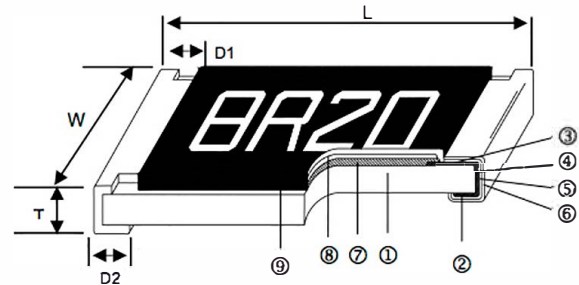


Thin Film Precision Chip Resistor—RN Series



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

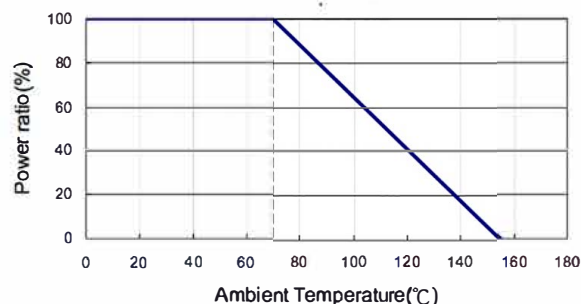
Type	Size (Inch)	L	W	T	D1	D2	Weight (g) (1000pcs)
RN02	0201	0.58 ± 0.05	0.29 ± 0.05	0.23 ± 0.05	0.12 ± 0.05	0.15 ± 0.05	0.14
RN04	0402	1.00 ± 0.05	0.50 ± 0.05	0.30 ± 0.05	0.20 ± 0.10	0.20 ± 0.10	0.54
RN06	0603	1.55 ± 0.10	0.80 ± 0.10	0.45 ± 0.10	0.30 ± 0.20	0.30 ± 0.20	1.83
RN10	0805	2.00 ± 0.15	1.25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

Part Numbering

RN	06	B	1001	CT5	—	25
Product Type	Dimensions	Resistance Tolerance	Resistance	Packaging Code*	Power Rating	TCR (PPM/ $^\circ\text{C}$)
	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: $\pm 1\%$	4R70: 4.7 Ω 1001: 1K Ω 1004: 1M Ω	CT1: Tape & 1K Reel CT4: Tape & 4K Reel CT5: Tape & 5k Reel CT10: Tape & 10k Reel	Blank : Standard X : 1/10W W : 1/8W M : 1/6W P : 1/5W V : 1/4W O : 1/3W U : 1/2W Q : 3/4W T : 1W	2 ± 2 3: ± 3 5: ± 5 10: ± 10 15: ± 15 25: ± 25 50: ± 50

*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 - 4.99KΩ	±25	
								49.9Ω - 33KΩ	±50	
RN04 (0402)	1/16W	-55 ~ +155°C	25V	50V	49.9Ω - 12KΩ	10Ω - 255KΩ	4.7Ω – 511KΩ		±25 ±50	
RN06 (0603)	1/16W	-55 ~ +155°C	50V	100V	4.7Ω - 332KΩ	4.7Ω - 1MΩ	1Ω - 1MΩ		±25 ±50	
RN10 (0805)	1/10W	-55 ~ +155°C	100V	200V	4.7Ω -1MΩ	4.7Ω - 2MΩ	1Ω - 2MΩ		±25 ±50	
RN12 (1206)	1/8W	-55 ~ +155°C	150V	300V	4.7Ω - 1MΩ	4.7Ω - 2.49MΩ	1Ω - 2.49MΩ		±25 ±50	
RN14 (1210)	1/4W									
RN20 (2010)	1/4W	-55 ~ +155°C	150V	300V	4.7Ω - 1MΩ	4.7Ω - 3MΩ	1Ω - 3MΩ		±25 ±50	
RN25 (2512)	1/2W									

■ 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%	±0.25%	±0.5%	±1%	
RN04 (0402)	1/16W	-55 ~ +155°C	25V	50V	49.9Ω - 4.99KΩ						±2 ±3 ±5
					49.9Ω - 12KΩ	49.9Ω - 60KΩ					±10
						49.9Ω -69.8KΩ					±15
RN06 (0603)	1/16W	-55 ~ +155°C	50V	100V	24.9Ω - 15KΩ						±2 ±3 ±5
					24.9Ω - 100KΩ	4.7Ω - 511KΩ					±10 ±15
RN10 (0805)	1/10W	-55 ~ +155°C	100V	200V	24.9Ω - 30KΩ						±2 ±3 ±5
					24.9Ω - 200KΩ	4.7Ω – 1MΩ					±10 ±15
RN12 (1206)	1/8W	-55 ~ +155°C	150V	300V	24.9Ω - 49.9KΩ						±2 ±3 ±5
					24.9Ω - 499KΩ	4.7Ω - 1MΩ					±10 ±15
RN14 (1210)	1/ 4W	-55 ~ +155°C	150V	300V	24.9Ω - 49.9KΩ						±2 ±3 ±5
					24.9Ω - 499KΩ	4.7Ω - 1MΩ					±10 ±15
RN20 (2010)	1/4W	-55 ~ +155°C	150V	300V	24.9Ω - 100KΩ						±2 ±3 ±5
					24.9Ω - 499KΩ	4.7Ω - 1MΩ					±10 ±15
RN25 (2512)	1/2W	-55 ~ +155°C	150V	300V	24.9Ω - 100KΩ						±2 ±3 ±5
					24.9Ω - 499KΩ	4.7Ω - 1MΩ					±10 ±15

■ High Power Rating 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%	±0.25%	±0.5%	±1%	
RN06 (0603)	1/10W	-55 ~ +155°C	75V	150V	24.9Ω - 15KΩ						±2 ±3 ±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						±2 ±3 ±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 - 499KΩ					±25 ±50
RN12 (1206)	1/4W	-55 ~ +155°C	200V	400V	24.9Ω - 49.9KΩ						±2 ±3 ±5
					24.9Ω - 499KΩ	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 – 49.9KΩ						±2 ±3 ±5
					24.9Ω - 499KΩ	4.7Ω - 1MΩ				±10 ±15 ±25 ±50	
RN20 (2010)	1/3W	-55 ~ +155°C	200V	400V	24.9Ω - 49.9KΩ						±2 ±3 ±5
					24.9Ω - 499KΩ	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.

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

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

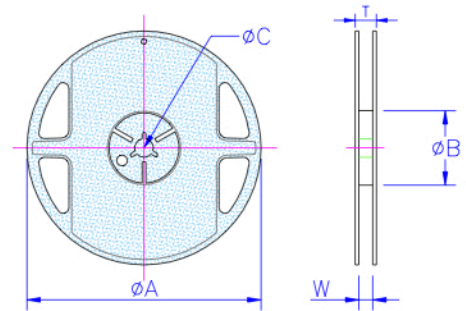
■ Storage Temperature: 25 $\pm 3^\circ\text{C}$; Humidity < 80%RH

Packaging

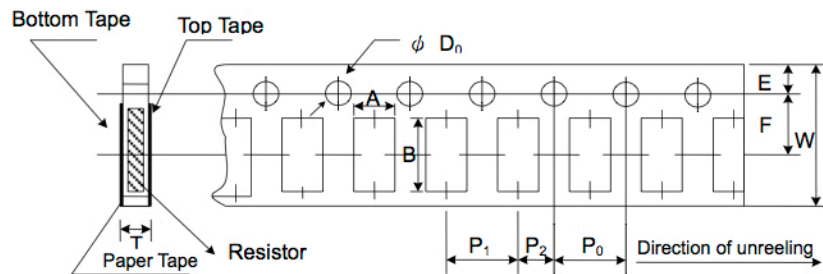
Packaging Quantity & Reel Specifications

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



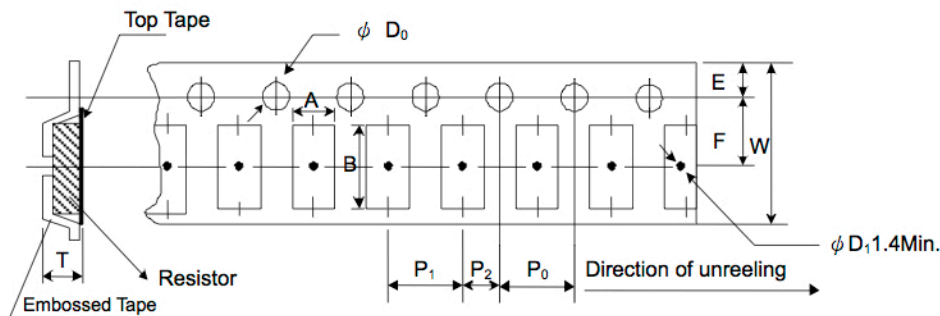
Paper Tape Specifications



Unit: mm

Type	A	B	W	E	F	P ₀	P ₁	P ₂	ΦD ₀	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

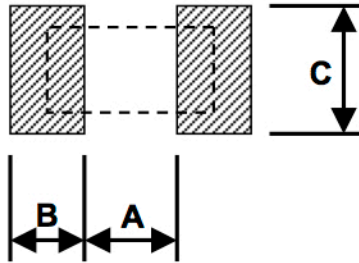


Unit: mm

Type	A	B	W	E	F	P ₀	P ₁	P ₂	ΦD ₀	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

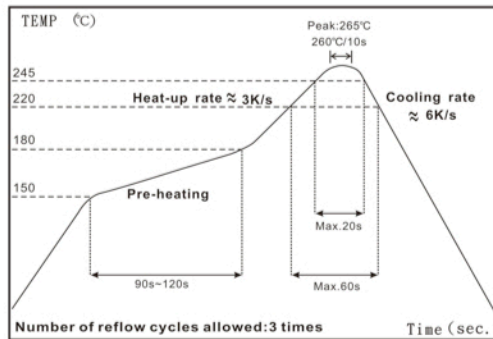
Recommend Land Pattern

Unit: mm

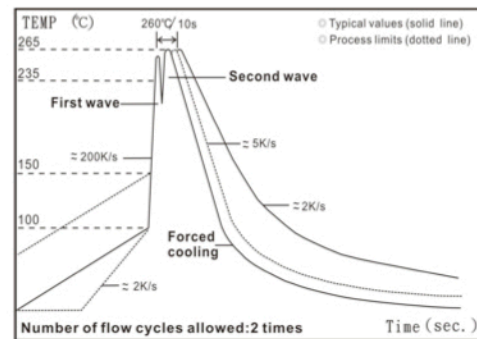


Type	A	B	C
RN02	0.25	0.30	0.40±0.2
RN04	0.50	0.50	0.60±0.2
RN06	0.80	1.00	0.90±0.2
RN10	1.00	1.00	1.35±0.2
RN12	2.00	1.15	1.70±0.2
RN14	2.00	1.15	2.50±0.2
RN20	3.60	1.40	2.50±0.2
RN25	4.90	1.60	3.10±0.2

Soldering Condition



IR Reflow Soldering

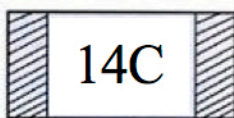


Wave Soldering (Flow Soldering)

- (1) Time of IR reflow soldering at maximum temperature point 260°C : 10s
- (2) Time of wave soldering at maximum temperature point 260°C : 10s
- (3) Time of soldering iron at maximum temperature point 410°C : 5s

Marking

0603 3digit marking



3digit marking for Example: 14C=13K7 Ω 13C=13K3 Ω

68B=4K99 Ω 68X=49.9 Ω

Marking Table

Code	E96		Code	E96		Code	E96		Code	E96	
01	100		25	178		49	316		73	562	
02	102		26	182		50	324		74	576	
03	105		27	187		51	332		75	590	
04	107		28	191		52	340		76	604	
05	110		29	196		53	348		77	619	
06	113		30	200		54	357		78	634	
07	115		31	205		55	365		79	649	
08	118		32	210		56	374		80	665	
09	121		33	215		57	383		81	681	
10	124		34	221		58	392		82	698	
11	127		35	226		59	402		83	715	
12	130		36	232		60	412		84	732	
13	133		37	237		61	422		85	750	
14	137		38	243		62	432		86	768	
15	140		39	249		63	442		87	787	
16	143		40	255		64	453		88	806	
17	147		41	261		65	464		89	825	
18	150		42	267		66	475		90	845	
19	154		43	274		67	487		91	866	
20	158		44	280		68	499		92	887	
21	162		45	287		69	511		93	909	
22	165		46	294		70	523		94	931	
23	169		47	301		71	536		95	953	
24	174		48	309		72	549		96	976	
Code	A	B	C	D	E	F	G	H	X	Y	Z
Multiplier	10 ⁰	10 ¹	10 ²	10 ³	10 ⁴	10 ⁵	10 ⁶	10 ⁷	10 ⁻¹	10 ⁻²	10 ⁻³

0603 3digit marking for E24

Example: 101=100Ω 102=1KΩ

E24	10	11	12	13	15	16	18	20	22	24	27	30	33	36	39	43	47	51	56	62	68	75	82	91
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0805~2512 4digit marking

Example

Resistance	100Ω	2.2KΩ	10KΩ	49.9KΩ	100KΩ
marking	1000	2201	1002	4992	1003