



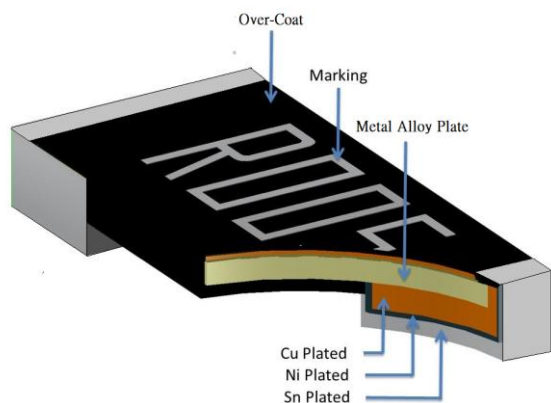
# MA Series Metal Alloy Low-Resistance Resistor Product Specifications

Document No. S-10-12-05-11

Released Date 2019/03/07

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## ■ Metal Alloy Low Resistance Chip Resistor — MA Series



### ■ Application

- Entertainment product
- Power supply
- Measuring instrument
- Industrial product
- Battery management system

### ■ Features

- Low Resistance / Low TCR
- Excellent long term stability
- RoHs compliant and halogen free.
- Lead free.
- High precision current sensing and voltage division.
- ACE-Q200 qualified available.

### ■ Parts Number Explanation

#### ■ Example:

|                     |                                      |  |  |  |  |                               |
|---------------------|--------------------------------------|--|--|--|--|-------------------------------|
| MA                  | 2512                                 | 20   | F  | R001   | M  | Z                             |
| <b>Product Type</b> | <b>Size (Inch)</b>                   | <b>Rated Power</b>   | <b>Tolerance</b>                           | <b>Resistance</b>  | <b>Material</b>                                | <b>Optional</b>               |
|                     | 1206<br>2512<br>2725<br>2728<br>4527 | 07=0.75W<br>10=1.00W<br>20=2.00W<br>30=3.00W<br>40=4.00W<br>50=5.00W | D : ±0.5%<br>F : ±1%<br>G : ±2%<br>J : ±5% | 0m20=0.2mR<br>2m50=2.5mR<br>R000=0mR<br>R005=5.0mR<br>R100=100mR<br>R500=500mR | S : MnCuSn<br>M : MnCu<br>F : FeCrAl<br>C : Cu | A: For Automotive Electronics |



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## Standard Electrical Specifications

| TYPE   | Rating Power at 70°C | T.C.R. (ppm/°C) | Max. Rating Current | Max. Overload Current | Resistance Range (mΩ) |                                  | Material  | Operating Temperature Range (°C) |
|--------|----------------------|-----------------|---------------------|-----------------------|-----------------------|----------------------------------|---|----------------------------------|
|        |                      |                 |                     |                       | 0.5% (D)              | 1.0% (F)<br>2.0% (G)<br>5.0% (J) |   |                                  |
| MA1206 | 0.75W                | ≤ ±50           | 3.83A               | 7.66A                 | 51~100                | 51~100                           | R051~R100 : FeCrAl                                      | -55 ~ +170                       |
|        | 1W                   |                 | 31.62A              | 63.25A                | 7~50                  | 1~50                             | R001 : MnCuSn<br>R002~R007 : MnCu<br>R008~R050 : FeCrAl |                                  |
| MA2512 | 1W                   |                 | 44.72A              | 100.00A               | 7~450                 | 0.5~450                          | R0005 : MnCuSn  |                                  |
|        | 2W                   |                 | 63.25A              | 141.42A               | 7~450                 | 0.5~450                          | R001~R006 : MnCu  |                                  |
|        | 3W                   |                 | 77.46A              | 154.91A               | 7~100                 | 0.5~100                          | R007~R450 : FeCrAl                                      |                                  |
| MA2725 | 4W                   |                 | 126.49A             | 252.98A               | ---                   | 0.25~3                           | R00025 : MnCuSn<br>R0005~R0025 : MnCu<br>R003 : FeCrAl  |                                  |
| MA2728 | 4W                   |                 | 31.62A              | 54.77A                | 7~450                 | 4~450                            | R004~R450 : FeCrAl                                      |                                  |
| MA4527 | 2W                   |                 | 63.25A              | 109.54A               | 7~100                 | 0.5~100                          | R0005 : MnCuSn  |                                  |
|        | 3W                   |                 | 77.46A              | 134.16A               | 7~60                  | 0.5~60                           | R001~R005 : MnCu  |                                  |
|        | 5W                   |                 | 100A                | 173.20A               | 7~500                 | 0.5~500                          | R006~R500 : FeCrAl                                      |                                  |

## Jumper Specifications

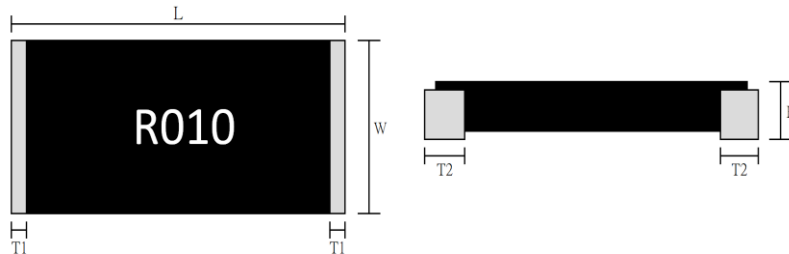
| Type   | Rating Power at 70°C | Max. Rating Current | Resistance (mΩ) | Material    | Operating Temperature Range (°C) |
|--------|----------------------|---------------------|-----------------|-------------|----------------------------------|
| MA1206 | 1W                   | 70.7A               | ≤ 0.2           | Jumper : Cu | -55~+170°C                       |
| MA2512 | 2W                   | 100A                |                 |             |                                  |



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## ■ Type Dimension



FOR MA1206~4527

## ■ Dimension

Unit : mm

| Type   | Power Rating | Resistance Range | L           | W           | H           | T1          | T2          |             |
|--------|--------------|------------------|-------------|-------------|-------------|-------------|-------------|-------------|
| MA1206 | 0.75W        | 51~100 mΩ        | 3.200±0.254 | 1.650±0.254 | 0.350±0.254 | 0.40±0.254  | 0.508±0.254 |             |
|        | 1W           | 1~2mΩ            |             |             | 0.630±0.254 |             |             |             |
|        |              | 3~50mΩ           |             |             | 0.430±0.254 |             |             |             |
| MA2512 | 1W<br>2W     | 0.5~1mΩ          | 6.350±0.254 | 3.050±0.254 | 0.650±0.254 | 1.05±0.254  | 2.200±0.254 |             |
|        |              | 1.5mΩ            |             |             | 0.510±0.254 |             | 2.000±0.254 |             |
|        |              | 2mΩ              |             |             |             |             | 1.400±0.254 |             |
|        |              | 2.5~75 mΩ        |             |             |             |             | 1.100±0.254 |             |
|        |              | 76~200 mΩ        |             |             |             |             | 0.75±0.254  | 1.100±0.254 |
|        |              | 201~450mΩ        |             |             |             |             | 0.410±0.254 | 0.75±0.254  |
|        | 3W           | 0.5~1mΩ          |             |             | 0.650±0.254 | 1.05±0.254  | 2.200±0.254 |             |
|        |              | 1.5mΩ            |             |             | 0.540±0.254 | 0.75±0.254  | 2.000±0.254 |             |
|        |              | 2mΩ              |             |             |             | 0.75±0.254  | 1.400±0.254 |             |
|        |              | 2.5~100mΩ        |             |             |             | 0.75±0.254  | 1.100±0.254 |             |
|        |              |                  |             |             |             | 0.75±0.254  | 1.100±0.254 |             |
| MA2725 | 4W           | 0.25mΩ           | 6.800±0.254 | 6.350±0.254 | 0.770±0.254 | 0.200~1.500 | 2.300±0.254 |             |
|        |              | 0.5mΩ            |             |             | 0.650±0.254 |             |             |             |
|        |              | 1mΩ              |             |             | 0.650±0.254 |             | 1.800±0.254 |             |
|        |              | 1.5~3mΩ          |             |             | 0.550±0.254 |             |             |             |
| MA2728 | 4W           | 4~450mΩ          | 6.600±0.254 | 6.700±0.254 | 0.620±0.254 | 0.200~1.000 | 1.100±0.254 |             |



**MA Series Metal Alloy Low-Resistance Resistor Product Specifications**

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| Type   | Power Rating | Resistance Range | L            | W           | H           | T1          | T2          |             |
|--------|--------------|------------------|--------------|-------------|-------------|-------------|-------------|-------------|
| MA4527 | 2W           | 0.5mΩ            | 11.300±0.500 | 6.600±0.500 | 0.770±0.254 | 0.200~1.000 | 3.000±0.254 |             |
|        |              | 1~1.5mΩ          |              |             | 0.650±0.254 |             |             |             |
|        |              | 2~5mΩ            |              |             | 0.550±0.254 |             |             | 2.000±0.254 |
|        |              | 6~100mΩ          |              |             | 0.770±0.254 |             |             |             |
|        | 3W           | 0.5mΩ            |              |             | 0.650±0.254 |             | 3.000±0.254 |             |
|        |              | 1~1.5mΩ          |              |             | 0.770±0.254 |             |             |             |
|        |              | 2~5mΩ            |              |             | 0.550±0.254 |             |             | 2.000±0.254 |
|        |              | 6~60mΩ           |              |             | 0.770±0.254 |             |             |             |
|        | 5W           | 0.5mΩ            |              |             | 0.720±0.254 |             | 3.000±0.254 |             |
|        |              | 1~1.5mΩ          |              |             | 0.620±0.254 |             |             |             |
|        |              | 2~5mΩ            |              |             |             |             |             |             |
|        |              | 6~500mΩ          |              |             |             |             |             | 2.000±0.254 |

**Jumper Dimension**

Unit : mm

| Type   | Power Rating | Resistance Range | L           | W           | H           | T1         | T2          |
|--------|--------------|------------------|-------------|-------------|-------------|------------|-------------|
| MA1206 | 1W           | < 0.2mΩ          | 3.200±0.254 | 1.650±0.254 | 0.670±0.254 | 0.40±0.254 | 0.508±0.254 |
| MA2512 | 2W           | < 0.2mΩ          | 6.350±0.254 | 3.050±0.254 | 0.670±0.254 | 1.05±0.254 | 1.100±0.254 |



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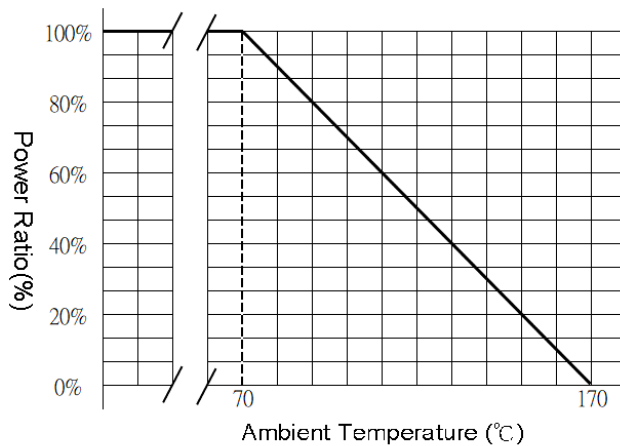
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### ■ Performance Characteristics

#### Power Derating Curve

The Operating Temperature Range: -55°C ~+170°C.

For resistors operated in ambient temperatures above 70°C, power rating must be derating in accordance with the curve below



#### ■ Rating Current

The following equation may be used to determine the DC (Direct Current) or AC (Alternating Current) (RMS, root mean square value) of normal rated power. However, if the result value exceeds the highest current of regulated standards (paragraph 5), the highest normal rated power is to be used

$$I = \sqrt{P/R}$$

I = Rating current (A)

P= Rating Power (W)

R= Resistance(Ω)

#### ■ Marking Format:

- All the other products marking are 4 digits.
- “R” designates the decimal location in ohms  
e.g. 1mΩ the product marking is R001.  
25mΩ the product marking is R025.  
100mΩ the product marking is R100.
- “m” designates the decimal location in milli-ohms  
e.g. 0.25mΩ the product marking is 0m25.  
0.5mΩ the product marking is 0m50.  
5.5mΩ the product marking is 5m50.  
25.5mΩ the product marking is 25m5.
- 0Ω product marking is 0R
- The criteria to distinguishing the mark on the surface of products are that characters can be identified.



# MA Series Metal Alloy Low-Resistance Resistor Product Specifications

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## Reliability test and requirement

| Test Item                                     | Test Method                | Procedure  | Requirements   |
|---|----------------------------|--|--|
| Temperature Coefficient of Resistance (T.C.R) | JIS C 5201-1 clause 4.8    | $\text{T.C.R. (ppm/}^\circ\text{C)} = \frac{(R2-R1)}{R1 (T2-T1)} \times 10^6$ <p>R1: resistance at room temperature (T1)<br/>R2: resistance at 150°C (T2)</p>  | Refer to Standard Electrical Specifications  |
| Short Time Overload                           | JIS C 5201-1 clause 4.13   | <p>The number of rated power are as follows:</p> <ul style="list-style-type: none"> <li>MA1206-0.75W: 4 times of rated power</li> <li>MA1206-1W: 4 times of rated power</li> <li>MA2512-1W: 5 times of rated power</li> <li>MA2512-2W: 5 times of rated power</li> <li>MA2512-3W: 4 times of rated power</li> <li>MA2725-4W: 4 times of rated power</li> <li>MA2728-4W: 3 times of rated power</li> <li>MA4527-2W: 5 times of rated power</li> <li>MA4527-3W: 5 times of rated power</li> <li>MA4527-5W: 3 times of rated power</li> </ul> <p>Rating power duration: 5secs</p> | <ul style="list-style-type: none"> <li>MA4527: <math>\Delta R/R1 \leq \pm 2.0\%</math></li> <li>The others: <math>\Delta R/R1 \leq \pm 0.5\%</math></li> </ul> |
| High Temperature Exposure                     | JIS C 5201-1 clause 4.23.2 | 1,000hrs at + 170 °C   | <ul style="list-style-type: none"> <li>MA4527: <math>\Delta R/R1 \leq \pm 2.0\%</math></li> <li>The others: <math>\Delta R/R1 \leq \pm 1.0\%</math></li> </ul> |
| Soldering Heat                                | JIS C 5201-1 clause 4.18   | 260±5°C for 10 seconds.  | $\Delta R/R1 \leq \pm 0.5\%$   |
| Temperature Cycling                           | JIS C 5201-1 clause 4.19   | -55°C to +150°C, 1,000cycles, 15min at each extreme  | $\Delta R/R1 \leq \pm 0.5\%$   |
| Bias Humidity                                 | JIS C 5201-1 clause 4.24   | 1,000hrs@+85°C/85%RH, 10%Bias 1.5hrs "ON", 0.5hrs "OFF"  | $\Delta R/R1 \leq \pm 0.5\%$   |
| Load at Rated Power                           | JIS C 5201-1 clause 4.25   | 1,000hrs@70 °C, 1.5hrs "ON", 0.5hrs "OFF"  | <ul style="list-style-type: none"> <li>MA4527: <math>\Delta R/R1 \leq \pm 2.0\%</math></li> <li>The others: <math>\Delta R/R1 \leq \pm 1.0\%</math></li> </ul> |
| Solderability                                 | JIS C 5201-1 clause 4.17   | 245±5°C for 2±0.5secs  | >95% coverage  |
| Dielectric Withstanding Voltage               | JIS-C5201-1 clause 4.7     | Applied 500VAC for 1 minute, and Limit surge current 50 mA (max.)  | No short or burned on the appearance.  |
| Core Body Strength                            | JIS-C5201-1 clause 4.15    | Central part pressurizing force : 5N , 10 seconds  | No broken  |



# MA Series Metal Alloy Low-Resistance Resistor Product Specifications

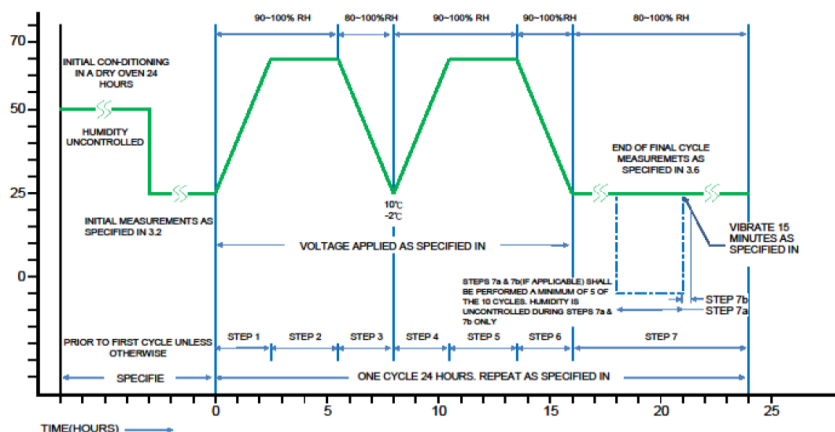
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|   |                         |   |   |
|---|-------------------------|---|---|
| Terminal Strength                       | JIS-C5201-1 clause 4.32 | Pressurizing force : 17.7N , 10 seconds   | No broken                                 |
| Terminal Bending Strength               | JIS-C5201-1 clause 4.33 | Bending once for 2mm , 10 seconds   | $\Delta R/R1 \leq \pm 0.5\%$<br>No broken |
| Moisture Resistance (Climatic Sequence) | MIL-STD 202 Method 106  | T=24 hours / Cycle , 10Cycles .<br>Steps 7a& 7b not required. Unpowered .<br>(Figure 1) | $\Delta R/R1 \leq \pm 0.5\%$              |

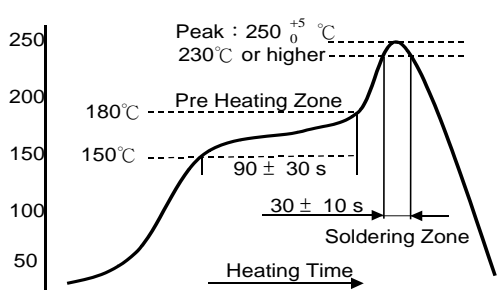
## For Jumper

| Test Item                 | Test Method                | Procedure  | Requirements      |
|---------------------------|----------------------------|--|-------------------|
| Short Time Overload       | JIS C 5201-1 clause 4.13   | 4 times of rated power , 5secs                           | $\leq 0.2m\Omega$ |
| Temperature Cycling       | JIS C 5201-1 clause 4.19   | -55°C to +150°C, 1,000cycles, 15min at each extreme      | $\leq 0.2m\Omega$ |
| High Temperature Exposure | JIS C 5201-1 clause 4.23.2 | 1,000hrs at + 170 °C                                     | $\leq 0.2m\Omega$ |
| Bias Humidity             | JIS C 5201-1 clause 4.24   | 1,000hrs @+85°C/85%RH, 10%Bias 1.5hrs "ON", 0.5hrs "OFF" | $\leq 0.2m\Omega$ |
| Load at Rated Power       | JIS C 5201-1 clause 4.25   | 1,000hrs @70 °C, 1.5hrs "ON", 0.5hrs "OFF"               | $\leq 0.2m\Omega$ |
| Solderability             | JIS C 5201-1 clause 4.17   | 245±5°C for 2±0.5secs                                    | >95% coverage     |

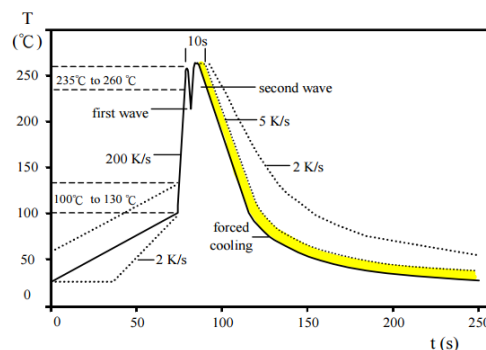
Figure 1



**■ Soldering Profile**

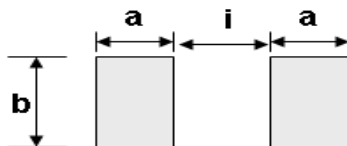


Reflow Soldering



WAVE soldering.

**■ Recommend Land Pattern Design**



**■ Dimension**

Unit: mm

| TYPE               | Resistance Range              | a    | b    | i    |
|--------------------|-------------------------------|------|------|------|
| MA1206 – 0.75W,1W  | Jumper : $\leq 0.2m\Omega$    | 1.00 | 1.90 | 1.40 |
|                    | 1m $\Omega$ ~100m $\Omega$    | 1.60 | 2.18 | 0.66 |
| MA2512 -1W, 2W, 3W | Jumper : $\leq 0.2m\Omega$    | 2.11 | 3.68 | 3.18 |
|                    | 0.5m $\Omega$ ~1.5m $\Omega$  | 3.05 | 3.68 | 1.27 |
|                    | 2m $\Omega$ ~3.5m $\Omega$    | 2.11 | 3.68 | 3.18 |
|                    | 3.6m $\Omega$ ~450m $\Omega$  | 1.90 | 3.68 | 3.50 |
| MA2725 - 4W        | 0.25m $\Omega$ ~0.5m $\Omega$ | 3.18 | 6.86 | 1.32 |
|                    | 1m $\Omega$ ~3m $\Omega$      | 2.34 | 6.86 | 3.00 |
| MA2728 - 4W        | 4m $\Omega$ ~450m $\Omega$    | 2.75 | 7.82 | 3.51 |
| MA4527 – 2W,3W,5W  | 0.5m $\Omega$ ~3m $\Omega$    | 4.50 | 8.74 | 4.50 |
|                    | 3.5m $\Omega$ ~100m $\Omega$  | 3.40 | 8.74 | 6.43 |
|                    | 101m $\Omega$ ~500m $\Omega$  | 2.93 | 8.74 | 7.63 |

**■ Packing Quantity**

| TYPE   | PCS /Reel |
|--------|-----------|
| MA1206 | 5000      |
| MA2512 | 4000      |
| MA2725 | 2000      |
| MA2728 | 2000      |
| MA4527 | 1000      |





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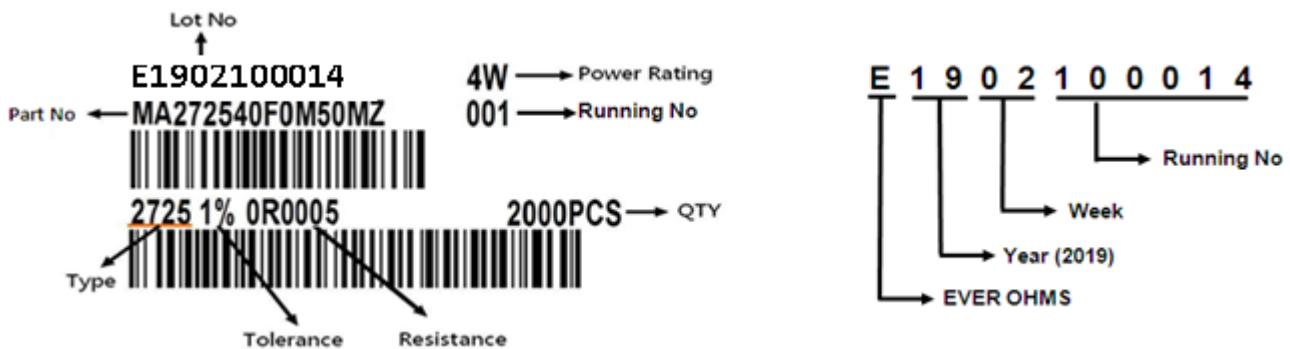
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## ■ Plating Thickness:

Ni:  $\geq 2\mu\text{m}$

Sn(Tin):  $\geq 3\mu\text{m}$

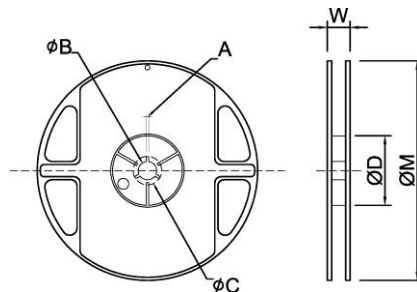
## ■ Label :



## ■ Appendix For SMD Chip Resistor

### ● Packaging Information

#### ■ Reel Dimensions

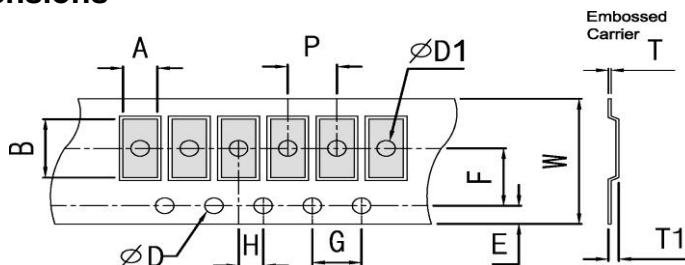


#### ■ Dimension

Unit: mm

| Reel Type / Tape                          | A             | $\phi B$       | $\phi C$       | $\phi D$       | W              | $\phi M$      |
|---|---------------|----------------|----------------|----------------|----------------|---------------|
| 7" reel for 8 mm embossed<br>(for MA1206) | 2.0 $\pm$ 0.5 | 13.2 $\pm$ 0.5 | 17.7 $\pm$ 0.5 | 60.0 $\pm$ 0.5 | 12.0 $\pm$ 0.5 | 178 $\pm$ 1.0 |
| 7" reel for 12 mm embossed                | 2.5 $\pm$ 0.5 | 13.5 $\pm$ 0.5 | 17.7 $\pm$ 0.5 | 60.0 $\pm$ 0.5 | 16.2 $\pm$ 0.5 | 178 $\pm$ 1.0 |
| 7" reel for 24 mm embossed                | 2.0 $\pm$ 0.5 | 13.2 $\pm$ 0.5 | 17.7 $\pm$ 0.5 | 60.0 $\pm$ 0.5 | 24.4 $\pm$ 2.0 | 178 $\pm$ 1.0 |

**■ Embossed Dimensions**



**■ Dimension**

**Unit: mm**

| Item   | W         | P         | E         | F         | $\phi D$                           | $\phi D1$ | G        | H        | A         | Bo        | T1        | T         |
|--------|-----------|-----------|-----------|-----------|------------------------------------|-----------|----------|----------|-----------|-----------|-----------|-----------|
| MA1206 | 8.0±0.30  | 4.0±0.10  | 1.75±0.10 | 3.5±0.10  | 1.50 <sup>+0.1</sup> <sub>-0</sub> | 1.0±0.10  | 4.0±0.10 | 2.0±0.10 | 2.03±0.10 | 3.55±0.10 | 0.70±0.10 | 0.20±0.05 |
| MA2512 | 12.0±0.30 | 4.0±0.10  | 1.75±0.10 | 5.5±0.10  |                                    | 1.55±0.10 | 4.0±0.10 | 2.0±0.10 | 3.50±0.10 | 6.75±0.10 | 0.90±0.10 | 0.20±0.05 |
| MA2725 | 12.0±0.30 | 8.0±0.10  | 1.75±0.10 | 5.5±0.10  |                                    | 1.55±0.10 | 4.0±0.10 | 2.0±0.10 | 6.81±0.10 | 7.16±0.10 | 1.05±0.10 | 0.25±0.05 |
| MA2728 | 12.0±0.30 | 8.0±0.10  | 1.75±0.10 | 5.5±0.10  |                                    | 1.55±0.10 | 4.0±0.10 | 2.0±0.10 | 7.10±0.10 | 7.05±0.10 | 0.95±0.10 | 0.20±0.05 |
| MA4527 | 24.0±0.30 | 12.0±0.10 | 1.75±0.10 | 11.5±0.10 |                                    | 1.50±0.10 | 4.0±0.10 | 2.0±0.10 | 7.38±0.10 | 12.0±0.10 | 1.05±0.10 | 0.30±0.10 |

**■ Storage Temperature**

Temperature : 25±5°C, Humidity : 60±20%

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[PR2512FKF7W0R004L](#) [RC1005F124CS](#) [RL73K3AR56JTDF](#) [RL7520WT-R001-F](#) [RL7520WT-R009-G](#) [RL7520WT-R020-F](#)  
[RLP73N1ER43JTD](#) [LRC-LR2512LF-01-R820J](#) [WR06X104JGLJ](#) [TL2BR01F](#) [65709-330](#) [SP1R12J](#) [RL7520WT-R039-G](#) [RL7520WT-R002-F](#)  
[LRF2010-R003JW](#) [KRL1632E-C-R200-F-T5](#) [KRL1632E-C-R200-F-T1](#) [Y14880R02000B9R](#) [RLP73M1ER051FTDF](#) [RLP73M2AR051FTDF](#)  
[RLP73M2AR075FTDF](#) [RLP73M1JR051FTDF](#) [RLP73N1JR47FTDF](#) [SR731ERTTP5R10F](#) [SR731ERTTP100J](#) [SR731ERTTP6R80F](#)  
[SR731ERTTP4R70F](#) [SR731ERTTP2R20F](#) [SR731ERTTP3R90F](#) [SR731ERTTP1R00F](#) [SR731ERTTP10R0F](#) [SR731ERTTP2R00F](#)  
[SR731ERTTP8R20F](#) [SR731ERTTP3R9J](#) [SR731ERTTP8R2J](#) [SR731ERTTP2R0J](#) [SR731ERTTP4R7J](#) [SR731ERTTP9R1J](#) [SR731ERTTP1R0J](#)  
[SR731ERTTP2R2J](#) [SR731ERTTP5R1J](#) [SR731ERTTP6R8J](#) [SR731ERTTP9R10F](#)