

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



21842-1



## DESCRIPTION

The IL420 and IL4208 consists of a GaAs IRLED optically coupled to a photosensitive non-zero crossing TRIAC network. The TRIAC consists of two inverse parallel connected monolithic SCRs. These three semiconductors are assembled in a six pin 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 2 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. When conducting, the FET clamps the base of the phototransistors, disabling the first stage SCR predriver.

The 600 V, 800 V blocking voltage permits control of offline voltages up to 240 V<sub>AC</sub>, with a safety factor of more than two, and is sufficient for as much as 380 V<sub>AC</sub>.

The IL420, IL4208 isolates low-voltage logic from 120 V<sub>AC</sub>, 240 V<sub>AC</sub>, and 380 V<sub>AC</sub> lines to control resistive, inductive, or capacitive loads including motors, solenoids, high current thyristors or TRIAC and relays.

## FEATURES

- High input sensitivity  $I_{FT} = 2 \text{ mA}$
- 600 V, 800 V blocking voltage
- 300 mA on-state current
- High static dV/dt 10 kV/μs
- Very low leakage < 10 μA
- Isolation test voltage 5300 V<sub>RMS</sub>
- Small 6-pin DIP package
- Compliant to RoHS Directive 2002/95/EC and in accordance to WEEE 2002/96/EC


**RoHS**  
COMPLIANT

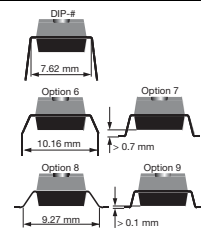
## APPLICATIONS

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

## AGENCY APPROVALS

- UL1577, file no. E52744 system code H, double protection
- CSA 93751
- DIN EN 60747-5-2 (VDE 0884)/DIN EN 60747-5-5 (pending), available with option 1

## ORDERING INFORMATION



AGENCY CERTIFIED/PACKAGE	BLOCKING VOLTAGE V <sub>DRM</sub> (V)	
<b>UL, cUL</b>	<b>600</b>	<b>800</b>
DIP-6	IL420	IL4208
DIP-6, 400 mil, option 6	IL420-X006	-
SMD-6, option 7	IL420-X007T <sup>(1)</sup>	IL4208-X007T <sup>(1)</sup>
SMD-6, option 8	IL420-X008T	-
SMD-6, option 9	IL420-X009T <sup>(1)</sup>	IL4208-X009T <sup>(1)</sup>
<b>VDE, UL, cUL</b>	<b>600</b>	<b>800</b>
DIP-6	IL420-X001	-
DIP-6, 400 mil, option 6	IL420-X016	-
SMD-6, option 7	IL420-X017T <sup>(1)</sup>	-

### Note

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

<b>ABSOLUTE MAXIMUM RATINGS</b> ( $T_{amb} = 25\text{ }^{\circ}\text{C}$ , unless otherwise specified)					
PARAMETER	TEST CONDITION	PART	SYMBOL	VALUE	UNIT
<b>INPUT</b>					
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 from 25 °C				1.33	mW/°C
<b>OUTPUT</b>					
Peak off-state voltage		IL420	$V_{DRM}$	600	V
		IL4208	$V_{DRM}$	800	V
RMS on-state current			$I_{TM}$	300	mA
Single cycle surge current			$I_{TSM}$	3	A
Power dissipation			$P_{diss}$	500	mW
Derate from 25 °C				6.6	mW/°C
<b>COUPLER</b>					
Isolation test voltage between emitter and detector	$t = 1\text{ s}$		$V_{ISO}$	5300	$V_{RMS}$
Pollution degree (DIN VDE 0109)				2	
Creepage distance				$\geq 7$	mm
Clearance distance				$\geq 7$	mm
Comparative tracking <sup>(1)</sup>				$\geq 175$	
Isolation resistance	$V_{IO} = 500\text{ V}, T_{amb} = 25\text{ }^{\circ}\text{C}$		$R_{IO}$	$\geq 10^{12}$	$\Omega$
	$V_{IO} = 500\text{ V}, T_{amb} = 100\text{ }^{\circ}\text{C}$		$R_{IO}$	$\geq 10^{11}$	$\Omega$
Storage temperature range			$T_{stg}$	- 55 to + 150	°C
Ambient temperature range			$T_{amb}$	- 55 to + 100	°C
Soldering temperature <sup>(2)</sup>	max. $\leq 10\text{ s}$ dip soldering $\geq 0.5\text{ mm}$ from case bottom		$T_{sld}$	260	°C

### Notes

- 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.

<sup>(1)</sup> Index per DIN IEC60112/VDE 0303 part 1, group IIIa per DIN VDE 6110.

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



Optocoupler, Phototriac Output, Vishay Semiconductors  
High dV/dt, Low Input Current

ELECTRICAL CHARACTERISTICS (T <sub>amb</sub> = 25 °C, unless otherwise specified)							
PARAMETER	TEST CONDITION	PART	SYMBOL	MIN.	TYP.	MAX.	UNIT
<b>INPUT</b>							
Forward voltage	I <sub>F</sub> = 10 mA		V <sub>F</sub>		1.16	1.35	V
Reverse current	V <sub>R</sub> = 6 V		I <sub>R</sub>		0.1	10	μA
Input capacitance	V <sub>F</sub> = 0 V, f = 1 MHz		C <sub>IN</sub>		40		pF
Thermal resistance, junction to ambient			R <sub>thja</sub>		750		°C/W
<b>OUTPUT</b>							
Off-state current	V <sub>D</sub> = V <sub>DRM</sub> , T <sub>amb</sub> = 100 °C		I <sub>DRM</sub>		10	100	μA
On-state voltage	I <sub>T</sub> = 300 mA		V <sub>TM</sub>		1.7	3	V
Surge (non-repetitive), on-state current	f = 50 Hz		I <sub>TSM</sub>			3	A
Holding current			I <sub>H</sub>		65	500	μA
Latching current	V <sub>T</sub> = 2.2 V		I <sub>L</sub>			500	μA
LED trigger current	V <sub>D</sub> = 5 V		I <sub>FT</sub>		1	2	mA
Trigger current temperature gradient			ΔI <sub>FT</sub> /ΔT <sub>j</sub>		7	14	μA/°C
Critical rate of rise off-state voltage	V <sub>D</sub> = 0.67 V <sub>DRM</sub> , T <sub>j</sub> = 25 °C		dV/dt <sub>cr</sub>	10 000			V/μs
	V <sub>D</sub> = 0.67 V <sub>DRM</sub> , T <sub>j</sub> = 80 °C		dV/dt <sub>cr</sub>	5000			V/μs
Critical rate of rise of voltage at current commutation	V <sub>D</sub> = 230 V <sub>RMS</sub> , I <sub>D</sub> = 300 mA <sub>RMS</sub> , T <sub>J</sub> = 25 °C		dV/dt <sub>crq</sub>		8		V/μs
	V <sub>D</sub> = 230 V <sub>RMS</sub> , I <sub>D</sub> = 300 mA <sub>RMS</sub> , T <sub>J</sub> = 85 °C		dV/dt <sub>crq</sub>		7		V/μs
Critical rate of rise of on-state current commutation			dI/dt <sub>crq</sub>		12		A/ms
Thermal resistance, junction to ambient			R <sub>thja</sub>		150		°C/W
<b>COUPLER</b>							
Critical rate of rise of coupled input/output voltage	I <sub>T</sub> = 0 A, V <sub>RM</sub> = V <sub>DM</sub> = V <sub>DRM</sub>		dV/dt		5000		V/μs
Capacitance (input to output)	f = 1 MHz, V <sub>IO</sub> = 0 V		C <sub>IO</sub>		0.8		pF
Isolation resistance	V <sub>IO</sub> = 500 V, T <sub>amb</sub> = 25 °C		R <sub>IO</sub>	≥ 10 <sup>12</sup>			Ω
	V <sub>IO</sub> = 500 V, T <sub>amb</sub> = 100 °C		R <sub>IO</sub>	≥ 10 <sup>11</sup>			Ω

**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.

SWITCHING CHARACTERISTICS (T <sub>amb</sub> = 25 °C, unless otherwise specified)						
PARAMETER	TEST CONDITION	SYMBOL	MIN.	TYP.	MAX.	UNIT
Turn-on time	V <sub>RM</sub> = V <sub>DM</sub> = V <sub>DRM</sub>	t <sub>on</sub>		35		μs

SAFETY AND INSULATION RATINGS ( $T_{amb} = 25\text{ }^{\circ}\text{C}$ , unless otherwise specified)						
PARAMETER	TEST CONDITION	SYMBOL	MIN.	TYP.	MAX.	UNIT
Climatic classification (according to IEC68 part 1)				55/100/21		
Comparative tracking index		CTI	175		399	
$V_{IOTM}$			8000			V
$V_{IORM}$			630			V
$P_{SO}$					500	mW
$I_{SI}$					250	mA
$T_{SI}$					175	$^{\circ}\text{C}$
Creepage distance	Standard DIP-8		7			mm
Clearance distance	Standard DIP-8		7			mm
Creepage distance	400 mil DIP-8		8			mm
Clearance distance	400 mil DIP-8		8			mm
Insulation thickness	For IL4208 only		0.4			mm

**Note**

- As per IEC60747-5-2, § 7.4.3.8.1, this optocoupler is suitable for “safe electrical insulation” only within the safety ratings. Compliance with the safety ratings shall be ensured by means of protective circuits.

**TYPICAL CHARACTERISTICS** ( $T_{amb} = 25\text{ }^{\circ}\text{C}$ , unless otherwise specified)



Fig. 1 - Forward Voltage vs. Forward Current



Fig. 3 - Maximum LED Power Dissipation



Fig. 2 - Peak LED Current vs. Duty Factor,  $\tau$



Fig. 4 - Typical Output Characteristics


**Fig. 5 - Current Reduction**

**Fig. 8 - Typical Off-State Current**

**Fig. 6 - Current Reduction**

**Fig. 9 - Power Dissipation**

**Fig. 7 - Typical Trigger Delay Time**

**Fig. 10 - Pulse Trigger Current**

# IL420, IL4208



Vishay Semiconductors Optocoupler, Phototriac Output,  
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## PACKAGE DIMENSIONS in millimeters



## PACKAGE MARKING (example)



### Notes

- Only options 1, 7, and 8 are reflected in the package marking.
- The VDE Logo is only marked on option 1 parts.
- Tape and reel suffix (T) is not part of the package marking.



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