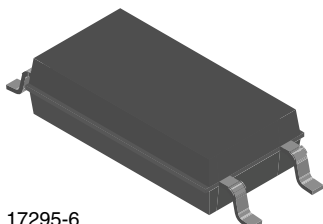
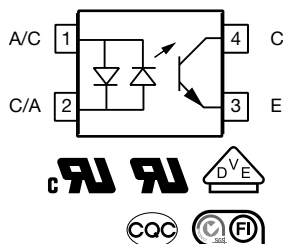


# Optocoupler, Phototransistor Output, AC Input, Low Input Current, 4 Pin LSOP, Long Creepage Mini-Flat Package



17295-6



## 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 long creepage mini-flat 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.

## FEATURES

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



**RoHS**  
COMPLIANT  
HALOGEN  
**FREE**  
**GREEN**  
(5-2008)

## APPLICATIONS

- Industrial controls
- Power supplies
- AC line monitor
- Battery powered equipment
- Programmable logic controllers

## LINKS TO ADDITIONAL RESOURCES



## AGENCY APPROVALS

(All parts are certified under base model VOL628A)

- [UL1577](#)
- [cUL](#)
- [DIN EN 60747-5-5 \(VDE 0884-5\), available with option 1](#)
- [BSI](#)
- [FIMKO](#)
- [CQC GB4943.1-2011](#)
- [CQC GB8898-2011](#)

**ORDERING INFORMATION**

|                                          |              |              |              |              |                |              |              |                |              |              |                     |              |              |
|------------------------------------------|--------------|--------------|--------------|--------------|----------------|--------------|--------------|----------------|--------------|--------------|---------------------|--------------|--------------|
| <div>V</div>                             | <div>O</div> | <div>L</div> | <div>6</div> | <div>2</div> | <div>8</div>   | <div>A</div> | <div>-</div> | <div>#</div>   | <div>X</div> | <div>0</div> | <div>0</div>        | <div>1</div> | <div>T</div> |
| PART NUMBER                              |              |              |              |              |                |              | CTR<br>BIN   | PACKAGE OPTION |              |              | TAPE<br>AND<br>REEL |              |              |
| AGENCY CERTIFIED / PACKAGE               |              | CTR (%)      |              |              |                |              |              |                |              |              |                     |              |              |
|                                          |              | 1 mA         |              |              |                |              |              |                |              |              |                     |              |              |
| UL, cUL, BSI, FIMKO, CQC                 |              | 50 to 600    |              |              | 63 to 125      |              |              | 100 to 200     |              |              |                     |              |              |
| LSOP-4, mini-flat, long creepage         |              | VOL628AT     |              |              | VOL628A-2T     |              |              | VOL628A-3T     |              |              |                     |              |              |
| UL, cUL, BSI, FIMKO, CQC, VDE (option 1) |              | 50 to 600    |              |              | 63 to 125      |              |              | 100 to 200     |              |              |                     |              |              |
| LSOP-4, mini-flat, long creepage         |              | -            |              |              | VOL628A-2X001T |              |              | VOL628A-3X001T |              |              |                     |              |              |

**Note**

- Additional options may be possible, please contact sales office

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

| PARAMETER                            | TEST CONDITION                    | SYMBOL     | VALUE       | UNIT               |
|--------------------------------------|-----------------------------------|------------|-------------|--------------------|
| <b>INPUT</b>                         |                                   |            |             |                    |
| Reverse voltage                      |                                   | $V_R$      | 6           | V                  |
| Power dissipation                    |                                   | $P_{diss}$ | 100         | mW                 |
| Forward current                      |                                   | $I_F$      | $\pm 60$    | mA                 |
| Junction temperature                 |                                   | $T_j$      | 125         | $^{\circ}\text{C}$ |
| <b>OUTPUT</b>                        |                                   |            |             |                    |
| Collector emitter voltage            |                                   | $V_{CEO}$  | 80          | V                  |
| Emitter collector voltage            |                                   | $V_{ECO}$  | 7           | V                  |
| Collector current                    |                                   | $I_C$      | 50          | mA                 |
|                                      | $t_p/T = 0.5, t_p < 10\text{ ms}$ | $I_C$      | 100         | mA                 |
| Power dissipation                    |                                   | $P_{diss}$ | 150         | mW                 |
| Junction temperature                 |                                   | $T_j$      | 125         | $^{\circ}\text{C}$ |
| <b>COUPLER</b>                       |                                   |            |             |                    |
| Total power dissipation              |                                   | $P_{tot}$  | 250         | mW                 |
| Storage temperature range            |                                   | $T_{stg}$  | -55 to +125 | $^{\circ}\text{C}$ |
| Ambient temperature range            |                                   | $T_{amb}$  | -55 to +110 | $^{\circ}\text{C}$ |
| Soldering temperature <sup>(1)</sup> | $\leq 10\text{ s}$                | $T_{sld}$  | 260         | $^{\circ}\text{C}$ |

**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
- <sup>(1)</sup> Refer to reflow profile for soldering conditions for surface mounted devices

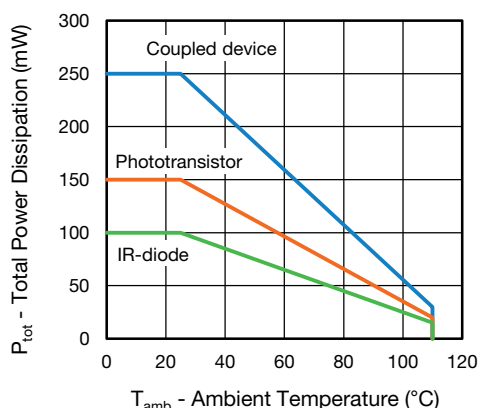


Fig. 1 - Total Power Dissipation vs. Ambient Temperature

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

| <b>CURRENT TRANSFER RATIO</b> ( $T_{amb} = 25^{\circ}\text{C}$ , unless otherwise specified) |                                                 |           |        |      |      |      |      |
|----------------------------------------------------------------------------------------------|-------------------------------------------------|-----------|--------|------|------|------|------|
| PARAMETER                                                                                    | TEST CONDITION                                  | PART      | SYMBOL | MIN. | TYP. | MAX. | UNIT |
| $I_C/I_F$                                                                                    | $I_F = \pm 1\text{ mA}$ , $V_{CE} = 5\text{ V}$ | VOL628A   | CTR    | 50   | -    | 600  | %    |
|                                                                                              |                                                 | VOL628A-2 | CTR    | 63   | -    | 125  | %    |
|                                                                                              |                                                 | VOL628A-3 | CTR    | 100  | -    | 200  | %    |

| SWITCHING CHARACTERISTICS (T <sub>amb</sub> = 25 °C, unless otherwise specified) |                                                                      |                  |      |      |      |      |
|----------------------------------------------------------------------------------|----------------------------------------------------------------------|------------------|------|------|------|------|
| PARAMETER                                                                        | TEST CONDITION                                                       | SYMBOL           | MIN. | TYP. | MAX. | UNIT |
| Turn on time                                                                     | V <sub>CC</sub> = 5 V, I <sub>C</sub> = 2 mA, R <sub>L</sub> = 100 Ω | t <sub>on</sub>  | -    | 6    | -    | μs   |
| Rise time                                                                        | V <sub>CC</sub> = 5 V, I <sub>C</sub> = 2 mA, R <sub>L</sub> = 100 Ω | t <sub>r</sub>   | -    | 3.5  | -    | μs   |
| Turn off time                                                                    | V <sub>CC</sub> = 5 V, I <sub>C</sub> = 2 mA, R <sub>L</sub> = 100 Ω | t <sub>off</sub> | -    | 5.5  | -    | μs   |
| Fall time                                                                        | V <sub>CC</sub> = 5 V, I <sub>C</sub> = 2 mA, R <sub>L</sub> = 100 Ω | t <sub>f</sub>   | -    | 5    | -    | μs   |

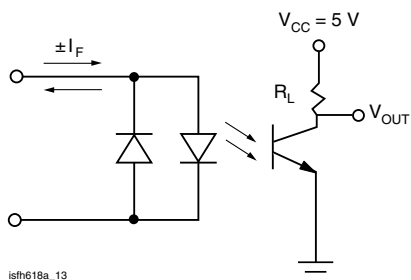


Fig. 2 - Test Circuit

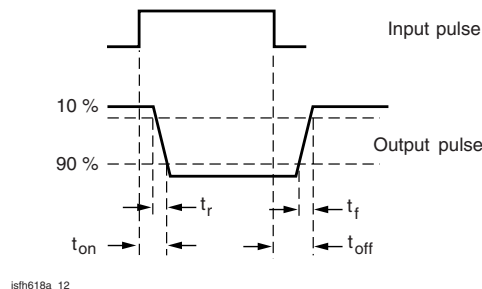


Fig. 3 - Test Circuit and Waveforms

| SAFETY AND INSULATION RATINGS                |                                                                                                                      |            |                |                    |
|----------------------------------------------|----------------------------------------------------------------------------------------------------------------------|------------|----------------|--------------------|
| PARAMETER                                    | TEST CONDITION                                                                                                       | SYMBOL     | VALUE          | UNIT               |
| Climatic classification                      | According to IEC 68 part 1                                                                                           |            | 55 / 110 / 21  |                    |
| Pollution degree                             | According to DIN VDE 0109                                                                                            |            | 2              |                    |
| Comparative tracking index                   | Insulation group IIIa                                                                                                | CTI        | 275            |                    |
| Maximum rated withstanding isolation voltage | According to UL1577, $t = 1\text{ min}$                                                                              | $V_{ISO}$  | 5000           | $V_{RMS}$          |
| Maximum transient isolation voltage          | According to DIN EN 60747-5-5                                                                                        | $V_{IOTM}$ | 8000           | $V_{peak}$         |
| Maximum repetitive peak isolation voltage    | According to DIN EN 60747-5-5                                                                                        | $V_{IORM}$ | 1050           | $V_{peak}$         |
| Isolation resistance                         | $T_{amb} = 25\text{ }^{\circ}\text{C}$ , $V_{IO} = 500\text{ V}$                                                     | $R_{IO}$   | $\geq 10^{12}$ | $\Omega$           |
|                                              | $T_{amb} = 100\text{ }^{\circ}\text{C}$ , $V_{IO} = 500\text{ V}$                                                    | $R_{IO}$   | $\geq 10^{11}$ | $\Omega$           |
|                                              | $T_{amb} = TS$ , $V_{IO} = 500\text{ V}$                                                                             | $R_{IO}$   | $\geq 10^9$    | $\Omega$           |
| Output safety power                          |                                                                                                                      | $P_{SO}$   | 265            | mW                 |
| Input safety current                         |                                                                                                                      | $I_{SI}$   | 130            | mA                 |
| Input safety temperature                     |                                                                                                                      | $T_S$      | 150            | $^{\circ}\text{C}$ |
| Creepage distance                            |                                                                                                                      |            | $\geq 8$       | mm                 |
| Clearance distance                           |                                                                                                                      |            | $\geq 8$       | mm                 |
| Insulation thickness                         |                                                                                                                      | DTI        | $\geq 0.4$     | mm                 |
| Input to output test voltage, method B       | $V_{IORM} \times 1.875 = V_{PR}$ , 100 % production test with $t_M = 1\text{ s}$ , partial discharge $< 5\text{ pC}$ | $V_{PR}$   | 2000           | $V_{peak}$         |
| Input to output test voltage, method A       | $V_{IORM} \times 1.6 = V_{PR}$ , 100 % sample test with $t_M = 10\text{ s}$ , partial discharge $< 5\text{ pC}$      | $V_{PR}$   | 1680           | $V_{peak}$         |

**Note**

- According to DIN EN 60747-5-5 (VDE 0884), § 7.4.3.8.2, (see Fig. 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

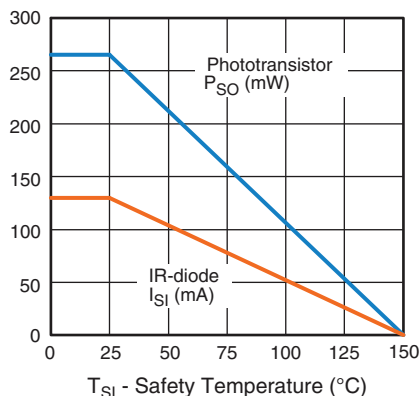


Fig. 4 - Derating Diagram

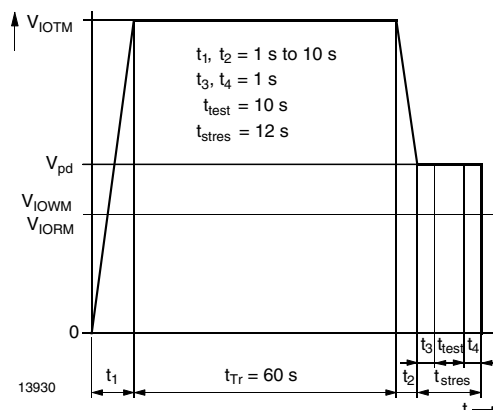


Fig. 5 - Test Pulse Diagram for Sample Test according to DIN EN 60747-5-5

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

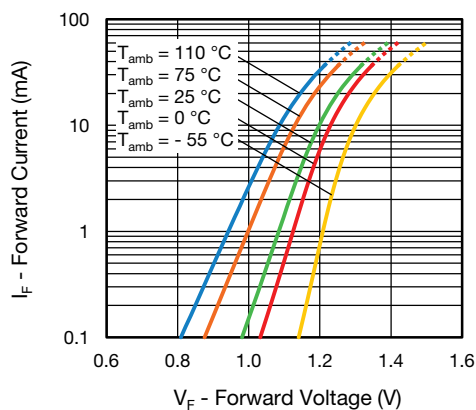


Fig. 6 - Forward Current vs. Forward Voltage

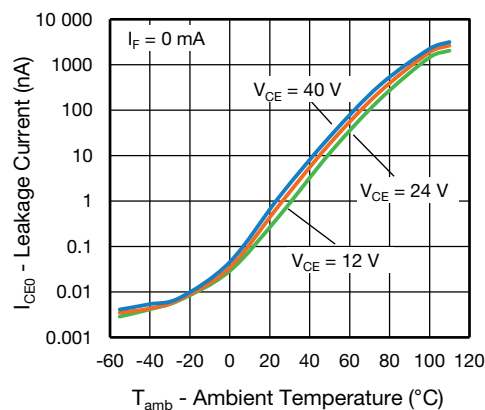


Fig. 8 - Collector Emitter Current vs. Ambient Temperature

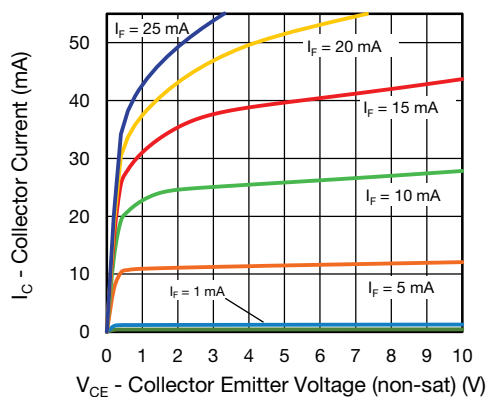


Fig. 7 - Collector Current vs. Collector Emitter Voltage (non-saturated)

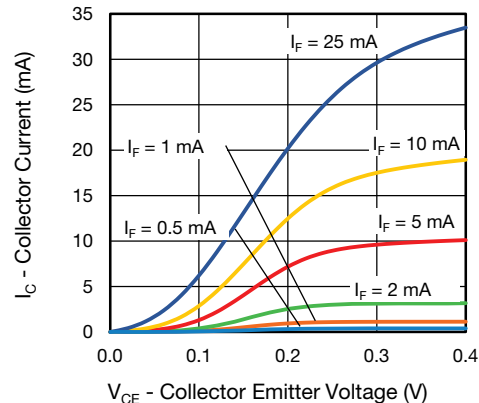


Fig. 9 - Collector Current vs. Collector Emitter Voltage (saturated)

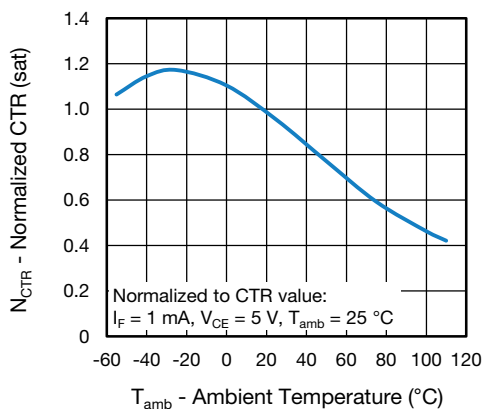


Fig. 10 - Normalized Current Transfer Ratio vs. Ambient Temperature (saturated)

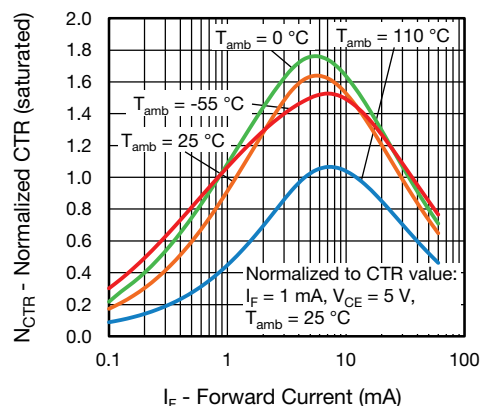


Fig. 13 - Normalized Current Transfer Ratio (saturated) vs. Forward Current

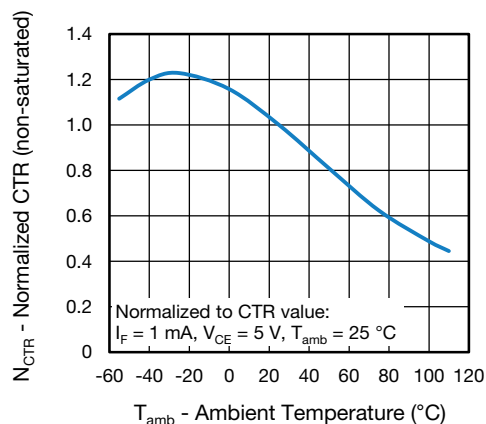


Fig. 11 - Normalized Current Transfer Ratio vs. Ambient Temperature (non-saturated)

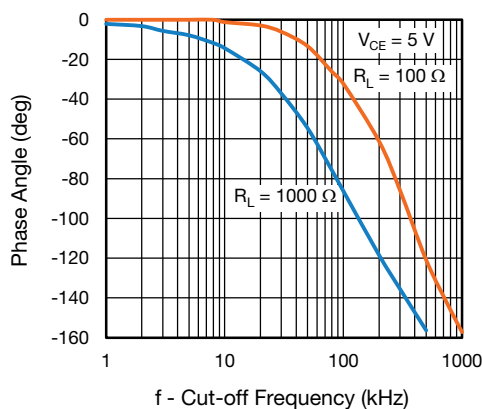


Fig. 14 - Phase Angle vs. Frequency

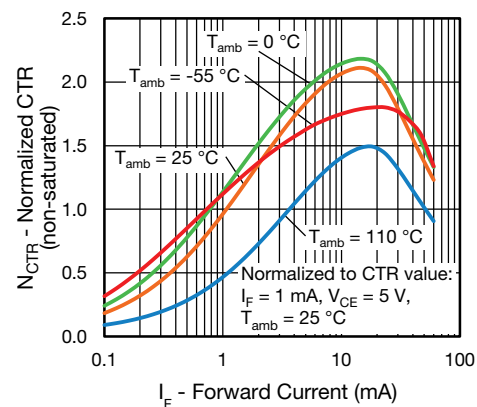


Fig. 12 - Normalized Current Transfer Ratio (non-saturated) vs. Forward Current

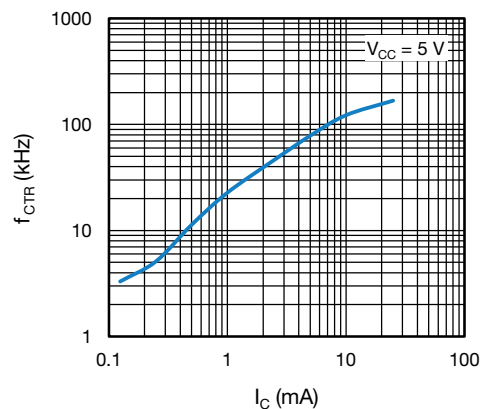


Fig. 15 -  $f_{CTR}$  vs. Collector Current

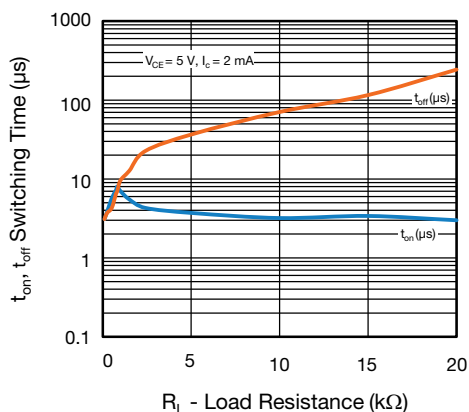


Fig. 16 - Switching Time vs. Load Resistance

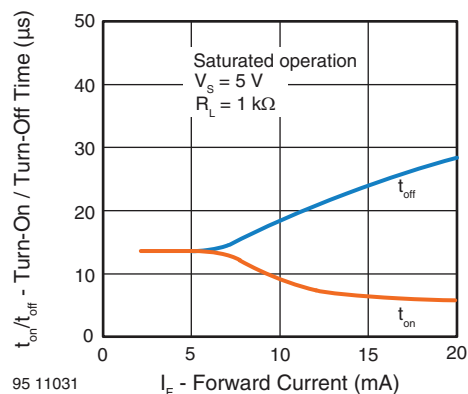


Fig. 18 - Turn-On/Turn-Off Time vs. Forward Current

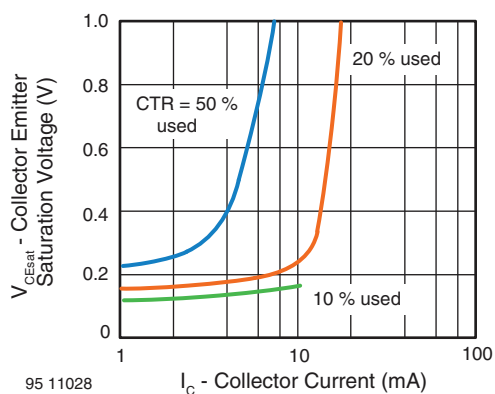


Fig. 17 - Collector Emitter Saturation Voltage vs. Collector Current

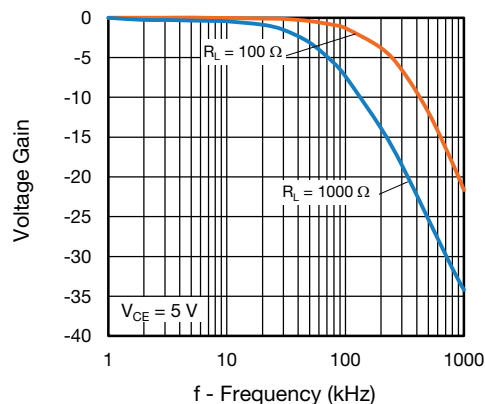
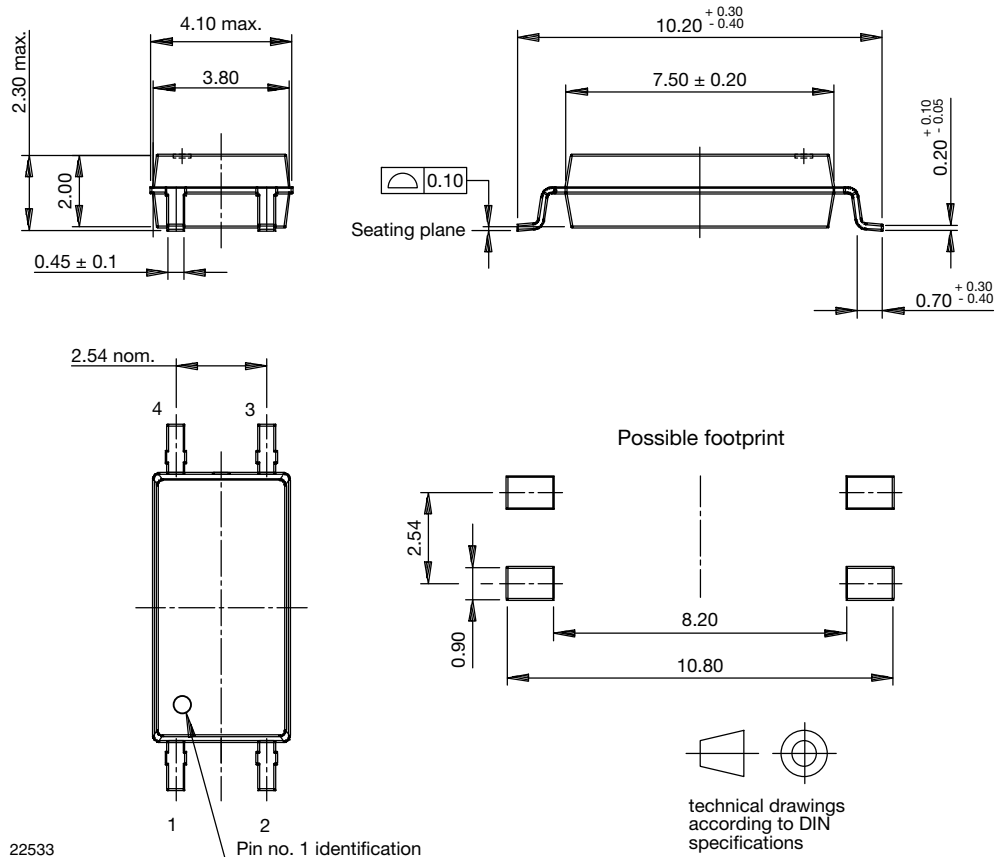
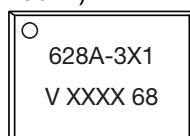


Fig. 19 - Voltage Gain vs. Cut-off Frequency

**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
- XXXX = LMC (lot marking code)

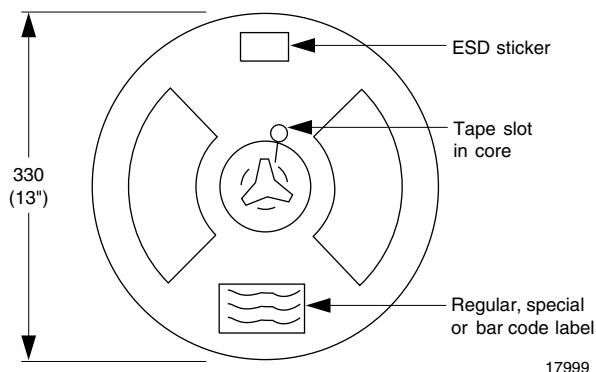
**TAPE AND REEL DIMENSIONS** (in millimeters)


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

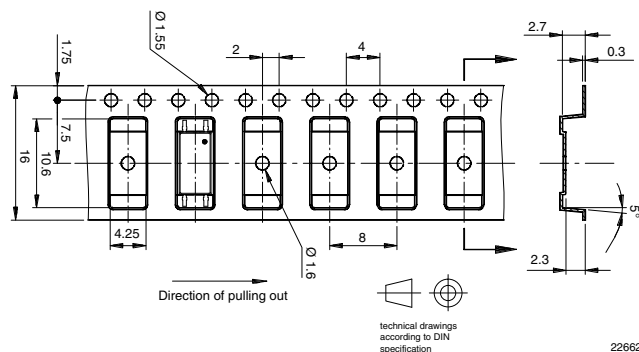
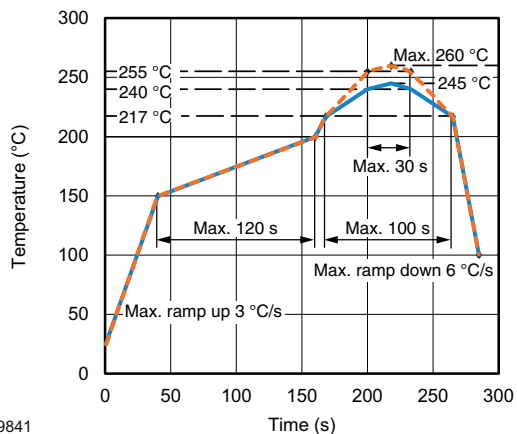


Fig. 21 - Tape Dimensions



## SOLDER PROFILE



19841

Fig. 22 - Lead (Pb)-free Reflow Solder Profile according to J-STD-020

## HANDLING AND STORAGE CONDITIONS

ESD level: HBM class 2

Floor life: unlimited

Conditions:  $T_{amb} < 30\text{ °C}$ , RH < 85 %

Moisture sensitivity level 1, according to J-STD-020



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