Towards Excellence in *Quality, Service & Innovation*

ASJ

DATA SHEET

High-Power Thick Film Chip Resistor

CPW Series

0.1% TO 5%, TCR -200 TO +400

SIZE: 0201/0402/0603/0805/1206/1210/2010/2512

RoHS-Compliant

Product Specification – Apr. 02, 2024 V15

1. SCOPE

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

1.2 The product is for general electronic purpose.

1.3 The products 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:

Ordering Code / Information

CPW	10	-	XXXX		-	F	K
Type	Size (Inch / mm)		Nominal Resistance			Resistance Tolerance	Packaging
High Power Thick Film Chip Resistors	05(0201/0603) 10(0402/1005) 16(0603/1608) 21(0805/2012) 32(1206/3216) 40(1210/3225) 50(2010/5025) 63(2512/6432)		Resistors	5% (3-Digit)	EX. 10Ω=100 4.7Ω=4R7 JUMPER=000	B=±0.1% D=0.5% F=±1% J=±5% Z=Zero Ohm	E = 4,000 pcs Lead Free L = 5,000 pcs Lead Free K = 10,000 pcs Lead Free Y = 20,000 pcs Lead Free N = 50,000 pcs Lead Free
				0.1% 0.5% 1% (4-Digit)	EX. 10.2Ω=10R2 10KΩ=1002 JUMPER=0000		

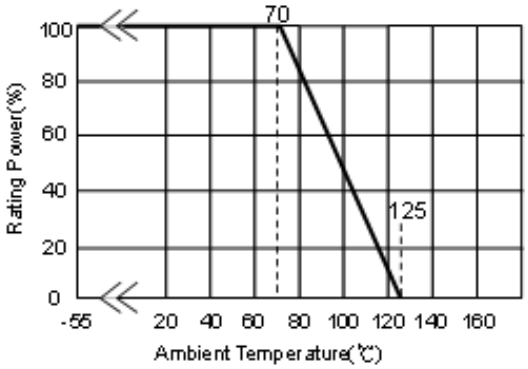
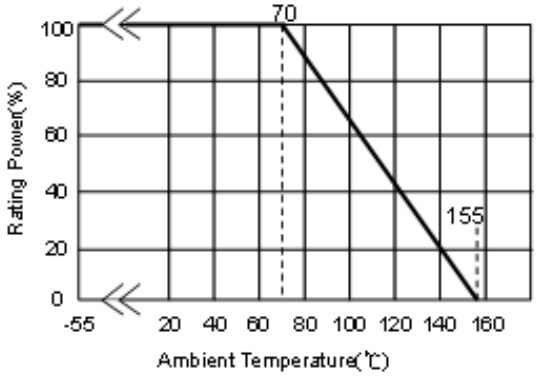
3. RATING

3.1 Rated Power

3.1.1 Resistor Rated Power

Type	Rated Power at 70℃	Max. Working Voltage	Max. Overload Voltage	JUMPER Rated Power		JUMPER Resistance Value	
				Z (±5%)	F (±1%)	Z (±5%)	F (±1%)
CPW05 (0201)	1/16W	25V	50V	0.5A	0.5A	50mΩ MAX	35mΩ MAX
CPW10 (0402)	1/8W	50V	100V	1.5A	2A	50mΩ MAX.	20mΩ MAX.
CPW16 (0603)	1/5W	75V	150V	1.5A	2.5A	50mΩ MAX.	20mΩ MAX.
CPW21 (0805)	1/4W	150V	300V	2.5A	3.5A	50mΩ MAX.	20mΩ MAX.
CPW32 (1206)	1/2W	200V	400V	3A	5A	50mΩ MAX.	20mΩ MAX.
CPW40 (1210)	3/4W	200V	400V	4A	6A	50mΩ MAX.	20mΩ MAX.
CPW50 (2010)	1W	200V	400V	4.5A	7A	50mΩ MAX.	20mΩ MAX.
CPW63 (2512)	2W	200V	400V	6A	10A	50mΩ MAX.	20mΩ MAX.

3.2 Power Derating Curve:

Type	CPW05 (0201)	Other
Operating Temperature Range	－55℃ ~ ＋125℃	－55℃ ~ ＋155℃
Explain	If the ambient temperature exceeds 70 degrees centigrade to 125 degrees centigrade, the power can be modified by the curve as below.	If the ambient temperature exceeds 70 degrees centigrade to 125 degrees centigrade, the power can be modified by the curve as below.
Figure		

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 (CPW05 : -55°C to +125°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.

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 Power		JUMPER Resistance Value	
					B(±0.1%) E-24、E-96	D(±0.5%) E-24、E-96	F(±1%) E-24、E-96	J(±5%) E-24	Z (±5%)	F (±1%)	Z (±5%)	F (±1%)
CPW05 (0201)	1/16W	25V	50V	-200 +400	------	1Ω≦R＜10Ω	1Ω≦R＜10Ω	1Ω≦R＜10Ω	0.5A	0.5A	50mΩ MAX.	35mΩ MAX.
				±200	------	10Ω≦R≦10MΩ	10Ω≦R≦10MΩ	10Ω≦R≦10MΩ				
CPW10 (0402)	1/8W	50V	100V	±100	100Ω≦R≦1MΩ	10Ω≦R≦1MΩ	10Ω≦R≦10MΩ	10Ω≦R≦20MΩ	1.5A	2A	50mΩ MAX.	20mΩ MAX.
				±200	------	------	1Ω≦R＜10Ω	1Ω≦R＜10Ω				
CPW16 (0603)	1/5W	75V	150V	±100	100Ω≦R≦1MΩ	10Ω≦R≦1MΩ	10Ω≦R≦10MΩ	10Ω≦R≦20MΩ	1.5A	2.5A	50mΩ MAX.	20mΩ MAX.
				±200	------	1Ω≦R＜10Ω	1Ω≦R＜10Ω	1Ω≦R＜10Ω				
CPW21 (0805)	1/4W	150V	300V	±100	100Ω≦R≦1MΩ	10Ω≦R≦10MΩ	10Ω≦R≦10MΩ	10Ω≦R≦20MΩ	2.5A	3.5A	50mΩ MAX.	20mΩ MAX.
				±200	------	1Ω≦R＜10Ω	1Ω≦R＜10Ω	1Ω≦R＜10Ω				
CPW32 (1206)	1/2W	200V	400V	±100	10Ω≦R≦1MΩ	10Ω≦R≦10MΩ	10Ω≦R≦10MΩ	10Ω≦R≦20MΩ	3A	5A	50mΩ MAX.	20mΩ MAX.
				±200	3Ω≦R＜10Ω	1Ω≦R＜10Ω	1Ω≦R＜10Ω	1Ω≦R＜10Ω				
CPW40 (1210)	3/4W	200V	400V	±100	100Ω≦R≦1MΩ	10Ω≦R≦10MΩ	10Ω≦R≦10MΩ	10Ω≦R≦20MΩ	4A	6A	50mΩ MAX.	20mΩ MAX.
				±200	------	------	1Ω≦R＜10Ω	1Ω≦R＜10Ω				
CPW50 (2010)	1W	200V	400V	±100	------	------	10Ω≦R≦10MΩ	10Ω≦R≦10MΩ	4.5A	7A	50mΩ MAX.	20mΩ MAX.
				±200			1Ω≦R＜10Ω	1Ω≦R＜10Ω				
CPW63 (2512)	2W	200V	400V	±100	100Ω≦R≦100K	100Ω≦R≦100K	10Ω≦R≦10MΩ	10Ω≦R≦10MΩ	6A	10A	50mΩ MAX.	20mΩ 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= Voltage rating (v)
P= Power rating (w)
R= Nominal resistance(Ω)

4. MARKING ON PRODUCT

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

Part Number	Color	Marking on Product
CPW05 (0201)	-	No marking
CPW10 (0402)	-	No marking
CPW16 (0603)	Light Yellow	1) Tolerance : ±0.1%(B), ±0.5%(D), ± 1.0%(F) ° Four Numerals Marking (E96 Series) ° 0603 Three Characters Marking based on E-96 marking standard. 2) Tolerance; ±5.0% (J) Three Numerals Marking 3) Zero ohm jumper resistor The marking used shall be 0
CPW21 (0805)	Light Yellow	
CPW32 (1206)	Light Yellow	
CPW40 (1210)	Light Yellow	
CPW50 (2010)	Light Yellow	
CPW63 (2512)	Light Yellow	

4.1 Numeric Numbering

4.1.1 0.1%, 0.5%, 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 X 10^0 = 1
10 Ω	10R0	10 X 10^0 = 10
100 Ω	1000	100 X 10^0 = 100
4.7K Ω	4701	470 X 10^1 = 470 0
47K Ω	4702	470 X 10^2 = 470 00
470K Ω	4703	470 X 10^3 = 470 000
1M Ω	1004	100 X 10^4 = 100 0000

4.1.2 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 X 10^0 = 1
10 Ω	100	10 X 10^0 = 1 0
100 Ω	101	10 X 10^1 = 1 00
4.7K Ω	472	47 X 10^2 = 47 00
47K Ω	473	47 X 10^3 = 47 000
470K Ω	474	47 X 10^4 = 47 0000
4.7M Ω	475	47 10^5 = 47 00000

4.1.3 0603 1% Tolerance: ***Three Character E-96 Marking Standard.***
The first 2 digits for the 3 digits E-96 part marking standard, (Refer Table 2 & 3). The third character is a letter multiplier:

Nominal resistance	***Marking***	***Remark***
33.2 Ω	51 X	332 X 10^{-1} Ω
150 Ω	18 A	150 X 10^{0} Ω
4.99K Ω	68 B	499 X 10^{1} Ω
1 0.2K Ω	02 C	102 X 10^{2} Ω
100K Ω	01 D	100 10^{3} Ω

4.1.4 EIA-96 Marking Scheme

Table 2 Significant figures

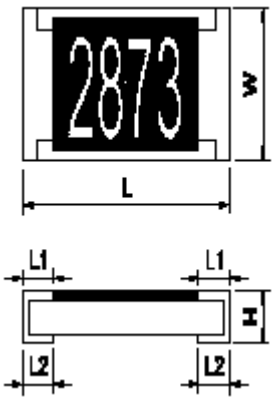
Significant Figures	Symbol	Significant Figures	Symbol	Significant Figures	Symbol	Significant Figures	Symbol
100	01	178	25	316	49	562	73
102	02	182	26	324	50	576	74
105	03	187	27	332	51	590	75
107	04	191	28	340	52	604	76
110	05	196	29	348	53	619	77
113	06	200	30	357	54	634	78
115	07	205	31	365	55	649	79
118	08	210	32	374	56	665	80
121	09	215	33	383	57	681	81
124	10	221	34	392	58	698	82
127	11	226	35	402	59	715	83
130	12	232	36	412	60	732	84
133	13	237	37	422	61	750	85
137	14	243	38	432	62	768	86
140	15	249	39	442	63	787	87
143	16	255	40	453	64	806	88
147	17	261	41	464	65	825	89
150	18	267	42	475	66	845	90
154	19	274	43	487	67	866	91
158	20	280	44	499	68	887	92
162	21	287	45	511	69	909	93
165	22	294	46	523	70	931	94
169	23	301	47	536	71	953	95
174	24	309	48	549	72	976	96

Table 3 Multiplier

Symbol	Multiplier	Symbol	Multiplier
A	10^{0}	G	10^{6}
B	10^{1}	H	10^{7}
C	10^{2}	X	10^{-1}
D	10^{3}	Y	10^{-2}
E	10^{4}		
F	10^{5}		

5. DIMENSION, CONSTRUCTION AND MATERIAL

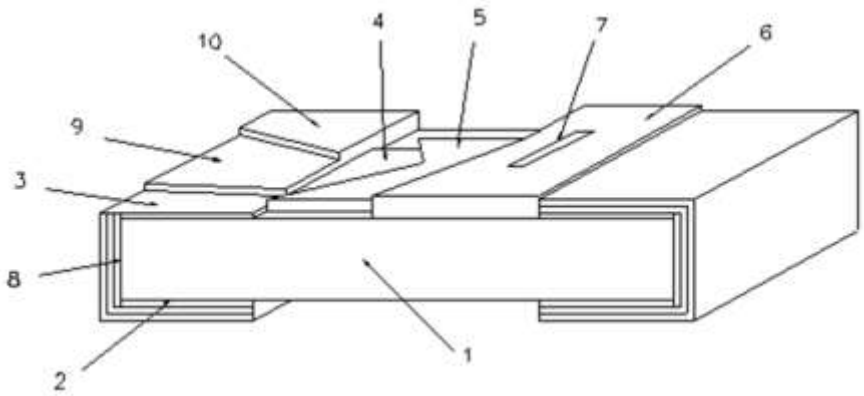
5.1 Dimension



Unit:mm

Type \ Dimension / Size Code		L	W	H	L1	L2
CPW05	**0201**	0.60±0.03	0.30±0.03	0.23±0.03	0.15±0.05	0.15±0.05
CPW10	**0402**	1.00±0.10	0.50±0.05	0.30±0.05	0.20±0.10	0.25±0.10
CPW16	**0603**	1.55±0.10	0.80±0.10	0.45±0.10	0.30±0.15	0.30±0.15
CPW21	**0805**	2.00±0.10	1.25±0.10	0.50±0.10	0.35±0.20	0.35±0.15
CPW32	**1206**	3.05±0.10	1.55±0.10	0.50±0.10	0.45±0.20	0.35±0.15
CPW40	**1210**	3.05±0.10	2.55±0.10	0.55±0.10	0.50±0.20	0.50±0.20
CPW50	**2010**	4.95±0.10	2.45±0.10	0.70±0.10	0.65±0.20	0.60±0.20
CPW63	**2512**	6.40±0.20	3.20±0.20	0.70±0.10	0.60±0.20	1.25±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:

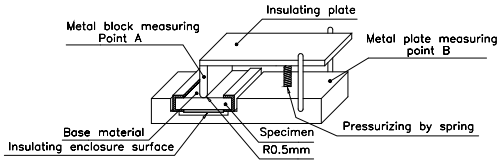
5.3.1 Ni : ≧ 2 μm

5.3.2 Sn (Tin) : ≧ 3 μm

5.3.3 Sn (Tin) : Matte Sn

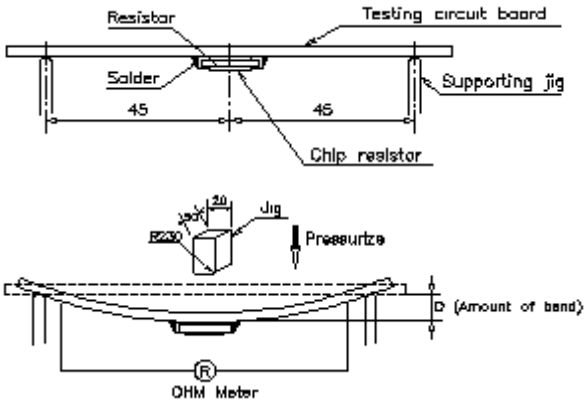
6. RELIABILITY TEST

6.1 Electrical Performance Test

Item	Conditions	Specifications	
		Resistors	Jumper
Temperature Coefficient of Resistance	***Refer to JIS-C5201-1 4.8*** $TCR(ppm/^{\circ}C) = \frac{(R2-R1)}{R1(T2-T1)} x10^6$ R1: Resistance at room temperature R2: Resistance at -55℃ or +125℃ T1: Room temperature T2: Temperature -55℃ or +125℃	Refer to item 3.10	NA
Short Time Overload	***Refer to JIS-C5201-1 4.13*** 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. general specifications)	0.1%、0.5%、1%: △R%= ±1.0% 5%: △R%=± 2.0%	Refer to item 3.10
Insulation Resistance	***Refer to JIS-C5201-1 4.6*** 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.  	≧10^9Ω	
Dielectric Withstand Voltage	***Refer to JIS-C5201-1 4.7*** Put the resistor in the fixture, add VAC (see spec. below) in +,- terminal for. CPW21、32、40 、50、63 apply 500 VAC 1 minute. CPW10、16 apply 300 VAC 1 minute.	No short or burned on the appearance.	

6.2 Mechanical Performance Test

Item	Conditions	Specifications	
		Resistors	Jumper
Terminal Strength	***Refer to JIS-C5201-1 4.16*** Test1:The resistor mounted on the board applied 5N (CPW05:3N)pushing force on the sample rear for 10sec. Test2:The resistor mounted on the board slowly add force on the sample rear until the sample termination is breakdown.	Test1:No evidence of mechanical damage Test2:CPW05≧3N Other type≧5N	
Resistance to Solvent	***Refer to JIS-C5201-1 4.29*** 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.	CPW05: △R%=±1.0% Other type: △R%=±0.5%	Refer to item 3.10
Solderability	***Refer to JIS-C5201-1 4.17*** 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.	Solder coverage over 95%	
Resistance to Soldering Heat	***Refer to JIS-C5201-1 4.18*** ◎Test method 1 (solder pot test): The tested resistor be immersed into molten solder of 260^{+5}_{-0} ℃ for 10^{+1}_{-0} 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^{+1}_{-0} 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.	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%	Refer to item 3.10

Item	Conditions	Specifications	
		Resistors	Jumper
Joint Strength of Solder	***Refer to JIS-C5201-1 4.33*** ◎Bending Strength: Solder tested resistor on to PC board. Add force in the middle down, and under load measured its resistance variance rate. D:CPW10、16、21=5mm CPW05、32、40=3mm CPW50、63=2mm 	△R%=±1.0%	Refer to item 3.10

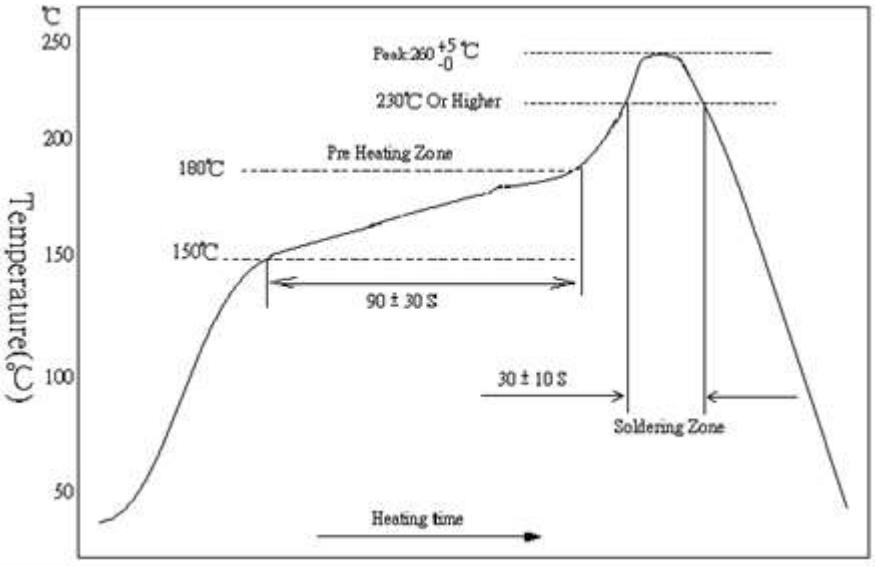
6.3 Environmental Test

Item	Conditions	Specifications	
		Resistors	Jumper
Resistance to Dry Heat	***Refer to JIS-C5201-1 4.25*** 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.	0.1%、0.5%、1%: △R%=±1.0% 5%: △R%=±2.0%	Refer to item 3.10
Thermal Shock	***Refer to MIL-STD 202 Method 107*** 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	0.1%、0.5%、1%: △R%=±0.5% 5%: △R%=±1.0%	Refer to item 3.10
Loading Life in Moisture	***Refer to JIS-C5201-1 4.24*** 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.	0.1%、0.5%、1%: △R%=±0.5% 5%: △R%=±2.0%	Refer to item 3.10
Load Life	***Refer to JIS-C5201-1 4.25*** 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.	0.1%、0.5%、1%: △R%=±0.5% 5%: △R%=±2.0%	Refer to item 3.10

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

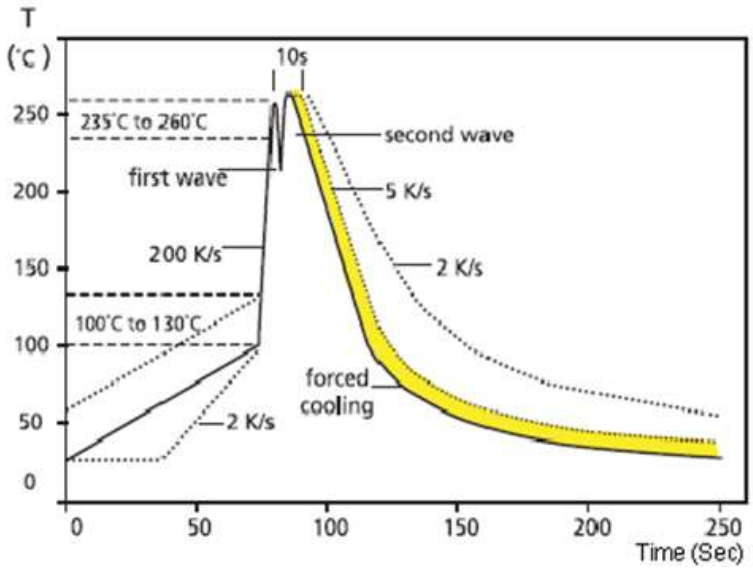
Soldering Profile:

6.1.1 Lead-Free IR Re-flow Soldering Profile



Remark : The peak temperature of soldering heat is 260^{+5}_{-0} ℃ for 10 seconds.

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

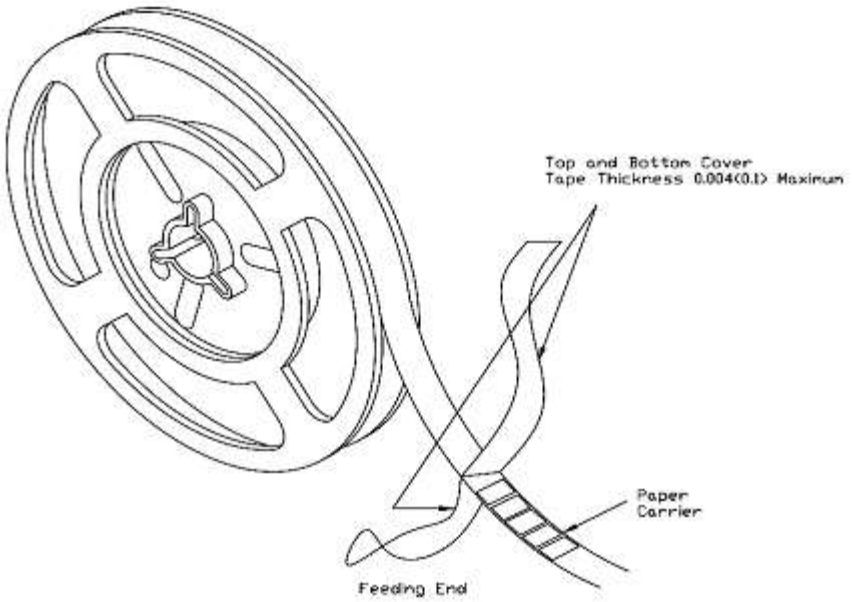


6.1.3 Soldering Iron: Temperature 350℃±10℃ , dwell time shall be less than 3 sec.

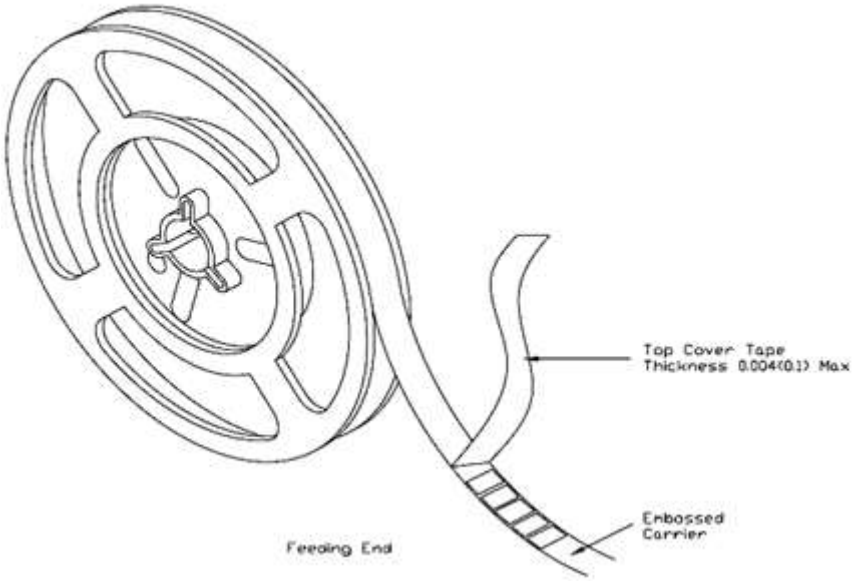
7. TAPING

7.1 Structure of Taping

Paper Carrier

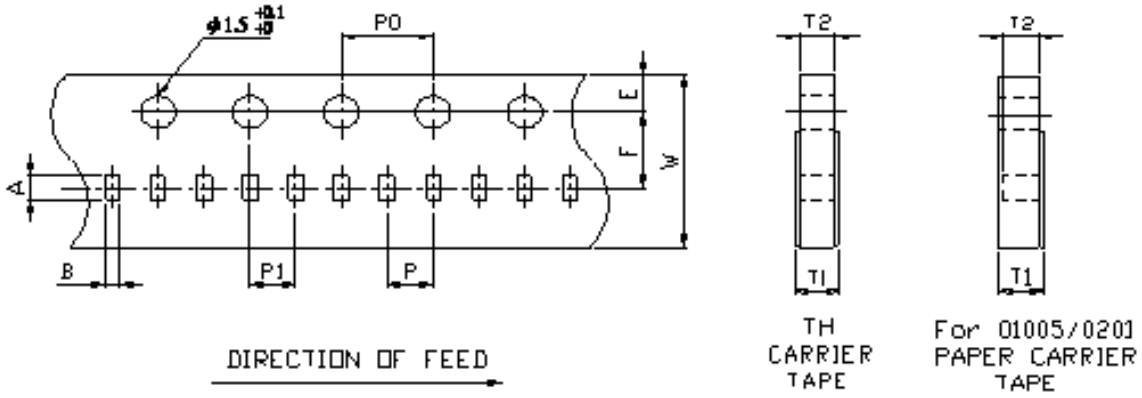


Embossed Plastic Carrier



7.2 Dimension

7.2.1 Dimension of Punched Paper Tape Carrier System (CPW – 05, 10)

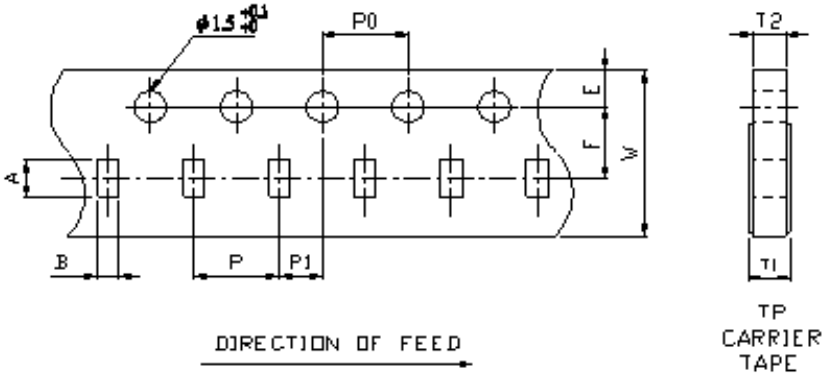


Remark : Pitch tolerance over any 10 pitches of Po is ± 0.2 mm

Dimension of Punched Paper Tape Carrier System (CPW- 05, 10)

Type	Dimensions (mm)										
Size	A	B	W	E	F	T1	T2	P	P0	10xP0	P1
CPW05	0.68±0.05	0.38±0.03	8.00±0.10	1.75±0.10	3.50±0.05	$0.42^{+0.1}_{-0}$	0.28±0.02	2.00±0.05	4.00±0.05	40.00±0.20	2.00±0.05
CPW10	1.15±0.05	0.65±0.05	8.00±0.20	1.75±0.10	3.50±0.05	$0.40^{+0.2}_{-0}$	0.40±0.05	2.00±0.10	4.00±0.05	40.00±0.20	2.00±0.05

7.2.2 Dimension of Punched Paper Tape Carrier System /Plastic Embossed Carrier System
(CPW-16, 21, 32, 40, 50, 63)

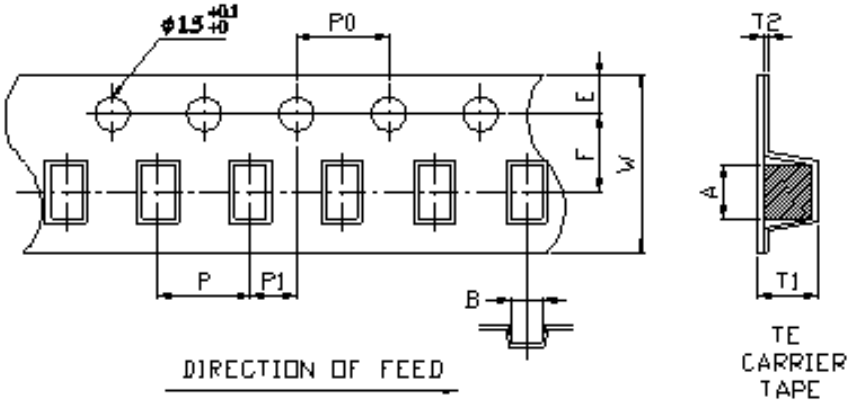


Remark : Pitch tolerance over any 10 pitches of Po is ± 0.2 mm

Dimension of Punched Paper Tape Carrier System (CPW - 16, 21, 32, 40)

Type	Dimensions (mm)										
Size	A	B	W	E	F	T1	T2	P	P0	10xP0	P1
CPW16	1.80±0.10	1.00±0.10	8.00±0.20	1.75±0.10	3.50±0.05	$0.60^{+0.2}_{-0}$	0.60±0.10	4.00±0.10	4.00±0.05	40.00±0.20	2.00±0.05
CPW21	2.30±0.10	1.55±0.10	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	40.00±0.20	2.00±0.05
CPW32	3.50±0.20	1.90±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	40.00±0.20	2.00±0.05
CPW40	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	40.00±0.20	2.00±0.05

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



Type	Dimensions (mm)										
Size	A	B	W	E	F	T1	T2	P	P0	10xP0	P1
CPW50	5.50±0.20	2.80±0.20	12.00±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	40.00±0.20	2.00±0.05
CPW63	6.70±0.20	3.40±0.20	12.00±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	40.00±0.20	2.00±0.05

7.3 Packaging

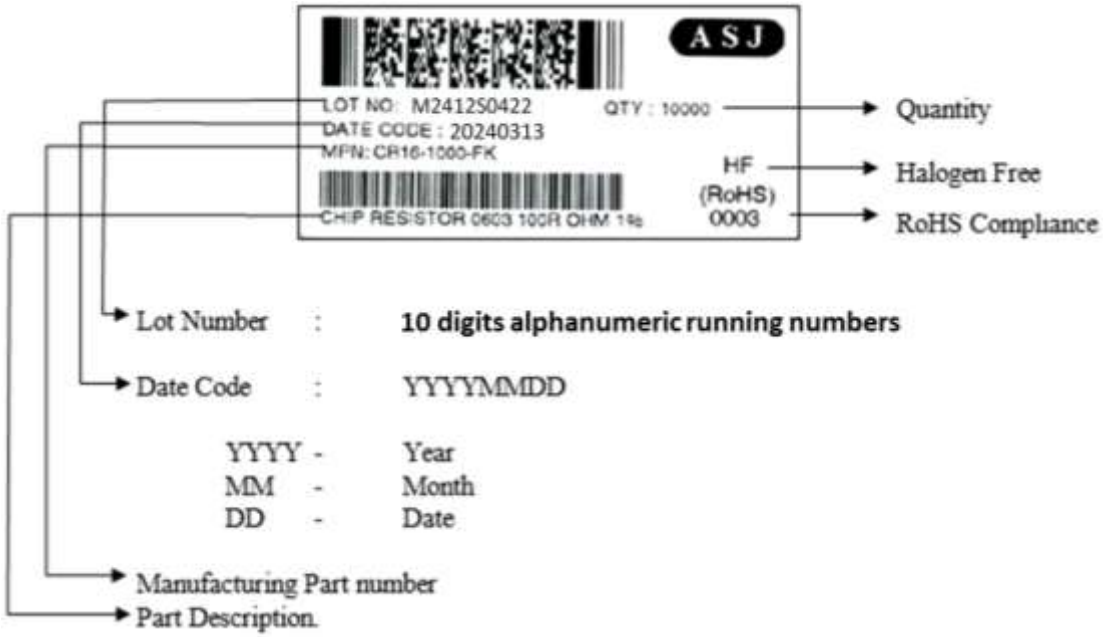
7.3.1 Taping

Quantity – Tape and Reels

Code	Quantity	Reel	Remark
CPW05 CPW10	10,000 pcs	7”	2mm pitch
	20,000 pcs	7”	2mm pitch
	50,000 pcs	13”	2mm pitch
CPW16 CPW21 CPW32 CPW40	5,000 pcs	7”	4mm pitch
	10,000 pcs	10”	
	20,000 pcs	13”	
CPW50	4,000 pcs	7”	Embossed 4mm pitch
CPW63	4,000 pcs	7”	Embossed 4mm pitch

7.3.2 Identification

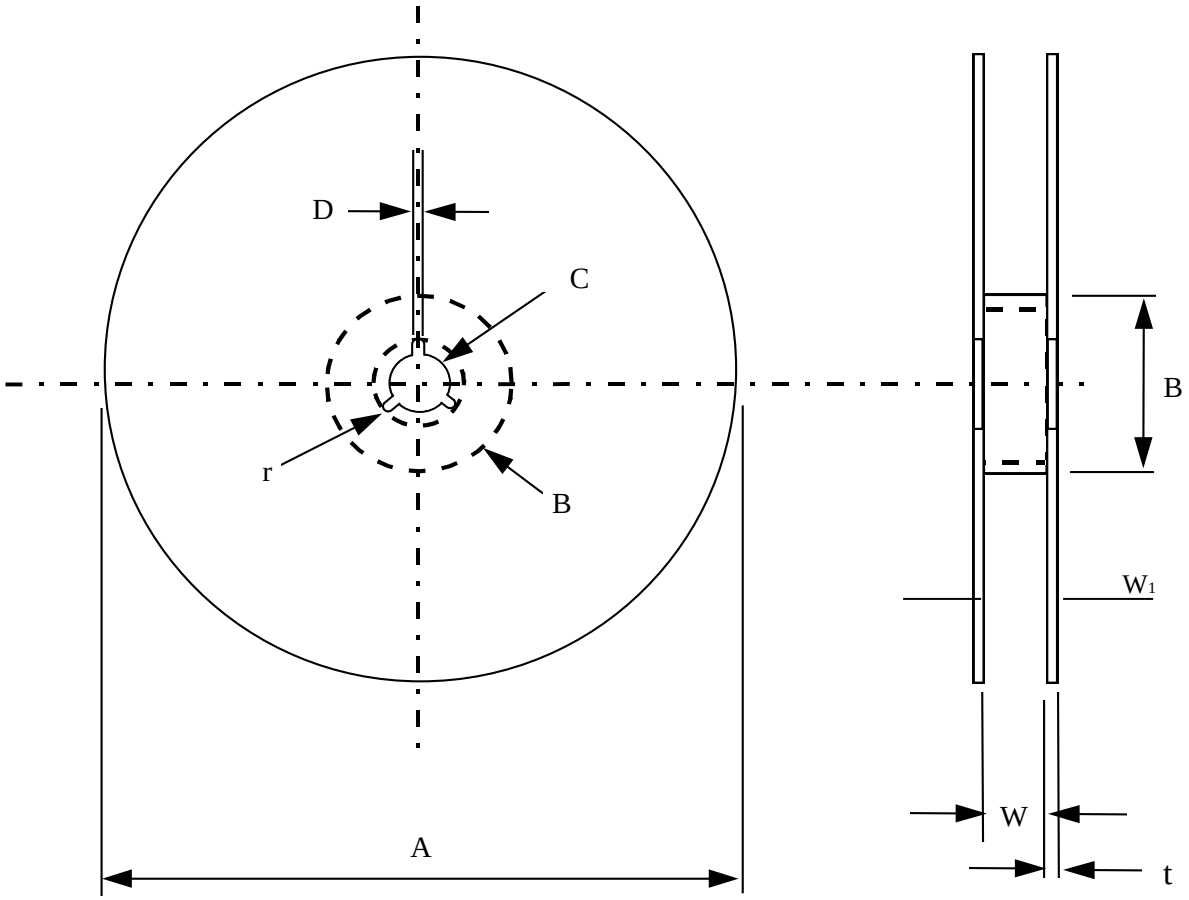
Production label that indicates the 10 digits lot number, product type, resistance value and tolerance shall be pasted on the surface of each reel.



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

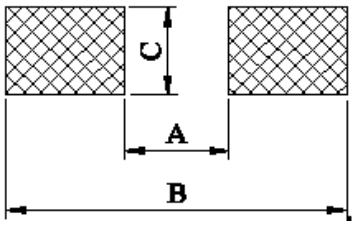
7.3.4 Reel Dimension



Model	A	B	C	D	W	W_1	t	r
7"Reel (5K) (except 0402 10K)	ϕ178±2.0	ϕ80min	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 (2K) (for 2512)	ϕ178±2.0	ϕ60min	13.5±0.5	ϕ2.0± 0.5	13.8±0.5	14.4 max	1.2± 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)	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.



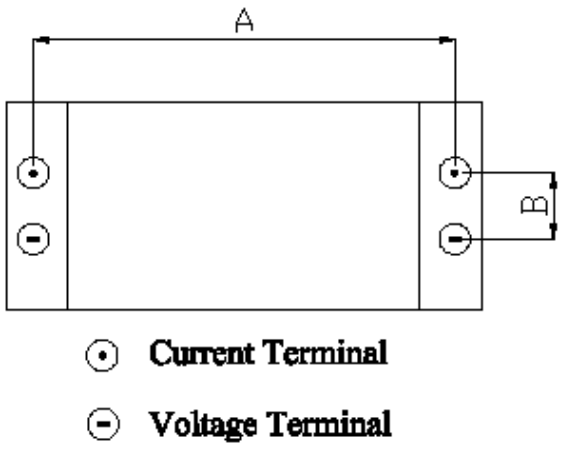
Unit:mm

TYPE \ DIM	A	B	C
CPW05	0.3	1.0	0.4
CPW10	0.5	1.5	0.6
CPW16	0.8	2.1	0.9
CPW21	1.2	3.0	1.3
CPW32	2.2	4.2	1.6
CPW40	2.2	4.2	2.8
CPW50	3.5	6.1	2.8
CPW63	3.8	8.0	3.5

9 MEASUREMENT POINT

Bottom electrode

Unit : mm



TYPE \ DIM	A	B
CPW05	**0.44±0.05**	**0.22±0.05**
CPW10	**0.80±0.05**	**0.24±0.05**
CPW16	**1.35±0.05**	**0.35±0.05**
CPW21	**1.80±0.05**	**0.35±0.05**
CPW32	**2.90±0.05**	**0.35±0.05**
CPW40	**2.90±0.05**	**0.35±0.05**
CPW50	**4.50±0.05**	**1.15±0.05**
CPW63	**5.90±0.05**	**1.60±0.05**

10 REVISION HISTORY

REVISION	DATE	CHANGE NOTIFICATION	DESCRIPTION
Version.1	13.02.2015		Initial Release
Version.2	15.12.2015		Surface Mount Land Pattern updated
Version.3	23.05.2016	ECO No.: 002/2016	Revise clause 2 and 7.7.1.1, change CPW63 packaging from 2000 pcs to 4000 pcs , Revise clause 5.1, change Chip dimension CPW63 (H) from 1.05±0.1 to 0.70±0.10,
Version.4	28.10.2016	PCN-ECO: 01/2016	Update clause 2, Part Numbering System Update clause 3.10, Resistance, Resistance Tolerance and TCR information Update clause 7.7.4, 13" reel information
Version.5	24.10.2017		Typo error on clause 2 Typo error on 3.10
Version.6	21.06.2018		Remove AEC-Q200 standard on clause 1.3
Version.7	28.12.2018		Update Datasheet
Version.8	12.04.2019		Update Datasheet
Version.9	28.08.2019		Update clause 3.9
Version.10	24.06.2020		Revise clause 2 part numbering system
Version.11	05.08.2020		Add clause 1.3
Version.12	02.11.2020		Revise clause 3.1.1 Resistor rated power Revise clause 3.10 TCR table
Version.13	15.09.2021		Revise clause 3.1.1 resistor rated power table Revise clause 3.10 TCR table
Version 14	28.04.2023		Revise clause 3.8 Product Assurance
Version 15	02.04.2024		Revise clause 7.3.2 Identification

DATA SHEET

Fully Lead-Free High Power Thick Film Chip Resistor

CPWF Series

1% TO 5%, TCR -200 TO +400

SIZE: 0201/0402/0603/0805/1206/1210/2010/2512

RoHs Compliant

1. SCOPE

1.1 This specification is applicable to CPWF series fully lead-free and halogen-free high power thick film chip resistors.

1.2 Fully lead-free products – No RoHS exemptions.

1.3 The product is for general electronic purpose.

2. PART NUMBERING SYSTEM

Part Numbering is made in accordance with the following system:

CPWF	32	-	100			-	J	L
Type	Size		Nominal Resistance				Resistance Tolerance	Packaging
Fully Lead-Free High Power Thick Film Chip Resistors	05(0201) 10(0402) 16(0603) 21(0805) 32(1206) 40(1210) 50(2010) 63(2512)		Resistors	5% (3-Digit)	EX. 10Ω=100 4.7Ω=4R7 Jumper=000		F=±1% J=±5% Z=Zero ohm	E = 4,000 pcs Lead Free L = 5,000 pcs Lead Free K = 10,000 pcs Lead Free Y = 20,000 pcs Lead Free Refer to clause 7.3.1.1
				1% (4-Digit)	EX. 10.2Ω=10R2 10KΩ=1002 Jumper=0000			

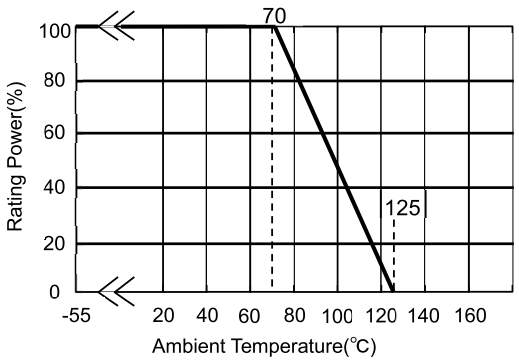
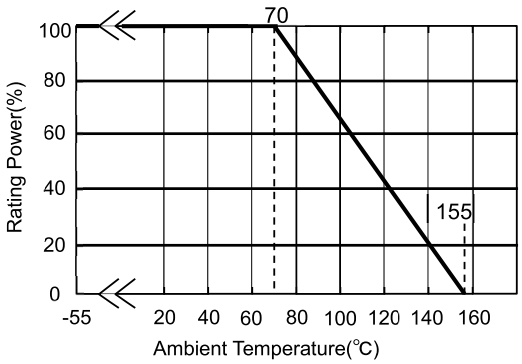
3. RATING

3.1 Rated Power

3.1.1 Resistor Rated Power

Type	Rate Power at 70℃	Max. Working Current	Max. Overload Current
CPWF05 (0201)	1/16 W	25V	50V
CPWF10 (0402)	1/8 W	50V	100V
CPWF16 (0603)	1/5 W	75V	150V
CPWF21 (0805)	1/4 W	150V	300V
CPWF32 (1206)	1/2 W	200V	400V
CPWF40 (1210)	3/4 W	200V	400V
CPWF50 (2010)	1W	200V	400V
CPWF63 (2512)	1.5W	200V	400V

3.2 Power Derating Curve:

Type	CPWF05 (0201)	Other
Operating Temperature Range	- 55℃ ~ + 125℃	- 55℃ ~ + 155℃
Explain	For resistors operated in ambient temperatures above 70℃, power rating shall be derated in accordance with figure below.	For resistors operated in ambient temperatures above 70℃, power rating shall be derated in accordance with figure below.
Figure		

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 resistors shall warranty 24 months from manufacturing date with control condition.

3.9 ASJ resistors are RoHS compliance in accordance to RoHS Directive.

3.10 Resistance, Resistance Tolerance and Temperature Coefficient of Resistance.

Type	Rate Power at 70℃	Max. Working Current	Max. Overload Current	T.C.R (ppm/℃)	Resistance Range		JUMPER Rated Current		JUMPER Resistance Value	
					F(±1%) E-24、E-96	J(±5%) E-24	Z (±5%)	F (±1%)	Z (±5%)	F (±1%)
CPWF05 (0201)	1/16W	25V	50V	-200 /+400	1Ω≦R≦2.2MΩ	1Ω≦R≦2.2MΩ	0.5A	0.5A	50mΩ MAX	30mΩ MAX
				±200	2.2MΩ < R≦10MΩ	2.2MΩ < R≦10MΩ				
CPWF10 (0402)	1/8W	50V	100V	±150	1Ω≦R≦2.2MΩ	1Ω≦R≦2.2MΩ	1.5A	2A	50mΩ MAX	20mΩ MAX
				±250	2.2MΩ < R≦10MΩ	2.2MΩ < R≦10MΩ				
CPWF16 (0603)	1/5W	75V	150V	±150	1Ω≦R≦2.2MΩ	1Ω≦R≦2.2MΩ	1.5A	2.5A	50mΩ MAX	20mΩ MAX
				±250	2.2MΩ < R≦10MΩ	2.2MΩ < R≦10MΩ				
CPWF21 (0805)	1/4W	150V	300V	±150	1Ω≦R≦2.2MΩ	1Ω≦R≦2.2MΩ	2.5A	3.5A	50mΩ MAX	20mΩ MAX
				±250	2.2MΩ < R≦10MΩ	2.2MΩ < R≦10MΩ				
CPWF32 (1206)	1/2W	200V	400V	±150	1Ω≦R≦2.2MΩ	1Ω≦R≦2.2MΩ	3A	5A	50mΩ MAX	20mΩ MAX
				±250	2.2MΩ < R≦10MΩ	2.2MΩ < R≦10MΩ				
CPWF40 (1210)	3/4W	200V	400V	±150	1Ω≦R≦2.2MΩ	1Ω≦R≦2.2MΩ	4A	6A	50mΩ MAX	20mΩ MAX
				±250	2.2MΩ < R≦10MΩ	2.2MΩ < R≦10MΩ				
CPWF50 (2010)	1W	200V	400V	±150	1Ω≦R≦2.2MΩ	1Ω≦R≦2.2MΩ	4.5A	7A	50mΩ MAX	20mΩ MAX
				±250	2.2MΩ < R≦10MΩ	2.2MΩ < R≦10MΩ				
CPWF63 (2512)	1.5W	200V	400V	±150	1Ω≦R≦2.2MΩ	1Ω≦R≦2.2MΩ	6A	10A	50mΩ MAX	20mΩ MAX
				±250	2.2MΩ < R≦10MΩ	2.2MΩ < R≦10MΩ				
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= Voltage rating (v)
P= Power rating (w)
R= Nominal resistance(Ω)

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: 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 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 X 10^0 = 1
10 Ω	10R0	10 X 10^0 = 10
100 Ω	1000	100 X 10^0 = 100
4.7K Ω	4701	470 X 10^1 = 470 0
47K Ω	4702	470 X 10^2 = 470 00
470K Ω	4703	470 X 10^3 = 470 000
1M Ω	1004	100 X 10^4 = 100 0000

4.1.2 5% Tolerance: ***Three Numerals Marking***

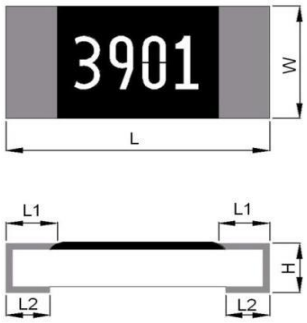
First 2 digits are significant figures; third digit is number of zeros. Letter R is decimal point.

Example

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

5. DIMENSIONS, CONSTRUCTIONS AND MATERIALS

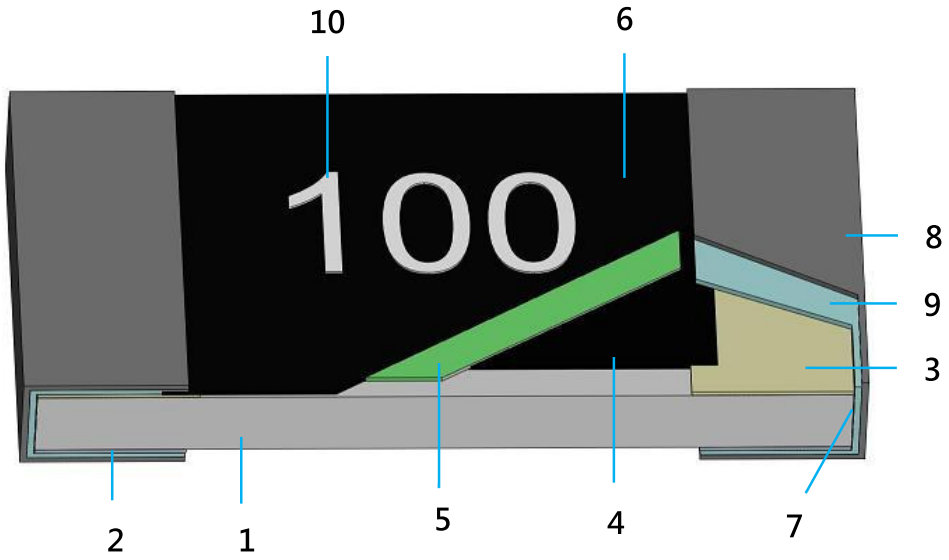
5.1 Dimensions



Unit:mm

Type \ Dimension / Size Code	L	W	H	L1	L2
CPWF05	**0201**	0.60±0.03	0.30±0.03	0.23±0.03	0.10±0.05	0.15±0.05
CPWF10	**0402**	1.00±0.10	0.50±0.05	0.30±0.05	0.20±0.10	0.25±0.10
CPWF16	**0603**	1.60±0.10	0.80±0.10	0.45±0.10	0.30±0.15	0.30±0.15
CPWF21	**0805**	2.00±0.10	1.25±0.10	0.50±0.10	0.35±0.20	0.35±0.15
CPWF32	**1206**	3.05±0.10	1.55±0.10	0.50±0.10	0.45±0.20	0.35±0.15
CPWF40	**1210**	3.05±0.10	2.55±0.10	0.55±0.10	0.50±0.20	0.50±0.20
CPWF50	**2010**	4.95±0.10	2.45±0.20	0.70±0.10	0.65±0.20	0.60±0.20
CPWF63	**2512**	6.40±0.20	3.20±0.20	0.70±0.10	0.60±0.20	1.25±0.20

5.2 Structure Graph:



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

5.3 Plating Thickness:

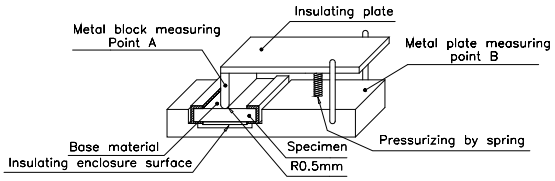
5.3.1 Ni:≧2μm

5.3.2 Sn(Tin):≧3μm

5.3.3 Sn(Tin): Matte Sn

6 Reliability Test

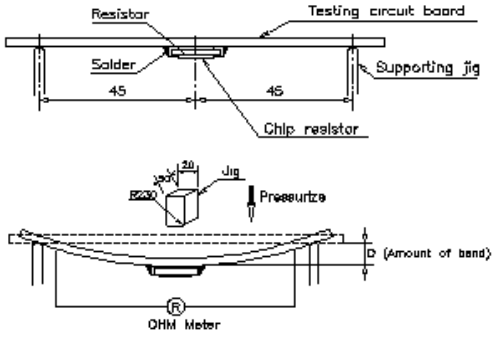
6.0.1 Electrical Performance Test

Item	Conditions	Specifications Resistors
Temperature Coefficient of Resistance	$TCR(ppm/^{\circ}C) = \frac{(R2-R1)}{R1(T2-T1)} x10^6$ 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	Refer to item 3.10
Short Time Overload	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) Refer to JIS-C5201-1 4.13	1%:△R=±1.0% 5%:△R=±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  	≧$10^9\Omega$
Dielectric Withstand Voltage	Put the resistor in the fixture, add VAC (see SPEC below) in +,- terminal for. CPWF05, 10, 16 apply 300VAC 1 minute CPWF21, 32、40、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±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 Refer to JIS-C5201-1 4.13	△R=±5.0%

Size / Jumper	(0201)	(0402)	(0603)	(0805)	(1206)	(1210)	(2010)	(2512)
±5%	1.25A	3.75A	3.75A	6.25A	7.5A	10A	11.25A	15A
±1%	1.25A	5A	6.25A	8.75A	12.5A	15A	17.5A	25A

6.0.2 Mechanical Performance Test

Item	Conditions	Specifications Resistors
Terminal Strength	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	Test 1 : No evidence of mechanical damage. Test 2: CPWF05≧3N OtypeType≧5N
Resistance to Solvent	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	△R%=±1.0%
Solderability	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	Solder coverage over 95%
Resistance to Soldering Heat	◎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	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%

Item	Conditions	Specifications
		Resistors
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: CPWF10, 16, 21=5mm CPWF05, 32, 40=3mm CPWF50、63=2mm  Refer to JIS-C5201-1 4.33	△R%=±1.0%

6.0.3 Environmental Test

<table>
<tr><th rowspan="2">Item</th><th rowspan="2">Conditions</th><th>Specifications</th></tr>
<tr><th>Resistors</th></tr>
<tr><td>Resistance to Dry Heat</td><td>Put tested resistor in chamber under temperature 155±5℃ for $1{,}000^{+48}_{-0}$ 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</td><td>1%:△R%=±1.0%
5%:△R%=±2.0%</td></tr>
<tr><td>Thermal Shock</td><td>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.
<table>
<tr><th colspan="2">Testing Condition</th></tr>
<tr><td>Lowest Temperature</td><td>-55±5℃</td></tr>
<tr><td>Highest Temperature</td><td>125±5℃</td></tr>
<tr><td>Temperature-retaining time</td><td>15 minutes each</td></tr>
</table>
Refer to MIL-STD 202 Method 107</td><td>△R%=±1.0%</td></tr>
<tr><td>Loading Life in Moisture</td><td>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.

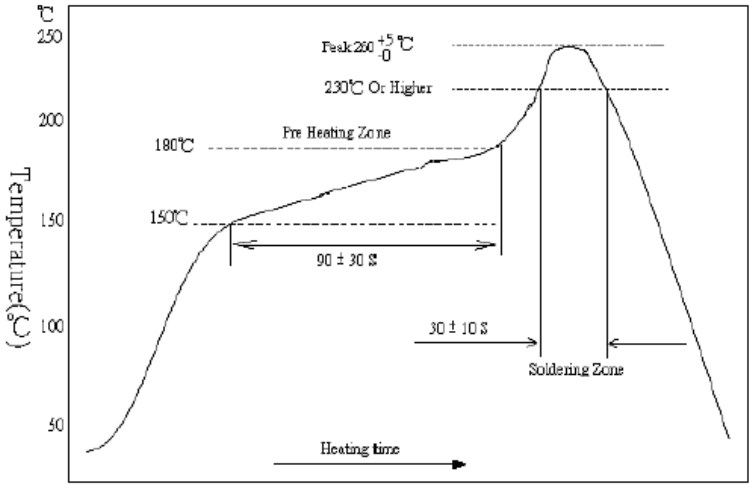
Refer to JIS-C5201-1 4.24</td><td>1%:△R%=±1.5%
5%:△R%=±3.0%</td></tr>
<tr><td>Load Life</td><td>Put the tested resistor in chamber under temperature 70±2℃ and load the rated voltage for 90 minutes on, 30 minutes off, total 1000 hours. Then leaving the tested resistor in room temperature for 60 minutes, and measure its resistance variance rate.

Refer to JIS-C5201-1 4.25</td><td>1%:△R%=±1.5%
5%:△R%=±3.0</td></tr>
</table>

6.1 Technical application notes: (This is for recommendation, customer are please to perform adjustment according to actual application)

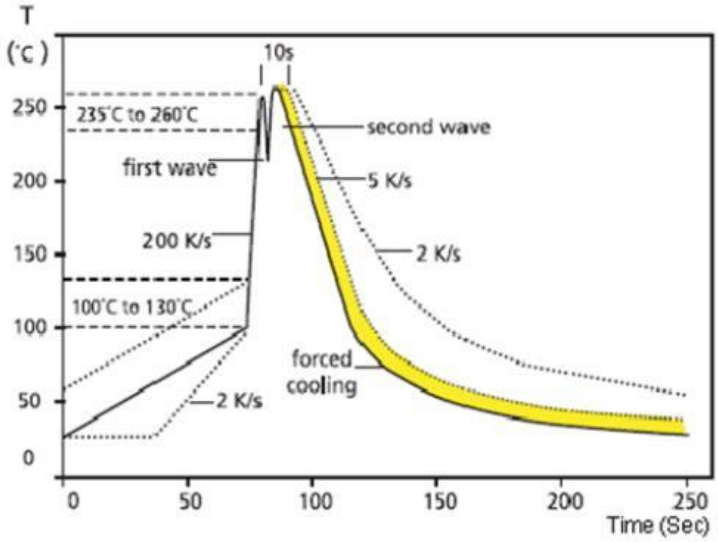
Soldering Profile :

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



Remark:The peak temperature of soldering heat is 260^{+5}_{-0} ℃ for 10 seconds.

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

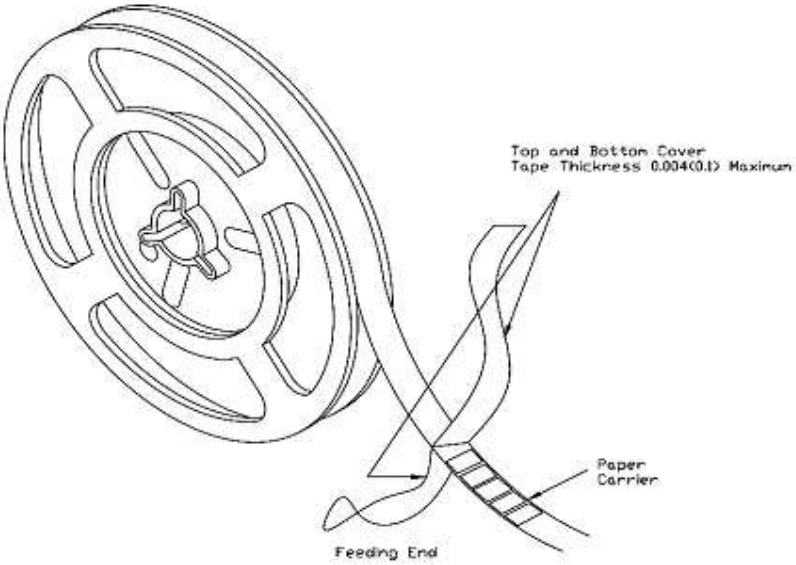


6.1.3 Soldering Iron: temperature 350℃±10℃ , dwell time shall be less than 3 sec.

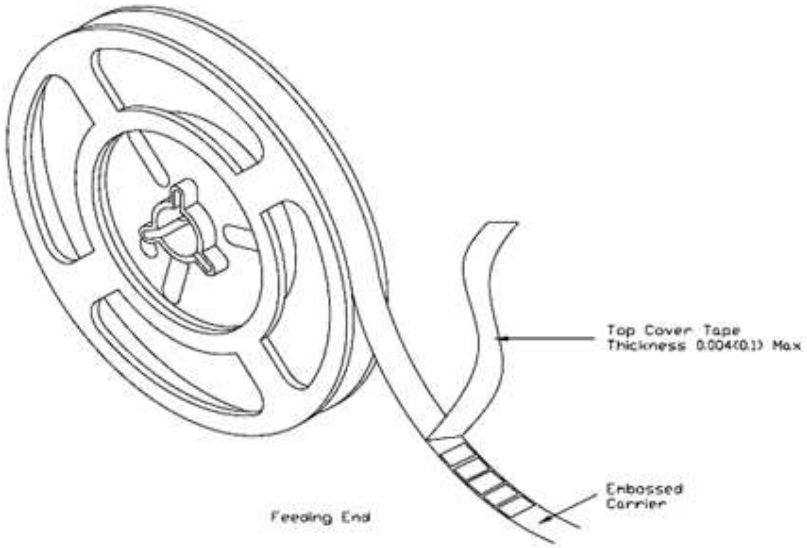
7 TAPING

7.1 Structure of Taping

Paper Carrier

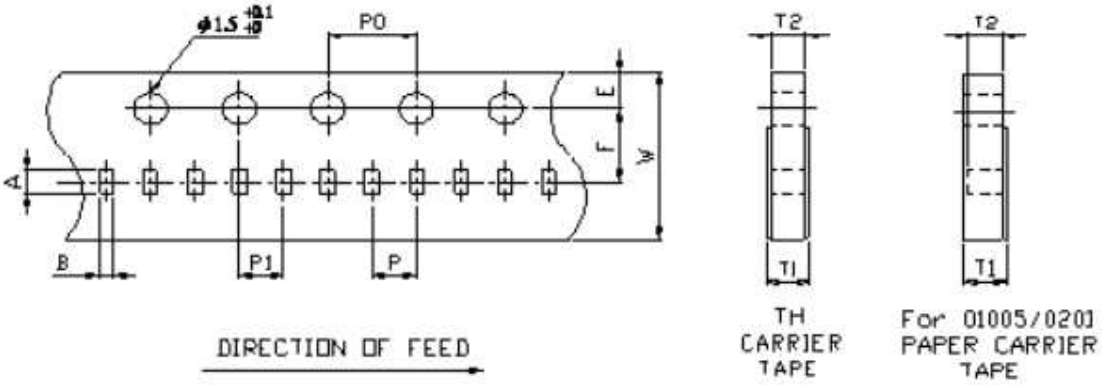


Embossed Plastic Carrier



7.2 Dimension

7.2.1 Dimension of Punched Paper Tape Carrier System (CPWF05,10)

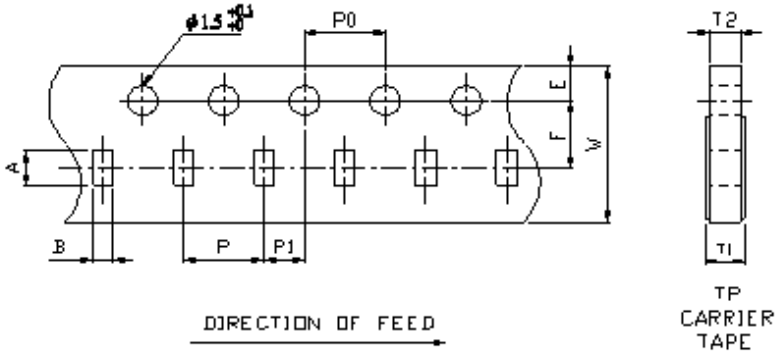


Remark : Pitch tolerance over any 10 pitches of Po is ± 0.2 mm

Dimension of Punched Paper Tape Carrier System (CPWF05,10)

Type	Dimensions (mm)										
Size	A	B	W	E	F	T1	T2	P	P0	10xP0	P1
CPWF05	0.68±0.05	0.38±0.03	8.00±0.10	1.75±0.10	3.50±0.05	$0.42^{+0.1}_{-0}$	0.28±0.02	2.00±0.05	4.00±0.05	40.0±0.20	2.00±0.05
CPWF10	1.15±0.05	0.65±0.05	8.00±0.20	1.75±0.10	3.50±0.05	$0.42^{+0.2}_{-0}$	0.40±0.05	2.00±0.10	4.00±0.05	40.0±0.20	2.00±0.05

7.2.2 Dimension of Punched Paper Tape Carrier System /Plastic Embossed Carrier System (CPWF-16,21,32, 40, 50, 63)

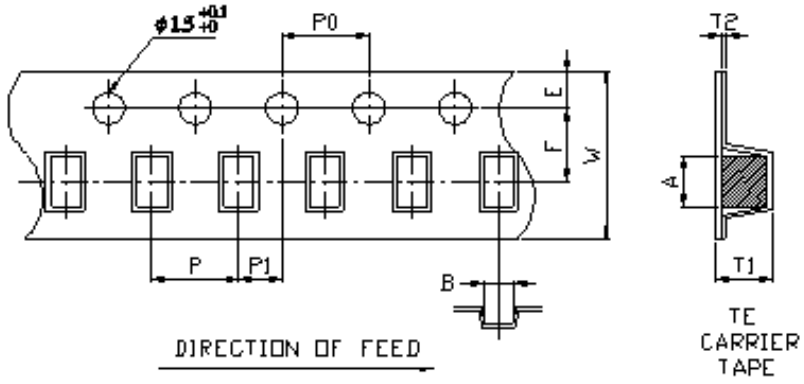


Remark : Pitch tolerance over any 10 pitches of Po is ± 0.2 mm

Dimension of Punched Paper Tape Carrier System (CPWF – 16,21,32,40)

Type	Dimensions (mm)										
Size	A	B	W	E	F	T1	T2	P	P0	10xP0	P1
CPWF16	1.8±0.10	1.0±0.10	8.0±0.20	1.75±0.10	3.50±0.05	$0.60^{+0.2}_{0}$	0.60±0.10	4.0±0.10	4.0±0.05	40.00±0.20	2.0±0.05
CPWF21	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	40.00±0.20	2.0±0.05
CPWF32	3.50±0.20	1.90±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	40.00±0.20	2.00±0.05
CPWF40	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	40.00±0.20	2.00±0.05

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



Type	Dimensions (mm)										
Size	A	B	W	E	F	T1	T2	P	P0	10xP0	P1
CPWF50	5.50±0.20	2.80±0.20	12.00±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	40.00±0.20	2.00±0.05
CPWF63	6.70±0.20	3.40±0.20	12.00±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	40.00±0.20	2.00±0.05

7.3 Packaging

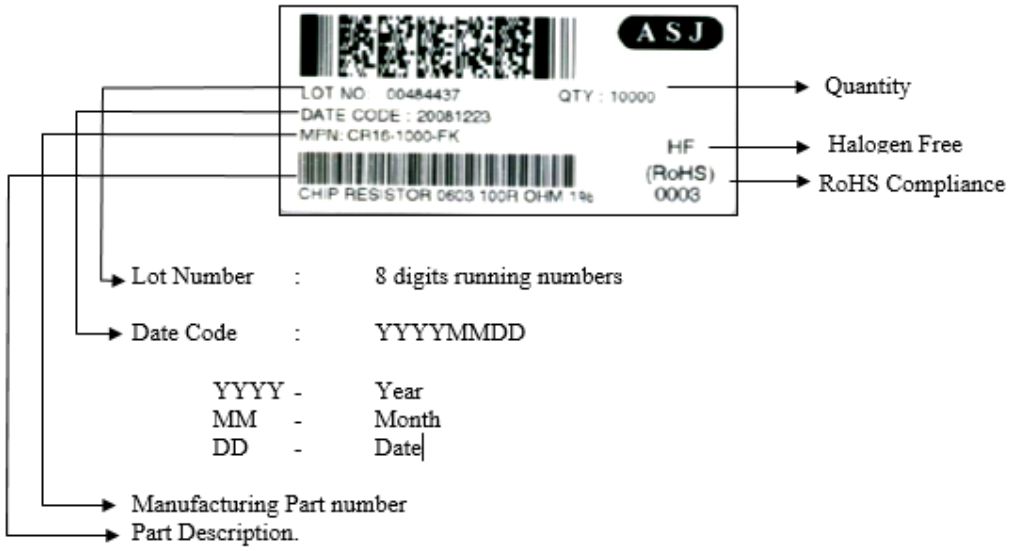
7.3.1 Taping

7.3.1.1 Quantity – Tape and Reels

Code	Quantity	Reel	Remark
CPWF05 CPWF10	10,000 pcs	7"	2mm pitch
	20,000 pcs	7"	2mm pitch
	50,000 pcs	13"	2mm pitch
CPWF16	5,000 pcs	7"	4mm pitch
CPWF21	10,000 pcs	10"	4mm pitch
CPWF32 CPWF40	20,000 pcs	13"	4mm pitch
CPWF50	4,000 pcs	7"	Embossed 4mm pitch
CPWF63	4,000 pcs	7"	Embossed 4mm pitch

7.3.2 Identification

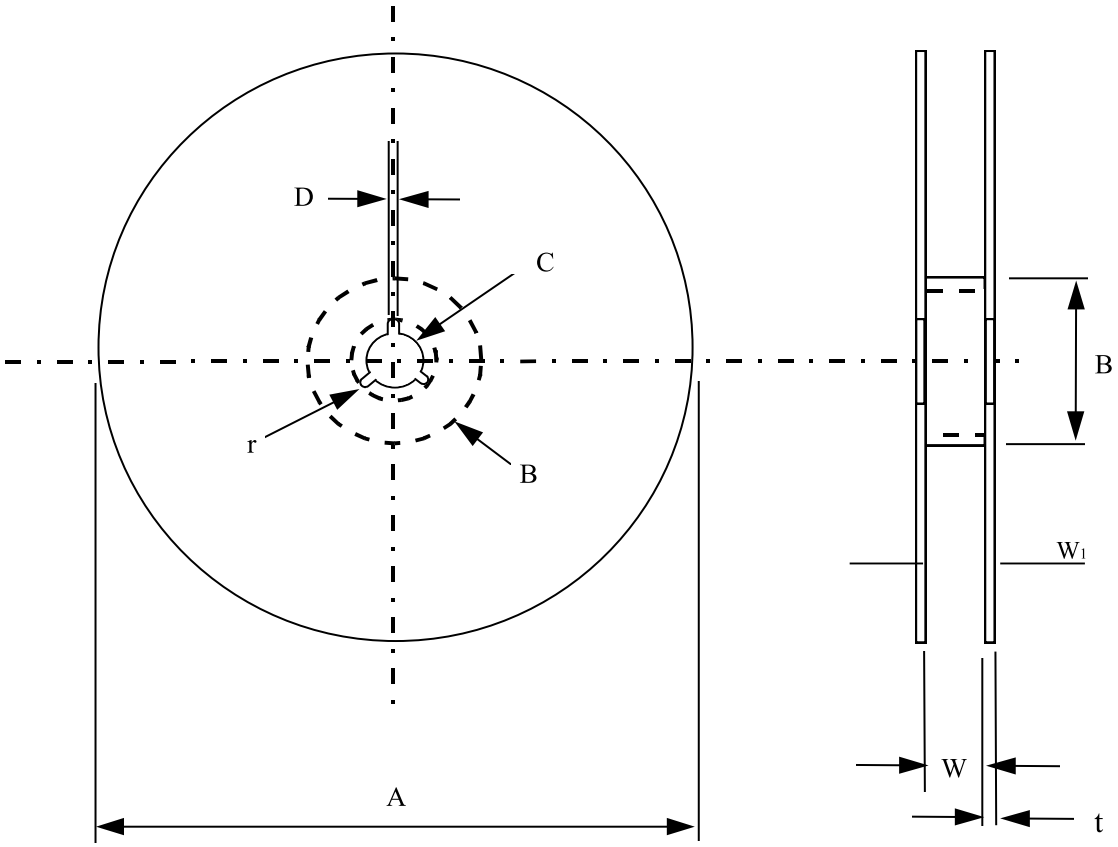
Production label that indicates the 8 digits lot number, product type, resistance value and tolerance shall be pasted on the surface of each reel.



7.3.3 Packaging Reel Box

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

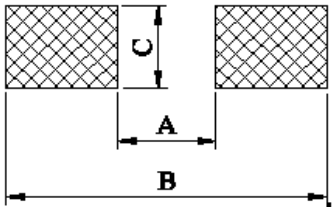
7.3.4 Reel Dimensions



Model	A	B	C	D	W	W_1	t	r
7"Reel (5K) (except 0402 10K)	ϕ178±2.0	ϕ80min	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 (2K) (for 2512)	ϕ178±2.0	ϕ60min	13.5±0.5	ϕ2.0± 0.5	13.8±0.5	14.4 max	1.2± 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)	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.

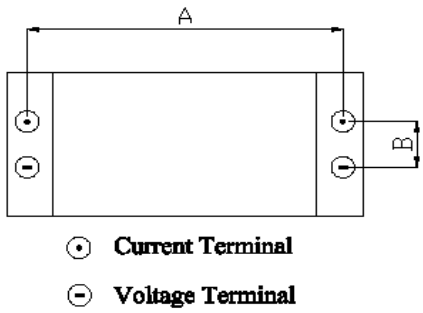


Unit:mm

TYPE \ DIM	A	B	C
CPWF05	0.3	1.0	0.4
CPWF10	0.5	1.5	0.6
CPWF16	0.8	2.1	0.9
CPWF21	1.2	3.0	1.3
CPWF32	2.2	4.2	1.6
CPWF40	2.2	4.2	2.8
CPWF50	3.5	6.1	2.8
CPWF63	3.8	8.0	3.5

9 Measurement Point

Bottom electrode



Unit : mm

TYPE \ DIM	A	B
CPWF05	**0.44±0.05**	**0.22±0.05**
CPWF10	**0.80±0.05**	**0.24±0.05**
CPWF16	**1.35±0.05**	**0.35±0.05**
CPWF21	**1.80±0.05**	**0.35±0.05**
CPWF32	**2.90±0.05**	**0.35±0.05**
CPWF40	**2.90±0.05**	**0.35±0.05**
CPWF50	**4.50±0.05**	**1.15±0.05**
CPWF63	**5.90±0.05**	**1.60±0.05**

10 REVISION HISTORY

REVISION	DATE	CHANGE NOTIFICATION	DESCRIPTION
Version.1	05.11.2019		Initial Release
Version.2	31.12.2019		Typo error in clause 4
Version.3	10.02.2021		Add in product CPWF05 – CPWF21 Revise clause 2 Part Numbering System Revise clause 3.1.1 Resistor rated power Revise clause 3.2 Power Derating curve Revise clause 3.5 Storage temperature range Revise clause 3.10 TCR table Revise clause 4 Marking on product Revise clause 5.1 Dimension Revise clause 6.0.1 item Dielectric withstand voltage Revise clause 6.0.2 item Joint strength of solder Revise clause 7.2.1 & 7.2.2 dimension of punch paper Revise clause 7.3.1.1 tape and reel qty Revise clause 8 land pattern Revise clause 9 measurement point
Version.4	07.03.2023		Revise clause 2 Part Numbering System Revise clause 3.2 Power derating curve Revise clause 3.8 Product Assurance Revise clause 3.10 TCR table Revise clause 4 Marking on product table Revise clause 6.0.1 item intermittent overload Revise clause 6.0.2 item Terminal strength Revise clause 6.1.1 IR reflow soldering profile

DATA SHEET

High Power Pulse-Proof Thick Film Chip Resistor

CPWS Series

1% TO 5%, TCR ±200

SIZE: 0402/0603/0805/1206/2010/2512

1. SCOPE

1.1 This specification is applicable to Lead-free and Halogen-free of RoHS directive for CPWS series Pulse-Proof 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:

Ordering Code / Information

CPWS	63	-	XXXX			-	F	E
Type	Size (Inch / mm)		Nominal Resistance				Resistance Tolerance	Packaging
High Power Pulse-Proof Thick Film Chip Resistors	10(0402) 16(0603) 21(0805) 32(1206) 50(2010) 63(2512)		Resistors	5% (3-Digit)	EX. 10Ω=100 4.7Ω=4R7		F=±1% J=±5%	E = 4,000 pcs Lead Free L = 5,000 pcs Lead Free K = 10,000 pcs Lead Free Y = 20,000 pcs Lead Free N = 50,000 pcs Lead Free
				1% (4-Digit)	EX. 10.2Ω=10R2 10KΩ=1002			

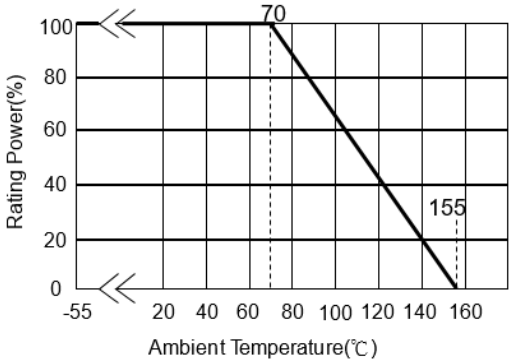
3. RATING

3.1 Rated Power

3.1.1 Resistor Rated Power

Type	Rate Power at 70℃	Max. Working Current	Max. Overload Current
CPWS10 (0402)	$\frac{1}{5}$W	50V	100V
CPWS16 (0603)	$\frac{1}{3}$W	75V	150V
CPWS21 (0805)	$\frac{1}{2}$W	150V	300V
CPWS32 (1206)	$\frac{3}{4}$W	200V	400V
CPWS50 (2010)	1W	200V	400V
CPWS63 (2512)	2W	200V	400V

3.2 Power Derating Curve:
Operating Temperature Range:- 55～155 ℃
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.

3.10 Resistance, Resistance Tolerance and Temperature Coefficient of Resistance.

Type	Rate Power at 70℃	Max. Working Current	Max. Overload Current	T.C.R (ppm/℃)	Resistance Range
					F(±1%) 、J(±5%) E-24 、E-96
CPWS10 (0402)	$\frac{1}{5}$W	50V	100V	±200	1Ω≦R≦10M
CPWS16 (0603)	$\frac{1}{3}$W	75V	150V	±200	1Ω≦R≦10M
CPWS21 (0805)	$\frac{1}{2}$W	150V	300V	±200	1Ω≦R≦10M
CPWS32 (1206)	$\frac{3}{4}$W	200V	400V	±200	1Ω≦R≦10M
CPWS50 (2010)	1W	200V	400V	±200	1Ω≦R≦10M
CPWS63 (2512)	2W	200V	400V	±200	1Ω≦R≦10M
Operating Temperature Range					-55℃ ~ +155℃

3.11 Rated Voltage:

Rated Voltage: DC voltage or AC voltage (rms.) based on the rated power.

The voltage can be calculated by the following formula. If the calculated value exceeds the Max. voltage specified in the Table 3.10, the Max. voltage rating is set as the voltage rating.

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

E= Rated voltage (v)

P= Power rating (w)

R= Nominal resistance(Ω)

4. MARKING ON PRODUCT

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

Part Number	Color	Marking on Product
CPWS10(0402)	---	No Marking
CPWS16(0603) CPWS21(0805) CPWS32(1206) CPWS50(2010) CPWS63(2512)	Light Yellow	1) Tolerance; ± 1% (F) Four Numerals Marking - 0603 three characters marking base on E-96 marking standard 2) Tolerance; ± 5% (F) Three Numerals Marking

4.1 Numeric Numbering

4.1.1 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 X 10^0 = 1
10 Ω	10R0	10 X 10^0 = 10
100 Ω	1000	100 X 10^0 = 100
4.7K Ω	4701	470 X 10^1 = 470 0
47K Ω	4702	470 X 10^2 = 470 00
470K Ω	4703	470 X 10^3 = 470 000
1M Ω	1004	100 X 10^4 = 100 0000

4.1.2 0603 1% tolerance: ***Three Character E-96 Marking Standard.***

The first 2 digits for the 3 digits E-96 part marking standard, (Refer Table 2 & 3).

The third character is a letter multiplier:

Nominal resistance	***Marking***	***Remark***
33.2 Ω	51 X	332 X 10^{-1} Ω
150 Ω	18 A	150 X 10^0 Ω
4.99K Ω	68 B	499 X 10^1 Ω
1 0.2K Ω	02 C	102 X 10^2 Ω
100K Ω	01 D	100 X 10^3 Ω

4.1.3 EIA-96 Marking Scheme

Table 2 Significant figures

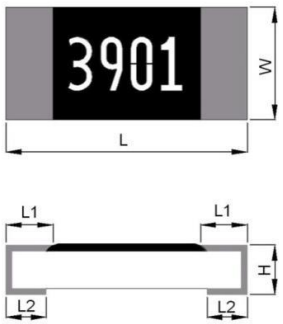
Significant Figures	Symbol	Significant Figures	Symbol	Significant Figures	Symbol	Significant Figures	Symbol
100	01	178	25	316	49	562	73
102	02	182	26	324	50	576	74
105	03	187	27	332	51	590	75
107	04	191	28	340	52	604	76
110	05	196	29	348	53	619	77
113	06	200	30	357	54	634	78
115	07	205	31	365	55	649	79
118	08	210	32	374	56	665	80
121	09	215	33	383	57	681	81
124	10	221	34	392	58	698	82
127	11	226	35	402	59	715	83
130	12	232	36	412	60	732	84
133	13	237	37	422	61	750	85
137	14	243	38	432	62	768	86
140	15	249	39	442	63	787	87
143	16	255	40	453	64	806	88
147	17	261	41	464	65	825	89
150	18	267	42	475	66	845	90
154	19	274	43	487	67	866	91
158	20	280	44	499	68	887	92
162	21	287	45	511	69	909	93
165	22	294	46	523	70	931	94
169	23	301	47	536	71	953	95
174	24	309	48	549	72	976	96

Table 3 Multiplier

Symbol	Multiplier	Symbol	Multiplier
A	10^0	G	10^6
B	10^1	H	10^7
C	10^2	X	10^{-1}
D	10^3	Y	10^{-2}
E	10^4		
F	10^5		

5. DIMENSION, CONSTRUCTION AND MATERIAL

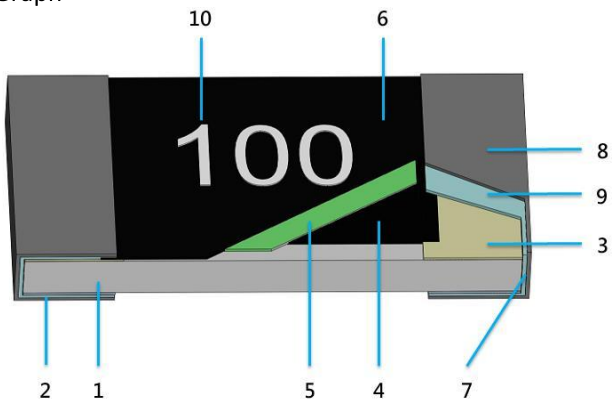
5.1 Dimension



Unit:mm

Type \ Dimension / Size Code		L	W	H	L1	L2
CPWS10	**0402**	1.00±0.10	0.50±0.05	0.30±0.05	0.20±0.10	0.25±0.10
CPWS16	**0603**	1.60±0.10	0.80±0.10	0.45±0.10	0.30±0.15	0.30±0.15
CPWS21	**0805**	2.00±0.10	1.25±0.10	0.50±0.10	0.35±0.20	0.35±0.15
CPWS32	**1206**	3.05±0.10	1.55±0.10	$0.50^{+0.10}_{-0.05}$	0.45±0.20	0.35±0.15
CPWS50	**2010**	5.00±0.20	2.50±0.20	0.55±0.10	0.60±0.20	0.60±0.20
CPWS63	**2512**	6.40±0.20	3.20±0.20	0.70±0.10	0.60±0.20	1.25±0.20

5.2 Structure Graph



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

5.3 Plating Thickness

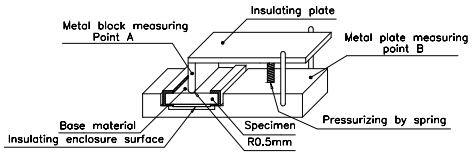
5.3.1 Ni: ≧ 2 µm

5.3.2 Sn (Tin): ≧ 3 µm

5.3.3 Sn (Tin): Matte Sn

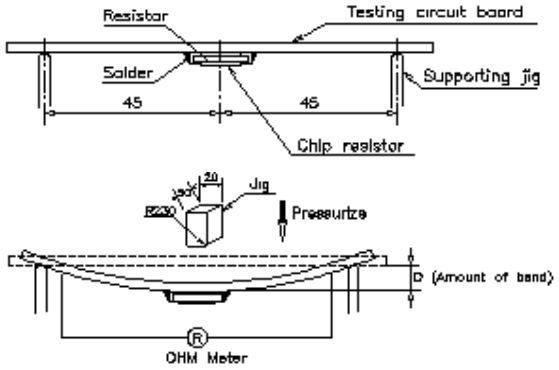
6. RELIABILITY TEST

6.1 Electrical Performance Test

Item	Conditions	Specifications Resistors
Temperature Coefficient of Resistance	***Refer to JIS-C5201-1 4.8*** $TCR(ppm/^{\circ}C) = \frac{(R2-R1)}{R1(T2-T1)} x10^6$ R1: Resistance at room temperature R2: Resistance at -55℃ or +125℃ T1: Room temperature T2: Temperature -55℃ or +125℃	Refer to item 3.10 general specifications
Short Time Overload	***Refer to JIS-C5201-1 4.13*** 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)	±1%: △R=±1.0% ±5%: △R=±2.0%
Insulation Resistance	***Refer to JIS-C5201-1 4.6*** 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.  	≧$10^9\Omega$
Dielectric Withstand Voltage	***Refer to JIS-C5201-1 4.7*** Put the resistor in the fixture, add VAC (see spec. below) in +,- terminal for. CPWS10, 16 apply 300 VAC 1 minute CPWS21, 32, 50, 63 apply 500 VAC 1 minute.	No short or burned on the appearance.
ESD	***Refer to EIAJED-4701-300 304*** Put the specimens on the test fixture and apply ±3KVDC on terminals for 1sec .Afterwards, the specimens stabilize for 30min or more and measure of its resistance variance rate.	△R%=±5.0%

6.2 Mechanical Performance Test

Item	Conditions	Specifications Resistors
Terminal Strength	***Refer to JIS-C5201-1 4.16*** Test1: The resistor mounted on the board applied 5N pushing force on the sample rear for 10 sec. Test2: The resistor mounted on the board slowly add force on the sample rear until the sample termination is breakdown.	Test1:No evidence of mechanical damage. Test2:≧5N
Resistance to Solvent	***Refer to JIS-C5201-1 4.29*** 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.	△R%=±1.0%
Solderability	***Refer to JIS-C5201-1 4.17*** 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±0.5 sec, then the resistor is left as placed under microscope to observe its solder area.	Solder coverage over 95%
Resistance to Soldering Heat	***Refer to JIS-C5201-1 4.18*** ◎Test method 1 (solder pot test): The tested resistor be immersed into molten solder of 260^{+5}_{-0} ℃ for 10^{+1}_{-0} 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^{+1}_{-0} 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.	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%

Item	Conditions	Specifications Resistors
Joint Strength of Solder	***Refer to JIS-C5201-1 4.33*** ◎Bending Strength: Solder tested resistor on to PC board. Add force in the middle down, and under load measured its resistance variance rate. D:CPWS10, 16, 21=5mm CPWS32=3mm CPWS50, 63=2mm 	△R%=±1.0%

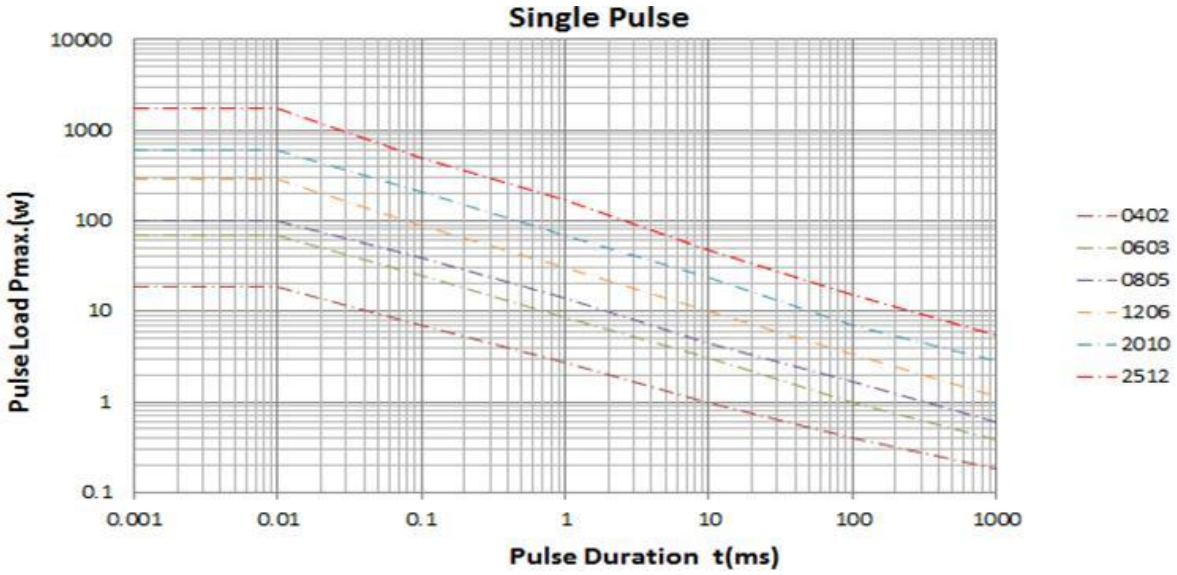
6.3 Environmental Test

Item	Conditions	Specifications Resistors
Resistance to Dry Heat	***Refer to JIS-C5201-1 4.25*** 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.	±1%: △R=±1.0% ±5%: △R=±2.0%
Thermal Shock	***Refer to MIL-STD 202 Method 107*** 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	△R%=±1.0%
Loading Life in Moisture	***Refer to JIS-C5201-1 4.24*** 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.	±1%: △R=±1.0% ±5%: △R=±2.0%
Load Life	***Refer to JIS-C5201-1 4.25*** 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.	±1%: △R=±1.0% ±5%: △R=±2.0%

6.4 Pulse Loading Capability

6.4.1 Single Pulse Load:

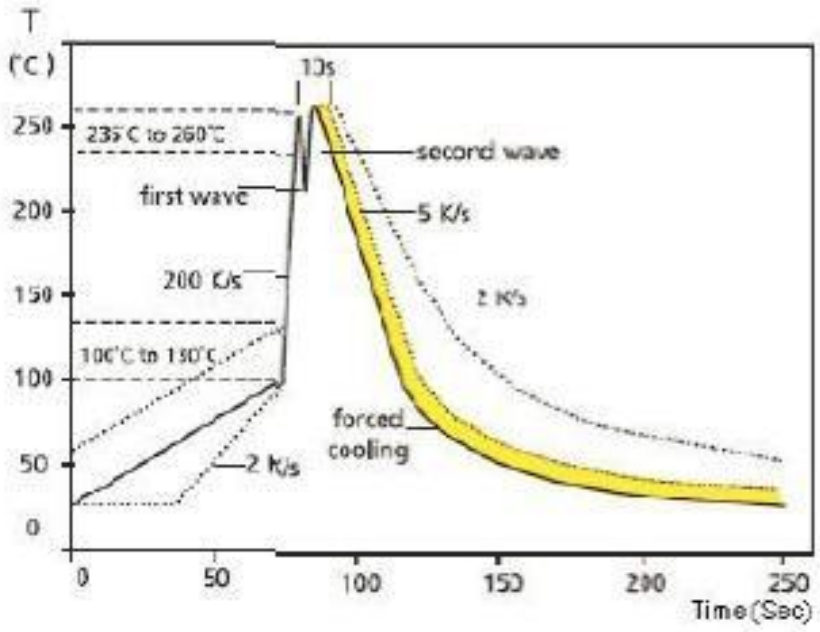
Pulse on a regular basis; maximum permissible peak pulse power (Pmax) as a function of a pulse duration. Vpeak≦0402(100V)、0603(150V)、0805(300V)、1206(400V)、2010(400V)、2512(400V)



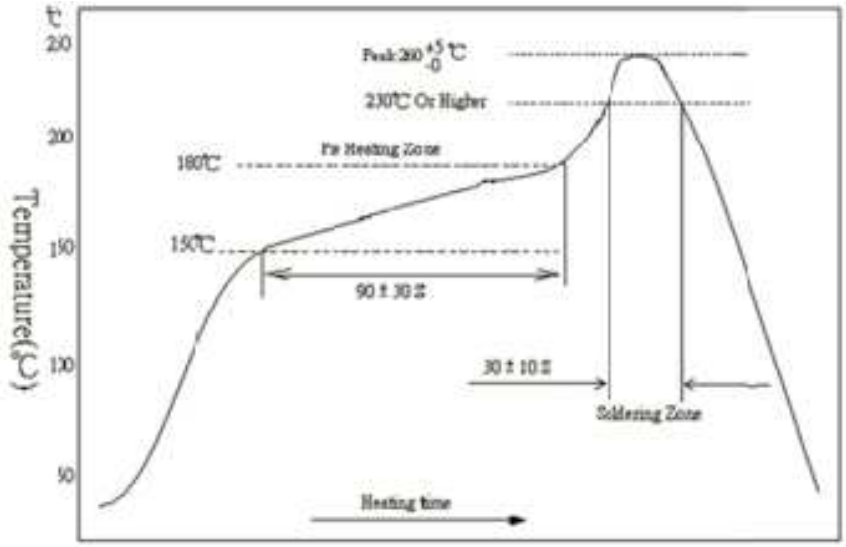
6.5 Technical application notes: (This is for recommendation, customer please perform adjustment according to the actual application)

Soldering Profile

6.5.1 Lead free double wave soldering profile (This applies to 0603 size inclusive above products)



6.5.2 Lead Free IR Reflow Soldering Profile



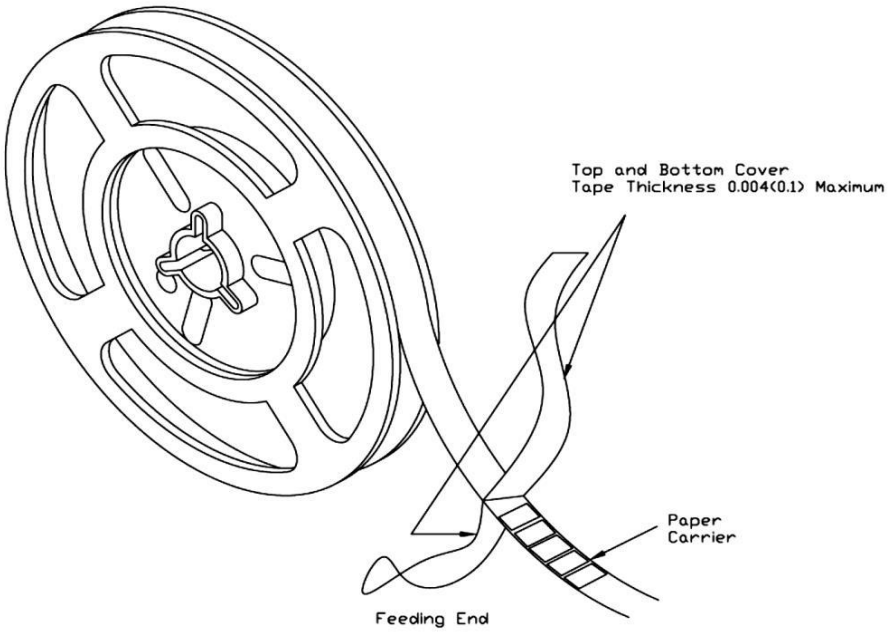
Remark: The peak temperature of soldering heat is 260 +5/-0 ℃ for 10 seconds

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

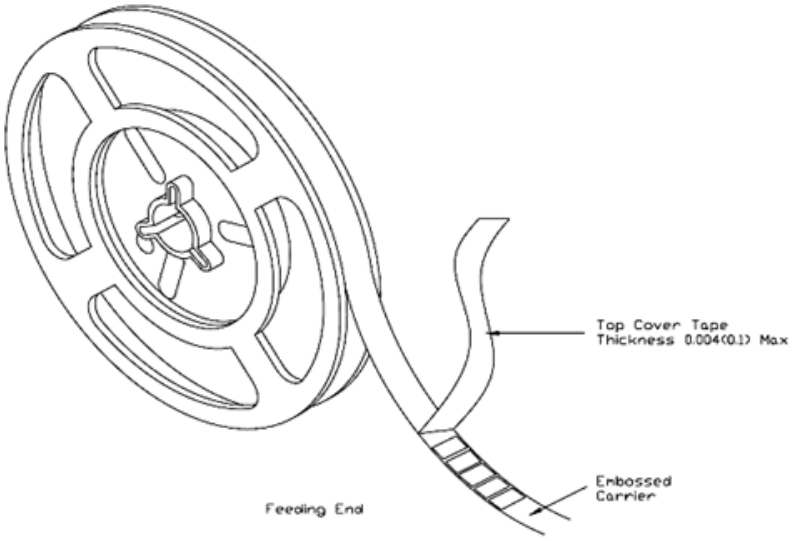
7 TAPING

7.1 Structure of Taping

Paper Carrier

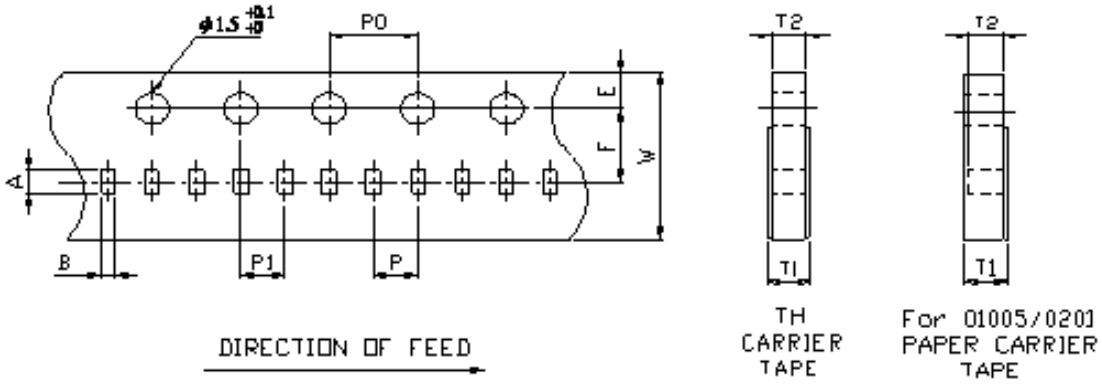


Embossed Plastic Carrier

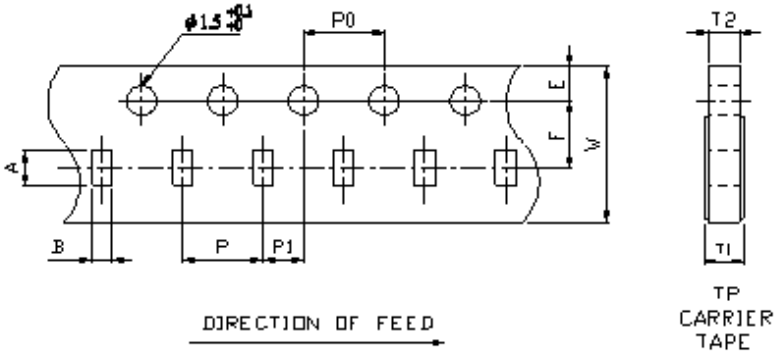


7.2 Dimension

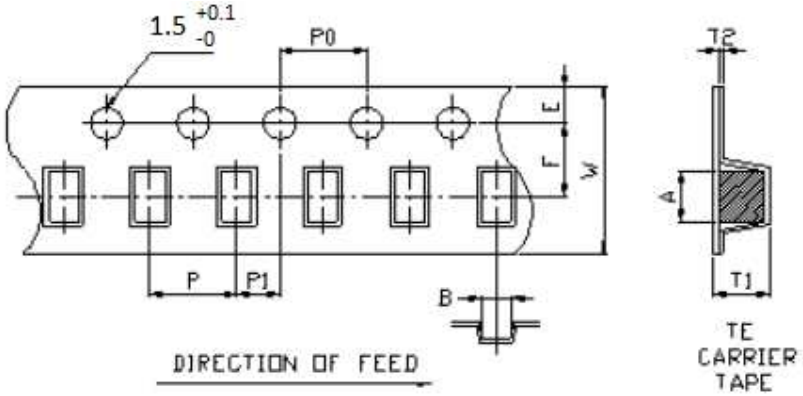
7.2.1 Dimension of Punched Paper Tape Carrier System(CPWS10)



7.2.2 Dimension of Punched Paper Tape Carrier System(CPWS16, 21, 32)



7.2.3 Dimension of Emboosed Tape Carrier System(CPWS50, 63)



Dimension of Punched Paper Tape Carrier System (CPWS – 63)

Code	A	B	W	E	F	T1	T2	P	P0	P1
CPWS10	1.15±0.05	0.65±0.05	8.00±0.20	1.75±0.10	3.50±0.05	$0.40^{+0.2}_{-0}$	0.40±0.05	2.00±0.10	4.00±0.05	2.00±0.05
CPWS16	1.80±0.10	1.00±0.10	8.00±0.20	1.75±0.10	3.50±0.05	$0.60^{+0.2}_{-0}$	0.60±0.10	2.00±0.10	4.00±0.05	2.00±0.05
CPWS21	2.30±0.10	1.55±0.10	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
CPWS32	3.50±0.20	1.90±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
CPWS50	5.50±0.20	2.80±0.20	12.00±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
CPWS63	6.70 ± 0.20	3.40 ± 0.20	12.00 ± 0.20	1.75 ± 0.10	5.50 ± 0.05	1.10 ± 0.15	0.23 ± 0.15	4.0 ± 0.10	4.00 ± 0.05	2.00 ± 0.05

7.3 Packaging

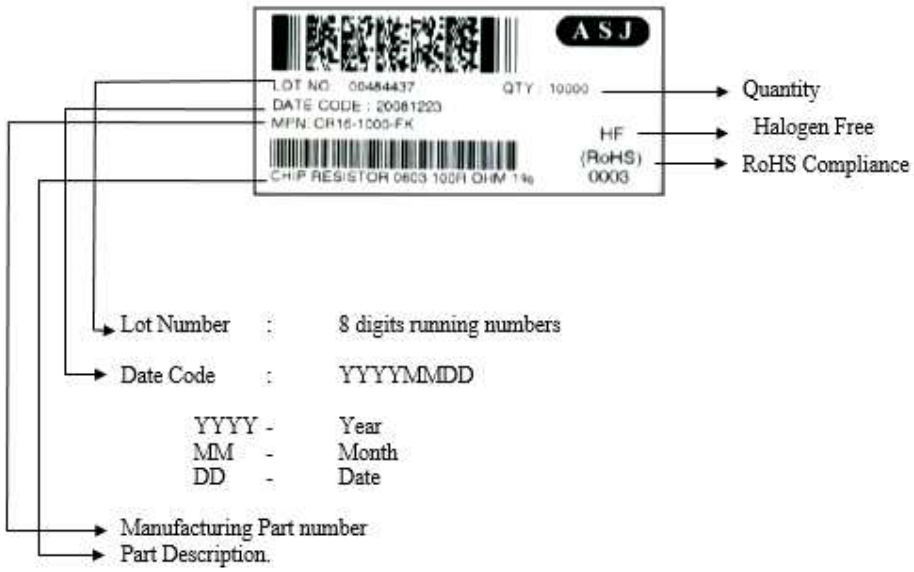
7.3.1 Taping

7.3.2 Quantity – Tape and Reels

Type	Qty(pcs/reel)	Reel	Remark
CPWS10	10,000	7”	Paper 2mm pitch
	20,000	7”	Paper 2mm pitch
	50,000	13”	Paper 2mm pitch
CPWS16	5,000	7”	Paper 4mm pitch
CPWS21	10,000	10”	Paper 4mm pitch
CPWS32	20,000	13”	Paper 4mm pitch
CPWS50 CPWS63	4,000	7”	Embossed 4mm pitch

7.4 Identification

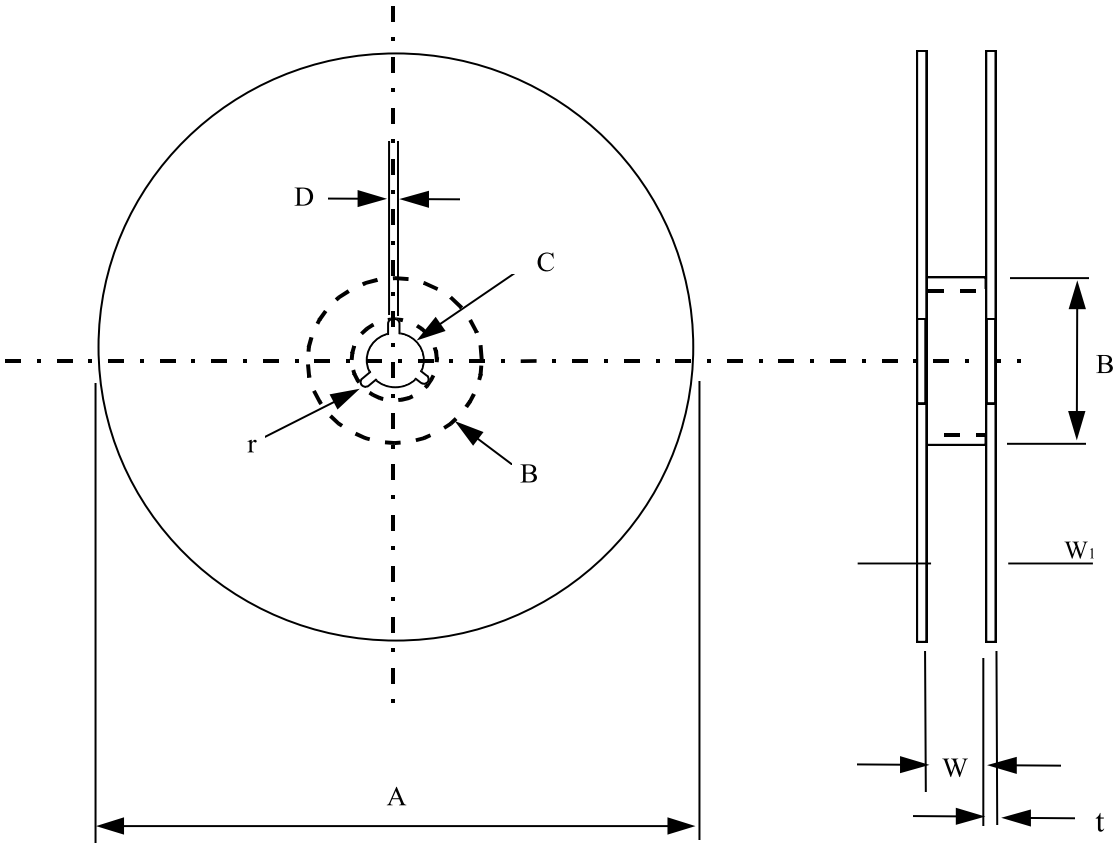
Production label that indicates the 8 digits lot number, product type, resistance value and tolerance shall be pasted on the surface of each reel.



7.4.1 Packaging Reel Box

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

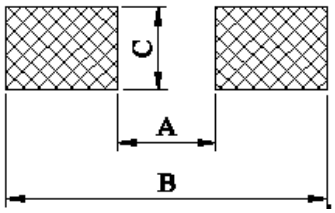
7.4.2 Reel Dimensions



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.

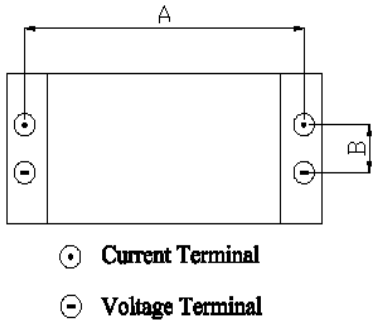


Unit:mm

TYPE \ DIM	A	B	C
CPWS10	0.50	1.80	0.50
CPWS16	0.50	2.50	1.27
CPWS21	0.66	3.56	1.78
CPWS32	1.50	4.30	2.18
CPWS50	3.50	6.10	2.80
CPWS63	3.80	8.00	3.50

9 MEASUREMENT POINT

Bottom electrode



Unit : mm

TYPE \ DIM	A	B
CPWS10	**0.80±0.05**	**0.24±0.05**
CPWS16	**1.35±0.05**	**0.35±0.05**
CPWS21	**1.80±0.05**	**0.35±0.05**
CPWS32	**2.90±0.05**	**0.35±0.05**
CPWS50	**4.50±0.05**	**1.15±0.05**
CPWS63	**5.90±0.05**	**1.60±0.05**

10 REVISION HISTORY

REVISION	DATE	CHANGE NOTICE	DESCRIPTION
Version.1	10.12.2019		Initial Release
Version.2	19.06.2020		Add new part CPWS10, 16, 21, 32, 50 Revise clause 2 Part Numbering System Revise clause 3.1.1 Resistor Rated Power Revise clause 3.10 TCR table Revise clause 4 Marking on product Add clause 4.1.2, 4.1.3 Revise clause 5.1 Dimension Revise clause 6.1 item Dielectric withstand voltage, item Joint Strength of solder Revise clause 6.4.1 Single pulse load Revise clause 7.2.2 and 7.2.3 and dimension table Revise clause 7.3.2 tape and reel quantity Revise clause 8 Land Pattern dimension Revise clause 9 Measurement point dimension
Version 3	02.06.2023		Revise clause 3.8 Product Assurance