**Recommended Land Pattern: [mm]**

- Dimension: 0.4 ±0.2
- Dimension: 0.4 ±0.2
- Dimension: 0.6 ±0.1
- Dimension: 1.25 ±0.1
- Dimension: 2.0 ±0.1
- Dimension: 0.4 ±0.2
- Dimension: 0.7
- Dimension: 1.3
- Dimension: 2.7

**Electrical Properties:**

<table>
<thead>
<tr>
<th>Properties</th>
<th>Test conditions</th>
<th>Value</th>
<th>Unit</th>
<th>Tol.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Resistance</td>
<td>R</td>
<td>2.2</td>
<td>Ω</td>
<td>±1%</td>
</tr>
<tr>
<td>Rated Power</td>
<td>$P_{\text{Rated}}$</td>
<td>0.33</td>
<td>W</td>
<td></td>
</tr>
<tr>
<td>Temperature Coefficient of Resistance (min.)</td>
<td>TCR</td>
<td>100</td>
<td>ppm/ °C</td>
<td>max.</td>
</tr>
<tr>
<td>Temperature Coefficient of Resistance (max.)</td>
<td>TCR</td>
<td>100</td>
<td>ppm/ °C</td>
<td>max.</td>
</tr>
<tr>
<td>Rated Current</td>
<td>$I_{\text{R}}$</td>
<td>0.38</td>
<td>A</td>
<td>max.</td>
</tr>
<tr>
<td>Rated Voltage</td>
<td>$U_{\text{R}}$</td>
<td>850</td>
<td>mV</td>
<td>max.</td>
</tr>
</tbody>
</table>

**General Information:**

- Operating Temperature: -55 up to +155 °C
- Storage Conditions (in original packaging): 5 °C - 35 °C; 25 % up to 75 % RH
- Test conditions of Electrical Properties: +20 °C, 35 % RH if not specified differently
- FIT according to separate documentation
- Component conform to REACh and RoHS requirements and standards

This electronic component has been designed and developed for usage in general electronic equipment only. This product is not authorized for use in equipment where a higher safety standard and reliability standard is especially required, or where failures of the product can reasonably be expected to cause serious personal injury or death, unless the parties have executed an agreement specifically governing such use. Moreover, Würth Elektronik eiSos GmbH & Co KG products are neither designed nor intended for use in areas such as military, aerospace, nuclear, medical, automotive, communication, power supply, control, transportation, signal, disaster prevention, medical, public information networks etc. Würth Elektronik eiSos GmbH & Co KG must be informed about the intent of such usage before the design or usage. In addition, sufficient reliability evaluation checks for safety must be performed on every electronic component which is used in electrical circuits that require high safety and reliability functions or performance.
### Mechanical Properties:

<table>
<thead>
<tr>
<th>Properties</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Termination Plating</td>
<td>CuNiSn</td>
</tr>
<tr>
<td>Adhesive Strength of Termination</td>
<td>60 ± 1 sec; 10N</td>
</tr>
<tr>
<td>Vibration Resistance</td>
<td>5 g for 20 minutes, 12 cycles each of 3 orientations @ 10 - 2000 - 10 Hz</td>
</tr>
<tr>
<td>Resistance to Solder Heat</td>
<td>Solder Temperature 260°C ± 5°C</td>
</tr>
<tr>
<td>Dipping Time</td>
<td>10 sec.</td>
</tr>
<tr>
<td>Specific</td>
<td>Refer to Soldering Profile</td>
</tr>
</tbody>
</table>

### Derating Curve:

- **Ambient temperature (°C)**: 
  - -55°C to 155°C
  - Area of recommended operation

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This electronic component has been designed and developed for usage in general electronic equipment only. This product is not authorized for use in equipment where a higher safety standard and reliability standard is especially required or where failure of the product is reasonably expected to cause severe personal injury or death, unless the parties have executed an agreement specifically governing such use. Moreover, Würth Elektronik eiSos GmbH & Co KG products are neither designed nor intended for use in areas such as military, aerospace, atomic power control, automatic, transportation, nuclear power control, telecommunication, signal control, disaster prevention, medical, public information network etc. Würth Elektronik eiSos GmbH & Co KG must be informed about the intent of such usage before the design or usage. In addition, sufficient reliability evaluation checks for safety must be performed on every electronic component which is used in electrical circuits that require high safety and reliability functions or performance.
Classification Reflow Profile for SMT components:

- Preheat Temperature Min: $T_{s \min}$
- Preheat Temperature Max: $T_{s \max}$
- Preheat Time $t_p$ from $T_{s \min}$ to $T_{s \max}$
- Ramp-up Rate ($T_L$ to $T_P$): 3 °C/second max.
- Liquidous Temperature: $T_L$ 217 °C
- Time $t_L$ maintained above $T_L$: $t_L$ 60 - 150 seconds
- Peak package body temperature: $T_P$ see table below
- Time within 5°C of actual peak temperature: $t_p$ 20 - 30 seconds
- Ramp-down Rate ($T_L$ to $T_P$): 6 °C/second max.
- Time 25°C to peak temperature: 8 minutes max.

refer to IPC/JEDEC J-STD-020E

Package Classification Reflow Temperature:

- PB-Free Assembly | Package Thickness < 1.6 mm: 260 °C
- PB-Free Assembly | Package Thickness 1.6 mm - 2.5 mm: 260 °C
- PB-Free Assembly | Package Thickness ≥ 2.5 mm: 250 °C

refer to IPC/JEDEC J-STD-020E
Cautions and Warnings:

The following conditions apply to all goods within the product series of Thick Film Resistors of Würth Elektronik eiSos GmbH & Co. KG:

General:

• This electronic component was designed and manufactured for use in general electronic equipment.
• Würth Elektronik must be asked for a written approval following the certain PRAP (level procedure) before incorporating the components into any equipment in the field such as military, aerospace, aviation, nuclear control, submarine, transportation (automotive control, train control, ship control), transportation signal, disaster prevention, medical, public information network etc. where higher safety and reliability are especially required and/or if there is the possibility of direct damage or human injury.
• Electronic components that will be used in safety-critical or high-reliability applications, should be pre-evaluated by the customer.
• Direct mechanical impact to the product shall be prevented as material of the body, pins or termination could break or in the worst case it could break.
• Avoid any water or heavy dust on resistor’s surface, which may cause electrical leakage, damage, overheating or corrosion.
• Würth Elektronik products are qualified according to international standards, which are listed in each product reliability report. Würth Elektronik does not warrant any customer qualified product characteristic, beyond Würth Elektronik specifications, for its validity and sustainability over time.
• The customer is responsible for the functionality of his or her own products. All technical specifications for standard products also apply to customer specific products.
• The component was designed and manufactured to be used within the datasheet specified values. If the usage and operation conditions specified in the datasheet are not met, the body, pins or termination may be damaged or dissolved.
• Do not apply any kind of flexural or compressive force onto soldered or unsoldered component.
• The resistance tolerance as specified within the datasheet is only valid on the date of delivery and according specified measurement criteria.

Product specific:

Storage conditions:

• A storage of Würth Elektronik products for longer than 24 months is not recommended. Within other effects, the terminals may suffer degradation, resulting in bad solderability. Therefore, all products shall be used within the period of 24 months based on the day of shipment.
• Do not expose the components into direct sunlight.
• These product must be stored in stable conditions within an ambient temperature between 5°C to 35°C with a relative humidity of 25 to 75%.
• The environment in which the resistors are operated and stored has to have atmospheric characteristics and must be free of dew condensation and toxic gases (e.g. chlorine, ammonia, sulfur, hydrogen sulphide and hydrogen sulfate).

Operating climatic conditions:

• Do not exceed the lower nor the upper specified temperature under no circumstances.
• Be aware that the specified resistance tolerance is only valid at the date of delivery.
• Do not use the resistors under high humidity, high temperature nor under high or low atmospheric pressure which may affect resistors reliability.
• Surface temperature including self-heating must be kept below the maximum operating temperature.
• Avoid any water or heavy dust on resistors surface, which may cause electrical leakage, damage, overheating or corrosion.

Operating load conditions:

• Do not use the resistor with any higher than specified rated dissipation, rated current or rated voltage.
• Violation of the technical product specifications such as exceeding the specified dissipation will void the warranty.
• When the resistors are operated in ambient temperature above the rated temperature, the power rating must be derated according to the derating curve.
• Verification and confirmation of performance characteristics of product, after on-board mounting, is advised.

Design of the PCB:

• The chip resistor shall be located to minimize any possible mechanical stress from deflection or board wrap.
• It is recommended to position the chip resistor in parallel to slits and perforations and as far away from slits, perforations, separation points, screw holes, frames and edges of the PCB to avoid mechanical stress.
• Determine the shape and size of the solder pads to have proper amount of solder on the terminations as the amount of solder at the terminations has a direct effect on resistance value and reliability of the resistor. The resistance value after soldering may change depending on the size of land pattern, the wiring pattern or solder amount, make sure the effect of the change of the resistance value before you use it.
• WE provide individual land patterns for each termination in the datasheet.
• Cracking of the solder fillet may occur with thermal cycling, because of mismatch of coefficients of thermal expansion between the board and the component. Pad size, amount of solder, and amount of heat radiating from the PCB must be designed carefully.
• The parasitic inductance of the chip resistor and the wiring may influence current detection under high frequency usage, make sure the effect before you use it.
• The PCB design (e.g. land pattern design and grounding planes) must be evaluated for each individual circuit to achieve the optimal soldering results.

Mounting:

• Adjust the bottom dead center of the mounting head not to press on the PCB surface to avoid any punctual pressure on component at pick & place.
• When a highly active halogenous (chlorine, bromine, etc.) flux is used, the residues of flux may negatively affect resistor performance and reliability.

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Mounting:

• Adjust the bottom dead center of the mounting head not to press on the PCB surface to avoid any punctual pressure on component at pick & place.
• When a highly active halogenous (chlorine, bromine, etc.) flux is used, the residues of flux may negatively affect resistor performance and reliability.
• The reflow soldering method must be used.
• Be careful when pick up the resistors with tweezers, there may be a case that the overcoat and / or the body can chip.
• Provide sufficient close up dimension, preventive maintenance and replacement of the centering jaw to avoid a crack when it is worn out.
• The resistor temperature could exceed 155°C depending on the wiring pattern, heat dissipation form surrounding, etc., which is not necessarily relevantly related to the rated dissipation. In advance, make sure that heat dissipation of resistor does not damage the PCB and any surrounding components.
• Provide support from the bottom side of the PCB by a support pin for minimizing the impact energy from the mounting head.
• In case of manual soldering, soldering tip shall not touch the product when install manually.

Adhesive:

• The adhesive should have sufficient coating and viscosity and should harden rapidly.
• The adhesive should be strong enough to hold parts on the board during the mounting and solder process and should have sufficient strength at high temperatures.
• The adhesive should have corrosion resistance, excellent insulation characteristics and no emission of toxic gasses nor any effect on the human body.
• Do not use too much adhesive to avoid pollution of the soldering pads.

Anti-pulse Characteristics:

• If transient overloads such as power pulse or voltage / current surges are applied to resistor products, performance and reliability may be degraded.
• Pay attention to discharges between terminations (arc-over) when high voltages are applied.

Soldering:

• The solder profile must comply with the Würth Elektronik technical soldering specification. All other profiles will void the warranty.
• All other soldering methods are at the customer’s own risk.
• Strong forces which may affect the coplanarity of the component’s electrical connection with the PCB (i.e. pins), can damage the part, resulting in avoid of the warranty.
• Customer needs to ensure that the applied solder paste, the paste thickness and solder conditions are applicable to guarantee a sufficient solder result according to the relevant criteria of IPC-A-610.
• Excessive amount of solder may lead to higher tensile force and chip cracking. Insufficient amount of solder may detach the resistor due to defective contacts.
• Do not use excessive nor insufficient flux.
• Provide enough washing when water-soluble flux is used.
• For reflow soldering, two times limitation is recommended.

Cleaning and Washing:

• Washing agents used during the production to clean the customer’s application, might damage or change the characteristics of the wire insulation body, the marking or the plating. Washing agent could have a negative effect on the long term functionality of the product.
• Avoid halogen in the flux or any contaminated flux as well as excessively high ultrasonic cleaning.

Coating, molding and potting of the PCB:

• If the product is potted in the customer’s application, the potting material might shrink or expand during and after hardening. Shrinking could lead to an incomplete seal, allowing contaminants into the body and termination. Expansion could damage the body or termination. We recommend a manual inspection after potting to avoid these effects.
• When coating and molding the PCB, verify the quality influence on the resistor.
• Verify the curing temperature and assure that there is no harmful decomposing or reaction-gas emission during curing.
• Do not exceed the maximal temperature rise of 20°C.

Handling:

• After soldering, please pay attention not to bend, twist or distort the PCB in handling and storage.
• Avoid excessive pressure during the functional check of the PCB.
• Avoid bending stress while breaking the PCB.
• After mounting, avoid piling up PCBs to avoid hitting of chip resistor to another board.

Disposal:

• Observe appropriate laws and regulations for handling and disposal of products or packaging materials.

These cautions and warnings comply with the state of the scientific and technical knowledge and are believed to be accurate and reliable. However, no responsibility is assumed for inaccuracies or incompleteness.
6. **Product Life Cycle**
Due to technical progress and economical evaluation we also reserve the right to discontinue production and delivery of products. As a standard reporting procedure of the Product Termination Notification (PTN) according to the JEDEC-Standard we will inform at an early stage about inevitable product discontinuance. According to this we cannot guarantee that all products within our product range will always be available. Therefore it needs to be verified with the field sales engineer or the internal sales person in charge about the current product availability expectancy before or when the product for application design-in disposal is considered. The approach named above does not apply in the case of individual agreements deviating from the foregoing for customer-specific products.

7. **Property Rights**
All the rights for contractual products produced by Würth Elektronik eiSos GmbH & Co. KG on the basis of ideas, development contracts as well as models or templates that are subject to copyright, patent or commercial protection supplied to the customer will remain with Würth Elektronik eiSos GmbH & Co. KG. Würth Elektronik eiSos GmbH & Co. KG does not warrant or represent that any license, either expressed or implied, is granted under any patent right, copyright, mask work right, or other intellectual property right relating to any combination, application, or process in which Würth Elektronik eiSos GmbH & Co. KG components or services are used.

8. **General Terms and Conditions**
Unless otherwise agreed in individual contracts, all orders are subject to the current version of the "General Terms and Conditions of Würth Elektronik eiSos Group", last version available at www.we-online.com.