

6-Pin DIP Low Input Current Phototransistor Optocouplers

MCT5210M, MCT5211M

Description

The MCT5210M and MCT5211M devices consist of a high-efficiency AlGaAs infrared emitting diode coupled with an NPN phototransistor in a six-pin dual-in-line package.

The devices are well suited for CMOS to LSTTL/TTL interfaces, offering 250% CTR CE(SAT) with 1 mA of LED input current. With an LED input current of 1.6 mA, data rates to 20 kbits/s are possible.

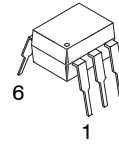
Both can easily interface LSTTL to LSTTL/TTL, and with use of an external base-to-emitter resistor data rates of 100 kbits/s can be achieved.

Features

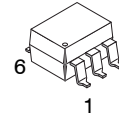
- High CTR_{CE(SAT)} Comparable to Darlington
- High Common Mode Transient Rejection: 5 kV/μs
- Data Rates Up to 150 kbits/s (NRZ)
- Safety and Regulatory Approvals:
 - UL1577; 4,170 VAC_{RMS} for 1 Minute
 - DIN-EN/IEC60747-5-5, 850 V Peak Working Insulation Voltage
- These are Pb-Free Devices

Applications

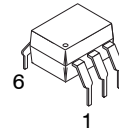
- CMOS to CMOS/LSTTL Logic Isolation
- LSTTL to CMOS/LSTTL Logic Isolation
- RS-232 Line Receiver
- Telephone Ring Detector
- AC Line Voltage Sensing
- Switching Power Supply



PDIP6 8.51x6.35, 2.54P
CASE 646BX

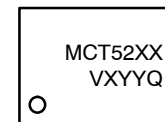


PDIP6 8.51x6.35, 2.54P
CASE 646BY



PDIP6 8.51x6.35, 2.54P
CASE 646BZ

MARKING DIAGRAM



MCT52XX = Device Number
XX = 10, 11

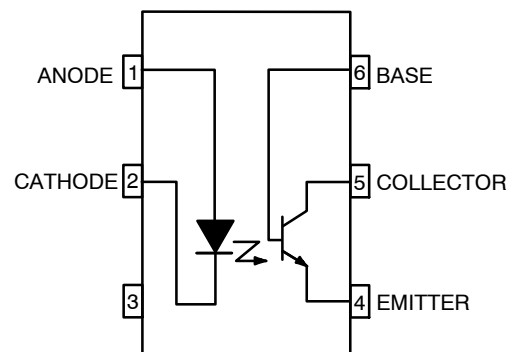
V = DIN EN/IEC60747-5-5 Option (only appears on component ordered with this option)

X = One-Digit Year Code, e.g., '5'

YY = Digit Work Week, Ranging from '01' to '53'

Q = Assembly Package Code

SCHEMATIC



ORDERING INFORMATION

See detailed ordering and shipping information on page 16 of this data sheet.

MCT5210M, MCT5211M

SAFETY AND INSULATION RATINGS (As per DIN EN/IEC 60747-5-5, this optocoupler is suitable for “safe electrical insulation” only within the safety limit data. Compliance with the safety ratings shall be ensured by means of protective circuits.)

Parameter		Characteristics
Installation Classifications per DIN VDE 0110/1.89 Table 1, For Rated Mains Voltage	<150 V _{RMS}	I–IV
	<300 V _{RMS}	I–IV
Climatic Classification		55/100/21
Pollution Degree (DIN VDE 0110/1.89)		2
Comparative Tracking Index		175

Symbol	Parameter	Value	Unit
V _{PR}	Input-to-Output Test Voltage, Method A, V _{IORM} × 1.6 = V _{PR} , Type and Sample Test with t _m = 10 s, Partial Discharge < 5 pC	1360	V _{peak}
	Input-to-Output Test Voltage, Method B, V _{IORM} × 1.875 = V _{PR} , 100% Production Test with t _m = 1 s, Partial Discharge < 5 pC	1594	V _{peak}
V _{IORM}	Maximum Working Insulation Voltage	850	V _{peak}
V _{IOTM}	Highest Allowable Over-Voltage	6000	V _{peak}
	External Creepage	≥7	mm
	External Clearance	≥7	mm
	External Clearance (for Option TV, 0.4" Lead Spacing)	≥10	mm
DTI	Distance Through Insulation (Insulation Thickness)	≥0.5	mm
T _S	Case Temperature (Note 1)	175	°C
I _{S, INPUT}	Input Current (Note 1)	350	mA
P _{S, OUTPUT}	Output Power (Note 1)	800	mW
R _{IO}	Insulation Resistance at T _S , V _{IO} = 500 V (Note 1)	>10 ⁹	Ω

1. Safety limit values – maximum values allowed in the event of a failure.

ABSOLUTE MAXIMUM RATINGS (T_A = 25°C unless otherwise noted)

Symbol	Parameter	Value	Unit
--------	-----------	-------	------

TOTAL DEVICE

T _{STG}	Storage Temperature	–40 to +125	°C
T _{OPR}	Operating Temperature	–40 to +100	°C
T _J	Junction Temperature	–40 to +125	°C
T _{SOL}	Lead Solder Temperature	260 for 10 seconds	°C
P _D	Total Device Power Dissipation @ 25°C (LED plus detector)	225	mW
	Derate Linearly from 25°C	3.5	mW/°C

EMITTER

I _F	Continuous Forward Current	50	mA
V _R	Reverse Input Voltage	6	V
I _{F(pk)}	Forward Current – Peak (1 μs pulse, 300 pps)	3.0	A
P _D	LED Power Dissipation at 25°C	75	mW
	Derate Linearly from 25°C	1.0	mW/°C

DETECTOR

I _C	Continuous Collector Current	150	mA
P _D	Detector Power Dissipation @ 25°C	150	mW
	Derate Linearly from 25°C	2.0	mW/°C

Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

MCT5210M, MCT5211M

ELECTRICAL CHARACTERISTICS (T_A = 25°C, unless otherwise noted)

Symbol	Parameter	Test Conditions	Min	Typ	Max	Unit
INDIVIDUAL COMPONENT CHARACTERISTICS						
EMITTER						
V _F	Input Forward Voltage	I _F = 5 mA	–	1.25	1.50	V
$\frac{\Delta V_F}{\Delta T_A}$	Forward Voltage Temperature Coefficient	I _F = 2 mA	–	–1.75	–	mV/°C
V _R	Reverse Voltage	I _R = 10 μA	6	–	–	V
C _J	Junction Capacitance	V _F = 0 V, f = 1.0 MHz	–	18	–	pF
DETECTOR						
BV _{CEO}	Breakdown Voltage Collector-to-Emitter	I _C = 1.0 mA, I _F = 0	30	100	–	V
BV _{CBO}	Breakdown Voltage Collector-to-Base	I _C = 10 μA, I _F = 0	30	120	–	V
BV _{EBO}	Breakdown Voltage Emitter-to-Base	I _E = 10 μA, I _F = 0	5	10	–	V
I _{CER}	Dark Current, Collector-to-Emitter	V _{CE} = 10 V, I _F = 0, R _{BE} = 1 MΩ	–	1	100	nA
C _{CE}	Capacitance, Collector-to-Emitter	V _{CE} = 0 V, f = 1 MHz	–	10	–	pF
C _{CB}	Capacitance, Collector-to-Base	V _{CB} = 0 V, f = 1 MHz	–	80	–	pF
C _{EB}	Capacitance, Emitter-to-Base	V _{EB} = 0 V, f = 1 MHz	–	15	–	pF

ELECTRICAL CHARACTERISTICS (T_A = 25°C, unless otherwise noted) (continued)

Symbol	Parameter	Test Conditions	Device	Min	Typ	Max	Unit
TRANSFER CHARACTERISTICS							
DC CHARACTERISTICS							
CTR _{CE(SAT)}	Saturated Current Transfer Ratio Collector-to-Emitter (Note 2)	I _F = 3.0 mA, V _{CE} = 0.4 V	MCT5210M	60	–	–	%
		I _F = 1.6 mA, V _{CE} = 0.4 V	MCT5211M	100	–	–	%
		I _F = 1.0 mA, V _{CE} = 0.4 V		75	–	–	%
CTR _(CE)	Current Transfer Ratio Collector-to-Emitter (Note 2)	I _F = 3.0 mA, V _{CE} = 5.0 V	MCT5210M	70	–	–	%
		I _F = 1.6 mA, V _{CE} = 5.0 V	MCT5211M	150	–	–	%
		I _F = 1.0 mA, V _{CE} = 5.0 V		110	–	–	%
CTR _(CB)	Current Transfer Ratio Collector-to-Base (Note 3)	I _F = 3.0 mA, V _{CE} = 4.3 V	MCT5210M	0.2	–	–	%
		I _F = 1.6 mA, V _{CE} = 4.3 V	MCT5211M	0.3	–	–	%
		I _F = 1.0 mA, V _{CE} = 4.3 V		0.25	–	–	%
V _{CE(SAT)}	Saturation Voltage	I _F = 3.0 mA, I _{CE} = 1.8 mA	MCT5210M	–	–	0.4	V
		I _F = 1.6 mA, I _{CE} = 1.6 mA	MCT5211M	–	–	0.4	V

MCT5210M, MCT5211M

ELECTRICAL CHARACTERISTICS (T_A = 25°C, unless otherwise noted) (continued)

Symbol	Parameter	Test Conditions		Device	Min	Typ	Max	Unit
TRANSFER CHARACTERISTICS								
AC CHARACTERISTICS								
T _{PHL}	Propagation Delay HIGH-to-LOW (Note 4)	R _L = 330 Ω, R _{BE} = ∞	I _F = 3.0 mA, V _{CC} = 5.0 V	MCT5210M	–	10	–	μs
		R _L = 3.3 kΩ, R _{BE} = 39 kΩ			–	7	–	μs
		R _L = 750 Ω, R _{BE} = ∞	I _F = 1.6 mA, V _{CC} = 5.0 V	MCT5211M	–	14	–	μs
		R _L = 4.7 kΩ, R _{BE} = 91 kΩ			–	15	–	μs
		R _L = 1.5 kΩ, R _{BE} = ∞			–	17	–	μs
		R _L = 10 kΩ, R _{BE} = 160 kΩ			–	24	–	μs
T _{PLH}	Propagation Delay LOW-to-HIGH (Note 5)	R _L = 330 Ω, R _{BE} = ∞	I _F = 3.0 mA, V _{CC} = 5.0 V	MCT5210M	–	0.4	–	μs
		R _L = 3.3 kΩ, R _{BE} = 39 kΩ			–	8	–	μs
		R _L = 750 Ω, R _{BE} = ∞	I _F = 1.6 mA, V _{CC} = 5.0 V	MCT5211M	–	2.5	–	μs
		R _L = 4.7 kΩ, R _{BE} = 91 kΩ			–	11	–	μs
		R _L = 1.5 kΩ, R _{BE} = ∞			–	7	–	μs
		R _L = 10 kΩ, R _{BE} = 160 kΩ			–	16	–	μs

ELECTRICAL CHARACTERISTICS (T_A = 25°C, unless otherwise noted) (continued)

Symbol	Parameter	Test Conditions	Min	Typ	Max	Unit
ISOLATION CHARACTERISTICS						
V _{ISO}	Input-Output Isolation Voltage (Note 6)	t = 1 Minute	4170	–	–	VAC _{RMS}
R _{ISO}	Isolation Resistance (Note 6)	V _{I-O} = ±500 VDC, T _A = 25°C	10 ¹¹	–	–	Ω
C _{ISO}	Isolation Capacitance (Note 7)	V _{I-O} = 0 V, f = 1 MHz	–	0.4	0.6	pF
CM _H	Common Mode Transient Rejection – Output HIGH	V _{CM} = 50 V _{P-P} , R _L = 750 Ω, I _F = 0	–	5000	–	V/μs
CM _L	Common Mode Transient Rejection – Output LOW	V _{CM} = 50 V _{P-P} , R _L = 750 Ω, I _F = 1.6 mA	–	5000	–	V/μs

Product parametric performance is indicated in the Electrical Characteristics for the listed test conditions, unless otherwise noted. Product performance may not be indicated by the Electrical Characteristics if operated under different conditions.

2. 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}).
3. 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%.
4. Referring to Figure 16 the T_{PHL} propagation delay is measured from the 50% point of the rising edge of the data input pulse to the 1.3 V point on the falling edge of the output pulse.
5. Referring to Figure 16 the T_{PLH} propagation delay is measured from the 50% point of the falling edge of data input pulse to the 1.3 V point on the rising edge of the output pulse.
6. Device considered a two terminal device: pins 1, 2, and 3 shorted together and pins 5, 6 and 7 are shorted together.
7. C_{ISO} is the capacitance between the input (pins 1, 2, 3 connected) and the output (pin 4, 5, 6 connected).

TYPICAL PERFORMANCE CURVES

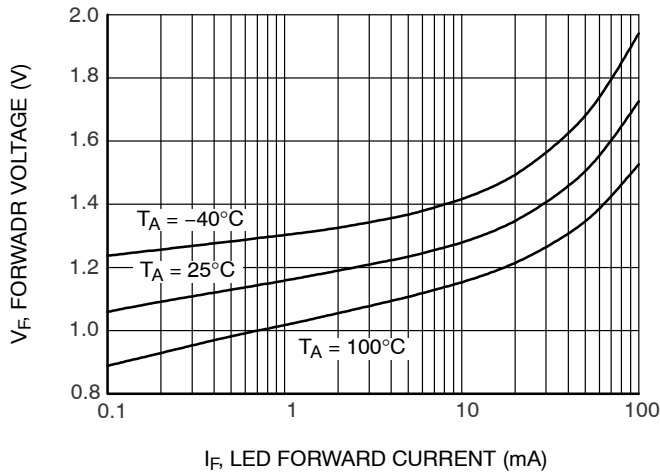


Figure 1. LED Forward Voltage vs. Forward Current

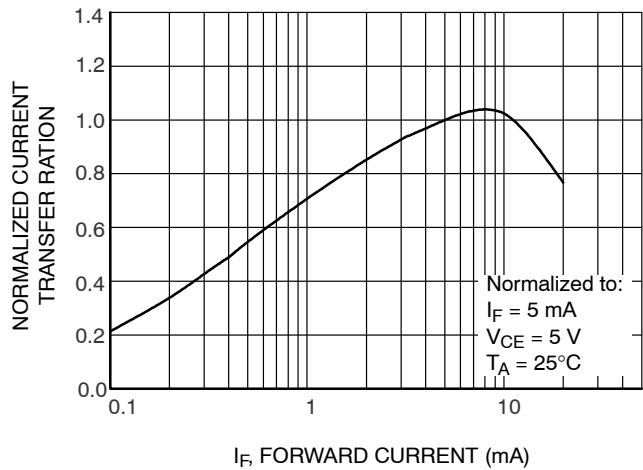


Figure 2. Normalized Current Transfer Ratio vs. Forward Current

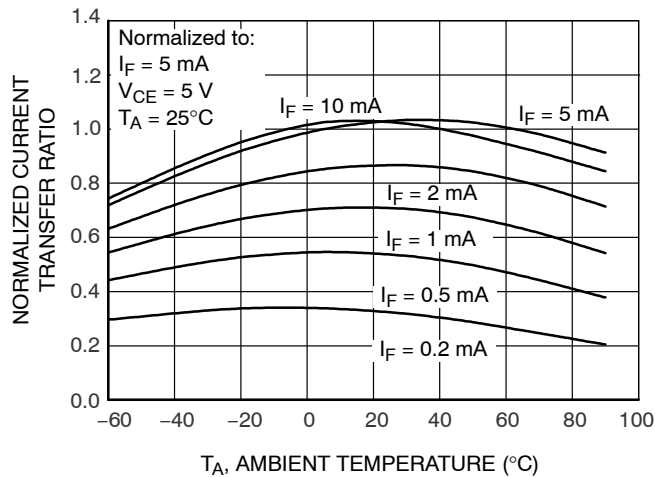


Figure 3. Normalized CTR vs. Temperature

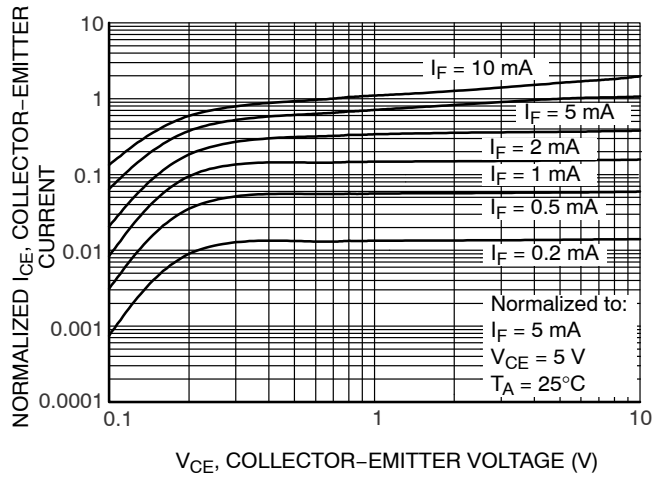


Figure 4. Normalized Collector vs. Collector-Emitter Voltage

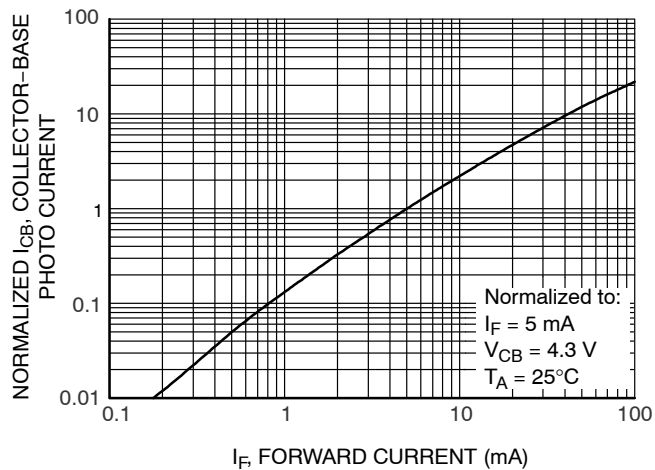


Figure 5. Normalized Collector Base Photocurrent Ratio vs. Forward Current

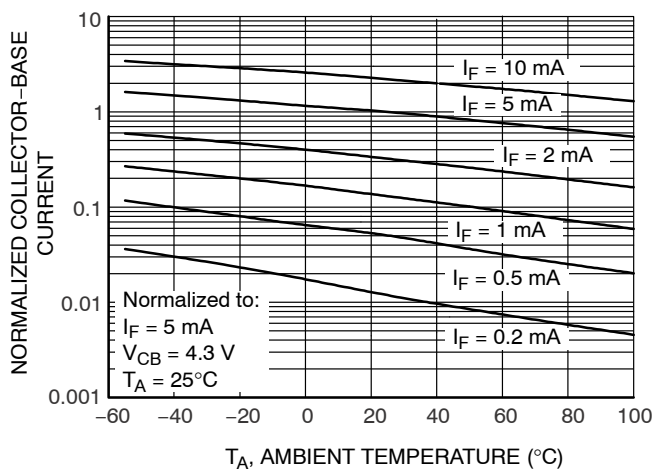


Figure 6. Normalized Collector-Base Current vs. Temperature

TYPICAL PERFORMANCE CURVES (continued)

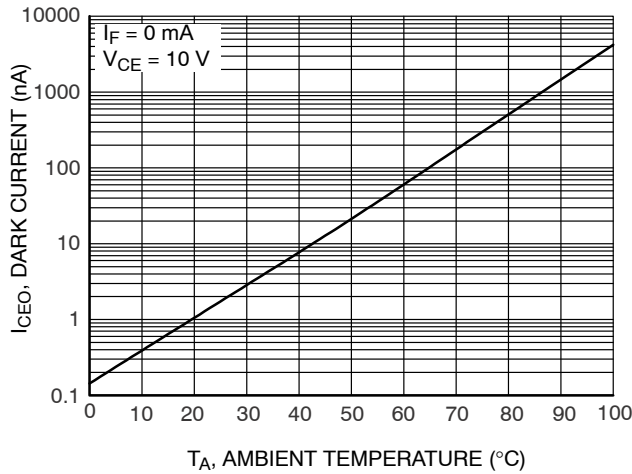


Figure 7. Collector-Emitter Dark Current vs. Ambient Temperature

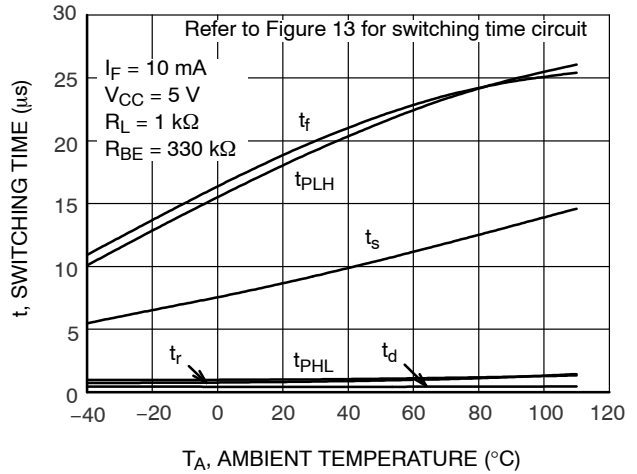


Figure 8. Switching Time vs. Ambient Temperature

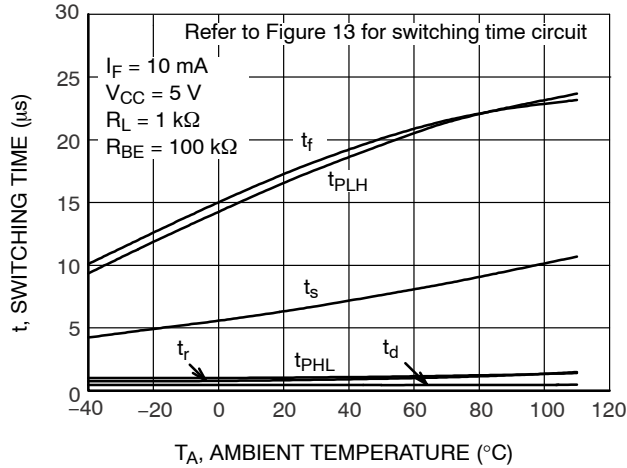


Figure 9. Switching Time vs. Ambient Temperature

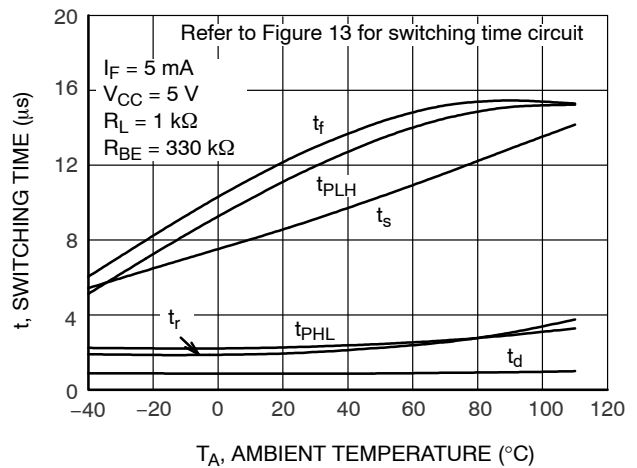


Figure 10. Switching Time vs. Ambient Temperature

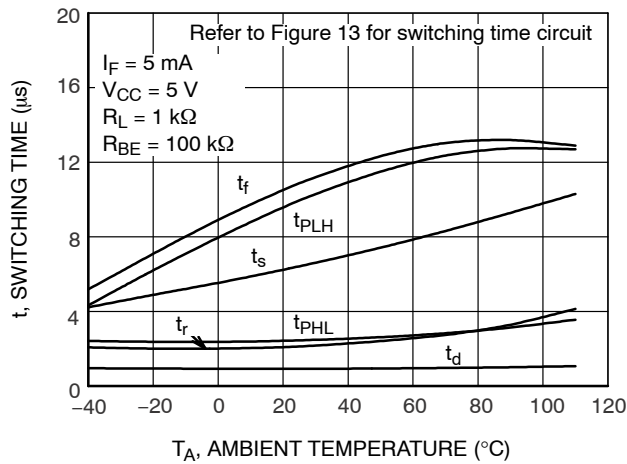


Figure 11. Switching Time vs. Ambient Temperature

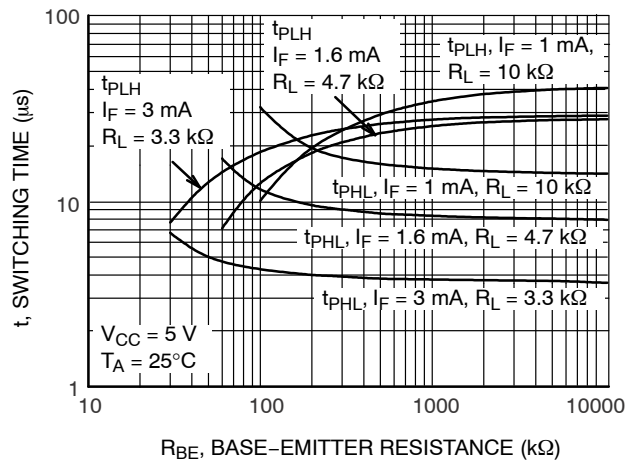


Figure 12. Switching Time vs. Base-Emitter Resistance

MCT5210M, MCT5211M

SWITCHING TIME TEST CIRCUIT AND WAVEFORMS

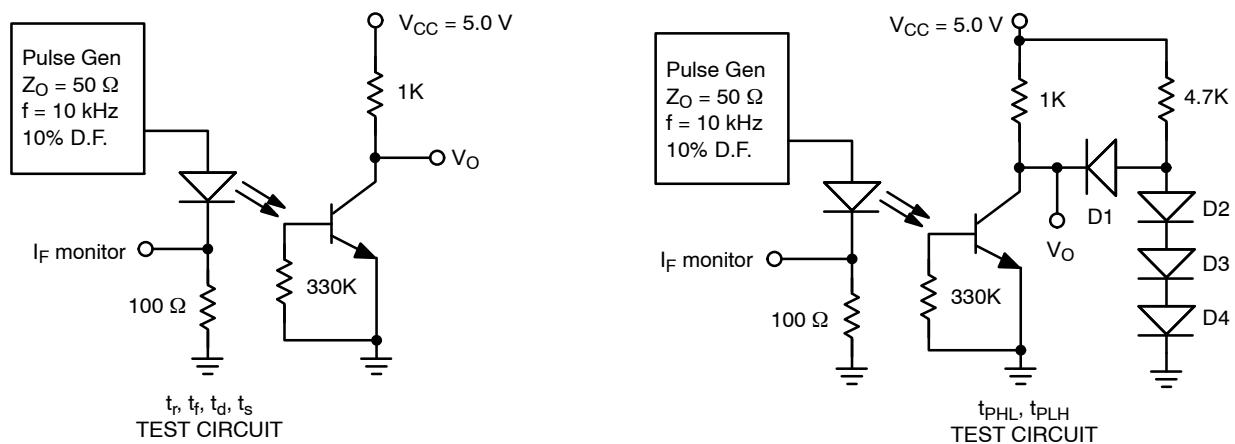


Figure 13. Switching Time Test Circuit

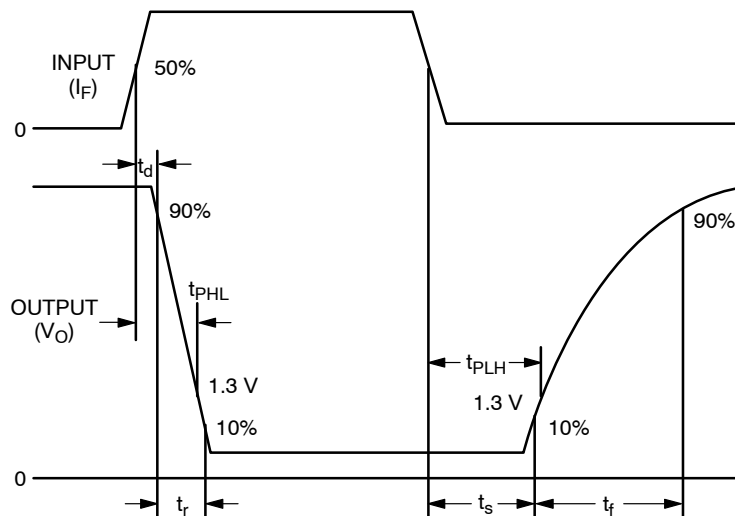


Figure 14. Switching Time Test Circuit

MCT5210M, MCT5211M

REFLOW PROFILE

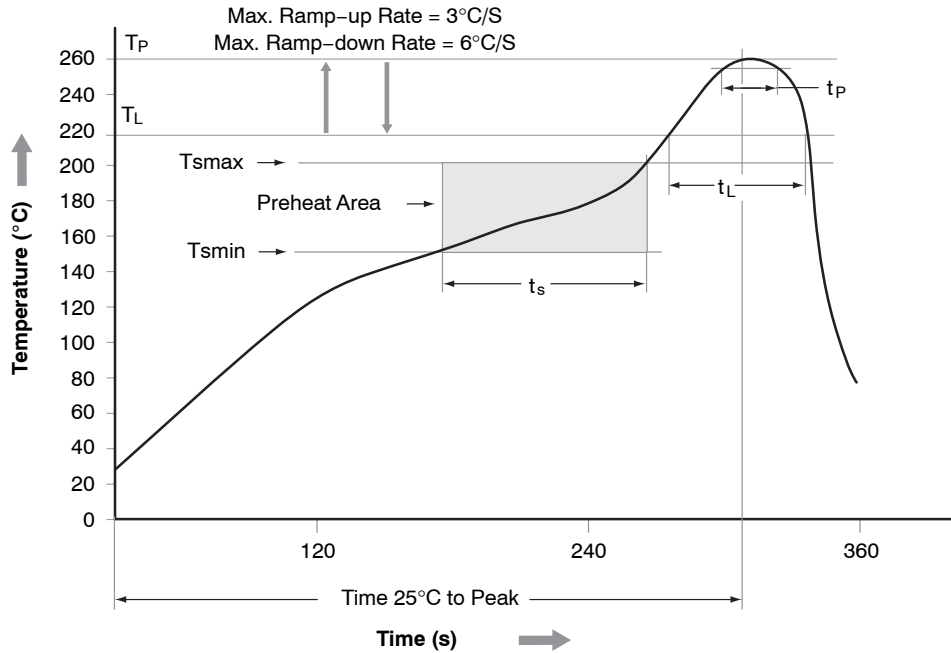


Figure 15. Reflow Profile

Table 1.

Profile Feature	Pb-Free Assembly Profile
Temperature Minimum (T_{sm})	150°C
Temperature Maximum (T_{sp})	260°C
Time (t_s) from (T_{sm} to T_{sp})	60 – 120 seconds
Ramp-up Rate (t_L to t_p)	3°C/second maximum
Liquidous Temperature (T_L)	217°C
Time (t_L) Maintained Above (T_L)	60 – 150 seconds
Peak Body Package Temperature	260°C +0°C / -5°C
Time (t_p) within 5°C of 260°C	30 seconds
Ramp-down Rate (T_P to T_L)	6°C/second maximum
Time 25°C to Peak Temperature	8 minutes maximum

ORDERING INFORMATION (Note 8)

Part Number	Package	Packing Method
MCT5210M	DIP 6-Pin	Tube (50 Units)
MCT5210SM	SMT 6-Pin (Lead Bend)	Tube (50 Units)
MCT5210SR2M	SMT 6-Pin (Lead Bend)	Tape and Reel (1000 Units)
MCT5210VM	DIP 6-Pin, DIN EN/IEC60747-5-5 Option	Tube (50 Units)
MCT5210SVM	SMT 6-Pin (Lead Bend), DIN EN/IEC60747-5-5 Option	Tube (50 Units)
MCT5210SR2VM	SMT 6-Pin (Lead Bend), DIN EN/IEC60747-5-5 Option	Tape and Reel (1000 Units)
MCT5210TVM	DIP 6-Pin, 0.4" Lead Spacing, DIN EN/IEC60747-5-5 Option	Tube (50 Units)

8. The product orderable part number system listed in this table also applies to the MCT5211M device.

PDIP6 8.51x6.35, 2.54P
CASE 646BX
ISSUE O

DATE 31 JUL 2016



NOTES:

- A) NO STANDARD APPLIES TO THIS PACKAGE.
- B) ALL DIMENSIONS ARE IN MILLIMETERS.
- C) DIMENSIONS ARE EXCLUSIVE OF BURRS, MOLD FLASH, AND TIE BAR EXTRUSION

DOCUMENT NUMBER:	98AON13449G	Electronic versions are uncontrolled except when accessed directly from the Document Repository. Printed versions are uncontrolled except when stamped "CONTROLLED COPY" in red.
DESCRIPTION:	PDIP6 8.51X6.35, 2.54P	PAGE 1 OF 1

onsemi and onsemi are trademarks of Semiconductor Components Industries, LLC dba onsemi or its subsidiaries in the United States and/or other countries. onsemi reserves the right to make changes without further notice to any products herein. onsemi makes no warranty, representation or guarantee regarding the suitability of its products for any particular purpose, nor does onsemi assume any liability arising out of the application or use of any product or circuit, and specifically disclaims any and all liability, including without limitation special, consequential or incidental damages. onsemi does not convey any license under its patent rights nor the rights of others.

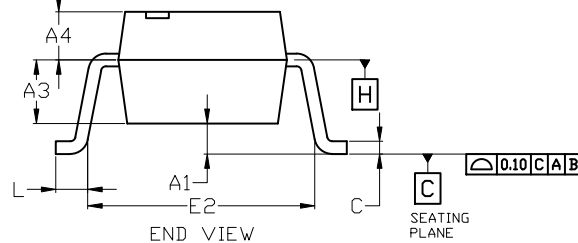
PDIP6 8.51x6.35, 2.54P
CASE 646BY
ISSUE A

DATE 15 JUL 2019


NOTES:

1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 2009.
2. CONTROLLING DIMENSION: MILLIMETERS
3. DIMENSIONS A, A1, AND L ARE MEASURED WITH THE PACKAGE SEATED.
4. DIMENSIONS D, D1, AND E1 DO NOT INCLUDE MOLD FLASH OR PROTRUSIONS. MOLD FLASH OR PROTRUSIONS ARE NOT TO EXCEED 2.54mm.
5. PACKAGE CONTOUR IS OPTIONAL (ROUNDED OR SQUARE CORNERS).
6. CENTER LINE OF CORNER LEADS IS LOCATED BY LOCATING THE CENTER OF FEATURE b2 AND b3.

DIM	MILLIMETERS		
	MIN.	NOM.	MAX.
A	---	---	4.80
A1	0.38	---	---
A2	3.28	3.40	3.53
A3	2.49 REF		
A4	1.89 REF		
b	0.41	0.46	0.51
b1	0.76	0.92	1.14
b2	0.25	0.28	0.36
b3	1.02	1.40	1.78
b4	1.778 REF		
c	0.20	0.25	0.30
D	8.13	8.51	8.89
D1	0.86 REF		
E	6.10	6.35	6.60
E1	8.43	9.17	9.90
E2	8.13 REF		
e	2.54 BSC		
L	0.16	0.52	0.88



For additional information on our Pb-Free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERM/D.

DOCUMENT NUMBER:	98AON13450G	Electronic versions are uncontrolled except when accessed directly from the Document Repository. Printed versions are uncontrolled except when stamped "CONTROLLED COPY" in red.
DESCRIPTION:	PDIP6 8.51x6.35, 2.54P	PAGE 1 OF 1

onsemi and onsemi are trademarks of Semiconductor Components Industries, LLC dba onsemi or its subsidiaries in the United States and/or other countries. onsemi reserves the right to make changes without further notice to any products herein. onsemi makes no warranty, representation or guarantee regarding the suitability of its products for any particular purpose, nor does onsemi assume any liability arising out of the application or use of any product or circuit, and specifically disclaims any and all liability, including without limitation special, consequential or incidental damages. onsemi does not convey any license under its patent rights nor the rights of others.

PDIP6 8.51x6.35, 2.54P
CASE 646BZ
ISSUE O

DATE 31 JUL 2016



NOTES:

- A) NO STANDARD APPLIES TO THIS PACKAGE.
- B) ALL DIMENSIONS ARE IN MILLIMETERS.
- C) DIMENSIONS ARE EXCLUSIVE OF BURRS, MOLD FLASH, AND TIE BAR EXTRUSION

DOCUMENT NUMBER:	98AON13451G	Electronic versions are uncontrolled except when accessed directly from the Document Repository. Printed versions are uncontrolled except when stamped "CONTROLLED COPY" in red.
DESCRIPTION:	PDIP6 8.51X6.35, 2.54P	PAGE 1 OF 1

onsemi and onsemi are trademarks of Semiconductor Components Industries, LLC dba onsemi or its subsidiaries in the United States and/or other countries. onsemi reserves the right to make changes without further notice to any products herein. onsemi makes no warranty, representation or guarantee regarding the suitability of its products for any particular purpose, nor does onsemi assume any liability arising out of the application or use of any product or circuit, and specifically disclaims any and all liability, including without limitation special, consequential or incidental damages. onsemi does not convey any license under its patent rights nor the rights of others.

onsemi, **Onsemi**, and other names, marks, and brands are registered and/or common law trademarks of Semiconductor Components Industries, LLC dba "**onsemi**" or its affiliates and/or subsidiaries in the United States and/or other countries. **onsemi** owns the rights to a number of patents, trademarks, copyrights, trade secrets, and other intellectual property. A listing of **onsemi**'s product/patent coverage may be accessed at www.onsemi.com/site/pdf/Patent-Marking.pdf. **onsemi** reserves the right to make changes at any time to any products or information herein, without notice. The information herein is provided "as-is" and **onsemi** makes no warranty, representation or guarantee regarding the accuracy of the information, product features, availability, functionality, or suitability of its products for any particular purpose, nor does **onsemi** assume any liability arising out of the application or use of any product or circuit, and specifically disclaims any and all liability, including without limitation special, consequential or incidental damages. Buyer is responsible for its products and applications using **onsemi** products, including compliance with all laws, regulations and safety requirements or standards, regardless of any support or applications information provided by **onsemi**. "Typical" parameters which may be provided in **onsemi** data sheets and/or specifications can and do vary in different applications and actual performance may vary over time. All operating parameters, including "Typicals" must be validated for each customer application by customer's technical experts. **onsemi** does not convey any license under any of its intellectual property rights nor the rights of others. **onsemi** products are not designed, intended, or authorized for use as a critical component in life support systems or any FDA Class 3 medical devices or medical devices with a same or similar classification in a foreign jurisdiction or any devices intended for implantation in the human body. Should Buyer purchase or use **onsemi** products for any such unintended or unauthorized application, Buyer shall indemnify and hold **onsemi** and its officers, employees, subsidiaries, affiliates, and distributors harmless against all claims, costs, damages, and expenses, and reasonable attorney fees arising out of, directly or indirectly, any claim of personal injury or death associated with such unintended or unauthorized use, even if such claim alleges that **onsemi** was negligent regarding the design or manufacture of the part. **onsemi** is an Equal Opportunity/Affirmative Action Employer. This literature is subject to all applicable copyright laws and is not for resale in any manner.

ADDITIONAL INFORMATION

TECHNICAL PUBLICATIONS:

Technical Library: www.onsemi.com/design/resources/technical-documentation
onsemi Website: www.onsemi.com

ONLINE SUPPORT: www.onsemi.com/support

For additional information, please contact your local Sales Representative at
www.onsemi.com/support/sales