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SPECIFICATION FOR APPROVAL

CUSTOMER	立創電子
CERTIFIED MODEL/TYPE	TSM1B224
PART NO.	TSM1B224F4153RZ (RoHS+HF)
APPLICATION	
CUSTOMER P/N	
ISSUE DATE	Jul. 22, 2022
REV. NO.	
REV. DATE	

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





REVISED RECORD SHEET

REV. NO	REV. DATE	REVISED CONTENT



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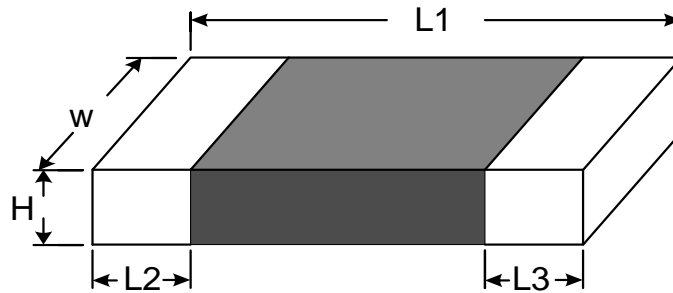
Part Number Code

Example :

TSM **1** **B** **224** **F** **415** **3** **R** **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)	1	0603
(3)	Definition of B Value	B	$B_{25/50}$
(4)	Zero Power Resistance at 25°C (R_{25})	224	$22 \times 10^4 \Omega = 220 \text{ K}\Omega$
(5)	Tolerance of R_{25}	F	$\pm 1\%$
(6)	B Value	415	4150K
(7)	Tolerance of B Value	3	$\pm 3\%$
(8)	Packaging	R	Reel
(9)	Optional Suffix	Z	RoHS+HF compliance

Structure and Dimensions



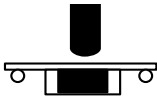
(unit : mm)

L1	W	H	L2 and L3
1.60±0.15	0.80±0.15	0.80±0.15	0.40±0.15

Electrical Characteristics

Part No.	Zero Power Resistance at 25°C	Tolerance of R ₂₅	B _{25/50} Value	Tolerance of B Value	Max. Power Dissipation at 25°C	Dissipation Factor	Thermal Time Constant	Operating Temperature Range
	R ₂₅ (KΩ)	(± %)	(K)	(± %)	P _{max} (mW)	δ (mW/°C)	τ (sec.)	T _L ~T _U (°C)
TSM1B224F4153RZ	220	1	4150	3	210	Approx. 2.1	Approx. 3.1	-40 ~ +125

Reliability

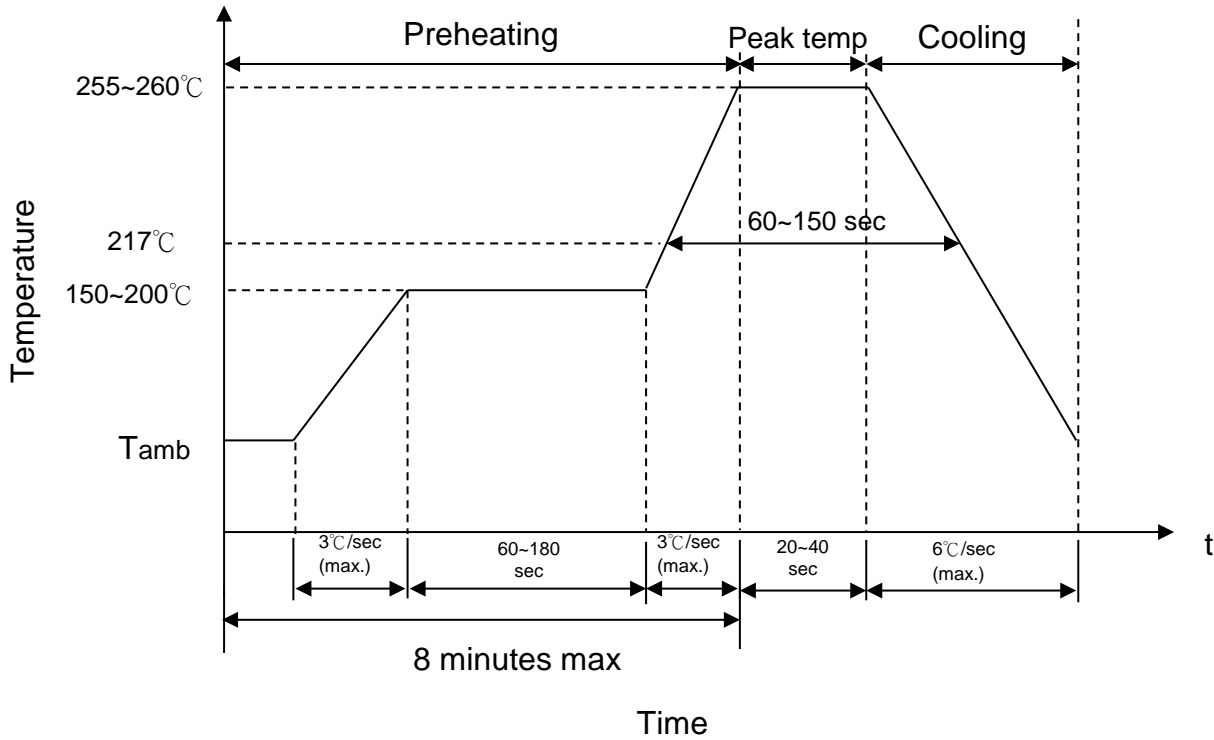
Item	Standard	Test conditions / Methods	Specifications															
Bending Strength	IEC 60068-2-21	Warp : 2mm ; Speed < 0.5mm/sec. Duration : 10 sec on PCB. 	No visible damage $ \Delta R_{25}/R_{25} \leq 5\%$															
Solderability	IEC60068-2-58	245 ± 5°C , 3 ± 0.3 sec	At least 95% of terminal 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	125 ± 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 1223 1168 1532"> <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>125 ± 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	125 ± 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	125 ± 5	30 ± 3																
4	Room temperature	5 ± 3																
Max. Power Dissipation	IEC60539-1 4.26.3	25 ± 5°C , P _{max.} , 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 CTRDP (Client Test Data Program).

Soldering Recommendation

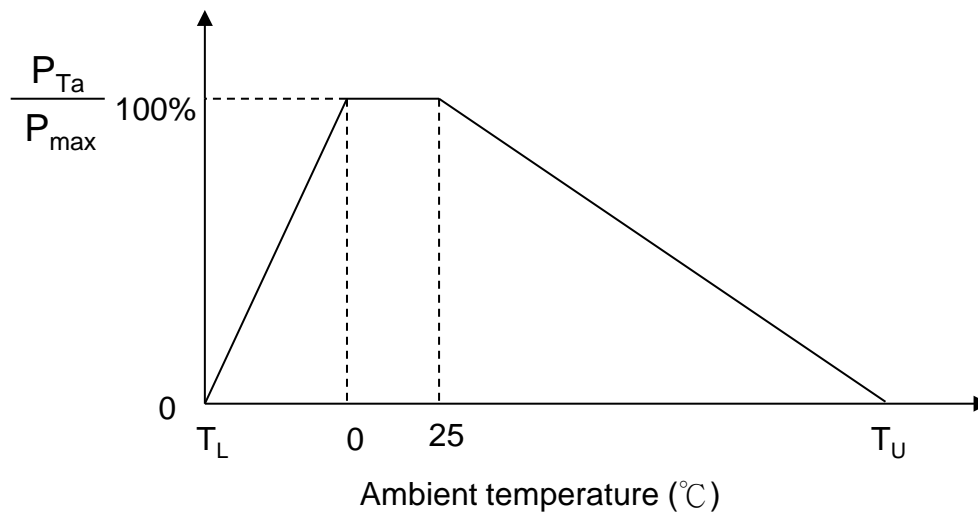
■ IR-Reflow Soldering Profile



■ 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)

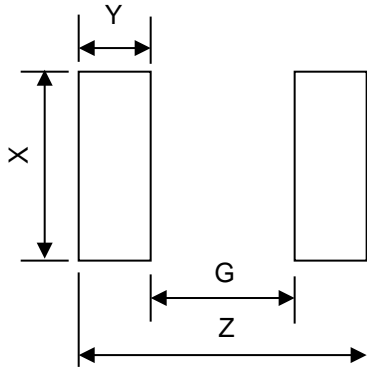
For example :

Ambient temperature(T_a)=55°C

Maximum operating temperature(T_u)= 125°C

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

Recommended Soldering Pad Dimensions



Size (EIA)	0603
Z	2.8 mm
G	0.8 mm
X	1.0 mm
Y	1.0 mm

RoHS Compliant Declaration

We hereby declare that the components delivered to your company are compliant with RoHS directive 2015/863/EU.

Warehouse Storage Conditions of Products

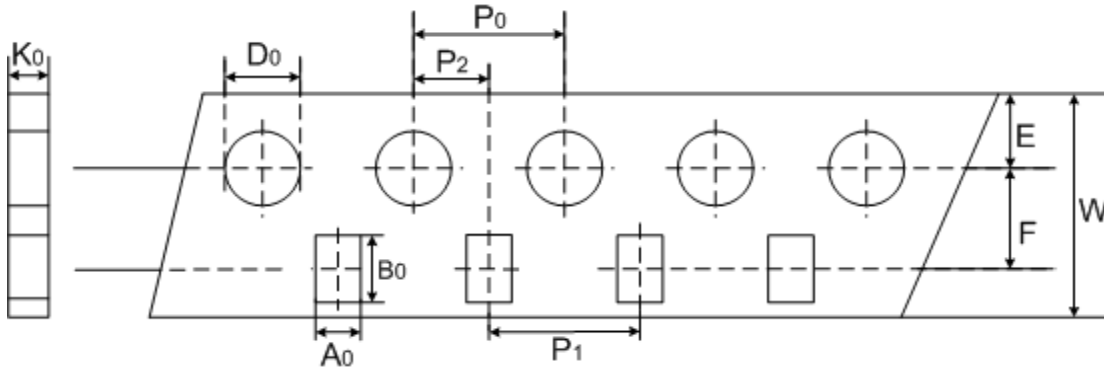
(I) Storage Conditions :

- 1.Storage Temperature : $-10^{\circ}\text{C} \sim +40^{\circ}\text{C}$
- 2.Relative Humidity : $\leq 75\%RH$
- 3.Keep away from corrosive atmosphere and sunlight.

(II) Period of Storage : 1 year

Packaging

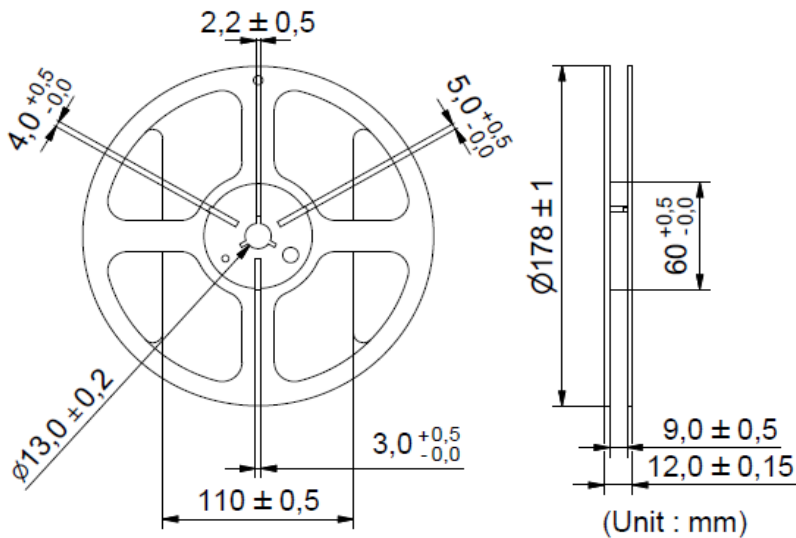
■ Taping Specification (0603 Series)



(Unit : mm)

Index	A_0	B_0	W	E	F	P_1	P_2	P_0	D_0	K_0
Size	± 0.2	± 0.2	± 0.2	± 0.1	± 0.05	± 0.1	± 0.05	± 0.1	± 0.1	± 0.1
0603	1.1	1.9	8	1.75	3.5	4	2	4	1.55	0.95

■ Quantity (4000 pcs / reel)



(Unit : mm)

Safety Approvals (Certified Model/Type : TSM1B224)



* UL 1434 / cUL recognized (File # E138827)



* TUV recognized (File # R 50167657)



* CQC GB/T 6663.1-2007 recognized (File # CQC12001080962)

Certificates

- (1) IATF 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. : TSM1B224F4153RZ

R25 =220 KOhm ± 1%

B25/50 = 4150 K ± 3%

Temperature (°C)	Rmax. (KΩ)	Rnor. (KΩ)	Rmin. (KΩ)	Temperature Tol.		Resistance Tol.	
				(°C)		(%)	
-40	9,946.2	8,815.6	7,812.7	-1.82	1.73	12.8%	-11.4%
-39	9,273.4	8,236.0	7,314.0	-1.79	1.70	12.6%	-11.2%
-38	8,646.2	7,694.6	6,847.2	-1.76	1.68	12.4%	-11.0%
-37	8,061.4	7,188.9	6,410.2	-1.73	1.65	12.1%	-10.8%
-36	7,516.5	6,716.6	6,001.3	-1.69	1.62	11.9%	-10.7%
-35	7,009.1	6,276.0	5,619.0	-1.66	1.60	11.7%	-10.5%
-34	6,537.1	5,865.3	5,262.0	-1.64	1.58	11.5%	-10.3%
-33	6,098.4	5,482.7	4,928.7	-1.61	1.56	11.2%	-10.1%
-32	5,690.9	5,126.7	4,617.9	-1.58	1.54	11.0%	-9.9%
-31	5,312.6	4,795.5	4,328.3	-1.56	1.52	10.8%	-9.7%
-30	4,961.6	4,487.6	4,058.5	-1.54	1.50	10.6%	-9.6%
-29	4,636.1	4,201.5	3,807.2	-1.52	1.48	10.3%	-9.4%
-28	4,334.2	3,935.6	3,573.2	-1.50	1.47	10.1%	-9.2%
-27	4,054.1	3,688.4	3,355.4	-1.48	1.45	9.9%	-9.0%
-26	3,794.2	3,458.6	3,152.4	-1.46	1.43	9.7%	-8.9%
-25	3,552.9	3,244.9	2,963.3	-1.44	1.42	9.5%	-8.7%
-24	3,328.9	3,046.0	2,787.0	-1.42	1.40	9.3%	-8.5%
-23	3,120.7	2,860.9	2,622.5	-1.40	1.38	9.1%	-8.3%
-22	2,927.0	2,688.4	2,469.0	-1.38	1.36	8.9%	-8.2%
-21	2,746.9	2,527.6	2,325.6	-1.36	1.35	8.7%	-8.0%
-20	2,579.1	2,377.6	2,191.6	-1.34	1.33	8.5%	-7.8%
-19	2,422.7	2,237.5	2,066.2	-1.32	1.31	8.3%	-7.7%
-18	2,276.9	2,106.6	1,948.9	-1.30	1.29	8.1%	-7.5%
-17	2,140.8	1,984.2	1,839.0	-1.28	1.27	7.9%	-7.3%
-16	2,013.7	1,869.8	1,736.0	-1.26	1.25	7.7%	-7.2%
-15	1,894.9	1,762.6	1,639.4	-1.23	1.23	7.5%	-7.0%
-14	1,783.8	1,662.2	1,548.7	-1.21	1.21	7.3%	-6.8%
-13	1,679.9	1,568.1	1,463.6	-1.19	1.18	7.1%	-6.7%
-12	1,582.7	1,479.9	1,383.7	-1.16	1.16	6.9%	-6.5%
-11	1,491.6	1,397.1	1,308.6	-1.14	1.14	6.8%	-6.3%
-10	1,406.3	1,319.5	1,237.9	-1.12	1.12	6.6%	-6.2%
-9	1,326.3	1,246.6	1,171.5	-1.09	1.10	6.4%	-6.0%
-8	1,251.3	1,178.1	1,109.0	-1.07	1.07	6.2%	-5.9%
-7	1,181.0	1,113.7	1,050.2	-1.04	1.05	6.0%	-5.7%
-6	1,115.0	1,053.3	994.89	-1.02	1.03	5.9%	-5.5%
-5	1,053.1	996.44	942.77	-1.00	1.00	5.7%	-5.4%
-4	994.92	942.98	893.67	-0.97	0.98	5.5%	-5.2%
-3	940.32	892.70	847.41	-0.95	0.96	5.3%	-5.1%
-2	889.03	845.39	803.81	-0.92	0.93	5.2%	-4.9%
-1	840.84	800.86	762.71	-0.90	0.91	5.0%	-4.8%

R - T Table

Part No. : TSM1B224F4153RZ

R25 =220 KOhm ± 1%

B25/50 = 4150 K ± 3%

Temperature (°C)	Rmax. (KΩ)	Rnor. (KΩ)	Rmin. (KΩ)	Temperature Tol. (°C)		Resistance Tol. (%)	
0	795.55	758.95	723.96	-0.87	0.89	4.8%	-4.6%
1	752.96	719.47	687.40	-0.85	0.86	4.7%	-4.5%
2	712.90	682.28	652.91	-0.82	0.84	4.5%	-4.3%
3	675.22	647.24	620.36	-0.80	0.81	4.3%	-4.2%
4	639.76	614.21	589.62	-0.77	0.79	4.2%	-4.0%
5	606.37	583.07	560.60	-0.75	0.76	4.0%	-3.9%
6	574.93	553.69	533.18	-0.72	0.74	3.8%	-3.7%
7	545.31	525.97	507.27	-0.70	0.71	3.7%	-3.6%
8	517.39	499.81	482.78	-0.67	0.69	3.5%	-3.4%
9	491.07	475.11	459.62	-0.65	0.66	3.4%	-3.3%
10	466.25	451.77	437.70	-0.62	0.64	3.2%	-3.1%
11	442.83	429.73	416.97	-0.59	0.61	3.0%	-3.0%
12	420.72	408.88	397.34	-0.57	0.59	2.9%	-2.8%
13	399.85	389.17	378.75	-0.54	0.56	2.7%	-2.7%
14	380.13	370.53	361.13	-0.52	0.53	2.6%	-2.5%
15	361.50	352.88	344.44	-0.49	0.51	2.4%	-2.4%
16	343.89	336.18	328.61	-0.46	0.48	2.3%	-2.3%
17	327.23	320.36	313.60	-0.43	0.45	2.1%	-2.1%
18	311.47	305.37	299.36	-0.41	0.42	2.0%	-2.0%
19	296.56	291.16	285.84	-0.38	0.40	1.9%	-1.8%
20	282.44	277.69	273.00	-0.35	0.37	1.7%	-1.7%
21	269.06	264.92	260.81	-0.32	0.34	1.6%	-1.6%
22	256.39	252.80	249.23	-0.30	0.31	1.4%	-1.4%
23	244.38	241.29	238.22	-0.27	0.28	1.3%	-1.3%
24	233.00	230.37	227.75	-0.24	0.25	1.1%	-1.1%
25	222.20	220.00	217.80	-0.21	0.22	1.0%	-1.0%
26	212.54	210.15	207.76	-0.24	0.25	1.1%	-1.1%
27	203.35	200.78	198.23	-0.27	0.29	1.3%	-1.3%
28	194.60	191.88	189.18	-0.31	0.32	1.4%	-1.4%
29	186.26	183.42	180.59	-0.34	0.35	1.6%	-1.5%
30	178.33	175.37	172.44	-0.37	0.38	1.7%	-1.7%
31	170.77	167.71	164.69	-0.40	0.41	1.8%	-1.8%
32	163.57	160.42	157.32	-0.43	0.45	2.0%	-1.9%
33	156.71	153.49	150.32	-0.46	0.48	2.1%	-2.1%
34	150.16	146.89	143.67	-0.50	0.51	2.2%	-2.2%
35	143.93	140.60	137.34	-0.53	0.54	2.4%	-2.3%
36	137.98	134.61	131.32	-0.56	0.58	2.5%	-2.4%
37	132.30	128.91	125.59	-0.60	0.61	2.6%	-2.6%
38	126.89	123.48	120.14	-0.63	0.64	2.8%	-2.7%
39	121.72	118.30	114.95	-0.66	0.68	2.9%	-2.8%

R - T Table

Part No. : TSM1B224F4153RZ

R25 =220 KOhm ± 1%

B25/50 = 4150 K ± 3%

Temperature (°C)	Rmax. (KΩ)	Rnor. (KΩ)	Rmin. (KΩ)	Temperature Tol. (°C)		Resistance Tol. (%)	
40	116.79	113.36	110.02	-0.70	0.71	3.0%	-2.9%
41	112.09	108.65	105.32	-0.73	0.74	3.2%	-3.1%
42	107.60	104.17	100.84	-0.76	0.78	3.3%	-3.2%
43	103.31	99.889	96.575	-0.80	0.81	3.4%	-3.3%
44	99.208	95.807	92.513	-0.83	0.85	3.6%	-3.4%
45	95.295	91.913	88.642	-0.87	0.88	3.7%	-3.6%
46	91.555	88.197	84.953	-0.90	0.91	3.8%	-3.7%
47	87.982	84.651	81.437	-0.94	0.95	3.9%	-3.8%
48	84.568	81.266	78.085	-0.98	0.98	4.1%	-3.9%
49	81.303	78.034	74.888	-1.01	1.02	4.2%	-4.0%
50	78.183	74.948	71.840	-1.05	1.05	4.3%	-4.1%
51	75.199	72.000	68.932	-1.09	1.09	4.4%	-4.3%
52	72.345	69.185	66.157	-1.12	1.13	4.6%	-4.4%
53	69.614	66.495	63.509	-1.16	1.16	4.7%	-4.5%
54	67.002	63.924	60.982	-1.20	1.20	4.8%	-4.6%
55	64.503	61.467	58.569	-1.24	1.23	4.9%	-4.7%
56	62.111	59.118	56.265	-1.27	1.27	5.1%	-4.8%
57	59.820	56.872	54.064	-1.31	1.31	5.2%	-4.9%
58	57.627	54.724	51.962	-1.35	1.34	5.3%	-5.0%
59	55.527	52.669	49.954	-1.39	1.38	5.4%	-5.2%
60	53.515	50.703	48.034	-1.43	1.42	5.5%	-5.3%
61	51.588	48.822	46.199	-1.47	1.46	5.7%	-5.4%
62	49.741	47.020	44.445	-1.51	1.49	5.8%	-5.5%
63	47.970	45.296	42.766	-1.55	1.53	5.9%	-5.6%
64	46.273	43.644	41.161	-1.59	1.57	6.0%	-5.7%
65	44.645	42.062	39.625	-1.63	1.61	6.1%	-5.8%
66	43.083	40.547	38.155	-1.67	1.65	6.3%	-5.9%
67	41.585	39.094	36.748	-1.72	1.68	6.4%	-6.0%
68	40.148	37.702	35.401	-1.76	1.72	6.5%	-6.1%
69	38.768	36.366	34.110	-1.80	1.76	6.6%	-6.2%
70	37.443	35.086	32.874	-1.84	1.80	6.7%	-6.3%
71	36.171	33.858	31.689	-1.88	1.84	6.8%	-6.4%
72	34.949	32.679	30.553	-1.93	1.88	6.9%	-6.5%
73	33.775	31.548	29.464	-1.97	1.92	7.1%	-6.6%
74	32.646	30.462	28.420	-2.01	1.96	7.2%	-6.7%
75	31.562	29.419	27.419	-2.05	2.00	7.3%	-6.8%
76	30.519	28.417	26.458	-2.10	2.04	7.4%	-6.9%
77	29.516	27.455	25.535	-2.14	2.08	7.5%	-7.0%
78	28.551	26.530	24.650	-2.19	2.12	7.6%	-7.1%
79	27.623	25.641	23.800	-2.23	2.15	7.7%	-7.2%

R - T Table

Part No. : TSM1B224F4153RZ

R25 =220 KOhm ± 1%

B25/50 = 4150 K ± 3%

Temperature (°C)	Rmax. (KΩ)	Rnor. (KΩ)	Rmin. (KΩ)	Temperature Tol. (°C)		Resistance Tol. (%)	
80	26.729	24.787	22.983	-2.27	2.19	7.8%	-7.3%
81	25.869	23.965	22.198	-2.32	2.23	7.9%	-7.4%
82	25.041	23.174	21.444	-2.36	2.27	8.1%	-7.5%
83	24.243	22.413	20.720	-2.41	2.31	8.2%	-7.6%
84	23.475	21.681	20.023	-2.45	2.35	8.3%	-7.6%
85	22.734	20.977	19.353	-2.49	2.39	8.4%	-7.7%
86	22.021	20.298	18.709	-2.54	2.43	8.5%	-7.8%
87	21.333	19.645	18.089	-2.58	2.47	8.6%	-7.9%
88	20.669	19.015	17.492	-2.63	2.51	8.7%	-8.0%
89	20.030	18.409	16.918	-2.67	2.55	8.8%	-8.1%
90	19.413	17.825	16.365	-2.72	2.59	8.9%	-8.2%
91	18.818	17.262	15.833	-2.76	2.63	9.0%	-8.3%
92	18.243	16.719	15.320	-2.81	2.67	9.1%	-8.4%
93	17.689	16.195	14.826	-2.85	2.71	9.2%	-8.5%
94	17.154	15.690	14.350	-2.90	2.75	9.3%	-8.5%
95	16.637	15.203	13.892	-2.94	2.79	9.4%	-8.6%
96	16.138	14.733	13.450	-2.99	2.83	9.5%	-8.7%
97	15.656	14.280	13.024	-3.04	2.87	9.6%	-8.8%
98	15.191	13.843	12.613	-3.08	2.91	9.7%	-8.9%
99	14.741	13.420	12.217	-3.13	2.95	9.8%	-9.0%
100	14.306	13.012	11.835	-3.17	2.99	9.9%	-9.1%
101	13.886	12.619	11.466	-3.22	3.03	10.0%	-9.1%
102	13.480	12.239	11.110	-3.27	3.07	10.1%	-9.2%
103	13.088	11.871	10.767	-3.31	3.11	10.2%	-9.3%
104	12.708	11.517	10.436	-3.36	3.15	10.3%	-9.4%
105	12.341	11.174	10.116	-3.41	3.20	10.4%	-9.5%
106	11.986	10.843	9.8077	-3.45	3.24	10.5%	-9.5%
107	11.643	10.523	9.5098	-3.50	3.28	10.6%	-9.6%
108	11.311	10.214	9.2221	-3.55	3.32	10.7%	-9.7%
109	10.990	9.9151	8.9443	-3.60	3.36	10.8%	-9.8%
110	10.679	9.6262	8.6760	-3.65	3.40	10.9%	-9.9%
111	10.379	9.3469	8.4169	-3.69	3.44	11.0%	-10.0%
112	10.088	9.0769	8.1665	-3.74	3.49	11.1%	-10.0%
113	9.8061	8.8157	7.9246	-3.79	3.53	11.2%	-10.1%
114	9.5335	8.5632	7.6909	-3.84	3.57	11.3%	-10.2%
115	9.2696	8.3190	7.4651	-3.89	3.61	11.4%	-10.3%
116	9.0142	8.0828	7.2469	-3.94	3.66	11.5%	-10.3%
117	8.7669	7.8543	7.0359	-3.99	3.70	11.6%	-10.4%
118	8.5274	7.6332	6.8320	-4.05	3.75	11.7%	-10.5%
119	8.2956	7.4193	6.6349	-4.10	3.79	11.8%	-10.6%

