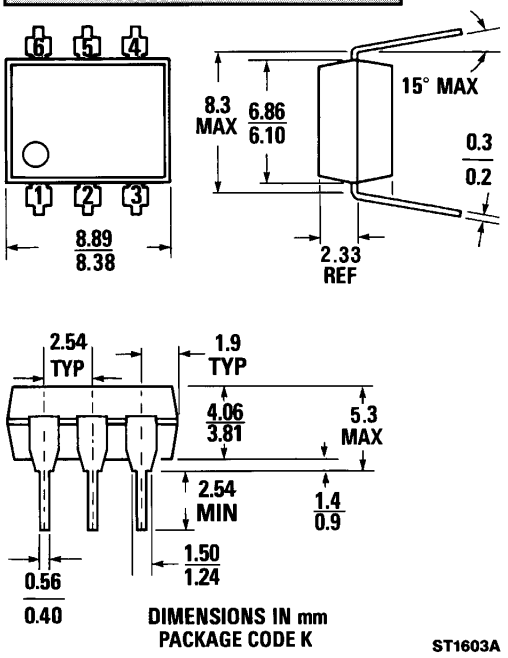
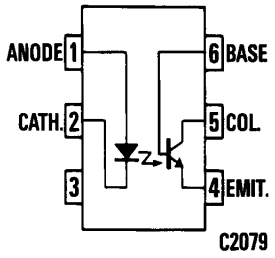
QT OPTOELECTRONICS

PHOTOTRANSISTOR OPTOCOUPLER

MCT271

PACKAGE DIMENSIONS





Equivalent Circuit

DESCRIPTION

The MCT271 is a phototransistor-type optically coupled isolator. A gallium arsenide infrared emitting diode is selectively coupled with an NPN silicon phototransistor.

FEATURES

- Controlled Current Transfer Ratio—45% to 90% (specified conditions)
- Maximum Turn-on-time—7 μseconds (specified condition)
- Maximum Turn-off-time—7 μseconds (specified condition)
- Underwriters Laboratory (U.L.) recognized—File E90700

APPLICATIONS

- Switching networks
- Power supply regulators
- Digital logic inputs
- Microprocessor inputs
- Appliance sensor systems

ABSOLUTE MAXIMUM RATINGS

TOTAL PACKAGE

Storage temperature ..... −55°C to 150°C
Operating temperature ..... −55°C to 100°C
Lead temperature
(soldering, 10 sec) ..... 260°C
Total package power dissipation @ 25°C
(LED plus detector) ..... 260 mW
Derate linearly from 25°C ..... 3.4 mW/°C

INPUT DIODE

Forward DC current ..... 60 mA
Reverse voltage ..... 3 V
Peak forward current
(1 μs pulse, 300 pps) ..... 3.0 A
Power dissipation 25°C ambient ..... 90 mW
Derate linearly from 25°C ..... 1.2 mW/°C

OUTPUT TRANSISTOR

Power dissipation @ 25°C ..... 200 mW
Derate linearly from 25°C ..... 2.67 mW/°C

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

INDIVIDUAL COMPONENT CHARACTERISTICS

CHARACTERISTIC	SYMBOL	MIN.	TYP.	MAX.	UNITS	TEST CONDITIONS
INPUT DIODE						
Forward voltage	V_F		1.20	1.50	V	I_F=20 mA
Forward voltage temp. coefficient	$\frac{\Delta V_F}{\Delta T_A}$		−1.8		mV/°C	
Reverse voltage	V_R	3.0	25		V	I_R=10 μA
Junction capacitance	C_J		50 65		pF pF	V_F=0 V, f=1 MHz V_F=1 V, f=1 MHz
Reverse leakage current	I_R		0.35	10	μA	V_R=3.0 V
OUTPUT TRANSISTOR						
DC forward current gain	h_{FE}	100	420			V_{CE}=5 V, I_C=100 μA
Breakdown voltage Collector to emitter	BV_{CEO}	30	45		V	I_C=1.0 mA, I_F=0
Collector to base	BV_{CBO}	70	130		V	I_C=10 μA, I_F=0
Emitter to base	BV_{EBO}	5	7		V	I_E=100 μA, I_F=0
Leakage current Collector to emitter	I_{CEO}		5	50	nA	V_{CE}=10 V, I_F=0
Capacitance Collector to emitter			8		pF	V_{CE}=0, f=1 MHz
Collector to base			20		pF	V_{CB}=5, f=1 MHz
Emitter to base			10		pF	V_{EB}=0, f=1 MHz

TRANSFER CHARACTERISTICS

DC CHARACTERISTICS	SYMBOL	MIN.	TYP.	MAX.	UNITS	TEST CONDITIONS
Current transfer ratio, collector to emitter (a)	CTR_{CE}	45	67	90	%	I_F=10 mA; V_{CE}=10 V
Current transfer ratio, collector to base	CTR_{CB}		0.15		%	I_F=10 mA; V_{CB}=10 V
Saturation voltage	$V_{CE(SAT)}$		0.14	.40	V	I_F=16 mA; I_C=2 mA

TRANSFER CHARACTERISTICS

CHARACTERISTICS	SYMBOL	MIN.	TYP.	MAX.	UNITS	TEST CONDITIONS
SWITCHING TIMES						
Non-saturated Turn-on time	t_{on}		4.9	7	μs	R_L=100Ω; I_C=2 mA; V_{CC}=5 V
Turn-off time	t_{off}		4.5	7	μs	See Figs. 10, 11
Saturated Turn-on time	t_{on}		5.2		μs	I_F=16 mA; R_L=1.9 KΩ
Turn-off time (Approximates a typical TTL interface)	t_{off}		38		μs	See Figs. 10, 11
Turn-on time	t_{on}		4.9		μs	I_F=16 mA; R_L=4.7 KΩ
Turn-off time (Approximates a typical low power TTL interface)	t_{off}		90		μs	See Figs. 10, 11

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

ISOLATION CHARACTERISTICS

CHARACTERISTICS	SYMBOL	MIN.	TYP.	MAX.	UNITS	TEST CONDITIONS
Steady state isolation	V_{iso}	7500			VAC-PEAK	$I_{I-O} \leq 1\ \mu A$, 1 minute
		5300			VAC-rms	$I_{I-O} \leq 1\ \mu A$, 1 minute
Isolation resistance	R_{iso}	10^{11}			ohms	V_{I-O}=500 VDC
Isolation capacitance	C_{iso}		0.5		pF	f=1 MHz

TYPICAL ELECTRICAL CHARACTERISTIC CURVES
(25°C Free Air Temperature Unless Otherwise Specified)

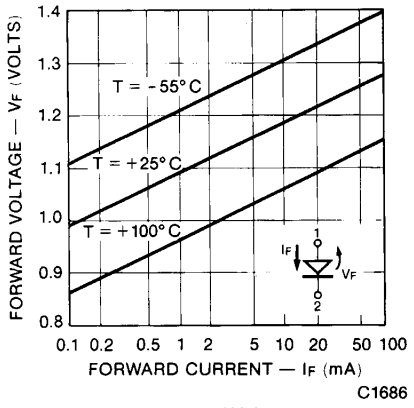


Fig. 1. Forward Voltage vs. Current

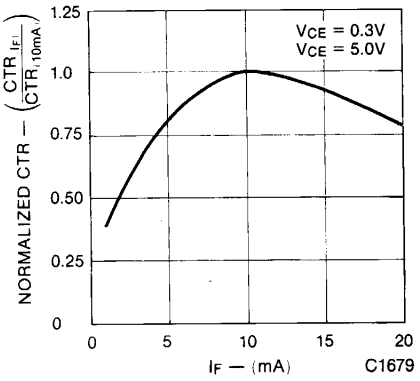


Fig. 2. Normalized CTR vs. Forward Current

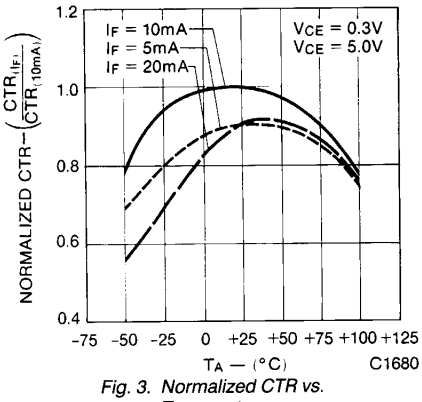


Fig. 3. Normalized CTR vs. Temperature

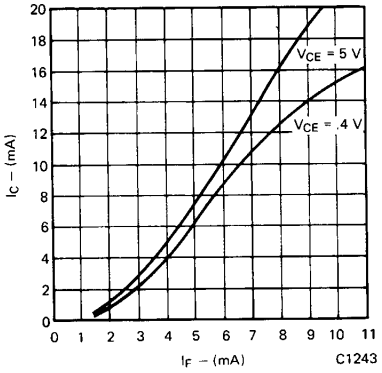


Fig. 4. Collector Current vs. Forward Current

TYPICAL ELECTRICAL CHARACTERISTIC CURVES

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

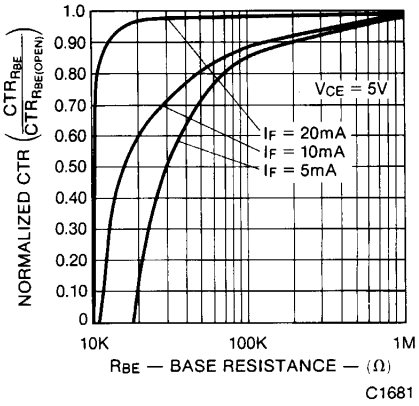


Fig. 5. CTR vs. RBE (Unsaturated)

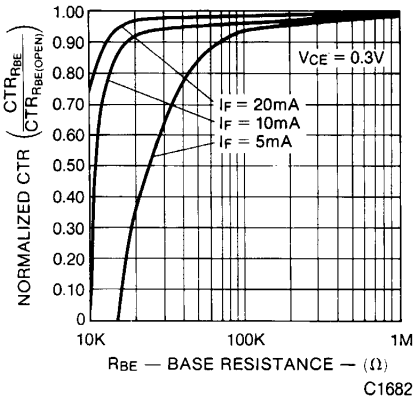


Fig. 6. CTR vs. RBE (Saturated)

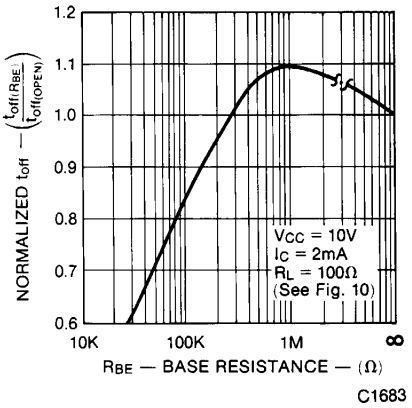


Fig. 7. Normalized T_{OFF} vs. RBE

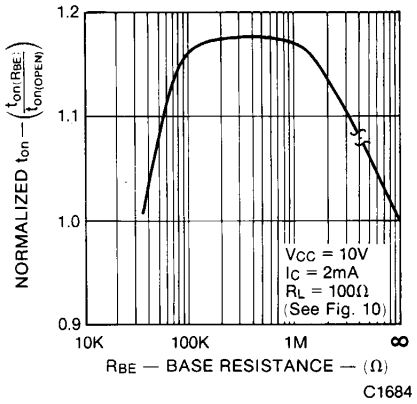


Fig. 8. Normalized T_{ON} vs. RBE

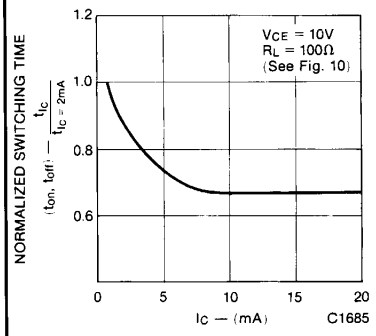


Fig. 9. Switching Time vs. IC

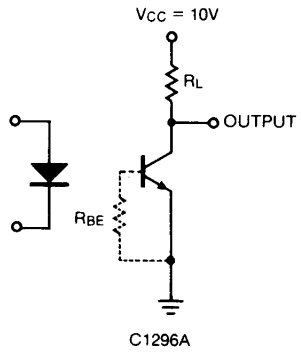


Fig. 10. Switching Time Test Circuit

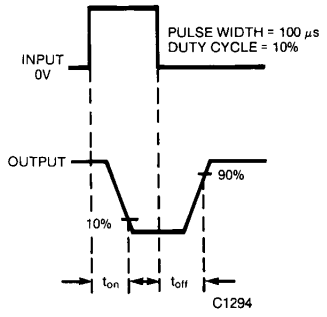


Fig. 11. Switching Time Waveforms