

## 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 <sub>rel</sub> <sup>(1)</sup> (mm) | DISTANCE RANGE FOR RELATIVE $I_{out} > 20\%$ (mm) | TYPICAL OUTPUT CURRENT UNDER TEST <sup>(2)</sup> (mA) | DAYLIGHT BLOCKING FILTER INTEGRATED |
|-------------|---|---|---|-------------------------------------|
| TCRT5000    | 2.5   | 0.2 to 15   | 1   | Yes                                 |
| TCRT5000L   | 2.5   | 0.2 to 15   | 1   | Yes                                 |

#### Notes

<sup>(1)</sup> CTR: current transference ratio,  $I_{out}/I_{in}$

<sup>(2)</sup> Conditions like in table basic characteristics/sensors

### ORDERING INFORMATION

| ORDERING CODE | PACKAGING | VOLUME <sup>(1)</sup>      | 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

<sup>(1)</sup> MOQ: minimum order quantity

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

| PARAMETER              | TEST CONDITION            | SYMBOL    | VALUE | UNIT       |
|------------------------|---------------------------|-----------|-------|------------|
| <b>INPUT (EMITTER)</b> |                           |           |       |            |
| 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 <sup>(1)</sup> |                                 |           |               |                  |
|---|---------------------------------|-----------|---------------|------------------|
| 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

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

## ABSOLUTE MAXIMUM RATINGS



Fig. 1 - Power Dissipation Limit vs. Ambient Temperature

| BASIC CHARACTERISTICS <sup>(1)</sup> |  |                                |      |      |      |       |
|--------------------------------------|--|--------------------------------|------|------|------|-------|
| 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                             | $\lambda_P$                    | 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            | $I_e = 100$ $\mu$ 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 | $I_C$ <sup>(2) (3)</sup>       | 0.5  | 1    | 2.1  | mA    |
| Collector emitter saturation voltage | $I_F = 10$ mA, $I_C = 0.1$ mA, $D = 12$ mm | $V_{CEsat}$ <sup>(2) (3)</sup> |      |      | 0.4  | V     |

## Note

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

<sup>(2)</sup> See figure 3

<sup>(3)</sup> 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

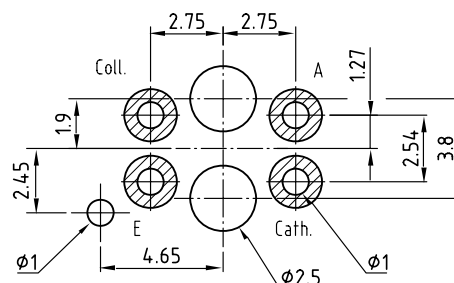


\* Tolerances related to reference plain

weight: ca. 0.23g



Footprint Top View



Drawing-No.: 6.550-5096.01-4

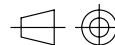
Issue: 4; 11.04.02

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



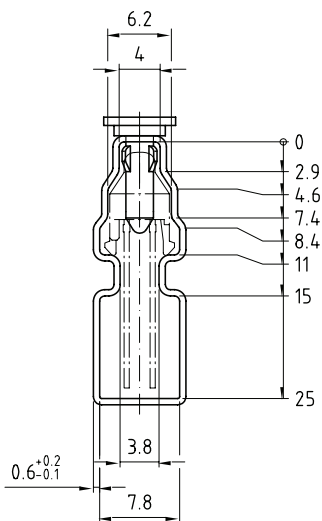
## TUBE DIMENSIONS in millimeters, TCRT5000



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

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

## TUBE DIMENSIONS in millimeters, TCRT5000L



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

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

## Packaging and Ordering Information

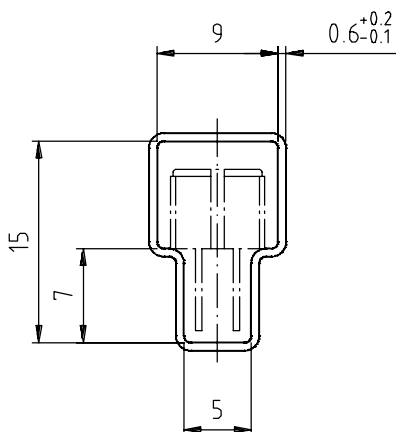
| PART NUMBER   | MOQ <sup>(1)</sup> | PCS PER TUBE | TUBE SPEC. (FIGURE) | CONSTITUENTS (FORMS) |
|---------------|--------------------|--------------|---------------------|----------------------|
| CNY70         | 4000               | 80           | 1                   | 28                   |
| TCPT1300X01   | 2000               | Reel         | <sup>(2)</sup>      | 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         | <sup>(2)</sup>      | 29                   |
| TCZT8020-PAER | 2500               | Bulk         | -                   | 22                   |

### Notes

<sup>(1)</sup> MOQ: minimum order quantity

<sup>(2)</sup> 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

Drawing refers to following types: TCRT 5000

15210

Fig. 2

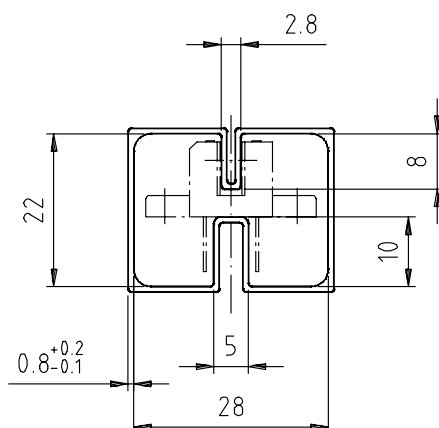


Drawing-No.: 9.700-5178.01-4  
Issue: 1; 25.02.00

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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