

Vishay Semiconductors

Optocoupler, Phototransistor Output, AC Input (Dual, Quad Channel)



DESCRIPTION

The ILD620, ILQ620, ILD620GB, and ILQ620GB are multi-channel input phototransistor optocouplers that use inverse parallel GaAs IRLED emitter and high gain NPN silicon phototransistors per channel. These devices are constructed using over/under leadframe optical coupling and double molded insulation resulting in a withstand test voltage of 5300 $V_{\rm RMS}$.

The LED parameters and the linear CTR characteristics make these devices well suited for AC voltage detection. The ILD620GB and ILQ620GB with its low I_F guaranteed CTR_{CEsat} minimizes power dissipation of the A_C voltage detection network that is placed in series with the LEDs. Eliminating the phototransistor base connection provides added electrical noise immunity from the transients found in many industrial control environments.

FEATURES

- · Identical channel to channel footprint
- ILD620 crosses to TLP620-2
- ILQ620 crosses to TLP620-4
- High collector emitter voltage, BV_{CEO} = 70 V
- Dual and quad packages feature:
- Reduced board space
 - Lower pin and parts count
 - Better channel to channel CTR match
- Improved common mode rejection
- Isolation test voltage 5300 V_{RMS}
- Material categorization: For definitions of compliance please see <u>www.vishay.com/doc?99912</u>

AGENCY APPROVALS

- UL1577, file no. E52744 system code H, double protection
- cUL tested to CSA 22.2 bulletin 5A
- DIN EN 60747-5-5 (VDE 0884)
- FIMKO
- CQC GB4943.1-2011 and GB8898:2011 (suitable for installation altitude below 2000 m)



Notes

Additional options may be possible, please contact sales office.

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

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Pb-free

RoHS

COMPLIANT



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ABSOLUTE MAXIMUM RATINGS (T _{amb} = 25 °C, unless otherwise specified)							
PARAMETER	TEST CONDITION	PART	SYMBOL	VALUE	UNIT		
INPUT							
Forward current			١ _F	± 60	mA		
Surge current			I _{FSM}	± 1.5	A		
Power dissipation			P _{diss}	100	mW		
Derate linearly from 25 °C				1.3	mW/°C		
OUTPUT							
Collector emitter breakdown voltage			BV _{CEO}	70	V		
Collector ourrent			Ι _C	50	mA		
Collector current	t < 1 s		Ι _C	100	mA		
Power dissipation			P _{diss}	150	mW		
Derate from 25 °C				2	mW/°C		
COUPLER							
Isolation test voltage	t = 1 s		V _{ISO}	5300	V _{RMS}		
Isolation voltage			V _{IORM}	890	VP		
Total power dissipation			P _{tot}	250	mW		
Paakaga dissinction		ILD620		400	mW		
Fackage dissipation		ILD620GB		400	mW		
Derate from 25 °C				5.33	mW/°C		
Package dissipation		ILQ620		500	mW		
Fackage dissipation		ILQ620GB		500	mW		
Derate from 25 °C				6.67	mW/°C		
Creepage distance				≥ 7	mm		
Clearance distance				≥ 7	mm		
lociation registerios	$V_{IO} = 500 \text{ V}, \text{ T}_{amb} = 25 ^{\circ}\text{C}$		R _{IO}	≥ 10 ¹²	Ω		
Isolation resistance	$V_{IO} = 500 \text{ V}, \text{ T}_{amb} = 100 ^{\circ}\text{C}$		R _{IO}	≥ 10 ¹¹	Ω		
Storage temperature			T _{stg}	- 55 to + 150	°C		
Operating temperature			T _{amb}	- 55 to + 100	°C		
Junction temperature			Tj	100	°C		
Soldering temperature ⁽¹⁾	2 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⁾ 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	$I_F = \pm 10 \text{ mA}$		V _F	1	1.15	1.3	V
Forward current	$V_{R} = \pm 0.7 V$		I _F		2.5	20	μA
Capacitance	$V_F = 0 V$, f = 1 MHz		Co		25		pF
Thermal resistance, junction to lead			R _{thJL}		750		K/W
OUTPUT							
Collector emitter capacitance	$V_{CE} = 5 V, f = 1 MHz$		C _{CE}		6.8		pF
Collector emitter leakage current	V _{CE} = 24 V		I _{CEO}		10	100	nA
	$T_A = 85 \ ^{\circ}C, \ V_{CE} = 24 \ V$		I _{CEO}		2	50	μA
Thermal resistance, junction to lead			R _{thJL}		500		K/W



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ELECTRICAL CHARACTERISTICS (T_{amb} = 25 °C, unless otherwise specified)							
PARAMETER	TEST CONDITION	PART	SYMBOL	MIN.	TYP.	MAX.	UNIT
COUPLER							
Off-state collector current	$V_F=\pm~0.7$ V, $V_{CE}=24$ V		I _{CEoff}		1	10	μA
Collector emitter saturation voltage	$l_{-} = \pm 8 m^{1} l_{-} = 2.4 m^{1}$	ILD620	V _{CEsat}			0.4	V
	$I_F = \pm 0 IIIA, I_{CE} = 2.4 IIIA$	ILQ620	V _{CEsat}			0.4	V
		ILD620GB	V _{CEsat}			0.4	V
	$r_F = \pm 1$ mA, $r_{CE} = 0.2$ mA	ILQ620GB	V _{CEsat}			0.4	V

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.

CURRENT TRANSFER RATIO (T _{amb} = 25 °C, unless otherwise specified)							
PARAMETER	TEST CONDITION	PART	SYMBOL	MIN.	TYP.	MAX.	UNIT
Channel/channel CTR match	$I_F = \pm 5 \text{ mA}, V_{CE} = 5 \text{ V}$		CTRX/CTRY	1 to 1		3 to 1	
CTR symmetry	$I_{CE} (I_F = -5 \text{ mA})/I_{CE} (I_F = +5 \text{ mA})$		I _{CE(RATIO)}	0.5		2	
Current transfer ratio	$l_{\rm E} = \pm 1$ mA. V _{CE} = 0.4 V	ILD620	CTR _{CEsat}		60		%
(collector emitter saturated)	$F = \pm 1 \text{ IIIA}, V_{CE} = 0.4 \text{ V}$	ILQ620	CTR _{CEsat}		60		%
Current transfer ratio		ILD620	CTR _{CE}	50	80	600	%
(collector emitter)	$F = \pm 3 \text{ mA}, V_{CE} = 3 \text{ V}$	ILQ620	CTR _{CE}	50	80	600	%
Current transfer ratio	1 - 1 - 1 - 1 - 0.4	ILD620GB	CTR _{CEsat}	30			%
(collector emitter saturated)	$V_{F} = \pm 1 \text{ mA}, V_{CE} = 0.4 \text{ V}$	ILQ620GB	CTR _{CEsat}	30			%
Current transfer ratio	$I_{-} = F_{-} = F_{-} $	ILD620GB	CTR _{CEsat}	100	200	600	%
(collector emitter)	$i_F = \pm 5 \text{ IIIA}, V_{CE} = 5 \text{ V}$	ILQ620GB	CTR _{CEsat}	100	200	600	%

SAFETY AND INSULATION RATED PARAMETERS							
PARAMETER	TEST CONDITION	SYMBOL	MIN.	TYP.	MAX.	UNIT	
Partial discharge test voltage - routine test	100 %, t _{test} = 1 s	V _{pd}	1.669			kV	
Partial discharge test voltage -	t _{Tr} = 60 s, t _{test} = 10 s,	V _{IOTM}	10			kV	
lot test (sample test)	(see figure 2)	V _{pd}	1.424			kV	
	V _{IO} = 500 V	R _{IO}	10 ¹²			Ω	
Insulation resistance	$V_{IO} = 500 \text{ V}, \text{ T}_{amb} = 100 ^{\circ}\text{C}$	R _{IO}	10 ¹¹			Ω	
Insulation resistance	V _{IO} = 500 V, T _{amb} = 150 °C (construction test only)	R _{IO}	10 ⁹			Ω	
Forward current		I _{si}			275	mA	
Power dissipation		P _{SO}			400	mW	
Rated impulse voltage		V _{IOTM}			10	kV	
Safety temperature		T _{si}			175	°C	

Note

 According to DIN EN 60747-5-5 (VDE 0884) (see figure 2). This optocoupler is suitable for safe electrical isolation only within the safety ratings. Compliance with the safety ratings shall be ensured by means of suitable protective circuits.



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Fig. 1 - Derating Diagram



Fig. 2 - Test Pulse Diagram for Sample Test According to DIN EN 60747-5-2 (VDE 0884); IEC 60747-5-5

SWITCHING CHARACTERISTICS (T _{amb} = 25 °C, unless otherwise specified)							
PARAMETER	TEST CONDITION	SYMBOL	MIN.	TYP.	MAX.	UNIT	
NON-SATURATED							
On time	$\begin{split} I_F &= \pm \mbox{ 10 mA, } V_{CC} = 5 \ V, \\ R_L &= 75 \ \Omega, \ 50 \ \% \ \mbox{of} \ V_{PP} \end{split}$	t _{on}		3		μs	
Rise time	$\begin{split} I_F &= \pm \mbox{ 10 mA, } V_{CC} = 5 \ V, \\ R_L &= 75 \ \Omega, \ 50 \ \% \ \mbox{of} \ V_{PP} \end{split}$	t _r		20		μs	
Off time	$\begin{split} I_F &= \pm \mbox{ 10 mA, } V_{CC} = 5 \ V, \\ R_L &= 75 \ \Omega, \ 50 \ \% \ \mbox{of} \ V_{PP} \end{split}$	t _o ff		2.3		μs	
Fall time	$I_F = \pm 10 \text{ mA}, V_{CC} = 5 \text{ V}, \\ R_L = 75 \ \Omega, 50 \ \% \text{ of } V_{PP}$	t _f		2		μs	
Propagation H to L	$\begin{split} I_F &= \pm \mbox{ 10 mA, } V_{CC} = 5 \ V, \\ R_L &= 75 \ \Omega, \ 50 \ \% \ \mbox{of} \ V_{PP} \end{split}$	t _{PHL}		1.1		μs	
Propagation L to H	$\begin{split} I_F &= \pm \mbox{ 10 mA, } V_{CC} = 5 \ V, \\ R_L &= 75 \ \Omega, \ 50 \ \% \ \mbox{of} \ V_{PP} \end{split}$	t _{PLH}		2.5		μs	
SATURATED							
On time	$ I_F = \pm \ 10 \ m\text{A}, \ V_{CC} = 5 \ V, \\ R_L = 1 \ k\Omega, \ V_{TH} = 1.5 \ V, $	t _{on}		4.3		μs	
Rise time	$ I_F = \pm \ 10 \ m\text{A}, \ V_{CC} = 5 \ V, \\ R_L = 1 \ k\Omega, \ V_{TH} = 1.5 \ V, $	t _r		2.8		μs	
Off time	$\begin{split} I_{F} &= \pm \; 10 \; \text{mA}, \; V_{CC} = 5 \; \text{V}, \\ R_{L} &= 1 \; \text{k} \Omega, \; V_{TH} = 1.5 \; \text{V}, \end{split}$	t _o ff		2.5		μs	
Fall time	$\begin{split} I_{F} &= \pm \; 10 \; \text{mA}, \; V_{CC} = 5 \; \text{V}, \\ R_{L} &= 1 \; \text{k} \Omega, \; V_{TH} = 1.5 \; \text{V}, \end{split}$	t _f		11		μs	
Propagation H to L	$I_F = \pm 10$ mA, $V_{CC} = 5$ V, R _L = 1 kΩ, V _{TH} = 1.5 V,	t _{PHL}		2.6		μs	
Propagation L to H	$I_{F} = \pm 10$ mA, $V_{CC} = 5$ V, R _L = 1 k Ω , V _{TH} = 1.5 V,	t _{PLH}		7.2		μs	



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



Fig. 3 - Non-Saturated Switching Timing



Fig. 4 - Saturated Switching Timing



Fig. 5 - Non-Saturated Switching Timing



Fig. 6 - Saturated Switching Timing



Fig. 7 - LED Forward Current vs.Forward Voltage





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5 For technical questions, contact: <u>optocoupleranswers@vishay.com</u> Document Number: 83653

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Fig. 9 - Maximum LED Current vs. Ambient Temperature



Fig. 10 - Maximum LED Power Dissipation



Fig. 11 - Collector Current vs. Diode Forward Current



Fig. 12 - Normalization Factor for Non-Saturated and Saturated CTR vs. $\rm I_F$



Fig. 13 - Normalization Factor for Non-Saturated and Saturated CTR vs. I_{F}



Fig. 14 - Normalization Factor for Non-Saturated and Saturated CTR vs. ${\rm I}_{\rm F}$

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Fig. 15 - Peak LED Current vs. Pulse Duration, $\boldsymbol{\tau}$



Fig. 17 - Maximum Collector Current vs. Collector Voltage



Fig. 16 - Maximum Detector Power Dissipation

PACKAGE DIMENSIONS in millimeters



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Option 7



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PACKAGE MARKING (example)

21764-95	

Notes

'ISHA

- Only option 1 and 7 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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