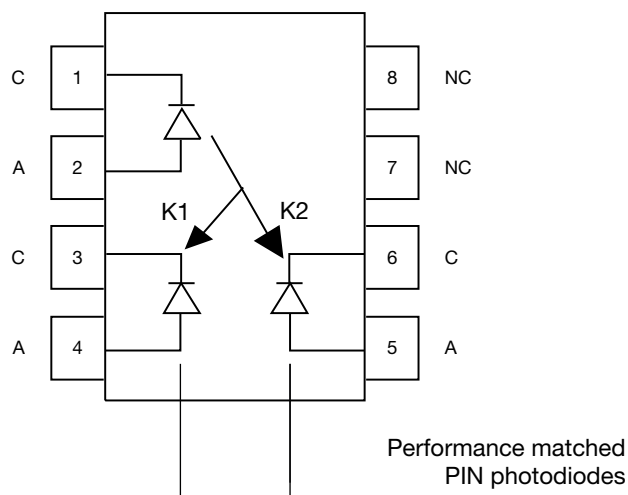
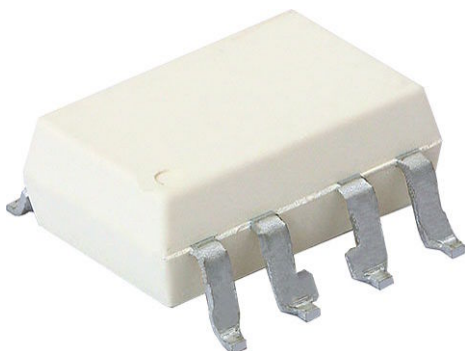


# Automotive Fast Response Linear Optocoupler for Voltage and Current Sensing



$$K3 = K2 / K1$$

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

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

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<sub>RMS</sub>
- Material categorization:  
for definitions of compliance please see  
[www.vishay.com/doc?99912](http://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



Models



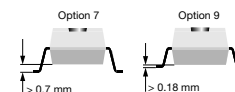
Ultra Librarian EDA/CAD



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
<b>INPUT</b>				
Power dissipation		$P_{diss}$	100	mW
Forward current		$I_F$	60	mA
Reverse voltage		$V_R$	5	V
Junction temperature		$T_j$	140	$^{\circ}\text{C}$
<b>OUTPUT</b>				
Power dissipation		$P_{diss}$	50	mW
Reverse voltage		$V_R$	50	V
Junction temperature		$T_j$	140	$^{\circ}\text{C}$
<b>COUPLER</b>				
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.



<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	$I_F = 10\text{ mA}$	$V_F$	-	1.4	1.5	V
Reverse current	$V_R = 5\text{ V}$	$I_R$	-	1	-	$\mu\text{A}$
Junction capacitance	$V_F = 0\text{ V}$ , $f = 1\text{ MHz}$	$C_j$	-	26	-	pF
<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	$I_F = 10\text{ mA}$	$I_{SC}$	-	90	-	$\mu\text{A}$
Junction capacitance	$V_F = 0\text{ V}$ , $f = 1\text{ MHz}$	$C_j$	-	12	-	pF
<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	0.005	0.009	0.015	
Servo photocurrent <sup>(1)(2)</sup>	$I_F = 10\text{ mA}$ , $V_{det} = -15\text{ V}$	$I_{P1}$	-	90	-	$\mu\text{A}$
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	-	$\mu\text{A}$
K3, transfer gain ( $K2/K1$ ) <sup>(1)(2)</sup>	$I_F = 10\text{ mA}$ , $V_{det} = -15\text{ V}$	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 $75\text{ }^{\circ}\text{C}$	$\Delta K3/\Delta T_A$	-	$\pm 0.005$	$\pm 0.15$	%/ $^{\circ}\text{C}$
Transfer gain linearity	$I_F = 2\text{ mA}$ to $10\text{ mA}$	$\Delta K3$	-	$\pm 0.25$	-	%
<b>PHOTOCONDUCTIVE OPERATION</b>						
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 <sup>(1)</sup> 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	-	$\mu\text{s}$
Fall time		$t_f$	-	0.8	-	$\mu\text{s}$

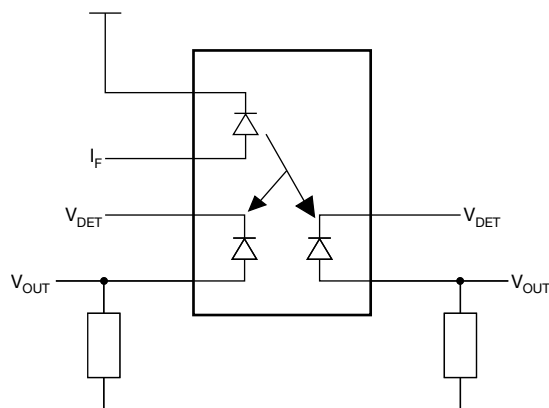


Fig. 1 - Test Circuit

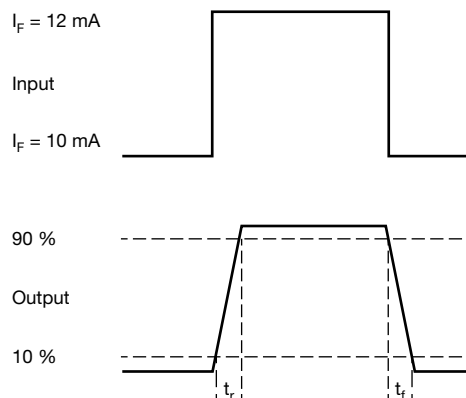


Fig. 2 - Switching Times

**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	$V_{IO} = 500 \text{ V}$ , $T_{amb} = 25 \text{ }^\circ\text{C}$	$R_{IO}$	$\geq 10^{12}$	$\Omega$
	$V_{IO} = 500 \text{ V}$ , $T_{amb} = 100 \text{ }^\circ\text{C}$	$R_{IO}$	$\geq 10^{11}$	$\Omega$
Output safety power		$P_{SO}$	400	mW
Input safety current		$I_{SI}$	275	mA
Safety temperature		$T_S$	175	$^\circ\text{C}$
Creepage distance	SMD-8, option 7; SMD-8, option 9		$\geq 8$	mm
Clearance distance			$\geq 8$	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.

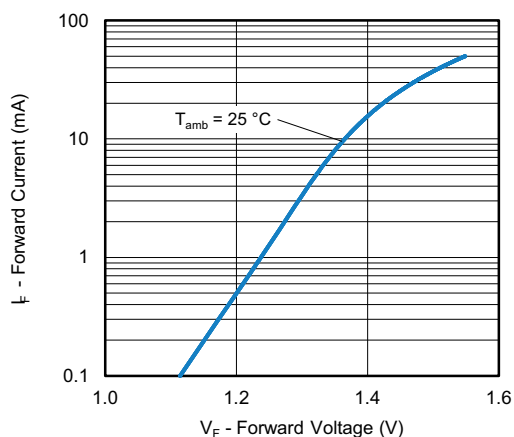
**TYPICAL CHARACTERISTICS** ( $T_{amb} = 25\text{ }^{\circ}\text{C}$ , unless otherwise specified)


Fig. 3 - Forward Voltage vs. Forward Current

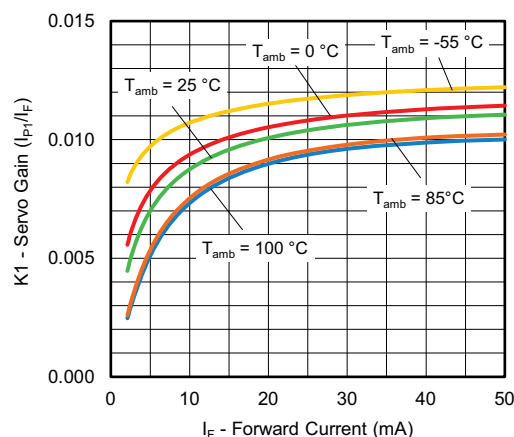


Fig. 6 - Servo Gain vs. Forward Current

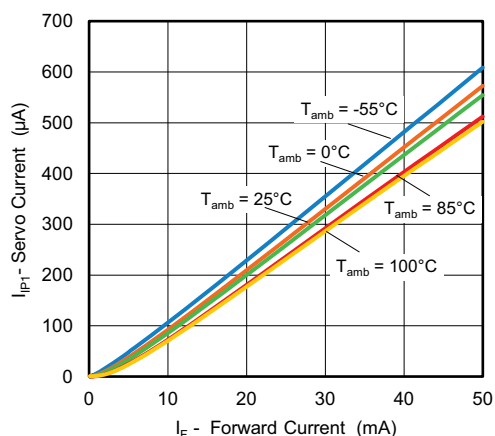


Fig. 4 - Servo Photocurrent vs. Forward Current

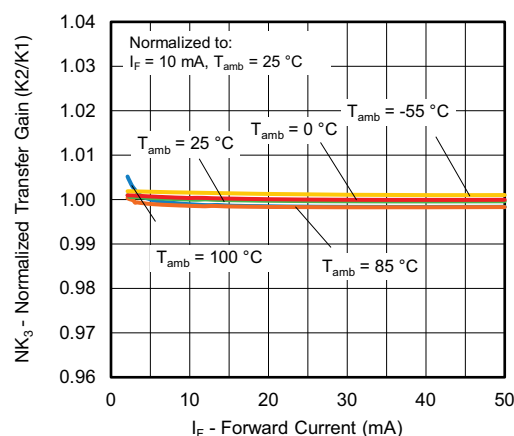


Fig. 7 - Normalized Transfer Gain vs. Forward Current

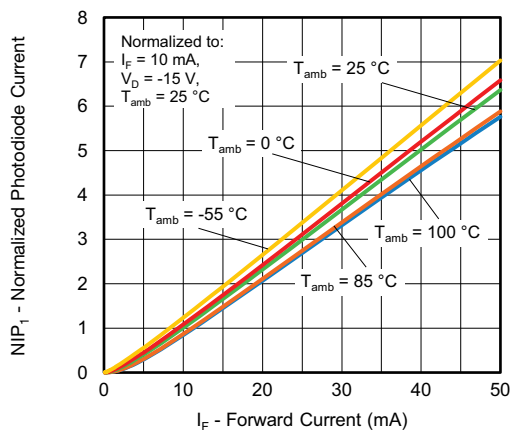
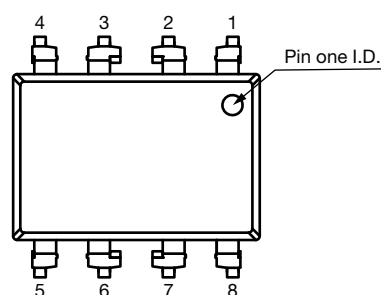
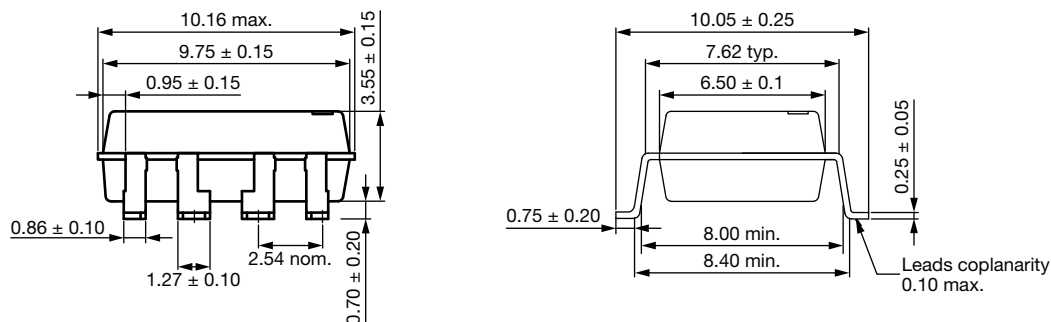
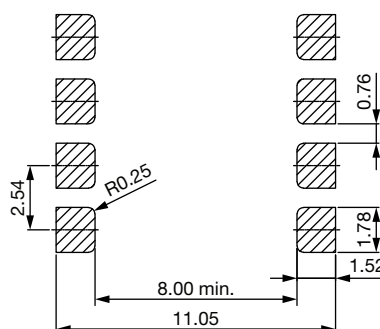


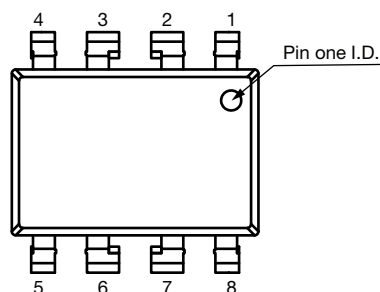
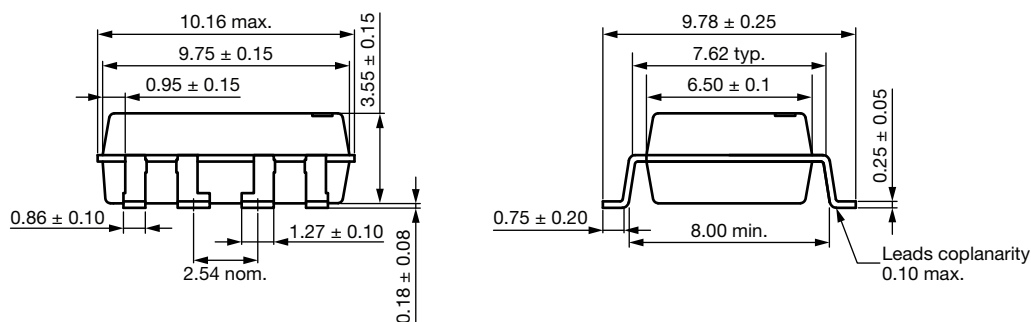
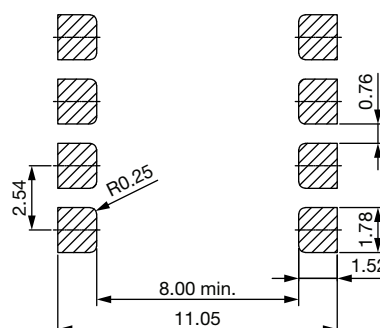
Fig. 5 - Normalized Photodiode Current vs. Forward Current

**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

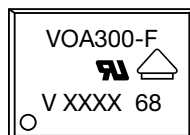
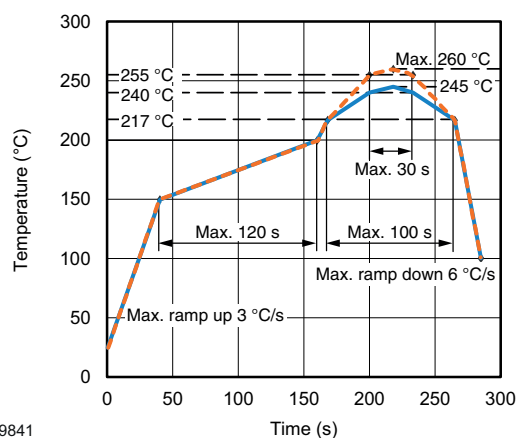


Fig. 8 - Example of VOA300-F-X001

### 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



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