6-Pin DIP Zero-Cross Triac Driver Optocoupler (600 Volt Peak)

MOC3061M, MOC3062M, MOC3063M, MOC3162M, MOC3163M

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.

Features
- Simplifies Logic Control of 115/240 VAC Power
- Zero Voltage Crossing to Minimize Conducted and Radiated Line Noise
- 600 V Peak Blocking Voltage
- Superior Static dv/dt
  - 600 V/\mu s (MOC306xM)
  - 1000 V/\mu s (MOC316xM)
- Safety and Regulatory Approvals
  - UL1577, 4,170 VAC RMS for 1 Minute
  - DIN EN/IEC60747–5–5
- These are Pb–Free Devices

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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MARKING DIAGRAM

SCHMATIC

ORDERING INFORMATION
See detailed ordering and shipping information on page 8 of this data sheet.
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.)

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Characteristics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Installation Classifications per DIN VDE 0110/1.89 Table 1, For Rated Mains Voltage</td>
<td></td>
</tr>
<tr>
<td>&lt;150 VRMS</td>
<td>I–IV</td>
</tr>
<tr>
<td>&lt;300 VRMS</td>
<td>I–IV</td>
</tr>
<tr>
<td>Climatic Classification</td>
<td>40/85/21</td>
</tr>
<tr>
<td>Pollution Degree (DIN VDE 0110/1.89)</td>
<td>2</td>
</tr>
<tr>
<td>Comparative Tracking Index</td>
<td>175</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Parameter</th>
<th>Value</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>VPR</td>
<td>Input–to–Output Test Voltage, Method A, (V_{PR} = V_{ORM} \times 1.6), Type and Sample Test with (t_m = 10) s, Partial Discharge &lt; 5 pC</td>
<td>1360</td>
<td>(V_{peak})</td>
</tr>
<tr>
<td></td>
<td>Input–to–Output Test Voltage, Method B, (V_{PR} = V_{ORM} \times 1.875), 100% Production Test with (t_m = 1) s, Partial Discharge &lt; 5 pC</td>
<td>1594</td>
<td>(V_{peak})</td>
</tr>
<tr>
<td>VORM</td>
<td>Maximum Working Insulation Voltage</td>
<td>850</td>
<td>(V_{peak})</td>
</tr>
<tr>
<td>VIOTM</td>
<td>Highest Allowable Over–Voltage</td>
<td>6000</td>
<td>(V_{peak})</td>
</tr>
<tr>
<td></td>
<td>External Creepage</td>
<td>≥7</td>
<td>mm</td>
</tr>
<tr>
<td></td>
<td>External Clearance</td>
<td>≥7</td>
<td>mm</td>
</tr>
<tr>
<td></td>
<td>External Clearance (for Option TV, 0.4” Lead Spacing)</td>
<td>≥10</td>
<td>mm</td>
</tr>
<tr>
<td>DTI</td>
<td>Distance Through Insulation (Insulation Thickness)</td>
<td>≥0.5</td>
<td>mm</td>
</tr>
<tr>
<td>(R_{IO})</td>
<td>Insulation Resistance at (T_S), (V_{IO} = 500) V</td>
<td>&gt;10⁹</td>
<td>(\Omega)</td>
</tr>
</tbody>
</table>

ABSOLUTE MAXIMUM RATINGS (\(T_A = 25^\circ C\) unless otherwise noted)

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Parameter</th>
<th>Device</th>
<th>Value</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>(T_{STG})</td>
<td>Storage Temperature</td>
<td>All</td>
<td>−40 to +150</td>
<td>°C</td>
</tr>
<tr>
<td>(T_{OPR})</td>
<td>Operating Temperature</td>
<td>All</td>
<td>−40 to +85</td>
<td>°C</td>
</tr>
<tr>
<td>(T_J)</td>
<td>Junction Temperature Range</td>
<td>All</td>
<td>−40 to +100</td>
<td>°C</td>
</tr>
<tr>
<td>(T_{SOL})</td>
<td>Lead Solder Temperature</td>
<td>All</td>
<td>260 for 10 seconds</td>
<td>°C</td>
</tr>
<tr>
<td>(P_D)</td>
<td>Total Device Power Dissipation at 25°C Ambient</td>
<td>All</td>
<td>250</td>
<td>mW</td>
</tr>
<tr>
<td></td>
<td>Derate Above 25°C</td>
<td></td>
<td>2.94</td>
<td>mW/°C</td>
</tr>
<tr>
<td>(I_F)</td>
<td>Continuous Forward Current</td>
<td>All</td>
<td>60</td>
<td>mA</td>
</tr>
<tr>
<td>(V_R)</td>
<td>Reverse Voltage</td>
<td>All</td>
<td>6</td>
<td>V</td>
</tr>
<tr>
<td>(P_D)</td>
<td>Total Power Dissipation at 25°C Ambient</td>
<td>All</td>
<td>120</td>
<td>mW</td>
</tr>
<tr>
<td></td>
<td>Derate Above 25°C</td>
<td></td>
<td>1.41</td>
<td>mW/°C</td>
</tr>
<tr>
<td>(V_{DRM})</td>
<td>Off–State Output Terminal Voltage</td>
<td>All</td>
<td>600</td>
<td>V</td>
</tr>
<tr>
<td>(I_{TSM})</td>
<td>Peak Non–Repetitive Surge Current (Single Cycle 60 Hz Sine Wave)</td>
<td>All</td>
<td>1</td>
<td>(A_{peak})</td>
</tr>
<tr>
<td>(I_{TM})</td>
<td>Peak Repetitive On–State Current</td>
<td>All</td>
<td>100</td>
<td>mA_{peak}</td>
</tr>
<tr>
<td>(P_D)</td>
<td>Total Power Dissipation at 25°C Ambient</td>
<td>All</td>
<td>150</td>
<td>mW</td>
</tr>
<tr>
<td></td>
<td>Derate Above 25°C</td>
<td></td>
<td>1.76</td>
<td>mW/°C</td>
</tr>
</tbody>
</table>

Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

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### ELECTRICAL CHARACTERISTICS

(\(T_A = 25^\circ\text{C},\) unless otherwise noted)

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Parameter</th>
<th>Test Conditions</th>
<th>Device</th>
<th>Min</th>
<th>Typ</th>
<th>Max</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>(V_F)</td>
<td>Input Forward Voltage</td>
<td>(I_F = 30) mA</td>
<td>All</td>
<td>–</td>
<td>1.3</td>
<td>1.5</td>
<td>V</td>
</tr>
<tr>
<td>(I_R)</td>
<td>Reverse Leakage Current</td>
<td>(V_R = 6) V</td>
<td>All</td>
<td>–</td>
<td>0.005</td>
<td>100</td>
<td>(\mu)A</td>
</tr>
</tbody>
</table>

### INDIVIDUAL COMPONENT CHARACTERISTICS

#### Emitter
- **\(V_F\) Input Forward Voltage**
  - \(I_F = 30\) mA
  - All
  - Min: –
  - Typ: 1.3 V
  - Max: 1.5 V

#### Detector
- **\(I_{DRM1}\) Peak Blocking Current, Either Direction**
  - \(V_{DRM} = 600\) V, \(I_F = 0\) (Note 1)
  - MOC306XM
  - Min: –
  - Typ: 10 nA
  - Max: 500 nA
  - MOC316XM
  - Min: –
  - Typ: 10 nA
  - Max: 100 nA

- **\(dv/dt\) Critical Rate of Rise of Off-State Voltage**
  - \(I_F = 0\) (Note 2)
  - MOC306XM
  - Min: 600 V/\(\mu\)s
  - Max: 1500 V/\(\mu\)s
  - MOC316XM
  - Min: 1000 V/\(\mu\)s
  - Max: –

### Transfer Characteristics
- **\(I_{FT}\) LED Trigger Current (Rated \(I_{FT}\))**
  - Main Terminal Voltage = 3 V (Note 3)
  - MOC3061M
  - Min: –
  - Typ: 15 mA
  - MOC3062M
  - Min: –
  - Typ: 10 mA
  - MOC3162M
  - Min: –
  - Typ: 5 mA
  - MOC3063M
  - Min: –
  - Typ: 10 mA
  - MOC3163M
  - Min: –
  - Typ: 5 mA

- **\(V_{TM}\) Peak On-State Voltage, Either Direction**
  - \(I_{TM} = 100\) mA peak, \(I_F = \text{rated } I_{FT}\)
  - All
  - Min: 1.8 V
  - Max: 3.0 V

- **\(I_{H}\) Holding Current, Either Direction**
  - All
  - Min: 500 \(\mu\)A
  - Max: –

### Zero Crossing Characteristics
- **\(V_{INH}\) Inhibit Voltage (MT1–MT2 Voltage Above Which Device will not Trigger)**
  - \(I_F = \text{rated } I_{FT}\)
  - MOC3061M
  - Min: –
  - Typ: 12 V
  - Max: 20 V
  - MOC3062M
  - Min: –
  - Typ: 12 V
  - Max: 15 V
  - MOC3162M
  - Min: –
  - Typ: 12 V
  - Max: 15 V
  - MOC3163M
  - Min: –
  - Typ: 12 V
  - Max: 15 V

- **\(I_{DRM2}\) Leakage in Inhibited State**
  - \(I_F = \text{rated } I_{FT}, V_{DRM} = 600\) V, off-state
  - All
  - Min: –
  - Typ: –
  - Max: 2 mA

### Isolation Characteristics
- **\(V_{ISO}\) Isolation Voltage**
  - \(f = 60\) Hz, \(t = 1\) Minute
  - \(\text{Max: } 4170\) V

- **\(R_{ISO}\) Isolation Resistance**
  - \(V_{O} = 500\) V
  - \(\text{Min: } 1011\) \(\Omega\)

- **\(C_{ISO}\) Isolation Capacitance**
  - \(V = 0\) V, \(f = 1\) MHz
  - \(\text{Max: } 0.2\) pF

Product parametric performance is indicated in the Electrical Characteristics for the listed test conditions, unless otherwise noted. Product performance may not be indicated by the Electrical Characteristics if operated under different conditions.

1. Test voltage must be applied within \(dv/dt\) rating.
2. This is static \(dv/dt\). Commutating \(dv/dt\) is a function of the load–driving thyristor(s) only.
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 \(I_{FT}\) (15 mA for MOC3061M, 10 mA for MOC3062M and MOC3162M, 5 mA for MOC3063M and MOC3163M) and absolute maximum \(I_F\) (60 mA).
4. 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.
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
Figure 5. $I_{ORM2}$, 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
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.

\( \text{Rin} \) is calculated so that \( I_F \) is equal to the rated \( I_{FT} \) of the part, 15 mA for the MOC3061M, 10 mA for the MOC3062M, or 5 mA for the MOC3063M.

The 39 \( \Omega \) 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 ON Semiconductor triac driver. Diodes can be 1N4001; resistors, R1 and R2, are optional 330 \( \Omega \).

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

Figure 9. Hot-Line Switching Application Circuit

Figure 10. Inverse-Parallel SCR Driver Circuit
Table: Profile Features and Pb-Free Assembly Profile

<table>
<thead>
<tr>
<th>Profile Feature</th>
<th>Pb-Free Assembly Profile</th>
</tr>
</thead>
<tbody>
<tr>
<td>Temperature Minimum (Tsmin)</td>
<td>150°C</td>
</tr>
<tr>
<td>Temperature Maximum (Tmax)</td>
<td>200°C</td>
</tr>
<tr>
<td>Time (tL) from (Tsmin to Tmax)</td>
<td>60 seconds to 120 seconds</td>
</tr>
<tr>
<td>Ramp–up Rate (TL to TP)</td>
<td>3°C/second maximum</td>
</tr>
<tr>
<td>Liquidous Temperature (TL)</td>
<td>217°C</td>
</tr>
<tr>
<td>Time (tL) Maintained Above (TL)</td>
<td>60 seconds to 150 seconds</td>
</tr>
<tr>
<td>Peak Body Package Temperature</td>
<td>260°C +0°C / –5°C</td>
</tr>
<tr>
<td>Time (tp) within 5°C of 260°C</td>
<td>30 seconds</td>
</tr>
<tr>
<td>Ramp–down Rate (TP to TL)</td>
<td>6°C/second maximum</td>
</tr>
<tr>
<td>Time 25°C to Peak Temperature</td>
<td>8 minutes maximum</td>
</tr>
</tbody>
</table>

**Figure 11. Reflow Profile**
## ORDERING INFORMATION (Note 5)

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Package</th>
<th>Shipping †</th>
</tr>
</thead>
<tbody>
<tr>
<td>MOC3061M</td>
<td>DIP 6–Pin (Pb–Free)</td>
<td>50 Units / Tube</td>
</tr>
<tr>
<td>MOC3061SM</td>
<td>SMT 6–Pin (Lead Bend) (Pb–Free)</td>
<td>50 Units / Tube</td>
</tr>
<tr>
<td>MOC3061SR2M</td>
<td>SMT 6–Pin (Lead Bend) (Pb–Free)</td>
<td>1000 / Tape &amp; Reel</td>
</tr>
<tr>
<td>MOC3061VM</td>
<td>DIP 6–Pin, DIN EN/IEC60747–5–5 Option (Pb–Free)</td>
<td>50 Units / Tube</td>
</tr>
<tr>
<td>MOC3061SVM</td>
<td>SMT 6–Pin (Lead Bend), DIN EN/IEC60747–5–5 Option (Pb–Free)</td>
<td>50 Units / Tube</td>
</tr>
<tr>
<td>MOC3061SR2VM</td>
<td>SMT 6–Pin (Lead Bend), DIN EN/IEC60747–5–5 Option (Pb–Free)</td>
<td>1000 / Tape &amp; Reel</td>
</tr>
<tr>
<td>MOC3061TVM</td>
<td>DIP 6–Pin, 0.4” Lead Spacing, DIN EN/IEC60747–5–5 Option (Pb–Free)</td>
<td>50 Units / Tube</td>
</tr>
</tbody>
</table>

†For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, BRD8011/D.

5. The product orderable part number system listed in this table also applies to the MOC3062M, MOC3063M, MOC3162M, and MOC3163M product families.
MECHANICAL CASE OUTLINE
PACKAGE DIMENSIONS

PDIP6 8.51x6.35, 2.54P
CASE 646BX
ISSUE O

DATE 31 JUL 2016

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

DOCUMENT NUMBER: 98AON13449G
DESCRIPTION: PDIP6 8.51X6.35, 2.54P

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**PDIP6 8.51x6.35, 2.54P**

**CASE 646BZ**

**ISSUE 0**

DATE 31 JUL 2016

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