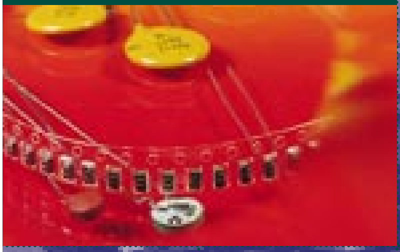
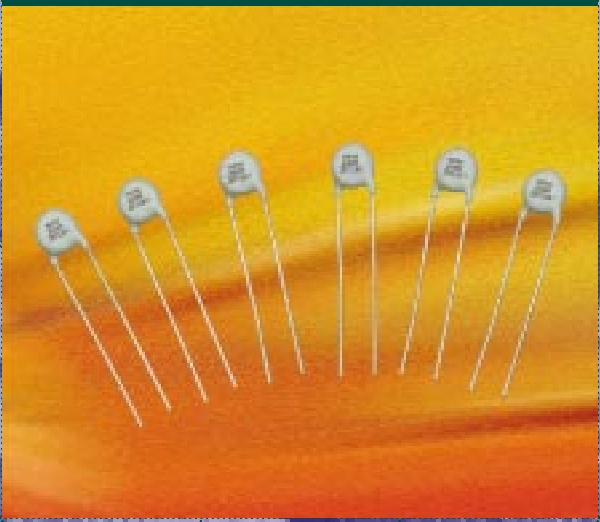
NTC Thermistors
Inrush current limiters





THOMSON-CSF
PASSIVE COMPONENTS

Contents

As we are anxious that our customers should benefit from the latest developments in the technology and standards.
TPC reserves the right to modify the characteristics published in this brochure.

THOMSON-CSF
PASSIVE COMPONENTS

NTC general characteristics

1 – INTRODUCTION

NTC thermistors are thermally sensitive resistors made from a mixture of Mn, Ni, Co, Cu, Fe oxides.
Sintered ceramic bodies of various sizes can be obtained. Strict conditions of mixing, pressing, sintering and metallization ensure an excellent reproductibility of the product characteristics.

This semi-conducting material reacts as a NTC resistor, whose resistance decreases with increasing temperature. This Negative Temperature Coefficient effect can result from an external change of the ambient temperature or an internal heating due to Joule effect of a current flowing through the thermistor.

By varying the composition and the size of the thermistors, a wide range of resistance values and temperature coefficients can be achieved.

2 – MAIN CHARACTERISTICS

2.1 CHARACTERISTICS WITH NO DISSIPATION

2.1.1. R(T) Characteristic

It has to be measured at near zero power dissipation so that the resultant heating of the NTC only produces a negligible measurement error.

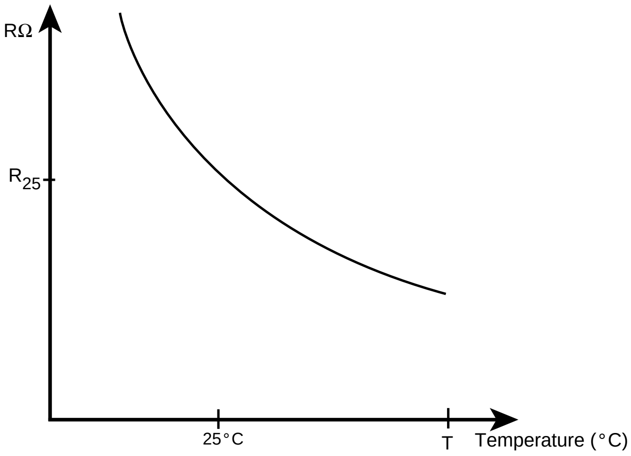


Figure 1 - R (T) curve

2.1.2. Nominal Resistance (Rn)

The nominal resistance of a NTC thermistor is given at 25°C.

2.2 CHARACTERISTICS WITH ENERGY DISSIPATION

When a current is flowing through a NTC thermistor, the power due to the Joule effect raises the temperature of the NTC above ambient.
The thermistor reaches a state of equilibrium when the power supplied becomes equal to the power dissipated in the environment.
The thermal behaviour of the thermistor is mainly dependant on the size, shape and mounting conditions.

Several parameters have been defined to characterize these properties :

2.2.1. Heat capacity (H)

The heat capacity is the amount of heat required to change the temperature of the thermistor by 1°C and is expressed in J/°C.

2.2.2. Dissipation factor (δ)

This is the ratio between the variation in dissipated power and the variation of temperature of the NTC.
It is expressed in mW/°C and may be measured as :

$$\delta = \frac{U.I}{85 - 25}$$

where U.I is the power necessary to raise to 85°C the temperature of a thermistor maintained in still air at 25°C.

2.2.3. Maximum permissible temperature

This is the maximum ambient temperature at which the thermistor may be operated with zero dissipation. Above this temperature, the stability of the resistance and the leads attachment can no longer be guaranteed.

The physical limit for NF thermistors is 215°C but a permanent use above 160°C ambient temperature is not recommended in order to preserve the reliability of the product (see page 8).

2.2.4. Maximum permissible power at 25°C

This is the power required by a thermistor maintained in still air at 25°C to reach the maximum temperature for which it is specified.
For higher ambient temperatures, the maximum permissible power is derated (see page 8).

NTC general characteristics

2.2.5. Voltage – Current curves V (I)

These curves describe the behaviour of the voltage drop V measured across the NTC as the current I through the NTC is increased.

They describe the state of equilibrium between power resulting from Joule effect and dissipated power in the surroundings.

They are displayed on pages 9 to 13 for different models of thermistors and illustrated on figure 2.

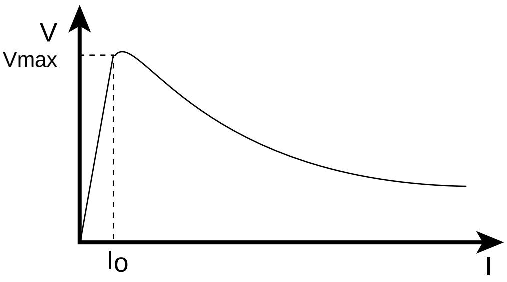


Figure 2 – Voltage – current curve V (I)

Several zones can be identified :

- low current zone
  dissipated energy only produces negligible heating and the curve V (I) is almost linear.

- non-linear zone
  the curve V (I) displays a maximum voltage Vmax for a current Io.

- high current zone
  for higher currents, an increase of the temperature of the NTC decreases the resistance and the voltage more rapidly than the increase of the current. Above a certain dissipated power, the temperature of the NTC exceeds the permissible value.

2.2.6. Thermal time constant

When a thermistor is self–heated to a temperature T above ambient temperature Tamb, and allowed to cool under zero power resistance, this will show a transient situation.

At any time interval dt, dissipation of the thermistor (δ(T – Tamb)dt) generates a temperature decrease –HdT, resulting in the equation

$$\frac{1}{(T - T_{amb})} dT = - \frac{\delta}{H} dt$$

The solution to this equation for any value of t, measured from t = 0, is :

$$\ln \frac{(T - T_{amb})}{(To - T_{amb})} = - \frac{\delta}{H} t$$

We can define a thermal time constant τ as :

$\tau = H/\delta$ expressed in seconds.

Where the time t = τ :

$$(T - T_{amb}) / (To - T_{amb}) = \exp - 1 = 0.368$$

expressing that for t = τ, the thermistor cools to 63,2% of the temperature difference between the initial To and T_{amb} (see figure 3).

According to IEC 539 our technical data indicate τ measured with To = 85°C, T_{amb} = 25°C and consequently T = 47.1°C.

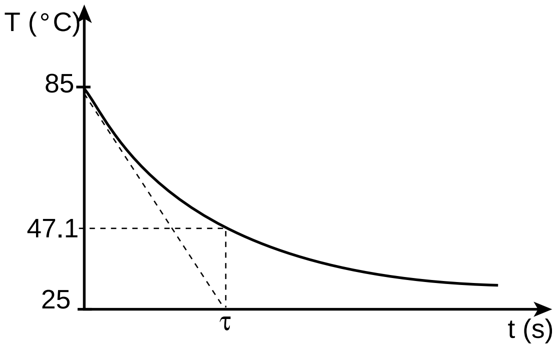


Figure 3 – Temperature–time curve T(t)

NTC as inrush current limiter

1 – APPLICATIONS

NF Thermistors are particularly well suited to suppress surge current generated at switch - on for :

- power supplies
- lighting systems
- soft start motors
- other power circuits

2 – TYPICAL CIRCUIT USED IN SWITCHING POWER SUPPLIES

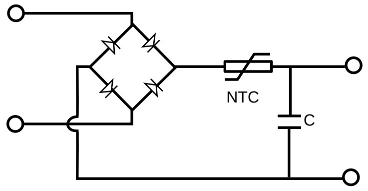


Figure 4

3 – NTC THERMISTORS AS INRUSH-CURRENT LIMITERS

In the above circuit, at power - on, the high resistance of the thermistor at 25°C limits the current to a I_O value as shown in figure 5.
This current heats up the thermistor resulting in a reduction of its resistance according to the R–T characteristic. So, after a maximum value Imax, the current decreases while the capacitor C is charging and finally reaches a steady - state value Iss.

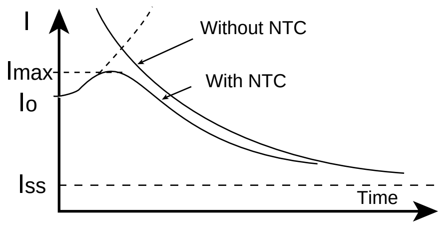


Figure 5

If a NTC thermistor is not used to limit the current at switching on, diodes bridge or fuses may be affected by excessive current surge.

4 – STEADY - STATE CURRENT (Iss)

The Iss value of the current is not linked to the capacitance value of the input filtering capacitor but to the current needed by the power supply at that time.

In continous operation, there is a thermal balance between the power generated by the Joule effect and the power thermally dissipated in the environment :

$$R_T I_{SS}^2 = \delta (T - T_{amb}) \text{ and thus } I_{SS} = \sqrt{\delta (T - T_A) / R_T}$$

Each NF thermistor is specified with a maximum Iss current - Iss max - that must be respected to prevent overheating of the component.

Once the capacitor is charged (few ms), the Iss current induces a decrease of the NTC resistance and therefore minimizes the losses of the power supply (figure 6).

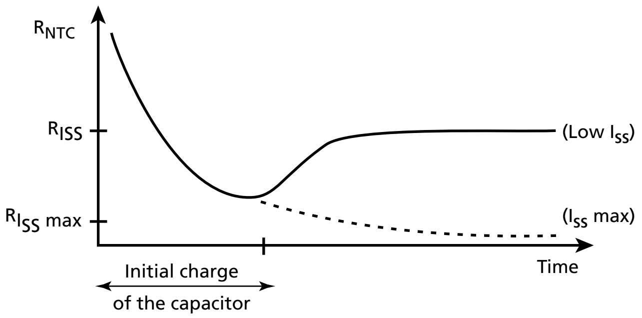


Figure 6

5 – ENVIRONMENT CONDITIONS

The performances of the NTC can be enhanced by improving the thermal dissipation (lower ambient temperature, air flows, appropriate mounting assuming good heat sinking by the leads).

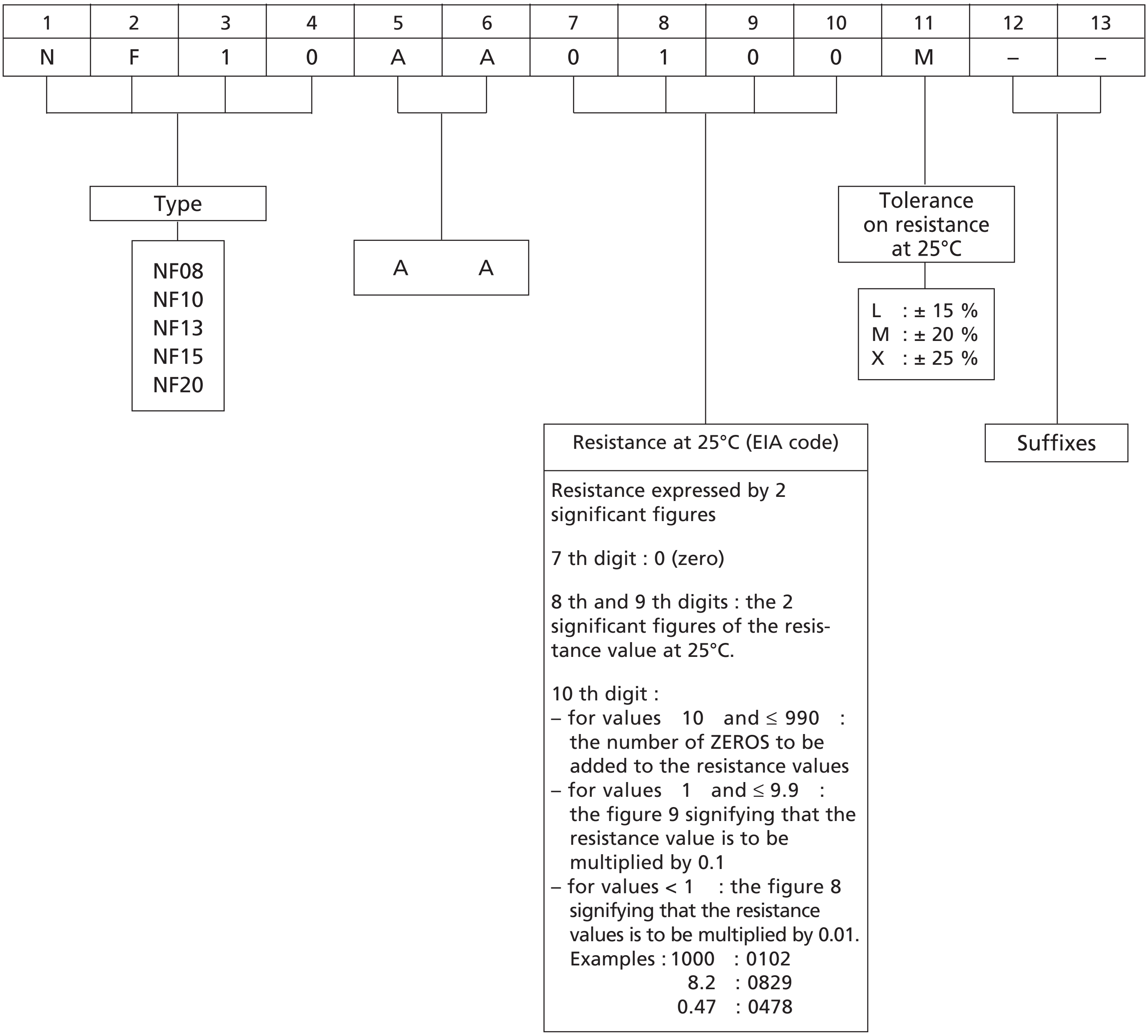
After operation, the NTC needs a certain amount of time to cool down and recover its protective function.

6 – SPECIAL RECOMMENDATIONS

- Do not touch the body of the thermistor by hand when working under high currents for preventing burns.
- Do not insert the thermistor on the PCB close to other components that may not withstand exposure to high temperature.
- Do not connect in parallel when more than one thermistor is used since one unit will tend to conduct almost all the current available.

How to order

Example : 10 ± 20 % with disc ø = 10 mm, bulk packing



1	2	3	4	5	6	7	8	9	10	11	12	13
N	F	1	0	A	A	0	1	0	0	M	–	–

Resistance expressed by 2 significant figures

7 th digit : 0 (zero)

8 th and 9 th digits : the 2 significant figures of the resistance value at 25°C.

10 th digit :
- for values 10 and ≤ 990 : the number of ZEROS to be added to the resistance values
- for values 1 and ≤ 9.9 : the figure 9 signifying that the resistance value is to be multiplied by 0.1
- for values < 1 : the figure 8 signifying that the resistance values is to be multiplied by 0.01.

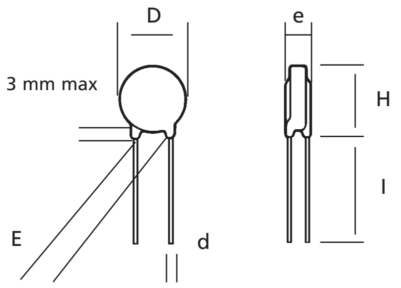
Examples : 1000 : 0102
8.2 : 0829
0.47 : 0478

SUFFIXES FOR BULK PACKING (Suffixes for taping : see page 15)

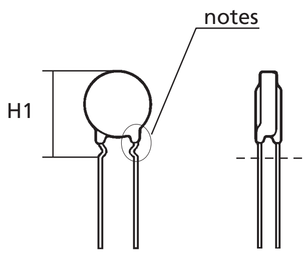
- -	straight leads 0.8 or 1 mm wire diameter and 7.62 lead spacing
HB	straight leads 0.6 mm wire diameter and 5.08 lead spacing
HL	internal kink 0.8 mm or 1 mm wire diameter and 7.62 lead spacing
1N	internal kink 0.6 mm wire diameter and 5.08 lead spacing
HY	Y kink 0.8 or 1 mm wire diameter and 7.62 lead spacing
2B	Y kink 0.6 mm wire diameter and 5.08 lead spacing

Inrush current limiters NF08 / 10 / 13 / 15 / 20

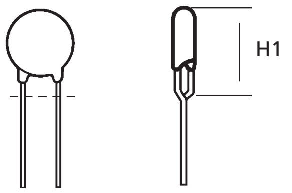
OUTLINE DRAWINGS



Straight leads (suffix - - or HB)



Internal kink (suffix HL or 1N)



Y kink (suffix HY or 2B)

Notes : In case of adding strength to the lead wire from the side, it may occur crack and fragment at a part of pant leg.

DIMENSIONS

Type	D max mm	e max mm	H max mm	H1 max mm	I min mm	d ± 0.02 mm	E ± 0.8 mm
NF08*	9.5	5.0	13.0	16.0	30	0.6	5.08
NF08	9.5	5.0	13.0	16.0	30	0.8	7.62
NF10*	11.5	5.0	15.0	18.0	30	0.6	5.08
NF10	11.5	5.0	15.0	18.0	30	0.8	7.62
NF13	15.0	6.0	18.0	22.0	30	0.8	7.62
NF15	17.0	6.0	20.0	24.0	30	1.0	7.62
NF20	22.0	6.0	25.0	29.0	30	1.0	7.62

GENERAL CHARACTERISTICS

Type	Standard tolerance %	Maximum operating T°C	Max power 25°C Watts	Thermal dissipation δ_{th} (mW/K)	Thermal time constant τ_c (s)	Heat capacity H (mJ/K)	Packing bulk / tape * / *
NF08*	20	- 40 / + 200	1.6	8	60	480	* / *
NF08	20	- 40 / + 200	2.2	11	60	660	* / *
NF10*	20	- 40 / + 200	2.0	10	75	750	* / –
NF10	20	- 40 / + 200	2.6	13	75	975	* / *
NF13	20	- 40 / + 200	3.2	16	100	1600	* / *
NF15	20	- 40 / + 200	4.1	20	115	2300	* / –
NF20	20	- 40 / + 200	5.0	25	160	4000	* / –

* 0.6 mm copper wire and 5.08 mm leads spacing for those two types.

Table of values

cUL	Ceramic Disc ø (mm)	Part number reference T_{ype}	Zero power resistance $R_{25°C}$ ( )	Max steady stade current $I_{ss\ max\ 25°C}$ (A)	Resistance at max current $R_{iss\ max}$ ( )
*	08	NF08AA0509MHB	5.0	2.9	0.20
*		NF08AA0809MHB	8.0	2.3	0.30
*		NF08AA0100MHB	10.0	2.1	0.37
*		NF08AA0150MHB	15.0	1.8	0.50
*		NF08AA0330MHB	33.0	1.3	0.97
*	08	NF08AA0509M - -	5.0	3.4	0.20
*		NF08AA0809M - -	8.0	2.7	0.30
*		NF08AA0100M - -	10.0	2.5	0.37
*		NF08AA0150M - -	15.0	2.1	0.50
*		NF08AA0330M - -	33.0	1.5	0.97
*	10	NF10AA0259MHB	2.5	4.5	0.10
*		NF10AA0409MHB	4.0	3.6	0.16
*		NF10AA0509MHB	5.0	3.3	0.19
*		NF10AA0809MHB	8.0	2.6	0.30
*		NF10AA0100MHB	10.0	2.5	0.34
*		NF10AA0160MHB	16.0	2.0	0.50
*		NF10AA0200MHB	20.0	1.9	0.59
*		NF10AA0250MHB	25.0	1.7	0.69
*		NF10AA0500MHB	50.0	1.4	1.07
*		NF10AA0800MHB	80.0	1.1	1.60
*		NF10AA0121MHB	120.0	1.0	1.90
*	10	NF10AA0259M - -	2.5	5.2	0.10
*		NF10AA0409M - -	4.0	4.1	0.16
*		NF10AA0509M - -	5.0	3.8	0.19
*		NF10AA0809M - -	8.0	3.0	0.30
*		NF10AA0100M - -	10.0	2.8	0.34
*		NF10AA0160M - -	16.0	2.3	0.50
*		NF10AA0200M - -	20.0	2.1	0.59
*		NF10AA0250M - -	25.0	2.0	0.69
*		NF10AA0500M - -	50.0	1.6	1.07
*		NF10AA0800M - -	80.0	1.3	1.60
*		NF10AA0121M - -	120.0	1.2	1.90
*	13	NF13AA0259M - -	2.5	5.7	0.10
*		NF13AA0509M - -	5.0	4.2	0.19
*		NF13AA0709M - -	7.0	3.7	0.24
*		NF13AA0809M - -	8.0	3.6	0.25
*		NF13AA0100M - -	10.0	3.3	0.30
*		NF13AA0150M - -	15.0	2.8	0.41
*		NF13AA0220M - -	22.0	2.3	0.61
*		NF13AA0330M - -	33.0	2.2	0.70
*		NF13AA0400M - -	40.0	2.0	0.80
*		NF13AA0600M - -	60.0	1.9	0.95
*	15	NF15AA0139M - -	1.3	8.9	0.05
*		NF15AA0159M - -	1.5	8.3	0.06
*		NF15AA0259M - -	2.5	6.6	0.09
*		NF15AA0309M - -	3.0	6.1	0.11
*		NF15AA0409M - -	4.0	5.5	0.13
*		NF15AA0509M - -	5.0	4.9	0.17
*		NF15AA0609M - -	6.0	4.7	0.19
*		NF15AA0709M - -	7.0	4.3	0.22
*		NF15AA0809M - -	8.0	4.2	0.24
*		NF15AA0100M - -	10.0	3.7	0.30
*		NF15AA0120M - -	12.0	3.5	0.33
*		NF15AA0160M - -	16.0	3.0	0.44
*		NF15AA0200M - -	20.0	3.1	0.43
*		NF15AA0250M - -	25.0	2.8	0.53
*		NF15AA0330M - -	33.0	2.5	0.66
*		NF15AA0400M - -	40.0	2.3	0.80
*		NF15AA0470M - -	47.0	2.3	0.74
*	20	NF20AA0109M - -	1.0	11.4	0.04
*		NF20AA0259M - -	2.5	7.8	0.08
*		NF20AA0409M - -	4.0	6.4	0.13
*		NF20AA0509M - -	5.0	5.9	0.15
*		NF20AA0100M - -	10.0	4.3	0.28
*		NF20AA0150M - -	15.0	4.0	0.32
*		NF20AA0330M - -	33.0	3.1	0.52

* cUL listing pending approval : file number 96SC16045 (tested by UL laboratories according to CSA standard)

. Electrical performances for suffixes HL and HY are identical to the suffix - -

. Electrical performances for suffixes 1N and 2B are identical to the suffix HB

Application guide

1 - How to determine the maximum steady state current of NF thermistors ?

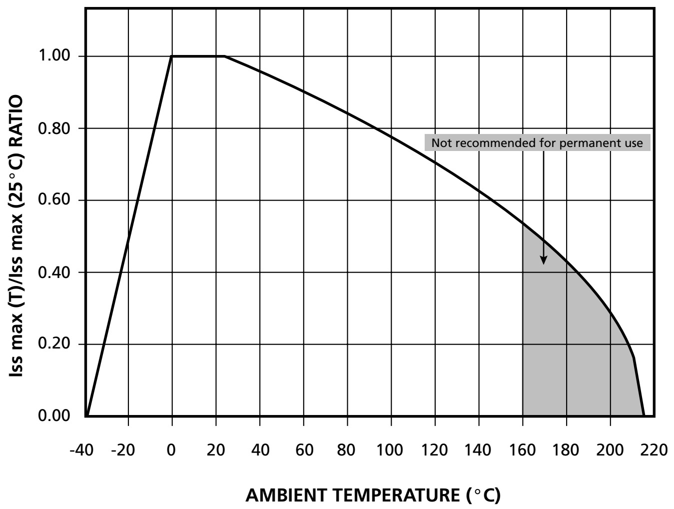
- If the ambient temperature is 25°C :
  the current is given in table page 7

- If the ambient temperature is different from 25°C :
  the current at 25°C must be derated as specified in the graph below.

Example : maximum steady state current of NF13AA0100M at 60°C ambient :

Iss_{max25} x 0.9 = 3.0 A.

Derating of maximum steady state current with ambient temperature



2 - How to calculate the working temperature of NF thermistor ?

Example : NF08AA0330M
I_{ss} = 0.2 A, $T_{ambient}$ = 25°C

- From the graph V (I) page 9, we find V_{ss} = 2.2 V therefore, R_{ss} = 11

- From the graph R(T) page 9, at R = 11 , we find T $\simeq$ 65°C

3 - How to calculate the working point of NF thermistor at a different ambient temperature than 25°C ?

Example : NF13AA0100M
I_{ss} = 3 A, $T_{ambient} = T_A$ = 60°C

- From § 4, page 4, we have $R_T I_{ss}^2 = \delta\ (T - T_A)$ and thus

$$T = \frac{R_T I_{ss}^2}{\delta} + T_A$$

- As R_T depends on T, this equation is quite complex to be solved by an algebraic way. The quickest manner to solve it is to operate by iterations :

  for NF13, δ = 16 mW/K (see page 6)

  therefore, the equation becomes :

  $$T = 562.5\ R_T + 60$$

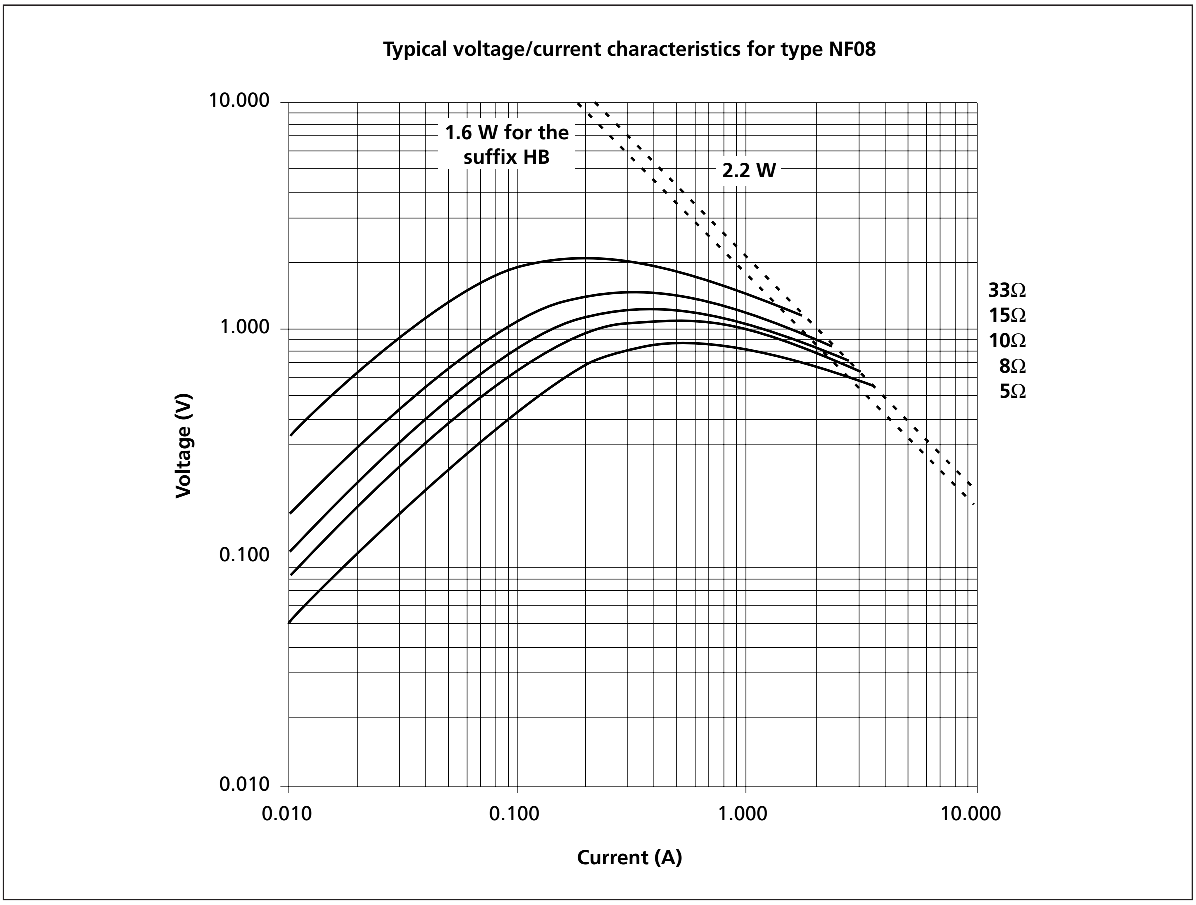
  from the R_T curve page 11 we find R_T starting from T :

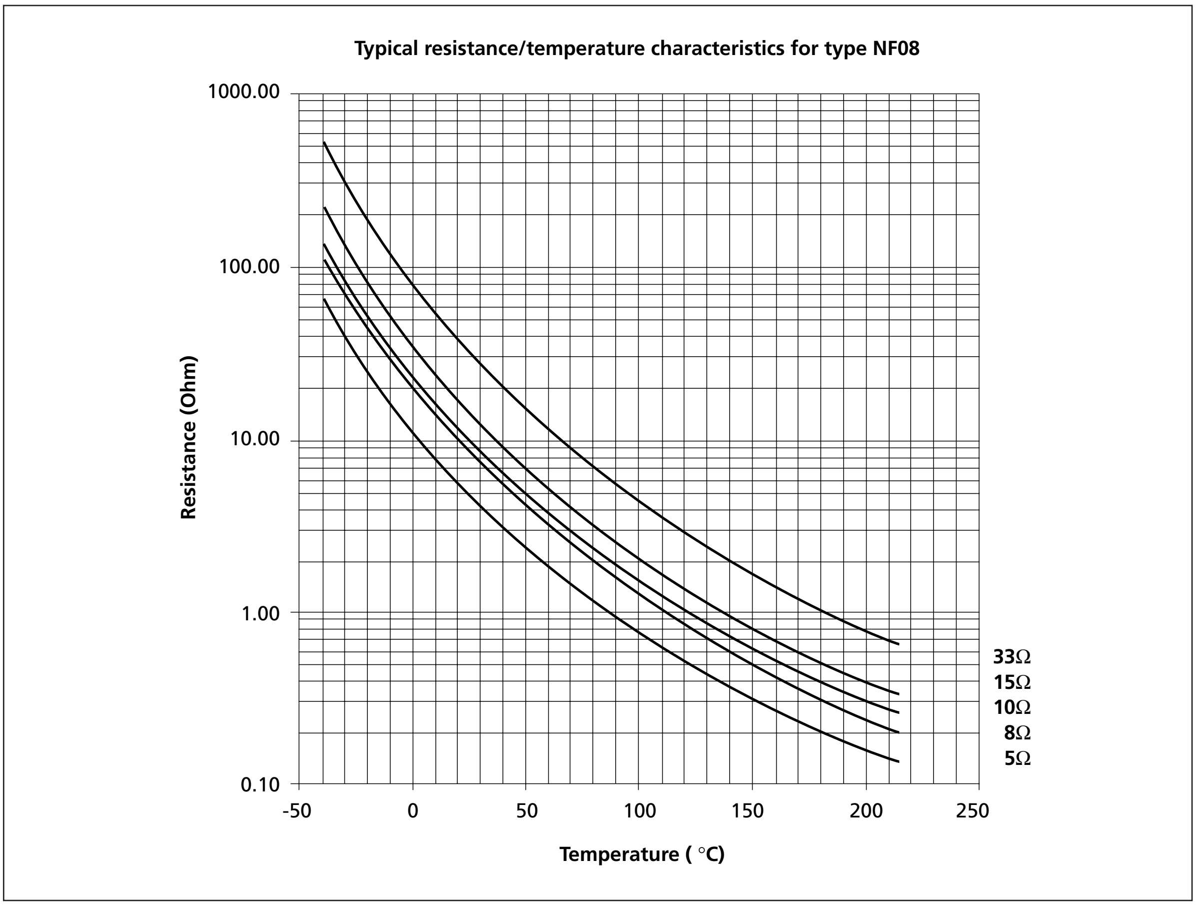
T(°C)	R_T ( )	⇒	$562.5\ R_T + 60$ (°C)
185	0.28		217
190	0.26		206
| 195	0.24		195
200	0.22		184

The working temperature of this NF thermistor is about 195°C when operating under I_{ss} = 3 A and T_A = 60°C (this temperature is the one for which we have $T = 562.5\ R_T + 60$).

Important : A discrepancy may exist between practice and theory due to the tolerance of the thermistor (± 20 % usually).

Voltage-current and resistance-temperature characteris-





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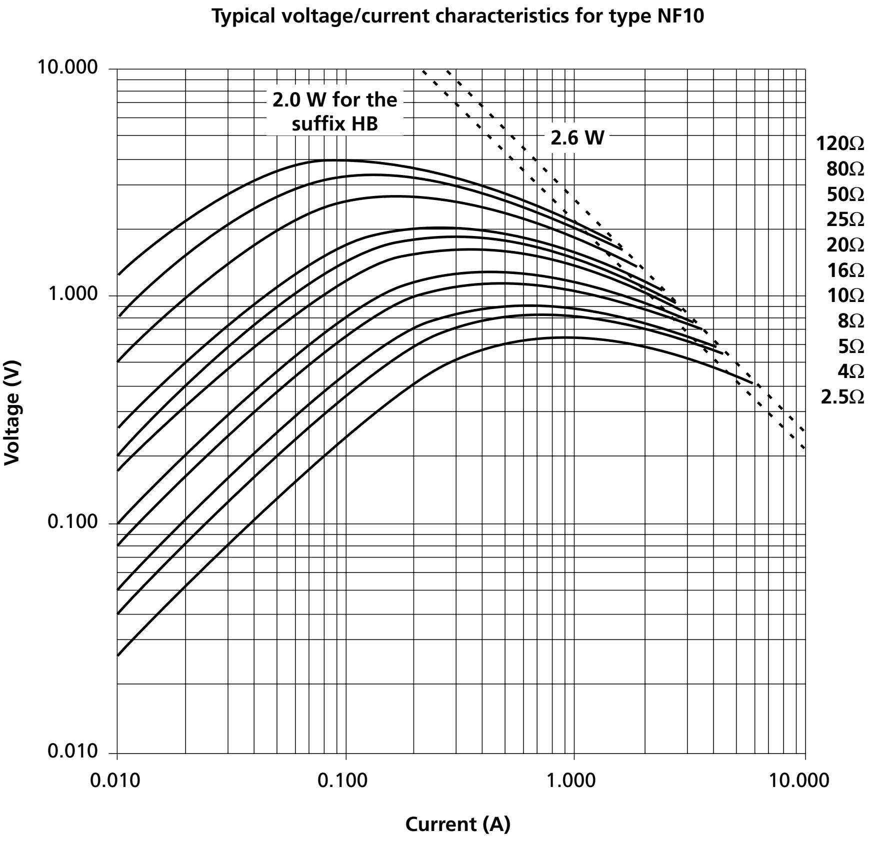
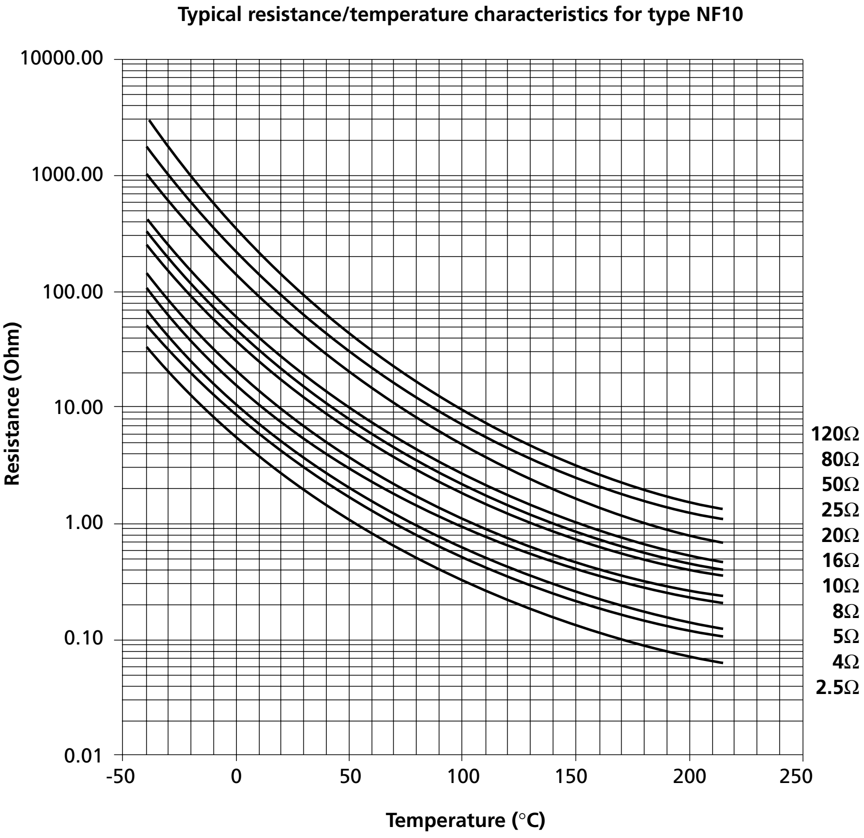
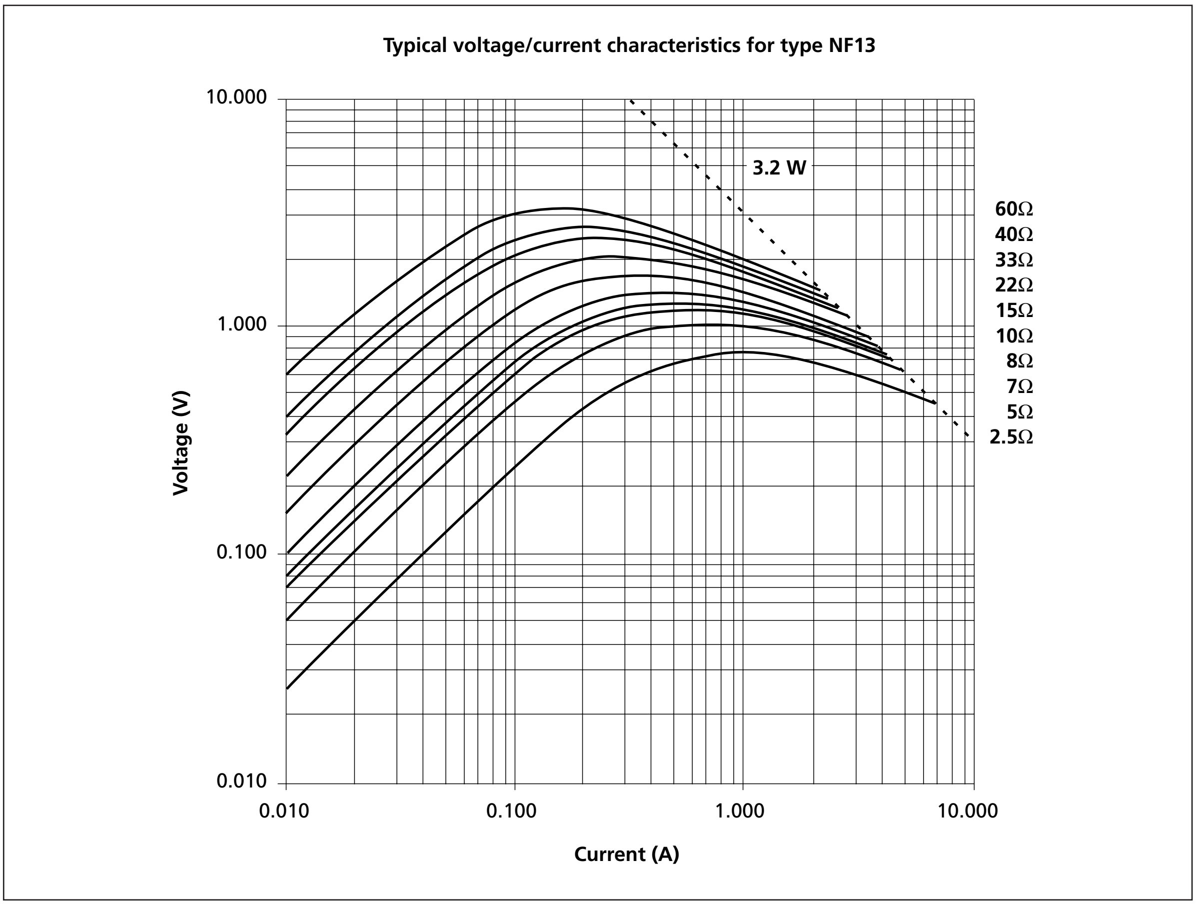
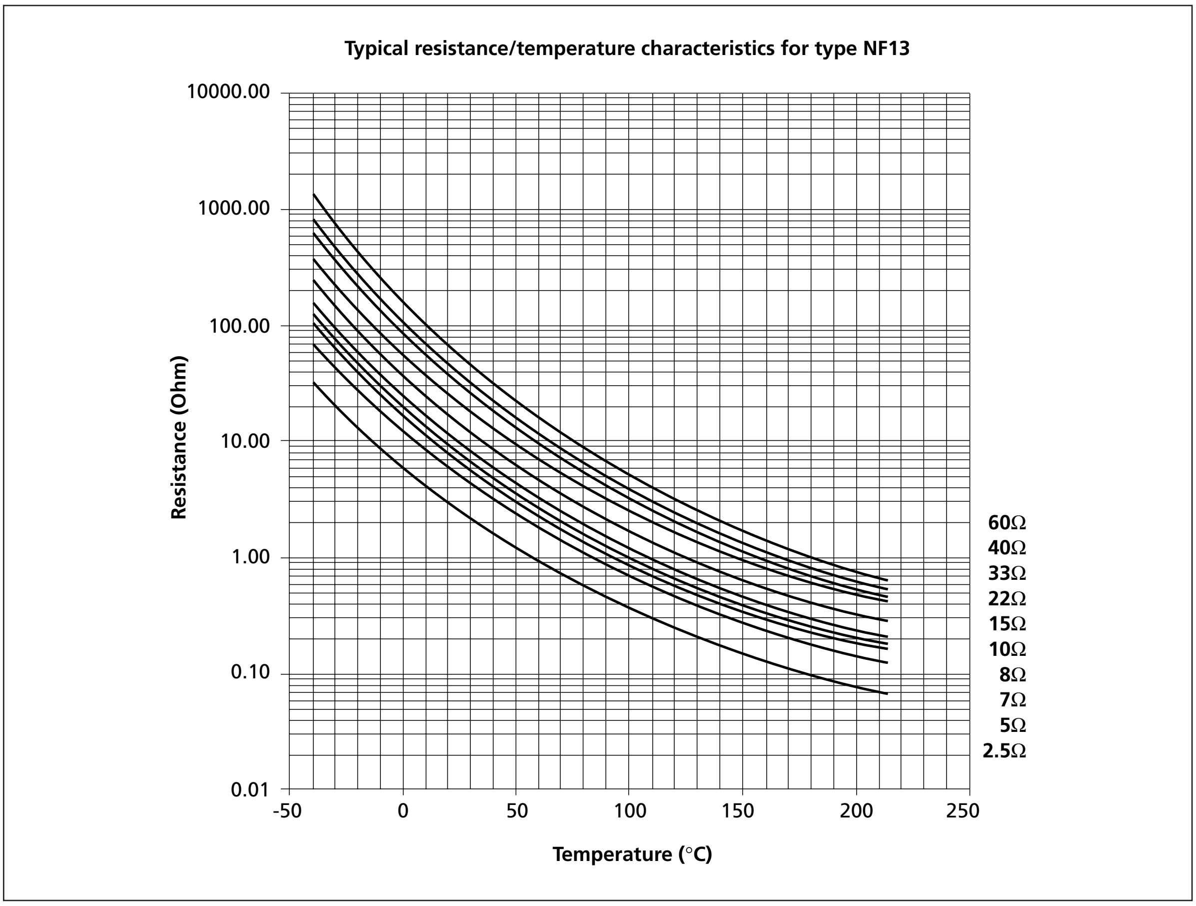


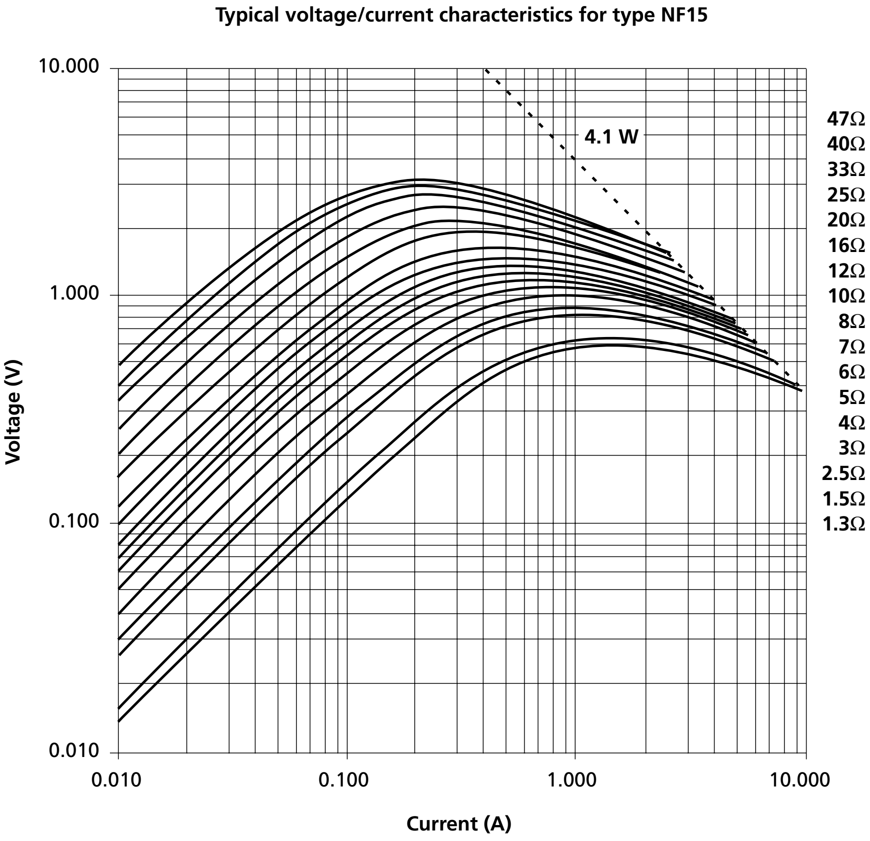


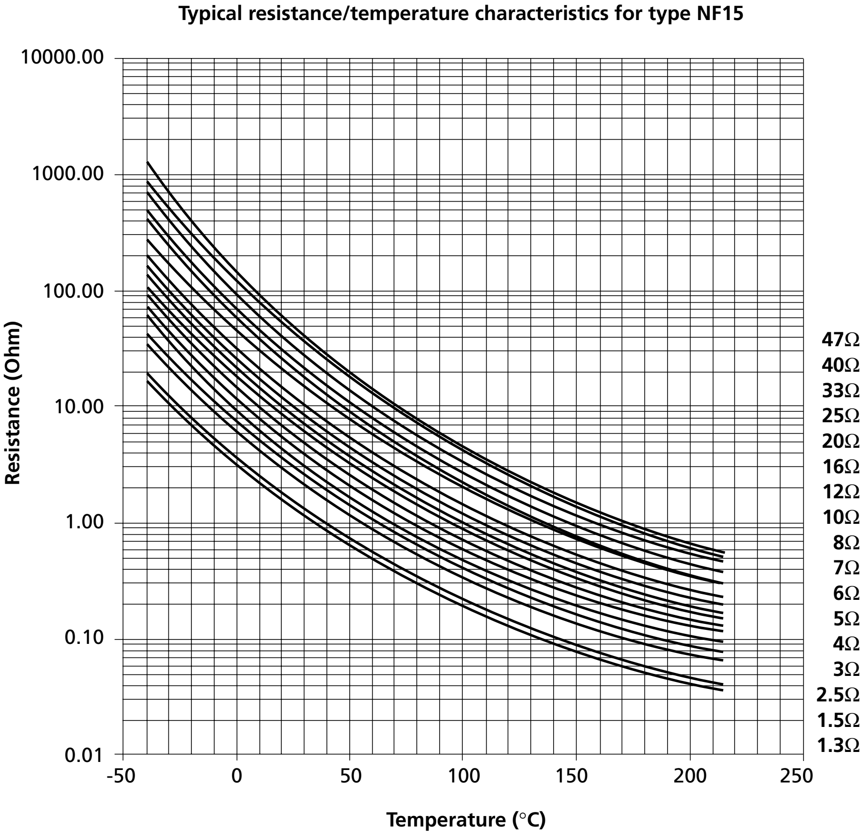
Voltage-current and resistance-temperature characteris-



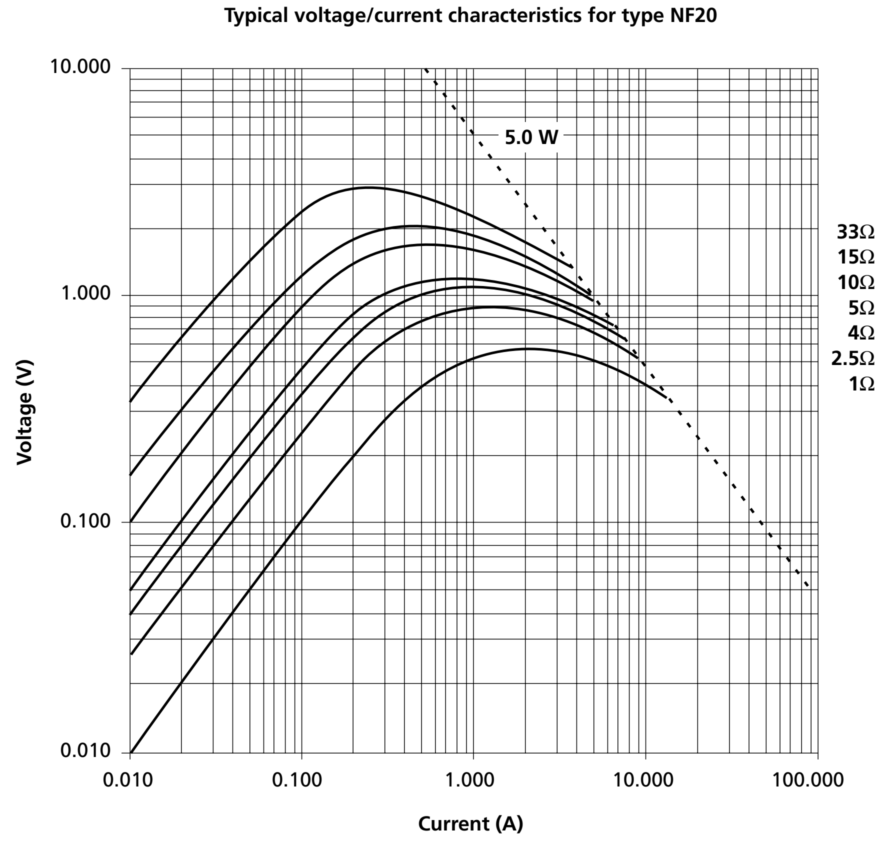


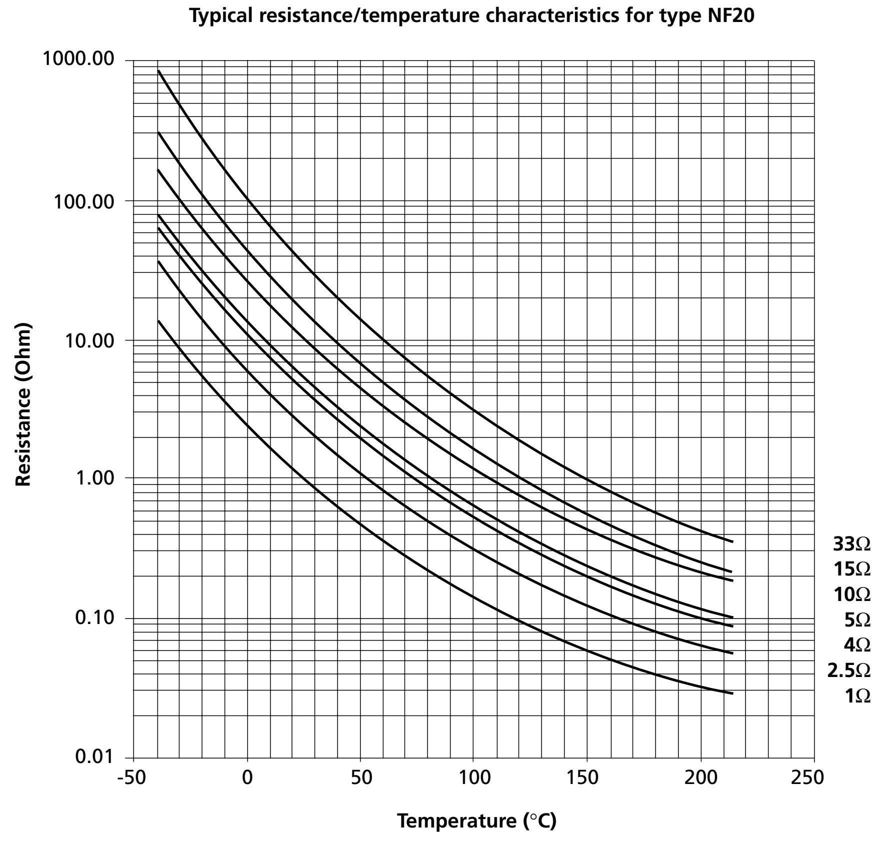
Voltage-current and resistance-temperature characteris-





Voltage-current and resistance-temperature characteris-

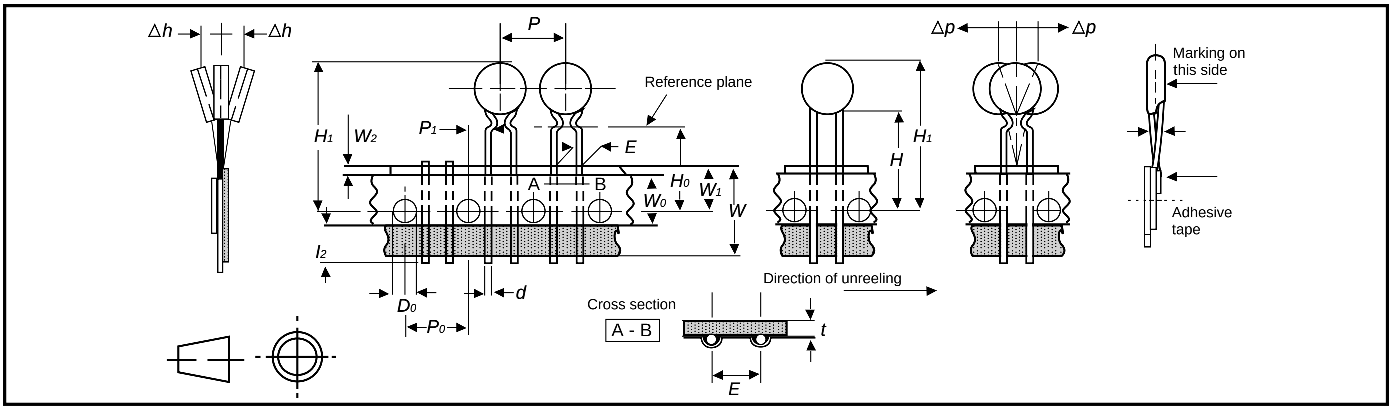




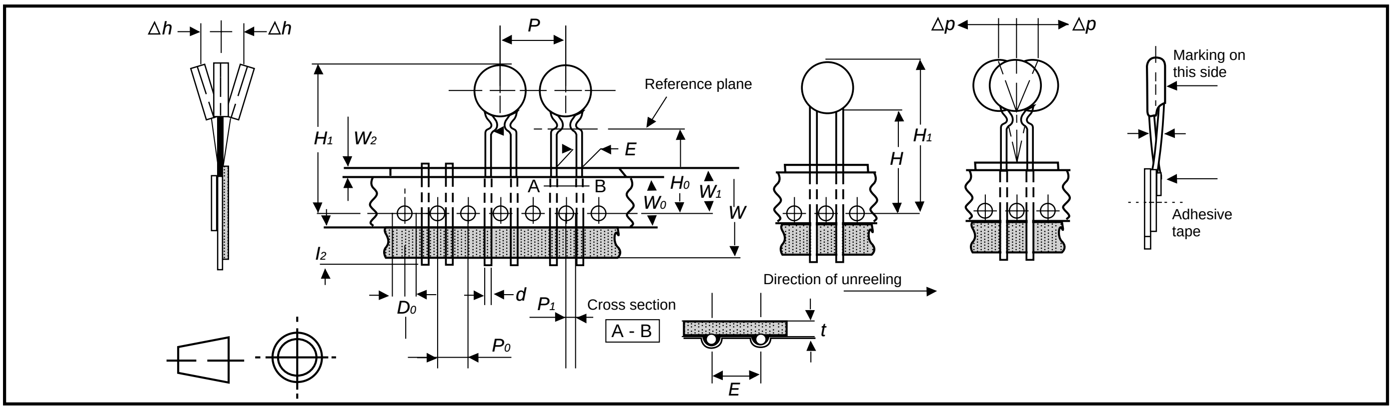
Taping characteristics

Taping of our thermistors is made according to IEC 286-2

Types : NF08 (5.08 mm lead spacing / 0.6 mm wire)



Types : NF08 - NF10 - NF13 (7.62 mm lead spacing / 0.8 mm wire)



Dimension characteristics	Value (mm)	Tolerance	
Leading tape width	18	+1/-0.5	W
Adhesive tape width	The hold down tape shall not protude beyond the carrier tape		W_0
Sprocket hole position	9	+0.75/-0.5	W_1
Distance between the tops of the tape and the adhesive	3 max		W_2
Diameter of sprocket hole	4	± 0.2	D_0
Distance between the tape axis and the bottom plane of component body	16/19.5	± 0.5	H
Distance between the tape axis and the kink	16/19.5	± 0.5	H_0
Distance between the tape axis and the top of component body NF08 NF08/10/13	35.5 max 45.0 max		H_1
Lead diameter	0.6 0.8	+ 10 % - 0.05	d
Protrusions beyond the lower side of the hold down tape	5 max		l_2
Lead spacing	5.08 7.62	± 0.8	E
Components pitch	12.7 25.4	± 0.3	p

Dimension characteristics	Value (mm)	Tolerance	
Sprocket holes pitch	12.7	± 0.3	P_0
Distance between the sprocket hole and the lead axis	3.8	± 0.7	P_1
Total thickness of tape	0.9 max		t
Verticality of components	0	± 2	Δp
Alignement of components	0	± 2	Δh

Taping characteristics

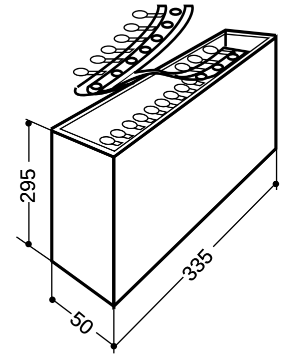
Packaging

For automatic insertion, the following types can be ordered on tape either in AMMOPACK (fan folder) or on REEL in accordance to IEC 286-2.

Missing components

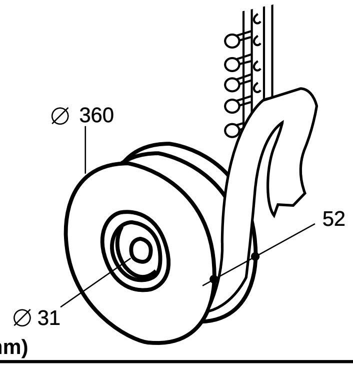
A maximum of 3 consecutive components may be missing from the bandolier, surrounded by at least 6 filled positions. The number of missing components may not exceed 0.5 % of the total per packing module.

AMMOPACK



Dimensions (mm)

REEL



Dimensions (mm)

Leads configuration and packaging suffixes

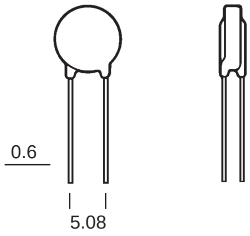
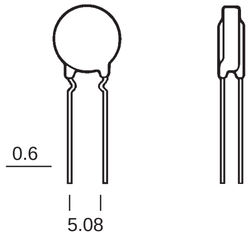
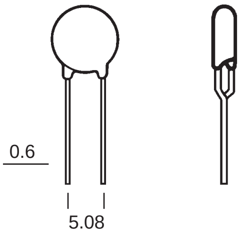
The tables below indicate the suffixes to be specified when ordering kink and packaging types. For devices on tape, it is necessary to specify the height (H or Ho) which is the distance between the tape axis (sprocket holes) and the sitting plane on the printed circuit board.

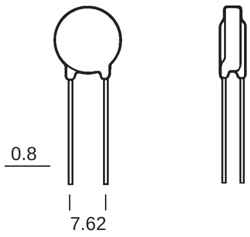
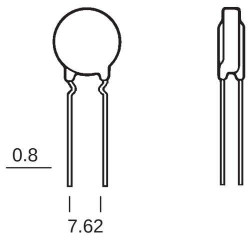
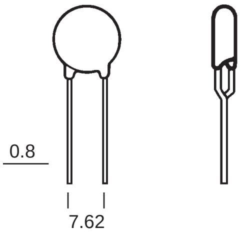
– Straight leads

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

Ho represents the distance between the sprocket holes axis and the base of the knee.

Types	NF08					
Leads	Straight		Kinked (type 1)		Kinked (type 2)	
Dimensions	 0.6 5.08		 0.6 5.08		 0.6 5.08	
Packaging	Ammopack	Reel	Ammopack	Reel	Ammopack	Reel
Ho = 16	DA	DB	DQ	DR	D7	D5
Ho = 19.5	DC	DD	DS	DT	D8	D6

Types	NF08 / 10 / 13					
Leads	Straight		Kinked (type 1)		Kinked (type 2)	
Dimensions	 0.8 7.62		 0.8 7.62		 0.8 7.62	
Packaging	Ammopack	Reel	Ammopack	Reel	Ammopack	Reel
Ho = 16	EA	EN	EC	EF	EQ	ER
Ho = 19.5	EB	ED				

Packaging

PACKAGING QUANTITIES

Type	Bulk	Ammopack	Reel
NF08 (5.08) NF08 (7.62)	450 450	1000 750	1000 750
NF10 (5.08) NF10 (7.62)	450 450	– 750	– 750
NF13 (7.62)	400	750	750
NF15 (7.62)	250	–	–
NF20 (7.62)	150	–	–

IDENTIFICATION - TRACEABILITY

On the packaging of all shipped thermistors, you will find a bar code label.

This label gives systematic information on the type of product, part number, lot number, manufacturing date and quantity.

An example is given below :

(H)Lot: 6B4960304407 /040 960108

(Q)Qty: 400

(2W)TPC-PN: NF13AA0100M - -

This information allows complete traceability of the entire manufacturing process, from raw materials to final inspection.

This is extremely useful for any information request, customer complaint or product return.

Quality

QUALITY SYSTEM

A high level of performance, quality and service has been achieved in setting up a quality system based on the ISO 9000 standard.

The system includes :

- a quality manual ensuring the proper organization,
- an incoming inspection,
- a manufacturing process control and a final inspection as described on page 18,
- reliability tests according to IEC 539 and CECC 43000 standards as described on page 19,
- continuous improvements programs.

APPROVALS

The quality of our products and organization has been recognized by the following approvals :

ISO 9002

Certificate of approval n° 928373

CECC 00114, part I

Certificate of approval of manufacturer n° 005-92

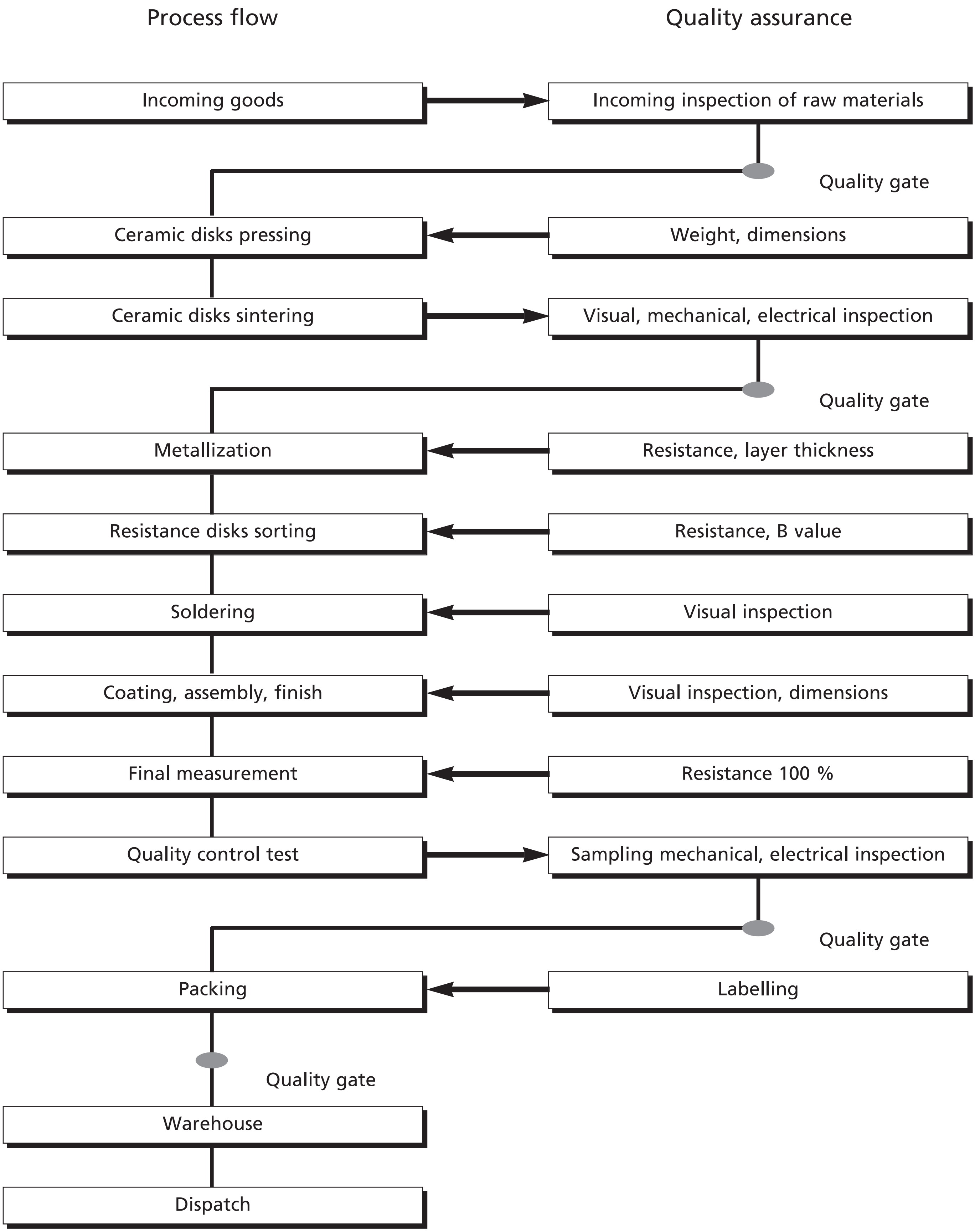
CECC 43003 - xxx

Specification in process for all standard NF types

Underwriters Laboratories, Inc.

cUL listing pending approval : tested by UL laboratories according to CSA standard.

Manufacturing process and quality assurance



Reliability

TEST DESCRIPTION	TEST CONDITION	TEST REQUIREMENT
DISSIPATION FACTOR	CECC 43000, Test as per 4.9	• Nominal value ± 30 %
THERMAL TIME CONSTANT	CECC 43000, Test as per 4.10	• Nominal value ± 30 %
ROBUSTNESS OF TERMINATIONS	IEC 68-2-21, Test Ua 10 N applied 10 s for 0.6 & 0.8 mm wire 20 N applied 10 s for 1.0 mm wire	• Δ R/R not to exceed ± 5 % • No visible damage
RESISTANCE TO SOLDERING HEAT	IEC 68-2-20, Test Tb method 1A 260°C, 5 s	• Δ R/R not to exceed ± 5 % • No visible damage
RAPID CHANGE IN TEMPERATURE	IEC 68-2-14, Test Na Ta : - 40°C ; Tb : + 150°C Duration : 30 min/cycle Total : 5 cycles	• Δ R/R not to exceed ± 10 % • No visible damage
VIBRATION	IEC 68-2-6, Test Fc method B4 Freq. range : 10 Hz ... 55 Hz Amplitude : 0.75 mm or 98 m/s/s Duration : 6 h (3 x 2 h)	• Δ R/R not to exceed ± 5 % • No visible damage
SHOCK	IEC 68-2-27, Test Ea Pulse shape : half sine Acceleration : 490 m/s/s Pulse duration : 11 ms 3 x 6 shocks	• Δ R/R not to exceed ± 5 % • No visible damage
CLIMATIC SEQUENCE	CECC 43000, Test as per 4.18 a) Dry heat - IEC 68-2-2, Test Ba Temperature / Duration : 125°C / 16 h b) Damp heat 1st cycle - IEC 68-2-4, Test D Temperature / Duration : 55°C / 24 h Humidity : 95-100 % Rh c) Cold - IEC 68-2-1, Test Aa Temperature / Duration : - 40°C / 2 h d) Damp heat remaining cycles 5 cycles	• Δ R/R not to exceed ± 10 % • No visible damage • Insulation resistance min 25 M • Voltage proof, no breakdown
DAMP HEAT, STEADY STATE	IEC 68-2-3, Test Ca Temperature / Duration : 40°C / 56 days Humidity : 93 %	• Δ R/R not to exceed ± 15 % • No visible damage • Insulation resistance min 25 M • Voltage proof, no breakdown
TEMPERATURE LIFE TEST	CECC 43000, Test as per 4.20.2 Temperature / Duration : 170°C / 1000 h	• Δ R/R not to exceed ± 20 % • No visible damage • Insulation resistance min 25 M
CURRENT LIFE TEST	CECC 43000, Test as per 4.20.1 Temperature / Duration : 25°C / 1000 h Maximum steady state current	• Δ R/R not to exceed ± 20 % • No visible damage • Insulation resistance min 25 M
PULSE STRENGTH TEST	1000 cycles at maximum steady state current On 1 min / Off 5 min	• Δ R/R not to exceed ± 20 % • No visible damage • Insulation resistance min 25 M

Worldwide sales offices

AMERICAS

BRAZIL

THOMSON-CSF COMPONENTS BRASIL Ltda
Av. Prof. Vicente Rao, 1620
CEP 0436-001
SAO PAULO - BRASIL
Tel. : (5511) 5247713
Fax : (5511) 2473059

USA

THOMSON-CSF PASSIVE COMPONENTS U.S.
2211 - H Distribution Center Drive
CHARLOTTE NC 28269
Tel. : (1 704) 597 0766
Fax : (1 704) 597 0553

EUROPE

BENELUX

THOMSON-CSF PASSIVE COMPONENTS BENELUX
Avenue Louise 363 - B 10
B-1050 BRUXELLES
Tel. : (32 2) 627 03 45
Fax : (32 2) 627 03 33

INT'L SALES HEADQUARTER

France & other countries
THOMSON-CSF PASSIVE COMPONENTS
29, avenue Carnot
91349 MASSY Cedex France
Tel. : (33) 1 69 93 41 41
Fax : (33) 1 69 93 42 90

GERMANY

THOMSON-CSF PASSIVE COMPONENTS
Perchtinger Strasse 3
D-81379 MUNCHEN 70
Tel. : (49 89) 78 79 0
Fax : (49 89)78 79 145

ITALY

THOMSON-CSF PASSIVE COMPONENTS
Viale Fulvio Testi, 117
20092 CINISELLO BALSAMO (MILANO)
Tel. : (39 2) 660 15 510
Fax : (39 2) 660 15 677

SPAIN AND PORTUGAL

THOMSON-CSF PASSIVE COMPONENTS
C/Principe de Vergara, 204 - 1°B
28002 MADRID
Tel. : (34) 1 564 02 72
Fax : (34) 1 564 19 40

U.K. AND IRELAND

THOMSON-CSF PASSIVE COMPONENTS
Unit 4 Cartel Business Centre
Stroudley Road
Basingstoke, Hants RG 24 OUG
Tel. : (44) 1256 84 33 23
Fax : (44) 1256 23 172

ASIA

HONG KONG

THOMSON-CSF PASSIVE COMPONENTS ASIA Ltd
81F Rays Industrial Building
71 Hung to Road
Kwun Tong
KOWLOON - HONG KONG
Tel. : (852) 2389 00 22
Fax : (852) 2797 80 81

INDIA

THOMSON-CSF PASSIVE COMPONENTS ASIA Ltd
India Representative Office
C 310 blue cross chambers
Infantry road cross
BANGALORE - 560001 INDIA
Tel. : (91 80) 555 0566
Fax : (91 80) 555 0566

SINGAPORE

THOMSON-CSF PASSIVE COMPONENTS SINGAPORE Pte Ltd
171 Kallang Way n° 03-08
Kolam Ayer Industrial Park
SINGAPORE 349250
Tel. : (65) 741 90 88
Fax : (65) 741 92 88

SHANGHAI

THOMSON-CSF PASSIVE COMPONENTS ASIA Ltd
Representative Office
Room 6011 Hua Ting Guest House
2525 Zhong Shan Xi Lu
Shanghai 200030
CHINA
Tel. : (8621) 6481 4564
Fax : (8621) 6481 4544

TAIWAN

THOMSON-CSF PASSIVE COMPONENTS TAIWAN Ltd
12 F n° 149-16, Sec. 2
Keelung Road. Taipei 110
TAIWAN ROC
Tel. : (8862) 378 6792
Fax : (8862) 736 2142

"Specifications mentioned in this publication are subject to change without notice"

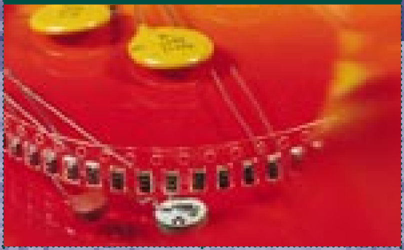
Power capacitors

Soft ferrite

Film capacitors

Ceramic capacitors

Non linear resistors



THOMSON-CSF
PASSIVE COMPONENTS

HEADQUARTERS : Avenue du Colonel Prat - 21850 Saint-Apollinaire - France - Tél. : (33) 03 80 71 74 00 - Fax : (33) 03 80 74 87 28 - Telex : THOM 616 780 F
SALES OFFICES : 29, avenue Carnot - 91349 Massy Cedex - France - Tél. : (33) 01 69 93 41 41 - Fax : (33) 01 69 93 40 92 Telex : THOM 616 780 F

Conception réalisation : SOREGRAPH, Crédits photos : Dominique SARRAUTE, Le Square des Photographes
SPC 896 - Design : PILOTE image,