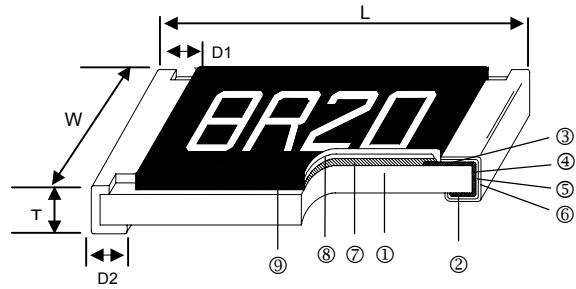


# Thin Film Precision Chip Resistor—RN Series



## Construction



① Alumina Substrate	④ Edge Electrode (NiCr)	⑦ Resistor Layer (NiCr)
② Bottom Electrode (Ag)	⑤ Barrier Layer (Ni)	⑧ Overcoat (Epoxy)
③ Top Electrode (Ag-Pd)	⑥ External Electrode (Sn)	⑨ Marking

## Features

- Advanced thin film technology
- Very tight tolerance down to  $\pm 0.01\%$
- Extremely low TCR down to  $\pm 5\text{PPM}/^\circ\text{C}$
- Wide resistance range 1ohm ~ 3Mega ohm
- Miniature size 0201 available

## Applications

- Medical Equipment
- Testing / Measurement Equipment
- Printer Equipment
- Automatic Equipment Controller
- Converters
- Communication Device, Cell Phone, GPS, PDA

## Dimensions

Unit: mm

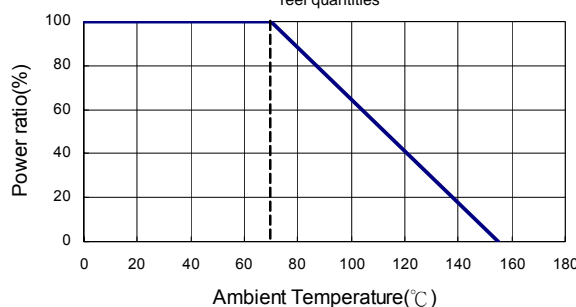
Type	Size (Inch)	L	W	T	D1	D2	Weight (g) (1000pcs)
RN02	0201	0.58 $\pm$ 0.05	0.29 $\pm$ 0.05	0.23 $\pm$ 0.05	0.12 $\pm$ 0.05	0.15 $\pm$ 0.05	0.14
RN04	0402	1.00 $\pm$ 0.05	0.50 $\pm$ 0.05	0.30 $\pm$ 0.05	0.20 $\pm$ 0.10	0.20 $\pm$ 0.10	0.54
RN06	0603	1.55 $\pm$ 0.10	0.80 $\pm$ 0.10	0.45 $\pm$ 0.10	0.30 $\pm$ 0.20	0.30 $\pm$ 0.20	1.83
RN10	0805	2.00 $\pm$ 0.15	1.25 $\pm$ 0.15	0.55 $\pm$ 0.10	0.30 $\pm$ 0.20	0.40 $\pm$ 0.25	4.71
RN12	1206	3.05 $\pm$ 0.15	1.55 $\pm$ 0.15	0.55 $\pm$ 0.10	0.42 $\pm$ 0.20	0.35 $\pm$ 0.25	9.02
RN14	1210	3.10 $\pm$ 0.15	2.40 $\pm$ 0.15	0.55 $\pm$ 0.10	0.40 $\pm$ 0.20	0.55 $\pm$ 0.25	10
RN20	2010	4.90 $\pm$ 0.15	2.40 $\pm$ 0.15	0.55 $\pm$ 0.10	0.60 $\pm$ 0.30	0.50 $\pm$ 0.25	23.61
RN25	2512	6.30 $\pm$ 0.15	3.10 $\pm$ 0.15	0.55 $\pm$ 0.10	0.60 $\pm$ 0.30	0.50 $\pm$ 0.25	38.06

## Part Numbering

RN	06	B	1001	CT5		25	LF
Product Type	Dimensions	Resistance Tolerance	Resistance	Packaging Code*	Power Rating	TCR (PPM/ $^\circ\text{C}$ )	Optional "LF" Designator
	02: 0201 04: 0402 06: 0603 10: 0805 12: 1206 14: 1210 20: 2010 25: 2512	T: $\pm 0.01\%$ Q: $\pm 0.02\%$ A: $\pm 0.05\%$ B: $\pm 0.1\%$ C: $\pm 0.25\%$ D: $\pm 0.5\%$ F: $\pm 1\%$	1R00: 1 $\Omega$ 4R70: 4.7 $\Omega$ 1001: 1K $\Omega$ 1004: 1M $\Omega$	CT1: Tape & 1K Reel CT4: Tape & 4K Reel CT5: Tape & 5k Reel CT10: Tape & 10k Reel	Blank : Standard Y : 1/16W X : 1/10W W : 1/8W P : 1/5W V : 1/4W O : 1/3W U : 1/2W Q : 3/4W T : 1W	5 = $\pm 5$ 10 = $\pm 10$ 15 = $\pm 15$ 25 = $\pm 25$ 50 = $\pm 50$	Cal-chip has completed the Lead-Free transition. All parts shipped with or without an "LF" at the end of the part number will be RoHS Compliant. Please contact your Sales Associate if you require Non-RoHS material.

\* See packaging specifications below for avail reel quantities

## Derating Curve



## Standard Electrical Specifications

Item Type	Power Rating at 70°C	Operating Temp. Range	Max. Operating Voltage	Max. Overload Voltage	Resistance Range					TCR (PPM/°C)
					±0.05%	±0.1%	±0.25%	±0.5%	±1%	
RN02 (0201)	1/32W	-55 ~ +155°C	15V	30V	—			49.9Ω - 5KΩ	±25	
								49.9Ω - 33KΩ	±50	
RN04 (0402)	1/16W	-55 ~ +155°C	25V	50V	10Ω - 205KΩ				±25	
					10Ω - 205KΩ		1Ω - 205KΩ		±50	
RN06 (0603)	1/16W	-55 ~ +155°C	50V	100V	4.7Ω - 332KΩ	4.7Ω - 1MΩ	2Ω - 1MΩ		±25 ±50	
RN10 (0805)	1/10W	-55 ~ +155°C	100V	200V	4.7Ω - 511KΩ	4.7Ω - 2MΩ	1Ω - 2MΩ		±25 ±50	
RN12 (1206)	1/8W	-55 ~ +155°C	150V	300V	4.7Ω - 1MΩ	4.7Ω - 2.5MΩ	1Ω - 2.5MΩ		±25 ±50	
RN14 (1210)	1/5W									
RN20 (2010)	1/4W	-55 ~ +155°C	150V	300V	4.7Ω - 1MΩ	4.7Ω - 3MΩ	1Ω - 3MΩ		±25 ±50	
RN25 (2512)	1/2W									

Operating Voltage= $\sqrt{P \cdot R}$  or Max. operating voltage listed above, whichever is lower.

Overload Voltage= $2.5 \cdot \sqrt{P \cdot R}$  or Max. overload voltage listed above, whichever is lower.

- Calchip is capable of manufacturing the optional spec based on customer's requirement.
- Lower Resistance: 1~10Ω

## Special Electrical Specifications

Item Type	Power Rating at 70°C	Operating Temp. Range	Max. Operating Voltage	Max. Overload Voltage	Resistance Range			TCR (PPM/°C)
					±0.01%	±0.05%	±0.1%	
RN04 (0402)	1/16W	-55 ~ +155°C	25V	50V	49.9Ω - 5KΩ			±5
					49.9Ω - 12KΩ			±10
					49.9Ω - 12KΩ		49.9Ω - 70KΩ	±15
RN06 (0603)	1/16W	-55 ~ +155°C	50V	100V	24.9Ω - 15KΩ			±5
					24.9Ω - 100KΩ	4.7Ω - 332KΩ		±10 ±15
RN10 (0805)	1/10W	-55 ~ +155°C	100V	200V	24.9Ω - 30KΩ			±5
					24.9Ω - 200KΩ	4.7Ω - 511KΩ		±10 ±15
RN12 (1206)	1/8W	-55 ~ +155°C	150V	300V	24.9Ω - 50KΩ			±5
					24.9Ω - 500KΩ	4.7Ω - 1MΩ		±10 ±15
RN14 (1210)	1/5W	-55 ~ +155°C	150V	300V	24.9Ω - 50KΩ			±5
					24.9Ω - 500KΩ	4.7Ω - 1MΩ		±10 ±15
RN20 (2010)	1/4W	-55 ~ +155°C	150V	300V	24.9Ω - 100KΩ			±5
					24.9Ω - 500KΩ	4.7Ω - 1MΩ		±10 ±15
RN25 (2512)	1/2W	-55 ~ +155°C	150V	300V	24.9Ω - 100KΩ			±5
					24.9Ω - 500KΩ	4.7Ω - 1MΩ		±10 ±15

Operating Voltage= $\sqrt{P \cdot R}$  or Max. operating voltage listed above, whichever is lower.

Overload Voltage= $2.5 \cdot \sqrt{P \cdot R}$  or Max. overload voltage listed above, whichever is lower.

## High Power Rating Electrical Specifications

Type	Item	Power Rating at 70°C	Operating Temp. Range	Max. Operating Voltage	Max. Overload Voltage	Resistance Range					TCR (PPM/°C)
						±0.01%	±0.05%	±0.1%	±0.25%	±0.5%	
RN06 (0603)	1/10W	-55 ~ +155°C	75V	150V	24.9Ω - 15KΩ					±5	
					24.9Ω - 100KΩ	4.7Ω - 332KΩ	4.7Ω - 332KΩ			±10 ±15	
	4.7Ω - 1MΩ			±25 ±50							
1/6W	-55 ~ +155°C	100V	150V	—	10Ω - 332KΩ				±25 ±50		
RN10 (0805)	1/8W	-55 ~ +155°C	150V	300V	24.9Ω - 30KΩ					±5	
					24.9Ω - 200KΩ	4.7Ω - 511KΩ	4.7Ω - 511KΩ			±10	
							4.7Ω - 1MΩ			±15	
	4.7Ω - 1MΩ	1Ω - 1MΩ	±25 ±50								
1/4W	-55 ~ +155°C	150V	300V	—	10Ω - 500KΩ				±25 ±50		
RN12 (1206)	1/4W	-55 ~ +155°C	200V	400V	24.9Ω - 50KΩ					±5	
					24.9Ω - 500KΩ	4.7Ω - 1MΩ			±10 ±15 ±25 ±50		
1/3W	-55 ~ +155°C	200V	400V	—	10Ω - 1MΩ				±25 ±50		
RN14 (1210)	1/3W	-55 ~ +155°C	200V	400V	24.9Ω - 50KΩ					±5	
					24.9Ω - 500KΩ	4.7Ω - 1MΩ			±10 ±15 ±25 ±50		
RN20 (2010)	1/3W	-55 ~ +155°C	200V	400V	24.9Ω - 50KΩ					±5	
					24.9Ω - 500KΩ	4.7Ω - 1MΩ			±10 ±15 ±25 ±50		
RN25 (2512)	3/4W	-55 ~ +155°C	200V	400V	24.9Ω - 2KΩ	4.7Ω - 2KΩ		1Ω - 2KΩ		±10 ±15 ±25 ±50	
	1W	-55 ~ +155°C	200V	400V	—	4.7Ω - 100Ω	1Ω - 100Ω			±25 ±50	

Operating Voltage= $\sqrt{P \cdot R}$  or Max. operating voltage listed above, whichever is lower.

Overload Voltage= $2.5 \cdot \sqrt{P \cdot R}$  or Max. overload voltage listed above, whichever is lower.

- Calchip is capable of manufacturing the optional spec based on customer's requirement.
- Lower Resistance: 1~10Ω ; High Power Rating

## Environmental Characteristics

Item	Requirement		Test Method
	Tol. $\leq$ 0.05%	Tol. $>$ 0.05%	
Temperature Coefficient of Resistance (T.C.R.)	As Spec.		+25/-55/+25/+125/+25°C
Short Time Overload	$\Delta R \pm 0.05\%$	$\Delta R \pm 0.2\%$	RCWV*2.5 or Max. overload voltage for 5 seconds
	$\Delta R \pm 0.2\%$ for high power rating		
Insulation Resistance	$>1000 \text{ M}\Omega$		Apply 100V <sub>DC</sub> for 1 minute
Endurance	$\Delta R \pm 0.05\%$	$\Delta R \pm 0.2\%$	70 $\pm$ 2°C, Max. working voltage for 1000 hrs with 1.5 hrs "ON" and 0.5 hrs "OFF"
	$>7\text{k}\Omega \Delta R \pm 0.5\%$		
	$\Delta R \pm 0.5\%$ for high power rating		
Damp Heat with Load	$\Delta R \pm 0.05\%$	$\Delta R \pm 0.3\%$	40 $\pm$ 2°C, 90~95% R.H. Max. working voltage for 1000 hrs with 1.5 hrs "ON" and 0.5 hrs "OFF"
	$\Delta R \pm 0.5\%$ for high power rating		
Bending Strength	$\Delta R \pm 0.05\%$	$\Delta R \pm 0.2\%$	Bending amplitude 3 mm for 10 seconds
Solderability	95% min. coverage		245 $\pm$ 5°C for 3 seconds
Resistance to Soldering Heat	$\Delta R \pm 0.05\%$	$\Delta R \pm 0.2\%$	260 $\pm$ 5°C for 10 seconds
Dielectric Withstand Voltage	By Type		Max. overload voltage for 1 minute
Thermal Shock	$\Delta R \pm 0.05\%$	$\Delta R \pm 0.25\%$	-55°C~150°C, 100 cycles
Low Temperature Operation	$\Delta R \pm 0.05\%$	$\Delta R \pm 0.2\%$	1 hour, -65°C, followed by 45 minutes of RCWV
	$\Delta R \pm 0.5\%$ for high power rating		

■ Reference Standards: MIL-STD-202, JIS-C 5201-1

■ Storage Temperature: 25 $\pm$ 3°C; Humidity < 80%RH

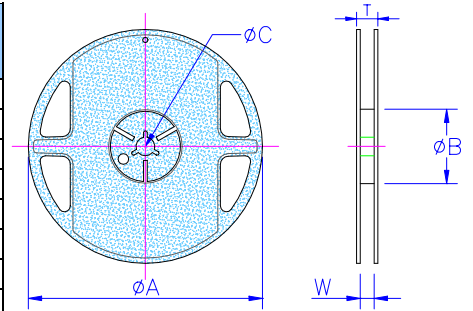
# ■ Packaging

Packaging Quantity & Reel Specifications

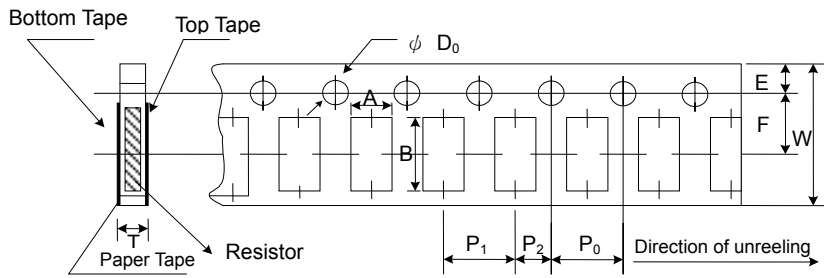
Unit: mm



Type	ΦA	ΦB	ΦC	W	T	Paper Tape (EA)	Embossed Plastic Tape (EA)
RN02	178.0 ± 1.0	60.0 + 1.0	13.5 ± 0.7	9.5 ± 1.0	11.5 ± 1.0	10k / 1k	-
RN04	178.0 ± 1.0	60.0 + 1.0	13.5 ± 0.7	9.5 ± 1.0	11.5 ± 1.0	10k / 1k	-
RN06	178.0 ± 1.0	60.0 + 1.0	13.5 ± 0.7	9.5 ± 1.0	11.5 ± 1.0	5k / 1k	-
RN10	178.0 ± 1.0	60.0 + 1.0	13.5 ± 0.7	9.5 ± 1.0	11.5 ± 1.0	5k / 1k	-
RN12	178.0 ± 1.0	60.0 + 1.0	13.5 ± 0.7	9.5 ± 1.0	11.5 ± 1.0	5k / 1k	-
RN14	178.0 ± 1.0	60.0 + 1.0	13.5 ± 0.7	9.5 ± 1.0	11.5 ± 1.0	5k / 1k	-
RN20	178.0 ± 1.0	60.0 + 1.0	13.5 ± 0.7	13.5 ± 1.0	15.5 ± 1.0	-	4k / 1k
RN25	178.0 ± 1.0	60.0 + 1.0	13.5 ± 0.7	13.5 ± 1.0	15.5 ± 1.0	-	4k / 1k



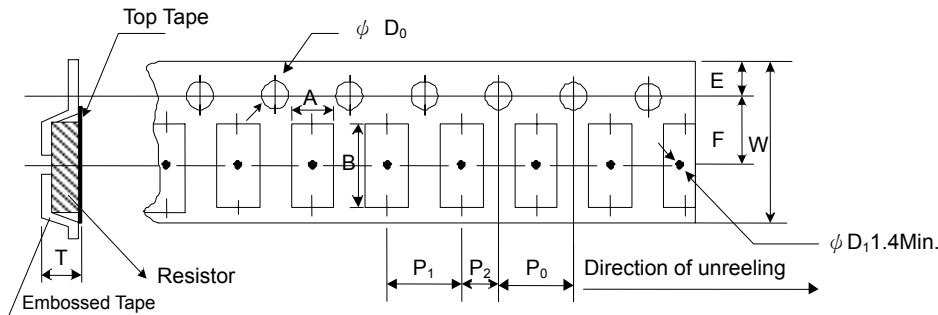
## Paper Tape Specifications



Unit: mm

Type	A	B	W	E	F	P <sub>0</sub>	P <sub>1</sub>	P <sub>2</sub>	ΦD <sub>0</sub>	T
RN02	0.40±0.05	0.70±0.05	8.00±0.10	1.75±0.05	3.5±0.05	4.00±0.10	2.00±0.05	2.00±0.05	1.55±0.03	0.42±0.02
RN04	0.70±0.05	1.16±0.05	8.00±0.10	1.75±0.05	3.5±0.05	4.00±0.10	2.00±0.05	2.00±0.05	1.55±0.05	0.40±0.03
RN06	1.10±0.05	1.90±0.05	8.00±0.10	1.75±0.05	3.5±0.05	4.00±0.10	4.00±0.10	2.00±0.05	1.55±0.05	0.60±0.03
RN10	1.60±0.05	2.37±0.05	8.00±0.10	1.75±0.05	3.5±0.05	4.00±0.10	4.00±0.10	2.00±0.05	1.55±0.05	0.75±0.05
RN12	2.00±0.05	3.55±0.05	8.00±0.10	1.75±0.05	3.5±0.05	4.00±0.10	4.00±0.10	2.00±0.05	1.55±0.05	0.75±0.05
RN14	2.75±0.05	3.40±0.05	8.00±0.10	1.75±0.05	3.5±0.05	4.00±0.05	4.00±0.10	2.00±0.05	1.60±0.10	0.75±0.05

## Embossed Plastic Tape Specifications

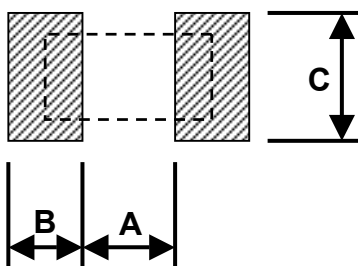


Unit: mm

Type	A	B	W	E	F	P <sub>0</sub>	P <sub>1</sub>	P <sub>2</sub>	ΦD <sub>0</sub>	T
RN20	2.85±0.10	5.45±0.10	12.0±0.10	1.75±0.10	5.5±0.05	4.00±0.05	4.00±0.10	2.00±0.05	1.50±0.10	1.00±0.20
RN25	3.40±0.10	6.65±0.10	12.0±0.10	1.75±0.10	5.5±0.05	4.00±0.05	4.00±0.10	2.00±0.05	1.50±0.10	1.00±0.20

## ■ Recommend Land Pattern

Unit: mm



Type	A	B	C
RN02	0.25	0.30	0.40±0.2
RN04	0.50	0.50	0.60±0.2
RN06	0.80	1.00	0.90±0.2
RN10	1.00	1.00	1.35±0.2
RN12	2.00	1.15	1.70±0.2
RN14	2.00	1.15	2.50±0.2
RN20	3.60	1.40	2.50±0.2
RN25	4.90	1.60	3.10±0.2