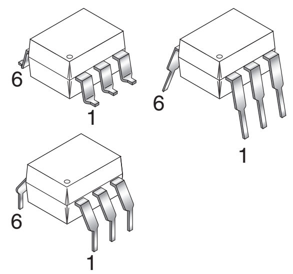
PHOTOTRANSISTOR OPTOCOUPLERS

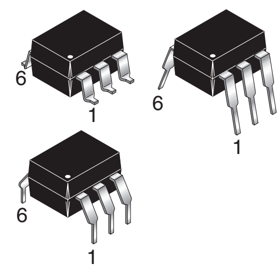
FAIRCHILD SEMICONDUCTOR®

MCT2 MCT2200 | MCT2E MCT2201 | MCT210 MCT2202 | MCT271

WHITE PACKAGE (-M SUFFIX)



BLACK PACKAGE (NO -M SUFFIX)



DESCRIPTION

The MCT2XXX series optoisolators consist of a gallium arsenide infrared emitting diode driving a silicon phototransistor in a 6-pin dual in-line package.

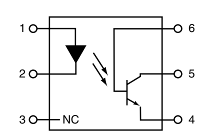
FEATURES

- UL recognized (File # E90700)
- VDE recognized (File # 94766)
  – Add option V for white package (e.g., MCT2V-M)
  – Add option 300 for black package (e.g., MCT2.300)
- MCT2 and MCT2E are also available in white package by specifying -M suffix, eg. MCT2-M

APPLICATIONS

- Power supply regulators
- Digital logic inputs
- Microprocessor inputs

SCHEMATIC



PIN 1. ANODE
2. CATHODE
3. NO CONNECTION
4. EMITTER
5. COLLECTOR
6. BASE

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ABSOLUTE MAXIMUM RATINGS

Parameter	Symbol	Device	Value	Units
TOTAL DEVICE Storage Temperature	T_{STG}	ALL	-55 to +150	°C
Operating Temperature	T_{OPR}	ALL	-55 to +100	°C
Lead Solder Temperature	T_{SOL}	ALL	260 for 10 sec	°C
Total Device Power Dissipation @ T_A = 25°C	P_D	-M	250	mW
		Non-M	260	
Derate above 25°C		-M	2.94	mW/°C
		Non-M	3.3	
EMITTER DC/Average Forward Input Current	I_F	-M	60	mA
		Non-M	100	
Reverse Input Voltage	V_R	ALL	3	V
Forward Current - Peak (300µs, 2% Duty Cycle)	I_F(pk)	ALL	3	A
LED Power Dissipation @ T_A = 25°C	P_D	-M	120	mW
		Non-M	150	
Derate above 25°C		-M	1.41	mW/°C
		Non-M	2.0	
DETECTOR Collector Current	I_C	ALL	50	mA
Collector-Emitter Voltage	V_{CEO}	ALL	30	V
Detector Power Dissipation @ T_A = 25°C	P_D	ALL	150	mW
Derate above 25°C		-M	1.76	mW/°C
		Non-M	2.0	

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ELECTRICAL CHARACTERISTICS (T_A = 25°C Unless otherwise specified.)

Individual Component Characteristics

Parameter	Test Conditions	Symbol	Device	Min	Typ**	Max	Unit
EMITTER							
Input Forward Voltage	(I_F = 20 mA)	V_F	MCT2/-M MCT2E/-M MCT271 MCT2200 MCT2201 MCT2202		1.25	1.50	V
	(T_A = 0-70°C, I_F = 40 mA)		MCT210		1.33		
Reverse Leakage Current	(V_R = 3.0 V)	I_R	MCT2/-M MCT2E/-M MCT271 MCT2200 MCT2201 MCT2202		0.001	10	µA
	(T_A = 0-70°C, V_R = 6.0 V)		MCT210				
DETECTOR	(I_C = 1.0 mA, I_F = 0)	BV_{CEO}	ALL	30	100		V
Collector-Emitter Breakdown Voltage	(T_A = 0-70°C)		MCT210				
Collector-Base Breakdown Voltage	(I_C = 10 µA, I_F = 0)	BV_{CBO}	MCT2/-M MCT2E/-M MCT271 MCT2200 MCT2201 MCT2202	70	120		V
	(T_A = 0-70°C)		MCT210	30			
Emitter-Collector Breakdown Voltage	(I_E = 100 µA, I_F = 0)	BV_{ECO}	MCT2/-M MCT2E/-M MCT271 MCT2200 MCT2201 MCT2202	7	10		V
	(T_A = 0-70°C)		MCT210	6	10		
Collector-Emitter Dark Current	(V_{CE} = 10 V, I_F = 0)	I_{CEO}	ALL		1	50	nA
	(V_{CE} = 5 V, T_A = 0-70°C)					30	µA
Collector-Base Dark Current	(V_{CB} = 10 V, I_F = 0)	I_{CBO}	ALL			20	nA
Capacitance	(V_{CE} = 0 V, f = 1 MHz)	C_{CE}	ALL		8		pF

** Typical values at T_A = 25°C

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TRANSFER CHARACTERISTICS (T_A = 25°C Unless otherwise specified.)

DC Characteristic	Test Conditions	Symbol	Device	Min	Typ**	Max	Unit
Output Collector Current	(T_A = 0-70°C)	CTR	MCT210	150			%
	(I_F = 10 mA, V_{CE} = 5 V)		MCT2200	20			
			MCT2201	100			
			MCT2202	63		125	
	(I_F = 10 mA, V_{CE} = 10 V)		MCT2 MCT2-M MCT2E MCT2E-M	20			
			MCT271	45		90	
	(I_F = 3.2 mA to 32 mA, V_{CE} = 0.4 V) (T_A = 0-70°C)		MCT210	50			
Collector-Emitter Saturation Voltage	(I_C = 2 mA, I_F = 16 mA)	$V_{CE\ (SAT)}$	MCT2 MCT2-M MCT2E MCT2E-M MCT271			0.4	V
	(I_C = 16 mA, I_F = 32 mA, T_A = 0-70°C)		MCT210				
	(I_C = 2.5 mA, I_F = 10 mA)		MCT2200 MCT2201 MCT2202				
AC Characteristic Saturated Turn-on Time from 5 V to 0.8 V	(I_F = 15 mA, V_{CC} = 5 V, R_L = 2 kΩ) (R_B = Open) (Fig. 20)	t_{on}	MCT2		1.1		µs
			MCT2E		1.1		
	(I_F = 20 mA, V_{CC} = 5 V, R_L = 2 kΩ) (R_B = 100 kΩ) (Fig. 20)		MCT2		1.3		
			MCT2E		1.3		
Saturated Turn-off Time from SAT to 2.0 V	(I_F = 15 mA, V_{CC} = 5 V, R_L = 2 kΩ) (R_B = Open) (Fig. 20)	t_{off}	MCT2		50		
			MCT2E		50		
	(I_F = 20 mA, V_{CC} = 5 V, R_L = 2 kΩ) (R_B = 100 kΩ) (Fig. 20)		MCT2		20		
			MCT2E		20		
Turn-on Time	(I_F = 10 mA, V_{CC} = 10 V, R_L = 100 Ω)	t_{on}	MCT2-M MCT2E-M		2		
Turn-off Time	(I_F = 10 mA, V_{CC} = 10 V, R_L = 100 Ω)	t_{off}	MCT2-M MCT2E-M		2		
Rise Time	(I_F = 10 mA, V_{CC} = 10 V, R_L = 100 Ω)	t_r	MCT2-M MCT2E-M		2		
Fall Time	(I_F = 10 mA, V_{CC} = 10 V, R_L = 100 Ω)	t_f	MCT2-M MCT2E-M		1.5		

** Typical values at T_A = 25°C

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TRANSFER CHARACTERISTICS (Cont.)

AC Characteristic	Test Conditions	Symbol	Device	Min	Typ**	Max	Unit
Saturated turn-on time	(I_F = 16 mA, R_L = 1.9kΩ, V_{CC} = 5 V) (Fig. 20)	t_{on}	MCT271		1.0		µs
Saturated turn-off time (Approximates a typical TTL interface)		t_{off}			48		
Saturated turn-on time	(I_F = 16 mA, R_L = 4.7kΩ, V_{CC} = 5 V) (Fig. 20)	t_{on}			1.0		
Saturated turn-off time (Approximates a typical low power TTL interface)		t_{off}			98		
Saturated rise time	(I_F = 16 mA, R_L = 560Ω, V_{CC} = 5 V) (Fig. 20, 21)	t_r	MCT210		1.0		
Saturated fall time		t_f			11		
Saturated propagation delay - high to low	(I_F = 16 mA, R_L = 2.7kΩ) (Fig. 20, 21)	$T_{PD\ (HL)}$			1.0		
Saturated propagation delay - low to high		$T_{PD\ (LH)}$			50		
Non-saturated turn on time	(I_C = 2 mA, V_{CC} = 10 V, R_L = 100Ω (Fig. 20)	T_{ON}	MCT2200 MCT2201 MCT2202		2	10	
Non-saturated turn off time		T_{OFF}			2	10	
Non-saturated rise time	(I_C = 2 mA, V_{CC} = 5 V, R_L = 100Ω) (Fig. 20)	t_r	MCT210		2		
Non-saturated fall time		t_f			2		
Non-saturated turn-on time	(I_C = 2 mA, V_{CC} = 5 V, R_L = 100Ω) (Fig. 20)	t_{on}	MCT271		2	7	
Non-saturated turn-off time		t_{off}			2	7	

** Typical values at T_A = 25°C

ISOLATION CHARACTERISTICS

Characteristic	Test Conditions	Symbol	Min	Typ*	Max	Units
Input-Output Isolation Voltage	(Non '-M', Black Package) (f = 60 Hz, t = 1 min)	V_{ISO}	5300			Vac(rms)
	('-M', White Package) (f = 60 Hz, t = 1 sec)		7500			Vac(pk)
Isolation Resistance	(V_{I-O} = 500 VDC)	R_{ISO}	10^{11}			Ω
Isolation Capacitance	(V_{I-O} = &, f = 1 MHz)	C_{ISO}		0.5		pF
	('-M' White Package)			0.2	2	pF

Note

* Typical values at T_A = 25°C

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TYPICAL PERFORMANCE CURVES

Fig. 1 LED Forward Voltage vs. Forward Current (Black Package)

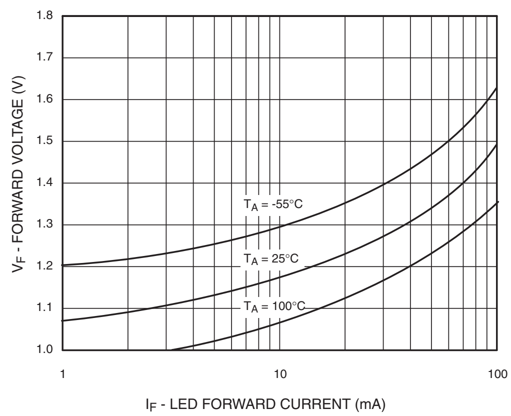

Fig. 2 LED Forward Voltage vs. Forward Current (White Package)

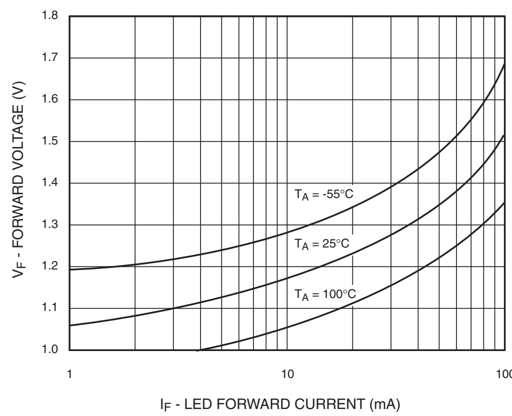

Fig.3 Normalized CTR vs. Forward Current (Black Package)

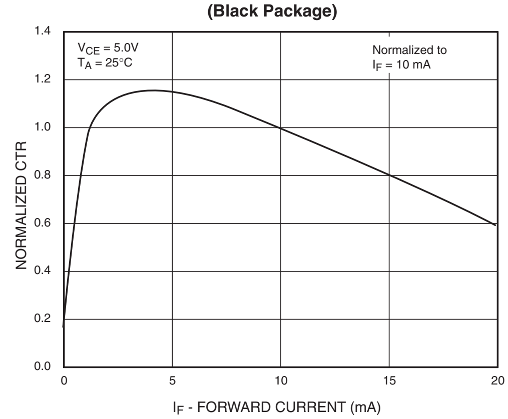

Fig.4 Normalized CTR vs. Forward Current (White Package)

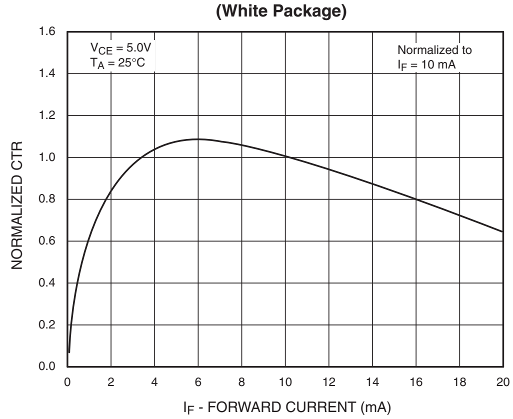

Fig. 5 Normalized CTR vs. Ambient Temperature (Black Package)

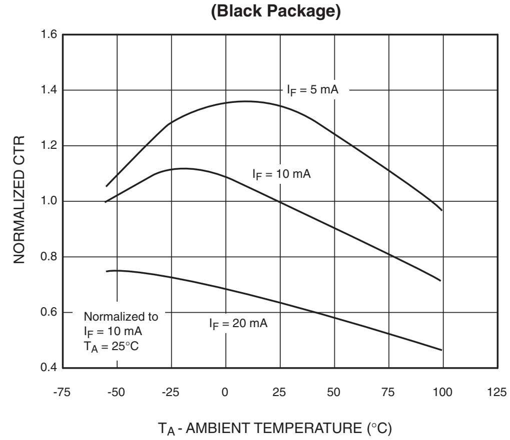

Fig. 6 Normalized CTR vs. Ambient Temperature (White Package)

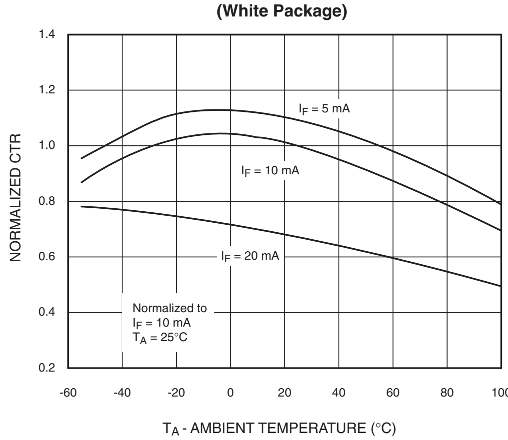

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Fig. 7 CTR vs. RBE (Unsaturated) (Black Package)

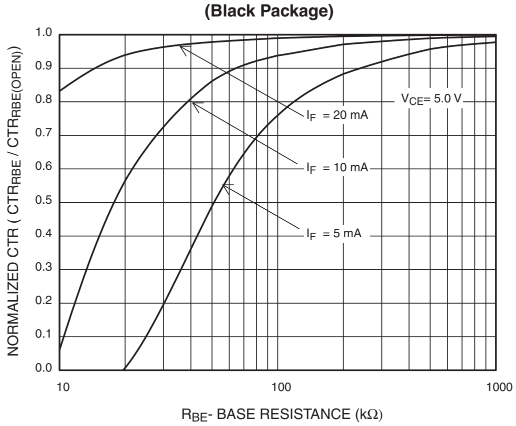

Fig. 8 CTR vs. RBE (Unsaturated) (White Package)

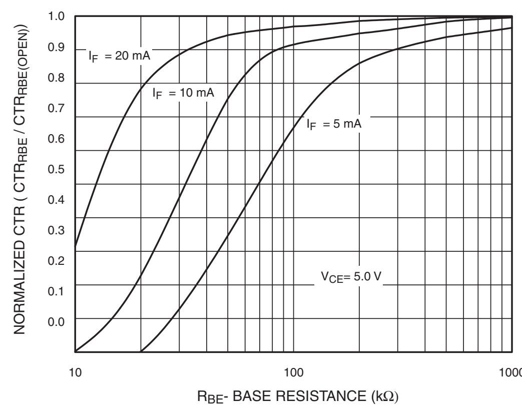

Fig. 9 CTR vs. RBE (Saturated) (Black Package)

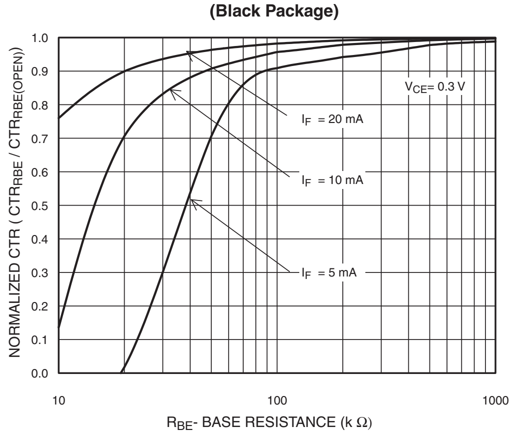

Fig. 10 CTR vs. RBE (Saturated) (White Package)

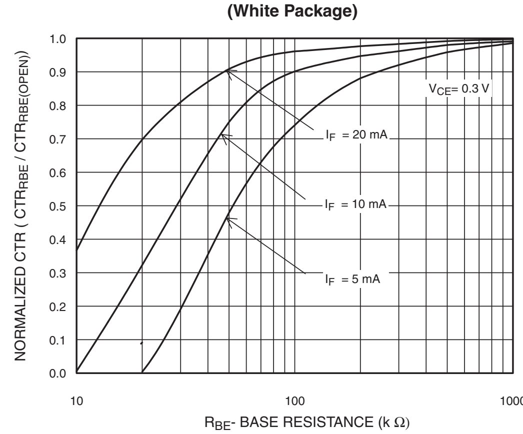

Fig. 11 Collector-Emitter Saturation Voltage vs Collector Current (Black Package)

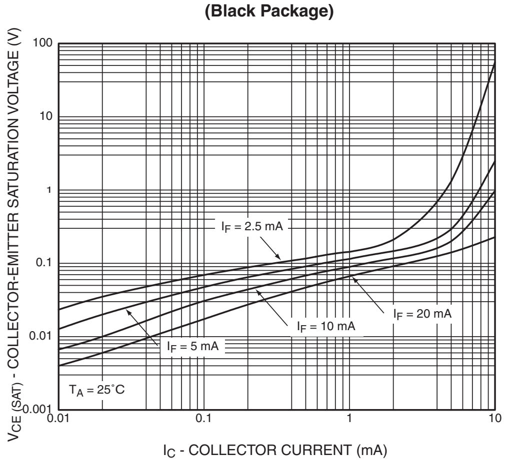

Fig. 12 Collector-Emitter Saturation Voltage vs Collector Current (White Package)

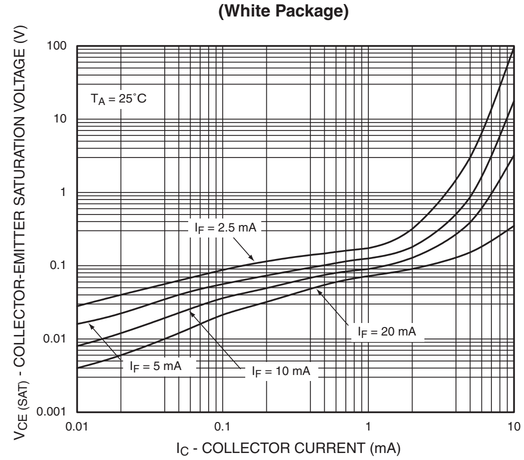

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Fig. 13 Switching Speed vs. Load Resistor (Black Package)

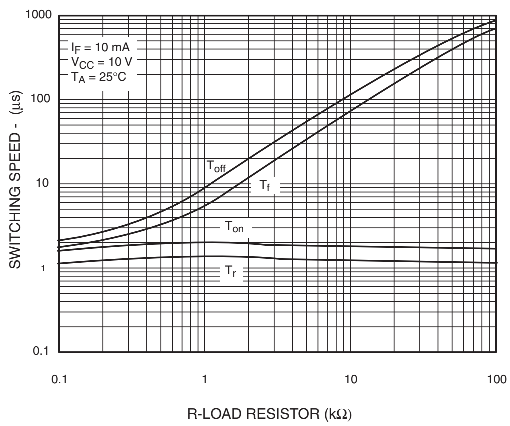

Fig. 14 Switching Speed vs. Load Resistor (White Package)

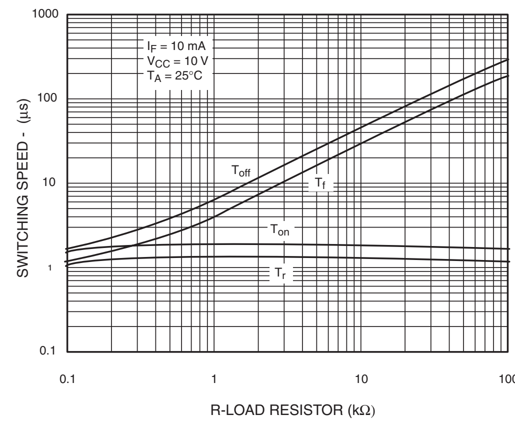

Fig. 15 Normalized t_{on} vs. R_{BE} (Black Package)

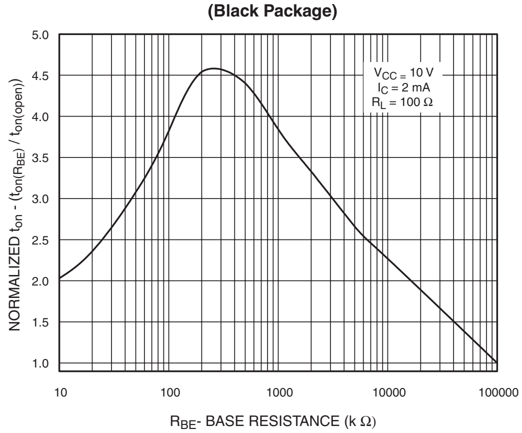

Fig. 16 Normalized t_{on} vs. R_{BE} (White Package)

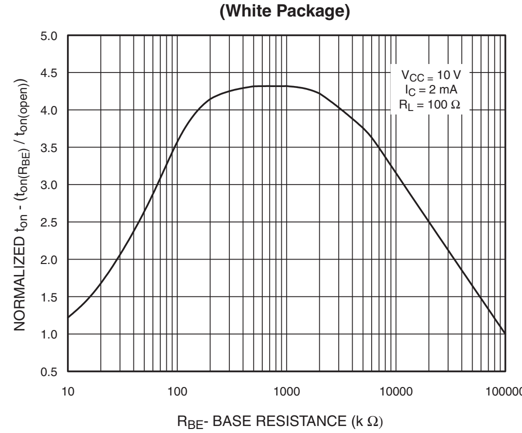

Fig. 17 Normalized t_{off} vs. R_{BE} (Black Package)

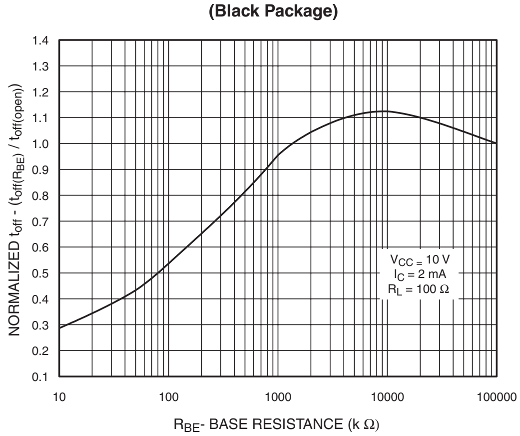

Fig. 18 Normalized t_{off} vs. R_{BE} (White Package)

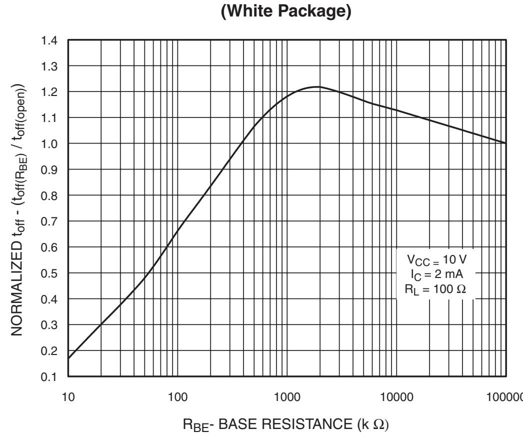

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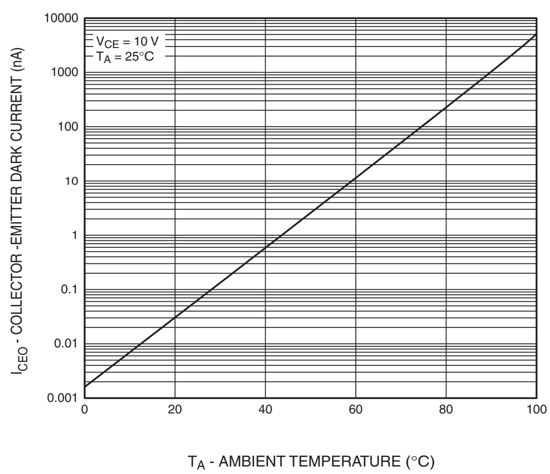
Fig. 19 Dark Current vs. Ambient Temperature



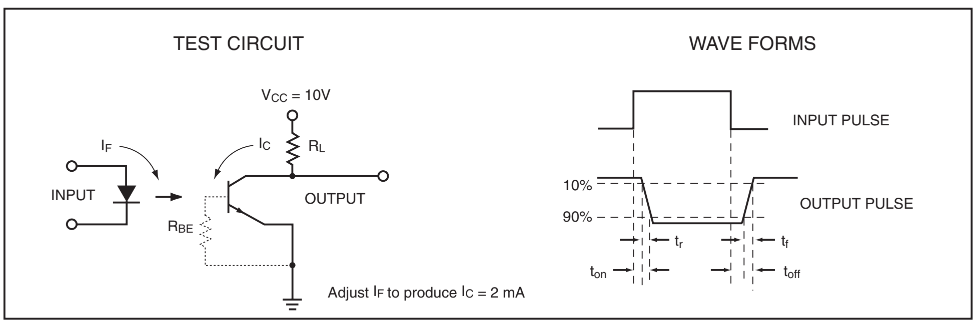


Figure 20. Switching Time Test Circuit and Waveforms

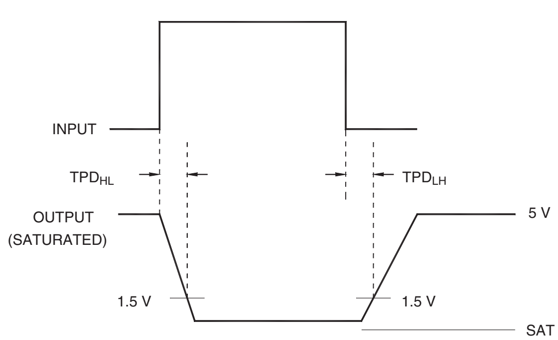


Figure 21. Switching Time Waveforms (MCT210)

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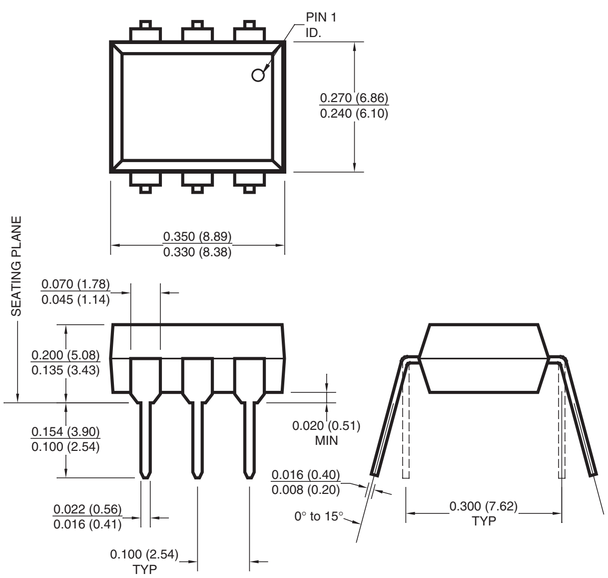
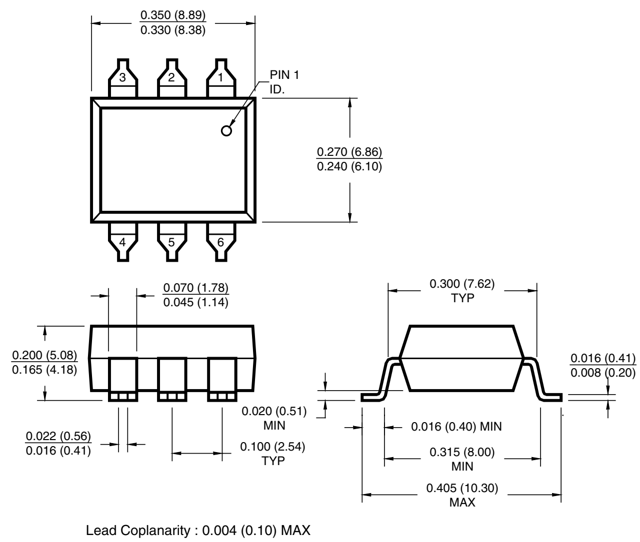
Black Package (No -M Suffix)

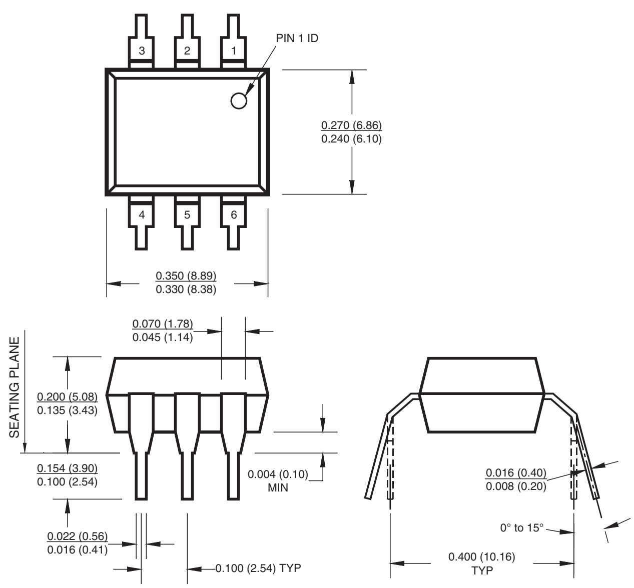
Package Dimensions (Through Hole)



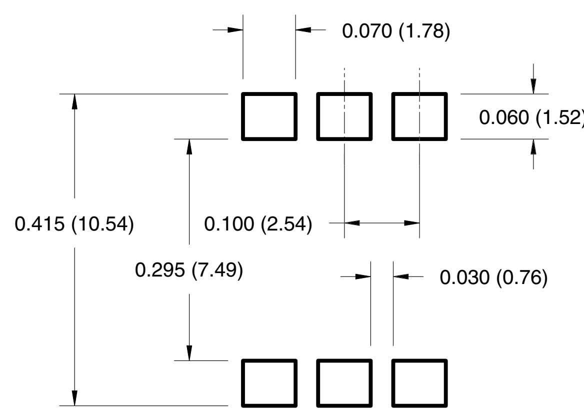
Package Dimensions (Surface Mount)



Package Dimensions (0.4” Lead Spacing)



Recommended Pad Layout for Surface Mount Leadform

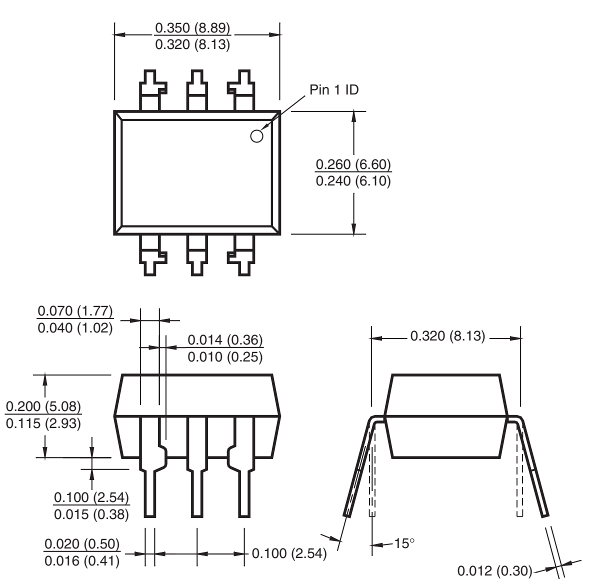


NOTE
All dimensions are in inches (millimeters)

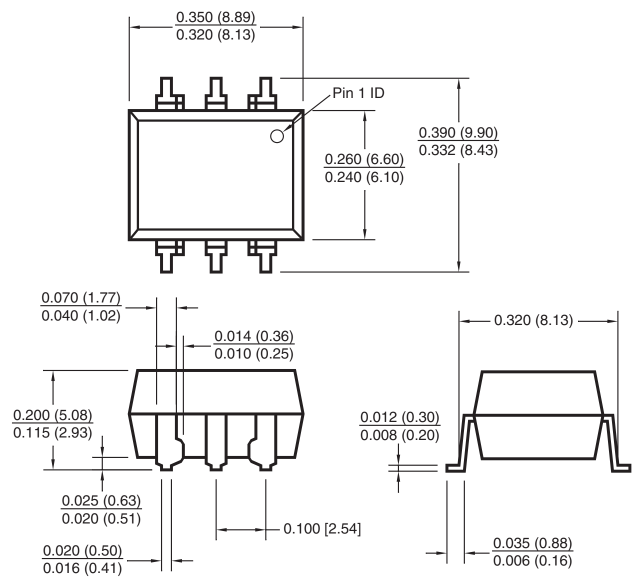
MCT2	MCT2E	MCT210	MCT271
MCT2200	MCT2201	MCT2202	

White Package (-M Suffix)

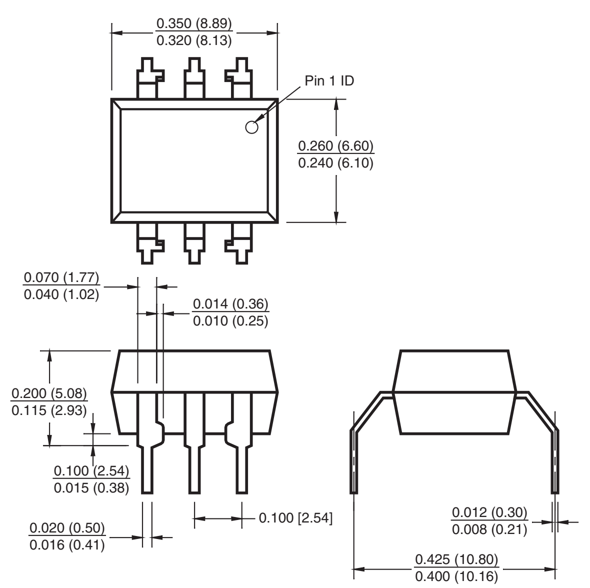
Package Dimensions (Through Hole)



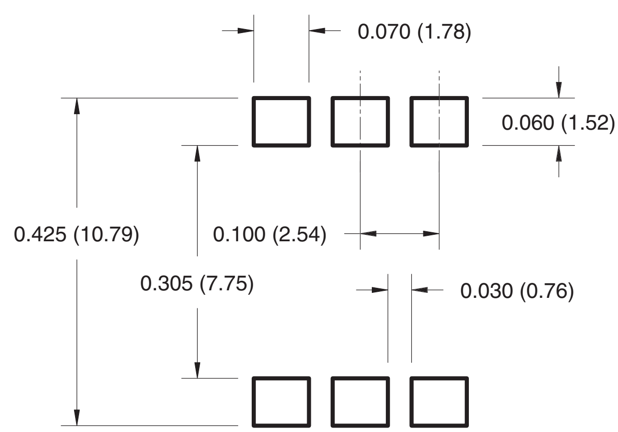
Package Dimensions (Surface Mount)



Package Dimensions (0.4” Lead Spacing)



Recommended Pad Layout for Surface Mount Leadform



NOTE
All dimensions are in inches (millimeters)

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ORDERING INFORMATION

Order Entry Identifier		
Black Package (No Suffix)	**White Package (-M Suffix)**	**Description**
.S	S	Surface Mount Lead Bend
.SD	SR2	Surface Mount; Tape and reel
.W	T	0.4" Lead Spacing
.300	V	VDE 0884
.300W	TV	VDE 0884, 0.4" Lead Spacing
.3S	SV	VDE 0884, Surface Mount
.3SD	SR2V	VDE 0884, Surface Mount, Tape & Reel

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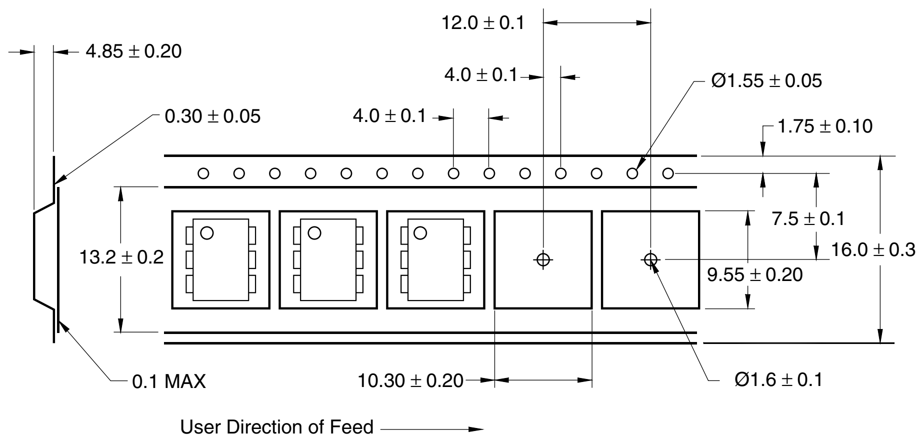
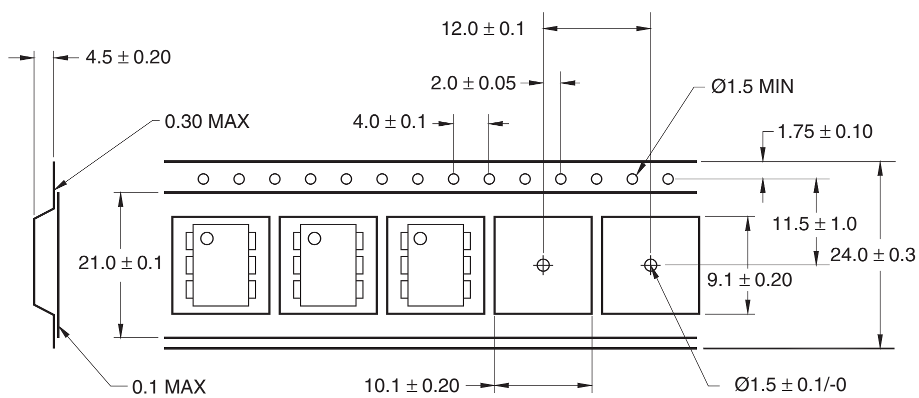
MCT2	MCT2E	MCT210	MCT271
MCT2200	MCT2201	MCT2202	

QT Carrier Tape Specifications (“D” Taping Orientation) (Black Package, No Suffix)



QT Carrier Tape Specifications (“D” Taping Orientation) (White Package, -M Suffix)



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2. A critical component in any component of a life support device or system whose failure to perform can be reasonably expected to cause the failure of the life support device or system, or to affect its safety or effectiveness.