

# Extra - High Power Thick Film Chip Resistor Kit

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**RoHS  
Compliant**

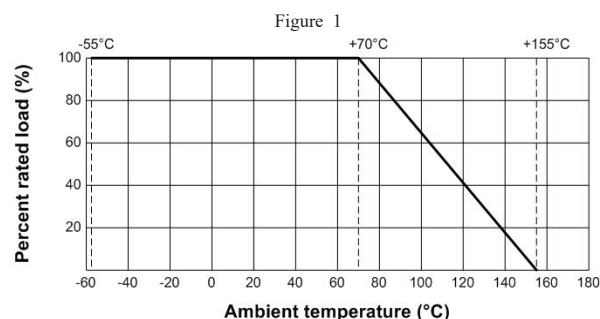
| Type | Power Rating | Resistance tolerance | Nominal Resistance |
|------|--------------|----------------------|--------------------|
| 2512 | 3W           | J                    | 10Ω                |

## Ratings

|                                 |                 |
|---------------------------------|-----------------|
| Power Rating at 70°C            | 3W              |
| Max. Working Voltage            | 250V            |
| Max. Overload Voltage           | 500V            |
| Dielectric Withstanding Voltage | 500V            |
| Temperature Range               | -55°C to +155°C |
| Ambient Temperature             | 70°C            |

## Power Rating Curve

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



**Nominal Resistance** : Effective figures of nominal resistance shall be in accordance with E-24 series

### 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 :

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

Note : Max. Working Voltage or  $\sqrt{P \times R}$  whichever is lesser

Max. Overload Voltage or  $2.5 \sqrt{P \times R}$  whichever is lesser

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)

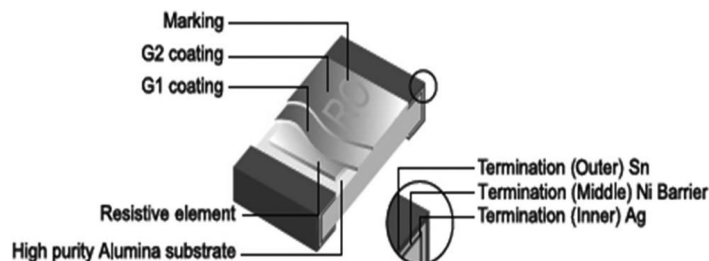
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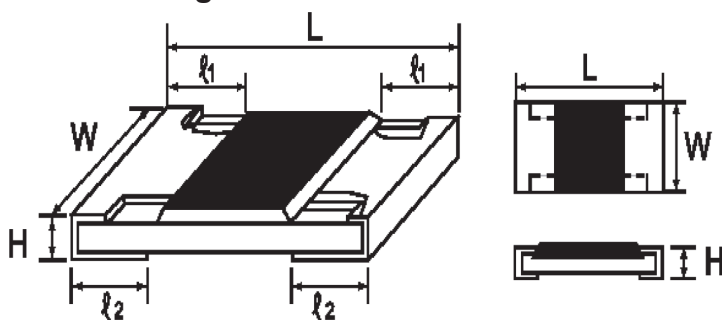
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## Construction



## Power Rating and Dimensions



| Type | Dimension (mm) |              |             |                |               |
|------|----------------|--------------|-------------|----------------|---------------|
|      | L $\pm 0.1$    | W $\pm 0.15$ | H $\pm 0.1$ | $l_1 \pm 0.25$ | $l_2 \pm 0.2$ |
| 2512 | 6.35           | 3.2          | 1.1         | 0.6            | 1.8           |

## Power Rating

| Type | Power Rating at 70°C | Tolerance % | Resistance Range | Standard Series |
|------|----------------------|-------------|------------------|-----------------|
| 2512 | 3W                   | Jumper      | <50mΩ            | -               |
|      |                      | $\pm 5$     | 1Ω to 10mΩ       | E-24            |

## Marking

### Resistors

A. Marking for E-24 series 5% in size: 3 Digits

\*The first 2 digits are significant figures of resistance and the 3th digit denoted number of zeros.

Ex. 

|  |     |  |
|--|-----|--|
|  | 102 |  |
|--|-----|--|

 1KΩ

\*For ohmic values below 10Ω, letter "R" is for decimal point.

Ex. 

|  |     |  |
|--|-----|--|
|  | R68 |  |
|--|-----|--|

 0.68Ω

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## Performance Specifications

| Characteristics                 | Limits                                                                                                         | Test Methods (JIS C 5201-1)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |      |             |      |   |                 |         |   |            |               |   |                  |         |   |            |               |
|---------------------------------|----------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|-------------|------|---|-----------------|---------|---|------------|---------------|---|------------------|---------|---|------------|---------------|
| Dielectric withstanding voltage | No evidence of flashover mechanical damage, arcing or insulation break down                                    | 4.7 Clamped in the trough of a 90°C metallic v-block and shall be tested at ac potential respectively specified in the type for 60-70 seconds                                                                                                                                                                                                                                                                                                                                                                                                                           |      |             |      |   |                 |         |   |            |               |   |                  |         |   |            |               |
| Temperature Coefficient         | 1Ω to 10Ω $\leq \pm 200$ PPM/°C<br>10.1Ω to 10mΩ $\leq \pm 100$ PPM/°C                                         | 4.8 Natural resistance change per temp. degree centigrade.<br>$\frac{R2-R1}{R1(t2-t1)} \times 10^6 \text{ (PPM/°C)}$<br>R1: Resistance value at room temperature (T1)<br>R2: Resistance value at room temp. plus 100°C (T2)<br>Test pattern: room temp. (T1), room temp. +100°C (T2)                                                                                                                                                                                                                                                                                    |      |             |      |   |                 |         |   |            |               |   |                  |         |   |            |               |
| Short time overload             | Resistance change rate is $\pm (2\% + 0.1\Omega)$ Max.                                                         | 4.13 Permanent resistance change after the application of a potential of 2.5 times RCWV for 5 seconds                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |      |             |      |   |                 |         |   |            |               |   |                  |         |   |            |               |
| Soldering temp. Reference       | Electrical characteristics shall be satisfied. Without distinct deformation in appearance. (95% coverage Min.) | <p><b>Wave soldering condition:</b> (2 cycles Max.)<br/>Pre-heat : 100°C to 120°C, 30 <math>\pm</math> 5 sec.<br/><b>Suggestion solder temp.:</b> 235°C to 255°C, 10 sec. (Max.)<br/><b>Peak temp.:</b> 260°C</p> <p><b>Reflow soldering condition:</b> (2 cycles Max.)<br/>Pre-heat : 150°C to 180°C, 90°C to 120 sec.<br/><b>Suggestion solder temp.:</b> 235°C to 255°C, 20 to 40 sec.<br/><b>Peak temp.:</b> 260°C</p> <p>Hand soldering condition:<br/>The soldering iron tip temperature should be less than 300°C and maximum contract time should be 5 sec.</p> |      |             |      |   |                 |         |   |            |               |   |                  |         |   |            |               |
| Soldering heat                  | Resistance change rate is: $\pm (1\% + 0.05\Omega)$ Max.                                                       | 4.18 Dip the resistor into a solder bath having a temperature of 260°C $\pm$ 3°C and hold it for 10 $\pm$ 1 seconds.                                                                                                                                                                                                                                                                                                                                                                                                                                                    |      |             |      |   |                 |         |   |            |               |   |                  |         |   |            |               |
| Temperature cycling             | Resistance change rate is $\pm (1\% + 0.1\Omega)$ Max.                                                         | <p>4.19 Resistance change after continuous 5 cycles for duty cycle specified below :</p> <table border="1"> <thead> <tr> <th>Step</th><th>Temperature</th><th>Time</th></tr> </thead> <tbody> <tr> <td>1</td><td>-55°C <math>\pm</math> 3°C</td><td>30 mins</td></tr> <tr> <td>2</td><td>Room temp.</td><td>10 to 15 mins</td></tr> <tr> <td>3</td><td>+155°C <math>\pm</math> 2°C</td><td>30 mins</td></tr> <tr> <td>4</td><td>Room temp.</td><td>10 to 15 mins</td></tr> </tbody> </table>                                                                            | Step | Temperature | Time | 1 | -55°C $\pm$ 3°C | 30 mins | 2 | Room temp. | 10 to 15 mins | 3 | +155°C $\pm$ 2°C | 30 mins | 4 | Room temp. | 10 to 15 mins |
| Step                            | Temperature                                                                                                    | Time                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |      |             |      |   |                 |         |   |            |               |   |                  |         |   |            |               |
| 1                               | -55°C $\pm$ 3°C                                                                                                | 30 mins                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |      |             |      |   |                 |         |   |            |               |   |                  |         |   |            |               |
| 2                               | Room temp.                                                                                                     | 10 to 15 mins                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |      |             |      |   |                 |         |   |            |               |   |                  |         |   |            |               |
| 3                               | +155°C $\pm$ 2°C                                                                                               | 30 mins                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |      |             |      |   |                 |         |   |            |               |   |                  |         |   |            |               |
| 4                               | Room temp.                                                                                                     | 10 to 15 mins                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |      |             |      |   |                 |         |   |            |               |   |                  |         |   |            |               |

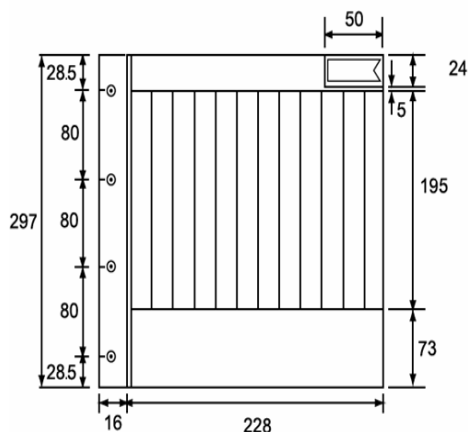
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| Characteristics       | Limits                                                  | Test Methods<br>(JIS C 5201-1)                                                                                                                                                                    |
|-----------------------|---------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Humidity              | Resistance change rate is $\pm (3\% + 0.1\Omega)$ Max.  | 4.24 Temporary resistance change after 240 hours exposure in a humidity test chamber controlled at $40\pm 2^{\circ}\text{C}$ and 90-95% relative humidity                                         |
| Load life in humidity | Resistance change rate is $\pm (3\% + 0.1\Omega)$ Max.  | 7.9 Resistance change after 1,000 hours (1.5 hours "on", 0.5 hour "off" ) at RCWV in a humidity chamber controlled at $40^{\circ}\text{C} \pm 2^{\circ}\text{C}$ and 90 to 95 % relative humidity |
| Load Life             | Resistance change rate is $\pm (3\% + 0.1\Omega)$ Max.  | 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 $70^{\circ}\text{C} \pm 2^{\circ}\text{C}$ ambient                   |
| Terminal bending      | Resistance change rate is $\pm (1\% + 0.05\Omega)$ Max. | 4.33 Twist of Test Board :<br>Y/X = 3/90 mm for 60 seconds                                                                                                                                        |

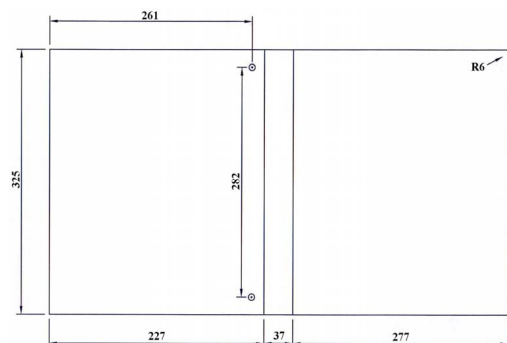
## Kit Resistors

Insert for Chip Kit



## Album for Chip Kit

\* Green Album



Dimensions : Millimetres

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## Storage Condition

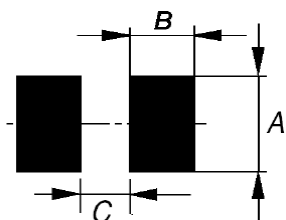
The performance of these products, including the solderability, is guaranteed for a year from the date of arrival at the company, provided that they remain packed as they were when delivered and stored at a temperature of  $25^{\circ}\text{C} \pm 10^{\circ}\text{C}$  and a relative humidity of  $60\%\text{RH} \pm 10\%\text{RH}$ , chemical and dust free atmosphere

Even within the above guarantee periods, do not store these products in the following conditions.

Otherwise, their electrical performance and/or solderability may be deteriorated, and the packaging materials (e.g. taping materials) may be deformed or deteriorated, resulting in mounting failures.

1. In salty air or in air with a high concentration of corrosive gas, such as  $\text{Cl}_2$ ,  $\text{H}_2\text{S}$ ,  $\text{NH}_3$ ,  $\text{SO}_2$ , or  $\text{NO}_2$
2. In direct sunlight

## Recommended Solder Pad



| A     | B     | C     |
|-------|-------|-------|
| 3.7mm | 2.8mm | 2.7mm |

4 layers PCB specification:

- 1) Outside 2 layers (Top and Bottom) with copper foil thickness at 2oz.
- 2) Inside 2 layers (Middle layers) with copper foil thickness at 4 oz.

**Product : Kit  $\pm 5\%$**

**E24 Series = 92 values (0R/1R to 10M)**

**(With resistor 1 strip per value)**

**Total Qty: 9200pcs.)**

| No. | Value |
|-----|-------|
| 1   | 0R    |
| 2   | 1R    |
| 3   | 1R2   |
| 4   | 1R5   |
| 5   | 1R8   |
| 6   | 2R2   |
| 7   | 2R7   |
| 8   | 3R3   |
| 9   | 3R9   |
| 10  | 4R7   |
| 11  | 5R1   |
| 12  | 5R6   |
| 13  | 6R8   |

| No. | Value |
|-----|-------|
| 14  | 8R2   |
| 15  | 10R   |
| 16  | 12R   |
| 17  | 15R   |
| 18  | 18R   |
| 19  | 22R   |
| 20  | 24R   |
| 21  | 27R   |
| 22  | 33R   |
| 23  | 39R   |
| 24  | 47R   |
| 25  | 56R   |
| 26  | 68R   |

| No. | Value |
|-----|-------|
| 27  | 82R   |
| 28  | 100R  |
| 29  | 120R  |
| 30  | 150R  |
| 31  | 180R  |
| 32  | 200R  |
| 33  | 220R  |
| 34  | 270R  |
| 35  | 300R  |
| 36  | 330R  |
| 37  | 390R  |
| 38  | 470R  |
| 39  | 560R  |

| No. | Value |
|-----|-------|
| 40  | 680R  |
| 41  | 750R  |
| 42  | 820R  |
| 43  | 1K    |
| 44  | 1K2   |
| 45  | 1K5   |
| 46  | 1K8   |
| 47  | 2K2   |
| 48  | 2K7   |
| 49  | 3K3   |
| 50  | 3K9   |
| 51  | 4K7   |
| 52  | 5K6   |

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| No. | Value |
|-----|-------|
| 53  | 6K8   |
| 54  | 8K2   |
| 55  | 10K   |
| 56  | 12K   |
| 57  | 15K   |
| 58  | 16K   |
| 59  | 18K   |
| 60  | 22K   |
| 61  | 27K   |
| 62  | 33K   |

| No. | Value |
|-----|-------|
| 63  | 39K   |
| 64  | 47K   |
| 65  | 56K   |
| 66  | 68K   |
| 67  | 82K   |
| 68  | 100K  |
| 69  | 120K  |
| 70  | 150K  |
| 71  | 180K  |
| 72  | 220K  |

| No. | Value |
|-----|-------|
| 73  | 270K  |
| 74  | 330K  |
| 75  | 390K  |
| 76  | 470K  |
| 77  | 560K  |
| 78  | 680K  |
| 79  | 820K  |
| 80  | 1M    |
| 81  | 1M2   |
| 82  | 1M5   |

| No. | Value |
|-----|-------|
| 83  | 1M8   |
| 84  | 2M2   |
| 85  | 2M7   |
| 86  | 3M3   |
| 87  | 3M9   |
| 88  | 4M7   |
| 89  | 5M6   |
| 90  | 6M8   |
| 91  | 8M2   |
| 92  | 10M   |

## Part Number Table

| Description                                               | Part Number |
|-----------------------------------------------------------|-------------|
| Chip Resistor Kit, 3W, 5%, 1R to 10M, E24, 2512, 4300 Pcs | MP002931    |

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