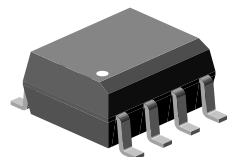
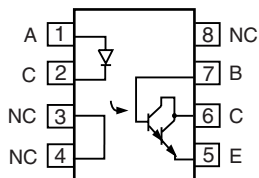


## Optocoupler, Photodarlington Output, Low Input Current, High Gain, with Base Connection



I179022



### DESCRIPTION

The IL221AT/IL222AT/IL223AT is a high current transfer ratio (CTR) optocoupler with a gallium arsenide infrared LED emitter and a silicon NPN photodarlington transistor detector.

The device has a CTR tested at 1.0 mA LED current. This low drive current permits easy interfacing from CMOS to LSTTL or TTL.

This optocoupler is constructed in a standard SOIC-8 foot print which makes it ideally suited for high density applications. In addition to eliminating through-hole requirements, this package conforms to standards for surface mount devices.

### FEATURES

- Isolation test voltage, 4000 V<sub>RMS</sub>
- Industry standard SOIC-8 surface mountable package
- Standard lead spacing, 0.05"
- Available only on tape and reel (conforms to EIA standard RS481A)
- Compatible with dual wave, vapor phase and IR reflow soldering
- 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 available with option 1

### ORDER INFORMATION

| PART    | REMARKS             |
|---------|---------------------|
| IL221AT | CTR > 100 %, SOIC-8 |
| IL222AT | CTR > 200 %, SOIC-8 |
| IL223AT | CTR > 500 %, SOIC-8 |

### ABSOLUTE MAXIMUM RATINGS

| PARAMETER                           | TEST CONDITION | SYMBOL               | VALUE | UNIT  |
|-------------------------------------|----------------|----------------------|-------|-------|
| <b>INPUT</b>                        |                |                      |       |       |
| Peak reverse voltage                |                | V <sub>R</sub>       | 6.0   | V     |
| 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>    | 5.0   | V     |
| Collector base breakdown voltage    |                | BV <sub>CBO</sub>    | 70    | V     |
| I <sub>CMAX</sub> DC                |                | I <sub>CMAX</sub> DC | 50    | mA    |
| I <sub>CMAX</sub>                   | t < 1.0 ms     | I <sub>CMAX</sub>    | 100   | mW    |
| Power dissipation                   |                | P <sub>diss</sub>    | 150   | mW    |
| Derate linearly from 25 °C          |                |                      | 2.0   | mW/°C |



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**ABSOLUTE MAXIMUM RATINGS**

| PARAMETER                                                         | TEST CONDITION      | SYMBOL           | VALUE         | UNIT             |
|-------------------------------------------------------------------|---------------------|------------------|---------------|------------------|
| <b>COUPLER</b>                                                    |                     |                  |               |                  |
| Isolation test voltage                                            | $t = 1.0 \text{ s}$ | $V_{\text{ISO}}$ | 4000          | $V_{\text{RMS}}$ |
| Total package dissipation<br>(at 25 °C ambient)(LED and detector) |                     | $P_{\text{tot}}$ | 240           | mW               |
| Derate linearly from 25 °C                                        |                     |                  | 3.2           | mW/°C            |
| Storage temperature                                               |                     | $T_{\text{stg}}$ | - 55 to + 150 | °C               |
| Operating temperature                                             |                     | $T_{\text{amb}}$ | - 55 to + 100 | °C               |
| Soldering time at 260 °C                                          |                     |                  | 10            | s                |

**Note**

$T_{\text{amb}} = 25 \text{ °C}$ , 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.

**ELECTRICAL CHARACTERISTICS**

| PARAMETER                             | TEST CONDITION                              | PART | SYMBOL             | MIN. | TYP. | MAX. | UNIT             |
|---------------------------------------|---------------------------------------------|------|--------------------|------|------|------|------------------|
| <b>INPUT</b>                          |                                             |      |                    |      |      |      |                  |
| Forward voltage                       | $I_F = 1.0 \text{ mA}$                      |      | $V_F$              |      | 1.0  | 1.5  | V                |
| Reverse current                       | $V_R = 6 \text{ V}$                         |      | $I_R$              |      | 0.1  | 100  | $\mu\text{A}$    |
| Capacitance                           | $V_R = 0 \text{ V}$ , $f = 1.0 \text{ MHz}$ |      | $C_O$              |      | 25   |      | pF               |
| <b>OUTPUT</b>                         |                                             |      |                    |      |      |      |                  |
| Collector emitter breakdown voltage   | $I_C = 100 \mu\text{A}$                     |      | $BV_{\text{CEO}}$  | 30   |      |      | V                |
| Emitter collector breakdown voltage   | $I_E = 100 \mu\text{A}$                     |      | $BV_{\text{ECO}}$  | 5.0  |      |      | V                |
| Emitter emitter breakdown voltage     | $I_C = 10 \mu\text{A}$                      |      | $BV_{\text{CBO}}$  | 70   |      |      | V                |
| Collector emitter capacitance         | $V_{\text{CE}} = 10 \text{ V}$              |      | $C_{\text{CE}}$    |      | 3.4  |      | pF               |
| <b>COUPLER</b>                        |                                             |      |                    |      |      |      |                  |
| Saturation voltage, collector emitter | $I_{\text{CE}} = 0.5 \text{ mA}$            |      | $V_{\text{CEsat}}$ |      |      | 1.0  | V                |
| Capacitance (input to output)         |                                             |      | $C_{\text{IO}}$    |      | 0.5  |      | pF               |
| Resistance (input to output)          |                                             |      | $R_{\text{IO}}$    |      | 100  |      | $\text{G}\Omega$ |

**Note**

$T_{\text{amb}} = 25 \text{ °C}$ , 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 | $I_F = 1.0 \text{ mA}$ , $V_{\text{CE}} = 5.0 \text{ V}$ | IL221AT | $\text{CTR}_{\text{DC}}$ | 100  |      |      | %    |
|                        |                                                          | IL222AT | $\text{CTR}_{\text{DC}}$ | 200  |      |      | %    |
|                        |                                                          | IL223AT | $\text{CTR}_{\text{DC}}$ | 500  |      |      | %    |

**SAFETY AND INSULATION RATINGS**

| PARAMETER                                               | TEST CONDITION | SYMBOL | MIN. | TYP.      | MAX. | UNIT |
|---------------------------------------------------------|----------------|--------|------|-----------|------|------|
| Climatic classification<br>(according to IEC 68 part 1) |                |        |      | 55/100/21 |      |      |
| Comparative tracking index                              |                | CTI    | 175  |           | 399  |      |
| $V_{\text{IOTM}}$                                       |                |        | 6000 |           |      | V    |
| $V_{\text{IORM}}$                                       |                |        | 560  |           |      | V    |
| $P_{\text{SO}}$                                         |                |        |      |           | 350  | mW   |
| $I_{\text{SI}}$                                         |                |        |      |           | 150  | mA   |

| SAFETY AND INSULATION RATINGS          |                        |        |      |      |      |      |
|----------------------------------------|------------------------|--------|------|------|------|------|
| PARAMETER                              | TEST CONDITION         | SYMBOL | MIN. | TYP. | MAX. | UNIT |
| $T_{SI}$                               |                        |        |      |      | 165  | °C   |
| Creepage distance                      |                        |        | 4    |      |      | mm   |
| Clearance distance                     |                        |        | 4    |      |      | mm   |
| Insulation thickness, reinforced rated | per IEC 60950 2.10.5.1 |        | 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

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

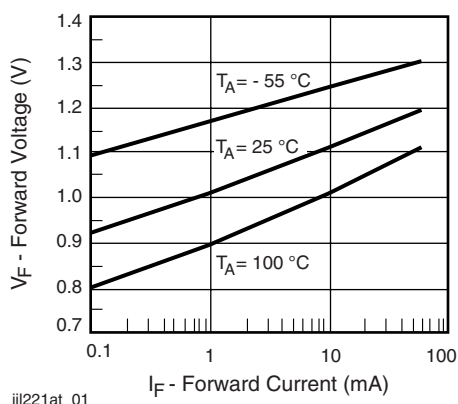


Fig. 1 - Forward Voltage vs. Forward Current

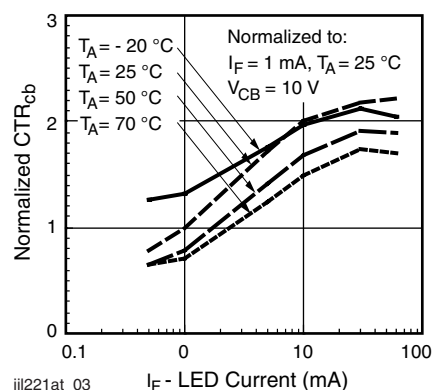


Fig. 3 - Normalized  $CTR_{cb}$  vs.  $I_F$

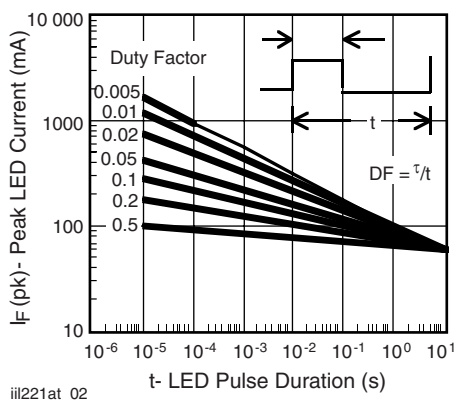


Fig. 2 - Peak LED Current vs. Duty Factor,  $\tau$

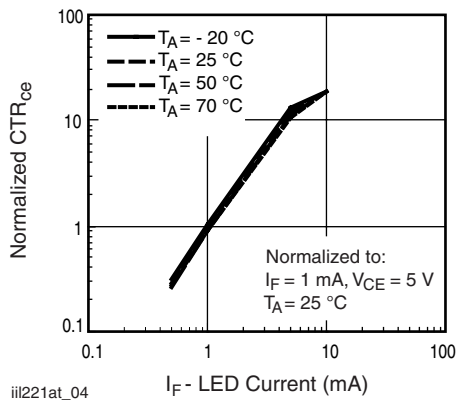


Fig. 4 - Normalized  $CTR_{CE}$  vs. LED Current

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

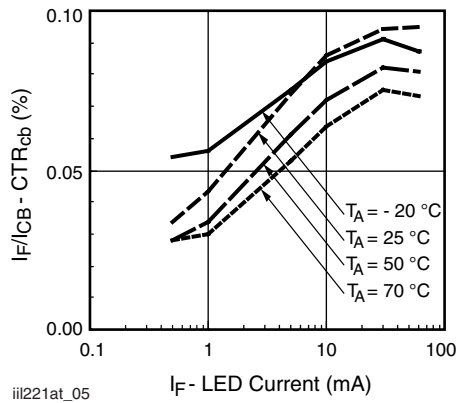


Fig. 5 - CTR<sub>CE</sub> vs. LED Current

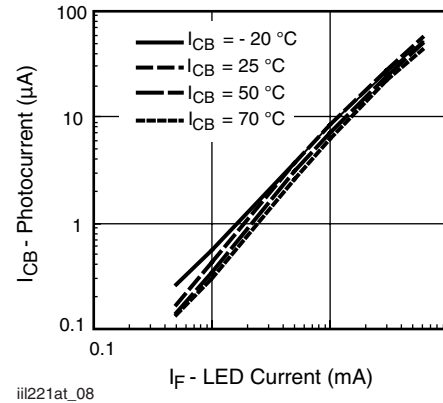


Fig. 8 - Photocurrent vs. LED Current

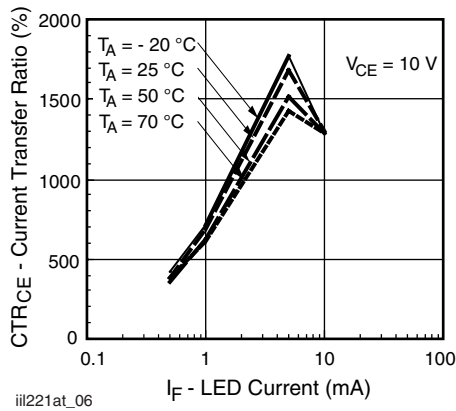


Fig. 6 - CTR vs. LED Current

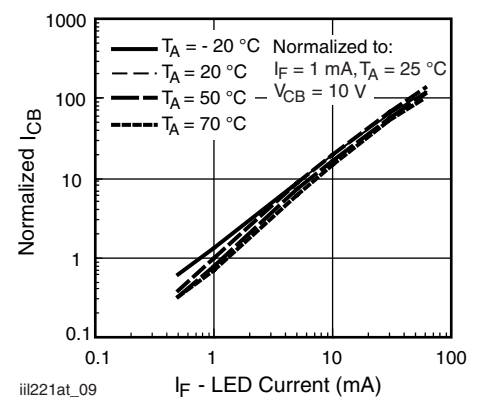


Fig. 9 - Normalized I<sub>CB</sub> vs. I<sub>F</sub>

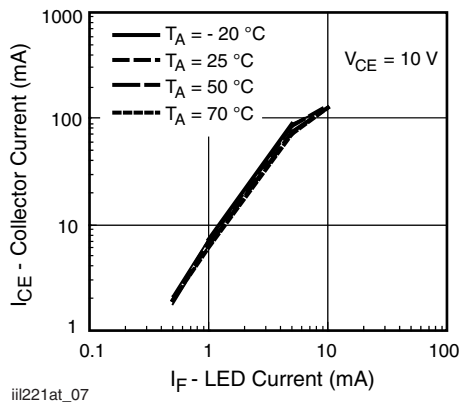


Fig. 7 - Collector Current vs. LED Current

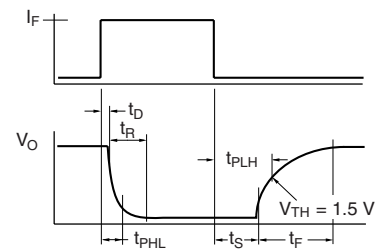
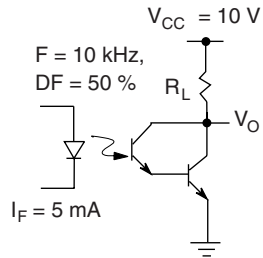


Fig. 10 - Switching Timing

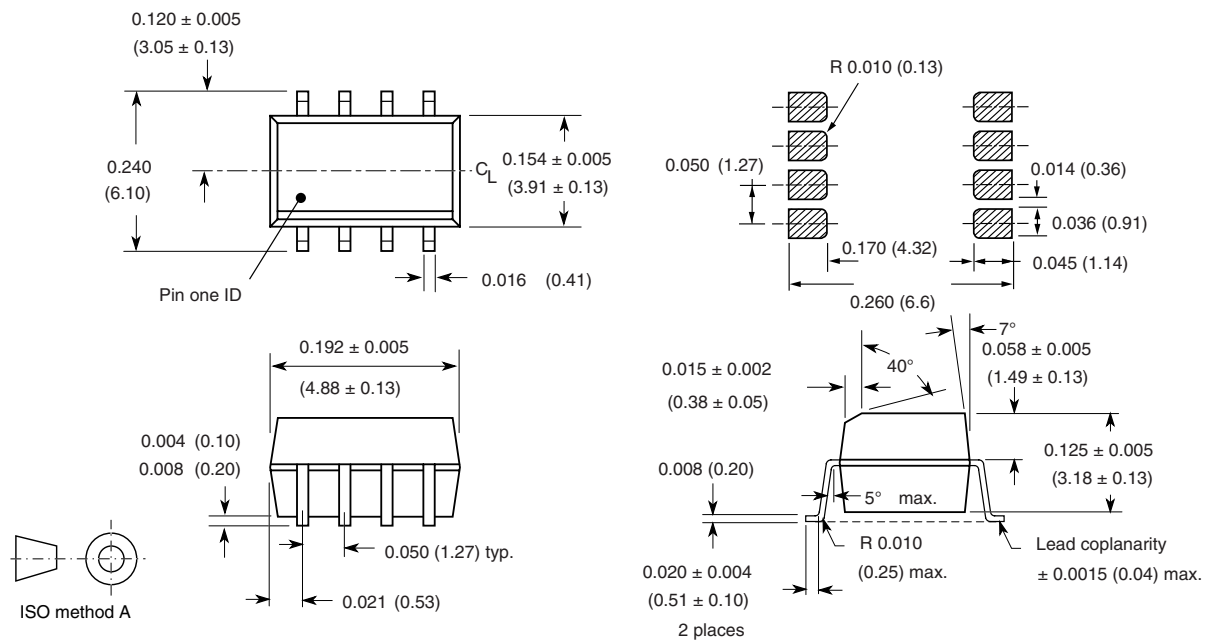
Vishay Semiconductors Optocoupler, Photodarlington Output,  
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iii221at\_11

Fig. 11 - Switching Schematic

## PACKAGE DIMENSIONS in inches (millimeters)



i178003



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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.

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