TIL189-1 THRU TIL189-4
TIL190-1 THRU TIL190-4
OPTOCOUPLERS/OPTOISOLATORS

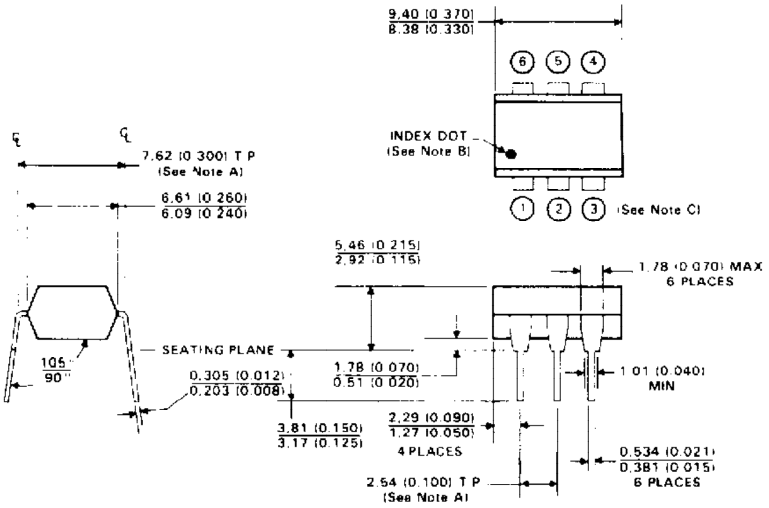
SOOS038A D2987, JANUARY 1987 – REVISED JULY 1989

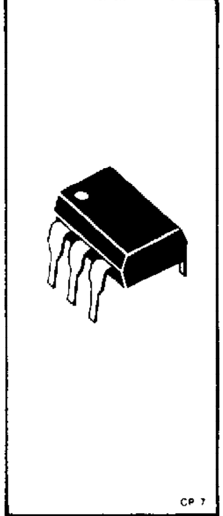
- **High Direct-Current Transfer Ratios, 500% Minimum at I_F = 10 mA and Up to 1500% at I_F = 2 mA with Choice of Four Categories**
- **Plastic Dual-In-Line Package**
- **High-Voltage Electrical Isolation, 3.535 kV Peak (2.5 kV rms)**
- **Gallium Arsenide Diode Infrared Source Optically Coupled to a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

description

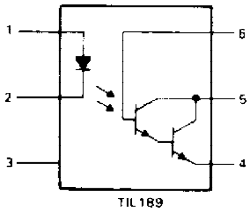
The TIL189 and TIL190 Optocouplers are designed for use in applications that require high current transfer ratio and high voltage isolation between the input and output. The TIL189 has the base connected for applications where a base signal or resistor is required. The TIL190 is designed with no internal 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

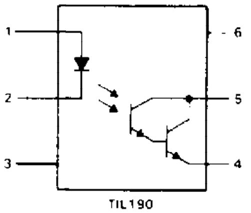




NOTES
A. Leads are within 0,13 mm (0.005 inch) radius of true position (T.P.) with maximum material condition and unit installed.
B. Pin 1 identified by index dot.
C. Terminal connections:
   1. Anode } Infrared-emitting diode
   2. Cathode }
   3. No internal connection
   4. Emitter }
   5. Collector } Phototransistor
   6. TIL189: Base }
      TIL190: No internal connection



TIL189



TIL190

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	± 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.

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

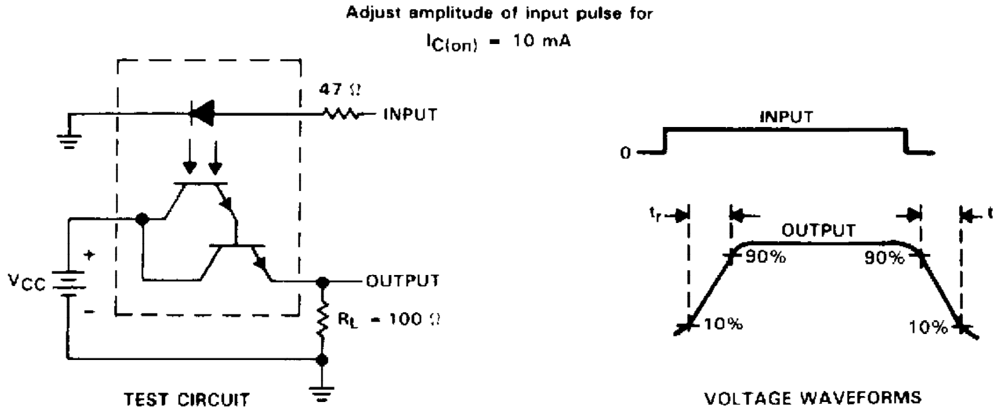
PARAMETER			TEST CONDITIONS	TIL189			TIL190			UNIT
				MIN	TYP	MAX	MIN	TYP	MAX	
$V_{(BR)CBO}$	Collector-base breakdown voltage		I_C = 10 µA, I_E = 0, I_F = 0	100						V
$V_{(BR)CEO}$	Collector-emitter breakdown voltage		I_C = 1 mA, I_B = 0, I_F = 0	55			55			V
$V_{(BR)EBO}$	Emitter-base breakdown voltage		I_E = 10 µA, I_C = 0, I_F = 0	14						V
$V_{(BR)ECO}$	Emitter-collector breakdown voltage		I_E = 100 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	Photo-transistor operation	TIL189-1, TIL190-1	V_{CE} = 1 V, I_F = 2 mA, I_B = 0	5			5			mA
		TIL189-2, TIL190-2		10			10			
		TIL189-3, TIL190-3		20			20			
		TIL189-4, TIL190-4		30			30			
			V_{CE} = 1 V, I_F = 10 mA, I_B = 0	50			50			
	Photodiode operation		V_{CB} = 1 V, I_F = 10 mA, I_E = 0	5	15					µA
$I_{C(off)}$	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_{IO}	Input-to-output internal resistance		$V_{in\text{-}out}$ = ±500 V, See Note 5	10^{11}			10^{11}			Ω
C_{io}	Input-to-output capacitance		$V_{in\text{-}out}$ = 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, R_L = 100 Ω, see Figure 1		100			100		µs
t_f	Fall time			100			100		µs

PARAMETER MEASUREMENT INFORMATION



TEST CIRCUIT

VOLTAGE WAVEFORMS

NOTES: A The input waveform is supplied by a generator with the following characteristics: $Z_O = 50$ Ω, $t_r \le 15$ ns, duty cycle ≈ 1%.
B The output waveform is monitored on an oscilloscope with the following characteristics: $t_r \le 12$ ns, $R_I \ge 1$ MΩ, $C_{in} \le 20$ pF.

FIGURE 1. SWITCHING TIMES

TYPICAL CHARACTERISTICS

FORWARD CURRENT
vs
FORWARD VOLTAGE

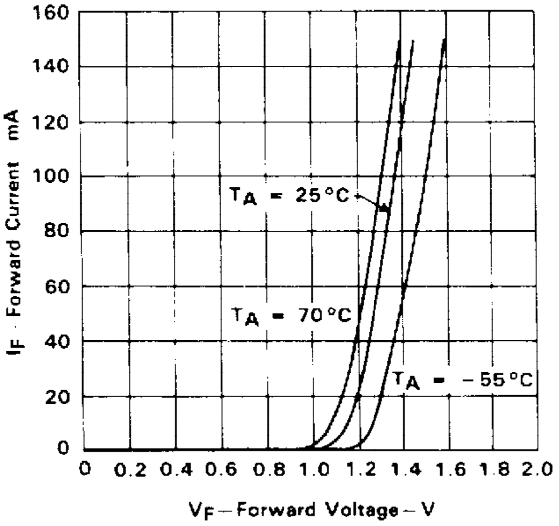


FIGURE 2

COLLECTOR CURRENT
vs
COLLECTOR-EMITTER VOLTAGE

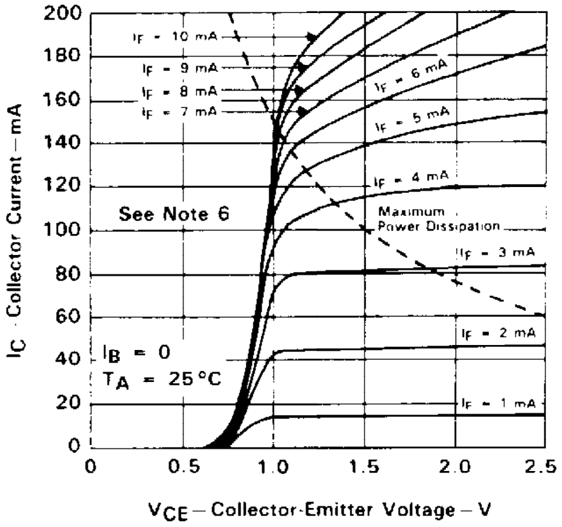


FIGURE 3

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

TYPICAL CHARACTERISTICS

COLLECTOR CURRENT
vs
INPUT DIODE FORWARD CURRENT

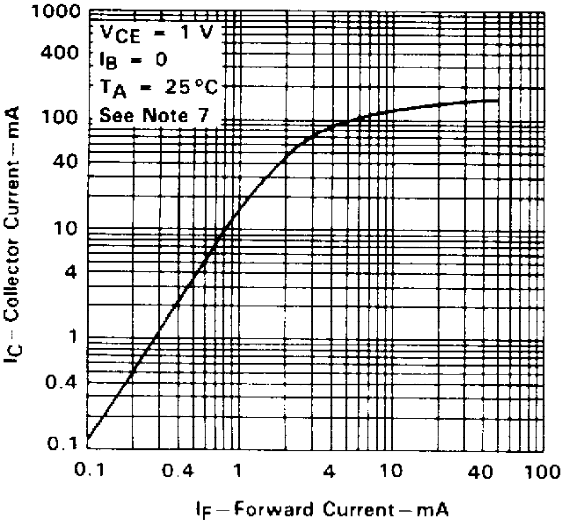


FIGURE 4

RELATIVE ON-STATE COLLECTOR CURRENT
vs
FREE-AIR TEMPERATURE

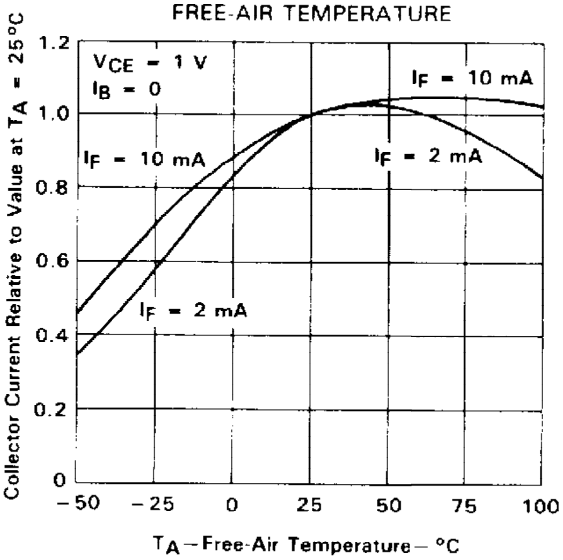


FIGURE 5

TIL189
NORMALIZED TRANSISTOR STATIC
FORWARD CURRENT TRANSFER RATIO
vs
COLLECTOR CURRENT

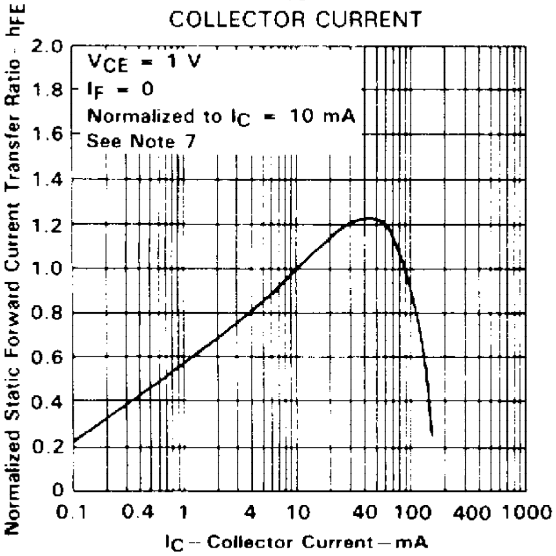


FIGURE 6

TIL189
NORMALIZED TRANSISTOR STATIC
FORWARD CURRENT TRANSFER RATIO
vs
FREE-AIR TEMPERATURE

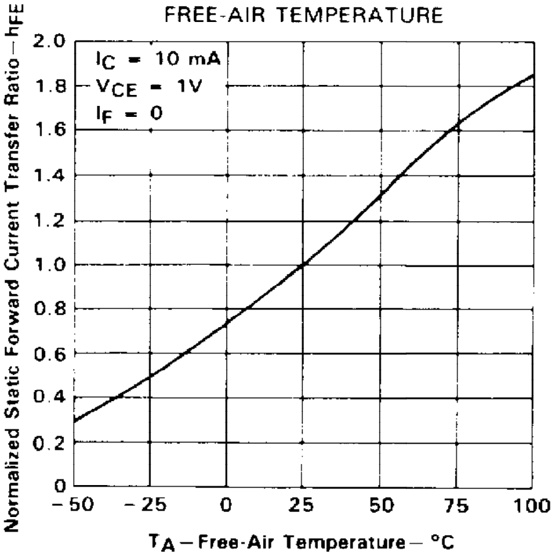


FIGURE 7

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

TYPICAL CHARACTERISTICS

TIL189
RELATIVE ON-STATE COLLECTOR CURRENT
(PHOTODIODE OPERATION)
vs
FREE-AIR TEMPERATURE

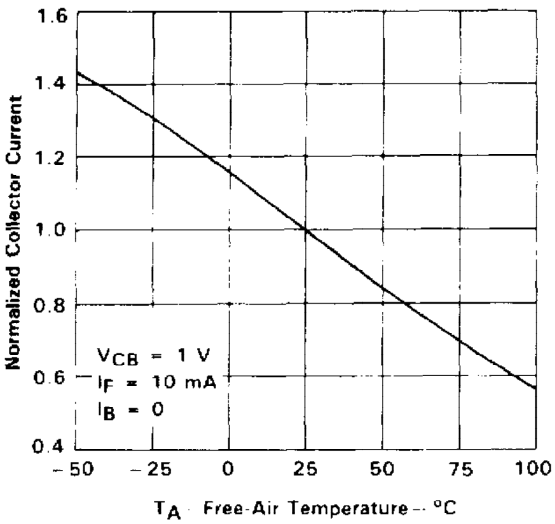


FIGURE 8

RELATIVE COLLECTOR-EMITTER
BREAKDOWN VOLTAGE
vs
FREE-AIR TEMPERATURE

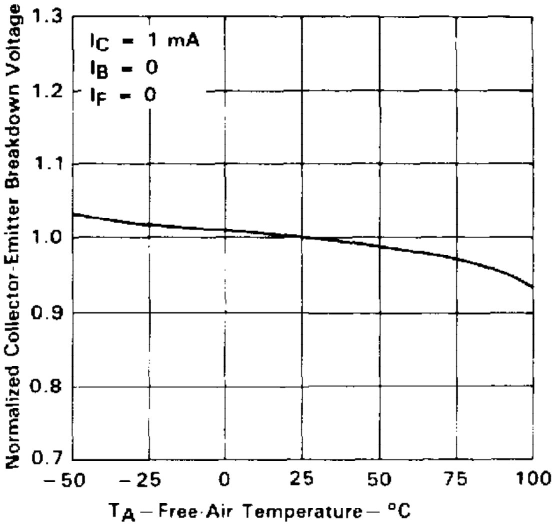


FIGURE 9

OFF-STATE COLLECTOR CURRENT
vs
FREE-AIR TEMPERATURE

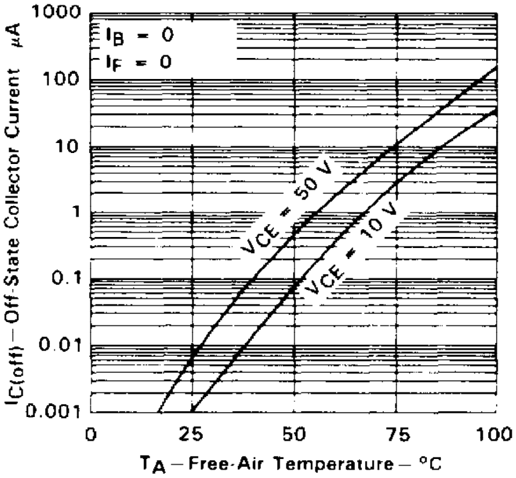


FIGURE 10

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