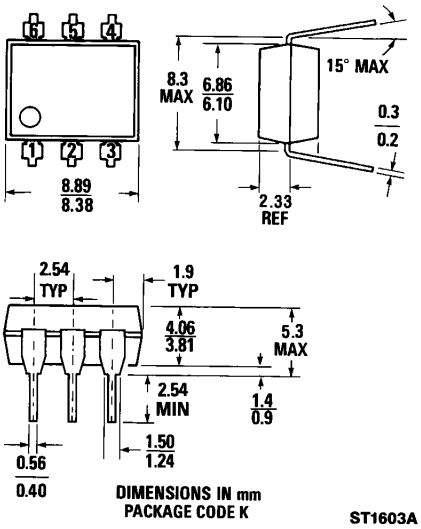
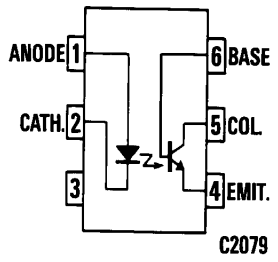
QT OPTOELECTRONICS

PHOTOTRANSISTOR OPTOCOUPLER

MCT2

PACKAGE DIMENSIONS





Equivalent Circuit

DESCRIPTION

The MCT2 is a 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
- UL recognized—File E90700

ABSOLUTE MAXIMUM RATINGS

TOTAL PACKAGE

Storage temperature ..... −55°C to 150°C
Operating temperature ..... −55°C to 100°C
Lead soldering temperature (10 sec) ..... 260°C

INPUT DIODE

Forward current ..... 60 mA
Reverse voltage ..... 3.0 V
Peak forward current
(1 μs pulse, 300 pps) ..... 3.0 A
Power dissipation 25°C ambient ..... 200 mW
Derate linearly from 25°C ..... 2.6 mW/°C

OUTPUT TRANSISTOR

Power dissipation at 25°C ambient ..... 200 mW
Derate linearly from 25°C ..... 2.6 mW/°C
Total package power dissipation at 25°C ambient
(LED plus detector) ..... 250 mW
Derate linearly from 25°C ..... 3.3 mW/°C
Collector-emitter current (I_{CE}) ..... 50 mA

QT OPTOELECTRONICS

PHOTOTRANSISTOR OPTOCOUPLER

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		1.25	1.50	V	I_F=20 mA
Reverse voltage	V_R	3.0	25		V	I_R=10 μA
Junction capacitance	C_J		50		pF	V_F=0 V, F=1 MHz
Reverse leakage current	I_R		.01	10	μA	V_R=3.0 V
DETECTOR						
DC forward current gain	h_{FE}		250			V_{CE}=5 V, I_C=100 μA
Collector to emitter breakdown volt	BV_{CEO}	30	85		V	I_C=1.0 mA, I_F=0
Collector to base breakdown voltage	BV_{CBO}	70	165		V	I_C=10 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 base leakage current	I_{CBO}		0.1	20	nA	V_{CB}=10 V, I_F=0
Capacitance collector to emitter	C_{CEO}		8		pF	V_{CE}=0
Capacitance collector to base	C_{CBO}		20		pF	V_{CB}=10 V
Capacitance emitter to base	C_{EBO}		10		pF	V_{BE}=0

TRANSFER CHARACTERISTICS

CHARACTERISTICS	SYMBOL	MIN.	TYP.	MAX.	UNITS	TEST CONDITIONS
COUPLED						
DC collector current transfer ratio	CTR_{CE}	20	60		%	V_{CE}=10 V, I_F=10 mA, Note 1
DC base current transfer ratio	CTR_{CB}		.35		%	V_{CB}=10 V, I_F=10 mA
Collector-emitter, saturation voltage	V_{CE}(sat)		0.24	0.4	V	I_C=2.0 mA, I_F=16 mA

TRANSFER CHARACTERISTICS

AC CHARACTERISTICS		SYMBOL	MIN.	TYP.	MAX.	UNITS	TEST CONDITIONS
Bandwidth (see note 2)		B_W		150		KHz	I_C=2 mA, V_{CE}=10 V, R_L=100Ω
SWITCHING TIMES							
Saturated t on (from 5 V to 0.8 V)		t_{on} (SAT)		10		μs	R_L=2 KΩ, I_F=15 mA, V_{CC}=5 V
t off (from SAT to 2.0 V)		t_{off} (SAT)		30		μs	R_B=open (Fig. 10 and Fig. 11)
Saturated t on (from 5 V to 0.8 V)		t_{on} (SAT)		10		μs	R_L=2 KΩ, I_F=20 mA, V_{CC}=5 V
t off (from SAT to 2.0 V)		t_{off} (SAT)		27		μs	R_B=100 KΩ (Fig. 10 and Fig. 11)
Non-saturated Base	Rise Time	t_r		300		ns	R_L=1 KΩ, V_{CB}=10 V
	Fall Time	t_f		300		ns	

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		7500			VAC PEAK	1 minute
		5300			VRMS	1 minute
Isolation resistance		10^{11}	10^{12}		Ω	V_{I-O}=500 V
Isolation capacitance			.5		pF	f=1 MHz

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

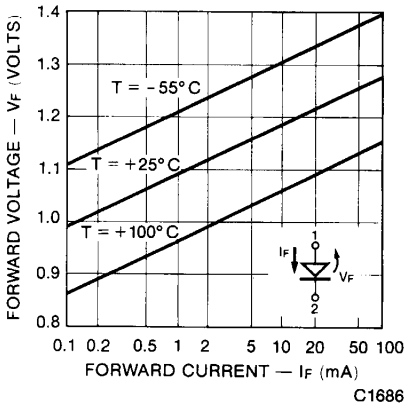


Fig. 1. Forward Voltage vs. Current

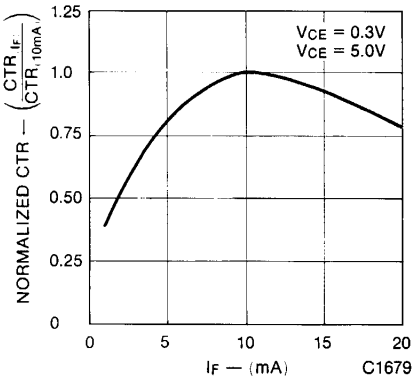


Fig. 2. Normalized CTR vs. Forward Current

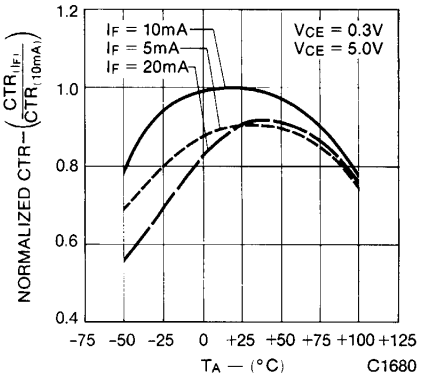


Fig. 3. Normalized CTR vs. Temperature

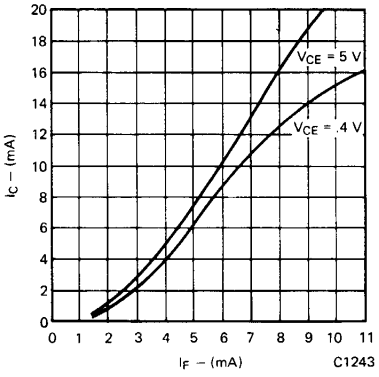


Fig. 4. Collector Current vs. Forward Current

TYPICAL ELECTRO-OPTICAL CHARACTERISTIC CURVES

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

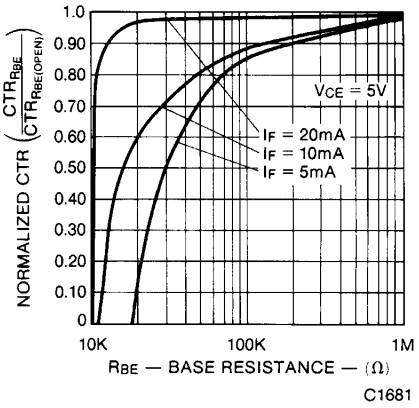


Fig. 5. CTR vs. RBE (Unsaturated)

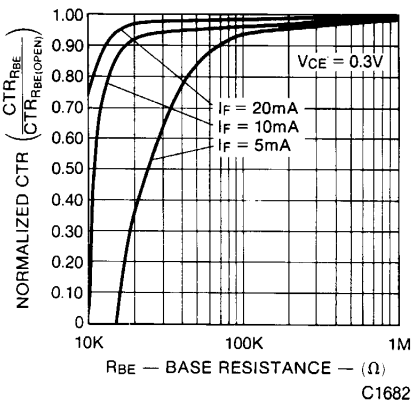


Fig. 6. CTR vs. RBE (Saturated)

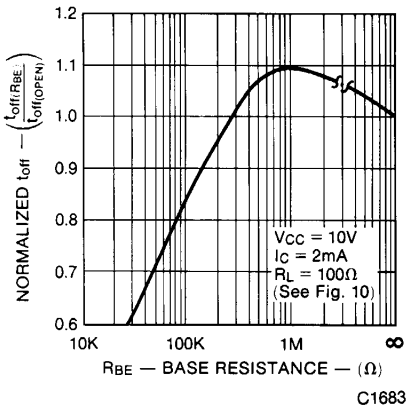


Fig. 7. Normalized T_{OFF} vs. RBE

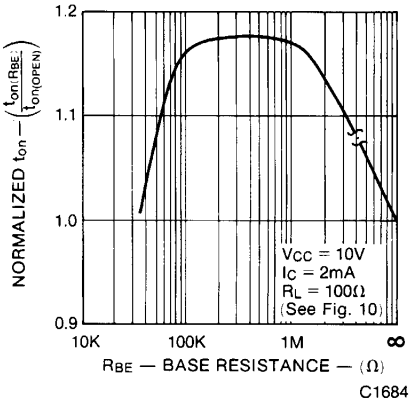


Fig. 8. Normalized T_{ON} vs. RBE

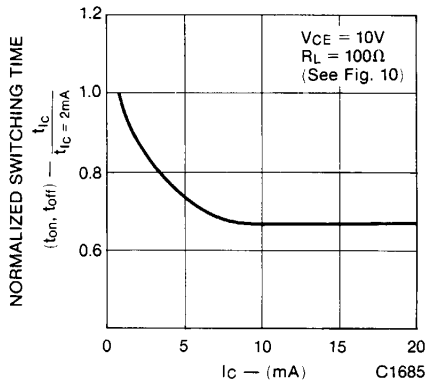


Fig. 9. Switching Time vs. IC

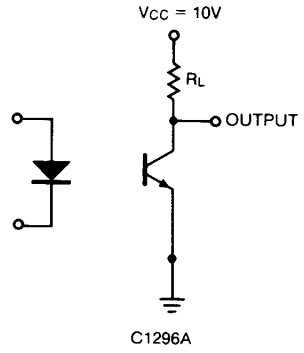


Fig. 10. Switching Time Test Circuit

TYPICAL ELECTRO-OPTICAL CHARACTERISTIC CURVES

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

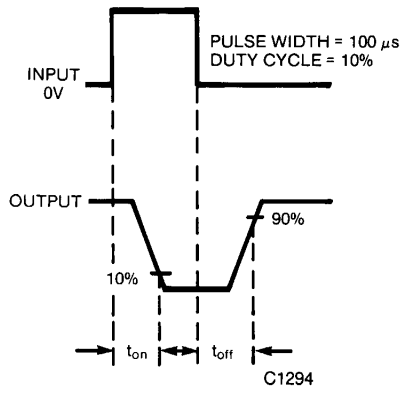


Fig. 11. Switching Time Waveforms

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 3 dB down from the 1 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 inital value, to 10%.