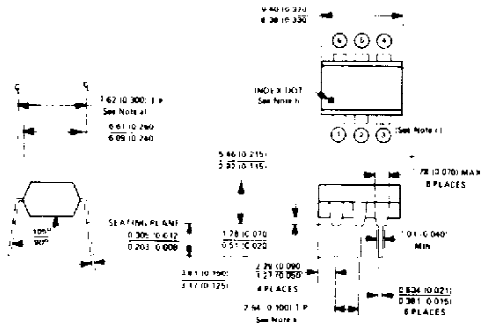
SOOS035 D2493 SEPTEMBER 1978 - REVISED MARCH 1983

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 μs, t_f = 2 μs 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.



NOTES:
a. Leads are within 0,127 (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 } Infrared-emitting diode
2. Cathode
3. No internal connection
4. Emitter } Phototransistor
5. Collector
6. Base

FALLS WITHIN JEDEC MO-001AM DIMENSIONS
ALL LINEAR DIMENSIONS ARE IN MILLIMETERS AND PARENTHETICALLY IN INCHES

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 μs, 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-circulated.
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	
*$V_{(BR)CBO}$	Collector-Base Breakdown Voltage	I_C = 100 μA, I_E = 0, I_F = 0	70			70			V
*$V_{(BR)CEO}$	Collector-Emitter Breakdown Voltage	I_C = 1 mA, I_B = 0, I_F = 0	30			30			V
*$V_{(BR)ECO}$	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

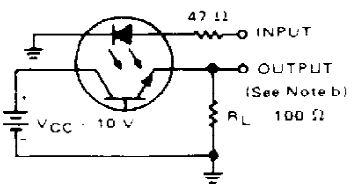
NOTE 5: These parameters are measured between both input diode leads shorted together and all the phototransistor leads shorted together

switching characteristics at 25°C free-air temperature

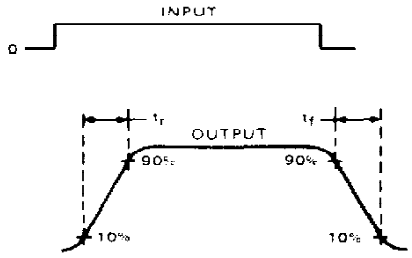
PARAMETER			TEST CONDITIONS	TYP	UNIT
t_r	Rise Time	Phototransistor Operation	V_{CC} = 10 V, I_B = 0, $I_{C(on)}$ = 2 mA, R_L = 100 Ω, See Test Circuit A of Figure 1	2	μs
t_f	Fall Time			2	
t_r	Rise Time	Photodiode Operation	V_{CC} = 10 V, I_E = 0, $I_{C(on)}$ = 20 μA, R_L = 1 kΩ, See Test Circuit B of Figure 1	1	μs
t_f	Fall Time			1	

PARAMETER MEASUREMENT INFORMATION

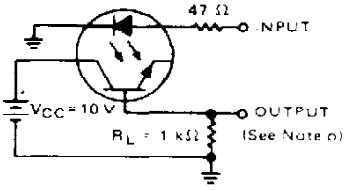
Adjust amplitude of input pulse for:
$I_{C(on)}$ = 2 mA (Test Circuit A) or
$I_{C(on)}$ = 20 μA (Test Circuit B)



TEST CIRCUIT A
PHOTOTRANSISTOR OPERATION



VOLTAGE WAVEFORMS



TEST CIRCUIT B
PHOTODIODE OPERATION

NOTES a. 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.
b. 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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