



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/ μ s Typical, 1000 V/ μ s 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

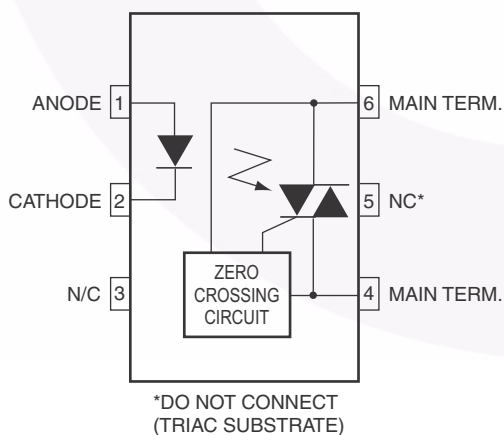


Figure 1. Schematic

Package Outlines

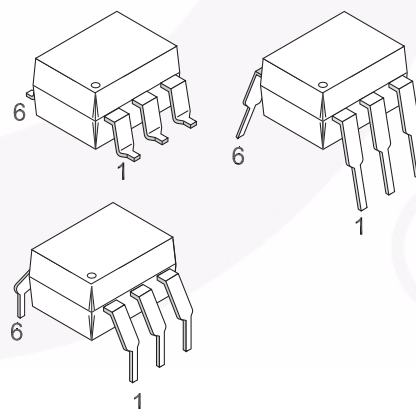


Figure 2. Package Outlines

MOC303XM, MOC304XM — 6-Pin DIP Zero-Cross 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 _{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

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
TOTAL DEVICE				
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°C Ambient	All	250	mW
	Derate Above 25°C		2.94	mW/ $^\circ\text{C}$
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/ $^\circ\text{C}$
DETECTOR				
V_{DRM}	Off-State Output Terminal Voltage	MOC3031M MOC3032M MOC3033M	250	V
		MOC3041M MOC3042M 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/ $^\circ\text{C}$

Electrical Characteristics

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

Individual Component Characteristics

Symbol	Parameters	Test Conditions	Device	Min.	Typ.	Max.	Unit
EMITTER							
V_F	Input Forward Voltage	$I_F = 30\text{ mA}$	All		1.25	1.50	V
I_R	Reverse Leakage Current	$V_R = 6\text{ V}$	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	$I_{\text{TM}} = 100\text{ mA peak}$, $I_F = 0$	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 = $3\text{ V}^{(3)}$	MOC3031M			15	mA
			MOC3041M				
			MOC3032M			10	
			MOC3042M				
I_{H}	Holding Current, Either Direction		MOC3033M			5	μA
			MOC3043M				
			All		400		μA

Zero Crossing Characteristics

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

Isolation Characteristics

Symbol	Parameter	Test Conditions	Device	Min.	Typ.	Max.	Unit
V_{ISO}	Isolation Voltage ⁽⁴⁾	$t = 1\text{ Minute}$	All	4170			V_{ACRMS}

Notes:

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

Typical Performance Curves

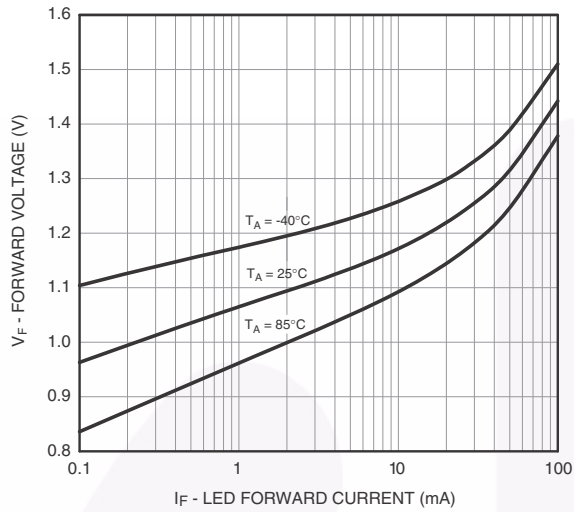


Figure 3. LED Forward Voltage vs. Forward Current

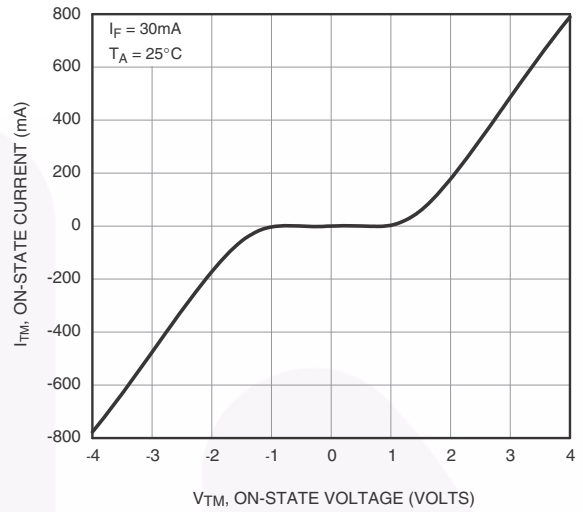


Figure 4. On-State Characteristics

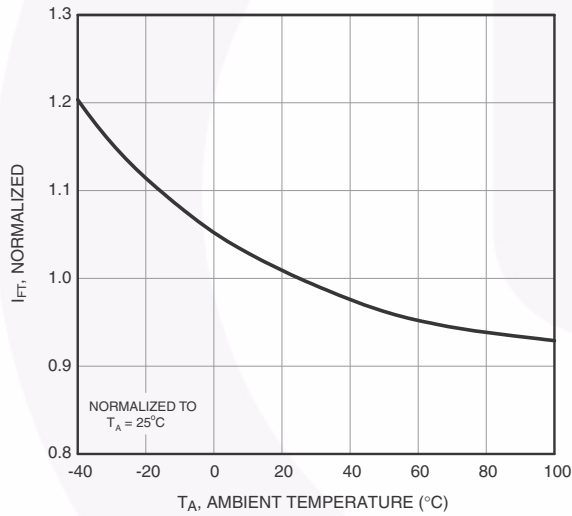


Figure 5. Trigger Current vs. Temperature

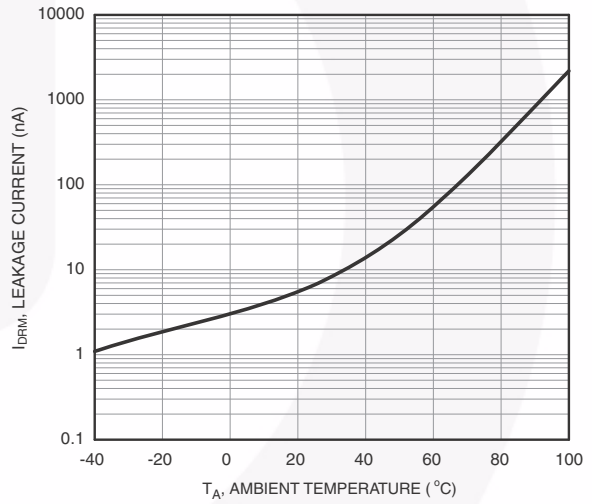


Figure 6. Leakage Current, I_{DRM} vs. Temperature

Typical Performance Curves (Continued)

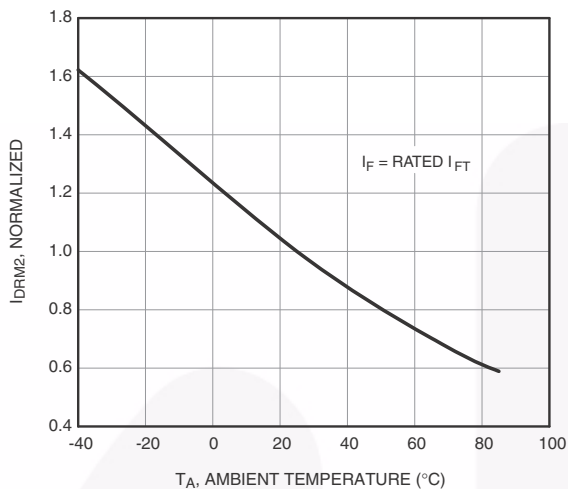


Figure 7. I_{DRM2} - Leakage in Inhibit State vs. Temperature

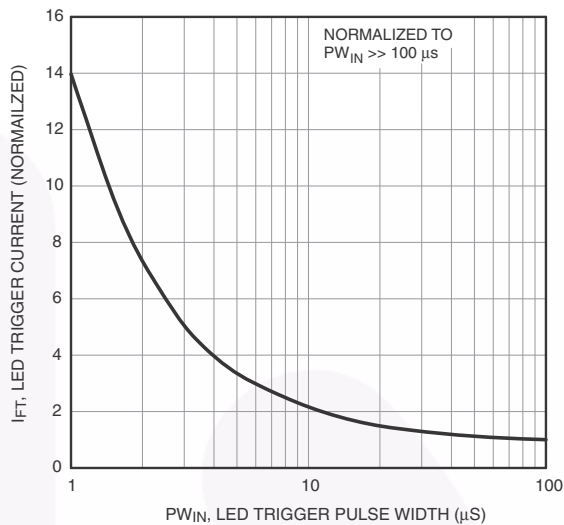


Figure 8. LED Current Required to Trigger vs. LED Pulse Width

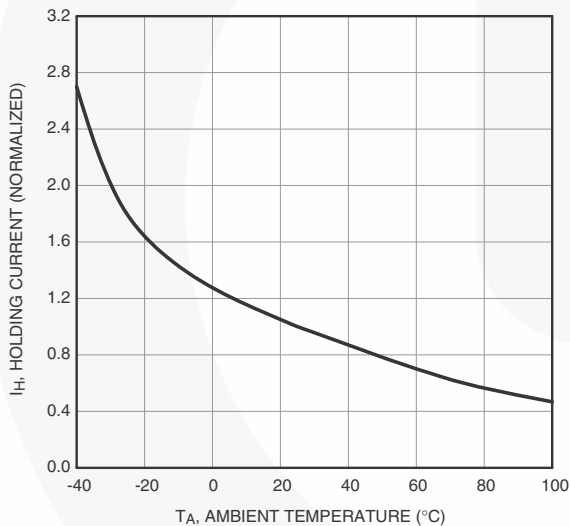


Figure 9. Holding Current, I_H vs. Temperature

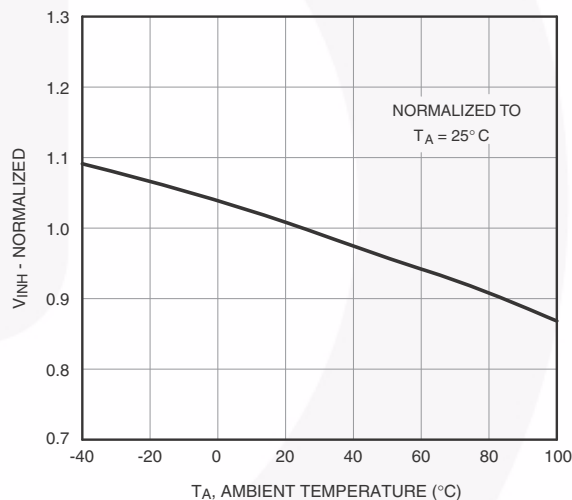


Figure 10. Inhibit Voltage vs. Temperature

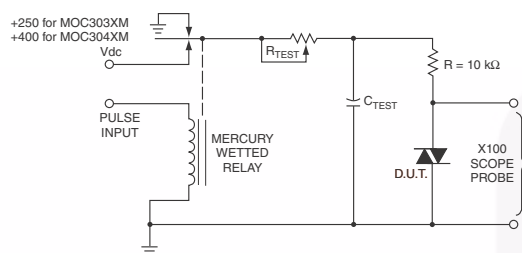


Figure 11. Static dv/dt Test Circuit

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. τ_{RC} is measured at this point and recorded.

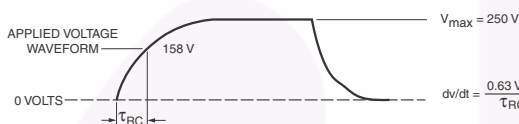


Figure 12. Static dv/dt Test Waveform (MOC3031M, MOC3032M, MOC3033M)

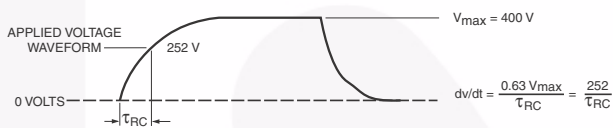
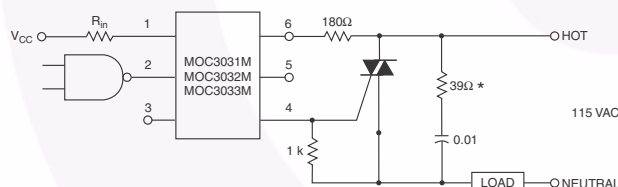


Figure 13. Static dv/dt Test Waveform (MOC3041M, MOC3042M, MOC3043M)

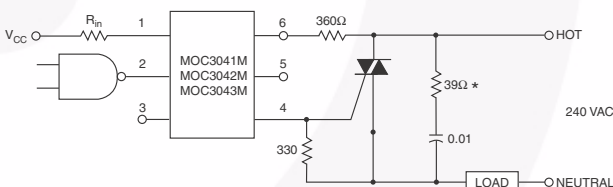
Typical circuit (Fig 14, 15) for use when hot line switching is required. In this circuit the “hot” side of the line is switched and the load connected to the cold or neutral side. The load may be connected to either the neutral or hot line.

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 0.01 μ F capacitor are for snubbing of the triac and may or may not be necessary depending upon the particular triac and load used.



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

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



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

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

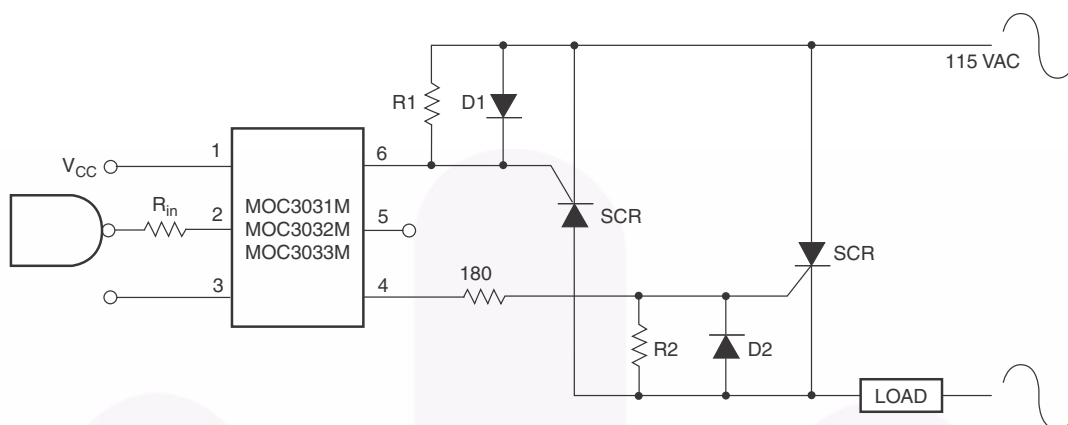


Figure 16. Inverse-Parallel SCR Driver Circuit (MOC3031M, MOC3032M, MOC3033M)

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.

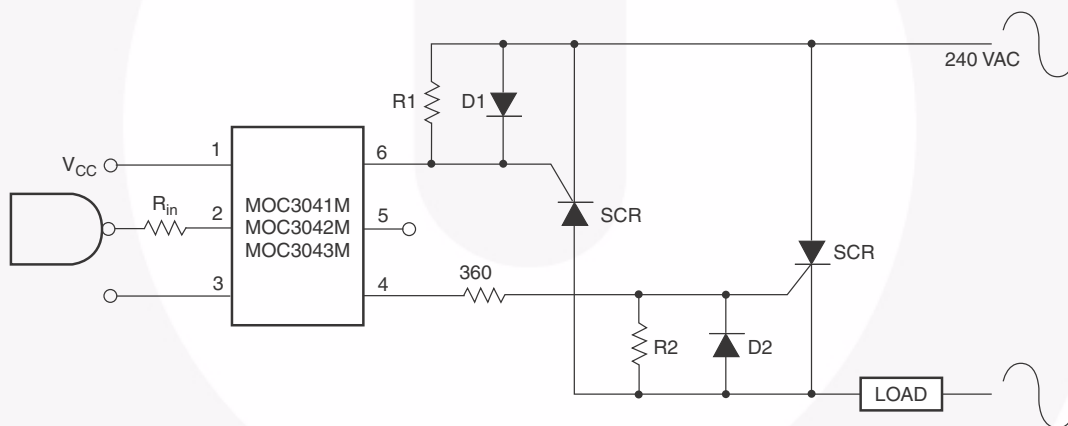


Figure 17. Inverse-Parallel SCR Driver Circuit (MOC3041M, MOC3042M, MOC3043M)

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

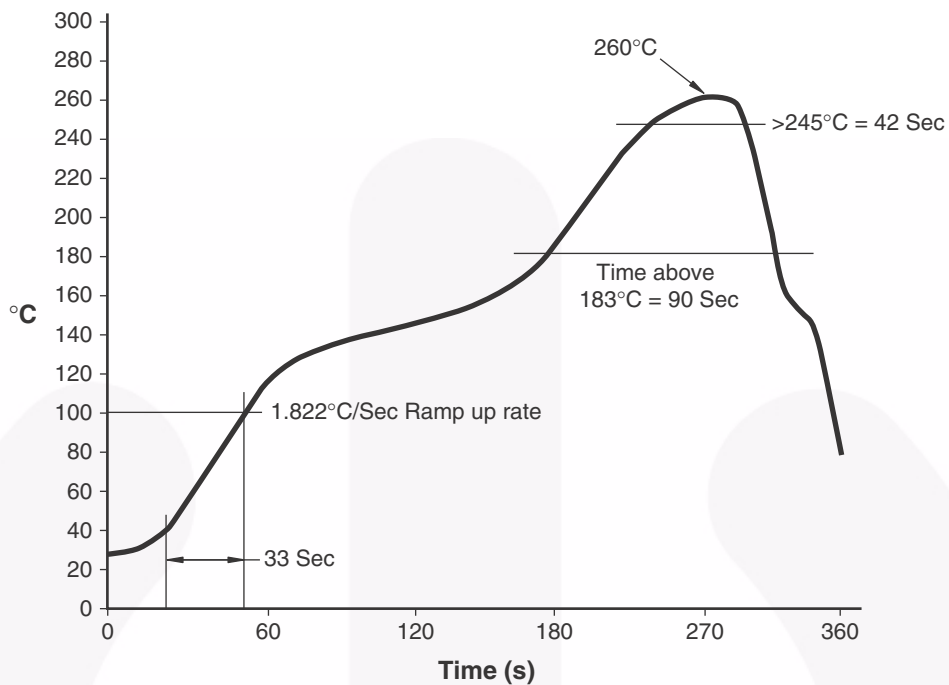


Figure 18. Reflow Profile

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

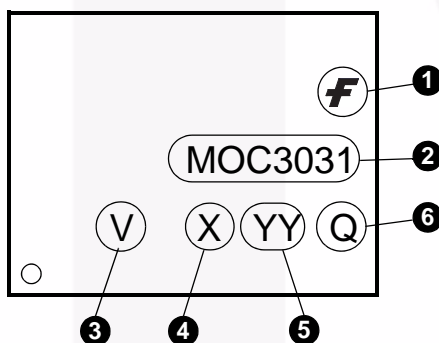


Figure 19. Top Mark

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 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





TRADEMARKS

The following includes registered and unregistered trademarks and service marks, owned by Fairchild Semiconductor and/or its global subsidiaries, and is not intended to be an exhaustive list of all such trademarks.

- AccuPower™
- AttitudeEngine™
- Awinda®
- AX-CAP®*
- BitSiC™
- Build it Now™
- CorePLUS™
- CorePOWER™
- CROSSVOL™
- CTL™
- Current Transfer Logic™
- DEUXPEED®
- Dual Cool™
- EcoSPARK®
- EfficientMax™
- ESBC™
- F**™
- Fairchild®
- Fairchild Semiconductor®
- FACT Quiet Series™
- FACT®
- FastvCore™
- FETBench™
- FPS™
- F-PFS™
- FRFET®
- Global Power ResourceSM
- GreenBridge™
- Green FPS™
- Green FPS™ e-Series™
- Gmax™
- GTO™
- IntelliMAX™
- ISOPLANAR™
- Making Small Speakers Sound Louder and Better™
- MegaBuck™
- MICROCOUPLER™
- MicroFET™
- MicroPak™
- MicroPak2™
- MillerDrive™
- MotionMax™
- MotionGrid®
- MTi®
- MTx®
- MVN®
- mWSaver®
- OptoHiT™
- OPTOLOGIC®
- OPTOPLANAR®
- ®
- Power Supply WebDesigner™
- PowerTrench®
- PowerXS™
- Programmable Active Droop™
- QFET®
- QS™
- Quiet Series™
- RapidConfigure™
- ™
- Saving our world, 1mW/W/kW at a time™
- SignalWise™
- SmartMax™
- SMART START™
- Solutions for Your Success™
- SPM®
- STEALTH™
- SuperFET®
- SuperSOT™-3
- SuperSOT™-6
- SuperSOT™-8
- SupreMOS®
- SyncFET™
- Sync-Lock™
- ®
- TinyBoost®
- TinyBuck®
- TinyCalc™
- TinyLogic®
- TINYOPTO™
- TinyPower™
- TinyPWM™
- TinyWire™
- TranSiC™
- TriFault Detect™
- TRUECURRENT®*
- μSerDes™
- ™
- UHC®
- Ultra FRFET™
- UniFET™
- VcX™
- VisualMax™
- VoltagePlus™
- XS™
- Xsens™
- 仙童®

* Trademarks of System General Corporation, used under license by Fairchild Semiconductor.

DISCLAIMER

FAIRCHILD SEMICONDUCTOR RESERVES THE RIGHT TO MAKE CHANGES WITHOUT FURTHER NOTICE TO ANY PRODUCTS HEREIN TO IMPROVE RELIABILITY, FUNCTION, OR DESIGN. TO OBTAIN THE LATEST, MOST UP-TO-DATE DATASHEET AND PRODUCT INFORMATION, VISIT OUR WEBSITE AT [HTTP://WWW.FAIRCHILDSEMI.COM](http://www.fairchildsemi.com). FAIRCHILD DOES NOT ASSUME ANY LIABILITY ARISING OUT OF THE APPLICATION OR USE OF ANY PRODUCT OR CIRCUIT DESCRIBED HEREIN; NEITHER DOES IT CONVEY ANY LICENSE UNDER ITS PATENT RIGHTS, NOR THE RIGHTS OF OTHERS. THESE SPECIFICATIONS DO NOT EXPAND THE TERMS OF FAIRCHILD'S WORLDWIDE TERMS AND CONDITIONS, SPECIFICALLY THE WARRANTY THEREIN, WHICH COVERS THESE PRODUCTS.

AUTHORIZED USE

Unless otherwise specified in this data sheet, this product is a standard commercial product and is not intended for use in applications that require extraordinary levels of quality and reliability. This product may not be used in the following applications, unless specifically approved in writing by a Fairchild officer: (1) automotive or other transportation, (2) military/aerospace, (3) any safety critical application – including life critical medical equipment – where the failure of the Fairchild product reasonably would be expected to result in personal injury, death or property damage. Customer's use of this product is subject to agreement of this Authorized Use policy. In the event of an unauthorized use of Fairchild's product, Fairchild accepts no liability in the event of product failure. In other respects, this product shall be subject to Fairchild's Worldwide Terms and Conditions of Sale, unless a separate agreement has been signed by both Parties.

ANTI-COUNTERFEITING POLICY

Fairchild Semiconductor Corporation's Anti-Counterfeiting Policy. Fairchild's Anti-Counterfeiting Policy is also stated on our external website, www.fairchildsemi.com, under Terms of Use

Counterfeiting of semiconductor parts is a growing problem in the industry. All manufacturers of semiconductor products are experiencing counterfeiting of their parts. Customers who inadvertently purchase counterfeit parts experience many problems such as loss of brand reputation, substandard performance, failed applications, and increased cost of production and manufacturing delays. Fairchild is taking strong measures to protect ourselves and our customers from the proliferation of counterfeit parts. Fairchild strongly encourages customers to purchase Fairchild parts either directly from Fairchild or from Authorized Fairchild Distributors who are listed by country on our web page cited above. Products customers buy either from Fairchild directly or from Authorized Fairchild Distributors are genuine parts, have full traceability, meet Fairchild's quality standards for handling and storage and provide access to Fairchild's full range of up-to-date technical and product information. Fairchild and our Authorized Distributors will stand behind all warranties and will appropriately address any warranty issues that may arise. Fairchild will not provide any warranty coverage or other assistance for parts bought from Unauthorized Sources. Fairchild is committed to combat this global problem and encourage our customers to do their part in stopping this practice by buying direct or from authorized distributors.

PRODUCT STATUS DEFINITIONS

Definition of Terms

Datasheet Identification	Product Status	Definition
Advance Information	Formative / In Design	Datasheet contains the design specifications for product development. Specifications may change in any manner without notice.
Preliminary	First Production	Datasheet contains preliminary data; supplementary data will be published at a later date. Fairchild Semiconductor reserves the right to make changes at any time without notice to improve design.
No Identification Needed	Full Production	Datasheet contains final specifications. Fairchild Semiconductor reserves the right to make changes at any time without notice to improve the design.
Obsolete	Not In Production	Datasheet contains specifications on a product that is discontinued by Fairchild Semiconductor. The datasheet is for reference information only.

Rev. I77