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**SD50114XXX, PT RTD probe sensor**

The history of revision change for the specification

| Date       | Revision | Changes      |
|------------|----------|--------------|
| 2019/09/21 | A0       | New Approval |
|            |          |              |
|            |          |              |
|            |          |              |
|            |          |              |

## SD50114XXX, PT RTD probe sensor

### Features / Applications :

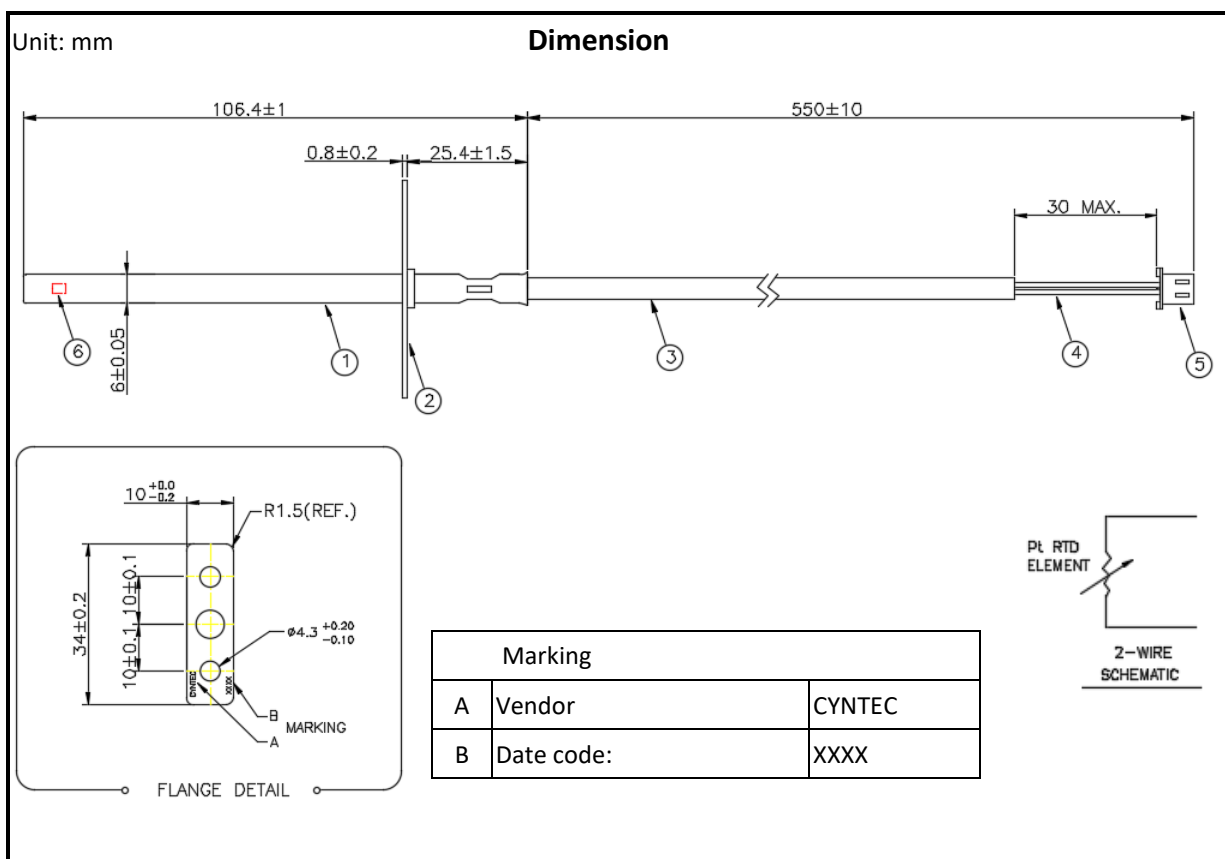
- Features:
  - Low drift
  - Long service life
  - Wide temperature range
  - Wide range of resistance values
  - Temperature linear control
  - High precision
  - Fast response time
  - RoHS compliant
- Application:
  - Home Appliances: Oven



### Electrical Specifications :

| Characteristics                             | Feature       |
|---------------------------------------------|---------------|
| Resistance value at 0°C                     | 500±1.2 Ω     |
| Temperature coefficient of resistance (TCR) | 3850ppm/°C    |
| Operation Temperature Range                 | -40°C~ +538°C |
| Maximum Applied current                     | 2 mA          |

## Outline Drawing :



## Outline Specifications :

| No. | Material       | Specification                                                                                                                        |
|-----|----------------|--------------------------------------------------------------------------------------------------------------------------------------|
| ①   | Probe tube     | Φ6XL106.4 mm, material: 300 series stainless steel tube.<br>Discoloration due to welding and high temperature testing is acceptable. |
| ②   | Flange         | Material: 300 series stainless steel.                                                                                                |
| ③   | Cable          | Silicone cable, maximum temperature 180 °C                                                                                           |
| ④   | Wire           | 24 awg pure nickel wire with Teflon insulation over each.                                                                            |
| ⑤   | Connector      | Terminal: Molex 5263, 08-70-1039<br>Housing: Molex 5264-N2,50-37-5023                                                                |
| ⑥   | Sensor element | 500 ohms thin film platinum RTD, $\alpha(TCR)=3850 \text{ ppm}/^{\circ}\text{C}$<br>ESD sensitivity level: $\pm 2\text{KV}$          |

## Type Designation :

SD      501      1      4      XXX  
(1)      (2)      (3) (4)      (5)

Where:

- (1) Series No: SD= PT probe
- (2) Resistance Value: 501=50X10=500 ohm
- (3) TCR/Class: 1 = 3850/C
- (4) Package type : 4 = Metal tube type
- (5) Serial no

## Characteristics :

### Electrical

| Item                  | Specification and Requirement                                                      | Test Method                                                                                                       |
|-----------------------|------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------|
| Dielectric strength   | Current leakage<1mA<br>No breakdown.                                               | Apply 2000 VAC for 1 minute at 500℃ and 3000 VAC for 1 second at room temperature.                                |
| Insulation resistance | >50 Mega ohms                                                                      | Apply 500 VDC between the leads wire and stainless steel tube for 1 second.                                       |
| Short time overload   | $\Delta R(0 \text{ degree}) \leq 0.24\%$<br>Without distinct damage in appearance. | Repeat 10 cycles as follow:<br>Apply current: 5mA rated current for 5 seconds and 30 seconds at room temperature. |
| ESD                   | $\Delta R(0 \text{ degree}) \leq 0.24\%$                                           | Human body, 2KV.                                                                                                  |

### Mechanical

| Item                    | Specification and Requirement | Test Method                                                                                                    |
|-------------------------|-------------------------------|----------------------------------------------------------------------------------------------------------------|
| Bracket pull force      | >8 kgf                        | Apply axial pull force on the bracket assembled in probe housing.                                              |
| Wire pull force         | >2.5 kgf                      | Apply axial pull force on the leads wire in probe housing.                                                     |
| Crimping pull out force | >3 kgf                        | Fix the crimped terminal to the jig, apply axial pull out force on the wire at the speed rate of 100 mm/minute |

### Endurance

| Item                  | Specification and Requirement                                                      | Test Method                                                                                                                                                              |
|-----------------------|------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Low temperature test  | $\Delta R(0 \text{ degree}) \leq 0.24\%$<br>Without distinct damage in appearance. | Keep the probe sensor in $-55^{\circ}\text{C}$ for 1000 hours.                                                                                                           |
| High temperature test | $\Delta R(0 \text{ degree}) \leq 0.24\%$<br>Without distinct damage in appearance. | Keep the probe sensor in $538^{\circ}\text{C}$ for 1000 hours.                                                                                                           |
| Humidity test         | $\Delta R(0 \text{ degree}) \leq 0.24\%$<br>Without distinct damage in appearance. | Keep the probe sensor in $60^{\circ}\text{C}$ and 90%~95% R.H. for 1000 hours.                                                                                           |
| Thermal cycles        | $\Delta R(0 \text{ degree}) \leq 0.24\%$<br>Without distinct damage in appearance. | (1) Keep the probe sensor in $538^{\circ}\text{C}$ for 3 hours.<br>(2) keep the probe sensor in $70^{\circ}\text{C}$ for 30 minutes.<br>Repeat (1) ~ (2) for 150 cycles. |
| Thermal shock         | $\Delta R(0 \text{ degree}) \leq 0.24\%$<br>Without distinct damage in appearance. | (1) Keep the probe sensor in $538^{\circ}\text{C}$ for 10 minutes.<br>(2) Keep the probe sensor in room temperature for 5 minutes.<br>Repeat (1)~(2) for 250 times.      |

## Temperature and resistance relationship:

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

When  $T < 0^{\circ}\text{C}$  :

$$R_t = R_0 [ 1 + aT + bT^2 + cT^3 ( T - 100 ) ]$$

When  $T \geq 0^{\circ}\text{C}$  :

$$R_t = R_0 (1 + aT + bT^2)$$

Where

$R_t$ : resistance at a certain temperature  $T$

$R_0$ : resistance at  $0^{\circ}\text{C}$

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

Coefficient for  $\text{TCR}=3850 \text{ PPM}/^{\circ}\text{C}$  (IEC 751 Standard)

| Temperature                | a            | b            | c            |
|----------------------------|--------------|--------------|--------------|
| $T < 0^{\circ}\text{C}$    | 3.90830 E-03 | -5.77500E-07 | -4.18300E-12 |
| $T \geq 0^{\circ}\text{C}$ | 3.90830E-03  | -5.77500E-07 | 0            |

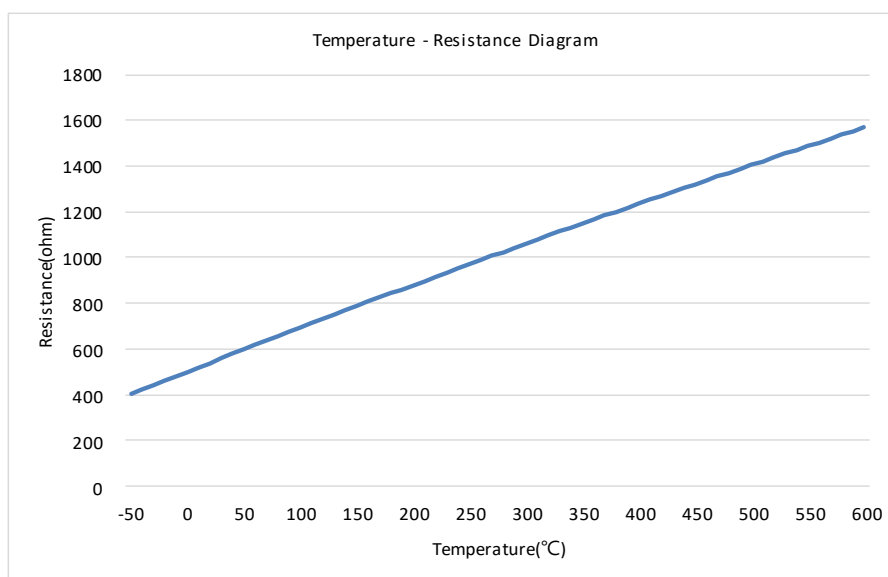
- Temperature deviation

$$\pm(a+b |t|)^{\circ}\text{C}$$

$$a = 0.60$$

$$b = 0.007$$

- Temperature – Resistance Diagram



## Resistance tolerance and Temperature Deviation table of PT 500:

| Temperature<br>(°C) | Resistance<br>(Ω) | Permissible<br>Deviation<br>(±°C) | Permissible<br>Deviation<br>(±Ω) | Temperature<br>(°C) | Resistance<br>(Ω) | Permissible<br>Deviation<br>(±°C) | Permissible<br>Deviation<br>(±Ω) |
|---------------------|-------------------|-----------------------------------|----------------------------------|---------------------|-------------------|-----------------------------------|----------------------------------|
| -50                 | 401.53            | 0.95                              | 1.89                             | 90                  | 673.53            | 1.23                              | 2.34                             |
| -45                 | 411.45            | 0.92                              | 1.81                             | 95                  | 683.04            | 1.27                              | 2.40                             |
| -40                 | 421.35            | 0.88                              | 1.74                             | 100                 | 692.53            | 1.30                              | 2.47                             |
| -35                 | 431.24            | 0.85                              | 1.67                             | 105                 | 702.00            | 1.34                              | 2.53                             |
| -30                 | 441.11            | 0.81                              | 1.60                             | 110                 | 711.46            | 1.37                              | 2.59                             |
| -25                 | 450.96            | 0.78                              | 1.53                             | 115                 | 720.91            | 1.41                              | 2.65                             |
| -20                 | 460.80            | 0.74                              | 1.45                             | 120                 | 730.34            | 1.44                              | 2.71                             |
| -15                 | 470.62            | 0.71                              | 1.38                             | 125                 | 739.76            | 1.48                              | 2.78                             |
| -10                 | 480.43            | 0.67                              | 1.31                             | 130                 | 749.16            | 1.51                              | 2.84                             |
| -5                  | 490.22            | 0.64                              | 1.24                             | 135                 | 758.55            | 1.55                              | 2.90                             |
| 0                   | 500.00            | 0.60                              | 1.20                             | 140                 | 767.92            | 1.58                              | 2.96                             |
| 5                   | 509.76            | 0.64                              | 1.24                             | 145                 | 777.28            | 1.62                              | 3.02                             |
| 10                  | 519.51            | 0.67                              | 1.31                             | 150                 | 786.63            | 1.65                              | 3.08                             |
| 15                  | 529.25            | 0.71                              | 1.37                             | 155                 | 795.96            | 1.69                              | 3.14                             |
| 20                  | 538.97            | 0.74                              | 1.44                             | 160                 | 805.27            | 1.72                              | 3.20                             |
| 25                  | 548.67            | 0.78                              | 1.50                             | 165                 | 814.57            | 1.76                              | 3.26                             |
| 30                  | 558.36            | 0.81                              | 1.57                             | 170                 | 823.86            | 1.79                              | 3.32                             |
| 35                  | 568.04            | 0.85                              | 1.63                             | 175                 | 833.13            | 1.83                              | 3.38                             |
| 40                  | 577.70            | 0.88                              | 1.70                             | 180                 | 842.39            | 1.86                              | 3.44                             |
| 45                  | 587.35            | 0.92                              | 1.76                             | 185                 | 851.64            | 1.90                              | 3.50                             |
| 50                  | 596.99            | 0.95                              | 1.83                             | 190                 | 860.86            | 1.93                              | 3.56                             |
| 55                  | 606.60            | 0.99                              | 1.89                             | 195                 | 870.08            | 1.97                              | 3.62                             |
| 60                  | 616.21            | 1.02                              | 1.96                             | 200                 | 879.28            | 2.00                              | 3.68                             |
| 65                  | 625.80            | 1.06                              | 2.02                             | 205                 | 888.47            | 2.04                              | 3.74                             |
| 70                  | 635.38            | 1.09                              | 2.09                             | 210                 | 897.64            | 2.07                              | 3.79                             |
| 75                  | 644.94            | 1.13                              | 2.15                             | 215                 | 906.79            | 2.11                              | 3.85                             |
| 80                  | 654.48            | 1.16                              | 2.21                             | 220                 | 915.94            | 2.14                              | 3.91                             |
| 85                  | 664.02            | 1.20                              | 2.28                             | 225                 | 925.07            | 2.18                              | 3.97                             |

| Temperature<br>(°C) | Resistance<br>(Ω) | Permissible<br>Deviation<br>(±°C) | Permissible<br>Deviation<br>(±Ω) | Temperature<br>(°C) | Resistance<br>(Ω) | Permissible<br>Deviation<br>(±°C) | Permissible<br>Deviation<br>(±Ω) |
|---------------------|-------------------|-----------------------------------|----------------------------------|---------------------|-------------------|-----------------------------------|----------------------------------|
| 230                 | 934.18            | 2.21                              | 4.03                             | 380                 | 1200.88           | 3.26                              | 5.66                             |
| 235                 | 943.28            | 2.25                              | 4.08                             | 385                 | 1209.55           | 3.30                              | 5.71                             |
| 240                 | 952.36            | 2.28                              | 4.14                             | 390                 | 1218.20           | 3.33                              | 5.76                             |
| 245                 | 961.43            | 2.32                              | 4.20                             | 395                 | 1226.84           | 3.37                              | 5.81                             |
| 250                 | 970.49            | 2.35                              | 4.25                             | 400                 | 1235.46           | 3.40                              | 5.86                             |
| 255                 | 979.53            | 2.39                              | 4.31                             | 405                 | 1244.07           | 3.44                              | 5.91                             |
| 260                 | 988.56            | 2.42                              | 4.37                             | 410                 | 1252.66           | 3.47                              | 5.96                             |
| 265                 | 997.57            | 2.46                              | 4.42                             | 415                 | 1261.24           | 3.51                              | 6.01                             |
| 270                 | 1006.57           | 2.49                              | 4.48                             | 420                 | 1269.81           | 3.54                              | 6.06                             |
| 275                 | 1015.55           | 2.53                              | 4.53                             | 425                 | 1278.36           | 3.58                              | 6.11                             |
| 280                 | 1024.52           | 2.56                              | 4.59                             | 430                 | 1286.89           | 3.61                              | 6.16                             |
| 285                 | 1033.48           | 2.60                              | 4.64                             | 435                 | 1295.42           | 3.65                              | 6.21                             |
| 290                 | 1042.42           | 2.63                              | 4.70                             | 440                 | 1303.92           | 3.68                              | 6.26                             |
| 295                 | 1051.35           | 2.67                              | 4.75                             | 445                 | 1312.42           | 3.72                              | 6.30                             |
| 300                 | 1060.26           | 2.70                              | 4.81                             | 450                 | 1320.90           | 3.75                              | 6.35                             |
| 305                 | 1069.15           | 2.74                              | 4.86                             | 455                 | 1329.36           | 3.79                              | 6.40                             |
| 310                 | 1078.04           | 2.77                              | 4.92                             | 460                 | 1337.81           | 3.82                              | 6.45                             |
| 315                 | 1086.91           | 2.81                              | 4.97                             | 465                 | 1346.24           | 3.86                              | 6.50                             |
| 320                 | 1095.76           | 2.84                              | 5.02                             | 470                 | 1354.67           | 3.89                              | 6.55                             |
| 325                 | 1104.60           | 2.88                              | 5.08                             | 475                 | 1363.07           | 3.93                              | 6.59                             |
| 330                 | 1113.42           | 2.91                              | 5.13                             | 480                 | 1371.46           | 3.96                              | 6.64                             |
| 335                 | 1122.24           | 2.95                              | 5.19                             | 485                 | 1379.84           | 4.00                              | 6.69                             |
| 340                 | 1131.03           | 2.98                              | 5.24                             | 490                 | 1388.20           | 4.03                              | 6.73                             |
| 345                 | 1139.81           | 3.02                              | 5.29                             | 495                 | 1396.55           | 4.07                              | 6.78                             |
| 350                 | 1148.58           | 3.05                              | 5.34                             | 500                 | 1404.89           | 4.10                              | 6.83                             |
| 355                 | 1157.33           | 3.09                              | 5.40                             |                     |                   |                                   |                                  |
| 360                 | 1166.07           | 3.12                              | 5.45                             |                     |                   |                                   |                                  |
| 365                 | 1174.80           | 3.16                              | 5.50                             |                     |                   |                                   |                                  |
| 370                 | 1183.51           | 3.19                              | 5.55                             |                     |                   |                                   |                                  |
| 375                 | 1192.20           | 3.23                              | 5.60                             |                     |                   |                                   |                                  |