

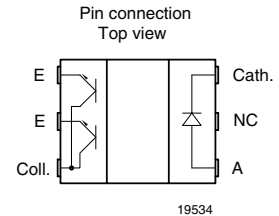
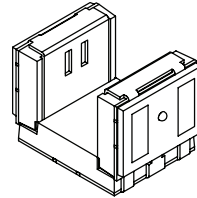
## Subminiature Dual Channel Transmissive Optical Sensor with Phototransistor Outputs, RoHS Compliant, Released for Lead (Pb)-free Solder Process, AEC-Q101 Released

### Description

The TCUT1300X01 is a compact transmissive sensor that includes an infrared emitter and two phototransistor detectors, located face-to-face in a surface mount package.

### Features

- Product designed and qualified acc. AEC-Q101 for the automotive market
- Package type: Surface mount
- Detector type: Phototransistor
- Dimensions:  
L 5.5 mm x W 4 mm x H 4 mm
- Gap: 3 mm
- Aperture: 0.3 mm
- Channel distance (center to center): 0.8 mm
- Typical output current under test:  $I_C = 0.6$  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

- Automotive optical sensors
- Accurate position sensor for encoder
- Sensor for motion, speed and direction

### Absolute Maximum Ratings

$T_{amb} = 25$  °C, unless otherwise specified

#### Coupler

Parameter	Test condition	Symbol	Value	Unit
Power dissipation	$T_{amb} \leq 25$ °C	P	150	mW
Ambient temperature range		$T_{amb}$	- 40 to + 85	°C
Storage temperature range		$T_{stg}$	- 40 to + 100	°C
Soldering temperature	in accordance with fig. 15	$T_{sd}$	260	°C

#### Input (Emitter)

Parameter	Test condition	Symbol	Value	Unit
Reverse voltage		$V_R$	5	V
Forward current		$I_F$	25	mA
Forward surge current	$t_p \leq 10$ $\mu$ s	$I_{FSM}$	200	mA
Power dissipation	$T_{amb} \leq 25$ °C	$P_V$	75	mW

#### Output (Detector)

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

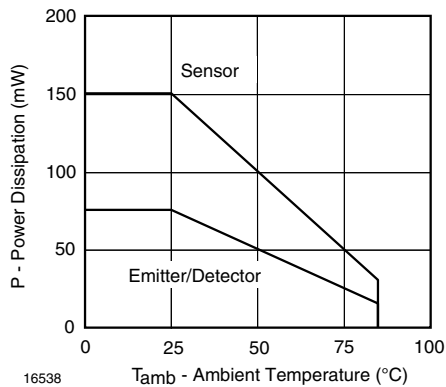


Figure 1. Power Dissipation Limit vs. Ambient Temperature

## Electrical Characteristics

T<sub>amb</sub> = 25 °C, unless otherwise specified

### Coupler

Parameter	Test condition	Symbol	Min	Typ.	Max	Unit
Collector current per channel	V <sub>CE</sub> = 5 V, I <sub>F</sub> = 15 mA	I <sub>C</sub>	300	600		μA
Collector emitter saturation voltage	I <sub>F</sub> = 15 mA, I <sub>C</sub> = 0.05 mA	V <sub>CEsat</sub>			0.4	V

### Input (Emitter)

Parameter	Test condition	Symbol	Min	Typ.	Max	Unit
Forward voltage	I <sub>F</sub> = 15 mA	V <sub>F</sub>		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

### Output (Detector)

Parameter	Test condition	Symbol	Min	Typ.	Max	Unit
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, E = 0	I <sub>CEO</sub>		1	100	nA

### Switching Characteristics

Parameter	Test condition	Symbol	Min	Typ.	Max	Unit
Rise time	I <sub>C</sub> = 0.3 mA, V <sub>CE</sub> = 5 V, R <sub>L</sub> = 100 Ω (see figure 2)	t <sub>r</sub>		20.0	150	μs
Fall time	I <sub>C</sub> = 0.3 mA, V <sub>CE</sub> = 5 V, R <sub>L</sub> = 100 Ω (see figure 2)	t <sub>f</sub>		30.0	150	μs

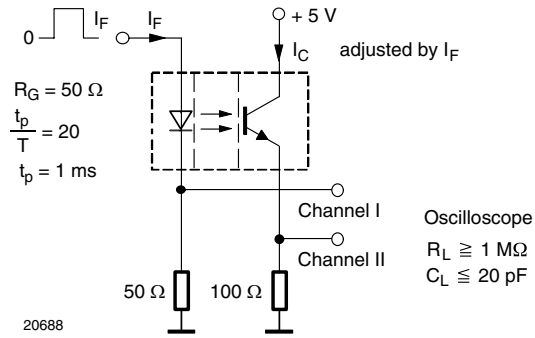


Figure 2. Test Circuit for  $t_r$  and  $t_f$

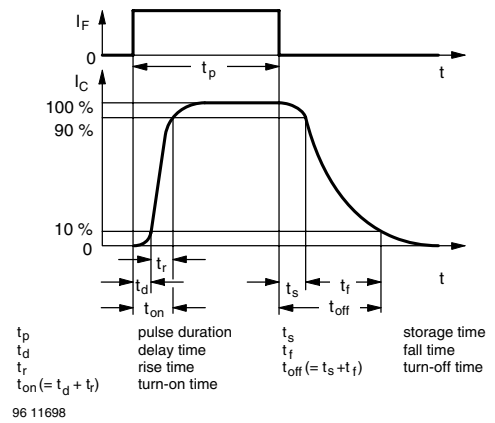


Figure 3. Switching Times

## Typical Characteristics

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

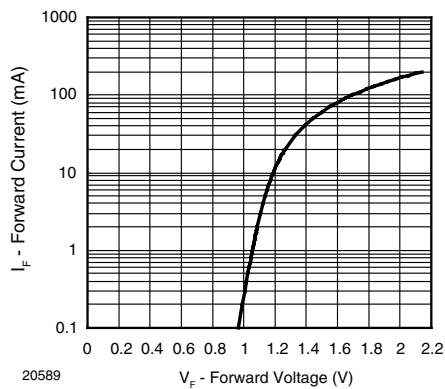


Figure 4. Forward Current vs. Forward Voltage

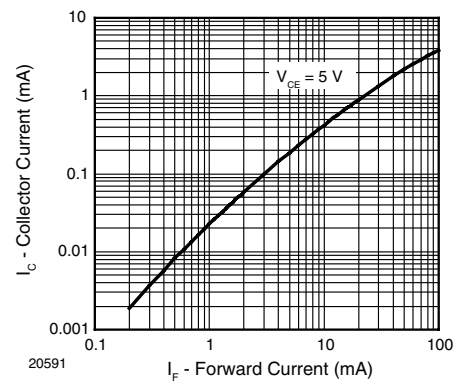


Figure 6. Collector Current vs. Forward Current

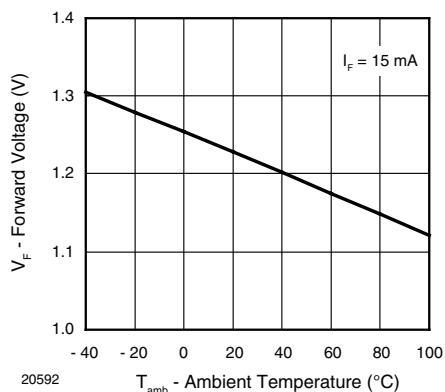


Figure 5. Forward Voltage vs. Ambient Temperature

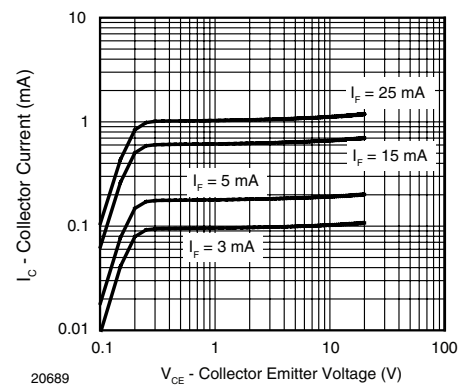


Figure 7. Collector Current vs. Collector Emitter Voltage

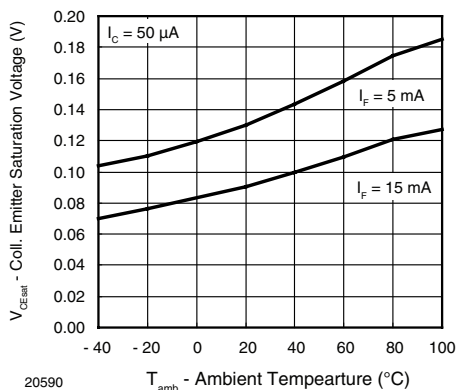


Figure 8. Collector Emitter Saturation Voltage vs. Ambient Temperature

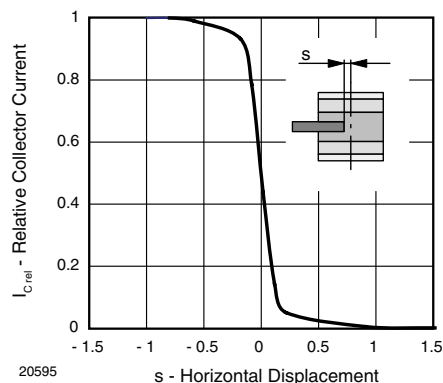


Figure 11. Relative Collector Current vs. Horizontal Displacement

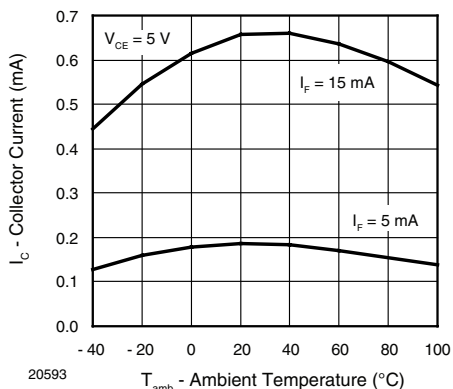


Figure 9. Collector Current vs. Ambient Temperature

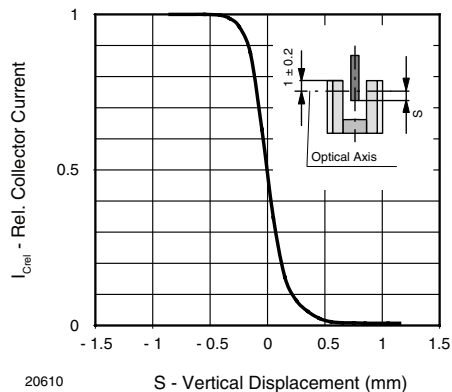


Figure 12. Relative Collector Current vs. Vertical Displacement

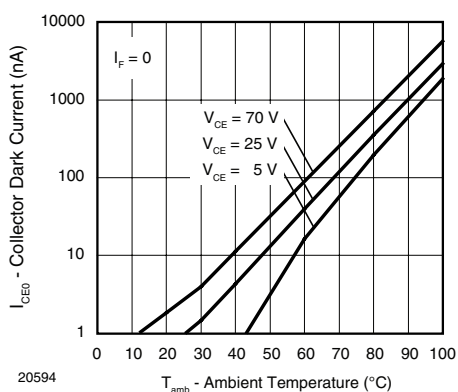


Figure 10. Collector Dark Current vs. Ambient Temperature

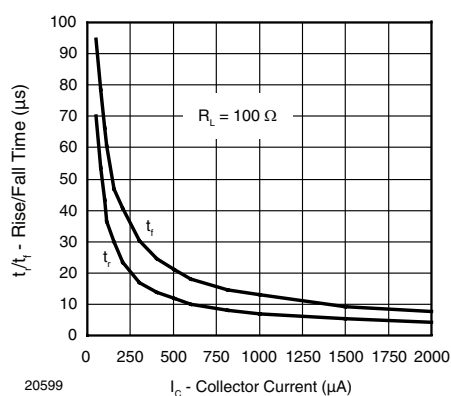


Figure 13. Rise/Fall Time vs. Collector Current

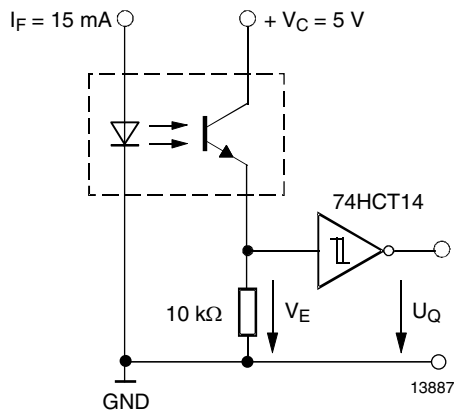


Figure 14. Application example

### Floor Life

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

### Reflow Solder Profile

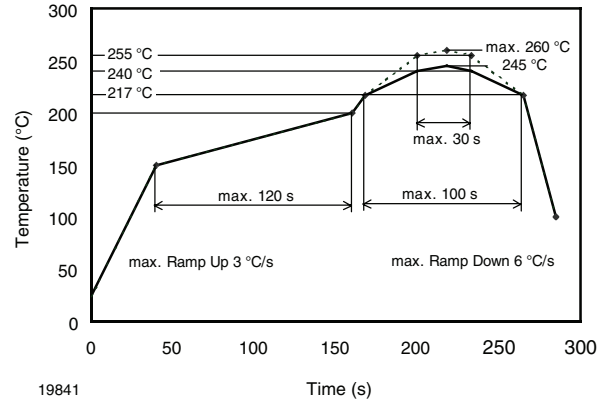
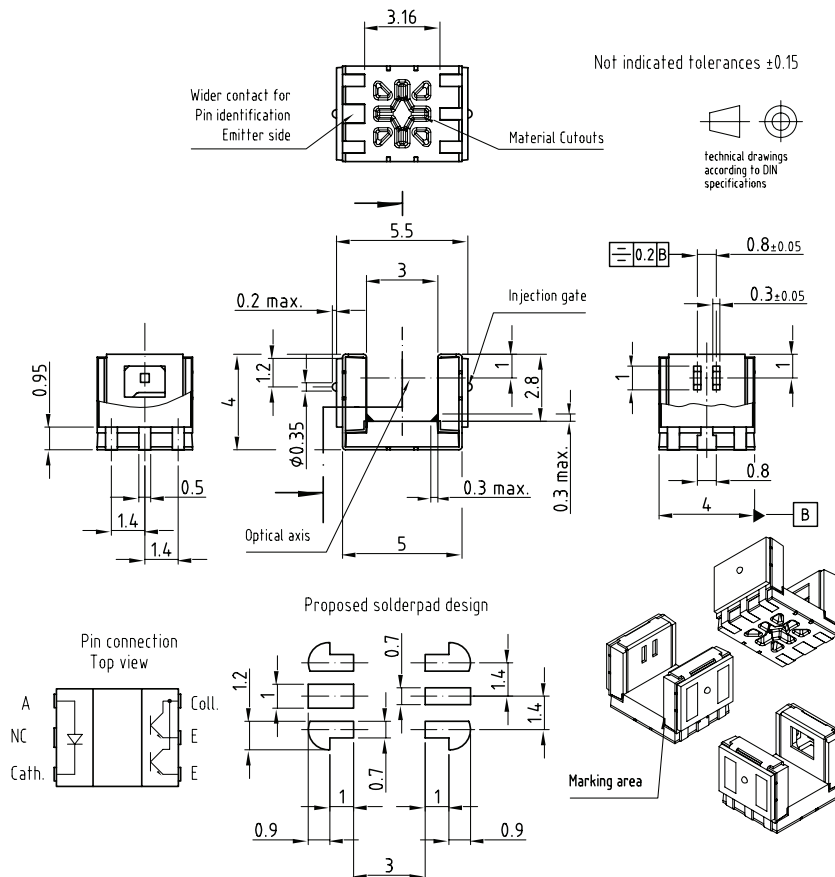


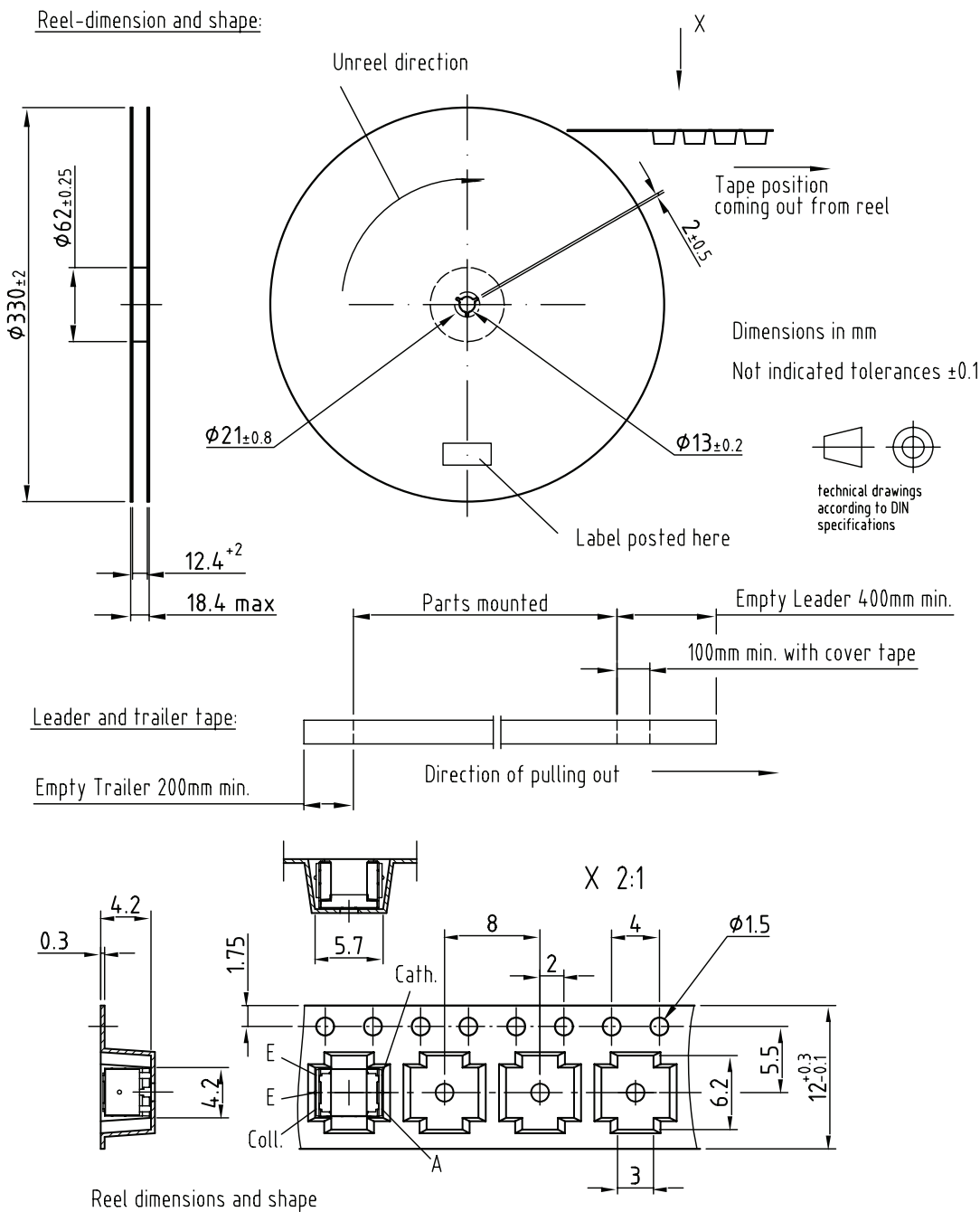
Figure 15. Lead (Pb)-free Reflow Solder Profile acc. J-STD-020C

### Package Dimensions in millimeters



Drawing-No.: 6.541-5061.01-4  
 Issue: 02.02.07  
 19536

## Package Dimensions in millimeters



Drawing-No.: 9.800-5092.01-4  
Issue: 19.01.07



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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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