

FEATURES

- LEAD (Pb)-FREE CONSTRUCTION
- COMPLIES WITH RoHS DIRECTIVE 2002/95/EC WITHOUT EXEMPTIONS
- EIA STANDARD SIZING 0201 (1/20W), 0402 (1/16W), 0603 (1/10W), 0805 (1/8W), 1206 (1/4W) AND 1210 (1/3W)
- THICK FILM CONSTRUCTION USING HIGH PURITY ALUMINA SUBSTRATE WITH PB-FREE RESISTIVE PASTE COVERED WITH PROTECTIVE OVERCOAT
- HIGH TEMPERATURE (+260°C) REFLOW SOLDERING COMPATIBLE
- AVAILABLE IN ZERO OHM (JUMPER)

*RoHS Compliant
Pb Free
($<100\text{ppm}$)*



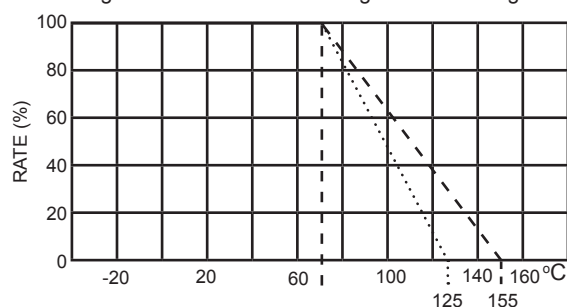
Type	EIA Size	Power Rating at 70°C	Max.*1 Working Voltage	Max.*2 Overload Voltage	Resistance Tolerance (Code)	Temperature Coefficient (ppm/°C)	Resistance Range (Ω)	Resistance Value	Operating Temperature Range (°C)
NRCL02	0201	1/20 (0.05) W	25V	50V	±1% (F)	±200	100 ~ 1M	E-24,E-96	-55 ~ +125
						+800/-100	1.0 ~ 9.76		
						+600/-0	10 ~ 97.6		
					±5% (J)	±200	100 ~ 10M	E-24	
						+800/-100	1.0 ~ 9.1		
						+600/-0	10 ~ 91		
NRCL04	0402	1/16 (0.063) W	50V	100V	±1% (F)	+500/-300	1.0 ~ 9.76	E-24,E-96	-55 ~ +125
						±100	10 ~ 1M		
						±300	1.02M ~ 10M		
					±5% (J)	+500/-300	1.0 ~ 9.1	E-24	
						±200	10 ~ 1M		
						±300	1.1M ~ 10M		
NRCL06	0603	1/10 (0.10) W	50V	100V	±1% (F)	+500/-300	1.0 ~ 9.76	E-24,E-96	-55 ~ +155
						±100	10 ~ 1M		
						±200	1.02M ~ 10M		
					±5% (J)	+500/-300	1.0 ~ 9.1	E-24	
						±200	10 ~ 10M		
						±200	10 ~ 10M		
NRCL10	0805	1/8 (0.125) W	150V	300V	±1% (F)	+500/-300	1.0 ~ 9.76	E-24,E-96	-55 ~ +155
						±100	10 ~ 1M		
						±200	1.02M ~ 10M		
					±5% (J)	+500/-300	1.0 ~ 9.1	E-24	
						±200	10 ~ 1M		
						±200	10 ~ 1M		
NRCL12	1206	1/4 (0.25) W	200V	400V	±1% (F)	+500/-300	1.0 ~ 9.76	E-24,E-96	-55 ~ +155
						±100	10 ~ 1M		
						±200	1.02M ~ 10M		
					±5% (J)	+500/-300	1.0 ~ 9.1	E-24	
						±200	10 ~ 10M		
						±200	10 ~ 10M		
NRCL25	1210	1/3 (0.33) W	200V	400V	±1% (F)	+500/-300	1.0 ~ 9.76	E-24,E-96	-55 ~ +155
						±100	10 ~ 1M		
						±200	1.02M ~ 10M		
					±5% (J)	+500/-300	1.0 ~ 9.1	E-24	
						±200	10 ~ 10M		
						±200	10 ~ 10M		
NRCL02ZOTR0.5AF		0201	Zero Ohm Jumper	Rated Current 0.5A (0.05Ω max. DC Resistance)					-55 ~ +125
NRCL02ZOTRF		0201		Rated Current 1.0A (0.05Ω max. DC Resistance)					
NRCL04ZOTRF		0402		Rated Current 1.0A (0.05Ω max. DC Resistance)					
NRCL06ZOTRF		0603		Rated Current 1.0A (0.05Ω max. DC Resistance)					-55 ~ +155
NRCL10ZOTRF		0805		Rated Current 1.5A (0.05Ω max. DC Resistance)					
NRCL12ZOTRF		1206		Rated Current 2.0A (0.05Ω max. DC Resistance)					
NRCL25ZOTRF		1210		Rated Current 2.5A (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)

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

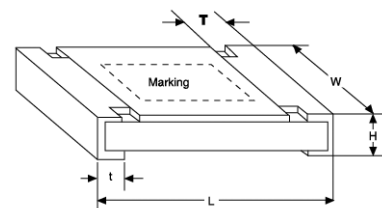
Note *2 - Maximum allowable Overload voltage is 2.5 times the Maximum Working Voltage (see Note *1 above).

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

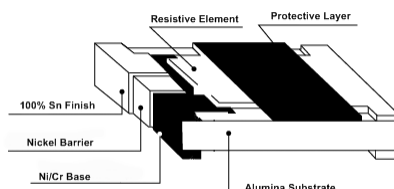


DIMENSIONS (mm)

Type	Power Rating	EIA Size	L	W	H	T	t
NRCL02	1/20W	0201	0.6 ± 0.03	0.3 ± 0.03	0.23 ± 0.03	0.10 ± 0.05	0.15 ± 0.05
NRCL04	1/16W	0402	1.0 ± 0.05	0.50 ± 0.05	0.35 ± 0.05	0.20 ± 0.10	0.25 ± 0.10
NRCL06	1/10W	0603	1.6 ± 0.10	0.8 ± 0.10	0.45 ± 0.15	0.30 ± 0.10	0.30 ± 0.15
NRCL10	1/8W	0805	2.0 ± 0.10	1.25 ± 0.10	0.50 ± 0.15	0.40 ± 0.20	0.40 ± 0.20
NRCL12	1/4W	1206	3.1 ± 0.10	1.60 ± 0.10	0.60 ± 0.15	0.50 ± 0.20	0.45 ± 0.20
NRCL25	1/3W	1210	3.1 ± 0.10	2.60 ± 0.10	0.55 ± 0.10	0.50 ± 0.20	0.50 ± 0.20
NRCL02ZO	Jumper	0201	Same as NRCL02				
NRCL04ZO	Jumper	0402	Same as NRCL04				
NRCL06ZO	Jumper	0603	Same as NRCL06				
NRCL10ZO	Jumper	0805	Same as NRCL10				
NRCL12ZO	Jumper	1206	Same as NRCL12				
NRCL25ZO	Jumper	1210	Same as NRCL25				



CONSTRUCTION



PART NUMBER SYSTEM (5% tolerance E-24 values)

NRCL 10 J 103 TR 10 E

- RoHS compliant
- Opt. reel quantity for 0201 ~ 1210 case sizes
- Tape & Reel Packaging
- Resistance Code: First 3 figures are significant, 4th digit is the multiplier, "R" indicates a decimal point.
- Tolerance Code: J=5%
- Size Code
- Series

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

PART NUMBER SYSTEM (1% tolerance E-24 & E-96 values)

NRCL 10 F 1003 TR 10 E

- RoHS compliant
- Opt. reel quantity for 0201 ~ 1210 case sizes
- Tape & Reel Packaging
- Resistance Code: First 3 figures are significant, 4th digit is the multiplier, "R" indicates a decimal point.
- Tolerance Code: F=1%
- Size Code
- Series

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

Marking (No marking on 0201 and 0402 size).

1. For **E-12 & E-24** Series ($\pm 1\% = F$, $\pm 2\% = G$, $\pm 5\% = J$, (STD) Tolerance In 0603, 0805, 1206, 1210, 2010 and 2512 sizes: _

3 DIGIT SYSTEM - First two digits are significant and third digit is multiplier, "R" indicates decimal on values under 10 ohms.

Examples: R10 = .10 ohms 1R0 = 1.0 ohms 102 = 1k ohms 470 = 47 ohms
103 = 10k ohms 101 = 100 ohms 104 = 100k ohms 105 = 1 megohms

2. For **E-96** Series ($\pm 1\% = F$ Tolerance) in 0805, 1206 and 1210 sizes:

4 DIGIT SYSTEM - First 3 digits are significant and fourth digit is multiplier, "R" indicates decimal on values under 100 ohms.

Examples: 0R10 = .10 ohms 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

3. For **E-96** Series ($\pm 1\% = F$ Tolerance) in 0603 size

3 DIGIT SYSTEM (Due to space restrictions)

STANDARD E-12, E-24, E-96 VALUES AND 0603 1% TOLERANCE RESISTANCE CODES

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

E-12	E-24	E-96							
Value	Value	Value	Code	Value	Code	Value	Code	Value	Code
10	100	100	01	102	02	105	03	107	04
12	110	110	05	113	06	115	07	118	08
15	120	121	09	124	10	127	11	130	12
18	130	133	13	137	14	140	15	143	16
22	150	147	17	150	18	154	19	158	20
27	160	162	21	165	22	169	23	174	24
33	180	178	25	182	26	187	27	191	28
39	200	196	29	200	30	205	31	210	32
47	220	215	33	221	34	226	35	232	36
56	240	237	37	243	38	249	39	255	40
68	270	261	41	267	42	274	43	280	44
82	300	287	45	294	46	301	47	309	48
91	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 ⁰	10 ¹	10 ²	10 ³	10 ⁴	10 ⁵	10 ⁶	10 ⁷	10 ⁻¹	10 ⁻²	10 ⁻³

CODING FORMULA



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

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

0603 E-96 MARKING EXAMPLES

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

0603 1% E-12/E-24 Values

160 Ω = 161
12K Ω = 123
8.2M Ω = 825



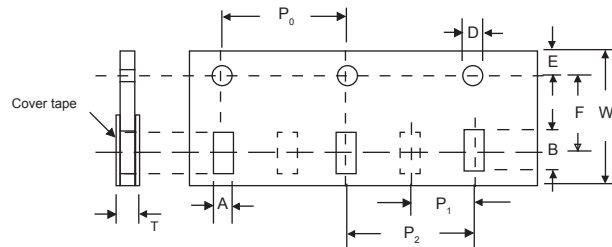
TAPING SPECIFICATIONS REEL QUANTITY

Type	Power Rating	EIA Size	Qty per 7" Reel (Std)	Qty per 10" Reel (Opt)	Qty per 13" Reel (Opt)
NRCL02	1/20W	0201	10,000	n/a	n/a
NRCL04	1/16W	0402	10,000	n/a	n/a
NRCL06	1/10W	0603	5,000	10,000	20,000
NRCL10	1/8W	0805	5,000	10,000	20,000
NRCL12	1/4W	1206	5,000	10,000	20,000
NRCL25	1/3W	1210	5,000	10,000	20,000
NRCL02ZO	Jumper	0201	10,000	n/a	n/a
NRCL04ZO	Jumper	0402	10,000	n/a	n/a
NRCL06ZO	Jumper	0603	5,000	10,000	20,000
NRCL10ZO	Jumper	0805	5,000	10,000	20,000
NRCL12ZO	Jumper	1206	5,000	10,000	20,000
NRCL25ZO	Jumper	1210	5,000	10,000	20,000

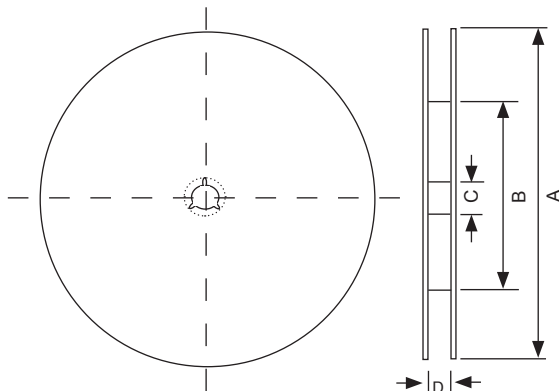
CARRIER TAPE DIMENSIONS (mm)

Type	EIA Size	A	B	D	E	F	P _o	P ₁	P ₂	T	W
NRCL02*	0201	0.37 ± 0.05	0.67 ± 0.05	1.5 ^{+0.1/-0.0}	1.75 ± 0.1	3.5 ± 0.20	4.0 ± 0.10	2.0 ± 0.10	N/A	0.40 ± 0.05	8.0 ± 0.3
NRCL04*	0402	0.70 ± 0.10	1.20 ± 0.10					N/A	4.0 ± 0.10	0.65 ± 0.05	
NRCL06*	0603	1.10 ± 0.20	1.90 ± 0.20							1.0 max.	
NRCL10*	0805	1.65 ± 0.20	2.40 ± 0.20								
NRCL12*	1206	2.00 ± 0.20	3.60 ± 0.20								
NRCL25*	1210	3.00 ± 0.20	3.60 ± 0.20								

* Same for JUMPER (ZO) types.



REEL SPECIFICATIONS



Type	EIA Size	A ± 2.0			B ± 1.0	C ± 0.2	D ± 0.5
NRCL02*	0201	φ178 (Std)	-	-	φ60	φ13	φ9.0
NRCL04*	0402						
NRCL06*	0603	φ178 (Std)	φ254 (Opt)	φ330 (Opt)			
NRCL10*	0805						
NRCL12*	1206						
NRCL25*	1210						

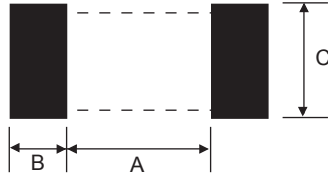
* Same for JUMPER (ZO) types.

1. Leader tape : Approximately 250 m/m (160mm for 0201 case size) leader shall be provided at each end of the tape.

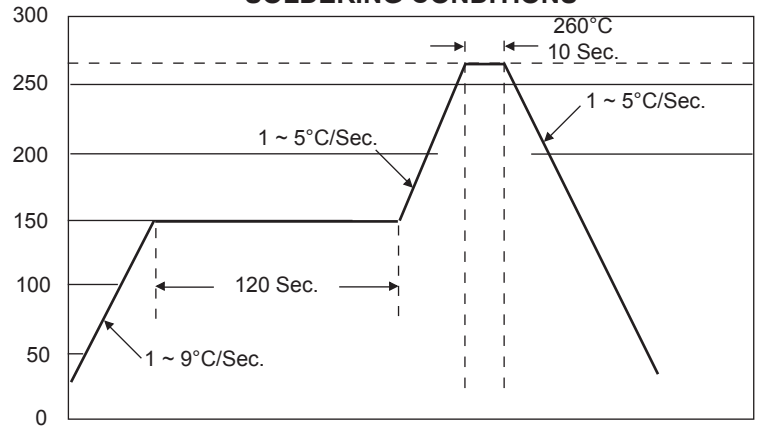
2. Accumulative tolerance of feeding hole and chip pocket shall not exceed 0.2mm over 10 pitches.

LAND PATTERN DIMENSIONS (mm)

Type	EIA Size	A	B	C
NRCL02	0201	0.30	0.30	0.30
NRCL04	0402	0.50	0.50	0.60
NRCL06	0603	0.90	0.60	0.90
NRCL10	0805	1.20	0.70	1.30
NRCL12	1206	2.00	0.90	1.60
NRCL25	1210	2.00	0.90	2.80



PEAK REFLOW SOLDERING CONDITIONS



ENVIRONMENTAL CHARACTERISTICS

Item	Specification		Test Method
	Tol. $\pm 1.0\% \text{ \& } \pm 5\%$	0Ω	
Resistance	As specified	$<50\text{m}\Omega$	Measured at: $<10\Omega @ 0.1\text{V}$, $<100\Omega @ 0.3\text{V}$, $<1\text{K}\Omega @ 1.0\text{V}$, $<10\text{K}\Omega @ 3\text{V}$, $<100\text{K}\Omega @ 10\text{V}$, $<1\text{M}\Omega @ 25\text{V}$, $<10\text{M}\Omega @ 30\text{V}$
Temperature Coefficient of Resistance	As specified	N/A	JIS C5201-1 Clause 4.8
Short Time Overload	$\Delta R/R \text{ max. } \pm(2\% + 0.10\Omega)$	$<50\text{m}\Omega$	RCWV x 2.5 or Max Overloading Voltage for 5 seconds whichever is less JIS C5201-1 Clause 4.13
Resistance to soldering heat	$\Delta R/R \text{ max. } \pm(1\% + 0.05\Omega)$	$<50\text{m}\Omega$	Immersion for 10 ± 1 second in SAC solder $+260^\circ\text{C}$ JIS C5201-1 Clause 4.18
Temperature Cycling	$\Delta R/R \text{ max. } \pm(1\% + 0.05\Omega)$	$<50\text{m}\Omega$	5 cycles $-55^\circ\text{C}/+20^\circ\text{C}/+155^\circ\text{C}$ JIS C5201-1 Clause 4.19
Humidity Load Life	$10\Omega \leq R < 1\text{M}\Omega$ $\Delta R/R \text{ max. } \pm(3\% + 0.10\Omega)$ $R < 10\Omega$ or $> 1\text{M}\Omega$ $\Delta R/R \text{ max. } \pm(5\% + 0.10\Omega)$	$<50\text{m}\Omega$	1,000 hours @ $+40^\circ\text{C}$, 90% ~ 95% RH JIS C5201-1 Clause 4.24
Load Life	$10\Omega \leq R < 1\text{M}\Omega$ $\Delta R/R \text{ max. } \pm(3\% + 0.10\Omega)$ $R < 10\Omega$ or $> 1\text{M}\Omega$ $\Delta R/R \text{ max. } \pm(5\% + 0.10\Omega)$	$<50\text{m}\Omega$	1,000 hours @ $+70^\circ\text{C}$ JIS C5201-1 Clause 4.25
Adhesion Strength	No removal of termination		5N for 10 seconds JIS C5201-1 Clause 4.32
Bending Strength	No visible damage $\Delta R/R \text{ max. } \pm(1\% + 0.05\Omega)$	$<50\text{m}\Omega$	5mm (0201 & 0402), 3mm (0603 ~ 1210) deflection for 10 seconds JIS C5201-1 Clause 4.33