

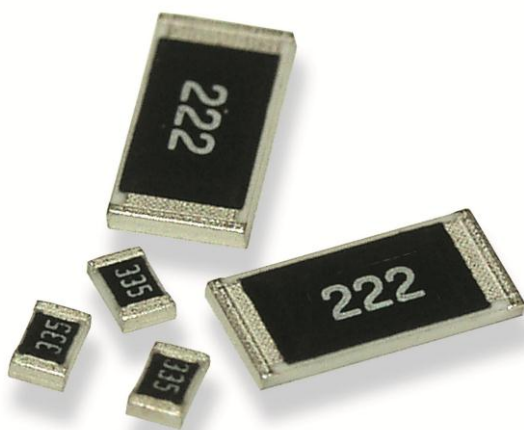


## PRODUCT SPECIFICATION

Description: CRGH Series High Power Thick Film Chip Resistors

Product Type: (Resistance range:  $1.0\Omega \sim 10M\Omega$ )

|              |                                   |
|--------------|-----------------------------------|
| CRGH0603_XXX | (CRGH0603 1/5W +/- 1% & 5% Taped) |
| CRGH0805_XXX | (CRGH0805 1/3W +/- 1% & 5% Taped) |
| CRGH1206_XXX | (CRGH1206 1/2W +/- 1% & 5% Taped) |
| CRGH2010JXXX | (CRGH2010 1W +/- 1% & 5% Taped)   |
| CRGH2512JXXX | (CRGH2512 2W +/- 1% & 5% Taped)   |



Parts corresponding to RoHS Compliant: 2005-Apr.-1



## High Power Thick Film Chip Resistors

### 1. Scope:

This specification relates to the Tyco Electronics Thick Film Chip Resistors (Lead Free)

### 2. Type designation:

The type designation shall be in the following form:

Ex.

| Type     | Power Rating | Resistance tolerance | Nominal Resistance |
|----------|--------------|----------------------|--------------------|
| CRGH0603 | 1/5W         | F (1%)<br>J (5%)     | 1K0                |
| CRGH0805 | 1/3W         |                      |                    |
| CRGH1206 | 1/2W         |                      |                    |
| CRGH2010 | 1W           |                      |                    |
| CRGH2512 | 2W           |                      |                    |

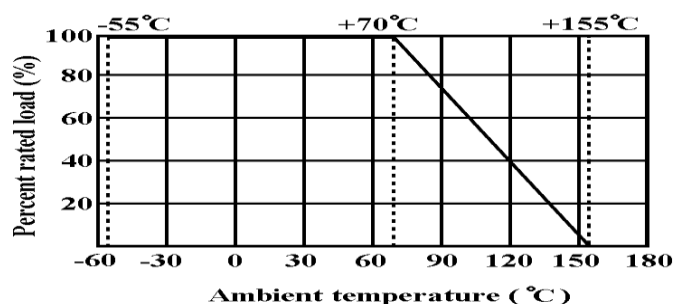
### 3. Ratings:

| Type                            | CRGH0603       | CRGH0805 | CRGH1206 | CRGH2010 | CRGH2512 |
|---------------------------------|----------------|----------|----------|----------|----------|
| Power Rating                    | 0.20W          | 0.33W    | 0.50W    | 1.0W     | 2.0W     |
| Max. Working Voltage            | 50 V           | 150 V    | 200 V    | 200 V    | 250 V    |
| Max. Overload Voltage           | 100 V          | 300 V    | 400 V    | 400 V    | 500 V    |
| Dielectric Withstanding Voltage | 300 V          | 500 V    | 500 V    | 500 V    | 500 V    |
| Temperature Range               | -55°C ~ +155°C |          |          |          |          |
| Ambient Temperature             | 70°C           |          |          |          |          |

#### 3.1 Power rating:

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 fig. 1.

Figure 1



#### 3.2 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:

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

Where : RCWV = Rated DC or RMS AC continuous working voltage at commercial-line frequency and waveform (volt)

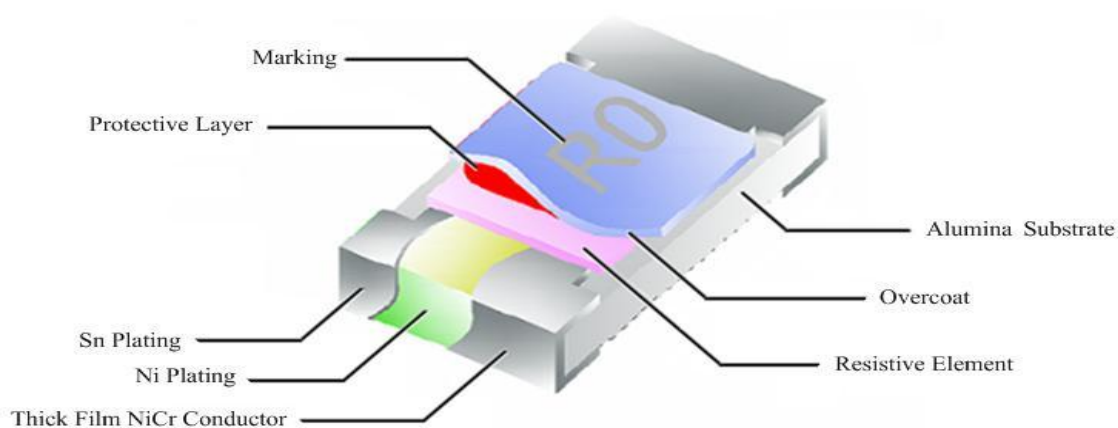
P = Power Rating (watt)

R = Nominal Resistance (ohm)

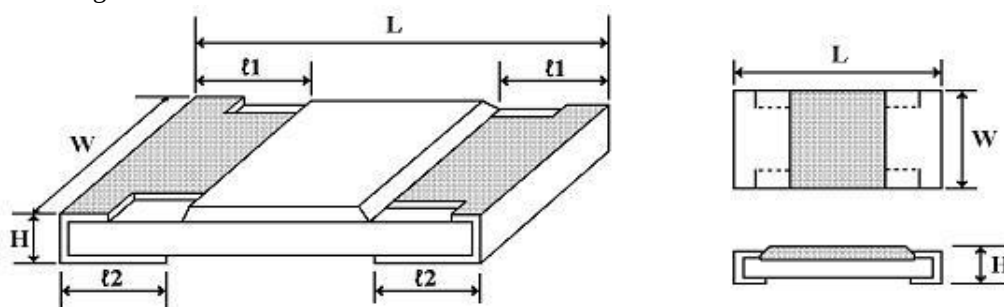
In no case shall the rated DC or RMS AC continuous working voltage be greater than the applicable maximum value.

## High Power Thick Film Chip Resistors

### 4. Construction :



### 5. Power rating and dimensions



#### Dimension :

| Type     | Dimension (mm)  |                      |                 |                 |                 |
|----------|-----------------|----------------------|-----------------|-----------------|-----------------|
|          | L               | W                    | H               | l1              | l2              |
| CRGH0603 | $1.60 \pm 0.10$ | $0.80 + 0.15 - 0.10$ | $0.45 \pm 0.10$ | $0.30 \pm 0.20$ | $0.30 \pm 0.20$ |
| CRGH0805 | $2.00 \pm 0.15$ | $1.25 + 0.15 - 0.10$ | $0.55 \pm 0.10$ | $0.40 \pm 0.20$ | $0.40 \pm 0.20$ |
| CRGH1206 | $3.10 \pm 0.15$ | $1.55 + 0.15 - 0.10$ | $0.55 \pm 0.10$ | $0.45 \pm 0.20$ | $0.45 \pm 0.20$ |
| CRGH2010 | $5.00 \pm 0.20$ | $2.50 \pm 0.15$      | $0.55 \pm 0.10$ | $0.60 \pm 0.25$ | $0.50 \pm 0.20$ |
| CRGH2512 | $6.35 \pm 0.10$ | $3.20 \pm 0.15$      | $0.55 \pm 0.10$ | $0.60 \pm 0.25$ | $1.80 \pm 0.20$ |

#### Power Rating :

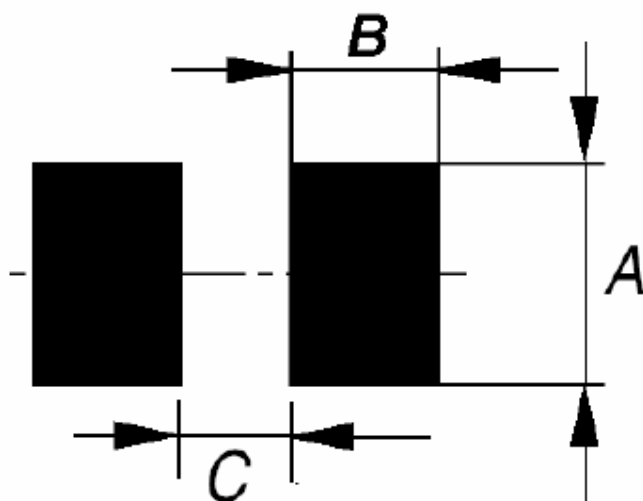
| Type     | Power Rating at 70°C | Tolerance % | Resistance Range            | Standard Series | TCR                                         |
|----------|----------------------|-------------|-----------------------------|-----------------|---------------------------------------------|
| CRGH0603 | 0.20W                | $\pm 1$     | $1\Omega \sim 10M\Omega$    | E-96            | $\leq 10\Omega$<br>$\pm 200PPM/^{\circ}C <$ |
|          |                      | $\pm 5$     | $1\Omega \sim 10M\Omega$    | E-24            | $10\Omega \pm 100PPM/^{\circ}C$             |
| CRGH0805 | 0.33W                | $\pm 1$     | $1\Omega \sim 10M\Omega$    | E-96            | $\leq 10\Omega$<br>$\pm 200PPM/^{\circ}C <$ |
|          |                      | $\pm 5$     | $1\Omega \sim 10M\Omega$    | E-24            | $10\Omega \pm 100PPM/^{\circ}C$             |
| CRGH1206 | 0.50W                | $\pm 1$     | $1\Omega \sim 10M\Omega$    | E-96            | $\leq 10\Omega$<br>$\pm 200PPM/^{\circ}C <$ |
|          |                      | $\pm 5$     | $1\Omega \sim 10M\Omega$    | E-24            | $10\Omega \pm 100PPM/^{\circ}C$             |
| CRGH2010 | 1.00W                | $\pm 1$     | $1\Omega \sim 10M\Omega$    | E-24            | $< 10\Omega$<br>$\pm 200PPM/^{\circ}C <$    |
|          |                      | $\pm 5$     | $1\Omega \sim 10M\Omega$    |                 | $10\Omega \pm 100PPM/^{\circ}C$             |
| CRGH2512 | 2.00W                | $\pm 1$     | $1\Omega \sim 9.76\Omega$   | E-96            | $< 10\Omega$<br>$\pm 200PPM/^{\circ}C <$    |
|          |                      | $\pm 5$     | $1.1M\Omega \sim 10M\Omega$ | E-24            | $10\Omega \pm 100PPM/^{\circ}C$             |

Customer:

Part No.: CRGH Series

## High Power Thick Film Chip Resistors

### 5.1 PCB Layout Plan:



Dimension :

| Type     | Dimension (mm) |      |      |
|----------|----------------|------|------|
|          | A              | B    | C    |
| CRGH0603 | 1.00           | 1.00 | 0.60 |
| CRGH0805 | 1.30           | 1.20 | 1.00 |
| CRGH1206 | 1.80           | 1.20 | 2.20 |
| CRGH2010 | 3.00           | 1.50 | 3.80 |
| CRGH2512 | 3.50           | 1.90 | 5.00 |

## High Power Thick Film Chip Resistors

### 6. Marking :

#### 6.1 Resistors

A.  $\pm 5\%$  Tolerance : the first two digits are significant figures of resistance and the third denoted number of zeros.

Ex.

|  |     |  |              |
|--|-----|--|--------------|
|  | 333 |  | 33K $\Omega$ |
|--|-----|--|--------------|

B. For ohmic values below 10  $\Omega$ , read letter "R" as decimal point.

Ex.

|  |     |  |              |
|--|-----|--|--------------|
|  | 2R2 |  | 2.2 $\Omega$ |
|--|-----|--|--------------|

C. For E-96 series [ $\pm 1\%$  (F) tolerance] in CRGH0603 size 3 digit system (due to space restrictions) please refer to page 4. for coding formula

Ex.

|  |     |  |                |
|--|-----|--|----------------|
|  | 02C |  | 10.2K $\Omega$ |
|--|-----|--|----------------|

D.  $\pm 1\%$  Toler CRGH0805\_XXX (CRGH0805 1/3W  $\pm 1\%$  & 5% Taped)  
resistance and the fourth digit denoted number of zeros. Letter "R" is for decimal point.

Ex.

|      |      |  |               |
|------|------|--|---------------|
| CRGH | 2701 |  | 2.7K $\Omega$ |
|------|------|--|---------------|

|  |      |  |               |
|--|------|--|---------------|
|  | 10R5 |  | 10.5 $\Omega$ |
|--|------|--|---------------|

#### 6.2 Labels

Label shall be marked with the following item :

Label shall be marked with the following item :

- A. Nominal Resistance and Resistance Tolerance
- B. Power Rating and Size
- C. Quantity
- D. Part No.
- E. P.O.No.
- F. Lot No.

Ex.

|                                                                                     |                               |                                                                                     |            |
|-------------------------------------------------------------------------------------|-------------------------------|-------------------------------------------------------------------------------------|------------|
| <b>tyco</b> / Electronics                                                           |                               |  |            |
| CHIP RESISTORS                                                                      |                               |                                                                                     |            |
| RESISTANCE:                                                                         | 330K                          | $\Omega$                                                                            | $\pm 5\%$  |
| WATTAGE:                                                                            | 1/2W                          | SIZE:                                                                               | CRGH0603   |
| QUANTITY:                                                                           | 5,000                         | PCS                                                                                 | Pb-Free    |
| PART NO.:                                                                           | CRGH0603F330K RoHS 2002/95/EC |                                                                                     |            |
| LOT NO. :                                                                           | 825723                        | REF #                                                                               | 2456319325 |
|  |                               |                                                                                     |            |

Remark : **For CRGH0603**  $\pm 1\%$  : Label is 332K, value is 332K $\Omega$ , marking is 51D

$\pm 5\%$  : Label is 330K, value is 330K $\Omega$ , marking is 334

$\pm 1\%$  : Label is 330K, value is 330K $\Omega$ , marking is 3303

High Power Thick Film Chip Resistors

**Mutiplier Code :**

| Code       | A  | B  | C  | D  | E  | F  | G  | H  | X  | Y  | Z  |
|------------|----|----|----|----|----|----|----|----|----|----|----|
| Multiplier | 0  | 1  | 2  | 3  | 4  | 5  | 6  | 7  | -1 | -2 | -3 |
|            | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 |

**Coding**

XX

Resistance Code

**Formula**

X

Multiplier Code

**Example :**

$10K2 = \begin{matrix} 102 \\ \downarrow \\ 02 \end{matrix} \times \begin{matrix} 10^2 \\ \downarrow \\ C \end{matrix} = 02C$

$33R2 = \begin{matrix} 332 \\ \downarrow \\ 51 \end{matrix} \times \begin{matrix} 10^{-1} \\ \downarrow \\ X \end{matrix} = 51X$

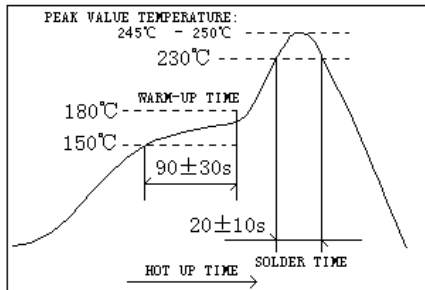
| Value | Code | Value | Code | Value | Code | Value | Code | Value | Code |
|-------|------|-------|------|-------|------|-------|------|-------|------|
| 100   | 01   | 162   | 21   | 261   | 41   | 422   | 61   | 681   | 81   |
| 102   | 02   | 165   | 22   | 267   | 42   | 432   | 62   | 698   | 82   |
| 105   | 03   | 169   | 23   | 274   | 43   | 442   | 63   | 715   | 83   |
| 107   | 04   | 174   | 24   | 280   | 44   | 453   | 64   | 732   | 84   |
| 110   | 05   | 178   | 25   | 287   | 45   | 464   | 65   | 750   | 85   |
| 113   | 06   | 182   | 26   | 294   | 46   | 475   | 66   | 768   | 86   |
| 115   | 07   | 187   | 27   | 301   | 47   | 487   | 67   | 787   | 87   |
| 118   | 08   | 191   | 28   | 309   | 48   | 499   | 68   | 806   | 88   |
| 121   | 09   | 196   | 29   | 316   | 49   | 511   | 69   | 825   | 89   |
| 124   | 10   | 200   | 30   | 324   | 50   | 523   | 70   | 845   | 90   |
| 127   | 11   | 205   | 31   | 332   | 51   | 536   | 71   | 866   | 91   |
| 130   | 12   | 210   | 32   | 340   | 52   | 549   | 72   | 887   | 92   |
| 133   | 13   | 215   | 33   | 348   | 53   | 562   | 73   | 909   | 93   |
| 137   | 14   | 221   | 34   | 357   | 54   | 576   | 74   | 931   | 94   |
| 140   | 15   | 226   | 35   | 365   | 55   | 590   | 75   | 953   | 95   |
| 143   | 16   | 232   | 36   | 374   | 56   | 604   | 76   | 976   | 96   |
| 147   | 17   | 237   | 37   | 383   | 57   | 619   | 77   |       |      |
| 150   | 18   | 243   | 38   | 392   | 58   | 634   | 78   |       |      |
| 154   | 19   | 249   | 39   | 402   | 59   | 649   | 79   |       |      |
| 158   | 20   | 255   | 40   | 412   | 60   | 665   | 80   |       |      |

\*Marking for CRGH0603 E-96 series, the resistance value that no have multiplier code indicate marking follow this:  
 The first two digits are significant figures of resistance and the third one denoted number of zeros  
 and under line the marking letters.

Ex.

|  |            |  |
|--|------------|--|
|  | <u>122</u> |  |
|--|------------|--|

1.2KΩ

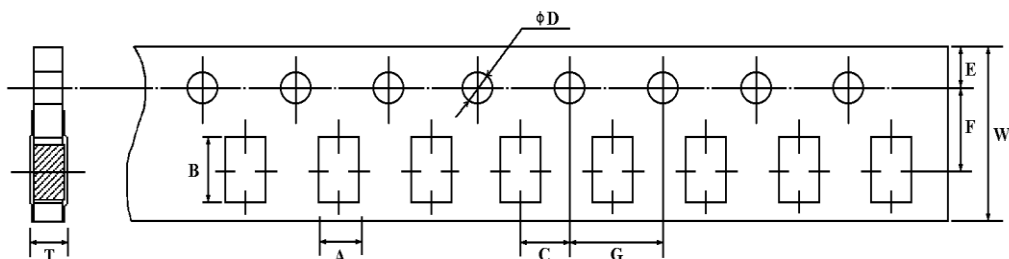
|                                      |                                                                                   |                                                                                                                                                                                                                                                                                                         |              |
|--------------------------------------|-----------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|
| Customer:                            |                                                                                   | Part No.: CRGH Series                                                                                                                                                                                                                                                                                   |              |
| High Power Thick Film Chip Resistors |                                                                                   |                                                                                                                                                                                                                                                                                                         |              |
| 7. Performance specification :       |                                                                                   |                                                                                                                                                                                                                                                                                                         |              |
| Characteristics                      | Limits                                                                            | Test Methods<br>( 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              | See Page 2                                                                        | 4.8 Natural resistance change per temp. degree centigrade.<br>$\frac{R2-R1}{R1(t2-t1)} \times 10^6 \quad (\text{PPM}/^{\circ}\text{C})$<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<br>± 5% (2.0% + 0.1Ω) Max.<br>± 1% (1.0% + 0.1Ω) Max.   | 4.13 Permanent resistance change after the application of a potential of 2.5 times RCWV for 5 seconds.                                                                                                                                                                                                  |              |
| Solderability                        | 95 % coverage Min.                                                                | Wave Solder:<br>Test temperature of solder:<br>245°C ±3°C dipping time in solder : 2-3 seconds.<br>Reflow Solder:<br>                                                                                               |              |
| Soldering heat                       | Resistance change rate is:<br>±(1%+0.05Ω) Max.                                    | 4.18 Dip the resistor into a solder bath having a temperature of 260°C ± 3°C and hold it for 10 ± 1 seconds.                                                                                                                                                                                            |              |
| Temperature cycling                  | Resistance Change Rate Is<br>± 5% (1.0% + 0.05Ω) Max.<br>± 1% (0.5% + 0.05Ω) Max. | 4.19 Resistance change after continuous 5 cycles for duty cycle specified below :                                                                                                                                                                                                                       |              |
|                                      |                                                                                   | Step                                                                                                                                                                                                                                                                                                    | Temperature  |
|                                      |                                                                                   | 1                                                                                                                                                                                                                                                                                                       | -55°C ± 3°C  |
|                                      |                                                                                   | 2                                                                                                                                                                                                                                                                                                       | Room temp.   |
|                                      |                                                                                   | 3                                                                                                                                                                                                                                                                                                       | +155°C ± 2°C |
| Humidity                             | Resistance change rate is<br>± 5% (3.0% + 0.1Ω) Max.<br>± 1% (1.0% + 0.1Ω) Max.   | 4.24 Temporary resistance change after 240 hours exposure in a humidity test chamber controlled at 40±2°C and 90-95% relative humidity                                                                                                                                                                  |              |
| Load life in Humidty                 | Resistance change rate is<br>± 5% (3.0% + 0.1Ω) Max.<br>± 1% (1.0% + 0.1Ω) 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 ± 2°C and 90 to 95% relative humidity                                                                                                                                        |              |
| Load Life                            | Resistance change rate is<br>± 5% (3.0% + 0.1Ω) Max.<br>± 1% (1.0% + 0.1Ω) 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°C ± 2°C ambient                                                                                                                                                         |              |
| Terminal Bending                     | Resistance change rate is<br>± (1.0% + 0.05Ω) Max.                                | 4.33 Twist of Test Board :<br>Y/X = 3/90 mm for 60 seconds                                                                                                                                                                                                                                              |              |

## High Power Thick Film Chip Resistors

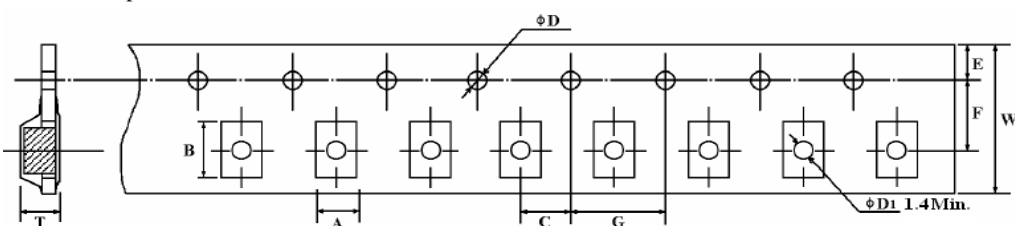
### 6. Packing specification :

#### 6.1 Taping Dimension (mm)

##### A. Paper tape



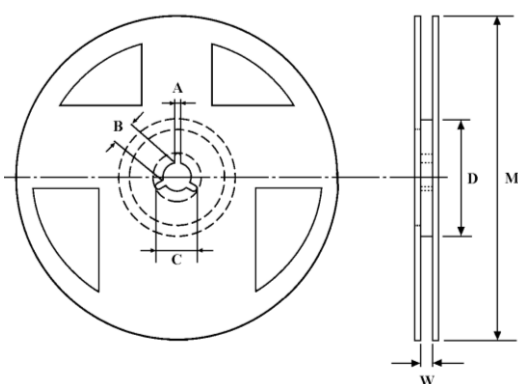
##### B. Plastic tape



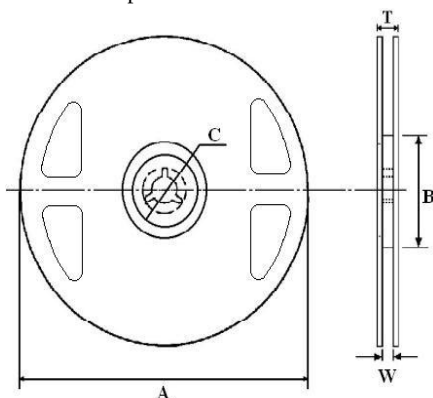
| Type     | $A \pm 0.2$ | $B \pm 0.2$ | $C \pm 0.05$ | $\phi D +0.1$<br>$-0$ | $E \pm 0.1$ | $F \pm 0.05$ | $G \pm 0.1$ | $W \pm 0.2$ | $T \pm 0.1$   |
|----------|-------------|-------------|--------------|-----------------------|-------------|--------------|-------------|-------------|---------------|
| CRGH0603 | 1.10        | 1.90        | 2.0          | 1.5                   | 1.75        | 3.5          | 4.0         | 8.0         | 0.67          |
| CRGH0805 | 1.65        | 2.40        | 2.0          | 1.5                   | 1.75        | 3.5          | 4.0         | 8.0         | 0.81          |
| CRGH1206 | 2.00        | 3.60        | 2.0          | 1.5                   | 1.75        | 3.5          | 4.0         | 8.0         | 0.81          |
| CRGH2010 | 2.80        | 5.50        | 2.0          | $1.5+0.25$            | 1.75        | 5.5          | 4.0         | 12.0        | $1.2 \pm 0.0$ |
| CRGH2512 | 3.60        | 6.90        | 2.0          | $1.5+0.25$            | 1.75        | 5.5          | 4.0         | 12.0        | $1.2 \pm 0.0$ |

#### 7.2 Reel Dimension (mm)

##### A. Paper tape



##### B. Plastic tape



| Type     | Packaging | Quantity Per Reel | A           | B            | C            | D            | $M \pm 2$     | $W \pm 1$      | $T \pm 1$      |
|----------|-----------|-------------------|-------------|--------------|--------------|--------------|---------------|----------------|----------------|
| CRGH0603 | Paper     | 5,000 pcs.        | $2 \pm 0.5$ | $13 \pm 0.5$ | $21 \pm 0.5$ | $60 \pm 1.0$ | $178 \pm 2.0$ | $10 \pm 1.0$   | -              |
| CRGH0805 | Paper     | 5,000 pcs.        | $2 \pm 0.5$ | $13 \pm 0.5$ | $21 \pm 0.5$ | $60 \pm 1.0$ | $178 \pm 2.0$ | $10 \pm 1.0$   | -              |
| CRGH1206 | Paper     | 5,000 pcs.        | $2 \pm 0.5$ | $13 \pm 0.5$ | $21 \pm 0.5$ | $60 \pm 1.0$ | $178 \pm 2.0$ | $10 \pm 1.0$   | -              |
| CRGH2010 | Plastic   | 4,000 pcs.        | 180-3.0     | $60 \pm 1.0$ | $13 \pm 0.2$ | -            | -             | $13.5 \pm 0.5$ | $15.4 \pm 1.0$ |
| CRGH2512 | Plastic   | 4,000 pcs.        | 180-3.0     | $60 \pm 1.0$ | $13 \pm 0.2$ | -            | -             | $13.5 \pm 0.5$ | $15.4 \pm 1.0$ |

Customer:

Part No.: CRGH Series

## High Power Thick Film Chip Resistors

## Part Number System

## Explanation of Part Number System

| 1                                                   | 2 | 3 | 4 | 5                                    | 6 | 7 | 8 | 9                        | 10                                                                                                                                               | 11 | 12 | 13 |
|-----------------------------------------------------|---|---|---|--------------------------------------|---|---|---|--------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------|----|----|----|
| C                                                   | R | G | H | 0                                    | 6 | 0 | 3 | F                        | 1                                                                                                                                                | 0  | 0  | K  |
| <u>Series Name</u>                                  |   |   |   | <u>Case Size / Wattage:</u>          |   |   |   | <u>Tolerance:</u>        | <u>Resistance Value:</u>                                                                                                                         |    |    |    |
| CRGH Series High Power<br>Thick Film Chip Resistors |   |   |   | 0603<br>0805<br>1206<br>2010<br>2512 |   |   |   | F ~ ± 1%<br><br>J ~ ± 5% | 1R0 - 1.0 ohm<br>100R - 100 ohms<br>1K0 - 1000 ohms<br>10K - 10,000 ohms<br>100K - 100,000 ohms<br>1M0 - 1,000,000 ohms<br>10M - 10,000,000 ohms |    |    |    |

CRGH0805\_XXX (CRGH0805 1/3W +/- 1% &amp; 5% Taped)

CRGH2512JXXX (CRGH2512 2W +/- 1% &amp; 5% Taped)