

## NTC Thermistors, Mini Epoxy PVC Insulated Leads



QUICK REFERENCE DATA		
PARAMETER	VALUE	UNIT
Resistance value at 25 °C	4.7K to 100K	Ω
Tolerance on $R_{25}$ -value	±1.0 to ± 5.0	%
$B_{25/85}$ -value	3435 to 4190	K
Tolerance on $B_{25/85}$	± 0.5 to ± 1.5	%
Operating temperature range at zero dissipation	- 40 to 105	°C
Maximum power dissipation at 55 °C	100	mW
Accuracy of temperature measurement (for 1% types)	± 0.5 between 0 and 40 ± 1.0 between - 40 and 80	°C
Dissipation factor $\delta$ (in still air)	≈ 3	mW/K
Response time (in oil)	≈ 2.5	s
Climatic category (LCT/UCT/days)	40/105/28	
Minimum dielectric withstanding voltage between leads and coated body	500	$V_{RMS}$
Weight (40 mm length)	0.2	g

### FEATURES

- High adhesive strength between the PVC wire and the encapsulating lacquer
- Accurate down to ± 0.3°C
- Small body of max. 3 mm for easy installation
- Material categorization:  
For definitions of compliance please see [www.vishay.com/doc?99912](http://www.vishay.com/doc?99912)


**RoHS**  
COMPLIANT

### APPLICATIONS

- Temperature measurement, sensing and control
- On battery packs, heat-sinks, tubing, enclosures, etc.

### DESCRIPTION

These sensors consist of small NTC chip soldered between stranded Awg#30, 105 °C resistant, PVC (UL2651), or PVC 105 °C single hook-up wires (acc. to UL1061). Terminations are solder dipped. They are lacquered and insulated with a black epoxy coating.

### MARKING

Black lacquered body without additional mark

### PACKAGING

SPQ: 125 items (for standard 40 mm lead wire length)

### MOUNTING

By soldering the wire end, or crimping connector. The body can be inserted in a tube, free in air, tape attached or glued. Not intended for fluid immersed applications or continuous contact with water. Not for potting in hard material or over-molding applications. Consult Vishay for specific application or mounting.

### DESIGN-IN SUPPORT

- For complete curve computation in °C or °F, visit: [www.vishay.com/resistors-non-linear/curve-computation-list](http://www.vishay.com/resistors-non-linear/curve-computation-list)
- Other R/T curves available on request
- The lead length can be customized
- Connectors can be added to the wire end

DIMENSIONS in millimeters		
Electronic components of assessed quality measured in accordance with IEC 60539-1		
Outline	NTCLE413E2	NTCLE428E3
<b>D</b>	Ø 3 max.	Ø 3 max.
<b>L</b>	40 ± 5 (or refer to table SAP description)	40 ± 5 (or refer to table SAP description)
<b>L1</b>	10 max.	10 max.
<b>L2</b>	3 ± 1	3 ± 1
<b>L3</b>	15 (for information)	-
<b>W</b>	2 (for information)	-
<b>Ø d</b>	1 (for information)	0.85 (for information)



GENERAL ORDER INFORMATION																									
PART NUMBER: NTC L E413 E2 103 H 400																									
<table border="1" style="width:100%; text-align:center;"> <tr> <td>N</td><td>T</td><td>C</td><td>L</td><td>E</td><td>4</td><td>1</td><td>3</td><td>E</td><td>2</td><td>1</td><td>0</td><td>3</td><td>H</td><td>4</td><td>0</td><td>0</td><td></td> </tr> </table>								N	T	C	L	E	4	1	3	E	2	1	0	3	H	4	0	0	
N	T	C	L	E	4	1	3	E	2	1	0	3	H	4	0	0									
PRODUCT FAMILY	EXECUTION	TYPE	RoHS COMPLIANCE TERMINATION TYPE	$R_{25}$ -VALUE	$R_{25}$ TOL.	LEAD LENGTH	ADDITIONAL INFORMATION																		
NTC	L = Leaded	<b>E413</b> = Epoxy, PVC Awg#30 105 °C UL2651 <b>E428</b> = Epoxy, PVC Awg#30 105°C single hook-up	<b>E2</b> = Sn alloy <b>E3</b> = Pure Sn <b>E4</b> = Pure metal (other than Sn)	<b>472</b> = $47 \times 10^2 \Omega = 4700 \Omega$ <b>502</b> = $50 \times 10^2 \Omega = 5000 \Omega$ <b>103</b> = $10 \times 10^3 \Omega = 10\,000 \Omega$ <b>473</b> = $47 \times 10^3 \Omega = 47\,000 \Omega$ <b>104</b> = $10 \times 10^4 \Omega = 100\,000 \Omega$  <b>Cxxxx</b> = Customized	<b>F</b> = 1 % <b>G</b> = 2 % <b>H</b> = 3 % <b>J</b> = 5 %	<b>abc</b> = $ab \times 10^c$ (in millimeters)  Examples: <b>400</b> = $40 \times 10^0 = 40 \text{ mm}$ <b>102</b> = $10 \times 10^2 = 1000 \text{ mm}$	<b>Blank</b> = No special  <b>Special <math>B_{25/85}</math> value:</b> <b>L</b> (low): $3000 \leq B_{25/85} < 3500$ <b>M</b> (medium): $3500 \leq B_{25/85} < 3750$ <b>H</b> (high): $3750 \leq B_{25/85} < 4000$ <b>X</b> (very high): $4000 \leq B_{25/85} < 4250$  <b>C:</b> With 2 poles connector MOLEX 50212-8000/ MOLEX 35507-0200, pitch 2 mm																		

ELECTRICAL DATA AND ORDERING INFORMATION								
SAP MATERIAL AND ORDERING NUMBER (2)		$R_{25}$		$B_{25/85}$		L		R/T TABLE
		k $\Omega$	$\pm$ %	K	$\pm$ %	mm	$\pm$ mm	
NTCLE413E2472H400	<b>NTCLE428E3472H400</b>	4.7	3	3984	0.5	40	5	Table 1
<b>NTCLE413E2502H400</b>	NTCLE428E3502H400	5	3	3984	0.5	40	5	Table 2
<b>NTCLE413E2103F400L</b>	<b>NTCLE428E3103F400L</b>	10	1	3435	1	40	5	Table 3
<b>NTCLE413E2103F520L</b>	<b>NTCLE428E3103F520L</b>	10	1	3435	1	52	5	Table 3
<b>NTCLE413E2103F102L</b>	-	10	1	3435	1	1000	20	Table 3
<b>NTCLE413E2103J520L</b>	-	10	5	3435	1	52	5	Table 4
<b>NTCLE413E2103H400</b>	<b>NTCLE428E3103H400</b>	10	3	3984	0.5	40	5	Table 5
NTCLE413E3103H301C (1)	NTCLE428E3103H301	10	3	3984	0.5	300	10	Table 5
NTCLE413E2103H401	-	10	3	3984	0.5	400	10	Table 5
NTCLE413E2473H400	NTCLE428E3473H400	47	3	4090	1.5	40	5	Table 6
NTCLE413E2104H400	-	100	3	4190	1.5	40	5	Table 7

**Note**

- (1) NTCLE413E2103H301C:  
 "C" = Connector MOLEX 50212-8000 or equivalent. Connector housing, 2 poles. MOLEX 35507-0200 Sherlock 2.0 mm.
- (2) Preferred types are marked in **bold**



Table 1

PART IDENTIFICATION	R <sub>25</sub>		B <sub>25/85</sub>	
	kΩ	± %	K	± %
NTCLE413-428 4.7K 3 % B3984 K	4.7	3	3984	0.5

RESISTANCE VALUES AT INTERMEDIATE TEMPERATURES							
TEMPERATURE (°C)	R <sub>T</sub> (Ω)	R <sub>T</sub> /R <sub>25</sub>	ΔR/R (%)	TCR (%/K)	ΔT (K)	R <sub>MIN.</sub> (Ω)	R <sub>MAX.</sub> (Ω)
- 40.0	157 109	33.427	4.92	- 6.63	0.74	149 382	164 836
- 35.0	113 422	24.132	4.73	- 6.41	0.74	108 052	118 791
- 30.0	82 782	17.613	4.56	- 6.19	0.74	79 010	86 555
- 25.0	61 053	12.990	4.39	- 5.99	0.73	58 375	63 731
- 20.0	45 478	9.6761	4.22	- 5.79	0.73	43 557	47 399
- 15.0	34 199	7.2765	4.07	- 5.61	0.73	32 809	35 590
- 10.0	25 953	5.5218	3.92	- 5.43	0.72	24 936	26 969
- 5.0	19 866	4.2268	3.77	- 5.26	0.72	19 117	20 615
0.0	15 333	3.2624	3.63	- 5.10	0.71	14 777	15 890
5.0	11 929	2.5381	3.49	- 4.94	0.71	11 512	12 346
10.0	9351.5	1.9897	3.36	- 4.80	0.70	9036.9	9666.2
15.0	7384.3	1.5711	3.24	- 4.65	0.70	7145.1	7623.5
20.0	5871.6	1.2493	3.12	- 4.52	0.69	5688.5	6054.6
25.0	4700.0	1.00000	3.00	- 4.39	0.68	4559.0	4841.0
30.0	3786.3	0.80560	3.11	- 4.26	0.73	3668.4	3904.2
35.0	3069.0	0.65297	3.22	- 4.14	0.78	2970.1	3167.9
40.0	2502.2	0.53239	3.33	- 4.03	0.83	2418.9	2585.5
45.0	2051.7	0.43653	3.43	- 3.92	0.88	1981.3	2122.1
50.0	1691.4	0.35987	3.53	- 3.81	0.93	1631.7	1751.1
55.0	1401.7	0.29823	3.63	- 3.71	0.98	1350.8	1452.5
60.0	1167.4	0.24838	3.72	- 3.61	1.03	1123.9	1210.9
65.0	976.97	0.20787	3.81	- 3.51	1.09	939.70	1014.2
70.0	821.40	0.17477	3.90	- 3.42	1.14	789.34	853.45
75.0	693.68	0.14759	3.99	- 3.34	1.20	666.02	721.35
80.0	588.35	0.12518	4.07	- 3.25	1.25	564.39	612.30
85.0	501.07	0.10661	4.15	- 3.17	1.31	480.26	521.88
90.0	428.45	0.091159	4.23	- 3.09	1.37	410.31	446.58
95.0	367.75	0.078246	4.31	- 3.02	1.43	351.91	383.60
100.0	316.83	0.067411	4.38	- 2.94	1.49	302.94	330.72
105.0	273.94	0.058284	4.46	- 2.87	1.55	261.73	286.14



Table 2

PART IDENTIFICATION	$R_{25}$		$B_{25/85}$	
	k $\Omega$	$\pm$ %	K	$\pm$ %
NTCLE413-428 5K 3 % B3984 K	5	3	3984	0.5

RESISTANCE VALUES AT INTERMEDIATE TEMPERATURES							
TEMPERATURE (°C)	$R_T$ ( $\Omega$ )	$R_T/R_{25}$	$\Delta R/R$ (%)	TCR (%/K)	$\Delta T$ (K)	$R_{MIN.}$ ( $\Omega$ )	$R_{MAX.}$ ( $\Omega$ )
-40.0	167 137	33.427	4.92	- 6.63	0.74	158 917	175 358
-35.0	120 661	24.132	4.73	- 6.41	0.74	114 949	126 373
-30.0	88 066	17.613	4.56	- 6.19	0.74	84 053	92 079
-25.0	64 950	12.990	4.39	- 5.99	0.73	62 101	67 799
-20.0	48 381	9.6761	4.22	- 5.79	0.73	46 337	50 424
-15.0	36 382	7.2765	4.07	- 5.61	0.73	34 903	37 862
-10.0	27 609	5.5218	3.92	- 5.43	0.72	26 528	28 690
-5.0	21 134	4.2268	3.77	- 5.26	0.72	20 337	21 931
0.0	16 312	3.2624	3.63	- 5.10	0.71	15 720	16 904
5.0	12 691	2.5381	3.49	- 4.94	0.71	12 247	13 134
10.0	9948.4	1.9897	3.36	- 4.80	0.70	9613.7	10 283
15.0	7855.6	1.5711	3.24	- 4.65	0.70	7601.2	8110.1
20.0	6246.4	1.2493	3.12	- 4.52	0.69	6051.6	6441.1
25.0	5000.0	1.00000	3.00	- 4.39	0.68	4850.0	5150.0
30.0	4028.0	0.80560	3.11	- 4.26	0.73	3902.6	4153.4
35.0	3264.9	0.65297	3.22	- 4.14	0.78	3159.6	3370.1
40.0	2661.9	0.53239	3.33	- 4.03	0.83	2573.3	2750.6
45.0	2182.6	0.43653	3.43	- 3.92	0.88	2107.7	2257.6
50.0	1799.4	0.35987	3.53	- 3.81	0.93	1735.8	1862.9
55.0	1491.1	0.29823	3.63	- 3.71	0.98	1437.0	1545.3
60.0	1241.9	0.24838	3.72	- 3.61	1.03	1195.7	1288.1
65.0	1039.3	0.20787	3.81	- 3.51	1.09	999.69	1079.0
70.0	873.83	0.17477	3.90	- 3.42	1.14	839.73	907.93
75.0	737.96	0.14759	3.99	- 3.34	1.20	708.53	767.39
80.0	625.90	0.12518	4.07	- 3.25	1.25	600.42	651.39
85.0	533.05	0.10661	4.15	- 3.17	1.31	510.92	555.19
90.0	455.79	0.091159	4.23	- 3.09	1.37	436.50	475.08
95.0	391.23	0.078246	4.31	- 3.02	1.43	374.37	408.08
100.0	337.06	0.067411	4.38	- 2.94	1.49	322.28	351.83
105.0	291.42	0.058284	4.46	- 2.87	1.55	278.44	304.41



Table 3

PART IDENTIFICATION	R <sub>25</sub>		B <sub>25/85</sub>	
	kΩ	± %	K	± %
NTCLE413-428 10K 1 % B3435 K	10	1	3435	1.0

RESISTANCE VALUES AT INTERMEDIATE TEMPERATURES							
TEMPERATURE (°C)	R <sub>T</sub> (Ω)	R <sub>T</sub> /R <sub>25</sub>	ΔR/R (%)	TCR (%/K)	ΔT (K)	R <sub>MIN.</sub> (Ω)	R <sub>MAX.</sub> (Ω)
- 40.0	190 953	19.095	4.24	- 5.46	0.78	182 848	199 057
- 35.0	145 953	14.595	3.93	- 5.30	0.74	140 213	151 693
- 30.0	112 440	11.244	3.63	- 5.14	0.71	108 354	116 526
- 25.0	87 285	8.7285	3.35	- 4.99	0.67	84 364	90 206
- 20.0	68 260	6.8260	3.07	- 4.85	0.63	66 164	70 355
- 15.0	53 762	5.3762	2.80	- 4.71	0.60	52 254	55 270
- 10.0	42 636	4.2636	2.55	- 4.57	0.56	41 549	43 723
- 5.0	34 038	3.4038	2.30	- 4.44	0.52	33 254	34 822
0.0	27 348	2.7348	2.07	- 4.31	0.48	26 783	27 913
5.0	22 108	2.2108	1.84	- 4.19	0.44	21 702	22 515
10.0	17 979	1.7979	1.62	- 4.08	0.40	17 689	18 270
15.0	14 706	1.4706	1.40	- 3.96	0.35	14 499	14 912
20.0	12 094	1.2094	1.20	- 3.86	0.31	11 949	12 239
25.0	10 000	1.0000	1.00	- 3.75	0.27	9900.0	10 100
30.0	8310.8	0.83108	1.19	- 3.65	0.33	8211.7	8409.8
35.0	6941.1	0.69411	1.38	- 3.55	0.39	6845.5	7036.7
40.0	5824.9	0.58249	1.56	- 3.46	0.45	5734.1	5915.6
45.0	4910.6	0.49106	1.73	- 3.37	0.51	4825.6	4995.7
50.0	4158.3	0.41583	1.90	- 3.28	0.58	4079.2	4237.3
55.0	3536.2	0.35362	2.06	- 3.20	0.65	3463.2	3609.2
60.0	3019.7	0.30197	2.22	- 3.12	0.71	2952.5	3086.8
65.0	2588.8	0.25888	2.38	- 3.04	0.78	2527.3	2650.4
70.0	2228.0	0.22280	2.53	- 2.96	0.85	2171.7	2284.3
75.0	1924.6	0.19246	2.67	- 2.89	0.92	1873.1	1976.0
80.0	1668.4	0.16684	2.81	- 2.82	1.00	1621.5	1715.3
85.0	1451.3	0.14513	2.95	- 2.75	1.07	1408.5	1494.2
90.0	1266.7	0.12667	3.08	- 2.69	1.15	1227.7	1305.8
95.0	1109.2	0.11092	3.21	- 2.62	1.22	1073.6	1144.8
100.0	974.26	0.097426	3.34	- 2.56	1.30	941.74	1006.8
105.0	858.33	0.085833	3.46	- 2.50	1.38	828.62	888.04



Table 4

PART IDENTIFICATION	$R_{25}$		$B_{25/85}$	
	k $\Omega$	$\pm$ %	K	$\pm$ %
NTCLE413-428 10K 5 % B3435 K	10	5	3435	1.0

RESISTANCE VALUES AT INTERMEDIATE TEMPERATURES							
TEMPERATURE (°C)	$R_T$ ( $\Omega$ )	$R_T/R_{25}$	$\Delta R/R$ (%)	TCR (%/K)	$\Delta T$ (K)	$R_{MIN.}$ ( $\Omega$ )	$R_{MAX.}$ ( $\Omega$ )
- 40.0	190 953	19.095	8.37	- 5.46	1.53	174 965	206 940
- 35.0	145 953	14.595	8.05	- 5.30	1.52	134 205	157 700
- 30.0	112 440	11.244	7.74	- 5.14	1.51	103 739	121 141
- 25.0	87 285	8.7285	7.44	- 4.99	1.49	80 792	93 779
- 20.0	68 260	6.8260	7.15	- 4.85	1.48	63 377	73 142
- 15.0	53 762	5.3762	6.88	- 4.71	1.46	50 066	57 459
- 10.0	42 636	4.2636	6.61	- 4.57	1.45	39 818	45 455
- 5.0	34 038	3.4038	6.35	- 4.44	1.43	31 875	36 201
0.0	27 348	2.7348	6.11	- 4.31	1.42	25 677	29 018
5.0	22 108	2.2108	5.87	- 4.19	1.40	20 810	23 406
10.0	17 979	1.7979	5.64	- 4.08	1.38	16 965	18 994
15.0	14 706	1.4706	5.42	- 3.96	1.37	13 908	15 503
20.0	12 094	1.2094	5.21	- 3.86	1.35	11 465	12 724
25.0	10 000	1.0000	5.00	- 3.75	1.33	9500.0	10 500
30.0	8310.8	0.83108	5.20	- 3.65	1.42	7878.6	8742.9
35.0	6941.1	0.69411	5.39	- 3.55	1.52	6566.8	7315.4
40.0	5824.9	0.58249	5.58	- 3.46	1.61	5499.8	6149.9
45.0	4910.6	0.49106	5.76	- 3.37	1.71	4627.7	5193.5
50.0	4158.3	0.41583	5.94	- 3.28	1.81	3911.4	4405.1
55.0	3536.2	0.35362	6.11	- 3.20	1.91	3320.3	3752.2
60.0	3019.7	0.30197	6.27	- 3.12	2.01	2830.3	3209.0
65.0	2588.8	0.25888	6.43	- 3.04	2.12	2422.3	2755.3
70.0	2228.0	0.22280	6.59	- 2.96	2.22	2081.2	2374.7
75.0	1924.6	0.19246	6.74	- 2.89	2.33	1794.9	2054.2
80.0	1668.4	0.16684	6.88	- 2.82	2.44	1553.5	1783.3
85.0	1451.3	0.14513	7.03	- 2.75	2.55	1349.4	1553.3
90.0	1266.7	0.12667	7.17	- 2.69	2.67	1176.0	1357.5
95.0	1109.2	0.11092	7.30	- 2.62	2.78	1028.2	1190.2
100.0	974.26	0.097426	7.43	- 2.56	2.90	901.86	1046.7
105.0	858.33	0.085833	7.56	- 2.50	3.02	793.45	923.21



Table 5

PART IDENTIFICATION	R <sub>25</sub>		B <sub>25/85</sub>	
	kΩ	± %	K	± %
NTCLE413-428 10K 3 % B3984 K	10	3	3984	0.5

RESISTANCE VALUES AT INTERMEDIATE TEMPERATURES							
TEMPERATURE (°C)	R <sub>T</sub> (Ω)	R <sub>T</sub> /R <sub>25</sub>	ΔR/R (%)	TCR (%/K)	ΔT (K)	R <sub>MIN.</sub> (Ω)	R <sub>MAX.</sub> (Ω)
- 40.0	334 274	33.427	4.92	- 6.63	0.74	317 833	350 716
- 35.0	241 323	24.132	4.73	- 6.41	0.74	229 899	252 747
- 30.0	176 133	17.613	4.56	- 6.19	0.74	168 106	184 159
- 25.0	129 900	12.990	4.39	- 5.99	0.73	124 201	135 599
- 20.0	96 761	9.6761	4.22	- 5.79	0.73	92 674	100 848
- 15.0	72 765	7.2765	4.07	- 5.61	0.73	69 806	75 724
- 10.0	55 218	5.5218	3.92	- 5.43	0.72	53 056	57 380
- 5.0	42 268	4.2268	3.77	- 5.26	0.72	40 674	43 861
0.0	32 624	3.2624	3.63	- 5.10	0.71	31 440	33 809
5.0	25 381	2.5381	3.49	- 4.94	0.71	24 494	26 268
10.0	19 897	1.9897	3.36	- 4.80	0.70	19 227	20 566
15.0	15 711	1.5711	3.24	-4.65	0.70	15 202	16 220
20.0	12 493	1.2493	3.12	- 4.52	0.69	12 103	12 882
25.0	10 000	1.00000	3.00	- 4.39	0.68	9700.0	10 300
30.0	8056.0	0.80560	3.11	- 4.26	0.73	7805.1	8306.8
35.0	6529.7	0.65297	3.22	- 4.14	0.78	6319.3	6740.2
40.0	5323.9	0.53239	3.33	- 4.03	0.83	5146.6	5501.1
45.0	4365.3	0.43653	3.43	- 3.92	0.88	4215.4	4515.1
50.0	3598.7	0.35987	3.53	- 3.81	0.93	3471.6	3725.8
55.0	2982.3	0.29823	3.63	- 3.71	0.98	2874.0	3090.5
60.0	2483.8	0.24838	3.72	- 3.61	1.03	2391.3	2576.3
65.0	2078.7	0.20787	3.81	- 3.51	1.09	1999.4	2157.9
70.0	1747.7	0.17477	3.90	- 3.42	1.14	1679.5	1815.9
75.0	1475.9	0.14759	3.99	- 3.34	1.20	1417.1	1534.8
80.0	1251.8	0.12518	4.07	- 3.25	1.25	1200.8	1302.8
85.0	1066.1	0.10661	4.15	- 3.17	1.31	1021.8	1110.4
90.0	911.59	0.091159	4.23	- 3.09	1.37	873.01	950.16
95.0	782.46	0.078246	4.31	- 3.02	1.43	748.75	816.17
100.0	674.11	0.067411	4.38	- 2.94	1.49	644.56	703.66
105.0	582.84	0.058284	4.46	- 2.87	1.55	556.87	608.82



Table 6

PART IDENTIFICATION	$R_{25}$		$B_{25/85}$	
	k $\Omega$	$\pm$ %	K	$\pm$ %
NTCLE413-428 47K 3 % B4090 K	47	3	4090	1.5

RESISTANCE VALUES AT INTERMEDIATE TEMPERATURES							
TEMPERATURE (°C)	$R_T$ ( $\Omega$ )	$R_T/R_{25}$	$\Delta R/R$ (%)	TCR (%/K)	$\Delta T$ (K)	$R_{MIN.}$ ( $\Omega$ )	$R_{MAX.}$ ( $\Omega$ )
-40.0	1 589 068	33.810	8.91	- 6.54	1.36	1 447 482	1 730 653
-35.0	1 151 627	24.503	8.34	- 6.34	1.32	1 055 560	1 247 693
-30.0	842 790	17.932	7.80	- 6.15	1.27	777 081	908 499
-25.0	622 597	13.247	7.27	- 5.96	1.22	577 315	667 878
-20.0	464 110	9.8747	6.77	- 5.79	1.17	432 690	495 530
-15.0	348 989	7.4253	6.29	- 5.62	1.12	327 051	370 927
-10.0	264 628	5.6304	5.82	- 5.45	1.07	249 224	280 032
-5.0	202 280	4.3038	5.37	- 5.30	1.01	191 412	213 148
0.0	155 823	3.3154	4.94	- 5.14	0.96	148 124	163 522
5.0	120 932	2.5730	4.52	- 5.00	0.91	115 460	126 404
10.0	94 528	2.0112	4.12	- 4.86	0.85	90 630	98 425
15.0	74 399	1.5830	3.74	- 4.72	0.79	71 619	77 178
20.0	58 945	1.2542	3.36	- 4.59	0.73	56 964	60 927
25.0	47 000	1.0000	3.00	- 4.47	0.67	45 590	48 410
30.0	37 706	0.80226	3.35	- 4.35	0.77	36 443	38 969
35.0	30 429	0.64743	3.69	- 4.23	0.87	29 307	31 551
40.0	24 696	0.52545	4.02	- 4.12	0.97	23 705	25 688
45.0	20 154	0.42880	4.33	- 4.01	1.08	19 281	21 027
50.0	16 534	0.35178	4.64	- 3.91	1.19	15 767	17 301
55.0	13 633	0.29006	4.94	- 3.81	1.30	12 960	14 306
60.0	11 296	0.24035	5.23	- 3.71	1.41	10 706	11 887
65.0	9404.5	0.20010	5.51	- 3.62	1.52	8886.6	9922.3
70.0	7865.2	0.16735	5.78	- 3.53	1.64	7410.7	8319.7
75.0	6606.9	0.14057	6.04	- 3.44	1.75	6207.6	7006.2
80.0	5573.5	0.11858	6.30	- 3.36	1.87	5222.3	5924.6
85.0	4721.0	0.10045	6.55	- 3.28	2.00	4411.8	5030.2
90.0	4014.7	0.085420	6.79	- 3.20	2.12	3742.0	4287.4
95.0	3427.2	0.072919	7.03	- 3.13	2.25	3186.3	3668.1
100.0	2936.5	0.062478	7.26	- 3.05	2.38	2723.3	3149.6
105.0	2525.0	0.053723	7.48	- 2.98	2.51	2336.1	105.0





Table 7

PART IDENTIFICATION	$R_{25}$		$B_{25/85}$	
	k $\Omega$	$\pm$ %	K	$\pm$ %
NTCLE413-428 100K 3 % B4190 K	100	3	4190	1.5

RESISTANCE VALUES AT INTERMEDIATE TEMPERATURES							
TEMPERATURE (°C)	$R_T$ ( $\Omega$ )	$R_T/R_{25}$	$\Delta R/R$ (%)	TCR (%/K)	$\Delta T$ (K)	$R_{MIN.}$ ( $\Omega$ )	$R_{MAX.}$ ( $\Omega$ )
-40.0	3 666 299	36.663	9.05	- 6.69	1.35	3 334 354	3 998 244
-35.0	2 637 588	26.376	8.47	- 6.49	1.31	2 414 139	2 861 036
-30.0	1 916 576	19.166	7.91	- 6.29	1.26	1 764 917	2 068 236
-25.0	1 406 111	14.061	7.38	- 6.10	1.21	1 302 387	1 509 836
-20.0	1 041 184	10.412	6.86	- 5.92	1.16	969 745	1 112 622
-15.0	777 846	7.7785	6.37	- 5.75	1.11	728 330	827 362
-10.0	586 097	5.8610	5.89	- 5.58	1.06	551 581	620 613
-5.0	445 257	4.4526	5.43	- 5.42	1.00	421 079	469 435
0.0	340 942	3.4094	4.99	- 5.26	0.95	323 936	357 948
5.0	263 054	2.6305	4.56	- 5.11	0.89	251 054	275 054
10.0	204 446	2.0445	4.15	- 4.97	0.84	195 960	212 931
15.0	160 014	1.6001	3.75	- 4.83	0.78	154 008	166 020
20.0	126 087	1.2609	3.37	- 4.70	0.72	121 837	130 336
25.0	100 000	1.00000	3.00	- 4.57	0.66	97 000	103 000
30.0	79 808	0.79808	3.36	- 4.45	0.75	77 128	82 488
35.0	64 077	0.64077	3.70	- 4.33	0.86	61 703	66 451
40.0	51 745	0.51745	4.04	- 4.22	0.96	49 655	53 836
45.0	42 021	0.42021	4.36	- 4.11	1.06	40 187	43 855
50.0	34 308	0.34308	4.68	- 4.00	1.17	32 702	35 913
55.0	28 156	0.28156	4.98	- 3.90	1.28	26 752	29 559
60.0	23 222	0.23222	5.28	- 3.80	1.39	21 996	24 449
65.0	19 246	0.19246	5.57	- 3.71	1.50	18 174	20 318
70.0	16 025	0.16025	5.85	- 3.62	1.62	15 088	16 961
75.0	13 402	0.13402	6.12	- 3.53	1.73	12 582	14 222
80.0	11 258	0.11258	6.38	- 3.45	1.85	10 539	11 976
85.0	9495.8	0.094958	6.64	- 3.36	1.97	8865.6	10 126
90.0	8042.0	0.080420	6.89	- 3.28	2.10	7488.3	8595.7
95.0	6837.3	0.068373	7.13	- 3.21	2.22	6350.0	7324.7
100.0	5835.1	0.058351	7.36	- 3.13	2.35	5405.4	6264.7
105.0	4997.8	0.049978	7.59	- 3.06	2.48	4618.4	5377.3



## 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 and agree to fully indemnify and hold Vishay and its distributors harmless from and against any and all claims, liabilities, expenses and damages arising or resulting in connection with such use or sale, including attorneys fees, even if such claim alleges that Vishay or its distributor was negligent regarding the design or manufacture of the part. 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.**