

# 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/ $\mu$ s typical, 1000 V/ $\mu$ s guaranteed
- VDE recognized (File # 94766), ordering option V (e.g., MOC3043VM)

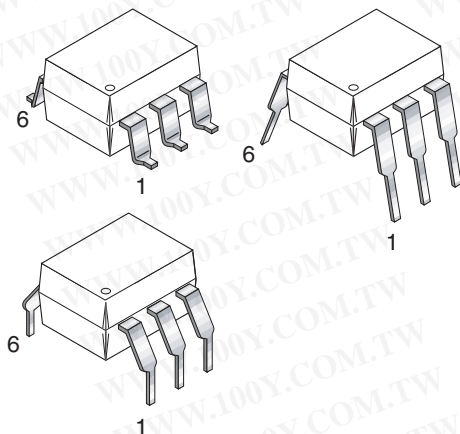
### Applications

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

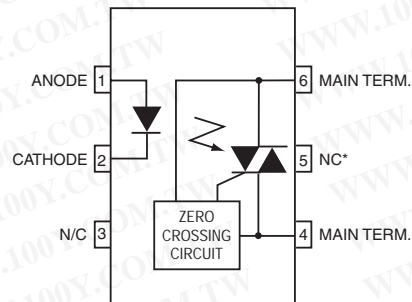
### Description

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)

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### Absolute Maximum Ratings ( $T_A = 25^\circ\text{C}$ unless otherwise noted)

Parameters	Symbol	Device	Value	Units
<b>TOTAL DEVICE</b>				
Storage Temperature	$T_{STG}$	All	-40 to +150	$^\circ\text{C}$
Operating Temperature	$T_{OPR}$	All	-40 to +85	$^\circ\text{C}$
Lead Solder Temperature	$T_{SOL}$	All	260 for 10 sec	$^\circ\text{C}$
Junction Temperature Range	$T_J$	All	-40 to +100	$^\circ\text{C}$
Isolation Surge Voltage <sup>(1)</sup> (peak AC voltage, 60Hz, 1 sec duration)	$V_{ISO}$	All	7500	Vac(pk)
Total Device Power Dissipation @ 25 $^\circ\text{C}$ Derate above 25 $^\circ\text{C}$	$P_D$	All	250	mW
			2.94	mW/ $^\circ\text{C}$
<b>EMITTER</b>				
Continuous Forward Current	$I_F$	All	60	mA
Reverse Voltage	$V_R$	All	6	V
Total Power Dissipation 25 $^\circ\text{C}$ Ambient Derate above 25 $^\circ\text{C}$	$P_D$	All	120	mW
			1.41	mW/ $^\circ\text{C}$
<b>DETECTOR</b>				
Off-State Output Terminal Voltage	$V_{DRM}$	MOC3031M/2M/3M	250	V
		MOC3041M/2M/3M	400	
Peak Repetitive Surge Current (PW = 100 $\mu\text{s}$ , 120 pps)	$I_{TSM}$	All	1	A
Total Power Dissipation @ 25 $^\circ\text{C}$ Ambient Derate above 25 $^\circ\text{C}$	$P_D$	All	150	mW
		All	1.76	mW/ $^\circ\text{C}$

**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 ( $T_A = 25^\circ\text{C}$ Unless otherwise specified)

#### Individual Component Characteristics

Parameters	Test Conditions	Symbol	Device	Min	Typ	Max	Units
<b>EMITTER</b>							
Input Forward Voltage	$I_F = 30\text{ mA}$	$V_F$	All		1.25	1.5	V
Reverse Leakage Current	$V_R = 6\text{ V}$	$I_R$	All		0.01	100	$\mu\text{A}$
<b>DETECTOR</b>							
Peak Blocking Current, Either Direction	Rated $V_{DRM}$ , $I_F = 0$ (note 1)	$I_{DRM1}$	All			100	nA
Peak On-State Voltage, Either Direction	$I_{TM} = 100\text{ mA peak}$ , $I_F = 0$	$V_{TM}$	All		1.8	3	V
Critical Rate of Rise of Off-State Voltage	$I_F = 0$ (Figure 9, note 3)	dv/dt	All	1000			V/ $\mu\text{s}$

#### Transfer Characteristics ( $T_A = 25^\circ\text{C}$ Unless otherwise specified.)

DC Characteristics	Test Conditions	Symbol	Device	Min	Typ	Max	Units
LED Trigger Current	Main terminal voltage = 3V (note 2)	$I_{FT}$	MOC3031M/ MOC3041M			15	mA
			MOC3032M/ MOC3042M			10	
			MOC3033M/ MOC3043M			5	
Holding Current, Either Direction		$I_H$	All		400		$\mu\text{A}$

**Zero Crossing Characteristics** ( $T_A = 25^\circ\text{C}$  Unless otherwise specified.)

Characteristics	Test Conditions	Symbol	Device	Min	Typ	Max	Units
Inhibit Voltage	$I_F = \text{rated } I_{FT}$ , MT1-MT2 voltage above which device will not trigger off-state	$V_{IH}$	All			20	V
Leakage in Inhibited State	$I_F = \text{rated } I_F$ , rated $V_{DRM}$ , off-state	$I_{DRM2}$	All			500	$\mu\text{A}$

**Note**

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

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Figure 1. LED Forward Voltage vs. Forward Current

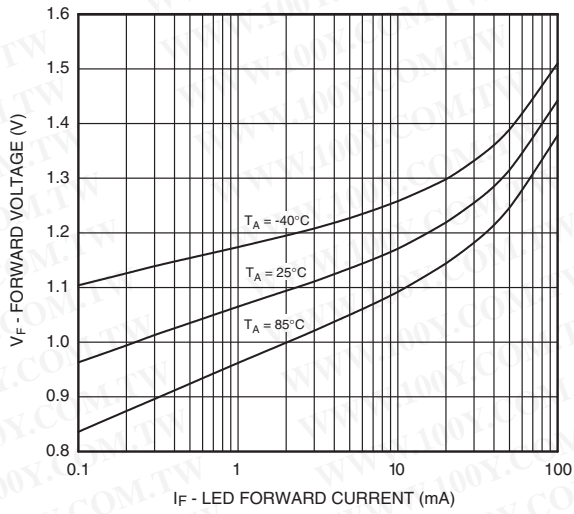


Figure 2. On-State Characteristics

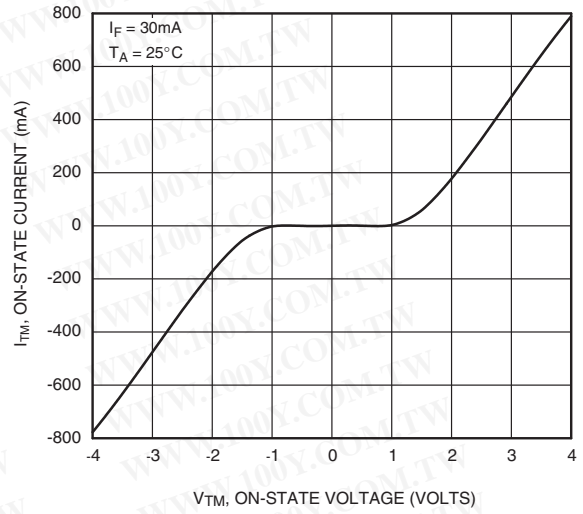


Figure 3. Trigger Current vs. Temperature

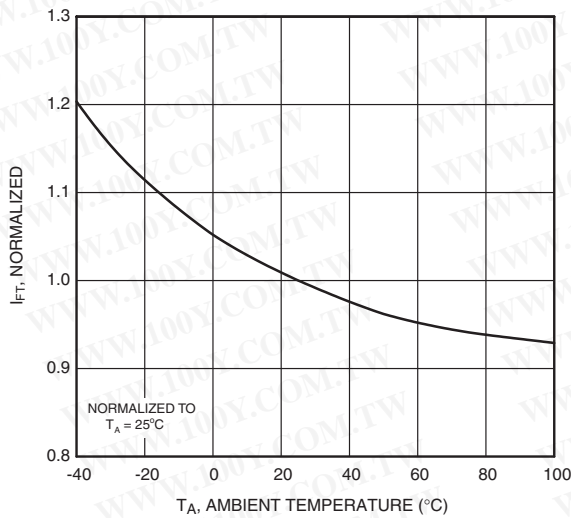
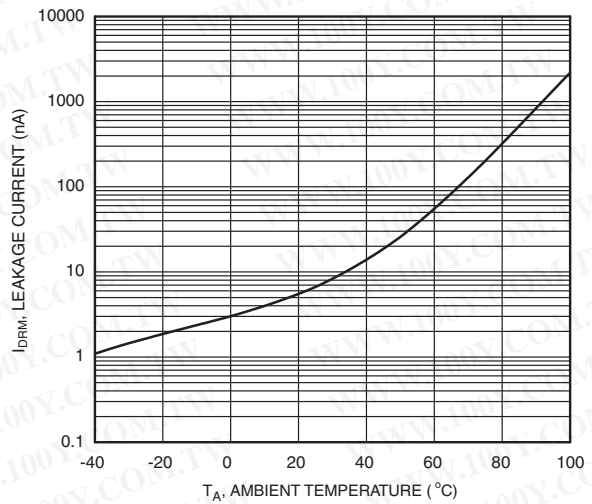


Figure 4. Leakage Current,  $I_{DRM}$  vs. Temperature



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

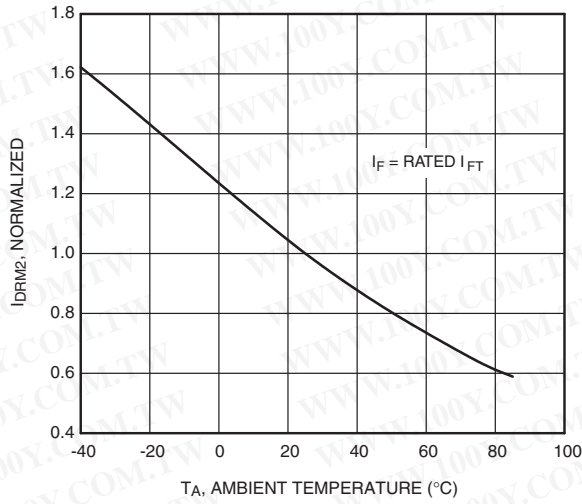


Figure 6. LED Current Required to Trigger vs. LED Pulse Width

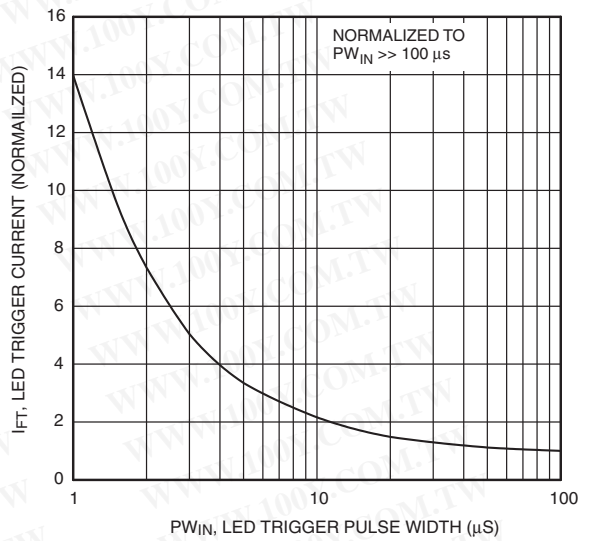


Figure 7. Holding Current,  $I_H$  vs. Temperature

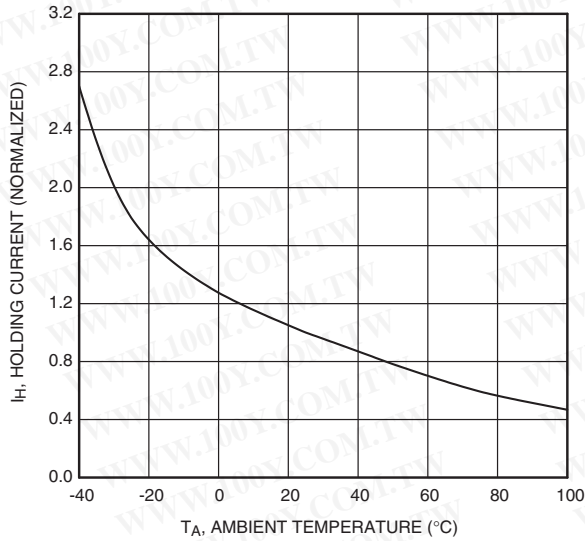
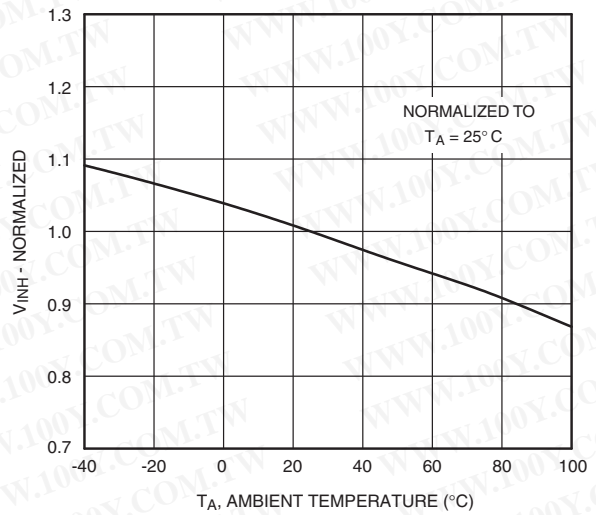


Figure 8. Inhibit Voltage vs. Temperature



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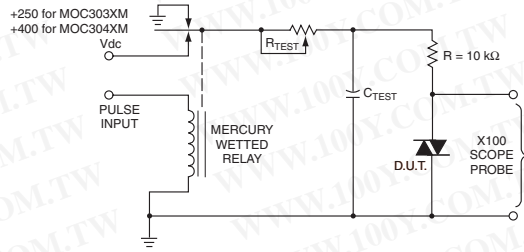


Figure 9. Static dv/dt Test Circuit

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

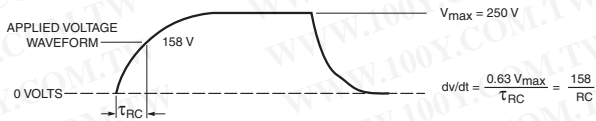


Figure 10. Static dv/dt Test Waveform (MOC3031M, MOC3032M, MOC3033M)

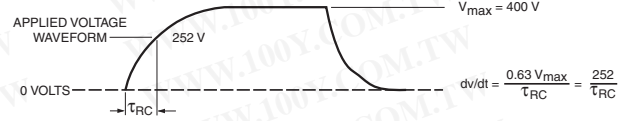
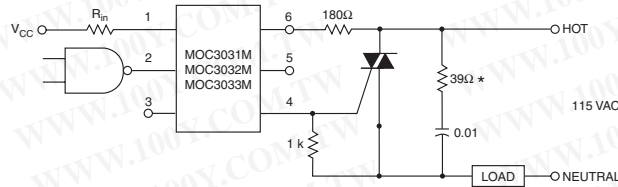


Figure 11. Static dv/dt Test Waveform (MOC3041M, MOC3042M, MOC3043M)

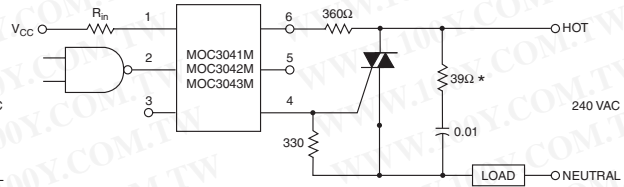
Typical circuit (Fig 12, 13) for use when hot line switching is required. In this circuit the “hot” side of the line is switched and the load connected to the cold or neutral side. The load may be connected to either the neutral or hot line.

$R_{in}$  is calculated so that  $I_F$  is equal to the rated  $I_{FT}$  of the part, 5 mA for the MOC3033M and MOC3043M, 10 mA for the MOC3032M and MOC3042M, or 15 mA for the MOC3031M and MOC3041M. The 39 ohm resistor and 0.01  $\mu$ 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.

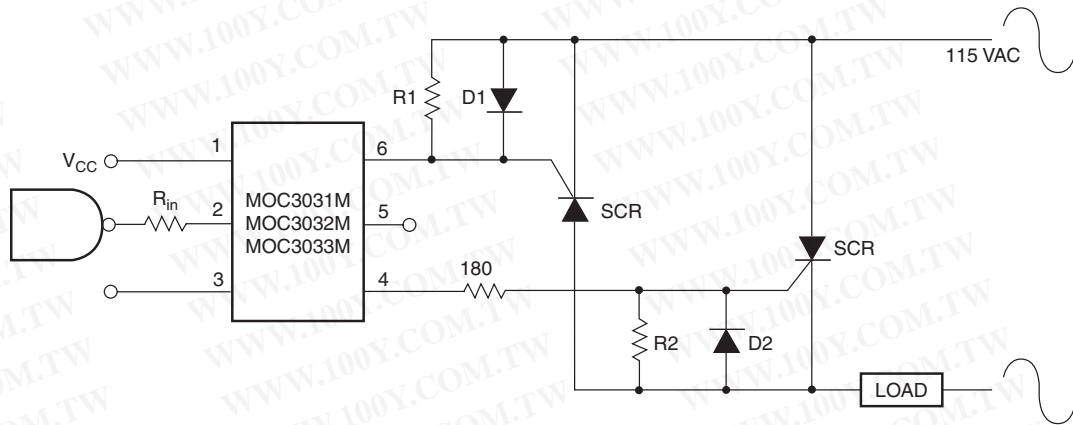
Figure 12. Hot-Line Switching Application Circuit (MOC3031M, MOC3032M, MOC3033M)



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

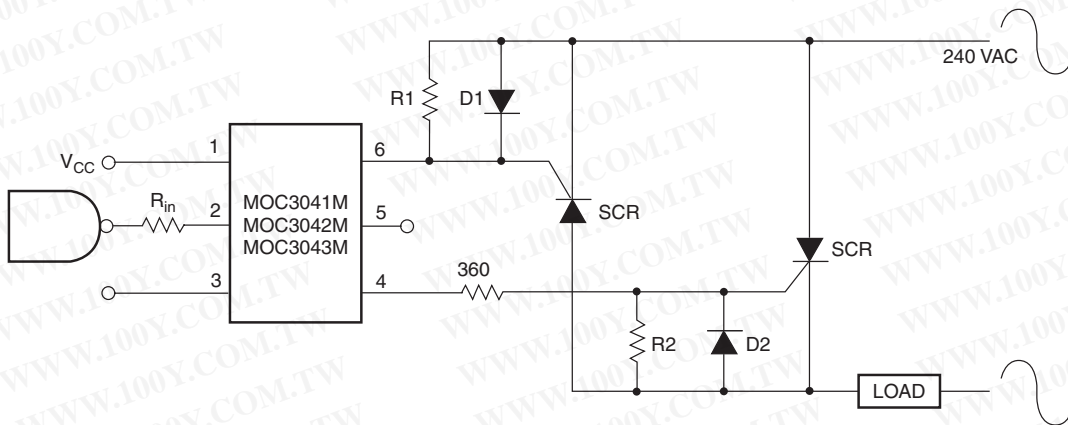
Figure 13. Hot-Line Switching Application Circuit (MOC3041M, MOC3042M, MOC3043M)

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**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 1 k ohm.



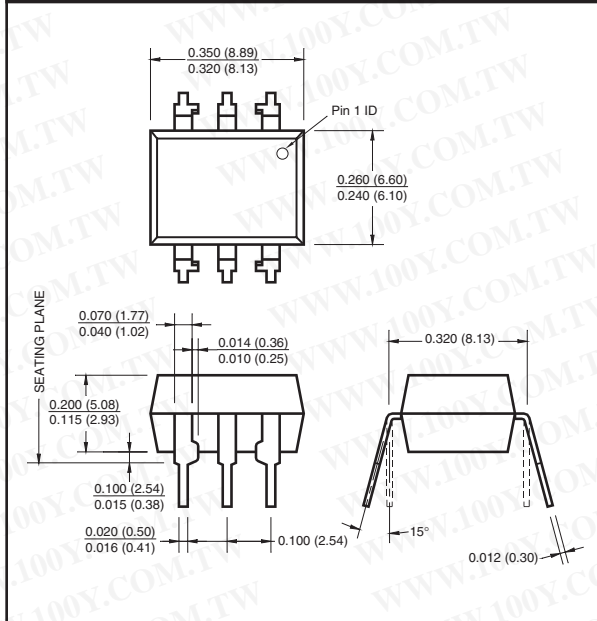
**Figure 15. Inverse-Parallel SCR Driver Circuit  
(MOC3041M, MOC3042M, MOC3043M)**

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 330 ohm.

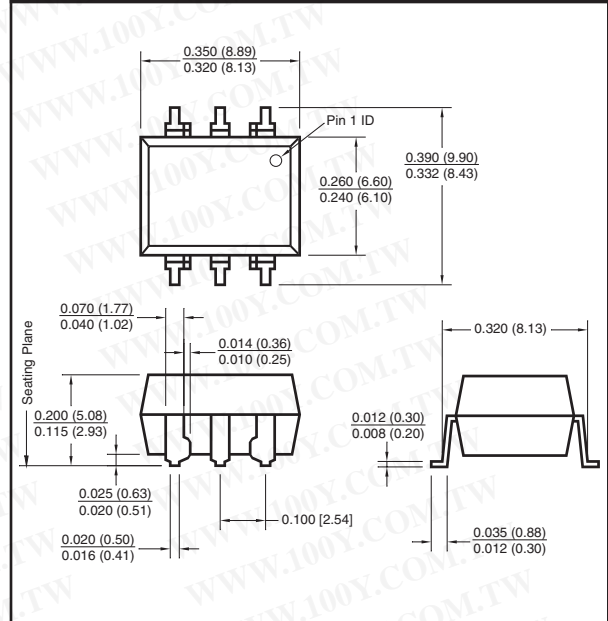
Note: This optoisolator should not be used to drive a load directly. It is intended to be a trigger device only.

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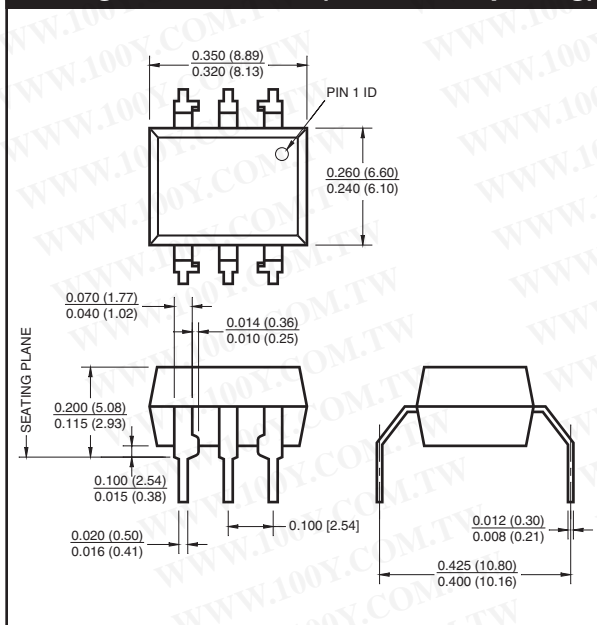
### Package Dimensions (Through Hole)



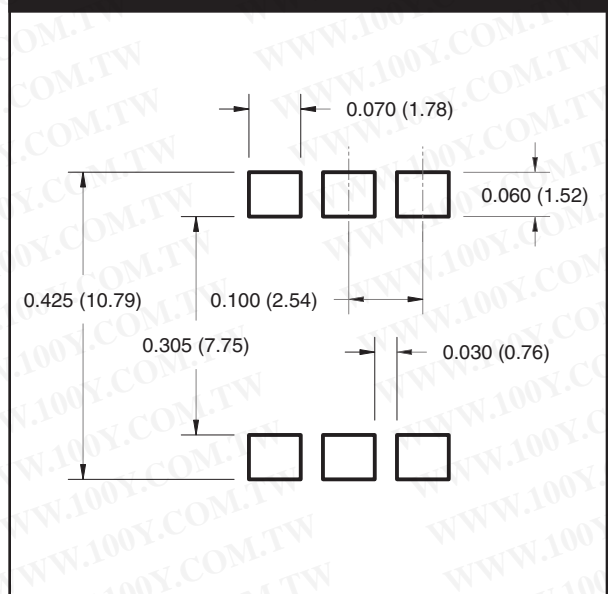
### Package Dimensions (Surface Mount)



### Package Dimensions (0.4" Lead Spacing)



### Recommended Pad Layout for Surface Mount Leadform



**NOTE**

All dimensions are in inches (millimeters)

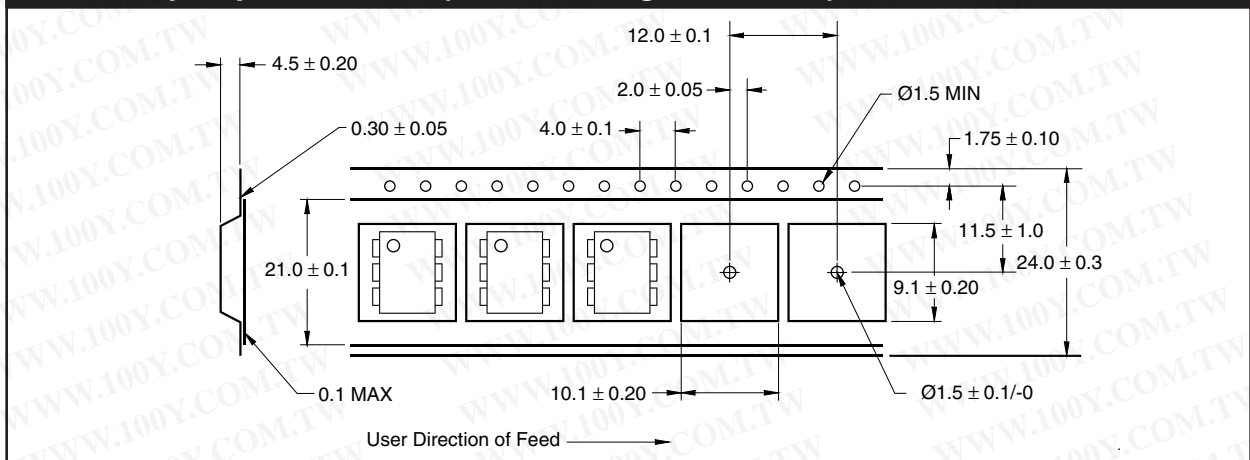
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## Ordering Information

Option	Order Entry Identifier	Description
S	S	Surface Mount Lead Bend
SR2	SR2	Surface Mount; Tape and reel
T	T	0.4" Lead Spacing
V	V	VDE 0884
TV	TV	VDE 0884, 0.4" Lead Spacing
SV	SV	VDE 0884, Surface Mount
SR2V	SR2V	VDE 0884, Surface Mount, Tape & Reel

### Carrier Tape Specifications (White Package, -M Suffix)



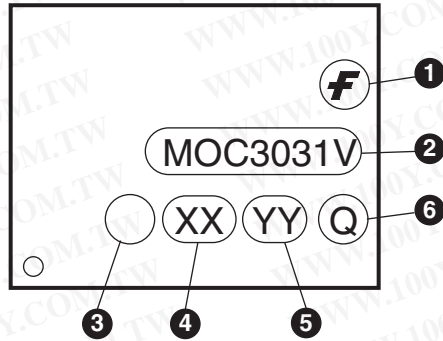
#### NOTE

All dimensions are in inches (millimeters)

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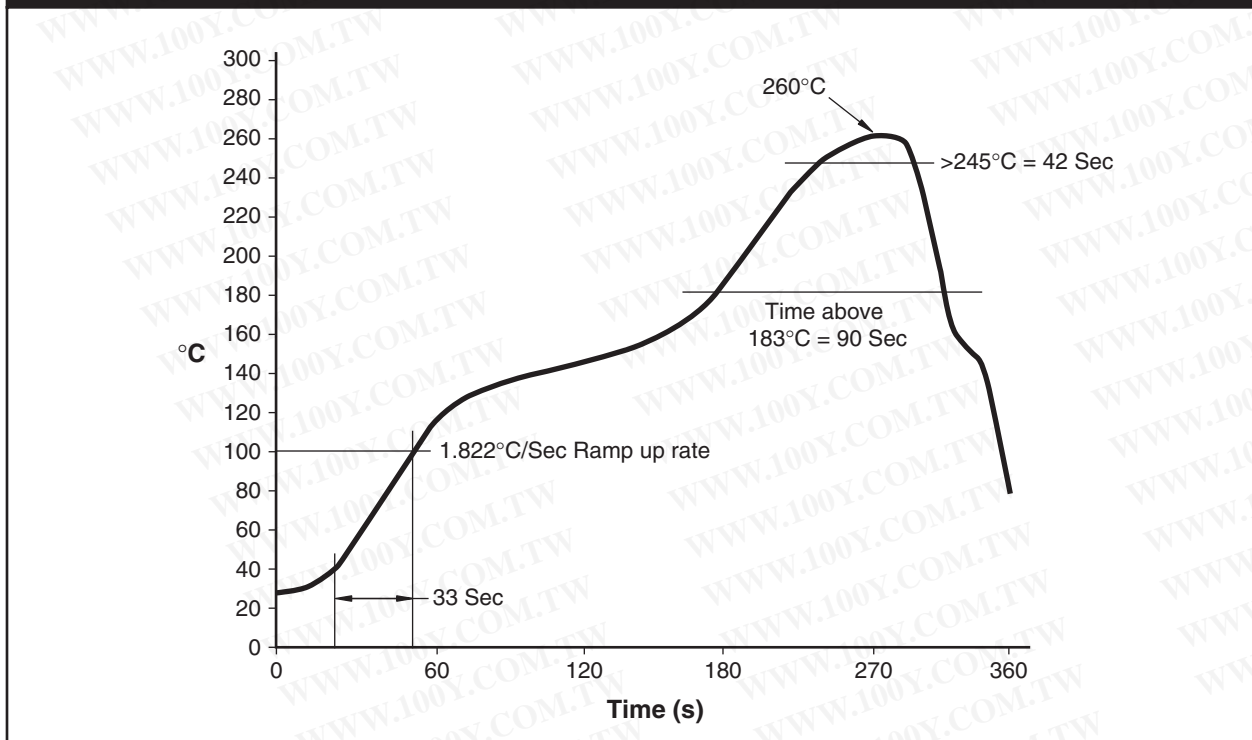
## Marking Information



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.

### Reflow Profile (White Package, -M Suffix)



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

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EcoSPARK™	I <sup>2</sup> C™	MSXPro™	RapidConnect™	UniFET™
E <sup>2</sup> C MOS™	i-Lo™	OCX™	μSerDes™	VCX™
EnSigna™	ImpliedDisconnect™	OCXPro™	SILENT SWITCHER®	Wire™
FACT™	IntelliMAX™	OPTOLOGIC®	SMART START™	
FACT Quiet Series™		OPTOPLANAR™	SPM™	
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The Power Franchise®		POP™	SuperFET™	
Programmable Active Droop™		Power247™	SuperSOT™-3	
		PowerEdge™	SuperSOT™-6	

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2. A critical component is 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.

## PRODUCT STATUS DEFINITIONS

### Definition of Terms

Datasheet Identification	Product Status	Definition
Advance Information	Formative or In Design	This datasheet contains the design specifications for product development. Specifications may change in any manner without notice.
Preliminary	First Production	This datasheet contains preliminary data, and supplementary data will be published at a later date. Fairchild Semiconductor reserves the right to make changes at any time without notice in order to improve design.
No Identification Needed	Full Production	This datasheet contains final specifications. Fairchild Semiconductor reserves the right to make changes at any time without notice in order to improve design.
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