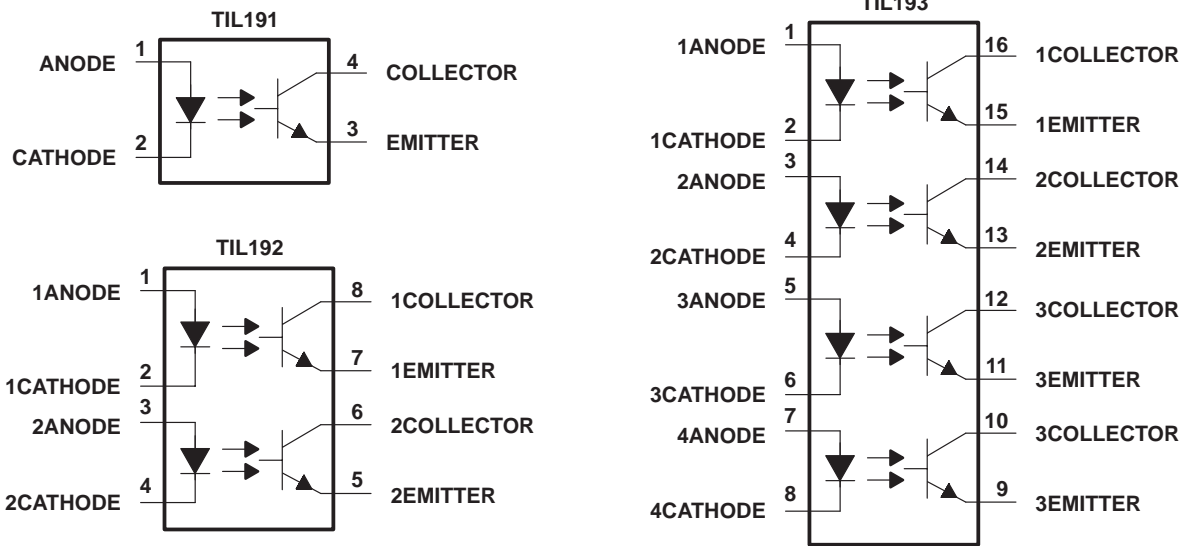


- Gallium-Arsenide-Diode Infrared Source
- Source Is Optically Coupled to Silicon npn Phototransistor
- Choice of One, Two, or Four Channels
- Choice of Three Current-Transfer Ratios
- High-Voltage Electrical Isolation 3.535 kV Peak (2.5 kV rms)
- Plastic Dual-In-Line Packages
- UL Listed — File #E65085

**description**

These optocouplers consist of one gallium-arsenide light-emitting diode and one silicon npn phototransistor per channel. The TIL191 has a single channel in a 4-pin package, the TIL192 has two channels in an 8-package, and the TIL193 has four channels in a 16-pin package. The standard devices, TIL191, TIL192, and TIL193, are tested for a current-transfer ratio of 20% minimum. Devices selected for a current-transfer ratio of 50% and 100% minimum are designated with the suffix A and B respectively.

**schematic diagrams**



**absolute maximum ratings at 25°C free-air (unless otherwise noted)†**

Input-to-output voltage (see Note 1)	±3.535 kV peak or dc (±2.5 kV rms)
Collector-emitter voltage (see Note 2)	35 V
Emitter-collector voltage	7 V
Input diode reverse voltage	5 V
Input diode continuous forward current at (or below) 25°C free-air temperature (see Note 3)	50 mA
Continuous total power dissipation at (or below) 25°C free-air temperature:	
Phototransistor (see Note 4)	150 mW
Input diode plus phototransistor per channel (see Note 5)	200 mW
Storage temperature range, T <sub>stg</sub>	–55°C to 125°C
Lead temperature 1,6 mm (1/16 inch) from case for 10 seconds	260°C

† Stresses beyond those listed under “absolute maximum ratings” may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated under “recommended operating conditions” is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

- NOTES:
1. This rating applies for sine-wave operation at 50 Hz or 60 Hz. This capability is verified by testing in accordance with UL requirements.
  2. This value applies when the base-emitter diode is open circuited.
  3. Derate linearly to 100°C free-air temperature at the rate of 0.67 mA/°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 2.67 mW/°C.

TIL191, TIL192, TIL193, TIL191A, TIL192A, TIL193A  
 TIL191B, TIL192B, TIL193B  
 OPTOCOUPLERS

SOES026B – APRIL 1989 – REVISED APRIL 1998

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

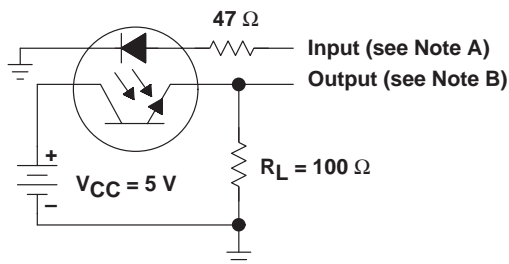
PARAMETER		TEST CONDITIONS	MIN	TYP	MAX	UNIT
$V_{(BR)CEO}$	Collector-emitter breakdown voltage	$I_C = 0.5 \text{ mA}$ , $I_F = 0$	35			V
$V_{(BR)ECO}$	Emitter-collector breakdown voltage	$I_C = 100 \mu\text{A}$ , $I_F = 0$	7			V
$I_R$	Input diode static reverse current	$V_R = 5 \text{ V}$			10	$\mu\text{A}$
$I_{C(off)}$	Off-state collector current	$V_{CE} = 24 \text{ V}$ , $I_F = 0$			100	nA
CTR	Current transfer ratio	TIL191, TIL192, TIL193	$I_F = 5 \text{ mA}$ , $V_{CE} = 5 \text{ V}$		20%	
		TIL191A, TIL192A, TIL193A			50%	
		TIL191B, TIL192B, TIL193B			100%	
$V_F$	Input diode static forward voltage	$I_F = 20 \text{ mA}$			1.4	V
$V_{CE(sat)}$	Collector-emitter saturation voltage	$I_F = 5 \text{ mA}$ , $I_C = 1 \text{ mA}$			0.4	V
$C_{io}$	Input-to-output capacitance	$V_{in-out} = 0 \text{ mA}$ , $f = 1 \text{ MHz}$ , See Note 6		1		pF
$r_{io}$	Input-to-output internal resistance	$V_{in-out} = \pm 1 \text{ mA}$ , See Note 6		$10^{11}$		$\Omega$

NOTE 6: These parameters are measured between all input diode leads shorted together and all phototransistor leads shorted together.

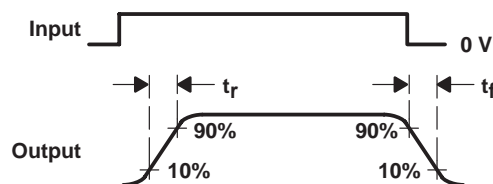
**switching characteristics at 25°C free-air temperature**

PARAMETER		TEST CONDITIONS	MIN	TYP	MAX	UNIT
$t_r$	Rise time	$V_{CC} = 5 \text{ V}$ , $I_{C(on)} = 2 \text{ mA}$ , $R_L = 100 \Omega$ , See Figure 1		6		$\mu\text{s}$
$t_f$	Fall time			6		

**PARAMETER MEASUREMENT INFORMATION**



**TEST CIRCUIT**



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

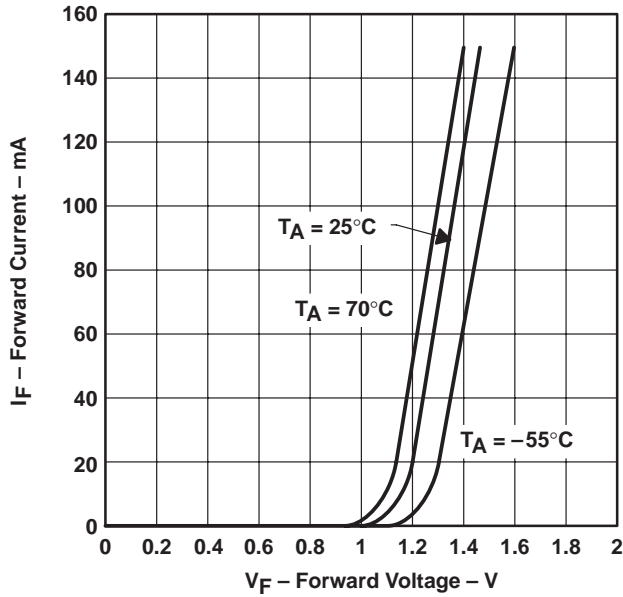
**VOLTAGE WAVEFORMS**

- NOTES: A. The input waveform is supplied by a generator with the following characteristics:  $Z_{OUT} = 50 \Omega$ ,  $t_r \leq 15 \text{ ns}$ , duty cycle  $\approx 1\%$ ,  $t_w = 100 \mu\text{s}$ .  
 B. The output waveform is monitored on a oscilloscope with the following characteristic:  $t_r \leq 12 \text{ ns}$ ,  $R_{in} \geq 1 \text{ M}\Omega$ ,  $C_{in} \leq 20 \text{ pF}$ .

**Figure 1. Switching Times**

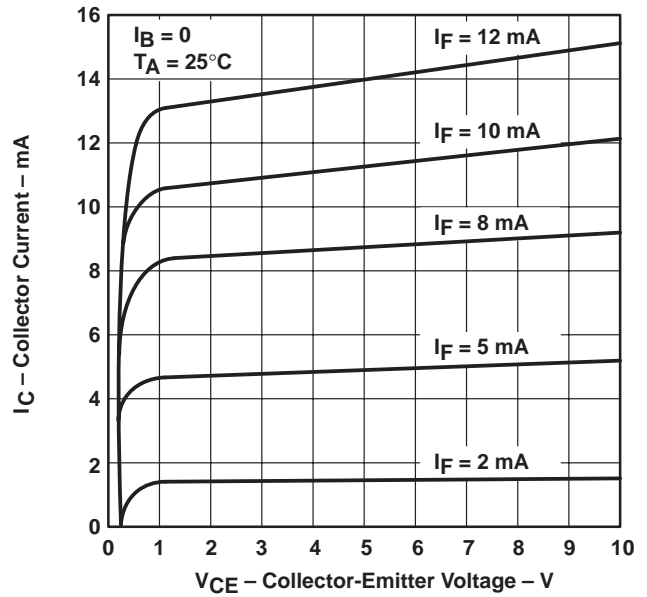
**TYPICAL CHARACTERISTICS**

**FORWARD CURRENT  
 vs  
 FORWARD VOLTAGE**



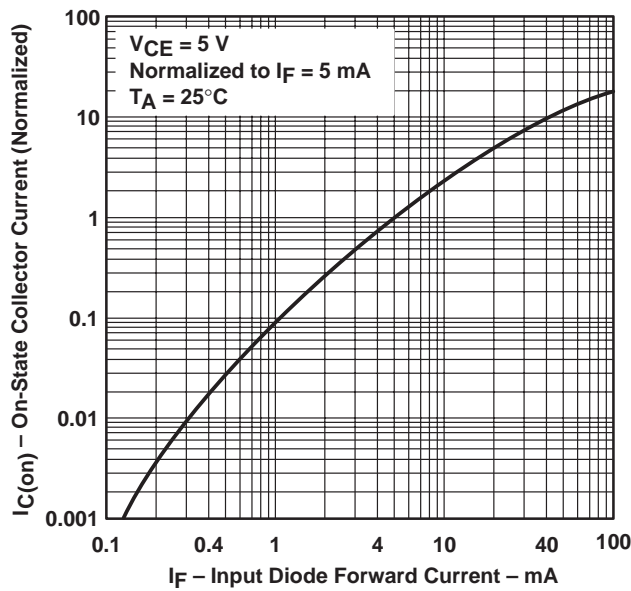
**Figure 2**

**TIL191, TIL192, TIL193  
 COLLECTOR CURRENT  
 vs  
 COLLECTOR-EMITTER VOLTAGE**



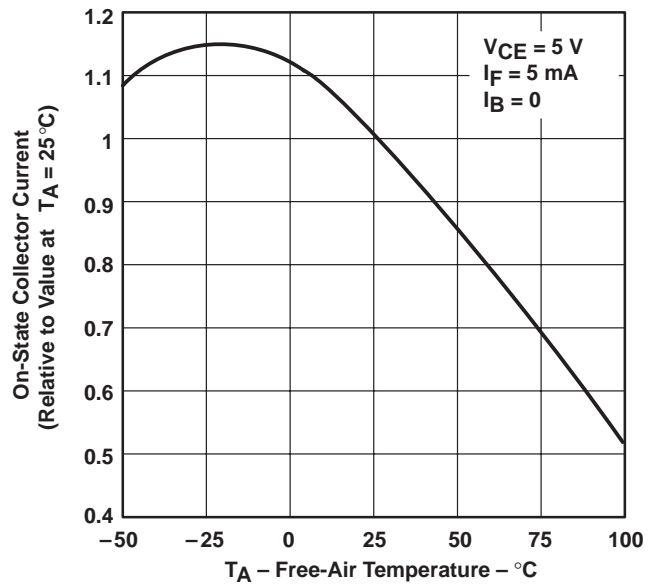
**Figure 3**

**ON-STATE COLLECTOR CURRENT (NORMALIZED)  
 vs  
 INPUT DIODE FORWARD CURRENT**



**Figure 4**

**ON-STATE COLLECTOR CURRENT  
 (RELATIVE TO VALUE AT 25°C)  
 vs  
 FREE-AIR TEMPERATURE**



**Figure 5**

TYPICAL CHARACTERISTICS

COLLECTOR-EMITTER SATURATION VOLTAGE  
 VS  
 FREE-AIR TEMPERATURE

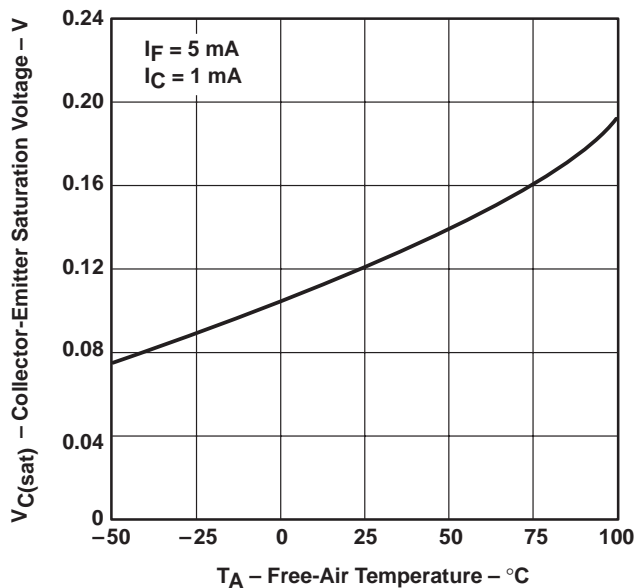


Figure 6

APPLICATION INFORMATION

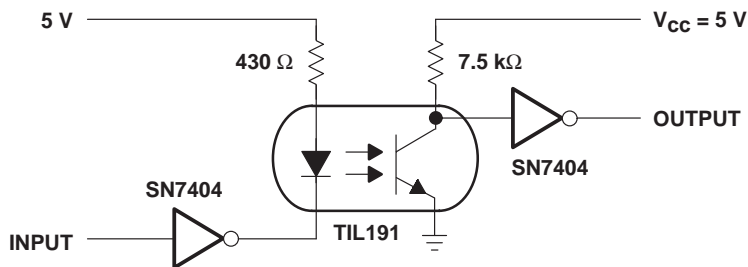
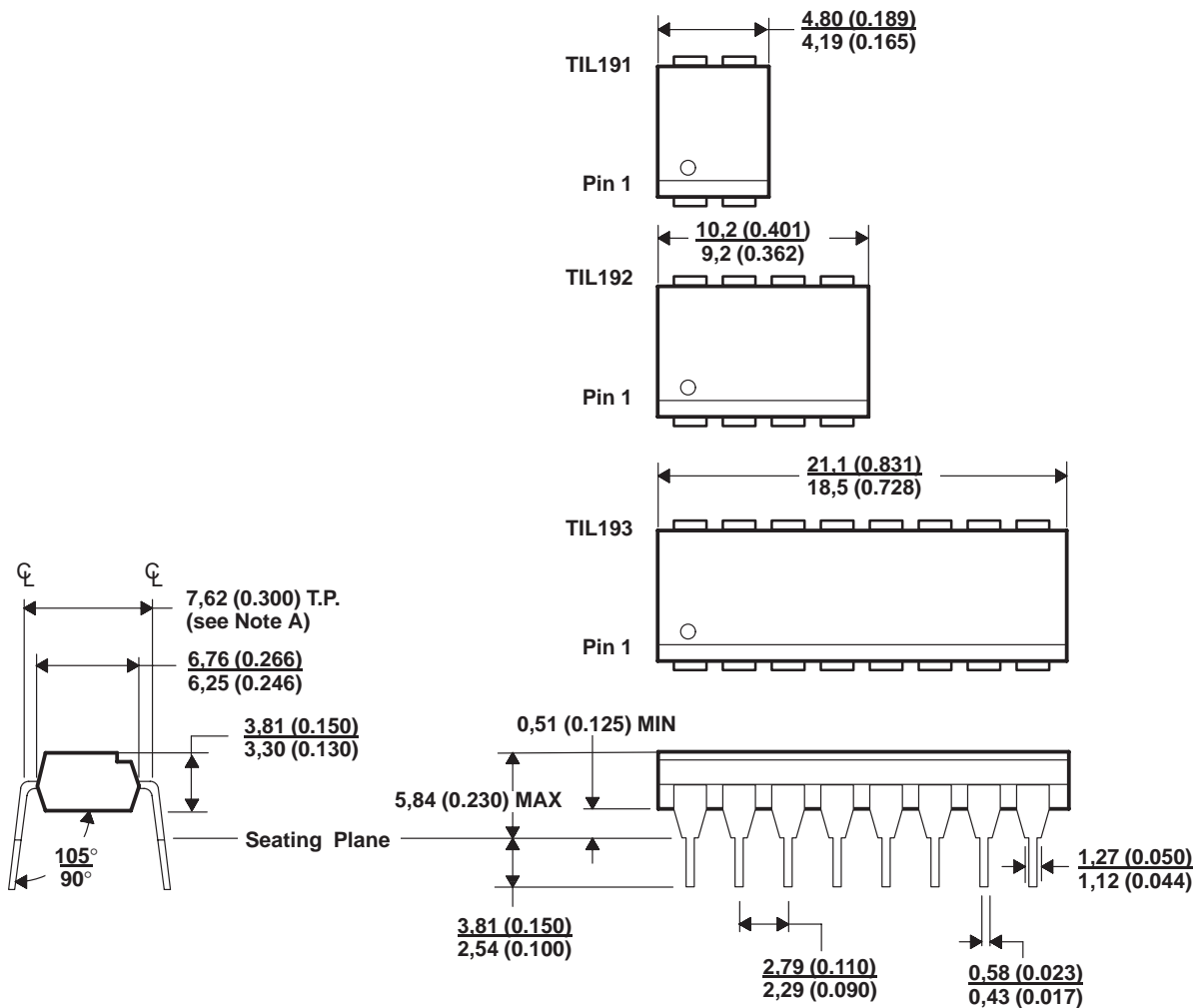


Figure 7

**MECHANICAL INFORMATION**



- NOTES: A. Each pin centerline is located within 0,25 (0.010) of its true longitudinal position.  
 B. All linear dimensions are given in millimeters and parenthetically given in inches.

**Figure 8. Mechanical Information**

**PACKAGING INFORMATION**

Orderable Device	Status <sup>(1)</sup>	Package Type	Package Drawing	Pins	Package Qty	Eco Plan <sup>(2)</sup>	Lead/Ball Finish	MSL Peak Temp <sup>(3)</sup>
TIL191	OBSOLETE	PDIP	N	4		TBD	Call TI	Call TI
TIL191A	OBSOLETE	PDIP	P	4		TBD	Call TI	Call TI
TIL191B	OBSOLETE	PDIP	P	4		TBD	Call TI	Call TI
TIL192	OBSOLETE	PDIP	N	8		TBD	Call TI	Call TI
TIL192A	OBSOLETE	PDIP	P	8		TBD	Call TI	Call TI
TIL192B	OBSOLETE	PDIP	P	8		TBD	Call TI	Call TI
TIL193	OBSOLETE	PDIP	N	16		TBD	Call TI	Call TI
TIL193A	OBSOLETE	PDIP	P	16		TBD	Call TI	Call TI
TIL193B	OBSOLETE	PDIP	P	16		TBD	Call TI	Call TI

<sup>(1)</sup> The marketing status values are defined as follows:

**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.

**NRND:** Not recommended for new designs. Device is in production to support existing customers, but TI does not recommend using this part in a new design.

**PREVIEW:** Device has been announced but is not in production. Samples may or may not be available.

**OBSOLETE:** TI has discontinued the production of the device.

<sup>(2)</sup> 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.

**Pb-Free (RoHS):** TI's terms "Lead-Free" or "Pb-Free" mean semiconductor products that are compatible with the current RoHS requirements for all 6 substances, including the requirement that lead not exceed 0.1% by weight in homogeneous materials. Where designed to be soldered at high temperatures, TI Pb-Free products are suitable for use in specified lead-free processes.

**Green (RoHS & no Sb/Br):** TI defines "Green" to mean Pb-Free (RoHS compatible), and free of Bromine (Br) and Antimony (Sb) based flame retardants (Br or Sb do not exceed 0.1% by weight in homogeneous material)

<sup>(3)</sup> MSL, Peak Temp. -- The Moisture Sensitivity Level rating according to the JEDEC industry standard classifications, and peak solder temperature.

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P (R-PDIP-T8)

PLASTIC DUAL-IN-LINE



- NOTES: A. All linear dimensions are in inches (millimeters).  
 B. This drawing is subject to change without notice.  
 C. Falls within JEDEC MS-001

For the latest package information, go to [http://www.ti.com/sc/docs/package/pkg\\_info.htm](http://www.ti.com/sc/docs/package/pkg_info.htm)

N (R-PDIP-T\*\*)

PLASTIC DUAL-IN-LINE PACKAGE

16 PINS SHOWN



4040049/E 12/2002

- NOTES:
- A. All linear dimensions are in inches (millimeters).
  - B. This drawing is subject to change without notice.
  - (C) Falls within JEDEC MS-001, except 18 and 20 pin minimum body length (Dim A).
  - (D) The 20 pin end lead shoulder width is a vendor option, either half or full width.



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