

## Optocoupler, Phototransistor Output, Very High Isolation Voltage



### DESCRIPTION

The CNY64, CNY65, and CNY66 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 60950/EN 60950**  
Office machines
- **VDE 0804**  
Telecommunication apparatus and data processing
- **IEC60065**  
Safety for mains-operated electronic and related household apparatus
- **VDE 0700/IEC 60335**  
Household equipment
- **VDE 0160**  
Electronic equipment for electrical power installation
- **VDE 0750/IEC60601**  
Medical equipment

### 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  $\geq 200$**
- Compliant to RoHS Directive 2002/95/EC and in accordance to WEEE 2002/96/EC



**RoHS**  
COMPLIANT

### APPLICATIONS

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

- for appl. class I - IV at mains voltage  $\leq 300$  V
- for appl. class I - IV at mains voltage  $\leq 600$  V
- for appl. class I - III at mains voltage  $\leq 1000$  V according to DIN EN 60747-5-2 (VDE 0884), suitable for:
  - Switch-mode power supplies
  - Line receiver
  - Computer peripheral interface
  - Microprocessor system interface

### AGENCY APPROVALS

- UL1577, file no. E76222 system code H, J, and K
- DIN EN 60747-5-2 (VDE 0884)/DIN EN 60747-5-5 (pending), available with option 1
- 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   |  |   |   |
|--|--|---|---|
| <div style="display: flex; justify-content: space-around; align-items: center;"> <div style="border: 1px solid black; padding: 5px; margin: 2px;">C</div> <div style="border: 1px solid black; padding: 5px; margin: 2px;">N</div> <div style="border: 1px solid black; padding: 5px; margin: 2px;">Y</div> <div style="border: 1px solid black; padding: 5px; margin: 2px;">6</div> </div> <p style="text-align: center;">PART NUMBER</p> | <div style="border: 1px solid black; padding: 5px; margin: 2px;">#</div> <p>PACKAGE OPTION</p> | <div style="border: 1px solid black; padding: 5px; margin: 2px;">x</div> <p>CTR BIN</p> | <div style="display: flex; justify-content: space-around; align-items: center;"> <div style="text-align: center;"> <p>DIP, 400 mil</p> <p>10.16 mm</p> </div> <div style="text-align: center;"> <p>DIP, 600 mil</p> <p>15.24 mm</p> </div> <div style="text-align: center;"> <p>DIP, 700 mil</p> <p>17.8 mm</p> </div> </div> |
| AGENCY CERTIFIED/PACKAGE   | CTR (%)  |   |   |
| <b>UL, VDE</b>   | <b>50 to 300</b>   | <b>63 to 125</b>  | <b>100 to 200</b>   |
| DIP-4 HV, 400 mil, high isolation distance   | CNY64  | CNY64A  | CNY64B  |
| DIP-4 HV, 600 mil, high isolation distance   | CNY65  | CNY65A  | CNY65B  |
| DIP-4 HV, 700 mil, high isolation distance   | CNY66  | -   | CNY66B  |

| <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 CNY64  | $t = 1\text{ min}$                   | $V_{ISO}$  | 8200          | $V_{RMS}$          |
| DC isolation test voltage CNY65  | $t = 1\text{ s}$                     | $V_{ISO}$  | 13.9          | kV                 |
| DC isolation test voltage CNY66  | $t = 1\text{ s}$                     | $V_{ISO}$  | 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  | $I_F = 50\text{ mA}$   | $V_F$       |      | 1.25 | 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  | $V_{CE} = 20\text{ V}, I_F = 0\text{ A}$                           | $I_{CEO}$   |      |      | 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 |
| $I_C/I_F$   | $V_{CE} = 5\text{ V}$ , $I_F = 10\text{ mA}$ | CNY64,<br>CNY65,<br>CNY66 | CTR    | 50   |      | 300  | %    |
|   |  | CNY64A                    | CTR    | 63   |      | 125  | %    |
|   |  | CNY65A                    | CTR    | 63   |      | 125  | %    |
|   |  | CNY64B                    | CTR    | 100  |      | 200  | %    |
|   |  | CNY65B                    | CTR    | 100  |      | 200  | %    |
|   |  | CNY66B                    | CTR    | 100  |      | 200  | %    |

| SAFETY AND INSULATION RATED PARAMETERS                  |   |            |           |      |      |      |                    |
|---|---|------------|-----------|------|------|------|--------------------|
| PARAMETER   | TEST CONDITION  | 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) | $t_{Tr} = 60\text{ s}$ , $t_{test} = 10\text{ s}$ ,<br>(see fig. 2)                           | $V_{pd}$   | 2.2       |      |      |      | kV                 |
| Insulation resistance                                   | $V_{IO} = 500\text{ V}$ , $T_{amb} = 25\text{ }^{\circ}\text{C}$                              | $R_{IO}$   | $10^{12}$ |      |      |      | $\Omega$           |
|   | $V_{IO} = 500\text{ V}$ , $T_{amb} = 100\text{ }^{\circ}\text{C}$                             | $R_{IO}$   | $10^{11}$ |      |      |      | $\Omega$           |
|   | $V_{IO} = 500\text{ V}$ , $T_{amb} = 150\text{ }^{\circ}\text{C}$<br>(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  |      | $^{\circ}\text{C}$ |

**Note**

- According to DIN EN 60747-5-2 (see fig. 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.

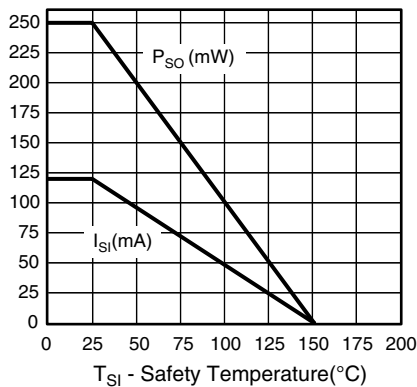


Fig. 1 - Safety Derating Diagram

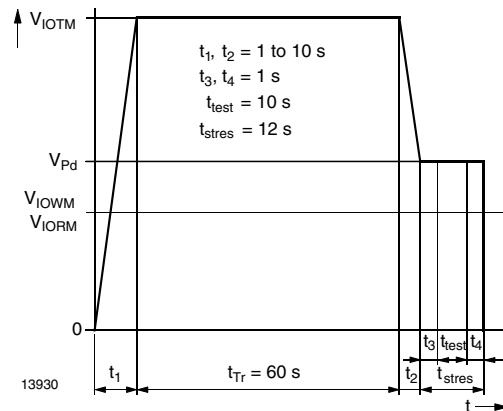


Fig. 2 - Test Pulse Diagram for Sample Test According to DIN EN 60747-5-2 (VDE 0884); IEC60747-5-5

| SWITCHING CHARACTERISTICS ( $T_{amb} = 25\text{ }^{\circ}\text{C}$ , unless otherwise specified) |   |           |      |      |      |               |
|--|---|-----------|------|------|------|---------------|
| PARAMETER  | TEST CONDITION  | SYMBOL    | MIN. | TYP. | MAX. | UNIT          |
| Delay time   | $V_S = 5\text{ V}$ , $I_C = 5\text{ mA}$ , $R_L = 100\text{ }\Omega$ , (see fig. 3) | $t_d$     |      | 2.6  |      | $\mu\text{s}$ |
| Rise time  | $V_S = 5\text{ V}$ , $I_C = 5\text{ mA}$ , $R_L = 100\text{ }\Omega$ , (see fig. 3) | $t_r$     |      | 2.4  |      | $\mu\text{s}$ |
| Fall time  | $V_S = 5\text{ V}$ , $I_C = 5\text{ mA}$ , $R_L = 100\text{ }\Omega$ , (see fig. 3) | $t_f$     |      | 2.7  |      | $\mu\text{s}$ |
| Storage time   | $V_S = 5\text{ V}$ , $I_C = 5\text{ mA}$ , $R_L = 100\text{ }\Omega$ , (see fig. 3) | $t_s$     |      | 0.3  |      | $\mu\text{s}$ |
| Turn-on time   | $V_S = 5\text{ V}$ , $I_C = 5\text{ mA}$ , $R_L = 100\text{ }\Omega$ , (see fig. 3) | $t_{on}$  |      | 5    |      | $\mu\text{s}$ |
| Turn-off time  | $V_S = 5\text{ V}$ , $I_C = 5\text{ mA}$ , $R_L = 100\text{ }\Omega$ , (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 |      | $\mu\text{s}$ |

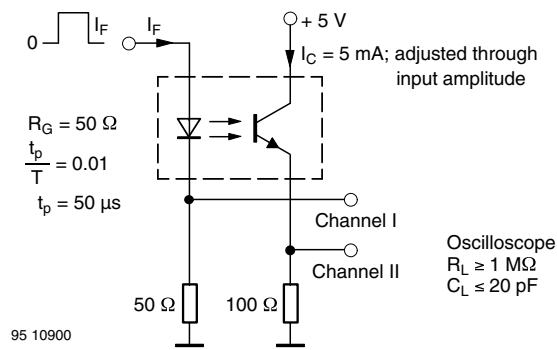


Fig. 3 - Test Circuit, Non-Saturated Operation

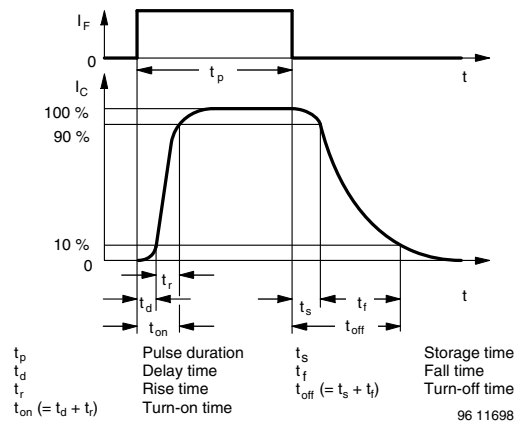


Fig. 5 - Switching Times



Fig. 4 - Test Circuit, Saturated Operation

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

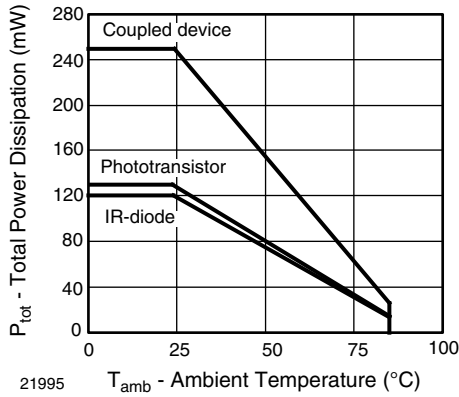


Fig. 6 - Total Power Dissipation vs. Ambient Temperature

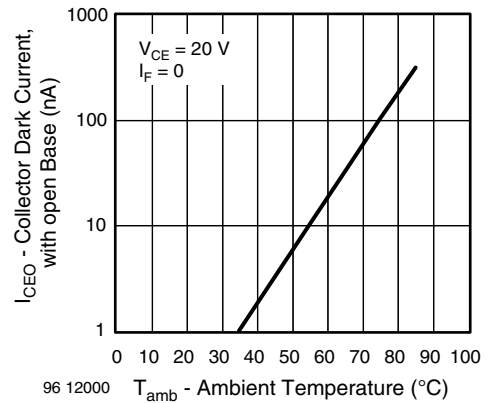


Fig. 9 - Collector Dark Current vs. Ambient Temperature

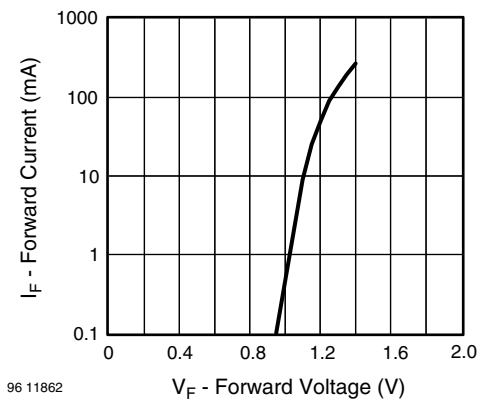


Fig. 7 - Forward Current vs. Forward Voltage

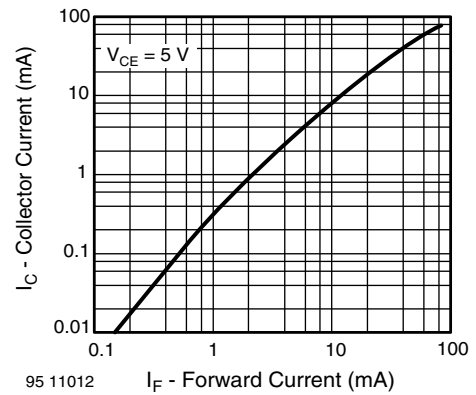


Fig. 10 - Collector Current vs. Forward Current

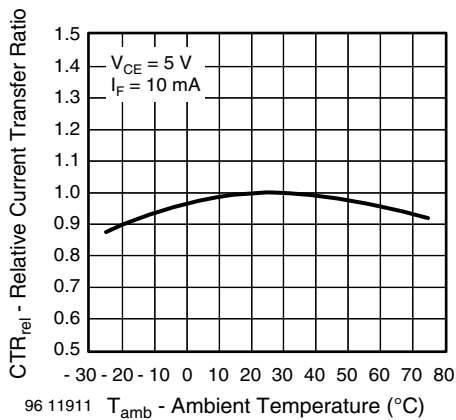


Fig. 8 - Relative Current Transfer Ratio vs. Ambient Temperature

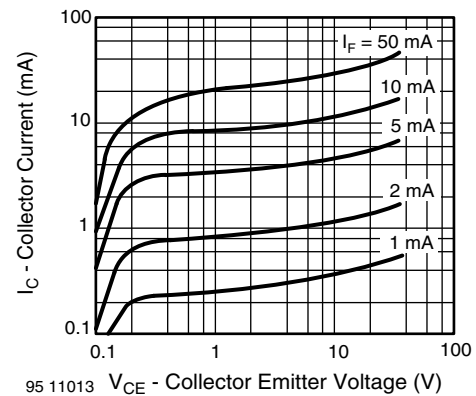


Fig. 11 - Collector Current vs. Collector Emitter Voltage



Fig. 12 - Collector Emitter Saturation Voltage vs. Collector Current



Fig. 15 - Turn-on/Turn-off Time vs. Forward Current

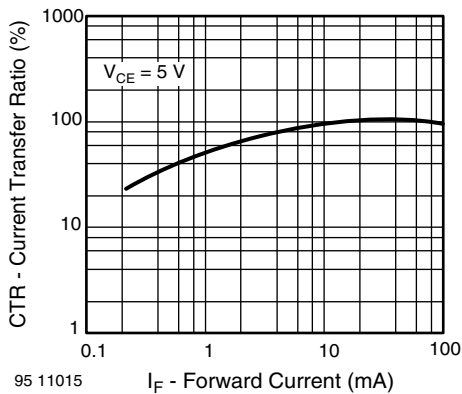


Fig. 13 - Current Transfer Ratio vs. Forward Current

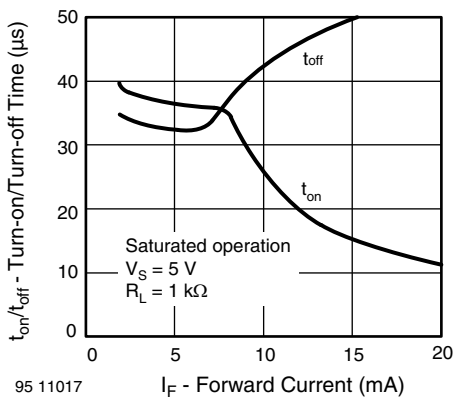


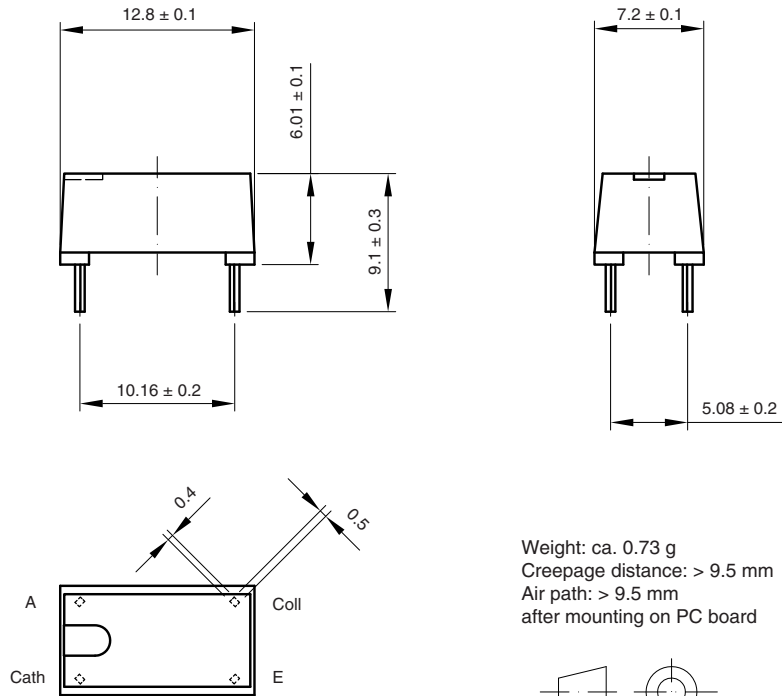
Fig. 14 - Turn-on/Turn-off Time vs. Collector Current



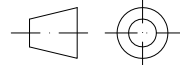
# CNY64, CNY65, CNY66

Optocoupler, Phototransistor Output, Vishay Semiconductors  
Very High Isolation Voltage

## PACKAGE DIMENSIONS in millimeters FOR CNY64



Weight: ca. 0.73 g  
Creepage distance: > 9.5 mm  
Air path: > 9.5 mm  
after mounting on PC board



technical drawings  
according to DIN  
specifications

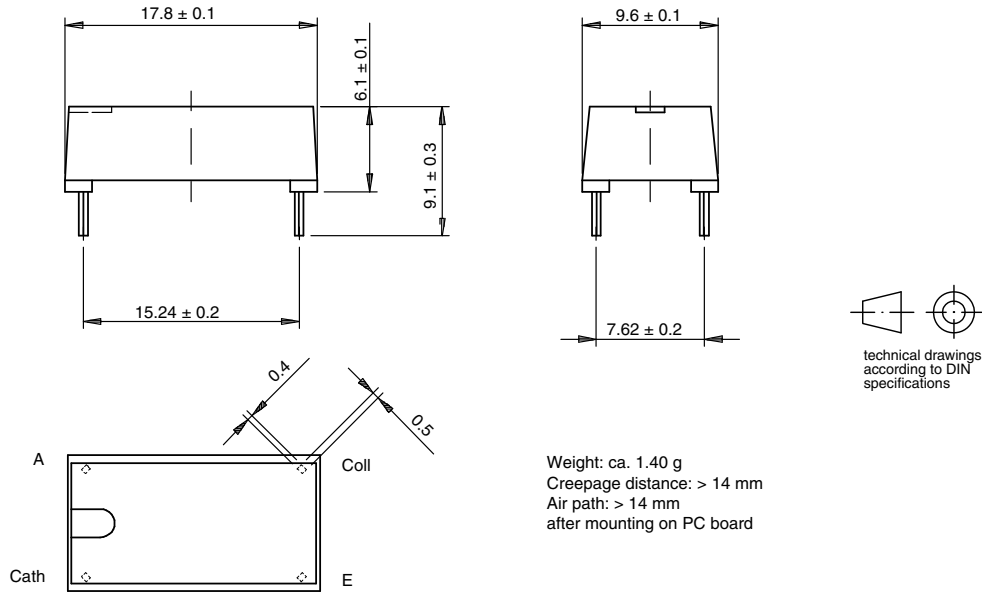
Drawing-No.: 6.544-5038.01-4  
Issue: 2; 10.11.98  
14765

# CNY64, CNY65, CNY66



Vishay Semiconductors Optocoupler, Phototransistor Output,  
Very High Isolation Voltage

## PACKAGE DIMENSIONS in millimeters FOR CNY65

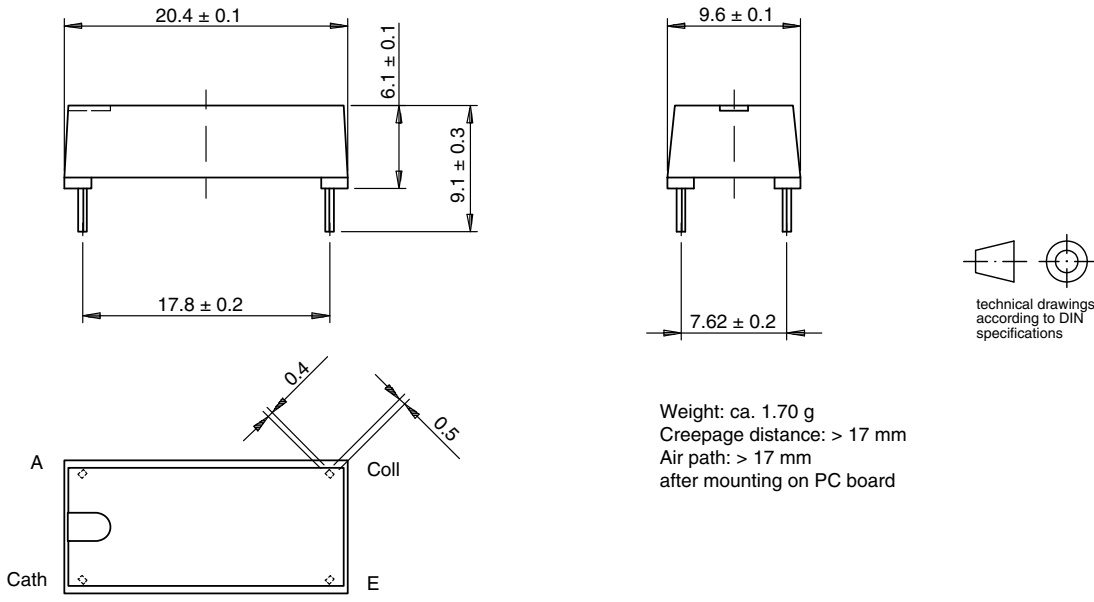


technical drawings according to DIN specifications

Weight: ca. 1.40 g  
Creepage distance: > 14 mm  
Air path: > 14 mm  
after mounting on PC board

Drawing-No.: 6.544-5036.01-1  
Issue: 2; 10.11.98  
14763

## PACKAGE DIMENSIONS in millimeters FOR CNY66

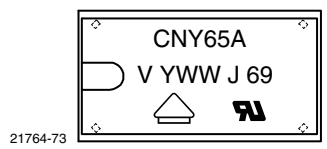


technical drawings according to DIN specifications

Weight: ca. 1.70 g  
Creepage distance: > 17 mm  
Air path: > 17 mm  
after mounting on PC board

Drawing-No.: 6.544-5037.01-4  
Issue: x; 10.11.98  
14764

## PACKAGE MARKING







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