



# 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_A <sup>(2)</sup> | Tape and reel | MOQ: 1100 pcs, 1100 pcs/reel | Drypack, MSL 1<br>PCN-OPT-1311-2024 |

### Notes

<sup>(1)</sup> MOQ: minimum order quantity

<sup>(2)</sup> TCUT1630X01\_A represents the post PCN parts; for more details: [PCN-OPT-1311-2024](http://www.vishay.com/doc?991000)



| <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**

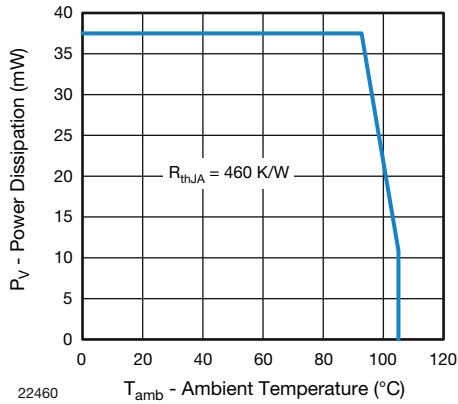


Fig. 1 - Power Dissipation Limit vs. Ambient Temperature

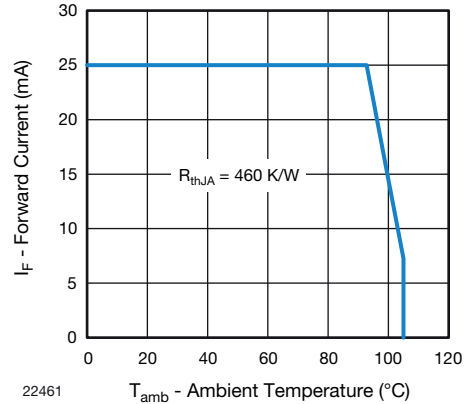


Fig. 2 - Forward Current Limit vs. Ambient Temperature

| <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  | $\mu\text{s}$ |

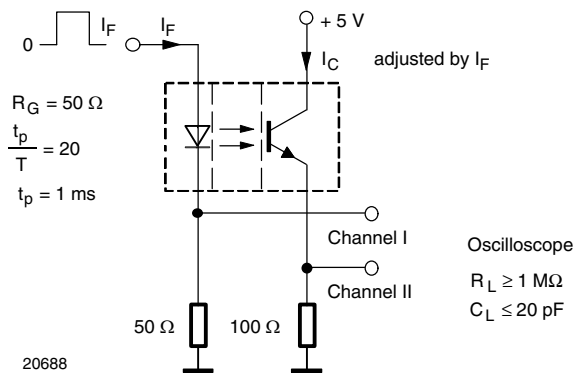
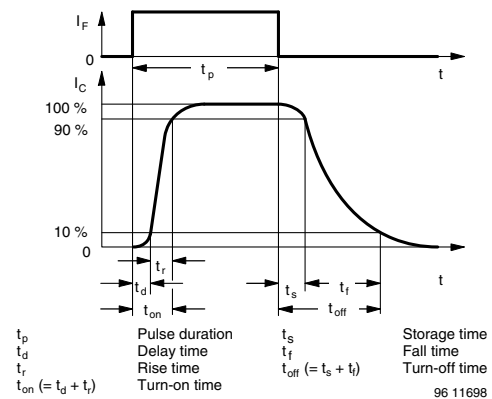

 Fig. 3 - Test Circuit for  $t_r$  and  $t_f$ 


Fig. 4 - Switching Times

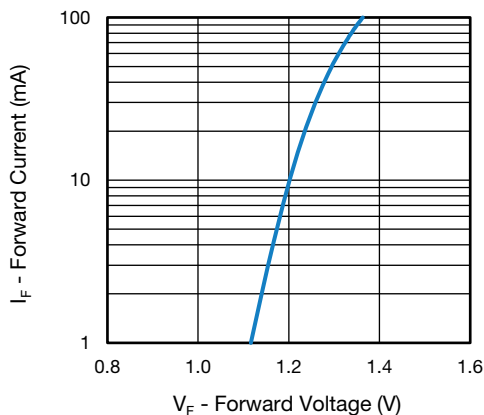
**BASIC CHARACTERISTICS** ( $T_{amb} = 25\text{ }^{\circ}\text{C}$ , unless otherwise specified)


Fig. 5 - Forward Current vs. Forward Voltage

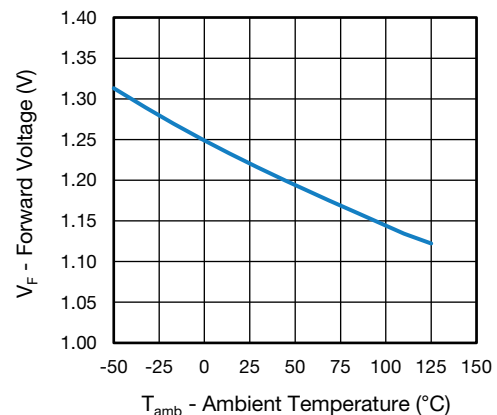


Fig. 6 - Forward Voltage vs. Ambient Temperature

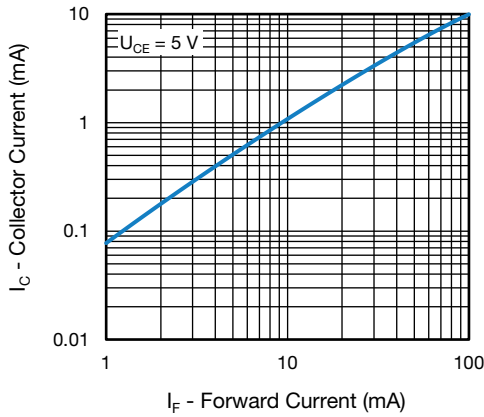


Fig. 7 - Collector Current vs. Forward Current

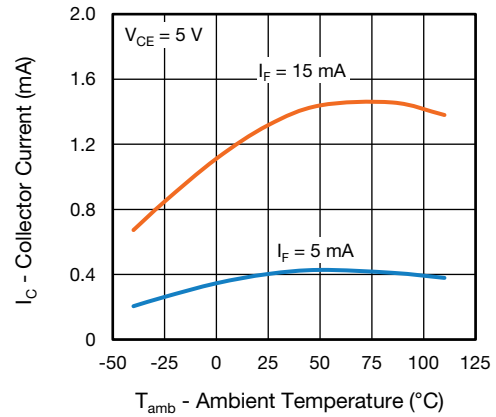


Fig. 10 - Collector Current vs. Ambient Temperature

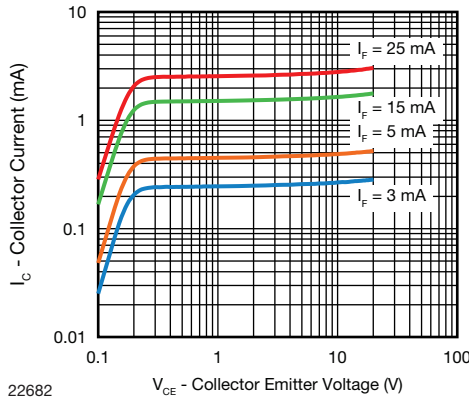


Fig. 8 - Collector Current vs. Collector Emitter Voltage

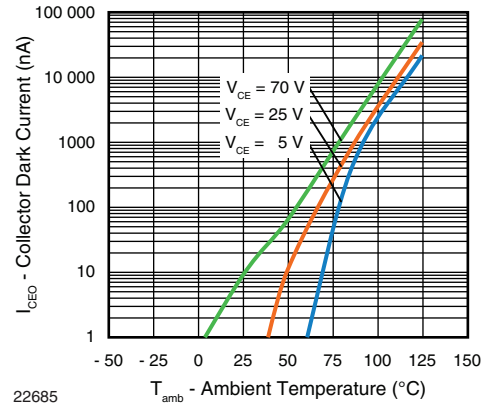


Fig. 11 - Collector Dark Current vs. Ambient Temperature

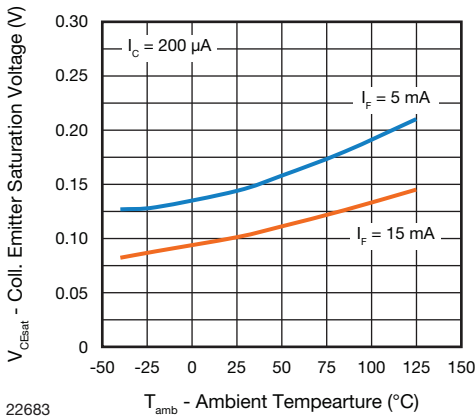


Fig. 9 - Collector Emitter Saturation Voltage vs. Ambient Temperature

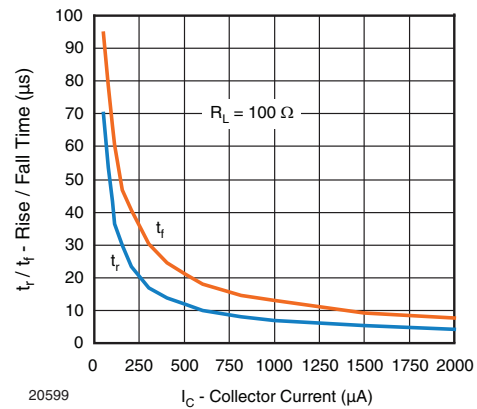


Fig. 12 - Rise / Fall Time vs. Collector Current

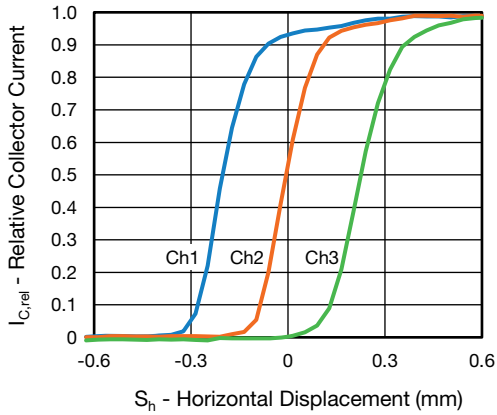


Fig. 13 - Relative Collector Current vs. Horizontal Displacement Horizontal Shutter (0.25 mm thickness)

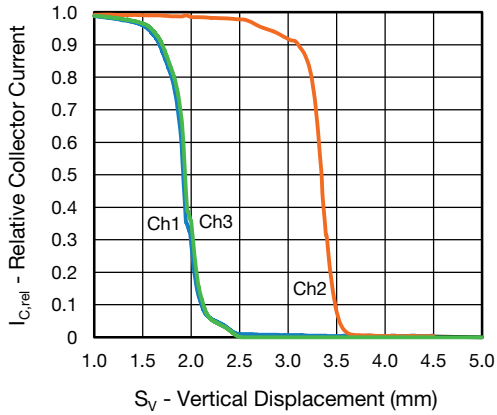


Fig. 14 - Relative Collector Current vs. Vertical Displacement Vertical Shutter (0.25 mm thickness)

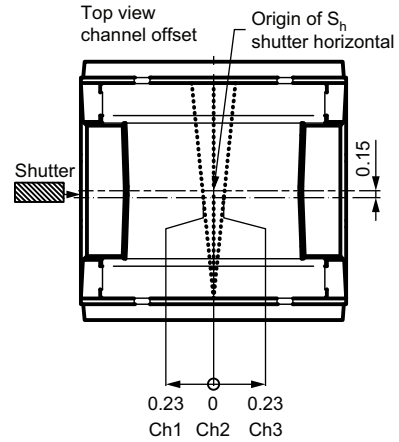


Fig. 16 - Top View Sensor Channel Positions and Origin of Horizontal Shutter

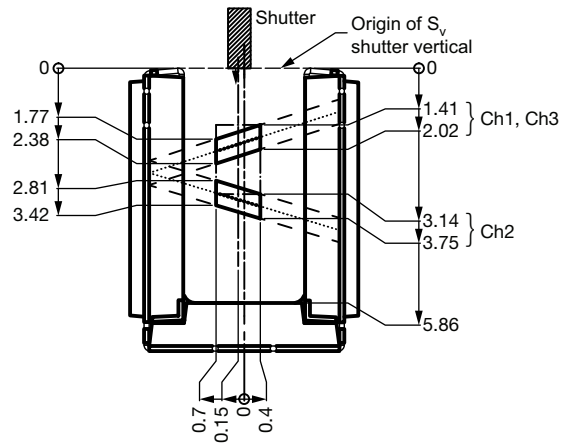


Fig. 17 - Top View Sensor Channel Positions and Origin of Vertical Shutter

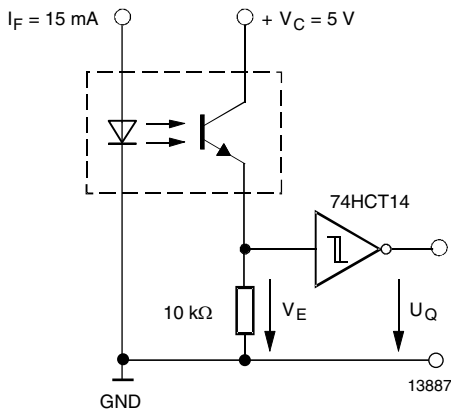


Fig. 15 - Application example

**REFLOW SOLDER PROFILE**

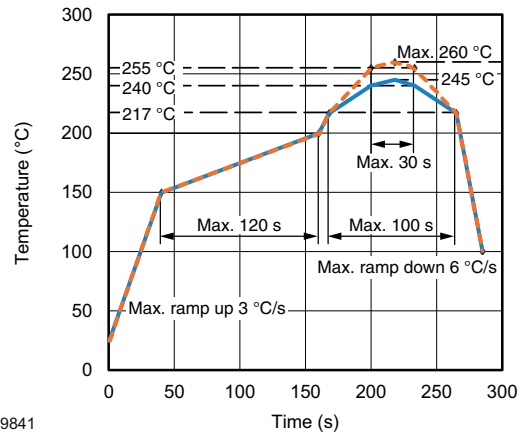


Fig. 18 - Lead (Pb)-free Reflow Solder Profile According to J-STD-020

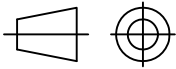


**FLOOR LIFE**

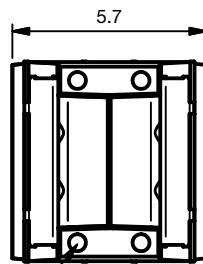
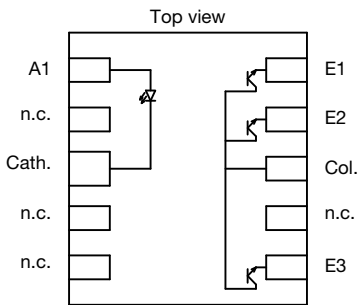
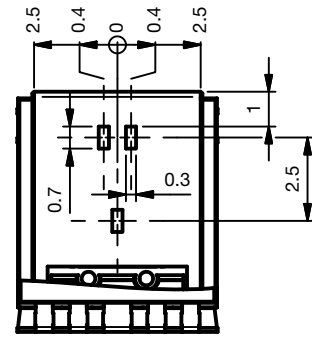
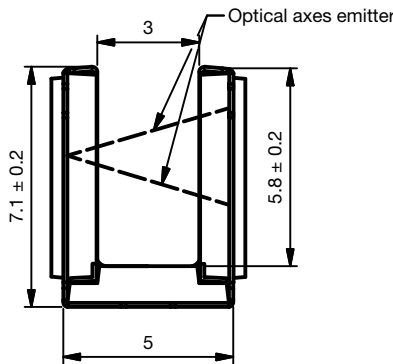
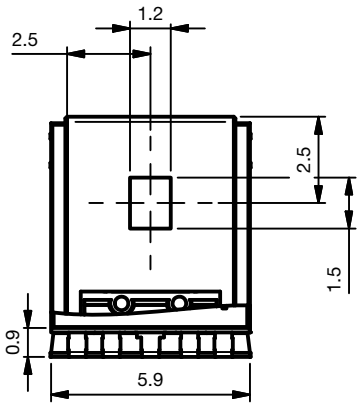
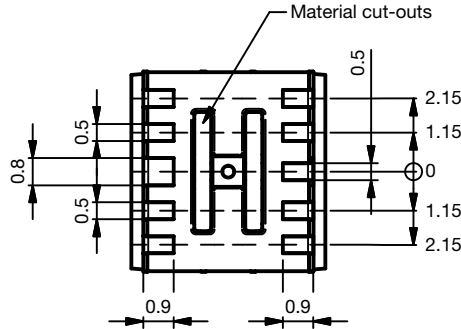
Level 1, according to JEDEC®, J-STD-020. No time limit.

**PACKAGE DIMENSIONS** in millimeters

Not indicated tolerances ± 0.15 mm

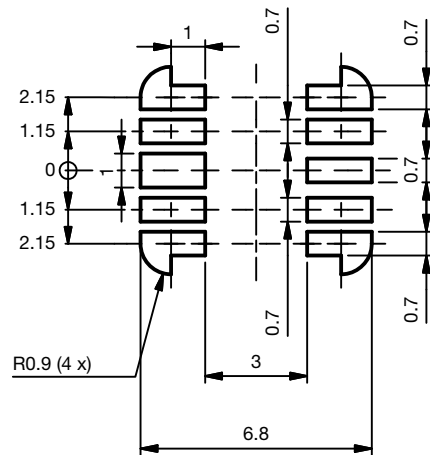


Technical drawings according to DIN specification.

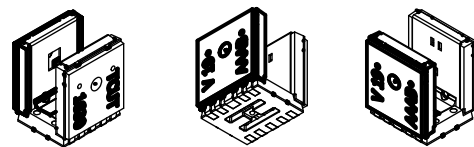


**Note**  
• Do not connect n.c. pins to the circuit

**Recommended Footprint**



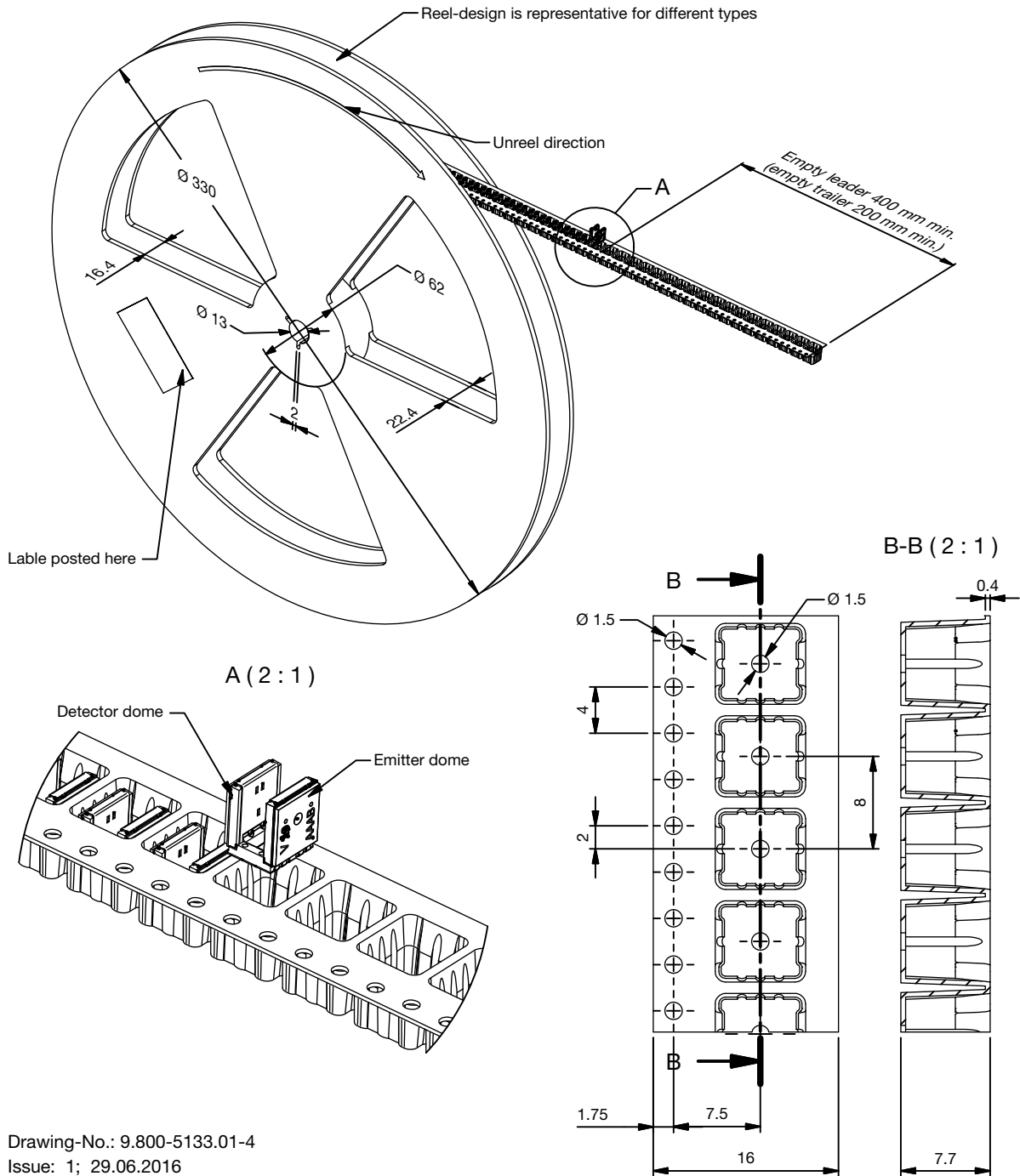
Drawing No.: 6.541-5106.01-4  
Issue: 1; 20.06.2016





**PACKAGE DIMENSIONS** in millimeters

Volume/reel = 1100 pcs



Drawing-No.: 9.800-5133.01-4  
Issue: 1; 29.06.2016



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