Towards Excellence in *Quality, Service & Innovation*

ASJ

DATA SHEET

General Purpose Thick Film Chip Resistor

CR Series

0.1% To 5%, TCR ±100 To ±200

SIZE: 1210/1812/2010/2512

RoHS Compliant

Product Specification – Dec. 22, 2023 V9

1. SCOPE

1.1 This specification is applicable to Lead-free and Halogen-free of RoHS Directive for CR series thick film chip resistors.

1.2 The products for 1210, 1812, 2010 and 2512 are tested and passed based on the test conditions and methods defined in AEC-Q200.

2. PART NUMBERING SYSTEM

Part Numbering is made in accordance with the following system:

CR	48	-	1002			-	F	E
Type	**Size**		**Nominal Resistance**				**Resistance Tolerance**	**Packaging**
General Purpose Thick Film Chip Resistors	40(1210) 48(1812) 50(2010) 63(2512)		Resistors	3-Digit	E24 Series 4.7Ω=4R7 Jumper = 000		B=±0.1% D=±0.5% F=±1% G=±2% J=±5% Z=Zero Ohm	E=4,000 pcs Lead Free L=5,000 pcs Lead Free K=10,000 pcs Lead Free Y=20,000pcs Lead Free
				4-Digit	E96 Series 10.2Ω=10R2 10KΩ=1002 Jumper = 0000			

3. RATING

3.1 Rated Power

3.1.1 Resistor Rated Power

Type	Rated Power at 70℃	Max. Working Voltage	Max. Overload Voltage	T.C.R (ppm/℃)	JUMPER Rated Current		JUMPER Resistance Value	
					Z (±5%)	F (±1%)	Z (±5%)	F (±1%)
CR40 (1210)	1/2 W	200V	400V	±100 ±200	2A	3.5A	50mΩ MAX.	35mΩ MAX.
CR48 (1812)	3/4 W	200V	400V	±100 ±200	2A	4.5A	50mΩ MAX.	35mΩ MAX.
CR50 (2010)	3/4 W	200V	400V	±100 ±200	2A	4.5A	50mΩ MAX.	35mΩ MAX.
CR63 (2512)	1W	200V	400V	±100 ±200	2A	5A	50mΩ MAX.	35mΩ MAX.

3.2 Power Derating Characteristics

Rated Power shall be the load power corresponding to nominal wattage suitable for continuous use at 70°C ambient temperatures. In case the ambient temperature exceeds 70°C, reduce the load power in accordance with Derating curve in Fig. 1.

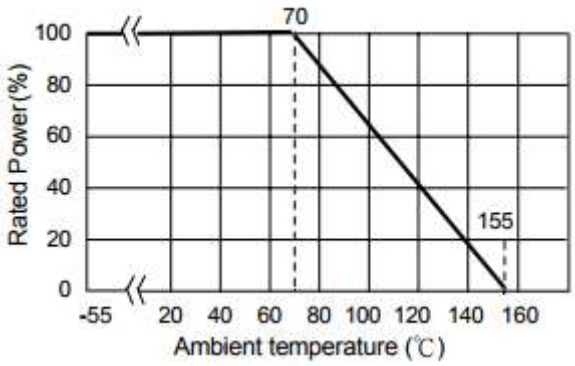


Fig.1 Power Derating Characteristics

3.3 Standard Atmospheric Condition

Unless otherwise specified, the standard range of atmospheric conditions for making measurements and tests is as follows:

Ambient Temperature = + 5°C to +35°C

Relative Humidity = < 85% RH

Air Pressure = 86 kPa to 106kPa

If there may be any doubt about the results, measurement shall be made within the following limits:

Ambient Temperature = 20 ± 2°C

Relative Humidity = 60 to 70% RH

Air Pressure = 86 kPa to 106kPa

3.4 Operating Temperature Range -55°C to +155°C

3.4 Storage Temperature Range -5°C to + 40°C

3.6 Flammability Rating Tested in accordance to UL-94, V-0

3.7 Moisture Sensitivity Level Rating: Level 1

3.8 Product Assurance

ASJ resistor shall warranty 24 months from manufacturing date with control conditions.

3.9 ASJ resistors are RoHS-compliant in accordance to RoHS Directive.

3.10 Resistance, Resistance Tolerance and Temperature Coefficient of Resistance.

Type	Rated Power at 70℃	Max. Working Voltage	Max. Overload Voltage	T.C.R (ppm/℃)	Resistance Range				JUMPER Rated Current		JUMPER Resistance Value	
					B(±0.1%) E-24、E-96	D(±0.5%) E-24、E-96	F(±1%) E-24、E-96	G(±2%)、J(±5%) E-24	Z (±5%)	F (±1%)	Z (±5%)	F (±1%)
CR40 (1210)	1/2W	200V	400V	±100	100Ω≦R≦1MΩ	10Ω≦R≦10MΩ	10Ω≦R≦27MΩ	10Ω≦R≦27MΩ	2A	3.5A	50mΩ MAX.	35mΩ MAX
				±200	------	------	1Ω≦R＜10Ω	1Ω≦R＜10Ω				
CR48 (1812)	3/4W	200V	400V	±100	100Ω≦R≦1MΩ	10Ω≦R≦10MΩ	10Ω≦R≦20MΩ	10Ω≦R≦20MΩ	2A	4.5A	50mΩ MAX.	35mΩ MAX
				±200	------	------	1Ω≦R＜10Ω	1Ω≦R＜10Ω				
CR50 (2010)	3/4W	200V	400V	±100	100Ω≦R≦1MΩ	10Ω≦R≦10MΩ	10Ω≦R≦20MΩ	10Ω≦R≦20MΩ	2A	4.5A	50mΩ MAX.	35mΩ MAX
				±200	------	------	1Ω≦R＜10Ω	1Ω≦R＜10Ω				
CR63 (2512)	1W	200V	400V	±100	100Ω≦R≦1MΩ	10Ω≦R≦10MΩ	10Ω≦R≦20MΩ	10Ω≦R≦20MΩ	2A	5A	50mΩ MAX.	35mΩ MAX
				±200	------	------	1Ω≦R＜10Ω	1Ω≦R＜10Ω				
Operating Temperature Range				－55℃ ~ ＋155℃ (0201:－55℃ ~ ＋125℃)								

3.11 Rated Voltage

The resistor shall have a DC continuous working voltage or a rms. AC continuous working voltage at commercial-line frequency and wave form corresponding to the power rating, as determined from the following :

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

E= Rated voltage (v)
P= Power rating (w)
R= Nominal resistance(Ω)

3.12 All product, product specifications and data are subject to change without notice to improve reliability, function or design or otherwise.

4. MARKING ON PRODUCT

The nominal resistance shall be marked on the surface of each resistor

Part Number	Color	Marking on Product
CR40 CR48 CR50 CR63	Light Yellow	1) Tolerance : ±0.1%, 0.5%, 1.0% (F) ° Four Numerals Marking (E96 Series) 2) Tolerance; ± 2.0% (G), ±5.0% (J) Three Numerals Marking 3) Zero ohm jumper resistor The marking used shall be 0

4.1 Numeric Numbering

4.1.1 5% Tolerance: ***Three Numerals Marking***

First 2 digits are significant figures; third digit is number of zeros. Letter R is decimal point.

Example

Nominal Resistance	***Marking***	***Remarks***
1 Ω	1R0	$1 \times 10^0 = 1$
10 Ω	100	$10 \times 10^0 = 1\,0$
100 Ω	101	$10 \times 10^1 = 1\,00$
4.7K Ω	472	$47 \times 10^2 = 47\,00$
47K Ω	473	$47 \times 10^3 = 47\,000$
470K Ω	474	$47 \times 10^4 = 47\,0000$
4.7M Ω	475	$47 \times 10^5 = 47\,00000$

4.1.2 1% Tolerance : ***Four Numerals Marking***

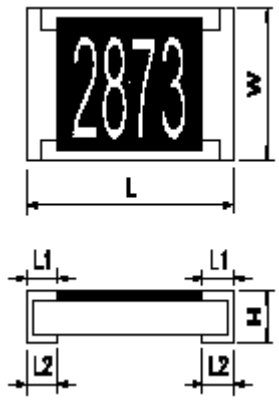
First 3 digits are significant figures; fourth digit is number of zeros.

Examples:

Nominal Resistance	***Marking***	***Remarks***
1 Ω	1R00	$1 \times 10^0 = 1$
10 Ω	10R0	$10 \times 10^0 = 10$
100 Ω	1000	$100 \times 10^0 = 100$
4.7K Ω	4701	$470 \times 10^1 = 470\,0$
47K Ω	4702	$470 \times 10^2 = 470\,00$
470K Ω	4703	$470 \times 10^3 = 470\,000$
1M Ω	1004	$100 \times 10^4 = 100\,0000$

5. DIMENSION, CONSTRUCTION AND MATERIAL

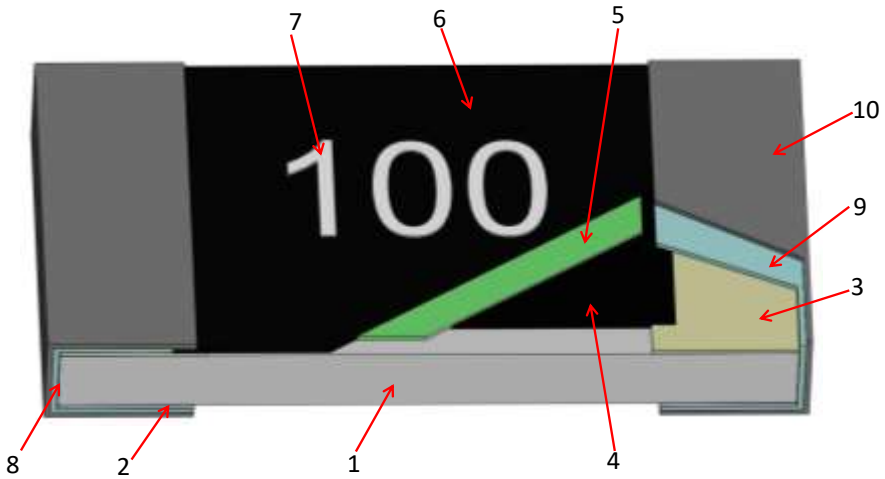
5.1 Dimension



Unit:mm

Type \ Dimension / Size Code	L	W	H	L1	L2
CR40 **1210**	3.05±0.10	2.55±0.10	0.55±0.10	0.50±0.20	0.50±0.20
CR48 **1812**	4.40±0.20	3.15±0.20	0.47±0.20	0.60±0.20	0.60±0.20
CR50 **2010**	5.00±0.20	2.50±0.20	0.55±0.10	0.60±0.20	0.60±0.20
CR63 **2512**	6.30±0.20	3.20±0.20	0.55±0.10	0.60±0.20	0.60±0.20

5.2 Structure Graph



1	Ceramic substrate	6	2nd Protective coating
2	Bottom inner electrode	7	Marking
3	Top inner electrode	8	Terminal inner electrode
4	Resistive layer	9	Ni plating
5	1st Protective coating	10	Sn plating

5.3 Plating Thickness

Ni : ≧ 2 µm

Sn (Tin) : ≧ 3 µm

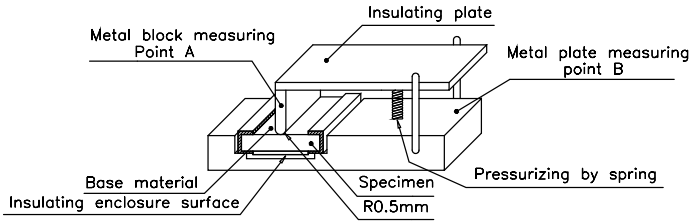
Sn (Tin) : Matte Sn

6. RELIABILITY TEST

6.1 Electrical Performance Test

<table>
<tr><th rowspan="2">Item</th><th rowspan="2">Conditions</th><th colspan="2">Specifications</th></tr>
<tr><th>Resistors</th><th>Jumper</th></tr>
<tr><td>Temperature Coefficient of Resistance</td><td>$TCR(ppm/^{\circ}C)=\frac{(R2-R1)}{R1(T2-T1)}10^6$
R1: Resistance at room temperature
R2: Resistance at -55℃ or +125℃
T1: Room temperature
T2: Temperature -55℃ or +125℃

Refer to JIS-C5201-1 4.8</td><td>Refer to item 3.10</td><td>NA</td></tr>
<tr><td>Short Time Overload</td><td>Applied 2.5 times rated voltage for 5 seconds and release the load for about 30 minutes, then measure its resistance variance rate. (Rated voltage refer to item 3.10 general specifications)

Refer to JIS-C5201-1 4.13</td><td>0.1%、0.5%、1%:△R%=±1.0%
2%、5%:△R%=±2.0%</td><td>Refer to item 3.10</td></tr>
<tr><td>Insulation Resistance</td><td>Put the resistor in the fixture, add 100 VDC in + ,- terminal for 60 sec then measured the insulation resistance between electrodes and insulating enclosure or between electrodes and base material.
Refer to JIS-C5201-1 4.6
 
</td><td>≧$10^9\Omega$</td><td></td></tr>
<tr><td>Dielectric Withstand Voltage</td><td>Put the resistor in the fixture, add VAC (see SPEC below) in +,- terminal for.
CR40、48、50、63 apply 500 VAC 1 minute.

Refer to JIS-C5201-1 4.7</td><td colspan="2">No short or burned on the appearance.</td></tr>
<tr><td>Intermittent Overload</td><td>Put the tested resistor in chamber under temperature 25±2℃ and load 2.5 times rated DC voltage for 1 sec on, 25 sec off, $10{,}000^{+400}_{-0}$ test cycles, then it be left at no-load for 1 hour , then measure its resistance variance rate.
Jumper : Applied Maximum overload current
<table>
<tr><th>Type / Jumper</th><th>CR40 (1210)</th><th>CR48 (1812)</th><th>CR50 (2010)</th><th>CR63 (2512)</th></tr>
<tr><td>±5%</td><td>5A</td><td>5A</td><td>5A</td><td>5A</td></tr>
<tr><td>±1%</td><td>10A</td><td>12.5A</td><td>12.5A</td><td>17.5A</td></tr>
</table>
Refer to JIS-C5201-1 4.13</td><td>△R%=±5.0%</td><td>Refer to item 3.10</td></tr>
</table>

6.2 Mechanical Performance Test

<table>
<tr><th rowspan="2">Item</th><th rowspan="2">Conditions</th><th colspan="2">Specifications</th></tr>
<tr><th>Resistors</th><th>Jumper</th></tr>
<tr><td>Terminal Strength</td><td>Test 1 : The resistor mounted on the board applied 5N pushing force on the sample rear for 10 sec.
Test 2 : The resistor mounted on the board slowly add force on the sample rear until the sample termination is breakdown.

Refer to JIS-C5201-1 4.16</td><td colspan="2">Test 1 : No evidence of mechanical damage.
Test 2 : ≧5N</td></tr>
<tr><td>Resistance to Solvent</td><td>The tested resistor be immersed into isopropyl alcohol of 20~25℃ for 5 minutes, then the resistor is left in the room for 48 hrs, and measured its resistance variance rate.

Refer to JIS-C5201-1 4.29</td><td><table><tr><th>Type</th><th>Spec</th></tr><tr><td>△R%</td><td>△R%=±0.5%</td></tr></table></td><td>Refer to item 3.10</td></tr>
<tr><td>Solderability</td><td>Preconditioning
Put the tested resistor in the apparatus of PCT, at a temperature of 105℃, humidity of 100% RH, and pressure of 1.22×10^5 Pa for a duration of 4 hours. Then after left the tested resistor in room temperature for 2 hours or more.
Test method:
The resistor be immersed into solder pot in temperature 235±5℃ for 2 sec, then the resistor is left as placed under microscope to observed its solder area.

Refer to JIS-C5201-1 4.17</td><td colspan="2">Solder coverage over 95%</td></tr>
<tr><td>Resistance to Soldering Heat</td><td>◎Test method 1 (Solder pot test):
The tested resistor be immersed into molten solder of 260^{+5}_{-0} ℃ for 10 seconds. Then the resistor is left in the room for 1 hour.

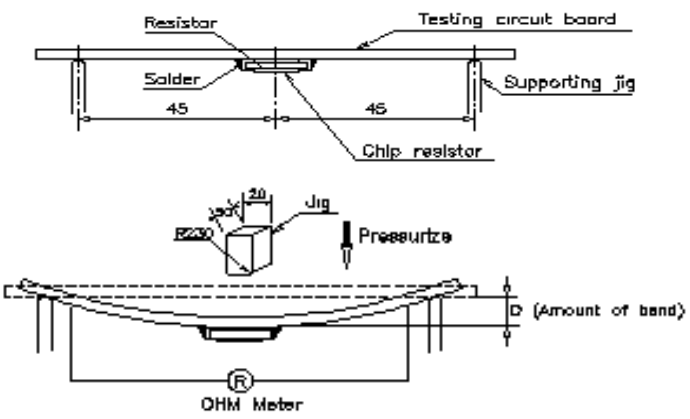
◎Test method 2 (Solder pot test):
The tested resistor be immersed into molten solder of 260^{+5}_{-0} ℃ for 30 seconds. Then the resistor is left as placed under microscope to observe its solder area.

◎Test method 3 (Electric iron test):
Preheating temperature : 350±10℃
Electric iron preheating time : 3^{+1}_{-0} sec
Preheating the electric iron on electrode termination, as after that step placed the iron over 60 min. and measured its resistance variance rate.

Refer to JIS-C5201-1 4.18</td><td>Test item 1:
(1).Variance rate on resistance
△R%=±1.0%

Test item 2:
(1).Solder coverage over 95%.
(2).The underlying material (such as ceramic) shall not be visible at the crest corner area of the electrode.

Test item 3:
(1).Variance rate on resistance
△R%=±1.0%</td><td>Refer to item 3.10</td></tr>
</table>

Item	Conditions	Specifications	
		Resistors	Jumper
Joint Strength of Solder	◎Bending Strength Solder tested resistor on to PC board add force in the middle down, and under load measured its resistance variance rate. D: CR40=3mm CR48、50、63=2mm  Refer to JIS-C5201-1 4.33	△R%=±1.0%	Refer to item 3. general specifications

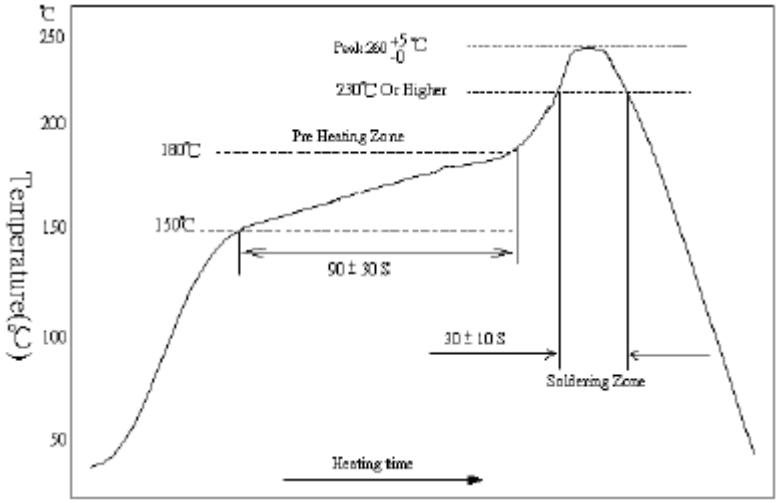
6.3 Environmental Test

Item	Conditions	Specifications	
		Resistors	Jumper
Resistance to Dry Heat	Put tested resistor in chamber under temperature 155±5℃ for 1000^{+48}_{-0} hours. Then leaving the tested resistor in room temperature for 60 minutes, and measure its resistance variance rate.(RTT01 for 125±3℃) Refer to JIS-C5201-1 4.25	0.1%、0.5%、1%:△R%=±1.0% 2%、5%:△R%=±2.0%	Refer to item 3.10
Thermal Shock	Put the tested resistor in the chamber under the Thermal Shock which shown in the following table shall be repeated 300 times consecutively. Then leaving the tested resistor in the room temperature for 1 hours, and measure its resistance variance rate. Testing Condition: Lowest Temperature -55±5℃; Highest Temperature 125±5℃; Temperature-retaining time 15 minutes each Refer to MIL-STD 202 Method 107	0.1%、0.5%、1%:△R%=±0.5% 2%、5%:△R%=±1.0%	Refer to item 3.10
Loading Life in Moisture	Put the tested resistor in the chamber under temperature 40±2℃, relative humidity 90~95% and load the rated voltage for 90 minutes on, 30 minutes off, total 1000 hours. Then leaving the tested resistor in room temperature for 60 minutes, and measure its resistance variance rate. Refer to JIS-C5201-1 4.24	Type: Range; Spec: 0.1%、0.5%、1%: △R%=±0.5%; 2%、5%: △R%=±2.0%	Refer to item 3.10
Load Life	Put the tested resistor in chamber under temperature 70±2℃ and load the rated voltage for 90 minutes on, 30 minutes off, total 1000 hours. Then leaving the tested resistor in room temperature for 60 minutes, and measure its resistance variance rate. Refer to JIS-C5201-1 4.25	Type: Range; Spec: 0.1%、0.5%、1%: △R%=±0.5%; 2%、5%: △R%=±2.0%	Refer to item 3.10

6.4 Recommended Soldering Method

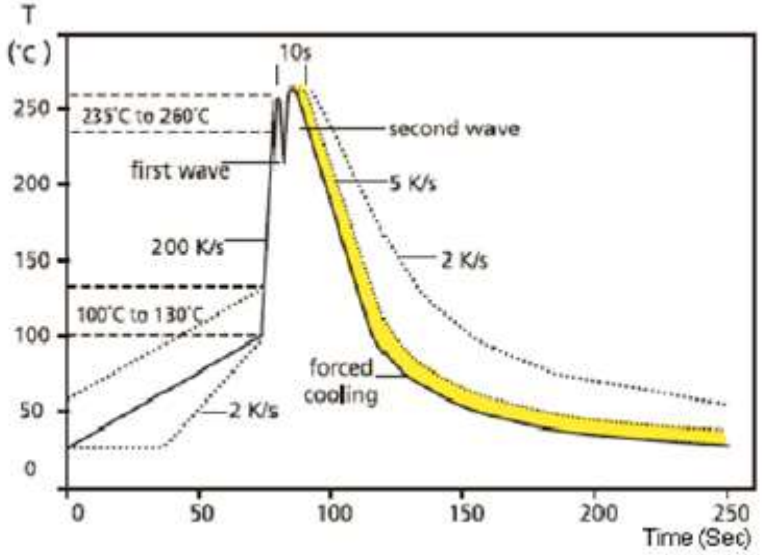
Technical application notes: This is for recommendation, customer please perform adjustment according to actual application.

6.4.1 Lead-Free Reflow Soldering Profile (MEET J-STD-020D)



Remark : The peak temperature of soldering heat is 260^{+5}_{-0} ˚C for 10 second

6.4.2 Lead-Free Double Wave Soldering Profile (This applies to 0603 size inclusive above products)

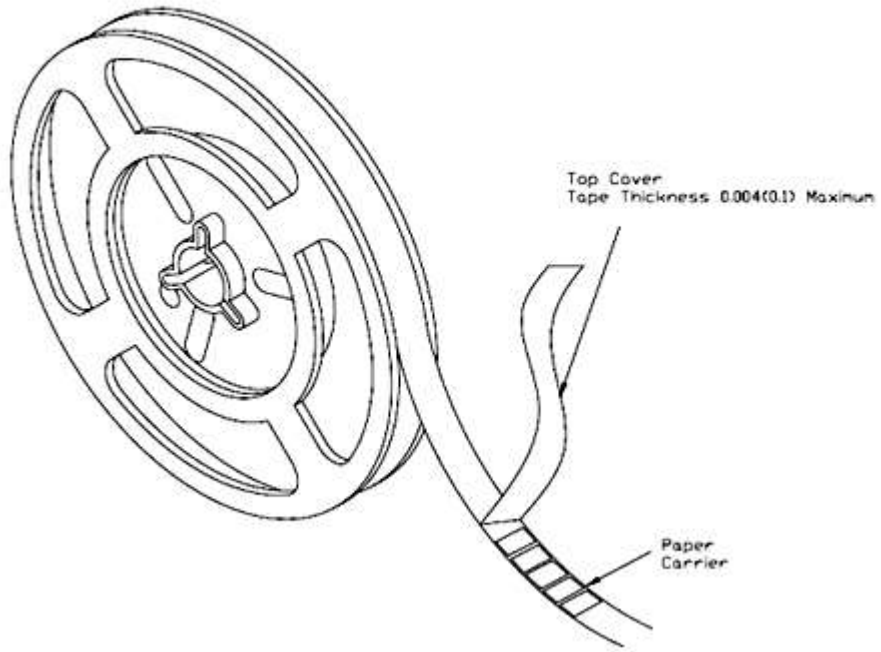


6.4.3 Soldering iron : Temperature 350˚C ± 10˚C, dwell time shall be less than 3 sec

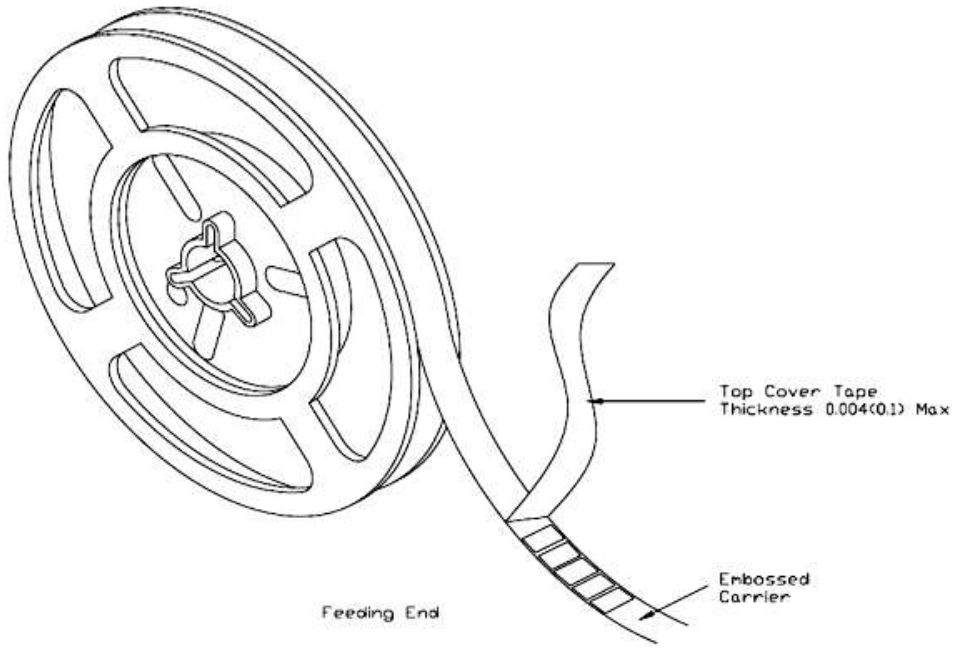
7. TAPING

7.1 Structure of Taping

Paper Carrier

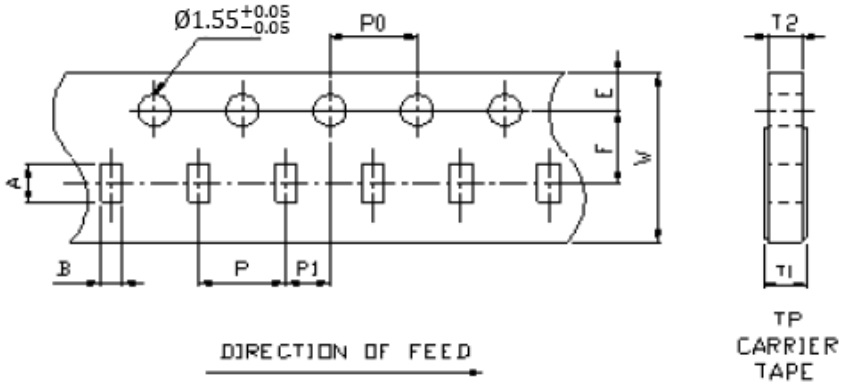


Embossed Plastic Carrier



7.2 Dimension

7.2.1 Dimension of Punched Paper Tape Carrier System /Plastic Embossed Carrier System (CR40)

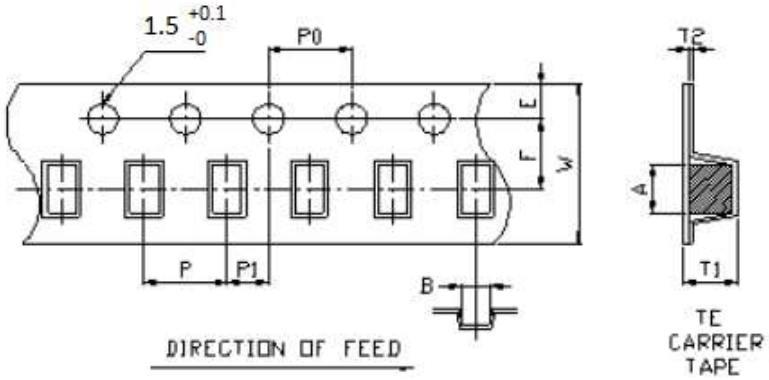


Remark: Pitch tolerance over any 10 pitches of Po is ± 0.2 mm

Dimension of Punched Paper Tape Carrier System (CR - 40)

Code	A	B	W	E	F	T1	T2	P	P0	P1	10P0
CR40	3.50±0.20	2.80±0.20	8.00±0.20	1.75±0.10	3.50±0.05	$0.75^{+0.2}_{-0}$	0.75±0.10	4.00±0.10	4.00±0.05	2.00±0.05	40.0±0.20

7.2.2 Dimension of Plastic Embossed Carrier System (CR-48, 50, 63)



Remark : Pitch tolerance over any 10 pitches of Po is ± 0.2 mm

Dimension of Plastic Embossed Carrier System (CR 48, 50, 63)

Code	A	B	W	E	F	T1	T2	P	P0	P1
CR48	4.90 ± 0.10	3.40 ± 0.10	12.0 ± 0.20	1.75 ± 0.10	5.50 ± 0.05	0.75±0.10	0.23±0.02	4.00±0.10	4.00±0.10	2.00±0.05
CR50	5.50 ± 0.20	2.80 ± 0.20	12.0 ± 0.20	1.75 ± 0.10	5.50 ± 0.05	1.10±0.15	0.23±0.15	4.00±0.10	4.00±0.05	2.00±0.05
CR63	6.70 ± 0.20	3.40 ± 0.20	12.0 ± 0.20	1.75 ± 0.10	5.50 ± 0.05	1.10±0.15	0.23±0.15	4.00±0.10	4.00±0.05	2.00±0.05

7.3 Packaging

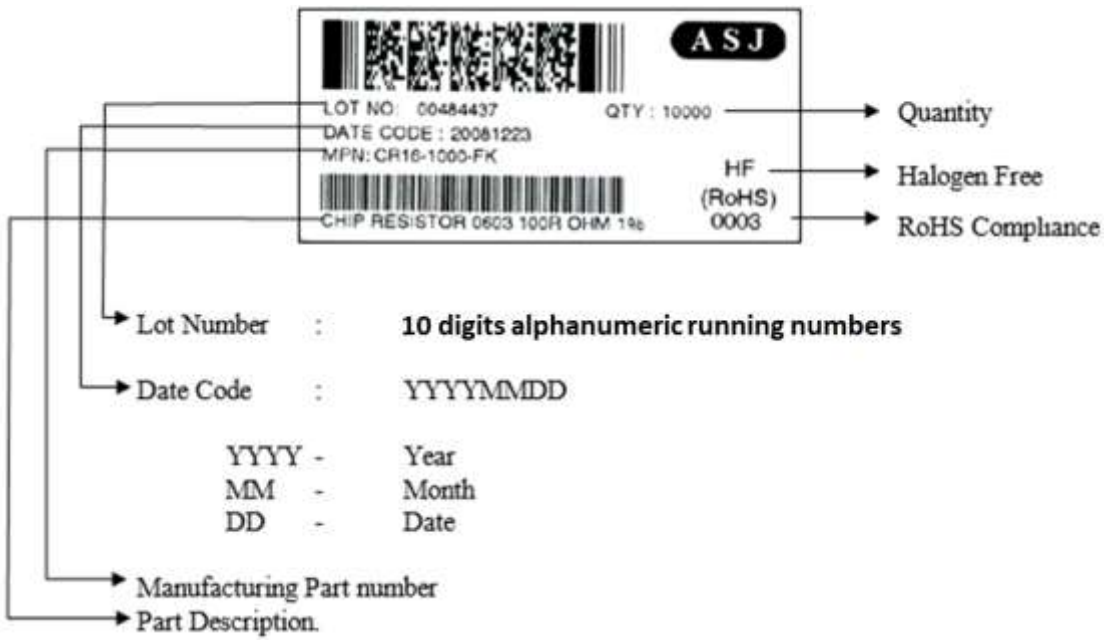
7.3.1 Taping

Quantity – Tape and Reels

Code	Quantity	Model	Remarks
CR40	5000 pcs	7" Reel	4mm pitch
	10000 pcs	10" Reel	4mm pitch
	20000 pcs	13" Reel	4mm pitch
CR48(1812) CR50(2010) CR63(2512)	4000 pcs	7" Reel	4mm pitch
	10000 pcs	13" Reel	4mm pitch
			4mm pitch

7.3.2 Identification

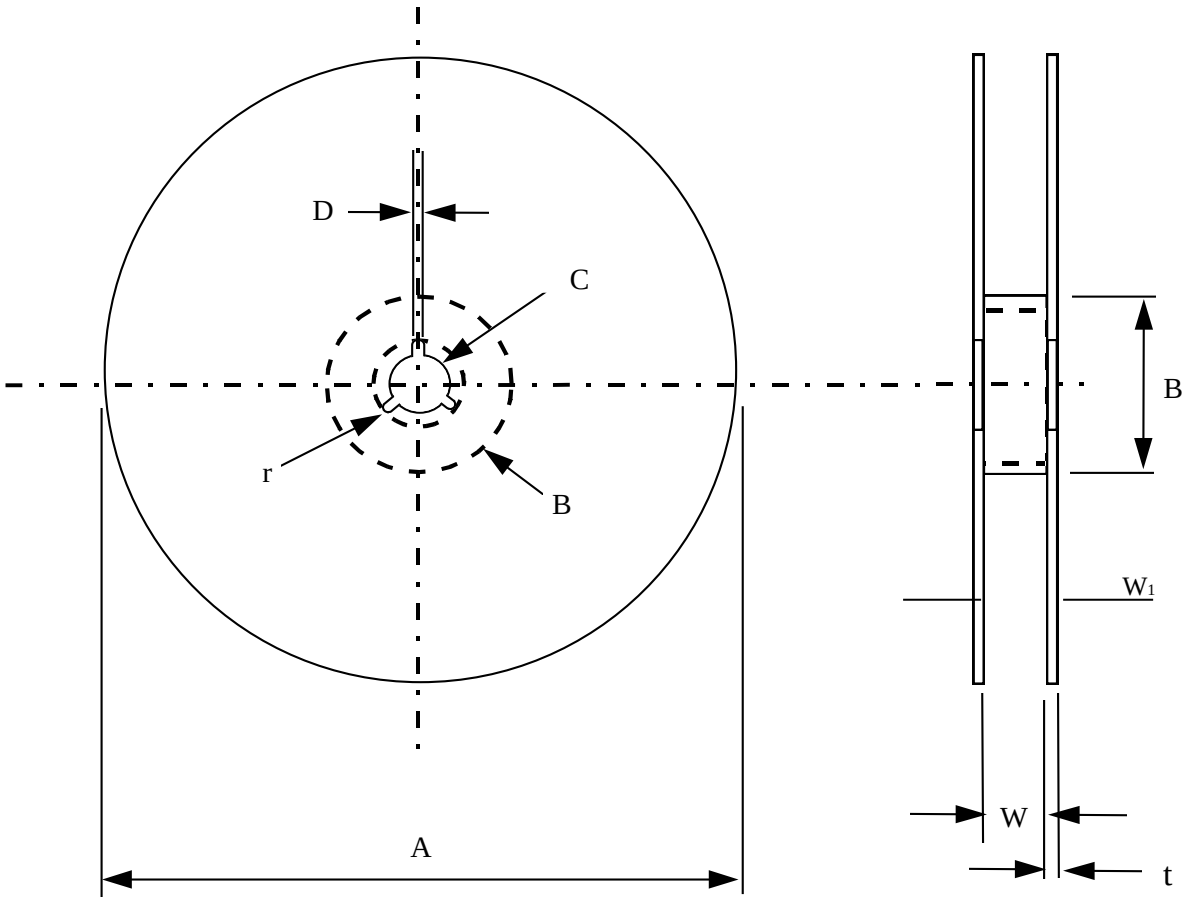
Production label that indicates the 10 digits lot number, product type, resistance value and tolerance shall be pasted on the surface of each reel.



7.3.3 Packaging Reel Box

Dimension	Reel Box	Number of Reels
185 × 60 × 186 mm	25K Box	5
185 × 120 × 186 mm	50K Box	10

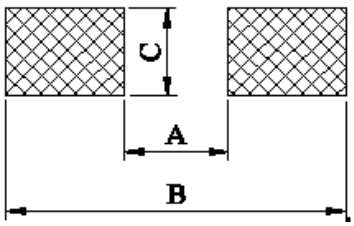
7.3.4 Reel Dimensions



Model	A	B	C	D	W	W_1	t	r
7"Reel (5K) (except 0402 10K)	ϕ178±2.0	ϕ60min	13± 0.2	ϕ2.0± 0.5	11± 0.1	14.4 max	1.0± 0.1	1.0
7"Reel (4K)	ϕ178±2.0	ϕ60min	13± 0.2	ϕ2.0± 0.5	13±1.0	14.4 max	1.2± 0.1	1.0
7''Reel (10K)	ϕ178±2.0	ϕ60min	13± 0.2	ϕ2.0± 0.5	11± 0.1	14.4 max	1.0± 0.1	1.0
10"Reel (10K)	ϕ254±2.0	ϕ60min	13± 0.2	ϕ2.0± 0.5	11± 1.0	14.4 max	1.5± 0.1	1.0
13"Reel (20K, 50K)	ϕ330±2.0	ϕ60min	13± 0.2	ϕ2.0± 0.5	11± 1.0	14.4 max	2.1± 0.1	-
13"Reel (20K)	ϕ330±1.0	ϕ100±1	13.5±0.5	2~3±0.5	10±0.5	-	-	-

8. SURFACE MOUNT LAND PATTERNS DESIGN (FOR REFLOW SOLDERING)

When a component is soldered, the resistance after soldering changes slightly depending on the size of the soldering area and the amount of soldering. When designing a circuit, it is necessary to consider the effect of a decrease or increase in its resistance.

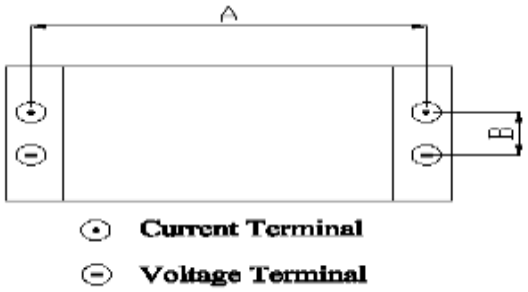


Unit:mm

TYPE \ DIM	A	B	C
CR40	2.2	4.2	2.8
CR48	3.1	5.9	3.0
CR50	3.5	6.1	2.8
CR63	3.8	8.0	3.5

9. MEASUREMENT POINT

Bottom electrode



Unit : mm

TYPE \ DIM	A	B
CR40	2.90±0.05	0.35±0.05
CR48	3.70±0.05	0.60±0.05
CR50	4.50±0.05	1.15±0.05
CR63	5.90±0.05	1.60±0.05

10. REVISION HISTORY

REVISION	DATE	CHANGE NOTIFICATION	DESCRIPTION
Version.1	01.12.2016		Initial Release
Version.2	06.02.2018		1、update information to clause 1 2、update information to clause 2 3、update information to clause 3.1 4、update information to clause 3.10 5、update information to clause 5.1 6、update information to clause 6 7、update information to clause 6.1.1 and 6.1.2 8、update information to clause 7.1.1
Version.3	28.03.2019		1、Add in CR40, CR50, CR63 to the datasheet 2、Update clause 2 Part Numbering System 3、Update clause 3.1.1 table 4、Update clause 3.10 table 5、Update clause 4 table 6、Update clause 5.1 table 7、Update clause 6 test condition and specification 8、Update clause 7.2 dimension for CR40, CR50, CR63 9、Update clause 7.7.1.1 tape and reel 10、Update clause 7.7.4 reel dimension table 11、Update clause 8 Land Pattern table 12、Update clause 9 measurement point table
Version.4	06.09.2019		Revise clause 3.9
Version.5	22.11.2019		Revise clause 9 measurement point for CR48
Version.6	06.08.2021		Revise clause 3.1.1, 3.10, change J to Z for jumper.
Version.7	15.09.2021		Revise clause 6.1.1, add (MEET J-STD-020D) to Lead Free Reflow Soldering Profile
Version.8	22.12.2021		Revise clause 3.1.1 Resistor rated power Revise clause 3.10 TCR table Revise clause 7.3.1.1 tape and reel qty
Version 9	22.12.2023		Revise clause 3.8 Product Assurance Revise clause 7.3.2 Identification