FAIRCHILD SEMICONDUCTOR®

January 2009

MOC3031M, MOC3032M, MOC3033M, MOC3041M, MOC3042M, MOC3043M
6-Pin DIP Zero-Cross Optoisolators Triac Driver Output (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
- VDE recognized (File # 94766), ordering option V (e.g., MOC3043VM)

Applications

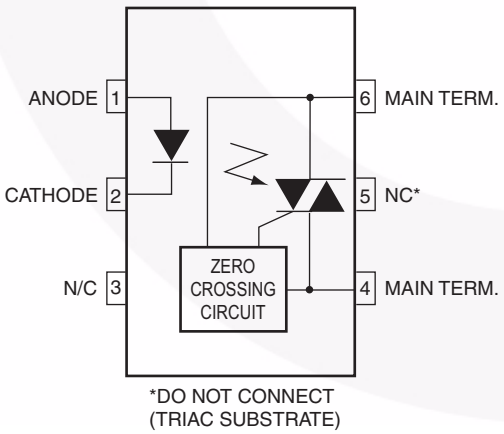
- Solenoid/valve controls
- Lighting controls
- Static power switches
- AC motor drives
- Temperature controls
- E.M. contactors
- AC motor starters
- Solid state relays

Description

The MOC303XM and MOC304XM devices consist of a AlGaAs infrared emitting diode optically coupled to a monolithic silicon detector performing the function of a zero voltage crossing bilateral triac driver.

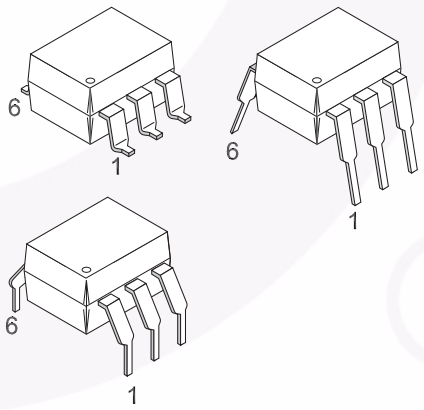
They are designed for use with a triac in the interface of logic systems to equipment powered from 115 VAC lines, such as teletypewriters, CRTs, solid-state relays, industrial controls, printers, motors, solenoids and consumer appliances, etc.

Schematic



*DO NOT CONNECT (TRIAC SUBSTRATE)

Package Outlines



Absolute Maximum Ratings (T_A = 25°C unless otherwise noted)

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.

Symbol	Parameters	Device	Value	Units
TOTAL DEVICE				
T_{STG}	Storage Temperature	All	-40 to +150	°C
T_{OPR}	Operating Temperature	All	-40 to +85	°C
T_{SOL}	Lead Solder Temperature	All	260 for 10 sec	°C
T_J	Junction Temperature Range	All	-40 to +100	°C
V_{ISO}	Isolation Surge Voltage(1) (peak AC voltage, 60Hz, 1 sec. duration, $I_{I-O} \leq 2\mu A$)	All	7500	Vac(pk)
P_D	Total Device Power Dissipation @ 25°C	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 25°C Ambient	All	120	mW
	Derate above 25°C		1.41	mW/°C
DETECTOR				
V_{DRM}	Off-State Output Terminal Voltage	MOC3031M/2M/3M	250	V
		MOC3041M/2M/3M	400	
I_{TSM}	Peak Repetitive Surge Current (PW = 100μs, 120 pps)	All	1	A
P_D	Total Power Dissipation @ 25°C Ambient	All	150	mW
	Derate above 25°C	All	1.76	mW/°C

Note

1. Isolation surge 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.

Electrical Characteristics (T_A = 25°C Unless otherwise specified)

Individual Component Characteristics

Symbol	Parameters	Test Conditions	Device	Min.	Typ.	Max.	Units
EMITTER							
V_F	Input Forward Voltage	I_F = 30mA	All		1.25	1.5	V
I_R	Reverse Leakage Current	V_R = 6V	All		0.01	100	µA
DETECTOR							
I_{DRM1}	Peak Blocking Current, Either Direction	Rated V_{DRM}, I_F = 0(2)	All			100	nA
V_{TM}	Peak On-State Voltage, Either Direction	I_{TM} = 100mA peak, I_F = 0	All		1.8	3	V
dv/dt	Critical Rate of Rise of Off-State Voltage	I_F = 0 (Figure 9)(4)	All	1000			V/µs

Transfer Characteristics

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

Zero Crossing Characteristics

Symbol	Characteristics	Test Conditions	Device	Min.	Typ.	Max.	Units
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_F , rated V_{DRM}, off-state	All			500	µA

Notes:

2. Test voltage must be applied within dv/dt rating.
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} (15mA for MOC3031M & MOC3041M, 10mA for MOC3032M & MOC3042M, 5mA for MOC3033M & MOC3043M) and absolute max I_F (60mA).
4. This is static dv/dt. See Figure 9 for test circuit. Commutating dv/dt is a function of the load-driving thyristor(s) only.

Typical Performance Curves

Figure 1. LED Forward Voltage vs. Forward Current

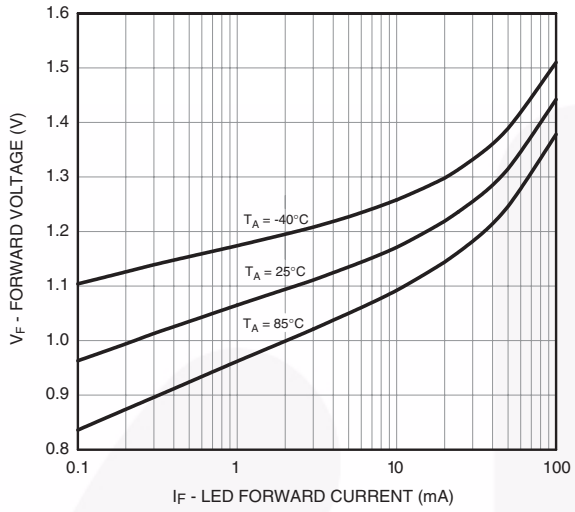


Figure 2. On-State Characteristics

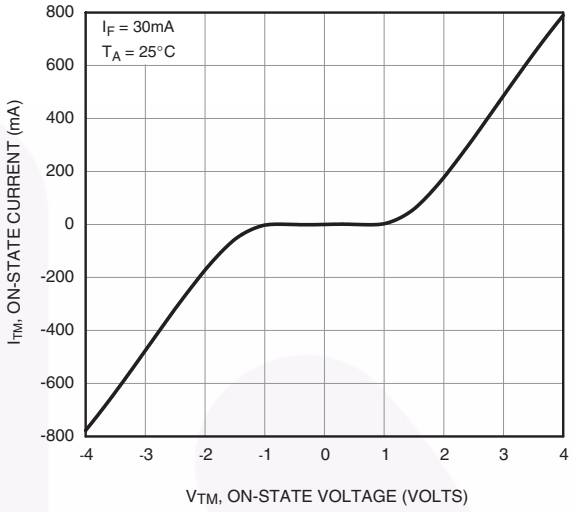


Figure 3. Trigger Current vs. Temperature

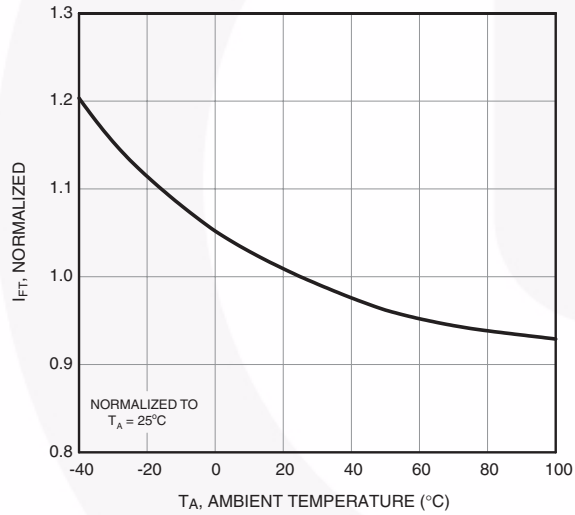
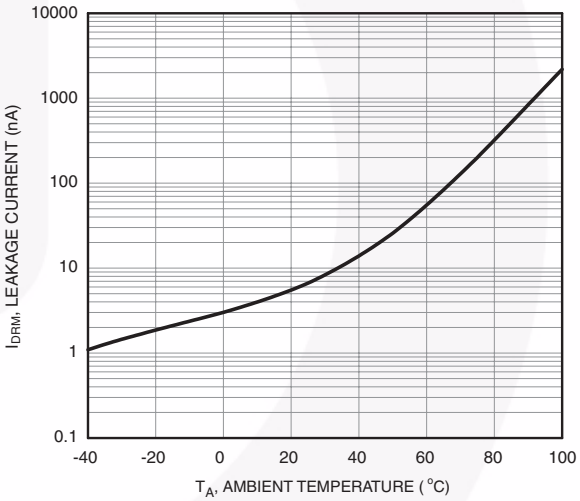


Figure 4. Leakage Current, I_{DRM} vs. Temperature



Typical Performance Curves (Continued)

Figure 5. I_{DRM2} - Leakage in Inhibit State vs. Temperature

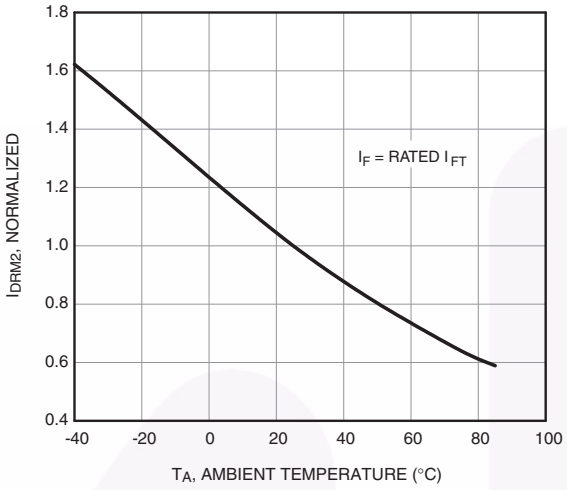


Figure 6. LED Current Required to Trigger vs. LED Pulse Width

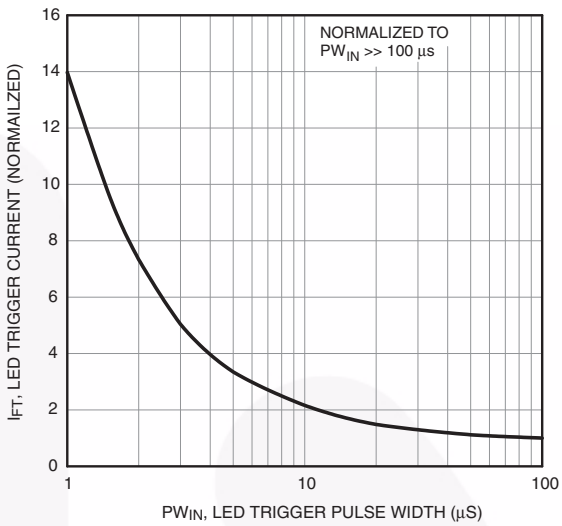


Figure 7. Holding Current, I_H vs. Temperature

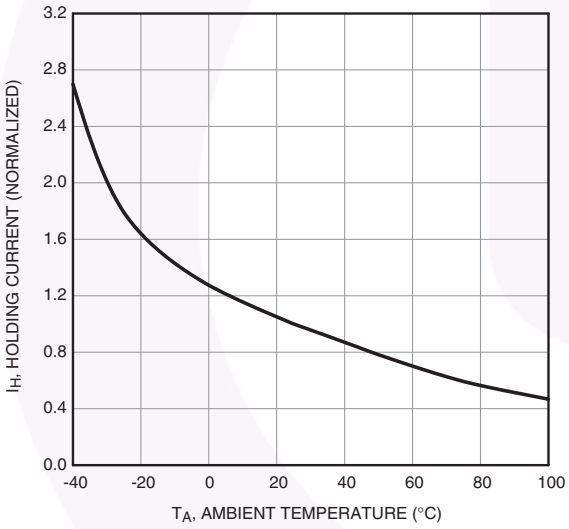
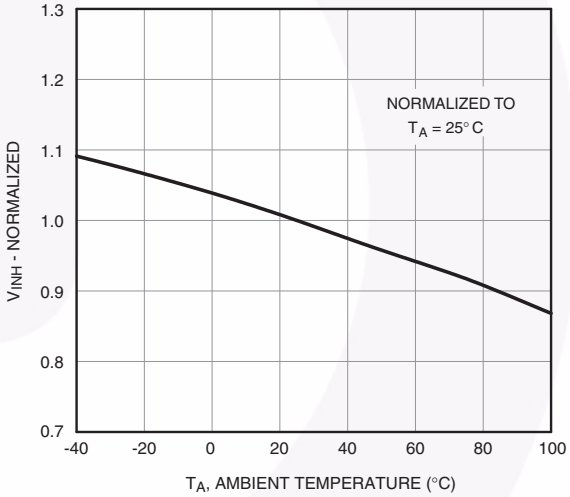


Figure 8. Inhibit Voltage vs. Temperature



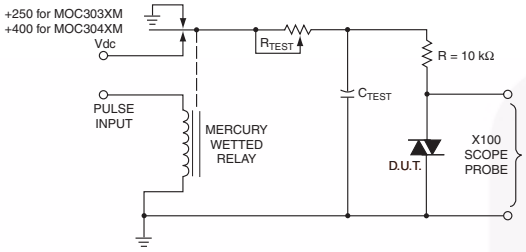


Figure 9. Static dv/dt Test Circuit

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.

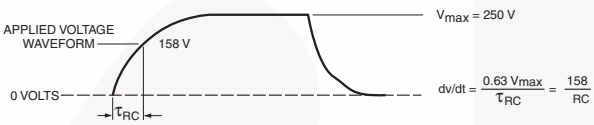


Figure 10. Static dv/dt Test Waveform (MOC3031M, MOC3032M, MOC3033M)

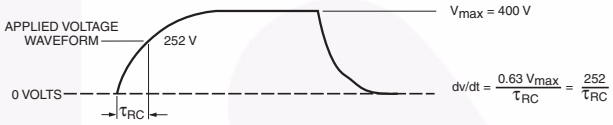


Figure 11. Static dv/dt Test Waveform (MOC3041M, MOC3042M, MOC3043M)

Typical circuit (Fig 12, 13) 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.

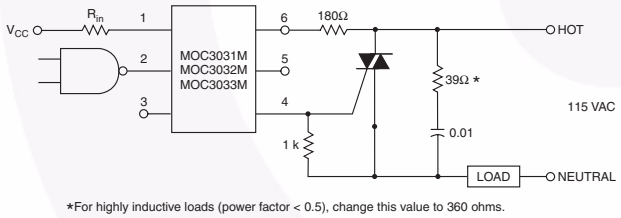


Figure 12. Hot-Line Switching Application Circuit (MOC3031M, MOC3032M, MOC3033M)

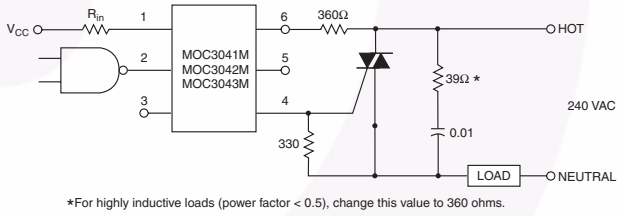


Figure 13. Hot-Line Switching Application Circuit (MOC3041M, MOC3042M, MOC3043M)

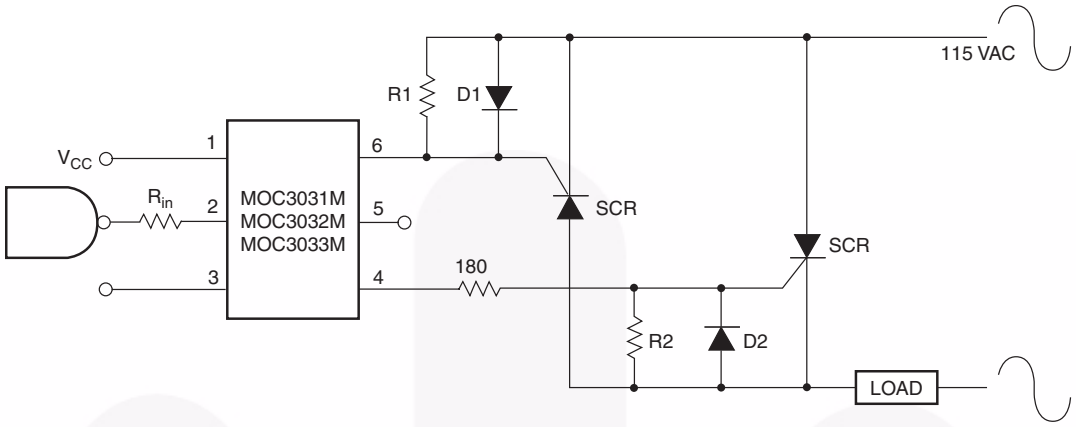


Figure 14. Inverse-Parallel SCR Driver Circuit (MOC3031M, MOC3032M, MOC3033M)

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.

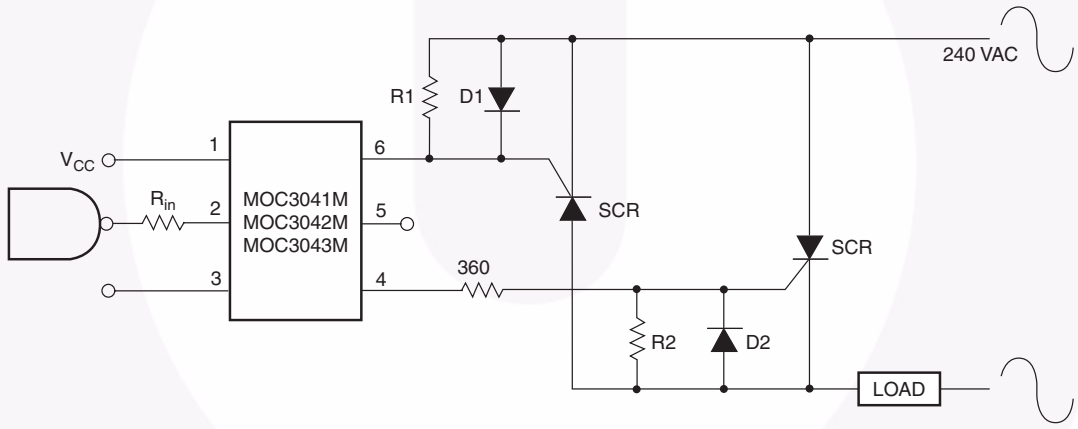


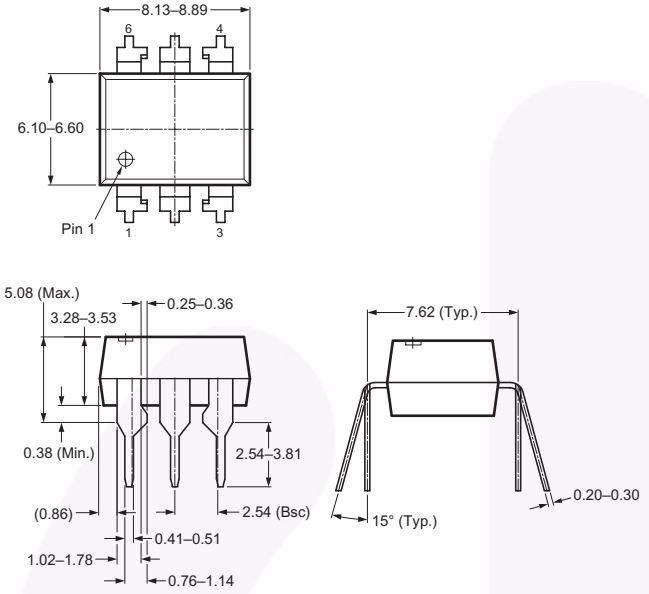
Figure 15. Inverse-Parallel SCR Driver Circuit (MOC3041M, MOC3042M, MOC3043M)

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.

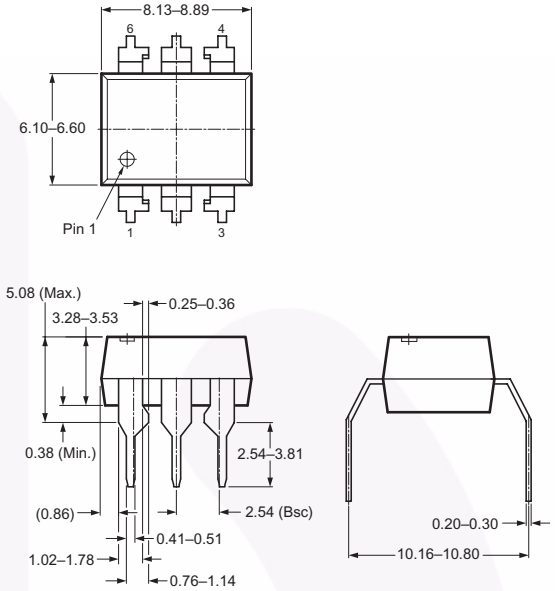
Note:
This optoisolator should not be used to drive a load directly. It is intended to be a trigger device only.

Package Dimensions

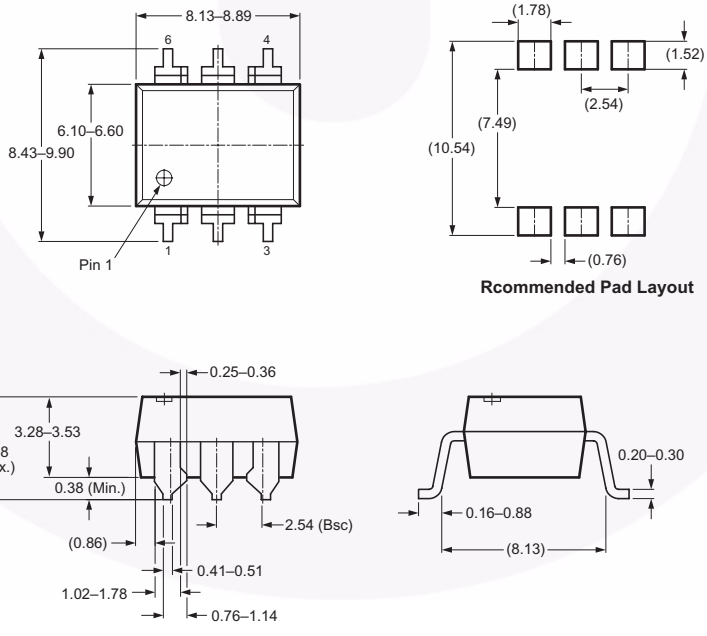
Through Hole



0.4" Lead Spacing



Surface Mount

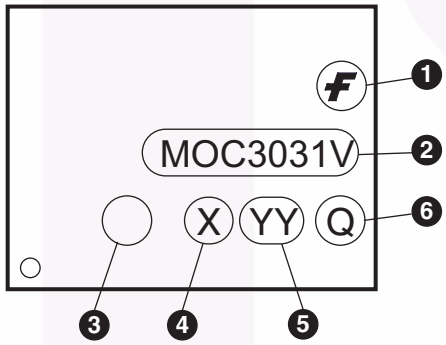


Note:
All dimensions in mm.

Ordering Information

Option	Order Entry Identifier (Example)	Description
No option	MOC3031M	Standard Through Hole Device
S	MOC3031SM	Surface Mount Lead Bend
SR2	MOC3031SR2M	Surface Mount; Tape and Reel
T	MOC3031TM	0.4" Lead Spacing
V	MOC3031VM	VDE 0884
TV	MOC3031TVM	VDE 0884, 0.4" Lead Spacing
SV	MOC3031SVM	VDE 0884, Surface Mount
SR2V	MOC3031SR2VM	VDE 0884, Surface Mount, Tape and Reel

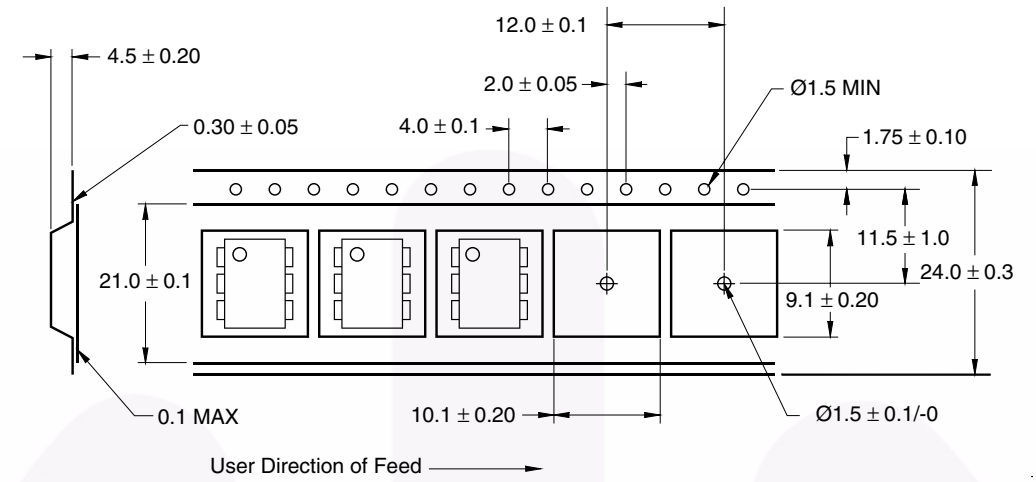
Marking Information



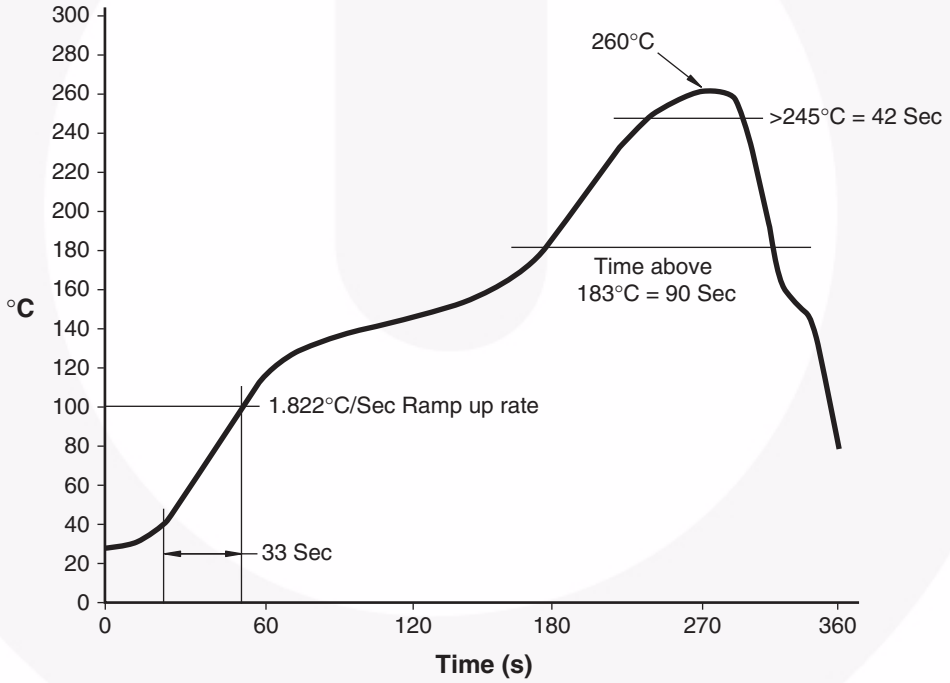
Definitions	
1	Fairchild logo
2	Device number
3	VDE mark (Note: Only appears on parts ordered with VDE option – See order entry table)
4	One digit year code, e.g., '3'
5	Two digit work week ranging from '01' to '53'
6	Assembly package code

*Note – Parts that do not have the 'V' option (see definition 3 above) that are marked with date code '325' or earlier are marked in portrait format.

Carrier Tape Specification



Reflow Profile



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2. A critical component in any component of a life support, device, or system whose failure to perform can be reasonably expected to cause the failure of the life support device or system, or to affect its safety or effectiveness.

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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.

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