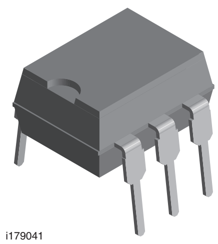
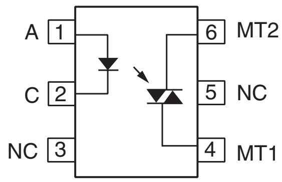
Optocoupler, Phototriac Output, High dV/dt, Very Low Input Current





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 IL4216/IL4217/IL4218 uses two discrete SCRs resulting in a commutating dV/dt of greater than 10 kV/µs. 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 VAC, with a safety factor more than two, and is sufficient for as much as 380 VAC. 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
- Inverse parallel SCRs provide commutating dV/dt > 10 kV/ µs
- Very Low Leakage < 10 µA
- Isolation test voltage 5300 V_{RMS}
- Lead (Pb)-free component
- Component in accordance to RoHS 2002/95/EC and WEEE 2002/96/EC

APPLICATIONS

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

AGENCY APPROVALS

- UL1577, file no. E52744 system code J
- CSA 93751
- DIN EN 60747-5-2 (VDE 0884)/DIN EN 60747-5-5 pending available with option 1
- BSI IEC 60950; IEC 60065
- FIMKO

ORDER INFORMATION

PART	REMARKS
IL4216	600 V V_{DRM}, DIP-6
IL4217	700 V V_{DRM}, DIP-6
IL4218	800 V V_{DRM}, DIP-6
IL4216-X006	600 V V_{DRM}, DIP-6 400 mil (option 6)
IL4216-X009	600 V V_{DRM}, SMD-6 (option 9)
IL4217-X007	700 V V_{DRM}, SMD-6 (option 7)
IL4217-X009	700 V V_{DRM}, SMD-6 (option 9)
IL4218-X006	800 V V_{DRM}, DIP-6 400 mil (option 6)
IL4218-X007	800 V V_{DRM}, SMD-6 (option 7)
IL4218-X009	800 V V_{DRM}, SMD-6 (option 9)

Note

For additional information on the available options refer to option information.

ABSOLUTE MAXIMUM RATINGS (1)					
PARAMETER	**TEST CONDITION**	**PART**	**SYMBOL**	**VALUE**	**UNIT**
INPUT					
Reverse voltage			V_R	6.0	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}	3.0	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				≥ 7.0	mm
Clearance				≥ 7.0	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}	$\geq 10^{12}$	Ω
	V_{IO} = 500 V, T_{amb} = 100 °C		R_{IO}	$\geq 10^{11}$	Ω
Lead soldering temperature (2)	5.0 s		T_{sld}	260	°C

Notes

(1) T_{amb} = 25 °C, unless otherwise specified.
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							
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}	6.0	30		V
Reverse current	V_R = 6.0 V		I_R		0.1	10	µA
Input capacitance	V_F = 0 V, f = 1.0 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	3.0	V
On-state current	PF = 1.0, $V_{T(RMS)}$ = 1.7 V		I_{TM}			300	mA
Surge (non-repetitive, on-state current)	f = 50 Hz		I_{TSM}			3.0	A
Holding current	V_T = 3.0 V		I_H		65	200	µA
Latching current	V_T = 2.2 V		I_L		5.0		mA
LED trigger current	V_{AK} = 5.0 V		I_{FT}		0.7	1.3	mA
Critical rate of rise of off-state voltage	V_D = 0.67 V_{DRM}, T_{amb} = 25 °C		dV/dt_{cr}	10000			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 = 0.67 V_{DRM}, $dI/dt_{crq} \leq$ 15 A/ms, T_{amb} = 25 °C		dV/dt_{crq}	10000			V/µs
	V_D = 0.67 V_{DRM}, $dI/dt_{crq} \leq$ 15 A/ms, T_{amb} = 80 °C		dV/dt_{crq}	5000			V/µs
Off-state current	I_T = 300 mA		dI/dt		100		A/ms
Thermal resistance, junction to lead			R_{thjl}		150		°C/W
COUPLER							
Capacitance (input to output)	f = 1.0 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	1.0		mA

Note

T_{amb} = 25 °C, unless otherwise specified.
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.

But in the case of a zero voltage crossing optotriac, the commutating dV/dt spikes can inhibit one half of the TRIAC from turning on. If the spike potential exceeds the inhibit voltage of the zero cross detection circuit, half of the TRIAC will be held-off and not turn-on. This hold-off condition can be eliminated by using a snubber or capacitor placed directly across the optotriac as shown in Figure 1. Note that the value of the capacitor increases as a function of the load current.

The hold-off condition also can be eliminated by providing a higher level of LED drive current. The higher LED drive provides a larger photocurrent which causes. The phototransistor to turn-on before the commutating spike has activated the zero cross network. Figure 8 shows the relationship of the LED drive for power factors of less than 1.0. The curve shows that if a device requires 1.5 mA for a resistive load, then 1.8 times (2.7 mA) that amount would be required to control an inductive load whose power factor is less than 0.3.

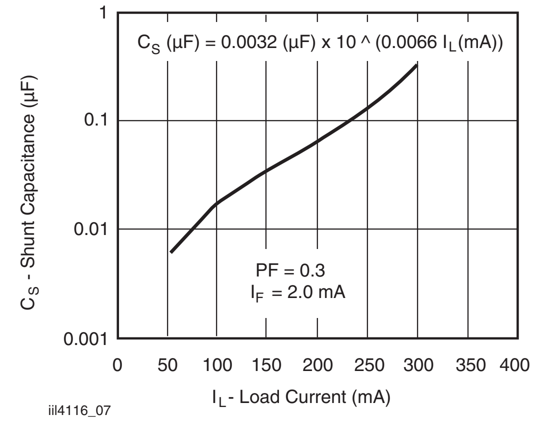


Fig. 3 - Shunt Capacitance vs. Load Current vs. Power Factor

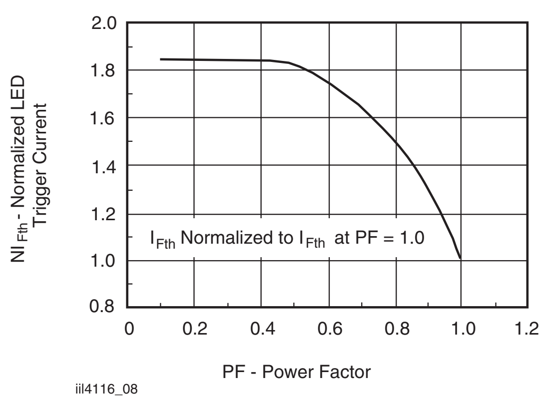


Fig. 4 - Normalized LED Trigger Current

TYPICAL CHARACTERISTICS

T_{amb} = 25 °C, unless otherwise specified

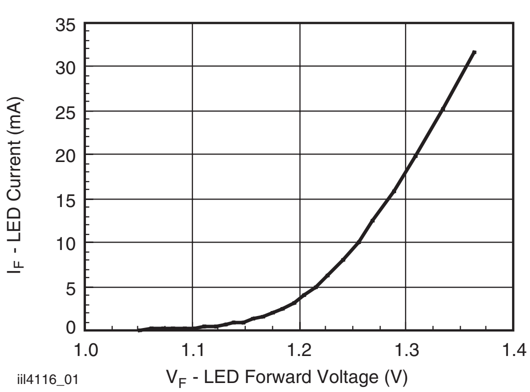


Fig. 5 - LED Forward Current vs. Forward Voltage

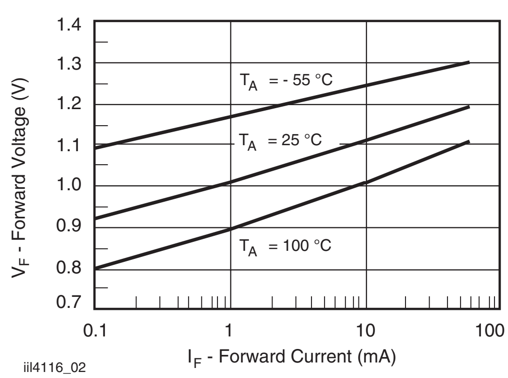


Fig. 6 - Forward Voltage vs. Forward Current

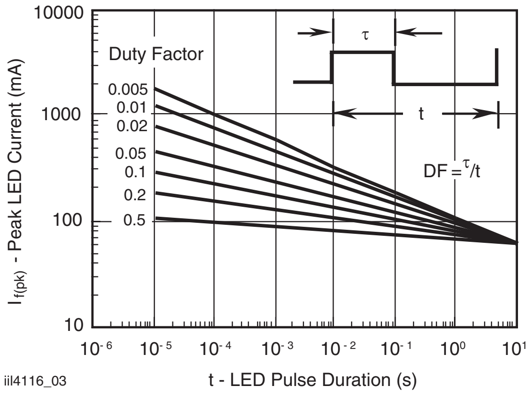


Fig. 7 - Peak LED Current vs. Duty Factor, τ

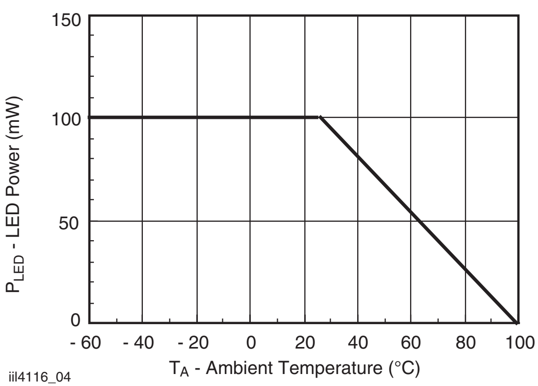


Fig. 8 - Maximum LED Power Dissipation

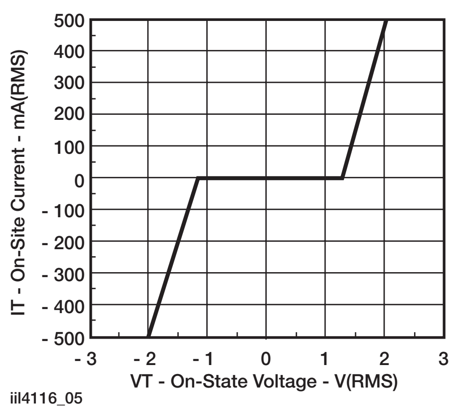


Fig. 9 - On-State Terminal Voltage vs. Terminal Current

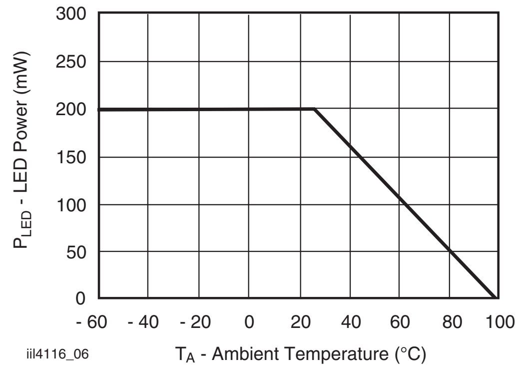
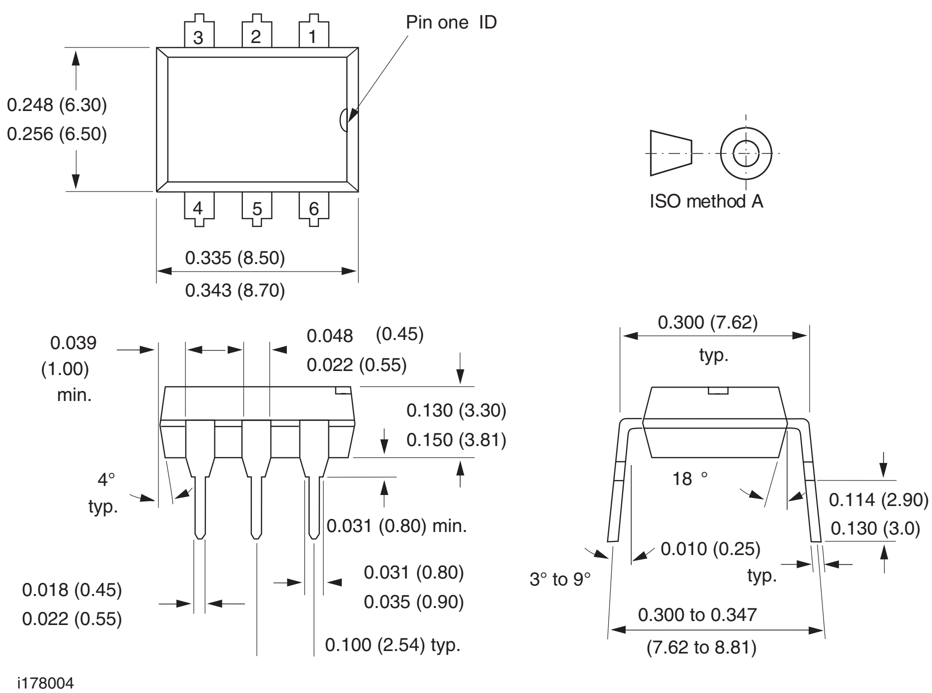
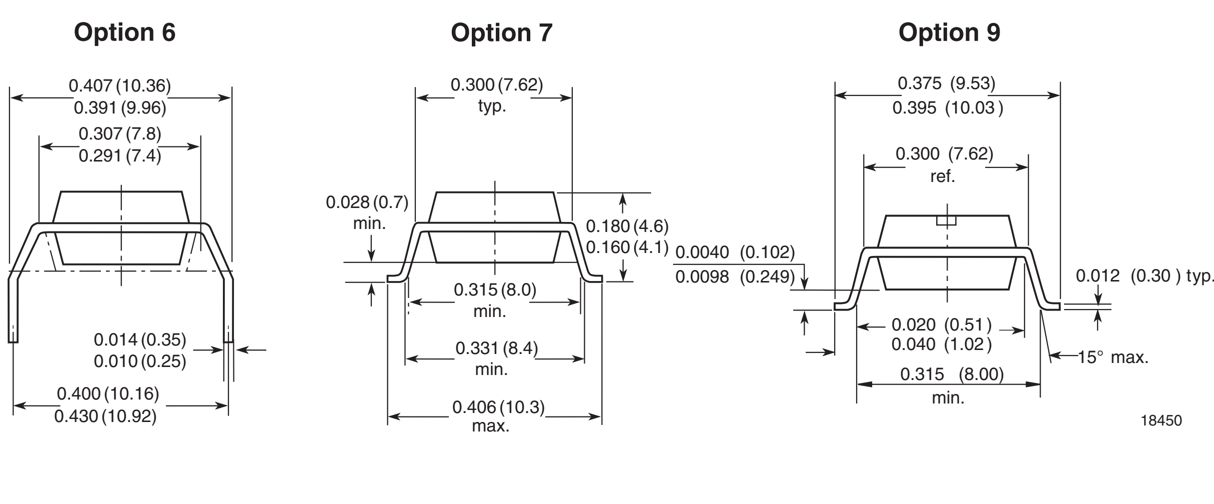


Fig. 10 - Maximum Output Power Dissipation

PACKAGE DIMENSIONS in inches (millimeters)





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1. Meet all present and future national and international statutory requirements.
2. Regularly and continuously improve the performance of our products, processes, distribution and operating systems with respect to their impact on the health and safety of our employees and the public, as well as their impact on the environment.

It is particular concern to control or eliminate releases of those substances into the atmosphere which are known as ozone depleting substances (ODSs).

The Montreal Protocol (1987) and its London Amendments (1990) intend to severely restrict the use of ODSs and forbid their use within the next ten years. Various national and international initiatives are pressing for an earlier ban on these substances.

Vishay Semiconductor GmbH has been able to use its policy of continuous improvements to eliminate the use of ODSs listed in the following documents.

1. Annex A, B and list of transitional substances of the Montreal Protocol and the London Amendments respectively.
2. Class I and II ozone depleting substances in the Clean Air Act Amendments of 1990 by the Environmental Protection Agency (EPA) in the USA.
3. Council Decision 88/540/EEC and 91/690/EEC Annex A, B and C (transitional substances) respectively.

Vishay Semiconductor GmbH can certify that our semiconductors are not manufactured with ozone depleting substances and do not contain such substances.

Vishay Semiconductor GmbH, P.O.B. 3535, D-74025 Heilbronn, Germany

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