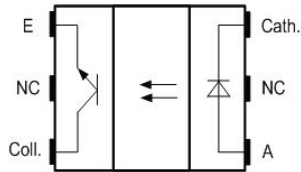


## Tall Dome Transmissive Optical Sensor with Phototransistor Output



### DESCRIPTION

The TCPT1600X01 is a compact transmissive sensor that includes an infrared emitter and a phototransistor detector, located face-to-face in a surface mount package. The tall dome design supports additional mechanical room for vertical signal encoding.

### FEATURES

- Package type: surface mount
- Detector type: phototransistor
- Dimensions (L x W x H in mm): 5.5 x 4 x 5.7
- 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
- Lead (Pb)-free soldering released
- 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  
HALOGEN  
**FREE**  
**GREEN**  
(5-2008)

### APPLICATIONS

- Automotive optical sensors
- Accurate position sensor for encoder
- Sensor for motion, speed, and direction
- Sensor for “turn and push” encoding

| PRODUCT SUMMARY |                |                     |   |                                     |
|-----------------|----------------|---------------------|---|-------------------------------------|
| PART NUMBER     | GAP WIDTH (mm) | APERTURE WIDTH (mm) | TYPICAL OUTPUT CURRENT UNDER TEST <sup>(1)</sup> (mA) | DAYLIGHT BLOCKING FILTER INTEGRATED |
| TCPT1600X01     | 3              | 0.3                 | 1.6   | No                                  |

#### Note

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

| ORDERING INFORMATION |               |                              |                |
|----------------------|---------------|------------------------------|----------------|
| ORDERING CODE        | PACKAGING     | VOLUME <sup>(1)</sup>        | REMARKS        |
| TCPT1600X01          | Tape and reel | MOQ: 1300 pcs, 1300 pcs/reel | Drypack, MSL 1 |

#### Note

<sup>(1)</sup> 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  | $T_{amb} \leq 95\text{ }^{\circ}\text{C}$                   | $P_{tot}$ | 37.5        | mW                 |
| Junction temperature   |   | $T_j$     | 110         | $^{\circ}\text{C}$ |
| Ambient temperature range  |   | $T_{amb}$ | -40 to +105 | $^{\circ}\text{C}$ |
| 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  | $T_{amb} \leq 95\text{ }^{\circ}\text{C}$                   | $I_F$     | 25          | mA                 |
| Forward surge current  | $t_p \leq 10\text{ }\mu\text{s}$                            | $I_{FSM}$ | 200         | mA                 |
| Power dissipation  | $T_{amb} \leq 95\text{ }^{\circ}\text{C}$                   | $P_V$     | 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**

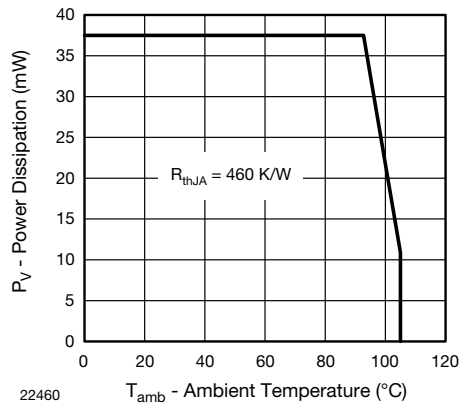


Fig. 1 - Power Dissipation Limit vs. Ambient Temperature

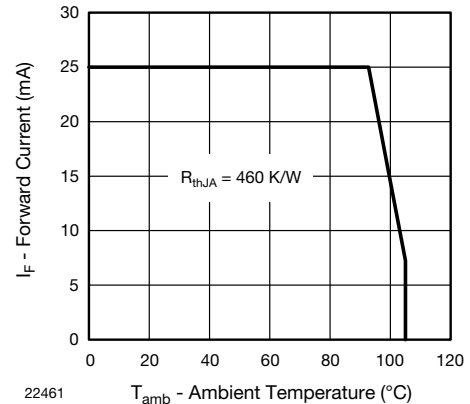


Fig. 2 - Forward Current Limit vs. Ambient Temperature

| ELECTRICAL CHARACTERISTICS (T <sub>amb</sub> = 25 °C, unless otherwise specified) |   |                    |      |      |      |      |
|---|---|--------------------|------|------|------|------|
| PARAMETER   | TEST CONDITION  | SYMBOL             | MIN. | TYP. | MAX. | UNIT |
| <b>COUPLER</b>  |   |                    |      |      |      |      |
| Collector current   | V <sub>CE</sub> = 5 V, I <sub>F</sub> = 15 mA                                       | I <sub>C</sub>     | 0.7  | 1.6  | -    | mA   |
| Collector emitter saturation voltage  | I <sub>F</sub> = 15 mA, I <sub>C</sub> = 0.2 mA                                     | V <sub>CEsat</sub> | -    | -    | 0.4  | V    |
| <b>INPUT (EMITTER)</b>  |   |                    |      |      |      |      |
| Forward voltage   | I <sub>F</sub> = 15 mA  | V <sub>F</sub>     | 1    | 1.2  | 1.4  | V    |
| Reverse current   | V <sub>R</sub> = 5 V  | I <sub>R</sub>     | -    | -    | 10   | μA   |
| Junction capacitance  | V <sub>R</sub> = 0 V, f = 1 MHz   | C <sub>j</sub>     | -    | 25   | -    | pF   |
| <b>OUTPUT (DETECTOR)</b>  |   |                    |      |      |      |      |
| Collector emitter voltage I <sub>C</sub>  | I <sub>C</sub> = 1 mA   | V <sub>CEO</sub>   | 20   | -    | -    | V    |
| Emitter collector voltage   | I <sub>E</sub> = 100 μA   | V <sub>ECO</sub>   | 7    | -    | -    | V    |
| Collector dark current  | V <sub>CE</sub> = 25 V, I <sub>F</sub> = 0 A, E = 0 lx                              | I <sub>CEO</sub>   | -    | 1    | 100  | nA   |
| <b>SWITCHING CHARACTERISTICS</b>  |   |                    |      |      |      |      |
| Rise time   | I <sub>C</sub> = 0.7 mA, V <sub>CE</sub> = 5 V, R <sub>L</sub> = 100 Ω (see fig. 3) | t <sub>r</sub>     | -    | 9    | 150  | μs   |
| Fall time   | I <sub>C</sub> = 0.7 mA, V <sub>CE</sub> = 5 V, R <sub>L</sub> = 100 Ω (see fig. 3) | t <sub>f</sub>     | -    | 16   | 150  | μs   |

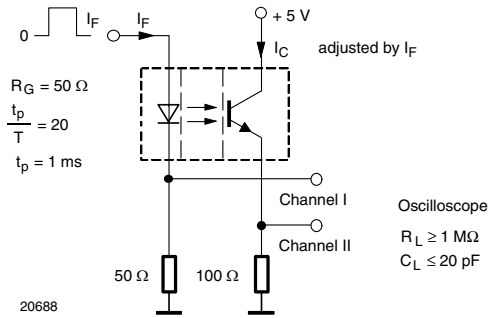


Fig. 3 - Test Circuit for t<sub>r</sub> and t<sub>f</sub>

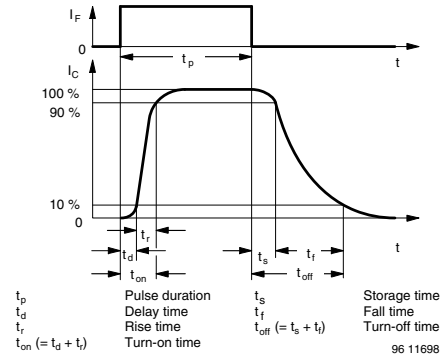


Fig. 4 - Switching Times

**BASIC CHARACTERISTICS** (T<sub>amb</sub> = 25 °C, unless otherwise specified)

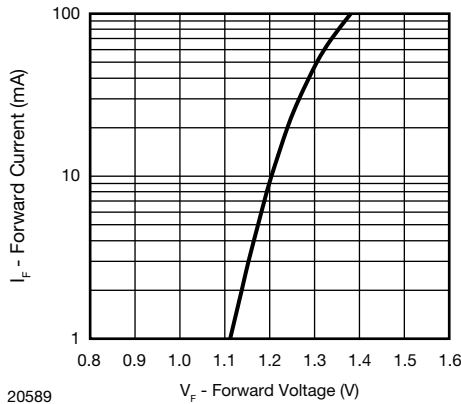


Fig. 5 - Forward Current vs. Forward Voltage

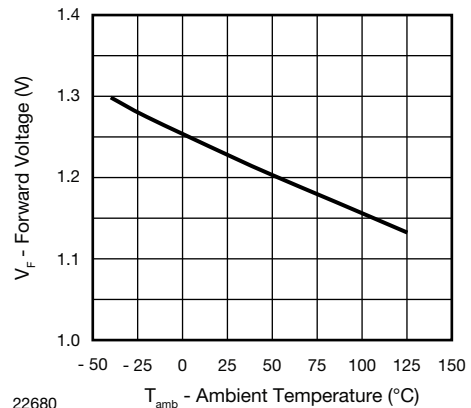


Fig. 6 - Forward Voltage vs. Ambient Temperature

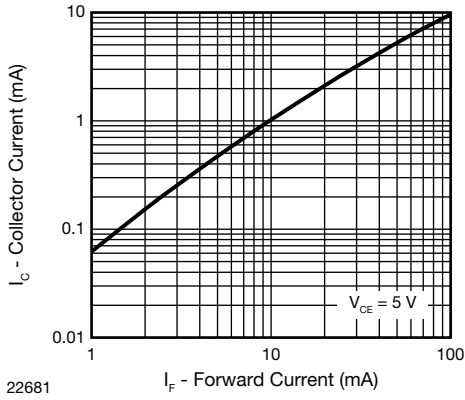


Fig. 7 - Collector Current vs. Forward Current



Fig. 10 - Collector Current vs. Ambient Temperature

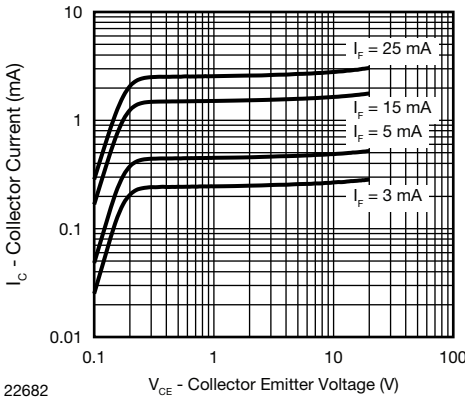


Fig. 8 - Collector Current vs. Collector Emitter Voltage

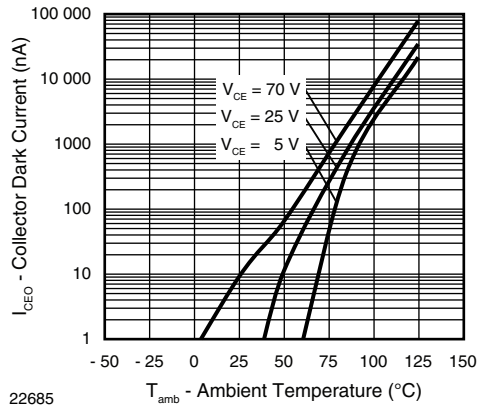


Fig. 11 - Collector Dark Current vs. Ambient Temperature

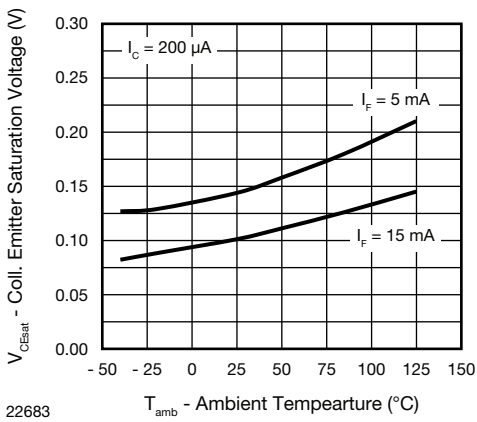


Fig. 9 - Collector Emitter Saturation Voltage vs. Ambient Temperature

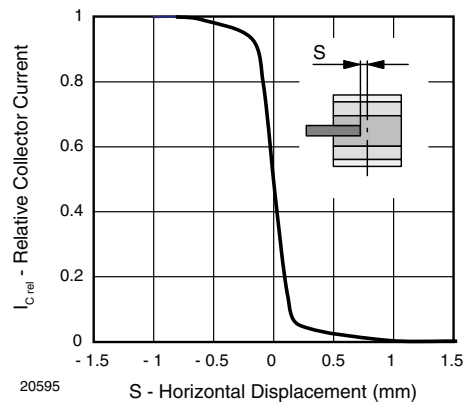


Fig. 12 - Relative Collector Current vs. Horizontal Displacement

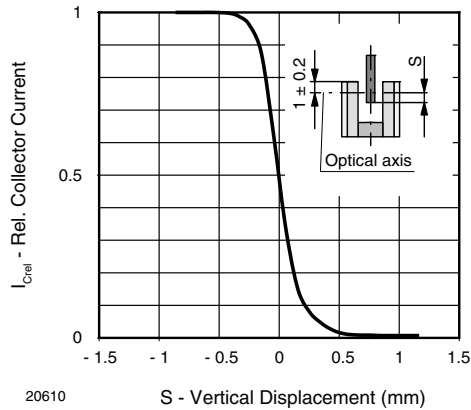


Fig. 13 - Relative Collector Current vs. Vertical Displacement



Fig. 15 - Application example

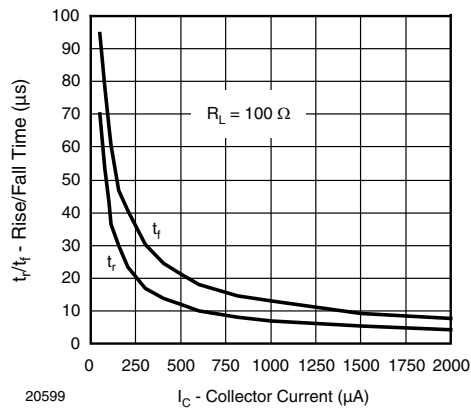


Fig. 14 - Rise/Fall Time vs. Collector Current

**REFLOW SOLDER PROFILE**



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

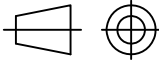
**FLOOR LIFE**

Level 1, acc. JEDEC®, J-STD-020. No time limit.

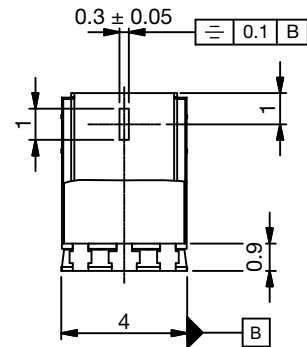
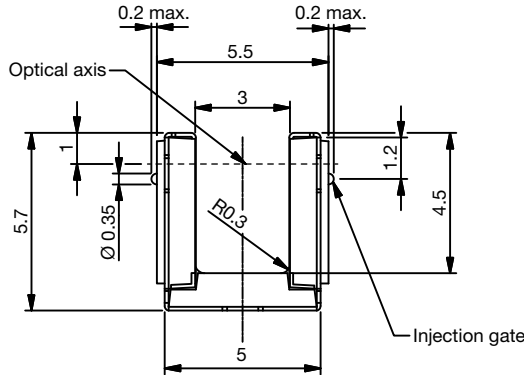
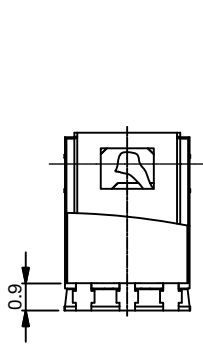
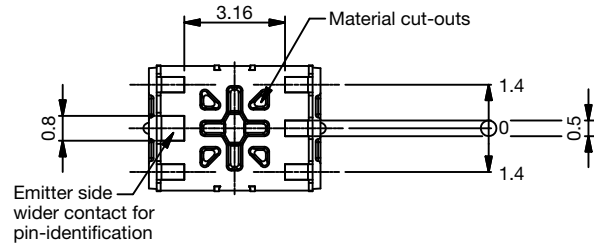


PACKAGE DIMENSIONS in millimeters

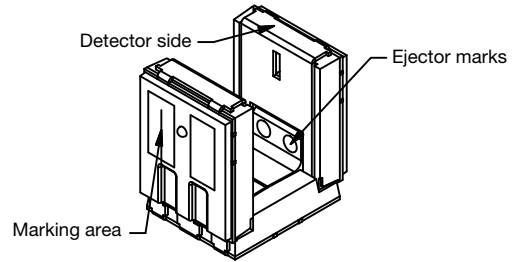
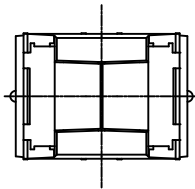
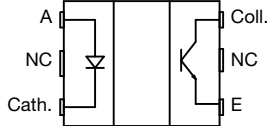
Not indicated tolerances ± 0.15



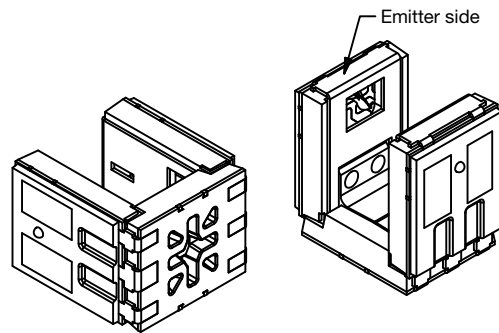
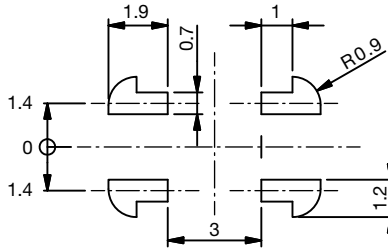
Technical drawings according to DIN specification.



Pin connection top view

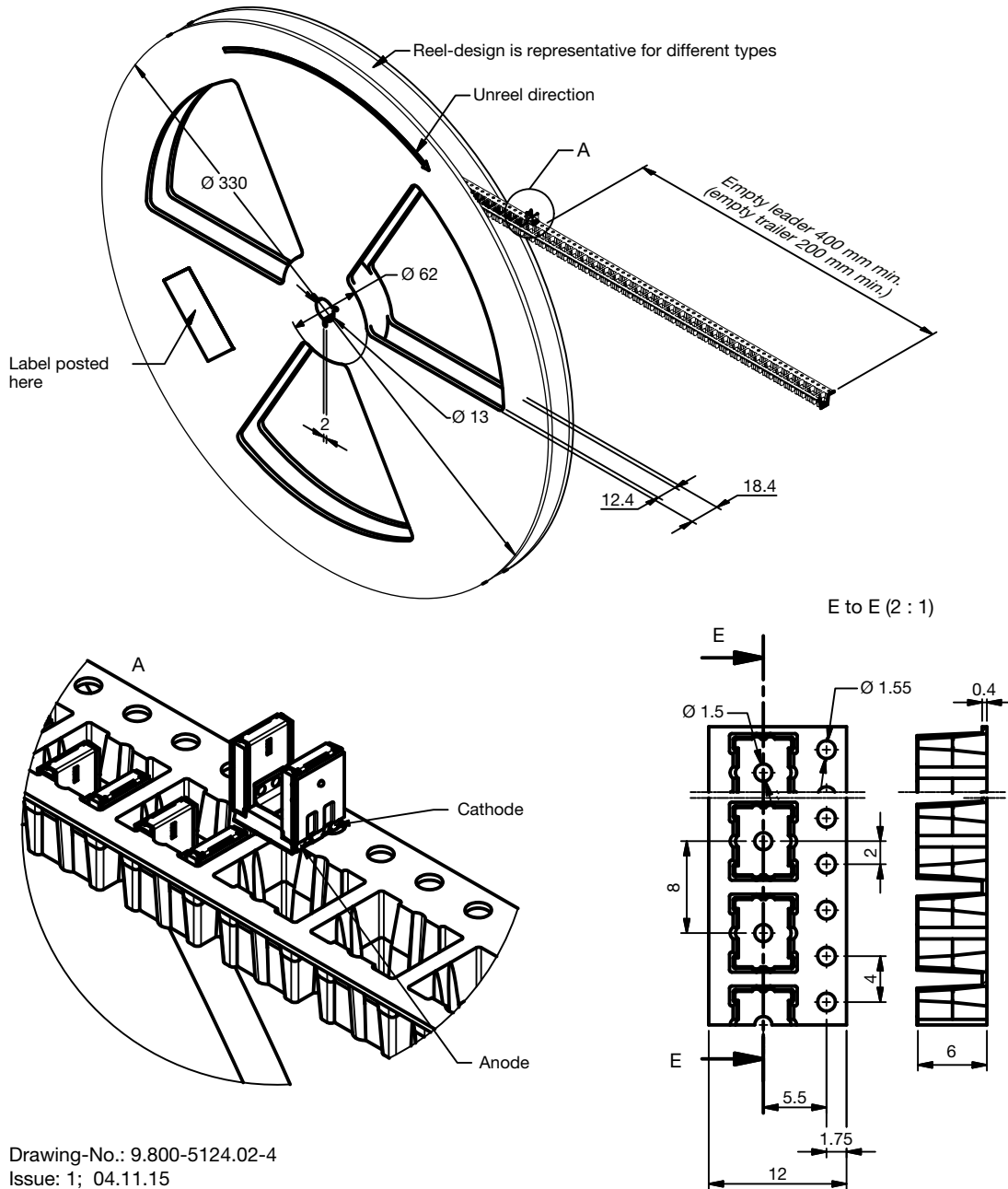


Proposed solderpad design



Drawing-No.: 6.541-5099.01-4  
Issue: 1; 04.11.15

**PACKAGE DIMENSIONS** in millimeters



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