SYC SEMICONDUCTORES Y COMPONENTES

# MOC3061M, MOC3062M, MOC3063M, MOC3162M, MOC3163M 6-Pin DIP Zero-Cross Phototriac Driver Optocoupler (600 Volt Peak)

## Features

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

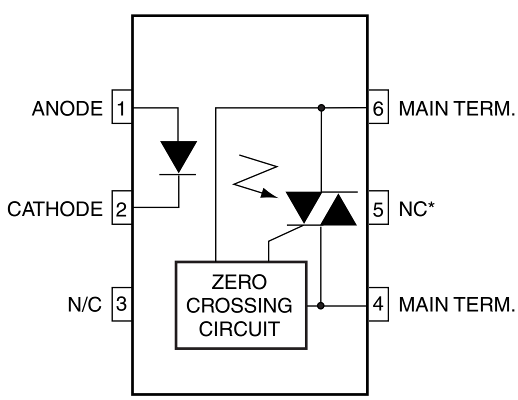
## Applications

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

## Description

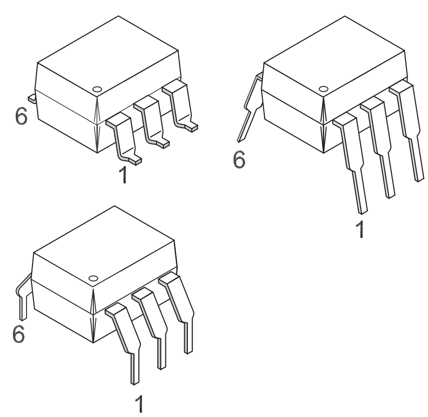
The MOC306XM and MOC316XM devices consist of a GaAs infrared emitting diode optically coupled to a monolithic silicon detector performing the function of a zero voltage crossing bilateral triac driver. They are designed for use with a triac in the interface of logic systems to equipment powered from 115/240 VAC lines, such as solid-state relays, industrial controls, motors, solenoids and consumer appliances, etc.

## 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) | All | 7500 | Vac(pk) |
| $P_D$ | Total Device Power Dissipation @ 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 @ 25°C Ambient | All | 120 | mW |
| | Derate above 25°C | | 1.41 | mW/°C |
| **DETECTOR** | | | | |
| $V_{DRM}$ | Off-State Output Terminal Voltage | All | 600 | V |
| $I_{TSM}$ | Peak Repetitive Surge Current (PW = 100µs, 120pps) | All | 1 | A |
| $P_D$ | Total Power Dissipation @ 25°C Ambient | All | 150 | mW |
| | Derate above 25°C | | 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 | | 1.3 | 1.5 | V |
| $I_R$ | Reverse Leakage Current | $V_R$ = 6V | All | | 0.005 | 100 | µA |
| **DETECTOR** | | | | | | | |
| $I_{DRM1}$ | Peak Blocking Current, Either Direction | $V_{DRM}$ = 600V, $I_F = 0^{(2)}$ | MOC316XM | | 10 | 100 | nA |
| | | | MOC306XM | | 10 | 500 | |
| dv/dt | Critical Rate of Rise of Off-State Voltage | $I_F$ = 0 (Figure 9)$^{(3)}$ | MOC306XM | 600 | 1500 | | V/µs |
| | | | MOC316XM | 1000 | | | |

### Transfer Characteristics

| Symbol | DC Characteristics | Test Conditions | Device | Min. | Typ.* | Max. | Units |
|---|---|---|---|---|---|---|---|
| $I_{FT}$ | LED Trigger Current (rated $I_{FT}$) | Main Terminal Voltage = $3V^{(3)}$ | MOC3061M | | | 15 | mA |
| | | | MOC3062M/ MOC3162M | | | 10 | |
| | | | MOC3063M/ MOC3163M | | | 5 | |
| $V_{TM}$ | Peak On-State Voltage, Either Direction | $I_{TM}$ = 100 mA peak, $I_F$ = rated $I_{FT}$ | All | | 1.8 | 3 | V |
| $I_H$ | Holding Current, Either Direction | | All | | 500 | | µA |

### Zero Crossing Characteristics

| Symbol | Characteristics | Test Conditions | Device | Min. | Typ.* | Max. | Units |
|---|---|---|---|---|---|---|---|
| $V_{INH}$ | Inhibit Voltage (MT1-MT2 voltage above which device will not trigger) | $I_F$ = Rated $I_{FT}$ | MOC3061M/2M/3M | | 12 | 20 | V |
| | | | MOC3162M/3M | | 12 | 15 | |
| $I_{DRM2}$ | Leakage in Inhibited State | $I_F$ = Rated $I_{FT}$, $V_{DRM}$ = 600V, off state | All | | 150 | 500 | µA |

### Isolation Characteristics

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

*Typical values at $T_A$ = 25°C

**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 MOC3061M, 10mA for MOC3062M & MOC3162M, 5mA for MOC3063M & MOC3163M) 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**

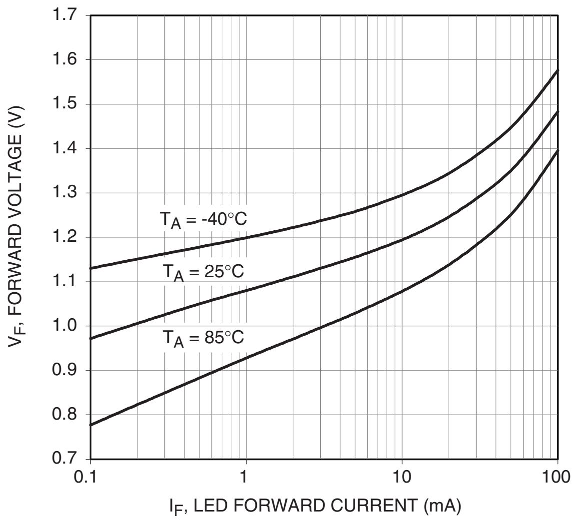



**Figure 2. Trigger Current Vs. Temperature**

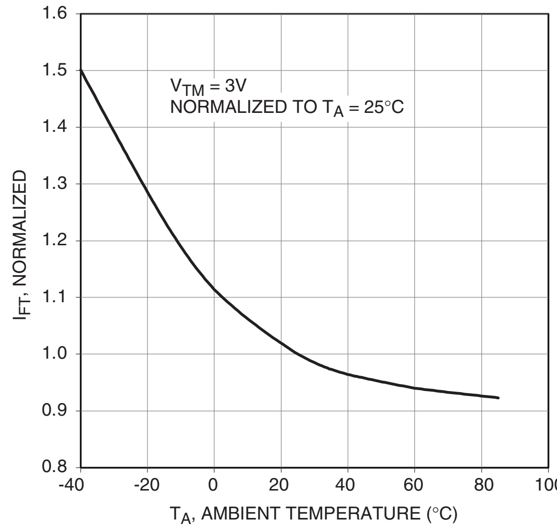



**Figure 3. LED Current Required to Trigger vs. LED Pulse Width**

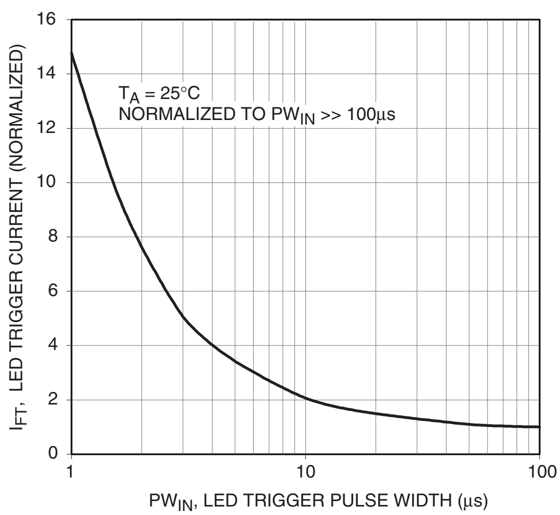
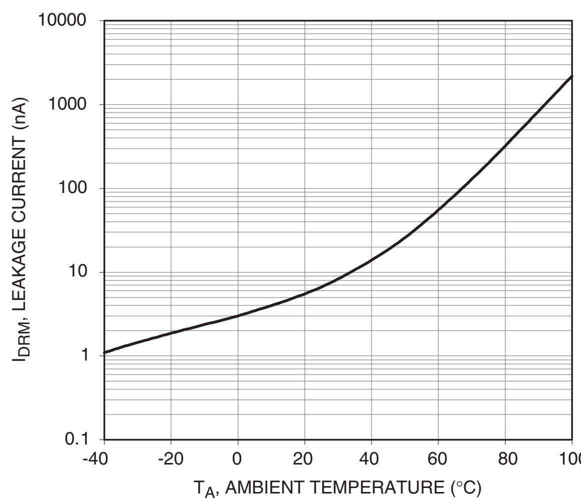



**Figure 4. Leakage Current, $I_{DRM}$ vs. Temperature**



## Typical Performance Curves (Continued)

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

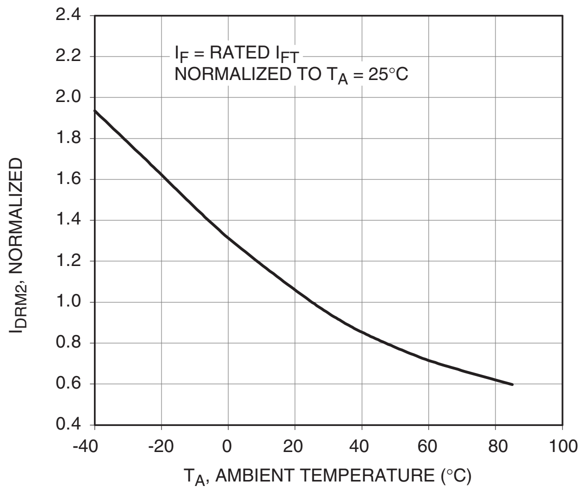



**Figure 6. On-State Characteristics**

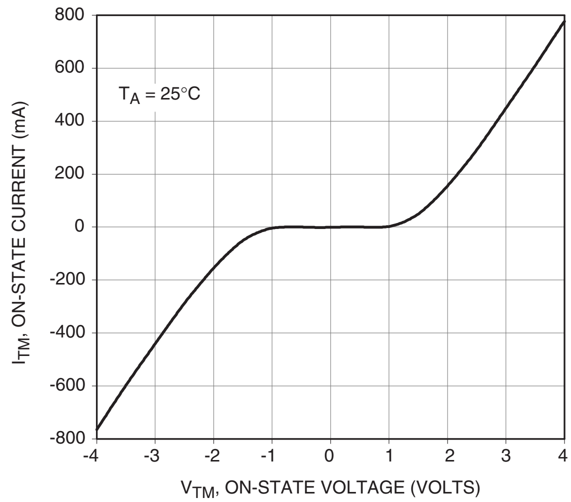



**Figure 7. $I_H$, Holding Current vs. Temperature**

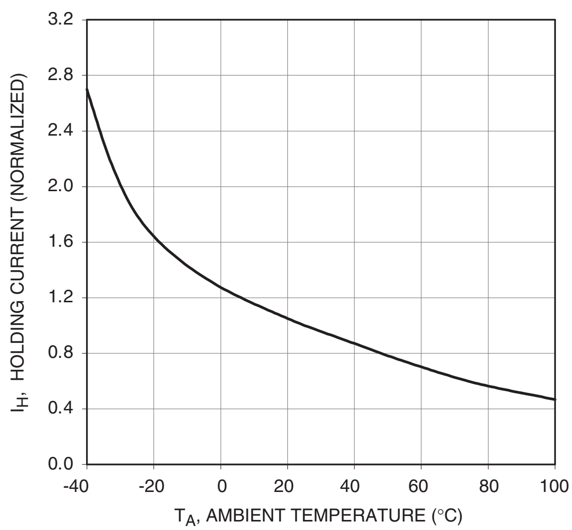
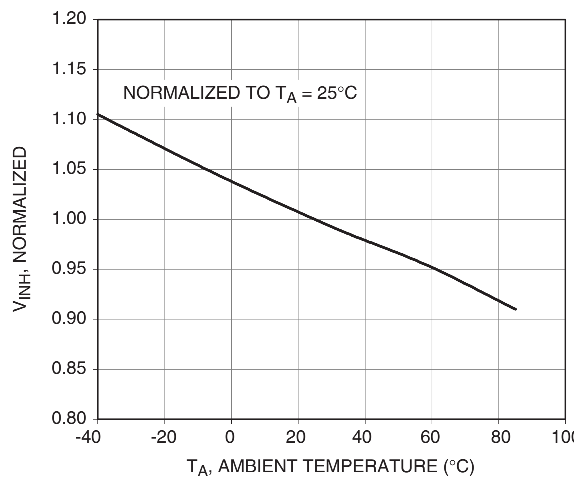



**Figure 8. Inhibit Voltage vs. Temperature**



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

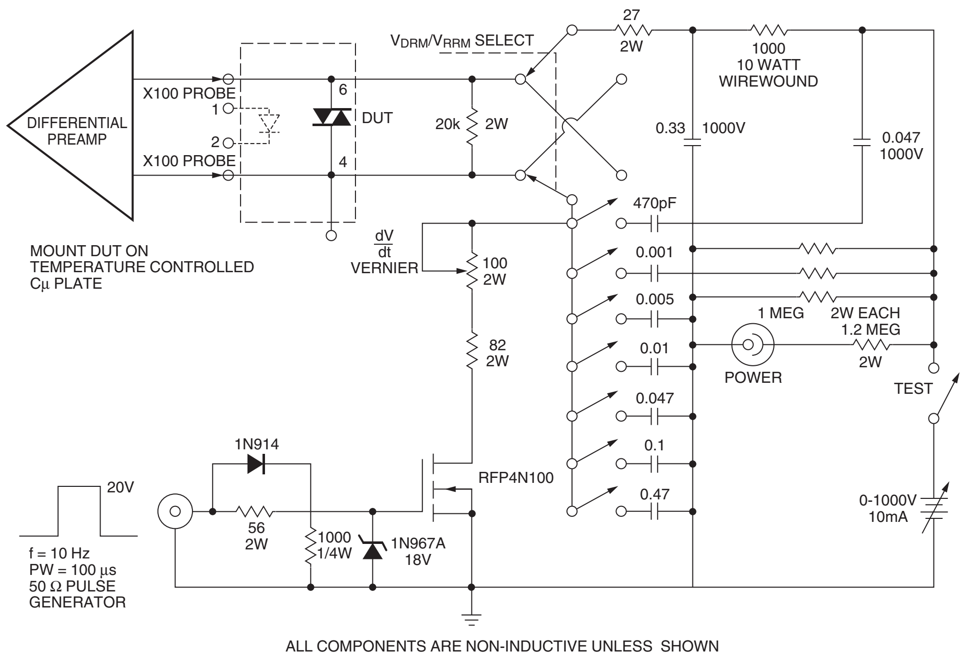



**Figure 9. Circuit for Static $\frac{dV}{dt}$ Measurement of Power Thyristors**

## 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, 15mA for the MOC3061M, 10mA for the MOC3062M, or 5mA for the MOC3063M. The 39Ω resistor and 0.01μF capacitor are for snubbing of the triac and is often, but not always, necessary depending upon the particular triac and load used.

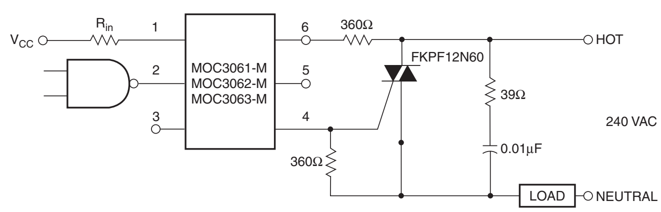



**Figure 10. Hot-Line Switching Application Circuit**

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.

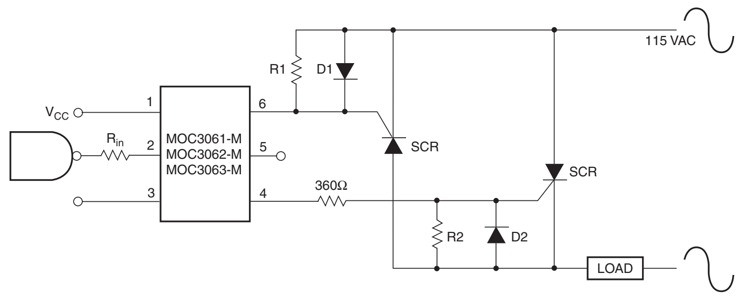
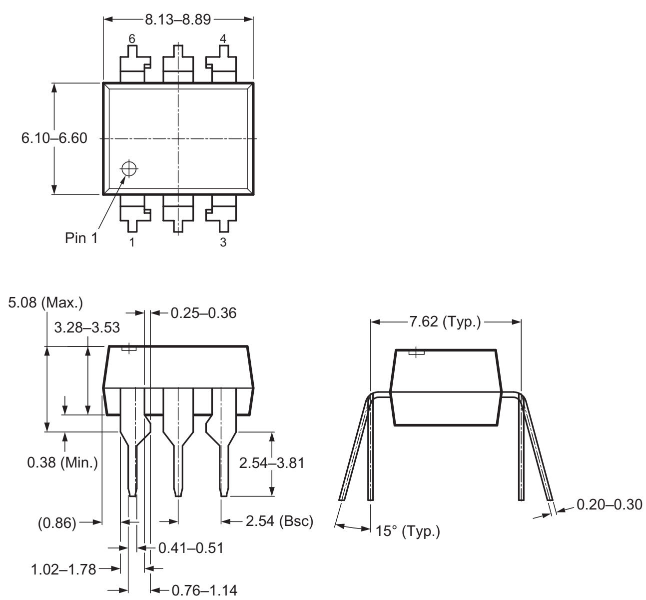


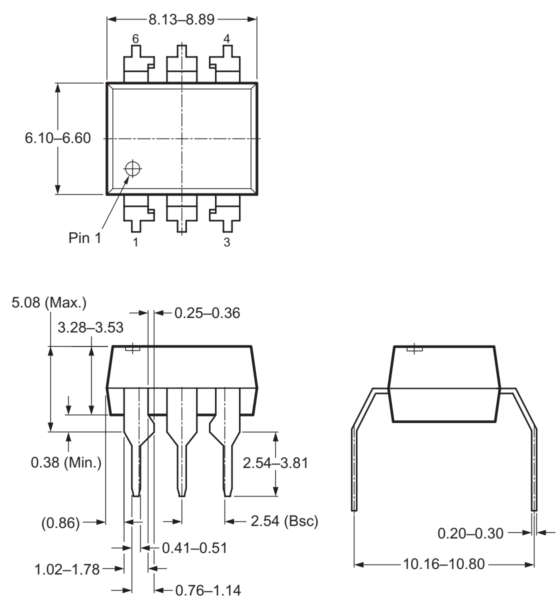

**Figure 11. Inverse-Parallel SCR Driver Circuit**

## Package Dimensions

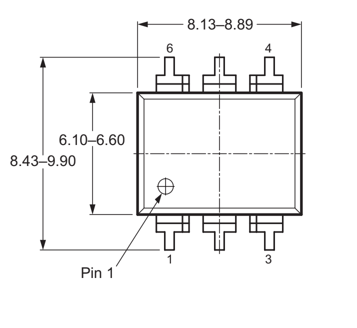
### Through Hole

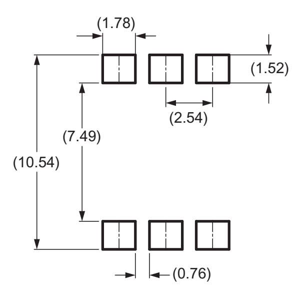



### 0.4" Lead Spacing

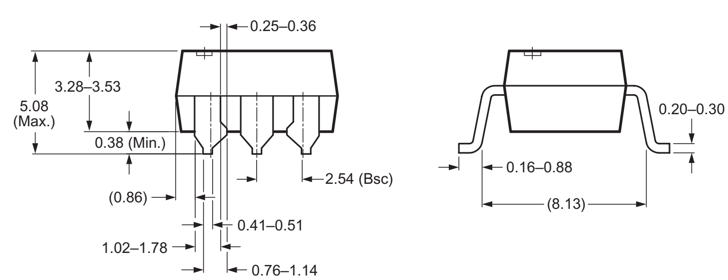



### Surface Mount




**Rcommended Pad Layout**

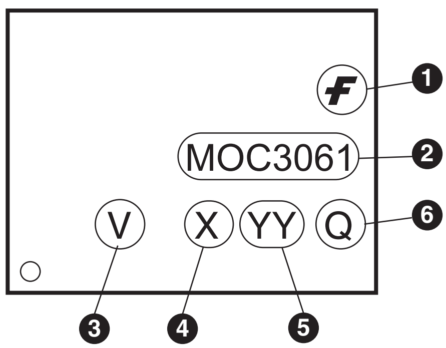



**Note:**
All dimensions in mm.

## Ordering Information

| Option | Order Entry Identifier (Example) | Description |
|---|---|---|
| No option | MOC3061M | Standard Through Hole Device |
| S | MOC3061SM | Surface Mount Lead Bend |
| SR2 | MOC3061SR2M | Surface Mount; Tape and Reel |
| T | MOC3061TM | 0.4" Lead Spacing |
| V | MOC3061VM | VDE 0884 |
| TV | MOC3061TVM | VDE 0884, 0.4" Lead Spacing |
| SV | MOC3061SVM | VDE 0884, Surface Mount |
| SR2V | MOC3061SR2VM | VDE 0884, Surface Mount, Tape and Reel |

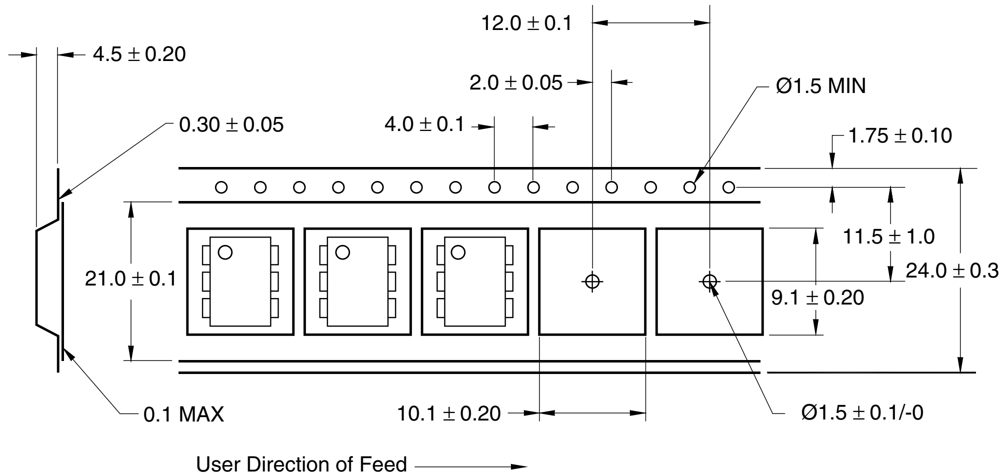
## Marking Information




| 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