

NRCPA Series

Surface Mount Pulse Withstanding Thick Film Chip Resistor



FEATURES

- EXCELLENT ANTI-SURGE CHARACTERISTICS
- AEC-Q200 QUALIFIED
- RATED POWER UPGRADE IN SMALLER PACKAGE SIZE
- MEETS +85°C/85%RH TEST 1000 HOURS
- ANTI-SULFUR CHARACTERISTICS (EIA-977 CONDITION 1)
- AVAILABLE IN $\pm 0.5\%$ (D) TOLERANCE
- REFLOW SOLDERING COMPATIBLE



SPECIFICATIONS (STANDARD & HIGHER POWER RATINGS)

Type	EIA Size	Power Rating at 70°C	Max. *1 Working Voltage	Max. *2 Overload Voltage	Resistance Tolerance Code	Temperature Coefficient (ppm/°C)	Resistance Range (Ω)	Resistance Value	Operating Temperature Range
NRCPA04	0402	1/5W (0.20W)	50V	100V	0.5% (D)	$\pm 100\text{ppm}$	100 ~ 1M	E24 & E96	-55°C ~ +155°C
					1% (F)	$\pm 300\text{ppm}$	1.0 ~ 20	E24 & E96	
						$\pm 100\text{ppm}$	20.5 ~ 1M	E24 & E96	
					5% (J)	$\pm 300\text{ppm}$	1.0 ~ 20	E-24	
NRCPA06	0603	1/10W (0.10W)	50	100	0.5% (D)	$\pm 200\text{ppm}$	10 ~ 249	E-24, E-96	
						$\pm 100\text{ppm}$	300 ~ 1M	E-24, E-96	
					1% (F)	$\pm 200\text{ppm}$	1.0 ~ 249	E-24, E-96	
						$\pm 100\text{ppm}$	300 ~ 1M	E-24, E-96	
NRCPA06H	0603	1/4W (0.25W)	75	150	0.5% (D)	$\pm 200\text{ppm}$	10 ~ 294	E-24, E-96	
						$\pm 100\text{ppm}$	300 ~ 1M	E-24, E-96	
					1% (F)	$\pm 200\text{ppm}$	1.0 ~ 294	E-24, E-96	
						$\pm 100\text{ppm}$	300 ~ 1M	E-24, E-96	
NRCPA10	0805	1/8W (0.125W)	150	300	0.5% (D)	$\pm 200\text{ppm}$	10 ~ 249	E-24, E-96	
						$\pm 100\text{ppm}$	300 ~ 20M	E-24, E-96	
					1% (F)	$\pm 200\text{ppm}$	1.0 ~ 249	E-24, E-96	
						$\pm 100\text{ppm}$	300 ~ 20M	E-24, E-96	
NRCPA10H	0805	2/5W (0.40W)	150	300	0.5% (D)	$\pm 200\text{ppm}$	10 ~ 294	E-24, E-96	
						$\pm 100\text{ppm}$	300 ~ 1M	E-24, E-96	
					1% (F)	$\pm 200\text{ppm}$	1.0 ~ 294	E-24, E-96	
						$\pm 100\text{ppm}$	300 ~ 1M	E-24, E-96	
NRCPA10U	0805	1/2W (0.50W)	400	600	0.5% (D)	$\pm 200\text{ppm}$	10 ~ 294	E-24, E-96	
						$\pm 100\text{ppm}$	300 ~ 1M	E-24, E-96	
					1% (F)	$\pm 200\text{ppm}$	1.0 ~ 249	E-24, E-96	
						$\pm 100\text{ppm}$	300 ~ 1M	E-24, E-96	
		Jumper - 5A			5% (J)	$\pm 200\text{ppm}$	1.0 ~ 270	E-24	
						$\pm 100\text{ppm}$	300 ~ 1M	E-24	
					-	0Ω ($\leq 8\text{m}\Omega$)		-	
		Jumper - 6A			5% (J)	$\pm 200\text{ppm}$	1.0 ~ 270	E-24	
						$\pm 100\text{ppm}$	300 ~ 1M	E-24	
					-	0Ω ($\leq 5\text{m}\Omega$)			

Note *1 - Maximum allowable continuous Working Voltage for all resistors is the lower of the two values:
"Maximum Working Voltage" as specified above
(or)

Note *2 - Maximum allowable Overload voltage is 2.5 times the Maximum Working Voltage (see Note *1 above) or Maximum Overload Voltage as specified in the table whichever is lower

$$\sqrt{\text{Power rating (Watts)} \times \text{Resistance (Ohms)}}$$

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Type	EIA Size	Power Rating at 70°C	Max. *1 Working Voltage	Max. *2 Overload Voltage	Resistance Tolerance Code	Temperature Coefficient (ppm/°C)	Resistance Range (Ω)	Resistance Value	Operating Temperature Range		
NRCPA12	1206	1/3W (0.33W)	200	400	0.5% (D)	±200ppm	10 ~ 20	E-24, E-96	-55°C ~ +155°C		
						±100ppm	20.5 ~ 20M				
					1% (F)	±200ppm	1.0 ~ 20	E-24, E-96			
						±100ppm	20.5 ~ 20M				
					5% (J)	±200ppm	1.0 ~ 20	E-24			
						±100ppm	22 ~ 20M				
NRCPA12H	1206	1/2W (0.50W)	200	400	0.5% (D)	±200ppm	10 ~ 20	E-24, E-96			
						±100ppm	20.5 ~ 1M				
					1% (F)	±200ppm	1.0 ~ 20	E-24, E-96			
						±100ppm	20.5 ~ 1M				
					5% (J)	±200ppm	1.0 ~ 20	E-24			
						±100ppm	22 ~ 1M				
NRCPA12U	1206	3/4W (0.75W)	500	1000	0.5% (D)	±200ppm	10 ~ 20	E-24, E-96			
						±100ppm	20.5 ~ 1M				
					1% (F)	±200ppm	1.0 ~ 20	E-24, E-96			
						±100ppm	20.5 ~ 1M				
					5% (J)	±200ppm	1.0 ~ 20	E-24			
						±100ppm	22 ~ 1M				
		Jumper -10A			-		0Ω (≤5mΩ)			-	
		NRCPA25			1210	1/2W (0.50W)	200	400		0.5% (D)	±200ppm
±100ppm	20.5 ~ 20M										
1% (F)	±200ppm		1.0 ~ 20	E-24, E-96							
	±100ppm		20.5 ~ 20M								
5% (J)	±200ppm		1.0 ~ 20	E-24							
	±100ppm		22 ~ 20M								
NRCPA25H	1210	3/4W (0.75W)	200	400	0.5% (D)	±200ppm	10 ~ 20	E-24, E-96			
						±100ppm	20.5 ~ 1M				
					1% (F)	±200ppm	1.0 ~ 20	E-24, E-96			
						±100ppm	20.5 ~ 1M				
					5% (J)	±200ppm	1.0 ~ 20	E-24			
						±100ppm	22 ~ 1M				
NRCPA50	2010	3/4W (0.75W)	400	800	0.5% (D)	±200ppm	10 ~ 20	E-24, E-96			
						±100ppm	20.5 ~ 20M				
					1% (F)	±200ppm	1.0 ~ 20	E-24, E-96			
						±100ppm	20.5 ~ 20M				
					5% (J)	±200ppm	1.0 ~ 20	E-24			
						±100ppm	22 ~ 20M				
NRCPA50H	2010	1W (1.0W)	400	800	0.5% (D)	±200ppm	10 ~ 20	E-24, E-96			
						±100ppm	20.5 ~ 1M				
					1% (F)	±200ppm	1.0 ~ 20	E-24, E-96			
						±100ppm	20.5 ~ 1M				
					5% (J)	±200ppm	1.0 ~ 20	E-24			
						±100ppm	22 ~ 20M				
NRCPA100	2512	3/4W (0.75W)	500	1000	0.5% (D)	±200ppm	10 ~ 20	E-24, E-96			
						±100ppm	20.5 ~ 20M				
					1% (F)	±200ppm	1.0 ~ 20	E-24, E-96			
						±100ppm	20.5 ~ 20M				
					5% (J)	±200ppm	1.0 ~ 20	E-24			
						±100ppm	22 ~ 20M				
NRCPA100H	2512	2W (2.0W)	500	1000	0.5% (D)	±200ppm	10	E-24, E-96			
						±100ppm	10.2 ~ 200K				
					1% (F)	±200ppm	1.0 ~ 10	E-24, E-96			
						±100ppm	10.2 ~ 200K				
					5% (J)	±200ppm	1.0 ~ 10	E-24			
						±100ppm	11 ~ 200K				

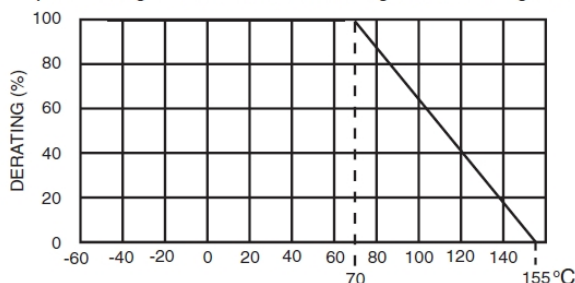
Performance Passives By Design

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Power Derating Curve: For operation above 70°C, power rating must be derated according to the following chart:



PART NUMBER SYSTEM (E-24 VALUES)

NRCPA 06 H F 181 TR 10 Q Y F

- Series
- Size: 06=0603, 10=0805, 12=1206, 25=1210
- Special Power Rating Code: Blank = Standard, H = Higher Power, U = Ultra High Power
- Tolerance Code: D=0.5%, F=1%, J=5%
- Resistance Code: First 2 figures are significant, 3rd digit is the multiplier, "R" indicates a decimal point.
- Tape & Reel Packaging
- Optional Reel Quantity*
- Q = AEC Q-200 Qualified
- RoHS compliant

"Y" denotes suitable for automotive equipment, sourced to special production and inspection at IATF-16949 certified production site

PART NUMBER SYSTEM (E-96 VALUES)

NRCPA 06 H F 1151 TR 10 Q Y F

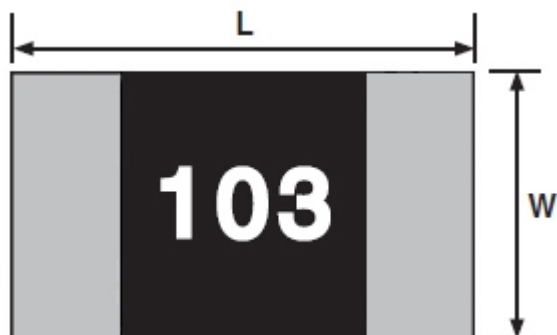
- Series
- Size: 06=0603, 10=0805, 12=1206, 25=1210
- Special Power Rating Code: Blank = Standard, H = Higher Power, U = Ultra High Power
- Tolerance Code: D=0.5%, F=1%
- Resistance Code: First 3 figures are significant, 4th digit is the multiplier, "R" indicates a decimal point.
- Tape & Reel Packaging
- Optional Reel Quantity*
- Q = AEC Q-200 Qualified
- RoHS compliant

"Y" denotes suitable for automotive equipment, sourced to special production and inspection at IATF-16949 certified production site

* See page 9 for optional reel sizes and quantities.

COMPONENT DIMENSIONS (mm)

Type	EIA Size	L	W	H	P2	P1
NRCPA04	0402	1.00 ± 0.10	0.50 ± 0.05	0.35 ± 0.10	0.20 ± 0.10	0.20 ± 0.10
NRCPA06	0603	1.60 ± 0.10	0.80 ± 0.10	0.45 ± 0.10	0.30 ± 0.20	0.30 ± 0.20
NRCPA10/H	0805	2.00 ± 0.10	1.25 ± 0.10	0.50 ± 0.10	0.35 ± 0.20	0.40 ± 0.20
NRCPA10U	0805	2.00 ± 0.10	1.25 ± 0.10	0.55 ± 0.10	0.35 ± 0.20	0.40 ± 0.20
NRCPA12	1206	3.10 ± 0.10	1.55 ± 0.10	0.55 ± 0.10	0.50 ± 0.25	0.50 ± 0.20
NRCPA12U	1206	3.10 ± 0.10	1.55 ± 0.10	0.55 ± 0.10	0.60 ± 0.25	0.55 ± 0.25
NRCPA25	1210	3.10 ± 0.10	2.60 ± 0.15	0.55 ± 0.10	0.50 ± 0.25	0.50 ± 0.20
NRCPA50	2010	5.00 ± 0.10	2.50 ± 0.15	0.55 ± 0.10	0.60 ± 0.25	0.50 ± 0.20
NRCPA100	2512	6.35 ± 0.10	3.10 ± 0.15	0.55 ± 0.10	0.60 ± 0.25	0.50 ± 0.20
NRCPA100H	2512	6.35 ± 0.20	3.15 ± 0.15	0.60 ± 0.10	0.80 ± 0.25	0.60 ± 0.30



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E-24 AND E-96 STANDARD VALUES

E-24	Codes for 0603 E-96 Values							
	Code	E96	Code	E96	Code	E96	Code	E96
100								
110	02	102	28	191	52	340	75	590
120	03	105	29	196	53	348	76	604
130	04	107	31	205	54	357	77	619
150	06	113	32	210	55	365	78	634
160	07	115	33	215	56	374	79	649
180	08	118	34	221	57	383	80	665
200	09	121	35	226	58	392	81	681
220	10	124	36	232	59	402	82	698
240	11	127	37	237	60	412	83	715
270	13	133	38	243	61	422	84	732
300	14	137	39	249	62	432	86	768
330	15	140	40	255	63	442	87	787
360	16	143	41	261	64	453	88	806
390	17	147	42	267	65	464	89	825
430	19	154	43	274	66	475	90	845
470	20	158	44	280	67	487	91	866
510	21	162	45	287	68	499	92	887
560	22	165	46	294	69	511	93	909
620	23	169	47	301	70	523	94	931
680	24	174	48	309	71	536	95	953
750	25	178	49	316	72	549	96	976
820	26	182	50	324	73	562		
910	27	187	51	332	74	576		

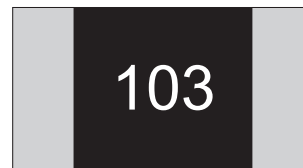
COMPONENT MARKING EXAMPLES (0805 ~ 2512 Sizes)

0603 E-24 & E-96 parts marked with three characters

No Marking on 0402 Size Part

1% AND 5% TOLERANCE E-24 VALUES

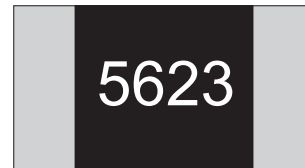
Value: 10K Ω



0603 Sizes

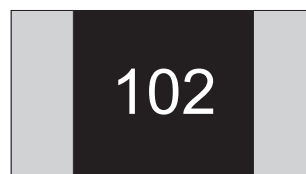
0.5% & 1% TOLERANCE E-96 VALUES

Value: 562K Ω



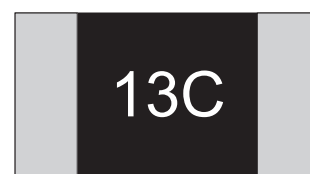
0805 ~ 2512 Sizes

Example: 102 = 1K



0603 Sizes

Example: 13C = 13.3K



0603 Sizes

0603 0.5% & 1% E-96 VALUES

10 Ω = 01X

4.99k Ω = 68B

150K Ω = 18D

1 Meg Ω = 01E

0603 0.5% & 1% E-24 VALUES

160 Ω = 161

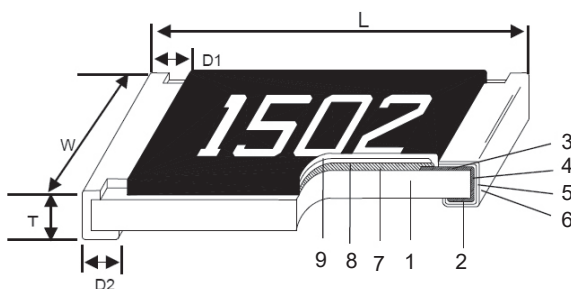
12K Ω = 123

8.2M Ω = 825

MULTIPLIER CODE

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

CONSTRUCTION



No.	Item
1	Alumina Substrate
2	Bottom Electrode
3	Top Electrode
4	Edge Electrode
5	Bottom Layer
6	External Electrode
7	Resistor Layer
8	Primary Overcoat
9	Secondary Overcoat

NRCPA Series

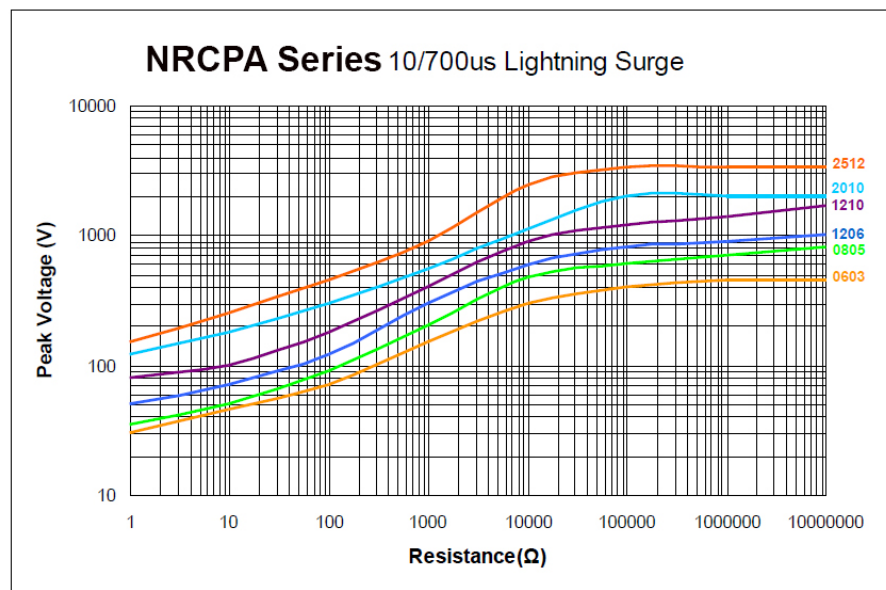
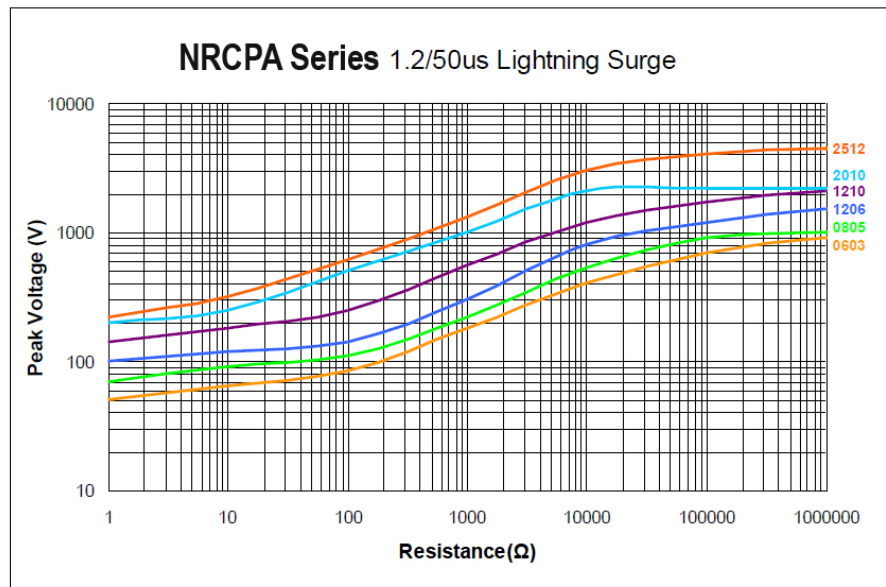
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Lightening Surge

Resistors are tested in accordance with IED 60115-1 using both 1.2/50ms and 10/700 pulse shapes. The limit of acceptance is a shift in resistance of less than 1% from the initial value.



NRCPA Series

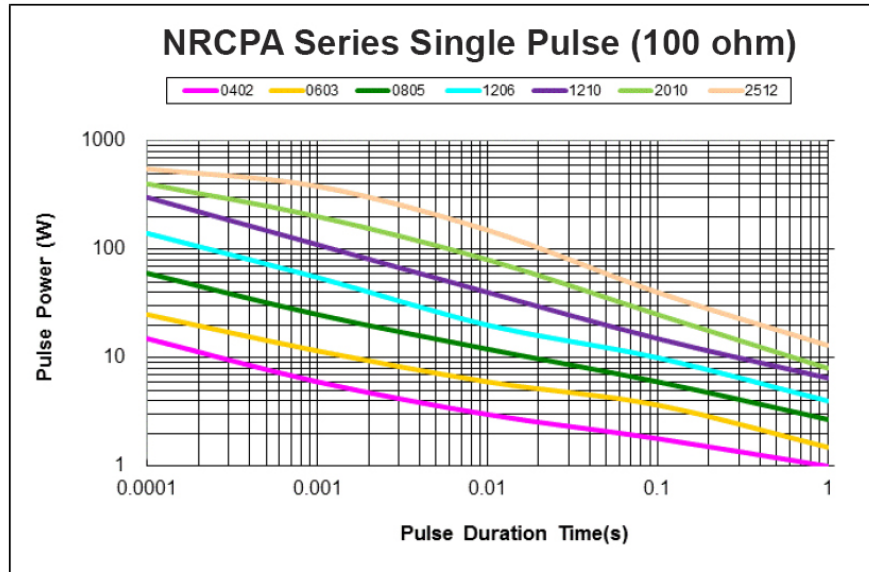
Surface Mount Pulse Withstanding

Thick Film Chip Resistor



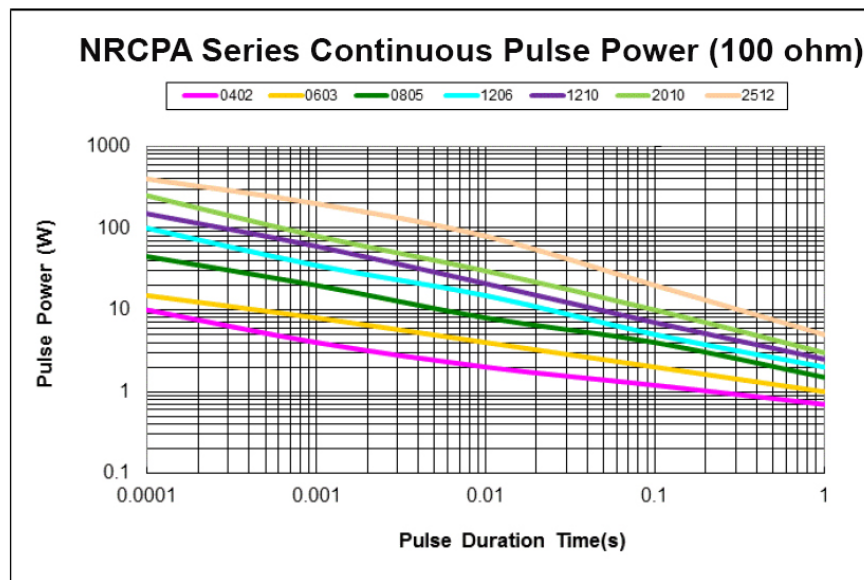
Pulse withstanding capacity

The limit of acceptance was a shift in resistance of less than 1% from the initial value. The power applied was subject to the restrictions of the maximum permissible impulse voltage graph shown.



Continuous Pulse withstanding capacity

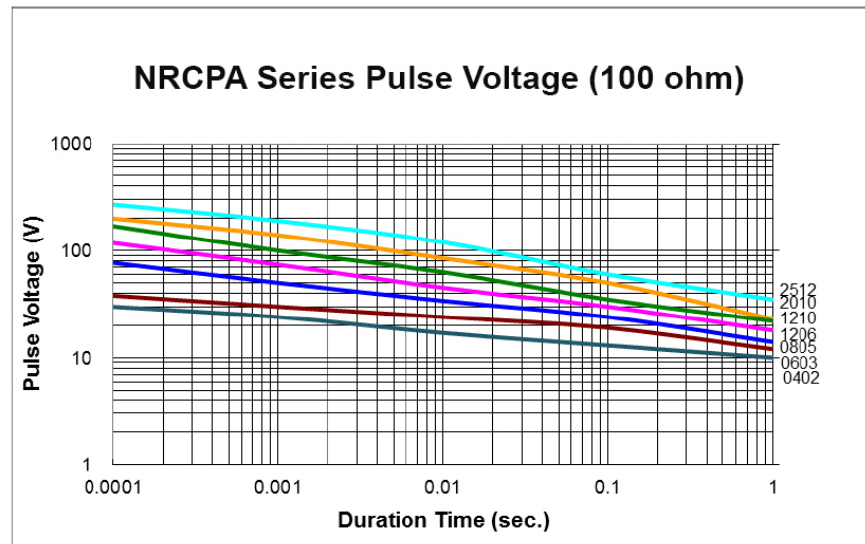
The continuous load graph was obtained by applying repetitive rectangular pulses where the pulse period was adjusted so that the average power dissipated in the resistor was equal to its rated power at 70 degrees C. Again the limit of acceptance was a shift in resistance of less than 1% from the initial value.



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PERFORMANCE CHARACTERISTICS

Test Items	Requirement 5% tol and below	Jumper	Test Method
Temperature Coefficient of Resistance (T.C.R.)	As Specified		JISC 5201-1 4.8 IEC60115-1 4.8 At 25°C/+55°C and 25°C/+125°C, 25°C is the reference temperature
Short Time Overload	± (1.0%+0.05Ω)	0603: 8mΩ 0805: 5mΩ 1206: 5mΩ	JISC 5201-1 4.13 IEC60115-1 1 4.13 RCWV*2.5 or Max. Overload Voltage whichever is lower for 5 seconds Jumper:2* I _{max} for 5 seconds
Insulation Resistance	≥10G		JISC 5201-1 4.6 IEC60115-1 4.6 Maximum Overload Voltage for 1 Minute
Operational Life	± (1.0%+0.05Ω)	0603: 8mΩ 0805: 5mΩ 1206: 5mΩ	MIL-STD-202 Method 108 Condition D Steady State TA=125°C at derated power. Measurement at 24±4 hours after test conclusion.
Biased Humidity	± (1.0%+0.05Ω)	0603: 8mΩ 0805: 5mΩ 1206: 5mΩ	MIL-STD-202 Method 103 1000 hrs 85°C /85%RH 10% of operating power
High Temperature Exposure	± (1.0%+0.05Ω)	0603: 8mΩ 0805: 5mΩ 1206: 5mΩ	MIL-STD-202 Method 108 at +155°C for 1000 hrs
Board Flex	± (1.0%+0.05Ω)	0603: 8mΩ 0805: 5mΩ 1206: 5mΩ	AEC-Q200 005 Bending once for 60 seconds 2010, 2512 sizes: 2mm, Other sizes: 3mm
Solderability	95% min. coverage		JIS-C-5201-1 4.17 IEC 60115-1 4.17 245±5°C for 3 seconds
Resistance to Soldering Heat	± (0.5%+0.05Ω)	0603: 8mΩ 0805: 5mΩ 1206: 5mΩ	JIS-C-5201-1 4.18 IEC 60115-1 4.18 260±5°C for 10 seconds
Voltage Proof	No breakdown or flashover		JIS-C-5201-1 4.18 IEC 60115-1 4.18 1.42 times Max. Operating Voltage for 1 minute
Leaching	Individual leaching area 5% Total leaching area 10%		JIS-C-5201-1 4.18 IEC 60068-2 58 8.2.1 260±5°C for 30 seconds
Temperature Cycling	± (0.5%+0.05Ω)	0603: 8mΩ 0805: 5mΩ 1206: 5mΩ	JESD22 Method JA-104 55°C to +125°C, 1000 cycles
Mechanical Shock	± (0.25%+0.05Ω)	0603: 8mΩ 0805: 5mΩ 1206: 5mΩ	MIL-STD-202 Method 213 Wave Form: Tolerance for half sine shock pulse. Peak value is 100g's. Normal duration (D) is 6

Performance Passives By Design

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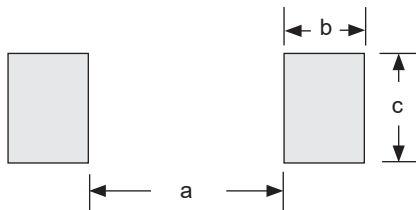


PERFORMANCE CHARACTERISTICS

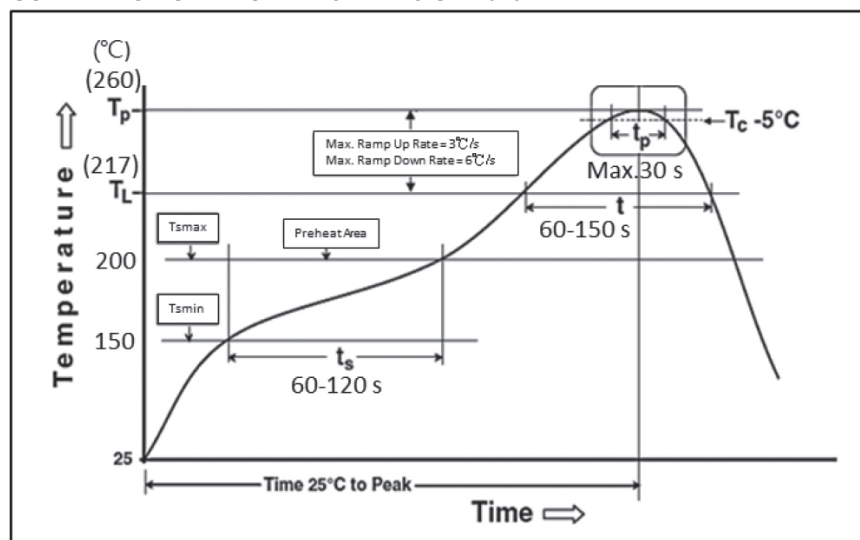
Test Items	Requirement 5% tol and below	Jumper	Jumper
Vibration	$\pm (0.5\%+0.05\Omega)$	0603: 8m Ω 0805: 5m Ω 1206: 5m Ω	MIL-STD-202 Method 204 5 gs for 20 min., 12 cycles each of 3 orientations, 10~2000 Hz
ESD	$\pm (3\%+0.05\Omega)$		AEC-Q200-002 Human body model 0402/0603: 1KV 0805 and above: 2KV
Resistance to Solvents	No visible damage on appearance and marking.		MIL-STD-202 Method 215 Add Aqueous wash chemical OKEM Clean or equivalent. Do not use banned solvents.
Terminal Strength	No broken		AEC-Q200-006 Force of 1.8kg for 60 seconds.
Flammability	No ignition of the tissue paper or scorching or the pinewood board		UL-94 V-0 or V-1 are acceptable. Electrical test not required
Sulfur Test	$\Delta R \pm 1\%$	0603: 8m Ω 0805: 5m Ω 1206: 5m Ω	EIA-977 (Condition A) 60 $\pm 2^\circ\text{C}$, no power rating for 500 hrs.

LAND PATTERN DIMENSIONS (mm)

Type	EIA Size	a	b	c
NRCPA04	0402	0.50	0.45	0.60
NRCPA06	0603	0.90	0.60	0.90
NRCPA10	0805	1.20	0.70	1.30
NRCPA12	1206	2.00	0.90	1.60
NRCPA25	1210	2.00	0.90	2.80
NRCPA50	2010	3.80	0.90	2.80
NRCPA100	2512	4.90	1.00	3.40



SOLDERING CONDITION IPC/JEDEC J-STD-020



NRCPA Series

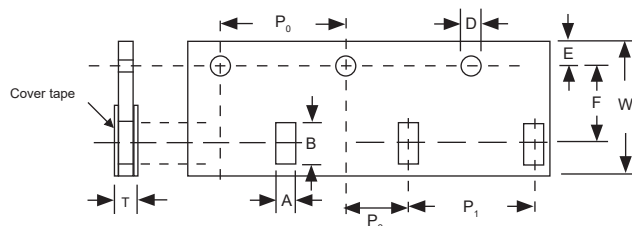
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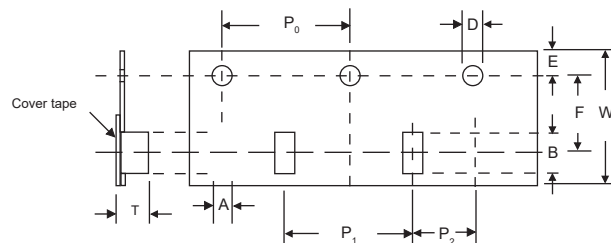
PAPER CARRIER TAPE DIMENSIONS (mm)

Type	EIA Size	A	B	D	E	F	P ₀	P ₁	P ₂	T	W
NRCPA04	0402	0.65 ± 0.10	1.15 ± 0.10	1.5 +0.1/-0	1.75 ± 0.1	3.5 ± 0.05	4.0 ± 0.1	2.0 ± 0.05	2.0 ± 0.05	0.45 ± 0.1	8.0 ± 0.2
NRCPA06	0603	1.10 ± 0.10	1.90 ± 0.10					0.70 ± 0.1			
NRCPA10	0805	1.60 ± 0.10	2.40 ± 0.10					0.85 ± 0.1			
NRCPA12	1206	1.90 ± 0.10	3.50 ± 0.20								
NRCPA25	1210	2.90 ± 0.10	3.50 ± 0.20								

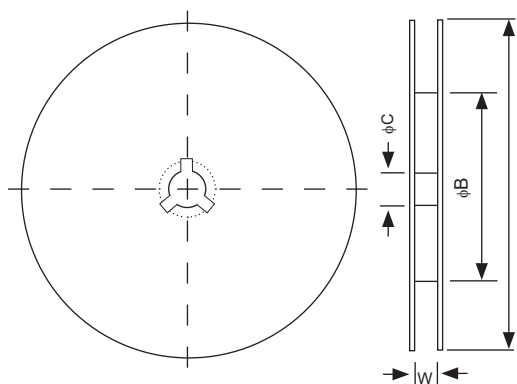


PLASTIC CARRIER TAPE DIMENSIONS (mm)

Type	EIA Size	A	B	D	E	F	P ₀	P ₁	P ₂	T	W
NRCPA50	2010	2.80 ± 0.20	5.40 ± 0.20	1.5 +0.1/-0	1.75 ± 0.10	5.5 ± 0.05	4.0 ± 0.1	4.0 ± 0.1	2.0 ± 0.1	1.20 +0	12.0 ± 0.3
NRCPA100	2512	3.50 ± 0.20	6.70 ± 0.10								



REEL DIMENSIONS AND QUANTITY



Type	Material	φA (mm)	φA (inch)	W	φB	φC	W	Quantity	
NRCPA04	Paper	178.5±1.5	7"	9.0±0.5	60 ^{+1/-0}	13±0.2	9.0±0.5	10K	
		254.0±1.0*	10"	9.5±0.5	100±0.5	13±0.2	9.5±0.5	20K*	
		330.0±1.0*	13"		100±0.5	13±0.2	9.5±0.5	40K*	
NRCPA06	Paper	178.5±1.5	7"	9.5±0.5	60 ^{+1/-0}	13±0.2	9.0±0.5	5K	
NRCPA10		254.0±1.0*	10"		100±0.5	13±0.2	9.5±0.5	10K*	
NRCPA12									
NRCPA25		330.0±1.0*	13"		100±0.5	13±0.2	9.5±0.5	20K*	
NRCPA50	Plastic	178.5±1.5	7"	13.5±0.5	60 ^{+1/-0}	13±0.5	13.5±0.5	4K	
NRCPA100		254.0±1.0*	10"	12.5±0.5	62±0.5	13±0.5	12.5±0.5	8K*	

* Denotes optional reel sizes and quantities. Contact NIC for dimensions of optional reel sizes and current availability.