

TIL124, TIL125, TIL126 OPTOCOUPERS

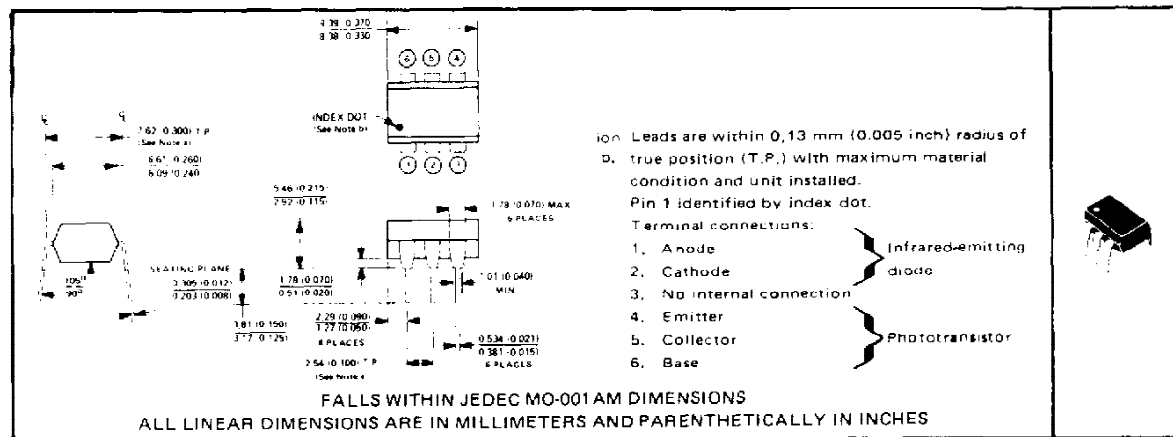
SO05044 D2227, MAY 1977—REVISED DECEMBER 1982

COMPATIBLE WITH STANDARD TTL INTEGRATED CIRCUITS

- Gallium Arsenide Diode Infrared Source Optically Coupled to a Silicon N-P-N Phototransistor
- High Direct-Current Transfer Ratio
- High-Voltage Electrical Isolation . . . 5000-V Rating
- Plastic Dual-In-Line Package
- High-Speed Switching: $t_r = 2 \mu s$, $t_f = 2 \mu s$ Typical
- Typical Applications Include Remote Terminal Isolation, SCR and Triac Triggers, Mechanical Relays, and Pulse Transformers

mechanical data

The package consists of a gallium arsenide infrared-emitting diode and an n-p-n silicon phototransistor mounted on a 6-lead frame encapsulated within an electrically nonconductive plastic compound. The case will withstand soldering temperature with no deformation and device performance characteristics remain stable when operated in high-humidity conditions. Unit weight is approximately 0.52 grams.



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

Input-to-Output Voltage	±5 kV
Collector-Base Voltage	70 V
Collector-Emitter Voltage (See Note 1)	30 V
Emitter-Collector Voltage	7 V
Emitter-Base Voltage	7 V
Input-Diode Reverse Voltage	3 V
Input-Diode Continuous Forward Current	100 mA
Continuous Power Dissipation at (or below) 25°C Free-Air Temperature:	
Infrared-Emitting Diode (See Note 2)	150 mW
Phototransistor (See Note 3)	150 mW
Total, Infrared-Emitting Diode plus Phototransistor (See Note 4)	250 mW
Storage Temperature Range	–55°C to 150°C
Lead Temperature 1,6 mm (1/16 inch) from Case for 10 Seconds	260°C

- NOTES
1. This value applies when the base-emitter diode is open-circuited.
 2. Derate linearly to 100°C free-air temperature at the rate of 2 mW/°C.
 3. Derate linearly to 100°C free-air temperature at the rate of 2 mW/°C.
 4. Derate linearly to 100°C free-air temperature at the rate of 3.33 mW/°C.

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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electrical characteristics at 25°C free-air temperature

PARAMETER		TEST CONDITIONS	TIL124			TIL125			TIL126			UNIT
			MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX	
$V_{(BR)IC80}$	Collector-Base Breakdown Voltage	$I_C = 10 \mu A, I_E = 0, I_F = 0$	70			70			70			V
$V_{(BR)CEO}$	Collector-Emitter Breakdown Voltage	$I_C = 1 mA, I_B = 0, I_F = 0$	30			30			30			V
$V_{(BR)EBO}$	Emitter-Base Breakdown Voltage	$I_E = 10 \mu A, I_C = 0, I_F = 0$	7			7			7			V
I_R	Input Diode Static Reverse Current	$V_R = 3 V$			10			10			10	μA
$I_{C(on)}$	On-State Collector Current	Phototransistor Operation $V_{CE} = 10 V, I_F = 10 mA, I_B = 0$	1	3		2	5		5	9		mA
		Photodiode Operation $V_{CB} = 10 V, I_F = 10 mA, I_E = 0$	5	20		5	20		5	20		μA
$I_{C(off)}$	Off-State Collector Current	Phototransistor Operation $V_{CE} = 10 V, I_F = 0, I_B = 0$		1	50		1	50		1	50	nA
		Photodiode Operation $V_{CB} = 10 V, I_F = 0, I_E = 0$		0.1	20		0.1	20		0.1	20	
h_{FE}	Transistor Static Forward Current Transfer Ratio	$V_{CE} = 5 V, I_C = 10 mA, I_F = 0$	50	100		100	200		100	550		
V_F	Input Diode Static Forward Voltage	$I_F = 10 mA$		1.2	1.4		1.2	1.4		1.2	1.4	V
$V_{CE(sat)}$	Collector-Emitter Saturation Voltage	$I_C = 1 mA, I_F = 10 mA, I_B = 0$		0.25	0.4		0.25	0.4		0.25	0.4	V
r_{io}	Input-to-Output Internal Resistance	$V_{in-out} = 500 V$, See Note 5		10^{11}			10^{11}			10^{11}		Ω
C_{io}	Input-to-Output Capacitance	$V_{in-out} = 0, f = 1 MHz$, See Note 5		1	1.3		1	1.3		1	1.3	pF

NOTE 5: These parameters are measured between both input diode leads shorted together and all the phototransistor leads shorted together.

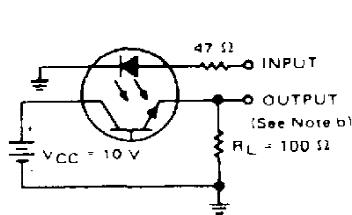
switching characteristics at 25°C free-air temperature

PARAMETER			TEST CONDITIONS	MIN	TYP	MAX	UNIT
t_r	Rise Time	Phototransistor Operation	$V_{CC} = 10\text{ V}$, $I_{C(on)} = 2\text{ mA}$, $R_L = 100\ \Omega$, See Test Circuit A of Figure 1		5	10	μs
t_f	Fall Time				5	10	
t_r	Rise Time	Photodiode Operation	$V_{CC} = 10\text{ V}$, $I_{C(on)} = 20\ \mu\text{A}$, $R_L = 1\text{ k}\Omega$, See Test Circuit B of Figure 1		1		μs
t_f	Fall Time				1		

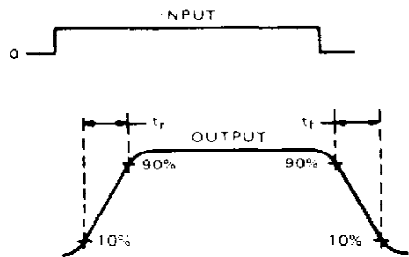
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PARAMETER MEASUREMENT INFORMATION

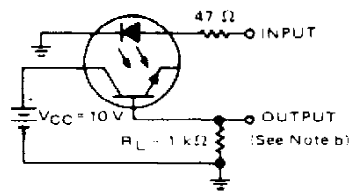
Adjust amplitude of input pulse for:
 $I_{C(on)} = 2\text{ mA}$ (Test Circuit A) or
 $I_{C(on)} = 20\text{ }\mu\text{A}$ (Test Circuit B)



TEST CIRCUIT A
PHOTOTRANSISTOR OPERATION



VOLTAGE WAVEFORMS

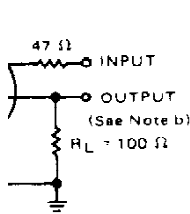


TEST CIRCUIT B
PHOTODIODE OPERATION

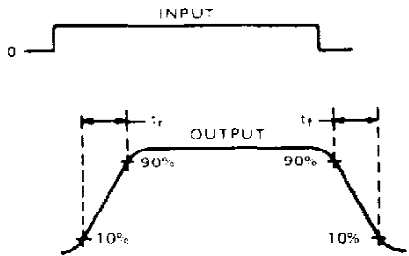
NOTES: 1. The input waveform is supplied by a generator with the following characteristics: $Z_o = 50\text{ }\Omega$, $t_r = 15\text{ ns}$, duty cycle $\geq 1\%$.

PARAMETER MEASUREMENT INFORMATION

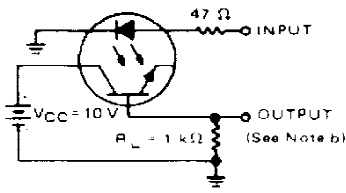
Adjust amplitude of input pulse for:
 $I_{C(on)} = 2\text{ mA}$ (Test Circuit A) or
 $I_{C(on)} = 20\text{ }\mu\text{A}$ (Test Circuit B)



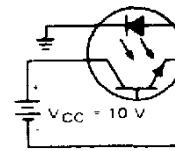
TEST CIRCUIT A
PHOTOTRANSISTOR OPERATION



VOLTAGE WAVEFORMS



TEST CIRCUIT B
PHOTODIODE OPERATION



TEST CIRCUIT C
PHOTOTRANSISTOR OPERATION

1. The input waveform is supplied by a generator with the following characteristics: $Z_o = 50\text{ }\Omega$, $t_r = 15\text{ ns}$, duty cycle $\geq 1\%$.

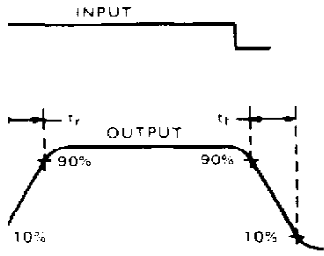
NOTES: 1. The input waveform is supplied by a generator with the following characteristics: $Z_o = 50\text{ }\Omega$, $t_r = 15\text{ ns}$, duty cycle $\geq 1\%$.

PARAMETER MEASUREMENT INFORMATION

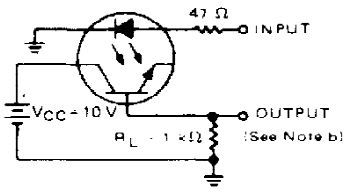
PARAMETER MEASUREMENT INFORMATION

Adjust amplitude of input pulse for:
 $I_{C(on)} = 2\text{ mA}$ (Test Circuit A) or
 $I_{C(on)} = 20\text{ }\mu\text{A}$ (Test Circuit B)

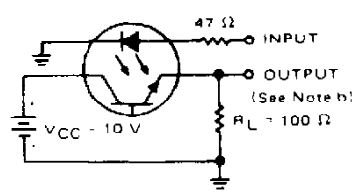
Adjust amplitude of input pulse for:
 $I_{C(on)} = 2\text{ mA}$ (Test Circuit A) or
 $I_{C(on)} = 20\text{ }\mu\text{A}$ (Test Circuit B)



VOLTAGE WAVEFORMS



TEST CIRCUIT B
PHOTODIODE OPERATION



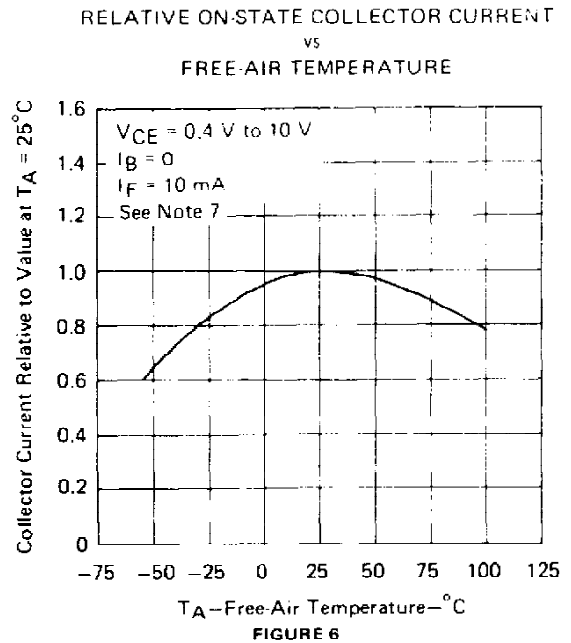
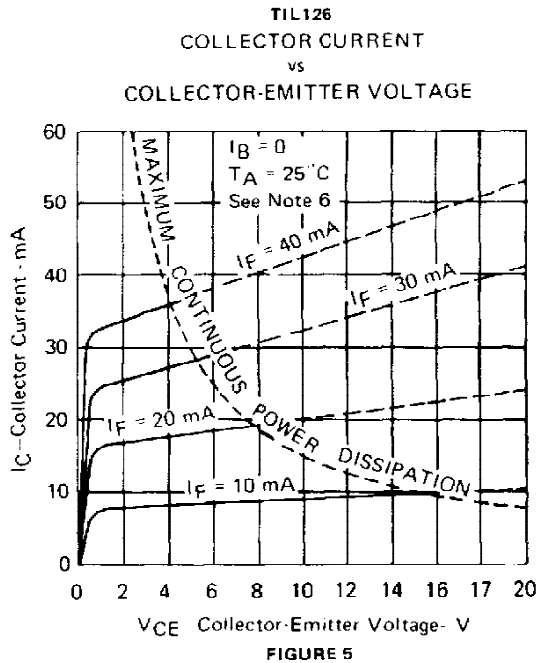
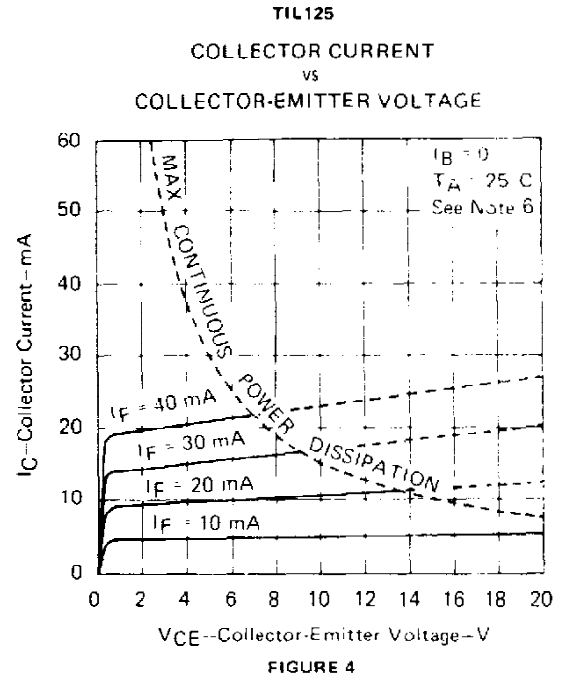
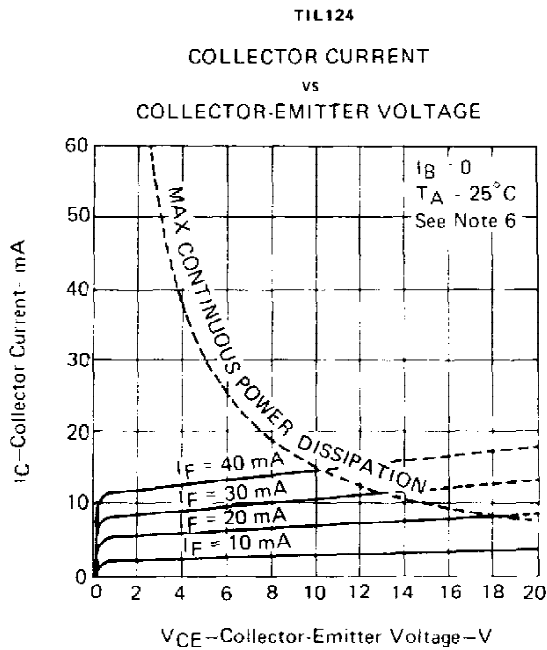
TEST CIRCUIT A
PHOTOTRANSISTOR OPERATION

1. The input waveform is supplied by a generator with the following characteristics: $Z_o = 50\text{ }\Omega$, $t_r = 15\text{ ns}$, duty cycle $\geq 1\%$.

NOTES: 1. The input waveform is supplied by a generator with the following characteristics: $Z_o = 50\text{ }\Omega$, $t_r = 15\text{ ns}$, duty cycle $\geq 1\%$.

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TYPICAL CHARACTERISTICS



NOTES 6. Pulse operation of input diode is required for operation beyond limits shown by dotted lines.
7. These parameters were measured using pulse techniques. $t_w = 1$ ms, duty cycle $\leq 2\%$.

TYPICAL CHARACTERISTICS

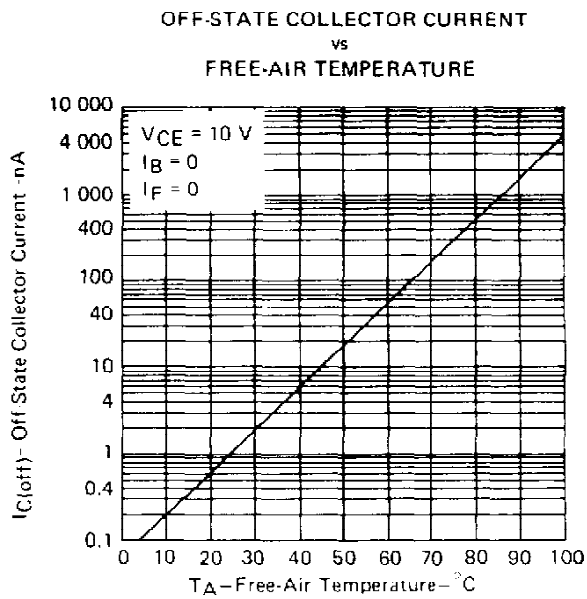


FIGURE 7

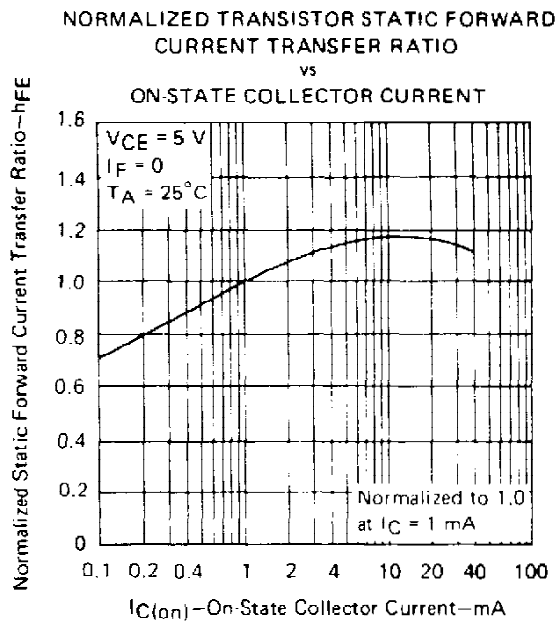


FIGURE 8

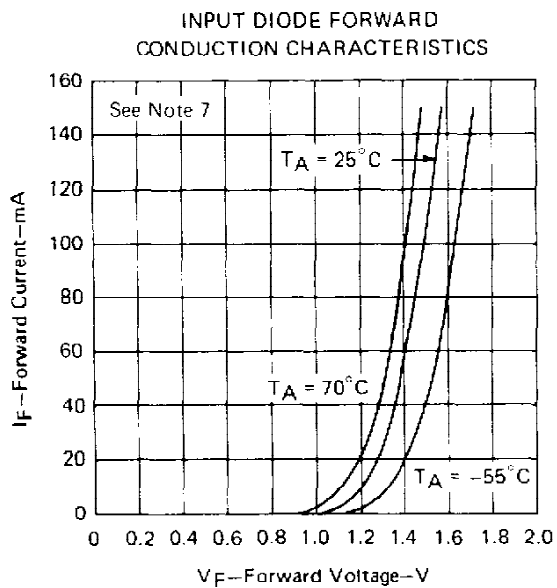


FIGURE 9

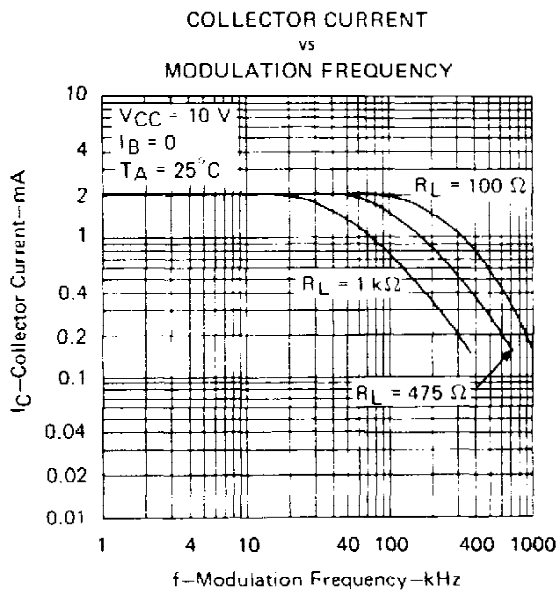


FIGURE 10

NOTE 7: These parameters were measured using pulse techniques. $t_w = 1\text{ ms}$, duty cycle $\leq 2\%$.

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