NTRF Series

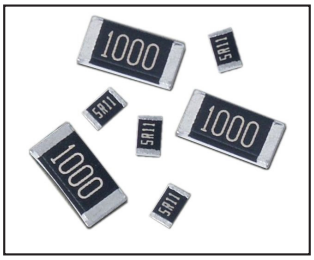
High Frequency (up to 70 GHz)
Thin Film Precision Chip Resistor

ROHS/REACH COMPLIANT HALOGEN FREE

NIC COMPONENTS Performance Passives By Design

FEATURES

- SMALL STANDARD SIZE 0201 CASE SIZE
- HIGH FREQUENCY (0201 - 70GHz, 0402 & 0603 - 50GHz)
- HIGH PURITY ALUMINA SUBSTRATE
- OHMIC RANGE (10 Ω ~ 1K Ω)
- SMALL INTERNAL REACTANCE (<10mΩ)
- RESISTOR TOLERANCE TO ±0.1%
- LOW TCR(DOWN TO ±25 PPM/°C



SPECIFICATIONS

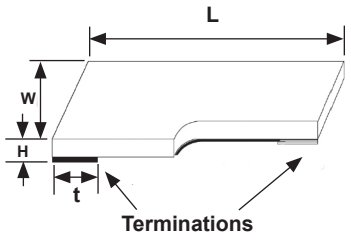
Type	EIA Size	Power Rating At 70°C	Max.*1 Working Voltage	Max.*2 Overload Voltage	Resistance Tolerance (Code)	Temperature Coefficient (ppm/°C)	Resistance Range (Ω)	Temperature Range
NTRF02	0201	1/32 (0.031)W	15V	30V	±0.1% (B) ±0.25 (C) ±0.5%(D) ±1% (F)	±25(C) ±50(D)	20Ω ~ 500Ω	-55°C ~ +155°C
NTRF04	0402	1/20 (0.05)W	30V	60V			10Ω ~ 1KΩ	
NTRF06	0603	1/8 (0.125)W	50V	100V				
NTRF10	0805	1/5 (0.20)W	50V	100V				
NTRF12	1206	1/3 (0.33)W	75V	150V				

*Please refer to page 5 for information regarding max working and overload voltage ratings

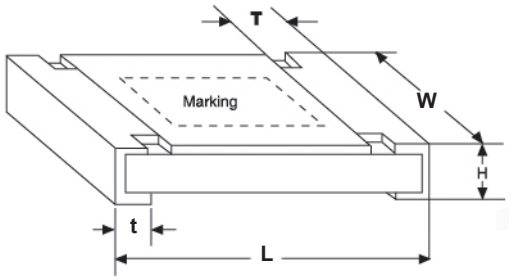
DIMENSIONS (mm) & LAND PATTERNS (mm)

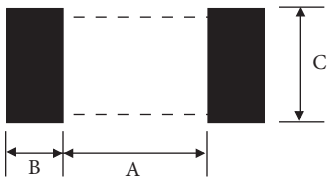
Type	L	W	H	T	t	A	B	C	Weight (1000 pcs)
NTRF02	0.58 ± 0.05	0.30 ± 0.05	0.21 ± 0.07	n/a	0.15 ± 0.10	0.25	0.30	0.40 ± 0.2	0.12g
NTRF04	1.00 ± 0.07	0.50 ± 0.07	0.38 ± 0.15	0.20 ± 0.15	0.20 ± 0.15	0.50	0.50	0.60 ± 0.2	0.73g
NTRF06	1.55 ± 0.10	0.80 ± 0.10	0.45 ± 0.15	0.30 ± 0.20	0.30 ± 0.20	0.80	1.00	0.90 ± 0.2	2.08 g
NTRF10	2.00 ± 0.15	1.25 ± 0.15	0.45 ± 0.15	0.30 ± 0.20	0.35 ± 0.20	1.00	1.00	1.35 ± 0.2	4.15 g
NTRF12	3.05 ± 0.20	1.55 ± 0.20	0.45 ± 0.15	0.45 ± 0.20	0.35 ± 0.25	2.00	1.15	1.70 ± 0.2	7.59 g

0201



0402 ~ 1206





PART NUMBER SYSTEM

NTRF 10 B 1003 C TR 1K F

- F — RoHS compliant
- 1K — Optional 1,000 piece reel quantity
- TR — Tape & Reel Packaging
- C — Temperature Coefficient Code: C = ±25ppm, D = ±50ppm
- 1003 — Resistance Code: First 3 digits are significant figures (both E-24 and E-96 values), 4th digit is the multiplier, "R" indicates a decimal point.
- B — Tolerance Code: B = ± 0.1%, C = ± 0.25%, D = ± 0.5%, F = ± 1%
- 10 — Size Code: 02=0201, 04=0402, 06=0603, 10=0805, 12=1206
- NTRF — Series

NTRF Series

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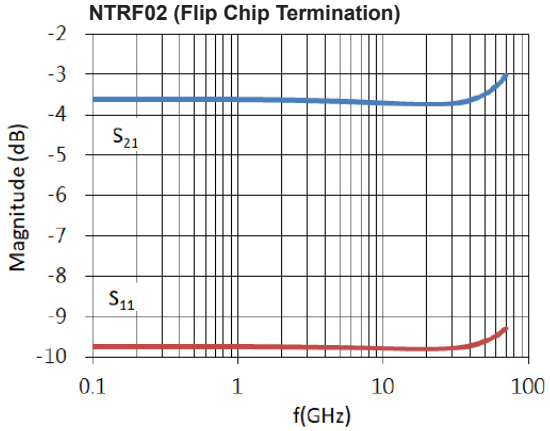
NIC COMPONENTS Performance Passives By Design

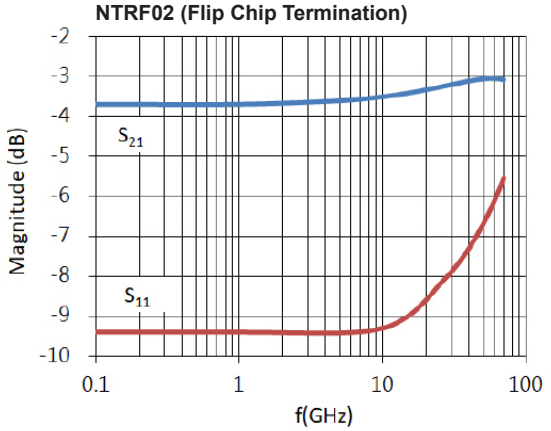
Note: Flip Chip Termination components are manufactured with the resistive film layer facing down toward the base of the component in closer proximity to the pcb.

S-PARAMETERS
NTRF02 (Flip Chip Termination)



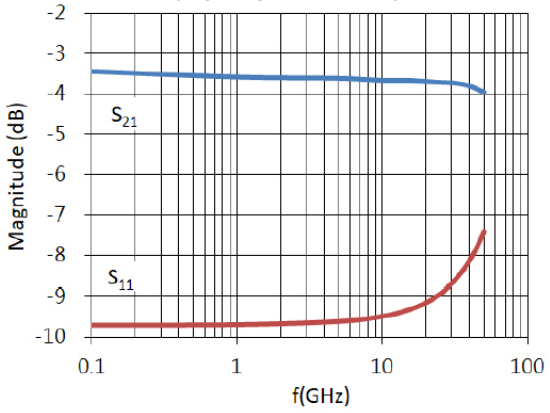
NTRF02 flip chip (Z0 = ZI = ZS = R = 50Ω)

S-PARAMETERS
NTRF02 (Flip Chip Termination)



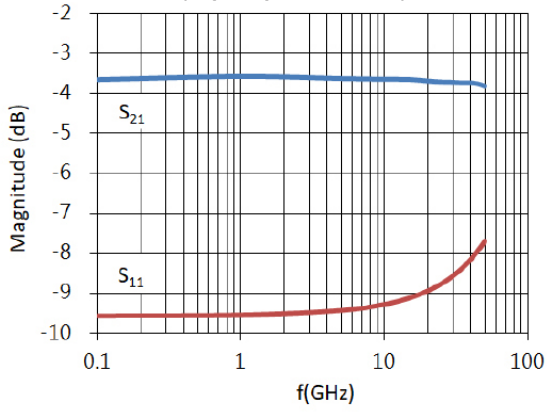
NTRF02 flip chip (Z0 = ZI = ZS = R = 100Ω)

S-PARAMETERS
NTRF04 (Flip Chip Termination)



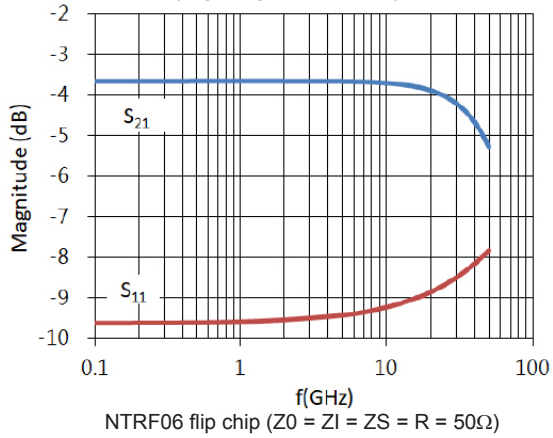
NTRF04 flip chip (Z0 = ZI = ZS = R = 50Ω)

S-PARAMETERS
NTRF04 (Flip Chip Termination)



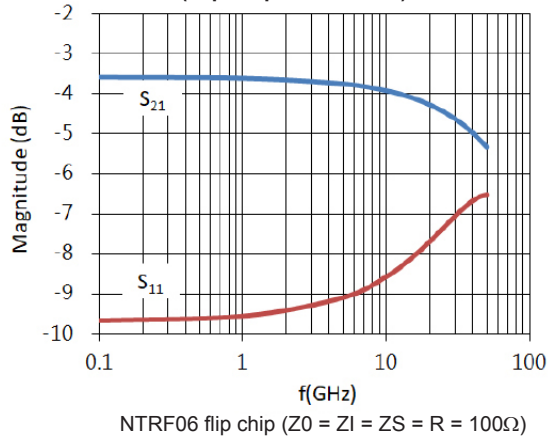
NTRF04 flip chip (Z0 = ZI = ZS = R = 100Ω)

S-PARAMETERS
NTRF06 (Flip Chip Termination)



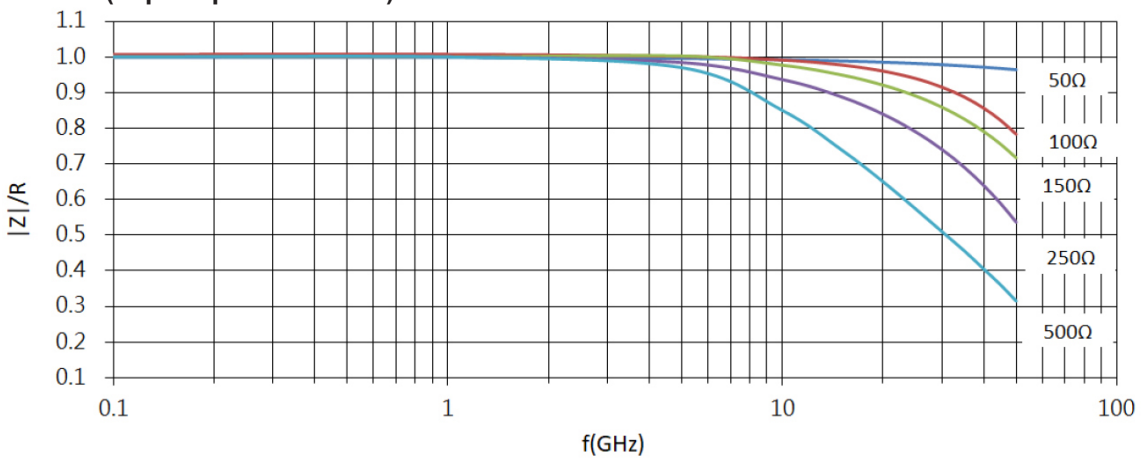
NTRF06 flip chip (Z0 = ZI = ZS = R = 50Ω)

S-PARAMETERS
NTRF06 (Flip Chip Termination)

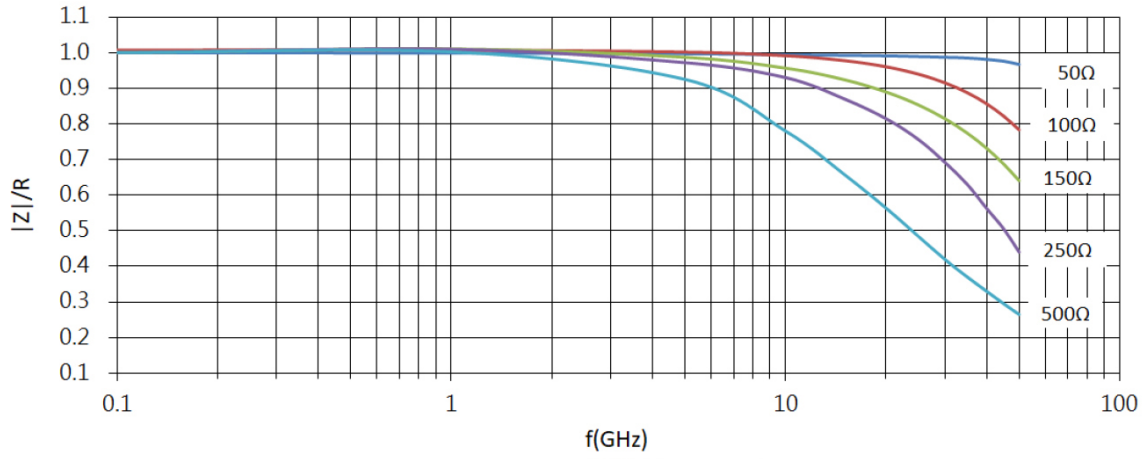


NTRF06 flip chip (Z0 = ZI = ZS = R = 100Ω)

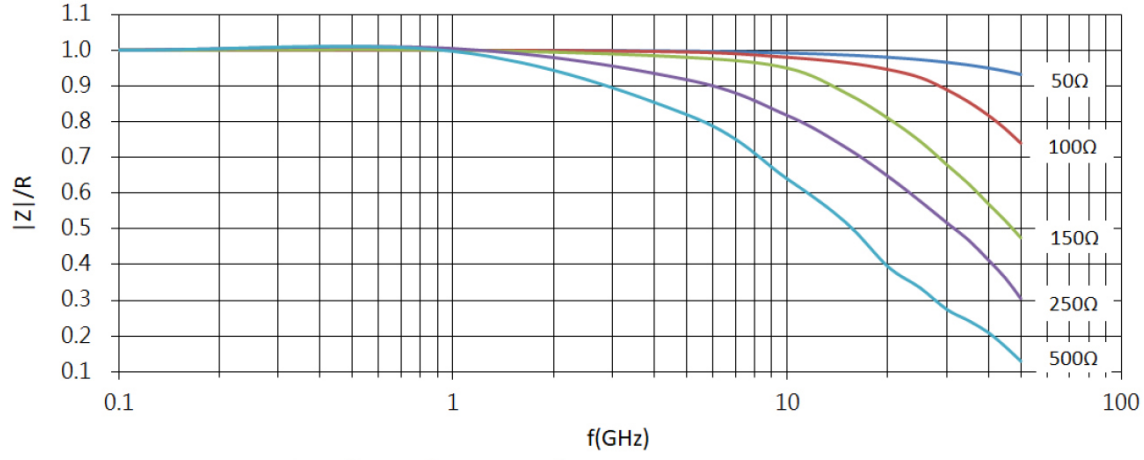
INTERNAL IMPEDANCE CURVES
NTRF02 (Flip Chip Termination)



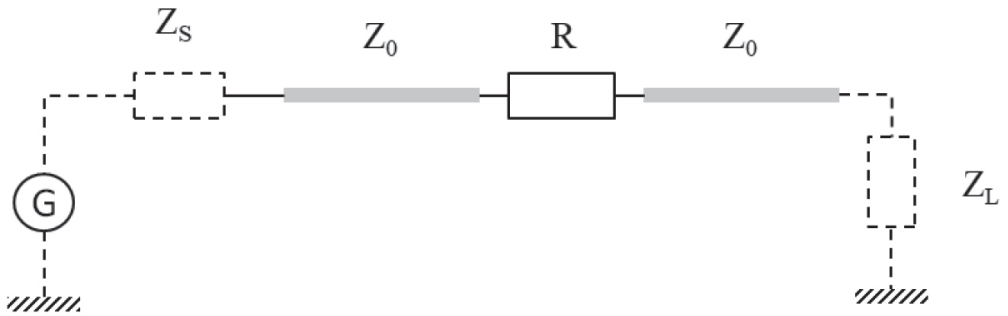
INTERNAL IMPEDANCE CURVES
NTRF04 (Flip Chip Termination)



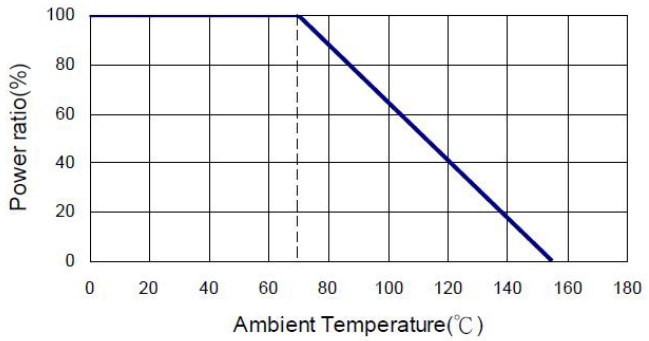
INTERNAL IMPEDANCE CURVES
NTRF06 (Flip Chip Termination)



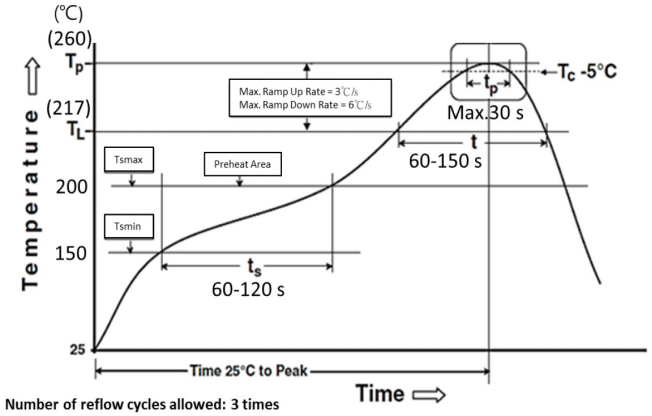
EQUIVALENT CIRCUIT FOR S-PARAMETERS



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



SOLDERING CONDITIONS (IPC/JEDEC J-STD-020)



Number of reflow cycles allowed: 3 times

Pb-Free Assembly	Time
Preheat Temp min (Tsmin)	150°C
Preheat Temp max (Tsmax)	200°C
Preheat time (ts)	60 - 120 seconds
Ramp-up rate (T_L to T_P)	3°C/second max.
Liquidous temperature (T_L)	217°C
Time (t_L) maintained above T_L	60 - 150 seconds
Peak Temperature min (T_P min)	235°C
Peak Temperature max (T_P max)	260°C
Time (T_P) within 5°C of the specified classification temperature (T_C)	30 seconds max.
Ramp-down rate (T_P to T_L)	6°C/second max.
Time 25°C to peak temperature	8 minutes max.

ENVIRONMENTAL CHARACTERISTICS

Item	Requirement	Test Method*
Standard Temperature Range: -55°C ~ +155°C (power derating above +70°C)		
Temperature Coefficient of Resistance	As specified	MIL-STD-202 Method 304 +25/-55/+25/+125/+25
Short Time Overload	ΔR ±0.2%	JIS-C-5201-1 4:13 RCWV x 2.5 or Max Overloading Voltage for 5 Seconds
Dielectric Withstanding Voltage	By Type	MIL-STD-202 Method 301 Apply Max. Overload Voltage for 1 minute
Insulation Resistance	> 9999 MΩ	MIL-STD-202 Method 302 Apply 100Vdc for 1 minute
Endurance	ΔR ±0.5%	MIL-STD-202 Method 108 70±2°C, RCWV for 1000 hrs with 1.5 hours "ON" and 0.5 hours OFF
Damp Heat with Load	ΔR ±0.5%	MIL-STD-202 Method 103 40±2°C, 90~95% R.H. RCWV for 1000 hrs with 1.5 hours "ON" and 0.5 hours OFF
Bending Strength	ΔR ±0.1%	JIS-C-5201-1 4.33 Bending Amplitude 3mm for 60 seconds
Solderability	95% Minimum Coverage Except 0201	MIL-STD-202 Method 208 245°C ±5°C, for 3 seconds
Resistance to Soldering Heat	ΔR ±0.1% Except 0201	MIL-STD-202 Method 210 260°C ±5°C for 10 seconds
Low Temperature Operation	ΔR ±0.2%	JIS-C-5201-1 4.36 1 hour @ -65°C followed by 45 minutes of RCWV
High Temperature Exposure	ΔR ±0.5%	MIL-STD-202 Method 108 @ +155°C ffor 1000 hrs

RCWV (Rated Continuous Working Voltage) = √(P*R) or Max. Operating voltage whichever is lower
Storage Temperature: 15 ~28 °C; Humidity < 80%RH
Shelf Life: 2 years from production date

Note *1 - Maximum allowable continuous Working Voltage for all resistors is the lower of the two values:

Maximum Working Voltage" as specified above or:

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

Note *2 - Maximum Overload Voltage for all resistors is the lower of the two values:

Maximum Overload Voltage" as specified above or

$$2.5 \times \sqrt{\text{Power rating (Watts) x Resistance (Ohms)}}$$

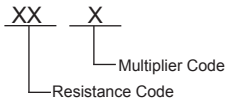
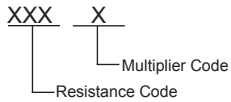
STANDARD E-24 AND E-96 VALUES AND RESISTANCE CODES

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

MARKING IDENTIFIERS

0402 Size	0603 Size	0805 and 1206 Size
No marking on 0201 & 0402 sizes	3 Digit Marking System: 2 digit value code + 1 digit multiplier code  E24 0603 Multiplier Code: 10e multiplier E96 0603 Multiplier Code: Per table 0603 Marking Examples: 101 = 100 Ω (E24) 13C = 13.3 KΩ (E96) 68B = 4.99 KΩ (E96) 103 = 10 KΩ (E24)	4 Digit Marking System: 3 digit value code + 1 digit multiplier code where "R" denotes a decimal  Value Multiplier Code: 10e multiplier Marking Examples: 10R0 = 10 Ω 1332 = 13.3 KΩ 4992 = 49.9 KΩ 1003 = 100 KΩ

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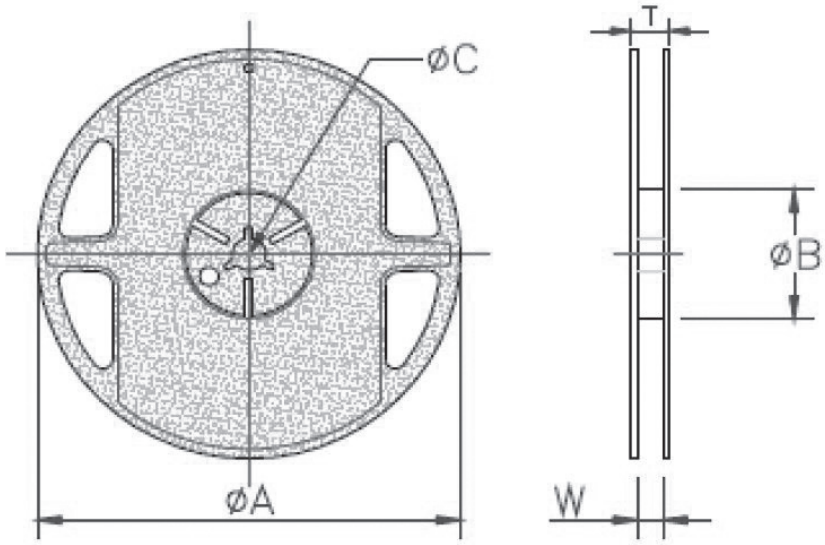
NIC COMPONENTS Performance Passives By Design

TAPING SPECIFICATIONS

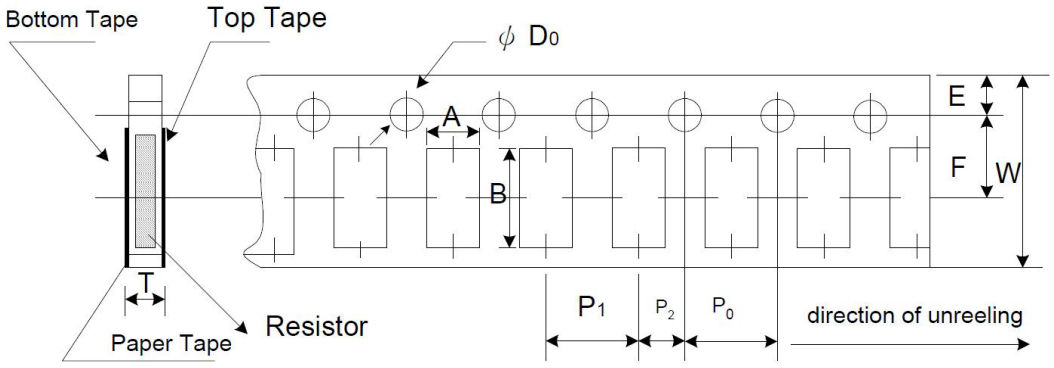
Type	EIA Size	A	B	C	W	T	Paper Tape (EA)
NTRF02	0201	1.78 ±1.0	60.0 ± 1.0	13.5 ± 0.7	9.5 ± 1.0	11.5 ± 1.0	10,000
NTRF04	0402	1.78 ±1.0	60.0 ± 1.0	13.5 ± 0.7	9.5 ± 1.0	11.5 ± 1.0	10,000
NTRF06	0603	1.78 ±1.0	60.0 ± 1.0	13.5 ± 0.7	9.5 ± 1.0	11.5 ± 1.0	5,000
NTRF10	0805	1.78 ±1.0	60.0 ± 1.0	13.5 ± 0.7	9.5 ± 1.0	11.5 ± 1.0	5,000
NTRF12	1206	1.78 ±1.0	60.0 ± 1.0	13.5 ± 0.7	9.5 ± 1.0	11.5 ± 1.0	5,000

REEL DIMENSIONS (mm)



PAPER TAPE DIMENSIONS (mm)

Type	EIA Size	A	B	D	E	F	P_0	P_1	P_2	W	T
NTRF02	0201	0.40 ± 0.05	0.70 ± 0.05	1.55 ±0.03	1.75 ±0.05	3.5 ±0.05	4.00 ± 0.10	2.00 ±0.05	2.00 ±0.05	8.00 ± 0.10	0.42 ± 0.02
NTRF04	0402	0.66 ± 0.06	1.18 ± 0.06	1.55 ±0.05	1.75 ±0.10	3.5 ±0.05	4.00 ± 0.10	2.00 ±0.05	2.00 ±0.05	8.00 ± 0.20	0.60 ± 0.03
NTRF06	0603	1.10 ± 0.05	1.90 ± 0.05	1.55 ±0.05	1.75 ± 0.05	3.5 ±0.05	4.00 ± 0.10	4.00 ± 0.10	2.00 ±0.05	8.00 ± 0.10	0.60 ± 0.03
NTRF10	0805	1.60 ± 0.05	2.37 ± 0.05	1.55 ±0.05	1.75± 0.05	3.5 ±0.05	4.00 ± 0.10	4.00 ± 0.10	2.00 ±0.05	8.00 ± 0.10	0.75 ± 0.05
NTRF12	1206	2.00 ± 0.05	3.55 ± 0.05	1.55 ±0.05	1.75± 0.05	3.5 ±0.05	4.00 ± 0.10	4.00 ± 0.10	2.00 ± 0.05	8.00 ± 0.10	0.75 ± 0.05



Unit: mm