



# 1% Thick Film Chip Resistors

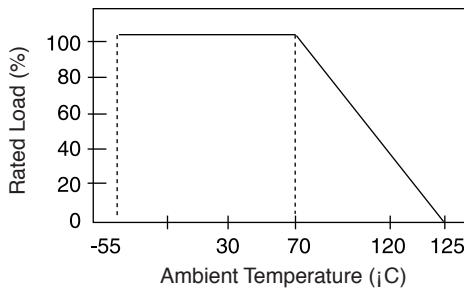
## CR1 Series

### FEATURES

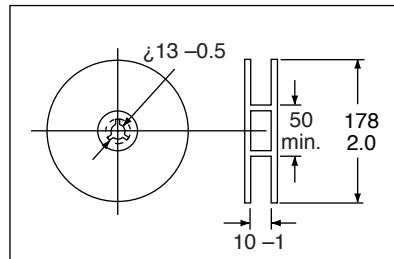
- Temperature Range: -55°C ~ +125°C
- High purity alumina substrate
- Wave or flow solderable
- Excellent high frequency characteristics
- Wrap around termination
- Inner electrode protection



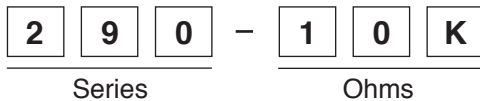
### DERATING CURVE



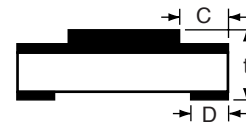
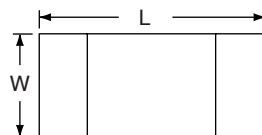
### REEL DIMENSIONS (mm)



### PART NUMBERING SYSTEM



### SERIES, SIZE, WATTAGE, VOLTAGE, AND DIMENSIONS



| Series | Case Size | Power Rating | Voltage (max.) |      | Dimensions (mm) |             |            |            |             |
|--------|-----------|--------------|----------------|------|-----------------|-------------|------------|------------|-------------|
|        |           |              | W.V.           | O.V. | L               | W           | C          | D          | t           |
| 290    | 1206      | 1/8          | 200            | 400  | 3.1 ± 0.15      | 1.55 ± 0.15 | 0.45 ± 0.2 | 0.45 ± 0.2 | 0.55 ± 0.10 |
| 292    | 0805      | 1/10         | 150            | 300  | 2.0 ± 0.15      | 1.25 ± 0.15 | 0.40 ± 0.2 | 0.40 ± 0.2 | 0.55 ± 0.10 |
| 302    | 0603      | 1/10         | 50             | 100  | 1.6 ± 0.10      | 0.8 ± 0.15  | 0.30 ± 0.2 | 0.30 ± 0.2 | 0.45 ± 0.10 |
| 304    | 0402      | 1/16         | 25             | 50   | 1.00 ± 0.1      | 0.5 ± 0.05  | 0.2 ± 0.1  | 0.25 ± 0.1 | 0.35 ± 0.05 |



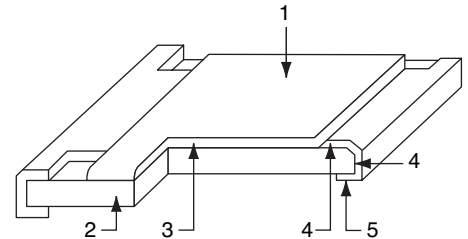
## STANDARD STOCKED VALUES (Ω)

|      |      |      |      |      |     |     |     |       |       |       |       |       |       |       |       |       |       |      |      |      |      |
|------|------|------|------|------|-----|-----|-----|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|------|------|------|------|
| 10   | 16.9 | 28.7 | 48.7 | 82.5 | 140 | 237 | 392 | 665   | 1.13K | 1.91K | 3.16K | 5.36K | 9.09K | 15.4K | 26.1K | 43.2K | 73.2K | 124K | 210K | 348K | 590K |
| 10.2 | 17.4 | 29.4 | 49.9 | 84.5 | 143 | 243 | 402 | 681   | 1.15K | 1.96K | 3.24K | 5.49K | 9.31K | 15.8K | 26.7K | 44.2K | 75K   | 127K | 215K | 357K | 604K |
| 10.5 | 17.8 | 30.1 | 51.1 | 86.6 | 147 | 249 | 412 | 698   | 1.18K | 2.0K  | 3.32K | 5.62K | 9.53K | 16.2K | 27.4K | 45.3K | 76.8K | 130K | 221K | 365K | 619K |
| 10.7 | 18.2 | 30.9 | 52.3 | 88.7 | 150 | 255 | 422 | 715   | 1.21K | 2.05K | 3.4K  | 5.76K | 9.76K | 16.5K | 28K   | 46.4K | 78.7K | 133K | 226K | 374K | 634K |
| 11   | 18.7 | 31.6 | 53.6 | 90.9 | 154 | 261 | 432 | 732   | 1.24K | 2.1K  | 3.48K | 5.9K  | 10K   | 16.9K | 28.7K | 47.5K | 80.6K | 137K | 232K | 383K | 649K |
| 11.3 | 19.1 | 32.4 | 54.9 | 93.1 | 158 | 267 | 442 | 750   | 1.27K | 2.15K | 3.57K | 6.04K | 10.2K | 17.4K | 29.4K | 48.7K | 82.5K | 140K | 237K | 392K | 665K |
| 11.5 | 19.6 | 33.2 | 56.2 | 95.3 | 162 | 274 | 453 | 768   | 1.3K  | 2.21K | 3.65K | 6.19K | 10.5K | 17.8K | 30K   | 49.9K | 84.5K | 143K | 243K | 402K | 681K |
| 11.8 | 20   | 34   | 57.6 | 97.6 | 165 | 280 | 464 | 787   | 1.33K | 2.26K | 3.74K | 6.34K | 10.7K | 18.2K | 30.1K | 51.1K | 86.6K | 147K | 249K | 412K | 698K |
| 12.1 | 20.5 | 34.8 | 59   | 100  | 169 | 287 | 475 | 806   | 1.37K | 2.32K | 3.83K | 6.49K | 11.K  | 18.7K | 30.9K | 52.3K | 88.7K | 150K | 255K | 422K | 715K |
| 12.4 | 21   | 35.7 | 60.4 | 102  | 174 | 294 | 487 | 825   | 1.40K | 2.37K | 3.92K | 6.65K | 11.3K | 19.1K | 31.6K | 53.6K | 90.9K | 154K | 261K | 432K | 732K |
| 12.7 | 21.5 | 36.5 | 61.9 | 105  | 178 | 300 | 499 | 845   | 1.43K | 2.43K | 4.02K | 6.81K | 11.5K | 19.6K | 32.4K | 54.9K | 93.1K | 158K | 267K | 442K | 750K |
| 13   | 22.1 | 37.4 | 63.4 | 107  | 182 | 301 | 511 | 866   | 1.47K | 2.49K | 4.12K | 6.98K | 11.8K | 20K   | 33.2K | 56.2K | 95.3K | 162K | 274K | 453K | 768K |
| 13.3 | 22.6 | 38.3 | 64.9 | 110  | 187 | 309 | 523 | 887   | 1.5K  | 2.55K | 4.22K | 7.15K | 12.1K | 20.5K | 34.K  | 57.6K | 97.6K | 165K | 280K | 464K | 787K |
| 13.7 | 23.2 | 39.2 | 66.5 | 113  | 191 | 316 | 536 | 909   | 1.54K | 2.61K | 4.32K | 7.32K | 12.4K | 21.K  | 34.8K | 59.0K | 100K  | 169K | 287K | 475K | 806K |
| 14   | 23.7 | 40.2 | 68.1 | 115  | 196 | 324 | 549 | 931   | 1.58K | 2.67K | 4.42K | 7.5K  | 12.7K | 21.5K | 35.7K | 60.4K | 102K  | 174K | 294K | 487K | 825K |
| 14.3 | 24.3 | 41.2 | 69.8 | 118  | 200 | 332 | 562 | 953   | 1.62K | 2.74K | 4.53K | 7.68K | 13K   | 22.1K | 36.5K | 61.9K | 105K  | 178K | 300K | 499K | 845K |
| 14.7 | 24.9 | 42.2 | 71.5 | 121  | 205 | 340 | 576 | 976   | 1.65K | 2.8K  | 4.64K | 7.87K | 13.3K | 22.6K | 37.4K | 63.4K | 107K  | 182K | 301K | 511K | 866K |
| 15   | 25.5 | 43.2 | 73.2 | 124  | 210 | 348 | 590 | 1.0K  | 1.69K | 2.87K | 4.75K | 8.06K | 13.7K | 23.2K | 38.3K | 64.9K | 110K  | 187K | 309K | 523K | 887K |
| 15.4 | 26.1 | 44.2 | 75   | 127  | 215 | 357 | 604 | 1.02K | 1.74K | 2.94K | 4.87K | 8.25K | 14.K  | 23.7K | 39.2K | 66.5K | 113K  | 191K | 316K | 536K | 909K |
| 15.8 | 26.7 | 45.3 | 76.8 | 130  | 221 | 365 | 619 | 1.05K | 1.78K | 3.0K  | 4.99K | 8.45K | 14.3K | 24.3K | 40.2K | 68.1K | 115K  | 196K | 324K | 549K | 931K |
| 16.2 | 27.4 | 46.4 | 78.7 | 133  | 226 | 374 | 634 | 1.07K | 1.82K | 3.01K | 5.11K | 8.66K | 14.7K | 24.9K | 41.2K | 69.8K | 118K  | 200K | 332K | 562K | 953K |
| 16.5 | 28   | 47.5 | 80.6 | 137  | 232 | 383 | 649 | 1.1K  | 1.87K | 3.09K | 5.23K | 8.87K | 15K   | 25.5K | 42.2K | 71.5K | 121K  | 205K | 340K | 576K | 976K |

1M

## CONSTRUCTION

| No. | Part Name                                                             |
|-----|-----------------------------------------------------------------------|
| 1   | Protective coating: Epoxy                                             |
| 2   | Al <sub>2</sub> O <sub>3</sub> high purity alumina substrate: Al 96fi |
| 3   | Resistive element: metal film                                         |
| 4   | Termination (Inner): Ag/Pd                                            |
| 5   | Termination (Between): Ni plating film                                |
| 6   | Termination (Outer): Sn plating film                                  |



## CHARACTERISTICS

| Characteristics                 | Limits                                                                      | Test Methods ( JIS C 5201-1 )                                                                                                                                                                                                                                                                                                                |
|---------------------------------|-----------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Temperature coefficient         | 1Ω ~ 10Ω ≤ ±400 PPM / °C<br>11Ω ~ 10MΩ ≤ ±200 PPM / °C                      | 5.2 Natural resistance change per temp. degree centigrade.<br>R <sub>2</sub> -R <sub>1</sub><br>———— x10 <sup>6</sup> (PPM/°C)<br>R <sub>1</sub> (t <sub>2</sub> -t <sub>1</sub> )<br>R <sub>1</sub> : Resistance value at room temperature (t <sub>1</sub> )<br>R <sub>2</sub> : Resistance value at room temp.plus 100°C (t <sub>2</sub> ) |
| Short time overload             | Resistance change rate is ± (2.0 % + 0.1Ω) Max.                             | 5.5 Permanent resistance change after the application of a potential of 2.5 times RCWV for 5 seconds.                                                                                                                                                                                                                                        |
| Insulation resistance           | 1,000M Ω or more                                                            | 5.6 Apply 500V DC between protective coating and termination for 1 minute                                                                                                                                                                                                                                                                    |
| Dielectric withstanding voltage | No evidence of flashover mechanical damage,arcing or insulation break down. | 5.7 Apply 500V AC between protective coating and termination for 1 minute                                                                                                                                                                                                                                                                    |
| Terminal bending                | ±(1.0% +0.05Ω) Max.                                                         | 6.1.4 Twist of Test Board:<br>Y/X=5/90mm for 10 seconds                                                                                                                                                                                                                                                                                      |



# 1% Thick Film Chip Resistors

## CR1 Series

### ■ CHARACTERISTICS (Cont.)

| Characteristics       | Limits                                                                                     | Test Methods ( JIS C 5201-1 )                                                                                                                                                                                                                                                                                                                                                   |                               |             |      |   |                               |         |   |            |            |   |                                |         |   |            |            |
|-----------------------|--------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------|-------------|------|---|-------------------------------|---------|---|------------|------------|---|--------------------------------|---------|---|------------|------------|
| Temperature cycling   | $\pm (1.0\% + 0.05\Omega)$ Max.                                                            | 7.4 Resistance change after continuous 5 cycles for duty shown below:                                                                                                                                                                                                                                                                                                           |                               |             |      |   |                               |         |   |            |            |   |                                |         |   |            |            |
|                       |                                                                                            | <table><tr><th>Step</th><th>Temperature</th><th>Time</th></tr><tr><td>1</td><td>-55°C <math>\pm 3^{\circ}\text{C}</math></td><td>30 mins</td></tr><tr><td>2</td><td>Room temp.</td><td>10~15 mins</td></tr><tr><td>3</td><td>+155°C <math>\pm 2^{\circ}\text{C}</math></td><td>30 mins</td></tr><tr><td>4</td><td>Room temp.</td><td>10~15 mins</td></tr></table>               | Step                          | Temperature | Time | 1 | -55°C $\pm 3^{\circ}\text{C}$ | 30 mins | 2 | Room temp. | 10~15 mins | 3 | +155°C $\pm 2^{\circ}\text{C}$ | 30 mins | 4 | Room temp. | 10~15 mins |
|                       |                                                                                            | Step                                                                                                                                                                                                                                                                                                                                                                            | Temperature                   | Time        |      |   |                               |         |   |            |            |   |                                |         |   |            |            |
|                       |                                                                                            | 1                                                                                                                                                                                                                                                                                                                                                                               | -55°C $\pm 3^{\circ}\text{C}$ | 30 mins     |      |   |                               |         |   |            |            |   |                                |         |   |            |            |
|                       |                                                                                            | 2                                                                                                                                                                                                                                                                                                                                                                               | Room temp.                    | 10~15 mins  |      |   |                               |         |   |            |            |   |                                |         |   |            |            |
| 3                     | +155°C $\pm 2^{\circ}\text{C}$                                                             | 30 mins                                                                                                                                                                                                                                                                                                                                                                         |                               |             |      |   |                               |         |   |            |            |   |                                |         |   |            |            |
| 4                     | Room temp.                                                                                 | 10~15 mins                                                                                                                                                                                                                                                                                                                                                                      |                               |             |      |   |                               |         |   |            |            |   |                                |         |   |            |            |
| Load life in humidity | Resistance change rate is $\pm (3.0\% + 0.1\Omega)$ 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°C $\pm 2^{\circ}\text{C}$ and 90 to 95 % relative humidity                                                                                                                                                                                              |                               |             |      |   |                               |         |   |            |            |   |                                |         |   |            |            |
| Load life             | Resistance change rate is $\pm (3.0\% + 0.1\Omega)$ Max.                                   | 7.10 Permanent resistance change after 1,000 hours operating at RCWV, with duty cycle of ( 1.5 hours "on", 0.5 hour "off" ) at 70°C $\pm 2^{\circ}\text{C}$ ambient                                                                                                                                                                                                             |                               |             |      |   |                               |         |   |            |            |   |                                |         |   |            |            |
| Soldering Heat        | Electrical characteristics shall be satisfied. Without distinct deformation in appearance. | <u>Solder bath method</u><br>Pre-Heat: 100 ro 105°C, 30 $\pm 5$ sec.<br>Temperature: 265 $\pm 3^{\circ}\text{C}$ , 5 +1/-0 sec<br><br><u>Reflow soldering method</u><br>Peak: 250 +5/-0°C<br>230°C or higher, 30 $\pm 10\text{Sec}$ .<br><br><u>Solder iron method</u><br>Bit temperature: 350° $\pm 10^{\circ}\text{C}$<br>Application time of soldering iron: 3 +1/-0 seconds |                               |             |      |   |                               |         |   |            |            |   |                                |         |   |            |            |
| Solderability         | 95% Coverage min.                                                                          | 6.5 Test temperature of solder: 245° $\pm 3^{\circ}\text{C}$<br>Dipping them solder: 2~3 seconds                                                                                                                                                                                                                                                                                |                               |             |      |   |                               |         |   |            |            |   |                                |         |   |            |            |



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Authorized Distributor

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