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TIL153, TIL154, TIL155 OPTOCOUPLERS

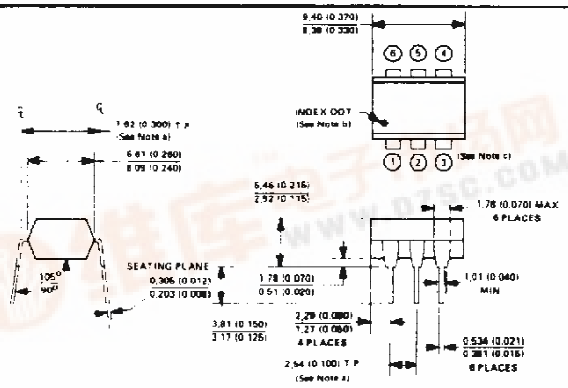
SOOS050 D2491, SEPTEMBER–REVISED DECEMBER 1982

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.



NOTES:

a. Leads are within 0.13 mm (0.005 inch) radius of true position (T.P.) with maximum material condition and unit installed.

b. Pin 1 identified by index dot.

Terminal connections:

1. Anode } Infrared-emitting diode
2. Cathode
3. No internal connection
4. Emitter } Phototransistor
5. Collector
6. Base

FALLS WITHIN JEDEC MO-001AM DIMENSIONS

ALL LINEAR DIMENSIONS ARE IN MILLIMETERS AND PARENTHETICALLY IN INCHES

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.

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electrical characteristics at 25°C free-air temperature

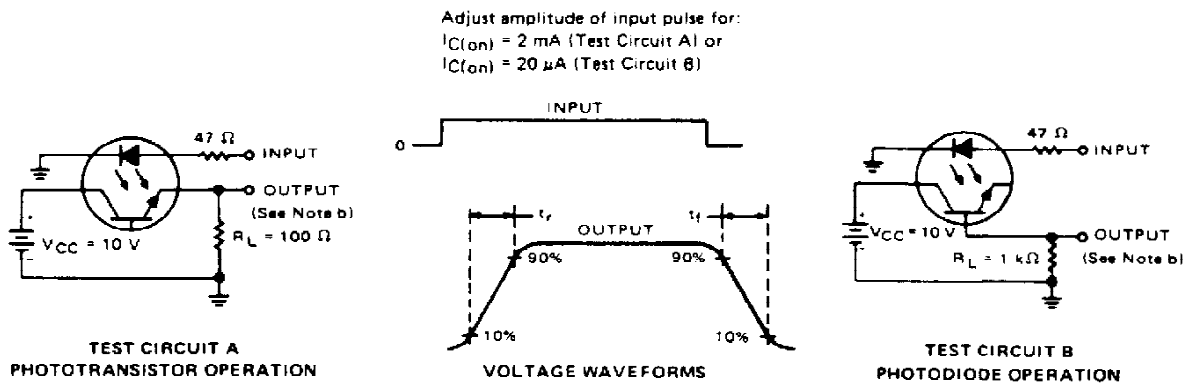
PARAMETER			TEST CONDITIONS	TIL153 MIN	TIL153 TYP	TIL153 MAX	TIL154 MIN	TIL154 TYP	TIL154 MAX	TIL155 MIN	TIL155 TYP	TIL155 MAX	UNIT
$V_{(BR)CBO}$	Collector-Base Breakdown Voltage		$I_C = 10\ \mu A$, $I_E = 0$, $I_F = 0$	70			70			70			V
$V_{(BR)CEO}$	Collector-Emitter Breakdown Voltage		$I_C = 1$ mA, $I_B = 0$, $I_F = 0$	30			30			30			V
$V_{(BR)EBO}$	Emitter-Base Breakdown Voltage		$I_E = 10\ \mu A$, $I_C = 0$, $I_F = 0$	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, $I_F = 10$ mA, $I_B = 0$	1	3		2	5		5	9		mA
		Photodiode Operation	$V_{CB} = 10$ V, $I_F = 10$ mA, $I_E = 0$		10			10			10		μA
$I_{C(off)}$	Off-State Collector Current	Phototransistor Operation	$V_{CE} = 10$ V, $I_F = 0$, $I_B = 0$		1	50		1	50		1	50	nA
		Photodiode Operation	$V_{CB} = 10$ V, $I_F = 0$, $I_E = 0$		0.1	20		0.1	20		0.1	20	
h_{FE}	Transistor Static Forward Current Transfer Ratio		$V_{CE} = 5$ V, $I_C = 10$ mA, $I_F = 0$	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, $I_F = 10$ mA, $I_B = 0$		0.25	0.4		0.25	0.4		0.25	0.4	V
r_{IO}	Input-to-Output Internal Resistance		$V_{in\text{-}out} = 500$ V, See Note 5	10^{11}			10^{11}			10^{11}			Ω
C_{io}	Input-to-Output Capacitance		$V_{in\text{-}out} = 0$, $f = 1$ MHz, 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 Operation	$V_{CC} = 10$ V, $I_{C(on)} = 2$ mA, $R_L = 100\ \Omega$, See Test Circuit A of Figure 1		5	10	μs
t_f	Fall Time				5	10	
t_r	Rise Time	Photodiode Operation	$V_{CC} = 10$ V, $I_{C(on)} = 20\ \mu A$, $R_L = 1\ k\Omega$, See Test Circuit B of Figure 1		1		μs
t_f	Fall Time				1		

PARAMETER MEASUREMENT INFORMATION



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

TYPICAL CHARACTERISTICS

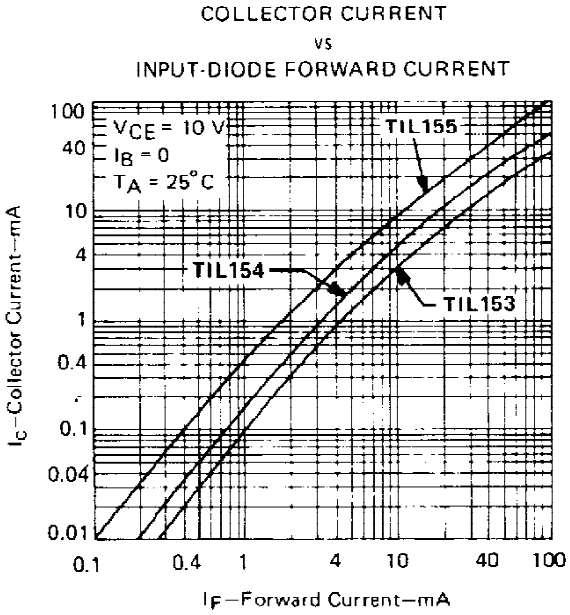


FIGURE 2

TYPICAL CHARACTERISTICS

TIL153

COLLECTOR CURRENT
vs
COLLECTOR-EMITTER VOLTAGE

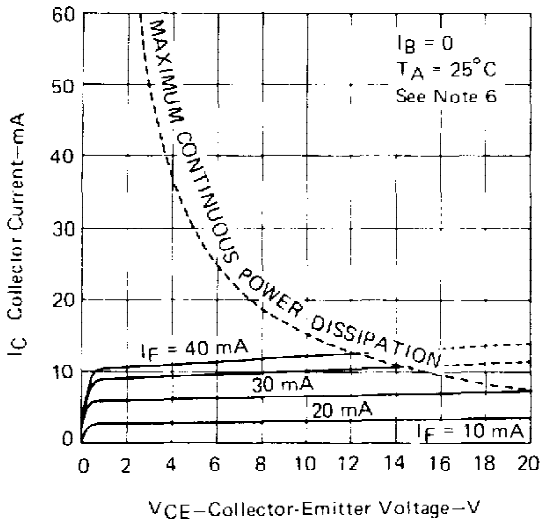


FIGURE 3

TIL154

COLLECTOR CURRENT
vs
COLLECTOR-EMITTER VOLTAGE

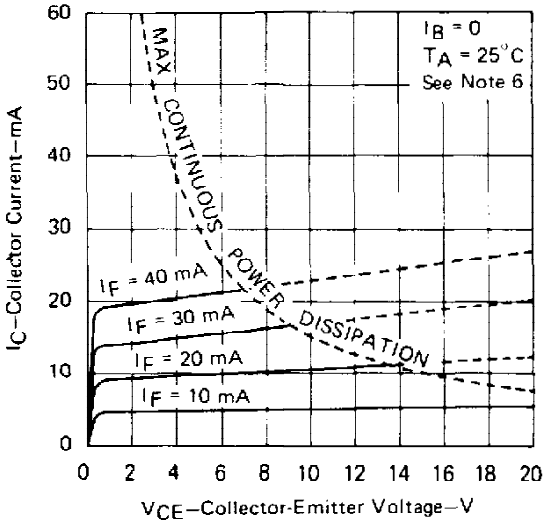


FIGURE 4

TIL155

COLLECTOR CURRENT
vs
COLLECTOR-EMITTER VOLTAGE

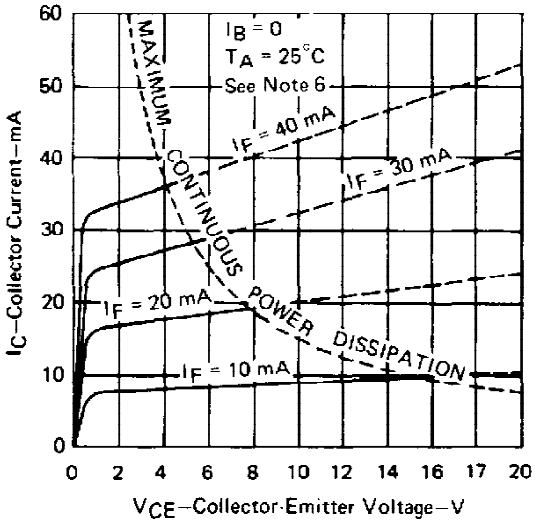


FIGURE 5

RELATIVE ON-STATE COLLECTOR CURRENT
vs
FREE-AIR TEMPERATURE

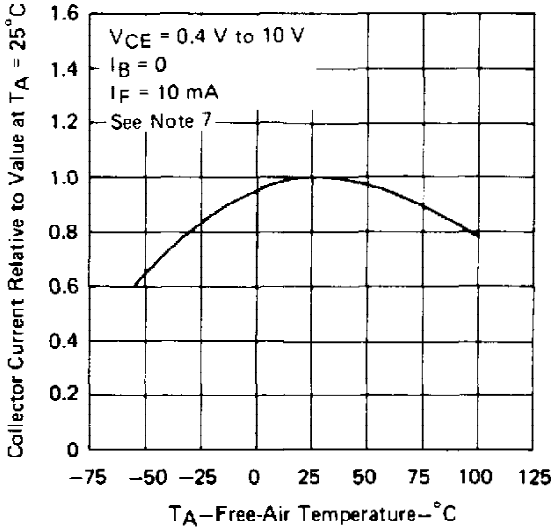


FIGURE 6

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. $t_w = 1$ ms, duty cycle ≤ 2%.

TYPICAL CHARACTERISTICS

OFF-STATE COLLECTOR CURRENT
vs
FREE-AIR TEMPERATURE

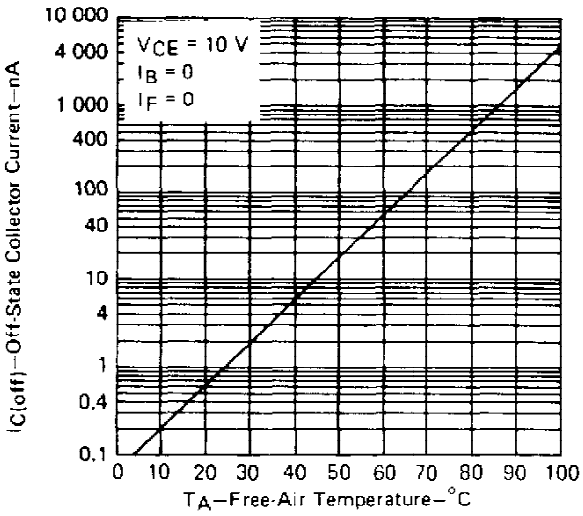


FIGURE 7

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

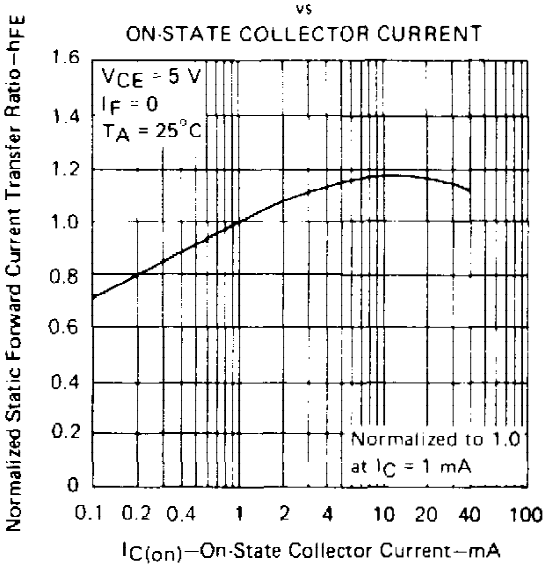


FIGURE 8

INPUT DIODE FORWARD
CONDUCTION CHARACTERISTICS

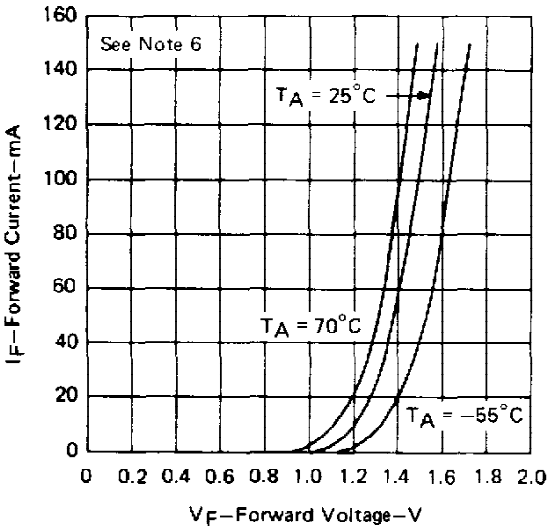


FIGURE 9

COLLECTOR CURRENT
vs
MODULATION FREQUENCY

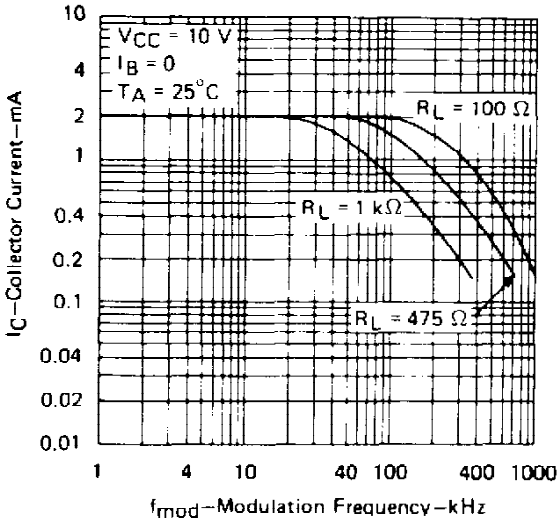


FIGURE 10

NOTE 6: These parameters were measured using pulse techniques. t_w = 1 ms, duty cycle ≤ 2%

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