# Sulfur Resistant Thick Film Chip Resistors

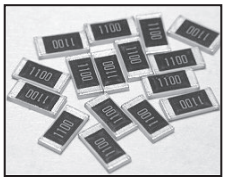
NRC-AS Series

**FEATURES**

- EIA STANDARD SIZING 0201, 0402, 0603, 0805, 1206, 1210, 2010 AND 2512
- SUIT FOR HIGH RELIABILITY APPLICATIONS IN HARSH ENVIRONMENTS
- AEC-Q200 QUALIFIED OPTION AVAILABLE (SEE PAGE 3 FOR AUTOMOTIVE PART NUMBERING SYSTEM)
- AVAILABLE IN STANDARD AND HIGH POWER RATINGS
- SAC REFLOW SOLDERABLE (THREE TIMES AT 260°C FOR 10 SECONDS)

**RoHS Compliant**
includes all homogeneous materials

*See Part Number System for Details



## STANDARD POWER 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)*3 | Resistance Values | Operating Temperature Range |
|---|---|---|---|---|---|---|---|---|---|
| NRC-AS02 | 0201 | 0.05W | 25V | 50V | ±1%(F), ±5%(J) | ±200ppm | 1 ~ 10M | E-24 & 96 | -55°C ~ +125°C |
| NRC-AS04 | 0402 | 0.063W | 50V | 100V | ±0.5%(D), ±1%(F), ±5%(J) | ±100ppm | 10 ~ 1M | E-24 & 96 | -55°C ~ +155°C |
| | | | | | | ±200ppm | 1 ~ 9.76<br>1.02M ~ 10M | | |
| NRC-AS06 | 0603 | 0.10W | 75V | 100V | ±0.5%(D), ±1%(F), ±5%(J) | ±100ppm | 10 ~ 1M | E-24 & 96 | |
| | | | | | | ±200ppm | 1 ~ 9.76<br>1.02M ~ 10M | | |
| NRC-AS10 | 0805 | 0.125W | 150V | 300V | ±0.5%(D), ±1%(F), ±5%(J) | ±100ppm | 10 ~ 1M | E-24 & 96 | |
| | | | | | | ±200ppm | 1 ~ 9.76<br>1.02M ~ 10M | | |
| NRC-AS12 | 1206 | 0.25W | 200V | 400V | ±0.5%(D), ±1%(F), ±5%(J) | ±100ppm | 10 ~ 1M | E-24 & 96 | |
| | | | | | | ±200ppm | 1 ~ 9.76<br>1.02M ~ 10M | | |
| NRC-AS25 | 1210 | 0.33W | 200V | 400V | ±0.5%(D), ±1%(F), ±5%(J) | ±100ppm | 10 ~ 1M | E-24 & 96 | |
| | | | | | | ±200ppm | 1 ~ 9.76<br>1.02M ~ 10M | | |
| NRC-AS50 | 2010 | 0.75W | 200V | 400V | ±0.5%(D), ±1%(F), ±5%(J) | ±100ppm | 10 ~ 1M | E-24 & 96 | |
| | | | | | | ±200ppm | 1 ~ 9.76<br>1.02M ~ 10M | | |
| NRC-AS100 | 2512 | 1.0W | 250V | 500V | ±0.5%(D), ±1%(F), ±5%(J) | ±100ppm | 10 ~ 1M | E-24 & 96 | |
| | | | | | | ±200ppm | 1 ~ 9.76<br>1.02M ~ 10M | | |

## HIGH POWER 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)*3 | Resistance Values | Operating Temperature Range |
|---|---|---|---|---|---|---|---|---|---|
| NRC-AS02P | 0201 | 0.083W | 25V | 50V | ±1%(F), ±5%(J) | ±200ppm | 10 ~ 1M | E-24 & 96 | -55°C ~ +125°C |
| NRC-AS04P | 0402 | 0.10W | 50V | 100V | ±1%(F), ±5%(J) | ±100ppm | 10 ~ 1M | E-24 & 96 | -55°C ~ +155°C |
| | | | | | | ±200ppm | 1 ~ 9.76 | | |
| NRC-AS06P | 0603 | 0.25W | 75V | 150V | ±1%(F), ±5%(J) | ±100ppm | 10 ~ 1M | E-24 & 96 | |
| | | | | | | ±200ppm | 1 ~ 9.76 | | |
| NRC-AS10P | 0805 | 0.33W | 150V | 300V | ±1%(F), ±5%(J) | ±100ppm | 10 ~ 1M | E-24 & 96 | |
| | | | | | | ±200ppm | 1 ~ 9.76 | | |
| NRC-AS12P | 1206 | 0.33W | 200V | 400V | ±1%(F), ±5%(J) | ±100ppm | 10 ~ 1M | E-24 & 96 | |
| | | | | | | ±200ppm | 1 ~ 9.76 | | |
| NRC-AS25P | 1210 | 0.50W | 200V | 400V | ±1%(F), ±5%(J) | ±100ppm | 10 ~ 1M | E-24 & 96 | |
| | | | | | | ±200ppm | 1 ~ 9.76 | | |
| NRC-AS50P | 2010 | 1.0W | 200V | 400V | ±1%(F), ±5%(J) | ±100ppm | 10 ~ 1M | E-24 & 96 | |
| | | | | | | ±200ppm | 1 ~ 9.76 | | |

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

"Maximum Working Voltage" as specified above or the result of the following formula

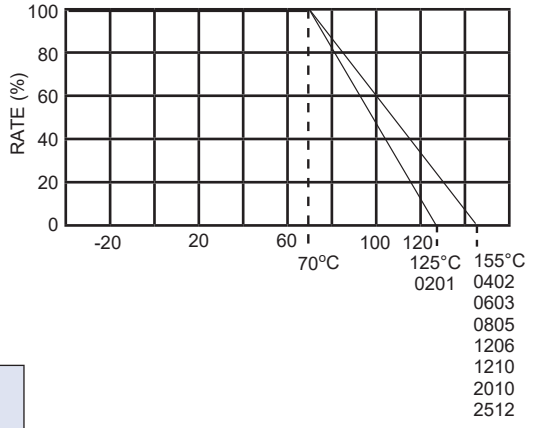
$$\sqrt{\text{Power rating (Watts) x Resistance (Ohms)}}$$

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

"Maximum Overload Voltage" as specified above or 2x the result of the following formula

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

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



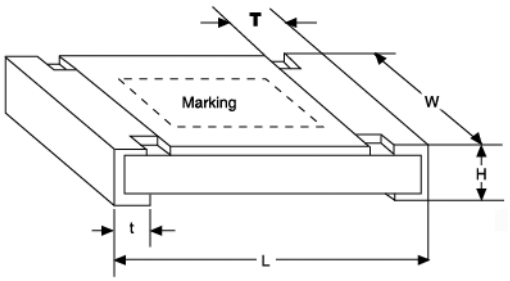

## ZERO OHM JUMPERS*

| Part Number | EIA Size | Max. Current at 70°C | Max. Resistance | Operating Temperature Range |
|---|---|---|---|---|
| NRC-AS02ZOTRF | 0201 | 1A | <50mΩ | -55°C ~ +125°C |
| NRC-AS04ZOTRF | 0402 | 1A | <50mΩ | -55°C ~ +155°C |
| NRC-AS06ZOTRF | 0603 | 1A | <50mΩ | |
| NRC-AS10ZOTRF | 0805 | 2A | <50mΩ | |
| NRC-AS12ZOTRF | 1206 | 2A | <50mΩ | |
| NRC-AS25ZOTRF | 1210 | 2.5A | <50mΩ | |
| NRC-AS50ZOTRF | 2010 | 3.5A | <50mΩ | |
| NRC-AS100ZOTRF | 2512 | 4A | <50mΩ | |

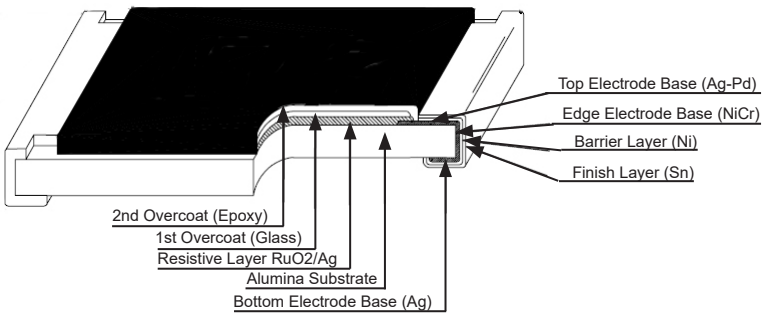
*Optional AEC Q-200 Qualified "TRQYF" is also available

## DIMENSIONS (mm)

| Type | EIA Size | L | W | H | T | t |
|---|---|---|---|---|---|---|
| NRC-AS02 | 0201 | 0.60 ± 0.03 | 0.30 ± 0.03 | 0.23 ± 0.03 | 0.15 ± 0.05 | 0.15 ± 0.05 |
| NRC-AS04 | 0402 | 1.00 ± 0.05 | 0.50 ± 0.05 | 0.35 ± 0.05 | 0.20 ± 0.10 | 0.20 ± 0.10 |
| NRC-AS06 | 0603 | 1.60 ± 0.10 | 0.80 ± 0.10 | 0.45 ± 0.10 | 0.30 ± 0.20 | 0.30 ± 0.20 |
| NRC-AS10 | 0805 | 2.00 ± 0.10 | 1.25 ± 0.10 | 0.50 ± 0.10 | 0.35 ± 0.20 | 0.40 ± 0.20 |
| NRC-AS12 | 1206 | 3.10 ± 0.10 | 1.55 ± 0.10 | 0.55 ± 0.10 | 0.50 ± 0.25 | 0.50 ± 0.20 |
| NRC-AS25 | 1210 | 3.10 ± 0.10 | 2.60 ± 0.15 | 0.55 ± 0.10 | 0.50 ± 0.25 | 0.50 ± 0.20 |
| NRC-AS50 | 2010 | 5.00 ± 0.10 | 2.50 ± 0.15 | 0.55 ± 0.10 | 0.60 ± 0.25 | 0.50 ± 0.20 |
| NRC-AS100 | 2512 | 6.35 ± 0.10 | 3.10 ± 0.15 | 0.55 ± 0.10 | 0.60 ± 0.25 | 0.50 ± 0.20 |




**CONSTRUCTION**



## PART NUMBER SYSTEM

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

NRC-AS 12 J 103 TR F
- F — RoHS compliant
- TR — Tape & Reel Packaging
- 103 — Resistance Code: First 2 figures are significant, 3rd digit is the multiplier, "R" indicates a decimal point.
- J — Tolerance Code: J = ±5%
- 12 — Case Size and Power Rating Code (add "P" for higher power rated parts)
- NRC-AS — Series

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

NRC-AS 12 F 1002 TR F
- F — RoHS compliant
- TR — Tape & Reel Packaging
- 1002 — Resistance Code: First 3 figures are significant, 4th digit is the multiplier, "R" indicates a decimal point.
- F — Tolerance Code: F = ±1%
- 12 — Case Size and Power Rating Code (add "P" for higher power rated parts)
- NRC-AS — Series

## PART NUMBER SYSTEM - AUTOMOTIVE OPTION
## (Standard Power Ratings Only)

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

NRC-AS 12 J 103 TR QY F
- F — RoHS compliant
- TR — Tape & Reel Packaging
- 103 — Resistance Code: First 2 figures are significant, 3rd digit is the multiplier, "R" indicates a decimal point.
- J — Tolerance Code: J = ±5%
- 12 — Case Size
- NRC-AS — Series
- QY — "QY" denotes optional AEC Q-200 qualified parts suitable for automotive equipment, sourced to special production and inspection at IATF-16949 certified production site

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

NRC-AS 12 F 1002 TR QY F
- F — RoHS compliant
- TR — Tape & Reel Packaging
- 1002 — Resistance Code: First 3 figures are significant, 4th digit is the multiplier, "R" indicates a decimal point.
- F — Tolerance Code: F = ±1%
- 12 — Case Size
- NRC-AS — Series
- QY — "QY" denotes optional AEC Q-200 qualified parts suitable for automotive equipment, sourced to special production and inspection at IATF-16949 certified production site

## ENVIRONMENTAL CHARACTERISTICS (NON--AUTOMOTIVE)

| Item | Specification | | | Test Method |
|---|---|---|---|---|
| | ±0.5% & ±1% tolerance | ±5% tolerance | Zero Ohm Jumper | |
| Temperature Coefficient of Resistance | As specified | | | -55°C ~ +125°C, +25°C reference point |
| Short Time Overload | ΔR ±1% +0.05Ω | ΔR ±2% +0.05Ω | <50mΩ | RCWV x 2.5 or Max Overloading Voltage for 5 Seconds |
| Insulation Resistance | >10GΩ | | | Maximum Overload Voltage for 1 Minute |
| Load Life | ΔR ±2% +0.10Ω | ΔR ±3% +0.10Ω | <100mΩ | Max. WV +70°C, 1.5 hours ON, 0.5 hours OFF Total time 1,000 |
| Damp Heat (with load) | ΔR ±2% +0.10Ω | ΔR ±3% +0.10Ω | <100mΩ | +40°C, 90% ~ 95% RH, Max. WV 1.5 hours ON, 0.5 hours OFF Total time 1,000 |
| Resistance to Dry Heat | ΔR ±1% +0.05Ω | ΔR ±1.5% +0.05Ω | <50mΩ | +125°C or +155°C for 1000 hours |
| Temperature Cycling | ΔR ±0.5% +0.05Ω | ΔR ±1% +0.05Ω | <50mΩ | -55°C to +125°C or +155°C, 5 cycles |
| Bending Strength | ΔR ±1% +0.05Ω | ΔR ±2% +0.05Ω | <50mΩ | Bending amplitude 3mm (2mm for 2010 & 2512) One bend for 5 seconds |
| Resistance to Soldering Heat | ΔR ±0.5% +0.05Ω | ΔR ±1% +0.05Ω | <50mΩ | 260°C ±5°C for 10 seconds |
| Sulfur Test | ΔR ±0.5% +0.05Ω | ΔR ±0.5% +0.05Ω | <50mΩ | 1,000ppm H2S, +50°C ± 2°C, 91 ~ 93% RH for 1,000 hours (no power) |
| Leaching Test | Individual leaching are ≤ 5% Total leaching area ≤ 10% | | | +260°C for 30 seconds |

## ENVIRONMENTAL CHARACTERISTICS (AUTOMOTIVE GRADE PRODUCTS)

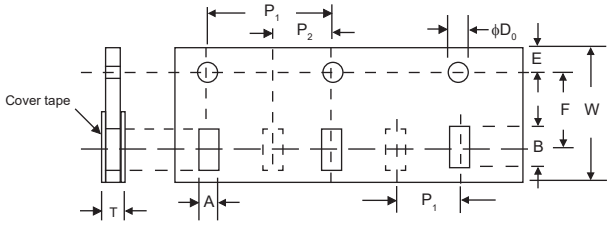
| Item | Specification | | | Test Method |
|---|---|---|---|---|
| | ±0.5% & ±1% tolerance | ±5% tolerance | Zero Ohm Jumper | |
| Temperature Coefficient of Resistance | As specified | | | JIS C5201-1 4.8, IEC 60115-1 4.8<br>-55°C ~ +125°C, +25°C reference temperature |
| Short Time Overload | ΔR ±1% +0.05Ω | ΔR ±2% +0.05Ω | <50mΩ | JIS C5201-1 4.13, IEC 60115-1 4.13<br>RCWV x 2.5 or Max Overloading Voltage whichever is less for 5 Seconds |
| Insulation Resistance | >10GΩ | | | JIS C5201-1 4.6, IEC 60115-1 4.6<br>Maximum Overload Voltage for 1 Minute |
| Load Life | ΔR ±2% +0.10Ω | ΔR ±3% +0.10Ω | <100mΩ | JIS C5201-1 4.25, IEC 60115-1 4.25.1, MIL-STD-202, Method 108<br>Rated WV, +70°C, 1.5 hours ON, 0.5 hours OFF<br>Total time 1,000 hours |
| Biased Humidity | ΔR ±2% +0.10Ω | ΔR ±3% +0.10Ω | <100mΩ | MIL-STD-202, Method 103<br>1000 hours, +85°C/85% RH 10% of operating power |
| High Temperature Exposure | ΔR ±1% +0.05Ω | ΔR ±1.5% +0.05Ω | <50mΩ | MIL-STD-202, Method 108<br>+155°C for 1000 hours |
| Temperature Cycling | ΔR ±0.5% +0.05Ω | ΔR ±1.5% +0.05Ω | <50mΩ | JESD22 Method JA-104<br>-55°C to +125°C, 1000 cycles |
| Bending Strength | ΔR ±1% +0.05Ω | ΔR ±1% +0.05Ω | <50mΩ | AEC-Q200-005<br>Bending amplitude 3mm (2mm for 2010 & 2512)<br>One bend for 60 seconds |
| Resistance to Solvents | No visible damage of appearance and marking | | | MIL-STD-202, Method 215<br>Add aquesous wash chemical (OKEM clean or equivalent). Do not use banned solvents |
| Terminal Strength | No broken terminals | | | AEC-Q200-006<br>Force of 1.8kg for 60 seconds |
| Solderability | >95% Coverage | | | JIS C5201-1 4.17, IEC 60115-1 4.17, J-STD-002<br>+245°C ±5°C for 3 seconds |
| Resistance to Soldering Heat | ΔR ±0.5% +0.05Ω | ΔR ±1% +0.05Ω | <50mΩ | MIL-STD-202, Method 210<br>260°C ±5°C for 10 seconds |
| Voltage Proof | No breakdown or flashover | | | JIS C5201-1 4.7, IEC 60115-1 4.7<br>1.42 times maximum operating voltage for 1 minute |
| Flammability | No ignition of the tissue paper or scorching of the pinewood board | | | UL-94<br>V-0 or V-1 are acceptable. Electrical test not required |
| Sulfur Test | ΔR ±0.5% | | <50mΩ | ASTM-B-809-95<br>H2S, +50°C ± 2°C, 91 ~ 93% RH<br>for 1,000 hours (no power) |
| Leaching Test | Individual leaching are ≤ 5%<br>Total leaching area ≤ 10% | | | JIS C5201-1 4.18, IEC 60068-2-58 8.2.1<br>+260°C for 30 seconds |
| Mechanical Shock | ΔR ±0.25% +0.05Ω | ΔR ±1.0% +0.05Ω | <50mΩ | MIL-STD-202, Method 213<br>Wave Form: Tolerance for half sine wave pulse.<br>Peak Value is 100g's. Normal duration (D) is 6. |
| Vibration | ΔR ±0.5% +0.05Ω | ΔR ±1.0% +0.05Ω | <50mΩ | MIL-STD-202, Method 204<br>5g's for 20 minutes, 12 cycles each of 3 orientations,<br>10 ~ 2000Hz |
| ESD | ΔR ±1.0% +0.05Ω | | <50mΩ | AEC-Q200-002<br>Human body, 2KV |

## STANDARD E-24, E-96 VALUES AND 0603 RESISTANCE CODES

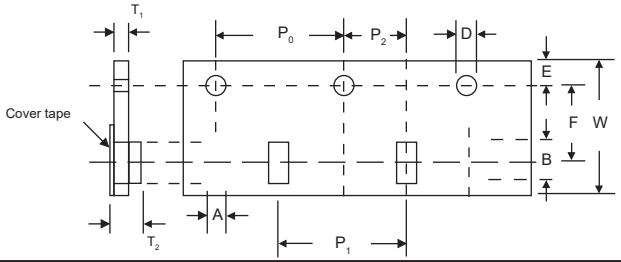
| E-24 | E-96 | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Value | Value | Code | Value | Code | Value | Code | Value | Code |
| 100 | 100 | 01 | 102 | 02 | 105 | 03 | 107 | 04 |
| 110 | 110 | 05 | 113 | 06 | 115 | 07 | 118 | 08 |
| 120 | 121 | 09 | 124 | 10 | 127 | 11 | 130 | 12 |
| 130 | 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 |

## PAPER CARRIER TAPE DIMENSIONS (mm)

| Type | EIA Case Size | A | B | W ± 0.20 | E ± 0.10 | F ± 0.05 | $P_0$ ± 0.10 | $P_1$ ± 0.05 | $P_2$ ± 0.05 | $\phi D_0$ $^{+0.1}/_{-0}$ | T |
|---|---|---|---|---|---|---|---|---|---|---|---|
| NRC-AS02 | 0201 | 0.38±0.05 | 0.68±0.05 | 8.0 | 1.75 | 3.50 | 4.00 | 2.00 | 2.00 | 1.50 | 0.42±0.20 |
| NRC-AS04 | 0402 | 0.65±0.10 | 1.15±0.10 | 8.0 | 1.75 | 3.50 | 4.00 | 2.00 | 2.00 | 1.50 | 0.45±0.10 |
| NRC-AS06 | 0603 | 1.10±0.10 | 1.90±0.10 | 8.0 | 1.75 | 3.50 | 4.00 | 4.00 | 2.00 | 1.50 | 0.70±0.10 |
| NRC-AS10 | 0805 | 1.60±0.10 | 2.40±0.20 | 8.0 | 1.75 | 3.50 | 4.00 | 4.00 | 2.00 | 1.50 | 0.85±0.10 |
| NRC-AS12 | 1206 | 1.90±0.10 | 3.50±0.20 | 8.0 | 1.75 | 3.50 | 4.00 | 4.00 | 2.00 | 1.50 | 0.85±0.10 |
| NRC-AS25 | 1210 | 2.90±0.10 | 3.50±0.20 | 8.0 | 1.75 | 3.50 | 4.00 | 4.00 | 2.00 | 1.50 | 0.85±0.10 |

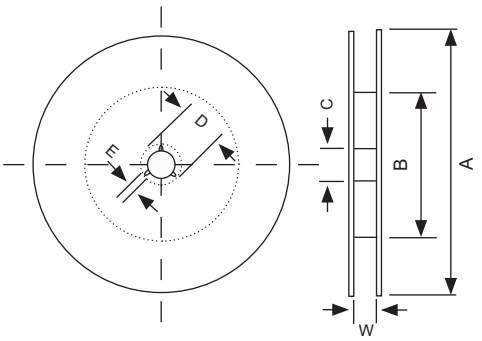



| Type | EIA Case Size | A | B | W ± 0.30 | E ± 0.10 | F ± 0.05 | $P_0$ ± 0.10 | $P_1$ ± 0.05 | $P_2$ ± 0.05 | $\phi D_0$ $^{+0.1}/_{-0}$ | T max. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| NRC-AS50 | 2010 | 2.8±0.10 | 5.5±0.10 | 12.0 | 1.75 | 5.50 | 4.00 | 4.00 | 2.00 | 1.50 | 1.2 |
| NRC-AS100 | 2512 | 3.5±0.10 | 6.7±0.10 | 12.0 | 1.75 | 5.50 | 4.00 | 4.00 | 2.00 | 1.50 | 1.2 |



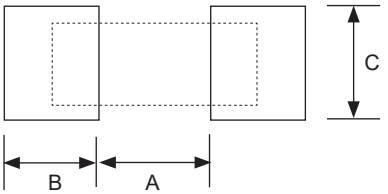
## REEL DIMENSIONS (mm)

| Type | EIA Case Size | Reel Quantity | Tape Width | Reel Diameter | ϕB | ϕC | W | T |
|---|---|---|---|---|---|---|---|---|
| NRC-AS02 | 0201 | 15,000 | 8mm | 178.5 ± 1.5 | 60.0 +1/-0 | 13.0 ±0.2 | 9.0 ±0.5 | 12.5 ±0.5 |
| NRC-AS04 | 0402 | 10,000 | | | | | | |
| NRC-AS06 | 0603 | 5,000 | | | 100 ±0.5 | | 9.5 ±0.5 | 13.5 ±0.5 |
| NRC-AS10 | 0805 | 5,000 | | | | | | |
| NRC-AS12 | 1206 | 5,000 | | | | | | |
| NRC-AS25 | 1210 | 5,000 | | | | | | |
| NRC-AS50 | 2010 | 4,000 | 12mm | | 60.0 +1/-0 | 13.0 ±0.5 | 13.0 ±0.5 | 15.5 ±0.5 |
| NRC-AS100 | 2512 | 4,000 | | | | | | |




## LAND PATTERN DIMENSIONS (mm)

| Type | EIA Case Size | A | B | C |
|---|---|---|---|---|
| NRC-AS02 | 0201 | 0.30 | 0.25 | 0.30 |
| NRC-AS04 | 0402 | 0.50 | 0.45 | 0.60 |
| NRC-AS06 | 0603 | 0.90 | 0.60 | 0.90 |
| NRC-AS10 | 0805 | 1.20 | 0.70 | 1.30 |
| NRC-AS12 | 1206 | 2.00 | 0.90 | 1.60 |
| NRC-AS25 | 1210 | 2.00 | 0.90 | 2.80 |
| NRC-AS50 | 2010 | 3.80 | 0.90 | 2.80 |
| NRC-AS100 | 2512 | 3.80 | 1.60 | 3.50 |




**Reflow Soldering Heat Profile and Limits**
→ www.niccomp.com/resource/files/resistive/NIC-ChipR-Reflow-Sept2020-Rev2.pdf
**Wave soldering?** – Please review your wave soldering process profile with NIC: tpmg@niccomp.com