

4N22, 4N23, 4N24
OPTOCOUPERS

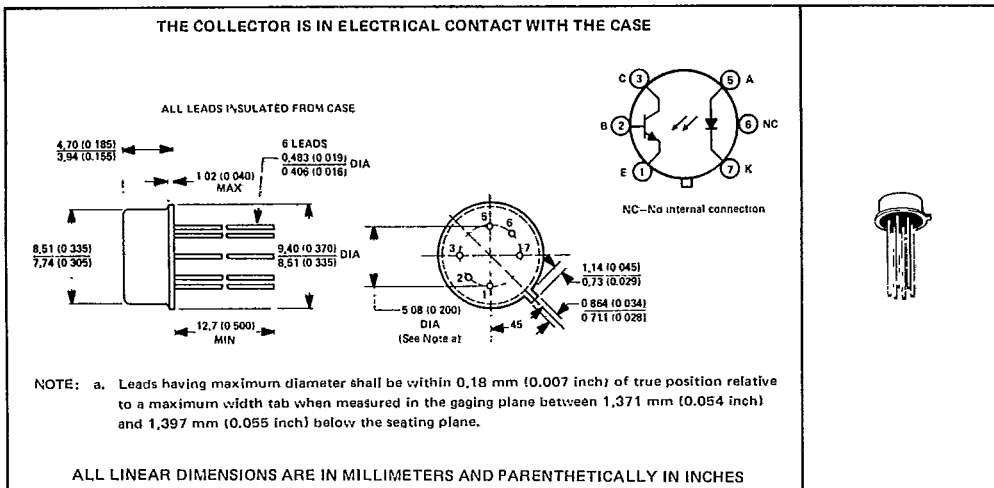
D1424, AUGUST 1973—REVISED APRIL 1987

7-41-83

JEDEC REGISTERED DEVICES
GALLIUM ARSENIDE DIODE INFRARED SOURCE OPTICALLY COUPLED
TO A HIGH-GAIN N-P-N SILICON PHOTOTRANSISTOR

- JAN, JAN TX, JAN TXV Versions Available
- Base Lead Provided for Conventional Transistor Biasing
- High Overall Current Gain . . . 1.5 Typ (4N24)
- High-Gain, High-Voltage Transistor. . . $h_{FE} = 700$ Typ (4N24),
 $V_{(BR)CEO} = 35$ V MIN
- High-Voltage Electrical Isolation . . . 1-kV Rating
- Stable over Wide Temperature Range

*mechanical data



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Optocouplers (Isolators)

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

Input-to-Output Voltage	±1 kV
Collector-Base Voltage	35 V
Collector-Emitter Voltage	35 V
Emitter-Base Voltage	4 V
Input Diode Reverse Voltage	2 V
Input Diode Continuous Forward Current at (or below) 65°C Free-Air Temperature (See Note 1)	40 mA
Continuous Collector Current	50 mA
Peak Diode Current (See Note 2)1A
Continuous Transistor Power Dissipation at (or below) 25°C Free-Air Temperature (See Note 3)	300 mW
Storage Temperature Range	-55°C to 125°C
Lead Temperature 1.6 mm (1/16 Inch) from Case for 10 Seconds	240°C

- NOTES. 1. Derate linearly to 125°C free-air temperature at the rate of 0.67 mA/°C.
2. This value applies for $t_w \leq 1 \mu s$, PRR ≤ 300 pps.
3. Derate linearly to 125°C free-air temperature at the rate of 3 mW/°C.

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

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OPTOCOUPLEDERS

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

PARAMETER	TEST CONDITIONS	4N22			4N23			4N24			UNIT
		MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX	
V(BR)CBO	Collector-Base Breakdown Voltage I _C = 100 μA, I _E = 0, I _F = 0	35			35			35			V
V(BR)CEO	Collector-Emitter Breakdown Voltage I _C = 1 mA, I _B = 0, I _F = 0	35			35			35			V
V(BR)EBO	Emitter-Base Breakdown Voltage I _E = 100 μA, I _C = 0, I _F = 0	4			4			4			V
I _R	Input Diode Static Reverse Current V _R = 2 V	100			100			100			μA
I _{C(on)}	On-State Collector Current V _{CE} = 5 V, I _B = 0, I _F = 2 mA	0.15			0.2			0.4			mA
		1			2.5			4			
		2.5 4			6 8			10 15			
		1			2.5			4			
I _{C(off)}	Off-State Collector Current V _{CE} = 20 V, I _B = 0, I _F = 0	100			100			100			nA
		100			100			100			μA
V _F	Input Diode Static Forward Voltage I _F = 10 mA, T _A = -55°C	1 1.5			1 1.5			1 1.5			V
		0.8 1.3			0.8 1.3			0.8 1.3			
		0.7 1.2			0.7 1.2			0.7 1.2			
V _{CE(sat)}	Collector-Emitter Saturation Voltage I _C = 2.5 mA, I _B = 0, I _F = 20 mA	0.3									V
					0.3						
								0.3			
r _{IO}	Input-to-Output Internal Resistance V _{in-out} = ±1 kV, See Note 5	10 ¹¹			10 ¹¹			10 ¹¹			Ω
C _{IO}	Input-to-Output Capacitance V _{in-out} = 0, f = 1 MHz, See Note 4	5			5			5			pF

*switching characteristics at 25°C free-air temperature

PARAMETER	TEST CONDITIONS	4N22			4N23			4N24			UNIT
		MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX	
t _r	Rise Time V _{CC} = 10 V, I _{F(on)} = 10 mA,	15			15			20			μs
t _f	Fall Time R _L = 100 Ω, See Figure 1	15			15			20			μs

NOTE 4: These parameters are measured between all the input diode leads shorted together and all the phototransistor leads shorted together.

†JEDEC registered data



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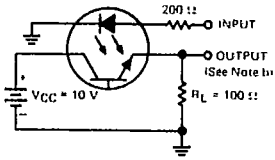
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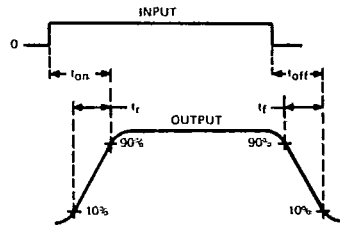
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*PARAMETER MEASUREMENT INFORMATION



TEST CIRCUIT

Adjust amplitude of input pulse for $I_{F(on)} = 10 \text{ mA}$



VOLTAGE WAVEFORMS

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

*JEDEC registered data

FIGURE 1—SWITCHING TIMES

TYPICAL CHARACTERISTICS

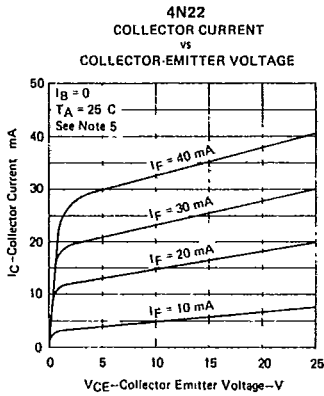


FIGURE 2

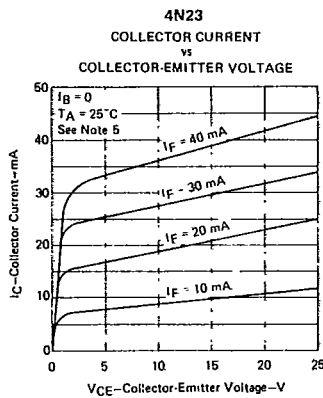


FIGURE 3

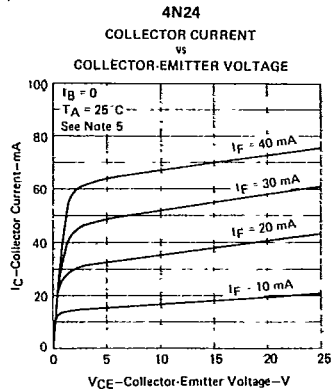


FIGURE 4

NOTE 5 This parameter was measured using pulse techniques, $t_w = 100 \mu\text{s}$, duty cycle = 1%.

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TYPICAL CHARACTERISTICS

INPUT DIODE FORWARD CONDUCTION CHARACTERISTICS

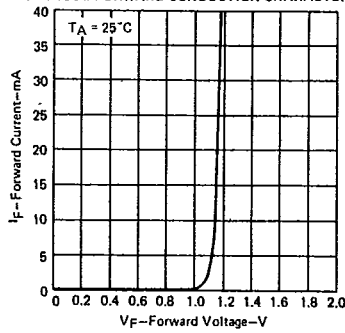


FIGURE 5

NORMALIZED ON STATE COLLECTOR CURRENT[†]
vs
FREE-AIR TEMPERATURE

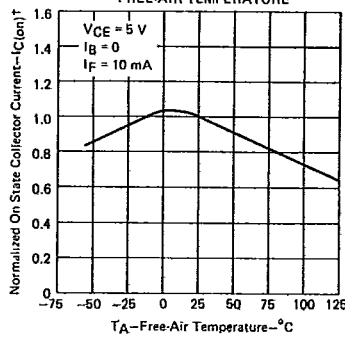


FIGURE 6

PHOTOTRANSISTOR COLLECTOR CURRENT
vs
INPUT-DIODE FORWARD CURRENT

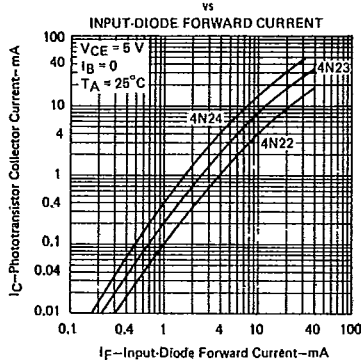


FIGURE 7

OFF-STATE COLLECTOR CURRENT
vs
FREE-AIR TEMPERATURE

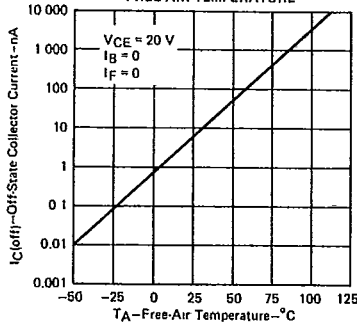


FIGURE 8

AVERAGE SWITCHING TIME
vs
LOAD RESISTANCE

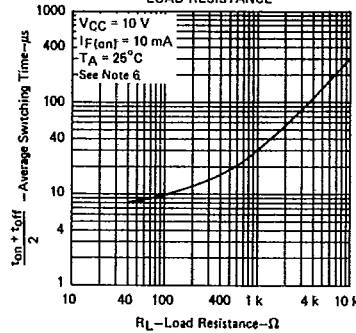


FIGURE 9

NOTE 6: This parameter was measured in the test circuit of Figure 1 with R_L varied between 40 Ω and 10 k Ω .



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