

**TIL118-1, TIL118-2, TIL118-3  
OPTOCOPLERS**

D1607, NOVEMBER 1973—REVISED JULY 1989

- Gallium Arsenide Diode Infrared Source Optically Coupled to a Silicon N-P-N Phototransistor
- High Direct-Current Transfer Ratio
- High-Voltage Electrical Isolation . . . 3.53 kV
- Plastic Dual-In-Line Package
- High-Speed Switching:  $t_r = 2 \mu s$ ,  $t_f = 2 \mu s$  Typical
- Choice of Three Current Transfer Ratios
- No Base Lead Connection for High EMI Environment

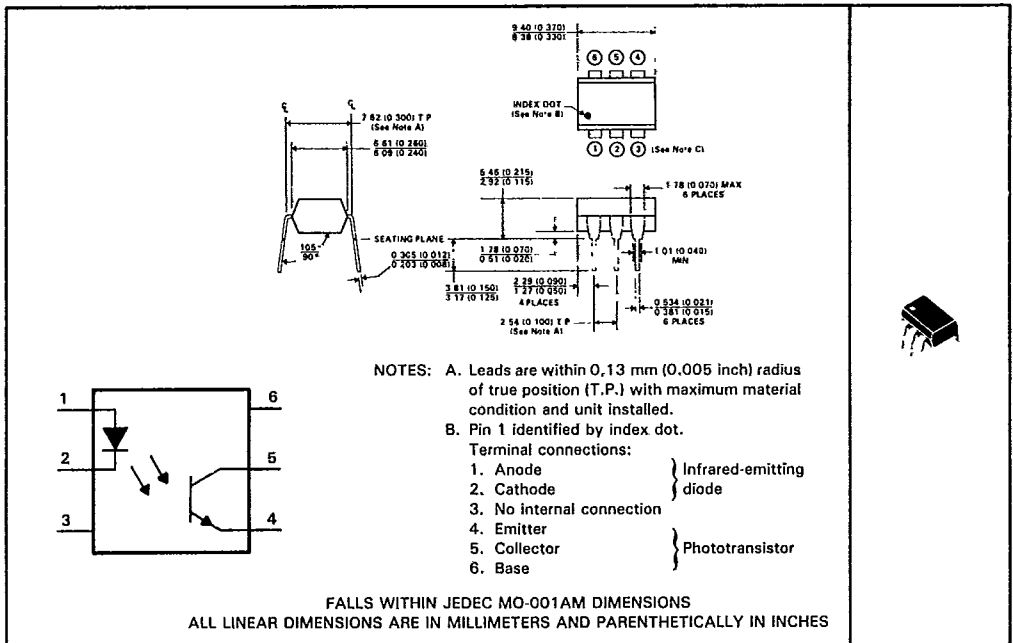
T-41-83

**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.

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Optocouplers (Isolators)



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.

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OPTOCOUPERS**

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

Input-to-output voltage .....	±3.535 kV peak or dc (±2.5 kV rms)
Collector-emitter voltage (see Note 1) .....	30 V
Emitter-collector voltage .....	7 V
Input diode reverse voltage .....	3 V
Input diode continuous forward current at (or below) 25°C free-air temperature (see Note 2) .....	100 mA
Continuous power dissipation at (or below) 25°C free-air temperature:	
Infrared-emitting diode (see Note 3) .....	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 1.33 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.

**3 electrical characteristics at 25°C free-air temperature**

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PARAMETER		TEST CONDITIONS			MIN	TYP	MAX	UNIT
V <sub>(BR)CEO</sub>	Collector-emitter breakdown voltage	I <sub>C</sub> = 1 mA,	I <sub>B</sub> = 0,	I <sub>F</sub> = 0	30			V
	Emitter-collector breakdown voltage	I <sub>E</sub> = 10 μA,	I <sub>F</sub> = 0		7			V
I <sub>C(on)</sub>	On-state collector current	Photo-transistor operation	TIL118-1 TIL118-2 TIL118-3	V <sub>CE</sub> = 5 V, I <sub>F</sub> = 10 mA, I <sub>B</sub> = 0	2			mA
					5			
					10			
I <sub>C(off)</sub>	Off-state collector current	Phototransistor operation		V <sub>CE</sub> = 5 V, I <sub>F</sub> = 0, I <sub>B</sub> = 0		1	100	nA
V <sub>F</sub>	Input diode static forward voltage			I <sub>F</sub> = 10 mA		1.2	1.5	V
V <sub>CE(sat)</sub>	Collector-emitter saturation voltage	I <sub>C</sub> = 2 mA,	I <sub>F</sub> = 10 mA,	I <sub>B</sub> = 0			0.4	V
r <sub>IO</sub>	Input-to-output internal resistance	V <sub>in-out</sub> = ±500 V, See Note 5			10 <sup>11</sup>			Ω
C <sub>io</sub>	Input-to-output capacitance	V <sub>in-out</sub> = 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.

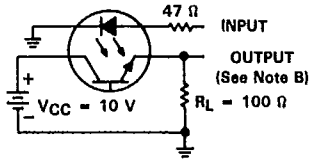
**switching characteristics at 25°C free-air temperature**

PARAMETER		TEST CONDITIONS			MIN	TYP	MAX	UNIT
t <sub>r</sub>	Rise time	Phototransistor operation	V <sub>CC</sub> = 10 V,	I <sub>C(on)</sub> = 2 mA,		2	15	μs
t <sub>f</sub>	Fall time							

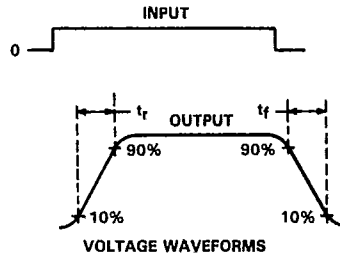
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PARAMETER MEASUREMENT INFORMATION

Adjust amplitude of input pulse for:  
 $I_{C(on)} = 2 \text{ mA}$



TEST CIRCUIT



VOLTAGE WAVEFORMS

NOTES: A. The input waveform is supplied by a generator with the following characteristics:  $Z_{out} = 50 \Omega$ ,  $t_r \leq 15 \text{ ns}$ , duty cycle = 1%,  $t_w = 100 \mu\text{s}$ .  
B. The output waveform is monitored on an oscilloscope with the following characteristics:  $t_r \leq 12 \text{ ns}$ ,  $R_{in} \geq 1 \text{ M}\Omega$ ,  $C_{in} \leq 20 \text{ pF}$ .

FIGURE 1. SWITCHING TIMES

TYPICAL CHARACTERISTICS

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COLLECTOR CURRENT  
vs  
COLLECTOR-EMITTER VOLTAGE

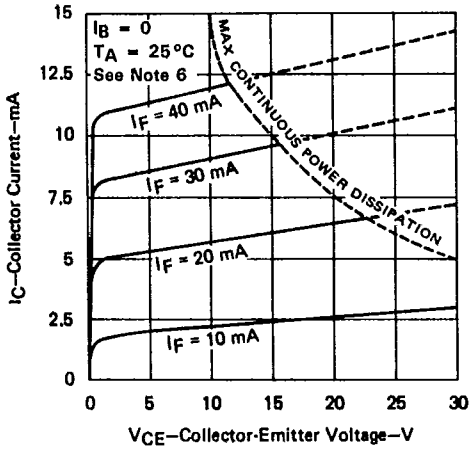


FIGURE 2

COLLECTOR CURRENT  
vs  
INPUT-DIODE FORWARD CURRENT

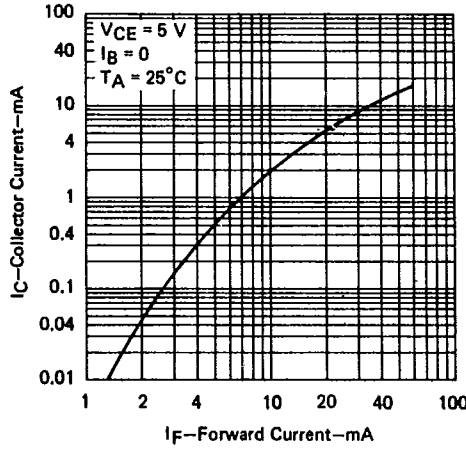


FIGURE 3

NOTE 6: Pulse operation of input diode is required for operation beyond limits shown by dotted lines.

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TYPICAL CHARACTERISTICS

RELATIVE ON-STATE COLLECTOR CURRENT  
vs  
FREE-AIR TEMPERATURE

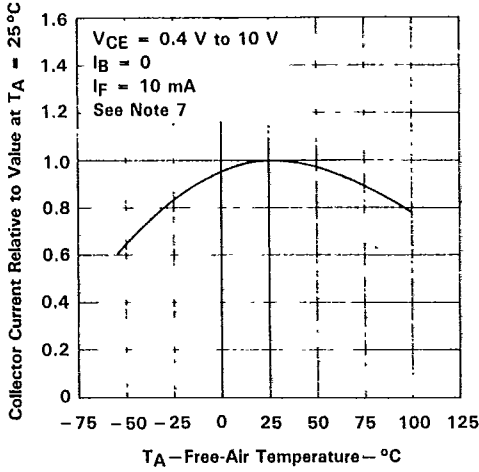


FIGURE 4

OFF-STATE COLLECTOR CURRENT  
vs  
FREE-AIR TEMPERATURE

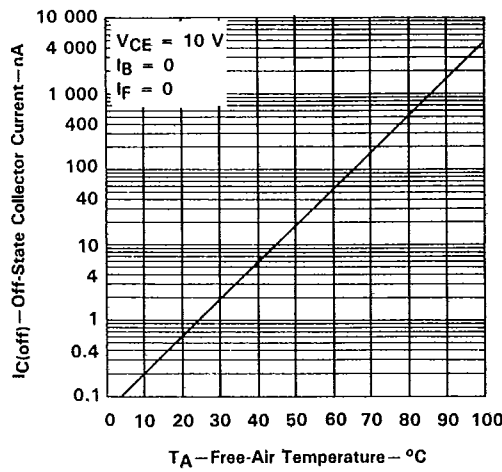


FIGURE 5

INPUT DIODE FORWARD  
CONDUCTION CHARACTERISTICS

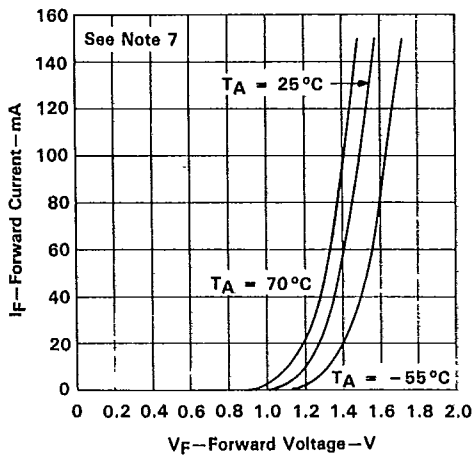


FIGURE 6

COLLECTOR CURRENT  
vs  
MODULATION FREQUENCY

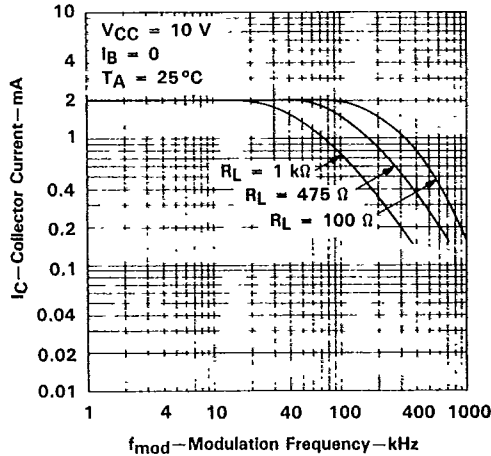


FIGURE 7

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

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