

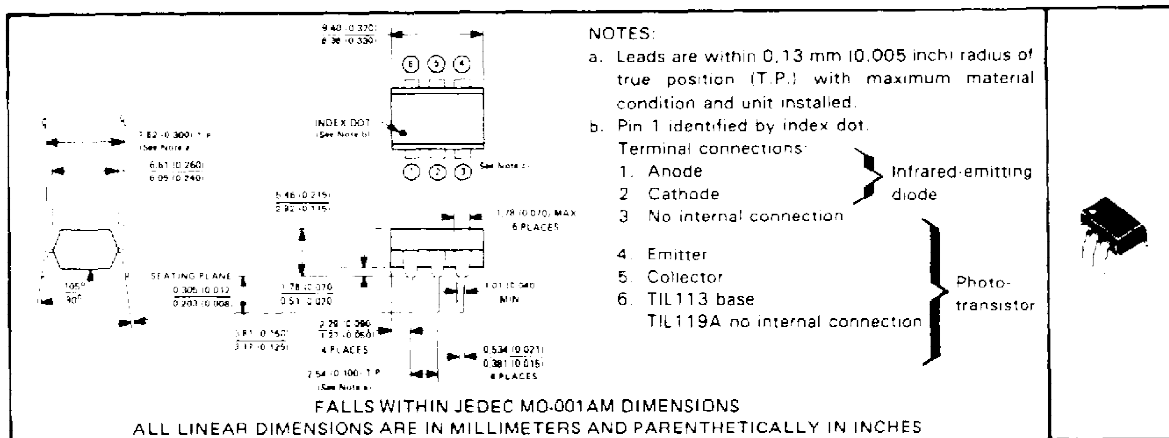
# TIL113, TIL119A OPTOCOUPERS

SOOS042A D1499, AUGUST 1981—REVISED JUNE 1989

- 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 TIL113 for Conventional Transistor Biasing
- No Base Lead Connection on TIL119A 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 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 Voltage                                                                     | ±1.5 kV        |
| Collector-Base Voltage (TIL113)                                                             | 30 V           |
| Collector-Emitter Voltage (See Note 1)                                                      | 30 V           |
| Emitter-Collector Voltage                                                                   | 7 V            |
| Emitter-Base Voltage (TIL113)                                                               | 7 V            |
| Input-Diode Reverse Voltage                                                                 | 3 V            |
| Input-Diode Continuous Forward Current at (or below) 25°C Free-Air Temperature (See Note 2) | 100 mA         |
| Continuous Power Dissipation at (or below) 25°C Free-Air Temperature:                       |                |
| Infrared-Emitting Diode (See Note 3)                                                        | 150 mW         |
| Phototransistor (See Note 4)                                                                | 150 mW         |
| Total (Infrared-Emitting Diode plus Phototransistor, See Note 5)                            | 250 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:
- This value applies when the base-emitter diode is open circuited.
  - Derate linearly to 100°C free-air temperature at the rate of 1.33 mW/°C.
  - Derate linearly to 100°C free-air temperature at the rate of 2 mW/°C.
  - Derate linearly to 100°C free-air temperature at the rate of 2 mW/°C.
  - Derate linearly to 100°C free-air temperature at the rate of 3.33 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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# TIL113, TIL119A OPTOCOUPERS

electrical characteristics at 25°C free-air temperature

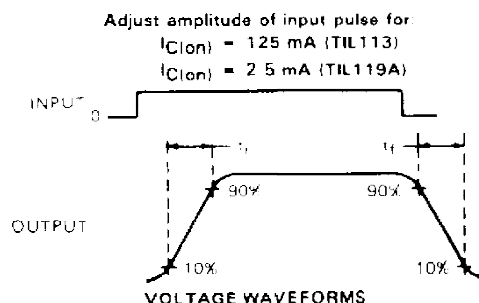
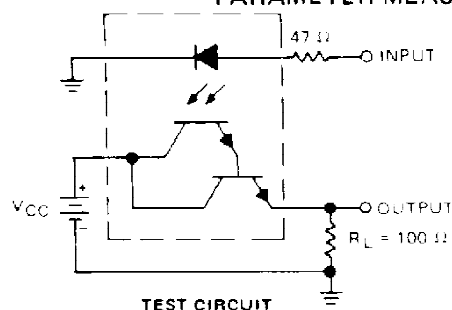
| PARAMETER                                                 | TEST CONDITIONS†                                           | TIL113           |        |     | TIL119A          |     |     | UNIT     |
|-----------------------------------------------------------|------------------------------------------------------------|------------------|--------|-----|------------------|-----|-----|----------|
|                                                           |                                                            | MIN              | TYP    | MAX | MIN              | TYP | MAX |          |
| $V_{(BR)CBO}$ Collector-Base Breakdown Voltage            | $I_C = 10 \mu A$ , $I_E = 0$ , $I_F = 0$                   | 30               |        |     |                  |     |     | V        |
| $V_{(BR)CEO}$ Collector-Emitter Breakdown Voltage         | $I_C = 1 \text{ mA}$ , $I_E = 0$ , $I_F = 0$               | 30               |        |     | 30               |     |     | V        |
| $V_{(BR)EBO}$ Emitter-Base Breakdown Voltage              | $I_E = 10 \mu A$ , $I_C = 0$ , $I_F = 0$                   | 7                |        |     |                  |     |     | V        |
| $V_{(BR)ECO}$ Emitter-Collector Breakdown Voltage         | $I_E = 10 \mu A$ , $I_F = 0$                               |                  |        |     | 7                |     |     | V        |
| $I_{C(on)}$ On State Collector Current                    | $V_{CE} = 1 \text{ V}$ , $I_B = 0$ , $I_F = 10 \text{ mA}$ | 30               | 100    |     |                  |     |     | mA       |
|                                                           | $V_{CE} = 1 \text{ V}$ , $I_F = 10 \text{ mA}$             |                  |        |     | 30               | 160 |     |          |
| $I_{C(off)}$ Off-State Collector Current                  | $V_{CE} = 10 \text{ V}$ , $I_B = 0$ , $I_F = 0$            |                  |        | 100 |                  |     | 100 | nA       |
| $h_{FE}$ Transistor Static Forward Current Transfer Ratio | $V_{CE} = 1 \text{ V}$ , $I_C = 10 \text{ mA}$ , $I_F = 0$ |                  | 15,000 |     |                  |     |     |          |
| $V_F$ Input Diode Static Forward Voltage                  | $I_F = 10 \text{ mA}$                                      |                  |        | 1.5 |                  |     | 1.5 | V        |
| $V_{CE(sat)}$ Collector-Emitter Saturation Voltage        | $I_C = 125 \text{ mA}$ , $I_B = 0$ , $I_F = 50 \text{ mA}$ |                  |        | 1.2 |                  |     |     | V        |
|                                                           | $I_C = 30 \text{ mA}$ , $I_F = 10 \text{ mA}$              |                  |        |     |                  |     | 1   |          |
| $r_{iO}$ Input-to-Output Internal Resistance              | $V_{in-out} = \pm 1.5 \text{ kV}$ , See Note 6             | 10 <sup>11</sup> |        |     | 10 <sup>11</sup> |     |     | $\Omega$ |
| $C_{iO}$ Input-to-Output Capacitance                      | $V_{in-out} = 0$ , $f = 1 \text{ MHz}$ , See Note 6        |                  | 1      | 1.3 |                  | 1   | 1.3 | pF       |

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

| PARAMETER       | TEST CONDITIONS                                        | TIL113 |     |     | TIL119A |     |     | UNIT    |
|-----------------|--------------------------------------------------------|--------|-----|-----|---------|-----|-----|---------|
|                 |                                                        | MIN    | TYP | MAX | MIN     | TYP | MAX |         |
| $t_r$ Rise Time | $V_{CC} = 15 \text{ V}$ , $I_{C(on)} = 125 \text{ mA}$ |        | 300 |     |         |     |     | $\mu s$ |
| $t_f$ Fall Time | $R_L = 100 \Omega$ , See Figure 1                      |        | 300 |     |         |     |     |         |
| $t_r$ Rise Time | $V_{CC} = 10 \text{ V}$ , $I_{C(on)} = 2.5 \text{ mA}$ |        |     |     |         | 300 |     | $\mu s$ |
| $t_f$ Fall Time | $R_L = 100 \Omega$ , See Figure 1                      |        |     |     |         | 300 |     |         |

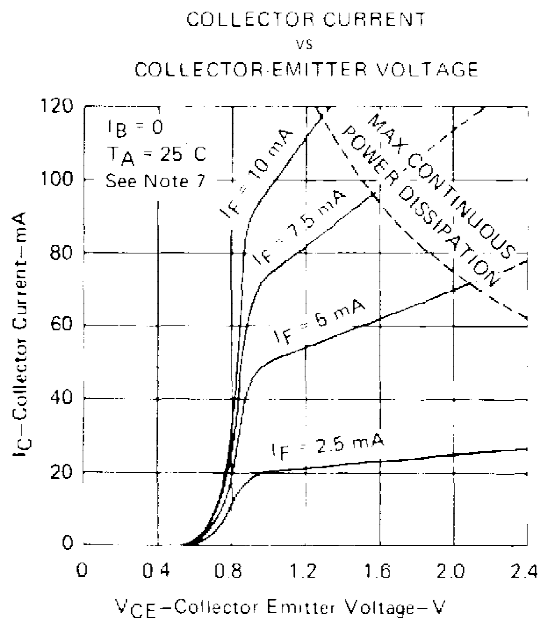
## PARAMETER MEASUREMENT INFORMATION



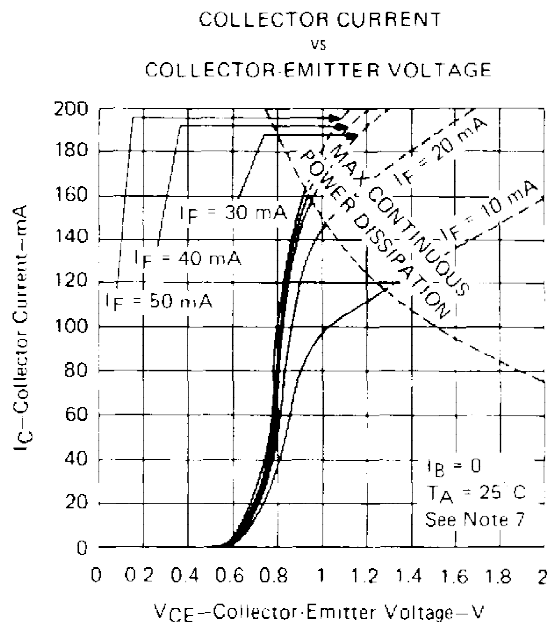
- NOTES: a. The input waveform is supplied by a generator with the following characteristics:  $Z_{out} = 50 \Omega$ ,  $t_r = 15 \text{ ns}$ , duty cycle = 1%,  $t_w = 500 \mu s$ .  
b. The output waveform is monitored on an oscilloscope with the following characteristics:  $t_r = 12 \text{ ns}$ ,  $R_{in} = 1 \text{ M}\Omega$ ,  $C_{in} = 20 \text{ pF}$ .

FIGURE 1—SWITCHING TIMES

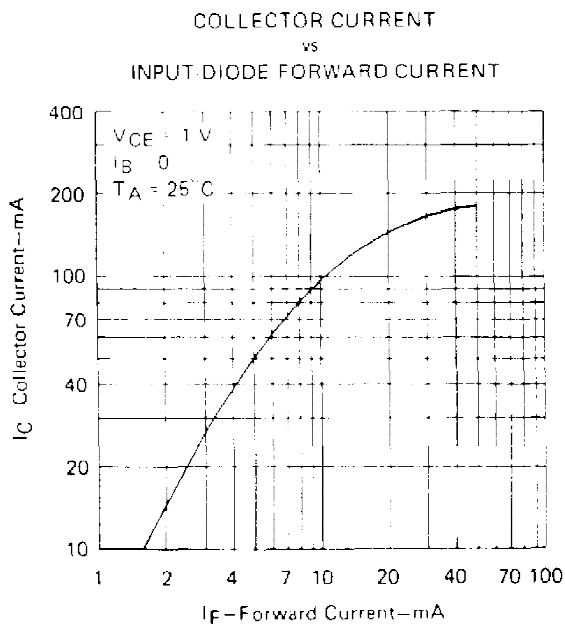
**TYPICAL CHARACTERISTICS**



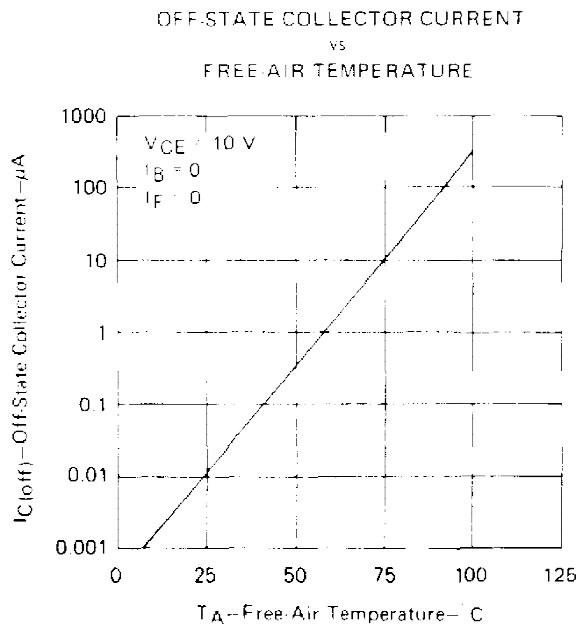
**FIGURE 2**



**FIGURE 3**



**FIGURE 4**



**FIGURE 5**

NOTE 7: Pulse operation of input diode is required for operation beyond limits shown by dotted line.

# TIL113, TIL119A OPTOCOUPERS

## TYPICAL CHARACTERISTICS

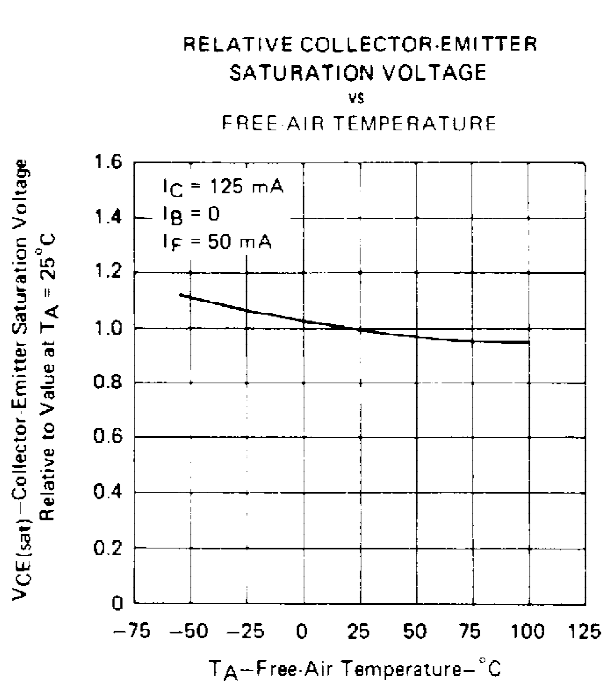


FIGURE 6

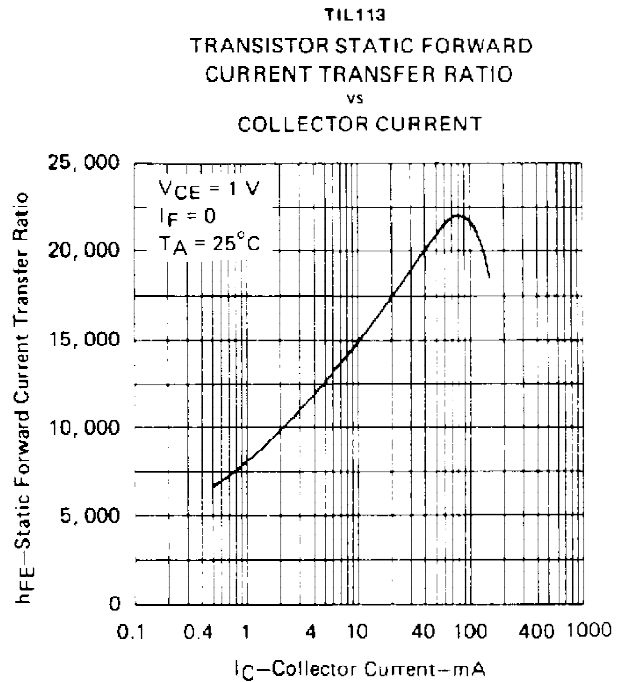


FIGURE 7

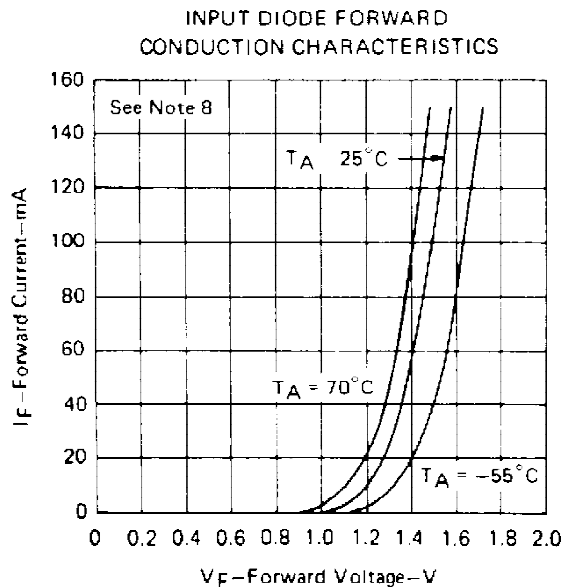


FIGURE 8

NOTE 8: This parameter was measured using pulse techniques.  $t_w = 1\text{ ms}$ , duty cycle  $\leq 2\%$ .

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## PACKAGING INFORMATION

| Orderable Device | Status <sup>(1)</sup> | Package Type | Package Drawing | Pins | Package Qty | Eco Plan <sup>(2)</sup> | Lead/Ball Finish | MSL Peak Temp <sup>(3)</sup> |
|------------------|-----------------------|--------------|-----------------|------|-------------|-------------------------|------------------|------------------------------|
| TIL113           | OBSOLETE              | PDIP         | N               | 6    |             | TBD                     | Call TI          | Call TI                      |
| TIL119           | OBSOLETE              | PDIP         | N               | 6    |             | TBD                     | Call TI          | Call TI                      |
| TIL119A          | OBSOLETE              | PDIP         | N               | 6    |             | TBD                     | Call TI          | Call TI                      |

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**TBD:** The Pb-Free/Green conversion plan has not been defined.

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<sup>(3)</sup> MSL, Peak Temp. -- The Moisture Sensitivity Level rating according to the JEDEC industry standard classifications, and peak solder temperature.

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