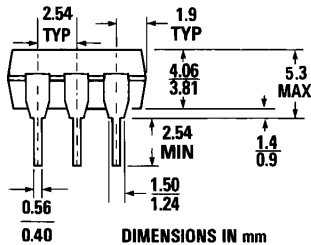
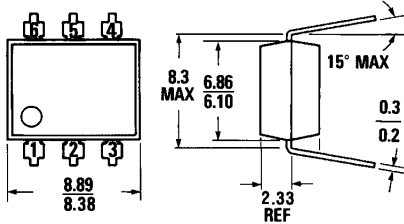


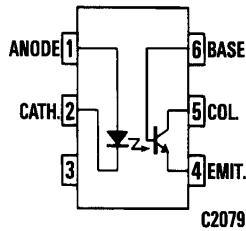
**4N25 4N27**  
**4N26 4N28**

## PACKAGE DIMENSIONS



DIMENSIONS IN mm  
PACKAGE CODE K

ST1603A



C2079

Equivalent Circuit

## DESCRIPTION

The 4N25, 4N26, 4N27, and 4N28 series of optocouplers have an NPN silicon planar phototransistor optically coupled to a gallium arsenide diode.

## FEATURES & APPLICATIONS

- AC line/digital logic isolator
- Digital logic/digital logic isolator
- Telephone/telegraph line receiver
- Twisted pair line receiver
- High frequency power supply feedback control
- Relay contact monitor
- Power supply monitor
- Small package size and low cost
- Excellent frequency response
- UL recognized—File E90700

## ABSOLUTE MAXIMUM RATINGS

### TOTAL PACKAGE

*Storage temperature	.....	-55°C to 150°C
*Operating temperature at junction	.....	-55°C to 100°C
*Lead temperature (soldering, 10 sec)	.....	260°C
*Total package power dissipation at 25°C ambient (LED plus detector)	.....	250 mW
*Derate linearly from 25°C	.....	3.3 mW/°C

### INPUT DIODE

*Forward DC current continuous	.....	80 mA
*Reverse voltage	.....	3.0 V
*Peak forward current (300 μs, 2% duty cycle)	.....	3.0 A
*Power dissipation at 25°C ambient	.....	150 mW
*Derate linearly from 25°C	.....	2.0 mW/°C

### OUTPUT TRANSISTOR

*Collector emitter voltage (BV <sub>CEO</sub> )	.....	30 V
*Collector base voltage (BV <sub>CBO</sub> )	.....	70 V
*Emitter collector voltage (BV <sub>ECO</sub> )	.....	7 V
*Power dissipation at 25°C ambient	.....	150 mW
*Derate linearly from 25°C	.....	2.0 mW/°C

\*Indicates JEDEC Registered Data.

## ELECTRO-OPTICAL CHARACTERISTICS (25°C Free Air Temperature Unless Otherwise Specified)

### INDIVIDUAL COMPONENT CHARACTERISTICS

CHARACTERISTICS	SYMBOL	MIN.	TYP.	GUAR. MAX.	UNITS	TEST CONDITIONS
<b>INPUT DIODE</b>						
*Forward voltage	$V_f$		1.20	1.50	V	$I_f = 10 \text{ mA}$
Capacitance	C		150		pF	$V_f = 0 \text{ V}, f = 1 \text{ MHz}$
*Reverse leakage current			.05	100	$\mu\text{A}$	$V_R = 3.0 \text{ V}, R_L = 1.0 \text{ M}\Omega$
<b>DETECTOR</b>						
DC forward current gain	$h_{FE}$		250			$V_{CE} = 5 \text{ V}, I_C = 500 \mu\text{A}$
*Collector to emitter breakdown voltage	$BV_{CEO}$	30	65		V	$I_C = 1.0 \text{ mA}, I_B = 0$
*Collector to base breakdown voltage	$BV_{CBO}$	70	165		V	$I_C = 100 \mu\text{A}, I_E = 0$
*Emitter to collector breakdown voltage	$BV_{ECO}$	7	14		V	$I_E = 100 \mu\text{A}, I_B = 0$
*Collector to emitter leakage current (4N25, 4N26, 4N27)	$I_{CEO}$		3.5	50	nA	$V_{CE} = 10 \text{ V}$ Base Open
*Collector to emitter leakage current (4N28)				100	nA	
*Collector to base leakage current	$I_{CBO}$		0.1	20	nA	$V_{CB} = 10 \text{ V}$ Emitter Open

### TRANSFER CHARACTERISTICS

DC CHARACTERISTICS	SYMBOL	MIN.	TYP.	GUAR. MAX.	UNITS	TEST CONDITIONS
*Collector output current (a) (4N25, 4N26) (4N27, 4N28)	$I_C$	2.0 1.0	5.0 3.0	— —	mA	$V_{CE} = 10 \text{ V}, I_f = 10 \text{ mA}, I_B = 0$
*Collector-emitter saturation	$V_{CE(SAT)}$		0.2	0.5	V	$I_C = 2.0 \text{ mA}, I_f = 50 \text{ mA}$

### TRANSFER CHARACTERISTICS

AC CHARACTERISTICS	SYMBOL	TYP.	UNITS	TEST CONDITIONS
Non-saturated Collector Delay time	$t_d$	0.5	$\mu\text{S}$	$R_L = 100 \Omega, I_C = 2 \text{ mA}, V_{CC} = 10 \text{ V}$ (Fig. 10 and 11)
Rise time	$t_r$	2.5	$\mu\text{S}$	
Fall time	$t_f$	2.6	$\mu\text{S}$	
Non-saturated Collector Delay time	$t_d$	2.0	$\mu\text{S}$	$R_L = 1\text{k}\Omega, I_C = 2 \text{ mA}, V_{CC} = 10 \text{ V}$ (Fig. 10 and 11)
Rise time	$t_r$	15	$\mu\text{S}$	
Fall time	$t_f$	15	$\mu\text{S}$	

\*Indicates JEDEC Registered Data.

- (a) Pulse Test: Pulse Width = 300  $\mu\text{s}$ , Duty Cycle  $\leq 2.0\%$
- (b) For this test LED pins 1 and 2 are common and Phototransistor pins 4, 5 and 6 are common.
- (c) If adjusted to yield  $I_C = 2 \text{ mA}$  and  $t_c = 0.7 \text{ mA RMS}$ ; Bandwidth referenced to 10 kHz.

## ELECTRO-OPTICAL CHARACTERISTICS (25°C Free Air Temperature Unless Otherwise Specified) (Cont'd)

### TRANSFER CHARACTERISTICS (Cont'd)

AC CHARACTERISTICS	SYMBOL	MIN.	TYP.	GUAR. MAX.	UNITS	TEST CONDITIONS
Saturated						
$t_{on}$ (from 5 V to 0.8 V)	$t_{on}$ (SAT)		5		$\mu s$	$R_L=2k\Omega, I_F=15\text{ mA}, V_{CC}=5\text{ V}$
$t_{off}$ (from SAT to 2.0 V)	$t_{off}$ (SAT)		25		$\mu s$	$R_B=Open$ (Fig. 10)
Saturated						
$t_{on}$ (from 5 V to 0.8 V)	$t_{on}$ (SAT)		5		$\mu s$	$R_L=2k\Omega, I_F=20\text{ mA}, V_{CC}=5\text{ V}$
$t_{off}$ (from SAT to 2.0 V)	$t_{off}$ (SAT)		18		$\mu s$	$R_B=100k\Omega$ (Fig. 10)
Non-saturated						
Base—Collector photo diode						
Rise time	$t_r$		175		ns	$R_L=1k\Omega, V_{CB}=10\text{ V}$
Fall time	$t_f$		175		ns	
Isolation voltage (b) (4N25, 4N26, 4N27, 4N28) *(4N26, 4N27) *(4N28)	$V_{iso}$	5300 1500 500	— — —	— — —	V V V	$I_{i0} \leq 1\ \mu A$ RMS, $t=1\text{ minute}$ Peak Peak
Isolation resistance (b)			$10^{11}$		$\Omega$	$V=500\text{ VDC}$
Isolation capacitance (b)			1.3		pF	$V=0, f=1.0\text{ MHz}$
Bandwidth (c) (also see note 2)	$B_w$		300		kHz	$I_C=2.0\text{ mA}, R_L=100\ \Omega$ (Fig. 12)

\*Indicates JEDEC Registered Data.

(a) Pulse Test: Pulse Width=300  $\mu s$ , Duty Cycle  $\leq 2.0\%$

(b) For this test LED pins 1 and 2 are common and Phototransistor pins 4, 5 and 6 are common.

(c) If adjusted to yield  $I_C=2\text{ mA}$  and  $i_C=0.7\text{ mA RMS}$ ; Bandwidth referenced to 10 kHz.

### TYPICAL ELECTRO-OPTICAL CHARACTERISTIC CURVES

(25°C Free Air Temperature Unless Otherwise Specified)

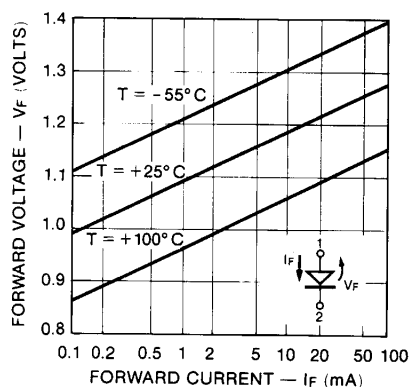


Fig. 1. Forward Voltage vs. Current

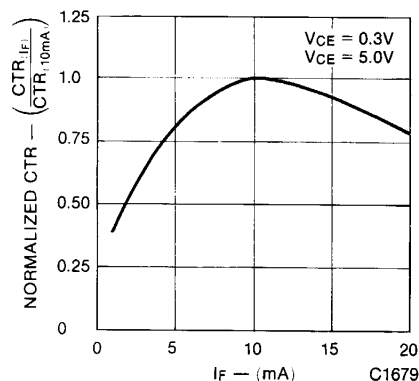


Fig. 2. Normalized CTR vs. Forward Current

**TYPICAL ELECTRO-OPTICAL CHARACTERISTIC CURVES**  
(25°C Free Air Temperature Unless Otherwise Specified) (Cont'd)

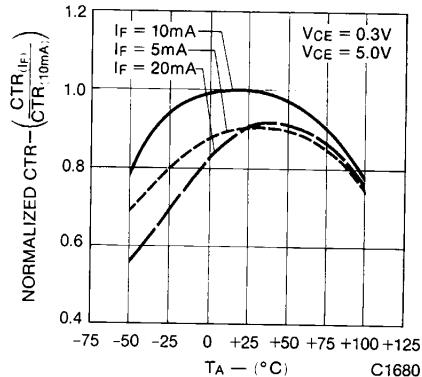


Fig. 3. Normalized CTR vs. Temperature

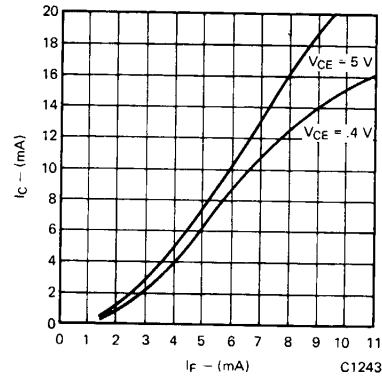


Fig. 4. Collector Current vs. Forward Current

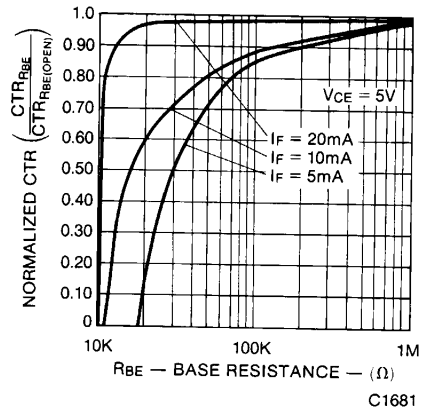


Fig. 5. CTR vs. R<sub>BE</sub> (Unsaturated)

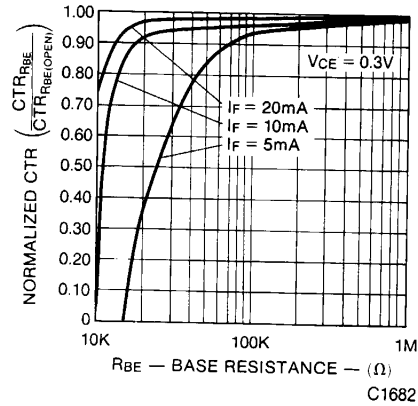


Fig. 6. CTR vs. R<sub>BE</sub> (Saturated)

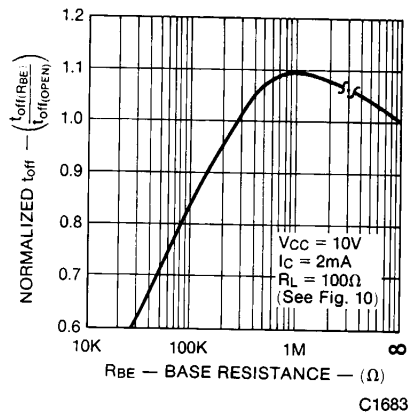


Fig. 7. Normalized T<sub>off</sub> vs. R<sub>BE</sub>

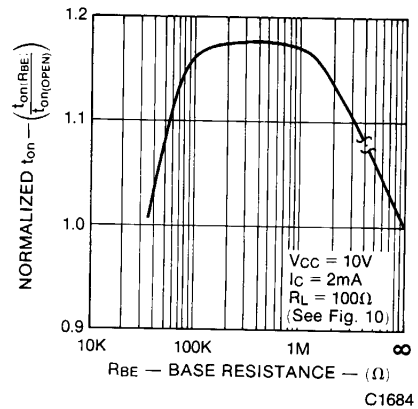


Fig. 8. Normalized T<sub>on</sub> vs. R<sub>BE</sub>

**TYPICAL ELECTRO-OPTICAL CHARACTERISTIC CURVES**  
(25°C Free Air Temperature Unless Otherwise Specified) (Cont'd)

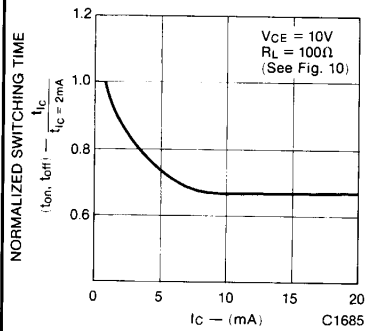


Fig. 9. Switching Time vs. IC

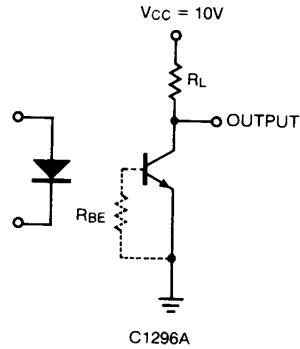


Fig. 10. Switching Time Test Circuit

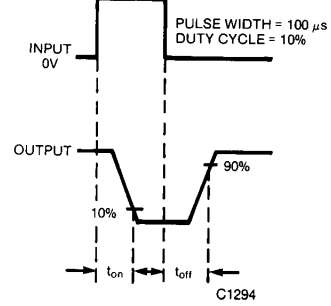


Fig. 11. Switching Time Waveforms

**OPERATING SCHEMATICS**

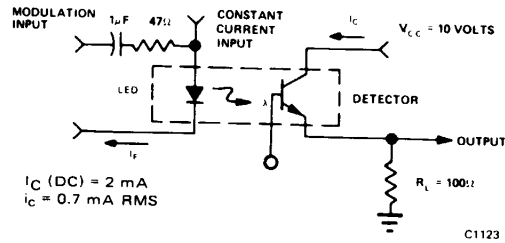


Fig. 12. Modulation Circuit Used to Obtain Output vs. Frequency Plot

**NOTES**

1. The current transfer ratio ( $I_C/I_F$ ) is the ratio of the detector collector current to the LED input current with  $V_{CE}$  at 10 volts.
2. The frequency at which  $i_c$  is 3dB down from the 10 kHz value.
3. Rise time ( $t_r$ ) is the time required for the collector current to increase from 10% of its final value to 90%.  
Fall time ( $t_f$ ) is the time required for the collector current to decrease from 90% of its initial value to 10%.