## SensorsX

# SX-TEEB Series

Precision NTC Temperature Sensors



| −40 to +150 °C | Up to +200 °C | 7 Package Styles |
|---|---|---|
| Standard operating range | Custom designs | Customizable dimensions |

## ■ OVERVIEW

The SX-TEEB Series comprises NTC thermistor temperature sensors for temperature measurement and control. Seven package styles are available, with customizable dimensions, lead wires and terminations. The series offers high sensitivity, fast thermal response and long-term stability for industrial, automotive, energy-storage, medical-equipment and appliance applications. The standard operating range is −40 to +150 °C, depending on lead-wire material; selected custom designs are available for operation up to +200 °C.



## ■ FEATURES

- ◆ Stable performance and long-term reliability
- ◆ High sensitivity and fast thermal response
- ◆ Tight resistance and B-value tolerances for consistent performance
- ◆ Good insulation, moisture resistance, and mechanical durability
- ◆ Multiple configurable package styles


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## ■ TYPICAL APPLICATIONS

### Application Fields

- Energy storage system temperature monitoring
- Medical equipment temperature control
- Industrial automation temperature monitoring
- Automotive electronics temperature sensing
- Power tool temperature protection
- Thermal management for communication equipment
- EV battery and charging temperature monitoring
- Home appliance temperature sensing
- Process equipment temperature control

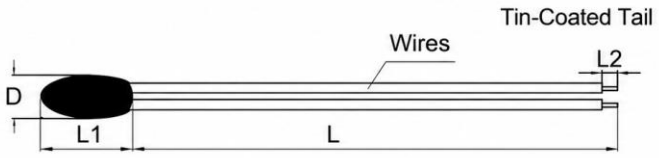
## ■ PRODUCT CONFIGURATIONS

| SensorsX Model | Package Type |
|---|---|
| SX-TEEB1 | Epoxy encapsulation with wire leads |
| SX-TEEB2 | Metal encapsulation with wire leads |
| SX-TEEB3 | Non-metal encapsulation with wire leads |
| SX-TEEB4 | Embedded metal sheet with wire leads |
| SX-TEEB5 | Special Housing |
| SX-TEEB6 | Injection-molded encapsulation with wire leads |
| SX-TEEB7 | Ceramic Sleeve with wire leads |

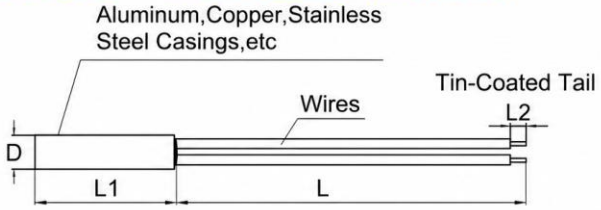
## ■ STRUCTURE AND DIMENSIONS

Package form and dimensions can be customized. Parameters D, L1, L2, and L are specified by the user.

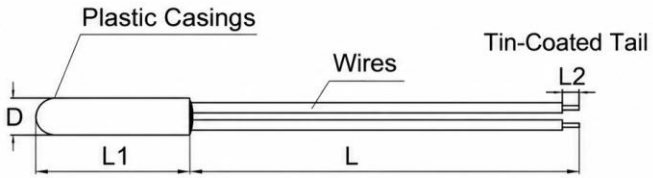
**SX-TEEB1 — Epoxy encapsulation**



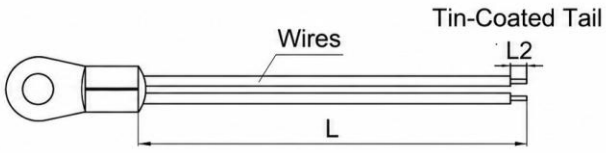

**SX-TEEB2 — Metal casing (Al/Cu/SS)**




**SX-TEEB3 — Non-metal / plastic casing**



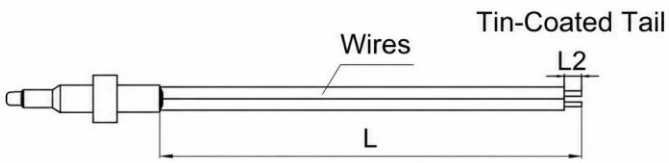

**SX-TEEB4 — Embedded metal sheet**



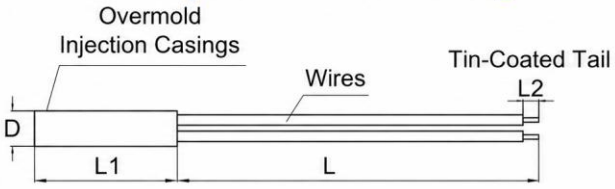


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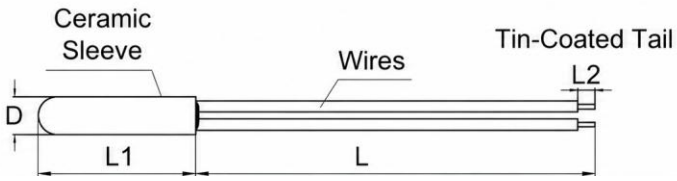
### SX-TEEB5 — Special Housing




### SX-TEEB6 — Injection-molded casing




### SX-TEEB7 — Ceramic Sleeve




## ■ ELECTRICAL SPECIFICATIONS

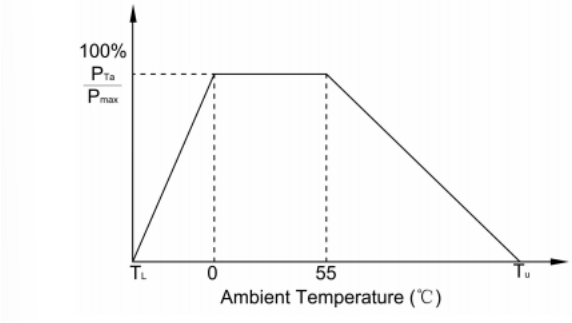
| Standard R25 / B-Value Combination | R25 (kΩ) | R25 Tolerance | B25/50 (K) | B Tolerance | Pmax (mW) | Operating Range |
|---|---|---|---|---|---|---|
| 2 kΩ / 3470 K | 2 | ±0.5% / ±1% / ±2% / ±3% / ±5% | 3470 | ±1% / ±2% | 50 | −40 to +150 °C* |
| 5 kΩ / 3470 K | 5 | ±0.5% / ±1% / ±2% / ±3% / ±5% | 3470 | ±1% / ±2% | 50 | −40 to +150 °C* |
| 5 kΩ / 3950 K | 5 | ±0.5% / ±1% / ±2% / ±3% / ±5% | 3950 | ±1% / ±2% | 50 | −40 to +150 °C* |
| 10 kΩ / 3380 K | 10 | ±0.5% / ±1% / ±2% / ±3% / ±5% | 3380 | ±1% / ±2% | 50 | −40 to +150 °C* |
| 10 kΩ / 3470 K | 10 | ±0.5% / ±1% / ±2% / ±3% / ±5% | 3470 | ±1% / ±2% | 50 | −40 to +150 °C* |
| 10 kΩ / 3950 K | 10 | ±0.5% / ±1% / ±2% / ±3% / ±5% | 3950 | ±1% / ±2% | 50 | −40 to +150 °C* |
| 15 kΩ / 3950 K | 15 | ±0.5% / ±1% / ±2% / ±3% / ±5% | 3950 | ±1% / ±2% | 50 | −40 to +150 °C* |
| 20 kΩ / 3950 K | 20 | ±0.5% / ±1% / ±2% / ±3% / ±5% | 3950 | ±1% / ±2% | 50 | −40 to +150 °C* |
| 50 kΩ / 3950 K | 50 | ±0.5% / ±1% / ±2% / ±3% / ±5% | 3950 | ±1% / ±2% | 50 | −40 to +150 °C* |
| 100 kΩ / 3950 K | 100 | ±0.5% / ±1% / ±2% / ±3% / ±5% | 3950 | ±1% / ±2% | 50 | −40 to +150 °C* |
| 100 kΩ / 4450 K | 100 | ±0.5% / ±1% / ±2% / ±3% / ±5% | 4450 | ±1% / ±2% | 50 | −40 to +150 °C* |

* The standard operating range depends on the lead-wire material. Custom designs are available for operation up to +200 °C.

The difference between B25/50 = 3380 K and B25/85 = 3435 K arises solely from the temperature points used in the B-value calculation. All other electrical and mechanical characteristics remain identical.

## ■ POWER DERATING

### Power Derating Curve




For example:
Ambient temperature ($T_a$) = 85℃
Maximum operating temperature ($T_u$) = 150℃

$$P_{Ta} = \frac{T_u - T_a}{T_u - 55} \times P_{max} = 68.4\% P_{max}$$


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## ■ R–T CHARACTERISTICS

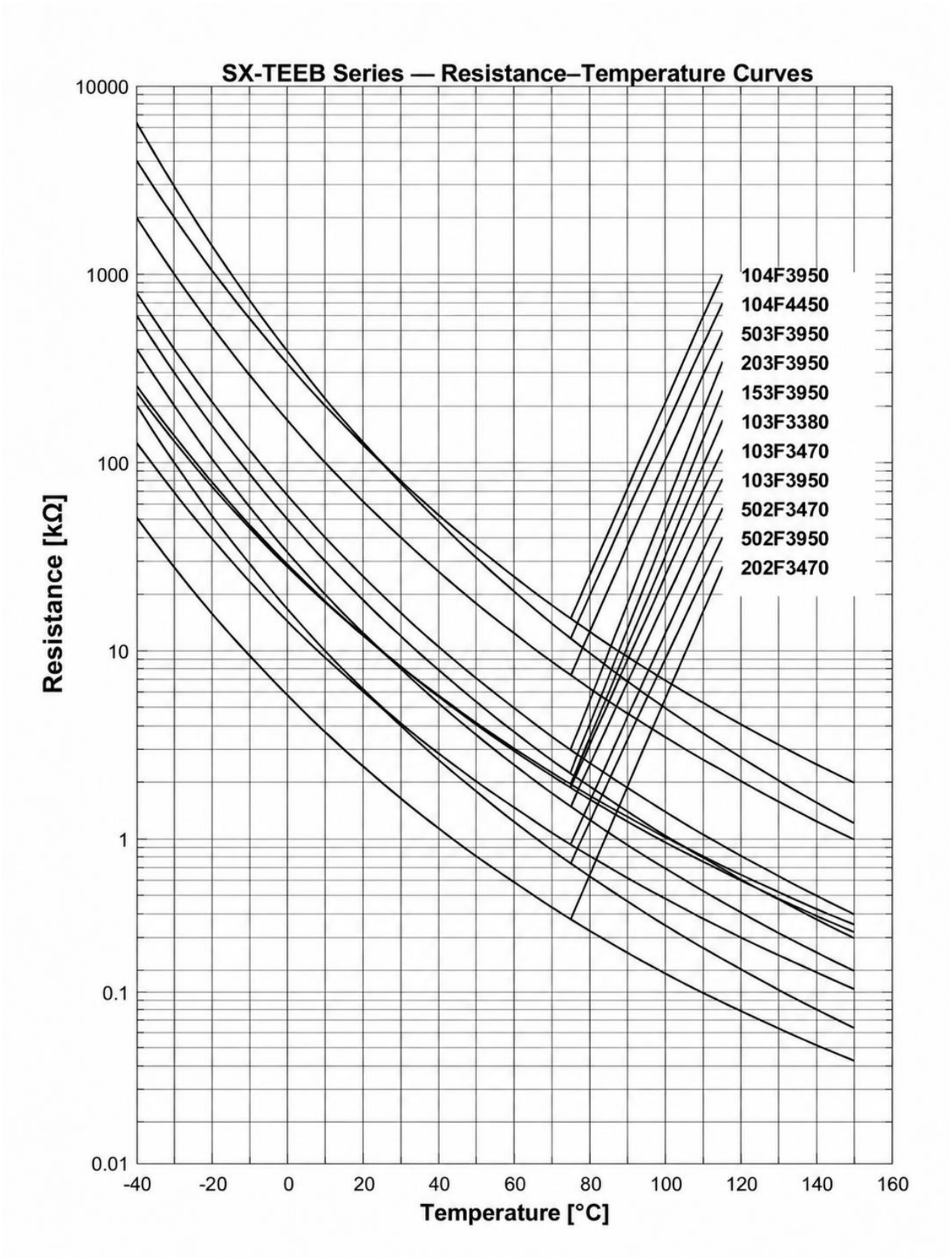
The following table provides resistance in kΩ from −40 to +150 °C for the specified R25/B-value combinations.

### R-T Characteristics and Curves

| Resistance Value (kΩ) / Temperature (℃) | Type | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | 202F 3470 | 502F 3470 | 502F 3950 | 103F 3380 | 103F 3470 | 103F 3950 | 153F 3950 | 203F 3950 | 503F 3950 | 104F 3950 | 104F 4450 |
| -40 | 35.58 | 112.2 | 141.2 | 203.7 | 214.8 | 280.6 | 413.0 | 550.6 | 1475 | 3169 | 4155 |
| -35 | 27.17 | 83.15 | 105.9 | 152.9 | 162.6 | 206.7 | 306.8 | 409.1 | 1090 | 2336 | 2970 |
| -30 | 20.93 | 62.58 | 80.03 | 116.2 | 123.7 | 154.0 | 228.6 | 304.8 | 809.0 | 1730 | 2144 |
| -25 | 16.26 | 47.68 | 60.76 | 89.35 | 94.78 | 116.0 | 171.2 | 228.4 | 603.3 | 1287 | 1562 |
| -20 | 12.76 | 36.70 | 46.29 | 69.39 | 73.15 | 88.23 | 129.4 | 172.5 | 453.0 | 962.9 | 1149 |
| -15 | 10.10 | 28.50 | 35.38 | 54.39 | 56.93 | 67.70 | 98.75 | 131.6 | 343.2 | 725.5 | 852.0 |
| -10 | 8.067 | 22.32 | 27.16 | 43.00 | 44.69 | 52.35 | 76.11 | 101.4 | 262.5 | 551.1 | 636.9 |
| -5 | 6.494 | 17.62 | 20.94 | 34.24 | 35.36 | 40.74 | 59.20 | 78.93 | 202.6 | 422.0 | 479.6 |
| 0 | 5.246 | 14.06 | 16.15 | 27.51 | 28.11 | 32.04 | 46.72 | 62.29 | 157.9 | 326.5 | 362.8 |
| 5 | 4.296 | 11.27 | 12.65 | 22.17 | 22.64 | 25.10 | 36.66 | 48.88 | 123.9 | 253.6 | 277.7 |
| 10 | 3.524 | 9.128 | 9.932 | 18.01 | 18.30 | 19.85 | 29.12 | 38.83 | 98.03 | 198.9 | 213.4 |
| 15 | 2.902 | 7.441 | 7.845 | 14.72 | 14.88 | 15.77 | 23.25 | 31.00 | 78.01 | 157.1 | 165.0 |
| 20 | 2.399 | 6.105 | 6.238 | 12.10 | 12.17 | 12.58 | 18.64 | 24.86 | 62.42 | 124.9 | 128.3 |
| 25 | 2.000 | 5.000 | 5.000 | 10.00 | 10.00 | 10.00 | 15.00 | 20.00 | 50.00 | 100.0 | 100.0 |
| 30 | 1.654 | 4.173 | 4.022 | 8.315 | 8.278 | 8.123 | 12.14 | 16.18 | 40.53 | 80.50 | 78.87 |
| 35 | 1.379 | 3.472 | 3.259 | 6.946 | 6.879 | 6.573 | 9.855 | 13.14 | 32.86 | 65.18 | 62.34 |
| 40 | 1.153 | 2.897 | 2.657 | 5.831 | 5.745 | 5.345 | 8.033 | 10.71 | 26.75 | 53.08 | 49.53 |
| 45 | 0.967 | 2.425 | 2.178 | 4.918 | 4.821 | 4.368 | 6.578 | 8.770 | 21.86 | 43.45 | 39.55 |
| 50 | 0.814 | 2.035 | 1.796 | 4.168 | 4.064 | 3.590 | 5.410 | 7.214 | 17.94 | 35.75 | 31.75 |
| 55 | 0.687 | 1.711 | 1.487 | 3.546 | 3.440 | 2.965 | 4.471 | 5.961 | 14.77 | 29.55 | 25.62 |
| 60 | 0.583 | 1.443 | 1.238 | 3.030 | 2.925 | 2.463 | 3.712 | 4.949 | 12.21 | 24.55 | 20.77 |
| 65 | 0.496 | 1.221 | 1.036 | 2.600 | 2.496 | 2.056 | 3.097 | 4.129 | 10.14 | 20.48 | 16.93 |
| 70 | 0.425 | 1.036 | 0.871 | 2.239 | 2.139 | 1.726 | 2.595 | 3.460 | 8.455 | 17.17 | 13.87 |
| 75 | 0.365 | 0.882 | 0.735 | 1.935 | 1.839 | 1.456 | 2.185 | 2.913 | 7.077 | 14.45 | 11.41 |
| 80 | 0.315 | 0.753 | 0.623 | 1.678 | 1.587 | 1.235 | 1.847 | 2.463 | 5.948 | 12.21 | 9.445 |
| 85 | 0.274 | 0.647 | 0.531 | 1.461 | 1.374 | 1.052 | 1.567 | 2.090 | 5.020 | 10.36 | 7.850 |
| 90 | 0.238 | 0.557 | 0.454 | 1.275 | 1.193 | 0.889 | 1.335 | 1.780 | 4.253 | 8.824 | 6.554 |
| 95 | 0.208 | 0.482 | 0.389 | 1.118 | 1.040 | 0.772 | 1.140 | 1.521 | 3.618 | 7.544 | 5.497 |
| 100 | 0.183 | 0.419 | 0.336 | 0.983 | 0.911 | 0.666 | 0.977 | 1.303 | 3.090 | 6.474 | 4.631 |
| 105 | 0.160 | 0.365 | 0.290 | 0.867 | 0.800 | 0.575 | 0.839 | 1.119 | 2.648 | 5.576 | 3.917 |
| 110 | 0.141 | 0.319 | 0.252 | 0.767 | 0.707 | 0.499 | 0.722 | 0.963 | 2.278 | 4.822 | 3.327 |
| 115 | 0.124 | 0.279 | 0.219 | 0.681 | 0.627 | 0.433 | 0.622 | 0.830 | 1.967 | 4.187 | 2.836 |
| 120 | 0.108 | 0.245 | 0.191 | 0.607 | 0.560 | 0.377 | 0.537 | 0.717 | 1.704 | 3.651 | 2.426 |
| 125 | 0.095 | 0.215 | 0.168 | 0.544 | 0.504 | 0.329 | 0.465 | 0.620 | 1.482 | 3.199 | 2.082 |
| 130 | 0.082 | 0.188 | 0.147 | 0.488 | 0.456 | 0.287 | 0.402 | 0.536 | 1.292 | 2.815 | 1.791 |
| 135 | 0.071 | 0.163 | 0.129 | 0.440 | 0.417 | 0.250 | 0.348 | 0.465 | 1.130 | 2.491 | 1.546 |
| 140 | 0.06 | 0.141 | 0.113 | 0.398 | 0.385 | 0.218 | 0.302 | 0.403 | 0.992 | 2.217 | 1.337 |
| 145 | 0.051 | 0.121 | 0.100 | 0.362 | 0.360 | 0.190 | 0.263 | 0.351 | 0.874 | 1.985 | 1.158 |
| 150 | 0.042 | 0.103 | 0.088 | 0.331 | 0.340 | 0.166 | 0.229 | 0.305 | 0.772 | 1.789 | 1.005 |


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## ■ R–T CHARACTERISTIC CURVES

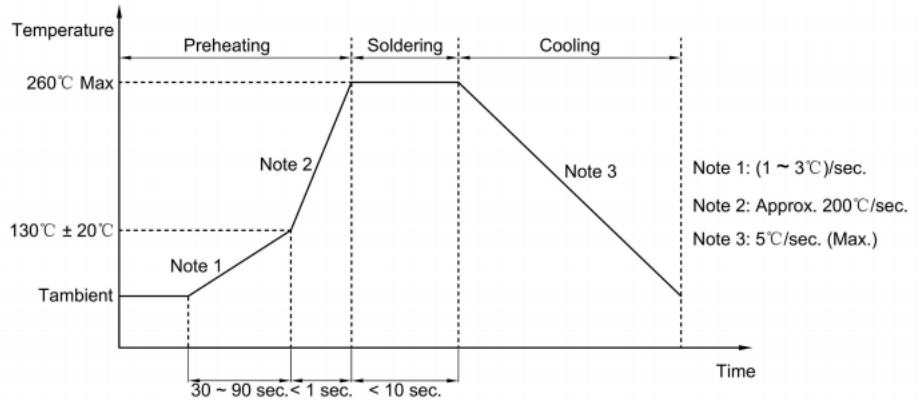




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## ■ SOLDERING AND REWORKING

### Wave Soldering Profile




## ■ RECOMMENDED REWORKING CONDITIONS — SOLDERING IRON

| Item | Condition |
|---|---|
| Soldering iron tip temperature | 360 °C max. |
| Soldering time | 3 s max. |
| Distance from thermistor | 2 mm min. |

## ■ RELIABILITY

| No. | Test / Standard | Conditions / Method | Acceptance Criteria |
|---|---|---|---|
| 1 | Terminal tensile strength<br>IEC 60068-2-21 | Keep unit fixed; apply 20 ± 1 N for 10 ± 1 s. | No visible damage; \|ΔR25/R25\| ≤ 2% |
| 2 | Solderability<br>IEC 60068-2-20 | 245 ± 5 °C for 2–3 s. | Coverage area ≥ 95% |
| 3 | Resistance to soldering heat<br>IEC 60068-2-20 | Solder bath 260 ± 5 °C; insertion depth 6 mm from resistor body; 5 ± 1 s. | No visible damage; \|ΔR25/R25\| ≤ 2% |
| 4 | Damp heat, steady state<br>IEC 60068-2-78 | 40 ± 2 °C; 93 ± 2% RH; 500 h. | No visible damage; \|ΔR25/R25\| ≤ 2% |
| 5 | Rapid temperature change<br>IEC 60068-2-14 | 5 cycles: TL ± 5 °C, 30 ± 3 min; room temp., 5 ± 3 min; TU ± 5 °C, 30 ± 3 min; room temp., 5 ± 3 min. | No visible damage; \|ΔR25/R25\| ≤ 2% |
| 6 | High-temperature storage<br>IEC 60068-2-2 | TU ± 2 °C for 1,000 h. | No visible damage; \|ΔR25/R25\| ≤ 2% |
| 7 | Low-temperature storage<br>IEC 60068-2-1 | TL ± 2 °C for 1,000 h. | No visible damage; \|ΔR25/R25\| ≤ 2% |


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## ■ ORDER INFORMATION

### Ordering Code Example: SX-TEEB-1103F3950F

This example represents an epoxy-encapsulated NTC temperature sensor with a nominal resistance of 10 kΩ at 25 °C (R25), a resistance tolerance of ±1%, a B25/50 value of 3950 K, and a B-value tolerance of ±1%.

Custom dimensions, lead-wire materials, lead lengths and terminations are available on request.

| Model Number | |
|---|---|
| **SX-TEEB** | |
| **Package Type** | |
| **1** | Epoxy encapsulation with wire leads |
| **2** | Metal encapsulation with wire leads |
| **3** | Non-metal encapsulation with wire leads (Plastic) |
| **4** | Embedded metal sheet with wire leads |
| **5** | Special connection encapsulation (Threaded) |
| **6** | Injection-molded encapsulation with wire leads |
| **7** | Ceramic Sleeve with wire leads |
| **Zero-Power Resistance at 25 °C** | |
| **102** | 1 kΩ |
| **202** | 2 kΩ |
| **502** | 5 kΩ |
| **103** | 10 kΩ |
| **153** | 15 kΩ |
| **203** | 20 kΩ |
| **503** | 50 kΩ |
| **104** | 100 kΩ |
| **R25 Tolerance** | |
| **E** | ±0.5% |
| **F** | ±1% |
| **G** | ±2% |
| **H** | ±3% |
| **J** | ±5% |
| **B Value** | |
| **3380** | 3380 K |
| **3435** | 3435 K (B25/85) |
| **3470** | 3470 K |
| **3950** | 3950 K |
| **4050** | 4050 K |
| **4450** | 4450 K |
| **B-Value Tolerance** | |


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| | |
|---|---|
| **F** | ±1% |
| **G** | ±2% |
| **Customized Information** | |
| **D** | Optional configuration- specify requirements when ordering. |

Note: Available R25/B-value combinations are listed in Electrical Specifications. Other combinations are subject to confirmation.

## ■ PACKAGING AND QUANTITY

- Bulk: 500 pcs/bag (customizable upon request)

## ■ RECOMMENDED STORAGE CONDITIONS

- Storage temperature: −10 to +40 °C
- Relative humidity: ≤ 75% RH
- Do not store in environments containing corrosive gases or in direct sunlight.
- Shelf life: 1 year from delivery under the recommended storage conditions.


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