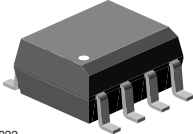
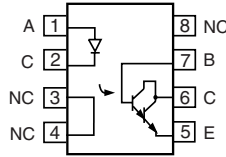




## Optocoupler, Photodarlington Output, Low Input Current, High Gain, with Base Connection



1179022



### DESCRIPTION

The VO221AT, VO222AT, VO223AT are high current transfer ratio (CTR) optocouplers with a gallium arsenide infrared LED emitter and a silicon NPN photodarlington transistor detector.

The device has a CTR tested at 1 mA LED current. This low drive current permits easy interfacing from CMOS to LSTTL or TTL.

### FEATURES

- Isolation test voltage, 4000 V<sub>RMS</sub>
- Lead (Pb)-free component
- Component in accordance to RoHS 2002/95/EC and WEEE 2002/96/EC



RoHS COMPLIANT

### AGENCY APPROVALS

- UL1577, file no. E52744 system code Y
- CUL - file no. E52744, equivalent to CSA bulletin 5A
- DIN EN 60747-5-5 (VDE 0884) available with option 1

### ORDER INFORMATION

PART	REMARKS
VO221AT	CTR > 100 %, SOIC-8
VO222AT	CTR > 200 %, SOIC-8
VO223AT	CTR > 500 %, SOIC-8

### ABSOLUTE MAXIMUM RATINGS

PARAMETER	TEST CONDITION	SYMBOL	VALUE	UNIT
<b>INPUT</b>				
Peak reverse voltage		V <sub>R</sub>	6	V
Peak forward current	1 μs, 300 pps	I <sub>FM</sub>	1	A
Forward continuous current		I <sub>F</sub>	60	mA
Power dissipation		P <sub>diss</sub>	90	mW
Derate linearly from 25 °C			1.2	mW/°C
<b>OUTPUT</b>				
Collector emitter breakdown voltage		BV <sub>CEO</sub>	30	V
Emitter collector breakdown voltage		BV <sub>ECO</sub>	5	V
Collector base breakdown voltage		BV <sub>CBO</sub>	70	V
I <sub>Cmax, DC</sub>		I <sub>Cmax, DC</sub>	50	mA
I <sub>Cmax</sub>	t < 1 ms	I <sub>Cmax</sub>	100	mA
Power dissipation		P <sub>diss</sub>	150	mW
<b>COUPLER</b>				
Derate linearly from 25 °C			2	mW/°C
Isolation test voltage	t = 1 s	V <sub>ISO</sub>	4000	V <sub>RMS</sub>
Total package dissipation (at 25 °C ambient) (LED and detector)		P <sub>tot</sub>	240	mW
Derate linearly from 25 °C			3.2	mW/°C
Storage temperature		T <sub>stg</sub>	- 40 to + 150	°C
Operating temperature		T <sub>amb</sub>	- 40 to + 100	°C
Soldering time at 260 °C		T <sub>slid</sub>	10	s

### Note

T<sub>amb</sub> = 25 °C, unless otherwise specified.

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.

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Vishay Semiconductors Optocoupler, Photodarlington Output,  
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ELECTRICAL CHARACTERISTICS						
PARAMETER	TEST CONDITION	SYMBOL	MIN.	TYP.	MAX.	UNIT
<b>INPUT</b>						
Forward voltage	$I_F = 1 \text{ mA}$	$V_F$		1	1.5	V
Reverse current	$V_R = 6 \text{ V}$	$I_R$		0.1	100	$\mu\text{A}$
Capacitance	$V_R = 0 \text{ V}, f = 1 \text{ MHz}$	$C_O$		25		pF
<b>OUTPUT</b>						
Collector emitter breakdown voltage	$I_C = 100 \mu\text{A}$	$BV_{CEO}$	30			V
Emitter collector breakdown voltage	$I_C = 10 \mu\text{A}$	$BV_{ECO}$	5			V
Collector base breakdown voltage	$I_C = 10 \mu\text{A}$	$BV_{CBO}$	70			V
Collector emitter leakage current	$V_{CE} = 20 \text{ V}$	$I_{CEO}$			40	nA
Collector base current		$I_{CBO}$			1	nA
Emitter base current		$I_{EBO}$			1	nA
Collector emitter capacitance	$V_{CE} = 10 \text{ V}$	$C_{CE}$		3.4		pF
Saturation voltage, collector emitter	$I_{CE} = 0.5 \text{ mA}$	$V_{CEsat}$			1	V
<b>COUPLER</b>						
Capacitance (input to output)		$C_{IO}$		0.5		pF

## Note

$T_{amb} = 25 \text{ }^\circ\text{C}$ , unless otherwise specified.

Minimum and maximum values are tested requirements. Typical values are characteristics of the device and are the result of engineering evaluations. Typical values are for information only and are not part of the testing requirements.

CURRENT TRANSFER RATIO							
PARAMETER	TEST CONDITION	PART	SYMBOL	MIN.	TYP.	MAX.	UNIT
Current transfer ratio	$I_F = 1 \text{ mA}, V_{CE} = 5 \text{ V}$	VO221AT	$CTR_{DC}$	100			%
		VO222AT	$CTR_{DC}$	200			%
		VO223AT	$CTR_{DC}$	500			%

SWITCHING CHARACTERISTICS						
PARAMETER	TEST CONDITION	SYMBOL	MIN.	TYP.	MAX.	UNIT
Turn-on time	$V_{CC} = 10 \text{ V}, R_L = 100 \Omega, I_F = 5 \text{ mA}$	$t_{on}$		3		$\mu\text{s}$
Turn-off time	$V_{CC} = 10 \text{ V}, R_L = 100 \Omega, I_F = 5 \text{ mA}$	$t_{off}$		3		$\mu\text{s}$

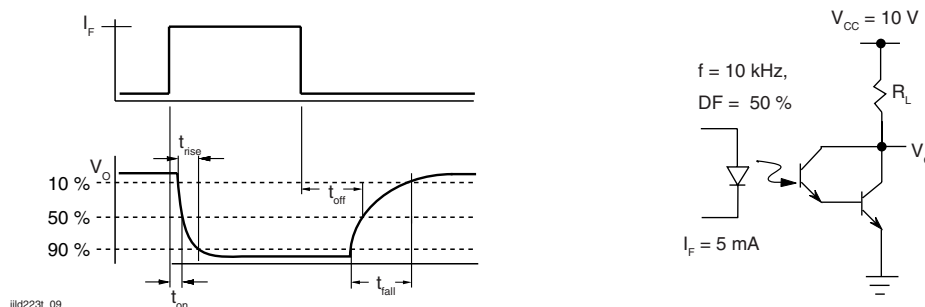


Fig. 1 - Switching Test Circuit



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SAFETY AND INSULATION RATINGS						
PARAMETER	TEST CONDITION	SYMBOL	MIN.	TYP.	MAX.	UNIT
Climatic classification (according to IEC 68 part 1)				40/100/21		
Polution degree				2		
Comparative tracking index		CTI	175		399	
Isolation test voltage	1 s	$V_{ISO}$	4000			$V_{RMS}$
Peak transient overvoltage		$V_{IOTM}$	6000			V
Peak insulation voltage		$V_{IORM}$	560			V
Resistance (input to output)		$R_{IO}$		100		$G\Omega$
Safety rating - power output		$P_{SO}$			350	mW
Safety rating - input current		$I_{SI}$			150	mA
Safety rating - temperature		$T_{SI}$			165	$^{\circ}C$
External creepage distance			4			mm
External clearance distance			4			mm
Internal creepage distance			3.3			mm
Insulation thickness			0.2			mm

**Note**

As per IEC 60747-5-2, § 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**

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

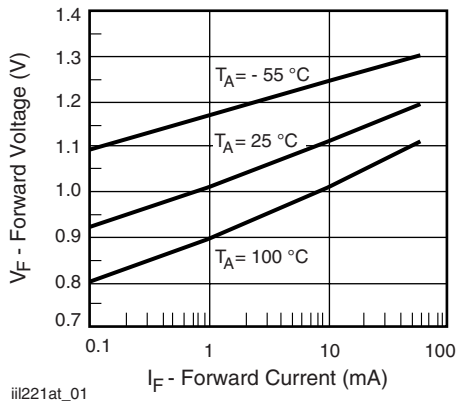


Fig. 2 - Forward Voltage vs. Forward Current

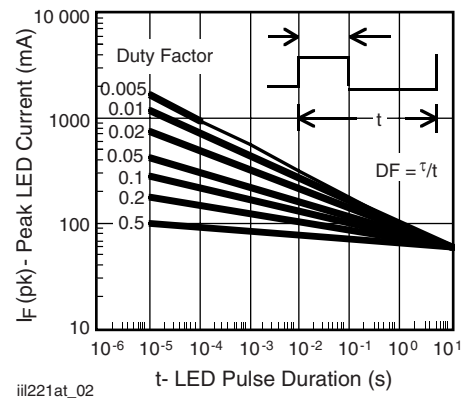


Fig. 3 - Peak LED Current vs. Duty Factor,  $\tau$

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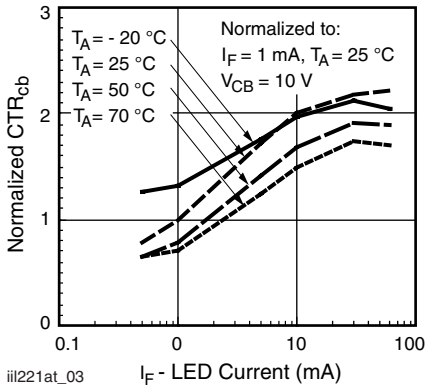


Fig. 4 - Normalized  $CTR_{cb}$  vs.  $I_F$

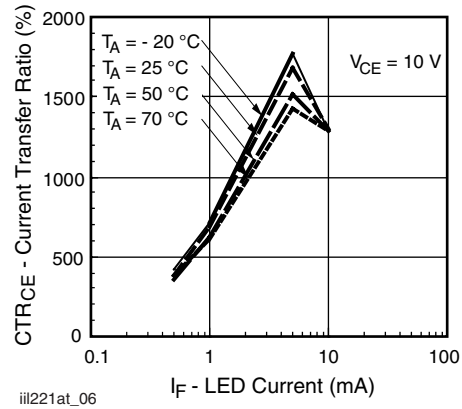


Fig. 7 - CTR vs. LED Current

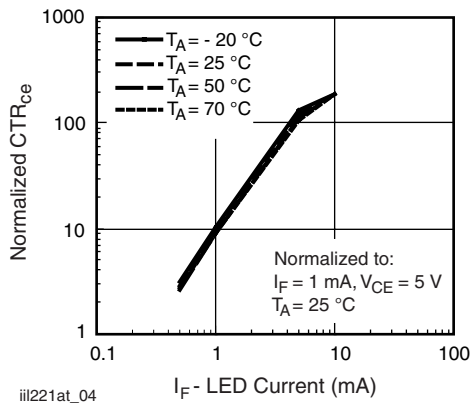


Fig. 5 - Normalized  $CTR_{CE}$  vs. LED Current

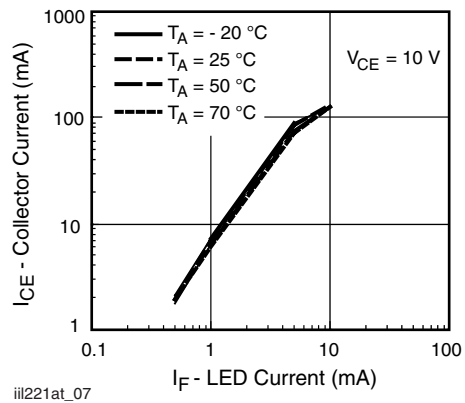


Fig. 8 - Collector Current vs. LED Current

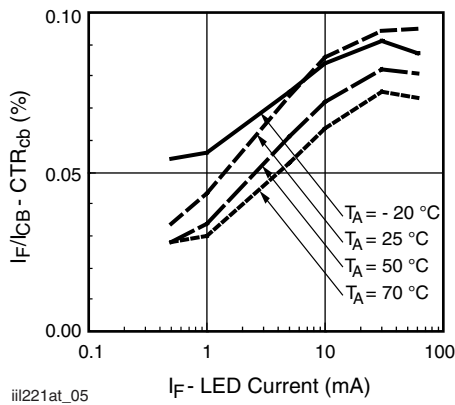


Fig. 6 -  $CTR_{CB}$  vs. LED Current

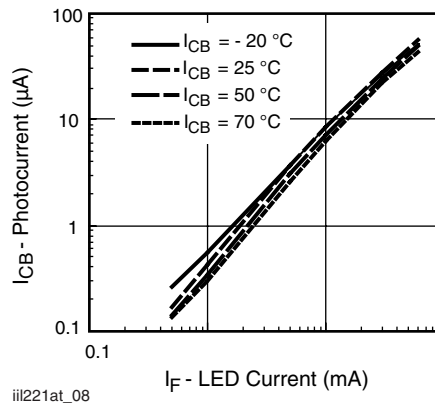


Fig. 9 - Photocurrent vs. LED Current



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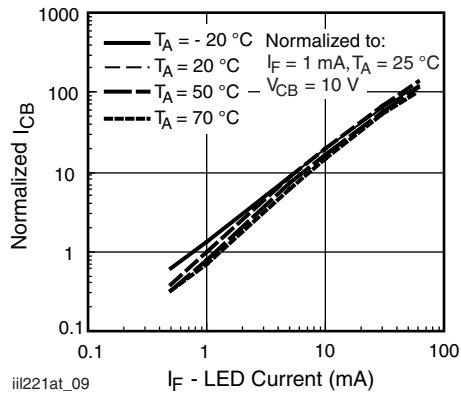
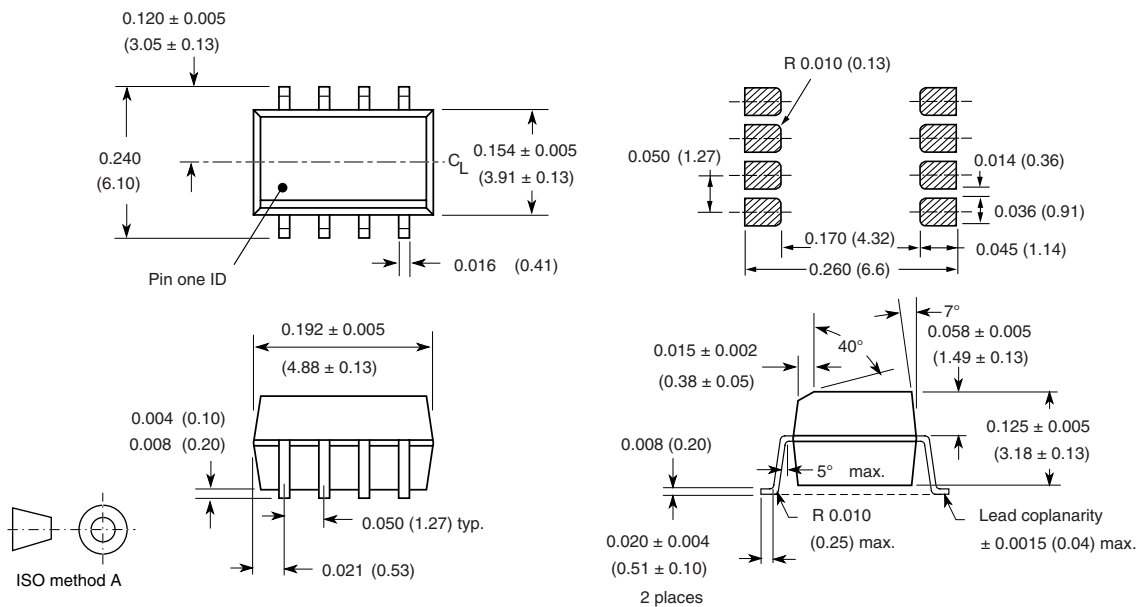


Fig. 10 - Normalized  $I_{CB}$  vs.  $I_F$

## PACKAGE DIMENSIONS in inches (millimeters)



i178003



Vishay Semiconductors Optocoupler, Photodarlington Output,  
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## **OZONE DEPLETING SUBSTANCES POLICY STATEMENT**

It is the policy of Vishay Semiconductor GmbH to

1. Meet all present and future national and international statutory requirements.
2. Regularly and continuously improve the performance of our products, processes, distribution and operating systems with respect to their impact on the health and safety of our employees and the public, as well as their impact on the environment.

It is particular concern to control or eliminate releases of those substances into the atmosphere which are known as ozone depleting substances (ODSs).

The Montreal Protocol (1987) and its London Amendments (1990) intend to severely restrict the use of ODSs and forbid their use within the next ten years. Various national and international initiatives are pressing for an earlier ban on these substances.

Vishay Semiconductor GmbH has been able to use its policy of continuous improvements to eliminate the use of ODSs listed in the following documents.

1. Annex A, B and list of transitional substances of the Montreal Protocol and the London Amendments respectively.
2. Class I and II ozone depleting substances in the Clean Air Act Amendments of 1990 by the Environmental Protection Agency (EPA) in the USA.
3. Council Decision 88/540/EEC and 91/690/EEC Annex A, B and C (transitional substances) respectively.

Vishay Semiconductor GmbH can certify that our semiconductors are not manufactured with ozone depleting substances and do not contain such substances.

We reserve the right to make changes to improve technical design  
and may do so without further notice.

Parameters can vary in different applications. All operating parameters must be validated for each customer application by the customer. Should the buyer use Vishay Semiconductors products for any unintended or unauthorized application, the buyer shall indemnify Vishay Semiconductors against all claims, costs, damages, and expenses, arising out of, directly or indirectly, any claim of personal damage, injury or death associated with such unintended or unauthorized use.

Vishay Semiconductor GmbH, P.O.B. 3535, D-74025 Heilbronn, Germany



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