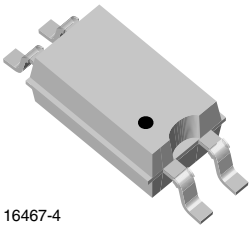
# Optocoupler, Phototransistor Output, Single Channel, Half Pitch Mini-Flat Package



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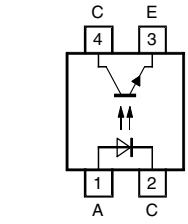



## FEATURES

- Low profile package (half pitch)
- AC isolation test voltage 3750 $V_{RMS}$
- Low coupling capacitance of typical 0.3 pF
- Current transfer ratio (CTR) selected into groups
- Low temperature coefficient of CTR
- Wide ambient temperature range
- Material categorization: For definitions of compliance please see www.vishay.com/doc?99912

Pb-free

e3

RoHS COMPLIANT

## DESCRIPTION

The TCMT110. series consist of a phototransistor optically coupled to a gallium arsenide infrared-emitting diode in a 4 pin package.

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

## APPLICATIONS

- Programmable logic controllers
- Modems
- Answering machines
- General applications

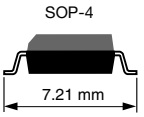
## AGENCY APPROVALS

- UL1577, file no. E76222 system code M, double protection
- cUL CSA 22.2 bulletin 5A, double protection
- DIN EN 60747-5-5 (VDE 0884-5)
- FIMKO: FI EN 60950-1:2006
- BSI: BS EN60065:2002
  BS EN60950-1:2006

## ORDERING INFORMATION

| T | C | M | T | 1 | 1 | 0 | # |
|---|---|---|---|---|---|---|---|

PART NUMBER




| AGENCY CERTIFIED/ PACKAGE | CTR (%) | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 5 mA | 10 mA | | | | 5 mA | | | | |
| UL, cUL, FIMKO, BSI, VDE | 50 to 600 | 40 to 80 | 63 to 125 | 100 to 200 | 160 to 320 | 50 to 150 | 100 to 300 | 80 to 160 | 130 to 260 | 200 to 400 |
| SOP-4 | TCMT1100 | TCMT1101 | TCMT1102 | TCMT1103 | TCMT1104 | TCMT1105 | TCMT1106 | TCMT1107 | TCMT1108 | TCMT1109 |

**Note**

- Available only on tape and reel.

| ABSOLUTE MAXIMUM RATINGS ($T_{amb}$ = 25 °C, unless otherwise specified) | | | | |
|---|---|---|---|---|
| **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 | | $V_{CEO}$ | 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 |
| Power dissipation | | $P_{diss}$ | 150 | mW |
| Junction temperature | | $T_j$ | 125 | °C |
| **COUPLER** | | | | |
| AC isolation test voltage (RMS) | Related to standard climate 23/50 DIN 50014 | $V_{ISO}$ | 3750 | $V_{RMS}$ |
| Total power dissipation | | $P_{tot}$ | 250 | mW |
| Operating ambient temperature range | | $T_{amb}$ | - 40 to + 100 | °C |
| Storage temperature range | | $T_{stg}$ | - 40 to + 125 | °C |
| Soldering temperature [1] | | $T_{sld}$ | 260 | °C |

**Notes**

- 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.

(1) Wave soldering three cycles are allowed. Also refer to “Assembly Instructions” (www.vishay.com/doc?80054).

| ELECTRICAL CHARACTERISTICS ($T_{amb}$ = 25 °C, unless otherwise specified) | | | | | | |
|---|---|---|---|---|---|---|
| **PARAMETER** | **TEST CONDITION** | **SYMBOL** | **MIN.** | **TYP.** | **MAX.** | **UNIT** |
| **INPUT** | | | | | | |
| Forward voltage | $I_F$ = 50 mA | $V_F$ | | 1.25 | 1.6 | V |
| Junction capacitance | $V_R$ = 0, f = 1 MHz | $C_j$ | | 50 | | pF |
| **OUTPUT** | | | | | | |
| Collector emitter voltage | $I_C$ = 100 µA | $V_{CEO}$ | 70 | | | V |
| Emitter collector voltage | $I_E$ = 100 µA | $V_{ECO}$ | 7 | | | V |
| Collector dark current | $V_{CE}$ = 20 V, $I_F$ = 0 A | $I_{CEO}$ | | | 100 | nA |
| **COUPLER** | | | | | | |
| Collector emitter saturation voltage | $I_F$ = 10 mA, $I_C$ = 1 mA | $V_{CEsat}$ | | | 0.3 | V |
| Cut-off frequency | $V_{CE}$ = 5 V, $I_F$ = 10 mA, $R_L$ = 100 Ω | $f_c$ | | 100 | | kHz |
| Coupling capacitance | f = 1 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 °C, unless otherwise specified) | | | | | | | |
|---|---|---|---|---|---|---|---|
| PARAMETER | TEST CONDITION | PART | SYMBOL | MIN. | TYP. | MAX. | UNIT |
| $I_C/I_F$ | $V_{CE}$ = 5 V, $I_F$ = 5 mA | TCMT1100 | CTR | 50 | | 600 | % |
| | $V_{CE}$ = 5 V, $I_F$ = 10 mA | TCMT1101 | CTR | 40 | | 80 | % |
| | | TCMT1102 | CTR | 63 | | 125 | % |
| | | TCMT1103 | CTR | 100 | | 200 | % |
| | | TCMT1104 | CTR | 160 | | 320 | % |
| | $V_{CE}$ = 5 V, $I_F$ = 5 mA | TCMT1105 | CTR | 50 | | 150 | % |
| | | TCMT1106 | CTR | 100 | | 300 | % |
| | | TCMT1107 | CTR | 80 | | 160 | % |
| | | TCMT1108 | CTR | 130 | | 260 | % |
| | | TCMT1109 | CTR | 200 | | 400 | % |

| SWITCHING CHARACTERISTICS ($T_{amb}$ = 25 °C, unless otherwise specified) | | | | | | |
|---|---|---|---|---|---|---|
| PARAMETER | TEST CONDITION | SYMBOL | MIN. | TYP. | MAX. | UNIT |
| Delay time | $V_S$ = 5 V, $I_C$ = 2 mA, $R_L$ = 100 Ω, (see figure 1) | $t_d$ | | 3 | | µs |
| Rise time | $V_S$ = 5 V, $I_C$ = 2 mA, $R_L$ = 100 Ω, (see figure 1) | $t_r$ | | 3 | | µs |
| Fall time | $V_S$ = 5 V, $I_C$ = 2 mA, $R_L$ = 100 Ω, (see figure 1) | $t_f$ | | 4.7 | | µs |
| Storage time | $V_S$ = 5 V, $I_C$ = 2 mA, $R_L$ = 100 Ω, (see figure 1) | $t_s$ | | 0.3 | | µs |
| Turn-on time | $V_S$ = 5 V, $I_C$ = 2 mA, $R_L$ = 100 Ω, (see figure 1) | $t_{on}$ | | 6 | | µs |
| Turn-off time | $V_S$ = 5 V, $I_C$ = 2 mA, $R_L$ = 100 Ω, (see figure 1) | $t_{off}$ | | 5 | | µs |
| Turn-on time | $V_S$ = 5 V, $I_F$ = 10 mA, $R_L$ = 1 kΩ, (see figure 2) | $t_{on}$ | | 9 | | µs |
| Turn-off time | $V_S$ = 5 V, $I_F$ = 10 mA, $R_L$ = 1 kΩ, (see figure 2) | $t_{off}$ | | 18 | | µs |

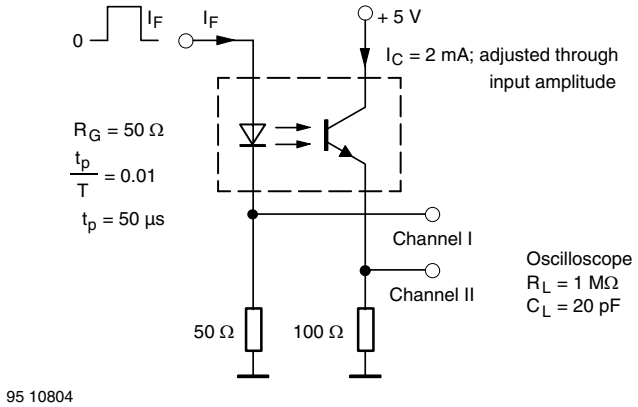



Fig. 1 - Test Circuit, Non-Saturated Operation

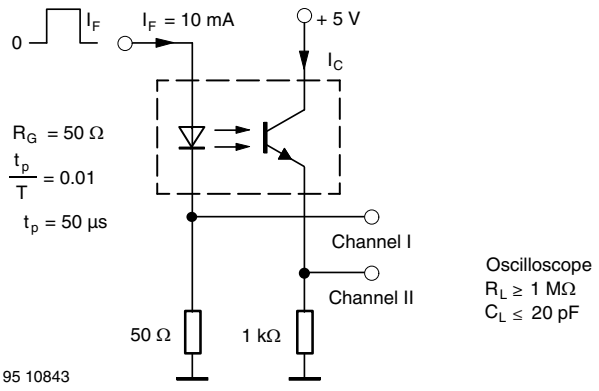



Fig. 2 - Test Circuit, Saturated Operation

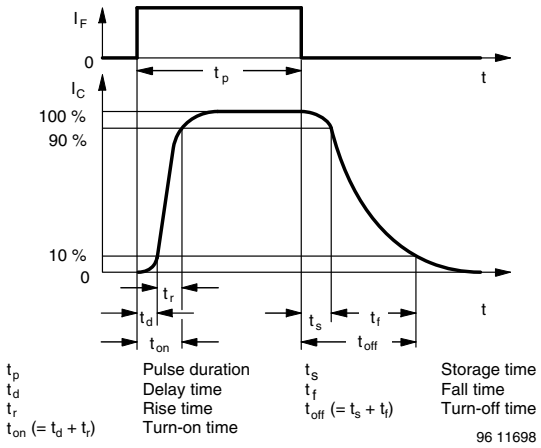



Fig. 3 - Switching Times

| SAFETY AND INSULATION RATINGS | | | | | | |
|---|---|---|---|---|---|---|
| **PARAMETER** | **TEST CONDITION** | **SYMBOL** | **MIN.** | **TYP.** | **MAX.** | **UNIT** |
| Climatic classification | IEC 68 part 1 | | | 40/110/21 | | |
| Comparative tracking index | | CTI | 175 | | 399 | |
| $V_{IOTM}$ | | | 6000 | | | V |
| $V_{IORM}$ | | | 707 | | | V |
| $P_{SO}$ | | | | | 265 | mW |
| $I_{SI}$ | | | | | 130 | mA |
| $T_{SI}$ | | | | | 150 | °C |
| Creepage distance | | | 5 | | | mm |
| Clearance distance | | | 5 | | | mm |
| Insulation thickness, reinforced rated | per IEC60950 2.10.5.1 | | 0.4 | | | mm |

**Note**

- As per IEC 60747-5-2, § 7.4.3.8.1, this optocoupler is suitable for “safe electrical insulation” only within the safety ratings. Compliance with the safety ratings shall be ensured by means of protective circuits.

## TYPICAL CHARACTERISTICS ($T_{amb}$ = 25 °C, unless otherwise specified)

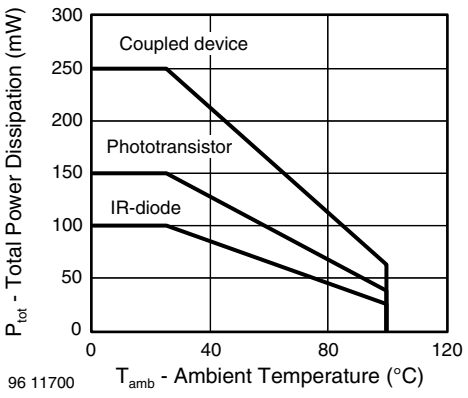



Fig. 4 - Total Power Dissipation vs. Ambient Temperature

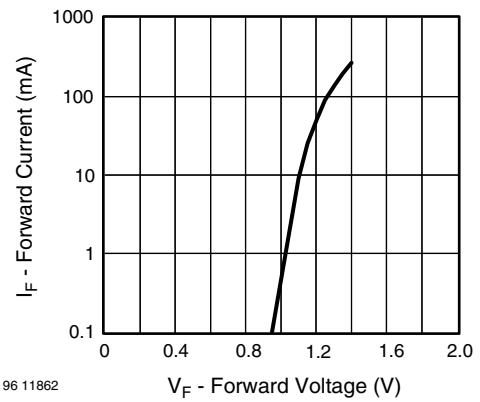



Fig. 5 - Forward Current vs. Forward Voltage

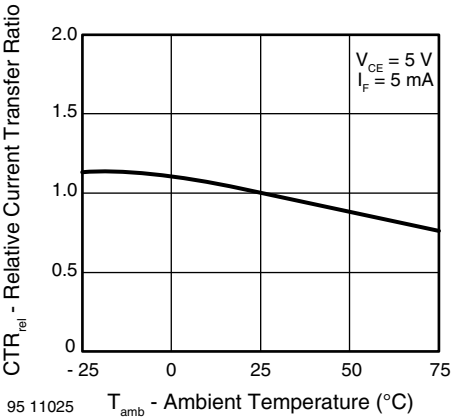



Fig. 6 - Relative Current Transfer Ratio vs. Ambient Temperature

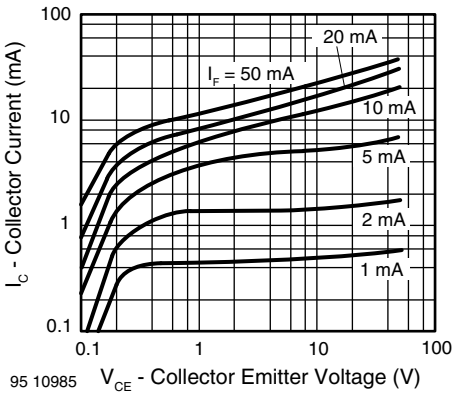



Fig. 9 - Collector Current vs. Collector Emitter Voltage

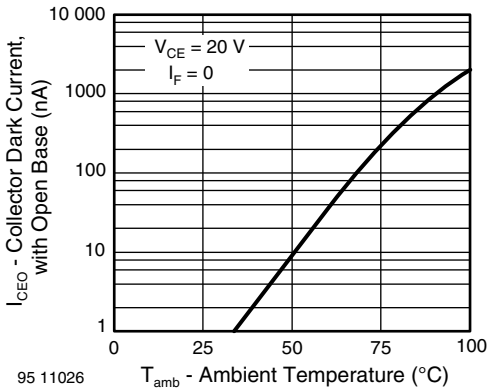



Fig. 7 - Collector Dark Current vs. Ambient Temperature

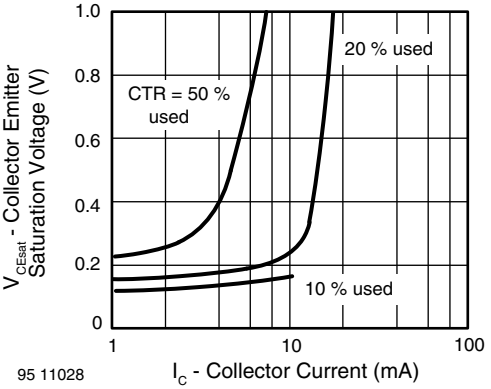



Fig. 10 - Collector Emitter Saturation Voltage vs. Collector Current

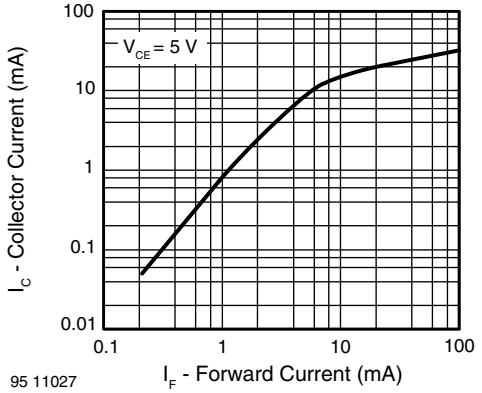



Fig. 8 - Collector Current vs. Forward Current

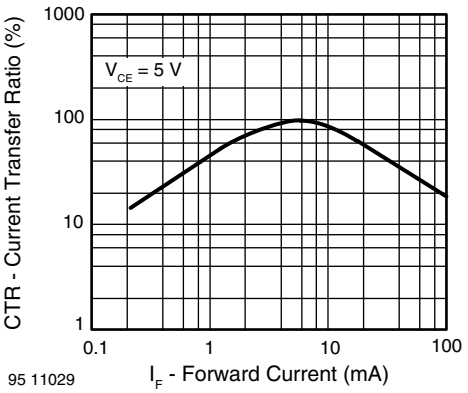



Fig. 11 - Current Transfer Ratio vs. Forward Current

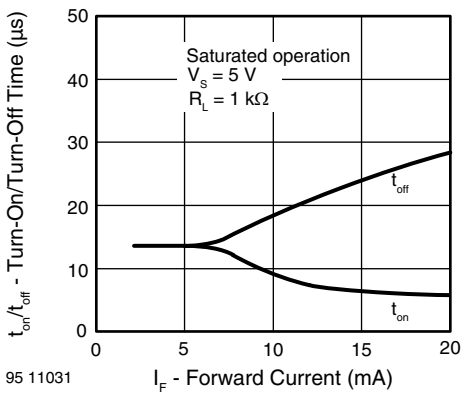



Fig. 12 - Turm-on/off Time vs. Forward Current

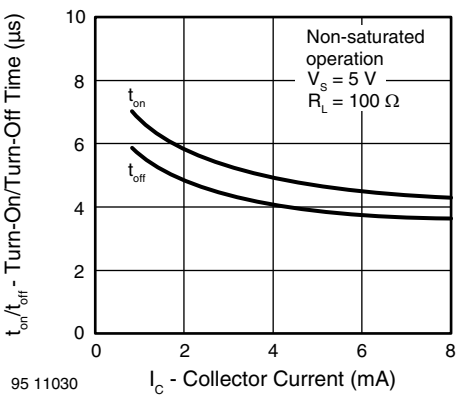
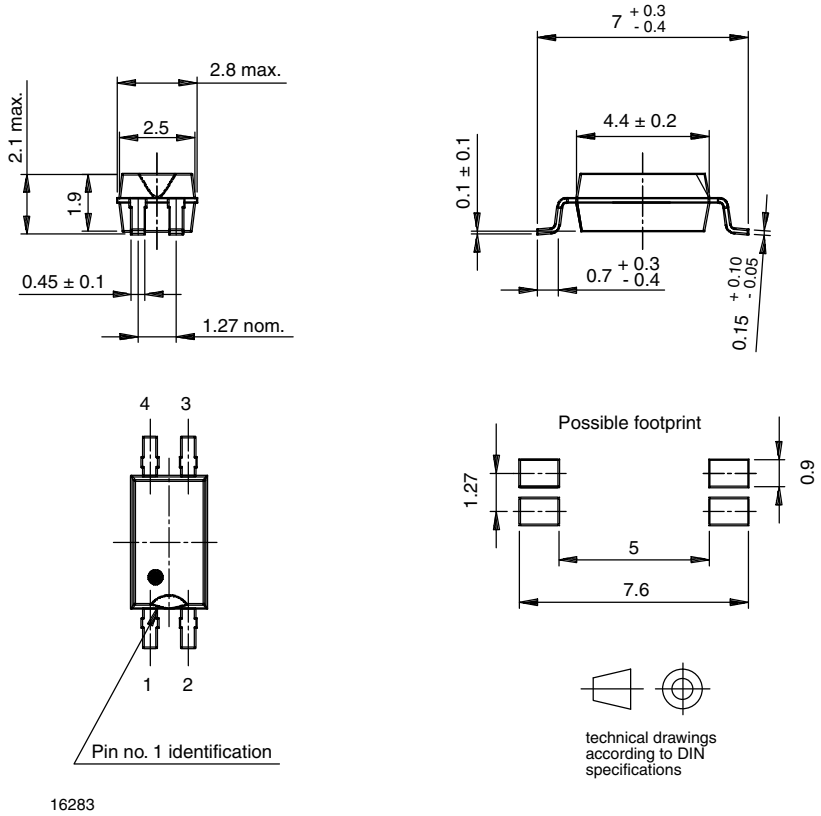
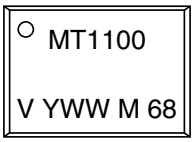



Fig. 13 - Turn-on/off Time vs. Collector Current

## **PACKAGE DIMENSIONS** in millimeters




## **PACKAGE MARKING** (example)



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