# APPROVAL SHEET

## MR02X(W)

## ±5%, ±1%

Thick Film General purpose chip resistors

Automotive compliant AEC Q-200 qualified

Anti-Sulfuration

Size 0201

RoHS 2 Compliant with exemption 7C-I

Halogen free

## FEATURE

1. Automotive grade AEC Q200 qualified with 100% CCD visual inspection
2. High reliability and stability 1%
3. Reduced size of final equipment
4. Suitable for high density print circuit board assembly
5. Higher component and equipment reliability
6. RoHS 2 compliant with exemption 7C-I and Halogen free products

## APPLICATION

- Mobile phone
- PDA
- Camcorders
- Palmtop computers
- Hybrid module

## DESCRIPTION

The resistors are constructed in a high grade ceramic body (aluminum oxide). Internal metal electrodes are added at each end and connected by a resistive paste that is applied to the top surface of the substrate. The composition of the paste is adjusted to give the approximate resistance required and the value is trimmed to nominated value within tolerance which controlled by laser trimming of this resistive layer.

The resistive layer is covered with a protective coat. Finally, the two external end terminations are added. For ease of soldering the outer layer of these end terminations is a pure Tin.

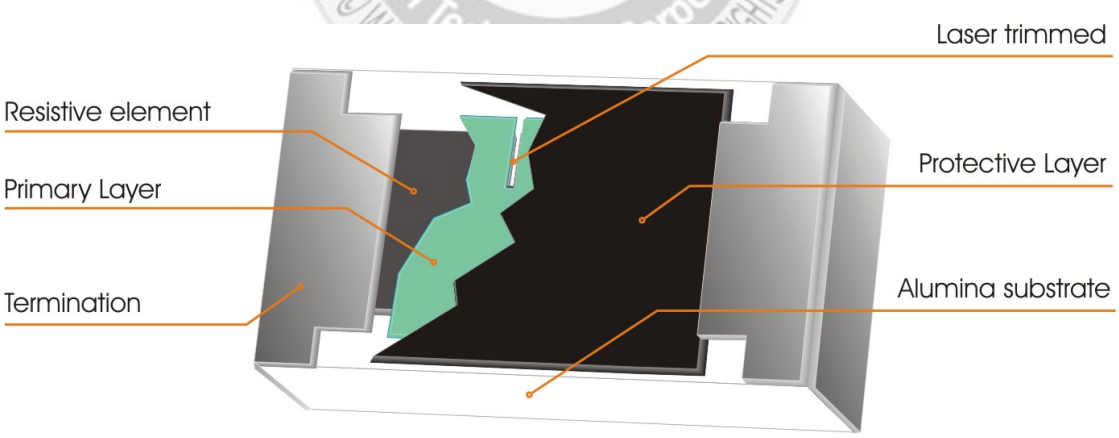



Fig 1. Construction of Chip-R

## QUICK REFERENCE DATA

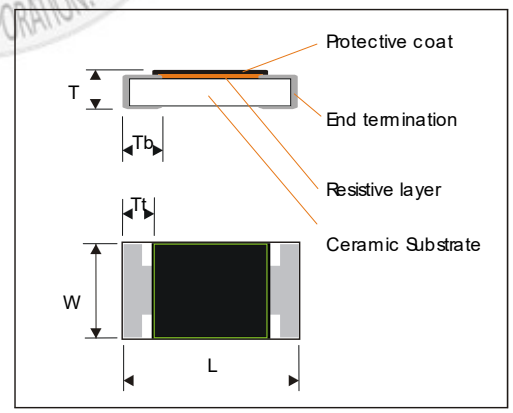
| Item | General Specification | |
|---|---|---|
| Series No. | MR02X(W) | |
| Size code | 0201(0603) | |
| Resistance Range | 1Ω~10MΩ ( ±5% tolerance ), Jumper<br>1Ω~ 10MΩ ( ±1% tolerance ) | |
| Resistance Tolerance | ±1%<br>E96+E24 | ±5%<br>E24 |
| TCR (ppm/°C) | 1.02MΩ - 10MΩ, ≤±200ppm<br>51Ω - 1MΩ, ≤±100ppm<br>10Ω - 49.9Ω, ≤±200ppm<br>1 - 9.76Ω, +600 ~ -200ppm | |
| Max. dissipation @ $T_{amb}$=70°C | 1/20 W | |
| Max. Operation Voltage | 25V | |
| Max. Overload Voltage | 50V | |
| Operation temperature | -55 ~ +155°C | |

Note :

1. This is the maximum voltage that may be continuously supplied to the resistor element, see “IEC publication 60115-8”
2. Max. Operation Voltage : So called RCWV (Rated Continuous Working Voltage) is determined by
   $RCWV = \sqrt{Rated\,Power \times Resistance\,Value}$ or Max. RCWV listed above, whichever is lower.
3. Jumper max. 50mohm, rated current 1A, peak current 2.5A

## DIMENSION(unit : mm)

| | MR02X(W) |
|---|---|
| **L** | 0.60 ± 0.03 |
| **W** | 0.30 ± 0.03 |
| **T** | 0.23 ± 0.03 |
| **Tb** | 0.15 ± 0.05 |
| **Tt** | 0.10 ± 0.05 |



## CATALOGUE NUMBERS

The resistors have a catalogue number starting with :

| MR02 | X | 472_ | J | A | L |
|---|---|---|---|---|---|
| **Size code**<br>MR02 : 0201 | **Type code**<br>X : Normal<br>W: 1% For <10Ω / >1MΩ | **Resistance code**<br>5%, E24: 2 significant digits followed by no. of zeros and a blank<br>100Ω = 101_<br>10KΩ = 103_<br>("_" means a blank)<br>1%, E24+E96: 3 significant digits followed by no. of zeros<br>100Ω =1000<br>37.4KΩ =3742 | **Tolerance**<br>J : ±5%<br>F : ±1%<br>P : Jumper | **Packaging code**<br>A : 7" Reeled (15Kpcs/Reel)<br>H : 13" Reeled (50Kpcs/Reel)<br>G : 13" Reeled (70Kpcs/Reel) | **Termination code**<br>L = Sn base (lead free) |

Standard taping quantity 15,000pcs per 7" reel! 70,000pcs per 13" reel!

## MARKING

MR02X(W) has no marking.

## FUNCTIONAL DESCRIPTION

### Product characterization

Standard values of nominal resistance are taken from the E24/E96 series for resistors with a tolerance of ±5% & ±1%. The values of the E24/E96 series are in accordance with "IEC publication 60063"

### Derating

The power that the resistor can dissipate depends on the operating temperature; see Fig.2

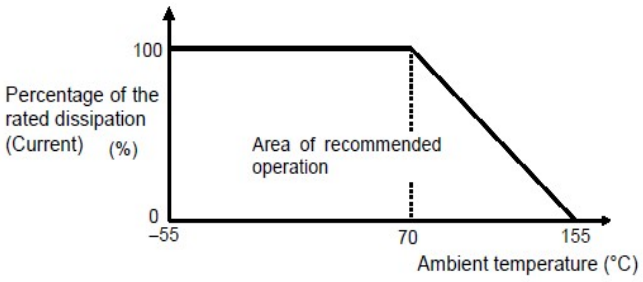



Figure 2. Maximum dissipation in percentage of rated power

As a function of the ambient temperature

## MOUNTING

Due to their rectangular shapes and small tolerances, Surface Mountable Resistors are suitable for handling by automatic placement systems.

Chip placement can be on ceramic substrates and printed-circuit boards (PCBs).

Electrical connection to the circuit is by individual soldering condition.

The end terminations guarantee a reliable contact.

## Storage and Handling Conditions:

1. Products are recommended to be used up within two years since operation date as ensured shelf life. Check solderability in case shelf life extension is needed.
2. To store products with following condition:

   Temperature :5 to 40°C

   Humidity :20 to 70% relative humidity
3. Caution:

   a. Don't store products in a corrosive environment such as sulfide, chloride gas, or acid.

   It may cause oxdization of electrode, which easily be resulted in poor soldering.

   b. To store products on the shelf and avoid exposure to moisture.

c. Don't expose products to excessive shock, vibration, direct sunlight and so on.

## SOLDERING CONDITION

The robust construction of chip resistors allows them to be completely immersed in a solder bath of 260°C for 10 seconds. Therefore, it is possible to mount Surface Mount Resistors on one side of a PCB and other discrete components on the reverse (mixed PCBs).

Surface Mount Resistors are tested for solderability at 235°C during 2 seconds. The test condition for no leaching is 260°C for 30 seconds. Typical examples of soldering processes that provide reliable joints without any damage are given in Fig 3.

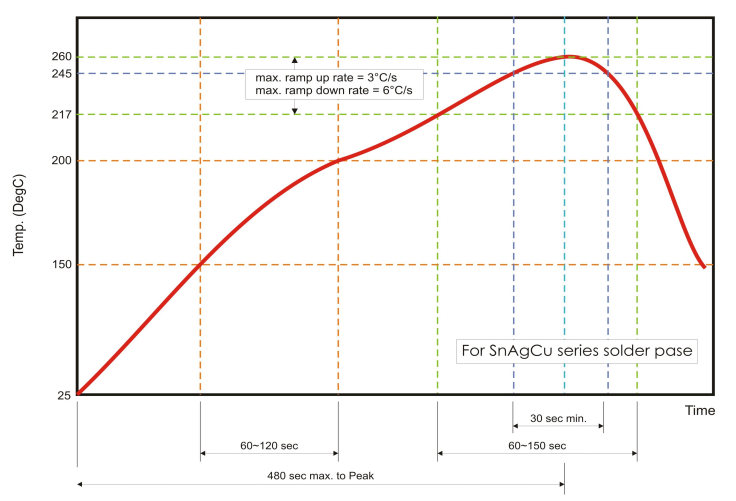
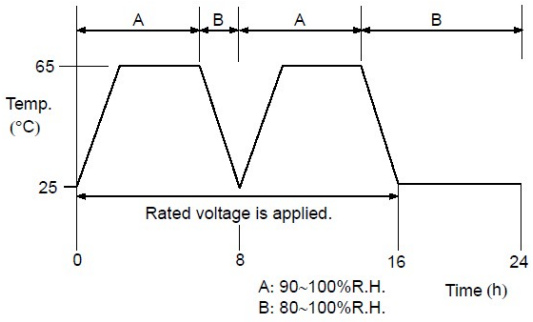



Fig 3. Infrared soldering profile for Chip Resistors

SMT process with SnAgCu series solder paste

## TEST AND REQUIREMENTS

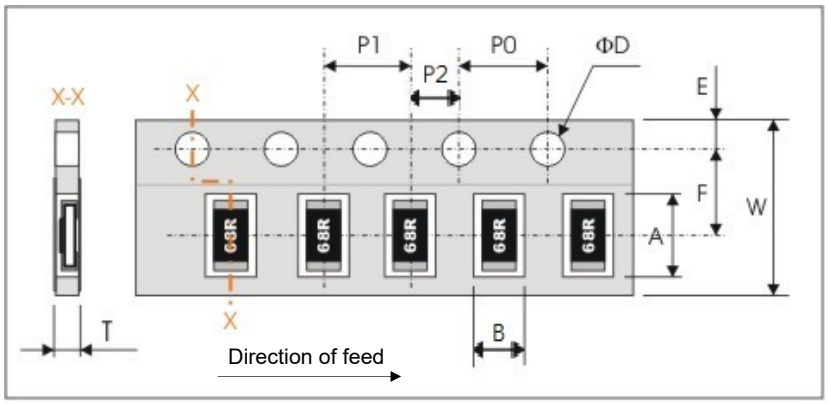
The test standard condition for tests shall be in accordance with Sub-clause 4.2, JIS C 5201-1: 2011
The performance shall be satisfied in follows.

<table>
<tr><th>No</th><th>Test items</th><th>Condition of test</th><th>Performance requirements</th></tr>
<tr><td>1</td><td>Resistance</td><td>Sub-clause 4.5</td><td>As in 4.5.2<br>The resistance value shall correspond with the rated resistance taking into account the specified tolerance<br>Chip jumper: 50mΩ max.</td></tr>
<tr><td>2</td><td>Temperature characteristic of resistance</td><td>4.8<br>Natural resistance change per change in degree centigrade<br>$\frac{R_2 - R_1}{R_1(t_2 - t_1)} \times 10^6$<br>$t_1$: 20°C+5°C-1°C, $t_2$: 155°C+5°C-1°C<br>$R_1$ : Resistance at reference temperature<br>$R_2$ : Resistance at test temperature</td><td>Within the specified tolerance<br>Refer to “QUICK REFERENCE DATA”</td></tr>
<tr><td>3</td><td>Resistance to soldering heat</td><td>MIL-STD-202 Method 210<br>Test by a piece<br>Temperature of solder bath: 270 ±5°C<br>Immersion time: 10 ±1s<br>After immersion into solder, leaving at the room temp. for 1h or more and then measure the resistance</td><td>Resistor: ΔR/R: Within ±(0.5%+0.05Ω)<br>Chip jumper: 50mΩ max.<br>No evidence of appearance damage</td></tr>
<tr><td>4</td><td>Solderability</td><td>J-STD-002<br>a)Pre-condition: 155°C, 4h<br>Immersion time: 5s<br>b)Pre-condition: Steam aging, 1h<br>Temp. of solder bath: 260°C<br>Immersion time: 7s</td><td>The surface of terminal immersed shall be min. of 95% covered with a new coating of solder</td></tr>
<tr><td>5</td><td>Temperature cycling</td><td>JESD22 Method JA-104<br>Test cycle: 1000 cycles for duty cycle as specified below:
<table>
<tr><th>Step</th><th>Temperature(°C)</th><th>Time(min)</th></tr>
<tr><td>1</td><td>-55</td><td>5~10</td></tr>
<tr><td>2</td><td>+125</td><td>5~10</td></tr>
</table></td><td>Resistor: ΔR/R: Within ±(2%+0.05Ω)<br>Chip jumper: 50mΩ max.<br>No evidence of appearance damage</td></tr>
<tr><td>6</td><td>Moisture Resistance</td><td>MIL-STD-202 Method 106<br>Test condition: 10 cycles for duty as shown as below:<br> 
</td><td>Resistor: ΔR/R: Within ±(2%+0.1Ω)<br>Chip jumper: 50mΩ max.<br>No evidence of appearance damage</td></tr>
</table>

| No | Test items | Condition of test | Performance requirements |
|---|---|---|---|
| 7 | Operational life | MIL-STD-202 Method 108<br>Test temp.: 125 ±2°C<br>Test power: 35% of rated power shall be applied for continuously<br>Test period: 1000 +48/-0 h | Resistor: ΔR/R: Within ±(3%+0.1Ω)<br>Chip jumper: 50mΩ max.<br>No evidence of appearance damage |
| 8 | Bias humidity | MIL-STD-202 Method 103<br>Test condition: 85°C & 85% R.H.<br>Test power: 10% of rated power shall be applied for continuously<br>Test period: 1000 +48/-0 h | Resistor: ΔR/R: Within ±(3%+0.1Ω)<br>Chip jumper: 50mΩ max.<br>No evidence of appearance damage |
| 9 | High Temperature exposure | MIL-STD-202 Method 108<br>Test condition: 155 ±2°C<br>Test period: 1000 +48/-0 h | Resistor: ΔR/R: Within ±(3%+0.1Ω)<br>Chip jumper: 50mΩ max.<br>No evidence of appearance damage |
| 10 | Substrate bending test | AEC-Q200-005<br>Bent value: 2mm(Among the fulcrums: 90mm)<br>Duration: 10s | Resistor: ΔR/R: Within ±(1%+0.05Ω)<br>Chip jumper: 50mΩ max.<br>No evidence of appearance damage |
| 11 | Adhesion | AEC-Q200-006<br>Force: 3N<br>Duration: 60s±1s | No remarkable damage or removal of the terminations |
| 12 | Mechanical Shock | MIL-STD-202 Method 213<br>Peak acceleration: 1500g Peak<br>Half sine pulse<br>Velocity 15.4ft/sec<br>The shock specified above shall be applied in each direction of 3 mutually perpendicular axis (3 total of 18 shocks) | The resistance value shall correspond with the rated resistance taking into account the specified tolerance<br>No evidence of appearance damage |
| 13 | Vibration | MIL-STD-202 Method 204<br>Peak acceleration: 5g's<br>Each direction of 3 mutually perpendicular axis<br>Test cycle: 12 Cycles | Resistor: ΔR/R: Within ±(1%+0.05Ω)<br>Chip jumper: 50mΩ max.<br>No evidence of appearance damage |
| 14 | Thermal shock | MIL-STD-202 Method 107<br>Test cycle: 300 cycles for duty cycle as specified below: | Resistor: ΔR/R: Within ±(2%+0.1Ω)<br>Chip jumper: 50mΩ max.<br>No evidence of appearance damage |
| | | Step \| Temperature(°C) \| Time(min)<br>1 \| -55 \| 15<br>2 \| +125 \| 15 | |
| | | Max transfer time: 20s | |
| 15 | ESD test | AEC-Q200-200<br>Test condition: 300V | Resistor: ΔR/R: Within ±(1%+0.05Ω)<br>Chip jumper: 50mΩ max.<br>No evidence of appearance damage |
| 16 | Hydrogen sulphide test | H2S concentration: 3ppm<br>Test temp.: 40°C<br>Relative humidity: 90%<br>Test period : 1000h | Resistor: ΔR/R: Within ±(1%+0.05Ω)<br>Chip jumper: 50mΩ max.<br>No evidence of appearance damage |

## PACKAGING

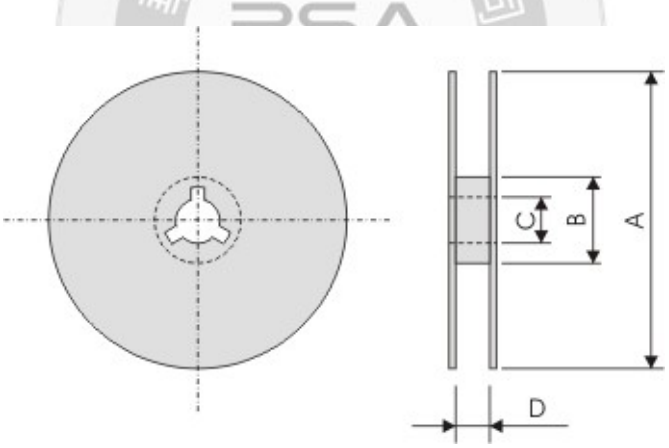
**Paper Tape specifications** (unit :mm)




| Series No. | A | B | W | F | E |
|---|---|---|---|---|---|
| MR02X | 0.67±0.05 | 0.37±0.05 | 8.00±0.20 | 3.50±0.05 | 1.75±0.10 |

| Series No. | P1 | P0 | P2 | ΦD | T |
|---|---|---|---|---|---|
| MR02X | 2.00±0.05 | 4.00±0.05 | 2.00±0.05 | $\Phi 1.50^{+0.1}_{-0.0}$ | 0.45±0.05 |

**Reel dimensions**




| Symbol | A | B | C | D |
|---|---|---|---|---|
| 7” Reel | Φ178.0±0.2 | Φ60.0±1.0 | 13.0±0.2 | 9.0±0.5 |
| 13” Reel | Φ330.0±2.0 | Φ100.0±1.0 | 13.0±0.2 | 9.0±0.5 |

**Taping quantity and Tape material**

- Chip resistors 15,000 pcs 7” Reel, Paper tape.
- Chip resistors 70,000 pcs 13” Reel, Paper tape.