

ASJ

DATA SHEET

High Precision Low-Resistance Thick Film Chip
Resistors

CR Series(<1Ω)

1%, TCR ±100

SIZE: 0805/1206/2010/2512



HIGH PRECISION LOW-RESISTANCE THICK FILM CHIP RESISTORS

CR Series (< 1Ω)

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1. SCOPE

- 1.1 This specification is applicable to Lead-free and Halogen-free of RoHS Directive for CR series precision low-resistance thick film chip resistors.
- 1.2 The product is for general electronic purpose.

2. PART NUMBERING SYSTEM

Part Numbering is made in accordance with the following system:

CR	32	-	R560	-	F	L	-	F
Type	Size		Nominal Resistance		Resistance Tolerance	Packaging		TCR
High Precision Low Resistance Thick Film Chip Resistors	21(0805) 32(1206) 50(2010) 63(2512)		4 Digit EX. 0.15Ω=R150 0.56Ω=R560		F=±1%	E=4,000 pcs Lead Free L=5,000 pcs Lead Free K=10,000 pcs Lead Free Y=20,000 pcs Lead Free Refer to clause 7.3.2		F = 100ppm/°C

3. RATING

3.1 Rated Power

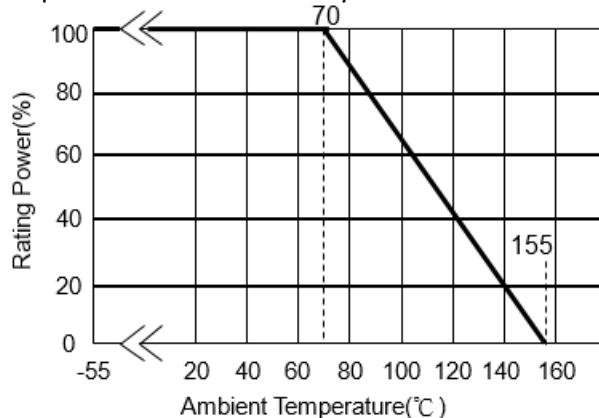
3.1.1 Resistor Rated Power

Type	Rated Power at 70°C	Max. Rated Current	Max. Overload Current
CR21 (0805)	$\frac{1}{8}$ W	0.83A	2.08A
CR32 (1206)	$\frac{1}{4}$ W	1.29A	1.94A
CR50 (2010)	$\frac{3}{4}$ W	2.50A	6.25A
CR63 (2512)	1W	2.89A	7.22A

3.2 Power Derating Curve.

Temperature Range: - 55°C ~ + 155°C

If the ambient temperature exceeds 70 degrees centigrade to 155 degrees centigrade, the power can be modified by the curve as below.



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

3.5 Storage Temperature Range -5°C to + 40°C / < 85% RH

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.

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3.10 Resistance, Resistance Tolerance and Temperature Coefficient of Resistance.

Type	Rated Power at 70°C	Max. Rated Current	Max. Overload Current	T.C.R (ppm / °C)	Resistance Range
					F(±1%) E-96
CR21 (0805)	$\frac{1}{8}$ W	0.83A	2.08A	±100	150 mΩ ≤ R < 1Ω
CR32 (1206)	$\frac{1}{4}$ W	1.29A	1.94A	±100	150 mΩ ≤ R < 1Ω
CR50 (2010)	$\frac{3}{4}$ W	2.50A	6.25A	±100	120 mΩ ≤ R < 1Ω
CR63 (2512)	1W	2.89A	7.22A	±100	120 mΩ ≤ R < 1Ω
Operating Temperature Range					-55°C ~ +155°C

3.11 Current Rating:

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

$$I = \sqrt{P/R}$$

I= Rated current (A)
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

Type		Resistance Range	Tolerance ≤ 1%	Tolerance > 1%
Single	Sizes: 01005、0201、0402	All	No Marking	
		Jumper=0Ω		
	Size: 0603	< 1Ω	4-digits Marking	4-digits Marking
		≥ 1Ω	3-digits Marking	3-digits Marking
		Jumper=0Ω	3-digits Marking	1-digit Marking
	Sizes: 0805、1206、1210 1812、2010、2512	< 1Ω	4-digits Marking	4-digits Marking
		≥ 1Ω	4-digits Marking	3-digits Marking
		Jumper=0Ω	3-digits Marking	1-digit Marking

4.1 Numeric Numbering

4.1.1 Resistance range: < 1Ω

0603、0805、1206、1210、2010、2512、±1%、±2%、±5% Tolerance:

Resistance range ≥ 100 mΩ: 4 digits in E-24 series or E-96 series, later three digits are significant figures, first digit is multiplier (10⁻³).

《EX》 Marking → R220 (E-24series)

$$R220 = 220 \times 10^{-3} = 0.22 \Omega = 220 \text{ m}\Omega$$



Marking → R102 (E-96series)

$$R102 = 102 \times 10^{-3} = 0.102 \Omega = 102 \text{ m}\Omega$$



Resistance range < 100 mΩ: 4 digits in E-24 series, later two digits are significant figures, first digit is multiplier (10⁻³)

《EX》 Marking → R022

$$R022 = 22 \times 10^{-3} = 0.022 \Omega = 22 \text{ m}\Omega$$



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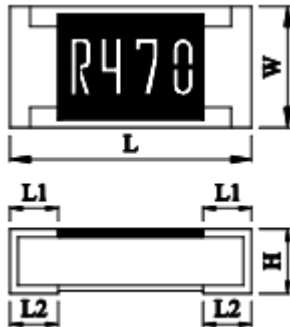
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5. DIMENSION, CONSTRUCTION AND MATERIAL

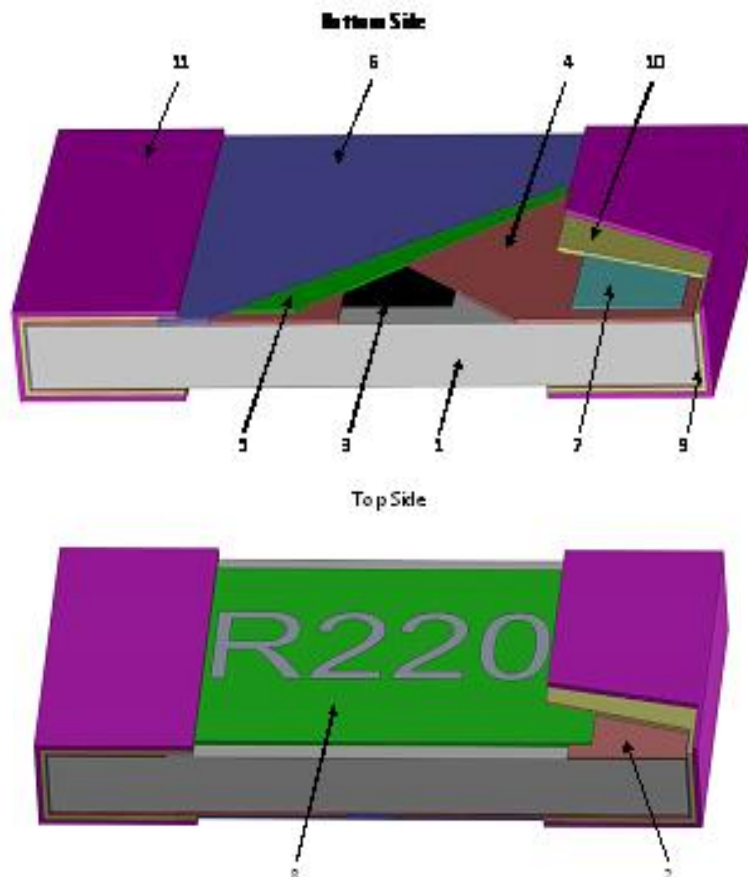
5.1 Dimension

Unit: mm



Dimension		L	W	H	L1	L2
Type	Size Code					
CR21	0805	2.00±0.10	1.25±0.10	0.50±0.10	0.35±0.20	0.35±0.20
CR32	1206	3.05±0.10	1.55±0.10	0.50±0.10	0.45±0.20	0.65±0.15
CR50	2010	5.00±0.10	2.50±0.10	0.60±0.10	0.65±0.20	0.65±0.20
CR63	2512	6.40±0.20	3.20±0.10	0.60±0.10	0.65±0.20	0.65±0.20

5.2 Construction



1	Ceramic substrate	7	2nd Bottom inner electrode
2	Top inner electrode	8	G2 layer + Marking
3	Resistive layer	9	Terminal inner electrode
4	1 st Bottom inner electrode	10	Ni plating
5	1st Protective coating	11	Sn plating
6	2nd Protective coating		

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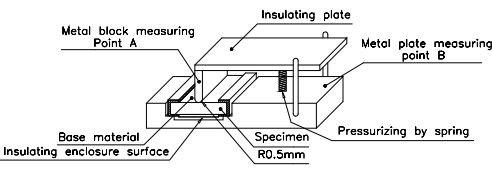
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6. RELIABILITY TEST

6.1 Electrical Performance Test

Item	Conditions	Specifications
		Resistors
Temperature Coefficient of Resistance	$TCR(ppm/^{\circ}C) = \frac{(R2 - R1)}{R1(T2 - T1)} \times 10^6$ R1: Resistance at room temperature R2: Resistance at -55°C or +125°C T1: Room temperature T2: Temperature -55°C or +125°C Refer to JIS-C5201-1 4.8	Refer to item 3.10
Short Time Overload	Applied 2.5 times rated current for 5 seconds and release the load for about 30 minutes, then measure its resistance variance rate. (Rated current refer to item 3.10) Refer to JIS-C5201-1 4.13	$\Delta R\% = \pm 2.0\%$
Insulation Resistance	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 	$\geq 10^9 \Omega$
Dielectric Withstand Voltage	Put the resistor in the fixture, add VAC (see spec. below) in +, - terminal for. CR21 、 32 、 50 、 63 apply 500 VAC 1 minute. Refer to JIS-C5201-1 4.7	No short or burned on the appearance.
Intermittent Overload	Put the tested resistor in chamber under temperature $25 \pm 2^{\circ}C$ and load the rated DC current for 1 sec on , 25 sec off , $10,000_{-0}^{+400}$ test cycles, then it be left at no-load for 1 hour , then measure its resistance variance rate. Refer to JIS-C5201-1 4.13	$\Delta R\% = \pm 5.0\%$

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6.2 Mechanical Performance Test

Item	Conditions	Specifications
		Resistors
Terminal Strength	<p>Test1:The resistor mounted on the board applied 5N pushing force on the sample rear for 10 sec.</p> <p>Test2:The resistor mounted on the board slowly add force on the sample rear until the sample termination is breakdown.</p> <p>Refer to JIS-C5201-1 4.16</p>	<p>Test1:No evidence of mechanical damage.</p> <p>Test2:$F \geq 5N$</p>
Resistance to Solvent	<p>The tested resistor be immersed into isopropyl alcohol of 20~25°C for 5 minutes, then the resistor is left in the room for 48 hrs., and measured its resistance variance rate.</p> <p>Refer to JIS-C5201-1 4.29</p>	$\Delta R\% = \pm 2.0\%$
Solderability	<p>Preconditioning: Put the tested resistor in the apparatus of PCT, at a temperature of 105°C, 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.</p> <p>Test method: The resistor be immersed into solder pot in temperature $235 \pm 5^\circ C$ for 2 sec, then the resistor is left as placed under microscope to observe its solder area.</p> <p>Refer to JIS-C5201-1 4.17</p>	Solder coverage over 95%
Resistance to Soldering Heat	<p>◎Test method 1 (solder pot test): The tested resistor be immersed into molten solder of 260^{+5}_0 °C for 10 seconds. Then the resistor is left in the room for 1 hour.</p> <p>◎Test method 2 (solder pot test): The tested resistor be immersed into molten solder of 260^{+5}_0 °C for 10 seconds. Then the resistor is left as placed under microscope to observe its solder area.</p> <p>◎Test method 3 (Electric iron test): Preheating temperature: $350 \pm 10^\circ C$ 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.</p> <p>Refer to JIS-C5201-1 4.18</p>	<p>Test item 1: (1).Variance rate on resistance $\Delta R\% = \pm 2.0\%$</p> <p>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.</p> <p>Test item 3: (1).Variance rate on resistance $\Delta R\% = \pm 2.0\%$</p>

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Item	Conditions	Specifications
		Resistors
Joint Strength of Solder	<p>◎Bending Strength: Solder tested resistor on to PC board. Add force in the middle down, and under load measured its resistance variance rate. D:CR21=5mm CR32=3mm CR50、63=2mm</p> <p>Refer to JIS-C5201-1 4.33</p>	ΔR%=±2.0%

6.3 Environmental Test

Item	Conditions	Specifications								
		Resistors								
Resistance to Dry Heat	<p>Put tested resistor in chamber under temperature 155±5°C for 1,000⁺⁴⁸₋₀ hours. Then leaving the tested resistor in room temperature for 60 minutes, and measure its resistance variance rate.</p> <p>Refer to JIS-C5201-1 4.25</p>	ΔR%=±2.0%								
Thermal Shock	<p>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.</p> <table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th colspan="2">Testing Condition</th> </tr> </thead> <tbody> <tr> <td>Lowest Temperature</td> <td>-55±5°C</td> </tr> <tr> <td>Highest Temperature</td> <td>125±5°C</td> </tr> <tr> <td>Temperature-retaining time</td> <td>15 minutes each</td> </tr> </tbody> </table> <p>Refer to MIL-STD 202 Method 107</p>	Testing Condition		Lowest Temperature	-55±5°C	Highest Temperature	125±5°C	Temperature-retaining time	15 minutes each	ΔR%=±2.0%
Testing Condition										
Lowest Temperature	-55±5°C									
Highest Temperature	125±5°C									
Temperature-retaining time	15 minutes each									
Loading Life in Moisture	<p>Put the tested resistor in the chamber under temperature 40±2°C, relative humidity 90~95% and load the rated current 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.</p> <p>Refer to JIS-C5201-1 4.24</p>	ΔR%=±3.0%								
Load Life	<p>Put the tested resistor in chamber under temperature 70±2°C and load the rated current 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.</p> <p>Refer to JIS-C5201-1 4.25</p>	ΔR%=±3.0%								



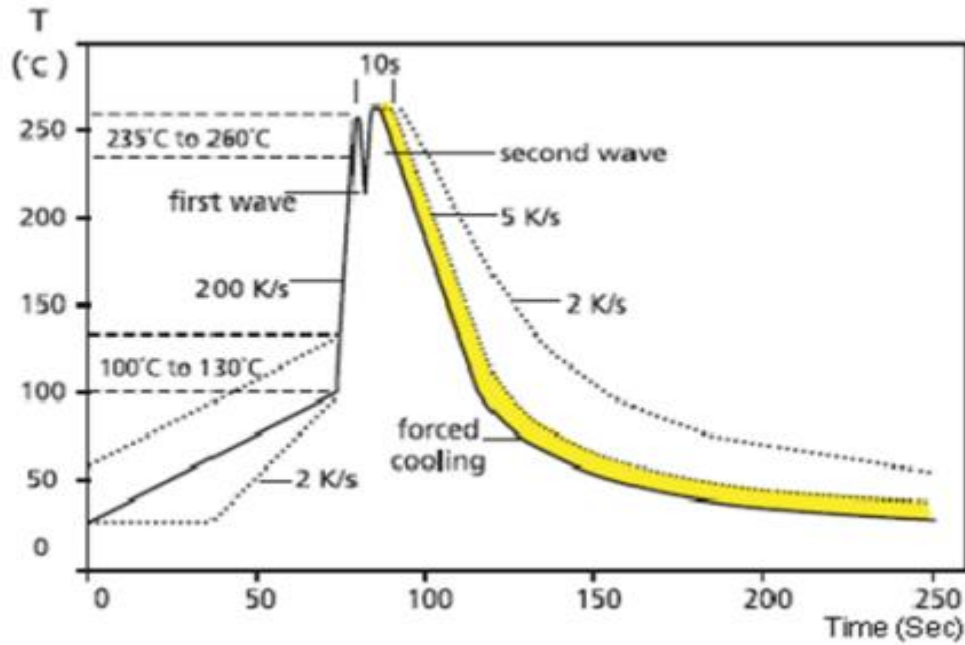
Product Specification

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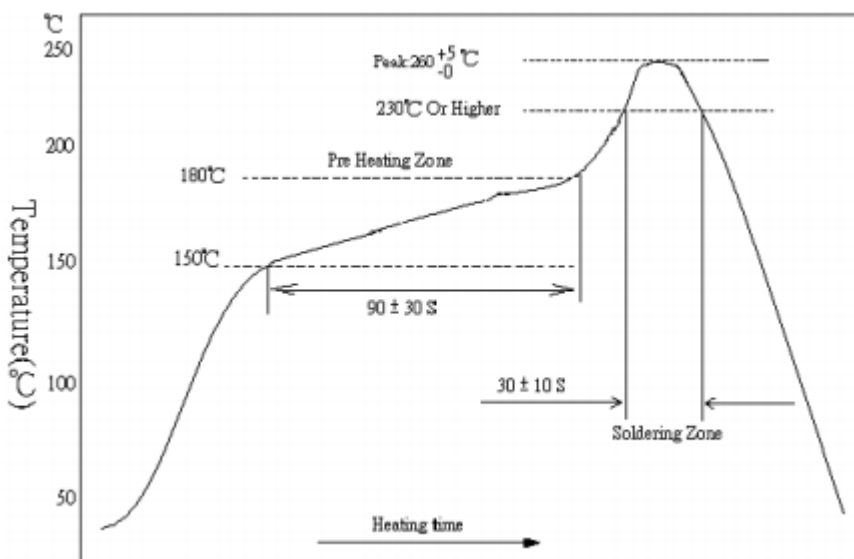
6.4 Soldering Profile

Technical application note: (This is for recommendation, customer please perform adjustment according to the actual application)

6.4.1 Lead-Free Double Wave Soldering Profile. (This applies to 0603 size inclusive above product)



6.4.2 Lead-Free IR Reflow Soldering Profile



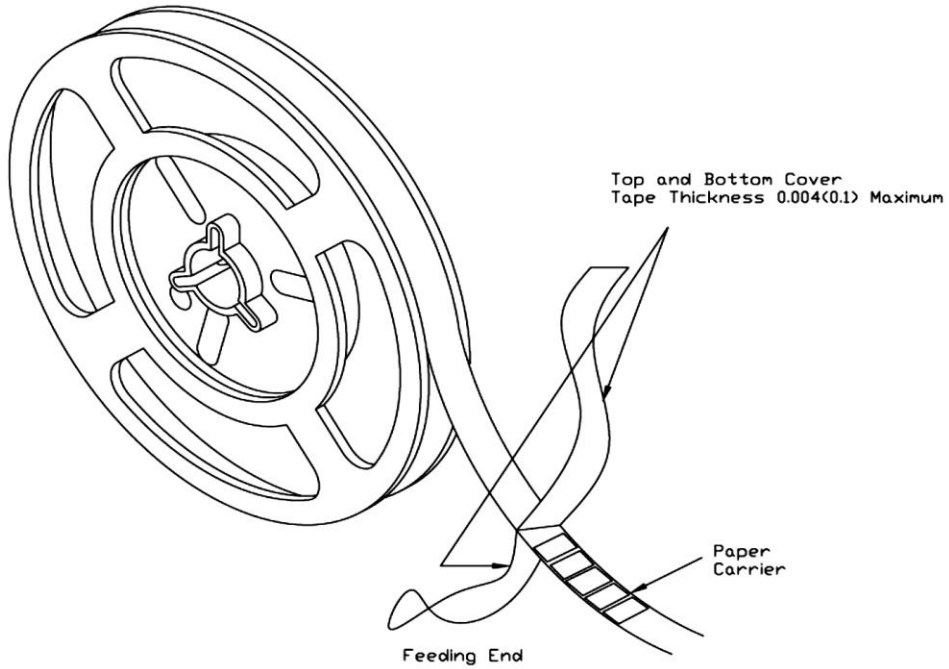
Remark: The peak temperature of soldering heat is 260 ± 5 °C for 10 seconds.

6.1.3 Soldering Iron: Temperature 350°C±10°C, dwell time shall be less than 3 sec.

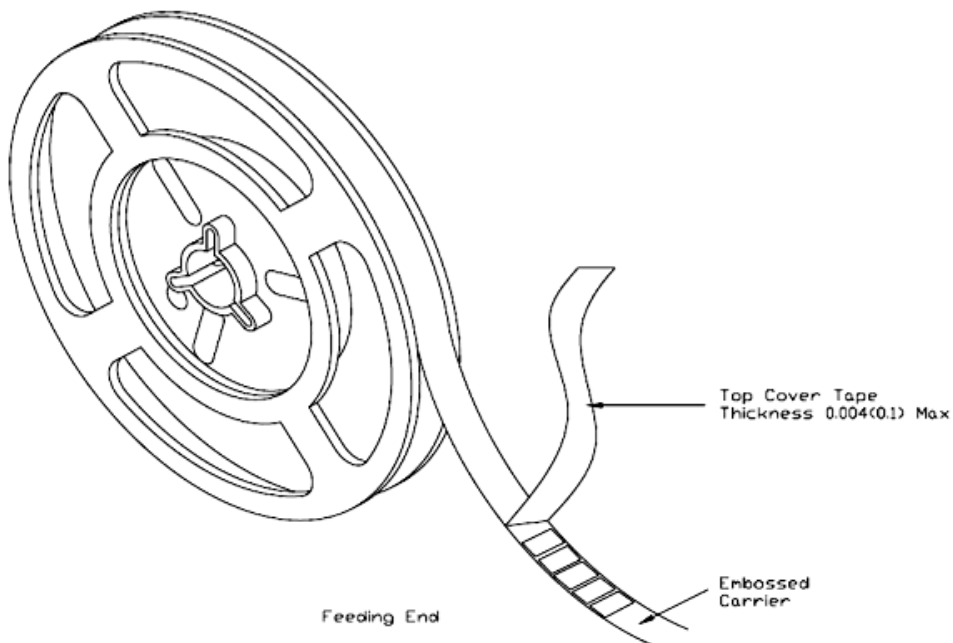
7. TAPING

7.1 Structure of Taping

Paper Carrier



Embossed Plastic Carrier



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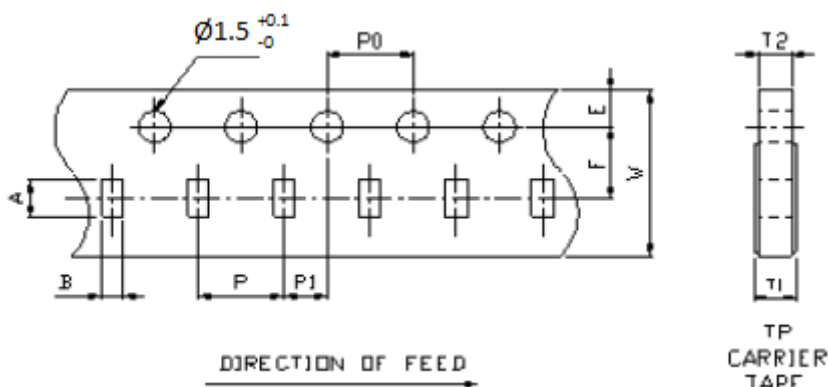
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7.2 Dimension

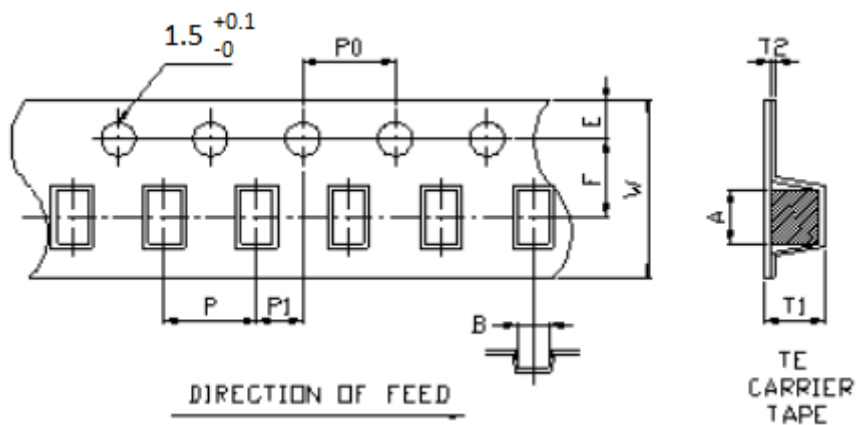
7.2.1 Dimension of Punched Paper Tape Carrier System /Plastic Embossed Carrier System (CR21, 32)



Remark : Pitch tolerance over any 10 pitches of P₀ is ± 0.2 mm

Dimension of Punched Paper Tape Carrier System (CR - 21, 32)

Code	A	B	W	E	F	T1	T2	P	P0	P1
CR21	2.3±0.10	1.55±0.1	8.0±0.20	1.75±0.10	3.50±0.05	0.75 ^{+0.2} ₋₀	0.75±0.10	4.0±0.10	4.0±0.05	2.0±0.05
CR32	3.5±0.20	1.9±0.20	8.0±0.20	1.75±0.10	3.50±0.05	0.75 ^{+0.2} ₋₀	0.75±0.10	4.0±0.10	4.0±0.05	2.0±0.05



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

Code	A	B	W	E	F	T1	T2	P	P0	P1
CR50	5.5±0.20	2.8±0.20	12.0±0.20	1.75±0.10	5.50±0.05	1.10±0.15	0.23±0.15	4.0±0.10	4.0±0.05	2.0±0.05
CR63	6.7±0.20	3.4±0.20	12.0±0.20	1.75±0.10	5.50±0.05	1.10±0.15	0.23±0.15	4.0±0.10	4.0±0.05	2.0±0.05



Product Specification

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7.3 Packaging

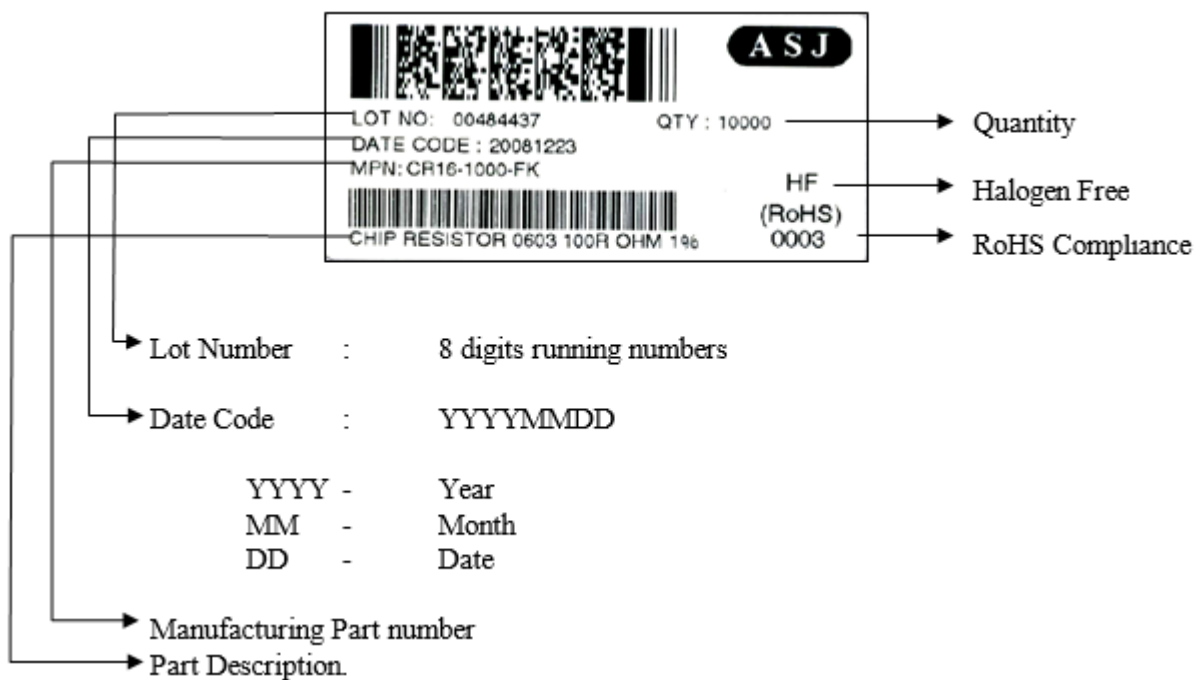
7.3.1 Taping

7.3.2 Quantity – Tape and Reels

Code	Quantity	Model	Remarks
CR21 CR32	5000 pcs	7" Reel	4mm pitch
	10000 pcs	10" Reel	4mm pitch
	20000 pcs	13" Reel	4mm pitch
CR50 CR63	4000 pcs	7" Reel	4mm pitch

7.3.3 Identification

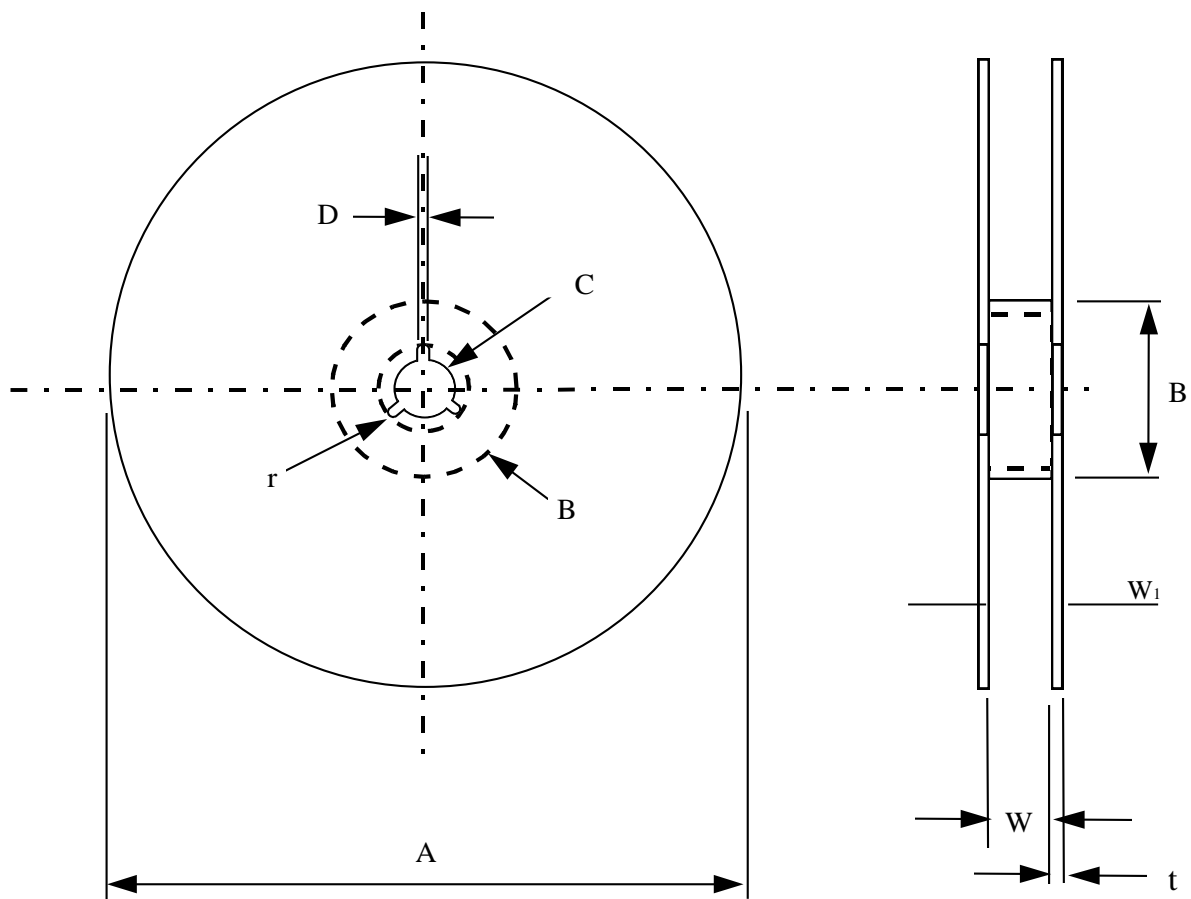
Production label that indicates the 8 digits lot number, product type, resistance value and tolerance shall be pasted on the surface of each reel.



7.3.4 Packaging Reel Box

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

7.3.5 Reel Dimension



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, 50K)	φ330±1.0	φ100±1	13.5±0.5	2~3±0.5	10±0.5	-	-	-

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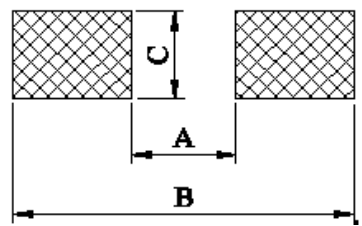
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8. SURFACE MOUNT LAND PATTERNS DESIGN (FOR REFLOW SOLDERING)

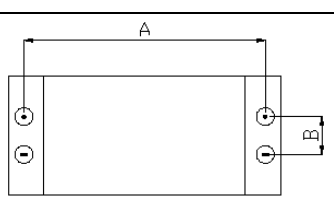
When a component is soldered, the resistance after soldering changes slightly depending on the size of the soldering area and the amount of soldering. When designing a circuit, it is necessary to consider the effect of a decrease or increase in its resistance.

Unit:mm



DIM TYPE	A	B	C
CR21	1.2	3.0	1.3
CR32	2.2	4.2	1.6
CR50	3.5	6.1	2.8
CR63	3.8	8.0	3.5

9. MEASUREMENT POINT

Measure from bottom electrodes	Unit : mm		
 <p>⊕ Current Terminal ⊖ Voltage Terminal</p>	DIM TYPE	A	B
	CR21	1.80±0.05	0.35±0.05
	CR32	2.90±0.05	0.35±0.05
	CR50	4.50±0.05	1.15±0.05
	CR63	5.90±0.05	1.60±0.05

10. PLATING THICKNESS

Ni: $\geq 2 \mu\text{m}$

Sn (Tin): $\geq 3 \mu\text{m}$

Sn (Tin): Matte Sn

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11. REVISION HISTORY

REVISION	DATE	CHANGE NOTIFICATION	DESCRIPTION
Version.1	05.11.2019		Initial Release
Version.2	31.12.2019		Typo error in clause 2
Version.3	29.05.2020		Revise clause 2 Part Numbering System Revise clause 3.5
Version 4	19.06.2023		Revise clause 3.8 Product Assurance



Product Specification

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