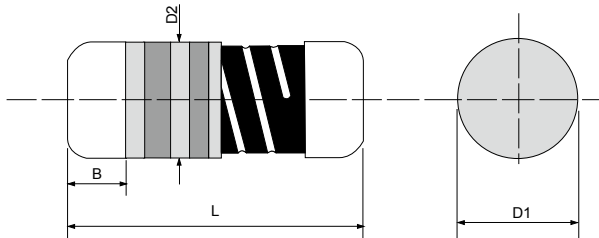


# MM102 Metal Film MELF Resistor

Quality • Reliability  
Cost-Down via Innovation

MM102



## Specifications Per

- IEC 60115-1
- EN140401-803

## Features

- SMD enabled structure
- Excellent solderability termination
- Products meet RoHS requirements and do not contain substances of very high concern identified by European Chemicals Agency

## DIMENSIONS

| Type  | Body Length (L, mm) | Cap Diameter (D1, mm) | Body Diameter (D2, mm) | Soldering spot (B, mm) | Net Weight Per 1000 pcs |
|-------|---------------------|-----------------------|------------------------|------------------------|-------------------------|
| MM102 | 2.1 ± 0.1           | 1.1 ± 0.1             | D1+0.02/-0.1           | 0.5 Min.               | 7 grams                 |

## GENERAL SPECIFICATIONS

| Type  | Power Rating at 70°C | Maximum Working Voltage | Maximum Overload Voltage | Minimum Resistance | Maximum Resistance | Resistance Tolerance | Available Resistance Value |
|-------|----------------------|-------------------------|--------------------------|--------------------|--------------------|----------------------|----------------------------|
| MM102 | 0.2W                 | 150V                    | 300V                     | 0Ω, 10Ω            | 221KΩ              | ±0.5%                | E-192                      |
|       |                      |                         |                          | 0.22Ω              | 2.2MΩ              | ±1%~±5%              | E-24 / E-96                |

Special sizes and specifications available on request.

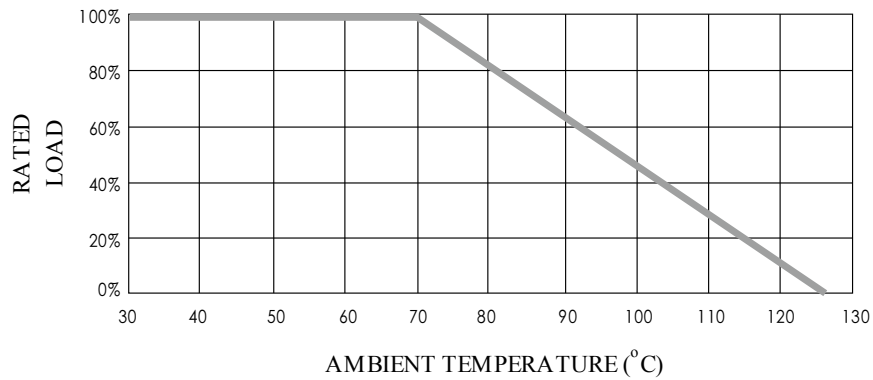
## PART NUMBER

Example: MM102F162RTKRTR3K0

| MM102 | F                                      | 162R  | TKR  | TR3K0   |
|-------|--|---|--|---|
| Type  | Tolerance*                             | Resistance  | TCR  | Packaging   |
|       | D (0.5%)<br>F (1%)<br>G (2%)<br>J (5%) | 162Ω<br><b>4-character code</b><br>containing -<br>3 significant digits<br>1 letter multiplier<br><br><u>OHM MULTIPLIER</u><br>R = 1<br>K = 10 <sup>3</sup><br>M = 10 <sup>6</sup><br>G = 10 <sup>9</sup> | 50ppm<br><b>3-character code</b><br><br>Insert the corresponding Code for the temperature coefficient available for the specific product.<br><br>TKQ = ±25PPM<br>TKR = ±50PPM<br>TKS = ±100PPM | <b>5-character code</b><br>TR=Tape Reel<br><br><u>MM102</u><br>3K0 = 3,000<br>6K0 = 6,000<br>10K = 10,000 |

\* May not be applicable to all product types or to all resistance values. Please check with us before placing order.

## ■ POWER DERATING CURVE

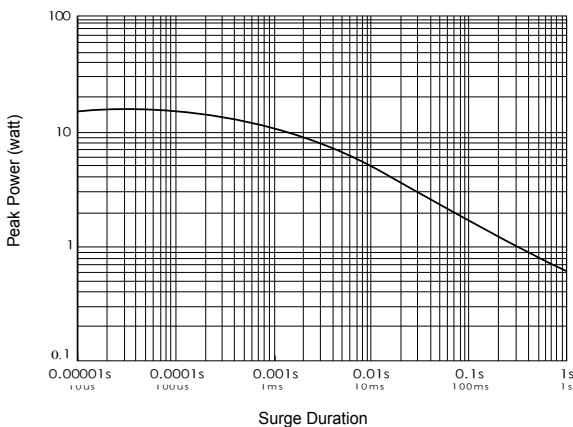


## ■ TECHNICAL SUMMARY

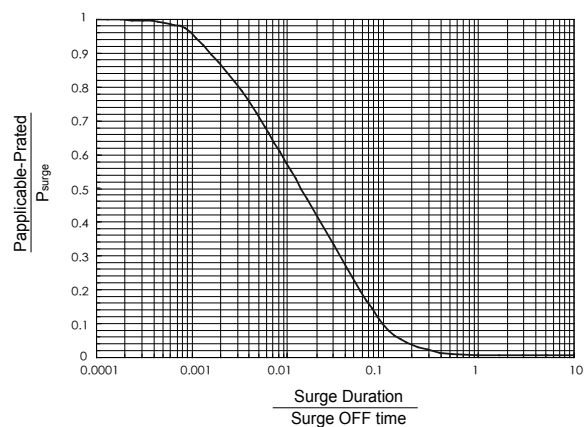
| Characteristics   | Limits           |                |
|---|------------------|----------------|
| Operating Temperature Range, °C   | -55 ~ +125       |                |
| Temperature Coefficient, PPM / °C*  | ±1%, ±2%         | ±25, ±50, ±100 |
|   | ±5%              | ±100           |
| Dielectric Withstanding Voltage, VAC or DC                                  | 150              |                |
| Insulation Resistance, MΩ   | >10 <sup>4</sup> |                |
| Tin Whisker (JESD201 Temperature Cycling & High Temp./Humidity Storage), μm | <5               |                |

\* Not applicable to all resistance values. Please check with us regarding the PPM of specific resistance value(s).

## ■ SINGLE SURGE PERFORMANCE



## ■ SURGE POWER DERATING CURVE



### Notes:

• SINGLE SURGE PERFORMANCE graph is good for NON REPETITIVE applications operating in an ambient temperature of 70°C or less. For temperatures above 70°C, the graph power must be derated further linearly down to zero at 125°C.

• To determine applicable surge power in continuous-surge applications:

1. Identify allowable duration and peak power P<sub>surge</sub> of single surge;
2. Determine ratio of surge duration/surge OFF time in application;
3. Calculate P<sub>applicable</sub> backwardly according to Y-axis of SURGE POWER DERATING CURVE.

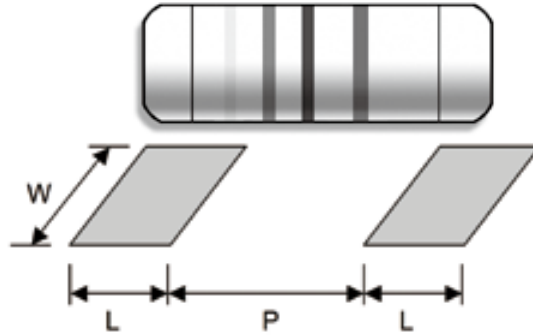
### ■ PERFORMANCE SPECIFICATIONS

| Characteristics                            | Test Conditions   | Limits               |                       |
|--|---|----------------------|-----------------------|
|  |   |                      |                       |
| Short Time Overload                        | <b>IEC 60115-1 4.13</b><br>5 seconds 2.5x rated voltage (not over max. overload voltage)  | 0.22Ω to 221KΩ       | ± 0.5%                |
|  |   | >221KΩ               | ± 0.75%               |
| Load Life                                  | <b>IEC 60115-1 4.25.1</b><br>Rated load (not over max. working voltage) 1,000 hours with 1.5 hours ON, 0.5 hours OFF, at (70±2)°C   | 0.22Ω to 100Ω        | ± 5%                  |
|  |   | >100Ω to 221KΩ       | ± 2.5%                |
|  |   | >221KΩ               | ± 3.0%                |
| Load Life In Humidity                      | <b>IEC 60115-1 4.24</b><br>56 days rated load (not over max. working voltage) at (40±2)°C and (93±3)% relative humidity   | 0.22Ω to 100Ω        | ± 5%                  |
|  |   | >100Ω                | ± 2.5%                |
| Load Life In Humidity (accelerated mode)   | <b>IEC 60115-1 4.37</b><br>1,000 hours at 85°C and 85% relative humidity with 0.1x rated voltage (not over 100V)  | 0.22Ω to 100Ω        | ± 5%                  |
|  |   | >100Ω to 221KΩ       | ± 3.5%                |
|  |   | >221KΩ               | ± 5%                  |
| Periodic Electric Overload                 | <b>IEC 60115-1 4.39</b><br>3.9x rated voltage (not over max. overload voltage) with 0.1s ON, 2.5s OFF for 1,000 cycles  | ± 1.5%               |                       |
| Resistance To Soldering Heat               | <b>IEC 60115-1 4.18.2</b><br>Dip the resistor into a solder bath measured (260±5)°C and hold it for a 10±1 seconds  | 0.22Ω to 100Ω        | ± 2.5%                |
|  |   | >100Ω                | ± 0.5%                |
| Thermal Endurance                          | <b>IEC 60115-1 4.25.3</b><br>1,000 hours at without load  | 125°C                | 0.22Ω to 100Ω ± 5.0%  |
|  |   |                      | >100Ω to 221KΩ ± 1.5% |
|  |   |                      | >221KΩ ± 2.0%         |
| Thermal Shock                              | <b>IEC 60115-1 4.19</b><br>-55°C 30minutes, +125°C 30minutes  | 5 cycles             | ±0.5%                 |
|  |   | 1,000 cycles         | ±2.0%                 |
| Single pulse high voltage overload         | <b>IEC 60115-1 4.27</b><br>• 5 pulses of 1.2/50μs at 10x rated voltage (not over max. overload voltage) with interval of 12 sec.<br>• 10 pulses of 10/700μs at 10x rated voltage (not over max. overload voltage) with interval of 60 sec.  | ± 1.0%               |                       |
|  |   | ± 1.0%               |                       |
| Electrostatic discharge (Human body model) | <b>IEC 60115-1 4.38</b><br>3 positive & 3 negative discharges with 1.5KV<br>(For continuous surge application please see Surge Performance paragraph)   | ± 1.0%               |                       |
| Climatic test                              | <b>IEC 60115-1 4.23</b><br>4.23.2 - dry heat: 16 hours 125°C<br>4.23.3 - damp heat: 24 hours 55°C with 95% relative humidity<br>4.23.4 - cold: 2 hours -55°C<br>4.23.5 - negative air pressure: 2 hour 8.5KPa at (25±10)°C<br>4.23.6 - damp heat cyclic: 5 days 55°C with 95% relative humidity<br>4.23.7 - DC load: rated voltage at -55°C and 125°C each 1 Min. | ± 2.0%               |                       |
| Solderability                              | <b>IEC 60115-1 4.17.2</b><br>Solder area covered after (235±3)°C/(2±0.2) seconds with flux applied  | 95% min. coverage    |                       |
| Vibration                                  | <b>IEC 60115-1 4.22</b><br>Six hours in each parallel and axial direction with a simple harmonic motion having an amplitude of 1.52mm and 10 to 2,000 Hz.   | ±1.0%                |                       |
| Bending test                               | <b>IEC 60115-1 4.33</b><br>Pressing depth 2mm, 3 times  | ± 0.25%              |                       |
| Flammability                               | <b>IEC 60115-1 4.35</b><br>Needle flame test 10s  | No burning after 30s |                       |

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■ SUGGESTED PAD LAYOUT

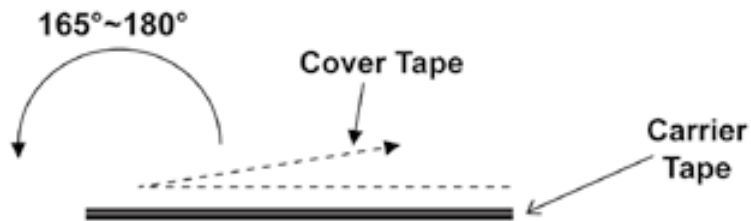


| Type  | Soldering Mode | Pad Length (L, mm, Min.) | Pad Spacing (P, mm) | Pad Width (W, mm, Min.) |
|-------|----------------|--------------------------|---------------------|-------------------------|
| MM102 | Reflow         | 0.8                      | 0.9 ± 0.05          | 1.3                     |
|       | Wave           | 1.2                      | 0.7 ± 0.05          | 1.5                     |

For better heat dissipation / lower heat resistance, increase W & L.

■ COVER TAPE PEELING SPECIFICATION

Recommended peeling force: 50gf±5gf



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