Reflective Optical Sensor with Transistor Output

**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.

**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: $I_C = 1 \text{ mA}$
- 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

**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**

<table>
<thead>
<tr>
<th>PART NUMBER</th>
<th>DISTANCE FOR MAXIMUM $\text{CTR}_{\text{rel}}$ (mm)</th>
<th>DISTANCE RANGE FOR RELATIVE $I_{\text{out}} &gt; 20 %$ (mm)</th>
<th>TYPICAL OUTPUT CURRENT UNDER TEST (mA)</th>
<th>DAYLIGHT BLOCKING FILTER INTEGRATED</th>
</tr>
</thead>
<tbody>
<tr>
<td>TCRT5000</td>
<td>2.5</td>
<td>0.2 to 15</td>
<td>1</td>
<td>Yes</td>
</tr>
<tr>
<td>TCRT5000L</td>
<td>2.5</td>
<td>0.2 to 15</td>
<td>1</td>
<td>Yes</td>
</tr>
</tbody>
</table>

**Notes**
(1) $\text{CTR}$: current transfere ratio, $I_{\text{out}}/I_{\text{in}}$
(2) Conditions like in table basic characteristics/sensors

**ORDERING INFORMATION**

<table>
<thead>
<tr>
<th>ORDERING CODE</th>
<th>PACKAGING</th>
<th>VOLUME (1)</th>
<th>REMARKS</th>
</tr>
</thead>
<tbody>
<tr>
<td>TCRT5000</td>
<td>Tube</td>
<td>MOQ: 4500 pcs, 50 pcs/tube</td>
<td>3.5 mm lead length</td>
</tr>
<tr>
<td>TCRT5000L</td>
<td>Tube</td>
<td>MOQ: 2400 pcs, 48 pcs/tube</td>
<td>15 mm lead length</td>
</tr>
</tbody>
</table>

**Note**
(1) MOQ: minimum order quantity

**ABSOLUTE MAXIMUM RATINGS (1)**

<table>
<thead>
<tr>
<th>PARAMETER</th>
<th>TEST CONDITION</th>
<th>SYMBOL</th>
<th>VALUE</th>
<th>UNIT</th>
</tr>
</thead>
<tbody>
<tr>
<td>INPUT (EMITTER)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reverse voltage</td>
<td></td>
<td>$V_R$</td>
<td>5</td>
<td>V</td>
</tr>
<tr>
<td>Forward current</td>
<td></td>
<td>$I_F$</td>
<td>60</td>
<td>mA</td>
</tr>
<tr>
<td>Forward surge current</td>
<td>$I_p \leq 10 \mu s$</td>
<td>$I_{FSM}$</td>
<td>3</td>
<td>A</td>
</tr>
<tr>
<td>Power dissipation</td>
<td>$T_{\text{amb}} \leq 25 \degree C$</td>
<td>$P_V$</td>
<td>100</td>
<td>mW</td>
</tr>
<tr>
<td>Junction temperature</td>
<td></td>
<td>$T_J$</td>
<td>100</td>
<td>\degree C</td>
</tr>
</tbody>
</table>

---

For technical questions, contact: sensorstechsupport@vishay.com

www.vishay.com
TCRT5000, TCRT5000L
Vishay Semiconductors Reflective Optical Sensor with Transistor Output

ABSOLUTE MAXIMUM RATINGS (1)

<table>
<thead>
<tr>
<th>PARAMETER</th>
<th>TEST CONDITION</th>
<th>SYMBOL</th>
<th>VALUE</th>
<th>UNIT</th>
</tr>
</thead>
<tbody>
<tr>
<td>OUTPUT (DETECTOR)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Collector emitter voltage</td>
<td>VCEO</td>
<td>70</td>
<td>V</td>
<td></td>
</tr>
<tr>
<td>Emitter collector voltage</td>
<td>VECO</td>
<td>5</td>
<td>V</td>
<td></td>
</tr>
<tr>
<td>Collector current</td>
<td>IC</td>
<td>100</td>
<td>mA</td>
<td></td>
</tr>
<tr>
<td>Power dissipation</td>
<td>PV</td>
<td>100</td>
<td>mW</td>
<td></td>
</tr>
<tr>
<td>Junction temperature</td>
<td>TJ</td>
<td>100</td>
<td>°C</td>
<td></td>
</tr>
<tr>
<td>SENSOR</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total power dissipation</td>
<td>Ptot</td>
<td>200</td>
<td>mW</td>
<td></td>
</tr>
<tr>
<td>Ambient temperature range</td>
<td>Tamb</td>
<td>- 25 to + 85</td>
<td>°C</td>
<td></td>
</tr>
<tr>
<td>Storage temperature range</td>
<td>Tstg</td>
<td>- 25 to + 100</td>
<td>°C</td>
<td></td>
</tr>
<tr>
<td>Soldering temperature</td>
<td>Ts</td>
<td>260</td>
<td>°C</td>
<td></td>
</tr>
</tbody>
</table>

Note
(1) Tamb = 25 °C, unless otherwise specified

ABSOLUTE MAXIMUM RATINGS

Fig. 1 - Power Dissipation Limit vs. Ambient Temperature

BASIC CHARACTERISTICS (1)

<table>
<thead>
<tr>
<th>PARAMETER</th>
<th>TEST CONDITION</th>
<th>SYMBOL</th>
<th>MIN.</th>
<th>TYP.</th>
<th>MAX.</th>
<th>UNIT</th>
</tr>
</thead>
<tbody>
<tr>
<td>INPUT (EMITTER)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Forward voltage</td>
<td>IF = 60 mA</td>
<td>VF</td>
<td>1.25</td>
<td>1.5</td>
<td>V</td>
<td></td>
</tr>
<tr>
<td>Junction capacitance</td>
<td>VR = 0 V, f = 1 MHz</td>
<td>Cj</td>
<td>17</td>
<td></td>
<td>pF</td>
<td></td>
</tr>
<tr>
<td>Radiant intensity</td>
<td>IF = 60 mA, tp = 20 ms</td>
<td>IE</td>
<td>21</td>
<td></td>
<td>mW/sr</td>
<td></td>
</tr>
<tr>
<td>Peak wavelength</td>
<td>IF = 100 mA</td>
<td>λp</td>
<td>940</td>
<td></td>
<td>nm</td>
<td></td>
</tr>
<tr>
<td>Virtual source diameter</td>
<td>Method: 63 % encircled energy</td>
<td>d</td>
<td>2.1</td>
<td></td>
<td>mm</td>
<td></td>
</tr>
<tr>
<td>OUTPUT (DETECTOR)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Collector emitter voltage</td>
<td>IC = 1 mA</td>
<td>VCEO</td>
<td>70</td>
<td></td>
<td>V</td>
<td></td>
</tr>
<tr>
<td>Emitter collector voltage</td>
<td>IE = 100 μA</td>
<td>VECO</td>
<td>7</td>
<td></td>
<td>V</td>
<td></td>
</tr>
<tr>
<td>Collector dark current</td>
<td>VCE = 20 V, IF = 0 A, E = 0 lx</td>
<td>ICED</td>
<td>10</td>
<td>200</td>
<td>nA</td>
<td></td>
</tr>
<tr>
<td>SENSOR</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Collector current</td>
<td>VCE = 5 V, IF = 10 mA, D = 12 mm</td>
<td>IC (2) (3)</td>
<td>0.5</td>
<td>1</td>
<td>2.1</td>
<td>mA</td>
</tr>
<tr>
<td>Collector emitter saturation voltage</td>
<td>IF = 10 mA, IC = 0.1 mA, D = 12 mm</td>
<td>VCESat (2) (3)</td>
<td>0.4</td>
<td></td>
<td>V</td>
<td></td>
</tr>
</tbody>
</table>

Note
(1) Tamb = 25 °C, unless otherwise specified
(2) See figure 3
(3) Test surface: mirror (Mfr. Spindler a. Hoyer, Part No. 340005)
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Fig. 2 - Test Circuit

BASIC CHARACTERISTICS
T_{amb} = 25 °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

Vishay Semiconductors Reflective Optical Sensor with Transistor Output

Fig. 8 - Current Transfer Ratio vs. Forward Current

Fig. 9 - Relative Collector Current vs. Distance

PACKAGE DIMENSIONS in millimeters, TCRT5000

Marking area

Reference plane

Tolerances related to reference plane

Footprint Top View
Reflective Optical Sensor with Transistor Output

Vishay Semiconductors

PACKAGE DIMENSIONS in millimeters, TCRT5000L

TCRT5000, TCRT5000L

REFLECTION OPTICAL SENSOR WITH TRANSISTOR OUTPUT

Weight: ca. 0.23g

Drawing-No. 6550-5146.01-4
Issue: 4, 11.04.02
09 11307
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Reflective Optical Sensor with Transistor Output

**TUBE DIMENSIONS** in millimeters, **TCRT5000**

![Diagram of TCRT5000 tube dimensions]

**TUBE DIMENSIONS** in millimeters, **TCRT5000L**

![Diagram of TCRT5000L tube dimensions]
### 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

![Tube Specification Figure]

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

Drawing-No: 9.700-5097.01-4
Issue: 1, 25 02 00

Fig. 1
Packaging and Ordering Information

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Fig. 2

Drawing No.: 9700-5139.01-4
Issue: 1; 10.05.00

Drawing refers to following types: TCRT 5000

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

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Fig. 3

Drawing No.: 9700-5178.01-4
Issue: 1; 25.02.00

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

---
Packaging and Ordering Information

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Fig. 4

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

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

Fig. 5

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

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

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

Fig. 6

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

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

Fig. 7
Packaging and Ordering Information

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Fig. 8

Drawing-No.: 9700-5222.01-4
Issue: 2; 19.11.04
20257

With stopper pins
Tolerance: ±0.5mm
Length: 450±1mm
All dimensions in mm
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