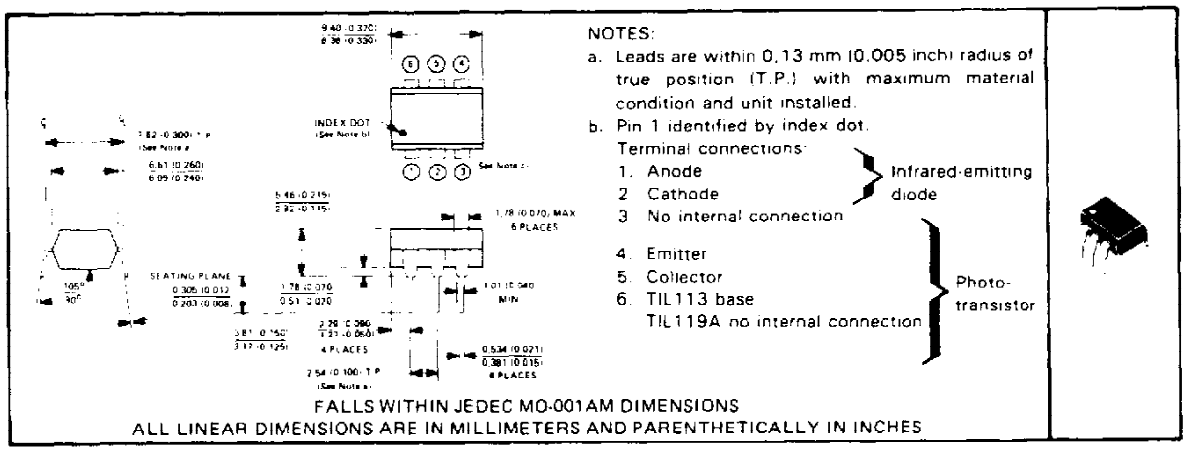
SOOS042A D1499, AUGUST 1981 – REVISED JUNE 1989

- **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
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.

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electrical characteristics at 25°C free-air temperature

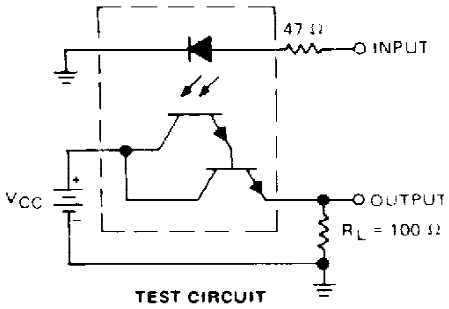
PARAMETER		TEST CONDITIONS†			TIL113 MIN	TIL113 TYP	TIL113 MAX	TIL119A MIN	TIL119A TYP	TIL119A MAX	UNIT
$V_{(BR)CBO}$	Collector Base Breakdown Voltage	$I_C = 10\ \mu A$,	$I_E = 0$,	$I_F = 0$	30						V
$V_{(BR)CEO}$	Collector-Emitter Breakdown Voltage	$I_C = 1$ mA,	$I_B = 0$,	$I_F = 0$	30			30			V
$V_{(BR)EBO}$	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	$V_{CE} = 1$ 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	$V_{in-out} = \pm 1.5$ 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.

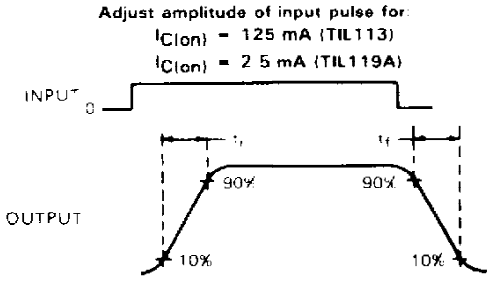
switching characteristics at 25°C free-air temperature

PARAMETER		TEST CONDITIONS		TL113 MIN	TL113 TYP	TL113 MAX	TIL119A MIN	TIL119A TYP	TIL119A MAX	UNIT
t_r	Rise Time	$V_{CC} = 15$ V,	$I_{C(on)} = 125$ mA,		300					μs
t_f	Fall Time	$R_L = 100\ \Omega$,	See Figure 1		300					
t_r	Rise Time	$V_{CC} = 10$ V,	$I_{C(on)} = 2.5$ mA,					300		μs
t_f	Fall Time	$R_L = 100\ \Omega$,	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: $Z_{out} = 50\ \Omega$, $t_r \leq 15$ ns, duty cycle = 1%, $t_w = 500\ \mu s$.
b. The output waveform is monitored on an oscilloscope with the following characteristics: $t_r \leq 12$ ns, $R_{in} \geq 1\ M\Omega$, $C_{in} \leq 20$ pF.

FIGURE 1–SWITCHING TIMES

TYPICAL CHARACTERISTICS

COLLECTOR CURRENT
vs
COLLECTOR-EMITTER VOLTAGE

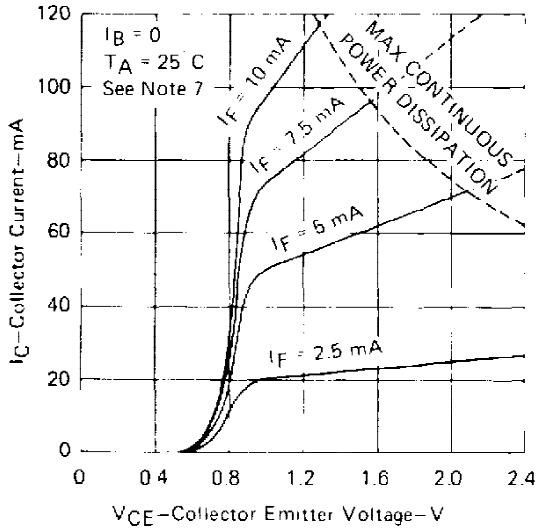


FIGURE 2

COLLECTOR CURRENT
vs
COLLECTOR-EMITTER VOLTAGE

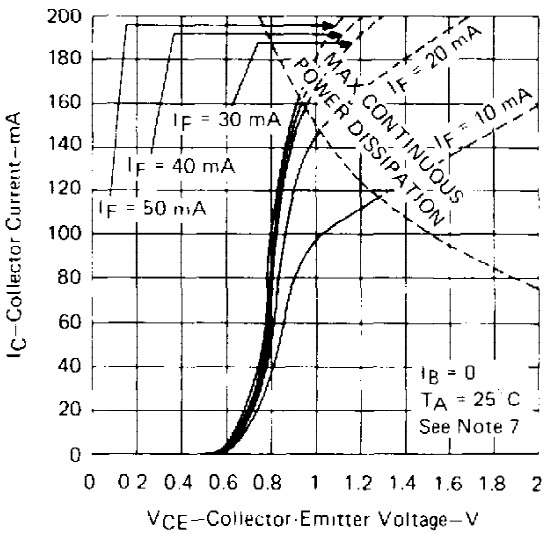


FIGURE 3

COLLECTOR CURRENT
vs
INPUT DIODE FORWARD CURRENT

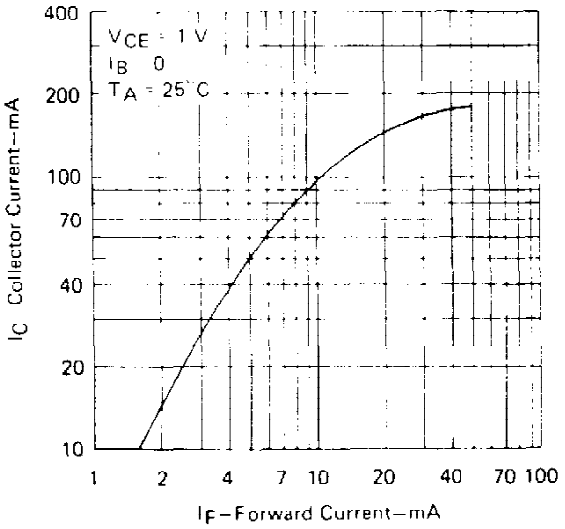


FIGURE 4

OFF-STATE COLLECTOR CURRENT
vs
FREE-AIR TEMPERATURE

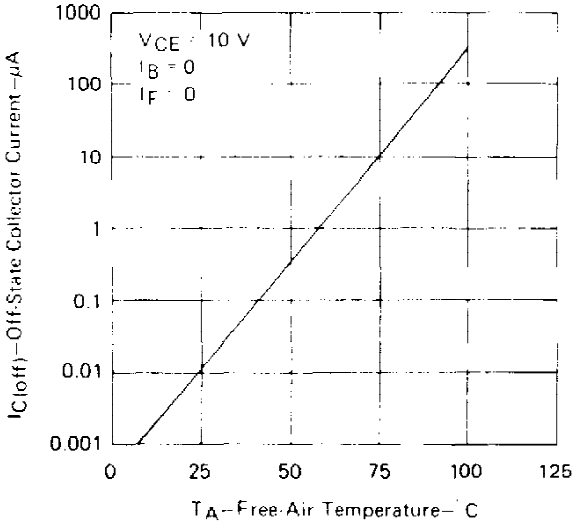


FIGURE 5

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

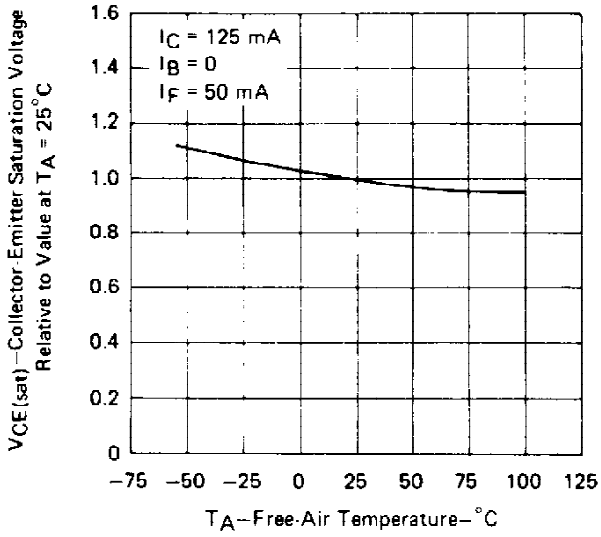


FIGURE 6

TIL113
TRANSISTOR STATIC FORWARD CURRENT TRANSFER RATIO vs COLLECTOR CURRENT

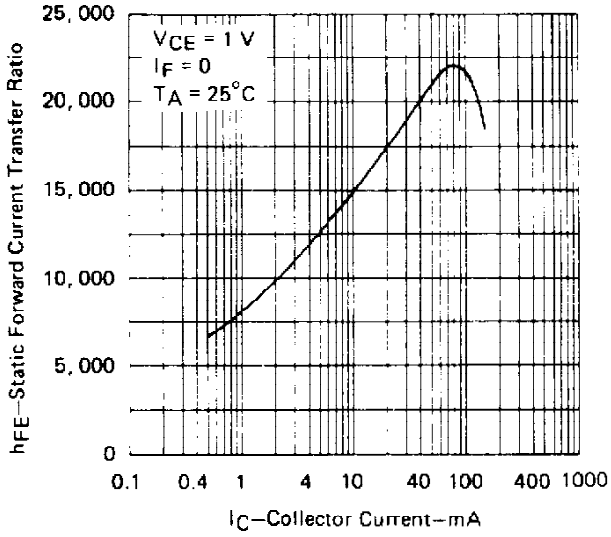


FIGURE 7

INPUT DIODE FORWARD CONDUCTION CHARACTERISTICS

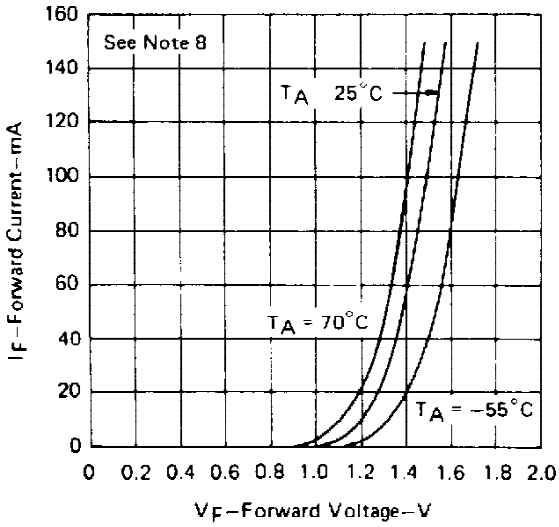


FIGURE 8

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

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