Gallium Arsenide Diode Infrared Source Optically Coupled to a Silicon N-P-N Darlington-Connected Phototransistor
- High Direct-Current Transfer Ratio... 300% Minimum at 10 mA
- High-Voltage Electrical Isolation... 1500-Volt Rating
- Plastic Dual-In-Line Package
- Base Lead Provided on TIL 113 for Conventional Transistor Biasing
- No Base Lead Connection on TIL 119A for High-EMI Environments
- Typical Applications Include Remote Terminal Isolation, SCR and Triac Triggers, Mechanical Relays, and Pulse Transformers

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 temperatures 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
2. Cathode
3. No internal connection
4. Emitter
5. Collector
6. TIL 113 base
7. TIL 119A no internal connection

FALLS WITHIN JEDEC MO-001AM DIMENSIONS

ALL LINEAR DIMENSIONS ARE IN MILLIMETERS AND PARENTHESES IN INCHES

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

- Input to Output Voltage
- Collector Base Voltage (TIL 113)
- Collector Emitter Voltage (See Note 1)
- Emitter Collector Voltage
- Emitter Base Voltage (TIL 113)
- Input Diode Reverse Voltage

Continuous Forward Current at (or below) 25°C Free-Air Temperature (See Note 2)

- Infrared Emitter Diode (See Note 3)
- Phototransistor (See Note 4)

Total (Infrared Emitter Diode plus Phototransistor, See Note 5)

Storage Temperature Range

Lead Temperature 1.6 mm (1/16 Inch) from Case for 10 Seconds

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 130 mA°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 0.2 mW°C
5. Derate linearly to 100°C free air temperature at the rate of 3.33 mW°C

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electrical characteristics at 25° C free-air temperature

<table>
<thead>
<tr>
<th>PARAMETER</th>
<th>TEST CONDITIONS 1</th>
<th>TIL113</th>
<th>TIL119A</th>
<th>UNIT</th>
</tr>
</thead>
<tbody>
<tr>
<td>VBRICBO Collector Base</td>
<td>Ic = 10 mA, Ie = 0, If = 0</td>
<td>30</td>
<td>30</td>
<td>V</td>
</tr>
<tr>
<td>Breakdown Voltage</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>VBRICBO Collector Emitter</td>
<td>Ic = 1 mA, Ie = 0, If = 0</td>
<td>100</td>
<td>100</td>
<td>mA</td>
</tr>
<tr>
<td>Breakdown Voltage</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>VBRICBO Emitter Base</td>
<td>Ie = 10 mA, Ic = 0, Ic = 0</td>
<td>7</td>
<td></td>
<td>V</td>
</tr>
<tr>
<td>Breakdown Voltage</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>VBRICBO Emitter Collector</td>
<td>Ie = 10 mA, Ic = 0</td>
<td>7</td>
<td></td>
<td>V</td>
</tr>
<tr>
<td>Breakdown Voltage</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ic(On) Off State Collector Current</td>
<td>Vce = 1 V, Ie = 0, Ic = 10 mA</td>
<td>30</td>
<td>100</td>
<td>mA</td>
</tr>
<tr>
<td>VCE(On) On State Collector Current</td>
<td>Vce = 1 V, Ic = 10 mA</td>
<td>30</td>
<td>160</td>
<td>mA</td>
</tr>
<tr>
<td>Transistor Static Forward Current Transfer Ratio</td>
<td>Vce = 1 V, Ic = 11 mA, Ic = 0</td>
<td>15000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vf Input Diode Static</td>
<td>If = 10 mA</td>
<td>1.5</td>
<td>1.5</td>
<td>V</td>
</tr>
<tr>
<td>Forward Voltage</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>VCE(Isat) Collector-Emitter Saturation Voltage</td>
<td>If = 125 mA, Ie = 0, If = 50 mA</td>
<td>1.2</td>
<td></td>
<td>V</td>
</tr>
<tr>
<td>Ic = 30 mA, Ic = 10 mA</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>hFE Input to Output Internal Resistance</td>
<td>Vpout = 15 kV, See Note 6</td>
<td>10 3</td>
<td>10 3</td>
<td>V</td>
</tr>
<tr>
<td>VCC Input to Output Capacitance</td>
<td>Vin = 0, 1 - 1 MHz, See Note 6</td>
<td>1</td>
<td>1</td>
<td>pF</td>
</tr>
</tbody>
</table>

NOTE 6 These parameters are measured between both input diode leads shorted together and all the phototransistor leads shorted together.

*Reference to the base are not applicable to TIL119A.

switching characteristics at 25° C free-air temperature

<table>
<thead>
<tr>
<th>PARAMETER</th>
<th>TEST CONDITIONS 1</th>
<th>TIL113</th>
<th>TIL119A</th>
<th>UNIT</th>
</tr>
</thead>
<tbody>
<tr>
<td>t1 Rise Time</td>
<td>Vcc = 15 V, Ic(On) = 125 mA</td>
<td>300</td>
<td>300</td>
<td>ns</td>
</tr>
<tr>
<td>t1 Fall Time</td>
<td>Rl = 100 kΩ, See Figure 1</td>
<td>300</td>
<td>300</td>
<td>ns</td>
</tr>
<tr>
<td>t1 Rise Time</td>
<td>Vcc = 10 V, Ic(On) = 2.5 mA</td>
<td>300</td>
<td>300</td>
<td>ns</td>
</tr>
<tr>
<td>t1 Fall Time</td>
<td>Rl = 100 kΩ, See Figure 1</td>
<td>300</td>
<td>300</td>
<td>ns</td>
</tr>
</tbody>
</table>

PARAMETER MEASUREMENT INFORMATION

Adjust amplitude of input pulse for:

<table>
<thead>
<tr>
<th>Ic(On)</th>
<th>125 mA (TIL113)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ic(On)</td>
<td>2.5 mA (TIL119A)</td>
</tr>
</tbody>
</table>

NOTES:
1. The input waveform is supplied by a generator with the following characteristics: Tp = 50 μs, tp = 15 μs, duty cycle < 15%, t = 800 μs.

2. The output waveform is monitored on an oscilloscope with the following characteristics: t = 12 ms, Rm = 1 MΩ, Cm = 20 pF.

FIGURE 1—SWITCHING TIMES
NOTE 7. Pulse operation of input diode is required for operation beyond limits shown by dotted line.
TIL113, TIL119A
OPTOCOUPLES

TYPICAL CHARACTERISTICS

RELATIVE COLLECTOR-EMITTER SATURATION VOLTAGE
VS FREE AIR TEMPERATURE

FIGURE 6

TIL113
TRANSISTOR STATIC FORWARD CURRENT TRANSFER RATIO
VS COLLECTOR CURRENT

FIGURE 7

INPUT DIODE FORWARD CONDUCTION CHARACTERISTICS

FIGURE 8

NOTE 8: This parameter was measured using pulse techniques. T_{A} = 1 ms, duty cycle < 2%.

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