

MCT5200

MCT5201

MCT5210

MCT5211

Description

The MCT52XX series consists of a high-efficiency AlGaAs, infrared emitting diode, coupled with an NPN phototransistor in a six pin dual-in-line package.

The MCT52XX is well suited for CMOS to LSTT/TTL interfaces, offering 250% $CTR_{CE(SAT)}$ with 1 mA of LED input current. When an LED input current of 1.6 mA is supplied data rates to 20K bits/s are possible.

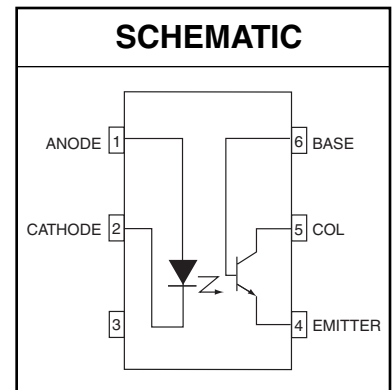
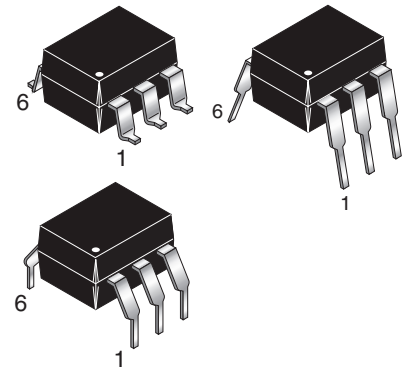
The MCT52XX can easily interface LSTTL to LSTTL/TTL, and with use of an external base to emitter resistor data rates of 100K bits/s can be achieved.

Features

- High $CTR_{CE(SAT)}$ comparable to Darlington
- CTR guaranteed 0°C to 70°C
- High common mode transient rejection 5kV/μs
- Data rates up to 150 kbits/s (NRZ)
- Underwriters Laboratory (UL) recognized (file #E90700)
- VDE recognized (file #94766)
 - Add option 300 (e.g., MCT5211.300)

Applications

- CMOS to CMOS/LSTTL logic isolation
- LSTTL to CMOS/LSTTL logic isolation
- RS-232 line receiver
- Telephone ring detector
- AC line voltage sensing
- Switching power supply



Parameters	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 @ 25°C (LED plus detector) Derate Linearly From 25°C	P _D	All	260	mW
			3.5	mW/°C
EMITTER				
Continuous Forward Current	I _F	All	50	mA
Reverse Input Voltage	V _R	All	6	V
Forward Current - Peak (1 μs pulse, 300 pps)	I _{F(pk)}	All	3.0	A
LED Power Dissipation	P _D	All	75	mW
Derate Linearly From 25°C		All	1.0	mW/°C
DETECTOR				
Continuous Collector Current	I _C	All	150	mA
Detector Power Dissipation	P _D	All	150	mW
Derate Linearly from 25°C		All	2.0	mW/°C

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ELECTRICAL CHARACTERISTICS ($T_A = 25^\circ\text{C}$ Unless otherwise specified.)

INDIVIDUAL COMPONENT CHARACTERISTICS

Parameters	Test Conditions	Symbol	Device	Min	Typ**	Max	Units
EMITTER							
Input Forward Voltage	($I_F = 5\text{ mA}$)	V_F	All		1.25	1.5	V
Forward Voltage Temp. Coefficient	($I_F = 2\text{ mA}$)	$\frac{\Delta V_F}{\Delta T_A}$	All		-1.75		mV/ $^\circ\text{C}$
Reverse Voltage	($I_R = 10\text{ }\mu\text{A}$)	V_R	All	6			V
Junction Capacitance	($V_F = 0\text{ V}$, $f = 1.0\text{ MHz}$)	C_J	All		18		pF
DETECTOR							
Collector-Emitter Breakdown Voltage	($I_C = 1.0\text{ mA}$, $I_F = 0$)	BV_{CEO}	All	30	100		V
Collector-Base Breakdown Voltage	($I_C = 10\text{ }\mu\text{A}$, $I_F = 0$)	BV_{CBO}	All	30	120		V
Emitter-Base Breakdown Voltage	($I_C = 10\text{ }\mu\text{A}$, $I_F = 0$)	BV_{EBO}	All	5	10		V
Collector-Emitter Dark Current	($V_{CE} = 10\text{ V}$, $I_F = 0$, $R_{BE} = 1\text{ M}\Omega$)	I_{CER}	All		1	100	nA
Capacitance Collector to Emitter	($V_{CE} = 0$, $f = 1\text{ MHz}$)	C_{CE}	All		10		pF
Collector to Base	($V_{CB} = 0$, $f = 1\text{ MHz}$)	C_{CB}	All		80		pF
Emitter to Base	($V_{EB} = 0$, $f = 1\text{ MHz}$)	C_{EB}	All		15		pF

ISOLATION CHARACTERISTICS

Characteristic	Test Conditions	Symbol	Device	Min	Typ**	Max	Units
Input-Output Isolation Voltage ⁽¹⁰⁾	($f = 60\text{ Hz}$, $t = 1\text{ min.}$)	V_{ISO}	All	5300			Vac(rms)
Isolation Resistance ⁽¹⁰⁾	$V_{I-O} = 500\text{ VDC}$, $T_A = 25^\circ\text{C}$	R_{ISO}	All	10^{11}			Ω
Isolation Capacitance ⁽⁹⁾	$V_{I-O} = 0$, $f = 1\text{ MHz}$	C_{ISO}	All		0.7		pF
Common Mode Transient Rejection – Output High	$V_{CM} = 50\text{ V}_{P-P}$, $R_L = 750\Omega$, $I_F = 0$	CM_H	MCT5210/11		5000		V/ μs
	$V_{CM} = 50\text{ V}_{P-P}$, $R_L = 1\text{ K}\Omega$, $I_F = 0$		MCT5200/01				
Common Mode Transient Rejection – Output Low	$V_{CM} = 50\text{ V}_{P-P}$, $R_L = 750\Omega$, $I_F = 1.6\text{ mA}$	CM_L	MCT5210/11		5000		V/ μs
	$V_{CM} = 50\text{ V}_{P-P}$, $R_L = 1\text{ K}\Omega$, $I_F = 5\text{ mA}$		MCT5200/01				

**All typical $T_A = 25^\circ\text{C}$

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TRANSFER CHARACTERISTICS ($T_A = 0^\circ\text{C}$ to 70°C Unless otherwise specified.)							
DC Characteristics	Test Conditions	Symbol	Device	Min	Typ**	Max	Units
Saturated Current Transfer Ratio ⁽¹⁾ (Collector to Emitter)	$I_F = 10\text{ mA}, V_{CE} = 0.4\text{ V}$	$CTR_{CE(SAT)}$	MCT5200	75			%
	$I_F = 5\text{ mA}, V_{CE} = 0.4\text{ V}$		MCT5201	120			
	$I_F = 3.0\text{ mA}, V_{CE} = 0.4\text{ V}$		MCT5210	60			
	$I_F = 1.6\text{ mA}, V_{CE} = 0.4\text{ V}$		MCT5211	100			
	$I_F = 1.0\text{ mA}, V_{CE} = 0.4\text{ V}$			75			
Current Transfer Ratio (Collector to Emitter) ⁽¹⁾	$I_F = 3.0\text{ mA}, V_{CE} = 5.0\text{ V}$	$CTR_{(CE)}$	MCT5210	70			%
	$I_F = 1.6\text{ mA}, V_{CE} = 5.0\text{ V}$		MCT5211	150			
	$I_F = 1.0\text{ mA}, V_{CE} = 5.0\text{ V}$			110			
Current Transfer Ratio Collector to Base ⁽²⁾	$I_F = 10\text{ mA}, V_{CB} = 4.3\text{ V}$	$CTR_{(CB)}$	MCT5200	0.2			%
	$I_F = 5\text{ mA}, V_{CB} = 4.3\text{ V}$		MCT5201	0.28			
	$I_F = 3.0\text{ mA}, V_{CE} = 4.3\text{ V}$		MCT5210	0.2			
	$I_F = 1.6\text{ mA}, V_{CE} = 4.3\text{ V}$		MCT5211	0.3			
	$I_F = 1.0\text{ mA}, V_{CE} = 4.3\text{ V}$			0.25			
Saturation Voltage	$I_F = 10\text{ mA}, I_{CE} = 7.5\text{ mA}$	$V_{CE(SAT)}$	MCT5200			0.4	V
	$I_F = 5\text{ mA}, I_{CE} = 6\text{ mA}$		MCT5201			0.4	
	$I_F = 3.0\text{ mA}, I_{CE} = 1.8\text{ mA}$		MCT5210			0.4	
	$I_F = 1.6\text{ mA}, I_{CE} = 1.6\text{ mA}$		MCT5211			0.4	
AC Characteristics	Test Conditions	Symbol	Device	Min	Typ	Max	Units
Propagation Delay High to Low ⁽³⁾	$R_L = 330\ \Omega, R_{BE} = \infty$	T_{PHL}	MCT5210		10		μs
	$R_L = 3.3\text{ k}\Omega, R_{BE} = 39\text{ k}\Omega$				7		
	$R_L = 750\ \Omega, R_{BE} = \infty$		MCT5211		14		
	$R_L = 4.7\text{ k}\Omega, R_{BE} = 91\text{ k}\Omega$				15		
	$R_L = 1.5\text{ k}\Omega, R_{BE} = \infty$				17		
	$R_L = 10\text{ k}\Omega, R_{BE} = 160\text{ k}\Omega$				24		
	$V_{CE} = 0.4\text{ V}, V_{CC} = 5\text{ V},$ $R_L = \text{fig. 13}, R_{BE} = 330\text{ k}\Omega$		MCT5200		1.6	12	
			MCT5201		3	30	
Propagation Delay Low to High ⁽⁴⁾	$R_L = 330\ \Omega, R_{BE} = \infty$	T_{PLH}	MCT5210		0.4		μs
	$R_L = 3.3\text{ k}\Omega, R_{BE} = 39\text{ k}\Omega$				8		
	$R_L = 750\ \Omega, R_{BE} = \infty$		MCT5211		2.5		
	$R_L = 4.7\text{ k}\Omega, R_{BE} = 91\text{ k}\Omega$				11		
	$R_L = 1.5\text{ k}\Omega, R_{BE} = \infty$				7		
	$R_L = 10\text{ k}\Omega, R_{BE} = 160\text{ k}\Omega$				16		
	$V_{CE} = 0.4\text{ V}, V_{CC} = 5\text{ V},$ $R_L = \text{fig. 13}, R_{BE} = 330\text{ k}\Omega$		MCT5200		18	20	
			MCT5201		12	13	
Delay Time ⁽⁵⁾	$V_{CE} = 0.4\text{ V},$ $R_{BE} = 330\text{ k}\Omega,$ $R_L = 1\text{ k}\Omega, V_{CC} = 5\text{ V}$	t_d	MCT5200		0.5	7	μs
			MCT5201		1.1	15	
Rise Time ⁽⁶⁾	$V_{CE} = 0.4\text{ V},$ $R_{BE} = 330\text{ k}\Omega,$ $R_L = 1\text{ k}\Omega, V_{CC} = 5\text{ V}$	t_r	MCT5200		1.3	6	μs
			MCT5201		2.5	20	

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TRANSFER CHARACTERISTICS (T _A = 0°C to 70°C Unless otherwise specified.) (Continued)								
DC Characteristics	Test Conditions		Symbol	Device	Min	Typ**	Max	Units
Storage Time ⁽⁷⁾	V _{CE} = 0.4V, R _{BE} = 330 kΩ, R _L = 1 kΩ, V _{CC} = 5V	I _F = 10mA	t _s	MCT5200		15	18	μs
		I _F = 5mA		MCT5201		10	13	
Fall Time ⁽⁸⁾	V _{CE} = 0.4V, R _{BE} = 330 kΩ, R _L = 1 kΩ, V _{CC} = 5V	I _F = 10mA	t _f	MCT5200		16	30	μs
		I _F = 5mA		MCT5201		16	30	

**All typicals at $T_A = 25^\circ\text{C}$

Notes

1. DC Current Transfer Ratio (CTR_{CE}) is defined as the transistor collector current (I_{CE}) divided by the input LED current (I_F) x 100%, at a specified voltage between the collector and emitter (V_{CE}).
2. The collector base Current Transfer Ratio (CTR_{CB}) is defined as the transistor collector base photocurrent (I_{CB}) divided by the input LED current (I_F) time 100%.
3. Referring to Figure 14 the T_{PHL} propagation delay is measured from the 50% point of the rising edge of the data input pulse to the 1.3V point on the falling edge of the output pulse.
4. Referring to Figure 14 the T_{PLH} propagation delay is measured from the 50% point of the falling edge of data input pulse to the 1.3V point on the rising edge of the output pulse.
5. Delay time (t_d) is measured from 50% of rising edge of LED current to 90% of V_o falling edge.
6. Rise time (t_r) is measured from 90% to 10% of V_o falling edge.
7. Storage time (t_s) is measured from 50% of falling edge of LED current to 10% of V_o rising edge.
8. Fall time (t_f) is measured from 10% to 90% of V_o rising edge.
9. C_{ISO} is the capacitance between the input (pins 1, 2, 3 connected) and the output, (pin 4, 5, 6 connected).
10. Device considered a two terminal device: Pins 1, 2, and 3 shorted together, and pins 5, 6 and 7 are shorted together.

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TYPICAL PERFORMANCE GRAPHS

Fig. 1 LED Forward Voltage vs. Forward Current

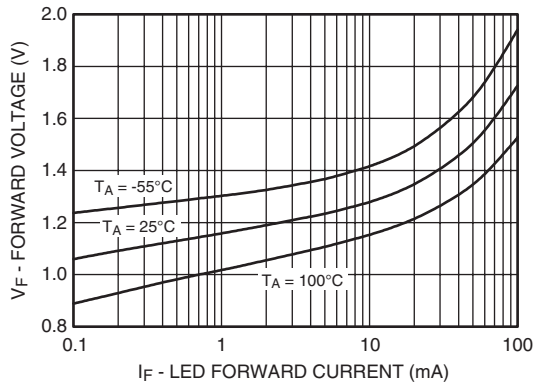


Fig. 2 Normalized Current Transfer Ratio vs. Forward Current

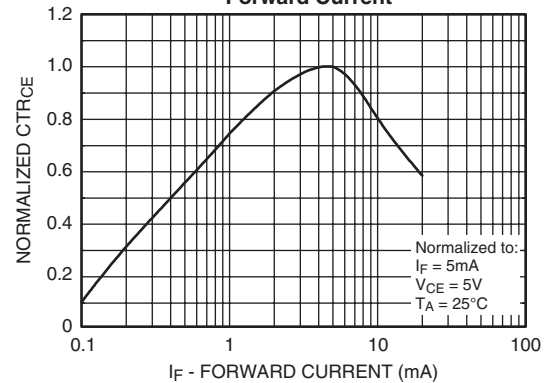


Fig. 3 Normalized CTR vs. Temperature

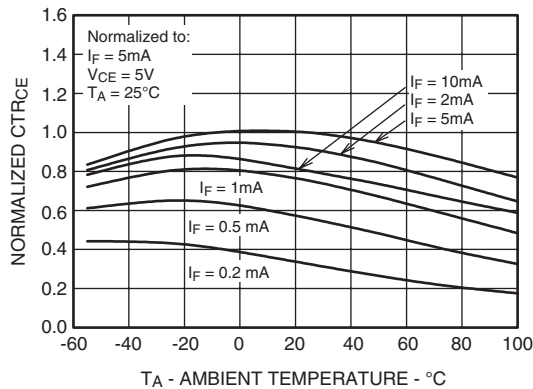


Fig. 4 Normalized Collector vs. Collector - Emitter Voltage

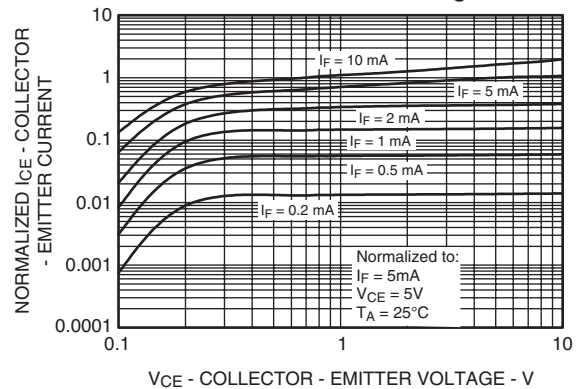


Fig. 5 Normalized Collector Base Photocurrent Ratio vs. Forward Current

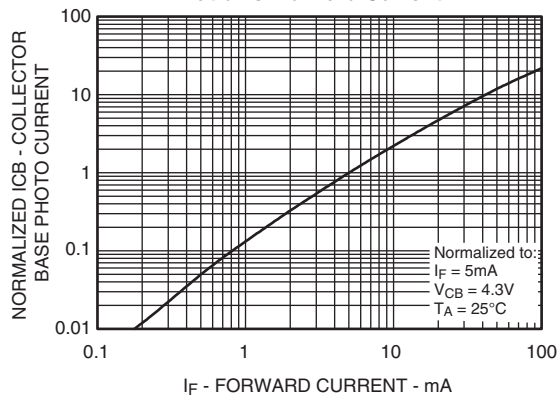
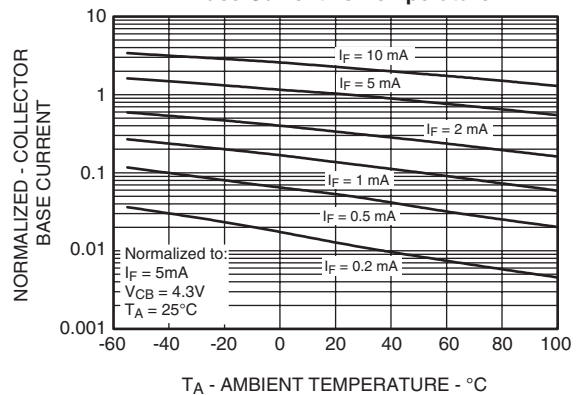


Fig. 6 Normalized Collector - Base Current vs. Temperature



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TYPICAL PERFORMANCE GRAPHS (Continued)

Fig. 7 Collector-Emitter Dark Current vs. Ambient Temperature

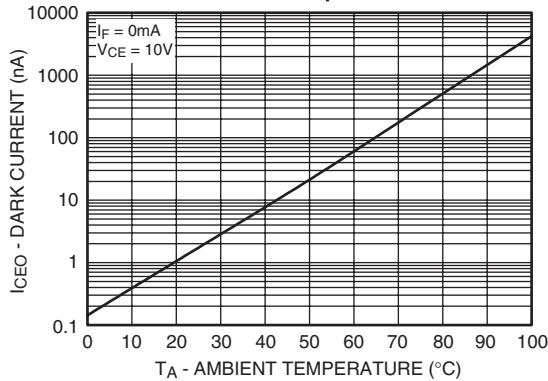


Fig. 8 Switching Time vs. Ambient Temperature

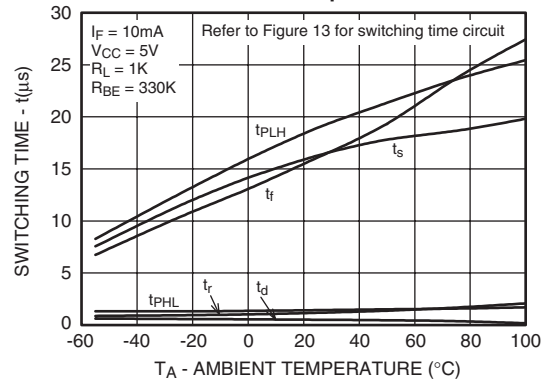


Fig. 9 Switching Time vs. Ambient Temperature

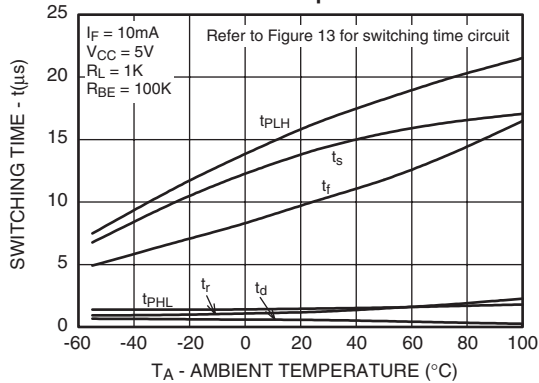


Fig. 10 Switching Time vs. Ambient Temperature

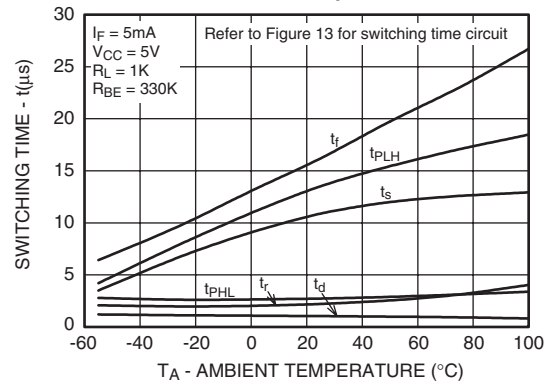


Fig. 11 Switching Time vs. Ambient Temperature

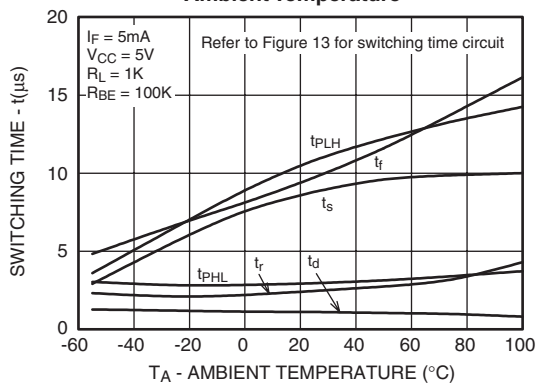
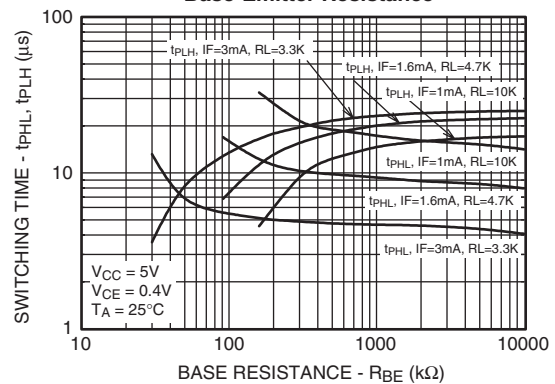


Fig. 12 Turn-on Time vs. Base-Emitter Resistance



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

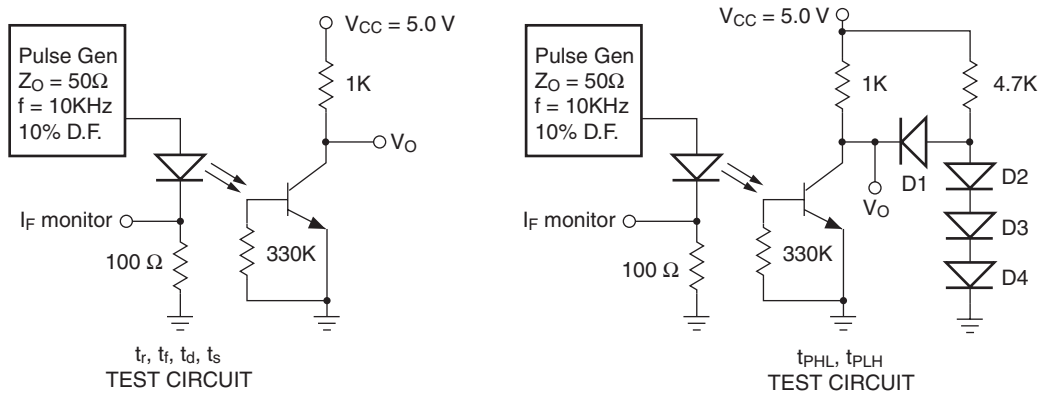


Figure 13.

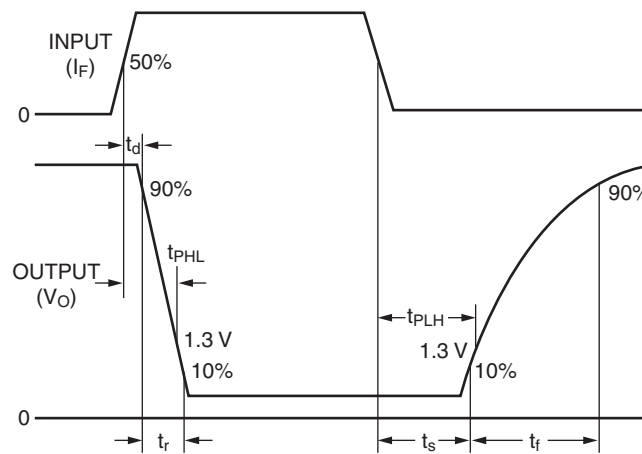


Figure 14. Switching Circuit Waveforms

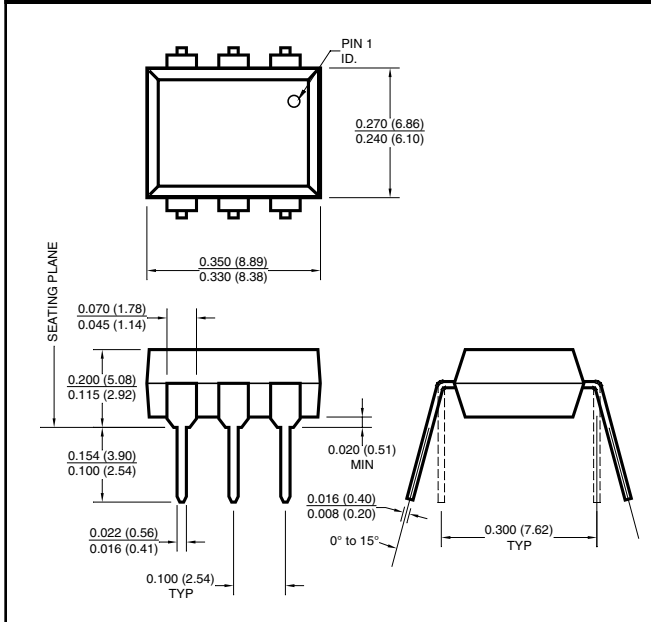
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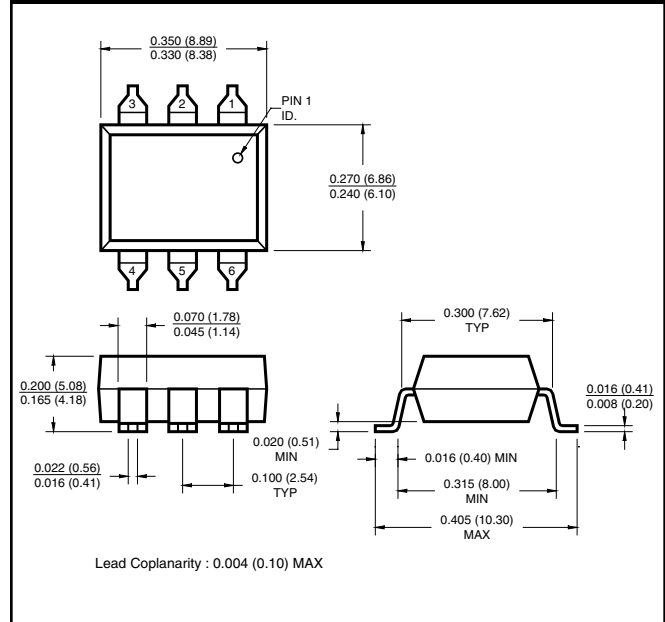
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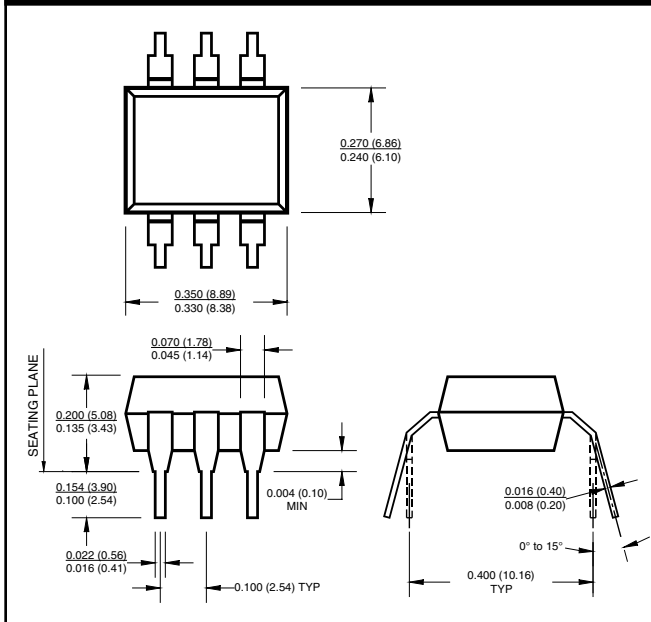
Package Dimensions (Through Hole)



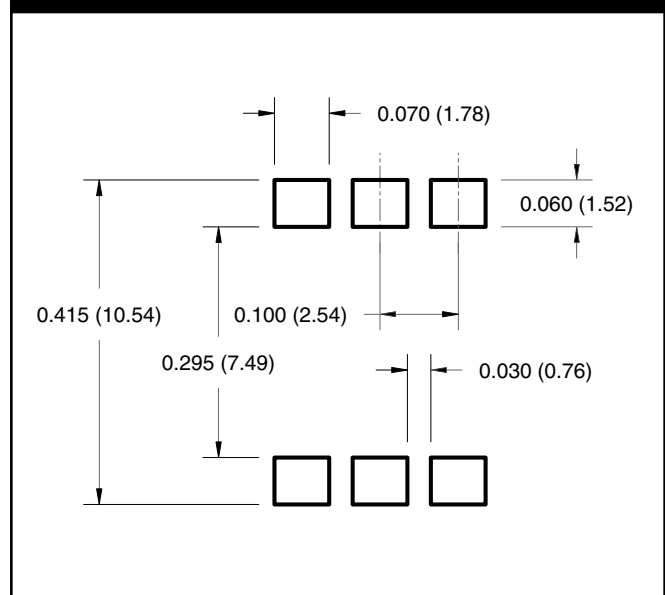
Package Dimensions (Surface Mount)



Package Dimensions (0.4" Lead Spacing)



**Recommended Pad Layout for
Surface Mount Leadform**



Note

All dimensions are in inches (millimeters)

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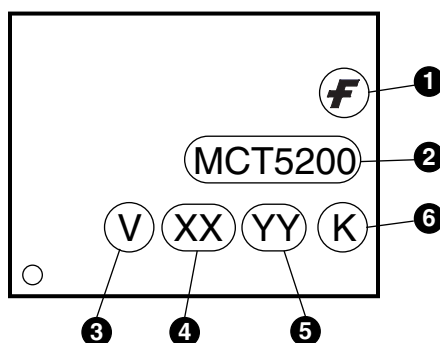
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ORDERING INFORMATION

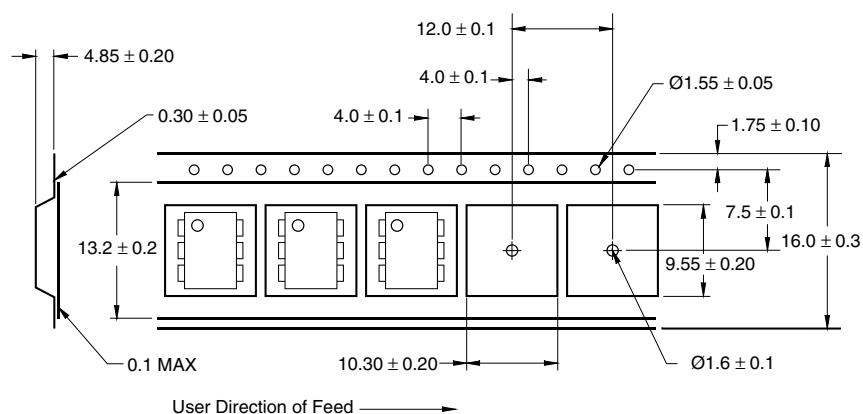
Option	Order Entry Identifier	Description
S	.S	Surface Mount Lead Bend
SD	.SD	Surface Mount; Tape and Reel
W	.W	0.4" Lead Spacing
300	.300	VDE 0884
300W	.300W	VDE 0884, 0.4" Lead Spacing
3S	.3S	VDE 0884, Surface Mount
3SD	.3SD	VDE 0884, Surface Mount, Tape and Reel

MARKING INFORMATION



Definitions	
1	Fairchild logo
2	Device number
3	VDE mark (Note: Only appears on parts ordered with VDE option – See order entry table)
4	Two digit year code, e.g., '03'
5	Two digit work week ranging from '01' to '53'
6	Assembly package code

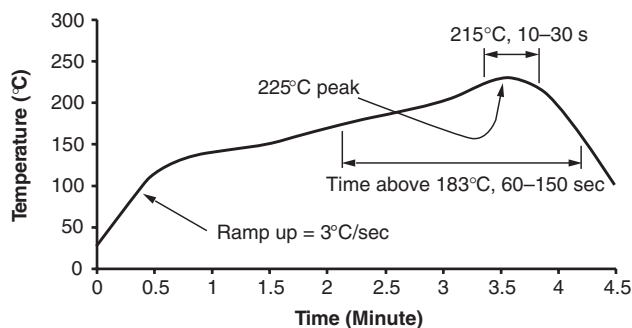
Carrier Tape Specifications



NOTE

All dimensions are in inches (millimeters)

Reflow Profile (Black Package, No Suffix)



- Peak reflow temperature: 225°C (package surface temperature)
- Time of temperature higher than 183°C for 60–150 seconds
- One time soldering reflow is recommended

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