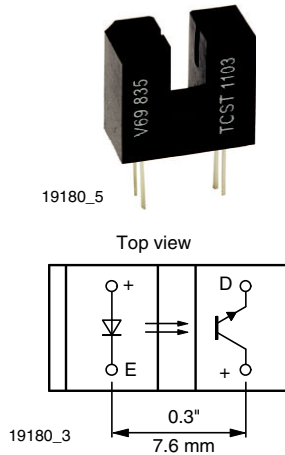


## Transmissive Optical Sensor with Phototransistor Output



### FEATURES

- Package type: leaded
- Detector type: phototransistor
- Dimensions (L x W x H in mm): 11.9 x 6.3 x 10.8
- Gap (in mm): 3.1
- Typical output current under test:  $I_C = 4$  mA (TCST1103)
- Typical output current under test:  $I_C = 2$  mA (TCST1202)
- Typical output current under test:  $I_C = 0.5$  mA (TCST1300)
- 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 TCST1103, TCST1202, and TCST1300 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.

### 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 |
| TCST1103        | 3.1            | 1                   | 4   | Yes                                 |
| TCST1202        | 3.1            | 0.5                 | 2   | Yes                                 |
| TCST1300        | 3.1            | 0.25                | 0.5   | Yes                                 |

#### Note

- Conditions like in table basic characteristics/coupler

| ORDERING INFORMATION |           |                            |                         |
|----------------------|-----------|----------------------------|-------------------------|
| ORDERING CODE        | PACKAGING | VOLUME <sup>(1)</sup>      | REMARKS                 |
| TCST1103             | Tube      | MOQ: 1020 pcs, 85 pcs/tube | Without mounting flange |
| TCST1202             | Tube      | MOQ: 1020 pcs, 85 pcs/tube | Without mounting flange |
| TCST1300             | Tube      | MOQ: 1020 pcs, 85 pcs/tube | Without mounting flange |

#### Note

- MOQ: minimum order quantity

| ABSOLUTE MAXIMUM RATINGS ( $T_{amb} = 25$ °C, unless otherwise specified) |   |           |               |      |
|---|---|-----------|---------------|------|
| 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   |



| ABSOLUTE MAXIMUM RATINGS ( $T_{amb} = 25\text{ }^{\circ}\text{C}$ , unless otherwise specified) |   |           |       |                    |
|---|---|-----------|-------|--------------------|
| 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   | $t_p \leq 10\text{ }\mu\text{s}$          | $I_{FSM}$ | 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   | $^{\circ}\text{C}$ |

**ABSOLUTE MAXIMUM RATINGS**

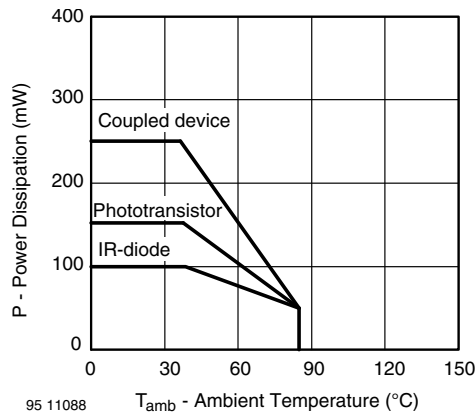


Fig. 1 - Power Dissipation Limit vs. Ambient Temperature

| BASIC CHARACTERISTICS ( $T_{amb} = 25\text{ }^{\circ}\text{C}$ , unless otherwise specified) |   |          |             |      |      |      |      |
|--|---|----------|-------------|------|------|------|------|
| PARAMETER  | TEST CONDITION                            | PART     | SYMBOL      | MIN. | TYP. | MAX. | UNIT |
| <b>COUPLER</b>   |   |          |             |      |      |      |      |
| Current transfer ratio   | $V_{CE} = 5\text{ V}, I_F = 20\text{ mA}$ | TCST1103 | CTR         | 10   | 20   |      | %    |
|  |   | TCST1202 | CTR         | 5    | 10   |      | %    |
|  |   | TCST1300 | CTR         | 1.25 | 2.5  |      | %    |
| Collector current  | $V_{CE} = 5\text{ V}, I_F = 20\text{ mA}$ | TCST1103 | $I_C$       | 2    | 4    |      | mA   |
|  |   | TCST1202 | $I_C$       | 1    | 2    |      | mA   |
|  |   | TCST1300 | $I_C$       | 0.25 | 0.5  |      | mA   |
| Collector emitter saturation voltage   | $I_F = 20\text{ mA}, I_C = 1\text{ mA}$   | TCST1103 | $V_{CEsat}$ |      |      | 0.4  | V    |
|  | $I_F = 20\text{ mA}, I_C = 0.5\text{ mA}$ | TCST1202 | $V_{CEsat}$ |      |      | 0.4  | V    |
|  | $I_F = 20\text{ mA}, I_C = 0.1\text{ mA}$ | TCST1300 | $V_{CEsat}$ |      |      | 0.4  | V    |
| Resolution, path of the shutter crossing the radiant sensitive zone                          | $I_{Crel} = 10\text{ \% to }90\text{ \%}$ | TCST1103 | s           |      | 0.6  |      | mm   |
|  |   | TCST1202 | s           |      | 0.4  |      | mm   |
|  |   | TCST1300 | s           |      | 0.2  |      | mm   |

| BASIC CHARACTERISTICS ( $T_{amb} = 25\text{ }^{\circ}\text{C}$ , unless otherwise specified) |  |      |           |      |      |      |               |
|--|--|------|-----------|------|------|------|---------------|
| 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   | $I_C = 2\text{ mA}$ , $V_S = 5\text{ V}$ ,<br>$R_L = 100\text{ }\Omega$ (see figure 2) |      | $t_{on}$  |      | 10   |      | $\mu\text{s}$ |
| Turn-off time  | $I_C = 2\text{ mA}$ , $V_S = 5\text{ V}$ ,<br>$R_L = 100\text{ }\Omega$ (see figure 2) |      | $t_{off}$ |      | 8    |      | $\mu\text{s}$ |

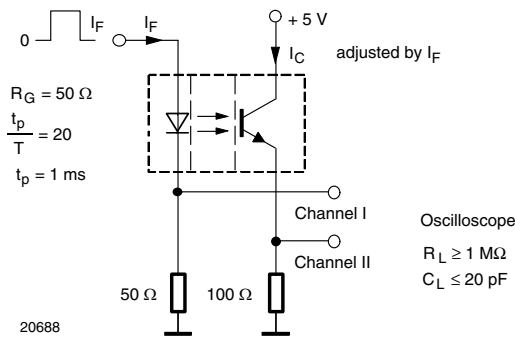

 Fig. 2 - Test Circuit for  $t_{on}$  and  $t_{off}$ 


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

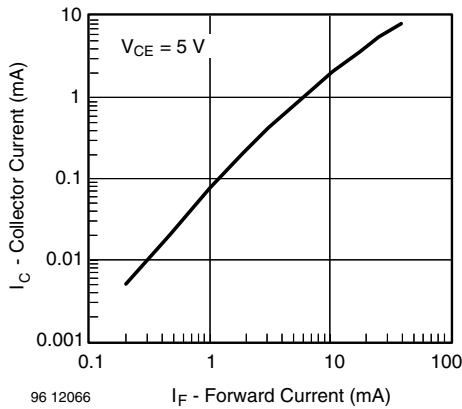


Fig. 7 - Collector Current vs. Forward Current

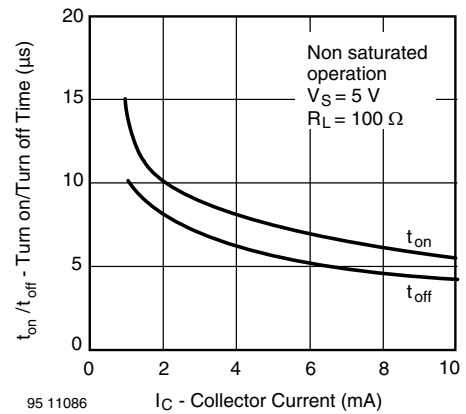


Fig. 10 - Turn-off/Turn-on Time vs. Collector Current

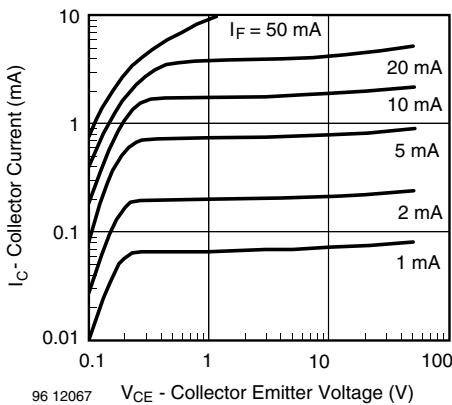


Fig. 8 - Collector Current vs. Collector Emitter Voltage

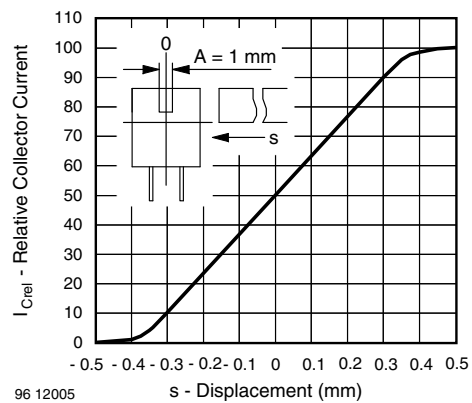


Fig. 11 - Relative Collector Current vs. Displacement



Fig. 12 - Relative Collector Current vs. Displacement

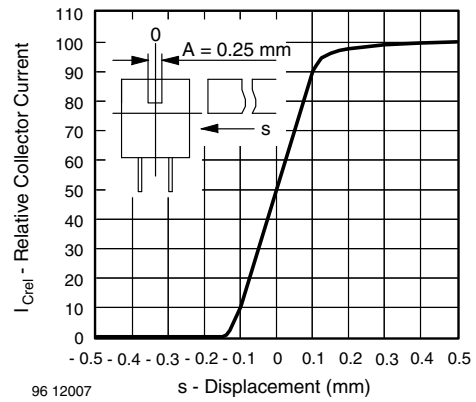


Fig. 13 - Relative Collector Current vs. Displacement

**PACKAGE DIMENSIONS** in millimeters



Drawing-No.: 6.550-5039.01-4

Issue: 2; 10.11.98

96 12094

weight: ca. 0.80g



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

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

Drawing-No.: 9.700-5097.01-4

Issue: 1; 25.02.00

15198

Fig. 1

# 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



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

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



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

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

Fig. 8



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