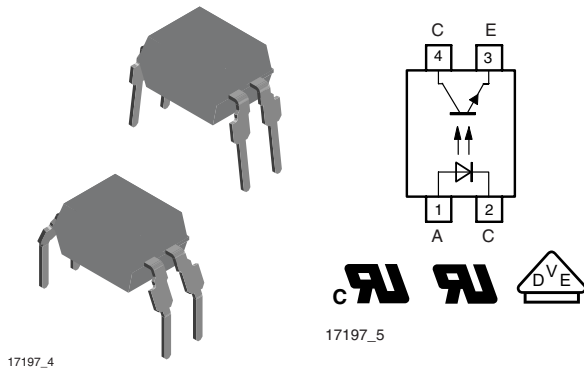


## Optocoupler, Phototransistor Output, High Temperature



### DESCRIPTION

The TCET110. consists of a phototransistor optically coupled to a gallium arsenide infrared-emitting diode in a 4-lead plastic dual inline package.

### AGENCY APPROVALS

- UL1577, file no. E52744, double protection
- cUL tested, file A52744
- BSI: EN 60065:2002, EN 60950:2000
- DIN EN 60747-5-5 (VDE 0884)
- FIMKO

### FEATURES

- High common mode rejection
- Low temperature coefficient of CTR
- CTR offered in 9 groups
- Reinforced isolation provides circuit protection against electrical shock (safety class II)
- Isolation materials according to UL 94 V-O
- Pollution degree 2 (DIN/VDE 0110/resp. IEC 60664)
- Climatic classification 55/100/21 (IEC 60068 part 1)
- Rated impulse voltage (transient overvoltage)  $V_{IOTM} = 6 \text{ kV}_{peak}$
- Isolation test voltage (partial discharge test voltage)  $V_{pd} = 1.6 \text{ kV}$
- Rated isolation voltage (RMS includes DC)  $V_{IOWM} = 600 \text{ V}_{RMS}$
- Rated recurring peak voltage (repetitive)  $V_{IORM} = 848 \text{ V}_{peak}$
- Creepage current resistance according to VDE 0303/ IEC 60112 comparative tracking index:  $CTI \geq 175$
- 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  $\leq 300 \text{ V}$
- for appl. class I - III at mains voltage  $\leq 600 \text{ V}$  according to DIN EN 60747-5-5 (VDE 0884), suitable for:
  - Switch-mode power supplies
  - Line receiver
  - Computer peripheral interface
  - Microprocessor system interface



# TCET1100, TCET1100G

Optocoupler, Phototransistor Output, Vishay Semiconductors  
High Temperature

## ORDER INFORMATION

| PART      | REMARKS                            |
|-----------|------------------------------------|
| TCET1100  | CTR 50 % to 600 %, DIP-4           |
| TCET1101  | CTR 40 % to 80 %, DIP-4            |
| TCET1102  | CTR 63 % to 125 %, DIP-4           |
| TCET1103  | CTR 100 % to 200 %, DIP-4          |
| TCET1104  | CTR 160 % to 320 %, DIP-4          |
| TCET1105  | CTR 50 % to 150 %, DIP-4           |
| TCET1106  | CTR 100 % to 300 %, DIP-4          |
| TCET1107  | CTR 80 % to 160 %, DIP-4           |
| TCET1108  | CTR 130 % to 260 %, DIP-4          |
| TCET1109  | CTR 200 % to 400 %, DIP-4          |
| TCET1100G | CTR 50 % to 600 %, DIP-4, 400 mil  |
| TCET1101G | CTR 40 % to 80 %, DIP-4, 400 mil   |
| TCET1102G | CTR 63 % to 125 %, DIP-4, 400 mil  |
| TCET1103G | CTR 100 % to 200 %, DIP-4, 400 mil |
| TCET1104G | CTR 160 % to 320 %, DIP-4, 400 mil |
| TCET1105G | CTR 50 % to 150 %, DIP-4, 400 mil  |
| TCET1106G | CTR 100 % to 300 %, DIP-4, 400 mil |
| TCET1107G | CTR 80 % to 160 %, DIP-4, 400 mil  |
| TCET1108G | CTR 130 % to 260 %, DIP-4, 400 mil |
| TCET1109G | CTR 200 % to 400 %, DIP-4, 400 mil |

### Note

G = lead form 10.16 mm; G is not marked on the body

## ABSOLUTE MAXIMUM RATINGS <sup>(1)</sup>

| PARAMETER                            | TEST CONDITION                | SYMBOL    | VALUE         | UNIT      |
|--------------------------------------|-------------------------------|-----------|---------------|-----------|
| <b>INPUT</b>                         |                               |           |               |           |
| Reverse voltage                      |                               | $V_R$     | 6             | V         |
| Forward current                      |                               | $I_F$     | 60            | mA        |
| Forward surge current                | $t_p \leq 10 \mu s$           | $I_{FSM}$ | 1.5           | A         |
| <b>OUTPUT</b>                        |                               |           |               |           |
| Collector emitter voltage            |                               | $V_{CEO}$ | 70            | V         |
| Emitter collector voltage            |                               | $V_{ECO}$ | 7             | V         |
| Collector current                    |                               | $I_C$     | 50            | mA        |
| Collector peak current               | $t_p/T = 0.5, t_p \leq 10 ms$ | $I_{CM}$  | 100           | mA        |
| <b>COUPLER</b>                       |                               |           |               |           |
| Isolation test voltage (RMS)         | $t = 1 min$                   | $V_{ISO}$ | 5000          | $V_{RMS}$ |
| Operating ambient temperature range  |                               | $T_{amb}$ | - 40 to + 100 | °C        |
| Storage temperature range            |                               | $T_{stg}$ | - 55 to + 125 | °C        |
| Soldering temperature <sup>(2)</sup> | 2 mm from case, $\leq 10 s$   | $T_{sld}$ | 260           | °C        |

### Notes

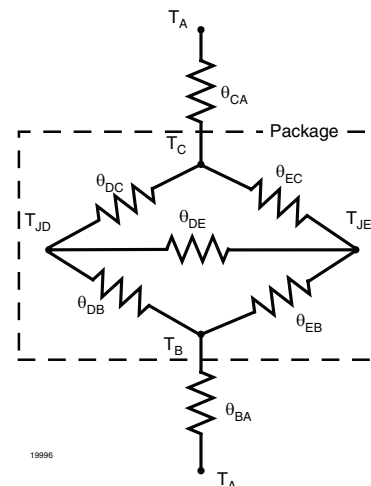
<sup>(1)</sup>  $T_{amb} = 25 ^\circ C$ , unless otherwise specified.

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.

<sup>(2)</sup> Refer to wave profile for soldering conditions for through hole devices (DIP).

## THERMAL CHARACTERISTICS (1)

| PARAMETER                                                 | SYMBOL        | VALUE | UNIT |
|-----------------------------------------------------------|---------------|-------|------|
| LED power dissipation                                     | $P_{diss}$    | 100   | mW   |
| Output power dissipation                                  | $P_{diss}$    | 150   | mW   |
| Maximum LED junction temperature                          | $T_{jmax.}$   | 125   | °C   |
| Maximum output die junction temperature                   | $T_{jmax.}$   | 125   | °C   |
| Thermal resistance, junction emitter to board             | $\theta_{EB}$ | 173   | °C/W |
| Thermal resistance, junction emitter to case              | $\theta_{EC}$ | 149   | °C/W |
| Thermal resistance, junction detector to board            | $\theta_{DB}$ | 111   | °C/W |
| Thermal resistance, junction detector to case             | $\theta_{DC}$ | 127   | °C/W |
| Thermal resistance, junction emitter to junction detector | $\theta_{ED}$ | 173   | °C/W |
| Thermal resistance, board to ambient (2)                  | $\theta_{BA}$ | 197   | °C/W |
| Thermal resistance, case to ambient (2)                   | $\theta_{CA}$ | 4041  | °C/W |



### Note

(1) The thermal model is represented in the thermal network below. Each resistance value given in this model can be used to calculate the temperatures at each node for a given operating condition. The thermal resistance from board to ambient will be dependent on the type of PCB, layout and thickness of copper traces. For a detailed explanation of the thermal model, please reference Vishay's "Thermal Characteristics of Optocouplers" application note.

(2) For 2 layer FR4 board (4" x 3" x 0.062").

## ELECTRICAL CHARACTERISTICS

| 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            | $I_C = 1 \text{ mA}$                                          | $V_{CEO}$   | 70   |      |      | V    |
| Emitter collector voltage            | $I_E = 100 \mu\text{A}$                                       | $V_{ECO}$   | 7    |      |      | V    |
| Collector emitter cut-off current    | $V_{CE} = 20 \text{ V}, I_F = 0 \text{ A}, E = 0$             | $I_{CEO}$   |      | 10   | 100  | 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                    | $V_{CE} = 5 \text{ V}, I_F = 10 \text{ mA}, R_L = 100 \Omega$ | $f_c$       |      | 110  |      | kHz  |
| Coupling capacitance                 | $f = 1 \text{ MHz}$                                           | $C_k$       |      | 0.3  |      | pF   |

### Note

$T_{amb} = 25 \text{ °C}$ , 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.



# TCET1100, TCET1100G

Optocoupler, Phototransistor Output, Vishay Semiconductors  
High Temperature

| CURRENT TRANSFER RATIO |                                           |                       |        |      |      |      |      |
|------------------------|-------------------------------------------|-----------------------|--------|------|------|------|------|
| PARAMETER              | TEST CONDITION                            | PART                  | SYMBOL | MIN. | TYP. | MAX. | UNIT |
| $I_C/I_F$              | $V_{CE} = 5\text{ V}, I_F = 1\text{ mA}$  | TCET1101<br>TCET1101G | CTR    | 13   | 30   |      | %    |
|                        |                                           | TCET1102<br>TCET1102G | CTR    | 22   | 45   |      | %    |
|                        |                                           | TCET1103<br>TCET1103G | CTR    | 34   | 70   |      | %    |
|                        |                                           | TCET1104<br>TCET1104G | CTR    | 56   | 90   |      | %    |
|                        | $V_{CE} = 5\text{ V}, I_F = 5\text{ mA}$  | TCET1100<br>TCET1100G | CTR    | 50   |      | 600  | %    |
|                        |                                           | TCET1105<br>TCET1105G | CTR    | 50   |      | 150  | %    |
|                        |                                           | TCET1106<br>TCET1106G | CTR    | 100  |      | 300  | %    |
|                        |                                           | TCET1107<br>TCET1107G | CTR    | 80   |      | 160  | %    |
|                        |                                           | TCET1108<br>TCET1108G | CTR    | 130  |      | 260  | %    |
|                        |                                           | TCET1109<br>TCET1109G | CTR    | 200  |      | 400  | %    |
|                        | $V_{CE} = 5\text{ V}, I_F = 10\text{ mA}$ | TCET1101<br>TCET1101G | CTR    | 40   |      | 80   | %    |
|                        |                                           | TCET1102<br>TCET1102G | CTR    | 63   |      | 125  | %    |
|                        |                                           | TCET1103<br>TCET1103G | CTR    | 100  |      | 200  | %    |
|                        |                                           | TCET1104<br>TCET1104G | CTR    | 160  |      | 320  | %    |

| 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  |                | $V_{IOTM}$ |      |      | 6    | kV   |
| Safety temperature     |                | $T_{si}$   |      |      | 150  | °C   |

## Note

According to DIN EN 60747-5-5 (see figure 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.

| INSULATION RATED PARAMETERS                             |                                                                              |            |           |      |      |          |
|---------------------------------------------------------|------------------------------------------------------------------------------|------------|-----------|------|------|----------|
| PARAMETER                                               | TEST CONDITION                                                               | SYMBOL     | MIN.      | TYP. | MAX. | UNIT     |
| Partial discharge test voltage - routine test           | 100 %, $t_{test} = 1\text{ s}$                                               | $V_{pd}$   | 1.6       |      |      | kV       |
| Partial discharge test voltage - lot test (sample test) | $t_{Tr} = 60\text{ s}, t_{test} = 10\text{ s},$<br>(see figure 2)            | $V_{IOTM}$ | 6         |      |      | kV       |
|                                                         |                                                                              | $V_{pd}$   | 1.3       |      |      | kV       |
| Insulation resistance                                   | $V_{IO} = 500\text{ V}$                                                      | $R_{IO}$   | $10^{12}$ |      |      | $\Omega$ |
|                                                         | $V_{IO} = 500\text{ V}, T_{amb} = 100\text{ °C}$                             | $R_{IO}$   | $10^{11}$ |      |      | $\Omega$ |
|                                                         | $V_{IO} = 500\text{ V}, T_{amb} = 150\text{ °C}$<br>(construction test only) | $R_{IO}$   | $10^9$    |      |      | $\Omega$ |

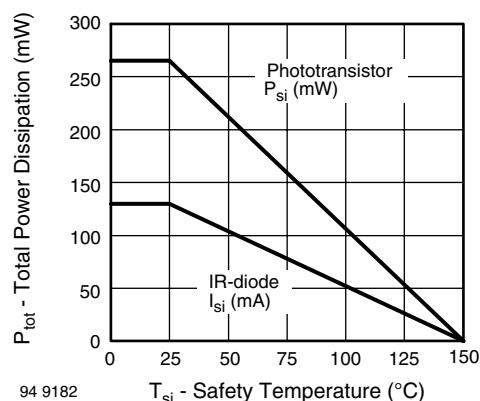


Fig. 1 - Derating Diagram

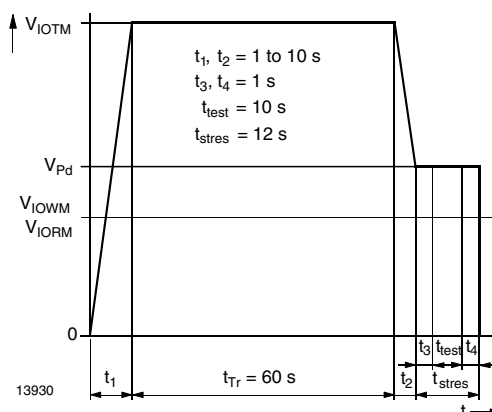


Fig. 2 - Test Pulse Diagram for Sample Test According to DIN EN 60747-5-5/DIN EN 60747-: IEC 60747

| Switching Characteristics |                                                                                          |           |      |      |      |               |
|---------------------------|------------------------------------------------------------------------------------------|-----------|------|------|------|---------------|
| Parameter                 | Test Condition                                                                           | Symbol    | Min. | Typ. | Max. | Unit          |
| Delay time                | $V_S = 5\text{ V}$ , $I_C = 2\text{ mA}$ , $R_L = 100\ \Omega$ ,<br>(see figure 3)       | $t_d$     |      | 3    |      | $\mu\text{s}$ |
| Rise time                 | $V_S = 5\text{ V}$ , $I_C = 2\text{ mA}$ , $R_L = 100\ \Omega$ ,<br>(see figure 3)       | $t_r$     |      | 3    |      | $\mu\text{s}$ |
| Turn-on time              | $V_S = 5\text{ V}$ , $I_C = 2\text{ mA}$ , $R_L = 100\ \Omega$ ,<br>(see figure 3)       | $t_{on}$  |      | 6    |      | $\mu\text{s}$ |
| Storage time              | $V_S = 5\text{ V}$ , $I_C = 2\text{ mA}$ , $R_L = 100\ \Omega$ ,<br>(see figure 3)       | $t_s$     |      | 0.3  |      | $\mu\text{s}$ |
| Fall time                 | $V_S = 5\text{ V}$ , $I_C = 2\text{ mA}$ , $R_L = 100\ \Omega$ ,<br>(see figure 3)       | $t_f$     |      | 4.7  |      | $\mu\text{s}$ |
| Turn-off time             | $V_S = 5\text{ V}$ , $I_C = 2\text{ mA}$ , $R_L = 100\ \Omega$ ,<br>(see figure 3)       | $t_{off}$ |      | 5    |      | $\mu\text{s}$ |
| Turn-on time              | $V_S = 5\text{ V}$ , $I_F = 10\text{ mA}$ , $R_L = 1\text{ k}\Omega$ ,<br>(see figure 4) | $t_{on}$  |      | 9    |      | $\mu\text{s}$ |
| Turn-off time             | $V_S = 5\text{ V}$ , $I_F = 10\text{ mA}$ , $R_L = 1\text{ k}\Omega$ ,<br>(see figure 4) | $t_{off}$ |      | 10   |      | $\mu\text{s}$ |

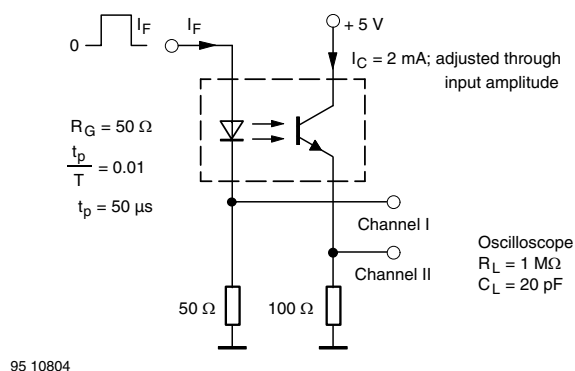


Fig. 3 - Test Circuit, Non-Saturated Operation

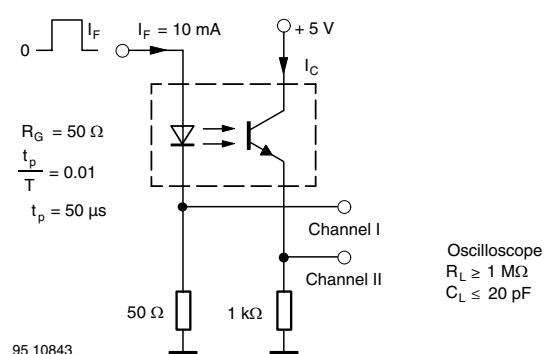


Fig. 4 - Test Circuit, Saturated Operation

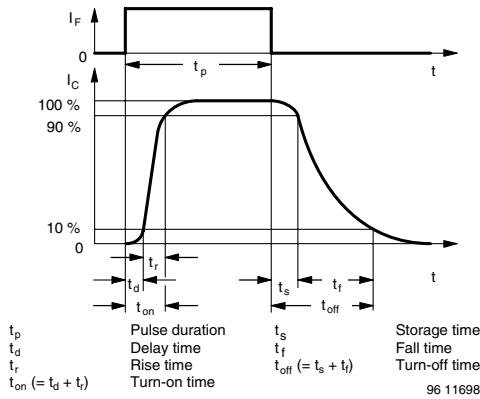


Fig. 5 - Switching Times

### TYPICAL CHARACTERISTICS

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

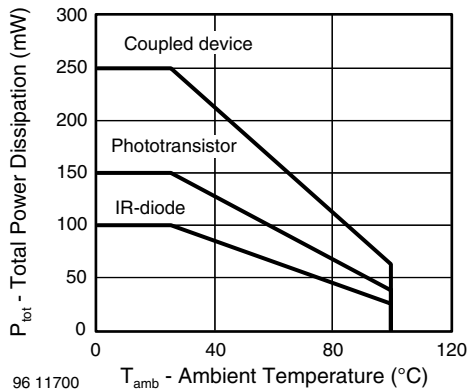


Fig. 6 - Total Power Dissipation vs. Ambient Temperature

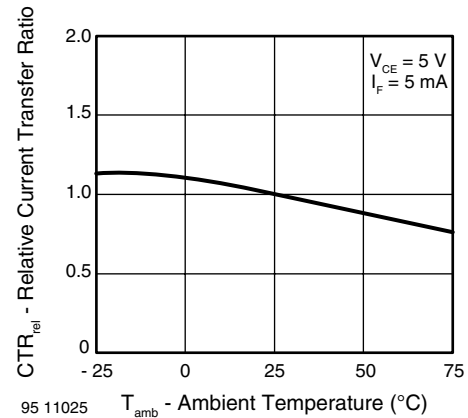


Fig. 8 - Relative Current Transfer Ratio vs. Ambient Temperature

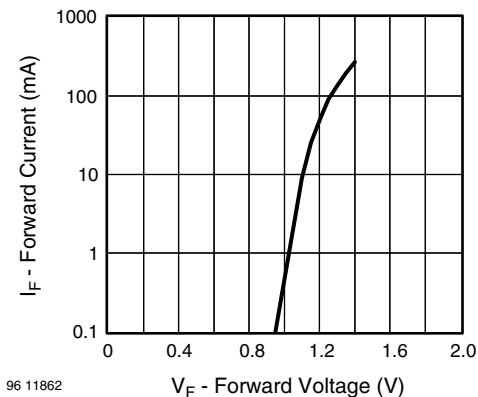


Fig. 7 - Forward Current vs. Forward Voltage

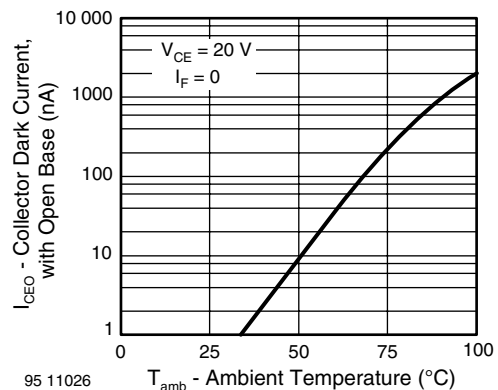


Fig. 9 - Collector Dark Current vs. Ambient Temperature

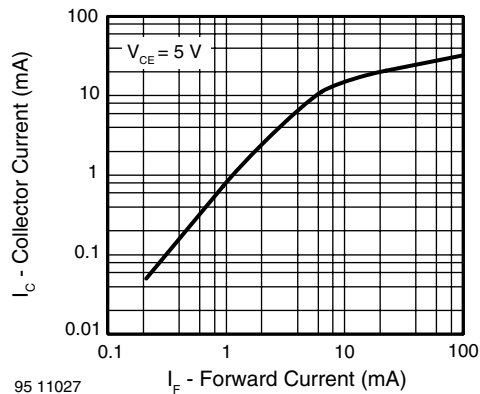


Fig. 10 - Collector Current vs. Forward Current

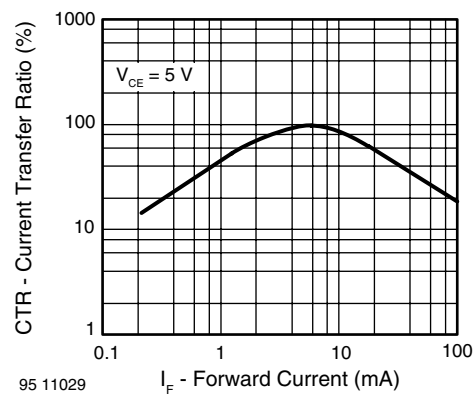


Fig. 13 - Current Transfer Ratio vs. Forward Current

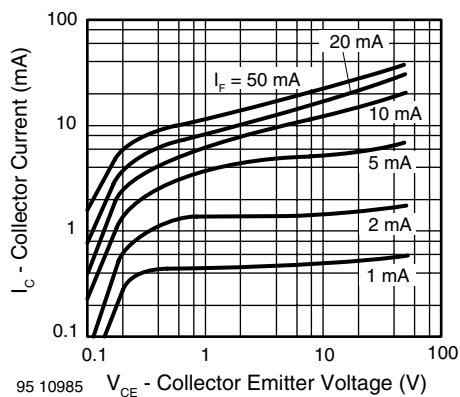


Fig. 11 - Collector Current vs. Collector Emitter Voltage

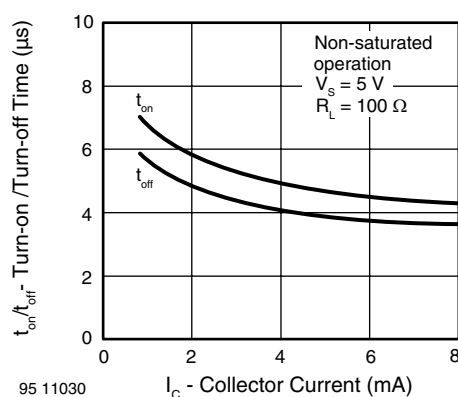


Fig. 14 - Turn-on/off Time vs. Collector Current

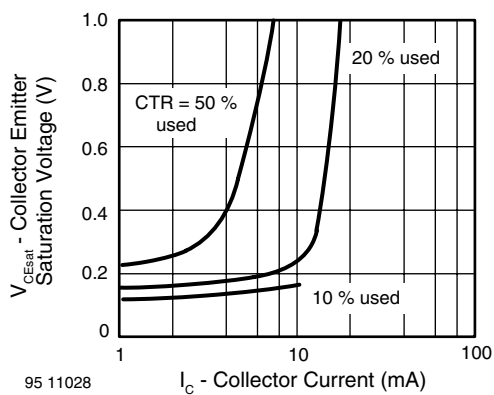


Fig. 12 - Collector Emitter Saturation Voltage vs. Collector Current

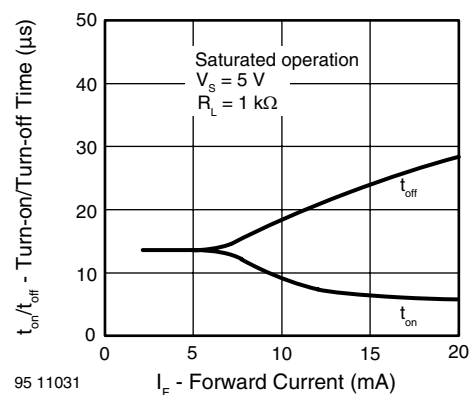


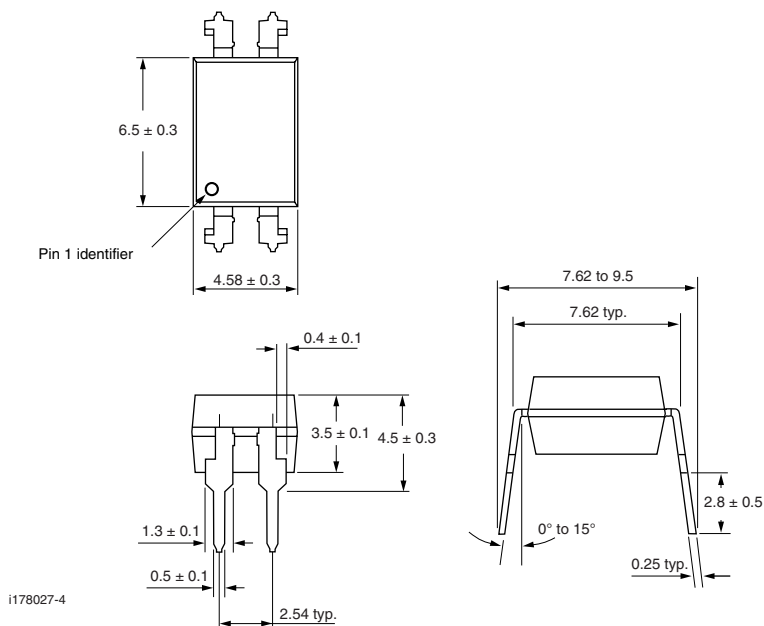
Fig. 15 - Turn-on/off Time vs. Forward Current



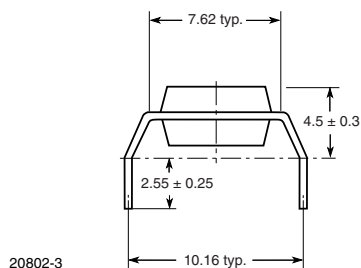
# TCET1100, TCET1100G

Optocoupler, Phototransistor Output, Vishay Semiconductors  
High Temperature

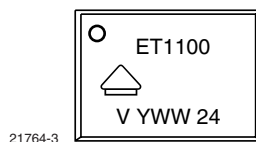
## PACKAGE DIMENSIONS in millimeters



### TCET1100G type



## PACKAGE MARKING







### Disclaimer

All product specifications and data are subject to change without notice.

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