

## Subminiature Dual Channel Transmissive Optical Sensor with Phototransistor Outputs



19534



21847

### 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

- 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
- Channel distance (center to center): 0.8 mm
- Typical output current under test:  $I_C = 0.6 \text{ mA}$
- Emitter wavelength: 950 nm
- Lead (Pb)-free soldering released
- Moisture sensitivity level (MSL): 1
- Compliant to RoHS Directive 2002/95/EC and in accordance to WEEE 2002/96/EC

AUTOMOTIVE GRADE


 RoHS COMPLIANT  
**GREEN**  
 (5-2009)\*\*

### Note

\*\* Please see document "Vishay Material Category Policy":  
[www.vishay.com/doc?99902](http://www.vishay.com/doc?99902)

### APPLICATIONS

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

PRODUCT SUMMARY				
PART NUMBER	GAP WIDTH (mm)	APERTURE WIDTH (mm)	TYPICAL OUTPUT CURRENT UNDER TEST <sup>(1)</sup> (mA)	DAYLIGHT BLOCKING FILTER INTEGRATED
TCUT1300X01	3	0.3	0.6	No

### Note

- Conditions like in table basic characteristics/coupler

ORDERING INFORMATION			
ORDERING CODE	PACKAGING	VOLUME <sup>(1)</sup>	REMARKS
TCUT1300X01	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	$T_{amb} \leq 95\text{ }^{\circ}\text{C}$	$P_{tot}$	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

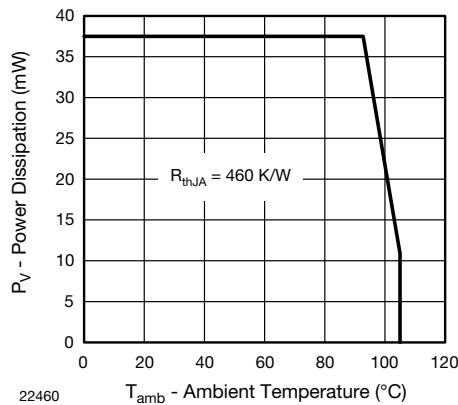


Fig. 1 - Power Dissipation Limit vs. Ambient Temperature

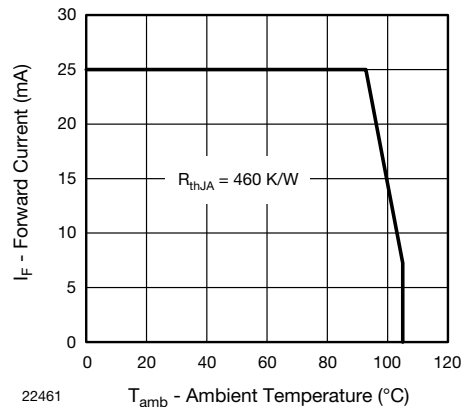


Fig. 2 - Forward Current Limit vs. Ambient Temperature

<b>ELECTRICAL 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 per channel	$V_{CE} = 5\text{ V}$ , $I_F = 15\text{ mA}$	$I_C$	300	600		$\mu\text{A}$
Collector emitter saturation voltage	$I_F = 15\text{ mA}$ , $I_C = 0.05\text{ mA}$	$V_{CEsat}$			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	$I_C = 0.3\text{ mA}$ , $V_{CE} = 5\text{ V}$ , $R_L = 100\text{ }\Omega$ (see fig. 3)	$t_r$		20	150	$\mu\text{s}$
Fall time	$I_C = 0.3\text{ mA}$ , $V_{CE} = 5\text{ V}$ , $R_L = 100\text{ }\Omega$ (see fig. 3)	$t_f$		30	150	$\mu\text{s}$

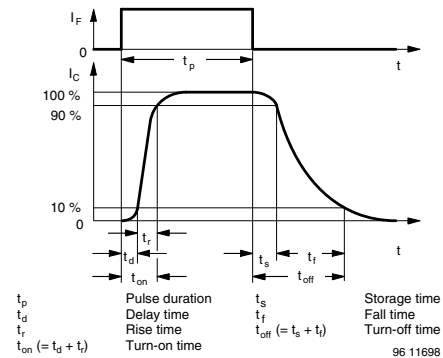

 Fig. 3 - Test Circuit for  $t_r$  and  $t_f$ 


Fig. 4 - Switching Times

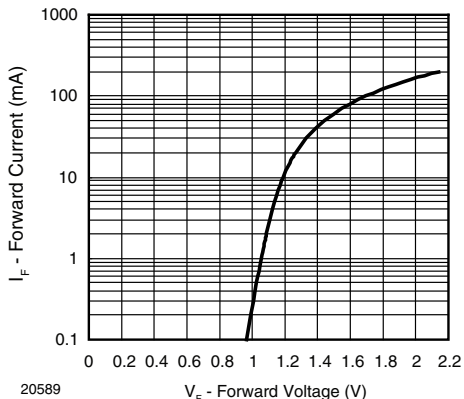
**BASIC CHARACTERISTICS** ( $T_{amb} = 25\text{ }^{\circ}\text{C}$ , unless otherwise specified)


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

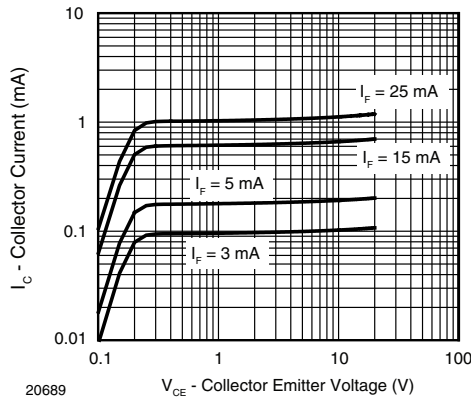


Fig. 8 - Collector Current vs. Collector Emitter Voltage



Fig. 11 - Collector Dark Current vs. Ambient Temperature

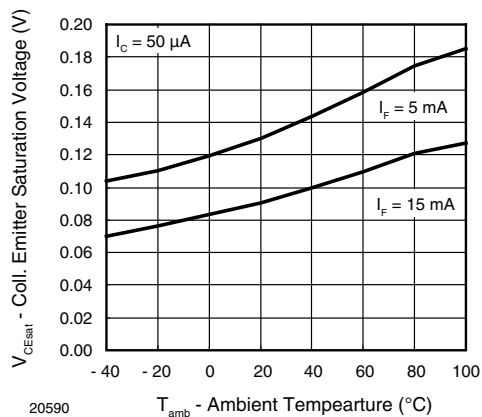


Fig. 9 - Collector Emitter Saturation Voltage vs. Ambient Temperature



Fig. 12 - Relative Collector Current vs. Horizontal Displacement



Fig. 13 - Relative Collector Current vs. Vertical Displacement

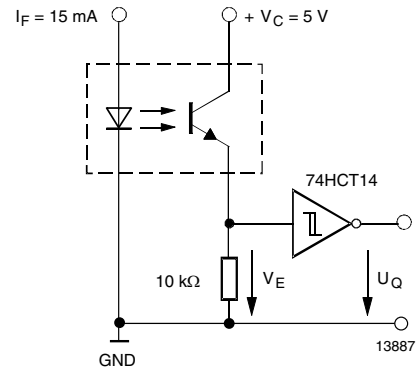


Fig. 15 - Application example

**REFLOW SOLDER PROFILE**


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

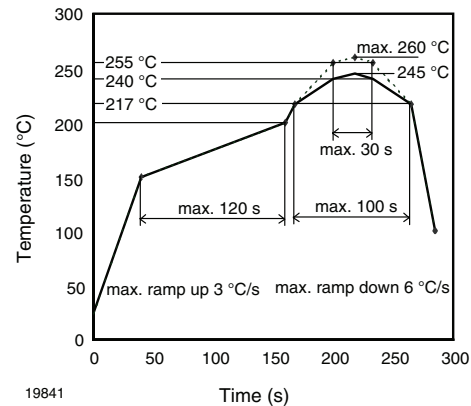


Fig. 16 - Lead (Pb)-free Reflow Solder Profile acc. J-STD-020

**FLOOR LIFE**

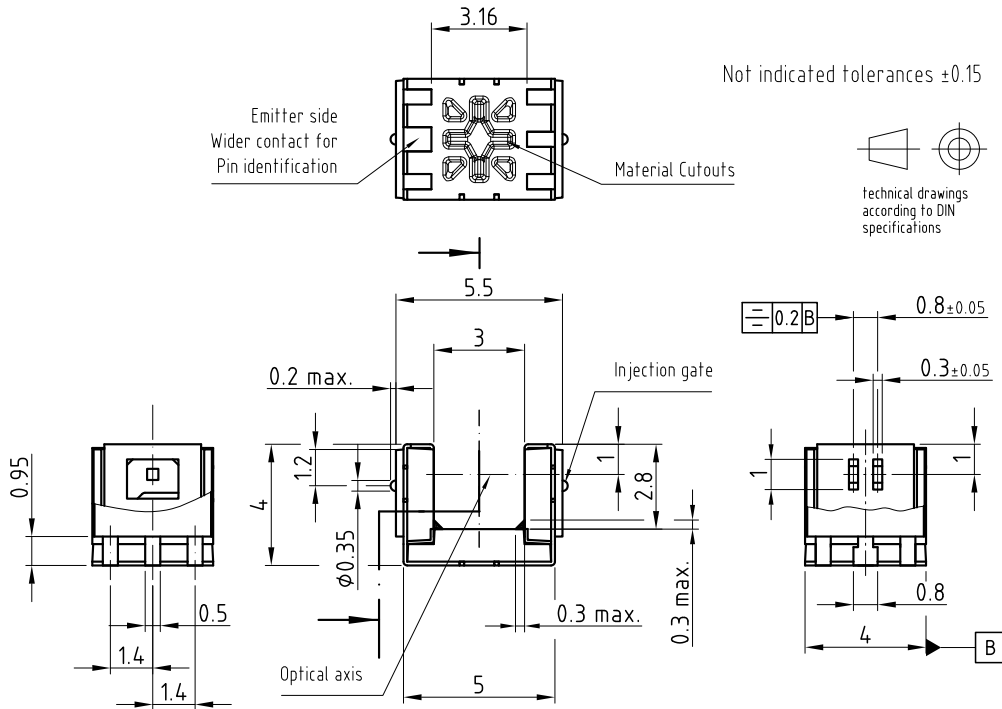
Level 1, acc. JEDEC, J-STD-020. No time limit.

<b>RELIABILITY TESTS IN REFERENCE TO AEC-Q101 RELEASE</b>			
TEST	CONDITION	DURATION	LOT SIZE - REJECTS
High temperature storage	$T_{stg(max.)} = 100\text{ °C}$	1000 h	3 x 50 pcs - 0 pcs
Low temperature storage	$T_{stg(min.)} = -40\text{ °C}$	1000 h	3 x 50 pcs - 0 pcs
Temperature cycling	$-40\text{ °C}/+100\text{ °C}$	1000 x	3 x 77 pcs - 0 pcs
H3TRB	85 °C/85 % RH, emitters: $V_R = 4\text{ V}$ , detectors: $V_{CEO} = 5\text{ V}$	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, $T_{amb} = 25\text{ °C}$	1000 h (15 000 cycles)	3 x 77 pcs - 0 pcs

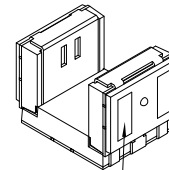
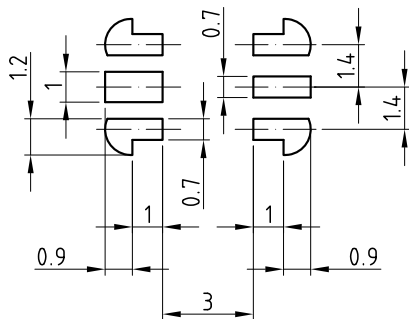
<b>RELIABILITY TESTS IN REFERENCE TO ENHANCED TEMPERATURE RELEASE ACC. AEC-Q101</b>			
TEST	CONDITION	DURATION	LOT SIZE - REJECTS
High temperature storage	$T_{stg(max.)} = 125\text{ °C}$	1000 h	1 x 50 pcs - 0 pcs
Temperature cycling	$-40\text{ °C}/+150\text{ °C}$	1000 x	1 x 77 pcs - 0 pcs
Power temperature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



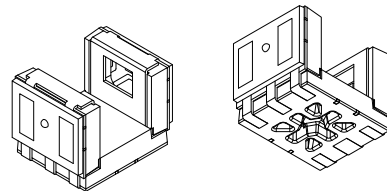
### PACKAGE DIMENSIONS in millimeters



### Proposed solderpad design



Marking area



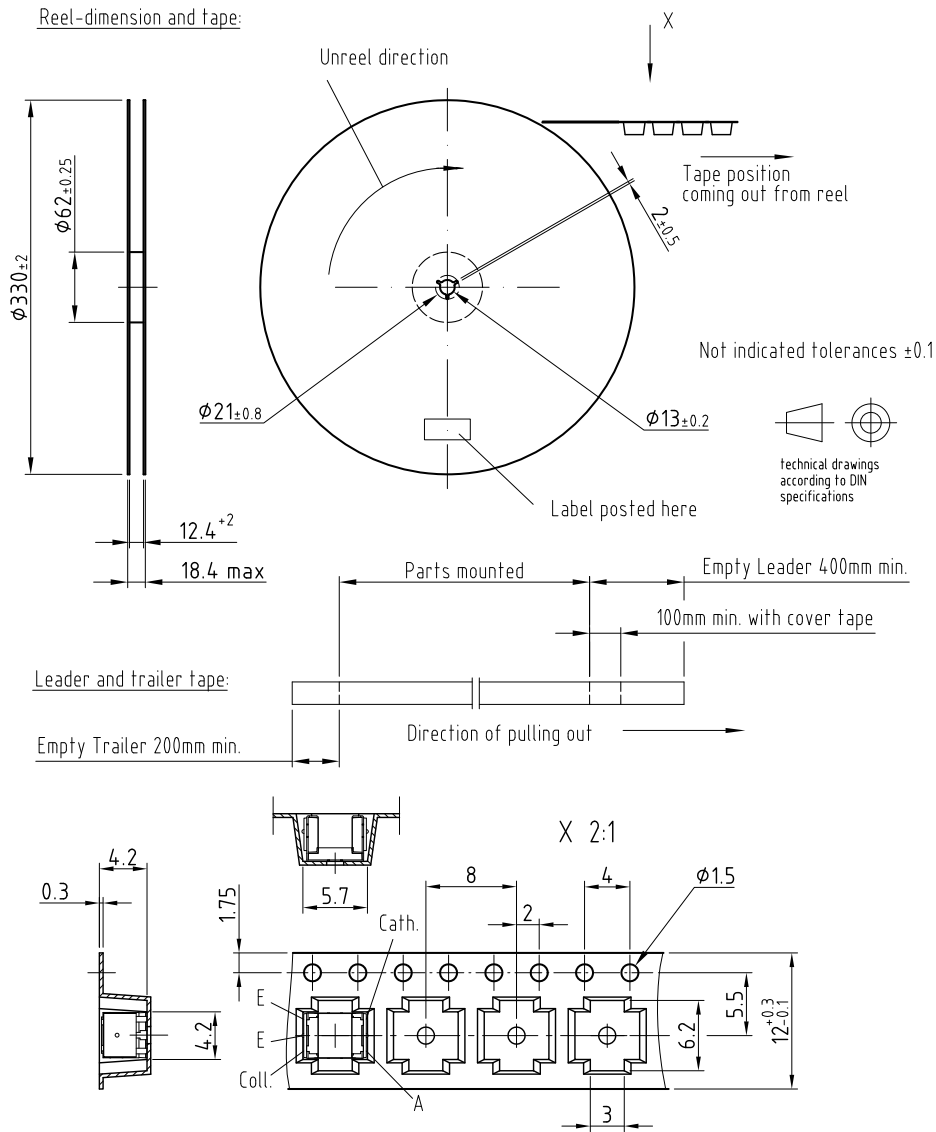
Drawing-No.: 6.541-5061.01-4

Issue: 6; 14.05.07

19536

**PACKAGE DIMENSIONS** in millimeters

Volume/reel = 2000 pcs



Drawing-No.: 9.800-5092.01-4

Issue: 1; 14.05.07

20611

## 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: ±0.5mm

Length: 575±1mm

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

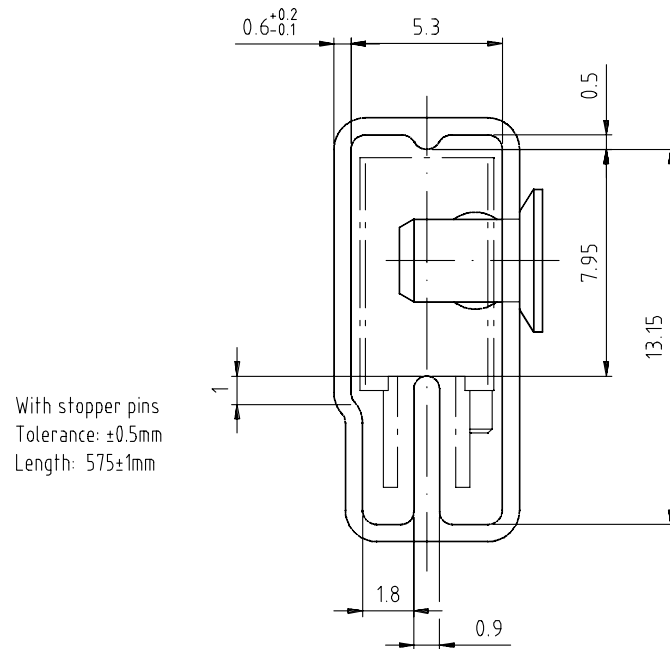


With rubber stopper  
Tolerance: ±0.5mm  
Length: 575±1mm

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

# Packaging and Ordering Information

Vishay Semiconductors Packaging and Ordering Information



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

Fig. 8



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