**Is Now Part of**

**ON Semiconductor®**

**To learn more about ON Semiconductor, please visit our website at**
**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. Please email any questions regarding the system integration to 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. 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.

August 2015

# MOC3031M, MOC3032M, MOC3033M, MOC3041M, MOC3042M, MOC3043M
# 6-Pin DIP Zero-Cross Triac Driver Output Optocoupler (250/400 Volt Peak)

## Features

- Simplifies Logic Control of 115 VAC Power
- Zero Voltage Crossing
- dv/dt of 2000 V/µs Typical, 1000 V/µs Guaranteed
- Peak Blocking Voltage
  - 250 V, MOC303XM
  - 400 V, MOC304XM
- Safety and Regulatory Approvals
  - UL1577, 4,170 $VAC_{RMS}$ for 1 Minute
  - DIN EN/IEC60747-5-5

## Applications

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

## Description

The MOC303XM and MOC304XM 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 triac in the interface of logic systems to equipment powered from 115 VAC lines, such as teletypewriters, CRTs, solid-state relays, industrial controls, printers, motors, solenoids and consumer appliances, etc.

## Schematic

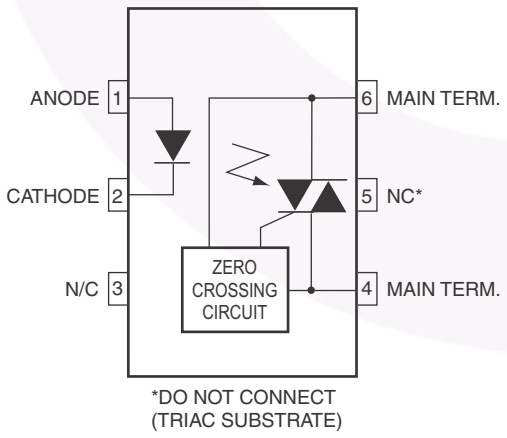



**Figure 1. Schematic**

## Package Outlines

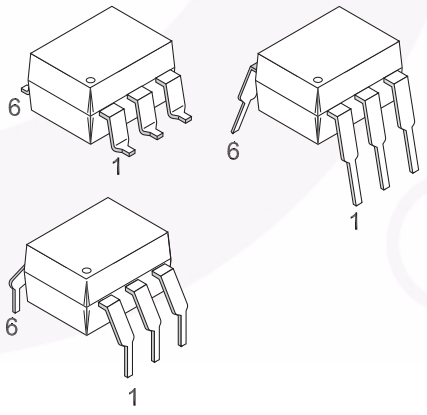



**Figure 2. Package Outlines**

©2005 Fairchild Semiconductor Corporation

## 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 | 1275 | $V_{peak}$ |
| | 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 |
| $R_{IO}$ | Insulation Resistance at $T_S$, $V_{IO}$ = 500 V | > $10^9$ | Ω |

©2005 Fairchild Semiconductor Corporation

## 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°C unless otherwise specified.

| Symbol | Parameters | Device | Value | Unit |
|---|---|---|---|---|
| **TOTAL DEVICE** | | | | |
| $T_{STG}$ | Storage Temperature | All | -40 to +150 | °C |
| $T_{OPR}$ | Operating Temperature | All | -40 to +85 | °C |
| $T_J$ | Junction Temperature Range | All | -40 to +100 | °C |
| $T_{SOL}$ | Lead Solder Temperature | All | 260 for 10 seconds | °C |
| $P_D$ | Total Device Power Dissipation at 25°C Ambient | All | 250 | mW |
| | Derate Above 25°C | | 2.94 | mW/°C |
| **EMITTER** | | | | |
| $I_F$ | Continuous Forward Current | All | 60 | mA |
| $V_R$ | Reverse Voltage | All | 6 | V |
| $P_D$ | Total Power Dissipation at 25°C Ambient | All | 120 | mW |
| | Derate Above 25°C | | 1.41 | mW/°C |
| **DETECTOR** | | | | |
| $V_{DRM}$ | Off-State Output Terminal Voltage | MOC3031M<br>MOC3032M<br>MOC3033M | 250 | V |
| | | MOC3041M<br>MOC3042M<br>MOC3043M | 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 | 150 | mW |
| | Derate Above 25°C | | 1.76 | mW/°C |

## Electrical Characteristics

$T_A$ = 25°C unless otherwise specified.

### Individual Component Characteristics

| Symbol | Parameters | Test Conditions | Device | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|---|
| **EMITTER** | | | | | | | |
| $V_F$ | Input Forward Voltage | $I_F$ = 30 mA | All | | 1.25 | 1.50 | V |
| $I_R$ | Reverse Leakage Current | $V_R$ = 6 V | All | | 0.01 | 100 | µA |
| **DETECTOR** | | | | | | | |
| $I_{DRM1}$ | Peak Blocking Current, Either Direction | Rated $V_{DRM}$, $I_F$ = 0(1) | All | | | 100 | nA |
| $V_{TM}$ | Peak On-State Voltage, Either Direction | $I_{TM}$ = 100 mA peak, $I_F$ = 0 | All | | 1.8 | 3.0 | V |
| dv/dt | Critical Rate of Rise of Off-State Voltage | $I_F$ = 0 (Figure 11)(2) | All | 1000 | 2000 | | V/µs |

### Transfer Characteristics

| Symbol | DC Characteristics | Test Conditions | Device | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|---|
| $I_{FT}$ | LED Trigger Current | Main Terminal Voltage = 3 V(3) | MOC3031M<br>MOC3041M | | | 15 | mA |
| | | | MOC3032M<br>MOC3042M | | | 10 | |
| | | | MOC3033M<br>MOC3043M | | | 5 | |
| $I_H$ | Holding Current, Either Direction | | All | | 400 | | µA |

### Zero Crossing Characteristics

| Symbol | Characteristics | Test Conditions | Device | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|---|
| $V_{IH}$ | Inhibit Voltage | $I_F$ = rated $I_{FT}$, MT1-MT2 voltage above which device will not trigger off-state | All | | | 20 | V |
| $I_{DRM2}$ | Leakage in Inhibited State | $I_F$ = rated $I_{FT}$, rated $V_{DRM}$ off-state | All | | | 2 | mA |

### Isolation Characteristics

| Symbol | Parameter | Test Conditions | Device | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|---|
| $V_{ISO}$ | Isolation Voltage(4) | t = 1 Minute | All | 4170 | | | $VAC_{RMS}$ |

**Notes:**

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.
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 MOC3031M and MOC3041M, 10 mA for MOC3032M and MOC3042M, 5 mA for MOC3033M and MOC3043M) and absolute maximum $I_F$ (60 mA).
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.

©2005 Fairchild Semiconductor Corporation

## Typical Performance Curves

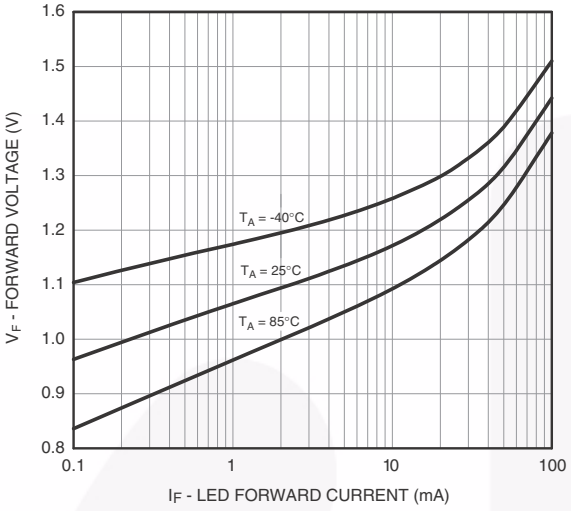



**Figure 3. LED Forward Voltage vs. Forward Current**

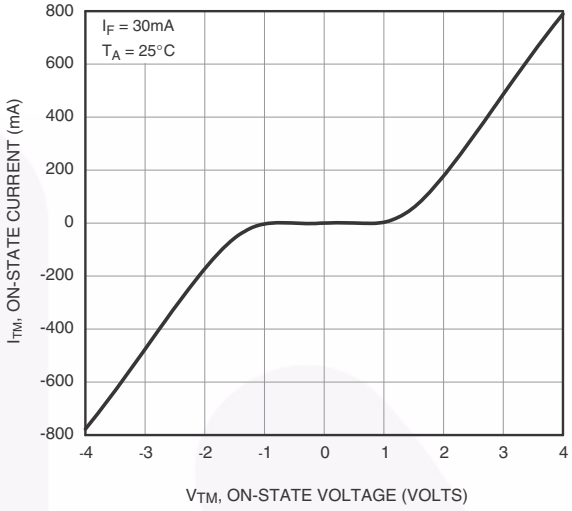



**Figure 4. On-State Characteristics**

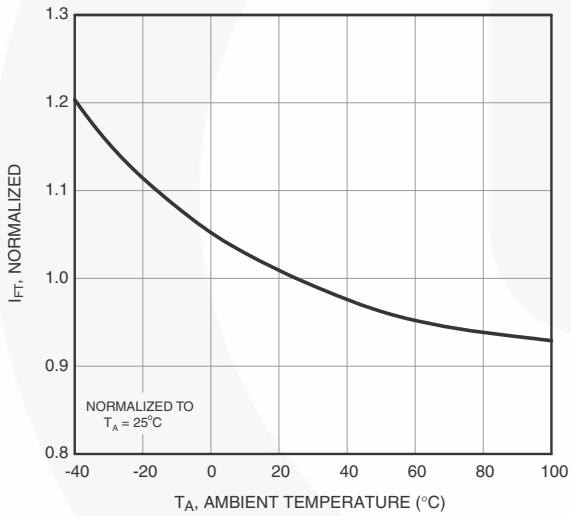



**Figure 5. Trigger Current vs. Temperature**

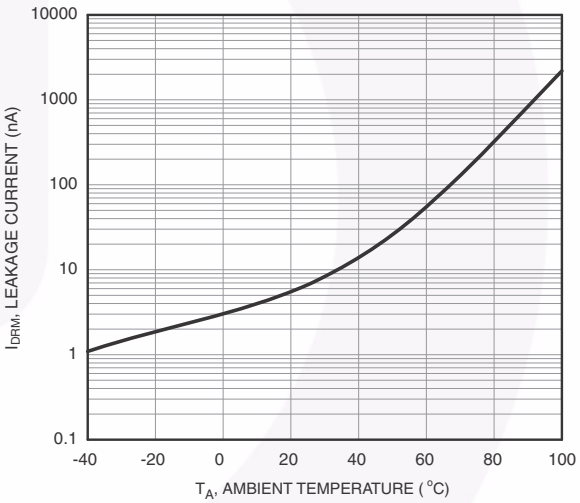



**Figure 6. Leakage Current, $I_{DRM}$ vs. Temperature**

## Typical Performance Curves (Continued)

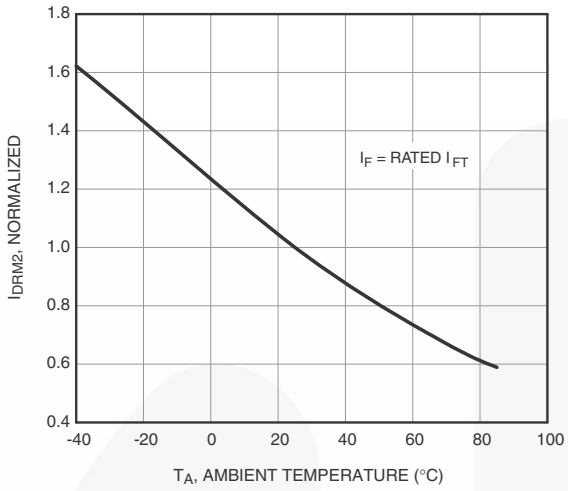



**Figure 7. $I_{DRM2}$ - Leakage in Inhibit State vs. Temperature**

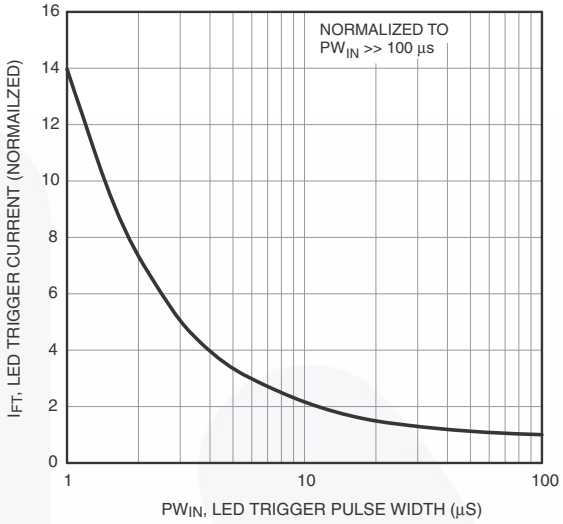



**Figure 8. LED Current Required to Trigger vs. LED Pulse Width**

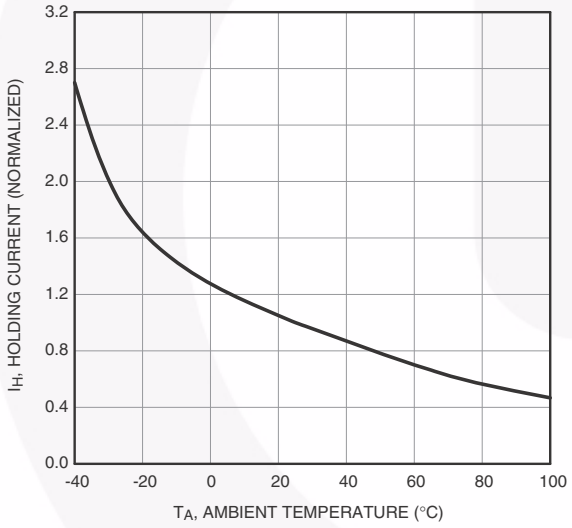



**Figure 9. Holding Current, $I_H$ vs. Temperature**

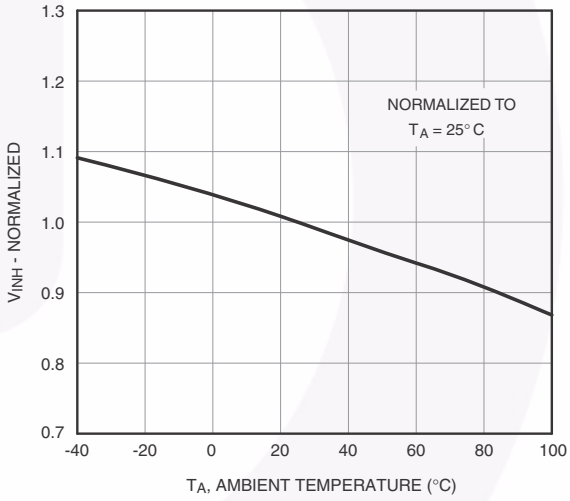



**Figure 10. Inhibit Voltage vs. Temperature**

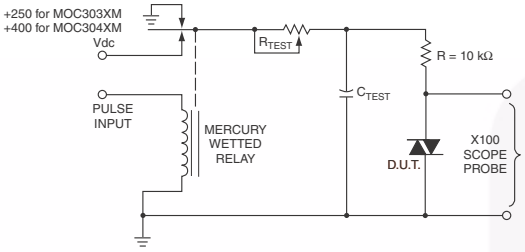



Figure 11. Static dv/dt Test Circuit

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. $\tau_{RC}$ is measured at this point and recorded.

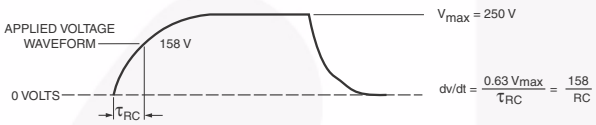



Figure 12. Static dv/dt Test Waveform (MOC3031M, MOC3032M, MOC3033M)

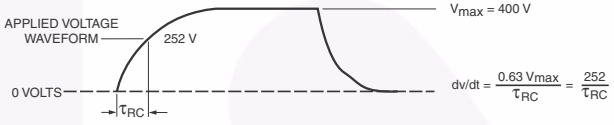



Figure 13. Static dv/dt Test Waveform (MOC3041M, MOC3042M, MOC3043M)

Typical circuit (Fig 14, 15) 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, 5mA for the MOC3033M and MOC3043M, 10mA for the MOC3032M and MOC3042M, or 15mA for the MOC3031M and MOC3041M. The 39 ohm resistor and 0.01µF capacitor are for snubbing of the triac and may or may not be necessary depending upon the particular triac and load used.

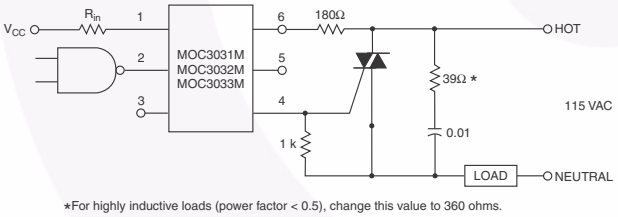



Figure 14. Hot-Line Switching Application Circuit (MOC3031M, MOC3032M, MOC3033M)

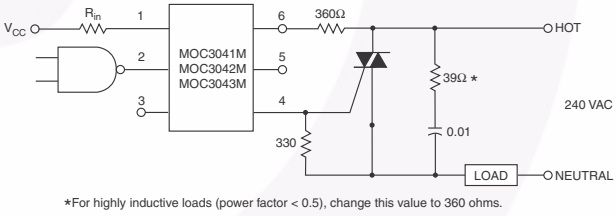



Figure 15. Hot-Line Switching Application Circuit (MOC3041M, MOC3042M, MOC3043M)

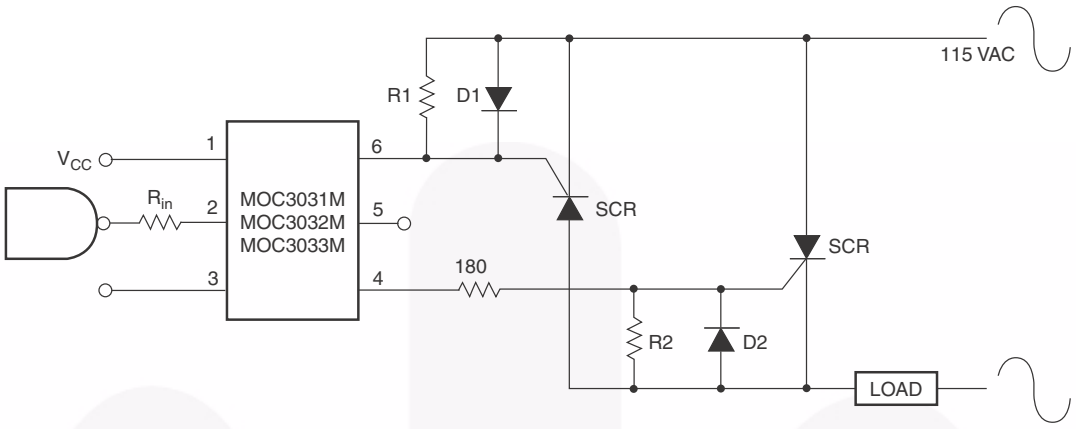



**Figure 16. Inverse-Parallel SCR Driver Circuit (MOC3031M, MOC3032M, MOC3033M)**

Suggested method of firing two, back-to-back SCR's with a Fairchild triac driver. Diodes can be 1N4001; resistors, R1 and R2, are optional 1kΩ.

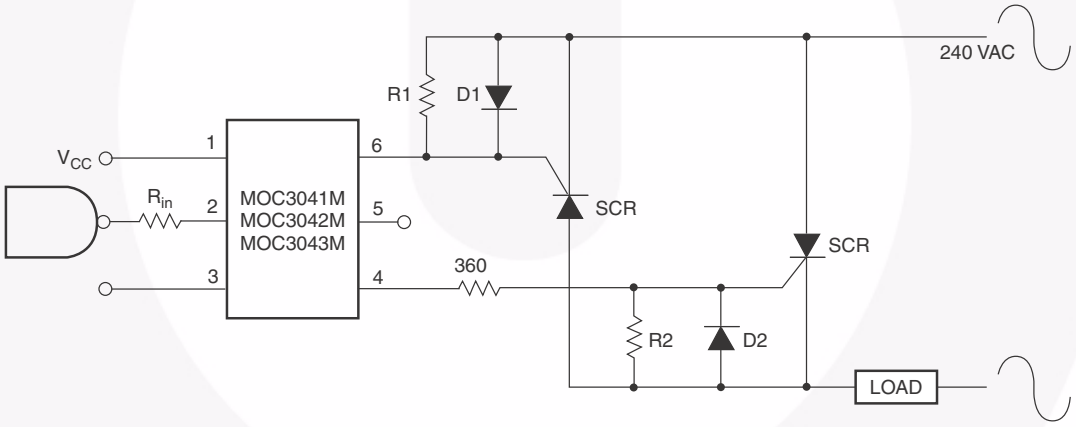



**Figure 17. Inverse-Parallel SCR Driver Circuit (MOC3041M, MOC3042M, MOC3043M)**

Suggested method of firing two, back-to-back SCR's with a Fairchild triac driver. Diodes can be 1N4001; resistors, R1 and R2, are optional 330Ω.

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

## Reflow Profile

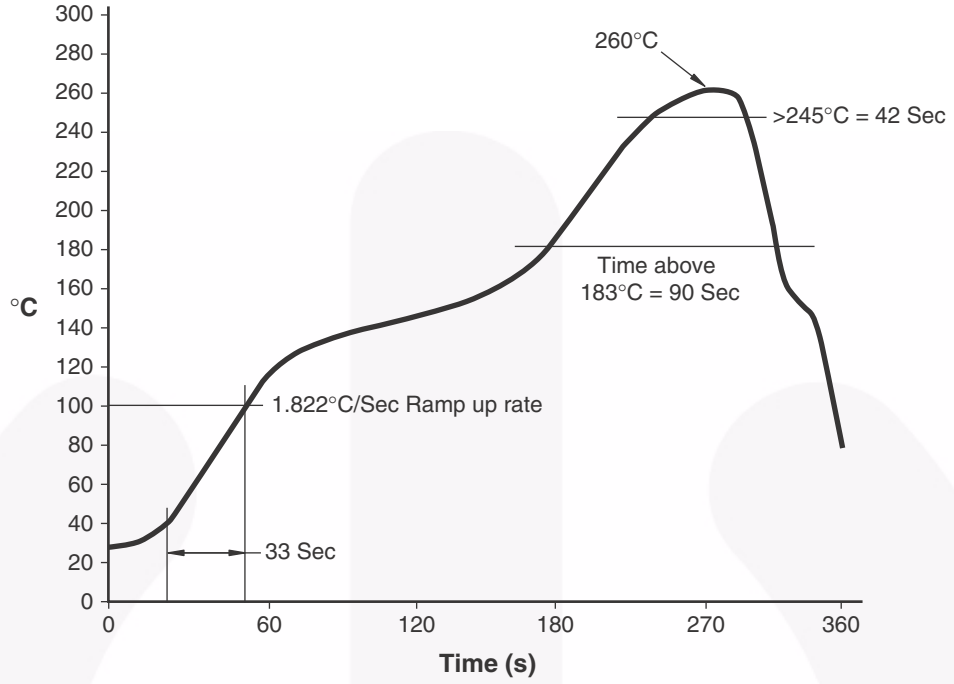



**Figure 18. Reflow Profile**

## Ordering Information[5]

| Part Number | Package | Packing Method |
|---|---|---|
| MOC3031M | DIP 6-Pin | Tube (50 Units) |
| MOC3031SM | SMT 6-Pin (Lead Bend) | Tube (50 Units) |
| MOC3031SR2M | SMT 6-Pin (Lead Bend) | Tape and Reel (1000 Units) |
| MOC3031VM | DIP 6-Pin, DIN EN/IEC60747-5-5 Option | Tube (50 Units) |
| MOC3031SVM | SMT 6-Pin (Lead Bend), DIN EN/IEC60747-5-5 Option | Tube (50 Units) |
| MOC3031SR2VM | SMT 6-Pin (Lead Bend), DIN EN/IEC60747-5-5 Option | Tape and Reel (1000 Units) |
| MOC3031TVM | DIP 6-Pin, 0.4” Lead Spacing, DIN EN/IEC60747-5-5 Option | Tube (50 Units) |

**Note:**

5. The product orderable part number system listed in this table also applies to the MOC3032M, MOC3033M, MOC3041M, MOC3042M, and MOC3043M product families.

## Marking Information

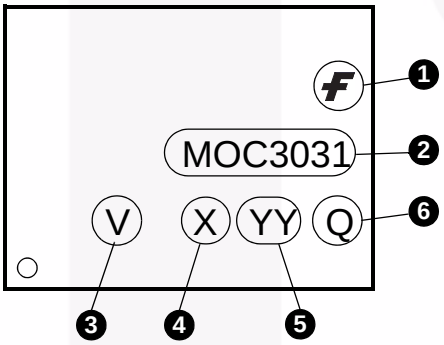
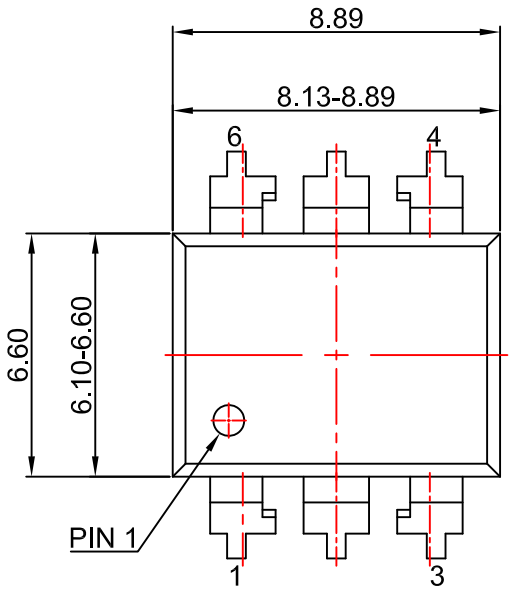
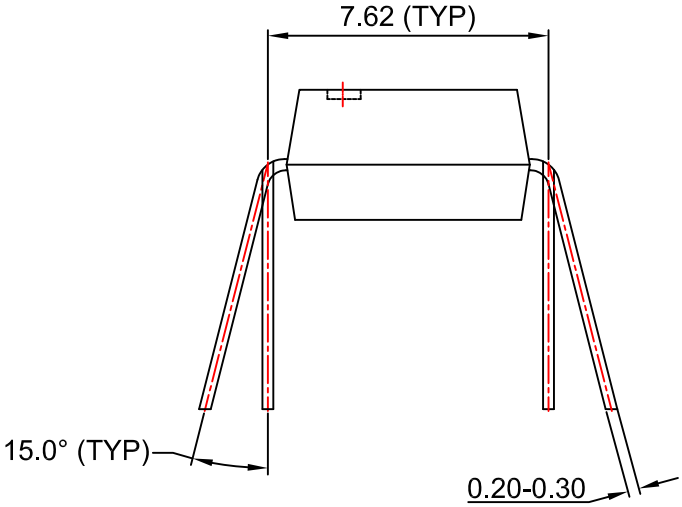
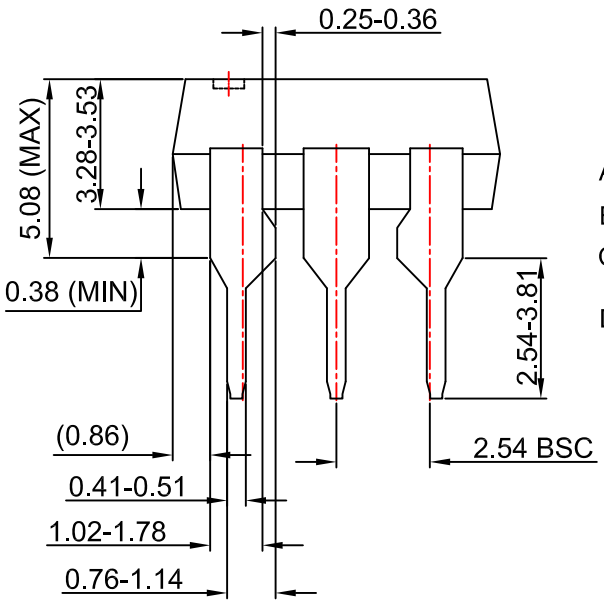



**Figure 19. Top Mark**

| 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:

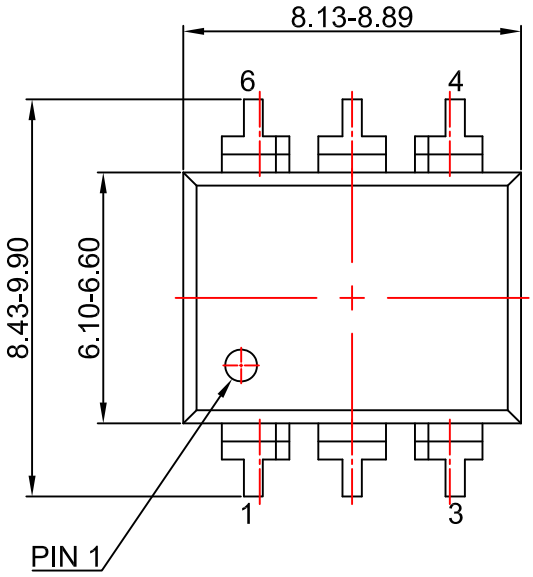
A) NO STANDARD APPLIES TO THIS PACKAGE.

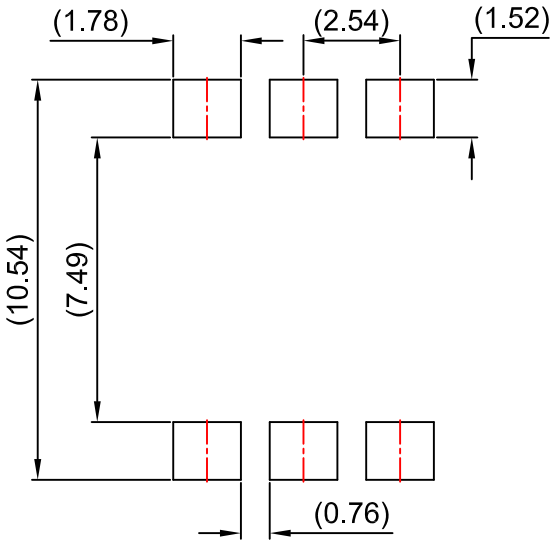
B) ALL DIMENSIONS ARE IN MILLIMETERS.

C) DIMENSIONS ARE EXCLUSIVE OF BURRS, MOLD FLASH, AND TIE BAR EXTRUSION

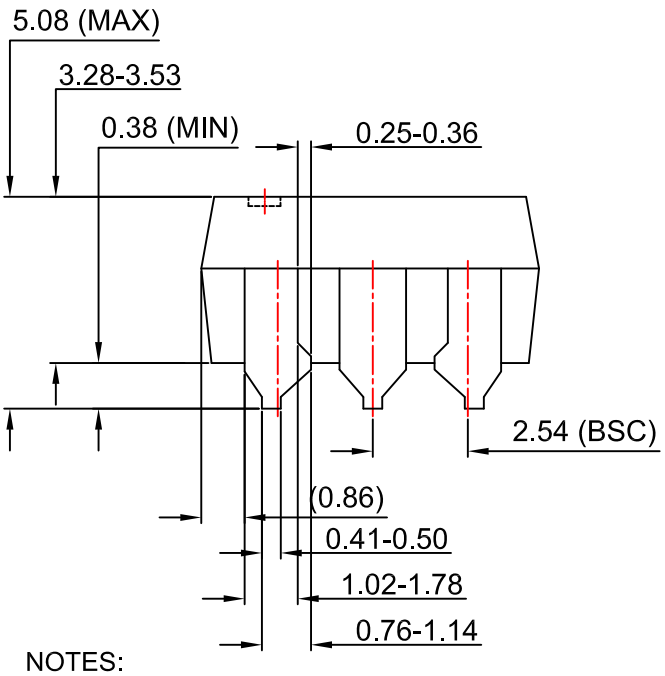
D) DRAWING FILENAME AND REVSION: MKT-N06BREV4.

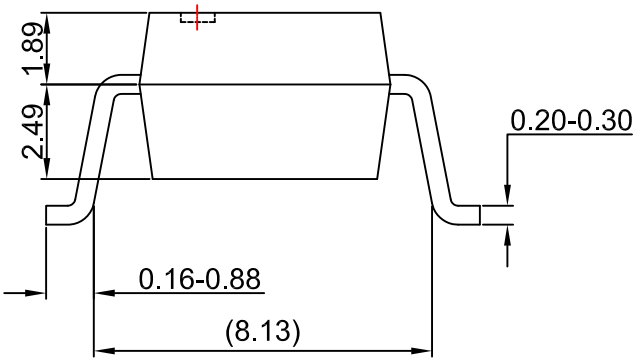
FAIRCHILD




LAND PATTERN RECOMMENDATION




NOTES:

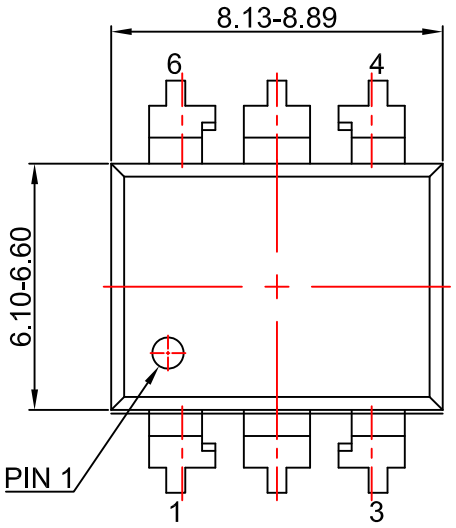
A) NO STANDARD APPLIES TO THIS PACKAGE.

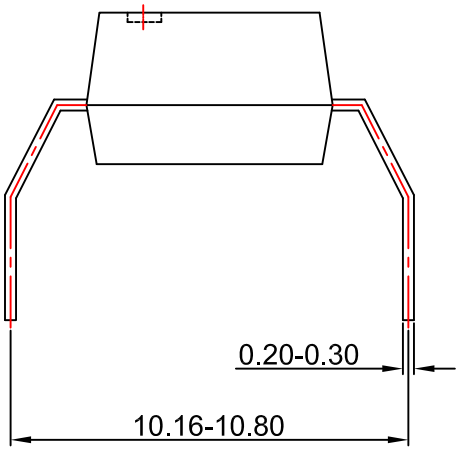
B) ALL DIMENSIONS ARE IN MILLIMETERS.

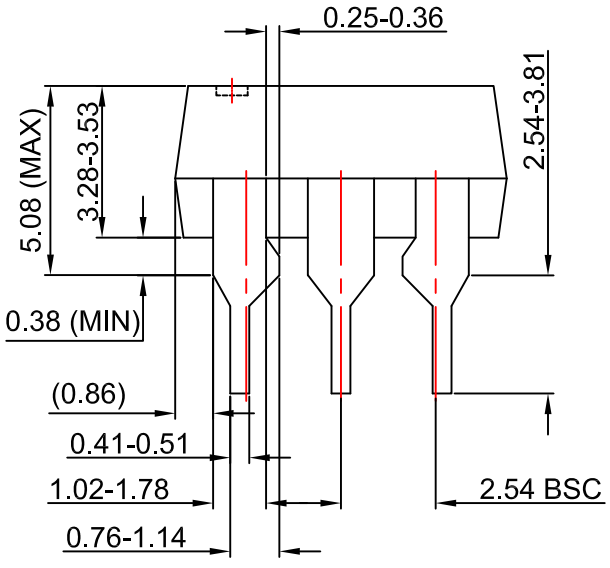
C) DIMENSIONS ARE EXCLUSIVE OF BURRS, MOLD FLASH, AND TIE BAR EXTRUSION

D) DRAWING FILENAME AND REVSION : MKT-N06CREV4.

FAIRCHILD




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 REVSION: MKT-N06Drev4

FAIRCHILD

ON Semiconductor and ON 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. 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

**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**

**Order Literature**: http://www.onsemi.com/orderlit

For additional information, please contact your local Sales Representative

## Looking for pricing, stock, or lifecycle information?

Click below to explore more details on WIN SOURCE:

- View MOC3032VM on WIN SOURCE
- Fairchild/ON Semiconductor Information

## Optimize Your Supply Chain with WIN SOURCE Solutions

- Global Sourcing Solution
- Obsolete Management
- Cost Control Management
- Shortage Management
- Alternative Solution
- Excess Inventory Management