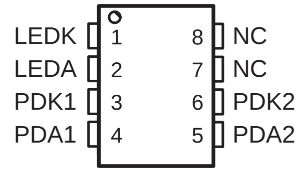
- **ac or dc Signal Coupling**
- **Wide Bandwidth . . . >200 kHz**
- **High Transfer-Gain Stability . . . ±0.05%/°C**
- **3500 V Peak Isolation**
- **UL Approval Pending**
- **Applications**
  - **Power-Supply Feedback**
  - **Medical-Sensor Isolation**
  - **Opto Direct-Access Arrangement (DAA)**
  - **Isolated Process-Control Transducers**

P PACKAGE
(TOP VIEW)

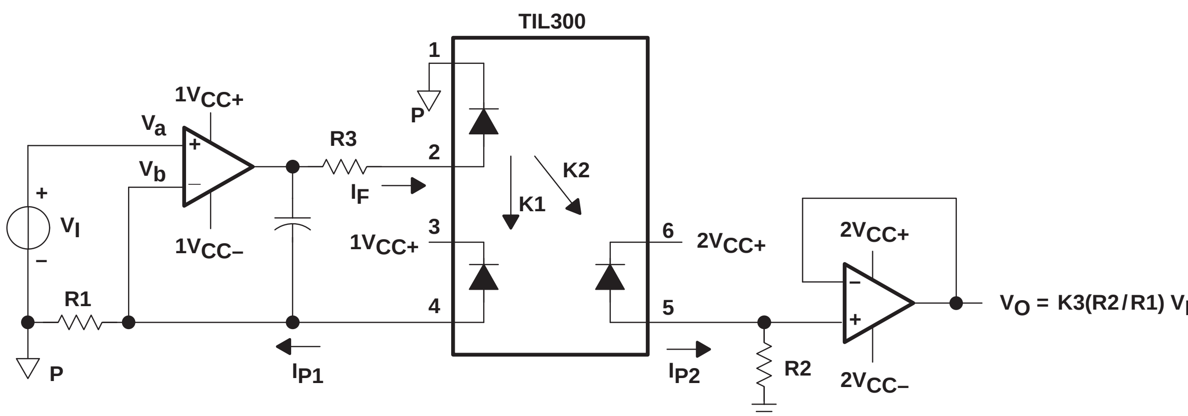


NC – No internal connection

description

The TIL300 precision linear optocoupler consists of an infrared LED irradiating an isolated feedback photodiode and an output photodiode in a bifurcated arrangement. The feedback photodiode captures a percentage of the flux of the LED and generates a control signal that can be used to regulate the LED drive current. This technique is used to compensate for the nonlinear time and temperature characteristics of the LED. The output-side photodiode produces an output signal that is linearly proportional to the servo-optical flux emitted from the LED.

A typical application circuit (shown in Figure 1) uses an operational amplifier as the input to drive the LED. The feedback photodiode sources current through R1, which is connected to the inverting input of the input operational amplifier. The photocurrent I_{P1} assumes a magnitude that satisfies the relationship $I_{P1} = V_I/R1$. The magnitude of the current is directly proportional to the LED current through the feedback transfer gain $K1(V_I/R1 = K1 \times I_F)$. The operational amplifier supplies LED current to produce sufficient photocurrent to keep the node voltage V_b equal to node voltage V_a.



NOTES: A. K1 is servo current gain, the ratio of the feedback photodiode current (I_{P1}) to the input LED current (I_F), i.e. $K1 = I_{P1}/I_F$.
B. K2 is forward gain, the ratio of the output photodiode current (I_{P2}) to the input LED current (I_F), i.e. $K2 = I_{P2}/I_F$.
C. K3 is transfer gain, the ratio of the forward gain to the servo gain, i.e. K3 = K2/K1.

Figure 1. Typical Application Circuit

Please be aware that an important notice concerning availability, standard warranty, and use in critical applications of Texas Instruments semiconductor products and disclaimers thereto appears at the end of this data sheet.

Terminal Functions

TERMINAL NAME	NO.	I/O	DESCRIPTION
LEDK	1		LED cathode
LEDA	2		LED anode
PDK1	3		Photodiode 1 cathode
PDA1	4		Photodiode 1 anode
PDA2	5		Photodiode 2 anode
PDK2	6		Photodiode 2 cathode
NC	7		No internal connection
NC	8		No internal connection

absolute maximum ratings over operating free-air temperature range (unless otherwise noted)†

Emitter

Continuous total power dissipation (see Note 1) . . . . 160 mW
Input LED forward current, I_F . . . . 60 mA
Surge current with pulse width < 10 µs . . . . 250 mA
Reverse voltage, V_R . . . . 5 V
Reverse current, I_R . . . . 10 µA

Detector

Continuous power dissipation (see Note 2) . . . . 50 mW
Reverse voltage, V_R . . . . 50 V

Coupler

Continuous total power dissipation (see Note 3) . . . . 210 mW
Storage temperature, T_{stg} . . . . –55°C to 150°C
Operating temperature, T_A . . . . –55°C to 100°C
Input-to-output voltage . . . . 3535 Vpeak
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. Derate linearly from 25°C at a rate of 2.66 mW/°C.
2. Derate linearly from 25°C at a rate of 0.66 mW/°C.
3. Derate linearly from 25°C at a rate of 3.33 mW/°C.

electrical characteristics at T_A = 25°C

Emitter

PARAMETER		CONDITIONS		MIN	TYP†	MAX	UNIT
V_F	Forward voltage	I_F = 10 mA			1.25	1.50	V
	Temperature coefficient of V_F				–2.2		mV/°C
I_R	Reverse current	V_R = 5 V				10	µA
t_r	Rise time	I_F = 10 mA,	ΔI_F = 2 mA		1		µs
t_f	Fall time	I_F = 10 mA,	ΔI_F = 2 mA		1		µs
C_j	Junction capacitance	V_F = 0,	f = 1 MHz		15		pF

Detector

PARAMETER		CONDITIONS		MIN	TYP†	MAX	UNIT
I_{DK}†	Dark current	V_R = 15 V,	I_F = 0			25	nA
	Open circuit voltage	I_F = 10 mA			0.5		V
I_{OS}	Short circuit current limit	I_F = 10 mA			80		µA
C_j	Junction capacitance	V_F = 0,	f = 1 MHz		12		pF

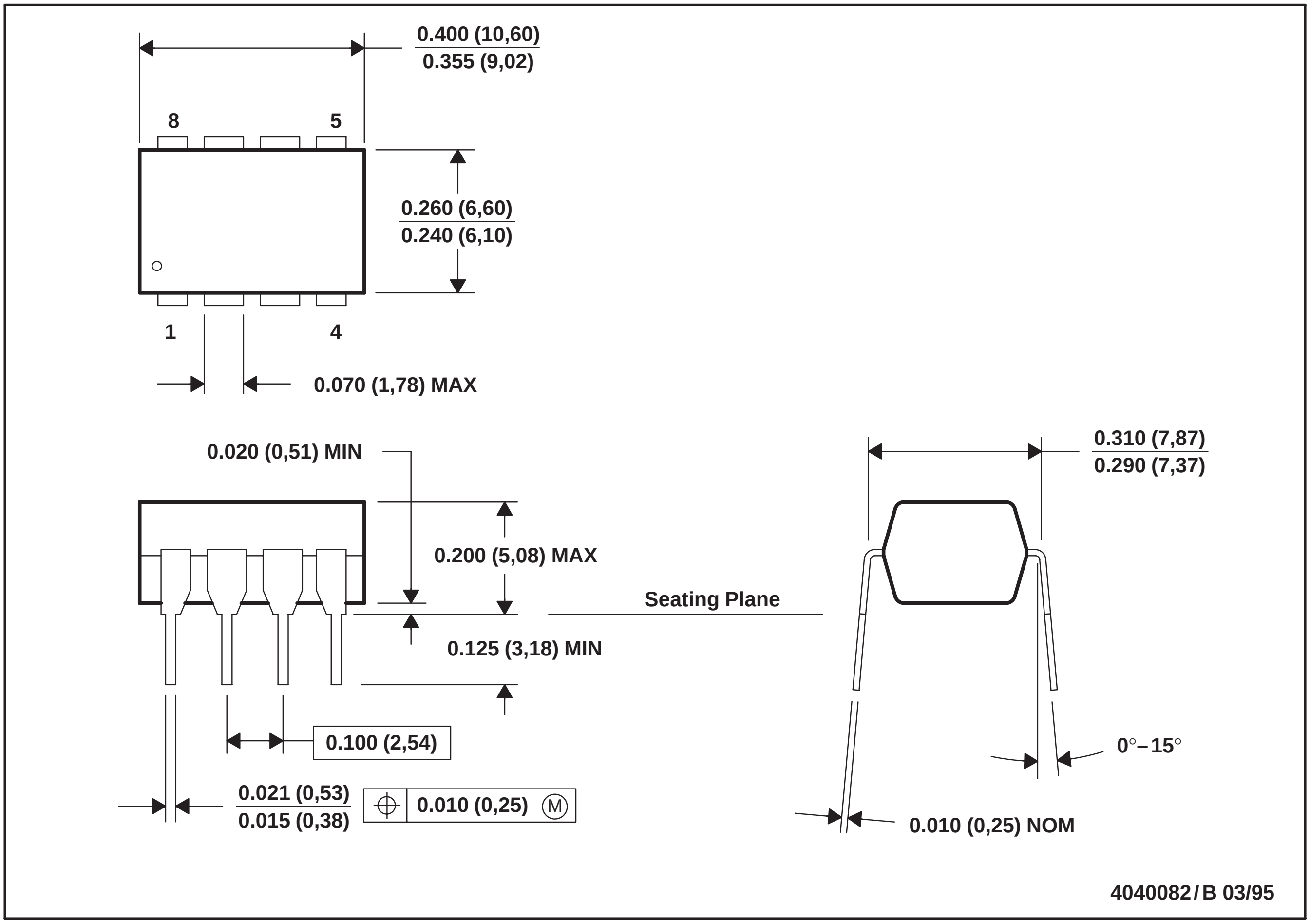
Coupler

PARAMETER			CONDITIONS		MIN	TYP†	MAX	UNIT
K1‡	Servo current gain		Detector bias voltage = –15 V	I_F = 1 mA	0.3%	0.7%	1.5%	
				I_F = 10 mA	0.5%	1.25%	2%	
K2§	Forward current gain			I_F = 1 mA	0.3%	0.7%	1.5%	
				I_F = 10 mA	0.5%	1.25%	2%	
K3¶	Transfer gain	TIL300		I_F = 1 mA	0.75	1	1.25	
				I_F = 10 mA	0.75	1	1.25	
		TIL300A		I_F = 1 mA	0.9	1	1.10	
				I_F = 10 mA	0.9	1	1.10	
	Gain temperature coefficient	K1/K2	I_F = 10 mA			–0.5		%/°C
		K3				±0.005		
ΔK3#	Transfer gain linearity		I_F = 1 to 10 mA			±0.25%		
			I_F = 1 to 10 mA,	T_A = 0 to 75°C		±0.5%		
BW	Bandwidth		I_F = 10 mA, $I_{F(MODULATION)}$ = ±2 mA	R_L = 1 kΩ,		200		kHz
t_r	Rise time		I_F = 10 mA, $I_{F(MODULATION)}$ = ±2 mA	R_L = 1 kΩ,		1.75		µs
t_f	Fall time		I_F = 10 mA, $I_{F(MODULATION)}$ = ±2 mA	R_L = 1 kΩ,		1.75		µs
V_{iso}†	Peak Isolation voltage		I_{IO} = 10 µA, time = 1 minute	f = 60 Hz	3535			V

† This symbol is not currently listed within EIA or JEDEC standards for semiconductor symbology.
‡ Servo current gain (K1) is the ratio of the feedback photodiode current (I_{P1}) to the input LED current (I_F) current (I_F), i.e. K1 = I_{P1}/I_F.
§ Forward gain (K2 is the ratio of the output photodiode current (I_{P2}) to the input LED current (I_F), i.e. K2 = I_{P2}/I_F.
¶ Transfer gain (K3) is the ratio of the forward gain to the servo gain, i.e. K3 = K2/K1.
# Transfer gain linearity (ΔK3) is the percent deviation of the transfer gain K3 as a function of LED input current (I_F) or the package temperature.

MECHANICAL DATA

P (R-PDIP-T8) **PLASTIC DUAL-IN-LINE PACKAGE**



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