

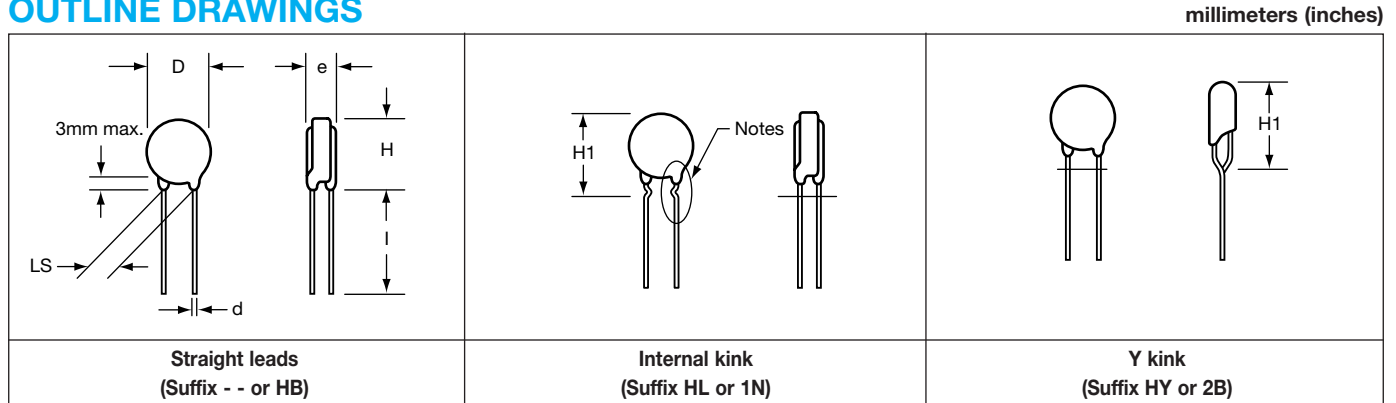
# NTC Inrush Current Limiters Thermistors



NF 08 - 10 - 13 - 15 - 20

(For more details see also the catalog dedicated to this range)

## OUTLINE DRAWINGS



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

## DIMENSIONS millimeters (inches)

Type	D max mm	e max mm	H max mm	H1 max mm	l min mm	d ±0.02 mm (±0.008)	LS ±0.8 mm (±0.030)
NF08*	9.5 (.374)	5.0 (.197)	13.0 (.512)	16.0 (.630)	30 (1.181)	0.6 (.024)	5.08 (.20)
NF08	9.5 (.374)	5.0 (.197)	13.0 (.512)	16.0 (.630)	30 (1.181)	0.8 (.031)	7.62 (.03)
NF10*	11.5 (.453)	5.0 (.197)	15.0 (.591)	18.0 (.709)	30 (1.181)	0.6 (.024)	5.08 (.20)
NF10	11.5 (.453)	5.0 (.197)	15.0 (.591)	18.0 (.709)	30 (1.181)	0.8 (.031)	7.62 (.30)
NF13	15.0 (.591)	6.0 (.236)	18.0 (.709)	22.0 (.866)	30 (1.181)	0.8 (.031)	7.62 (.30)
NF15	17.0 (.669)	6.0 (.236)	20.0 (.787)	24.0 (.945)	30 (1.181)	1.0 (.039)	7.62 (.30)
NF20	22.0 (.866)	6. (.236)	25.0 (.984)	29.0 (1.142)	30 (1.181)	1.0 (.039)	7.62 (.30)

## GENERAL CHARACTERISTICS

Type	Standard tolerance** %	Maximum operating T°C	Max power 25°C Watts	Thermal dissipation δ <sub>th</sub> (mW/K)	Thermal time constant τ <sub>C</sub> (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.

\*\* Other tolerances available: L: ±15, X: ±25%

## SUFFIXES FOR BULK PACKING (Suffixes for taping: see page 35)

- - 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

## HOW TO ORDER

**NF13**

Type

**AA**

Inrush Current Limiters

**0509**

Resistance  
5 kΩ

**M**

Tolerance  
M (±20%)

**--**

Suffix  
Bulk, Straight Leads  
(See illustration above)



# Table of Values



NF 08 - 10 - 13 - 15 - 20

cUL	Ceramic Disc ø (mm)	Part number reference T <sub>ype</sub>	Zero power resistance R <sub>25°C</sub> (Ω)	Max steady state current I <sub>ss</sub> max 25°C (A)	Resistance at max current R <sub>iss</sub> max (Ω)
*	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
*	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
*		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
*	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	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	

\* cL/L approval (File E167822)

- 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



# NTC Inrush Current Limiters Thermistors

## Application Guide

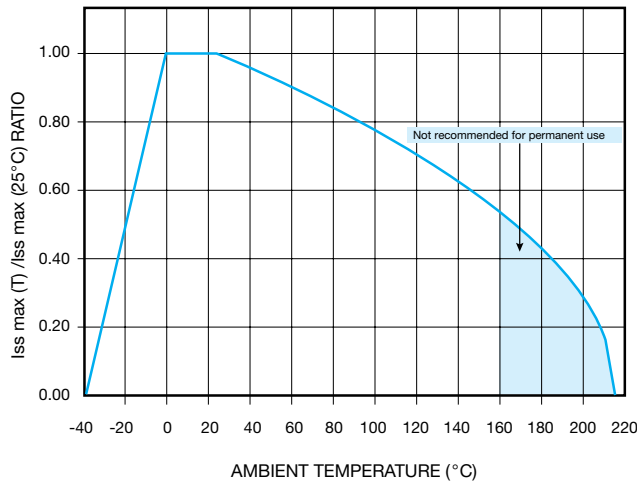
### 1 – HOW TO DETERMINE THE MAXIMUM STEADY STATE CURRENT OF NF THERMISTORS?

- If the ambient temperature is 25°C: the current is given in table page 30.
- 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:

$$I_{SS_{max25}} \times 0.9 = 3.0 \text{ A.}$$

#### Derating of maximum steady state current with ambient temperature



### 2 – HOW TO CALCULATE THE WORKING TEMPERATURE OF NF THERMISTOR?

Example: NF08AA0330M

$$I_{SS} = 0.2 \text{ A, } T_{\text{ambient}} = 25^\circ\text{C}$$

- From the graph V (I) page 32, we find  $V_{SS} = 2.2 \text{ V}$  therefore,  $R_{SS} = 11 \Omega$
- From the graph R(T), page 32, at  $R = 11 \Omega$ , we find  $T \pm 65^\circ\text{C}$

### 3 – HOW TO CALCULATE THE WORKING POINT OF NF THERMISTOR AT A DIFFERENT AMBIENT TEMPERATURE THAN 25°C?

Example: NF13AA0100M

$$I_{SS} = 3 \text{ A, } T_{\text{ambient}} = T_A = 60^\circ\text{C}$$

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

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

- 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,  $\delta = 16 \text{ mW/K}$  (see page 29)

therefore, the equation becomes:

$$T = 562.5 R_T + 60$$

from the  $R_T$  curve page 33 we find  $R_T$  starting from  $T$ :

T (°C)	$R_T$ ( $\Omega$ )	$\Rightarrow$	$562.5 R_T + 60$ (°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  $I_{SS} = 3 \text{ A}$  and  $T_A = 60^\circ\text{C}$  (this temperature is the one for which we have  $T = 562.5 R_T + 60$ ).

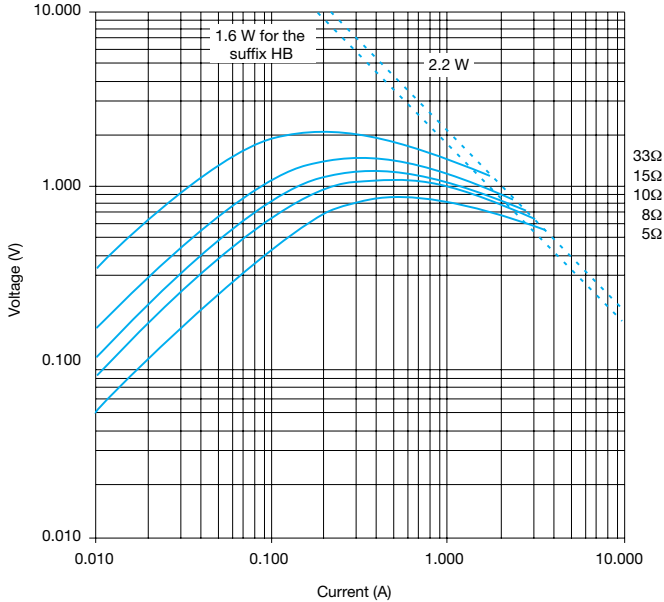
**Important:** A discrepancy may exist between practice and theory due to the tolerance of the thermistor ( $\pm 20\%$  usually).

# NTC Inrush Current Limiters Thermistors

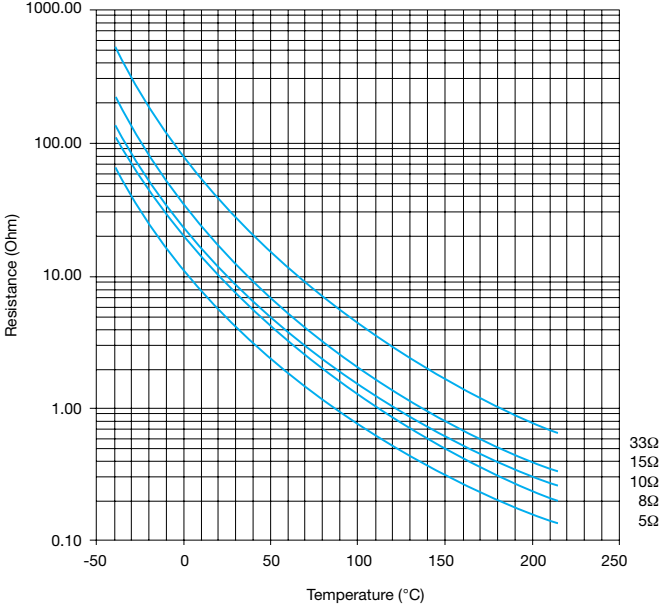


## Voltage-Current and Resistance-Temperature Characteristics

### TYPICAL VOLTAGE/CURRENT CHARACTERISTICS FOR TYPE NF08



### TYPICAL RESISTANCE/TEMPERATURE CHARACTERISTICS FOR TYPE NF08

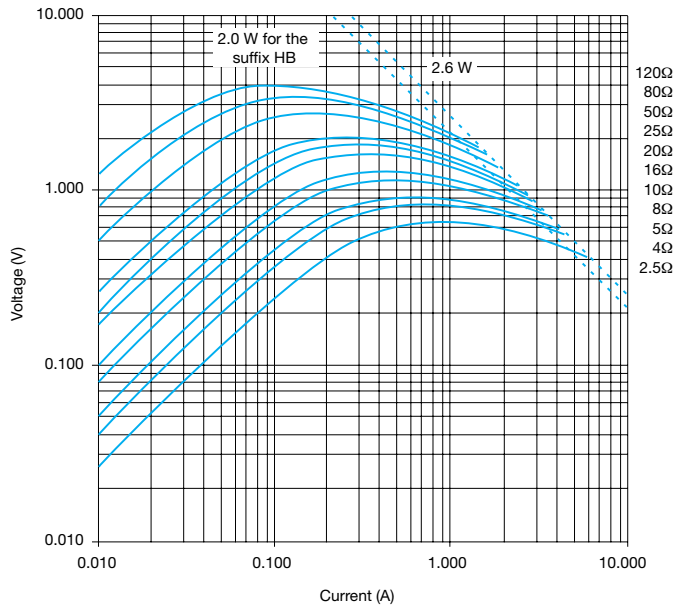


# NTC Inrush Current Limiters Thermistors

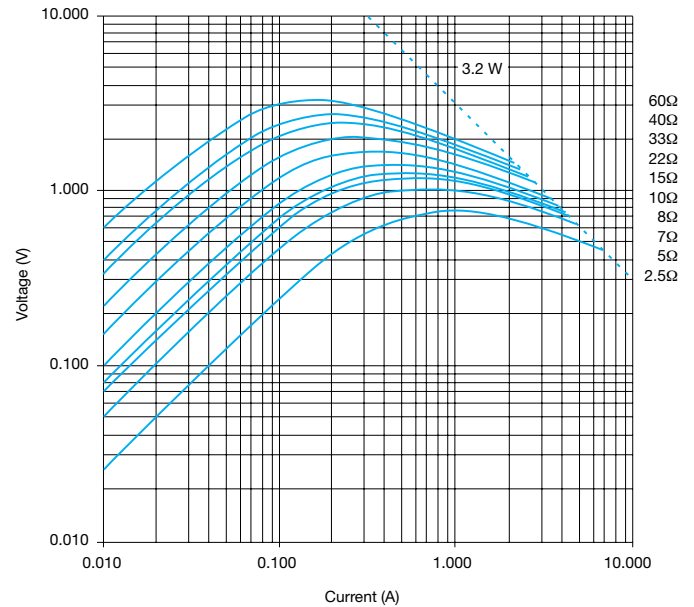


## Voltage-Current and Resistance-Temperature Characteristics

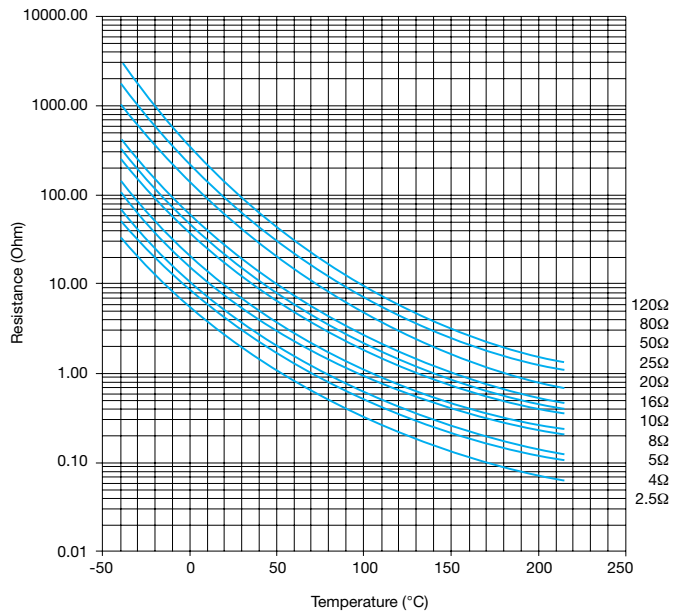
**TYPICAL VOLTAGE/CURRENT CHARACTERISTICS FOR TYPE NF10**



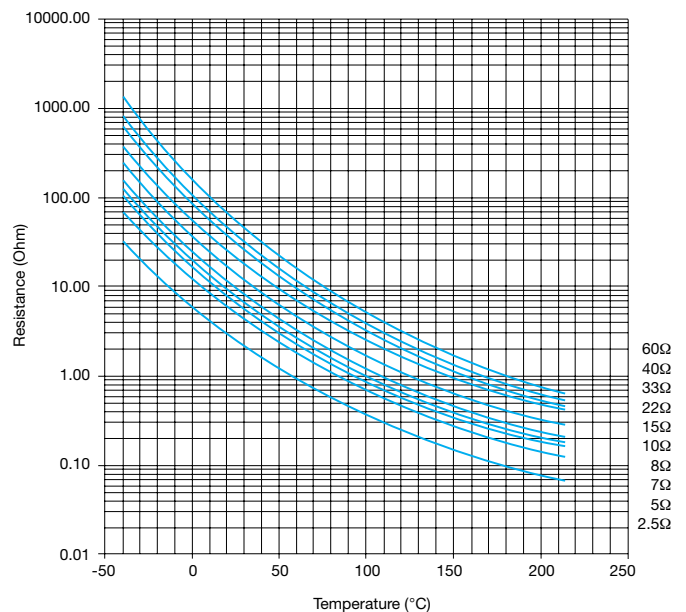
**TYPICAL VOLTAGE/CURRENT CHARACTERISTICS FOR TYPE NF13**



**TYPICAL RESISTANCE/TEMPERATURE CHARACTERISTICS FOR TYPE NF10**



**TYPICAL RESISTANCE/TEMPERATURE CHARACTERISTICS FOR TYPE NF13**

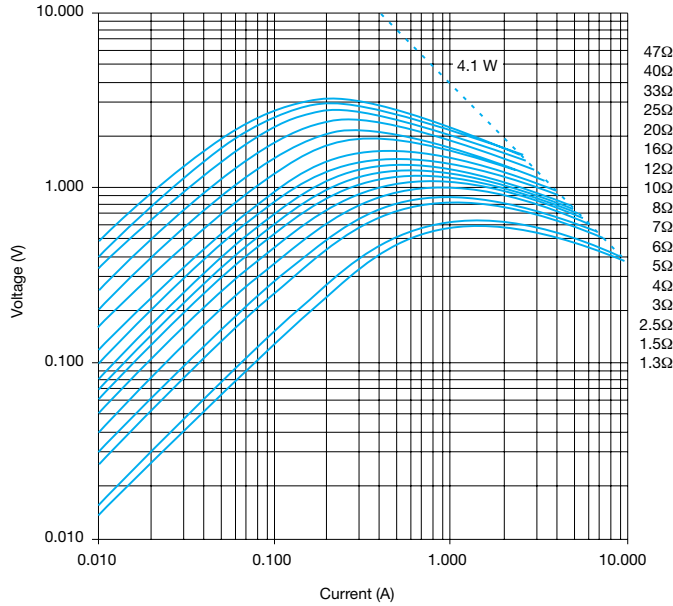


# NTC Inrush Current Limiters Thermistors

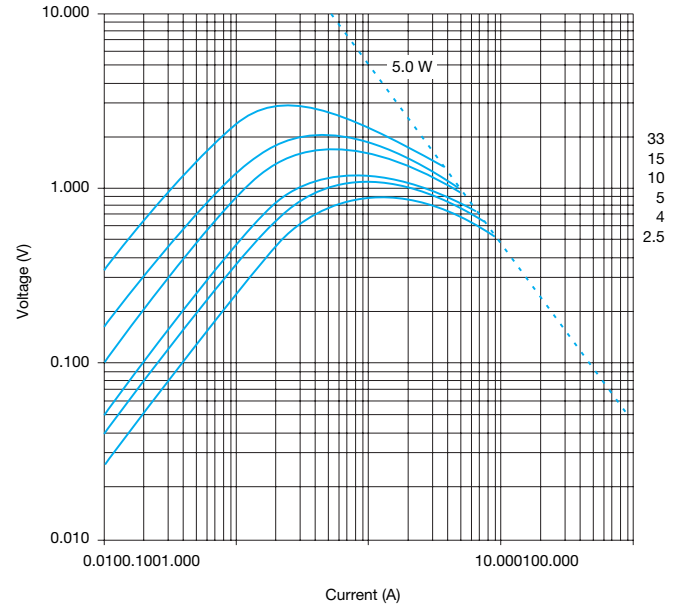


## Voltage-Current and Resistance-Temperature Characteristics

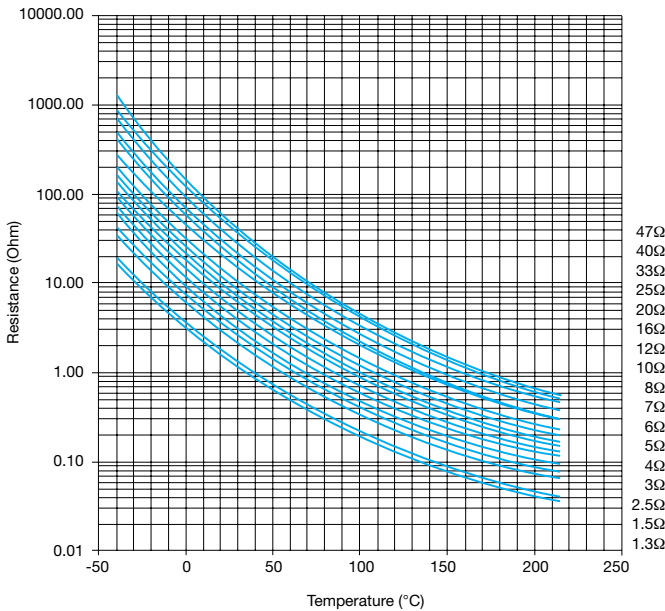
**TYPICAL VOLTAGE/CURRENT CHARACTERISTICS FOR TYPE NF15**



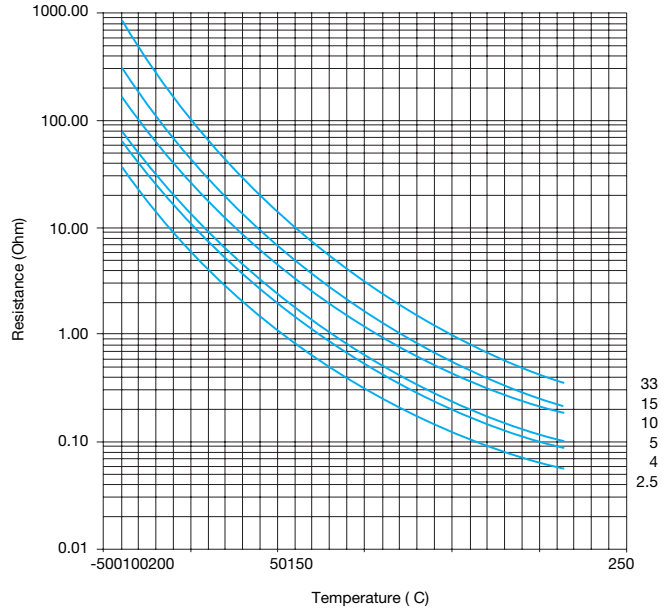
**TYPICAL VOLTAGE/CURRENT CHARACTERISTICS FOR TYPE NF20**



**TYPICAL RESISTANCE/TEMPERATURE CHARACTERISTICS FOR TYPE NF15**



**TYPICAL RESISTANCE/TEMPERATURE CHARACTERISTICS FOR TYPE NF20**



### PACKAGING AND KINK SUFFIXES

The following types can be ordered on tape either in AMMOPACK (fan folder) or on REEL in accordance with IEC 286-2.

Types	Straight		NF08 Internal Kink		"Y" Kink	
Leads	Straight		Internal Kink		"Y" Kink	
<b>DIMENSIONS:</b> millimeters (inches)						
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	Straight		NF08 / 10 / 13 Internal Kink		"Y" Kink	
Leads	Straight		Internal Kink		"Y" Kink	
<b>DIMENSIONS:</b> millimeters (inches)						
Packaging	AMMOPACK	REEL	AMMOPACK	REEL	AMMOPACK	REEL
Ho = 16	EA	EN	EC	EF	EQ	ER
Ho = 19.5	EB	ED				

### PACKAGING QUANTITIES

Type	AMMOPACK	REEL	BULK
NF08* (5.08)	1000	1000	450
NF08 (7.62)	750	750	
NF10* (5.08)			450
NF10 (7.62)	750	750	
NF13 (7.62)	750	750	400
NF15 (7.62)	–	–	250
NF20 (7.62)	–	–	150