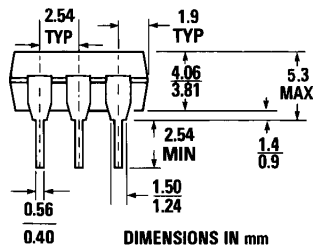
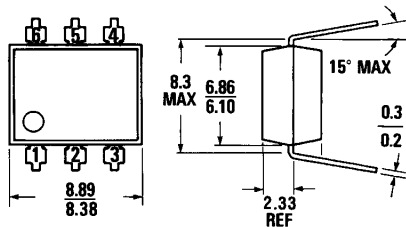


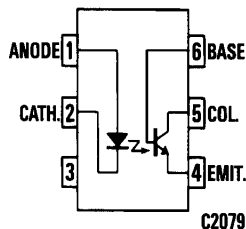
**4N25 4N27**  
**4N26 4N28**

**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  $\mu$ s, 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 ( $BV_{CE0}$ ) ..... 30 V
- \*Collector base voltage ( $BV_{CBO}$ ) ..... 70 V
- \*Emitter collector voltage ( $BV_{ECO}$ ) ..... 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  $I_f = 0.7 \text{ mA RMS}$ ; 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		$\mu s$	$R_L = 2k\Omega$ , $I_F = 15$ mA, $V_{CC} = 5$ V
$t_{off}$ (from SAT to 2.0 V)	$t_{off}$ (SAT)		25		$\mu s$	$R_B = \text{Open}$ (Fig. 10)
Saturated $t_{on}$ (from 5 V to 0.8 V)	$t_{on}$ (SAT)		5		$\mu s$	$R_L = 2k\Omega$ , $I_F = 20$ mA, $V_{CC} = 5$ 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	$R_L = 1k\Omega$ , $V_{CB} = 10$ 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	$I_{IO} \leq 1 \mu A$ RMS, $t = 1$ minute Peak Peak
Isolation resistance (b)			$10^{11}$		$\Omega$	$V = 500$ VDC
Isolation capacitance (b)			1.3		pF	$V = 0$ , $f = 1.0$ MHz
Bandwidth (c) (also see note 2)	$B_w$		300		kHz	$I_C = 2.0$ 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  $I_C = 2$  mA and  $i_C = 0.7$  mA RMS; Bandwidth referenced to 10 kHz.

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

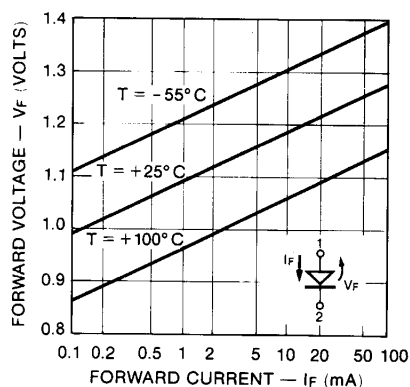


Fig. 1. Forward Voltage vs. Current

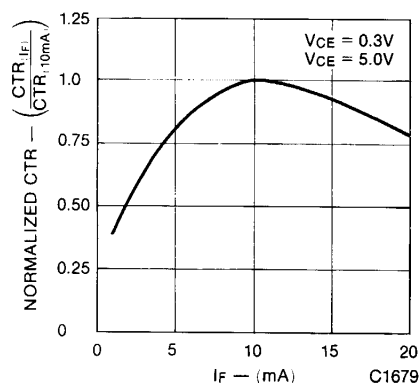


Fig. 2. Normalized CTR vs. Forward Current

**TYPICAL ELECTRO-OPTICAL CHARACTERISTIC CURVES**

(25°C Free Air Temperature Unless Otherwise Specified) (Cont'd)

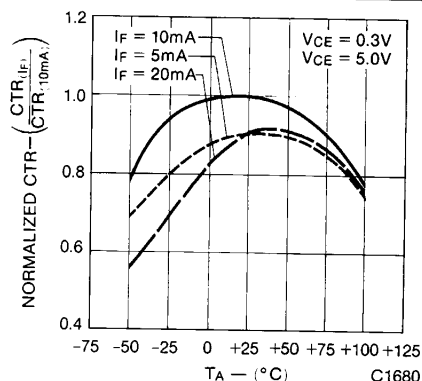


Fig. 3. Normalized CTR vs. Temperature

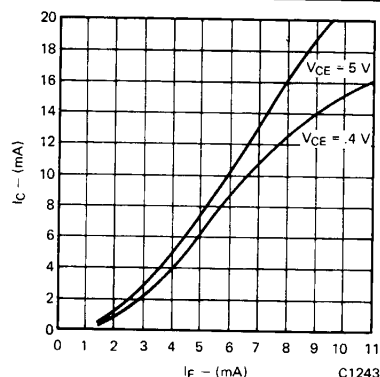


Fig. 4. Collector Current vs. Forward Current

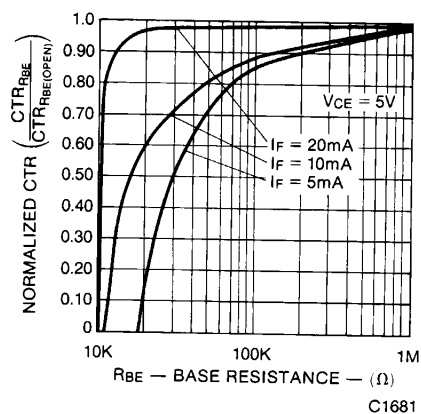


Fig. 5. CTR vs.  $R_{BE}$  (Unsaturated)

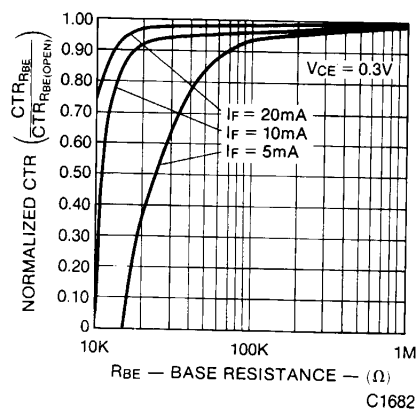


Fig. 6. CTR vs.  $R_{BE}$  (Saturated)

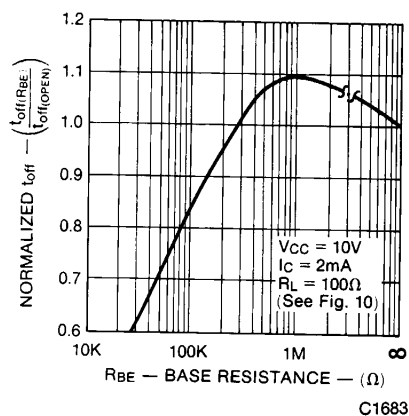


Fig. 7. Normalized  $T_{OFF}$  vs.  $R_{BE}$

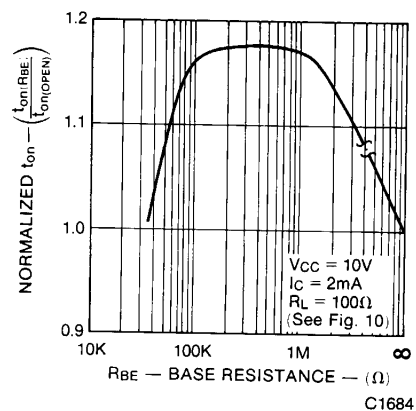


Fig. 8. Normalized  $T_{ON}$  vs.  $R_{BE}$

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

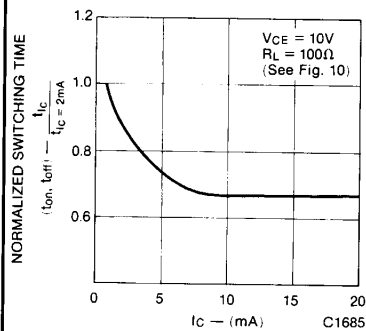


Fig. 9. Switching Time vs.  $I_C$

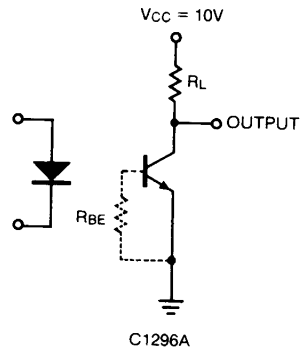


Fig. 10. Switching Time Test Circuit

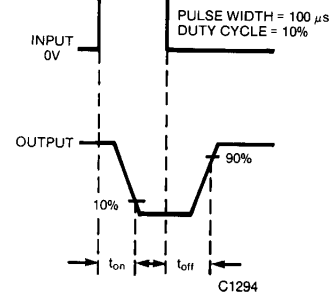


Fig. 11. Switching Time Waveforms

**OPERATING SCHEMATICS**

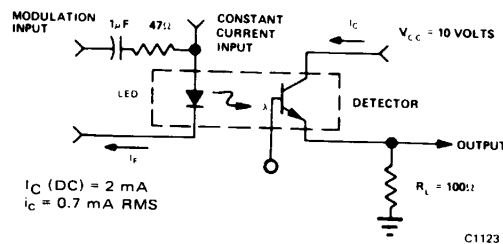


Fig. 12. Modulation Circuit Used to Obtain Output vs. Frequency Plot

**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%.