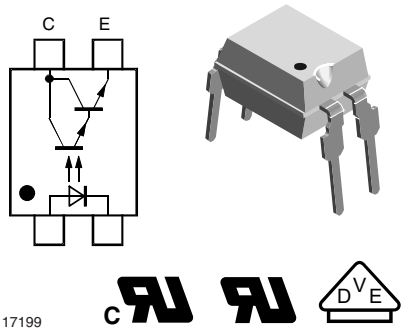
# Optocoupler, Phototransistor Output, High Gain




## DESCRIPTION

The TCED1100 consists of a phototransistor optically coupled to a gallium arsenide infrared-emitting diode in a 4-lead up to 16-lead plastic dual inline package.
The elements are mounted on one leadframe 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 60747-5-5**
  Optocoupler for electrical safety requirements
- **IEC EN 60950**
  Office machines (applied for reinforced isolation for mains voltage ≤ 400 $V_{RMS}$)
- **VDE 0804**
  Telecommunication apparatus and data processing
- **IEC 60065**
  Safety for mains-operated electronic and related household apparatus

## FEATURES

- Extra low coupling capacity - typical 0.2 pF
- High common mode rejection
- Available in single or four channels
- Rated impulse voltage (transient overvoltage) $V_{IOTM}$ = 8 kV peak
- Isolation test voltage (partial discharge test voltage) $V_{pd}$ = 1.6 kV peak
- Rated isolation voltage (RMS includes DC) $V_{IOWM}$ = 600 $V_{RMS}$
- Rated recurring peak voltage (repetitive) $V_{IORM}$ = 600 $V_{RMS}$ (848 V peak)
- Thickness though insulation ≥ 0.75 mm
- Creepage current resistance according to VDE 0303/ IEC 60112 comparative tracking index: CTI ≥ 175
- Lead (Pb)-free component
- Component in accordance to RoHS 2002/95/EC and WEEE 2002/96/EC

## APPLICATIONS

- Switch-mode power supplies
- Line receiver
- Computer peripheral interface
- Microprocessor system interface
- Reinforced isolation provides circuit protection against electrical shock (safety class II)
- 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 - III at mains voltage ≤ 600 V
  according to DIN EN 60747-5-5

## AGENCY APPROVALS

- UL1577, file no. E76222 system code U, double protection
- CSA 22.2 bulletin 5A, double protection
- BSI IEC60950; IEC60065
- DIN EN 60747-5-5
- FIMKO

## ORDER INFORMATION

| PART | REMARKS |
|---|---|
| TCED1100 | CTR 600 %, DIP-4 |
| TCED1100G | CTR 600 %, DIP-4 |

**Note**
G = leadform 10.16 mm; G is not marked on the body.

| ABSOLUTE MAXIMUM RATINGS (1) | | | | |
|---|---|---|---|---|
| **PARAMETER** | **TEST CONDITION** | **SYMBOL** | **VALUE** | **UNIT** |
| **INPUT** | | | | |
| Reverse voltage | | $V_R$ | 6 | V |
| Forward current | | $I_F$ | 60 | mA |
| Forward surge current | $t_p \leq 10$ µs | $I_{FSM}$ | 1.5 | A |
| Power dissipation | | $P_{diss}$ | 100 | mW |
| Junction temperature | | $T_j$ | 125 | °C |
| **OUTPUT** | | | | |
| Collector emitter voltage | | $V_{CEO}$ | 35 | V |
| Emitter collector voltage | | $V_{ECO}$ | 7 | V |
| Collector current | | $I_C$ | 80 | mA |
| Collector peak current | $t_p/T = 0.5$, $t_p \leq 10$ ms | $I_{CM}$ | 100 | mA |
| Power dissipation | | $P_{diss}$ | 150 | mW |
| Junction temperature | | $T_j$ | 125 | °C |
| **COUPLER** | | | | |
| Isolation test voltage (RMS) | | $V_{ISO}$ | 5000 | $V_{RMS}$ |
| Total power dissipation | | $P_{tot}$ | 250 | mW |
| Operating ambient temperature range | | $T_{amb}$ | - 40 to + 100 | °C |
| Storage temperature range | | $T_{stg}$ | - 55 to + 125 | °C |
| Soldering temperature (2) | 2 mm from case, $t \leq 10$ s | $T_{sld}$ | 260 | °C |

**Notes**

(1) $T_{amb}$ = 25 °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 ratings for extended periods of the time can adversely affect reliability.

(2) Refer to wave profile for soldering conditions for through hole devices.

| ELECTRICAL CHARACTERISTCS | | | | | | |
|---|---|---|---|---|---|---|
| **PARAMETER** | **TEST CONDITION** | **SYMBOL** | **MIN.** | **TYP.** | **MAX.** | **UNIT** |
| **INPUT** | | | | | | |
| Forward voltage | $I_F$ = 20 mA | $V_F$ | | 1.15 | 1.4 | 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 ermitter cut-off current | $V_{CE}$ = 10 V, $I_F$ = 0, E = 0 | $I_{CEO}$ | | 15 | 100 | nA |
| **COUPLER** | | | | | | |
| Collector emitter saturation voltage | $I_F$ = 10 mA, $I_C$ =5 mA | $V_{CEsat}$ | | | 1 | V |
| Cut-off frequency | $V_{CE}$ = 5 V, $I_F$ = 10 mA, $R_L$ = 100 Ω | $f_c$ | | 10 | | kHz |
| Coupling capacitance | f = 1 MHz | $C_k$ | | 0.3 | | pF |

**Note**

$T_{amb}$ = 25 °C, unless otherwise specified.
Minimum and maximum values are tested requierements. Typical values are characteristics of the device and are the result of engineering evaluations. Typical values are for information only and are not part of the testing requirements.

| CURRENT TRANSFER RATIO | | | | | | | |
|---|---|---|---|---|---|---|---|
| **PARAMETER** | **TEST CONDITION** | **PART** | **SYMBOL** | **MIN.** | **TYP.** | **MAX.** | **UNIT** |
| $I_C/I_F$ | $V_{CE}$ = 2 V, $I_F$ = 1 mA | TCED1100 | CTR | 600 | 800 | | % |

| MAXIMUM SAFETY RATINGS | | | | | | |
|---|---|---|---|---|---|---|
| **PARAMETER** | **TEST CONDITION** | **SYMBOL** | **MIN.** | **TYP.** | **MAX.** | **UNIT** |
| **INPUT** | | | | | | |
| Forward current | | $I_F$ | | | 130 | mA |
| **OUTPUT** | | | | | | |
| Power dissipation | | $P_{diss}$ | | | 265 | mW |
| **COUPLER** | | | | | | |
| Rated impulse voltage | | $V_{IOTM}$ | | | 8 | kV |
| Safety temperature | | $T_{si}$ | | | 150 | °C |

**Note**

According to DIN EN 60747-5-5 (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.

| INSULATION RATED PARAMETERS | | | | | | |
|---|---|---|---|---|---|---|
| **PARAMETER** | **TEST CONDITION** | **SYMBOL** | **MIN.** | **TYP.** | **MAX.** | **UNIT** |
| Partial discharge test voltage - routine test | 100 %, $t_{test}$ = 1 s | $V_{pd}$ | 1.6 | | | kV |
| Partial discharge test voltage - lot test (sample test) | $t_{Tr}$ = 60 s, $t_{test}$ = 10 s, (see figure 2) | $V_{IOTM}$ | 8 | | | kV |
| | | $V_{pd}$ | 1.3 | | | kV |
| Insulation resistance | $V_{IO}$ = 500 V | $R_{IO}$ | $10^{12}$ | | | Ω |
| | $V_{IO}$ = 500 V, $T_{amb}$ = 100 °C | $R_{IO}$ | $10^{11}$ | | | Ω |
| | $V_{IO}$ = 500 V, $T_{amb}$ = 150 °C (construction test only) | $R_{IO}$ | $10^{9}$ | | | Ω |

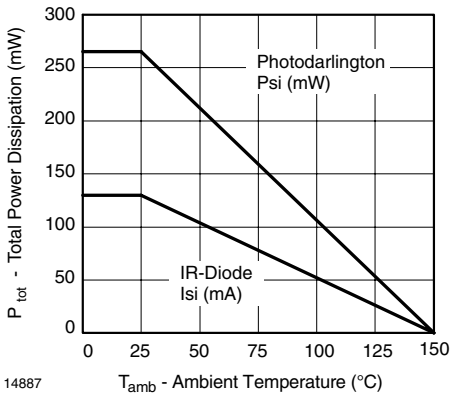



Fig. 1 - Derating Diagram

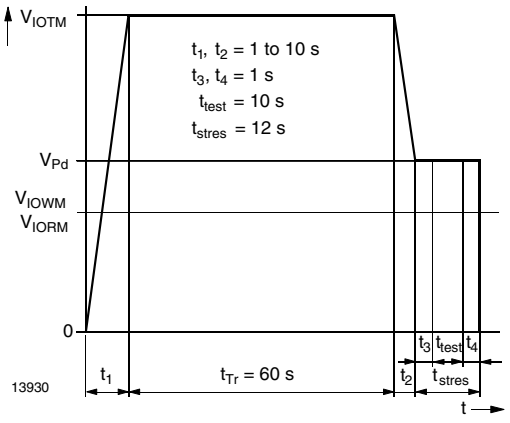



Fig. 2 - Test Pulse Diagram for Sample Test According to DIN EN 60747-5-5/DIN EN 60747-; IEC60747

| SWITCHING CHARACTERISTICS | | | | | | |
|---|---|---|---|---|---|---|
| **PARAMETER** | **TEST CONDITION** | **SYMBOL** | **MIN.** | **TYP.** | **MAX.** | **UNIT** |
| Rise time | $V_{CC}$ = 2 V, $I_C$ = 10 mA, $R_L$ = 100 Ω, (see figure 3) | $t_r$ | | 300 | | µs |
| Fall time | $V_{CC}$ = 2 V, $I_C$ = 10 mA, $R_L$ = 100 Ω, (see figure 3) | $t_f$ | | 250 | | µs |

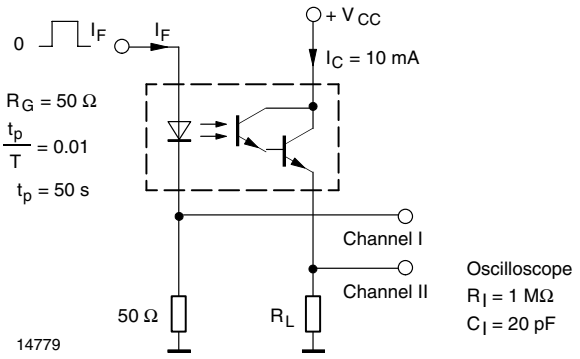



Fig. 3 - Test Circuit, Non-Saturated Operation

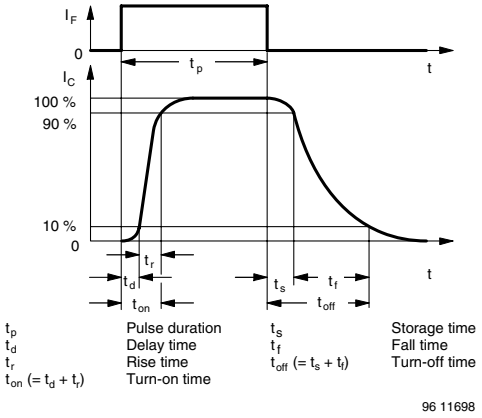



Fig. 4 - Switching Times

## TYPICAL CHARACTERISTICS

$T_{amb}$ = 25 °C, unless otherwise specified

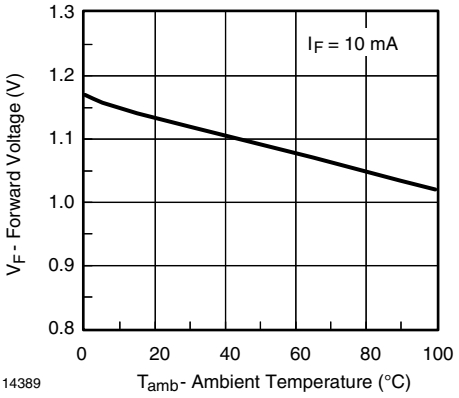



Fig. 5 - Forward Voltage vs. Ambient Temperature

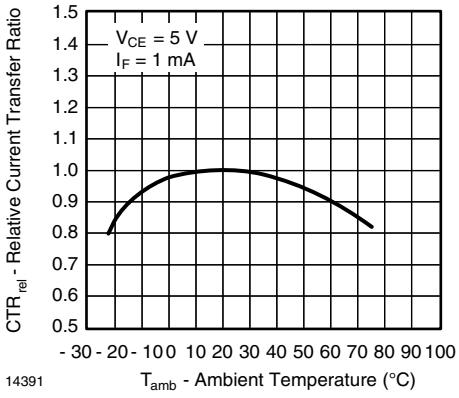



Fig. 7 - Relative Current Transfer Ratio vs. Ambient Temperature

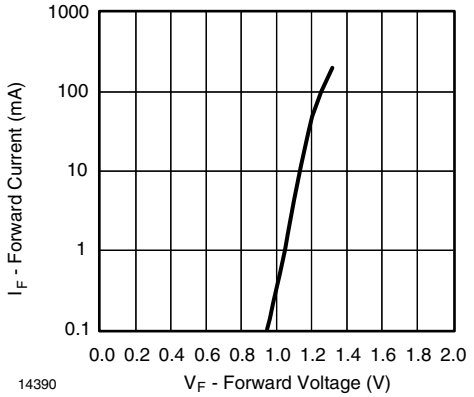



Fig. 6 - Forward Current vs. Forward Voltage

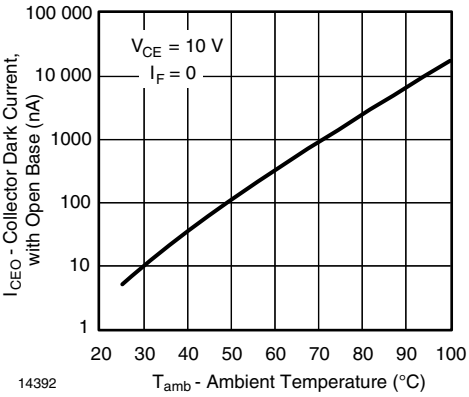



Fig. 8 - Collector Dark Current vs. Ambient Temperature

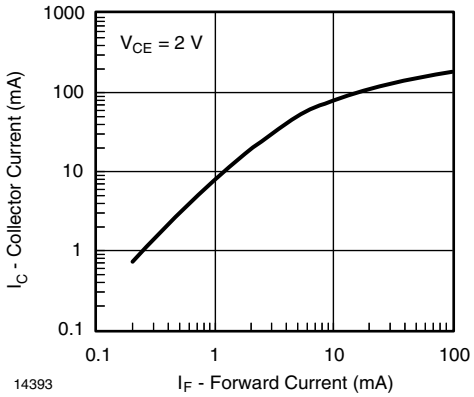



Fig. 9 - Collector Current vs. Forward Current

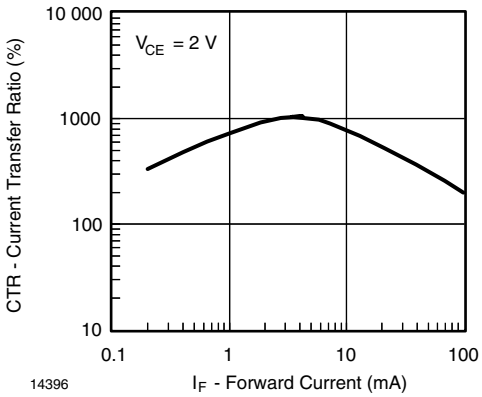



Fig. 12 - Current Transfer Ratio vs. Forward Current

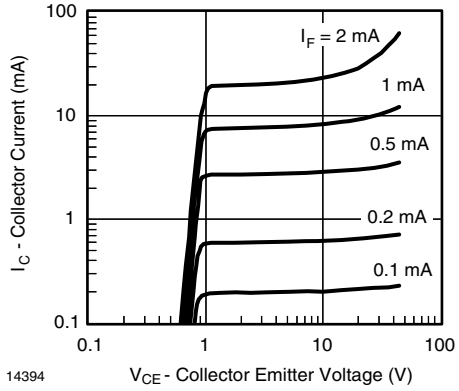



Fig. 10 - Collector Current vs. Collector Emitter Voltage

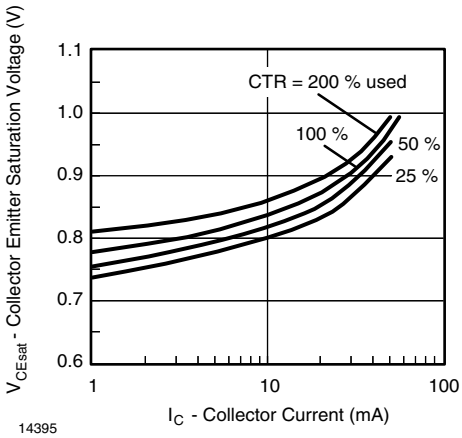
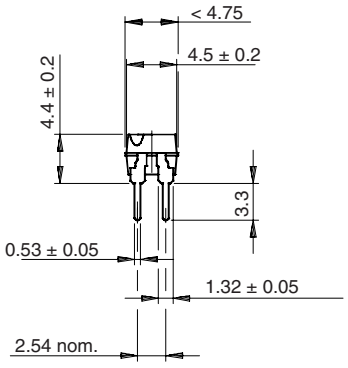
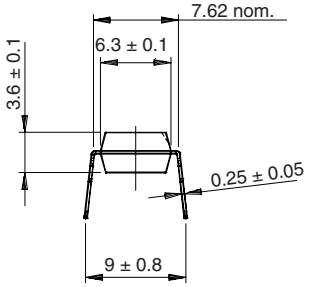


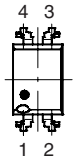

Fig. 11 - Collector Emitter Saturation Voltage vs. Collector Current

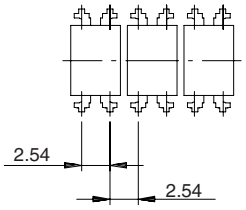
**PACKAGE DIMENSIONS** in millimeters



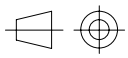




E. g.:
Special features: endstackable to 2.54 mm (0.100") spacing




Weight: ca. 0.25 g
Creepage distance: > 6 mm
Air path: > 6 mm
after mounting on PC board



technical drawings according to DIN specifications

Drawing-No.: 6.544-5302.03-4
Issue: 5; 20.03.02

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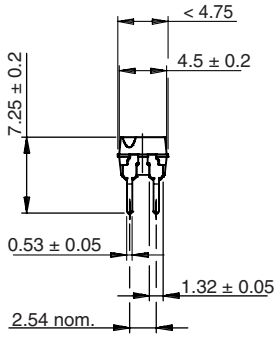
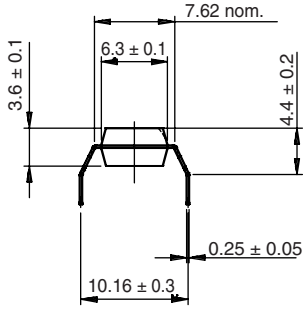
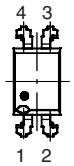
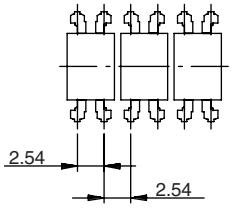


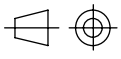




E. g.:
Special features: endstackable to 2.54 mm (0.100") spacing




Weight: ca. 0.25 g
Creepage distance: > 8 mm
Air path: > 8 mm
after mounting on PC board



technical drawings according to DIN specifications

Drawing-No.: 6.544-5303.03-4
Issue: 4; 20.03.02

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## 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.



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