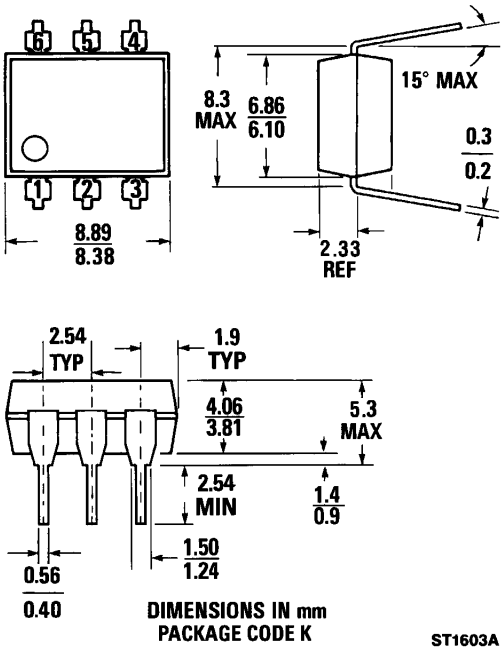
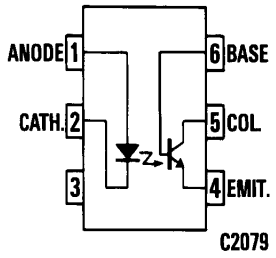
QT OPTOELECTRONICS

PHOTOTRANSISTOR OPTOCOUPLER

MCT210

PACKAGE DIMENSIONS





Equivalent Circuit

DESCRIPTION

The MCT210 incorporates a NPN silicon planar phototransistor optically coupled to a gallium arsenide infrared emitting diode. The MCT210 has a specified minimum CTR of 50%, saturated, and 150%, unsaturated.

FEATURES

- TTL compatible 1-10 gate loads
- High CTR with transistor output MCT210—150% min.
- Specified CTR over temperature range
- Good logic load characteristics
  V_{OL}=0.4 V @ 1.6 mA to 16mA
  output sinking (I_{OL})
- UL recognized (File #E90700)

APPLICATIONS

- Digital logic isolation
- Line receivers
- Feedback control circuits
- Monitoring circuits

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 current ..... 60 mA
Reverse voltage ..... 3.0 V
Peak forward current
(1 μs pulse, 300 pps) ..... 3.0 A
Power dissipation 25°C to 70° ambient ..... 90 mW
Derate linearly from +70°C ..... 2.0 mW/°C

OUTPUT TRANSISTOR

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

ELECTRO-OPTICAL CHARACTERISTICS
(0° to +70°C 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=40 mA
Forward voltage temp. coefficient	$\frac{\Delta V_F}{\Delta T_A}$		−1.8		mV/°C	
Reverse breakdown voltage	BV_R	6.0	15		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		.01	10	μA	V_R=6.0 V
OUTPUT TRANSISTOR						
DC forward current gain	h_{FE}		400			V_{CE}=5 V, I_C=10 mA
Breakdown voltage Collector to emitter	BV_{CEO}	30	45		V	I_C=1.0 mA, I_F=0
Collector to base	BV_{CBO}	30			V	I_C=10 μA, I_F=0
Emitter to collector	BV_{ECO}	6	8		V	I_E=100 μA, I_F=0
Leakage current Collector to emitter	I_{CEO}		5	50	nA	V_{CE}=5 V, I_F=0, T_A=+25°C
				30	μA	V_{CE}=5 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 CHARACTERISTIC	SYMBOL	MIN.	TYP.	MAX.	UNITS	TEST CONDITIONS
Current transfer ratio, collector to emitter MCT210 (a)	I_{CE}/I_F	50	70		%	V_{CE}=0.4 V, I_F=3.2 mA to 32 mA
		150	225		%	V_{CE}=5.0 V, I_F=10 mA
Current transfer ratio, collector to base	I_{CB}/I_F		0.6		%	V_{CB}=5.0 V, I_F=10 mA
Saturation voltage collector to emitter	$V_{CE(SAT)}$		0.2	0.4	V	I_C=16 mA, I_F=32 mA

ELECTRO-OPTICAL CHARACTERISTICS
(0° to +70°C Temperature Unless Otherwise Specified) (Cont'd)

TRANSFER CHARACTERISTICS (Cont'd)

CHARACTERISTIC	SYMBOL	MIN.	TYP.	MAX.	UNITS	TEST CONDITIONS
SWITCHING TIMES						
Non-saturated						
Rise time	t_r		4		μs	R_L=100 Ω, I_C=2 mA, V_{CC}=5 V
Fall time	t_f		5		μs	See Figs. 15 and 16
Saturated						
Rise time	t_r		2.5		μs	R_L=560 Ω, I_F=16 mA
Fall time	t_f		25		μs	See Figs. 15 and 16
Propagation delay						
High to low	$T_{PD(HL)}$		2		μs	R_L=2.7K, I_F=16 mA
Low to high	$T_{PD(LH)}$		10		μs	See Figs. 15 and 16

ISOLATION CHARACTERISTICS

CHARACTERISTIC	SYMBOL	MIN.	TYP.	MAX.	UNITS	TEST CONDITIONS
Steady state isolation	V_{iso}	7500			VAC-PEAK	I_{I-O}≤1 μA, 1 minute
		5300			VAC-RMS	I_{I-O}≤1 μA, 1 minute
Isolation resistance	R_{iso}	10^{11}	5×10^{12}		ohms	V_{I-O}=500 VDC, T_A=+25°C
Isolation capacitance	C_{iso}		1.0		pF	f=1 MHz

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

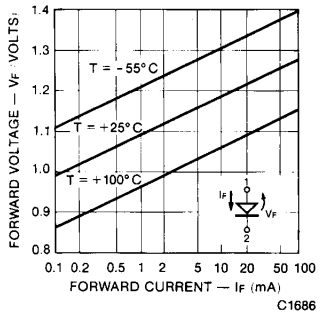


Fig. 1. Forward Voltage vs. Forward Current

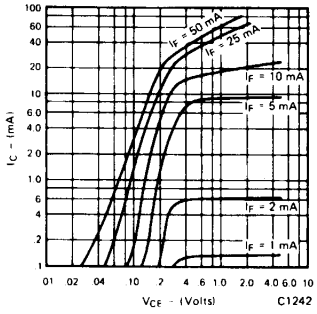


Fig. 2. Collector Current vs. Collector to Emitter Voltage

TYPICAL ELECTRICAL CHARACTERISTIC CURVES

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

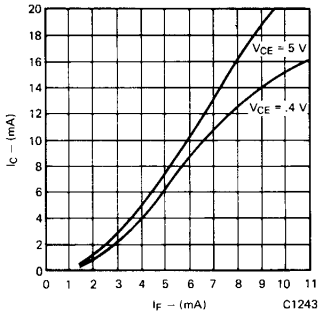


Fig. 3. Collector Current vs. Forward Current

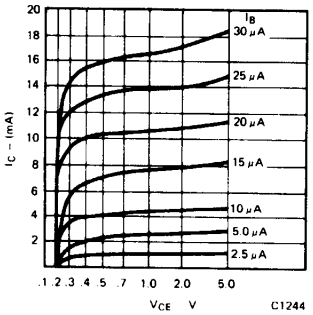


Fig. 4. Collector Current vs. Collector to Emitter Voltage

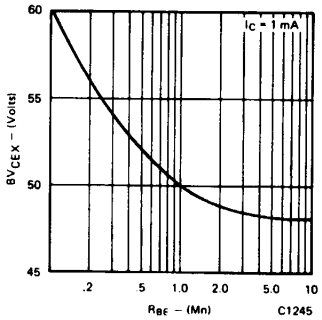


Fig. 5. Collector to Emitter Breakdown Voltage vs. Base to Emitter Resistance

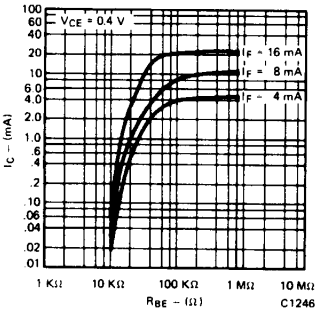


Fig. 6. Saturated CTR vs. Base to Emitter Resistance

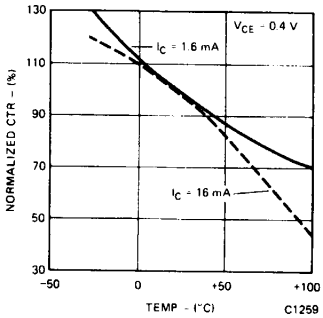


Fig. 7. Current Transfer Ratio (saturated) vs. Temperature

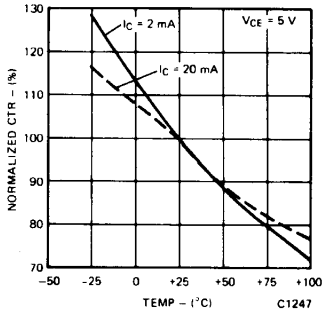


Fig. 8. Current Transfer Ratio (unsaturated) vs. Temperature

TYPICAL ELECTRICAL CHARACTERISTIC CURVES

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

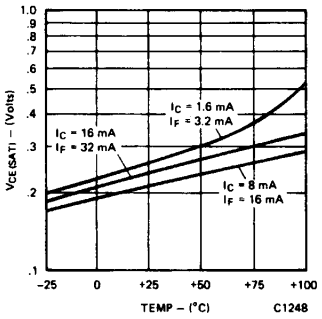


Fig. 9. Collector to Emitter Saturation Voltage vs. Temperature

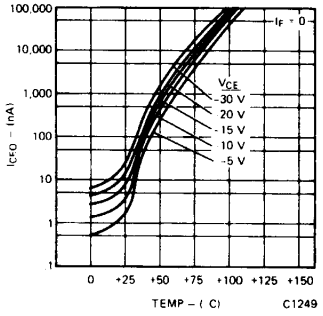


Fig. 10 Collector to Emitter Leakage Current vs. Temperature

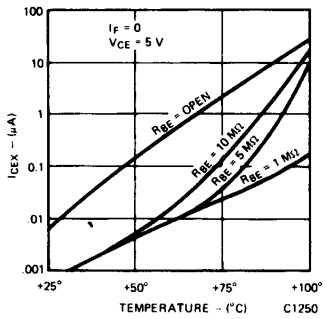


Fig. 11. Collector to Emitter Leakage Current vs.Temperature

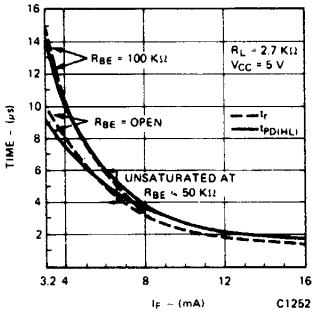


Fig. 12. Switch-on Time vs. I_F Drive (saturated)

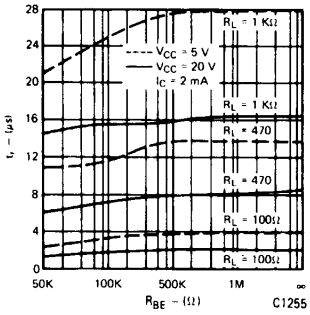


Fig. 13. Rise Time vs. Base to Emitter Resistance (non-saturated)

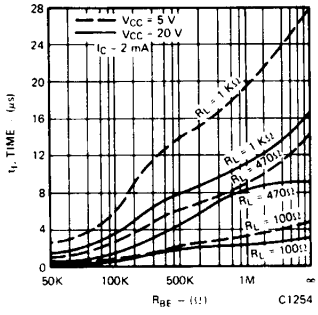


Fig. 14. Fall Time vs. Base to Emitter Resistance (non-saturated)

TYPICAL ELECTRICAL CHARACTERISTIC CURVES

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

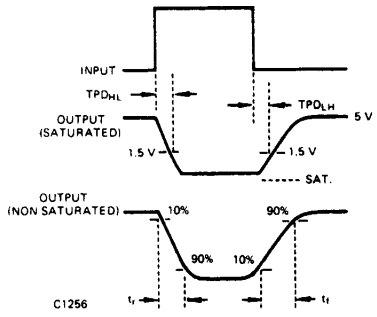


Fig. 15 Switching Time Waveforms

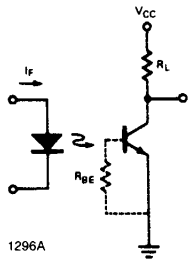


Fig. 16 Switching Time Test Circuits

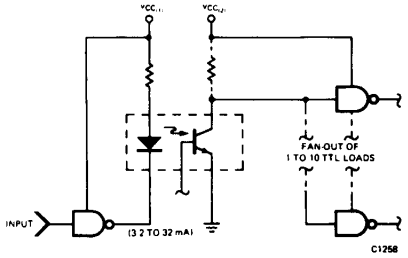


Fig. 17. Typical TTL Interface at Operating Temperatures of 0° to 70°C