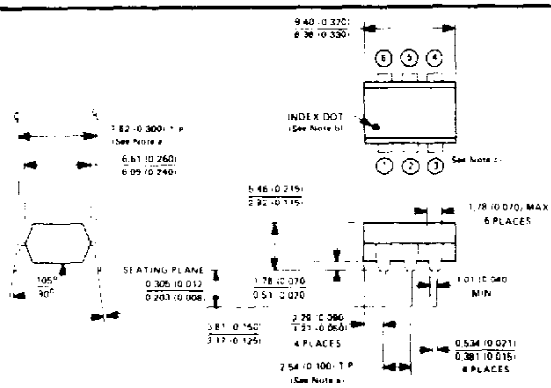
SOOS042A D1499, AUGUST 1981 – REVISED JUNE 1989

- 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.



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

} Infrared-emitting diode

4. Emitter
5. Collector
6. TIL113 base
   TIL119A no internal connection

} Photo-transistor

FALLS WITHIN JEDEC MO-001AM DIMENSIONS
ALL LINEAR DIMENSIONS ARE IN MILLIMETERS AND PARENTHETICALLY IN INCHES

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 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 1.33 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 2 mW/°C.
5. Derate linearly to 100°C free air temperature at the rate of 3.33 mW/°C.

electrical characteristics at 25°C free-air temperature

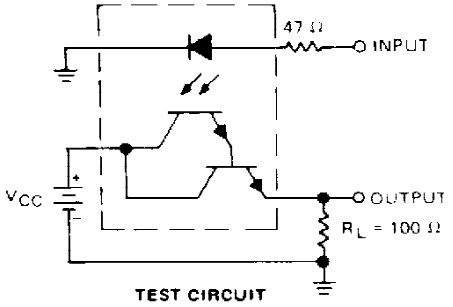
PARAMETER		TEST CONDITIONS†			TIL113			TIL119A			UNIT
					MIN	TYP	MAX	MIN	TYP	MAX	
$V_{(BR)CBO}$	Collector Base Breakdown Voltage	I_C = 10 µA,	I_E = 0,	I_F = 0	30						V
$V_{(BR)CEO}$	Collector-Emitter Breakdown Voltage	I_C = 1 mA,	I_B = 0,	I_F = 0	30			30			V
$V_{(BR)EBO}$	Emitter-Base Breakdown Voltage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

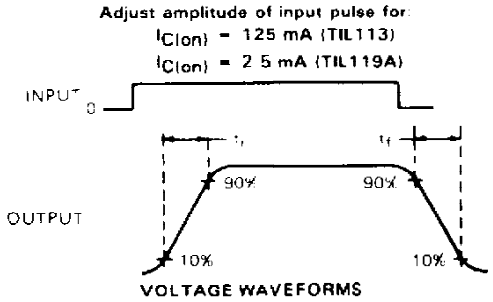
switching characteristics at 25°C free-air temperature

PARAMETER		TEST CONDITIONS			TL113			TIL119A			UNIT
					MIN	TYP	MAX	MIN	TYP	MAX	
t_r	Rise Time	V_{CC} = 15 V,	$I_{C(on)}$ = 125 mA,			300					µs
t_f	Fall Time	R_L = 100 Ω,	See Figure 1			300					
t_r	Rise Time	V_{CC} = 10 V,	$I_{C(on)}$ = 2.5 mA,						300		µs
t_f	Fall Time	R_L = 100 Ω,	See Figure 1						300		

PARAMETER MEASUREMENT INFORMATION



TEST CIRCUIT



VOLTAGE WAVEFORMS

NOTES: a. The input waveform is supplied by a generator with the following characteristics: Z_{out} ≈ 50 Ω, t_r ≤ 15 ns, duty cycle ≈ 1%, t_w = 500 µs.
b. The output waveform is monitored on an oscilloscope with the following characteristics: t_r ≤ 12 ns, R_{in} ≥ 1 MΩ, C_{in} ≤ 20 pF.

FIGURE 1–SWITCHING TIMES

TYPICAL CHARACTERISTICS

COLLECTOR CURRENT
vs
COLLECTOR-EMITTER VOLTAGE

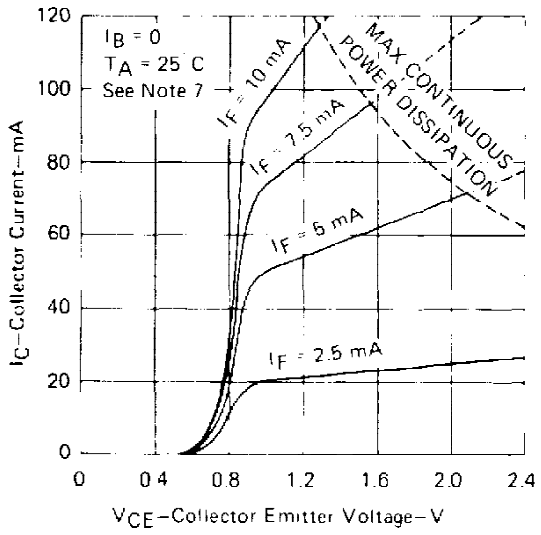


FIGURE 2

COLLECTOR CURRENT
vs
COLLECTOR-EMITTER VOLTAGE

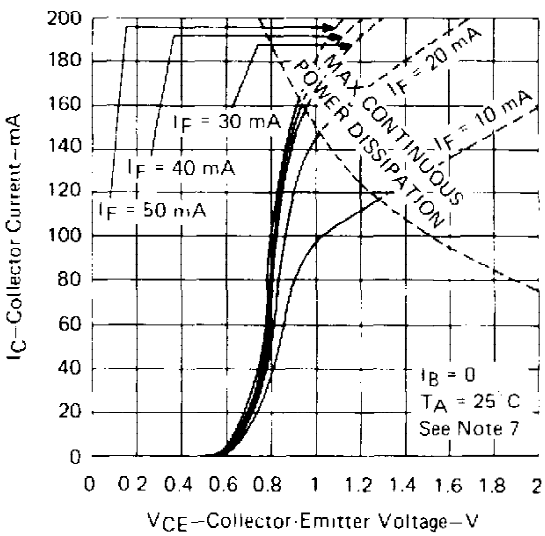


FIGURE 3

COLLECTOR CURRENT
vs
INPUT DIODE FORWARD CURRENT

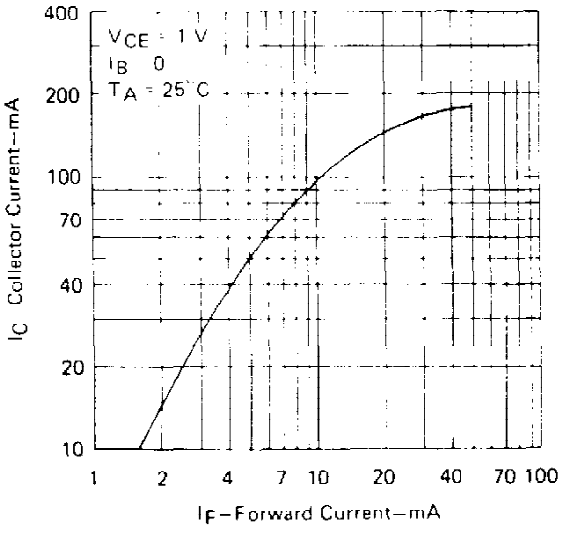


FIGURE 4

OFF-STATE COLLECTOR CURRENT
vs
FREE-AIR TEMPERATURE

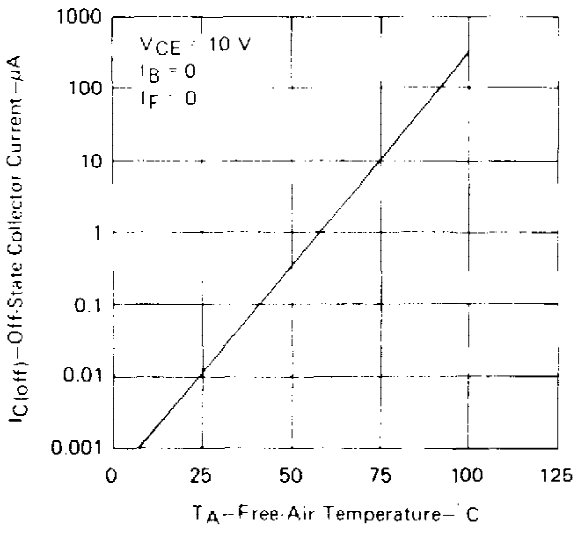


FIGURE 5

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

TYPICAL CHARACTERISTICS

RELATIVE COLLECTOR-EMITTER SATURATION VOLTAGE vs FREE-AIR TEMPERATURE

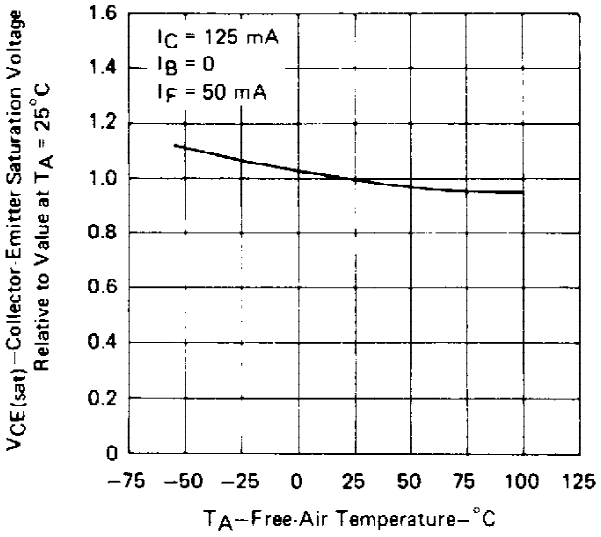


FIGURE 6

TIL113

TRANSISTOR STATIC FORWARD CURRENT TRANSFER RATIO vs COLLECTOR CURRENT

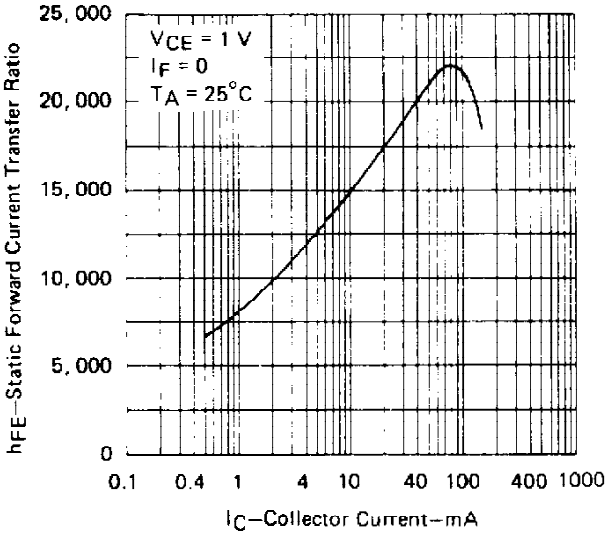


FIGURE 7

INPUT DIODE FORWARD CONDUCTION CHARACTERISTICS

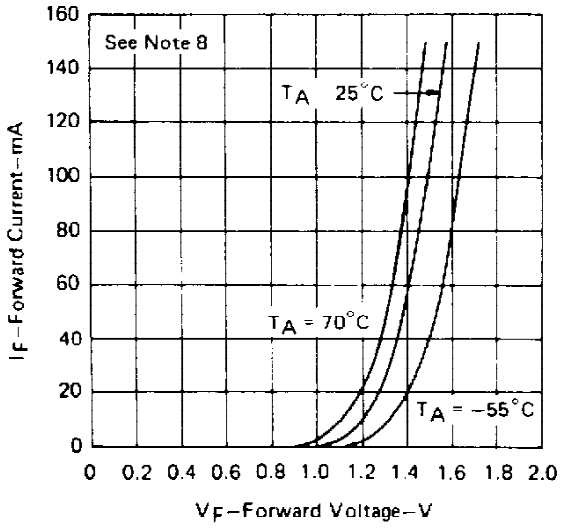


FIGURE 8

NOTE 8: This parameter was measured using pulse techniques. t_w = 1 ms, duty cycle ≤ 2%.

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PACKAGING INFORMATION

Orderable Device	Status [1]	Package Type	Package Drawing	Pins	Package Qty	Eco Plan [2]	Lead/Ball Finish	MSL Peak Temp [3]
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

[1] The marketing status values are defined as follows:
ACTIVE: Product device recommended for new designs.
LIFEBUY: TI has announced that the device will be discontinued, and a lifetime-buy period is in effect.
NRND: Not recommended for new designs. Device is in production to support existing customers, but TI does not recommend using this part in a new design.
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OBSOLETE: TI has discontinued the production of the device.

[2] Eco Plan - The planned eco-friendly classification: Pb-Free (RoHS) or Green (RoHS & no Sb/Br) - please check http://www.ti.com/productcontent for the latest availability information and additional product content details.
TBD: The Pb-Free/Green conversion plan has not been defined.
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[3] MSL, Peak Temp. -- The Moisture Sensitivity Level rating according to the JEDEC industry standard classifications, and peak solder temperature.

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