

TIL187-1 THRU TIL187-4
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AC-INPUT OPTOCOUPPLERS/OPTOISOLATORS

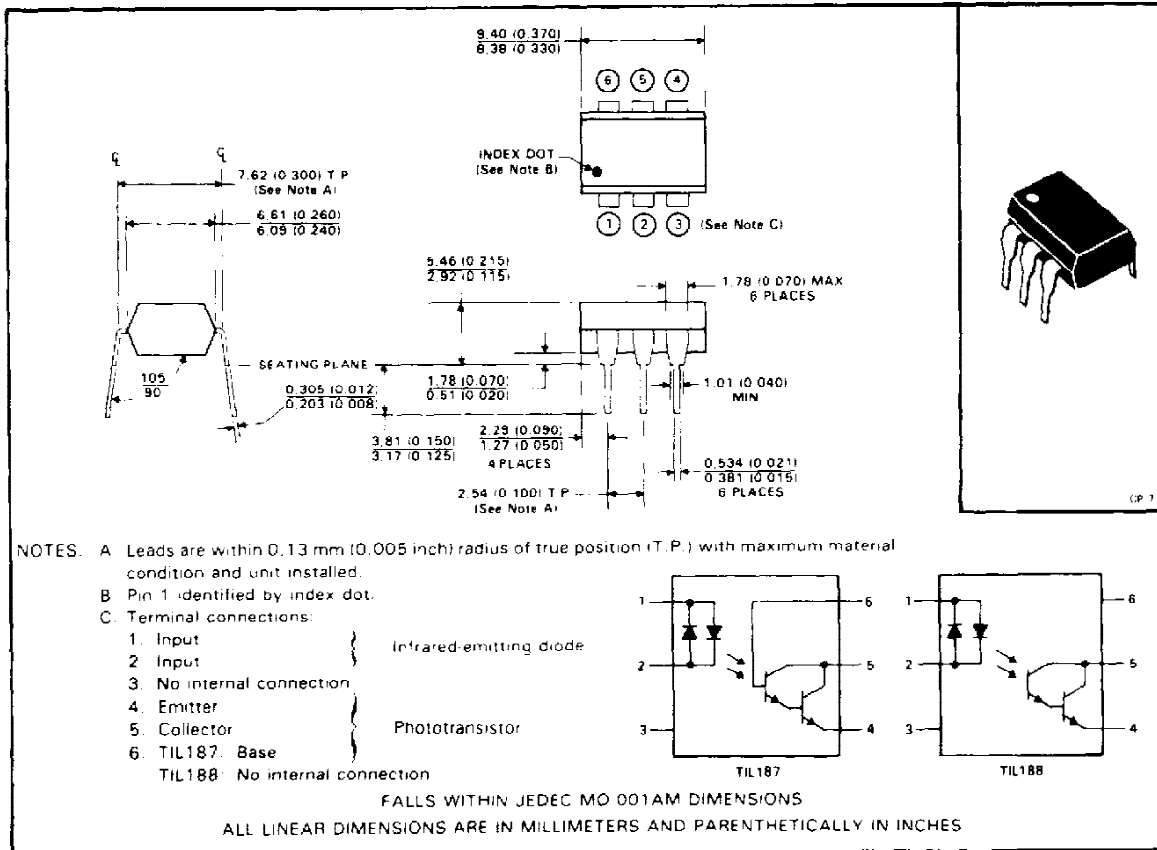
SOOS012A D2980, JANUARY 1987—REVISED JULY 1989

- AC Signal Input
- Gallium Arsenide Dual-Diode Infrared Source Optically Coupled to a Silicon N-P-N Darlington Phototransistor
- Plastic Dual-In-Line Package
- High-Voltage Electrical Isolation, 3.535 kV Peak (2.5 kV rms)
- High Current Transfer Ratio, 500% Minimum at $I_f = 10$ mA, Up to 1500% Minimum at $I_f = 2$ mA with Four Categories
- High $V_{(BR)CEO}$, 55 V Min
- UL Recognized — File # E65085
- No Base Lead Connection on TIL188 for High-EMI Environment

description

The TIL187 and TIL188 Optocouplers are designed for use in AC applications that require very high current transfer ratio and high voltage isolation between input and output. These optocouplers consist of two GaAs light-emitting diodes connected in a reverse-parallel configuration and a silicon n-p-n Darlington phototransistor. The TIL187 has the base connected for applications where a base signal or base resistor is required. The TIL188 is designed with no base connected for applications where high base-noise immunity is desired. Users can select from four different current gains (TIL187-1 through TIL187-4 and TIL188-1 through TIL188-4).

mechanical data



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absolute maximum ratings at 25°C free-air temperature (unless otherwise noted)

Input-to-output voltage	±3.535 kV peak or dc (±2.5 kV rms)
Collector-base voltage (TIL187)	100 V
Collector-emitter voltage (see Note 1)	55 V
Emitter-collector voltage	7 V
Emitter-base voltage (TIL187)	14 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 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 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 3.33 mW/°C.



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electrical characteristics at 25°C free-air temperature (unless otherwise noted)

PARAMETER		TEST CONDITIONS	TIL187			TIL188			UNIT
			MIN	TYP	MAX	MIN	TYP	MAX	
$V_{(BR)CBO}$	Collector-base breakdown voltage	$I_C = 10 \mu A, I_E = 0, I_F = 0$	100						V
$V_{(BR)CEO}$	Collector-emitter breakdown voltage	$I_C = 1 mA, I_B = 0, I_F = 0$	55			55			V
$V_{(BR)EBO}$	Emitter-base breakdown voltage	$I_E = 10 \mu A, I_C = 0, I_F = 0$	14						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	TIL187-1, TIL188-1	5			5			mA
		TIL187-2, TIL188-2	10			10			
		TIL187-3, TIL188-3	20			20			
		TIL187-4, TIL188-4	30			30			
	Photodiode operation	$V_{CE} = 1 V, I_F = 10 mA, I_B = 0$	50			50			μA
$I_{C(off)}$	Off-state collector current	$V_{CE} = 10 V, I_F = 0, I_B = 0$			100			100	nA
h_{FE}	Transistor static forward current transfer ratio	$V_{CE} = 1 V, I_C = 10 mA, I_F = 0$	25000						
V_F^{\dagger}	Input diode static forward voltage	$I_F = 10 mA$	1	1.2	1.5	1	1.2	1.5	V
$V_{CE(sat)}$	Collector-emitter saturation voltage	$I_C = 50 mA, I_F = 10 mA, I_B = 0$	0.87		1	0.87		1	V
r_{iO}	Input-to-output internal resistance	$V_{in-out} = \pm 500 V$, 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
$I_{C(on)1}$	On-state collector current	$V_{CE} = 1 V, I_F = 2 mA$	1		3	1		3	
$I_{C(on)2}$	symmetry ratio (see Note 6)								

[†]These parameters apply for either direction of the input current.

NOTES: 5. These parameters are measured between both input-diode leads shorted together and all the phototransistor leads shorted together.

6. The higher of the two $I_{C(on)}$ values generated by the two diodes is taken as $I_{C(on)1}$.

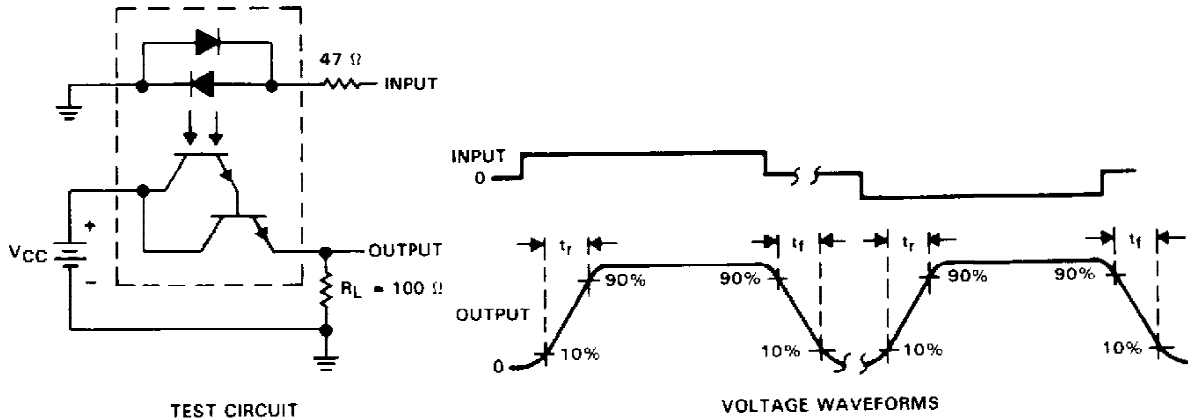
switching characteristics at 25°C free-air temperature

PARAMETER	TEST CONDITIONS	TIL187			TIL188			UNIT
		MIN	TYP	MAX	MIN	TYP	MAX	
t_r	Rise time	$V_{CC} = 10 V, I_{C(on)1} = 10 mA, R_L = 100 \Omega$		100		100		μs
t_f	Fall time		100		100		μs	

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PARAMETER MEASUREMENT INFORMATION

Adjust amplitude of input pulse is for $I_{C(on)} = 10 \text{ mA}$



NOTES: A The input waveform is supplied by a generator with the following characteristics: $Z_0 = 50 \Omega$, $t_r \leq 15 \text{ ns}$, duty cycle = 1%.
B The output waveform is monitored on an oscilloscope with the following characteristics: $t_r \leq 12 \text{ ns}$, $R_1 \geq 1 \text{ M}\Omega$, $C_p \leq 20 \text{ pF}$.

FIGURE 1. SWITCHING TIMES

TYPICAL CHARACTERISTICS

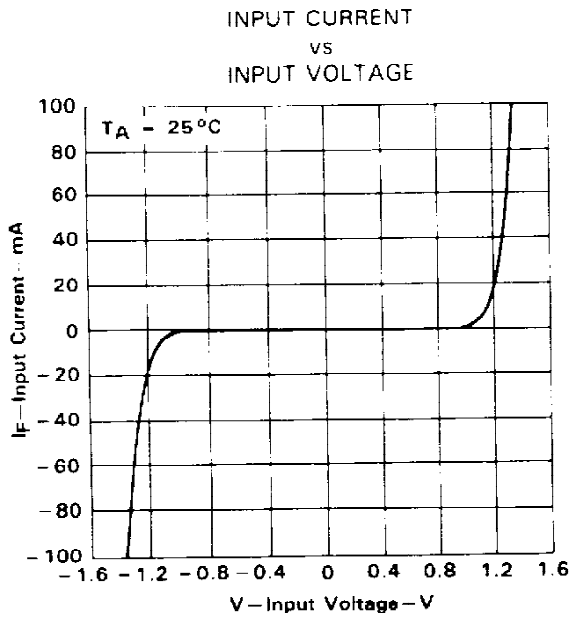


FIGURE 2

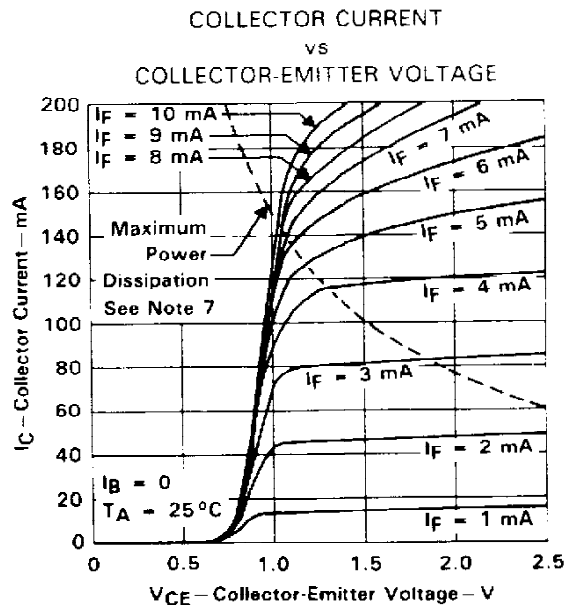
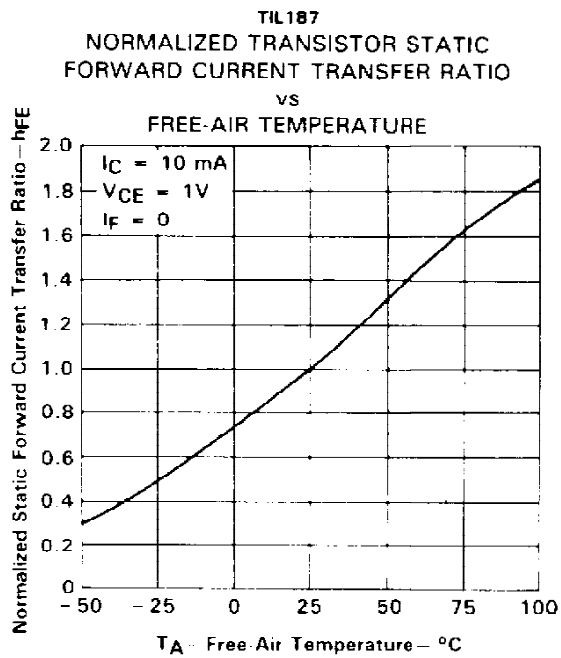
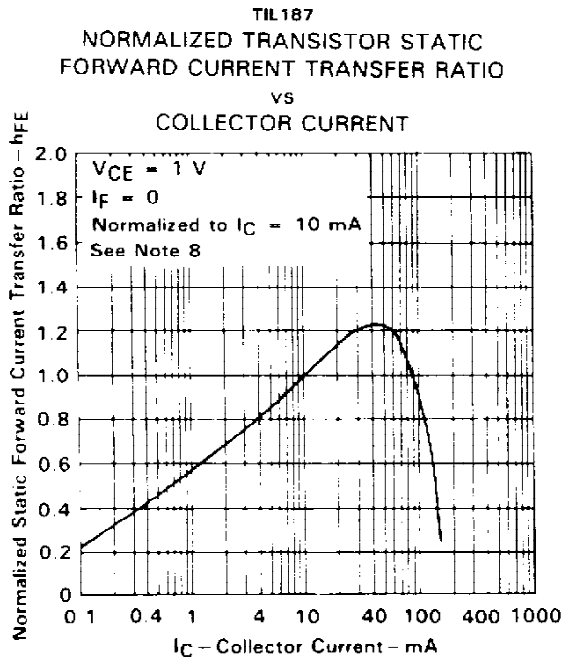
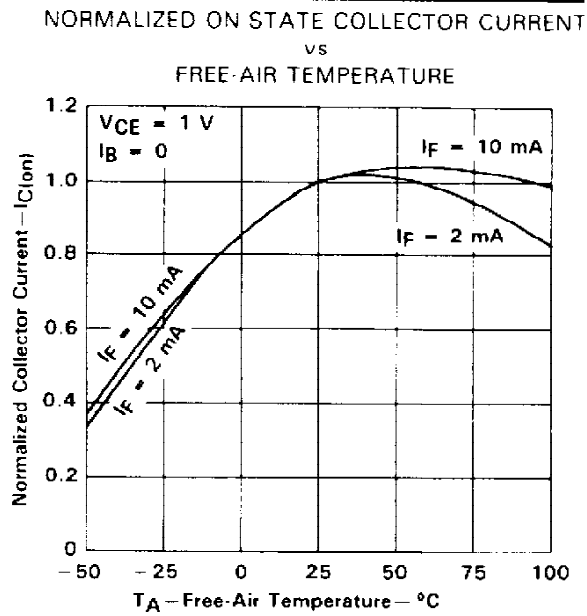
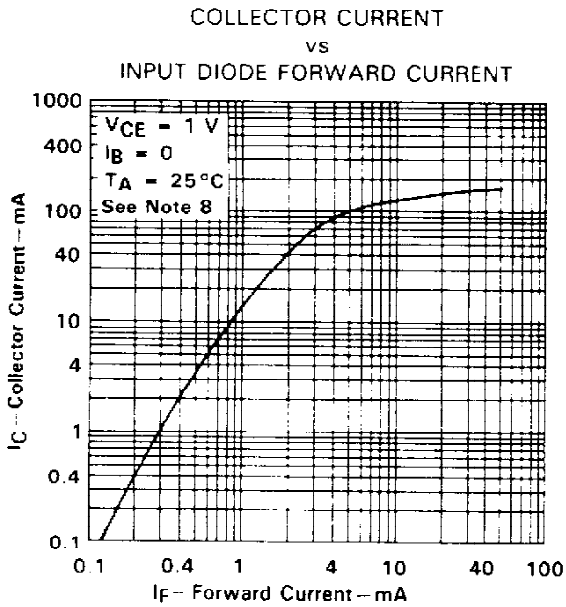


FIGURE 3

Note 7: Pulse operation is required for operation beyond limits shown by the dashed line.

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NOTE 8: These parameters were measured using pulse techniques $t_w = 1$ ms, duty cycle $\leq 2\%$.

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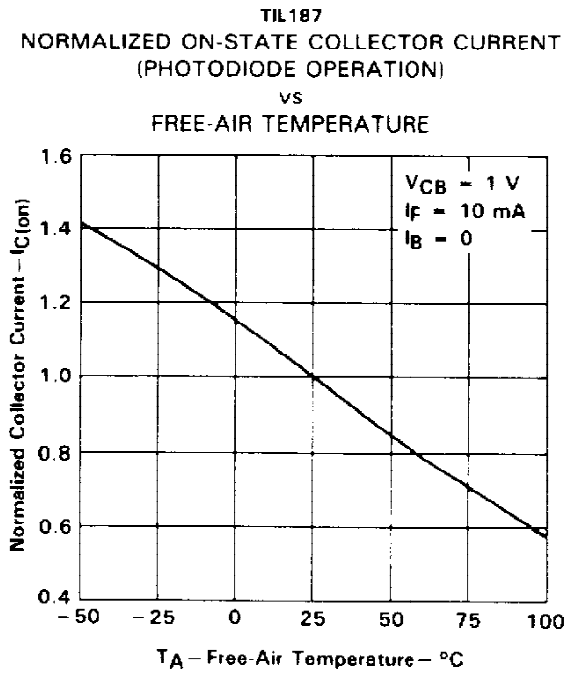


FIGURE 8

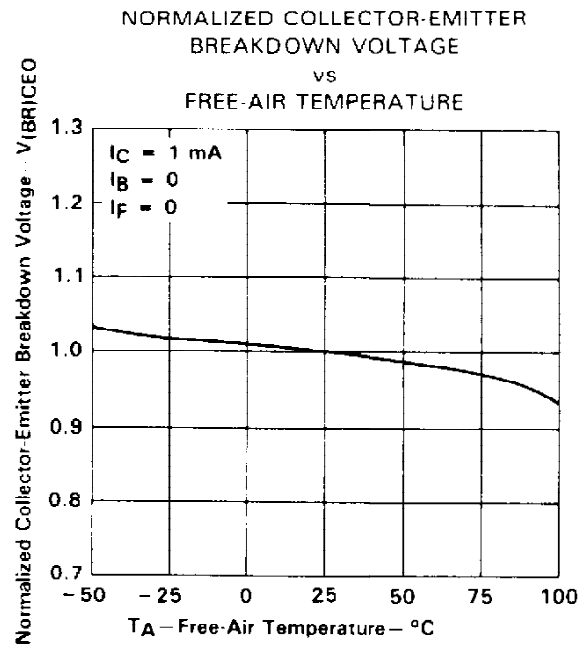


FIGURE 9

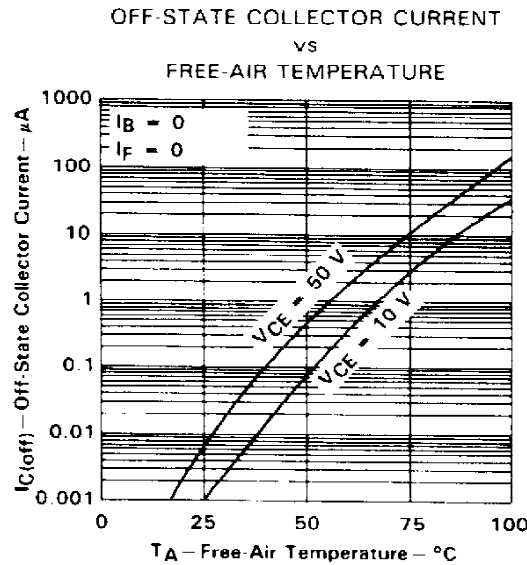


FIGURE 10

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Orderable Device	Status ⁽¹⁾	Package Type	Package Drawing	Pins	Package Qty	Eco Plan ⁽²⁾	Lead/Ball Finish	MSL Peak Temp ⁽³⁾
TIL187-1	OBSOLETE	PDIP	N	6		TBD	Call TI	Call TI
TIL187-2	OBSOLETE	PDIP	N	6		TBD	Call TI	Call TI
TIL187-3	OBSOLETE	PDIP	N	6		TBD	Call TI	Call TI
TIL187-4	OBSOLETE	PDIP	N	6		TBD	Call TI	Call TI
TIL188-1	OBSOLETE	PDIP	P	6		TBD	Call TI	Call TI
TIL188-2	OBSOLETE	PDIP	P	6		TBD	Call TI	Call TI
TIL188-3	OBSOLETE	PDIP	N	6		TBD	Call TI	Call TI
TIL188-4	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.

PREVIEW: Device has been announced but is not in production. Samples may or may not be available.

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.

Pb-Free (RoHS): TI's terms "Lead-Free" or "Pb-Free" mean semiconductor products that are compatible with the current RoHS requirements for all 6 substances, including the requirement that lead not exceed 0.1% by weight in homogeneous materials. Where designed to be soldered at high temperatures, TI Pb-Free products are suitable for use in specified lead-free processes.

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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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