

6N137 OPTOCOUPLER/OPTOISOLATOR

SOOS003 D291B, JULY 1986

- Gallium Arsenide Phosphide LED Optically Coupled to Integrated Circuit Detector
- 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
- Plastic Dual-In-Line Package
- UL Recognized . . . File Number 65085

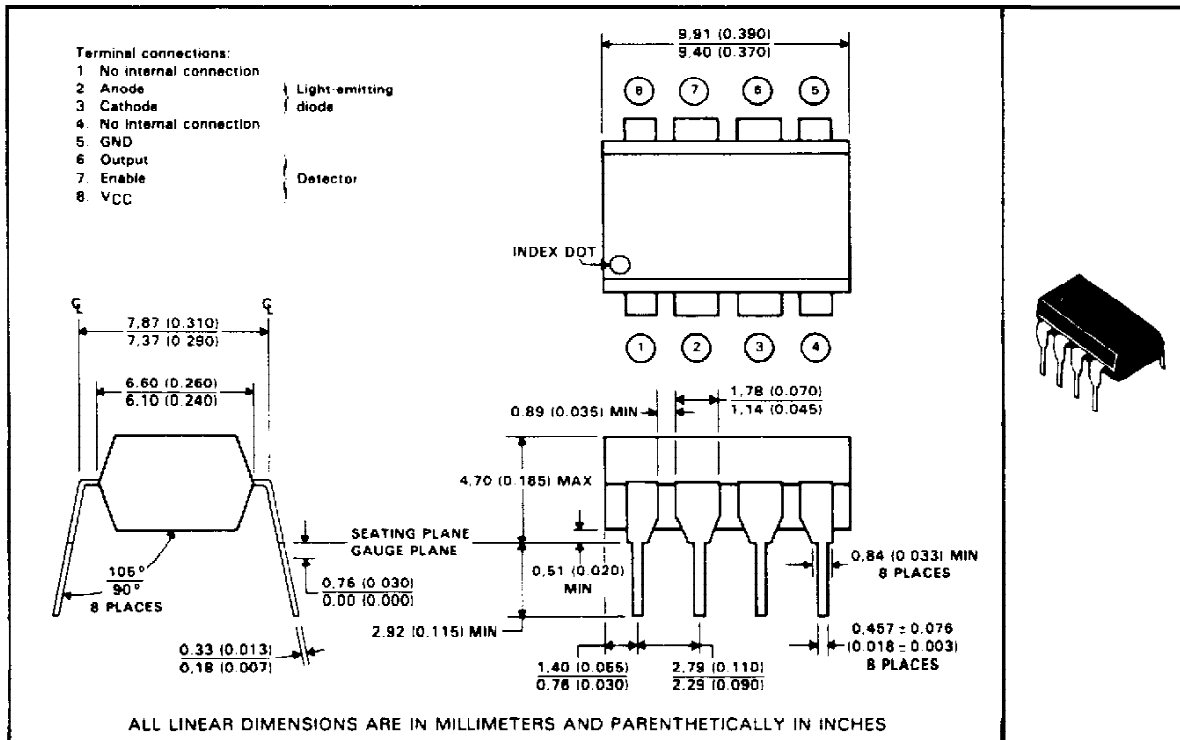
description

The 6N137 optocoupler is designed for use in high-speed digital interfacing applications that require high-voltage isolation between the input and output. Applications include line receivers, microprocessors or computer interface, digital programming of floating power supplies, motors, and other control systems.

The 6N137 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 6N137 is characterized for operation over the temperature range of 0°C to 70°C.

*mechanical data



*JEDEC registered data. This data sheet contains all applicable registered data in effect at the time of publication.

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**TEXAS
INSTRUMENTS**
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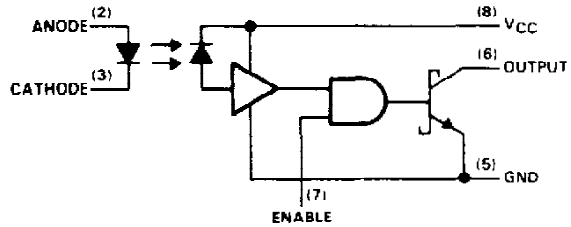
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OPTOCOUPLER/OPTOISOLATOR

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) (TI-guaranteed value)	40 mA
(JEDEC-registered value)	20 mA
Average forward input current (TI-guaranteed value)	20 mA
(JEDEC-registered value)	10 mA
Output current	50 mA
Output power dissipation	85 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

*JEDEC registered data

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.

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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 mA, T _A = 25°C		1.6	1.75	V
αV _F Temperature coefficient of forward voltage	I _F = 10 mA		-1.8		mV/°C
*V _{BR} Input reverse breakdown voltage	I _R = 10 μA, T _A = 25°C	5			V
*V _{OL} Low-level output voltage	V _{CC} = 5.5 V, V _{I(EN)} = 2 V, I _F = 5 mA, I _{OL} = 13 mA		0.23	0.6	V
*I _{OH} High-level output current	V _{CC} = 5.5 V, V _O = 5.5 V, V _{I(EN)} = 2 V, I _F = 250 μA			250	μA
I _{H(EN)} High-level enable input current	V _{CC} = 5.5 V, V _{I(EN)} = 2 V		-0.2		mA
*I _{L(EN)} Low-level enable input current	V _{CC} = 5.5 V, V _{I(EN)} = 0.5 V		-0.5	-2	mA
*I _{CCH} Supply current, high-level output	V _{CC} = 5.5 V, V _{I(EN)} = 0.5 V, I _F = 0		10	15	mA
*I _{CCL} Supply current, low-level output	V _{CC} = 5.5 V, V _{I(EN)} = 0.5 V, I _F = 10 mA		13	18	mA
*I _{IO} Input-output insulation leakage current	V _{IO} = 3000 V, t = 5 s, T _A = 25°C, RH = 45%, See Note 1			1	μA
r _{IO} Input-output resistance	V _{IO} = 500 V, T _A = 25°C, See Note 1		10 ¹²		Ω
C _i Input capacitance	V _F = 0, f = 1 MHz		60		pF
C _{IO} Input-output capacitance	f = 1 MHz, T _A = 25°C, See Note 1		0.6		pF

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† All typical values are at V_{CC} = 5 V, T_A = 25°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 V, T_A = 25°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 mA, R _L = 350 Ω, C _L = 15 pF, See Figure 1		42	75	ns
*t _{PHL} Propagation delay time, high-to-low level output, from LED input	I _F = 7.5 mA, R _L = 350 Ω, C _L = 15 pF, See Figure 1		42	75	ns
t _{PLH(EN)} Propagation delay time, low-to-high level output, from enable	I _F = 7.5 mA, R _L = 350 Ω, C _L = 15 pF, See Figure 2		40		ns
t _{PHL(EN)} Propagation delay time, high-to-low-level output, from enable	I _F = 7.5 mA, R _L = 350 Ω, C _L = 15 pF, See Figure 2		25		ns
t _r Rise time	I _F = 7.5 mA, R _L = 350 Ω, C _L = 15 pF		20		ns
t _f Fall time	I _F = 7.5 mA, R _L = 350 Ω, C _L = 15 pF		30		ns
$\frac{dV_{CM}}{dt}$ (H) Common mode input transient immunity, high-level output	ΔV _{CM} = 10 V, I _F = 0, R _L = 350 Ω, See Note 2 and Figure 3		50		V/μs
$\frac{dV_{CM}}{dt}$ (L) Common-mode input transient immunity, low-level output	ΔV _{CM} = -10 V, I _F = 5 mA, R _L = 350 Ω, See Note 2 and Figure 3		-150		V/μs

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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, 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

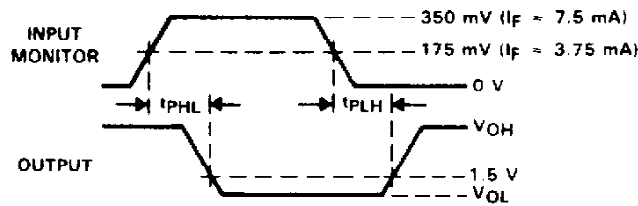
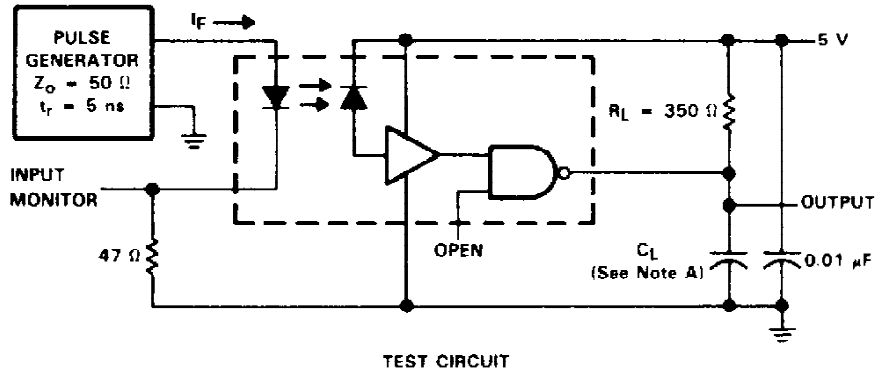


FIGURE 1. t_{PLH} AND t_{PHL} FROM LED INPUT TEST CIRCUIT AND WAVEFORMS

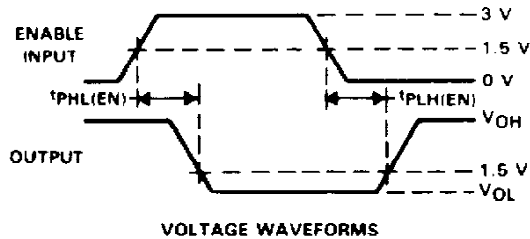
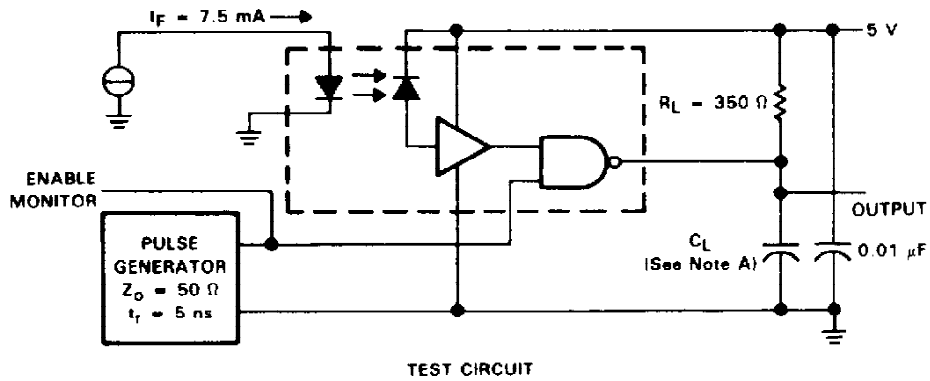


FIGURE 2. t_{PLH(EN)} AND t_{PHL(EN)} FROM ENABLE TEST CIRCUIT AND WAVEFORMS

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

PARAMETER MEASUREMENT INFORMATION

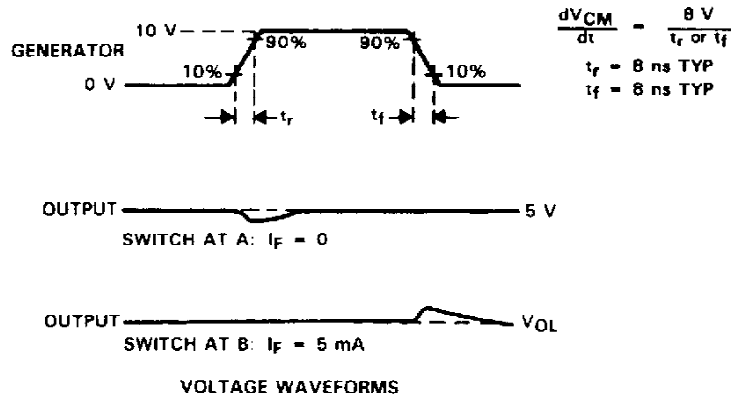
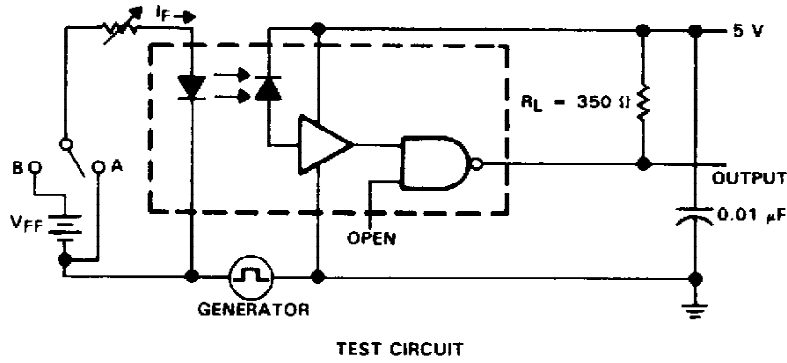


FIGURE 3. TRANSIENT IMMUNITY TEST CIRCUIT AND WAVEFORMS

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.

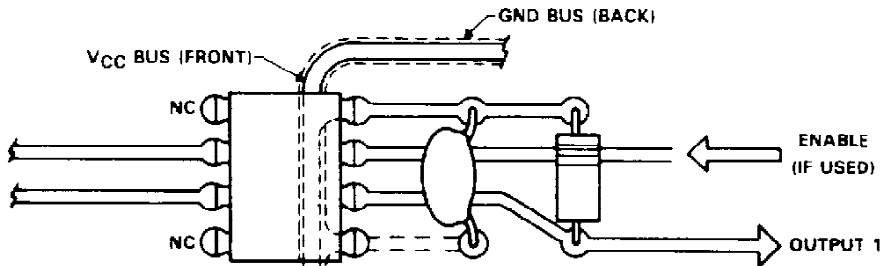


FIGURE 4. RECOMMENDED PRINTED CIRCUIT BOARD LAYOUT

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TYPICAL CHARACTERISTICS

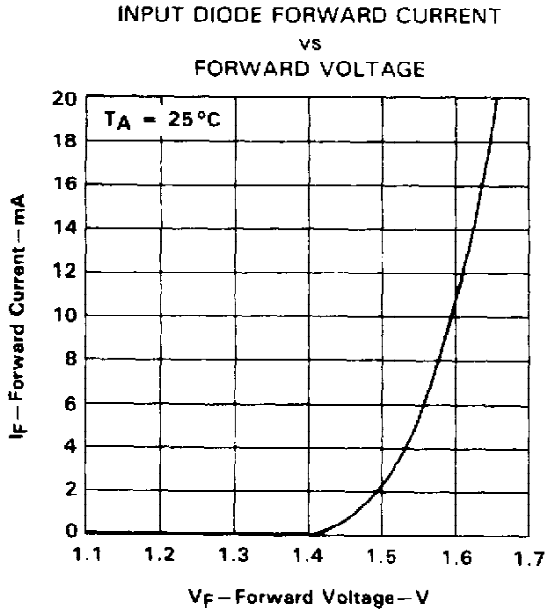


FIGURE 5

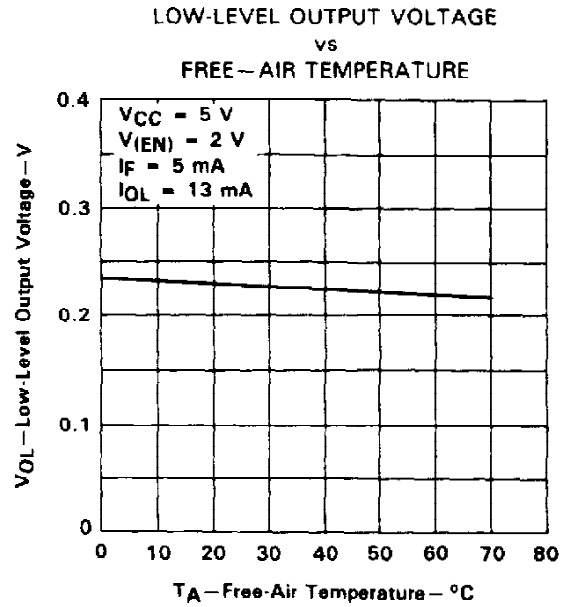


FIGURE 6

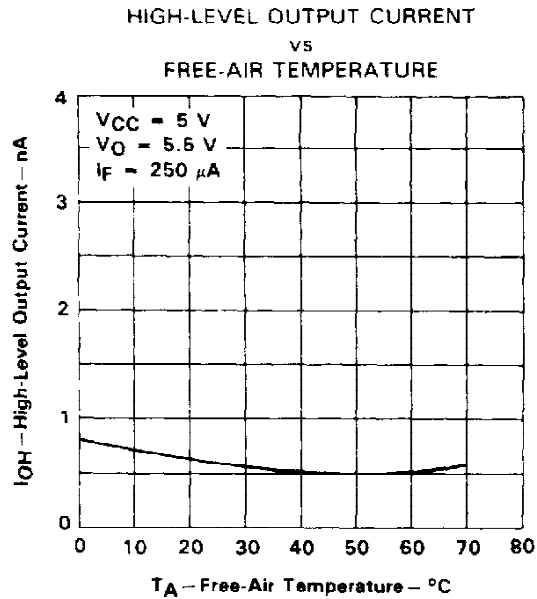


FIGURE 7

TYPICAL CHARACTERISTICS

PROPAGATION DELAY TIME FROM LED INPUT
vs
PULSE FORWARD CURRENT

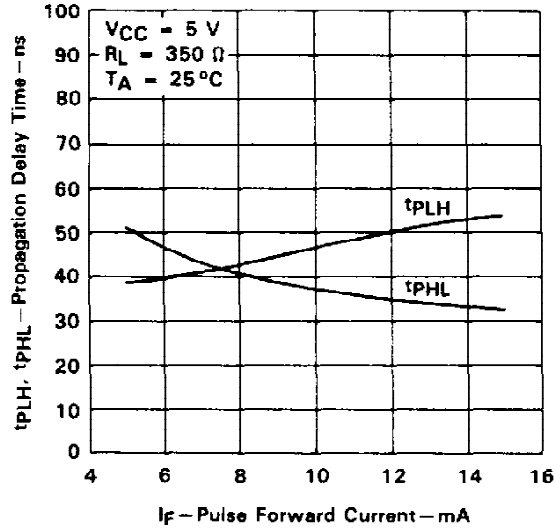


FIGURE 8

PROPAGATION DELAY TIME FROM LED INPUT
vs
LOAD RESISTANCE

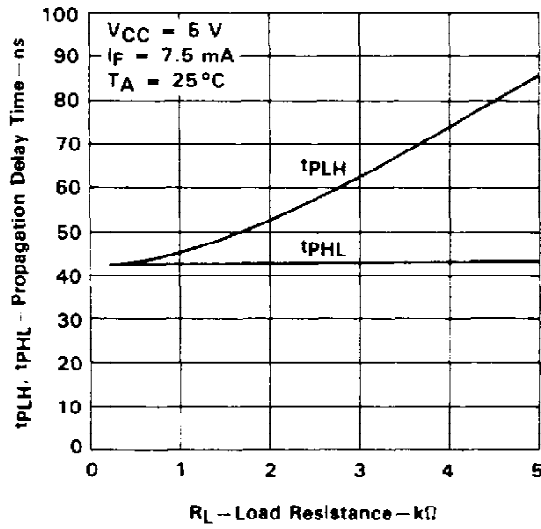


FIGURE 9

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