

Optocoupler with Phototransistor Output

Description

The CNY64/ CNY65/ CNY66 consist of a phototransistor optically coupled to a gallium arsenide infrared-emitting diode in a 4-lead plastic package. The single components are mounted in opposite one-another, providing a distance between input and output for highest safety requirements of > 3 mm.

Applications

Circuits for safe protective separation against electrical shock according to safety class II (reinforced isolation):

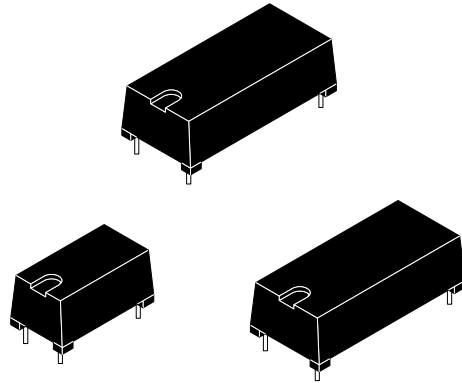
- For appl. class I – IV at mains voltage ≤ 300 V
- For appl. class I – IV at mains voltage ≤ 600 V
- For appl. class I – III at mains voltage ≤ 1000 V according to VDE 0884, table 2, suitable for:

Switch-mode power supplies, line receiver, computer peripheral interface, microprocessor system interface.

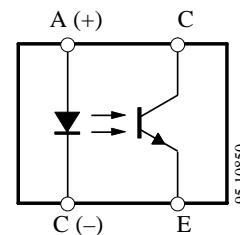
VDE Standards

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

- **VDE 0884**
Optocoupler for electrical safety requirements
- **IEC 950/EN 60950**
Office machines (applied for reinforced isolation for mains voltage ≤ 400 V_{RMS})
- **VDE 0804**
Telecommunication apparatus and data processing
- **IEC 65**
Safety for mains-operated electronic and related household apparatus
- **VDE 0700/IEC 335**
Household equipment
- **VDE 0160**
Electronic equipment for electrical power installation
- **VDE 0750/IEC 601**
Medical equipment



14832



95 10850


0884



Order Instruction

Ordering Code	CTR Ranking	Remarks
CNY64/ CNY65/ CNY66	50 to 300%	
CNY64A/ CNY65A	63 to 125%	
CNY64B/ CNY65B	100 to 200%	

Features

Approvals:

- Underwriters Laboratory (UL) 1577 recognized, file number E-76222
- VDE 0884, Certificate number 76814

VDE 0884 related features:

- Rated impulse voltage (transient overvoltage) $V_{IOTM} = 8 \text{ kV peak}$
- Isolation test voltage (partial discharge test voltage) $V_{pd} = 2.8 \text{ kV peak}$

- Rated insulation voltage (RMS includes DC) $V_{IOWM} = 1000 V_{RMS}$ (1450 V peak)
- Rated recurring peak voltage (repetitive) $V_{IORM} = 1000 V_{RMS}$
- Creepage current resistance according to VDE 0303/IEC 112
Comparative Tracking Index: **CTI** = 200
- Thickness through insulation > 3 mm
- Coupling Systems:
CNY64 Coupling System H,
CNY65 Coupling System J,
CNY66 Coupling System K,

Absolute Maximum Ratings

Input (Emitter)

Parameter	Test Conditions	Symbol	Value	Unit
Reverse voltage		V_R	5	V
Forward current		I_F	75	mA
Forward surge current	$t_p \leq 10 \mu\text{s}$	I_{FSM}	1.5	A
Power dissipation	$T_{amb} \leq 25^\circ\text{C}$	P_V	120	mW
Junction temperature		T_j	100	$^\circ\text{C}$

Output (Detector)

Parameter	Test Conditions	Symbol	Value	Unit
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	$T_{amb} \leq 25^\circ\text{C}$	P_V	130	mW
Junction temperature		T_j	100	$^\circ\text{C}$

Coupler

Parameter	Test Conditions	Symbol	Value	Unit
AC isolation test voltage (RMS)	$t = 1 \text{ min}$	V_{IO}	8.2	kV
Total power dissipation	$T_{amb} \leq 25^\circ\text{C}$	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, $t \leq 10 \text{ s}$	T_{sd}	260	$^\circ\text{C}$

**Electrical Characteristics** ($T_{amb} = 25^{\circ}\text{C}$)

Input (Emitter)

Parameter	Test Conditions	Symbol	Min.	Typ.	Max.	Unit
Forward voltage	$I_F = 50\text{ mA}$	V_F		1.25	1.6	V
Junction capacitance	$V_R = 0, f = 1\text{ MHz}$	C_j		50		pF

Output (Detector)

Parameter	Test Conditions	Symbol	Min.	Typ.	Max.	Unit
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 cut-off current	$V_{CE} = 20\text{ V}, I_f = 0$	I_{CEO}			200	nA

Coupler

Parameter	Test Conditions	Symbol	Min.	Typ.	Max.	Unit
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

Current Transfer Ratio (CTR)

Parameter	Test Conditions	Type	Symbol	Min.	Typ.	Max.	Unit
I_C/I_F	$V_{CE} = 5\text{ V}, I_F = 10\text{ mA}$	CNY64, CNY65, CNY66	CTR	0.5	1	3	
		CNY64A, CNY65A	CTR	0.63		1.25	
		CNY64B, CNY65B	CTR	1		2	



Maximum Safety Ratings (according to VDE 0884) see figure 1

This device is used for protective separation against electrical shock only within the maximum safety ratings. This must be ensured by using protective circuits in the applications.

Input (Emitter)

Parameters	Test Conditions	Symbol	Value	Unit
Forward current		I_{si}	120	mA

Output (Detector)

Parameters	Test Conditions	Symbol	Value	Unit
Power dissipation	$T_{amb} \leq 25^\circ\text{C}$	P_{si}	250	mW

Coupler

Parameters	Test Conditions	Symbol	Value	Unit
Rated impulse voltage		V_{IOTM}	8	kV
Safety temperature		T_{si}	180	$^\circ\text{C}$

Insulation Rated Parameters (according to VDE 0884)

Parameter	Test Conditions	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_{IOTM}	8			kV
		V_{pd}	2.2			kV
Insulation resistance	$V_{IO} = 500\text{ V}$	R_{IO}	10^{12}			Ω
	$V_{IO} = 500\text{ V}$, $T_{amb} = 100^\circ\text{C}$	R_{IO}	10^{11}			Ω
	$V_{IO} = 500\text{ V}$, $T_{amb} = 180^\circ\text{C}$ (construction test only)	R_{IO}	10^9			Ω

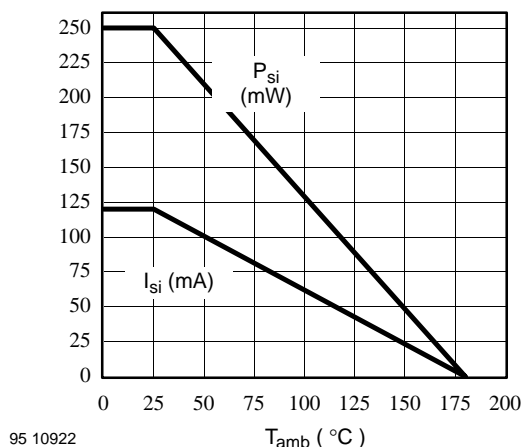


Figure 1. Derating diagram

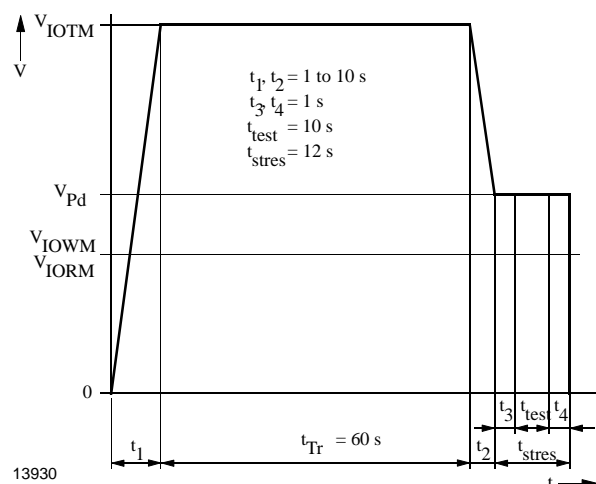


Figure 2. Test pulse diagram for sample test according to DIN VDE 0884

Switching Characteristics

Parameter	Test Conditions	Symbol	Typ.	Unit
Delay time	$V_S = 5\text{ V}$, $I_C = 5\text{ mA}$, $R_L = 100\ \Omega$ (see figure 3)	t_d	2.6	μs
Rise time		t_r	2.4	μs
Fall time		t_f	2.7	μs
Storage time		t_s	0.3	μs
Turn-on time		t_{on}	5.0	μs
Turn-off time		t_{off}	3.0	μs
Turn-on time	$V_S = 5\text{ V}$, $I_F = 10\text{ mA}$, $R_L = 1\text{ k}\Omega$ (see figure 4)	t_{on}	25.0	μs
Turn-off time		t_{off}	42.5	μs

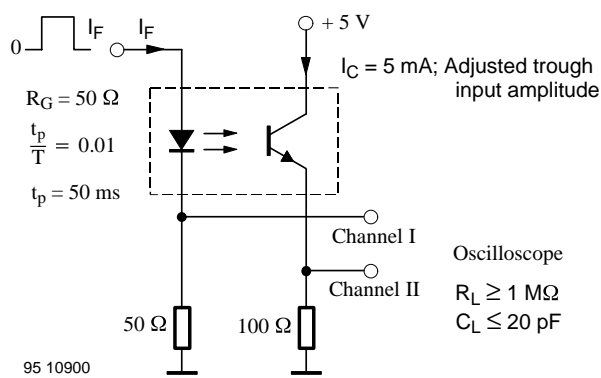


Figure 3. Test circuit, non-saturated operation

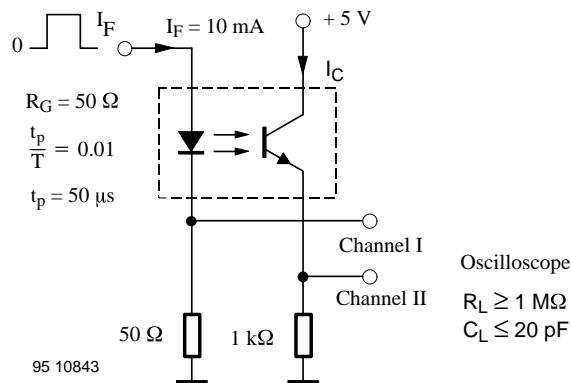


Figure 4. Test circuit, saturated operation

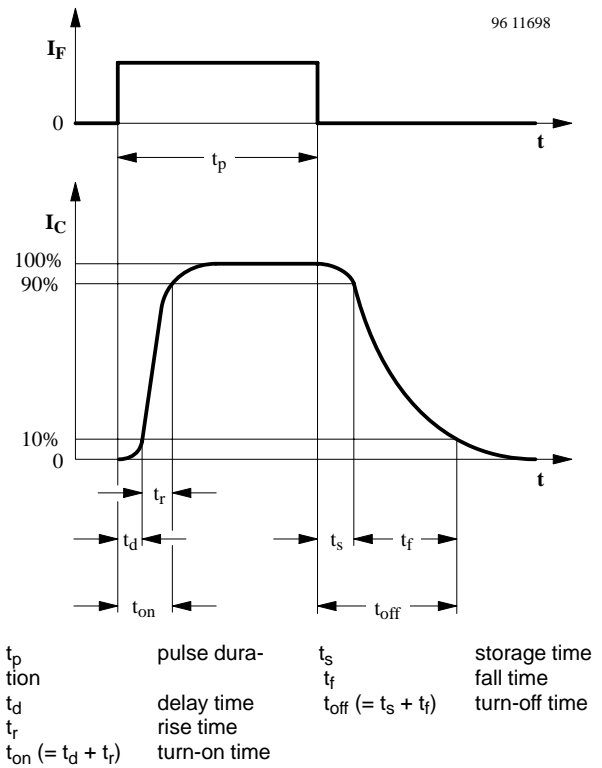


Figure 5. Switching times

Typical Characteristics ($T_{amb} = 25^{\circ}\text{C}$, unless otherwise specified)

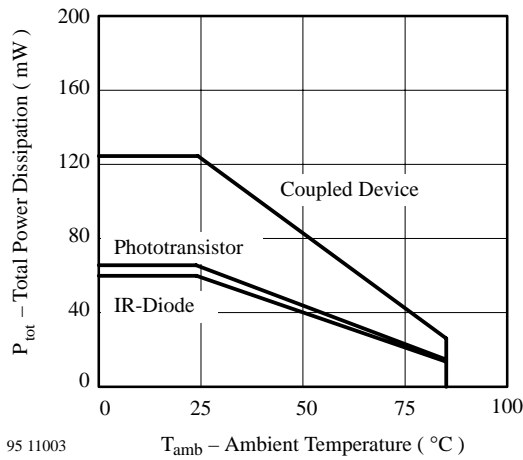


Figure 6. Total Power Dissipation vs. Ambient Temperature

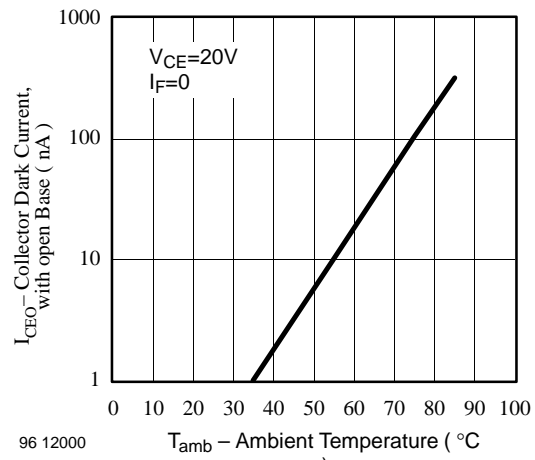


Figure 9. Collector Dark Current vs. Ambient Temperature

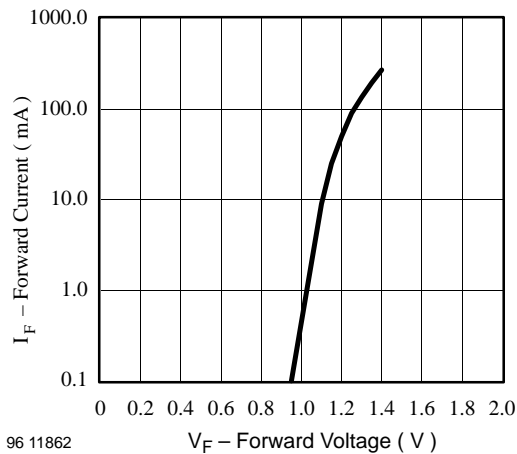


Figure 7. Forward Current vs. Forward Voltage

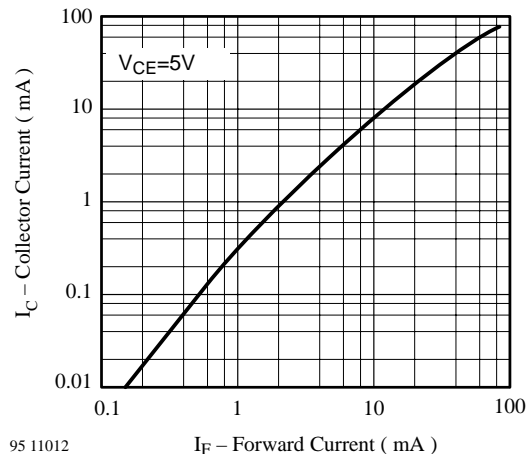


Figure 10. Collector Current vs. Forward Current

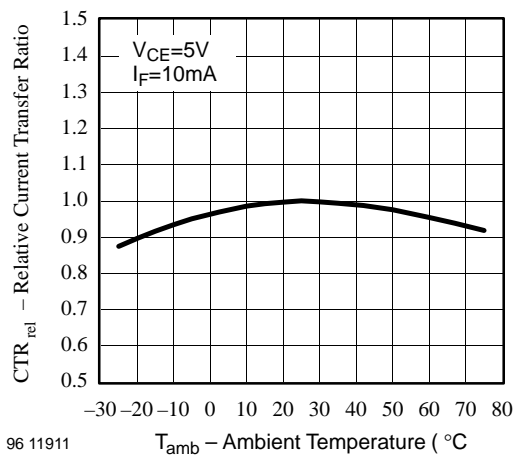


Figure 8. Relative Current Transfer Ratio vs. Ambient Temperature

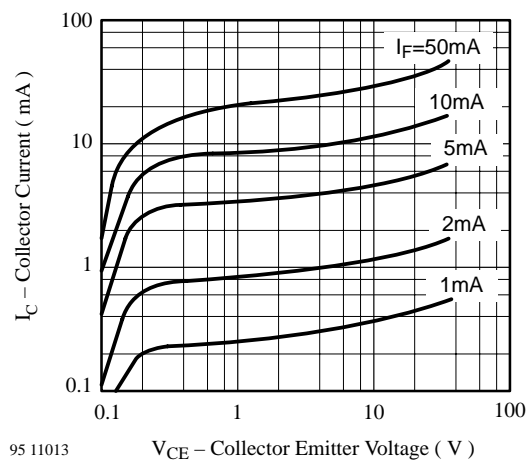
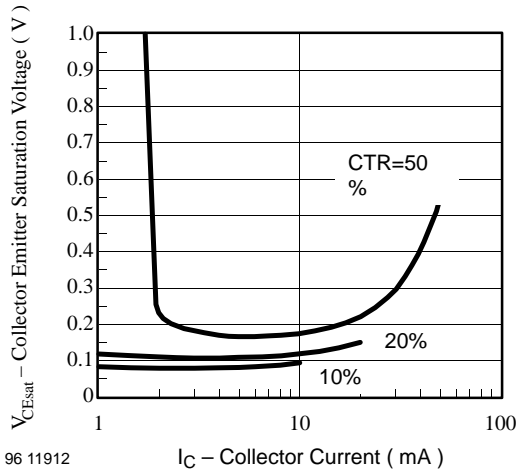
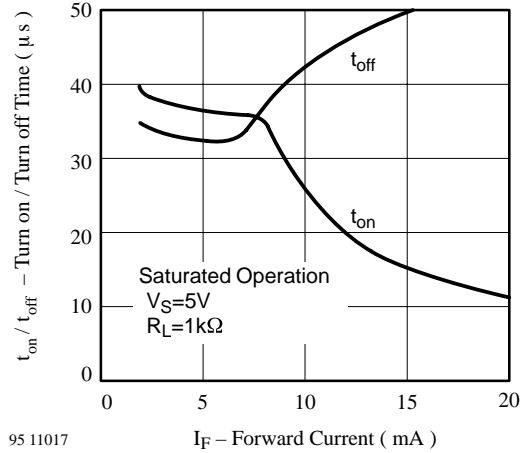


Figure 11. Collector Current vs. Collector Emitter Voltage



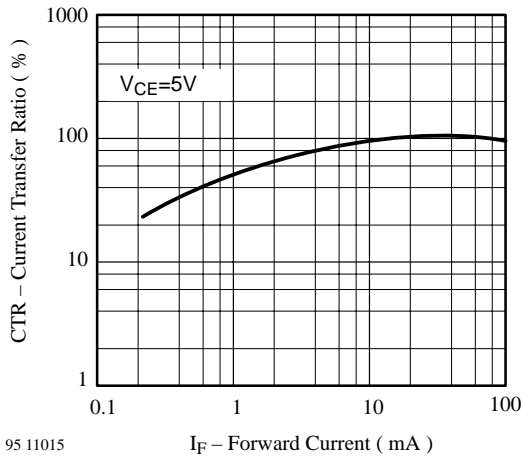
96 11912 I_C – Collector Current (mA)

Figure 12. Collector Emitter Saturation Voltage vs. Collector Current



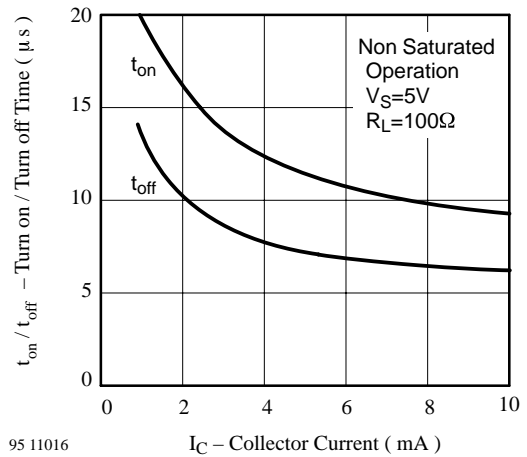
95 11017 I_F – Forward Current (mA)

Figure 14. Turn on / off Time vs. Forward Current



95 11015 I_F – Forward Current (mA)

Figure 13. Current Transfer Ratio vs. Forward Current



95 11016 I_C – Collector Current (mA)

Figure 15. Turn on / off Time vs. Collector Current

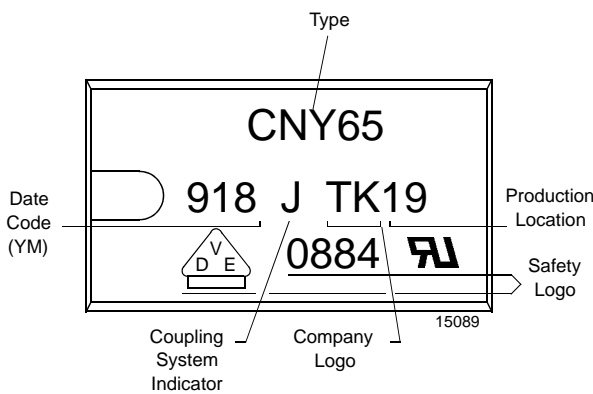
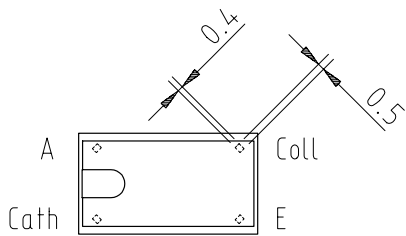
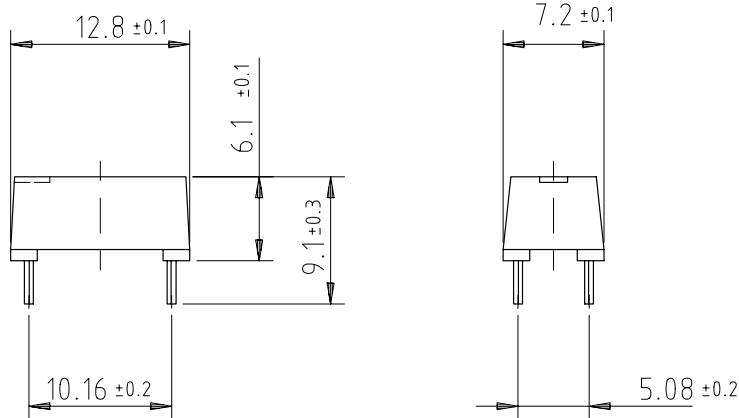


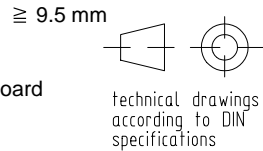
Figure 16. Marking example

Dimensions of CNY64 in mm



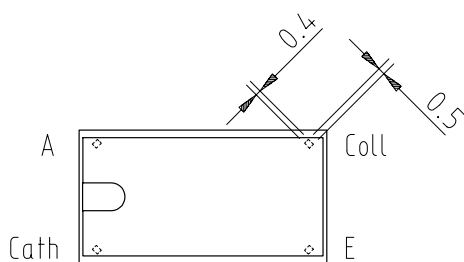
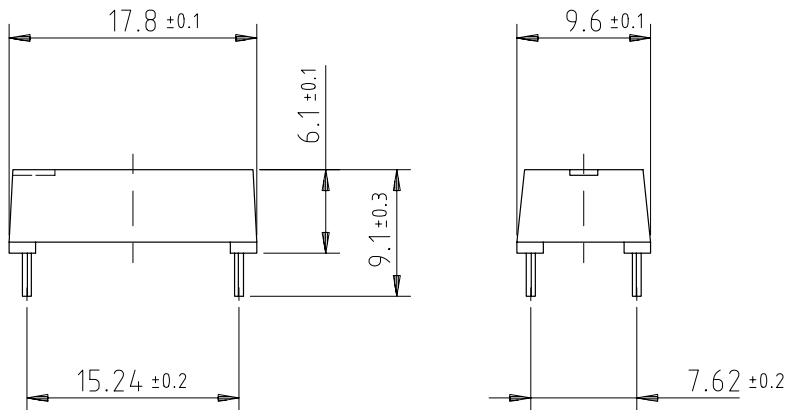
weight: ca. 0.73 g
 creepage distance:
 air path: ≥ 9.5 mm

after mounting on PC board



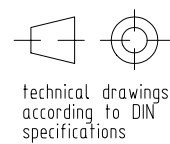
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Dimensions of CNY65 in mm



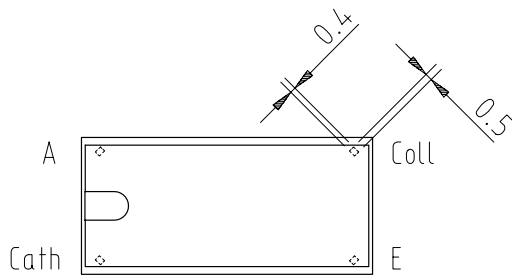
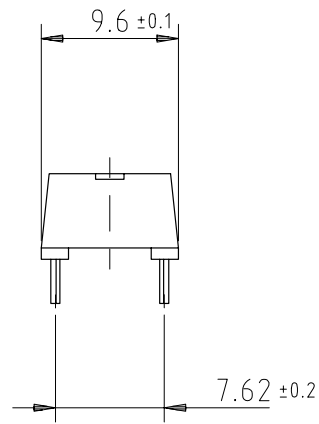
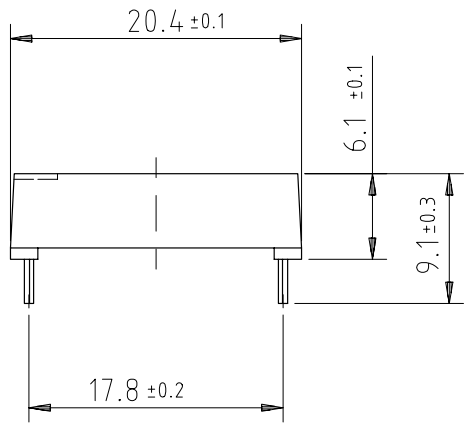
weight: ca. 1.40 g
 creepage distance: ≥ 14 mm
 air path: ≥ 14 mm

after mounting on PC board



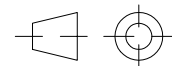
14763

Dimensions of CNY66 in mm



weight: ca. 1.70 g
 creepage distance: ≥ 17 mm
 air path: ≥ 17 mm

after mounting on PC board



technical drawings
 according to DIN
 specifications

14764