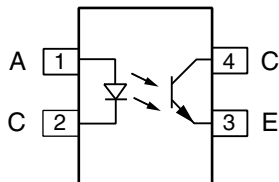
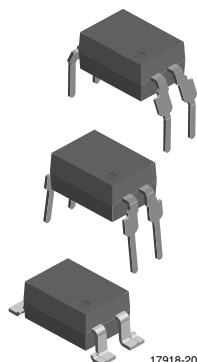


# Optocoupler, Phototransistor Output, High Reliability, 5300 V<sub>RMS</sub>



## FEATURES

- Excellent CTR linearity depending on forward current
- Isolation test voltage, 5300 V<sub>RMS</sub>
- Fast switching times
- Low CTR degradation
- Low coupling capacitance
- Material categorization:  
For definitions of compliance please see [www.vishay.com/doc?99912](http://www.vishay.com/doc?99912)



## DESCRIPTION

The SFH615A feature a variety of transfer ratios, 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 plastic DIP-4 package.

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

The couplers are end-stackable with 2.54 mm lead spacing. Creepage and clearance distances of > 8 mm are achieved with option 6. 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.

## APPLICATIONS

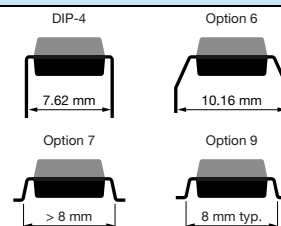
- Switchmode power supply
- Telecom
- Battery powered equipment

## AGENCY APPROVALS

- UL file no. E52744
- cUL tested to CSA 22.2 bulletin 5A
- DIN EN 60747-5-5 (VDE 0884-5) available with option 1
- BSI EN 60950; EN 60065
- FIMKO
- CQC

## ORDERING INFORMATION

|             |   |   |   |   |   |   |   |         |                |   |   |   |               |
|-------------|---|---|---|---|---|---|---|---------|----------------|---|---|---|---------------|
| S           | F | H | 6 | 1 | 5 | A | - | #       | X              | 0 | # | # | T             |
| PART NUMBER |   |   |   |   |   |   |   | CTR BIN | PACKAGE OPTION |   |   |   | TAPE AND REEL |



| AGENCY CERTIFIED/PACKAGE | CTR (%)                       |                                |                               |                               |
|--------------------------|-------------------------------|--------------------------------|-------------------------------|-------------------------------|
|                          | 40 to 80                      | 63 to 125                      | 100 to 200                    | 160 to 320                    |
| UL, cUL, BSI, FIMKO      |                               |                                |                               |                               |
| DIP-4                    | SFH615A-1                     | SFH615A-2                      | SFH615A-3                     | SFH615A-4                     |
| DIP-4, 400 mil, option 6 | SFH615A-1X006                 | SFH615A-2X006                  | SFH615A-3X006                 | -                             |
| SMD-4, option 7          | -                             | -                              | SFH615A-3X007T <sup>(1)</sup> | -                             |
| SMD-4, option 9          | -                             | SFH615A-2X009T                 | SFH615A-3X009T <sup>(1)</sup> | SFH615A-4X009                 |
| UL, cUL, VDE, BSI, FIMKO |                               |                                |                               |                               |
| DIP-4                    | SFH615A-1X001                 | SFH615A-2X001                  | SFH615A-3X001                 | SFH615A-4X001                 |
| DIP-4, 400 mil, option 6 | SFH615A-1X016                 | SFH615A-2X016                  | SFH615A-3X016                 | SFH615A-4X016                 |
| SMD-4, option 7          | SFH615A-1X017T <sup>(1)</sup> | SFH615A-2X017T <sup>(1)</sup>  | SFH615A-3X017                 | SFH615A-4X017T <sup>(1)</sup> |
| SMD-4, option 9          | -                             | SFH615A-2X019T                 | -                             | -                             |
|                          |                               | SFH615A-2X019T3 <sup>(2)</sup> |                               |                               |

## Notes

- Additional options may be possible, please contact sales office.
- <sup>(1)</sup> Also available in tubes; do not add T to end.
- <sup>(2)</sup> T3 rotation in tape and reel packaging.



| <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                  |
| DC forward current                                                                                     |                                                                   | $I_F$      | 60             | mA                 |
| Forward surge current                                                                                  | $t_p \leq 10\text{ }\mu\text{s}$                                  | $I_{FSM}$  | 2.5            | A                  |
| LED power dissipation                                                                                  | at $25\text{ }^{\circ}\text{C}$                                   | $P_{diss}$ | 70             | mW                 |
| <b>OUTPUT</b>                                                                                          |                                                                   |            |                |                    |
| Collector emitter voltage                                                                              |                                                                   | $V_{CEO}$  | 70             | 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 $25\text{ }^{\circ}\text{C}$                                   | $P_{diss}$ | 150            | mW                 |
| <b>COUPLER</b>                                                                                         |                                                                   |            |                |                    |
| Isolation test voltage between emitter and detector                                                    | $t = 1\text{ s}$                                                  | $V_{ISO}$  | 5300           | $V_{RMS}$          |
| Creepage distance                                                                                      |                                                                   |            | $\geq 7$       | mm                 |
| Clearance distance                                                                                     |                                                                   |            | $\geq 7$       | mm                 |
| Isolation thickness between emitter and detector                                                       |                                                                   |            | $\geq 0.4$     | mm                 |
| Comparative tracking index per DIN IEC 112/VDE 0303, part 1                                            |                                                                   | CTI        | $\geq 175$     |                    |
| Isolation resistance                                                                                   | $V_{IO} = 500\text{ V}$ , $T_{amb} = 25\text{ }^{\circ}\text{C}$  | $R_{IO}$   | $\geq 10^{12}$ | $\Omega$           |
|                                                                                                        | $V_{IO} = 500\text{ V}$ , $T_{amb} = 100\text{ }^{\circ}\text{C}$ | $R_{IO}$   | $\geq 10^{11}$ | $\Omega$           |
| Operation temperature                                                                                  |                                                                   | $T_{amb}$  | -55 to +100    | $^{\circ}\text{C}$ |
| Storage temperature range                                                                              |                                                                   | $T_{stg}$  | -55 to +150    | $^{\circ}\text{C}$ |
| Soldering temperature <sup>(1)</sup>                                                                   | 2 mm from case, $\leq 10\text{ s}$                                | $T_{sld}$  | 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 (SMD). Refer to wave profile for soldering conditions for through hole devices (DIP).

| ELECTRICAL CHARACTERISTICS (T <sub>amb</sub> = 25 °C, unless otherwise specified) |                                   |           |                    |      |      |      |      |
|-----------------------------------------------------------------------------------|-----------------------------------|-----------|--------------------|------|------|------|------|
| PARAMETER                                                                         | TEST CONDITION                    | PART      | SYMBOL             | MIN. | TYP. | MAX. | UNIT |
| INPUT                                                                             |                                   |           |                    |      |      |      |      |
| Forward voltage                                                                   | I <sub>F</sub> = 60 mA            |           | V <sub>F</sub>     |      | 1.35 | 1.65 | V    |
| Reverse current                                                                   | V <sub>R</sub> = 6 V              |           | I <sub>R</sub>     |      | 0.01 | 10   | μA   |
| Capacitance                                                                       | V <sub>R</sub> = 0 V, f = 1 MHz   |           | C <sub>O</sub>     |      | 13   |      | pF   |
| OUTPUT                                                                            |                                   |           |                    |      |      |      |      |
| Collector emitter capacitance                                                     | V <sub>CE</sub> = 5 V, f = 1 MHz  |           | C <sub>CE</sub>    |      | 5.2  |      | pF   |
| Collector emitter leakage current                                                 | V <sub>CE</sub> = 10 V            | SFH615A-1 | I <sub>CEO</sub>   |      | 2    | 50   | nA   |
|                                                                                   |                                   | SFH615A-2 | I <sub>CEO</sub>   |      | 2    | 50   | nA   |
|                                                                                   |                                   | SFH615A-3 | I <sub>CEO</sub>   |      | 5    | 100  | nA   |
|                                                                                   |                                   | SFH615A-4 | I <sub>CEO</sub>   |      | 5    | 100  | nA   |
| COUPLER                                                                           |                                   |           |                    |      |      |      |      |
| Collector emitter saturation voltage                                              | I <sub>F</sub> = 10 mA, f = 1 MHz |           | V <sub>CEsat</sub> |      | 0.25 | 0.4  | V    |
| Coupling capacitance                                                              |                                   |           | C <sub>C</sub>     |      | 0.4  |      | pF   |

**Note**

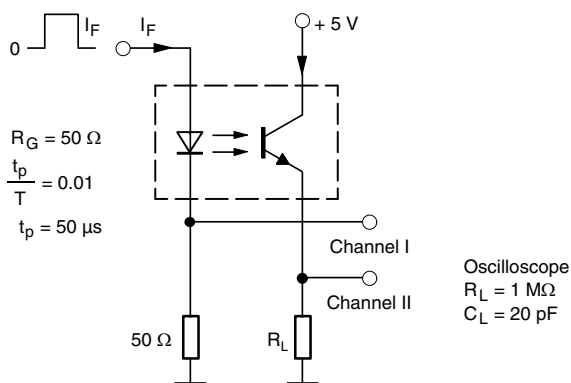
- Minimum and maximum values are testing requirements. Typical values are characteristics of the device and are the result of engineering evaluation. Typical values are for information only and are not part of the testing requirements.

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

| PARAMETER | TEST CONDITION                               | PART      | SYMBOL | MIN. | TYP. | MAX. | UNIT |
|-----------|----------------------------------------------|-----------|--------|------|------|------|------|
| $I_C/I_F$ | $I_F = 10\text{ mA}$ , $V_{CE} = 5\text{ V}$ | SFH615A-1 | CTR    | 40   |      | 80   | %    |
|           |                                              | SFH615A-2 | CTR    | 63   |      | 125  | %    |
|           |                                              | SFH615A-3 | CTR    | 100  |      | 200  | %    |
|           |                                              | SFH615A-4 | CTR    | 160  |      | 320  | %    |
|           | $I_F = 1\text{ mA}$ , $V_{CE} = 5\text{ V}$  | SFH615A-1 | CTR    | 13   | 30   |      | %    |
|           |                                              | SFH615A-2 | CTR    | 22   | 45   |      | %    |
|           |                                              | SFH615A-3 | CTR    | 34   | 70   |      | %    |
|           |                                              | SFH615A-4 | CTR    | 56   | 90   |      | %    |

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

| PARAMETER            | TEST CONDITION                                                          | PART      | SYMBOL    | MIN. | TYP. | MAX. | UNIT          |
|----------------------|-------------------------------------------------------------------------|-----------|-----------|------|------|------|---------------|
| <b>NON-SATURATED</b> |                                                                         |           |           |      |      |      |               |
| Turn-on time         | $I_F = 10\text{ mA}$ , $V_{CC} = 5\text{ V}$ , $R_L = 75\text{ }\Omega$ |           | $t_{on}$  |      | 3    |      | $\mu\text{s}$ |
| Rise time            | $I_F = 10\text{ mA}$ , $V_{CC} = 5\text{ V}$ , $R_L = 75\text{ }\Omega$ |           | $t_r$     |      | 2    |      | $\mu\text{s}$ |
| Turn-off time        | $I_F = 10\text{ mA}$ , $V_{CC} = 5\text{ V}$ , $R_L = 75\text{ }\Omega$ |           | $t_{off}$ |      | 2.3  |      | $\mu\text{s}$ |
| Fall time            | $I_F = 10\text{ mA}$ , $V_{CC} = 5\text{ V}$ , $R_L = 75\text{ }\Omega$ |           | $t_f$     |      | 2    |      | $\mu\text{s}$ |
| Cut-off frequency    | $I_F = 10\text{ mA}$ , $V_{CC} = 5\text{ V}$ , $R_L = 75\text{ }\Omega$ |           | $f_{CO}$  |      | 100  |      | kHz           |
| <b>SATURATED</b>     |                                                                         |           |           |      |      |      |               |
| Turn-on time         | $I_F = 20\text{ mA}$                                                    | SFH615A-1 | $t_{on}$  |      | 3    |      | $\mu\text{s}$ |
|                      | $I_F = 10\text{ mA}$                                                    | SFH615A-2 | $t_{on}$  |      | 4.2  |      | $\mu\text{s}$ |
|                      |                                                                         | SFH615A-3 | $t_{on}$  |      | 4.2  |      | $\mu\text{s}$ |
|                      | $I_F = 5\text{ mA}$                                                     | SFH615A-4 | $t_{on}$  |      | 6    |      | $\mu\text{s}$ |
| Rise time            | $I_F = 20\text{ mA}$                                                    | SFH615A-1 | $t_r$     |      | 2    |      | $\mu\text{s}$ |
|                      | $I_F = 10\text{ mA}$                                                    | SFH615A-2 | $t_r$     |      | 3    |      | $\mu\text{s}$ |
|                      |                                                                         | SFH615A-3 | $t_r$     |      | 3    |      | $\mu\text{s}$ |
|                      | $I_F = 5\text{ mA}$                                                     | SFH615A-4 | $t_r$     |      | 4    |      | $\mu\text{s}$ |
| Turn-off time        | $I_F = 20\text{ mA}$                                                    | SFH615A-1 | $t_{off}$ |      | 18   |      | $\mu\text{s}$ |
|                      | $I_F = 10\text{ mA}$                                                    | SFH615A-2 | $t_{off}$ |      | 23   |      | $\mu\text{s}$ |
|                      |                                                                         | SFH615A-3 | $t_{off}$ |      | 23   |      | $\mu\text{s}$ |
|                      | $I_F = 5\text{ mA}$                                                     | SFH615A-4 | $t_{off}$ |      | 25   |      | $\mu\text{s}$ |
| Fall time            | $I_F = 20\text{ mA}$                                                    | SFH615A-1 | $t_f$     |      | 11   |      | $\mu\text{s}$ |
|                      | $I_F = 10\text{ mA}$                                                    | SFH615A-2 | $t_f$     |      | 14   |      | $\mu\text{s}$ |
|                      |                                                                         | SFH615A-3 | $t_f$     |      | 14   |      | $\mu\text{s}$ |
|                      | $I_F = 5\text{ mA}$                                                     | SFH615A-4 | $t_f$     |      | 15   |      | $\mu\text{s}$ |



95 10804-3

Fig. 1 - Test Circuit, Non-Saturated Operation

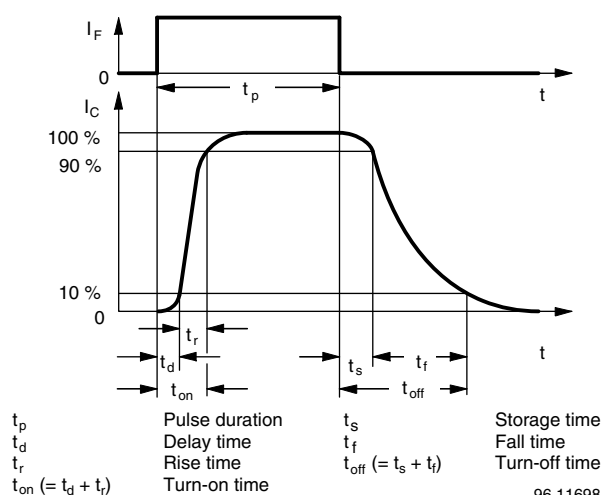
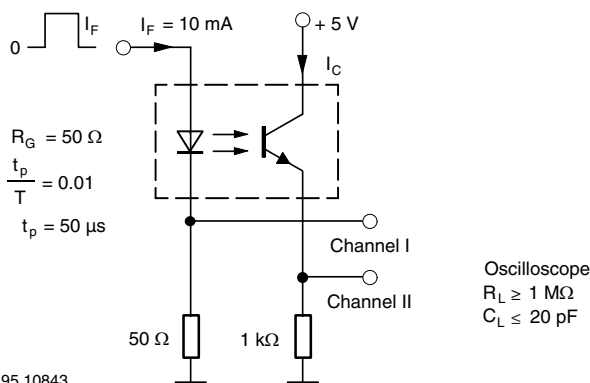


Fig. 3 - Switching Times



95 10843

Fig. 2 - Test Circuit, Saturated Operation

| SAFETY AND INSULATION RATINGS                        |                        |                   |      |           |      |      |
|------------------------------------------------------|------------------------|-------------------|------|-----------|------|------|
| PARAMETER                                            | TEST CONDITION         | SYMBOL            | MIN. | TYP.      | MAX. | UNIT |
| Climatic classification (according to IEC 68 part 1) |                        |                   |      | 55/100/21 |      |      |
| Comparative tracking index                           |                        | CTI               | 175  |           | 399  |      |
| Rated impulse voltage                                |                        | V <sub>IOTM</sub> |      |           | 8    | kV   |
| Maximum working voltages                             | Recurring peak voltage | V <sub>IORM</sub> |      |           | 890  | V    |
| Forward current                                      |                        | I <sub>SI</sub>   |      |           | 275  | mA   |
| Power dissipation                                    |                        | P <sub>SO</sub>   |      |           | 400  | mW   |
| Safety temperature                                   |                        | T <sub>SI</sub>   |      |           | 175  | °C   |
| Creepage distance                                    |                        |                   | 7.0  |           |      | mm   |
| Clearance distance                                   |                        |                   | 7.0  |           |      | mm   |
| Isolation distance                                   | per IEC 60950 2.10.5.1 |                   | 0.4  |           |      | mm   |

**Note**

- According to DIN EN 60747-5-5 (VDE 0884-5). These optocouplers are suitable for “safe electrical insulation” only within the safety ratings. Compliance with the safety ratings shall be ensured by means of protective circuits.

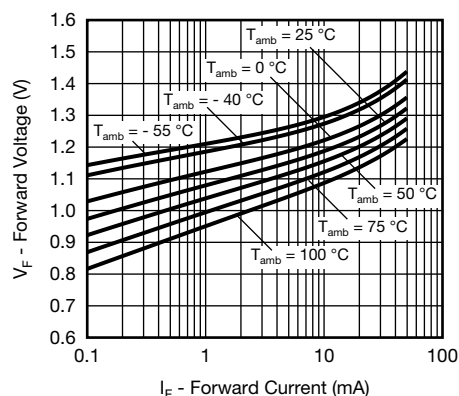
**TYPICAL CHARACTERISTICS** ( $T_{amb} = 25\text{ }^{\circ}\text{C}$ , unless otherwise specified)


Fig. 4 - Forward Voltage vs. Forward Current

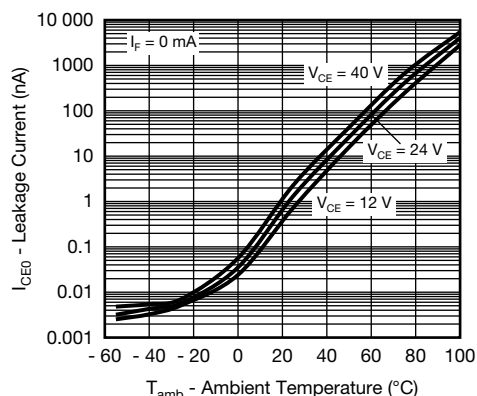


Fig. 7 - Leakage Current vs. Ambient Temperature

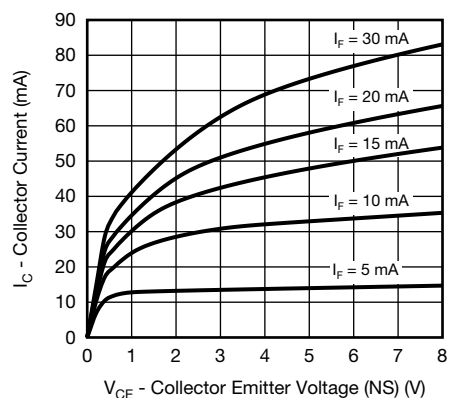


Fig. 5 - Collector Current vs. Collector Emitter Voltage (NS)

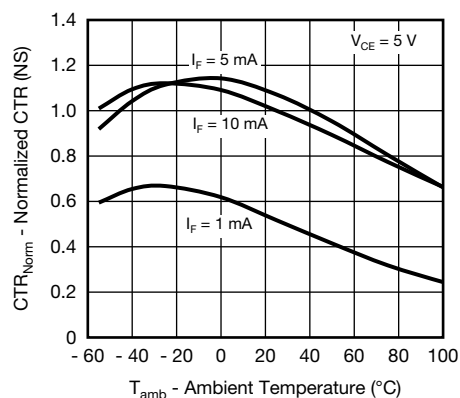


Fig. 8 - Normalized CTR (NS) vs. Ambient Temperature

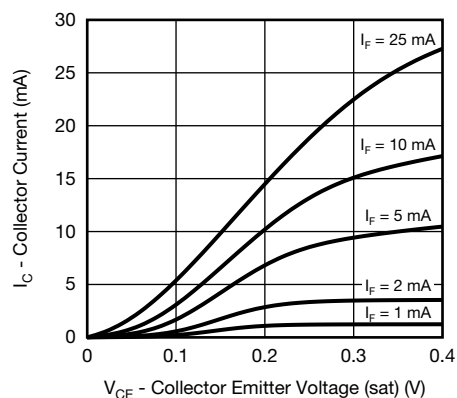


Fig. 6 - Collector Current vs. Collector Emitter Voltage (sat)

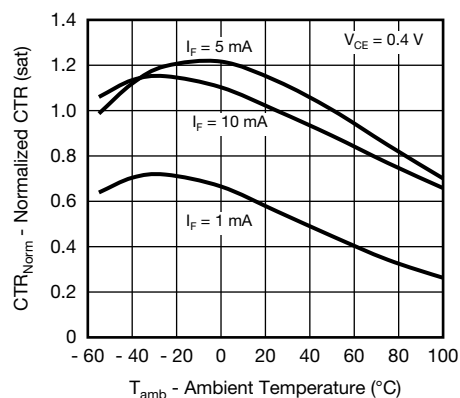


Fig. 9 - Normalized CTR (sat) vs. Ambient Temperature

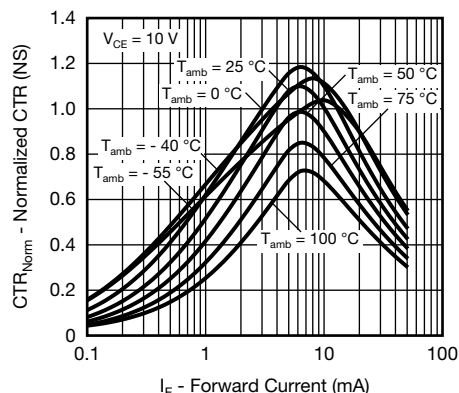


Fig. 10 - Normalized CTR (NS) vs. Forward Current

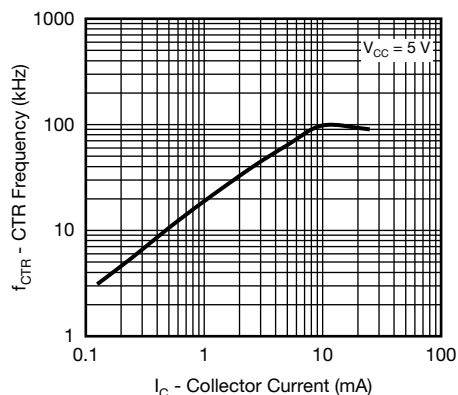


Fig. 13 - CTR Frequency vs. Collector Current

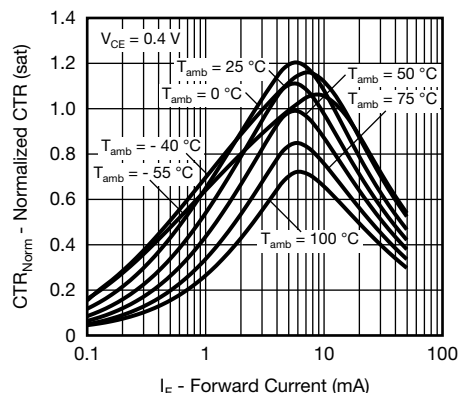


Fig. 11 - Normalized CTR (sat) vs. Forward Current

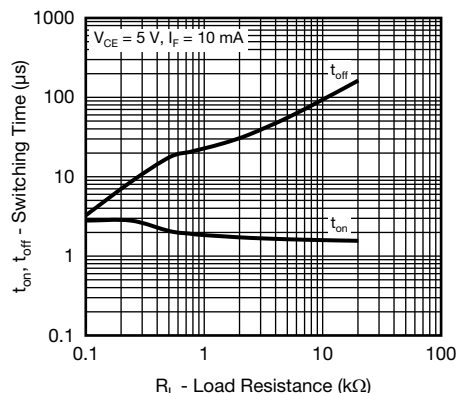


Fig. 14 - Switching Time vs. Load Resistance

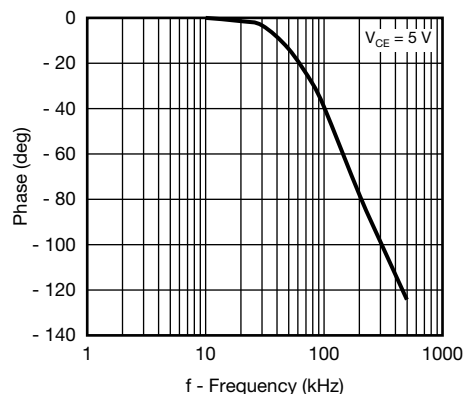
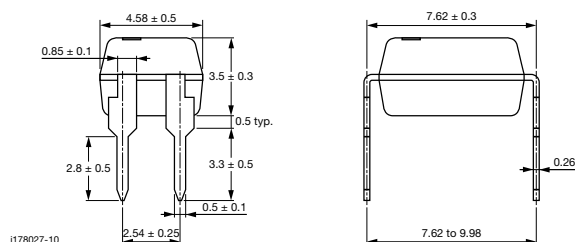
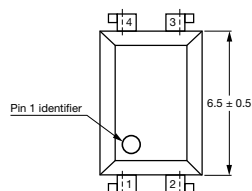


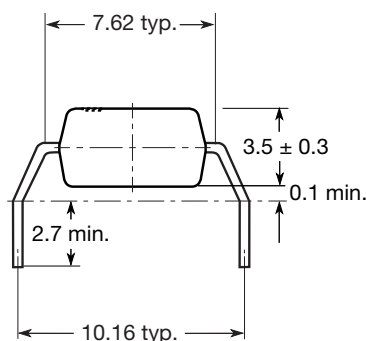
Fig. 12 - CTR Frequency vs. Phase Angle



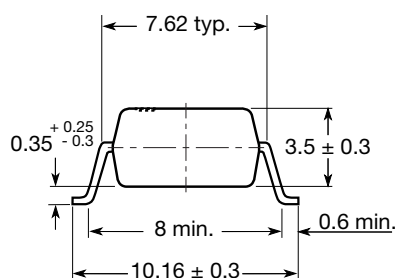
**PACKAGE DIMENSIONS** in millimeters



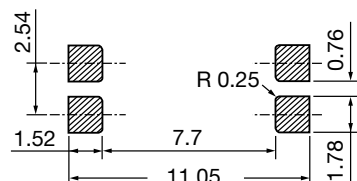
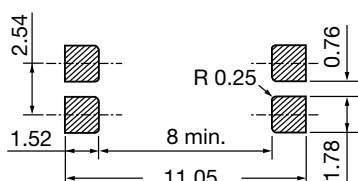
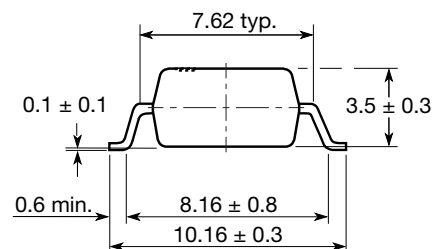
**Option 6**



**Option 7**

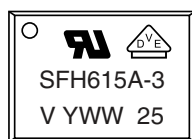


**Option 9**



20802-28

**PACKAGE MARKING** (Example)



**Notes**

- 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      |

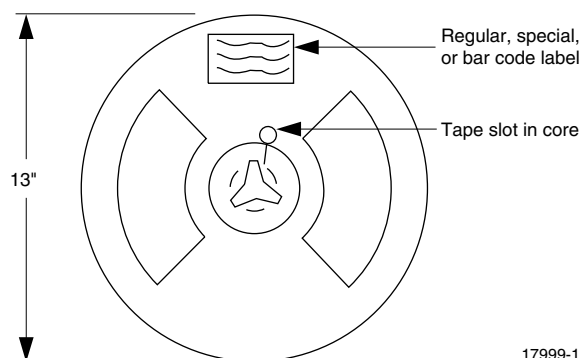


Fig. 15 - Tape and Reel Shipping Medium

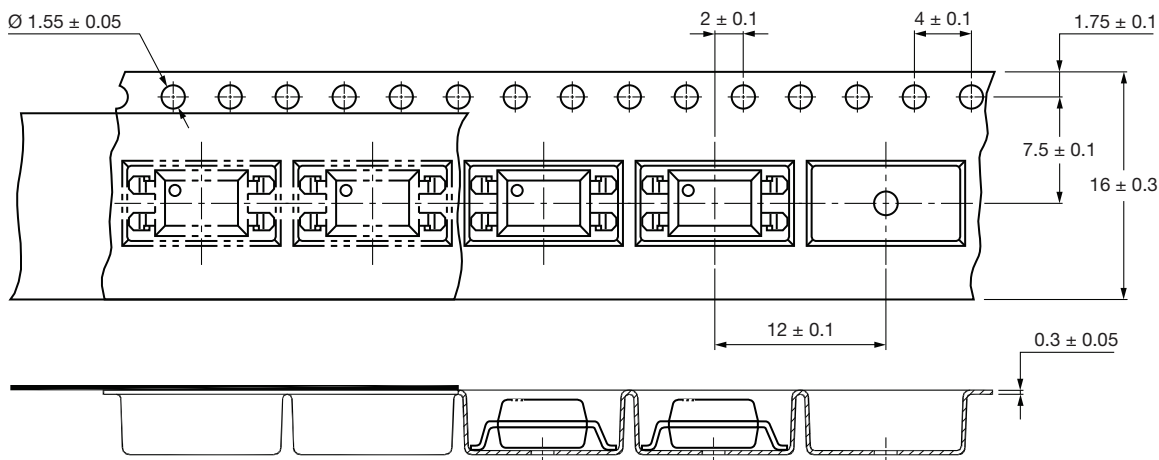


Fig. 16 - Tape and Packing for Option 7 and Option 9

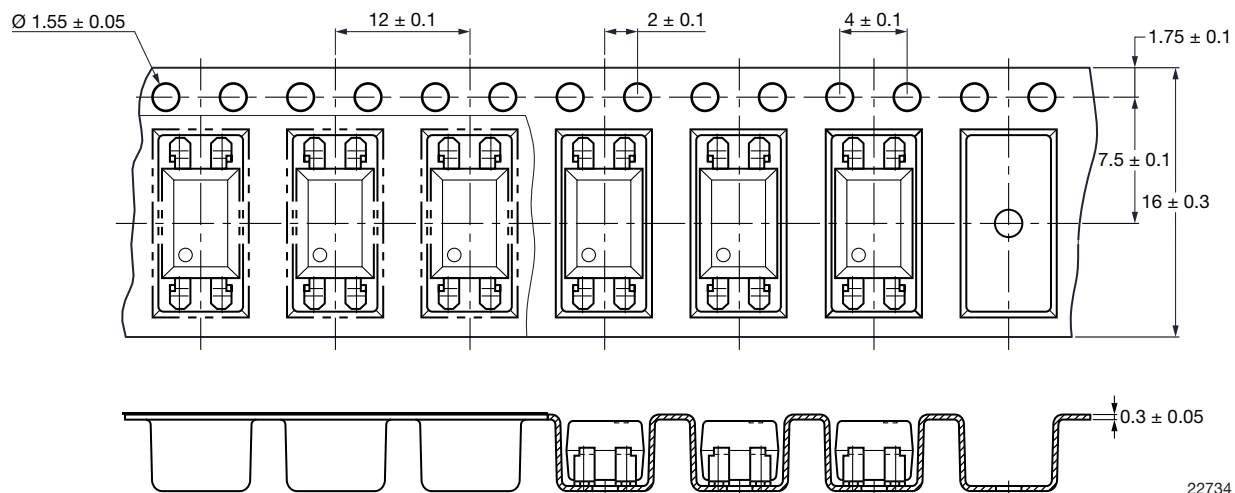


Fig. 17 - Tape Packing for Option 7 and Option 9, T3 Rotation (2000 units per reel)





## Disclaimer

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### Офис по работе с юридическими лицами:

105318, г.Москва, ул.Щербаковская д.3, офис 1107, 1118, ДЦ «Щербаковский»

Телефон: +7 495 668-12-70 (многоканальный)

Факс: +7 495 668-12-70 (доб.304)

E-mail: [info@moschip.ru](mailto:info@moschip.ru)

Skype отдела продаж:

moschip.ru

moschip.ru\_4

moschip.ru\_6

moschip.ru\_9