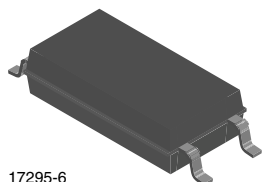
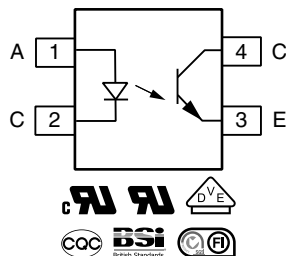


# Optocoupler, Phototransistor Output, 4 Pin LSOP, Long Creepage Mini-Flat Package



17295-6



## DESCRIPTION

The VOL617A has a GaAs infrared emitting diode emitter, which is optically coupled to a silicon planar phototransistor detector, and is 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.

## FEATURES

- Low profile package
- High collector emitter voltage,  $V_{CEO} = 80\text{ V}$
- Isolation test voltage,  $5000\text{ V}_{RMS}$
- Isolation voltage  $V_{IORM} = 1050\text{ V}_{peak}$
- 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

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

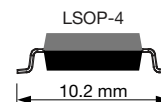
## AGENCY APPROVALS

(All parts are certified under base model VOL617A)

- 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 | 1 | 7 | A | - | #       | X              | 0 | 0 | 1             | T |
| PART NUMBER |   |   |   |   |   |   |   | CTR BIN | PACKAGE OPTION |   |   | TAPE AND REEL |   |



| AGENCY CERTIFIED/<br>PACKAGE             | CTR (%)       |                |                |                |                |                |                |
|------------------------------------------|---------------|----------------|----------------|----------------|----------------|----------------|----------------|
|                                          | 5 mA          |                |                |                |                |                |                |
| UL, cUL, BSI, FIMKO, CQC                 | 50 to 600     | 40 to 80       | 63 to 125      | 100 to 200     | 160 to 320     | 80 to 160      | 130 to 260     |
| 4 pin LSOP, mini-flat, long creepage     | VOL617AT      | VOL617A-1T     | VOL617A-2T     | VOL617A-3T     | VOL617A-4T     | -              | -              |
| UL, cUL, BSI, FIMKO, CQC, VDE (option 1) | 50 to 600     | 40 to 80       | 63 to 125      | 100 to 200     | 160 to 320     | 80 to 160      | 130 to 260     |
| 4 pin LSOP, mini-flat, long creepage     | VOL617A-X001T | VOL617A-1X001T | VOL617A-2X001T | VOL617A-3X001T | VOL617A-4X001T | VOL617A-7X001T | VOL617A-8X001T |

| <b>ABSOLUTE MAXIMUM RATINGS</b> ( $T_{amb} = 25\text{ }^{\circ}\text{C}$ , 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 surge current                                                                                  | $t_p < 10\text{ }\mu\text{s}$     | $I_{FSM}$  | 1.5         | A                  |
| Forward current                                                                                        |                                   | $I_F$      | 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>                                                                   | $\leq 10\text{ s}$                | $T_{slid}$ | 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.

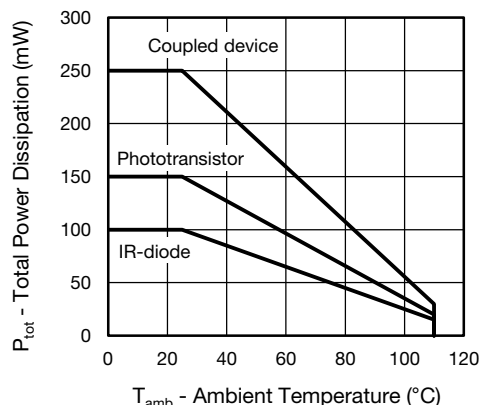


Fig. 1 - Total Power Dissipation vs. Ambient Temperature

| <b>ELECTRICAL CHARACTERISTICS</b> ( $T_{amb} = 25\text{ }^{\circ}\text{C}$ , unless otherwise specified) |                                          |             |      |      |      |               |
|----------------------------------------------------------------------------------------------------------|------------------------------------------|-------------|------|------|------|---------------|
| PARAMETER                                                                                                | TEST CONDITION                           | SYMBOL      | MIN. | TYP. | MAX. | UNIT          |
| <b>INPUT</b>                                                                                             |                                          |             |      |      |      |               |
| Forward voltage                                                                                          | $I_F = 5\text{ mA}$                      | $V_F$       | -    | 1.16 | 1.5  | V             |
| Capacitance                                                                                              | $V_R = 0\text{ V}, f = 1\text{ MHz}$     | $C_O$       | -    | 45   | -    | pF            |
| Reverse current                                                                                          | $V_R = 6\text{ V}$                       | $I_R$       | -    | -    | 100  | $\mu\text{A}$ |
| <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                                                                     | $I_C = 1.0\text{ mA}, I_F = 5\text{ mA}$ | $V_{CEsat}$ | -    | 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.

**CURRENT TRANSFER RATIO** ( $T_{amb} = 25\text{ }^{\circ}\text{C}$ , unless otherwise specified)

| PARAMETER | TEST CONDITION                              | PART      | SYMBOL | MIN. | TYP. | MAX. | UNIT |
|-----------|---------------------------------------------|-----------|--------|------|------|------|------|
| $I_C/I_F$ | $I_F = 5\text{ mA}$ , $V_{CE} = 5\text{ V}$ | VOL617A   | CTR    | 50   | -    | 600  | %    |
|           |                                             | VOL617A-1 | CTR    | 40   | -    | 80   | %    |
|           |                                             | VOL617A-2 | CTR    | 63   | -    | 125  | %    |
|           |                                             | VOL617A-3 | CTR    | 100  | -    | 200  | %    |
|           |                                             | VOL617A-4 | CTR    | 160  | -    | 320  | %    |
|           |                                             | VOL617A-7 | CTR    | 80   | -    | 160  | %    |
|           |                                             | VOL617A-8 | CTR    | 130  | -    | 260  | %    |

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

| PARAMETER     | TEST CONDITION                                                          | SYMBOL    | MIN. | TYP. | MAX. | UNIT          |
|---------------|-------------------------------------------------------------------------|-----------|------|------|------|---------------|
| Turn on time  | $V_{CC} = 5\text{ V}$ , $I_C = 2\text{ mA}$ , $R_L = 100\text{ }\Omega$ | $t_{on}$  | -    | 6    | -    | $\mu\text{s}$ |
| Rise time     | $V_{CC} = 5\text{ V}$ , $I_C = 2\text{ mA}$ , $R_L = 100\text{ }\Omega$ | $t_r$     | -    | 3.5  | -    | $\mu\text{s}$ |
| Turn off time | $V_{CC} = 5\text{ V}$ , $I_C = 2\text{ mA}$ , $R_L = 100\text{ }\Omega$ | $t_{off}$ | -    | 5.5  | -    | $\mu\text{s}$ |
| Fall time     | $V_{CC} = 5\text{ V}$ , $I_C = 2\text{ mA}$ , $R_L = 100\text{ }\Omega$ | $t_f$     | -    | 5    | -    | $\mu\text{s}$ |

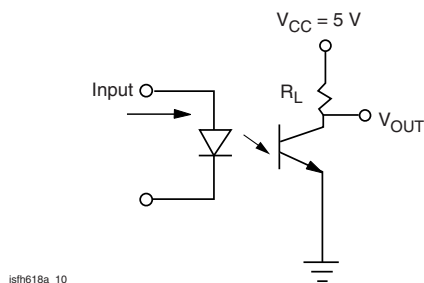


Fig. 2 - Test Circuit

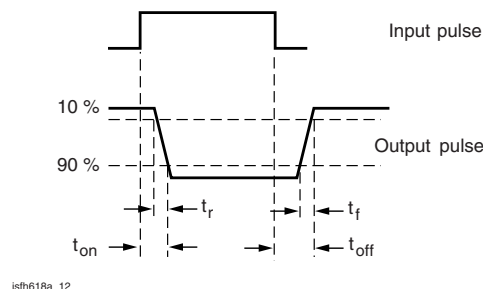


Fig. 3 - Test Circuit and Waveforms

**SAFETY AND INSULATION RATINGS**

| PARAMETER                                               | TEST CONDITION                                                                                  | SYMBOL     | VALUE     | UNIT               |
|---------------------------------------------------------|-------------------------------------------------------------------------------------------------|------------|-----------|--------------------|
| Partial discharge test voltage - routine test           | 100 %, $t_{test} = 1\text{ s}$                                                                  | $V_{pd}$   | 2         | kV                 |
| Partial discharge test voltage - lot test (sample test) | $t_{Tr} = 60\text{ s}$ , $t_{test} = 10\text{ s}$ , (see figure 4)                              | $V_{IOTM}$ | 8         | kV                 |
|                                                         |                                                                                                 | $V_{pd}$   | 1.68      | kV                 |
| Maximum withstanding isolation voltage                  | $t = 1\text{ min}$                                                                              | $V_{ISO}$  | 5000      | $V_{RMS}$          |
| Insulation voltage                                      |                                                                                                 | $V_{IORM}$ | 1050      | $V_{peak}$         |
| Insulation resistance                                   | $V_{IO} = 500\text{ V}_{DC}$ , $T_{amb} = 25\text{ }^{\circ}\text{C}$                           | $R_{IO}$   | $10^{12}$ | $\Omega$           |
|                                                         | $V_{IO} = 500\text{ V}_{DC}$ , $T_{amb} = 100\text{ }^{\circ}\text{C}$                          | $R_{IO}$   | $10^{11}$ | $\Omega$           |
|                                                         | $V_{IO} = 500\text{ V}_{DC}$ , $T_{amb} = 150\text{ }^{\circ}\text{C}$ (construction test only) | $R_{IO}$   | $10^9$    | $\Omega$           |
| Safety rating - maximum input current                   |                                                                                                 | $I_{si}$   | 130       | mA                 |
| Safety rating - maximum power dissipation               |                                                                                                 | $P_{SO}$   | 265       | mW                 |
| Rated impulse voltage                                   |                                                                                                 | $V_{IOTM}$ | 8         | kV                 |
| Safety rating - maximum ambient temperature             |                                                                                                 | $T_{si}$   | 150       | $^{\circ}\text{C}$ |
| Comparative tracking index                              |                                                                                                 | CTI        | 275       |                    |
| Clearance distance                                      |                                                                                                 |            | 8         | mm                 |
| Creepage distance                                       |                                                                                                 |            | 8         | mm                 |
| Insulation distance (internal)                          |                                                                                                 | DTI        | 0.4       | mm                 |

**Note**

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

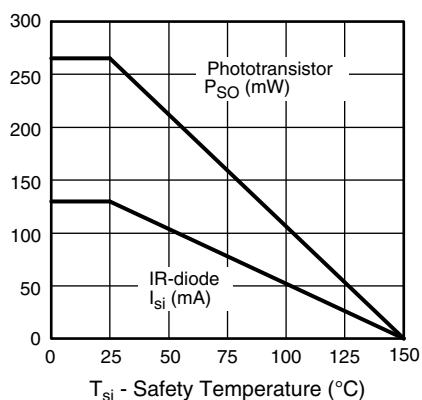


Fig. 4 - Derating Diagram

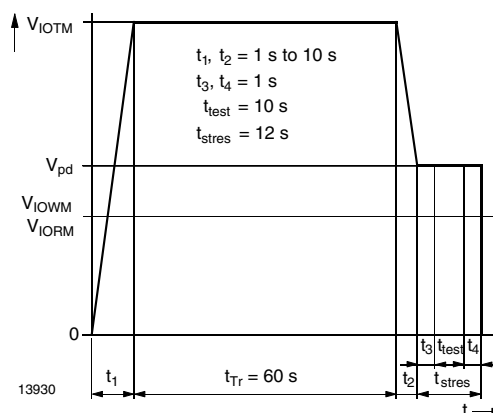


Fig. 5 - Test Pulse Diagram for Sample Test according to DIN EN 60747-5-5

### TYPICAL CHARACTERISTICS (T<sub>amb</sub> = 25 °C, unless otherwise specified)

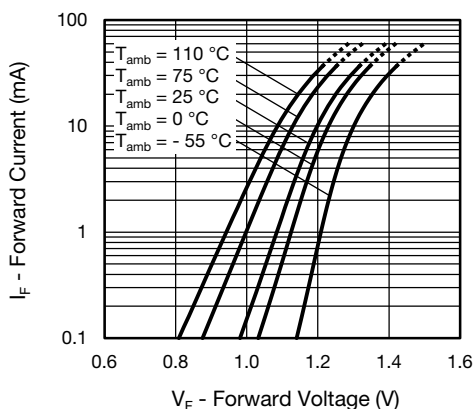


Fig. 6 - Forward Current vs. Forward Voltage

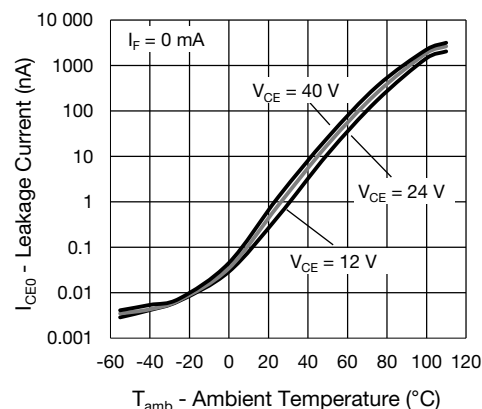


Fig. 8 - Collector Emitter Current vs. Ambient Temperature

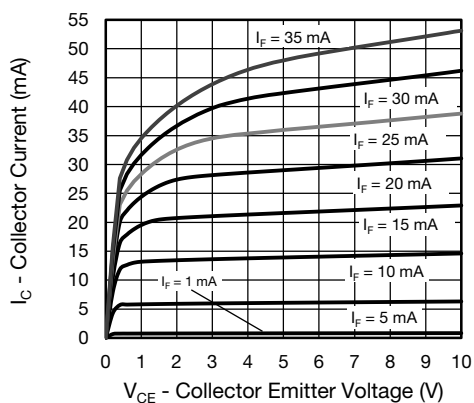


Fig. 7 - Collector Current vs. Collector Emitter Voltage

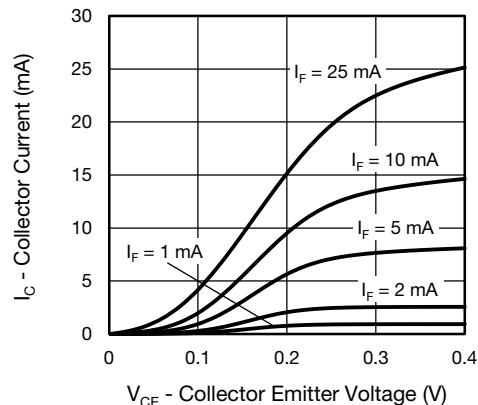


Fig. 9 - Collector Current vs. Collector Emitter Voltage

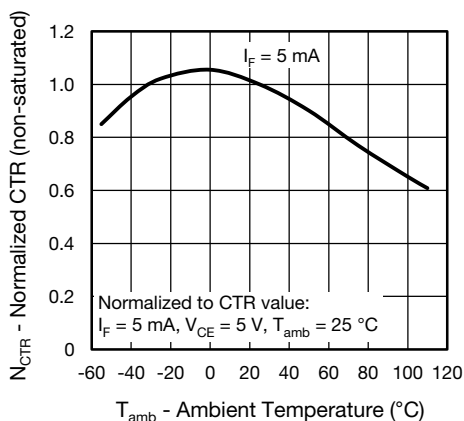


Fig. 10 - Normalized Current Transfer Ratio (non-saturated) vs. Ambient Temperature

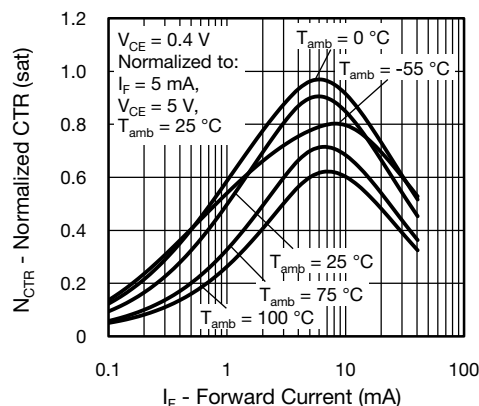


Fig. 13 - Normalized Current Transfer Ratio (saturated) vs. Forward Current

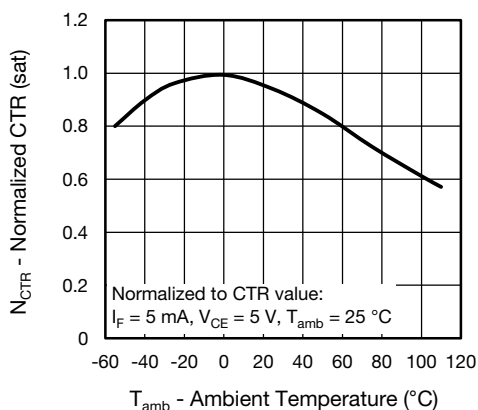


Fig. 11 - Normalized Current Transfer Ratio (saturated) vs. Ambient Temperature

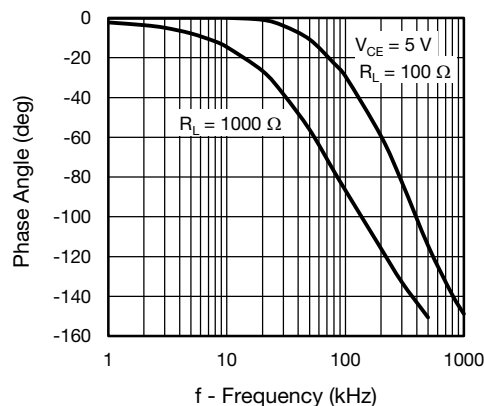


Fig. 14 - Cut-Off Frequency vs. Phase Angle

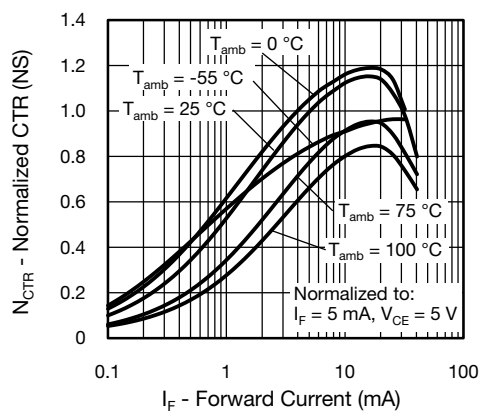


Fig. 12 - Normalized Current Transfer Ratio (non-saturated) vs. Forward Current

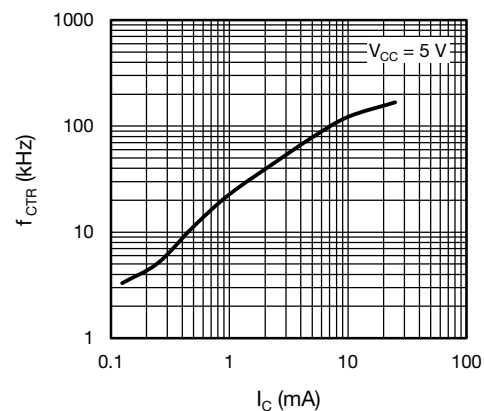


Fig. 15 - Cut-Off Frequency vs. Collector Current

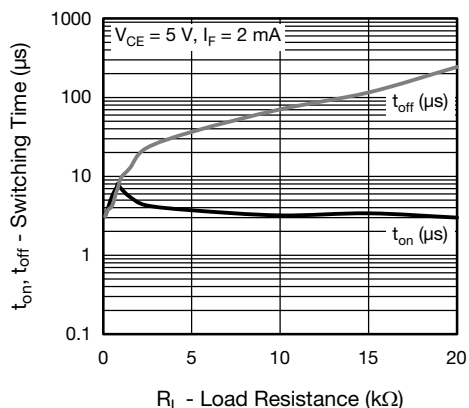


Fig. 16 - Switching Time vs. Load Resistance

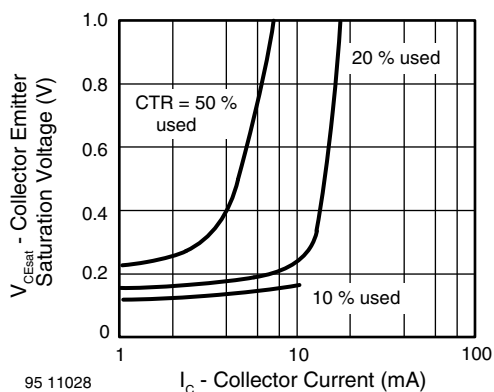


Fig. 17 - Collector Emitter Saturation Voltage vs. Collector Current

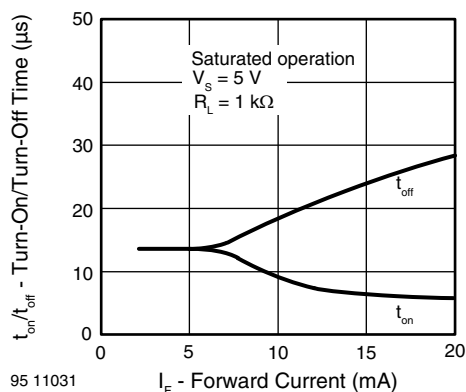
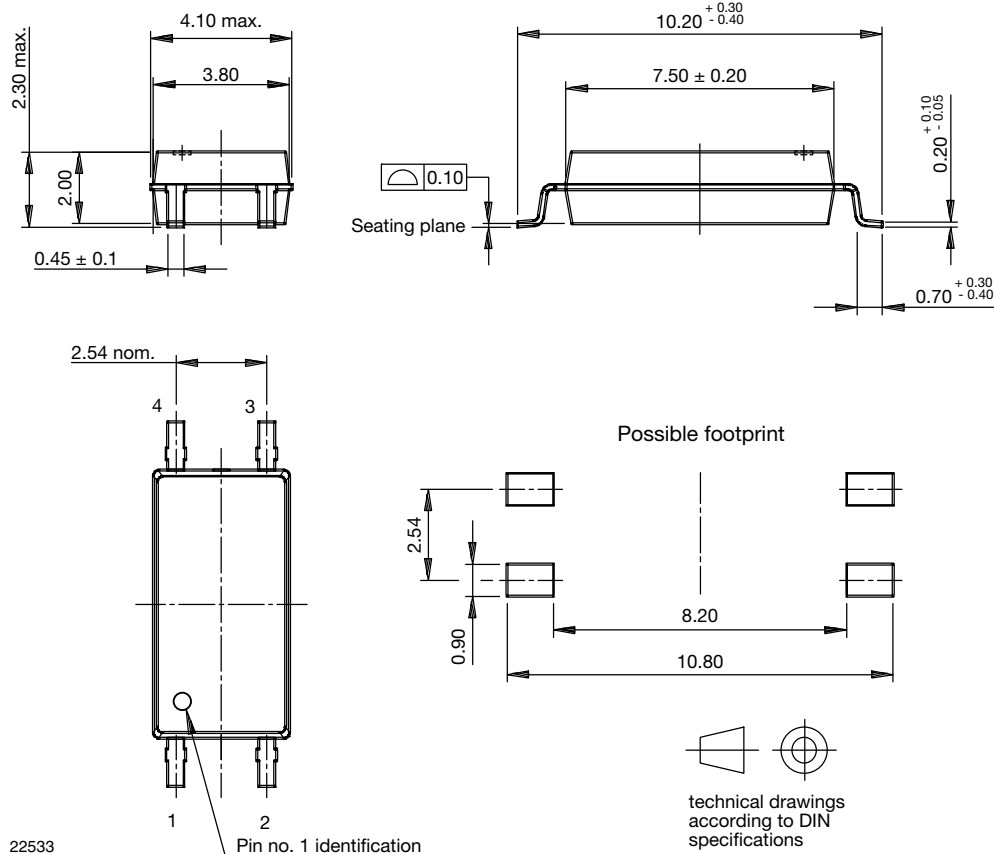
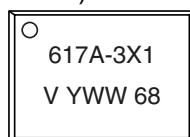


Fig. 18 - Turn-On/Turn-Off Time vs. Forward Current

**PACKAGE DIMENSIONS** (in millimeters)

**PACKAGE MARKING** (example of VOL617A-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.

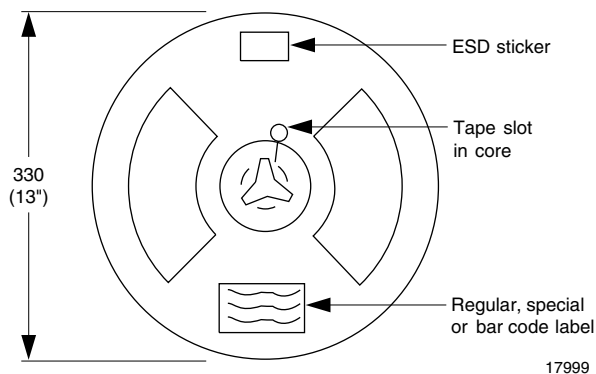
**TAPE AND REEL DIMENSIONS** (in millimeters)


Fig. 19 - Reel Dimensions (3000 units per reel)

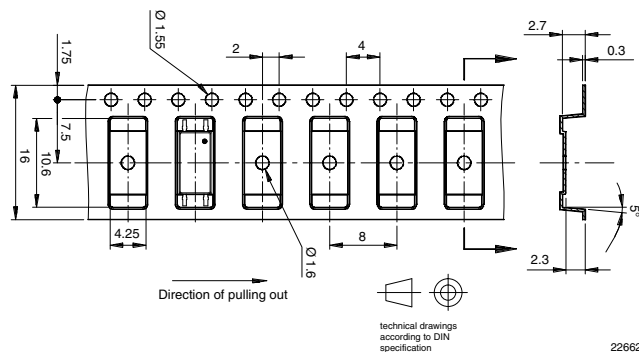
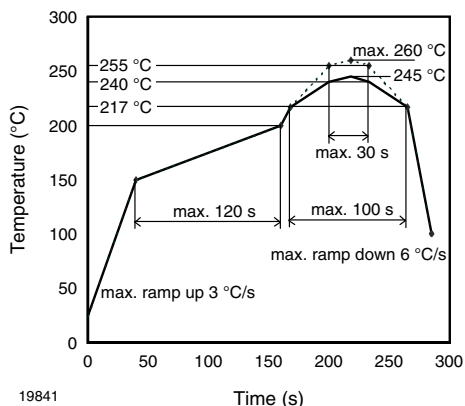


Fig. 20 - Tape Dimensions

## SOLDER PROFILE



19841

Fig. 21 - 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



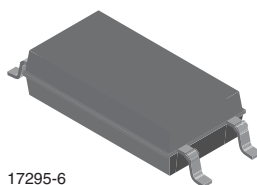
## Footprint and Schematic Information for VOL617A

The footprint and schematic symbols for the following parts can be accessed using the associated links. They are available in Eagle, Altium, KiCad, OrCAD / Allegro, Pulsonix, and PADS.

Note that the 3D models for these parts can be found on the Vishay product page.

| PART NUMBER    | FOOTPRINT / SCHEMATIC                                                                                                            |
|----------------|----------------------------------------------------------------------------------------------------------------------------------|
| VOL617A-1T     | <a href="http://www.snapeda.com/parts/VOL617A-1T/Vishay/view-part">www.snapeda.com/parts/VOL617A-1T/Vishay/view-part</a>         |
| VOL617A-1X001T | <a href="http://www.snapeda.com/parts/VOL617A-1X001T/Vishay/view-part">www.snapeda.com/parts/VOL617A-1X001T/Vishay/view-part</a> |
| VOL617A-2T     | <a href="http://www.snapeda.com/parts/VOL617A-2T/Vishay/view-part">www.snapeda.com/parts/VOL617A-2T/Vishay/view-part</a>         |
| VOL617A-2X001T | <a href="http://www.snapeda.com/parts/VOL617A-2X001T/Vishay/view-part">www.snapeda.com/parts/VOL617A-2X001T/Vishay/view-part</a> |
| VOL617A-3T     | <a href="http://www.snapeda.com/parts/VOL617A-3T/Vishay/view-part">www.snapeda.com/parts/VOL617A-3T/Vishay/view-part</a>         |
| VOL617A-3X001T | <a href="http://www.snapeda.com/parts/VOL617A-3X001T/Vishay/view-part">www.snapeda.com/parts/VOL617A-3X001T/Vishay/view-part</a> |
| VOL617A-4T     | <a href="http://www.snapeda.com/parts/VOL617A-4T/Vishay/view-part">www.snapeda.com/parts/VOL617A-4T/Vishay/view-part</a>         |
| VOL617A-4X001T | <a href="http://www.snapeda.com/parts/VOL617A-4X001T/Vishay/view-part">www.snapeda.com/parts/VOL617A-4X001T/Vishay/view-part</a> |
| VOL617A-7X001T | <a href="http://www.snapeda.com/parts/VOL617A-7X001T/Vishay/view-part">www.snapeda.com/parts/VOL617A-7X001T/Vishay/view-part</a> |
| VOL617A-8X001T | <a href="http://www.snapeda.com/parts/VOL617A-8X001T/Vishay/view-part">www.snapeda.com/parts/VOL617A-8X001T/Vishay/view-part</a> |
| VOL617AT       | <a href="http://www.snapeda.com/parts/VOL617AT/Vishay/view-part">www.snapeda.com/parts/VOL617AT/Vishay/view-part</a>             |
| VOL617AX001T   | <a href="http://www.snapeda.com/parts/VOL617AX001T/Vishay/view-part">www.snapeda.com/parts/VOL617AX001T/Vishay/view-part</a>     |

For technical issues and product support, please contact [optocoupleranswers@vishay.com](mailto:optocoupleranswers@vishay.com).



17295-6



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