TIL186-1, TIL186-2, TIL186-3, TIL186-4
AC-INPUT OPTOCOUPLERS

SOOS011A D2961, DECEMBER 1986—REVISED JUNE 1989

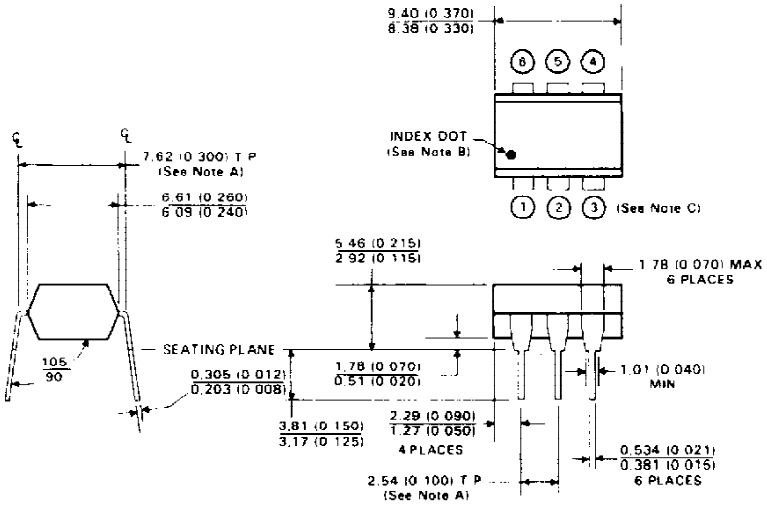
- A-C Signal Input
- Gallium Arsenide Dual-Diode Infrared Sources Coupled to a Silicon NPN Photo-Transistor
- Plastic Dual-In-Line Package
- UL-Recognized — File # E65085
- Choice of Four Current Transfer Ratios
- High-Voltage Electrical Isolation 3.535 kV Peak (2.5 kV rms)
- High-Speed Switching . . . t_f = 4 μs Typ

description

The TIL186 optocoupler is designed for use in ac input signal applications that require high-voltage isolation between input and output. Users can select from four different current gains (TIL186-1 through TIL186-4). These optocouplers consist of two GaAs light-emitting input diodes connected in a reverse-parallel configuration for ac input applications and a silicon npn output phototransistor.

mechanical data

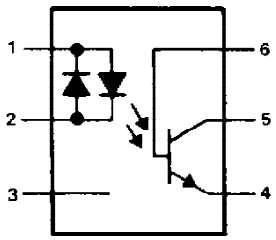
The package is mounted on a 6-pin lead frame encapsulated within an electrically nonconductive plastic compound. The case will withstand soldering temperature with no deformation. Device performance characteristics will remain stable when operated in high-humidity conditions. Unit weight is approximately 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.



ALL LINEAR DIMENSIONS ARE IN MILLIMETERS AND PARENTHETICALLY IN INCHES

CP-7

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

Input-to-output voltage	±3.535 kV peak (±2.5 kV rms)
Collector-base voltage	100 V
Collector-emitter voltage (see Note 1)	55 V
Emitter-collector voltage	7 V
Emitter-base voltage	7 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
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			MIN	TYP	MAX	UNIT
$V_{(BR)CBO}$	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			V
$V_{(BR)EBO}$	Emitter-base breakdown voltage		I_E = 10 μA,	I_C = 0,	I_F = 0	7			V
$V_{(BR)ECO}$	Emitter-collector breakdown voltage		I_E = 100 μA,	I_B = 0,	I_F = 0	7			V
$I_{C(on)}$†	On-state collector current	Phototransistor operation	V_{CE} = 10 V, I_B = 0	I_F = 2 mA,	TIL186-1	0.1			mA
					TIL186-2	0.2			
					TIL186-3	0.5			
					TIL186-4	1			
			V_{CE} = 10 V, I_B = 0	I_F = 10 mA,	TIL186-1	1			
					TIL186-2	2			
					TIL186-3	5			
					TIL186-4	10			
		Photodiode operation	V_{CB} = 10 V,	I_F = 10 mA,	I_E = 0	5	12		μA
$I_{C(off)}$	Off-state collector current		V_{CE} = 50 V,	I_F = 20 mA,	I_B = 0		2	200	nA
h_{FE}	Transistor static forward current transfer ratio		V_{CE} = 5 V,	I_C = 10 mA,	I_F = 0	100	550		
V_F†	Input diode static forward voltage		I_F = 10 mA			1	1.16	1.5	V
$V_{CE(sat)}$†	Collector-emitter saturation voltage		I_C = 1 mA,	I_F = 10 mA,	I_B = 0		0.14	0.4	V
r_{IO}	Input-to-output internal resistance		$V_{in\ out}$ = ±500 V,	See Note 5		10^{11}			Ω
C_{io}	Input-to-output capacitance		$V_{in\text{-}out}$ = 0,	f = 1 MHz,	See Note 5		1	2	pF
$I_{C(on)1}/I_{C(on)2}$	On-state collector current symmetry ratio (see Note 6)		V_{CE} = 10 V,	I_F = 10 mA,	I_E = 0	1		3	

†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.

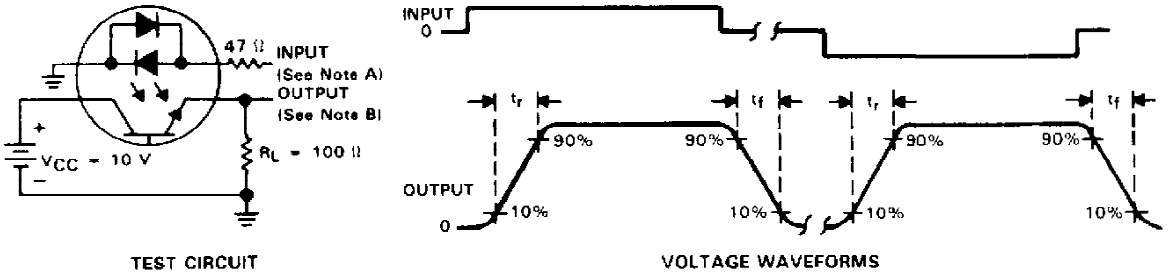
6. The higher of the two $I_{C(on)}$ values generated by the two diodes is taken as $I_{C(on)1}$.

switching characteristics at 25°C free-air temperature

PARAMETER		TEST CONDITIONS	MIN	TYP	MAX	UNIT
t_r	Rise time	V_{CC} = 10 V, $I_{C(on)}$ = 2 mA, R_L = 100 Ω, See Figure 1		4	10	μs
t_f	Fall time			4	10	μs

PARAMETER MEASUREMENT INFORMATION

Adjust amplitude of input pulse is for $I_{C(on)}$ = 2 mA



TEST CIRCUIT VOLTAGE WAVEFORMS

NOTES: A. The input waveform is supplied by a generator with the following characteristics: Z_O = 50 Ω, t_r ≤ 15 ns, duty cycle = 1%.
B. The output waveform is monitored on an oscilloscope with the following characteristics: t_r ≤ 12 ns, R_I ≥ 1 MΩ, C_I ≤ 20 pF.

FIGURE 1. SWITCHING TIMES

TYPICAL CHARACTERISTICS

INPUT CURRENT
vs
INPUT VOLTAGE

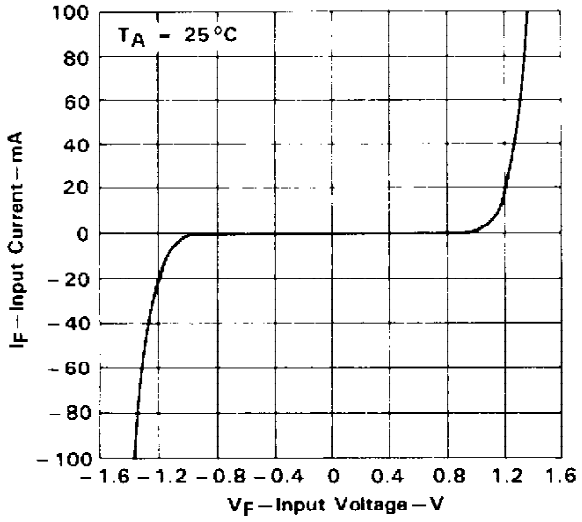


FIGURE 2

COLLECTOR CURRENT
vs
COLLECTOR-EMITTER VOLTAGE

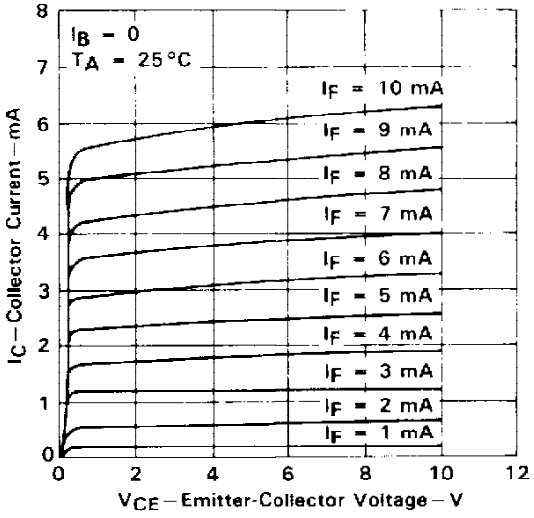


FIGURE 3

TYPICAL CHARACTERISTICS

NORMALIZED ON-STATE COLLECTOR CURRENT
vs
INPUT DIODE FORWARD CURRENT

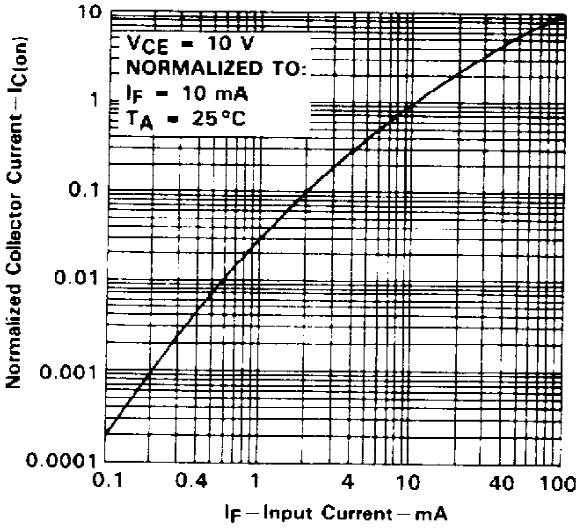


FIGURE 4

RELATIVE ON-STATE COLLECTOR CURRENT
vs
FREE-AIR TEMPERATURE

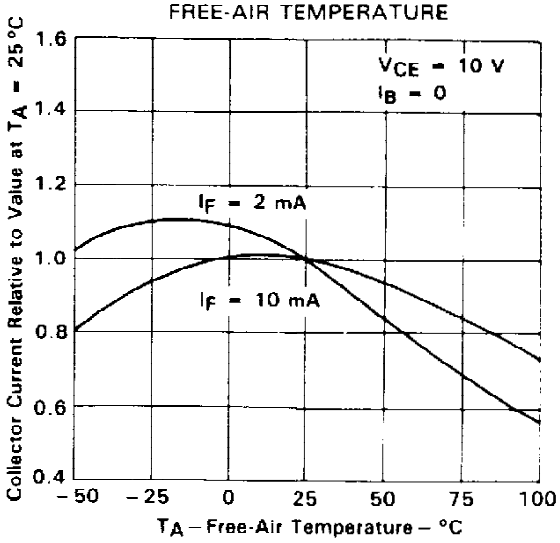


FIGURE 5

NORMALIZED TRANSISTOR STATIC FORWARD
CURRENT TRANSFER RATIO
vs
COLLECTOR CURRENT

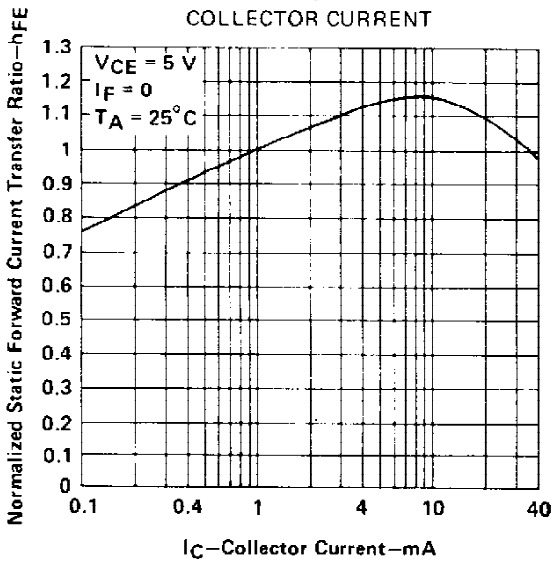


FIGURE 6

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

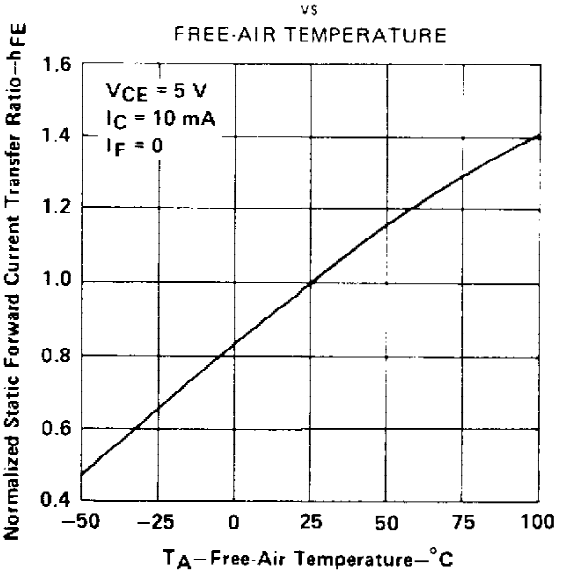


FIGURE 7

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PACKAGING INFORMATION

Orderable Device	Status (1)	Package Type	Package Drawing	Pins	Package Qty	Eco Plan (2)	Lead/Ball Finish	MSL Peak Temp (3)
TIL186-1	OBSOLETE	PDIP	N	6		TBD	Call TI	Call TI
TIL186-2	OBSOLETE	PDIP	N	6		TBD	Call TI	Call TI
TIL186-3	OBSOLETE	PDIP	N	6		TBD	Call TI	Call TI
TIL186-4	OBSOLETE	PDIP	N	6		TBD	Call TI	Call TI

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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.
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(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.
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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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