



# Triple Channel Transmissive Optical Sensor With Phototransistor Outputs for “Turn and Push” Encoding



## DESCRIPTION

The TCUT1630X01 is a compact transmissive sensor that includes an infrared emitter and three phototransistor detectors, located face-to-face in a surface-mount package. The tall dome design supports an additional transistor and additional mechanical room for vertical signal encoding.

## FEATURES

- Package type: surface-mount
- Detector type: phototransistor
- Dimensions (L x W x H in mm): 5.7 x 5.9 x 7.1
- AEC-Q101 qualified
- Gap (in mm): 3
- Aperture (in mm): 0.3
- Typical output current under test:  $I_C = 1.3 \text{ mA}$
- 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)



## 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
TCUT1630X01	3	0.3	1.3	No

### Note

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

ORDERING INFORMATION			
ORDERING CODE	PACKAGING	VOLUME <sup>(1)</sup>	REMARKS
TCUT1630X01	Tape and reel	MOQ: 1100 pcs, 1100pcs/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>				
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. 17	$T_{sd}$	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
Total 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	$\mu\text{A}$
Total power dissipation	$T_{amb} \leq 95\text{ }^{\circ}\text{C}$	$P_V$	37.5	mW

**ABSOLUTE MAXIMUM RATINGS**

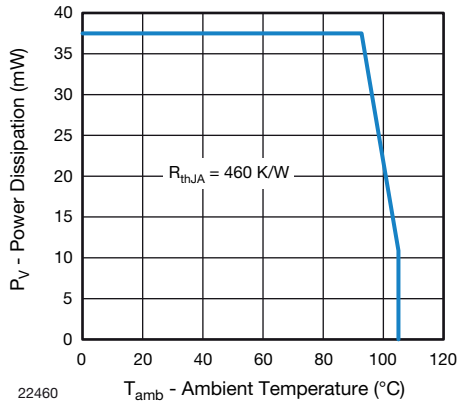


Fig. 1 - Power Dissipation Limit vs. Ambient Temperature

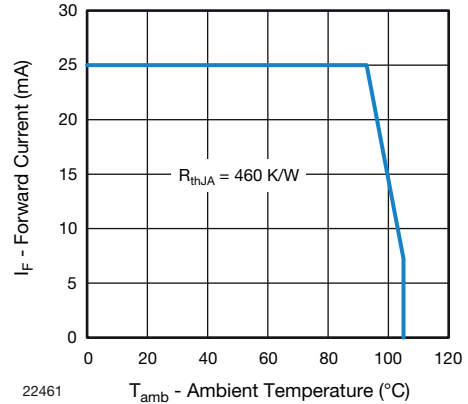


Fig. 2 - Forward Current Limit vs. Ambient Temperature

<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	$V_{CE} = 5\text{ V}$ , $I_F = 15\text{ mA}$	$I_C$	0.45	1.3	-	mA
Collector emitter saturation voltage	$I_F = 15\text{ mA}$ , $I_C = 0.2\text{ mA}$	$V_{CEsat}$	-	-	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	$I_C = 0.7\text{ mA}$ , $V_{CE} = 5\text{ V}$ , $R_L = 100\text{ }\Omega$ (see Fig. 3)	$t_r$	-	9	150	$\mu\text{s}$
Fall time	$I_C = 0.7\text{ mA}$ , $V_{CE} = 5\text{ V}$ , $R_L = 100\text{ }\Omega$ (see Fig. 3)	$t_f$	-	16	150	$\mu\text{s}$

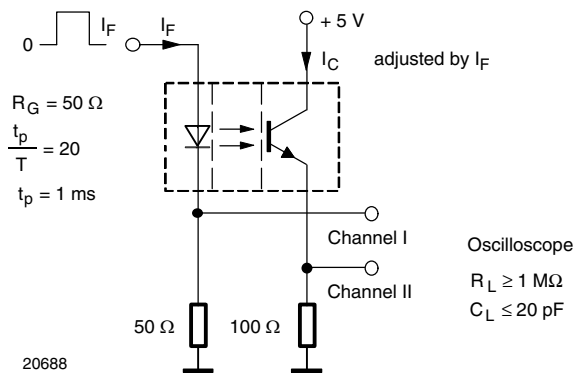
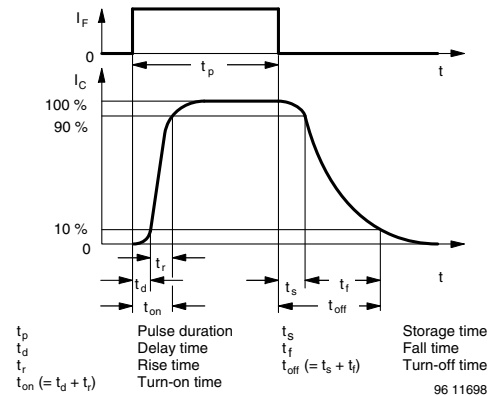

 Fig. 3 - Test Circuit for  $t_r$  and  $t_f$ 


Fig. 4 - Switching Times

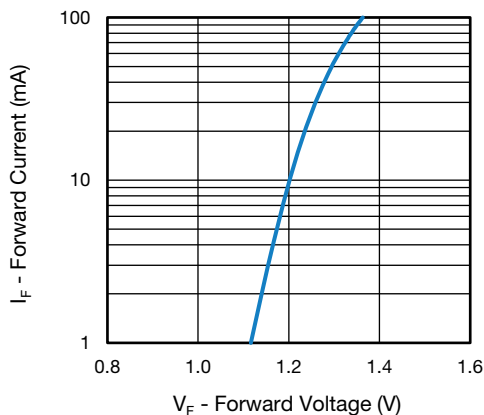
**BASIC CHARACTERISTICS** ( $T_{amb} = 25\text{ }^{\circ}\text{C}$ , unless otherwise specified)


Fig. 5 - Forward Current vs. Forward Voltage

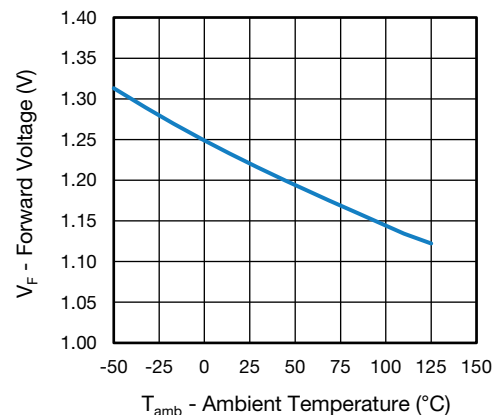


Fig. 6 - Forward Voltage vs. Ambient Temperature

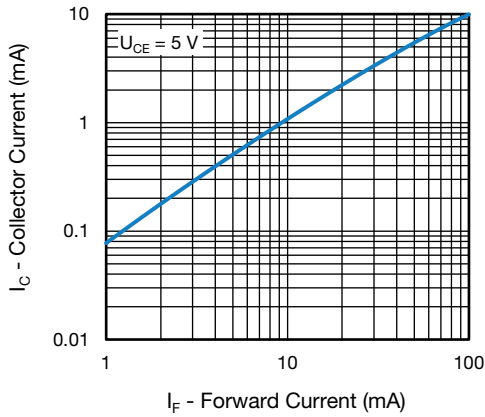


Fig. 7 - Collector Current vs. Forward Current

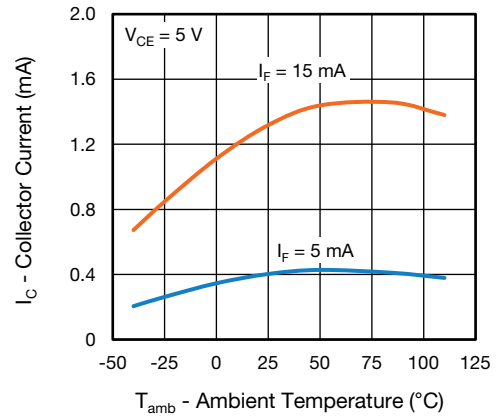


Fig. 10 - Collector Current vs. Ambient Temperature

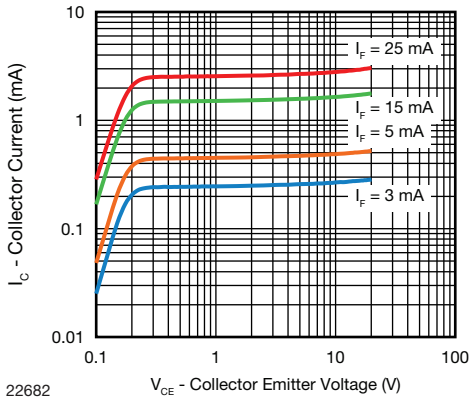


Fig. 8 - Collector Current vs. Collector Emitter Voltage

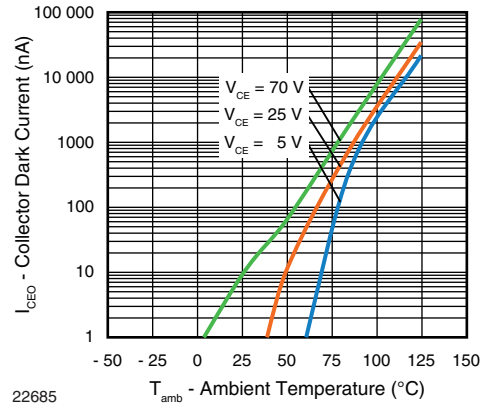


Fig. 11 - Collector Dark Current vs. Ambient Temperature

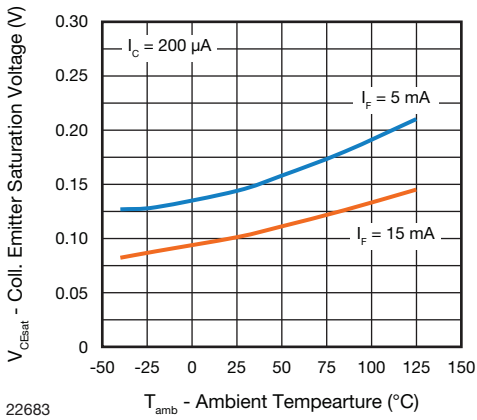


Fig. 9 - Collector Emitter Saturation Voltage vs. Ambient Temperature

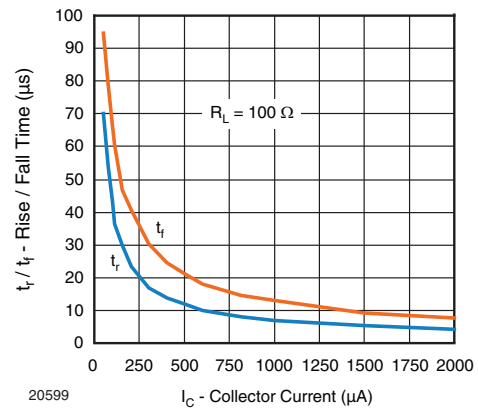


Fig. 12 - Rise / Fall Time vs. Collector Current

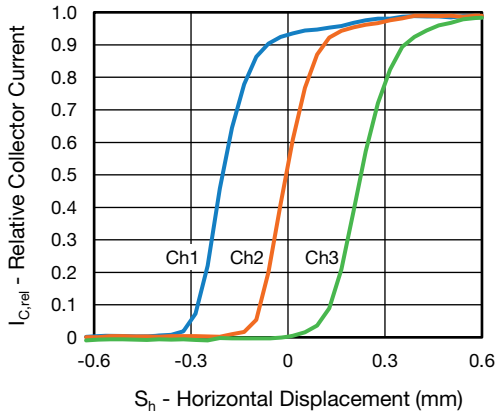


Fig. 13 - Relative Collector Current vs. Horizontal Displacement Horizontal Shutter (0.25 mm thickness)

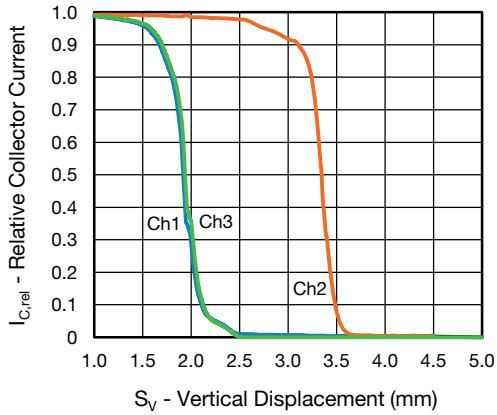


Fig. 14 - Relative Collector Current vs. Vertical Displacement Vertical Shutter (0.25 mm thickness)

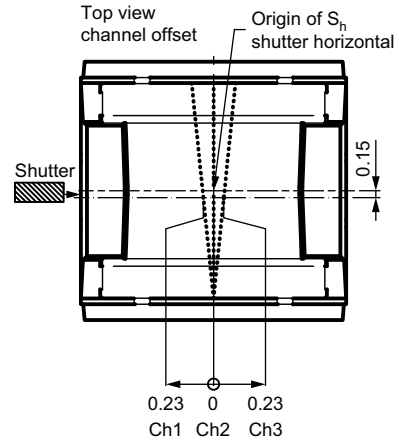


Fig. 16 - Top View Sensor Channel Positions and Origin of Horizontal Shutter

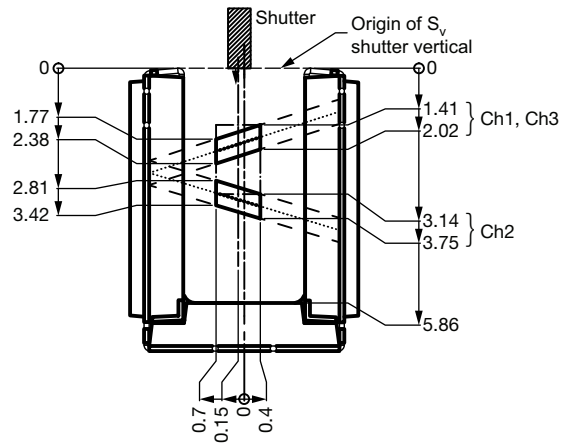


Fig. 17 - Top View Sensor Channel Positions and Origin of Vertical Shutter

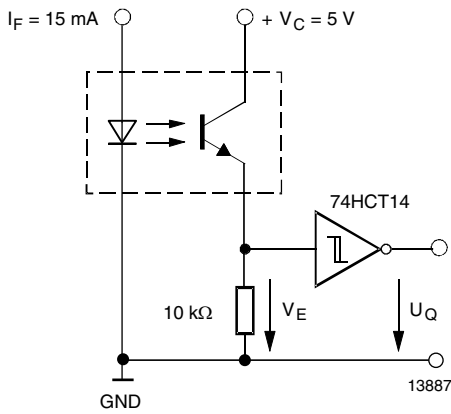
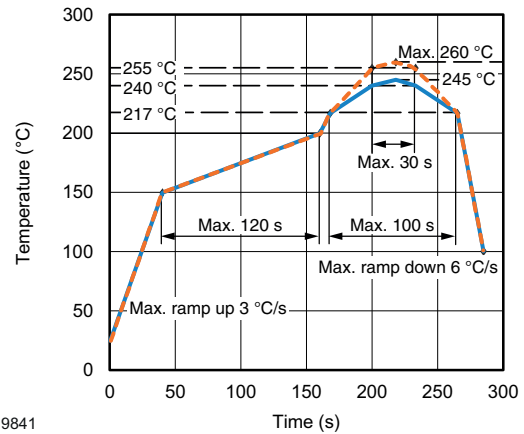


Fig. 15 - Application example

**REFLOW SOLDER PROFILE**



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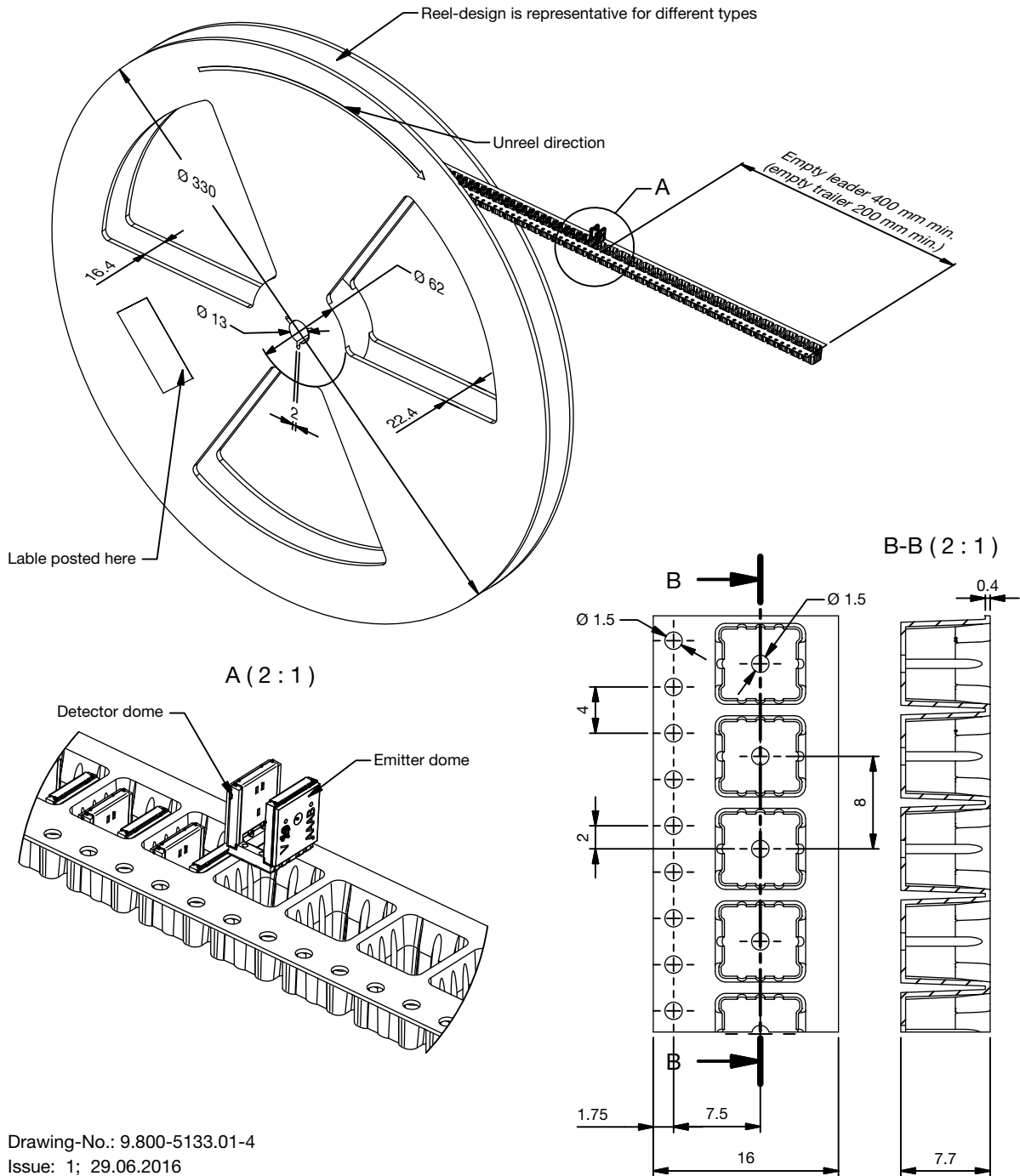
Fig. 18 - Lead (Pb)-free Reflow Solder Profile According to J-STD-020





**PACKAGE DIMENSIONS** in millimeters

Volume/reel = 1100 pcs



Drawing-No.: 9.800-5133.01-4  
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