

# TIL156, TIL157A OPTOCOUPERS

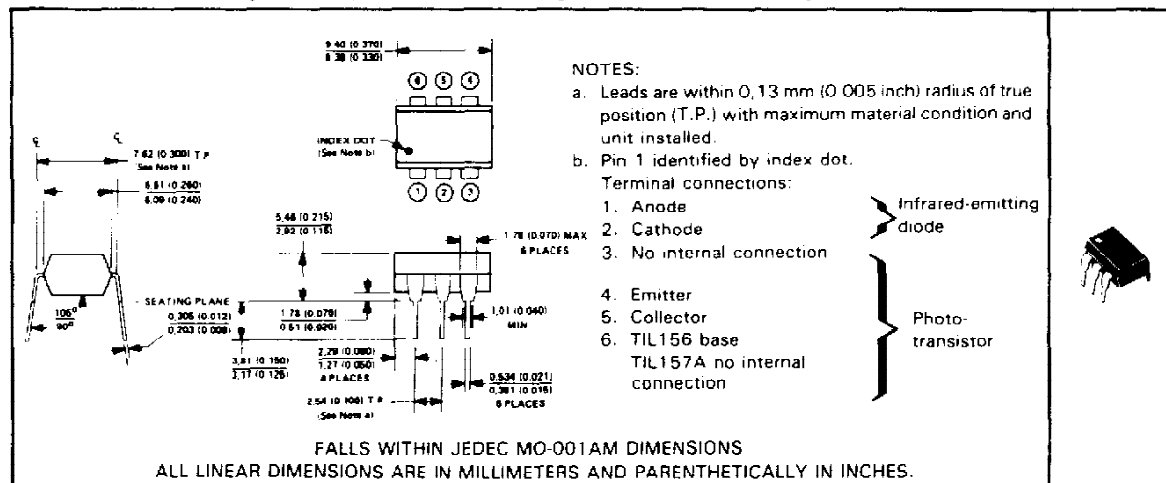
SOOS047A D2492, SEPTEMBER 1978—REVISED JUNE 1989

UL LISTED — FILE #E65085

- GaAs-Diode Light Source Optically Coupled to a Silicon N-P-N Darlington-Connected Phototransistor
- High Direct-Current Transfer Ratio . . . 300% Minimum at 10 mA
- Plug-In Replacement for TIL113 and TIL119A
- High-Voltage Electrical Isolation . . . 2500 V RMS (3535 V Peak)
- No Base Connection on TIL157A for Environments with High Electromagnetic Interference

## mechanical data

The package consists of a gallium arsenide infrared-emitting diode and an n-p-n silicon darlington-connected 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 RMS Voltage (See Note 1)	2500 V
Collector-Base Voltage (TIL156)	30 V
Collector-Emitter Voltage (See Note 2)	30 V
Emitter-Collector Voltage	7 V
Emitter-Base Voltage (TIL156)	7 V
Input-Diode Reverse Voltage	3 V
Input-Diode Continuous Forward Current at (or below) 25°C Free-Air Temperature (See Note 3)	100 mA
Continuous Phototransistor Power Dissipation at (or below) 25°C Free-Air Temperature (See Note 4)	150 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
- This rating applies for sine-wave operation at 50 or 60 Hz. Service capability is verified by testing in accordance with UL requirements.
  - This value applies when the base-emitter diode is open-circuited.
  - Derate linearly to 100°C free-air temperature at the rate of 1.33 mA/°C.
  - Derate linearly to 100°C free-air temperature at the rate of 2 mW/°C.

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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electrical characteristics at 25°C free-air temperature

PARAMETER	TEST CONDITIONS†	TIL156			TIL157A			UNIT
		MIN	TYP	MAX	MIN	TYP	MAX	
$V_{(BR)CBO}$ Collector-Base Breakdown Voltage	$I_C = 10 \mu A$ , $I_E = 0$ , $I_F = 0$	30						V
$V_{(BR)CEO}$ Collector-Emitter Breakdown Voltage	$I_C = 1 mA$ , $I_B = 0$ , $I_F = 0$	30			30			V
$V_{(BR)EBO}$ Emitter-Base Breakdown Voltage	$I_E = 10 \mu A$ , $I_C = 0$ , $I_F = 0$	7						V
$V_{(BR)ECO}$ Emitter-Collector Breakdown Voltage	$I_E = 10 \mu A$ , $I_F = 0$				7			V
$I_R$ Input Diode Static Reverse Current	$V_R = 3 V$			10			10	$\mu A$
$I_{C(on)}$ On-State Collector Current	$V_{CE} = 1 V$ , $I_B = 0$ , $I_F = 10 mA$ $V_{CE} = 1 V$ , $I_F = 10 mA$	30	100		30	160		mA
$I_{C(off)}$ Off-State Collector Current	$V_{CE} = 10 V$ , $I_B = 0$ , $I_F = 0$		100			100		nA
$h_{FE}$ Transistor Static Forward Current Transfer Ratio	$V_{CE} = 1 V$ , $I_C = 10 mA$ , $I_F = 0$		15 000					
$V_F$ Input Diode Static Forward Voltage	$I_F = 10 mA$		1.5			1.5		V
$V_{CE(sat)}$ Collector-Emitter Saturation Voltage	$I_C = 125 mA$ , $I_B = 0$ , $I_F = 50 mA$ $I_C = 30 mA$ , $I_F = 10 mA$		1.2			1		V
$r_{iO}$ Input-to-Output Internal Resistance	$V_{in-out} = 500 V$ , See Note 5	10 <sup>11</sup>			10 <sup>11</sup>			$\Omega$
$C_{iO}$ Input-to-Output Capacitance	$V_{in-out} = 0$ , $f = 1 MHz$ , See Note 5		1	1.3		1	1.3	pF

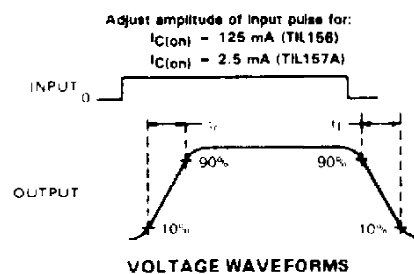
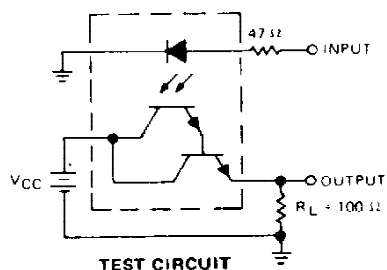
Note 5: These parameters are measured between both input-diode leads shorted together and all the phototransistor leads shorted together.

†References to the base are not applicable to the TIL157A.

switching characteristics at 25°C free-air temperature

PARAMETER	TEST CONDITIONS†	TIL156			TIL157A			UNIT
		MIN	TYP	MAX	MIN	TYP	MAX	
$t_r$ Rise Time	$V_{CC} = 15 V$ , $I_{C(on)} = 125 mA$ , $R_L = 100 \Omega$ , See Figure 1		300					$\mu s$
$t_f$ Fall Time	$V_{CC} = 15 V$ , $I_{C(on)} = 125 mA$ , $R_L = 100 \Omega$ , See Figure 1		300					$\mu s$
$t_r$ Rise Time	$V_{CC} = 10 V$ , $I_{C(on)} = 2.5 mA$ , $R_L = 100 \Omega$ , See Figure 1				300			$\mu s$
$t_f$ Fall Time	$V_{CC} = 10 V$ , $I_{C(on)} = 2.5 mA$ , $R_L = 100 \Omega$ , See Figure 1				300			$\mu s$

## PARAMETER MEASUREMENT INFORMATION

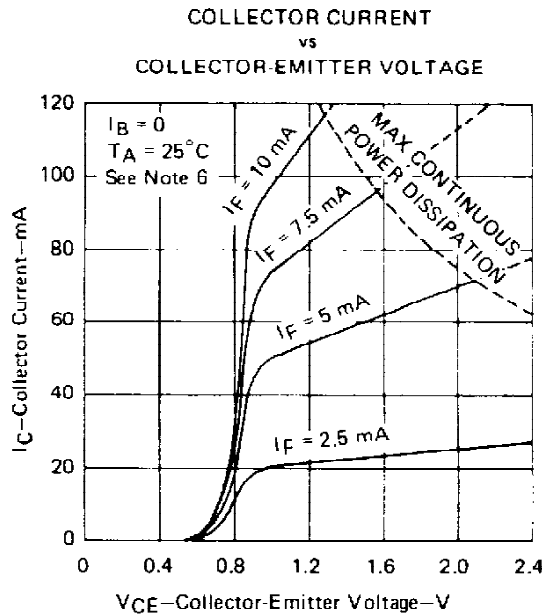


NOTES: a. The input waveform is supplied by a generator with the following characteristics:  $Z_{out} = 50 \Omega$ ,  $t_r \leq 15 ns$ , duty cycle  $\approx 1\%$ ,  $t_w = 500 \mu s$ .

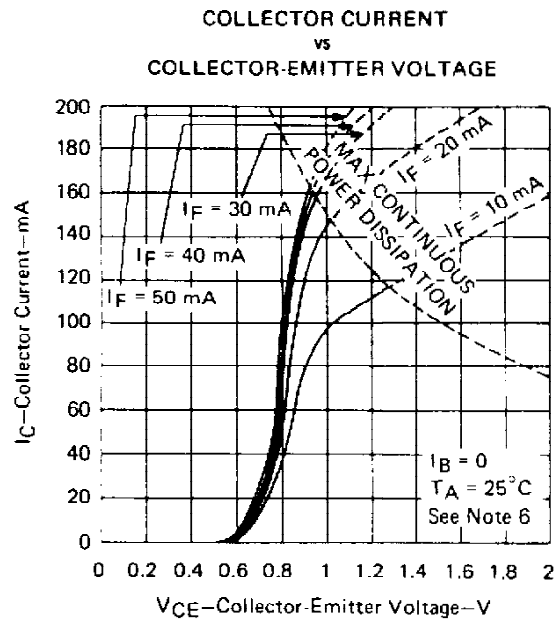
b. The output waveform is monitored on an oscilloscope with the following characteristics:  $t_r \leq 12 ns$ ,  $R_{in} \approx 1 M\Omega$ ,  $C_{in} \leq 20 pF$ .

FIGURE 1—SWITCHING TIMES

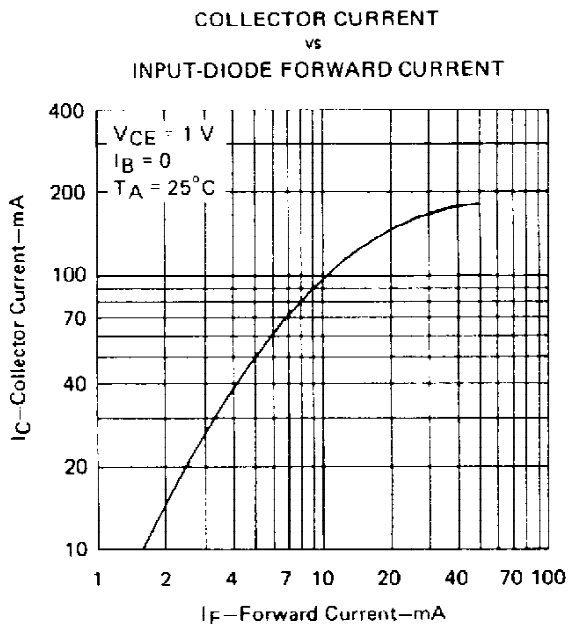
**TYPICAL CHARACTERISTICS**



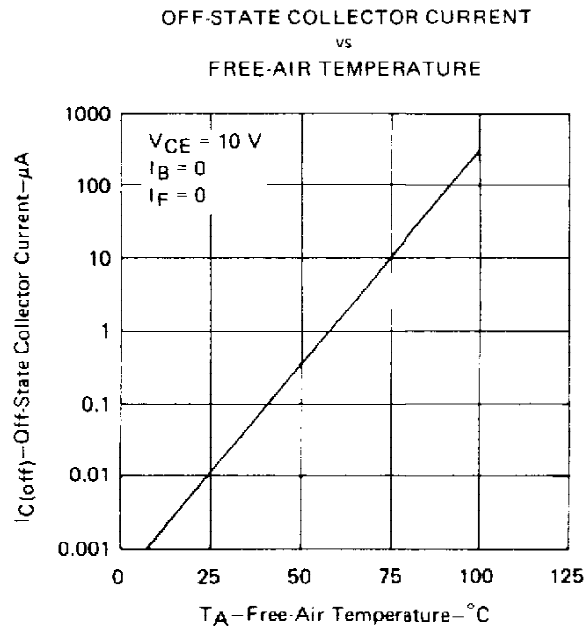
**FIGURE 2**



**FIGURE 3**



**FIGURE 4**



**FIGURE 5**

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

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## TYPICAL CHARACTERISTICS

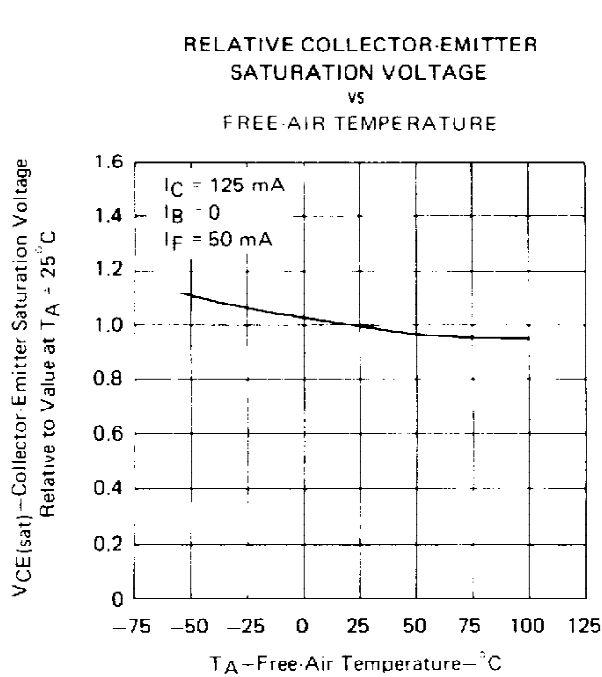


FIGURE 6

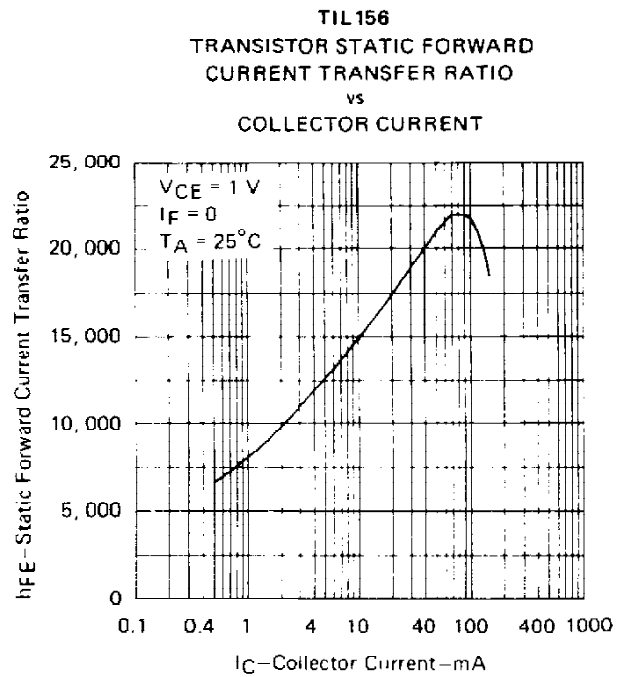


FIGURE 7

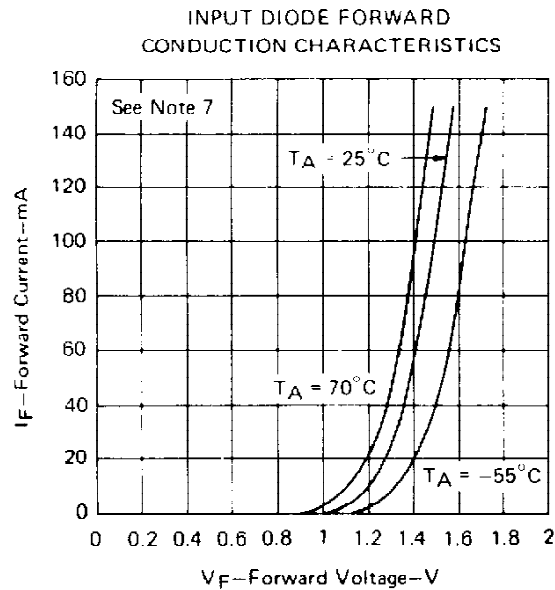


FIGURE 8

NOTE 7: This parameter was measured using pulse techniques,  $t_w = 1\text{ ms}$ , duty cycle  $\leq 2\%$ .

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