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}

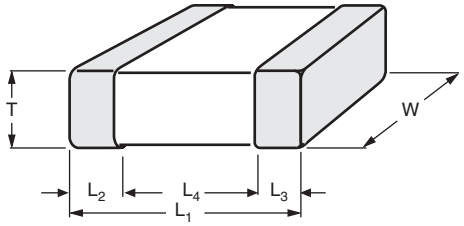
(2) Type NTCS0603E3202*LT only available in 5 % tolerance on R_{25}

(3) Type NTCS0603E3153*MT is not UL recognized

For technical questions, contact: nlr@vishay.com

THIS DOCUMENT IS SUBJECT TO CHANGE WITHOUT NOTICE. THE PRODUCTS DESCRIBED HEREIN AND THIS DOCUMENT ARE SUBJECT TO SPECIFIC DISCLAIMERS, SET FORTH AT www.vishay.com/doc?91000

DIMENSIONS in millimeters



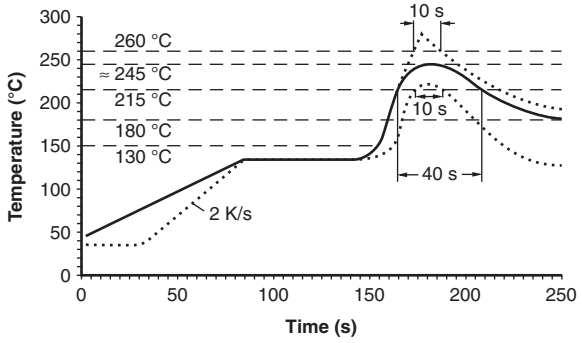
L_1	W	T	L_2 AND L_3 MIN.	L_4 MIN.
1.6 ± 0.15	0.8 ± 0.15	0.8 ± 0.15	0.2	0.4

SOLDERING CONDITIONS

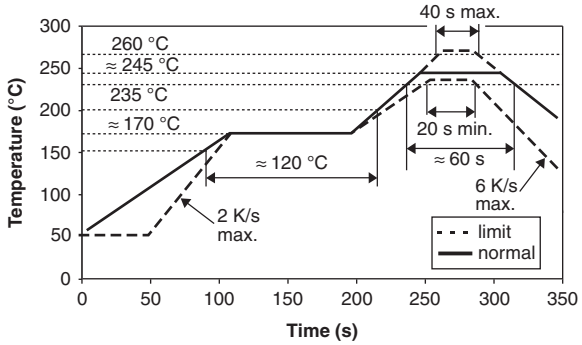
This SMD thermistor is only suitable for wave or reflow soldering, in accordance with JEDEC J-STD-020. The maximum temperature of 260 °C during 40 s should not be exceeded.

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

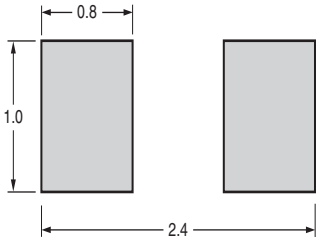
Reflow Soldering



Lead (Pb)-free Reflow Soldering Profile



Recommended solder land pattern dimensions (mm)

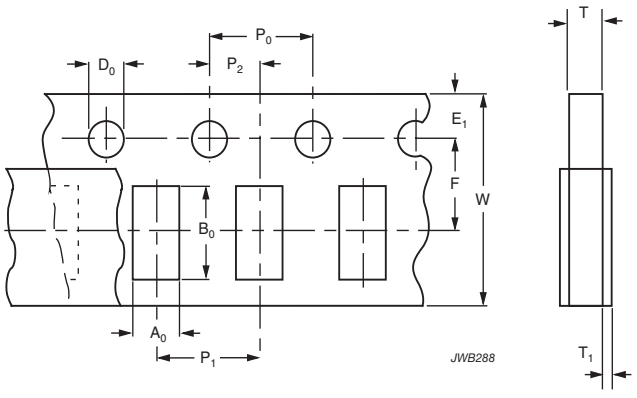


PACKAGING

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

For technical questions, contact: nlr@vishay.com

THIS DOCUMENT IS SUBJECT TO CHANGE WITHOUT NOTICE. THE PRODUCTS DESCRIBED HEREIN AND THIS DOCUMENT ARE SUBJECT TO SPECIFIC DISCLAIMERS, SET FORTH AT www.vishay.com/doc?91000

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

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

For technical questions, contact: nlr@vishay.com

THIS DOCUMENT IS SUBJECT TO CHANGE WITHOUT NOTICE. THE PRODUCTS DESCRIBED HEREIN AND THIS DOCUMENT ARE SUBJECT TO SPECIFIC DISCLAIMERS, SET FORTH AT www.vishay.com/doc?91000

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

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

For technical questions, contact: nlr@vishay.com

THIS DOCUMENT IS SUBJECT TO CHANGE WITHOUT NOTICE. THE PRODUCTS DESCRIBED HEREIN AND THIS DOCUMENT ARE SUBJECT TO SPECIFIC DISCLAIMERS, SET FORTH AT www.vishay.com/doc?91000

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

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

For technical questions, contact: nlr@vishay.com

THIS DOCUMENT IS SUBJECT TO CHANGE WITHOUT NOTICE. THE PRODUCTS DESCRIBED HEREIN AND THIS DOCUMENT ARE SUBJECT TO SPECIFIC DISCLAIMERS, SET FORTH AT www.vishay.com/doc?91000

Disclaimer

ALL PRODUCT, PRODUCT SPECIFICATIONS AND DATA ARE SUBJECT TO CHANGE WITHOUT NOTICE TO IMPROVE RELIABILITY, FUNCTION OR DESIGN OR OTHERWISE.

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 in any datasheet or in any other disclosure relating to any product.

Vishay makes no warranty, representation or guarantee regarding the suitability of the products for any particular purpose or the continuing production of any product. To the maximum extent permitted by applicable law, Vishay disclaims (i) any and all liability arising out of the application or use of any product, (ii) any and all liability, including without limitation special, consequential or incidental damages, and (iii) any and all implied warranties, including warranties of fitness for particular purpose, non-infringement and merchantability.

Statements regarding the suitability of products for certain types of applications are based on Vishay’s knowledge of typical requirements that are often placed on Vishay products in generic applications. Such statements are not binding statements about the suitability of products for a particular application. It is the customer’s responsibility to validate that a particular product with the properties described in the product specification is suitable for use in a particular application. Parameters provided in datasheets and/or specifications may vary in different applications and performance may vary over time. All operating parameters, including typical parameters, must be validated for each customer application by the customer’s technical experts. Product specifications do not expand or otherwise modify Vishay’s terms and conditions of purchase, including but not limited to the warranty expressed therein.

Except as expressly indicated in writing, Vishay products are not designed for use in medical, life-saving, or life-sustaining applications or for any other application in which the failure of the Vishay product could result in personal injury or death. Customers using or selling Vishay products not expressly indicated for use in such applications do so at their own risk. Please contact authorized Vishay personnel to obtain written terms and conditions regarding products designed for such applications.

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

Material Category Policy

Vishay Intertechnology, Inc. hereby certifies that all its products that are identified as RoHS-Compliant fulfill the definitions and restrictions defined under Directive 2011/65/EU of The European Parliament and of the Council of June 8, 2011 on the restriction of the use of certain hazardous substances in electrical and electronic equipment (EEE) - recast, unless otherwise specified as non-compliant.

Please note that some Vishay documentation may still make reference to RoHS Directive 2002/95/EC. We confirm that all the products identified as being compliant to Directive 2002/95/EC conform to Directive 2011/65/EU.

Vishay Intertechnology, Inc. hereby certifies that all its products that are identified as Halogen-Free follow Halogen-Free requirements as per JEDEC JS709A standards. Please note that some Vishay documentation may still make reference to the IEC 61249-2-21 definition. We confirm that all the products identified as being compliant to IEC 61249-2-21 conform to JEDEC JS709A standards.