

TIL124, TIL125, TIL126 OPTOCOPLERS

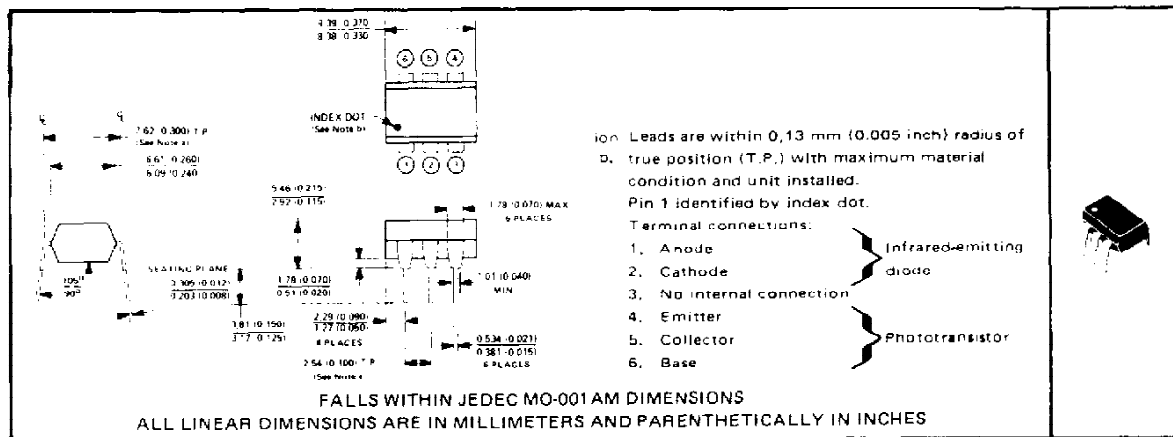
SO05044 D2227, MAY 1977—REVISED DECEMBER 1982

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.

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TEXAS
INSTRUMENTS

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TIL124, TIL125, TIL126 OPTOCOUPERS

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	nA
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	$V_{in-out} = 500 V, \text{ See Note 5}$		10^{11}		10^{11}			10^{11}			Ω
C_{io} Input-to-Output Capacitance	$V_{in-out} = 0, f = 1 MHz, \text{ See Note 5}$		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.

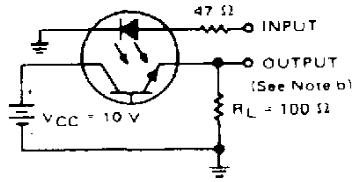
switching characteristics at 25°C free-air temperature

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

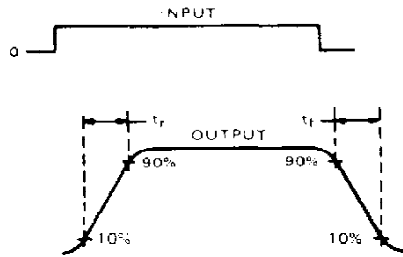
TIL124, TIL125, TIL126 OPTOCOUPLED

PARAMETER MEASUREMENT INFORMATION

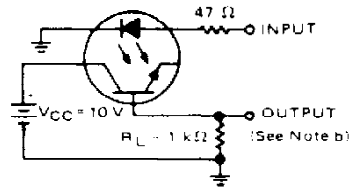
Adjust amplitude of input pulse for:
 $I_{C(on)} = 2 \text{ mA}$ (Test Circuit A) or
 $I_{C(on)} = 20 \mu\text{A}$ (Test Circuit B)



TEST CIRCUIT A
PHOTOTRANSISTOR OPERATION



VOLTAGE WAVEFORMS

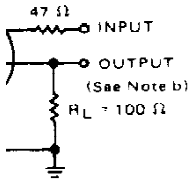


TEST CIRCUIT B
PHOTODIODE OPERATION

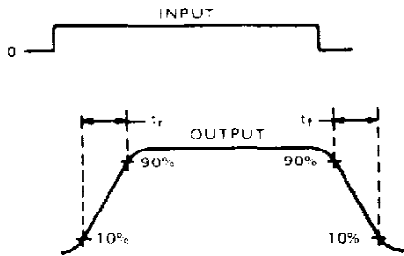
NOTES: 1. The input waveform is supplied by a generator with the following characteristics: $f = 50 \text{ kHz}$, $t_r = 15 \text{ ns}$, duty cycle $\geq 1\%$.

PARAMETER MEASUREMENT INFORMATION

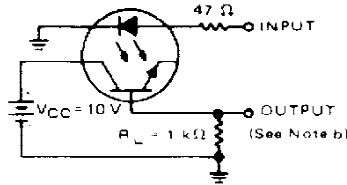
Adjust amplitude of input pulse for:
 $I_{C(on)} = 2 \text{ mA}$ (Test Circuit A) or
 $I_{C(on)} = 20 \mu\text{A}$ (Test Circuit B)



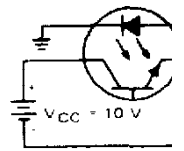
TEST CIRCUIT A
PHOTOTRANSISTOR OPERATION



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: $f = 50 \text{ kHz}$, $t_r = 15 \text{ ns}$, duty cycle $\geq 1\%$.

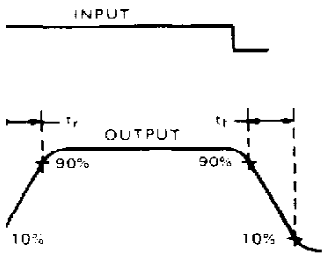
NOTES: 1. The input waveform is supplied by a generator with the following characteristics: $f = 50 \text{ kHz}$, $t_r = 15 \text{ ns}$, duty cycle $\geq 1\%$.

PARAMETER MEASUREMENT INFORMATION

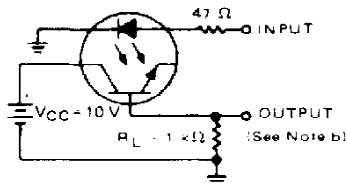
PARAMETER MEASUREMENT INFORMATION

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

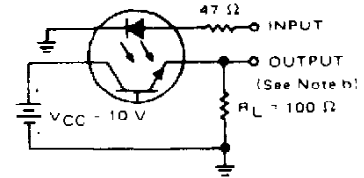
Adjust amplitude of input pulse for:
 $I_{C(on)} = 2 \text{ mA}$ (Test Circuit A) or
 $I_{C(on)} = 20 \mu\text{A}$ (Test Circuit B)



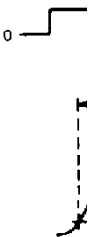
VOLTAGE WAVEFORMS



TEST CIRCUIT B
PHOTODIODE OPERATION



TEST CIRCUIT A
PHOTOTRANSISTOR OPERATION

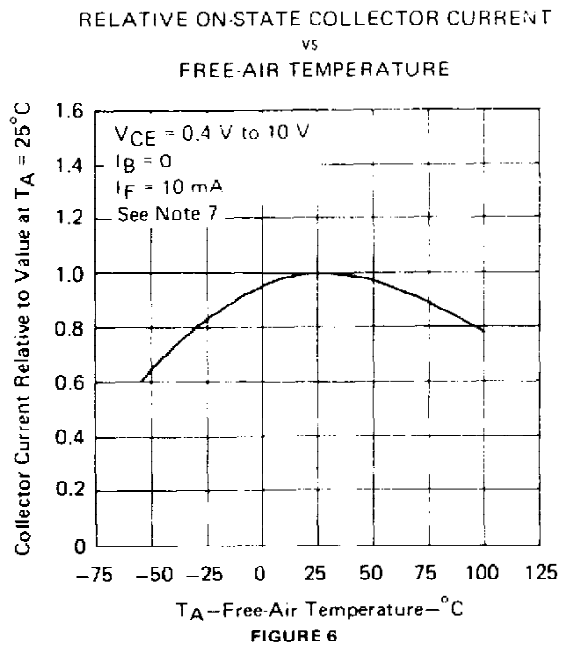
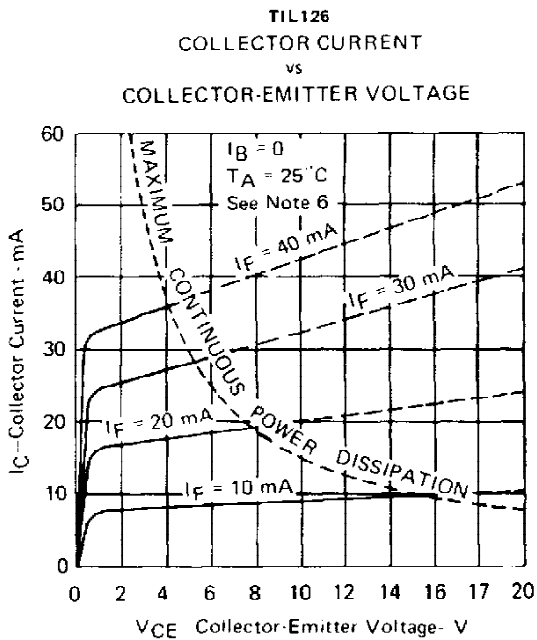
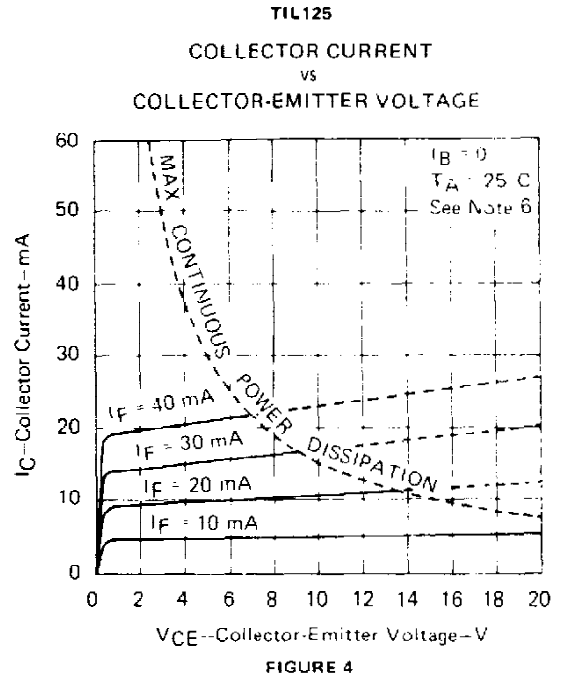
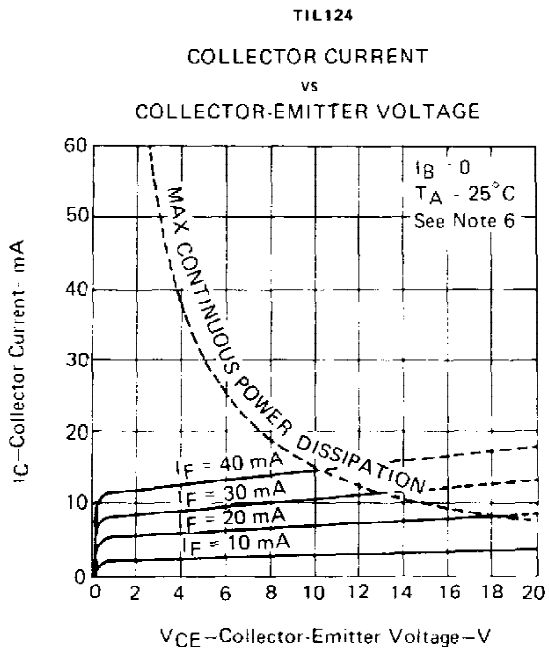


1. The input waveform is supplied by a generator with the following characteristics: $f = 50 \text{ kHz}$, $t_r = 15 \text{ ns}$, duty cycle $\geq 1\%$.

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

**TIL124, TIL125, TIL126
OPTOCOUPERS**

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

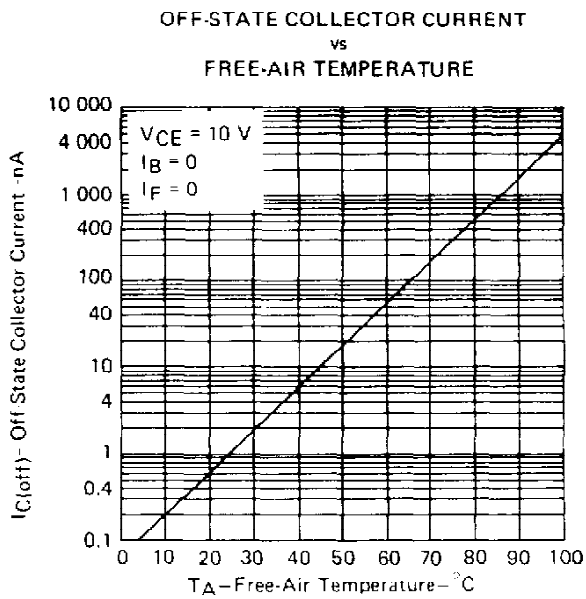


FIGURE 7

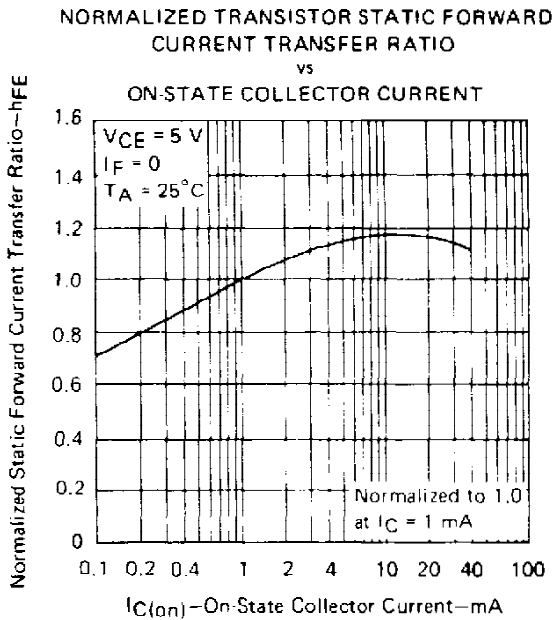


FIGURE 8

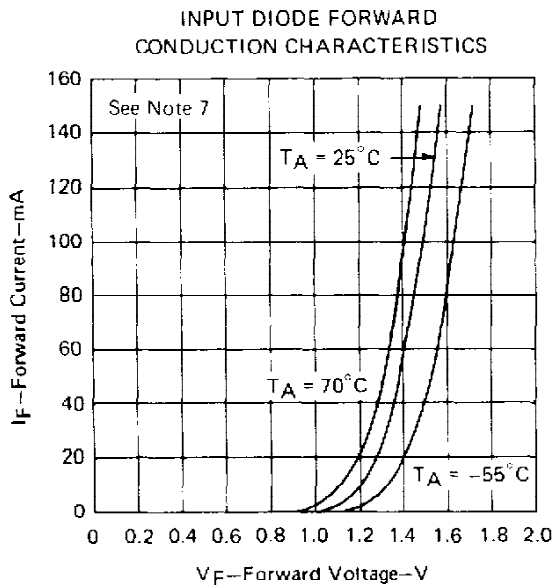


FIGURE 9

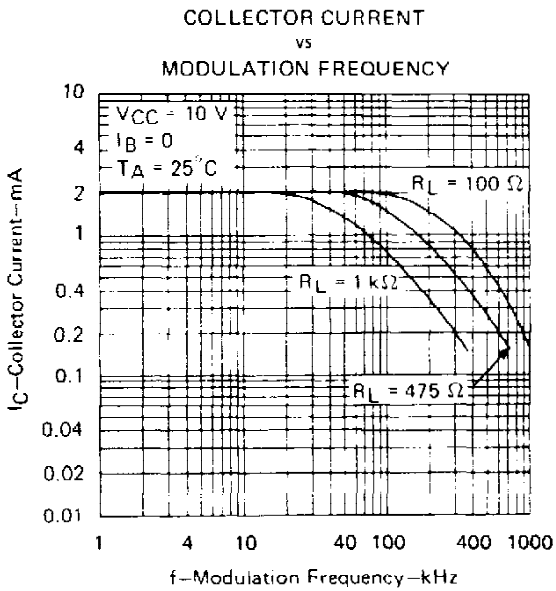


FIGURE 10

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

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Orderable Device	Status ⁽¹⁾	Package Type	Package Drawing	Pins	Package Qty	Eco Plan ⁽²⁾	Lead/Ball Finish	MSL Peak Temp ⁽³⁾
TIL124	OBSOLETE	PDIP	N	6		TBD	Call TI	Call TI
TIL125	OBSOLETE	PDIP	N	6		TBD	Call TI	Call TI
TIL126	OBSOLETE	PDIP	N	6		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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