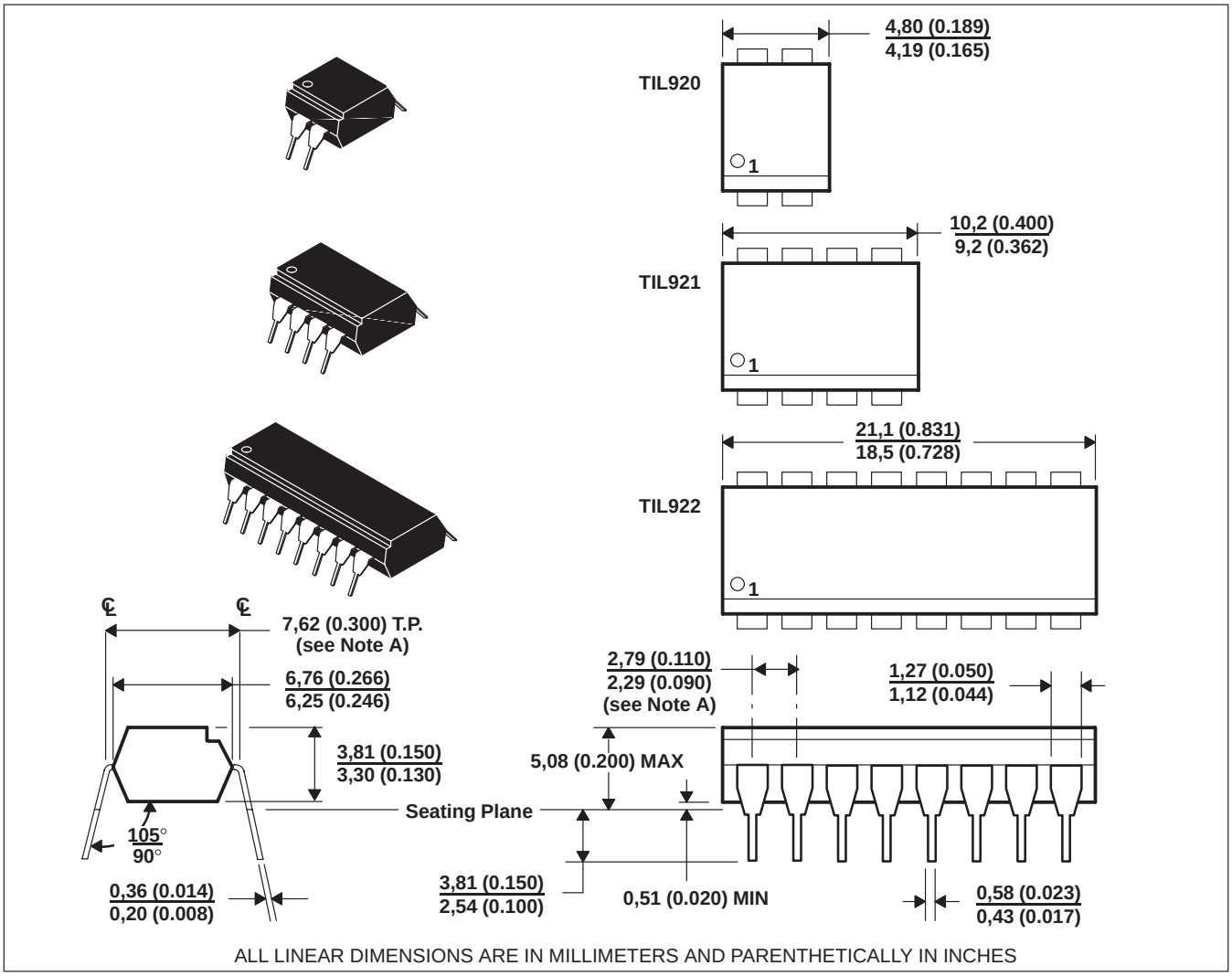
- **AC Signal Input**
- **Gallium-Arsenide Diode Infrared Source**
- **Source Is Optically Coupled to Silicon N-P-N Phototransistor**
- **Choice of One, Two, or Four Channels**
- **Choice of Three Current-Transfer Ratios**
- **High-Voltage Electrical Isolation . . . 7.5 kV Peak (5.3 kV rms)**
- **Plastic Dual-In-Line Packages**
- **UL Listed – File No. 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 TIL920 has one channel in a 4-pin package, the TIL921 has two channels in an 8-pin package, and the TIL922 has four channels in a 16-pin package. The standard devices, TIL920, TIL921, and TIL922, 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.

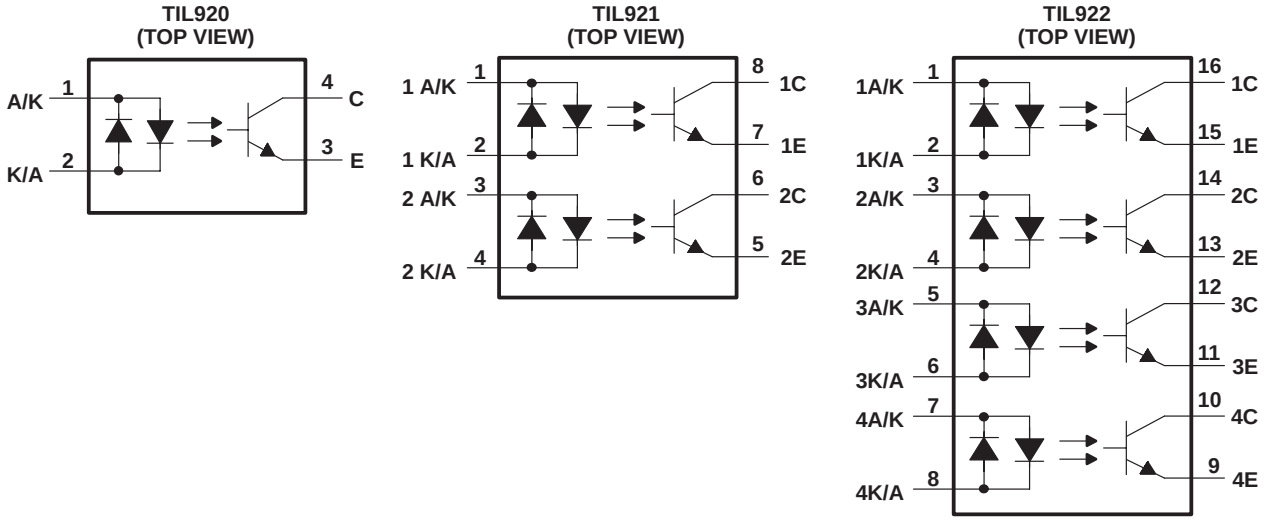
## mechanical data




ALL LINEAR DIMENSIONS ARE IN MILLIMETERS AND PARENTHETICALLY IN INCHES

NOTE A: Each pin centerline is located 0,25 (0.010) of its true longitudinal position.

## schematic diagrams




## absolute maximum ratings, $T_A$ = 25°C (unless otherwise noted)

Input-to-output voltage (see Note 1) . . . . . ±7.5 kV peak or dc (±5.3 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) . . . . . ±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
Operating free-air temperature range, $T_A$ . . . . . –55°C to 100°C
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, $T_A$ = 25°C (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 µA, | $I_F$ = 0 | 7 | | | V |
| $I_{C(off)}$ | Off-state collector current | | $V_{CE}$ = 24 V, | $I_F$ = 0 | | | 100 | nA |
| CTR† | Current transfer ratio | TIL920, TIL921, TIL922 | $I_F$ = 5 mA, | $V_{CE}$ = 5 V | 20% | | | |
| | | TIL920A, TIL921A, TIL922A | | | 50% | | | |
| | | TIL920B, TIL921B, TIL922B | | | 100% | | | |
| $V_F$† | Input diode static forward voltage | | $I_F$ = 20 mA | | | | 1.4 | V |
| $V_{CE(sat)}$† | 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 | | $V_{in-out}$ = ±1 kV, | See Note 6 | | $10^{11}$ | | Ω |
| $I_{C(on)1}$ / $I_{C(on)2}$ | On-state collector current symmetry ratio (see Note 7) | | $V_{CE}$ = 5 V, | $I_F$ = 5 mA | 1 | | 3 | |

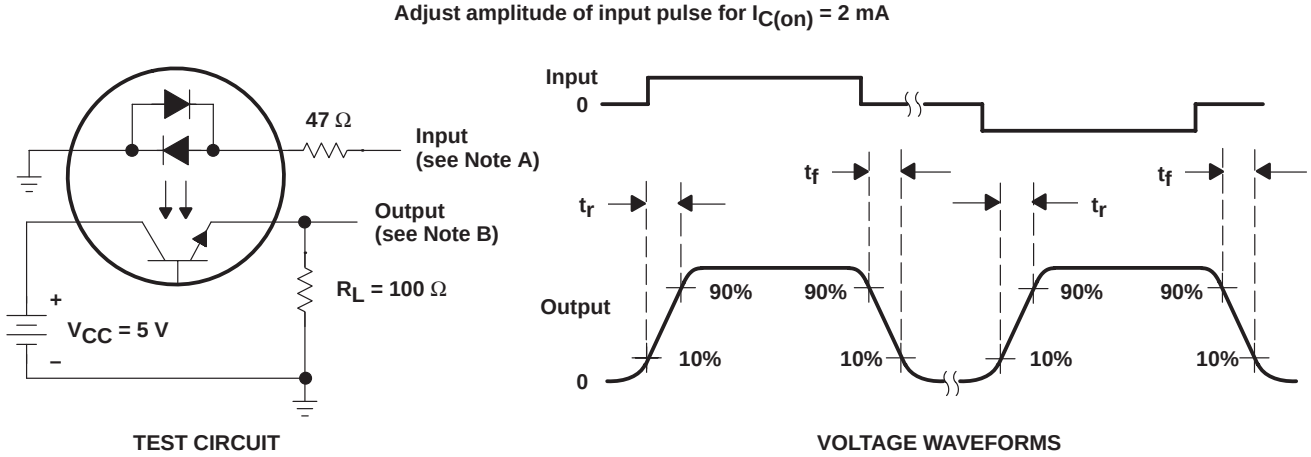
† These parameters apply to either direction of the input current.
NOTES: 6. These parameters are measured between all input-diode leads shorted together and all phototransistor leads shorted together.
7. The higher of the two values of $I_{C(on)}$ generated by the two diodes is taken as $I_{C(on)1}$.

## switching characteristics, $T_A$ = 25°C

| PARAMETER† | | TEST CONDITIONS | TYP | UNIT |
|---|---|---|---|---|
| $t_r$ | Rise time | $V_{CC}$ = 5 V, $I_{C(on)}$ = 2 mA, $R_L$ = 100 Ω, See Figure 1 | 6 | µs |
| $t_f$ | Fall time | | 6 | |

† These parameters apply to either direction of the input current.

## PARAMETER MEASUREMENT INFORMATION




TEST CIRCUIT VOLTAGE WAVEFORMS

NOTES: A. The input waveform is supplied by a generator with the following characteristics: $Z_O$ = 50 Ω, $t_r \le 15$ ns, duty cycle = 1%.
B. The output waveform is monitored on an oscilloscope with the following characteristics: $t_r \le 12$ ns, $R_i \ge 1$ MΩ, $C_i \le 20$ pF.

**Figure 1. Switching Times**

## TYPICAL CHARACTERISTICS

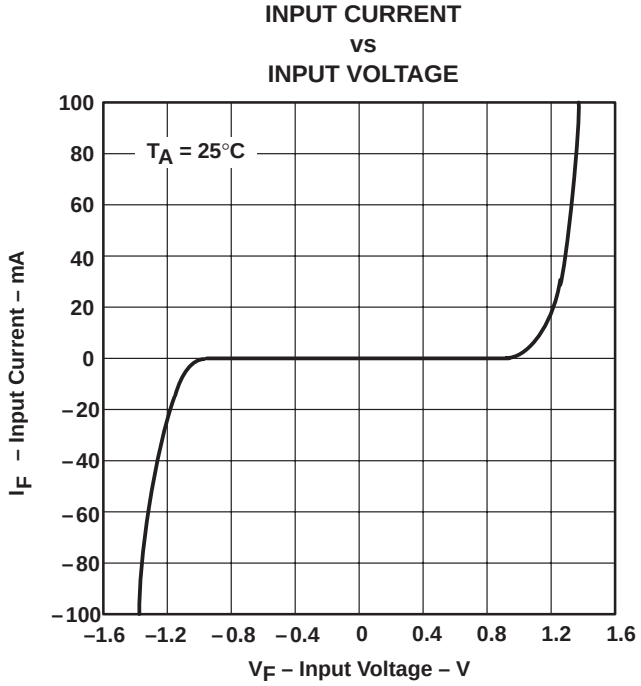



**Figure 2**

## TYPICAL CHARACTERISTICS

**COLLECTOR CURRENT vs COLLECTOR-EMITTER VOLTAGE**

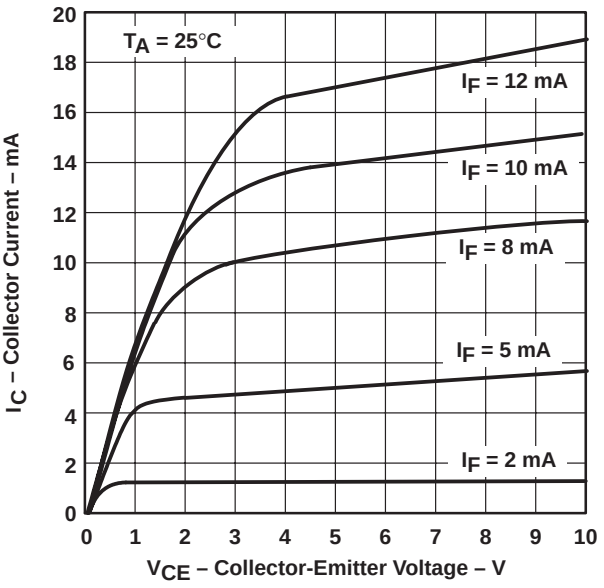



Figure 3

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

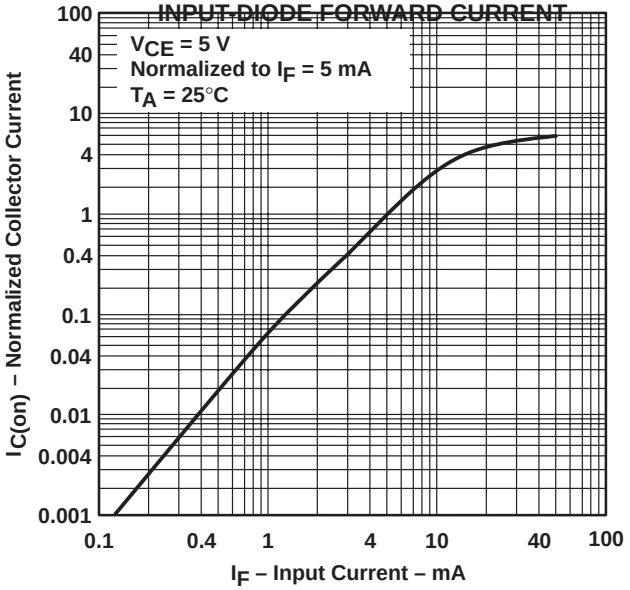



Figure 4

**RELATIVE ON-STATE COLLECTOR CURRENT vs FREE-AIR TEMPERATURE**

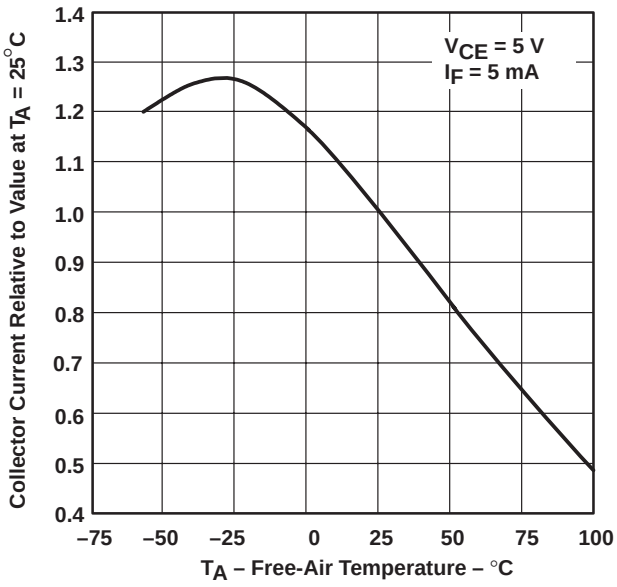



Figure 5

**TYPICAL COLLECTOR-EMITTER SATURATION VOLTA vs FREE-AIR TEMPERATURE**

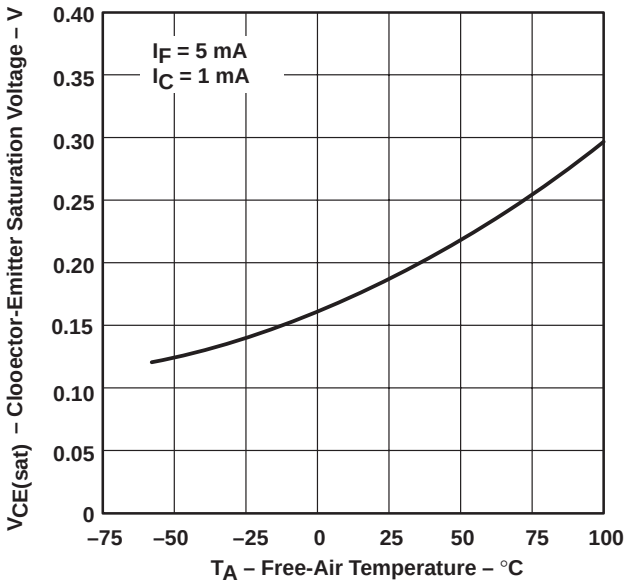



Figure 6

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