SMD 0603, Glass Protected NTC Thermistors

FEATURES

- TCR ranging from - 7 %/K at - 40 °C to - 2 %/K at 150 °C
- Tolerance on R_{25} down to 1 %, and on $B_{25/85}$ down to 1 %
- Suitable for wave or reflow soldering
- NiSn terminations
- Fully glass coated and protected
- cUL recognized for safety applications (file E148885)
- AEC-Q200 qualified
- Material categorization: For definitions of compliance please see www.vishay.com/doc?99912

AUTOMOTIVE GRADE

RoHS COMPLIANT

HALOGEN FREE

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 0603 chip thermistors with a negative temperature coefficient. The device has no marking.

PACKAGING

Available in 8 mm punched paper tape on reel package of 4000 units.

DESIGN-IN SUPPORT

For complete Curve Computation, visit:
www.vishay.com/resistors-non-linear/curve-computation-list/

QUICK REFERENCE DATA

PARAMETER	VALUE	UNIT
Resistance value at 25 °C	2.0K to 100K	Ω
Tolerance on R_{25}-value	± 1; ± 2; ± 3; ± 5	%
$B_{25/85}$-value	3420 to 4100	K
Tolerance on $B_{25/85}$-value	± 1	%
Maximum dissipation at 25 °C	125	mW
Thermal time constant τ	≈ 8	s
Dissipation factor D	3.0	mW/K
Operating temperature range at zero power	- 40 to + 150	°C
Weight	≈ 0.006	g

ELECTRICAL DATA AND ORDERING INFORMATION

R_{25}-VALUE (kΩ)	$B_{25/85}$-VALUE (K)	TOLERANCE ON $B_{25/85}$ (%)	SAP MATERIAL AND ORDERING NUMBER (1)
2.0	3420	± 1	NTCS0603E3202*LT (2)
2.2	3520	± 1	NTCS0603E3222*MT
2.7	3600	± 1	NTCS0603E3272*MT
4.7	3830	± 1	NTCS0603E3472*HT
10	3435	± 1	NTCS0603E3103*LT
10	3610	± 1	NTCS0603E3103*MT
10	3960	± 1	NTCS0603E3103*HT
15	3600	± 1	NTCS0603E3153*MT (3)
22	3730	± 1	NTCS0603E3223*MT
33	3860	± 1	NTCS0603E3333*HT
47	3960	± 1	NTCS0603E3473*HT
68	3985	± 1	NTCS0603E3683*HT
100	4100	± 1	NTCS0603E3104*XT

Notes

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

(2) Type NTCS0603E3202*LT only available in 5 % tolerance on R_{25}

(3) Type NTCS0603E3153*MT is not UL recognized

For technical questions, contact: nlr@vishay.com

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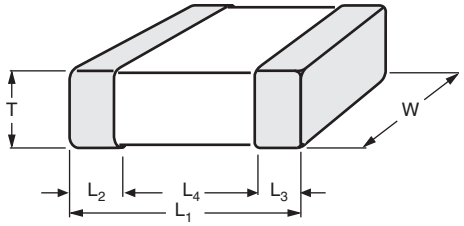
DIMENSIONS in millimeters



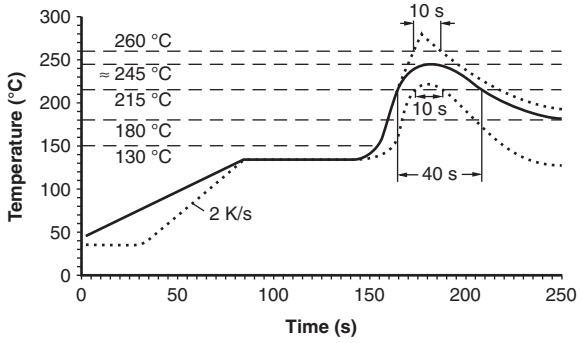
L_1	W	T	L_2 AND L_3 MIN.	L_4 MIN.
1.6 ± 0.15	0.8 ± 0.15	0.8 ± 0.15	0.2	0.4

SOLDERING CONDITIONS

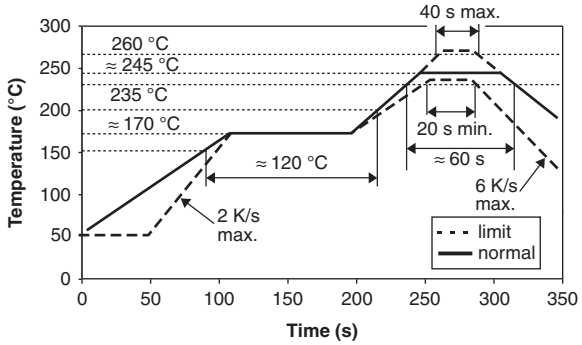
This SMD thermistor is only suitable for wave or reflow soldering, in accordance with JEDEC J-STD-020. The maximum temperature of 260 °C during 40 s should not be exceeded.

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

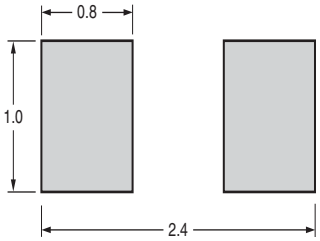
Reflow Soldering



Lead (Pb)-free Reflow Soldering Profile



Recommended solder land pattern dimensions (mm)

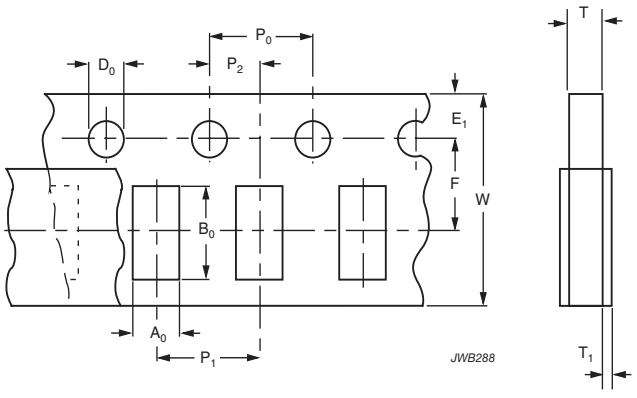


PACKAGING

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_0 (1)	1.15	± 0.1
B_0 (1)	1.9	± 0.1
W	8.0	± 0.2
E_1	1.75	± 0.1
F	3.5	± 0.05
D_0	1.55	± 0.05
P_0 (2)	4.0	± 0.1
P_1	4.0	± 0.1
P_2	2.0	± 0.05
T tape thickness	1.1	Max.
T_1 cover tape	< 0.1	-

Notes

(1) Measured 0.3 mm above base pocket

(2) P_0 pitch cumulative error over any 10 pitches ± 0.2 mm

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RESISTANCE VALUES AT INTERMEDIATE TEMPERATURES WITH R_{25} AT 2.0 kΩ, 2.2 kΩ, 2.7 kΩ, AND 4.7 kΩ								
T_{OPER} (°C)	PART NUMBER NTCS0603E3202*MT		PART NUMBER NTCS0603E3222*MT		PART NUMBER NTCS0603E3272*MT		PART NUMBER NTCS0603E3472*HT	
	R_T (Ω)	TCR (%/K)	R_T (Ω)	TCR (%/K)	R_T (Ω)	TCR (%/K)	R_T (Ω)	TCR (%/K)
- 40	44 297	- 5.93	53 503	- 6.11	65 247	- 6.26	152 832	- 6.66
- 35	33 114	- 5.71	39 637	- 5.89	48 436	- 6.03	110 192	- 6.43
- 30	25 010	- 5.51	29 680	- 5.68	36 340	- 5.82	80 369	- 6.20
- 25	19 076	- 5.32	22 451	- 5.48	27 539	- 5.61	59 267	- 5.98
- 20	14 687	- 5.14	17 149	- 5.29	21 069	- 5.42	44 170	- 5.78
- 15	11 410	- 4.96	13 221	- 5.11	16 265	- 5.23	33 252	- 5.58
- 10	8940.4	- 4.80	10 283	- 4.94	12 664	- 5.06	25 276	- 5.39
- 5	7062.8	- 4.64	8066.2	- 4.77	9940.1	- 4.89	19 392	- 5.21
0	5623.4	- 4.48	6378.5	- 4.62	7862.7	- 4.72	15 009	- 5.04
5	4510.9	- 4.34	5083.1	- 4.47	6265.2	- 4.57	11 716	- 4.87
10	3644.4	- 4.20	4080.7	- 4.32	5027.3	- 4.42	9219.5	- 4.71
15	2964.6	- 4.06	3299.2	- 4.18	4060.9	- 4.28	7311.4	- 4.56
20	2427.4	- 3.94	2685.5	- 4.05	3301.2	- 4.14	5841.3	- 4.42
25	**2000.0**	**- 3.81**	**2200.0**	**- 3.93**	**2700.0**	**- 4.02**	**4700.0**	**- 4.28**
30	1657.7	- 3.70	1813.5	- 3.80	2221.1	- 3.89	3807.5	- 4.15
35	1382.0	- 3.58	1503.7	- 3.69	1837.3	- 3.77	3104.5	- 4.02
40	1158.4	- 3.48	1253.9	- 3.58	1528.0	- 3.66	2547.2	- 3.90
45	976.12	- 3.37	1051.3	- 3.47	1277.2	- 3.55	2102.4	- 3.78
50	826.68	- 3.27	886.05	- 3.37	1072.8	- 3.45	1745.3	- 3.67
55	703.51	- 3.18	750.49	- 3.27	905.29	- 3.35	1456.8	- 3.56
60	601.48	- 3.09	638.72	- 3.18	767.40	- 3.25	1222.4	- 3.46
65	516.53	- 3.00	546.09	- 3.09	653.33	- 3.16	1030.9	- 3.36
70	445.49	- 2.92	468.95	- 3.00	558.52	- 3.07	873.61	- 3.26
75	385.79	- 2.84	404.41	- 2.92	479.37	- 2.99	743.79	- 3.17
80	335.42	- 2.76	350.18	- 2.84	413.02	- 2.90	636.11	- 3.08
85	292.73	- 2.69	304.40	- 2.76	357.17	- 2.83	546.36	- 3.00
90	256.40	- 2.61	265.61	- 2.69	309.97	- 2.75	471.22	- 2.92
95	225.37	- 2.55	232.60	- 2.62	269.92	- 2.68	408.03	- 2.84
100	198.77	- 2.48	204.39	- 2.55	235.83	- 2.61	354.67	- 2.77
105	175.88	- 2.42	180.22	- 2.49	206.70	- 2.54	309.43	- 2.69
110	156.11	- 2.35	159.41	- 2.42	181.72	- 2.48	270.91	- 2.62
115	138.98	- 2.29	141.44	- 2.36	160.24	- 2.41	238.01	- 2.56
120	124.09	- 2.24	125.88	- 2.3	141.70	- 2.35	209.79	- 2.49
125	111.11	- 2.18	112.35	- 2.25	125.65	- 2.30	185.50	- 2.43
130	99.757	- 2.13	100.55	- 2.19	111.72	- 2.24	164.53	- 2.37
135	89.796	- 2.08	90.239	- 2.14	99.589	- 2.19	146.36	- 2.31
140	81.033	- 2.03	81.192	- 2.09	88.997	- 2.13	130.57	- 2.26
145	73.304	- 1.98	73.235	- 2.04	79.724	- 2.08	116.80	- 2.20
150	66.468	- 1.94	66.218	- 1.99	71.585	- 2.04	104.76	- 2.15

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RESISTANCE VALUES AT INTERMEDIATE TEMPERATURES WITH R_{25} AT 10 kΩ, 15 kΩ, AND 22 kΩ

T_{OPER} (°C)	PART NUMBER NTCS0603E3103*LT		PART NUMBER NTCS0603E3103*MT		PART NUMBER NTCS0603E3103*HT		PART NUMBER NTCS0603E3153*MT		PART NUMBER NTCS0603E3223*MT	
	R_T (Ω)	TCR (%/K)	R_T (Ω)	TCR (%/K)	R_T (Ω)	TCR (%/K)	R_T (Ω)	TCR (%/K)	R_T (Ω)	TCR (%/K)
- 40	183 402	- 5.54	243 448	- 6.06	347 116	- 6.66	362 484	- 6.07	603 212	- 6.28
- 35	139 680	- 5.35	180 772	- 5.85	250 089	- 6.45	269 089	- 5.85	443 043	- 6.06
- 30	107 381	- 5.17	135 623	- 5.65	182 023	- 6.25	201 888	- 5.64	328 858	- 5.86
- 25	83 297	- 4.99	102 751	- 5.46	133 804	- 6.06	152 997	- 5.45	246 572	- 5.66
- 20	65 175	- 4.82	78 576	- 5.28	99 313	- 5.87	117 051	- 5.26	186 661	- 5.47
- 15	51 419	- 4.66	60 623	- 5.10	74 408	- 5.68	90 361	- 5.09	142 608	- 5.29
- 10	40 889	- 4.51	47 168	- 4.94	56 257	- 5.50	70 354	- 4.92	109 910	- 5.12
- 5	32 763	- 4.36	36 995	- 4.78	42 910	- 5.33	55 223	- 4.76	85 420	- 4.96
0	26 444	- 4.21	29 240	- 4.63	33 009	- 5.16	43 682	- 4.61	66 919	- 4.80
5	21 493	- 4.08	23 280	- 4.49	25 602	- 5.00	34 807	- 4.47	52 827	- 4.66
10	17 586	- 3.95	18 664	- 4.35	20 015	- 4.85	27 929	- 4.33	42 007	- 4.51
15	14 482	- 3.82	15 064	- 4.22	15 767	- 4.70	22 561	- 4.20	33 638	- 4.38
20	11 999	- 3.70	12 236	- 4.10	12 512	- 4.55	18 340	- 4.08	27 117	- 4.25
25	**10 000**	**- 3.59**	**10 000**	**- 3.98**	**10 000**	**- 4.41**	**15 000**	**- 3.96**	**22 000**	**- 4.12**
30	8355.2	- 3.56	8220.3	- 3.86	8046.8	- 4.28	12 340	- 3.85	17 958	- 4.00
35	7004.1	- 3.49	6795.2	- 3.75	6517.6	- 4.15	10 207	- 3.74	14 746	- 3.89
40	5891.3	- 3.43	5647.3	- 3.65	5312.5	- 4.03	8488.7	- 3.64	12 176	- 3.77
45	4972.5	- 3.36	4717.5	- 3.55	4356.6	- 3.91	7095.4	- 3.54	10 109	- 3.67
50	4211.6	- 3.29	3960.3	- 3.45	3593.6	- 3.79	5959.8	- 3.44	8435.9	- 3.57
55	3579.7	- 3.22	3340.4	- 3.36	2981.0	- 3.68	5029.4	- 3.35	7075.0	- 3.47
60	3053.3	- 3.15	2830.3	- 3.27	2486.2	- 3.58	4263.3	- 3.26	5962.1	- 3.38
65	2613.3	- 3.08	2408.6	- 3.18	2084.3	- 3.48	3629.6	- 3.18	5047.4	- 3.29
70	2244.5	- 3.01	2058.4	- 3.10	1756.2	- 3.38	3102.9	- 3.10	4292.0	- 3.20
75	1934.4	- 2.94	1766.2	- 3.02	1486.9	- 3.28	2663.2	- 3.02	3665.1	- 3.12
80	1672.8	- 2.87	1521.4	-2.95	1264.7	- 3.19	2294.6	- 2.94	3142.6	- 3.04
85	1451.3	- 2.81	1315.4	- 2.87	1080.6	- 3.10	1984.3	- 2.87	2705.2	- 2.96
90	1263.4	- 2.74	1141.4	- 2.80	927.23	- 3.02	1722.0	- 2.80	2337.6	- 2.88
95	1103.3	- 2.68	993.91	- 2.73	798.94	- 2.94	1499.6	- 2.73	2027.3	- 2.81
100	966.49	- 2.62	868.35	- 2.67	691.16	- 2.86	1310.2	- 2.67	1764.3	- 2.74
105	849.29	- 2.55	761.11	- 2.61	600.23	- 2.78	1148.3	- 2.61	1540.7	- 2.68
110	748.56	- 2.50	669.19	- 2.54	523.20	- 2.71	1009.6	- 2.55	1349.9	- 2.61
115	661.73	- 2.44	590.14	- 2.48	457.68	- 2.64	890.23	- 2.49	1186.4	- 2.55
120	586.65	- 2.38	521.94	- 2.43	401.76	- 2.57	787.23	- 2.43	1045.9	- 2.49
125	521.56	- 2.32	462.92	- 2.37	353.85	- 2.51	698.07	- 2.38	924.73	- 2.43
130	464.96	- 2.27	411.68	- 2.32	312.65	- 2.44	620.67	- 2.32	819.95	- 2.38
135	415.62	- 2.22	367.08	- 2.27	277.10	- 2.38	553.27	- 2.27	729.04	- 2.32
140	372.48	- 2.17	328.14	- 2.22	246.34	- 2.32	494.43	- 2.22	649.93	- 2.27
145	334.66	- 2.12	294.05	- 2.17	219.62	- 2.27	442.91	- 2.18	580.89	- 2.22
150	301.43	- 2.07	264.12	- 2.12	196.35	- 2.21	397.69	- 2.13	520.48	- 2.17

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RESISTANCE VALUES AT INTERMEDIATE TEMPERATURES WITH R_{25} AT 33 kΩ, 47 kΩ, 68 kΩ, AND 100 kΩ

T_{OPER} (°C)	PART NUMBER NTCS0603E3333*HT		PART NUMBER NTCS0603E3473*HT		PART NUMBER NTCS0603E3683*HT		PART NUMBER NTCS0603E3104*XT	
	R_T (Ω)	TCR (%/K)	R_T (Ω)	TCR (%/K)	R_T (Ω)	TCR (%/K)	R_T (Ω)	TCR (%/K)
- 40	1 061 183	- 6.70	1 643 693	- 6.85	2 324 376	- 6.77	3 921 252	- 7.03
- 35	764 125	- 6.44	1 174 859	- 6.59	1 667 529	- 6.52	2 774 565	- 6.77
- 30	557 158	- 6.20	850 461	- 6.34	1 211 148	- 6.28	1 988 706	- 6.52
- 25	411 058	- 5.97	623 018	- 6.11	889 917	- 6.05	1 442 861	- 6.28
- 20	306 646	- 5.75	461 557	- 5.89	661 047	- 5.84	1 058 901	- 6.06
- 15	231 157	- 5.55	345 583	- 5.69	496 103	- 5.64	785 573	- 5.85
- 10	175 977	- 5.36	261 354	- 5.49	375 941	- 5.45	588 793	- 5.65
- 5	135 223	- 5.18	199 536	- 5.31	287 504	- 5.28	445 602	- 5.47
0	104 827	- 5.01	153 714	- 5.13	221 786	- 5.11	340 346	- 5.29
5	81 946	- 4.84	119 427	- 4.97	172 502	- 4.95	262 229	- 5.12
10	64 569	- 4.69	93 541	- 4.81	135 221	- 4.79	203 723	- 4.96
15	51 262	- 4.54	73 832	- 4.66	106 786	- 4.65	159 522	- 4.80
20	40 989	- 4.40	58 703	- 4.52	84 928	- 4.51	125 851	- 4.66
25	**33 000**	**- 4.27**	**47 000**	**- 4.38**	**68 000**	**- 4.38**	**100 000**	**- 4.52**
30	26 741	- 4.14	37 881	- 4.25	54 796	- 4.26	80 003	- 4.39
35	21 804	- 4.02	30 726	- 4.13	44 427	- 4.14	64 422	- 4.26
40	17 884	- 3.91	25 073	- 4.01	36 232	- 4.02	52 200	- 4.14
45	14 751	- 3.80	20 579	- 3.89	29 714	- 3.91	42 548	- 4.02
50	12 234	- 3.69	16 984	- 3.79	24 499	- 3.81	34 879	- 3.91
55	10 198	- 3.59	14 092	- 3.68	20 304	- 3.71	28 749	- 3.80
60	8543.9	- 3.49	11 751	- 3.58	16 909	- 3.61	23 820	- 3.70
65	7191.9	- 3.40	9847.6	- 3.49	14 149	- 3.52	19 835	- 3.60
70	6081.4	- 3.31	8290.7	- 3.40	11 893	- 3.43	16 597	- 3.51
75	5164.9	- 3.22	7011.4	- 3.31	10 041	- 3.34	13 951	- 3.42
80	4405.0	- 3.14	5955.0	- 3.22	8512.2	- 3.26	11 780	- 3.33
85	3772.0	- 3.06	5078.7	- 3.14	7245.5	- 3.18	9988.4	- 3.25
90	3242.6	- 2.99	4348.7	- 3.07	6191.1	- 3.11	8504.3	- 3.17
95	2797.8	- 2.91	3737.8	- 2.99	5310.0	- 3.03	7269.4	- 3.09
100	2422.8	- 2.84	3224.6	- 2.92	4570.7	- 2.96	6237.5	- 3.02
105	2105.3	- 2.78	2791.8	- 2.85	3948.0	- 2.90	5371.7	- 2.95
110	1835.5	- 2.71	2425.3	- 2.87	3421.5	- 2.83	4642.5	- 2.88
115	1605.4	- 2.65	2113.9	- 2.72	2974.8	- 2.77	4025.9	- 2.81
120	1408.5	- 2.59	1848.4	- 2.65	2594.5	- 2.71	3502.7	- 2.75
125	1239.5	- 2.53	1621.2	- 2.59	2269.6	- 2.65	3057.1	- 2.68
130	1093.9	- 2.47	1426.1	- 2.54	1991.2	- 2.59	2676.4	- 2.62
135	968.07	- 2.42	1258.1	- 2.48	1751.9	- 2.53	2350.1	- 2.57
140	859.04	- 2.36	1112.9	- 2.42	1545.5	- 2.48	2069.5	- 2.51
145	764.28	- 2.31	987.19	- 2.37	1367.1	- 2.43	1827.4	- 2.46
150	681.69	- 2.26	877.91	- 2.32	1212.3	- 2.38	1617.9	- 2.40

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