



Is Now Part of



**ON Semiconductor®**

To learn more about ON Semiconductor, please visit our website at  
[www.onsemi.com](http://www.onsemi.com)

Please note: As part of the Fairchild Semiconductor integration, some of the Fairchild orderable part numbers will need to change in order to meet ON Semiconductor's system requirements. Since the ON Semiconductor product management systems do not have the ability to manage part nomenclature that utilizes an underscore (\_), the underscore (\_) in the Fairchild part numbers will be changed to a dash (-). This document may contain device numbers with an underscore (\_). Please check the ON Semiconductor website to verify the updated device numbers. The most current and up-to-date ordering information can be found at [www.onsemi.com](http://www.onsemi.com). Please email any questions regarding the system integration to [Fairchild\\_questions@onsemi.com](mailto:Fairchild_questions@onsemi.com).

ON Semiconductor and the ON Semiconductor logo are trademarks of Semiconductor Components Industries, LLC dba ON Semiconductor or its subsidiaries in the United States and/or other countries. ON Semiconductor owns the rights to a number of patents, trademarks, copyrights, trade secrets, and other intellectual property. A listing of ON Semiconductor's product/patent coverage may be accessed at [www.onsemi.com/site/pdf/Patent-Marking.pdf](http://www.onsemi.com/site/pdf/Patent-Marking.pdf). ON Semiconductor reserves the right to make changes without further notice to any products herein. ON Semiconductor makes no warranty, representation or guarantee regarding the suitability of its products for any particular purpose, nor does ON Semiconductor 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 ON Semiconductor products, including compliance with all laws, regulations and safety requirements or standards, regardless of any support or applications information provided by ON Semiconductor. "Typical" parameters which may be provided in ON Semiconductor 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. ON Semiconductor does not convey any license under its patent rights nor the rights of others. ON Semiconductor 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 ON Semiconductor products for any such unintended or unauthorized application, Buyer shall indemnify and hold ON Semiconductor 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 ON Semiconductor was negligent regarding the design or manufacture of the part. ON Semiconductor is an Equal Opportunity/Affirmative Action Employer. This literature is subject to all applicable copyright laws and is not for resale in any manner.



July 2015

# MOC3010M, MOC3011M, MOC3012M, MOC3020M, MOC3021M, MOC3022M, MOC3023M 6-Pin DIP Random-Phase Triac Driver Output Optocoupler (250/400 Volt Peak)

## 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<sub>AC</sub>RMS for 1 Minute
  - DIN EN/IEC60747-5-5

## Applications

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

## 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<sub>AC</sub> operations.

## Schematic



Figure 1. Schematic

## Package Outlines



Figure 2. Package Outlines

MOC301XM, MOC302XM — 6-Pin DIP Random-Phase Triac Driver Output Optocoupler (250/400 Volt Peak)

## 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 <sub>RMS</sub>	I–IV
	< 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 <sub>PR</sub>	Input-to-Output Test Voltage, Method A, V <sub>IORM</sub> × 1.6 = V <sub>PR</sub> , Type and Sample Test with t <sub>m</sub> = 10 s, Partial Discharge < 5 pC	1275	V <sub>peak</sub>
	Input-to-Output Test Voltage, Method B, V <sub>IORM</sub> × 1.875 = V <sub>PR</sub> , 100% Production Test with t <sub>m</sub> = 1 s, Partial Discharge < 5 pC	1594	V <sub>peak</sub>
V <sub>IORM</sub>	Maximum Working Insulation Voltage	850	V <sub>peak</sub>
V <sub>IOTM</sub>	Highest Allowable Over-Voltage	6000	V <sub>peak</sub>
	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 <sub>S</sub> , V <sub>IO</sub> = 500 V	> 10 <sup>9</sup>	Ω

## Absolute Maximum Ratings

Stresses exceeding the absolute maximum ratings may damage the device. The device may not function or be operable above the recommended operating conditions and stressing the parts to these levels is not recommended. In addition, extended exposure to stresses above the recommended operating conditions may affect device reliability. The absolute maximum ratings are stress ratings only.  $T_A = 25^\circ\text{C}$  unless otherwise specified.

Symbol	Parameters	Device	Value	Unit
<b>TOTAL DEVICE</b>				
$T_{STG}$	Storage Temperature	All	-40 to +150	$^\circ\text{C}$
$T_{OPR}$	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 $25^\circ\text{C}$ Ambient	All	330	mW
	Derate Above $25^\circ\text{C}$		4.4	mW/ $^\circ\text{C}$
<b>EMITTER</b>				
$I_F$	Continuous Forward Current	All	60	mA
$V_R$	Reverse Voltage	All	3	V
$P_D$	Total Power Dissipation at $25^\circ\text{C}$ Ambient	All	100	mW
	Derate Above $25^\circ\text{C}$		1.33	mW/ $^\circ\text{C}$
<b>DETECTOR</b>				
$V_{DRM}$	Off-State Output Terminal Voltage	MOC3010M MOC3011M MOC3012M	250	V
		MOC3020M MOC3021M MOC3022M MOC3023M	400	
$I_{TSM}$	Peak Repetitive Surge Current (PW = 100 $\mu\text{s}$ , 120 pps)	All	1	A
$P_D$	Total Power Dissipation at $25^\circ\text{C}$ Ambient	All	300	mW
	Derate Above $25^\circ\text{C}$		4	mW/ $^\circ\text{C}$

## Electrical Characteristics

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

### Individual Component Characteristics

Symbol	Parameters	Test Conditions	Device	Min.	Typ.	Max.	Unit
<b>EMITTER</b>							
$V_F$	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	$\mu\text{A}$
<b>DETECTOR</b>							
$I_{\text{DRM}}$	Peak Blocking Current, Either Direction	Rated $V_{\text{DRM}}, I_F = 0^{(1)}$	All		10	100	nA
$V_{\text{TM}}$	Peak On-State Voltage, Either Direction	$I_{\text{TM}} = 100\text{ mA peak}, I_F = 0$	All		1.8	3.0	V

### Transfer Characteristics

Symbol	DC Characteristics	Test Conditions	Device	Min.	Typ.	Max.	Unit
$I_{\text{FT}}$	LED Trigger Current	Voltage = $3\text{ V}^{(2)}$	MOC3020M			30	mA
			MOC3010M			15	
			MOC3021M				
			MOC3011M			10	
			MOC3022M				
			MOC3012M			5	
			MOC3023M				
$I_{\text{H}}$	Holding Current, Either Direction		All		100		$\mu\text{A}$

### Isolation Characteristics

Symbol	Parameter	Test Conditions	Device	Min.	Typ.	Max.	Unit
$V_{\text{ISO}}$	Isolation Voltage <sup>(3)</sup>	$t = 1\text{ Minute}$	All	4170			$V_{\text{ACRMS}}$

#### Notes:

- Test voltage must be applied within dv/dt rating.
- All devices are guaranteed to trigger at an  $I_F$  value less than or equal to max  $I_{\text{FT}}$ . Therefore, recommended operating  $I_F$  lies between max  $I_{\text{FT}}$  (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 voltage,  $V_{\text{ISO}}$ , is an internal device dielectric breakdown rating. For this test, pins 1 and 2 are common, and pins 4, 5 and 6 are common.

## Typical Performance Curves



Figure 3. LED Forward Voltage vs. Forward Current



Figure 4. On-State Characteristics



Figure 5. Trigger Current vs. Ambient Temperature



Figure 6. LED Current Required to Trigger vs. LED Pulse Width



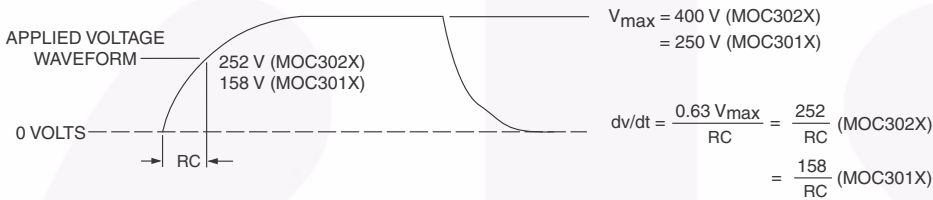
Figure 7. dv/dt vs. Temperature



Figure 8. Leakage Current,  $I_{DRM}$  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 DUT with a normal LED input current, then removing the current. The variable  $R_{TEST}$  allows the dv/dt to be gradually increased until the DUT 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 DUT stops triggering.  $\tau_{RC}$  is measured at this point and recorded.



**Note:**

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

**Figure 9. Static dv/dt Test Circuit**



**Figure 10. Resistive Load**



**Figure 11. Inductive Load with Sensitive Gate Triac ( $I_{GT} \leq 15 \text{ mA}$ )**



Figure 12. Inductive Load with sensitive Gate Triac ( $I_{GT} \leq 15 \text{ mA}$ )



In this circuit the "hot" side of the line is switched and the load connected to the cold or ground side. The 39  $\Omega$  resistor and 0.01  $\mu\text{F}$  capacitor are for snubbing of the triac, and the 470  $\Omega$  resistor and 0.05  $\mu\text{F}$  capacitor are for snubbing the coupler. These components may or may not be necessary depending upon the particular and load used.

Figure 13. Typical Application Circuit



### Reflow Profile



Figure 14. Reflow Profile

### Ordering Information<sup>(4)</sup>

Part Number	Package	Packing Method
MOC3010M	DIP 6-Pin	Tube (50 Units)
MOC3010SM	SMT 6-Pin (Lead Bend)	Tube (50 Units)
MOC3010SR2M	SMT 6-Pin (Lead Bend)	Tape and Reel (1000 Units)
MOC3010VM	DIP 6-Pin, DIN EN/IEC60747-5-5 Option	Tube (50 Units)
MOC3010SVM	SMT 6-Pin (Lead Bend), DIN EN/IEC60747-5-5 Option	Tube (50 Units)
MOC3010SR2VM	SMT 6-Pin (Lead Bend), DIN EN/IEC60747-5-5 Option	Tape and Reel (1000 Units)
MOC3010TVM	DIP 6-Pin, 0.4" Lead Spacing, DIN EN/IEC60747-5-5 Option	Tube (50 Units)

**Note:**

4. 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 15. Top Mark

Top Mark Definitions	
1	Fairchild 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



- 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
  - D) DRAWING FILENAME AND REVISION: MKT-N06BREV4.





LAND PATTERN RECOMMENDATION



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
- D) DRAWING FILENAME AND REVISION : MKT-N06CREV4.





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
- D) DRAWING FILENAME AND REVISION: MKT-N06Drev4



ON Semiconductor and  are trademarks of Semiconductor Components Industries, LLC dba ON Semiconductor or its subsidiaries in the United States and/or other countries. ON Semiconductor owns the rights to a number of patents, trademarks, copyrights, trade secrets, and other intellectual property. A listing of ON Semiconductor's product/patent coverage may be accessed at [www.onsemi.com/site/pdf/Patent-Marking.pdf](http://www.onsemi.com/site/pdf/Patent-Marking.pdf). ON Semiconductor reserves the right to make changes without further notice to any products herein. ON Semiconductor makes no warranty, representation or guarantee regarding the suitability of its products for any particular purpose, nor does ON Semiconductor 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 ON Semiconductor products, including compliance with all laws, regulations and safety requirements or standards, regardless of any support or applications information provided by ON Semiconductor. "Typical" parameters which may be provided in ON Semiconductor 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. ON Semiconductor does not convey any license under its patent rights nor the rights of others. ON Semiconductor 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 ON Semiconductor products for any such unintended or unauthorized application, Buyer shall indemnify and hold ON Semiconductor 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 ON Semiconductor was negligent regarding the design or manufacture of the part. ON Semiconductor is an Equal Opportunity/Affirmative Action Employer. This literature is subject to all applicable copyright laws and is not for resale in any manner.

## PUBLICATION ORDERING INFORMATION

### LITERATURE FULFILLMENT:

Literature Distribution Center for ON Semiconductor  
19521 E. 32nd Pkwy, Aurora, Colorado 80011 USA  
**Phone:** 303-675-2175 or 800-344-3860 Toll Free USA/Canada  
**Fax:** 303-675-2176 or 800-344-3867 Toll Free USA/Canada  
**Email:** [orderlit@onsemi.com](mailto:orderlit@onsemi.com)

**N. American Technical Support:** 800-282-9855 Toll Free  
USA/Canada  
**Europe, Middle East and Africa Technical Support:**  
Phone: 421 33 790 2910  
**Japan Customer Focus Center**  
Phone: 81-3-5817-1050

**ON Semiconductor Website:** [www.onsemi.com](http://www.onsemi.com)  
**Order Literature:** <http://www.onsemi.com/orderlit>  
For additional information, please contact your local  
Sales Representative

# Mouser Electronics

Authorized Distributor

Click to View Pricing, Inventory, Delivery & Lifecycle Information:

[ON Semiconductor:](#)

[MOC3012M](#)

[MOC3012SM](#)

[MOC3012VM](#)

[MOC3012TVM](#)

[MOC3012SR2VM](#)

[MOC3012SVM](#)

[MOC3012SR2M](#)



Компания «ЭлектроПласт» предлагает заключение долгосрочных отношений при поставках импортных электронных компонентов на взаимовыгодных условиях!

Наши преимущества:

- Оперативные поставки широкого спектра электронных компонентов отечественного и импортного производства напрямую от производителей и с крупнейших мировых складов;
- Поставка более 17-ти миллионов наименований электронных компонентов;
- Поставка сложных, дефицитных, либо снятых с производства позиций;
- Оперативные сроки поставки под заказ (от 5 рабочих дней);
- Экспресс доставка в любую точку России;
- Техническая поддержка проекта, помощь в подборе аналогов, поставка прототипов;
- Система менеджмента качества сертифицирована по Международному стандарту ISO 9001;
- Лицензия ФСБ на осуществление работ с использованием сведений, составляющих государственную тайну;
- Поставка специализированных компонентов (Xilinx, Altera, Analog Devices, Intersil, Interpoint, Microsemi, Aeroflex, Peregrine, Syfer, Eurofarad, Texas Instrument, Miteq, Cobham, E2V, MA-COM, Hittite, Mini-Circuits, General Dynamics и др.);

Помимо этого, одним из направлений компании «ЭлектроПласт» является направление «Источники питания». Мы предлагаем Вам помощь Конструкторского отдела:

- Подбор оптимального решения, техническое обоснование при выборе компонента;
- Подбор аналогов;
- Консультации по применению компонента;
- Поставка образцов и прототипов;
- Техническая поддержка проекта;
- Защита от снятия компонента с производства.



#### Как с нами связаться

**Телефон:** 8 (812) 309 58 32 (многоканальный)

**Факс:** 8 (812) 320-02-42

**Электронная почта:** [org@eplast1.ru](mailto:org@eplast1.ru)

**Адрес:** 198099, г. Санкт-Петербург, ул. Калинина, дом 2, корпус 4, литера А.