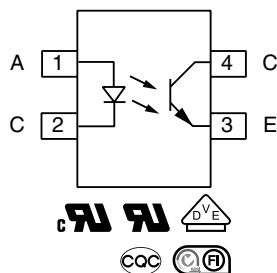
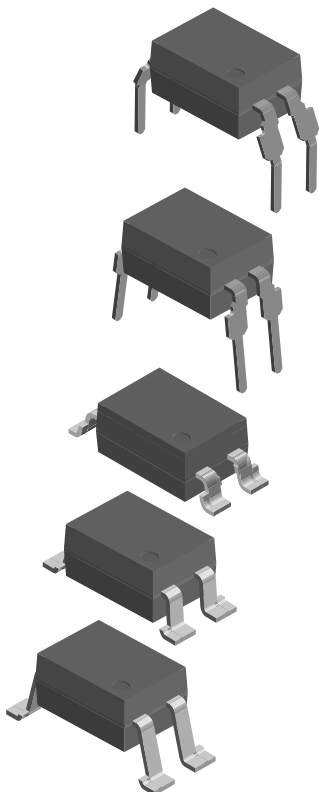


# Optocoupler, Phototransistor Output, High Reliability, 5300 V<sub>RMS</sub>, Low Input Current



## DESCRIPTION

The 110 °C rated VO618A feature a high current transfer ratio, low coupling capacitance and high isolation voltage. These couplers have a GaAs infrared diode emitter, which is optically coupled to a silicon planar phototransistor detector, and is incorporated in a 4 pin DIP package.

The coupling devices are designed for signal transmission between two electrically separated circuits.

The couplers are end-stackable with 2.54 mm spacing.

Creepage and clearance distances of > 8.0 mm are achieved with option 6 and 8. This version complies with IEC 60950 (DIN VDE 0805) for reinforced insulation up to an operation voltage of 400 V<sub>RMS</sub> or DC. Specifications subject to change.

## FEATURES

- Operating temperature from -55 °C to +110 °C
- Good CTR linearity depending on forward current
- Isolation test voltage, 5300 V<sub>RMS</sub>
- High collector emitter voltage, V<sub>CEO</sub> = 80 V
- Low saturation voltage
- Fast switching times
- Low CTR degradation
- Temperature stable
- Low coupling capacitance
- End stackable, 0.100" (2.54 mm) spacing
- High common mode interference 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

- AC adapters
- SMPS
- PLC
- Factory automation
- Game consoles

## AGENCY APPROVALS

- [UL 1577](#)
- [cUL](#)
- [DIN EN 60747-5-5 \(VDE 0884-5\), available with option 1](#)
- [BSI](#)
- [FIMKO](#)
- [CQC](#)

## LINKS TO ADDITIONAL RESOURCES

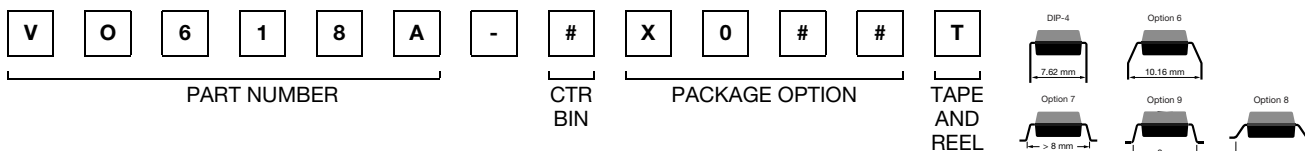

[Product Page](#)

[Design Tools](#)

[Models](#)

[Footprints](#)

[Schematics](#)

**ORDERING INFORMATION**


| AGENCY CERTIFIED / PACKAGE                 | CTR (%)          |                  |                   |                   |
|--------------------------------------------|------------------|------------------|-------------------|-------------------|
|                                            | 1 mA             |                  |                   |                   |
| <b>UL, cUL, BSI, FIMKO</b>                 | <b>50 to 600</b> | <b>63 to 125</b> | <b>100 to 200</b> | <b>160 to 320</b> |
| DIP-4                                      | VO618A           | VO618A-2         | VO618A-3          | VO618A-4          |
| SMD-4, option 9                            | -                | VO618A-2X009T    | VO618A-3X009T     | VO618A-4X009T     |
| <b>UL, cUL, BSI, FIMKO, VDE (option 1)</b> | <b>50 to 600</b> | <b>63 to 125</b> | <b>100 to 200</b> | <b>160 to 320</b> |
| DIP-4, 400 mil, option 6                   | -                | -                | -                 | VO618A-4X016      |
| SMD-4, option 7                            | -                | VO618A-2X017T    | VO618A-3X017T     | VO618A-4X017T     |
| SMD-4, 400 mil, option 8                   | -                | -                | VO618A-3X018T     | -                 |
| SMD-4, option 9                            | -                | -                | VO618A-3X019T     | VO618A-4X019T     |

**Note**

- Additional options may be possible, please contact sales office

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

| PARAMETER                 | TEST CONDITION                        | SYMBOL     | VALUE       | UNIT               |
|---------------------------|---------------------------------------|------------|-------------|--------------------|
| <b>INPUT</b>              |                                       |            |             |                    |
| Reverse voltage           |                                       | $V_R$      | 6           | V                  |
| Forward current           |                                       | $I_F$      | 60          | mA                 |
| Forward surge current     | $t_p \leq 10 \mu\text{s}$             | $I_{FSM}$  | 1.5         | A                  |
| LED power dissipation     | at $25^{\circ}\text{C}$               | $P_{diss}$ | 70          | mW                 |
| <b>OUTPUT</b>             |                                       |            |             |                    |
| Collector emitter voltage |                                       | $V_{CEO}$  | 80          | V                  |
| Emitter collector voltage |                                       | $V_{ECO}$  | 7           | V                  |
| Collector current         |                                       | $I_C$      | 50          | mA                 |
| Collector peak current    | $t_p/T = 0.5, t_p \leq 10 \text{ ms}$ | $I_{CM}$   | 100         | mA                 |
| Output power dissipation  | at $25^{\circ}\text{C}$               | $P_{diss}$ | 150         | mW                 |
| <b>COUPLER</b>            |                                       |            |             |                    |
| Total power dissipation   |                                       | $P_{tot}$  | 200         | mW                 |
| Operation temperature     |                                       | $T_{amb}$  | -55 to +110 | $^{\circ}\text{C}$ |
| Storage temperature range |                                       | $T_{stg}$  | -55 to +150 | $^{\circ}\text{C}$ |
| Soldering temperature     | 2 mm from case, $\leq 10 \text{ s}$   | $T_{slid}$ | 260         | $^{\circ}\text{C}$ |

**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.

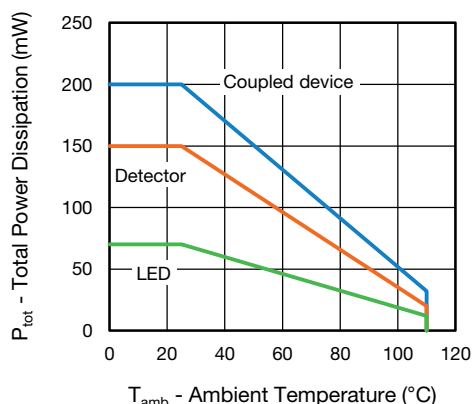


Fig. 1 - Total Power Dissipation vs. Ambient Temperature

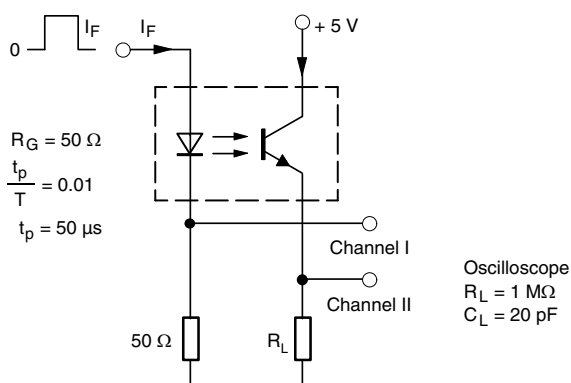
| <b>ELECTRICAL CHARACTERISTICS</b> ( $T_{amb} = 25^{\circ}\text{C}$ , unless otherwise specified) |                                              |             |      |      |      |               |
|--------------------------------------------------------------------------------------------------|----------------------------------------------|-------------|------|------|------|---------------|
| PARAMETER                                                                                        | TEST CONDITION                               | SYMBOL      | MIN. | TYP. | MAX. | UNIT          |
| <b>INPUT</b>                                                                                     |                                              |             |      |      |      |               |
| Forward voltage                                                                                  | $I_F = 5\text{ mA}$                          | $V_F$       | 1    | 1.1  | 1.65 | V             |
| Reverse current                                                                                  | $V_R = 6\text{ V}$                           | $I_R$       | -    | 0.01 | 10   | $\mu\text{A}$ |
| Junction capacitance                                                                             | $V_R = 0\text{ V}$ , $f = 1\text{ MHz}$      | $C_j$       | -    | 13   |      | pF            |
| <b>OUTPUT</b>                                                                                    |                                              |             |      |      |      |               |
| Collector emitter leakage current                                                                | $V_{CE} = 10\text{ V}$                       | $I_{CEO}$   | -    | 10   | 200  | nA            |
| Collector emitter capacitance                                                                    | $V_{CE} = 5\text{ V}$ , $f = 1\text{ MHz}$   | $C_{CE}$    | -    | 5.2  | -    | pF            |
| Collector emitter breakdown voltage                                                              | $I_C = 1\text{ mA}$                          | $BV_{CEO}$  | 80   | -    | -    | V             |
| Emitter collector breakdown voltage                                                              | $I_E = 100\text{ }\mu\text{A}$               | $BV_{ECO}$  | 7    | -    | -    | V             |
| <b>COUPLER</b>                                                                                   |                                              |             |      |      |      |               |
| Collector emitter saturation voltage                                                             | $I_F = 1\text{ mA}$ , $I_C = 0.25\text{ mA}$ | $V_{CEsat}$ | -    | 0.25 | 0.4  | V             |
| Coupling capacitance                                                                             | $f = 1\text{ MHz}$                           | $C_C$       | -    | 0.4  | -    | 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 |
| $I_C/I_F$                                                                                    | $I_F = 1\text{ mA}$ , $V_{CE} = 5\text{ V}$ | VO618A   | CTR    | 50   | -    | 600  | %    |
|                                                                                              |                                             | VO618A-2 | CTR    | 63   | -    | 125  | %    |
|                                                                                              |                                             | VO618A-3 | CTR    | 100  | -    | 200  | %    |
|                                                                                              |                                             | VO618A-4 | CTR    | 160  | -    | 320  | %    |

| <b>SWITCHING CHARACTERISTICS</b> ( $T_{amb} = 25\text{ }^{\circ}\text{C}$ , unless otherwise specified) |                                                                        |         |            |      |      |      |               |
|---------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------|---------|------------|------|------|------|---------------|
| PARAMETER                                                                                               | TEST CONDITION                                                         | CTR BIN | SYMBOL     | MIN. | TYP. | MAX. | UNIT          |
| <b>NON-SATURATED</b>                                                                                    |                                                                        |         |            |      |      |      |               |
| Rise and fall time                                                                                      | $I_F = 1\text{ mA}$ , $V_{CC} = 5\text{ V}$ , $R_L = 75\text{ }\Omega$ |         | $t_r, t_f$ | -    | 2    | -    | $\mu\text{s}$ |
| Turn-on time                                                                                            | $I_F = 1\text{ mA}$ , $V_{CC} = 5\text{ V}$ , $R_L = 75\text{ }\Omega$ |         | $t_{on}$   | -    | 3    | -    | $\mu\text{s}$ |
| Turn-off time                                                                                           |                                                                        |         | $t_{off}$  | -    | 2.3  | -    | $\mu\text{s}$ |
| Cut-off frequency                                                                                       | $I_F = 1\text{ mA}$ , $V_{CC} = 5\text{ V}$ , $R_L = 75\text{ }\Omega$ |         | $f_{ctr}$  | -    | 100  | -    | kHz           |
| <b>SATURATED</b>                                                                                        |                                                                        |         |            |      |      |      |               |
| Turn-on time                                                                                            | $I_F = 1\text{ mA}$                                                    |         | $t_{on}$   | -    | 4.2  | -    | $\mu\text{s}$ |
| Turn-off time                                                                                           | $I_F = 1\text{ mA}$                                                    |         | $t_{off}$  | -    | 23   | -    | $\mu\text{s}$ |
| Rise time                                                                                               | $I_F = 1\text{ mA}$                                                    |         | $t_r$      | -    | 3    | -    | $\mu\text{s}$ |
| Fall time                                                                                               | $I_F = 1\text{ mA}$                                                    |         | $t_f$      | -    | 14   | -    | $\mu\text{s}$ |



95 10804-3

Fig. 2 - Test Circuit, Non-Saturated Operation

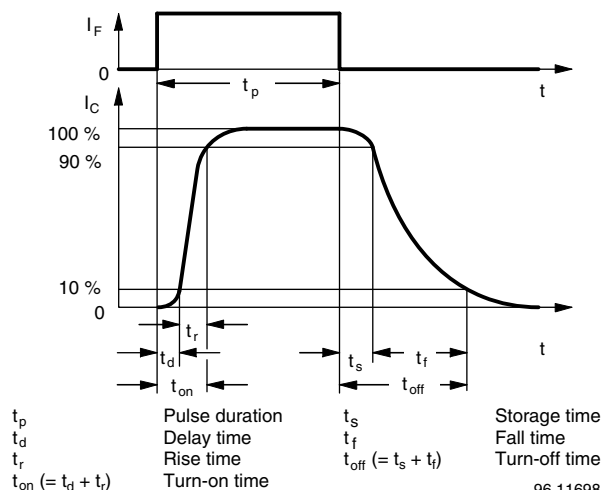
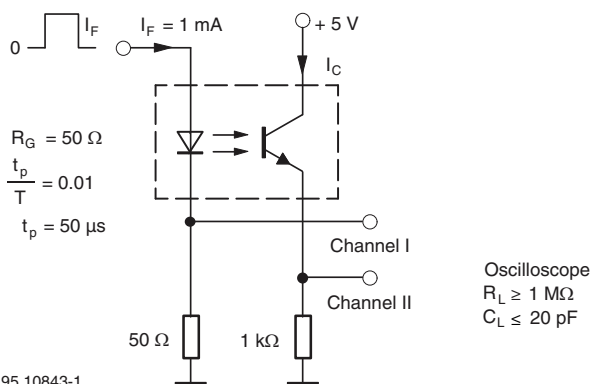


Fig. 4 - Switching Times



95 10843-1

Fig. 3 - Test Circuit, Saturated Operation

| SAFETY AND INSULATION RATINGS                |                                                                   |            |                |                    |
|----------------------------------------------|-------------------------------------------------------------------|------------|----------------|--------------------|
| PARAMETER                                    | TEST CONDITION                                                    | SYMBOL     | VALUE          | UNIT               |
| Climatic classification                      | According to IEC 68 part 1                                        |            | 55 / 115 / 21  |                    |
| Pollution degree                             | According to DIN VDE 0109                                         |            | 2              |                    |
| Comparative tracking index                   | Insulation group IIIa                                             | CTI        | 175            |                    |
| Maximum rated withstanding isolation voltage | According to UL 1577, t = 1 min                                   | $V_{ISO}$  | 5300           | $V_{RMS}$          |
| 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                                     | $V_{IORM}$ | 890            | $V_{peak}$         |
| Isolation resistance                         | $T_{amb} = 25\text{ }^{\circ}\text{C}$ , $V_{IO} = 500\text{ V}$  | $R_{IO}$   | $\geq 10^{12}$ | $\Omega$           |
|                                              | $T_{amb} = 115\text{ }^{\circ}\text{C}$ , $V_{IO} = 500\text{ V}$ | $R_{IO}$   | $\geq 10^{11}$ | $\Omega$           |
| Output safety power                          |                                                                   | $P_{SO}$   | 700            | mW                 |
| Input safety current                         |                                                                   | $I_{SI}$   | 400            | mA                 |
| Input safety temperature                     |                                                                   | $T_S$      | 175            | $^{\circ}\text{C}$ |
| Creepage distance                            | DIP-4                                                             |            | $\geq 7$       | mm                 |
| Clearance distance                           |                                                                   |            | $\geq 7$       | mm                 |
| Creepage distance                            | DIP-4, 400 mil, option 6                                          |            | $\geq 8$       | mm                 |
| Clearance distance                           |                                                                   |            | $\geq 8$       | mm                 |
| Creepage distance                            | SMD-4, option 7                                                   |            | $\geq 7$       | mm                 |
| Clearance distance                           |                                                                   |            | $\geq 7$       | mm                 |
| Creepage distance                            | SMD-4, 400 mil, option 8                                          |            | $\geq 8$       | mm                 |
| Clearance distance                           |                                                                   |            | $\geq 8$       | mm                 |
| Creepage distance                            | SMD-4, option 9                                                   |            | $\geq 7$       | mm                 |
| Clearance distance                           |                                                                   |            | $\geq 7$       | mm                 |
| Insulation thickness                         |                                                                   | DTI        | $\geq 0.4$     | mm                 |

**Note**

- As per DIN EN 60747-5-5, § 7.4.3.8.2, 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.

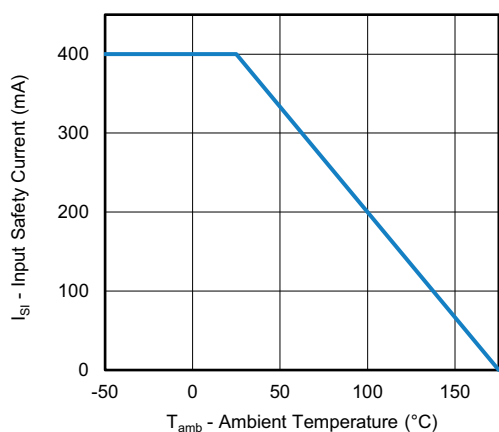


Fig. 5 - Input Safety Current vs. Ambient Temperature

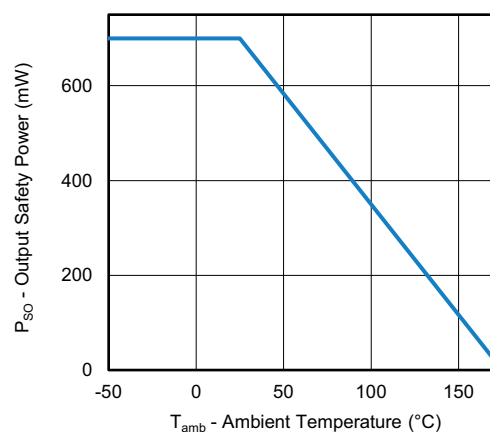


Fig. 6 - Output Safety Power vs. Ambient Temperature

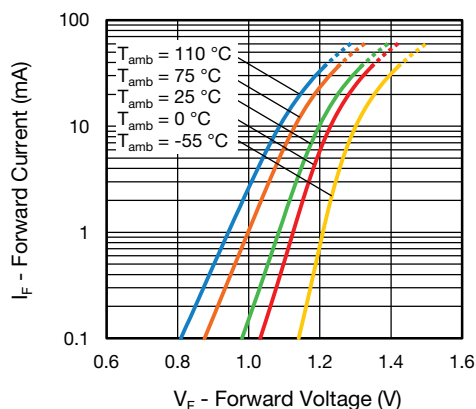
**TYPICAL CHARACTERISTICS** ( $T_{amb} = 25\text{ }^{\circ}\text{C}$ , unless otherwise specified)


Fig. 7 - Forward Voltage vs. Forward Current

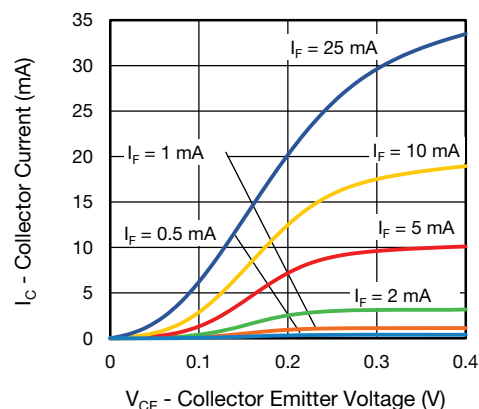


Fig. 10 - Collector Current vs. Collector Emitter Voltage

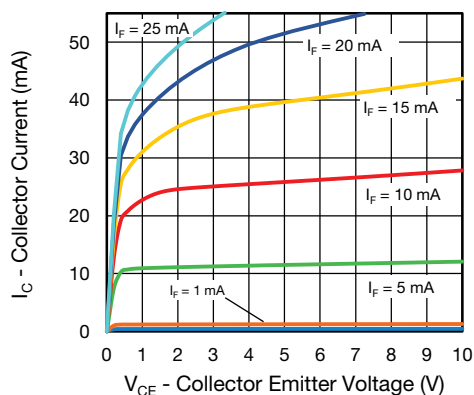


Fig. 8 - Collector Current vs. Collector Emitter Voltage

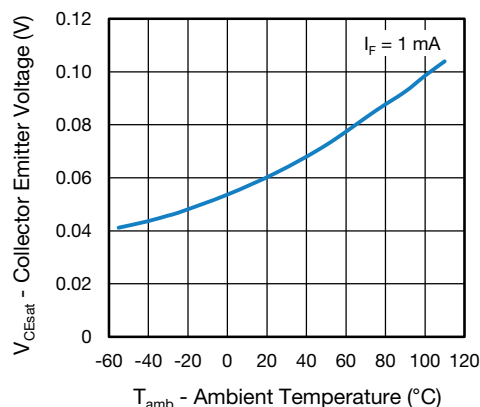


Fig. 11 - Collector Emitter Voltage vs. Ambient Temperature

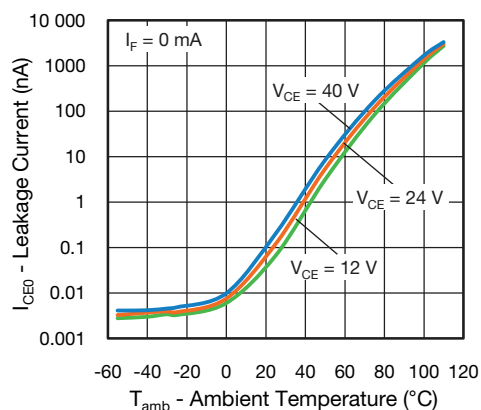


Fig. 9 - Collector Emitter Current vs. Ambient Temperature

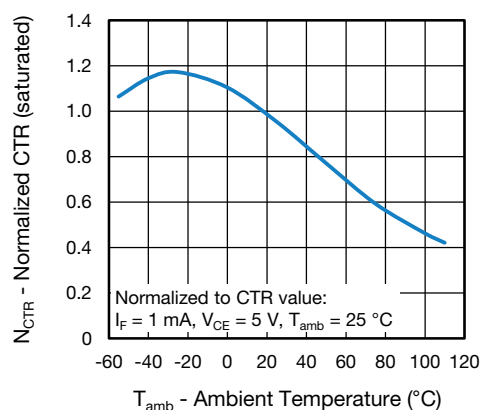


Fig. 12 - Normalized Current Transfer Ratio vs. Ambient Temperature (sat.)

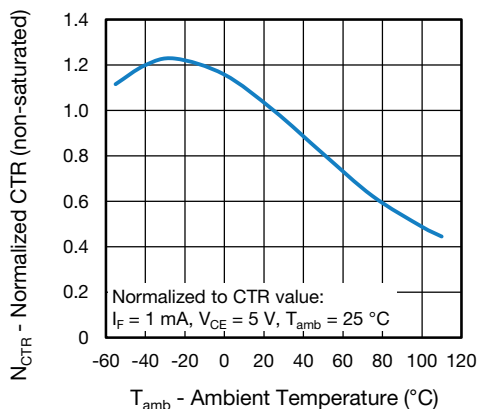


Fig. 13 - Normalized Current Transfer Ratio vs. Ambient Temperature (non-sat.)

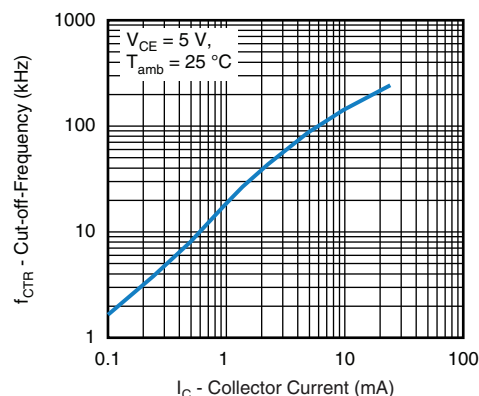


Fig. 16 - Cut-Off Frequency vs. Collector Current

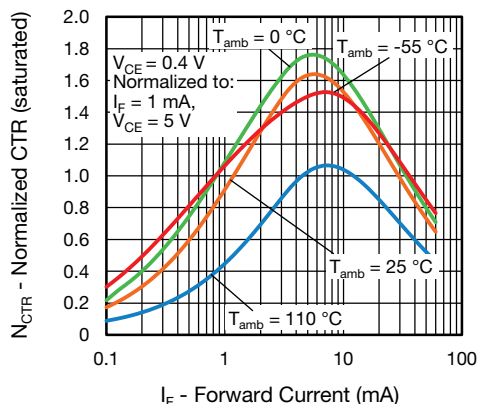


Fig. 14 - Current Transfer Ratio vs. Forward Current (sat.)

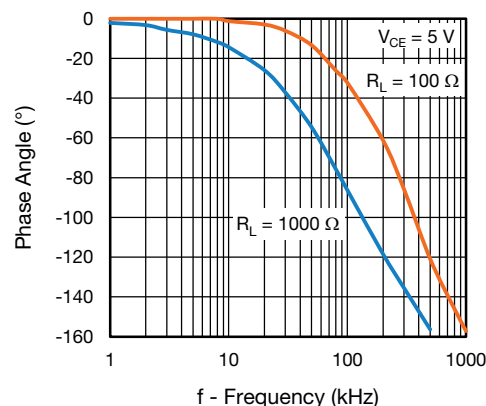


Fig. 17 - Phase Angle vs. Frequency

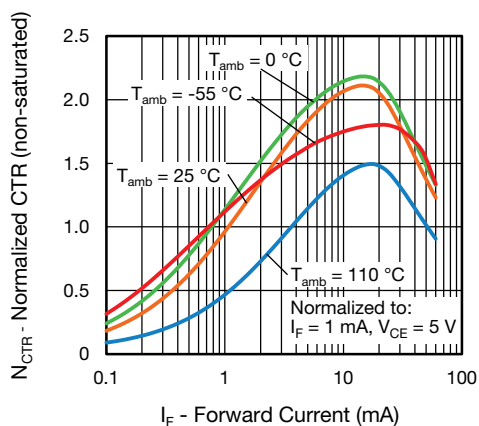


Fig. 15 - Current Transfer Ratio vs. Forward Current (non-sat.)

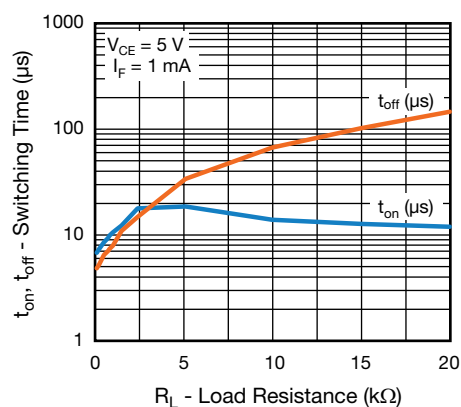


Fig. 18 - Switching Time vs. Load Resistance

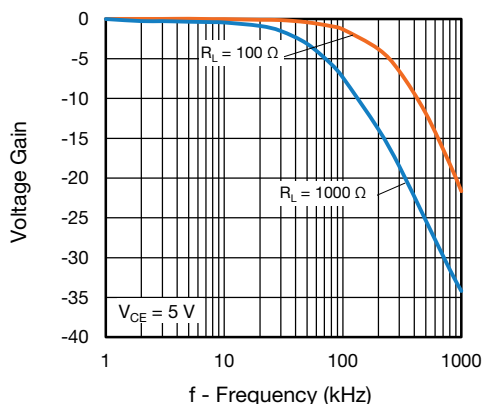
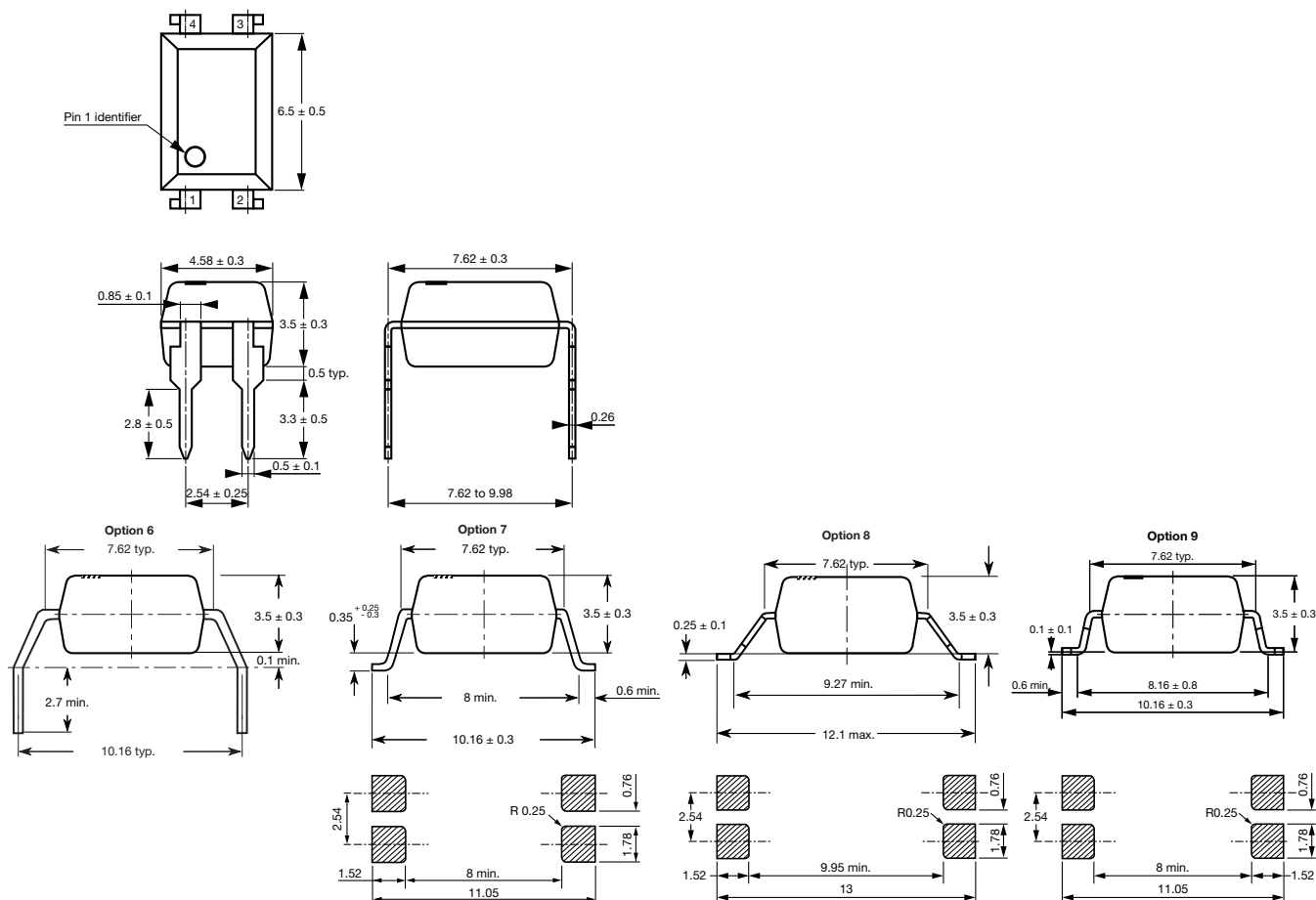
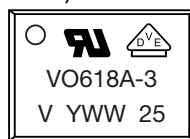


Fig. 19 - Voltage Gain vs. Frequency

**PACKAGE DIMENSIONS** in millimeters


**PACKAGE MARKING** (Example of VO618A-3X017T)

**Notes**

- The VDE logo is only marked on option 1 parts. Option information is not marked on the part.
- Tape and reel suffix (T) is not part of the package marking

**PACKING INFORMATION**

| DEVICE PER TUBE |            |           |           |
|-----------------|------------|-----------|-----------|
| TYPE            | UNITS/TUBE | TUBES/BOX | UNITS/BOX |
| DIP-4           | 100        | 40        | 4000      |

| TAPE AND REEL PACKING |            |
|-----------------------|------------|
| TYPE                  | UNITS/REEL |
| SMD-4, option 7       | 1000       |
| SMD-4, option 8       | 2000       |
| SMD-4, option 9       | 1000       |

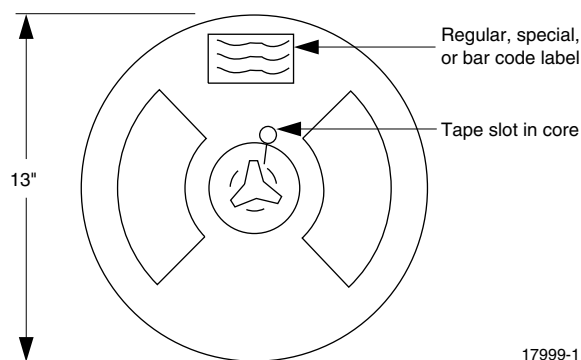


Fig. 20 - Tape and Reel Shipping Medium

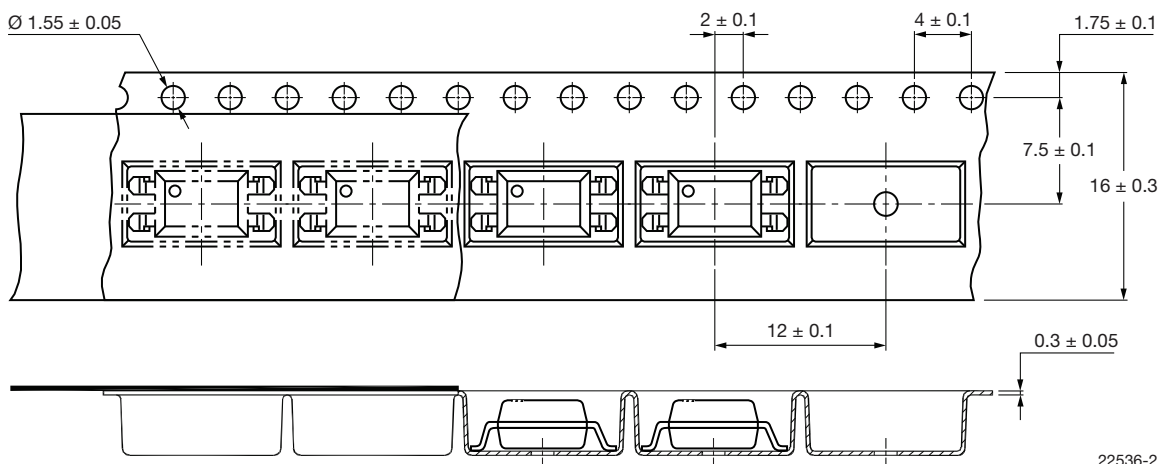


Fig. 21 - Tape and Packing for Option 7 and Option 9

## TAPE AND REEL

### Option 8

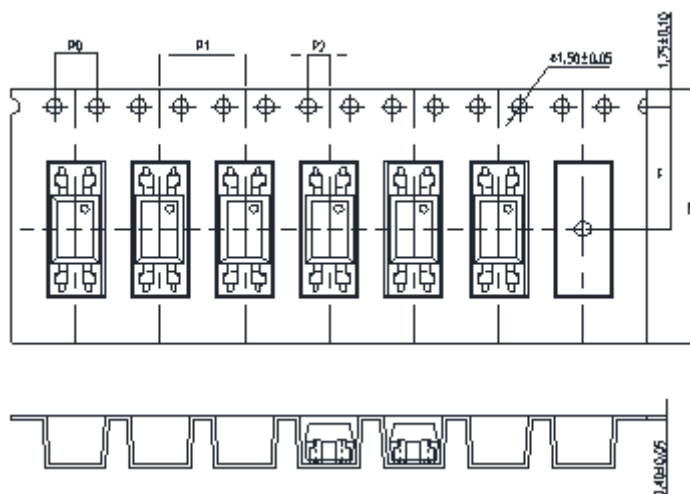


Fig. 22 - Tape and Packing for Option 8

| DESCRIPTION                            | SYMBOL | DIMENSIONS in mm (inch) |
|----------------------------------------|--------|-------------------------|
| Tape width                             | W      | 24 ± 0.3 (0.63)         |
| Pitch of spocket holes                 | P0     | 4 ± 0.1 (0.15)          |
| Distance of compartment                | F      | 11.5 ± 0.1 (0.295)      |
|                                        | P2     | 2 ± 0.1 (0.079)         |
| Distance of compartment to compartment | P1     | 8 ± 0.1 (0.472)         |

## SOLDER PROFILES

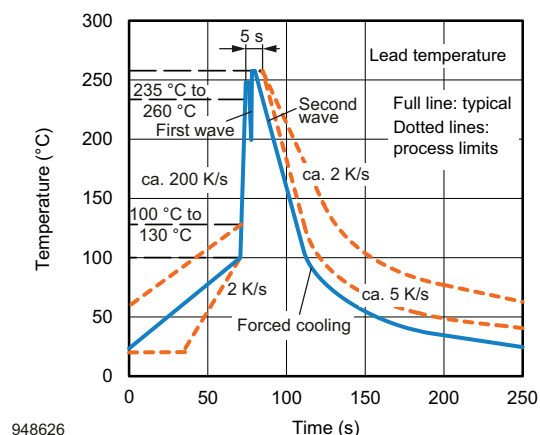


Fig. 23 - Wave Soldering Double Wave Profile According to J-STD-020 for DIP Devices

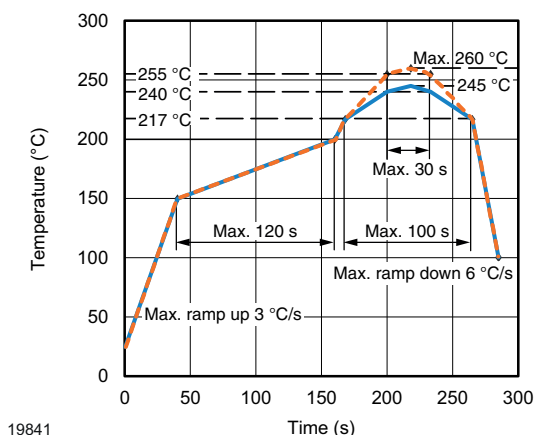


Fig. 24 - Lead (Pb)-free Reflow Solder Profile According to J-STD-020 for SMD Devices

## 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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