

**FAIRCHILD**  
SEMICONDUCTOR®

# 6-PIN DIP ZERO-CROSS PHOTOTRIAC DRIVER OPTOCOUPLER (600V PEAK)

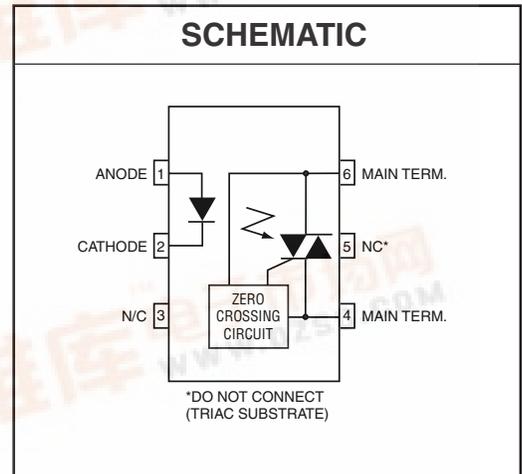
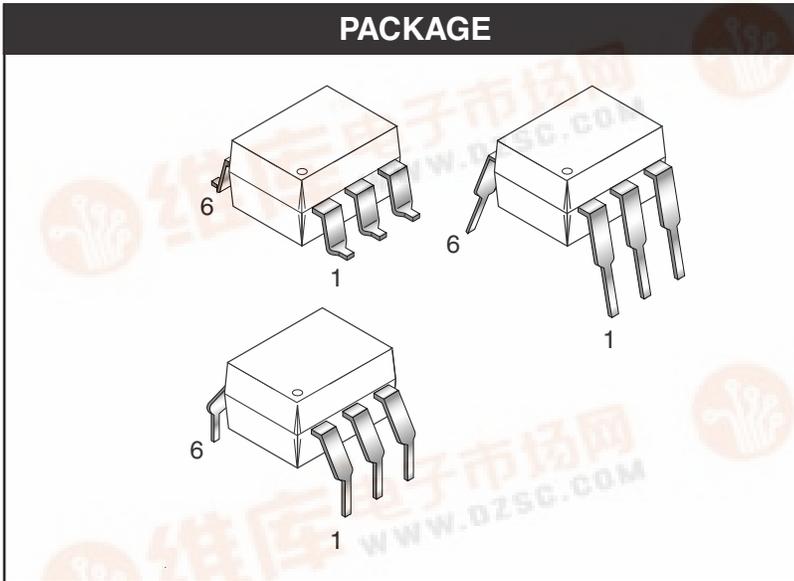
MOC3061-M

MOC3062-M

MOC3063-M

MOC3162-M

MOC3163-M



## DESCRIPTION

The MOC306X-M and MOC316X-M 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 115/240 VAC lines, such as solid-state relays, industrial controls, motors, solenoids and consumer appliances, etc.

## FEATURES

- Simplifies logic control of 115/240 VAC power
- Zero voltage crossing
- $dv/dt$  of 1000 V/ $\mu s$  guaranteed (MOC316X-M),  
– 600 V/ms guaranteed (MOC306X-M)
- VDE recognized (File # 94766)  
– ordering option V (e.g., MOC3063V-M)
- Underwriters Laboratories (UL) recognized (File #E90700, volume 2)

## APPLICATIONS

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



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| <b>ABSOLUTE MAXIMUM RATINGS</b> ( $T_A = 25^\circ\text{C}$ 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>(4)</sup> (peak AC voltage, 60Hz, 1 sec duration)     | $V_{ISO}$ | All    | 7500           | Vac(pk)              |
| Total Device Power Dissipation @ 25 $^\circ\text{C}$                               | $P_D$     | All    | 250            | mW                   |
| Derate above 25 $^\circ\text{C}$   |           |        | 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                                | $P_D$     | All    | 120            | mW                   |
| Derate above 25 $^\circ\text{C}$   |           |        | 1.41           | mW/ $^\circ\text{C}$ |
| <b>DETECTOR</b>  |           |        |                |                      |
| Off-State Output Terminal Voltage  | $V_{DRM}$ | All    | 600            | V                    |
| Peak Repetitive Surge Current (PW = 100 $\mu\text{s}$ , 120 pps)                   | $I_{TSM}$ | All    | 1              | A                    |
| Total Power Dissipation @ 25 $^\circ\text{C}$ Ambient                              | $P_D$     | All    | 150            | mW                   |
| Derate above 25 $^\circ\text{C}$   |           |        | 1.76           | mW/ $^\circ\text{C}$ |

# 6-PIN DIP ZERO-CROSS PHOTOTRIAC DRIVER OPTOCOUPLER (600V PEAK)

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## ELECTRICAL CHARACTERISTICS (TA = 25°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                    |             | 1.3      | 1.5        | V                |
| Reverse Leakage Current                    | $V_R = 6 \text{ V}$                                 | $I_R$             | All                    |             | 0.005    | 100        | $\mu\text{A}$    |
| <b>DETECTOR</b>                            |   |                   |                        |             |          |            |                  |
| Peak Blocking Current, Either Direction    | $V_{\text{DRM}} = 600\text{V}$ , $I_F = 0$ (note 1) | $I_{\text{DRM1}}$ | MOC316X-M<br>MOC306X-M |             | 10<br>10 | 100<br>500 | nA               |
| Critical Rate of Rise of Off-State Voltage | $I_F = 0$ (figure 9, note 3)                        | dv/dt             | MOC306X-M<br>MOC316X-M | 600<br>1000 | 1500     |            | V/ $\mu\text{s}$ |

### TRANSFER CHARACTERISTICS (TA = 25°C Unless otherwise specified.)

| DC Characteristics                           | Test Conditions  | Symbol          | Device  | Min | Typ* | Max           | Units         |
|--|--|-----------------|---|-----|------|---------------|---------------|
| LED Trigger Current (rated $I_{\text{FT}}$ ) | main terminal Voltage = 3V (note 2)  | $I_{\text{FT}}$ | MOC3061-M<br>MOC3062-M/<br>MOC3162-M<br>MOC3063-M/<br>MOC3163-M |     |      | 15<br>10<br>5 | mA            |
| Peak On-State Voltage, Either Direction      | $I_{\text{TM}} = 100 \text{ mA peak}$ ,<br>$I_F = \text{rated } I_{\text{FT}}$ | $V_{\text{TM}}$ | All   |     | 1.8  | 3             | V             |
| Holding Current, Either Direction            |  | $I_H$           | All   |     | 500  |               | $\mu\text{A}$ |

### ZERO CROSSING CHARACTERISTICS

| Characteristics   | Test Conditions   | Symbol            | Device                          | Min | Typ*     | Max      | Units         |
|---|---|-------------------|---------------------------------|-----|----------|----------|---------------|
| Inhibit Voltage (MT1-MT2 voltage above which device will not trigger) | $I_F = \text{Rated } I_{\text{FT}}$   | $V_{\text{INH}}$  | MOC3061-M/2M/3M<br>MOC3062-M/3M |     | 12<br>12 | 20<br>15 | V             |
| Leakage in Inhibited State  | $I_F = \text{Rated } I_{\text{FT}}$ ,<br>$V_{\text{DRM}} = 600\text{V}$ , off state | $I_{\text{DRM2}}$ | All                             |     | 150      | 500      | $\mu\text{A}$ |

### ISOLATION CHARACTERISTICS

| Characteristics   | Test Conditions                           | Symbol           | Device | Min  | Typ* | Max | Units |
|-------------------|---|------------------|--------|------|------|-----|-------|
| Isolation Voltage | $f = 60 \text{ Hz}$ , $t = 1 \text{ sec}$ | $V_{\text{ISO}}$ | All    | 7500 |      |     | V     |

\*Typical values at  $T_A = 25^\circ\text{C}$

#### 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  $I_{\text{FT}}$  (15 mA for MOC3061-M, 10 mA for MOC3062-M & MOC3162-M, 5 mA for MOC3063-M & MOC3163-M) and absolute max  $I_F$  (60 mA).
- This is static dv/dt. See Figure 9 for test circuit. Commutating dv/dt is a function of the load-driving thyristor(s) only.
- Isolation surge 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.

MOC3061-M

MOC3062-M

MOC3063-M

MOC3162-M

MOC3163-M

Figure 1. LED Forward Voltage vs. Forward Current

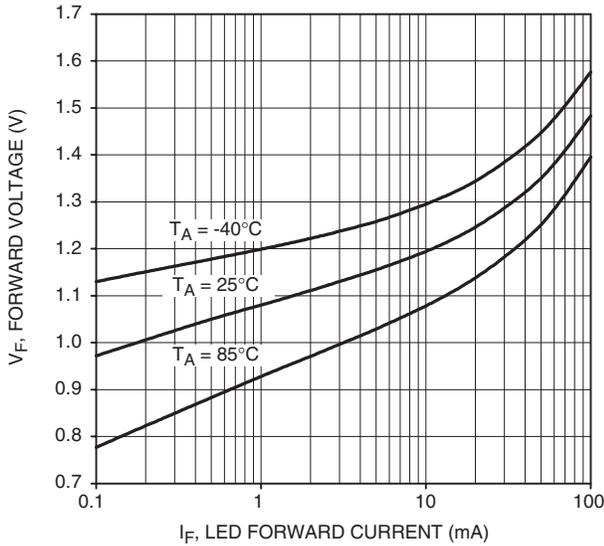


Figure 2. Trigger Current Vs. Temperature

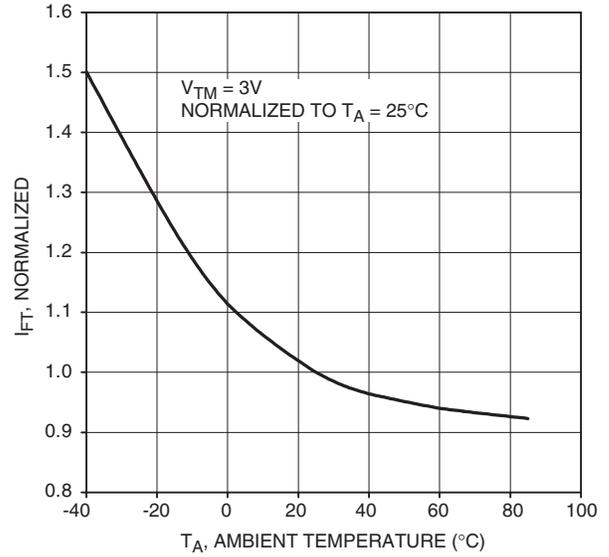


Figure 3. LED Current Required to Trigger vs. LED Pulse Width

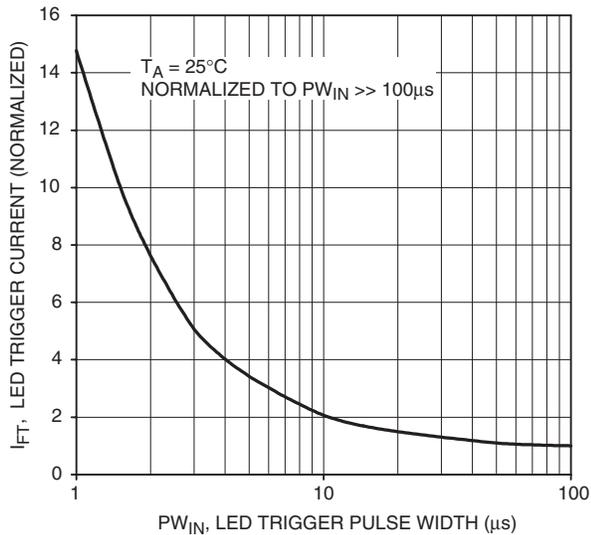
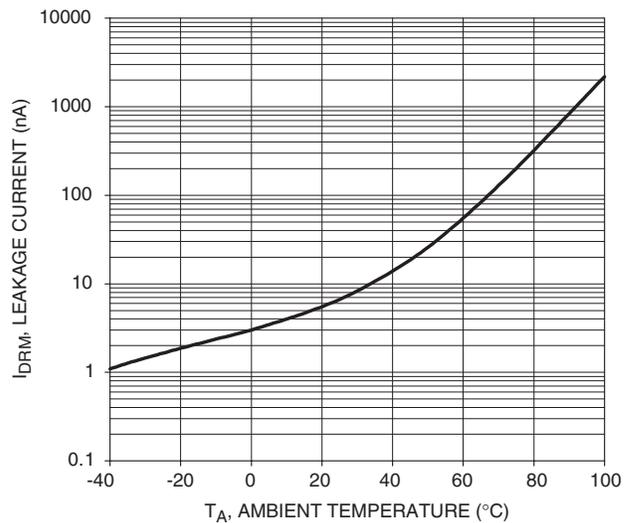
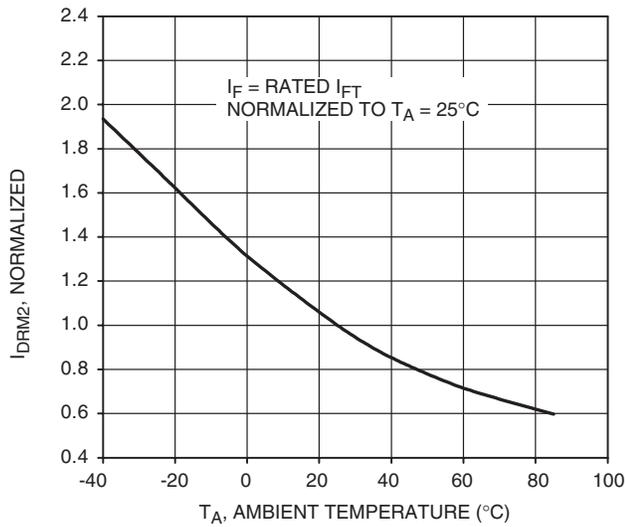


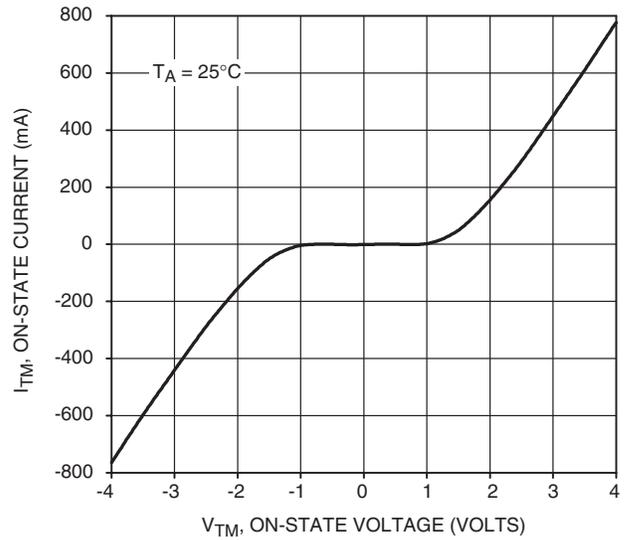
Figure 4. Leakage Current, I<sub>DRM</sub> vs. Temperature



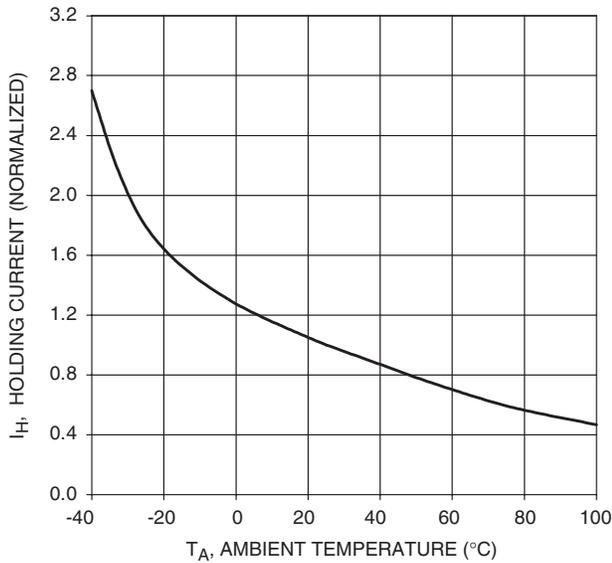
**Figure 5.  $I_{DRM2}$ , Leakage in Inhibit State vs. Temperature**



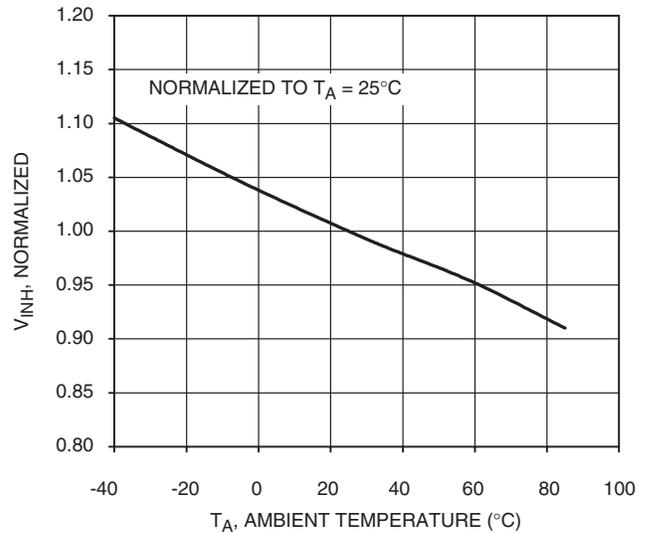
**Figure 6. On-State Characteristics**



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



**Figure 8. Inhibit Voltage vs. Temperature**



**MOC3061-M    MOC3062-M    MOC3063-M    MOC3162-M    MOC3163-M**

1. 100x scope probes are used, to allow high speeds and voltages.
2. 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 vernier resistor combined with various capacitor combinations 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.

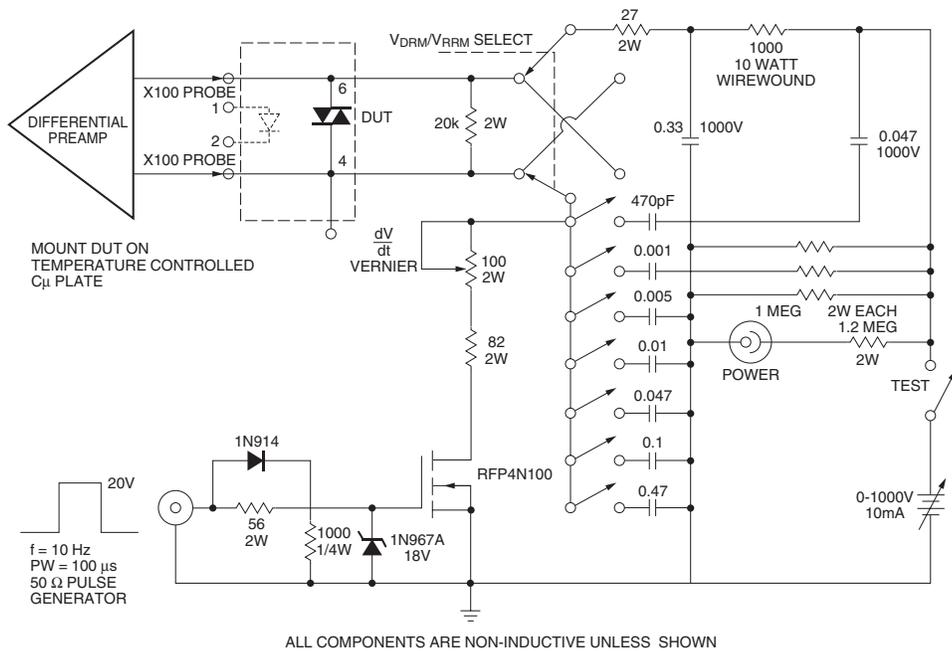


Figure 9. Circuit for Static  $\frac{dv}{dt}$  Measurement of Power Thyristors

## BASIC APPLICATIONS

Typical circuit 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, 15 mA for the MOC3061-M, 10 mA for the MOC3062-M, or 5 mA for the MOC3063-M. The 39 ohm resistor and 0.01  $\mu$ F capacitor are for snubbing of the triac and is often, but not always, necessary depending upon the particular triac and load used.

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.

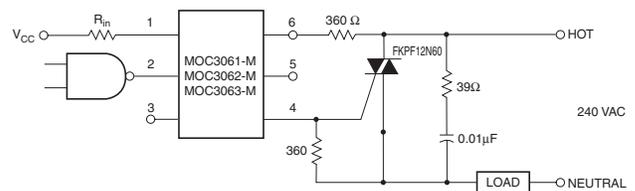


Figure 10. Hot-Line Switching Application Circuit

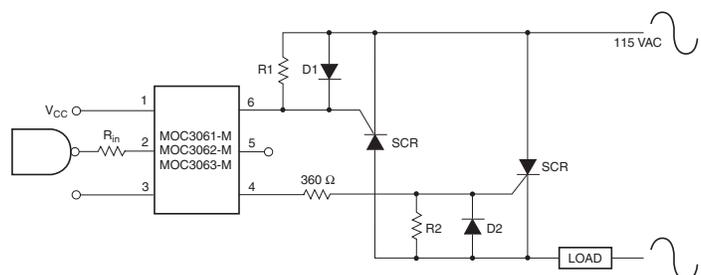


Figure 11. Inverse-Parallel SCR Driver Circuit

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MOC3061-M

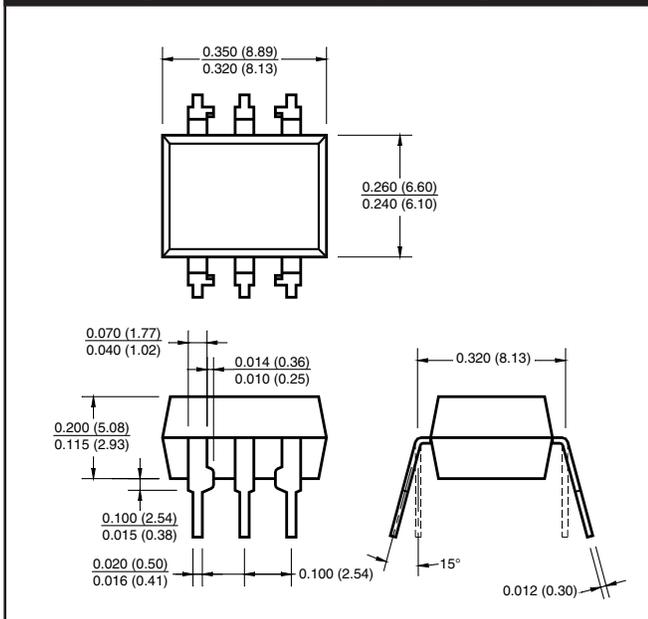
MOC3062-M

MOC3063-M

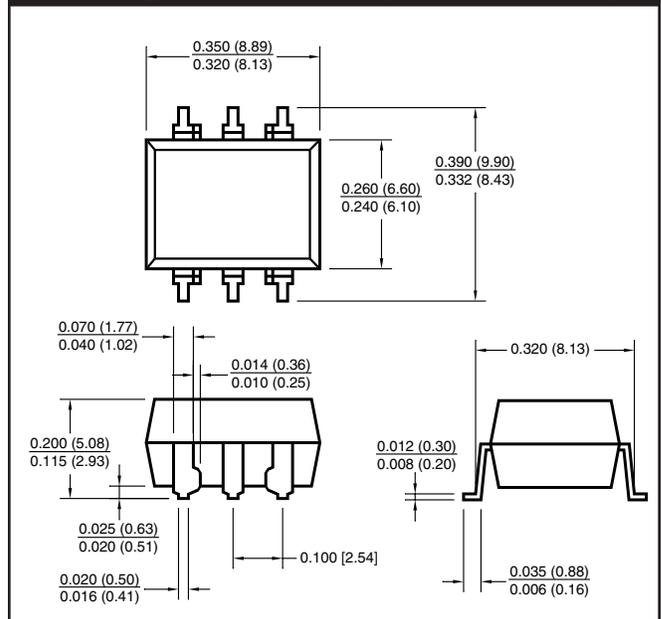
MOC3162-M

MOC3163-M

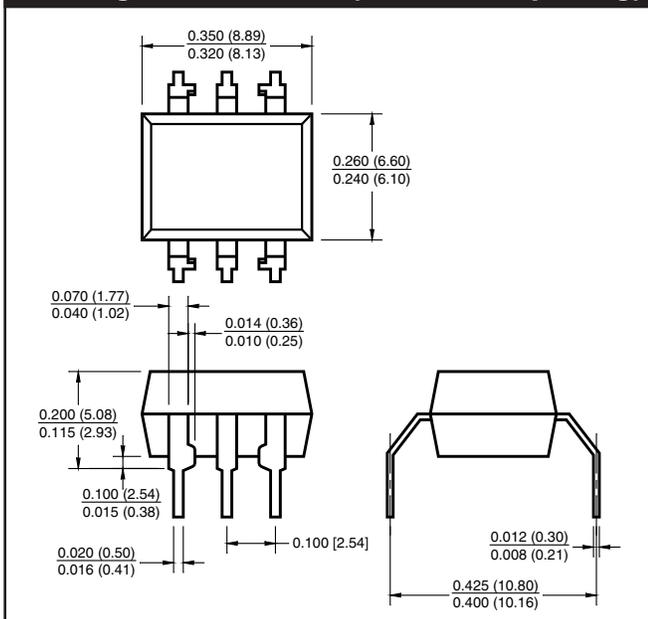
## Package Dimensions (Through Hole)



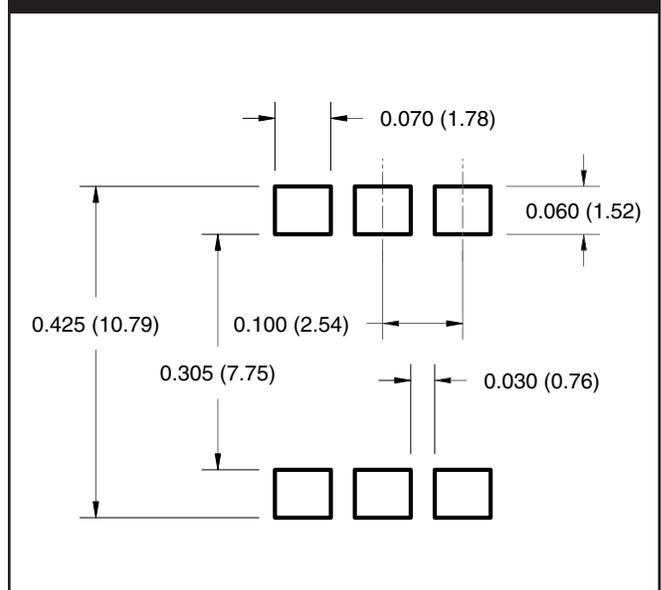
## Package Dimensions (Surface Mount)



## Package Dimensions (0.4" Lead Spacing)



## Recommended Pad Layout for Surface Mount Leadform



**NOTE**

All dimensions are in inches (millimeters)

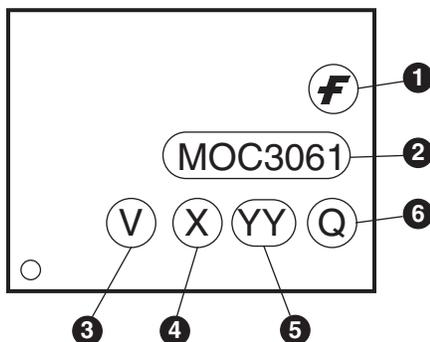
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**ORDERING INFORMATION**

| 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 |

**MARKING INFORMATION**

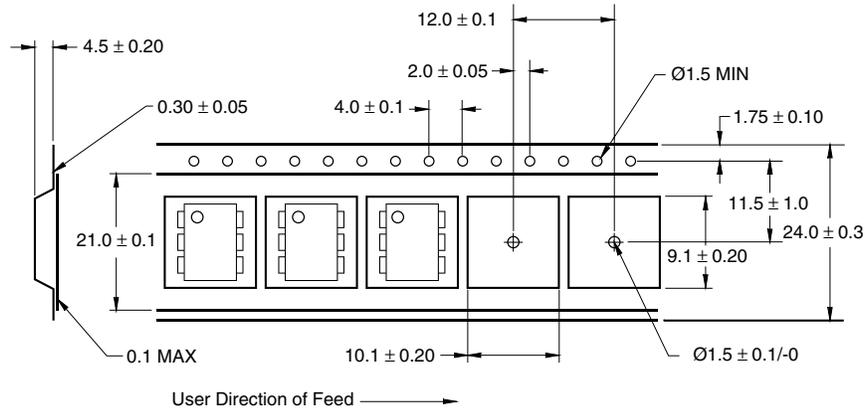


| Definitions |  |
|-------------|--|
| 1           | Fairchild logo   |
| 2           | Device number  |
| 3           | VDE mark (Note: Only appears on parts ordered with VDE option – See order entry table) |
| 4           | One digit year code, e.g., '3'   |
| 5           | Two digit work week ranging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

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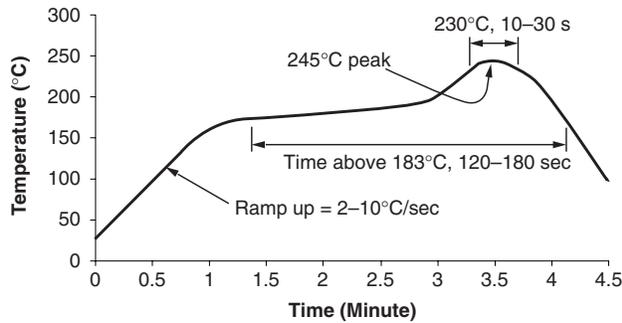
**Carrier Tape Specifications**



**NOTE**

All dimensions are in inches (millimeters)

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



- Peak reflow temperature: 245°C (package surface temperature)
- Time of temperature higher than 183°C for 120–180 seconds
- One time soldering reflow is recommended



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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.