

# TIL189-1 THRU TIL189-4 TIL190-1 THRU TIL190-4 OPTOCOUPERS/OPTOISOLATORS

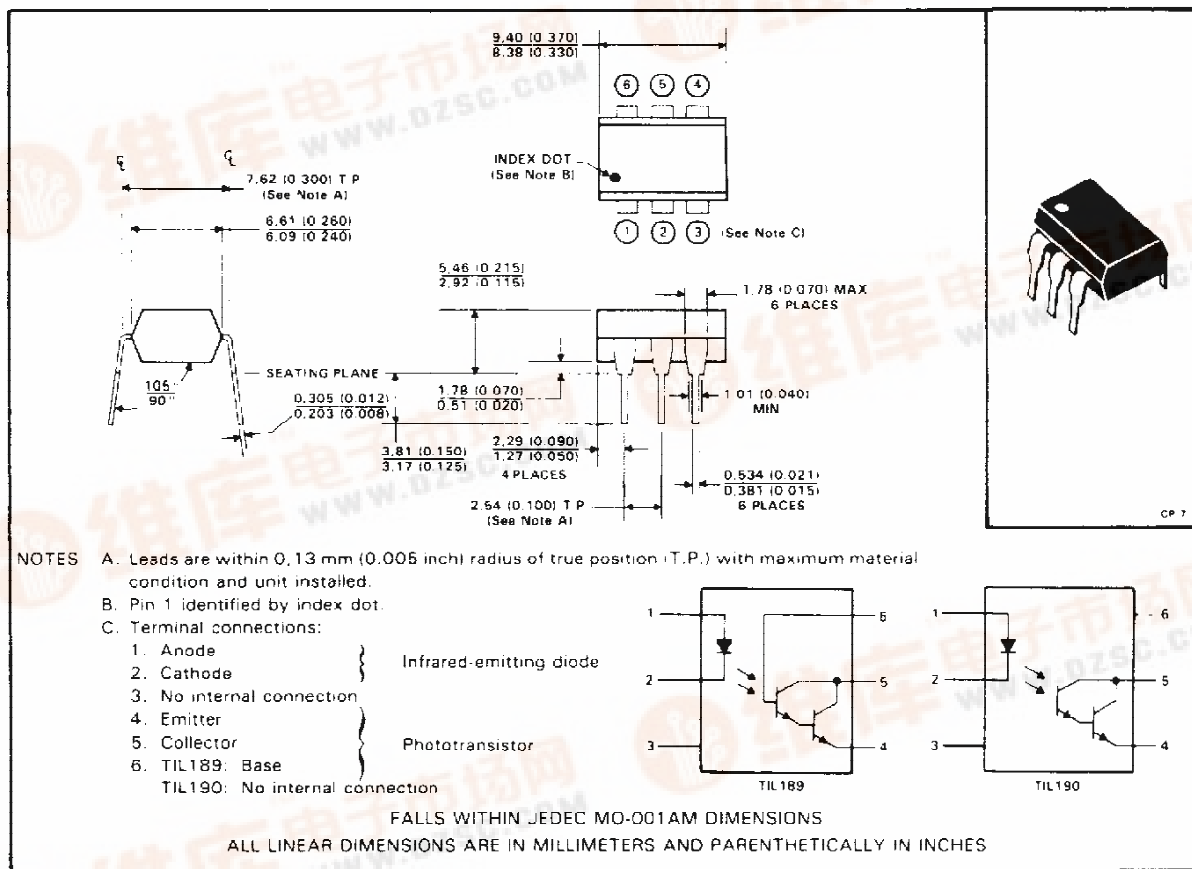
SOOS038A D2987, JANUARY 1987—REVISED JULY 1989

- High Direct-Current Transfer Ratios, 500% Minimum at  $I_F = 10 \text{ mA}$  and Up to 1500% at  $I_F = 2 \text{ mA}$  with Choice of Four Categories
- Plastic Dual-In-Line Package
- High-Voltage Electrical Isolation, 3.535 kV Peak (2.5 kV rms)
- Gallium Arsenide Diode Infrared Source Optically Coupled to a Silicon N-P-N Darlington Phototransistor
- No Base Lead Connection on TIL190 for High-EMI Environment
- UL Recognized — File # E65085

## description

The TIL189 and TIL190 Optocouplers are designed for use in applications that require high current transfer ratio and high voltage isolation between the input and output. The TIL189 has the base connected for applications where a base signal or resistor is required. The TIL190 is designed with no internal base connection for applications where high base-noise immunity is desired. Users can select from four different current gains (TIL189-1 through TIL189-4 and TIL190-1 through TIL190-4).

## mechanical data



**TIL189-1 THRU TIL189-4  
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OPTOCOUPERS/OPTOISOLATORS**

**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 (TIL189)	100 V
Collector-emitter voltage (see Note 1)	55 V
Emitter-collector voltage	7 V
Emitter-base voltage (TIL189)	14 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 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	TIL189			TIL190			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	$I_E = 100 \mu A, I_F = 0$				7			V
$I_R$	Input diode static reverse current	$V_R = 3 V$			10			10	$\mu A$
$I_{C(on)}$	On-state collector current	Photo-transistor operation TIL189-1, TIL190-1 TIL189-2, TIL190-2 TIL189-3, TIL190-3 TIL189-4, TIL190-4 $V_{CE} = 1 V, I_F = 2 mA, I_B = 0$	5			5			mA
			10			10			
			20			20			
			30			30			
	Photodiode operation	$V_{CE} = 1 V, I_F = 10 mA, I_B = 0$	50			50			$\mu A$
		$V_{CB} = 1 V, I_F = 10 mA, I_E = 0$	5	15					
$I_{C(off)}$	Off-state collector current	$V_{CE} = 10 V, I_F = 0, I_B = 0$		1	100		1	100	nA
$h_{FE}$	Transistor static forward current transfer ratio	$V_{CE} = 1 V, I_C = 10 mA, I_F = 0$		25000					
$V_F$	Input diode static forward voltage	$I_F = 10 mA$		1.2	1.5		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
$r_{ID}$	Input-to-output internal resistance	$V_{in-out} = \pm 500 V$ , See Note 5		$10^{11}$			$10^{11}$		$\Omega$
$C_{io}$	Input-to-output capacitance	$V_{in-out} = 0, f = 1 MHz$ , See Note 5		1	1.3		1	1.3	pF

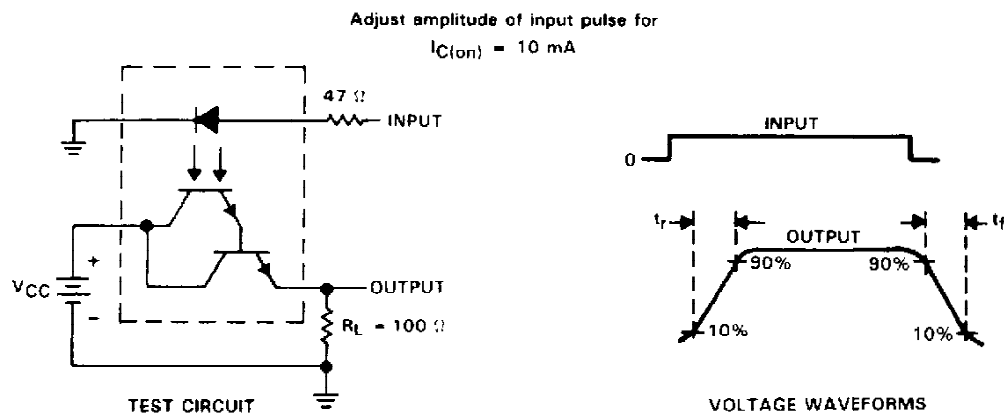
NOTE 5: These parameters are measured between both input-diode leads shorted together and all the phototransistor leads shorted together.

switching characteristics at 25 °C free-air temperature

PARAMETER	TEST CONDITIONS	TIL189			TIL190			UNIT
		MIN	TYP	MAX	MIN	TYP	MAX	
$t_r$ Rise time	$V_{CC} = 10 V, I_{C(on)} = 10 mA,$		100			100		$\mu s$
$t_f$ Fall time	$R_L = 100 \Omega$ , see Figure 1		100			100		$\mu s$

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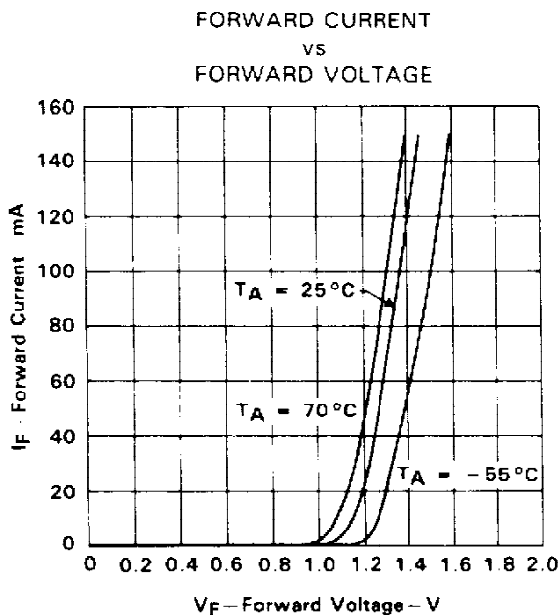
**PARAMETER MEASUREMENT INFORMATION**



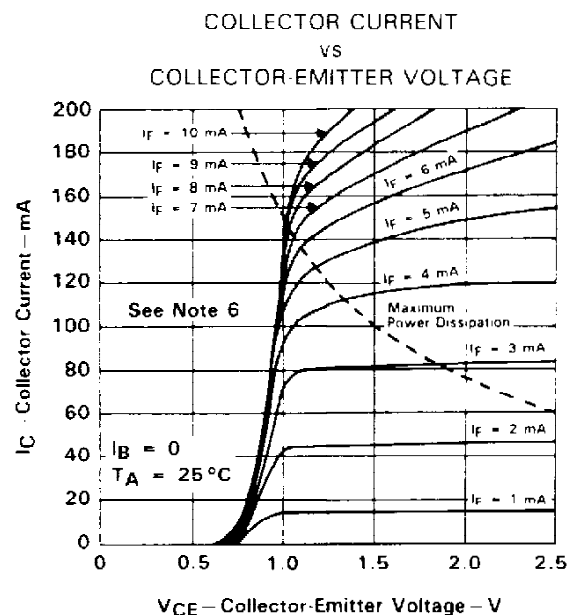
NOTES: A The input waveform is supplied by a generator with the following characteristics:  $Z_0 = 50 \Omega$ ,  $t_r \leq 15 \text{ ns}$ , duty cycle = 1%.  
B The output waveform is monitored on an oscilloscope with the following characteristics:  $t_r \leq 12 \text{ ns}$ ,  $R_I \geq 1 \text{ M}\Omega$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

**FIGURE 1. SWITCHING TIMES**

**TYPICAL CHARACTERISTICS**



**FIGURE 2**

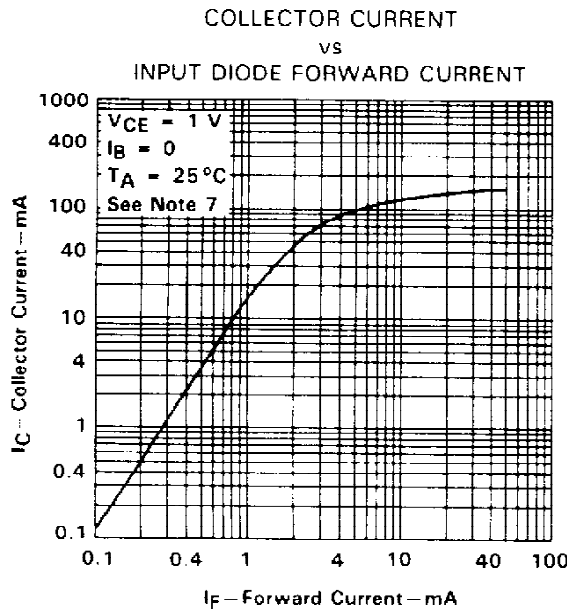


**FIGURE 3**

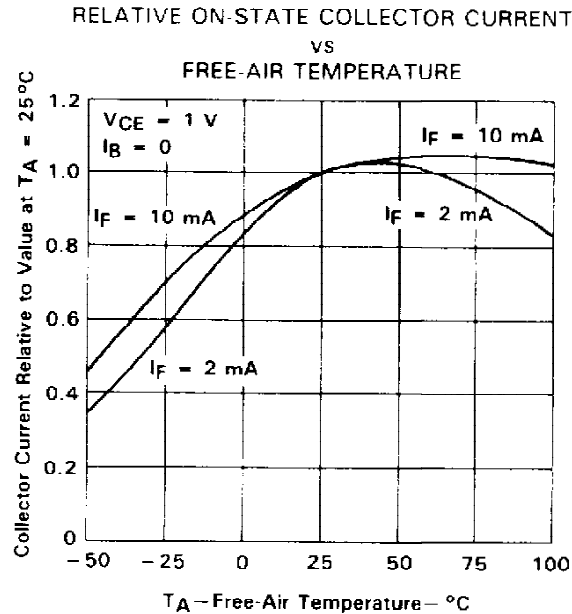
NOTE 6 Pulse operation is required for operation beyond limits shown by the dashed line.

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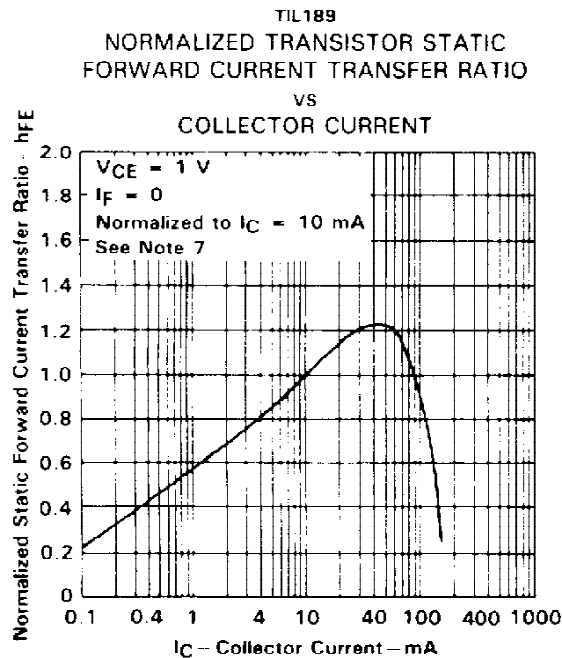
**TYPICAL CHARACTERISTICS**



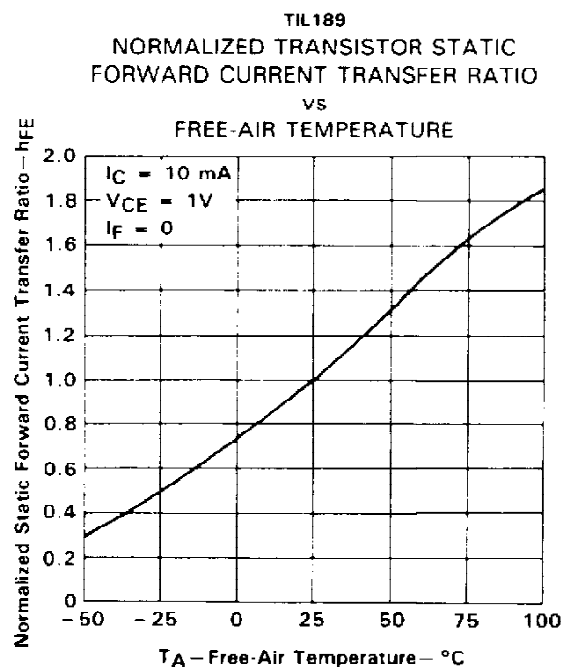
**FIGURE 4**



**FIGURE 5**



**FIGURE 6**

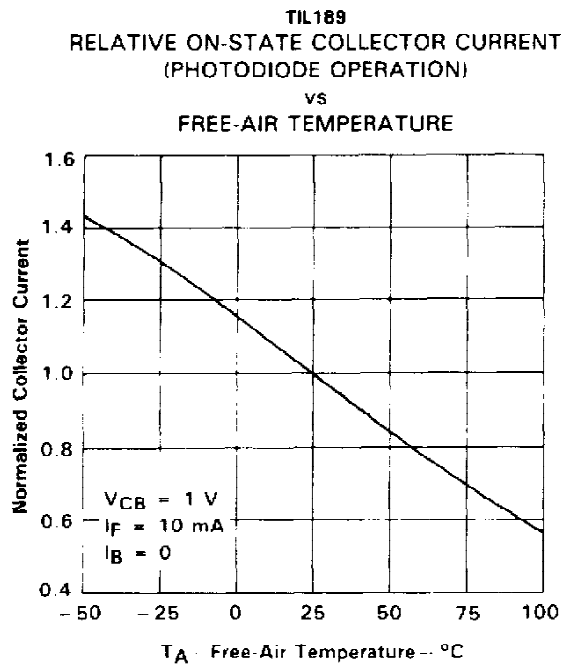


**FIGURE 7**

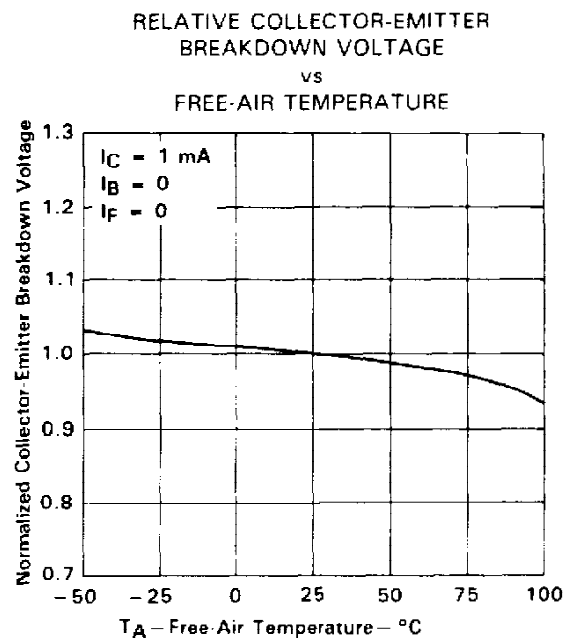
NOTE 7: These parameters were measured using pulse techniques  $t_w = 1$  ms, duty cycle  $\leq 2\%$ .

**TIL189-1 THRU TIL189-4  
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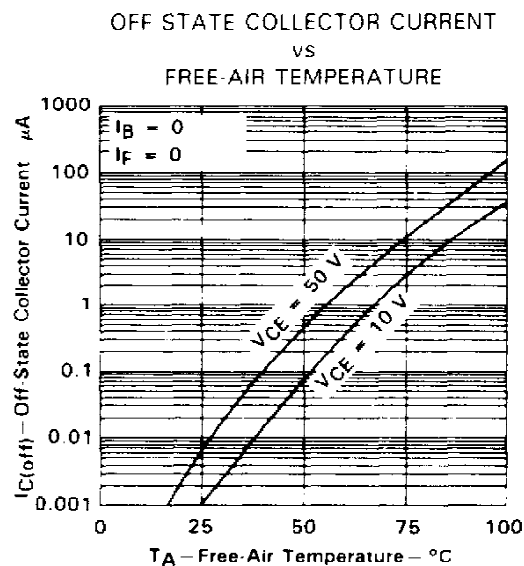
**TYPICAL CHARACTERISTICS**



**FIGURE 8**



**FIGURE 9**



**FIGURE 10**

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Orderable Device	Status <sup>(1)</sup>	Package Type	Package Drawing	Pins	Package Qty	Eco Plan <sup>(2)</sup>	Lead/Ball Finish	MSL Peak Temp <sup>(3)</sup>
TIL189-1	OBSOLETE	PDIP	N	6		TBD	Call TI	Call TI
TIL189-3	OBSOLETE	PDIP	N	6		TBD	Call TI	Call TI
TIL189-4	OBSOLETE	PDIP	N	6		TBD	Call TI	Call TI
TIL190-1	OBSOLETE	PDIP	N	6		TBD	Call TI	Call TI
TIL190-2	OBSOLETE	PDIP	N	6		TBD	Call TI	Call TI
TIL190-3	OBSOLETE	PDIP	N	6		TBD	Call TI	Call TI
TIL190-4	OBSOLETE	PDIP	N	6		TBD	Call TI	Call TI

<sup>(1)</sup> 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.

<sup>(2)</sup> 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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<sup>(3)</sup> MSL, Peak Temp. -- The Moisture Sensitivity Level rating according to the JEDEC industry standard classifications, and peak solder temperature.

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