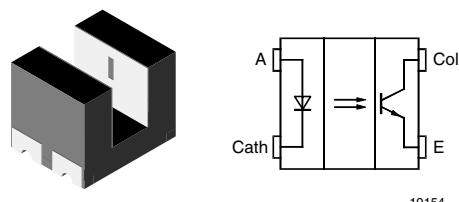


# Subminiature Transmissive Optical Sensor with Phototransistor Output, RoHS Compliant, Released for Lead (Pb)-free Solder Process

## Description

The TCPT1200 is a compact transmissive sensor that includes an infrared emitter and phototransistor detector, located face-to-face on the optical axes in a surface mount package.



## Features

- Package type: Surface mount
- Detector type: Phototransistor
- Dimensions:  
L 5 mm x W 4 mm x H 4 mm
- Gap: 2 mm
- Aperture: 0.3 mm
- Typical output current under test:  $I_C = 0.5 \text{ mA}$
- Emitter wavelength: 950 nm
- Lead (Pb)-free soldering released
- Lead (Pb)-free component in accordance with RoHS 2002/95/EC and WEEE 2002/96/EC
- Minimum order quantity: 2000 pcs, 2000 pcs/reel



## Applications

- Accurate position sensor for encoder
- Detection of motion direction
- Computer mouse and trackballs

## Absolute Maximum Ratings

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

### Coupler

Parameter	Test condition	Symbol	Value	Unit
Power dissipation	$T_{amb} \leq 25 \text{ }^{\circ}\text{C}$	P	150	mW
Ambient temperature range		$T_{amb}$	- 40 to + 85	$^{\circ}\text{C}$
Storage temperature range		$T_{stg}$	- 40 to + 100	$^{\circ}\text{C}$
Soldering temperature	in accordance with fig. 13	$T_{sd}$	260	$^{\circ}\text{C}$

### Input (Emitter)

Parameter	Test condition	Symbol	Value	Unit
Reverse voltage		$V_R$	5	V
Forward current		$I_F$	25	mA
Pulse forward current	$t_p = 0.1 \text{ ms}; t_p / T = 0.01$	$I_{FP}$	100	mA
Power dissipation	$T_{amb} \leq 25 \text{ }^{\circ}\text{C}$	$P_V$	75	mW

### Output (Detector)

Parameter	Test condition	Symbol	Value	Unit
Collector emitter voltage		$V_{CEO}$	70	V
Emitter collector voltage		$V_{ECO}$	7	V
Collector current		$I_C$	20	mA
Power dissipation	$T_{amb} \leq 25 \text{ }^{\circ}\text{C}$	$P_V$	75	mW

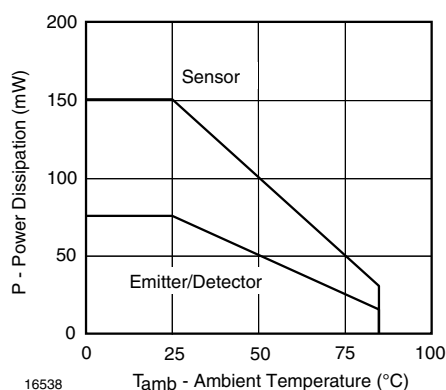


Figure 1. Power Dissipation Limit vs. Ambient Temperature

## Electrical Characteristics

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

### Coupler

Parameter	Test condition	Symbol	Min	Typ.	Max	Unit
Collector current	$V_{CE} = 5\text{ V}$ , $I_F = 15\text{ mA}$	$I_C$	300	500		$\mu\text{A}$
Collector emitter saturation voltage	$I_F = 15\text{ mA}$ , $I_C = 0.05\text{ mA}$	$V_{CEsat}$			0.4	V

### Input (Emitter)

Parameter	Test condition	Symbol	Min	Typ.	Max	Unit
Forward voltage	$I_F = 15\text{ mA}$	$V_F$		1.2	1.5	V
Reverse current	$V_R = 5\text{ V}$	$I_R$			10	$\mu\text{A}$
Junction capacitance	$V_R = 0\text{ V}$ , $f = 1\text{ MHz}$	$C_j$		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	$I_E = 100\text{ }\mu\text{A}$	$V_{ECO}$	7			V
Collector dark current	$V_{CE} = 25\text{ V}$ , $I_F = 0$ , $E = 0$	$I_{CEO}$		10	100	nA

### Switching Characteristics

Parameter	Test condition	Symbol	Min	Typ.	Max	Unit
Rise time	$I_C = 0.3\text{ mA}$ , $V_{CE} = 5\text{ V}$ , $R_L = 1000\text{ }\Omega$ (see figure 3)	$t_r$		20.0	150	$\mu\text{s}$
Fall time	$I_C = 0.3\text{ mA}$ , $V_{CE} = 5\text{ V}$ , $R_L = 1000\text{ }\Omega$ (see figure 3)	$t_f$		30.0	150	$\mu\text{s}$

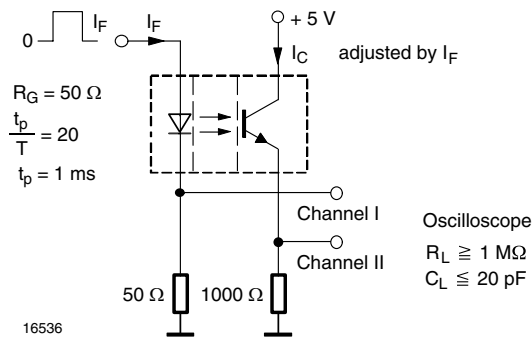


Figure 2. Test Circuit for  $t_r$  and  $t_f$

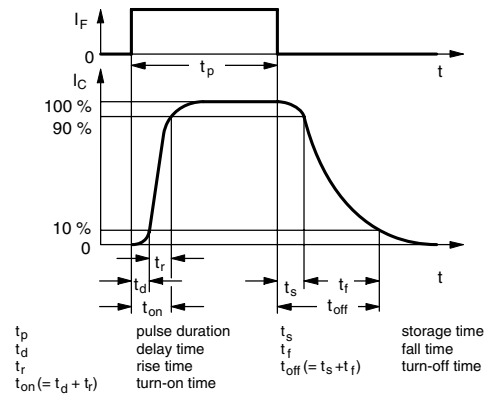


Figure 3. Switching Times

## Typical Characteristics

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

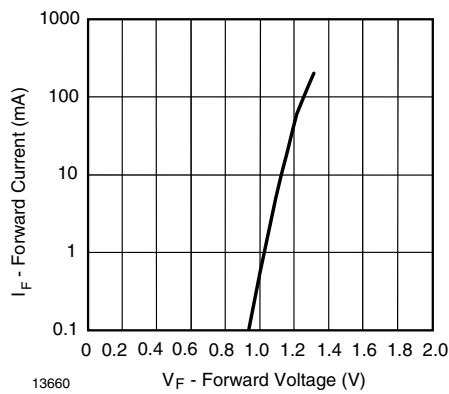


Figure 4. Forward Current vs. Forward Voltage

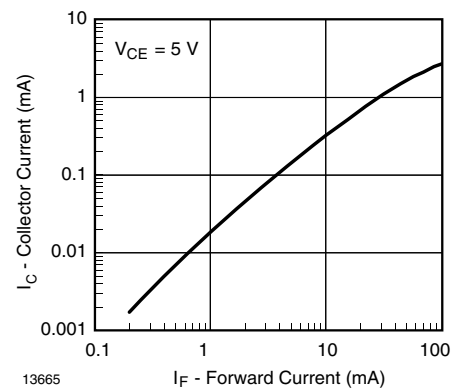


Figure 6. Collector Current vs. Forward Current

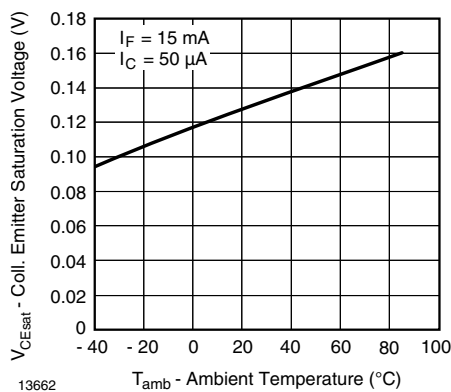


Figure 5. Collector Emitter Saturation Voltage vs. Ambient Temperature

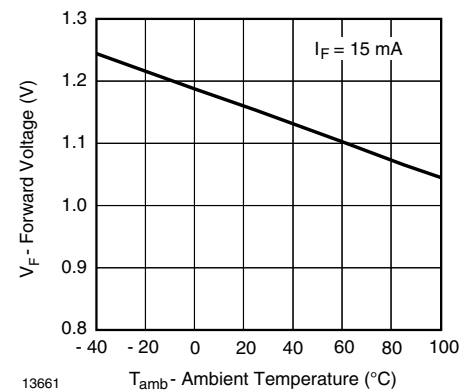


Figure 7. Forward Voltage vs. Ambient Temperature

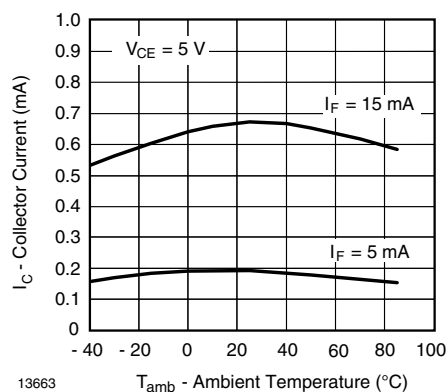


Figure 8. Collector Current vs. Ambient Temperature

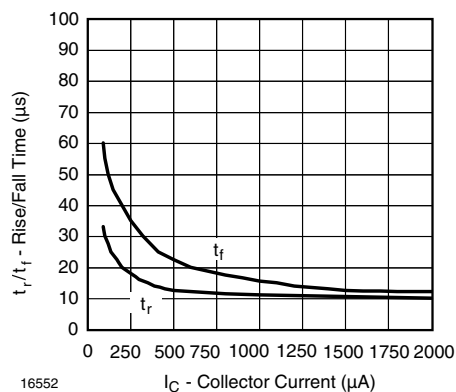


Figure 11. Rise/Fall Time vs. Collector Current

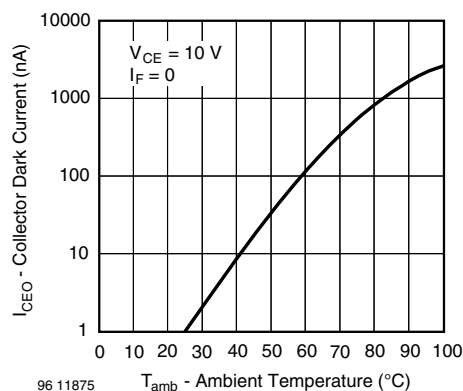


Figure 9. Collector Dark Current vs. Ambient Temperature

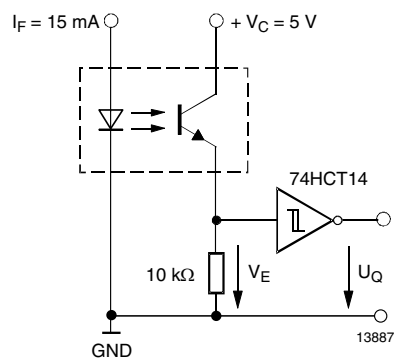


Figure 12. Application example

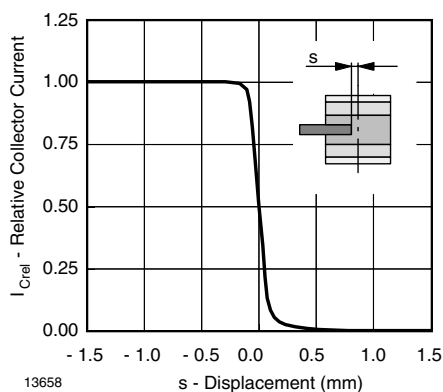


Figure 10. Relative Collector Current vs. Displacement

## Reflow Solder Profiles

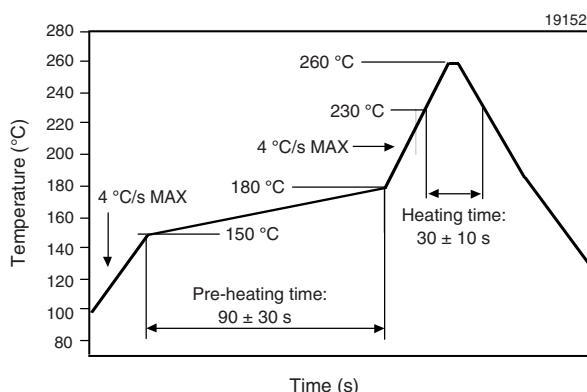


Figure 13. Lead (Pb)-free (Sn) Reflow Solder Profile

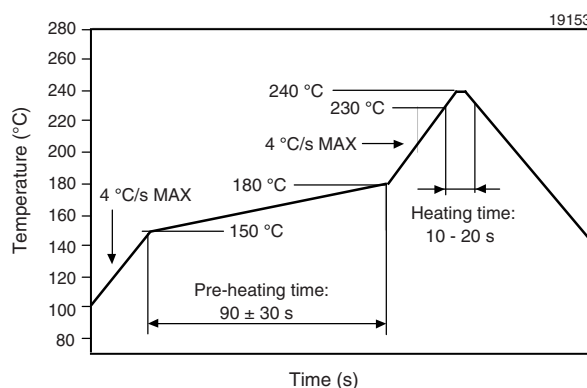


Figure 14. Lead Tin (SnPb) Reflow Solder Profile

## Drypack

Devices are packed in moisture barrier bags (MBB) to prevent the products from absorbing moisture during transportation and storage. Each bag contains a desiccant.

## Floor Life

Floor life (time between soldering and removing from MBB) must not exceed the time indicated in J-STD-020. According JEDEC, J-STD-020, this component is released to Moisture Sensitivity Level 2, for use of Lead Tin (SnPb) Reflow Solder Profile (Figure 14) or Level 3, for use of Lead (Pb)-free (Sn) Reflow Solder Profile (Figure 13).

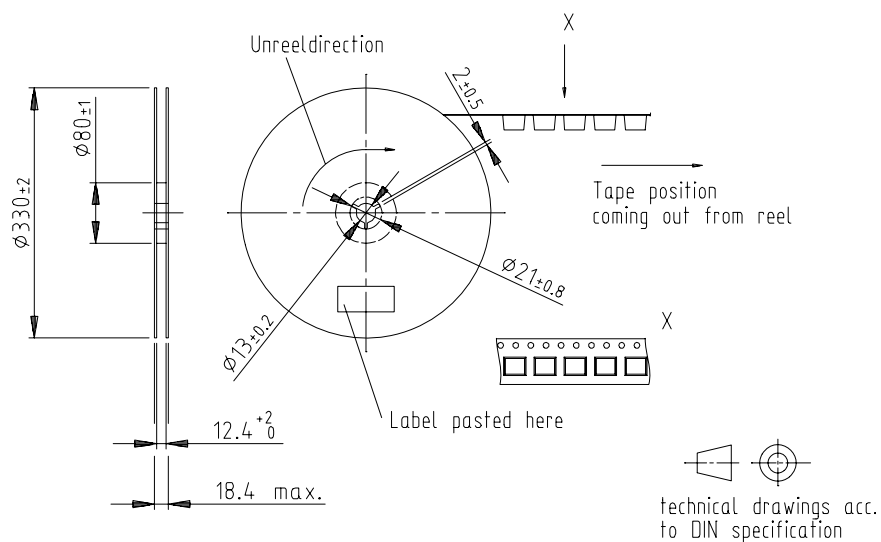
Floor Life: 12 month (Level 2) or 168 hours (Level 3)

Floor Conditions:  $T_{amb} < 30^{\circ}\text{C}$ ,  $\text{RH} < 60\%$

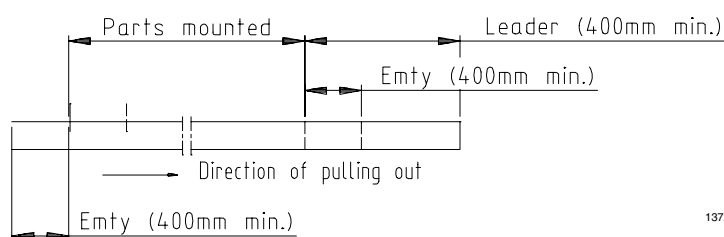
## Drying

In case of moisture absorption, devices should be baked before soldering. Conditions see J-STD-020 or Label. Devices taped on reel dry using recommended conditions 192 h at  $40^{\circ}\text{C}$  ( $\pm 5^{\circ}\text{C}$ ),  $\text{RH} < 5\%$  or 96 h at  $60^{\circ}\text{C}$  ( $\pm 5^{\circ}\text{C}$ ),  $\text{RH} < 5\%$ .

### Dimensions of Reel and Tape in millimeters

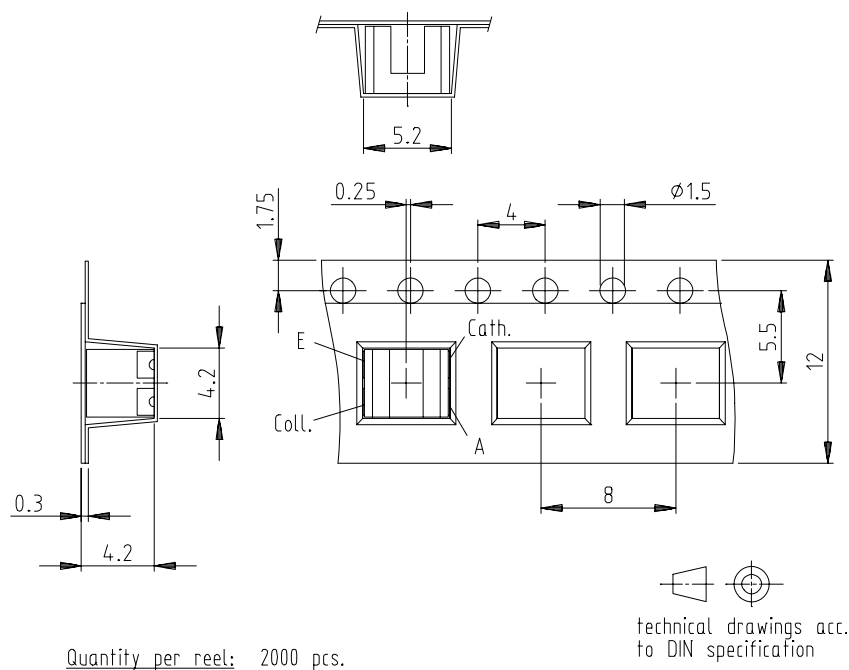


#### Leader and trailer tape:



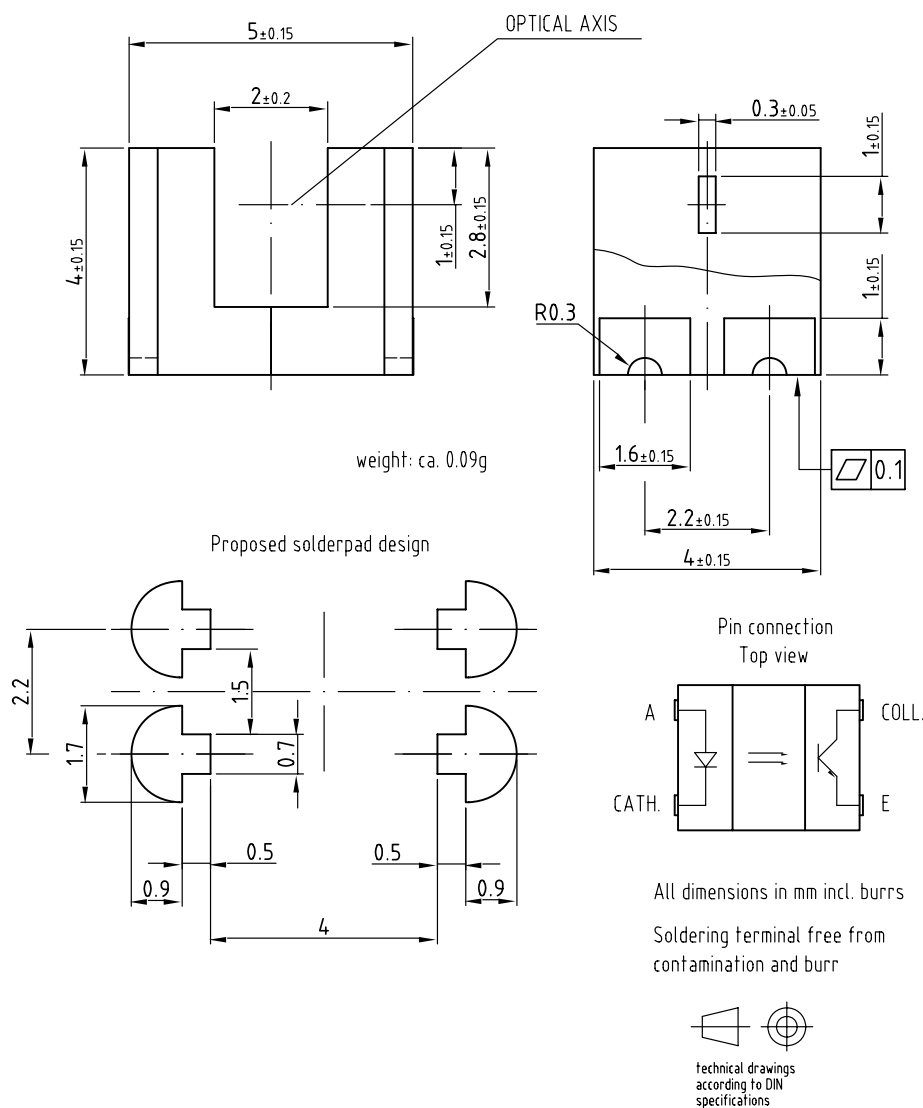
13722

### Dimensions of Tape in millimeters



Quantity per reel: 2000 pcs.

13721

**Package Dimensions**


Drawing-No.: 6.541-5043.01-4

Issue: 12; 17.12.04

19310



### Ozone Depleting Substances Policy Statement

It is the policy of Vishay Semiconductor GmbH to

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.

We reserve the right to make changes to improve technical design  
and may do so without further notice.

Parameters can vary in different applications. All operating parameters must be validated for each customer application by the customer. Should the buyer use Vishay Semiconductors products for any unintended or unauthorized application, the buyer shall indemnify Vishay Semiconductors against all claims, costs, damages, and expenses, arising out of, directly or indirectly, any claim of personal damage, injury or death associated with such unintended or unauthorized use.

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