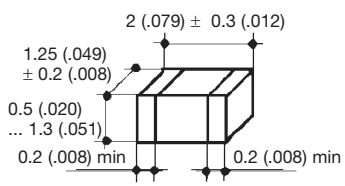
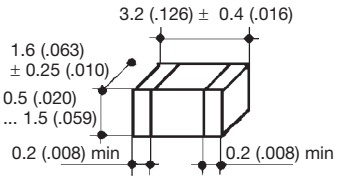
NTC SMD THERMISTORS

NC 12 – NC 20 (PdPtAg Termination)

Chip thermistors are a high quality and low cost device especially developed for surface mounting applications. They are widely used for temperature compensation but can also achieve temperature control of printed circuits. Its silver - palladium - platinum metallization provides a high degree of resistance to dewetting of the terminations during soldering (typically 260°C / 15 s). Parts are suitable for hybrid assembly process, not suitabel for lead free soldering.

Types	NC 12 IEC SIZE : 0805	NC 20 IEC SIZE : 1206
DIMENSIONS: millimeters (inches)		
Terminations	Silver – palladium – platinum metallization	
Marking	On packaging only	
Climatic category	40/125/56	
Operating temperature	-55°C to +150°C	
Tolerance on Rn (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	7 s

Resistance - Temperature characteristics: pages 29 to 33.

FEATURES

- Fast thermal response
- Commercial, Industrial and Automotive Applications
- PdPtAg Termination
- Suitable for hybrid assembly
- AEC-Q200 based qualified

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

RoHS COMPLIANT

HOW TO ORDER

NC 20 — **Type**
NC12 (0805)
NC20 (1206)

K 0 — **Material Code**
K
(See tables pages 15)

0103 — **Resistance**
10,000 Ω
(See tables page 15)

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

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NTC SMD THERMISTORS

NC 12 – NC 20 (PdPtAg Termination)

TABLE OF VALUES

NC 12 IEC SIZE : 0805				
Types	**Rn at 25°C (Ω)**	**Material Code**	**B (K) (ΔB/B (1) ± 5% (2) ± 3%)**	**α at 25°C (%/°C)**
NC 12 KC 0 180	18	KC	3470 ± 5%	– 3.9
NC 12 KC 0 220	22			
NC 12 KC 0 270	27			
NC 12 KC 0 330	33			
NC 12 KC 0 390	39			
NC 12 KC 0 470	47			
NC 12 KC 0 560	56			
NC 12 KC 0 680	68			
NC 12 KC 0 820	82			
NC 12 KC 0 101	100			
NC 12 MC 0 121	120	MC	3910 ± 3%	– 4.4
NC 12 MC 0 151	150			
NC 12 MC 0 181	180			
NC 12 MC 0 221	220			
NC 12 MC 0 271	270			
NC 12 MC 0 331	330			
NC 12 MC 0 391	390			
NC 12 MC 0 471	470			
NC 12 MC 0 561	560			
NC 12 MC 0 681	680			
NC 12 MC 0 821	820			
NC 12 MC 0 102	1,000			
NC 12 MC 0 122	1,200			
NC 12 MC 0 152	1,500			
NC 12 MC 0 182	1,800			
NC 12 MC 0 222	2,200			
NC 12 MC 0 272	2,700			
NC 12 MC 0 332	3,300			
NC 12 J 0 0332	3,300	J	3480 ± 3%	– 3.9
NC 12 J 0 0392	3,900			
NC 12 J 0 0472	4,700			
NC 12 J 0 0502	5,000			
NC 12 J 0 0562	5,600			
NC 12 K 0 0682	6,800	K	3630 ± 3%	– 4.0
NC 12 K 0 0822	8,200			
NC 12 K 0 0103	10,000			
NC 12 K 0 0123	12,000			
NC 12 L 0 0153	15,000	L	3790 ± 3%	– 4.2
NC 12 L 0 0183	18,000			
NC 12 M 0 0223	22,000	M	3950 ± 3%	– 4.4
NC 12 M 0 0273	27,000			
NC 12 M 0 0333	33,000			
NC 12 M 0 0393	39,000			
NC 12 N 0 0473	47,000	N	4080 ± 3%	– 4.6
NC 12 N 0 0503				
NC 12 N 0 0563	56,000			
NC 12 L 2 0683	68,000	L2	3805 ± 3%	– 4.1
NC 12 N 0 0823	82,000	N	4080 ± 3%	– 4.6
NC 12 P 0 0104	100,000	P	4220 ± 3%	– 4.7
NC 12 P 0 0124	120,000			
NC 12 P 0 0154	150,000			
NC 12 P 0 0184	180,000			
NC 12 Q 0 0224	220,000	Q	4300 ± 3%	-4.7

NC 20 IEC SIZE : 1206				
Types	**Rn at 25°C (Ω)**	**Material Code**	**B (K) (ΔB/B (1) ± 5% (2) ± 3%)**	**α at 25°C (%/°C)**
NC 20 KC 0 100	10	KC	3470 ± 5%	– 3.9
NC 20 KC 0 120	12			
NC 20 KC 0 150	15			
NC 20 KC 0 180	18			
NC 20 KC 0 220	22			
NC 20 KC 0 270	27			
NC 20 KC 0 330	33			
NC 20 KC 0 390	39			
NC 20 KC 0 470	47			
NC 20 KC 0 560	56			
NC 20 KC 0 680	68			
NC 20 KC 0 820	82			
NC 20 KC 0 101	100			
NC 20 MC 0 121	120	MC	3910 ± 3%	– 4.4
NC 20 MC 0 151	150			
NC 20 MC 0 181	180			
NC 20 MC 0 221	220			
NC 20 MC 0 271	270			
NC 20 MC 0 331	330			
NC 20 MC 0 391	390			
NC 20 MC 0 471	470			
NC 20 MC 0 561	560			
NC 20 MC 0 681	680			
NC 20 MC 0 821	820			
NC 20 MC 0 102	1,000			
NC 20 MC 0 122	1,200			
NC 20 MC 0 152	1,500			
NC 20 I 0 0182	1,800	I	3250 ± 5%	– 3.7
NC 20 I 0 0222	2,200			
NC 20 I 0 0272	2,700			
NC 20 I 0 0332	3,300			
NC 20 J 0 0392	3,900	J	3480 ± 3%	– 3.9
NC 20 J 0 0472	4,700			
NC 20 J 0 0502	5,000			
NC 20 J 0 0562	5,600			
NC 20 J 0 0682	6,800			
NC 20 K 0 0822	8,200	K	3630 ± 3%	– 4.0
NC 20 K 0 0103	10,000			
NC 20 K 0 0123	12,000			
NC 20 K 0 0153	15,000			
NC 20 L 0 0183	18,000	L	3790 ± 3%	– 4.2
NC 20 L 0 0223	22,000			
NC 20 M 0 0273	27,000	M	3950 ± 3%	– 4.4
NC 20 M 0 0333	33,000			
NC 20 M 0 0393	39,000			
NC 20 M 4 0473	47,000	M4	3995 ± 3%	– 4.4
NC 20 M 4 0503	50,000			
NC 20 N 0 0563	56,000	N	4080 ± 3%	– 4.6
NC 20 N 0 0683	68,000			
NC 20 N 0 0823	82,000			
NC 20 N 0 0104	100,000			
NC 20 P 0 0124	120,000	P	4220 ± 3%	– 4.7
NC 20 P 0 0154	150,000			
NC 20 P 0 0184	180,000			
NC 20 P 0 0224	220,000			
NC 20 Q 0 0274	270,000	Q	4300 ± 3%	– 4.7
NC 20 Q 0 0334	330,000			
NC 20 Q 0 0394	390,000			
NC 20 Q 0 0474	470,000			
NC 20 R 0 0564	560,000	R	4400 ± 3%	– 4.8
NC 20 R 0 0684	680,000			
NC 20 R 0 0824	820,000			
NC 20 R 0 0105	1,000,000			

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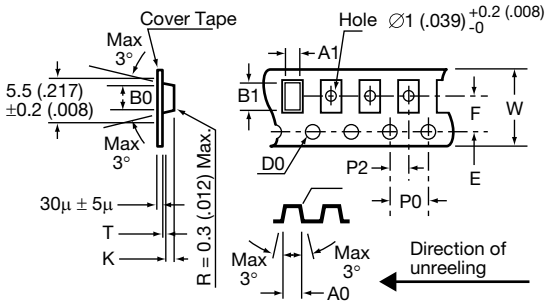
PACKAGING FOR AUTOMATIC INSERTION

NTC Chip Thermistors / NC/NB Series

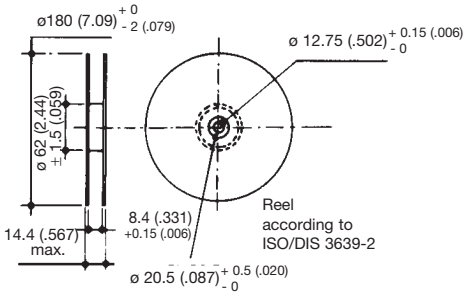
AUTOMATIC INSERTION

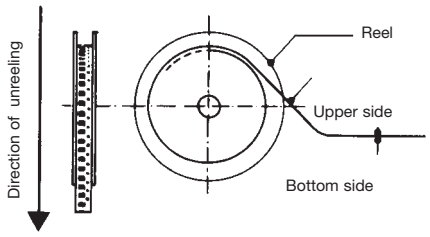
Super 8 Plastic Tape Packaging:

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

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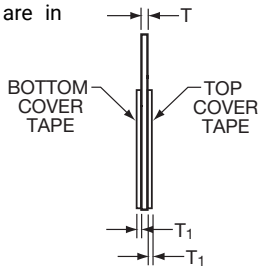
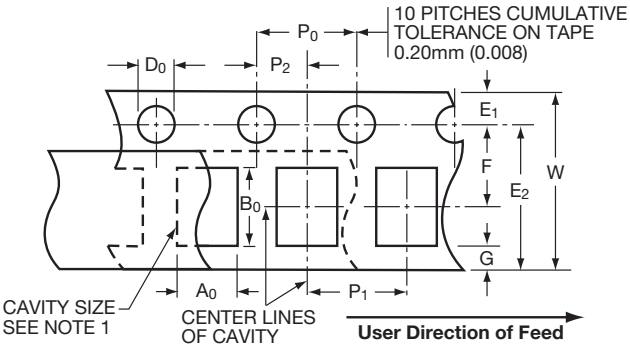
AUTOMATIC INSERTION

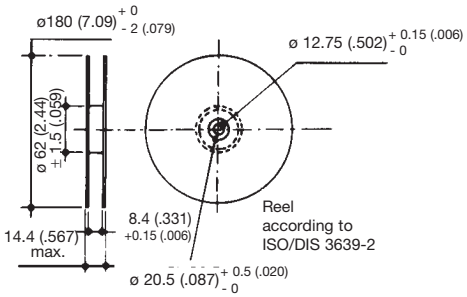
8mm Paper Tape Packaging:

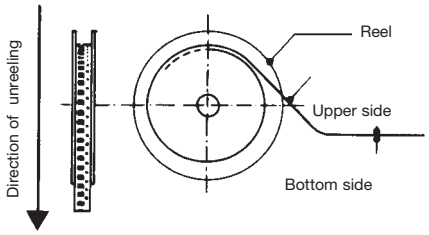
The mechanical and dimensional reel characteristics are in accordance with the IEC publication 286-3.





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/+0.1	±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	0805/0603	P_1	4	±0.1
	0402		2	±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			

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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 ± 5°C for 2 ± 1 seconds.

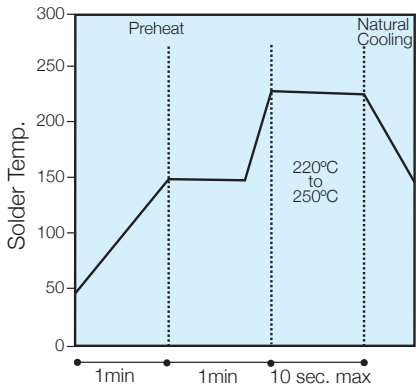
Terminations will resist leaching for at least the immersion times and conditions recommendations shown below.

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

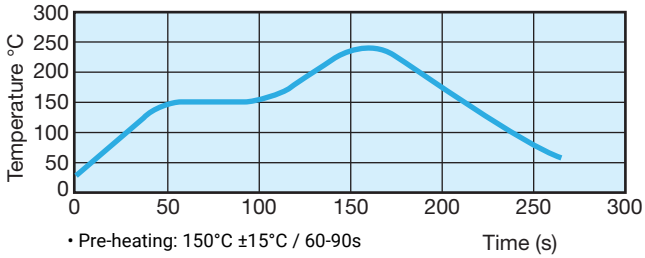
NB products are compatible with a wide range of soldering conditions consistent with good manufacturing practice for surface mount components. This includes Pb free reflow processes with peak temperatures up to 270°C. Recommended profiles for reflow and wave soldering are shown below for reference.

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

Reflow

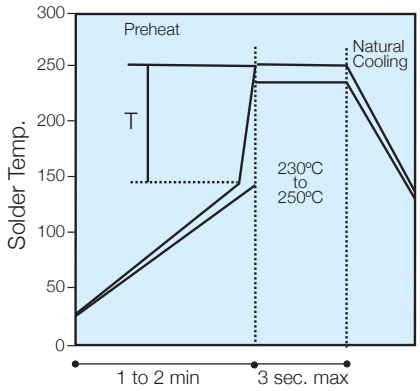


(Minimize soldering time)



- Pre-heating: 150°C ±15°C / 60-90s
- Max. Peak Gradient: 2.5°C/s
- Peak Temperature: 245°C ±5°C
- Time at >230°C: 40s Max.

Wave



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

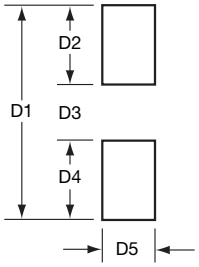
a) The visual standards used for evaluation of solder joints will need to be modified as lead free joints are not as bright as with tin-lead pastes and the fillet may not be as large.

b) Resin color may darken slightly due to the increase in temperature required for the new pastes.

c) 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.

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 (0.31)	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)

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NTC ACCURATE THERMISTORS

NP30 - NJ 28 – NI 24 – NK 20

High precision resistance and an outstanding ability to reproduce the sensibility index B, make these ranges of products the types of thermistors ideal for temperature measurement applications.

Leaded or unleaded, these small size and rapid response time thermistors are able to meet the most accurate requirements.

FEATURES

- High Accuracy
- Fast thermal response
- Commercial, Industrial and Automotive Applications
- AEC-Q200 based qualification

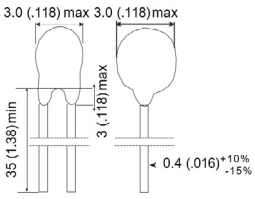
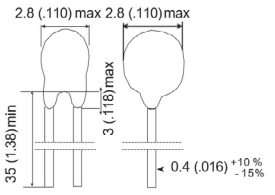
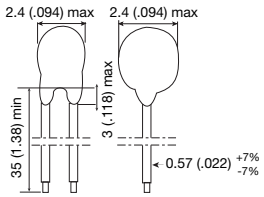
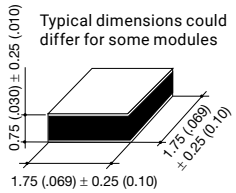
APPLICATIONS

- Temperature measurement
- Liquid level or flow detection
- Alarms and fire detectors
- HVAC and Refrigeration
- Fans
- Air intake temperature
- Electric pump module
- Water Temperature
- Evaporator probe
- and more

OPTIONS

Consult factory for availability of options

- other nominal resistance values
- other tolerances
- controlled dimensions (e.g. reduced head size for NP30)
- alternative lead materials (e.g. steel, nickel)
- customized lead lengths, spacing, forming (kink) etc.
- epoxy coating on leads (NP30)

Types	NP 30	NJ 28	NI 24	NK 20
Finish	Coated chip with epoxy+ tinned copper wires	Coated chip with phenolic resin + varnish + tinned copper wires	Coated chip with epoxy AWG30 insulated leads + Silver plated nickel wires	Chip for Wire bonding
DIMENSIONS: millimeters (inches)				
Marking	On packaging only			
Operating temperature	-55°C to +150°C			
Tolerance on Rn (25°C)	±1%, ±2%, ±3%, ±5%			
Maximum dissipation at 25°C	0.16 W			
Thermal dissipation factor	4 mW/°C	3 mW/°C	1.5 mW/°C	2 mW/°C
Thermal time constant	9 s	8 s	16 s	6 s
Response time	< 2 s			

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HOW TO ORDER

NP30	MA	0502	H	--
Type	**Material Code**	**Resistance**	**Tolerance**	**Packaging**
NP30 NJ28 NI24 NK20	MA (See table above)	5 kΩ (See table above)	F (±1%) G (±2%) H (±3%) J (±5%)	– –: Bulk CA: Ammopack, H=16mm* CB: Tape & Reel, H=16mm* CC: Tape & Reel, H=19mm* CD: Tape & Reel, H=19mm* *Available for NP30 and NJ28 only (See table page 25)

TABLE OF VALUES–NP30–NJ28–NI24–NK20

Part Number	Rn at 25°C (Ω)	Available Rn Tol at 25°C	Material Code	B25/85 (K)	at 25°C (%/°C)
N_ _ _JA0501 - - -	500	F, G, H, J	JA	3564±1%	-3.91
N_ _ _JA0102 - - -	1,000	F, G, H, J	JA	3564±1%	-3.91
N_ _ _JA0202 - - -	2,000	F, G, H, J	JA	3564±1%	-3.91
N_ _ _KA0202 - - -	2,000	F, G, H, J	KA	3625±1%	-4.38
N_ _ _JA0212 - - -	2,100	F, G, H, J	JA	3564±1%	-3.91
N_ _ _MA0222 - - -	2,200	F, G, H, J	MA	3965±0.5%	-4.38
N_ _ _ME0222 - - -	2,200	F, G, H, J	ME	3975±0.5%	-4.40
N_ _ _MA0272 - - -	2,700	F, G, H, J	MA	3965±0.5%	-4.38
N_ _ _ME0272 - - -	2,700	F, G, H, J	ME	3975±0.5%	-4.40
N_ _ _MN0272 - - -	2,700	F, G, H, J	MN	4077±0.5%	-4.47
N_ _ _MA0282 - - -	2,800	F, G, H, J	MA	3965±0.5%	-4.38
N_ _ _ME0282 - - -	2,800	F, G, H, J	ME	3975±0.5%	-4.40
N_ _ _MN0282 - - -	2,800	F, G, H, J	MN	4077±0.5%	-4.47
N_ _ _MA0302 - - -	3,000	F, G, H, J	MA	3965±0.5%	-4.38
N_ _ _ME0302 - - -	3,000	F, G, H, J	ME	3975±0.5%	-4.40
N_ _ _MN0302 - - -	3,000	F, G, H, J	MN	4077±0.5%	-4.47
N_ _ _MA0392 - - -	3,900	F, G, H, J	MA	3965±0.5%	-4.38
N_ _ _MN0392 - - -	3,900	F, G, H, J	ME	3975±0.5%	-4.40
N_ _ _ME0392 - - -	3,900	F, G, H, J	MN	4077±0.5%	-4.47
N_ _ _MA0472 - - -	4,700	F, G, H, J	MA	3965±0.5%	-4.38
N_ _ _ME0472 - - -	4,700	F, G, H, J	ME	3975±0.5%	-4.40
N_ _ _MN0472 - - -	4,700	F, G, H, J	MN	4077±0.5%	-4.47
N_ _ _MA0502 - - -	5,000	F, G, H, J	MA	3965±0.5%	-4.38
N_ _ _ME0502 - - -	5,000	F, G, H, J	ME	3975±0.5%	-4.40
N_ _ _MN0502 - - -	5,000	F, G, H, J	MN	4077±0.5%	-4.47
N_ _ _MA0512 - - -	5,100	F, G, H, J	MA	3965±0.5%	-4.38
N_ _ _ME0512 - - -	5,100	F, G, H, J	ME	3975±0.5%	-4.40
N_ _ _MN0512 - - -	5,100	F, G, H, J	MN	4077±0.5%	-4.47
N_ _ _MA0602 - - -	6,000	F, G, H, J	MA	3965±0.5%	-4.38
N_ _ _ME0602 - - -	6,000	F, G, H, J	ME	3975±0.5%	-4.4
N_ _ _MN0602 - - -	6,000	F, G, H, J	MN	4077±0.5%	-4.47

_ _ _ = Insert Product type (NP30, NJ28, NI24, NK20)

- - - = Insert Tolerance and packaging code

TABLE OF VALUES–NP30–NJ28–NI24–NK20

Part Number	Rn at 25°C (Ω)	Available Rn Tol at 25°C	Material Code	B25/85 (K)	at 25°C (%/°C)
N_ _ _MA0702 - - -	7,000	F, G, H, J	MA	3965±0.5%	-4.38
N_ _ _ME0702 - - -	7,000	F, G, H, J	ME	3975±0.5%	-4.4
N_ _ _MN0702 - - -	7,000	F, G, H, J	MN	4077±0.5%	-4.47
N_ _ _MA0802 - - -	8,000	F, G, H, J	MA	3965±0.5%	-4.38
N_ _ _ME0802 - - -	8,000	F, G, H, J	ME	3975±0.5%	-4.4
N_ _ _MN0802 - - -	8,000	F, G, H, J	MN	4077±0.5%	-4.47
N_ _ _MA0103 - - -	10,000	F, G, H, J	MA	3965±0.5%	-4.38
N_ _ _NA0103 - - -	10,000	F, G, H, J	NA	4100±1%	-4.6
N_ _ _NA0123 - - -	12,000	F, G, H, J	NA	4100±1%	-4.6
N_ _ _NA0153 - - -	15,000	F, G, H, J	NA	4100±1%	-4.6
N_ _ _PA0203 - - -	20,000	F, G, H, J	PA	4235±1%	-4.8
N_ _ _PA0253 - - -	25,000	F, G, H, J	PA	4235±1%	-4.8
N_ _ _PA0303 - - -	30,000	F, G, H, J	PA	4235±1%	-4.8
N_ _ _QA0473 - - -	47,000	F, G, H, J	QA	4250±1%	-4.8
N_ _ _QA0503 - - -	50,000	F, G, H, J	QA	4250±1%	-4.8
N_ _ _RA0104 - - -	100,000	F, G, H, J	RA	4380±1%	-4.9
N_ _ _RA0154 - - -	150,000	F, G, H, J	RA	4380±1%	-4.9
N_ _ _RA0204 - - -	200,000	F, G, H, J	RA	4380±1%	-4.9

_ _ _ = Insert Product type (NP30, NJ28, NI24, NK20)

- - - = Insert Tolerance and packaging code

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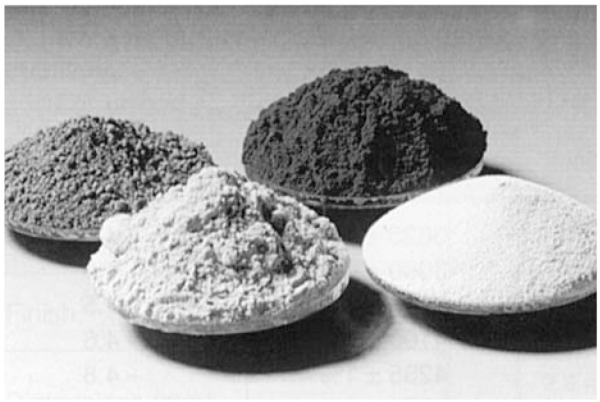
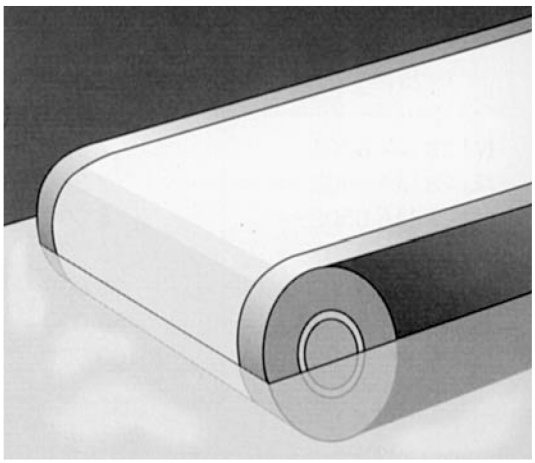
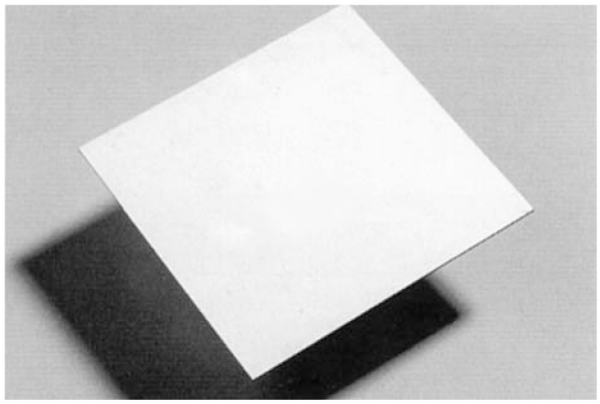
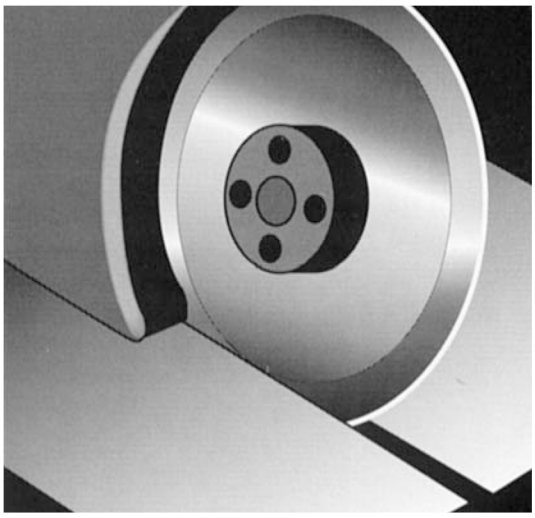
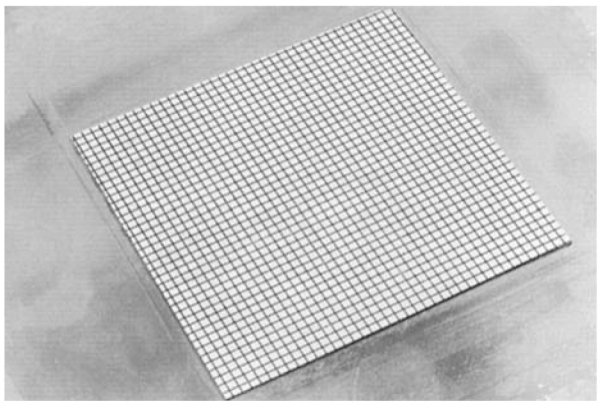
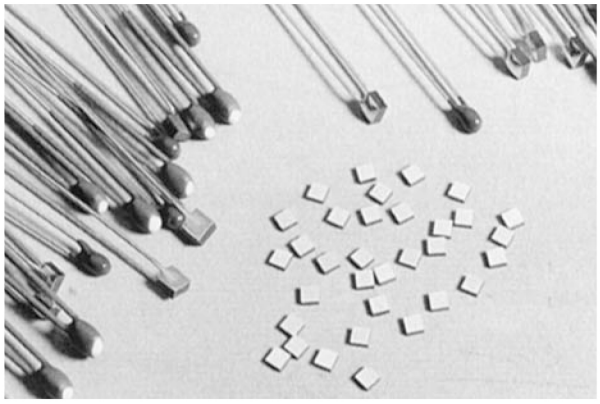


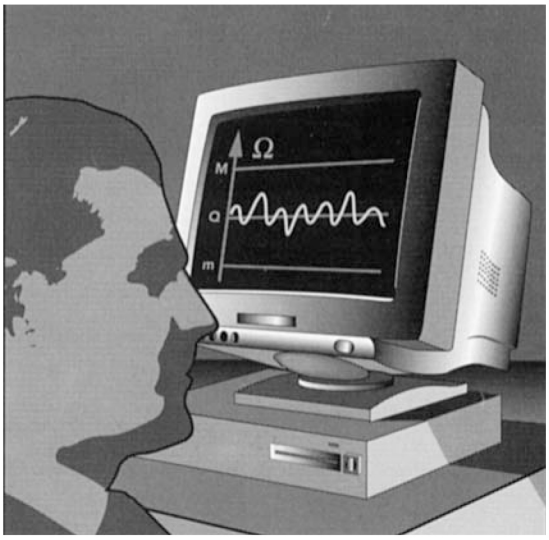






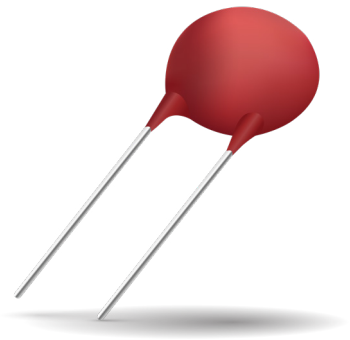





Ω
M
a
m

NTC DISC THERMISTORS

ND 03/06/09 – NE 03/06/09 – NV 06/09



APPLICATIONS

- ND or NE: Commerical, Industrial and Automotive Applications AEC-Q200 based Qual
  NV: Professional Applicationsl
- Alarm and temperature measurement application
- Temperature regulation application
- Level detection application
- Compensation application and more

TECHNOLOGY

- ND: epoxy-phenolic resin coating
  NE: epoxy resin coating (recommended for severe mounting conditions)
  NV: epoxy varnish coating
- Leads: Radial copper wire tinned
- Marking: on package only for ND03 & NE03
  ND/NE 06/09: Nominal resistance and tolerance for ±5%, ±10%
  NV06/09: Nominal resistance and tolerance
- Delivery Mode: Bulk, reeled or ammopacked

PERFORMANCE CHARACTERISTICS

Types	General purpose			Professional	
	ND03 or NE03	ND06 or NE06	ND09 or NE09	NV06	NV09
Climatic category				55/125/56-434	55/125/56-434
Operating Temperature	−55 to +150°C	−55 to +150°C	−55 to +150°C	−55 to +150°C	−55 to +150°C
Tolerance on Rn (25°C)	330Ω to 1MΩ : ± ±3*, 5, 10, 20% 1500Ω to 150 kΩ : ± 3%	±3*, 5, 10, ±20%	±3*, 5, 10, ±20%	±2, 3, 5, ±10%	±2, 3, 5, ±10%
Maximum dissipation at 25°C	0.25 W	0.71 W	0.9 W	0.69 W	0.85 W
Thermal dissipation factor	5 mW/°C	7.1 mW/°C	9 mW/°C	6.9 mW/°C	8.5 mW/°C
Thermal time constant	10 s	22 s	30 s	18 s	30 s
Response time	< 3s				

STANDARDIZATION

NV range : approved by
NFC 93271
Type: TN115 A for NV06
TN116 for NV09
List: GAM-T1
List: LNZ

OPTIONS

Consult factory for availability of options:

- other nominal resistance values
- other tolerances
- alternative lead materials or lengths
- controlled dimensions

* Optional tolerance, please contact factory

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HOW TO ORDER

ND06	P0	0103	K	--
Type	**Material Code**	**Resistance**	**Tolerance**	**Packaging**
ND03 NE03 ND06 NE06 NV06 ND09 NE09 NV09	P (See tables page 23-25)	10 kΩ (See tables page 22-24)	G (±2%) for NV H (±3%)* J (±5%) K (±10%) M (±20%)	– –: Bulk Ammopack (See table page 26) Tape and reel (See table page 26)

* Optional tolerance, please contact factory

TABLE OF VALUES

ND03/NE03 TYPE

Part Number	Rn at 25°C (Ω)	Material Code	B (K) $\left(\frac{B}{B}\ ^{(1)\pm5\%}_{(2)\pm3\%}\right)$	α at 25°C (%/°C)
N_03J00681	680	J	3480 (2)	– 3.9
N_03J00102	1,000			
N_03K00152	1,500	K	3630 (2)	– 4.0
N_03K00222	2,200			
N_03L00272	2,700	L	3790 (2)	– 4.2
N_03L00332	3,300			
N_03M00472	4,700	M	3950 (2)	– 4.4
N_03M00682	6,800			
N_03N00103	10,000	N	4080 (2)	– 4.6
N_03N00153	15,000			
N_03P00223	22,000	P	4220 (2)	– 4.7
N_03P00333	33,000			
N_03Q00473	47,000	Q	4300 (2)	– 4.7
N_03Q00683	68,000			
N_03R00104	100,000	R	4400 (2)	– 4.8
N_03R00154	150,000			
N_03S00224	220,000	S	4520 (2)	– 5.0
N_03T00334	330,000	T	4630 (2)	– 5.1
N_03T00474	470,000			
N_03U00105	1,000,000	U	4840 (2)	– 5.3

ND03/NE03

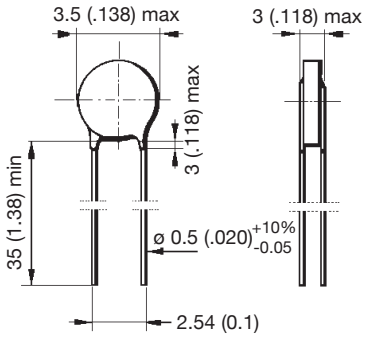


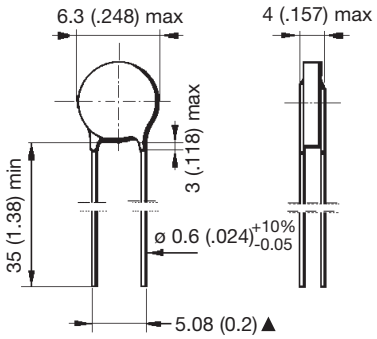
TABLE OF VALUES

ND06/NE06/NV06

Part Number	Rn at 25°C (Ω)	Material Code	B (K) $\left(\frac{B}{B}\ ^{(1)\pm 5\%}_{(2)\pm 3\%}\right)$	α at 25°C (%/°C)
N_06J00151	150	J	3480 (2)	− 3.9
N_06J00221	220			
N_06K00331	330	K	3630 (2)	− 4.0
N_06K00471	470			
N_06L00681	680	L	3790 (2)	− 4.2
N_06L00102	1,000			
N_06M00152	1,500	M	3950 (2)	− 4.4
N_06N00222	2,200	N	4080 (2)	− 4.6
N_06N00332	3,300			
N_06P00472	4,700	P	4220 (2)	− 4.7
N_06P00682	6,800			
N_06P00103	10,000			
N_06Q00153	15,000	Q	4300 (2)	− 4.7
N_06Q00223	22,000			
N_06R00333	33,000	R	4400 (2)	− 4.8
N_06S00473	47,000	S	4520 (2)	− 5.0
N_06S00683	68,000			
N_06T00104	100,000	T	4630 (2)	− 5.1
N_06U00154	150,000	U	4840 (2)	− 5.3
N_06U00224	220,000			
N_06U00334	330,000			

For other resistance values, please consult us.

ND06/NE06



NV06

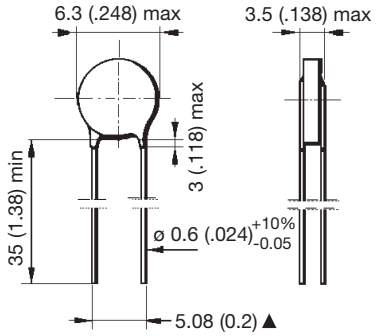


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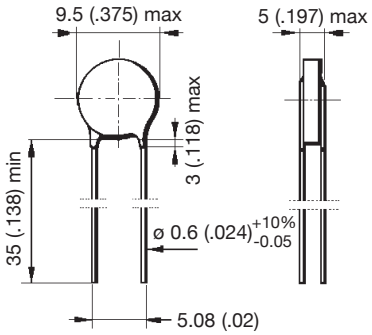
TABLE OF VALUES

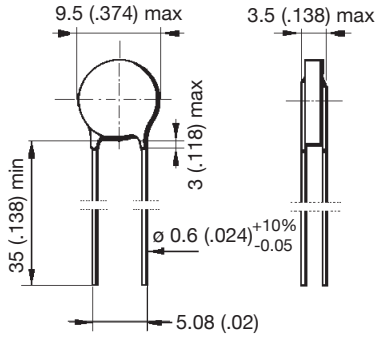
ND09/NE09/NV09

Part Number	Rn at 25°C (Ω)	Material Code	B (K) $\left(B/B \begin{matrix}(1)\pm 5\% \\ (2)\pm 3\%\end{matrix}\right)$	α at 25°C (%/°C)
N_09J00680	68	J	3480 (2)	– 3.9
N_09J00101	100			
N_09K00151	150	K	3630 (2)	– 4.0
N_09K00221	220			
N_09L00331	330	L	3790 (2)	– 4.2
N_09M00471	470	M	3950 (2)	– 4.4
N_09M00681	680			
N_09N00102	1,000	N	4080 (2)	– 4.6
N_09N00152	1,500			
N_09P00222	2,200	P	4220 (2)	– 4.7
N_09P00332	3,300			
N_09Q00472	4,700	Q	4300 (2)	– 4.7
N_09Q00682	6,800			
N_09R00103	10,000	R	4400 (2)	– 4.8
N_09R00153	15,000			
N_09S00223	22,000	S	4520 (2)	– 5.0
N_09T00333	33,000	T	4630 (2)	– 5.1
N_09T00473	47,000			
N_09U00683	68,000	U	4840 (2)	– 5.3
N_09U00104	100,000			
N_09U00154	150,000			

ND09/NE09



NV09



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PACKAGING AND KINK SUFFIXES

Tables below indicate the suffixes to specify when ordering to get the required kink and packaging. For devices on tape, it is necessary to specify the height (H or Ho) which is the distance between the tape axis (sprocket holes axis) and the seating plane on the printed circuit board. The following types can be ordered on tape either in AMMOPACK (fan folder) or on REEL in accordance with IEC 286-2.

– **Straight leads:**

H represents the distance between the sprocket holes axis and the bottom plane of component body (base of resin or base of stand off).

– **Kinked leads and flat leads:**

Ho represents the distance between the sprocket holes axis and the base on the knee (kinked leads) or the bottom of the flat part (flat leads).

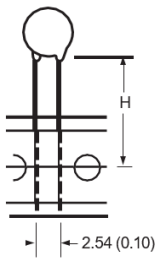
• Reel & Ammopack

millimeters (inches)

Types	Suffix	H or Ho	Leads	Quantity/Size	Packaging
ND/NE 03 & NJ28	CA	16 ± 0.5 (0.630 ± 0.020)	Straight	3000	AMMOPACK
	CB	16 ± 0.5 (0.630 ± 0.020)	Straight	3000	REEL
	CC	19.5 ± 0.5 (0.768 ± 0.020)	Straight	3000	AMMOPACK
	CD	19.5 ± 0.5 (0.768 ± 0.020)	Straight	3000	REEL
NP30	CA	16 ± 0.5 (0.630 ± 0.020)	Straight	2000	AMMOPACK
	CB	16 ± 0.5 (0.630 ± 0.020)	Straight	2000	REEL
	CC	19.5 ± 0.5 (0.768 ± 0.020)	Straight	2000	AMMOPACK
	CD	19.5 ± 0.5 (0.768 ± 0.020)	Straight	2000	REEL
ND/NE/NV 06/09	DA	16 ± 0.5 (0.630 ± 0.020)	Straight	1500	AMMOPACK
	DB	16 ± 0.5 (0.630 ± 0.020)	Straight	1500	REEL
	DC	19.5 ± 0.5 (0.768 ± 0.020)	Straight	1500	AMMOPACK
	DD	19.5 ± 0.5 (0.768 ± 0.020)	Straight	1500	REEL
	DL	16 ± 0.5 (0.630 ± 0.020)	Kinked	1500	AMMOPACK
	DM	16 ± 0.5) (0.630 ± 0.020)	Kinked	1500	REEL
	DN	19.5 ± 0.5 (0.768 ± 0.020)	Kinked	1500	AMMOPACK
	DP	19.5 ± 0.5 (0.768 ± 0.020)	Kinked	1500	REEL

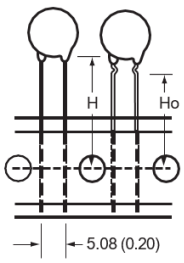
NTC

Type
ND03
NE03
NJ28
NP30



NTC

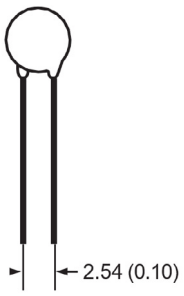
Types
ND/NE/NV
06/09



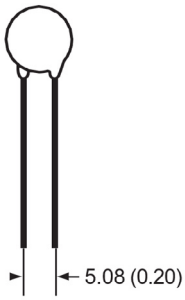
• Bulk

Type	Quantity/box
ND/NE03	3000
ND/NE06	1500
ND/NE09	1500
NV06	100
NV09	100
NI24 NJ28 NK20 NP30	1000

ND03 / NE03
NJ28 / NP30



ND/NE/NV
06/09



RoHS COMPLIANT

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TAPING CHARACTERISTICS

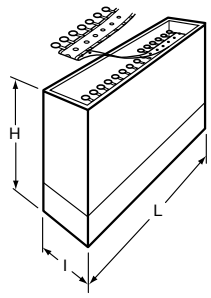
Missing components

A maximum of 3 consecutive components may be missing from the bandolier, surrounded by at least 6 filled positions. The number of missing components may not exceed 0.5% of the total per packing module.

The beginning and the end of tape exhibit 8 or 9 blank positions.

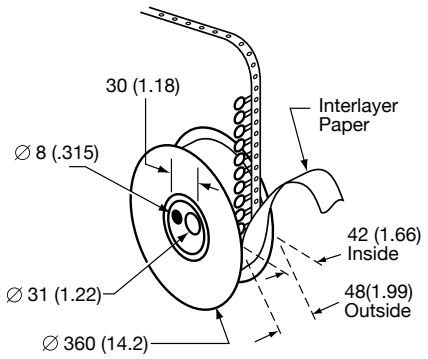
DIMENSIONS: millimeters (inches)

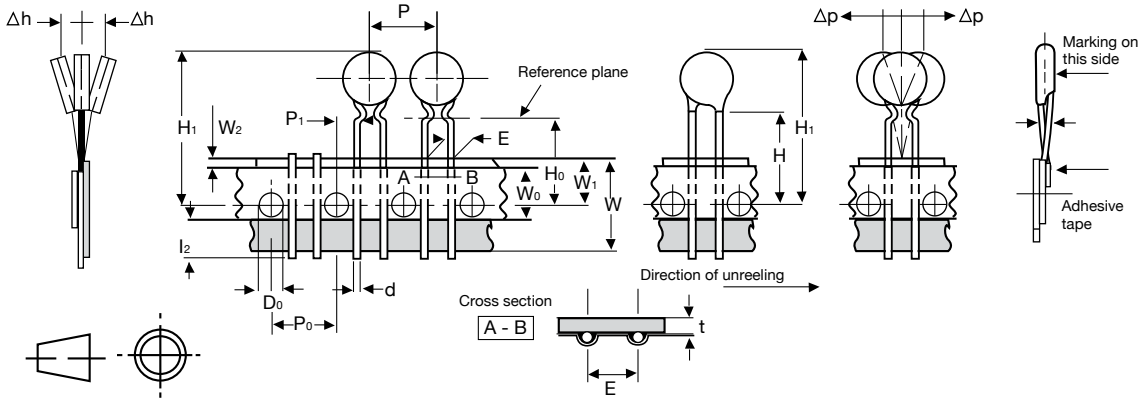
AMMOPACK



L	I	H
330 (13.0)	46 (1.81)	290 (11.4)

REEL



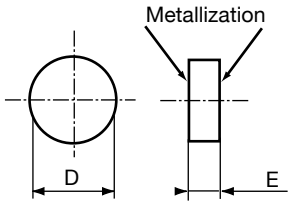


Value	Tolerance	Dimensions Characteristics	
18	+1 / -0.5	W	Leading tape width
6	±0.3	W_0	Adhesive tape width
9	+0.75 / -0.5	W_1	Sprocket hole position
3 max.		W_2	Distance between the top of the tape and the adhesive
4	±0.2	D_0	Diameter of sprocket hole
16/19.5	±0.5	H_0	Distance between the tape axis and the seating plane of the component
		H_1	Distance between the tape axis and the top of component body

Value		Tolerance	Dimensions Characteristics	
12.7		±0.2	P_0	Sprocket holes pitch
254		±1	–	Distance between 21 consecutive holes 20 pitches
0.7		±0.2	t	Total thickness of tape
2.54	5.08	+0.6 -0.1	E	Lead spacing
5.08	3.85	± 0.7	P_1	Distance between the sprocket hole axis and the lead axis
12.7		±1.0	P	Spacing of components
0.5	0.6	±5%	d	Lead diameter
0		±1.3	^{3}P	Verticality of components
0		±2	^{3}h	Alignment of components

NTC LEADLESS DISC THERMISTORS

This type of product is widely used in automotive and consumer applications. They are assembled in custom-probes for sensing the temperature of liquids (water, oil, ...), gases or surface of any other component. The metallization covers completely the surfaces of the thermistor. The particularly flat and smooth surfaces ensure an excellent electrical and thermal contact under pressure.

Types	NR
Physical data (dim. in mm)	
Marking	On package only / On parts upon request
Operating temperature	-40°C to +200°C
Values and tolerances	Custom - designed products defined with: D ± D R_1 ± R_1/R_1 at T_1 E ± E R_2 ± R_2/R_2 at T_2, . . .

DESIGN OF THE THERMISTOR

Choice of the resistances

If the application is to measure the temperature around a defined point, a unique nominal resistance can be chosen (for example, among standard values of the ND range products presented on pages 20 to 24).

When it is required to measure the temperature over selected ranges T_1 –T_2 , T_2 –T_3 , ..., the corresponding resistance R_1 , R_2 , R_3 , ..., must be such that they can be located on the R (T) characteristic of an existing NTC material (for example among standard materials whose R (T) are displayed on pages 29 to 33).

The resistances must also be compatible with the resistivity of the material and the dimensions of the thermistor.

Choice of the tolerances

The precision of the temperature measurement determines the calculation of the tolerance on the resistance:

$\Delta R/R = \alpha$ (%/°C). ΔT (°C)

For example, the NTC NR55--3049-99, using “N5” material (R (T) characteristic displayed on page 31), requires a precision of 1°C over the temperature range 110°C - 120°C.

The tolerances can be calculated:

$\Delta R_{110°C} / R_{110°C}$ = 1°C* 2.91%/°C = 2.91%

$\Delta R_{120°C} / R_{120°C}$ = 1°C* 2.76%/°C = 2.76%

*For your specific requirements, please consult us.

HOW TO ORDER

NR55 - - 3002 - 99

Type **P/N Code**

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NTC LEADLESS DISC THERMISTORS

We present below some examples of our custom - designed products as an illustration of the different ways to define products.

DIMENSIONS: millimeters (inches)

Types	D	E	Material Code	B (k)	$R_1 \pm \Delta R_1$ at T_1	T_1 (°C)	$R_2 \pm \Delta R_2$ at T_2	T_2 (°C)	$R_3 \pm \Delta R_3$ at T_3	T_3 (°C)
NR 55 -- 3002 - 99	5.5 (.217) ± 0.5 (.020)	1.1 (.043) ± 0.4 (.016)	N5	4160	1230 Ω ± 7.5%	40	160 Ω ± 5%	96.5	-	-
NR 67 -- 3068 - 99	6.7 (.264) ± 0.5 (.020)	1.7 (.067) ± 0.3 (.012)	N	4080	150 Ω ± 3.3%	100	51 Ω ± 5.3%	140	-	-
NR 55 -- 3049 - 99	5.5 (.217) ± 0.5 (.020)	1.0 (.040) ± 0.2 (.008)	N5	4160	107 Ω ± 2.9%	110	80.6 Ω ± 2.8%	120	-	-
NR 55 -- 3046 - 99	5.5 (.217) ± 0.5 (.020)	1.3 (.051) ± 0.4 (.016)	S	4520	48600 Ω± 7.5%	25	3210 Ω ± 5%	90	-	-
NR 49 -- 3119 - 99	4.9 (.193) ± 0.3 (.012)	1.5 (.060) ± 0.4 (.016)	M	3950	840 Ω ± 10%	37.8	84 Ω ± 5%	104.4	-	-
NR 55 -- 3114 - 99	5.5 (.217) ± 0.4 (.016)	1.0 (.040) ± 0.2 (.008)	P	4220	5000 Ω ± 10%	25	-	-	-	-
NR 70 -- 3121 - 99	7.0 (.275) ± 0.3 (.012)	1.2 (.047) ± 0.2 (.008)	L	3790	210 Ω ± 10%	40	40 Ω ± 7.5%	90	30 Ω ± 6.7%	100
NR 29 -- 3107 - 99	2.9 (.014) ± 0.3 (.012)	1.7 (.067) ± 0.3 (.012)	K	3630	2050 Ω ± 6%	25	193 Ω ± 5.4%	96.5	-	-
NR 55 -- 3122 - 99	5.5 (.217) ± 0.5 (.020)	1.5 (.060) ± 0.4 (.016)	J	3480	210 Ω ± 5%	25	-	-	-	-
NR 55 -- 3126 - 99	5.5 (.217) ± 0.5 (.020)	1.0 (.040) ± 0.2 (.008)	P	4220	3340 Ω ± 10%	25	264 Ω ± 7%	90	107 Ω ± 7%	120
NR 47 -- 3116 - 99	4.7 (.185) ± 0.4 (.016)	1.2 (.047) ± 0.2 (.008)	R	4400	33000 Ω ± 2%	25	-	-	-	-
NR 49 -- 3113 - 99	4.9 (.193) ± 0.3 (.012)	1.2 (.047) ± 0.2 (.008)	N	4080	1680 Ω ± 10%	40	382 Ω ± 6.7%	80	176 Ω ± 5%	105
NR 47 -- 3101 - 99	4.6 (.181) ± 0.3 (.012)	1.4 (.055) ± 0.3 (.012)	J	3480	146 Ω ± 13%	40	22 Ω ± 10%	100	-	-
NR 55 -- 3071 - 99	5.8 (.228) ± 0.3 (.012)	1.0 (.040) ± 0.2 (.008)	L	3790	262 Ω ± 8.7%	40	120 Ω ± 10%	60	35.5 Ω ± 7.8%	100
NR 61 -- 3063 - 99	6.1 (.240) ± 0.3 (.012)	1.5 (.060) ± 0.3 (.012)	N	4080	760 Ω ± 9.2%	50	130 Ω ± 8.5%	100	56.6 Ω ± 8.5%	130
NR 67 -- 3053 - 99	6.7 (.264) ± 0.4 (.016)	1.7 (.067) ± 0.3 (.012)	N	4080	540 Ω ± 11%	60	144 Ω ± 7%	100	-	-
NR 50 -- 3048 - 99	5.0 (.197) ± 0.5 (.020)	1.5 (.060) ± 0.5 (.020)	J	3480	233 Ω ± 10%	25	13.3 Ω ± 7%	121	-	-
NR 60 -- 3021 - 99	6.0 (.236) ± 0.5 (.020)	3.2 (.125) ± 0.3 (.012)	P	4220	3640 Ω ± 3%	40	457 Ω ± 3%	96.5	-	-
NR 55 -- 3016 - 99	5.5 (.217) ± 0.5 (.020)	1.1 (.043) ± 0.4 (.016)	Q	4300	5500 Ω ± 9%	40	650 Ω ± 7.7%	96.5	-	-

Resistance - Temperature characteristics: pages 29 to 33.

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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)
1.4 pt	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

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TABLES OF RESISTANCE VS TEMPERATURE

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) L0 3790		
	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

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TABLES OF RESISTANCE VS TEMPERATURE

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 3995		
	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	103.6	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	7.591	1.06	-5.68
-10	5.730	0.91	-5.51
-5	4.362	0.77	-5.34
0	3.349	0.63	-5.18
5	2.592	0.49	-5.03
10	2.021	0.36	-4.88
15	1.587	0.24	-4.74
20	1.256	0.12	-4.60
25	1.0000	0.00	-4.47
30	0.8016	0.11	-4.35
35	0.6465	0.22	-4.23
40	0.5246	0.33	-4.11
45	0.4281	0.43	-4.00
50	0.3514	0.53	-3.89
55	0.2899	0.63	-3.79
60	0.2404	0.72	-3.69
65	0.2004	0.81	-3.59
70	0.1678	0.90	-3.50
75	0.1411	0.99	-3.41
80	0.1193	1.07	-3.32
85	0.1012	1.15	-3.24
90	0.08624	1.23	-3.16
95	0.07378	1.31	-3.08
100	0.06336	1.38	-3.00
105	0.05462	1.46	-2.93
110	0.04725	1.53	-2.86
115	0.04101	1.60	-2.79
120	0.03572	1.67	-2.73
125	0.03122	1.73	-2.66
130	0.02736	1.80	-2.60
135	0.02406	1.86	-2.54
140	0.02121	1.92	-2.49
145	0.01876	1.98	-2.43
150	0.01663	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

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TABLES OF RESISTANCE VS TEMPERATURE

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	0.8	-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

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TABLES OF RESISTANCE VS TEMPERATURE

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

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TABLES OF RESISTANCE VS TEMPERATURE

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

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NC20N00563KBA NC20K00103JBA NC20KC0470KBA NC12MC0332KBA NC20KC0560KBA NC12MC0221JBA NC12N00563KBA NC12MC0561KBA NC12MC0181KBA NC20Q00474JBA NC12KC0560JBA NC20MC0561JBA NC20MC0331JBA NC12MC0471JBA NC20KC0100KBA NC12KC0470JBA NC12P00104JBB NC12L00153KBB NC12MC0151KBA NC12KC0390JBA NC12MC0102JBA NC12P00154JBB NC12M00223KBA NC12N00683KBB NC20MC0391JBA NC20N00823KBA NC12MC0152KBA NC20MC0121JBA NC12K00103KBB NC12K00103MBB NC12L00153MBB NC12M00223K-- NC12P00104J-- NC12P00104KBB NC20I00222JBE NC20I00332JBE NC20KC0180MBA NC20L00223K-- NC20M00473MBA NC20MC0102JBE NC20MC0102KBA NC20Q00474KBA NC20K00103KBA NC20J00472JBA NC20P00224KBA NC20N00104KBA NC20MC0681KBA NC12MC0271JBA NC20MC0271JBA NC20KC0220JBA NC12KC0101JBA NC12MC0331KBA NC20R00105JBA NC20MC0221KBA NC12K00103JBB NC12MC0121JBA NC20KC0101KBA NC12MC0272JBA NC12Q00224JBA NC12KC0820JBA NC20L00223KBA NC20J00682JBA NC12MC0222KBA NC20MC0181JBA NC12N00473KBA NC12KC0680JBA NC12KC0220JBA NC20J00472KBA NC20MC0152JBA NC20M00333KBA NC20I00332KBA NC20MC0102JBA NC20KC0390MBA NC20M00273KBA NC20M00333JBA NC20P00224JBA NC20R00684KBA NC20R00105KBA NC12N00473KBB NC12MC0471JBB NC12MC0222KBB NC20N00563KBB NC12MC0271JBB NC12KC0820JBB NC20N00104KBB NC12MC0221JBB NC20N00823KBB NC20J00682JBB NC12MC0121JBB NC20MC0221KBB NC20MC0121JBB NC20R00105JBB NC20MC0271JBB NC12Q00224JBB NC20MC0681KBB NC20K00103KBB NC12MC0151KBB NC20MC0331JBB NC20MC0561JBB NC20KC0101KBB