

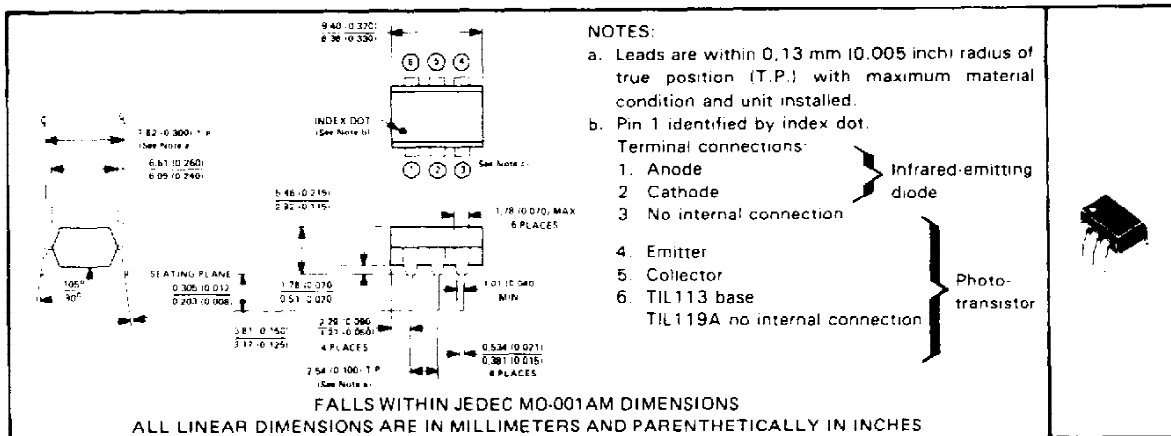
# TIL113, TIL119A OPTOCOUPLED

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 OPTOCOUPLEDERS

electrical characteristics at 25°C free-air temperature

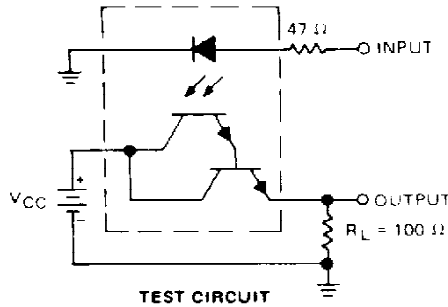
PARAMETER	TEST CONDITIONS†	TIL113			TIL119A			UNIT
		MIN	TYP	MAX	MIN	TYP	MAX	
V <sub>(BR)CBO</sub>	Collector-Base Breakdown Voltage I <sub>C</sub> = 10 μA, I <sub>E</sub> = 0, I <sub>F</sub> = 0	30						V
V <sub>(BR)CEO</sub>	Collector-Emitter Breakdown Voltage I <sub>C</sub> = 1 mA, I <sub>B</sub> = 0, I <sub>F</sub> = 0	30			30			V
V <sub>(BR)EBO</sub>	Emitter-Base Breakdown Voltage I <sub>E</sub> = 10 μA, I <sub>C</sub> = 0, I <sub>F</sub> = 0	7						V
V <sub>(BR)ECO</sub>	Emitter-Collector Breakdown Voltage I <sub>E</sub> = 10 μA, I <sub>F</sub> = 0				7			V
I <sub>C(on)</sub>	On State Collector Current V <sub>CE</sub> = 1 V, I <sub>B</sub> = 0, I <sub>F</sub> = 10 mA	30	100					mA
	V <sub>CE</sub> = 1 V, I <sub>F</sub> = 10 mA				30	160		
I <sub>C(off)</sub>	Off-State Collector Current V <sub>CE</sub> = 10 V, I <sub>B</sub> = 0, I <sub>F</sub> = 0			100			100	nA
h <sub>FE</sub>	Transistor Static Forward Current Transfer Ratio V <sub>CE</sub> = 1 V, I <sub>C</sub> = 10 mA, I <sub>F</sub> = 0		15,000					
V <sub>F</sub>	Input Diode Static Forward Voltage I <sub>F</sub> = 10 mA			1.5			1.5	V
V <sub>CE(sat)</sub>	Collector-Emitter Saturation Voltage I <sub>C</sub> = 125 mA, I <sub>B</sub> = 0, I <sub>F</sub> = 50 mA			1.2				V
	I <sub>C</sub> = 30 mA, I <sub>F</sub> = 10 mA						1	
r <sub>IO</sub>	Input-to-Output Internal Resistance V <sub>in-out</sub> = ±1.5 kV. See Note 6		10 <sup>11</sup>			10 <sup>11</sup>		Ω
C <sub>io</sub>	Input-to-Output Capacitance V <sub>in-out</sub> = 0, f = 1 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.

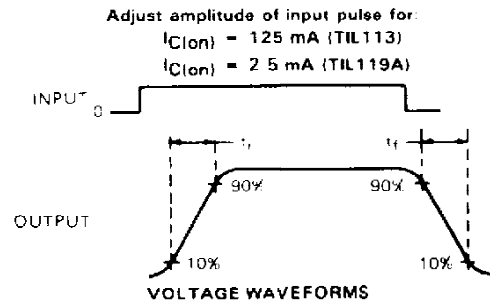
switching characteristics at 25°C free-air temperature

PARAMETER	TEST CONDITIONS	TIL113			TIL119A			UNIT
		MIN	TYP	MAX	MIN	TYP	MAX	
t <sub>r</sub>	Rise Time V <sub>CC</sub> = 15 V, I <sub>C(on)</sub> = 125 mA, R <sub>L</sub> = 100 Ω, See Figure 1		300					μs
t <sub>f</sub>	Fall Time		300					
t <sub>r</sub>	Rise Time V <sub>CC</sub> = 10 V, I <sub>C(on)</sub> = 2.5 mA, R <sub>L</sub> = 100 Ω, See Figure 1					300		μs
t <sub>f</sub>	Fall Time					300		

## PARAMETER MEASUREMENT INFORMATION



TEST CIRCUIT



- NOTES: a. The input waveform is supplied by a generator with the following characteristics: Z<sub>out</sub> = 50 Ω, t<sub>r</sub> = 15 ns, duty cycle = 1%, t<sub>w</sub> = 500 μs.  
b. The output waveform is monitored on an oscilloscope with the following characteristics: t<sub>r</sub> = 12 ns, R<sub>in</sub> = 1 MΩ, C<sub>in</sub> = 20 pF

FIGURE 1—SWITCHING TIMES

TYPICAL CHARACTERISTICS

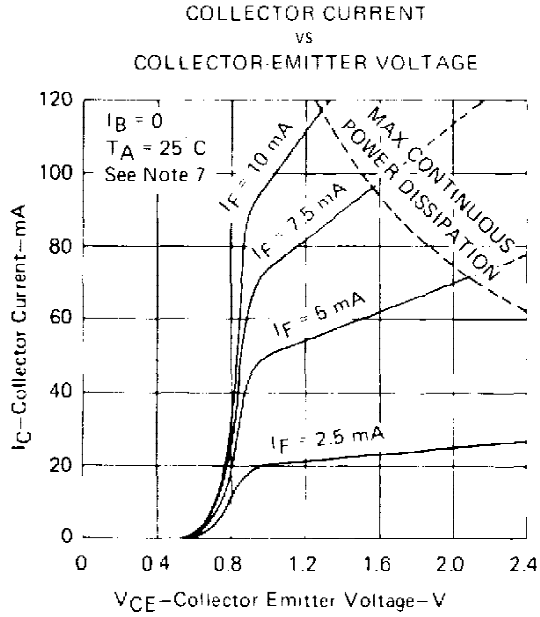


FIGURE 2

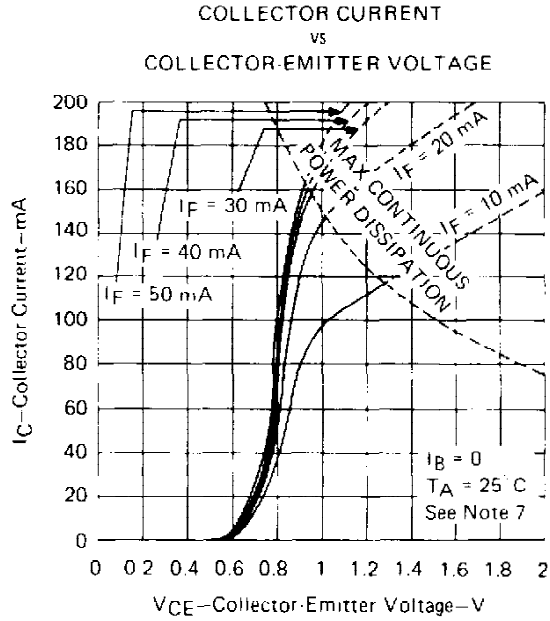


FIGURE 3

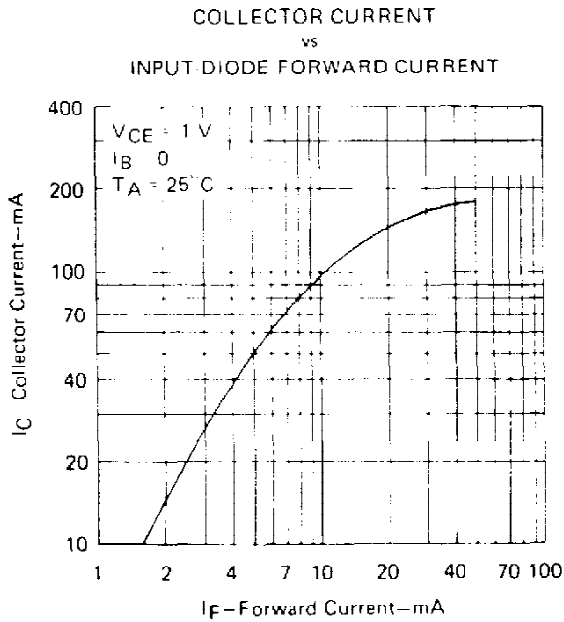


FIGURE 4

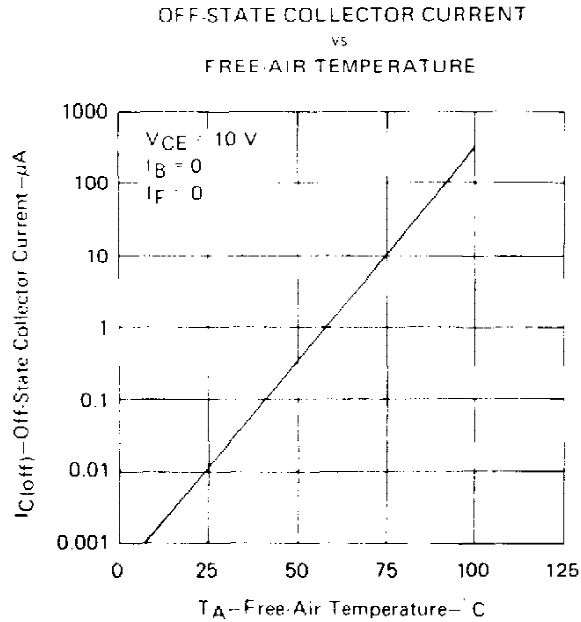


FIGURE 5

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

**TIL113, TIL119A  
OPTOCOUPERS**

**TYPICAL CHARACTERISTICS**

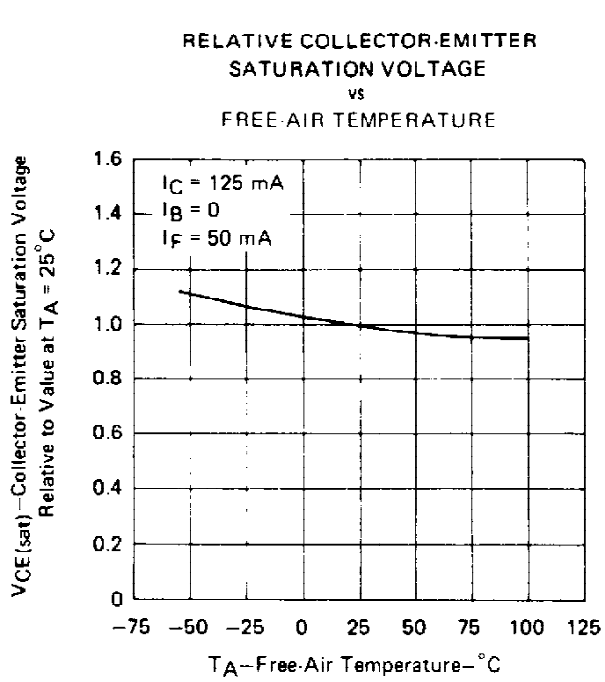


FIGURE 6

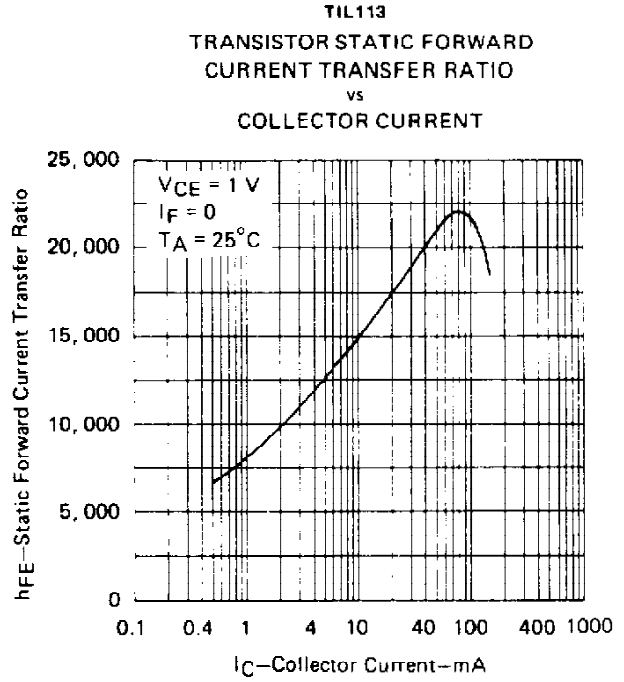


FIGURE 7

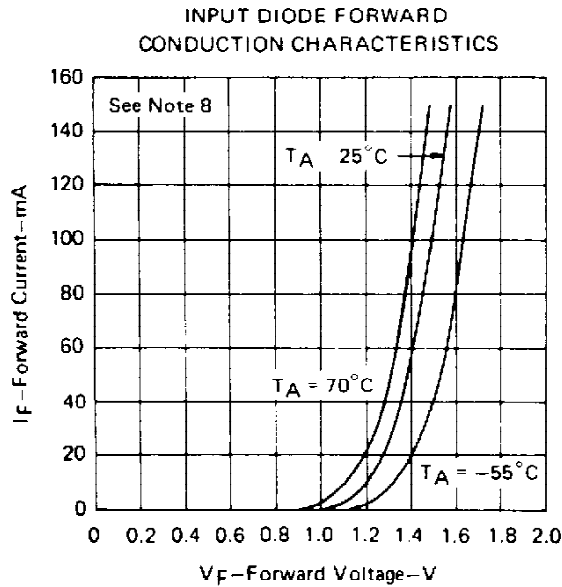


FIGURE 8

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

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