TIL120, TIL121
OPTOCOUPLERS

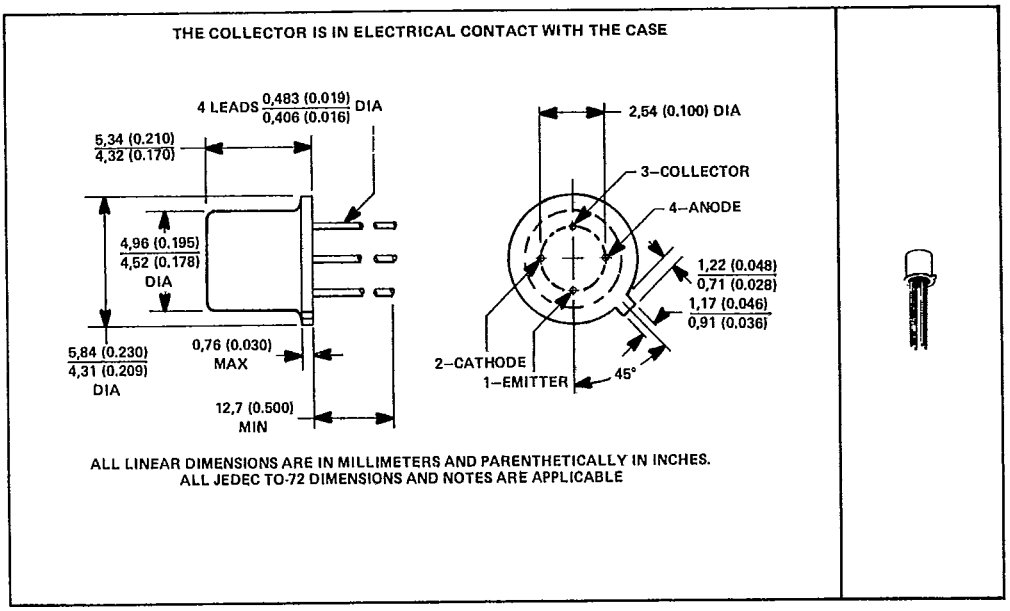
D1956, NOVEMBER 1974

GALLIUM ARSENIDE DIODE INFRARED SOURCE OPTICALLY COUPLED TO A HIGH-GAIN N-P-N SILICON PHOTOTRANSISTOR

T-41-83

- Photon Coupling for Isolator Applications
- High Overall Current Gain . . . 1.0 Typ (TIL121)
- High-Gain, High-Voltage Transistor . . . $V_{(BR)CEO}$ = 35 V Min
- High-Voltage Electrical Isolation . . . 1-kV Rating
- Stable Over Wide Temperature Range

mechanical data



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

Input-to-Output Voltage	±1 kV
Collector-Emitter Voltage	35 V
Emitter-Collector Voltage	7 V
Input Diode Reverse Voltage	3 V
Input Diode Continuous Forward Current at (or below) 65°C Free-Air Temperature (See Note 1)	40 mA
Continuous Collector Current	50 mA
Continuous Transistor Power Dissipation at (or below) 25°C Free-Air Temperature (See Note 2)	190 mW
Operating Free-Air Temperature Range	−55°C to 125°C
Storage Temperature Range	−55°C to 150°C
Lead Temperature 1,6 mm (1/16 Inch) from Case for 10 Seconds	240°C

NOTES: 1. Derate linearly to 125°C free-air temperature at the rate of 0.67 mA/°C.
2. Derate linearly to 125°C free-air temperature at the rate of 1.9 mW/°C.

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electrical characteristics at 25°C free-air temperature (unless otherwise noted)

PARAMETER		TEST CONDITIONS		TIL120			TIL121			UNIT
				MIN	TYP	MAX	MIN	TYP	MAX	
$V_{(BR)CEO}$	Collector-Emitter Breakdown Voltage	I_C = 1 mA,	I_F = 0	35			35			V
$V_{(BR)ECO}$	Emitter-Collector Breakdown Voltage	I_E = 100 μA,	I_F = 0	7			7			V
I_R	Input Diode Static Reverse Current	V_R = 3 V				100			100	μA
$I_{C(on)}$	On-State Collector Current	V_{CE} = 5 V,	I_F = 10 mA	2.5	6		5	10		mA
$I_{C(off)}$	Off-State Collector Current	V_{CE} = 20 V,	I_F = 0		6	100		6	100	nA
		V_{CE} = 20 V, T_A = 100°C	I_F = 0,		4			4		μA
V_F	Input Diode Static Forward Voltage	I_F = 10 mA				1.3			1.3	V
$V_{CE(sat)}$	Collector-Emitter Saturation Voltage	I_C = 2.5 mA,	I_F = 20 mA			0.3				V
		I_C = 10 mA,	I_F = 20 mA						0.3	
r_{IO}	Input-to-Output Internal Resistance	V_{in-out} = ±1 kV,	See Note 3	10^{11}	10^{12}		10^{11}	10^{12}		Ω
C_{IO}	Input-to-Output Capacitance	V_{in-out} = 0, See Note 3	f = 1 MHz,		2.5			2.5		pF

NOTE 3 These parameters are measured between both input diode leads shorted together and both phototransistor leads shorted together.

switching characteristics at 25°C free-air temperature

PARAMETER		TEST CONDITIONS		TIL120			TIL121			UNIT
				MIN	TYP	MAX	MIN	TYP	MAX	
t_r	Rise Time	V_{CC} = 20 V,	$I_{C(on)}$ = 5 mA		3	20		6	20	μs
t_f	Fall Time	R_L = 100 Ω,	See Figure 1		3	20		6	20	

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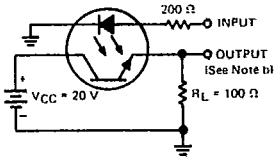
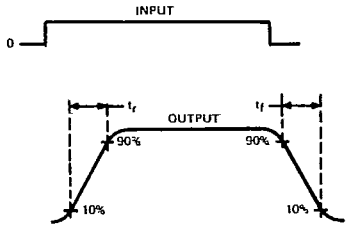
PARAMETER MEASUREMENT INFORMATION

Adjust amplitude of input pulse for
$I_{C(on)}$ = 5 mA



TEST CIRCUIT



VOLTAGE WAVEFORMS

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. Waveforms are 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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Optocouplers (Isolators)

TYPICAL CHARACTERISTICS

TIL120
COLLECTOR CURRENT
vs
COLLECTOR-EMITTER VOLTAGE

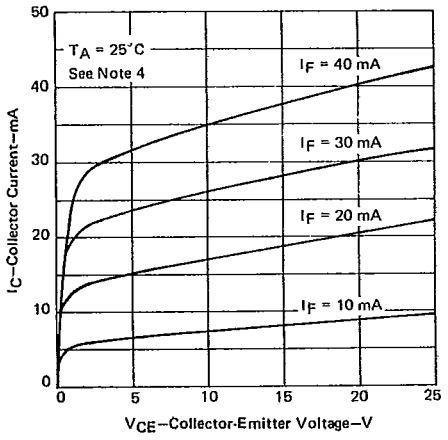

FIGURE 2

TIL121
COLLECTOR CURRENT
vs
COLLECTOR-EMITTER VOLTAGE

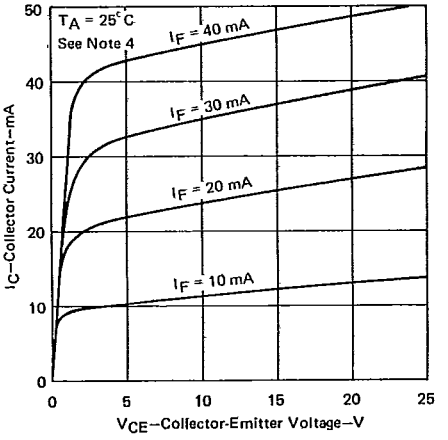

FIGURE 3

NOTE 4: This parameter was measured using pulse techniques. t_w = 100 μs, duty cycle = 1%.

TYPICAL CHARACTERISTICS

INPUT DIODE FORWARD CONDUCTION CHARACTERISTICS

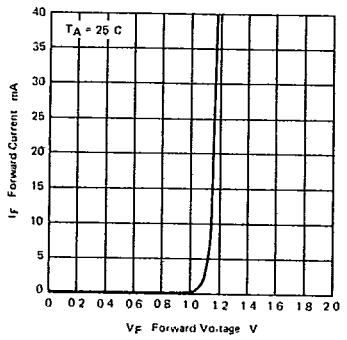

FIGURE 4

NORMALIZED ON-STATE COLLECTOR CURRENT
vs
FREE AIR TEMPERATURE

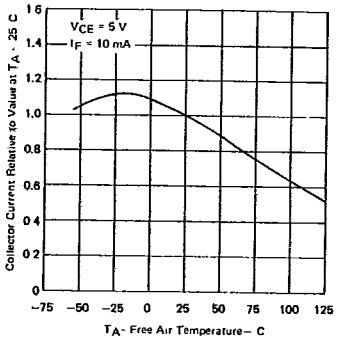

FIGURE 5

PHOTOTRANSISTOR COLLECTOR CURRENT
vs
INPUT-DIODE FORWARD CURRENT

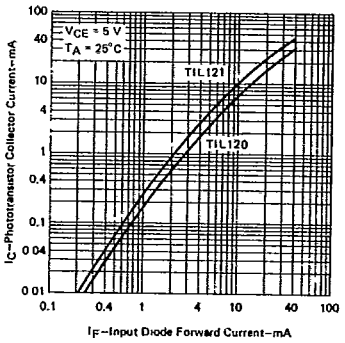

FIGURE 6

OFF-STATE COLLECTOR CURRENT
vs
FREE-AIR TEMPERATURE

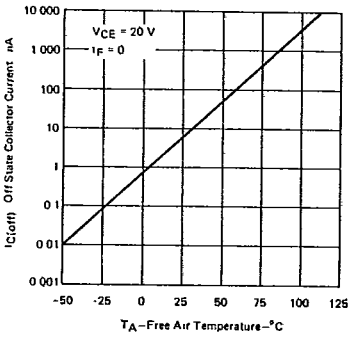

FIGURE 7

TIL120
AVERAGE SWITCHING TIME
vs
LOAD RESISTANCE

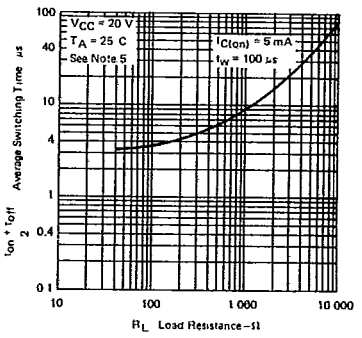

FIGURE 8

NOTE 5: These parameters were measured in the test circuit of Figure 1 with R_L varied between 40 Ω and 10 kΩ.

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