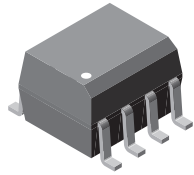
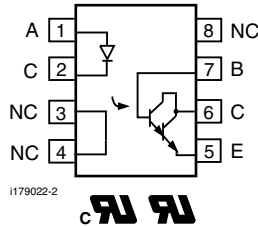




Optocoupler, Photodarlington Output, Low Input Current, High Gain, with Base Connection



i179074



FEATURES

- Isolation test voltage, 4000 V_{RMS}
- Material categorization:
For definitions of compliance please see www.vishay.com/doc?99912



RoHS COMPLIANT

AGENCY APPROVALS

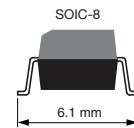
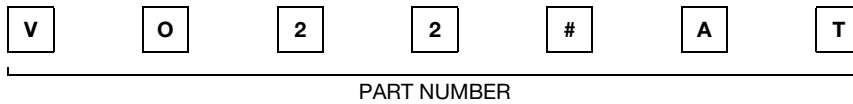
- UL1577, file no. E52744 system code Y
- cUL - file no. E52744, equivalent to CSA bulletin 5A
- DIN EN 60747-5-5 (VDE 0884-5) approved, contact customer service if this option is required

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_{amb} = 25 °C, unless otherwise specified)

| PARAMETER | TEST CONDITION | SYMBOL | VALUE | UNIT |
|-------------------------------------|----------------|-----------------------|-------|-------|
| INPUT | | | | |
| Peak reverse voltage | | V _R | 6 | V |
| Peak forward current | 1 μs, 300 pps | I _{FM} | 1 | A |
| Forward continuous current | | I _F | 60 | mA |
| Power dissipation | | P _{diss} | 90 | mW |
| Derate linearly from 25 °C | | | 1.2 | mW/°C |
| OUTPUT | | | | |
| Collector emitter breakdown voltage | | BV _{CEO} | 30 | V |
| Emitter collector breakdown voltage | | BV _{ECO} | 5 | V |
| Collector base breakdown voltage | | BV _{CBO} | 70 | V |
| I _{Cmax, DC} | | I _{Cmax, DC} | 50 | mA |
| I _{Cmax} | t < 1 ms | I _{Cmax} | 100 | mA |
| Power dissipation | | P _{diss} | 150 | mW |

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

| PARAMETER | TEST CONDITION | SYMBOL | VALUE | UNIT |
|---|------------------|-----------|---------------|-----------|
| COUPLER | | | | |
| 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 |
|---------------------------------------|---|-------------|------|------|------|---------------|
| INPUT | | | | | | |
| 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 | μA |
| Capacitance | $V_R = 0\text{ V}$, $f = 1\text{ MHz}$ | C_O | | 25 | | pF |
| OUTPUT | | | | | | |
| 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 |
| COUPLER | | | | | | |
| 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 | | μs |
| Turn-off time | $V_{CC} = 10\text{ V}$, $R_L = 100\ \Omega$, $I_F = 5\text{ mA}$ | t_{off} | | 3 | | μs |

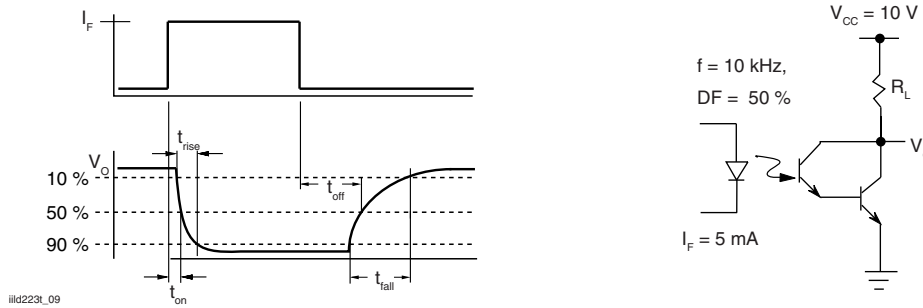


Fig. 1 - Switching Test Circuit

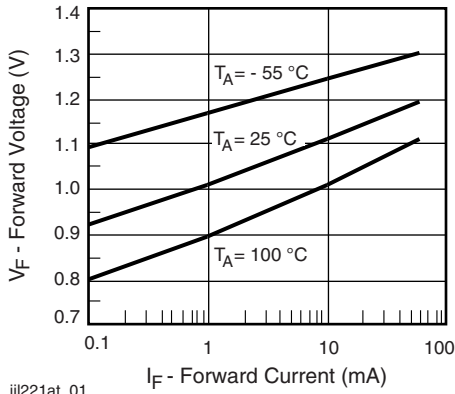
SAFETY AND INSULATION RATINGS

| 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} | | Ω |
| 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

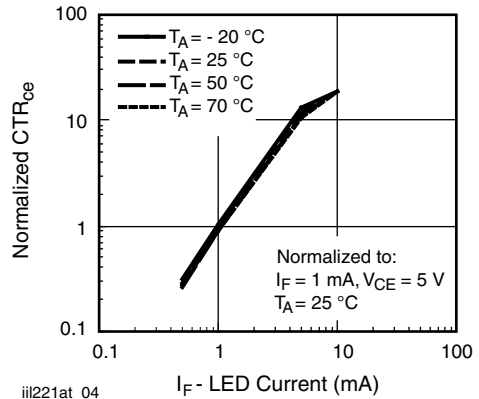
- As per IEC 60747-5-2, § 7.4.3.8.1, this optocoupler is suitable for "safe electrical insulation" only within the safety ratings. Compliance with the safety ratings shall be ensured by means of protective circuits.

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



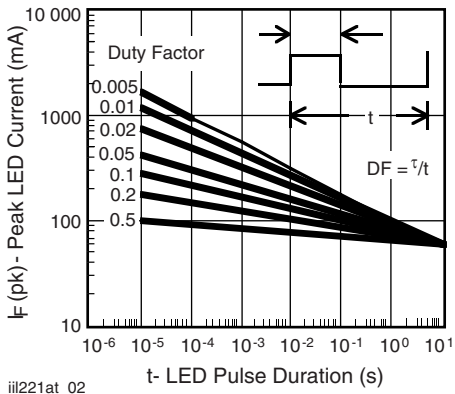
iii221at_01

Fig. 2 - Forward Voltage vs. Forward Current



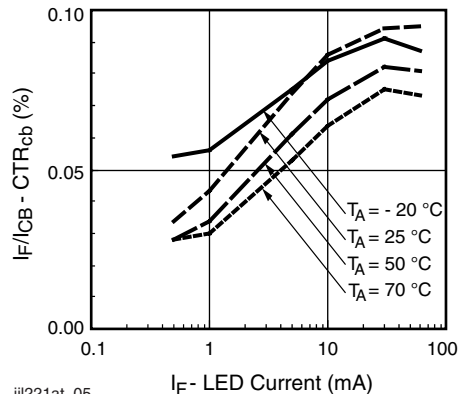
iii221at_04

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



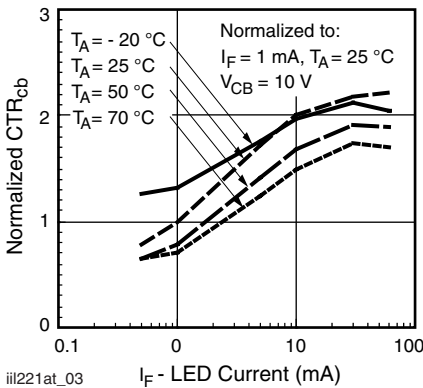
iii221at_02

Fig. 3 - Peak LED Current vs. Duty Factor, τ



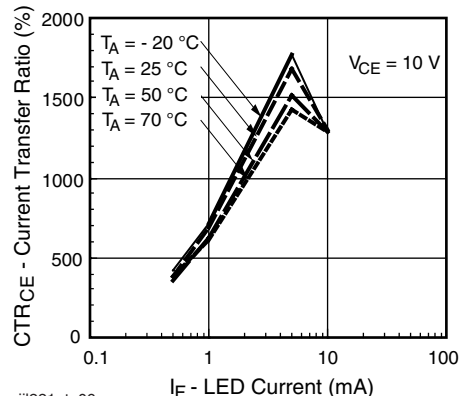
iii221at_05

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



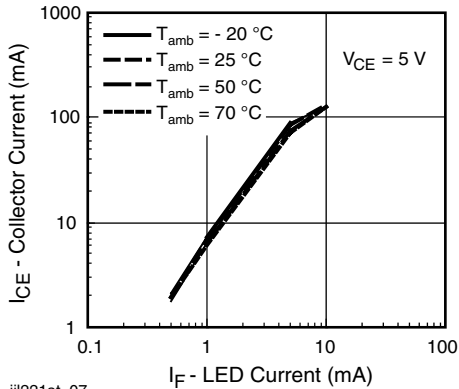
iii221at_03

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



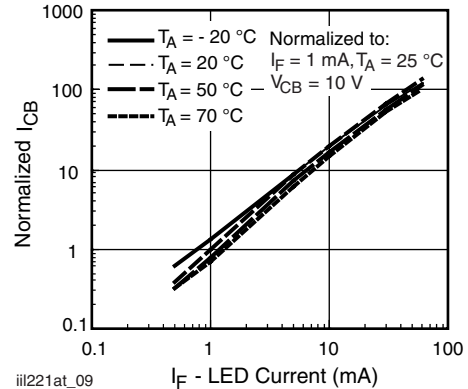
iii221at_06

Fig. 7 - CTR vs. LED Current



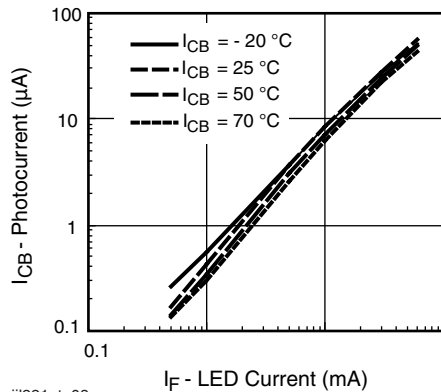
iii221at_07

Fig. 8 - Collector Current vs. LED Current



iii221at_09

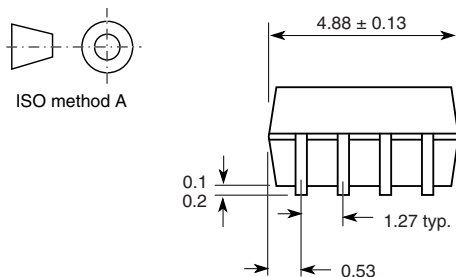
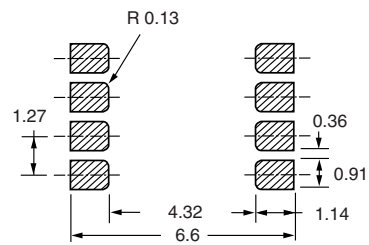
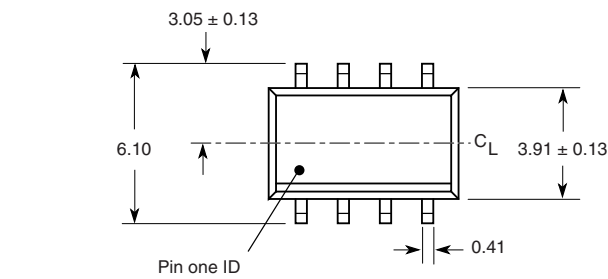
Fig. 10 - Normalized I_{CB} vs. I_F



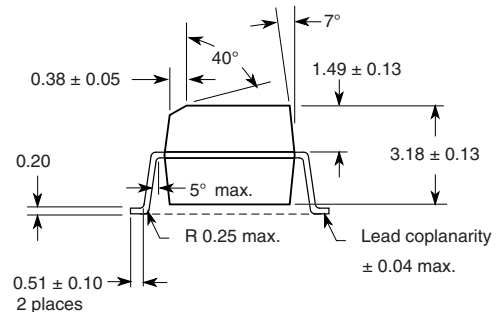
iii221at_08

Fig. 9 - Photocurrent vs. LED Current

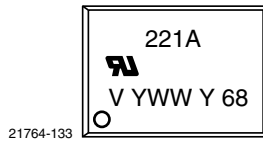
PACKAGE DIMENSIONS in millimeters



i178003



PACKAGE MARKING (example)



TAPE AND REEL PACKAGING

Dimensions in millimeters

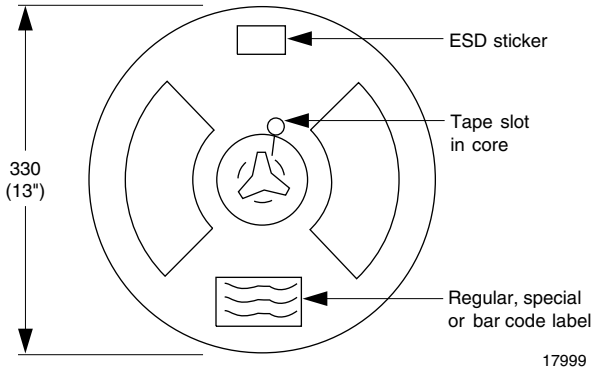


Fig. 11 - Tape and Reel Shipping Medium (EIA-481, revision A, and IEC 60286), 2000 units per reel

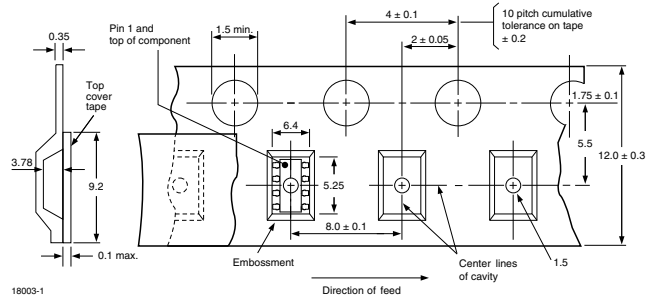


Fig. 12 - Tape Dimensions, 2000 Parts per Reel



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