

TIL153, TIL154, TIL155 OPTOCOUPERS

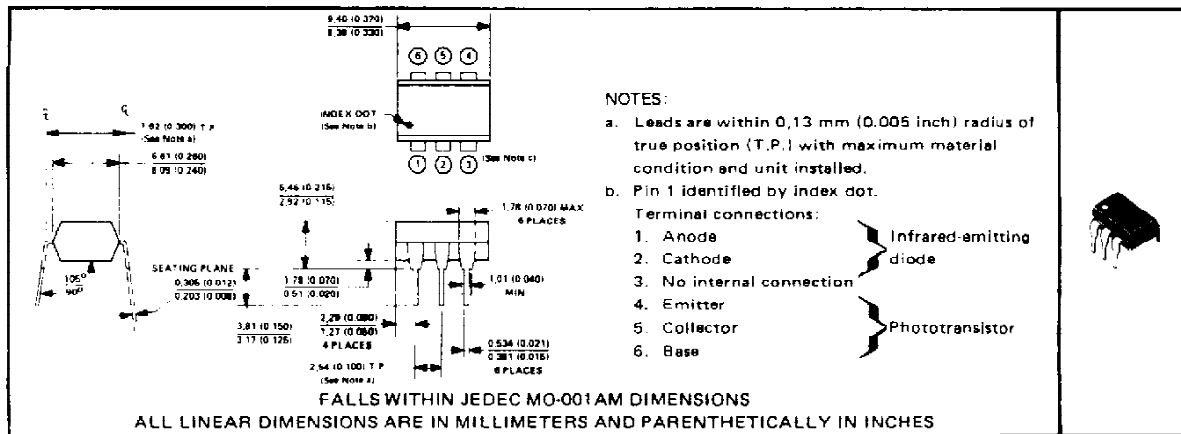
SOOS050 D2491, SEPTEMBER-REVISED DECEMBER 1982

UL LISTED — FILE # E65085

- GaAs-Diode Infrared Source Optically Coupled to a Silicon N-P-N Phototransistor
- Direct-Current Transfer Ratio . . . 10% to 50%
- Plug-In Replacements for TIL111 Series
- High-Voltage Electrical Isolation . . . 2500 V RMS (3535 V Peak)

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.



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	70 V
Collector-Emitter Voltage (See Note 2)	30 V
Emitter-Collector Voltage	7 V
Emitter-Base Voltage	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: 1. This rating applies for sine-wave operation at 50 or 60 Hz. Service capability is verified by testing in accordance with UL requirements.

2. This value applies when the base-emitter diode is open-circuited.

3. Derate linearly to 100°C free-air temperature at the rate of 1.33 mA/°C.

4. 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.

TEXAS
INSTRUMENTS

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electrical characteristics at 25°C free-air temperature

PARAMETER		TEST CONDITIONS	TIL153			TIL154			TIL155			UNIT
			MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX	
$V_{(BR)CBO}$	Collector-Base Breakdown Voltage	$I_C = 10 \mu A$, $I_E = 0$	70			70			70			V
$V_{(BR)CEO}$	Collector-Emitter Breakdown Voltage	$I_C = 1 mA$, $I_E = 0$	30			30			30			V
$V_{(BR)EBO}$	Emitter-Base Breakdown Voltage	$I_E = 10 \mu A$, $I_C = 0$	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 $V_{CE} = 10 V$, $I_B = 0$	1	3		2	5		5	9		mA
	Photodiode Operation	$V_{CB} = 10 V$, $I_E = 0$		10			10			10		μA
$I_{C(off)}$	Off-State Collector Current	Phototransistor Operation $V_{CE} = 10 V$, $I_B = 0$		1	50		1	50		1	50	nA
	Photodiode Operation	$V_{CB} = 10 V$, $I_E = 0$		0.1	20		0.1	20		0.1	20	
h_{FE}	Transistor Static Forward Current Transfer Ratio	$V_{CE} = 5 V$, $I_E = 0$	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	$I_C = 1 mA$, $I_B = 0$		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	$V_{in-out} = 0$, See Note 5		1	1.3		1	1.3		1	1.3	pF

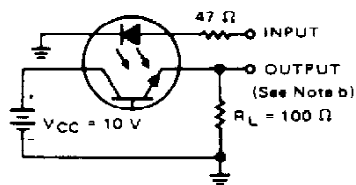
NOTE 5: These parameters are measured between both input diode leads shorted together and all the phototransistor leads shorted together.

switching characteristics at 25°C free-air temperature

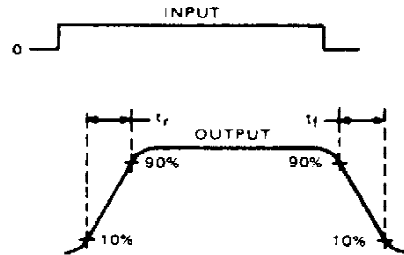
PARAMETER		TEST CONDITIONS		MIN	TYP	MAX	UNIT
t_r Rise Time	Phototransistor	$V_{CC} = 10 V$, $I_{C(on)} = 2 mA$, $R_L = 100 \Omega$			5	10	μs
t_f Fall Time	Operation	See Test Circuit A of Figure 1			5	10	
t_r Rise Time	Photodiode	$V_{CC} = 10 V$, $I_{C(on)} = 20 \mu A$, $R_L = 1 k\Omega$			1		μs
t_f Fall Time	Operation	See Test Circuit B of Figure 1			1		

PARAMETER MEASUREMENT INFORMATION

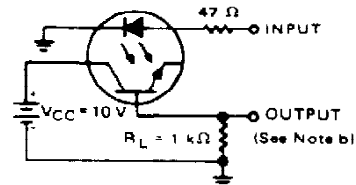
Adjust amplitude of input pulse for:
 $I_{C(on)} = 2 \text{ mA}$ (Test Circuit A) or
 $I_{C(on)} = 20 \mu\text{A}$ (Test Circuit B)



**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: $Z_{out} = 50 \Omega$, $t_r \leq 15 \text{ ns}$, duty cycle $\approx 1\%$, $t_w = 100 \mu\text{s}$.
 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

COLLECTOR CURRENT
 VS
 INPUT-DIODE FORWARD CURRENT

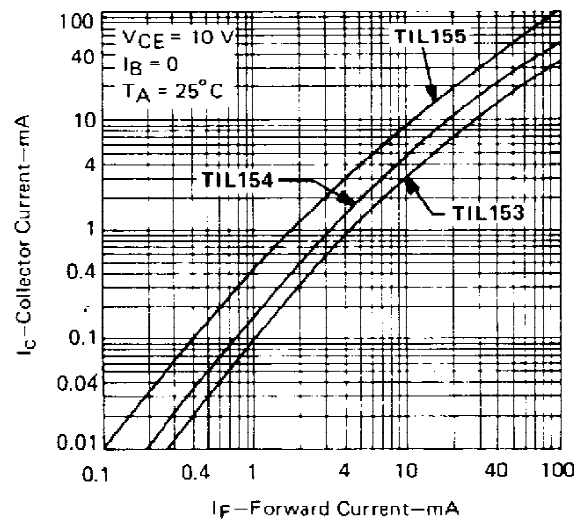


FIGURE 2

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TYPICAL CHARACTERISTICS

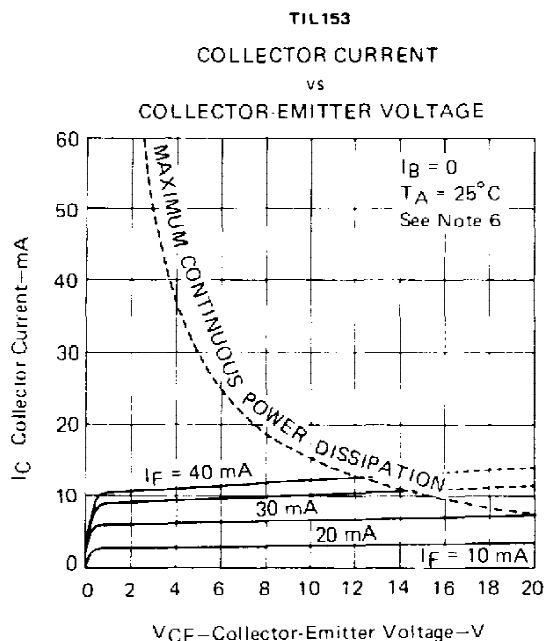


FIGURE 3

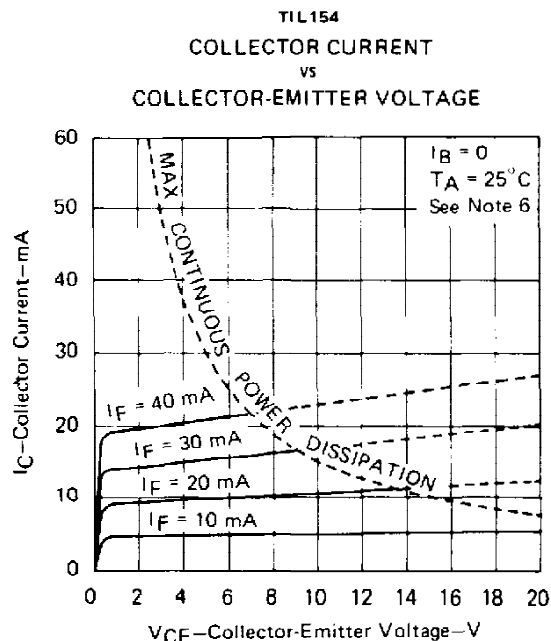


FIGURE 4

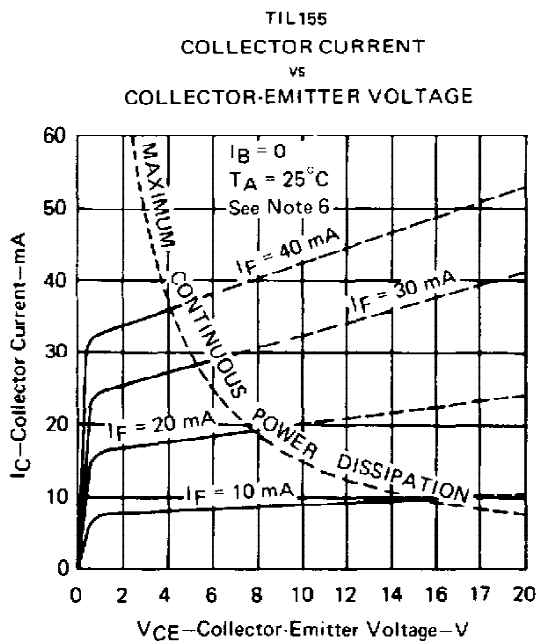


FIGURE 5

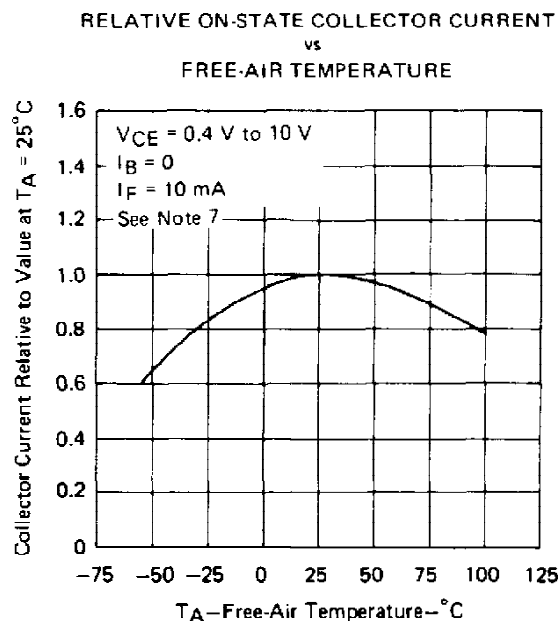


FIGURE 6

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. $t_w = 1\text{ ms}$, duty cycle $\leq 2\%$.

TYPICAL CHARACTERISTICS

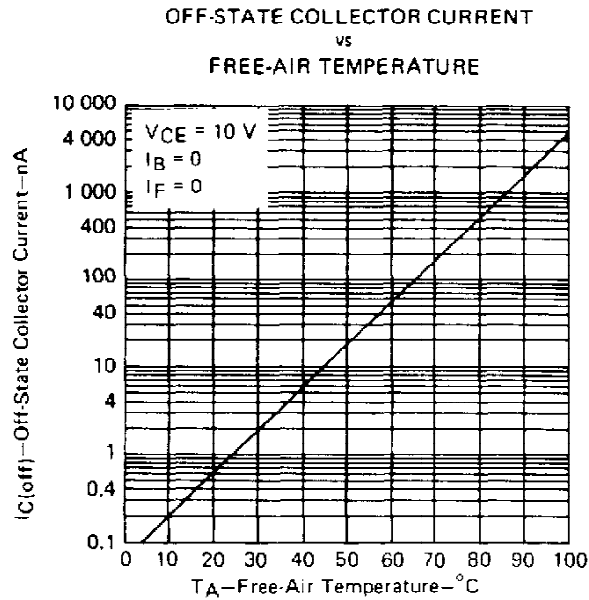


FIGURE 7

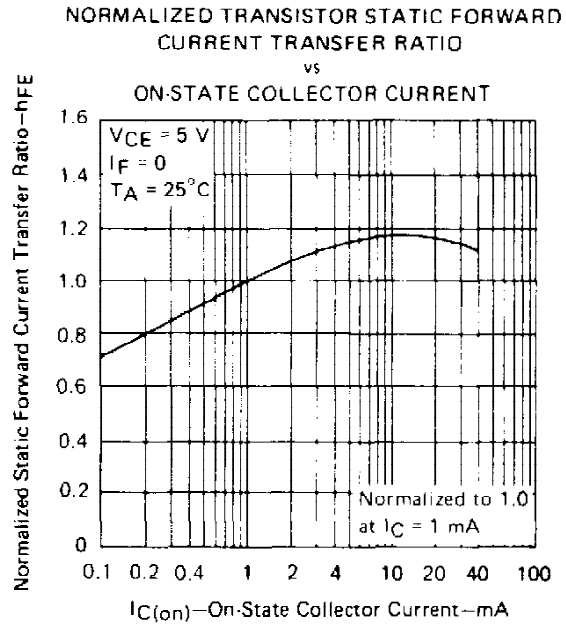


FIGURE 8

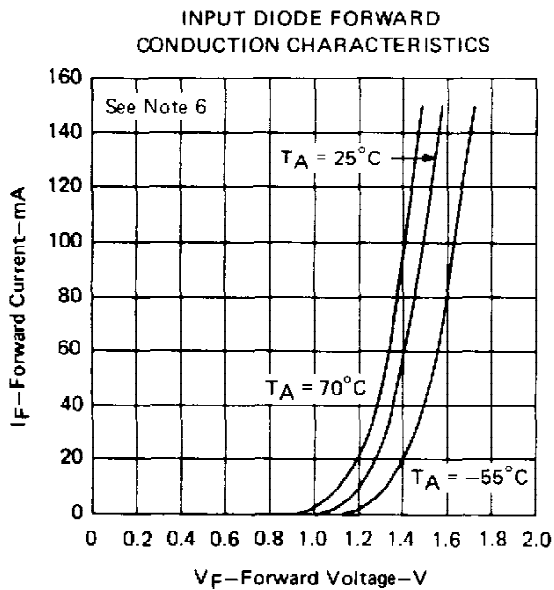


FIGURE 9

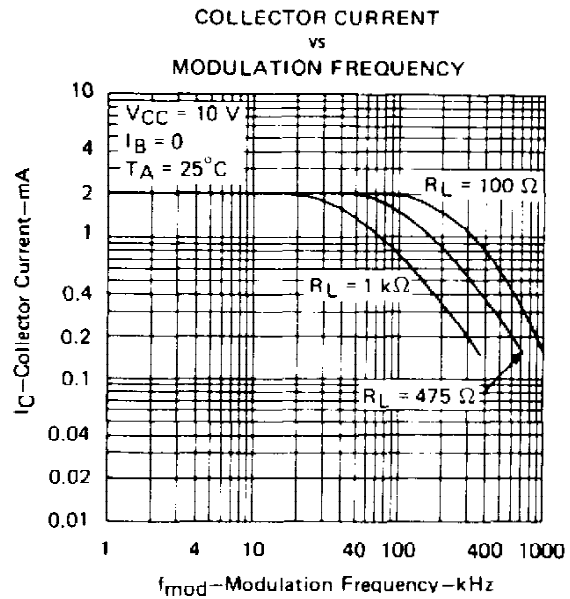


FIGURE 10

NOTE 6: These parameters were measured using pulse techniques, $t_w = 1\text{ ms}$, duty cycle $< 2\%$

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