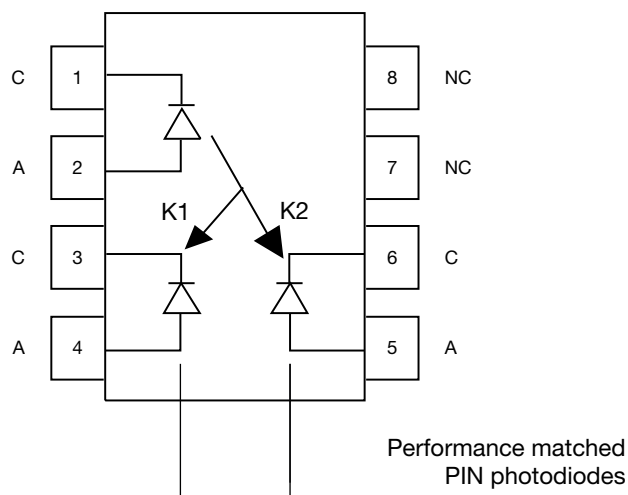
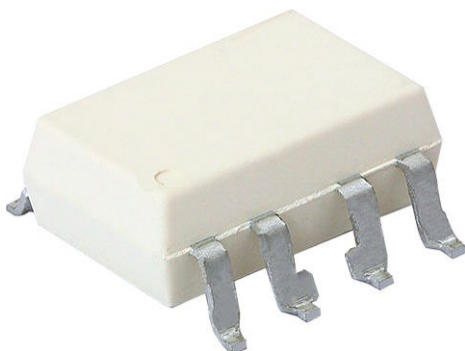


Automotive Fast Response Linear Optocoupler for Voltage and Current Sensing



$$K3 = K2 / K1$$

$$K1 = I_{P1} / I_F$$

$$K2 = I_{P2} / I_F$$

Performance matched
PIN photodiodes



DESCRIPTION

The VOA300 linear optocoupler consists of an infrared emitter 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.

FEATURES

- AEC-Q102 qualified
- High gain linearity, $\pm 0.25\%$ typically
- Wide bandwidth, 1.4 MHz typically
- High gain stability, $\pm 0.005\%/^{\circ}\text{C}$ typically
- High isolation voltage 5300 V_{RMS}
- Material categorization:
for definitions of compliance please see
www.vishay.com/doc?99912

AUTOMOTIVE
GRADE



RoHS
COMPLIANT
HALOGEN
FREE
GREEN
(5-2008)

APPLICATIONS

- Galvanically isolated voltage and current sensing of automotive batteries
- On board charger (OBC) voltage monitoring
- DC/DC converter and AC/DC inverter stage voltage monitoring
- Isolated signal transfer for temperature sensors

AGENCY APPROVALS

- [UL](#)
- [cUL](#)
- [DIN EN 60747-5-5 \(VDE 0884-5\)](#)
- [BSI](#)
- [CQC](#)

LINKS TO ADDITIONAL RESOURCES



[Product Page](#)



[Application Notes](#)



[3D Models](#)



[SPICE Models](#)



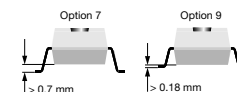
[Ultra Librarian EDA/CAD](#)



[Design Tools](#)

ORDERING INFORMATION

V	O	A	3	0	0	-	D	E	F	G	-	X	0	#	#	T
PART NUMBER						K3 BIN					PACKAGE OPTION					TAPE AND REEL



AGENCY CERTIFIED / PACKAGE	K3 BIN			
VDE, UL, cUL, CQC	0.765 to 1.181	0.851 to 1.061	0.945 to 1.181	0.945 to 1.061
SMD-8, option 7	VOA300-DEFG-X017T	VOA300-EF-X017T	VOA300-FG-X017T	VOA300-F-X017T
SMD-8, option 9	VOA300-DEFG-X019T	VOA300-EF-X019T	VOA300-FG-X019T	VOA300-F-X019T

Note

- Additional options may be possible, please contact sales office

ABSOLUTE MAXIMUM RATINGS ($T_{amb} = 25\text{ }^{\circ}\text{C}$, unless otherwise specified)

PARAMETER	TEST CONDITION	SYMBOL	VALUE	UNIT
INPUT				
Power dissipation		P_{diss}	100	mW
Forward current		I_F	60	mA
Reverse voltage		V_R	5	V
Junction temperature		T_j	140	$^{\circ}\text{C}$
OUTPUT				
Power dissipation		P_{diss}	50	mW
Reverse voltage		V_R	50	V
Junction temperature		T_j	140	$^{\circ}\text{C}$
COUPLER				
Total package dissipation at 25 $^{\circ}\text{C}$		P_{tot}	150	mW
Storage temperature		T_{stg}	-40 to +150	$^{\circ}\text{C}$
Operating temperature		T_{amb}	-40 to +125	$^{\circ}\text{C}$

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.



ELECTRICAL CHARACTERISTICS ($T_{amb} = 25\text{ }^{\circ}\text{C}$, unless otherwise specified)						
PARAMETER	TEST CONDITION	SYMBOL	MIN.	TYP.	MAX.	UNIT
INPUT (LED EMITTER)						
Forward voltage	$I_F = 10\text{ mA}$	V_F	-	1.4	1.5	V
Reverse current	$V_R = 5\text{ V}$	I_R	-	1	-	μA
Junction capacitance	$V_F = 0\text{ V}$, $f = 1\text{ MHz}$	C_j	-	26	-	pF
OUTPUT						
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}	-	90	-	μA
Junction capacitance	$V_F = 0\text{ V}$, $f = 1\text{ MHz}$	C_j	-	12	-	pF
COUPLER						
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	0.005	0.009	0.015	
Servo photocurrent ⁽¹⁾⁽²⁾	$I_F = 10\text{ mA}$, $V_{det} = -15\text{ V}$	I_{P1}	-	90	-	μA
K2, forward gain (I_{P2}/I_F)	$I_F = 10\text{ mA}$, $V_{det} = -15\text{ V}$	K2	0.005	0.009	0.015	
Forward current	$I_F = 10\text{ mA}$, $V_{det} = -15\text{ V}$	I_{P2}	-	90	-	μA
K3, transfer gain ($K2/K1$) ⁽¹⁾⁽²⁾	$I_F = 10\text{ mA}$, $V_{det} = -15\text{ V}$	K3	0.765	1	1.181	K2/K1
Transfer gain stability	$I_F = 10\text{ mA}$, $V_{det} = -15\text{ V}$, $T_{amb} = 0\text{ }^{\circ}\text{C}$ to $75\text{ }^{\circ}\text{C}$	$\Delta K3/\Delta T_A$	-	± 0.005	± 0.15	%/ $^{\circ}\text{C}$
Transfer gain linearity	$I_F = 2\text{ mA}$ to 10 mA	$\Delta K3$	-	± 0.25	-	%
PHOTOCONDUCTIVE OPERATION						
Frequency response	$I_F = 10\text{ mA}$, $MOD = \pm 4\text{ mA}$, $R_L = 50\text{ }\Omega$	BW (-3 db)	-	1.4	-	MHz
Phase response at 200 kHz	$V_{det} = -15\text{ V}$		-	-45	-	$^{\circ}$

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 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
 K3 = K2/K1. K3 is tested at $I_F = 10\text{ mA}$, $V_{det} = -15\text{ V}$
- (2) Bin categories: All VOA300s are sorted into a K3 bin, indicated by an alpha character that is marked on the part. The bins range from "D" through "G" as mentioned in ⁽¹⁾ above.
- (3) Category options: for customers requiring a narrower selection of bins, the bins can be grouped together as follows:
 VOA300-DEFG: order this part number to receive categories D, E, F, G only
 VOA300-EF: order this part number to receive categories E, F only
 VOA300-E: order this part number to receive category E only

SWITCHING CHARACTERISTICS

PARAMETER	TEST CONDITION	SYMBOL	MIN.	TYP.	MAX.	UNIT
Rise time	$I_F = 10 \text{ mA}$, MOD = +2 mA, $R_L = 10 \text{ k}\Omega$	t_r	-	0.8	-	μs
Fall time		t_f	-	0.8	-	μs

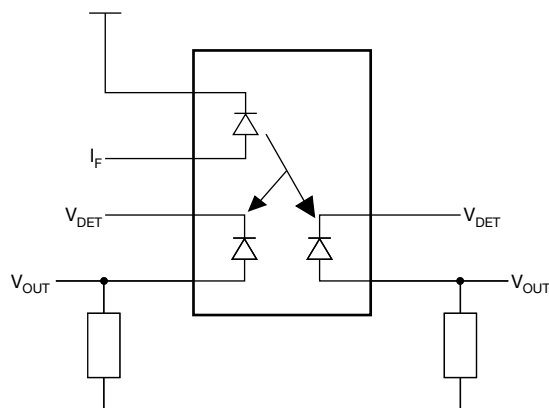


Fig. 1 - Test Circuit

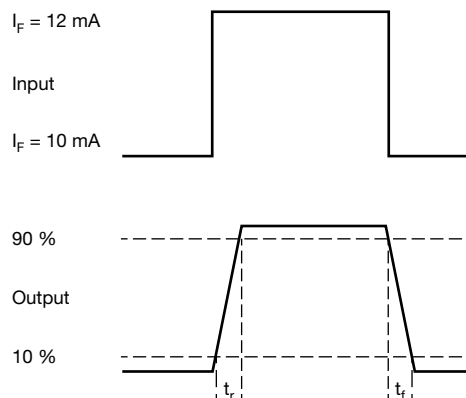


Fig. 2 - Switching Times

SAFETY AND INSULATION RATINGS

PARAMETER	TEST CONDITION	SYMBOL	VALUE	UNIT
Climatic classification	According to IEC 68 part 1		40 / 125 / 21	
Comparative tracking index		CTI	400	
Maximum rated withstanding isolation voltage	$t = 1 \text{ min}$	V_{ISO}	5300	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}	$\geq 10^{12}$	Ω
	$V_{IO} = 500 \text{ V}$, $T_{amb} = 100 \text{ }^\circ\text{C}$	R_{IO}	$\geq 10^{11}$	Ω
Output safety power		P_{SO}	400	mW
Input safety current		I_{SI}	275	mA
Safety temperature		T_S	175	$^\circ\text{C}$
Creepage distance	SMD-8, option 7; SMD-8, option 9		≥ 8	mm
Clearance distance			≥ 8	mm
Insulation thickness		DTI	≥ 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.

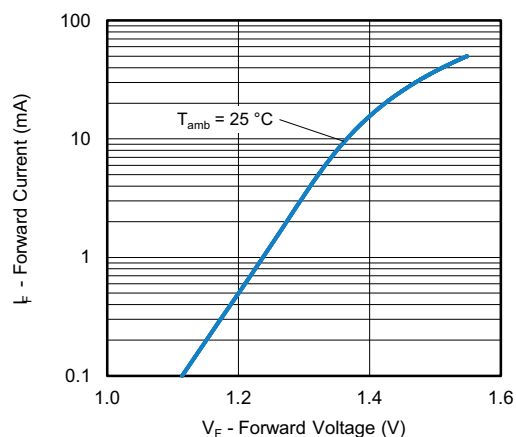
TYPICAL CHARACTERISTICS ($T_{amb} = 25\text{ }^{\circ}\text{C}$, unless otherwise specified)


Fig. 3 - Forward Voltage vs. Forward Current

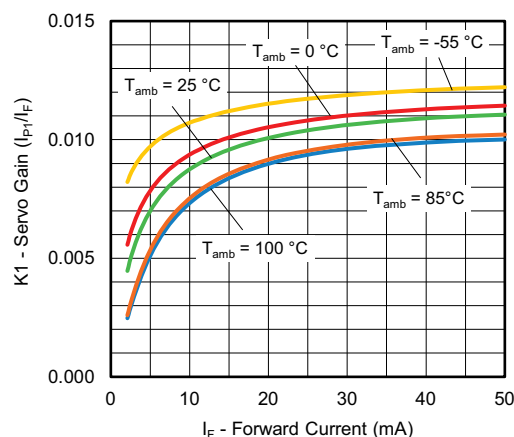


Fig. 6 - Servo Gain vs. Forward Current

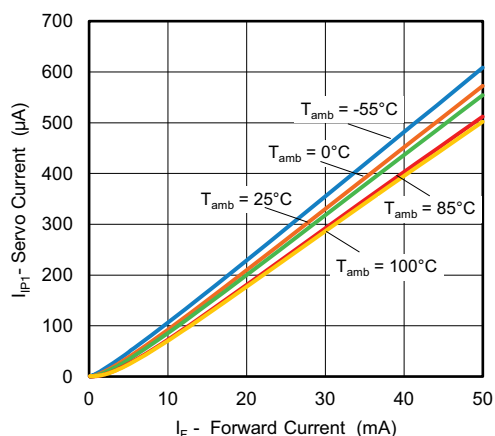


Fig. 4 - Servo Photocurrent vs. Forward Current

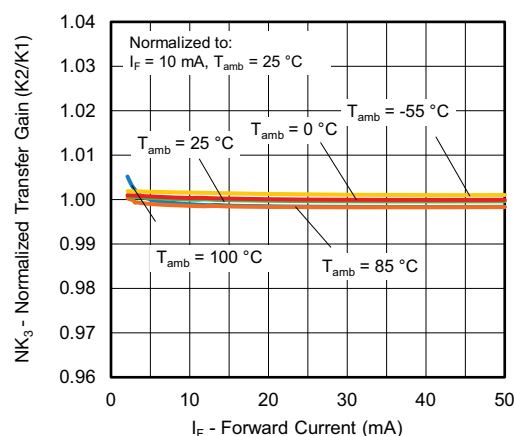


Fig. 7 - Normalized Transfer Gain vs. Forward Current

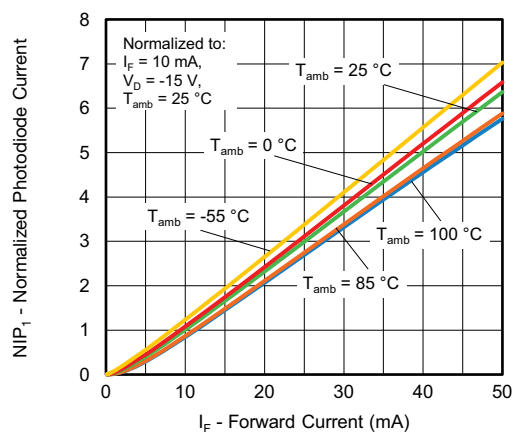
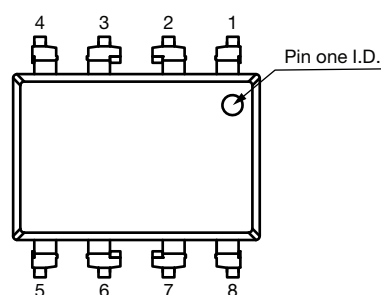
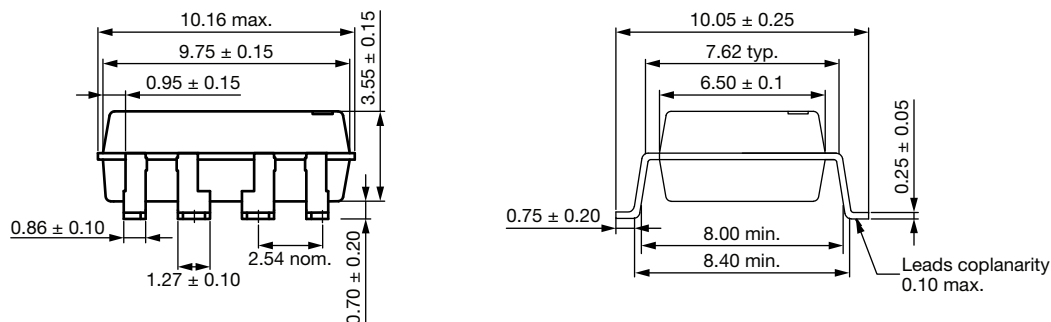
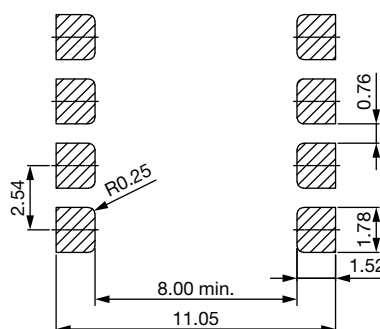
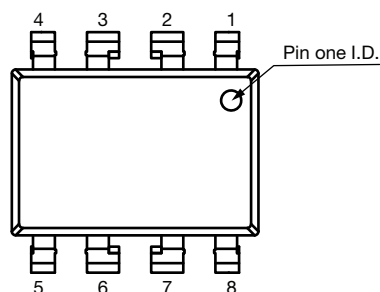
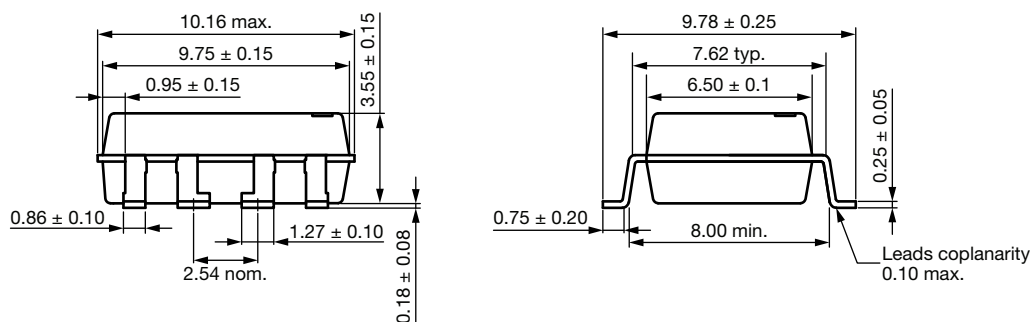
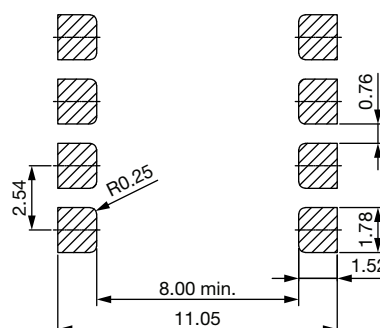


Fig. 5 - Normalized Photodiode Current vs. Forward Current

PACKAGE DIMENSIONS (in millimeters)

Option 7

Recommended footprint


Drawing No.: VMS 006-2330
Issue: C; 02.06.2022

Option 9

Recommended footprint


Drawing No.: VMS 006-2330
Issue: C; 02.06.2022

PACKAGE MARKING

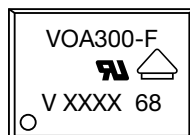
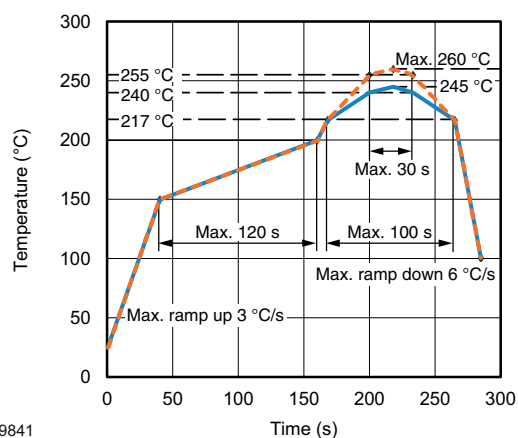


Fig. 8 - Example of VOA300-F-X001

Notes

- XXXX = LMC (lot marking code)
- VDE logo is only marked on "option 1" parts
- Tape and reel suffix (T) is not part of the package marking

SOLDER PROFILES



19841

Fig. 9 - Lead (Pb)-free Reflow Solder Profile According to J-STD-020 for SMD Devices

HANDLING AND STORAGE CONDITIONS

ESD level: HBM class 1C

Floor life: unlimited

Conditions: $T_{amb} < 30\text{ °C}$, RH < 60 %

Moisture sensitivity level 1, according to J-STD-020



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.

Hyperlinks included in this datasheet may direct users to third-party websites. These links are provided as a convenience and for informational purposes only. Inclusion of these hyperlinks does not constitute an endorsement or an approval by Vishay of any of the products, services or opinions of the corporation, organization or individual associated with the third-party website. Vishay disclaims any and all liability and bears no responsibility for the accuracy, legality or content of the third-party website or for that of subsequent links.

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.