

## SMD 0603, Glass Protected NTC Thermistors



QUICK REFERENCE DATA	
PARAMETER	VALUE
Resistance value at 25 °C	2.2 kΩ to 100 kΩ
Tolerance on $R_{25}$ - value	± 1 %; ± 2 %; ± 3 %; ± 5 %
$B_{25/85}$ value	3420K to 4100K
Tolerance on $B_{25/85}$ - value	± 1 %
Maximum dissipation at 25 °C	125 mW
Thermal time constant $\tau$	≈ 8 s
Dissipation factor D	3.0 mW/K
Operating temperature range at zero power	- 40 °C to + 150 °C
R/T values	See tables
Climatic category	40/125/56
Weight	≈ 0.006 g

### 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
- Old part number was 2322 615 3...
- 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 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/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 $B_{25/85}$ (%)	12 NC ORDERING CODE 2381 615 3... <sup>(1)</sup>	SAP MATERIAL NO. NTCS0603E3... <sup>(2)</sup>
2.0	3420	± 1	*202	202*LT
2.2	3520	± 1	*222	222*MT
2.7	3600	± 1	*272	272*MT
4.7	3830	± 1	*472	472*HT
10	3610	± 1	*103	103*MT
15	3600	± 1	*153	153*MT
22	3730	± 1	*223	223*MT
33	3860	± 1	*333	333*HT
47	3960	± 1	*473	473*HT
68	3985	± 1	*683	683*HT
100	4100	± 1	*104	104*XT

#### Notes

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

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

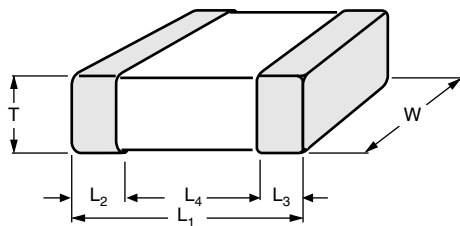
# 2381 615 3..../NTCS0603E3.....T



Vishay BCcomponents

SMD 0603, 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.
1.6 ± 0.15	0.8 ± 0.15	0.8 ± 0.15	0.2	0.4

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 2.0, 2.2 AND 2.7 kΩ							
T <sub>OPER</sub> [°C]	PART NUMBER 2381 615 3*202/ NTCS0603E3202*MT		PART NUMBER 2381 615 3*222/ NTCS0603E3222*MT		PART NUMBER 2381 615 3*272/ NTCS0603E3272*MT		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	44 297	-5.93	53 503	-6.11	65 247	-6.26	7.58
-35	33 114	-5.71	39 637	-5.89	48 436	-6.03	6.83
-30	25 010	-5.51	29 680	-5.68	36 340	-5.82	6.13
-25	19 076	-5.32	22 451	-5.48	27 539	-5.61	5.45
-20	14 687	-5.14	17 149	-5.29	21 069	-5.42	4.80
-15	11 410	-4.96	13 221	-5.11	16 265	-5.23	4.18
-10	8940.4	-4.80	10 283	-4.94	12 664	-5.06	3.58
-5	7062.8	-4.64	8066.2	-4.77	9940.1	-4.89	3.01
0	5623.4	-4.48	6378.5	-4.62	7862.7	-4.72	2.46
5	4510.9	-4.34	5083.1	-4.47	6265.2	-4.57	1.93
10	3644.4	-4.20	4080.7	-4.32	5027.3	-4.42	1.42
15	2964.6	-4.06	3299.2	-4.18	4060.9	-4.28	0.93
20	2427.4	-3.94	2685.5	-4.05	3301.2	-4.14	0.46
25	2000.0	-3.81	2200.0	-3.93	2700.0	-4.02	0.00
30	1657.7	-3.70	1813.5	-3.80	2221.1	-3.89	0.22
35	1382.0	-3.58	1503.7	-3.69	1837.3	-3.77	0.43
40	1158.4	-3.48	1253.9	-3.58	1528.0	-3.66	0.64
45	976.12	-3.37	1051.3	-3.47	1277.2	-3.55	0.84
50	826.68	-3.27	886.05	-3.37	1072.8	-3.45	1.03
55	703.51	-3.18	750.49	-3.27	905.29	-3.35	1.22
60	601.48	-3.09	638.72	-3.18	767.40	-3.25	1.40
65	516.53	-3.00	546.09	-3.09	653.33	-3.16	1.58
70	445.49	-2.92	468.95	-3.00	558.52	-3.07	1.75
75	385.79	-2.84	404.41	-2.92	479.37	-2.99	1.92
80	335.42	-2.76	350.18	-2.84	413.02	-2.90	2.08
85	292.73	-2.69	304.40	-2.76	357.17	-2.83	2.23
90	256.40	-2.61	265.61	-2.69	309.97	-2.75	2.54
95	225.37	-2.55	232.60	-2.62	269.92	-2.68	2.85
100	198.77	-2.48	204.39	-2.55	235.83	-2.61	3.14
105	175.88	-2.42	180.22	-2.49	206.70	-2.54	3.43
110	156.11	-2.35	159.41	-2.42	181.72	-2.48	3.71
115	138.98	-2.29	141.44	-2.36	160.24	-2.41	3.98
120	124.09	-2.24	125.88	-2.30	141.70	-2.35	4.24
125	111.11	-2.18	112.35	-2.25	125.65	-2.30	4.50
130	99.757	-2.13	100.55	-2.19	111.72	-2.24	4.76
135	89.796	-2.08	90.239	-2.14	99.589	-2.19	5.00
140	81.033	-2.03	81.192	-2.09	88.997	-2.13	5.25
145	73.304	-1.98	73.235	-2.04	79.724	-2.08	5.48
150	66.468	-1.94	66.218	-2.04	71.585	-2.04	5.71



# 2381 615 3.../NTCS0603E3.....T

SMD 0603, 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 4.7, 10 AND 15 k<math>\Omega</math></b>							
$T_{OPER}$ [°C]	PART NUMBER 2381 615 3*472/ NTCS0603E3472*HT		PART NUMBER 2381 615 3*103/ NTCS0603E3103*MT		PART NUMBER 2381 615 3*153/ NTCS0603E3153*MT		$\Delta R/R$ DUE TO $B_{tol}$ [± %]
	$R_T$ [ $\Omega$ ]	TCR [%/K]	$R_T$ [ $\Omega$ ]	TCR [%/K]	$R_T$ [ $\Omega$ ]	TCR [%/K]	
-40	152 832	- 6.66	243 448	- 6.06	362 484	- 6.07	7.58
-35	110 192	- 6.43	180 772	- 5.85	269 089	- 5.85	6.83
-30	80 369	- 6.20	135 623	- 5.65	201 888	- 5.64	6.13
-25	59 267	- 5.98	102 751	- 5.46	152 997	- 5.45	5.45
-20	44 170	- 5.78	78 576	- 5.28	117 051	- 5.26	4.80
-15	33 252	- 5.58	60 623	- 5.10	90 361	- 5.09	4.18
-10	25 276	- 5.39	47 168	- 4.94	70 354	- 4.92	3.58
-5	19 392	- 5.21	36 995	- 4.78	55 223	- 4.76	3.01
0	15 009	- 5.04	29 240	- 4.63	43 682	- 4.61	2.46
5	11 716	- 4.87	23 280	- 4.49	34 807	- 4.47	1.93
10	9219.5	- 4.71	18 664	- 4.35	27 929	- 4.33	1.42
15	7311.4	- 4.56	15 064	- 4.22	22 561	- 4.20	0.93
20	5841.3	- 4.42	12 236	- 4.10	18 340	- 4.08	0.46
25	4700.0	- 4.28	10 000	- 3.98	15 000	- 3.96	0.00
30	3807.5	- 4.15	8220.3	- 3.86	12 340	- 3.85	0.22
35	3104.5	- 4.02	6795.2	- 3.75	10 207	- 3.74	0.43
40	2547.2	- 3.90	5647.3	- 3.65	8488.7	- 3.64	0.64
45	2102.4	- 3.78	4717.5	- 3.55	7095.4	- 3.54	0.84
50	1745.3	- 3.67	3960.3	- 3.45	5959.8	- 3.44	1.03
55	1456.8	- 3.56	3340.4	- 3.36	5029.4	- 3.35	1.22
60	1222.4	- 3.46	2830.3	- 3.27	4263.3	- 3.26	1.40
65	1030.9	- 3.36	2408.6	- 3.18	3629.6	- 3.18	1.58
70	873.61	- 3.26	2058.4	- 3.10	3102.9	- 3.10	1.75
75	743.79	- 3.17	1766.2	- 3.02	2663.2	- 3.02	1.92
80	636.11	- 3.08	1521.4	- 2.95	2294.6	- 2.94	2.08
85	546.36	- 3.00	1315.4	- 2.87	1984.3	- 2.87	2.23
90	471.22	- 2.92	1141.4	- 2.80	1722.0	- 2.80	2.54
95	408.03	- 2.84	993.91	- 2.73	1499.6	- 2.73	2.85
100	354.67	- 2.77	868.35	- 2.67	1310.2	- 2.67	3.14
105	309.43	- 2.69	761.11	- 2.61	1148.3	- 2.61	3.43
110	270.91	- 2.62	669.19	- 2.54	1009.6	- 2.55	3.71
115	238.01	- 2.56	590.14	- 2.48	890.23	- 2.49	3.98
120	209.79	- 2.49	521.94	- 2.43	787.23	- 2.43	4.24
125	185.50	- 2.43	462.92	- 2.37	698.07	- 2.38	4.50
130	164.53	- 2.37	411.68	- 2.32	620.67	- 2.32	4.76
135	146.36	- 2.31	367.08	- 2.27	553.27	- 2.27	5.00
140	130.57	- 2.26	328.14	- 2.22	494.43	- 2.22	5.25
145	116.80	- 2.20	294.05	- 2.17	442.91	- 2.18	5.48
150	104.76	- 2.15	264.12	- 2.12	397.69	- 2.13	5.71

# 2381 615 3..../NTCS0603E3.....T



Vishay BCcomponents

SMD 0603, 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 22, 33 AND 47 k<math>\Omega</math></b>							
$T_{OPER}$ [°C]	PART NUMBER 2381 615 3*223/ NTCS0603E3223*MT		PART NUMBER 2381 615 3*333/ NTCS0603E3333*HT		PART NUMBER 2381 615 3*473/ NTCS0603E3473*HT		$\Delta R/R$ DUE TO $B_{tol}$ [± %]
	$R_T$ [ $\Omega$ ]	TCR [%/K]	$R_T$ [ $\Omega$ ]	TCR [%/K]	$R_T$ [ $\Omega$ ]	TCR [%/K]	
- 40	603 212	- 6.28	1 061 183	- 6.70	1 643 693	- 6.85	7.58
- 35	443 043	- 6.06	764 125	- 6.44	1 174 859	- 6.59	6.83
- 30	328 858	- 5.86	557 158	- 6.20	850 461	- 6.34	6.13
- 25	246 572	- 5.66	411 058	- 5.97	623 018	- 6.11	5.45
- 20	186 661	- 5.47	306 646	- 5.75	461 557	- 5.89	4.80
- 15	142 608	- 5.29	231 157	- 5.55	345 583	- 5.69	4.18
- 10	109 910	- 5.12	175 977	- 5.36	261 354	- 5.49	3.58
- 5	85 420	- 4.96	135 223	- 5.18	199 536	- 5.31	3.01
0	66 919	- 4.80	104 827	- 5.01	153 714	- 5.13	2.46
5	52 827	- 4.66	81 946	- 4.84	119 427	- 4.97	1.93
10	42 007	- 4.51	64 569	- 4.69	93 541	- 4.81	1.42
15	33 638	- 4.38	51 262	- 4.54	73 832	- 4.66	0.93
20	27 117	- 4.25	40 989	- 4.40	58 703	- 4.52	0.46
25	22 000	- 4.12	33 000	- 4.27	47 000	- 4.38	0.00
30	17 958	- 4.00	26 741	- 4.14	37 881	- 4.25	0.22
35	14 746	- 3.89	21 804	- 4.02	30 726	- 4.13	0.43
40	12 176	- 3.77	17 884	- 3.91	25 073	- 4.01	0.64
45	10 109	- 3.67	14 751	- 3.80	20 579	- 3.89	0.84
50	8435.9	- 3.57	12 234	- 3.69	16 984	- 3.79	1.03
55	7075.0	- 3.47	10 198	- 3.59	14 092	- 3.68	1.22
60	5962.1	- 3.38	8543.9	- 3.49	11 751	- 3.58	1.40
65	5047.4	- 3.29	7191.9	- 3.40	9847.6	- 3.49	1.58
70	4292.0	- 3.20	6081.4	- 3.31	8290.7	- 3.40	1.75
75	3665.1	- 3.12	5164.9	- 3.22	7011.4	- 3.31	1.92
80	3142.6	- 3.04	4405.0	- 3.14	5955.0	- 3.22	2.08
85	2705.2	- 2.96	3772.0	- 3.06	5078.7	- 3.14	2.23
90	2337.6	- 2.88	3242.6	- 2.99	4348.7	- 3.07	2.54
95	2027.3	- 2.81	2797.8	- 2.91	3737.8	- 2.99	2.85
100	1764.3	- 2.74	2422.8	- 2.84	3224.6	- 2.92	3.14
105	1540.7	- 2.68	2105.3	- 2.78	2791.8	- 2.85	3.43
110	1349.9	- 2.61	1835.5	- 2.71	2425.3	- 2.87	3.71
115	1186.4	- 2.55	1605.4	- 2.65	2113.9	- 2.72	3.98
120	1045.9	- 2.49	1408.5	- 2.59	1848.4	- 2.65	4.24
125	924.73	- 2.43	1239.5	- 2.53	1621.2	- 2.59	4.50
130	819.95	- 2.38	1093.9	- 2.47	1426.1	- 2.54	4.76
135	729.04	- 2.32	968.07	- 2.42	1258.1	- 2.48	5.00
140	649.93	- 2.27	859.04	- 2.36	1112.9	- 2.42	5.25
145	580.89	- 2.22	764.28	- 2.31	987.19	- 2.37	5.48
150	520.48	- 2.17	681.69	- 2.26	877.91	- 2.32	5.71



# 2381 615 3..../NTCS0603E3.....T

SMD 0603, Glass Protected  
NTC Thermistors

Vishay BCcomponents

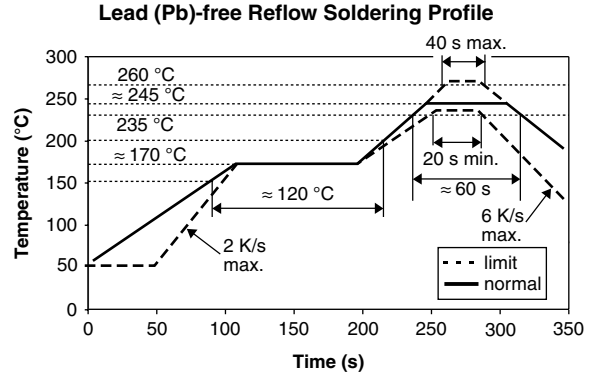
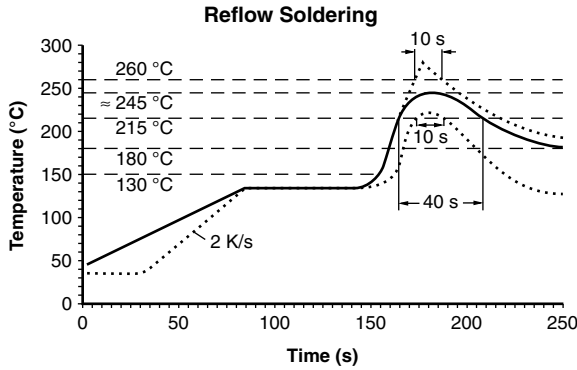
For complete Curve Computation, visit: [www.vishay.com/thermistors/curve-computation-list/](http://www.vishay.com/thermistors/curve-computation-list/)

<b>RESISTANCE VALUES AT INTERMEDIATE TEMPERATURES WITH <math>R_{25}</math> AT 68 AND 100 k<math>\Omega</math></b>					
$T_{OPER}$ [°C]	PART NUMBER 2381 615 3*683/ NTCS0603E3683*HT		PART NUMBER 2381 615 3*104/ NTCS0603E3104*XT		$\Delta R/R$ DUE TO $B_{tot}$ [± %]
	$R_T$ [ $\Omega$ ]	TCR [%/K]	$R_T$ [ $\Omega$ ]	TCR [%/K]	
-40	2 324 376	-6.77	3 921 252	-7.03	7.58
-35	1 667 529	-6.52	2 774 565	-6.77	6.83
-30	1 211 148	-6.28	1 988 706	-6.52	6.13
-25	889 917	-6.05	1 442 861	-6.28	5.45
-20	661 047	-5.84	1 058 901	-6.06	4.80
-15	496 103	-5.64	785 573	-5.85	4.18
-10	375 941	-5.45	588 793	-5.65	3.58
-5	287 504	-5.28	445 602	-5.47	3.01
0	221 786	-5.11	340 346	-5.29	2.46
5	172 502	-4.95	262 229	-5.12	1.93
10	135 221	-4.79	203 723	-4.96	1.42
15	106 786	-4.65	159 522	-4.80	0.93
20	84 928	-4.51	125 851	-4.66	0.46
25	68 000	-4.38	100 000	-4.52	0.00
30	54 796	-4.26	80 003	-4.39	0.22
35	44 427	-4.14	64 422	-4.26	0.43
40	36 232	-4.02	52 200	-4.14	0.64
45	29 714	-3.91	42 548	-4.02	0.84
50	24 499	-3.81	34 879	-3.91	1.03
55	20 304	-3.71	28 749	-3.80	1.22
60	16 909	-3.61	23 820	-3.70	1.40
65	14 149	-3.52	19 835	-3.60	1.58
70	11 893	-3.43	16 597	-3.51	1.75
75	10 041	-3.34	13 951	-3.42	1.92
80	8512.2	-3.26	11 780	-3.33	2.08
85	7245.5	-3.18	9988.4	-3.25	2.23
90	6191.1	-3.11	8504.3	-3.17	2.54
95	5310.0	-3.03	7269.4	-3.09	2.85
100	4570.7	-2.96	6237.5	-3.02	3.14
105	3948.0	-2.90	5371.7	-2.95	3.43
110	3421.5	-2.83	4642.5	-2.88	3.71
115	2974.8	-2.77	4025.9	-2.81	3.98
120	2594.5	-2.71	3502.7	-2.75	4.24
125	2269.6	-2.65	3057.1	-2.68	4.50
130	1991.2	-2.59	2676.4	-2.62	4.76
135	1751.9	-2.53	2350.1	-2.57	5.00
140	1545.5	-2.48	2069.5	-2.51	5.25
145	1367.1	-2.43	1827.4	-2.46	5.48
150	1212.3	-2.38	1617.9	-2.40	5.71

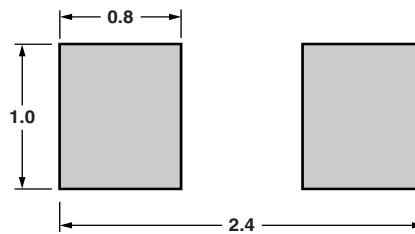
**SOLDERING CONDITIONS**

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.



Dimensions of the solder lands



**TESTS AND REQUIREMENTS**

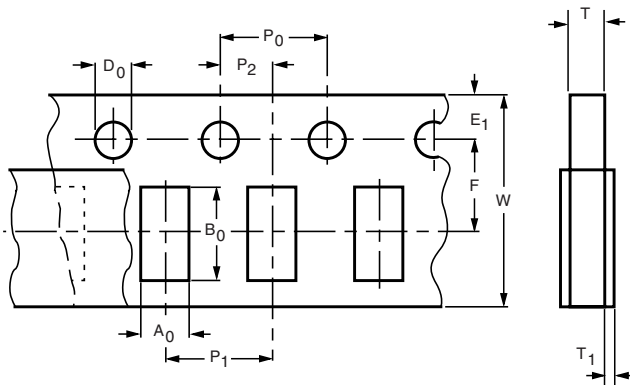
SOLDERABILITY AND RESISTANCE TO SOLDERING HEAT				
IEC 60068-2-58	TEST METHOD	TEST	PROCEDURE	REQUIREMENTS
6	T <sub>C</sub>	Solderability	2 s at 235 °C	Min. 95 % of surface wetted
		Resistance to soldering heat	10 s at 260 °C	$\Delta R/R < 5 \%$

**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>	1.15	± 0.1
B <sub>0</sub> <sup>(1)</sup>	1.9	± 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	1.1	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.