NTRWH Series

Automotive High Power Thin Film Chip Resistor

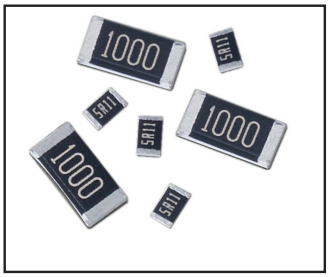
AEC-Q200 QUALIFIED

ROHS/REACH COMPLIANT HALOGEN FREE

NIC COMPONENTS Performance Passives By Design

FEATURES

- SUPERIOR TEMPERATURE CYCLING ROBUSTNESS
- 10Ω ~ 100KΩ RESISTANCE RANGE
- RESISTOR TOLERANCES DOWN TO ±0.1%
- LOW TCR OPTIONS DOWN TO ±25 PPM/°C
- ADVANCED SULFUR RESISTANCE VERIFIED ACCORDING ASTM B809
- AEC-Q200 QUALIFIED FOR AUTOMOTIVE APPLICATIONS
- OPERATING TEMPERATURE UP TO 175°C FOR 1000 HOURS
- RATED DISSIPATION 0.4W FOR SIZE 0805



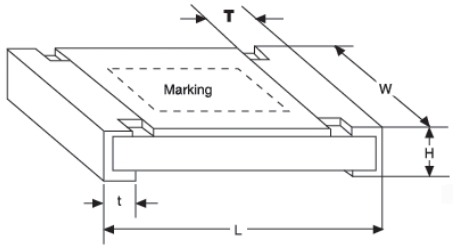
SPECIFICATIONS

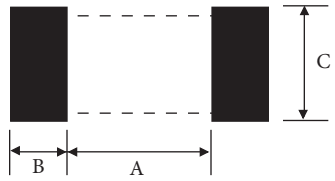
Type	EIA Size	Power Rating At 85°C	Temperature Range	Max.*1 Working Voltage	Max.*2 Overload Voltage	Resistance Tolerance (Code)	Temperature Coefficient (ppm/°C)	Resistance Range (Ω)
NTRWH04	0402	0.20W	-55 °C ~ +175 °C	50V	100V	±0.1% (B), ±0.5%(D), ±1% (F)	±25(C), ±50(D)	47Ω ~ 100KΩ
NTRWH06	0603	0.25W		75V	150V	±0.1% (B)	±25(C)	47Ω ~ 100KΩ
						±0.5%(D), ±1% (F)	±25(C), ±50(D)	10Ω ~ 100KΩ
NTRWH10	0805	0.40W		150V	300V	±0.1% (B)	±25(C)	47Ω ~ 100KΩ
						±0.5%(D), ±1% (F)	±25(C), ±50(D)	10Ω ~ 100KΩ

*Please refer to page 3 for information regarding max working and overload voltage ratings

DIMENSIONS (mm) & LAND PATTERNS (mm)

Type	L	W	H	T	t	A	B	C
NTRWH04	1.00±0.05	0.50±0.05	0.30±0.05	0.20±0.10	0.20±0.10	0.50	0.50	0.60±0.2
NTRWH06	1.55±0.10	0.80±0.10	0.45±0.10	0.30±0.20	0.30±0.20	0.80	1.00	0.90±0.2
NTRWH10	2.00±0.15	1.25±0.15	0.55±0.10	0.30±0.20	0.40±0.20	1.00	1.00	1.35±0.2





PART NUMBER SYSTEM

NTRWH 10 B 49R9 C TR Q Y F

- F — RoHS compliant
- Y — "Y" denotes suitable for automotive equipment, sourced to special production and inspection at IATF-16949 certified production site
- Q — AEC-Q200 Qualified
- TR — Tape & Reel Packaging: TR = Standard Tape & Reel, TR1K = Optional 1,000 quantity
- C — Temperature Coefficient Code: C ±25ppm, D = ±50ppm
- 49R9 — 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: 04=0402, 06=0603 and 10=0805
- NTRWH — Series

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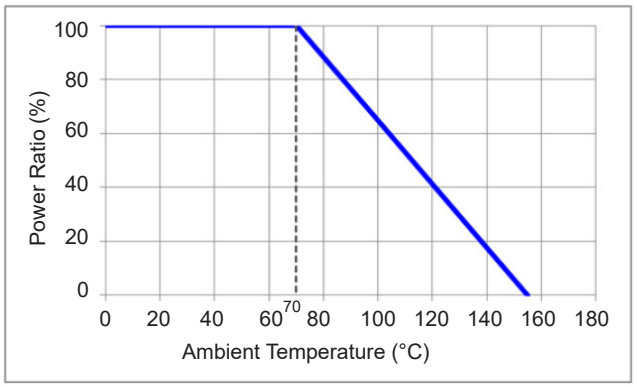
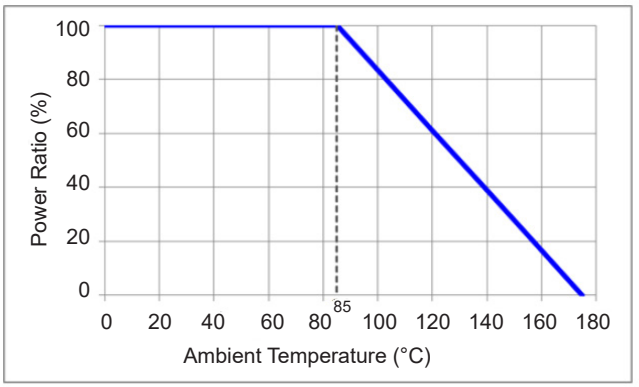
COMPONENTS
Performance Passives By Design

Standard Operation Derating Curve



Advanced Power Operation Derating Curve



RCWV (Rated Continuous Working Voltage) = √(P*R) or Max. Operating voltage whichever is lower

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

"Maximum Working Voltage" as specified above or:

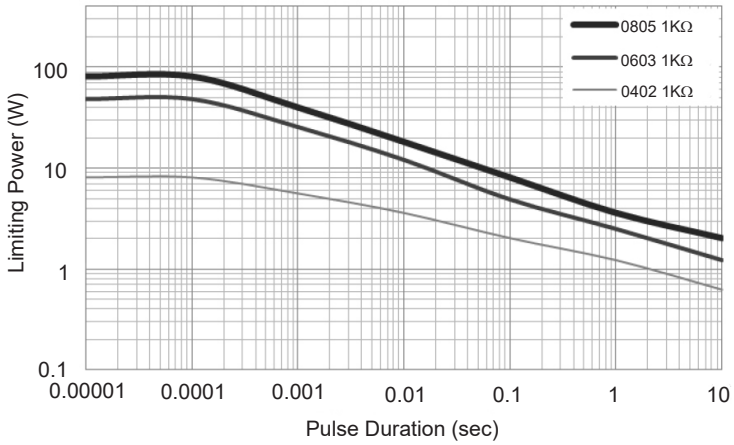
$\sqrt{\text{Power rating (Watts) x Resistance (Ohms)}}$

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

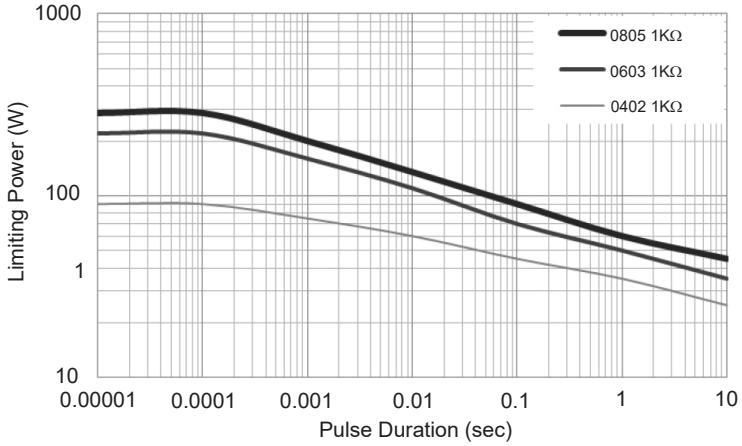
Maximum Overload Voltage" as specified above or

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

SINGLE PULSE POWER



CONTINUOUS PULSE POWER



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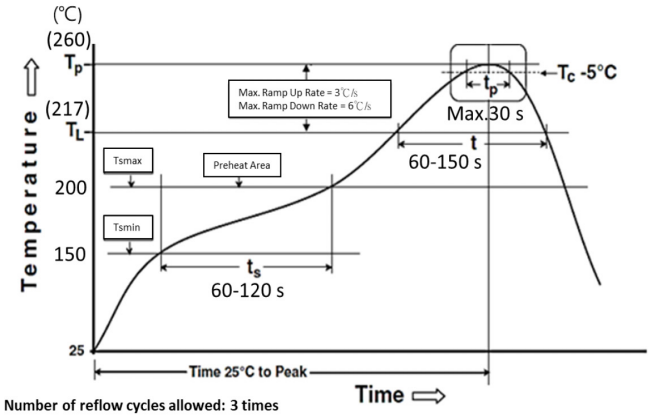
STANDARD ELECTRICAL SPECIFICATIONS

Type	Power Rating @ 85°C	Operating Temperature Range	Max. Operating Voltage	Max. Overload Voltage	Resistance Range			TCR (PPM/°C)
					±0.1%	±0.5%	±1%	
NTRWH04	0.20W	-55 ~ +175°C	50V	100V	47Ω ~ 100KΩ			±25(C), ±50(D)
NTRWH06	0.25W	-55 ~ +175°C	75V	150V	47Ω ~ 100KΩ	10Ω ~ 100KΩ		±25(C)
					n/a	10Ω ~ 100KΩ		±50(D)
NTRWH10	0.40W	-55 ~ +175°C	150V	300V	47Ω ~ 100KΩ	10Ω ~ 100KΩ		±25(C)
					n/a	10Ω ~ 100KΩ		±50(D)

MAXIMUM RESISTANCE CHANGE AT RATED DISSIPATION

Operation Mode		Standard P 70	Advanced Temperature P 85
Rated dissipation	NTRWH04	0.200W	0.200W
	NTRWH06	0.250W	0.250W
	NTRWH10	0.400W	0.400W
Operating temperature range		-55 ~ 155°C	-55 ~ 175°C
Permissible film temperature		155°C	175°C
Max. resistance change at rated dissipation for resistance range, |ΔR/R| after:	NTRWH04	47Ω ~ 100KΩ	47Ω ~ 100KΩ
	NTRWH06	10Ω ~ 100KΩ	10Ω ~ 100KΩ
	NTRWH10	10Ω ~ 100KΩ	10Ω ~ 100KΩ
	1000hr	≤0.2%	≤0.3%
	8000hr	≤0.4%	-

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



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 (TL to TP)	3°C/second max.
Liquidous temperature (TL)	217°C
Time (tL) maintained above TL	60 - 150 seconds
Peak Temperature min (TP min)	235°C
Peak Temperature max (TP max)	260°C
Time (TP) within 5°C of the specified classification temperature (TC)	30 seconds max.
Ramp-down rate (TP to TL)	6°C/second max.
Time 25°C to peak temperature	8 minutes max.

STORAGE CONDITIONS

Storage Temperature: 15 ~28 °C; Humidity < 80%RH

ENVIRONMENTAL CHARACTERISTICS

Item	Requirement			Test Method*
Temperature Coefficient of Resistance	As specified			MIL-STD 202 Method 304 +25/55/+25/+125/+25°C
Short Time Overload (Power Operating Mode)	ΔR ± 0.25%			JISC 5201 1 4.13 RCWV*2.5 or Max. overload voltage whichever is lower for 5 seconds
Insulation Resistance	> 1000MΩ			MIL-STD 202 Method 302 Apply 100VDC for 1 minute
Endurance	Power @ 70°C	1,000 hours	ΔR ± 0.20%	MIL-STD-202 Method 108 RCWV for 1000hrs with 1.5 hrs “ON” and 0.5 hrs "OFF"
		8,000 hours	ΔR ± 0.40%	
	Advanced temperature @ 85°C	1,000 hours	ΔR ± 0.30%	
High Temperature Exposure	155°C	ΔR ± 0.2%		MIL-STD 202 Method 108 1000 hrs
	175°C	ΔR ± 0.3%		
Temperature Cycling	ΔR ± 0.25%			JESD22 Method JA104 -55 °C to +155°C, 1000 cycles

ENVIRONMENTAL CHARACTERISTICS

Item	Requirement	Test Method*
Biased Humidity	Power Operation Mode ΔR ± 0.5%	MIL-STD 202 Method 103 1000 hrs 85°C/85%RH 10% of operating power (≤100 V)
Bendiing Strength	ΔR ± 0.1%	JISC 5201 1 4.33 Bending once for 60 seconds Bending displacement: 0402, 0603, 0805 sizes: 3 mm
Solderability	95% Minimum Coverage	JISC 5201 1 4.17 IEC60115 1 4.17 245°C ± 5°C for 3 seconds
Resistance to Soldering Heat	ΔR ± 0.1%	JISC 5201 1 4.18 IEC60115 1 4.18 260°C ± 5°C for 10 seconds
Terminal strength	No Broken	AEC-Q200-006 Force of 1.8kg for 60 seconds.
Mechanical Shock	ΔR ± 0.1%	MIL-STD 202 Method 213 Wave Form: Tolerance for half sne shock pulse. Peak value is 100g's. Normal duration (D) is 6.
Vibration	ΔR ±0.1%	MIL-STD 202 Method 204 5 g's for 20 min., 12 cycles each of 3 orientations, 10-2000 Hz
ESD	ΔR±0.5%	AECQ200 002 Human body model 0402 0.4KV, 0603 0.5KV, 0805 1. 5KV
Resistance to solvents	Marking Unsmeared	MIL-STD 202 Method 215 Add Aqueous wash chemical OKEM Clean or equivalent. Do not use banned solvents.
Flammability	No ignition of the tissue paper or scorching or the pinewood board	UL94V-0 or V-1 are acceptable. Electrical test not required.

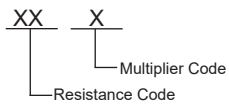
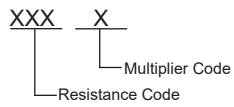
STANDARD E-24 AND E-96 VALUES AND RESISTANCE CODES

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	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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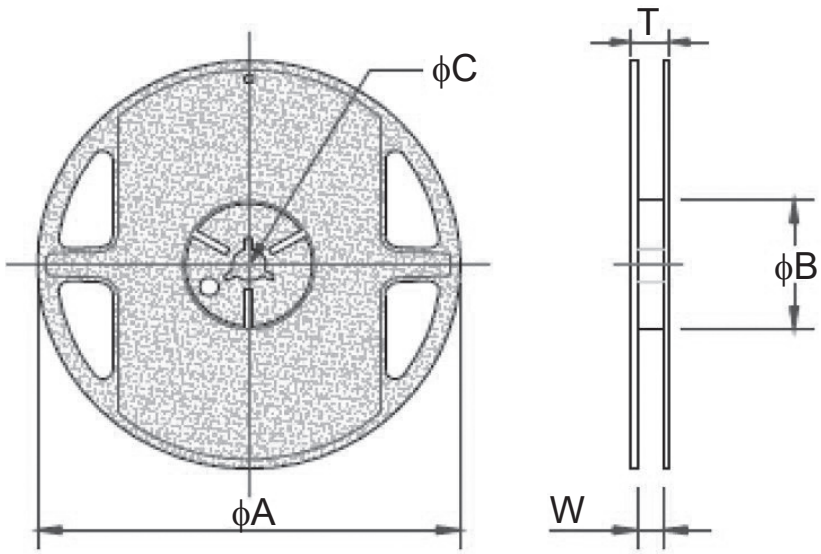
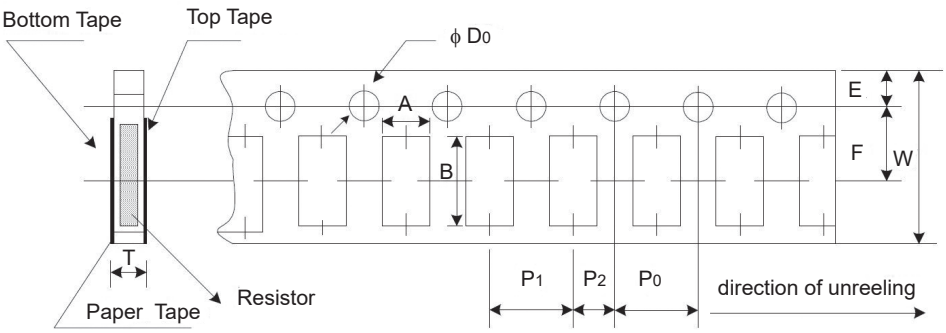
TAPING SPECIFICATIONS

Type	EIA Size	A	B	C	W	T	Paper Tape (EA)
NTRWH04	0402	178 ±1.0	60.0±1.0	13.5 ±0.7	9.5 ± 1.0	11.5 ±1.0	10,000
NTRWH06	0603						5,000
NTRWH10	0805						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
NTRWH04	0402	0.70 ± 0.05	1.16 ± 0.05	1.55 ±0.05	1.75 ± 0.05	3.5 ±0.05	4.00 ± 0.10	2.00 ± 0.05	2.00 ±0.05	8.00 ± 0.10	0.40 ± 0.03
NTRWH06	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
NTRWH10	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