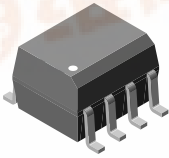
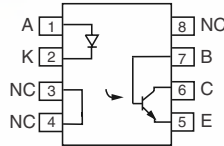


# Optocoupler, Phototransistor Output, with Base Connection in SOIC-8 Package



1179002



## DESCRIPTION

The VO211AT, VO212AT, VO213AT are optically coupled pairs with a gallium arsenide infrared LED and silicon NPN phototransistor. Signal information, including a DC level, can be transmitted by the device while maintaining a high degree of electrical isolation between input and output.

The VO211AT, VO212AT, VO213AT comes in a standard SOIC-8 small outline package for surface mounting which makes it ideally suited for high density applications with limited space.

## 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             |
|---------|---------------------|
| VO211AT | CTR > 20 %, SOIC-8  |
| VO212AT | CTR > 50 %, SOIC-8  |
| VO213AT | CTR > 100 %, 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>     | 7             | 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               |
| Derate linearly from 25 °C          |                  |                       | 2             | mW/°C            |
| <b>COUPLER</b>                      |                  |                       |               |                  |
| Isolation test voltage              |                  | V <sub>ISO</sub>      | 4000          | V <sub>RMS</sub> |
| Total package dissipation           | 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.



# VO211AT, VO212AT, VO213AT



Vishay Semiconductor Optocoupler, Phototransistor Output, with  
Base Connection in SOIC-8 Package

| ELECTRICAL CHARACTERISTICS            |                         |      |             |      |      |      |               |
|---------------------------------------|-------------------------|------|-------------|------|------|------|---------------|
| PARAMETER                             | TEST CONDITION          | PART | SYMBOL      | MIN. | TYP. | MAX. | UNIT          |
| INPUT                                 |                         |      |             |      |      |      |               |
| Forward voltage                       | $I_F = 10 \text{ mA}$   |      | $V_F$       |      | 1.3  | 1.5  | V             |
| Reverse current                       | $V_R = 6 \text{ V}$     |      | $I_R$       |      | 0.1  | 100  | $\mu\text{A}$ |
| Capacitance                           | $V_R = 0 \text{ V}$     |      | $C_O$       |      | 13   |      | pF            |
| OUTPUT                                |                         |      |             |      |      |      |               |
| Collector emitter breakdown voltage   | $I_C = 100 \mu\text{A}$ |      | $BV_{CEO}$  | 30   |      |      | V             |
| Emitter collector breakdown voltage   | $I_E = 10 \mu\text{A}$  |      | $BV_{ECO}$  | 7    |      |      | V             |
| Collector base breakdown voltage      | $I_C = 100 \mu\text{A}$ |      | $BV_{CBO}$  | 100  |      |      | V             |
| Collector base current                |                         |      | $I_{CBO}$   |      |      | 1    | nA            |
| Emitter base current                  |                         |      | $I_{EBO}$   |      |      | 1    | nA            |
| Collector dark current                | $V_{CE} = 10 \text{ V}$ |      | $I_{CEO}$   |      | 5    | 50   | nA            |
| Collector emitter capacitance         | $V_{CE} = 0 \text{ V}$  |      | $C_{CE}$    |      | 10   |      | pF            |
| Saturation voltage, collector emitter | $I_F = 10 \text{ mA}$   |      | $V_{CEsat}$ |      |      | 0.4  | V             |
| COUPLER                               |                         |      |             |      |      |      |               |
| Isolation test voltage                | 1 s                     |      | $V_{ISO}$   | 4000 |      |      | $V_{RMS}$     |

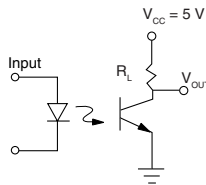
## Note

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

Minimum and maximum values were 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 | $I_F = 10 \text{ mA}$ , $V_{CE} = 5 \text{ V}$ | VO211AT | CTR    | 20   | 50   |      | %    |
|                        |                                                | VO212AT | CTR    | 50   | 80   |      | %    |
|                        |                                                | VO213AT | CTR    | 100  | 130  |      | %    |

| SWITCHING CHARACTERISTICS |                                                                     |      |           |      |      |      |               |
|---------------------------|---------------------------------------------------------------------|------|-----------|------|------|------|---------------|
| PARAMETER                 | TEST CONDITION                                                      | PART | SYMBOL    | MIN. | TYP. | MAX. | UNIT          |
| Turn-on time              | $I_C = 2 \text{ mA}$ , $R_L = 100 \Omega$ , $V_{CC} = 10 \text{ V}$ |      | $t_{on}$  |      | 3    |      | $\mu\text{s}$ |
| Turn-off time             | $I_C = 2 \text{ mA}$ , $R_L = 100 \Omega$ , $V_{CC} = 10 \text{ V}$ |      | $t_{off}$ |      | 3    |      | $\mu\text{s}$ |
| Rise time                 | $I_C = 2 \text{ mA}$ , $R_L = 100 \Omega$ , $V_{CC} = 10 \text{ V}$ |      | $t_r$     |      | 3    |      | $\mu\text{s}$ |
| Fall time                 | $I_C = 2 \text{ mA}$ , $R_L = 100 \Omega$ , $V_{CC} = 10 \text{ V}$ |      | $t_f$     |      | 2    |      | $\mu\text{s}$ |



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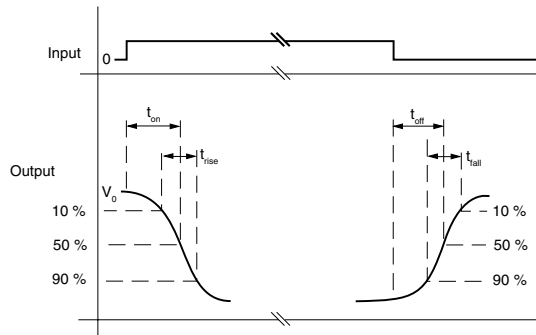
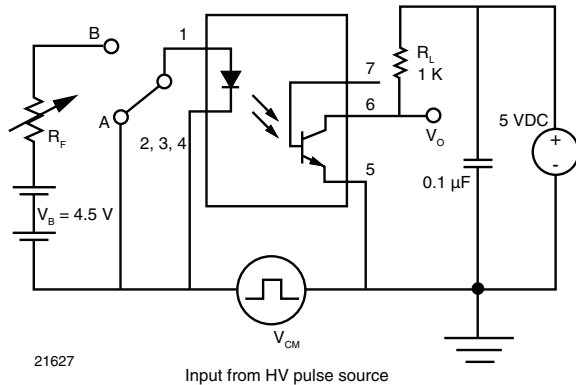


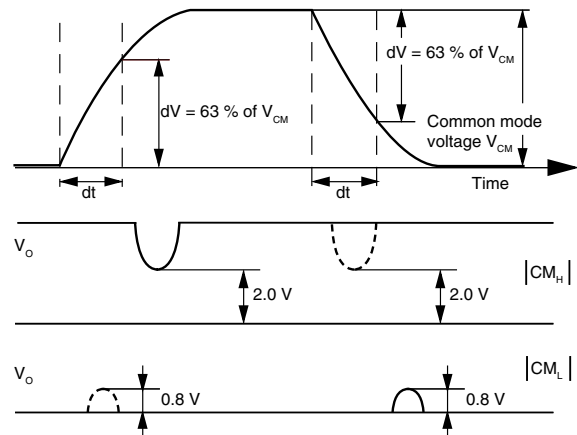
Fig. 1 - Switching Test Circuit

| COMMON MODE TRANSIENT IMMUNITY               |                                                                                     |            |      |      |      |                        |
|----------------------------------------------|-------------------------------------------------------------------------------------|------------|------|------|------|------------------------|
| PARAMETER                                    | TEST CONDITION                                                                      | SYMBOL     | MIN. | TYP. | MAX. | UNIT                   |
| Common mode transient immunity at logic high | $V_{CM} = 1000 \text{ V}_{P-P}$ , $R_L = 1 \text{ k}\Omega$ , $I_F = 0 \text{ mA}$  | $ C_{MH} $ |      | 5000 |      | $\text{V}/\mu\text{s}$ |
| Common mode transient immunity at logic low  | $V_{CM} = 1000 \text{ V}_{P-P}$ , $R_L = 1 \text{ k}\Omega$ , $I_F = 10 \text{ mA}$ | $ C_{ML} $ |      | 5000 |      | $\text{V}/\mu\text{s}$ |



21627

Input from HV pulse source



21626

Fig. 2 - Test Circuit for Common Mode Transient Immunity

# VO211AT, VO212AT, VO213AT



Vishay Semiconductor Optocouplers Phototransistor Output, with  
Base Connection in SOIC-8 Package

| SAFETY AND INSULATION RATINGS                           |                |            |      |           |      |           |
|---------------------------------------------------------|----------------|------------|------|-----------|------|-----------|
| PARAMETER                                               | TEST CONDITION | SYMBOL     | MIN. | TYP.      | MAX. | UNIT      |
| Climatic classification<br>(according to IEC 68 part 1) |                |            |      | 40/100/21 |      |           |
| Pollution 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  | °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

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

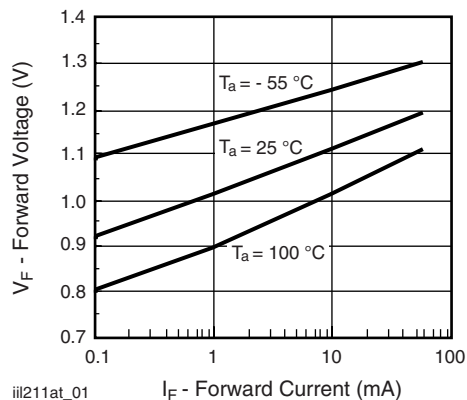


Fig. 3 - Forward Voltage vs. Forward Current

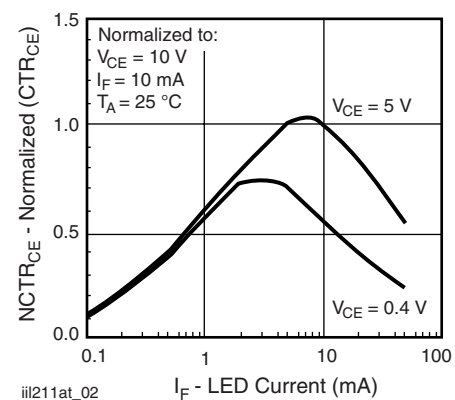
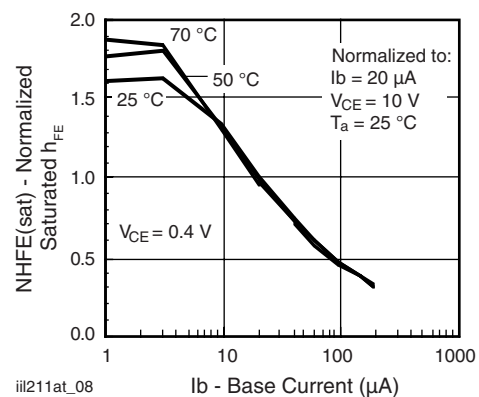
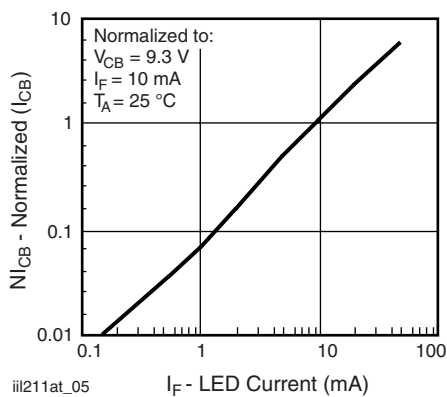
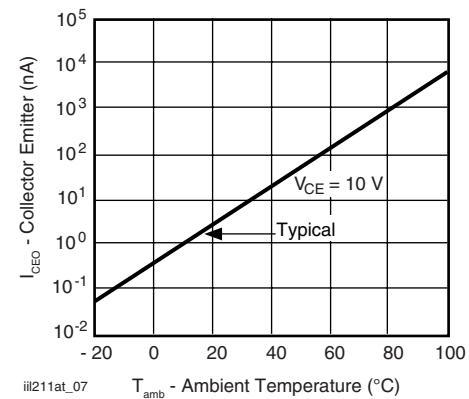
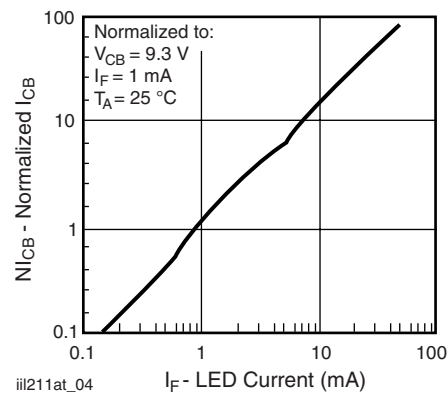
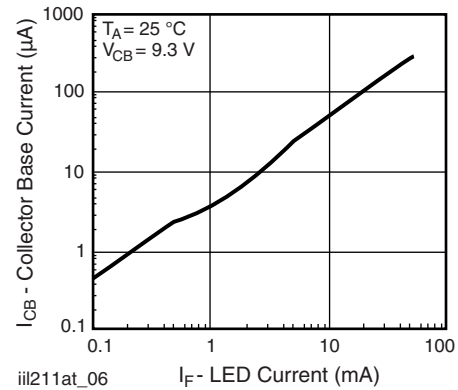
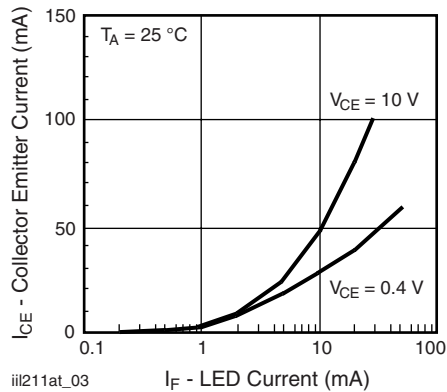


Fig. 4 - Normalized Non-Saturated and Saturated  $CTR_{CE}$  vs. LED Current



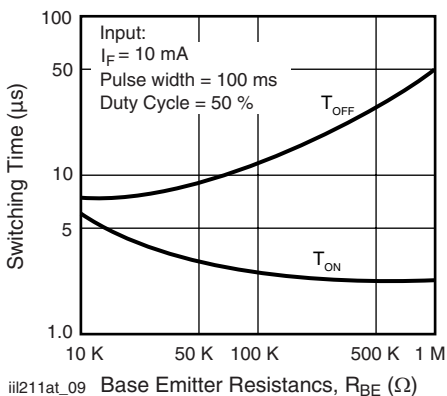


Fig. 11 - Typical Switching Characteristics vs. Base Resistance (Saturated Operation)

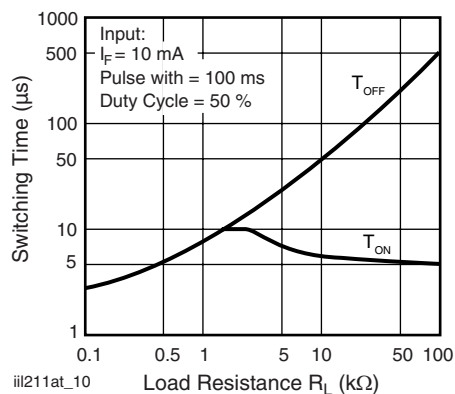
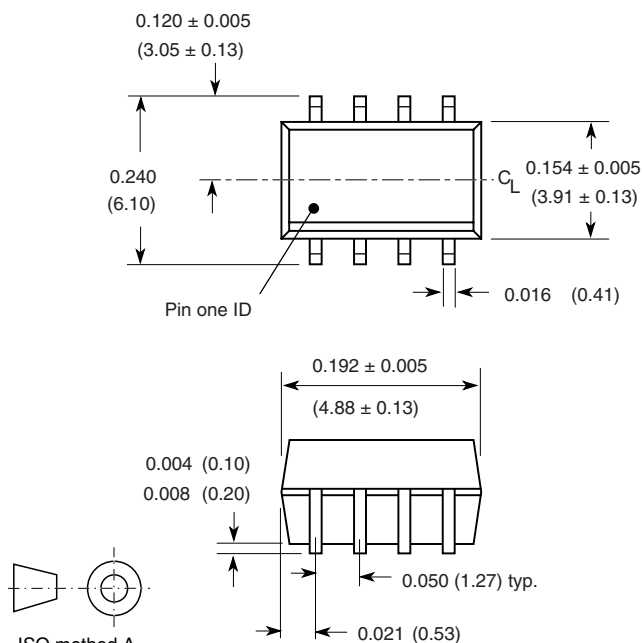
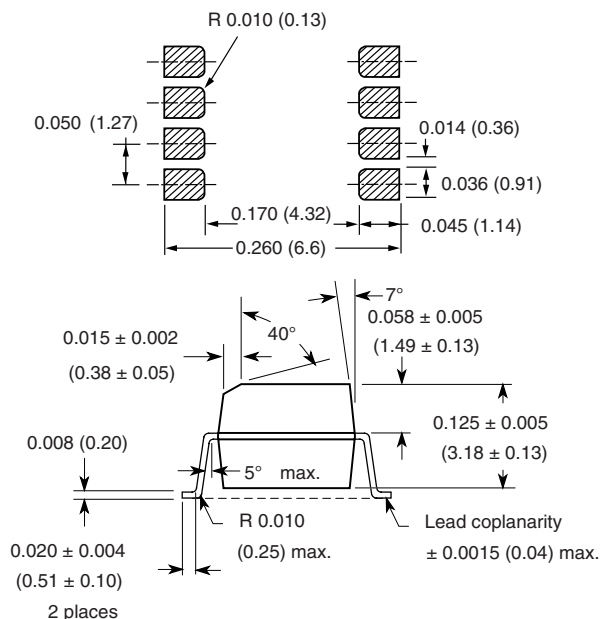


Fig. 12 - Typical Switching Times vs. Load Resistance

## PACKAGE DIMENSIONS in inches (millimeters)



i178003





## 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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