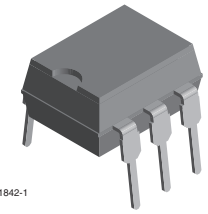
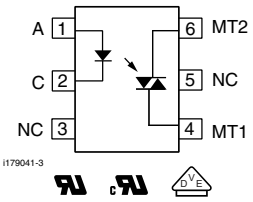
# Optocoupler, Phototriac Output, High dV/dt, Low Input Current




## DESCRIPTION

The IL4216, IL4217, IL4218 consists of an AlGaAs IRLED optically coupled to a pair of photosensitive non-zero crossing SCR chips and are connected inversely parallel to form a TRIAC. These three semiconductors are assembled in a six pin 0.3 inch dual in-line package.

High input sensitivity is achieved by using an emitter follower phototransistor and a cascaded SCR predriver resulting in an LED trigger current of less than 1.3 mA (DC). The use of a proprietary dV/dt clamp results in a static dV/dt of greater than 10 kV/µs. This clamp circuit has a MOSFET that is enhanced when high dV/dt spikes occur between MT1 and MT2 of the TRIAC. The FET clamps the base of the phototransistor when conducting, disabling the internal SCR predriver.

The blocking voltage of up to 800 V permits control of off-line voltages up to 240 $V_{AC}$, with a safety factor more than two, and is sufficient for as much as 380 $V_{AC}$. Current handling capability is up to 300 mA RMS, continuous at 25 °C.

The IL4216, IL4217, IL4218 isolates low-voltage logic from 120, 240, and 380 VAC lines to control resistive inductive, or capacitive loads including motors solenoids, high current thyristors or TRIAC and relays.

## FEATURES

- High input sensitivity $I_{FT}$ = 1.3 mA
- 300 mA on-state current
- High static dV/dt 10000 V/µs, typical
- Very low leakage < 10 µA
- Isolation test voltage 5300 $V_{RMS}$
- Compliant to RoHS Directive 2002/95/EC and in accordance to WEEE 2002/96/EC

Pb-free

e3

RoHS COMPLIANT

## APPLICATIONS

- Solid state relay
- Industrial controls
- Office equipment
- Consumer appliances

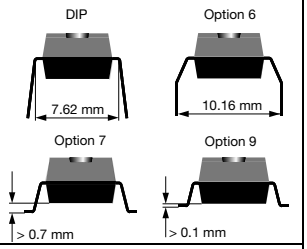
## AGENCY APPROVALS

- UL1577, file no. E52744 system code J
- CSA 93751
- DIN EN 60747-5-5 (VDE 0884) available with option 1
- BSI IEC60950; IEC60065
- FIMKO

## ORDERING INFORMATION

| I | L | 4 | 2 | 1 | # | - | X | 0 | # | # | T |
|---|---|---|---|---|---|---|---|---|---|---|---|

PART NUMBER — PACKAGE OPTION — TAPE AND REEL




| AGENCY CERTIFIED/PACKAGE | BLOCKING VOLTAGE $V_{DRM}$ (V) | | |
|---|---|---|---|
| **UL, cUL, BSI, FIMKO** | **600** | **700** | **800** |
| DIP-6 | IL4216 | IL4217 | IL4218 |
| DIP-6, 400 mil, option 6 | IL4216-X006 | - | IL4218-X006 |
| SMD-6, option 7 | IL4216-X007T | IL4217-X007 | - |
| SMD-6, option 9 | IL4216-X009T (1) | IL4217-X009 | - |
| **VDE, UL, cUL, BSI, FIMKO** | **600** | **700** | **800** |
| DIP-6 | IL4216-X001 | - | IL4218-X001 |
| DIP-6, 400 mil, option 6 | IL4216-X016 | - | IL4218-X016 |
| SMD-6, option 7 | - | - | IL4218-X017T (1) |
| SMD-6, option 9 | - | - | IL4218-X019T (1) |

**Note**

(1) Also available in tubes, do not put T on the end.

| **ABSOLUTE MAXIMUM RATINGS** (1) ($T_{amb}$ = 25 °C, unless otherwise specified) | | | | | |
|---|---|---|---|---|---|
| **PARAMETER** | **TEST CONDITION** | **PART** | **SYMBOL** | **VALUE** | **UNIT** |
| **INPUT** | | | | | |
| Reverse voltage | | | $V_R$ | 6 | V |
| Forward current | | | $I_F$ | 60 | mA |
| Surge current | | | $I_{FSM}$ | 2.5 | A |
| Power dissipation | | | $P_{diss}$ | 100 | mW |
| Derate linearly from 25 °C | | | | 1.33 | mW/°C |
| Thermal resistance | | | $R_{th}$ | 750 | °C/W |
| **OUTPUT** | | | | | |
| Peak off-state voltage | | IL4216 | $V_{DRM}$ | 600 | V |
| | | IL4217 | $V_{DRM}$ | 700 | V |
| | | IL4218 | $V_{DRM}$ | 800 | V |
| RMS on-state current | | | $I_{DRM}$ | 300 | mA |
| Single cycle surge | | | $I_{TSM}$ | 3 | A |
| Power dissipation | | | $P_{diss}$ | 300 | mW |
| Derate linearly from 25 °C | | | | 6.6 | mW/°C |
| Thermal resistance | | | $R_{th}$ | 150 | °C/W |
| **COUPLER** | | | | | |
| Creepage distance | | | | ≥ 7 | mm |
| Clearance | | | | ≥ 7 | mm |
| Storage temperature | | | $T_{stg}$ | - 55 to + 150 | °C |
| Ambient temperature | | | $T_{amb}$ | - 55 to + 100 | °C |
| Isolation test voltage | | | $V_{ISO}$ | 5300 | $V_{RMS}$ |
| Isolation resistance | $V_{IO}$ = 500 V, $T_{amb}$ = 25 °C | | $R_{IO}$ | ≥ $10^{12}$ | Ω |
| | $V_{IO}$ = 500 V, $T_{amb}$ = 100 °C | | $R_{IO}$ | ≥ $10^{11}$ | Ω |
| Lead soldering temperature (2) | 5 s | | $T_{sld}$ | 260 | °C |

**Notes**

(1) Stresses in excess of the absolute maximum ratings can cause permanent damage to the device. Functional operation of the device is not implied at these or any other conditions in excess of those given in the operational sections of this document. Exposure to absolute maximum ratings for extended periods of the time can adversely affect reliability.

(2) Refer to reflow profile for soldering conditions for surface mounted devices (SMD). Refer to wave profile for soldering conditions for through hole devices (DIP).

| **ELECTRICAL CHARACTERISTICS** ($T_{amb}$ = 25 °C, unless otherwise specified) | | | | | | | |
|---|---|---|---|---|---|---|---|
| **PARAMETER** | **TEST CONDITION** | **PART** | **SYMBOL** | **MIN.** | **TYP.** | **MAX.** | **UNIT** |
| **INPUT** | | | | | | | |
| Forward voltage | $I_F$ = 20 mA | | $V_F$ | | 1.3 | 1.5 | V |
| Breakdown voltage | $I_R$ = 10 µA | | $V_{BR}$ | 6 | 30 | | V |
| Reverse current | $V_R$ = 6 V | | $I_R$ | | 0.1 | 10 | µA |
| Input capacitance | $V_F$ = 0 V, f = 1 MHz | | $C_{IN}$ | | 40 | | pF |
| Thermal resistance, junction to lead | | | $R_{thjl}$ | | 750 | | °C/W |
| **OUTPUT** | | | | | | | |
| Repetitive peak off-state voltage | $I_{DRM}$ = 100 µA | IL4216 | $V_{DRM}$ | 600 | 650 | | V |
| | | IL4217 | $V_{DRM}$ | 700 | 750 | | V |
| | | IL4218 | $V_{DRM}$ | 800 | 850 | | V |
| Off-state voltage | $I_{D(RMS)}$ = 70 µA | IL4216 | $V_{D(RMS)}$ | 424 | 460 | | V |
| | | IL4217 | $V_{D(RMS)}$ | 484 | 536 | | V |
| | | IL4218 | $V_{D(RMS)}$ | 565 | 613 | | V |
| Off-state current | $V_D$ = 600 V, $T_{amb}$ = 100 °C | | $I_{D(RMS)}$ | | 10 | 100 | µA |
| Reverse current | $V_R$ = 600 V, $T_{amb}$ = 25 °C | | $I_{RMS}$ | | 10 | 100 | µA |
| On-state voltage | $I_T$ = 300 mA | | $V_{TM}$ | | 1.7 | 3 | V |
| On-state current | PF = 1, $V_{T(RMS)}$ = 1.7 V | | $I_{TM}$ | | | 300 | mA |
| Surge (non-repetitive, on-state current) | f = 50 Hz | | $I_{TSM}$ | | | 3 | A |
| Holding current | $V_T$ = 3 V | | $I_H$ | | 65 | 200 | µA |
| Latching current | $V_T$ = 2.2 V | | $I_L$ | | | 500 | µA |
| LED trigger current | $V_{AK}$ = 5 V | | $I_{FT}$ | | 0.7 | | mA |
| Critical rate of rise of off-state voltage | $V_D$ = 0.67 $V_{DRM}$, $T_{amb}$ = 25 °C | | $dV/dt_{cr}$ | 10 000 | | | V/µs |
| | $V_D$ = 0.67 $V_{DRM}$, $T_{amb}$ = 80 °C | | $dV/dt_{cr}$ | 5000 | | | V/µs |
| Critical rate of rise of voltage at current commutation | $V_D$ = 230 $V_{RMS}$, $I_D$ = 300 $mA_{RMS}$, $T_J$ = 25 °C | | $dV/dt_{crq}$ | | 8 | | V/µs |
| | $V_D$ = 230 $V_{RMS}$, $I_D$ = 300 $mA_{RMS}$, $T_J$ = 85 °C | | $dV/dt_{crq}$ | | 7 | | V/µs |
| Critical rate of rise of on-state current commutation | $V_D$ = 230 $V_{RMS}$, $I_D$ = 300 $mA_{RMS}$, $T_J$ = 25 °C | | $dI/dt_{crq}$ | | 12 | | A/ms |
| Thermal resistance, junction to lead | | | $R_{thjl}$ | | 150 | | °C/W |
| **COUPLER** | | | | | | | |
| Capacitance (input to output) | f = 1 MHz, $V_{IO}$ = 0 V | | $C_{IO}$ | | 0.8 | | pF |
| Critical rate of rise of coupled input to output voltage | $I_T$ = 0, $V_{RM}$ = $V_{DM}$ = 300 VAC | | $dV_{(IO)}/dt$ | 5000 | 1 | | mA |

**Note**

- Minimum and maximum values are testing requirements. Typical values are characteristics of the device and are the result of engineering evaluation. Typical values are for information only and are not part of the testing requirements.

## POWER FACTOR CONSIDERATIONS

A snubber is not needed to eliminate false operation of the TRIAC driver because of the IL4216, IL4217, IL4218 high static and commutating dV/dt with loads between 1 and 0.8 power factors. When inductive loads with power factors less than 0.8 are being driven, include a RC snubber or a single capacitor directly across the device to damp the peak commutating dV/dt spike. Normally a commutating dV/dt causes a turning-off device to stay on due to the stored energy remaining in the turning-off device.

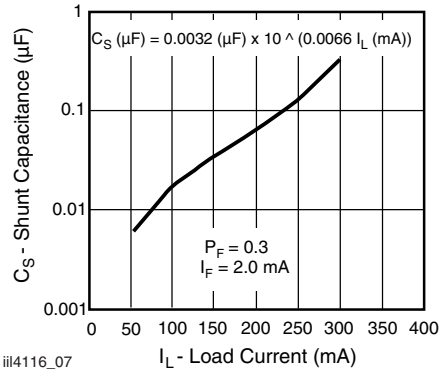



Fig. 1 - Shunt Capacitance vs. Load Current vs. Power Factor

## TYPICAL CHARACTERISTICS ($T_{amb}$ = 25 °C, unless otherwise specified)

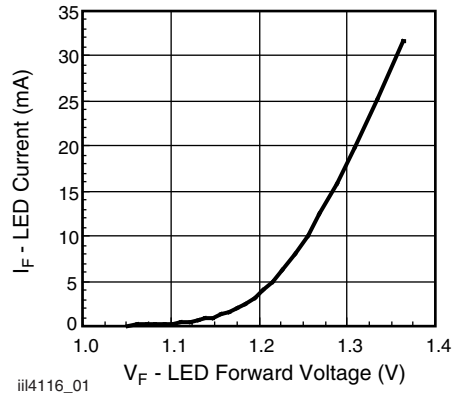



Fig. 2 - LED Forward Current vs. Forward Voltage

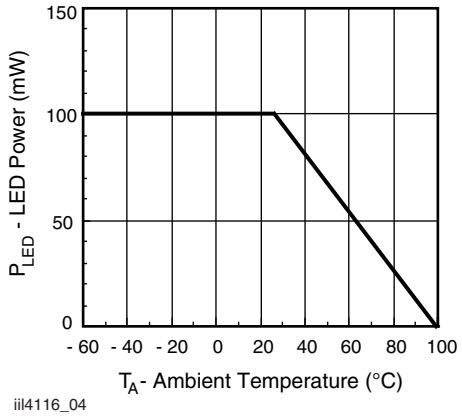



Fig. 5 - Maximum LED Power Dissipation

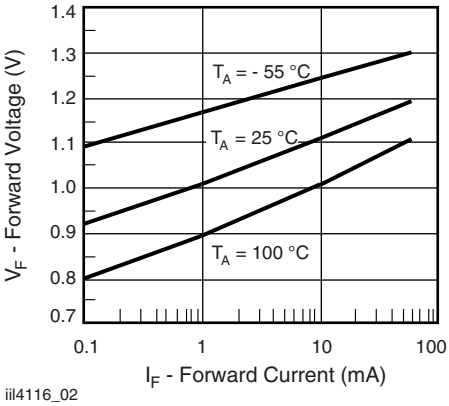



Fig. 3 - Forward Voltage vs. Forward Current

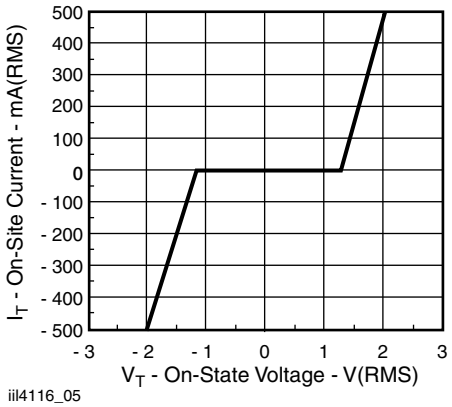



Fig. 6 - On-State Terminal Voltage vs. Terminal Current

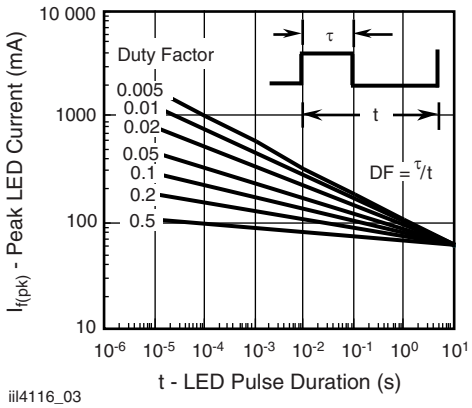



Fig. 4 - Peak LED Current vs. Duty Factor, τ

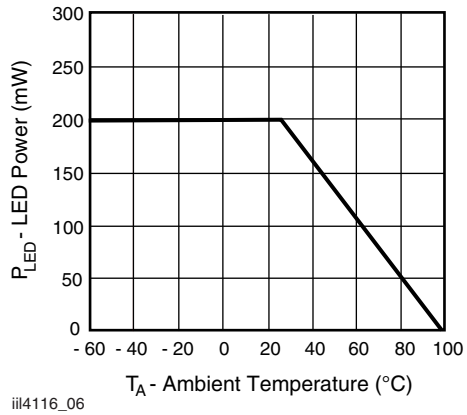
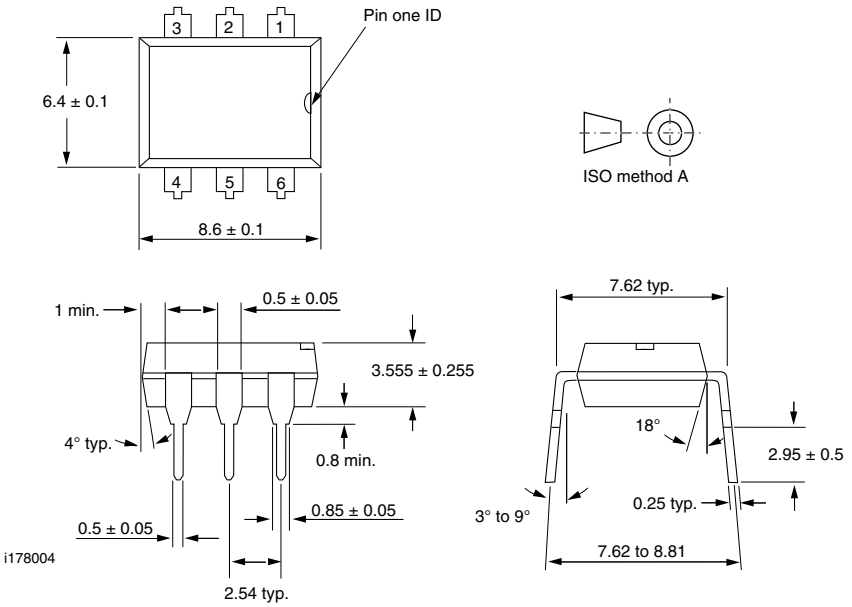
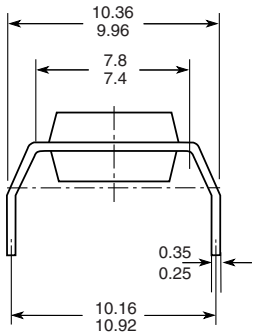



Fig. 7 - Maximum Output Power Dissipation

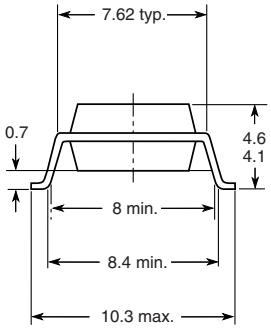
**PACKAGE DIMENSIONS** in millimeters



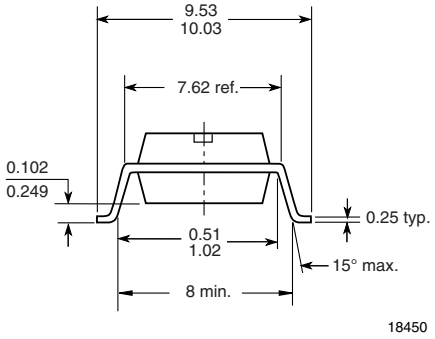

**Option 6**




**Option 7**




**Option 9**



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