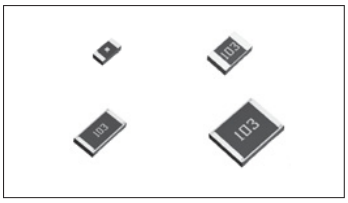
# High Voltage Resistance Chip Resistors

**KTR Series**

Datasheet

## ●Features

1) Twice the rated voltage of conventional products..
2) Perfect for use in high voltage circuit. (Camera Flash circuit, etc)
3) ROHM resistors have obtained ISO9001 / ISO / TS16949 certification.
4) Corresponds to AEC-Q200. (KTR18)



## ●Products List

| Part No. | Size (mm) | Size (inch) | Rated Power (70°C) (W) | Limiting Element Voltage (V) | Temperature Coefficient (ppm / °C) | Resistance Tolerance (%) | Resistance Range | Operating Temperature Range (°C) | Automotive Grade Available |
|---|---|---|---|---|---|---|---|---|---|
| **KTR03** | 1608 | 0603 | 0.1 | 350 | ±200 | J(±5%) | 1Ω to 10MΩ (E24 Series) | −55 to +155 | YES |
| | | | | | ±100 | F(±1%) | 1Ω to 10MΩ (E24,96 Series) | | |
| **KTR10** | 2012 | 0805 | 0.125 | 400 | ±200 | J(±5%) | 1Ω to 30MΩ (E24 Series) | | YES |
| | | | | | ±100 | F(±1%) | 1Ω to 10MΩ (E24,96 Series) | | |
| **KTR18** | 3216 | 1206 | 0.25 | 500 | ±200 | J(±5%) | 1Ω to 15MΩ (E24 Series) | | YES |
| | | | | | ±100 | F(±1%) | 1Ω to 10MΩ (E24,96 Series) | | |
| **KTR25** | 3225 | 1210 | 0.33 | 600 | ±200 | J(±5%) | 1Ω to 10MΩ (E24 Series) | | YES |
| | | | | | ±100 | F(±1%) | 1Ω to 10MΩ (E24,96 Series) | | |

∗E24 : Standard products, E96 : Custom products.

## ●Part Number Description

K T R | 1 0 | E Z P | J | 1 0 0

**Part No.**
**KTR**
(High Voltage Resistance Chip Resistors)

**Size** (mm [inch])
03 (1608 [0603])
10 (2012 [0805])
18 (3216 [1206])
25 (3225 [1210])

**Packaging Specifications Code**

| Part No. | Code | Packaging specifications | Quantity / Reel |
|---|---|---|---|
| **KTR03** | EZP | Paper tape (4mm Pitch) | 5,000 |
| **KTR10** | EZP | Paper tape (4mm Pitch) | 5,000 |
| **KTR18** | EZP | Paper tape (4mm Pitch) | 5,000 |
| **KTR25** | JZP | Embossed tape (4mm Pitch) | 4,000 |

**Resistance Tolerance**
F ( ±1% )
J ( ±5% )

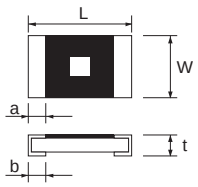
**Nominal Resistance**
Resistance code, 3 or 4 digits.
000 denotes jumper type.

| Resistance tolerance | | Resistance code |
|---|---|---|
| **F** | : | 4 digits |
| **J** | : | 3 digits |

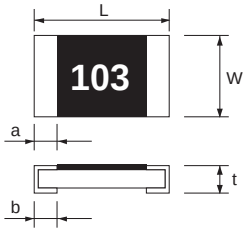
Ex.)
1Ω = 1R00 ( ±1% )
1R0 ( ±5% )
10Ω = 10R0 ( ±1% )
100 ( ±5% )
1MΩ = 1004 ( ±1% )
105 ( ±5% )

## ●Chip Resistor Dimensions and Markings

■ **KTR03**




■ **KTR10 / 18 / 25**



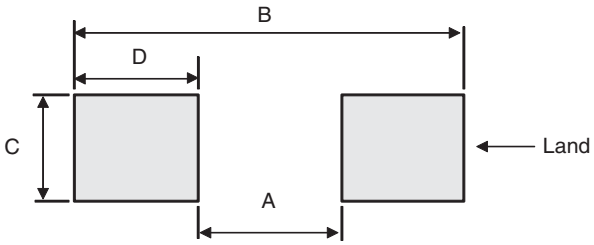

<Marking method>
There are three or four digits used for the calculation number according to IEC code and “R”is used for the decimal point.

(Unit : mm)

| Part No. | (mm) | (inch) | L | W | t | a | b | Marking existence |
|---|---|---|---|---|---|---|---|---|
| **KTR03** | 1608 | 0603 | 1.6±0.1 | 0.8±0.1 | 0.45±0.1 | 0.3±0.2 | 0.3±0.2 | No ∗ |
| **KTR10** | 2012 | 0805 | 2.0±0.1 | 1.25±0.1 | 0.55±0.1 | 0.3±0.2 | 0.4±0.2 | Yes |
| **KTR18** | 3216 | 1206 | 3.2±0.15 | 1.6±0.15 | 0.55±0.1 | 0.3±0.25 | 0.5±0.25 | Yes |
| **KTR25** | 3225 | 1210 | 3.2±0.15 | 2.5±0.15 | 0.55±0.1 | 0.3±0.25 | 0.5±0.25 | Yes |

∗Only with square mark

## ●Land pattern Example



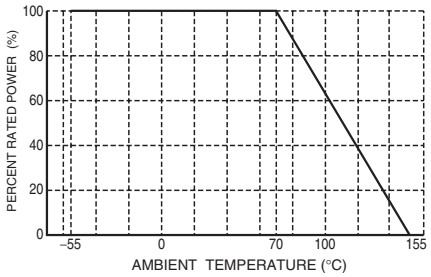

(Unit : mm)

| Dimensions / Part No. | A | B | C | D |
|---|---|---|---|---|
| **KTR03** | 1.0 | 2.0 | 0.8 | 0.5 |
| **KTR10** | 1.2 | 2.6 | 1.15 | 0.7 |
| **KTR18** | 2.2 | 4.0 | 1.5 | 0.9 |
| **KTR25** | 2.2 | 4.0 | 2.3 | 0.9 |

## ●Derating Curve

When the ambient temperature exceeds 70°C, power dissipation must be adjusted according to the derating curves below.

■ KTR03 / 10 / 18 / 25




## ●Characteristics

| Test Items | Guaranteed Value<br>Resistor Type | Test Conditions |
|---|---|---|
| Resistance | See P.1 | 20°C |
| Variation of resistance with temperature | See P.1 | Measurement : +20 / –55 / +20 / +125°C |
| Overload | ± (2.0%+0.1Ω) | Test voltage is the smaller one of ① or ②<br>① Rated voltage (current) ×2.5, 2s.<br>② Maximum overload voltage ※ |
| Solderability | A new uniform coating of minimum of 95% of the surface being immersed and no soldering damage. | Rosin·Ethanol : 25% (Weight)<br>Soldering condition : 245±5°C<br>Duration of immersion : 2.0±0.5s |
| Resistance to soldering heat | ± (1.0%+0.05Ω)<br>No remarkable abnormality on the appearance. | Soldering condition : 260±5°C<br>Duration of immersion : 10±1s |
| Rapid change of temperature | ± (1.0%+0.05Ω) | Test temp. : –55°C to +125°C 5cycle |
| Damp heat, steady state | ± (3.0%+0.1Ω) | 40°C, 93%RH (Relative Humidity)<br>Test time : 1,000h to 1,048h |
| Endurance at 70°C | ± (3.0%+0.1Ω) | 70°C<br>Rated voltage (current)<br>1.5h : ON – 0.5h : OFF<br>Test time : 1,000h to 1,048h |
| Endurance | ± (3.0%+0.1Ω) | 155°C<br>Test time : 1,000h to 1,048h |
| Resistance to solvent | ± (1.0%+0.05Ω) | 23±5°C, Immersion cleaning, 5±0.5min<br>Solvent : 2–propanol |
| Bend strength of the end face plating | ± (1.0%+0.05Ω)<br>Without mechanical damage such as breaks. | – |

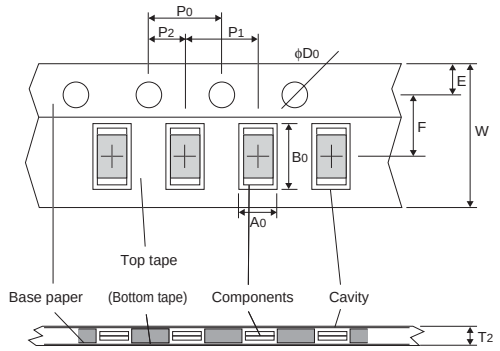
※Maximum overload voltage (Test voltage)

| KTR03 | KTR10 | KTR18 | KTR25 |
|---|---|---|---|
| 500V | 800V | 1000V | 1200V |

Compliance Standard(s) : IEC60115–8
JISC 5201–8

## ●Tape Dimensions

■ Paper Tape

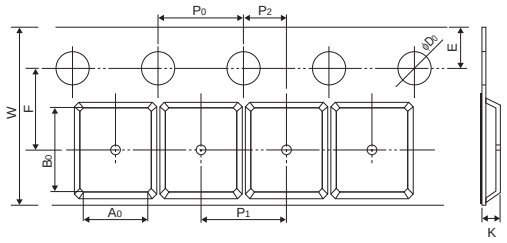



(Unit : mm)

| Part No. | W | F | E | A0 | B0 |
|---|---|---|---|---|---|
| **KTR03** | 8.0±0.3 | 3.5±0.05 | 1.75±0.1 | 1.1±0.1 | 1.9±0.1 |
| **KTR10** | 8.0±0.3 | 3.5±0.05 | 1.75±0.1 | $1.65^{+0.2}_{-0.1}$ | $2.4^{+0.2}_{-0.1}$ |
| **KTR18** | 8.0±0.3 | 3.5±0.05 | 1.75±0.1 | $1.95^{+0.1}_{-0.05}$ | $3.5^{+0.15}_{-0.05}$ |

| Part No. | D0 | P0 | P1 | P2 | T2 |
|---|---|---|---|---|---|
| **KTR03** | $\phi1.5^{+0.1}_{0}$ | 4.0±0.1 | 4.0±0.1 | 2.0±0.05 | Max 1.1 |
| **KTR10** | $\phi1.5^{+0.1}_{0}$ | 4.0±0.1 | 4.0±0.1 | 2.0±0.05 | Max 1.1 |
| **KTR18** | $\phi1.5^{+0.1}_{0}$ | 4.0±0.1 | 4.0±0.1 | 2.0±0.05 | Max 1.1 |

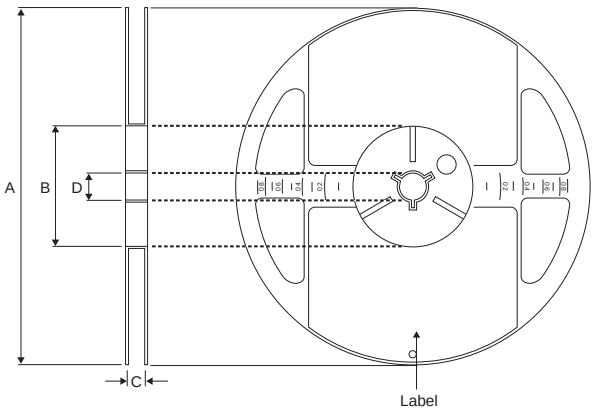
■ Embossed Tape



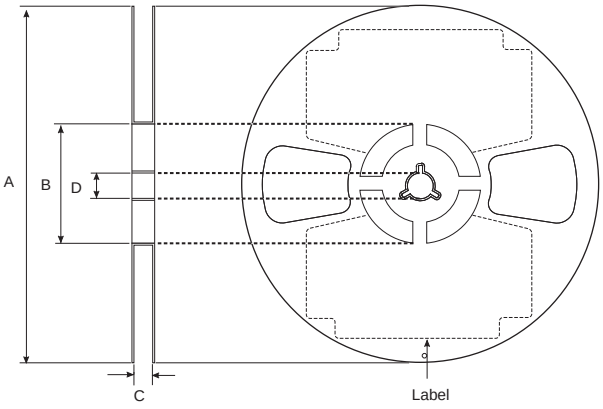

(Unit : mm)

| Part No. | W | F | E | A0 | B0 |
|---|---|---|---|---|---|
| **KTR25** | 8.0±0.3 | 3.5±0.05 | 1.75±0.1 | 3.0±0.1 | 3.5±0.1 |
| | D0 | P0 | P1 | P2 | K |
| | $\phi1.5^{+0.1}_{0}$ | 4.0±0.1 | 4.0±0.1 | 2.0±0.05 | Max 1.1 |

## ●Reel Dimensions




ACCORDING TO EIAJ ET-7200B




ACCORDING TO EIAJ ET-7200B (RRV)

(Unit : mm)

| Part No. | A | B | C | D |
|---|---|---|---|---|
| **KTR03** | $\phi180^{0}_{-1.5}$ | $\phi60^{+1.0}_{0}$ | $9^{+1.0}_{0}$ | φ13±0.2 |
| **KTR10** | | | | |
| **KTR18** | | | | |
| **KTR25** | | | | |

## Notes

1) The information contained herein is subject to change without notice.

2) Before you use our Products, please contact our sales representative and verify the latest specifications :

3) Although ROHM is continuously working to improve product reliability and quality, semiconductors can break down and malfunction due to various factors.
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4) Examples of application circuits, circuit constants and any other information contained herein are provided only to illustrate the standard usage and operations of the Products. The peripheral conditions must be taken into account when designing circuits for mass production.

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7) The Products specified in this document are not designed to be radiation tolerant.

8) For use of our Products in applications requiring a high degree of reliability (as exemplified below), please contact and consult with a ROHM representative : transportation equipment (i.e. cars, ships, trains), primary communication equipment, traffic lights, fire/crime prevention, safety equipment, medical systems, servers, solar cells, and power transmission systems.

9) Do not use our Products in applications requiring extremely high reliability, such as aerospace equipment, nuclear power control systems, and submarine repeaters.

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## FAQ



### 1. Should the power dissipation value be considered a ‘peak’ or ‘effective’ value?

Consider this the ‘effective’ value when used with commercial frequencies (50Hz/60Hz in Japan) and ‘peak’ value otherwise.

### 2. Where are the resistors manufactured?

We have 3 manufacturing facilities in Asia: Philippines (Manila), Thailand (Bangkok) and China.

### 3. What is ROHM’s definition of the ambient temperature in the derating curves?

ROHM defines the ambient temperature as the temperature surrounding a an isolated (unconnected) resistor based on a number of factors. For reference, we list the following excerpts from JIS (Japanese Industrial Standards) defining ambient temperature (similar to IEC 68-3-1 and 68-3-1A). [Source: JIS Handbook ‘Electronic Test Methods: JIS C 0010 Environmental Test, Part 1 – General and Guidance (IEC60068-1:88)].
4.6 Ambient temperature : Temperature of the air defined for the two following cases. Note : In applying these definitions, guidance should be sought from JIS C 0000/IEC 68-3-1 and its supplement 68-3-1A.
4.6.1 Non-heat-dissipating specimens : Temperature of the air surrounding the specimen.
4.6.2 Heat-dissipating specimens : Temperature of the air in free air conditions at such is neglibible.
Note : In practice, the ambient temperature is taken as the average of temperature measured at a number of points in a horizontal plane situated between 0mm and 50mm below the specimen at half the distance between the specimen and the wall of the chamber or at 1m distance from the specimen, whichever is less. Suitable precautions should be taken to avoide heat radiation affecting these measurements.

: unquote

JIS C 0095 Background Information, Section One – Cold and Dry Heat Tests
1.4 Ambient temperature Users of components and equipments, particularly equipments, require to know the maximum and minimum values of ambient temperature between which the item will operate and these should be specific for the purposeof testing. Certain difficulties arise here due to the fact that heat transfer is connected with temperature gradients and that therefore the temperature of the medium surrouding device is necessarily varying in space. Consequently, the "ambient temperature" of the surrouding atmosphere shall be specially defined.

: unquote

### 4. How is the failure rate of chip resistors calculated?

According to MIL standards established by the Pentagon in the US, chip resistors are in the RM class, meaning the failure rate is calculated by the following formula:

$\lambda_P = \lambda_b \times \lambda_T \times \lambda_P \times \lambda_S \times \lambda_Q \times \lambda_E$

The unit being the ‘number of failures every $10^6$ hours’ (114 years). The parameters are denoted as follows:
$\lambda_b$ Basic failure rate
$\lambda_T$ Temperature factor
$\lambda_P$ Electric Power factor
$\lambda_S$ Electric Power stress factor
$\lambda_Q$ Quality factor
$\lambda_E$ Environmental factor

The following values should be applied:
$\lambda_b =$ 0.0037
$\lambda_Q =$ 3.0
$\lambda_E =$ 1.0

Each value for $\lambda_t$, $\lambda_p$, and $\lambda_s$ can be obtained from the MIL standard table. Effectively $\lambda_p = \lambda_b$, so the basic failure rate can be calculated based on each package type. MTBF (Mean Time Between Failures) can be determined by calculating the reciprocal of the failure rate: $1 / \lambda$

**5. What is the structure of the chip resistor electrodes and how are they plated?**

Rectangular chip resistors possess two electrodes consisting of three layers over a ceramic substrate (alumina). The bottom layer is a silver-based thick film material, the middle is composed of nickel, and the top layer is tin. Please note that all ROHM chip resistors are lead-free.

**6. What are the results of whisker studies?**

ROHM performs 3 types of tests:
1. Temperature cycling (3000 cycles, −30ºC / +80ºC)
2. High temperature / High humidity (60ºC, 80%RH, 2000hrs)
3. Storage at room temperature for 3000hrs

The surface is then verified using a scanning electron microscope. Whiskers must be less than 0.1mm in length.

**7. What is the resistance value of 'jumper' chip resistors?**

Ideally jumper resistors have no resistance. However, every conductive element possesses a certain level of resistance. ROHM's jumper resistors normally have a resistance less than 50mΩ

**8. What are the recommended soldering conditions for chip resistors?**

Please refer to the 'Soldering Conditions' section on our website for details. Generally, Pb-free solder paste (Sn-3Ag-0.5Cu) should be used. Flow and manual soldering is not recommended small part of our line up. However, if such methods will be used, ROHM recommends thorough testing under actual conditions before mass production.

**9. How do you calculate the pulse current limit for chip resistors?**

The pulse limit is determined from the rated current or the maximum voltage per element, regardless of pulse time. In the case of a single pulse (one time voltage pulse), reference data is available. For continuous pulse operation data can be provided upon request.

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