

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

SOOS011A D2981, DECEMBER 1986—REVISED JUNE 1989

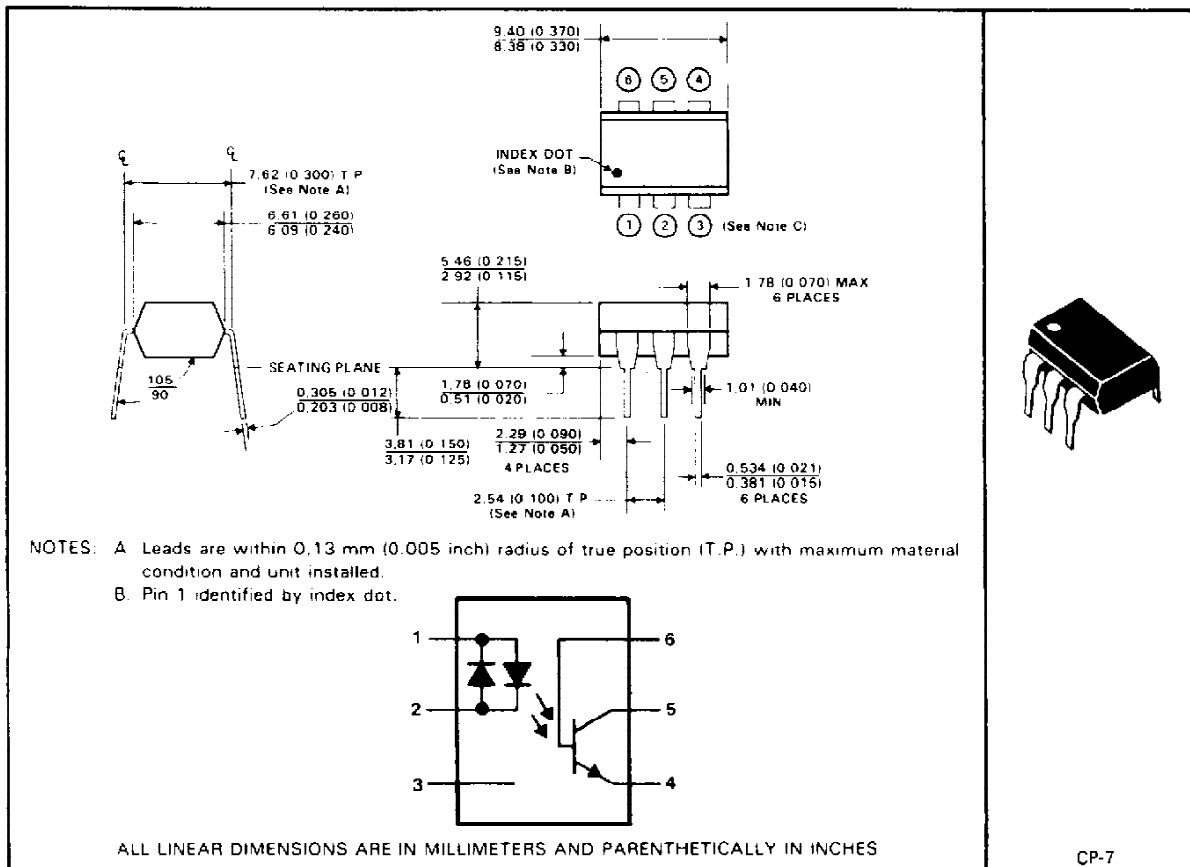
- A-C Signal Input
- Gallium Arsenide Dual-Diode Infrared Sources Coupled to a Silicon NPN Photo-Transistor
- Plastic Dual-In-Line Package
- UL-Recognized — File # E65085
- Choice of Four Current Transfer Ratios
- High-Voltage Electrical Isolation
3.535 kV Peak (2.5 kV rms)
- High-Speed Switching . .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



PRODUCTION DATA documents contain information current as of publication date. Products conform to specifications per the terms of Texas Instruments standard warranty. Production processing does not necessarily include testing of all parameters.

TEXAS
INSTRUMENTS

POST OFFICE BOX 655303 • DALLAS, TEXAS 75265

Copyright © 1989, Texas Instruments Incorporated

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

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.

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

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

† 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	$V_{CC} = 10 \text{ V}$, $I_{C(on)} = 2 \text{ mA}$, $R_L = 100 \Omega$, See Figure 1		4	10	μs
t_f Fall time			4	10	μs

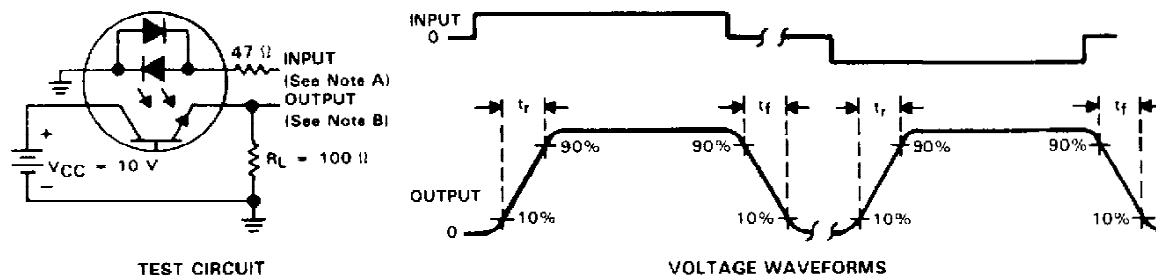


POST OFFICE BOX 655303 • DALLAS, TEXAS 75285

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

PARAMETER MEASUREMENT INFORMATION

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



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

FIGURE 1. SWITCHING TIMES

TYPICAL CHARACTERISTICS

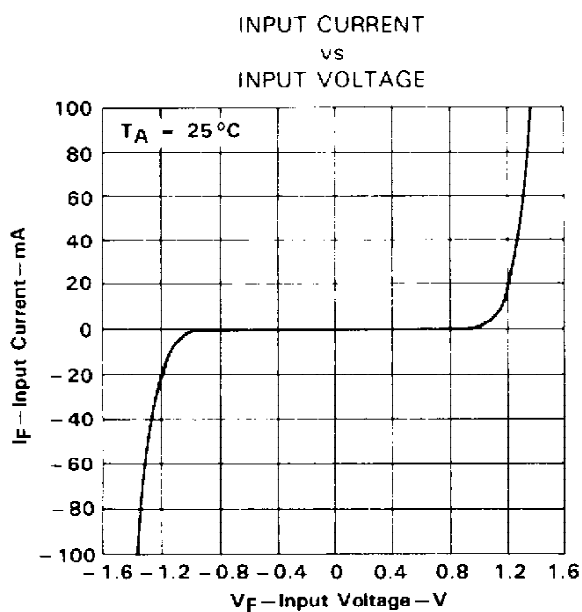


FIGURE 2

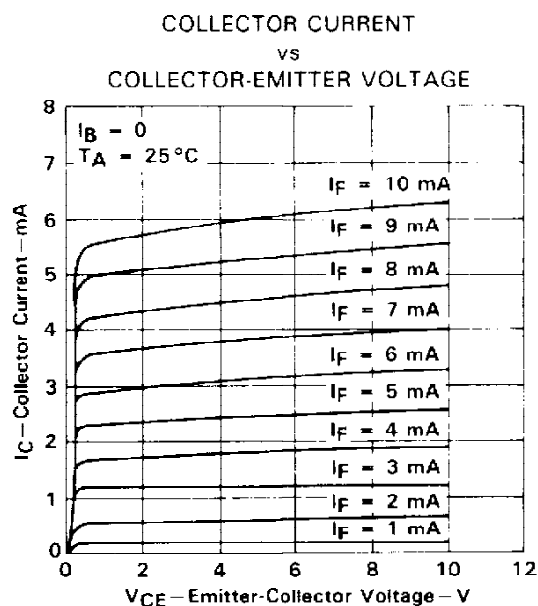


FIGURE 3

TYPICAL CHARACTERISTICS

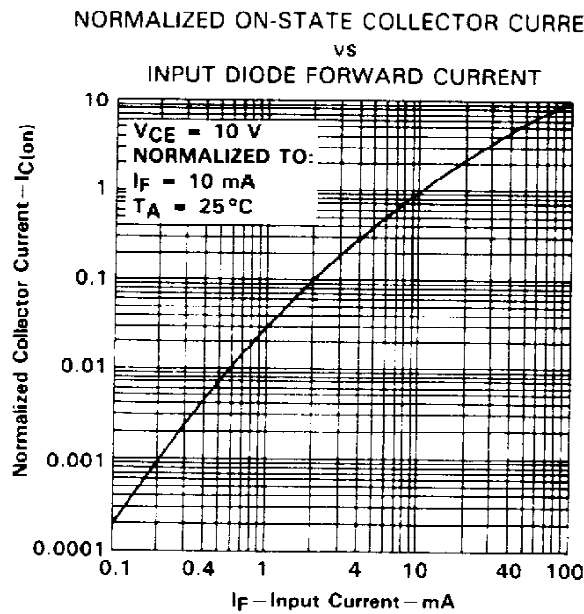


FIGURE 4

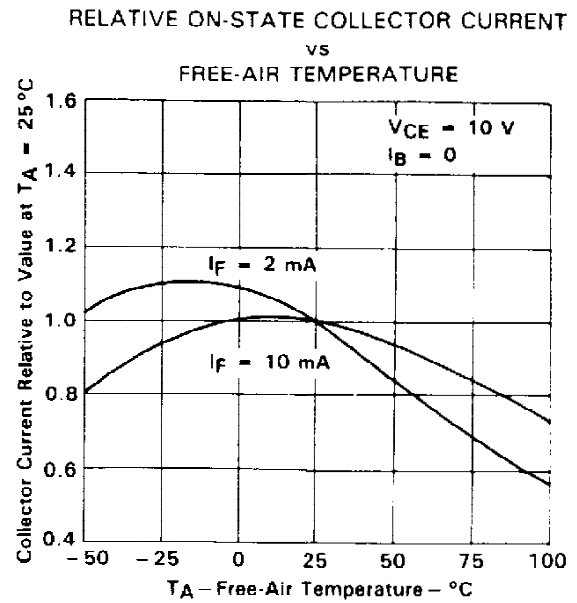


FIGURE 5

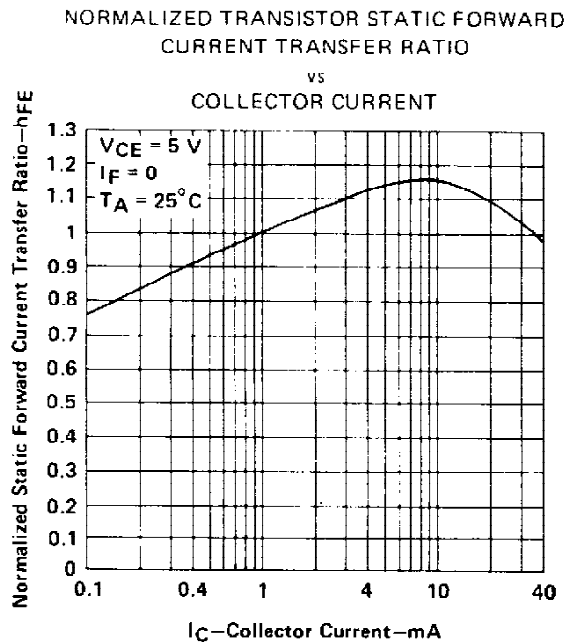


FIGURE 6

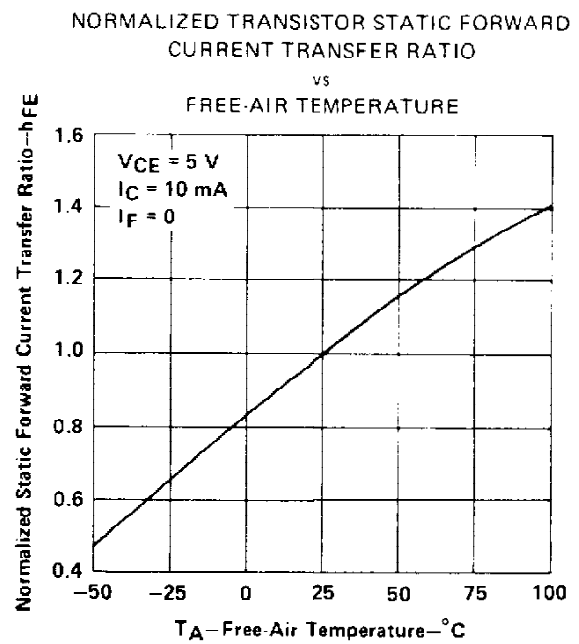


FIGURE 7

IMPORTANT NOTICE

Texas Instruments (TI) reserves the right to make changes to its products or to discontinue any semiconductor product or service without notice, and advises its customers to obtain the latest version of relevant information to verify, before placing orders, that the information being relied on is current.

TI warrants performance of its semiconductor products and related software to the specifications applicable at the time of sale in accordance with TI's standard warranty. Testing and other quality control techniques are utilized to the extent TI deems necessary to support this warranty. Specific testing of all parameters of each device is not necessarily performed, except those mandated by government requirements.

Certain applications using semiconductor products may involve potential risks of death, personal injury, or severe property or environmental damage ("Critical Applications").

TI SEMICONDUCTOR PRODUCTS ARE NOT DESIGNED, INTENDED, AUTHORIZED, OR WARRANTED TO BE SUITABLE FOR USE IN LIFE-SUPPORT APPLICATIONS, DEVICES OR SYSTEMS OR OTHER CRITICAL APPLICATIONS.

Inclusion of TI products in such applications is understood to be fully at the risk of the customer. Use of TI products in such applications requires the written approval of an appropriate TI officer. Questions concerning potential risk applications should be directed to TI through a local SC sales office.

In order to minimize risks associated with the customer's applications, adequate design and operating safeguards should be provided by the customer to minimize inherent or procedural hazards.

TI assumes no liability for applications assistance, customer product design, software performance, or infringement of patents or services described herein. Nor does TI warrant or represent that any license, either express or implied, is granted under any patent right, copyright, mask work right, or other intellectual property right of TI covering or relating to any combination, machine, or process in which such semiconductor products or services might be or are used.

IMPORTANT NOTICE

Texas Instruments and its subsidiaries (TI) reserve the right to make changes to their products or to discontinue any product or service without notice, and advise customers to obtain the latest version of relevant information to verify, before placing orders, that information being relied on is current and complete. All products are sold subject to the terms and conditions of sale supplied at the time of order acknowledgement, including those pertaining to warranty, patent infringement, and limitation of liability.

TI warrants performance of its semiconductor products to the specifications applicable at the time of sale in accordance with TI's standard warranty. Testing and other quality control techniques are utilized to the extent TI deems necessary to support this warranty. Specific testing of all parameters of each device is not necessarily performed, except those mandated by government requirements.

CERTAIN APPLICATIONS USING SEMICONDUCTOR PRODUCTS MAY INVOLVE POTENTIAL RISKS OF DEATH, PERSONAL INJURY, OR SEVERE PROPERTY OR ENVIRONMENTAL DAMAGE ("CRITICAL APPLICATIONS"). TI SEMICONDUCTOR PRODUCTS ARE NOT DESIGNED, AUTHORIZED, OR WARRANTED TO BE SUITABLE FOR USE IN LIFE-SUPPORT DEVICES OR SYSTEMS OR OTHER CRITICAL APPLICATIONS. INCLUSION OF TI PRODUCTS IN SUCH APPLICATIONS IS UNDERSTOOD TO BE FULLY AT THE CUSTOMER'S RISK.

In order to minimize risks associated with the customer's applications, adequate design and operating safeguards must be provided by the customer to minimize inherent or procedural hazards.

TI assumes no liability for applications assistance or customer product design. TI does not warrant or represent that any license, either express or implied, is granted under any patent right, copyright, mask work right, or other intellectual property right of TI covering or relating to any combination, machine, or process in which such semiconductor products or services might be or are used. TI's publication of information regarding any third party's products or services does not constitute TI's approval, warranty or endorsement thereof.