

Surface Mount, NTC Thermistors



FEATURES

- High sensitivity
- High accuracy over a wide temperature range
- Suitable for wave or reflow soldering
- NiSn terminations
- Fully glass coated

APPLICATIONS

- Temperature compensation, sensing and protection in, for example:
 - Battery chargers
 - Consumer equipment
 - Office equipment

DESCRIPTION

Size 0603 chip thermistors with a negative temperature coefficient. The device has no marking.

PACKAGING

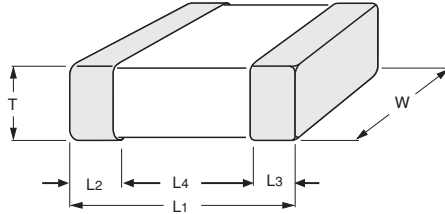
Available in 8 mm punched paper tape on reel package of 4000 units.

QUICK REFERENCE DATA

PARAMETER	VALUE
Resistance value at 25 °C	2.2 kΩ to 100 kΩ
Tolerance on R ₂₅ -value	±2%; ±3%; ±5%; ±10%
Tolerance on B _{25/85} -value	see Table below
Maximum dissipation at 25 °C	125 mW
Thermal time constant τ	≈8 s
Operating temperature range	–40 to +150 °C
R/T values	see Tables
Climatic category	40/125/56
Mass	≈0.0045 g

ELECTRICAL DATA AND ORDERING INFORMATION

R ₂₅ (kΩ)	B _{25/85} -VALUE (K)	TOLERANCE ON B _{25/85} (%)	CATALOG NUMBER 2322 615 3....			
			±2% TOL. ON R ₂₅	±3% TOL. ON R ₂₅	±5% TOL. ON R ₂₅	±10% TOL. ON R ₂₅
2.2	3520	±1	34222	36222	33222	32222
2.7	3600	±1	34272	36272	33272	32272
4.7	3830	±1	34472	36472	33472	32472
10	3610	±1	34103	36103	33103	32103
15	3600	±1	34153	36153	33153	32153
22	3730	±1	34223	36223	33223	32223
33	3860	±1	34333	36333	33333	32333
47	3960	±1	34473	36473	33473	32473
68	3985	±1	34683	36683	33683	32683
100	4100	±1	34104	36104	33104	32104

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

RESISTANCE VALUES AT INTERMEDIATE TEMPERATURES WITH R₂₅ AT 2.2 KΩ

T _{oper} (°C)	CATALOG NUMBER 2322 615 3.222		
	R _T (Ω)	TC (%/K)	ΔR/R DUE TO B-TOLERANCE (%)
-40	53502.61	-6.11	7.58
-35	39637.33	-5.89	6.83
-30	29679.76	-5.68	6.13
-25	22450.97	-5.48	5.45
-20	17148.62	-5.29	4.80
-15	13220.63	-5.11	4.18
-10	10283.06	-4.94	3.58
-5	8066.16	-4.77	3.01
0	6378.54	-4.62	2.46
5	5083.09	-4.47	1.93
10	4080.75	-4.32	1.42
15	3299.24	-4.18	0.93
20	2685.45	-4.05	0.46
25	2200.00	-3.93	0.00
30	1813.46	-3.80	0.22
35	1503.70	-3.69	0.43
40	1253.93	-3.58	0.64
45	1051.33	-3.47	0.84
50	886.05	-3.37	1.03
55	750.49	-3.27	1.22
60	638.72	-3.18	1.40
65	546.09	-3.09	1.58
70	468.95	-3.00	1.75
75	404.41	-2.92	1.92
80	350.18	-2.84	2.08
85	304.40	-2.76	2.23
90	265.61	-2.69	2.54
95	232.60	-2.62	2.85
100	204.39	-2.55	3.14
105	180.22	-2.49	3.43
110	159.41	-2.42	3.71
115	141.44	-2.36	3.98
120	125.88	-2.30	4.24
125	112.35	-2.25	4.50
130	100.55	-2.19	4.76
135	90.24	-2.14	5.00
140	81.19	-2.09	5.25
145	73.23	-2.04	5.48
150	66.22	-1.99	5.71

RESISTANCE VALUES AT INTERMEDIATE TEMPERATURES WITH R₂₅ AT 2.7 K Ω

T _{oper} (°C)	CATALOG NUMBER 2322 615 3.272		
	R _T (Ω)	TC (%/K)	$\Delta R/R$ DUE TO B-TOLERANCE (%)
-40	70762.57	-6.26	7.58
-35	52048.04	-6.03	6.83
-30	38704.41	-5.82	6.13
-25	29084.12	-5.61	5.45
-20	22074.19	-5.42	4.80
-15	16914.12	-5.23	4.18
-10	13078.64	-5.06	3.58
-5	10201.06	-4.89	3.01
0	8022.83	-4.72	2.46
5	6359.87	-4.57	1.93
10	5079.88	-4.42	1.42
15	4086.95	-4.28	0.93
20	3310.90	-4.14	0.46
25	2700.00	-4.02	0.00
30	2215.79	-3.89	0.22
35	1829.45	-3.77	0.43
40	1519.26	-3.66	0.64
45	1268.68	-3.55	0.84
50	1065.09	-3.45	1.03
55	898.74	-3.35	1.22
60	762.09	-3.25	1.40
65	649.26	-3.16	1.58
70	555.63	-3.07	1.75
75	477.56	-2.99	1.92
80	412.18	-2.90	2.08
85	357.17	-2.83	2.23
90	310.69	-2.75	2.54
95	271.26	-2.68	2.85
100	237.68	-2.61	3.14
105	208.97	-2.54	3.43
110	184.33	-2.48	3.71
115	163.12	-2.41	3.98
120	144.79	-2.35	4.24
125	128.90	-2.30	4.50
130	115.08	-2.24	4.76
135	103.02	-2.19	5.00
140	92.47	-2.13	5.25
145	83.22	-2.08	5.48
150	75.07	-2.04	5.71

RESISTANCE VALUES AT INTERMEDIATE TEMPERATURES WITH R₂₅ AT 4.7 K Ω

T _{oper} (°C)	CATALOG NUMBER 2322 615 3.472		
	R _T (Ω)	TC (%/K)	$\Delta R/R$ DUE TO B-TOLERANCE (%)
-40	152831.92	-6.66	7.58
-35	110192.48	-6.43	6.83
-30	80369.15	-6.20	6.13
-25	59267.29	-5.98	5.45
-20	44169.70	-5.78	4.80
-15	33252.16	-5.58	4.18
-10	25276.18	-5.39	3.58
-5	19391.74	-5.21	3.01
0	15009.33	-5.04	2.46



T _{oper} (°C)	CATALOG NUMBER 2322 615 3.472		
	R _T (Ω)	TC (%/K)	ΔR/R DUE TO B-TOLERANCE (%)
5	11715.98	-4.87	1.93
10	9219.53	-4.71	1.42
15	7311.41	-4.56	0.93
20	5841.30	-4.42	0.46
25	4700.00	-4.28	0.00
30	3807.45	-4.15	0.22
35	3104.52	-4.02	0.43
40	2547.18	-3.90	0.64
45	2102.41	-3.78	0.84
50	1745.26	-3.67	1.03
55	1456.75	-3.56	1.22
60	1222.36	-3.46	1.40
65	1030.87	-3.36	1.58
70	873.61	-3.26	1.75
75	743.79	-3.17	1.92
80	636.11	-3.08	2.08
85	546.36	-3.00	2.23
90	471.22	-2.92	2.54
95	408.03	-2.84	2.85
100	354.67	-2.77	3.14
105	309.43	-2.69	3.43
110	270.91	-2.62	3.71
115	238.01	-2.56	3.98
120	209.79	-2.49	4.24
125	185.50	-2.43	4.50
130	164.53	-2.37	4.76
135	146.36	-2.31	5.00
140	130.57	-2.26	5.25
145	116.80	-2.20	5.48
150	104.76	-2.15	5.71

RESISTANCE VALUES AT INTERMEDIATE TEMPERATURES WITH R₂₅ AT 10 KΩ

T _{oper} (°C)	CATALOG NUMBER 2322 615 3.103		
	R _T (Ω)	TC (%/K)	ΔR/R DUE TO B-TOLERANCE (%)
-40	243448.30	-6.06	7.58
-35	180771.94	-5.85	6.83
-30	135622.82	-5.65	6.13
-25	102751.48	-5.46	5.45
-20	78575.54	-5.28	4.80
-15	60622.56	-5.10	4.18
-10	47167.68	-4.94	3.58
-5	36995.19	-4.78	3.01
0	29239.78	-4.63	2.46
5	23279.76	-4.49	1.93
10	18664.43	-4.35	1.42
15	15064.25	-4.22	0.93
20	12236.28	-4.10	0.46
25	10000.00	-3.98	0.00
30	8220.27	-3.86	0.22
35	6795.17	-3.75	0.43
40	5647.32	-3.65	0.64
45	4717.53	-3.55	0.84
50	3960.30	-3.45	1.03

T _{oper} (°C)	CATALOG NUMBER 2322 615 3.103		
	R _T (Ω)	TC (%/K)	ΔR/R DUE TO B-TOLERANCE (%)
55	3340.37	-3.36	1.22
60	2830.32	-3.27	1.40
65	2408.64	-3.18	1.58
70	2058.41	-3.10	1.75
75	1766.22	-3.02	1.92
80	1521.40	-2.95	2.08
85	1315.43	-2.87	2.23
90	1141.44	-2.80	2.54
95	993.91	-2.73	2.85
100	868.35	-2.67	3.14
105	761.11	-2.61	3.43
110	669.19	-2.54	3.71
115	590.14	-2.48	3.98
120	521.94	-2.43	4.24
125	462.92	-2.37	4.50
130	411.68	-2.32	4.76
135	367.08	-2.27	5.00
140	328.14	-2.22	5.25
145	294.05	-2.17	5.48
150	264.12	-2.12	5.71

RESISTANCE VALUES AT INTERMEDIATE TEMPERATURES WITH R₂₅ AT 15 KΩ

T _{oper} (°C)	CATALOG NUMBER 2322 615 3.153		
	R _T (Ω)	TC (%/K)	ΔR/R DUE TO B-TOLERANCE (%)
-40	362484.49	-6.07	7.58
-35	269088.54	-5.85	6.83
-30	201887.78	-5.64	6.13
-25	152996.55	-5.45	5.45
-20	117051.45	-5.26	4.80
-15	90360.69	-5.09	4.18
-10	70354.10	-4.92	3.58
-5	55223.01	-4.76	3.01
0	43681.57	-4.61	2.46
5	34806.62	-4.47	1.93
10	27929.29	-4.33	1.42
15	22560.62	-4.20	0.93
20	18340.15	-4.08	0.46
25	15000.00	-3.96	0.00
30	12339.55	-3.85	0.22
35	10207.46	-3.74	0.43
40	8488.74	-3.64	0.64
45	7095.43	-3.54	0.84
50	5959.80	-3.44	1.03
55	5029.40	-3.35	1.22
60	4263.35	-3.26	1.40
65	3629.59	-3.18	1.58
70	3102.87	-3.10	1.75
75	2663.17	-3.02	1.92
80	2294.55	-2.94	2.08
85	1984.26	-2.87	2.23
90	1722.03	-2.80	2.54
95	1499.58	-2.73	2.85
100	1310.17	-2.67	3.14



T _{oper} (°C)	CATALOG NUMBER 2322 615 3.153		
	R _T (Ω)	TC (%/K)	ΔR/R DUE TO B-TOLERANCE (%)
105	1148.34	-2.61	3.43
110	1009.58	-2.55	3.71
115	890.23	-2.49	3.98
120	787.23	-2.43	4.24
125	698.07	-2.38	4.50
130	620.67	-2.32	4.76
135	553.27	-2.27	5.00
140	494.43	-2.22	5.25
145	442.91	-2.18	5.48
150	397.69	-2.13	5.71

RESISTANCE VALUES AT INTERMEDIATE TEMPERATURES WITH R ₂₅ AT 22 KΩ			
T _{oper} (°C)	CATALOG NUMBER 2322 615 3.223		
	R _T (Ω)	TC (%/K)	ΔR/R DUE TO B-TOLERANCE (%)
-40	603211.80	-6.28	7.58
-35	443042.83	-6.06	6.83
-30	328857.73	-5.86	6.13
-25	246572.40	-5.66	5.45
-20	186660.99	-5.47	4.80
-15	142608.21	-5.29	4.18
-10	109909.84	-5.12	3.58
-5	85419.80	-4.96	3.01
0	66918.84	-4.80	2.46
5	52826.61	-4.66	1.93
10	42007.45	-4.51	1.42
15	33638.10	-4.38	0.93
20	27116.78	-4.25	0.46
25	22000.00	-4.12	0.00
30	17958.43	-4.00	0.22
35	14745.66	-3.89	0.43
40	12176.02	-3.77	0.64
45	10108.62	-3.67	0.84
50	8435.86	-3.57	1.03
55	7075.02	-3.47	1.22
60	5962.13	-3.38	1.40
65	5047.43	-3.29	1.58
70	4291.97	-3.20	1.75
75	3665.11	-3.12	1.92
80	3142.63	-3.04	2.08
85	2705.24	-2.96	2.23
90	2337.57	-2.88	2.54
95	2027.26	-2.81	2.85
100	1764.33	-2.74	3.14
105	1540.72	-2.68	3.43
110	1349.86	-2.61	3.71
115	1186.38	-2.55	3.98
120	1045.88	-2.49	4.24
125	924.73	-2.43	4.50
130	819.95	-2.38	4.76
135	729.04	-2.32	5.00
140	649.93	-2.27	5.25
145	580.89	-2.22	5.48
150	520.48	-2.17	5.71

RESISTANCE VALUES AT INTERMEDIATE TEMPERATURES WITH R₂₅ AT 33 K Ω

T _{oper} (°C)	CATALOG NUMBER 2322 615 3.333		
	R _T (Ω)	TC (%/K)	$\Delta R/R$ DUE TO B-TOLERANCE (%)
-40	1061183.25	-6.70	7.58
-35	764124.83	-6.44	6.83
-30	557157.76	-6.20	6.13
-25	411057.96	-5.97	5.45
-20	306646.44	-5.75	4.80
-15	231156.78	-5.55	4.18
-10	175976.71	-5.36	3.58
-5	135222.68	-5.18	3.01
0	104827.07	-5.01	2.46
5	81945.82	-4.84	1.93
10	64568.99	-4.69	1.42
15	51261.67	-4.54	0.93
20	40989.49	-4.40	0.46
25	33000.00	-4.27	0.00
30	26740.98	-4.14	0.22
35	21803.80	-4.02	0.43
40	17883.65	-3.91	0.64
45	14751.46	-3.80	0.84
50	12233.79	-3.69	1.03
55	10198.43	-3.59	1.22
60	8543.91	-3.49	1.40
65	7191.86	-3.40	1.58
70	6081.39	-3.31	1.75
75	5164.90	-3.22	1.92
80	4404.97	-3.14	2.08
85	3772.02	-3.06	2.23
90	3242.57	-2.99	2.54
95	2797.84	-2.91	2.85
100	2422.78	-2.84	3.14
105	2105.27	-2.78	3.43
110	1835.47	-2.71	3.71
115	1605.39	-2.65	3.98
120	1408.51	-2.59	4.24
125	1239.47	-2.53	4.50
130	1093.87	-2.47	4.76
135	968.07	-2.42	5.00
140	859.04	-2.36	5.25
145	764.28	-2.31	5.48
150	681.69	-2.26	5.71

RESISTANCE VALUES AT INTERMEDIATE TEMPERATURES WITH R₂₅ AT 47 K Ω

T _{oper} (°C)	CATALOG NUMBER 2322 615 3.473		
	R _T (Ω)	TC (%/K)	$\Delta R/R$ DUE TO B-TOLERANCE (%)
-40	1643692.75	-6.85	7.58
-35	1174859.36	-6.59	6.83
-30	850461.50	-6.34	6.13
-25	623018.26	-6.11	5.45
-20	461556.69	-5.89	4.80
-15	345583.02	-5.69	4.18
-10	261354.11	-5.49	3.58
-5	199536.23	-5.31	3.01
0	153713.87	-5.13	2.46
5	119426.97	-4.97	1.93
10	93541.28	-4.81	1.42



T _{oper} (°C)	CATALOG NUMBER 2322 615 3.473		
	R _T (Ω)	TC (%/K)	ΔR/R DUE TO B-TOLERANCE (%)
15	73831.58	-4.66	0.93
20	58702.60	-4.52	0.46
25	47000.00	-4.38	0.00
30	37881.11	-4.25	0.22
35	30725.55	-4.13	0.43
40	25072.93	-4.01	0.64
45	20578.93	-3.89	0.84
50	16984.15	-3.79	1.03
55	14091.76	-3.68	1.22
60	11751.42	-3.58	1.40
65	9847.55	-3.49	1.58
70	8290.73	-3.40	1.75
75	7011.37	-3.31	1.92
80	5954.99	-3.22	2.08
85	5078.74	-3.14	2.23
90	4348.67	-3.07	2.54
95	3737.83	-2.99	2.85
100	3224.64	-2.92	3.14
105	2791.80	-2.85	3.43
110	2425.34	-2.87	3.71
115	2113.94	-2.72	3.98
120	1848.39	-2.65	4.24
125	1621.16	-2.59	4.50
130	1426.09	-2.54	4.76
135	1258.09	-2.48	5.00
140	1112.95	-2.42	5.25
145	987.19	-2.37	5.48
150	877.91	-2.32	5.71

RESISTANCE VALUES AT INTERMEDIATE TEMPERATURES WITH R₂₅ AT 68 KΩ

T _{oper} (°C)	CATALOG NUMBER 2322 615 3.683		
	R _T (Ω)	TC (%/K)	ΔR/R DUE TO B-TOLERANCE (%)
-40	2324375.76	-6.77	7.58
-35	1667529.37	-6.52	6.83
-30	1211147.53	-6.28	6.13
-25	889916.80	-6.05	5.45
-20	661046.51	-5.84	4.80
-15	496103.17	-5.64	4.18
-10	375940.63	-5.45	3.58
-5	287504.04	-5.28	3.01
0	221786.10	-5.11	2.46
5	172502.28	-4.95	1.93
10	135221.13	-4.79	1.42
15	106786.33	-4.65	0.93
20	84928.25	-4.51	0.46
25	68000.00	-4.38	0.00
30	54796.21	-4.26	0.22
35	44427.35	-4.14	0.43
40	36231.83	-4.02	0.64
45	29713.87	-3.91	0.84
50	24499.27	-3.81	1.03
55	20303.65	-3.71	1.22

T _{oper} (°C)	CATALOG NUMBER 2322 615 3.683		
	R _T (Ω)	TC (%/K)	ΔR/R DUE TO B-TOLERANCE (%)
60	16909.48	-3.61	1.40
65	14149.29	-3.52	1.58
70	11893.39	-3.43	1.75
75	10040.74	-3.34	1.92
80	8512.21	-3.26	2.08
85	7245.46	-3.18	2.23
90	6191.15	-3.11	2.54
95	5310.02	-3.03	2.85
100	4570.69	-2.96	3.14
105	3947.95	-2.90	3.43
110	3421.48	-2.83	3.71
115	2974.79	-2.77	3.98
120	2594.49	-2.71	4.24
125	2269.63	-2.65	4.50
130	1991.22	-2.59	4.76
135	1751.89	-2.53	5.00
140	1545.52	-2.48	5.25
145	1367.06	-2.43	5.48
150	1212.28	-2.38	5.71

RESISTANCE VALUES AT INTERMEDIATE TEMPERATURES WITH R₂₅ AT 100 KΩ

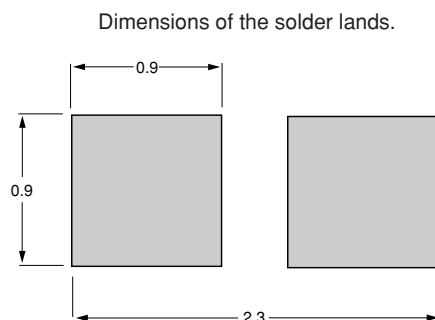
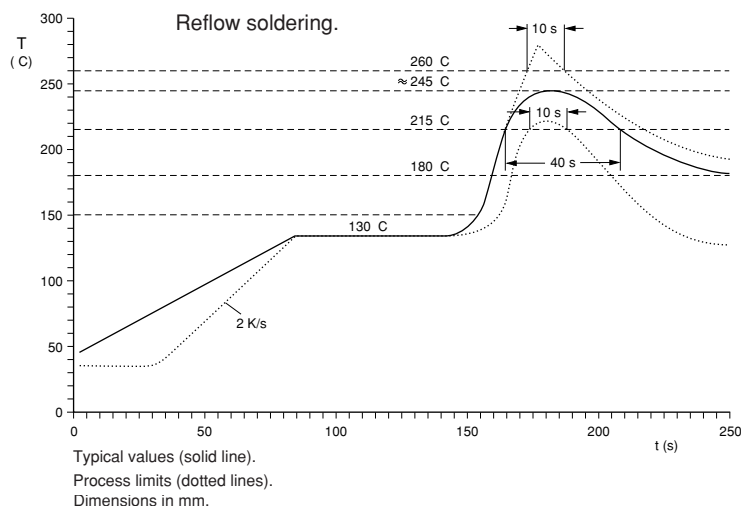
T _{oper} (°C)	CATALOG NUMBER 2322 615 3.104		
	R _T (Ω)	TC (%/K)	ΔR/R DUE TO B-TOLERANCE (%)
-40	3921252.41	-7.03	7.58
-35	2774564.66	-6.77	6.83
-30	1988706.07	-6.52	6.13
-25	1442860.78	-6.28	5.45
-20	1058901.24	-6.06	4.80
-15	785573.28	-5.85	4.18
-10	588792.99	-5.65	3.58
-5	445601.87	-5.47	3.01
0	340346.26	-5.29	2.46
5	262229.45	-5.12	1.93
10	203722.79	-4.96	1.42
15	159521.65	-4.80	0.93
20	125851.24	-4.66	0.46
25	100000.00	-4.52	0.00
30	80002.55	-4.39	0.22
35	64422.07	-4.26	0.43
40	52199.54	-4.14	0.64
45	42548.23	-4.02	0.84
50	34879.32	-3.91	1.03
55	28748.92	-3.80	1.22
60	23820.09	-3.70	1.40
65	19835.37	-3.60	1.58
70	16596.82	-3.51	1.75
75	13951.27	-3.42	1.92
80	11779.54	-3.33	2.08
85	9988.36	-3.25	2.23
90	8504.34	-3.17	2.54
95	7269.45	-3.09	2.85
100	6237.53	-3.02	3.14
105	5371.72	-2.95	3.43
110	4642.45	-2.88	3.71

T_{oper} (°C)	CATALOG NUMBER 2322 615 3.104		
	R_T (Ω)	TC (%/K)	$\Delta R/R$ DUE TO B-TOLERANCE (%)
115	4025.87	-2.81	3.98
120	3502.66	-2.75	4.24
125	3057.12	-2.68	4.50
130	2676.44	-2.62	4.76
135	2350.10	-2.57	5.00
140	2069.46	-2.51	5.25
145	1827.38	-2.46	5.48
150	1617.93	-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 10 s should not be exceeded.

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

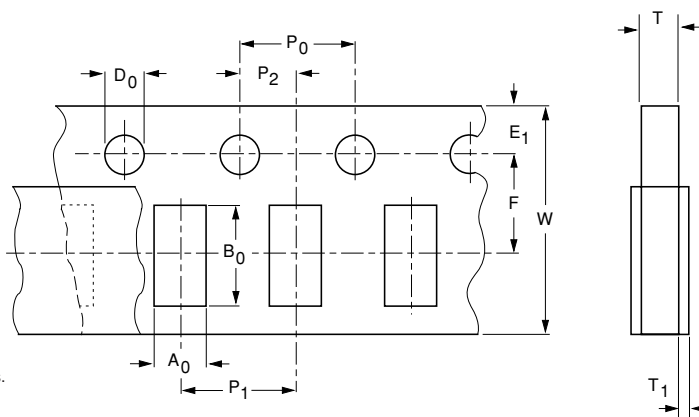


PACKAGING

TAPE SPECIFICATIONS

All tape specifications are in accordance with "IEC 60286-3". Basic dimensions are given below. Carrier tape material is paper.

PAPER TAPE

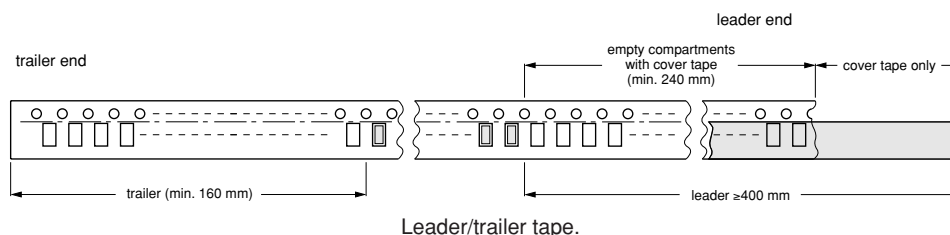


Cumulative pitch error: 0.2 mm over 10 pitches.
Cumulative tolerance over 10 holes: ± 0.2 mm.

DIMENSIONS OF PAPER TAPE in millimeters		
PARAMETER	DIMENSION	TOLERANCE
A ₀ ; note 1	1.15	±0.1
B ₀ ; note 1	1.9	±0.1
K ₀	4.1	±0.1
W	8.0	±0.2
E1	1.75	±0.1
F	3.5	±0.05
D ₀	1.55	±0.05
D ₁	1.5	+0.1/-0.0
P ₀ ; note 2	4.0	±0.1
P ₁	12	±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. P₀ pitch tolerance over any 10 pitches is ±0.2 mm.

LEADER/TRAILER TAPE SPECIFICATION**TAPING PACKAGE REQUIREMENTS**

Component is free and not sticking to top and/or bottom tape.

Component should be easy to remove from carrier tape.

TESTS AND REQUIREMENTS

SOLDERABILITY AND RESISTANCE TO SOLDERING HEAT				
IEC 60068-2-58	TEST METHOD	TEST	PROCEDURE	REQUIREMENTS
6	T _c	solderability	2 s at 235 °C	min. 95% of surface wetted
		resistance to soldering heat	10 s at 260 °C	ΔR/R < 5%