



ISO14001



ISO/TS16949



244546



245468



REG.-Nr.A759



CQC04001010656

## Specification for Approval

**Customer**                    深圳市嘉立創科技發展有限公司

**Product Name**            **LEAD-FREE METAL OXIDE FILM FIXED RESISTORS**

**Part Name**                 **MOR    SERIES    ±5%**

88 Longteng Road, Economic & Technical Development Zone, Kunshan City, Jiangsu, China

TEL: 86 512 57631411 / 22 / 33

FAX: 86 512 57631431

Email: [globalsales@uniohm.com](mailto:globalsales@uniohm.com)    [localsales@uniohm.com](mailto:localsales@uniohm.com)

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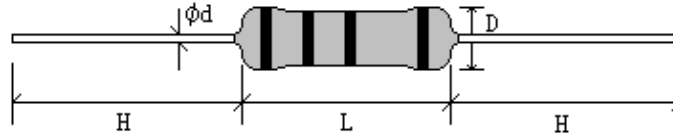
| File Name: <b>MO SERIES ±5%</b> |                           | Date       | <b>2015.11.07</b> | Edition No. | <b>1</b>   |
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| Amendment Record                |                           |            |                   | Signature   |            |
| Edition                         | Prescription of amendment | Amend Page | Amend Date        | Amended by  | Checked by |
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**1.0 Scope:**

This specification for approve Lead-Free Metal Oxide Film Fixed Resistors manufactured by UNIOHM.

**2.0 Ratings & dimension:**



**2.1 Normal size**

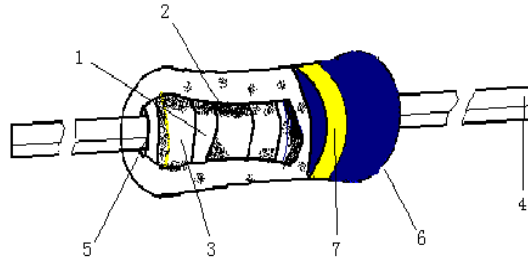
| Type   | Dimension(mm) |          |        |     | Max working voltage | Max overload voltage | Dielectric withstanding voltage | Tolerance | Resistance range |
|--------|---------------|----------|--------|-----|---------------------|----------------------|---------------------------------|-----------|------------------|
|        | D             | L        | d±0.05 | H±3 |                     |                      |                                 |           |                  |
| MO1/4W | 2.2±0.5       | 6.5±1.0  | 0.54   | 28  | 250V                | 400V                 | 250V                            | ±5%       | 0.1Ω~470KΩ       |
| MO1/2W | 3.0±0.6       | 9.5±1.0  | 0.54   | 28  | 250V                | 400V                 | 250V                            | ±5%       | 0.1Ω~560KΩ       |
| MO1W   | 4.0±0.6       | 11.5±1.0 | 0.65   | 28  | 350V                | 600V                 | 350V                            | ±5%       | 0.1Ω~560KΩ       |
| MO2W   | 5.0±0.6       | 15.5±1.0 | 0.70   | 28  | 350V                | 600V                 | 350V                            | ±5%       | 0.1Ω~560KΩ       |
| MO3W   | 6.0±0.6       | 17.5±1.0 | 0.75   | 28  | 500V                | 800V                 | 500V                            | ±5%       | 0.1Ω~560KΩ       |
| MO5W   | 8.0±0.6       | 24.5±1.0 | 0.75   | 38  | 750V                | 1000V                | 750V                            | ±5%       | 0.1Ω~680KΩ       |
| MO7W   | 8.0±0.6       | 29.5±1.0 | 0.75   | 38  | 750V                | 1000V                | 750V                            | ±5%       | 20Ω~150KΩ        |
| MO8W   | 8.0±0.6       | 39.5±1.0 | 0.75   | 38  | 750V                | 1000V                | 750V                            | ±5%       | 30Ω~200KΩ        |
| MO9W   | 8.0±0.6       | 52.5±1.0 | 0.75   | 38  | 750V                | 1000V                | 750V                            | ±5%       | 50Ω~200KΩ        |

**2.2 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 |                     |                      |                                 |           |                  |
| MO1/2WS | 2.2±0.5       | 6.5±1.0  | 0.54   | 28  | 250V                | 400V                 | 250V                            | ±5%       | 0.1Ω~470KΩ       |
| MO1WS   | 3.5±0.6       | 9.5±1.0  | 0.60   | 28  | 350V                | 600V                 | 350V                            | ±5%       | 0.1Ω~560KΩ       |
| MO2WS   | 4.5±0.6       | 11.5±1.0 | 0.65   | 28  | 350V                | 600V                 | 350V                            | ±5%       | 0.1Ω~560KΩ       |
| MO3WS   | 5.0±0.6       | 15.5±1.0 | 0.70   | 28  | 350V                | 600V                 | 350V                            | ±5%       | 0.1Ω~560KΩ       |
| MO5WSS  | 6.0±0.6       | 17.5±1.0 | 0.75   | 28  | 500V                | 800V                 | 500V                            | ±5%       | 0.1Ω~560KΩ       |
| MO5WS   | 8.0±0.6       | 24.5±1.0 | 0.75   | 38  | 500V                | 800V                 | 500V                            | ±5%       | 0.1Ω~680KΩ       |

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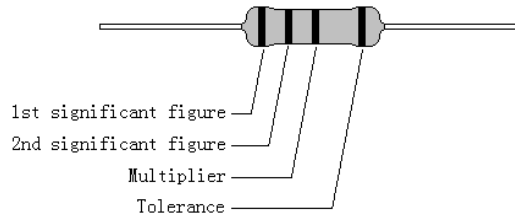
**3.0 Structure:**



| No. | Name           | Component  |
|-----|----------------|--|
| 1   | Basic body     | Ceramic  |
| 2   | Resistor layer | Metal Oxide Film   |
| 3   | End cap        | Steel (Tinned iron cap)  |
| 4   | Lead wire      | Tinned copper wire   |
| 5   | Joint          | By welding   |
| 6   | Coating        | Silicon resin with different color ①Gray (Normal size) ② Sea blue (Small size) |
| 7   | Color code     | Epoxy resin  |

**4.0 Mark**

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



**4.1 Label:**

Label shall have some items as below:

- 1 Type and style
- 2 Nominal resistances
- 3 Resistance tolerances
- 4 Quantities
- 5 Lot number
- 6 PPM

**Example:**

| METAL OXIDE FILM FIXED RESISTORS |           |
|----------------------------------|-----------|
| WATT: 2WS                        | VAL:100KΩ |
| Q'TY: 1,000                      | TOL: 5%   |
| LOT: 3021548                     | PPM:      |

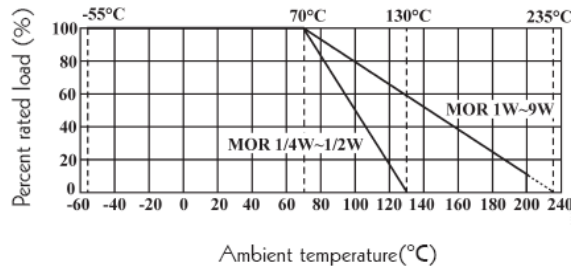
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### 5.0 Derating Curve:

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 power would be derate as shown in figure 1

Figure1



### 6.0 Voltage rating:

Resistors should have a direct-current (DC) continuous voltage rating and an alternating-current (AC) continuous voltage rating relates to Power Rating, formula shown as below:

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

RCWV: Rated DC or RMS ac continuous working voltage at commercial-line frequency and waveform (Volt.)

- P: Power Rating (Watt.)
- R: Nominal Resistance (Ohm)

Resistors would be burned out if it overloaded, such as higher than the maximum value of series' RCWV. And we named 2.5 times RCWV is OVERLOAD Voltage.

### 7.0 Performance specification:

| Item                    | Limits  | Test Method (JIS-C-5201&5202)  |
|-------------------------|---|--|
| Temperature Coefficient | <b>1/4W 1/2WS</b><br>≤100KΩ: ±350PPM/°C<br>100KΩ<R≤470KΩ: 0 ~ -700PPM/°C<br><b>1/2W、1WS:</b><br>≤120KΩ: ±350PPM/°C<br>120KΩ<R≤560KΩ 0~ -700PPM/°C<br><b>1W、2W、2WS、3W、3WS、5WSS</b><br>≤150KΩ: ±350PPM/°C<br>150KΩ<R≤560KΩ 0~ -700PPM/°C<br><b>5W 5WS</b><br>≤180KΩ: ±350PPM/°C<br>180KΩ<R≤680KΩ 0 ~ -700PPM/°C<br><b>7W、8W、9W:</b><br>±350PPM/°C | 4.8 Natural resistance changes per temp. Degree centigrade<br><br>$\frac{R_2 - R_1}{R_1(T_2 - T_1)} * 10^6 (PPM/°C)$<br>R1: resistance value at room temp. (T1)<br>R2: resistance value at room temp. +100°C (Tt2)<br>Test pattern: room temp. (T1), room temp. +100°C(T2) |
| Short-time overload     | Resistance change rate is:<br>± (1%+0.05Ω) <sub>max</sub> for normal size.<br>± (2%+0.05Ω) <sub>max</sub> for small size.<br>With no evidence of mechanical damage.   | 4.13 Permanent resistance change after the application of a potential of 2.5 times RCWV for 5 seconds.   |

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| Item                            | Limits  | Test Method (JIS-C-5201&5202)  |      |             |      |   |             |         |   |            |              |   |              |         |   |            |              |
|---------------------------------|---|--|------|-------------|------|---|-------------|---------|---|------------|--------------|---|--------------|---------|---|------------|--------------|
| Dielectric withstanding voltage | No evidence of flashover mechanical damage, arcing or insulation break down.  | 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                  | Resistance change rate is:<br>± (2%+0.05Ω) <sub>Max</sub> for normal size.<br>± (5%+0.05Ω) <sub>Max</sub> for small size.<br>With no evidence of mechanical damage. | 4.28 Resistance change after 10,000 cycles (1 second "ON", 25 seconds "OFF") at 4 times RCWV.  |      |             |      |   |             |         |   |            |              |   |              |         |   |            |              |
| Terminal strength               | No evidence of mechanical damage  | 4.16 Direct load:<br>Resistance to a 2.5Kg direct load for 10 seconds in the direction of the longitudinal axis of the terminal leads.<br>Twist test:<br>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.   |      |             |      |   |             |         |   |            |              |   |              |         |   |            |              |
| Resistance to soldering heat    | Resistance change rate is:<br>± (1%+0.05Ω) <sub>Max</sub> . 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.  |      |             |      |   |             |         |   |            |              |   |              |         |   |            |              |
| Solderability                   | 95% coverage Min.   | 4.17 The area covered with a new, smooth, clean, shiny and continuous surface free from concentrated pinholes.<br>Test temp. Of solder:245°C±3°C<br>Dwell time in solder: 2~3seconds.  |      |             |      |   |             |         |   |            |              |   |              |         |   |            |              |
| Resistance to solvent           | No deterioration of protective coatings & markings  | 4.29 Specimens shall be immersed in a bath of trichloroethylene completely for 3 min. With ultrasonic  |      |             |      |   |             |         |   |            |              |   |              |         |   |            |              |
| Temperature cycling             | Resistance change rate is:<br>±(2%+0.05Ω) <sub>Max</sub> . With no evidence of mechanical damage.   | 4.19 Resistance change after continuous five cycles for duty cycle specified:<br><table border="1" style="margin-left: 20px;"> <thead> <tr> <th>Step</th> <th>Temperature</th> <th>Time</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>-55°C ± 3°C</td> <td>30 mins</td> </tr> <tr> <td>2</td> <td>Room temp.</td> <td>10 - 15 mins</td> </tr> <tr> <td>3</td> <td>+155°C ± 2°C</td> <td>30 mins</td> </tr> <tr> <td>4</td> <td>Room temp.</td> <td>10 - 15 mins</td> </tr> </tbody> </table> | Step | Temperature | Time | 1 | -55°C ± 3°C | 30 mins | 2 | Room temp. | 10 - 15 mins | 3 | +155°C ± 2°C | 30 mins | 4 | Room temp. | 10 - 15 mins |
| Step                            | Temperature   | Time   |      |             |      |   |             |         |   |            |              |   |              |         |   |            |              |
| 1                               | -55°C ± 3°C   | 30 mins  |      |             |      |   |             |         |   |            |              |   |              |         |   |            |              |
| 2                               | Room temp.  | 10 - 15 mins   |      |             |      |   |             |         |   |            |              |   |              |         |   |            |              |
| 3                               | +155°C ± 2°C  | 30 mins  |      |             |      |   |             |         |   |            |              |   |              |         |   |            |              |
| 4                               | Room temp.  | 10 - 15 mins   |      |             |      |   |             |         |   |            |              |   |              |         |   |            |              |
| Humidity (steady state)         | Resistance change rate is:<br>± (2%+0.05Ω) <sub>Max</sub> . With no evidence of mechanical damage   | 4.24 temporary resistance changes after a 240 hours exposure in a humidity test chamber controlled at 40°C ± 2°C and 90 to 95% relative humidity.  |      |             |      |   |             |         |   |            |              |   |              |         |   |            |              |
| Load life in humidity           | ΔR/R:<br>≅ ±5% for <100KΩ;<br>≅ ±10% for ≧100KΩ;  | 7.9 resistance change after 1,000 hours (1.5 hours "ON",0.5 hour "OFF") at RCWV in a humidity test chamber controlled at 40°C±2°C and 90 to 95% relative humidity.   |      |             |      |   |             |         |   |            |              |   |              |         |   |            |              |
| Load life                       | ΔR/R:<br>≅ ±5% for <100KΩ;<br>≅ ±10% for ≧100KΩ;  | 4.25.1 permanent resistance change after 1,000 hours operating at RCWV with duty cycle of 1.5 hours "ON", 0.5 hour "OFF" at 70°C±2°C ambient.  |      |             |      |   |             |         |   |            |              |   |              |         |   |            |              |

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| Item            | Limits   | Test Method (JIS-C-5201&5202)  |
|-----------------|--|--|
| Flame retardant | Resistor insulation is self-extinguishing within 10 seconds after externally applied flame is removed. | 4.26 The burner is placed remote fro, resistor ignited and adjusted to produce a blue flame 38mm in height and a top of flame 127mm above the top of burner tube. Resistor is supported from its lead at 45° from the horizontal so that the lower end of resistor is the top of blue flame. The test flame is placed to remain for 15 seconds and removed for 15 seconds. The operation is to be repeated until resistor has been subjected to 5 application of test flame. |

### 8.0 Explanation of Part No. system:

The standard Part No. contains 14 codes.

8.1 1<sup>st</sup>~3<sup>rd</sup> codes: Product type

8.2 4<sup>th</sup> code: Special feature.

Example: MOR0=Metal Oxide Film Fixed Resistors

8.3 5<sup>th</sup>~6<sup>th</sup> codes: Power rating

8.3.1 The 5<sup>th</sup> code would be “W”, “S”, or “U” if the resistors’ power rating is lower than 1W.

8.3.2 The 6<sup>th</sup> code would be “W”, “S”, or “U” if the resistors’ power rating is greater than 1W.

8.3.3 We named “W” to indicate “normal size”, “S” for “small size”, and “U” for “ultra-small size”.

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

| Wattage          | 1/2 | 1/3 | 1/4 | 1/5 | 1/6 | 1/8 | 1/10 | 1/16 |
|------------------|-----|-----|-----|-----|-----|-----|------|------|
| Normal size      | W2  | W3  | W4  | W5  | W6  | W8  | WA   | WG   |
| Small size       | S2  | S3  | S4  | S5  | S6  | S8  | SA   | SG   |
| Ultra-small size | U2  | U3  | U4  | U5  | U6  | U8  | UA   | UG   |

1W~16W (≥1W)

| Wattage          | 1  | 2  | 3  | 5  | 7  | 8  | 9  | 10 | 15 |
|------------------|----|----|----|----|----|----|----|----|----|
| Normal size      | 1W | 2W | 3W | 5W | 7W | 8W | 9W | AW | FW |
| Small size       | 1S | 2S | 3S | 5S | 7S | 8S | 9S | AS | FS |
| Ultra-small size | 1U | 2U | 3U | 5U | 7U | 8U | 9U | AU | FU |

8.4 7<sup>th</sup> code: Resistance Tolerance.

F=±1%      G=±2%      J=±5%      K= ±10%

8.5 8<sup>th</sup>~11<sup>th</sup> codes: Resistance Value.

8.5.1 For the standard resistance values of E-24 series in 5% and 10% tolerance, 8<sup>th</sup> code would be “0”, 9<sup>th</sup>~10<sup>th</sup> codes would be the significant figures of the resistance, and 11<sup>th</sup> code is the power of ten.

For the standard resistance values of E-96 series in ≤2% tolerance, 8<sup>th</sup>~10<sup>th</sup> codes would be the significant figures of the resistance, and 11<sup>th</sup> code is the power of ten.

8.5.2 As mentioned above, 11<sup>th</sup> code would be the power of ten, so we use those code in 11<sup>th</sup> digit shown as following:

0=10<sup>0</sup>      1=10<sup>1</sup>      2=10<sup>2</sup>      3=10<sup>3</sup>      4=10<sup>4</sup>      5=10<sup>5</sup>  
6=10<sup>6</sup>      J=10<sup>-1</sup>      K=10<sup>-2</sup>      L=10<sup>-3</sup>      M=10<sup>-4</sup>

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8.6 12<sup>th</sup>~14<sup>th</sup> codes

8.6.1 12<sup>th</sup> code: Packaging Type

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

8.6.2 13<sup>th</sup> code: Standard Packing Quantity of Tape/Box & Tape/Reel packaging types.

If the packing type is Bulk packing, this digit should be "0".

A=500pcs      B=2500pcs      1=1000pcs      2=2000pcs

8.6.3 For the FORMED type products, 13<sup>th</sup>~14<sup>th</sup> codes would be forming types shown as below:

MF=M-type with flattened lead wire      MK= M-type with kinked lead wire

ML= M-type with normal lead wire

MC= M type with kinked lead and narrow pitch wire

F0= F-type      F1= F1-type      F2= F2-type      F3= F3-type

8.6.4 14<sup>th</sup> code: Special features for additional information.

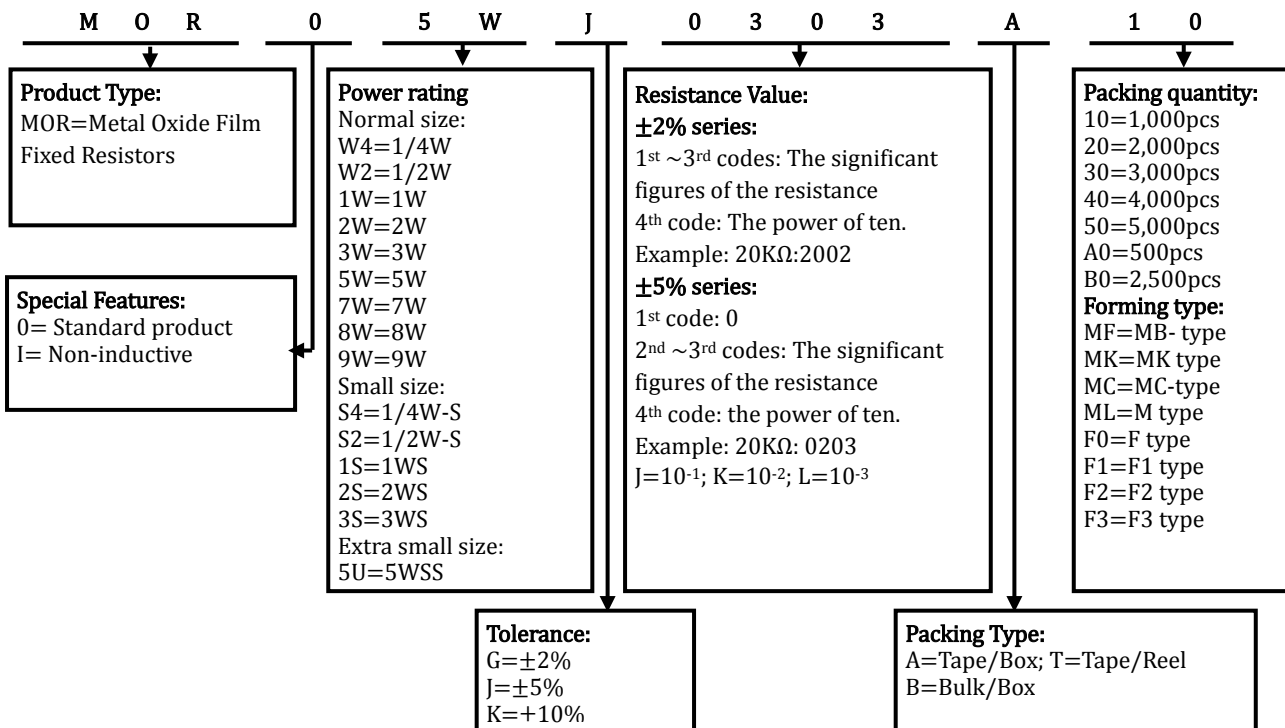
P=Panasert type      1=Avisert type 1      2=Avisert type 2

3=Avisert type 3

A=Cutting type CO 1/4W-A type

B= Cutting type CO 1/4W-B type

9.0 Ordering Procedure ( Example: MOR 5W ±5% 30KΩ T/B-1000 )

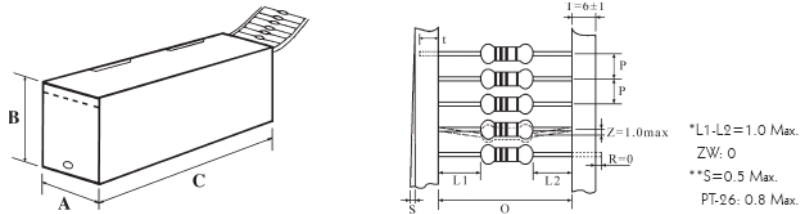


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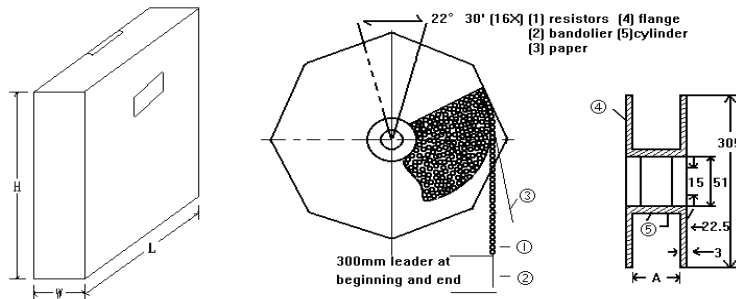
**10.0 Standard Packing:**

**10.1 Tapes in Box Packing: Unit: T/B (mm)**



| Part No. | O    | P      | A±5 | B±5 | C±5 | Qty/Box  |
|----------|------|--------|-----|-----|-----|----------|
| MO 1/4W  | 52±1 | 5±0.3  | 75  | 116 | 255 | 5,000pcs |
| MO 1/2WS | 52±1 | 5±0.3  | 75  | 116 | 255 | 5,000pcs |
| MO 1/2W  | 52±1 | 5±0.3  | 75  | 70  | 255 | 1,000pcs |
| MO 1WS   | 58±1 | 5±0.3  | 80  | 70  | 255 | 1,000pcs |
| MO 1W    | 58±1 | 5±0.3  | 80  | 82  | 255 | 1,000pcs |
| MO 2WS   | 58±1 | 5±0.3  | 80  | 82  | 255 | 1,000pcs |
| MO 2W    | 65±1 | 10±0.5 | 90  | 119 | 255 | 1,000pcs |
| MO 3WS   | 65±1 | 10±0.5 | 90  | 119 | 255 | 1,000pcs |
| MO 3W    | 65±5 | 10±0.5 | 90  | 88  | 255 | 500pcs   |
| MO 5WSS  | 65±5 | 10±0.5 | 90  | 88  | 255 | 500pcs   |
| MO 5WS   | 90±5 | 10±0.5 | 115 | 124 | 500 | 500pcs   |

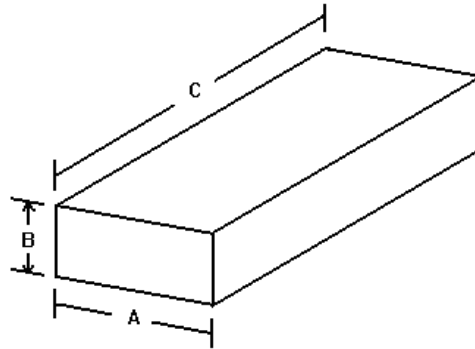
**10.2 Tapes in Reel Packing: Unit: Reel (mm)**



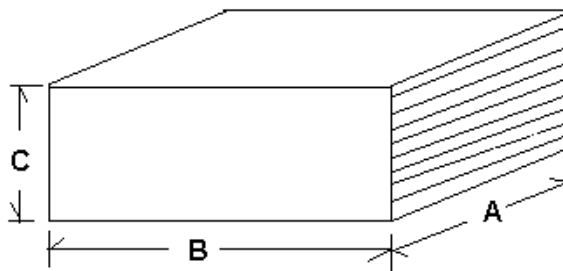
| Part No. | A    | W±5 | H±5 | L±5 | Qty/Box  |
|----------|------|-----|-----|-----|----------|
| MO 1/4W  | 73±2 | 85  | 295 | 293 | 5,000pcs |
| MO 1/2WS | 73±2 | 85  | 295 | 293 | 5,000pcs |
| MO 1/2W  | 73±2 | 85  | 295 | 293 | 3,500pcs |
| MO 1WS   | 73±2 | 85  | 295 | 293 | 2,500pcs |
| MO 1W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

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10.3 Bulk in Box Packing: Unit: Box (mm)



| Part No. | A±5 | B±5 | C±5 | Qty. of Bag/Box |
|----------|-----|-----|-----|-----------------|
| MO 1/4W  | 140 | 80  | 240 | 250/10,000pcs   |
| MO 1/2WS | 140 | 80  | 240 | 250/10,000pcs   |
| MO 1/2W  | 140 | 80  | 240 | 200/4,000pcs    |
| MO 1WS   | 140 | 80  | 240 | 200/4,000pcs    |
| MO 1W    | 140 | 80  | 240 | 100/2,500pcs    |
| MO 2WS   | 140 | 80  | 240 | 100/2,500pcs    |
| MO 2W    | 140 | 80  | 240 | 100/1,500pcs    |
| MO 3WS   | 140 | 80  | 240 | 100/1,500pcs    |
| MO 3W    | 140 | 80  | 240 | 100/1,000pcs    |
| MO 5WSS  | 140 | 80  | 240 | 100/1,000pcs    |



| Part No. | A±5 | B±5 | C±5 | Qty/Box   |
|----------|-----|-----|-----|-----------|
| MO 5WS   | 140 | 80  | 240 | 25/400pcs |
| MO 5W    | 140 | 80  | 240 | 25/400pcs |
| MO 7W    | 140 | 80  | 240 | 25/300pcs |

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ISO14001



ISO/TS16949



244546



245468



REG.-Nr.A759



CQC04001010656

## 11.0 Precaution for storage/Transportation:

11.1 We strongly recommend the storage condition:

Temperature: 15°C~35°C; Humidity: 25%~75%.

Even under the storage condition mentioned above, solderability of products would degrade if stored over 1 year.

11.2 Store / transport cartons in the correct direction which signed on a carton side. Otherwise bent leads may occur due to excessive stress applied when dropping of a carton.

11.3 Product performance and soldered connections may deteriorate if the products are stored in the following places:

11.3.1 In high electrostatic;

11.3.2 In direct sunshine, rain, snow or condensation;

11.3.3 Exposed to sea winds or corrosive gases, including Cl<sub>2</sub>, H<sub>2</sub>S, NH<sub>3</sub>, SO<sub>2</sub>, and NO<sub>2</sub>.

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