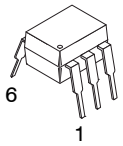
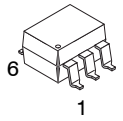
General Purpose Phototransistor Optocouplers, 6-Pin

MCT2EM, TIL111M, TIL117M



PDIP6 8.51x6.35, 2.54P
CASE 646BX



PDIP6 8.51x6.35, 2.54P
CASE 646BY

Description

The general purpose optocouplers consist of a gallium arsenide infrared emitting diode driving a silicon photo−transistor in a standard plastic six−pin dual−in−line package.

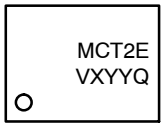
Features

- Minimum Current Transfer Ratio at I_F = 10 mA, V_{CE} = 10 V
  - 20% for MCT2EM
  - 50% for TIL117M
- 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

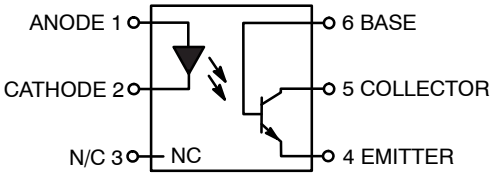
- Power Supply Regulators
- Digital Logic Inputs
- Microprocessor Inputs

MARKING DIAGRAM



MCT2E = Device Number
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 7 of this data sheet.

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} x 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} x 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	Device	Value	Unit
TOTAL DEVICE				
T_{STG}	Storage Temperature	All	−40 to +125	°C
T_{OPR}	Operating Temperature	All	−40 to +100	°C
T_J	Junction Temperature Range	All	−40 to +125	°C
T_{SOL}	Lead Solder Temperature	All	260 for 10 seconds	°C
P_D	Total Device Power Dissipation at T_A = 25°C	All	250	mW
	Derate Above 25°C	All	2.94	mW/°C
EMITTER				
I_F		All	60	mA
V_R	Reverse Input Voltage	TIL111M	3	V
		MCT2EM, TIL117M	6	V
I_F(pk)	Forward Current − Peak (300 μs, 2% Duty Cycle)	All	3	A
P_D	LED Power Dissipation at T_A = 25°C	All	120	mW
	Derate Above 25°C	All	1.41	mW/°C
DETECTOR				
V_{CEO}	Collector−to−Emitter Voltage	All	30	V
V_{CBO}	Collector−to−Base Voltage	All	70	V
V_{ECO}	Emitter−to−Collector Voltage	All	7	V
V_{EBO}	Emitter−to−Base Voltage	All	7	V
P_D	Detector Power Dissipation at T_A = 25°C	All	150	mW
	Derate Above 25°C	All	1.76	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.

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 = 10 mA	–	1.18	1.50	V
I_R	Reverse Leakage Current	V_R = 6.0 V	–	0.001	10	μA
DETECTOR						
BV_{CEO}	Collector–to–Emitter Breakdown Voltage	I_C = 1.0 mA, I_F = 0	30	100	–	V
BV_{CBO}	Collector–to–Base Breakdown Voltage	I_C = 100 μA, I_F = 0	70	120	–	V
BV_{EBO}	Emitter–to–Base Breakdown Voltage	I_E = 10 μA, I_F = 0	7	10	–	V
BV_{ECO}	Emitter–to–Collector Breakdown Voltage	I_E = 100 μA, I_F = 0	7	10	–	V
I_{CEO}	Collector–to–Emitter Dark Current	V_{CE} = 10 V, I_F = 0	–	1	50	nA
I_{CBO}	Collector–to–Base Dark Current	V_{CB} = 10 V	–	–	20	nA
C_{CE}	Capacitance	V_{CE} = 0 V, f = 1 MHz	–	8	–	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	Current Transfer Ratio, Collector–to–Emitter	I_F = 10 mA, V_{CE} = 10 V	MCT2EM	20	–	–	%
			TIL117M	50	–	–	
$V_{CE(SAT)}$	Collector–to–Emitter Saturation Voltage	I_C = 2 mA, I_F = 16 mA	MCT2EM, TIL111M	–	–	0.4	V
		I_C = 0.5 mA, I_F = 10 mA	TIL117M	–	–	0.4	
AC CHARACTERISTICS							
T_{ON}	Non–Saturated Turn–on Time	I_F = 10 mA, V_{CC} = 10 V, R_L = 100 Ω (Figure 11)	MCT2EM	–	2	–	μs
		I_C = 2 mA, V_{CC} = 10 V, R_L = 100 Ω (Figure 11)	TIL117M	–	2	10	μs
T_{OFF}	Turn–off Time	I_F = 10 mA, V_{CC} = 10 V, R_L = 100 Ω (Figure 11)	MCT2EM	–	2	–	μs
		I_F = 2 mA, V_{CC} = 10 V, R_L = 100 Ω (Figure 11)	TIL117M	–	2	10	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	t = 1 Minute	4170	–	–	VAC_{RMS}
C_{ISO}	Isolation Capacitance	$V_{I–O}$ = 0 V, f = 1 MHz	–	0.2	–	pF
R_{ISO}	Isolation Resistance	$V_{I–O}$ = ±500 VDC, T_A = 25°C	10^{11}	–	–	Ω

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.

TYPICAL PERFORMANCE CURVES

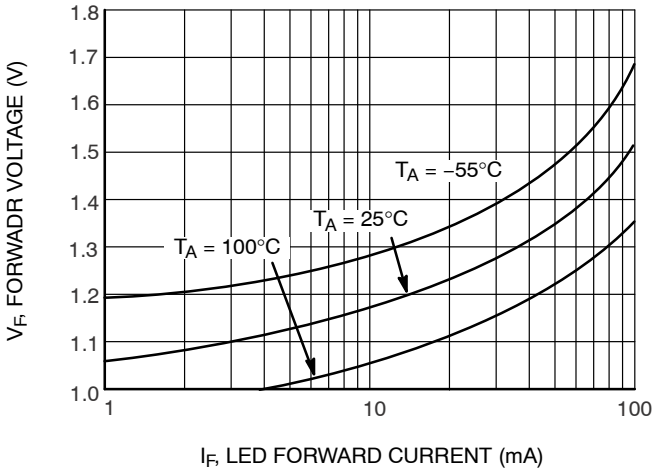


Figure 1. LED Forward Voltage vs. Forward Current

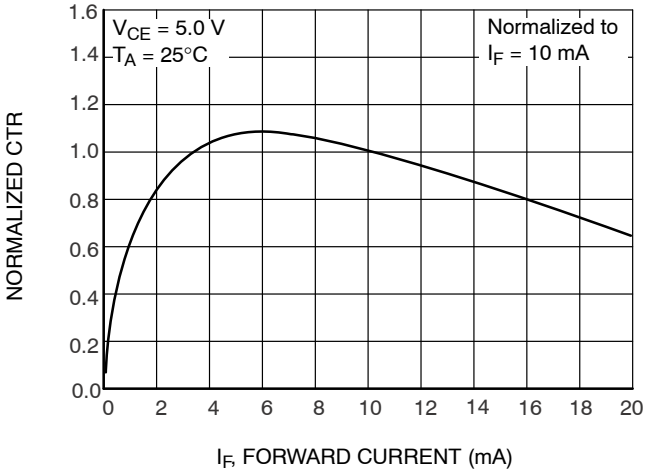


Figure 2. Normalized CTR vs. Forward Current

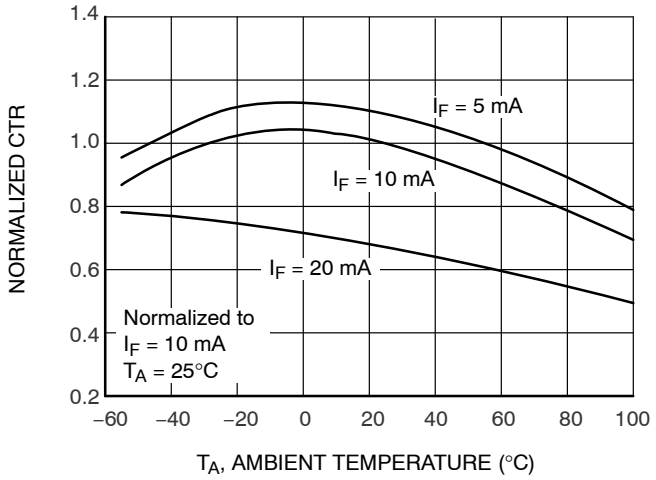


Figure 3. Normalized CTR vs. Ambient Temperature

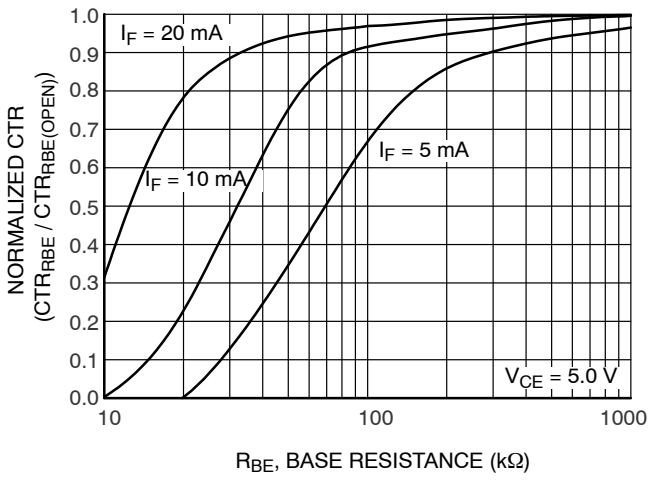


Figure 4. CTR vs. RBE (Unsaturated)

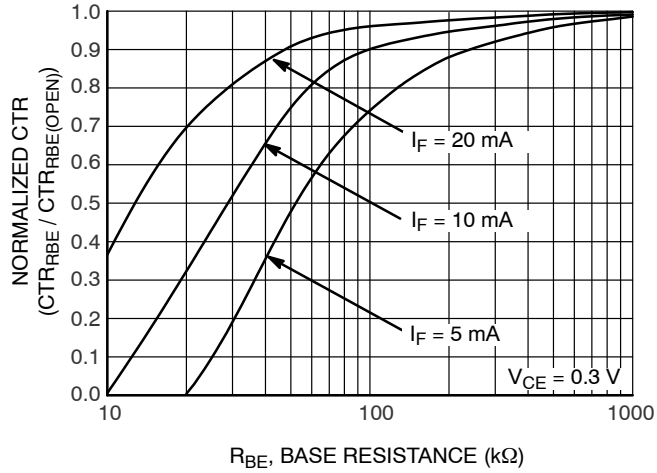


Figure 5. CTR vs. RBE (Saturated)

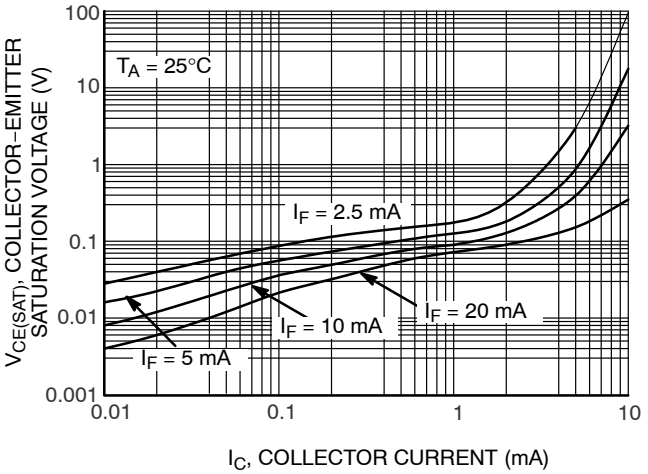


Figure 6. Collector−Emitter Saturation Voltage vs. Collector Current

TYPICAL PERFORMANCE CURVES (continued)

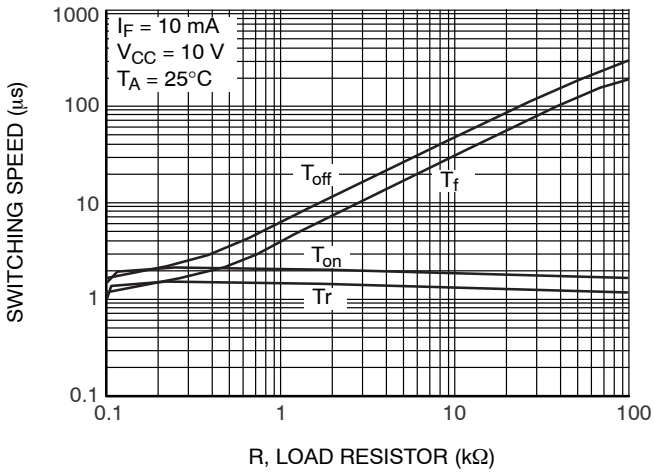


Figure 7. Switching Speed vs. Load Resistor

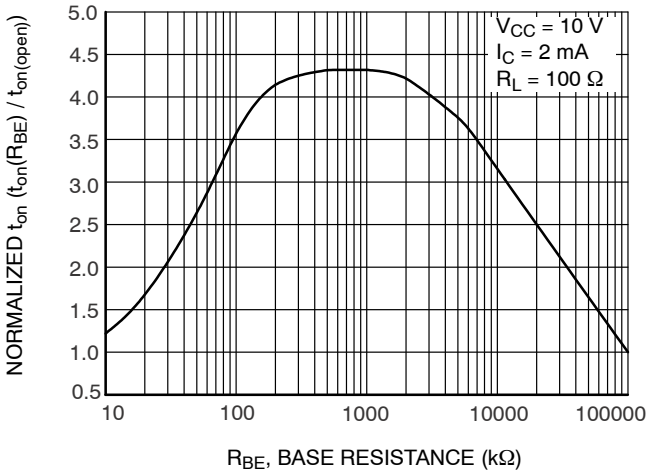


Figure 8. Normalized t_{on} vs. R_{BE}

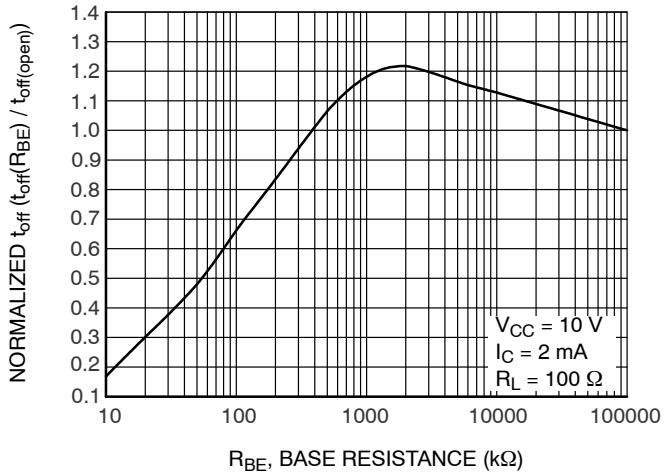


Figure 9. Normalized t_{off} vs. R_{BE}

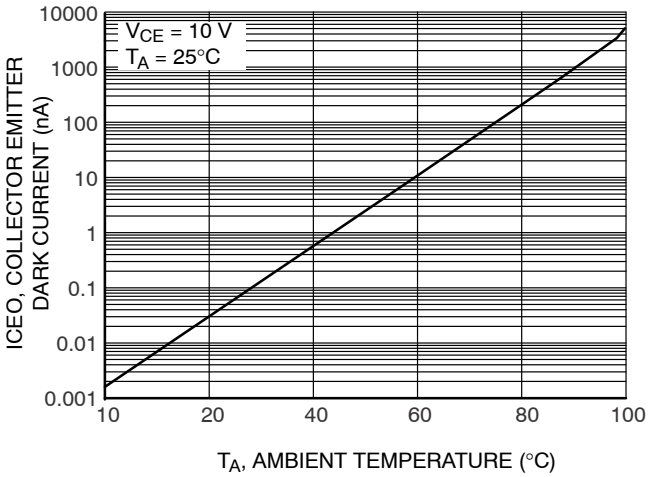


Figure 10. Dark Current vs. Ambient Temperature

SWITCHING TIME TEST CIRCUIT AND WAVEFORMS

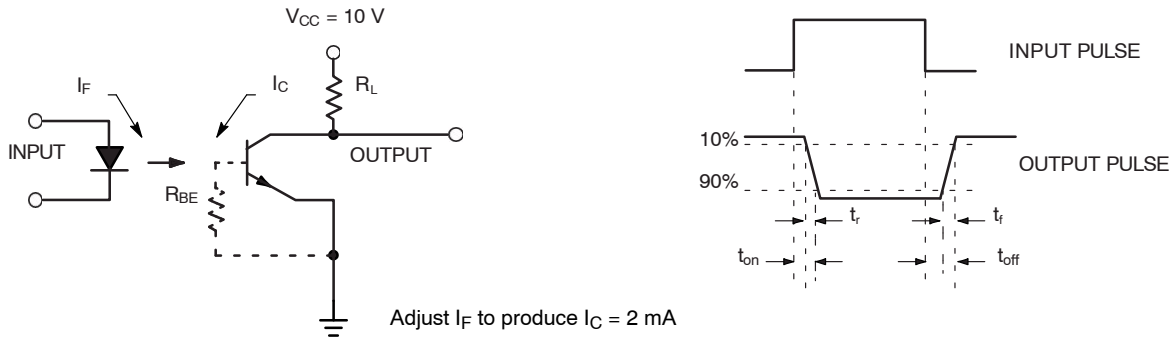


Figure 11. Switching Time Test Circuit and Waveforms

REFLOW PROFILE

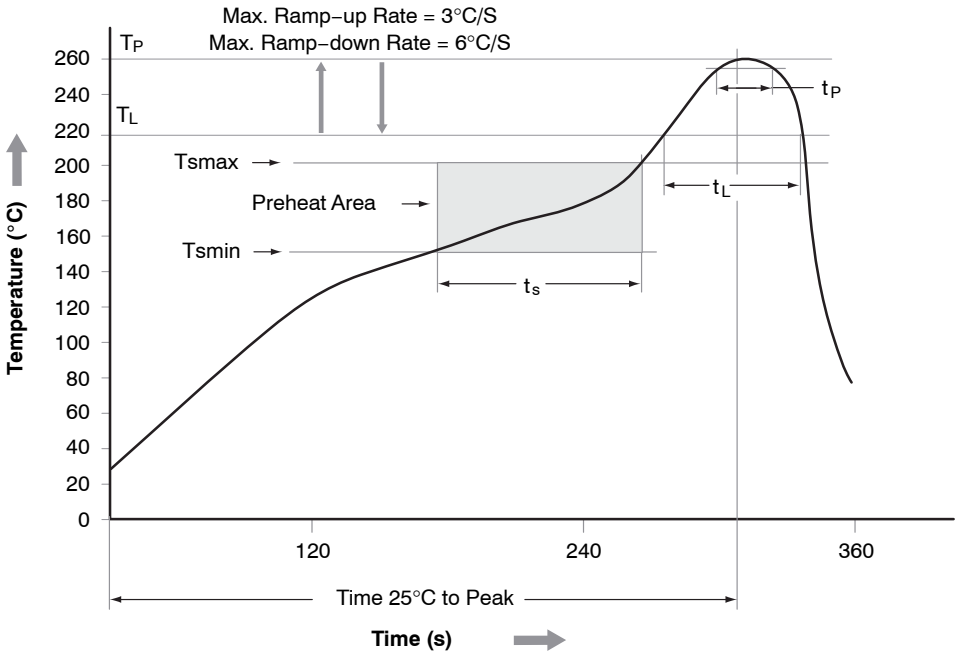


Figure 12. Reflow Profile

Table 1.

Profile Feature	Pb−Free Assembly Profile
Temperature Minimum (Tsmin)	150°C
Temperature Maximum (Tsmax)	200°C
Time (t_S) from (Tsmin to Tsmax)	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

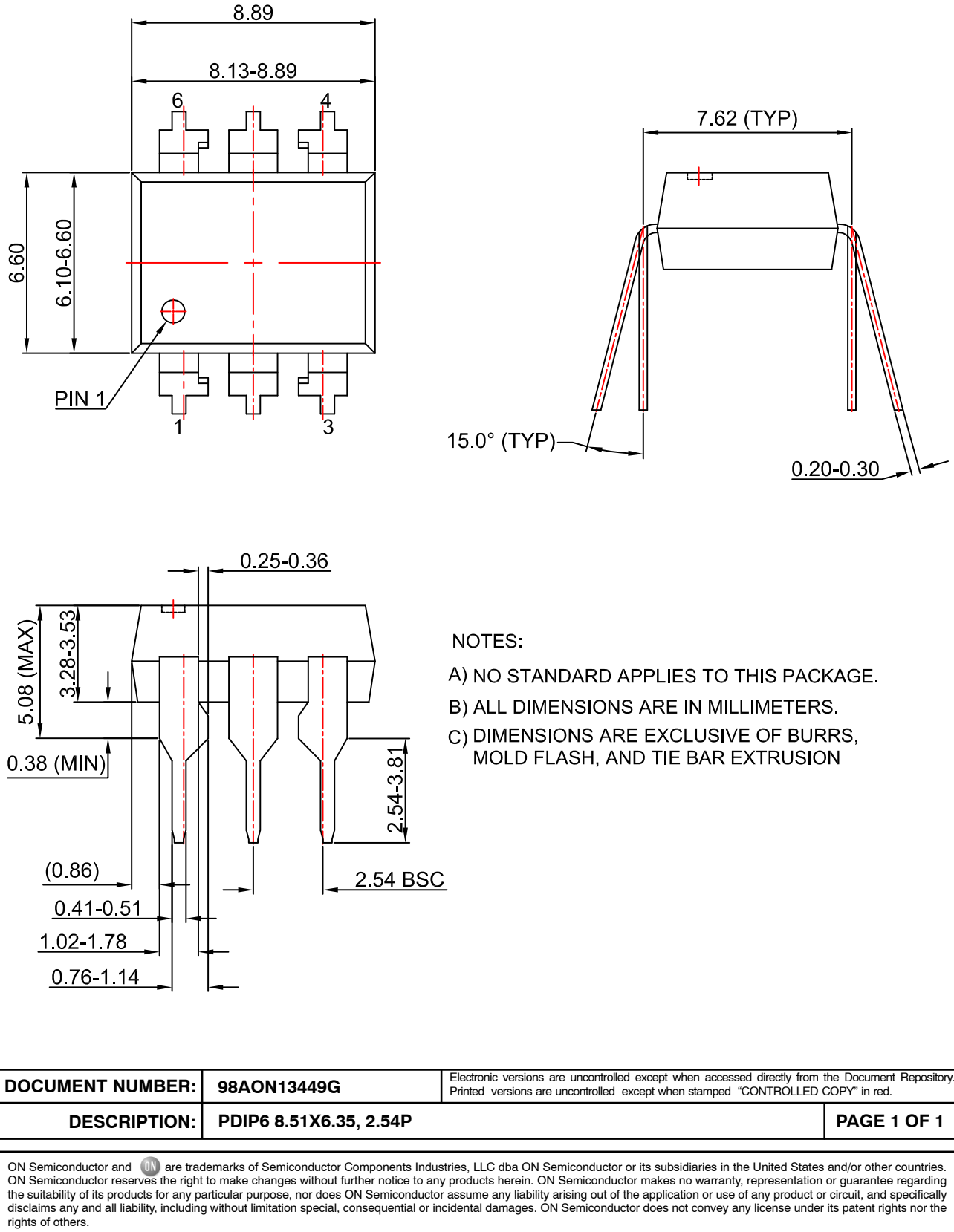
ORDERING INFORMATION (Note 2)

Part Number	Package	Packing Method
MCT2EM	DIP 6−Pin	Tube (50 Units)
MCT2ESM	SMT 6−Pin (Lead Bend)	Tube (50 Units)
MCT2ESR2M	SMT 6−Pin (Lead Bend)	Tape and Reel (1000 Units)
MCT2EVM	DIP 6−Pin, DIN EN/IEC60747−5−5 Option	Tube (50 Units)
MCT2ESVM	SMT 6−Pin (Lead Bend), DIN EN/IEC60747−5−5 Option	Tube (50 Units)
MCT2ESR2VM	SMT 6−Pin (Lead Bend), DIN EN/IEC60747−5−5 Option	Tape and Reel (1000 Units)
MCT2ETVM	DIP 6−Pin, 0.4” Lead Spacing, DIN EN/IEC60747−5−5 Option	Tube (50 Units)

2. The product orderable part number system listed in this table also applies to the TIL111M and TIL117M devices.

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

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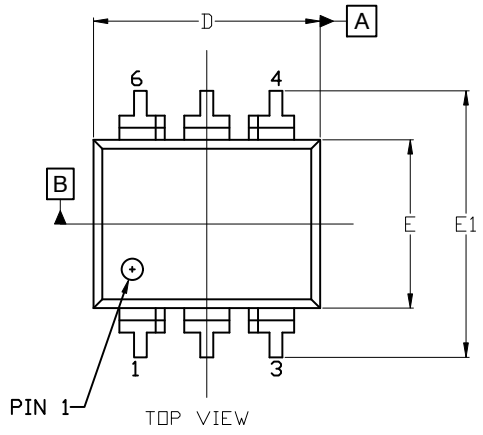
MECHANICAL CASE OUTLINE
PACKAGE DIMENSIONS

ON Semiconductor®

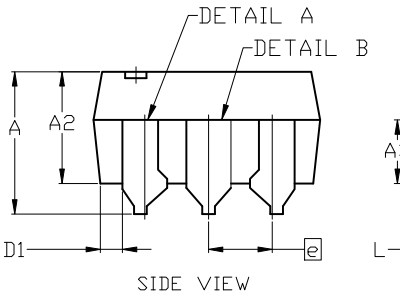
PDIP6 8.51x6.35, 2.54P
CASE 646BY
ISSUE A

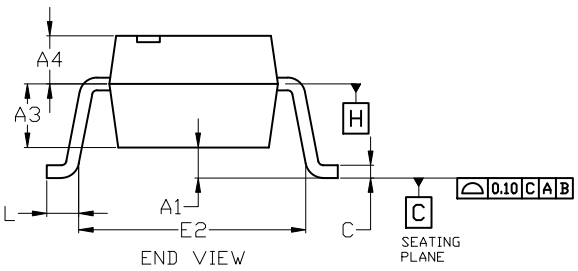
DATE 15 JUL 2019

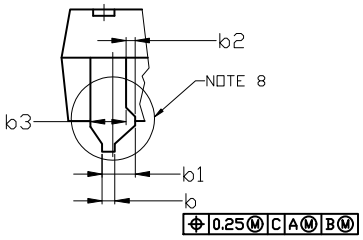


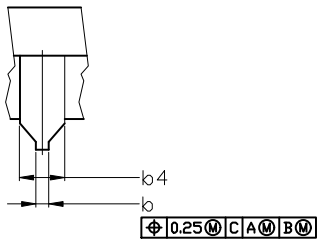
NOTES:
1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 2009.
2. CONTROLLING DIMENSION: MILLIMETERS
3. DIMENSIONS A, A1, AND L ARE MEASURED WITH THE PACKAGE SEATED.
4. DIMENSIONS D, D1, AND E1 DO NOT INCLUDE MOLD FLASH OR PROTRUSIONS. MOLD FLASH OR PROTRUSIONS ARE NOT TO EXCEED 2.54mm.
5. PACKAGE CONTOUR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

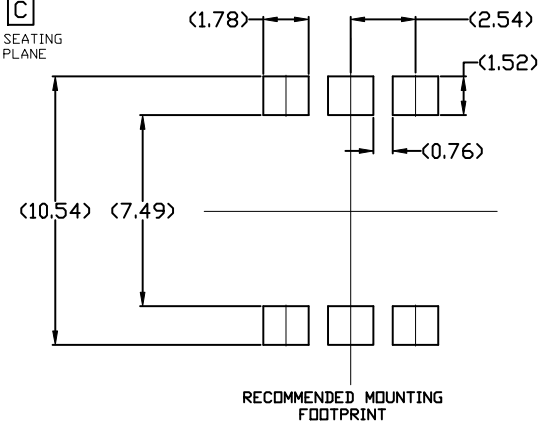
DIM	MILLIMETERS		
	MIN.	NOM.	MAX.
A	---	---	4.80
A1	0.38	---	---
A2	3.28	3.40	3.53
A3		2.49 REF	
A4		1.89 REF	
b	0.41	0.46	0.51
b1	0.76	0.92	1.14
b2	0.25	0.28	0.36
b3	1.02	1.40	1.78
b4		1.778 REF	
c	0.20	0.25	0.30
D	8.13	8.51	8.89
D1		0.86 REF	
E	6.10	6.35	6.60
E1	8.43	9.17	9.90
E2		8.13 REF	
e		2.54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

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