	L	H

logic diagram (positive logic)



absolute maximum ratings over operating free-air temperature range (unless otherwise noted)

Supply voltage, V _{CC}	7 V
Reverse input voltage	5 V
Enable input voltage (not to exceed V _{CC} by more than 500 mV)	5.5 V
Output voltage	7 V
Peak forward input current (≤ 1 ms duration)	40 mA
Average forward input current	20 mA
Output current	25 mA
Output power dissipation	40 mW
Storage temperature range	-55 °C to 125 °C
Operating free-air temperature range	0 °C to 70 °C
Lead temperature 1,6 mm (1/16 inch) from case for 10 seconds	260 °C

recommended operating conditions

		MIN	NOM	MAX	UNIT
V _{CC}	Output supply voltage (see Note 1)	4.5	5	5.5	V
V _{IH(EN)}	High-level enable input voltage (see Note 2)	2		V _{CC}	V
V _{IL(EN)}	Low-level enable input voltage	0		0.8	V
I _{F(on)}	Input forward current to turn output on	6.3		15	mA
I _{F(off)}	Input forward current to turn output off	0		250	μA
I _{OL}	Low-level (on-state) output current			13	mA
T _A	Operating free-air temperature	0		70	°C

- NOTES: 1. All voltage values are with respect to GND (pin 5).
2. No external pullup is required at the enable input; an open circuit will establish the high level.

HCPL2601 OPTOCOUPLER/OPTOISOLATOR

electrical characteristics over recommended operating free-air temperature range (unless otherwise noted)

PARAMETER		TEST CONDITIONS	MIN	TYP [†]	MAX	UNIT
V_F	Input forward voltage	$I_F = 10 \text{ mA}$, $T_A = 25^\circ\text{C}$		1.6	1.75	V
α_{VF}	Temperature coefficient of forward voltage	$I_F = 10 \text{ mA}$		-1.8		mV/°C
V_{BR}	Input reverse breakdown voltage	$I_R = 10 \mu\text{A}$, $T_A = 25^\circ\text{C}$	5			V
V_{OL}	Low-level output voltage	$V_{CC} = 5.5 \text{ V}$, $V_{(EN)} = 2 \text{ V}$, $I_F = 5 \text{ mA}$, $I_{OL} = 13 \text{ mA}$		0.23	0.6	V
I_{OH}	High-level output current	$V_{CC} = 5.5 \text{ V}$, $V_O = 5.5 \text{ V}$, $V_{(EN)} = 2 \text{ V}$, $I_F = 250 \mu\text{A}$			250	μA
$I_{IH(EN)}$	High-level enable input current	$V_{CC} = 5.5 \text{ V}$, $V_{(EN)} = 2 \text{ V}$		-0.2		mA
$I_{IL(EN)}$	Low-level enable input current	$V_{CC} = 5.5 \text{ V}$, $V_{(EN)} = 0.5 \text{ V}$		-0.5	-2	mA
I_{CCH}	Supply current, high-level output	$V_{CC} = 5.5 \text{ V}$, $V_{(EN)} = 0.5 \text{ V}$, $I_F = 0$		10	15	mA
I_{CCL}	Supply current, low-level output	$V_{CC} = 5.5 \text{ V}$, $V_{(EN)} = 0.5 \text{ V}$, $I_F = 10 \text{ mA}$		13	19	mA
I_{IO}	Input-output insulation leakage current	$V_{IO} = 3000 \text{ V}$, $t = 5 \text{ s}$, $T_A = 25^\circ\text{C}$, $RH = 45\%$, See Note 1			1	μA
r_{IO}	Input-output resistance	$V_{IO} = 500 \text{ V}$, $T_A = 25^\circ\text{C}$, See Note 1		10^{12}		Ω
C_i	Input capacitance	$V_F = 0$, $f = 1 \text{ MHz}$		60		pF
C_{io}	Input-output capacitance	$f = 1 \text{ MHz}$, $T_A = 25^\circ\text{C}$, See Note 1		0.6		pF

[†] All typical values are at $V_{CC} = 5 \text{ V}$, $T_A = 25^\circ\text{C}$.

NOTE 1: These parameters are measured between pins 2 and 3 shorted together and pins 5, 6, 7, and 8 shorted together.

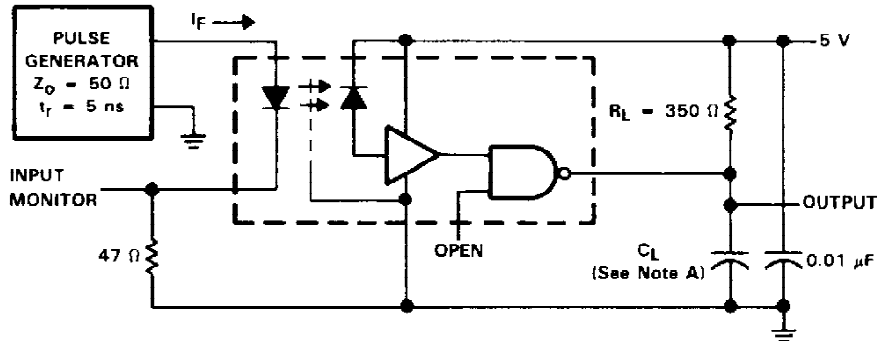
switching characteristics at $V_{CC} = 5 \text{ V}$, $T_A = 25^\circ\text{C}$

PARAMETER		TEST CONDITIONS	MIN	TYP	MAX	UNIT
t_{PLH}	Propagation delay time, low-to-high level output, from LED input	$I_F = 7.5 \text{ mA}$, $R_L = 350 \Omega$, $C_L = 15 \text{ pF}$, See Figure 1		42	75	ns
t_{PHL}	Propagation delay time, high-to-low level output, from LED input	$I_F = 7.5 \text{ mA}$, $R_L = 350 \Omega$, $C_L = 15 \text{ pF}$, See Figure 1		42	75	ns
$t_{PLH(EN)}$	Propagation delay time, low-to-high level output, from enable	$I_F = 7.5 \text{ mA}$, $R_L = 350 \Omega$, $C_L = 15 \text{ pF}$, See Figure 2		40		ns
$t_{PHL(EN)}$	Propagation delay time, high-to-low level output, from enable	$I_F = 7.5 \text{ mA}$, $R_L = 350 \Omega$, $C_L = 15 \text{ pF}$, See Figure 2		25		ns
t_r	Rise time	$I_F = 7.5 \text{ mA}$, $R_L = 350 \Omega$, $C_L = 15 \text{ pF}$		20		ns
t_f	Fall time	$I_F = 7.5 \text{ mA}$, $R_L = 350 \Omega$, $C_L = 15 \text{ pF}$		30		ns
$\frac{dV_{CM}}{dt}$ (H)	Common-mode input transient immunity, high-level output	$\Delta V_{CM} = 50 \text{ V}$, $I_F = 0$, $R_L = 350 \Omega$, See Note 2 and Figure 3	1000	10000		V/ μs
$\frac{dV_{CM}}{dt}$ (L)	Common-mode input transient immunity, low-level output	$\Delta V_{CM} = -50 \text{ V}$, $I_F = 7.5 \text{ mA}$, $R_L = 350 \Omega$, See Note 2 and Figure 3	-1000	-1000		V/ μs

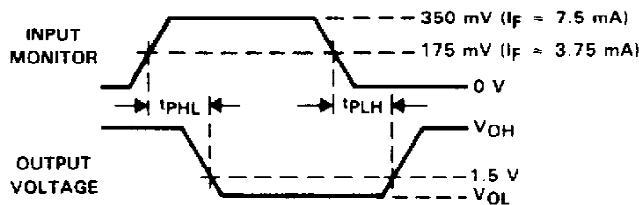
NOTE 2: Common-mode input transient immunity, high-level output, is the maximum rate of rise of the common-mode input voltage that does not cause the output voltage to drop below 2 V. Common-mode input transient immunity, low-level output, is the maximum rate of fall of the common-mode input voltage that does not cause the output voltage to rise above 0.8 V.

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PARAMETER MEASUREMENT INFORMATION

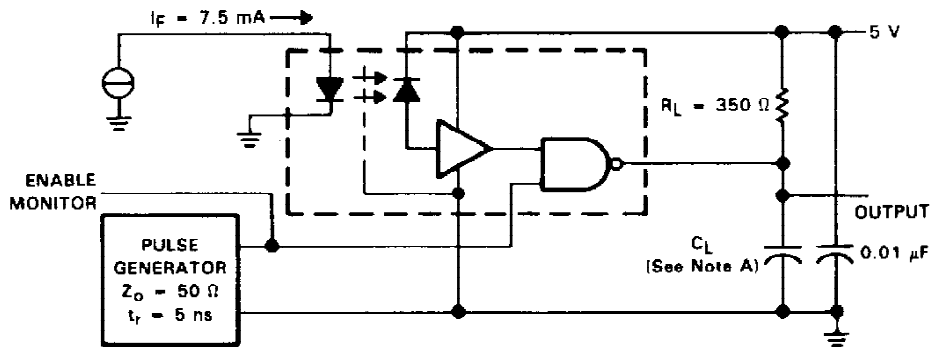


TEST CIRCUIT

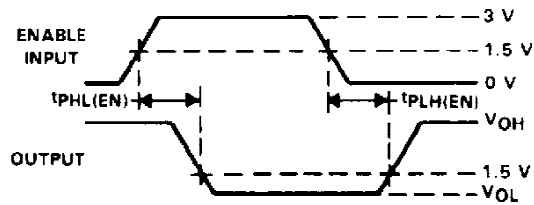


WAVEFORMS

FIGURE 1. t_{PLH} AND t_{PHL} FROM LED INPUT TEST CIRCUIT AND WAVEFORMS



TEST CIRCUIT

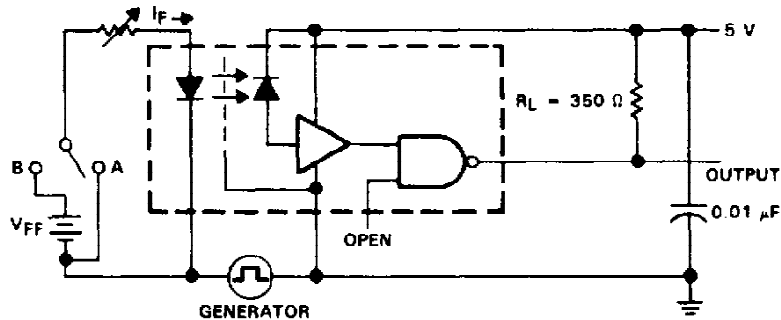


VOLTAGE WAVEFORMS

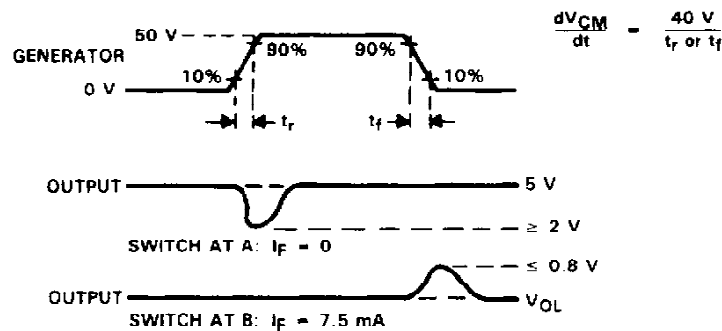
FIGURE 2. $t_{PLH(EN)}$ AND $t_{PHL(EN)}$ FROM ENABLE TEST CIRCUIT AND WAVEFORMS

NOTE A: C_L is approximately 15 pF, which includes probe and stray wiring capacitances.

PARAMETER MEASUREMENT INFORMATION



TEST CIRCUIT



VOLTAGE WAVEFORMS

FIGURE 3. TRANSIENT IMMUNITY TEST CIRCUIT AND WAVEFORMS

TYPICAL APPLICATION INFORMATION

A ceramic capacitor (0.01 μF to 0.1 μF) should be connected between pins 8 and 5 to stabilize the high-gain amplifier. The total lead length between the capacitor and the optocoupler should not exceed 20 mm (0.8 inches). Failure to provide a bypass capacitor may result in impaired switching characteristics.

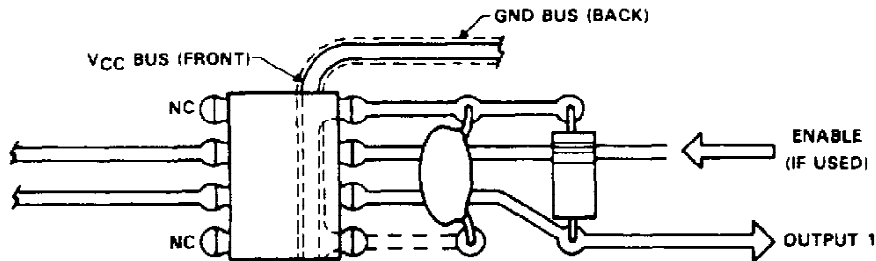


FIGURE 4. RECOMMENDED PRINTED CIRCUIT BOARD LAYOUT

**HCPL2601
OPTOCOUPLER/OPTOISOLATOR**

TYPICAL CHARACTERISTICS

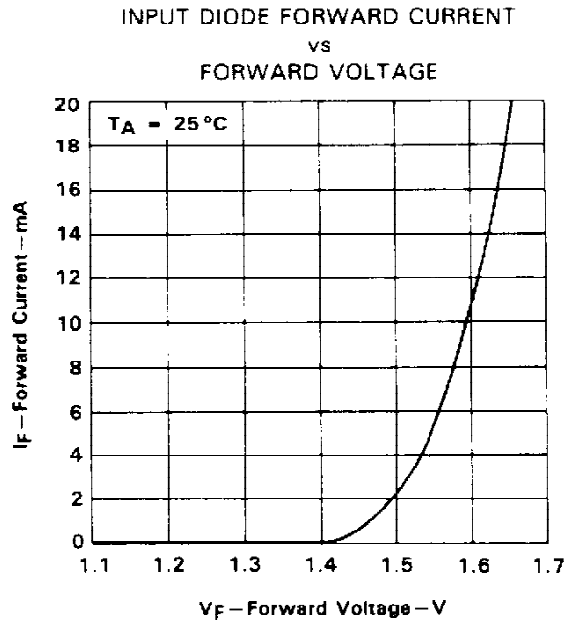


FIGURE 5

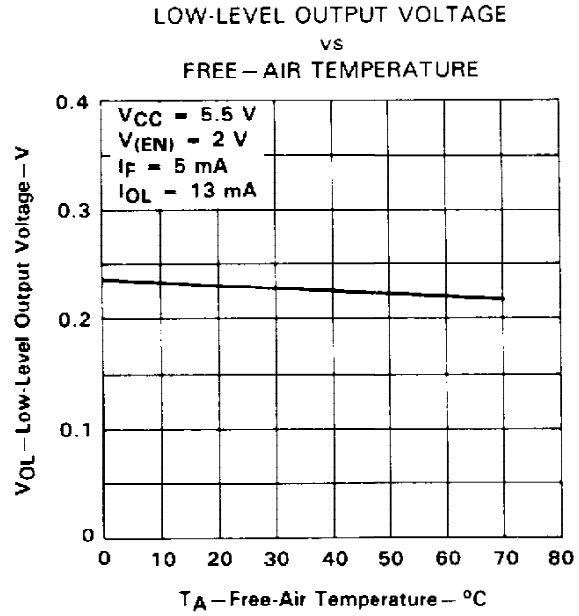


FIGURE 6

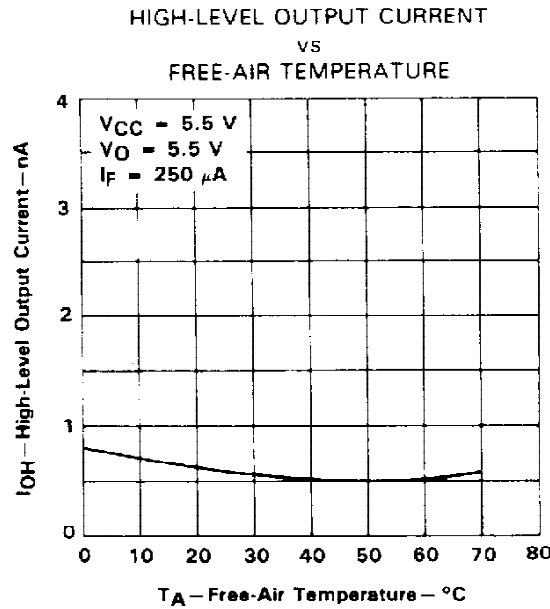


FIGURE 7

TYPICAL CHARACTERISTICS

PROPAGATION DELAY TIME FROM LED INPUT
vs
PULSE FORWARD CURRENT

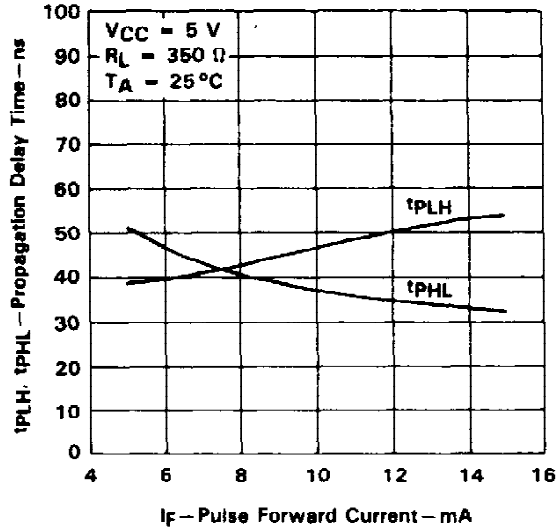


FIGURE 8

PROPAGATION DELAY TIME FROM LED INPUT
vs
LOAD RESISTANCE

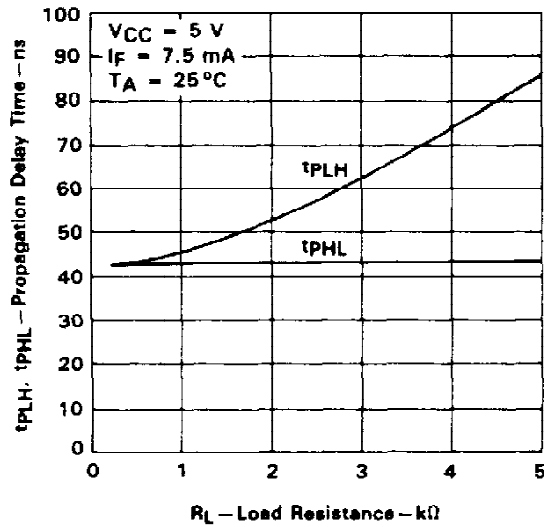


FIGURE 9

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