Gallium Arsenide Diode Light Source Optically Coupled to a Silicon N-P-N Phototransistor

High Direct-Current Transfer Ratio

Base Lead Provided for Conventional Transistor Biasing

High-Voltage Electrical Isolation ... 1.5-kV Rating

Plastic Dual-In-Line Package

High-Speed Switching: $t_r = 2 \mu s$, $t_f = 2 \mu s$ Typical

**mechanical data**

The package consists of a gallium arsenide light-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)**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input-to-Output Voltage</td>
<td>$\pm 1.5$ kV</td>
</tr>
<tr>
<td>Collector-Base Voltage</td>
<td>30 V</td>
</tr>
<tr>
<td>Collector-Emitter Voltage (See Note 1)</td>
<td>20 V</td>
</tr>
<tr>
<td>Emitter-Collector Voltage</td>
<td>4 V</td>
</tr>
<tr>
<td>Emitter-Base Voltage</td>
<td>4 V</td>
</tr>
<tr>
<td>Input-Diode Reverse Voltage</td>
<td>3 V</td>
</tr>
<tr>
<td>Input-Diode Continuous Forward Current at (or below) 25°C Free-Air Temperature (See Note 2)</td>
<td>60 mA</td>
</tr>
<tr>
<td>Continuous Power Dissipation at (or below) 25°C Free-Air Temperature:</td>
<td></td>
</tr>
<tr>
<td>Light-Emitting Diode (See Note 3)</td>
<td>100 mW</td>
</tr>
<tr>
<td>Phototransistor (See Note 4)</td>
<td>150 mW</td>
</tr>
<tr>
<td>Storage Temperature Range</td>
<td>–55°C to 150°C</td>
</tr>
<tr>
<td>Lead Temperature 1/16 inch from case for 10 seconds</td>
<td>240°C</td>
</tr>
</tbody>
</table>

**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 0.8 mA/°C.
3. Derate linearly to 100°C free-air temperature at the rate of 1.33 mW/°C.
4. Derate linearly to 100°C free-air temperature at the rate of 2 mW/°C.
TYPE TIL112
OPTICALLY COUPLED ISOLATOR

electrical characteristics at 25°C free-air temperature

<table>
<thead>
<tr>
<th>PARAMETER</th>
<th>TEST CONDITIONS</th>
<th>MIN</th>
<th>TYP</th>
<th>MAX</th>
<th>UNIT</th>
</tr>
</thead>
<tbody>
<tr>
<td>V(BR)CEO Collector-Base Breakdown Voltage</td>
<td>IC = 10 μA, IE = 0, IF = 0</td>
<td>30</td>
<td></td>
<td></td>
<td>V</td>
</tr>
<tr>
<td>V(BR)EBO Emitter-Base Breakdown Voltage</td>
<td>IC = 10 μA, IE = 0, IF = 0</td>
<td>30</td>
<td></td>
<td></td>
<td>V</td>
</tr>
<tr>
<td>I(C(on)) Collector Current On-State</td>
<td>VCE = 5 V, IB = 0, IF = 10 mA</td>
<td>0.2</td>
<td>2</td>
<td></td>
<td>mA</td>
</tr>
<tr>
<td>I(C(off)) Collector Current Off-State</td>
<td>VCE = 5 V, IB = 0, IF = 0</td>
<td>1</td>
<td>100</td>
<td></td>
<td>nA</td>
</tr>
<tr>
<td>hFE Transistor Static Forward Current Transfer Ratio</td>
<td>VCE = 5 V, IC = 10 mA, IF = 0</td>
<td>50</td>
<td>200</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vf Input Diode Static Forward Voltage</td>
<td>IF = 10 mA</td>
<td>1.2</td>
<td>1.5</td>
<td></td>
<td>V</td>
</tr>
<tr>
<td>VCE(sat) Collector-Emitter Saturation Voltage</td>
<td>IC = 2 mA, IB = 0, IF = 50 mA</td>
<td>0.5</td>
<td></td>
<td></td>
<td>V</td>
</tr>
<tr>
<td>Rin, out Input-to-Output Internal Resistance</td>
<td>Vout = ±1.5 kV, See Note 5</td>
<td>10^6</td>
<td></td>
<td></td>
<td>Ω</td>
</tr>
<tr>
<td>Cin, out Input-to-Output Capacitance</td>
<td>Vout = 0, f = 1 MHz, See Note 5</td>
<td>1</td>
<td>2</td>
<td></td>
<td>pF</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>PARAMETER</th>
<th>TEST CONDITIONS</th>
<th>MIN</th>
<th>TYP</th>
<th>MAX</th>
<th>UNIT</th>
</tr>
</thead>
<tbody>
<tr>
<td>tr Rise Time</td>
<td>VCC = 10 V, I(C(on)) = 2 mA, RL = 100 Ω, See Test Circuit A of Figure 1</td>
<td>2</td>
<td>15</td>
<td></td>
<td>μs</td>
</tr>
<tr>
<td>tf Fall Time</td>
<td>VCC = 10 V, I(C(on)) = 20 μA, RL = 1 kΩ, See Test Circuit B of Figure 1</td>
<td>2</td>
<td>15</td>
<td></td>
<td>μs</td>
</tr>
</tbody>
</table>

PARAMETER MEASUREMENT INFORMATION

Adjust amplitude of input pulse for:
I(C(on)) = 2 mA (Test Circuit A) or
I(C(on)) = 20 μA (Test Circuit B)

NOTES:

a. The input waveform is supplied by a generator with the following characteristics: Zout = 50 Ω, tR ≤ 15 ns, duty cycle = 1%,
   tr = 100 μs.

b. The output waveform is monitored on an oscilloscope with the following characteristics: tR < 12 ns, Rin > 1 MΩ, Cin < 20 pF.

FIGURE 1—SWITCHING TIMES
TYPICAL CHARACTERISTICS

COLLECTOR CURRENT
vs
COLLECTOR-EMITTER VOLTAGE

FIGURE 2

COLLECTOR CURRENT
vs
INPUT-DIODE FORWARD CURRENT

FIGURE 3

RELATIVE ON-STATE COLLECTOR CURRENT
vs
FREE-AIR TEMPERATURE

FIGURE 4

OFF-STATE COLLECTOR CURRENT
vs
FREE-AIR TEMPERATURE

FIGURE 5

NOTES:
6. Pulse operation of input diode is required for operation beyond limits shown by dotted line.
7. These parameters were measured using pulse techniques t_w = 1 ms, duty cycle < 2%.
TYPE TIL112
OPTICALLY COUPLED ISOLATOR

TYPICAL CHARACTERISTICS

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

VCE = 5 V
IF = 0
TA = 25°C

Normalized to 1.0 at IF = 1 mA

FIGURE 6

INPUT-DIODE FORWARD CONDUCTION CHARACTERISTICS

FIGURE 7

COLLECTOR CURRENT VS MODULATION FREQUENCY

VCC = 10 V
IB = 0
TA = 25°C
RL = 1 kΩ
RL = 475 Ω
RL = 100 Ω

FIGURE 8

NOTE 7: These parameters were measured using pulse techniques tW = 1 ms, duty cycle ≤ 2%.

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