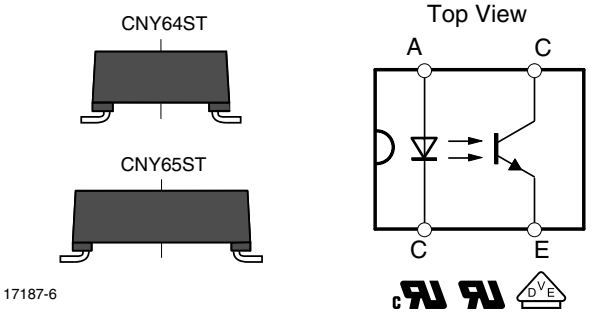
# Optocoupler, Phototransistor Output, Very High Isolation Voltage




## FEATURES

- Rated recurring peak voltage (repetitive) $V_{IORM}$ = 1500 $V_{peak}$
- Thickness through insulation ≥ 3 mm
- Creepage current resistance according to VDE 0303 / IEC 60112 comparative tracking index: **CTI** ≥ 475
- Moisture sensitivity level MSL4
  - Follow defined storage and soldering requirements
- Material categorization: for definitions of compliance please see www.vishay.com/doc?99912

Pb-free
e4
RoHS COMPLIANT
HALOGEN FREE
GREEN (5-2008)

## LINKS TO ADDITIONAL RESOURCES

3D Models | Models | Related Documents | Footprints

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

## APPLICATIONS

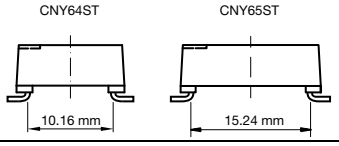
- Solar and wind power diagnostic, monitoring, and communication equipment
- Welding equipment
- High voltage motors
- Switch-mode power supplies
- Line receiver
- Computer peripheral interface
- Microprocessor system interface
- Circuits for safe protective separation against electrical shock according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

## AGENCY APPROVALS

- UL 1577
- cUL 1577
- DIN EN 60747-5-5 (VDE 0884-5)

## ORDERING INFORMATION

| C | N | Y | 6 | # | X | X | X | S | T |
|---|---|---|---|---|---|---|---|---|---|
| PART NUMBER | | | | PACKAGE OPTION | CTR BIN | | | | |




| AGENCY CERTIFIED/PACKAGE | CTR (%) | | | |
|---|---|---|---|---|
| | 5 mA | | | |
| **UL, cUL, 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 |


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| **ABSOLUTE MAXIMUM RATINGS** ($T_{amb}$ = 25 °C, unless otherwise specified) | | | | |
|---|---|---|---|---|
| **PARAMETER** | **TEST CONDITION** | **SYMBOL** | **VALUE** | **UNIT** |
| **INPUT** | | | | |
| Reverse voltage | | $V_R$ | 5 | V |
| Forward current | | $I_F$ | 75 | mA |
| Forward surge current | $t_p \leq 10$ µs | $I_{FSM}$ | 1.5 | A |
| Power dissipation | | $P_{diss}$ | 120 | mW |
| Junction temperature | | $T_j$ | 100 | °C |
| **OUTPUT** | | | | |
| Collector emitter voltage | | $V_{CEO}$ | 32 | V |
| Emitter collector voltage | | $V_{ECO}$ | 7 | V |
| Collector current | | $I_C$ | 50 | mA |
| Collector peak current | $t_p/T = 0.5$, $t_p \leq 10$ ms | $I_{CM}$ | 100 | mA |
| Power dissipation | | $P_{diss}$ | 130 | mW |
| Junction temperature | | $T_j$ | 100 | °C |
| **COUPLER** | | | | |
| Total power dissipation | | $P_{tot}$ | 250 | mW |
| Ambient temperature range | | $T_{amb}$ | -55 to +85 | °C |
| Storage temperature range | | $T_{stg}$ | -55 to +100 | °C |
| Soldering temperature | See reflow profile in “Soldering Guidelines” | $T_{sld}$ | 245 | °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.

| **ELECTRICAL CHARACTERISTICS** ($T_{amb}$ = 25 °C, unless otherwise specified) | | | | | | |
|---|---|---|---|---|---|---|
| **PARAMETER** | **TEST CONDITION** | **SYMBOL** | **MIN.** | **TYP.** | **MAX.** | **UNIT** |
| **INPUT** | | | | | | |
| Forward voltage | $I_F$ = 50 mA | $V_F$ | - | 1.32 | 1.6 | V |
| Junction capacitance | $V_R$ = 0 V, f = 1 MHz | $C_j$ | - | 50 | - | pF |
| **OUTPUT** | | | | | | |
| Collector emitter voltage | $I_C$ = 1 mA | $V_{CEO}$ | 32 | - | - | V |
| Emitter collector voltage | $I_E$ = 100 µA | $V_{ECO}$ | 7 | - | - | V |
| Collector emitter leakage current | $V_{CE}$ = 20 V, $I_F$ = 0 mA | $I_{CEO}$ | - | - | 200 | nA |
| **COUPLER** | | | | | | |
| Collector emitter saturation voltage | $I_F$ = 10 mA, $I_C$ = 1 mA | $V_{CEsat}$ | - | - | 0.3 | V |
| Cut-off frequency | $V_{CE}$ = 5 V, $I_F$ = 10 mA, $R_L$ = 100 Ω | $f_c$ | - | 110 | - | kHz |
| Coupling capacitance | f = 1 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 °C, unless otherwise specified) | | | | | | | |
|---|---|---|---|---|---|---|---|
| **PARAMETER** | **TEST CONDITION** | **PART** | **SYMBOL** | **MIN.** | **TYP.** | **MAX.** | **UNIT** |
| $I_C/I_F$ | $V_{CE}$ = 5 V, $I_F$ = 5 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 | % |


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

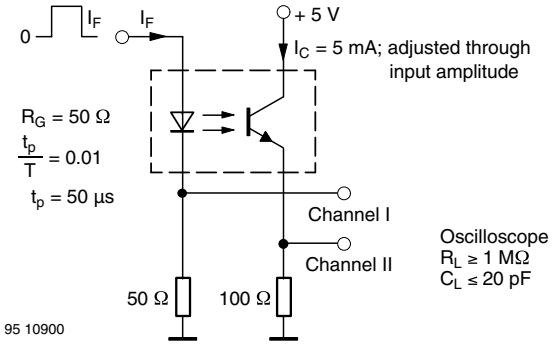



Fig. 1 - Test Circuit, Non-Saturated Operation

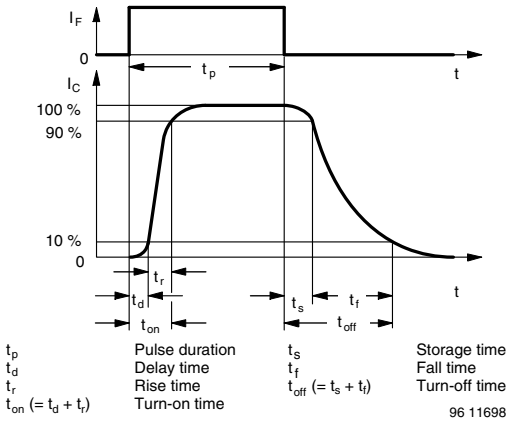



Fig. 3 - Switching Times

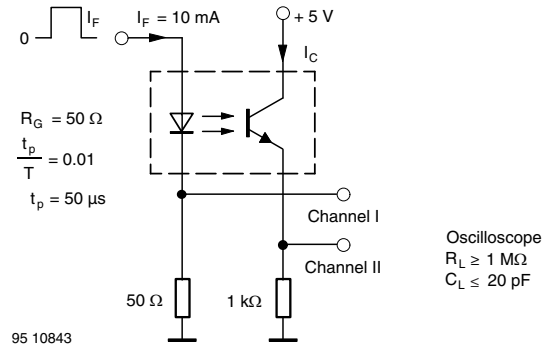



Fig. 2 - Test Circuit, Saturated Operation


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| SAFETY AND INSULATION RATINGS | | | | |
|---|---|---|---|---|
| **PARAMETER** | **TEST CONDITION** | **SYMBOL** | **VALUE** | **UNIT** |
| Climatic classification | According to IEC 68 part 1 | | 55 / 85 / 21 | |
| Pollution degree | According to DIN VDE 0109 | | 2 | |
| Comparative tracking index | Insulation group II | CTI | 475 | |
| Maximum rated withstanding isolation voltage | According to UL1577, t = 1 min | $V_{ISO}$ | 8200 | $V_{RMS}$ |
| Tested withstanding isolation voltage | According to UL1577, t = 1 s | $V_{ISO}$ | 13 900 | $V_{peak}$ |
| Maximum transient isolation voltage | According to DIN EN 60747-5-5 | $V_{IOTM}$ | 12 000 | $V_{peak}$ |
| Maximum repetitive peak isolation voltage | According to DIN EN 60747-5-5 | $V_{IORM}$ | 1500 | $V_{peak}$ |
| Isolation resistance | $T_{amb}$ = 25 °C, $V_{IO}$ = 500 V | $R_{IO}$ | ≥ $10^{12}$ | Ω |
| | $T_{amb}$ = 100 °C, $V_{IO}$ = 500 V | $R_{IO}$ | ≥ $10^{11}$ | Ω |
| | $T_{amb}$ = TS, $V_{IO}$ = 500 V | $R_{IO}$ | ≥ $10^{9}$ | Ω |
| Output safety power | | $P_{SO}$ | 250 | mW |
| Input safety current | | $I_{SI}$ | 120 | mA |
| Input safety temperature | | $T_S$ | 150 | °C |
| Creepage distance | CNY64 | | ≥ 9.5 | mm |
| Clearance distance | | | ≥ 9.5 | mm |
| Creepage distance | CNY65 | | ≥ 14 | mm |
| Clearance distance | | | ≥ 14 | mm |
| Insulation thickness | | DTI | ≥ 3 | mm |
| Input to output test voltage, method B | $V_{IORM}$ x 1.875 = $V_{PR}$, 100 % production test with $t_M$ = 1 s, partial discharge < 5 pC | $V_{PR}$ | 3375 | $V_{peak}$ |
| Input to output test voltage, method A | $V_{IORM}$ x 1.6 = $V_{PR}$, 100 % sample test with $t_M$ = 10 s, partial discharge < 5 pC | $V_{PR}$ | 2880 | $V_{peak}$ |

**Note**

- According to DIN EN 60747-5-5 (see Fig. 5). 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.

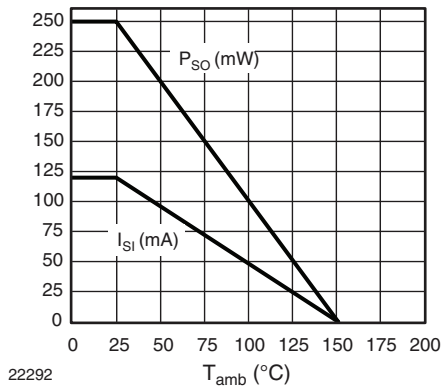



Fig. 4 - Safety Derating Diagram

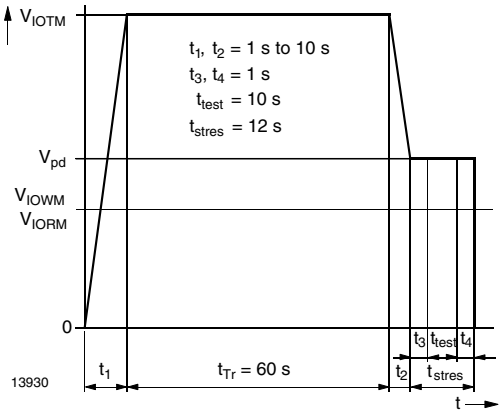



Fig. 5 - Test Pulse Diagram for Sample Test According to DIN EN 60747-5-5 (VDE 0884-5); IEC60747-5-5


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## TYPICAL CHARACTERISTICS ($T_{amb}$ = 25 °C, unless otherwise specified)

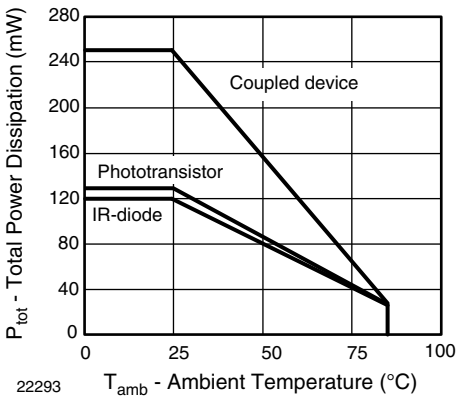



Fig. 6 - Total Power Dissipation vs. Ambient Temperature

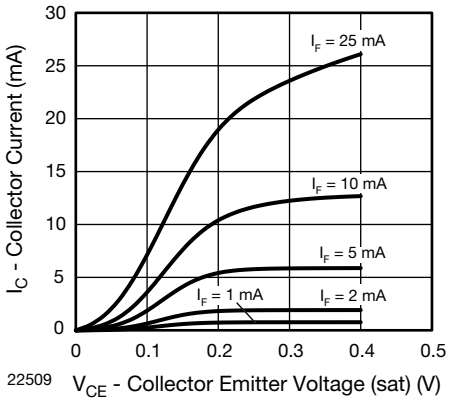



Fig. 9 - Collector Current vs. Collector Emitter Voltage

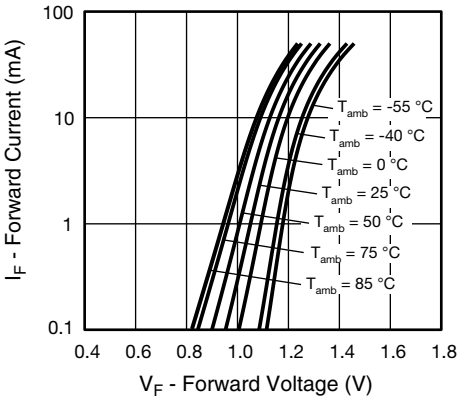



Fig. 7 - Forward Current vs. Forward Voltage

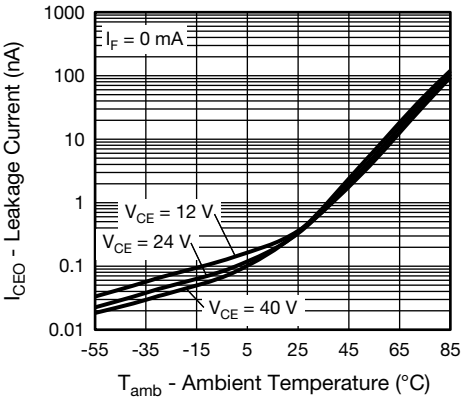



Fig. 10 - Leakage Current vs. Ambient Temperature

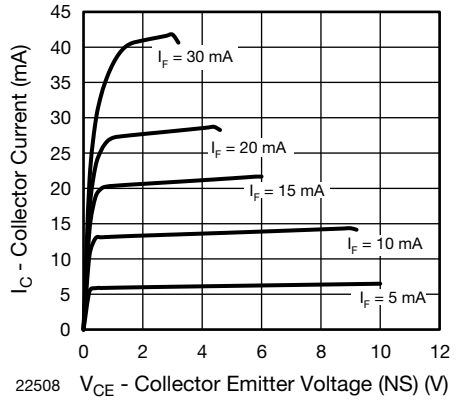



Fig. 8 - Collector Current vs. Collector Emitter Voltage (non-saturated)

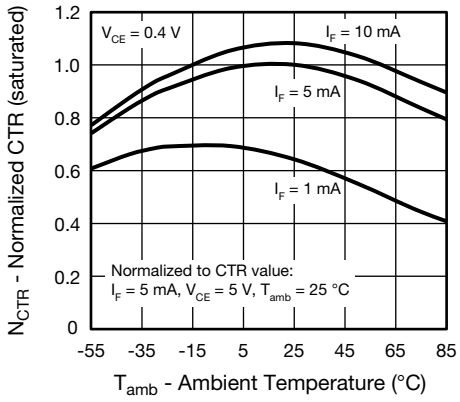



Fig. 11 - Normalized CTR (saturated) vs. Ambient Temperature


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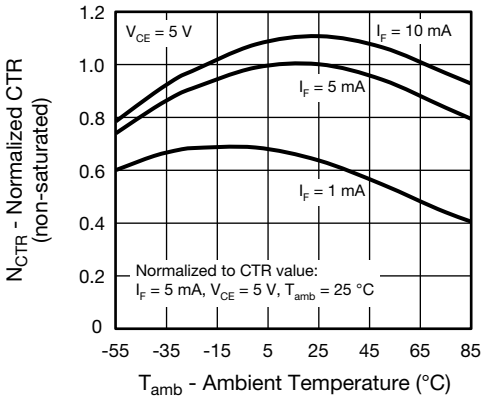



Fig. 12 - Normalized CTR (non-saturated) vs. Ambient Temperature

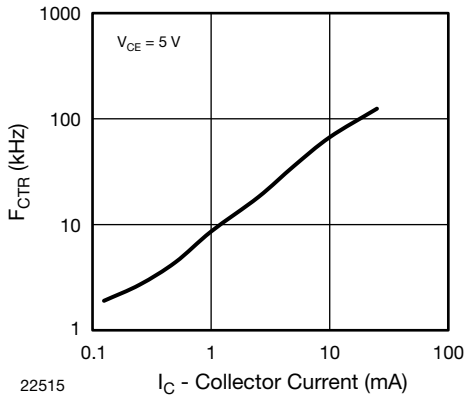



Fig. 15 - $F_{CTR}$ vs. Collector Current

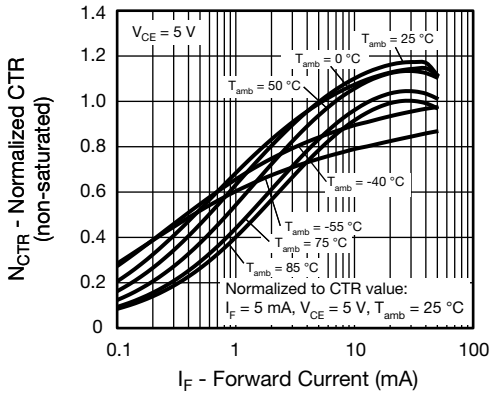



Fig. 13 - Normalized CTR (non-saturated) vs. Forward Current

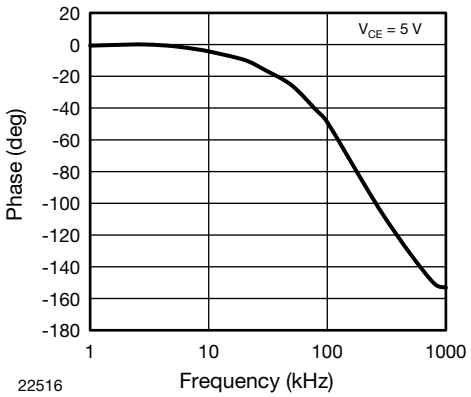



Fig. 16 - $F_{CTR}$ vs. Phase Angle

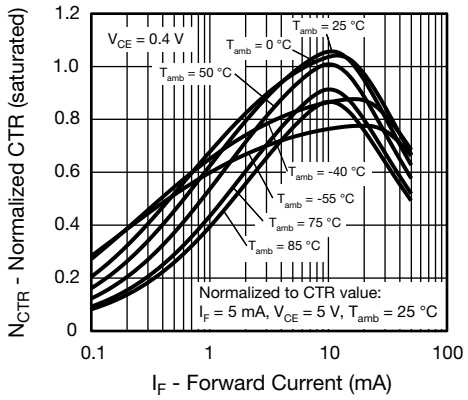



Fig. 14 - Normalized CTR (saturated) vs. Forward Current

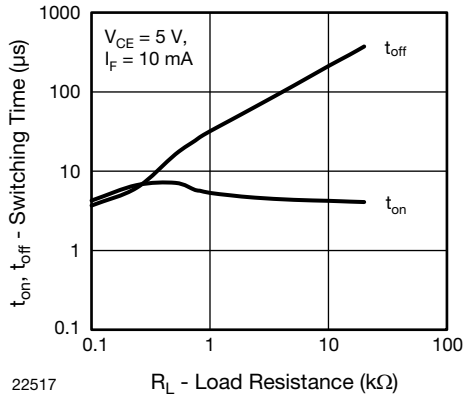
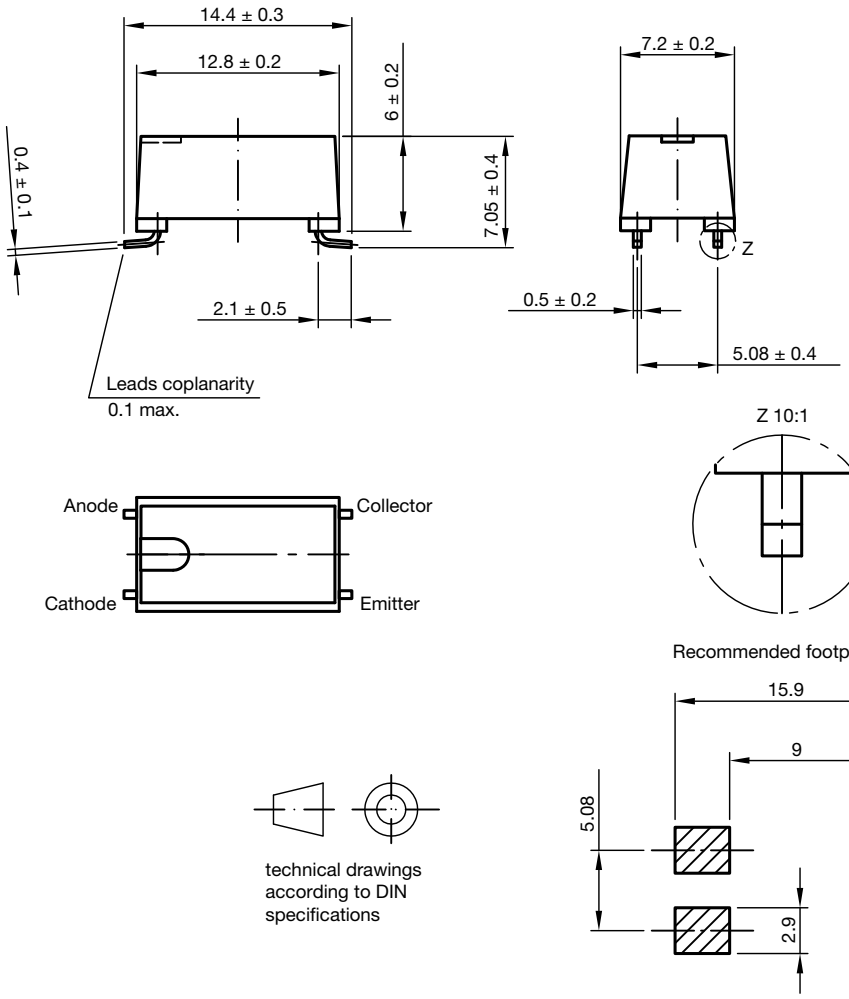



Fig. 17 - Switching Time vs. Load Resistance


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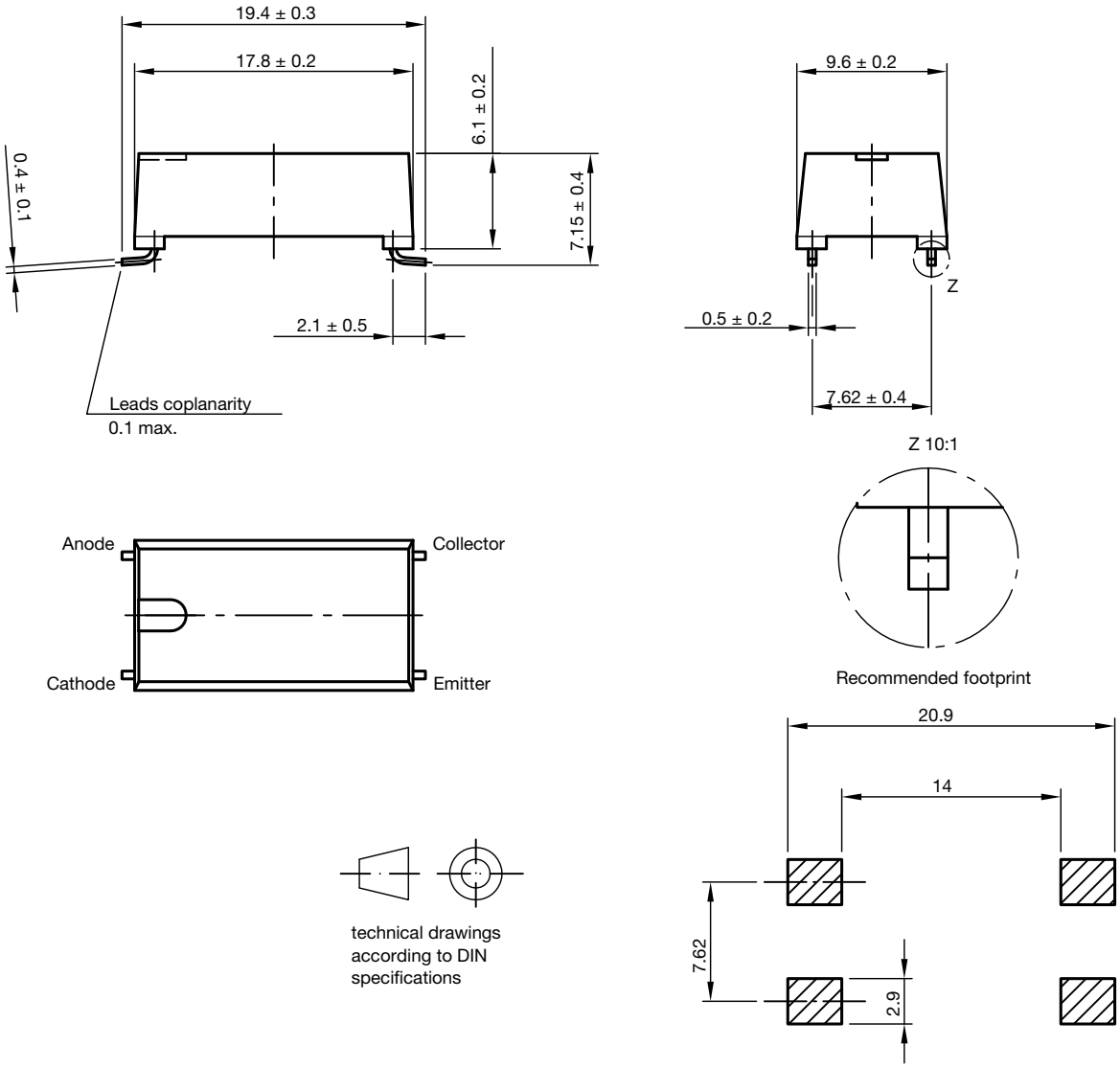
**PACKAGE DIMENSIONS** in millimeters **FOR CNY64A...ST**



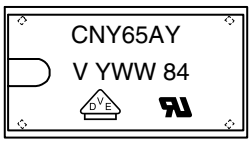


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## PACKAGE DIMENSIONS in millimeters FOR CNY65A...ST




## PACKAGE MARKING (Example)

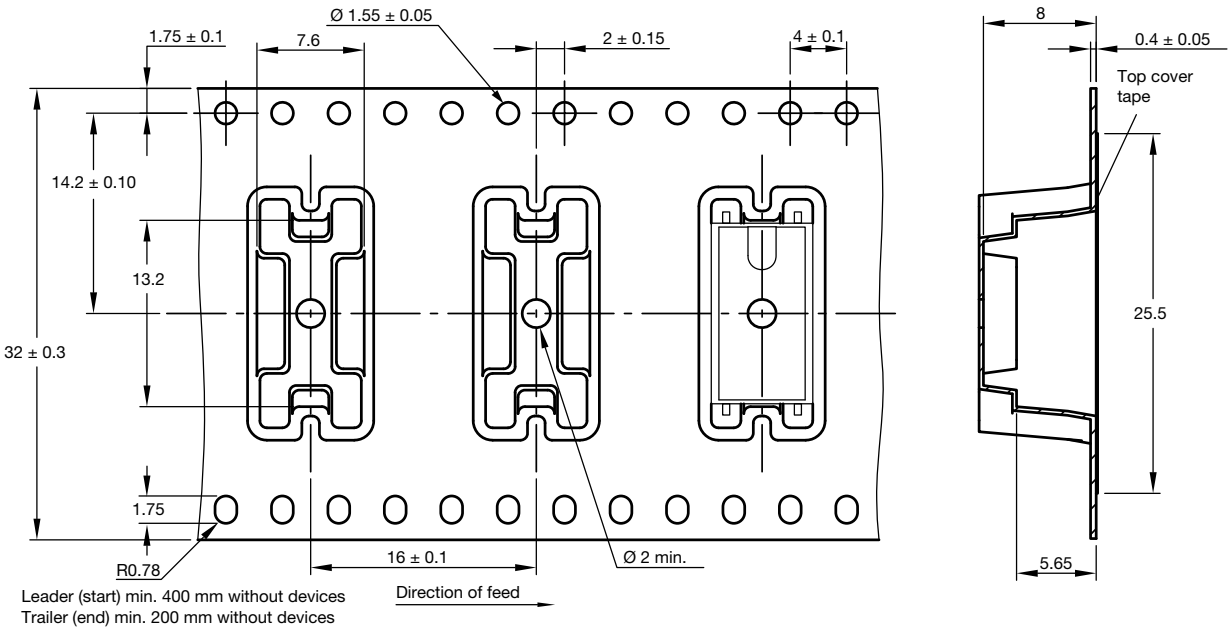



**Note**

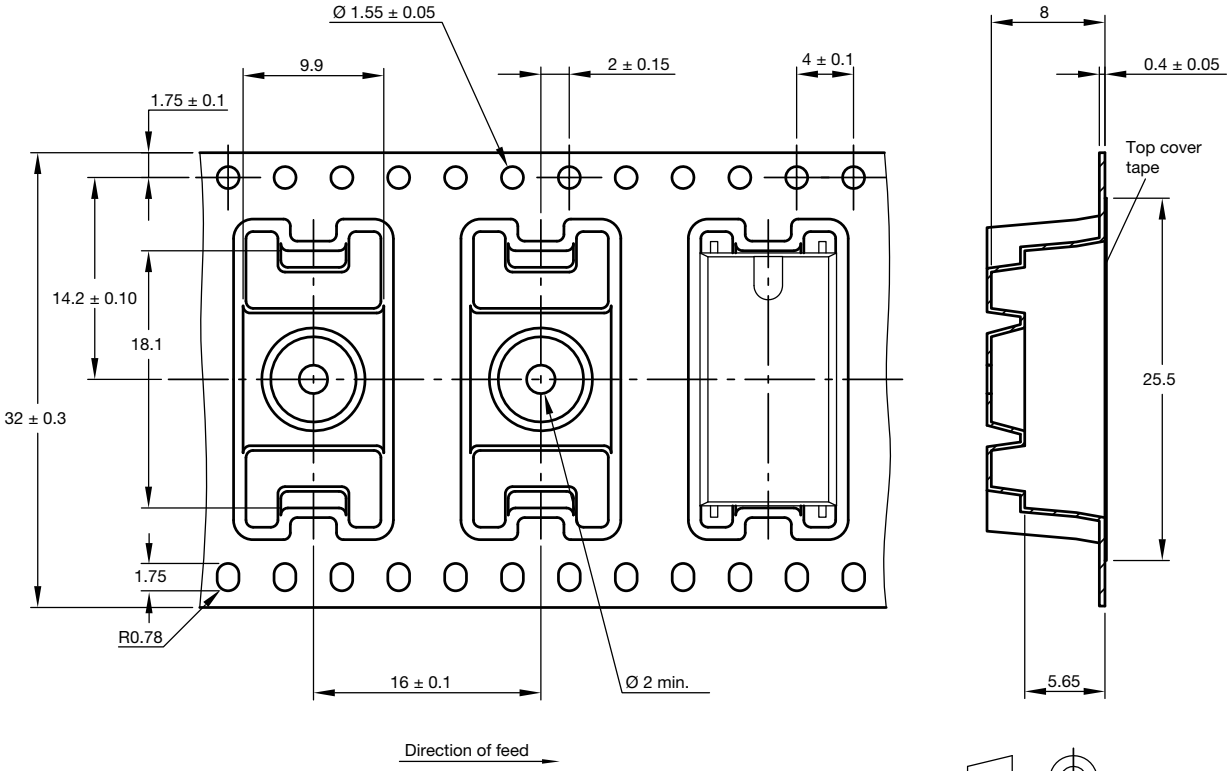
- The “T” at the end of the product designation is not marked on the package


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## **TAPE DIMENSIONS** in millimeters **FOR CNY64A...ST**



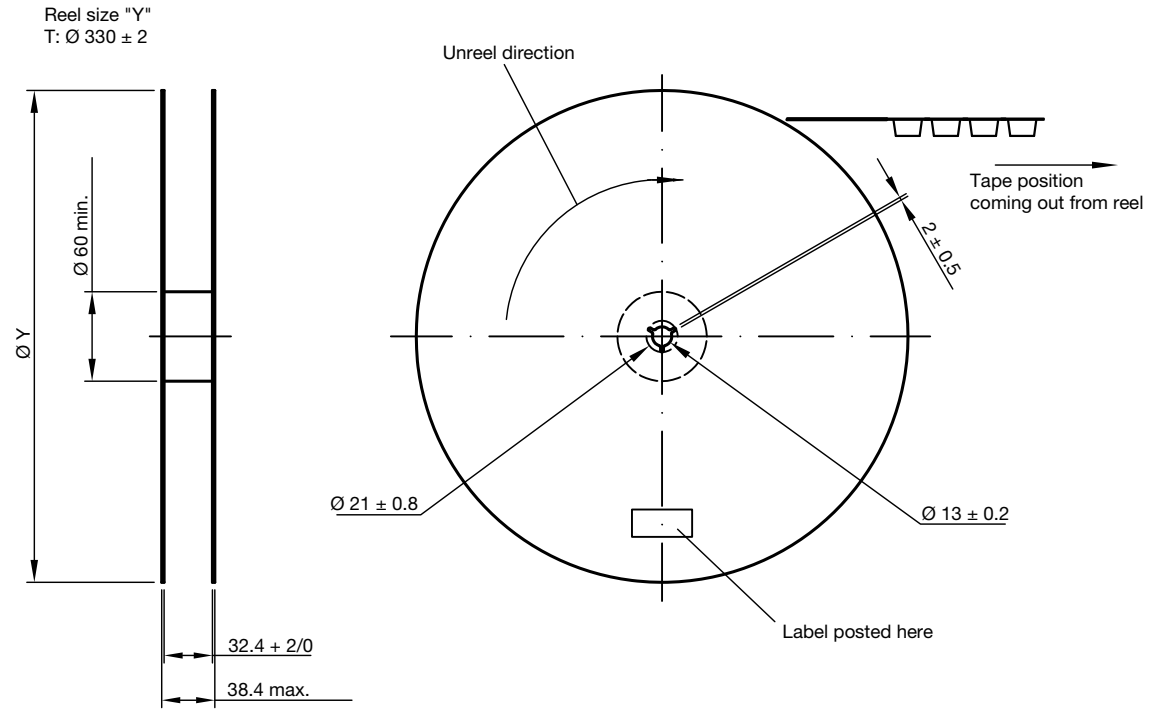

## **TAPE DIMENSIONS** in millimeters **FOR CNY65A...ST**

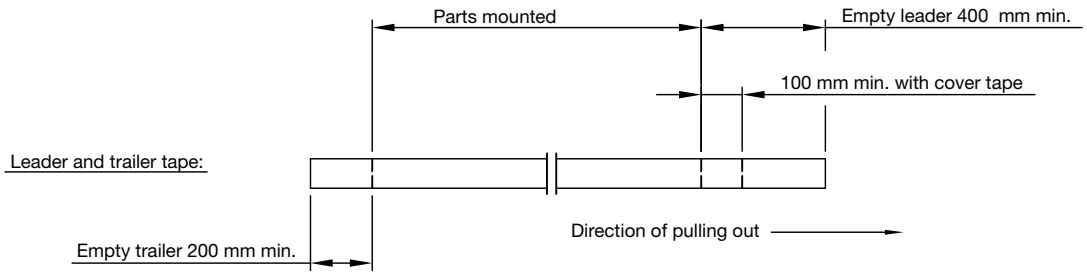


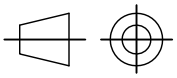


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**REEL DIMENSIONS** in millimeters



Not indicated tolerances ± 0.1

Drawing-No.: 9.800-5120.01-4
Issue: 1; 23.05.11

technical drawings
according to DIN
specifications

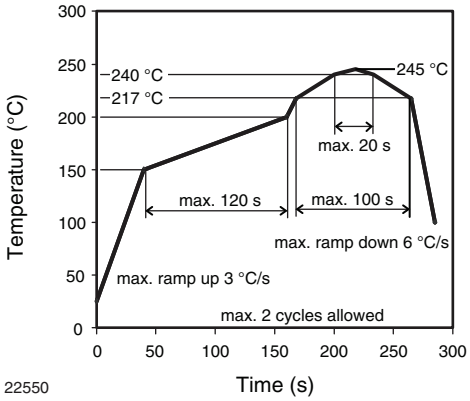
| TAPE AND REEL INFORMATION | | | |
|---|---|---|---|
| **TYPE** | **UNITS/REEL** | **REELS/BOX** | **UNITS/BOX** |
| CNY64 | 400 | 2 | 800 |
| CNY65 | 400 | 2 | 800 |


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## 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 °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 °C ± 5 °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 °C ± 5 °C, RH < 5 %

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


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