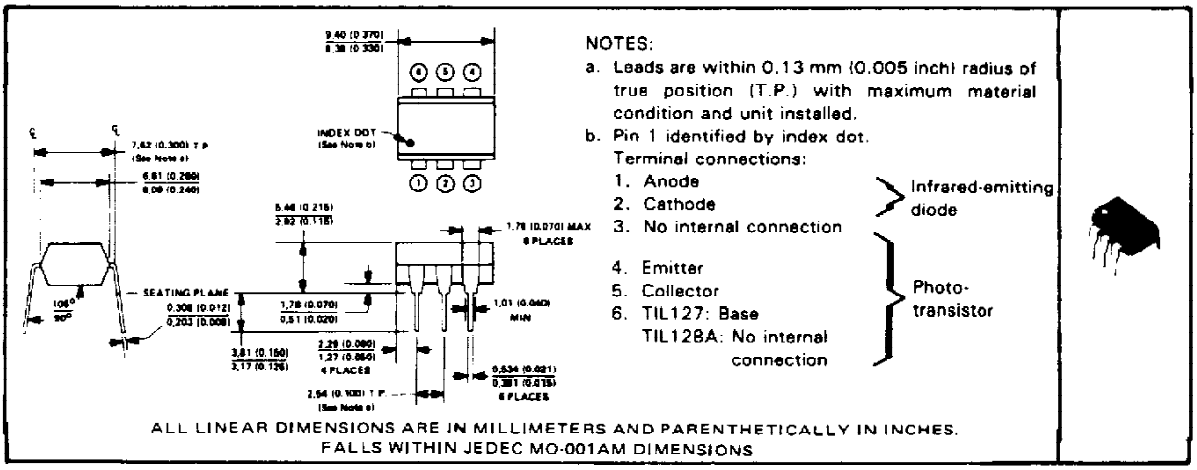
SOOS045A D2328, MAY 1977—REVISED JUNE 1989

- 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 . . . 5000-Volt Rating
- Plastic Dual-In-Line Package
- Typical Applications Include Remote Terminal Isolation, SCR and Triac Triggers, Mechanical Relays, and Pulse Transformers
- No Base Connection on TIL128A for Environments with High Electromagnetic Interference

mechanical data

The package consists of a gallium arsenide infrared-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)

Input-to-Output Voltage	±5 kV
Collector-Base Voltage (TIL127)	30 V
Collector-Emitter Voltage (See Note 1)	30 V
Emitter-Collector Voltage	7 V
Emitter-Base Voltage (TIL127)	7 V
Input-Diode Reverse Voltage	3 V
Input-Diode Continuous Forward Current	100 mA
Continuous Power Dissipation at (or below) 25°C Free-Air Temperature:	
Infrared-Emitting Diode (See Note 2)	150 mW
Phototransistor (See Note 3)	150 mW
Total (Infrared-Emitting Diode plus Phototransistor, See Note 4)	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 2 mW/°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 3.33 mW/°C.

electrical characteristics at 25°C free-air temperature

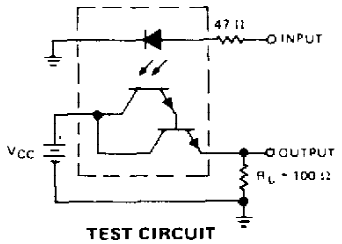
PARAMETER		TEST CONDITIONS†			TIL127			TIL128A			UNIT
					MIN	TYP	MAX	MIN	TYP	MAX	
$V_{(BR)CBO}$	Collector-Base Breakdown Voltage	I_C = 10 μA,	I_E = 0,	I_F = 0	30						V
$V_{(BR)CEO}$	Collector-Emitter Breakdown Voltage	I_C = 1 mA,	I_B = 0,	I_F = 0	30			30			V
$V_{(BR)EBO}$	Emitter-Base Breakdown Voltage	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_R	Input Diode Static Reverse Current	V_R = 3 V					10			10	μA
$I_{C(on)}$	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} = 500 V,	See Note 5		10^{11}			10^{11}			Ω
C_{io}	Input-to-Output Capacitance	V_{in-out} = 0,	f = 1 MHz,	See Note 5		1	1.3		1	1.3	pF

NOTE 5: These parameters are measured between both input-diode leads shorted together and all the phototransistor leads shorted together.
†References to the base are not applicable to the TIL128A.

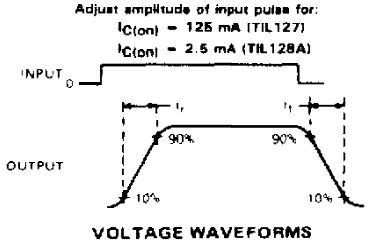
switching characteristics at 25°C free-air temperature

PARAMETER		TEST CONDITIONS†		TIL127			TIL128A			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

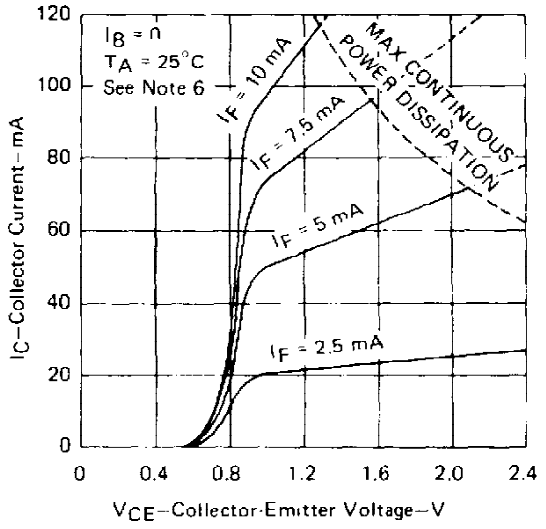


FIGURE 2

COLLECTOR CURRENT
vs
COLLECTOR-EMITTER VOLTAGE

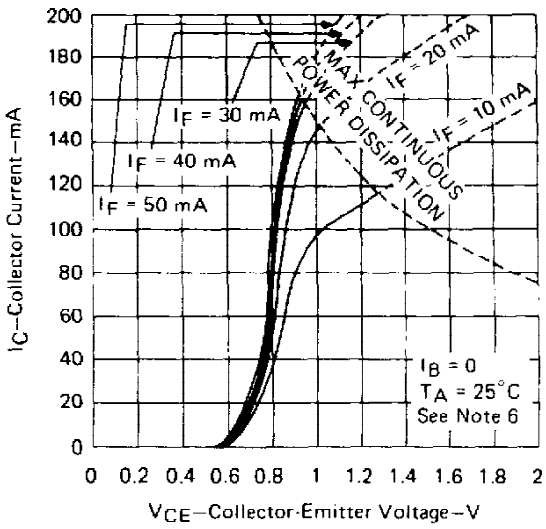


FIGURE 3

COLLECTOR CURRENT
vs
INPUT-DIODE FORWARD CURRENT

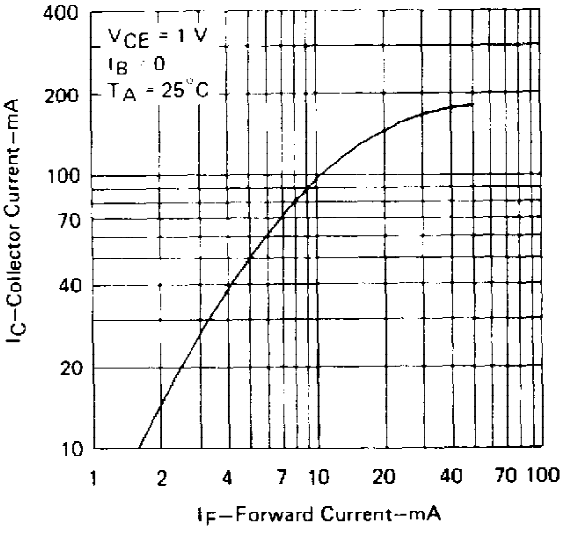


FIGURE 4

OFF-STATE COLLECTOR CURRENT
vs
FREE-AIR TEMPERATURE

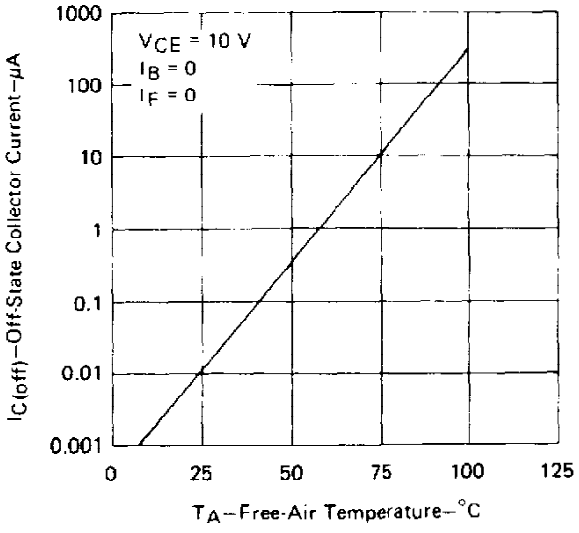


FIGURE 5

NOTE 6: 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

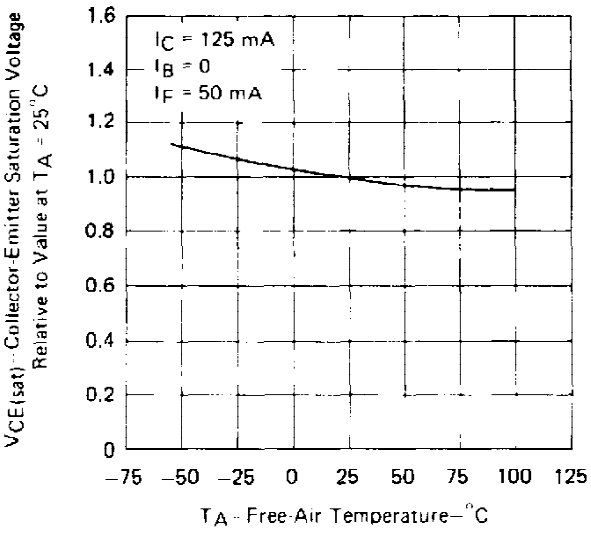


FIGURE 6

TIL127

TRANSISTOR STATIC FORWARD CURRENT TRANSFER RATIO vs COLLECTOR CURRENT

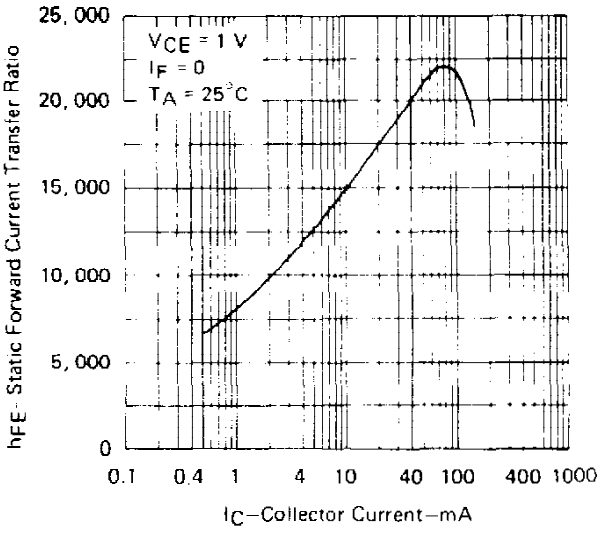


FIGURE 7

INPUT DIODE FORWARD CONDUCTION CHARACTERISTICS

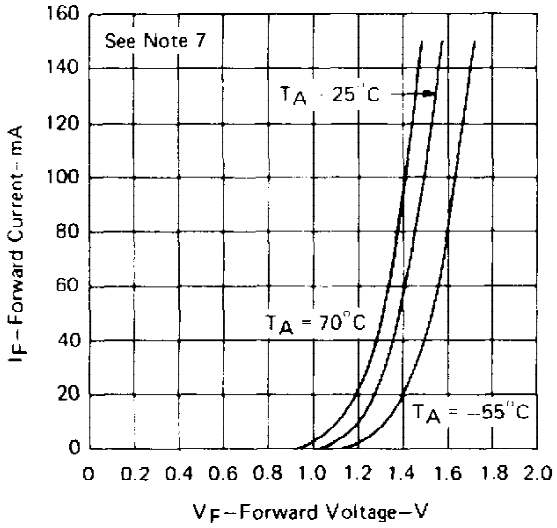


FIGURE 8

NOTE 7: This parameter was measured using pulse techniques, t_w = 1 ms, duty cycle ≤ 2%.

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