

4N25, 4N26, 4N27, 4N28 OPTOCOUPERS

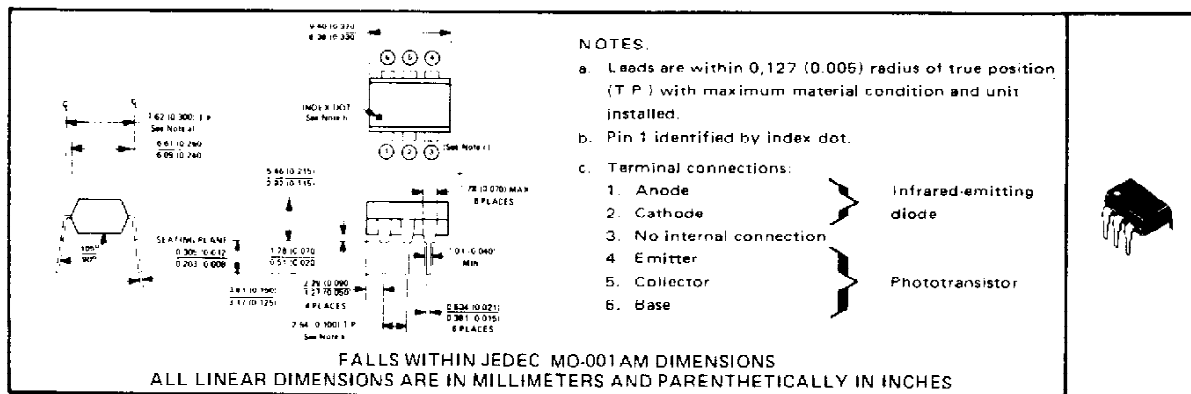
SOOS035 D2493 SEPTEMBER 1978 - REVISED MARCH 1983

COMPATIBLE WITH STANDARD TTL INTEGRATED CIRCUITS

- Gallium Arsenide Diode Infrared Source Optically Coupled to a Silicon N-P-N Phototransistor
- High Direct-Current Transfer Ratio
- High-Voltage Electrical Isolation . . . 2.5-kV, 1.5-kV, or 0.5-kV Rating
- Plastic Dual-In-Line Package
- High-Speed Switching . . . $t_r = 2 \mu s$, $t_f = 2 \mu s$ Typical

mechanical data

The package consists of a gallium arsenide infrared-emitting diode and an n-p-n silicon phototransistor mounted on a 6-lead frame encapsulated within an electrically nonconductive plastic compound. The case will 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.



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

*Peak Input-to-Output Voltage:	4N25	± 2.5 kV
	4N26, 4N27	± 1.5 kV
	4N28	± 0.5 kV
*Collector-Base Voltage		70 V
*Collector-Emitter Voltage (See Note 1)		30 V
*Emitter-Collector Voltage		7 V
Emitter-Base Voltage		7 V
*Input-Diode Reverse Voltage		3 V
*Input-Diode Continuous Forward Current at (or below) 25°C Free-Air Temperature (See Note 2)		80 mA
*Input-Diode Peak Forward Current ($t_W = 300 \mu s$, duty cycle = 2%)		3 A
*Continuous Power Dissipation at (or below) 25°C Free-Air Temperature:		
Infrared-Emitting Diode (See Note 3)		150 mW
Phototransistor (See Note 3)		150 mW
Total, Infrared-Emitting Diode plus Phototransistor (See Note 4)		250 mW
*Storage Temperature Range		- 55°C to 150°C
*Lead Temperature 1,6 mm (1/16 inch) from Case for 10 Seconds		260°C

*JEDEC registered data. This data sheet contains all applicable JEDEC-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 mA/°C.
3. Derate linearly to 100 °C free-air temperature at the rate of 2 mW/°C.
4. Derate linearly to 100 °C free-air temperature at the rate of 3.33 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.

TEXAS
INSTRUMENTS

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

PARAMETER	TEST CONDITIONS	4N25, 4N26			4N27, 4N28			UNIT
		MIN	TYP	MAX	MIN	TYP	MAX	
*V _{BRICBO} Collector-Base Breakdown Voltage	I _C = 100 µA, I _E = 0, I _F = 0	70			70			V
*V _{BRICEO} Collector-Emitter Breakdown Voltage	I _C = 1 mA, I _B = 0, I _F = 0	30			30			V
*V _{BRIECO} Emitter-Collector Breakdown Voltage	I _E = 100 µA, I _B = 0, I _F = 0	7			7			V
*I _R Input Diode Static Reverse Current	V _R = 3 V			100			100	µA
*I _{C(on)} On-State Collector Current (Phototransistor Operation)	V _{CE} = 10 V, I _B = 0, I _F = 10 mA	2	5		1	3		mA
I _{C(on)} On-State Collector Current (Photodiode Operation)	V _{CB} = 10 V, I _E = 0, I _F = 10 mA	20			20			µA
*I _{C(off)} Off-State Collector Current (Phototransistor Operation)	V _{CE} = 10 V, I _B = 0, I _F = 0	1	50		1	50		nA
*I _{C(off)} Off-State Collector current (Photodiode Operation)	V _{CB} = 10 V, I _E = 0, I _F = 0	0.1	20		0.1	20		nA
*V _F Input Diode Static Forward Voltage	I _F = 10 mA	1.25	1.5		1.25	1.5		V
*V _{CE(sat)} Collector-Emitter Saturation Voltage	I _C = 2 mA, I _B = 0, I _F = 50 mA	0.25	0.5		0.25	0.5		V
r _{IO} Input-to-Output Internal resistance	V _{in-out} = ±2.5 kV for 4N25, ±1.5 kV for 4N26, 4N27, ±0.5 kV for 4N28, See Note 5	10 ¹¹	10 ¹²		10 ¹¹	10 ¹²		Ω
C _{IO} Input-to-Output Capacitance	V _{in-out} = 0, f = 1 MHz, See Note 5	1			1			pF

*JEDEC registered data

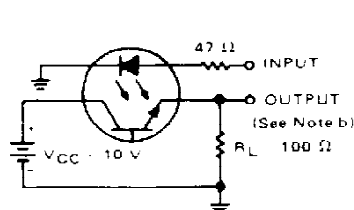
NOTE 5: These parameters are measured between both input diode leads shorted together and all the phototransistor leads shorted together

switching characteristics at 25°C free-air temperature

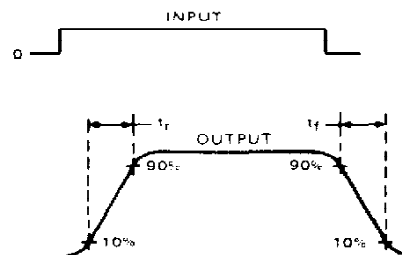
PARAMETER		TEST CONDITIONS		TYP	UNIT
t _r	Rise Time	Phototransistor	V _{CC} = 10 V, I _B = 0, I _{C(on)} = 2 mA,	2	µs
t _f	Fall Time	Operation	R _L = 100 Ω, See Test Circuit A of Figure 1	2	
t _r	Rise Time	Photodiode	V _{CC} = 10 V, I _E = 0, I _{C(on)} = 20 µA,	1	µs
t _f	Fall Time	Operation	R _L = 1 kΩ, See Test Circuit B of Figure 1	1	

PARAMETER MEASUREMENT INFORMATION

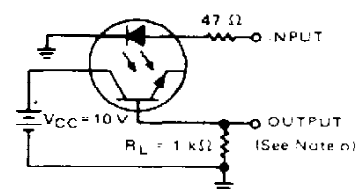
Adjust amplitude of input pulse for:
I_{C(on)} = 2 mA (Test Circuit A) or
I_{C(on)} = 20 µA (Test Circuit B)



TEST CIRCUIT A
PHOTOTRANSISTOR OPERATION



VOLTAGE WAVEFORMS



TEST CIRCUIT B
PHOTODIODE OPERATION

- NOTES
- The input waveform is supplied by a generator with the following characteristics: Z_{out} = 50 Ω, t_r ≤ 15 ns, duty cycle ≈ 1%, t_W = 100 µs.
 - The output waveform is monitored on an oscilloscope with the following characteristics: t_r ≤ 12 ns, R_{in} ≥ 1 MΩ, C_{in} ≤ 20 pF.

FIGURE 1 – SWITCHING TIMES

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