TIL181
OPTOCOUPLER

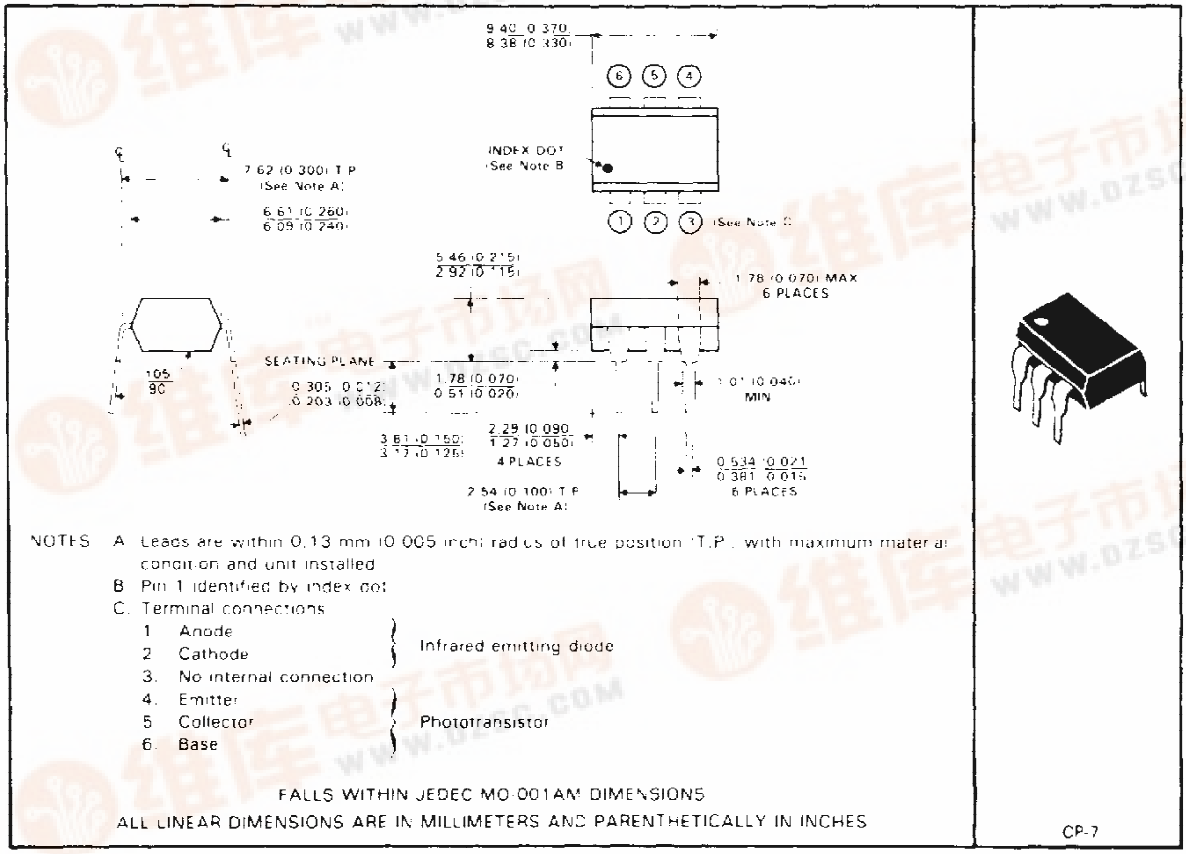
SOOS002 D2906, OCTOBER 1985 – REVISED MARCH 1988

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.



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

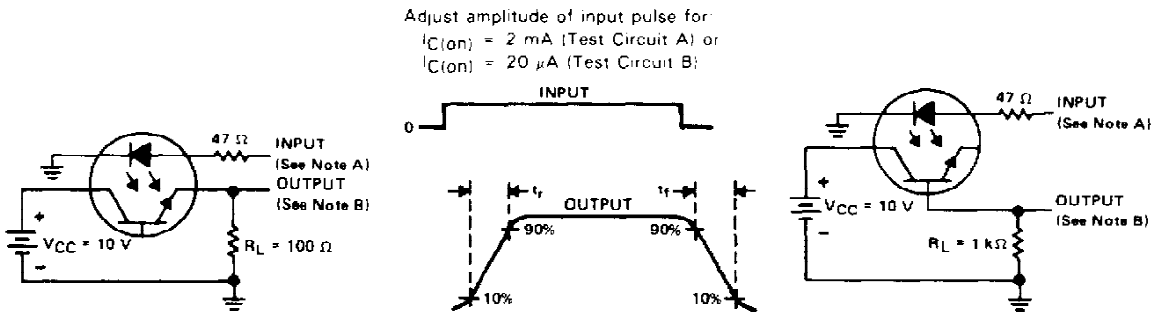
PARAMETER			TEST CONDITIONS			MIN	TYP	MAX	UNIT
$V_{(BR)CBO}$	Collector base breakdown voltage		I_C = 10 µA,	I_E = 0,	I_F = 0	70			V
$V_{(BR)CEO}$	Collector emitter breakdown voltage		I_C = 1 mA,	I_B = 0,	I_F = 0	30			V
$V_{(BR)EBO}$	Emitter base breakdown voltage		I_E = 10 µA,	I_C = 0,	I_F = 0	7			V
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

COLLECTOR CURRENT
vs
COLLECTOR-EMITTER VOLTAGE

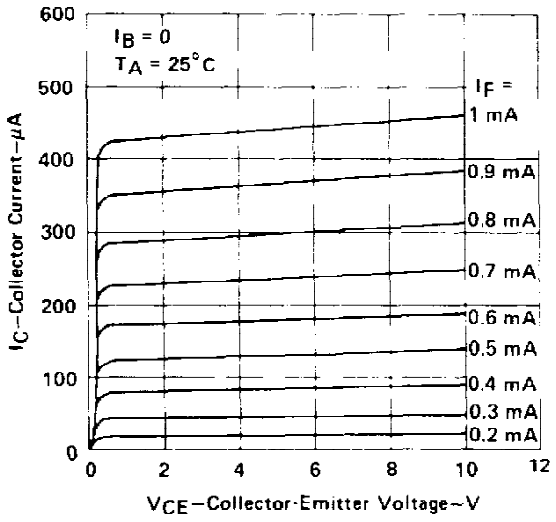


FIGURE 2

COLLECTOR CURRENT
vs
COLLECTOR-EMITTER VOLTAGE

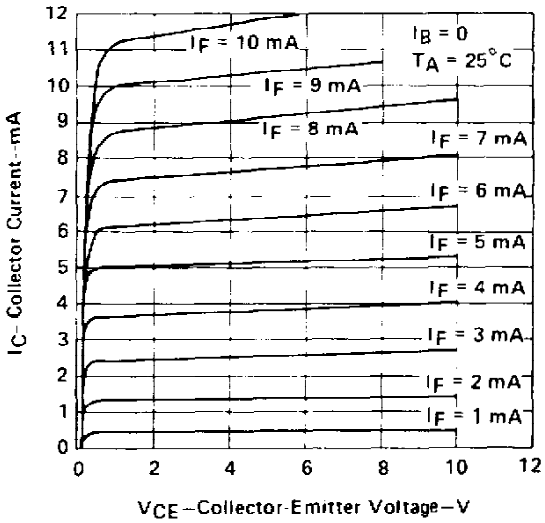


FIGURE 3

TYPICAL CHARACTERISTICS

PHOTOTRANSISTOR COLLECTOR CURRENT
vs
INPUT DIODE FORWARD CURRENT

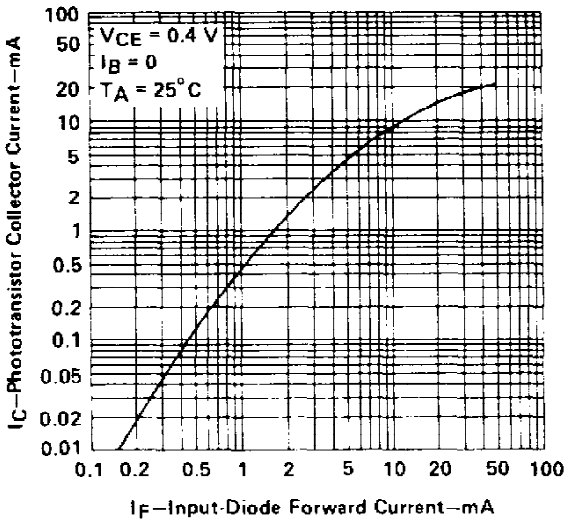


FIGURE 4

RELATIVE ON-STATE COLLECTOR CURRENT
vs
FREE-AIR TEMPERATURE

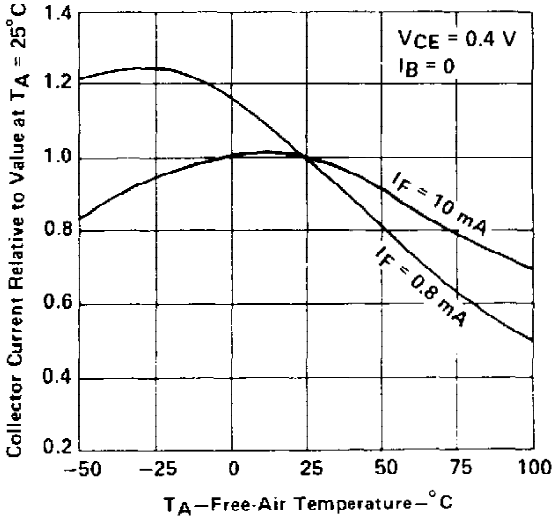


FIGURE 5

NORMALIZED TRANSISTOR STATIC FORWARD CURRENT TRANSFER RATIO
vs
COLLECTOR CURRENT

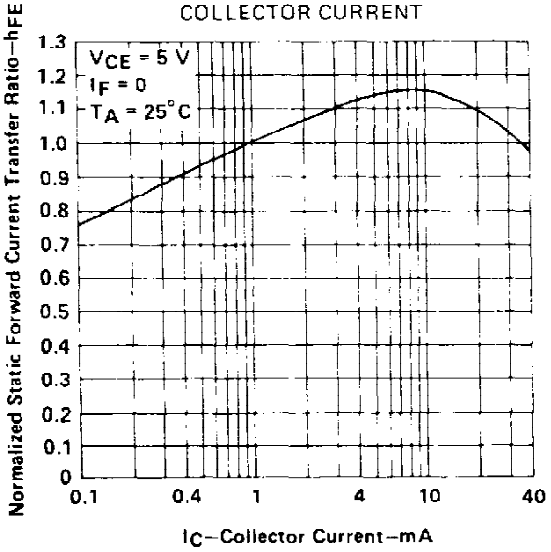


FIGURE 6

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

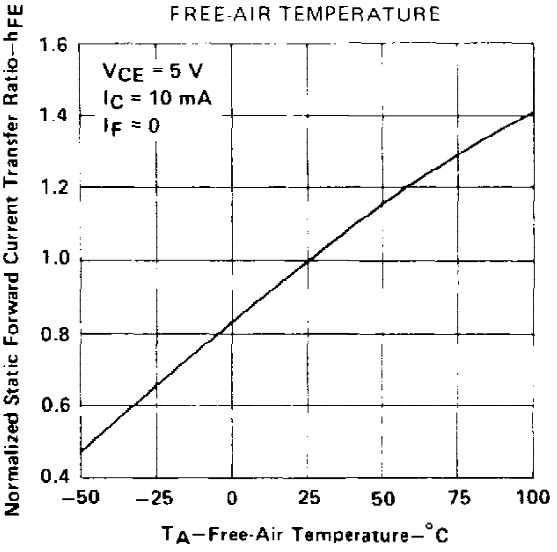


FIGURE 7

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