

# TIL194, TIL195, TIL196, TIL194A, TIL195A, TIL196A TIL194B, TIL195B, TIL196B AC-INPUT OPTOCOUPLEDERS

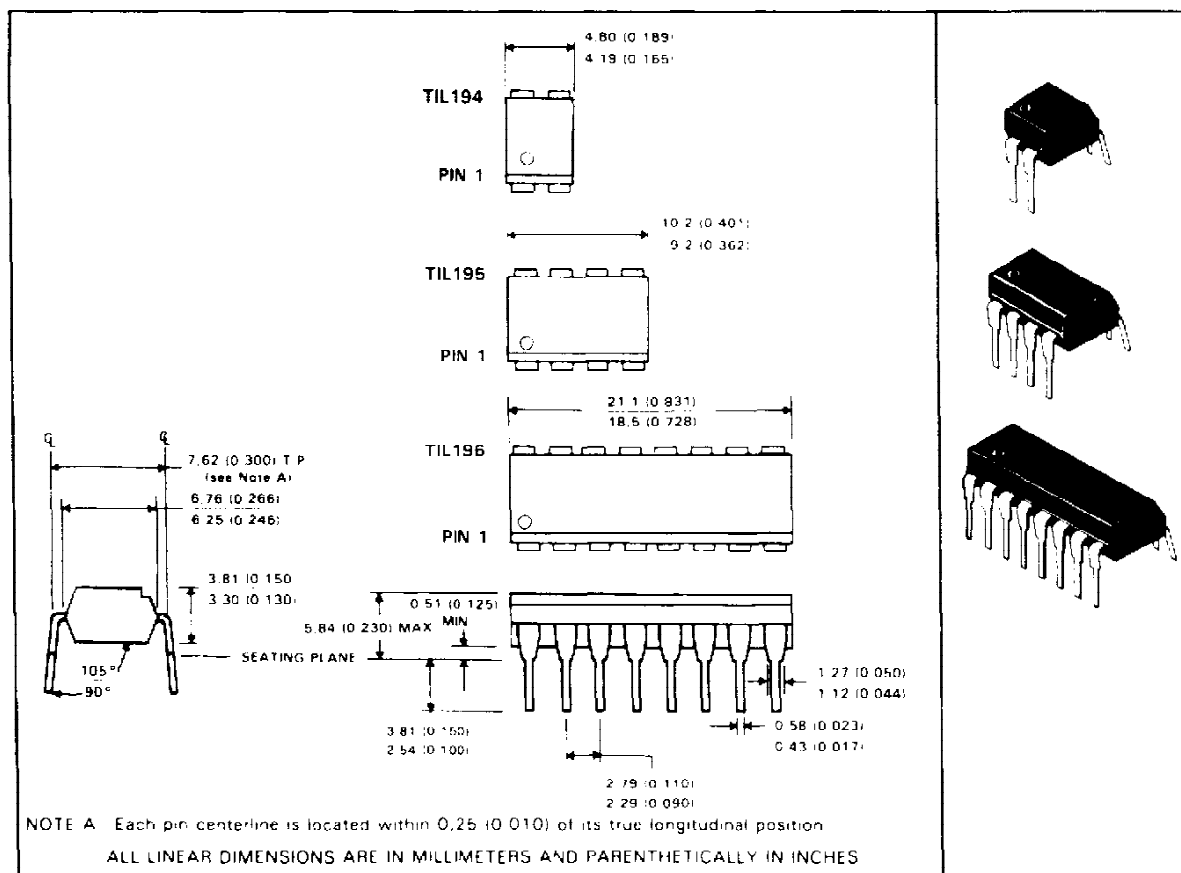
SOES001 03287 MAY 1989 - REVISED SEPTEMBER 1989

- AC Signal Input
- Gallium-Arsenide Diode Infrared Source
- Source Is Optically Coupled to Silicon N-P-N 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 two gallium-arsenide light-emitting diodes connected in a reverse-parallel configuration for ac-input applications and a silicon n-p-n phototransistor per channel. The TIL 194 has one channel in a 4-pin package, the TIL195 has two channels in an 8-pin package, and the TIL196 has four channels in a 16-pin package. The standard devices, TIL194, TIL195, and TIL196, 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.

## mechanical data



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.

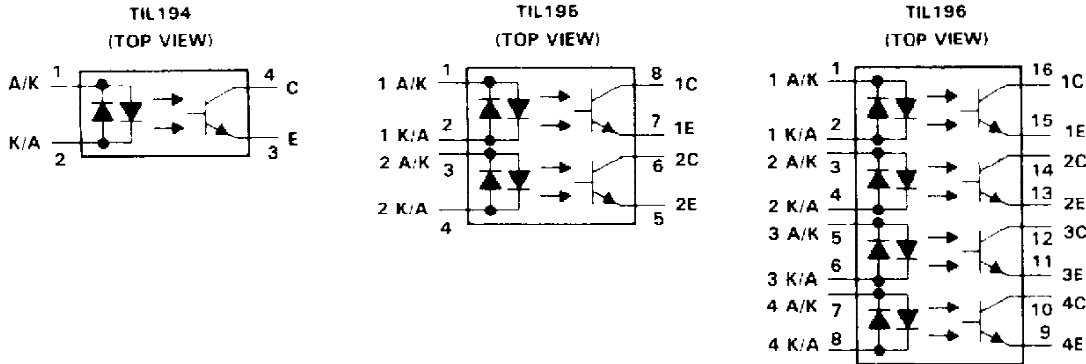
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INSTRUMENTS

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**TIL194, TIL195, TIL196, TIL194A, TIL195A, TIL196A  
TIL194B, TIL195B, TIL196B  
AC-INPUT OPTOCOUPLEDERS**

**schematic diagrams**



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

Input-to-output voltage (see Note 1)	$\pm 3.535$ kV peak or dc ( $\pm 2.5$ kV rms)
Collector-emitter voltage (see Note 2)	35 V
Emitter-collector voltage	7 V
Input diode continuous forward current at (or below) 25°C free-air temperature (see Note 3)	$\pm 50$ mA
Continuous 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	-55°C to 125°C
Lead temperature 1.6 mm (1/16 inch) from case for 10 seconds	260°C

- NOTES: 1. This rating applies for sine wave operation at 50 or 60 Hz. Service 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.

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

PARAMETER		TEST CONDITIONS	MIN	TYP	MAX	UNIT
$V_{(BR)CEO}$	Collector-emitter breakdown voltage	$I_C = 0.5$ mA, $I_F = 0$	35			V
$V_{(BR)ECO}$	Emitter-collector breakdown voltage	$I_C = 100$ $\mu$ A, $I_F = 0$	7			V
$I_{C(off)}$	Off-state collector current	$V_{CE} = 24$ V, $I_F = 0$			100	nA
$CTR^\dagger$	Current transfer ratio	TIL194, TIL195, TIL196		20%		
		TIL194A, TIL195A, TIL196A	$I_F = 5$ mA, $V_{CE} = 5$ V	50%		
		TIL194B, TIL195B, TIL196B		100%		
$V_F^\dagger$	Input diode static forward voltage	$I_F = 20$ mA			1.4	V
$V_{CE(sat)}^\dagger$	Collector-emitter saturation voltage	$I_F = 5$ mA, $I_C = 1$ mA			0.4	V
$C_{io}$	Input-to-output capacitance	$V_{in-out} = 0$ , $f = 1$ MHz, See Note 6		1		pF
$r_{io}$	Input-to-output internal resistance	$V_{in-out} = \pm 1$ kV, See Note 6		$10^{11}$		$\Omega$
$I_{C(on)1}$ $I_{C(on)2}$	On-state collector current symmetry ratio (see Note 7)	$V_{CE} = 5$ V, $I_F = 5$ mA	1		3	

$^\dagger$ These parameters apply to either direction of the input current.

- NOTES: 6: These parameters are measured between all input diode leads shorted together and all phototransistor leads shorted together.  
7: The higher of the two values of  $I_{C(on)}$  generated by the two diodes is taken as  $I_{C(on)1}$ .

**TIL194, TIL195, TIL196, TIL194A, TIL195A, TIL196A  
TIL194B, TIL195B, TIL196B  
AC-INPUT OPTOCOUPERS**

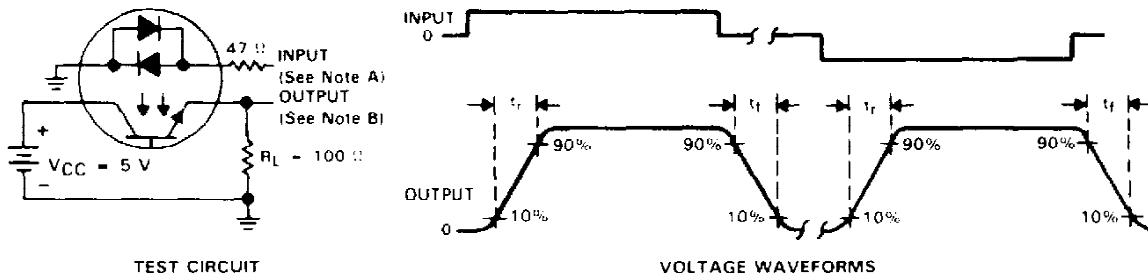
switching characteristics at 25°C free-air temperature

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

<sup>†</sup>These parameters apply to either direction of the input current.

**PARAMETER MEASUREMENT INFORMATION**

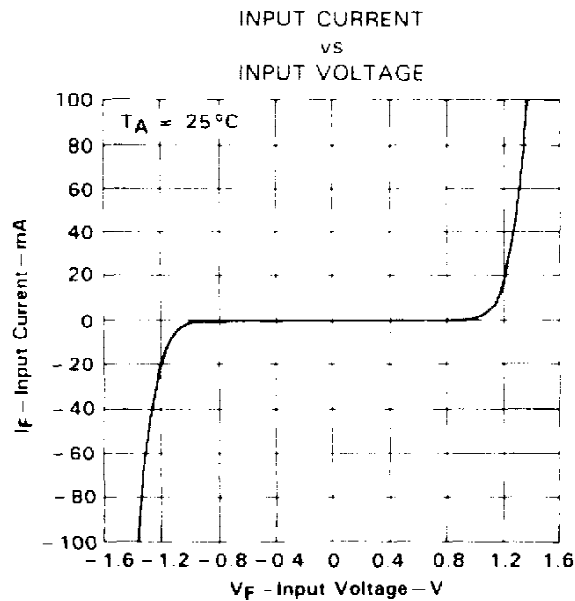
Adjust amplitude of input pulse for  $I_{C(on)} = 2 \text{ mA}$



NOTES: A The input waveform is supplied by a generator with the following characteristics:  $Z_0 = 50 \Omega$ ,  $t_r \leq 15 \text{ ns}$ , duty cycle = 1%  
B The output waveform is monitored on an oscilloscope with the following characteristics:  $t_r \leq 12 \text{ ns}$ ,  $R_i \geq 1 \text{ M}\Omega$ ,  $C_i < 20 \text{ pF}$

**FIGURE 1. SWITCHING TIMES**

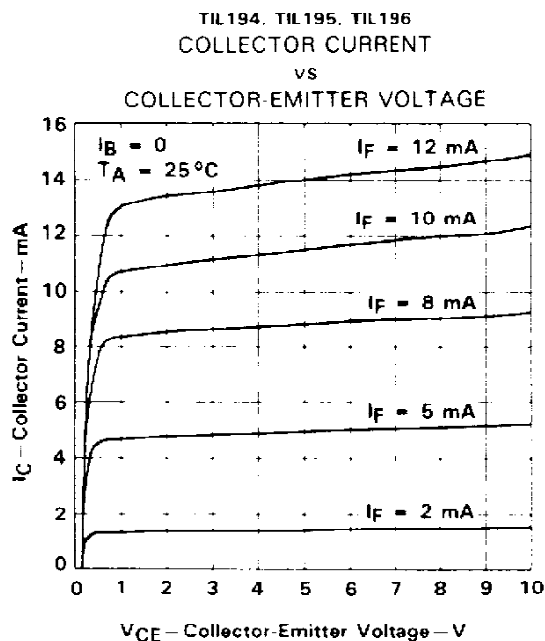
**TYPICAL CHARACTERISTICS**



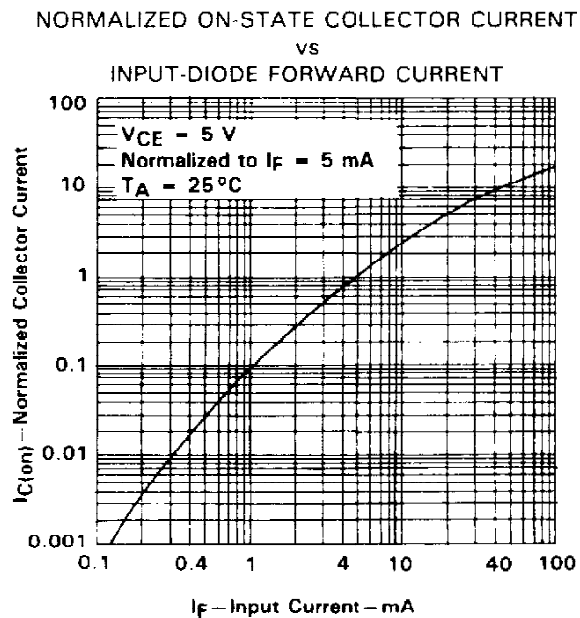
**FIGURE 2**

**TIL194, TIL195, TIL196, TIL194A, TIL195A, TIL196A  
TIL194B, TIL195B, TIL196B  
AC-INPUT OPTOCOUPERS**

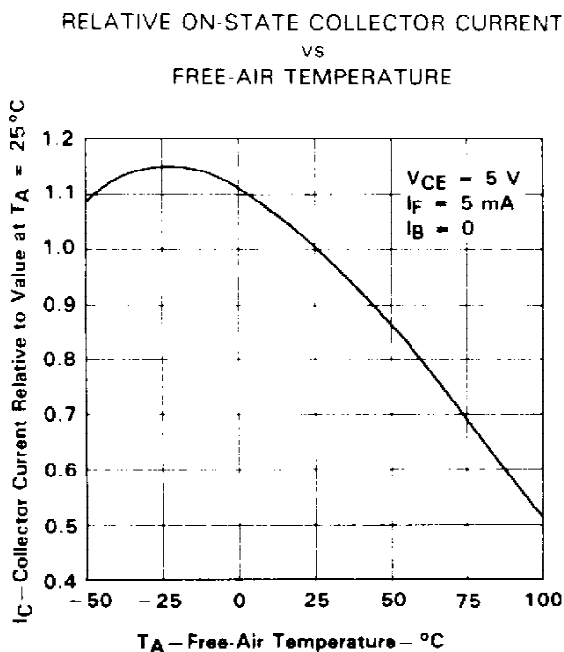
**TYPICAL CHARACTERISTICS**



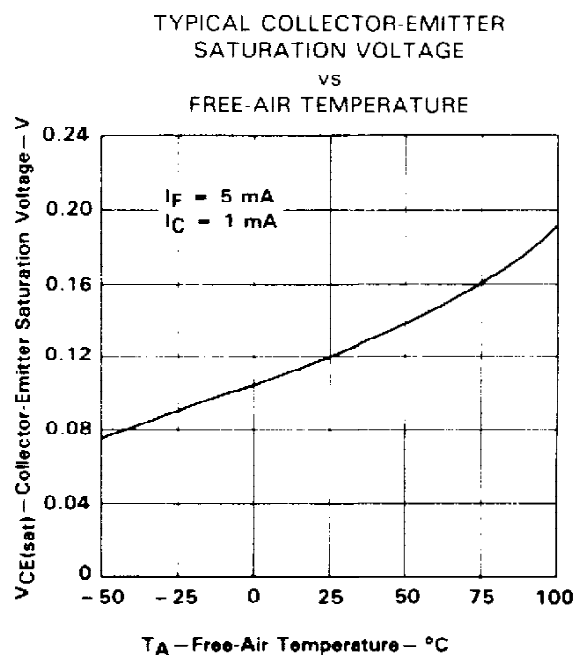
**FIGURE 3**



**FIGURE 4**



**FIGURE 5**



**FIGURE 6**

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