THICK FILM CHIP RESISTORS
- RHO SERIES -

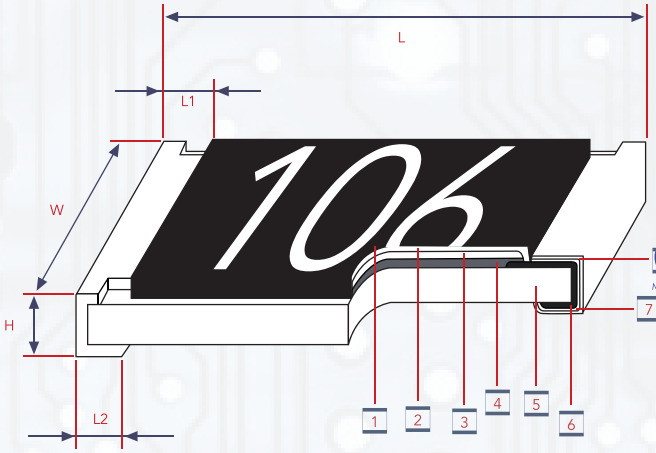
SCOPE

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

PART NUMBER SYSTEM

RHO	06	J	107	CT
TYPE	DIMENSIONS	TOLERANCE	RESISTANCE VALUE	PACKING TYPE
RHO SERIES	04: 0402 06: 0603 10: 0805 12: 1206 14: 1210	J ~ ±5%	5% - 3 Digit: 1st 2 are significant, 3rd is multiplier (10x), "R" indicates decimal on value <10ohm, 000 jumper "0"ohm" 1% - 4 digit: 1st 3 are significant, 4th is multiplier (10x), "R" indicates decimal on value <100 ohm	T - T/R Packing

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 avaialble 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

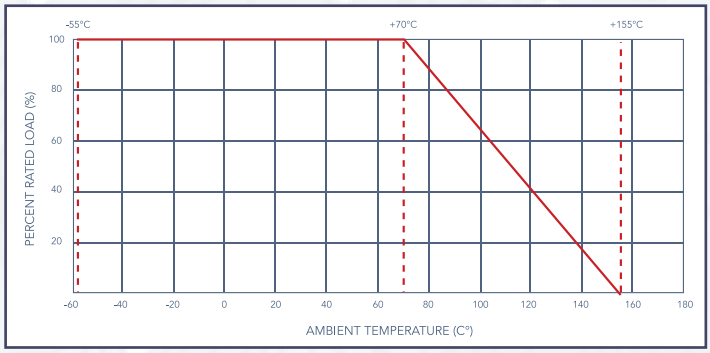
WHERE - RCWV - Rated DC or RMS AC continuous working voltage at commercial-line frequency and waveform (volt)

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

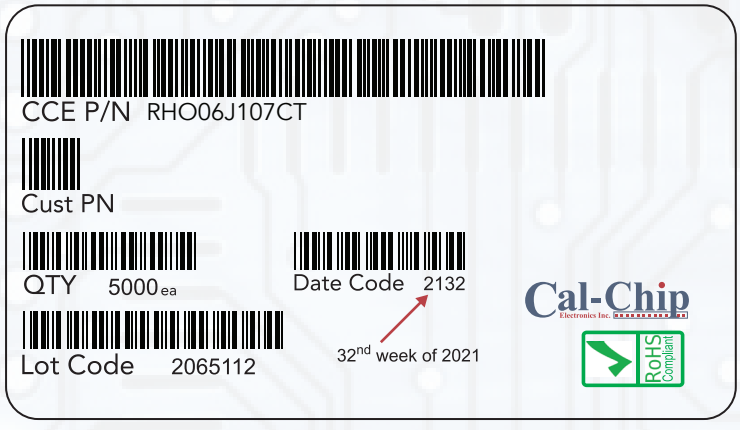
RESISTORS

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

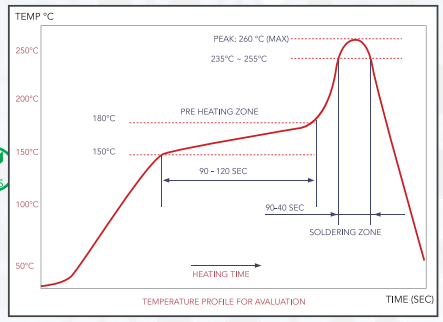
EX.  10MΩ

LABLES

- Lable shall be marked with the following items



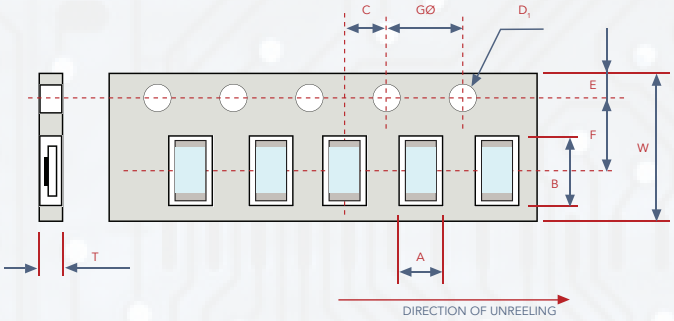
PERFORMANCE SPECIFICATION

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. $\frac{R_2 - R_1}{R_2 (t_2-t_1)} \times 10^6$ (PPM/°C) R_1: Resistance value at room temperature (t_1) R_2: Resistance value at room temp. plus 100°C (t_2) (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 RCWV 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.)	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 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 MS LEVEL 1 RoHS  HAND SOLDERING CONDITION: The soldering iron tip temperature should be less than 300°C and maximum contract time should be 5 sec.
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: 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 (Sub-clause 4.19)
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 RCWV 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 RCWV, 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

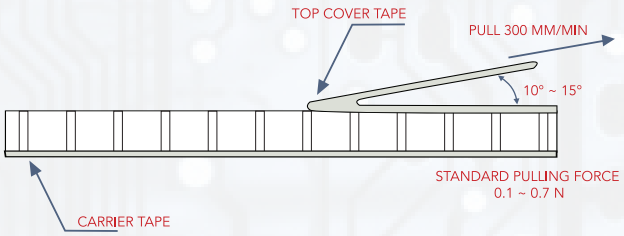
- Taping Dimension (mm)

PAPER TAPING

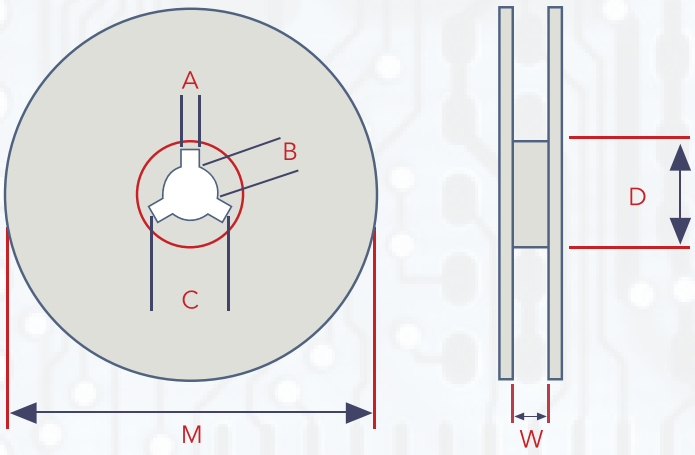


TYPE	A ± 0.2	B ± 0.2	C ± 0.05	ØD + 0.1 - 0	E ± 0.1	F ± 0.05	G ± 0.1	W ± 0.2	T ± 0.1
RHO04 0402	0.65+/-.1	1.2+/-.1	2.0	1.50	1.75	3.50	4.0	8.0	0.42+/-.05
RHO06 0603	1.10	1.90	2.0	1.5	1.75	3.5	4.0	8.0	0.67
RHO10 0805	1.65	2.40	2.0	1.5	1.75	3.5	4.0	8.0	0.81
RHO12 1206	2.00	3.60	2.0	1.5	1.75	3.5	4.0	8.0	0.81
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

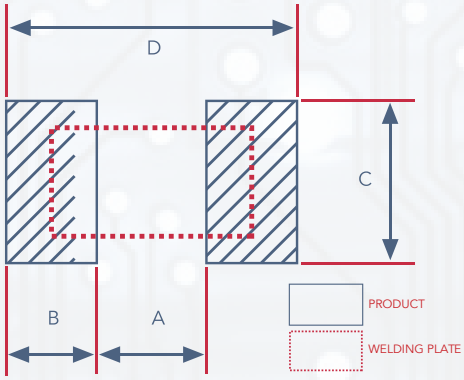
- This product complies to EU RoHS directive, EU PAHs directive, EU PFOS directive and Halogen free.
- Ozone layer depleting substances.
- Ozone depleting substances are not used in our manufacturing process of this product.
- This product is not manufactured using Chloro fluorocarbons (CFCs), Hydrochlorofluorocarbons (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°C ± 10°C and a relative humidity of 60%RH ± 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 Cl_2, H_2S, NH_3, SO_2, or NO_2
2. In direct sunlight

SOLDERING PAD RECOMMENDED



TYPE	DIMENSION (MM)			
	A	B	C	D
RHO04 0402	0.5+/-.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

MS LEVEL 1

LEGAL DISCLAIMER

The information provided in the catalog/data sheet is for the purpose of describing product specifications only, and Cal-Chip Electronics, Inc. and its affiliates (hereinafter collectively referred to as "Cal-Chip Electronics, Inc.") hereby disclaim any liability for any errors, inaccuracies or incompleteness contained in any product-related information (including but not limited to product specifications, datasheets, pictures, graphics).

Cal-Chip Electronics, Inc. reserves the right to modify this content without prior notice.
Thank you for your understanding.

Cal-Chip Electronics, Inc. makes no representation, warranty, and guarantee as to the fitness of its products for any particular purpose or the continuing production of any Cal-Chip Electronics, Inc. products.
To the maximum extent permitted by law, Cal-Chip Electronics, Inc. disclaims

(i) any and all liability arising out of the application or use of any Cal-Chip Electronics, Inc. product,
(ii) any and all liability, including without limitation special, consequential or incidental damages, and
(iii) any and all implied warranties, including warranties of fitness for a particular purpose, non-infringement and merchantability.

Cal-Chip Electronics, Inc. products are not intended for use in medical, life-saving, or life-sustaining equipment, nor are they intended for any other purpose where product failure or mismanagement could endanger life or cause harm to or death to the human body. Customers use or sell Cal-Chip Electronics, Inc. products for the above purposes at their own risk. If need products for such purposes, please be sure to consult with our company to obtain relevant information about the applicable products.

Regardless of the application of Cal-Chip Electronics, Inc. products, it is recommended to carry out safety tests while using measures such as protective circuits and redundant circuits to protect the safety of equipment.