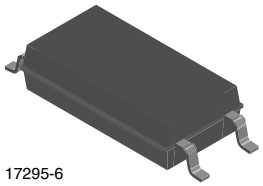
# Optocoupler, Phototransistor Output, AC Input, Low Input Current, 4 Pin LSOP, Long Creepage Mini-Flat Package



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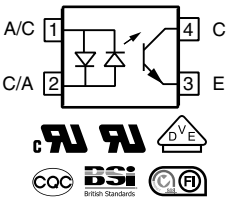



## FEATURES

- Low profile package
- High collector emitter voltage, $V_{CEO}$ = 80 V
- Isolation test voltage, 5000 $V_{RMS}$
- Low coupling capacitance
- High common mode transient immunity
- Material categorization:
  For definitions of compliance please see www.vishay.com/doc?99912

Pb-free

e3

RoHS COMPLIANT

GREEN (5-2008)

## DESCRIPTION

The VOL628A has two GaAs infrared emitting diodes, which are optically coupled to a silicon planar phototransistor detector, and are incorporated in a 4 pin LSOP wide body package.

It features a high current transfer ratio, low coupling capacitance, and high isolation voltage.

The coupling device is designed for signal transmission between two electrically separated circuits.

## APPLICATIONS

- Telecom
- Industrial controls
- Battery powered equipment
- Office machines
- Programmable controllers

## AGENCY APPROVALS

(All parts are certified under base model VOL628A)

- UL1577, file no. E76222
- cUL CSA 22.2 bulletin 5A, double protection
- DIN EN 60747-5-5 (VDE 0884-5), available with option 1
- BSI: EN 60065:2002, EN 60950-1:2006
- FIMKO EN60950-1
- CQC: GB8898-2011, GB4943.1-2011

## ORDERING INFORMATION

| V | O | L | 6 | 2 | 8 | A | - | # | X | 0 | 0 | 1 | T |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| PART NUMBER | | | | | | | | CTR BIN | PACKAGE OPTION | | | | TAPE AND REEL |

| AGENCY CERTIFIED/PACKAGE | CTR (%) | | | |
|---|---|---|---|---|
| | 1 mA | | | |
| **UL, cUL, BSI, FIMKO, CQC** | **50 to 600** | **40 to 80** | **63 to 125** | **100 to 200** |
| 4 pin LSOP, mini-flat, long creepage | VOL628AT | VOL628A-1T | VOL628A-2T | VOL628A-3T |
| **UL, cUL, BSI, FIMKO, CQC, VDE (option 1)** | **50 to 600** | **40 to 80** | **63 to 125** | **100 to 200** |
| 4 pin LSOP, mini-flat, long creepage | VOL628A-X001T | VOL628A-1X001T | VOL628A-2X001T | VOL628A-3X001T |

| ABSOLUTE MAXIMUM RATINGS ($T_{amb}$ = 25 °C, unless otherwise specified) | | | | |
|---|---|---|---|---|
| **PARAMETER** | **TEST CONDITION** | **SYMBOL** | **VALUE** | **UNIT** |
| **INPUT** | | | | |
| Reverse voltage | | $V_R$ | 6 | V |
| Power dissipation | | $P_{diss}$ | 100 | mW |
| Forward current | | $I_F$ | ± 60 | mA |
| Junction temperature | | $T_j$ | 125 | °C |
| **OUTPUT** | | | | |
| Collector emitter voltage | | $V_{CEO}$ | 80 | V |
| Emitter collector voltage | | $V_{ECO}$ | 7 | V |
| Collector current | | $I_C$ | 50 | mA |
| | $t_p/T$ = 0.5, $t_p$ < 10 ms | $I_C$ | 100 | mA |
| Power dissipation | | $P_{diss}$ | 150 | mW |
| Junction temperature | | $T_j$ | 125 | °C |
| **COUPLER** | | | | |
| Isolation test voltage between emitter and detector | t = 1 min | $V_{ISO}$ | 5000 | $V_{RMS}$ |
| Total power dissipation | | $P_{tot}$ | 250 | mW |
| Storage temperature range | | $T_{stg}$ | - 55 to + 125 | °C |
| Ambient temperature range | | $T_{amb}$ | - 55 to + 110 | °C |
| Soldering temperature (1) | ≤ 10 s | $T_{sld}$ | 260 | °C |

**Notes**

- 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.

(1) Refer to reflow profile for soldering conditions for surface mounted devices.

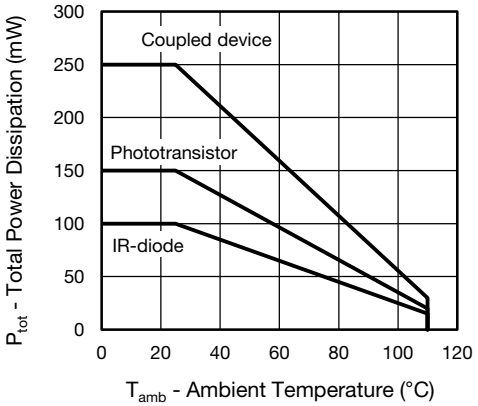



Fig. 1 - Total Power Dissipation vs. Ambient Temperature

| ELECTRICAL CHARACTERISTICS ($T_{amb}$ = 25 °C, unless otherwise specified) | | | | | | | |
|---|---|---|---|---|---|---|---|
| **PARAMETER** | **TEST CONDITION** | **PART** | **SYMBOL** | **MIN.** | **TYP.** | **MAX.** | **UNIT** |
| **INPUT** | | | | | | | |
| Forward voltage | $I_F$ = ± 5 mA | | $V_F$ | | 1.16 | 1.5 | V |
| Reverse current | $V_R$ = 6 V | | $I_R$ | | | 100 | µA |
| Capacitance | $V_R$ = 0 V, f = 1 MHz | | $C_O$ | | 45 | | pF |
| **OUTPUT** | | | | | | | |
| Collector emitter leakage current | $V_{CE}$ = 10 V, $I_F$ = 0 A | | $I_{CEO}$ | | 10 | 200 | nA |
| Collector emitter capacitance | $V_{CE}$ = 5 V, f = 1 MHz | | $C_{CE}$ | | 7 | | pF |
| **COUPLER** | | | | | | | |
| Collector emitter saturation voltage | $I_C$ = 0.2 mA, $I_F$ = ± 1 mA | VOL628A | $V_{CEsat}$ | | 0.25 | 0.4 | V |
| | $I_C$ = 0.2 mA, $I_F$ = ± 1 mA | VOL628A-1T | $V_{CEsat}$ | | 0.25 | 0.4 | V |
| | $I_C$ = 0.32 mA, $I_F$ = ± 1 mA | VOL628A-2T | $V_{CEsat}$ | | 0.25 | 0.4 | V |
| | $I_C$ = 0.5 mA, $I_F$ = ± 1 mA | VOL628A-3T | $V_{CEsat}$ | | 0.25 | 0.4 | V |
| Coupling capacitance | f = 1 MHz | | $C_C$ | | 0.25 | | pF |

**Note**

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

| CURRENT TRANSFER RATIO ($T_{amb}$ = 25 °C, unless otherwise specified) | | | | | | | |
|---|---|---|---|---|---|---|---|
| **PARAMETER** | **TEST CONDITION** | **PART** | **SYMBOL** | **MIN.** | **TYP.** | **MAX.** | **UNIT** |
| $I_C/I_F$ | $I_F$ = ± 1 mA, $V_{CE}$ = 5 V | VOL628A | CTR | 50 | | 600 | % |
| | | VOL628A-1 | CTR | 40 | | 80 | % |
| | | VOL628A-2 | CTR | 63 | | 125 | % |
| | | VOL628A-3 | CTR | 100 | | 200 | % |

| SWITCHING CHARACTERISTICS ($T_{amb}$ = 25 °C, unless otherwise specified) | | | | | | |
|---|---|---|---|---|---|---|
| **PARAMETER** | **TEST CONDITION** | **SYMBOL** | **MIN.** | **TYP.** | **MAX.** | **UNIT** |
| Turn on time | $V_{CC}$ = 5 V, $I_C$ = 2 mA, $R_L$ = 100 Ω | $t_{on}$ | | 6 | | µs |
| Rise time | $V_{CC}$ = 5 V, $I_C$ = 2 mA, $R_L$ = 100 Ω | $t_r$ | | 3.5 | | µs |
| Turn off time | $V_{CC}$ = 5 V, $I_C$ = 2 mA, $R_L$ = 100 Ω | $t_{off}$ | | 5.5 | | µs |
| Fall time | $V_{CC}$ = 5 V, $I_C$ = 2 mA, $R_L$ = 100 Ω | $t_f$ | | 5 | | µs |

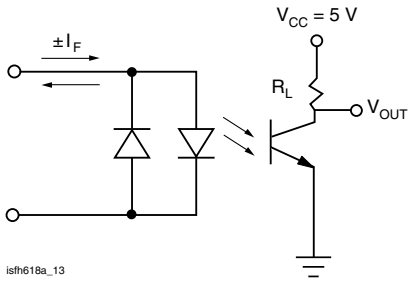



Fig. 2 - Test Circuit

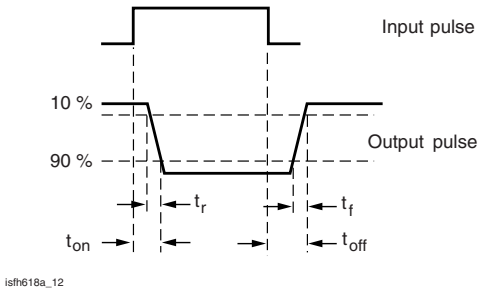



Fig. 3 - Test Circuit and Waveforms

| SAFETY AND INSULATION RATED PARAMETERS | | | | | | |
|---|---|---|---|---|---|---|
| **PARAMETER** | **TEST CONDITION** | **SYMBOL** | **MIN.** | **TYP.** | **MAX.** | **UNIT** |
| Partial discharge test voltage - routine test | 100 %, $t_{test}$ = 1 s | $V_{pd}$ | 2 | | | $kV_{peak}$ |
| Partial discharge test voltage - lot test (sample test) | $t_{Tr}$ = 60 s, $t_{test}$ = 10 s, (see figure 4) | $V_{IOTM}$ | | | 8 | $kV_{peak}$ |
| | | $V_{pd}$ | 1.68 | | | $kV_{peak}$ |
| Insulation voltage | | $V_{IORM}$ | | | 1050 | $V_{peak}$ |
| Insulation resistance | $V_{IO}$ = 500 V, $T_{amb}$ = 25 °C | $R_{IO}$ | $10^{12}$ | | | Ω |
| | $V_{IO}$ = 500 V, $T_{amb}$ = 100 °C | $R_{IO}$ | $10^{11}$ | | | Ω |
| | $V_{IO}$ = 500 V, $T_{amb}$ = 150 °C (construction test only) | $R_{IO}$ | $10^9$ | | | Ω |
| Safety rating - maximum input current | | $I_{si}$ | | | 130 | mA |
| Safety rating - maximum power dissipation | | $P_{SO}$ | | | 265 | mW |
| Safety rating - maximum ambient temperature | | $T_{si}$ | | | 150 | °C |
| Clearance distance | | | 8 | | | mm |
| Creepage distance | | | 8 | | | mm |
| Insulation distance (internal) | | | 0.4 | | | mm |

**Note**

- According to DIN EN 60747-5-5 (VDE 0884), § 7.4.3.8.2, (see figure 4). This optocoupler is suitable for safe electrical isolation only within the safety ratings. Compliance with the safety ratings shall be ensured by means of suitable protective circuits.

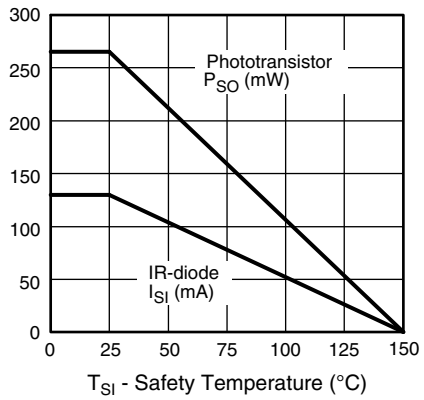



Fig. 4 - Derating Diagram

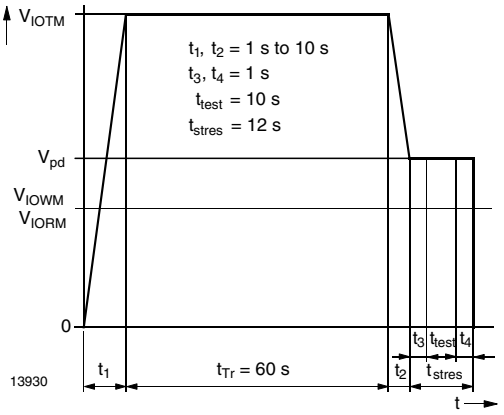



Fig. 5 - Test Pulse Diagram for Sample Test according to DIN EN 60747-5-5

## TYPICAL CHARACTERISTICS ($T_{amb}$ = 25 °C, unless otherwise specified)

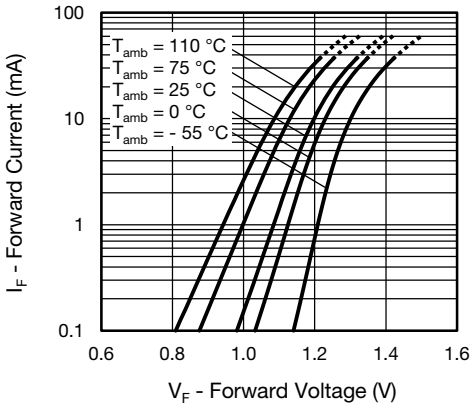



Fig. 6 - Forward Voltage vs. Forward Current

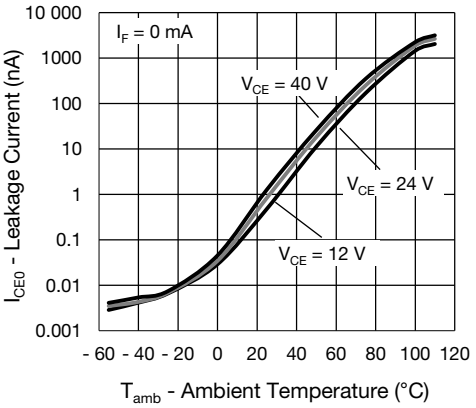



Fig. 8 - Collector Emitter Current vs. Ambient Temperature

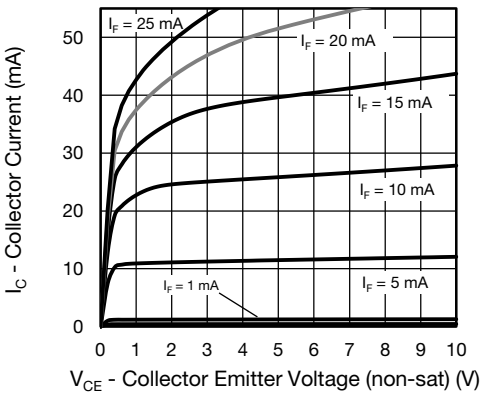



Fig. 7 - Collector Current vs. Collector Emitter Voltage (non-saturated)

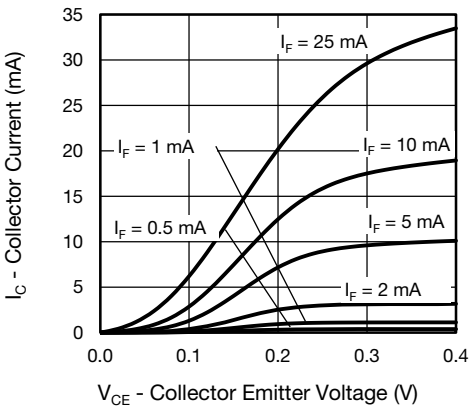



Fig. 9 - Collector Current vs. Collector Emitter Voltage (saturated)

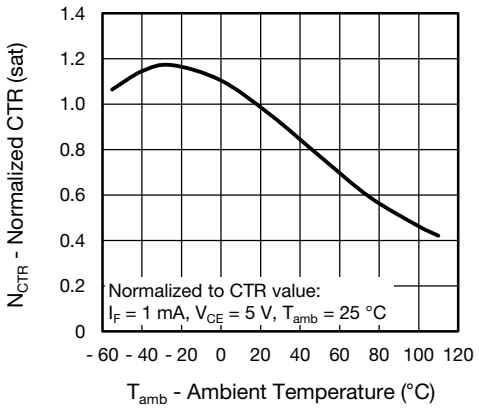



Fig. 10 - Normalized Current Transfer Ratio vs. Ambient Temperature (saturated)

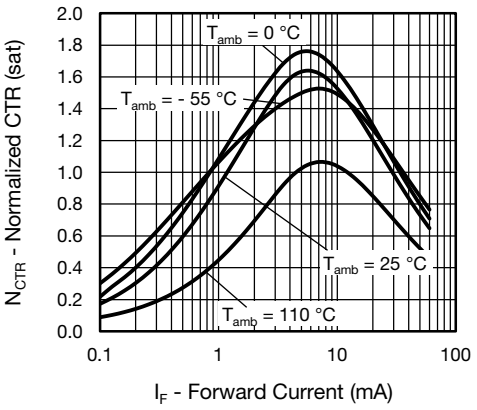



Fig. 13 - Current Transfer Ratio vs. Forward Current (non-saturated) Normalized to 1 mA at 25 °C

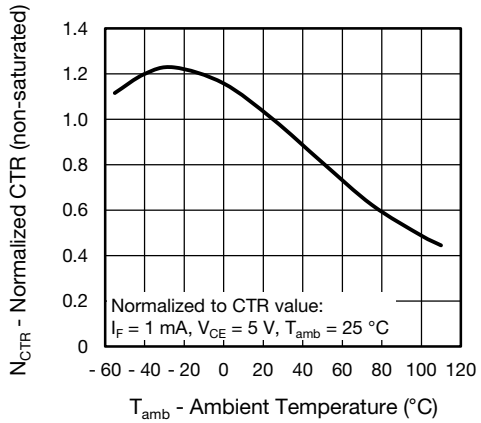



Fig. 11 - Normalized Current Transfer Ratio vs. Ambient Temperature (non-saturated)

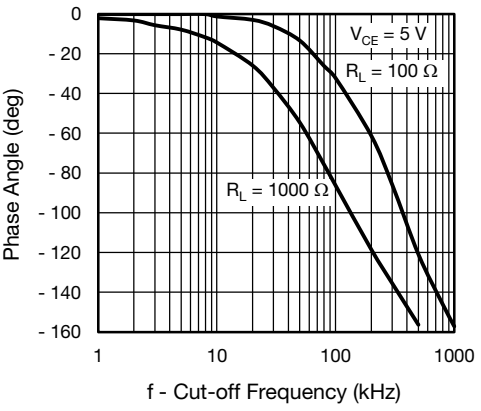



Fig. 14 - $f_{CTR}$ vs. Phase Angle

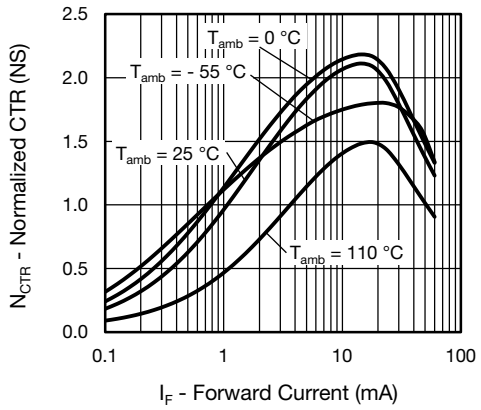



Fig. 12 - Current Transfer Ratio vs. Forward Current (saturated) Normalized to 1 mA at 25 °C

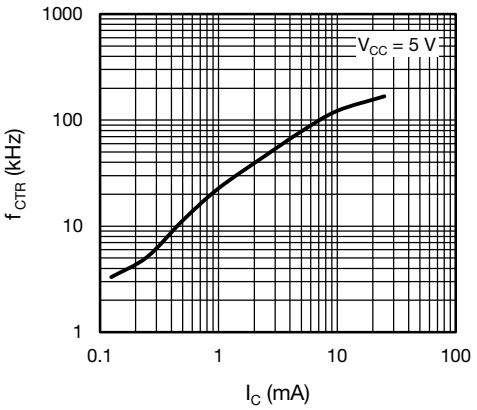



Fig. 15 - Cut-off Frequency (- 3 dB) vs. Collector Current

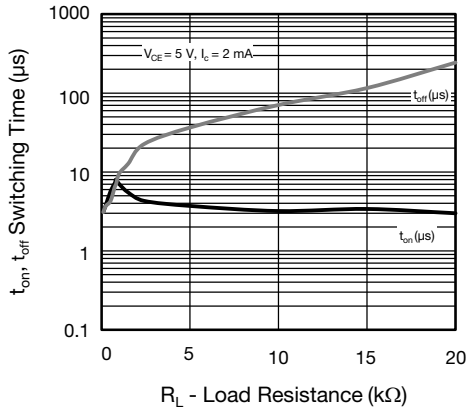



Fig. 16 - Switching Time vs. Load Resistance

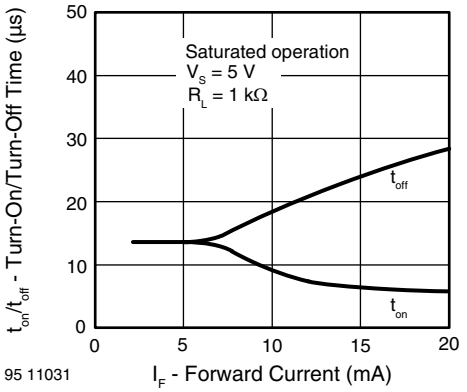



Fig. 18 - Turn-On/Turn-Off Time vs. Forward Current

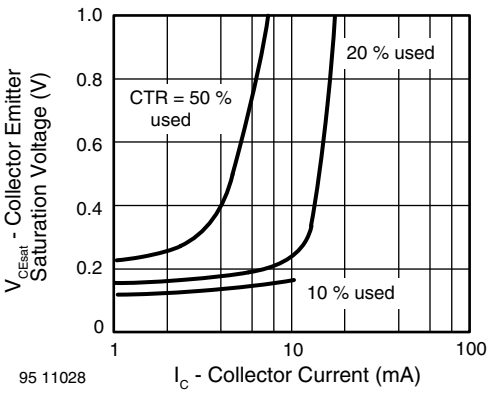



Fig. 17 - Collector Emitter Saturation Voltage vs. Collector Current

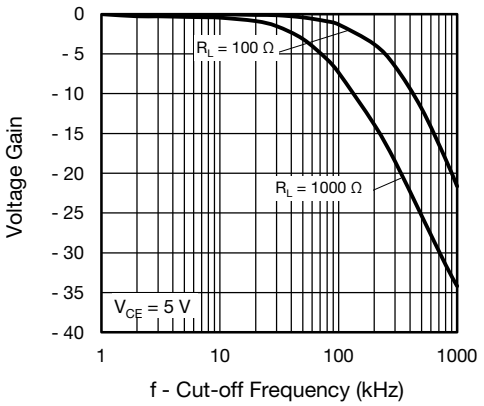
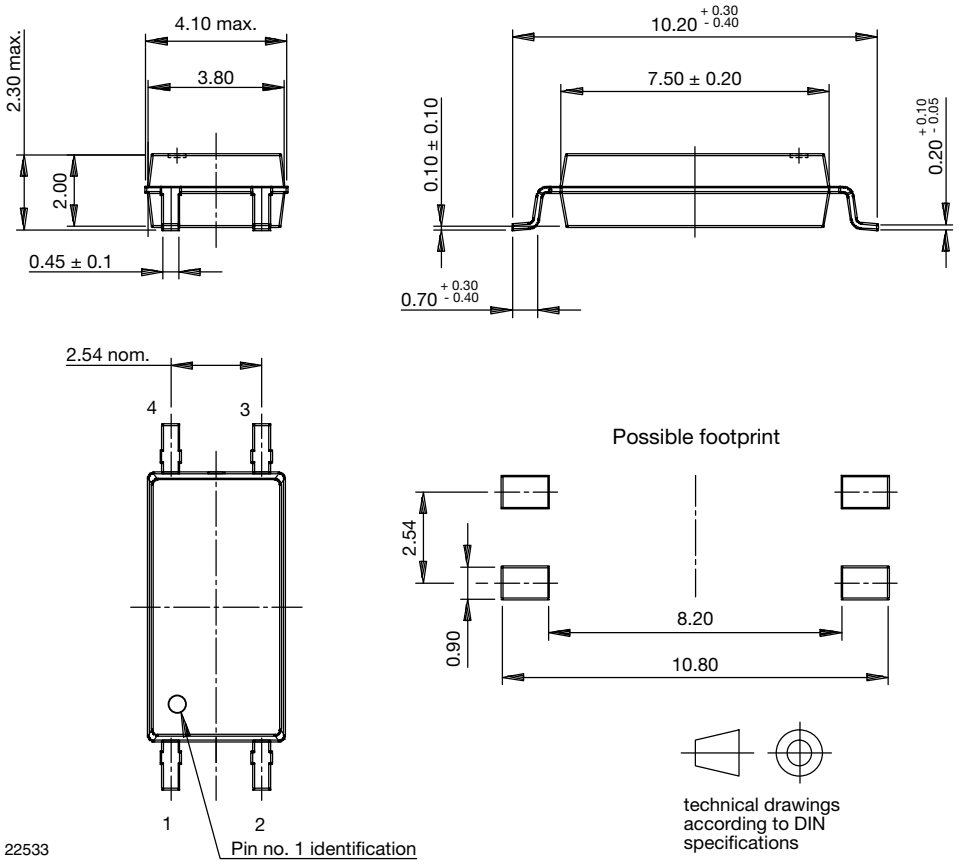
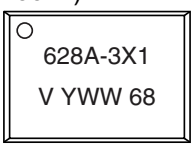



Fig. 19 - Voltage Gain vs. Cut-off Frequency

## **PACKAGE DIMENSIONS** in millimeters




## **PACKAGE MARKING** (example of VOL628A-3X001T)




**Notes**

- Only option 1 is reflected in the package marking with the characters “X1”.
- Tape and reel suffix (T) is not part of the package marking.

## **TAPE AND REEL DIMENSIONS** in millimeters

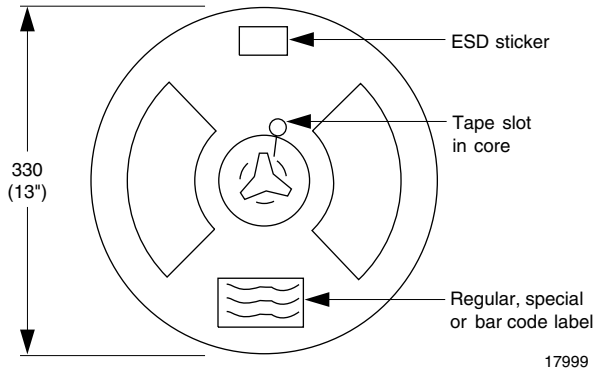



Fig. 20 - Reel Dimensions (3000 units per reel)

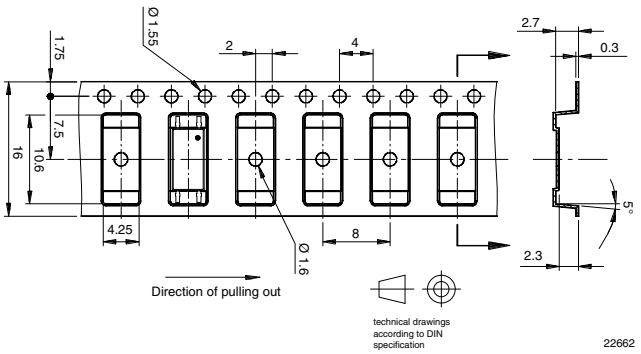



Fig. 21 - Tape Dimensions

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