TIL124, TIL125, TIL126
OPTOCOUPLERS

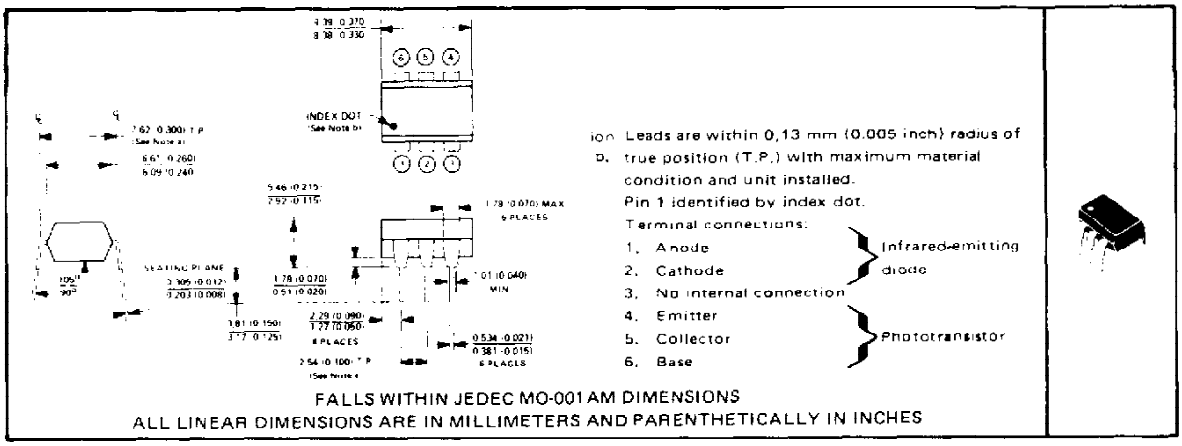
SOOS044 D2227, MAY 1977 – REVISED DECEMBER 1982

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 μs, t_f = 2 μs 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.



FALLS WITHIN JEDEC MO-001AM DIMENSIONS
ALL LINEAR DIMENSIONS ARE IN MILLIMETERS AND PARENTHETICALLY IN INCHES

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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electrical characteristics at 25°C free-air temperature

PARAMETER			TEST CONDITIONS	TIL124			TIL125			TIL126			UNIT
				MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX	
$V_{(BR)CBO}$	Collector-Base Breakdown Voltage		I_C = 10 µA, 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 µA, 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 V, $I_{C(on)}$ = 2 mA, R_L = 100 Ω, 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 µA, R_L = 1 kΩ, See Test Circuit B of Figure 1		1		µs
t_f	Fall Time				1		

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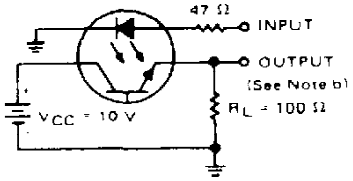
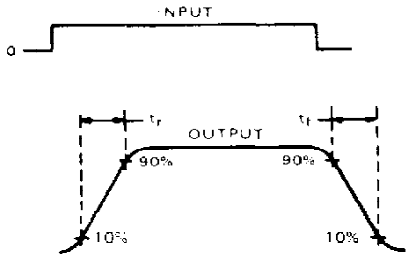
PARAMETER MEASUREMENT INFORMATION

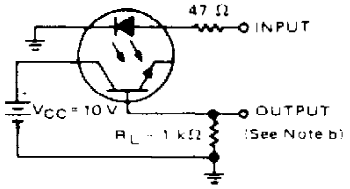
Adjust amplitude of input pulse for:
$I_{C(on)}$ = 2 mA (Test Circuit A) or
$I_{C(on)}$ = 20 μA (Test Circuit B)



TEST CIRCUIT A
PHOTOTRANSISTOR OPERATION



VOLTAGE WAVEFORMS

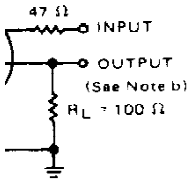


TEST CIRCUIT B
PHOTODIODE OPERATION

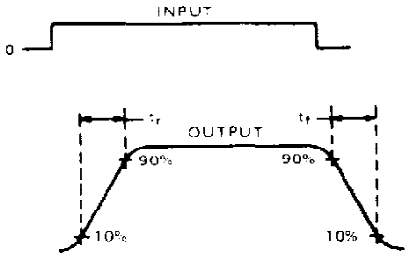
NOTES: a. The input waveform is supplied by a generator with the following characteristics: Z_out = 50 Ω, t_r = t_f = 15 ns, duty cycle = 1%

PARAMETER MEASUREMENT INFORMATION

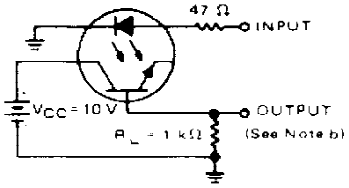
Adjust amplitude of input pulse for:
$I_{C(on)}$ = 2 mA (Test Circuit A) or
$I_{C(on)}$ = 20 μA (Test Circuit B)



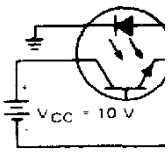
ICUIT A
OR OPERATION



VOLTAGE WAVEFORMS



TEST CIRCUIT B
PHOTODIODE OPERATION

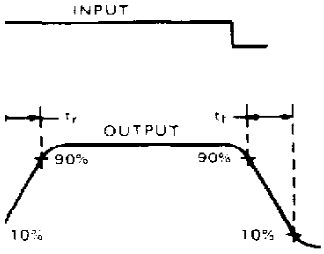


TEST CIR
PHOTOTRANSIST

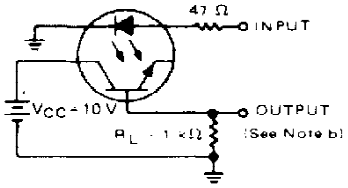
NOTES: a. The input waveform is supplied by a generator with the following characteristics: Z_out = 50 Ω, t_r = t_f = 15 ns, duty cycle = 1%

I MEASUREMENT INFORMATION

st amplitude of input pulse for:
n) = 2 mA (Test Circuit A) or
n) = 20 μA (Test Circuit B)



VOLTAGE WAVEFORMS



TEST CIRCUIT B
PHOTODIODE OPERATION

PARAMETER

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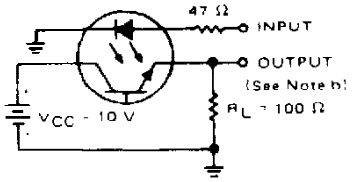
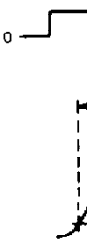
$I_{C(o}$
$I_{C(o}$



TEST CIRCUIT A
PHOTOTRANSISTOR OPERATION



NOTES: a. The input waveform is supplied by a generator

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TYPICAL CHARACTERISTICS

TIL124

COLLECTOR CURRENT
vs
COLLECTOR-EMITTER VOLTAGE

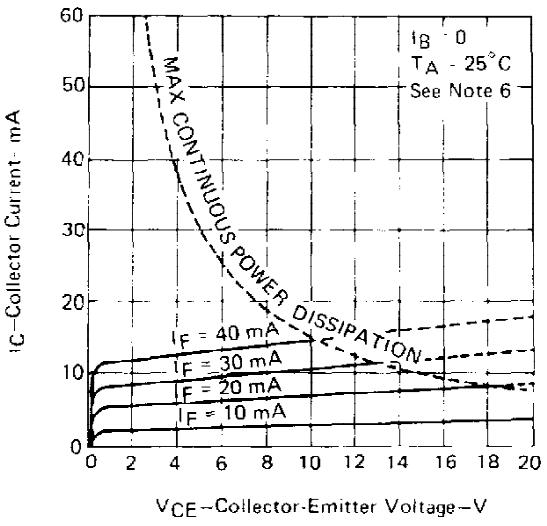

FIGURE 3

TIL125

COLLECTOR CURRENT
vs
COLLECTOR-EMITTER VOLTAGE

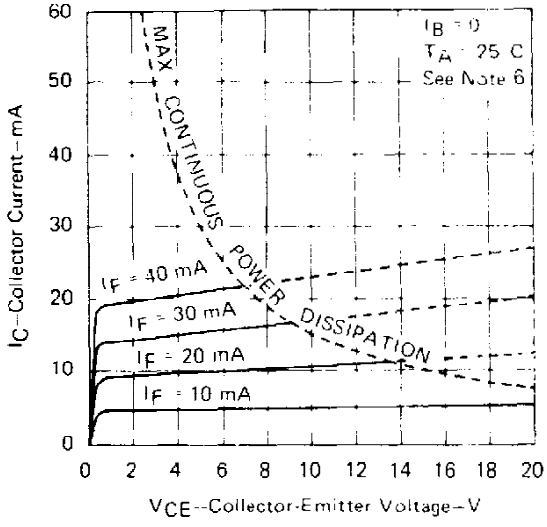

FIGURE 4

TIL126

COLLECTOR CURRENT
vs
COLLECTOR-EMITTER VOLTAGE

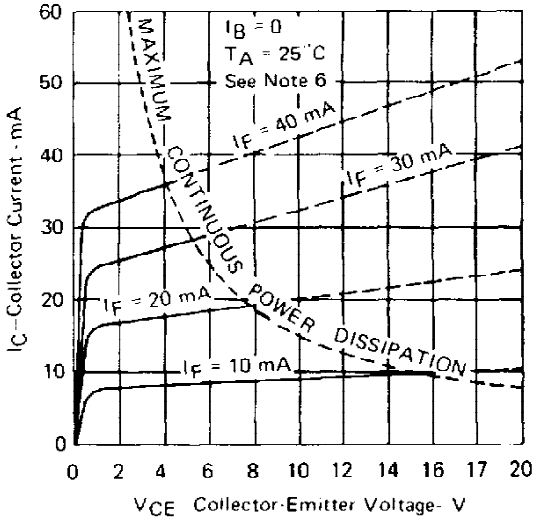

FIGURE 5

RELATIVE ON-STATE COLLECTOR CURRENT
vs
FREE-AIR TEMPERATURE

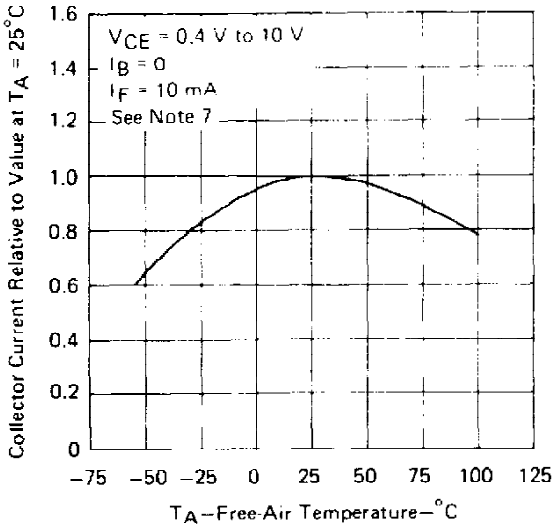

FIGURE 6

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 ≤ 2%.

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TYPICAL CHARACTERISTICS

OFF-STATE COLLECTOR CURRENT
vs
FREE-AIR TEMPERATURE

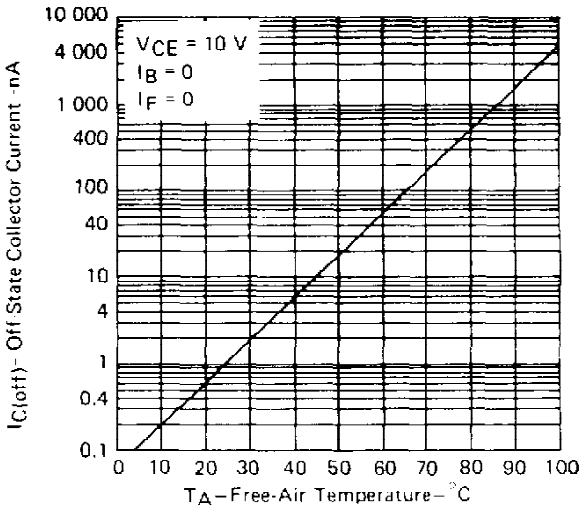

FIGURE 7

NORMALIZED TRANSISTOR STATIC FORWARD
CURRENT TRANSFER RATIO
vs
ON-STATE COLLECTOR CURRENT

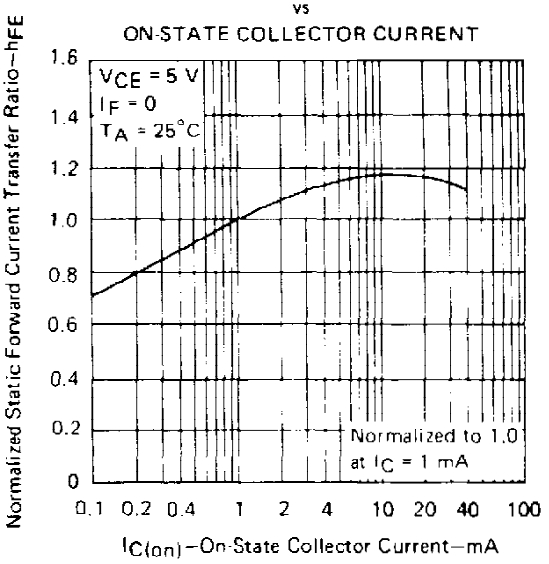

FIGURE 8

INPUT DIODE FORWARD
CONDUCTION CHARACTERISTICS

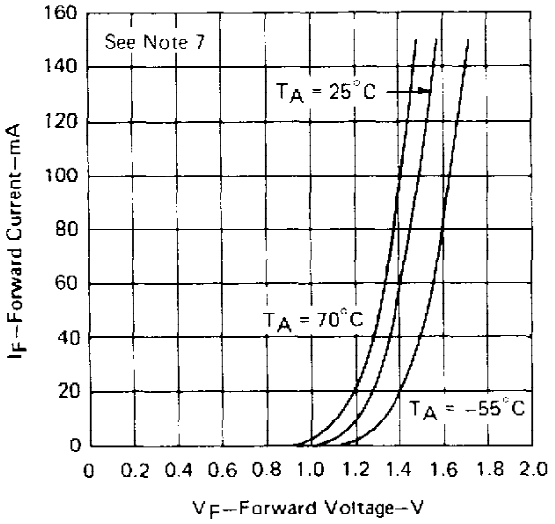

FIGURE 9

COLLECTOR CURRENT
vs
MODULATION FREQUENCY

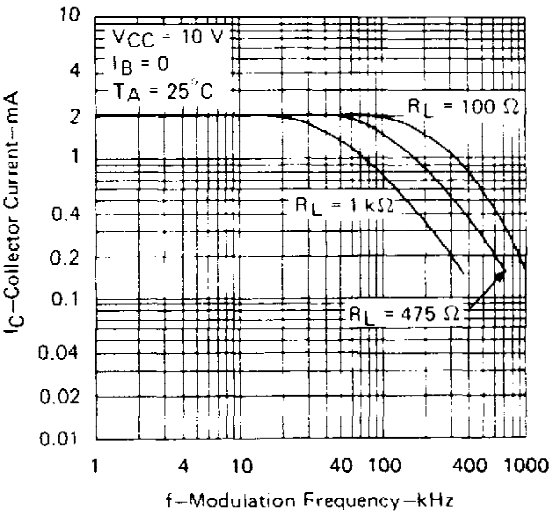

FIGURE 10

NOTE 7: These parameters were measured using pulse techniques. t_w = 1 ms, duty cycle ≤ 2%.

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