

# Automotive Grade Thick Film Chip Resistors

NRCA Series

## FEATURES

- EIA STANDARD SIZING 0201(1/20W), 0402(1/16W), 0603(1/10W), 0805(1/8W), 1206(1/4W), 1210(1/2W), 2010(1/2W) AND 2512(1W)
- HIGH RELIABILITY AUTOMOTIVE GRADE AEC Q-200 QUALIFIED
- SULFUR RESISTANT (H<sub>2</sub>S 3PPM, 40°C, RH 90%, 1000 HOURS)
- BOTH FLOW SOLDER AND REFLOW SOLDERING ARE APPLICABLE
- AVAILABLE IN ZERO OHM (JUMPER)

*Expanded  
0201 Case Size*

*Automotive Grade  
Resistors*



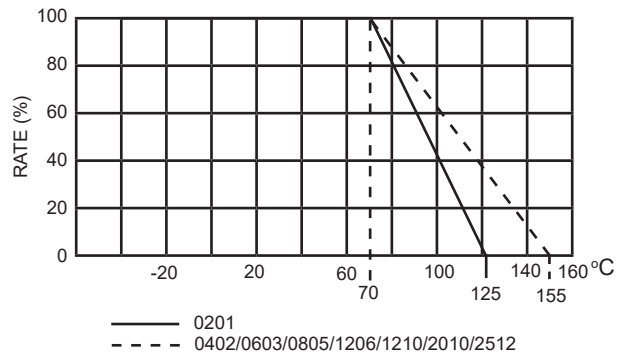
Type	EIA Size	Power Rating at 70°C	Max.*1 Working Voltage	Max.*2 Overload Voltage	Resistance Tolerance (Code)	Temperature Coefficient (ppm/°C)	Resistance Range (Ω)	Resistance Value	Temperature Range
NRCA02	0201	1/20 (0.05) W	25V	50V	±1% (F), ±5% (J)	+600/-200	1.0 ~ 9.76	E-24,E-96	-55°C ~ +125°C
						±200	10 ~ 49.9		
						±100	51 ~ 1M		
						±200	1.02M ~ 10M		
NRCA04	0402	1/16 (0.063) W	50V	100V	±1% (F), ±5% (J)	+400/-200	1.0 ~ 10		
						±100	10.2 ~ 1M		
						±200	1.02M ~ 10M		
NRCA06	0603	1/10 (0.10) W	75V	150V	±1% (F), ±5% (J)	+400/-200	1.0 ~ 10		
						±100	10.2 ~ 1M		
						±200	1.02M ~ 10M		
NRCA10	0805	1/8 (0.125) W	150V	300V	±1% (F), ±5% (J)	+400/-200	1.0 ~ 10		
						±100	10.2 ~ 1M		
						±200	1.02M ~ 10M		
NRCA12	1206	1/4 (0.25) W	200V	400V	±1% (F), ±5% (J)	+400/-200	1.0 ~ 10		
						±100	10.2 ~ 1M		
						±200	1.02M ~ 10M		
NRCA25	1210	1/2 (0.50) W	200V	400V	±1% (F), ±5% (J)	+400/-200	1.0 ~ 10		
						±100	10.2 ~ 1M		
						±200	1.02M ~ 10M		
NRCA50	2010	1/2 (0.50) W	200V	400V	±1% (F), ±5% (J)	±200	1.0 ~ 9.96		
						±100	10 ~ 1M		
						±200	1.02M ~ 10M		
NRCA100	2512	1 (1.0) W	200V	400V	±1% (F), ±5% (J)	±200	1.0 ~ 9.96		
						±100	10 ~ 1M		
						±200	1.02M ~ 10M		
NRCA02ZO	0201	Zero Ohm			Rated Current 1.0A (0.05Ω max. DC Resistance)				
NRCA04ZO	0402				Rated Current 1.0A (0.05Ω max. DC Resistance)				
NRCA06ZO	0603				Rated Current 1.0A (0.05Ω max. DC Resistance)				
NRCA10ZO	0805				Rated Current 1.5A (0.05Ω max. DC Resistance)				
NRCA12ZO	1206				Rated Current 2.0A (0.05Ω max. DC Resistance)				
NRCA25ZO	1210				Rated Current 3.0A (0.05Ω max. DC Resistance)				
NRCA50ZO	2010				Rated Current 3.2A (0.05Ω max. DC Resistance)				
NRCA100ZO	2512				Rated Current 4.5A (0.05Ω max. DC Resistance)				

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

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

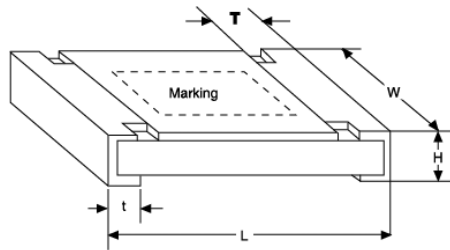
Note \*2 - Maximum allowable Overload voltage is two times the Maximum Working Voltage (see Note \*1 above).

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

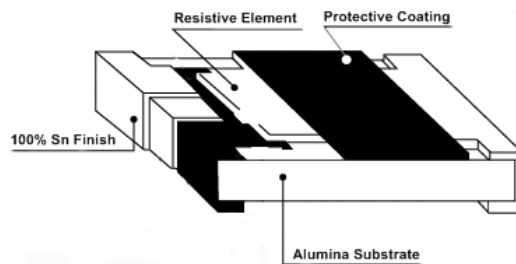


## DIMENSIONS (mm)

Type	Power Rating	EIA Size	L	W	H	T	t	
NRCA02	1/20W	0201	0.60 ± 0.03	0.30 ± 0.03	0.23 ± 0.03	0.10 ± 0.05	0.15 ± 0.05	
NRCA04	1/16W	0402	1.00 ± 0.05	0.50 ± 0.05	0.35 ± 0.05	0.20 ± 0.10	0.25 ± 0.10	
NRCA06	1/10W	0603	1.60 ± 0.10	0.80 ± 0.10	0.45 ± 0.15	0.30 ± 0.10	0.30 ± 0.15	
NRCA10	1/8W	0805	2.00 ± 0.10	1.25 ± 0.10	0.50 ± 0.15	0.40 ± 0.20	0.40 ± 0.20	
NRCA12	1/4W	1206	3.10 ± 0.10	1.60 ± 0.10	0.60 ± 0.15	0.50 ± 0.20	0.45 ± 0.20	
NRCA25	1/2W	1210	3.10 ± 0.10	2.60 ± 0.10	0.55 ± 0.10	0.50 ± 0.20	0.50 ± 0.20	
NRCA50	1/2W	2010	5.00 ± 0.20	2.50 ± 0.20	0.55 ± 0.10	0.65 ± 0.25	0.60 ± 0.25	
NRCA100	1W	2512	6.40 ± 0.20	3.20 ± 0.20	0.60 ± 0.10	0.65 ± 0.25	0.90 ± 0.25	
NRCA02ZO	JUMPER	0201	Same as NRCA02					
NRCA04ZO	JUMPER	0402	Same as NRCA04					
NRCA06ZO	JUMPER	0603	Same as NRCA06					
NRCA10ZO	JUMPER	0805	Same as NRCA10					
NRCA12ZO	JUMPER	1206	Same as NRCA12					
NRCA25ZO	JUMPER	1210	Same as NRCA25					
NRCA50ZO	JUMPER	2010	Same as NRCA50					
NRCA100ZO	JUMPER	2512	Same as NRCA100					



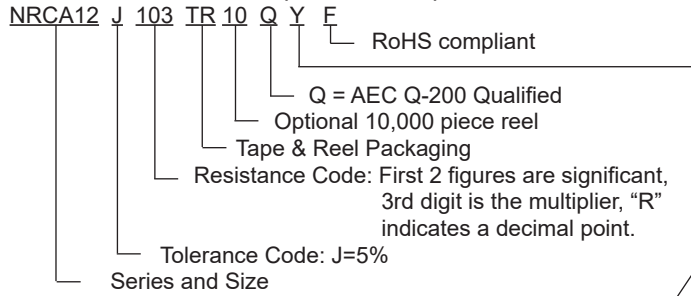
## CONSTRUCTION



## ENVIRONMENTAL CHARACTERISTICS

Item	Specification		Test Method
	All Values	Zero Ohm Jumper	
Temperature Coefficient of Resistance	As specified		JISC5201-1:1998, Clause 4.8
Load Life	$\Delta R \pm(1\% +0.05\Omega)$	<50m $\Omega$	1000 +48/-0 hrs, 35% of rated power,+125°C $\pm 2^\circ\text{C}$ MIL-STD-202, Method 108
Bias Humidity	$\Delta R \pm(1\% +0.05\Omega)$	<50m $\Omega$	1000 +48/-0 hrs, 10% or rated power, +85°C/85% RH MIL-STD-202, Method 103
Resistance to Dry Heat	$\Delta R \pm(1\% +0.05\Omega)$	<50m $\Omega$	1000 +48/-0 hrs, without load, +155°C $\pm 3^\circ\text{C}$ MIL-STD-202, Method 108
Temperature Cycling	$\Delta R \pm(0.5\% +0.05\Omega)$	<50m $\Omega$	1,000 cycles, -55°C ~ +155°C, dwell time 5~10 min. JESD22, Method JA-104
Bending Strength	$\Delta R \pm(1\% +0.05\Omega)$ No visible damage	<50m $\Omega$	Resistors mounted on a 90mm glass epoxy resin PCB (FR4), bending once, 2mm for 10 sec. AEC-Q200-005
Mechanical Shock	Within specified tolerances. No visible damage	<50m $\Omega$	1/2 Sine Pulse/1500g Peak/Velocity 15.4ft/sec. MIL-STD-202, Method 108
Terminal Strength	No remarkable damage or removal of terminations		Pressurizing force of 1Kg for 60 $\pm 1$ sec. AEC-Q200-006
Vibration	$\Delta R \pm(1\% +0.05\Omega)$ No visible damage	<50m $\Omega$	5g's for 20 min., 12 cycles in each of 3 orientations MIL-STD-202, Method 204
Thermal Shock	$\Delta R \pm(0.5\% +0.05\Omega)$ No visible damage	<50m $\Omega$	300 cycles, -55°C ~ +155°C, dwell time 15 min., maximum transfer time 20 sec. MIL-STD-202, Method 107
ESD	$\Delta R \pm(1\% +0.05\Omega)$ No visible damage	<50m $\Omega$	Contact 1.0KV (0.5KV for 0201 & 0402) AEC-Q200-002
Resistance to Soldering Heat	$\Delta R \pm(0.5\% +0.05\Omega)$ No visible damage	<50m $\Omega$	Un-mounted chips are completely immersed for 10 $\pm 1$ sec. in SAC solder bath at +270°C $\pm 5^\circ\text{C}$ MIL-STD-202, Method 210
Sulfur Resistance	$\Delta R \pm 1\%$ max.	<50m $\Omega$	3ppm H <sub>2</sub> S, 40°C, RH 90%, 1000 hours
Solderability	95% minimum coverage No visible damage		1) Bake the sample at +155°C for 4 hrs and dip in solder +235°C for 5 sec. 2) Steam the sample for 1 hr and dip in solder +260°C for 7 sec. J-STD-002

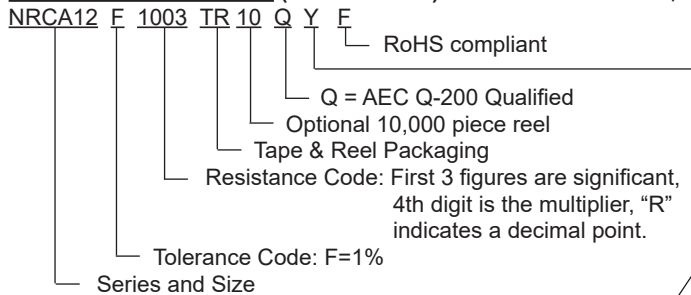
### PART NUMBER SYSTEM (E-24 VALUES)



Examples of Resistance Code: 4R7 = 4.7 ohms    103 = 10K ohms  
 100 = 10 ohms    104 = 100K ohms  
 101 = 100 ohms    105 = 1 meg ohms  
 102 = 1K ohms    106 = 10meg ohms

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

### PART NUMBER SYSTEM (E-96 VALUES)



Examples of Resistance Code: 10R0 = 10 ohms    1004 = 1meg ohms  
 47R5 = 47.5 ohms    1050 = 105 ohms  
 1000 = 100 ohms    1501 = 1.5K ohms  
 1001 = 1K ohms    1052 = 10.5K ohms  
 1002 = 10K ohms    1153 = 115K ohms  
 1003 = 100K ohms    1214 = 1.21meg ohms

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

### Marking (No marking on 0201 & 0402 size).

- For **E-12 & E-24** Series ( $\pm 5\%$  = J) Tolerance In 0603, 0805, 1206 and 1210 sizes:  
 3 DIGIT SYSTEM - First two digits are significant and third digit is multiplier, "R" indicates decimal on values under 10 ohms.  
 Examples: 1R0 = 1.0 ohms    102 = 1K ohms    470 = 47 ohms  
 103 = 10k ohms    101 = 100 ohms    104 = 100K ohms    105 = 1 Megohms
- For **E-12 & E-24** Series ( $\pm 5\%$  = J) Tolerance In 2010 and 2512 sizes:  
 4 DIGIT SYSTEM - First 3 digits are significant and fourth digit is multiplier, "R" indicates decimal on values under 100 ohms.  
 Examples: 1R00 = 1.0 ohms    10R0 = 10 ohms    1003 = 100 Kohms  
 1000 = 100 ohms    1004 = 1 Megohms    1001 = 1K ohms
- For **E-96** Series ( $\pm 1\%$  Tolerance) in 0805, 1206, 1210, 2010 AND 2512 sizes:  
 4 DIGIT SYSTEM - First 3 digits are significant and fourth digit is multiplier, "R" indicates decimal on values under 100 ohms.  
 Examples: 1R00 = 1.0 ohms    10R0 = 10 ohms    1003 = 100 Kohms  
 1000 = 100 ohms    1004 = 1 Megohms    1001 = 1K ohms  
 1052 = 10.5K ohms    1002 = 10K ohms    2213 = 221K ohms
- For **E-96** Series ( $\pm 1\%$  Tolerance) in 0603 size  
 3 DIGIT SYSTEM (Due to space restrictions)

## STANDARD E-24 AND E-96 VALUES AND 0603 1% TOLERANCE RESISTANCE CODES

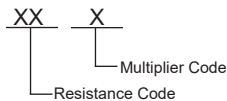
Note: 0603 1% resistor values that are exclusive to E-24 (ex. 12K) are marked with the three character 5% tolerance code

E-24			E-96							
Value	Value	Code	Value	Code	Value	Code	Value	Code	Value	Code
100	100	01	102	02	105	03	107	04		
110	110	05	113	06	115	07	118	08		
120	121	09	124	10	127	11	130	12		
130	133	13	137	14	140	15	143	16		
150	147	17	150	18	154	19	158	20		
160	162	21	165	22	169	23	174	24		
180	178	25	182	26	187	27	191	28		
200	196	29	200	30	205	31	210	32		
220	215	33	221	34	226	35	232	36		
240	237	37	243	38	249	39	255	40		
270	261	41	267	42	274	43	280	44		
300	287	45	294	46	301	47	309	48		
330	316	49	324	50	332	51	340	52		
360	348	53	357	54	365	55	374	56		
390	383	57	392	58	402	59	412	60		
430	422	61	432	62	442	63	453	64		
470	464	65	475	66	487	67	499	68		
510	511	69	523	70	536	71	549	72		
560	562	73	576	74	590	75	604	76		
620	619	77	634	78	649	79	665	80		
680	681	81	698	82	715	83	732	84		
750	750	85	768	86	787	87	806	88		
820	825	89	845	90	866	91	887	92		
910	909	93	931	94	953	95	976	96		

### MULTIPLIER CODE

Code	A	B,b	C	D,d	E	F	G	H	X	Y	Z
Multiplier	10 <sup>0</sup>	10 <sup>1</sup>	10 <sup>2</sup>	10 <sup>3</sup>	10 <sup>4</sup>	10 <sup>5</sup>	10 <sup>6</sup>	10 <sup>7</sup>	10 <sup>-1</sup>	10 <sup>-2</sup>	10 <sup>-3</sup>

### CODING FORMULA



Example:  $10.2k\Omega = \frac{102}{02} \times \frac{10^2}{C} \Omega = 02C$

$33.2 \Omega = \frac{332}{51} \times \frac{10^{-1}}{X} = 51X$

### 0603 VALUE

#### MARKING EXAMPLES

- 10Ω = 01X
- 7.5k Ω = 85B or 85b
- 150k Ω = 18D or 18d
- 1 MegΩ = 01E

#### 0603 1% E-12/E-24 Values

- 160Ω = 161
- 12KΩ = 123
- 8.2MΩ = 825

## TAPING SPECIFICATIONS

### (1) Carrier Material

Type	Power Rating	EIA Size	Carrier Tape		
			Fig.	Material	Width (mm)
NRCA02	1/20W	0201	A	Paper	8
NRCA04	1/16W	0402	A	Paper	8
NRCA06	1/10W	0603	A	Paper	8
NRCA10	1/8W	0805	A	Paper	8
NRCA12	1/4W	1206	A	Paper	8
NRCA25	1/2W	1210	A	Paper	8
NRCA50	1/2W	2010	B	Plastic	12
NRCA100	1W	2512	B	Plastic	12

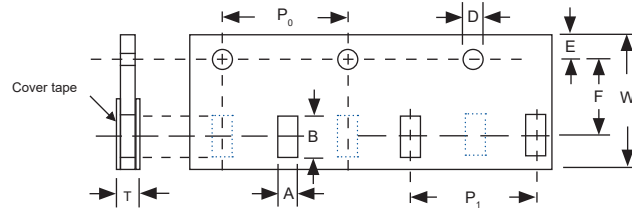


## (2) PAPER TAPE DIMENSIONS (mm)

FIG. A

Type	EIA Size	A	B	D	E	F	P <sub>0</sub>	P <sub>1</sub>	T <sub>2</sub>	W
NRCA02	0201	0.37 ± 0.05	0.67 ± 0.05	1.5 +0.1/-1	1.75 ± 0.1	3.5 ± 0.05	4.0 ± 0.1	2.0 ± 0.05	0.45 ± 0.05	8.0 ± 0.2
NRCA04	0402	0.70 ± 0.10	1.20 ± 0.10					2.0 ± 0.1	0.4 ± 0.05	
NRCA06	0603	1.10 ± 0.20	1.90 ± 0.20					4.0 ± 0.1	1.0 max.	
NRCA10	0805	1.65 ± 0.20	2.40 ± 0.20							
NRCA12	1206	2.00 ± 0.20	3.60 ± 0.20							
NRCA25	1210	3.00 ± 0.20	3.60 ± 0.20							

\* Same for JUMPER (ZO) types.

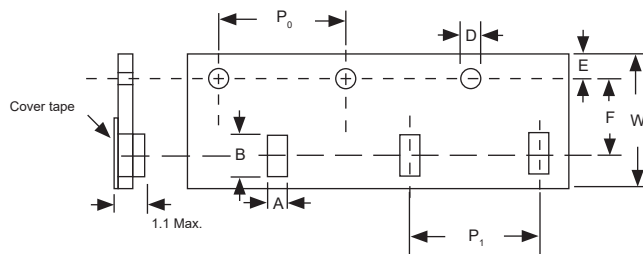


## (3) EMBOSSED PLASTIC TAPE SPECIFICATION

FIG. B.

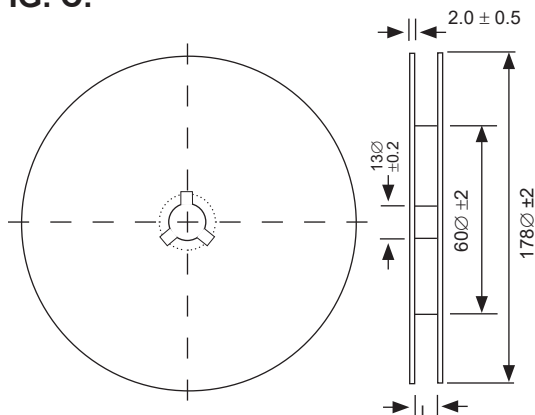
Type	EIA Size	A	B	D	E	F	P <sub>0</sub>	P <sub>1</sub>	T	W
NRCA50	2010	2.80 ± 0.20	5.50 ± 0.20	1.5 ± 0.1	1.75 ± 0.1	5.50 ± 0.05	4.0 ± 0.1	4.0 ± 0.05	1.2 max.	12.0 ± 0.1
NRCA100	2512	3.60 ± 0.20	6.90 ± 0.20							

\* Same for JUMPER (ZO) types.



## (4) REEL DIMENSIONS AND QUANTITIES

FIG. C.



Type	EIA Size	L	Quantity*		
			7" reel	10" reel	13" reel
NRCA02	0201	9.0 ± 0.5	15,000	n/a	70,000
NRCA04	0402		10,000	n/a	n/a
NRCA06	0603		5,000	10,000	20,000
NRCA10	0805		5,000	10,000	20,000
NRCA12	1206		5,000	10,000	20,000
NRCA25	1210	14.0 ± 0.2	5,000	10,000	20,000
NRCA50	2010		4,000	n/a	n/a
NRCA100	2512		4,000	n/a	n/a

\* Same for JUMPER (ZO) types.

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HS102M25V12.5X16F](#) [NRCA12F1001TRQYF](#) [NRC-S06F2212TRF](#) [NCD180J1KVNPOJTRF](#) [NRC-S06F1692TRF](#)  
[NCD102M1KVZ5U.250STRF](#) [NTC-T105K20TRAF](#) [NMC-P1206X7R104K100TRPF](#) [NMC-H1206NPO471K1KVTRPLPF](#) [NML04J9N1TRF](#)  
[NRSNA4I4J150TR40KF](#) [NCC0805F261HTRF](#) [NRWA470M35V6.3X11TBF](#) [NACE221M16V6.3X8TR13F](#) [NRSS332M50V18X35.5F](#)  
[NDTM106K25F1TRF](#) [NACZ221M50V10X10.5TR13F](#) [NCM15X7R103K50F](#) [NCD103M1KVZ5UF](#) [NRSS682M25V18X35.5F](#)  
[NEXC224Z5.5V10.5X8.5TRF](#) [NRLRW221M450V30X35SF](#) [NDTM225K50F2TRF](#) [NEXT105Z5.5V21.5X13F](#) [NRSZ471M50V12.5X20F](#)  
[NTCL106K35TRDF](#) [NRWA331M25V10X12.5F](#) [NRSY472M25V16X31.5F](#) [NEXS105Z5.5V28.5X14F](#) [NRLR181M400V25X30SF](#)  
[NRSZ102M25V12.5X20F](#) [NUVA33T385TRF](#) [NUVA33V405TRF](#) [NRLMW331M250V30X25F](#) [NRLF103M25V35X20F](#) [NDTM106K35F](#)  
[NRLMW102M200V35X35F](#) [NPIS43LS220MTRF](#) [NDTM476K35F2F](#) [NTC-T475K50TRDF](#) [NCD222M1KVZ5UKF](#)  
[NRLR472M63V25X40SF](#) [NTP157M10TRD\(40\)F](#) [NPIM74C3R3MTRF](#) [NPI104C100MTRF](#) [NRLM102M100V25X25F](#)