6-Pin DIP Zero-Cross Triac Driver Optocoupler (800 V Peak)

MOC3081M, MOC3082M, MOC3083M

ON Semiconductor®

www.onsemi.com

Description

The MOC3081M, MOC3082M and MOC3083M devices consist of a GaAs infrared emitting diode optically coupled to a monolithic silicon detector performing the function of a zero voltage crossing bilateral triac driver.

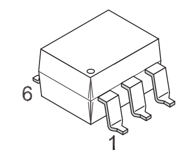
They are designed for use with a discrete power triac in the interface of logic systems to equipment powered from 240 VAC lines, such as solid−state relays, industrial controls, motors, solenoids and consumer appliances, etc.

Features

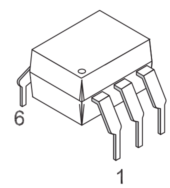
- Simplifies Logic Control of 240 VAC Power
- Zero Voltage Crossing to Minimize Conducted and Radiated Line Noise
- 800 V Peak Blocking Voltage
- Superior Static dv/dt
  - 1500 V/μs Typical, 600 V/μs Guaranteed
- Safety and Regulatory Approvals
  - UL1577, 4,170 VAC_{RMS} for 1 Minute
  - DIN EN/IEC60747−5−5
- These are Pb−Free Devices

Applications

- Solenoid/Valve Controls
- Lighting Controls
- Static Power Switches
- AC Motor Starters
- Temperature Controls
- E.M. Contactors
- AC Motor Drives
- Solid State Relays



PDIP6 8.51x6.35, 2.54P
CASE 646BY



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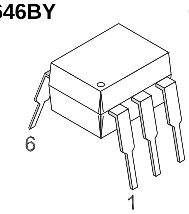

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CASE 646BX

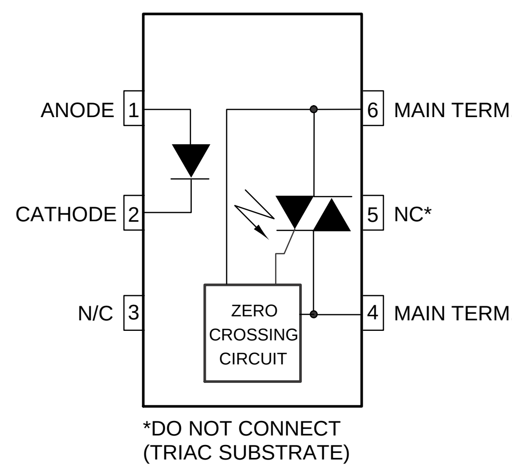


Figure 1. Schematic

ORDERING INFORMATION

See detailed ordering and shipping information on page 9 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		40/85/21
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	Vpeak
	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	Vpeak
V_{IORM}	Maximum Working Insulation Voltage	850	Vpeak
V_{IOTM}	Highest Allowable Over−Voltage	6000	Vpeak
	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
R_{IO}	Insulation Resistance at T_S, V_{IO} = 500 V	> 10^9	Ω

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

Symbol	Parameters	Value	Unit
Total Device			
T_{STG}	Storage Temperature	−40 to 150	°C
T_{OPR}	Operating Temperature	−40 to 85	°C
T_J	Junction Temperature Range	−40 to 100	°C
T_{SOL}	Lead Solder Temperature	260 for 10 seconds	°C
P_D	Total Device Power Dissipation at 25°C Ambient	250	mW
	Derate Above 25°C	2.94	mW/°C
Emitter			
I_F	Continuous Forward Current	60	mA
V_R	Reverse Voltage	6	V
P_D	Total Power Dissipation at 25°C Ambient	120	mW
	Derate Above 25°C	1.41	mW/°C
Detector			
V_{DRM}	Off−State Output Terminal Voltage	800	V
I_{TSM}	Peak Non−Repetitive Surge Current (Single Cycle 60 Hz Sine Wave)	1	A
P_D	Total Power Dissipation at 25°C Ambient	150	mW
	Derate Above 25°C	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 specified

INDIVIDUAL COMPONENT CHARACTERISTICS

Symbol	Parameters	Test Conditions	Min.	Typ.	Max.	Unit
Emitter						
V_F	Input Forward Voltage	I_F = 30 mA		1.3	1.5	V
I_R	Reverse Leakage Current	V_R = 6 V		0.005	100	μA
Detector						
I_{DRM1}	Peak Blocking Current, Either Direction	V_{DRM} = 800 V, I_F = 0(1)		10	500	nA
dv/dt	Critical Rate of Rise of Off−State Voltage	I_F = 0 (Figure 10) (2)	600	1500		V/μs

1. Test voltage must be applied within dv/dt rating.
2. This is static dv/dt. See Figure 11 for test circuit. Commutating dv/dt is a function of the load−driving thyristor(s) only.

TRANSFER CHARACTERISTICS

Symbol	DC Characteristics	Test Conditions	Device	Min.	Typ.	Max.	Unit
I_{FT}	LED Trigger Current (Rated I_{FT})	Main Terminal Voltage = 3 V(3)	MOC3081M			15	mA
			MOC3082M			10	
			MOC3083M			5	
V_{TM}	Peak On−State Voltage, Either Direction	I_{TM} = 100 mA peak, I_F = rated I_{FT}	All		1.8	3.0	V
I_H	Holding Current, Either Direction		All		500		μA

3. All devices are guaranteed to trigger at an I_F value less than or equal to max I_{FT}. Therefore, recommended operating I_F lies between max I_{FT} (15 mA for MOC3081M, 10 mA for MOC3082M, 5 mA for MOC3083M) and absolute maximum I_F (60 mA).

ZERO CROSSING CHARACTERISTICS

Symbol	Parameters	Test Conditions	Min.	Typ.	Max.	Unit
V_{INH}	Inhibit Voltage (MT1−MT2 voltage above which device will not trigger)	I_F = Rated I_{FT}		12	20	V
I_{DRM2}	Leakage in Inhibited State	I_F = Rated I_{FT}, V_{DRM} = 800 V, off−state			2	mA

ISOLATION CHARACTERISTICS

Symbol	Parameters	Test Conditions	Min.	Typ.	Max.	Unit
V_{ISO}	Isolation Voltage (4)	f = 60 Hz, t = 1 Minute	4170			VAC_{RMS}
R_{ISO}	Isolation Resistance	V_{I-O} = 500 V_{DC}		10^{11}		Ω
C_{ISO}	Isolation Capacitance	V = 0 V, f = 1 MHz		0.2		pF

4. Isolation voltage, V_{ISO}, is an internal device dielectric breakdown rating. For this test, pins 1 and 2 are common, and pins 4, 5 and 6 are common.

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

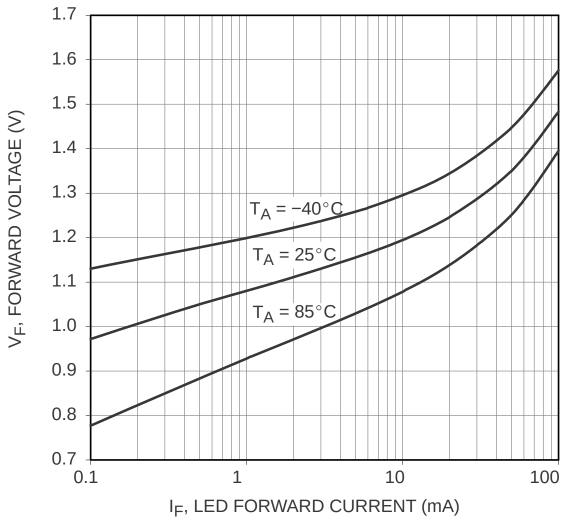


Figure 2. LED Forward Voltage vs. Forward Current

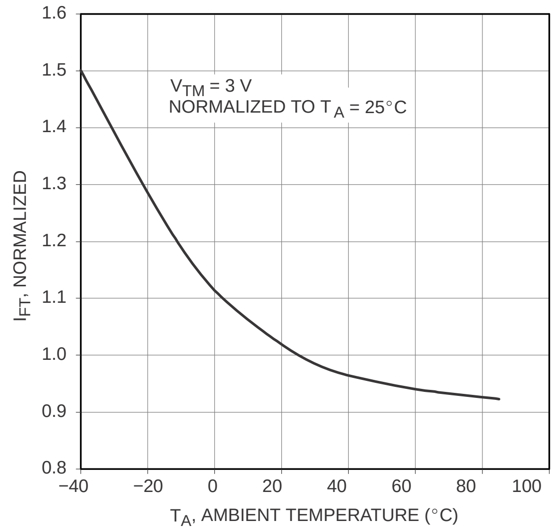


Figure 3. Trigger Current vs. Temperature

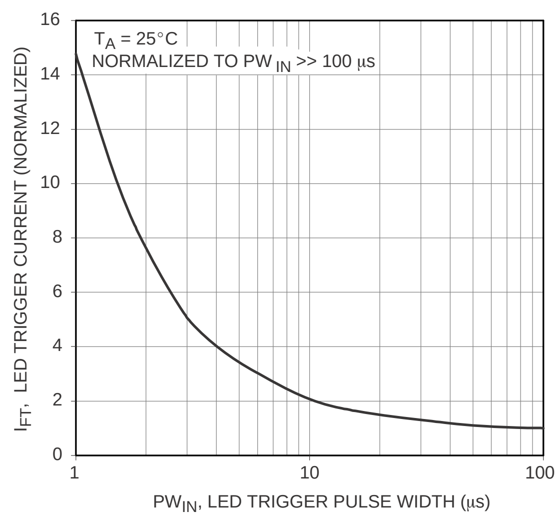


Figure 4. LED Current Required to Trigger vs. LED Pulse Width

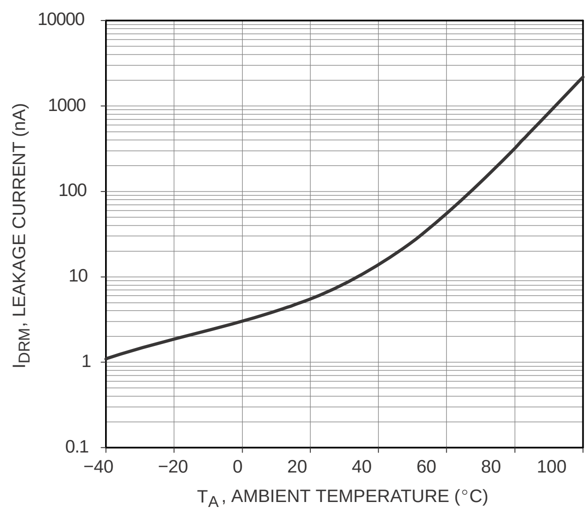


Figure 5. Leakage Current, I_{DRM} vs. Temperature

TYPICAL PERFORMANCE CURVES (Continued)

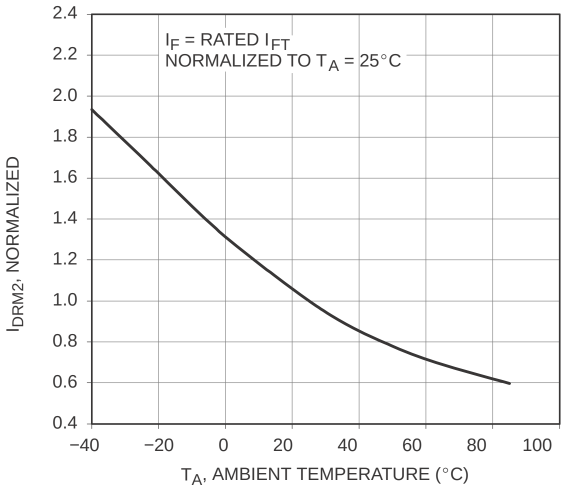


Figure 6. I_{DRM2}, Leakage in Inhibit State vs. Temperature

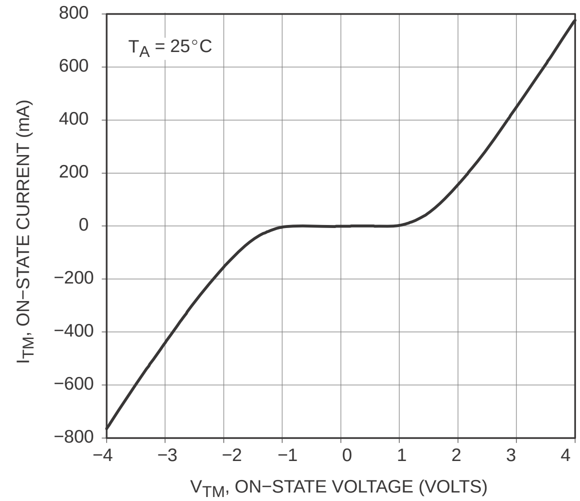


Figure 7. On−State Characteristics

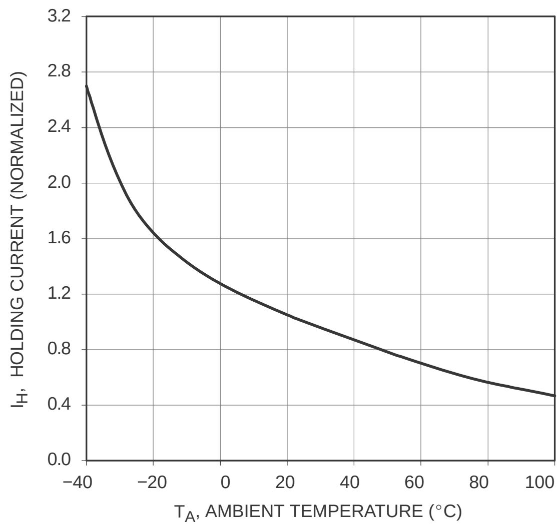


Figure 8. I_H, Holding Current vs. Temperature

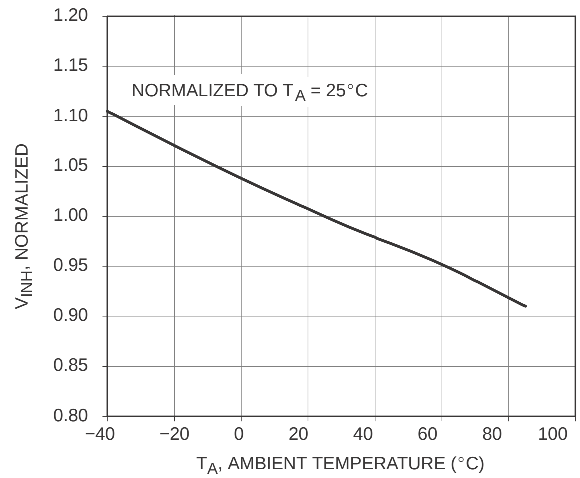
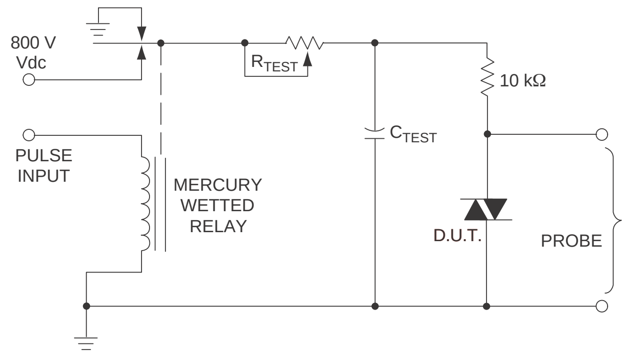


Figure 9. Inhibit Voltage vs. Temperature



1. The mercury wetted relay provides a high speed repeated pulse to the D.U.T.
2. 100x scope probes are used, to allow high speeds and voltages.
3. The worst−case condition for static dv/dt is established by triggering the D.U.T. with a normal LED input current, then removing the current. The variable R_{TEST} allows the dv/dt to be gradually increased until the D.U.T. continues to trigger in response to the applied voltage pulse, even after the LED current has been removed. The dv/dt is then decreased until the D.U.T. stops triggering. τ_{RC} is measured at this point and recorded.

Figure 10. Static dv/dt Test Circuit

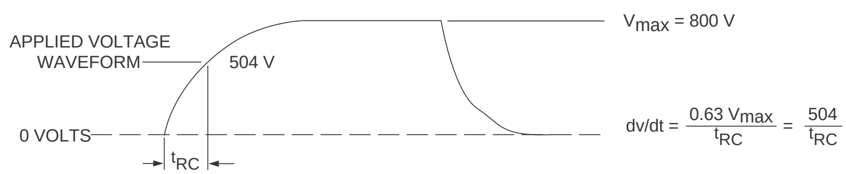
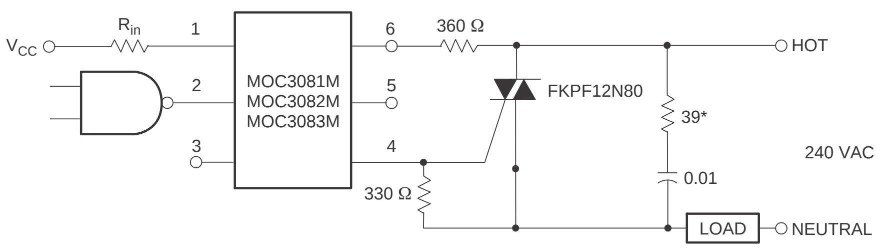


Figure 11. Static dv/dt Test Waveform

Typical circuit for use when hot line switching is required. In this circuit the “hot” side of the line is switched and the load connected to the cold or neutral side. The load may be connected to either the neutral or hot line.

R_{IN} is calculated so that I_F is equal to the rated I_{FT} of the part, 15 mA for the MOC3081M, 10 mA for the MOC3082M, and 5 mA for the MOC3083M. The 39 Ω resistor and 0.01 μF capacitor are for snubbing of the triac and may or may not be necessary depending upon the particular triac and load use.



* For highly inductive loads (power factor < 0.5), change this value to 360 Ω.

Figure 12. Hot−Line Switching Application Circuit

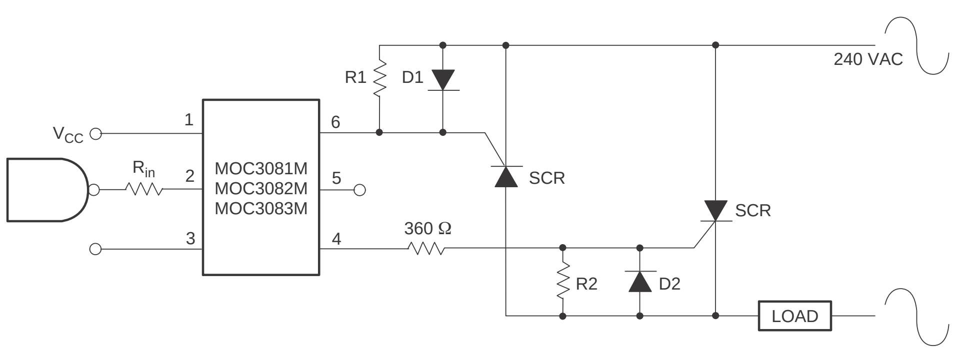


Figure 13. Inverse−Parallel SCR Driver Circuit

Suggested method of firing two, back−to−back SCR’s with an ON Semiconductor triac driver. Diodes can be 1N4001; resistors, R1 and R2, are optional 330 Ω.

NOTE: This optoisolator should not be used to drive a load directly. It is intended to be a trigger device only.

Reflow Profile

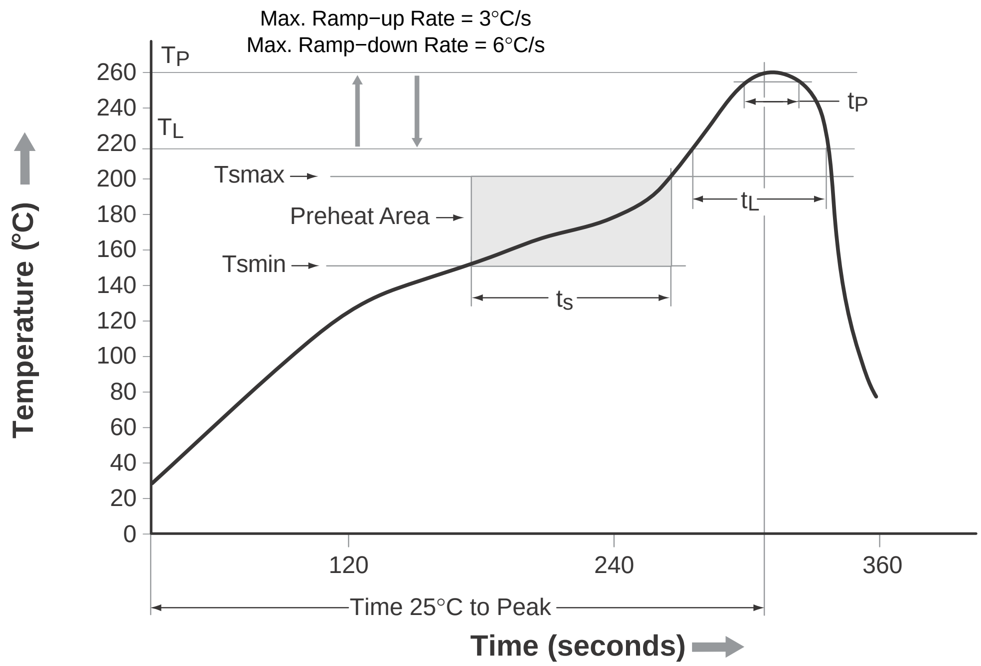


Figure 14. Reflow Profile

Profile Freature	Pb−Free Assembly Profile
Temperature Minimum (Tsmin)	150°C
Temperature Maximum (Tsmax)	200°C
Time (t_S) from (Tsmin to Tsmax)	60 seconds to 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 seconds to 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

Part Number	Package	Shipping
MOC3081M	DIP 6−Pin	50 Units / Tube
MOC3081SM	SMT 6−Pin (Lead Bend)	50 Units / Tube
MOC3081SR2M	SMT 6−Pin (Lead Bend)	1000 Units / Tape & Reel
MOC3081VM	DIP 6−Pin, DIN EN/IEC60747−5−5 Option	50 Units / Tube
MOC3081SVM	SMT 6−Pin (Lead Bend), DIN EN/IEC60747−5−5 Option	50 Units / Tube
MOC3081SR2VM	SMT 6−Pin (Lead Bend), DIN EN/IEC60747−5−5 Option	1000 Units / Tape & Reel
MOC3081TVM	DIP 6−Pin, 0.4” Lead Spacing, DIN EN/IEC60747−5−5 Option	50 Units / Tube

NOTE: The product orderable part number system listed in this table also applies to the MOC3011M, MOC3012M, MOC3020M, MOC3021M, MOC3022M, and MOC3083M product families.

MARKING INFORMATION

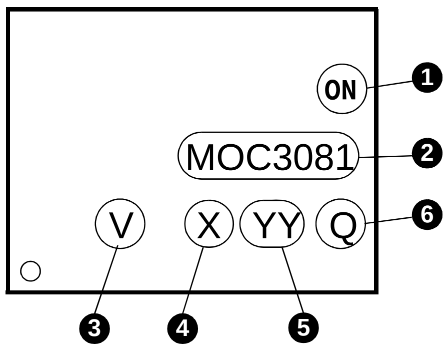


Figure 15. Top Mark

Top Mark Definitions	
1	ON Semiconductor Logo
2	Device Number
3	DIN EN/IEC60747−5−5 Option (only appears on component ordered with this option)
4	One−Digit Year Code, e.g., ‘5’
5	Two−Digit Work Week, Ranging from ‘01’ to ‘53’
6	Assembly Package Code

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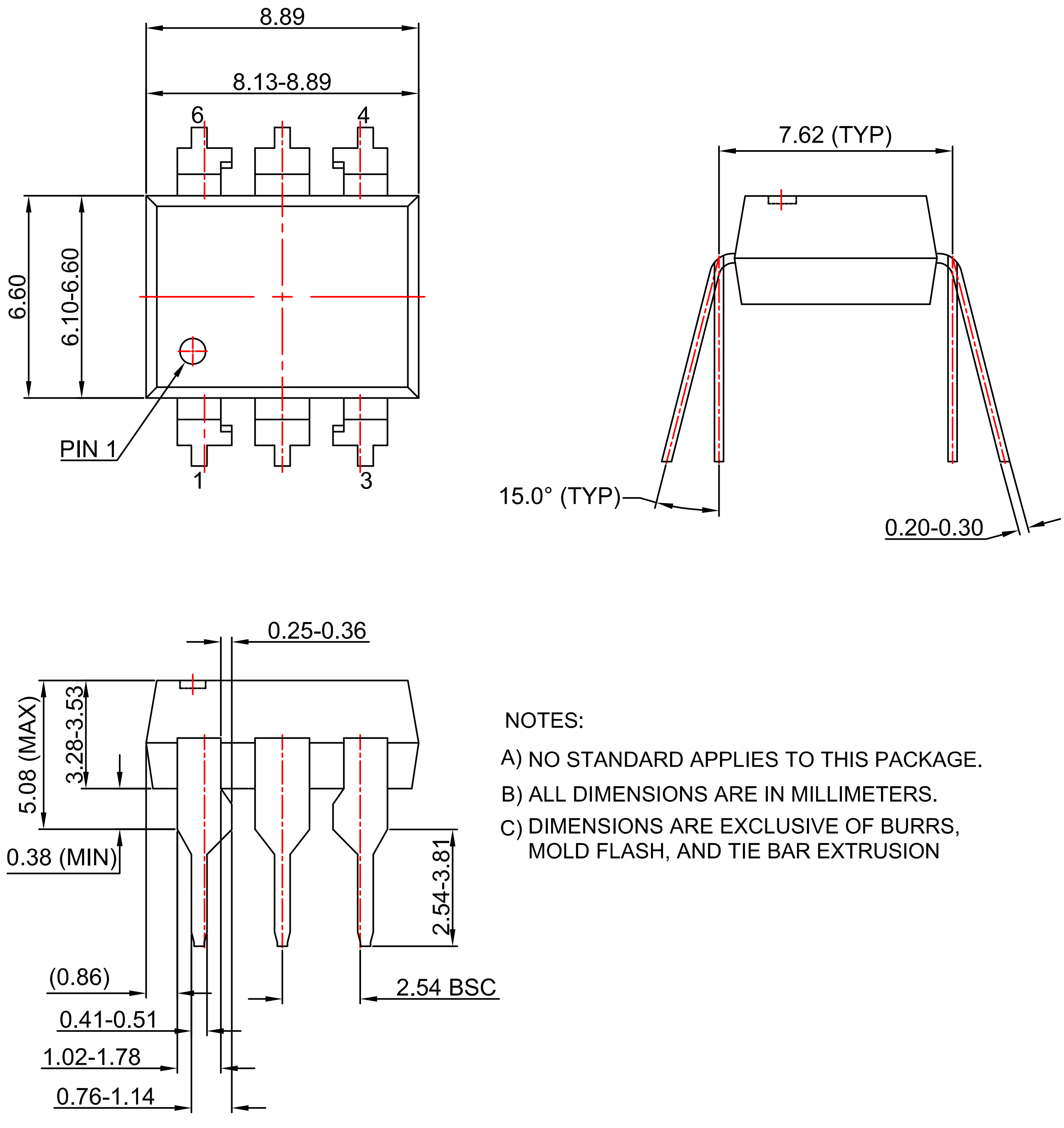
PDIP6 8.51x6.35, 2.54P
CASE 646BX
ISSUE O

DATE 31 JUL 2016



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CASE 646BY
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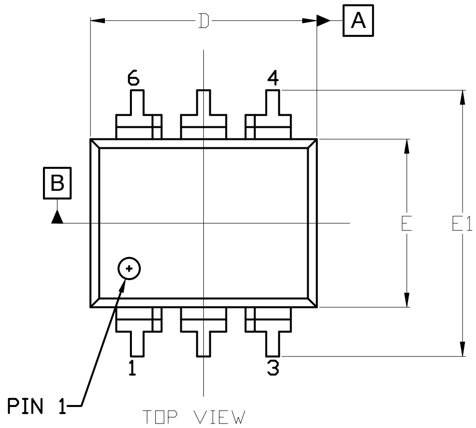
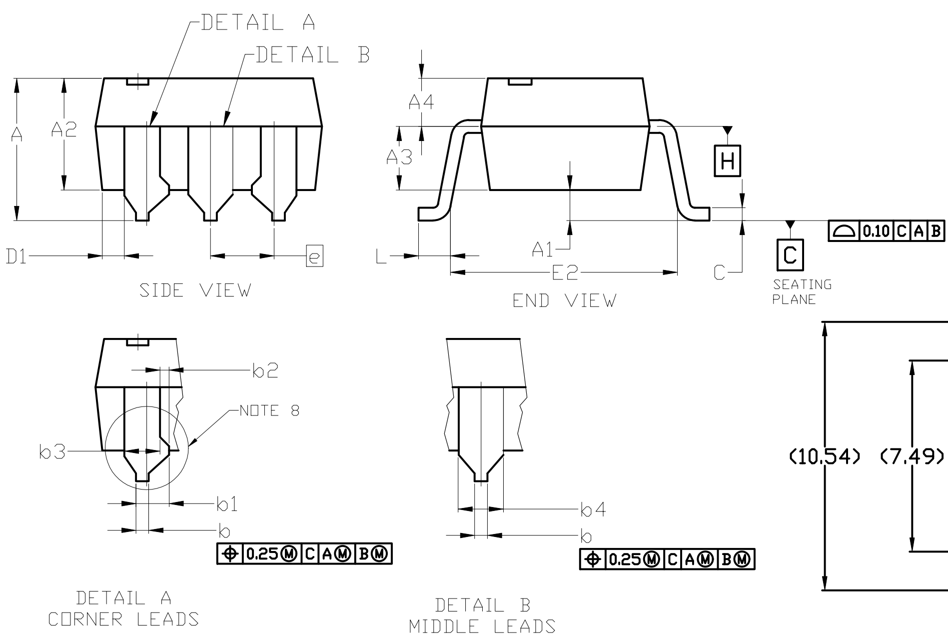
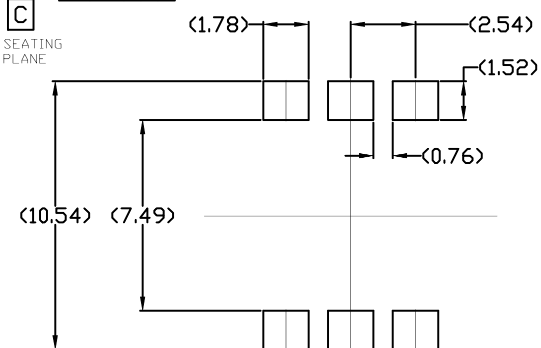


NOTES:
1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 2009.
2. CONTROLLING DIMENSION: MILLIMETERS
3. DIMENSIONS A, A1, AND L ARE MEASURED WITH THE PACKAGE SEATED.
4. DIMENSIONS D, D1, AND E1 DO NOT INCLUDE MOLD FLASH OR PROTRUSIONS. MOLD FLASH OR PROTRUSIONS ARE NOT TO EXCEED 2.54mm.
5. PACKAGE CONTOUR 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.	MILLIMETERS NOM.	MILLIMETERS 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





RECOMMENDED MOUNTING FOOTPRINT

* 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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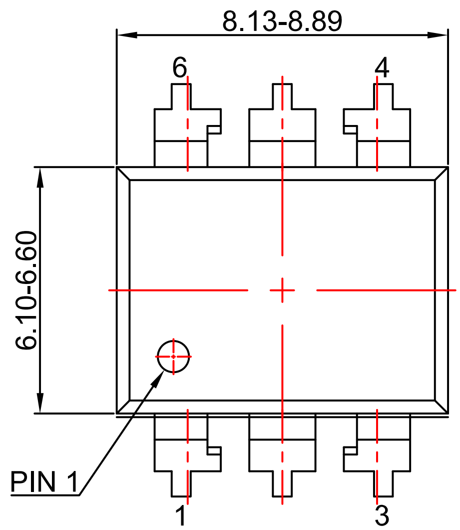

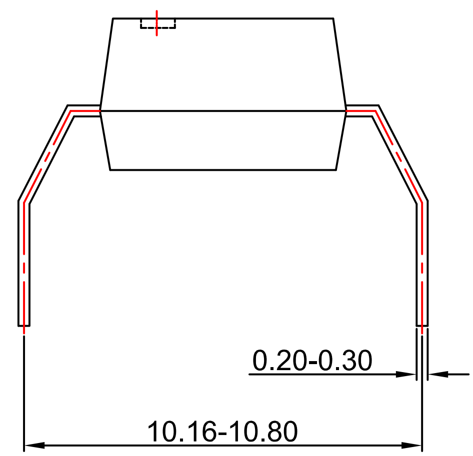

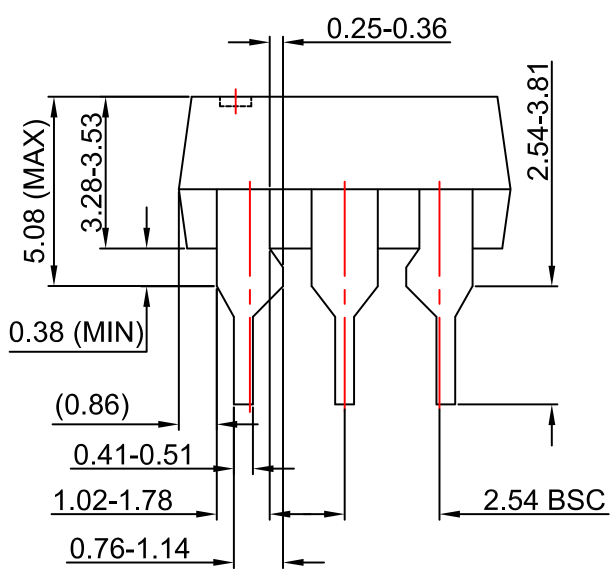

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