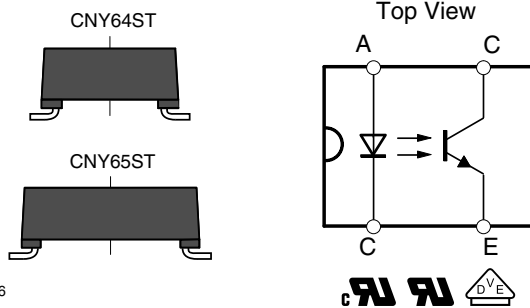




# Optocoupler, Phototransistor Output, Very High Isolation Voltage



17187-6

## FEATURES

- Rated recurring peak voltage (repetitive)  $V_{IORM} = 1500 V_{peak}$
- 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
- Material categorization: for definitions of compliance please see [www.vishay.com/doc?99912](http://www.vishay.com/doc?99912)



## LINKS TO ADDITIONAL RESOURCES



## 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  $\leq 300$  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 60747-5-5 (VDE 0884-5)

## AGENCY APPROVALS

- [UL 1577](#)
- [cUL 1577](#)
- [DIN EN 60747-5-5 \(VDE 0884-5\)](#)

ORDERING INFORMATION				
<div style="display: flex; justify-content: space-around; align-items: center;"> <div style="border: 1px solid black; padding: 2px 5px;">C</div> <div style="border: 1px solid black; padding: 2px 5px;">N</div> <div style="border: 1px solid black; padding: 2px 5px;">Y</div> <div style="border: 1px solid black; padding: 2px 5px;">6</div> <div style="border: 1px solid black; padding: 2px 5px;">#</div> <div style="border: 1px solid black; padding: 2px 5px;">X</div> <div style="border: 1px solid black; padding: 2px 5px;">X</div> <div style="border: 1px solid black; padding: 2px 5px;">X</div> <div style="border: 1px solid black; padding: 2px 5px;">S</div> <div style="border: 1px solid black; padding: 2px 5px;">T</div> </div>				
PART NUMBER	PACKAGE OPTION	CTR BIN		
		 10.16 mm	 15.24 mm	
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



ABSOLUTE MAXIMUM RATINGS (T <sub>amb</sub> = 25 °C, unless otherwise specified)				
PARAMETER	TEST CONDITION	SYMBOL	VALUE	UNIT
<b>INPUT</b>				
Reverse voltage		V <sub>R</sub>	5	V
Forward current		I <sub>F</sub>	75	mA
Forward surge current	t <sub>p</sub> ≤ 10 μs	I <sub>FSM</sub>	1.5	A
Power dissipation		P <sub>diss</sub>	120	mW
Junction temperature		T <sub>j</sub>	100	°C
<b>OUTPUT</b>				
Collector emitter voltage		V <sub>CEO</sub>	32	V
Emitter collector voltage		V <sub>ECO</sub>	7	V
Collector current		I <sub>C</sub>	50	mA
Collector peak current	t <sub>p</sub> /T = 0.5, t <sub>p</sub> ≤ 10 ms	I <sub>CM</sub>	100	mA
Power dissipation		P <sub>diss</sub>	130	mW
Junction temperature		T <sub>j</sub>	100	°C
<b>COUPLER</b>				
Total power dissipation		P <sub>tot</sub>	250	mW
Ambient temperature range		T <sub>amb</sub>	-55 to +85	°C
Storage temperature range		T <sub>stg</sub>	-55 to +100	°C
Soldering temperature	See reflow profile in "Soldering Guidelines"	T <sub>sld</sub>	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 <sub>amb</sub> = 25 °C, unless otherwise specified)						
PARAMETER	TEST CONDITION	SYMBOL	MIN.	TYP.	MAX.	UNIT
<b>INPUT</b>						
Forward voltage	I <sub>F</sub> = 50 mA	V <sub>F</sub>	-	1.32	1.6	V
Junction capacitance	V <sub>R</sub> = 0 V, f = 1 MHz	C <sub>j</sub>	-	50	-	pF
<b>OUTPUT</b>						
Collector emitter voltage	I <sub>C</sub> = 1 mA	V <sub>CEO</sub>	32	-	-	V
Emitter collector voltage	I <sub>E</sub> = 100 μA	V <sub>ECO</sub>	7	-	-	V
Collector emitter leakage current	V <sub>CE</sub> = 20 V, I <sub>F</sub> = 0 mA	I <sub>CEO</sub>	-	-	200	nA
<b>COUPLER</b>						
Collector emitter saturation voltage	I <sub>F</sub> = 10 mA, I <sub>C</sub> = 1 mA	V <sub>CEsat</sub>	-	-	0.3	V
Cut-off frequency	V <sub>CE</sub> = 5 V, I <sub>F</sub> = 10 mA, R <sub>L</sub> = 100 Ω	f <sub>c</sub>	-	110	-	kHz
Coupling capacitance	f = 1 MHz	C <sub>k</sub>	-	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 <sub>amb</sub> = 25 °C, unless otherwise specified)							
PARAMETER	TEST CONDITION	PART	SYMBOL	MIN.	TYP.	MAX.	UNIT
I <sub>C</sub> /I <sub>F</sub>	V <sub>CE</sub> = 5 V, I <sub>F</sub> = 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	%

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 Fig. 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 Fig. 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 Fig. 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 Fig. 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 Fig. 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 Fig. 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 Fig. 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 Fig. 4)	$t_{off}$	-	42.5	-	$\mu\text{s}$

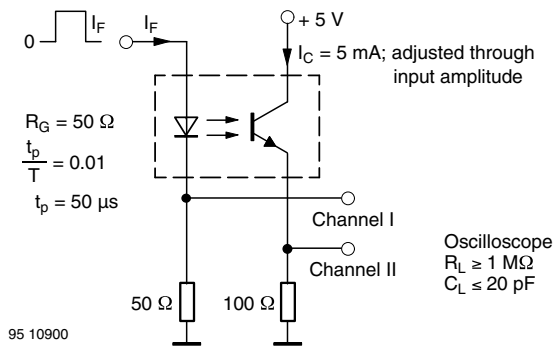


Fig. 1 - Test Circuit, Non-Saturated Operation

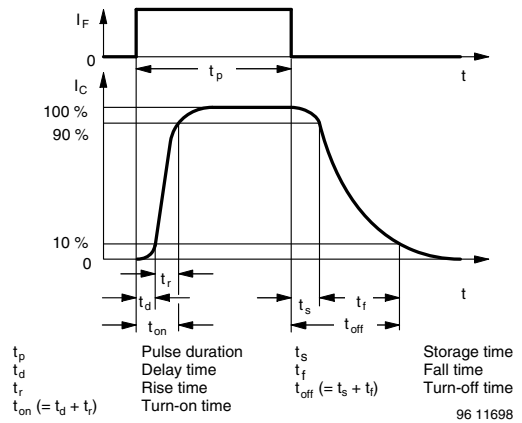


Fig. 3 - Switching Times

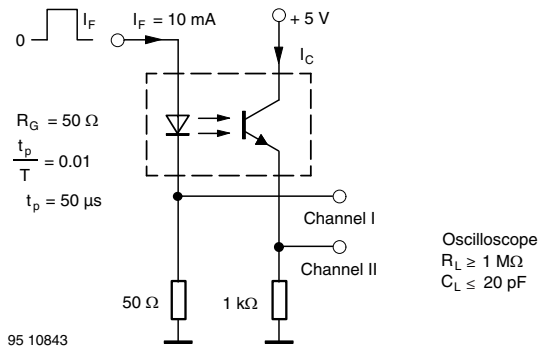


Fig. 2 - Test Circuit, Saturated Operation

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	$T_{amb} = 25\text{ }^{\circ}\text{C}$ , $V_{IO} = 500\text{ V}$	$R_{IO}$	$\geq 10^{12}$	$\Omega$
	$T_{amb} = 100\text{ }^{\circ}\text{C}$ , $V_{IO} = 500\text{ V}$	$R_{IO}$	$\geq 10^{11}$	$\Omega$
	$T_{amb} = TS$ , $V_{IO} = 500\text{ V}$	$R_{IO}$	$\geq 10^9$	$\Omega$
Output safety power		$P_{SO}$	250	mW
Input safety current		$I_{SI}$	120	mA
Input safety temperature		$T_S$	150	$^{\circ}\text{C}$
Creepage distance	CNY64		$\geq 9.5$	mm
Clearance distance			$\geq 9.5$	mm
Creepage distance	CNY65		$\geq 14$	mm
Clearance distance			$\geq 14$	mm
Insulation thickness		DTI	$\geq 3$	mm
Input to output test voltage, method B	$V_{IORM} \times 1.875 = V_{PR}$ , 100 % production test with $t_M = 1\text{ s}$ , partial discharge $< 5\text{ pC}$	$V_{PR}$	3375	$V_{peak}$
Input to output test voltage, method A	$V_{IORM} \times 1.6 = V_{PR}$ , 100 % sample test with $t_M = 10\text{ s}$ , partial discharge $< 5\text{ pC}$	$V_{PR}$	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.

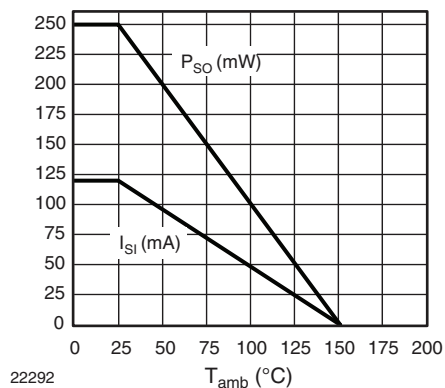


Fig. 4 - Safety Derating Diagram

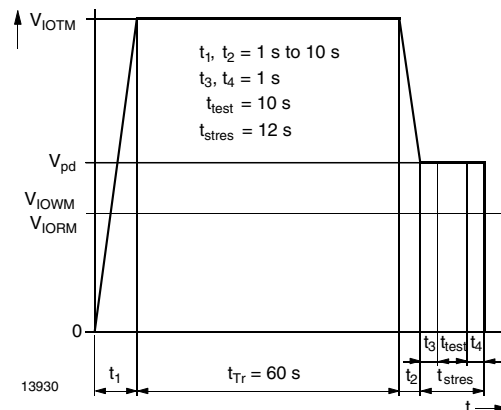


Fig. 5 - Test Pulse Diagram for Sample Test According to DIN EN 60747-5-5 (VDE 0884-5); IEC60747-5-5



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

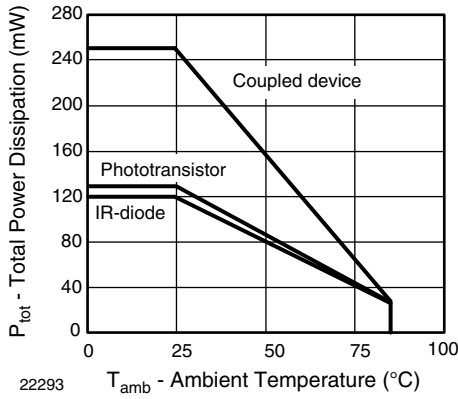


Fig. 6 - Total Power Dissipation vs. Ambient Temperature

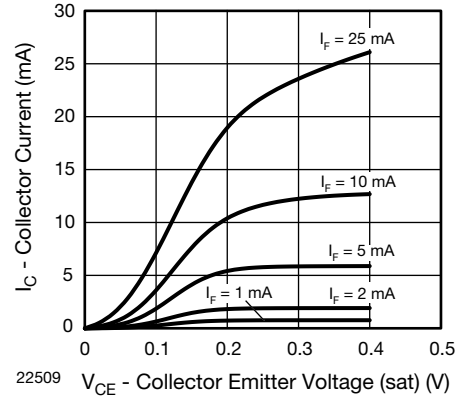


Fig. 9 - Collector Current vs. Collector Emitter Voltage

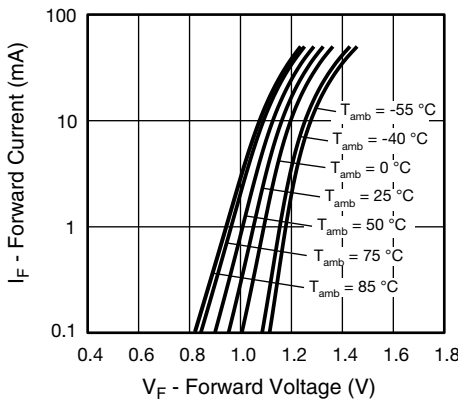


Fig. 7 - Forward Current vs. Forward Voltage

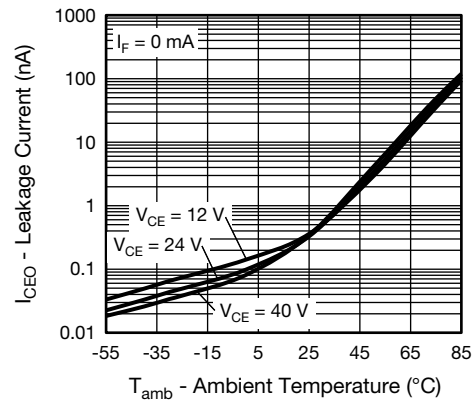


Fig. 10 - Leakage Current vs. Ambient Temperature

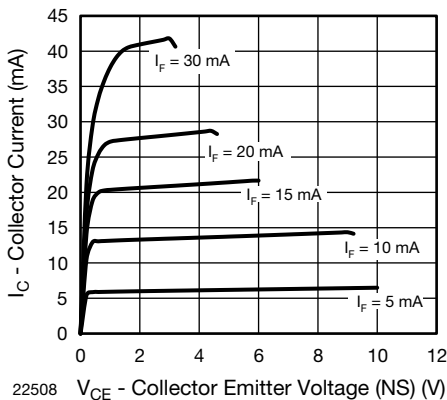


Fig. 8 - Collector Current vs. Collector Emitter Voltage (non-saturated)

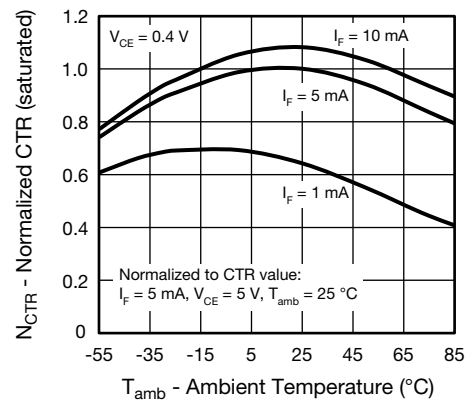


Fig. 11 - Normalized CTR (saturated) vs. Ambient Temperature

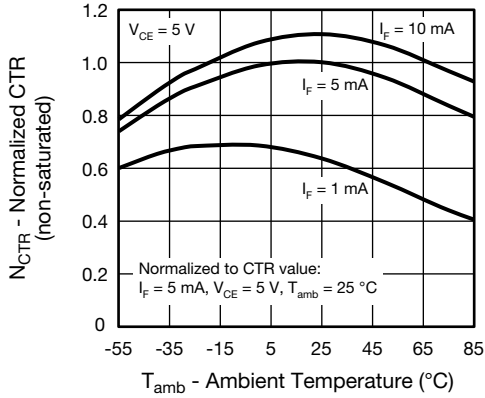


Fig. 12 - Normalized CTR (non-saturated) vs. Ambient Temperature

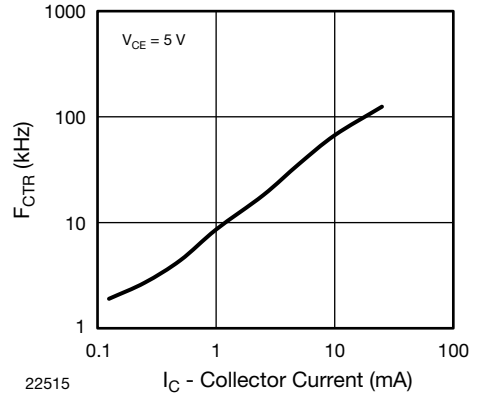


Fig. 15 - F\_CTR vs. Collector Current

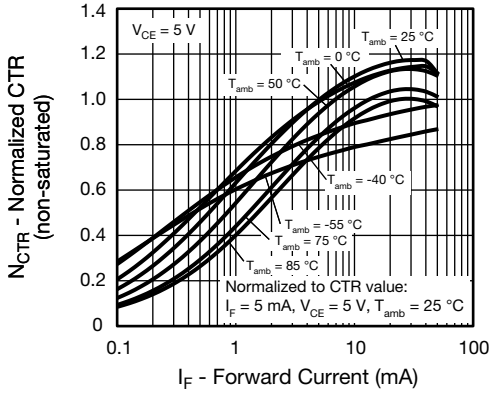


Fig. 13 - Normalized CTR (non-saturated) vs. Forward Current

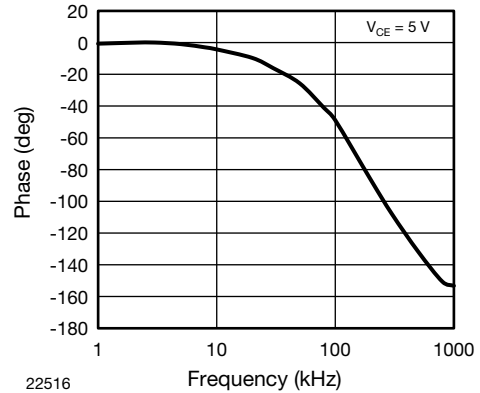


Fig. 16 - F\_CTR vs. Phase Angle

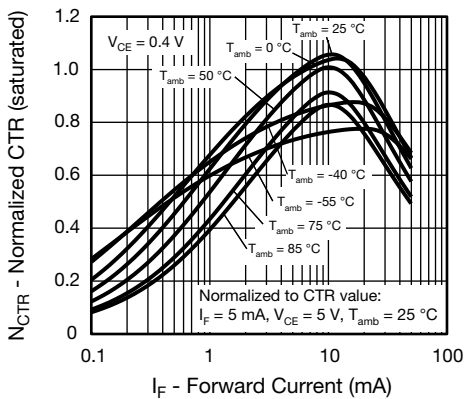


Fig. 14 - Normalized CTR (saturated) vs. Forward Current

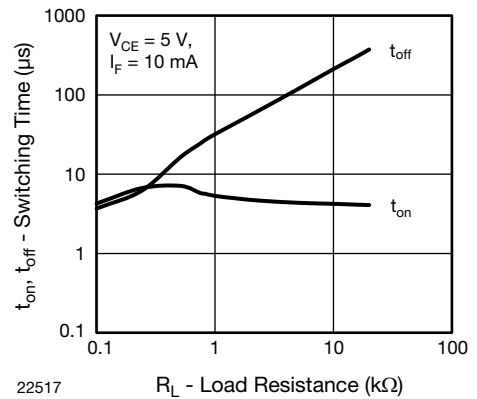
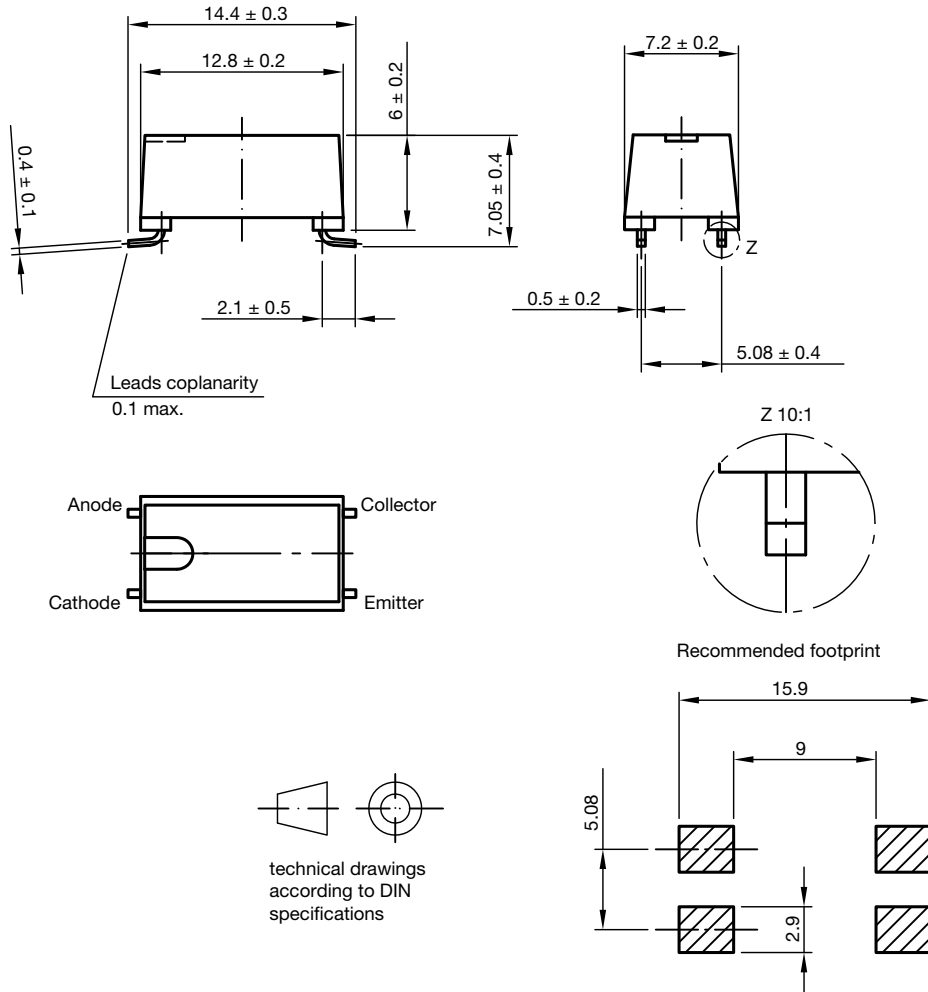


Fig. 17 - Switching Time vs. Load Resistance

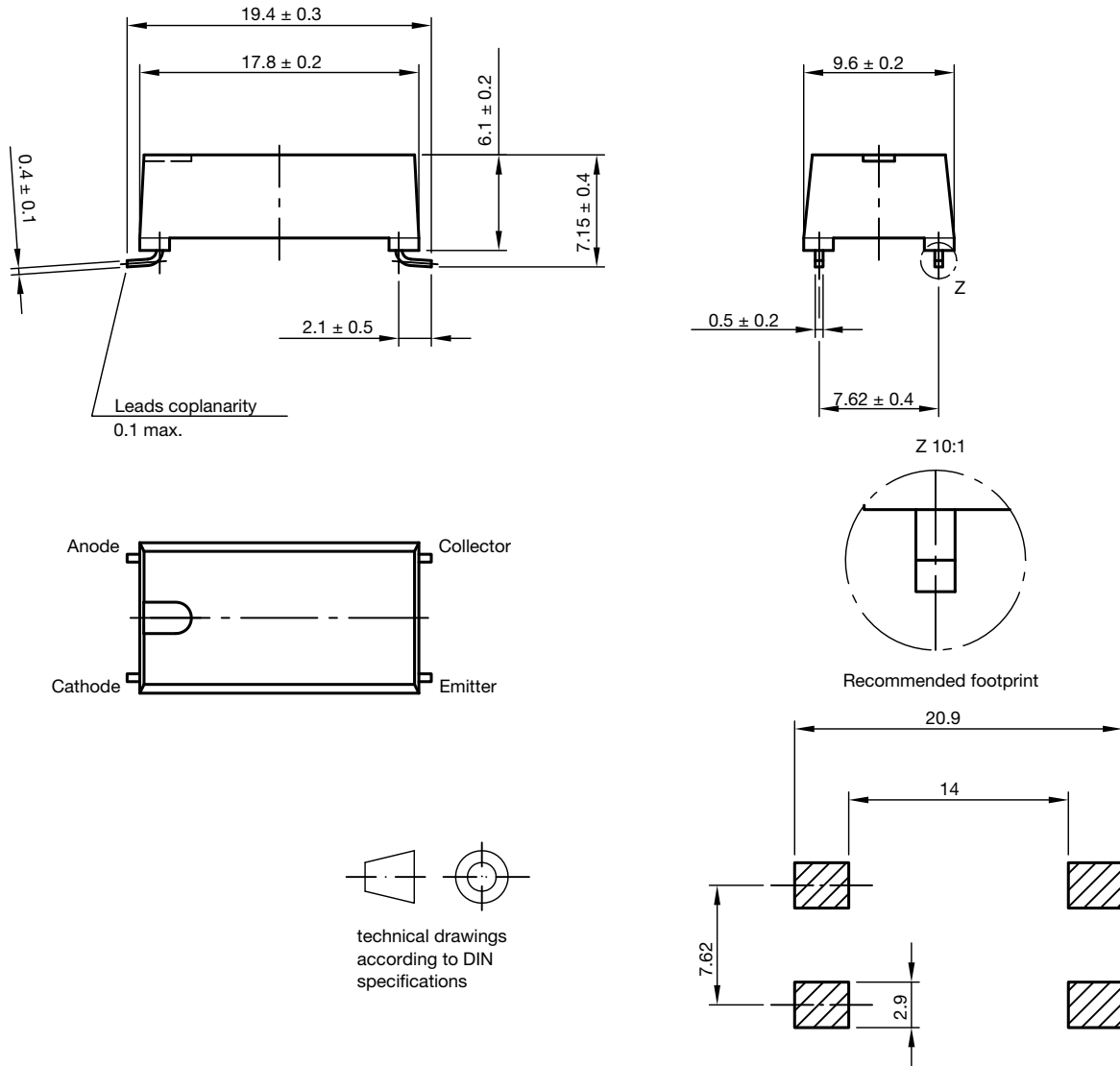


**PACKAGE DIMENSIONS** in millimeters **FOR CNY64A...ST**

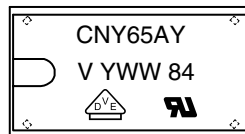




PACKAGE DIMENSIONS in millimeters FOR CNY65A...ST



PACKAGE MARKING (Example)



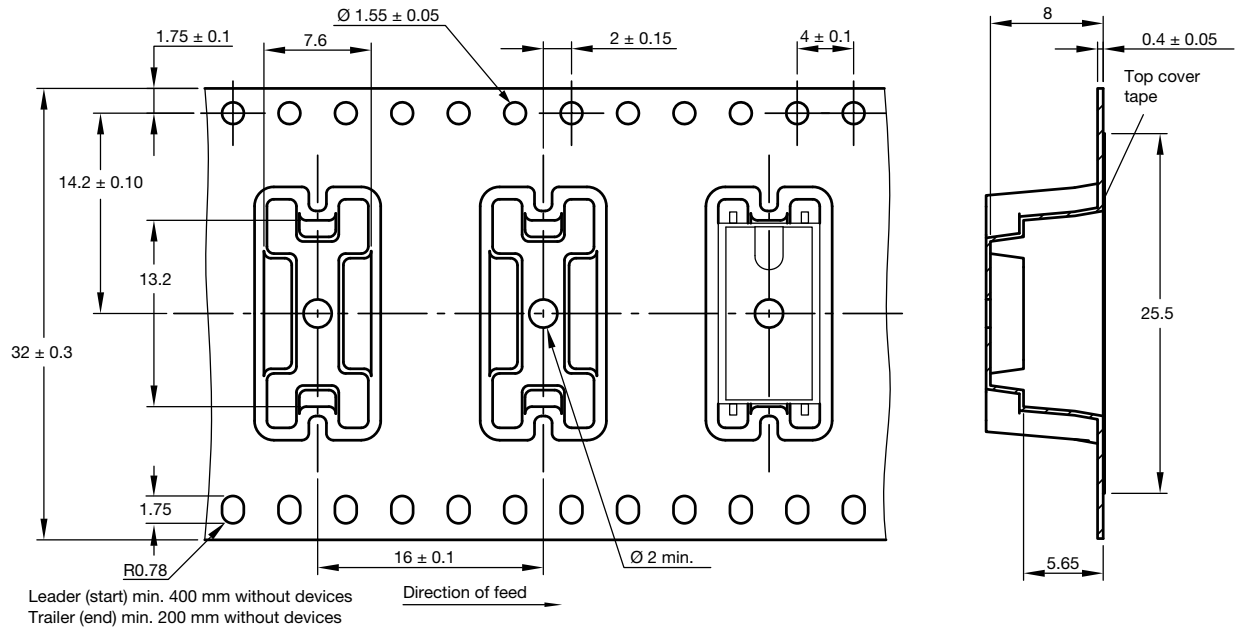
Note

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

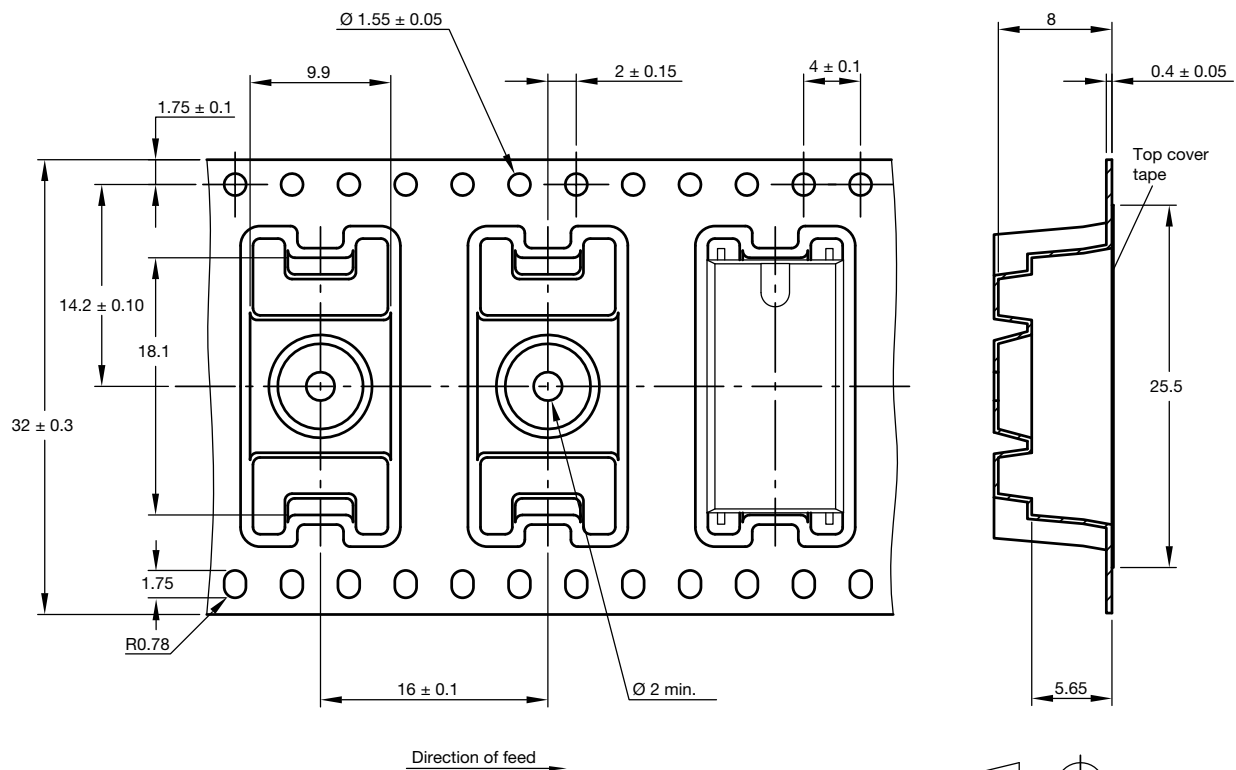




TAPE DIMENSIONS in millimeters FOR CNY64A...ST

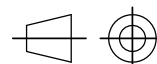


TAPE DIMENSIONS in millimeters FOR CNY65A...ST



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

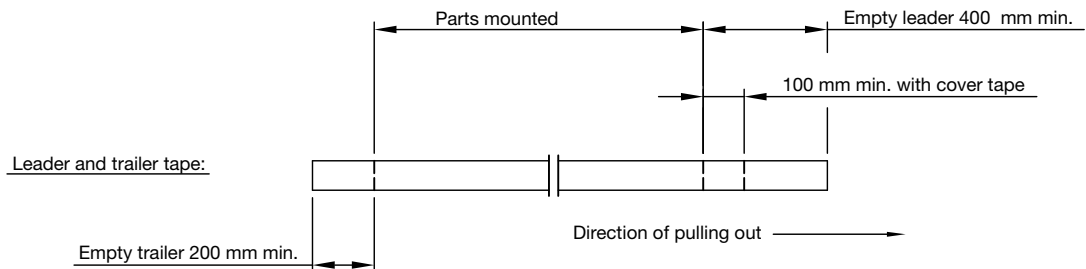
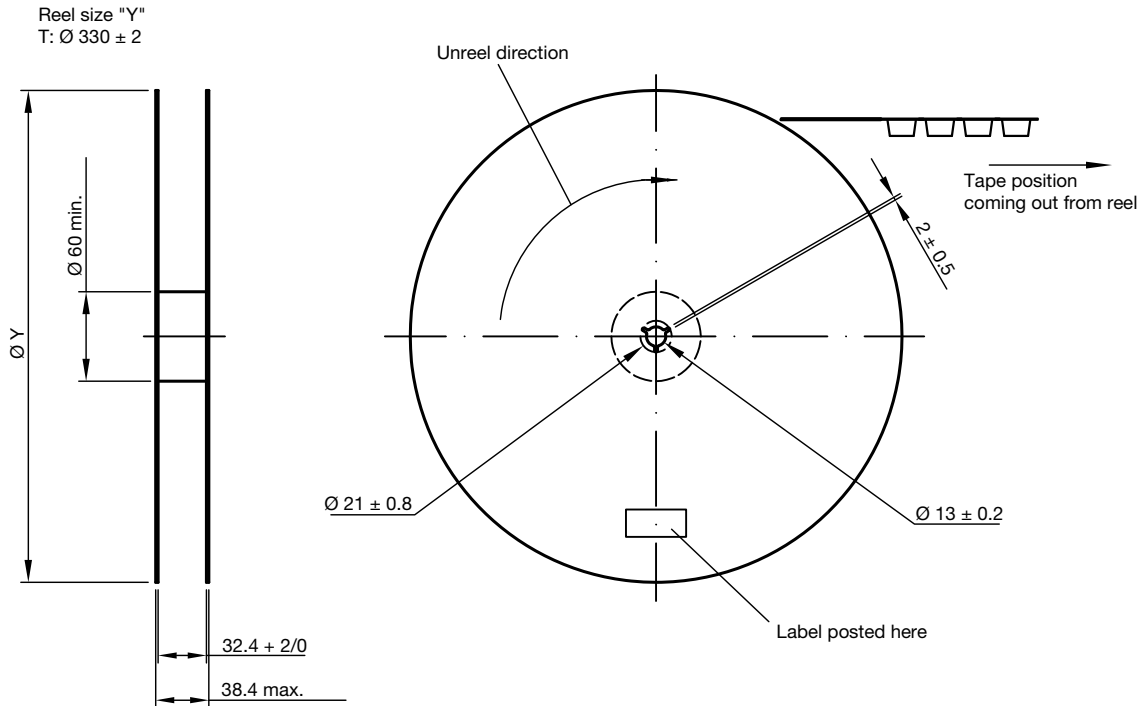
Drawing-No.: 9.700-5376.01-4  
Issue: 1; 23.05.11



technical drawings according to DIN specifications

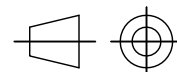


**REEL DIMENSIONS** in millimeters



Not indicated tolerances  $\pm 0.1$

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



technical drawings according to DIN specifications

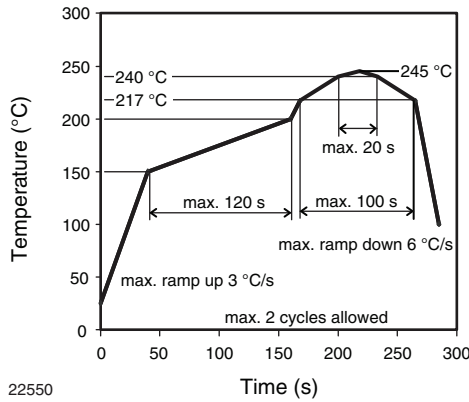
TAPE AND REEL INFORMATION			
TYPE	UNITS/REEL	REELS/BOX	UNITS/BOX
CNY64	400	2	800
CNY65	400	2	800



**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)



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