

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

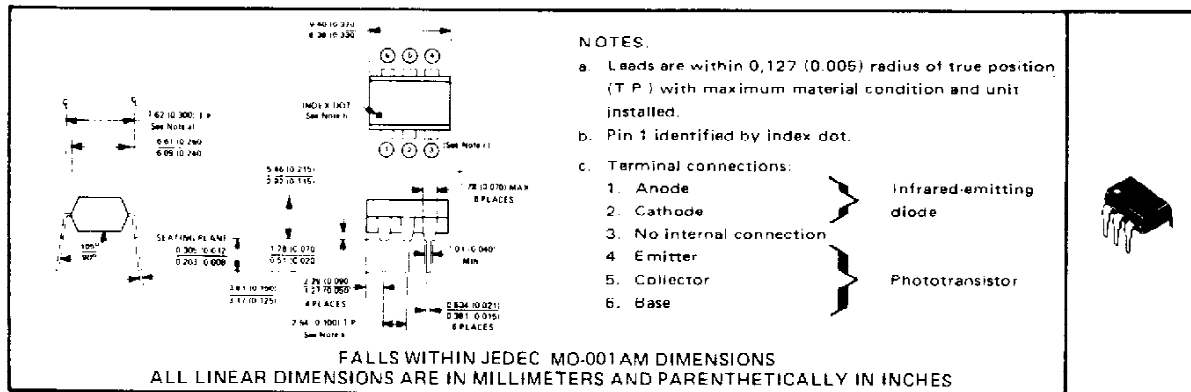
SOOS035 D2493 SEPTEMBER 1978 - REVISED MARCH 1983

## 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.

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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 <sub>(BR)CBO</sub> Collector-Base Breakdown Voltage	I <sub>C</sub> = 100 μA, I <sub>E</sub> = 0, I <sub>F</sub> = 0	70			70			V
*V <sub>(BR)CEO</sub> Collector-Emitter Breakdown Voltage	I <sub>C</sub> = 1 mA, I <sub>B</sub> = 0, I <sub>F</sub> = 0	30			30			V
*V <sub>(BR)ECO</sub> Emitter-Collector Breakdown Voltage	I <sub>E</sub> = 100 μA, I <sub>B</sub> = 0, I <sub>F</sub> = 0	7			7			V
*I <sub>R</sub> Input Diode Static Reverse Current	V <sub>R</sub> = 3 V	100			100			μA
*I <sub>C(on)</sub> On-State Collector Current (Phototransistor Operation)	V <sub>CE</sub> = 10 V, I <sub>B</sub> = 0, I <sub>F</sub> = 10 mA	2	5		1	3		mA
I <sub>C(on)</sub> On-State Collector Current (Photodiode Operation)	V <sub>CB</sub> = 10 V, I <sub>E</sub> = 0, I <sub>F</sub> = 10 mA	20			20			μA
*I <sub>C(off)</sub> Off-State Collector Current (Phototransistor Operation)	V <sub>CE</sub> = 10 V, I <sub>B</sub> = 0, I <sub>F</sub> = 0	1 50			1 50			nA
*I <sub>C(off)</sub> Off-State Collector current (Photodiode Operation)	V <sub>CB</sub> = 10 V, I <sub>E</sub> = 0, I <sub>F</sub> = 0	0.1	20		0.1	20		nA
*V <sub>F</sub> Input Diode Static Forward Voltage	I <sub>F</sub> = 10 mA	1.25	1.5		1.25	1.5		V
*V <sub>CE(sat)</sub> Collector-Emitter Saturation Voltage	I <sub>C</sub> = 2 mA, I <sub>B</sub> = 0, I <sub>F</sub> = 50 mA	0.25	0.5		0.25	0.5		V
r <sub>IO</sub> Input-to-Output Internal resistance	V <sub>in-out</sub> = ± 2.5 kV for 4N25, ± 1.5 kV for 4N26, 4N27, ± 0.5 kV for 4N28. See Note 5	10 <sup>11</sup>	10 <sup>12</sup>		10 <sup>11</sup>	10 <sup>12</sup>		Ω
C <sub>IO</sub> Input-to-Output Capacitance	V <sub>in-out</sub> = 0, f = 1 MHz, See Note 5	1			1			pF

\*JEDEC registered data

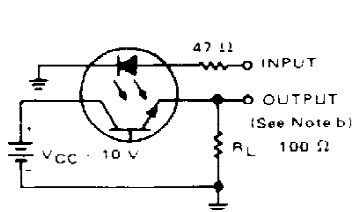
NOTE 5: These parameters are measured between both input diode leads shorted together and all the phototransistor leads shorted together

switching characteristics at 25°C free-air temperature

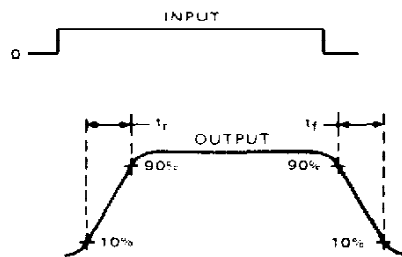
PARAMETER		TEST CONDITIONS	TYP	UNIT
t <sub>r</sub>	Rise Time	Phototransistor V <sub>CC</sub> = 10 V, I <sub>B</sub> = 0, I <sub>C(on)</sub> = 2 mA, R <sub>L</sub> = 100 Ω. See Test Circuit A of Figure 1	2	μs
t <sub>f</sub>	Fall Time	Operation	2	
t <sub>r</sub>	Rise Time	Photodiode V <sub>CC</sub> = 10 V, I <sub>E</sub> = 0, I <sub>C(on)</sub> = 20 μA, R <sub>L</sub> = 1 kΩ. See Test Circuit B of Figure 1	1	μs
t <sub>f</sub>	Fall Time	Operation	1	

## PARAMETER MEASUREMENT INFORMATION

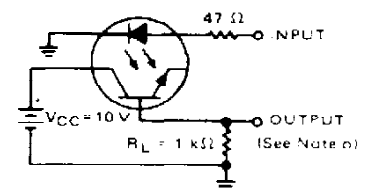
Adjust amplitude of input pulse for:  
I<sub>C(on)</sub> = 2 mA (Test Circuit A) or  
I<sub>C(on)</sub> = 20 μA (Test Circuit B)



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<sub>OUT</sub> = 50 Ω, t<sub>r</sub> < 15 ns, duty cycle ≈ 1%, t<sub>w</sub> = 100 μs.
  - The output waveform is monitored on an oscilloscope with the following characteristics: t<sub>r</sub> < 12 ns, R<sub>in</sub> ≥ 1 MΩ, C<sub>in</sub> < 20 pF.

FIGURE 1 – SWITCHING TIMES

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Orderable Device	Status <sup>(1)</sup>	Package Type	Package Drawing	Pins	Package Qty	Eco Plan <sup>(2)</sup>	Lead/Ball Finish	MSL Peak Temp <sup>(3)</sup>
4N25	OBSOLETE	PDIP	N	6		TBD	Call TI	Call TI
4N26	OBSOLETE	PDIP	N	6		TBD	Call TI	Call TI
4N27	OBSOLETE	PDIP	P	6		TBD	Call TI	Call TI
4N28	OBSOLETE	PDIP	N	6		TBD	Call TI	Call TI

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<sup>(3)</sup> MSL, Peak Temp. -- The Moisture Sensitivity Level rating according to the JEDEC industry standard classifications, and peak solder temperature.

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