

FOD410, FOD4108, FOD4116, FOD4118 6-Pin DIP Zero-Cross Triac Drivers

Features

- 300mA on-state current
- Zero-voltage crossing
- High blocking voltage
 - 800V (FOD4108, FOD4118)
 - 600V (FOD410, FOD4116)
- High trigger sensitivity
 - 1.3mA (FOD4116, FOD4118)
 - 2mA (FOD410, FOD4108)
- High static dv/dt (10,000V/μs)
- UL, VDE, CSA approved
- Lead free assembly

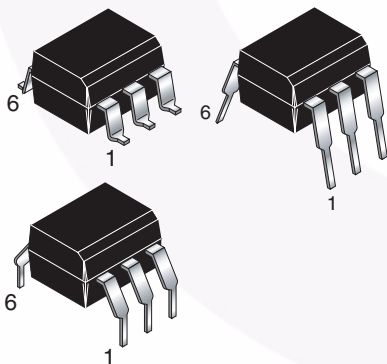
Applications

- Solid-state relays
- Industrial controls
- Lighting controls
- Static power switches
- AC motor starters

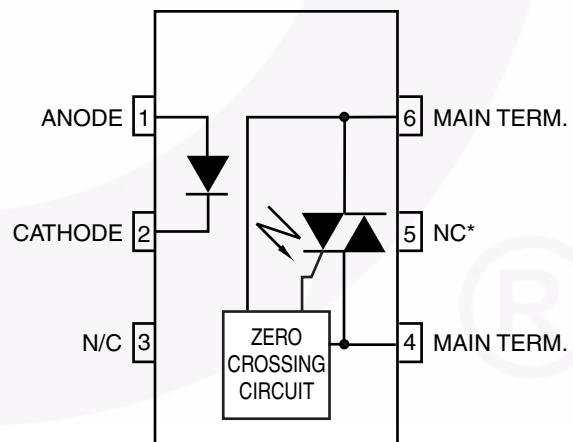
Description

The FOD410, FOD4108, FOD4116 and FOD4118 devices consist of an infrared emitting diode coupled to a hybrid triac formed with two inverse parallel SCRs which form the triac function capable of driving discrete triacs. The FOD4116 and FOD4118 utilize a high efficiency infrared emitting diode which offers an improved trigger sensitivity. These devices are housed in a standard 6-pin dual in-line (DIP) package.

Package



Schematic



*DO NOT CONNECT
(TRIAC SUBSTRATE)

Absolute Maximum Ratings ($T_A = 25^\circ\text{C}$ 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 | -55 to +150 | $^\circ\text{C}$ |
| T_{OPR} | Operating Temperature | All | -55 to +100 | $^\circ\text{C}$ |
| T_{SOL} | Lead Solder Temperature (Wave) | All | 260 for 10 sec | $^\circ\text{C}$ |
| T_J | Junction Temperature Range | All | 125 | $^\circ\text{C}$ |
| V_{ISO} | Isolation Test Voltage ⁽¹⁾ (rms AC voltage, 60Hz, 1 min. duration) | All | 5000 | Vac(rms) |
| P_{DTOTAL} | Total Device Power Dissipation @ 25°C Derate above 25°C | All | 500 | mW |
| | | | 6.6 | mW/ $^\circ\text{C}$ |
| EMITTER | | | | |
| I_F | Continuous Forward Current | All | 30 | mA |
| V_R | Reverse Voltage | All | 6 | V |
| P_{DE} | Total Power Dissipation 25°C Ambient Derate above 25°C | All | 50 | mW |
| | | | 0.71 | mW/ $^\circ\text{C}$ |
| DETECTOR | | | | |
| V_{DRM} | Off-State Output Terminal Voltage | FOD410, FOD4116 | 600 | V |
| | | FOD4108, FOD4118 | 800 | |
| I_{TSM} | Peak Non-Repetitive Surge Current (single cycle 60Hz sine wave) | All | 3 | A |
| I_{TM} | Peak On-State Current | All | 300 | mA |
| P_{DDET} | Total Power Dissipation @ 25°C Ambient Derate above 25°C | All | 450 | mW |
| | | | 5.9 | mW/ $^\circ\text{C}$ |

Note:

1. Isolation voltage, V_{ISO} , is an internal device dielectric breakdown rating. For this test, Pins 1, 2 and 3 are common, and Pins 4, 5 and 6 are common. 5,000 VRMS for 1 minute duration is equivalent to 6,000 VRMS for 1 second duration.

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 = 20mA | All | | 1.25 | 1.5 | V |
| I _R | Reverse Leakage Current | V _R = 6V | All | | 0.0001 | 10 | μA |
| DETECTOR | | | | | | | |
| I _{D(RMS)} | Peak Blocking Current, Either Direction | I _F = 0, T _A = 100°C ⁽²⁾ | V _D = 800V | FOD4108, FOD4118 | 3 | 100 | μA |
| | | | V _D = 600V | FOD410, FOD4116 | | | |
| I _{R(RMS)} | Reverse Current | T _A = 100°C | V _D = 800V | FOD4108, FOD4118 | 3 | 100 | μA |
| | | | V _D = 600V | FOD410, FOD4116 | | | |
| dv/dt | Critical Rate of Rise of Off-State Voltage | I _F = 0 ⁽⁴⁾ (Fig. 11) | | 10,000 | | | V/μs |

Transfer Characteristics

| Symbol | DC Characteristics | Test Conditions | Device | Min. | Typ.* | Max. | Units |
|----------------------|---|---|---|--------------------------|--------|------|-------|
| I _{FT} | LED Trigger Current | Main Terminal Voltage = 5V ⁽³⁾ | FOD410, FOD4108 | | 0.65 | 2.0 | mA |
| | | | FOD4116, FOD4118 | | 0.65 | 1.3 | |
| V _{TM} | Peak On-State Voltage, Either Direction | I _{TM} = 300 mA peak, I _F = rated I _{FT} | All | | 2.2 | 3 | V |
| I _H | Holding Current, Either Direction | V _T = 3V | All | | 200 | 500 | μA |
| I _L | Latching Current | V _T = 2.2V | All | | 5 | | mA |
| t _{ON} | Turn-On Time | PF = 1.0, I _T = 300mA | V _{RM} = V _{DM} = 565 VAC | FOD4108 | | 60 | μs |
| | | | V _{RM} = V _{DM} = 424 VAC | FOD410, FOD4116, FOD4118 | | | |
| t _{OFF} | Turn-Off Time | | V _{RM} = V _{DM} = 565 VAC | FOD4108 | | 52 | μs |
| | | | V _{RM} = V _{DM} = 424 VAC | FOD410, FOD4116, FOD4118 | | | |
| dv/dt _{crq} | Critical Rate of Rise of Voltage at Current Commutation | V _D = 0.67 V _{DRM} , di/dt _{crq} ≤ 15 A/ms | T _j = 25°C | All | 10,000 | | V/μs |
| | | | T _j = 80°C | | 5,000 | | |
| di/dt _{cr} | Critical Rate of Rise of On-State Current | | All | | | 8 | A/μs |
| dV(IO)/dt | Critical Rate of Rise of Coupled Input/Output Voltage | I _T = 0A, V _{RM} = V _{DM} = 424VAC | All | | 10,000 | | V/μs |

*Typical values at T_A = 25°C

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

Zero Crossing Characteristics

| Symbol | DC Characteristics | Test Conditions | Min. | Typ.* | Max. | Units |
|------------|---|---|------|-------|------|---------------|
| V_{INH} | Inhibit Voltage (MT1-MT2 voltage above which device will not trigger) | $I_F = \text{Rated } I_{FT}$ | | 8 | 25 | V |
| I_{DRM2} | Leakage in Inhibited State | $I_F = \text{Rated } I_{FT}$, Rated V_{DRM} , off state | | 20 | 200 | μA |

Isolation Characteristics

| Symbol | Characteristics | Test Conditions | Min. | Typ.* | Max. | Units |
|-----------|--------------------------------|--|------|-------|------|----------|
| V_{ISO} | Input-Output Isolation Voltage | $f = 60\text{Hz}$, $t = 1 \text{ min.}^{(5)}$ | 5000 | | | Vac(rms) |

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

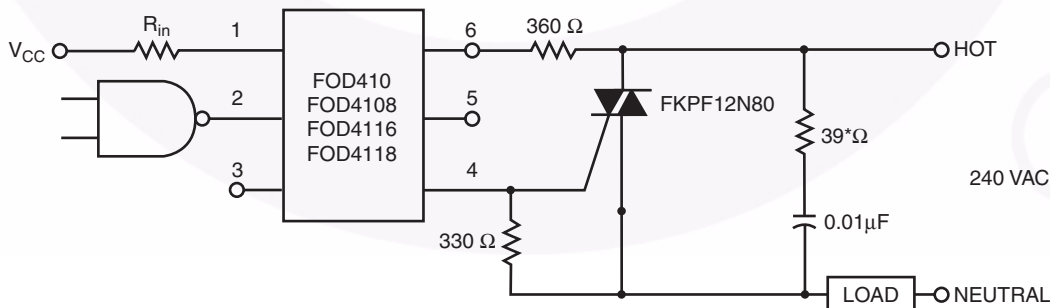
Notes:

- 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_{FT} . Therefore, recommended operating I_F lies between max I_{FT} (2mA for FOD410 and FOD4108 and 1.3mA for FOD4116 and FOD4118 and the absolute max I_F (60mA).
- This is static dv/dt . See Figure 11 for test circuit. Commutating dv/dt is a function of the load-driving thyristor(s) only.
- Isolation voltage, V_{ISO} , is an internal device dielectric breakdown rating. For this test, Pins 1, 2 and 3 are common, and Pins 4, 5 and 6 are common.

Typical Application

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, 2mA for FOD410 and FOD4108, 1.3mA for FOD4116 and FOD4118. The 39 Ω resistor and 0.01 μF capacitor are for snubbing of the triac and may or may not be necessary depending upon the particular triac and load use.



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

Figure 1. Hot-Line Switching Application Circuit

Typical Performance Curves

Figure 2. Forward Voltage (V_F) vs. Forward Current (I_F)

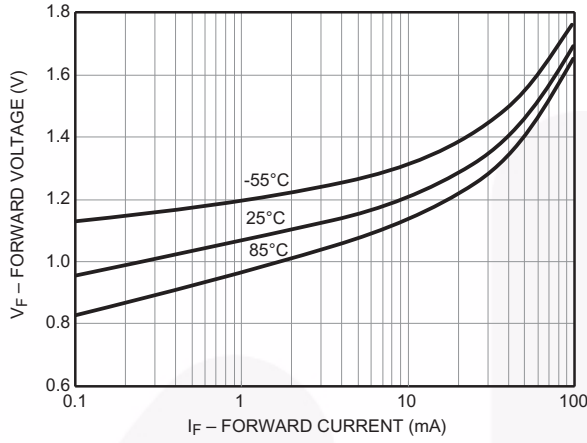


Figure 3. Normalized LED Trigger Current (I_{FT}) vs. Ambient Temperature (T_A)

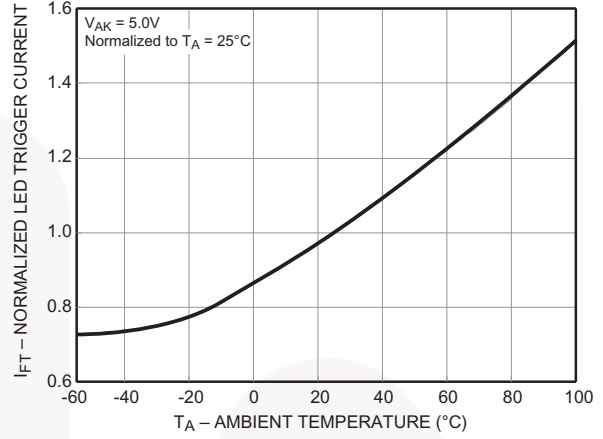


Figure 4. Peak LED Current vs. Duty Factor, Tau

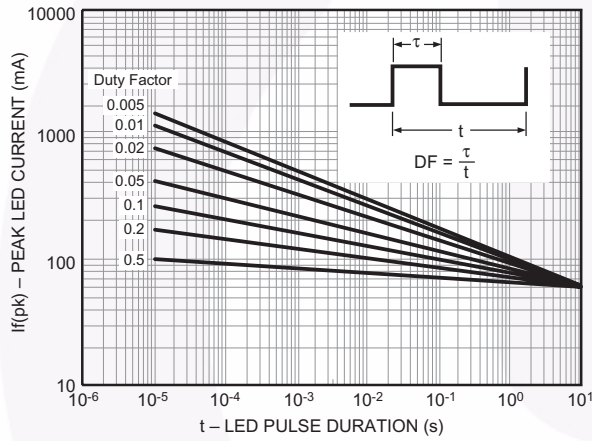


Figure 5. Trigger Delay Time

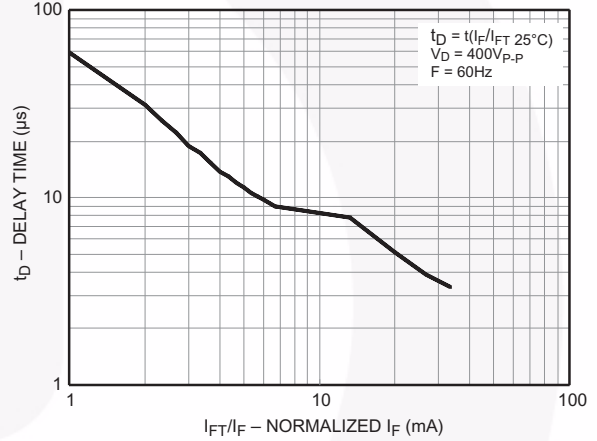


Figure 6. Pulse Trigger Current

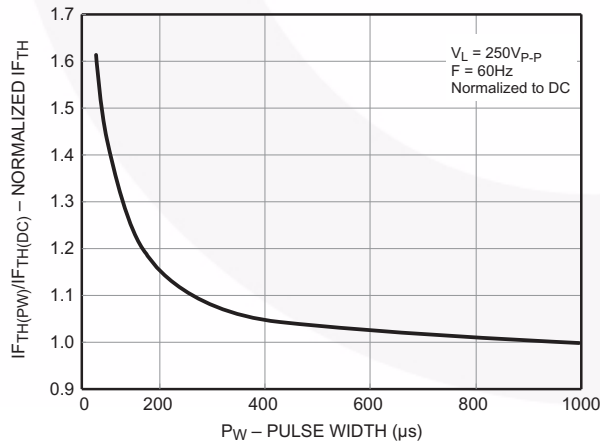
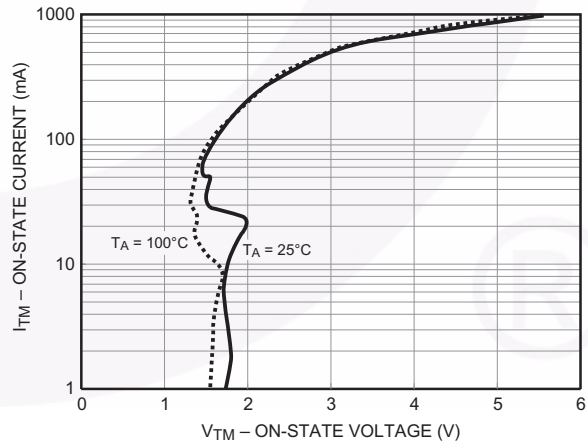


Figure 7. On-State Voltage (V_{TM}) vs. On-State Current (I_{TM})



Typical Performance Curves (Continued)

Figure 8. Normalized Holding Current (I_H) vs. Ambient Temperature (T_A)

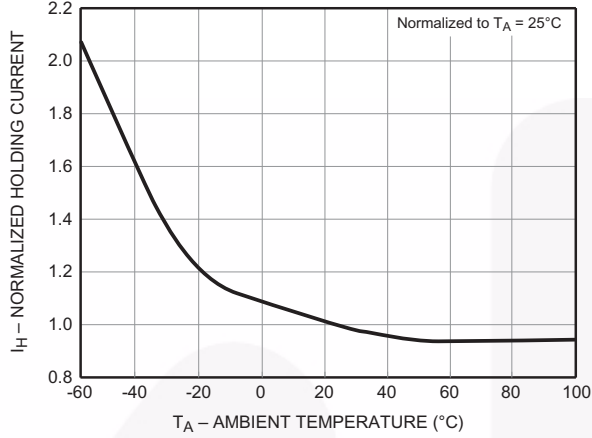


Figure 9. Normalized Off-State Current (I_{DRM}) vs. Ambient Temperature (T_A)

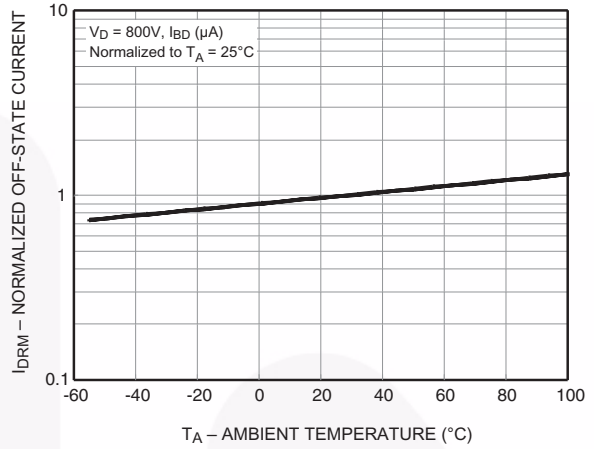


Figure 10. Normalized Inhibit Voltage (V_{INH}) vs. Ambient Temperature (T_A)

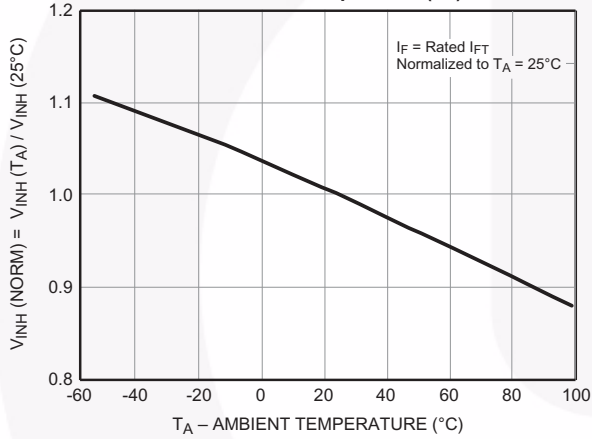


Figure 11. Normalized Leakage in Inhibit State (I_{DRM2}) vs. Ambient Temperature (T_A)

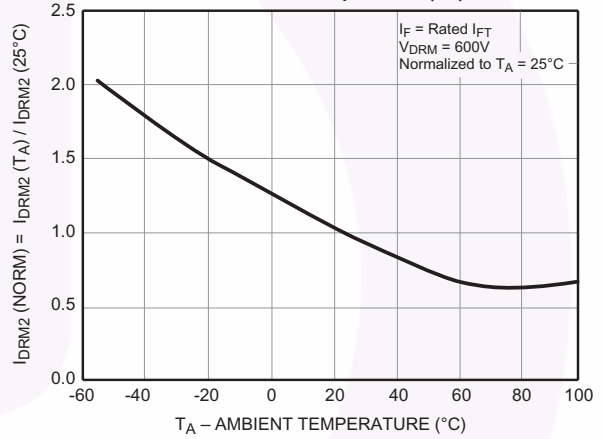
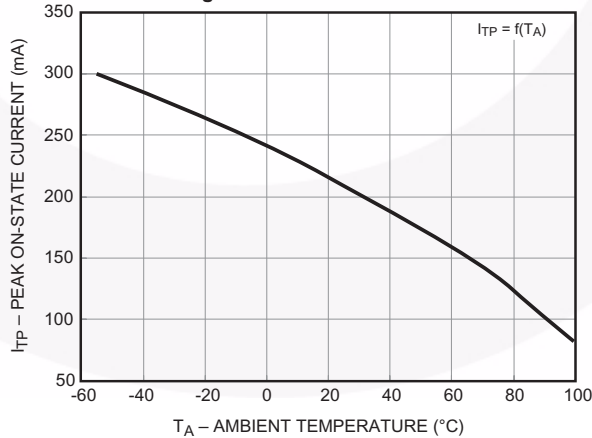
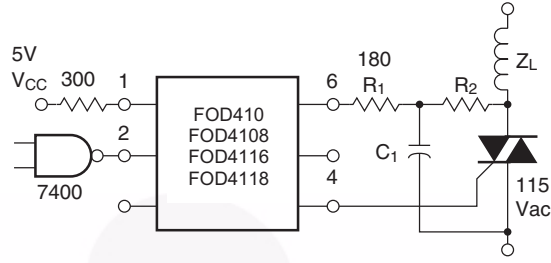


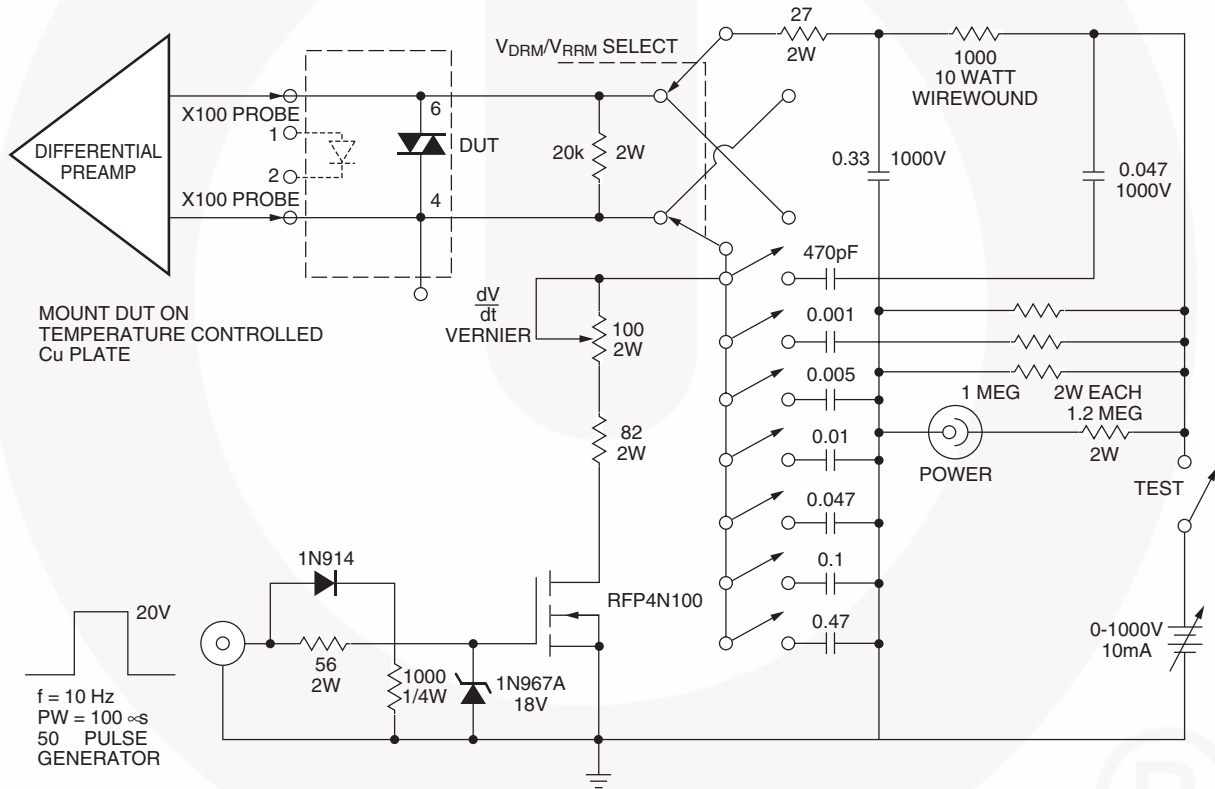
Figure 12. Current Reduction





NOTE: Circuit supplies 25mA drive to gate of triac at $V_{in} = 25V$ and $T_A < 70^\circ C$

| TRIAC | | |
|----------|-------|-----|
| I_{GT} | R_2 | C |
| 15 mA | 2400 | 0.1 |
| 30 mA | 1200 | 0.2 |
| 50 mA | 800 | 0.3 |



ALL COMPONENTS ARE NON-INDUCTIVE UNLESS SHOWN

Figure 11. Circuit for Static $\frac{dv}{dt}$ Measurement of Power Thyristors

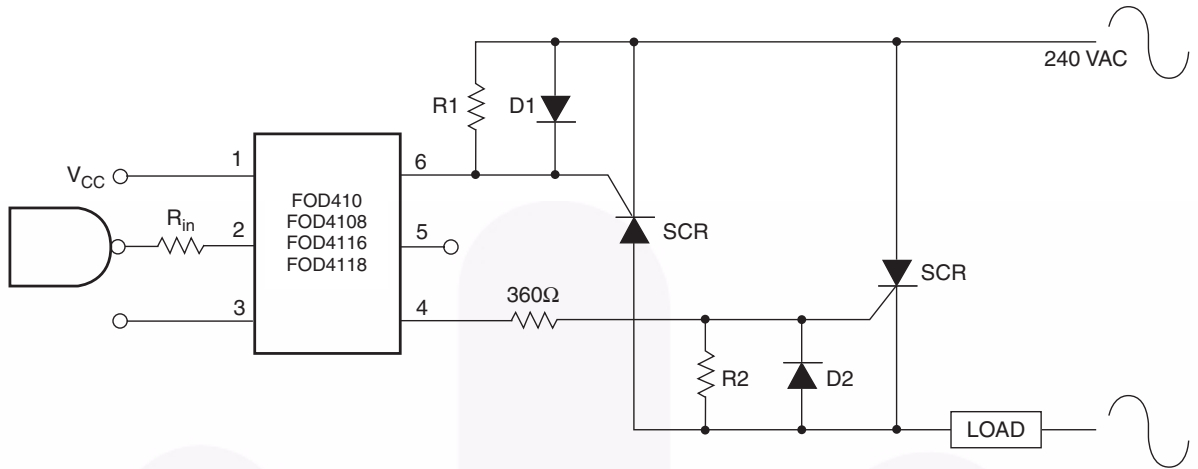


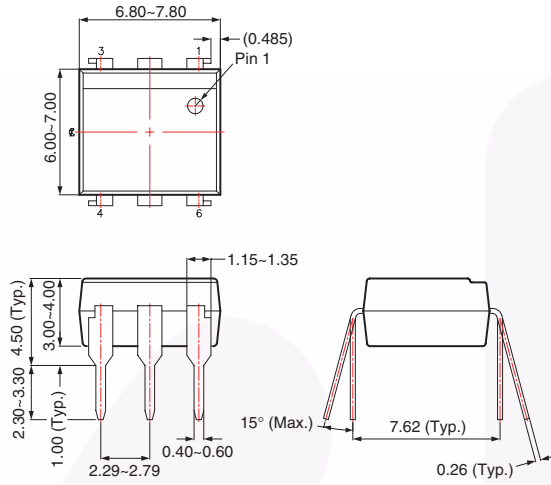
Figure 12. Inverse-Parallel SCR Driver Circuit

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.

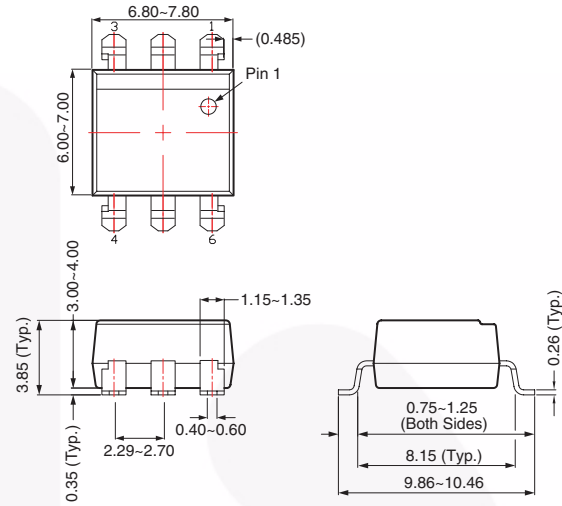
Note: This optoisolator should not be used to drive a load directly. It is intended to be a discrete triac driver device only.

Package Dimensions

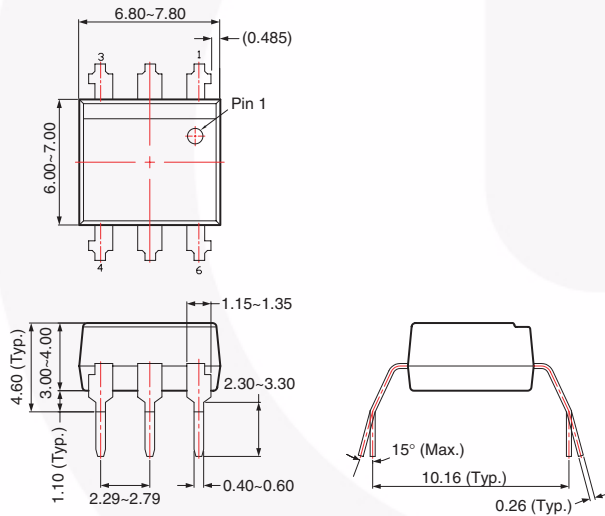
Through Hole



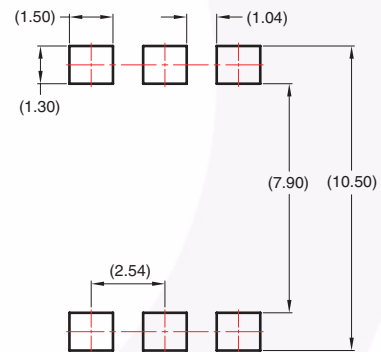
Surface Mount



0.4" Lead Spacing



Recommended Pad Layout for Surface Mount Leadforms



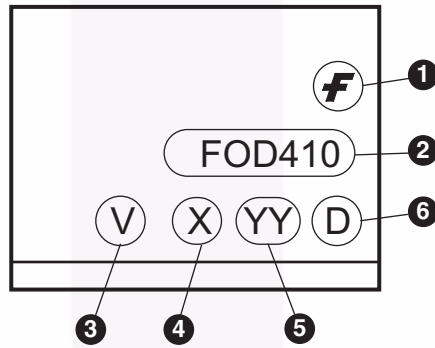
Note:

All dimensions are in millimeters.

Ordering Information

| Option | Order Entry Identifier (example) | Description |
|--------|----------------------------------|--|
| None | FOD410 | Standard Through Hole Device |
| S | FOD410S | Surface Mount Lead Bend |
| SD | FOD410SD | Surface Mount; Tape and reel |
| T | FOD410T | 0.4" Lead Spacing |
| V | FOD410V | IEC60747-5-2 certification |
| TV | FOD410TV | IEC60747-5-2 certification, 0.4" Lead Spacing |
| SV | FOD410SV | IEC60747-5-2 certification, Surface Mount |
| SDV | FOD410SDV | IEC60747-5-2 certification, Surface Mount, Tape & Reel |

Marking Information



| Definitions | |
|-------------|---|
| 1 | Fairchild logo |
| 2 | Device number |
| 3 | VDE mark indicates IEC60747-5-2 certified (Note: Only appears on parts ordered with VDE option – See order entry table) |
| 4 | One digit year code, e.g., '7' |
| 5 | Two digit work week ranging from '01' to '53' |
| 6 | Assembly package code |

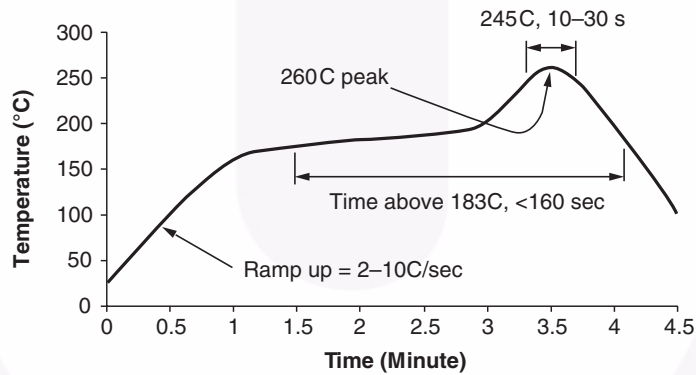
Carrier Tape Specifications



Note:

All dimensions are in inches (millimeters).

Reflow Profile






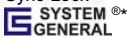


- Peak reflow temperature: 260C (package surface temperature)
- Time of temperature higher than 183C for 160 seconds or less
- One time soldering reflow is recommended



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| Datasheet Identification | Product Status | Definition |
|--------------------------|-----------------------|---|
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| Preliminary | First Production | Datasheet contains preliminary data; supplementary data will be published at a later date. Fairchild Semiconductor reserves the right to make changes at any time without notice to improve design. |
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Rev. 140



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