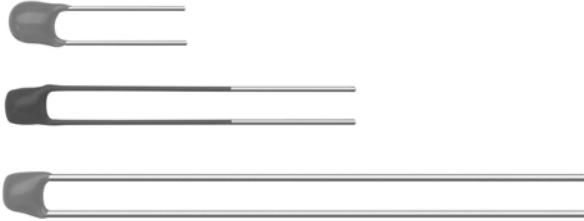


## NTC Thermistors, Accuracy Line



### QUICK REFERENCE DATA

PARAMETER	VALUE
Resistance value at 25 °C	2 to 470 kΩ
Tolerance on R <sub>25</sub> - value	± 5 %; ± 3 %; ± 2 %; ± 1 %
Tolerance on B <sub>25/85</sub> - value	± 2.5 to 0.5 %
Maximum dissipation	100 mW
Dissipation factor δ	2.2 mW/K
Response time; note 1	≈ 1.7 s
Thermal time constant τ	13 s
Operating temperature range at: zero dissipation (continuously)	- 40 to + 125 °C
zero dissipation (for short maximum dissipation (100 mW))	≤ 150 °C 0 to + 55 °C
Climatic category	40/125/56
Mass	≈ 0.11 g

#### Notes

- Response time in silicone oil MS200/50. This is the time needed for the sensor to reach 63.2 % of the total temperature difference when subjected to a temperature change from 25 °C in air to 85 °C in oil.
- Valid for all types with the exception of 2381 640 5.474.

### FEATURES

- Accurate over a wide temperature range (tolerance on B-value between 2.5 % and 0.5 %)
- Good stability over a long life
- Excellent price/performance ratio
- Flexible leads
- Low heat conductivity through 0.4 mm diameter Ni-leads
- Old part number was 2322 640 5....
- Component in accordance to RoHS 2002/95/EC and WEEE 2002/96/EC

### APPLICATIONS

- Temperature sensing and control

These thermistors have a negative temperature coefficient. The device consists of a chip with two tinned nickel leads and is color coded.

### PACKAGING

The thermistors are packed in cardboard boxes; the smallest packing quantity is 500 units.

### MARKING

The thermistors are marked with colored bands; see Dimensions and “Electrical data and ordering information”

### MOUNTING

By soldering in any position.

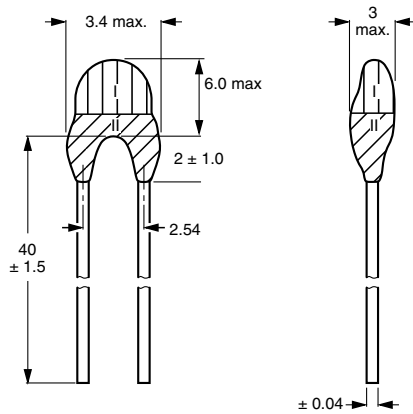
### ELECTRICAL DATA AND ORDERING INFORMATION

R <sub>25</sub> (kΩ)	B <sub>25/85</sub> - VALUE	12NC ORDERING CODE 2381 640 5....	SAP MATERIAL NO. NTCL202E3.....	CODING (see dimensions)	
				I	II
2	3528 K ± 0.5 %	*202	202*BO	orange	orange
2.7	3977 K ± 0.75 %	*272	272*BO	red	red
4.7	3977 K ± 0.75 %	*472	472*BO	green	green
5	3977 K ± 0.75%	*502	502*BO	black	white
10	3977 K ± 0.75 %	*103	103*BO	blue	blue
12	3740 K ± 2 %	*123	123*BO	yellow	yellow
22	3740 K ± 2 %	*223	223*BO	white	white
47	4090 K ± 1.5 %	*473	473*BO	black	black
68	4190 K ± 1.5 %	*683	683*BO	grey	grey
100	4190 K ± 1.5 %	*104	104*BO	brown	brown
470	4570 K ± 1.5 %	*474	474*BO	violet	violet

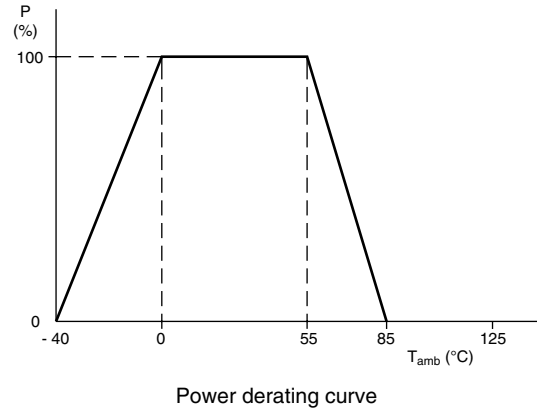
#### Notes

- replace \* in 12NC by 3 for ± 5 %, 6 for ± 3 %, 4 for ± 2 %, 5 for ± 1 %
- replace \* in SAP by J for ± 5 %, H for ± 3 %, G for ± 2 %, F for ± 1 %

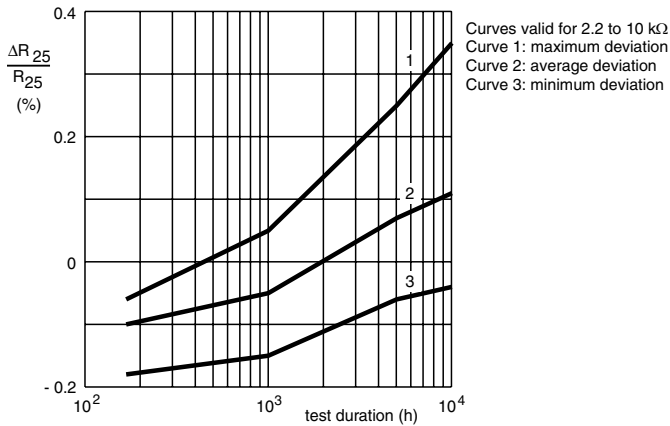
**DIMENSIONS** in millimeters



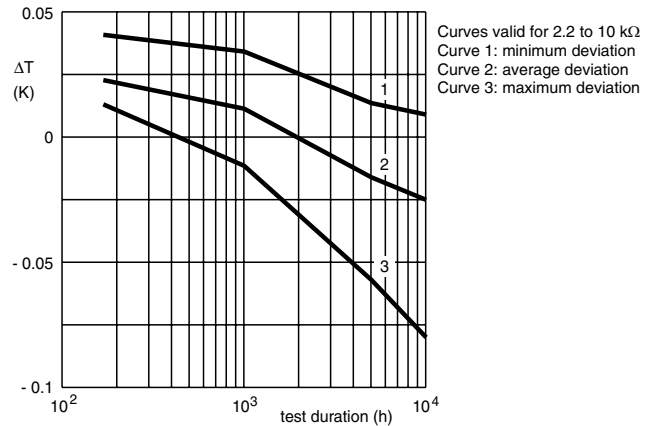
**DERATING AND LONG TERM STABILITY**



**LONG TERM STABILITY OF R<sub>25</sub> AS A FUNCTION OF TEST DURATION AT MAXIMUM TEMPERATURE (150 °C)**



**LONG TERM STABILITY OF T AS A FUNCTION OF TEST DURATION AT MAXIMUM TEMPERATURE (150 °C)**



<b>RESISTANCE VALUES AT INTERMEDIATE TEMPERATURES WITH R<sub>25</sub> AT 2 kΩ</b>				
T <sub>OPER</sub> (°C)	R <sub>T</sub> /R <sub>25</sub>	ΔR DUE TO B-TOLERANCE (%)	TCR (%/K)	R <sub>25</sub>
				2381 640 .....,; see note 1
-40	23.3402	1.65	-6.06	5.202
-35	17.3347	1.49	-5.84	46 684
-30	13.0166	1.34	-5.62	34 672
-25	9.8764	1.19	-5.42	26 035
-20	7.5682	1.05	-5.23	19 754
-15	5.8541	0.92	-5.05	15 138
-10	4.5688	0.79	-4.87	11 709
-5	3.5961	0.66	-4.71	9138
0	2.8533	0.54	-4.55	7193
5	2.2815	0.43	-4.40	5707
10	1.8376	0.31	-4.26	4563
15	1.4904	0.21	-4.12	3675
20	1.2169	0.10	-3.99	2981
25	1.0000	0.00	-3.87	2434
30	0.8266	0.10	-3.75	2000
35	0.6873	0.19	-3.63	1653
40	0.5746	0.28	-3.53	1375
45	0.4827	0.37	-3.42	1149
50	0.4073	0.46	-3.32	965.0
				814.7



<b>RESISTANCE VALUES AT INTERMEDIATE TEMPERATURES WITH R<sub>25</sub> AT 2 kΩ</b>				
T <sub>OPER</sub> (°C)	R <sub>T</sub> /R <sub>25</sub>	ΔR DUE TO B-TOLERANCE (%)	TCR (%/K)	R <sub>25</sub>
				2381 640 .....; see note 1
55	0.3452	0.54	- 3.23	5.202
60	0.2937	0.62	- 3.14	690.5
65	0.2508	0.70	- 3.05	587.5
70	0.2149	0.78	- 2.97	501.7
75	0.1847	0.85	- 2.89	429.8
80	0.1593	0.92	- 2.81	369.5
85	0.1377	0.99	- 2.73	318.6
90	0.1194	1.06	- 2.66	275.5
95	0.1038	1.13	- 2.59	238.9
100	0.09045	1.19	- 2.53	207.6
105	0.07900	1.25	- 2.46	180.9
110	0.06915	1.31	- 2.40	158.0
115	0.06066	1.37	- 2.34	138.3
120	0.05332	1.43	- 2.29	121.3
125	0.04696	1.49	- 2.23	106.6
130	0.04143	1.54	- 2.18	93.9
135	0.03662	1.60	- 2.13	82.9
140	0.03243	1.65	- 2.08	73.3
145	0.02877	1.70	- 2.03	64.9
150	0.02556	1.75	- 2.33	57.5
				51.1

<b>RESISTANCE VALUES AT INTERMEDIATE TEMPERATURES WITH R<sub>25</sub> AT 2.7 kΩ , 4.7 kΩ, 5 kΩ &amp; 10 kΩ</b>							
T <sub>OPER</sub> (°C)	R <sub>T</sub> /R <sub>25</sub>	ΔR DUE TO B-TOLERANCE (%)	TCR (%/K)	R <sub>25</sub>			
				2381 640 .....; see note 1			
				5.272	5.472	5.502	5.103
- 40	33.21	2.66	6.57	89.67	156.1	166.1	332.1
- 35	23.99	2.41	6.36	64.77	112.8	120.0	240.0
- 30	17.52	2.17	6.15	47.31	82.35	87.60	175.2
- 25	12.93	1.94	5.95	34.91	60.77	64.65	129.3
- 20	9.636	1.71	5.76	26.02	45.30	48.18	96.36
- 15	7.250	1.50	5.58	19.58	34.08	36.25	72.50
- 10	5.505	1.29	5.40	14.86	25.87	27.52	55.05
- 5	4.216	1.08	5.24	11.38	19.81	21.08	42.16
0	3.255	0.89	5.08	8.790	15.30	16.28	32.56
5	2.534	0.70	4.92	6.842	11.91	12.67	25.34
10	1.987	0.52	4.78	5.366	9.340	9.936	19.87
15	1.570	0.34	4.64	4.239	7.378	7.849	15.70
20	1.249	0.17	4.50	3.372	5.869	6.244	12.49
25	1.000	0.00	4.37	2.700	4.700	5.000	10.00
30	0.8059	0.16	4.25	2.176	3.788	4.030	8.059
35	0.6535	0.32	4.13	1.764	3.072	3.267	6.535
40	0.5330	0.47	4.02	1.439	2.505	2.665	5.330
45	0.4372	0.62	3.91	1.180	2.055	2.186	4.372
50	0.3605	0.77	3.80	0.973	1.694	1.803	3.606
55	0.2989	0.91	3.70	0.807	1.405	1.494	2.989
60	0.2490	1.05	3.60	0.672	1.170	1.245	2.490
65	0.2084	1.18	3.51	0.562	0.9797	1.042	2.084
70	0.1753	1.31	3.42	0.473	0.8239	0.8765	1.753
75	0.1481	1.44	3.33	0.399	0.6960	0.7405	1.481
80	0.1256	1.57	3.25	0.339	0.5905	0.6282	1.256
85	0.1070	1.69	3.16	0.289	0.5031	0.5352	1.070
90	0.09154	1.81	3.09	0.247	0.4303	0.4577	0.9154
95	0.07860	1.93	3.01	0.212	0.3694	0.3930	0.7860
100	0.06773	2.04	2.94	0.182	0.3183	0.3387	0.6773
105	0.05858	2.15	2.87	0.158	0.2753	0.2929	0.5858
110	0.05083	2.26	2.80	0.137	0.2389	0.2542	0.5083
115	0.04426	2.37	2.73	0.1195	0.2080	0.2213	0.4426
120	0.03866	2.47	2.67	0.1044	0.1817	0.1933	0.3866
125	0.03387	2.57	2.61	0.0915	0.1592	0.1694	0.3387

RESISTANCE VALUES AT INTERMEDIATE TEMPERATURES WITH R <sub>25</sub> AT 2.7 k $\Omega$ , 4.7 k $\Omega$ , 5 k $\Omega$ & 10 k $\Omega$							
T <sub>OPER</sub> (°C)	R <sub>T</sub> /R <sub>25</sub>	$\Delta$ R DUE TO B-TOLERANCE (%)	TCR (%/K)	R <sub>25</sub>			
				2381 640 .....; see note 1			
				5.272	5.472	5.502	5.103
130	0.02977	2.67	2.55	0.0804	0.1399	0.1488	0.2977
135	0.02624	2.77	2.49	0.0709	0.1233	0.1312	0.2624
140	0.02319	2.86	2.43	0.0626	0.1090	0.1160	0.2319
145	0.02055	2.96	2.38	0.0555	0.0966	0.1028	0.2055
150	0.01826	3.05	2.33	0.0493	0.0858	0.0913	0.1826

RESISTANCE VALUES AT INTERMEDIATE TEMPERATURES WITH R <sub>25</sub> AT 12 k $\Omega$ AND 22 k $\Omega$					
T <sub>AMB</sub> (°C)	R <sub>T</sub> /R <sub>25</sub>	$\Delta$ R DUE TO B-TOLERANCE (%)	TCR (%/K)	R <sub>25</sub>	
				2381 640 .....; see note 1	
				5.123	5.223
- 40	25.78	6.81	6.09	309.4	567.2
- 35	19.13	6.16	5.89	229.5	420.8
- 30	14.32	5.53	5.70	171.8	315.0
- 25	10.82	4.93	5.52	129.8	238.0
- 20	8.245	4.35	5.35	98.93	181.4
- 15	6.335	3.80	5.19	76.02	139.4
- 10	4.907	3.26	5.03	58.88	107.9
- 5	3.830	2.74	4.88	45.95	84.25
0	3.011	2.24	4.73	36.13	66.24
5	2.384	1.76	4.60	28.60	52.45
10	1.900	1.30	4.46	22.80	41.81
15	1.525	0.85	4.34	18.30	33.55
20	1.231	0.42	4.21	14.77	27.09
25	1.000	0.00	4.10	12.00	22.00
30	0.8170	0.41	3.98	9.804	17.97
35	0.6712	0.80	3.88	8.054	14.77
40	0.5543	1.19	3.77	6.652	12.20
45	0.4602	1.57	3.67	5.522	10.12
50	0.3839	1.94	3.57	4.607	8.447
55	0.3219	2.30	3.48	3.862	7.081
60	0.2710	2.65	3.39	3.252	5.963
65	0.2293	2.99	3.30	2.751	5.044
70	0.1947	3.33	3.22	2.337	4.284
75	0.1661	3.66	3.14	1.993	3.654
80	0.1422	3.98	3.06	1.707	3.129
85	0.1223	4.29	2.99	1.467	2.690
90	0.1055	4.60	2.92	1.266	2.321
95	0.09135	4.90	2.85	1.096	2.010
100	0.07937	5.19	2.78	0.9524	1.746
105	0.06919	5.48	2.71	0.8302	1.522
110	0.06050	5.76	2.65	0.7260	1.331
115	0.05307	6.04	2.59	0.6369	1.168
120	0.04670	6.31	2.53	0.5604	1.027
125	0.04121	6.57	2.47	0.4945	0.9065

RESISTANCE VALUES AT INTERMEDIATE TEMPERATURES WITH R <sub>25</sub> AT 47 k $\Omega$					
T <sub>AMB</sub> (°C)	R <sub>T</sub> /R <sub>25</sub>	$\Delta$ R DUE TO B-TOLERANCE (%)	TCR (%/K)	R <sub>25</sub>	
				2381 640 .....; see note 1	
				5.473	
- 40	33.81	5.55	6.55	1589	
- 35	24.50	5.02	6.34	1151	
- 30	17.93	4.52	6.15	842.8	
- 25	13.25	4.03	5.96	622.6	
- 20	9.875	3.56	5.78	464.1	
- 15	7.425	3.10	5.61	349.0	
- 10	5.630	2.67	5.45	264.6	
- 5	4.304	2.24	5.29	202.3	



<b>RESISTANCE VALUES AT INTERMEDIATE TEMPERATURES WITH R<sub>25</sub> AT 47 kΩ</b>					
T <sub>AMB</sub> (°C)	R <sub>T</sub> /R <sub>25</sub>	ΔR DUE TO B-TOLERANCE (%)	TCR (%/K)	R <sub>25</sub>	
				2381 640 .....; see note 1	
				5.473	
0	3.315	1.84	5.14	155.8	
5	2.573	1.44	4.99	120.9	
10	2.011	1.07	4.85	94.53	
15	1.583	0.70	4.72	74.40	
20	1.254	0.34	4.59	58.95	
25	1.000	0.00	4.46	47.00	
30	0.8024	0.33	4.34	37.71	
35	0.6474	0.66	4.23	30.43	
40	0.5255	0.98	4.12	24.70	
45	0.4288	1.28	4.01	20.15	
50	0.3518	1.59	3.91	16.53	
55	0.2901	1.88	3.81	13.63	
60	0.2403	2.17	3.71	11.30	
65	0.2001	2.45	3.62	9.404	
70	0.1674	2.72	3.53	7.865	
75	0.1406	2.99	3.44	6.607	
80	0.1186	3.25	3.36	5.573	
85	0.1004	3.51	3.28	4.721	
90	0.08542	3.76	3.20	4.015	
95	0.07292	4.00	3.13	3.427	
100	0.06248	4.24	3.06	2.936	
105	0.05372	4.47	2.98	2.525	
110	0.04635	4.70	2.92	2.179	
115	0.04013	4.93	2.85	1.886	
120	0.03485	5.15	2.79	1.638	
125	0.03037	5.36	2.73	1.427	
130	0.02654	5.57	2.67	1.247	
135	0.02326	5.78	2.61	1.093	
140	0.02044	5.98	2.55	0.9608	
145	0.01802	6.18	2.50	0.8468	
150	0.01592	6.37	2.44	0.7483	

<b>RESISTANCE VALUES AT INTERMEDIATE TEMPERATURES WITH R<sub>25</sub> AT 68 kΩ AND 100 kΩ</b>					
T <sub>AMB</sub> (°C)	R <sub>T</sub> /R <sub>25</sub>	ΔR DUE TO B-TOLERANCE (%)	TCR (%/K)	R <sub>25</sub>	
				2381 640 .....; see note 1	
				6.683	6.104
- 40	36.66	5.69	6.70	2493	3666
- 35	26.38	5.15	6.49	1794	2638
- 30	19.17	4.63	6.29	1303	1917
- 25	14.06	4.13	6.10	956.2	1406
- 20	10.41	3.65	5.92	708.0	1041
- 15	7.779	3.18	5.74	528.9	777.9
- 10	5.861	2.73	5.57	398.5	586.1
- 5	4.453	2.30	5.41	302.8	445.3
0	3.409	1.88	5.26	231.8	340.9
5	2.631	1.48	5.11	178.9	263.1
10	2.044	1.09	4.97	139.0	204.4
15	1.600	0.72	4.83	108.8	160.0
20	1.261	0.35	4.70	85.74	126.1
25	1.000	0.00	4.57	68.00	100.0
30	0.7981	0.34	4.45	54.27	79.81
35	0.6408	0.67	4.35	43.57	64.08
40	0.5175	1.00	4.22	35.19	51.74
45	0.4202	1.32	4.11	28.57	42.02
50	0.3431	1.63	4.00	23.33	34.31
55	0.2816	1.93	3.90	19.15	28.16
60	0.2322	2.22	3.80	15.79	23.22
65	0.1925	2.51	3.71	13.09	19.25
70	0.1602	2.79	3.62	10.90	16.03

<b>RESISTANCE VALUES AT INTERMEDIATE TEMPERATURES WITH R<sub>25</sub> AT 68 kΩ AND 100 kΩ</b>					
T <sub>AMB</sub> (°C)	R <sub>T</sub> /R <sub>25</sub>	ΔR DUE TO B-TOLERANCE (%)	TCR (%/K)	R <sub>25</sub>	
				2381 640 .....; see note 1	
				6.683	6.104
75	0.1340	3.06	3.53	9.114	13.40
80	0.1126	3.33	3.45	7.655	11.26
85	0.09496	3.59	3.36	6.457	9.496
90	0.08042	3.85	3.28	5.469	8.042
95	0.06837	4.10	3.21	4.649	6.837
100	0.05835	4.35	3.13	3.968	5.835
105	0.04998	4.59	3.06	3.399	4.998
110	0.04296	4.82	2.99	2.921	4.296
115	0.03705	5.05	2.92	2.519	3.705
120	0.03206	5.28	2.86	2.180	3.206
125	0.02783	5.50	2.80	1.892	2.783

<b>RESISTANCE VALUES AT INTERMEDIATE TEMPERATURES WITH R<sub>25</sub> AT 470 kΩ</b>					
T <sub>AMB</sub> (°C)	R <sub>T</sub> /R <sub>25</sub>	ΔR DUE TO B-TOLERANCE (%)	TCR (%/K)	R <sub>25</sub>	
				2381 640 .....; see note 1	
				5.474	22 850
- 40	48.62	6.22	7.13	16 068	11 413
- 35	34.19	5.63	6.91	8 185	5 926
- 30	24.28	5.06	6.71	4 329	3 190
- 25	17.42	4.51	6.52	2 371	1 776
- 20	12.61	3.98	6.33	1 342	1 021
- 15	9.211	3.47	6.15	783.0	604.6
- 10	6.788	2.98	5.98	470.0	367.8
- 5	5.045	2.51	5.82	289.6	229.5
0	3.781	2.06	5.66	182.9	146.7
5	2.855	1.62	5.50	118.2	95.80
10	2.173	1.19	5.36	78.03	63.88
15	1.666	0.78	5.22	52.55	43.43
20	1.286	0.38	5.08	36.05	30.06
25	1.000	0.00	4.95	25.16	21.15
30	0.7825	0.37	4.82	17.85	15.12
35	0.6163	0.74	4.70	12.86	10.97
40	0.4883	1.09	4.59	9.396	
45	0.3892	1.44	4.47		
50	0.3120	1.77	4.36		
55	0.2515	2.10	4.26		
60	0.2038	2.43	4.15		
65	0.1660	2.74	4.06		
70	0.1359	3.05	3.96		
75	0.1118	3.35	3.87		
80	0.09240	3.64	3.78		
85	0.07670	3.93	3.69		
90	0.06395	4.21	3.61		
95	0.05354	4.48	3.53		
100	0.04501	4.75	3.45		
105	0.03798	5.01	3.37		
110	0.03218	5.27	3.30		
115	0.02736	5.52	3.23		
120	0.02335	5.77	3.16		
125	0.01999	6.01	3.09		

**Note**

1. Replace dot in last 5 digits of catalog number by a number according to the following details and depending on tolerance on required R<sub>25</sub> - value: 4 for a tolerance of ± 2 %; 6 for a tolerance of ± 3 %; 3 for a tolerance of ± 5 %; 2 for a tolerance of ± 10 %.



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