

## Type RN73 Series

### Key Features

High precision -  
TCR 5ppm/°C and  
10ppm/°C

Tolerance down to 0.01%

Thin film (nichrome)

Terminal finish –  
electroplated 100% matte  
Sn



### Applications

Communications

Industrial Controls

Instrumentation

Medical

The RN73 series is a high stability precision chip resistor range offering various power dissipations relating to chip size, TCR's down to 5ppm/°C and resistance tolerances to 0.01%. The resistor is produced with three sputtered layers giving optimum performance. Values are restricted to the E96 and E24 value grids. The RN73 has accurate and uniform physical dimensions to facilitate placement.

### Electrical Characteristics

|                                  |     | 0402         |      |      |      |      |      | 0603         |      |      |      |      |      |
|----------------------------------|-----|--------------|------|------|------|------|------|--------------|------|------|------|------|------|
| Rated Power @ 70°C               |     | 0.063W       |      |      |      |      |      | 0.063W       |      |      |      |      |      |
| Resistance Range Ω               | Min | 49R9         | 49R9 | 49R9 | 49R9 | 49R9 | 49R9 | 24R9         | 24R9 | 24R9 | 4R7  | 24R9 | 4R7  |
|                                  | Max | 20K          | 20K  | 20K  | 20K  | 20K  | 100K | 60K          | 100K | 60K  | 332K | 60K  | 511K |
| Tolerance (%)                    |     | 0.01         |      | 0.05 |      | 0.1  |      | 0.01         |      | 0.05 |      | 0.1  |      |
| Code Letter                      |     | L            |      | A    |      | B    |      | L            |      | A    |      | B    |      |
| T.C.R. (PPM°C)                   |     | 5            | 10   | 5    | 10   | 5    | 10   | 5            | 10   | 5    | 10   | 5    | 10   |
| Code Letter                      |     | A            | C    | A    | C    | A    | C    | A            | C    | A    | C    | A    | C    |
| Selection Series                 |     | E24 & E96    |      |      |      |      |      | E24 & E96    |      |      |      |      |      |
| Max operating Voltage            |     | 25V          |      |      |      |      |      | 50V          |      |      |      |      |      |
| Max. Overload voltage            |     | 50V          |      |      |      |      |      | 100V         |      |      |      |      |      |
| Operating Temp. range            |     | -55 ~ +155°C |      |      |      |      |      | -55 ~ +155°C |      |      |      |      |      |
| Insulation Resistance (dry min.) |     | >9999MΩ      |      |      |      |      |      | >9999MΩ      |      |      |      |      |      |
| Stability                        |     | 0.5%         |      |      |      |      |      | 0.5%         |      |      |      |      |      |

|                                  |     | 0805         |      |      |     |      |     | 1206         |      |      |     |      |     |
|----------------------------------|-----|--------------|------|------|-----|------|-----|--------------|------|------|-----|------|-----|
| Rated Power @ 70°C               |     | 0.1W         |      |      |     |      |     | 0.125W       |      |      |     |      |     |
| Resistance                       | Min | 24R9         | 24R9 | 24R9 | 4R7 | 24R9 | 4R7 | 24R9         | 24R9 | 24R9 | 4R7 | 24R9 | 4R7 |
| Range Ω                          | Max | 150K         | 200K | 150K | 1M0 | 150K | 1M0 | 300K         | 499K | 300K | 1M5 | 300K | 1M5 |
| Tolerance (%)                    |     | 0.01         |      | 0.05 |     | 0.1  |     | 0.01         |      | 0.05 |     | 0.1  |     |
| Code Letter                      |     | L            |      | A    |     | B    |     | L            |      | A    |     | B    |     |
| T.C.R. (PPM°C)                   |     | 5            | 10   | 5    | 10  | 5    | 10  | 5            | 10   | 5    | 10  | 5    | 10  |
| Code Letter                      |     | A            | C    | A    | C   | A    | C   | A            | C    | A    | C   | A    | C   |
| Selection Series                 |     | E24 & E96    |      |      |     |      |     | E24 & E96    |      |      |     |      |     |
| Max operating Voltage            |     | 100V         |      |      |     |      |     | 150V         |      |      |     |      |     |
| Max. Overload voltage            |     | 200V         |      |      |     |      |     | 300V         |      |      |     |      |     |
| Operating Temp. range            |     | -55 ~ +155°C |      |      |     |      |     | -55 ~ +155°C |      |      |     |      |     |
| Insulation Resistance (dry min.) |     | >9999MΩ      |      |      |     |      |     | >9999MΩ      |      |      |     |      |     |
| Stability                        |     | 0.5%         |      |      |     |      |     | 0.5%         |      |      |     |      |     |

|                                  |     | 1210         |      |      |     |      |     | 2010         |      |      |     |      |     |
|----------------------------------|-----|--------------|------|------|-----|------|-----|--------------|------|------|-----|------|-----|
| Rated Power @ 70°C               |     | 0.25W        |      |      |     |      |     | 0.25W        |      |      |     |      |     |
| Resistance                       | Min | 24R9         | 24R9 | 24R9 | 4R7 | 24R9 | 4R7 | 24R9         | 24R9 | 24R9 | 4R7 | 24R9 | 4R7 |
| Range Ω                          | Max | 300K         | 499K | 300K | 1M0 | 300K | 1M0 | 300K         | 499K | 300K | 1M0 | 300K | 1M0 |
| Tolerance (%)                    |     | 0.01         |      | 0.05 |     | 0.1  |     | 0.01         |      | 0.05 |     | 0.1  |     |
| Code Letter                      |     | L            |      | A    |     | B    |     | L            |      | A    |     | B    |     |
| T.C.R. (PPM°C)                   |     | 5            | 10   | 5    | 10  | 5    | 10  | 5            | 10   | 5    | 10  | 5    | 10  |
| Code Letter                      |     | A            | C    | A    | C   | A    | C   | A            | C    | A    | C   | A    | C   |
| Selection Series                 |     | E24 & E96    |      |      |     |      |     | E24 & E96    |      |      |     |      |     |
| Max operating Voltage            |     | 150V         |      |      |     |      |     | 150V         |      |      |     |      |     |
| Max. Overload voltage            |     | 300V         |      |      |     |      |     | 300V         |      |      |     |      |     |
| Operating Temp. range            |     | -55 ~ +155°C |      |      |     |      |     | -55 ~ +155°C |      |      |     |      |     |
| Insulation Resistance (dry min.) |     | >9999MΩ      |      |      |     |      |     | >9999MΩ      |      |      |     |      |     |
| Stability                        |     | 0.5%         |      |      |     |      |     | 0.5%         |      |      |     |      |     |

|                                  |     | 2512         |      |      |     |      |     |
|----------------------------------|-----|--------------|------|------|-----|------|-----|
| Rated Power @ 70°C               |     | 0.5W         |      |      |     |      |     |
| Resistance                       | Min | 24R9         | 24R9 | 24R9 | 4R7 | 24R9 | 4R7 |
| Range Ω                          | Max | 300K         | 499K | 300K | 1M0 | 300K | 1M0 |
| Tolerance (%)                    |     | 0.01         |      | 0.05 |     | 0.1  |     |
| Code Letter                      |     | L            |      | A    |     | B    |     |
| T.C.R. (PPM°C)                   |     | 5            | 10   | 5    | 10  | 5    | 10  |
| Code Letter                      |     | A            | C    | A    | C   | A    | C   |
| Selection Series                 |     | E24 & E96    |      |      |     |      |     |
| Max operating Voltage            |     | 150V         |      |      |     |      |     |
| Max. Overload voltage            |     | 300V         |      |      |     |      |     |
| Operating Temp. range            |     | -55 ~ +155°C |      |      |     |      |     |
| Insulation Resistance (dry min.) |     | >9999MΩ      |      |      |     |      |     |
| Stability                        |     | 0.5%         |      |      |     |      |     |

Operating Voltage= $\sqrt{P \cdot R}$  or Max. operating voltage listed above, whichever is lower.

Overload Voltage= $2.5 \cdot \sqrt{P \cdot R}$  or Max. overload voltage listed above, whichever is lower.

## Environmental Characteristics

| Item                                        | Requirement                                                |             | Test Method                                                                                             |
|---------------------------------------------|------------------------------------------------------------|-------------|---------------------------------------------------------------------------------------------------------|
|                                             | Tol. ≤0.05%                                                | TOL. >0.05% |                                                                                                         |
| Temperature Coefficient of Resistance (TCR) | As per TCRs specified in Electrical Characteristics tables |             | MIL-STD-202 Method 304<br>+25/-55/+25/+125/+25°C                                                        |
| Short Time Overload                         | ΔR±0.05%                                                   | ΔR±0.2%     | JIS-C-5201-1 5.5<br>RCWV*2.5 or Max. overload voltage<br>whichever is lower for 5 seconds               |
| Insulation Resistance                       | >9999MΩ                                                    |             | MIL-STD-202 Method 302<br>Apply 100VDC for 1 minute                                                     |
| Endurance                                   | ΔR±0.05%                                                   | ΔR±0.2%     | MIL-STD-202 Method 108A<br>70±2°C, RCWV for 1000 hrs with 1.5 hrs<br>“ON” and 0.5 hrs “OFF”             |
|                                             | >7kΩ ΔR±0.5%                                               |             |                                                                                                         |
| Damp Heat with Load                         | ΔR±0.05%                                                   | ΔR±0.3%     | MIL-STD-202 Method 103B<br>40±2°C, 90~95% R.H. RCWV for 1000 hrs<br>with 1.5 hrs “ON” and 0.5 hrs “OFF” |
| Bending Strength                            | ΔR±0.05%                                                   | ΔR±0.1%     | JIS-C-5201-1 6.1.4<br>Bending amplitude 3 mm for 10 seconds                                             |
| Solderability                               | 95% min. coverage                                          |             | MIL-STD-202 Method 208H<br>245±5°C for 3 seconds                                                        |
| Resistance to Soldering Heat                | ΔR±0.05%                                                   | ΔR±0.2%     | MIL-STD-202 Method 210E<br>260±5°C for 10 seconds                                                       |
| Dielectric Withstand Voltage                | By Type                                                    |             | MIL-STD-202 Method 301<br>Max. overload voltage for 1 minute                                            |
| Thermal Shock                               | ΔR±0.05%                                                   | ΔR±0.25%    | MIL-STD-202 Method 107G<br>-55°C ~150°C, 100 cycles                                                     |
| Low Temperature Operation                   | ΔR±0.05%                                                   | ΔR±0.2%     | JIS-C-5201-1 7.1<br>1 hour, -65°C, followed by 45 minutes of<br>RCWV                                    |
| High Temperature Exposure                   | ΔR±0.5%                                                    |             | MIL-STD-202 Method 108<br>At 155°C for 1000 hours                                                       |

Storage Temperature: 25 $\pm$ 3°C; Humidity < 80%RH

## Derating Curve



For resistors operated in ambient temperatures above 70°C, power rating must be derated in accordance with this curve

## Construction and dimensions



|   |                       |   |                         |   |                       |
|---|-----------------------|---|-------------------------|---|-----------------------|
| ① | Alumina Substrate     | ④ | Edge Electrode (NiCr)   | ⑦ | Resistor Layer (NiCr) |
| ② | Bottom Electrode (Ag) | ⑤ | Barrier Layer (Ni)      | ⑧ | Overcoat (Epoxy)      |
| ③ | Top Electrode ( Ag)   | ⑥ | External Electrode (Sn) | ⑨ | Marking               |

| Size | L (mm)    | W (mm)    | T (mm)    | D1 (mm)   | D2 (mm)   | Weight (g)<br>(1000 Pcs.) |
|------|-----------|-----------|-----------|-----------|-----------|---------------------------|
| 0402 | 1.00±0.05 | 0.50±0.05 | 0.30±0.05 | 0.20±0.10 | 0.20±0.10 | 0.54                      |
| 0603 | 1.55±0.10 | 0.80±0.10 | 0.45±0.10 | 0.30±0.20 | 0.30±0.20 | 1.83                      |
| 0805 | 2.00±0.15 | 1.25±0.15 | 0.55±0.10 | 0.30±0.20 | 0.40±0.20 | 4.71                      |
| 1206 | 3.05±0.15 | 1.55±0.15 | 0.55±0.10 | 0.42±0.20 | 0.35±0.25 | 9.02                      |
| 1210 | 3.10±0.15 | 2.40±0.15 | 0.55±0.10 | 0.40±0.20 | 0.55±0.25 | 10                        |
| 2010 | 4.90±0.15 | 2.40±0.15 | 0.55±0.10 | 0.60±0.30 | 0.50±0.25 | 23.61                     |
| 2512 | 6.30±0.15 | 3.10±0.15 | 0.55±0.10 | 0.60±0.30 | 0.50±0.25 | 38.06                     |

## Suggested PCB Layout Plan



| Recommended Land Pattern |      |      |          |
|--------------------------|------|------|----------|
| Size                     | A    | B    | C        |
| 0402                     | 0.50 | 0.50 | 0.60±0.2 |
| 0603                     | 0.80 | 1.00 | 0.90±0.2 |
| 0805                     | 1.00 | 1.00 | 1.35±0.2 |
| 1206                     | 2.00 | 1.15 | 1.70±0.2 |
| 1210                     | 2.00 | 1.15 | 2.50±0.2 |
| 2010                     | 3.60 | 1.40 | 2.50±0.2 |
| 2512                     | 4.90 | 1.60 | 3.10±0.2 |

## Marking

Case sizes 0805 to 2512 IEC 4 Digit Marking:

|            |             |             |            |              |              |
|------------|-------------|-------------|------------|--------------|--------------|
| Resistance | 100R (100Ω) | 2K2 (2.2kΩ) | 10K (10kΩ) | 499K (499kΩ) | 100K (100kΩ) |
| Code       | 1000        | 2201        | 1002       | 4992         | 1003         |

Case Size 0603 E24 3 digit marking – Example 101 = 100R 102=1K0

|     |    |    |    |    |    |    |    |    |    |    |    |    |
|-----|----|----|----|----|----|----|----|----|----|----|----|----|
| E24 | 10 | 11 | 12 | 13 | 15 | 16 | 18 | 20 | 22 | 24 | 27 | 30 |
|     | 33 | 36 | 39 | 43 | 47 | 51 | 56 | 62 | 68 | 75 | 82 | 91 |

Case size 0603 E96 3 digit marking – Examples 14C = 13K7 68B = 4K99 68X = 49R9

| Code | E96 | Code | E96 | Code | E96 | Code | E96 |
|------|-----|------|-----|------|-----|------|-----|
| 01   | 100 | 25   | 178 | 49   | 316 | 73   | 562 |
| 02   | 102 | 26   | 182 | 50   | 324 | 74   | 576 |
| 03   | 105 | 27   | 187 | 51   | 332 | 75   | 590 |
| 04   | 107 | 28   | 191 | 52   | 340 | 76   | 604 |
| 05   | 110 | 29   | 196 | 53   | 348 | 77   | 619 |
| 06   | 113 | 30   | 200 | 54   | 357 | 78   | 634 |
| 07   | 115 | 31   | 205 | 55   | 365 | 79   | 649 |
| 08   | 118 | 32   | 210 | 56   | 374 | 80   | 665 |
| 09   | 121 | 33   | 215 | 57   | 383 | 81   | 681 |
| 10   | 124 | 34   | 221 | 58   | 392 | 82   | 698 |
| 11   | 127 | 35   | 226 | 59   | 402 | 83   | 715 |
| 12   | 130 | 36   | 232 | 60   | 412 | 84   | 732 |
| 13   | 133 | 37   | 237 | 61   | 422 | 85   | 750 |
| 14   | 137 | 38   | 243 | 62   | 432 | 86   | 768 |
| 15   | 140 | 39   | 249 | 63   | 442 | 87   | 787 |
| 16   | 143 | 40   | 255 | 64   | 453 | 88   | 806 |
| 17   | 147 | 41   | 261 | 65   | 464 | 89   | 825 |
| 18   | 150 | 42   | 267 | 66   | 475 | 90   | 845 |
| 19   | 154 | 43   | 274 | 67   | 487 | 91   | 866 |
| 20   | 158 | 44   | 280 | 68   | 499 | 92   | 887 |
| 21   | 162 | 45   | 287 | 69   | 511 | 93   | 909 |
| 22   | 165 | 46   | 294 | 70   | 523 | 94   | 931 |
| 23   | 169 | 47   | 301 | 71   | 536 | 95   | 953 |
| 24   | 174 | 48   | 309 | 72   | 549 | 96   | 976 |

| Code       | A               | B               | C               | 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> |

NB For case size 0603 values other than E24 and E96 resistors will be supplied unmarked.

All resistors smaller than 0603 supplied unmarked.

## Packaging

### Packing Quantity and Reel Specification



| Size | ØA ±1.0 | ØB ±1.0 | ØC ±0.7 | W ±1.0 | T ±1.0 | Paper Tape  | Embossed Plastic Tape |
|------|---------|---------|---------|--------|--------|-------------|-----------------------|
| 0402 | 178.0   | 60.0    | 13.5    | 9.5    | 11.5   | 1000 / 5000 | N/A                   |
| 0603 |         |         |         |        |        |             |                       |
| 0805 |         |         |         |        |        |             |                       |
| 1206 |         |         |         |        |        |             |                       |
| 1210 |         |         |         |        |        |             |                       |
| 2010 |         |         |         | 13.5   | 15.5   | N/A         | 4000                  |
| 2512 |         |         |         |        |        |             |                       |

### Paper tape Specification



| Size | A ±0.05 | B ±0.05 | W<br>±0.10 | E<br>±0.05 | F ±0.05 | P <sub>0</sub> | P <sub>1</sub> | P <sub>2</sub> ±0.05 | ØD <sub>0</sub> | T             |
|------|---------|---------|------------|------------|---------|----------------|----------------|----------------------|-----------------|---------------|
| 0402 | 0.70    | 1.16    | 8.00       | 1.75       | 3.5     | 4.00 ±0.10     | 2.00<br>±0.05  | 2.00                 | 1.55 ±0.05      | 0.40<br>±0.03 |
| 0603 | 1.10    | 1.90    |            |            |         |                | 4.00<br>±0.10  |                      |                 | 0.60<br>±0.03 |
| 0805 | 1.60    | 2.37    |            |            |         |                |                |                      |                 |               |
| 1206 | 2.00    | 3.55    |            |            |         | 4.00<br>±0.10  | 0.75<br>±0.05  |                      |                 |               |
| 1210 | 2.75    | 3.40    |            |            |         |                |                |                      |                 |               |

### Peel force of top cover tape

The peel speed shall be about 300mm/min $\pm$ 5%

The peel force of top cover tape shall be between 8gf to 60gf



### Embossed Plastic Tape Specifications



| Type | A               | B               | W               | E               | F              | P <sub>0</sub>  | P <sub>1</sub>  | P <sub>2</sub>  | ØD <sub>0</sub> | T               |
|------|-----------------|-----------------|-----------------|-----------------|----------------|-----------------|-----------------|-----------------|-----------------|-----------------|
| 2010 | 2.85 $\pm$ 0.10 | 5.45 $\pm$ 0.10 | 12.0 $\pm$ 0.10 | 1.75 $\pm$ 0.10 | 5.5 $\pm$ 0.05 | 4.00 $\pm$ 0.05 | 4.00 $\pm$ 0.10 | 2.00 $\pm$ 0.05 | 1.50 $\pm$ 0.10 | 1.00 $\pm$ 0.20 |
| 2512 | 3.40 $\pm$ 0.10 | 6.65 $\pm$ 0.10 | 12.0 $\pm$ 0.10 | 1.75 $\pm$ 0.10 | 5.5 $\pm$ 0.05 | 4.00 $\pm$ 0.05 | 4.00 $\pm$ 0.10 | 2.00 $\pm$ 0.05 | 1.50 $\pm$ 0.10 | 1.00 $\pm$ 0.20 |

### Peel force of top cover tape

The peel speed shall be about 300mm/min $\pm$ 5%

The peel force of top cover tape shall be between 20gf to 80g



## Reflow Solder Profile



Time of Reflow soldering at maximum temperature point 260°C = 10s

## Wave Solder Profile



Time of Wave soldering at maximum temperature point 260°C = 10s

Time of Soldering Iron at maximum temperature point 410°C = 5s

## How To Order

| RN73                            | C                                                                                       | 2A                                                                                      | 100R                                                                                      | B                                                               | TD                                                                                                                                                                           |
|---------------------------------|-----------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------|-----------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Common Part                     | TCR                                                                                     | Package Size                                                                            | Value                                                                                     | Tolerance                                                       | Packaging                                                                                                                                                                    |
| RN73 - High Precision Resistors | A - $\pm 5ppm/^{\circ}C$<br><br>*C - $\pm 10ppm/^{\circ}C$<br><br>*preferred stock item | 1E - 0402<br>1J - 0603<br>2A - 0805<br>2B - 1206<br>2E - 1210<br>2H - 2010<br>3A - 2512 | 100R<br>(100 $\Omega$ )<br><br>1K0<br>(1000 $\Omega$ )<br><br>100K<br>(100,000 $\Omega$ ) | L - $\pm 0.01\%$<br><br>A - $\pm 0.05\%$<br><br>B - $\pm 0.1\%$ | TG - 250 cut tape length<br>(1E, 1J, 2A, 2B)<br><br>TDF - 1000 reel<br>(1E, 1J, 2A, 2B)<br><br>TD - 5000 reel<br>(1E, 1J, 2A, 2B, 2E)<br><br>TE - 4000 reel<br>(2H, 3A only) |

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