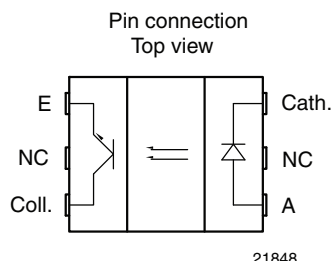


# Subminiature Transmissive Optical Sensor with Transistor Output



19601



21848

## DESCRIPTION

The TCPT1300X01 is a compact transmissive sensor that includes an infrared emitter and a phototransistor detector, 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
- Typical output current under test:  $I_C = 0.6$  mA
- Emitter wavelength: 950 nm
- Moisture sensitivity level (MSL): 1
- Compliant to RoHS Directive 2002/95/EC and in accordance to WEEE 2002/96/EC

### 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
- Detection of motion speed



## PRODUCT SUMMARY

| PART NUMBER | GAP WIDTH (mm) | APERTURE WIDTH (mm) | TYPICAL OUTPUT CURRENT UNDER TEST <sup>(1)</sup> (mA) | DAYLIGHT BLOCKING FILTER INTEGRATED |
|-------------|----------------|---------------------|-------------------------------------------------------|-------------------------------------|
| TCPT1300X01 | 3              | 0.3                 | 0.6                                                   | No                                  |

### Note

- Conditions like in table basic characteristics/coupler

## ORDERING INFORMATION

| ORDERING CODE | PACKAGING     | VOLUME <sup>(1)</sup>        | REMARKS        |
|---------------|---------------|------------------------------|----------------|
| TCPT1300X01   | 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           | $\mu\text{A}$      |

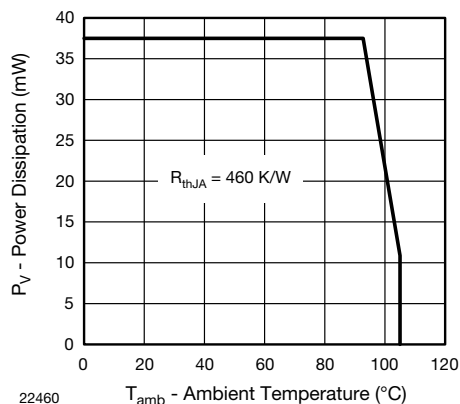
**ABSOLUTE MAXIMUM RATINGS**

Fig. 1 - Power Dissipation Limit vs. Ambient Temperature

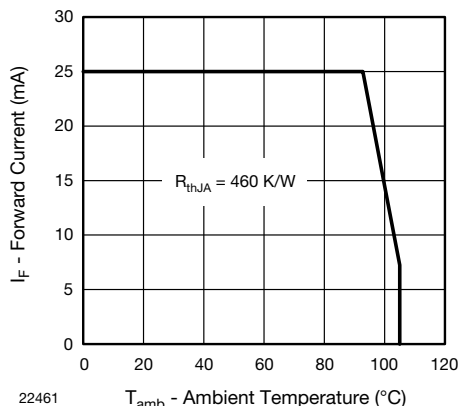


Fig. 2 - Forward Current Limit vs. Ambient Temperature

| <b>BASIC 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                                                                                   | $V_{CE} = 5\text{ V}$ , $I_F = 15\text{ mA}$                                             | $I_C$       | 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 figure 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 figure 3) | $t_f$       |      | 30   | 150  | $\mu\text{s}$ |

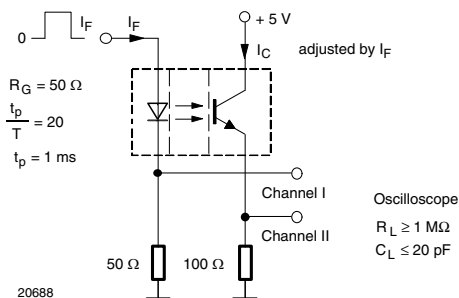
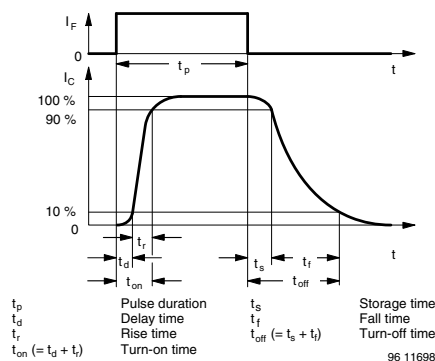

Fig. 3 - Test Circuit for  $t_r$  and  $t_f$ 


Fig. 4 - Switching Times

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

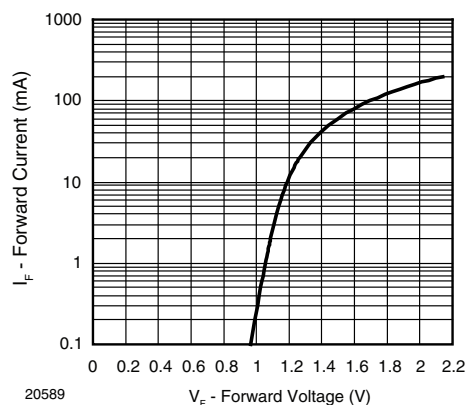


Fig. 5 - Forward Current vs. Forward Voltage

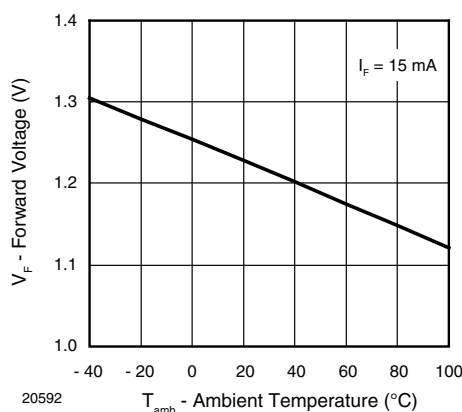


Fig. 6 - Forward Voltage vs. Ambient Temperature

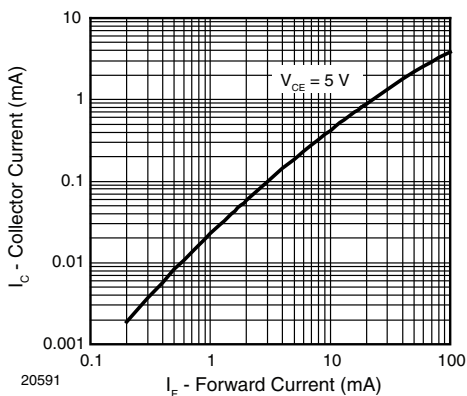


Fig. 7 - Collector Current vs. Forward Current

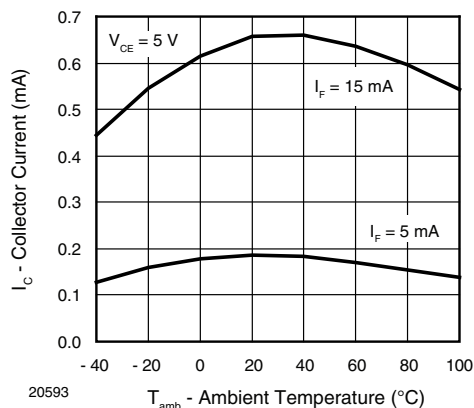


Fig. 10 - Collector Current vs. Ambient Temperature

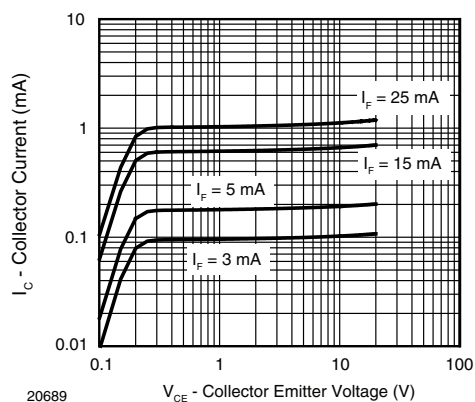


Fig. 8 - Collector Current vs. Collector Emitter Voltage

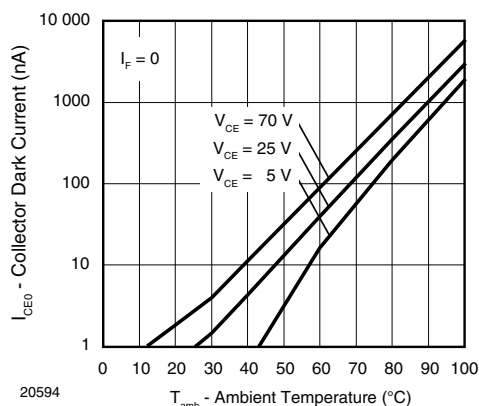


Fig. 11 - Collector Dark Current vs. Ambient Temperature

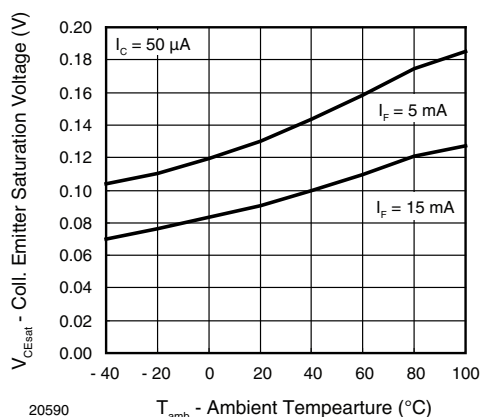


Fig. 9 - Collector Emitter Saturation Voltage vs. Ambient Temperature

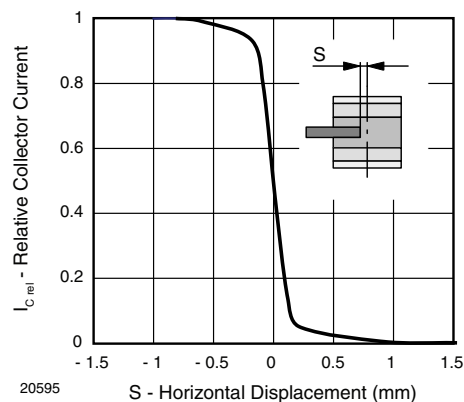


Fig. 12 - Relative Collector Current vs. Horizontal Displacement

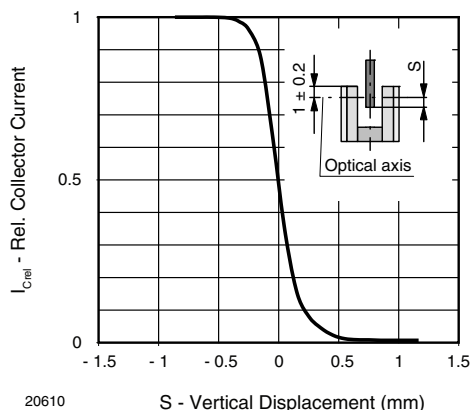


Fig. 13 - Relative Collector Current vs. Vertical Displacement

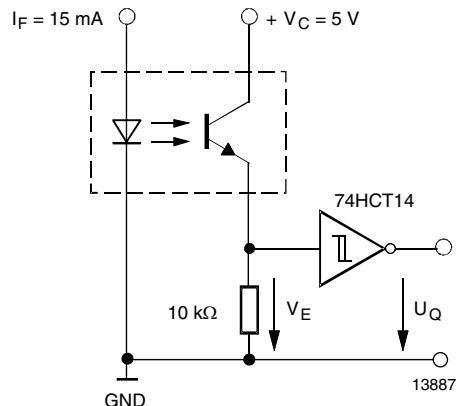


Fig. 15 - Application example

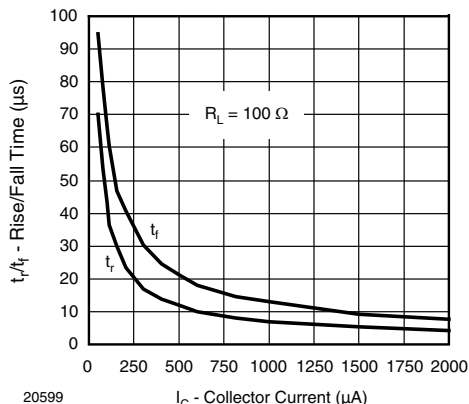


Fig. 14 - Rise/Fall Time vs. Collector Current

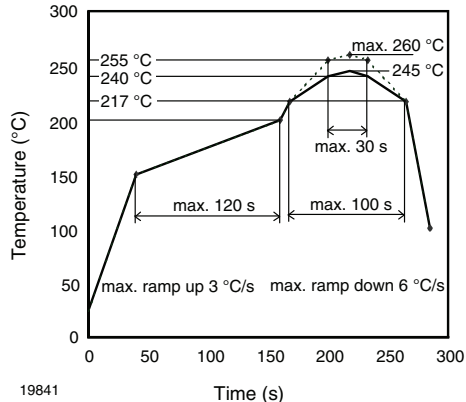


Fig. 16 - Lead (Pb)-free Reflow Solder Profile acc. J-STD-020

### FLOOR LIFE

No time limit.

Moisture sensitivity level (MSL) 1, acc. JEDEC, J-STD-020.

### RELIABILITY TESTS IN REFERENCE TO AEC-Q101 RELEASE

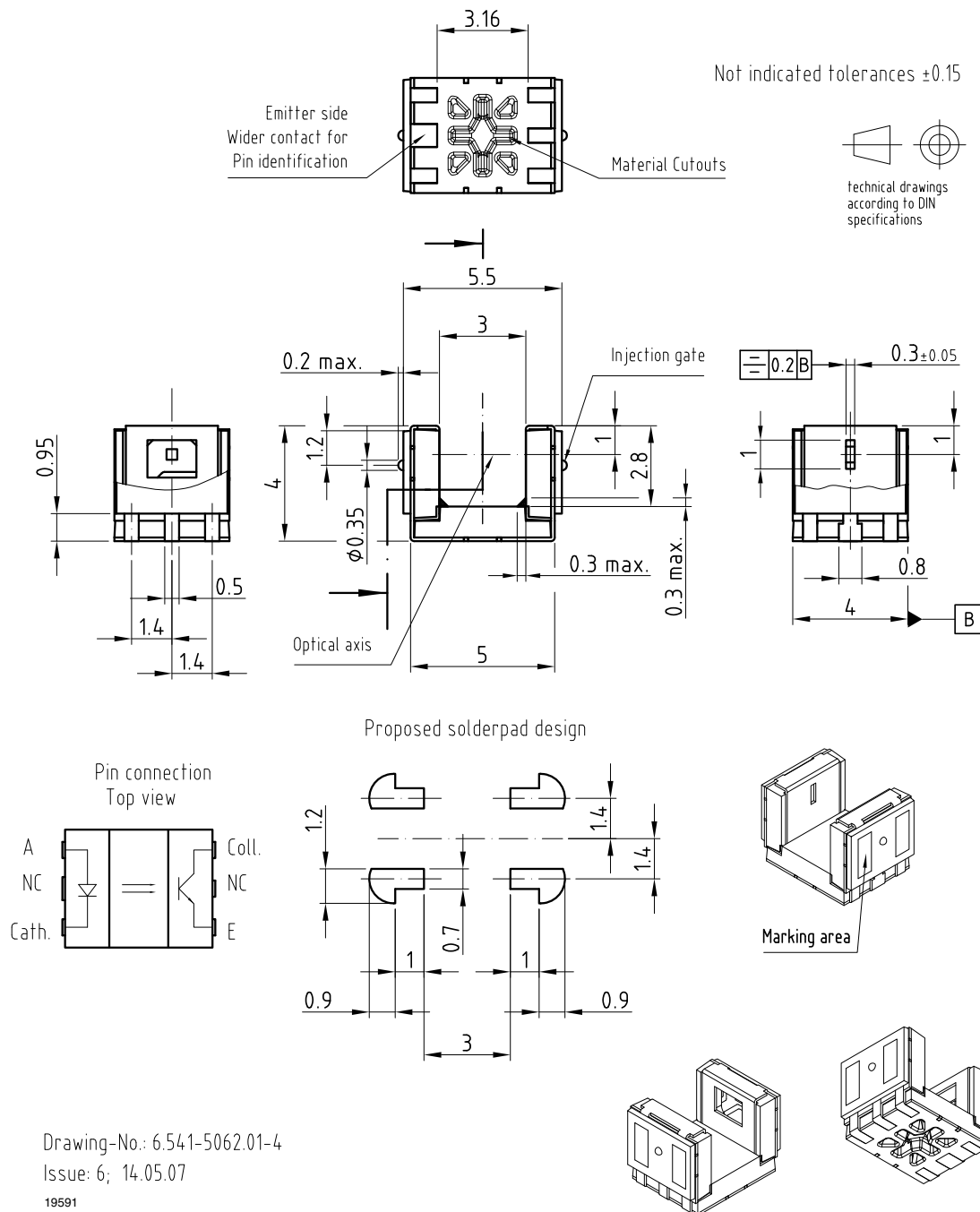
| TEST                          | CONDITION                                                                                                                                          | DURATION                  | LOT SIZE - REJECTS |
|-------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------|--------------------|
| High temperature storage      | $T_{stg} (max.) = 100\text{ }^{\circ}\text{C}$                                                                                                     | 1000 h                    | 3 x 50 pcs - 0 pcs |
| Low temperature storage       | $T_{stg} (min.) = -40\text{ }^{\circ}\text{C}$                                                                                                     | 1000 h                    | 3 x 50 pcs - 0 pcs |
| Temperature cycling           | $-40\text{ }^{\circ}\text{C}/+100\text{ }^{\circ}\text{C}$                                                                                         | 1000 x                    | 3 x 77 pcs - 0 pcs |
| H3TRB                         | 85 °C/85 % RH,<br>emitters: $V_R = 4\text{ V}$ , detectors: $V_{CE0} = 5\text{ V}$                                                                 | 1000 h                    | 3 x 77 pcs - 0 pcs |
| Intermittent operational life | Emitters: $I_F = 80\text{ mA DC}$ , detectors: $V_{CE} = 16\text{ V}$ ,<br>duty cycle: 2 min on, 2 min off, $T_{amb} = 25\text{ }^{\circ}\text{C}$ | 1000 h<br>(15 000 cycles) | 3 x 77 pcs - 0 pcs |

### RELIABILITY TESTS IN REFERENCE TO ENHANCED TEMPERATURE RELEASE ACC. AEC-Q101

| TEST                     | CONDITION                                                                                                                            | DURATION                  | LOT SIZE - REJECTS |
|--------------------------|--------------------------------------------------------------------------------------------------------------------------------------|---------------------------|--------------------|
| High temperature storage | $T_{stg} (max.) = 125\text{ }^{\circ}\text{C}$                                                                                       | 1000 h                    | 1 x 50 pcs - 0 pcs |
| Temperature cycling      | $-40\text{ }^{\circ}\text{C}/+150\text{ }^{\circ}\text{C}$                                                                           | 1000 x                    | 1 x 77 pcs - 0 pcs |
| Power temperature cycle  | $-25\text{ }^{\circ}\text{C}/+85\text{ }^{\circ}\text{C}$ , $I_F = 50\text{ mA}$ , $V_{CE} = 16\text{ V}$ ,<br>2 min. on, 2 min. off | 1000 h<br>(15 000 cycles) | 1 x 77 pcs - 0 pcs |

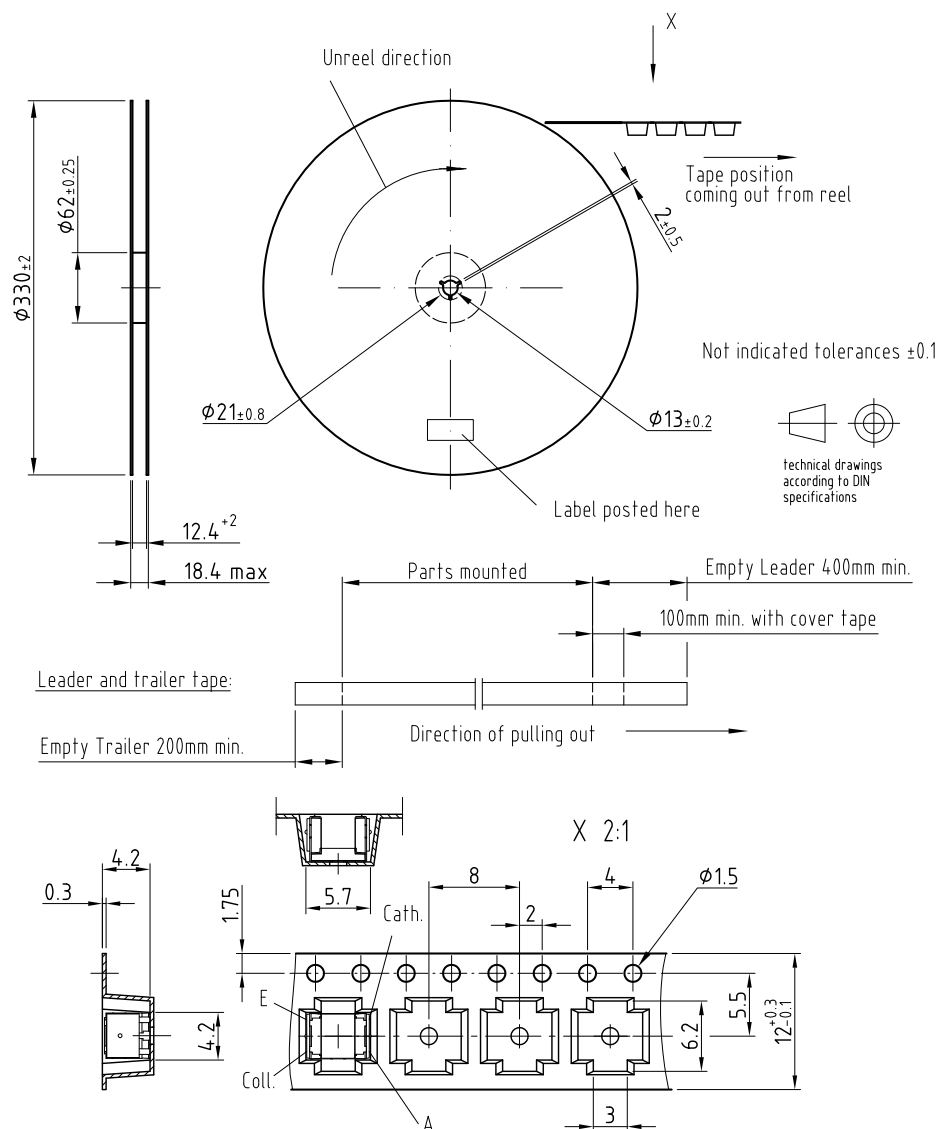


PACKAGE DIMENSIONS in millimeters



### PACKAGE DIMENSIONS in millimeters

Volume/reel = 2000 pcs



Drawing-No.: 9.800-5092.02-4

Issue: 1; 14.05.07

20601



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