FAIRCHILD
SEMICONDUCTOR™

GlobalOptoisolator™

VDE | UL | CSA | SETI | SEMKO | DEMKO | NEMKO | BABT

# 6-Pin DIP Random-Phase Optoisolators Triac Driver Output
## (400 Volts Peak)

**MOC3021**
**MOC3022**
**MOC3023**

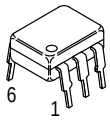
The MOC3020 Series consists of gallium arsenide infrared emitting diodes, optically coupled to a silicon bilateral switch.

- ***To order devices that are tested and marked per VDE 0884 requirements, the suffix "V" must be included at end of part number. VDE 0884 is a test option.***

They are designed for applications requiring isolated triac triggering.

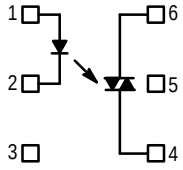
**Recommended for 115/240 Vac(rms) Applications:**

- Solenoid/Valve Controls
- Lamp Ballasts
- Interfacing Microprocessors to 115 Vac Peripherals
- Motor Controls
- Static ac Power Switch
- Solid State Relays
- Incandescent Lamp Dimmers




**STANDARD THRU HOLE**

**SCHEMATIC**




1. ANODE
2. CATHODE
3. NC
4. MAIN TERMINAL
5. SUBSTRATE
   DO NOT CONNECT
6. MAIN TERMINAL

**MAXIMUM RATINGS** ($T_A$ = 25°C unless otherwise noted)

| Rating | Symbol | Value | Unit |
|---|---|---|---|
| **INFRARED EMITTING DIODE** | | | |
| Reverse Voltage | $V_R$ | 3 | Volts |
| Forward Current — Continuous | $I_F$ | 60 | mA |
| Total Power Dissipation @ $T_A$ = 25°C<br>Negligible Power in Triac Driver<br>Derate above 25°C | $P_D$ | 100<br><br>1.33 | mW<br><br>mW/°C |
| **OUTPUT DRIVER** | | | |
| Off–State Output Terminal Voltage | $V_{DRM}$ | 400 | Volts |
| Peak Repetitive Surge Current<br>(PW = 1 ms, 120 pps) | $I_{TSM}$ | 1 | A |
| Total Power Dissipation @ $T_A$ = 25°C<br>Derate above 25°C | $P_D$ | 300<br>4 | mW<br>mW/°C |
| **TOTAL DEVICE** | | | |
| Isolation Surge Voltage(1)<br>(Peak ac Voltage, 60 Hz, 1 Second Duration) | $V_{ISO}$ | 7500 | Vac(pk) |
| Total Power Dissipation @ $T_A$ = 25°C<br>Derate above 25°C | $P_D$ | 330<br>4.4 | mW<br>mW/°C |
| Junction Temperature Range | $T_J$ | –40 to +100 | °C |
| Ambient Operating Temperature Range | $T_A$ | –40 to +85 | °C |
| Storage Temperature Range | $T_{stg}$ | –40 to +150 | °C |
| Soldering Temperature (10 s) | $T_L$ | 260 | °C |

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 noted)

| Characteristic | | Symbol | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| **INPUT LED** | | | | | | |
| Reverse Leakage Current ($V_R$ = 3 V) | | $I_R$ | — | 0.05 | 100 | μA |
| Forward Voltage ($I_F$ = 10 mA) | | $V_F$ | — | 1.15 | 1.5 | Volts |
| **OUTPUT DETECTOR** ($I_F$ = 0 unless otherwise noted) | | | | | | |
| Peak Blocking Current, Either Direction (Rated $V_{DRM}$(1)) | | $I_{DRM}$ | — | 10 | 100 | nA |
| Peak On–State Voltage, Either Direction ($I_{TM}$ = 100 mA Peak) | | $V_{TM}$ | — | 1.8 | 3 | Volts |
| Critical Rate of Rise of Off–State Voltage (Figure 7, Note 2) | | dv/dt | — | 10 | — | V/μs |
| **COUPLED** | | | | | | |
| LED Trigger Current, Current Required to Latch Output (Main Terminal Voltage = 3 V(3)) | MOC3021 | $I_{FT}$ | — | 8 | 15 | mA |
| | MOC3022 | | — | — | 10 | |
| | MOC3023 | | — | — | 5 | |
| Holding Current, Either Direction | | $I_H$ | — | 100 | — | μA |

1. Test voltage must be applied within dv/dt rating.
2. This is static dv/dt. See Figure 7 for test circuit. 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 MOC3021, 10 mA for MOC3022, 5 mA for MOC3023) and absolute max $I_F$ (60 mA).

## TYPICAL ELECTRICAL CHARACTERISTICS

**$T_A$ = 25°C**

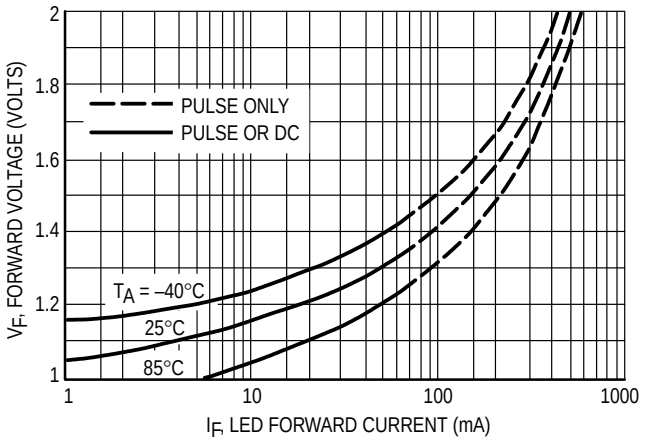



**Figure 1. LED Forward Voltage versus Forward Current**

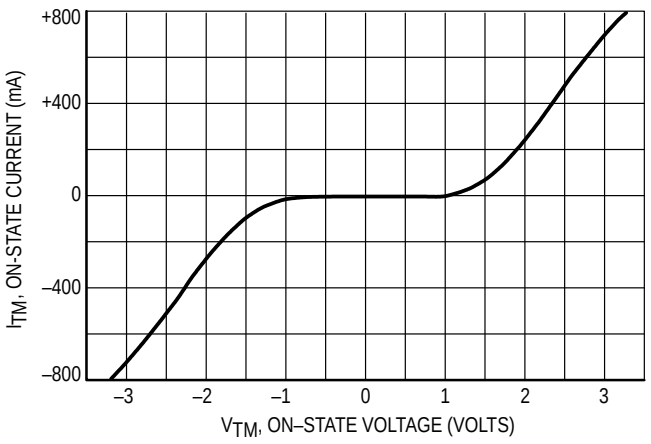



**Figure 2. On–State Characteristics**

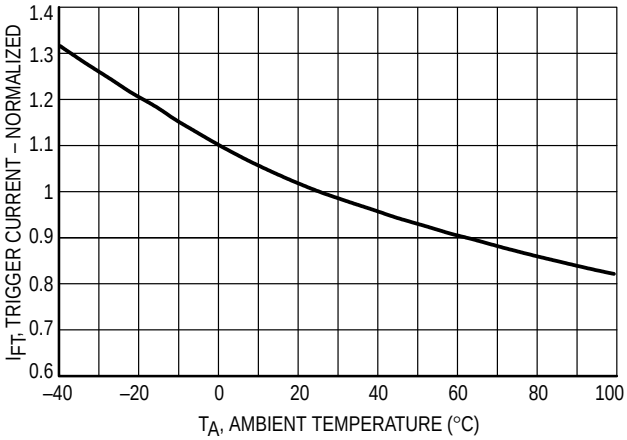



**Figure 3. Trigger Current versus Temperature**

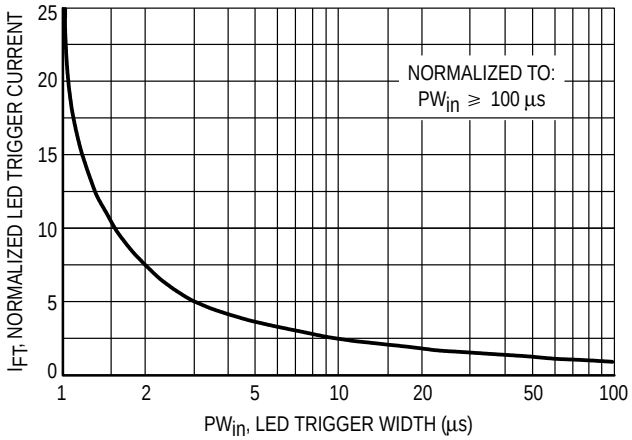



**Figure 4. LED Current Required to Trigger versus LED Pulse Width**

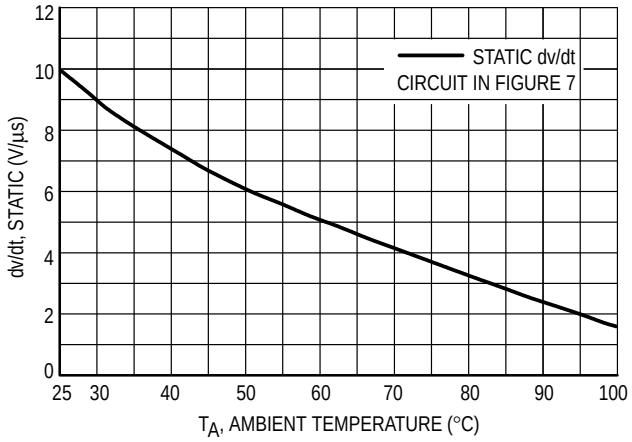



**Figure 5. dv/dt versus Temperature**

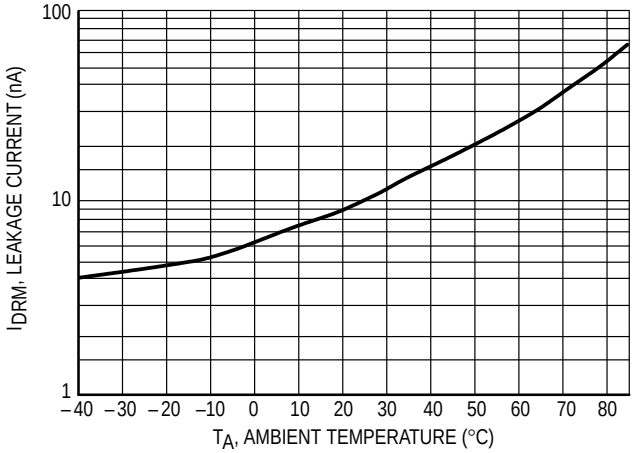
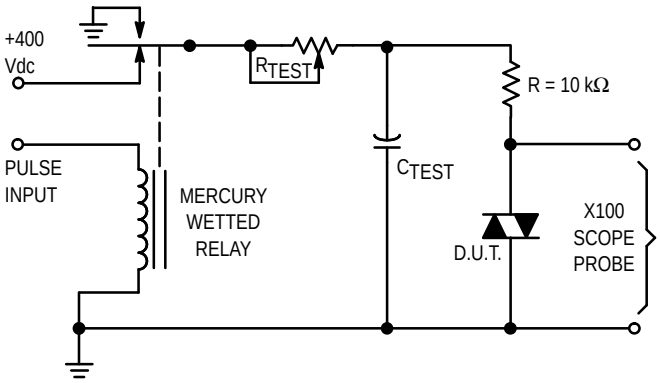



**Figure 6. Leakage Current, $I_{DRM}$ versus Temperature**




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.

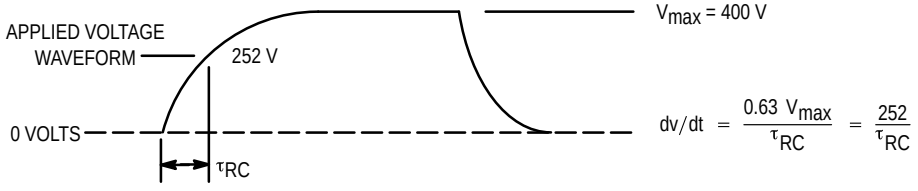
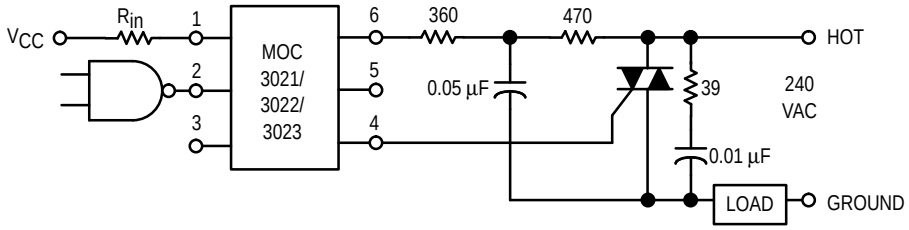



**Figure 7. Static dv/dt Test Circuit**




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

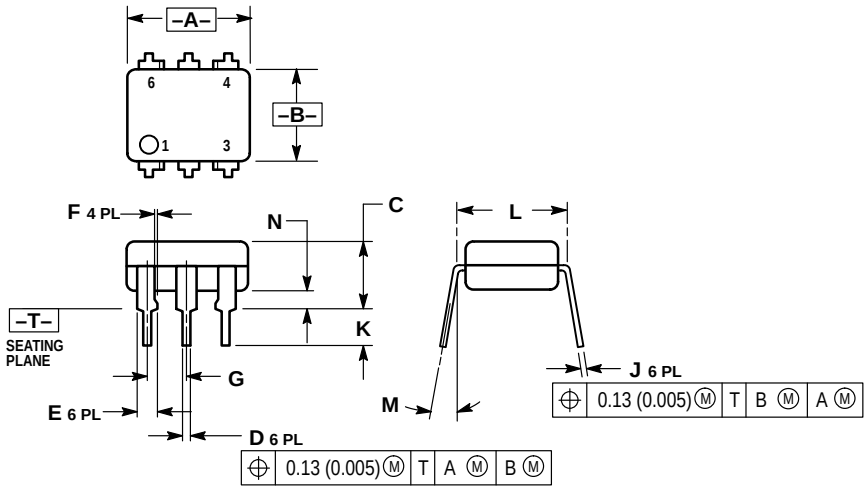
Additional information on the use of optically coupled triac drivers is available in Application Note AN–780A.

In this circuit the “hot” side of the line is switched and the load connected to the cold or ground side.

The 39 ohm resistor and 0.01 µF capacitor are for snubbing of the triac, and the 470 ohm resistor and 0.05 µF capacitor are for snubbing the coupler. These components may or may not be necessary depending upon the particular triac and load used.

**Figure 8. Typical Application Circuit**

## PACKAGE DIMENSIONS

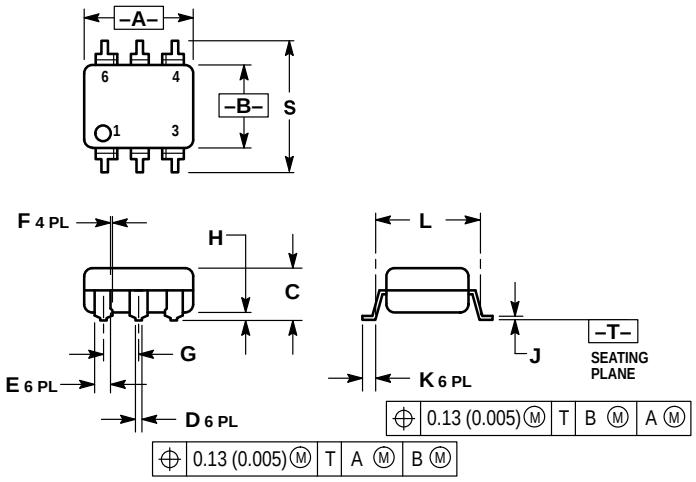



NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.
3. DIMENSION L TO CENTER OF LEAD WHEN FORMED PARALLEL.

| | INCHES | | MILLIMETERS | |
|---|---|---|---|---|
| DIM | MIN | MAX | MIN | MAX |
| A | 0.320 | 0.350 | 8.13 | 8.89 |
| B | 0.240 | 0.260 | 6.10 | 6.60 |
| C | 0.115 | 0.200 | 2.93 | 5.08 |
| D | 0.016 | 0.020 | 0.41 | 0.50 |
| E | 0.040 | 0.070 | 1.02 | 1.77 |
| F | 0.010 | 0.014 | 0.25 | 0.36 |
| G | 0.100 BSC | | 2.54 BSC | |
| J | 0.008 | 0.012 | 0.21 | 0.30 |
| K | 0.100 | 0.150 | 2.54 | 3.81 |
| L | 0.300 BSC | | 7.62 BSC | |
| M | 0° | 15° | 0° | 15° |
| N | 0.015 | 0.100 | 0.38 | 2.54 |

STYLE 6:
PIN 1. ANODE
2. CATHODE
3. NC
4. MAIN TERMINAL
5. SUBSTRATE
6. MAIN TERMINAL

### THRU HOLE

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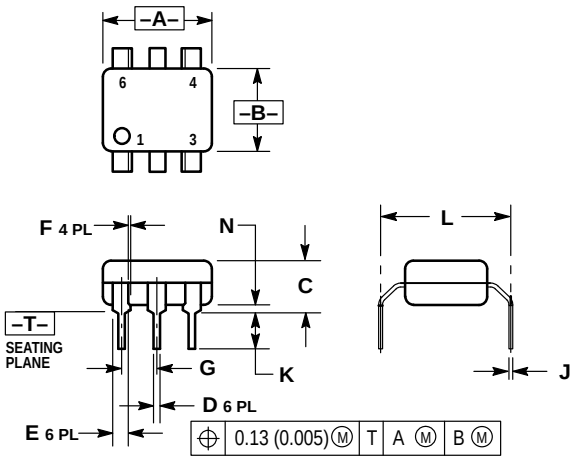
| C | 0.115 | 0.200 | 2.93 | 5.08 |
| D | 0.016 | 0.020 | 0.41 | 0.50 |
| E | 0.040 | 0.070 | 1.02 | 1.77 |
| F | 0.010 | 0.014 | 0.25 | 0.36 |
| G | 0.100 BSC | | 2.54 BSC | |
| H | 0.020 | 0.025 | 0.51 | 0.63 |
| J | 0.008 | 0.012 | 0.20 | 0.30 |
| K | 0.006 | 0.035 | 0.16 | 0.88 |
| L | 0.320 BSC | | 8.13 BSC | |
| S | 0.332 | 0.390 | 8.43 | 9.90 |

### SURFACE MOUNT

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|---|---|---|---|---|
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| B | 0.240 | 0.260 | 6.10 | 6.60 |
| C | 0.115 | 0.200 | 2.93 | 5.08 |
| D | 0.016 | 0.020 | 0.41 | 0.50 |
| E | 0.040 | 0.070 | 1.02 | 1.77 |
| F | 0.010 | 0.014 | 0.25 | 0.36 |
| G | 0.100 BSC | | 2.54 BSC | |
| J | 0.008 | 0.012 | 0.21 | 0.30 |
| K | 0.100 | 0.150 | 2.54 | 3.81 |
| L | 0.400 | 0.425 | 10.16 | 10.80 |
| N | 0.015 | 0.040 | 0.38 | 1.02 |

**0.4" LEAD SPACING**

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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.