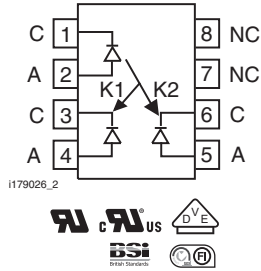


# Linear Optocoupler, High Gain Stability, Wide Bandwidth



## FEATURES

- Couples AC and DC signals
- 0.01 % servo linearity
- Wide bandwidth, > 200 kHz
- High gain stability,  $\pm 0.005 \%/^{\circ}\text{C}$  typically
- Low input-output capacitance
- Low power consumption, < 15 mW
- Isolation rated voltage 4420 V<sub>RMS</sub>
- Internal insulation distance, > 0.4 mm
- Material categorization: for definitions of compliance please see [www.vishay.com/doc?99912](http://www.vishay.com/doc?99912)


**RoHS**  
COMPLIANT

## APPLICATIONS

- Power supply feedback voltage / current
- Medical sensor isolation
- Audio signal interfacing
- Isolated process control transducers
- Digital telephone isolation

## AGENCY APPROVALS

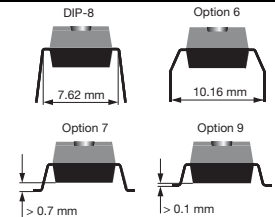
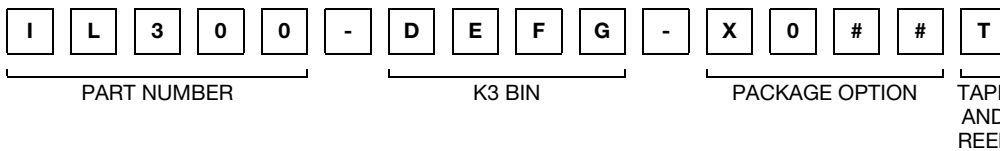
- UL
- cUL
- DIN EN 60747-5-5 (VDE 0884-5) available with option 1
- BSI
- FIMKO
- CQC

## DESCRIPTION

The IL300 linear optocoupler consists of an AlGaAs IRLED irradiating an isolated feedback and an output PIN photodiode in a bifurcated arrangement. The feedback photodiode captures a percentage of the LEDs flux and generates a control signal ( $I_{P1}$ ) that can be used to servo the LED drive current. This technique compensates for the LED's non-linear, time, and temperature characteristics. The output PIN photodiode produces an output signal ( $I_{P2}$ ) that is linearly related to the servo optical flux created by the LED.

The time and temperature stability of the input-output coupler gain ( $K3$ ) is insured by using matched PIN photodiodes that accurately track the output flux of the LED.

## ORDERING INFORMATION



AGENCY CERTIFIED / PACKAGE	K3 BIN							
<b>UL, cUL, BSI, FIMKO</b>	<b>0.557 to 1.618</b>	<b>0.765 to 1.181</b>	<b>0.851 to 1.181</b>	<b>0.765 to 0.955</b>	<b>0.851 to 1.061</b>	<b>0.945 to 1.181</b>	<b>0.851 to 0.955</b>	<b>0.945 to 1.061</b>
DIP-8	IL300	IL300-DEFG	-	-	IL300-EF	-	IL300-E	IL300-F
DIP-8, 400 mil, option 6	IL300-X006	IL300-DEFG-X006	-	-	IL300-EF-X006	IL300-FG-X006	IL300-E-X006	IL300-F-X006
SMD-8, option 7	IL300-X007T <sup>(1)</sup>	IL300-DEFG-X007T <sup>(1)</sup>	IL300-EFG-X007	IL300-DE-X007T	IL300-EF-X007T <sup>(1)</sup>	IL300-FG-X007T	IL300-E-X007T	IL300-F-X007T <sup>(1)</sup>
SMD-8, option 9	IL300-X009T <sup>(1)</sup>	IL300-DEFG-X009T <sup>(1)</sup>	-	-	IL300-EF-X009T <sup>(1)</sup>	-	-	IL300-F-X009T <sup>(1)</sup>
<b>VDE, UL, BSI, FIMKO</b>	<b>0.557 to 1.618</b>	<b>0.765 to 1.181</b>	<b>0.851 to 1.181</b>	<b>0.765 to 0.955</b>	<b>0.851 to 1.061</b>	<b>0.945 to 1.181</b>	<b>0.851 to 0.955</b>	<b>0.945 to 1.061</b>
DIP-8	IL300-X001	IL300-DEFG-X001	-	-	IL300-EF-X001	-	IL300-E-X001	IL300-F-X001
DIP-8, 400 mil, option 6	IL300-X016	IL300-DEFG-X016	IL300-EFG-X016	-	IL300-EF-X016	-	-	IL300-F-X016
SMD-8, option 7	IL300-X017	IL300-DEFG-X017T <sup>(1)</sup>	-	-	IL300-EF-X017T <sup>(1)</sup>	-	IL300-E-X017T	IL300-F-X017T <sup>(1)</sup>
SMD-8, option 9	-	-	-	-	-	-	IL300-E-X009T	IL300-F-X019T <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	SYMBOL	VALUE	UNIT
<b>INPUT</b>				
Power dissipation		$P_{diss}$	160	mW
Derate linearly from 25 °C			2.13	mW/°C
Forward current		$I_F$	60	mA
Surge current (pulse width < 10 μs)		$I_{PK}$	250	mA
Reverse voltage		$V_R$	5	V
Thermal resistance		$R_{th}$	470	K/W
Junction temperature		$T_j$	100	°C
<b>OUTPUT</b>				
Power dissipation		$P_{diss}$	50	mW
Derate linearly from 25 °C			0.65	mW/°C
Reverse voltage		$V_R$	50	V
Thermal resistance		$R_{th}$	1500	K/W
Junction temperature		$T_j$	100	°C
<b>COUPLER</b>				
Total package dissipation at 25 °C		$P_{tot}$	210	mW
Derate linearly from 25 °C			2.8	mW/°C
Storage temperature		$T_{stg}$	-55 to +150	°C
Operating temperature		$T_{amb}$	-55 to +100	°C

**Note**

- 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

<b>ELECTRICAL CHARACTERISTICS</b> ( $T_{amb} = 25\text{ }^{\circ}\text{C}$ , unless otherwise specified)						
PARAMETER	TEST CONDITION	SYMBOL	MIN.	TYP.	MAX.	UNIT
<b>INPUT (LED EMITTER)</b>						
Forward voltage	$I_F = 10\text{ mA}$	$V_F$	-	1.25	1.50	V
$V_F$ temperature coefficient		$\Delta V_F / \Delta^{\circ}\text{C}$	-	-2.2	-	mV/°C
Reverse current	$V_R = 5\text{ V}$	$I_R$	-	1	-	μA
Junction capacitance	$V_F = 0\text{ V}, f = 1\text{ MHz}$	$C_j$	-	15	-	pF
Dynamic resistance	$I_F = 10\text{ mA}$	$\Delta V_F / \Delta I_F$	-	6	-	Ω
<b>OUTPUT</b>						
Dark current	$V_{det} = -15\text{ V}, I_F = 0\text{ A}$	$I_D$	-	1	25	nA
Open circuit voltage	$I_F = 10\text{ mA}$	$V_D$	-	500	-	mV
Short circuit current	$I_F = 10\text{ mA}$	$I_{SC}$	-	120	-	μA
Junction capacitance	$V_F = 0\text{ V}, f = 1\text{ MHz}$	$C_j$	-	12	-	pF
Noise equivalent power	$V_{det} = 15\text{ V}$	NEP	-	$4 \times 10^{-14}$	-	W/√Hz
<b>COUPLER</b>						
Input-output capacitance	$V_F = 0\text{ V}, f = 1\text{ MHz}$		-	1	-	pF
K1, servo gain ( $I_{P1}/I_F$ )	$I_F = 10\text{ mA}, V_{det} = -15\text{ V}$	K1	0.006	0.012	0.017	
Servo photocurrent <sup>(1)(2)</sup>	$I_F = 10\text{ mA}, V_{det} = -15\text{ V}$	$I_{P1}$	-	120	-	μA
K2, forward gain ( $I_{P2}/I_F$ )	$I_F = 10\text{ mA}, V_{det} = -15\text{ V}$	K2	0.006	0.012	0.017	
Forward current	$I_F = 10\text{ mA}, V_{det} = -15\text{ V}$	$I_{P2}$	-	120	-	μA
K3, transfer gain ( $K2/K1$ ) <sup>(1)(2)</sup>	$I_F = 10\text{ mA}, V_{det} = -15\text{ V}$	K3	0.56	1	1.65	K2/K1
Transfer gain stability	$I_F = 10\text{ mA}, V_{det} = -15\text{ V}$	$\Delta K3 / \Delta T_A$	-	± 0.005	± 0.15	%/°C
Transfer gain linearity	$I_F = 1\text{ mA to }10\text{ mA}$	$\Delta K3$	-	± 0.25	-	%
	$I_F = 1\text{ mA to }10\text{ mA}, T_{amb} = 0\text{ }^{\circ}\text{C to }75\text{ }^{\circ}\text{C}$		-	± 0.5	-	%



ELECTRICAL CHARACTERISTICS ( $T_{amb} = 25\text{ }^{\circ}\text{C}$ , unless otherwise specified)						
PARAMETER	TEST CONDITION	SYMBOL	MIN.	TYP.	MAX.	UNIT
<b>PHOTOCONDUCTIVE OPERATION</b>						
Frequency response	$I_{Fq} = 10\text{ mA}$ , $MOD = \pm 4\text{ mA}$ , $R_L = 50\text{ }\Omega$	BW (-3 db)	-	200	-	kHz
Phase response at 200 kHz	$V_{det} = -15\text{ V}$		-	-45	-	Deg.

**Notes**

- Minimum and maximum values were tested 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
- (1) Bin sorting: K3 (transfer gain) is sorted into bins that are  $\pm 6\%$ , as follows:
  - Bin A = 0.557 to 0.626
  - Bin B = 0.620 to 0.696
  - Bin C = 0.690 to 0.773
  - Bin D = 0.765 to 0.859
  - Bin E = 0.851 to 0.955
  - Bin F = 0.945 to 1.061
  - Bin G = 1.051 to 1.181
  - Bin H = 1.169 to 1.311
  - Bin I = 1.297 to 1.456
  - Bin J = 1.442 to 1.618
 K3 = K2/K1. K3 is tested at  $I_F = 10\text{ mA}$ ,  $V_{det} = -15\text{ V}$
- (2) Bin categories: All IL300s are sorted into a K3 bin, indicated by an alpha character that is marked on the part. The bins range from "A" through "J".  
The IL300 is shipped in tubes of 50 each. Each tube contains only one category of K3. The category of the parts in the tube is marked on the tube label as well as on each individual part
- (3) Category options: standard IL300 orders will be shipped from the categories that are available at the time of the order. Any of the ten categories may be shipped. For customers requiring a narrower selection of bins, the bins can be grouped together as follows:  
IL300-DEFG: order this part number to receive categories D, E, F, G only  
IL300-EF: order this part number to receive categories E, F only  
IL300-E: order this part number to receive category E only

SWITCHING CHARACTERISTICS						
PARAMETER	TEST CONDITION	SYMBOL	MIN.	TYP.	MAX.	UNIT
Switching time	$\Delta I_F = 2\text{ mA}$ , $I_{Fq} = 10\text{ mA}$	$t_r$	-	1	-	$\mu\text{s}$
		$t_f$	-	1	-	$\mu\text{s}$
Rise time		$t_r$	-	1.75	-	$\mu\text{s}$
Fall time		$t_f$	-	1.75	-	$\mu\text{s}$

COMMON MODE TRANSIENT IMMUNITY						
PARAMETER	TEST CONDITION	SYMBOL	MIN.	TYP.	MAX.	UNIT
Common mode capacitance	$V_F = 0\text{ V}$ , $f = 1\text{ MHz}$	$C_{CM}$	-	0.5	-	pF
Common mode rejection ratio	$f = 60\text{ Hz}$ , $R_L = 2.2\text{ k}\Omega$	CMRR	-	130	-	dB

SAFETY AND INSULATION RATINGS				
PARAMETER	TEST CONDITION	SYMBOL	VALUE	UNIT
Climatic classification	According to IEC 68 part 1		55 / 100 / 21	
Comparative tracking index		CTI	175	
Maximum rated withstanding isolation voltage	$t = 1\text{ min}$	$V_{ISO}$	4420	$V_{RMS}$
Maximum transient isolation voltage		$V_{IOTM}$	10 000	$V_{peak}$
Maximum repetitive peak isolation voltage		$V_{IORM}$	890	$V_{peak}$
Isolation resistance	$V_{IO} = 500\text{ V}$ , $T_{amb} = 25\text{ }^{\circ}\text{C}$	$R_{IO}$	$\geq 10^{12}$	$\Omega$
	$V_{IO} = 500\text{ V}$ , $T_{amb} = 100\text{ }^{\circ}\text{C}$	$R_{IO}$	$\geq 10^{11}$	$\Omega$
Output safety power		$P_{SO}$	400	mW
Input safety current		$I_{SI}$	275	mA
Safety temperature		$T_S$	175	$^{\circ}\text{C}$
Creepage distance			$\geq 7$	mm
Clearance distance			$\geq 7$	mm
Insulation thickness		DTI	$\geq 0.4$	mm

**Note**

- As per IEC 60747-5-5, § 7.4.3.8.2, 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)

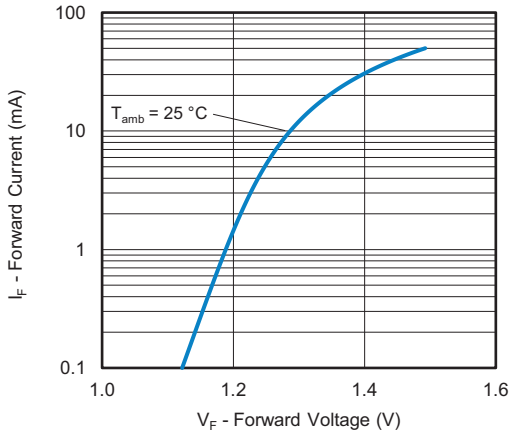


Fig. 1 - Forward Current vs. Forward Voltage

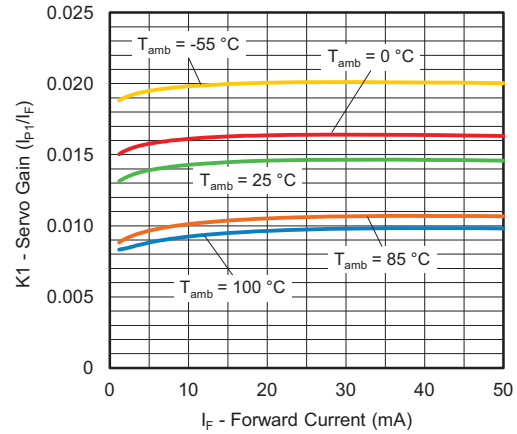


Fig. 4 - Servo Gain vs. Forward Current

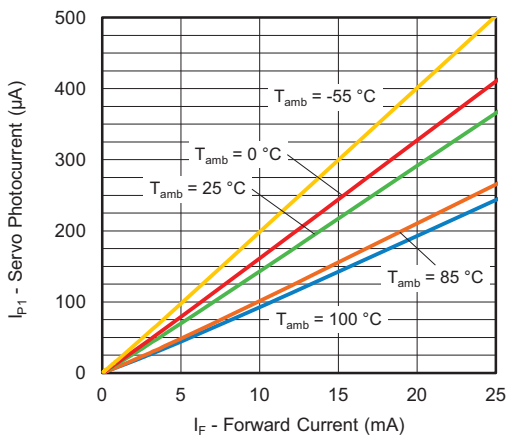


Fig. 2 - Servo Photocurrent vs. Forward Current

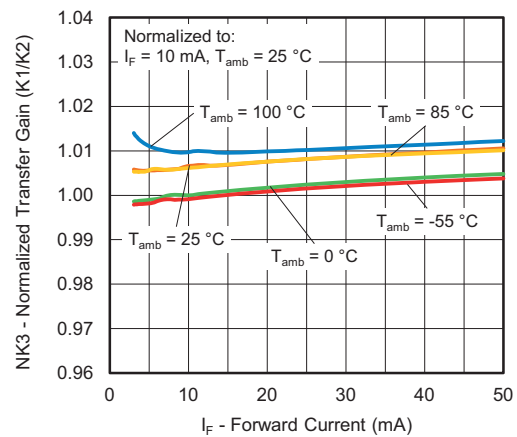


Fig. 5 - Normalized Transfer Gain vs. Forward Current

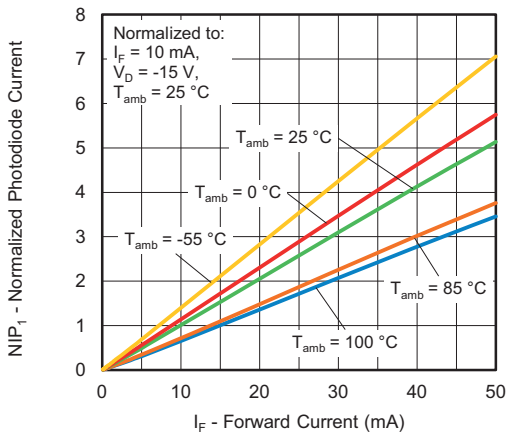


Fig. 3 - Normalized Photodiode Current vs. Forward Current

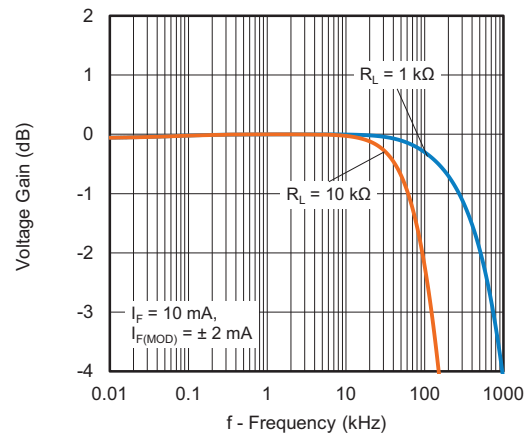


Fig. 6 - Voltage Gain vs. Frequency (2 mA)

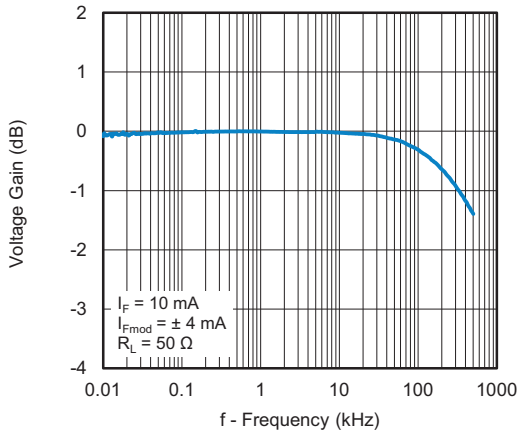


Fig. 7 - Voltage Gain vs. Frequency

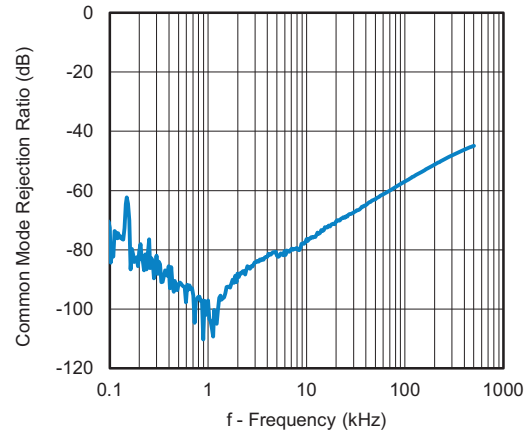


Fig. 9 - Common-Mode Rejection Ratio vs. Frequency

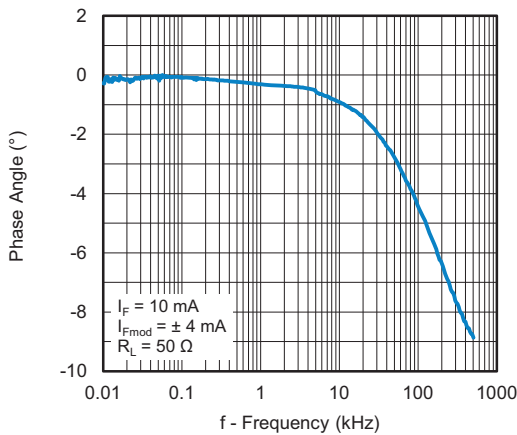


Fig. 8 - Phase Angle vs. Frequency

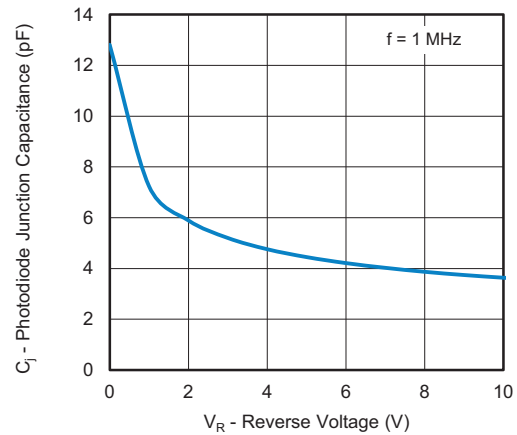
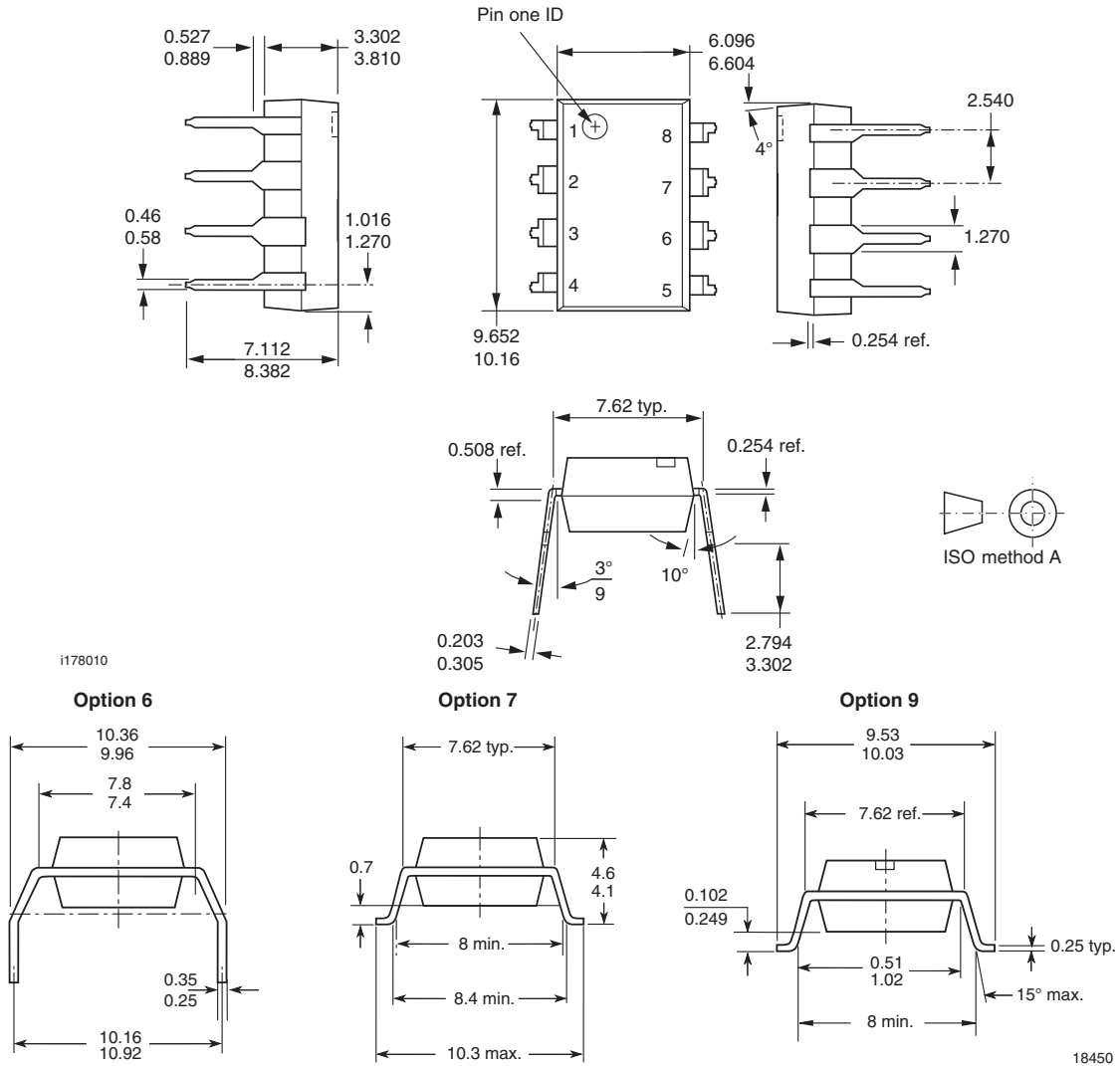


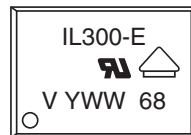
Fig. 10 - Photodiode Junction Capacitance vs. Reverse Voltage



PACKAGE DIMENSIONS (in millimeters)



PACKAGE MARKING (example of IL300-E-X001)





## **Disclaimer**

ALL PRODUCT, PRODUCT SPECIFICATIONS AND DATA ARE SUBJECT TO CHANGE WITHOUT NOTICE TO IMPROVE RELIABILITY, FUNCTION OR DESIGN OR OTHERWISE.

Vishay Intertechnology, Inc., its affiliates, agents, and employees, and all persons acting on its or their behalf (collectively, "Vishay"), disclaim any and all liability for any errors, inaccuracies or incompleteness contained in any datasheet or in any other disclosure relating to any product.

Vishay makes no warranty, representation or guarantee regarding the suitability of the products for any particular purpose or the continuing production of any product. To the maximum extent permitted by applicable law, Vishay disclaims (i) any and all liability arising out of the application or use of any product, (ii) any and all liability, including without limitation special, consequential or incidental damages, and (iii) any and all implied warranties, including warranties of fitness for particular purpose, non-infringement and merchantability.

Statements regarding the suitability of products for certain types of applications are based on Vishay's knowledge of typical requirements that are often placed on Vishay products in generic applications. Such statements are not binding statements about the suitability of products for a particular application. It is the customer's responsibility to validate that a particular product with the properties described in the product specification is suitable for use in a particular application. Parameters provided in datasheets and / or specifications may vary in different applications and performance may vary over time. All operating parameters, including typical parameters, must be validated for each customer application by the customer's technical experts. Product specifications do not expand or otherwise modify Vishay's terms and conditions of purchase, including but not limited to the warranty expressed therein.

Except as expressly indicated in writing, Vishay products are not designed for use in medical, life-saving, or life-sustaining applications or for any other application in which the failure of the Vishay product could result in personal injury or death. Customers using or selling Vishay products not expressly indicated for use in such applications do so at their own risk. Please contact authorized Vishay personnel to obtain written terms and conditions regarding products designed for such applications.

No license, express or implied, by estoppel or otherwise, to any intellectual property rights is granted by this document or by any conduct of Vishay. Product names and markings noted herein may be trademarks of their respective owners.