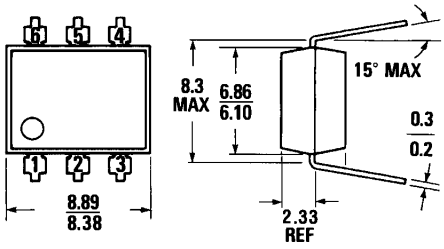
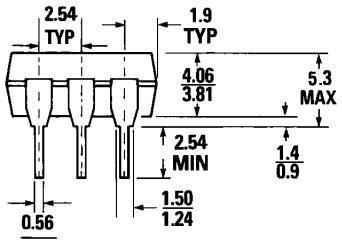
QT OPTOELECTRONICS

PHOTOTRANSISTOR OPTOCOUPLERS

4N35 4N36 4N37

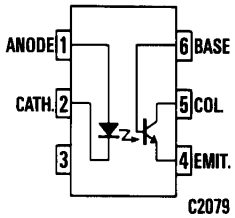
PACKAGE DIMENSIONS





DIMENSIONS IN mm
PACKAGE CODE K

ST1603A



Equivalent Circuit

DESCRIPTION

The 4N35, 4N36, and 4N37 series of optocouplers have an NPN silicon planar phototransistor optically coupled to a gallium arsenide infrared emitting 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
- Industrial controls
- Covered under UL component recognition program, reference File E90700
- High DC current transfer ratio

ABSOLUTE MAXIMUM RATINGS

TOTAL PACKAGE

*Relative humidity ..... 85% @ 85°C
*Storage temperature ..... −55°C to 150°C
*Operating temperature ..... −55°C to 100°C
*Lead temperature (soldering, 10 sec) ..... 260°C

INPUT DIODE

*Forward DC current (continuous) ..... 60 mA
Reverse voltage ..... 6 volts
*Peak forward current
(1 μs pulse, 300 pps) ..... 3.0 A
*Power dissipation at T_A=25°C ..... 100 mW†
*Power dissipation at T_C=25°C ..... 100 mW†
(T_C indicates collector lead temp 1/32" from case)

OUTPUT TRANSISTOR

*Power dissipation at 25°C ambient ..... 300 mW
Derate linearly above 25°C ..... 4 mW/°C
*Power dissipation at T_C=25°C ..... 500 mW††
(T_C indicates collector lead temp 1/32" from case)

*V_{CEO} ..... 30 volts
*V_{CBO} ..... 70 volts
*V_{ECO} ..... 7 volts
*Collector current (continuous) ..... 100 mA

*Indicates JEDEC registered values †Derate 1.33 mW/°C above 25°C. ††Derate 6.7 mW/°C above 25°C.

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

INDIVIDUAL COMPONENT CHARACTERISTICS

CHARACTERISTIC	SYMBOL	MIN.	TYP.	MAX.	UNITS	TEST CONDITIONS
INPUT DIODE						
*Forward voltage	V_F	.8		1.50	V	I_F=10 mA
*Forward voltage temp. coefficient	V_F	.9		1.7	V	I_F=10 mA, T_A=−55°C
*Forward voltage	V_F	.7		1.4	V	I_F=10 mA, T_A=+100°C
*Junction capacitance	C_J			100	pF	V_F=0 V, f=1 mHz
*Reverse leakage current			.01	10	μA	V_R=6.0 V
DETECTOR						
DC forward current gain	h_{FE}		250			V_{CE}=5 V, I_C=100 μA
*Collector to emitter breakdown voltage	BV_{CEO}	30	65		V	I_C=10 mA, I_F=0
*Collector to base breakdown voltage	BV_{CBO}	70	165		V	I_C=100 μA, I_F=0
*Emitter to collector breakdown voltage	BV_{ECO}	7	14		V	I_E=100 μA, I_F=0
Collector to emitter, leakage current	I_{CEO}		5	50	nA	V_{CE}=10 V, I_F=0
*Collector to emitter leakage current (dark)	I_{CEO}			500	μA	V_{CE}=30 V, I_F=0, T_A=100°C
Capacitance collector to emitter	C_{CEW}		8		pF	V_{CE}=0
Capacitance collector to base	C_{CBO}		20		pF	V_{CB}=10 V
Capacitance base to emitter	C_{BEO}		10		pF	V_{BE}=0

TRANSFER CHARACTERISTICS

CHARACTERISTICS	SYMBOL	MIN.	TYP.	MAX.	UNITS	TEST CONDITIONS
COUPLED						
†*DC current transfer ratio	CTR	100			%	I_F=10 mA, V_{CE}=10 V
†*DC current transfer ratio	CTR	40			%	I_F=10 mA, V_{CE}=10 V, T_A=−55°C
†*DC current transfer ratio	CTR	40			%	I_F=10 mA, V_{CE}=10 V, T_A=+100°C
*Saturation voltage—collector to emitter	$V_{CE(SAT)}$			.3	volts	I_F=10 mA, I_C=0.5 mA

TRANSFER CHARACTERISTICS

AC CHARACTERISTICS	SYMBOL	MIN.	TYP.	MAX.	UNITS	TEST CONDITIONS
*Turn on time	t_{ON}		5	10	μsec	V_{CC}=10 V, I_C=2 mA, R_L=100Ω, (Fig. 10 and Fig. 11)
*Turn off time	t_{OFF}		5	10	μsec	V_{CC}=10 V, I_C=2 mA, R_L=100Ω, (Fig. 10 and Fig. 11)

*Indicates JEDEC registered values
†Pulse test: pulse width=300μS,
duty cycle≤2.0%

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

ISOLATION CHARACTERISTICS

CHARACTERISTICS	SYMBOL	MIN.	TYP.	MAX.	UNITS	TEST CONDITIONS
Isolation voltage all devices	V_{ISO}	5300			V_{RMS}	$I_{I-O} \leq 1\mu A$ t=1 minute
*Input to output isolation current (pulse width=8 msec) (see Note 1)	I_{I-O}					
4N35				100	μA	V_{iso}=3550 VAC (peak)
4N36				100	μA	V_{iso}=2500 VAC (peak)
4N37				100	μA	V_{iso}=1500 VAC (peak)
*Input to output resistance	R_{I-O}	100			gigaohms	Input to output voltage= 500 V (see Note 1)
*Input to output capacitance	C_{I-O}			2.5	picofarads	Input to output voltage= O V, f=1 MHz (see Note 1)

*Indicates JEDEC registered values
†Pulse test: pulse width=300μS, duty cycle≤2.0%

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

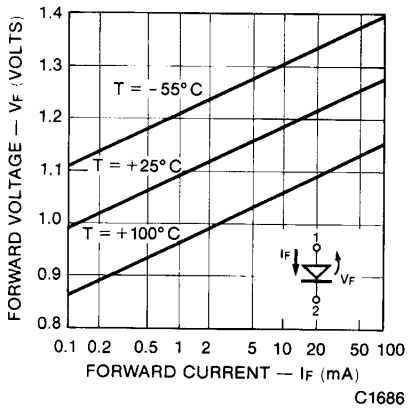


Fig. 1. Forward Voltage vs. Current

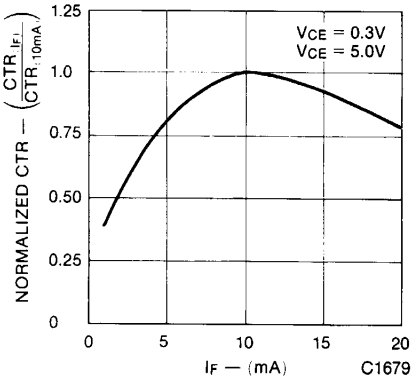


Fig. 2. Normalized CTR vs. Forward Current

TYPICAL ELECTRO-OPTICAL CHARACTERISTIC CURVES

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

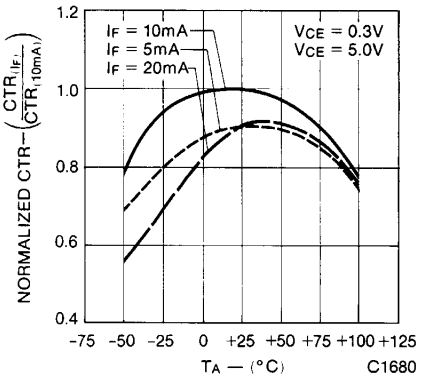


Fig. 3. Normalized CTR vs. Temperature

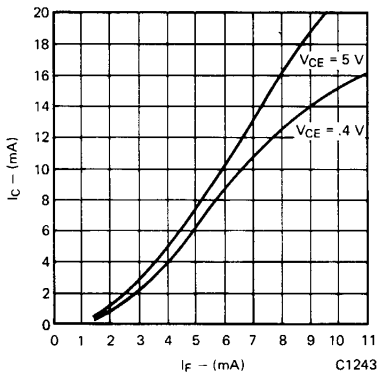


Fig. 4. Collector Current vs. Forward Current

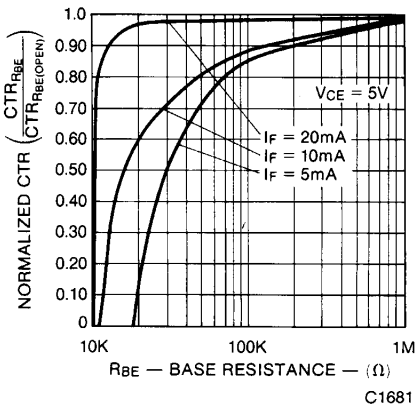


Fig. 5. CTR vs. RBE (Unsaturated)

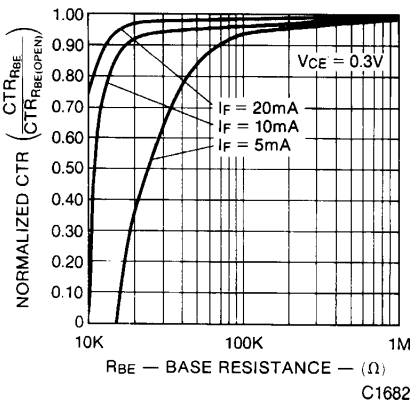


Fig. 6. CTR vs. RBE (Saturated)

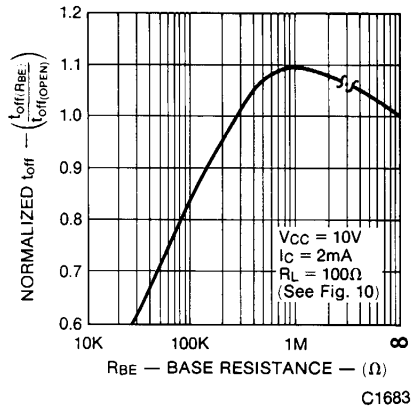


Fig. 7. Normalized T_{OFF} vs. RBE

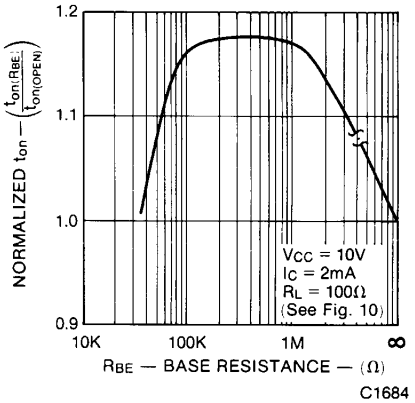


Fig. 8. Normalized T_{ON} vs. RBE

TYPICAL ELECTRO-OPTICAL CHARACTERISTIC CURVES

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

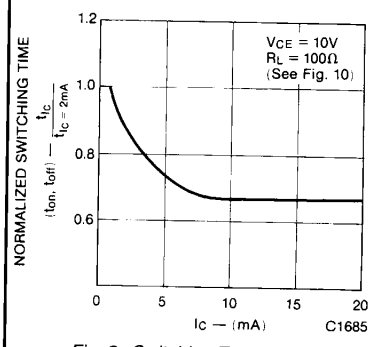


Fig. 9. Switching Time vs. IC

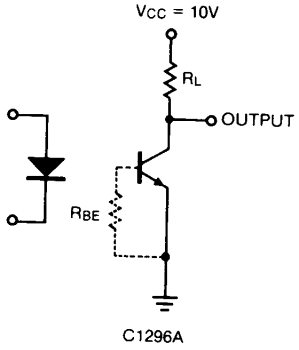


Fig. 10. Switching Time Test Circuit

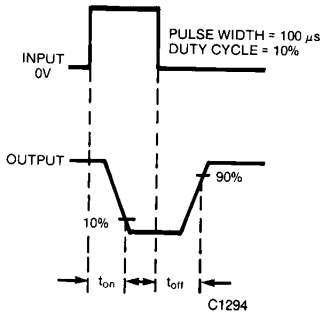


Fig. 11. Switching Time Waveforms

NOTES

1. *Tests of input to output isolation current resistance and capacitance are performed with the input terminals (diode) shorted together and the output terminals (transistor) shorted together.*
2. *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.*
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%.