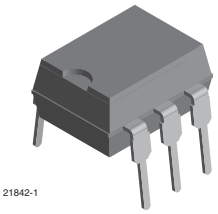
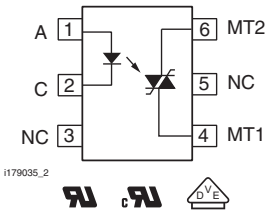
Optocoupler, Phototriac Output, High dV/dt, Low Input Current





FEATURES

- High input sensitivity I_{FT} = 2 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_{RMS}
- Small 6-pin DIP package
- Compliant to RoHS Directive 2002/95/EC and in accordance to WEEE 2002/96/EC

Pb-free

e3

RoHS COMPLIANT

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 clam 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 VAC, with a safety factor of more than two, and is sufficient for as much as 380 V_{AC}.

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

APPLICATIONS

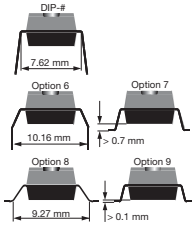
- Solid state relays
- Industrial controls
- Office equipment
- Consumer appliances

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

I	L	4	2	0	#	-	X	0	#	#	T
PART NUMBER							PACKAGE OPTION				TAPE AND REEL



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

Note

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

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ABSOLUTE MAXIMUM RATINGS (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 from 25 °C				1.33	mW/°C
OUTPUT					
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
COUPLER					
Isolation test voltage between emitter and detector	t = 1 s		V_{ISO}	5300	V_{RMS}
Pollution degree (DIN VDE 0109)				2	
Creepage distance				≥ 7	mm
Clearance distance				≥ 7	mm
Comparative tracking (1)				≥ 175	
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
Storage temperature range			T_{stg}	- 55 to + 150	°C
Ambient temperature range			T_{amb}	- 55 to + 100	°C
Soldering temperature (2)	max. ≤ 10 s dip soldering ≥ 0.5 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.

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

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

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ELECTRICAL CHARACTERISTICS (T_{amb} = 25 °C, unless otherwise specified)							
PARAMETER	**TEST CONDITION**	**PART**	**SYMBOL**	**MIN.**	**TYP.**	**MAX.**	**UNIT**
INPUT							
Forward voltage	I_F = 10 mA		V_F		1.16	1.35	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 ambient			R_{thja}		750		°C/W
OUTPUT							
Off-state current	$V_D = V_{DRM}$, T_{amb} = 100 °C		I_{DRM}		10	100	µA
On-state voltage	I_T = 300 mA		V_{TM}		1.7	3	V
Surge (non-repetitive), on-state current	f = 50 Hz		I_{TSM}			3	A
Holding current			I_H		65	500	µA
Latching current	V_T = 2.2 V		I_L			500	µA
LED trigger current	V_D = 5 V		I_{FT}		1	2	mA
Trigger current temperature gradient			$\Delta I_{FT}/\Delta T_j$		7	14	µA/°C
Critical rate of rise off-state voltage	V_D = 0.67 V_{DRM}, T_j = 25 °C		dV/dt_{cr}	10 000			V/µs
	V_D = 0.67 V_{DRM}, T_j = 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			dI/dt_{crq}		12		A/ms
Thermal resistance, junction to ambient			R_{thja}		150		°C/W
COUPLER							
Critical rate of rise of coupled input/output voltage	I_T = 0 A, $V_{RM} = V_{DM} = V_{DRM}$		dV/dt		5000		V/µs
Capacitance (input to output)	f = 1 MHz, V_{IO} = 0 V		C_{IO}		0.8		pF
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

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_{amb} = 25 °C, unless otherwise specified)						
PARAMETER	**TEST CONDITION**	**SYMBOL**	**MIN.**	**TYP.**	**MAX.**	**UNIT**
Turn-on time	$V_{RM} = V_{DM} = V_{DRM}$	t_{on}		35		µs

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SAFETY AND INSULATION RATINGS (T_{amb} = 25 °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	°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 °C, unless otherwise specified)

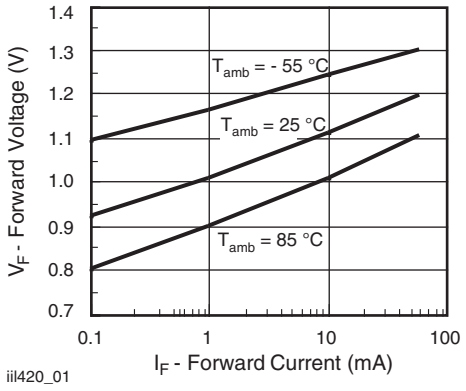

Fig. 1 - Forward Voltage vs. Forward Current

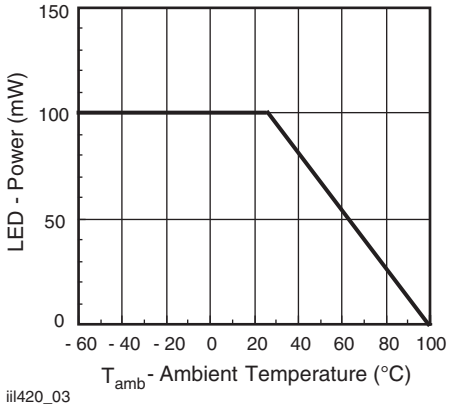

Fig. 3 - Maximum LED Power Dissipation

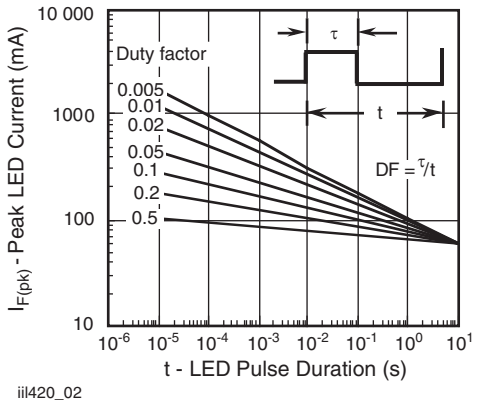

Fig. 2 - Peak LED Current vs. Duty Factor, τ

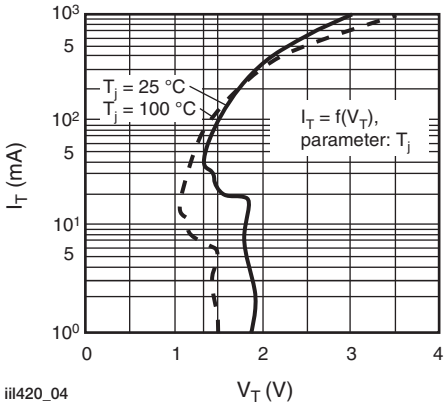

Fig. 4 - Typical Output Characteristics

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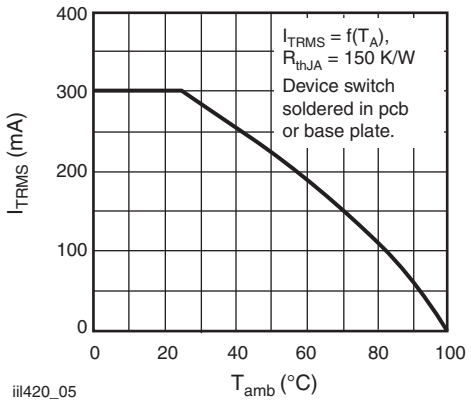

Fig. 5 - Current Reduction

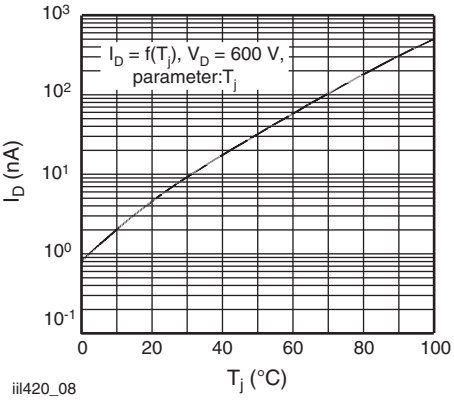

Fig. 8 - Typical Off-State Current

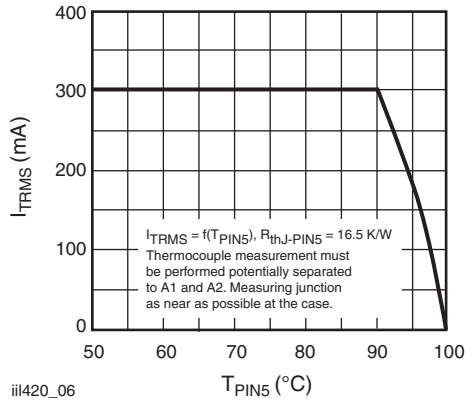

Fig. 6 - Current Reduction

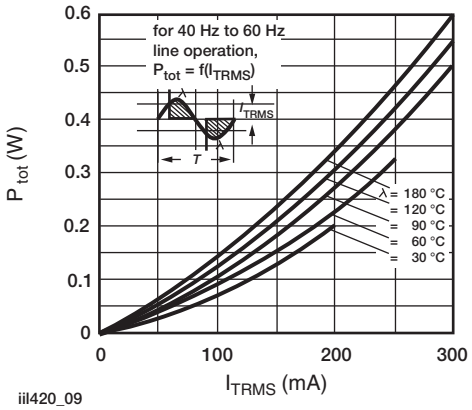

Fig. 9 - Power Dissipation

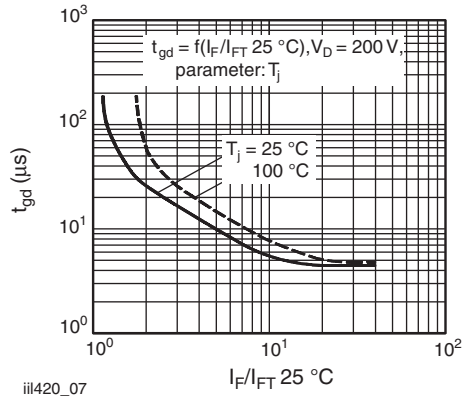

Fig. 7 - Typical Trigger Delay Time

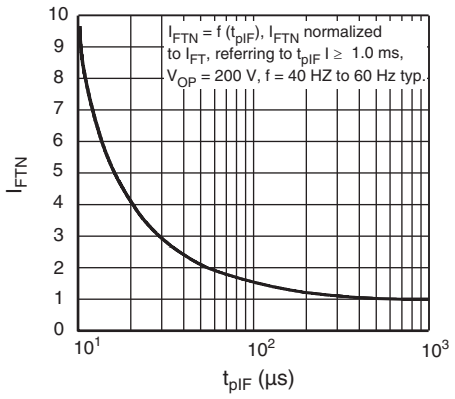

Fig. 10 - Pulse Trigger Current

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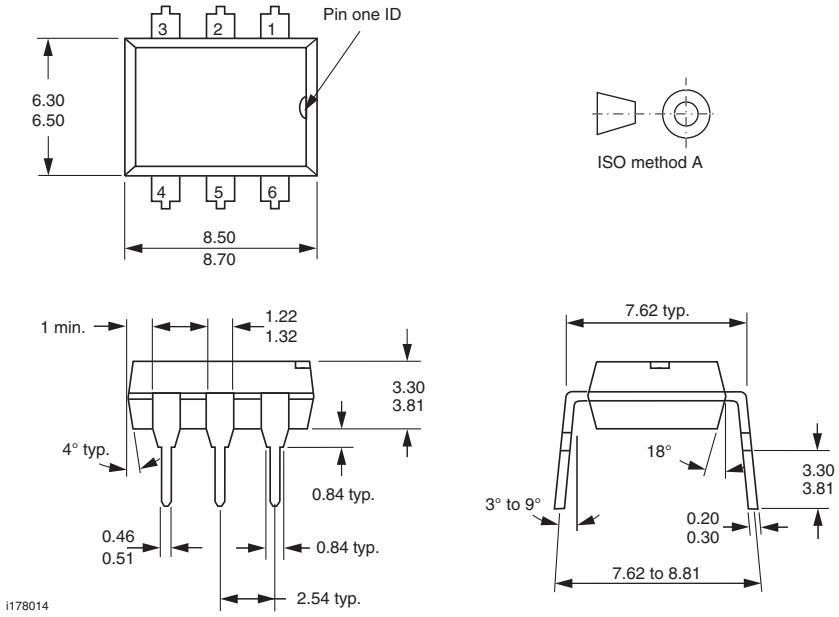
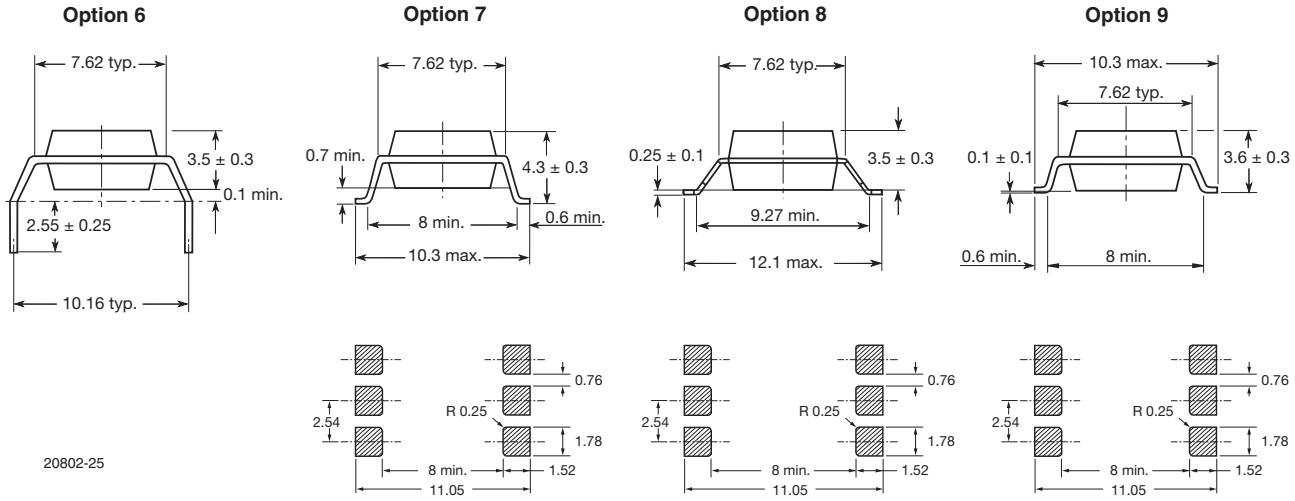
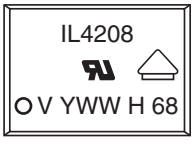
PACKAGE DIMENSIONS in millimeters





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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