

# **SPECIFICATIONS**

Thick Film Chip Resistors

**CRG-Serie**

### CRG Series

#### 1. Scope

This specification covers the general requirements for Thick Film Chip Resistors series CRG.

#### 2. Type designation (How to order)

<u>CRG</u>	<u>16G</u>	<u>I</u>	<u>102</u>	<u>J</u>
↓	↓	↓	↓	↓
Type (SN Plating)	Power Rating (1)	Taping (2)	Nominal R. Value (3)	Tolerance (4)

(1) Power Rating:

16GS	= 0.063 W
16G	= 0.100 W
10G	= 0.125 W
8G	= 0.250 W

(2) Taping (Packaging): 5k, 10k or 25 k pcs. per tape & reel

(3) Nominal R. Value: Standard decade values E-24 series  
E-96 series are also available for tolerance F

e.g.: E-24 series	10 ohm = 100
	1k ohm = 102
E-96 series	10 ohm = 10R0
	1k ohm = 1001

(4) Tolerance:

F = ±	1 %
J = ±	5 %

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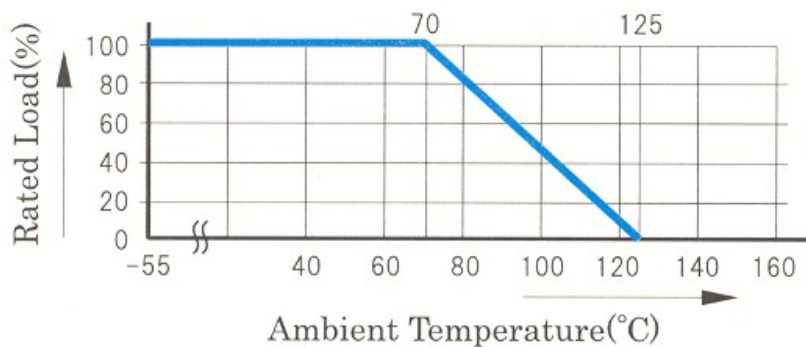
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### 3. Rating

#### 3.1 Power Rating

Type	Case size	Power rating at 70°C (W)	Max. working voltage (V)	Max. overload voltage (V)
CRG16GS	0402	0.063	50	100
CRG16G	0603	0.100	50	100
CRG10G	0805	0.125	150	300
CRG8G	1206	0.250	200	400

#### 3.2 Derating Curve



#### 3.3 Rated Voltage

The rated voltage shall be calculated from the equation below, when the rated voltage exceeds the maximum working voltage, the maximum working voltage shall be the rated voltage.

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

E: Rated voltage (V)  
P: Rated power (W)  
R: Nominal resistance ( $\Omega$ )

#### 3.4 Operating temperature range

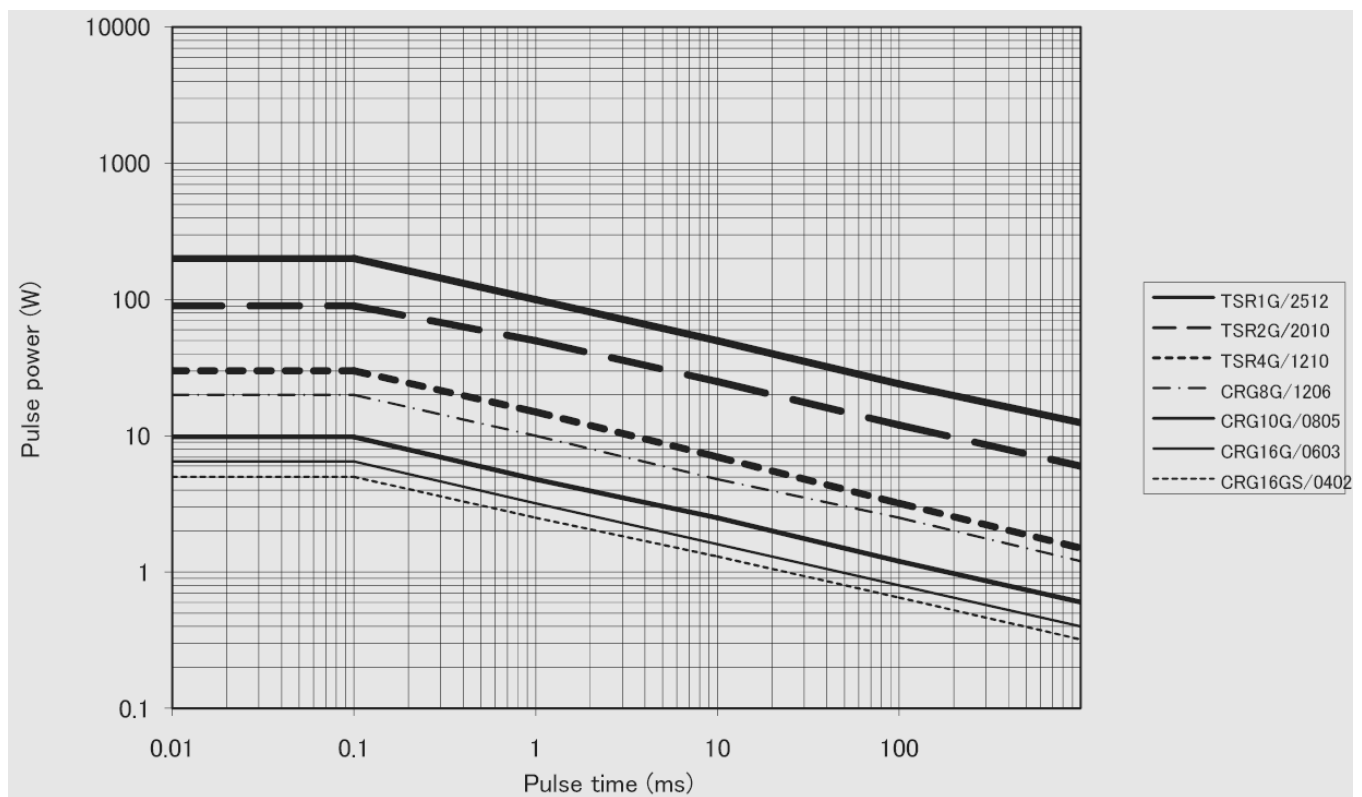
-55°C ~ +125°C

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### 3.5 Current Rating for jumper

Type	Case size	Rated Current	Max. Overload Current	Resistance Range
CRG16GS	0402	1.0A	2.0A	≤50mΩ
CRG16G	0603			
CRG10G	0805	2.0A	4.0A	
CRG8G	1206	2.0A	4.0A	

### 3.6 One Pulse Power rating



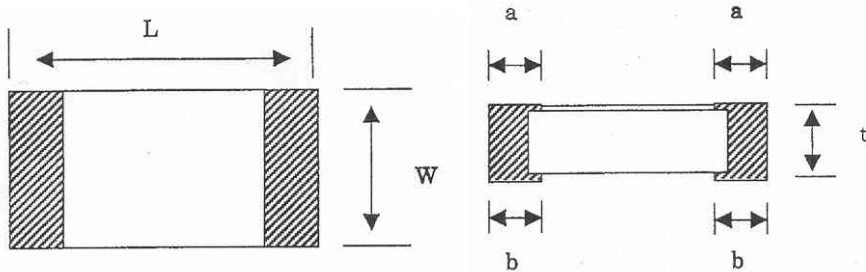
### 4. Resistance range (Ω) classified by T.C.R & tolerance

Type	Case size	TCR (ppm/°C)	±1%(F) E96, E24	±5% (J) E24
CRG16GS	0402	± 100	1R ~ 10M	0R ~ 10M
		± 200		
CRG16G	0603	± 100	1R ~ 10M	0R ~ 10M
		± 200		
CRG10G	0805	± 100	1R ~ 10M	0R ~ 10M
		± 200		
CRG8G	1206	± 100	1R ~ 10M	0R ~ 10M
		± 200		

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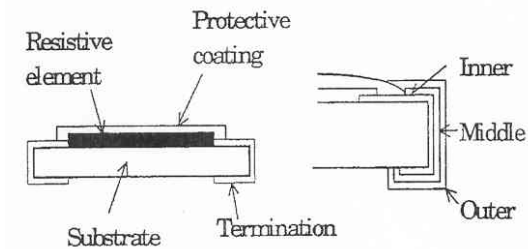
### 5. Dimensions, structure and materials



Unit: mm

Type	Case size	L	W	a	b	t
CRG16GS	0402	$1.0 \pm 0.05$	$0.5 \pm 0.05$	$0.2 \pm 0.1$	$0.25 \pm 0.1$	$0.35 \pm 0.05$
CRG16G	0603	$1.6 \pm 0.15$	$0.8 \pm 0.15$	$0.3 \pm 0.2$	$0.3 \pm 0.2$	$0.45 \pm 0.1$
CRG10G	0805	$2.0 \pm 0.2$	$1.25 \pm 0.1$	$0.4 \pm 0.2$	$0.4 \pm 0.2$	$0.5 \pm 0.1$
CRG8G	1206	$3.2 \pm 0.2$	$1.6 \pm 0.2$	$0.5 \pm 0.25$	$0.5 \pm 0.2$	$0.6 \pm 0.1$

Table of materials



Construction	Main Material
Substrate	$\text{Al}_2\text{O}_3$ (96%)
R. Element	$\text{RuO}_2$
Protective coating	$\text{PbO-SiO}_2\text{-Bi}_2\text{O}_3$
Inner termination	Ag/Pd
Middle termination	Ni Plating
Outer termination	Sn Plating

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### 6. Performance Specifications

Item	Specifications	Test Methods (JIS-C5202)
DC Resistance	Within each specified tolerance	Measured at DC voltage, at 20±2°C, 60 ~ 70%Rh
Temperature coefficient	Within each specified tolerance	Sequence of temperature: -55°C~+20°C, +20°C~+125°C
Short-time overload	±(2.0%+0.1Ω)	<u>RCWV</u> x 2.5 applied for 5 sec.
Intermittent overload	±(5.0%+0.1Ω)	<u>RCWV</u> x 2.5 applied for 10'000 cycles (1 sec. on & 25 sec. off)
Solderability	Min. 95 % coverage	Temperature: 245±5°C Immersion time: 3±0.5 sec. Preparation: Immersion in flux for 1 ~ 2 sec. Flux: rosin: methanol = 25wt%:75wt% Solder: Sn3.0Ag0.5Cu (Wt%)
Resistance to soldering heat	±(1%+0.1Ω) Jumper: within 50mΩ	Temperature: 260±5°C Immersion time: 10±1 sec.
Load life in humidity	±(3%+0.1Ω)	40°C, 90~95%Rh, Rated voltage 1'000 hours (90 min. on & 30 min. off)
Load life	±(3%+0.1Ω)	70°C, Rated voltage 1'000 hours (90 min. on & 30 min. off)
Heat shock	±(1%+0.1Ω)	Step 1: -55±3°C, 60 min. Step 2: +20±2°C, 3 min. Step 3: +125±3°C, 60 min. Step 4: +20±2°C, 3 min. 100 cycles
Robustness of resistor body	±(1%+0.1Ω)	Bending test: 10N(1.02Kgf), 10 sec.

Note: RCWV means Rated Continuous Working Voltage

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### 7. Marking of resistance value

Express resistance value on protective coating side with three or four digits. There is no marking on type CRG16GS, but label is attached to reel.

Tolerance	Marking expression
±1.0%(F)	four digits in case of E-96 series. three digits in case of E-24 series. please refer to appendix on type CRG16G
±5.0%(J)	three digits, in case of jumper chip: R00

### 8. Storage methods

Guarantee period of soldering: minimum 2 years (delivery packaging conditions)  
(Recommended storage conditions: +5 ~ +40°C, 40 ~ 70% RH.)

### 9. Soldering methods

Reflow and flow are both recommended.

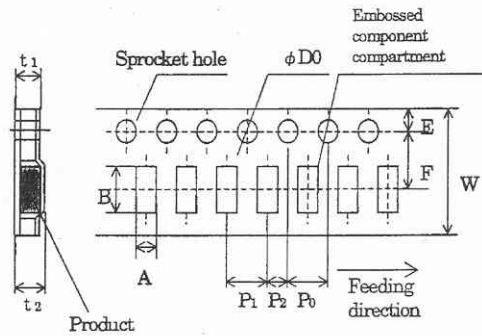
### 10. Packing

Case size	Type	Qty (Std)	Qty (Reference)
0402	CRG16GS	10'000 pcs.	
0603	CRG16G	5'000 pcs.	25'000 pcs.
0805	CRG10G		10'000 pcs.
1206	CRG8G		10'000 pcs.

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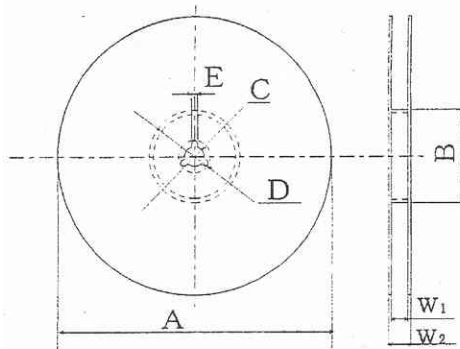
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### 11. Taping specifications



Type	A	B	W	E	F
CRG16GS	$0.65 \pm 0.1$	$1.15 \pm 0.1$	$8.0 \pm 0.2$	$1.75 \pm 0.1$	$3.5 \pm 0.05$
CRG16G	$1.1 \pm 0.2$	$1.9 \pm 0.2$			
CRG10G	$1.65 \pm 0.2$	$2.4 \pm 0.2$			
CRG8G	$2.0 \pm 0.2$	$3.6 \pm 0.2$			

Type	$P_1$	$P_2$	$P_0$	$\Phi D_0$	$t_1$	$t_2$
CRG16GS	$2.0 \pm 0.1$	$1.0 \pm 0.05$	$4.0 \pm 0.1$	$1.5 \pm 0.1$	max. 1	max. 1.4
CRG16G	$4.0 \pm 0.1$	$2.0 \pm 0.05$				
CRG10G						
CRG8G						



Unit: mm

Type	Materials	A	B	C	D
CRG16GS	plastics	$\Phi 180 \pm \begin{smallmatrix} 0 \\ 3.0 \end{smallmatrix}$	$\Phi 60 \pm \begin{smallmatrix} 1.0 \\ 0 \end{smallmatrix}$	$\Phi 13.0 \pm 0.2$	$10.5 \pm 0.4$
CRG16G					
CRG10G					
CRG8G					

Type	Materials	E	W1	W2
CRG16GS	plastics	$2.0 \pm 0.5$	$9.0 \pm 0.3$	$11.4 \pm 1.0$
CRG16G				
CRG10G				
CRG8G				



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Appendix: Marking method for CRG16GS xxx F

#1 Symbols for E-96 series nominal resistance value

Symbol	E96	Symbol	E96	Symbol	E96	Symbol	E96
0 1	100	2 5	178	4 9	316	7 3	562
0 2	102	2 6	182	5 0	324	7 4	576
0 3	105	2 7	187	5 1	332	7 5	590
0 4	107	2 8	191	5 2	340	7 6	604
0 5	110	2 9	196	5 3	348	7 7	619
0 6	113	3 0	200	5 4	357	7 8	634
0 7	115	3 1	205	5 5	365	7 9	649
0 8	118	3 2	210	5 6	374	8 0	665
0 9	121	3 3	215	5 7	383	8 1	681
1 0	124	3 4	221	5 8	392	8 2	698
1 1	127	3 5	226	5 9	402	8 3	715
1 2	130	3 6	232	6 0	412	8 4	732
1 3	133	3 7	237	6 1	422	8 5	750
1 4	137	3 8	243	6 2	432	8 6	768
1 5	140	3 9	249	6 3	442	8 7	787
1 6	143	4 0	255	6 4	453	8 8	806
1 7	147	4 1	261	6 5	464	8 9	825
1 8	150	4 2	267	6 6	475	9 0	845
1 9	154	4 3	274	6 7	487	9 1	866
2 0	158	4 4	280	6 8	499	9 2	887
2 1	162	4 5	287	6 9	511	9 3	909
2 2	165	4 6	294	7 0	523	9 4	931
2 3	169	4 7	301	7 1	536	9 5	953
2 4	174	4 8	309	7 2	549	9 6	976

#2 Symbols for multipliers

Symb	A	B	C	D	E	F	G	H
Mult	$10^0$	$10^1$	$10^2$	$10^3$	$10^4$	$10^5$	$10^6$	$10^7$

Symb	X	Y	Z
Mult	$10^{-1}$	$10^{-2}$	$10^{-3}$

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### #3 Examples

12.1Ω	...	121	x	10 <sup>-1</sup>	→	09X	51.1kΩ	...	511	x	10 <sup>2</sup>	→	69C
121Ω	...	121	x	10 <sup>0</sup>	→	09A	511kΩ	...	511	x	10 <sup>3</sup>	→	69D
1.21kΩ	...	121	x	10 <sup>1</sup>	→	09B	2MΩ	...	200	x	10 <sup>4</sup>	→	30E

### Example:

02C	...	<u>102</u>	x	<u>10<sup>2</sup></u>	→	10.2kΩ	51X	...	<u>332</u>	x	<u>10<sup>-1</sup></u>	→	33.2Ω
		↓		↓				↓		↓			
		Symbol 02						Symbol 51					Symbol X
				Symbol C									