

Subminiature Transmissive Optical Sensor with Transistor Output



19601



21848

DESCRIPTION

The TCPT1300X01 is a compact transmissive sensor that includes an infrared emitter and a phototransistor detector, located face-to-face in a surface mount package.

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: $I_C = 0.6$ mA
- Emitter wavelength: 950 nm
- Moisture sensitivity level (MSL): 1
- Compliant to RoHS Directive 2002/95/EC and in accordance to WEEE 2002/96/EC

Note

** Please see document "Vishay Material Category Policy": www.vishay.com/doc?99902

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 ⁽¹⁾ (mA) | DAYLIGHT BLOCKING FILTER INTEGRATED |
| TCPT1300X01 | 3 | 0.3 | 0.6 | No |

Note

- Conditions like in table basic characteristics/coupler

| ORDERING INFORMATION | | | |
|----------------------|---------------|------------------------------|----------------|
| ORDERING CODE | PACKAGING | VOLUME ⁽¹⁾ | REMARKS |
| TCPT1300X01 | Tape and reel | MOQ: 2000 pcs, 2000 pcs/reel | Drypack, MSL 1 |

Note

- MOQ: minimum order quantity



| ABSOLUTE MAXIMUM RATINGS (T _{amb} = 25 °C, unless otherwise specified) | | | | |
|---|---|------------------|---------------|------|
| PARAMETER | TEST CONDITION | SYMBOL | VALUE | UNIT |
| COUPLER | | | | |
| Total power dissipation | T _{amb} ≤ 95 °C | P _{tot} | 37.5 | mW |
| Junction temperature | | T _j | 110 | °C |
| Ambient temperature range | | T _{amb} | - 40 to + 105 | °C |
| Storage temperature range | | T _{stg} | - 40 to + 125 | °C |
| Soldering temperature | In accordance with fig. 16 | T _{sd} | 260 | °C |
| INPUT (EMITTER) | | | | |
| Reverse voltage | | V _R | 5 | V |
| Forward current | T _{amb} ≤ 95 °C | I _F | 25 | mA |
| Forward surge current | t _p ≤ 10 μs | I _{FSM} | 200 | mA |
| Power dissipation | T _{amb} ≤ 95 °C | P _V | 37.5 | mW |
| OUTPUT (DETECTOR) | | | | |
| 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 °C, V _{CE} = 5 V | I _{CEO} | 3.3 | μA |

ABSOLUTE MAXIMUM RATINGS



Fig. 1 - Power Dissipation Limit vs. Ambient Temperature



Fig. 2 - Forward Current Limit vs. Ambient Temperature

| BASIC CHARACTERISTICS ($T_{amb} = 25\text{ }^{\circ}\text{C}$, unless otherwise specified) | | | | | | |
|---|---|-------------|------|------|------|---------------|
| PARAMETER | TEST CONDITION | SYMBOL | MIN. | TYP. | MAX. | UNIT |
| COUPLER | | | | | | |
| Collector current | $V_{CE} = 5\text{ V}$, $I_F = 15\text{ mA}$ | I_C | 300 | 600 | | μA |
| Collector emitter saturation voltage | $I_F = 15\text{ mA}$, $I_C = 0.05\text{ mA}$ | V_{CEsat} | | | 0.4 | V |
| INPUT (EMITTER) | | | | | | |
| 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 | μA |
| Junction capacitance | $V_R = 0\text{ V}$, $f = 1\text{ MHz}$ | C_j | | 25 | | pF |
| OUTPUT (DETECTOR) | | | | | | |
| 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 |
| SWITCHING CHARACTERISTICS | | | | | | |
| Rise time | $I_C = 0.3\text{ mA}$, $V_{CE} = 5\text{ V}$, $R_L = 100\text{ }\Omega$ (see figure 3) | t_r | | 20 | 150 | μs |
| Fall time | $I_C = 0.3\text{ mA}$, $V_{CE} = 5\text{ V}$, $R_L = 100\text{ }\Omega$ (see figure 3) | t_f | | 30 | 150 | μs |


 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

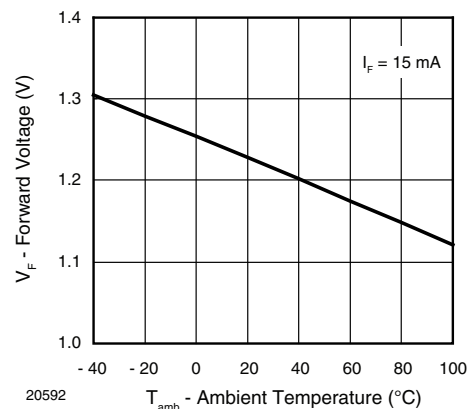


Fig. 6 - Forward Voltage vs. Ambient Temperature

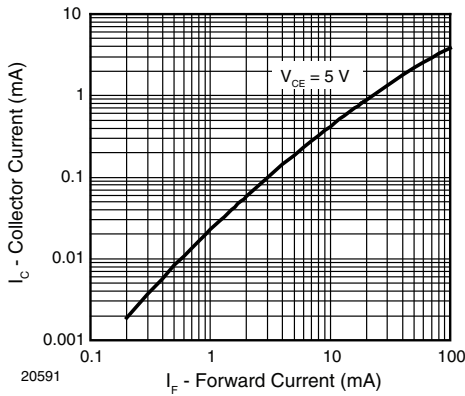


Fig. 7 - Collector Current vs. Forward Current

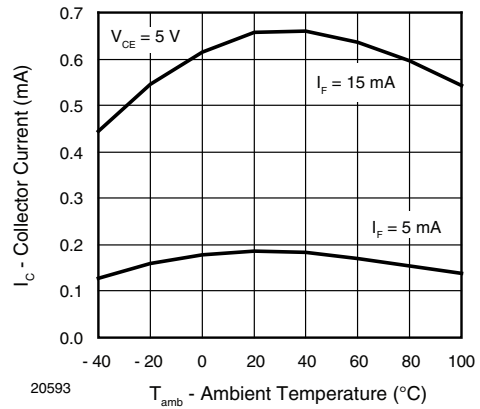


Fig. 10 - Collector Current vs. Ambient Temperature

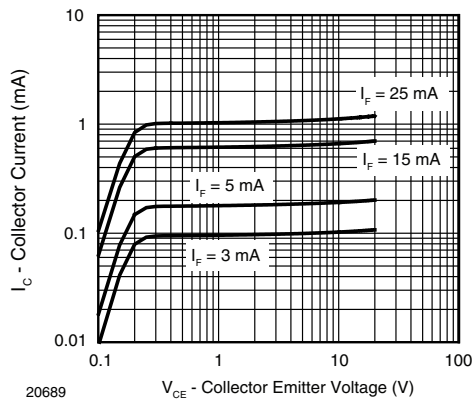


Fig. 8 - Collector Current vs. Collector Emitter Voltage

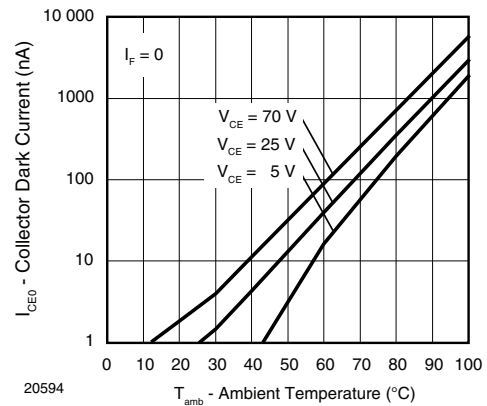


Fig. 11 - Collector Dark Current vs. Ambient Temperature

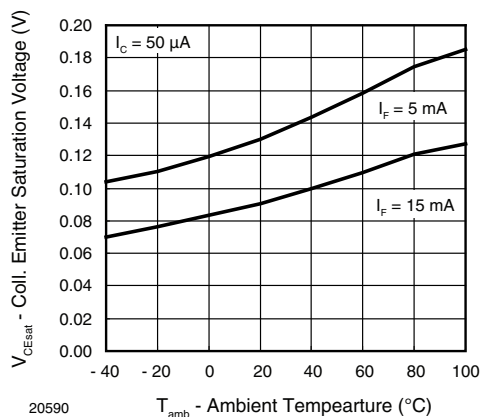


Fig. 9 - Collector Emitter Saturation Voltage vs. Ambient Temperature

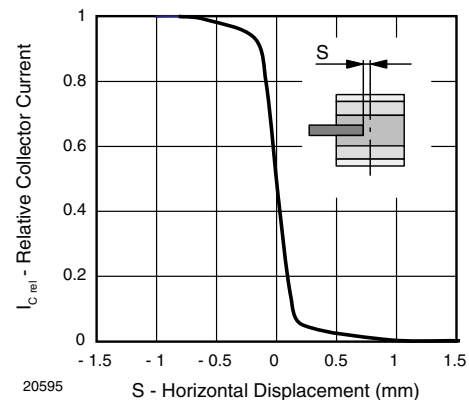


Fig. 12 - Relative Collector Current vs. Horizontal Displacement

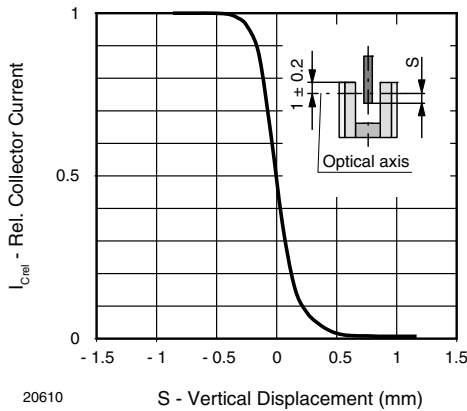


Fig. 13 - Relative Collector Current vs. Vertical Displacement

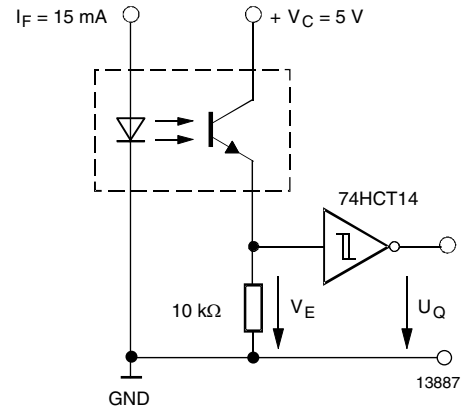


Fig. 15 - Application example



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

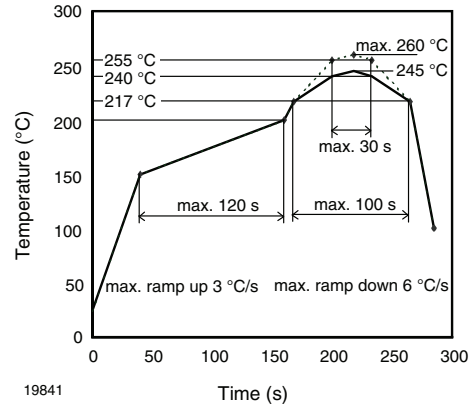


Fig. 16 - Lead (Pb)-free Reflow Solder Profile acc. J-STD-020

FLOOR LIFE

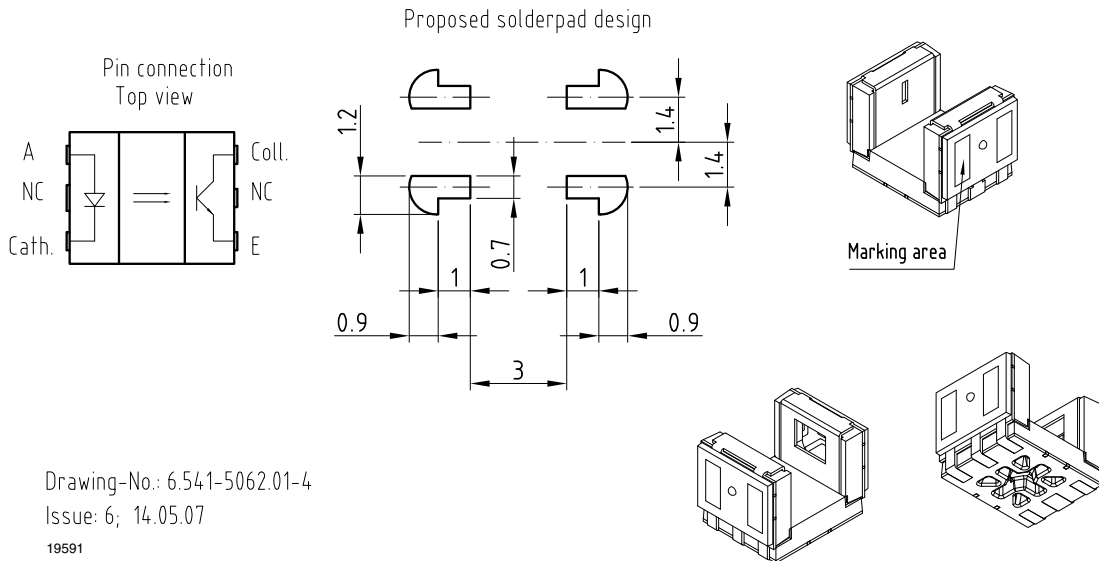
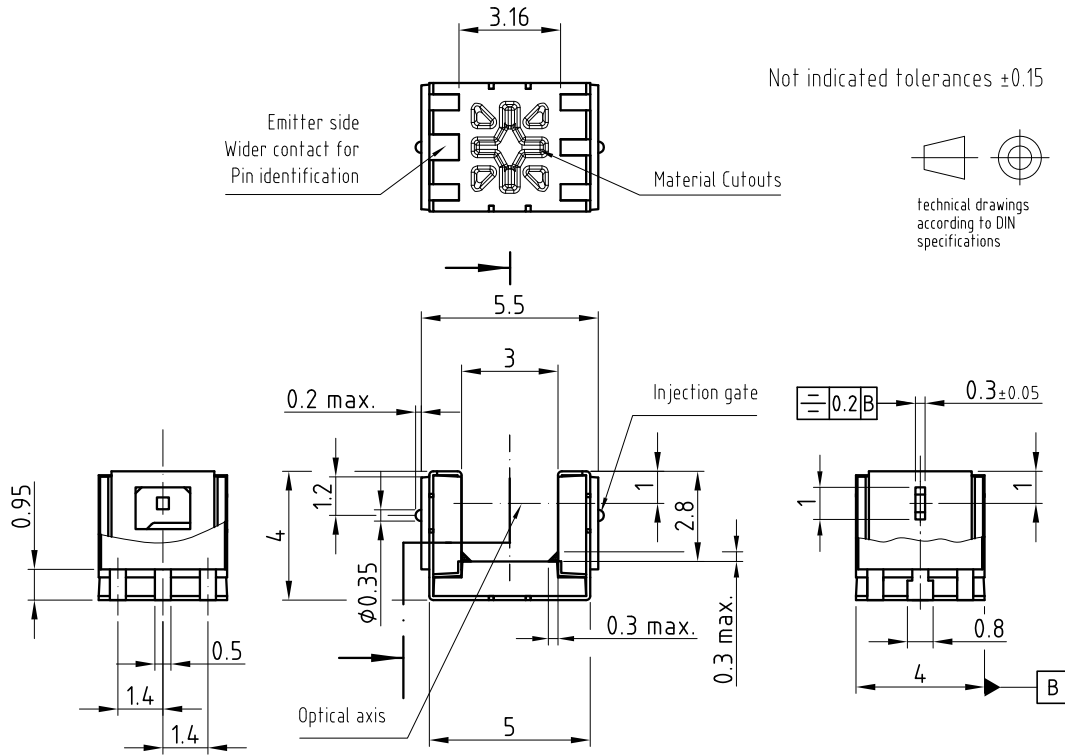
No time limit.
Moisture sensitivity level (MSL) 1, acc. JEDEC, J-STD-020.

| RELIABILITY TESTS IN REFERENCE TO AEC-Q101 RELEASE | | | |
|--|--|---------------------------|--------------------|
| TEST | CONDITION | DURATION | LOT SIZE - REJECTS |
| High temperature storage | $T_{stg(max.)} = 100\text{ }^{\circ}\text{C}$ | 1000 h | 3 x 50 pcs - 0 pcs |
| Low temperature storage | $T_{stg(min.)} = -40\text{ }^{\circ}\text{C}$ | 1000 h | 3 x 50 pcs - 0 pcs |
| Temperature cycling | $-40\text{ }^{\circ}\text{C}/+100\text{ }^{\circ}\text{C}$ | 1000 x | 3 x 77 pcs - 0 pcs |
| H3TRB | 85 °C/85 % RH, emitters: $V_R = 4\text{ V}$, detectors: $V_{CE0} = 5\text{ V}$ | 1000 h | 3 x 77 pcs - 0 pcs |
| Intermittent operational life | Emitters: $I_F = 80\text{ mA DC}$, detectors: $V_{CE} = 16\text{ V}$, duty cycle: 2 min on, 2 min off, $T_{amb} = 25\text{ }^{\circ}\text{C}$ | 1000 h (15 000 cycles) | 3 x 77 pcs - 0 pcs |

| RELIABILITY TESTS IN REFERENCE TO ENHANCED TEMPERATURE RELEASE ACC. AEC-Q101 | | | |
|--|--|---------------------------|--------------------|
| TEST | CONDITION | DURATION | LOT SIZE - REJECTS |
| High temperature storage | $T_{stg(max.)} = 125\text{ }^{\circ}\text{C}$ | 1000 h | 1 x 50 pcs - 0 pcs |
| Temperature cycling | $-40\text{ }^{\circ}\text{C}/+150\text{ }^{\circ}\text{C}$ | 1000 x | 1 x 77 pcs - 0 pcs |
| Power temperature cycle | $-25\text{ }^{\circ}\text{C}/+85\text{ }^{\circ}\text{C}$, $I_F = 50\text{ mA}$, $V_{CE} = 16\text{ V}$, 2 min. on, 2 min. off | 1000 h (15 000 cycles) | 1 x 77 pcs - 0 pcs |



PACKAGE DIMENSIONS in millimeters

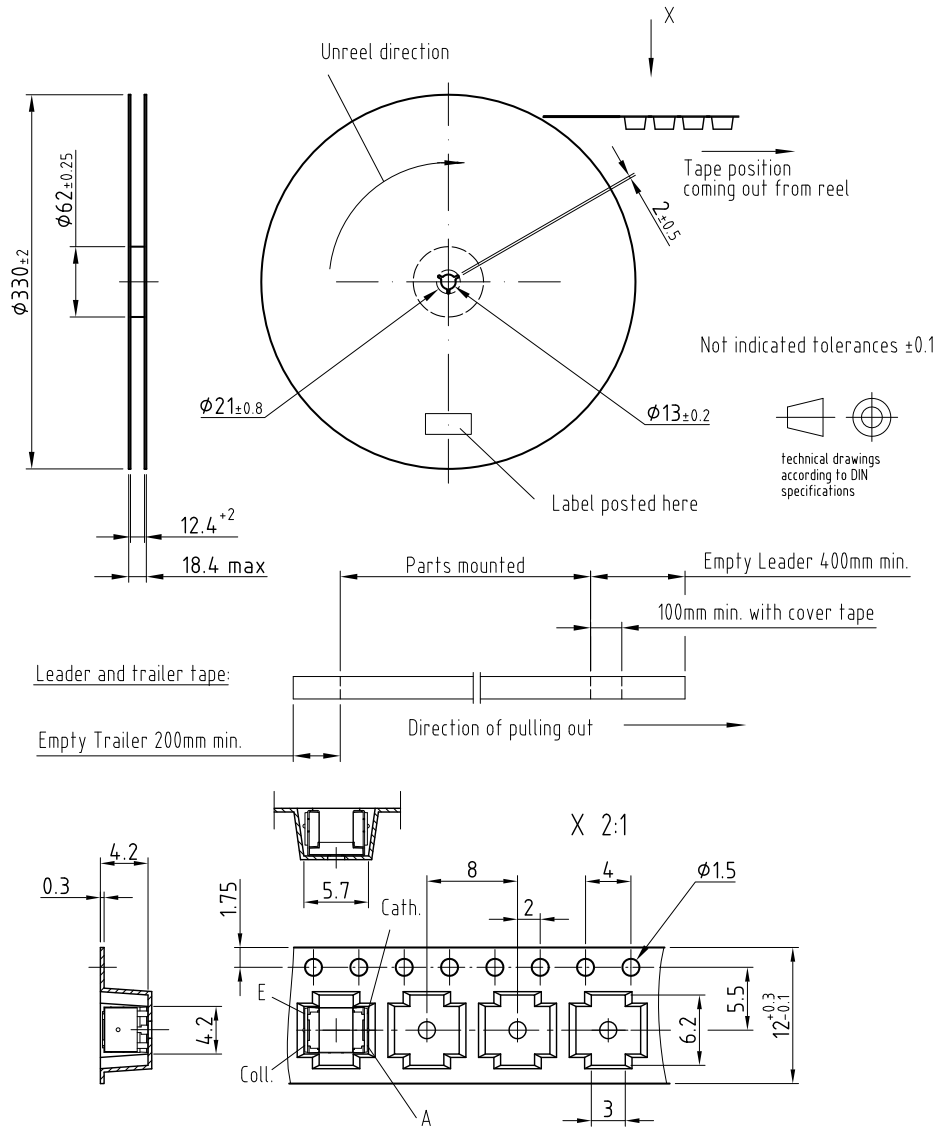


Drawing-No.: 6.541-5062.01-4
 Issue: 6; 14.05.07
 19591



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 ⁽¹⁾ | 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: ±0.5mm
Length: 575±1mm

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

15201

Fig. 3

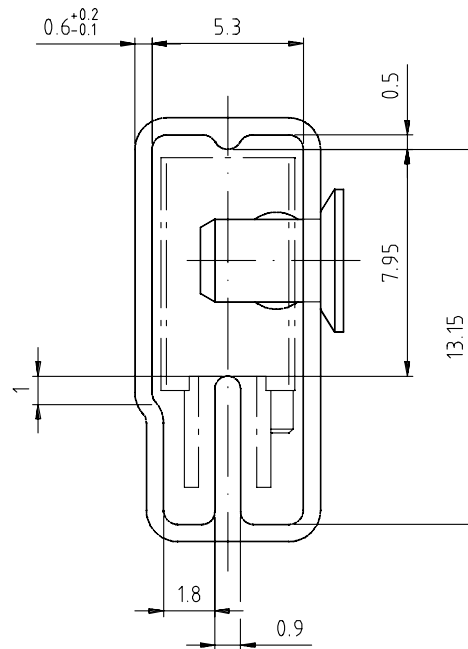


With rubber stopper
Tolerance: $\pm 0.5\text{mm}$
Length: $575 \pm 1\text{mm}$

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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