

# Subminiature Transmissive Optical Sensor with Transistor Output



19601



21848

## DESCRIPTION

The TCPT1350X01 is a compact transmissive sensor that includes an infrared emitter and a phototransistor detector, located face-to-face in a surface mount package. TCPT1350X01 is especially designed to meet high operating temperature requirements and is released for operating temperature ranges from - 40 °C to + 125 °C.

## FEATURES

- Package type: surface mount
- Detector type: phototransistor
- Dimensions (L x W x H in mm): 5.5 x 4 x 4
- AEC-Q101 qualified
- Gap (in mm): 3
- Aperture (in mm): 0.3
- Typical output current under test:  $I_C = 1.6$  mA
- Emitter wavelength: 950 nm
- Released for high operating temperatures up to 125 °C
- Moisture sensitivity level (MSL): 1
- Material categorization: For definitions of compliance please see [www.vishay.com/doc?99912](http://www.vishay.com/doc?99912)

 AUTOMOTIVE  
GRADE

**RoHS**  
COMPLIANT  
**GREEN**  
(5-2008)

## APPLICATIONS

- Automotive optical sensors
- Accurate position sensor for encoder
- Detection of motion speed

## PRODUCT SUMMARY

| PART NUMBER | GAP WIDTH (mm) | APERTURE WIDTH (mm) | TYPICAL OUTPUT CURRENT UNDER TEST <sup>(1)</sup> (mA) | DAYLIGHT BLOCKING FILTER INTEGRATED |
|-------------|----------------|---------------------|---|-------------------------------------|
| TCPT1350X01 | 3              | 0.3                 | 1.6   | No                                  |

### Note

- Conditions like in table basic characteristics/coupler

## ORDERING INFORMATION

| ORDERING CODE | PACKAGING     | VOLUME <sup>(1)</sup>        | REMARKS        |
|---------------|---------------|------------------------------|----------------|
| TCPT1350X01   | Tape and reel | MOQ: 2000 pcs, 2000 pcs/reel | Drypack, MSL 1 |

### Note

- MOQ: minimum order quantity



| <b>ABSOLUTE MAXIMUM RATINGS</b> ( $T_{amb} = 25\text{ }^{\circ}\text{C}$ , unless otherwise specified) |  |           |               |                    |
|--|--|-----------|---------------|--------------------|
| PARAMETER  | TEST CONDITION   | SYMBOL    | VALUE         | UNIT               |
| <b>COUPLER</b>   |  |           |               |                    |
| Total power dissipation  | $T_{amb} \leq 125\text{ }^{\circ}\text{C}$                     | $P_{tot}$ | 37.5          | mW                 |
| Junction temperature   |  | $T_j$     | 140           | $^{\circ}\text{C}$ |
| Ambient temperature range  |  | $T_{amb}$ | - 40 to + 125 | $^{\circ}\text{C}$ |
| Storage temperature range  |  | $T_{stg}$ | - 40 to + 125 | $^{\circ}\text{C}$ |
| Soldering temperature  | In accordance with fig. 16                                     | $T_{sd}$  | 260           | $^{\circ}\text{C}$ |
| <b>INPUT (EMITTER)</b>   |  |           |               |                    |
| Reverse voltage  |  | $V_R$     | 5             | V                  |
| Forward current  | $T_{amb} \leq 125\text{ }^{\circ}\text{C}$                     | $I_F$     | 25            | mA                 |
| Forward surge current  | $t_p \leq 10\text{ }\mu\text{s}$                               | $I_{FSM}$ | 200           | mA                 |
| Power dissipation  | $T_{amb} \leq 125\text{ }^{\circ}\text{C}$                     | $P_V$     | 37.5          | mW                 |
| <b>OUTPUT (DETECTOR)</b>   |  |           |               |                    |
| Collector emitter voltage  |  | $V_{CEO}$ | 20            | V                  |
| Emitter collector voltage  |  | $V_{ECO}$ | 7             | V                  |
| Collector current  |  | $I_C$     | 20            | mA                 |
| Collector dark current   | $T_{amb} = 85\text{ }^{\circ}\text{C}$ , $V_{CE} = 5\text{ V}$ | $I_{CEO}$ | 3.3           | $\mu\text{A}$      |

### ABSOLUTE MAXIMUM RATINGS

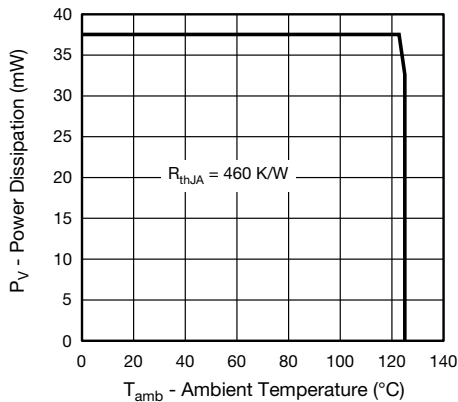


Fig. 1 - Power Dissipation Limit vs. Ambient Temperature

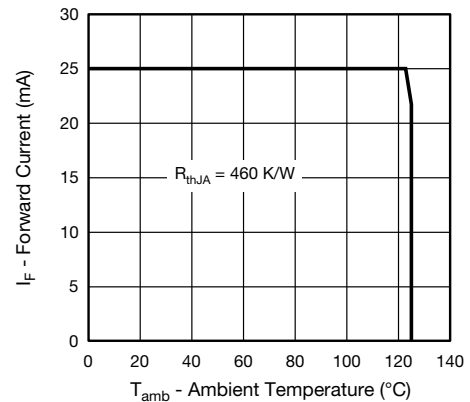


Fig. 2 - Forward Current Limit vs. Ambient Temperature

| <b>BASIC CHARACTERISTICS</b> ( $T_{amb} = 25\text{ }^{\circ}\text{C}$ , unless otherwise specified) |   |             |      |      |      |               |
|---|---|-------------|------|------|------|---------------|
| PARAMETER   | TEST CONDITION  | SYMBOL      | MIN. | TYP. | MAX. | UNIT          |
| <b>COUPLER</b>  |   |             |      |      |      |               |
| Collector current   | $V_{CE} = 5\text{ V}$ , $I_F = 15\text{ mA}$  | $I_C$       | 0.7  | 1.6  |      | mA            |
| Collector emitter saturation voltage  | $I_F = 15\text{ mA}$ , $I_C = 0.2\text{ mA}$  | $V_{CEsat}$ |      |      | 0.4  | V             |
| <b>INPUT (EMITTER)</b>  |   |             |      |      |      |               |
| Forward voltage   | $I_F = 15\text{ mA}$  | $V_F$       | 1    | 1.2  | 1.4  | V             |
| Reverse current   | $V_R = 5\text{ V}$  | $I_R$       |      |      | 10   | $\mu\text{A}$ |
| Junction capacitance  | $V_R = 0\text{ V}$ , $f = 1\text{ MHz}$   | $C_j$       |      | 25   |      | pF            |
| <b>OUTPUT (DETECTOR)</b>  |   |             |      |      |      |               |
| Collector emitter voltage $I_C$   | $I_C = 1\text{ mA}$   | $V_{CEO}$   | 20   |      |      | V             |
| Emitter collector voltage   | $I_E = 100\text{ }\mu\text{A}$  | $V_{ECO}$   | 7    |      |      | V             |
| Collector dark current  | $V_{CE} = 25\text{ V}$ , $I_F = 0\text{ A}$ , $E = 0\text{ lx}$                             | $I_{CEO}$   |      | 1    | 100  | nA            |
| <b>SWITCHING CHARACTERISTICS</b>  |   |             |      |      |      |               |
| Rise time   | $I_C = 0.7\text{ mA}$ , $V_{CE} = 5\text{ V}$ ,<br>$R_L = 100\text{ }\Omega$ (see figure 3) | $t_r$       |      | 9    | 150  | $\mu\text{s}$ |
| Fall time   | $I_C = 0.7\text{ mA}$ , $V_{CE} = 5\text{ V}$ ,<br>$R_L = 100\text{ }\Omega$ (see figure 3) | $t_f$       |      | 16   | 150  | $\mu\text{s}$ |

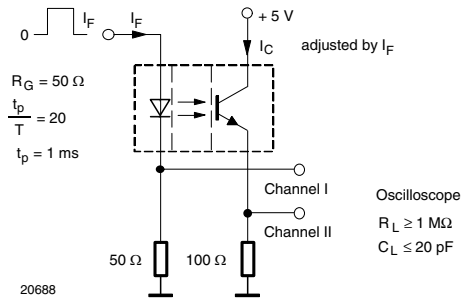

 Fig. 3 - Test Circuit for  $t_r$  and  $t_f$ 


Fig. 4 - Switching Times

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


Fig. 5 - Forward Current vs. Forward Voltage



Fig. 6 - Forward Voltage vs. Ambient Temperature



Fig. 7 - Collector Current vs. Forward Current



Fig. 10 - Collector Current vs. Ambient Temperature

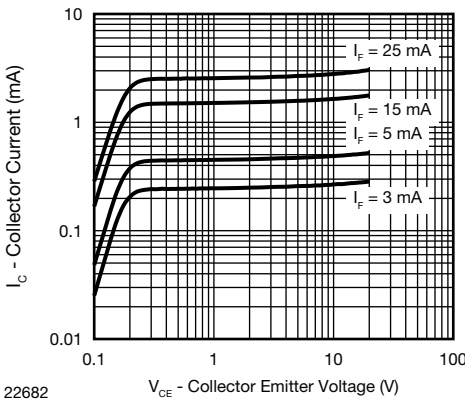


Fig. 8 - Collector Current vs. Collector Emitter Voltage



Fig. 11 - Collector Dark Current vs. Ambient Temperature



Fig. 9 - Collector Emitter Saturation Voltage vs. Ambient Temperature



Fig. 12 - Relative Collector Current vs. Horizontal Displacement

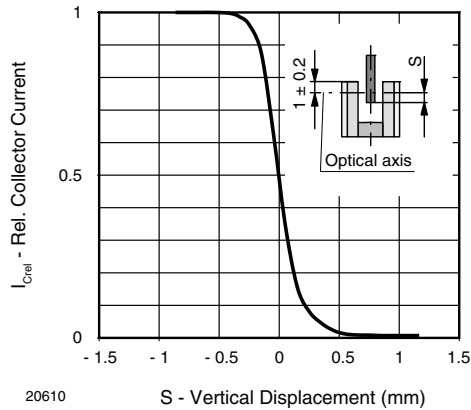


Fig. 13 - Relative Collector Current vs. Vertical Displacement

**REFLOW SOLDER PROFILE**

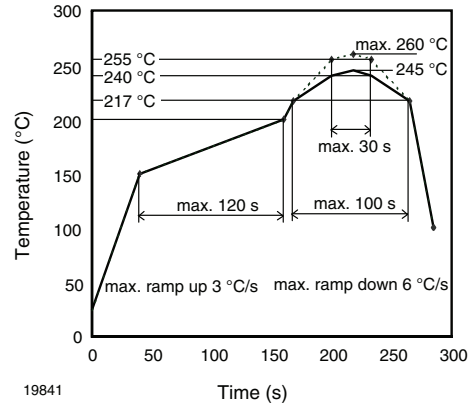


Fig. 16 - Lead (Pb)-free Reflow Solder Profile acc. J-STD-020

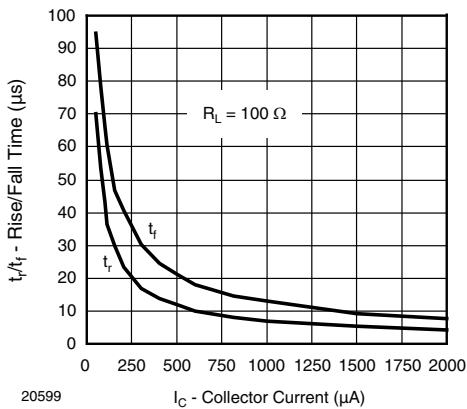


Fig. 14 - Rise/Fall Time vs. Collector Current

**FLOOR LIFE**

No time limit.  
Moisture sensitivity level (MSL) 1, acc. JEDEC, J-STD-020.

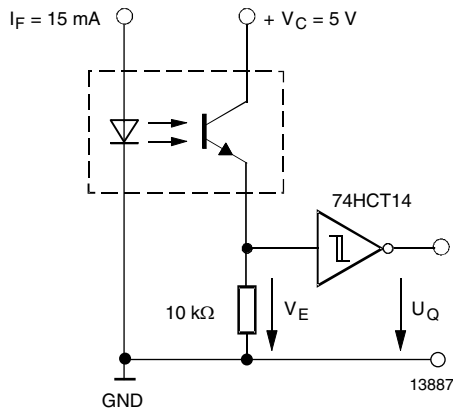
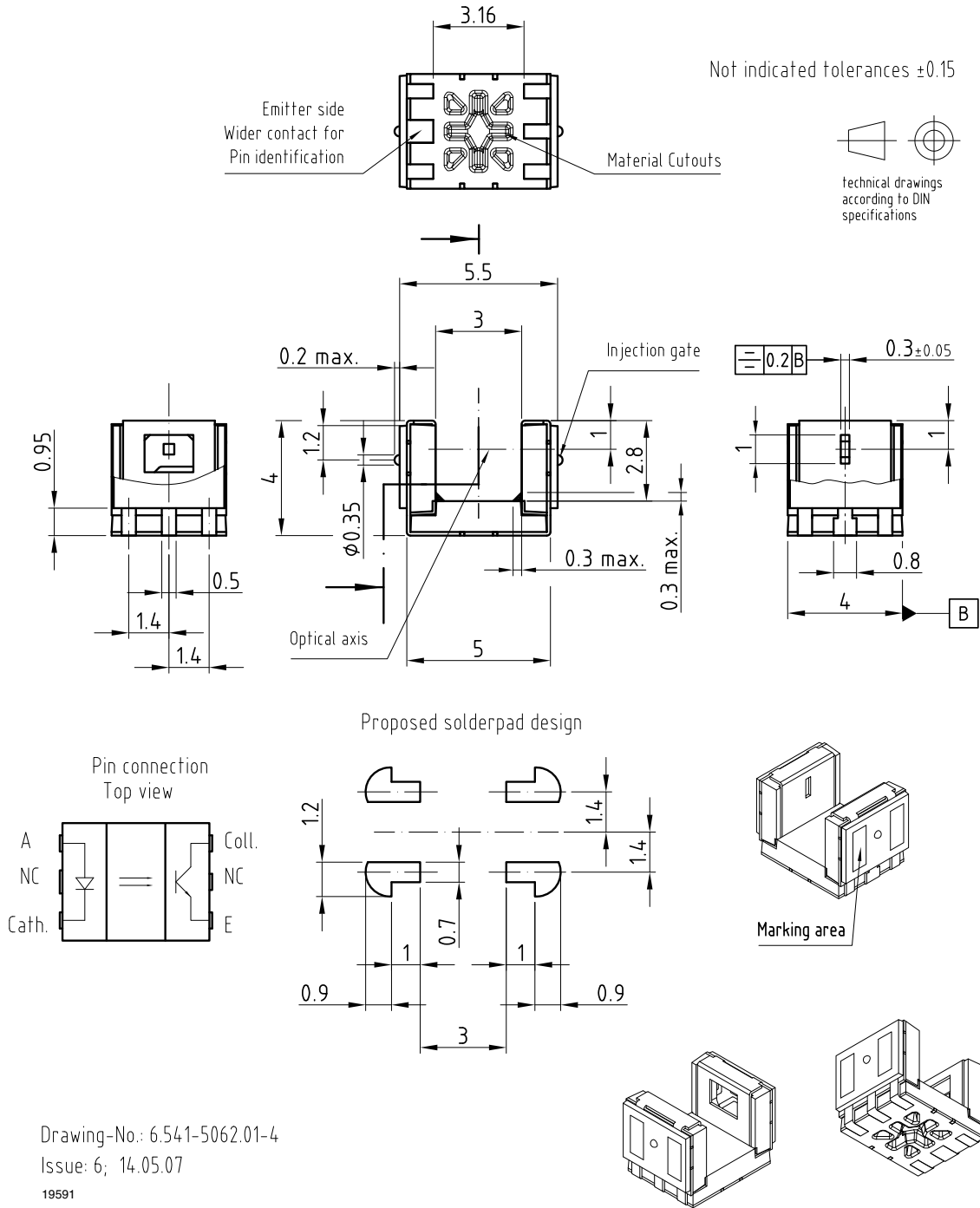


Fig. 15 - Application example

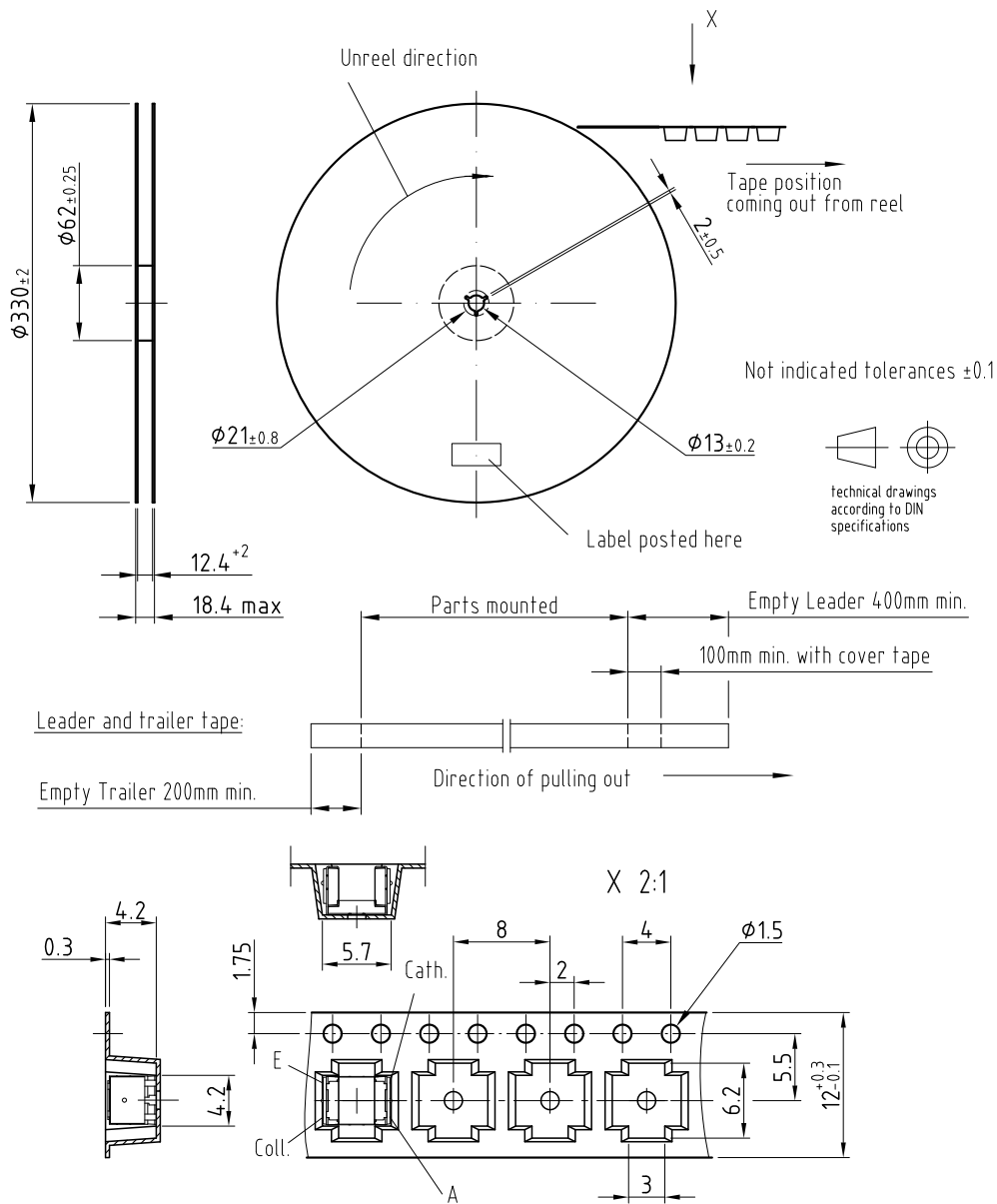


PACKAGE DIMENSIONS in millimeters



**PACKAGE DIMENSIONS** in millimeters

Volume/reel = 2000 pcs



Drawing-No.: 9.800-5092.02-4  
 Issue: 1; 14.05.07  
 20601

## 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



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

15201

Fig. 3

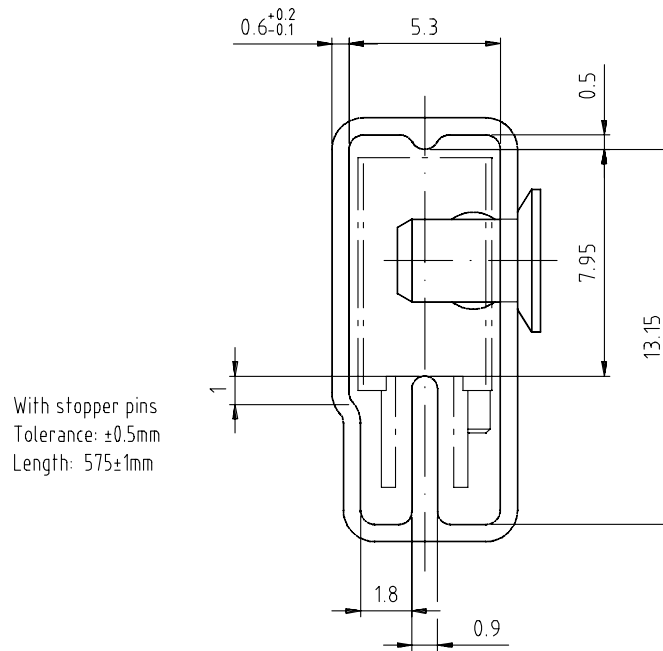


With rubber stopper  
Tolerance: ±0.5mm  
Length: 575±1mm

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:  $\pm 0.5\text{mm}$   
 Length:  $450 \pm 1\text{mm}$   
 All dimensions in mm

Fig. 8



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