600 V **IL4216**
700 V **IL4217**
800 V **IL4218**

Triac Optocoupler

FEATURES
- **High Input Sensitivity I_{FT}=1.3 mA**
- **600/700/800 V Blocking Voltage**
- **300 mA On-State Current**
- **High Static dv/dt 10,000 V/µsec., typical**
- **Inverse Parallel SCRs Provide Commutating dv/dt >10 kV/µsec**
- **Very Low Leakage <10 µA**
- **Isolation Test Voltage from Double Molded Package 5300 V_{RMS}**
- **Package, 6-Pin DIP**
- **Underwriters Lab File #E52744**
- **VDE Approval #0884 Available with Option 1**

DESCRIPTION
The IL421x 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, using high insulation double molded, over/under leadframe construction.

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).

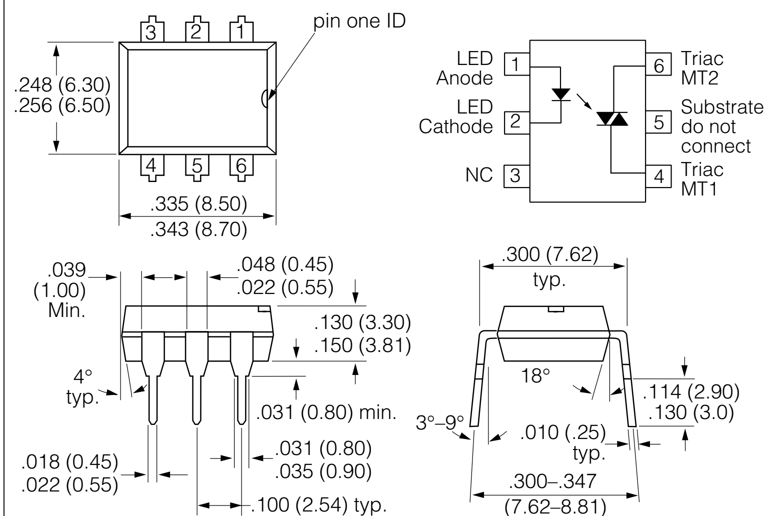
The IL421x uses two discrete SCRs resulting in a commutating dv/dt of greater than 10 kV/µs. The use of a proprietary *dv/dt* clamp results in a static dv/dt of greater than 10 kV/µs. This clamp circuit has a MOSFET that is enhanced when high dv/dt spikes occur between MT1 and MT2 of the TRIAC. The FET 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 of 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 IL421x 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.

Applications include solid-state relays, industrial controls, office equipment, and consumer appliances.

Dimensions in inches (mm)



Maximum Ratings
Emitter

Reverse Voltage .... 6.0 V
Forward Current .... 60 mA
Surge Current .... 2.5 A
Power Dissipation .... 100 mW
Derate Linearly from 25°C .... 1.33 mW/°C
Thermal Resistance .... 750 °C/W

Detector

Peak Off-State Voltage
- IL4216 .... 600 V
- IL4217 .... 700 V
- IL4218 .... 800 V

RMS On-State Current .... 300 mA
Single Cycle Surge .... 3.0 A
Total Power Dissipation .... 500 mW
Derate Linearly from 25°C .... 6.6 mW/°C
Thermal Resistance .... 150°C/W

Package

Lead Soldering Temperature .... 260°C/5.0 sec.
Creepage Distance .... ≥7.0 mm
Clearance .... ≥7.0 mm
Storage Temperature .... –55°C to +150°C
Operating Temperature .... –55°C to +100°C
Isolation Test Voltage .... 5300 V_{RMS}
Isolation Resistance
- V_{IO}=500 V, T_A=25°C .... $\geq 10^{12}\ \Omega$
- V_{IO}=500 V, T_A=100°C .... $\geq 10^{11}\ \Omega$

Characteristics T_A=25°C

Parameter	Symbol	Min.	Typ.	Max.	Unit	Condition
Emitter						
Forward Voltage	V_F	—	1.3	1.5	V	I_F=20 mA
Breakdown Voltage	V_{BR}	6.0	30	—	V	I_R=10 mA
Reverse Current	I_R	—	0.1	10	µA	V_R=6.0 V
Capacitance	C_O	—	40	—	pF	V_F=o V, f=1.0 MHz
Thermal Resistance, Junction to Lead	R_{THJL}	—	750	—	K/W	—
Output Detector						
Repetitive Peak Off-State Voltage IL4216 IL4217 IL4218	 V_{DRM} V_{DRM} V_{DRM}	 600 700 800	 650 750 850	—	 V V V	 I_{DRM}=100 µA I_{DRM}=100 µA I_{DRM}=100 µA
Off-State Voltage IL4216 IL4217 IL4218	 $V_{D(RMS)}$ $V_{D(RMS)}$ $V_{D(RMS)}$	 424 484 565	 460 536 613	—	 V V V	 $I_{D(RMS)}$=70 µA $I_{D(RMS)}$=70 µA $I_{D(RMS)}$=70 µA
Off-State Current	$I_{D(RMS)}$	—	10	100	µA	V_D=600 V, T_A=100°C
Reverse Current	$I_{R(RMS)}$	—	10	100	µA	V_R=600 V, T_A=100°C
On-State Voltage	V_{TM}	—	1.7	3.0	V	I_T=300 mA
On-State Current	I_{TM}	—	—	300	mA	PF=1.0, $V_{T(RMS)}$=1.7 V
Surge (Non-Repetitive) On-State Current	I_{TSM}	—	—	3.0	A	f=50 Hz
Holding Current	I_H	—	65	200	µA	V_T=3.0 V
Latching Current	I_L	—	5.0	—	mA	V_T=2.2 V
LED Trigger Current	I_{FT}	—	0.7	1.3	mA	V_{AK}=5.0 V
Turn-On Time	t_{ON}	—	35	—	µs	V_{RM}=V_{DM}=424 VAC
Turn-Off Time	t_{OFF}	—	50	—	µs	PF=1.0, I_T=300 mA
Critical State of Rise of Off-State Voltage	dv/dt_{cr}	10000	—	—	V/µs	V_D=0.67 V_{DRM}, T_j=25°C
		5000	—	—		V_D=0.67 V_{DRM}, T_j=80°C
Critical Rate of Rise of Voltage at Current Commutation	dv/dt_{crq}	10000	—	—	V/µs	V_D=0.67 V_{DRM}, di/dt_{crq}≤15 A/ms T_j=25°C
		5000	—	—		V_D=0.67 V_{DRM}, di/dt_{crq}≤15 A/ms T_j=80°C
Off-State Current	di/dt	—	100	—	A/ms	I_T=300 mA
Thermal Resistance, Junction to Lead	R_{THJL}	—	150	—	K/W	—
Package						
Critical Rate of Rise of Coupled Input-Output Voltage	$dv_{(IO)}/dt$	5000	—	—	V/µs	I_T=0 A, V_{RM}=V_{DM}=300 VAC
Common Mode Coupling Capacitor	C_{CM}	—	0.01	—	pF	—
Package Capacitance	C_{IO}	—	0.8	—	pF	f=1.0 MHz, V_{IO}=0 V

Figure 1. LED forward current vs. forward voltage

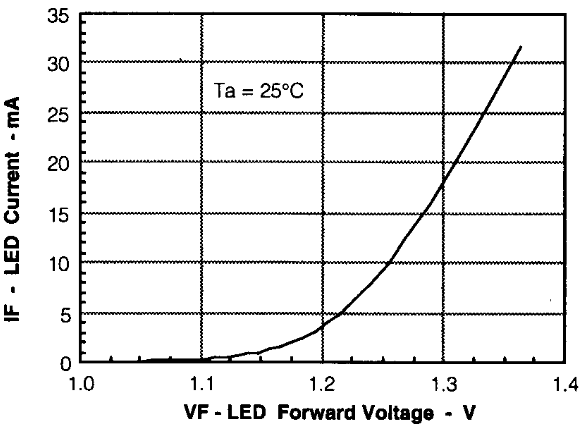


Figure 2. Forward voltage versus forward current

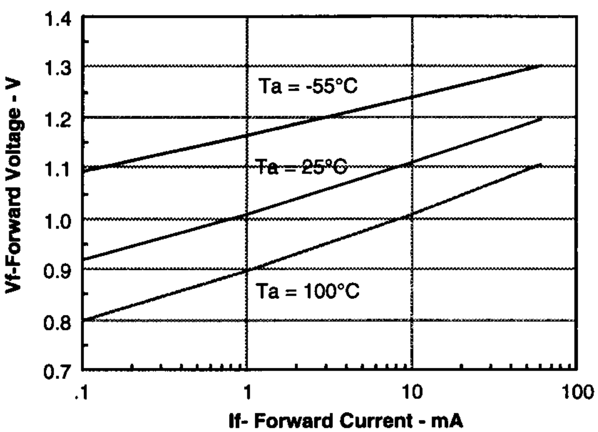


Figure 3. Peak LED current vs. duty factor, Tau

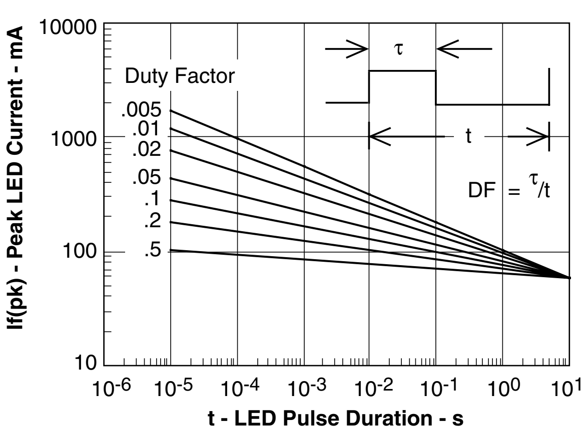


Figure 4. Maximum LED power dissipation

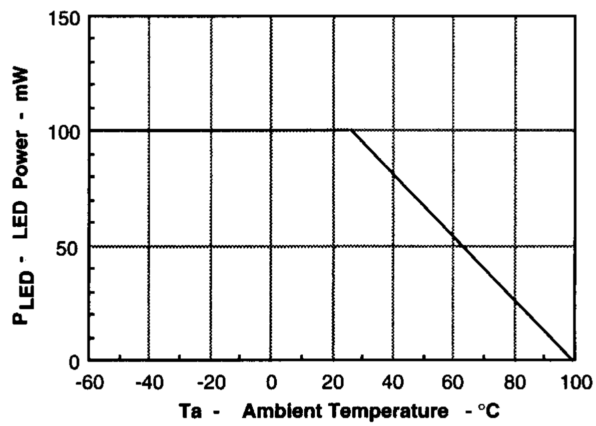


Figure 5. On-state terminal voltage vs. terminal current

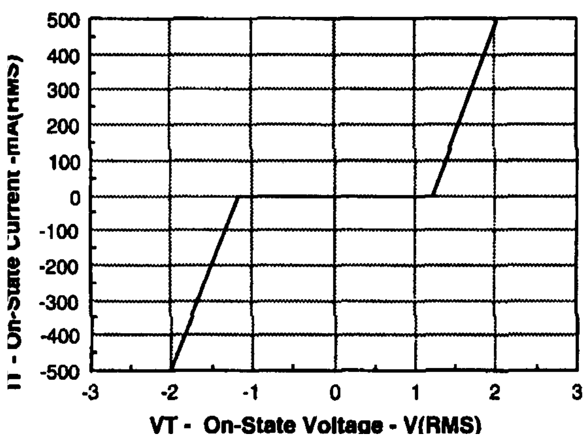
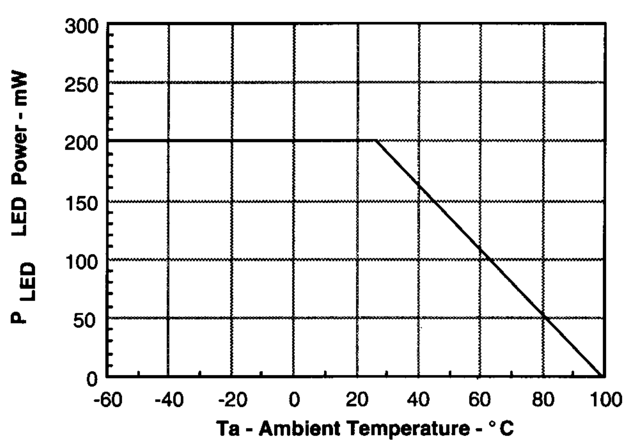


Figure 6. Maximum output power dissipation



Power Factor Considerations

A snubber isn't needed to eliminate false operation of the TRIAC driver because of the IL411's 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 7. 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 causer. 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.

Figure 7. Shunt capacitance versus load current versus power factor

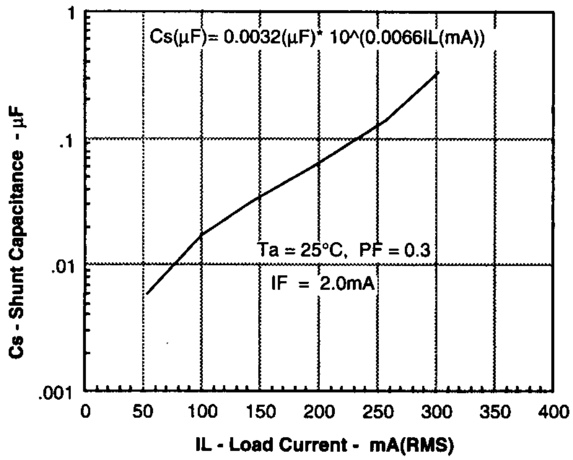


Figure 8. Normalized LED trigger current versus power factor