

Reflective Optical Sensor with Transistor Output



FEATURES

- Package type: leaded
- Detector type: phototransistor
- Dimensions (L x W x H in mm): 10.2 x 5.8 x 7
- Peak operating distance: 2.5 mm
- Operating range within > 20 % relative collector current: 0.2 mm to 15 mm
- Typical output current under test: $I_C = 1$ mA
- Daylight blocking filter
- Emitter wavelength: 950 nm
- Lead (Pb)-free soldering released
- Compliant to RoHS directive 2002/95/EC and in accordance to WEEE 2002/96/EC



RoHS
COMPLIANT

DESCRIPTION

The TCRT5000 and TCRT5000L are reflective sensors which include an infrared emitter and phototransistor in a leaded package which blocks visible light. The package includes two mounting clips. TCRT5000L is the long lead version.

APPLICATIONS

- Position sensor for shaft encoder
- Detection of reflective material such as paper, IBM cards, magnetic tapes etc.
- Limit switch for mechanical motions in VCR
- General purpose - wherever the space is limited

PRODUCT SUMMARY

| PART NUMBER | DISTANCE FOR MAXIMUM CTR _{rel} ⁽¹⁾ (mm) | DISTANCE RANGE FOR RELATIVE $I_{out} > 20\%$ (mm) | TYPICAL OUTPUT CURRENT UNDER TEST ⁽²⁾ (mA) | DAYLIGHT BLOCKING FILTER INTEGRATED |
|-------------|---|---|---|-------------------------------------|
| TCRT5000 | 2.5 | 0.2 to 15 | 1 | Yes |
| TCRT5000L | 2.5 | 0.2 to 15 | 1 | Yes |

Notes

⁽¹⁾ CTR: current transference ratio, I_{out}/I_{in}

⁽²⁾ Conditions like in table basic characteristics/sensors

ORDERING INFORMATION

| ORDERING CODE | PACKAGING | VOLUME ⁽¹⁾ | REMARKS |
|---------------|-----------|----------------------------|--------------------|
| TCRT5000 | Tube | MOQ: 4500 pcs, 50 pcs/tube | 3.5 mm lead length |
| TCRT5000L | Tube | MOQ: 2400 pcs, 48 pcs/tube | 15 mm lead length |

Note

⁽¹⁾ MOQ: minimum order quantity

ABSOLUTE MAXIMUM RATINGS ⁽¹⁾

| PARAMETER | TEST CONDITION | SYMBOL | VALUE | UNIT |
|------------------------|---------------------------|-----------|-------|------------|
| INPUT (EMITTER) | | | | |
| Reverse voltage | | V_R | 5 | V |
| Forward current | | I_F | 60 | mA |
| Forward surge current | $t_p \leq 10 \mu s$ | I_{FSM} | 3 | A |
| Power dissipation | $T_{amb} \leq 25^\circ C$ | P_V | 100 | mW |
| Junction temperature | | T_j | 100 | $^\circ C$ |

| ABSOLUTE MAXIMUM RATINGS ⁽¹⁾ | | | | |
|---|---------------------------------|-----------|---------------|------------------|
| PARAMETER | TEST CONDITION | SYMBOL | VALUE | UNIT |
| OUTPUT (DETECTOR) | | | | |
| Collector emitter voltage | | V_{CEO} | 70 | V |
| Emitter collector voltage | | V_{ECO} | 5 | V |
| Collector current | | I_C | 100 | mA |
| Power dissipation | $T_{amb} \leq 55^\circ\text{C}$ | P_V | 100 | mW |
| Junction temperature | | T_j | 100 | $^\circ\text{C}$ |
| SENSOR | | | | |
| Total power dissipation | $T_{amb} \leq 25^\circ\text{C}$ | P_{tot} | 200 | mW |
| Ambient temperature range | | T_{amb} | - 25 to + 85 | $^\circ\text{C}$ |
| Storage temperature range | | T_{stg} | - 25 to + 100 | $^\circ\text{C}$ |
| Soldering temperature | 2 mm from case, $t \leq 10$ s | T_{sd} | 260 | $^\circ\text{C}$ |

Note

⁽¹⁾ $T_{amb} = 25^\circ\text{C}$, unless otherwise specified

ABSOLUTE MAXIMUM RATINGS

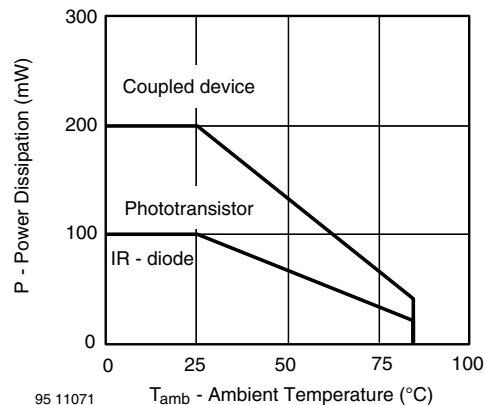


Fig. 1 - Power Dissipation Limit vs. Ambient Temperature

| BASIC CHARACTERISTICS ⁽¹⁾ | | | | | | |
|--------------------------------------|--|--------------------------------|------|------|------|-------|
| PARAMETER | TEST CONDITION | SYMBOL | MIN. | TYP. | MAX. | UNIT |
| INPUT (EMITTER) | | | | | | |
| Forward voltage | $I_F = 60$ mA | V_F | | 1.25 | 1.5 | V |
| Junction capacitance | $V_R = 0$ V, $f = 1$ MHz | C_j | | 17 | | pF |
| Radiant intensity | $I_F = 60$ mA, $t_p = 20$ ms | I_e | | | 21 | mW/sr |
| Peak wavelength | $I_F = 100$ mA | λ_P | 940 | | | nm |
| Virtual source diameter | Method: 63 % encircled energy | d | | 2.1 | | mm |
| OUTPUT (DETECTOR) | | | | | | |
| Collector emitter voltage | $I_C = 1$ mA | V_{CEO} | 70 | | | V |
| Emitter collector voltage | $I_e = 100$ μ A | V_{ECO} | 7 | | | V |
| Collector dark current | $V_{CE} = 20$ V, $I_F = 0$ A, $E = 0$ lx | I_{CEO} | | 10 | 200 | nA |
| SENSOR | | | | | | |
| Collector current | $V_{CE} = 5$ V, $I_F = 10$ mA, $D = 12$ mm | I_C ^{(2) (3)} | 0.5 | 1 | 2.1 | mA |
| Collector emitter saturation voltage | $I_F = 10$ mA, $I_C = 0.1$ mA, $D = 12$ mm | V_{CEsat} ^{(2) (3)} | | | 0.4 | V |

Note

⁽¹⁾ $T_{amb} = 25^\circ\text{C}$, unless otherwise specified

⁽²⁾ See figure 3

⁽³⁾ Test surface: mirror (Mfr. Spindler a. Hoyer, Part No. 340005)



Fig. 2 - Test Circuit



Fig. 3 - Test Circuit

BASIC CHARACTERISTICS

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



Fig. 4 - Forward Current vs. Forward Voltage



Fig. 6 - Collector Current vs. Forward Current



Fig. 5 - Relative Current Transfer Ratio vs. Ambient Temperature



Fig. 7 - Collector Emitter Saturation Voltage vs. Collector Current

TCRT5000, TCRT5000L

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Reflective Optical Sensor with
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Fig. 8 - Current Transfer Ratio vs. Forward Current



Fig. 9 - Relative Collector Current vs. Distance

PACKAGE DIMENSIONS in millimeters, TCRT5000



* Tolerances related to reference plain

weight: ca. 0.23g



Footprint Top View



Drawing-No.: 6.550-5096.01-4

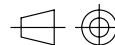
Issue: 4; 11.04.02

96 12073

PACKAGE DIMENSIONS in millimeters, **TCRT5000L**

* Tolerances related to reference plain "A"

** Tolerances related
 on lead end



technical drawings
according to DIN
specifications



weight: ca. 0.23g

Drawing-No.: 6.550-5146.01-4

Issue: 4; 11.04.02

95 11267

Footprint Top View



TCRT5000, TCRT5000L

Vishay Semiconductors

Reflective Optical Sensor with
Transistor Output



TUBE DIMENSIONS in millimeters, TCRT5000



With rubber stopper
Tolerance: ± 0.5 mm
Length: 575 ± 1 mm

Drawing-No.: 9.700-5139.01-4
Issue: 1; 10.05.00
20298

TUBE DIMENSIONS in millimeters, TCRT5000L



With stopper pins
Tolerance: ± 0.5 mm
Length: 575 ± 1 mm

Drawing-No.: 9.700-5178.01-4
Issue: 1; 25.02.00
20299

Packaging and Ordering Information

| PART NUMBER | MOQ ⁽¹⁾ | PCS PER TUBE | TUBE SPEC. (FIGURE) | CONSTITUENTS (FORMS) |
|---------------|--------------------|--------------|---------------------|----------------------|
| CNY70 | 4000 | 80 | 1 | 28 |
| TCPT1300X01 | 2000 | Reel | ⁽²⁾ | 29 |
| TCRT1000 | 1000 | Bulk | - | 26 |
| TCRT1010 | 1000 | Bulk | - | 26 |
| TCRT5000 | 4500 | 50 | 2 | 27 |
| TCRT5000L | 2400 | 48 | 3 | 27 |
| TCST1030 | 5200 | 65 | 5 | 24 |
| TCST1030L | 2600 | 65 | 6 | 24 |
| TCST1103 | 1020 | 85 | 4 | 24 |
| TCST1202 | 1020 | 85 | 4 | 24 |
| TCST1230 | 4800 | 60 | 7 | 24 |
| TCST1300 | 1020 | 85 | 4 | 24 |
| TCST2103 | 1020 | 85 | 4 | 24 |
| TCST2202 | 1020 | 85 | 4 | 24 |
| TCST2300 | 1020 | 85 | 4 | 24 |
| TCST5250 | 4860 | 30 | 8 | 24 |
| TCUT1300X01 | 2000 | Reel | ⁽²⁾ | 29 |
| TCZT8020-PAER | 2500 | Bulk | - | 22 |

Notes

⁽¹⁾ MOQ: minimum order quantity

⁽²⁾ Please refer to datasheets

TUBE SPECIFICATION FIGURES



With rubber stopper

Tolerance: $\pm 0.5\text{mm}$

Length: $575 \pm 1\text{mm}$

Drawing-No.: 9.700-5097.01-4

Issue: 1; 25.02.00

15198

Fig. 1



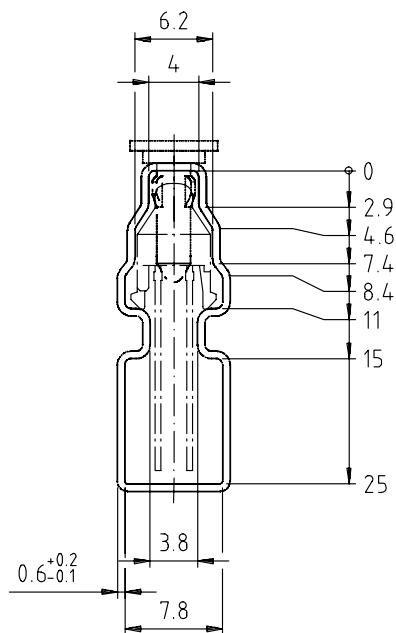
Drawing-No.: 9.700-5139.01-4
Issue: 1; 10.05.00

With rubber stopper
Tolerance: ± 0.5 mm
Length: 575 ± 1 mm

Drawing refers to following types: TCRT 5000

15210

Fig. 2

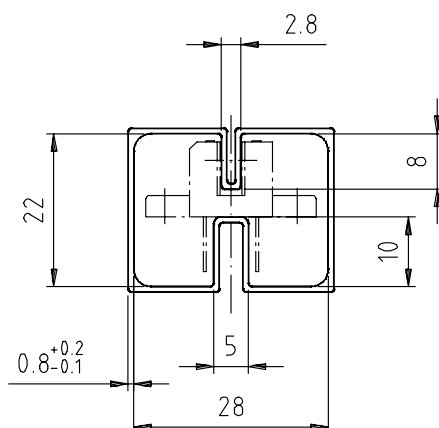


With stopper pins
Tolerance: ± 0.5 mm
Length: 575 ± 1 mm

Drawing-No.: 9.700-5178.01-4
Issue: 1; 25.02.00

15201

Fig. 3



With rubber stopper
Tolerance: $\pm 0.5\text{mm}$
Length: $575 \pm 1\text{mm}$

Drawing-No.: 9.700-5100.01-4
Issue: 1; 25.02.00

15199

Fig. 4

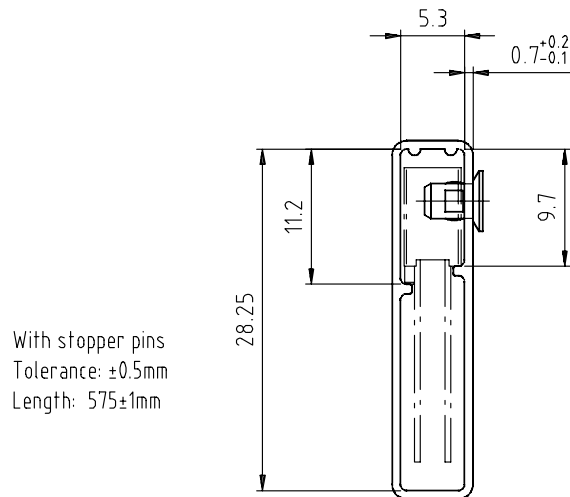


With stopper pins
Tolerance: $\pm 0.5\text{mm}$
Length: $575 \pm 1\text{mm}$

Drawing-No.: 9.700-5140.01-4
Issue: 1; 25.02.00

15202

Fig. 5



Drawing-No.: 9.700-5205.01-4
Issue: 1; 25.02.00

15196

Fig. 6



Drawing-No.: 9.700-5245.01-4
Issue: 1; 25.02.00

15195

Fig. 7



Fig. 8



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