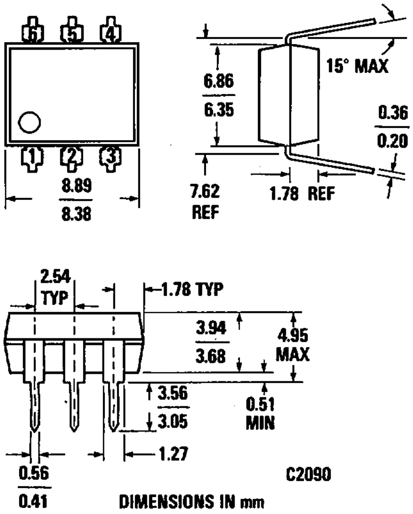
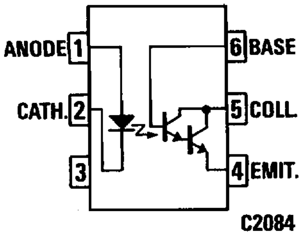
PHOTODARLINGTON OPTOCOUPLERS

4N32 4N33

PACKAGE DIMENSIONS



DIMENSIONS IN mm



Equivalent Circuit

DESCRIPTION

The 4N32 and 4N33 have a gallium arsenide infrared emitter optically coupled to a silicon planar photodarlington.

FEATURES & APPLICATIONS

- High isolation resistance—$10^{11}\Omega$
- High dielectric strength, input to output 2500 V RMS—1 minute
- Low coupling capacitance—1.0 pF
- Convenient package—plastic dual-in-line
- Long lifetime, solid state reliability
- Low weight—0.4 grams
- UL recognized—File E50151

ABSOLUTE MAXIMUM RATINGS (T_A=25°C Unless Otherwise Specified)

TOTAL PACKAGE

*Storage temperature	−55°C to 150°C
*Operating temperature at junction	−55°C to 100°C
*Lead soldering time @ 260°C	10 seconds
*Total power dissipation at 25°C ambient	250 mW
*Derate linearly from 25°C	3.3 mW/°C

INPUT DIODE

*Power dissipation @ 25°C ambient	150 mW
*Derate linearly from 55°C	2 mW/°C
*Continuous forward current	80 mA
Reverse current	10 mA
*Peak forward current (300 μsec, 2% duty cycle)	3.0 A

OUTPUT TRANSISTOR

*Power dissipation @ 25°C ambient	150 mW
*Derate linearly from 25°C	2.0 mW/°C
*Collector-emitter breakdown voltage (BV_{CEO})	30 V
*Collector-base breakdown voltage (BV_{CBO})	50 V
Emitter-base breakdown voltage (BV_{EBO})	8.0 V
*Emitter-collector breakdown voltage (BV_{ECO})	5 V

*Indicated JEDEC Registered data.

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

INDIVIDUAL COMPONENT CHARACTERISTICS

CHARACTERISTIC	SYMBOL	MIN.	TYP.	MAX.	UNIT	TEST CONDITION
DIODE (T_A=25°C unless otherwise noted) *Reverse leakage current	I_R		0.05	100	μA	V_R=3.0 V
*Forward voltage	V_F		1.2	1.5	Volts	I_F=10 mA
Capacitance	C		150		pF	V_F=0 V, f=1.0 MHz
DETECTOR (T_A=25°C and I_F=0 unless otherwise noted) *Collector-emitter dark current	I_{CEO}			100	nA	V_{CE}=10 V, base open
*Collector-base breakdown voltage	BV_{CBO}	30			Volts	I_C=100 μA, I_E=0
*Collector-emitter breakdown voltage	BV_{CEO}	30			Volts	I_C=100 μA, I_B=0
*Emitter-collector breakdown voltage	BV_{ECO}	5.0			Volts	I_E=100 μA, I_B=0
DC current gain	h_{FE}		5000			V_{CE}=5.0 V, I_C=500 μA

TRANSFER CHARACTERISTICS

DC CHARACTERISTICS	SYMBOL	MIN.	TYP.	MAX.	UNIT	TEST CONDITION
(T_A=25°C unless otherwise noted) *Collector output current (Note 1) 4N32, 4N33	I_C	50			mA	V_{CE}=10 V, I_F=10 mA, I_B=0
*Collector-emitter saturation voltage (1) 4N32, 4N33	$V_{CE(SAT)}$			1.0	Volts	I_C=2.0 mA, I_F=8.0 mA

TRANSFER CHARACTERISTICS

AC CHARACTERISTICS	SYMBOL	MIN.	TYP.	MAX.	UNIT	TEST CONDITION
(Fig. 6 and 7) Turn-on time	t_{ON}		0.6	5.0	μs	I_C=50 mA, I_F=200 mA, V_{CC}=10 V
Turn-off time 4N32, 4N33	t_{OFF}		45	100	μs	V_{CC}=10 V
Bandwidth (3)			30		kHz	

ISOLATION CHARACTERISTICS

CHARACTERISTICS	SYMBOL	MIN.	TYP.	MAX.	UNIT	TEST CONDITION
Isolation capacitance (Note 2)			0.8		pF	V=0, f=1.0 MHz
Isolation voltage (Note 2) 4N32, 4N33	V_{ISO}	2500	—	—	V	V RMS, t=1 minute
*(4N32)		2500	—	—	V	VDC
*(4N33)		1500	—	—	V	VDC
Isolation resistance (Note 2)	R_{ISO}		10^{11}		Ohms	V=500 VDC

*Indicates JEDEC Registered Data.
(1) Pulse test: pulse width=300 μs, duty cycle $\leqslant$ 2.0%
(2) For this test LED pins 1 and 2 are common and phototransistor pins 4, 5 and 6 are common.
(3) I_F adjusted to I_C=2.0 mA and ic=0.7 mA RMS.
(4) t_d and t_r are inversely proportional to the amplitude of I_F; t_s and t_f are not significantly affected by I_F.

TYPICAL ELECTRO-OPTICAL CHARACTERISTIC CURVES

(25°C Free Air Temperature Unless Otherwise Specified)

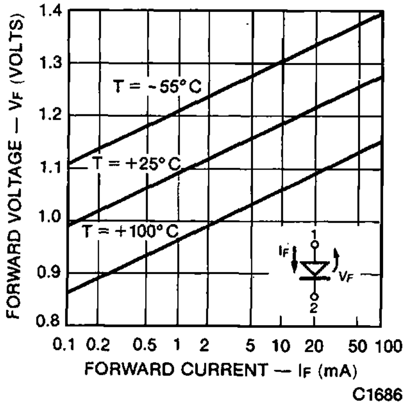


Fig. 1. Forward Voltage vs. Forward Current

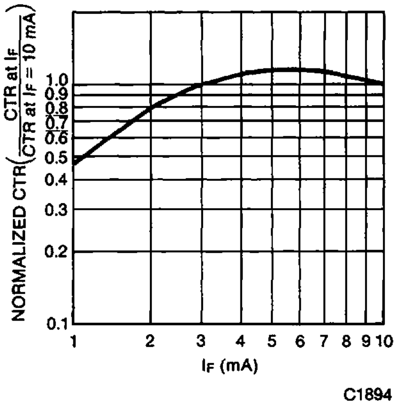


Fig. 2. Normalized CTR vs. I_F

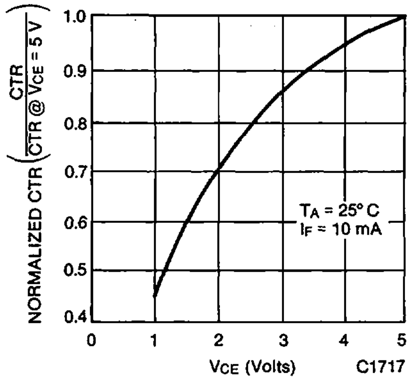


Fig. 3. Normalized CTR vs.– V_{CE}

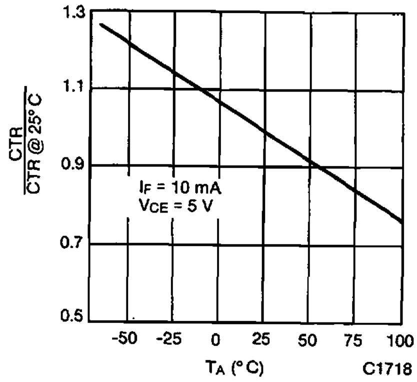


Fig. 4. Normalized CTR vs. Temperature

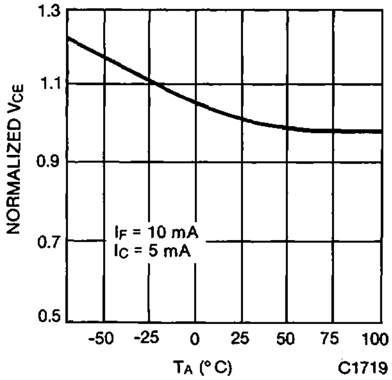


Fig. 5. Normalized $V_{CE(SAT)}$ vs. Temperature

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

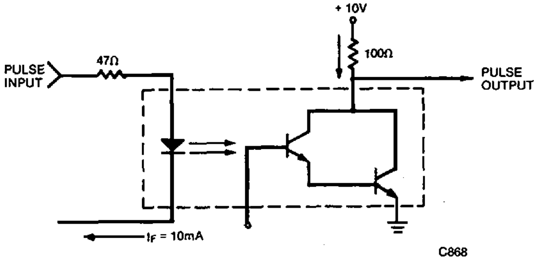


Fig. 6. Test Circuit

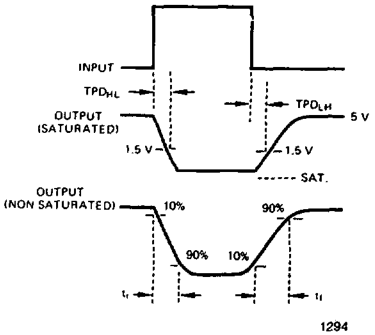


Fig. 7. Switching Waveforms

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 1 kHz value.*
3. *t_{ON} is measured from 10% of the leading edge of the input pulse to the 90% point on the leading edge of the output pulse. t_{OFF} is measured from 90% of the trailing edge of the input pulse to the 10% point on the trailing edge of the output pulse.*