

TIL153, TIL154, TIL155 OPTOCOUPLED

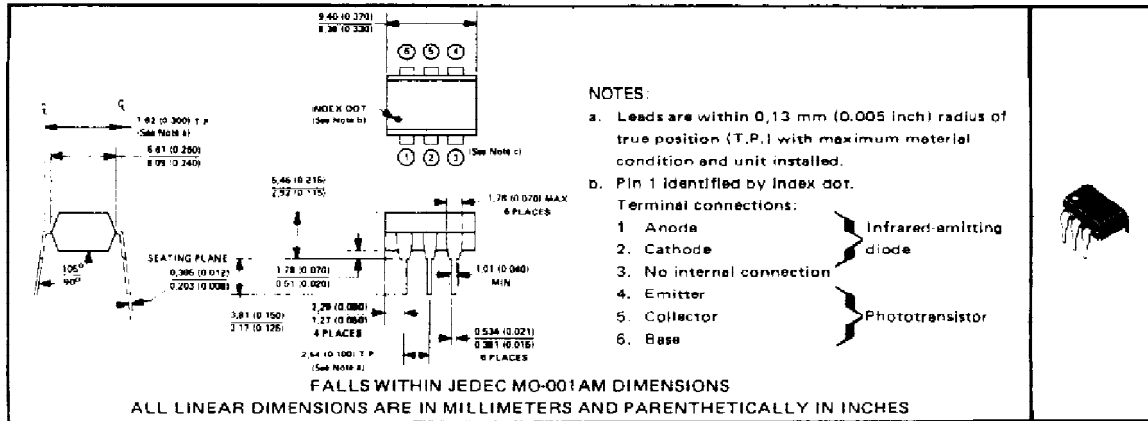
SOOS050 D2491, SEPTEMBER - REVISED DECEMBER 1982

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.

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TEXAS
INSTRUMENTS

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TIL153, TIL154, TIL155 OPTOCOUPERS

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 | $I_C = 10 \mu A, I_E = 0, I_F = 0$ | 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 $V_{CE} = 10 V, I_B = 0, I_F = 10 mA$ | 1 | 3 | | 2 | 5 | | 5 | 9 | | mA |
| | | Photodiode Operation $V_{CB} = 10 V, I_E = 0, I_F = 10 mA$ | | 10 | | | 10 | | | 10 | | μA |
| $I_{C(off)}$ | Off-State Collector Current | Phototransistor Operation $V_{CE} = 10 V, I_B = 0, I_F = 0$ | | 1 | 50 | | 1 | 50 | | 1 | 50 | nA |
| | | Photodiode Operation $V_{CB} = 10 V, I_E = 0, I_F = 0$ | | 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 | $I_C = 1 mA, I_B = 0, I_F = 10 mA$ | | 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 | $V_{in-out} = 0, f = 1 MHz,$ 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.

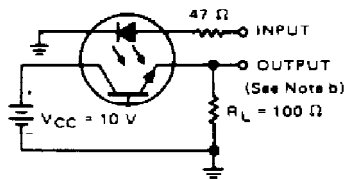
switching characteristics at 25°C free-air temperature

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

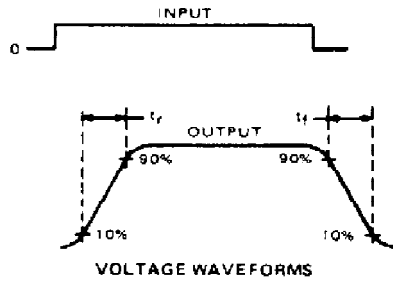
TIL153, TIL154, TIL155 OPTOCOUPLEDERS

PARAMETER MEASUREMENT INFORMATION

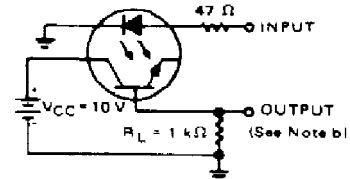
Adjust amplitude of input pulse for:
 $I_{C(on)} = 2 \text{ mA}$ (Test Circuit A) or
 $I_{C(on)} = 20 \mu\text{A}$ (Test Circuit B)



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

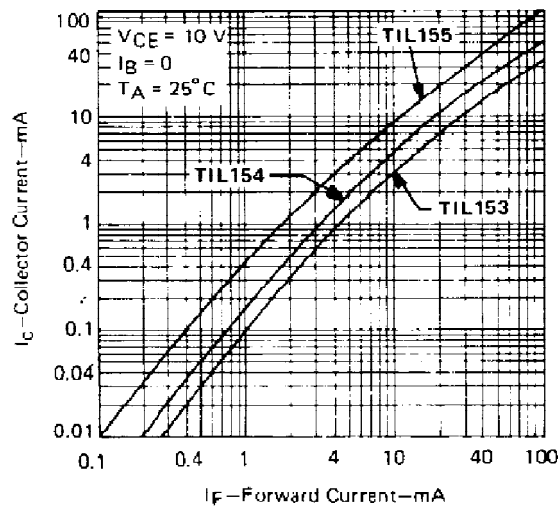
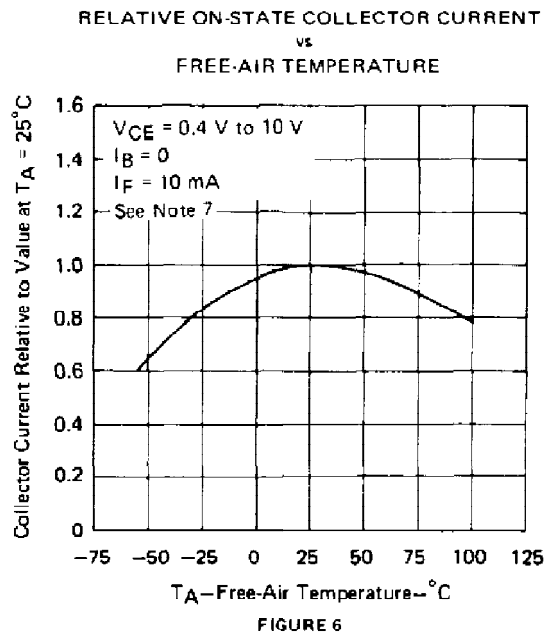
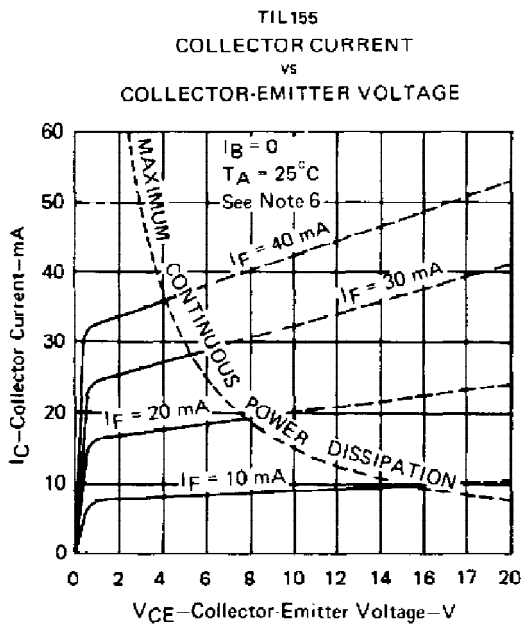
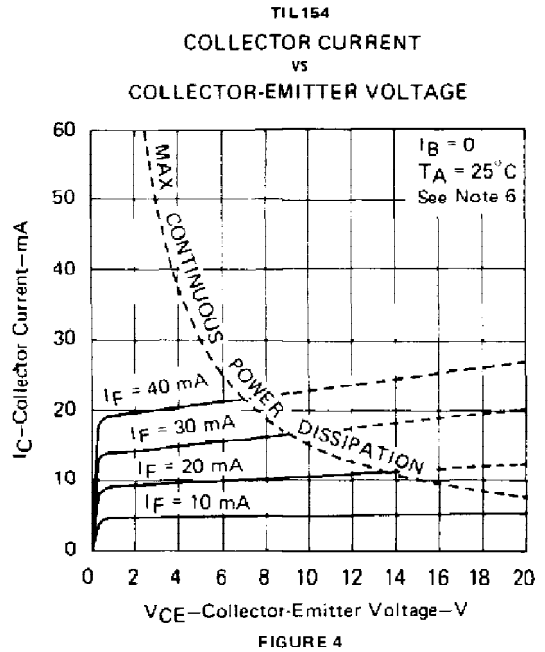
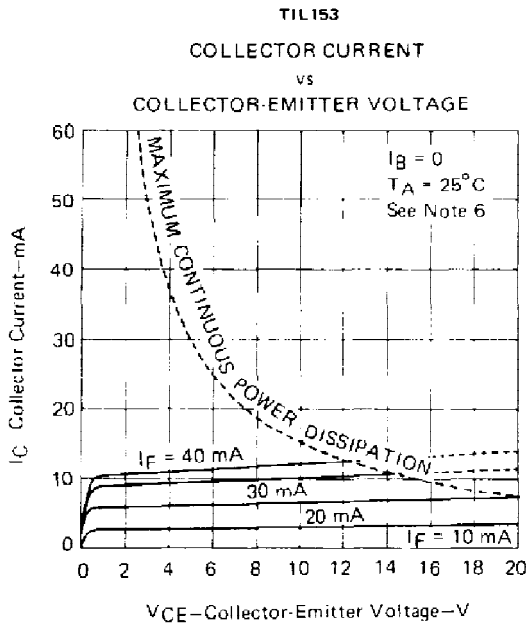


FIGURE 2

**TIL153, TIL154, TIL155
OPTOCOUPERS**

TYPICAL CHARACTERISTICS



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 $\leq 2\%$.

TYPICAL CHARACTERISTICS

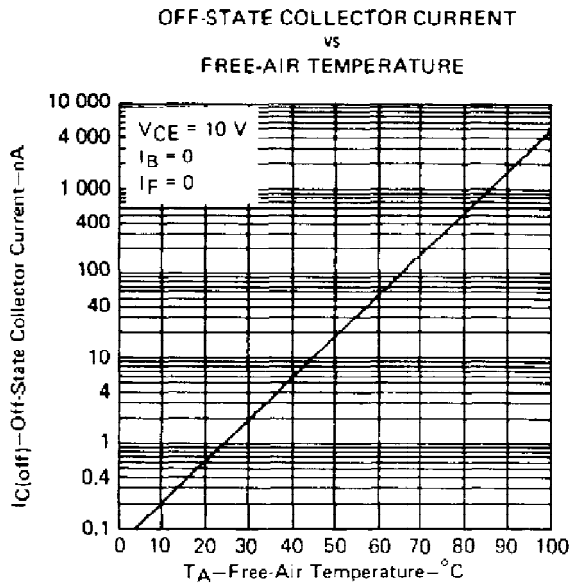


FIGURE 7

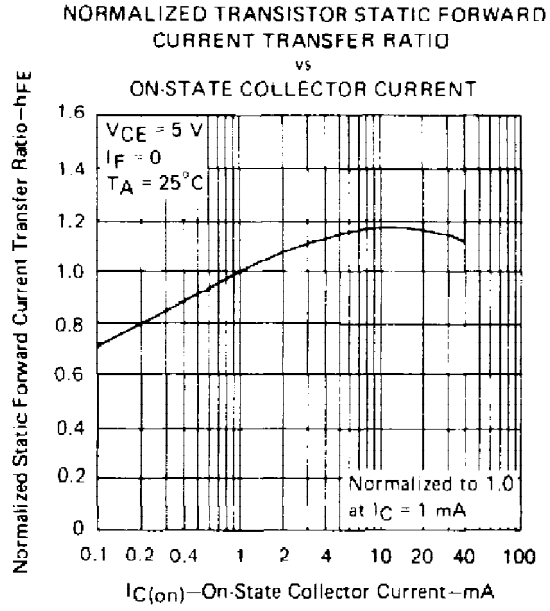


FIGURE 8

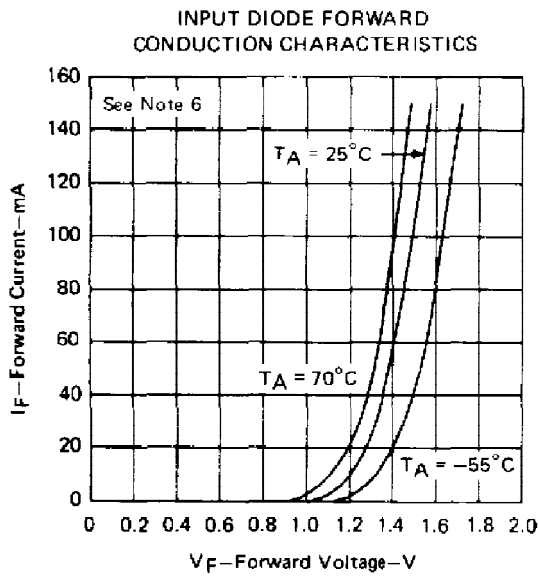


FIGURE 9

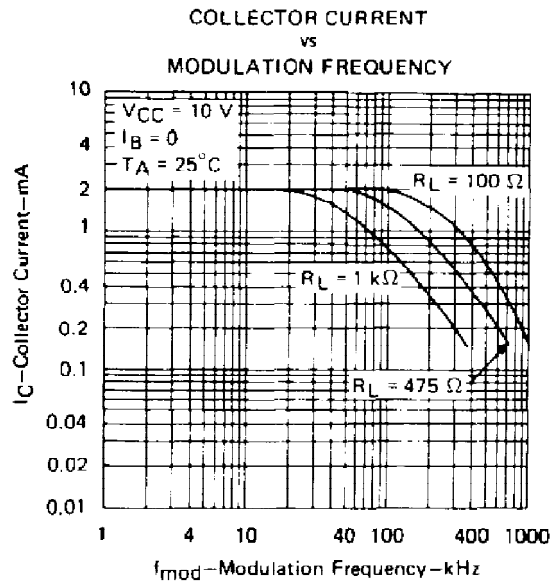


FIGURE 10

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

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