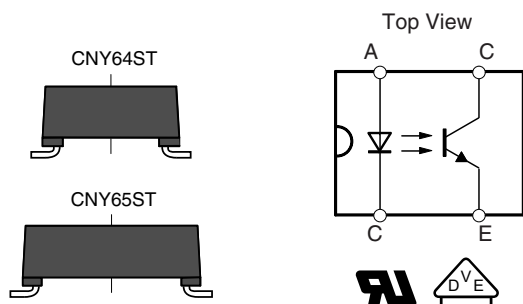




## Optocoupler, Phototransistor Output, Very High Isolation Voltage



17187-6

17187-5

### DESCRIPTION

The CNY6XST, the high isolation voltage SMD version optocouplers consist of a phototransistor optically coupled to a gallium arsenide infrared-emitting diode in a 4 pin plastic package.

The single components are mounted opposite one another, providing a distance between input and output for highest safety requirements of > 3 mm.

### VDE STANDARDS

These couplers perform safety functions according to the following equipment standards:

- **DIN EN 60747-5-2 (VDE 0884)**  
Optocoupler for electrical safety requirements
- **IEC 60065**  
Safety for mains-operated electronic and related household apparatus
- **VDE 0160**  
Electronic equipment for electrical power installation

### FEATURES

- Rated recurring peak voltage (repetitive)  
 $V_{IORM} = 1450 V_{peak}$
- Thickness through insulation  $\geq 3$  mm
- Creepage current resistance according to VDE 0303/IEC 60112 comparative tracking index: **CTI**  $\geq 475$
- Moisture sensitivity level MSL4
  - Follow defined storage and soldering requirements
- Compliant to RoHS Directive 2002/95/EC and in accordance to WEEE 2002/96/EC



**RoHS**  
COMPLIANT  
**GREEN**  
(5-2008)\*\*

### Note

\*\* Please see document "Vishay Material Category Policy":  
[www.vishay.com/doc?99902](http://www.vishay.com/doc?99902)

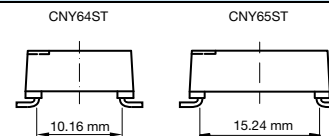
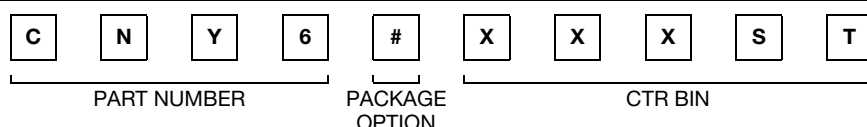
### APPLICATIONS

- Solar and wind power diagnostic, monitoring, and communication equipment
- Welding equipment
- High voltage motors
- Switch-mode power supplies
- Line receiver
- Computer peripheral interface
- Microprocessor system interface
- Circuits for safe protective separation against electrical shock according to safety class II (reinforced isolation):
  - for appl. class I to IV at mains voltage  $\leq 300$  V
  - for appl. class I to IV at mains voltage  $\leq 600$  V
  - for appl. class I to III at mains voltage  $\leq 1000$  V according to DIN EN 60747-5-2 (VDE 0884)

### AGENCY APPROVALS

- DIN EN 60747-5-2 (VDE 0884) (pending)
- UL1577, file no. E76222 system code H, J, and K (pending)
- VDE related features:
  - rated impulse voltage (transient overvoltage),  
 $V_{IOTM} = 12 kV_{peak}$
  - isolation test voltage (partial discharge test voltage),  
 $V_{pd} = 2.8 kV_{peak}$

### ORDERING INFORMATION



| AGENCY CERTIFIED/PACKAGE                  | CTR (%)   |           |           |            |
|-------------------------------------------|-----------|-----------|-----------|------------|
|                                           | 5 mA      |           |           |            |
| UL, VDE                                   | 50 to 300 | 50 to 150 | 80 to 240 | 100 to 300 |
| SMD-4 HV, 400 mil high isolation distance | CNY64ST   | CNY64AYST | CNY64ABST | CNY64AGRST |
| SMD-4 HV, 600 mil high isolation distance | CNY65ST   | CNY65AYST | CNY65ABST | CNY65AGRST |



| <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                                                                                        |                                         | $V_R$      | 5             | V                  |
| Forward current                                                                                        |                                         | $I_F$      | 75            | mA                 |
| Forward surge current                                                                                  | $t_p \leq 10\text{ }\mu\text{s}$        | $I_{FSM}$  | 1.5           | A                  |
| Power dissipation                                                                                      |                                         | $P_{diss}$ | 120           | mW                 |
| Junction temperature                                                                                   |                                         | $T_J$      | 100           | $^{\circ}\text{C}$ |
| <b>OUTPUT</b>                                                                                          |                                         |            |               |                    |
| Collector emitter voltage                                                                              |                                         | $V_{CEO}$  | 32            | 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                 |
| Power dissipation                                                                                      |                                         | $P_{diss}$ | 130           | mW                 |
| Junction temperature                                                                                   |                                         | $T_J$      | 100           | $^{\circ}\text{C}$ |
| <b>COUPLER</b>                                                                                         |                                         |            |               |                    |
| AC isolation test voltage CNY64AxxxST                                                                  | $t = 1\text{ min}$                      | $V_{ISO}$  | 8.2           | kV <sub>RMS</sub>  |
| DC isolation test voltage CNY65AxxxST                                                                  | $t = 1\text{ s}$                        | $V_{ISO}$  | 13.9          | kV                 |
| Total power dissipation                                                                                |                                         | $P_{tot}$  | 250           | mW                 |
| Ambient temperature range                                                                              |                                         | $T_{amb}$  | - 55 to + 85  | $^{\circ}\text{C}$ |
| Storage temperature range                                                                              |                                         | $T_{stg}$  | - 55 to + 100 | $^{\circ}\text{C}$ |
| Soldering temperature                                                                                  | 2 mm from case, $\leq 10\text{ s}$      | $T_{sld}$  | 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.

| <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                                                                                          | $I_F = 50\text{ mA}$                                                     | $V_F$       |      | 1.32 | 1.6  | V    |
| Junction capacitance                                                                                     | $V_R = 0$ , $f = 1\text{ MHz}$                                           | $C_j$       |      | 50   |      | pF   |
| <b>OUTPUT</b>                                                                                            |                                                                          |             |      |      |      |      |
| Collector emitter voltage                                                                                | $I_C = 1\text{ mA}$                                                      | $V_{CEO}$   | 32   |      |      | V    |
| Emitter collector voltage                                                                                | $I_E = 100\text{ }\mu\text{A}$                                           | $V_{ECO}$   | 7    |      |      | V    |
| Collector emitter leakage current                                                                        | $V_{CE} = 20\text{ V}$ , $I_F = 0\text{ mA}$                             | $I_{CEO}$   |      |      | 200  | nA   |
| <b>COUPLER</b>                                                                                           |                                                                          |             |      |      |      |      |
| Collector emitter saturation voltage                                                                     | $I_F = 10\text{ mA}$ , $I_C = 1\text{ mA}$                               | $V_{CEsat}$ |      |      | 0.3  | V    |
| Cut-off frequency                                                                                        | $V_{CE} = 5\text{ V}$ , $I_F = 10\text{ mA}$ , $R_L = 100\text{ }\Omega$ | $f_c$       |      | 110  |      | kHz  |
| Coupling capacitance                                                                                     | $f = 1\text{ MHz}$                                                       | $C_k$       |      | 0.3  |      | 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 |
| $I_C/I_F$                                                                                     | $V_{CE} = 5\text{ V}$ , $I_F = 5\text{ mA}$ | CNY64ST    | CTR    | 50   |      | 300  | %    |
|                                                                                               |                                             | CNY65ST    | CTR    | 50   |      | 300  | %    |
|                                                                                               |                                             | CNY64AYST  | CTR    | 50   |      | 150  | %    |
|                                                                                               |                                             | CNY65AYST  | CTR    | 50   |      | 150  | %    |
|                                                                                               |                                             | CNY64ABST  | CTR    | 80   |      | 240  | %    |
|                                                                                               |                                             | CNY65ABST  | CTR    | 80   |      | 240  | %    |
|                                                                                               |                                             | CNY64AGRST | CTR    | 100  |      | 300  | %    |
|                                                                                               |                                             | CNY65AGRST | CTR    | 100  |      | 300  | %    |

| SAFETY AND INSULATION PARAMETERS                        |                                                                                            |         |            |            |      |      |                    |
|---------------------------------------------------------|--------------------------------------------------------------------------------------------|---------|------------|------------|------|------|--------------------|
| PARAMETER                                               | TEST CONDITION                                                                             | PART    | SYMBOL     | MIN.       | TYP. | MAX. | UNIT               |
| Partial discharge test voltage - routine test           | 100 %, $t_{test} = 1\text{ s}$                                                             |         | $V_{pd}$   | 2.8        |      |      | kV                 |
| Partial discharge test voltage - lot test (sample test) | $t_{Tr} = 60\text{ s}$ , $t_{test} = 10\text{ s}$ , (see figure 2)                         |         | $V_{pd}$   | 2.2        |      |      | kV                 |
| Insulation resistance                                   | $V_{IO} = 500\text{ V}$ , $T_{amb} = 25\text{ }^{\circ}\text{C}$                           |         | $R_{IO}$   | $10^{12}$  |      |      | $\Omega$           |
|                                                         | $V_{IO} = 500\text{ V}$ , $T_{amb} = 100\text{ }^{\circ}\text{C}$                          |         | $R_{IO}$   | $10^{11}$  |      |      | $\Omega$           |
|                                                         | $V_{IO} = 500\text{ V}$ , $T_{amb} = 150\text{ }^{\circ}\text{C}$ (construction test only) |         | $R_{IO}$   | $10^9$     |      |      | $\Omega$           |
| Forward current                                         |                                                                                            |         | $I_{si}$   |            |      | 120  | mA                 |
| Power dissipation                                       |                                                                                            |         | $P_{so}$   |            |      | 250  | mW                 |
| Rated impulse voltage                                   |                                                                                            |         | $V_{IOTM}$ |            |      | 12   | kV                 |
| Safety temperature                                      |                                                                                            |         | $T_{si}$   |            |      | 150  | $^{\circ}\text{C}$ |
| Tracking resistance (comparative tracking index)        | Insulation group IVa                                                                       |         | CTI        | 475        |      |      |                    |
| Minimum external tracking (creepage distance)           | Measured from input pins to output pins                                                    | CNY64ST |            | $\geq 9.5$ |      |      | mm                 |
|                                                         |                                                                                            | CNY65ST |            | $\geq 14$  |      |      | mm                 |

**Note**

- According to DIN EN 60747-5-2 (see figure 2). 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.

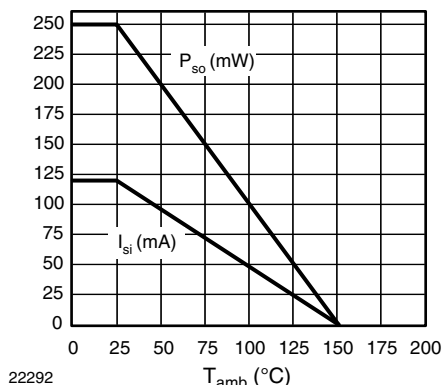


Fig. 1 - Safety Derating Diagram

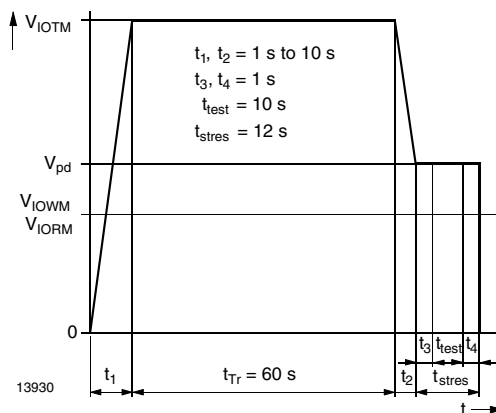


Fig. 2 - Test Pulse Diagram for Sample Test According to DIN EN 60747-5-2 (VDE 0884); IEC60747-5-5

| SWITCHING CHARACTERISTICS |                                                                                       |           |      |      |      |               |
|---------------------------|---------------------------------------------------------------------------------------|-----------|------|------|------|---------------|
| PARAMETER                 | TEST CONDITION                                                                        | SYMBOL    | MIN. | TYP. | MAX. | UNIT          |
| Delay time                | $V_S = 5\text{ V}$ , $I_C = 5\text{ mA}$ , $R_L = 100\ \Omega$ , (see figure 3)       | $t_d$     |      | 2.6  |      | $\mu\text{s}$ |
| Rise time                 | $V_S = 5\text{ V}$ , $I_C = 5\text{ mA}$ , $R_L = 100\ \Omega$ , (see figure 3)       | $t_r$     |      | 2.4  |      | $\mu\text{s}$ |
| Fall time                 | $V_S = 5\text{ V}$ , $I_C = 5\text{ mA}$ , $R_L = 100\ \Omega$ , (see figure 3)       | $t_f$     |      | 2.7  |      | $\mu\text{s}$ |
| Storage time              | $V_S = 5\text{ V}$ , $I_C = 5\text{ mA}$ , $R_L = 100\ \Omega$ , (see figure 3)       | $t_s$     |      | 0.3  |      | $\mu\text{s}$ |
| Turn-on time              | $V_S = 5\text{ V}$ , $I_C = 5\text{ mA}$ , $R_L = 100\ \Omega$ , (see figure 3)       | $t_{on}$  |      | 5    |      | $\mu\text{s}$ |
| Turn-off time             | $V_S = 5\text{ V}$ , $I_C = 5\text{ mA}$ , $R_L = 100\ \Omega$ , (see figure 3)       | $t_{off}$ |      | 3    |      | $\mu\text{s}$ |
| Turn-on time              | $V_S = 5\text{ V}$ , $I_F = 10\text{ mA}$ , $R_L = 1\text{ k}\Omega$ , (see figure 4) | $t_{on}$  |      | 25   |      | $\mu\text{s}$ |
| Turn-off time             | $V_S = 5\text{ V}$ , $I_F = 10\text{ mA}$ , $R_L = 1\text{ k}\Omega$ , (see figure 4) | $t_{off}$ |      | 42.5 |      | $\mu\text{s}$ |

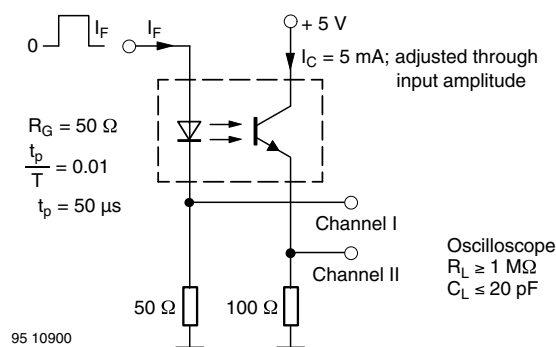


Fig. 3 - Test Circuit, Non-Saturated Operation

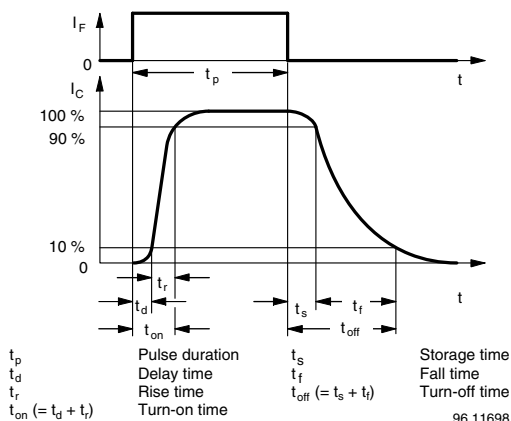


Fig. 5 - Switching Times

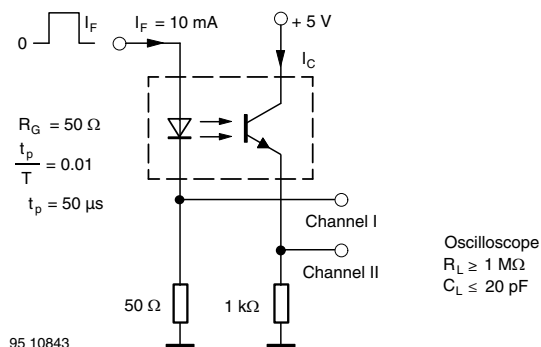


Fig. 4 - Test Circuit, Saturated Operation



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

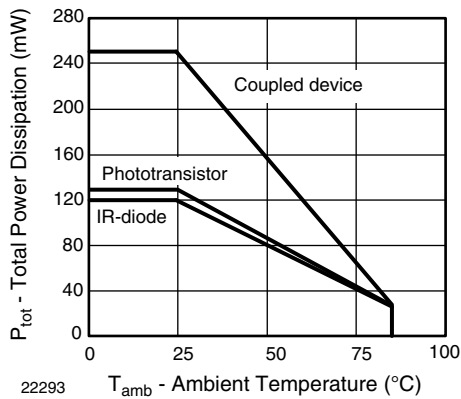


Fig. 6 - Total Power Dissipation vs. Ambient Temperature

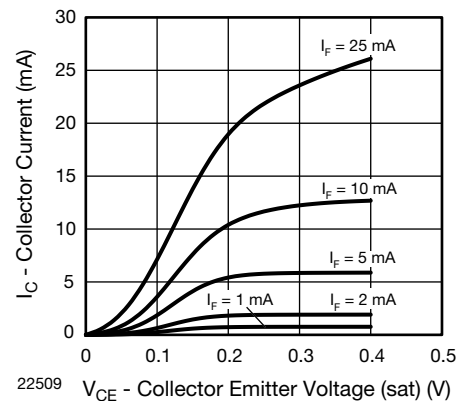


Fig. 9 - Collector Current vs. Collector Emitter Voltage

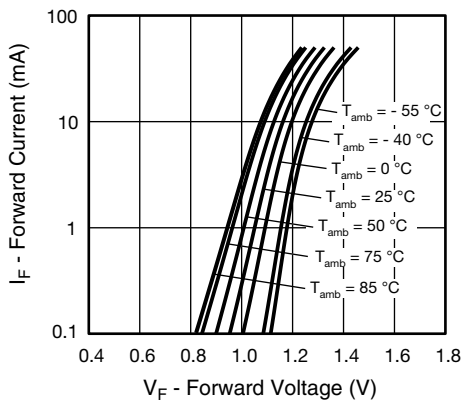


Fig. 7 - Forward Current vs. Forward Voltage

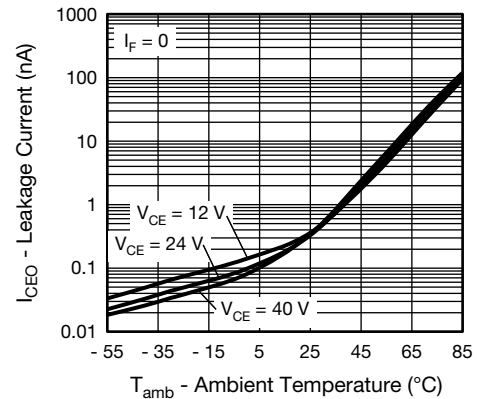


Fig. 10 - Leakage Current vs. Ambient Temperature

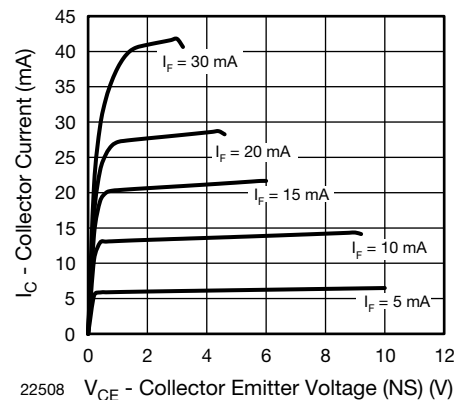


Fig. 8 - Collector Current vs. Collector Emitter Voltage (NS)

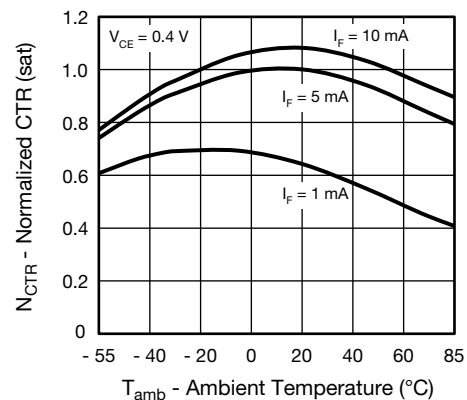


Fig. 11 - Normalized CTR (sat) vs. Ambient Temperature

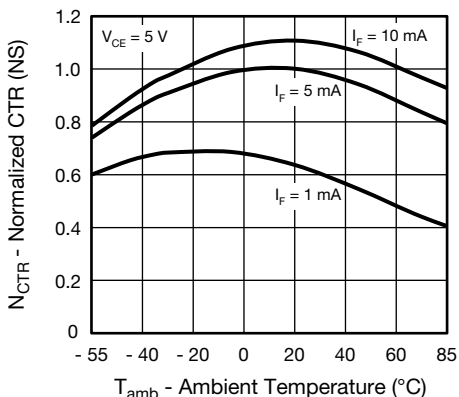


Fig. 12 - Normalized CTR (NS) vs. Ambient Temperature

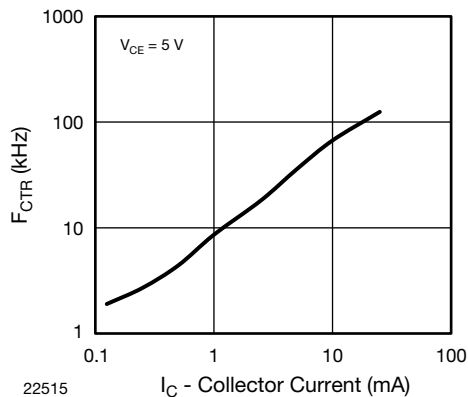


Fig. 15 -  $F_{CTR}$  vs. Collector Current

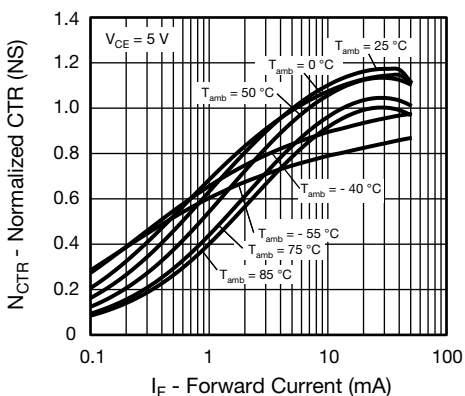


Fig. 13 - Normalized CTR (NS) vs. Forward Current

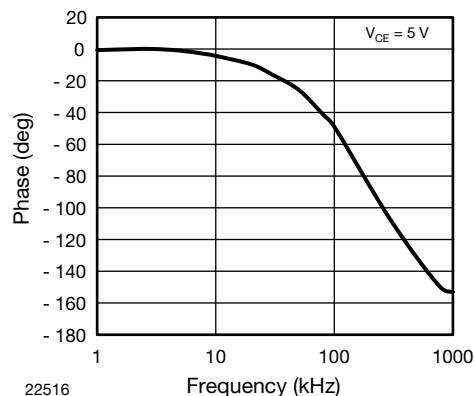


Fig. 16 -  $F_{CTR}$  vs. Phase Angle

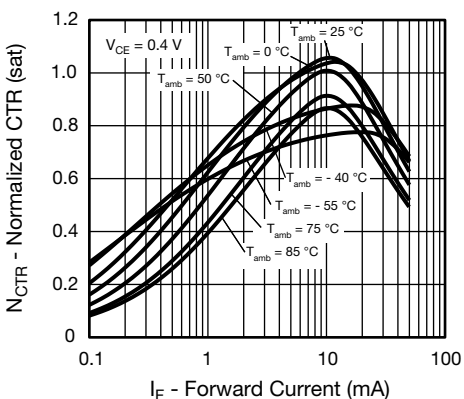


Fig. 14 - Normalized CTR (sat) vs. Forward Current

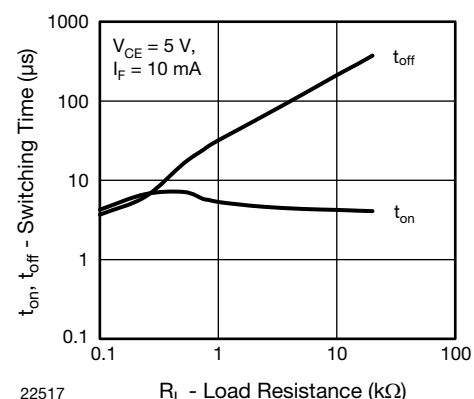


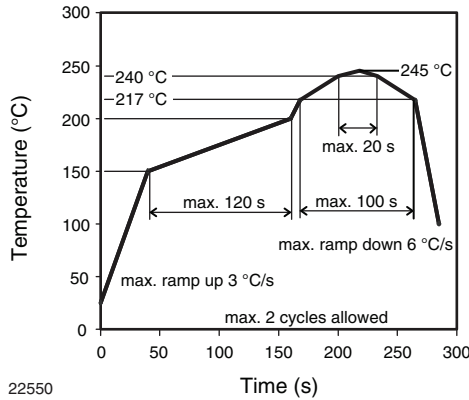
Fig. 17 - Switching Time vs. Load Resistance



## SOLDERING GUIDELINES

### Soldering Condition

The CNY64AxST, CNY65AxST are lead (Pb)-free devices. They are suitable for reflow soldering. However due to large package size, the peak package body temperature should not go above 245 °C.



### Drypack

Devices are packed in moisture barrier bags (MBB) to prevent moisture absorption during transportation and storage. Each bag contains a desiccant bag.

### Floor Life

Floor life (time between soldering and removing from MBB) must not exceed the time indicated on MBB label:

Floor life: 72 h

Conditions:  $T_{amb} < 30\text{ °C}$ ,  $RH < 60\%$

Moisture sensitivity level 4, according to J-STD-020.

### Drying

In case of moisture absorption devices should be baked before soldering according to the recommended conditions shown below

48 h at  $125\text{ °C} \pm 5\text{ °C}$ ,  $RH < 5\%$

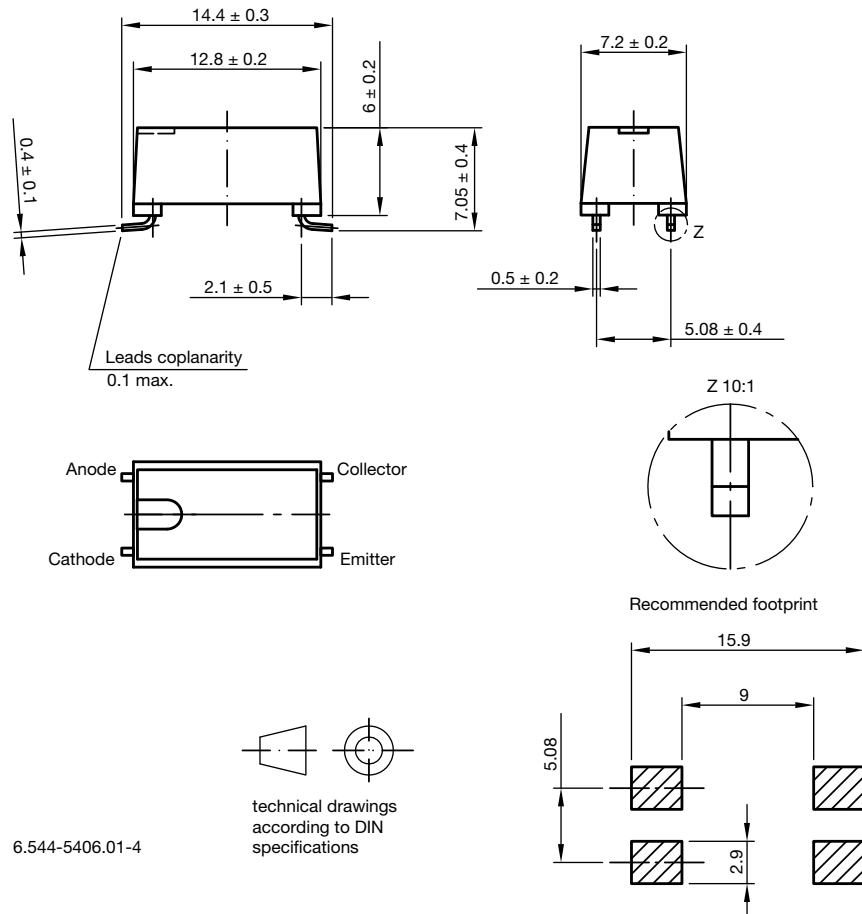
(Not suitable for tape and reel)

In case the floor time has not exceeded 10 days the units can be baked in tape and reel according to the following conditions

168 h at  $60\text{ °C} \pm 5\text{ °C}$ ,  $RH < 5\%$

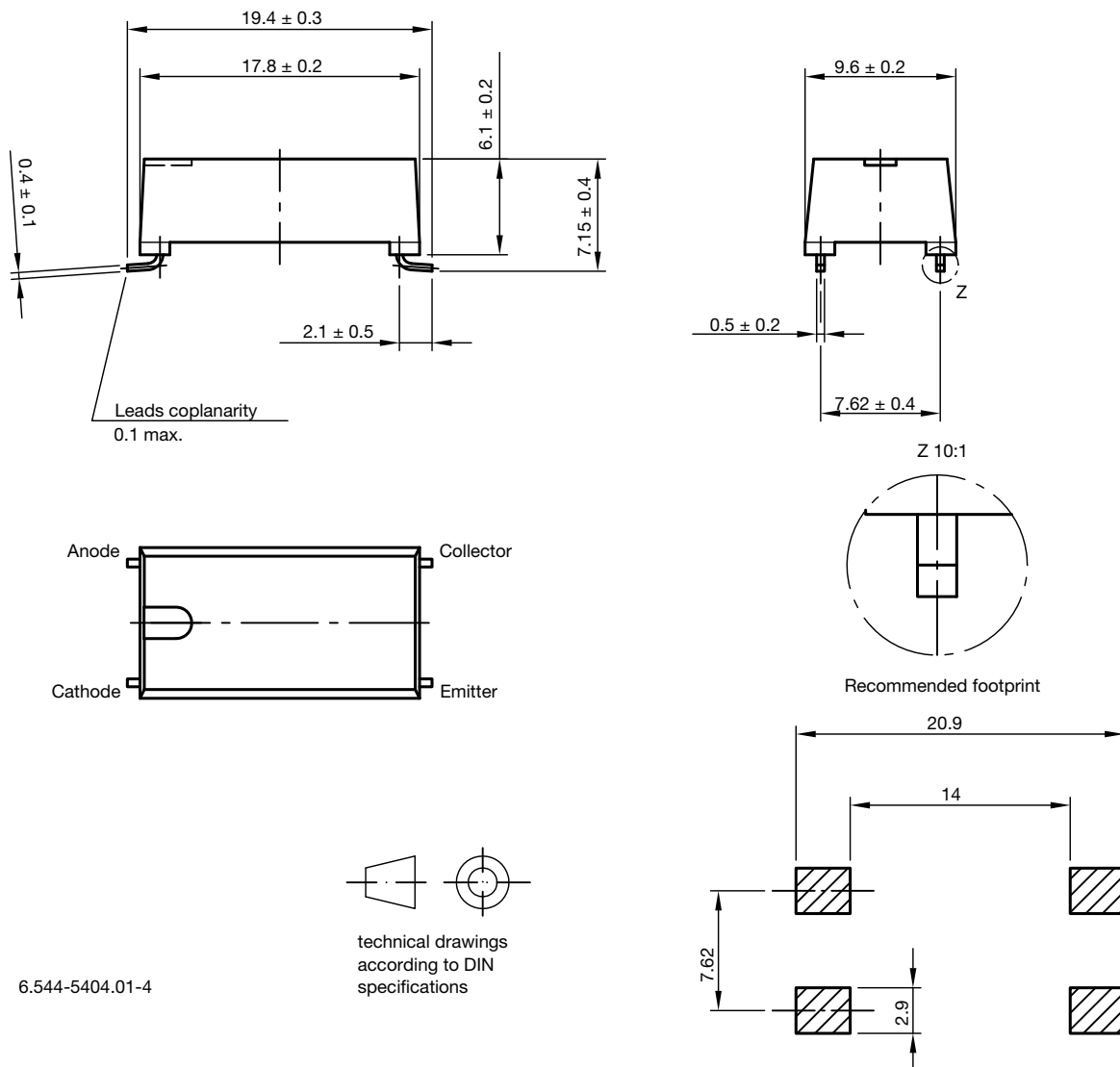
(Not suitable, if the floor time was exceeded by more than 10 days, or the allowed factory condition is exceeded)

## PACKAGE DIMENSIONS in millimeters FOR CNY64AxxxST

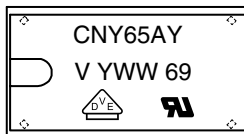




**PACKAGE DIMENSIONS** in millimeters **FOR CNY65AxxxST**



**PACKAGE MARKING** (example)

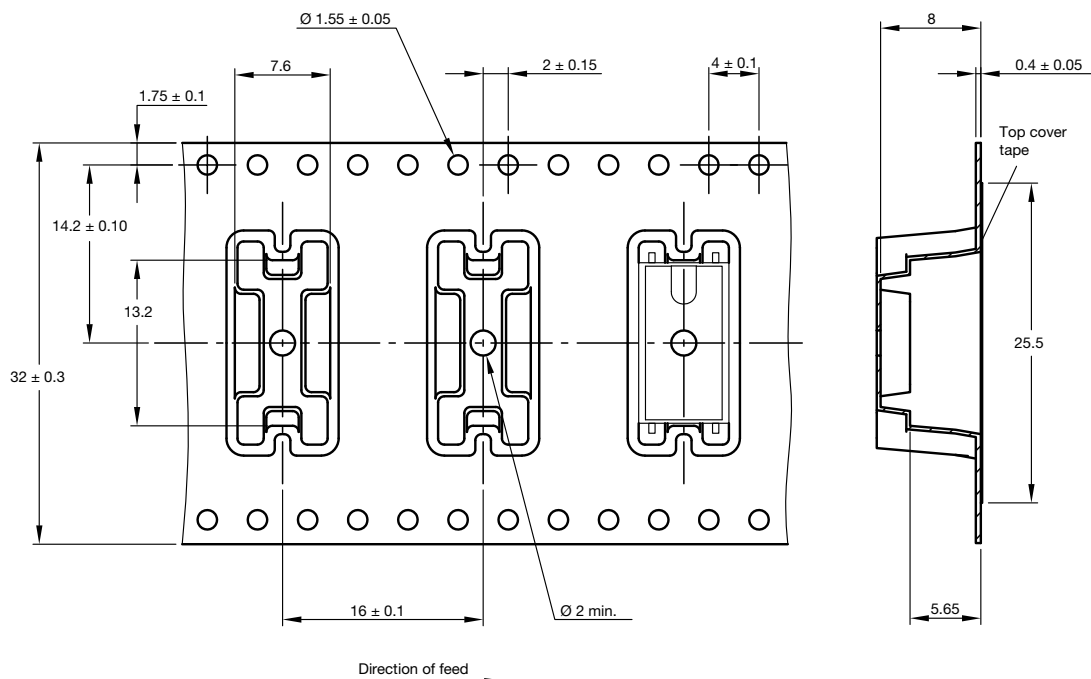


**Note**

- The "T" at the end of the product designation is not marked on the package

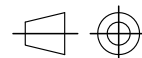


**TAPE DIMENSIONS** in millimeters **FOR CNY64AxxxST**



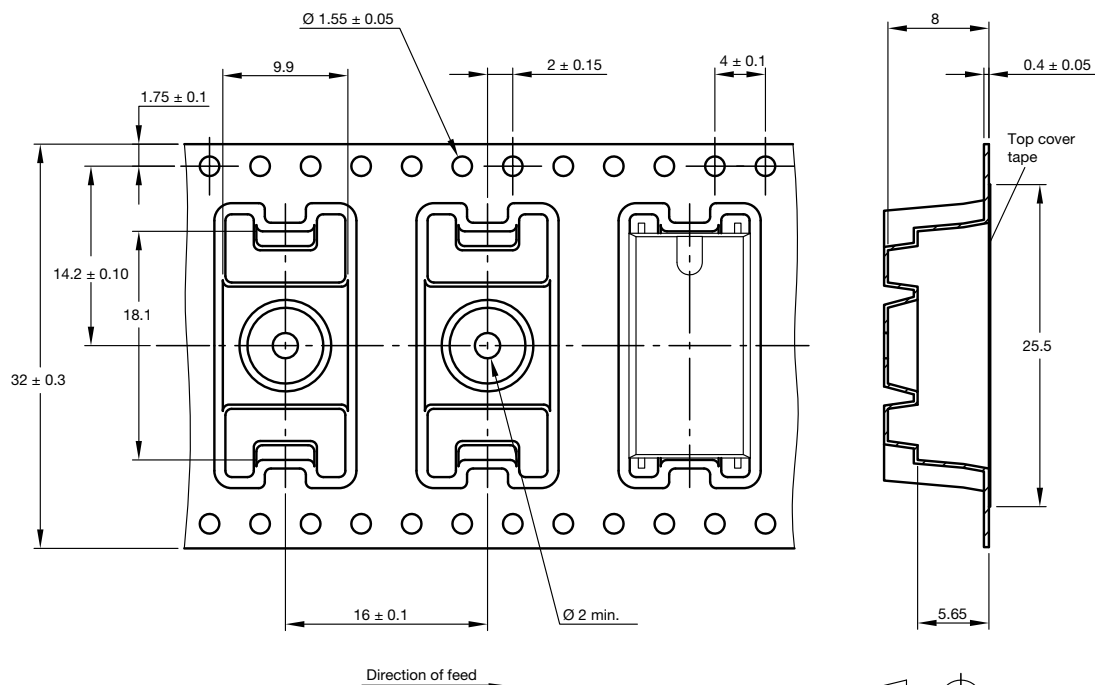
Leader (start) min. 400 mm without devices  
Trailer (end) min. 200 mm without devices

Drawing-No.: 9.700-5375.01-4  
Issue: 1; 23.05.11



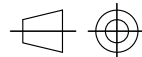
technical drawings  
according to DIN  
specifications

**TAPE DIMENSIONS** in millimeters **FOR CNY65AxxxST**



Leader (start) min. 400 mm without devices  
Trailer (end) min. 200 mm without devices

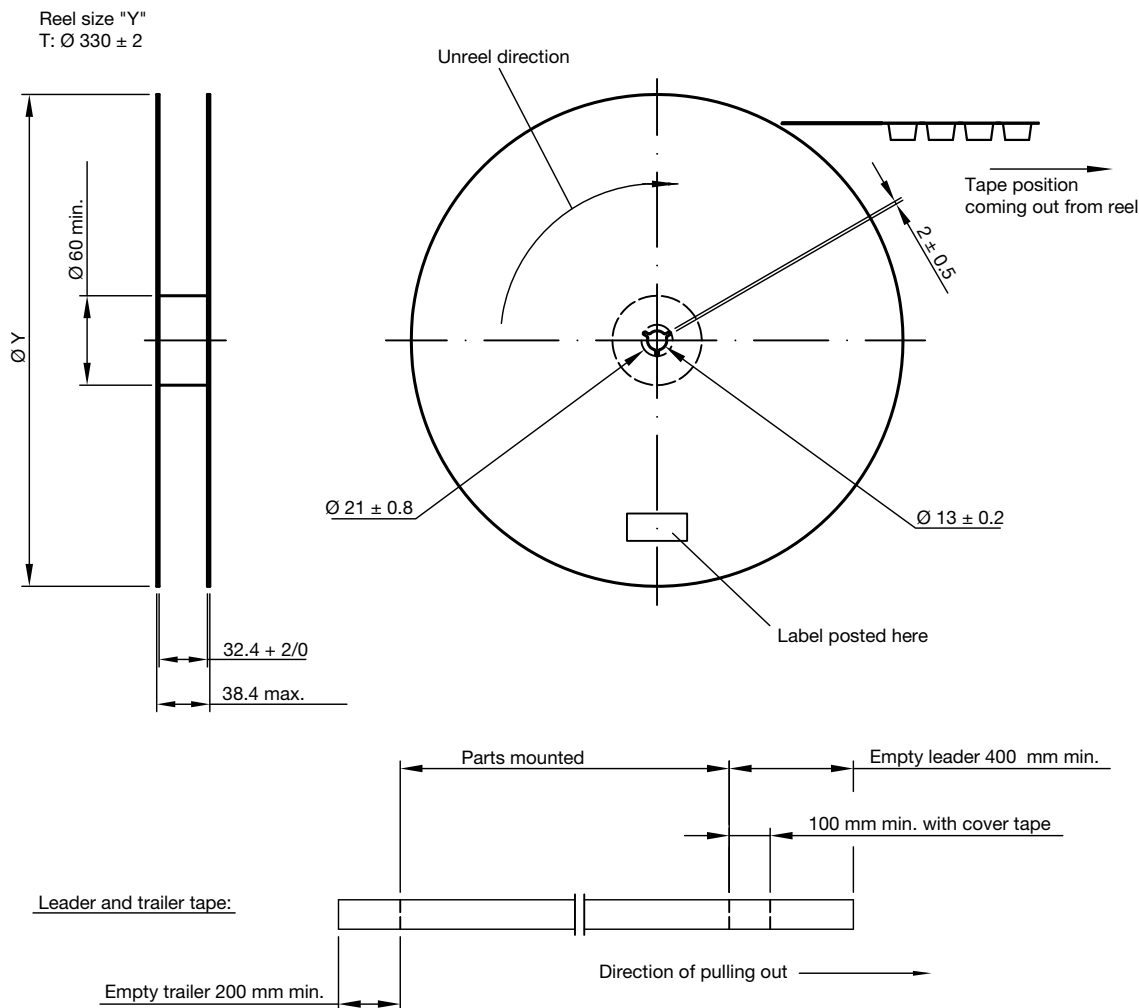
Drawing-No.: 9.700-5376.01-4  
Issue: 1; 23.05.11



technical drawings  
according to DIN  
specifications



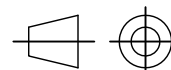
**REEL DIMENSIONS** in millimeters



Not indicated tolerances  $\pm 0.1$

Drawing-No.: 9.800-5120.01-4

Issue: 1; 23.05.11



technical drawings  
according to DIN  
specifications



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## Material Category Policy

**Vishay Intertechnology, Inc. hereby certifies that all its products that are identified as RoHS-Compliant fulfill the definitions and restrictions defined under Directive 2011/65/EU of The European Parliament and of the Council of June 8, 2011 on the restriction of the use of certain hazardous substances in electrical and electronic equipment (EEE) - recast, unless otherwise specified as non-compliant.**

**Please note that some Vishay documentation may still make reference to RoHS Directive 2002/95/EC. We confirm that all the products identified as being compliant to Directive 2002/95/EC conform to Directive 2011/65/EU.**

**Vishay Intertechnology, Inc. hereby certifies that all its products that are identified as Halogen-Free follow Halogen-Free requirements as per JEDEC JS709A standards. Please note that some Vishay documentation may still make reference to the IEC 61249-2-21 definition. We confirm that all the products identified as being compliant to IEC 61249-2-21 conform to JEDEC JS709A standards.**