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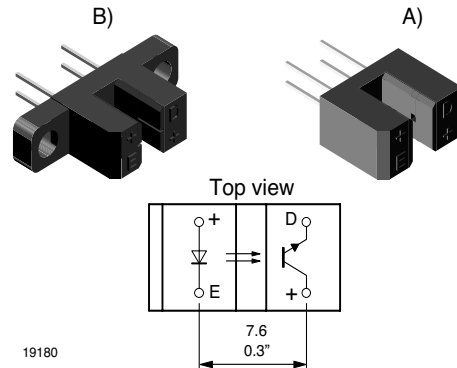
## Transmissive Optical Sensor with Phototransistor Output

### Description

The TCST1103/1202/1300/2103/2202/2300 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 and mounting flanges.

### Features

- Package type: Leaded
- Detector type: Phototransistor
- Dimensions package A:  
L 11.9 mm x W 6.3 mm x H 10.8 mm
- Dimensions package B:  
L 24.5 mm x W 6.3 mm x H 10.8 mm
- Gap: 3.1 mm
- Typical output current under test:  $I_C = 4 \text{ mA}$  (TCST1103/2103)
- Typical output current under test:  $I_C = 2 \text{ mA}$  (TCST1202/2202)
- Typical output current under test:  $I_C = 0.5 \text{ mA}$  (TCST1300/2300)



- Daylight blocking filter
- Emitter wavelength 950 nm
- Lead (Pb)-free soldering released
- Lead (Pb)-free component in accordance to RoHS 2002/95/EC and WEEE 2002/96/EC

### Applications

- Optical switch
- Photo interrupter
- Counter
- Encoder

### Order Instructions

Part Number	Remarks	Resolution, Aperture	Minimum Order Quantity
TCST1103	Without mounting flange <sup>A)</sup>	0.6 mm, 1 mm	1020 pcs, 85 pcs/tube
TCST1202	Without mounting flange <sup>A)</sup>	0.4 mm, 0.5 mm	1020 pcs, 85 pcs/tube
TCST1300	Without mounting flange <sup>A)</sup>	0.2 mm, 0.25 mm	1020 pcs, 85 pcs/tube
TCST2103	With mounting flange <sup>B)</sup>	0.6 mm, 1 mm	1020 pcs, 85 pcs/tube
TCST2202	With mounting flange <sup>B)</sup>	0.4 mm, 0.5 mm	1020 pcs, 85 pcs/tube
TCST2300	With mounting flange <sup>B)</sup>	0.2 mm, 0.25 mm	1020 pcs, 85 pcs/tube

### Absolute Maximum Ratings

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

### Coupler

Parameter	Test condition	Symbol	Value	Unit
Total power dissipation	$T_{amb} \leq 25 \text{ }^\circ\text{C}$	$P_{tot}$	250	mW
Operating temperature range		$T_{amb}$	- 55 to + 85	$^\circ\text{C}$
Storage temperature range		$T_{stg}$	- 55 to + 100	$^\circ\text{C}$
Soldering temperature	Distance to package: 2 mm; $t \leq 5 \text{ s}$	$T_{sd}$	260	$^\circ\text{C}$

## Input (Emitter)

Parameter	Test condition	Symbol	Value	Unit
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	$T_{amb} \leq 25^\circ C$	$P_V$	100	mW
Junction temperature		$T_j$	100	$^\circ C$

## Output (Detector)

Parameter	Test condition	Symbol	Value	Unit
Collector emitter voltage		$V_{CEO}$	70	V
Emitter collector voltage		$V_{ECO}$	7	V
Collector current		$I_C$	100	mA
Collector peak current	$t_p/T = 0.5, t_p \leq 10 ms$	$I_{CM}$	200	mA
Power dissipation	$T_{amb} \leq 25^\circ C$	$P_V$	150	mW
Junction temperature		$T_j$	100	$^\circ C$

## Electrical Characteristics

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

### Coupler

Parameter	Test condition	Part	Symbol	Min	Typ.	Max	Unit
Current Transfer Ratio	$V_{CE} = 5 V, I_F = 20 mA$	TCST1103, TCST2103	CTR	10	20		%
		TCST1202, TCST2202	CTR	5	10		%
		TCST1300, TCST2300	CTR	1.25	2.5		%
Collector current	$V_{CE} = 5 V, I_F = 20 mA$	TCST1103, TCST2103	$I_C$	2	4		mA
		TCST1202, TCST2202	$I_C$	1	2		mA
		TCST1300, TCST2300	$I_C$	0.25	0.5		mA
Collector emitter saturation voltage	$I_F = 20 mA, I_C = 1 mA$	TCST1103, TCST2103	$V_{CEsat}$			0.4	V
	$I_F = 20 mA, I_C = 0.5 mA$	TCST1202, TCST2202	$V_{CEsat}$			0.4	V
	$I_F = 20 mA, I_C = 0.1 mA$	TCST1300, TCST2300	$V_{CEsat}$			0.4	V
Resolution, path of the shutter crossing the radiant sensitive zone	$I_{Crel} = 10 to 90 \%$	TCST1103, TCST2103	s		0.6		mm
		TCST1202, TCST2202	s		0.4		mm
		TCST1300, TCST2300	s		0.2		mm

## Input (Emitter)

Parameter	Test condition	Symbol	Min	Typ.	Max	Unit
Forward voltage	$I_F = 60 mA$	$V_F$		1.25	1.6	V
Junction capacitance	$V_R = 0, f = 1 MHz$	$C_j$		50		pF

## Output (Detector)

Parameter	Test condition	Symbol	Min	Typ.	Max	Unit
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	$V_{CE} = 25 \text{ V}, I_F = 0, E = 0$	$I_{CEO}$			100	nA

## Switching Characteristics

Parameter	Test condition	Symbol	Min	Typ.	Max	Unit
Turn-on time	$V_S = 5 \text{ V}, I_C = 2 \text{ mA}, R_L = 100 \text{ } \Omega$ (see figure 1)	$t_{on}$		10.0		$\mu\text{s}$
Turn-off time	$V_S = 5 \text{ V}, I_C = 2 \text{ mA}, R_L = 100 \text{ } \Omega$ (see figure 1)	$t_{off}$		8.0		$\mu\text{s}$

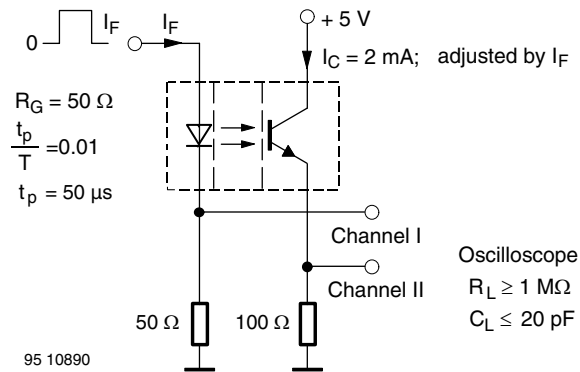


Figure 1. Test circuit for  $t_{on}$  and  $t_{off}$

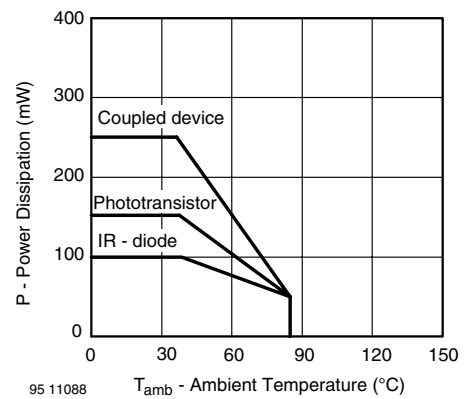


Figure 3. Power Dissipation Limit vs. Ambient Temperature

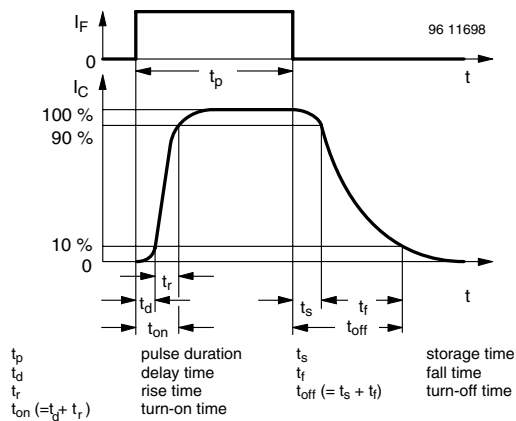


Figure 2. Switching Times

### Typical Characteristics

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

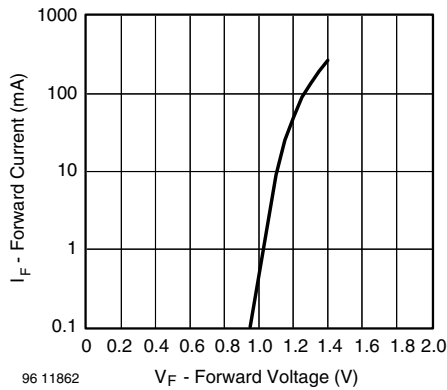


Figure 4. Forward Current vs. Forward Voltage

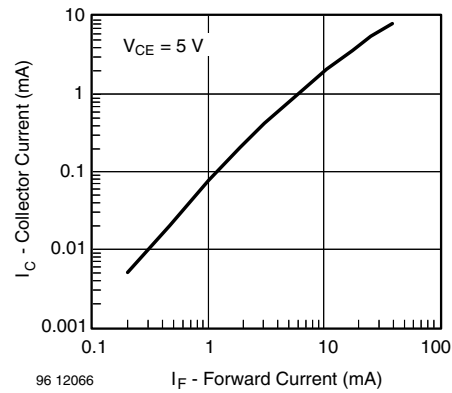


Figure 7. Collector Current vs. Forward Current

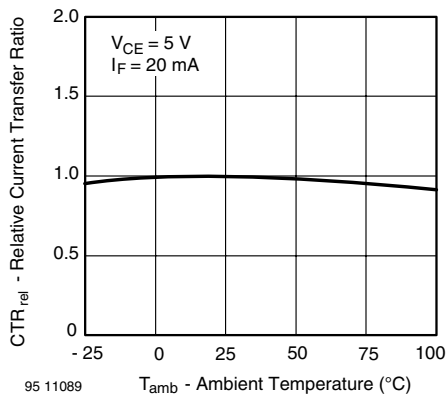


Figure 5. Relative Current Transfer Ratio vs. Ambient Temperature

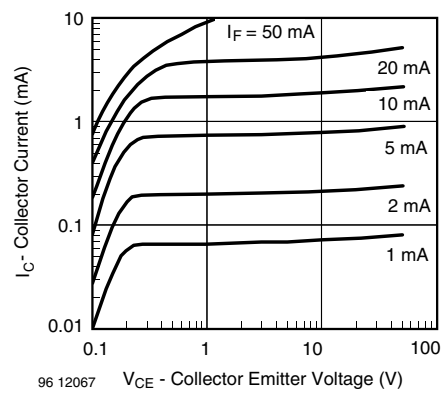


Figure 8. Collector Current vs. Collector Emitter Voltage

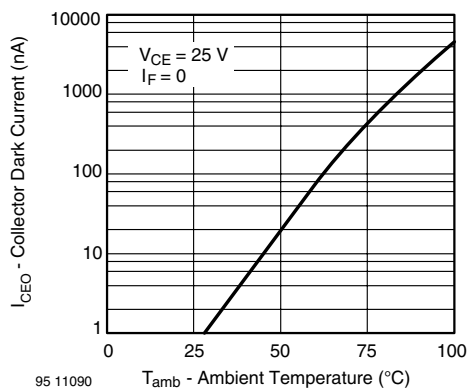


Figure 6. Collector Dark Current vs. Ambient Temperature

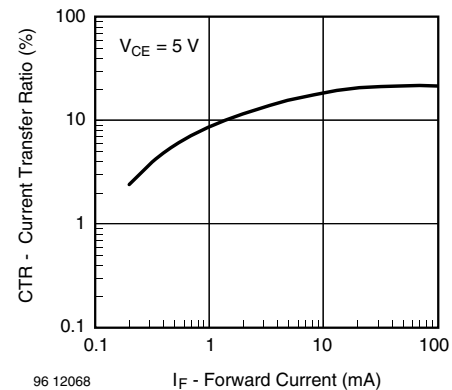


Figure 9. Current Transfer Ratio vs. Forward Current

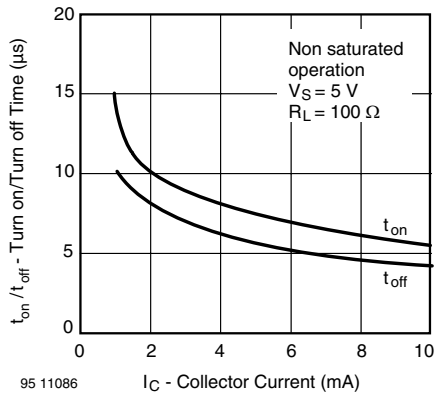


Figure 10. Turn on/off Time vs. Collector Current

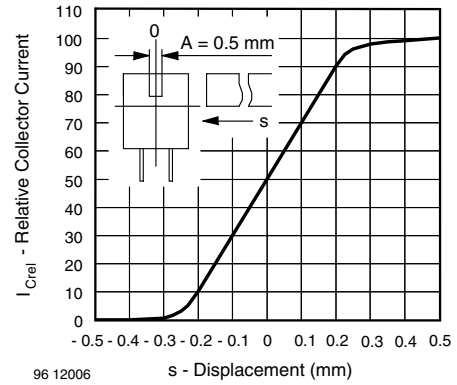


Figure 12. Relative Collector Current vs. Displacement

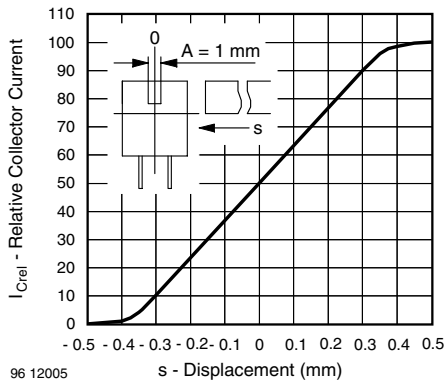


Figure 11. Relative Collector Current vs. Displacement

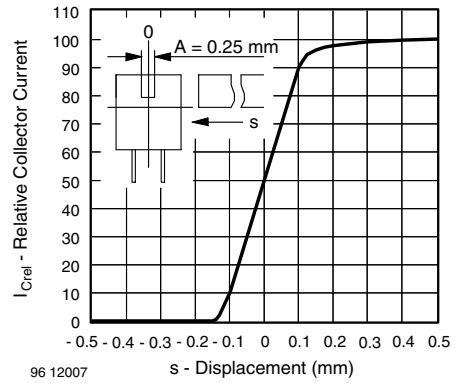
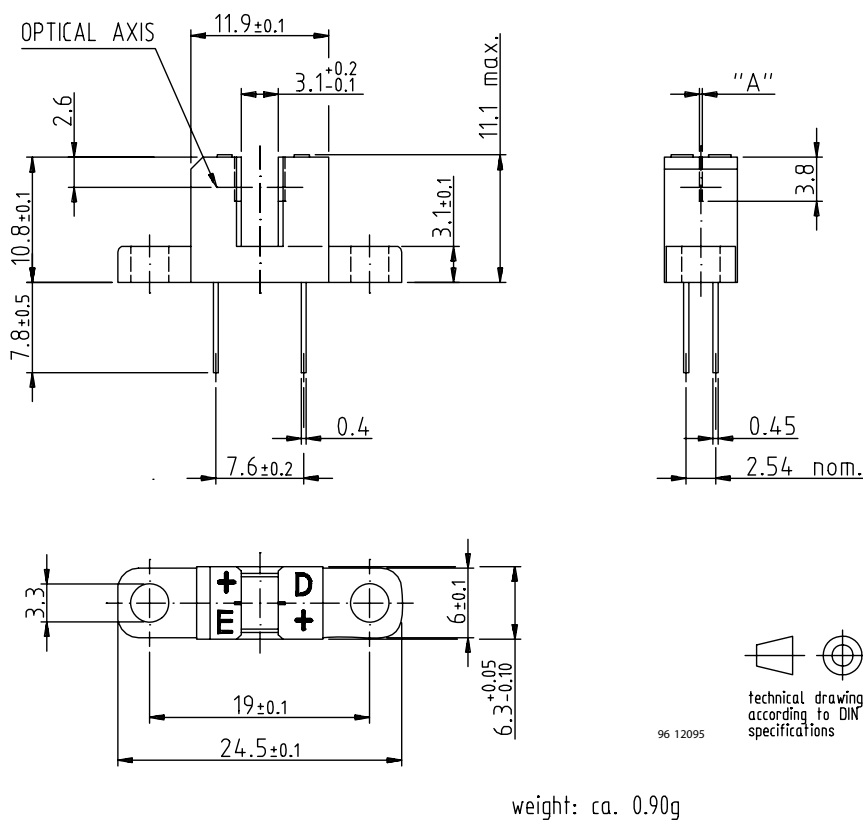
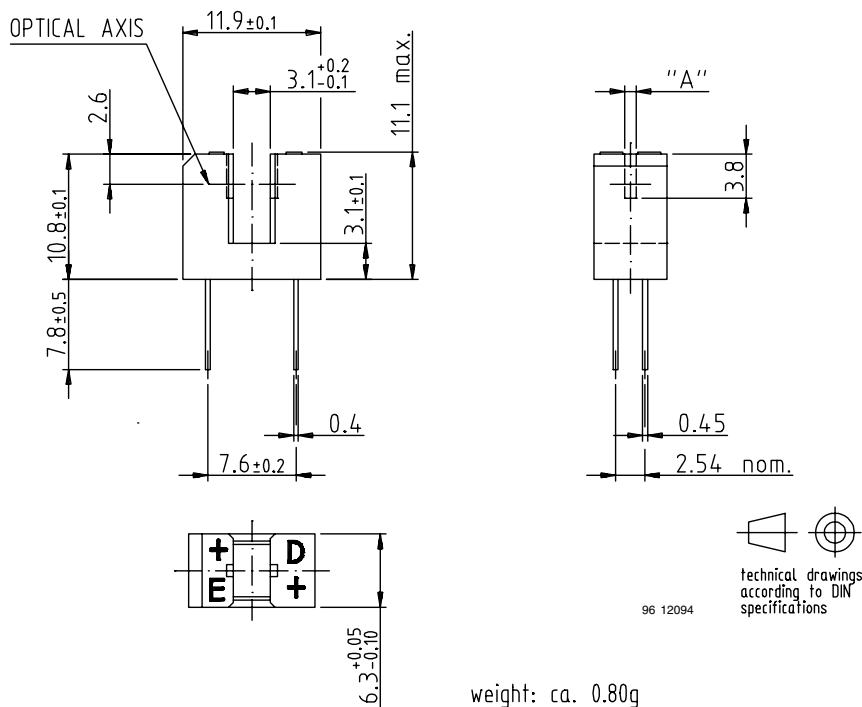


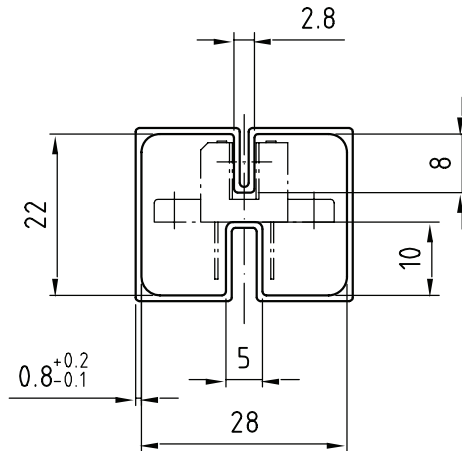
Figure 13. Relative Collector Current vs. Displacement

## Package Dimensions in mm





## Tube Dimensions



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

Drawing-No.: 9.700-5100.01-4

Issue: 1; 25.02.00

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1. Meet all present and future national and international statutory requirements.
2. Regularly and continuously improve the performance of our products, processes, distribution and operating systems with respect to their impact on the health and safety of our employees and the public, as well as their impact on the environment.

It is particular concern to control or eliminate releases of those substances into the atmosphere which are known as ozone depleting substances (ODSs).

The Montreal Protocol (1987) and its London Amendments (1990) intend to severely restrict the use of ODSs and forbid their use within the next ten years. Various national and international initiatives are pressing for an earlier ban on these substances.

Vishay Semiconductor GmbH has been able to use its policy of continuous improvements to eliminate the use of ODSs listed in the following documents.

1. Annex A, B and list of transitional substances of the Montreal Protocol and the London Amendments respectively
2. Class I and II ozone depleting substances in the Clean Air Act Amendments of 1990 by the Environmental Protection Agency (EPA) in the USA
3. Council Decision 88/540/EEC and 91/690/EEC Annex A, B and C (transitional substances) respectively.

Vishay Semiconductor GmbH can certify that our semiconductors are not manufactured with ozone depleting substances and do not contain such substances.

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