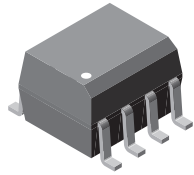
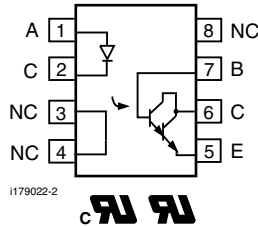




## Optocoupler, Photodarlington Output, Low Input Current, High Gain, with Base Connection



i179074



### FEATURES

- Isolation test voltage, 4000 V<sub>RMS</sub>
- Material categorization:  
For definitions of compliance please see [www.vishay.com/doc?99912](http://www.vishay.com/doc?99912)



RoHS COMPLIANT

### AGENCY APPROVALS

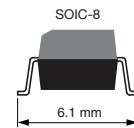
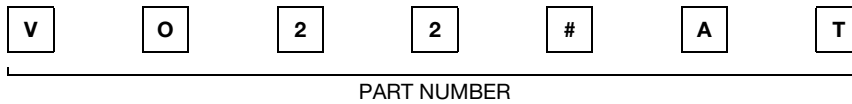
- UL1577, file no. E52744 system code Y
- cUL - file no. E52744, equivalent to CSA bulletin 5A
- DIN EN 60747-5-5 (VDE 0884-5) approved, contact customer service if this option is required

### 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.

### ORDERING INFORMATION



AGENCY CERTIFIED/PACKAGE	CTR (%)		
UL, cUL	≥ 100	≥ 200	≥ 500
SOIC-8	VO221AT	VO222AT	VO223AT

### ABSOLUTE MAXIMUM RATINGS (T<sub>amb</sub> = 25 °C, unless otherwise specified)

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

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

PARAMETER	TEST CONDITION	SYMBOL	VALUE	UNIT
<b>COUPLER</b>				
Derate linearly from 25 °C			2	mW/°C
Isolation test voltage	$t = 1\text{ s}$	$V_{ISO}$	4000	$V_{RMS}$
Total package dissipation (at 25 °C ambient) (LED and detector)		$P_{tot}$	240	mW
Derate linearly from 25 °C			3.2	mW/°C
Storage temperature		$T_{stg}$	- 40 to + 150	°C
Operating temperature		$T_{amb}$	- 40 to + 100	°C
Soldering time at 260 °C		$T_{sld}$	10	s

**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
<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	$I_C = 100\text{ }\mu\text{A}$	$BV_{CEO}$	30			V
Emitter collector breakdown voltage	$I_C = 10\text{ }\mu\text{A}$	$BV_{ECO}$	5			V
Collector base breakdown voltage	$I_C = 10\text{ }\mu\text{A}$	$BV_{CBO}$	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**

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

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

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

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		$\mu\text{s}$

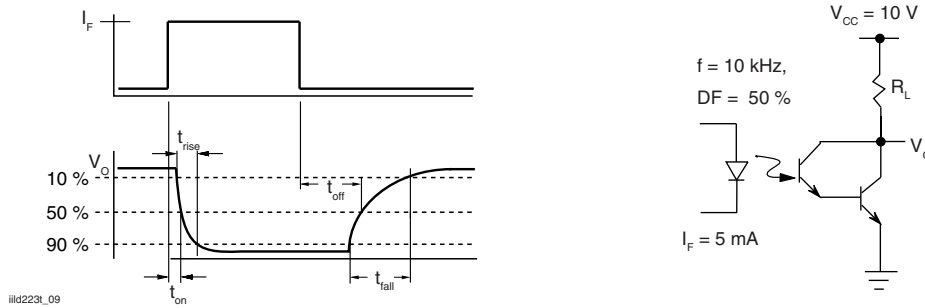


Fig. 1 - Switching Test Circuit

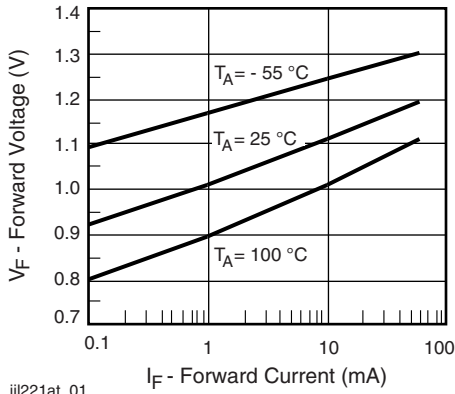
**SAFETY AND INSULATION RATINGS**

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)		$R_{IO}$		$10^{11}$		$\Omega$
Safety rating - power output		$P_{SO}$			350	mW
Safety rating - input current		$I_{SI}$			150	mA
Safety rating - temperature		$T_{SI}$			165	$^{\circ}\text{C}$
External creepage distance			4			mm
External clearance distance			4			mm
Internal creepage distance			3.3			mm
Insulation thickness			0.2			mm

**Note**

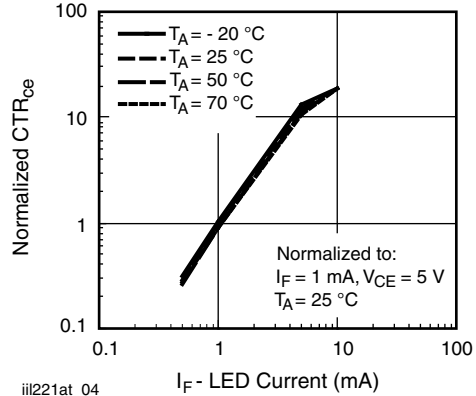
- As per IEC 60747-5-2, § 7.4.3.8.1, this optocoupler is suitable for "safe electrical insulation" only within the safety ratings. Compliance with the safety ratings shall be ensured by means of protective circuits.

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



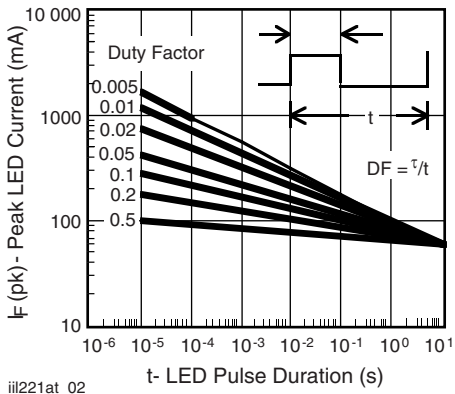
iii221at\_01

Fig. 2 - Forward Voltage vs. Forward Current



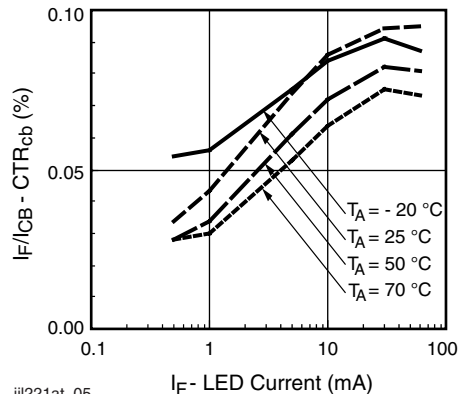
iii221at\_04

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



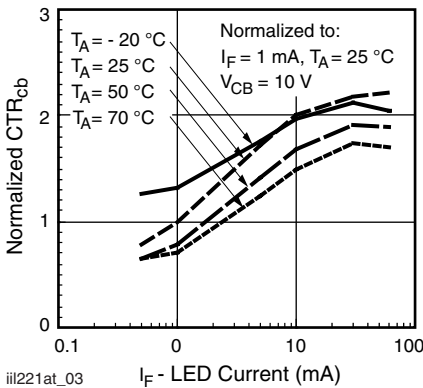
iii221at\_02

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



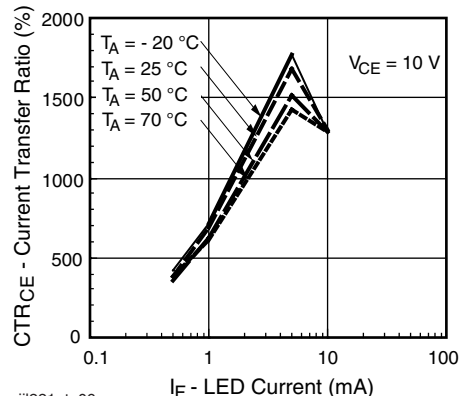
iii221at\_05

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



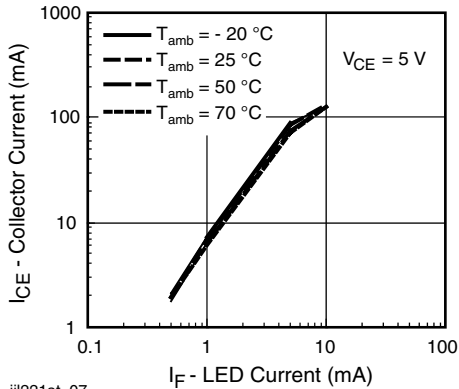
iii221at\_03

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



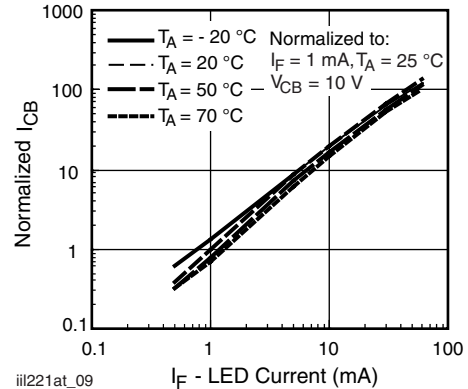
iii221at\_06

Fig. 7 - CTR vs. LED Current



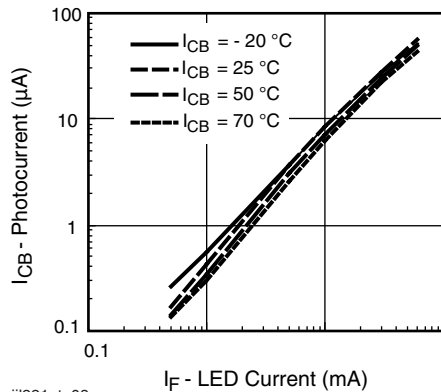
iii221at\_07

Fig. 8 - Collector Current vs. LED Current



iii221at\_09

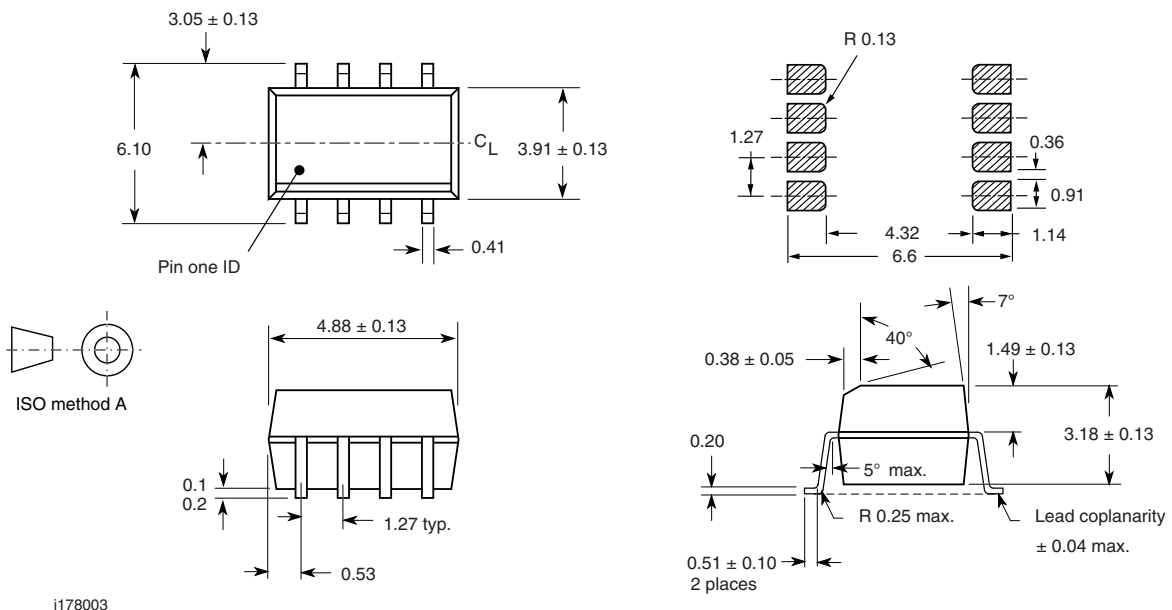
Fig. 10 - Normalized  $I_{CB}$  vs.  $I_F$



iii221at\_08

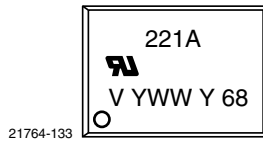
Fig. 9 - Photocurrent vs. LED Current

**PACKAGE DIMENSIONS** in millimeters



i178003

**PACKAGE MARKING** (example)



**TAPE AND REEL PACKAGING**

Dimensions in millimeters

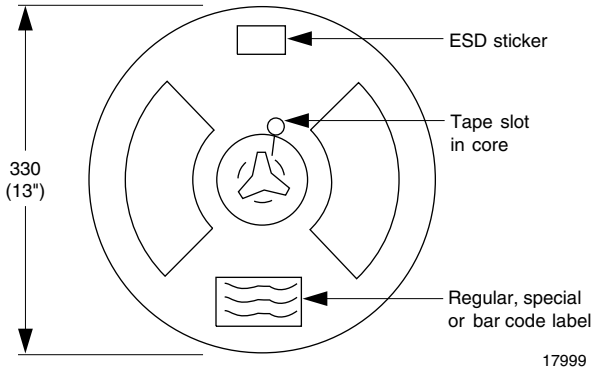


Fig. 11 - Tape and Reel Shipping Medium (EIA-481, revision A, and IEC 60286), 2000 units per reel

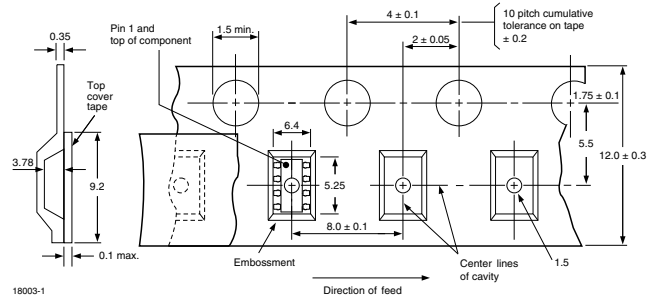


Fig. 12 - Tape Dimensions, 2000 Parts per Reel



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