# SA10200542, The Platinum Resistance temperature sensor (PT-RTD)

## The history of revision change for the specification

| Date | Revision | Changes |
|---|---|---|
| 2003/09/17 | A0 | New Approval |
| 2019/10/04 | A1 | Add temperature - resistance diagram and packaging |
| 2024/12/27 | A2 | Adjust ppm to lowercase |

# SA10200542, The Platinum Resistance temperature sensor (PT-RTD)

## Features / Applications



- Features:
  - Low drift
  - Long service life
  - Wide temperature range
  - Wide range of resistance values
  - Temperature linear control
  - High precision
  - Fast response time
  - RoHS compliant

- Applications:
  - Home Appliances: oven, air conditioner, refrigerator, calorimeter
  - Industrial Equipment: temperature controller
  - Medical: precision thermometer
  - Electronics: over-temperature protection

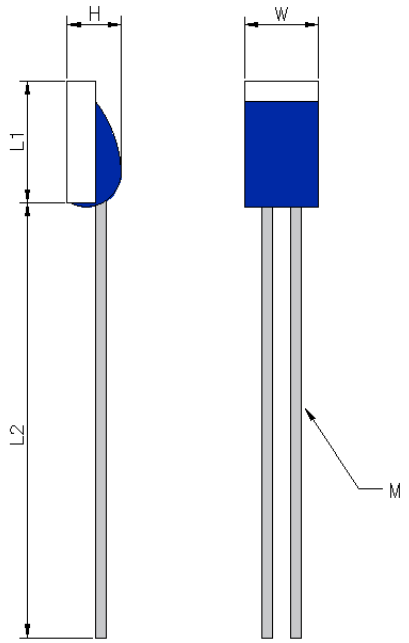
## Electrical Specifications

| Characteristics | Feature |
|---|---|
| Resistance value at 0°C | 1000 ± 1.2 Ω |
| Tolerance | Class B: ± 0.12% |
| Temperature coefficient of resistance (TCR) | 3850 ppm/°C |
| Operation temperature range | -50°C ~ +500 °C |
| Maximum applied current | 1 mA |
| Thermal response time (90%) | 15 seconds max. (In air at 1 m/sec.) |
| Self-heating | 2 mW/℃ (In air at 1 m/sec.) |

## Outline Drawing

Unit: mm

**Dimension**




| | |
|---|---|
| W | 2.0 ± 0.15 |
| H | 1.25 ± 0.2(TYP.) |
| L1 | 3.0 ± 0.15 |
| L2 | 10 ± 2 |
| M | Ni wire<br>ϕ0.22(TYP.) |

## Type Designation

| SA | 102 | 0 | 0 | XXX |
|---|---|---|---|---|
| (1) | (2) | (3) | (4) | (5) |

Where

(1) Series No: SA = Applicable temperature range 500 °C

(2) Resistance Value: 102 = $10*10^2$ = 1000 Ω

(3) TCR/Class: 0 = 3850 ppm/°C / B Class

(4) Package type: 0 = Glass coated

(5) Serial number

## Characteristics

**Electrical**

| Item | Specification and requirement | Test method |
|---|---|---|
| Insulation resistance | >100 MΩ | Apply 500 VDC between the lead wire and the glass coating for 1 minute at room temperature. |
| ESD | △R(0 °C): ≤0.12% | Human body, 2KV. |

**Endurance**

| Item | Specification and requirement | Test method |
|---|---|---|
| Low temperature test | △R(0 °C): ≤0.12%<br>Without distinct damage in appearance. | Keep the PT sensor in -50°C for 1000 hours. |
| High temperature test | △R(0 °C): ≤0.12%<br>Without distinct damage in appearance. | Keep the PT sensor in 500°C for 1000 hours. |
| Humidity test | △R(0 °C): ≤0.12%<br>Without distinct damage in appearance. | Keep the PT sensor in 60°C and 90% ~ 95% R.H. for 1000 hours. |
| Thermal shock | △R(0 °C): ≤012%<br>Without distinct damage in appearance. | Keep the PT sensor in 0°C ice water for at least 15 seconds then within 10 seconds directly put into 100°C hot water for at least 15 seconds.<br>Repeat the above process for at least 10 cycles. |

## Temperature and resistance relationship

- The temperature and resistance relationships used in this standard are as follows:

  When T < 0°C :

  $Rt = R0 [ 1 + aT + bT^2 + cT^3 ( T – 100 ) ]$

  When T ≧ 0°C :

  $Rt = R0 (1+ aT + bT^2 )$

  Where

  Rt: resistance at a certain temperature T

  R0: resistance at 0°C

  a, b, c : coefficient (refer to the following table)

  Coefficient for TCR = 3850 ppm/°C (IEC 751 Standard)

| Temperature | a | b | c |
|---|---|---|---|
| T < 0°C | 3.90830E-03 | -5.77500E-07 | -4.18300E-12 |
| T ≧ 0°C | 3.90830E-03 | -5.77500E-07 | 0 |

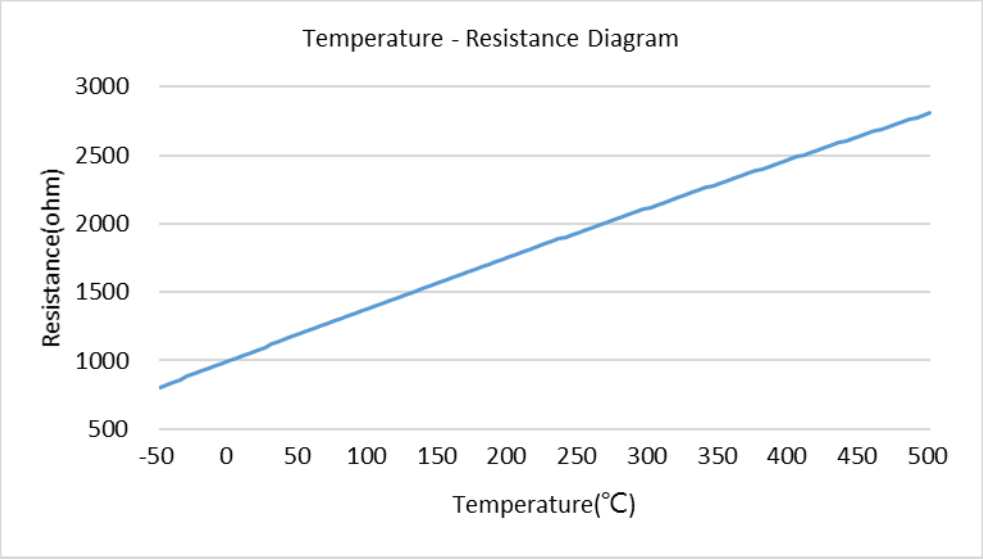
- Temperature deviation

  ± (a + b |t|)°C

  a = 0.3

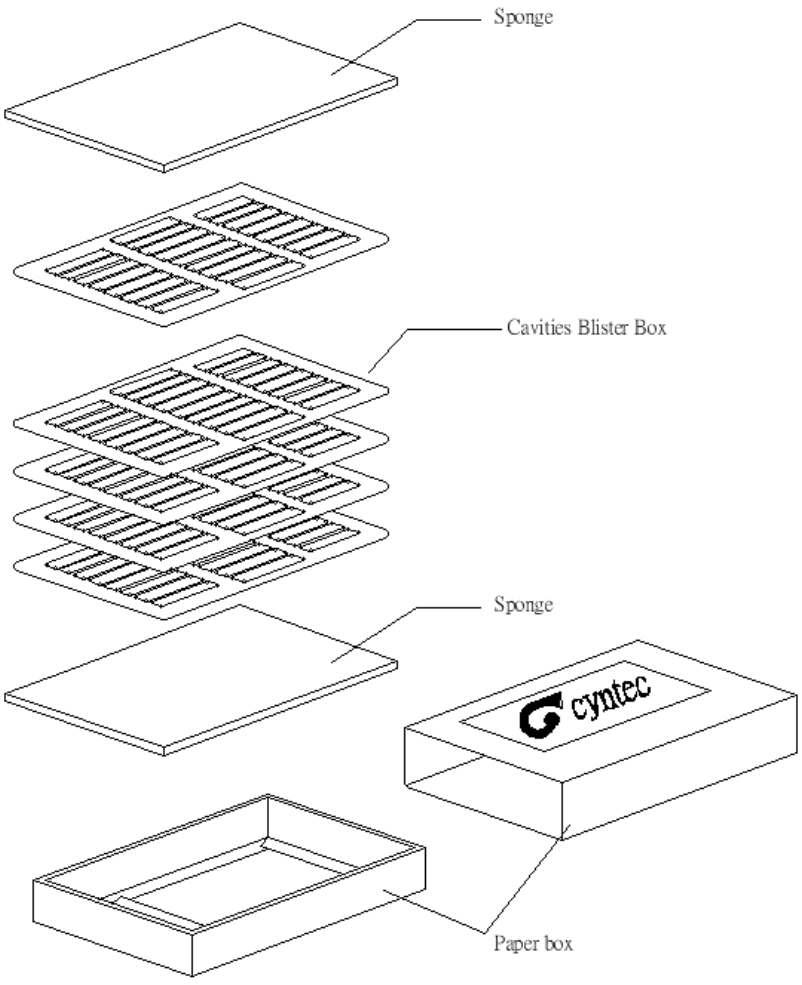
  b = 0.005

- Temperature – Resistance Diagram



## Packaging

| Box dimension | Quantity per box |
|---|---|
| 97 * 62 * 22mm | 100pcs |




## Order Information

| Part number | Dimension (mm) | | Nominal resistance at 0°C | Operating temperature range |
|---|---|---|---|---|
| | Sensor body | Wire length | | |
| SA10200542 | 2.0 * 3.0 | 10 | 1000 ± 1.2 Ω | -50°C ~ +500°C |

## Resistance tolerance and Temperature Deviation table of PT 1000 Class B

| Temperature (°C) | Resistance (Ω) | Temperature deviation (±°C) | Resistance tolerance (± Ω) | Temperature (°C) | Resistance (Ω) | Temperature deviation (± °C) | Resistance tolerance (± Ω) |
|---|---|---|---|---|---|---|---|
| -50 | 803.06 | 0.55 | 2.18 | 130 | 1498.32 | 0.95 | 3.57 |
| -45 | 822.90 | 0.53 | 2.08 | 135 | 1517.10 | 0.98 | 3.66 |
| -40 | 842.71 | 0.50 | 1.98 | 140 | 1535.84 | 1.00 | 3.75 |
| -35 | 862.48 | 0.48 | 1.88 | 145 | 1554.56 | 1.03 | 3.83 |
| -30 | 882.22 | 0.45 | 1.78 | 150 | 1573.25 | 1.05 | 3.92 |
| -25 | 901.92 | 0.43 | 1.67 | 155 | 1591.91 | 1.08 | 4.01 |
| -20 | 921.60 | 0.40 | 1.57 | 160 | 1610.54 | 1.10 | 4.10 |
| -15 | 941.24 | 0.38 | 1.47 | 165 | 1629.15 | 1.13 | 4.18 |
| -10 | 960.86 | 0.35 | 1.37 | 170 | 1647.72 | 1.15 | 4.27 |
| -5 | 980.44 | 0.33 | 1.27 | 175 | 1666.27 | 1.18 | 4.35 |
| 0 | 1000.00 | 0.30 | 1.20 | 180 | 1684.78 | 1.20 | 4.44 |
| 5 | 1019.53 | 0.33 | 1.27 | 185 | 1703.27 | 1.23 | 4.53 |
| 10 | 1039.03 | 0.35 | 1.36 | 190 | 1721.73 | 1.25 | 4.61 |
| 15 | 1058.49 | 0.38 | 1.46 | 195 | 1740.16 | 1.28 | 4.70 |
| 20 | 1077.94 | 0.40 | 1.55 | 200 | 1758.56 | 1.30 | 4.78 |
| 25 | 1097.35 | 0.43 | 1.65 | 205 | 1776.93 | 1.33 | 4.86 |
| 30 | 1116.73 | 0.45 | 1.74 | 210 | 1795.28 | 1.35 | 4.95 |
| 35 | 1136.08 | 0.48 | 1.84 | 215 | 1813.59 | 1.38 | 5.03 |
| 40 | 1155.41 | 0.50 | 1.93 | 220 | 1831.88 | 1.40 | 5.12 |
| 45 | 1174.70 | 0.53 | 2.02 | 225 | 1850.13 | 1.43 | 5.20 |
| 50 | 1193.97 | 0.55 | 2.12 | 230 | 1868.36 | 1.45 | 5.28 |
| 55 | 1213.21 | 0.58 | 2.21 | 235 | 1886.56 | 1.48 | 5.36 |
| 60 | 1232.42 | 0.60 | 2.30 | 240 | 1904.73 | 1.50 | 5.45 |
| 65 | 1251.60 | 0.63 | 2.40 | 245 | 1922.87 | 1.53 | 5.53 |
| 70 | 1270.75 | 0.65 | 2.49 | 250 | 1940.98 | 1.55 | 5.61 |
| 75 | 1289.87 | 0.68 | 2.58 | 255 | 1959.06 | 1.58 | 5.69 |
| 80 | 1308.97 | 0.70 | 2.67 | 260 | 1977.12 | 1.60 | 5.77 |
| 85 | 1328.03 | 0.73 | 2.76 | 265 | 1995.14 | 1.63 | 5.85 |
| 90 | 1347.07 | 0.75 | 2.85 | 270 | 2013.14 | 1.65 | 5.93 |
| 95 | 1366.08 | 0.78 | 2.94 | 275 | 2031.11 | 1.68 | 6.01 |
| 100 | 1385.06 | 0.80 | 3.03 | 280 | 2049.05 | 1.70 | 6.09 |
| 105 | 1404.00 | 0.83 | 3.12 | 285 | 2066.96 | 1.73 | 6.17 |
| 110 | 1422.93 | 0.85 | 3.21 | 290 | 2084.84 | 1.75 | 6.25 |
| 115 | 1441.82 | 0.88 | 3.30 | 295 | 2102.69 | 1.78 | 6.33 |
| 120 | 1460.68 | 0.90 | 3.39 | 300 | 2120.52 | 1.80 | 6.41 |
| 125 | 1479.51 | 0.93 | 3.48 | 305 | 2138.31 | 1.83 | 6.49 |

| Temperature (°C) | Resistance (Ω) | Temperature deviation (±°C) | Resistance tolerance (± Ω) |
|---|---|---|---|
| 310 | 2156.08 | 1.85 | 6.57 |
| 315 | 2173.81 | 1.88 | 6.65 |
| 320 | 2191.52 | 1.90 | 6.72 |
| 325 | 2209.20 | 1.93 | 6.80 |
| 330 | 2226.85 | 1.95 | 6.88 |
| 335 | 2244.47 | 1.98 | 6.95 |
| 340 | 2262.06 | 2.00 | 7.03 |
| 345 | 2279.63 | 2.03 | 7.11 |
| 350 | 2297.16 | 2.05 | 7.18 |
| 355 | 2314.67 | 2.08 | 7.26 |
| 360 | 2332.14 | 2.10 | 7.33 |
| 365 | 2349.59 | 2.13 | 7.41 |
| 370 | 2367.01 | 2.15 | 7.48 |
| 375 | 2384.40 | 2.18 | 7.56 |
| 380 | 2401.76 | 2.20 | 7.63 |
| 385 | 2419.10 | 2.23 | 7.71 |
| 390 | 2436.40 | 2.25 | 7.78 |
| 395 | 2453.67 | 2.28 | 7.85 |
| 400 | 2470.92 | 2.30 | 7.93 |
| 405 | 2488.14 | 2.33 | 8.00 |
| 410 | 2505.33 | 2.35 | 8.07 |
| 415 | 2522.48 | 2.38 | 8.14 |
| 420 | 2539.62 | 2.40 | 8.22 |
| 425 | 2556.72 | 2.43 | 8.29 |
| 430 | 2573.79 | 2.45 | 8.36 |
| 435 | 2590.83 | 2.48 | 8.43 |
| 440 | 2607.85 | 2.50 | 8.50 |
| 445 | 2624.83 | 2.53 | 8.57 |
| 450 | 2641.79 | 2.55 | 8.64 |
| 455 | 2658.72 | 2.58 | 8.71 |
| 460 | 2675.62 | 2.60 | 8.78 |
| 465 | 2692.49 | 2.63 | 8.85 |
| 470 | 2709.33 | 2.65 | 8.92 |
| 475 | 2726.14 | 2.68 | 8.99 |
| 480 | 2742.93 | 2.70 | 9.06 |
| 485 | 2759.68 | 2.73 | 9.12 |
| 490 | 2776.41 | 2.75 | 9.19 |
| 495 | 2793.11 | 2.78 | 9.26 |
| 500 | 2809.78 | 2.80 | 9.33 |