

## Applications

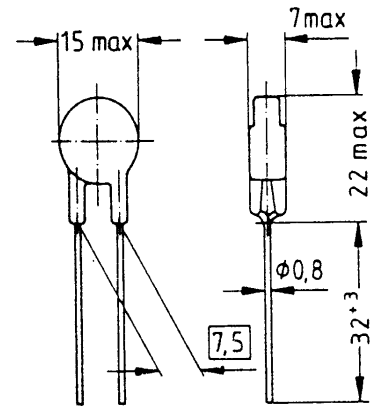
- Inrush current limiting in peripheral communication equipment, monitors, PCs, etc.
- Soft-start motors, e.g. in vacuum cleaners
- Circuit applications requiring high continuous currents
- Useable in series connection up to 245 V<sub>rms</sub>

## Features

- Coated thermistor disk
- Kinked leads of tinned, nickel-plated copper wire
- Wide resistance range
- Available on tape

## Options

Resistance tolerance < 20 % available



TNT0035-Y

Dimensions in mm  
Approx. weight 2.0 g

Lower/upper category temperature		- 55/+ 170	°C
Max. power at 25 °C	$P_{25}$	3.2	W
Resistance tolerance	$\Delta R/R_N$	± 20 %	
Rated temperature	$T_N$	25	°C
B value tolerance	$\Delta B/B$	± 3 %	
Dissipation factor (in air)	$\delta_{th}$	approx. 17	mW/K
Thermal cooling time constant (in air)	$\tau_c$	approx. 90	s
Heat capacity	$C_{th}$	approx. 1530	mJ/K

Type	$R_{25}$ Ω	$I_{max}$ ( $T = 25\text{ °C}$ ) A	No. of R/T char- acteristic	$B_{25/100}$ K	$C_T$ <sup>1)</sup> μF	Parameters for $R(I)$ <sup>1)</sup>		Ordering code
						$k$	$n$	
S 234/1.0/M	1.0	11.5	1201	2600	700	0.622	- 1.27	B57234-S109-M
S 234/2.2/M	2.2	9.0	1202	2800	700	0.806	- 1.30	B57234-S229-M
S 234/2.5/M	2.5	8.4	1202	2800	500	0.843	- 1.30	B57234-S259-M
S 234/4.7/M	4.7	6.6	1203	2900	700	1.03	- 1.32	B57234-S479-M
S 234/5.0/M	5.0	6.4	1203	2900	700	1.05	- 1.32	B57234-S509-M
S 234/7.0/M	7.0	6.0	1302	3000	700	1.16	- 1.33	B57234-S709-M
S 234/10/M	10	5.0	1308	3060	700	1.29	- 1.34	B57234-S100-M
S 234/15/M	15	4.0	1302	3000	700	1.49	- 1.33	B57234-S150-M
S 234/22/M	22	4.0	1304	3300	700	1.57	- 1.37	B57234-S220-M
S 234/33/M	33	3.3	1304	3300	900	1.78	- 1.37	B57234-S330-M
S 234/40/M	40	3.4	1306	3450	400	1.82	- 1.38	B57234-S400-M
S 234/60/M	60	4.0	1103	4000	400	1.77	- 1.44	B57234-S600-M
S 234/220/M	220	2.0	1013	3900	500	2.22	- 1.43	B57234-S221-M

<sup>1)</sup> For details on the capacitance  $C_T$  as well as on the parameters  $k$  and  $n$  refer to pages 189 - 191.

#### 4.2.4 Load derating

The power handling capability of an NTC thermistor cannot be fully utilized over the entire temperature range. For circuit dimensioning the derating curve given below provides information on the extent to which the current must be reduced at a certain ambient temperature.

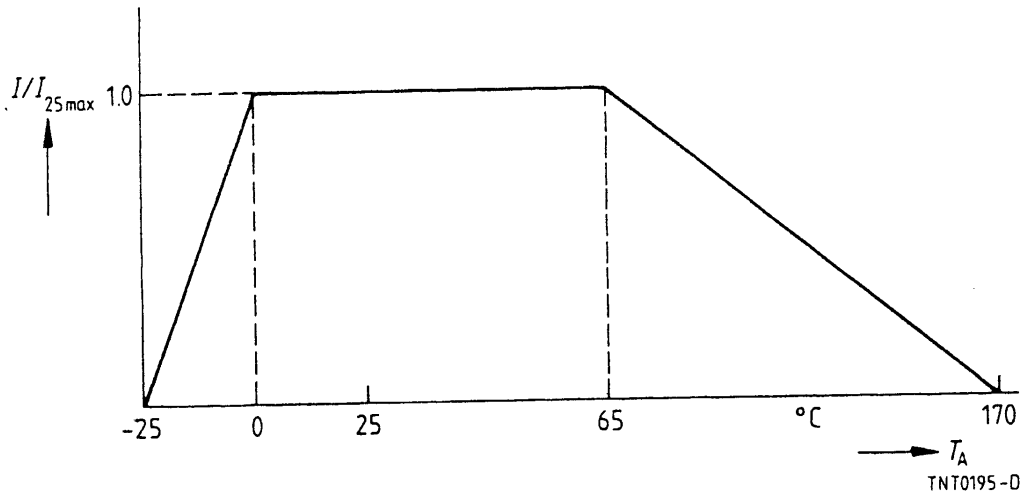


Figure 12

Derating curve

The  $I_{max}$  values specified in the data sheets ( $T_A = 25\text{ °C}$ ) denote the maximum permissible continuous current (dc or rms values for sine-shaped ac).

#### 4.2.5 Restart

When the load has been switched off the thermistor slowly cools down. Its resistance increases steadily, but the full resistance value is only reached after 1 to 2 minutes (depending on ambient temperature and type).

It may therefore be useful in some applications to bypass the thermistor during restart. Operation can thus be faster resumed and system performance will not be affected by the thermistor.

#### 4.2.6 Dependence of NTC resistance on current

The resistance effective in the usual operating current range can be approximated as follows:

$$R_{NTC} = k \cdot I^n \quad 0.3 \cdot I_{max} < I \leq I_{max}$$

$R_{NTC}$  Resistance value to be determined at current  $I$  [  $\Omega$  ]

$k, n$  Fit parameter, see individual data sheets

$I$  Current flowing through the NTC (insert numerical value in A)

The calculated values only serve as an estimate for operation in still air at an ambient temperature of 25 °C.

Note: With the equation above sufficiently accurate results are only obtained for the limited current range stated above.

#### 4.2.7 Pulse strength

The currents during turn-on are much higher than the rated currents during continuous operation. To test the effects of these current surges S+M uses the following standard procedure:

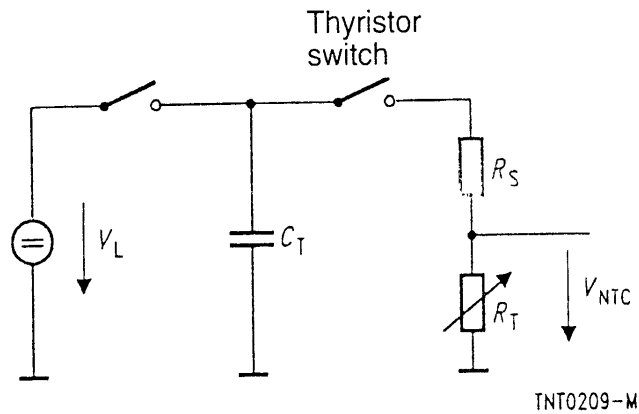


Figure 13

Test circuit for evaluating the pulse strength of an NTC thermistor

- $V_L$  Load voltage [ V ]
- $C_T$  Test capacitance [  $\mu\text{F}$  ]
- $R_S$  Series resistance [  $R_S = 1 \Omega$  ]
- $V_{NTC}$  Voltage drop across the NTC under test [ V ]

In the pulse test the capacitor  $C_T$  is discharged via the series resistor  $R_S$  and the NTC thermistor. The load voltage is chosen such that the voltage applied to the thermistor at the start of discharge is  $V_{NTC} = 345 \text{ V}$  (corresponds to  $(230 \text{ V} + \Delta V) \times \sqrt{2}$ ).

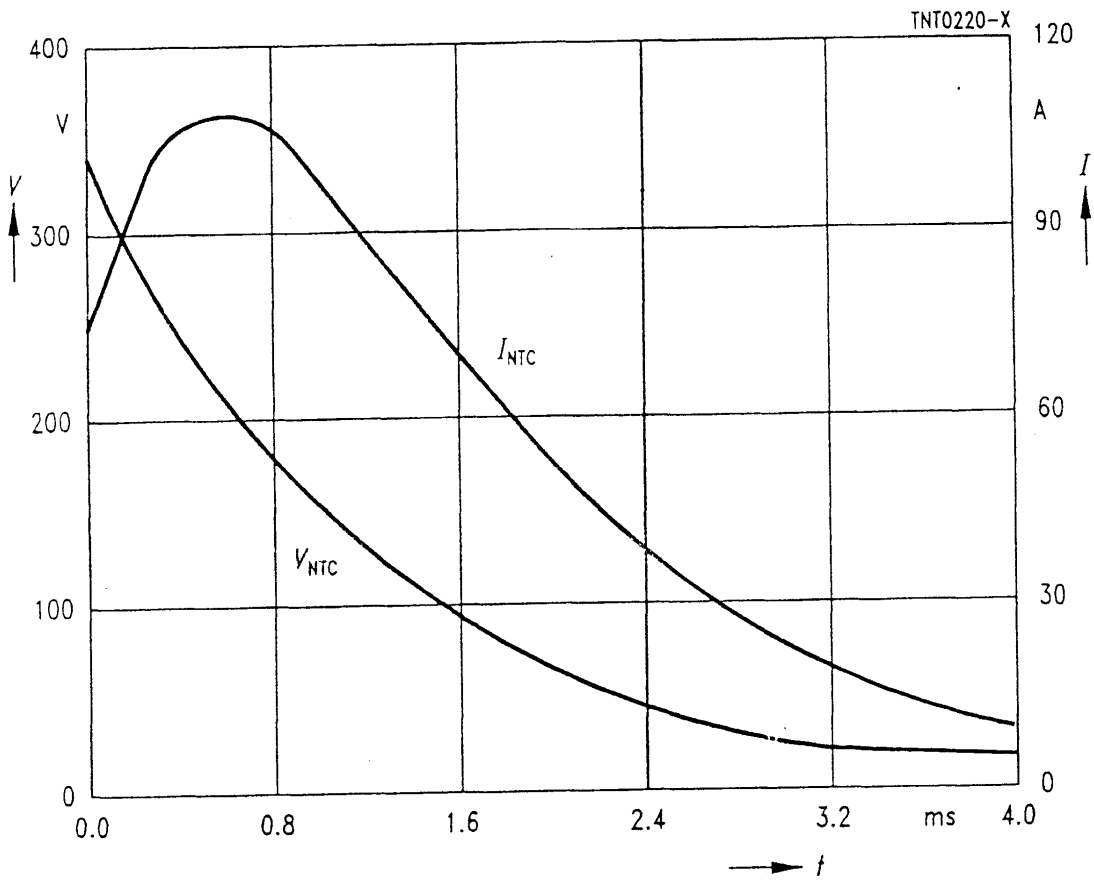


Figure 14  
Pulse strength test : typical curves

The maximum capacitances that can be switched depend on the individual thermistor type and are given in the data sheets.

#### 4.2.8 Applications

Inrush current limiters are primarily used in industrial electronics and equipment engineering. Application examples are:

Inrush current limiting in fluorescent, projector and halogen lamps, rotational speed limiting in kitchen machines, soft start of motors and switch-mode power supplies etc.

S+M thermistors are available in a variety of sizes and rated resistances to optimally match your application. The product line ranges from the small-size S153 with a maximum power of 1.4 W through to the at present largest S464 with a maximum power of 6.7 W. Maximum continuous ac currents of 20 A are reached. Inrush current limiters are presented on pages 250 to 255.