

## Thermistors for overload protection PTC 56 V and 265 V ( $T_s = 120\text{ }^\circ\text{C}$ )

### 2322 66. 0/1/3.... series

#### FEATURES

- Different voltages to be chosen in function of the application
- Available in three mechanical versions
  - 2322 66. 0.... naked discs
  - 2322 66. 1.... leaded
  - 2322 66. 3.... taped, on reel (to diameter 12.5 mm)
- Wide range of trip and non-trip currents: from 17 mA up to 3 A for the trip current
- Wide range of resistance: from  $1.6\ \Omega$  up to  $1.9\ \text{k}\Omega$
- Small ratio between trip and non-trip currents ( $I_t/I_{nt} \leq 1.5$  at  $25\text{ }^\circ\text{C}$ )
 
$$\left( \frac{I_t \text{ (at } 10\text{ }^\circ\text{C)}}{I_{nt} \text{ (at } 55\text{ }^\circ\text{C)}} = 2 \right)$$
- Leaded parts withstand mechanical stresses and vibration.

#### APPLICATIONS

- Telecommunications
- Automotive systems
- Industrial electronics
- Consumer electronics
- Electronic data processing.

#### DESCRIPTION

These directly heated thermistors have a positive temperature coefficient and are primarily intended for overload protection. They consist of a naked disc or with two tinned brass leads.

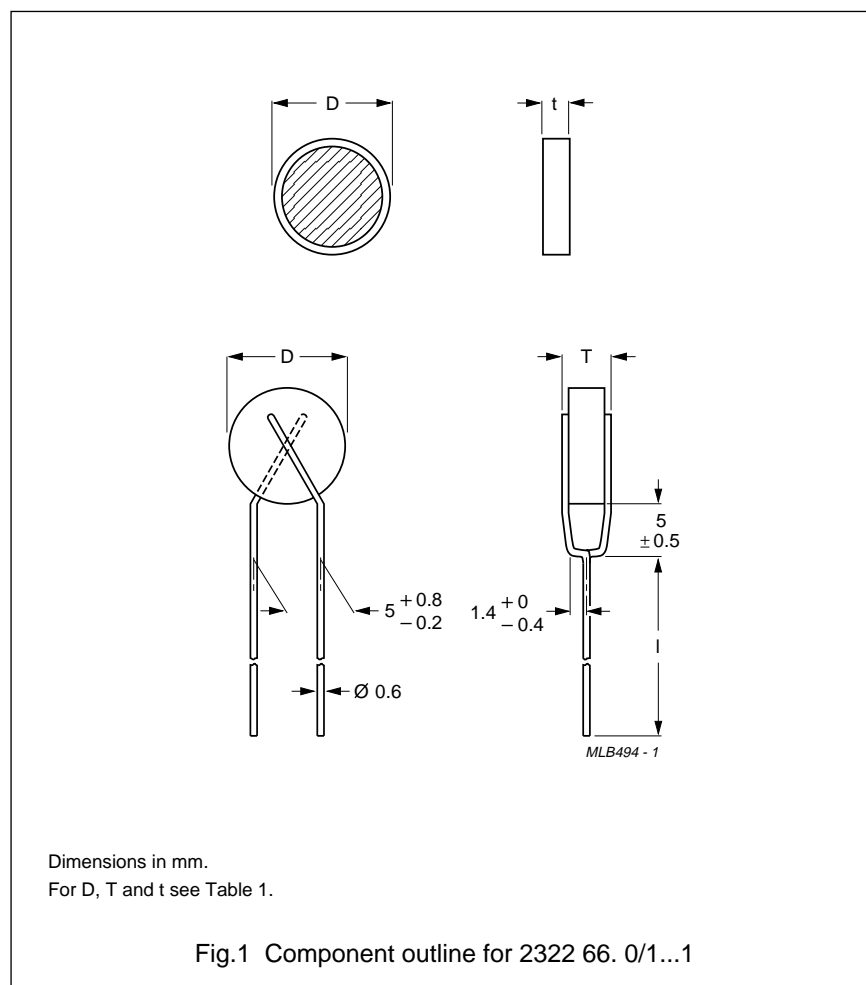
#### QUICK REFERENCE DATA

PARAMETER	VALUE	UNIT
Switch temperature; note 1	120	$^\circ\text{C}$
Maximum voltage:		
2322 66. 0/1/3...1	56	V (DC)
2322 66. 0/1/3...3	265	V (RMS)
Temperature range:		
2322 66. 0/1/3...1/3 at zero dissipation	-25 to 125	$^\circ\text{C}$
2322 66. 0/1/3...1/3 at $V_{\text{max}}$	0 to +70	$^\circ\text{C}$
Climatic category	25/125/56	

#### Note

1. For information only.

#### MECHANICAL DATA



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**Table 1** Device dimensions, packaging and catalogue numbers

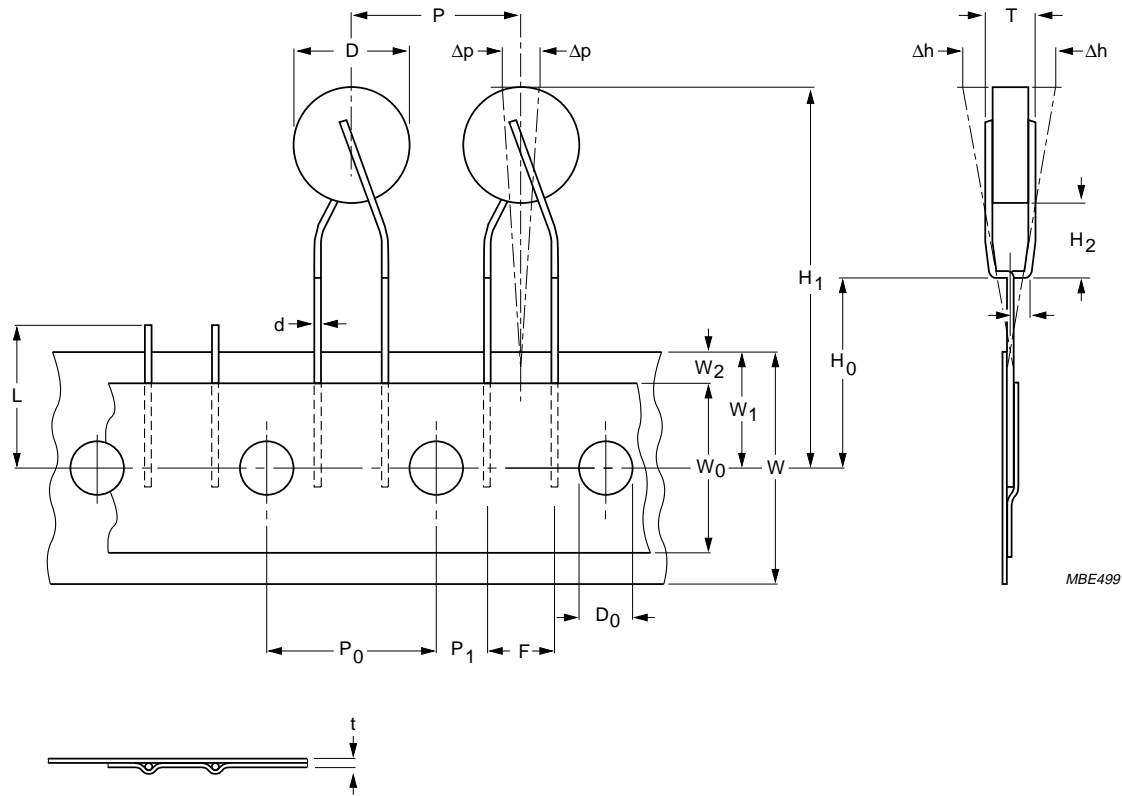
D TYP. (mm)	t $\pm 10\%$ (mm)	T MAX. (mm)	PACKAGING			CATALOGUE NUMBERS 2322 ... ..
			NAKED	LEADED BULK	LEADED TAPED	
4.5	1.6	4.0	Fig.1	Fig.1	Fig.2	660 .5691; 660 .6891; 660 .8291
	2.6	5.0				660 .1293; 660 .1593; 660 .1893; 660 .2293; 660 .2793
6.5	1.6	4.0	Fig.1	Fig.1	Fig.2	661 .1011; 661 .1211
	2.6	5.0				661 .3393; 661 .3993; 661 .4793; 661 .5693
8	1.6	4.0	Fig.1	Fig.1	Fig.2	661 .1511
	2.6	5.0				661 .6893; 661 .8293; 661 .1013
10	2.0	4.5	Fig.1	Fig.1	Fig.2	662 .1811
	2.6	5.0				662 .1213
12	2.0	4.5	Fig.1	Fig.1	Fig.3	662 .2211; 662 .2711
	2.6	5.0				662 .1513; 662 .1813
13	2.6	5.0	Fig.1	Fig.1	Fig.3	663 .3311; 663 .2213
16	2.6	5.0	Fig.1	Fig.1	–	663 .3911; 663 .4711; 663 .2713
20	3.2	6.0	Fig.1	Fig.1	–	664 .5611; 664 .6811; 664 .3313; 664 .3913; 664 .4713

# Thermistors for overload protection

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### Thermistors on tape

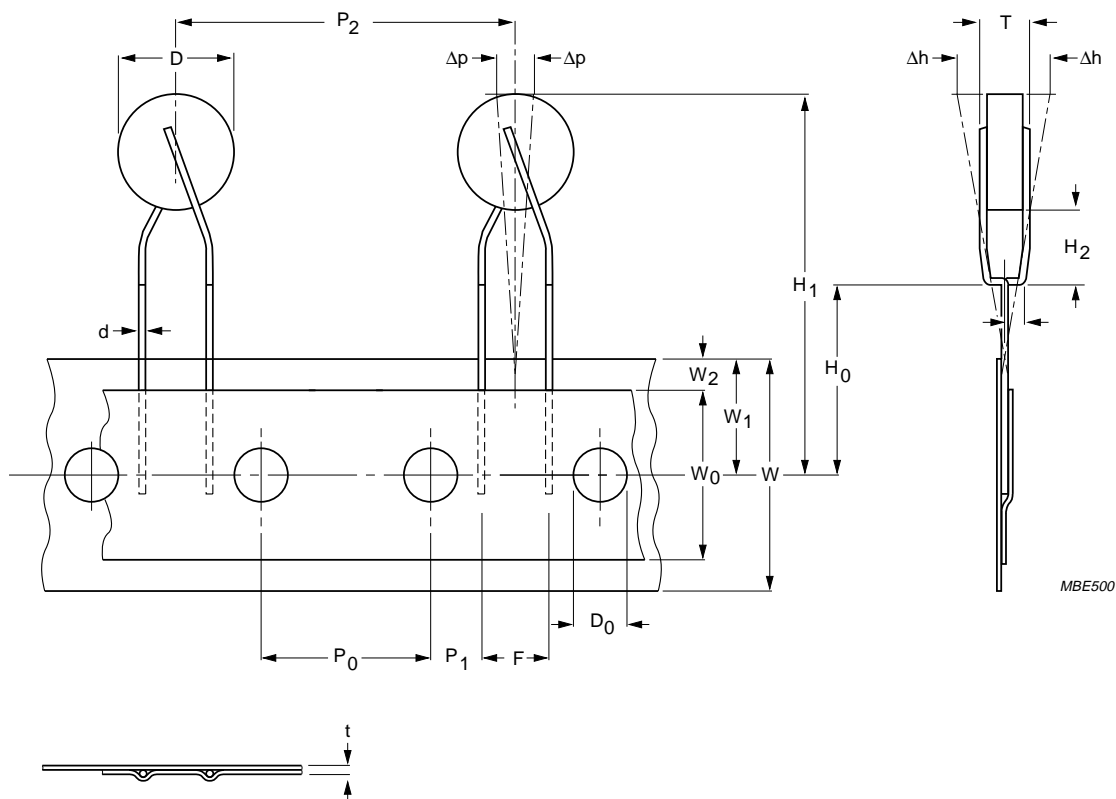


Max. 0.5% of the total number of thermistors per reel may be missing, but no more than 3 consecutive positions may be vacant.

Fig.2 Thermistors with  $\varnothing D < 12\text{ mm}$  on tape for 2322 66. 3...1/3.

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Max. 0.5% of the total number of thermistors per reel may be missing, but no more than 3 consecutive positions may be vacant.

Fig.3 Thermistors with  $\varnothing D \geq 12\text{ mm}$  on tape for 2322 66. 3...1/3.

### Characteristics concerning taped thermistors

PARAMETER	VALUE
Minimum pull out force of the component	5 N
Minimum pull off force of adhesive tape	6 N
Minimum tearing force tape	15 N
Maximum pull off force tape-reel	5 N
<b>Storage conditions</b>	
Storage temperature range	-25 to +40 °C
Maximum relative humidity	80%

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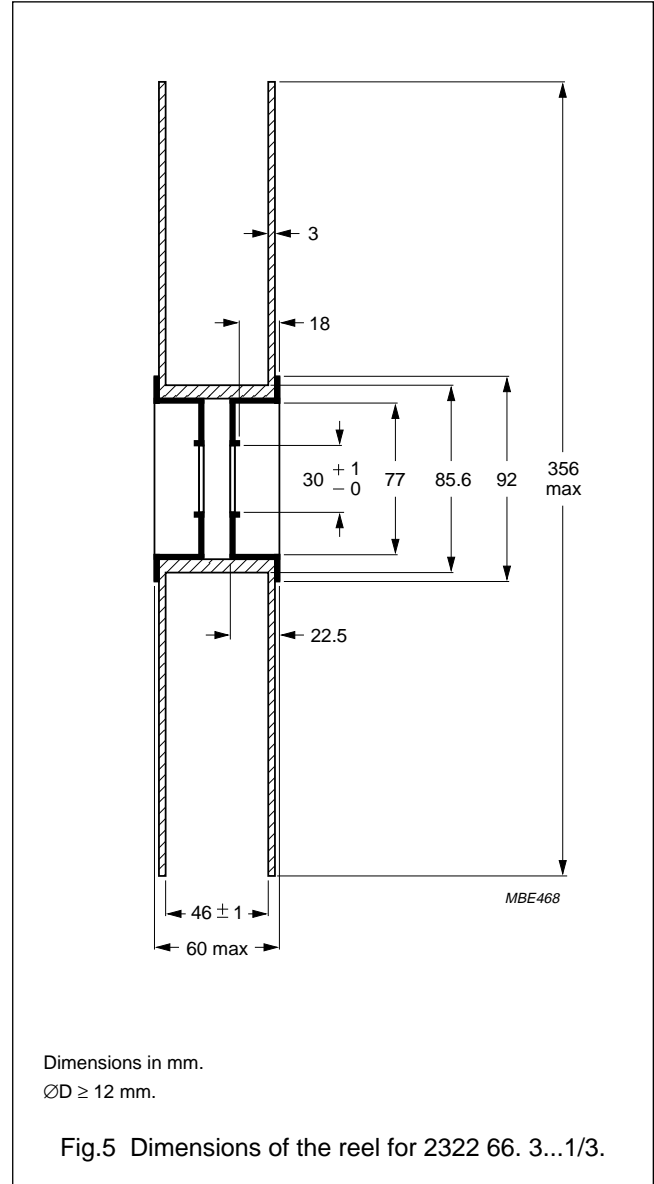
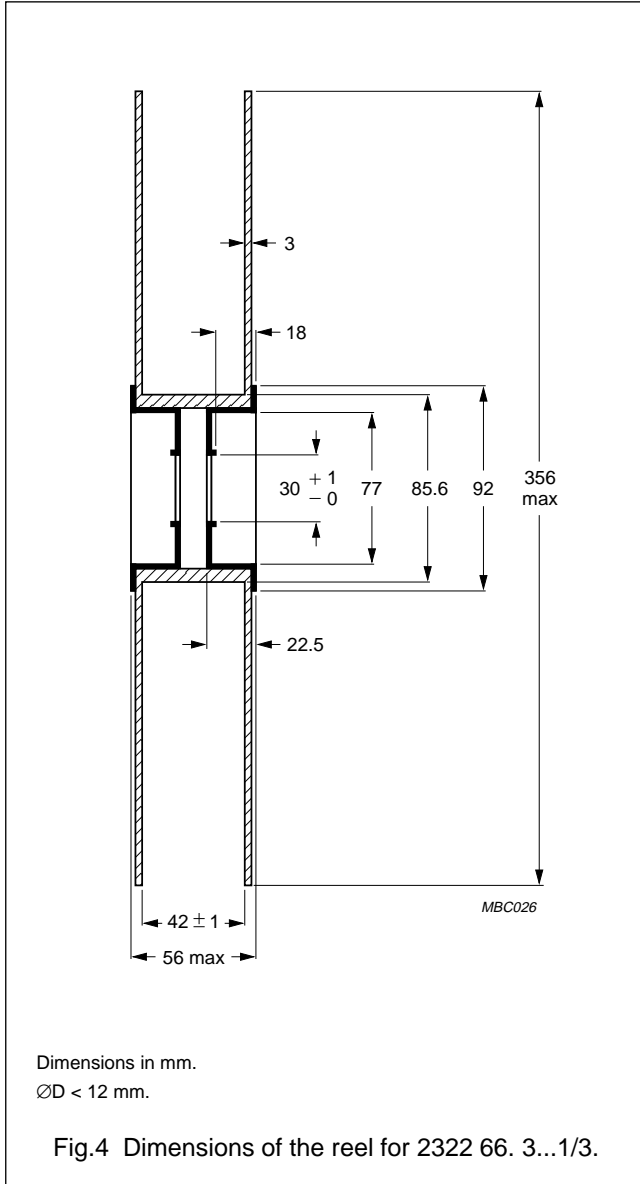
**Tape and additional device information****Table 2** Tape and other device dimensions; see Figs 1, 2 and 3

SYMBOL	PARAMETER	DIMENSIONS (mm)	TOLERANCE	REMARKS
D	body diameter:			
	2322 66. 0/1/3...1	see Table 1	$\pm 0.5$	
	2322 66. 0/1/3...3	see Table 1	$\pm 0.5$	
T	total thickness:			
	2322 66. 0/1/3...1	see Table 1		
	2322 66. 0/1/3...3	see Table 1		
d	lead diameter	0.6	$\pm 10\%$	
P	pitch between thermistors	12.7	$\pm 1$	
P <sub>2</sub>	pitch between thermistors	25.4	$\pm 2$	
P <sub>0</sub>	feed hole pitch	12.7	$\pm 0.3$	cumulative pitch error $\pm 1$ mm/20 pitches
P <sub>1</sub>	feed hole centre to lead centre	3.81	$\pm 0.7$	guaranteed between component and tape
$\Delta p$	component alignment	0	$\pm 1.3$	
F	lead to lead distance	5	+0.6 to -0.1	guaranteed between component and tape
$\Delta h$	component alignment	0	$\pm 2$	
W	tape width	18	+1 to -0.5	
W <sub>0</sub>	hold down tape width	$\geq 12.5$	-	
W <sub>1</sub>	hole position	9	$\pm 0.5$	
W <sub>2</sub>	hold down tape position	$\leq 3.0$	-	
H <sub>1</sub>	component height	$\leq 37$	-	
H <sub>0</sub>	lead-wire clinch height	16	$\pm 0.5$	
D <sub>0</sub>	feed hole diameter	4	$\pm 0.2$	
t	total tape thickness	$\leq 0.9$	-	with cardboard tape $0.5 \pm 0.1$ mm
L	length of snapped lead	$\leq 11$	-	

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Reel information



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## PACKAGING INFORMATION

PACKAGING		CATALOGUE NUMBERS	
SPQ	PQ	FIRST 7 DIGITS	LAST 5 DIGITS
5000	20000	2322 660	0...1
500	10000		1...1
3000	3000		3...1
3000	12000		0...3
500	10000		1...3
3000	3000		3...3
5000	5000		2322 661
250	5000	1...1	
3000	3000	3...1	
3000	3000	0...3	
250	5000	1...3	
3000	3000	3...3	
4000	4000	2322 662	
200	4000		11811
100	2000		12211–12711
1500	1500		31811
3000	3000		32211–32711
3000	3000		0...3
200	4000		11213
100	2000		11513–11813
3000	3000		31213
1500	1500		31513–31813
3000	3000		2322 663
100	2000	1...1	
550	2750	03911; 04711; 02713	
100	2000	1...3	
1500	1500	32213	
100	2000	2322 664	0...1
100	2000		1...1
250	1250		0...3
100	2000		1...3

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### ELECTRICAL DATA

**Table 3** Electrical data for **2322 66. 0/1/3...1**; max. voltage = 56 V (DC); see note 1. Preferred types in **bold**.

$I_{nt}^{(2)}$ MAX. at 25 °C (mA)	$I_t^{(2)}$ MIN. at 25 °C (mA)	$I_{nt}^{(2)}$ at 55 °C (mA)	$I_t^{(2)}$ at 10 °C (mA)	$R_{25}$ ( $\Omega$ )	V MAX. (DC) (V)	I MAX. at 25 °C (mA)	$I_{res}$ MAX. at $V_{max}$ and 25 °C (mA)	DISSIP. FACTOR (mW/K)	CATALOGUE NUMBERS <sup>(3)</sup>
70	100	56	112	$\approx 90$	56	460	30	6	<b>2322 660 .5691</b>
90	125	68	136	$\approx 60$	56	600	30	6	<b>2322 660 .6891</b>
105	150	82	164	$\approx 42$	56	750	30	6	<b>2322 660 .8291</b>
130	180	100	200	$\approx 32$	56	950	35	7	<b>2322 661 .1011</b>
155	220	120	240	$\approx 22$	56	1300	35	7	<b>2322 661 .1211</b>
195	275	150	300	$\approx 18$	56	1600	40	7.5	<b>2322 661 .1511</b>
230	330	180	360	$\approx 12.5$	56	2200	45	8	<b>2322 662 .1811</b>
285	400	220	440	$\approx 9$	56	2900	50	9	<b>2322 662 .2211</b>
350	495	270	540	$\approx 6.5$	56	4000	50	9	<b>2322 662 .2711</b>
425	600	330	660	$\approx 4.3$	56	6300	60	10	2322 663 .3311
505	710	390	780	$\approx 3.8$	56	7300	70	12	2322 663 .3911
605	808	470	940	$\approx 2.6$	56	12000	70	12	2322 663 .4711
725	1020	560	1120	$\approx 2.2$	56	14000	100	16	2322 664 .5611
878	1240	680	1360	$\approx 1.6$	56	18000	100	16	2322 664 .6811

### Notes

1. The thermistors are clamped at the seating plane.
2. For leadless types the values given for  $I_{nt}$  and  $I_t$  are only valid for thermistors mounted in accordance with "IEC 738". Thermistor dissipation depends on mounting and can slightly affect the typical values.
3. For leadless types replace the dot in the catalogue numbers by 0, for types with leads replace it by 1, and for reel packaging (for  $\varnothing D_{typ} \leq 13\text{ mm}$ ) replace it by 3.



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**Table 4** Electrical data for **2322 66. 0/1/3...3**; max. voltage = 265 V (RMS); see note 1. Preferred types in **bold**.

$I_{nt}^{(2)}$ MAX. at 25 °C (mA)	$I_t^{(2)}$ MIN. at 25 °C (mA)	$I_{nt}^{(2)}$ at 55 °C (mA)	$I_t^{(2)}$ at 10 °C (mA)	$R_{25}$ ( $\Omega$ )	V MAX. (RMS) (V)	I MAX. at 25 °C (mA)	$I_{res}$ MAX. at $V_{max}$ and 25 °C (mA)	DISSIP. FACTOR (mW/K)	CATALOGUE NUMBERS <sup>(3)</sup>
15	22	12	24	$\approx 1900$	265	110	5	6	<b>2322 660 .1293</b>
20	27	15	30	$\approx 1200$	265	135	5	6	<b>2322 660 .1593</b>
25	33	18	36	$\approx 850$	265	165	5	6	<b>2322 660 .1893</b>
30	40	22	44	$\approx 560$	265	200	6	6	<b>2322 660 .2293</b>
35	50	27	54	$\approx 380$	265	250	6	6	<b>2322 660 .2793</b>
45	60	33	66	$\approx 280$	265	290	7	7	<b>2322 661 .3393</b>
50	70	39	78	$\approx 200$	265	350	7	7	<b>2322 661 .3993</b>
60	85	47	94	$\approx 140$	265	420	7	7	<b>2322 661 .4793</b>
70	100	56	112	$\approx 100$	265	500	8	7	<b>2322 661 .5693</b>
90	125	68	136	$\approx 72$	265	600	8	8	<b>2322 661 .6893</b>
105	150	82	164	$\approx 50$	265	730	9	8	<b>2322 661 .8293</b>
130	185	100	200	$\approx 33$	265	900	9	8	<b>2322 661 .1013</b>
155	220	120	240	$\approx 26$	265	1100	12	8.5	<b>2322 662 .1213</b>
195	275	150	300	$\approx 20$	265	1300	12	9.5	<b>2322 662 .1513</b>
230	325	180	360	$\approx 14$	265	1700	14	9.5	<b>2322 662 .1813</b>
285	400	220	440	$\approx 10$	265	2100	16	10	2322 663 .2213
350	495	270	540	$\approx 8$	265	2500	19	12	2322 663 .2713
425	600	330	660	$\approx 7$	265	3000	25	16	2322 664 .3313
505	715	390	780	$\approx 5$	265	3600	25	16	2322 664 .3913
605	860	470	940	$\approx 3.5$	265	4300	25	16	2322 664 .4713

**Notes**

1. The thermistors are clamped at the seating plane.
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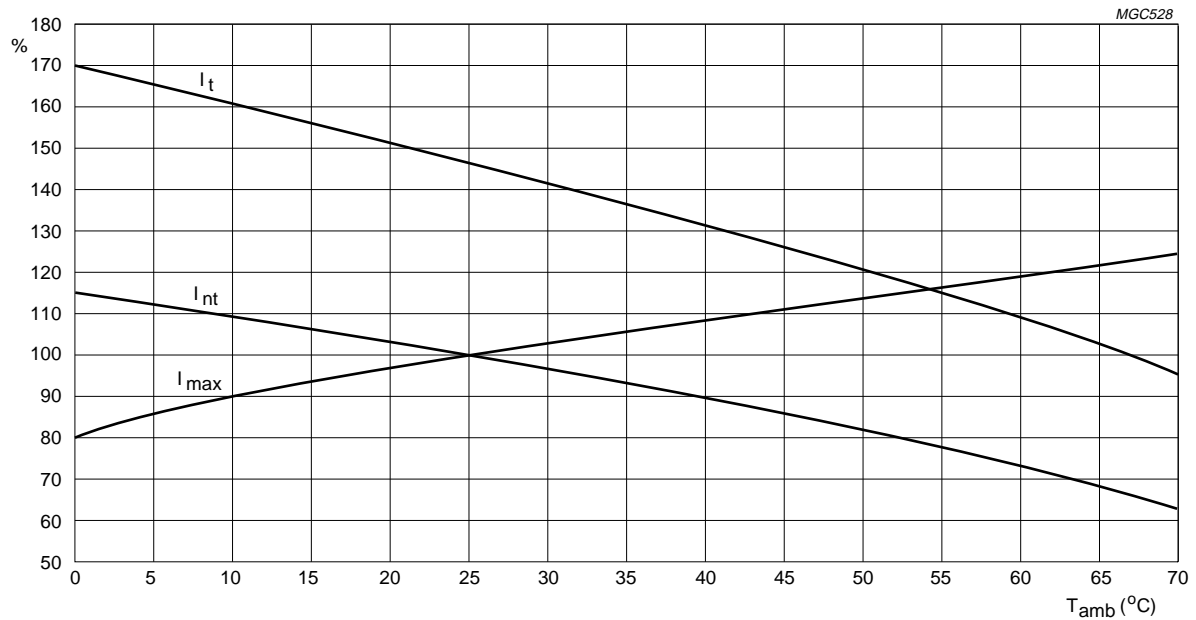
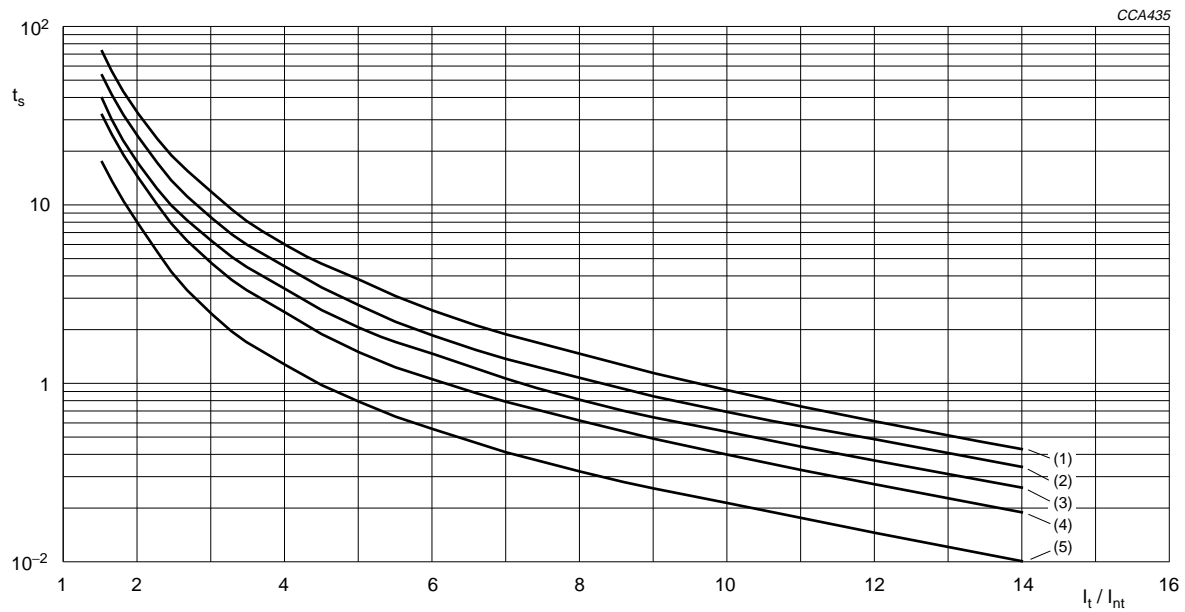


Fig.6 Current deviation as a function of the ambient temperature.

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Curve 1:  $\varnothing D = 12.0\text{ mm}$ .

Curve 2:  $\varnothing D = 10.0\text{ mm}$ .

Curve 3:  $\varnothing D = 8.0\text{ mm}$ .

Curve 4:  $\varnothing D = 6.5\text{ mm}$ .

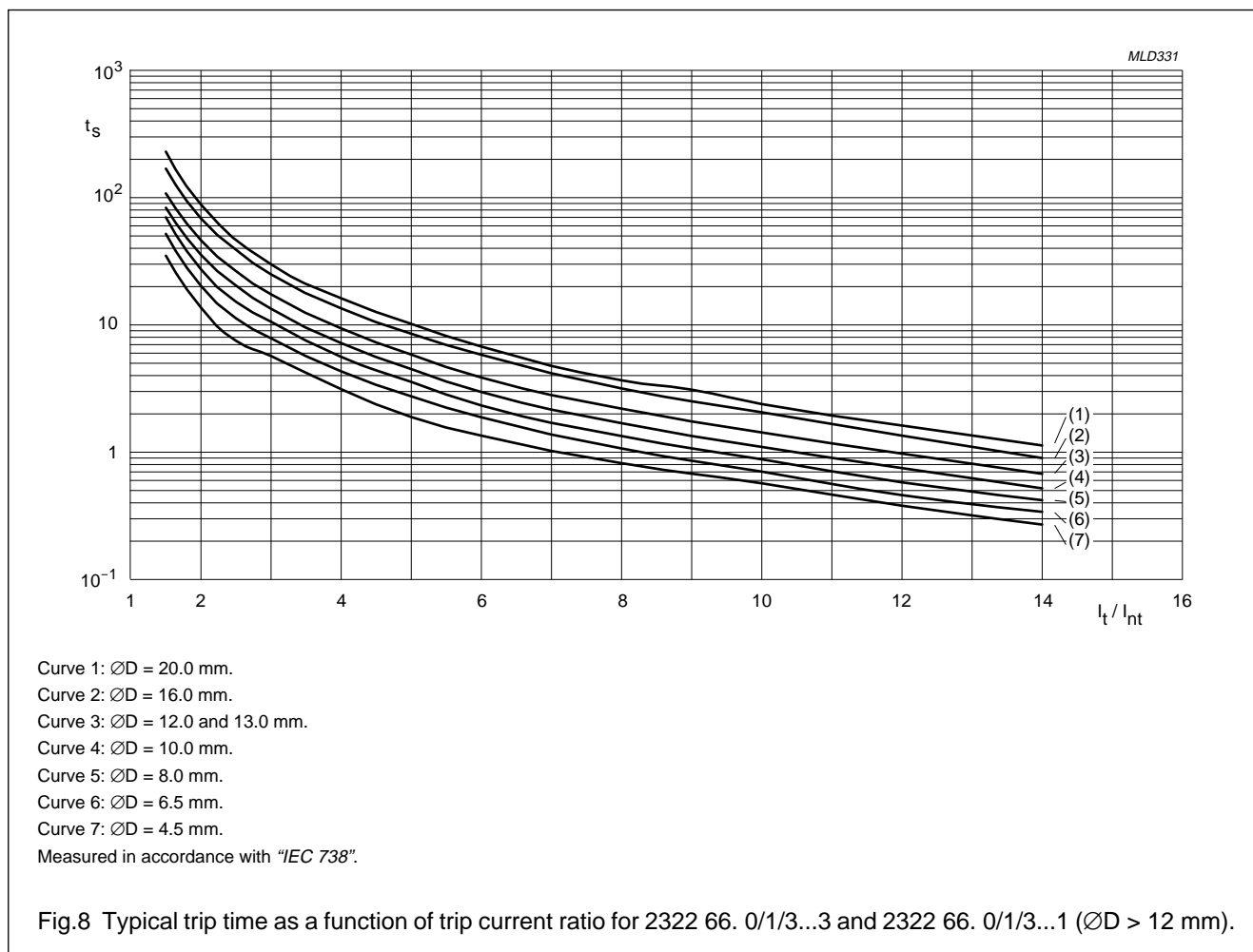
Curve 5:  $\varnothing D = 4.5\text{ mm}$ .

Measured in accordance with "IEC 738".

Fig.7 Typical trip time as a function of trip current ratio for 2322 66. 0/1/3...1.

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### Trip-time or switching time ( $t_s$ )

To check the trip-time for a specific PTC, refer to Table 3 or 4 for the value  $I_{nt}$ . Divide the overload or trip-current by this  $I_{nt}$  and you realize the factor  $I_t/I_{nt}$ . This rule is valid for any ambient temperature between 0 and 70 °C. Adapt the correct non-trip current with the appropriate curve in Fig.6. Figure 7 shows the relationship between the  $I_t/I_{nt}$  factor and the switching time as a function of the PTC diameter.

#### EXAMPLE

What will be the trip-time at  $I_{ol} = 3\text{ A}$  and  $T_{amb} = 10\text{ }^\circ\text{C}$  of a thermistor type 2322 662 12711; 6.5  $\Omega$ ;  $\varnothing D = 12\text{ mm}$ :

$I_{nt}$  from Table 3: 350 mA at 25 °C

$I_{nt}$ :  $350 \times 1.08 = 378\text{ mA}$  (10 °C).

Overload current = 3 A; factor:  $\frac{3}{0.378} = 7.94$ . In Fig.7 at the 12 mm line and  $I_t/I_{nt} = 7.94$ , the typical trip time is 1.6 s.

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### TESTS AND REQUIREMENTS

Clause numbers of tests and performance requirements refer to the "CECC draft secretariat 2371 (January 1989)". AQLs are selected from "IEC 410". Tables with requirements for lot by lot and periodic tests.

In these tables:

D = Destructive

ND = Non-destructive.

#### Acceptable quality level

CLAUSE NUMBER	TEST	D OR ND	CONDITIONS	PERFORMANCE
<b>Group A inspection (lot by lot)</b>				
SUB-GROUP A1		ND		
4.3.1	visual examination			no defect likely to impair function
4.3.2	marking			
4.3.3	dimensions (gauging)			as specified
SUB-GROUP A2		ND		
4.4	zero power resistance		temperature: 25 °C	as specified
4.21	tripping current		measured at 25 °C	as specified
4.22	non-tripping current		measured at 25 °C	as specified
4.23	residual current at $V_{max}$		measured at 25 °C	as specified
<b>Group B inspection (lot by lot)</b>				
SUB-GROUP B1		D		
4.13.1	soldering, solderability		solder bath method: 235 ±5 °C	the leads shall be evenly tinned

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CLAUSE NUMBER	TEST	D OR ND	CONDITIONS	PERFORMANCE
<b>Group C inspection (periodic)</b>				
SUB-GROUP C1		D		
4.20.1	endurance (cycling)		10 samples duration: 10 cycles temperature: 25 °C voltage: for 2322 66. 0/1/3....1, 56 V (DC) for 2322 66. 0/1/3....3, 265 V (RMS) $I_{max}$ : see Tables 3, 4 and Fig.6 cycle: 1 minute on and 9 minutes off visual examination zero power resistance at 25 °C	as in 4.20.1.8 $\Delta R/R: \leq \pm 10\%$
			10 samples duration: 10 cycles temperature: 0 °C voltage: for 2322 66. 0/1/3....1, 56 V (DC) for 2322 66. 0/1/3....3, 265 V (RMS) $I_{max}$ : see Tables 3, 4 and Fig.6 cycle: 1 minute on and 9 minutes off visual examination zero power resistance at 25 °C	as in 4.20.1.8 $\Delta R/R: \leq \pm 10\%$

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CLAUSE NUMBER	TEST	D OR ND	CONDITIONS	PERFORMANCE
SUB-GROUP C2		D		
4.12	robustness of terminations		half of the sample visual examination zero power resistance at 25 °C	as in 4.12.4; note 1 $\Delta R/R: \leq \pm 10\%$
4.13.2	resistance to soldering heat		test Tb of "IEC 68-2-20A" visual examination zero power resistance at 25 °C	as in 4.13.2.3 $\Delta R/R: \leq \pm 10\%$
4.14	rapid change of temperature		other half of the sample $T_A$ : lower category temperature: -25 °C $T_B$ : upper category temperature: +125 °C number of cycles: 5 visual examination zero power resistance at 25 °C	as in 4.14.4 $\Delta R/R: \leq \pm 10\%$
4.18 Climatic sequence			all the sample	as in 4.18.7.1
SUB-GROUP C3		D		
4.20.3	endurance at maximum rated temperature		duration: for 2322 66. 0/1/3....1 series, 24 hours at 70 °C and 56 V (DC) for 2322 66. 0/1/3....3 series, 24 hours at 70 °C and 265 V (RMS) examination at 24 hours visual examination zero power resistance at 25 °C	as in 4.20.3.10 $\Delta R/R: \leq \pm 10\%$
SUB-GROUP C4		D		
4.19	damp heat, steady state		visual examination zero power resistance at 25 °C	as in 4.19.5 $\Delta R/R: \leq \pm 10\%$

**Note**

1. Leads should neither come loose or break.