Temperature Compensation Devices
Surface Mount Thermistors

SMD (CHIP STYLE) Features

- Wide Ohmic Value Range
- Accurate & Stable
- Fast Thermal Response Time
- Standard Sizes
- High Sensitivity

NTC Thermistors

Negative Temperature Coefficient (NTC) thermistors are thermally sensitive semiconductor resistors which exhibit a decrease in resistance as absolute temperature increases. Change in the resistance of the NTC thermistor can be brought about either by a change in the ambient temperature or internally by self-heating resulting from current flowing through the device. Most of the practical applications of NTC thermistors are based on these material characteristics.

Surface Mount Thermistors

RTI manufactures precision resistance-temperature SMD thermistors. Standard values from 250 ohms to 150,000 ohms are available. As with RTI's disc and chip thermistors, SMD thermistors are suitable for temperature sensing applications over a wide range of resistance values and temperature coefficients. SMD's operating temperature range is from -55°C to +150°C. Dissipation constant is 2mW/°C, with a maximum power rating of 250mW @ 25°C.

Thermistor Terminology for SMD Temperature Measurement

- **D.C.** - The dissipation constant is the ratio, normally expressed in milliwatts per degree C (mw/°C), at a specified ambient temperature, of a change in power dissipated in a thermistor to the resultant change in body temperature.
- **T.C.** - The thermal time constant is the time required for a thermistor to change 63.2% of the total difference between its initial and final body temperature when subjected to a step function change in temperature under zero-power conditions and is normally expressed in seconds (S).
- **Alpha (α)** or Temperature Coefficient of Resistance - The temperature coefficient of resistance is the ratio at a specified temperature, T, of the rate of change of zero-power resistance with temperature to the zero-power resistance of the thermistor. The temperature coefficient is commonly expressed in percent per degree C (%/°C).

$$\alpha_T = \Delta R_T / \Delta T$$

SMD on Considerations

- Select Req'd. Resistance Value & Temperature Coefficient
- Calculate DEV for R @ T
- Determine Accuracy

Applications

Most semiconductors and the circuits comprised of them exhibit a positive temperature coefficient. NTC thermistors are well suited for compensating these responses to temperature changes. It is important to match the temperature of the compensating NTC thermistor to that of the component responsible for the temperature response.

RTI's SMD temperature measurement NTC sensors can operate over a wide temperature range (-55 to +150°C). They are stable throughout a long lifetime, and are small and comparatively inexpensive. Typically, they have negative temperature coefficients between -3.3 and -4.7%/°C at 25°C. RTI's SMD style thermistors are used in many applications that require a high degree of accuracy and reliability

- Accuracy Req'd.
- Review Power Dissipation
- Review Thermal Time Constant

used in many applications that require a high degree of accuracy and reliability.

Some of the most popular applications of NTC thermistors include:

- Temperature Compensation
- Temperature Measurement & Control
- LCD Controls
- Power Transistor Stabilization

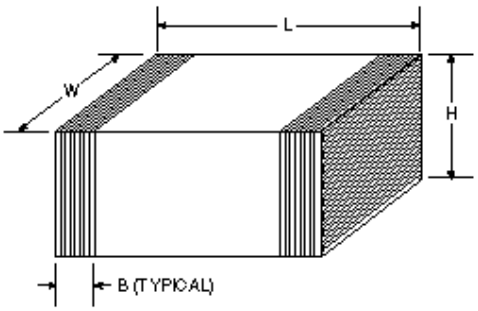
Selection Considerations for SMD NTC Devices

To determine the nominal resistance value of a thermistor at a specified temperature, multiply its R_T/R_{25} value for the desired temperature and R-T curve from the table on NTC Resistance/Temperature Conversion Tables by its nominal resistance value at 25°C. As an example, the nominal resistance value at 80°C for a thermistor with the part number KR0805B103K is 10,000 times 0.157, the R_T/R_{25} value in the R-T Curve "B" in the table under NTC Resistance/Temperature Conversion Tables.
Standard resistance tolerances at 25°C for RTI's SMD thermistors is ±10% and is indicated in its part number by the addition of the suffix K. To determine the resistance value at other than 25°C, add the appropriate DEV value from the NTC resistance/Temperature Conversion Tables to its resistance tolerance at 25°C. For example, the resistance tolerance at 80°C for a thermistor with part number KR0805B103K is ±10% ±3.0%, the DEV value from the R-T Curve "B" Table. Although standard sizes, resistance values and tolerances are listed on SMD Standard Products and Sizes, custom sizes, resistance values and tolerances are available depending on the application and volume requirements.

SMD
Configuration Options

- Standard EIA Sizes Available
- Bulk or Tape and Reel Packaging
- Two Sided & Wrap Around Terminations
- Silver Palladium Terminations

KR Series



RoHS

Size	0805		1206	
Units	Inches	Millimeters	Inches	Millimeters
W	0.049 ±0.008	1.240 ±0.200	0.063 ±0.008	1.600 ±0.200
H	0.051 Maximum	1.300 Maximum	0.059 Maximum	1.500 Maximum
L	0.079 ±0.008	2.000 ±0.200	0.126 ±0.008	3.200 ±0.200
B	0.008 Minimum	0.200 Minimum	0.008 Minimum	0.200 Minimum

STANDARD PRODUCTS

Part Number Size 0805	Part Number Size 1206	Resistance @ 25°C ±10% (Ohms)	Temperature Coefficient (α@25°C)
KR0805A251K	KR1206A251K	250	-3.3%/°C
KR0805A501K	KR1206A501K	500	-3.3%/°C
KR0805J102K	KR1206J102K	1.0K	-3.5%/°C
KR0805J252K	KR1206J252K	2.5K	-3.5%/°C
KR0805B502K	KR1206B502K	5.0K	-3.9%/°C
KR0805B103K	KR1206B103K	10K	-3.9%/°C
KR0805C203K	KR1206C203K	20K	-4.4%/°C
KR0805C253K	KR1206C253K	25K	-4.4%/°C

KR0805C503K	KR1206C503K	50K	-4.4%/°C
KR0805W104K	KR1206W104K	100K	-4.7%/°C
KR0805W154K	KR1206W154K	150K	-4.7%/°C

Ordering Information

KR	0805	A	251	K	X
Model	Size	R-T Curve	Resistance*	Tolerance**	Termination***

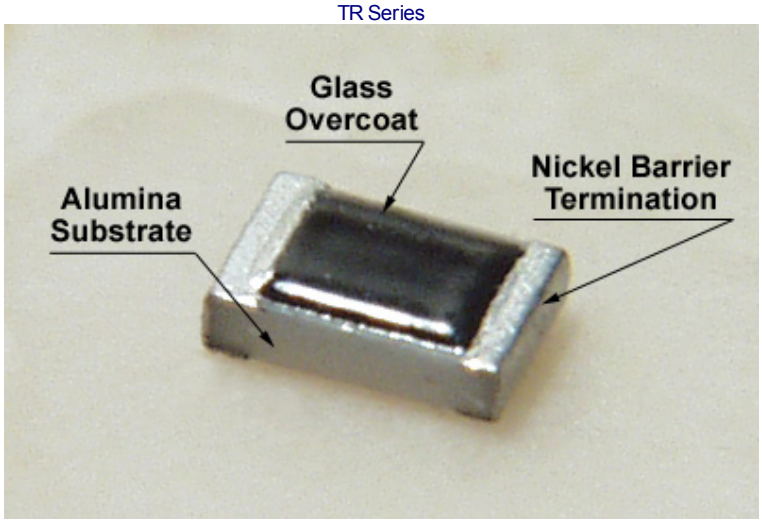
* Resistance value: First two digits are resistance value, third is the number of zeroes. Example: 251 = 250 ohms.
** Tolerances available: K = ±10% and J= ±5%.
***Terminations: No letter = Palladium Silver (Consult factory for optional terminations)

SMD Configuration Options

- Standard EIA Sizes Available
- Bulk or Tape and Reel Packaging
- Two Sided & Wrap Around Terminations
- Nickel barrier Terminations

RoHS

TR Series



Size	0603		0805	
Units	Inches	Millimeters	Inches	Millimeters
Length	0.063 ±0.006	1.60 ±0.150	0.080 ±0.008	2.00 ±0.20
Width	0.0315 ±0.006	0.80 ±0.15	0.050 ±0.004	1.25 ±0.10
Height	0.020 ±0.004	0.50 ±0.10	0.020 ±0.004	0.50 ±0.10
Termination	0.0012 ±0.0079	0.30 ±0.2	0.0016 ±0.008	0.40 ±0.20

STANDARD PRODUCTS

Part Number Size 0603	Part Number Size 0805	Resistance @ 25°C ±10% (Ohms)	Temperature Coefficient (α@25°C)
TR0603A251K	TR0805A251K	250	-3.3%/°C
TR0603A501K	TR0805A501K	500	-3.3%/°C
TR0603J102K	TR0805J102K	1.0K	-3.5%/°C
TR0603J252K	TR0805J252K	2.5K	-3.5%/°C
TR0603B502K	TR0805B502K	5.0K	-3.9%/°C
TR0603B103K	TR0805B103K	10K	-3.9%/°C
TR0603C203K	TR0805C203K	20K	-4.4%/°C
TR0603C253K	TR0805C253K	25K	-4.4%/°C
TR0603C503K	TR0805C503K	50K	-4.4%/°C
TR0603W104K	TR0805W104K	100K	-4.7%/°C
TR0603W154K	TR0805W154K	150K	-4.7%/°C

Ordering Information

TR	0805	A	251	K	X
Model	Size	R-T Curve	Resistance*	Tolerance**	Termination***

Resistance value: First two digits are resistance value, third is the number of zeroes. Example: 251 = 250 ohms.
** Tolerances available: K =±;10% and J=±;5%.
***Terminations: No letter = Nickel Barrier (Consult factory for optional terminations)
For tape and reel add suffix -T/R

NTC Resistance/Temperature Conversion Tables

Temperature °C	R-T Curve A		R-T Curve B		R-T Curve C		R-T Curve J		R-T Curve W	
	RT/R25	DEV	RT/R25	DEV	RT/R25	DEV	RT/R25	DEV	RT/R25	DEV

-60	43.0		75.0	6.6	140.5	6.6	52.5			
-55	31.9		54.1	6.1	96.4	6.1	39.0			
-50	24.3		39.7	5.6	67.0	5.6	29.2	18.5		
-45	18.6		29.2	5.2	47.2	5.2	22.1	17.0		
-40	14.4	7.6	21.7	4.7	33.7	4.7	16.9	15.4	40.2	7.6
-35	11.3	6.9	16.4	4.3	24.3	4.3	13.0	14.0	28.6	6.9
-30	8.93	6.2	12.5	3.8	17.7	3.8	10.1	12.5	20.6	6.2
-25	7.10	5.6	9.58	3.4	13.0	3.4	7.90	11.2	15.0	5.6
-20	5.69	5.0	7.42	3.0	9.71	3.0	6.24	9.9	11.0	5.0
-15	4.56	4.4	5.75	2.6	7.30	2.6	4.96	8.7	8.18	4.4
-10	3.68	3.7	4.50	2.2	5.53	2.2	3.97	7.4	6.12	3.7
-5	2.99	3.1	3.55	1.9	4.23	1.9	3.20	6.2	4.62	3.1
0	2.45	2.5	2.82	1.5	3.27	1.5	2.60	5.0	3.51	2.5
5	2.02	2.0	2.26	1.2	2.54	1.2	2.12	3.9	2.69	2.0
10	1.68	1.6	1.83	0.8	1.99	0.8	1.74	2.7	2.08	1.6
15	1.42	1.1	1.48	0.5	1.57	0.5	1.44	1.6	1.62	1.1
20	1.18	0.6	1.22	0.2	1.25	0.2	1.20	0.5	1.27	0.6
25	1.00	0.0	1.00	0.0	1.00	0.0	1.00	0.0	1.00	0.0
30	0.854	0.6	0.828	0.4	0.806	0.4	0.841	1.4	0.794	0.6
35	0.732	1.1	0.689	0.7	0.653	0.7	0.710	2.3	0.635	1.1
40	0.628	1.6	0.576	1.0	0.533	1.0	0.602	3.2	0.510	1.6
45	0.537	2.0	0.482	1.3	0.437	1.3	0.513	4.3	0.413	2.0
50	0.464	2.5	0.406	1.5	0.360	1.5	0.439	5.0	0.336	2.5
55	0.403	3.0	0.343	1.8	0.299	1.8	0.377	5.9	0.275	3.0
60	0.350	3.4	0.292	2.0	0.249	2.0	0.326	6.7	0.226	3.4
65	0.305	3.8	0.247	2.3	0.208	2.3	0.282	7.5	0.187	3.8
70	0.267	4.2	0.212	2.5	0.175	2.5	0.245	8.2	0.155	4.2
75	0.236	4.6	0.182	2.8	0.148	2.8	0.214	9.0	0.129	4.6
80	0.208	4.9	0.157	3.0	0.126	3.0	0.188	9.8	0.108	4.9
85	0.183	5.3	0.137	3.2	0.107	3.2	0.165	10.5	0.0912	5.3
90	0.163	5.6	0.120	3.4	0.0916	3.4	0.146	11.2	0.0771	5.6
95	0.145	6.0	0.105	3.6	0.0787	3.6	0.129	11.9	0.0654	6.0
100	0.130	6.3	0.0920	3.8	0.0679	3.8	0.114	12.6	0.0557	6.3
105	0.117	6.7	0.0812	4.0	0.0588	4.0	0.102	13.3	0.0476	6.7
110	0.105	7.0	0.0723	4.2	0.0511	4.2	0.0908	13.9	0.0408	7.0
115	0.0943	7.3	0.0641	4.4	0.0445	4.4	0.0813	14.4	0.0351	7.3
120	0.0852	7.6	0.0569	4.6	0.0389	4.6	0.0730	14.9	0.0303	7.6
125	0.0771	7.9	0.0508	4.8	0.0342	4.8	0.0657	15.6	0.0263	7.9
130	0.0700	8.2	0.0455	4.9	0.0301	4.9	0.0593	16.3	0.0228	8.2
135	0.0636	8.4	0.0408	5.1	0.0265	5.1	0.0536	17.0	0.0199	8.4
140	0.0579	8.6	0.0368	5.3	0.0235	5.3	0.0486	17.6	0.0173	8.6
145	0.0529	9.0	0.0332	5.4	0.0208	5.4	0.0442	18.0	0.0152	9.0
150	0.0483	9.3	0.0300	5.5	0.0185	5.5	0.0402	18.4	0.0133	9.3

NTC Resistance/Temperature Curve Characteristics

R-T Curve	A	B	C	J	W
Temperature Coefficient α@ 25°C	-3.3%/°C	-3.9%/°C	-4.4%/°C	-3.5%/°C	-4.7%/°C
Beta, ß	3000°K	3530°K	3965°K	3200°K	4250°K
R0°C/R50°C	5.3±5%	6.9±3%	9.1±3%	5.9±5%	10.45±5%
R25°C/R125°C	13.0	19.8	29.4	15.2	38.0

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