

NTC SMD Thermistors



NB 21 (Ni Barrier/100% Sn Termination)

Chip thermistors are high quality and low cost devices especially developed for surface mounting applications. They are widely used for temperature compensation but can also achieve temperature control of printed circuits.

A nickel barrier metallization provides outstanding qualities of solderability and enables this chip to meet the requirements of the most severe soldering processes including lead free soldering with peak temperatures up to 270°C.

| Types | NB 21 IEC SIZE : 0603 |
|--|--------------------------|
| DIMENSIONS: millimeters (inches) | |
| Terminations | Nickel Barrier/100% Tin |
| Marking | On packaging only |
| Climatic category | 40/125/56 |
| Operating temperature | -55°C to +150°C |
| Tolerance on R _n (25°C) | ±3%*, ±5%, ±10%, ±20% |
| Maximum dissipation at 25°C | 0.07 W |
| Thermal dissipation factor | 1 mW/°C |
| Thermal time constant | 4 s |

Resistance - Temperature characteristics: pages 29 to 33.

FEATURES

- Fast thermal response
- Commercial, Industrial and Automotive Applications
- Ni Barrier/100% Sn Termination
- Suitable for lead free reflow or wave soldering
- AEC-Q200 based qualification

APPLICATIONS

- LCD compensation
- Battery packs
- Mobile phones
- CD players
- Heating systems
- Air-conditioning systems
- Refrigeration
- Temperature control of Switch Mode Power Supplies
- Compensation of pressure sensors
- Protection of power transistors in various electronic circuits and more



HOW TO ORDER

| | | | | |
|----------------------------|--|---|---|---|
| NB 21 | K 0 | 0103 | M | BB |
| Type NB21 (0603) | Material Code K (See tables pages 11) | Resistance 10,000 Ω (See tables page 11) | Tolerance H (±3%)* J (±5%) K (±10%) M (±20%) | Suffix: Packaging --: Bulk (5000 pcs/bag) BB: Cardboard tape (180mm diam. reel, 4000 pcs/reel) BF: Cardboard tape (1/2 reel, 2000 pcs/reel) BD: Cardboard tape (330mm diam. reel, 10,000 pcs/reel) |

* Optional tolerance, please contact factory

NTC SMD Thermistors

NB 21 (Ni Barrier/100% Sn Termination)



TABLE OF VALUES

| NB 21 IEC SIZE : 0603 | | | | |
|--|--------------------|------------------|---|---------------------|
| Types | Rn at 25°C (Ω) | Material Code | B (K) ($\Delta B/B$ ⁽¹⁾ ± 5% ⁽²⁾ ± 3%) | α at 25°C (%/°C) |
| NB 21 KC 0 470 NB 21 KC 0 101 NB 21 KC 0 471 | 47 100 470 | KC | 3470 ± 5% | - 3.9 |
| NB 21 MC 0 102 | 1,000 | MC | 3910 ± 3% | - 4.4 |
| NB 21 J 0 0472 NB 21 J 0 0502 | 4,700 5,000 | J | 3480 ± 3% | - 3.9 |
| NB 21 J 5 0682 NB 21 J 5 0103 | 6,800 10,000 | J5 | 3480 ± 3% | - 3.9 |
| NB 21 K 0 0103 NB 21 K 0 0153 | 10,000 15,000 | K | 3630 ± 3% | - 4.0 |
| NB 21 L 0 0223 | 22,000 | L | 3790 ± 3% | - 4.2 |
| NB 21 M 0 0333 NB 21 M 0 0473 | 33,000 47,000 | M | 3950 ± 3% | - 4.4 |
| NB 21 M4 0 503 | 50,000 | M4 | 4000 ± 3% | - 4.4 |
| NB 21 L 2 0683 | 68,000 | L2 | 3805 ± 3% | - 4.1 |
| NB 21 N 0 0683 | 68,000 | N | 4080 ± 3% | - 4.6 |
| NB 21 N 5 0104 | 100,000 | N5 | 4160 ± 3% | - 4.7 |
| NB 21 P 0 0154 | 150,000 | P | 4220 ± 3% | - 4.7 |
| NB 21 Q 0 0334 NB 21 Q 0 0474 | 330,000 470,000 | Q | 4300 ± 3% | - 4.7 |

NTC SMD Thermistors

NB 12 - NB 20 (Ni Barrier/100% Sn Termination)



Chip thermistors are high quality and low cost devices especially developed for surface mounting applications. They are widely used for temperature compensation but can also achieve temperature control of printed circuits.

A nickel barrier metallization provides outstanding qualities of solderability and enables this chip to meet the requirements of the most severe soldering processes including lead free soldering with peak temperatures up to 270°C.

| Types | NB 12 IEC SIZE : 0805 | NB 20 IEC SIZE : 1206 |
|--|--------------------------|--------------------------|
| DIMENSIONS: millimeters (inches) | | |
| Terminations | Nickel Barrier/100% Tin | |
| Marking | On packaging only | |
| Climatic category | 40/125/56 | |
| Operating temperature | -55°C to +150°C | |
| Tolerance on R _n (25°C) | ±3%*, ±5%, ±10%, ±20% | |
| Maximum dissipation at 25°C | 0.12 W | 0.24 W |
| Thermal dissipation factor | 2 mW/°C | 4 mW/°C |
| Thermal time constant | 5 s | 7s |

Resistance - Temperature characteristics: pages 29 to 33.

FEATURES

- Fast thermal response
- Commercial, Industrial and Automotive Applications
- Ni Barrier/100% Sn Termination
- Suitable for lead free reflow or wave soldering
- AEC-Q200 based qualification

APPLICATIONS

- LCD compensation
- Battery packs
- Mobile phones
- CD players
- Heating systems
- Air-conditioning systems
- Refrigeration
- Temperature control of Switch Mode Power Supplies
- Compensation of pressure sensors
- Protection of power transistors in various electronic circuits and more



HOW TO ORDER

NB 20
Type
NB12 (0805)
NB20 (1206)

K 0
Material Code
K
(See tables pages 13)

0103
Resistance
10,000 Ω
(See tables page 13)

M
Tolerance
H (±3%)*
J (±5%)
K (±10%)
M (±20%)

BA
Suffix: Packaging
-- : Bulk (5000 pcs/bag)
NB20 BA: Plastic tape (180mm diam. reel, 3000 pcs/reel)
BE: Plastic tape (1/2 reel, 1500 pcs/reel)
BC: Plastic tape (330mm diam. reel, 10,000 pcs/reel)
NB12 BB: Cardboard tape (180mm diam. reel, 4000 pcs/reel)
BF: Cardboard tape (1/2 reel, 2000 pcs/reel)
BD: Cardboard tape (330mm diam. reel, 10,000 pcs/reel)

* Optional tolerance, please contact factory

NTC SMD Thermistors

NB 12 - NB 20 (Ni Barrier/100% Sn Termination)



TABLE OF VALUES

| NB 12 IEC SIZE : 0805 | | | | |
|--------------------------|----------------|---------------|--|----------------------------|
| Types | Rn at 25°C (Ω) | Material Code | B (K) ($\Delta B/B$ (1) $\pm 5\%$ (2) $\pm 3\%$) | α at 25°C (%/°C) |
| NB 12 KC 0 180 | 18 | KC | 3470 \pm 5% | - 3.9 |
| NB 12 KC 0 220 | 22 | | | |
| NB 12 KC 0 270 | 27 | | | |
| NB 12 KC 0 330 | 33 | | | |
| NB 12 KC 0 390 | 39 | | | |
| NB 12 KC 0 470 | 47 | | | |
| NB 12 KC 0 560 | 56 | | | |
| NB 12 KC 0 680 | 68 | | | |
| NB 12 KC 0 820 | 82 | | | |
| NB 12 KC 0 101 | 100 | | | |
| NB 12 MC 0 121 | 120 | MC | 3910 \pm 3% | - 4.4 |
| NB 12 MC 0 151 | 150 | | | |
| NB 12 MC 0 181 | 180 | | | |
| NB 12 MC 0 221 | 220 | | | |
| NB 12 MC 0 271 | 270 | | | |
| NB 12 MC 0 331 | 330 | | | |
| NB 12 MC 0 391 | 390 | | | |
| NB 12 MC 0 471 | 470 | | | |
| NB 12 MC 0 561 | 560 | | | |
| NB 12 MC 0 681 | 680 | | | |
| NB 12 MC 0 821 | 820 | | | |
| NB 12 MC 0 102 | 1,000 | | | |
| NB 12 MC 0 122 | 1,200 | | | |
| NB 12 MC 0 152 | 1,500 | | | |
| NB 12 MC 0 182 | 1,800 | | | |
| NB 12 MC 0 222 | 2,200 | | | |
| NB 12 MC 0 272 | 2,700 | | | |
| NB 12 MC 0 332 | 3,300 | | | |
| NB 12 J 0 0332 | 3,300 | J | 3480 \pm 3% | - 3.9 |
| NB 12 J 0 0392 | 3,900 | | | |
| NB 12 J 0 0472 | 4,700 | | | |
| NB 12 J 0 0502 | 5,000 | | | |
| NB 12 J 0 0562 | 5,600 | | | |
| NB 12 K 0 0682 | 6,800 | K | 3630 \pm 3% | - 4.0 |
| NB 12 K 0 0822 | 8,200 | | | |
| NB 12 K 0 0103 | 10,000 | | | |
| NB 12 K 0 0123 | 12,000 | | | |
| NB 12 L 0 0153 | 15,000 | | | |
| NB 12 L 0 0183 | 18,000 | | | |
| NB 12 M 0 0223 | 22,000 | M | 3950 \pm 3% | - 4.4 |
| NB 12 M 0 0273 | 27,000 | | | |
| NB 12 M 0 0333 | 33,000 | | | |
| NB 12 M 0 0393 | 39,000 | | | |
| NB 12 N 0 0473 | 47,000 | N | 4080 \pm 3% | - 4.6 |
| NB 12 N 0 0503 | 50,000 | | | |
| NB 12 N 0 0563 | 56,000 | | | |
| NB 12 L 2 0683 | 68,000 | L2 | 3805 \pm 3% | - 4.1 |
| NB 12 N 0 0823 | 82,000 | N | 4080 \pm 3% | - 4.6 |
| NB 12 P 0 0104 | 100,000 | P | 4220 \pm 3% | - 4.7 |
| NB 12 P 0 0124 | 120,000 | | | |
| NB 12 P 0 0154 | 150,000 | | | |
| NB 12 P 0 0184 | 180,000 | | | |
| NB 12 Q 0 0224 | 220,000 | Q | 4300 \pm 3% | -4.7 |

| NB 20 IEC SIZE : 1206 | | | | |
|--------------------------|----------------|---------------|--|----------------------------|
| Types | Rn at 25°C (Ω) | Material Code | B (K) ($\Delta B/B$ (1) $\pm 5\%$ (2) $\pm 3\%$) | α at 25°C (%/°C) |
| NB 20 MC 0 221 | 220 | MC | 3910 \pm 3% | - 4.4 |
| NB 20 MC 0 102 | 1,000 | M C | 3910 \pm 3% | - 4.4 |
| NB 20 J 0 0472 | 4,700 | J | 3480 \pm 3% | - 3.9 |
| NB 20 J 0 0502 | 5,000 | | | |
| NB 20 J 0 0562 | 5,600 | | | |
| NB 20 J 0 0682 | 6,800 | | | |
| NB 20 J 5 0822 | 8,200 | J5 | 3480 \pm 3% | - 3.9 |
| NB 20 K 0 0103 | 10,000 | K | 3630 \pm 3% | - 4.0 |
| NB 20 K 0 0123 | 12,000 | | | |
| NB 20 L 0 0153 | 15,000 | L | 3790 \pm 3% | - 4.2 |
| NB 20 L 0 0183 | 18,000 | | | |
| NB 20 L 0 0223 | 22,000 | | | |
| NB 20 M 0 0273 | 27,000 | M | 3950 \pm 3% | - 4.4 |
| NB 20 M 0 0333 | 33,000 | | | |
| NB 20 M 0 0393 | 39,000 | | | |
| NB 20 M 0 0473 | 47,000 | | | |
| NB 20 M 4 0503 | 50,000 | M4 | 4000 \pm 3% | - 4.4 |
| NB 20 N 0 0563 | 56,000 | N | 4080 \pm 3% | - 4.6 |
| NB 20 N 0 0683 | 68,000 | | | |
| NB 20 N 0 0823 | 82,000 | | | |
| NB 20 N 5 0104 | 100,000 | N5 | 4160 \pm 3% | - 4.7 |
| NB 20 P 0 0124 | 120,000 | P | 4220 \pm 3% | - 4.7 |
| NB 20 P 0 0154 | 150,000 | | | |
| NB 20 P 0 0184 | 180,000 | | | |
| NB 20 P 0 0224 | 220,000 | | | |
| NB 20 Q 0 0274 | 270,000 | Q | 4300 \pm 3% | - 4.7 |
| NB 20 Q 0 0334 | 330,000 | | | |
| NB 20 Q 0 0394 | 390,000 | | | |
| NB 20 Q 0 0474 | 470,000 | | | |
| NB 20 Q 0 0564 | 560,000 | R | 4400 \pm 3% | - 4.8 |
| NB 20 R 0 0684 | 680,000 | | | |
| NB 20 R 0 0824 | 820,000 | | | |
| NB 20 R 0 0105 | 1,000,000 | | | |

Packaging for Automatic Insertion

NTC Chip Thermistors / NC/NB Series



AUTOMATIC INSERTION

Super 8 Plastic Tape Packaging:

The mechanical and dimensional reel characteristics are in accordance with the IEC publication 286-3.



| Designation | Symbol | Value | Tolerance | |
|--------------------------------|--------------|-----------|-----------|---|
| Tape width | W | 8 | ±0.2 | |
| Tape thickness | T | 0.4 max. | | |
| Pitch of the sprocket holes | P0 | 4 | ±0.1 | |
| Diameter of the sprocket holes | D0 | 1.5 -0 | ±0.1 | |
| Distance | E | 1.75 | ±0.1 | |
| Distance (center to center) | F | 3.5 | ±0.05 | |
| Distance (center to center) | P2 | 2 | ±0.1 | |
| Sizes of the cavities | NC 12 (0805) | A0 | 1.5 | ±0.1 |
| | | B0 | 2.4 | ±0.1 |
| | | K | 1.4 max. | K ±0.1 (size is adjustable) (K = t1 +0.2) |
| | NC 20 (1206) | A0 | 1.95 | ±0.1 |
| | | B0 | 3.55 | ±0.1 |
| | | K | 1.5 max. | K ±0.1 (size is adjustable) (K = t1 +0.2) |



QUANTITY PER REEL

| Type | Suffix | Description | Qty Per Reel |
|--------------|--------|---------------------------------|--------------|
| NB20 NC20 | BA | Plastic tape (180mm diam. reel) | 3,000 pcs |
| | BE | Plastic tape (1/2 reel) | 1,500 pcs |
| | BC | Plastic tape (330mm diam. reel) | 10,000 pcs |

Packaging for Automatic Insertion

NTC Chip Thermistors / NC/NB Series



AUTOMATIC INSERTION

8mm Paper Tape Packaging:

The mechanical and dimensional reel characteristics are in accordance with the IEC publication 286-3.



| Designation | Symbol | Value | Tolerance |
|--------------------------------|--------|-----------|--------------|
| Tape width | W | 8 | $-.0.1/+0.3$ |
| Tape thickness | T | 1.1 max. | |
| Pitch of the sprocket holes | P_0 | 4 | ± 0.1 |
| Diameter of the sprocket holes | D_0 | 1.5 | ± 0.1 |
| Distance | E_1 | 1.75 | ± 0.1 |
| Distance (center to center) | F | 3.5 | ± 0.05 |
| Distance (center to center) | P_2 | 2 | ± 0.05 |
| Cover tape thickness | T_1 | 0.10 max. | |
| Distance | E_2 | 6.25 min. | |
| Distance | G | 0.75 min. | |
| Component pitch | P_1 | 0805/0603 | ± 0.1 |
| | | 0402 | ± 0.1 |



QUANTITY PER REEL

| Type | Suffix | Description | Qty Per Reel |
|------|--------|-----------------------------------|--------------|
| NB12 | BB | Cardboard tape (180mm diam. reel) | 4,000 pcs |
| NC12 | BF | Cardboard tape (1/2 reel) | 2,000 pcs |
| NB21 | BD | Cardboard tape (330mm diam. reel) | 10,000 pcs |
| NC21 | | | |

Surface Mounting Guide

Chip Thermistor – Application Notes



STORAGE

Good solderability is maintained for at least twelve months, provided the components are stored in their “as received” packaging at less than 40°C and 70% RH.

SOLDERABILITY / LEACHING

Terminations to be well soldered after immersion in a 60/40 tin/lead solder bath at $235 \pm 5^\circ\text{C}$ for 2 ± 1 seconds.

Terminations will resist leaching for at least the immersion times and conditions recommendations shown below.

| P/N | Termination Type | Solder Tin/Lead | Solder Temp °C | Immersion Time Seconds |
|-----|------------------|-----------------|----------------|------------------------|
| NC | AgPdPt | 60/40 | 260 ± 5 | 15 max |
| NB | Nickel Barrier | 60/40 | 260 ± 5 | 30 ± 1 |

NB products are compatible with a wide range of soldering conditions consistent with good manufacturing practice for surface mount components. This includes Pb free reflow processes with peak temperatures up to 270°C . Recommended profiles for reflow and wave soldering are shown below for reference.

NC products are recommended for lead soldering application or gluing techniques.

Wave



(Preheat chips before soldering)
T/maximum 150°C

- The visual standards used for evaluation of solder joints will need to be modified as lead free joints are not as bright as with tin-lead pastes and the fillet may not be as large.
- Resin color may darken slightly due to the increase in temperature required for the new pastes.
- Lead-free solder pastes do not allow the same self alignment as lead containing systems. Standard mounting pads are acceptable, but machine set up may need to be modified.

Reflow



(Minimize soldering time)

RECOMMENDED SOLDERING PAD LAYOUT

Dimensions in mm (inches)



REFLOW SOLDERING

| Case Size | P/N | D1 | D2 | D3 | D4 | D5 |
|-----------|------|----------------|----------------|----------------|----------------|----------------|
| 0603 | NB21 | 2.30 (.091) | 0.80 (.031) | 0.70 (.028) | 0.80 (.031) | 0.75 (.030) |
| 0805 | NB12 | 3.00 (.118) | 1.00 (.039) | 1.00 (.039) | 1.00 (.039) | 1.25 (.049) |
| 1206 | NB20 | 4.00 (.157) | 1.00 (.039) | 2.00 (.079) | 1.00 (.039) | 2.50 (.098) |

WAVE SOLDERING

| Case Size | P/N | D1 | D2 | D3 | D4 | D5 |
|-----------|------|----------------|----------------|----------------|----------------|----------------|
| 0603 | NB21 | 3.10 (.122) | 1.20 (.047) | 0.70 (.028) | 1.20 (.047) | 0.75 (.030) |
| 0805 | NB12 | 4.00 (.157) | 1.50 (.059) | 1.00 (.039) | 1.50 (.059) | 1.25 (.049) |
| 1206 | NB20 | 5.00 (.197) | 1.50 (.059) | 2.00 (.079) | 1.50 (.059) | 1.60 (.063) |



- Pre-heating: $150^\circ\text{C} \pm 15^\circ\text{C} / 60-90\text{s}$
- Max. Peak Gradient: 2.5°C/s
- Peak Temperature: $245^\circ\text{C} \pm 5^\circ\text{C}$
- Time at $>230^\circ\text{C}$: 40s Max.

Tables of Resistance vs Temperature



| T (°C) | Material B(K) | | |
|--------|---------------|--------|----------|
| | I 3250 | | |
| | R(T) / R25 | TF (%) | α (%/°C) |
| -55 | 42.35 | 21.9 | -5.98 |
| -50 | 31.48 | 20.0 | -5.78 |
| -45 | 23.63 | 18.1 | -5.59 |
| -40 | 17.91 | 16.3 | -5.41 |
| -35 | 13.70 | 14.6 | -5.23 |
| -30 | 10.58 | 13.1 | -5.06 |
| -25 | 8.232 | 11.6 | -4.90 |
| -20 | 6.460 | 10.1 | -4.74 |
| -15 | 5.110 | 8.8 | -4.59 |
| -10 | 4.072 | 7.5 | -4.45 |
| -5 | 3.268 | 6.3 | -4.31 |
| 0 | 2.641 | 5.1 | -4.18 |
| 5 | 2.148 | 4.0 | -4.05 |
| 10 | 1.759 | 2.9 | -3.92 |
| 15 | 1.449 | 1.9 | -3.81 |
| 20 | 1.200 | 0.9 | -3.69 |
| 25 | 1.000 | 0.0 | -3.58 |
| 30 | 0.8377 | 0.9 | -3.48 |
| 35 | 0.7054 | 1.8 | -3.38 |
| 40 | 0.5969 | 2.6 | -3.28 |
| 45 | 0.5076 | 3.5 | -3.19 |
| 50 | 0.4336 | 4.3 | -3.10 |
| 55 | 0.3720 | 5.1 | -3.01 |
| 60 | 0.3206 | 5.9 | -2.93 |
| 65 | 0.2774 | 6.6 | -2.85 |
| 70 | 0.2410 | 7.4 | -2.77 |
| 75 | 0.2102 | 8.1 | -2.70 |
| 80 | 0.1839 | 8.8 | -2.63 |
| 85 | 0.1616 | 9.5 | -2.56 |
| 90 | 0.1424 | 10.2 | -2.49 |
| 95 | 0.1259 | 10.9 | -2.43 |
| 100 | 0.1117 | 11.5 | -2.36 |
| 105 | 0.09938 | 12.2 | -2.30 |
| 110 | 0.08869 | 12.8 | -2.25 |
| 115 | 0.07938 | 13.4 | -2.19 |
| 120 | 0.07124 | 14.0 | -2.14 |
| 125 | 0.06410 | 14.6 | -2.08 |
| 130 | 0.05783 | 15.2 | -2.03 |
| 135 | 0.05230 | 15.7 | -1.98 |
| 140 | 0.04741 | 16.3 | -1.94 |
| 145 | 0.04308 | 16.8 | -1.89 |
| 150 | 0.03924 | 17.4 | -1.85 |

| T (°C) | Material B(K) | | |
|--------|---------------|--------|----------|
| | J-J5 3480 | | |
| | R(T) / R25 | TF (%) | α (%/°C) |
| -55 | 51.75 | 20.5 | -6.23 |
| -50 | 37.98 | 17.7 | -6.03 |
| -45 | 28.15 | 15.2 | -5.84 |
| -40 | 21.07 | 13.0 | -5.65 |
| -35 | 15.91 | 11.0 | -5.48 |
| -30 | 12.13 | 9.3 | -5.31 |
| -25 | 9.321 | 7.8 | -5.15 |
| -20 | 7.222 | 6.4 | -4.99 |
| -15 | 5.640 | 5.2 | -4.84 |
| -10 | 4.438 | 4.2 | -4.69 |
| -5 | 3.517 | 3.3 | -4.55 |
| 0 | 2.807 | 2.5 | -4.42 |
| 5 | 2.255 | 1.8 | -4.29 |
| 10 | 1.824 | 1.2 | -4.17 |
| 15 | 1.484 | 0.7 | -4.05 |
| 20 | 1.215 | 0.3 | -3.93 |
| 25 | 1.0000 | 0.0 | -3.82 |
| 30 | 0.8278 | 0.3 | -3.71 |
| 35 | 0.6889 | 0.7 | -3.61 |
| 40 | 0.5763 | 1.1 | -3.51 |
| 45 | 0.4845 | 1.5 | -3.41 |
| 50 | 0.4092 | 2.0 | -3.32 |
| 55 | 0.3472 | 2.5 | -3.23 |
| 60 | 0.2960 | 3.0 | -3.15 |
| 65 | 0.2533 | 3.5 | -3.06 |
| 70 | 0.2177 | 4.1 | -2.98 |
| 75 | 0.1879 | 4.7 | -2.90 |
| 80 | 0.1628 | 5.3 | -2.83 |
| 85 | 0.1415 | 5.9 | -2.76 |
| 90 | 0.12349 | 6.5 | -2.69 |
| 95 | 0.10813 | 7.1 | -2.62 |
| 100 | 0.09499 | 7.7 | -2.55 |
| 105 | 0.08372 | 8.4 | -2.49 |
| 110 | 0.07402 | 9.0 | -2.43 |
| 115 | 0.06564 | 9.7 | -2.37 |
| 120 | 0.05837 | 10.3 | -2.31 |
| 125 | 0.05206 | 11.0 | -2.26 |
| 130 | 0.04656 | 11.6 | -2.21 |
| 135 | 0.04175 | 12.3 | -2.15 |
| 140 | 0.03753 | 13.0 | -2.10 |
| 145 | 0.03382 | 13.6 | -2.06 |
| 150 | 0.03055 | 14.3 | -2.01 |

| T (°C) | Material B(K) | | |
|--------|---------------|--------|----------|
| | K 3630 | | |
| | R(T) / R25 | TF (%) | α (%/°C) |
| -55 | 56.27 | 21.4 | -6.25 |
| -50 | 41.22 | 18.5 | -6.06 |
| -45 | 30.48 | 15.9 | -5.89 |
| -40 | 22.74 | 13.6 | -5.71 |
| -35 | 17.11 | 11.5 | -5.55 |
| -30 | 12.98 | 9.7 | -5.39 |
| -25 | 9.931 | 8.1 | -5.24 |
| -20 | 7.655 | 6.7 | -5.09 |
| -15 | 5.945 | 5.4 | -4.95 |
| -10 | 4.651 | 4.4 | -4.81 |
| -5 | 3.663 | 3.4 | -4.67 |
| 0 | 2.905 | 2.6 | -4.54 |
| 5 | 2.319 | 1.9 | -4.42 |
| 10 | 1.862 | 1.3 | -4.30 |
| 15 | 1.505 | 0.8 | -4.18 |
| 20 | 1.223 | 0.3 | -4.07 |
| 25 | 1.0000 | 0.0 | -3.96 |
| 30 | 0.8219 | 0.3 | -3.85 |
| 35 | 0.6792 | 0.7 | -3.75 |
| 40 | 0.5641 | 1.1 | -3.65 |
| 45 | 0.4708 | 1.6 | -3.55 |
| 50 | 0.3949 | 2.1 | -3.46 |
| 55 | 0.3327 | 2.6 | -3.37 |
| 60 | 0.2816 | 3.1 | -3.28 |
| 65 | 0.2393 | 3.7 | -3.20 |
| 70 | 0.2043 | 4.3 | -3.12 |
| 75 | 0.1751 | 4.9 | -3.04 |
| 80 | 0.1506 | 5.5 | -2.96 |
| 85 | 0.1301 | 6.1 | -2.89 |
| 90 | 0.1128 | 6.8 | -2.82 |
| 95 | 0.09811 | 7.4 | -2.75 |
| 100 | 0.08564 | 8.1 | -2.68 |
| 105 | 0.07501 | 8.7 | -2.61 |
| 110 | 0.06591 | 9.4 | -2.55 |
| 115 | 0.05809 | 10.1 | -2.49 |
| 120 | 0.05136 | 10.8 | -2.43 |
| 125 | 0.04554 | 11.5 | -2.37 |
| 130 | 0.04049 | 12.2 | -2.32 |
| 135 | 0.03611 | 12.8 | -2.26 |
| 140 | 0.03228 | 13.5 | -2.21 |
| 145 | 0.02893 | 14.2 | -2.16 |
| 150 | 0.02600 | 14.9 | -2.11 |

| T (°C) | Material B(K) | | |
|--------|---------------|--------|----------|
| | KA 3625 | | |
| | R(T) / R25 | TF (%) | α (%/°C) |
| -55 | 61.22 | 7.1 | -6.55 |
| -50 | 44.25 | 6.1 | -6.33 |
| -45 | 32.34 | 5.3 | -6.12 |
| -40 | 23.88 | 4.5 | -5.92 |
| -35 | 17.81 | 3.8 | -5.73 |
| -30 | 13.41 | 3.2 | -5.54 |
| -25 | 10.19 | 2.7 | -5.37 |
| -20 | 7.815 | 2.2 | -5.20 |
| -15 | 6.041 | 1.8 | -5.04 |
| -10 | 4.707 | 1.5 | -4.89 |
| -5 | 3.696 | 1.1 | -4.74 |
| 0 | 2.923 | 0.9 | -4.60 |
| 5 | 2.329 | 0.6 | -4.46 |
| 10 | 1.867 | 0.4 | -4.33 |
| 15 | 1.507 | 0.3 | -4.21 |
| 20 | 1.224 | 0.1 | -4.09 |
| 25 | 1.0000 | 0.0 | -3.97 |
| 30 | 0.8217 | 0.1 | -3.86 |
| 35 | 0.6788 | 0.2 | -3.75 |
| 40 | 0.5638 | 0.4 | -3.65 |
| 45 | 0.4707 | 0.5 | -3.55 |
| 50 | 0.3948 | 0.7 | -3.46 |
| 55 | 0.3328 | 0.9 | -3.37 |
| 60 | 0.2817 | 1.0 | -3.28 |
| 65 | 0.2396 | 1.2 | -3.19 |
| 70 | 0.2046 | 1.4 | -3.11 |
| 75 | 0.1754 | 1.6 | -3.03 |
| 80 | 0.1510 | 1.8 | -2.96 |
| 85 | 0.1305 | 2.0 | -2.88 |
| 90 | 0.1131 | 2.3 | -2.81 |
| 95 | 0.09844 | 2.5 | -2.74 |
| 100 | 0.08596 | 2.7 | -2.68 |
| 105 | 0.07530 | 2.9 | -2.61 |
| 110 | 0.06618 | 3.1 | -2.55 |
| 115 | 0.05833 | 3.4 | -2.49 |
| 120 | 0.05157 | 3.6 | -2.43 |
| 125 | 0.04573 | 3.8 | -2.38 |
| 130 | 0.04065 | 4.0 | -2.32 |
| 135 | 0.03624 | 4.3 | -2.27 |
| 140 | 0.03239 | 4.5 | -2.22 |
| 145 | 0.02902 | 4.7 | -2.17 |
| 150 | 0.02607 | 5.0 | -2.12 |

| T (°C) | Material B(K) | | |
|--------|---------------|--------|----------|
| | KC 3470 | | |
| | R(T) / R25 | TF (%) | α (%/°C) |
| -55 | 60.08 | 34.0 | -7.00 |
| -50 | 43.19 | 29.4 | -6.71 |
| -45 | 31.42 | 25.3 | -6.44 |
| -40 | 23.13 | 21.6 | -6.18 |
| -35 | 17.22 | 18.4 | -5.94 |
| -30 | 12.95 | 15.5 | -5.71 |
| -25 | 9.842 | 12.9 | -5.49 |
| -20 | 7.550 | 10.7 | -5.29 |
| -15 | 5.845 | 8.7 | -5.10 |
| -10 | 4.564 | 6.9 | -4.91 |
| -5 | 3.594 | 5.4 | -4.74 |
| 0 | 2.853 | 4.1 | -4.58 |
| 5 | 2.281 | 3.0 | -4.42 |
| 10 | 1.838 | 2.0 | -4.27 |
| 15 | 1.491 | 1.2 | -4.13 |
| 20 | 1.217 | 0.5 | -4.00 |
| 25 | 1.0000 | 0.0 | -3.90 |
| 30 | 0.8267 | 0.5 | -3.74 |
| 35 | 0.6873 | 1.1 | -3.63 |
| 40 | 0.5747 | 1.8 | -3.52 |
| 45 | 0.4830 | 2.5 | -3.41 |
| 50 | 0.4081 | 3.3 | -3.31 |
| 55 | 0.3465 | 4.1 | -3.21 |
| 60 | 0.2955 | 5.0 | -3.12 |
| 65 | 0.2532 | 5.9 | -3.03 |
| 70 | 0.2179 | 6.8 | -2.94 |
| 75 | 0.1883 | 7.8 | -2.86 |
| 80 | 0.1634 | 8.7 | -2.78 |
| 85 | 0.1423 | 9.7 | -2.71 |
| 90 | 0.1244 | 10.8 | -2.63 |
| 95 | 0.10915 | 11.8 | -2.56 |
| 100 | 0.09608 | 12.9 | -2.50 |
| 105 | 0.08486 | 13.9 | -2.43 |
| 110 | 0.07519 | 15.0 | -2.37 |
| 115 | 0.06683 | 16.1 | -2.31 |
| 120 | 0.05957 | 17.2 | -2.25 |
| 125 | 0.05325 | 18.3 | -2.20 |
| 130 | 0.04774 | 19.4 | -2.14 |
| 135 | 0.04290 | 20.5 | -2.09 |
| 140 | 0.03866 | 21.6 | -2.04 |
| 145 | 0.03492 | 22.7 | -1.99 |
| 150 | 0.03162 | 23.8 | -1.95 |

| T (°C) | Material B(K) | | |
|--------|---------------|--------|----------|
| | KC 3470 | | |
| | R(T) / R25 | TF (%) | α (%/°C) |
| -55 | 82.54 | 22.3 | -7.12 |
| -50 | 58.03 | 19.3 | -6.87 |
| -45 | 41.31 | 16.6 | -6.63 |
| -40 | 29.75 | 14.2 | -6.40 |
| -35 | 21.68 | 12.0 | -6.18 |
| -30 | 15.97 | 10.1 | -5.98 |
| -25 | 11.88 | 8.5 | -5.78 |
| -20 | 8.931 | 7.0 | -5.59 |
| -15 | 6.777 | 5.7 | -5.40 |
| -10 | 5.188 | 4.5 | -5.23 |
| -5 | 4.007 | 3.6 | -5.06 |
| 0 | 3.120 | 2.7 | -4.90 |
| 5 | 2.449 | 2.0 | -4.75 |
| 10 | 1.937 | 1.3 | -4.60 |
| 15 | 1.543 | 0.8 | -4.46 |
| 20 | 1.238 | 0.4 | -4.33 |
| 25 | 1.0000 | 0.0 | -4.20 |
| 30 | 0.8128 | 0.3 | -4.07 |
| 35 | 0.6648 | 0.7 | -3.95 |
| 40 | 0.5469 | 1.2 | -3.84 |
| 45 | 0.4525 | 1.6 | -3.73 |
| 50 | 0.3764 | 2.2 | -3.62 |
| 55 | 0.3148 | 2.7 | -3.52 |
| 60 | 0.2646 | 3.3 | -3.42 |
| 65 | 0.2235 | 3.8 | -3.33 |
| 70 | 0.1896 | 4.5 | -3.24 |
| 75 | 0.1616 | 5.1 | -3.15 |
| 80 | 0.1383 | 5.7 | -3.07 |
| 85 | 0.1189 | 6.4 | -2.98 |
| 90 | 0.1026 | 7.1 | -2.91 |
| 95 | 0.08888 | 7.7 | -2.83 |
| 100 | 0.07728 | 8.4 | -2.76 |
| 105 | 0.06744 | 9.1 | -2.69 |
| 110 | 0.05905 | 9.8 | -2.62 |
| 115 | 0.05188 | 10.5 | -2.56 |
| 120 | 0.04572 | 11.3 | -2.49 |
| 125 | 0.04042 | 12.0 | -2.43 |
| 130 | 0.03585 | 12.7 | -2.37 |
| 135 | 0.03188 | 13.4 | -2.32 |
| 140 | 0.02843 | 14.1 | -2.26 |
| 145 | 0.02542 | 14.8 | -2.21 |
| 150 | 0.02279 | 15.6 | -2.16 |

Tables of Resistance vs Temperature



| T (°C) | Material B(K) | | |
|--------|---------------|--------|----------|
| | L2 3805 | | |
| | R(T) / R25 | TF (%) | α (%/°C) |
| -55 | 62.45 | 22.4 | -6.41 |
| -50 | 45.40 | 19.3 | -6.22 |
| -45 | 33.33 | 16.6 | -6.03 |
| -40 | 24.70 | 14.2 | -5.85 |
| -35 | 18.47 | 12.1 | -5.68 |
| -30 | 13.92 | 10.2 | -5.52 |
| -25 | 10.58 | 8.5 | -5.36 |
| -20 | 8.110 | 7.0 | -5.21 |
| -15 | 6.260 | 5.7 | -5.07 |
| -10 | 4.867 | 4.6 | -4.93 |
| -5 | 3.810 | 3.6 | -4.80 |
| 0 | 3.003 | 2.7 | -4.67 |
| 5 | 2.382 | 2.0 | -4.55 |
| 10 | 1.901 | 1.3 | -4.43 |
| 15 | 1.526 | 0.8 | -4.31 |
| 20 | 1.232 | 0.4 | -4.20 |
| 25 | 1.0000 | 0.0 | -4.10 |
| 30 | 0.8161 | 0.3 | -4.00 |
| 35 | 0.6694 | 0.7 | -3.90 |
| 40 | 0.5518 | 1.2 | -3.80 |
| 45 | 0.4570 | 1.7 | -3.71 |
| 50 | 0.3802 | 2.2 | -3.62 |
| 55 | 0.3178 | 2.7 | -3.53 |
| 60 | 0.2667 | 3.3 | -3.45 |
| 65 | 0.2248 | 3.9 | -3.37 |
| 70 | 0.1902 | 4.5 | -3.29 |
| 75 | 0.1615 | 5.1 | -3.22 |
| 80 | 0.1377 | 5.8 | -3.14 |
| 85 | 0.1179 | 6.4 | -3.07 |
| 90 | 0.1012 | 7.1 | -3.00 |
| 95 | 0.08721 | 7.8 | -2.94 |
| 100 | 0.07539 | 8.5 | -2.87 |
| 105 | 0.06538 | 9.2 | -2.81 |
| 110 | 0.05688 | 9.9 | -2.75 |
| 115 | 0.04963 | 10.6 | -2.69 |
| 120 | 0.04343 | 11.3 | -2.63 |
| 125 | 0.03812 | 12.0 | -2.58 |
| 130 | 0.03354 | 12.7 | -2.53 |
| 135 | 0.02960 | 13.5 | -2.47 |
| 140 | 0.02618 | 14.2 | -2.42 |
| 145 | 0.02322 | 14.9 | -2.37 |
| 150 | 0.02064 | 15.6 | -2.33 |

| T (°C) | Material B(K) | | |
|--------|---------------|--------|----------|
| | M 3950 | | |
| | R(T) / R25 | TF (%) | α (%/°C) |
| -55 | 99.59 | 15.6 | -7.42 |
| -50 | 68.97 | 14.3 | -7.16 |
| -45 | 48.40 | 12.9 | -6.91 |
| -40 | 34.38 | 11.7 | -6.67 |
| -35 | 24.71 | 10.5 | -6.45 |
| -30 | 17.97 | 9.4 | -6.23 |
| -25 | 13.20 | 8.3 | -6.02 |
| -20 | 9.804 | 7.3 | -5.82 |
| -15 | 7.352 | 6.3 | -5.63 |
| -10 | 5.565 | 5.4 | -5.45 |
| -5 | 4.251 | 4.5 | -5.28 |
| 0 | 3.275 | 3.7 | -5.11 |
| 5 | 2.544 | 2.9 | -4.95 |
| 10 | 1.992 | 2.1 | -4.80 |
| 15 | 1.572 | 1.4 | -4.65 |
| 20 | 1.249 | 0.7 | -4.51 |
| 25 | 1.0000 | 0.0 | -4.38 |
| 30 | 0.8057 | 0.7 | -4.25 |
| 35 | 0.6534 | 1.3 | -4.12 |
| 40 | 0.5331 | 1.9 | -4.00 |
| 45 | 0.4376 | 2.5 | -3.89 |
| 50 | 0.3612 | 3.1 | -3.77 |
| 55 | 0.2998 | 3.7 | -3.67 |
| 60 | 0.2501 | 4.3 | -3.57 |
| 65 | 0.2097 | 4.8 | -3.47 |
| 70 | 0.1767 | 5.3 | -3.37 |
| 75 | 0.1496 | 5.9 | -3.28 |
| 80 | 0.1272 | 6.4 | -3.19 |
| 85 | 0.1087 | 6.9 | -3.11 |
| 90 | 0.09320 | 7.4 | -3.03 |
| 95 | 0.08025 | 7.8 | -2.95 |
| 100 | 0.06937 | 8.3 | -2.87 |
| 105 | 0.06019 | 8.8 | -2.80 |
| 110 | 0.05242 | 9.2 | -2.73 |
| 115 | 0.04580 | 9.6 | -2.66 |
| 120 | 0.04016 | 10.1 | -2.60 |
| 125 | 0.03532 | 10.5 | -2.53 |
| 130 | 0.03117 | 10.9 | -2.47 |
| 135 | 0.02758 | 11.3 | -2.41 |
| 140 | 0.02448 | 11.7 | -2.36 |
| 145 | 0.02179 | 12.1 | -2.30 |
| 150 | 0.01945 | 12.4 | -2.25 |

| T (°C) | Material B(K) | | |
|--------|---------------|--------|----------|
| | MA 3965 | | |
| | R(T) / R25 | TF (%) | α (%/°C) |
| -55 | 101.09 | 2.47 | -7.49 |
| -50 | 69.81 | 2.26 | -7.22 |
| -45 | 48.87 | 2.06 | -6.96 |
| -40 | 34.65 | 1.87 | -6.71 |
| -35 | 24.87 | 1.69 | -6.48 |
| -30 | 18.06 | 1.52 | -6.26 |
| -25 | 13.259 | 1.35 | -6.05 |
| -20 | 9.837 | 1.19 | -5.84 |
| -15 | 7.372 | 1.04 | -5.65 |
| -10 | 5.578 | 0.89 | -5.47 |
| -5 | 4.259 | 0.75 | -5.29 |
| 0 | 3.280 | 0.61 | -5.12 |
| 5 | 2.548 | 0.48 | -4.96 |
| 10 | 1.994 | 0.35 | -4.81 |
| 15 | 1.573 | 0.23 | -4.66 |
| 20 | 1.250 | 0.11 | -4.52 |
| 25 | 1.0000 | 0.00 | -4.38 |
| 30 | 0.8054 | 0.11 | -4.25 |
| 35 | 0.6528 | 0.22 | -4.13 |
| 40 | 0.5324 | 0.32 | -4.01 |
| 45 | 0.4368 | 0.42 | -3.90 |
| 50 | 0.3603 | 0.52 | -3.79 |
| 55 | 0.2989 | 0.61 | -3.68 |
| 60 | 0.2492 | 0.70 | -3.58 |
| 65 | 0.2088 | 0.79 | -3.48 |
| 70 | 0.1758 | 0.88 | -3.39 |
| 75 | 0.1487 | 0.96 | -3.30 |
| 80 | 0.1263 | 1.04 | -3.21 |
| 85 | 0.1078 | 1.12 | -3.13 |
| 90 | 0.0923 | 1.20 | -3.05 |
| 95 | 0.0794 | 1.27 | -2.97 |
| 100 | 0.06857 | 1.35 | -2.90 |
| 105 | 0.05942 | 1.42 | -2.83 |
| 110 | 0.05167 | 1.49 | -2.76 |
| 115 | 0.04509 | 1.55 | -2.69 |
| 120 | 0.03948 | 1.62 | -2.62 |
| 125 | 0.03467 | 1.68 | -2.56 |
| 130 | 0.03055 | 1.75 | -2.50 |
| 135 | 0.02699 | 1.81 | -2.44 |
| 140 | 0.02392 | 1.87 | -2.39 |
| 145 | 0.02125 | 1.93 | -2.33 |
| 150 | 0.01894 | 1.98 | -2.28 |

| T (°C) | Material B(K) | | |
|--------|---------------|--------|----------|
| | MC 3910 | | |
| | R(T) / R25 | TF (%) | α (%/°C) |
| -55 | 100.6 | 23.0 | -7.56 |
| -50 | 69.29 | 19.9 | -7.27 |
| -45 | 48.40 | 17.1 | -7.00 |
| -40 | 34.27 | 14.6 | -6.75 |
| -35 | 24.57 | 12.4 | -6.50 |
| -30 | 17.83 | 10.5 | -6.27 |
| -25 | 13.09 | 8.7 | -6.05 |
| -20 | 9.71 | 7.2 | -5.84 |
| -15 | 7.282 | 5.9 | -5.64 |
| -10 | 5.514 | 4.7 | -5.45 |
| -5 | 4.215 | 3.7 | -5.27 |
| 0 | 3.250 | 2.8 | -5.10 |
| 5 | 2.528 | 2.0 | -4.93 |
| 10 | 1.982 | 1.4 | -4.77 |
| 15 | 1.567 | 0.8 | -4.62 |
| 20 | 1.247 | 0.4 | -4.48 |
| 25 | 1.0000 | 0.0 | -4.34 |
| 30 | 0.8072 | 0.4 | -4.21 |
| 35 | 0.6559 | 0.8 | -4.08 |
| 40 | 0.5362 | 1.2 | -3.96 |
| 45 | 0.4410 | 1.7 | -3.85 |
| 50 | 0.3647 | 2.2 | -3.74 |
| 55 | 0.3033 | 2.8 | -3.63 |
| 60 | 0.2535 | 3.4 | -3.53 |
| 65 | 0.2130 | 4.0 | -3.43 |
| 70 | 0.1798 | 4.6 | -3.34 |
| 75 | 0.1525 | 5.2 | -3.25 |
| 80 | 0.1300 | 5.9 | -3.16 |
| 85 | 0.1112 | 6.6 | -3.08 |
| 90 | 0.09552 | 7.3 | -2.99 |
| 95 | 0.08239 | 8.0 | -2.92 |
| 100 | 0.07133 | 8.7 | -2.84 |
| 105 | 0.06199 | 9.4 | -2.77 |
| 110 | 0.05406 | 10.1 | -2.70 |
| 115 | 0.04731 | 10.9 | -2.63 |
| 120 | 0.04153 | 11.6 | -2.57 |
| 125 | 0.03658 | 12.3 | -2.51 |
| 130 | 0.03231 | 13.1 | -2.45 |
| 135 | 0.02863 | 13.8 | -2.39 |
| 140 | 0.02544 | 14.6 | -2.33 |
| 145 | 0.02267 | 15.3 | -2.28 |
| 150 | 0.02025 | 16.1 | -2.23 |

| T (°C) | Material B(K) | | |
|--------|---------------|--------|----------|
| | ME 3975 | | |
| | R(T) / R25 | TF (%) | α (%/°C) |
| -55 | 103.9 | 2.47 | -7.56 |
| -50 | 71.53 | 2.26 | -7.28 |
| -45 | 49.94 | 2.06 | -7.01 |
| -40 | 35.32 | 1.87 | -6.76 |
| -35 | 25.29 | 1.69 | -6.53 |
| -30 | 18.32 | 1.52 | -6.30 |
| -25 | 13.43 | 1.35 | -6.08 |
| -20 | 9.945 | 1.19 | -5.88 |
| -15 | 7.440 | 1.04 | -5.68 |
| -10 | 5.621 | 0.89 | -5.50 |
| -5 | 4.286 | 0.75 | -5.32 |
| 0 | 3.297 | 0.61 | -5.15 |
| 5 | 2.557 | 0.48 | -4.98 |
| 10 | 2.000 | 0.35 | -4.83 |
| 15 | 1.576 | 0.23 | -4.68 |
| 20 | 1.251 | 0.11 | -4.54 |
| 25 | 1.0000 | 0.00 | -4.40 |
| 30 | 0.8048 | 0.11 | -4.27 |
| 35 | 0.6519 | 0.22 | -4.14 |
| 40 | 0.5313 | 0.32 | -4.02 |
| 45 | 0.4356 | 0.42 | -3.91 |
| 50 | 0.3591 | 0.52 | -3.80 |
| 55 | 0.2977 | 0.61 | -3.69 |
| 60 | 0.2481 | 0.70 | -3.59 |
| 65 | 0.2078 | 0.79 | -3.49 |
| 70 | 0.1749 | 0.88 | -3.40 |
| 75 | 0.1479 | 0.96 | -3.31 |
| 80 | 0.1256 | 1.04 | -3.22 |
| 85 | 0.1071 | 1.12 | -3.14 |
| 90 | 0.09175 | 1.20 | -3.06 |
| 95 | 0.07890 | 1.27 | -2.98 |
| 100 | 0.06810 | 1.35 | -2.90 |
| 105 | 0.05900 | 1.42 | -2.83 |
| 110 | 0.05130 | 1.49 | -2.76 |
| 115 | 0.04476 | 1.55 | -2.69 |
| 120 | 0.03918 | 1.62 | -2.63 |
| 125 | 0.03441 | 1.68 | -2.57 |
| 130 | 0.03031 | 1.75 | -2.50 |
| 135 | 0.02678 | 1.81 | -2.45 |
| 140 | 0.02373 | 1.87 | -2.39 |
| 145 | 0.02108 | 1.93 | -2.34 |
| 150 | 0.01878 | 1.98 | -2.28 |

| T (°C) | Material B(K) | | |
|--------|---------------|--------|----------|
| | M4 4400 | | |
| | R(T) / R25 | TF (%) | α (%/°C) |
| -55 | 98.22 | 23.5 | -7.38 |
| -50 | 68.17 | 20.3 | -7.12 |
| -45 | 47.92 | 17.5 | -6.88 |
| -40 | 34.11 | 14.9 | -6.64 |
| -35 | 24.57 | 12.7 | -6.42 |
| -30 | 17.89 | 10.7 | -6.20 |
| -25 | 13.17 | 8.9 | -6.00 |
| -20 | 9.790 | 7.4 | -5.80 |
| -15 | 7.349 | 6.0 | -5.62 |
| -10 | 5.568 | 4.8 | -5.44 |
| -5 | 4.256 | 3.8 | -5.27 |
| 0 | 3.280 | 2.8 | -5.11 |
| 5 | 2.549 | 2.1 | -4.95 |
| 10 | 1.996 | 1.4 | -4.80 |
| 15 | 1.574 | 0.8 | -4.66 |
| 20 | 1.250 | 0.4 | -4.52 |
| 25 | 1.0000 | 0.0 | -4.39 |
| 30 | 0.8049 | 0.4 | -4.27 |
| 35 | 0.6519 | 0.8 | -4.15 |
| 40 | 0.5311 | 1.2 | -4.03 |
| 45 | 0.4352 | 1.7 | -3.92 |
| 50 | 0.3586 | 2.3 | -3.81 |
| 55 | 0.2970 | 2.8 | -3.71 |
| 60 | 0.2472 | 3.4 | -3.61 |
| 65 | 0.2068 | 4.1 | -3.52 |
| 70 | 0.1738 | 4.7 | -3.42 |
| 75 | 0.1468 | 5.4 | -3.34 |
| 80 | 0.1245 | 6.0 | -3.25 |
| 85 | 0.1060 | 6.7 | -3.17 |
| 90 | 0.09060 | 7.4 | -3.09 |
| 95 | 0.07776 | 8.2 | -3.01 |
| 100 | 0.06700 | 8.9 | -2.94 |
| 105 | 0.05793 | 9.6 | -2.87 |
| 110 | 0.05026 | 10.4 | -2.80 |
| 115 | 0.04376 | 11.1 | -2.74 |
| 120 | 0.03822 | 11.9 | -2.67 |
| 125 | 0.03349 | 12.6 | -2.61 |
| 130 | 0.02944 | 13.4 | -2.55 |
| 135 | 0.02595 | 14.1 | -2.49 |
| 140 | 0.02294 | 14.9 | -2.44 |
| 145 | 0.02033 | 15.6 | -2.38 |
| 150 | 0.01807 | 16.4 | -2.33 |

Tables of Resistance vs Temperature



| T (°C) | Material B(K) | | |
|-----------|---------------|--------|----------|
| | MN 4077 | | |
| | R(T) / R25 | TF (%) | α (%/°C) |
| -55 | 103.56 | 2.54 | -7.39 |
| -50 | 71.79 | 2.32 | -7.14 |
| -45 | 50.39 | 2.12 | -6.90 |
| -40 | 35.79 | 1.92 | -6.68 |
| -35 | 25.71 | 1.74 | -6.46 |
| -30 | 18.67 | 1.56 | -6.25 |
| -25 | 13.70 | 1.39 | -6.06 |
| -20 | 10.15 | 1.22 | -5.87 |
| -15 | 7.59 | 1.06 | -5.68 |
| -10 | 5.73 | 0.91 | -5.51 |
| -5 | 4.36 | 0.77 | -5.34 |
| 0 | 3.35 | 0.63 | -5.18 |
| 5 | 2.59 | 0.49 | -5.03 |
| 10 | 2.02 | 0.36 | -4.88 |
| 15 | 1.59 | 0.24 | -4.74 |
| 20 | 1.26 | 0.12 | -4.60 |
| 25 | 1.00 | 0.00 | -4.47 |
| 30 | 0.80 | 0.11 | -4.35 |
| 35 | 0.65 | 0.22 | -4.23 |
| 40 | 0.52 | 0.33 | -4.11 |
| 45 | 0.43 | 0.43 | -4.00 |
| 50 | 0.35 | 0.53 | -3.89 |
| 55 | 0.29 | 0.63 | -3.79 |
| 60 | 0.24 | 0.72 | -3.69 |
| 65 | 0.20 | 0.81 | -3.59 |
| 70 | 0.17 | 0.90 | -3.50 |
| 75 | 0.14 | 0.99 | -3.41 |
| 80 | 0.12 | 1.07 | -3.32 |
| 85 | 0.10 | 1.15 | -3.24 |
| 90 | 0.09 | 1.23 | -3.16 |
| 95 | 0.07 | 1.31 | -3.08 |
| 100 | 0.06 | 1.38 | -3.00 |
| 105 | 0.05 | 1.46 | -2.93 |
| 110 | 0.05 | 1.53 | -2.86 |
| 115 | 0.04 | 1.60 | -2.79 |
| 120 | 0.04 | 1.67 | -2.73 |
| 125 | 0.03 | 1.73 | -2.66 |
| 130 | 0.03 | 1.80 | -2.60 |
| 135 | 0.02 | 1.86 | -2.54 |
| 140 | 0.02 | 1.92 | -2.49 |
| 145 | 0.02 | 1.98 | -2.43 |
| 150 | 0.02 | 2.04 | -2.38 |

| T (°C) | Material B(K) | | |
|-----------|---------------|--------|----------|
| | N 4080 | | |
| | R(T) / R25 | TF (%) | α (%/°C) |
| -55 | 110.1 | 24.0 | -7.50 |
| -50 | 75.89 | 20.7 | -7.25 |
| -45 | 52.97 | 17.8 | -7.01 |
| -40 | 37.42 | 15.2 | -6.78 |
| -35 | 26.75 | 12.9 | -6.56 |
| -30 | 19.33 | 10.9 | -6.35 |
| -25 | 14.11 | 9.1 | -6.14 |
| -20 | 10.41 | 7.5 | -5.95 |
| -15 | 7.758 | 6.1 | -5.76 |
| -10 | 5.834 | 4.9 | -5.58 |
| -5 | 4.426 | 3.8 | -5.41 |
| 0 | 3.387 | 2.9 | -5.24 |
| 5 | 2.614 | 2.1 | -5.08 |
| 10 | 2.033 | 1.4 | -4.93 |
| 15 | 1.593 | 0.9 | -4.78 |
| 20 | 1.258 | 0.4 | -4.64 |
| 25 | 1.0000 | 0.0 | -4.51 |
| 30 | 0.8004 | 0.4 | -4.37 |
| 35 | 0.6449 | 0.8 | -4.25 |
| 40 | 0.5228 | 1.3 | -4.13 |
| 45 | 0.4264 | 1.8 | -4.01 |
| 50 | 0.3497 | 2.3 | -3.90 |
| 55 | 0.2885 | 2.9 | -3.79 |
| 60 | 0.2392 | 3.5 | -3.68 |
| 65 | 0.1994 | 4.1 | -3.58 |
| 70 | 0.1671 | 4.8 | -3.49 |
| 75 | 0.1406 | 5.5 | -3.39 |
| 80 | 0.1189 | 6.2 | -3.30 |
| 85 | 0.1010 | 6.9 | -3.22 |
| 90 | 0.08616 | 7.6 | -3.13 |
| 95 | 0.07381 | 8.3 | -3.05 |
| 100 | 0.06347 | 9.1 | -2.97 |
| 105 | 0.05480 | 9.8 | -2.90 |
| 110 | 0.04748 | 10.6 | -2.83 |
| 115 | 0.04129 | 11.3 | -2.76 |
| 120 | 0.03603 | 12.1 | -2.69 |
| 125 | 0.03155 | 12.9 | -2.62 |
| 130 | 0.02771 | 13.7 | -2.56 |
| 135 | 0.02442 | 14.4 | -2.50 |
| 140 | 0.02158 | 15.2 | -2.44 |
| 145 | 0.01913 | 16.0 | -2.38 |
| 150 | 0.01700 | 16.8 | -2.33 |

| T (°C) | Material B(K) | | |
|-----------|---------------|--------|----------|
| | NA 4100 | | |
| | R(T) / R25 | TF (%) | α (%/°C) |
| -55 | 109.5 | 8.0 | -7.53 |
| -50 | 75.44 | 6.9 | -7.27 |
| -45 | 52.64 | 6.0 | -7.02 |
| -40 | 37.19 | 5.1 | -6.78 |
| -35 | 26.59 | 4.3 | -6.56 |
| -30 | 19.22 | 3.7 | -6.34 |
| -25 | 14.05 | 3.1 | -6.14 |
| -20 | 10.37 | 2.5 | -5.94 |
| -15 | 7.730 | 2.1 | -5.75 |
| -10 | 5.817 | 1.6 | -5.57 |
| -5 | 4.417 | 1.3 | -5.40 |
| 0 | 3.382 | 1.0 | -5.23 |
| 5 | 2.611 | 0.7 | -5.08 |
| 10 | 2.032 | 0.5 | -4.92 |
| 15 | 1.593 | 0.3 | -4.78 |
| 20 | 1.258 | 0.1 | -4.64 |
| 25 | 1.0000 | 0.0 | -4.51 |
| 30 | 0.8003 | 0.1 | -4.38 |
| 35 | 0.6446 | 0.3 | -4.25 |
| 40 | 0.5224 | 0.4 | -4.14 |
| 45 | 0.4258 | 0.6 | -4.02 |
| 50 | 0.3490 | 0.8 | -3.91 |
| 55 | 0.2877 | 1.0 | -3.81 |
| 60 | 0.2383 | 1.2 | -3.71 |
| 65 | 0.1984 | 1.4 | -3.61 |
| 70 | 0.1660 | 1.6 | -3.51 |
| 75 | 0.1395 | 1.8 | -3.42 |
| 80 | 0.1178 | 2.1 | -3.34 |
| 85 | 0.09989 | 2.3 | -3.25 |
| 90 | 0.08506 | 2.5 | -3.17 |
| 95 | 0.07271 | 2.8 | -3.09 |
| 100 | 0.06240 | 3.0 | -3.02 |
| 105 | 0.05375 | 3.3 | -2.94 |
| 110 | 0.04647 | 3.5 | -2.87 |
| 115 | 0.04032 | 3.8 | -2.81 |
| 120 | 0.03509 | 4.1 | -2.74 |
| 125 | 0.03065 | 4.3 | -2.68 |
| 130 | 0.02685 | 4.6 | -2.61 |
| 135 | 0.02359 | 4.8 | -2.55 |
| 140 | 0.02079 | 5.1 | -2.50 |
| 145 | 0.01837 | 5.4 | -2.44 |
| 150 | 0.01628 | 5.6 | -2.39 |

| T (°C) | Material B(K) | | |
|-----------|---------------|--------|----------|
| | NC 4080 | | |
| | R(T) / R25 | TF (%) | α (%/°C) |
| -55 | 105.4 | 24.0 | -7.45 |
| -50 | 72.89 | 20.7 | -7.20 |
| -45 | 51.04 | 17.8 | -6.95 |
| -40 | 36.18 | 15.2 | -6.72 |
| -35 | 25.94 | 12.9 | -6.50 |
| -30 | 18.81 | 10.9 | -6.29 |
| -25 | 13.78 | 9.1 | -6.08 |
| -20 | 10.20 | 7.5 | -5.89 |
| -15 | 7.621 | 6.1 | -5.71 |
| -10 | 5.748 | 4.9 | -5.53 |
| -5 | 4.373 | 3.8 | -5.36 |
| 0 | 3.355 | 2.9 | -5.20 |
| 5 | 2.595 | 2.1 | -5.04 |
| 10 | 2.023 | 1.4 | -4.89 |
| 15 | 1.588 | 0.9 | -4.75 |
| 20 | 1.256 | 0.4 | -4.61 |
| 25 | 1.0000 | 0.0 | -4.48 |
| 30 | 0.8014 | 0.4 | -4.35 |
| 35 | 0.6463 | 0.8 | -4.23 |
| 40 | 0.5243 | 1.3 | -4.11 |
| 45 | 0.4278 | 1.8 | -4.00 |
| 50 | 0.3510 | 2.3 | -3.89 |
| 55 | 0.2896 | 2.9 | -3.79 |
| 60 | 0.2401 | 3.5 | -3.69 |
| 65 | 0.2001 | 4.1 | -3.59 |
| 70 | 0.1675 | 4.8 | -3.50 |
| 75 | 0.1409 | 5.5 | -3.41 |
| 80 | 0.1190 | 6.2 | -3.32 |
| 85 | 0.1010 | 6.9 | -3.24 |
| 90 | 0.08605 | 7.6 | -3.16 |
| 95 | 0.07360 | 8.3 | -3.08 |
| 100 | 0.06319 | 9.1 | -3.01 |
| 105 | 0.05446 | 9.8 | -2.94 |
| 110 | 0.04710 | 10.6 | -2.87 |
| 115 | 0.04087 | 11.3 | -2.80 |
| 120 | 0.03559 | 12.1 | -2.73 |
| 125 | 0.03109 | 12.9 | -2.67 |
| 130 | 0.02724 | 13.7 | -2.61 |
| 135 | 0.02394 | 14.4 | -2.55 |
| 140 | 0.02111 | 15.2 | -2.49 |
| 145 | 0.01866 | 16.0 | -2.44 |
| 150 | 0.01654 | 16.8 | -2.38 |

| T (°C) | Material B(K) | | |
|-----------|---------------|--------|----------|
| | NE 4100 | | |
| | R(T) / R25 | TF (%) | α (%/°C) |
| -55 | 97.27 | 24.1 | -7.2 |
| -50 | 67.99 | 20.8 | -7.0 |
| -45 | 48.08 | 17.9 | -6.8 |
| -40 | 34.39 | 15.3 | -6.5 |
| -35 | 24.85 | 13.0 | -6.3 |
| -30 | 18.15 | 11.0 | -6.1 |
| -25 | 13.38 | 9.2 | -6.0 |
| -20 | 9.960 | 7.6 | -5.8 |
| -15 | 7.479 | 6.2 | -5.6 |
| -10 | 5.664 | 4.9 | -5.4 |
| -5 | 4.325 | 3.8 | -5.3 |
| 0 | 3.328 | 2.9 | -5.1 |
| 5 | 2.581 | 2.1 | -5.0 |
| 10 | 2.016 | 1.4 | -4.9 |
| 15 | 1.585 | 0.9 | -4.7 |
| 20 | 1.255 | 0.4 | -4.6 |
| 25 | 1.0000 | 0.0 | -4.5 |
| 30 | 0.8017 | 0.4 | -4.3 |
| 35 | 0.6466 | 0.8 | -4.2 |
| 40 | 0.5245 | 1.3 | -4.1 |
| 45 | 0.4278 | 1.8 | -4.0 |
| 50 | 0.3508 | 2.3 | -3.9 |
| 55 | 0.2891 | 2.9 | -3.8 |
| 60 | 0.2394 | 3.5 | -3.7 |
| 65 | 0.1992 | 4.2 | -3.6 |
| 70 | 0.1666 | 4.8 | -3.5 |
| 75 | 0.1399 | 5.5 | -3.4 |
| 80 | 0.11794 | 6.2 | -3.4 |
| 85 | 0.09987 | 6.9 | -3.3 |
| 90 | 0.08491 | 7.6 | -3.2 |
| 95 | 0.07246 | 8.4 | -3.1 |
| 100 | 0.06207 | 9.1 | -3.1 |
| 105 | 0.05336 | 9.9 | -3.0 |
| 110 | 0.04604 | 10.6 | -2.9 |
| 115 | 0.03985 | 11.4 | -2.8 |
| 120 | 0.03461 | 12.2 | -2.8 |
| 125 | 0.03015 | 12.9 | -2.7 |
| 130 | 0.02635 | 13.7 | -2.7 |
| 135 | 0.02309 | 14.5 | -2.6 |
| 140 | 0.0203 | 15.3 | -2.5 |
| 145 | 0.01789 | 16.1 | -2.5 |
| 150 | 0.01581 | 16.8 | -2.4 |

| T (°C) | Material B(K) | | |
|-----------|---------------|--------|----------|
| | N5 4160 | | |
| | R(T) / R25 | TF (%) | α (%/°C) |
| -55 | 115.8 | 16.3 | -7.52 |
| -50 | 79.72 | 14.1 | -7.28 |
| -45 | 55.54 | 12.1 | -7.04 |
| -40 | 39.15 | 10.4 | -6.82 |
| -35 | 27.91 | 8.8 | -6.61 |
| -30 | 20.11 | 7.4 | -6.40 |
| -25 | 14.64 | 6.2 | -6.20 |
| -20 | 10.77 | 5.1 | -6.01 |
| -15 | 7.996 | 4.2 | -5.83 |
| -10 | 5.991 | 3.3 | -5.65 |
| -5 | 4.529 | 2.6 | -5.48 |
| 0 | 3.454 | 2.0 | -5.31 |
| 5 | 2.655 | 1.4 | -5.16 |
| 10 | 2.057 | 1.0 | -5.00 |
| 15 | 1.606 | 0.6 | -4.86 |
| 20 | 1.263 | 0.3 | -4.72 |
| 25 | 1.0000 | 0.0 | -4.58 |
| 30 | 0.7973 | 0.3 | -4.45 |
| 35 | 0.6398 | 0.5 | -4.32 |
| 40 | 0.5167 | 0.9 | -4.20 |
| 45 | 0.4198 | 1.2 | -4.09 |
| 50 | 0.3430 | 1.6 | -3.97 |
| 55 | 0.2819 | 2.0 | -3.86 |
| 60 | 0.2329 | 2.4 | -3.76 |
| 65 | 0.1934 | 2.8 | -3.66 |
| 70 | 0.1614 | 3.3 | -3.56 |
| 75 | 0.1354 | 3.7 | -3.46 |
| 80 | 0.1141 | 4.2 | -3.37 |
| 85 | 0.09658 | 4.7 | -3.29 |
| 90 | 0.08211 | 5.2 | -3.20 |
| 95 | 0.07010 | 5.7 | -3.12 |
| 100 | 0.06009 | 6.2 | -3.04 |
| 105 | 0.05171 | 6.7 | -2.96 |
| 110 | 0.04467 | 7.2 | -2.89 |
| 115 | 0.03872 | 7.7 | -2.82 |
| 120 | 0.03369 | 8.2 | -2.75 |
| 125 | 0.02941 | 8.8 | -2.68 |
| 130 | 0.02576 | 9.3 | -2.62 |
| 135 | 0.02263 | 9.8 | -2.55 |
| 140 | 0.01995 | 10.3 | -2.49 |
| 145 | 0.01763 | 10.9 | -2.44 |
| 150 | 0.01563 | 11.4 | -2.38 |

Tables of Resistance vs Temperature



| T (°C) | Material B(K) P 4220 | | |
|-----------|-------------------------|--------|----------|
| | R(T) / R25 | TF (%) | α (%/°C) |
| -55 | 121.4 | 24.8 | -7.56 |
| -50 | 83.35 | 21.5 | -7.32 |
| -45 | 57.92 | 18.4 | -7.09 |
| -40 | 40.72 | 15.8 | -6.87 |
| -35 | 28.95 | 13.4 | -6.66 |
| -30 | 20.80 | 11.3 | -6.45 |
| -25 | 15.10 | 9.4 | -6.26 |
| -20 | 11.07 | 7.8 | -6.07 |
| -15 | 8.197 | 6.3 | -5.89 |
| -10 | 6.123 | 5.1 | -5.71 |
| -5 | 4.615 | 4.0 | -5.54 |
| 0 | 3.508 | 3.0 | -5.38 |
| 5 | 2.688 | 2.2 | -5.22 |
| 10 | 2.076 | 1.5 | -5.07 |
| 15 | 1.616 | 0.9 | -4.92 |
| 20 | 1.267 | 0.4 | -4.78 |
| 25 | 1.0000 | 0.0 | -4.64 |
| 30 | 0.7949 | 0.4 | -4.51 |
| 35 | 0.6359 | 0.8 | -4.38 |
| 40 | 0.5120 | 1.3 | -4.26 |
| 45 | 0.4148 | 1.8 | -4.14 |
| 50 | 0.3379 | 2.4 | -4.03 |
| 55 | 0.2769 | 3.0 | -3.92 |
| 60 | 0.2281 | 3.6 | -3.81 |
| 65 | 0.1890 | 4.3 | -3.71 |
| 70 | 0.1573 | 5.0 | -3.61 |
| 75 | 0.1316 | 5.7 | -3.52 |
| 80 | 0.1106 | 6.4 | -3.42 |
| 85 | 0.09337 | 7.1 | -3.34 |
| 90 | 0.07918 | 7.9 | -3.25 |
| 95 | 0.06743 | 8.6 | -3.17 |
| 100 | 0.05766 | 9.4 | -3.09 |
| 105 | 0.04950 | 10.2 | -3.01 |
| 110 | 0.04266 | 10.9 | -2.93 |
| 115 | 0.03691 | 11.7 | -2.86 |
| 120 | 0.03204 | 12.5 | -2.79 |
| 125 | 0.02791 | 13.3 | -2.72 |
| 130 | 0.02439 | 14.1 | -2.66 |
| 135 | 0.02139 | 14.9 | -2.59 |
| 140 | 0.01881 | 15.7 | -2.53 |
| 145 | 0.01660 | 16.5 | -2.47 |
| 150 | 0.01469 | 17.3 | -2.42 |

| T (°C) | Material B(K) PA 4235 | | |
|-----------|--------------------------|--------|----------|
| | R(T) / R25 | TF (%) | α (%/°C) |
| -55 | 123.40 | 8.3 | -7.68 |
| -50 | 84.33 | 7.2 | -7.42 |
| -45 | 58.39 | 6.2 | -7.17 |
| -40 | 40.93 | 5.3 | -6.93 |
| -35 | 29.04 | 4.5 | -6.71 |
| -30 | 20.83 | 3.8 | -6.49 |
| -25 | 15.11 | 3.2 | -6.29 |
| -20 | 11.07 | 2.6 | -6.09 |
| -15 | 8.190 | 2.1 | -5.90 |
| -10 | 6.117 | 1.7 | -5.72 |
| -5 | 4.610 | 1.3 | -5.54 |
| 0 | 3.505 | 1.0 | -5.38 |
| 5 | 2.686 | 0.7 | -5.22 |
| 10 | 2.075 | 0.5 | -5.07 |
| 15 | 1.615 | 0.3 | -4.92 |
| 20 | 1.267 | 0.1 | -4.78 |
| 25 | 1.0000 | 0.0 | -4.64 |
| 30 | 0.7949 | 0.1 | -4.51 |
| 35 | 0.6359 | 0.3 | -4.39 |
| 40 | 0.5119 | 0.4 | -4.27 |
| 45 | 0.4145 | 0.6 | -4.15 |
| 50 | 0.3376 | 2.4 | -4.04 |
| 55 | 0.2764 | 1.0 | -3.93 |
| 60 | 0.2276 | 1.2 | -3.83 |
| 65 | 0.1883 | 1.4 | -3.73 |
| 70 | 0.1566 | 1.7 | -3.63 |
| 75 | 0.1308 | 1.9 | -3.54 |
| 80 | 0.1098 | 2.1 | -3.45 |
| 85 | 0.09257 | 2.4 | -3.37 |
| 90 | 0.07836 | 2.6 | -3.28 |
| 95 | 0.06661 | 2.9 | -3.20 |
| 100 | 0.05685 | 3.1 | -3.13 |
| 105 | 0.04870 | 3.4 | -3.05 |
| 110 | 0.04188 | 3.7 | -2.98 |
| 115 | 0.03614 | 3.9 | -2.91 |
| 120 | 0.03129 | 4.2 | -2.84 |
| 125 | 0.02719 | 4.5 | -2.78 |
| 130 | 0.02370 | 4.7 | -2.71 |
| 135 | 0.02072 | 5.0 | -2.65 |
| 140 | 0.01817 | 5.3 | -2.59 |
| 145 | 0.01598 | 5.5 | -2.54 |
| 150 | 0.01409 | 5.8 | -2.48 |

| T (°C) | Material B(K) Q 4300 | | |
|-----------|-------------------------|--------|----------|
| | R(T) / R25 | TF (%) | α (%/°C) |
| -55 | 98.04 | 25.3 | -6.87 |
| -50 | 69.53 | 21.9 | -6.70 |
| -45 | 49.73 | 18.8 | -6.53 |
| -40 | 35.87 | 16.1 | -6.37 |
| -35 | 26.08 | 13.6 | -6.22 |
| -30 | 19.12 | 11.5 | -6.07 |
| -25 | 14.12 | 9.6 | -5.92 |
| -20 | 10.51 | 7.9 | -5.78 |
| -15 | 7.877 | 6.5 | -5.64 |
| -10 | 5.947 | 5.2 | -5.50 |
| -5 | 4.521 | 4.0 | -5.37 |
| 0 | 3.460 | 3.1 | -5.24 |
| 5 | 2.666 | 2.2 | -5.11 |
| 10 | 2.067 | 1.5 | -4.99 |
| 15 | 1.613 | 0.9 | -4.87 |
| 20 | 1.266 | 0.4 | -4.75 |
| 25 | 1.0000 | 0.0 | -4.63 |
| 30 | 0.7944 | 0.4 | -4.52 |
| 35 | 0.6347 | 0.8 | -4.41 |
| 40 | 0.5099 | 1.3 | -4.30 |
| 45 | 0.4119 | 1.9 | -4.20 |
| 50 | 0.3344 | 2.4 | -4.09 |
| 55 | 0.2730 | 3.1 | -3.99 |
| 60 | 0.2239 | 3.7 | -3.90 |
| 65 | 0.1846 | 4.4 | -3.80 |
| 70 | 0.1529 | 5.1 | -3.71 |
| 75 | 0.1272 | 5.8 | -3.62 |
| 80 | 0.1063 | 6.5 | -3.53 |
| 85 | 0.08927 | 7.2 | -3.44 |
| 90 | 0.07526 | 8.0 | -3.36 |
| 95 | 0.06372 | 8.8 | -3.28 |
| 100 | 0.05417 | 9.6 | -3.20 |
| 105 | 0.04622 | 10.4 | -3.13 |
| 110 | 0.03960 | 11.2 | -3.05 |
| 115 | 0.03405 | 12.0 | -2.98 |
| 120 | 0.02938 | 12.8 | -2.91 |
| 125 | 0.02545 | 13.6 | -2.84 |
| 130 | 0.02211 | 14.4 | -2.77 |
| 135 | 0.01928 | 15.2 | -2.71 |
| 140 | 0.01686 | 16.0 | -2.64 |
| 145 | 0.01479 | 16.8 | -2.58 |
| 150 | 0.01302 | 17.7 | -2.52 |

| T (°C) | Material B(K) QA 4250 | | |
|-----------|--------------------------|--------|----------|
| | R(T) / R25 | TF (%) | α (%/°C) |
| -55 | 99.06 | 8.3 | -7.09 |
| -50 | 69.60 | 7.2 | -6.88 |
| -45 | 49.42 | 6.2 | -6.68 |
| -40 | 35.45 | 5.3 | -6.49 |
| -35 | 25.67 | 4.5 | -6.30 |
| -30 | 18.77 | 3.8 | -6.13 |
| -25 | 13.84 | 3.2 | -5.96 |
| -20 | 10.29 | 2.6 | -5.79 |
| -15 | 7.719 | 2.1 | -5.64 |
| -10 | 5.834 | 1.7 | -5.49 |
| -5 | 4.442 | 1.3 | -5.34 |
| 0 | 3.407 | 1.0 | -5.20 |
| 5 | 2.632 | 0.7 | -5.07 |
| 10 | 2.047 | 0.5 | -4.94 |
| 15 | 1.602 | 0.3 | -4.81 |
| 20 | 1.262 | 0.1 | -4.69 |
| 25 | 1.0000 | 0.0 | -4.57 |
| 30 | 0.7971 | 0.1 | -4.46 |
| 35 | 0.6389 | 0.3 | -4.35 |
| 40 | 0.5149 | 0.4 | -4.24 |
| 45 | 0.4172 | 0.6 | -4.14 |
| 50 | 0.3397 | 0.8 | -4.04 |
| 55 | 0.2780 | 1.0 | -3.95 |
| 60 | 0.2286 | 1.2 | -3.85 |
| 65 | 0.1888 | 1.4 | -3.76 |
| 70 | 0.1567 | 1.7 | -3.68 |
| 75 | 0.1306 | 1.9 | -3.59 |
| 80 | 0.1093 | 2.1 | -3.51 |
| 85 | 0.09179 | 2.4 | -3.43 |
| 90 | 0.07743 | 2.6 | -3.36 |
| 95 | 0.06556 | 2.9 | -3.28 |
| 100 | 0.05571 | 3.2 | -3.21 |
| 105 | 0.04752 | 3.4 | -3.14 |
| 110 | 0.04067 | 3.7 | -3.07 |
| 115 | 0.03492 | 3.9 | -3.01 |
| 120 | 0.03008 | 4.2 | -2.94 |
| 125 | 0.02600 | 4.5 | -2.88 |
| 130 | 0.02254 | 4.7 | -2.82 |
| 135 | 0.01960 | 5.0 | -2.76 |
| 140 | 0.01709 | 5.3 | -2.71 |
| 145 | 0.01495 | 5.5 | -2.65 |
| 150 | 0.01311 | 5.8 | -2.60 |

| T (°C) | Material B(K) R 4400 | | |
|-----------|-------------------------|--------|----------|
| | R(T) / R25 | TF (%) | α (%/°C) |
| -55 | 113.90 | 25.9 | -7.13 |
| -50 | 79.71 | 22.4 | -6.95 |
| -45 | 56.30 | 19.2 | -6.77 |
| -40 | 40.13 | 16.4 | -6.60 |
| -35 | 28.85 | 14.0 | -6.44 |
| -30 | 20.92 | 11.8 | -6.28 |
| -25 | 15.29 | 9.8 | -6.12 |
| -20 | 11.27 | 8.1 | -5.97 |
| -15 | 8.368 | 6.6 | -5.82 |
| -10 | 6.261 | 5.3 | -5.68 |
| -5 | 4.719 | 4.1 | -5.53 |
| 0 | 3.583 | 3.1 | -5.40 |
| 5 | 2.739 | 2.3 | -5.26 |
| 10 | 2.108 | 1.5 | -5.13 |
| 15 | 1.634 | 0.9 | -5.00 |
| 20 | 1.274 | 0.4 | -4.88 |
| 25 | 1.0000 | 0.0 | -4.75 |
| 30 | 0.7897 | 0.4 | -4.64 |
| 35 | 0.6273 | 0.9 | -4.52 |
| 40 | 0.5012 | 1.4 | -4.41 |
| 45 | 0.4028 | 1.9 | -4.30 |
| 50 | 0.3255 | 2.5 | -4.19 |
| 55 | 0.2644 | 3.1 | -4.09 |
| 60 | 0.2159 | 3.8 | -3.98 |
| 65 | 0.1772 | 4.5 | -3.89 |
| 70 | 0.1462 | 5.2 | -3.79 |
| 75 | 0.1212 | 5.9 | -3.70 |
| 80 | 0.1009 | 6.7 | -3.60 |
| 85 | 0.08440 | 7.4 | -3.52 |
| 90 | 0.07092 | 8.2 | -3.43 |
| 95 | 0.05984 | 9.0 | -3.35 |
| 100 | 0.05071 | 9.8 | -3.26 |
| 105 | 0.04314 | 10.6 | -3.19 |
| 110 | 0.03685 | 11.4 | -3.11 |
| 115 | 0.03160 | 12.2 | -3.03 |
| 120 | 0.02719 | 13.1 | -2.96 |
| 125 | 0.02349 | 13.9 | -2.89 |
| 130 | 0.02036 | 14.7 | -2.82 |
| 135 | 0.01770 | 15.6 | -2.76 |
| 140 | 0.01545 | 16.4 | -2.69 |
| 145 | 0.01352 | 17.2 | -2.63 |
| 150 | 0.01187 | 18.1 | -2.57 |

| T (°C) | Material B(K) RA 4380 | | |
|-----------|--------------------------|--------|----------|
| | R(T) / R25 | TF (%) | α (%/°C) |
| -55 | 110.80 | 8.6 | -7.24 |
| -50 | 77.24 | 7.4 | -7.03 |
| -45 | 54.44 | 6.4 | -6.83 |
| -40 | 38.76 | 5.5 | -6.63 |
| -35 | 27.87 | 4.6 | -6.45 |
| -30 | 20.22 | 3.9 | -6.27 |
| -25 | 14.81 | 3.3 | -6.10 |
| -20 | 10.94 | 2.7 | -5.93 |
| -15 | 8.144 | 2.2 | -5.78 |
| -10 | 6.112 | 1.8 | -5.62 |
| -5 | 4.623 | 1.4 | -5.48 |
| 0 | 3.522 | 1.0 | -5.34 |
| 5 | 2.702 | 0.8 | -5.20 |
| 10 | 2.087 | 0.5 | -5.07 |
| 15 | 1.623 | 0.3 | -4.94 |
| 20 | 1.270 | 0.1 | -4.82 |
| 25 | 1.0000 | 0.0 | -4.70 |
| 30 | 0.7920 | 0.1 | -4.59 |
| 35 | 0.6308 | 0.3 | -4.47 |
| 40 | 0.5052 | 0.5 | -4.37 |
| 45 | 0.4068 | 0.6 | -4.26 |
| 50 | 0.3292 | 0.8 | -4.16 |
| 55 | 0.2678 | 1.0 | -4.07 |
| 60 | 0.2189 | 1.3 | -3.97 |
| 65 | 0.1797 | 1.5 | -3.88 |
| 70 | 0.1482 | 1.7 | -3.79 |
| 75 | 0.1228 | 2.0 | -3.71 |
| 80 | 0.1022 | 2.2 | -3.63 |
| 85 | 0.08536 | 2.5 | -3.55 |
| 90 | 0.07159 | 2.7 | -3.47 |
| 95 | 0.06028 | 3.0 | -3.39 |
| 100 | 0.05095 | 3.2 | -3.32 |
| 105 | 0.04322 | 3.5 | -3.25 |
| 110 | 0.03679 | 3.8 | -3.18 |
| 115 | 0.03142 | 4.1 | -3.11 |
| 120 | 0.02693 | 4.3 | -3.05 |
| 125 | 0.02315 | 4.6 | -2.98 |
| 130 | 0.01997 | 4.9 | -2.92 |
| 135 | 0.01728 | 5.2 | -2.86 |
| 140 | 0.01499 | 5.4 | -2.80 |
| 145 | 0.01304 | 5.7 | -2.75 |
| 150 | 0.01138 | 6.0 | -2.69 |



Tables of Resistance vs Temperature



| T (°C) | Material B(K) | | |
|-----------|---------------|--------|----------|
| | RC 4340 | | |
| | R(T) / R25 | TF (%) | α (%/°C) |
| -55 | 105.70 | 25.5 | -7.15 |
| -50 | 74.01 | 22.1 | -6.95 |
| -45 | 52.37 | 19.0 | -6.75 |
| -40 | 37.43 | 16.2 | -6.56 |
| -35 | 27.01 | 13.8 | -6.38 |
| -30 | 19.66 | 11.6 | -6.20 |
| -25 | 14.44 | 9.7 | -6.04 |
| -20 | 10.70 | 8.0 | -5.87 |
| -15 | 7.990 | 6.5 | -5.72 |
| -10 | 6.013 | 5.2 | -5.57 |
| -5 | 4.559 | 4.1 | -5.42 |
| 0 | 3.482 | 3.1 | -5.29 |
| 5 | 2.678 | 2.2 | -5.15 |
| 10 | 2.074 | 1.5 | -5.02 |
| 15 | 1.616 | 0.9 | -4.90 |
| 20 | 1.267 | 0.4 | -4.77 |
| 25 | 1.0000 | 0.0 | -4.66 |
| 30 | 0.7936 | 0.4 | -4.54 |
| 35 | 0.6334 | 0.8 | -4.43 |
| 40 | 0.5083 | 1.3 | -4.33 |
| 45 | 0.4100 | 1.9 | -4.23 |
| 50 | 0.3325 | 2.5 | -4.13 |
| 55 | 0.2709 | 3.1 | -4.03 |
| 60 | 0.2218 | 3.7 | -3.94 |
| 65 | 0.1825 | 4.4 | -3.85 |
| 70 | 0.1508 | 5.1 | -3.76 |
| 75 | 0.1251 | 5.8 | -3.67 |
| 80 | 0.1043 | 6.6 | -3.59 |
| 85 | 0.08727 | 7.3 | -3.51 |
| 90 | 0.07332 | 8.1 | -3.43 |
| 95 | 0.06184 | 8.9 | -3.36 |
| 100 | 0.05235 | 9.7 | -3.29 |
| 105 | 0.04448 | 10.5 | -3.22 |
| 110 | 0.03793 | 11.3 | -3.15 |
| 115 | 0.03245 | 12.1 | -3.08 |
| 120 | 0.02785 | 12.9 | -3.01 |
| 125 | 0.02399 | 13.7 | -2.95 |
| 130 | 0.02072 | 14.5 | -2.89 |
| 135 | 0.01796 | 15.4 | -2.83 |
| 140 | 0.01561 | 16.2 | -2.77 |
| 145 | 0.01360 | 17.0 | -2.72 |
| 150 | 0.01189 | 17.8 | -2.66 |

| T (°C) | Material B(K) | | |
|-----------|---------------|--------|----------|
| | T 4630 | | |
| | R(T) / R25 | TF (%) | α (%/°C) |
| -55 | 137.10 | 27.2 | -7.33 |
| -50 | 94.94 | 23.5 | -7.15 |
| -45 | 66.35 | 20.2 | -6.98 |
| -40 | 46.78 | 17.3 | -6.82 |
| -35 | 33.25 | 14.7 | -6.66 |
| -30 | 23.84 | 12.4 | -6.50 |
| -25 | 17.23 | 10.3 | -6.35 |
| -20 | 12.54 | 8.5 | -6.20 |
| -15 | 9.206 | 6.9 | -6.05 |
| -10 | 6.807 | 5.6 | -5.91 |
| -5 | 5.070 | 4.3 | -5.77 |
| 0 | 3.803 | 3.3 | -5.63 |
| 5 | 2.873 | 2.4 | -5.50 |
| 10 | 2.185 | 1.6 | -5.36 |
| 15 | 1.673 | 1.0 | -5.23 |
| 20 | 1.289 | 0.4 | -5.11 |
| 25 | 1.0000 | 0.0 | -4.99 |
| 30 | 0.7805 | 0.4 | -4.86 |
| 35 | 0.6129 | 0.9 | -4.75 |
| 40 | 0.4841 | 1.4 | -4.63 |
| 45 | 0.3847 | 2.0 | -4.52 |
| 50 | 0.3074 | 2.6 | -4.41 |
| 55 | 0.2470 | 3.3 | -4.30 |
| 60 | 0.1996 | 4.0 | -4.19 |
| 65 | 0.1621 | 4.7 | -4.09 |
| 70 | 0.1323 | 5.4 | -3.99 |
| 75 | 0.1086 | 6.2 | -3.89 |
| 80 | 0.08951 | 7.0 | -3.80 |
| 85 | 0.07416 | 7.8 | -3.71 |
| 90 | 0.06172 | 8.6 | -3.62 |
| 95 | 0.05160 | 9.5 | -3.53 |
| 100 | 0.04333 | 10.3 | -3.44 |
| 105 | 0.03655 | 11.2 | -3.36 |
| 110 | 0.03095 | 12.0 | -3.28 |
| 115 | 0.02632 | 12.9 | -3.20 |
| 120 | 0.02246 | 13.7 | -3.12 |
| 125 | 0.01925 | 14.6 | -3.05 |
| 130 | 0.01656 | 15.5 | -2.97 |
| 135 | 0.01429 | 16.4 | -2.90 |
| 140 | 0.01238 | 17.3 | -2.83 |
| 145 | 0.01076 | 18.1 | -2.77 |
| 150 | 0.009383 | 19.0 | -2.70 |

| T (°C) | Material B(K) | | |
|-----------|---------------|--------|----------|
| | U 4840 | | |
| | R(T) / R25 | TF (%) | α (%/°C) |
| -55 | 173.70 | 28.5 | -7.69 |
| -50 | 118.20 | 24.6 | -7.50 |
| -45 | 81.18 | 21.2 | -7.32 |
| -40 | 56.26 | 18.1 | -7.15 |
| -35 | 39.34 | 15.4 | -6.98 |
| -30 | 27.75 | 12.9 | -6.82 |
| -25 | 19.74 | 10.8 | -6.66 |
| -20 | 14.15 | 8.9 | -6.50 |
| -15 | 10.23 | 7.3 | -6.34 |
| -10 | 7.457 | 5.8 | -6.19 |
| -5 | 5.476 | 4.5 | -6.04 |
| 0 | 4.051 | 3.4 | -5.90 |
| 5 | 3.020 | 2.5 | -5.76 |
| 10 | 2.267 | 1.7 | -5.62 |
| 15 | 1.714 | 1.0 | -5.48 |
| 20 | 1.305 | 0.5 | -5.35 |
| 25 | 1.0000 | 0.0 | -5.22 |
| 30 | 0.7715 | 0.4 | -5.09 |
| 35 | 0.5991 | 0.9 | -4.97 |
| 40 | 0.4681 | 1.5 | -4.84 |
| 45 | 0.3680 | 2.1 | -4.72 |
| 50 | 0.2911 | 2.8 | -4.61 |
| 55 | 0.2316 | 3.4 | -4.49 |
| 60 | 0.1853 | 4.2 | -4.38 |
| 65 | 0.1491 | 4.9 | -4.28 |
| 70 | 0.1206 | 5.7 | -4.17 |
| 75 | 0.09812 | 6.5 | -4.07 |
| 80 | 0.08022 | 7.3 | -3.97 |
| 85 | 0.06591 | 8.2 | -3.87 |
| 90 | 0.05442 | 9.0 | -3.77 |
| 95 | 0.04515 | 9.9 | -3.68 |
| 100 | 0.03763 | 10.8 | -3.59 |
| 105 | 0.03150 | 11.7 | -3.50 |
| 110 | 0.02649 | 12.6 | -3.42 |
| 115 | 0.02237 | 13.5 | -3.33 |
| 120 | 0.01897 | 14.4 | -3.25 |
| 125 | 0.01615 | 15.3 | -3.17 |
| 130 | 0.01380 | 16.2 | -3.10 |
| 135 | 0.01184 | 17.1 | -3.02 |
| 140 | 0.01020 | 18.0 | -2.95 |
| 145 | 0.008814 | 19.0 | -2.88 |
| 150 | 0.007643 | 19.9 | -2.81 |

| T (°C) | Material B(K) | | |
|-----------|---------------|--------|----------|
| | S 4520 | | |
| | R(T) / R25 | TF (%) | α (%/°C) |
| -55 | 126.10 | 26.6 | -7.25 |
| -50 | 87.75 | 23.0 | -7.07 |
| -45 | 61.60 | 19.8 | -6.90 |
| -40 | 43.63 | 16.9 | -6.73 |
| -35 | 31.17 | 14.3 | -6.56 |
| -30 | 22.46 | 12.1 | -6.40 |
| -25 | 16.31 | 10.1 | -6.25 |
| -20 | 11.94 | 8.3 | -6.10 |
| -15 | 8.809 | 6.8 | -5.95 |
| -10 | 6.549 | 5.4 | -5.80 |
| -5 | 4.904 | 4.2 | -5.66 |
| 0 | 3.699 | 3.2 | -5.52 |
| 5 | 2.810 | 2.3 | -5.39 |
| 10 | 2.149 | 1.6 | -5.26 |
| 15 | 1.654 | 1.0 | -5.13 |
| 20 | 1.282 | 0.4 | -5.00 |
| 25 | 1.0000 | 0.0 | -4.88 |
| 30 | 0.7848 | 0.4 | -4.76 |
| 35 | 0.6196 | 0.9 | -4.64 |
| 40 | 0.4921 | 1.4 | -4.52 |
| 45 | 0.3931 | 2.0 | -4.41 |
| 50 | 0.3158 | 2.6 | -4.30 |
| 55 | 0.2551 | 3.2 | -4.20 |
| 60 | 0.2072 | 3.9 | -4.09 |
| 65 | 0.1691 | 4.6 | -3.99 |
| 70 | 0.1387 | 5.3 | -3.89 |
| 75 | 0.1144 | 6.1 | -3.80 |
| 80 | 0.0948 | 6.8 | -3.71 |
| 85 | 0.0789 | 7.6 | -3.61 |
| 90 | 0.06594 | 8.4 | -3.53 |
| 95 | 0.05538 | 9.2 | -3.44 |
| 100 | 0.04671 | 10.1 | -3.36 |
| 105 | 0.03956 | 10.9 | -3.28 |
| 110 | 0.03364 | 11.7 | -3.20 |
| 115 | 0.02872 | 12.6 | -3.12 |
| 120 | 0.02461 | 13.4 | -3.04 |
| 125 | 0.02117 | 14.3 | -2.97 |
| 130 | 0.01827 | 15.1 | -2.90 |
| 135 | 0.01583 | 16.0 | -2.83 |
| 140 | 0.01376 | 16.8 | -2.77 |
| 145 | 0.01200 | 17.7 | -2.70 |
| 150 | 0.01050 | 18.6 | -2.64 |

| T (°C) | Material B(K) | | |
|-----------|---------------|--------|----------|
| | SC 4500 | | |
| | R(T) / R25 | TF (%) | α (%/°C) |
| -55 | 129.80 | 26.5 | -7.51 |
| -50 | 89.31 | 22.9 | -7.29 |
| -45 | 62.15 | 19.7 | -7.07 |
| -40 | 43.72 | 16.8 | -6.87 |
| -35 | 31.07 | 14.3 | -6.68 |
| -30 | 22.29 | 12.0 | -6.49 |
| -25 | 16.15 | 10.0 | -6.31 |
| -20 | 11.80 | 8.3 | -6.14 |
| -15 | 8.703 | 6.8 | -5.97 |
| -10 | 6.470 | 5.4 | -5.81 |
| -5 | 4.849 | 4.2 | -5.66 |
| 0 | 3.662 | 3.2 | -5.51 |
| 5 | 2.786 | 2.3 | -5.36 |
| 10 | 2.135 | 1.6 | -5.23 |
| 15 | 1.647 | 0.9 | -5.09 |
| 20 | 1.279 | 0.4 | -4.96 |
| 25 | 1.0000 | 0.0 | -4.84 |
| 30 | 0.7865 | 0.4 | -4.72 |
| 35 | 0.6223 | 0.9 | -4.60 |
| 40 | 0.4953 | 1.4 | -4.49 |
| 45 | 0.3963 | 2.0 | -4.38 |
| 50 | 0.3189 | 2.6 | -4.28 |
| 55 | 0.2579 | 3.2 | -4.18 |
| 60 | 0.2096 | 3.9 | -4.08 |
| 65 | 0.1712 | 4.6 | -3.99 |
| 70 | 0.1405 | 5.3 | -3.89 |
| 75 | 0.1159 | 6.0 | -3.80 |
| 80 | 0.09595 | 6.8 | -3.72 |
| 85 | 0.07980 | 7.6 | -3.63 |
| 90 | 0.06664 | 8.4 | -3.55 |
| 95 | 0.05588 | 9.2 | -3.47 |
| 100 | 0.04704 | 10.0 | -3.40 |
| 105 | 0.03975 | 10.8 | -3.32 |
| 110 | 0.03371 | 11.7 | -3.25 |
| 115 | 0.02869 | 12.5 | -3.18 |
| 120 | 0.02450 | 13.4 | -3.12 |
| 125 | 0.02100 | 14.2 | -3.05 |
| 130 | 0.01805 | 15.1 | -2.99 |
| 135 | 0.01557 | 15.9 | -2.92 |
| 140 | 0.01347 | 16.8 | -2.86 |
| 145 | 0.01169 | 17.6 | -2.80 |
| 150 | 0.01017 | 18.5 | -2.75 |

Компания «Life Electronics» занимается поставками электронных компонентов импортного и отечественного производства от производителей и со складов крупных дистрибьюторов Европы, Америки и Азии.

С конца 2013 года компания активно расширяет линейку поставок компонентов по направлению коаксиальный кабель, кварцевые генераторы и конденсаторы (керамические, пленочные, электролитические), за счёт заключения дистрибьюторских договоров

Мы предлагаем:

- Конкурентоспособные цены и скидки постоянным клиентам.
- Специальные условия для постоянных клиентов.
- Подбор аналогов.
- Поставку компонентов в любых объемах, удовлетворяющих вашим потребностям.
- Приемлемые сроки поставки, возможна ускоренная поставка.
- Доставку товара в любую точку России и стран СНГ.
- Комплексную поставку.
- Работу по проектам и поставку образцов.
- Формирование склада под заказчика.
- Сертификаты соответствия на поставляемую продукцию (по желанию клиента).
- Тестирование поставляемой продукции.
- Поставку компонентов, требующих военную и космическую приемку.
- Входной контроль качества.
- Наличие сертификата ISO.

В составе нашей компании организован Конструкторский отдел, призванный помогать разработчикам, и инженерам.

Конструкторский отдел помогает осуществить:

- Регистрацию проекта у производителя компонентов.
- Техническую поддержку проекта.
- Защиту от снятия компонента с производства.
- Оценку стоимости проекта по компонентам.
- Изготовление тестовой платы монтаж и пусконаладочные работы.



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