

## FEATURES

- PRECISE TOLERANCE AND TEMPERATURE COEFFICIENT
- EIA STANDARD CASE SIZES (0201 ~ 2512)
- LOW NOISE, THIN FILM (NiCr) CONSTRUCTION
- REFLOW SOLDERABLE (Pb FREE TERMINATION FINISH)

**RoHS**  
**Compliant**  
includes all homogeneous materials

\*See Part Number System for Details



| 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 Values |
|-------|----------|----------------------|------------------------|-------------------------|-------------------------------------------|----------------------------------|----------------------|-------------------|
| NTR02 | 0201     | 1/20 (0.050)W        | 15V                    | 30V                     | ±0.5% (D)                                 | ± 25, ±50                        | 49.9 ~ 4.99KΩ        | E - 24            |
|       |          |                      |                        |                         | ±1.0% (F)                                 | ± 50                             | 49.9 ~ 33KΩ          |                   |
| NTR04 | 0402     | 1/16 (0.063)W        | 25V                    | 50V                     | ±0.01% (T), ±0.05% (A), ±0.1% (B)         | ±5                               | 49.9 ~ 4.99KΩ        | E-24 & E-96       |
|       |          |                      |                        |                         |                                           | ±10                              | 49.9 ~ 12KΩ          |                   |
|       |          |                      |                        |                         | ±0.01% (T), ±0.05% (A)                    | ±15                              | 49.9 ~ 12KΩ          |                   |
|       |          |                      |                        |                         | ±0.1% (B)                                 | ±15                              | 49.9 ~ 69.8KΩ        |                   |
|       |          |                      |                        |                         | ±0.1% (B), ±0.25% (C), ±0.5% (D), ±1% (F) | ±25                              | 10 ~ 205KΩ           |                   |
|       |          |                      |                        |                         | ±0.1% (B), ±0.25% (C)                     | ±50                              | 10 ~ 205KΩ           |                   |
| NTR06 | 0603     | 1/16 (0.063)W        | 50V                    | 100V                    | ±0.5% (D), ±1% (F)                        | ±50                              | 1.0 ~ 205KΩ          |                   |
|       |          |                      |                        |                         | ±0.01% (T), ±0.05% (A), ±0.1% (B)         | ±5                               | 24.9 ~ 15KΩ          |                   |
|       |          |                      |                        |                         | ±0.01% (T)                                | ±10, ±15                         | 24.9 ~ 100KΩ         |                   |
|       |          |                      |                        |                         | ±0.05% (A), ±0.1% (B)                     | ±10, ±15                         | 4.7 ~ 332KΩ          |                   |
|       |          |                      |                        |                         | ±0.05% (A)                                | ±25, ±50                         | 4.7 ~ 332KΩ          |                   |
|       |          |                      |                        |                         | ±0.1% (B)                                 | ±25, ±50                         | 4.7 ~ 1MΩ            |                   |
| NTR10 | 0805     | 1/10 (0.10) W        | 100V                   | 200V                    | ±0.25 (C), ±0.5 (D), ±1% (F)              | ±25, ±50                         | 2.0 ~ 1MΩ            |                   |
|       |          |                      |                        |                         | ±0.01% (T), ±0.05% (A), ±0.1% (B)         | ±5                               | 24.9 ~ 30KΩ          |                   |
|       |          |                      |                        |                         | ±0.01% (T)                                | ±10, ±15                         | 24.9 ~ 200KΩ         |                   |
|       |          |                      |                        |                         | ±0.05% (A), ±0.1% (B)                     | ±10, ±15                         | 4.7 ~ 511KΩ          |                   |
|       |          |                      |                        |                         | ±0.05 (A)                                 | ±25, ±50                         | 4.7 ~ 511KΩ          |                   |
|       |          |                      |                        |                         | ±0.1% (B)                                 | ±25, ±50                         | 4.7 ~ 2MΩ            |                   |
| NTR12 | 1206     | 1/8 (0.125) W        | 150V                   | 300V                    | ±0.25 (C), ±0.5 (D), ±1% (F)              | ±25, ±50                         | 1.0 ~ 2MΩ            |                   |
|       |          |                      |                        |                         | ±0.01% (T), ±0.05% (A), ±0.1% (B)         | ±5                               | 24.9 ~ 49.9KΩ        |                   |
|       |          |                      |                        |                         | ±0.01% (T)                                | ±10, ±15                         | 24.9 ~ 499KΩ         |                   |
|       |          |                      |                        |                         | ±0.05% (A), ±0.1% (B)                     | ±10, ±15                         | 4.7 ~ 1MΩ            |                   |
|       |          |                      |                        |                         | ±0.05% (A)                                | ±25, ±50                         | 4.7 ~ 1MΩ            |                   |
|       |          |                      |                        |                         | ±0.1% (B)                                 | ±25, ±50                         | 4.7 ~ 2.49MΩ         |                   |
| NTR_  | 1210     | 1/5 (0.20) W         | 150V                   | 300V                    | ±0.25% (C), ±0.5% (D), ±1% (F)            | ±25, ±50                         | 1.0 ~ 2.49MΩ         |                   |
|       |          |                      |                        |                         | ±0.01% (T), ±0.05% (A), ±0.1% (B)         | ±5                               | 24.9 ~ 49.9KΩ        |                   |
|       |          |                      |                        |                         | ±0.01% (T)                                | ±10, ±15                         | 24.9 ~ 499KΩ         |                   |
|       |          |                      |                        |                         | ±0.05% (A), ±0.1% (B)                     | ±10, ±15                         | 4.7 ~ 1MΩ            |                   |
|       |          |                      |                        |                         | ±0.05% (A)                                | ±25, ±50                         | 4.7 ~ 1MΩ            |                   |
|       |          |                      |                        |                         | ±0.1% (B)                                 | ±25, ±50                         | 4.7 ~ 2.49MΩ         |                   |
| NTR25 | 2010     | 1/4 (0.25) W         | 150V                   | 300V                    | ±0.25% (C), ±0.5% (D), ±1% (F)            | ±25, ±50                         | 1.0 ~ 2.49MΩ         |                   |
|       |          |                      |                        |                         | ±0.01% (T), ±0.05% (A), ±0.1% (B)         | ±5                               | 24.9 ~ 100KΩ         |                   |
|       |          |                      |                        |                         | ±0.01% (T)                                | ±10, ±15                         | 24.9 ~ 499KΩ         |                   |
|       |          |                      |                        |                         | ±0.05% (A), ±0.1% (B)                     | ±10, ±15                         | 4.7 ~ 1MΩ            |                   |
|       |          |                      |                        |                         | ±0.05% (A)                                | ±25, ±50                         | 4.7 ~ 1MΩ            |                   |
|       |          |                      |                        |                         | ±0.1% (B)                                 | ±25, ±50                         | 4.7 ~ 3MΩ            |                   |
| NTR50 | 2512     | 1/2 (0.50) W         | 150V                   | 300V                    | ±0.25% (C), ±0.5% (D), ±1% (F)            | ±25, ±50                         | 1.0 ~ 3MΩ            |                   |
|       |          |                      |                        |                         | ±0.01% (T), ±0.05% (A),                   | ±5                               | 24.9 ~ 100KΩ         |                   |
|       |          |                      |                        |                         | ±0.01% (T)                                | ±10, ±15                         | 24.9 ~ 499KΩ         |                   |
|       |          |                      |                        |                         | ±0.05% (A), ±0.1% (B)                     | ±10, ±15                         | 4.7 ~ 1MΩ            |                   |
|       |          |                      |                        |                         | ±0.05% (A)                                | ±25, ±50                         | 4.7 ~ 1MΩ            |                   |
|       |          |                      |                        |                         | ±0.05 (A)                                 | ±25, ±50                         | 4.7 ~ 1MΩ            |                   |
|       |          |                      |                        |                         | ±0.1% (B)                                 | ±25, ±50                         | 4.7 ~ 3MΩ            |                   |
|       |          |                      |                        |                         | ±0.25% (C), ±0.5% (D), ±1% (F)            | ±25, ±50                         | 1.0 ~ 3MΩ            |                   |

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 Overload Voltage for all resistors is the lower of the two values:  
"Maximum Overload Voltage" as specified above  
or

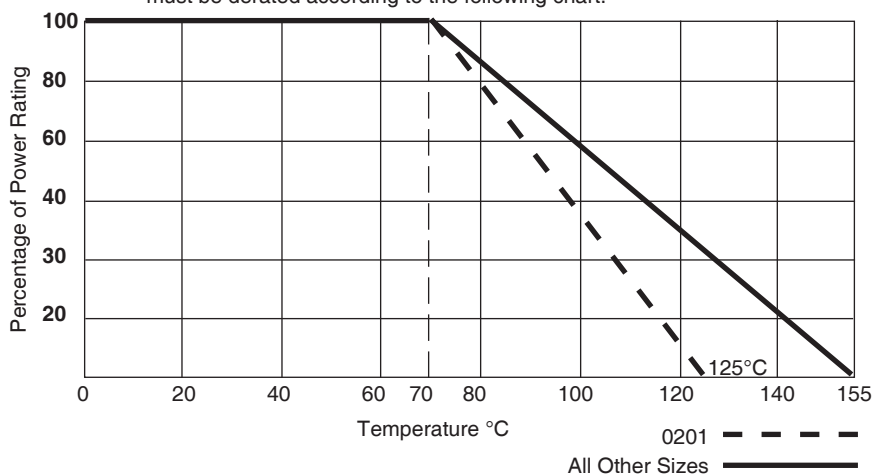
$$2 \times \sqrt{\text{Power rating (Watts)} \times \text{Resistance (Ohms)}}$$



## TYPICAL NOISE CHARACTERISTICS

| Resistance Value ( $\Omega$ ) | Case Size |        |        |
|-------------------------------|-----------|--------|--------|
|                               | 0603      | 0805   | 1206   |
| 1 ~ 9                         | -95dB     | -95dB  | -95dB  |
| 10 ~ 49                       | -85dB     | -85dB  | -85dB  |
| 50 ~ 99                       | -85dB     | -85dB  | -85dB  |
| 100 ~ 4.99K                   | -100dB    | -100dB | -105dB |
| 5K ~ 19.9K                    | -100dB    | -100dB | -100dB |
| 20K ~ 1M                      | -90dB     | -100dB | -100dB |

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



## ENVIRONMENTAL CHARACTERISTICS

| Item                                                                    | Specification        |                 | Typical      |         |         | Test Method*                                                                                                        |
|-------------------------------------------------------------------------|----------------------|-----------------|--------------|---------|---------|---------------------------------------------------------------------------------------------------------------------|
|                                                                         | Tol.<br>≤ 0.05%      | Tol.<br>> 0.05% | Tol. > 0.05% |         |         |                                                                                                                     |
|                                                                         |                      |                 | 0402         | 0603    | 0805    |                                                                                                                     |
| Standard Temperature Range: -55°C ~ +155°C (power derating above +70°C) |                      |                 |              |         |         |                                                                                                                     |
| Temperature Coefficient of Resistance                                   | As specified         | As specified    | -            | -       | -       | +25/-55/+25/+125/+25                                                                                                |
| Short Time Overload                                                     | ΔR ±0.05%            | ΔR ±0.2%        | -0.001%      | -0.002% | -0.005% | RCWV x 2.5 or Max Overloading Voltage for 5 Seconds                                                                 |
| Dielectric Withstanding Voltage                                         | As specified         |                 | 265V         | 298V    | 415V    | MIL-STD-202F Method 301<br>Apply Max. Overload Voltage for 1 minute                                                 |
| Insulation Resistance                                                   | >1000MΩ              |                 | >10GΩ        |         |         | MIL-STD-202F Method 302<br>Apply 100Vdc for 1 minute                                                                |
| Thermal Shock (N/A 0201 Size)                                           | ΔR ±0.05%            | ΔR ±0.25%       | 0.001%       | -0.02%  | 0.002%  | MIL-STD-202F Method 107G<br>-55°C ~ +150°C, 100 cycles                                                              |
| Load Life                                                               | ΔR ±0.05%            | ΔR ±0.2%        | no change    |         |         | MIL-STD-202F Method 108A<br>RCWV +70°C, 1.5 hours ON, 0.5 hours OFF<br>Total time 1,000 ~ 1,048 hours               |
|                                                                         | >7KΩ ΔR ±0.5%        |                 | 0.02%        | 0.03%   | 0.06%   |                                                                                                                     |
| Humidity (Steady State)                                                 | ΔR ±0.05%            | ΔR ±0.3%        | 0.003%       | 0.005%  | 0.007%  | MIL-STD-202F Method 103B<br>+40°C, 90% ~ 95% RH, RCWV 1.5 hours ON, 0.5 hours OFF<br>Total time 1,000 ~ 1,048 hours |
| Resistance to Dry Heat (N/A 0201 Size)                                  | ΔR ±0.05%            | ΔR ±0.5%        | 0.07%        | 0.02%   | 0.025%  | MIL-STD-202 Method 108<br>+125°C, 1000 hours                                                                        |
| Low Temperature Operation (N/A 0201 Size)                               | ΔR ±0.05%            | ΔR ±0.2%        | 0.006%       | 0.008%  | 0.001%  | JIS-C-502-7.1<br>1 hour @ -65°C followed by 45 minutes of RCWV                                                      |
| Bending Strength                                                        | ΔR ±0.05%            | ΔR ±0.2%        | 0.001%       | -0.010% | 0.002%  | JIS-C-5202-6.1.4<br>Bending Amplitude 3mm for 10 seconds                                                            |
| Solderability                                                           | 95% Minimum Coverage |                 | >95%         |         |         | MIL-STD-202F Method 208H<br>245°C ±5°C, 5 ±0.5 seconds                                                              |
| Resistance to Soldering Heat                                            | ΔR ±0.05%            | ΔR ±0.2%        | 0.001%       | -0.02%  | 0.006%  | MIL-STD-202F Method 210E<br>260°C ±5°C for 10 ±1 seconds                                                            |

\*0201 testing per IEC 60115 - 1



## 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   |

## MULTIPLIER CODE

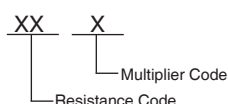
| Code       | A               | B, b            | C               | D, d            | E               | F               | G               | H               | X                | Y                | Z                |
|------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|------------------|------------------|------------------|
| 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> |

1. No marking on 0402 case size.

2. Marking for 0603 case size:

E-24 values and E-96 Series - ± 1% (F), ± 0.5% (D), ± 0.25% (C), ± 0.1% (B) tolerances

## CODING FORMULA

Example:  $10.2k\Omega = \frac{102}{02} \times 10^2 \Omega = 02C$  $33.2 \Omega = \frac{332}{51} \times 10^{-1} = 51X$ 

## MARKING EXAMPLES

10Ω = 01X  
 7.5k Ω = 85B  
 150k Ω = 18D  
 1 MegΩ = 01E

3. Marking for 0805, 1206, 2010 and 2512 case sizes:

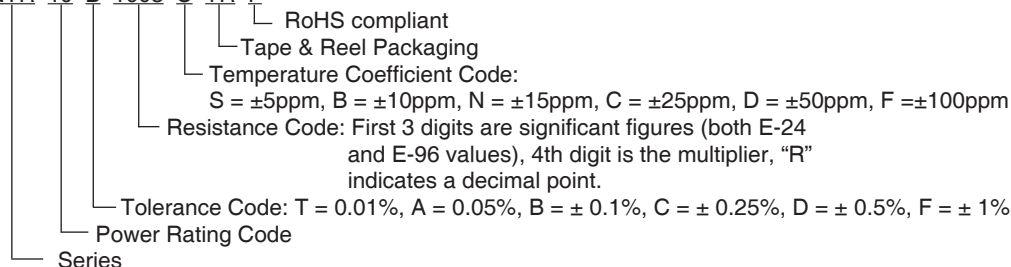
E-24 and E-96 series - ±1%(F), ±0.5% (D), ±0.25%(C), ±0.1% (B) tolerances

4 DIGIT MARKING SYSTEM - First 3 digits are the significant figures, the 4th digit is the multiplier. "R"= decimal point.

Examples: 0R10 = 0.10 ohms, 1R00 = 1.0 ohms, 22R1=22.1 ohms, 3320= 332 ohms, 4751=4.75K ohms,  
 1132=11.3K ohms, 6493=649K ohms

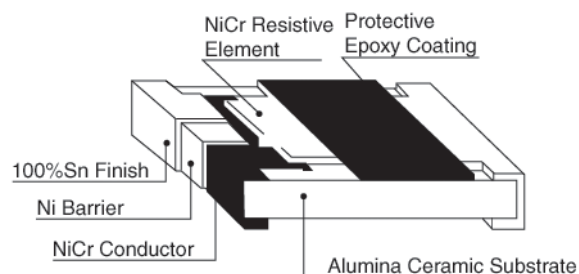
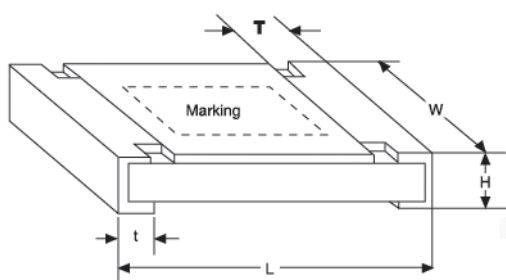
## PART NUMBER SYSTEM

NTR 10 B 1003 C TR F



## DIMENSIONS (mm)

| Type  | Power Rating | EIA Size | L               | W               | H               | T               | t               |
|-------|--------------|----------|-----------------|-----------------|-----------------|-----------------|-----------------|
| NTR02 | 1/20W        | 0201     | $0.58 \pm 0.05$ | $0.29 \pm 0.05$ | $0.23 \pm 0.03$ | $0.12 \pm 0.05$ | $0.15 \pm 0.05$ |
| NTR04 | 1/16W        | 0402     | $1.0 \pm 0.05$  | $0.5 \pm 0.05$  | $0.30 \pm 0.05$ | $0.2 \pm 0.10$  | $0.20 \pm 0.10$ |
| NTR06 | 1/16W        | 0603     | $1.55 \pm 0.10$ | $0.8 \pm 0.10$  | $0.45 \pm 0.10$ | $0.3 \pm 0.20$  | $0.30 \pm 0.20$ |
| NTR10 | 1/10W        | 0805     | $2.0 \pm 0.15$  | $1.25 \pm 0.15$ | $0.55 \pm 0.10$ | $0.3 \pm 0.20$  | $0.40 \pm 0.25$ |
| NTR12 | 1/8W         | 1206     | $3.05 \pm 0.10$ | $1.55 \pm 0.10$ | $0.55 \pm 0.10$ | $0.42 \pm 0.20$ | $0.35 \pm 0.25$ |
| NTR25 | 1/4W         | 2010     | $4.9 \pm 0.15$  | $2.4 \pm 0.15$  | $0.55 \pm 0.10$ | $0.6 \pm 0.30$  | $0.50 \pm 0.25$ |
| NTR50 | 1/2W         | 2512     | $6.3 \pm 0.15$  | $3.1 \pm 0.15$  | $0.55 \pm 0.10$ | $0.6 \pm 0.30$  | $0.50 \pm 0.25$ |



## TAPING SPECIFICATIONS

## (1) Availability

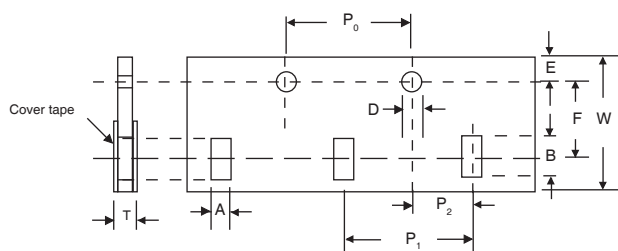
| Type  | Power Rating | EIA Size | Carrier Tape |          |            | Qty per Reel (pcs) |
|-------|--------------|----------|--------------|----------|------------|--------------------|
|       |              |          | Fig.         | Material | Width (mm) |                    |
| NTR02 | 1/20W        | 0201     | A            | Paper    | 8          | 20,000             |
| NTR04 | 1/16W        | 0402     | A            |          |            | 10,000             |
| NTR06 | 1/16W        | 0603     | A            |          |            | 5,000              |
| NTR10 | 1/10W        | 0805     | A            |          |            |                    |
| NTR12 | 1/8W         | 1206     | A            |          |            |                    |
| NTR25 | 1/4W         | 2010     | B            | Plastic  | 12         | 4,000              |
| NTR50 | 1/2W         | 2512     | B            |          |            |                    |

## (2) PAPER TAPE DIMENSIONS (mm)

FIG. A

| Type  | EIA Size | A           | B           | D           | E           | F           | P <sub>0</sub> | P <sub>1</sub> | P <sub>2</sub> | W         | T           |
|-------|----------|-------------|-------------|-------------|-------------|-------------|----------------|----------------|----------------|-----------|-------------|
| NTR02 | 0201     | 0.38 ± 0.03 | 0.68 ± 0.03 | 1.55 ± 0.05 | 1.75 ± 0.10 | 3.50 ± 0.05 | 4.0 ± 0.10     | 2.0 ± 0.05     | 2.0 ± 0.05     | 8.0 ± 0.1 | 0.31 ± 0.02 |
| NTR04 | 0402     | 0.67 ± 0.03 | 1.15 ± 0.03 |             |             |             |                | 4.0 ± 0.05     |                |           | 0.40 ± 0.03 |
| NTR06 | 0603     | 1.10 ± 0.05 | 1.90 ± 0.05 |             |             |             |                | 4.0 ± 0.05     |                |           | 0.60 ± 0.03 |
| NTR10 | 0805     | 1.60 ± 0.05 | 2.37 ± 0.05 |             |             |             |                | 4.0 ± 0.05     |                |           | 0.75 ± 0.05 |
| NTR12 | 1206     | 2.00 ± 0.05 | 3.55 ± 0.05 |             |             |             |                |                |                |           |             |

FIG. A

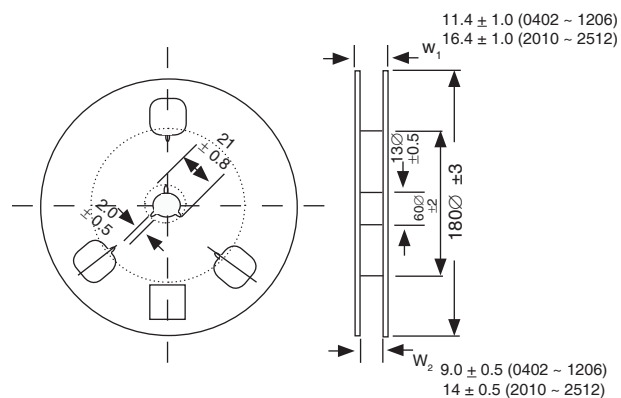
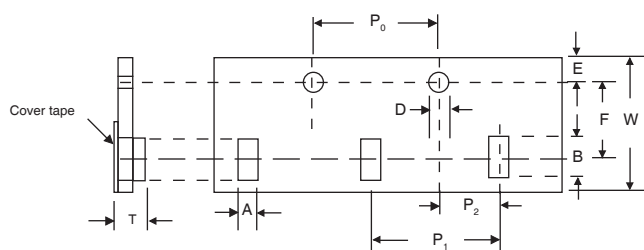


## (2) PLASTIC EMBOSED TAPE DIMENSIONS (mm)

FIG. B

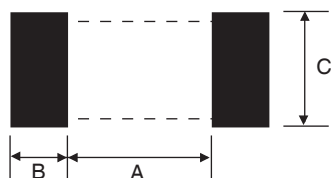
| Type  | EIA Size | A           | B           | D           | E           | F           | P <sub>0</sub> | P <sub>1</sub> | P <sub>2</sub> | W          | T           |
|-------|----------|-------------|-------------|-------------|-------------|-------------|----------------|----------------|----------------|------------|-------------|
| NTR25 | 2010     | 2.85 ± 0.10 | 5.45 ± 0.10 | 1.50 ± 0.10 | 1.75 ± 0.10 | 5.50 ± 0.05 | 4.0 ± 0.10     | 4.0 ± 0.05     | 2.0 ± 0.05     | 12.0 ± 0.1 | 0.85 ± 0.10 |
| NTR50 | 2512     | 3.40 ± 0.10 | 6.65 ± 0.10 |             |             |             |                |                |                |            |             |

FIG. B



## LAND PATTERN DIMENSIONS (mm)

| Type  | EIA Size | A    | B    | C          |
|-------|----------|------|------|------------|
| NTR02 | 0201     | 0.28 | 0.20 | 0.34       |
| NTR04 | 0402     | 0.50 | 0.50 | 0.60 ± 0.2 |
| NTR06 | 0603     | 0.80 | 0.70 | 0.90 ± 0.2 |
| NTR10 | 0805     | 1.00 | 1.00 | 1.35 ± 0.2 |
| NTR12 | 1206     | 2.00 | 1.15 | 1.70 ± 0.2 |
| NTR25 | 2010     | 3.60 | 1.40 | 2.40 ± 0.2 |
| NTR50 | 2512     | 4.90 | 1.60 | 3.00 ± 0.2 |

PEAK REFLOW  
SOLDERING CONDITIONS