

Chip NTC Thermistor Datasheet

Features

- Leadless , Size 0603
- SMD type suitable for high density mounting
- B constant tolerance  $\pm 3\%$
- Excellent solder ability
- Operating temperature:  $-40^{\circ}\text{C}$  to  $+125^{\circ}\text{C}$
- RoHS compliant & Lead-Free & Halogen Free

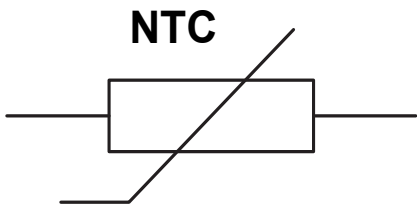
Applications

- Consumer Electronics, mobile phone, wearable device, TWS headphones, etc.
- Office automation such as printer , facsimile,word processor, etc.
- Industrial Power Supplies
- Medical Electronics
- IoT Sensor Nodes

Part Number Code

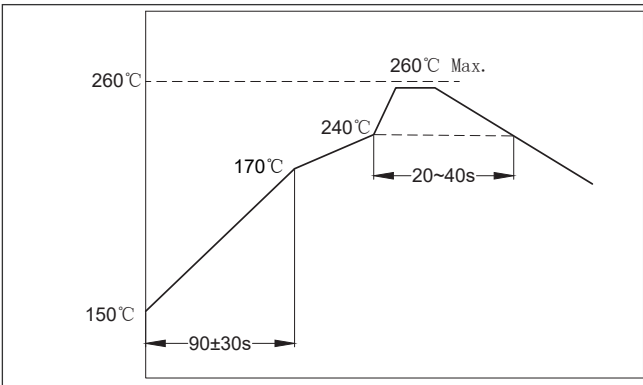
H NTC □□□□ - □□□ J □□□□ H B  
① ② ③ ④ ⑤ ⑥ ⑦ ⑧

- ① “HJC” Brand Code
- ② Chip NTC Thermistor
- ③ Chip Size/package
- ④ Rated Zero-Power Resistance : 103=10000Ω, 503=50000Ω, 104=100000Ω
- ⑤ Resistance Tolerance F: 1% G: 2% H: 3% J:5%
- ⑥ B Constant
- ⑦ B Constant Tolerance F: 1% H: 3%
- ⑧ B Constant calculation method A: 25°C/85°C B: 25°C/50°C



Recommended Soldering Conditions

Reflow Soldering Recommendation



| Profile Feature                          |                 | Condition            |
|------------------------------------------|-----------------|----------------------|
| Pre-heat                                 | Temperature Min | +150°C               |
|                                          | Temperature Max | +170°C               |
|                                          | Pre-heat Time   | 90±30 secs.          |
| ramp up rate                             |                 | 3°C /sec. Max        |
| Time above 240°C                         |                 | 20~40 secs           |
| Peak Temperature                         |                 | +260°C, 10 secs. Max |
| Ramp-down Rate                           |                 | 6°C /sec. Max        |
| Time 25°C to Peak Temp (T <sub>p</sub> ) |                 | 8 min. Max           |
| Do not exceed                            |                 | +260°C               |

Iron Soldering Recommendation

| Item                                                                                   | Conditions  |
|----------------------------------------------------------------------------------------|-------------|
| Temperature of Soldering Iron-tip                                                      | 280°C Max   |
| Soldering Time                                                                         | 3 secs. Max |
| Times for iron soldering                                                               | 1 time Max  |
| Note: Take care not to apply the tip of the soldering iron to the terminal electrodes. |             |

## ● Electrical Characteristics (Ta=25°C Unless otherwise specified)

| PARAMETER                      | CONDITION                   | VALUE        | UNIT  |
|--------------------------------|-----------------------------|--------------|-------|
| Rated Zero-Power Resistance    | T <sub>a</sub> =25°C ±0.1°C | 100±5%       | KΩ    |
| B Constant (Material Constant) | 25°C /50°C                  | 4250±3%      | K     |
| Permissible Operating Current  | T <sub>a</sub> =25°C ±0.1°C | 0.1          | mA    |
| Thermal Dissipation Constant   | T <sub>a</sub> =25°C ±0.1°C | 1.0          | mW/°C |
| Thermal Time Constant          | T <sub>a</sub> =25°C ±0.1°C | < 5          | sec   |
| Rated Electric Power           | T <sub>a</sub> =25°C ±0.1°C | 100          | mW    |
| Operating Temperature Range    | /                           | -40 to + 125 | °C    |

## ● Test and Measurement Procedures

Unless otherwise specified, the standard atmospheric conditions for measurement/test as:

| Items                | Condition       |
|----------------------|-----------------|
| Ambient Temperature: | 20±15°C         |
| Relative Humidity:   | 65±20%          |
| Air Pressure:        | 86kPa to 106kPa |

Inspection Equipment

1.Visual Examination: 20× magnifier

2.Resistance value test: Thermistor resistance tester

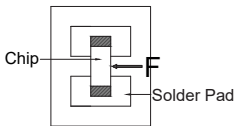
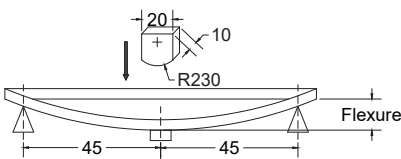
If any doubt on the results, measurements/tests should be made within the following limits:

| Items                | Condition       |
|----------------------|-----------------|
| Ambient Temperature: | 25±2°C          |
| Relative Humidity:   | 65±5%           |
| Air Pressure:        | 86kPa to 106kPa |

## ● Electrical Test

| Items                                 | Test Methods and Remarks                                                                                                                                                                                                                                                                        |
|---------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Nominal Zero-Power Resistance at 25°C | Ambient temperature: 25±0.05°C ; Measuring electric power: ≤ 0.1mW                                                                                                                                                                                                                              |
| Nominal B Constant                    | Measure the resistance at the ambient temperature of 25±0.05°C , 50±0.05°C or 85±0.05°C .<br>$B(25/50^{\circ}\text{C}) = \frac{\ln R_{25} - \ln R_{50}}{1/T_{25} - 1/T_{50}} \quad B(25/85^{\circ}\text{C}) = \frac{\ln R_{25} - \ln R_{85}}{1/T_{25} - 1/T_{85}}$                              |
| Thermal Time Constant                 | The total time for the temperature of the thermistor to change by 63.2% of the difference from ambient temperature T <sub>0</sub> (°C) to T <sub>1</sub> (°C) by the drastic change of the power applied to thermistor from Non-zero Power to Zero-Power state, normally expressed in second(S) |
| Dissipation Factor                    | The required power which makes the NTC thermistor body temperature raise 1°C through self-heated, normally expressed in milliwatts per degree Celsius (mW/°C) . It can be calculated by the following formula:<br>$\delta = \frac{W}{T - T_0}$                                                  |
| Rated Power                           | The necessary electric power makes thermistor' s temperature rise 100°C by self-heating at ambient temperature 25°C .                                                                                                                                                                           |
| Permissible operating current         | The current that keep body temperature of chip NTC on the PC board in still air rising 1° C by self-heating.                                                                                                                                                                                    |

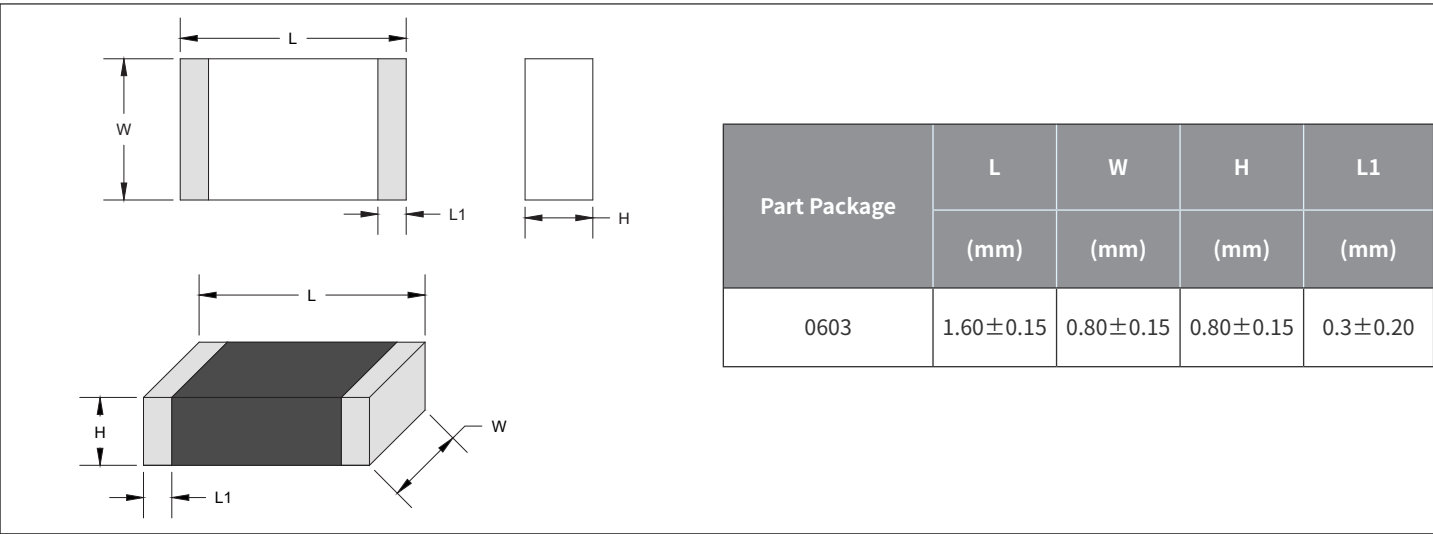
## ● Reliability Test

| Items                               | Standard              | Test Methods and Remarks                                                                                                                                                                                                                                                                                                                                                                                                                                                            | Requirements                                                        |             |          |            |            |         |           |                  |        |                                                                                                                                                                 |           |         |                                                  |                  |        |                                                                    |
|-------------------------------------|-----------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------|-------------|----------|------------|------------|---------|-----------|------------------|--------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|---------|--------------------------------------------------|------------------|--------|--------------------------------------------------------------------|
| Terminal Strength                   | IEC 60068-2-21        | <p>Solder the chip to the testing jig using eutectic solder. Then apply a force in the direction of the arrow.</p> <table><tr><th>Size</th><th>F</th><th>Duration</th></tr><tr><td>0402, 0603</td><td>5N</td><td>10±1s</td></tr><tr><td>0805</td><td>10N</td><td>10±1s</td></tr></table>                                                                                                                                                                                            | Size                                                                | F           | Duration | 0402, 0603 | 5N         | 10±1s   | 0805      | 10N              | 10±1s  | <p>No removal or split of the termination or other defects shall occur.</p>  |           |         |                                                  |                  |        |                                                                    |
| Size                                | F                     | Duration                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                     |             |          |            |            |         |           |                  |        |                                                                                                                                                                 |           |         |                                                  |                  |        |                                                                    |
| 0402, 0603                          | 5N                    | 10±1s                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                     |             |          |            |            |         |           |                  |        |                                                                                                                                                                 |           |         |                                                  |                  |        |                                                                    |
| 0805                                | 10N                   | 10±1s                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                     |             |          |            |            |         |           |                  |        |                                                                                                                                                                 |           |         |                                                  |                  |        |                                                                    |
| Resistance to Flexure               | IEC 60068-2-21        | <p>Solder the chip to the test jig (glass epoxy board shown in the right) using a eutectic solder. Then apply a force in the direction shown as follow;</p>  <table><tr><th>Size</th><th>Flexure</th><th>Speed</th><th>Duration</th></tr><tr><td>0402, 0603</td><td>1mm</td><td>&lt; 0.5mm/s</td><td>10±1s</td></tr><tr><td>0805</td><td>2mm</td><td>&lt; 0.5mm/s</td><td>10±1s</td></tr></table> | Size                                                                | Flexure     | Speed    | Duration   | 0402, 0603 | 1mm     | < 0.5mm/s | 10±1s            | 0805   | 2mm                                                                                                                                                             | < 0.5mm/s | 10±1s   | <p>No visible damage.<br/>  Δ R25/R25   ≤ 5%</p> |                  |        |                                                                    |
| Size                                | Flexure               | Speed                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Duration                                                            |             |          |            |            |         |           |                  |        |                                                                                                                                                                 |           |         |                                                  |                  |        |                                                                    |
| 0402, 0603                          | 1mm                   | < 0.5mm/s                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 10±1s                                                               |             |          |            |            |         |           |                  |        |                                                                                                                                                                 |           |         |                                                  |                  |        |                                                                    |
| 0805                                | 2mm                   | < 0.5mm/s                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 10±1s                                                               |             |          |            |            |         |           |                  |        |                                                                                                                                                                 |           |         |                                                  |                  |        |                                                                    |
| Dropping                            | IEC 60068-2-32        | Drop a chip 10 times on a concrete floor from a height of 1 meter.                                                                                                                                                                                                                                                                                                                                                                                                                  | No visible damage.                                                  |             |          |            |            |         |           |                  |        |                                                                                                                                                                 |           |         |                                                  |                  |        |                                                                    |
| Solderability                       | IEC 60068-2-58        | <p>1. Solder temperature: 245±5°C<br/>2. Duration: 3±0.3s<br/>3. Solder: Sn/3.0Ag/0.5Cu<br/>4. 25% Resin and 75% ethanol in weight</p>                                                                                                                                                                                                                                                                                                                                              | <p>No visible damage<br/>Wetting shall exceed 95% coverage.</p>     |             |          |            |            |         |           |                  |        |                                                                                                                                                                 |           |         |                                                  |                  |        |                                                                    |
| Resistance to Soldering Heat        | IEC 60068-2-58        | <p>1. Solder temperature: 260±5°C<br/>2. Duration: 10±1s<br/>3. Solder: Sn/3.0Ag/0.5Cu<br/>4. 25% Resin and 75% ethanol in weight<br/>5. The chip shall be stabilized at normal condition for 1~2 hours before measuring</p>                                                                                                                                                                                                                                                        | <p>No visible damage.<br/>  Δ R25/R25   ≤ 5%<br/>  Δ B/B   ≤ 2%</p> |             |          |            |            |         |           |                  |        |                                                                                                                                                                 |           |         |                                                  |                  |        |                                                                    |
| Temperature cycling                 | IEC 60068-2-14        | <p>1. 5 cycles of following sequence without loading.</p> <table><tr><th>Step</th><th>Temperature</th><th>Period</th></tr><tr><td>1</td><td>-40±5°C</td><td>30±3min</td></tr><tr><td>2</td><td>Room Temperature</td><td>5±3min</td></tr><tr><td>3</td><td>125±2°C</td><td>30±3min</td></tr><tr><td>4</td><td>Room Temperature</td><td>5±3min</td></tr></table> <p>2. The chip shall be stabilized at normal condition for 1~2 hours before measuring.</p>                           | Step                                                                | Temperature | Period   | 1          | -40±5°C    | 30±3min | 2         | Room Temperature | 5±3min | 3                                                                                                                                                               | 125±2°C   | 30±3min | 4                                                | Room Temperature | 5±3min | <p>No visible damage<br/>  Δ R25/R25   ≤ 5%<br/>  Δ B/B   ≤ 2%</p> |
| Step                                | Temperature           | Period                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                     |             |          |            |            |         |           |                  |        |                                                                                                                                                                 |           |         |                                                  |                  |        |                                                                    |
| 1                                   | -40±5°C               | 30±3min                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                     |             |          |            |            |         |           |                  |        |                                                                                                                                                                 |           |         |                                                  |                  |        |                                                                    |
| 2                                   | Room Temperature      | 5±3min                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                     |             |          |            |            |         |           |                  |        |                                                                                                                                                                 |           |         |                                                  |                  |        |                                                                    |
| 3                                   | 125±2°C               | 30±3min                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                     |             |          |            |            |         |           |                  |        |                                                                                                                                                                 |           |         |                                                  |                  |        |                                                                    |
| 4                                   | Room Temperature      | 5±3min                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                     |             |          |            |            |         |           |                  |        |                                                                                                                                                                 |           |         |                                                  |                  |        |                                                                    |
| Resistance to dry heat              | IEC 60068-2-2         | <p>1. 125±5°C in air, for 1000±24 hours without loading<br/>2. The chip shall be stabilized at normal condition for 1~2 hours before measuring</p>                                                                                                                                                                                                                                                                                                                                  | <p>No visible damage.<br/>  Δ R25/R25   ≤ 5%<br/>  Δ B/B   ≤ 2%</p> |             |          |            |            |         |           |                  |        |                                                                                                                                                                 |           |         |                                                  |                  |        |                                                                    |
| Resistance to cold                  | IEC 60068-2-1         | <p>1. -40±3°C in air, for 1000±24 hours without loading.<br/>2. The chip shall be stabilized at normal condition for 1~2 hours before measuring.</p>                                                                                                                                                                                                                                                                                                                                | <p>No visible damage.<br/>  Δ R25/R25   ≤ 5%<br/>  Δ B/B   ≤ 2%</p> |             |          |            |            |         |           |                  |        |                                                                                                                                                                 |           |         |                                                  |                  |        |                                                                    |
| Resistance to damp heat             | IEC 60068-2-78        | <p>1. 40±2°C , 90~95%RH in air, for 1000±24 hours without loading<br/>2. The chip shall be stabilized at normal condition for 1~2 hours before measuring.</p>                                                                                                                                                                                                                                                                                                                       | <p>No visible damage.<br/>  Δ R25/R25   ≤ 3%<br/>  Δ B/B   ≤ 2%</p> |             |          |            |            |         |           |                  |        |                                                                                                                                                                 |           |         |                                                  |                  |        |                                                                    |
| Resistance to high temperature load | IEC 60539-1<br>5.25.4 | <p>1. 85±2°C in air with permissive operating current for 1000±48 hours<br/>2. The chip shall be stabilized at normal condition for 1~2 hours before measuring</p>                                                                                                                                                                                                                                                                                                                  | <p>No visible damage.<br/>  Δ R25/R25   ≤ 5%<br/>  Δ B/B   ≤ 2%</p> |             |          |            |            |         |           |                  |        |                                                                                                                                                                 |           |         |                                                  |                  |        |                                                                    |

Environmental Specification

|                      |                                                                                                                                                                    |
|----------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Storage temperature: | -10°C to +40°C                                                                                                                                                     |
| Storage Conditions:  | Light-proof, Hermetically Sealed, Moisture-proof;<br>The components should be left in their original packing to avoid soldering problems due to oxidized contacts. |
| Relative humidity:   | < 75 % RH                                                                                                                                                          |
| Storage period       | The components should be employed within 6 months after delivery                                                                                                   |

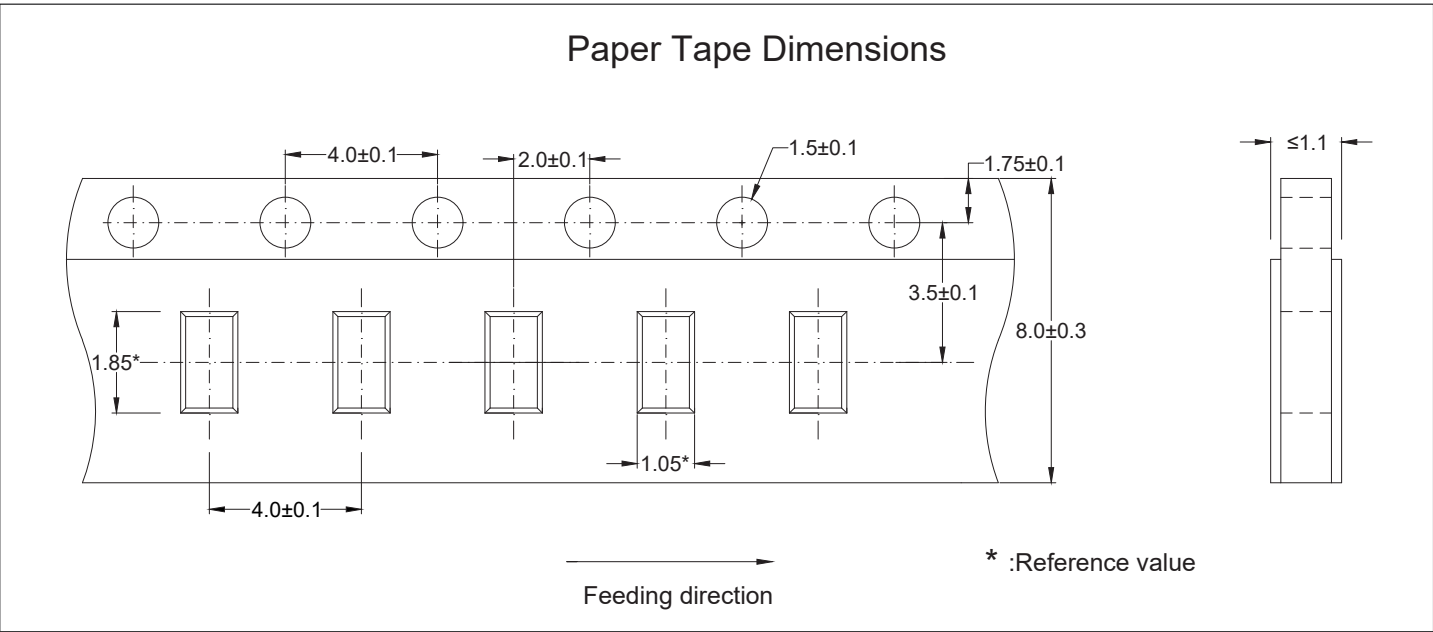
Physical Dimensions



Ordering Information

| PACKAGE | Part Number         | DELIVERY MODE | MPQ(PCS) |
|---------|---------------------|---------------|----------|
| 0603    | HNTC0603-104J4250HB | 7" REEL       | 4,000    |

Packaging Information



## ● R-T Chart

| Temp.(°C ) | R_Min(KΩ) | R_Typ( KΩ) | R_Max(KΩ) | R_Tolerance | Temp._Tolerance(°C ) |
|------------|-----------|------------|-----------|-------------|----------------------|
| -40        | 4022.168  | 4397.119   | 4795.007  | 9.05%       | 1.22                 |
| -39        | 3746.551  | 4092.874   | 4460.031  | 8.97%       | 1.21                 |
| -38        | 3491.669  | 3811.717   | 4150.698  | 8.89%       | 1.21                 |
| -37        | 3255.828  | 3551.749   | 3864.879  | 8.82%       | 1.21                 |
| -36        | 3037.483  | 3311.236   | 3600.637  | 8.74%       | 1.21                 |
| -35        | 2835.225  | 3088.599   | 3356.205  | 8.66%       | 1.21                 |
| -34        | 2647.767  | 2882.396   | 3129.972  | 8.59%       | 1.21                 |
| -33        | 2473.931  | 2691.31    | 2920.469  | 8.51%       | 1.21                 |
| -32        | 2312.643  | 2514.137   | 2726.353  | 8.44%       | 1.21                 |
| -31        | 2162.918  | 2349.778   | 2546.398  | 8.37%       | 1.21                 |
| -30        | 2023.855  | 2197.225   | 2379.483  | 8.29%       | 1.2                  |
| -29        | 1894.628  | 2055.558   | 2224.581  | 8.22%       | 1.2                  |
| -28        | 1774.481  | 1923.932   | 2080.754  | 8.15%       | 1.2                  |
| -27        | 1662.72   | 1801.573   | 1947.142  | 8.08%       | 1.2                  |
| -26        | 1558.707  | 1687.773   | 1822.957  | 8.01%       | 1.2                  |
| -25        | 1461.859  | 1581.881   | 1707.476  | 7.94%       | 1.2                  |
| -24        | 1371.457  | 1483.1     | 1599.821  | 7.87%       | 1.19                 |
| -23        | 1287.219  | 1391.113   | 1499.634  | 7.80%       | 1.19                 |
| -22        | 1208.687  | 1305.413   | 1406.354  | 7.73%       | 1.19                 |
| -21        | 1135.441  | 1225.531   | 1319.462  | 7.66%       | 1.19                 |
| -20        | 1067.092  | 1151.037   | 1238.481  | 7.60%       | 1.19                 |
| -19        | 1003.284  | 1081.535   | 1162.975  | 7.53%       | 1.19                 |
| -18        | 943.687   | 1016.661   | 1092.54   | 7.46%       | 1.18                 |
| -17        | 887.999   | 956.08     | 1026.806  | 7.40%       | 1.18                 |
| -16        | 835.941   | 899.481    | 965.431   | 7.33%       | 1.18                 |
| -15        | 787.253   | 846.579    | 908.099   | 7.27%       | 1.18                 |
| -14        | 741.698   | 797.111    | 854.522   | 7.20%       | 1.18                 |
| -13        | 699.056   | 750.834    | 804.431   | 7.14%       | 1.17                 |
| -12        | 659.124   | 707.524    | 757.579   | 7.07%       | 1.17                 |
| -11        | 621.714   | 666.972    | 713.737   | 7.01%       | 1.17                 |
| -10        | 586.651   | 628.988    | 672.695   | 6.95%       | 1.17                 |
| -9         | 553.727   | 593.342    | 634.202   | 6.89%       | 1.16                 |
| -8         | 522.849   | 559.931    | 598.143   | 6.82%       | 1.16                 |
| -7         | 493.879   | 528.602    | 564.351   | 6.76%       | 1.16                 |
| -6         | 466.687   | 499.212    | 532.669   | 6.70%       | 1.16                 |
| -5         | 441.155   | 471.632    | 502.954   | 6.64%       | 1.16                 |
| -4         | 417.201   | 445.772    | 475.109   | 6.58%       | 1.15                 |
| -3         | 394.687   | 421.48     | 448.966   | 6.52%       | 1.15                 |
| -2         | 373.518   | 398.652    | 424.414   | 6.46%       | 1.15                 |
| -1         | 353.607   | 377.193    | 401.345   | 6.40%       | 1.14                 |
| 0          | 334.872   | 357.012    | 379.663   | 6.34%       | 1.14                 |
| 1          | 317.219   | 338.006    | 359.255   | 6.29%       | 1.14                 |
| 2          | 300.598   | 320.122    | 340.061   | 6.23%       | 1.14                 |
| 3          | 284.943   | 303.287    | 322.004   | 6.17%       | 1.13                 |
| 4          | 270.194   | 287.434    | 305.009   | 6.11%       | 1.13                 |
| 5          | 256.292   | 272.500    | 289.007   | 6.06%       | 1.13                 |
| 6          | 243.185   | 258.426    | 273.936   | 6.00%       | 1.12                 |

## ● R-T Chart

| Temp.(°C ) | R_Min(KΩ) | R_Typ( KΩ) | R_Max(KΩ) | R_Tolerance | Temp._Tolerance(°C ) |
|------------|-----------|------------|-----------|-------------|----------------------|
| 7          | 230.823   | 245.160    | 259.737   | 5.95%       | 1.12                 |
| 8          | 219.158   | 232.649    | 246.353   | 5.89%       | 1.12                 |
| 9          | 208.149   | 220.847    | 233.734   | 5.84%       | 1.12                 |
| 10         | 197.754   | 209.710    | 221.832   | 5.78%       | 1.11                 |
| 11         | 187.937   | 199.196    | 210.602   | 5.73%       | 1.11                 |
| 12         | 178.661   | 189.268    | 200.003   | 5.67%       | 1.11                 |
| 13         | 169.895   | 179.890    | 189.996   | 5.62%       | 1.10                 |
| 14         | 161.607   | 171.028    | 180.545   | 5.57%       | 1.10                 |
| 15         | 153.768   | 162.651    | 171.616   | 5.51%       | 1.10                 |
| 16         | 146.350   | 154.726    | 163.173   | 5.46%       | 1.09                 |
| 17         | 139.330   | 147.232    | 155.193   | 5.41%       | 1.09                 |
| 18         | 132.686   | 140.142    | 147.647   | 5.35%       | 1.08                 |
| 19         | 126.396   | 133.432    | 140.508   | 5.30%       | 1.08                 |
| 20         | 120.437   | 127.080    | 133.754   | 5.25%       | 1.08                 |
| 21         | 114.793   | 121.066    | 127.362   | 5.20%       | 1.07                 |
| 22         | 109.443   | 115.368    | 121.310   | 5.15%       | 1.07                 |
| 23         | 104.372   | 109.970    | 115.578   | 5.10%       | 1.07                 |
| 24         | 99.562    | 104.852    | 110.147   | 5.05%       | 1.06                 |
| 25         | 95.000    | 100.000    | 105.000   | 5.00%       | 1.06                 |
| 26         | 90.586    | 95.398     | 100.215   | 5.05%       | 1.08                 |
| 27         | 86.399    | 91.032     | 95.674    | 5.10%       | 1.09                 |
| 28         | 82.429    | 86.889     | 91.362    | 5.15%       | 1.11                 |
| 29         | 78.661    | 82.956     | 87.267    | 5.20%       | 1.13                 |
| 30         | 75.085    | 79.222     | 83.377    | 5.24%       | 1.14                 |
| 31         | 71.691    | 75.675     | 79.681    | 5.29%       | 1.16                 |
| 32         | 68.468    | 72.306     | 76.168    | 5.34%       | 1.18                 |
| 33         | 65.407    | 69.104     | 72.828    | 5.39%       | 1.20                 |
| 34         | 62.498    | 66.061     | 69.652    | 5.44%       | 1.22                 |
| 35         | 59.734    | 63.167     | 66.631    | 5.48%       | 1.23                 |
| 36         | 57.106    | 60.415     | 63.756    | 5.53%       | 1.25                 |
| 37         | 54.607    | 57.797     | 61.020    | 5.58%       | 1.27                 |
| 38         | 52.230    | 55.306     | 58.416    | 5.62%       | 1.29                 |
| 39         | 49.969    | 52.934     | 55.936    | 5.67%       | 1.31                 |
| 40         | 47.817    | 50.677     | 53.573    | 5.72%       | 1.32                 |
| 41         | 45.770    | 48.528     | 51.324    | 5.76%       | 1.34                 |
| 42         | 43.821    | 46.482     | 49.181    | 5.81%       | 1.36                 |
| 43         | 41.965    | 44.533     | 47.139    | 5.85%       | 1.38                 |
| 44         | 40.197    | 42.675     | 45.191    | 5.90%       | 1.40                 |
| 45         | 38.512    | 40.904     | 43.334    | 5.94%       | 1.42                 |
| 46         | 36.905    | 39.213     | 41.561    | 5.99%       | 1.44                 |
| 47         | 35.373    | 37.601     | 39.869    | 6.03%       | 1.46                 |
| 48         | 33.912    | 36.063     | 38.254    | 6.08%       | 1.48                 |
| 49         | 32.519    | 34.595     | 36.713    | 6.12%       | 1.50                 |
| 50         | 31.189    | 33.195     | 35.241    | 6.16%       | 1.51                 |
| 51         | 29.922    | 31.859     | 33.837    | 6.21%       | 1.53                 |
| 52         | 28.713    | 30.584     | 32.496    | 6.25%       | 1.55                 |
| 53         | 27.558    | 29.366     | 31.214    | 6.29%       | 1.57                 |

## ● R-T Chart

| Temp.(°C ) | R_Min(KΩ) | R_Typ( KΩ) | R_Max(KΩ) | R_Tolerance | Temp._Tolerance(°C ) |
|------------|-----------|------------|-----------|-------------|----------------------|
| 54         | 26.455    | 28.203     | 29.990    | 6.34%       | 1.59                 |
| 55         | 25.402    | 27.091     | 28.819    | 6.38%       | 1.61                 |
| 56         | 24.396    | 26.028     | 27.700    | 6.42%       | 1.63                 |
| 57         | 23.435    | 25.013     | 26.630    | 6.47%       | 1.65                 |
| 58         | 22.516    | 24.042     | 25.606    | 6.51%       | 1.67                 |
| 59         | 21.638    | 23.113     | 24.627    | 6.55%       | 1.69                 |
| 60         | 20.798    | 22.224     | 23.689    | 6.59%       | 1.71                 |
| 61         | 19.995    | 21.374     | 22.792    | 6.63%       | 1.73                 |
| 62         | 19.226    | 20.561     | 21.933    | 6.67%       | 1.75                 |
| 63         | 18.491    | 19.782     | 21.110    | 6.72%       | 1.78                 |
| 64         | 17.787    | 19.036     | 20.323    | 6.76%       | 1.80                 |
| 65         | 17.113    | 18.323     | 19.568    | 6.80%       | 1.82                 |
| 66         | 16.470    | 17.640     | 18.846    | 6.84%       | 1.84                 |
| 67         | 15.854    | 16.986     | 18.155    | 6.88%       | 1.86                 |
| 68         | 15.263    | 16.360     | 17.492    | 6.92%       | 1.88                 |
| 69         | 14.698    | 15.760     | 16.856    | 6.96%       | 1.90                 |
| 70         | 14.156    | 15.184     | 16.247    | 7.00%       | 1.92                 |
| 71         | 13.635    | 14.631     | 15.661    | 7.04%       | 1.94                 |
| 72         | 13.136    | 14.101     | 15.099    | 7.08%       | 1.97                 |
| 73         | 12.657    | 13.592     | 14.559    | 7.12%       | 1.99                 |
| 74         | 12.198    | 13.104     | 14.041    | 7.16%       | 2.01                 |
| 75         | 11.758    | 12.635     | 13.544    | 7.19%       | 2.03                 |
| 76         | 11.337    | 12.187     | 13.069    | 7.23%       | 2.05                 |
| 77         | 10.932    | 11.757     | 12.612    | 7.27%       | 2.07                 |
| 78         | 10.544    | 11.344     | 12.173    | 7.31%       | 2.10                 |
| 79         | 10.172    | 10.947     | 11.751    | 7.35%       | 2.12                 |
| 80         | 9.814     | 10.566     | 11.346    | 7.39%       | 2.14                 |
| 81         | 9.471     | 10.200     | 10.957    | 7.42%       | 2.16                 |
| 82         | 9.141     | 9.848      | 10.583    | 7.46%       | 2.19                 |
| 83         | 8.824     | 9.510      | 10.223    | 7.50%       | 2.21                 |
| 84         | 8.520     | 9.185      | 9.877     | 7.54%       | 2.23                 |
| 85         | 8.227     | 8.873      | 9.545     | 7.57%       | 2.25                 |
| 86         | 7.946     | 8.572      | 9.225     | 7.61%       | 2.28                 |
| 87         | 7.676     | 8.283      | 8.917     | 7.65%       | 2.30                 |
| 88         | 7.416     | 8.006      | 8.621     | 7.69%       | 2.32                 |
| 89         | 7.166     | 7.738      | 8.336     | 7.72%       | 2.35                 |
| 90         | 6.925     | 7.481      | 8.061     | 7.76%       | 2.37                 |
| 91         | 6.695     | 7.234      | 7.798     | 7.79%       | 2.39                 |
| 92         | 6.473     | 6.997      | 7.545     | 7.83%       | 2.42                 |
| 93         | 6.259     | 6.769      | 7.301     | 7.87%       | 2.44                 |
| 94         | 6.054     | 6.548      | 7.066     | 7.90%       | 2.46                 |
| 95         | 5.856     | 6.337      | 6.839     | 7.94%       | 2.49                 |
| 96         | 5.665     | 6.132      | 6.620     | 7.97%       | 2.51                 |
| 97         | 5.480     | 5.934      | 6.409     | 8.01%       | 2.53                 |
| 98         | 5.303     | 5.744      | 6.206     | 8.04%       | 2.56                 |
| 99         | 5.132     | 5.561      | 6.010     | 8.08%       | 2.58                 |
| 100        | 4.967     | 5.384      | 5.821     | 8.11%       | 2.61                 |

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Chip NTC Thermistor

● R-T Chart

| Temp.(°C ) | R_Min(KΩ) | R_Typ( KΩ) | R_Max(KΩ) | R_Tolerance | Temp._Tolerance(°C ) |
|------------|-----------|------------|-----------|-------------|----------------------|
| 101        | 4.809     | 5.214      | 5.639     | 8.15%       | 2.63                 |
| 102        | 4.657     | 5.051      | 5.464     | 8.18%       | 2.66                 |
| 103        | 4.510     | 4.893      | 5.295     | 8.22%       | 2.68                 |
| 104        | 4.369     | 4.741      | 5.132     | 8.25%       | 2.70                 |
| 105        | 4.232     | 4.594      | 4.975     | 8.28%       | 2.73                 |
| 106        | 4.100     | 4.453      | 4.823     | 8.32%       | 2.75                 |
| 107        | 3.973     | 4.316      | 4.677     | 8.35%       | 2.78                 |
| 108        | 3.851     | 4.184      | 4.535     | 8.39%       | 2.80                 |
| 109        | 3.733     | 4.057      | 4.399     | 8.42%       | 2.83                 |
| 110        | 3.619     | 3.934      | 4.267     | 8.45%       | 2.85                 |
| 111        | 3.508     | 3.816      | 4.139     | 8.49%       | 2.88                 |
| 112        | 3.402     | 3.701      | 4.016     | 8.52%       | 2.90                 |
| 113        | 3.299     | 3.591      | 3.898     | 8.55%       | 2.93                 |
| 114        | 3.200     | 3.484      | 3.783     | 8.58%       | 2.96                 |
| 115        | 3.104     | 3.380      | 3.672     | 8.62%       | 2.98                 |
| 116        | 3.012     | 3.281      | 3.565     | 8.65%       | 3.01                 |
| 117        | 2.924     | 3.185      | 3.462     | 8.68%       | 3.03                 |
| 118        | 2.838     | 3.093      | 3.362     | 8.71%       | 3.06                 |
| 119        | 2.755     | 3.003      | 3.266     | 8.75%       | 3.08                 |
| 120        | 2.674     | 2.916      | 3.172     | 8.78%       | 3.11                 |
| 121        | 2.596     | 2.832      | 3.082     | 8.81%       | 3.14                 |
| 122        | 2.521     | 2.751      | 2.994     | 8.84%       | 3.16                 |
| 123        | 2.448     | 2.672      | 2.909     | 8.87%       | 3.19                 |
| 124        | 2.378     | 2.596      | 2.827     | 8.90%       | 3.22                 |
| 125        | 2.309     | 2.522      | 2.747     | 8.94%       | 3.24                 |