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

**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.

**PRODUCT SUMMARY**

<table>
<thead>
<tr>
<th>PART NUMBER</th>
<th>DISTANCE FOR MAXIMUM $CTR_{rel}$ (mm)</th>
<th>DISTANCE RANGE FOR RELATIVE $I_{out} &gt; 20%$ (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>

**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

**ABSOLUTE MAXIMUM RATINGS**

<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>$V_R$</td>
<td>5</td>
<td>V</td>
</tr>
<tr>
<td>Reverse voltage</td>
<td></td>
<td>$I_F$</td>
<td>60</td>
<td>mA</td>
</tr>
<tr>
<td>Forward current</td>
<td>$I_p \leq 10\mu$s</td>
<td>$I_{FSM}$</td>
<td>3</td>
<td>mA</td>
</tr>
<tr>
<td>Forward surge current</td>
<td></td>
<td>$P_V$</td>
<td>100</td>
<td>mW</td>
</tr>
<tr>
<td>Power dissipation</td>
<td>$T_{amb} \leq 25\degree$</td>
<td>$T_J$</td>
<td>100</td>
<td>°C</td>
</tr>
<tr>
<td>Junction temperature</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
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><strong>OUTPUT (DETECTOR)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Collector emitter voltage</td>
<td>V_{CEO}</td>
<td>70</td>
<td></td>
<td>V</td>
</tr>
<tr>
<td>Emitter collector voltage</td>
<td>V_{ECO}</td>
<td>5</td>
<td></td>
<td>V</td>
</tr>
<tr>
<td>Collector current</td>
<td>I_{C}</td>
<td>100</td>
<td></td>
<td>mA</td>
</tr>
<tr>
<td>Power dissipation</td>
<td>P_{V}</td>
<td>100</td>
<td></td>
<td>mW</td>
</tr>
<tr>
<td>Junction temperature</td>
<td>T_{J}</td>
<td>100</td>
<td></td>
<td>°C</td>
</tr>
<tr>
<td><strong>SENSOR</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total power dissipation</td>
<td>P_{tot}</td>
<td>200</td>
<td></td>
<td>mW</td>
</tr>
<tr>
<td>Ambient temperature range</td>
<td>T_{amb}</td>
<td>- 25 to + 85</td>
<td>°C</td>
<td></td>
</tr>
<tr>
<td>Storage temperature range</td>
<td>T_{stg}</td>
<td>- 25 to + 100</td>
<td>°C</td>
<td></td>
</tr>
<tr>
<td>Soldering temperature</td>
<td>T_{sd}</td>
<td>260</td>
<td></td>
<td>°C</td>
</tr>
</tbody>
</table>

Note
(1) T_{amb} = 25 °C, unless otherwise specified

### ABSOLUTE MAXIMUM RATINGS

![Fig. 1 - Power Dissipation Limit vs. Ambient Temperature](image)

### 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><strong>INPUT (EMITTER)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Forward voltage</td>
<td>I_{F} = 60 mA</td>
<td>V_{F}</td>
<td>1.25</td>
<td>1.5</td>
<td></td>
<td>V</td>
</tr>
<tr>
<td>Junction capacitance</td>
<td>V_{R} = 0 V, f = 1 MHz</td>
<td>C_{j}</td>
<td>17</td>
<td></td>
<td></td>
<td>pF</td>
</tr>
<tr>
<td>Radiant intensity</td>
<td>I_{F} = 60 mA, t_{p} = 20 ms</td>
<td>I_{e}</td>
<td>21</td>
<td></td>
<td></td>
<td>mW/sr</td>
</tr>
<tr>
<td>Peak wavelength</td>
<td>I_{F} = 100 mA</td>
<td>\lambda_{p}</td>
<td>940</td>
<td></td>
<td></td>
<td>nm</td>
</tr>
<tr>
<td>Virtual source diameter</td>
<td>Method: 63 % encircled energy</td>
<td>d</td>
<td>2.1</td>
<td></td>
<td></td>
<td>mm</td>
</tr>
<tr>
<td><strong>OUTPUT (DETECTOR)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Collector emitter voltage</td>
<td>I_{C} = 1 mA</td>
<td>V_{CEO}</td>
<td>70</td>
<td></td>
<td></td>
<td>V</td>
</tr>
<tr>
<td>Emitter collector voltage</td>
<td>I_{E} = 100 µA</td>
<td>V_{ECO}</td>
<td>7</td>
<td></td>
<td></td>
<td>V</td>
</tr>
<tr>
<td>Collector dark current</td>
<td>V_{CE} = 20 V, I_{F} = 0 A, E = 0 lx</td>
<td>I_{CEO}</td>
<td>10</td>
<td>200</td>
<td></td>
<td>nA</td>
</tr>
<tr>
<td><strong>SENSOR</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Collector current</td>
<td>V_{CE} = 5 V, I_{F} = 10 mA, D = 12 mm</td>
<td>I_{C} (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>I_{F} = 10 mA, I_{C} = 0.1 mA, D = 12 mm</td>
<td>V_{CESat} (2) (3)</td>
<td>0.4</td>
<td></td>
<td></td>
<td>V</td>
</tr>
</tbody>
</table>

Note
(1) T_{amb} = 25 °C, unless otherwise specified
(2) See figure 3
(3) Test surface: mirror (Mfr. Spindler a. Hoyer, Part No. 340005)
TCRT5000, TCRT5000L
Reflective Optical Sensor with Transistor Output
Vishay Semiconductors

**BASIC CHARACTERISTICS**

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

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**Fig. 2 - Test Circuit**

**Fig. 3 - Test Circuit**

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**Fig. 4 - Forward Current vs. Forward Voltage**

**Fig. 6 - Collector Current vs. Forward Current**

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**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

**PACKAGE DIMENSIONS** in millimeters, **TCRT5000**

- **V_{CE} = 5 V**
- **V_{CE} = 10 V**
- **I_F = 20 mA**

**Fig. 8 - Current Transfer Ratio vs. Forward Current**

**Fig. 9 - Relative Collector Current vs. Distance**

**Marking area**

**Reference plane**

**Footprint Top View**

- **Coll.**
- **A**
- **E**
- **Cath.**

**Drawing-No.: 6.550-5096.01-4**
**Issue: 4, 11.04.02**
TCRT5000, TCRT5000L
Reflective Optical Sensor with Transistor Output
Vishay Semiconductors

PACKAGE DIMENSIONS in millimeters, TCRT5000L

Drawing-No. 6550-5146.01-4
Issue 4, 11.04.02
IS 11037
TCRT5000, TCRT5000L
Vishay Semiconductors
Reflective Optical Sensor with Transistor Output

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

![TCRT5000 Dimensions Diagram]

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

![TCRT5000L Dimensions Diagram]
## Packaging and Ordering Information

### TUBE SPECIFICATION FIGURES

![Diagram](image)

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

**Drawing-No:** 9.700-5097.01-4  
**Issue:** 1, 25.02.00  
**Fig. 1**

### Notes

(1) MOQ: minimum order quantity  
(2) Please refer to datasheets

### PART NUMBER | MOQ (1) | PCS PER TUBE | TUBE SPEC. (FIGURE) | CONSTITUENTS (FORMS)
--- | --- | --- | --- | ---
CNY70 | 4000 | 80 | 1 | 28
TCPT1300X01 | 2000 | Reel (2) | 26
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
TCST8020-PAER | 2500 | Bulk | - | 22
Packaging and Ordering Information
Vishay Semiconductors Packaging and Ordering Information

Fig. 2

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

Drawing refers to following types: TCRT 5000

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

Fig. 3

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

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

www.vishay.com For technical questions, contact: optocoupleranswers@vishay.com Document Number: 80112
Rev. 1.1, 02-Jul-09
Fig. 4

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

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

Fig. 5

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

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

Vishay Semiconductors

Fig. 8

Drawing-No.: 9.700-5222.01-4
Issue: 2; 19.11.04
20257

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