



## PRODUCT SPECIFICATION

Description: CRGH Series High Power Thick Film Chip Resistors

Product Type: (Resistance range: 1.0Ω ~ 10MΩ)

|              |                                   |
|--------------|-----------------------------------|
| 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 ± 0.10    | 0.80 + 0.15<br>- 0.10 | 0.45 ± 0.10 | 0.30 ± 0.20 | 0.30 ± 0.20 |
| CRGH0805 | 2.00 ± 0.15    | 1.25 + 0.15<br>- 0.10 | 0.55 ± 0.10 | 0.40 ± 0.20 | 0.40 ± 0.20 |
| CRGH1206 | 3.10 ± 0.15    | 1.55 + 0.15<br>- 0.10 | 0.55 ± 0.10 | 0.45 ± 0.20 | 0.45 ± 0.20 |
| CRGH2010 | 5.00 ± 0.20    | 2.50 ± 0.15           | 0.55 ± 0.10 | 0.60 ± 0.25 | 0.50 ± 0.20 |
| CRGH2512 | 6.35 ± 0.10    | 3.20 ± 0.15           | 0.55 ± 0.10 | 0.60 ± 0.25 | 1.80 ± 0.20 |

Power Rating :

| Type     | Power Rating at 70°C | Tolerance % | Resistance Range | Standard Series | TCR                   |
|----------|----------------------|-------------|------------------|-----------------|-----------------------|
| CRGH0603 | 0.20W                | ± 1         | 1Ω ~ 10MΩ        | E-96            | ≤ 10Ω<br>±200PPM/°C < |
|          |                      | ± 5         | 1Ω ~ 10MΩ        | E-24            | 10Ω ±100PPM/°C        |
| CRGH0805 | 0.33W                | ± 1         | 1Ω ~ 10MΩ        | E-96            | ≤ 10Ω<br>±200PPM/°C < |
|          |                      | ± 5         | 1Ω ~ 10MΩ        | E-24            |                       |
| CRGH1206 | 0.50W                | ± 1         | 1Ω ~ 10MΩ        | E-96            | ≤ 10Ω<br>±200PPM/°C < |
|          |                      | ± 5         | 1Ω ~ 10MΩ        | E-24            |                       |
| CRGH2010 | 1.00W                | ± 1         | 1Ω ~ 10MΩ        | E-24            | < 10Ω<br>±200PPM/°C < |
|          |                      | ± 5         | 1Ω ~ 10MΩ        |                 |                       |
| CRGH2512 | 2.00W                | ± 1         | 1Ω ~ 9.76Ω       | E-96            | < 10Ω<br>±200PPM/°C < |
|          |                      | ± 5         | 1.1MΩ ~ 10MΩ     | E-24            |                       |

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 +/- 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

Customer:

Part No.: CRGH Series

**High Power Thick Film Chip Resistors**

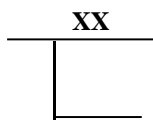
**Mutiplier Code :**

| 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 |

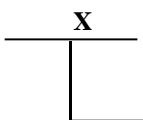
**Coding**

**Formula**

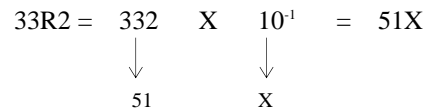
**Example :** 10K2 = 102 X 10<sup>2</sup> = 02C



Resistance Code



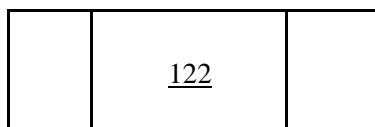
Multiplier Code



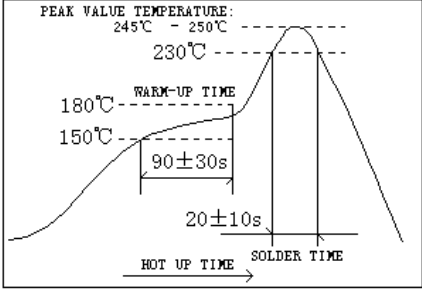
| Value | Code | Value | Code | Value | Code | Value | Code | Value | Code |
|-------|------|-------|------|-------|------|-------|------|-------|------|
| 100   | 01   | 162   | 21   | 261   | 41   | 422   | 61   | 681   | 81   |
| 102   | 02   | 165   | 22   | 267   | 42   | 432   | 62   | 698   | 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.



1.2KΩ

| <b>Customer:</b>                            |   | <b>Part No.: CRGH Series</b>   |             |              |      |   |             |         |   |            |              |   |              |         |   |            |              |
|---|---|--|-------------|--------------|------|---|-------------|---------|---|------------|--------------|---|--------------|---------|---|------------|--------------|
| <b>High Power Thick Film Chip Resistors</b> |   |  |             |              |      |   |             |         |   |            |              |   |              |         |   |            |              |
| <b>7. Performance specification :</b>       |   |  |             |              |      |   |             |         |   |            |              |   |              |         |   |            |              |
| 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>$\frac{R2-R1}{R1(t2-t1)} \times 10^6 \quad (\text{PPM}/^\circ\text{C})$ 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> <p>The graph shows a temperature profile for reflow soldering. The y-axis is temperature in °C (50 to 250) and the x-axis is time. Key points include: 150°C (90 ± 30s), 180°C (WARM-UP TIME), 230°C (20 ± 10s), and a peak value temperature range of 245°C to 250°C. The SOLDER TIME is indicated at the peak.</p>   |             |              |      |   |             |         |   |            |              |   |              |         |   |            |              |
| 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 :  |             |              |      |   |             |         |   |            |              |   |              |         |   |            |              |
|   |   | <table border="1"> <thead> <tr> <th>Step</th> <th>Temperature</th> <th>Time</th> </tr> </thead> <tbody> <tr> <td align="center">1</td> <td align="center">-55°C ± 3°C</td> <td align="center">30 mins</td> </tr> <tr> <td align="center">2</td> <td align="center">Room temp.</td> <td align="center">10 ~ 15 mins</td> </tr> <tr> <td align="center">3</td> <td align="center">+155°C ± 2°C</td> <td align="center">30 mins</td> </tr> <tr> <td align="center">4</td> <td align="center">Room temp.</td> <td align="center">10 ~ 15 mins</td> </tr> </tbody> </table> | Step        | Temperature  | Time | 1 | -55°C ± 3°C | 30 mins | 2 | Room temp. | 10 ~ 15 mins | 3 | +155°C ± 2°C | 30 mins | 4 | Room temp. | 10 ~ 15 mins |
|   |   | Step   | Temperature | Time         |      |   |             |         |   |            |              |   |              |         |   |            |              |
|   |   | 1  | -55°C ± 3°C | 30 mins      |      |   |             |         |   |            |              |   |              |         |   |            |              |
|   |   | 2  | Room temp.  | 10 ~ 15 mins |      |   |             |         |   |            |              |   |              |         |   |            |              |
| 3   | +155°C ± 2°C  | 30 mins  |             |              |      |   |             |         |   |            |              |   |              |         |   |            |              |
| 4   | Room temp.  | 10 ~ 15 mins   |             |              |      |   |             |         |   |            |              |   |              |         |   |            |              |
|   |   |  |             |              |      |   |             |         |   |            |              |   |              |         |   |            |              |
|   |   |  |             |              |      |   |             |         |   |            |              |   |              |         |   |            |              |
|   |   |  |             |              |      |   |             |         |   |            |              |   |              |         |   |            |              |
| 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 Humidity                       | 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   |             |              |      |   |             |         |   |            |              |   |              |         |   |            |              |

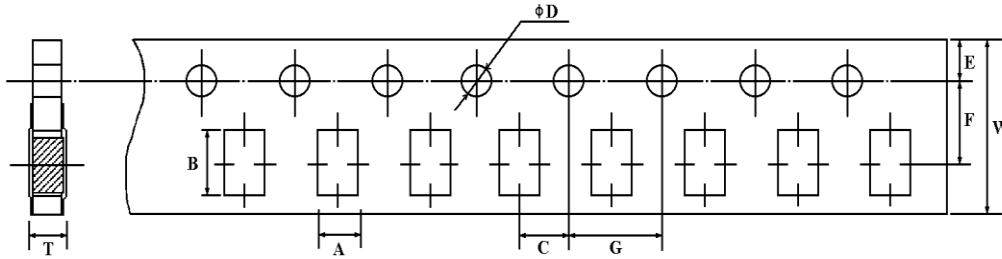


### High Power Thick Film Chip Resistors

#### 6. Packing specification :

##### 6.1 Taping Dimension (mm)

###### A. Paper tape



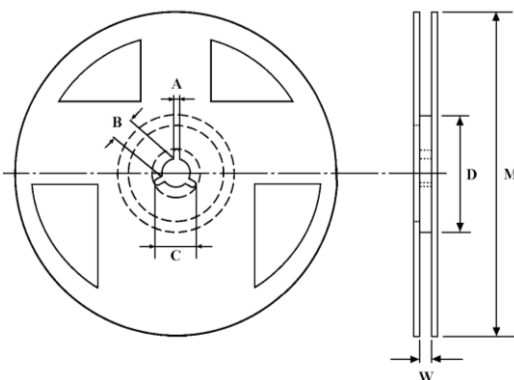
###### B. Plastic tape



| Type     | A ± 0.2 | B ± 0.2 | C ± 0.05 | $\phi D +0.1$<br>- 0 | E ± 0.1 | F ± 0.05 | G ± 0.1 | W ± 0.2 | T ± 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±0.0 |
| CRGH2512 | 3.60    | 6.90    | 2.0      | 1.5+0.25             | 1.75    | 5.5      | 4.0     | 12.0    | 1.2±0.0 |

##### 7.2 Reel Dimension (mm)

###### A. Paper tape



###### B. Plastic tape



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

**High Power Thick Film Chip Resistors**

**Part Number System**

**Explanation of Part Number System**



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

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