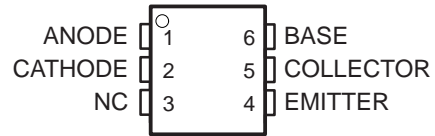


COMPATIBLE WITH STANDARD TTL INTEGRATED CIRCUITS

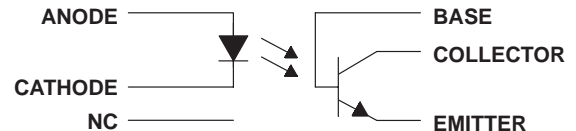
- Gallium-Arsenide-Diode Infrared Source
Optically Coupled to a Silicon npn Phototransistor
- High Direct-Current Transfer Ratio
- High-Voltage Electrical Isolation
1.5-kV, 2.5-kV, or 3.55-kV Rating
- High-Speed Switching
 $t_r = 7 \mu\text{s}$, $t_f = 7 \mu\text{s}$ Typical
- Typical Applications Include Remote Terminal Isolation, SCR and Triac Triggers, Mechanical Relays and Pulse Transformers
- Safety Regulatory Approval
UL/CUL, File No. E65085

DCJT† OR 6-TERMINAL DUAL-IN-LINE PACKAGE
(TOP VIEW)



†4N35 only
NC – No internal connection

schematic



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

| | | |
|---|------|----------------|
| Input-to-output peak voltage (8-ms half sine wave): | 4N35 | 3.55 kV |
| | 4N36 | 2.5 kV |
| | 4N37 | 1.5 kV |
| Input-to-output root-mean-square voltage (8-ms half sine wave): | 4N35 | 2.5 kV |
| | 4N36 | 1.75 kV |
| | 4N37 | 1.05 kV |
| Collector-base voltage | | 70 V |
| Collector-emitter voltage (see Note 1) | | 30 V |
| Emitter-base voltage | | 7 V |
| Input-diode reverse voltage | | 6 V |
| Input-diode forward current: | | |
| Continuous | | 60 mA |
| Peak (1 μs , 300 pps) | | 3 A |
| Phototransistor continuous collector current | | 100 mA |
| Continuous total power dissipation at (or below) 25°C free-air temperature: | | |
| Infrared-emitting diode (see Note 2) | | 100 mW |
| Phototransistor (see Note 3) | | 300 mW |
| Continuous power dissipation at (or below) 25°C lead temperature: | | |
| Infrared-emitting diode (see Note 4) | | 100 mW |
| Phototransistor (see Note 5) | | 500 mW |
| Operating temperature range, T_A | | -55°C to 100°C |
| Storage temperature range, T_{stg} | | -55°C to 150°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 conditions is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

- NOTES:
1. This value applies when the base-emitter diode is open-circuited.
 2. Derate linearly to 100°C free-air temperature at the rate of 1.33 mW/°C.
 3. Derate linearly to 100°C free-air temperature at the rate of 4 mW/°C.
 4. Derate linearly to 100°C lead temperature at the rate of 1.33 mW/°C. Lead temperature is measured on the collector lead 0.8 mm (1/32 inch) from the case.
 5. Derate linearly to 100°C lead temperature at the rate of 6.7 mW/°C.



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.

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.

 **TEXAS
INSTRUMENTS**

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4N35, 4N36, 4N37 OPTOCOUPERS

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

| PARAMETER | | TEST CONDITIONS | MIN | TYP | MAX | UNIT |
|---------------|--|--|--------------------|-----|------|----------|
| $V_{(BR)CBO}$ | Collector-base breakdown voltage | $I_C = 100 \mu A, I_E = 0, I_F = 0$ | 70† | | | V |
| $V_{(BR)CEO}$ | Collector-emitter breakdown voltage | $I_C = 10 mA, I_B = 0, I_F = 0$ | 30† | | | V |
| $V_{(BR)EBO}$ | Emitter-base breakdown voltage | $I_E = 100 \mu A, I_C = 0, I_F = 0$ | 7† | | | V |
| I_R | Input diode static reverse current | $V_R = 6 V$ | | | 10† | μA |
| I_{IO} | Input-to-output current | $V_{IO} = \text{rated peak value}, t = 8 ms$ | | | 100 | mA |
| $I_{C(on)}$ | On-state collector current | $V_{CE} = 10 V, I_F = 10 mA, I_B = 0$ | 10† | | | mA |
| | | $V_{CE} = 10 V, I_F = 10 mA, I_B = 0, T_A = -55^\circ C$ | 4† | | | |
| | | $V_{CE} = 10 V, I_F = 10 mA, I_B = 0, T_A = 100^\circ C$ | 4† | | | |
| $I_{C(off)}$ | Off-state collector current | $V_{CE} = 10 V, I_F = 0, I_B = 0$ | | 1 | 50 | nA |
| | | $V_{CE} = 30 V, I_F = 0, I_B = 0, T_A = 100^\circ C$ | | | 500† | μA |
| h_{FE} | Transistor static forward current transfer ratio | $V_{CE} = 5 V, I_C = 10 mA, I_F = 0$ | | 500 | | |
| V_F | Input diode static forward voltage | $I_F = 10 mA$ | 0.8† | | 1.5† | V |
| | | $I_F = 10 mA, T_A = -55^\circ C$ | 0.9† | | 1.7† | |
| | | $I_F = 10 mA, T_A = 100^\circ C$ | 0.7† | | 1.4† | |
| $V_{CE(sat)}$ | Collector-emitter saturation voltage | $I_C = 0.5 mA, I_F = 10 mA, I_B = 0 mA$ | | | 0.3† | V |
| r_{IO} | Input-to-output internal resistance | $V_{IO} = 500 V, \text{ See Note 6}$ | 10 ¹¹ † | | | Ω |
| C_{io} | Input-to-output capacitance | $V_{IO} = 0, f = 1 MHz, \text{ See Note 6}$ | | 1 | 2.5† | pF |

† JEDEC registered data

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

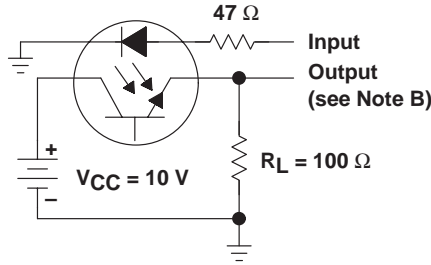
switching characteristics at 25°C free-air temperature†

| PARAMETER | | TEST CONDITIONS | MIN | TYP | MAX | UNIT |
|-----------|---------------|--|-----|-----|-----|---------|
| t_{on} | Time-on time | $V_{CC} = 10 V, I_{C(on)} = 2 mA,$ | | 7 | 10 | μs |
| t_{off} | Turn-off time | $R_L = 100 \Omega, \text{ See Figure 1}$ | | 7 | 10 | |

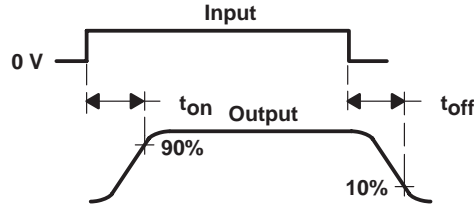
† JEDEC registered data



PARAMETER MEASUREMENT INFORMATION



TEST CIRCUIT



VOLTAGE WAVEFORMS

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

Figure 1. Switching Times

TYPICAL CHARACTERISTICS

OFF-STATE COLLECTOR CURRENT
vs
FREE-AIR TEMPERATURE

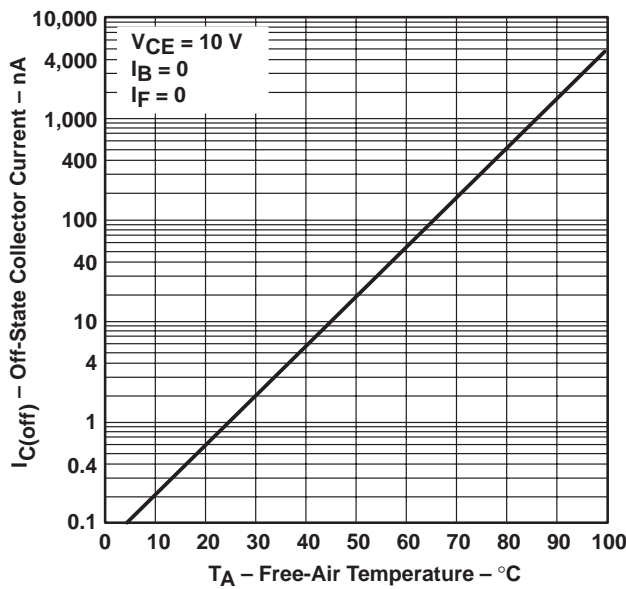


Figure 2

TRANSISTOR STATIC FORWARD
CURRENT TRANSFER RATIO (NORMALIZED)
vs
ON-STATE COLLECTOR CURRENT

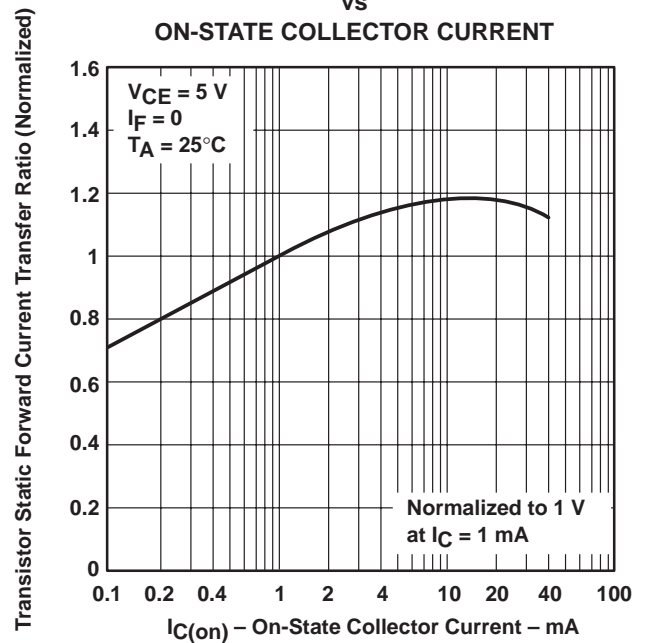


Figure 3

TYPICAL CHARACTERISTICS

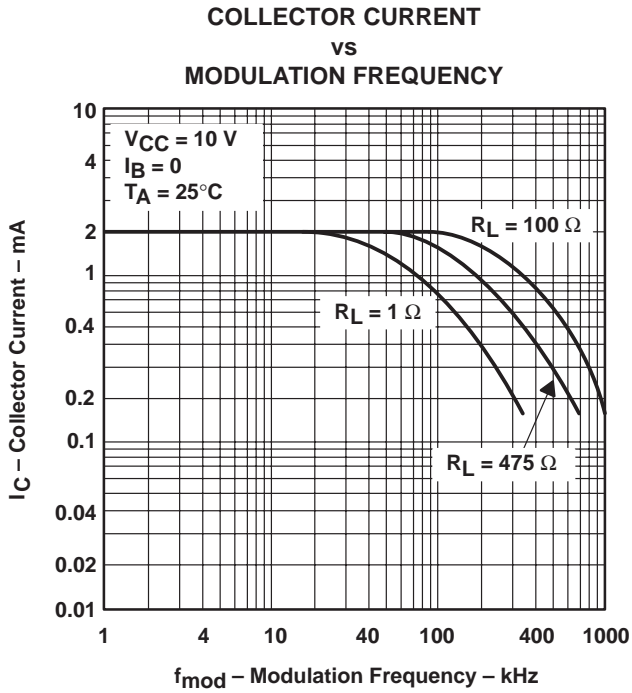


Figure 4

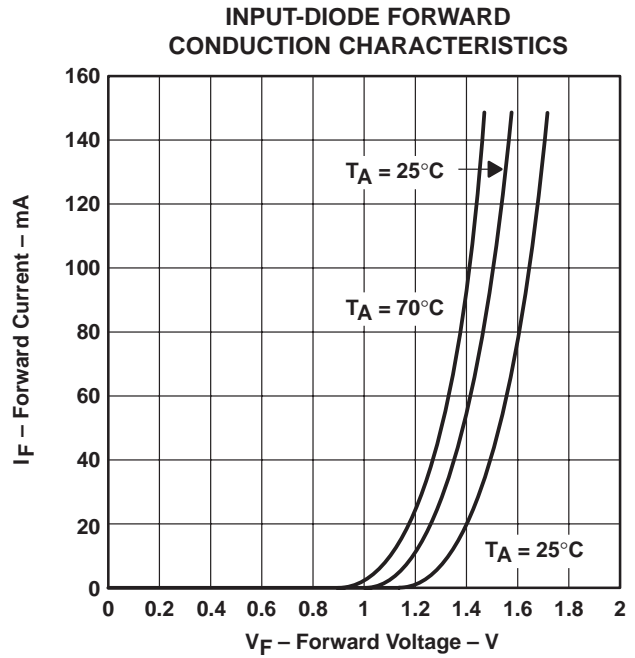


Figure 5

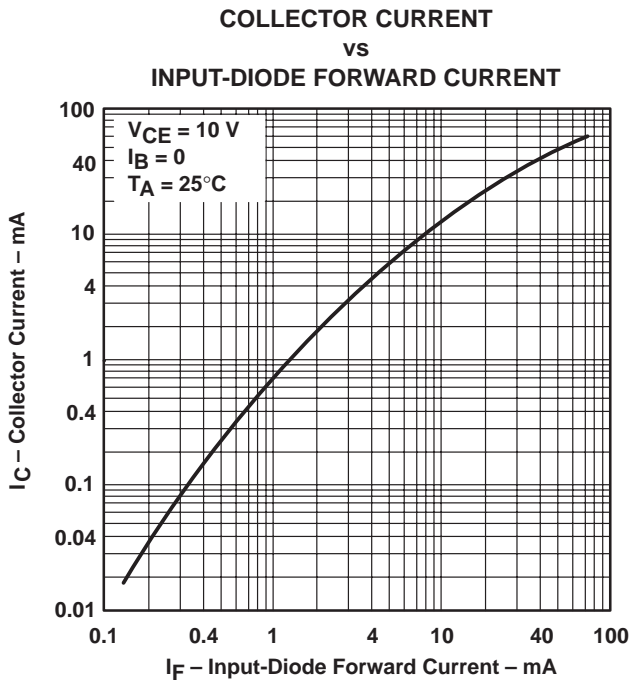
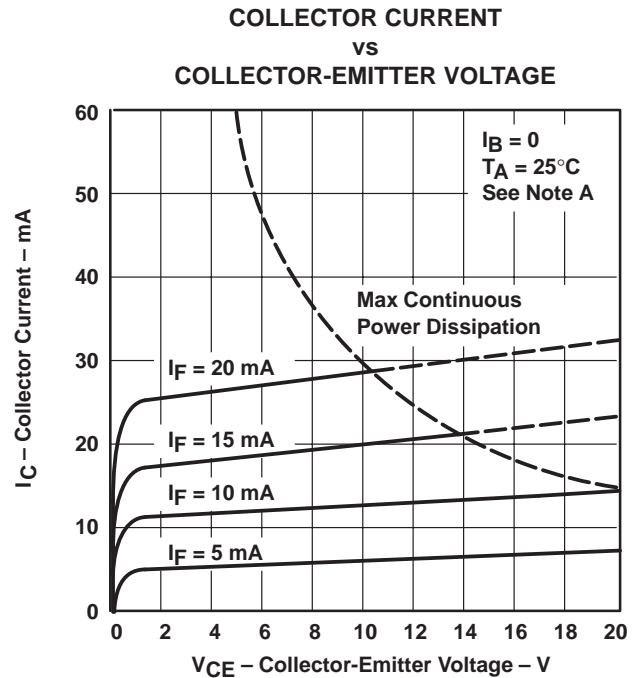


Figure 6



NOTE A. Pulse operation of input diode is required for operation beyond limits shown by dotted lines.

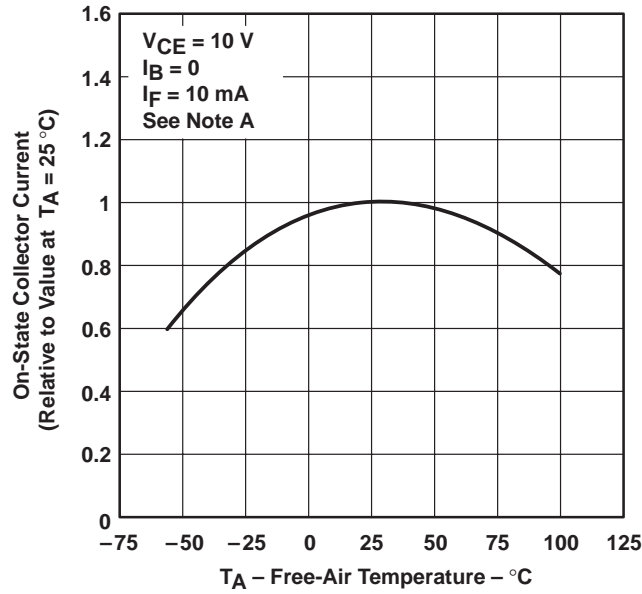
Figure 7

TYPICAL CHARACTERISTICS

ON-STATE COLLECTOR CURRENT
(RELATIVE TO VALUE AT 25°C)

vs

FREE-AIR TEMPERATURE



NOTE A. These parameters were measured using pulse techniques, $t_w = 1\text{ ms}$, duty cycle $\leq 2\%$.

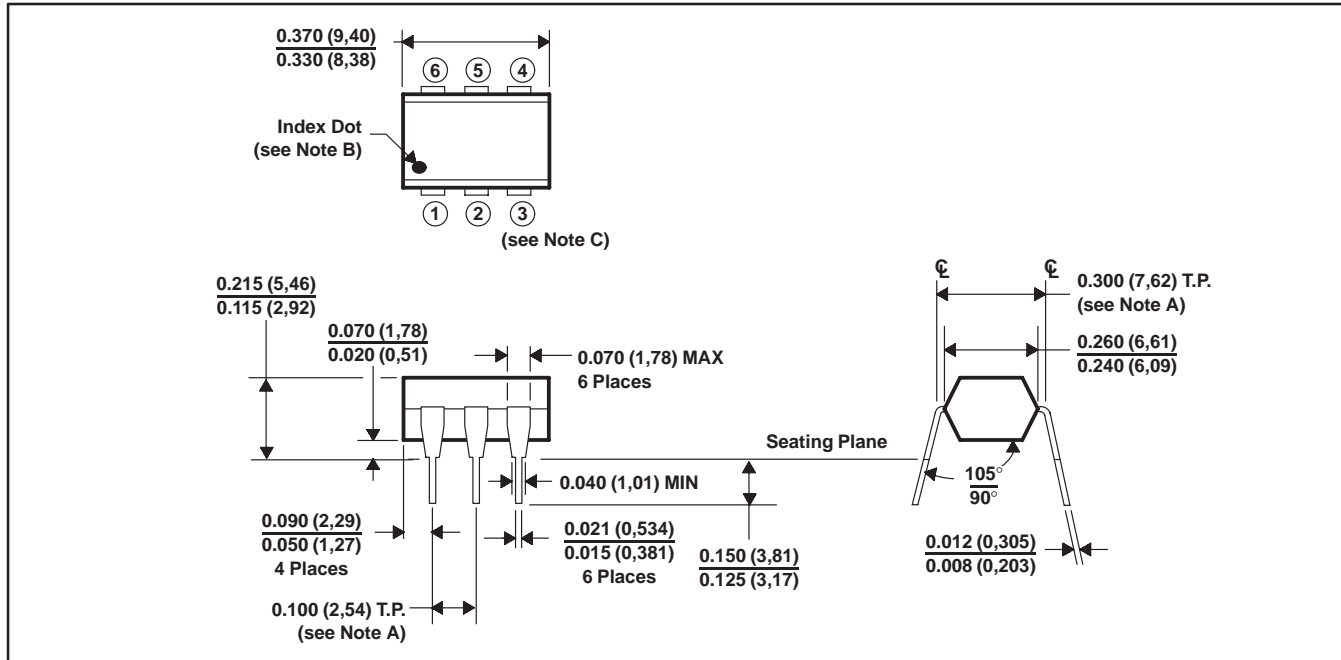
Figure 8

4N35, 4N36, 4N37 OPTOCOUPERS

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APPLICATION INFORMATION

The devices consist of a gallium-arsenide infrared-emitting diode and an npn silicon phototransistor. Each device is available in a 6-terminal plastic dual-in-line package, shown in Figure 9, or in a DCJ plastic dual surface-mount optocoupler package (see Mechanical Data).



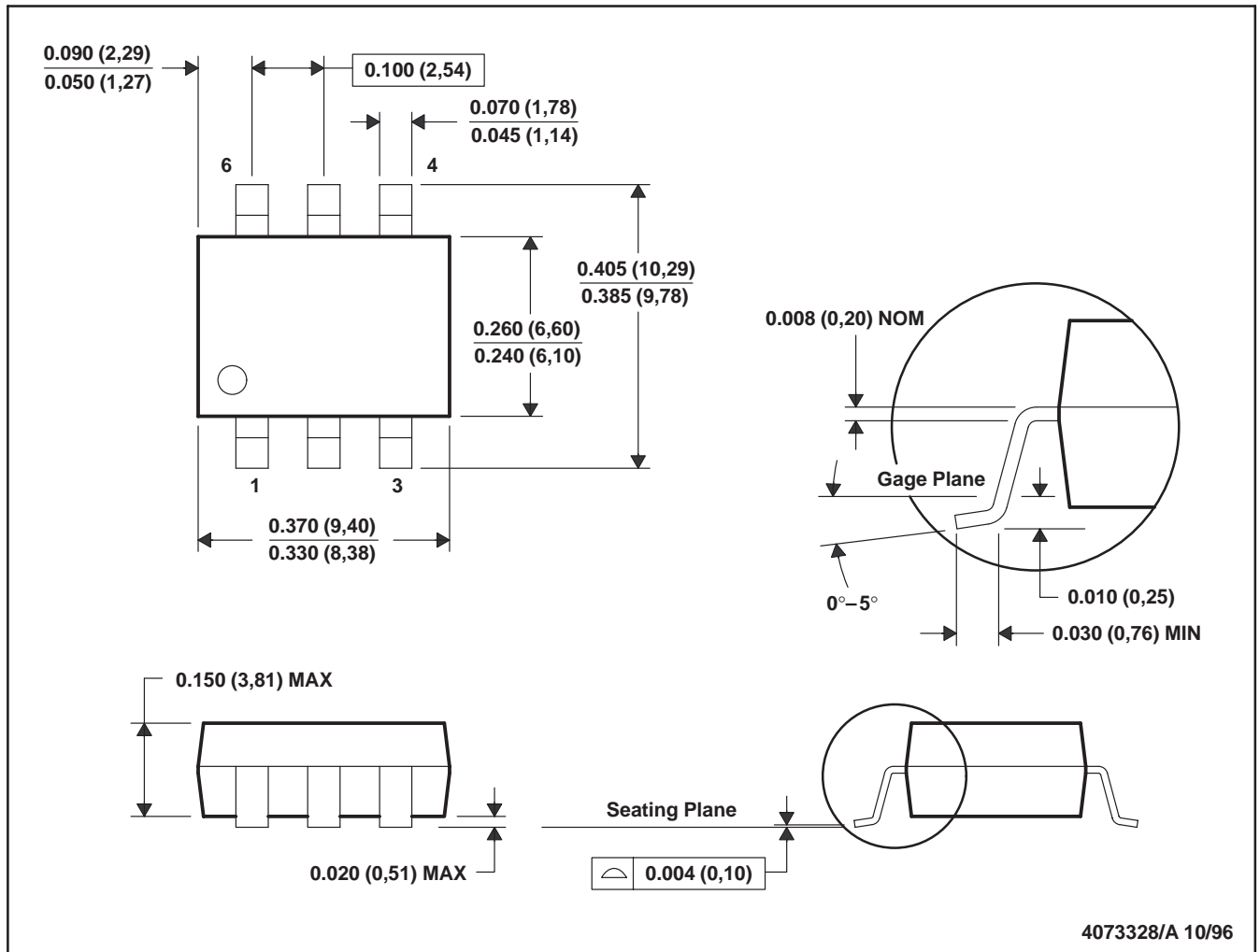
- NOTES: A. Terminals are within 0.005 (0,13) radius of true position (T.P.) with maximum material condition and unit installed.
 B. Terminal 1 identified by index dot.
 C. The dimensions given fall within JEDEC MO-001 AM dimensions.
 D. All linear dimensions are in inches (millimeters).

Figure 9. Plastic Dual-in-Line Package

MECHANICAL DATA

DCJ (R-PDSO-G6)

PLASTIC DUAL SMALL-OUTLINE OPTOCOUPLER



- NOTES: A. All linear dimensions are in inches (millimeters)
 B. This drawing is subject to change without notice.
 C. Terminal 1 identified by index dot.

PACKAGING INFORMATION

| Orderable Device | Status ⁽¹⁾ | Package Type | Package Drawing | Pins | Package Qty | Eco Plan ⁽²⁾ | Lead/Ball Finish | MSL Peak Temp ⁽³⁾ |
|------------------|-----------------------|--------------|-----------------|------|-------------|-------------------------|------------------|------------------------------|
| 4N35 | OBSOLETE | PDIP | N | 6 | | TBD | Call TI | Call TI |
| 4N35DCJ | OBSOLETE | OPTO | DCJ | 6 | | TBD | Call TI | Call TI |
| 4N36 | OBSOLETE | PDIP | N | 6 | | TBD | Call TI | Call TI |
| 4N37 | OBSOLETE | PDIP | N | 6 | | 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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