

DATA SHEET

Product Name Metal Glaze Film Fixed Resistors

Part Name MGR Series

File No. DIP-SP-006

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1. Scope

- 1.1 This specification for approve relates Metal Glaze Film Fixed Resistors manufactured by UNI-ROYAL.
- 1.2 Provide high stable performance against environment conditions & overload voltage
- 1.3 Can withstand High Surge Voltage
- 1.4 Wide resistance range & low TCR
- 1.5 VDE items available(File NO:40011056)
- 1.6 UL items available (File NO:E244546)
- 1.7 Compliant with RoHS directive.
- 1.8 Halogen free requirement.

2. Part No. System

The standard Part No. includes 14 digits with the following explanation:

2.1 Coated type, the 1st to 3rd digits are to indicate the product type and 4th digit is the special feature.

Example: MGR0= Metal Glaze film fixed Resistors;

2.2 5th~6th digits:

2.2.1 This is to indicate the wattage or power rating. To dieting the size and the numbers,

The following codes are used; and please refer to the following chart for detail:

W=Normal Size; S=Small Size; U= Ultra Small Size; “1”~“G”to denotes“1”~“16”as Hexadecimal:

1/16W~1/2W (< 1W)

| | | |
|-------------|-----|-----|
| Wattage | 1/2 | 1/4 |
| Normal Size | W2 | W4 |
| Small Size | S2 | S4 |

1W~16W ($\geq 1W$)

| | | | |
|------------------|----|----|----|
| Wattage | 1 | 2 | 3 |
| Normal Size | 1W | 2W | 3W |
| Small Size | 1S | 2S | 3S |
| Ultra Small Size | 1U | 2U | 3U |

2.2.2 For power rating less than 1 watt, the 5th digit will be the letters W, S or U to represent the size required & the 6th digit will be a number or a letter code.

Example: W2=1/2W; S2=1/2W-S.

2.2.3 For power of 1 watt to 16 watt, the 5th digit will be a number or a letter code and the 6th digit will be the letters of W, S or U.

Example: 1W=1W; 3U=3W-SS

2.3 The 7th digit is to denote the Resistance Tolerance. The following letter code is to be used for indicating the standard Resistance Tolerance.

F=±1% G=±2% J=±5%

2.4 The 8th to 11th digits is to denote the Resistance Value.

2.4.1 For the standard resistance values of E-24 series, the 8th digit is “0”,the 9th & 10th digits are to denote the significant figures of the resistance and the 11th digit is the number of zeros following;

For the standard resistance values of E-96 series, the 8th digit to the 10th digits is to denote the significant figures of the resistance and the 11th digit is the zeros following.

2.4.2 The following number s and the letter codes are to be used to indicate the number of zeros in the 11th digit:

0=10⁰ 1=10¹ 2=10² 3=10³ 4=10⁴ 5=10⁵ 6=10⁶ J=10⁻¹ K=10⁻² L=10⁻³ M=10⁻⁴

2.4.3 The 12th, 13th & 14th digits.The 12th digit is to denote the Packaging Type with the following codes:

A=Tape/Box (Ammo pack) B=Bulk/Box
T=Tape/Reel P=Tape/Box of PT-26 products

2.4.4 The 13th digit is normally to indicate the Packing Quantity of Tape/Box & Tape/Reel packaging types. The following letter code is to be used for some packing quantities:

A=500pcs B=2500pcs 1=1,000pcs 2=2,000pcs 5=5,000pcs

2.4.5 For the FORMED type products, the 13th & 14th digits are used to denote the forming types of the product with the following letter codes:

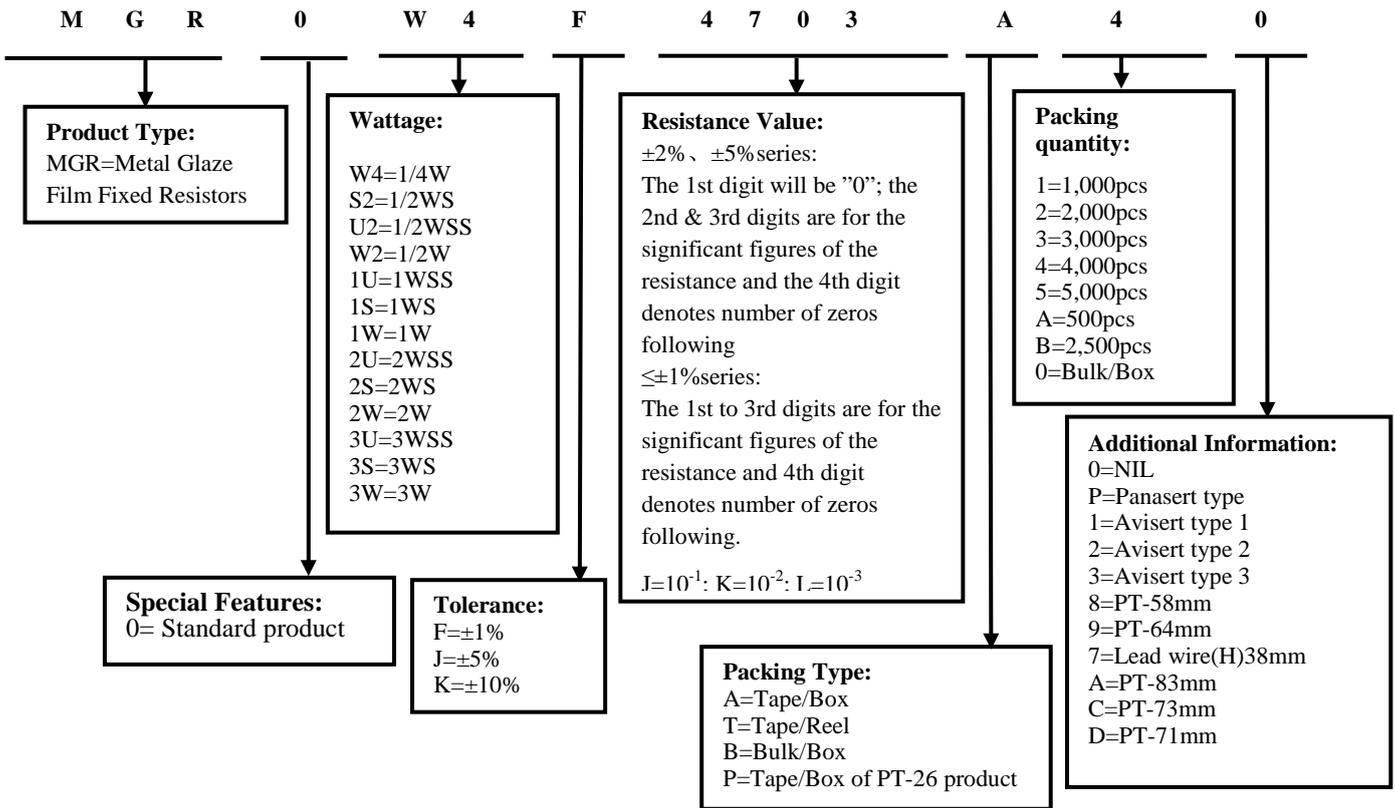
MF=M-type with flattened lead wire F0= F-type
MK= M-type with kinked lead wire F1= F1-type
ML= M-type with normal lead wire F2= F2-type
MC= M-type with bending lead wire F3= F3-type

2.4.6 For some items, the 14th digit alone can use to denote special features of additional information with the following codes:

0=NIL P=Panasert type 1=Avisert type 1 2=Avisert type 2
3=Avisert type 3 8=PT-58mm 9=PT-64mm 7=Lead wire(H)38mm
A=PT-83mm C=PT-73mm D=PT-71mm

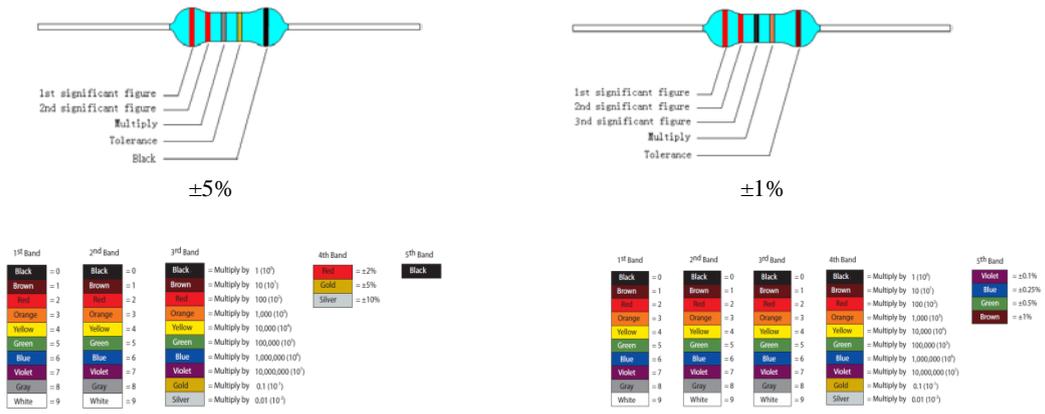
3. Ordering Procedure

(Example: MGR 1/4W ±1% 470K Ω T/B-4000)



4. Marking

Resistors shall be marked with color coding
Colors shall be in accordance with JIS C 0802



4.1 Label:

Label shall be marked with following items:

- (1) Type and style
- (2) Nominal resistance
- (3) Resistance tolerance
- (4) Quantity
- (5) Lot number
- (6) PPM

Example:

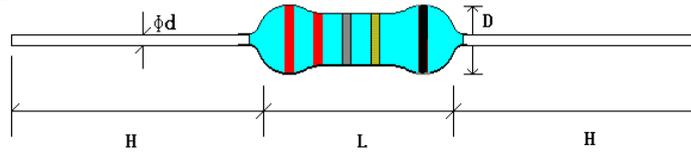
METAL GLAZE FILM FIXED RESISTORS

WATT: 1/2W VAL: 750KΩ

Q'TY: 1,000 TOL: 5%

LOT: 4021548 PPM:

5. Dimension & Resistance Range



5.1 Normal size

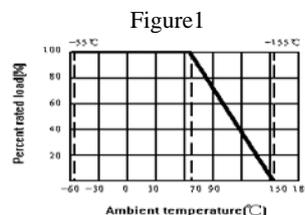
| Type | Dimension(mm) | | | | Max Working Voltage | Max Overload Voltage | Dielectric Withstanding Voltage | Tolerance | Resistance Range |
|----------|---------------|----------|------------|---------|---------------------|----------------------|---------------------------------|-----------|------------------|
| | D | L | d ±0.05 | H ±3 | | | | | |
| MGR 1/4W | 2.2±0.5 | 6.5±1.0 | 0.60 | 28 | 1600V | 2000V | 700V | ±1% | 1KΩ≤R≤10MΩ |
| | | | | | | | | ±2% | 10MΩ~100MΩ |
| | | | | | | | | ±5%, ±10% | 1KΩ~510MΩ |
| MGR 1/2W | 3.5±0.6 | 9.5±1.0 | 0.60 | 28 | 3500V | 4000V | 700V | ±1% | 1KΩ≤R≤10MΩ |
| | | | | | | | | ±2% | 10MΩ~100MΩ |
| | | | | | | | | ±5%, ±10% | 1KΩ~510MΩ |
| MGR 1W | 4.0±0.6 | 11.5±1.0 | 0.75 | 25 | 3500V | 4000V | 1000V | ±1% | 1KΩ≤R≤10MΩ |
| | | | | | | | | ±2% | 10MΩ~100MΩ |
| | | | | | | | | ±5%, ±10% | 1KΩ~1GΩ |
| MGR 2W | 5.0±0.6 | 15.5±1.0 | 0.80 | 28 | 3500V | 4000V | 1000V | ±1% | 1KΩ≤R≤10MΩ |
| | | | | | | | | ±2% | 10MΩ~100MΩ |
| | | | | | | | | ±5%, ±10% | 1KΩ~1GΩ |
| MGR 3W | 6.0±0.6 | 17.5±1.0 | 0.80 | 28 | 3500V | 4000V | 1000V | ±1% | 100KΩ~1MΩ |
| | | | | | | | | ±5%, ±10% | 1KΩ~100MΩ |

5.2 Small Size & Extra Small Size

| Type | Dimension(mm) | | | | Max Working Voltage | Max Overload Voltage | Dielectric Withstanding Voltage | Tolerance | Resistance Range |
|-----------|---------------|----------|------------|---------|---------------------|----------------------|---------------------------------|-----------|------------------|
| | D | L | d ±0.05 | H ±3 | | | | | |
| MGR 1/2WS | 2.2±0.5 | 6.5±1.0 | 0.60 | 28 | 500V | 700V | 500V | ±1% | 100KΩ~1MΩ |
| | | | | | | | | ±5%, ±10% | 1KΩ~33MΩ |
| MGR 1WS | 3.5±0.6 | 9.5±1.0 | 0.60 | 28 | 700V | 1000V | 700V | ±1% | 100KΩ~1MΩ |
| | | | | | | | | ±5%, ±10% | 1KΩ~33MΩ |
| MGR 2WS | 4.5±0.6 | 11.5±1.0 | 0.75 | 25 | 1000V | 1400V | 700V | ±1% | 100KΩ~1MΩ |
| | | | | | | | | ±5%, ±10% | 1KΩ~33MΩ |
| MGR 3WSS | 4.5±0.6 | 11.5±1.0 | 0.75 | 25 | 1000V | 1400V | 700V | ±1% | 100KΩ~1MΩ |
| | | | | | | | | ±5%, ±10% | 1KΩ~33MΩ |
| MGR 3WS | 5.0±0.6 | 15.5±1.0 | 0.80 | 28 | 1000V | 1400V | 700V | ±1% | 100KΩ~1MΩ |
| | | | | | | | | ±5%, ±10% | 1KΩ~33MΩ |

6. Derating Curve

Resistors shall have a power rating based on continuous load operation at an ambient temperature from -55°C to 70°C. For temperature in excess of 70°C, the load shall be derate as shown in figure 1



6.1 Voltage rating:

Resistors shall have a rated direct-current (DC) continuous working voltage or an approximate sine-wave root-mean-square (RMS) alternating-current (AC) continuous working voltage at commercial-line frequency and waveform corresponding to the power rating, as determined from the following formula:

$$RCWV = \sqrt{P \times R}$$

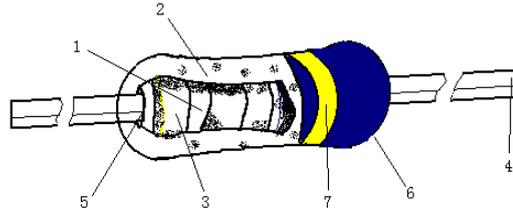
Where: RCWV = Rated DC or RMS AC continuous working voltage at commercial-line frequency and waveform (VOLT.)

P = power rating (WATT.) R = nominal resistance (OHM)

In no case shall the rated DC or RMS AC continuous working voltage be greater than the applicable maximum value.

The overload voltage is 2.5 times RCWV or Max. Overload voltage whichever is less.

7. Structure



| No. | Name | Material |
|-----|------------|------------------------------------|
| 1 | Basic Body | Rod type ceramics |
| 2 | Resistor | Metal Glaze Film (Ruthenium Oxide) |
| 3 | End Cap | Steel (Tin-Plated iron surface) |
| 4 | Lead Wire | Tin solder coated copper wire |
| 5 | Joint | By Welding |
| 6 | Coating | Color : Sky Blue |
| 7 | Color Code | Epoxy Resin |

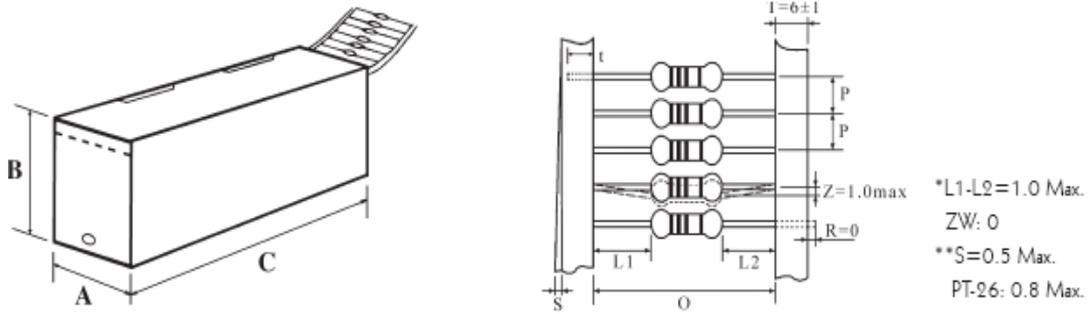
8. Performance Specification

| Characteristic | Limits | Test Methods (GB/T5729&JIS-C-5201&IEC60115-1) |
|---------------------------------|--|--|
| Temperature Coefficient | $\pm 200 \text{ PPM}/^\circ\text{C}$ | 4.8 Natural resistance changes per temp. Degree centigrade $\frac{R_2 - R_1}{R_1(t_2 - t_1)} \times 10^6 \text{ (PPM}/^\circ\text{C)}$ R ₁ : Resistance Value at room temperature (t ₁) ; R ₂ : Resistance at test temperature (t ₂) t ₁ : +25°C or specified room temperature t ₂ : Test temperature (-55°C or 125°C) |
| Short-time overload | $\Delta R/R \leq \pm(1\% + 0.05 \Omega)$, with no evidence of mechanical damage | 4.13 Permanent resistance change after the application of a potential of 2.5 times RCWV or Max. Overload Voltage whichever less for 5seconds. |
| Dielectric withstanding voltage | With no evidence of flashover, mechanical damage, arcing or insulation breakdown | 4.7 Resistors shall be clamped in the trough of a 90° metallic v-block and shall be tested at ac potential respectively specified in the above list for 60-70 seconds. |
| Pulse overload | $\Delta R/R \leq \pm(2\% + 0.05)$, with no evidence of mechanical damage | 4.28 Resistance change after 10,000 cycles (1 second "ON", 25 seconds "OFF") at 4 times RCWV or Max. Overload whichever less. |
| Resistance to soldering heat | $\Delta R/R \leq \pm(1\% + 0.05 \Omega)$ with no evidence of mechanical damage | 4.18 Permanent resistance change when leads immersed to a point 2.0-2.5mm from the body in 260°C ± 5°C solder for 10 ± 1 seconds. |
| Resistance to solvent | No deterioration of protective coatings & markings | 4.29 Specimens shall be immersed in a bath of IPA completely for 5 ± 0.5 min. With ultrasonic |
| Terminal strength | No evidence of mechanical damage | 4.16 Direct load: Resistance to a 2.5 kg direct load for 10 seconds in the direction of the longitudinal axis of the terminal leads. Twist test: Terminal leads shall be bent through 90° at a point of about 6mm from the body of the resistor and shall be rotated through 360° about the original axis of the bent terminal in alternating direction for a total of 3 rotations. |

| Solderability | Coverage must be over 95%. | 4.17 The area covered with a new, smooth, clean, shiny and continuous surface free from concentrated pinholes. Test temp. Of solder:245°C±3°C Dwell time in solder: 2~3seconds. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|-----------------------------|--|---|------------------|------------------|--------|------|------------------|------|-------|-----|---------|-----|-----|-----|---------|-----|-----|-----|------|-----|-----|-----|------------------|-----|------|-----|---------|-----|-----|-----|---------|-----|-----|-----|------|-----|-----|------|
| Rapid change of temperature | $\Delta R/R \leq \pm(1\%+0.05 \Omega)$ with no evidence of mechanical damage | 4.19 30 min at -55 °C and 30 min at 155°C; 100 cycles. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Load life in humidity | $\Delta R/R \leq \pm(5\%+0.05 \Omega)$ with no evidence of mechanical damage. | 7.9 Resistance change after 1000 hours (1.5hours“ON”, 0.5hours“OFF”) at RCWV or Max. Working Voltage whichever less in a humidity test chamber controlled at 40±2°C and 93±3% RH. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Load life | $\Delta R/R \leq \pm(5\%+0.05 \Omega)$ with no evidence of mechanical damage | 4.25.1 Permanent Resistance change after 1000 hours operating at RCWV or Max. Working Voltage whichever less with duty cycle of 1.5 hours “ON”, 0.5 hour “OFF” at 70±2°C ambient. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Surge withstanding voltage | <p>$\Delta R/R \leq \pm(20\%+0.05 \Omega)$ with no evidence of mechanical damage</p> <p>Test circuit:</p> | <p>The discharge cycle is repeated in above circuit: 2.5 seconds“ON”,2.5“OFF”,50 cycles, C=0.001uf. Applied voltage (DC source)</p> <table border="1"> <tr> <td>Resistance Range</td> <td>1/2W, 1W, 2W, 3W</td> </tr> <tr> <td>≥100KΩ</td> <td>10kV</td> </tr> </table> <p>***MGR 1/4W can specially provide : Surge Withstanding Voltage 10kV</p> <p>The discharge cycle is repeated in above circuit: 2.5 seconds“ON”,2.5 seconds “OFF”,10 cycles, C=0.01uf. Applied voltage (DC source)</p> <table border="1"> <thead> <tr> <th>Resistance range</th> <th>1/4W</th> <th>1/2WS</th> <th>1WS</th> </tr> </thead> <tbody> <tr> <td>100K-1M</td> <td>3kV</td> <td>3kV</td> <td>4kV</td> </tr> <tr> <td>1M1-6M2</td> <td>4kV</td> <td>4kV</td> <td>5kV</td> </tr> <tr> <td>≥6M8</td> <td>6kV</td> <td>6kV</td> <td>8kV</td> </tr> <tr> <th>Resistance range</th> <th>2WS</th> <th>3WSS</th> <th>3WS</th> </tr> <tr> <td>100K-1M</td> <td>5kV</td> <td>5kV</td> <td>8kV</td> </tr> <tr> <td>1M1-6M2</td> <td>6kV</td> <td>6kV</td> <td>9kV</td> </tr> <tr> <td>≥6M8</td> <td>9kV</td> <td>9kV</td> <td>10kV</td> </tr> </tbody> </table> | Resistance Range | 1/2W, 1W, 2W, 3W | ≥100KΩ | 10kV | Resistance range | 1/4W | 1/2WS | 1WS | 100K-1M | 3kV | 3kV | 4kV | 1M1-6M2 | 4kV | 4kV | 5kV | ≥6M8 | 6kV | 6kV | 8kV | Resistance range | 2WS | 3WSS | 3WS | 100K-1M | 5kV | 5kV | 8kV | 1M1-6M2 | 6kV | 6kV | 9kV | ≥6M8 | 9kV | 9kV | 10kV |
| Resistance Range | 1/2W, 1W, 2W, 3W | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| ≥100KΩ | 10kV | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Resistance range | 1/4W | 1/2WS | 1WS | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 100K-1M | 3kV | 3kV | 4kV | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1M1-6M2 | 4kV | 4kV | 5kV | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| ≥6M8 | 6kV | 6kV | 8kV | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Resistance range | 2WS | 3WSS | 3WS | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 100K-1M | 5kV | 5kV | 8kV | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1M1-6M2 | 6kV | 6kV | 9kV | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| ≥6M8 | 9kV | 9kV | 10kV | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Low Temperature Storage | $\Delta R/R \leq \pm(5\%+0.05 \Omega)$ with no evidence of mechanical damage | IEC 60068-2-1 (Aa) -55°C, for 2H. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| High Temperature Exposure | $\Delta R/R \leq \pm(5\%+0.05 \Omega)$ with no evidence of mechanical damage | MIL-STD-202 108A +155°C, for 16H. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

9. Packing

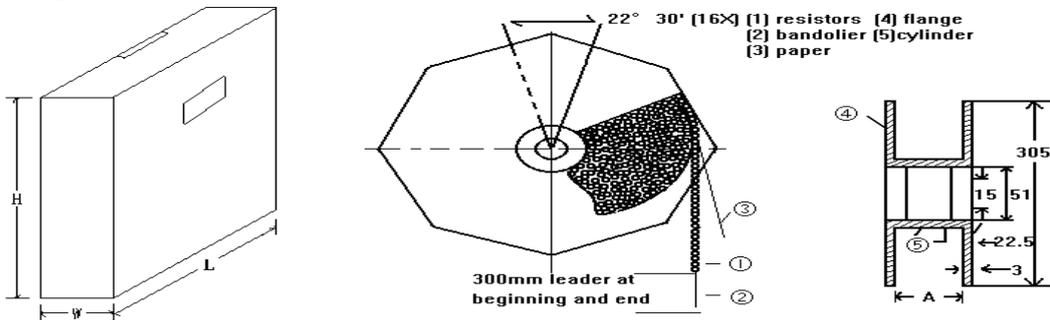
9.1 Tapes in Box Packing



Dimension of T/B (mm)

| Part No. | O | P | A±5 | B±5 | C±5 | Qty/Box |
|-----------|------|--------|-----|-----|-----|----------|
| MGR 1/4W | 52±1 | 5±0.3 | 75 | 116 | 255 | 4000 PCS |
| MGR 1/2W | 52±1 | 5±0.3 | 75 | 70 | 255 | 1000 PCS |
| MGR 1W | 52±1 | 5±0.3 | 86 | 82 | 255 | 1000 PCS |
| MGR 2W | 64±5 | 10±0.5 | 90 | 119 | 255 | 1000 PCS |
| MGR 3W | 64±5 | 10±0.5 | 90 | 88 | 255 | 500 PCS |
| MGR 1/2WS | 52±1 | 5±0.3 | 75 | 116 | 255 | 4000 PCS |
| MGR 1WS | 52±1 | 5±0.3 | 75 | 70 | 255 | 1000 PCS |
| MGR 2WS | 52±1 | 5±0.3 | 86 | 82 | 255 | 1000 PCS |
| MGR 3WSS | 52±1 | 5±0.3 | 86 | 82 | 255 | 1000 PCS |
| MGR 3WS | 64±5 | 10±0.5 | 90 | 119 | 255 | 1000 PCS |

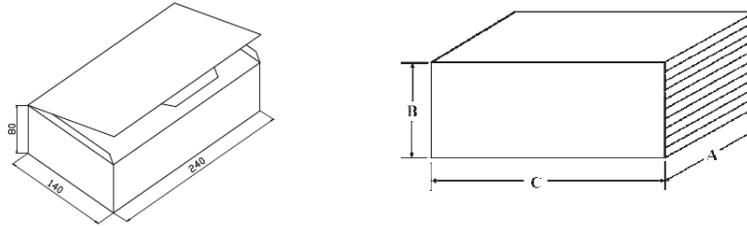
9.2 Tapes in Reel Packing



Dimension of Reel (mm)

| Part No. | O | A | W±5 | H±5 | L±5 | Qty/Box |
|-----------|------|------|-----|-----|-----|----------|
| MGR 1/4W | 52±1 | 73±2 | 85 | 295 | 293 | 5,000pcs |
| MGR 1/2W | 52±1 | 73±2 | 85 | 295 | 293 | 2,500pcs |
| MGR 1W | 52±1 | 73±2 | 85 | 295 | 293 | 1,000pcs |
| MGR 2W | 64±5 | 80±5 | 95 | 295 | 293 | 1,000pcs |
| MGR 3W | 64±5 | 80±5 | 95 | 295 | 293 | 1,000pcs |
| MGR 1/2WS | 52±1 | 73±2 | 85 | 295 | 293 | 5,000pcs |
| MGR 1WS | 52±1 | 73±2 | 85 | 295 | 293 | 2,500pcs |
| MGR 2WS | 52±1 | 73±2 | 85 | 295 | 293 | 1,000pcs |
| MGR 3WSS | 52±1 | 73±2 | 85 | 295 | 293 | 1,000pcs |
| MGR 3WS | 64±5 | 80±5 | 95 | 295 | 293 | 1,000pcs |

9.3 Bulk in Box Packing



| Part No. | Dimension of Box (mm) | | | Qty. of Bag/Box |
|-----------|-----------------------|-----|-----|-----------------|
| | A±5 | B±5 | C±5 | |
| MGR 1/4W | 140 | 80 | 240 | 500/10,000pcs |
| MGR 1/2W | 140 | 80 | 240 | 250/5,000pcs |
| MGR 1W | 140 | 80 | 240 | 100/2,500pcs |
| MGR 2W | 140 | 80 | 240 | 100/1,500pcs |
| MGR 3W | 140 | 80 | 240 | 100/1,000pcs |
| MGR 1/2WS | 140 | 80 | 240 | 500/10,000pcs |
| MGR 1WS | 140 | 80 | 240 | 250/5,000pcs |
| MGR 2WS | 140 | 80 | 240 | 100/2,500pcs |
| MGR 3WSS | 140 | 80 | 240 | 100/2,500pcs |
| MGR 3WS | 140 | 80 | 240 | 100/1,500pcs |

10. Note

10.1. UNI-ROYAL recommend products store in warehouse with temperature between 15 to 35°C under humidity between 25 to 75%RH.

Even under storage conditions recommended above, solder ability of products will be degraded stored over 1 year old.

10.2. Cartons must be placed in correct direction which indicated on carton, otherwise the reel or wire will be deformed.

10.3. Storage conditions as below are inappropriate:

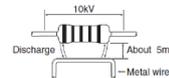
- a. Stored in high electrostatic environment
- b. Stored in direct sunshine, rain, snow or condensation.
- c. Exposed to sea wind or corrosive gases, such as Cl₂, H₂S, NH₃, SO₂, NO₂, Br etc.

10.4. Notice on Surge Load

Surge withstanding load voltage for the resistors cannot be guarantee when the undermentioned 4 items get to a remarkable overload in comparison with the conditions shown by surge withstanding voltage in Anti-surge characteristics. You are kind by requested to contact to us in advance if such a case is anticipated.

- a. Peak voltage to be applied
- b. Pulse width
- c. Conditions of protecting insulation around the resistor
- d. Situation of proximity conductivity object

As the fig. below for instance when a metal wire is placed at less than 5mm away from the resistor body, there is such a case that causes an electric discharge by a surge load 10kV and then destroys the outer coating.



11. Record

| Version | Description | Page | Date | Amended by | Checked by |
|---------|--|--------|--------------|-------------|------------|
| 1 | First version | 1~7 | Mar.20, 2018 | Haiyan Chen | Nana Chen |
| 2 | Modify characteristic | 5~6 | Feb.19, 2019 | Haiyan Chen | Yuhua Xu |
| 3 | Update VDE and UL certificate numbers | 1 | Sep.09, 2021 | Haiyan Chen | Yuhua Xu |
| 4 | Modify the temperature coefficient test conditions | 5 | Oct.28, 2022 | Haiyan Chen | Yuhua Xu |
| 5 | 1.Modify the coating color 2.Modify the surge withstanding voltage test methods | 5 6 | Mar.26, 2024 | Haiyan Chen | Yuhua Xu |
| 6 | Add the Notice on Surge Load | 8 | Jun.17, 2024 | Haiyan Chen | Yuhua Xu |