

## SMD 0402, Glass Protected NTC Thermistors



QUICK REFERENCE DATA	
PARAMETER	VALUE
Resistance value at 25 °C	4.7 kΩ to 100 kΩ
Tolerance on $R_{25}$ - value	± 1 %; ± 2 %; ± 3 %; ± 5 %
$B_{25/85}$ value	3490K to 4075K
Tolerance on $B_{25/85}$ - value	± 3 %
Maximum dissipation at 25 °C	70 mW
Thermal time constant $\tau$	≈ 5 s
Dissipation factor D	≈ 2.0 mW/K
Operating temperature range at zero power	- 40 °C to + 150 °C
R/T values	See tables
Climatic category	40/125/56
Weight	≈ 0.0012 g

### FEATURES

- TCR ranging from - 6.5 %/K at - 40 °C to - 2 %/K at 150 °C
- Tolerance on  $R_{25}$  down to 1 %, and on  $B_{25/85}$  down to 3 %
- Suitable for wave or reflow soldering
- NiSn terminations
- Fully glass coated and protected
- Old part number was 2322 615 4....
- Compliant to RoHS directive 2002/95/EC and in accordance to WEEE 2002/96/EC


**RoHS**  
COMPLIANT

### APPLICATIONS

- Temperature sensing, protection and compensation in automotive, industrial, telecom and consumer applications. Examples are:
  - Battery chargers
  - Power suppliers
  - Office equipment
  - LCD compensation
  - In-car entertainment

### DESCRIPTION

Size 0402 chip thermistors with a negative temperature coefficient. The device has no marking.

### PACKAGING

Available in 8 mm punched paper tape on reel package of 10 000 units.

### DESIGN-IN SUPPORT

For complete Curve Computation, visit:

[www.vishay.com/thermistors/curve-computation-list/](http://www.vishay.com/thermistors/curve-computation-list/)

ELECTRICAL DATA AND ORDERING INFORMATION				
$R_{25}$ - VALUE (kΩ)	$B_{25/85}$ - VALUE (K)	TOLERANCE ON $B_{25/85}$ (%)	12NC ORDERING CODE 2381 615 4... (1)	SAP MATERIAL NO. NTCS0402E3... (2)
4.7	3595	± 3	*472	472*MT
10	3490	± 3	*103	103*LT
15	3965	± 3	*153	153*HT
22	3590	± 3	*223	223*MT
33	3670	± 3	*333	333*MT
47	4075	± 3	*473	473*XT
68	3910	± 3	*683	683*HT
100	3950	± 3	*104	104*HT

#### Notes

(1) Replace \* in 12NC by 3 for ± 5 %, 6 for ± 3 %, 4 for ± 2 %, 5 for ± 1 % tolerance on  $R_{25}$

(2) Replace \* in SAP by J for ± 5 %, H for ± 3 %, G for ± 2 %, F for ± 1 % tolerance on  $R_{25}$

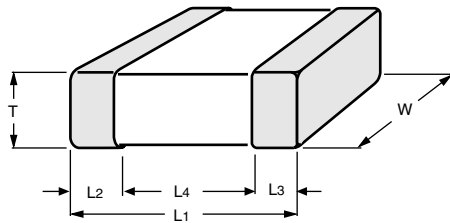
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## DIMENSIONS in millimeters



L <sub>1</sub>	W	T	L <sub>2</sub> and L <sub>3</sub> MIN.	L <sub>4</sub> MIN.
1.0 ± 0.15	0.5 ± 0.15	0.5 ± 0.15	0.1	0.3

For complete Curve Computation, visit: [www.vishay.com/thermistors/curve-computation-list/](http://www.vishay.com/thermistors/curve-computation-list/)

RESISTANCE VALUES AT INTERMEDIATE TEMPERATURES WITH R <sub>25</sub> AT 4.7 kΩ, 10 kΩ AND 15 kΩ							
T <sub>OPER</sub> [°C]	PART NUMBER 2381 615 4*472/ NTCS0402E3472*MT		PART NUMBER 2381 615 4*103/ NTCS0402E3103*LT		PART NUMBER 2381 615 4*153/ NTCS0402E3153*HT		ΔR/R DUE TO B <sub>tol</sub> [± %]
	R <sub>T</sub> [Ω]	TCR [%/K]	R <sub>T</sub> [Ω]	TCR [%/K]	R <sub>T</sub> [Ω]	TCR [%/K]	
-40	117 852	- 6.08	214 064	- 5.72	347 696	- 5.86	11.22
-35	87 377	- 5.89	161 527	- 5.55	260 574	- 5.68	10.14
-30	65 415	- 5.69	122 938	- 5.38	197 004	- 5.51	9.10
-25	49 435	- 5.51	94 353	- 5.21	150 213	- 5.34	8.11
-20	37 700	- 5.33	73 003	- 5.05	115 482	- 5.18	7.15
-15	29 003	- 5.16	56 928	- 4.90	89 489	- 5.02	6.24
-10	22 501	- 4.99	44 729	- 4.75	69 880	- 4.87	5.35
-5	17 599	- 4.83	35 402	- 4.61	54 973	- 4.73	4.50
0	13 873	- 4.68	28 217	- 4.47	43 555	- 4.59	3.68
5	11 019	- 4.53	22 643	- 4.33	34 747	- 4.45	2.89
10	8815.0	- 4.39	18 290	- 4.21	27 904	- 4.32	2.13
15	7101.0	- 4.26	14 867	- 4.08	22 552	- 4.20	1.40
20	5758.6	- 4.13	12 157	- 3.96	18 338	- 4.08	0.69
25	4700.0	- 4.00	10 000	- 3.85	15 000	- 3.96	0.00
30	3859.7	- 3.88	8271.8	- 3.74	12 340	- 3.85	0.66
35	3188.4	- 3.76	6879.3	- 3.63	10 207	- 3.74	1.31
40	2648.9	- 3.65	5751.0	- 3.53	8487.0	- 3.64	1.93
45	2212.7	- 3.55	4831.9	- 3.43	7092.9	- 3.54	2.53
50	1858.0	- 3.44	4079.3	- 3.34	5956.9	- 3.44	3.11
55	1568.1	- 3.34	3460.0	- 3.25	5026.4	- 3.35	3.68
60	1329.9	- 3.25	2947.8	- 3.16	4260.5	- 3.26	4.23
65	1133.1	- 3.16	2522.3	- 3.08	3627.1	- 3.18	4.76
70	969.76	- 3.07	2167.2	- 2.99	3100.9	- 3.09	5.28
75	833.56	- 2.98	1869.5	- 2.92	2661.8	- 3.01	5.78
80	719.47	- 2.90	1618.9	- 2.84	2293.9	- 3.01	6.27
85	623.48	- 2.83	1407.2	- 2.77	1984.3	- 3.01	6.74
90	542.38	- 2.75	1227.5	- 2.70	1722.7	- 2.99	7.20
95	473.58	- 2.68	1074.5	- 2.63	1500.9	- 2.99	7.65
100	414.98	- 2.61	943.67	- 2.56	1312.0	- 2.99	8.09
105	364.89	- 2.54	831.46	- 2.50	1150.7	- 2.99	8.51
110	321.91	- 2.47	734.86	- 2.44	1012.4	- 2.99	8.93
115	284.90	- 2.41	651.44	- 2.38	893.49	- 2.99	9.33
120	252.92	- 2.35	579.17	- 2.32	790.85	- 2.99	9.73
125	225.20	- 2.29	516.36	- 2.27	702.01	- 2.99	10.11
130	201.09	- 2.24	461.60	- 2.22	624.86	- 2.99	10.48
135	180.07	- 2.18	413.73	- 2.16	557.68	- 2.99	10.85
140	161.67	- 2.13	371.77	- 2.11	499.00	- 2.99	11.20
145	145.53	- 2.08	334.88	- 2.07	447.62	- 2.99	11.55
150	131.33	- 2.03	302.36	- 2.02	402.49	- 2.99	11.89



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<b>RESISTANCE VALUES AT INTERMEDIATE TEMPERATURES WITH <math>R_{25}</math> AT 22 k<math>\Omega</math>, 33 k<math>\Omega</math> AND 47 k<math>\Omega</math></b>							
$T_{OPER}$ [°C]	PART NUMBER 2381 615 4*223/ NTCS0402E3223*MT		PART NUMBER 2381 615 4*333/ NTCS0402E3333*MT		PART NUMBER 2381 615 4*473/ NTCS0402E3473*XT		$\Delta R/R$ DUE TO $B_{tol}$ [± %]
	$R_T$ [ $\Omega$ ]	TCR [%/K]	$R_T$ [ $\Omega$ ]	TCR [%/K]	$R_T$ [ $\Omega$ ]	TCR [%/K]	
-40	501 412	-5.84	831 939	-6.14	1 514 773	-6.19	11.22
-35	376 174	-5.66	615 449	-5.92	1 114 829	-6.07	10.14
-30	284 754	-5.48	460 194	-5.71	825 417	-5.95	9.10
-25	217 417	-5.31	347 596	-5.51	615 030	-5.82	8.11
-20	167 386	-5.15	265 065	-5.33	461 300	-5.69	7.15
-15	129 900	-4.99	203 964	-5.15	348 340	-5.55	6.24
-10	101 585	-4.84	158 295	-4.99	264 846	-5.41	5.35
-5	80 030	-4.70	123 854	-4.83	202 753	-5.27	4.50
0	63 497	-4.56	97 656	-4.68	156 285	-5.14	3.68
5	50 725	-4.43	77 566	-4.54	121 288	-5.00	2.89
10	40 787	-4.30	62 041	-4.40	94 762	-4.87	2.13
15	33 004	-4.17	49 955	-4.27	74 529	-4.74	1.40
20	26 868	-4.06	40 479	-4.15	58 997	-4.61	0.69
25	22 000	-3.94	33 000	-3.03	47 000	-4.48	0.00
30	18 115	-3.83	27 059	-3.91	37 675	-4.36	0.66
35	14 997	-3.73	22 311	-3.81	30 384	-4.24	1.31
40	12 480	-3.62	18 494	-3.70	24 649	-4.13	1.93
45	10 437	-3.53	15 408	-3.60	20 111	-4.01	2.53
50	8770.6	-3.43	12 900	-3.51	16 500	-3.90	3.11
55	7404.3	-3.34	10 850	-3.41	13 611	-3.80	3.68
60	6278.7	-3.25	9167.3	-3.33	11 286	-3.69	4.23
65	5347.1	-3.17	7778.9	-3.24	9406.7	-3.59	4.76
70	4572.5	-3.09	6628.2	-3.16	7878.8	-3.50	5.28
75	3925.6	-3.01	5670.2	-3.08	6630.6	-3.40	5.78
80	3383.3	-2.94	4869.3	-3.01	5606.0	-3.31	6.27
85	2926.6	-2.86	4197.0	-2.94	4760.9	-3.22	6.74
90	2540.7	-2.79	3630.4	-2.87	4060.8	-3.14	7.20
95	2213.2	-2.73	3151.1	-2.80	3478.2	-3.06	7.65
100	1934.4	-2.66	2744.1	-2.73	2991.2	-2.98	8.09
105	1696.1	-2.60	2397.3	-2.67	2582.5	-2.90	8.51
110	1491.8	-2.54	2100.7	-2.61	2238.1	-2.83	8.93
115	1316.1	-2.48	1846.4	-2.55	1946.8	-2.75	9.33
120	1164.4	-2.42	1627.5	-2.50	1699.4	-2.68	9.73
125	1033.1	-2.37	1438.5	-2.44	1488.5	-2.62	10.11
130	919.03	-2.31	1274.9	-2.39	1308.2	-2.55	10.48
135	819.74	-2.26	1132.8	-2.34	1153.4	-2.49	10.85
140	733.03	-2.21	1009.1	-2.29	1020.1	-2.43	11.20
145	657.10	-2.16	901.13	-2.24	904.86	-2.37	11.55
150	590.44	-2.12	806.58	-2.19	805.02	-2.31	11.89

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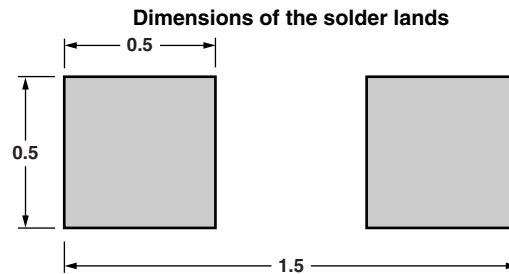
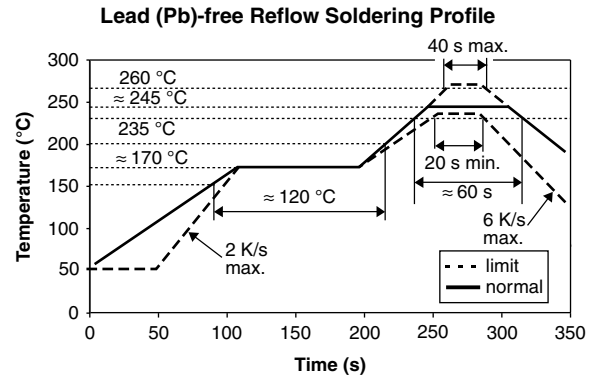
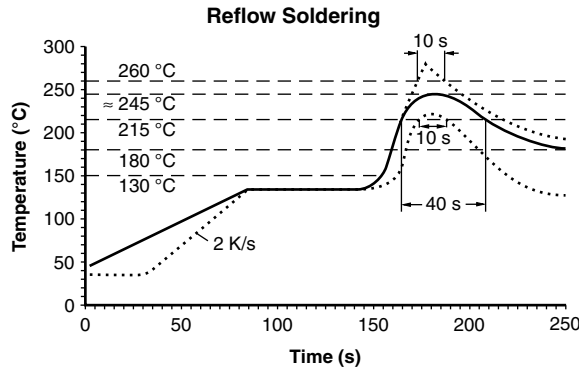
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<b>RESISTANCE VALUES AT INTERMEDIATE TEMPERATURES WITH <math>R_{25}</math> AT 68 k<math>\Omega</math> AND 100 k<math>\Omega</math></b>					
$T_{OPER}$ [°C]	PART NUMBER 2381 615 4*683/ NTCS0402E3683*HT		PART NUMBER 2381 615 4*104/ NTCS0402E3104*HT		$\Delta R/R$ DUE TO $B_{tol}$ [± %]
	$R_T$ [ $\Omega$ ]	TCR [%/K]	$R_T$ [ $\Omega$ ]	TCR [%/K]	
-40	2 179 612	-6.65	3 238 142	-6.57	11.22
-35	1 573 200	-6.40	2 344 882	-6.35	10.14
-30	1 149 311	-6.16	1 716 473	-6.13	9.10
-25	849 224	-5.94	1 269 493	-5.93	8.11
-20	634 231	-5.74	948 194	-5.74	7.15
-15	478 461	-5.54	714 901	-5.56	6.24
-10	364 399	-5.35	543 869	-5.38	5.35
-5	280 036	-5.18	417 320	-5.21	4.50
0	217 046	-5.01	322 855	-5.05	3.68
5	169 589	-4.86	251 741	-4.90	2.89
10	133 529	-4.71	197 771	-4.75	2.13
15	105 906	-4.56	156 492	-4.61	1.40
20	84 582	-4.43	124 685	-4.48	0.69
25	68 000	-4.30	100 000	-4.35	0.00
30	55 015	-4.18	80 711	-4.22	0.66
35	44 778	-4.06	65 539	-4.11	1.31
40	36 656	-3.95	53 530	-3.99	1.93
45	30 173	-3.84	43 967	-3.88	2.53
50	24 968	-3.74	36 306	-3.78	3.11
55	20 766	-3.64	30 135	-3.68	3.68
60	17 354	-3.54	25 138	-3.58	4.23
65	14 570	-3.45	21 069	-3.48	4.76
70	12 288	-3.36	17 740	-3.39	5.28
75	10 407	-3.28	15 003	-3.31	5.78
80	8851.1	-3.20	12 742	-3.22	6.27
85	7557.3	-3.12	10 867	-3.14	6.74
90	6477.3	-3.05	9303.8	-3.07	7.20
95	5572.1	-2.98	7996.1	-2.99	7.65
100	4810.3	-2.91	6897.4	-2.92	8.09
105	4166.9	-2.84	5970.8	-2.85	8.51
110	3621.4	-2.77	5186.3	-2.78	8.93
115	3157.3	-2.71	4519.8	-2.72	9.33
120	2761.2	-2.65	3951.5	-2.66	9.73
125	2421.9	-2.59	3465.3	-2.60	10.11
130	2130.4	-2.54	3048.0	-2.54	10.48
135	1879.2	-2.48	2688.7	-2.48	10.85
140	1662.0	-2.43	2378.3	-2.43	11.20
145	1473.7	-2.38	2109.4	-2.37	11.55
150	1310.1	-2.33	1875.8	-2.32	11.89

**SOLDERING CONDITIONS**

This SMD thermistor is only suitable for wave or reflow soldering, in accordance with "CECC 00802". The maximum temperature of 260 °C during 40 s should not be exceeded.

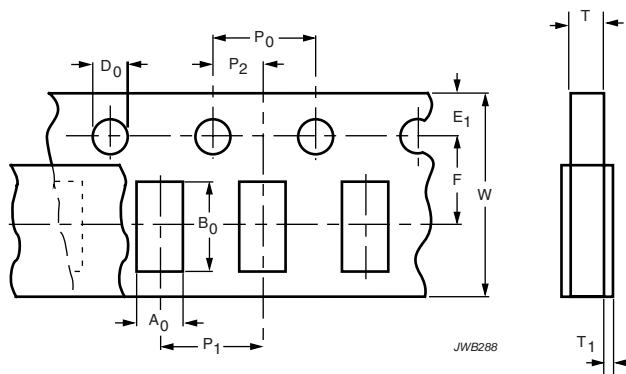
Typical examples of a soldering processes that will provide reliable joints without damage, are shown below.


**TESTS AND REQUIREMENTS**

SOLDERABILITY AND RESISTANCE TO SOLDERING HEAT				
IEC 60068-2-58	TEST METHOD	TEST	PROCEDURE	REQUIREMENTS
6	T <sub>C</sub>	Solderability	2 s at 235 °C	Min. 95 % of surface wetted
		Resistance to soldering heat	10 s at 260 °C	$\Delta R/R < 5\%$

**PACKAGING**
**TAPE SPECIFICATIONS**

All tape specifications are in accordance with "IEC 60286-3". Basic dimensions are given below. Carrier tape material is paper.

**PAPER TAPE**


DIMENSIONS OF PAPER TAPE in millimeters		
PARAMETER	DIMENSION	TOLERANCE
A <sub>0</sub> <sup>(1)</sup>	0.65	± 0.1
B <sub>0</sub> <sup>(1)</sup>	1.15	± 0.1
W	8.0	± 0.2
E <sub>1</sub>	1.75	± 0.1
F	3.5	± 0.05
D <sub>0</sub>	1.55	± 0.05
P <sub>0</sub> <sup>(2)</sup>	4.0	± 0.1
P <sub>1</sub>	4.0	± 0.1
P <sub>2</sub>	2.0	± 0.05
T tape thickness	0.8	max.
T <sub>1</sub> cover tape	< 0.1	-

**Notes**

<sup>(1)</sup> Measured 0.3 mm above base pocket

<sup>(2)</sup> P<sub>0</sub> pitch cumulative error over any 10 pitches ± 0.2 mm



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