

## Transmissive Optical Sensor with Phototransistor Output



19180\_4



19180\_3

### DESCRIPTION

The TCST2103, TCST2202, and TCST2300 are transmissive sensors that include an infrared emitter and phototransistor, located face-to-face on the optical axes in a leaded package which blocks visible light. These part numbers include options for aperture width.

### FEATURES

- Package type: leaded
- Detector type: phototransistor
- Dimensions (L x W x H in mm): 24.5 x 6.3 x 10.8
- Gap (in mm): 3.1
- Typical output current under test:  $I_C = 4$  mA (TCST2103)
- Typical output current under test:  $I_C = 2$  mA (TCST2202)
- Typical output current under test:  $I_C = 0.5$  mA (TCST2300)
- 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

### APPLICATIONS

- Optical switch
- Photo interrupter
- Counter
- Encoder

### PRODUCT SUMMARY

| PART NUMBER | GAP WIDTH (mm) | APERTURE WIDTH (mm) | TYPICAL OUTPUT CURRENT UNDER TEST <sup>(1)</sup> (mA) | DAYLIGHT BLOCKING FILTER INTEGRATED |
|-------------|----------------|---------------------|---|-------------------------------------|
| TCST2103    | 3.1            | 1                   | 4   | Yes                                 |
| TCST2202    | 3.1            | 0.5                 | 2   | Yes                                 |
| TCST2300    | 3.1            | 0.25                | 0.5   | Yes                                 |

**Note**

<sup>(1)</sup> Conditions like in table basic characteristics/coupler

### ORDERING INFORMATION

| ORDERING CODE | PACKAGING | VOLUME <sup>(1)</sup>      | REMARKS              |
|---------------|-----------|----------------------------|----------------------|
| TCST2103      | Tube      | MOQ: 1020 pcs, 85 pcs/tube | With mounting flange |
| TCST2202      | Tube      | MOQ: 1020 pcs, 85 pcs/tube | With mounting flange |
| TCST2300      | Tube      | MOQ: 1020 pcs, 85 pcs/tube | With mounting flange |

**Note**

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

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

| PARAMETER                 | TEST CONDITION                          | SYMBOL    | VALUE         | UNIT |
|---------------------------|---|-----------|---------------|------|
| <b>COUPLER</b>            |   |           |               |      |
| Total power dissipation   | $T_{amb} \leq 25$ °C                    | $P_{tot}$ | 250           | mW   |
| Ambient temperature range |   | $T_{amb}$ | - 55 to + 85  | °C   |
| Storage temperature range |   | $T_{stg}$ | - 55 to + 100 | °C   |
| Soldering temperature     | Distance to package: 2 mm; $t \leq 5$ s | $T_{sd}$  | 260           | °C   |

# TCST2103, TCST2202, TCST2300



Vishay Semiconductors Transmissive Optical Sensor with Phototransistor Output

| ABSOLUTE MAXIMUM RATINGS (1) |  |           |       |                  |
|------------------------------|--|-----------|-------|------------------|
| PARAMETER                    | TEST CONDITION                           | SYMBOL    | VALUE | UNIT             |
| <b>INPUT (EMITTER)</b>       |  |           |       |                  |
| Reverse voltage              |  | $V_R$     | 6     | V                |
| Forward current              |  | $I_F$     | 60    | mA               |
| Forward surge current        | $t_p \leq 10 \mu s$                      | $I_{FSM}$ | 3     | A                |
| Power dissipation            | $T_{amb} \leq 25 \text{ }^\circ\text{C}$ | $P_V$     | 100   | mW               |
| Junction temperature         |  | $T_j$     | 100   | $^\circ\text{C}$ |
| <b>OUTPUT (DETECTOR)</b>     |  |           |       |                  |
| Collector emitter voltage    |  | $V_{CEO}$ | 70    | V                |
| Emitter collector voltage    |  | $V_{ECO}$ | 7     | V                |
| Collector peak current       | $t_p/T = 0.5, t_p \leq 10 \text{ ms}$    | $I_{CM}$  | 200   | mA               |
| Power dissipation            | $T_{amb} \leq 25 \text{ }^\circ\text{C}$ | $P_V$     | 150   | mW               |
| Junction temperature         |  | $T_j$     | 100   | $^\circ\text{C}$ |

## Note

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

## ABSOLUTE MAXIMUM RATINGS



Fig. 1 - Power Dissipation Limit vs. Ambient Temperature

| BASIC CHARACTERISTICS (1)   |  |          |             |      |      |      |      |
|---|--|----------|-------------|------|------|------|------|
| PARAMETER   | TEST CONDITION   | PART     | SYMBOL      | MIN. | TYP. | MAX. | UNIT |
| <b>COUPLER</b>  |  |          |             |      |      |      |      |
| Current transfer ratio  | $V_{CE} = 5 \text{ V}, I_F = 20 \text{ mA}$            | TCST2103 | CTR         | 10   | 20   |      | %    |
|   |  | TCST2202 | CTR         | 5    | 10   |      | %    |
|   |  | TCST2300 | CTR         | 1.25 | 2.5  |      | %    |
| Collector current   | $V_{CE} = 5 \text{ V}, I_F = 20 \text{ mA}$            | TCST2103 | $I_C$       | 2    | 4    |      | mA   |
|   |  | TCST2202 | $I_C$       | 1    | 2    |      | mA   |
|   |  | TCST2300 | $I_C$       | 0.25 | 0.5  |      | mA   |
| Collector emitter saturation voltage                                | $I_F = 20 \text{ mA}, I_C = 1 \text{ mA}$              | TCST2103 | $V_{CEsat}$ |      |      | 0.4  | V    |
|   | $I_F = 20 \text{ mA}, I_C = 0.5 \text{ mA}$            | TCST2202 | $V_{CEsat}$ |      |      | 0.4  | V    |
|   | $I_F = 20 \text{ mA}, I_C = 0.1 \text{ mA}$            | TCST2300 | $V_{CEsat}$ |      |      | 0.4  | V    |
| Resolution, path of the shutter crossing the radiant sensitive zone | $I_{Crel} = 10 \text{ } \% \text{ to } 90 \text{ } \%$ | TCST2103 | s           |      | 0.6  |      | mm   |
|   |  | TCST2202 | s           |      | 0.4  |      | mm   |
|   |  | TCST2300 | s           |      | 0.2  |      | mm   |

| BASIC CHARACTERISTICS (1)        |  |      |           |      |      |      |               |
|----------------------------------|--|------|-----------|------|------|------|---------------|
| PARAMETER                        | TEST CONDITION   | PART | SYMBOL    | MIN. | TYP. | MAX. | UNIT          |
| <b>INPUT (EMITTER)</b>           |  |      |           |      |      |      |               |
| Forward voltage                  | $I_F = 60 \text{ mA}$  |      | $V_F$     |      | 1.25 | 1.6  | V             |
| Junction capacitance             | $V_R = 0 \text{ V}, f = 1 \text{ MHz}$   |      | $C_j$     |      | 50   |      | pF            |
| <b>OUTPUT (DETECTOR)</b>         |  |      |           |      |      |      |               |
| Collector emitter voltage        | $I_C = 1 \text{ mA}$   |      | $V_{CEO}$ | 70   |      |      | V             |
| Emitter collector voltage        | $I_E = 10 \text{ }\mu\text{A}$   |      | $V_{ECO}$ | 7    |      |      | V             |
| Collector dark current           | $V_{CE} = 25 \text{ V}, I_F = 0 \text{ A}, E = 0 \text{ lx}$                     |      | $I_{CEO}$ |      |      | 100  | nA            |
| <b>SWITCHING CHARACTERISTICS</b> |  |      |           |      |      |      |               |
| Turn-on time                     | $I_C = 2 \text{ mA}, V_S = 5 \text{ V}, R_L = 100 \text{ }\Omega$ (see figure 2) |      | $t_{on}$  |      | 10   |      | $\mu\text{s}$ |
| Turn-off time                    | $I_C = 2 \text{ mA}, V_S = 5 \text{ V}, R_L = 100 \text{ }\Omega$ (see figure 2) |      | $t_{off}$ |      | 8    |      | $\mu\text{s}$ |

**Note**

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



Fig. 2 - Test Circuit for  $t_{on}$  and  $t_{off}$



Fig. 3 - Switching Times

**BASIC CHARACTERISTICS**

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



Fig. 4 - Forward Current vs. Forward Voltage

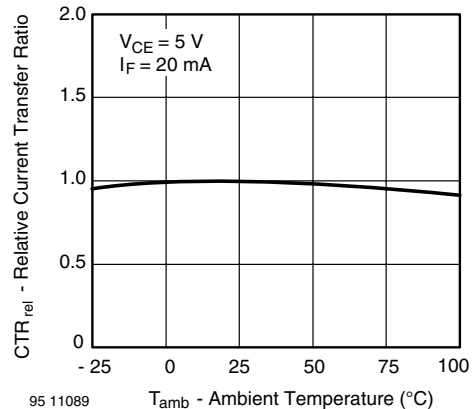


Fig. 5 - Relative Current Transfer Ratio vs. Ambient Temperature



Fig. 6 - Collector Dark Current vs. Ambient Temperature



Fig. 9 - Current Transfer Ratio vs. Forward Current



Fig. 7 - Collector Current vs. Forward Current



Fig. 10 - Turn-off/Turn-on Time vs. Collector Current



Fig. 8 - Collector Current vs. Collector Emitter Voltage



Fig. 11 - Relative Collector Current vs. Displacement



Fig. 12 - Relative Collector Current vs. Displacement

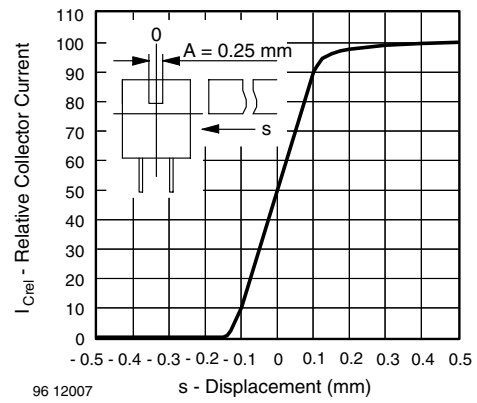


Fig. 13 - Relative Collector Current vs. Displacement

### PACKAGE DIMENSIONS in millimeters



technical drawings according to DIN specifications

weight: ca. 0.90g

Drawing-No.: 6.550-5040.01-4  
 Issue: 2; 10.11.98  
 96 12095

# TCST2103, TCST2202, TCST2300



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## TUBE DIMENSIONS in millimeters



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  
20252

## 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         | (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: ±0.5mm

Length: 575±1mm

Drawing-No.: 9.700-5097.01-4

Issue: 1; 25.02.00

15198

Fig. 1

# Packaging and Ordering Information

Vishay Semiconductors Packaging and Ordering Information



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: ±0.5mm  
Length: 575±1mm

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

15199

Fig. 4



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

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



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

With stopper pins  
 Tolerance:  $\pm 0.5$ mm  
 Length:  $450 \pm 1$ mm  
 All dimensions in mm

Fig. 8



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