# onsemi

# 6-Pin DIP Random-Phase Triac Driver Output Optocoupler (250/400 V Peak)

# MOC3010M, MOC3011M, MOC3012M, MOC3020M, MOC3021M, MOC3022M, MOC3023M

#### Description

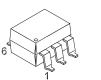
The MOC301XM and MOC302XM series are optically isolated triac driver devices. These devices contain a GaAs infrared emitting diode and a light activated silicon bilateral switch, which functions like a triac. They are designed for interfacing between electronic controls and power triacs to control resistive and inductive loads for 115  $V_{AC}$  operations.

#### Features

- Excellent I<sub>FT</sub> Stability IR Emitting Diode Has Low Degradation
- Peak Blocking Voltage
  - ◆ 250 V, MOC301XM
  - 400 V, MOC302XM
- Safety and Regulatory Approvals
  - UL1577, 4,170 VAC<sub>RMS</sub> for 1 Minute
  - DIN EN/IEC60747-5-5
- These are Pb–Free Devices

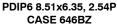
#### Applications

- Industrial Controls
- Solenoid/Valve Controls
- Traffic Lights
- Static AC Power Switch
- Vending Machines
- Incandescent Lamp Dimmers
- Solid State Relay
- Motor Control
- Lamp Ballasts





PDIP6 8.51x6.35, 2.54P F CASE 646BY





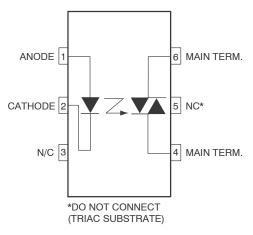


Figure 1. Schematic

#### 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	< 150 V <sub>RMS</sub>	I–IV
Rated Mains Voltage	< 300 V <sub>RMS</sub>	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	1275	Vpeak
	Input-to-Output Test Voltage, Method B, V <sub>IORM</sub> x 1.875 = V <sub>PR</sub> , 100% Production Test with $t_m$ = 1 s, Partial Discharge < 5 pC	1594	Vpeak
VIORM	Maximum Working Insulation Voltage	850	Vpeak
VIOTM	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 <sub>IO</sub>	Insulation Resistance at $T_S$ , $V_{IO}$ = 500 V	> 10 <sup>9</sup>	Ω

Symbol	Parameters	Device	Value	Unit
otal Device	9			•
T <sub>STG</sub>	Storage Temperature	All	-40 to 125	°C
T <sub>OPR</sub>	Operating Temperature	All	-40 to 85	°C
TJ	Junction Temperature Range	All	-40 to 100	°C
T <sub>SOL</sub>	Lead Solder Temperature	All	260 for 10 seconds	°C
P	Total Device Power Dissipation at 25°C Ambient	All	330	mW
PD	Derate Above 25°C	All	4.4	mW/°C
mitter				
I <sub>F</sub>	Continuous Forward Current	All	60	mA
V <sub>R</sub>	Reverse Voltage	All	3	V
Р	Total Power Dissipation at 25°C Ambient	All	100	mW
PD	Derate Above 25°C	All	1.33	mW/°C

#### ABSOLUTE MAXIMUM RATINGS (T<sub>A</sub> = 25°C unless otherwise specified)

$V_{DRM}$	Off-State Output Terminal Voltage	MOC3010M, MOC3011M, MOC3012M	250	V
		MOC3020M, MOC3021M, MOC3022M, MOC3023M	400	
I <sub>TSM</sub>	Peak Repetitive Surge Current (PW = 100 µs, 120 pps)	All	1	A
PD	Total Power Dissipation at 25°C Ambient	All	300	mW
гD	Derate Above 25°C		4	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

 $T_A = 25^{\circ}C$  unless otherwise specified

#### INDIVIDUAL COMPONENT CHARACTERISTICS

Symbol	Parameters	Test Conditions	Device	Min.	Тур.	Max.	Unit
Emitter			<u>.</u>				
V <sub>F</sub>	Input Forward Voltage	I <sub>F</sub> = 10 mA	All		1.15	1.50	V
I <sub>R</sub>	Reverse Leakage Current	$V_{R} = 3 V, T_{A} = 25^{\circ}C$	All		0.01	100	μA
Detector					_		
I <sub>DRM</sub>	Peak Blocking Current, Either Direction	Rated V <sub>DRM</sub> , $I_F = 0^{(1)}$	All		10	100	nA
dv/dt	Critical Rate of Rise of Off-State Volt- age	Rated V <sub>DRM</sub> , I <sub>F</sub> = 0	All	1000			V/µs

1. Test voltage must be applied within dv/dt rating.

#### TRANSFER CHARACTERISTICS

Symbol	DC Characteristics	Test Conditions	Device	Min.	Тур.	Max.	Unit
I <sub>FT</sub>	LED Trigger Current	Voltage = 3 V <sup>(2)</sup>	MOC3020M			30	mA
			MOC3010M			15	
			MOC3021M		15		
			MOC3011M			10	
			MOC3022M		10		
			MOC3012M			5	
			MOC3023M			5	
V <sub>TM</sub>	Peak On-State Voltage, Either Direc- tion	I <sub>TM</sub> = 100 mA peak, I <sub>F</sub> = Rated I <sub>FT</sub>	All		1.8	3.0	V
I <sub>H</sub>	Holding Current, Either Direction		All		100		μΑ

All devices are guaranteed to trigger at an I<sub>F</sub> value less than or equal to max I<sub>FT</sub>. Therefore, recommended operating I<sub>F</sub> lies between max I<sub>FT</sub> (30 mA for MOC3020M, 15 mA for MOC3010M and MOC3021M, 10 mA for MOC3011M and MOC3022M, 5 mA for MOC3012M and MOC3023M) and absolute maximum I<sub>F</sub> (60 mA).

#### **ISOLATION CHARACTERISTICS**

Symbol	Parameters	Test Conditions	Device	Min.	Тур.	Max.	Unit
V <sub>ISO</sub>	Isolation Voltage <sup>(3)</sup>	t = 1 Minute	All	4170			VAC <sub>RMS</sub>

3. Isolation voltage, V<sub>ISO</sub>, 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.

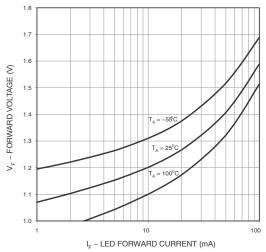


Figure 2. LED Forward Voltage vs. Forward Current

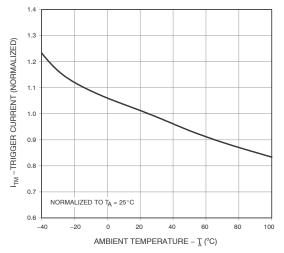


Figure 4. Trigger Current vs. Ambient Temperature

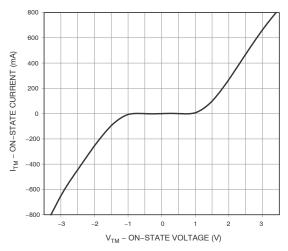


Figure 3. On–State Characteristics

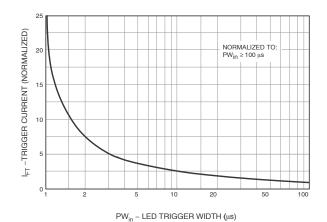
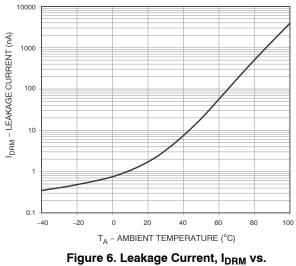


Figure 5. LED Current Required to Trigger vs. LED Pulse Width



Temperature

### **TYPICAL PERFORMANCE CURVES**

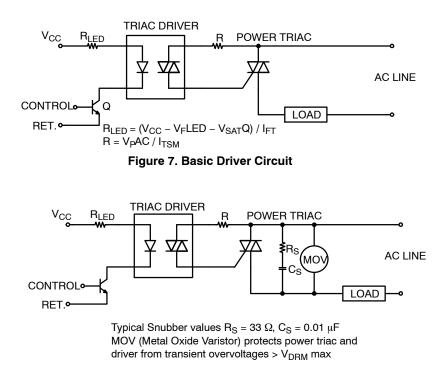


Figure 8. Triac Driver Circuit for Noisy Environments

**Reflow Profile** 

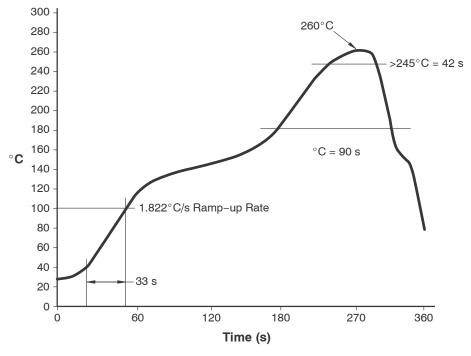


Figure 9. Reflow Profile

#### **ORDERING INFORMATION**

Part Number	Package	Shipping
MOC3010M	DIP 6-Pin	50 Units / Tube
MOC3010SM	SMT 6-Pin (Lead Bend)	50 Units / Tube
MOC3010SR2M	SMT 6-Pin (Lead Bend)	1000 Units / Tape & Reel
MOC3010VM	DIP 6-Pin, DIN EN/IEC60747-5-5 Option	50 Units / Tube
MOC3010SVM	SMT 6-Pin (Lead Bend), DIN EN/IEC60747-5-5 Option	50 Units / Tube
MOC3010SR2VM	SMT 6-Pin (Lead Bend), DIN EN/IEC60747-5-5 Option	1000 Units / Tape & Reel
MOC3010TVM	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 MOC3023M product families.

#### MARKING INFORMATION

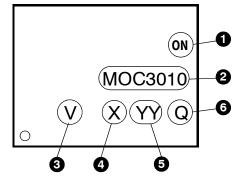


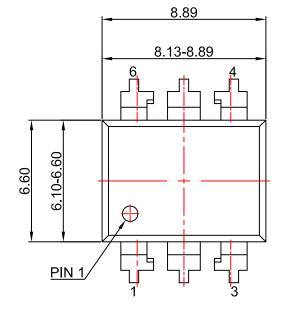
Figure 10. Top Marking

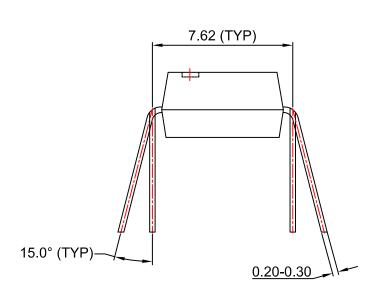
	Top Mark Definitions				
1	ON Semiconductor Logo				
2	Device Number				
3	DIN EN/IEC60747-5-5 Option (only appears on component ordered with this option)				
4	One-Digit Year Code, e.g., '5'				
5	Two-Digit Work Week, Ranging from '01' to '53'				
6	Assembly Package Code				

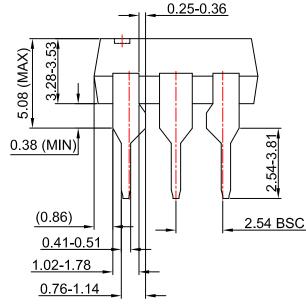


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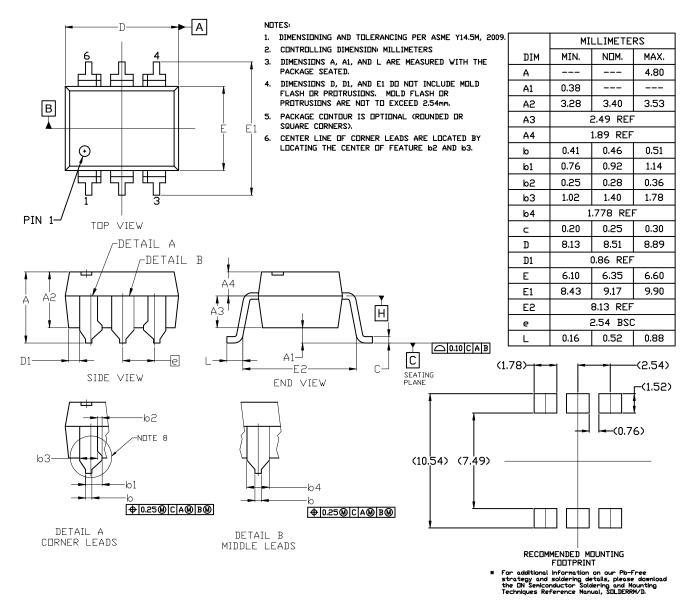
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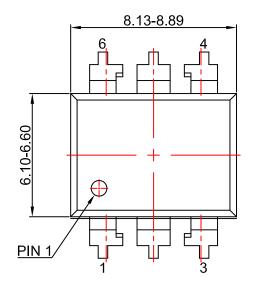


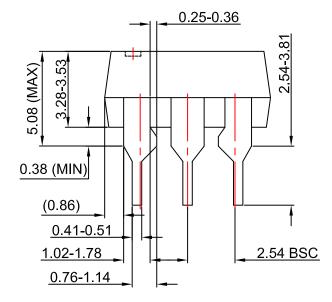
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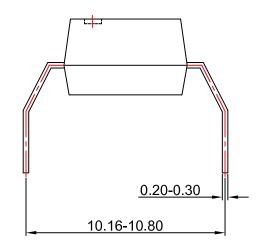


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