

## 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  $R_{25}$

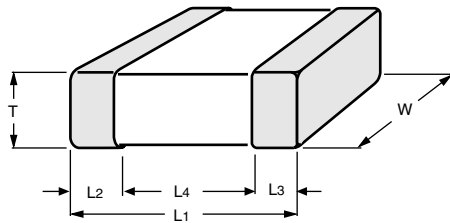
# 2381 615 4..../NTCS0402E3.....T



Vishay BCcomponents

SMD 0402, Glass Protected  
NTC Thermistors

## 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	- 3.04	6.27
85	623.48	- 2.83	1407.2	- 2.77	1984.3	- 3.06	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	- 2.92	7.65
100	414.98	- 2.61	943.67	- 2.56	1312.0	- 2.86	8.09
105	364.89	- 2.54	831.46	- 2.50	1150.7	- 2.80	8.51
110	321.91	- 2.47	734.86	- 2.44	1012.4	- 2.74	8.93
115	284.90	- 2.41	651.44	- 2.38	893.49	- 2.68	9.33
120	252.92	- 2.35	579.17	- 2.32	790.85	- 2.62	9.73
125	225.20	- 2.29	516.36	- 2.27	702.01	- 2.56	10.11
130	201.09	- 2.24	461.60	- 2.22	624.86	- 2.50	10.48
135	180.07	- 2.18	413.73	- 2.16	557.68	- 2.44	10.85
140	161.67	- 2.13	371.77	- 2.11	499.00	- 2.38	11.20
145	145.53	- 2.08	334.88	- 2.07	447.62	- 2.32	11.55
150	131.33	- 2.03	302.36	- 2.02	402.49	- 2.26	11.89



# 2381 615 4..../NTCS0402E3.....T

SMD 0402, Glass Protected  
NTC Thermistors

Vishay BCcomponents

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

<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

# 2381 615 4..../NTCS0402E3.....T



Vishay BCcomponents

SMD 0402, Glass Protected  
NTC Thermistors

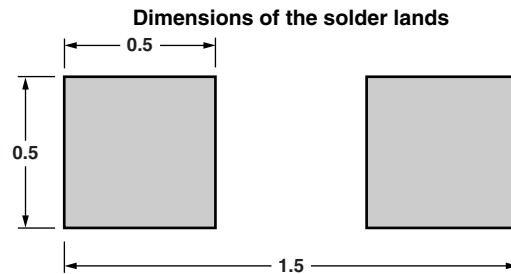
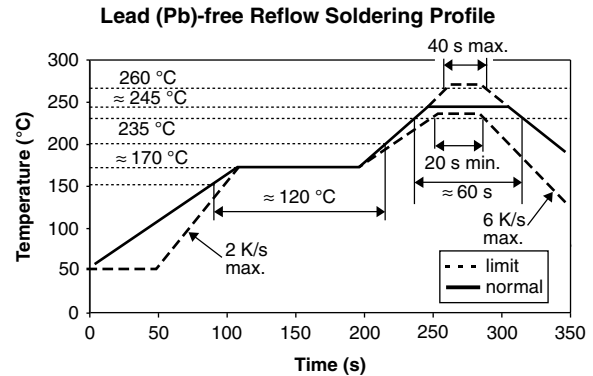
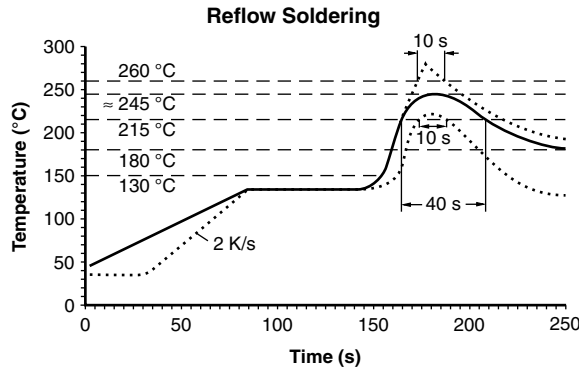
For complete Curve Computation, visit: [www.vishay.com/thermistors/curve-computation-list/](http://www.vishay.com/thermistors/curve-computation-list/)

<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.

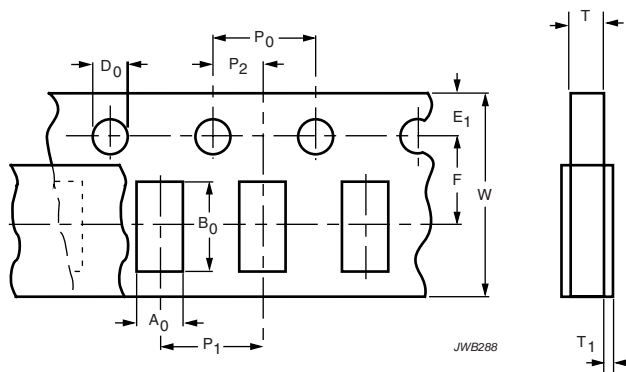
Typical examples of a soldering processes that will provide reliable joints without damage, are shown below.


**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



## Disclaimer

All product specifications and data are subject to change without notice.

Vishay Intertechnology, Inc., its affiliates, agents, and employees, and all persons acting on its or their behalf (collectively, "Vishay"), disclaim any and all liability for any errors, inaccuracies or incompleteness contained herein or in any other disclosure relating to any product.

Vishay disclaims any and all liability arising out of the use or application of any product described herein or of any information provided herein to the maximum extent permitted by law. The product specifications do not expand or otherwise modify Vishay's terms and conditions of purchase, including but not limited to the warranty expressed therein, which apply to these products.

No license, express or implied, by estoppel or otherwise, to any intellectual property rights is granted by this document or by any conduct of Vishay.

The products shown herein are not designed for use in medical, life-saving, or life-sustaining applications unless otherwise expressly indicated. Customers using or selling Vishay products not expressly indicated for use in such applications do so entirely at their own risk and agree to fully indemnify Vishay for any damages arising or resulting from such use or sale. Please contact authorized Vishay personnel to obtain written terms and conditions regarding products designed for such applications.

Product names and markings noted herein may be trademarks of their respective owners.