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## SPECIFICATION FOR APPROVAL

CUSTOMER	TRG (TESE003)
CERTIFIED	_____
MODEL/TYPE	_____
PART NO.	TSM2A223J393AHZ (RoHS+HF)
APPLICATION	_____
CUSTOMER P/N	_____
ISSUE DATE	Mar. 12, 2014
REV. NO.	_____
REV. DATE	_____

<b>FOR CUSTOMER APPROVAL</b>	<b>CHECKED BY</b>
	<i>Shu Ling Fu</i>
	<b>APPROVED BY</b>
	<i>Chun Chu Tu</i>





**REVISED RECORD SHEET**

REV. NO	REV. DATE	REVISED CONTENT



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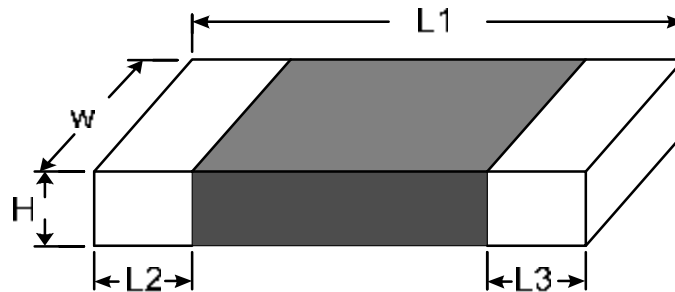
Part Number Code

Example :

**TSM** **2** **A** **223** **J** **393** **A** **H** **Z**  
(1) (2) (3) (4) (5) (6) (7) (8) (9)

No.	Item	Digit	Specification
(1)	Product Type	TSM	Thinking NTC thermistor TSM type
(2)	Size (EIA)	2	0805
(3)	Definition of B Value	A	$B_{25/85}$
(4)	Zero Power Resistance at 25°C ( $R_{25}$ )	223	$22 \times 10^3 \Omega = 22 \text{ K}\Omega$
(5)	Tolerance of $R_{25}$	J	$\pm 5\%$
(6)	B Value	393	3930K
(7)	Tolerance of B Value	A	$\pm 1.5\%$
(8)	Packaging	H	-40 ~ +150°C & Reel
(9)	Optional Suffix	Z	RoHS+HF compliance

### Structure and Dimensions



( unit : mm )

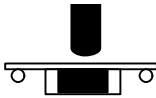
L1	W	H max.	L2 and L3
2.00±0.20	1.25±0.20	1.00	0.40±0.20

### Electrical Characteristics

Part No.	Zero Power Resistance at 25°C	Tolerance of R <sub>25</sub>	B <sub>25/85</sub> Value	Tolerance of B Value	Max. Power Dissipation at 25°C	Dissipation Factor	Thermal Time Constant	Operating Temperature Range
	R <sub>25</sub> (KΩ)	(± %)	(K)	(± %)	P <sub>max</sub> (mW)	δ (mW/°C)	τ (sec.)	T <sub>L</sub> ~T <sub>U</sub> (°C)
TSM2A223J393AHZ	22	5	3930	1.5	240	Approx. 2.4	Approx. 5.4	-40 ~ +150



Reliability

Item	Standard	Test conditions / Methods	Specifications															
Bending Strength	IEC 60068-2-21	Warp : 2mm ; Speed < 0.5mm/sec. Duration : 10 sec on PCB. 	No visible damage $ \Delta R_{25}/R_{25}  \leq 5\%$															
Solderability	IEC60068-2-58	245 ± 5°C , 3 ± 0.3 sec	At least 95% of terminal electrode is covered by new solder															
Resistance to Soldering Heat	IEC60068-2-58	260 ± 5°C , 10 ± 1 sec	No visible damage $ \Delta R_{25}/R_{25}  \leq 3\%$															
High Temperature Storage	IEC60068-2-2	150 ± 5°C , 1000 ± 24 hrs	No visible damage $ \Delta R_{25}/R_{25}  \leq 5\%$															
Damp Heat, Steady State	IEC60068-2-78	40 ± 2°C , 90 ~ 95 % RH , 1000 ± 24 hrs	No visible damage $ \Delta R_{25}/R_{25}  \leq 3\%$															
Rapid Change of Temperature	IEC60068-2-14	The conditions shown below shall be repeated 5 cycles on PCB <table border="1" data-bbox="523 1218 1168 1527"> <thead> <tr> <th>Step</th> <th>Temperature (°C)</th> <th>Period (minutes)</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>-40 ± 5</td> <td>30 ± 3</td> </tr> <tr> <td>2</td> <td>Room temperature</td> <td>5 ± 3</td> </tr> <tr> <td>3</td> <td>150 ± 5</td> <td>30 ± 3</td> </tr> <tr> <td>4</td> <td>Room temperature</td> <td>5 ± 3</td> </tr> </tbody> </table>	Step	Temperature (°C)	Period (minutes)	1	-40 ± 5	30 ± 3	2	Room temperature	5 ± 3	3	150 ± 5	30 ± 3	4	Room temperature	5 ± 3	No visible damage $ \Delta R_{25}/R_{25}  \leq 3\%$
Step	Temperature (°C)	Period (minutes)																
1	-40 ± 5	30 ± 3																
2	Room temperature	5 ± 3																
3	150 ± 5	30 ± 3																
4	Room temperature	5 ± 3																
Max. Power Dissipation	IEC60539-1 4.26.3	25 ± 5°C , P <sub>max.</sub> , 1000 ± 24 hrs	No visible damage $ \Delta R_{25}/R_{25}  \leq 5\%$															

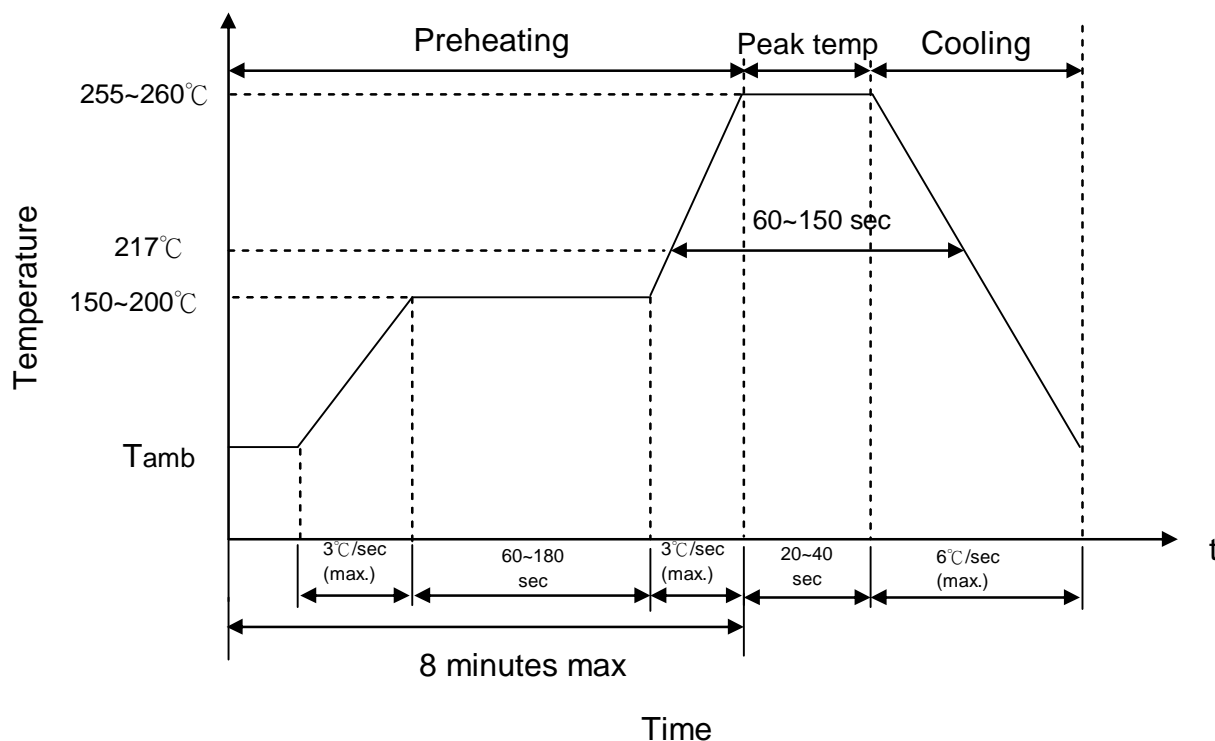
Products have been tested at Thinking Electronic

Industrial Co.,Ltd. Laboratory recognized by UL (Underwriters Laboratories Inc.) under CTD

(Client Test Data Program).

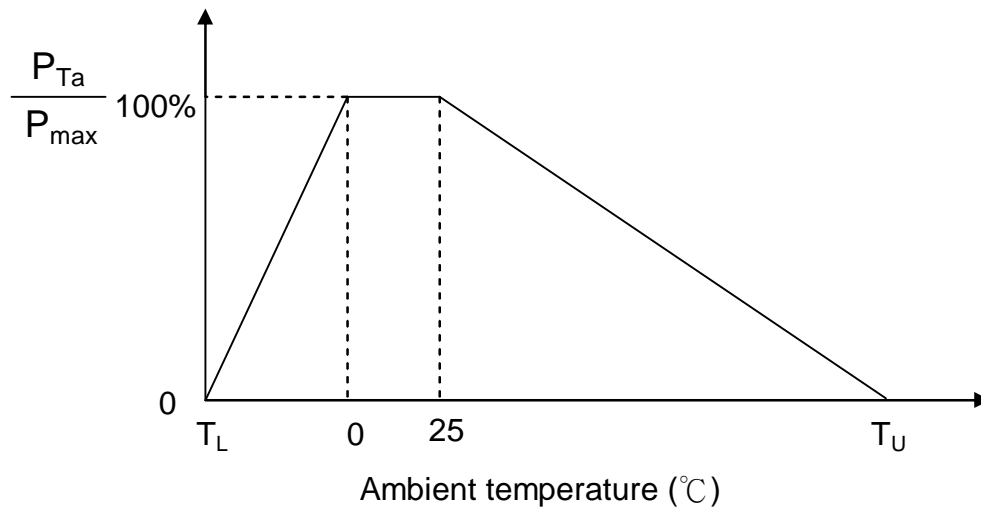
## Soldering Recommendation

### IR-Reflow Soldering Profile



### Recommended Reworking Conditions with Soldering Iron

Item	Conditions
Temperature of Soldering Iron-tip	360°C (max.)
Soldering Time	3 sec (max.)
Diameter of Soldering Iron-tip	φ 3mm (max.)
Caution: Not to touch the component surface with soldering iron directly to prevent component damage.	

Max. Power Dissipation Derating Curve

Note:  $T_L$  = Minimum operating temperature (°C)

$T_U$  = Maximum operating temperature (°C)

For example :

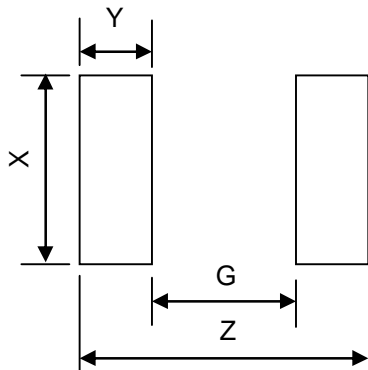
Ambient temperature( $T_a$ ) = 55°C

Maximum operating temperature( $T_u$ ) = 150°C

$P_{Ta} = (T_u - T_a) / (T_u - 25) \times P_{max} = 70\% P_{max}$



Recommended Soldering Pad Dimensions



Size (EIA)	0805
Z	3.4 mm
G	1.0 mm
X	1.4 mm
Y	1.2 mm

RoHS Compliant Declaration

We hereby declare that the components delivered to your company are compliant with RoHS directive 2011/65/EU.

Warehouse Storage Conditions of Products

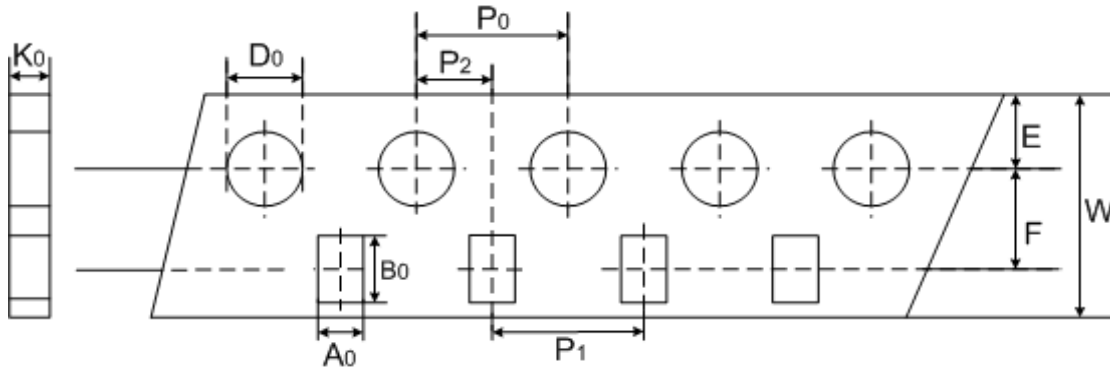
(I) Storage Conditions :

- 1.Storage Temperature : -10°C ~+40°C
- 2.Relative Humidity :  $\leq 75\%RH$
- 3.Keep away from corrosive atmosphere and sunlight.

(II) Period of Storage : 1 year

Packaging

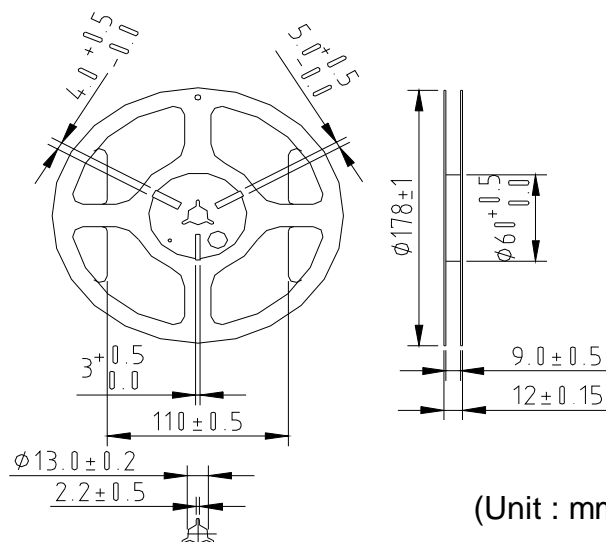
■ Taping Specification ( 0805 type)



(Unit : mm)

Index	$A_0$	$B_0$	$W$	$E$	$F$	$P_1$	$P_2$	$P_0$	$D_0$	$K_0$
Type	$\pm 0.2$	$\pm 0.2$	$\pm 0.2$	$\pm 0.1$	$\pm 0.05$	$\pm 0.1$	$\pm 0.05$	$\pm 0.1$	$\pm 0.1$	$\pm 0.1$
0805	1.5	2.3	8	1.75	3.5	4	2	4	1.55	1

■ Quantity ( 3500 pcs / reel )



(Unit : mm)



Certificates

- (1) TS 16949 certificate
- (2) ISO 9001 certificate
- (3) QC 080000 certificate

Test Report

- (1) RoHS test report
- (2) Halogen-free test report

R - T Table

Part No. : TSM2A223J393AHZ

R25 = 22 KOhm ± 5%

B25/85 = 3930 K ± 1.5%

Temperature (°C)	Rmax. (KΩ)	Rnor. (KΩ)	Rmin. (KΩ)	Temperature Tol.		Resistance Tol.	
				(°C)		(%)	
-40	640.49	580.77	525.29	-1.59	1.59	10.3%	-9.6%
-39	601.17	545.62	493.97	-1.59	1.59	10.2%	-9.5%
-38	564.58	512.88	464.76	-1.59	1.59	10.1%	-9.4%
-37	530.54	482.40	437.54	-1.59	1.59	10.0%	-9.3%
-36	498.87	454.03	412.18	-1.59	1.59	9.9%	-9.2%
-35	469.41	427.60	388.53	-1.59	1.59	9.8%	-9.1%
-34	441.98	402.97	366.48	-1.59	1.59	9.7%	-9.1%
-33	416.42	380.00	345.89	-1.59	1.59	9.6%	-9.0%
-32	392.58	358.56	326.66	-1.59	1.59	9.5%	-8.9%
-31	370.33	338.52	308.68	-1.59	1.59	9.4%	-8.8%
-30	349.53	319.79	291.84	-1.59	1.59	9.3%	-8.7%
-29	330.08	302.24	276.06	-1.59	1.59	9.2%	-8.7%
-28	311.86	285.80	261.26	-1.58	1.59	9.1%	-8.6%
-27	294.78	270.37	247.37	-1.58	1.59	9.0%	-8.5%
-26	278.76	255.89	234.31	-1.58	1.59	8.9%	-8.4%
-25	263.71	242.28	222.03	-1.57	1.58	8.8%	-8.4%
-24	249.57	229.48	210.47	-1.57	1.58	8.8%	-8.3%
-23	236.28	217.43	199.58	-1.57	1.57	8.7%	-8.2%
-22	223.78	206.09	189.32	-1.56	1.57	8.6%	-8.1%
-21	212.01	195.41	179.66	-1.55	1.56	8.5%	-8.1%
-20	200.93	185.34	170.54	-1.55	1.56	8.4%	-8.0%
-19	190.49	175.85	161.93	-1.54	1.56	8.3%	-7.9%
-18	180.66	166.90	153.81	-1.54	1.55	8.2%	-7.8%
-17	171.38	158.46	146.14	-1.53	1.55	8.2%	-7.8%
-16	162.64	150.49	138.90	-1.52	1.54	8.1%	-7.7%
-15	154.39	142.97	132.06	-1.52	1.54	8.0%	-7.6%
-14	146.61	135.87	125.60	-1.51	1.53	7.9%	-7.6%
-13	139.26	129.16	119.48	-1.51	1.53	7.8%	-7.5%
-12	132.33	122.82	113.70	-1.50	1.52	7.7%	-7.4%
-11	125.77	116.82	108.24	-1.49	1.51	7.7%	-7.3%
-10	119.58	111.15	103.06	-1.49	1.51	7.6%	-7.3%
-9	113.72	105.79	98.158	-1.48	1.50	7.5%	-7.2%
-8	108.19	100.71	93.516	-1.47	1.50	7.4%	-7.1%
-7	102.94	95.901	89.116	-1.46	1.49	7.3%	-7.1%
-6	97.983	91.346	84.945	-1.46	1.48	7.3%	-7.0%
-5	93.284	87.028	80.988	-1.45	1.47	7.2%	-6.9%
-4	88.830	82.933	77.234	-1.44	1.47	7.1%	-6.9%
-3	84.609	79.049	73.669	-1.43	1.46	7.0%	-6.8%
-2	80.605	75.362	70.284	-1.42	1.45	7.0%	-6.7%
-1	76.806	71.862	67.067	-1.41	1.44	6.9%	-6.7%

R - T Table

Part No. : TSM2A223J393AHZ

R25 =22 KOhm  $\pm$  5%B25/85 = 3930 K  $\pm$  1.5%

Temperature (°C)	Rmax. (K $\Omega$ )	Rnor. (K $\Omega$ )	Rmin. (K $\Omega$ )	Temperature Tol. (°C)		Resistance Tol. (%)	
0	73.200	68.536	64.009	-1.40	1.43	6.8%	-6.6%
1	69.776	65.377	61.102	-1.39	1.42	6.7%	-6.5%
2	66.524	62.373	58.335	-1.38	1.41	6.7%	-6.5%
3	63.433	59.517	55.703	-1.37	1.40	6.6%	-6.4%
4	60.495	56.800	53.198	-1.36	1.39	6.5%	-6.3%
5	57.701	54.215	50.812	-1.35	1.38	6.4%	-6.3%
6	55.044	51.755	48.540	-1.34	1.37	6.4%	-6.2%
7	52.517	49.413	46.376	-1.33	1.36	6.3%	-6.1%
8	50.112	47.183	44.313	-1.31	1.35	6.2%	-6.1%
9	47.824	45.059	42.348	-1.30	1.34	6.1%	-6.0%
10	45.646	43.037	40.476	-1.29	1.33	6.1%	-6.0%
11	43.573	41.111	38.691	-1.28	1.32	6.0%	-5.9%
12	41.600	39.276	36.989	-1.27	1.31	5.9%	-5.8%
13	39.721	37.528	35.367	-1.25	1.30	5.8%	-5.8%
14	37.932	35.862	33.820	-1.24	1.29	5.8%	-5.7%
15	36.230	34.276	32.346	-1.23	1.28	5.7%	-5.6%
16	34.608	32.764	30.940	-1.22	1.27	5.6%	-5.6%
17	33.065	31.324	29.600	-1.21	1.26	5.6%	-5.5%
18	31.595	29.952	28.323	-1.20	1.25	5.5%	-5.4%
19	30.196	28.644	27.105	-1.19	1.24	5.4%	-5.4%
20	28.864	27.399	25.943	-1.18	1.23	5.3%	-5.3%
21	27.595	26.212	24.836	-1.17	1.22	5.3%	-5.2%
22	26.387	25.081	23.781	-1.16	1.21	5.2%	-5.2%
23	25.237	24.004	22.774	-1.14	1.20	5.1%	-5.1%
24	24.143	22.978	21.815	-1.13	1.19	5.1%	-5.1%
25	23.100	22.000	20.900	-1.12	1.18	5.0%	-5.0%
26	22.136	21.068	20.002	-1.15	1.20	5.1%	-5.1%
27	21.217	20.180	19.147	-1.17	1.22	5.1%	-5.1%
28	20.341	19.334	18.332	-1.19	1.24	5.2%	-5.2%
29	19.505	18.528	17.556	-1.21	1.26	5.3%	-5.2%
30	18.708	17.760	16.818	-1.23	1.29	5.3%	-5.3%
31	17.948	17.027	16.114	-1.26	1.31	5.4%	-5.4%
32	17.222	16.329	15.443	-1.28	1.33	5.5%	-5.4%
33	16.531	15.663	14.805	-1.30	1.35	5.5%	-5.5%
34	15.871	15.029	14.196	-1.33	1.38	5.6%	-5.5%
35	15.241	14.423	13.616	-1.35	1.40	5.7%	-5.6%
36	14.640	13.846	13.063	-1.37	1.42	5.7%	-5.7%
37	14.066	13.295	12.535	-1.40	1.45	5.8%	-5.7%
38	13.518	12.769	12.032	-1.42	1.47	5.9%	-5.8%
39	12.994	12.267	11.552	-1.45	1.49	5.9%	-5.8%

R - T Table

Part No. : TSM2A223J393AHZ

R25 =22 KOhm  $\pm$  5%B25/85 = 3930 K  $\pm$  1.5%

Temperature (°C)	Rmax. (K $\Omega$ )	Rnor. (K $\Omega$ )	Rmin. (K $\Omega$ )	Temperature Tol. (°C)		Resistance Tol. (%)	
40	12.494	11.788	11.095	-1.47	1.52	6.0%	-5.9%
41	12.016	11.331	10.658	-1.50	1.54	6.1%	-5.9%
42	11.560	10.894	10.241	-1.52	1.56	6.1%	-6.0%
43	11.123	10.476	9.8422	-1.55	1.59	6.2%	-6.1%
44	10.706	10.077	9.4618	-1.57	1.61	6.2%	-6.1%
45	10.306	9.6956	9.0983	-1.60	1.64	6.3%	-6.2%
46	9.9241	9.3307	8.7509	-1.63	1.66	6.4%	-6.2%
47	9.5584	8.9817	8.4187	-1.65	1.69	6.4%	-6.3%
48	9.2082	8.6478	8.1011	-1.68	1.71	6.5%	-6.3%
49	8.8729	8.3281	7.7973	-1.70	1.73	6.5%	-6.4%
50	8.5516	8.0221	7.5065	-1.73	1.76	6.6%	-6.4%
51	8.2438	7.7290	7.2282	-1.76	1.78	6.7%	-6.5%
52	7.9486	7.4481	6.9617	-1.78	1.81	6.7%	-6.5%
53	7.6657	7.1790	6.7065	-1.81	1.83	6.8%	-6.6%
54	7.3943	6.9210	6.4619	-1.83	1.86	6.8%	-6.6%
55	7.1339	6.6737	6.2275	-1.86	1.88	6.9%	-6.7%
56	6.8839	6.4364	6.0029	-1.89	1.90	7.0%	-6.7%
57	6.6440	6.2087	5.7874	-1.91	1.93	7.0%	-6.8%
58	6.4136	5.9902	5.5807	-1.94	1.95	7.1%	-6.8%
59	6.1924	5.7804	5.3824	-1.96	1.98	7.1%	-6.9%
60	5.9797	5.5790	5.1921	-1.99	2.00	7.2%	-6.9%
61	5.7754	5.3855	5.0094	-2.02	2.02	7.2%	-7.0%
62	5.5790	5.1996	4.8339	-2.04	2.05	7.3%	-7.0%
63	5.3902	5.0210	4.6654	-2.07	2.07	7.4%	-7.1%
64	5.2085	4.8493	4.5035	-2.09	2.09	7.4%	-7.1%
65	5.0338	4.6842	4.3479	-2.12	2.12	7.5%	-7.2%
66	4.8657	4.5254	4.1984	-2.14	2.14	7.5%	-7.2%
67	4.7040	4.3727	4.0546	-2.17	2.17	7.6%	-7.3%
68	4.5483	4.2258	3.9164	-2.20	2.19	7.6%	-7.3%
69	4.3984	4.0845	3.7835	-2.22	2.21	7.7%	-7.4%
70	4.2541	3.9484	3.6556	-2.25	2.24	7.7%	-7.4%
71	4.1151	3.8175	3.5326	-2.27	2.26	7.8%	-7.5%
72	3.9812	3.6914	3.4142	-2.30	2.28	7.8%	-7.5%
73	3.8522	3.5701	3.3003	-2.32	2.31	7.9%	-7.6%
74	3.7280	3.4532	3.1907	-2.35	2.33	8.0%	-7.6%
75	3.6083	3.3406	3.0851	-2.38	2.36	8.0%	-7.6%
76	3.4929	3.2322	2.9835	-2.40	2.38	8.1%	-7.7%
77	3.3817	3.1278	2.8857	-2.43	2.41	8.1%	-7.7%
78	3.2745	3.0271	2.7915	-2.46	2.43	8.2%	-7.8%
79	3.1711	2.9302	2.7007	-2.48	2.46	8.2%	-7.8%

R - T Table

Part No. : TSM2A223J393AHZ

R25 =22 KOhm  $\pm$  5%B25/85 = 3930 K  $\pm$  1.5%

Temperature (°C)	Rmax. (K $\Omega$ )	Rnor. (K $\Omega$ )	Rmin. (K $\Omega$ )	Temperature Tol. (°C)		Resistance Tol. (%)	
80	3.0715	2.8367	2.6133	-2.51	2.48	8.3%	-7.9%
81	2.9754	2.7467	2.5291	-2.54	2.51	8.3%	-7.9%
82	2.8828	2.6598	2.4480	-2.57	2.53	8.4%	-8.0%
83	2.7934	2.5762	2.3699	-2.60	2.56	8.4%	-8.0%
84	2.7072	2.4955	2.2946	-2.62	2.58	8.5%	-8.1%
85	2.6241	2.4177	2.2220	-2.65	2.61	8.5%	-8.1%
86	2.5439	2.3427	2.1520	-2.68	2.64	8.6%	-8.1%
87	2.4665	2.2704	2.0846	-2.71	2.66	8.6%	-8.2%
88	2.3918	2.2006	2.0196	-2.74	2.69	8.7%	-8.2%
89	2.3198	2.1333	1.9569	-2.77	2.72	8.7%	-8.3%
90	2.2502	2.0684	1.8965	-2.80	2.75	8.8%	-8.3%
91	2.1831	2.0058	1.8383	-2.83	2.77	8.8%	-8.4%
92	2.1184	1.9454	1.7821	-2.86	2.80	8.9%	-8.4%
93	2.0558	1.8871	1.7279	-2.89	2.83	8.9%	-8.4%
94	1.9954	1.8309	1.6756	-2.93	2.86	9.0%	-8.5%
95	1.9372	1.7766	1.6252	-2.96	2.89	9.0%	-8.5%
96	1.8809	1.7242	1.5766	-2.99	2.92	9.1%	-8.6%
97	1.8265	1.6736	1.5296	-3.02	2.95	9.1%	-8.6%
98	1.7740	1.6248	1.4844	-3.06	2.98	9.2%	-8.6%
99	1.7233	1.5776	1.4406	-3.09	3.01	9.2%	-8.7%
100	1.6743	1.5321	1.3984	-3.12	3.04	9.3%	-8.7%
101	1.6269	1.4881	1.3577	-3.16	3.07	9.3%	-8.8%
102	1.5812	1.4456	1.3184	-3.19	3.10	9.4%	-8.8%
103	1.5369	1.4046	1.2804	-3.23	3.13	9.4%	-8.8%
104	1.4942	1.3649	1.2437	-3.26	3.16	9.5%	-8.9%
105	1.4528	1.3266	1.2083	-3.29	3.19	9.5%	-8.9%
106	1.4129	1.2895	1.1740	-3.33	3.23	9.6%	-9.0%
107	1.3742	1.2537	1.1409	-3.36	3.26	9.6%	-9.0%
108	1.3368	1.2191	1.1090	-3.40	3.29	9.7%	-9.0%
109	1.3007	1.1856	1.0781	-3.44	3.32	9.7%	-9.1%
110	1.2657	1.1532	1.0482	-3.47	3.35	9.7%	-9.1%
111	1.2318	1.1219	1.0193	-3.51	3.39	9.8%	-9.1%
112	1.1990	1.0916	0.99133	-3.54	3.42	9.8%	-9.2%
113	1.1672	1.0623	0.96430	-3.58	3.45	9.9%	-9.2%
114	1.1365	1.0339	0.93814	-3.61	3.48	9.9%	-9.3%
115	1.1067	1.0064	0.91282	-3.65	3.51	10.0%	-9.3%
116	1.0779	0.97974	0.88831	-3.69	3.55	10.0%	-9.3%
117	1.0499	0.95396	0.86459	-3.72	3.58	10.1%	-9.4%
118	1.0228	0.92897	0.84161	-3.76	3.61	10.1%	-9.4%
119	0.99659	0.90477	0.81936	-3.79	3.64	10.1%	-9.4%

