

## Optocoupler, Phototransistor Output

### Features

- Special construction:  
Therefore, extra low coupling capacity of typical 0.2 pF, high **Common Mode Rejection**
- Low temperature coefficient of CTR
- Rated isolation voltage (RMS includes DC)  
 $V_{IOWM} = 600 V_{RMS}$  (848 V peak)
- Rated recurring peak voltage (repetitive)  
 $V_{IORM} = 600 V_{RMS}$
- Thickness through insulation  $\geq 0.75$  mm
- Creepage current resistance according to VDE 0303/IEC 60112  
**Comparative Tracking Index: CTI  $\geq 275$**
- Rated impulse voltage (transient overvoltage)  
 $V_{IOTM} = 6$  kV peak
- Isolation test voltage (partial discharge test voltage)  $V_{pd} = 1.6$  kV
- Lead-free component
- Component in accordance to RoHS 2002/95/EC and WEEE 2002/96/EC

### Agency Approvals

- UL1577, File No. E76222 System Code A, Double Protection
- BSI: BS EN 41003, BS EN 60095 (BS415), Certificate number 7081 and 7402
- DIN EN 60747-5-2 (VDE0884)  
DIN EN 60747-5-5 pending
- VDE related features:
- FIMKO (SETI): EN 60950, Certificate No. 12399

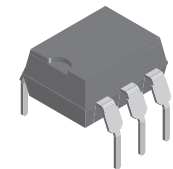
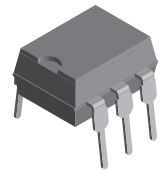
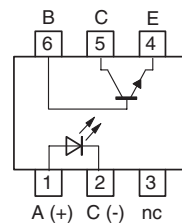
### Applications

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 - III at mains voltage  $\leq 600$  V according to DIN EN 60747-5-2(VDE0884)/ DIN EN 60747-5-5 pending, table 2, suitable for:

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



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### Order Information

| Part   | Remarks                              |
|--------|--------------------------------------|
| 4N25GV | CTR > 20 % wide lead spacing, DIP-6  |
| 4N35GV | CTR > 100 % wide lead spacing, DIP-6 |
| 4N25V  | CTR > 20 %, DIP-6                    |
| 4N35V  | CTR > 100 %, DIP-6                   |

For additional information on the available options refer to Option Information.

G=Leadform 10.16 mm; G is not marked on the body

### Description

The 4N25V/ 4N25GV/ 4N35V/ 4N35GV series consists of a phototransistor optically coupled to a gallium arsenide infrared-emitting diode in a 6-lead plastic dual inline package.

The elements are mounted on one leadframe using a **coplanar technique**, providing a fixed distance between input and output for highest safety requirements.

### VDE Standards

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

**DIN EN 60747-5-2(VDE0884)/ DIN EN 60747-5-5 pending**

Optocoupler for electrical safety requirements

**IEC EN 60950**

Office machines (applied for reinforced isolation for mains voltage  $\leq 400$  VRMS)

**VDE 0804**

Telecommunication apparatus and data processing

**IEC 60065**

Safety for mains-operated electronic and related household apparatus

### Absolute Maximum Ratings

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

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 Rating for extended periods of the time can adversely affect reliability.

### Input

| Parameter             | Test condition                   | Symbol     | Value | Unit               |
|-----------------------|----------------------------------|------------|-------|--------------------|
| Reverse voltage       |                                  | $V_R$      | 5     | V                  |
| Forward current       |                                  | $I_F$      | 60    | mA                 |
| Forward surge current | $t_p \leq 10\text{ }\mu\text{s}$ | $I_{FSM}$  | 3     | A                  |
| Power dissipation     |                                  | $P_{diss}$ | 100   | mW                 |
| Junction temperature  |                                  | $T_j$      | 125   | $^{\circ}\text{C}$ |

### Output

| Parameter                 | Test condition                       | Symbol     | Value | Unit               |
|---------------------------|--------------------------------------|------------|-------|--------------------|
| Collector emitter voltage |                                      | $V_{CEO}$  | 32    | V                  |
| Emitter collector voltage |                                      | $V_{CEO}$  | 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         |                                      | $P_{diss}$ | 150   | mW                 |
| Junction temperature      |                                      | $T_j$      | 125   | $^{\circ}\text{C}$ |

### Coupler

| Parameter                    | Test condition                       | Symbol    | Value         | Unit               |
|------------------------------|--------------------------------------|-----------|---------------|--------------------|
| Isolation test voltage (RMS) | $t = 1\text{ min}$                   | $V_{ISO}$ | 3750          | $V_{RMS}$          |
| Total power dissipation      |                                      | $P_{tot}$ | 250           | mW                 |
| Ambient temperature range    |                                      | $T_{amb}$ | - 55 to + 100 | $^{\circ}\text{C}$ |
| Storage temperature range    |                                      | $T_{stg}$ | - 55 to + 125 | $^{\circ}\text{C}$ |
| Soldering temperature        | 2 mm from case, $t \leq 10\text{ s}$ | $T_{sld}$ | 260           | $^{\circ}\text{C}$ |



## Electrical Characteristics

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

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.

## Input

| Parameter            | Test condition                 | Symbol | Min | Typ. | Max | Unit |
|----------------------|--------------------------------|--------|-----|------|-----|------|
| Forward voltage      | $I_F = 50\text{ mA}$           | $V_F$  |     | 1.2  | 1.4 | V    |
| Junction capacitance | $V_R = 0$ , $f = 1\text{ MHz}$ | $C_j$  |     | 50   |     | pF   |

## Output

| Parameter                         | Test condition                                                               | 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 leakage current | $V_{CE} = 10\text{ V}$ , $I_F = 0$ , $T_{amb} = 100\text{ }^{\circ}\text{C}$ | $I_{CEO}$ |     |      | 50  | nA            |
|                                   | $V_{CE} = 30\text{ V}$ , $I_F = 0$ , $T_{amb} = 100\text{ }^{\circ}\text{C}$ | $I_{CEO}$ |     |      | 500 | $\mu\text{A}$ |

## Coupler

| Parameter                            | Test condition                                                              | Symbol      | Min | Typ. | Max | Unit |
|--------------------------------------|-----------------------------------------------------------------------------|-------------|-----|------|-----|------|
| Collector emitter saturation voltage | $I_F = 50\text{ mA}$ , $I_C = 2\text{ mA}$                                  | $V_{CEsat}$ |     |      | 0.3 | V    |
| Cut-off frequency                    | $V_{CE} = 5\text{ V}$ , $I_F = 10\text{ mA}$ ,<br>$R_L = 100\text{ }\Omega$ | $f_c$       |     | 110  |     | kHz  |
| Coupling capacitance                 | $f = 1\text{ MHz}$                                                          | $C_k$       |     | 1    |     | pF   |

## Current Transfer Ratio

| Parameter | Test condition                                                                             | Part            | Symbol | Min | Typ. | Max | Unit |
|-----------|--------------------------------------------------------------------------------------------|-----------------|--------|-----|------|-----|------|
| $I_C/I_F$ | $V_{CE} = 10\text{ V}$ , $I_F = 10\text{ mA}$                                              | 4N25V<br>4N25GV | CTR    | 20  | 100  |     | %    |
|           |                                                                                            | 4N35V<br>4N35GV | CTR    | 100 | 150  |     | %    |
|           | $V_{CE} = 10\text{ V}$ , $I_F = 10\text{ mA}$ ,<br>$T_{amb} = 100\text{ }^{\circ}\text{C}$ | 4N35V<br>4N35GV | CTR    | 40  |      |     | %    |

## Maximum Safety Ratings

(according to DIN EN 60747-5-2(VDE0884)/ DIN EN 60747-5-5 pending) see figure 1

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.

## Input

| Parameter       | Test condition | Symbol | Min | Typ. | Max | Unit |
|-----------------|----------------|--------|-----|------|-----|------|
| Forward current |                | $I_F$  |     |      | 130 | mA   |

### Output

| Parameter         | Test condition | Symbol     | Min | Typ. | Max | Unit |
|-------------------|----------------|------------|-----|------|-----|------|
| Power dissipation |                | $P_{diss}$ |     |      | 265 | mW   |

### Coupler

| Parameter             | Test condition | Symbol     | Min | Typ. | Max | Unit |
|-----------------------|----------------|------------|-----|------|-----|------|
| Rated impulse voltage |                | $V_{IOTM}$ |     |      | 6   | kV   |
| Safety temperature    |                | $T_{si}$   |     |      | 150 | °C   |

### Insulation Rated Parameters

| Parameter                                               | Test condition                                                | Symbol     | Min       | Typ. | Max | Unit     |
|---------------------------------------------------------|---------------------------------------------------------------|------------|-----------|------|-----|----------|
| Partial discharge test voltage - Routine test           | 100 %, $t_{test} = 1$ s                                       | $V_{pd}$   | 1600      |      |     | V        |
| Partial discharge test voltage - Lot test (sample test) | $t_{Tr} = 60$ s, $t_{test} = 10$ s, (see figure 2)            | $V_{IOTM}$ | 6000      |      |     | V        |
|                                                         | $t_{Tr} = 60$ s, $t_{test} = 10$ s, (see figure 2)            | $V_{pd}$   | 1300      |      |     | V        |
| Insulation resistance                                   | $V_{IO} = 500$ V                                              | $R_{IO}$   | $10^{12}$ |      |     | $\Omega$ |
|                                                         | $V_{IO} = 500$ V, $T_{amb} = 100$ °C                          | $R_{IO}$   | $10^{11}$ |      |     | $\Omega$ |
|                                                         | $V_{IO} = 500$ V, $T_{amb} = 150$ °C (construction test only) | $R_{IO}$   | $10^9$    |      |     | $\Omega$ |

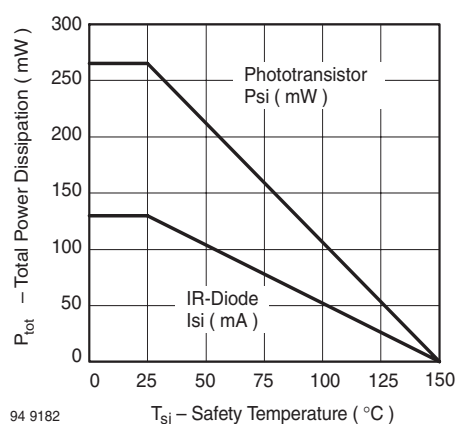


Figure 1. Derating diagram

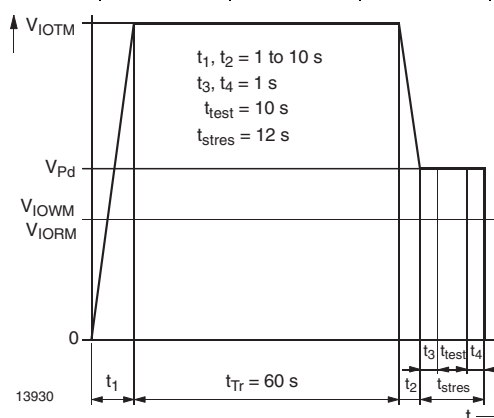


Figure 2. Test pulse diagram for sample test according to DIN EN 60747-5-2(VDE0884)/ DIN EN 60747-; IEC60747

## Switching Characteristics

| Parameter                    | Test condition                                                       | Part            | Symbol    | Min | Typ. | Max  | Unit          |
|------------------------------|----------------------------------------------------------------------|-----------------|-----------|-----|------|------|---------------|
| Delay time (see figure 3)    | $V_S = 5\text{ V}$ , $I_C = 5\text{ mA}$ , $R_L = 100\ \Omega$       | 4N25V<br>4N25GV | $t_d$     |     | 4.0  |      | $\mu\text{s}$ |
|                              | $V_S = 5\text{ V}$ , $I_C = 2\text{ mA}$ , $R_L = 100\ \Omega$       | 4N35V<br>4N35GV | $t_d$     |     | 2.5  |      | $\mu\text{s}$ |
| Rise time (see figure 3)     | $V_S = 5\text{ V}$ , $I_C = 5\text{ mA}$ , $R_L = 100\ \Omega$       | 4N25V<br>4N25GV | $t_r$     |     | 7.0  |      | $\mu\text{s}$ |
|                              | $V_S = 5\text{ V}$ , $I_C = 2\text{ mA}$ , $R_L = 100\ \Omega$       | 4N35V<br>4N35GV | $t_r$     |     | 3.0  |      | $\mu\text{s}$ |
| Fall time (see figure 3)     | $V_S = 5\text{ V}$ , $I_C = 5\text{ mA}$ , $R_L = 100\ \Omega$       | 4N25V<br>4N25GV | $t_f$     |     | 6.7  |      | $\mu\text{s}$ |
|                              | $V_S = 5\text{ V}$ , $I_C = 2\text{ mA}$ , $R_L = 100\ \Omega$       | 4N35V<br>4N35GV | $t_f$     |     | 4.2  |      | $\mu\text{s}$ |
| Storage time (see figure 3)  | $V_S = 5\text{ V}$ , $I_C = 5\text{ mA}$ , $R_L = 100\ \Omega$       | 4N25V<br>4N25GV | $t_s$     |     | 0.3  |      | $\mu\text{s}$ |
|                              | $V_S = 5\text{ V}$ , $I_C = 2\text{ mA}$ , $R_L = 100\ \Omega$       | 4N35V<br>4N35GV | $t_s$     |     | 0.3  |      | $\mu\text{s}$ |
| Turn-on time (see figure 3)  | $V_S = 5\text{ V}$ , $I_C = 5\text{ mA}$ , $R_L = 100\ \Omega$       | 4N25V<br>4N25GV | $t_{on}$  |     | 11.0 |      | $\mu\text{s}$ |
|                              | $V_S = 5\text{ V}$ , $I_C = 2\text{ mA}$ , $R_L = 100\ \Omega$       | 4N35V<br>4N35GV | $t_{on}$  |     |      | 10.0 | $\mu\text{s}$ |
| Turn-off time (see figure 3) | $V_S = 5\text{ V}$ , $I_C = 5\text{ mA}$ , $R_L = 100\ \Omega$       | 4N25V<br>4N25GV | $t_{off}$ |     | 7.0  |      | $\mu\text{s}$ |
|                              | $V_S = 5\text{ V}$ , $I_C = 2\text{ mA}$ , $R_L = 100\ \Omega$       | 4N35V<br>4N35GV | $t_{off}$ |     |      | 10.0 | $\mu\text{s}$ |
| Turn-on time (see figure 4)  | $V_S = 5\text{ V}$ , $I_F = 10\text{ mA}$ , $R_L = 1\text{ k}\Omega$ | 4N25V<br>4N25GV | $t_{on}$  |     | 25.0 |      | $\mu\text{s}$ |
|                              |                                                                      | 4N35V<br>4N35GV | $t_{on}$  |     | 9.0  |      | $\mu\text{s}$ |
| Turn-off time (see figure 4) | $V_S = 5\text{ V}$ , $I_F = 10\text{ mA}$ , $R_L = 1\text{ k}\Omega$ | 4N25V<br>4N25GV | $t_{off}$ |     | 42.5 |      | $\mu\text{s}$ |
|                              |                                                                      | 4N35V<br>4N35GV | $t_{off}$ |     | 25.0 |      | $\mu\text{s}$ |

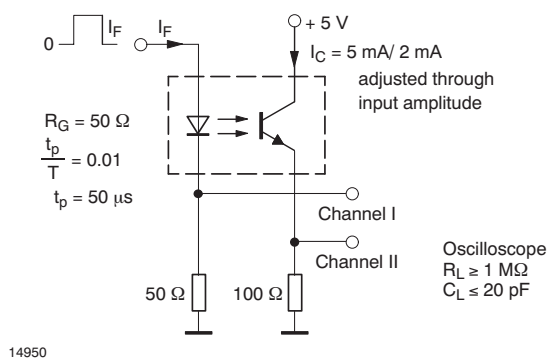


Figure 3. Test circuit, non-saturated operation

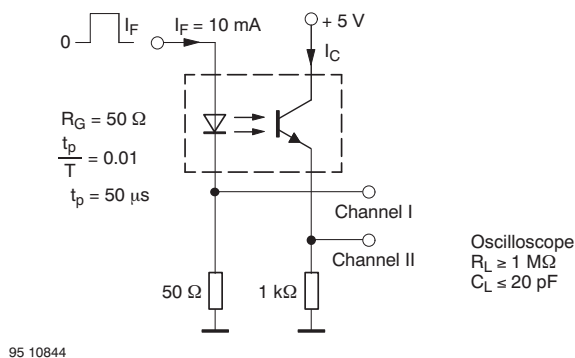
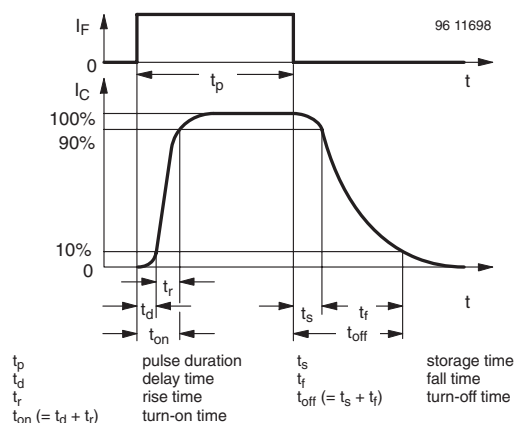


Figure 4. Test circuit, saturated operation

Figure 5. Switching Times



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

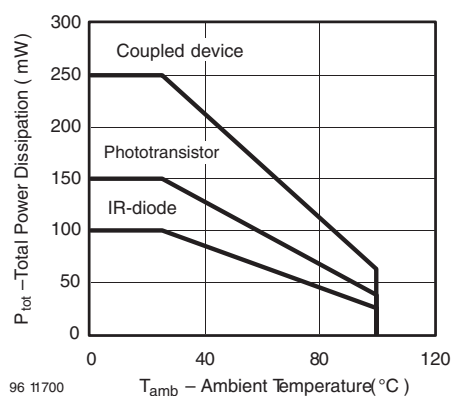


Figure 6. Total Power Dissipation vs. Ambient Temperature

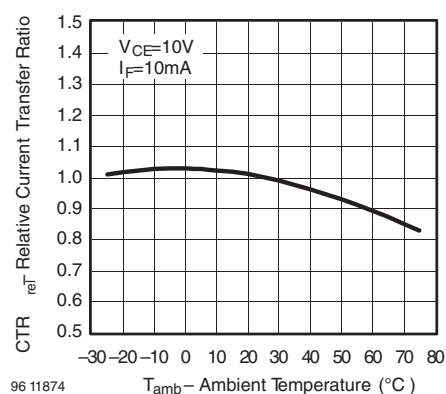


Figure 8. Relative Current Transfer Ratio vs. Ambient Temperature

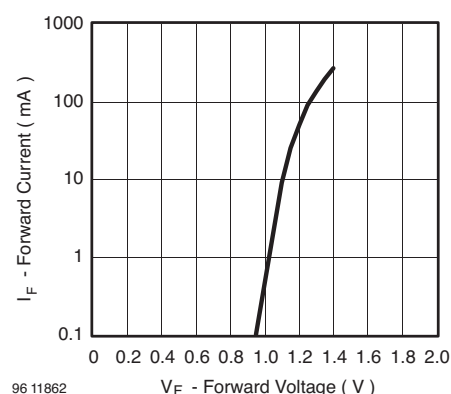


Figure 7. Forward Current vs. Forward Voltage

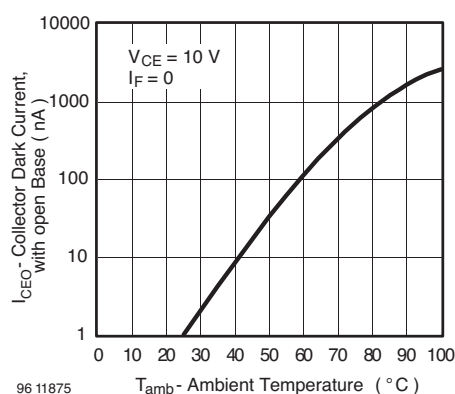


Figure 9. Collector Dark Current vs. Ambient Temperature

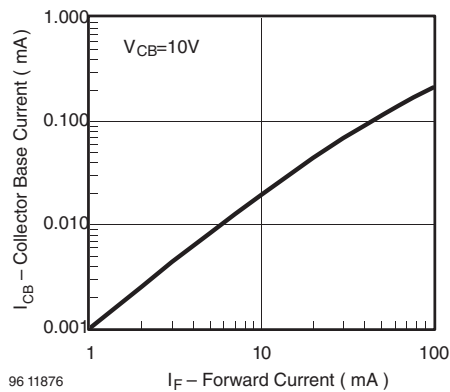


Figure 10. Collector Base Current vs. Forward Current

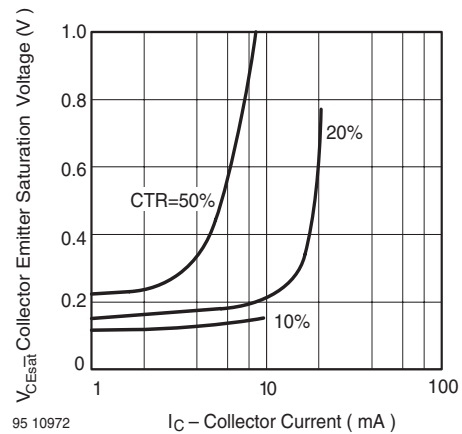


Figure 13. Collector Emitter Saturation Voltage vs. Collector Current

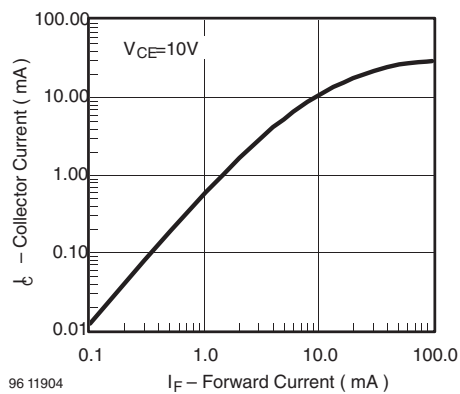


Figure 11. Collector Current vs. Forward Current

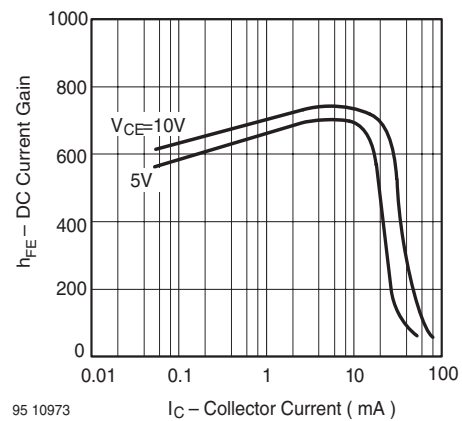


Figure 14. DC Current Gain vs. Collector Current

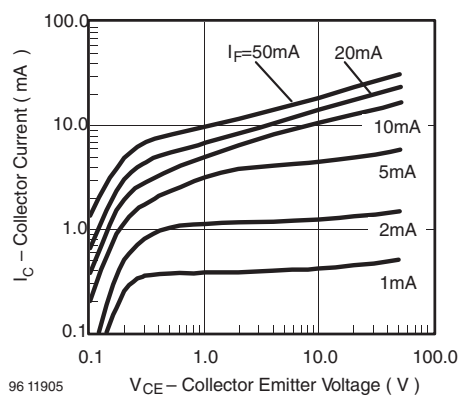


Figure 12. Collector Current vs. Collector Emitter Voltage

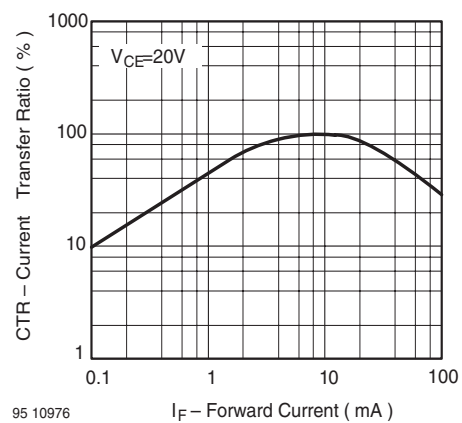


Figure 15. Current Transfer Ratio vs. Forward Current

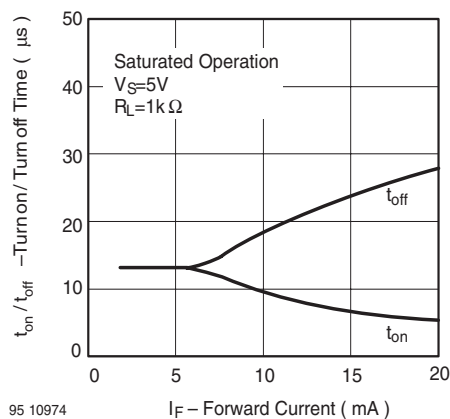


Figure 16. Turn on / off Time vs. Forward Current

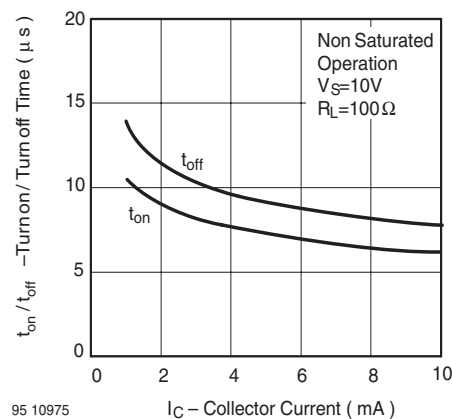
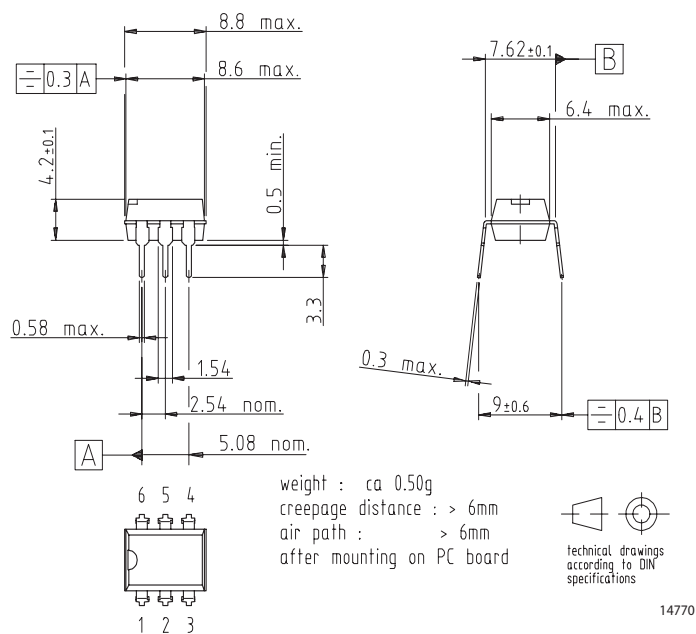
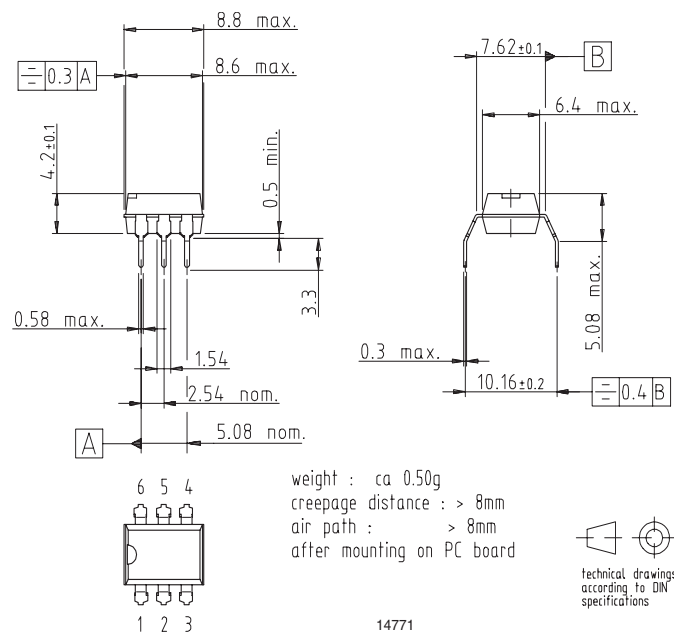


Figure 17. Turn on / off Time vs. Collector Current

## Package Dimensions in mm



## Package Dimensions in mm



## Ozone Depleting Substances Policy Statement

It is the policy of Vishay Semiconductor GmbH to

1. Meet all present and future national and international statutory requirements.
2. Regularly and continuously improve the performance of our products, processes, distribution and operating systems with respect to their impact on the health and safety of our employees and the public, as well as their impact on the environment.

It is particular concern to control or eliminate releases of those substances into the atmosphere which are known as ozone depleting substances (ODSs).

The Montreal Protocol (1987) and its London Amendments (1990) intend to severely restrict the use of ODSs and forbid their use within the next ten years. Various national and international initiatives are pressing for an earlier ban on these substances.

Vishay Semiconductor GmbH has been able to use its policy of continuous improvements to eliminate the use of ODSs listed in the following documents.

1. Annex A, B and list of transitional substances of the Montreal Protocol and the London Amendments respectively
2. Class I and II ozone depleting substances in the Clean Air Act Amendments of 1990 by the Environmental Protection Agency (EPA) in the USA
3. Council Decision 88/540/EEC and 91/690/EEC Annex A, B and C (transitional substances) respectively.

Vishay Semiconductor GmbH can certify that our semiconductors are not manufactured with ozone depleting substances and do not contain such substances.

We reserve the right to make changes to improve technical design  
and may do so without further notice.

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