

# THICK FILM CHIP RESISTOR

CAL-CHIP ELECTRONICS INC.



CAL-CHIP SERIES: **RM SERIES**



## • INTRODUCTION

**SCOPE** Applies to all sizes of rectangular-type fixed chip resistors with Ruthenium base as material.

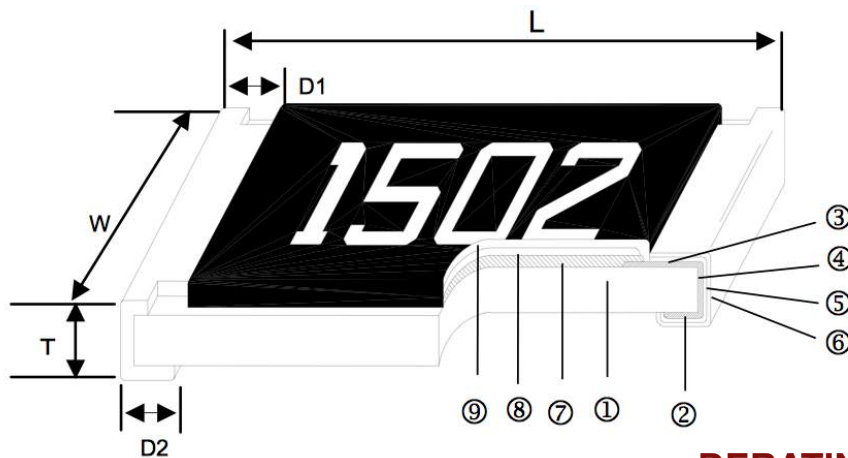
**FEATURES**

- Small size and light weight
- Highly reliable multilayer electrode construction
- Compatible with all soldering process

**APPLICATIONS**

- Telecommunication Equipments
- Radio and Tape Recorders, TV Tuners
- Digital Cameras, Watches, Pocket Calculators
- Computers, Instruments
- Medical and Military Equipment

## • CONSTRUCTION



## • DERATING CURVE

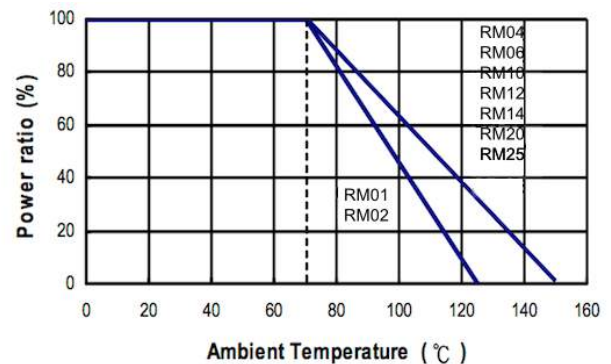


Table 2-2

|   |                       |   |                         |   |                            |
|---|-----------------------|---|-------------------------|---|----------------------------|
| 1 | Alumina Substrate     | 4 | Edge Electrode (NiCr)   | 7 | Resistor Layer             |
| 2 | Bottom Electrode (Ag) | 5 | Barrier Layer (Ni)      | 8 | Primary Overcoat (glass)   |
| 3 | Top Electrode (Ag-Pd) | 6 | External Electrode (Sn) | 9 | Secondary Overcoat (Epoxy) |

## • DIMENSIONS

| Type | Size (Inch) | L (mm)    | W (mm)    | T (mm)    | D1 (mm)   | D2 (mm)   | Weight (g) (1000 pcs) |
|------|-------------|-----------|-----------|-----------|-----------|-----------|-----------------------|
| RM01 | .01005      | 0.40±0.02 | 0.20±0.02 | 0.13±0.02 | 0.10±0.03 | 0.10±0.03 | 0.037                 |
| RM02 | .0201       | 0.60±0.03 | 0.30±0.03 | 0.23±0.03 | 0.15±0.05 | 0.15±0.05 | 0.150                 |
| RM04 | .0402       | 1.00±0.05 | 0.50±0.05 | 0.35±0.05 | 0.20±0.10 | 0.20±0.10 | 0.620                 |
| RM06 | .0603       | 1.60±0.10 | 0.80±0.10 | 0.45±0.10 | 0.30±0.20 | 0.30±0.20 | 2.042                 |
| RM10 | .0805       | 2.00±0.10 | 1.25±0.10 | 0.50±0.10 | 0.35±0.20 | 0.40±0.20 | 4.368                 |
| RM12 | 1206        | 3.10±0.10 | 1.55±0.10 | 0.55±0.10 | 0.50±0.25 | 0.50±0.20 | 8.947                 |
| RM14 | 1210        | 3.10±0.10 | 2.60±0.15 | 0.55±0.10 | 0.50±0.25 | 0.50±0.20 | 15.959                |
| RM15 | 1218        | 3.10±0.10 | 4.6±0.10  | 0.55±0.10 | 0.45±0.20 | 0.40±0.20 | 10.124                |
| RM20 | 2010        | 5.00±0.10 | 2.50±0.15 | 0.55±0.10 | 0.60±0.25 | 0.50±0.20 | 24.241                |
| RM25 | 2512        | 6.34±0.10 | 3.10±0.15 | 0.55±0.10 | 0.60±0.25 | 0.50±0.20 | 39.448                |

## • PART NUMBERING GUIDE

| RM          | 06  | J   | 100  | CT   | -H  |   |
|-------------|---|---|--|--|---|---|
| <b>TYPE</b> | <b>DIMENSIONS</b>   | <b>RESISTANCE TOLERANCE</b>                           | <b>NOMINAL RESISTANCE</b>  | <b>PACKAGING</b>   | <b>FUNCTION CODE</b>  |   |
| RM Series   | 01: 01005<br>02: 0201<br>04: 0402<br>06: 0603<br>10: 0805<br>12: 1206<br>14: 1210<br>15: 1218<br>20: 2010<br>25: 2512 | B: ±0.1%<br>C: ±0.25%<br>D: ±0.5%<br>F: ±1%<br>J: ±5% | 5% - 3 Digit: 1st 2 are significant, 3rd is multiplier (10x), "R" indicates decimal on value <10ohm, 000 jumper "0" ohm<br><br>.1%, .25%, .5%, 1% - 4 digit: 1st 3 are significant, 4th is multiplier (10x), "R" indicates decimal on value <100 ohm | CT: Taping Reel<br><br>01005 to 0402 Reel Sizes: CTD - 20K Reel (optional)<br><br>0603 to 1210 Reel Sizes: CTDK: 10K Reel (optional) | ___: Standard<br>-H: High Power<br>-U: Ultra High Power<br>-X: High Precision | ___: Standard TCR<br><br>50: TCR50 (Optional) |

• STANDARD ELECTRICAL SPECIFICATIONS



| Type / Item  | Power Rating at 70°C Jumper Rated Current | Operating Temp. Range | Max. Operating Voltage | Max. Overload Voltage | Resistance Range |      | TCR (PPM/°C) |
|--------------|---|-----------------------|------------------------|-----------------------|------------------|------|--------------|
|              |   |                       |                        |                       | ±1%              | ±5%  |              |
| RM01 (01005) | 1/32W                                     | -55 ~ + 125°C         | 15V                    | 30V                   | 10Ω - 1MΩ        |      | ±300         |
|              | Jumper: 0.5A                              |                       |                        |                       | 0Ω (<50mΩ)       |      | -            |
| RM02 (0201)  | 1/20W                                     | -55 ~ + 125°C         | 25V                    | 50V                   | 10Ω - 1MΩ        |      | ±200         |
|              | Jumper: 1A                                |                       |                        |                       | 0Ω (<50mΩ)       |      | -            |
| RM04 (0402)  | 1/16W                                     | -55 ~ + 155°C         | 50V                    | 100V                  | 1Ω - 9.76Ω       | ±200 |              |
|              | Jumper: 1A                                |                       |                        |                       | 10Ω - 1MΩ        | ±100 |              |
|              |   |                       |                        |                       | 1.02MΩ - 20MΩ    | ±200 |              |
|              |   |                       |                        |                       | 20.5MΩ - 100MΩ   | ±400 |              |
|              |   |                       |                        |                       | 0Ω (<50mΩ)       | -    |              |
| RM06 (0603)  | 1/10W                                     | -55 ~ + 155°C         | 75V                    | 150V                  | 1Ω - 9.76Ω       | ±200 |              |
|              | Jumper: 1A                                |                       |                        |                       | 10Ω - 1MΩ        | ±100 |              |
|              |   |                       |                        |                       | 1.02MΩ - 20MΩ    | ±200 |              |
|              |   |                       |                        |                       | 20.5MΩ - 100MΩ   | ±400 |              |
|              |   |                       |                        |                       | 0Ω (<50mΩ)       | -    |              |
| RM10 (0805)  | 1/8W                                      | -55 ~ + 155°C         | 150V                   | 300V                  | 1Ω - 9.76Ω       | ±200 |              |
|              | Jumper: 2A                                |                       |                        |                       | 10Ω - 1MΩ        | ±100 |              |
|              |   |                       |                        |                       | 1.02MΩ - 20MΩ    | ±200 |              |
|              |   |                       |                        |                       | 20.5MΩ - 100MΩ   | ±400 |              |
|              |   |                       |                        |                       | 0Ω (<50mΩ)       | -    |              |
| RM12 (1206)  | 1/4W                                      | -55 ~ + 155°C         | 200V                   | 400V                  | 1Ω - 9.76Ω       | ±200 |              |
|              | Jumper: 2A                                |                       |                        |                       | 10Ω - 1MΩ        | ±100 |              |
|              |   |                       |                        |                       | 1.02MΩ - 20MΩ    | ±200 |              |
|              |   |                       |                        |                       | 20.5MΩ - 100MΩ   | ±400 |              |
|              |   |                       |                        |                       | 0Ω (<50mΩ)       | -    |              |
| RM14 (1210)  | 1/3W                                      | -55 ~ + 155°C         | 200V                   | 400V                  | 1Ω - 9.76Ω       | ±200 |              |
|              | Jumper: 2.5A                              |                       |                        |                       | 10Ω - 1MΩ        | ±100 |              |
|              |   |                       |                        |                       | 1.02MΩ - 20MΩ    | ±200 |              |
|              |   |                       |                        |                       | 20.5MΩ - 100MΩ   | ±400 |              |
|              |   |                       |                        |                       | 0Ω (<50mΩ)       | -    |              |
| RM15 (1218)  | 1W  | -55 ~ + 155°C         | 500V                   | 500V                  | 1Ω - 9.76Ω       | ±200 |              |
|              | Jumper: 3.5A                              |                       |                        |                       | 10Ω - 1MΩ        | ±100 |              |
|              |   |                       |                        |                       | 1.02MΩ - 20MΩ    | ±200 |              |
|              |   |                       |                        |                       | 20.5MΩ - 100MΩ   | ±400 |              |
|              |   |                       |                        |                       | 0Ω (<50mΩ)       | -    |              |
| RM20 (2010)  | 3/4W                                      | -55 ~ + 155°C         | 200V                   | 400V                  | 1Ω - 9.76Ω       | ±200 |              |
|              | Jumper: 3.5A                              |                       |                        |                       | 10Ω - 1MΩ        | ±100 |              |
|              |   |                       |                        |                       | 1.02MΩ - 20MΩ    | ±200 |              |
|              |   |                       |                        |                       | 20.5MΩ - 100MΩ   | ±400 |              |
|              |   |                       |                        |                       | 0Ω (<50mΩ)       | -    |              |
| RM25 (2512)  | 1W  | -55 ~ + 155°C         | 250V                   | 500V                  | 1Ω - 9.76Ω       | ±200 |              |
|              | Jumper: 4A                                |                       |                        |                       | 10Ω - 1MΩ        | ±100 |              |
|              |   |                       |                        |                       | 1.02MΩ - 20MΩ    | ±200 |              |
|              |   |                       |                        |                       | 20.5MΩ - 100MΩ   | ±400 |              |
|              |   |                       |                        |                       | 0Ω (<50mΩ)       | -    |              |

## • HIGH PRECISION ELECTRICAL SPECIFICATIONS

| Type / Item | Power Rating at 70°C Jumper Rated Current | Operating Temp. Range | Max. Operating Voltage | Max. Overload Voltage | Resistance Range |              |              | TCR (PPM/°C) |
|-------------|---|-----------------------|------------------------|-----------------------|------------------|--------------|--------------|--------------|
|             |   |                       |                        |                       | ±0.1%            | ±0.25%       | ±0.5%        |              |
| RM04 (0402) | 1/16W                                     | -55 ~ + 155°C         | 50V                    | 100V                  | -                |              | 10Ω - 1MΩ    | ±100         |
|             |   |                       |                        |                       | -                |              | 1.02Ω - 10MΩ | ±200         |
| RM06 (0603) | 1/10W                                     |                       | 75V                    | 150V                  | 10Ω - 1MΩ        |              |              | ±100         |
|             |   |                       |                        |                       | -                | 1.02Ω - 10MΩ |              | ±200         |
| RM10 (0805) | 1/8W                                      |                       | 150V                   | 300V                  | 10Ω - 1MΩ        |              |              | ±100         |
|             |   |                       |                        |                       | -                | 1.02Ω - 10MΩ |              | ±200         |
| RM12 (1206) | 1/4W                                      |                       | 200V                   | 400V                  | 10Ω - 1MΩ        |              |              | ±100         |
|             |   |                       |                        |                       | -                | 1.02Ω - 10MΩ |              | ±200         |
| RM14 (1210) | 1/3W                                      | 200V                  | 400V                   | 10Ω - 1MΩ             |                  |              | ±100         |              |
|             |   |                       |                        | -                     | 1.02Ω - 10MΩ     |              | ±200         |              |
| RM20 (2010) | 3/4W                                      | 200V                  | 400V                   | 10Ω - 1MΩ             |                  |              | ±100         |              |
|             |   |                       |                        | -                     | 1.02Ω - 10MΩ     |              | ±200         |              |
| RM25 (2512) | 1W  | 250V                  | 500V                   | 10Ω - 1MΩ             |                  |              | ±100         |              |
|             |   |                       |                        | -                     | 1.02Ω - 10MΩ     |              | ±200         |              |

## • HIGH POWER & ULTRA HIGH POWER RATING ELECTRICAL SPECIFICATIONS

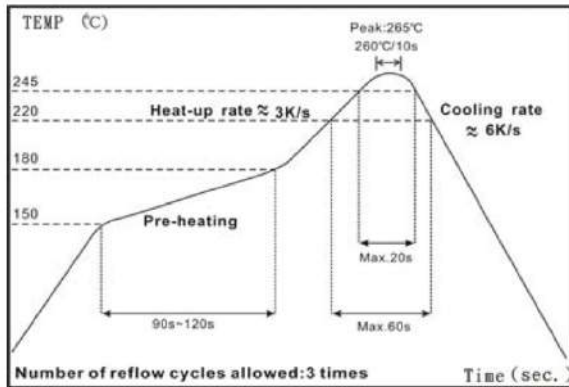
| Type / Item | Power Rating at 70°C Jumper Rated Current | Operating Temp. Range | Max. Operating Voltage | Max. Overload Voltage | Resistance Range         |           | TCR (PPM/°C) |
|-------------|---|-----------------------|------------------------|-----------------------|--------------------------|-----------|--------------|
|             |   |                       |                        |                       | ±1%                      | ±5%       |              |
| RM04 (0402) | 1/10 *1/8W                                | -55 ~ + 155°C         | 50V                    | 100V                  | 10Ω - 9.76Ω<br>10Ω - 1MΩ | ±200 ±100 |              |
| RM06 (0603) | 1/4W                                      |                       | 75V                    | 150V                  |                          |           |              |
| RM10 (0805) | 1/3W                                      |                       | 150V                   | 300V                  |                          |           |              |
| RM12 (1206) | 1/3 *1/2W                                 |                       | 200V                   | 400V                  |                          |           |              |
| RM14 (1210) | 1/2 *3/4W                                 |                       | 200V                   | 400V                  |                          |           |              |
| RM20 (2010) | 3/4 *1W                                   |                       | 200V                   | 400V                  |                          |           |              |
| RM25 (2512) | 2W  |                       | 250V                   | 500V                  |                          |           |              |

Operating Voltage =  $\sqrt{(P \cdot R)}$  or Max. operating voltage listed above, whichever is lower  
 Overload Voltage =  $2.5 \cdot \sqrt{(P \cdot R)}$  or Max. overload voltage listed above, whichever is lower  
 Cal-Chip is capable of manufacturing the optional spec based on customer's requirement

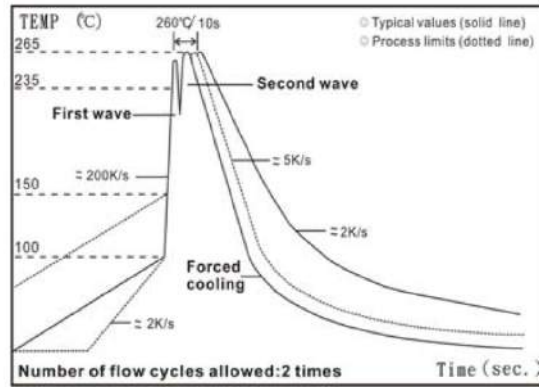
## • TC50 ELECTRICAL SPECIFICATIONS

| Type / Item | Power Rating at 70°C Jumper Rated Current | Operating Temp. Range | Max. Operating Voltage | Max. Overload Voltage | Resistance Range |        |            |     | TCR (PPM/°C) |
|-------------|---|-----------------------|------------------------|-----------------------|------------------|--------|------------|-----|--------------|
|             |   |                       |                        |                       | ±0.1%            | ±0.25% | ±0.5%      | ±1% |              |
| RM04 (0402) | 1/16W                                     | -55 ~ +155°C          | 50V                    | 100V                  | -                |        | 100Ω - 1MΩ |     | ±50          |
| RM06 (0603) | 1/10W                                     |                       | 75V                    | 150V                  | 10Ω - 1MΩ        |        | 10Ω - 10MΩ |     |              |
| RM10 (0805) | 1/8W                                      |                       | 150V                   | 300V                  |                  |        |            |     |              |
| RM12 (1206) | 1/4W                                      |                       | 200V                   | 400V                  |                  |        |            |     |              |
| RM14 (1210) | 1/3W                                      |                       | 200V                   | 400V                  |                  |        |            |     |              |
| RM20 (2010) | 3/4W                                      |                       | 200V                   | 400V                  |                  |        |            |     |              |
| RM25 (2512) | 1W  |                       | 250V                   | 500V                  |                  |        |            |     |              |

## • SOLDERING CONDITION



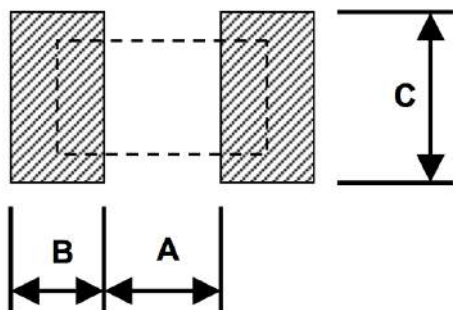
IR Reflow Soldering



Wave Soldering (Flow Soldering)

1. Time of IR Reflow soldering at maximum temperature point 260°C : 10s
2. Time of wave soldering at maximum temperature point 260°C : 10s
3. Time of soldering iron at maximum temperature point 410°C : 5s

## • RECOMMENDED LAND PATTERN



| Type | A (mm) | B (mm) | C (mm) |
|------|--------|--------|--------|
| RM01 | 0.14   | 0.18   | 0.25   |
| RM02 | 0.30   | 0.25   | 0.30   |
| RM04 | 0.50   | 0.45   | 0.60   |
| RM06 | 0.90   | 0.60   | 0.90   |
| RM10 | 1.20   | 0.70   | 1.30   |
| RM12 | 2.00   | 0.90   | 1.60   |
| RM14 | 2.00   | 0.90   | 2.80   |
| RM15 | 2.20   | 1.00   | 4.80   |
| RM20 | 3.80   | 0.90   | 2.80   |
| RM25 | 3.80   | 1.60   | 3.50   |

## • ENVIRONMENTAL CHARACTERISTICS

| Item   | Requirement  |                |        | Test Method   |
|--|--|----------------|--------|---|
|  | ±1% and Below  | ±5%            | Jumper |   |
| Temperature Coefficient of Resistance (T.C.R.) | As Spec.   |                |        | JIS-C-5201-1 4.8<br>IEC-60115-1 4.8<br>-55°C~+125°C, 25°C is the reference temperature  |
| Short Time Overload                            | ±(1.0%+0.05Ω)  | ±(2.0%+0.05Ω)  | <50mΩ  | JIS-C-5201-1 4.13<br>IEC-60115-1 4.13<br>RCWV*2.5 or Max. Overload voltage; whichever is lower for 5 seconds, 2 seconds for high power series |
| Insulation Resistance                          | ≥10G   |                |        | JIS-C-5201-1 4.6<br>IEC-60115-1 4.6<br>Max. Overload voltage for 1 minute   |
| Endurance                                      | ±(1.0%+0.10Ω)  | ±(2.0%+0.10Ω)  | <100mΩ | JIS-C-5201-1 4.25<br>IEC-60115-1 4.25.1<br>70±2°C, RCWV for 1000 hours with 1.5 hrs "ON" and 0.5 hrs "OFF"                                    |
| Damp Heat with Load                            | ±(1.0%+0.10Ω)  | ±(2.0%+0.10Ω)  | <100mΩ | JIS-C-5201-1 4.24<br>IEC-60115-1 4.24<br>40±2°C, 90~95% R.H., RCWV for 1000 hrs with 1.5 hrs "ON" and 0.5 hrs "OFF"                           |
| Dry Heat                                       | ±(1.0%+0.05Ω)  | ±(1.50%+0.05Ω) | <50mΩ  | JIS-C-5201-1 4.23<br>IEC-60115-1 4.23.2<br>at +125/+155°C for 1000 hrs  |
| Bending Strength                               | ±(1.0%+0.05Ω)  | ±(1.00%+0.05Ω) | <50mΩ  | JIS-C-5201-1 4.33<br>IEC-60115-1 4.33<br>Bending once for 5 seconds<br>2010, 2512 sizes: 2mm Other sizes: 3mm                                 |
| Solderability                                  | 95% min. coverage  |                |        | JIS-C-5201-1 4.17<br>IEC-60115-1 4.17<br>245±5°C for 3 seconds  |
| Resistance to Soldering Heat                   | ±(0.5%+0.05Ω)  | ±(1.00%+0.05Ω) | <50mΩ  | JIS-C-5201-1 4.18<br>IEC-60115-1 4.18<br>260±5°C for 10 seconds   |
| Voltage Proof                                  | No breakdown or flashover                                |                |        | JIS-C-5201-1 4.7<br>IEC-60115-1 4.7<br>1.42 times Max. Operating Voltage for 1 minute   |
| Leaching                                       | Individual leaching area ≤5%<br>Total leaching area ≤10% |                |        | JIS-C-5201-1 4.18<br>IEC-60068-2-58 8.2.1<br>260±5°C for 30 seconds   |
| Rapid Change of Temperature                    | ±(0.5%+0.05Ω)  | ±(1.00%+0.05Ω) | <50mΩ  | JIS-C-5201-1 4.19<br>IEC-60115-1 4.19<br>-55°C to +125/+155°C, 5 cycles   |

RCWV (Rated continuous working voltage)= $\sqrt{P \cdot R}$  or Max. Operating voltage whichever is lower.

Storage Temperature: 25±3°C, Humidity < 80%RH

## • MARKING

No marking for 01005, 0201 and 0402

Jumper for all: Letter "0"

1% for 0805 / 1206 / 1210 / 2010 / 2512 : 4 digit marking

Ex:

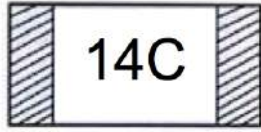
| Resistance | 100Ω | 2.2KΩ | 10KΩ | 49.9KΩ | 100KΩ |
|------------|------|-------|------|--------|-------|
| Marking    | 1000 | 2201  | 1002 | 4992   | 1003  |

## 5% for 0603 / 0805 / 1206 / 1210/ 2010 / 2512 : 3 digit marking in E24

Example: 101 = 100Ω    102 = 1KΩ (1st and 2nd are E24 code and 3rd code is multiplier)

| E24 Code | 10 | 11 | 12 | 13 | 15 | 16 | 18 | 20 | 22 | 24 | 27 | 30 | 33 | 36 | 39 | 43 | 47 | 51 | 56 | 62 | 68 | 75 | 82 | 91 |
|----------|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|
|----------|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|

## 1% for 0603: 3 digit marking in E96



Example: 14C = 13K7Ω  
68B = 4K99Ω

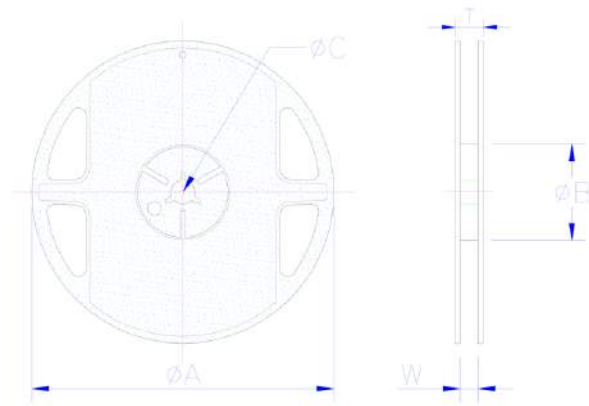
13C = 13K3Ω  
68X = 49.9Ω

Please Note: 1% E24 values will be marked the same as 5% E24

### MARKING TABLE

| Code       | E96 | Code | E96 | Code | E96 | Code | E96 |    |    |
|------------|-----|------|-----|------|-----|------|-----|----|----|
| 01         | 100 | 25   | 178 | 49   | 316 | 73   | 562 |    |    |
| 02         | 102 | 26   | 182 | 50   | 324 | 74   | 576 |    |    |
| 03         | 105 | 27   | 187 | 51   | 332 | 75   | 590 |    |    |
| 04         | 107 | 28   | 191 | 52   | 340 | 76   | 604 |    |    |
| 05         | 110 | 29   | 196 | 53   | 348 | 77   | 619 |    |    |
| 06         | 113 | 30   | 200 | 54   | 357 | 78   | 634 |    |    |
| 07         | 115 | 31   | 205 | 55   | 365 | 79   | 649 |    |    |
| 08         | 118 | 32   | 210 | 56   | 374 | 80   | 665 |    |    |
| 09         | 121 | 33   | 215 | 57   | 383 | 81   | 681 |    |    |
| 10         | 124 | 34   | 221 | 58   | 392 | 82   | 698 |    |    |
| 11         | 127 | 35   | 226 | 59   | 402 | 83   | 715 |    |    |
| 12         | 130 | 36   | 232 | 60   | 412 | 84   | 732 |    |    |
| 13         | 133 | 37   | 237 | 61   | 422 | 85   | 750 |    |    |
| 14         | 137 | 38   | 243 | 62   | 432 | 86   | 768 |    |    |
| 15         | 140 | 39   | 249 | 63   | 442 | 87   | 787 |    |    |
| 16         | 143 | 40   | 255 | 64   | 453 | 88   | 806 |    |    |
| 17         | 147 | 41   | 261 | 65   | 464 | 89   | 825 |    |    |
| 18         | 150 | 42   | 267 | 66   | 475 | 90   | 845 |    |    |
| 19         | 154 | 43   | 274 | 67   | 487 | 91   | 866 |    |    |
| 20         | 158 | 44   | 280 | 68   | 499 | 92   | 887 |    |    |
| 21         | 162 | 45   | 287 | 69   | 511 | 93   | 909 |    |    |
| 22         | 165 | 46   | 294 | 70   | 523 | 94   | 931 |    |    |
| 23         | 169 | 47   | 301 | 71   | 536 | 95   | 952 |    |    |
| 24         | 174 | 48   | 309 | 72   | 549 | 96   | 976 |    |    |
| Code       | A   | B    | C   | D    | E   | F    | G   | X  | Y  |
| Multiplier | 10  | 10   | 10  | 10   | 10  | 10   | 10  | 10 | 10 |

• **PACKAGING**



| Type                         | Packaging Quantity | Tape Width | Reel Diameter | $\Phi A$ (mm) | $\Phi B$ (mm) | $\Phi C$ (mm) | W        | T        |          |
|------------------------------|--------------------|------------|---------------|---------------|---------------|---------------|----------|----------|----------|
| RM01                         | Paper              | 10K        | 8mm           | 7 inch        | 175.5±1.5     | 60            | 13.0±0.2 | 9.0±0.5  | 12.5±0.5 |
|                              |                    | 20K        | 8mm           | 7 inch        | 175.5±1.5     | 60            | 13.0±0.2 | 9.0±0.5  | 12.5±0.5 |
| RM02<br>RM04                 | Paper              | 10K        | 8mm           | 7 inch        | 175.5±1.5     | 60            | 13.0±0.2 | 9.0±0.5  | 12.5±0.5 |
|                              |                    | 15K        | 8mm           | 7 inch        | 175.5±1.5     | 60            | 13.0±0.2 | 9.0±0.5  | 12.5±0.5 |
|                              |                    | 20K        | 8mm           | 10 inch       | 254±10        | 100±0.5       | 13.0±0.2 | 9.0±0.5  | 13.5±0.5 |
| RM06<br>RM10<br>RM12<br>RM14 | Paper              | 5K         | 8mm           | 7 inch        | 175.5±1.5     | 60            | 13.0±0.2 | 9.0±0.5  | 12.5±0.5 |
|                              |                    | 10K        | 8mm           | 10 inch       | 254±1.0       | 100±0.5       | 13.0±0.2 | 9.0±0.5  | 13.5±0.5 |
| RM15<br>RM20<br>RM25         | Embossed           | 4K         | 12mm          | 7 inch        | 178.5±1.5     | 60            | 13.0±0.5 | 13.0±0.5 | 13.5±0.5 |