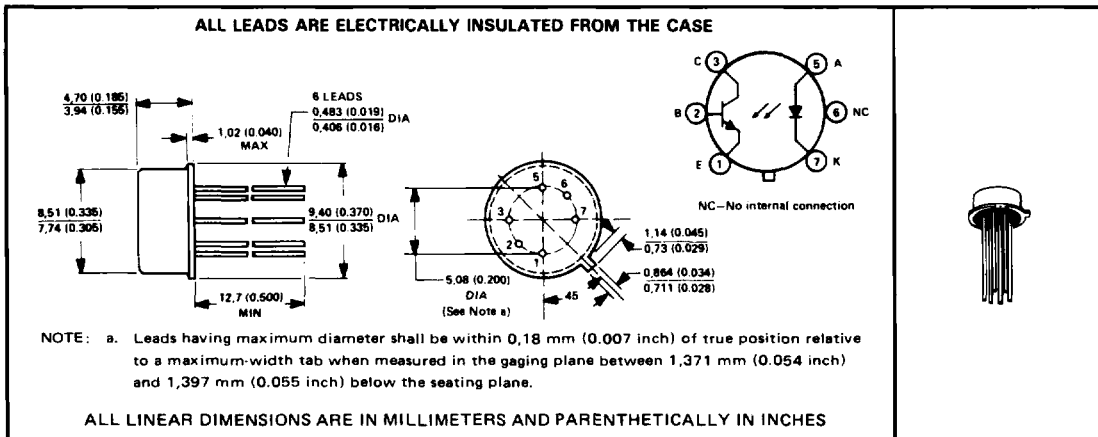


JEDEC REGISTERED DEVICES
 GALLIUM ARSENIDE DIODE INFRARED SOURCE OPTICALLY COUPLED
 TO A HIGH-GAIN N-P-N SILICON PHOTOTRANSISTOR

- Both Input and Output Circuits Are Isolated from the Can
- Base Lead Provided for Conventional Transistor Biasing
- High Overall Current Gain . . . 1.5 Typ (4N24A)
- High-Gain, High-Voltage Transistor . . . $h_{FE} = 700$ Typ (4N24A),
 $V_{(BR)CEO} = 35$ V Min
- High-Voltage Electrical Isolation . . . 1-kV Rating
- Stable over Wide Temperature Range
- Qualified to MIL-S-19500/486A

*mechanical data



*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)	1 A
Continuous transistor power dissipation at (or below) 25°C free-air temperature (see Note 3)	300 mW
Operating free-air temperature range	-55°C to 125°C
Storage temperature range	-55°C to 125°C
Lead temperature 1,6 mm (1/16 inch) from case for 10 seconds	240°C

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

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

PRODUCTION DATA documents contain information 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.



4N22A, 4N23A, 4N24A JAN, JANTX, AND JANTXV OPTOCOUPLEDERS

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

PARAMETER	TEST CONDITIONS	4N22A		4N23A		4N24A		UNIT
		MIN	TYP	MAX	MIN	TYP	MAX	
*V _{BRICBO}	Collector-base breakdown voltage I _C = 100 μA, I _E = 0, I _F = 0	35		35		35		V
*V _{BRICEO}	Collector-emitter breakdown voltage I _C = 1 mA, I _B = 0, I _F = 0	35		35		35		V
*V _{BRIEBO}	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
†h _{FE}	Transistor static forward current transfer ratio V _{CE} = 5 V, I _C = 10 mA, I _F = 0	200		300		400 700		
*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 4	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

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

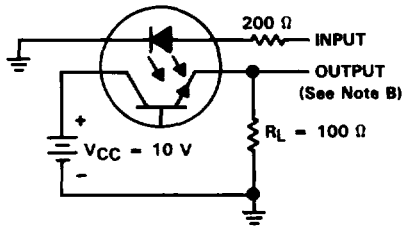
*switching characteristics at 25°C free-air temperature

PARAMETER	TEST CONDITIONS	4N22A		4N23A		4N24A		UNIT
		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

* JEDEC registered data

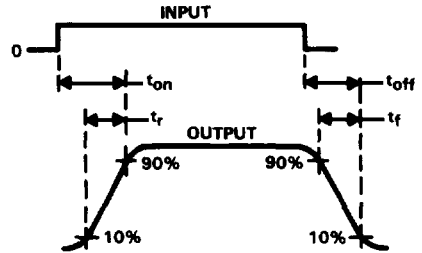
† The h_{FE} specification is a requirement of MIL-S-19500/486A and is not JEDEC registered.

***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 = 1%.
 B. Waveforms are monitored on an oscilloscope with the following characteristics: $t_r \leq 12 \text{ ns}$, $R_{in} \geq 1 \text{ M}\Omega$, $C_{in} \leq 20 \text{ pF}$.
 * JEDEC registered data

FIGURE 1. SWITCHING TIMES

TYPICAL CHARACTERISTICS

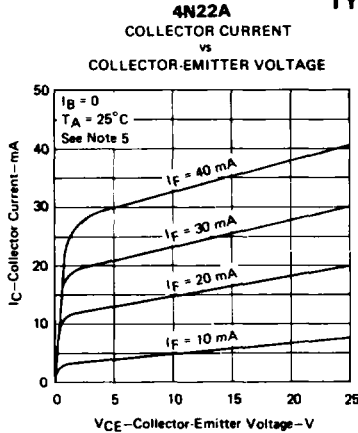


FIGURE 2

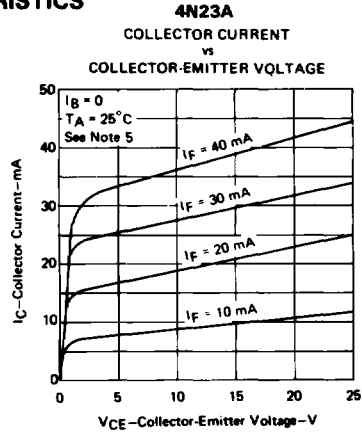


FIGURE 3

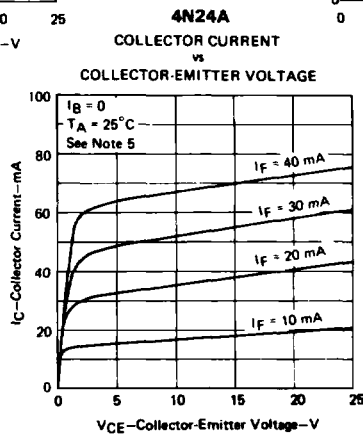


FIGURE 4

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

4N22A, 4N23A, 4N24A JAN, JANTX, AND JANTXV OPTOCOPLERS

TYPICAL CHARACTERISTICS

INPUT DIODE FORWARD CONDUCTION CHARACTERISTICS

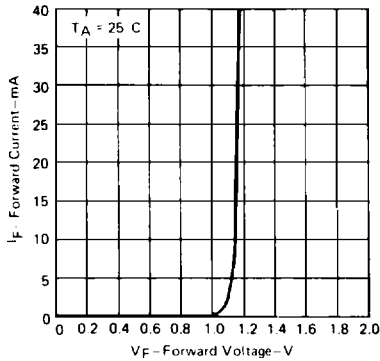


FIGURE 5

NORMALIZED ON-STATE COLLECTOR CURRENT[†]

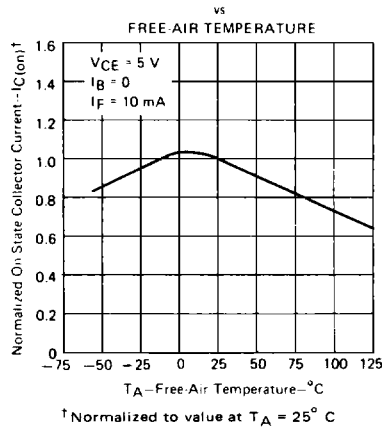


FIGURE 6

PHOTOTRANSISTOR COLLECTOR CURRENT

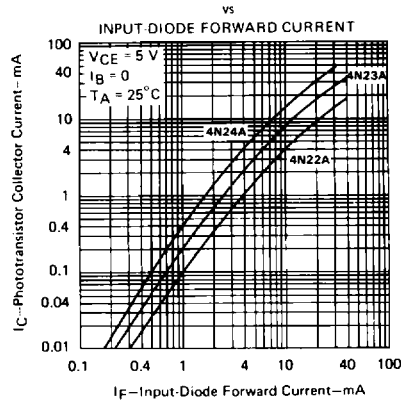


FIGURE 7

OFF-STATE COLLECTOR CURRENT

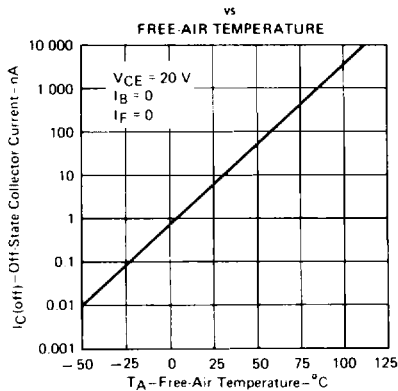


FIGURE 8

AVERAGE SWITCHING TIME

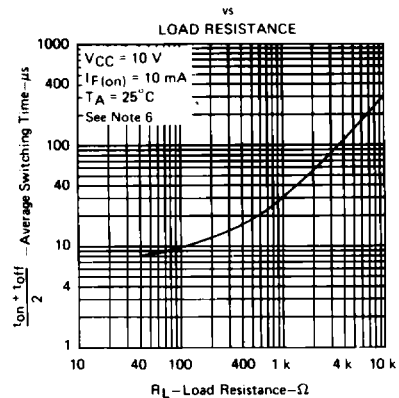


FIGURE 9

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