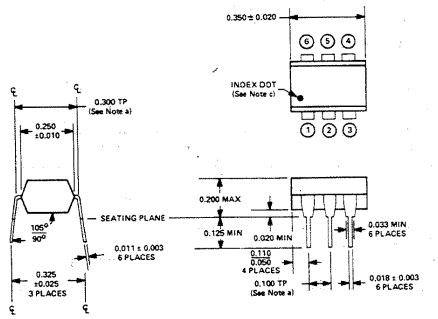
TYPE TIL112
OPTICALLY COUPLED ISOLATOR

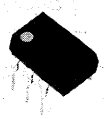
- Gallium Arsenide Diode Light Source Optically Coupled to a Silicon N-P-N Phototransistor
- High Direct-Current Transfer Ratio
- Base Lead Provided for Conventional Transistor Biasing
- High-Voltage Electrical Isolation . . . 1.5-kV Rating
- Plastic Dual-In-Line Package
- High-Speed Switching: t_r = 2 μs, t_f = 2 μs Typical

mechanical data

The package consists of a gallium arsenide light-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.



NOTES:
a. Leads are within 0.005 radius of true position (TP) at the gauge plane with maximum material condition and unit installed.
b. All dimensions are in inches unless otherwise noted.
c. Pin 1 identified by index dot.
d. Terminal connection:
1. Anode } Light-emitting diode
2. Cathode
3. No internal connection
4. Emitter } Phototransistor
5. Collector
6. Base



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

Input-to-Output Voltage	±1.5 kV
Collector-Base Voltage	30 V
Collector-Emitter Voltage (See Note 1)	20 V
Emitter-Collector Voltage	4 V
Emitter-Base Voltage	4 V
Input-Diode Reverse Voltage	3 V
Input-Diode Continuous Forward Current at (or below) 25°C Free-Air Temperature (See Note 2)	60 mA
Continuous Power Dissipation at (or below) 25°C Free-Air Temperature:	
Light-Emitting Diode (See Note 3)	100 mW
Phototransistor (See Note 4)	150 mW
Storage Temperature Range	−55°C to 150°C
Lead Temperature 1/16 inch from case for 10 seconds	240°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 0.8 mA/°C.
3. Derate linearly to 100°C free-air temperature at the rate of 1.33 mW/°C.
4. Derate linearly to 100°C free-air temperature at the rate of 2 mW/°C.

TYPE TIL112
OPTICALLY COUPLED ISOLATOR

electrical characteristics at 25°C free-air temperature

PARAMETER			TEST CONDITIONS			MIN	TYP	MAX	UNIT
$V_{(BR)CBO}$	Collector-Base Breakdown Voltage		I_C = 10 μA,	I_E = 0,	I_F = 0	30			V
$V_{(BR)CEO}$	Collector-Emitter Breakdown Voltage		I_C = 1 mA,	I_B = 0,	I_F = 0	20			V
$V_{(BR)EBO}$	Emitter-Base Breakdown Voltage		I_E = 10 μA,	I_C = 0,	I_F = 0	4			V
$I_{C(on)}$	On-State Collector Current	Phototransistor Operation	V_{CE} = 5 V,	I_B = 0,	I_F = 10 mA	0.2	2		mA
		Photodiode Operation	V_{CB} = 5 V,	I_E = 0,	I_F = 10 mA	2	10		μA
$I_{C(off)}$	Off-State Collector Current	Phototransistor Operation	V_{CE} = 5 V,	I_B = 0,	I_F = 0		1	100	nA
		Photodiode Operation	V_{CB} = 5 V,	I_E = 0,	I_F = 0		0.1	50	nA
h_{FE}	Transistor Static Forward Current Transfer Ratio		V_{CE} = 5 V,	I_C = 10 mA,	I_F = 0	50	200		
V_F	Input Diode Static Forward Voltage		I_F = 10 mA				1.2	1.5	V
$V_{CE(sat)}$	Collector-Emitter Saturation Voltage		I_C = 2 mA,	I_B = 0,	I_F = 50 mA			0.5	V
R_{in-out}	Input-to-Output Internal Resistance		V_{in-out} = ±1.5 kV,	See Note 5		10^{11}			Ω
C_{in-out}	Input-to-Output Capacitance		V_{in-out} = 0,	f = 1 MHz,	See Note 5		1	2	pF

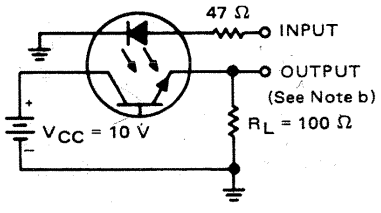
NOTE 5: These parameters are measured between both input diode leads shorted together and all the phototransistor leads shorted together.

switching characteristics at 25°C free-air temperature

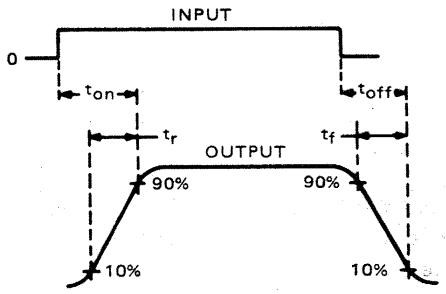
PARAMETER			TEST CONDITIONS	MIN	TYP	MAX	UNIT
t_r	Rise Time	Phototransistor	V_{CC} = 10 V, $I_{C(on)}$ = 2 mA, R_L = 100 Ω,		2	15	μs
t_f	Fall Time	Operation	See Test Circuit A of Figure 1		2	15	
t_r	Rise Time	Photodiode	V_{CC} = 10 V, $I_{C(on)}$ = 20 μA, R_L = 1 kΩ,		1		μs
t_f	Fall Time	Operation	See Test Circuit B of Figure 1		1		

PARAMETER MEASUREMENT INFORMATION

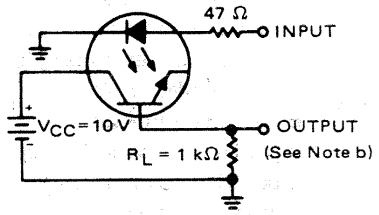
Adjust amplitude of input pulse for:
$I_{C(on)}$ = 2 mA (Test Circuit A) or
$I_{C(on)}$ = 20 μA (Test Circuit B)



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, $t_r \leq$ 15 ns, duty cycle ≈ 1%, t_w = 100 μs.
b. The output waveform is monitored on an oscilloscope with the following characteristics: $t_r \leq$ 12 ns, $R_{in} \geq$ 1 MΩ, $C_{in} \leq$ 20 pF.

FIGURE 1–SWITCHING TIMES

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TYPICAL CHARACTERISTICS

COLLECTOR CURRENT
vs
COLLECTOR-EMITTER VOLTAGE

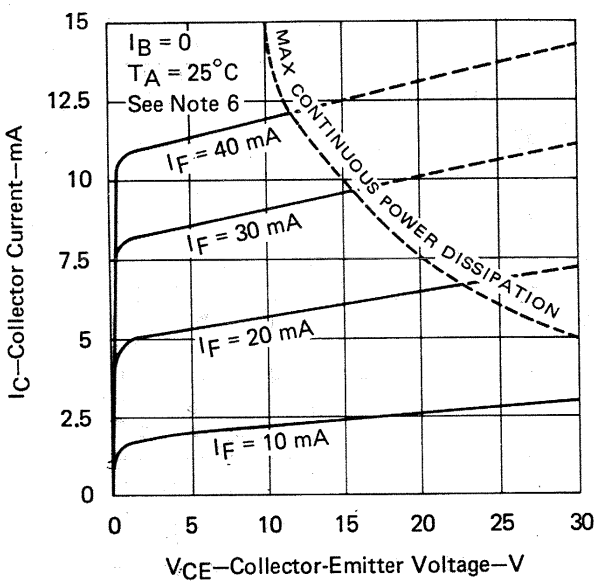

FIGURE 2

COLLECTOR CURRENT
vs
INPUT-DIODE FORWARD CURRENT

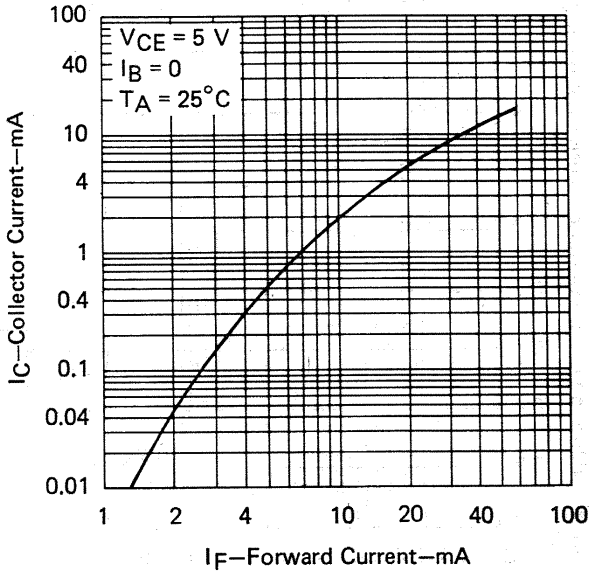

FIGURE 3

RELATIVE ON-STATE COLLECTOR CURRENT
vs
FREE-AIR TEMPERATURE

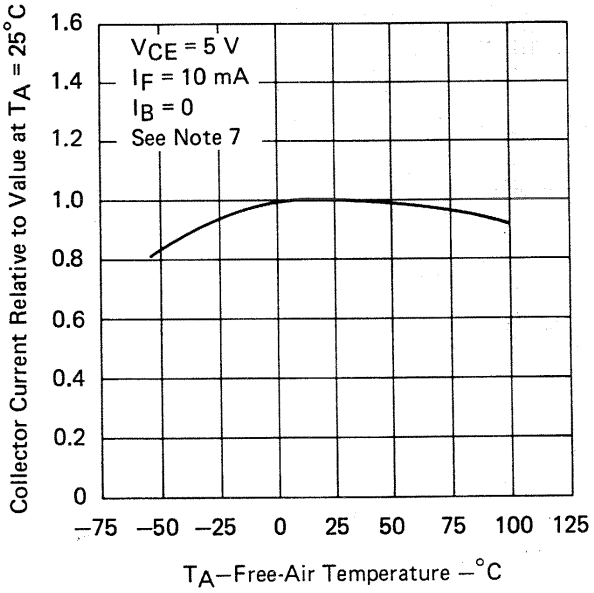

FIGURE 4

OFF-STATE COLLECTOR CURRENT
vs
FREE-AIR TEMPERATURE

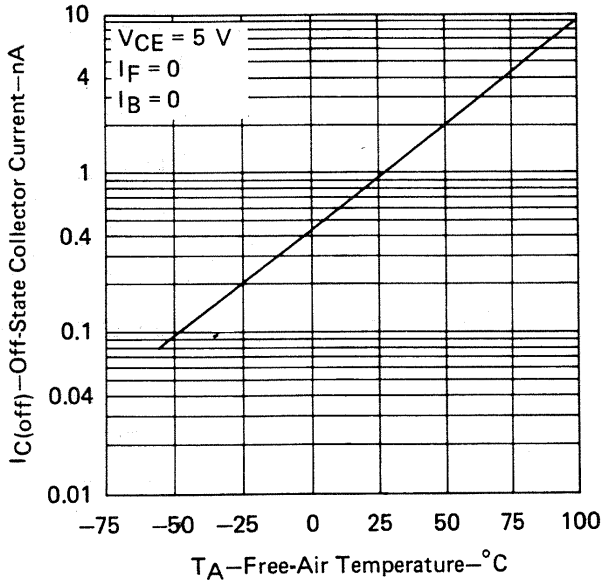

FIGURE 5

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

TYPICAL CHARACTERISTICS

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

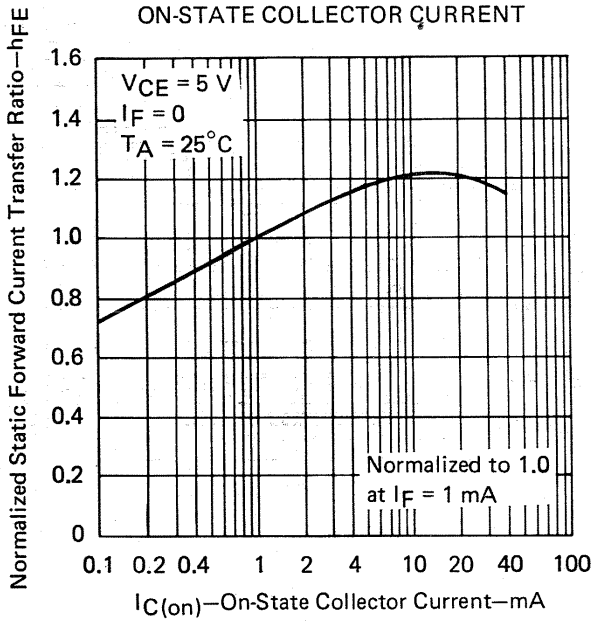

FIGURE 6

INPUT-DIODE FORWARD CONDUCTION CHARACTERISTICS

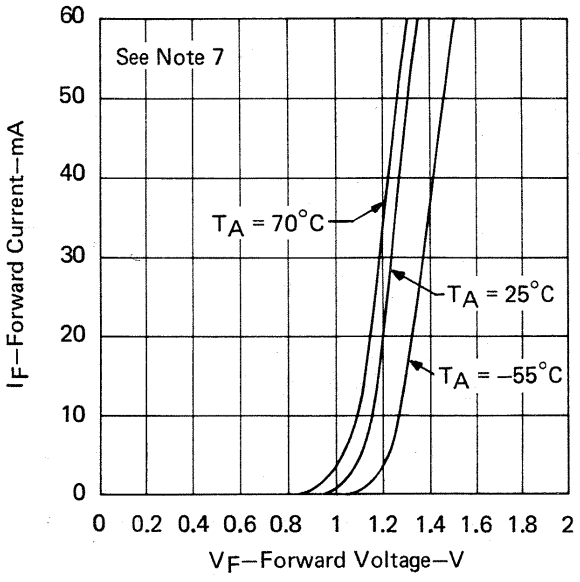

FIGURE 7

COLLECTOR CURRENT
vs
MODULATION FREQUENCY

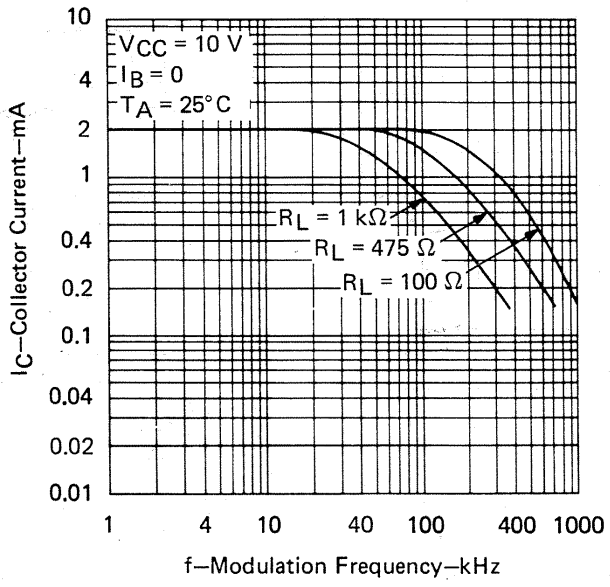

FIGURE 8

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