

THIN FILM PRECISION CHIP RESISTOR

- RN SERIES -

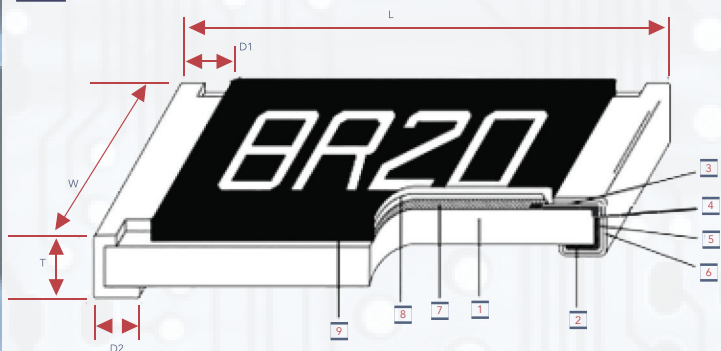
FEATURES

- Advanced thin film technology
- Very tight tolerance down to $\pm 0.01\%$
- Extremely low TCR down to $\pm 2\text{PPM}/^\circ\text{C}$
- Wide resistance range 1ohm
- 3Mega ohm
- Miniature size 0201 available
- Value range, indicating that all values of E-24 and E-96, and values under E-192 can be available upon request

APPLICATIONS

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

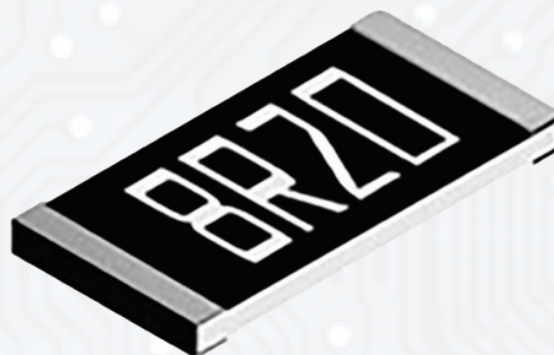
CONSTRUCTION AND DIMENSIONS



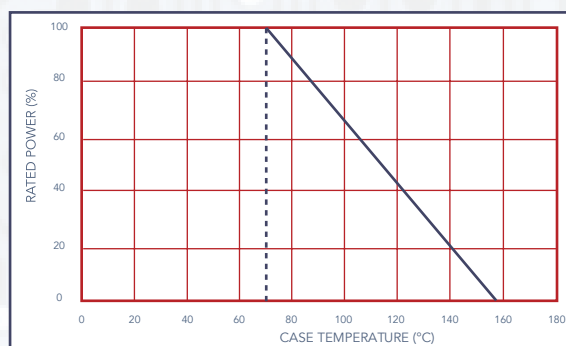
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|-------------------------|----------------------------------|------------------------------|
| 1 Alumina Substrate | 4 Edge Electrode (NiCr) | 7 Resistor Layer |
| 2 Bottom Electrode (Ag) | 5 Barrier Layer (Ni) 3~12µm | 8 Primary Overcoat (glass) |
| 3 Top Electrode (Ag-pd) | 6 External Electrode (Sn) 3~15µm | 9 Secondary Overcoat (Epoxy) |

PART NUMBERING GUIDE

RN	06	B	1001	CT5		25
PRODUCT TYPE	DIMENSIONS	RESISTANCE TOLERANCE	RESISTANCE	PACKAGING CODE*	POWER RATING	TCR (PPM/°C)
	02 : 0201 04 : 0402 06 : 0603 10 : 0805 12 : 1206 14 : 1210 20 : 2010 25 : 2512	T: $\pm 0.01\%$ U: $\pm 0.02\%$ A: $\pm 0.05\%$ B: $\pm 0.1\%$ C: $\pm 0.25\%$ D: $\pm 0.5\%$ F: $\pm 1\%$	4R70: 4.7Ω 1001: 1KΩ 1004: 1MΩ	CT1: Tape & 1K Reel CT4: Tape & 4K Reel CT5: Tape & 5k Reel CT10: Tape & 10k Reel *See packaging specifications below for avail reel quantities	Blank: Standard X: 1/10W W: 1/8W M: 1/6W P: 1/5W V: 1/4W O: 1/3W U: 1/2W A: 3/4W T: 1W Y: 1/16W Z: 1/20W K: 1/32W	2: ± 2 3: ± 3 5: ± 5 10: ± 10 15: ± 15 25: ± 25 50: ± 50



DERATING CURVE



TYPE	SIZE (INCH)	L (MM)	W (MM)	T (MM)	D1 (MM)	D2 (MM)	WEIGHT (G) (1000S)
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±0.10	0.50±0.05	0.35±0.05	0.20±0.10	0.20±0.10	0.54
RN06	0603	1.55±0.10	0.80±0.10	0.45±0.15	0.30±0.20	0.30±0.20	1.83
RN10	0805	2.00±0.15	1.25±0.15	0.50±0.15	0.35±0.20	0.40±0.25	4.71
RN12	1206	3.05±0.15	1.55±0.15	0.55±0.15	0.42±0.20	0.35±0.25	9.02
RN14	1210	3.10±0.15	2.60±0.15	0.55±0.10	0.42±0.20	0.55±0.25	10
RN20	2010	5.00±0.10	2.50±0.15	0.55±0.10	0.60±0.30	0.55±0.25	23.61
RN25	4527	6.30±0.15	3.10±0.15	0.55±0.10	0.60±0.30	0.55±0.25	38.06

STANDARD 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% ±0.02% ±0.05%	±0.1%	±0.25%	±0.5%	±1%	
RN02	0201	1/32W	-55 ~ +155°C	15V	30V	-	100Ω-12KΩ	-	39Ω - 12KΩ		±25
						-	100Ω-12KΩ	-	39Ω - 33KΩ		±50
RN04	0402	1/16W		25V	50V	10Ω - 332KΩ					±25 ±50
RN06	0603	1/16W		50V	100V	3.9Ω - 1MΩ		2Ω - 1MΩ			±25 ±50
RN10	0805	1/10W		100V	200V	4.7Ω - 2MΩ		1Ω - 2MΩ			±25 ±50
RN12	1206	1/8W		150V	300V	1Ω-2.49MΩ		1Ω - 2.49MΩ			±25 ±50
RN14	1210	1/4W				4.7Ω-2.49MΩ					
RN20	2010	1/2W		150V	300V	4.7Ω - 3MΩ		1Ω - 3MΩ			±25 ±50
RN25	2512	3/4W				1Ω - 3MΩ					

Lower Resistance: 1~10Ω

SPECIAL 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% ±0.02%	±0.05%	±0.1%	±0.25%	±0.5%	±1%		
RN04	0402	1/16W	-55 ~ + 155°C	25V	50V	10Ω - 8KΩ				10Ω - 10KΩ	10Ω - 8KΩ	±2 / ±3	
						10Ω - 10KΩ						±5	
						10Ω - 20KΩ						±10 / ±15	
RN06	0603	1/16W		50V	100V	4.7Ω - 40KΩ						±2 / ±3 / ±5	
						4.7Ω - 100KΩ						±10 / ±15	
RN10	0805	1/10W		100V	200V	4.7Ω - 80KΩ				4.7Ω - 100KΩ	4.7Ω - 80KΩ	±2 / ±3 / ±5	
						4.7Ω - 200KΩ	4.7Ω - 500KΩ					±10 / ±15	
RN12	1206	1/8W		150V	300V	4.7Ω - 120KΩ				4.7Ω - 150KΩ	4.7Ω - 120KΩ	±2 / ±3 / ±5	
						4.7Ω - 300KΩ	4.7Ω - 1MΩ					±10 / ±15	
RN14	1210	1/4W		150V	300V	4.7Ω - 150KΩ						±2 / ±3 / ±5	
						4.7Ω - 400KΩ						±10 / ±15	
RN20	2010	1/2W		150V	300V	4.7Ω - 360KΩ						±2 / ±3 / ±5	
						4.7Ω - 500KΩ	4.7Ω - 1MΩ					±10 / ±15	
RN25	2512	3/4W		150V	300V	4.7Ω - 600KΩ						±2 / ±3 / ±5	
						4.7Ω - 1.5MΩ						±10 / ±15	





HIGH POWER AND ULTRA 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% ±0.02%	±0.05%	±0.1%	±0.25%	±0.5%	±1%	
RN02	0201	1/20W	-55 ~ + 155°C	25V	50V	-		22Ω - 75KΩ				±25 / ±50
RN04	0402	1/10W		50V	100V	49.9Ω - 4.99KΩ			-			±1 / ±2 / ±3
						49.9Ω - 20KΩ						±5
						49.9Ω - 12KΩ			49.9Ω - 100KΩ			±10 / ±15
						-	49.9Ω - 12KΩ	4.7Ω - 332KΩ			±25 / ±50	
RN06	0603	1/10W		75V	150V	24.9Ω - 16KΩ						±2 / ±3 / ±5
						24.9Ω - 100KΩ	4.7Ω - 332KΩ	4.7Ω - 332KΩ				±10 / ±15
								4.7Ω - 1MΩ				±25 / ±50
RN10	0805	1/8W		150V	300V	24.9Ω - 30KΩ						±2 / ±3 / ±5
						24.9Ω - 200KΩ	4.7Ω - 511KΩ	4.7Ω - 332KΩ				±10
		4.7Ω - 1MΩ						±15				
		4.7Ω - 1MΩ						1Ω - 1MΩ			±25 / ±50	
		1/4W				-	10Ω - 499KΩ				±25 / ±50	
RN12	1206	1/4W		200V	400V	24.9Ω - 49.9KΩ						±2 / ±3 / ±5
						24.9Ω - 499KΩ	4.7Ω - 1MΩ				±5 / ±10 / ±15 / ±25 / ±50	
		1/3W				-	10Ω - 1MΩ				±25 / ±50	
RN14	1210	1/3W		200V	400V	24.9Ω - 49.9KΩ						±2 / ±3 / ±5
						24.9Ω - 499KΩ	4.7Ω - 1MΩ				±10 / ±15 / ±25 / ±50	
RN20	2010	3/4W		200V	400V	24.9Ω - 49.9KΩ						±2 / ±3 / ±5
						24.9Ω - 499KΩ	10Ω - 1MΩ				±10 / ±15 / ±25 / ±50	
RN25	2512	1W		200V	400V	10Ω-1.5MΩ						±25 / ±50



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	>1000MΩ		Apply 100V _{DC} for 5 seconds
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%	-5°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		

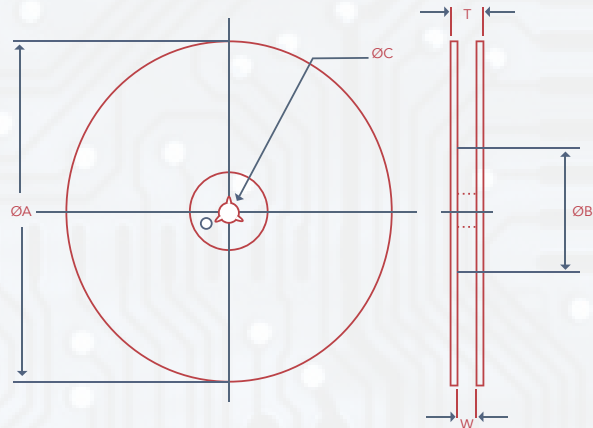
Reference standards: mil-std-202, jis-c 5201-1 | Storage temperature: 25±3°C; humidity <80%rh



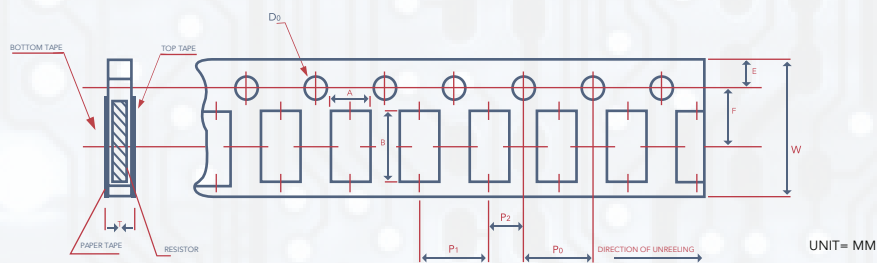
PACKAGING

- Packaging Quantity & Reel Specifications

TYPE	ØA	ØB	ØC	W	T	PAPER TAPE	UNIT= MM
							EMBOSSED PLASTIC TAPE
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	9.5 ± 1.0	11.5 ± 1.0		4k / 1k
RN25	178.0 ± 1.0	60.0 + 1.0	13.5 ± 0.7	9.5 ± 1.0	11.5 ± 1.0		4k / 1k

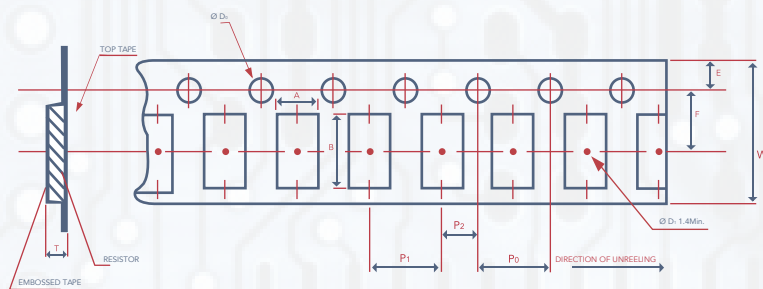


- Paper Tape Specifications



TYPE	A	B	W	E	F	P0	P1	P2	ØD0	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	2.00±0.10	2.00±0.10	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	2.00±0.10	2.00±0.10	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	2.00±0.10	2.00±0.10	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	2.00±0.10	2.00±0.10	1.50±0.10	0.75±0.05

- Embossed Plastic Tape Specifications

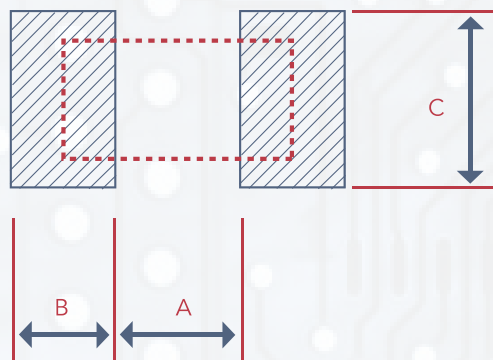


TYPE	A	B	W	E	F	P0	P1	P2	ØD0	T
RN20	2.85±0.10	5.45±0.10	12.00±0.10	1.75 ± 0.10	5.5±0.05	4.00±0.05	4.00±0.10	2.00±0.05	1.50±0.10	1.00±0.20
RN25	3.40±0.10	6.65±0.10	12.00±0.10	1.75 ± 0.10	5.5±0.05	4.00±0.05	4.00±0.10	2.00±0.10	1.50±0.10	1.00±0.20





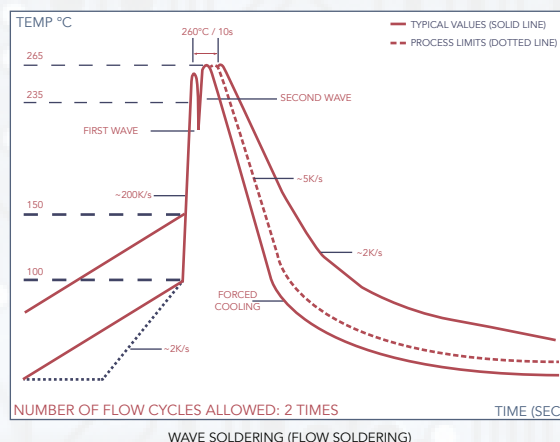
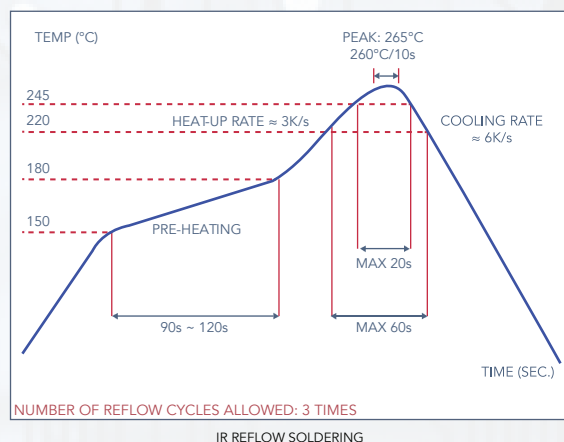
RECOMMENDED LAND PATTERN



TYPE	A (MM)	B (MM)	C (MM)
RN02	.25	.30	0.40 ± 0.2
RN04	0.50	0.50	0.60 ± 0.2
RN05	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



- Time of IR Reflow soldering at maximum temperature point 260°C : 10s
- Time of wave soldering at maximum temperature point 260°C : 10s
- Time of soldering iron at maximum temperature point 410°C : 5s

**MARKING****- 0603 - 3 DIGIT MARKING**

3 digit marking for Example

14C = 13K7Ω

13C = 13K3Ω

68B = 4K99Ω

68X = 49.9Ω

- 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	
506	113		30	200		54	357		78	634	
07	115		31	205		55	36		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	952	
24	174		48	309		72	549		96	976	
CODE	A	B	C	D	E	F	G	X	Y		
MULTIPLIER	10 ⁰	10 ¹	10 ²	10 ³	10 ⁴	10 ⁵	10 ⁶	10 ⁻¹	10 ⁻²		

0603 - 3 digit marking in E24

Example: 101 = 100Ω 102 = 1KΩ

E24 CODE	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 4 digit marking

EX:

RESISTANCE	100Ω	2.2KΩ	10KΩ	4.9KΩ	100KΩ
MARKING	1000	2201	1002	4992	1003

E-192 values are also available upon request but will have no marking on the part. Please ask sales rep for a quote and lead-time for any e-192 values.

