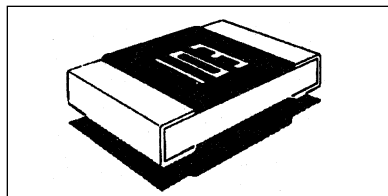


### Thick Film Chip Resistors - RM Series



"Fixed Chip Resistors" manufactured for more compact electronic components and automatic mounting system.

These Chip Resistors have electrical stability and mechanical stress due to used reliable metal glazed paste printed on Alumina substrate. Resistors will reduce your cost and save developmental time.

### FEATURES

1. Very small, thin and light weight.
2. Both flow soldering and reflow soldering are applicable.
3. Owing to the reduced lead inductance, the high frequency characteristic is excellent.
4. Suitable size and packaging for surface mount assembly.

### PART NUMBERING

(EX) 0805 1 /10 watt 5% 10ohm

| RM | 10 | J | 100 | CT |
|----|----|---|-----|----|
| 1  | 2  | 3 | 4   | 5  |

**1. Code Designation:** Thick Film Chip Resistors

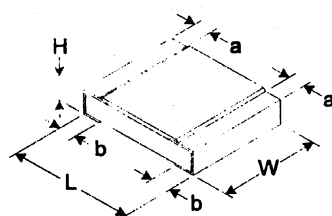
**2. Dimensions:** RM04 1.0x.5mm; RM06 1.6x.8mm;  
 RM10 2.0x1.25mm; RM12 3.2x1.6mm  
 RM14 3.2x2.65mm; RM20 5.0x2.5mm;  
 RM25 6.3x3.1 mm

**3. Resistance Tolerance:** F:  $\pm 1\%$ ; J:  $\pm 5\%$

**4. Nominal Resistance:** 5% - 3 Digit  
 1st 2 significant 3rd  
 is multiplier (10x)  
 1% - 4 digit  
 1st 3 significant  
 4th multiplier (10x)  
 0000 = jumper "0" ohm

**5. Packaging:** Bulk packaging: BP  
 Tape packaging: CT

## Thick Film Chip Resistors



### PERFORMANCE CHARACTERISTICS (TESTED PER MIL-STD-202)

| Type | Package Size | Power Rating (Watts)     | Maximum Working Voltage | Maximum Overload Voltage | Resistance Temperature Coefficient                   | Resistance Range                                                 | Tolerance                | Current Rating of Jumper <sup>3</sup> |
|------|--------------|--------------------------|-------------------------|--------------------------|------------------------------------------------------|------------------------------------------------------------------|--------------------------|---------------------------------------|
| RM04 | 0402         | 1/16 @ 70°C              | 50V                     | 100V                     | ±250ppm/°C<br>±200ppm/°C<br>±200ppm/°C               | 2.2Ω - 9.1Ω<br>10Ω - 3.3M<br>10Ω - 1M                            | ±5%<br>±5%<br>±1%        | 1A max.                               |
| RM06 | 0603         | 1/16 @ 70°C              | 50V                     | 100V                     | ±500ppm/°C<br>±500ppm/°C<br>±200ppm/°C<br>±100ppm/°C | 1.0Ω - 9.1Ω<br>1.1M - 5.6M<br>10Ω - 1M<br>10Ω - 1M               | ±5%<br>±5%<br>±5%<br>±1% | 1A max.                               |
| RM10 | 0805         | 1/10 <sup>1</sup> @ 70°C | 150V                    | 300V                     | ±500ppm/°C<br>±500ppm/°C<br>±200ppm/°C<br>±100ppm/°C | 1.0Ω - 9.1Ω<br>1.1M - 10M<br>10Ω - 1M<br>10Ω - 1M                | ±5%<br>±5%<br>±5%<br>±1% | 2A max.                               |
| RM12 | 1206         | 1/8 <sup>2</sup> @ 70°C  | 200V                    | 400V                     | ±500ppm/°C<br>±500ppm/°C<br>±200ppm/°C<br>±100ppm/°C | 1.0Ω - 9.1Ω<br>1.1M - 10M<br>10Ω - 1M<br>10Ω - 1M                | ±5%<br>±5%<br>±5%<br>±1% | 2A max.                               |
| RM14 | 1210         | 1/4 @ 70°C               | 200V                    | 400V                     | ±500ppm/°C<br>±500ppm/°C<br>±200ppm/°C<br>±100ppm/°C | 1.0Ω - 1.8Ω <sup>4</sup><br>2.2Ω - 9.1Ω<br>10Ω - 10M<br>10Ω - 1M | ±5%<br>±5%<br>±5%<br>±1% | 3A max.                               |
| RM20 | 2010         | 1/2 @ 70°C               | 200V                    | 400V                     | ±500ppm/°C<br>±200ppm/°C<br>±100ppm/°C               | 1.0Ω - 8.2Ω <sup>4</sup><br>10Ω - 1M<br>10Ω - 1M                 | ±5%<br>±5%<br>±1%        | 3A max.                               |
| RM25 | 2512         | 1 @ 70°C                 | 200V                    | 400V                     | ±500ppm/°C<br>±200ppm/°C<br>±100ppm/°C               | 1.0Ω - 8.2Ω <sup>4</sup><br>5.6Ω - 1M<br>47.5Ω - 1M              | ±5%<br>±5%<br>±1%        | 3A max.                               |

### DIMENSIONS

Inches (mm)

| Type | Body Length (L)                   | Body Width (W)                     | Body Height (H)                    | Top Terminator (a)    | Bottom Terminator (b)              |
|------|-----------------------------------|------------------------------------|------------------------------------|-----------------------|------------------------------------|
| RM04 | 0.39±.004/-0.002 (1.0±0.10/-0.05) | .020±.004/-0.002 (0.50±.10/-0.05)  | .014±.002 (.35±0.05)               | .008±.004 (0.20±0.10) | .010±.008/-0.004 (0.25±0.20/-0.10) |
| RM06 | .063±.004 (1.60±0.10)             | .031±.006/-0.002 (0.80±0.15/-0.05) | .018±.004 (0.45±0.10)              | .010±.004 (0.25±0.10) | .012±.008/-0.004 (0.30±0.20/-0.10) |
| RM10 | .078±.008 (2.00±0.20)             | .049±.008 (1.25±0.20)              | .018±.004 (0.45±0.10)              | .016±.008 (0.40±0.20) | .012±.008/-0.004 (0.30±0.20/-0.10) |
| RM12 | .122±.004 (3.10±0.10)             | .061±.004 (1.55±0.10)              | .021±.004/-0.002 (0.55±0.10/-0.05) | .018±.008 (0.45±0.20) | .012±.008/-0.004 (0.30±0.20/-0.10) |
| RM14 | .122±.004 (3.10±0.10)             | .100±.004 (2.55±0.10)              | .021±.004/-0.002 (0.55±0.10/-0.05) | .018±.008 (0.45±0.20) | .012±.008/-0.004 (0.30±0.20/-0.10) |
| RM20 | .197±.008 (5.00±0.20)             | .098±.008 (2.50±0.20)              | .021±.004 (0.55±0.10)              | .020±.008 (0.50±0.20) | .020±.008 (0.50±0.20)              |
| RM25 | .248±.008 (6.30±0.20)             | .124±.008 (3.15±0.20)              | .021±.004 (0.55±0.10)              | .020±.008 (0.50±0.20) | .020±.008 (0.50±0.20)              |

#### Notes

1. RM04 J & F are not marked.
2. RM10 is dual rated at 1/10W, 1/8W.
3. RM12 is dual rated at 1/4W, 1/8W.
4. Zero ohm (0.05Ω max.) jumper available in all sizes.
5. E-12 resistance ranges apply.
6. Higher and lower values available. Consult factory.

## Thick Film Chip Resistors

### MARKING



Resistance value in three digit designation system is marked on the glasscoat. Illustrated is a resistor of 15K $\Omega$ . Four digit resistance designation system is applied to RM12 and E-96 Series. For example, 1502 designated 15K $\Omega$ . (The last digit specifies the number of zeros.)

- For E-24 Series ( $\pm 5\%$ -J,  $\pm 2\%$ -G,  $\pm 10\%$ -K Tolerances) In 0603, 0805, 1206, 1210, 2010 and 2512 sizes:

**3 DIGIT SYSTEM** - First two digits are significant and third digit is multiplier, "R" indicates decimal on values under 10 ohms.

**Examples:** 10R = 10 ohms      102 = 1k ohms  
470 = 47 ohm      103 = 10k ohms  
101 = 100 ohms      104 = 100k ohms  
105 = 1 megohms

- For E-96 Series ( $\pm 1\%$ -F Tolerance)

In 0805, 1206, and 1210 sizes:

**4 DIGIT SYSTEM** - First three digits are significant and fourth digit is multiplier "R" indicates decimal on values under 10 ohms.

**Examples:** 10R0 = 10 ohms      1003 = 100k ohms  
1000 = 100 ohms      1004 = 1 megohms  
1001 = 1k ohms      1052 = 10.5k ohms  
1002 = 10k ohms      2213 = 221k ohms

- For E-96 Series ( $\pm 1\%$ -F Tolerance) in 0603 size

**3 DIGIT SYSTEM.** (Due to space restrictions)

| E-24  |      | E-96  |      |       |      |       |      |       |      |
|-------|------|-------|------|-------|------|-------|------|-------|------|
| Value | Code | Value | Code | Value | Code | Value | Code | Value | Code |
| 100   | 01   | 102   | 02   | 105   | 03   | 107   | 04   |       |      |
| 110   | 05   | 113   | 06   | 115   | 07   | 118   | 08   |       |      |
| 120   | 09   | 124   | 10   | 127   | 11   | 130   | 12   |       |      |
| 130   | 13   | 137   | 14   | 140   | 15   | 143   | 16   |       |      |
| 150   | 17   | 150   | 18   | 154   | 19   | 158   | 20   |       |      |
| 160   | 21   | 165   | 22   | 169   | 23   | 174   | 24   |       |      |
| 180   | 25   | 182   | 26   | 187   | 27   | 191   | 28   |       |      |
| 200   | 29   | 200   | 30   | 205   | 31   | 210   | 32   |       |      |
| 220   | 33   | 221   | 34   | 226   | 35   | 232   | 36   |       |      |
| 240   | 37   | 243   | 38   | 249   | 39   | 255   | 40   |       |      |
| 270   | 41   | 267   | 42   | 274   | 43   | 280   | 44   |       |      |
| 300   | 45   | 294   | 46   | 301   | 47   | 309   | 48   |       |      |
| 330   | 49   | 324   | 50   | 332   | 51   | 340   | 52   |       |      |
| 360   | 53   | 357   | 54   | 365   | 55   | 374   | 56   |       |      |
| 390   | 57   | 392   | 58   | 402   | 59   | 412   | 60   |       |      |
| 430   | 61   | 432   | 62   | 442   | 63   | 453   | 64   |       |      |
| 470   | 65   | 475   | 66   | 487   | 67   | 499   | 68   |       |      |
| 510   | 69   | 523   | 70   | 536   | 71   | 549   | 72   |       |      |
| 560   | 73   | 576   | 74   | 590   | 75   | 604   | 76   |       |      |
| 620   | 77   | 634   | 78   | 649   | 79   | 665   | 80   |       |      |
| 680   | 81   | 698   | 82   | 715   | 83   | 732   | 84   |       |      |
| 750   | 85   | 768   | 86   | 787   | 87   | 806   | 88   |       |      |
| 820   | 89   | 845   | 90   | 866   | 91   | 887   | 92   |       |      |
| 910   | 93   | 931   | 94   | 953   | 95   | 976   | 96   |       |      |

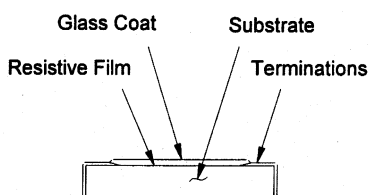
| 5% 3-Digit | 1% 4-Digit |
|------------|------------|
| 0603*      | 0805       |
| 0805       | 1206       |
| 1206       | 1210       |
| 1210       | 2010       |
| 2010       | 2512       |
| 2512       |            |

\*For 1%, a 3-digit alpha-numeric marking system is used.

### PERFORMANCE CHARACTERISTICS

| Items                              | Specifications, Requirement                          | Tested per EIA J-RC-2690A                          | Typical                   |
|------------------------------------|------------------------------------------------------|----------------------------------------------------|---------------------------|
| Moisture Resistance, Thermal Shock | $\pm(1\%+0.05\Omega)$ , No Mechanical Damage         | -55°C to +125°C, 5 cycles                          | Within $\pm 0.2\%$        |
| Low Temperature Exposure           | $\pm(3\%+0.1\Omega)$ , No Mechanical Damage          | -55°C, 1,000 Hours                                 | Within $\pm 0.5\%$        |
| Load Life                          | <1 meg $\pm(3\%+0.1\Omega)$ , $\geq 1$ meg $\pm 5\%$ | 70°C, rated voltage, 1.5hr on/0.5hr off, 1,000 hrs | See Graph                 |
| Load Life in Moisture              | <1 meg $\pm(3\%+0.1\Omega)$ , $\geq 1$ meg $\pm 5\%$ | 40°C, 95% R.H., 1.5hr on/0.5hr off, 1,000 hrs      | See Graph                 |
| Vibration                          | $\pm(1\%+0.05\Omega)$ , No Mechanical Damage         | 10-55 Hz, 3 direction, each 2 hours                | Within $\pm 0.1\%$        |
| Resistance to Soldering Heat       | $\pm(1\%+0.05\Omega)$ , No Mechanical Damage         | 270°C, 10 seconds                                  | See Graph                 |
| Solderability                      | min. 95% coverage                                    | 230°C, 3 seconds, flux applied <sup>1</sup>        | More than 97%             |
| Heat Resistance                    | Adhesion Curing                                      | $\pm(1\%+0.05\Omega)$                              | Within $\pm 0.3\%$        |
|                                    | Dry Heat                                             | $\pm(3\%+0.1\Omega)$ , No Mechanical Damage        | Within $\pm 0.5\%$        |
| Terminal Strength                  | Pull                                                 | $\pm(1\%+0.05\Omega)$ , No Mechanical Damage       | Within $\pm 0.2\%$        |
|                                    | Board Bending                                        | $\pm(1\%+0.05\Omega)$ , No Mechanical Damage       | Within $\pm 0.2\%$        |
| Dielectric Withstanding Voltage    | No Insulation Breakdown                              | 500V, 1 minute                                     | Above 900V                |
| Short Time Overload                | $\pm(1\%+0.05\Omega)$ , No Evidence of Arc           | 2 1/2 times rated voltage, 5 seconds               | Within $\pm 0.4\%$        |
| Insulation Resistance              | 1,000 meg minimum                                    | 500V, 1 minute                                     | Above 10 <sup>6</sup> meg |
| Voltage Coefficient                | +0/-100ppm/V (above 1K $\pm$ )                       | Rated Voltage & 1/10 times rated voltage           | Within -90ppm/V           |

### MATERIALS

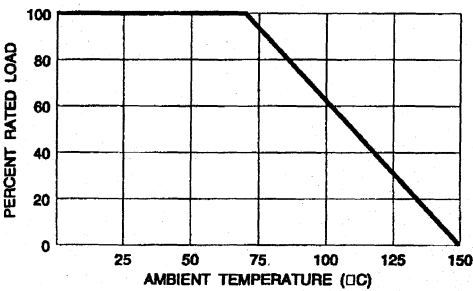


| Feature        | Material                                | Remarks (Reference Only) |
|----------------|-----------------------------------------|--------------------------|
| Substrate      | Alumina Porcelain                       | Purity 90% min.          |
| Resistive Film | Ruthenium-Oxide Film                    | 20 Microns Thick         |
| Coating        | Boro-Silicated Acid Lead Glass          | 20 Microns Thick         |
| Terminations   | 90/10 Tin-Lead (Electrical Plated) over | 3 Microns Thick          |
|                | Nickel (Electrical Plated) over         | 3 Microns Thick          |
|                | AG-PD (Silver Palladium[Glaze Printed]) | 8 Microns Thick          |

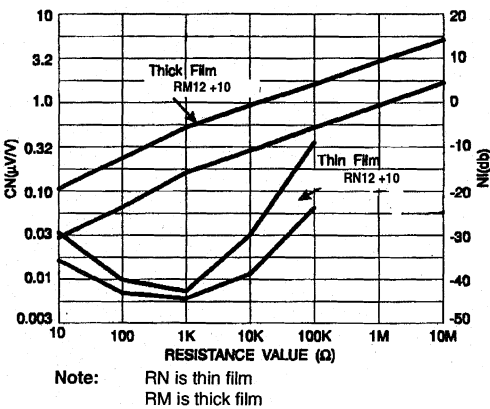
Thick Film Chip Resistors

PERFORMANCE CURVES

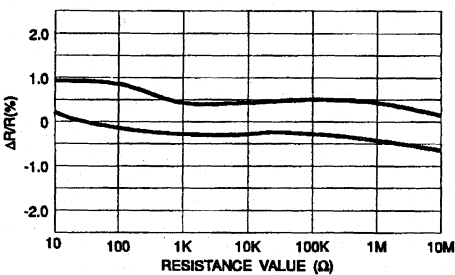
Power - Temperature Derating



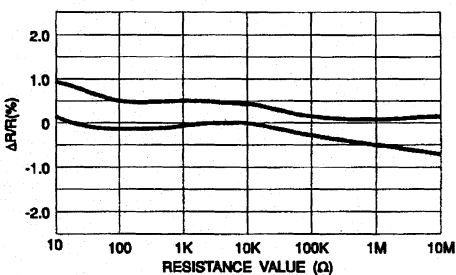
Current Noise



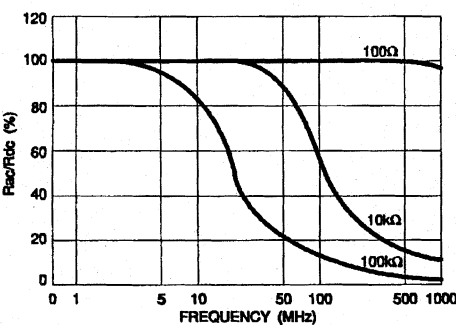
Load Life in Moisture (1,000 hours)



Load Life (1,000 hours)



High Frequency Characteristics



Resistance to Soldering Heat

