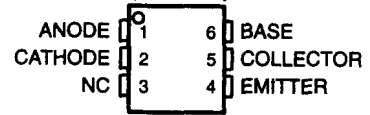


COMPATIBLE WITH STANDARD TTL INTEGRATED CIRCUITS

- 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
- Plastic Dual-In-Line Package
- High-Speed Switching
 $t_r = 7 \mu s$, $t_f = 7 \mu s$ Typical
- Typical Applications Include Remote Terminal
Isolation, SCR and Triac Triggers, Mechanical
Relays and Pulse Transformers

4N35, 4N36, OR 4N37 . . . PACKAGE
(TOP VIEW)



NC – No internal connection

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 mA
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 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.

‡ JEDEC registered data. This data sheet contains all applicable registered data in effect at the time of publication.

- 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.

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.



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	$V_{IO} = \text{rated peak value}, t = 8 \text{ ms}$			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	$V_{IO} = 0, f = 1 \text{ MHz}, \text{ See Note 6}$		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.

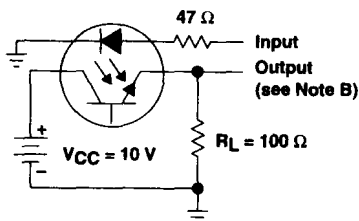
switching characteristics at 25°C free-air temperature†

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

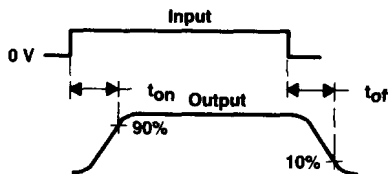
† JEDEC registered data



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: $t_f \leq 12 \text{ ns}$, $R_{in} \geq 1 \text{ M}\Omega$, $C_{in} \leq 20 \text{ pF}$

Figure 1. Switching Times

TYPICAL CHARACTERISTICS

OFF-STATE COLLECTOR CURRENT
vs
FREE-AIR TEMPERATURE

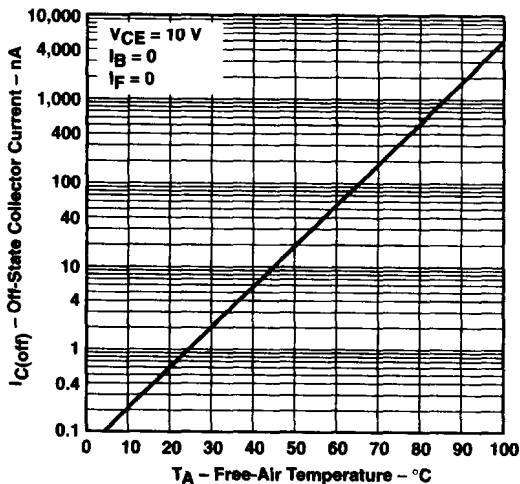


Figure 2

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

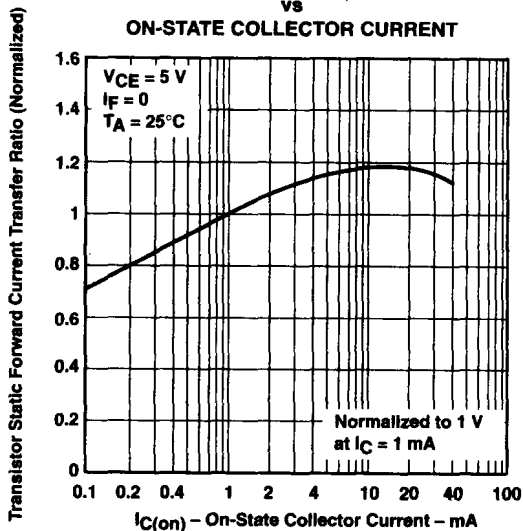
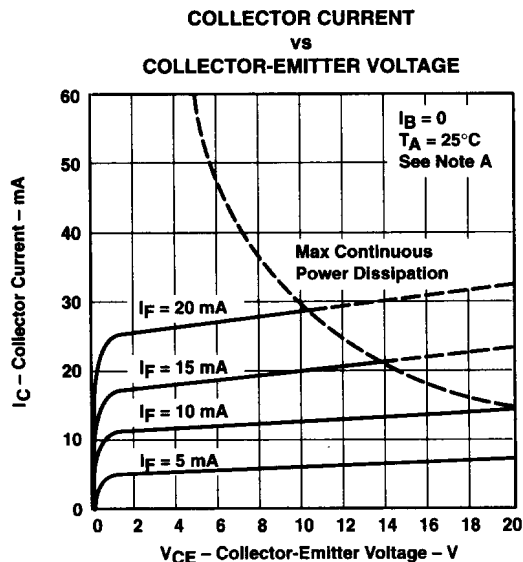
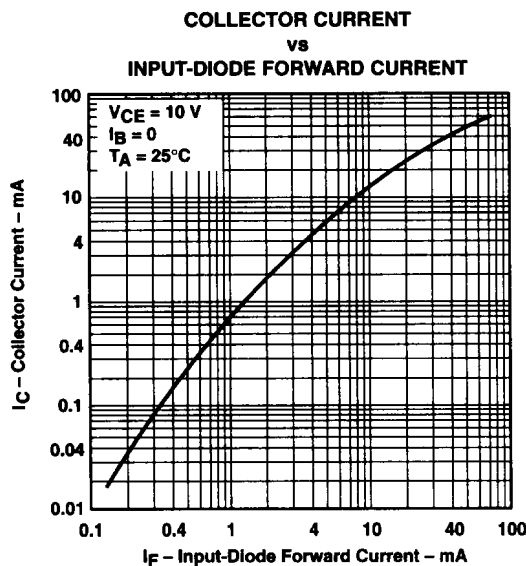
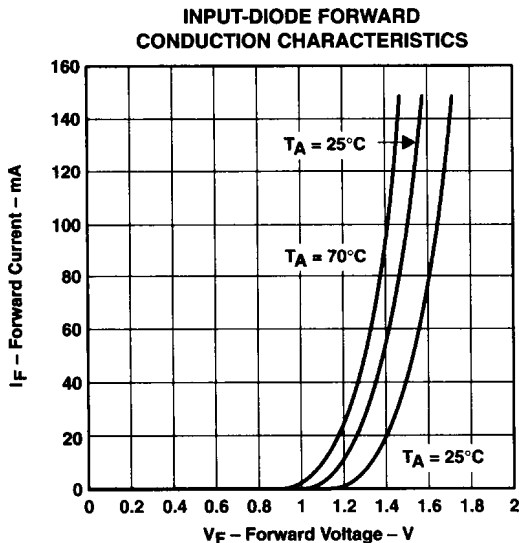
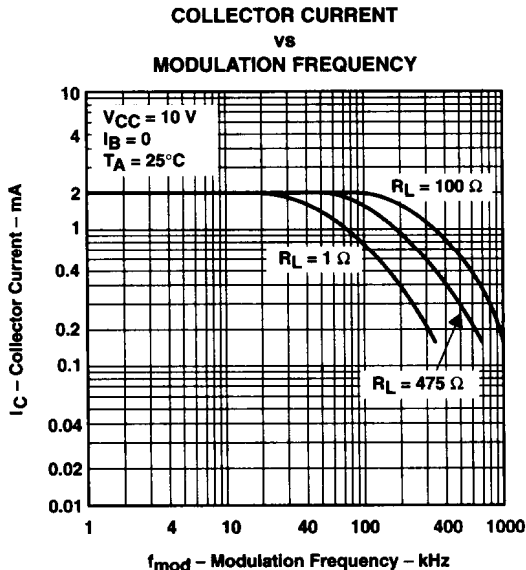


Figure 3

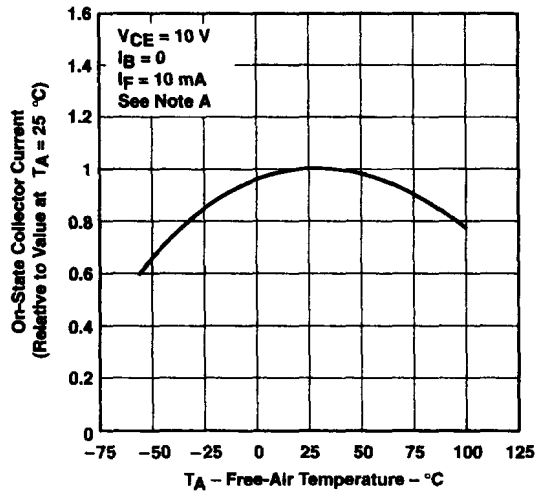
TYPICAL CHARACTERISTICS



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

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, $t_w = 1$ ms, duty cycle $\leq 2\%$.

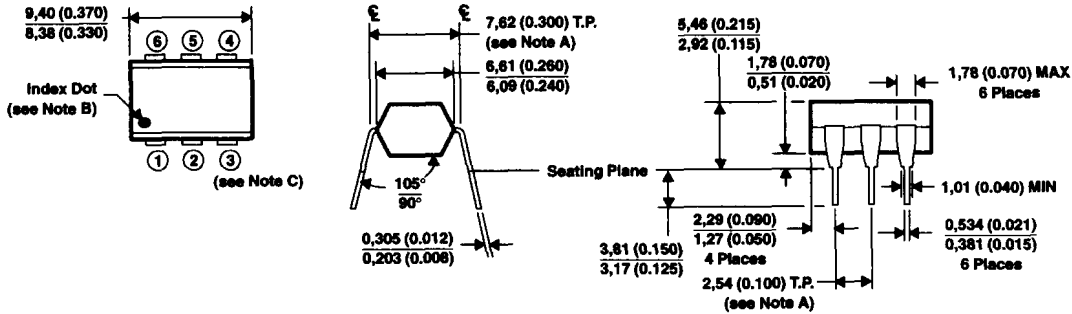
Figure 8

4N35, 4N36, 4N37 OPTOCOUPLERS

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MECHANICAL INFORMATION

The package consists of a gallium-arsenide infrared-emitting diode and an npn silicon phototransistor mounted on a 6-lead frame encapsulated within an electrically nonconductive plastic compound. The case can withstand soldering temperature with no deformation and device performance characteristics remain stable when operated in high humidity conditions. Unit weight is approximately 0.52 grams.



- NOTES:
- A. Leads are within 0.13 (0.005) radius of true position (T.P.) with maximum material condition and unit installed.
 - B. Pin 1 identified by index dot.
 - C. Terminal connections:
 1. Anode (part of the infrared-emitting diode)
 2. Cathode (part of the infrared-emitting diode)
 3. No internal connection
 4. Emitter (part of the phototransistor)
 5. Collector (part of the phototransistor)
 6. Base (part of the phototransistor)
 - D. The dimensions given fall within JEDEC MO-001 AM dimensions.
 - E. All linear dimensions are given in millimeters and parenthetically given in inches.

Figure 9. Mechanical Information