

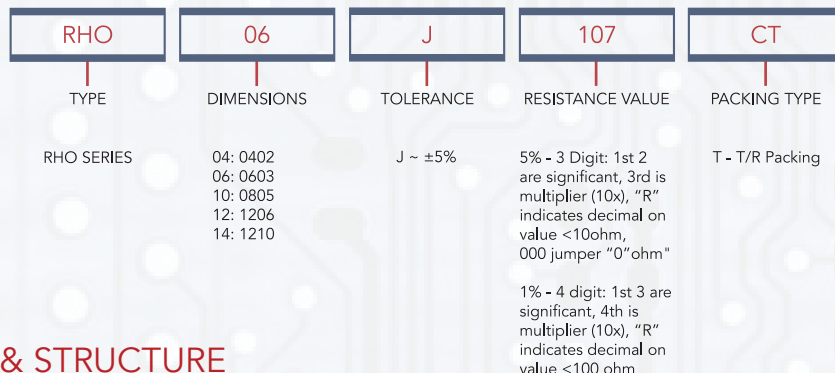
# THICK FILM CHIP RESISTORS

## - RHO SERIES -

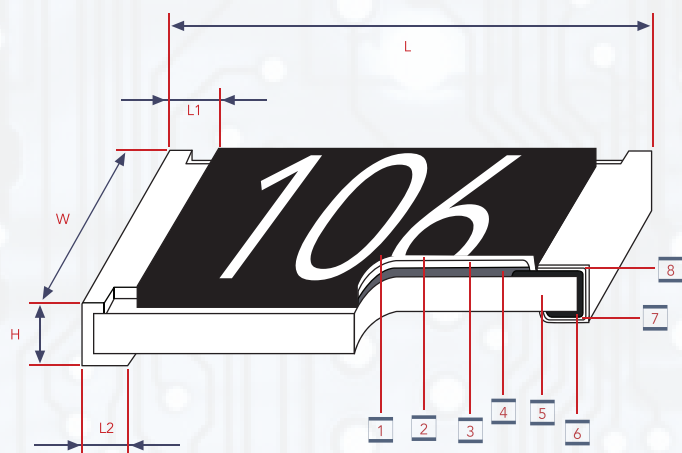
### SCOPE

- This specification for approval relates to High Value Thick Film Chip Resistors manufactured by Cal-Chip Electronics, Inc.'s specifications

### PART NUMBER SYSTEM



### DIMENSIONS & STRUCTURE



TYPE	DIMENSION (MM)				
	L	W	H	L1	L2
RHO04 0402	1.00 ± 0.10	0.50 ± 0.05	0.35 ± 0.05	0.20 ± 0.10	0.25 ± 0.10
RHO06 0603	1.60 ± 0.10	0.80 ± 0.10	0.45 ± 0.10	0.30 ± 0.20	0.30 ± 0.20
RHO10 0805	2.00 ± 0.15	1.25 + 0.15 - 0.10	0.55 ± 0.10	0.40 ± 0.20	0.40 ± 0.20
RHO12 1206	3.10 ± 0.15	1.55 + 0.15 - 0.10	0.55 ± 0.10	0.45 ± 0.20	0.45 ± 0.20
RHO14 1210	3.10 ± 0.10	2.60 ± 0.20	0.55 ± 0.10	0.50 ± 0.25	0.50 ± 0.20

- 1 Marking
- 2 G2 Coating
- 3 G1 Coating
- 4 Resistive Element
- 5 High Purity Alumina Substrate
- 6 Termination (inner) Ag
- 7 Termination (middle) Ni Barrier
- 8 Termination (outer) Sn

### RATINGS

TYPE	POWER RATING	MAX WORKING VOLTAGE	MAX OVERLOAD VOLTAGE	DIELECTRIC WITHSTANDING VOLTAGE	OPERATING TEMP.	AMBIENT TEMP.
0402	1/16 W	50 V	100 V	100 V	-55°C ~ 155°C	70°C
0603	1/10 W	75 V	150 V	300 V		
0805	1/8 W	150 V	300 V	500 V		
1206	1/4 W	200 V	400 V	500 V		
1210	1/2 W	200 V	500 V	500 V		

### NOMINAL RESISTANCE

- Effective figures of nominal resistance shall be in accordance:

- E-24 Values - these are preferred and will have standard MOQ
- E-96 Values - are available on case by case basis and availability and MOQ need to be confirmed with factory first

### 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:

$$RCWV = \sqrt{PxR}$$

NOTE - Max. Working Voltage or  $\sqrt{PxR}$  whichever is lesser  
Max. Overload Voltage or  $2.5 \sqrt{PxR}$  whichever is lesser

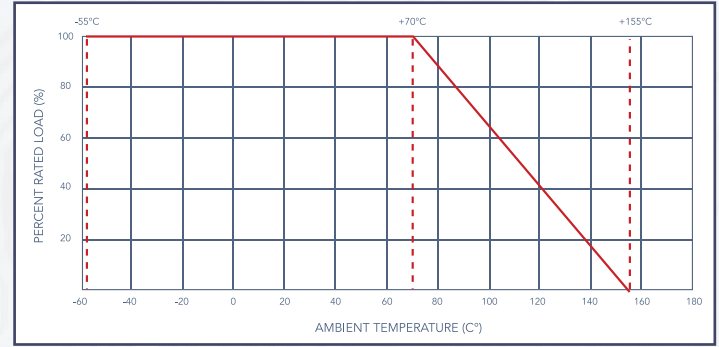
WHERE - RCWV - Rated DC or RMS AC continuous working voltage at commercial-line frequency and waveform (volt)

P - Power Rating (watt)  
R - Nominal Resistance (ohm)

## 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.

TYPE	POWER RATING 70°C	TOLERANCE %	RESISTANCE RANGE	TCR PPM / °C
RHO04 0402	1/16 W	±5	10MΩ - 100MΩ	E-24±200
RHO06 0603	1/10 W			
RHO10 0805	1/8 W			
RHO12 1206	1/4 W			
RHO14 1210	1/2 W			



## TYPE DESIGNATION

- The type designation shall be in the following form  
EX:

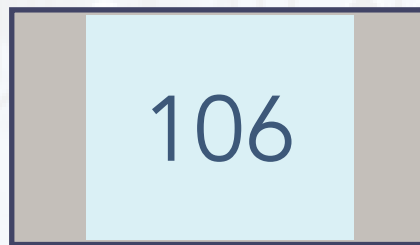
TYPE	POWER RATING	RESISTANCE TOLERANCE	NOMINAL RESISTANCE
RHO 0603	1/10	J	10MΩ

## MARKING

### RESISTORS

- ± 5% Tolerance 0402, 0603, 0805, 1206, 1210 : the first two digits are significant figures of resistance and the third one denoted number of zeros.


EX.




10MΩ

### LABELS


- Label shall be marked with the following items




CCE P/N RHO06J107CT




Cust PN



QTY 5000<sup>ea</sup>





Date Code 2132



Lot Code 2065112

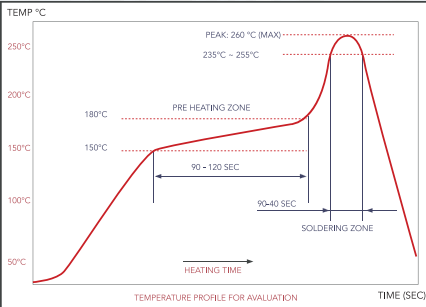
32<sup>nd</sup> week of 2021





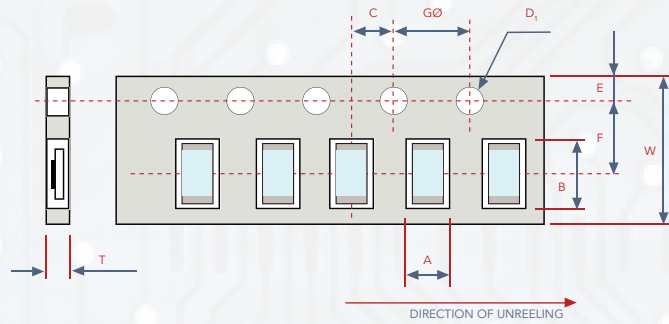
# PERFORMANCE SPECIFICATION

CHARACTERISTIC	LIMITS	TEST METHOD (JIS C 5201-1)															
Insulation Resistance	1,000 MΩ or more	Apply 500V DC between protective coating and termination for 1 min, then measure (Sub-clause 4.6)															
Dielectric Withstanding Voltage	No evidence of flashover mechanical damage, arcing or insulation break down	Apply 100V(0402) & 300V(0603) & 500V (0805,1206,1210) AC between protective coating and termination for 1 minute (Sub-clause 4.7)															
Temperature Coefficient	±200 PPM / °C	Natural resistance change per temp. degree centigrade. $\frac{R_2 - R_1}{R_1 (t_2 - t_1)} \times 10^6 \text{ (PPM/°C)}$ R <sub>1</sub> : Resistance value at room temperature (t <sub>1</sub> ) R <sub>2</sub> : Resistance value at room temp. plus 100°C (t <sub>2</sub> ) (Sub-clause 4.8)															
Short Time Overload	Resistance change rate is ±(2.0% + 0.05Ω) Max.	Permanent resistance change after the application of a potential of 2.5 times RCWW for 5 seconds (Sub-clause 4.13)															
Solderability	95% coverage Min.	Test temperature of solder : 245 ± 3°C Dipping them solder : 2-3 seconds (Sub-clause 4.17)															
Soldering Temperature Reference	Electrical characteristics shall be satisfied. Without distinct deformation in appearance. (95 % coverage Min.)	<p>WAVE SOLDERING CONDITION: (2 cycles Max.) Pre-heat : 100 ~ 120°C, 30 ± 5 sec Suggestion solder temp.: 235 ~ 250°C, 10 sec. (Max.) Peak temp.: 260°C</p> <p>REFLOW SOLDERING CONDITION: (2 cycles Max.) Pre-heat : 150 ~ 180°C, 90 ~ 120 sec. Suggestion solder temp.: 235 ~ 255°C, 20 ~ 40 sec. Peak temp.: 260°C</p>  <p>TEMPERATURE PROFILE FOR EVALUATION</p> <p>PEAK: 260 °C (MAX) 235°C ~ 255°C</p> <p>PRE HEATING ZONE 180°C 150°C 90 - 120 SEC</p> <p>SOLDERING ZONE 90-40 SEC</p> <p>HEATING TIME</p> <p>HAND SOLDERING CONDITION: The soldering iron tip temperature should be less than 300°C and maximum contract time should be 5 sec.</p>															
Soldering Heat	Resistance change rate is: ±(1.0% + 0.05Ω) Max	Dip the resistor into a solder bath having a temperature of 260°C±3°C and hold it for 10±1 seconds. (Sub-clause 4.18)															
Temperature Cycling	Resistance change rate is: ±(1.0% + 0.05Ω) Max	Resistance change after continuous 100 cycles for duty cycle specified below: <table border="1" data-bbox="852 1386 1128 1512"> <thead> <tr> <th>STEP</th> <th>TEMPERATURE</th> <th>TIME</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>-55°C ± 3°C</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 ± 2°C</td> <td>30 mins</td> </tr> <tr> <td>4</td> <td>Room Temp</td> <td>10 ~ 15 mins</td> </tr> </tbody> </table> (Sub-clause 4.19)	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															
Load Life in Humidity	Resistance change rate is: ±(3.0% + 0.05Ω) Max	Resistance change after 1,000 hours (1.5 hours "on", 0.5 hour "off") at RCWW in a humidity chamber controlled at 40°C ± 2°C and 90 to 95 % relative humidity (Sub-clause 4.24.2.1)															
Load Life	Resistance change rate is: ±(3.0% + 0.05Ω) Max	Permanent resistance change after 1,000 hours operating at RCWW, with duty cycle of (1.5 hours "on", 0.5 hour "off") at 70°C ± 2°C ambient (Sub-clause 4.25.1)															
Terminal Bending	Resistance change rate is: ±(1.0% + 0.05Ω) Max	Twist of Test Board: Y/X = 5/90 mm for 10 seconds (Sub-clause 4.33)															

## PACKING SPECIFICATION

- Taping Dimension (mm)

### PAPER TAPING

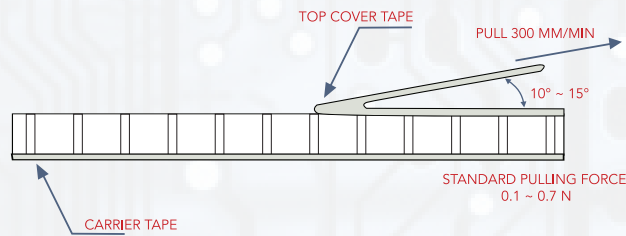


TYPE	A ± 0.2	B ± 0.2	C ± 0.05	ØD + 0.1 - 0	E ± 0.1	F ± 0.05	G ± 0.1	W ± 0.2	T ± 0.1
RHO04 0402	0.65+/-0.1	1.2+/-0.1	2.0	1.50	1.75	3.50	4.0	8.0	0.42+/-0.05
RHO06 0603	1.10	1.90	2.0	1.5	1.75	3.5	4.0	8.0	0.67
RHO10 0805	1.65	2.40	2.0	1.5	1.75	3.5	4.0	8.0	0.81
RHO12 1206	2.00	3.60	2.0	1.5	1.75	3.5	4.0	8.0	0.81
RHO14 1210	2.80	3.50	2.0	1.5	1.75	3.5	4.0	8.0	0.75

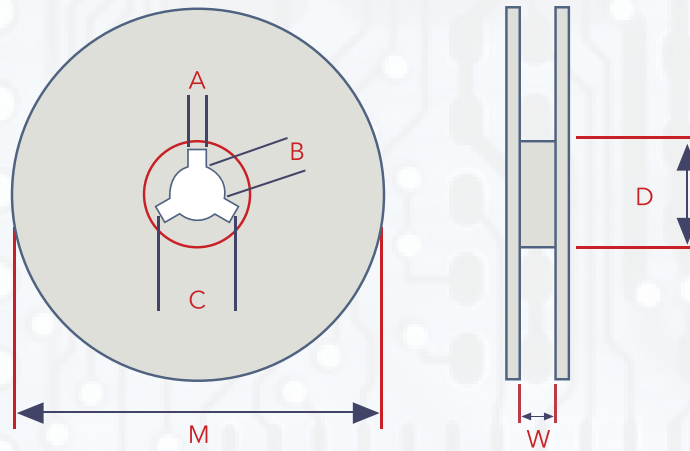
- Peeling Strength of Top Cover Tape

- Test Condition:

1.0 to 0.7 N at a peel-off speed of 300 mm / min



- Reel Dimension (mm)



TYPE	PACKAGING	QUANTITY PER REEL	A ± 0.5	B ± 0.5	C ± 0.5	D ± 1	M ± 2	W ± 1
RHO04 0402	Paper	10,000 pcs	2	13	21	60	178	10
RHO06 0603	Paper	5,000 pcs	2	13	21	60	178	10
RHO10 0805	Paper	5,000 pcs	2	13	21	60	178	10
RHO12 1206	Paper	5,000 pcs	2	13	21	60	178	10
RHO14 1210	Paper	5,000 pcs	2	13	21	60	178	10





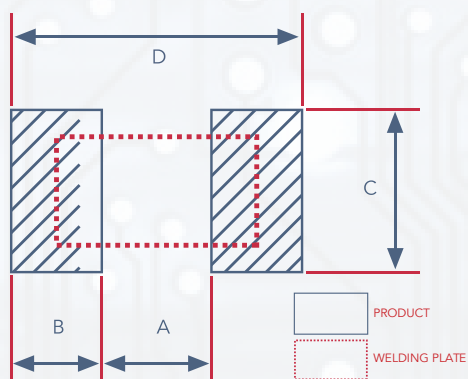
## ENVIRONMENTAL RELATED SUBSTANCE

- This product complies to EU RoHS directive, EU PAHs directive, EU PFOS directive and Halogen free.
- Ozone layer depleting substances.
- Ozone depleting substances are not used in our manufacturing process of this product.
- This product is not manufactured using Chloro fluorocarbons (CFCs), Hydrochlorofluorocarbons (HCFCs), Hydrobromofluorocarbons (HBFCs) or other ozone depleting substances in any phase of the manufacturing process.

## STORAGE CONDITION (MSL1)

- The performance of these products, including the solderability, is guaranteed for a year from the date of arrival at your company, provided that they remain packed as they were when delivered and stored at a temperature of  $25^{\circ}\text{C} \pm 10^{\circ}\text{C}$  and a relative humidity of  $60\%RH \pm 10\%RH$ , chemical and dust free atmosphere
- Even within the above guarantee periods, do not store these products in the following conditions.
- Otherwise, their electrical performance and/or solderability may be deteriorated, and the packaging materials (e.g. taping materials) may be deformed or deteriorated, resulting in mounting failures.
  1. In salty air or in air with a high concentration of corrosive gas, such as  $\text{Cl}_2$ ,  $\text{H}_2\text{S}$ ,  $\text{NH}_3$ ,  $\text{SO}_2$ , or  $\text{NO}_2$
  2. In direct sunlight

## SOLDERING PAD RECOMMENDED



TYPE	DIMENSION (MM)			
	A	B	C	D
RHO04 0402	0.5+/-0.05	0.45+/-0.05	0.5+/-0.05	1.4+/-0.05
RHO06 0603	0.9 ± 0.05	0.65 ± 0.05	0.8 ± 0.05	2.1 ± 0.05
RHO10 0805	1.0 ± 0.1	1.0 ± 0.1	1.3 ± 0.1	3.0 ± 0.1
RHO12 1206	2.0 ± 0.1	1.1 ± 0.1	1.6 ± 0.1	4.2 ± 0.1
RHO14 1210	2.0 ± 0.1	1.1 ± 0.1	2.6 ± 0.1	4.2 ± 0.1

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