

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_{FT} Stability – IR Emitting Diode Has Low Degradation
- Peak Blocking Voltage
 - ♦ 250 V, MOC301XM
 - ♦ 400 V, MOC302XM
- Safety and Regulatory Approvals
 - ♦ UL1577, 4,170 V_{AC}_{RMS} 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

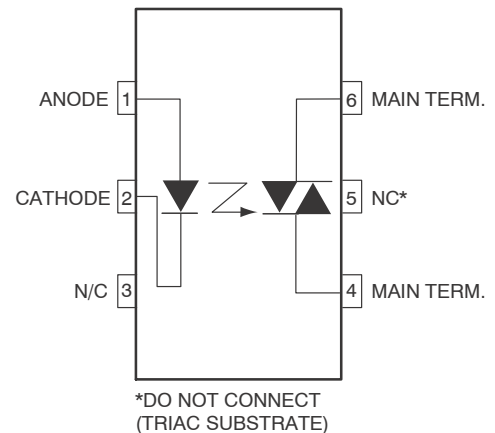
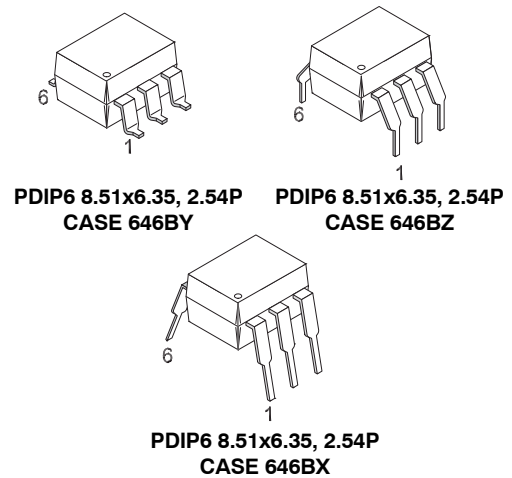


Figure 1. Schematic

ORDERING INFORMATION

See detailed ordering and shipping information on page 7 of this data sheet.

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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} × 1.6 = V _{PR} , Type and Sample Test with t _m = 10 s, Partial Discharge < 5 pC	1275	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
R _{IO}	Insulation Resistance at T _S , V _{IO} = 500 V	> 10 ⁹	Ω

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ABSOLUTE MAXIMUM RATINGS ($T_A = 25^\circ\text{C}$ unless otherwise specified)

Symbol	Parameters	Device	Value	Unit
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Total Device

T_{STG}	Storage Temperature	All	-40 to 125	$^\circ\text{C}$
T_{OPR}	Operating Temperature	All	-40 to 85	$^\circ\text{C}$
T_J	Junction Temperature Range	All	-40 to 100	$^\circ\text{C}$
T_{SOL}	Lead Solder Temperature	All	260 for 10 seconds	$^\circ\text{C}$
P_D	Total Device Power Dissipation at 25°C Ambient	All	330	mW
	Derate Above 25°C		4.4	mW/ $^\circ\text{C}$

Emitter

I_F	Continuous Forward Current	All	60	mA
V_R	Reverse Voltage	All	3	V
P_D	Total Power Dissipation at 25°C Ambient	All	100	mW
	Derate Above 25°C		1.33	mW/ $^\circ\text{C}$

Detector

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

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.

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ELECTRICAL CHARACTERISTICS

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

INDIVIDUAL COMPONENT CHARACTERISTICS

Symbol	Parameters	Test Conditions	Device	Min.	Typ.	Max.	Unit
Emitter							
V_F	Input Forward Voltage	$I_F = 10\text{ mA}$	All		1.15	1.50	V
I_R	Reverse Leakage Current	$V_R = 3\text{ V}$, $T_A = 25^\circ\text{C}$	All		0.01	100	μA
Detector							
I_{DRM}	Peak Blocking Current, Either Direction	Rated V_{DRM} , $I_F = 0^{(1)}$	All		10	100	nA
dv/dt	Critical Rate of Rise of Off-State Voltage	Rated V_{DRM} , $I_F = 0$	All	1000			V/ μs

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

TRANSFER CHARACTERISTICS

Symbol	DC Characteristics	Test Conditions	Device	Min.	Typ.	Max.	Unit
I_{FT}	LED Trigger Current	Voltage = 3 V ⁽²⁾	MOC3020M			30	mA
			MOC3010M			15	
			MOC3021M				
			MOC3011M			10	
			MOC3022M				
			MOC3012M			5	
			MOC3023M				
V_{TM}	Peak On-State Voltage, Either Direction	$I_{\text{TM}} = 100\text{ mA peak}$, $I_F = \text{Rated } I_{\text{FT}}$	All		1.8	3.0	V
I_H	Holding Current, Either Direction		All		100		μA

2. 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} (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_F (60 mA).

ISOLATION CHARACTERISTICS

Symbol	Parameters	Test Conditions	Device	Min.	Typ.	Max.	Unit
V_{ISO}	Isolation Voltage ⁽³⁾	$t = 1\text{ Minute}$	All	4170			$V_{\text{AC RMS}}$

3. 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

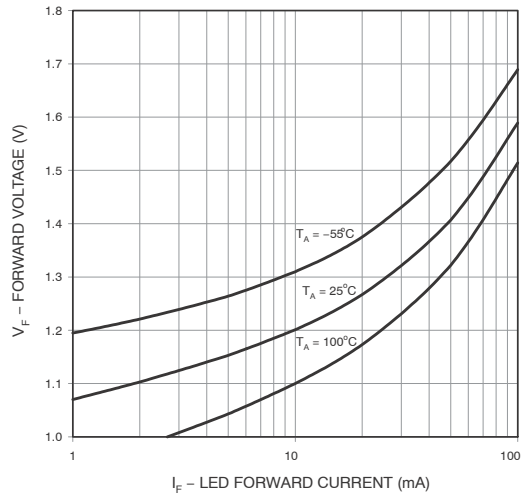


Figure 2. LED Forward Voltage vs. Forward Current

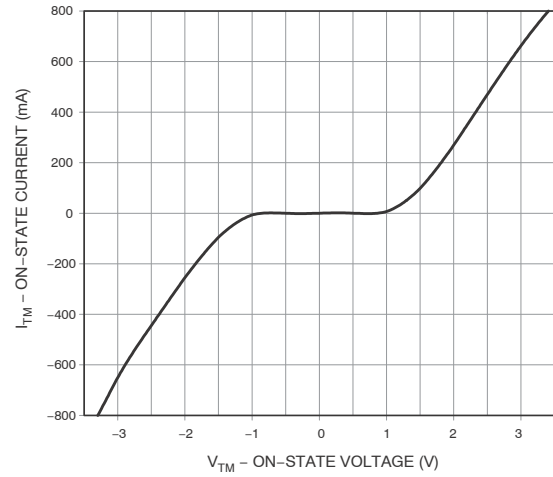


Figure 3. On-State Characteristics



Figure 4. Trigger Current vs. Ambient Temperature

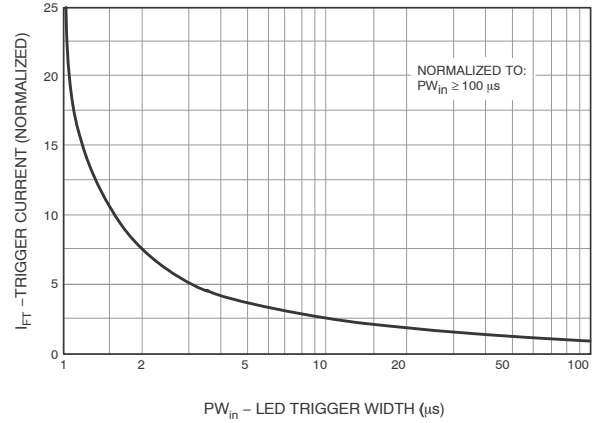


Figure 5. LED Current Required to Trigger vs. LED Pulse Width

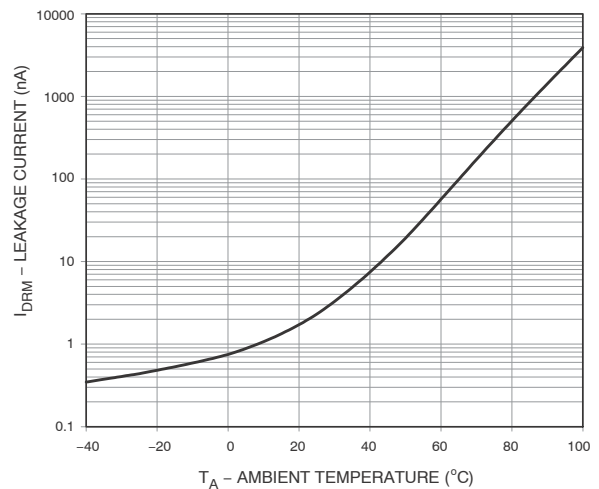


Figure 6. Leakage Current, I_{DRM} vs. Temperature

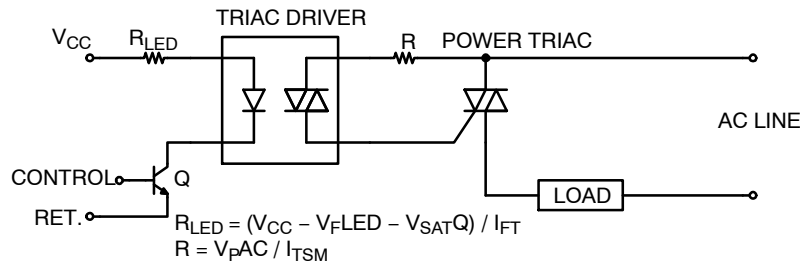


Figure 7. Basic Driver Circuit



Typical Snubber values $R_S = 33 \Omega$, $C_S = 0.01 \mu F$
 MOV (Metal Oxide Varistor) protects power triac and driver from transient overvoltages $> V_{DRM \max}$

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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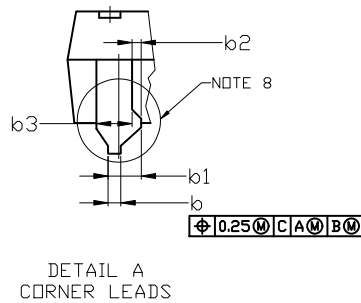
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5. PACKAGE CONTOUR IS OPTIONAL (ROUNDED OR SQUARE CORNERS).
6. CENTER LINE OF CORNER LEADS IS LOCATED BY LOCATING THE CENTER OF FEATURE b2 AND b3.

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.

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