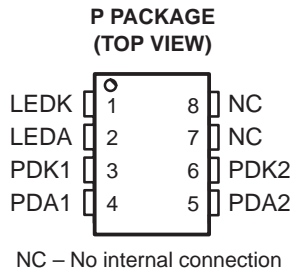


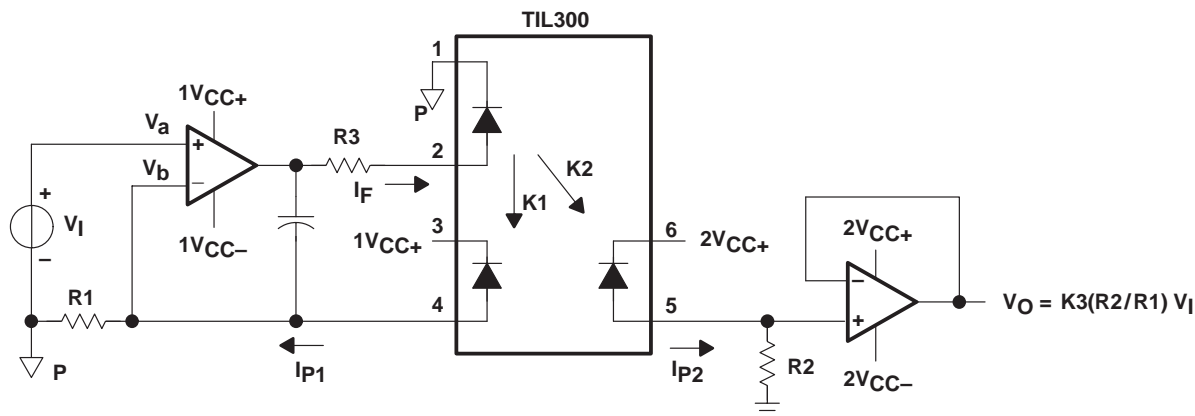
- **ac or dc Signal Coupling**
- **Wide Bandwidth . . . >200 kHz**
- **High Transfer-Gain Stability . . . $\pm 0.05\%/^{\circ}\text{C}$**
- **3500 V Peak Isolation**
- **UL Approval Pending**
- **Applications**
 - **Power-Supply Feedback**
 - **Medical-Sensor Isolation**
 - **Opto Direct-Access Arrangement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



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. K_1 is servo current gain, the ratio of the feedback photodiode current (I_{P1}) to the input LED current (I_F), i.e. $K_1 = I_{P1}/I_F$.
 B. K_2 is forward gain, the ratio of the output photodiode current (I_{P2}) to the input LED current (I_F), i.e. $K_2 = I_{P2}/I_F$.
 C. K_3 is transfer gain, the ratio of the forward gain to the servo gain, i.e. $K_3 = K_2/K_1$.

Figure 1. Typical Application Circuit



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PRODUCTION DATA information is 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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TIL300, TIL300A

PRECISION LINEAR OPTOCOUPLER

SOES019A – OCTOBER 1995 – REVISED JULY 1996

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 μ s 250 mA
 Reverse voltage, V_R 5 V
 Reverse current, I_R 10 μ A

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 V_{peak}
 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.



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electrical characteristics at $T_A = 25^\circ\text{C}$

Emitter

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

Detector

| PARAMETER | | CONDITIONS | MIN | TYP† | MAX | UNIT |
|------------------|-----------------------------|---------------------------------|-----|------|-----|---------------|
| I_{DK}^\dagger | Dark current | $V_R = 15\text{ V}$, $I_F = 0$ | | | 25 | nA |
| | Open circuit voltage | $I_F = 10\text{ mA}$ | | 0.5 | | V |
| I_{OS} | Short circuit current limit | $I_F = 10\text{ mA}$ | | 80 | | μA |
| C_j | Junction capacitance | $V_F = 0$, $f = 1\text{ MHz}$ | | 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, R _L = 1 kΩ, I _F (MODULATION) = ±2 mA | | 200 | | | kHz |
| t _r | Rise time | | I _F = 10 mA, R _L = 1 kΩ, I _F (MODULATION) = ±2 mA | | 1.75 | | | μs |
| t _f | Fall time | | I _F = 10 mA, R _L = 1 kΩ, I _F (MODULATION) = ±2 mA | | 1.75 | | | μs |
| V _{iso} † | Peak Isolation voltage | | I _{IO} = 10 μA, f = 60 Hz, time = 1 minute | | 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), 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 ($\Delta K3$) is the percent deviation of the transfer gain $K3$ as a function of LED input current (I_F) or the package temperature.

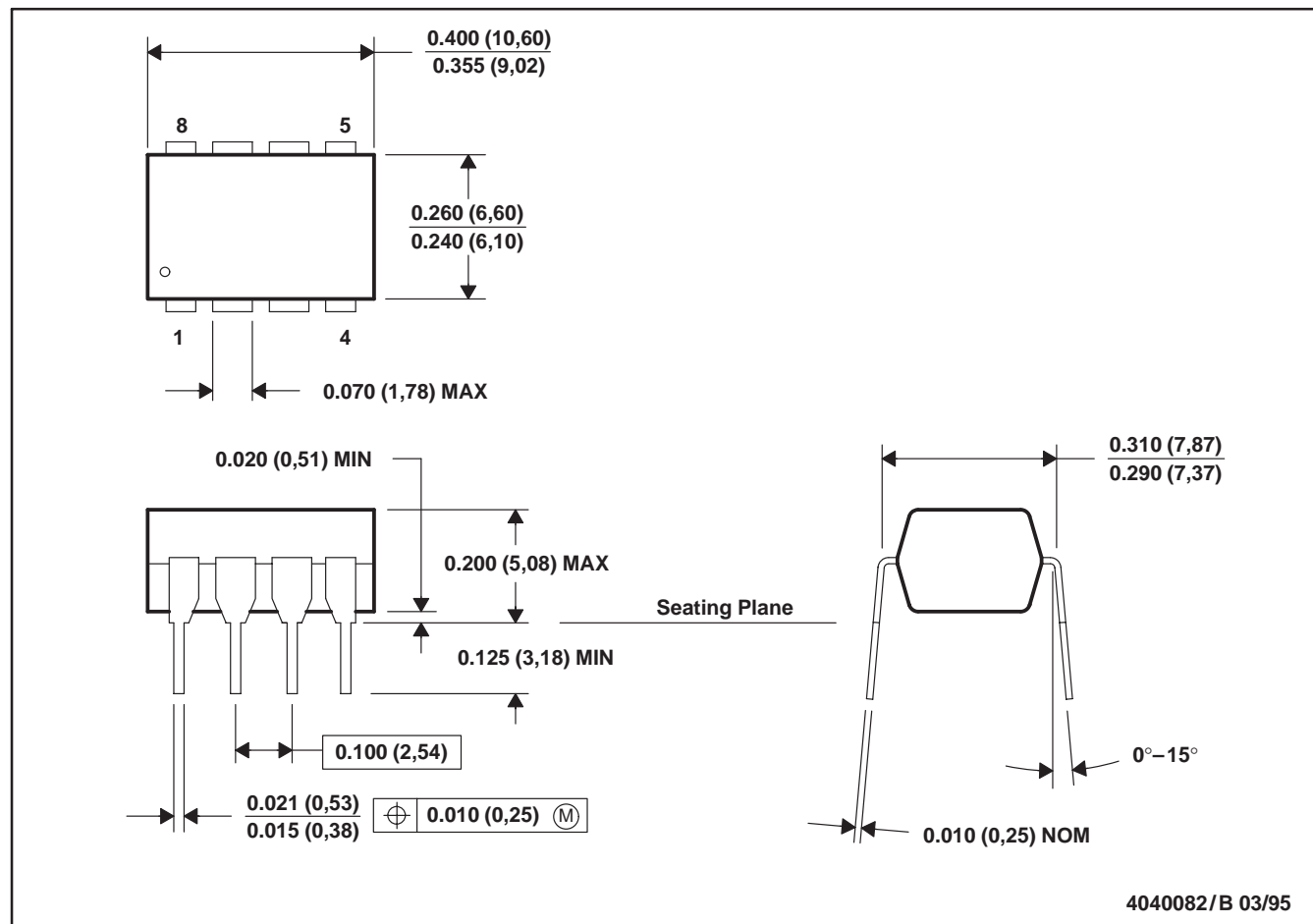
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MECHANICAL DATA

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

PACKAGING INFORMATION

| Orderable Device | Status ⁽¹⁾ | Package Type | Package Drawing | Pins | Package Qty | Eco Plan ⁽²⁾ | Lead/Ball Finish | MSL Peak Temp ⁽³⁾ |
|------------------|-----------------------|--------------|-----------------|------|-------------|-------------------------|------------------|------------------------------|
| TIL300 | OBSOLETE | PDIP | N | 8 | | TBD | Call TI | Call TI |
| TIL300A | OBSOLETE | PDIP | N | 8 | | TBD | Call TI | Call TI |
| TIL300ADCS | OBSOLETE | OPTO | DCS | 8 | | TBD | Call TI | Call TI |
| TIL300DCS | OBSOLETE | OPTO | DCS | 8 | | TBD | Call TI | Call TI |

⁽¹⁾ 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.

⁽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.

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)

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

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