TIL181
OPTOCOUPLER

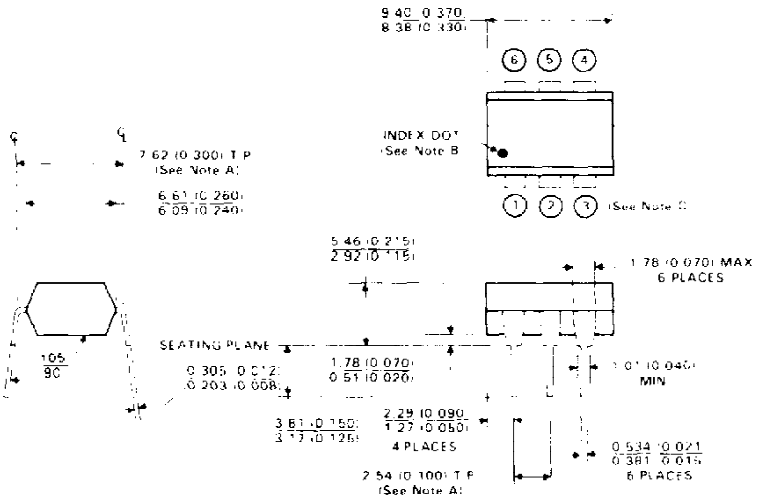
SOOS002 D2906, OCTOBER 1985 – REVISED MARCH 1988

COMPATIBLE WITH STANDARD TTL INTEGRATED CIRCUITS

- **Gallium Arsenide Diode Infrared Source Optically Coupled to a Silicon N-P-N Phototransistor**
- **High Direct-Current Transfer Ratio**
- **High-Voltage Electrical Isolation . . . 2.5 kV rms (3.535 kV peak)**
- **Plastic Dual-In-Line Package**
- **High-Speed Switching: t_r = 2 μs Typ, t_f = 2 μs Typ**
- **UL Recognized — File #E65085**
- **Primarily Used with Telephone Ring Detector TCM1520A and Tone Drivers TCM1501B, TCM1506B, TCM1512B, TCM1531, TCM1532, TCM1536, and TCM1539**

mechanical data

The package consists of a gallium arsenide infrared-emitting diode and an n-p-n silicon phototransistor mounted on a 6-pin 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.



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	Phototransistor
5	Collector	
6	Base	

FALLS WITHIN JEDEC MO-001AM DIMENSIONS

ALL LINEAR DIMENSIONS ARE IN MILLIMETERS AND PARENTHETICALLY IN INCHES

CP-7

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

Input-to-output voltage	±2.5 kV rms (±3.535 kV peak)
Collector-base voltage	70 V
Collector-emitter voltage (see Note 1)	30 V
Emitter-collector voltage	7 V
Emitter-base voltage	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.

electrical characteristics at 25°C free-air temperature

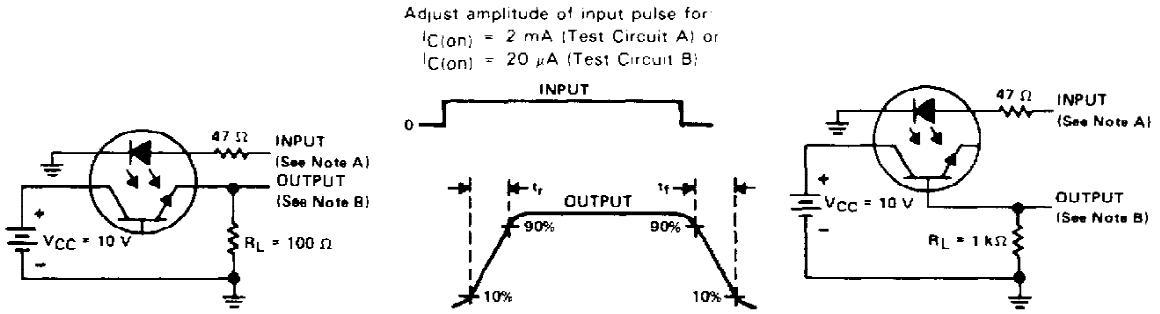
PARAMETER			TEST CONDITIONS			MIN	TYP	MAX	UNIT
$V_{(BR)CBO}$	Collector base breakdown voltage		I_C = 10 µA,	I_E = 0,	I_F = 0	70			V
$V_{(BR)CEO}$	Collector emitter breakdown voltage		I_C = 1 mA,	I_B = 0,	I_F = 0	30			V
$V_{(BR)EBO}$	Emitter base breakdown voltage		I_E = 10 µA,	I_C = 0,	I_F = 0	7			V
I_R	Input diode static reverse current		V_R = 3 V					10	µA
$I_{C(on)}$	On state collector current	Phototransistor operation	V_{CE} = 0.4 V,	I_F = 0.8 mA,	I_B = 0	100			µA
			V_{CE} = 0.4 V,	I_F = 10 mA,	I_B = 0	5			mA
		Photodiode operation	V_{CB} = 0.4 V,	I_F = 16 mA,	I_E = 0	7	20		µA
$I_{C(off)}$	Off state collector current	Phototransistor operation	V_{CE} = 10 V,	I_F = 0,	I_B = 0		1	50	nA
		Photodiode operation	V_{CB} = 10 V,	I_F = 0,	I_E = 0		0.1	20	
h_{FE}	Transistor static forward current transfer ratio		V_{CE} = 5 V,	I_C = 10 mA	I_F = 0	200	550		
V_F	Input diode static forward voltage		I_F = 16 mA				1.2	1.4	V
$V_{CE(sat)}$	Collector emitter saturation voltage		I_C = 5 mA	I_F = 10 mA,	I_B = 0		0.25	0.4	V
r_{IO}	Input to output internal resistance		$V_{in\ out}$ = 500 V	See Note 6		10^{11}			Ω
C_{IO}	Input to output capacitance		$V_{in\ out}$ = 0,	f = 1 MHz,	See Note 6		1	1.3	pF

NOTE 6: 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		MIN	TYP	MAX	UNIT
t_r	Rise time	Phototransistor operation	V_{CC} = 10 V, $I_{C(on)}$ = 2 mA, R_L = 100 Ω, See Test Circuit A of Figure 1		2	10	µs
t_f	Fall time				2	10	
t_r	Rise time	Photodiode operation	V_{CC} = 10 V, $I_{C(on)}$ = 20 µA, R_L = 1 kΩ, See Test Circuit B of Figure 1		1		µs
t_f	Fall time				1		

PARAMETER MEASUREMENT INFORMATION



TEST CIRCUIT A
PHOTOTRANSISTOR OPERATION

VOLTAGE WAVEFORMS

TEST CIRCUIT B
PHOTODIODE OPERATION

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 = 100 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

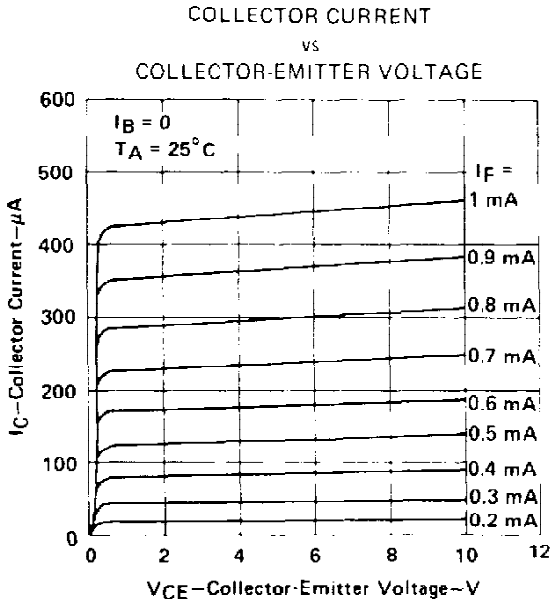


FIGURE 2

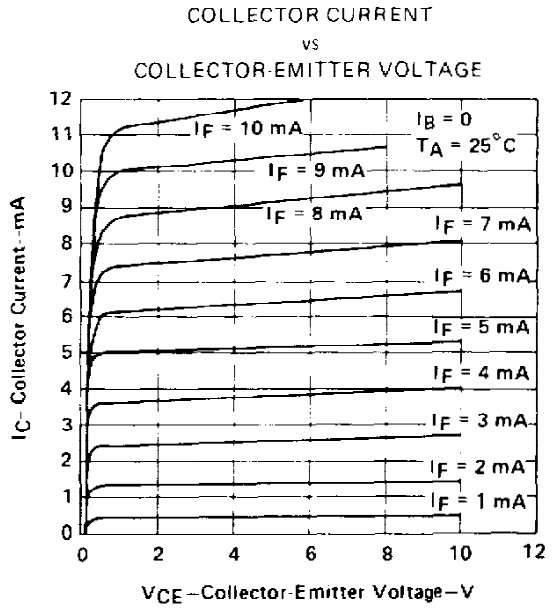


FIGURE 3

TYPICAL CHARACTERISTICS

PHOTOTRANSISTOR COLLECTOR CURRENT
vs
INPUT DIODE FORWARD CURRENT

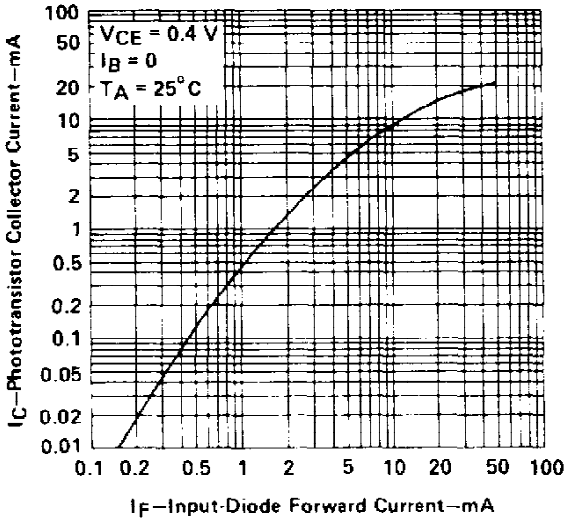


FIGURE 4

RELATIVE ON-STATE COLLECTOR CURRENT
vs
FREE-AIR TEMPERATURE

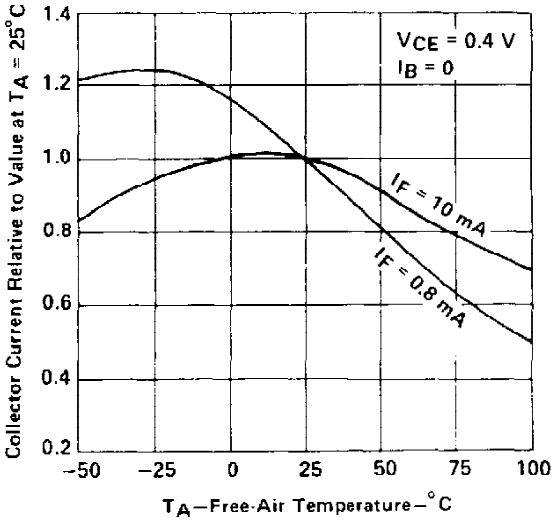


FIGURE 5

NORMALIZED TRANSISTOR STATIC FORWARD CURRENT TRANSFER RATIO
vs
COLLECTOR CURRENT

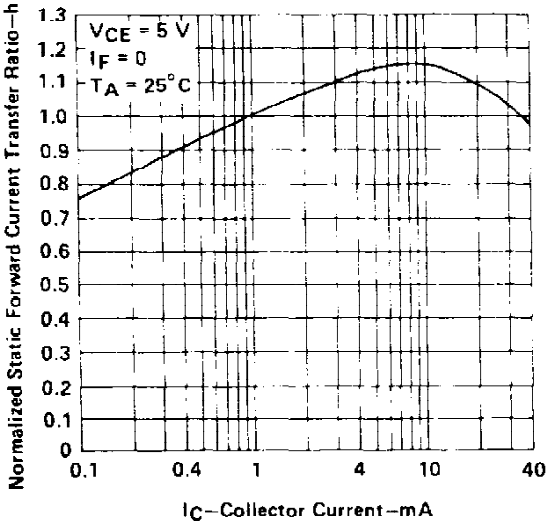


FIGURE 6

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

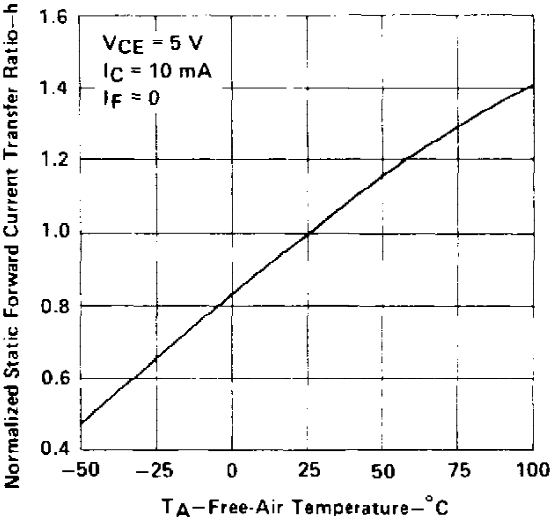


FIGURE 7

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