

## 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 0402 chip thermistors with a negative temperature coefficient. The device has no marking.

### PACKAGING

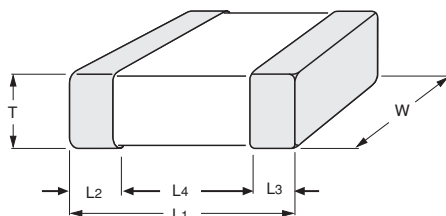
Available in 8 mm punched paper tape on reel package of 4000 units.

### QUICK REFERENCE DATA

PARAMETER	VALUE
Resistance value at 25 °C	4.7 kΩ to 100 kΩ
Tolerance on R <sub>25</sub> -value	±1%; ±2%; ±3%; ±5%; ±10%
Tolerance on B <sub>25/85</sub> -value	see Table below
Maximum dissipation at 25 °C	125 mW
Thermal time constant $\tau$	≈8 s
Operating temperature range	–40 to +150 °C
R/T values	see Tables
Climatic category	40/125/56
Mass	≈0.002 g

### ELECTRICAL DATA AND ORDERING INFORMATION

R <sub>25</sub> (kΩ)	B <sub>25/85</sub> -VALUE (K)	TOLERANCE ON B <sub>25/85</sub> (%)	CATALOG NUMBER 2322 615 4....				
			±1% TOL. ON R <sub>25</sub>	±2% TOL. ON R <sub>25</sub>	±3% TOL. ON R <sub>25</sub>	±5% TOL. ON R <sub>25</sub>	±10% TOL. ON R <sub>25</sub>
4.7	3595	±3	45472	44472	46472	43472	42472
10	3490	±3	45103	44103	46103	43103	42103
15	3600	±3	45153	44153	46153	43153	42153
22	3590	±3	45223	44223	46223	43223	42223
33	3670	±3	45333	44333	46333	43333	42333
47	4075	±3	45473	44473	46473	43473	42473
68	3910	±3	45683	44683	46683	43683	42683
100	3950	±3	45104	44104	46104	43104	42104

**DIMENSIONS** in millimeters

L <sub>1</sub>	W	T	L <sub>2</sub> and L <sub>3</sub> MIN.	L <sub>4</sub> MIN.
1.0 ±0.15	0.5 ±0.15	0.5 ±0.15	0.1	0.3

**RESISTANCE VALUES AT INTERMEDIATE TEMPERATURES WITH R<sub>25</sub> AT 4.7 KΩ**

T <sub>oper</sub> (°C)	CATALOG NUMBER 2322 615 4.472		
	R <sub>T</sub> (Ω)	TC (%/K)	ΔR/R DUE TO B-TOLERANCE (%)
-40	117851.65	-6.08	11.22
-35	87377.07	-5.89	10.14
-30	65414.86	-5.69	9.10
-25	49435.13	-5.51	8.11
-20	37699.56	-5.33	7.15
-15	29002.73	-5.16	6.24
-10	22501.16	-4.99	5.35
-5	17599.41	-4.83	4.50
0	13873.45	-4.68	3.68
5	11018.80	-4.53	2.89
10	8814.97	-4.39	2.13
15	7101.03	-4.26	1.40
20	5758.62	-4.13	0.69
25	4700.00	-4.00	0.00
30	3859.67	-3.88	0.66
35	3188.38	-3.76	1.31
40	2648.86	-3.65	1.93
45	2212.67	-3.55	2.53
50	1858.03	-3.44	3.11
55	1568.12	-3.34	3.68
60	1329.87	-3.25	4.23
65	1133.09	-3.16	4.76
70	969.76	-3.07	5.28
75	833.56	-2.98	5.78
80	719.47	-2.90	6.27
85	623.48	-2.83	6.74
90	542.38	-2.75	7.20
95	473.58	-2.68	7.65
100	414.98	-2.61	8.09
105	364.89	-2.54	8.51
110	321.91	-2.47	8.93
115	284.90	-2.41	9.33
120	252.92	-2.35	9.73
125	225.20	-2.29	10.11
130	201.09	-2.24	10.48
135	180.07	-2.18	10.85
140	161.67	-2.13	11.20
145	145.53	-2.08	11.55
150	131.33	-2.03	11.89

**RESISTANCE VALUES AT INTERMEDIATE TEMPERATURES WITH  $R_{25}$  AT 10  $k\Omega$** 

$T_{oper}$ (°C)	CATALOG NUMBER 2322 615 4.103		
	$R_T$ ( $\Omega$ )	TC (%/K)	$\Delta R/R$ DUE TO B-TOLERANCE (%)
-40	214063.67	-5.72	11.22
-35	161527.01	-5.55	10.14
-30	122938.33	-5.38	9.10
-25	94353.48	-5.21	8.11
-20	73003.30	-5.05	7.15
-15	56927.91	-4.90	6.24
-10	44729.13	-4.75	5.35
-5	35401.63	-4.61	4.50
0	28217.00	-4.47	3.68
5	22643.44	-4.33	2.89
10	18289.86	-4.21	2.13
15	14866.53	-4.08	1.40
20	12157.35	-3.96	0.69
25	10000.00	-3.85	0.00
30	8271.77	-3.74	0.66
35	6879.27	-3.63	1.31
40	5751.02	-3.53	1.93
45	4831.94	-3.43	2.53
50	4079.35	-3.34	3.11
55	3459.99	-3.25	3.68
60	2947.82	-3.16	4.23
65	2522.30	-3.08	4.76
70	2167.17	-2.99	5.28
75	1869.50	-2.92	5.78
80	1618.94	-2.84	6.27
85	1407.18	-2.77	6.74
90	1227.51	-2.70	7.20
95	1074.48	-2.63	7.65
100	943.67	-2.56	8.09
105	831.46	-2.50	8.51
110	734.86	-2.44	8.93
115	651.44	-2.38	9.33
120	579.17	-2.32	9.73
125	516.36	-2.27	10.11
130	461.60	-2.22	10.48
135	413.73	-2.16	10.85
140	371.77	-2.11	11.20
145	334.88	-2.07	11.55
150	302.36	-2.02	11.89

**RESISTANCE VALUES AT INTERMEDIATE TEMPERATURES WITH  $R_{25}$  AT 15  $k\Omega$** 

$T_{oper}$ (°C)	CATALOG NUMBER 2322 615 4.153		
	$R_T$ ( $\Omega$ )	TC (%/K)	$\Delta R/R$ DUE TO B-TOLERANCE (%)
-40	347696.43	-5.86	11.22
-35	260574.24	-5.68	10.14
-30	197003.50	-5.51	9.10
-25	150213.26	-5.34	8.11
-20	115481.81	-5.18	7.15
-15	89488.82	-5.02	6.24
-10	69880.15	-4.87	5.35
-5	54973.10	-4.73	4.50
0	43555.42	-4.59	3.68

T <sub>oper</sub> (°C)	CATALOG NUMBER 2322 615 4.153		
	R <sub>T</sub> (Ω)	TC (%/K)	ΔR/R DUE TO B-TOLERANCE (%)
5	34746.94	-4.45	2.89
10	27903.80	-4.32	2.13
15	22551.53	-4.20	1.40
20	18338.00	-4.08	0.69
25	15000.00	-3.96	0.00
30	12339.53	-3.85	0.66
35	10206.62	-3.74	1.31
40	8486.97	-3.64	1.93
45	7092.93	-3.54	2.53
50	5956.89	-3.44	3.11
55	5026.40	-3.35	3.68
60	4260.51	-3.26	4.23
65	3627.13	-3.18	4.76
70	3100.93	-3.09	5.28
75	2661.84	-3.01	5.78
80	2293.88	-3.94	6.27
85	1984.26	-3.86	6.74
90	1722.68	-2.79	7.20
95	1500.85	-2.72	7.65
100	1312.03	-2.66	8.09
105	1150.72	-2.59	8.51
110	1012.43	-2.53	8.93
115	893.49	-2.47	9.33
120	790.85	-2.41	9.73
125	702.01	-2.36	10.11
130	624.86	-2.30	10.48
135	557.68	-2.25	10.85
140	499.00	-2.20	11.20
145	447.62	-2.15	11.55
150	402.49	-2.10	11.89

**RESISTANCE VALUES AT INTERMEDIATE TEMPERATURES WITH R<sub>25</sub> AT 22 KΩ**

T <sub>oper</sub> (°C)	CATALOG NUMBER 2322 615 4.223		
	R <sub>T</sub> (Ω)	TC (%/K)	ΔR/R DUE TO B-TOLERANCE (%)
-40	501411.70	-5.84	11.22
-35	376174.12	-5.66	10.14
-30	284753.94	-5.48	9.10
-25	217416.83	-5.31	8.11
-20	167385.72	-5.15	7.15
-15	129899.74	-4.99	6.24
-10	101585.03	-4.84	5.35
-5	80030.20	-4.70	4.50
0	63497.49	-4.56	3.68
5	50724.55	-4.43	2.89
10	40787.18	-4.30	2.13
15	33003.71	-4.17	1.40
20	26867.64	-4.06	0.69
25	22000.00	-3.94	0.00
30	18115.28	-3.83	0.66
35	14996.99	-3.73	1.31
40	12479.89	-3.62	1.93
45	10437.10	-3.53	2.53
50	8770.63	-3.43	3.11



T <sub>oper</sub> (°C)	CATALOG NUMBER 2322 615 4.223		
	R <sub>T</sub> (Ω)	TC (%/K)	ΔR/R DUE TO B-TOLERANCE (%)
55	7404.33	-3.34	3.68
60	6278.71	-3.25	4.23
65	5347.05	-3.17	4.76
70	4572.46	-3.09	5.28
75	3925.65	-3.01	5.78
80	3383.28	-2.94	6.27
85	2926.64	-2.86	6.74
90	2540.69	-2.79	7.20
95	2213.23	-2.73	7.65
100	1934.40	-2.66	8.09
105	1696.12	-2.60	8.51
110	1491.82	-2.54	8.93
115	1316.06	-2.48	9.33
120	1164.37	-2.42	9.73
125	1033.06	-2.37	10.11
130	919.03	-2.31	10.48
135	819.74	-2.26	10.85
140	733.03	-2.21	11.20
145	657.10	-2.16	11.55
150	590.44	-2.12	11.89

RESISTANCE VALUES AT INTERMEDIATE TEMPERATURES WITH R <sub>25</sub> AT 33 KΩ			
T <sub>oper</sub> (°C)	CATALOG NUMBER 2322 615 4.333		
	R <sub>T</sub> (Ω)	TC (%/K)	ΔR/R DUE TO B-TOLERANCE (%)
-40	831938.59	-6.14	11.22
-35	615448.56	-5.92	10.14
-30	460193.66	-5.71	9.10
-25	347596.17	-5.51	8.11
-20	265065.49	-5.33	7.15
-15	203963.61	-5.15	6.24
-10	158295.25	-4.99	5.35
-5	123853.56	-4.83	4.50
0	97655.81	-4.68	3.68
5	77566.21	-4.54	2.89
10	62041.07	-4.40	2.13
15	49954.62	-4.27	1.40
20	40478.91	-4.15	0.69
25	33000.00	-3.03	0.00
30	27059.17	-3.91	0.66
35	22311.10	-3.81	1.31
40	18493.97	-3.70	1.93
45	15407.98	-3.60	2.53
50	12899.59	-3.51	3.11
55	10850.13	-3.41	3.68
60	9167.30	-3.33	4.23
65	7778.91	-3.24	4.76
70	6628.18	-3.16	5.28
75	5670.21	-3.08	5.78
80	4869.32	-3.01	6.27
85	4197.00	-2.94	6.74
90	3630.40	-2.87	7.20
95	3151.06	-2.80	7.65
100	2744.06	-2.73	8.09

T <sub>oper</sub> (°C)	CATALOG NUMBER 2322 615 4.333		
	R <sub>T</sub> (Ω)	TC (%/K)	ΔR/R DUE TO B-TOLERANCE (%)
105	2397.26	-2.67	8.51
110	2100.74	-2.61	8.93
115	1846.38	-2.55	9.33
120	1627.48	-2.50	9.73
125	1438.51	-2.44	10.11
130	1274.91	-2.39	10.48
135	1132.84	-2.34	10.85
140	1009.14	-2.29	11.20
145	901.13	-2.24	11.55
150	806.58	-2.19	11.89

**RESISTANCE VALUES AT INTERMEDIATE TEMPERATURES WITH R<sub>25</sub> AT 47 KΩ**

T <sub>oper</sub> (°C)	CATALOG NUMBER 2322 615 4.473		
	R <sub>T</sub> (Ω)	TC (%/K)	ΔR/R DUE TO B-TOLERANCE (%)
-40	1514773.04	-6.19	11.22
-35	1114828.57	-6.07	10.14
-30	825416.78	-5.95	9.10
-25	615030.13	-5.82	8.11
-20	461300.34	-5.69	7.15
-15	348340.37	-5.55	6.24
-10	264846.40	-5.41	5.35
-5	202753.02	-5.27	4.50
0	156284.67	-5.14	3.68
5	121288.05	-5.00	2.89
10	94762.48	-4.87	2.13
15	74529.09	-4.74	1.40
20	58997.38	-4.61	0.69
25	47000.00	-4.48	0.00
30	37675.36	-4.36	0.66
35	30383.98	-4.24	1.31
40	24648.51	-4.13	1.93
45	20110.62	-4.01	2.53
50	16499.77	-3.90	3.11
55	13610.61	-3.80	3.68
60	11286.36	-3.69	4.23
65	9406.70	-3.59	4.76
70	7878.79	-3.50	5.28
75	6630.61	-3.40	5.78
80	5605.99	-3.31	6.27
85	4760.94	-3.22	6.74
90	4060.80	-3.14	7.20
95	3478.15	-3.06	7.65
100	2991.19	-2.98	8.09
105	2582.50	-2.90	8.51
110	2238.12	-2.83	8.93
115	1946.79	-2.75	9.33
120	1699.40	-2.68	9.73
125	1488.54	-2.62	10.11
130	1308.18	-2.55	10.48
135	1153.38	-2.49	10.85
140	1020.05	-2.43	11.20
145	904.86	-2.37	11.55
150	805.02	-2.31	11.89

**RESISTANCE VALUES AT INTERMEDIATE TEMPERATURES WITH  $R_{25}$  AT 68 K $\Omega$** 

$T_{oper}$ (°C)	CATALOG NUMBER 2322 615 4.683		
	$R_T$ ( $\Omega$ )	TC (%/K)	$\Delta R/R$ DUE TO B-TOLERANCE (%)
-40	2179611.50	-6.65	11.22
-35	1573199.63	-6.40	10.14
-30	1149311.24	-6.16	9.10
-25	849224.01	-5.94	8.11
-20	634230.72	-5.74	7.15
-15	478461.46	-5.54	6.24
-10	364399.28	-5.35	5.35
-5	280036.50	-5.18	4.50
0	217045.88	-5.01	3.68
5	169588.77	-4.86	2.89
10	133528.58	-4.71	2.13
15	105905.55	-4.56	1.40
20	84581.95	-4.43	0.69
25	68000.00	-4.30	0.00
30	55014.80	-4.18	0.66
35	44778.07	-4.06	1.31
40	36656.44	-3.95	1.93
45	30173.47	-3.84	2.53
50	24968.25	-3.74	3.11
55	20765.51	-3.64	3.68
60	17353.94	-3.54	4.23
65	14570.33	-3.45	4.76
70	12287.85	-3.36	5.28
75	10407.39	-3.28	5.78
80	8851.06	-3.20	6.27
85	7557.32	-3.12	6.74
90	6477.32	-3.05	7.20
95	5572.07	-2.98	7.65
100	4810.32	-2.91	8.09
105	4166.88	-2.84	8.51
110	3621.41	-2.77	8.93
115	3157.34	-2.71	9.33
120	2761.19	-2.65	9.73
125	2421.90	-2.59	10.11
130	2130.39	-2.54	10.48
135	1879.16	-2.48	10.85
140	1662.00	-2.43	11.20
145	1473.74	-2.38	11.55
150	1310.08	-2.33	11.89

**RESISTANCE VALUES AT INTERMEDIATE TEMPERATURES WITH  $R_{25}$  AT 100 K $\Omega$** 

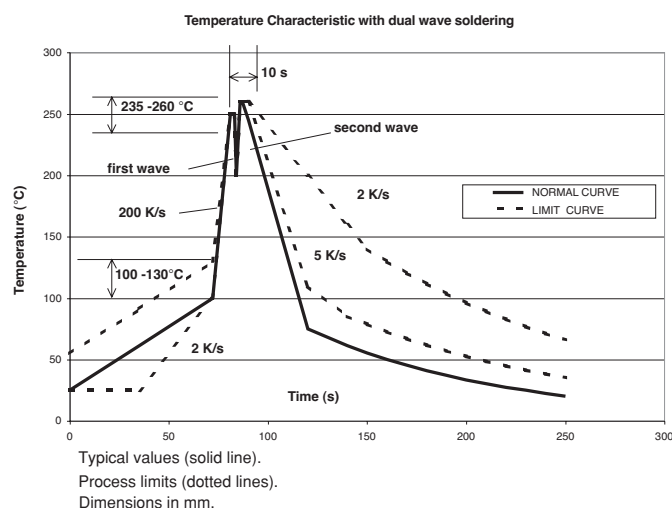
$T_{oper}$ (°C)	CATALOG NUMBER 2322 615 4.104		
	$R_T$ ( $\Omega$ )	TC (%/K)	$\Delta R/R$ DUE TO B-TOLERANCE (%)
-40	3238142.11	-6.57	11.22
-35	2344881.64	-6.35	10.14
-30	1716473.25	-6.13	9.10
-25	1269492.61	-5.93	8.11
-20	948194.33	-5.74	7.15
-15	714901.46	-5.56	6.24
-10	543869.12	-5.38	5.35
-5	417320.14	-5.21	4.50
0	322854.97	-5.05	3.68
5	251740.95	-4.90	2.89
10	197770.62	-4.75	2.13

T <sub>oper</sub> (°C)	CATALOG NUMBER 2322 615 4.104		
	R <sub>T</sub> (Ω)	TC (%/K)	ΔR/R DUE TO B-TOLERANCE (%)
15	156492.00	-4.61	1.40
20	124684.71	-4.48	0.69
25	100000.00	-4.35	0.00
30	80711.25	-4.22	0.66
35	65539.50	-4.11	1.31
40	53530.39	-3.99	1.93
45	43966.79	-3.88	2.53
50	36306.14	-3.78	3.11
55	30135.26	-3.68	3.68
60	25137.53	-3.58	4.23
65	21068.83	-3.48	4.76
70	17739.85	-3.39	5.28
75	15002.94	-3.31	5.78
80	12742.32	-3.22	6.27
85	10866.72	-3.14	6.74
90	9303.84	-3.07	7.20
95	7996.08	-2.99	7.65
100	6897.40	-2.92	8.09
105	5970.77	-2.85	8.51
110	5186.31	-2.78	8.93
115	4519.80	-2.72	9.33
120	3951.51	-2.66	9.73
125	3465.32	-2.60	10.11
130	3048.01	-2.54	10.48
135	2688.67	-2.48	10.85
140	2378.30	-2.43	11.20
145	2109.44	-2.37	11.55
150	1875.84	-2.32	11.89

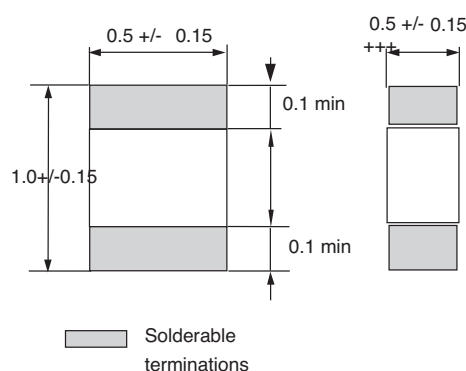
## SOLDERING CONDITIONS

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.

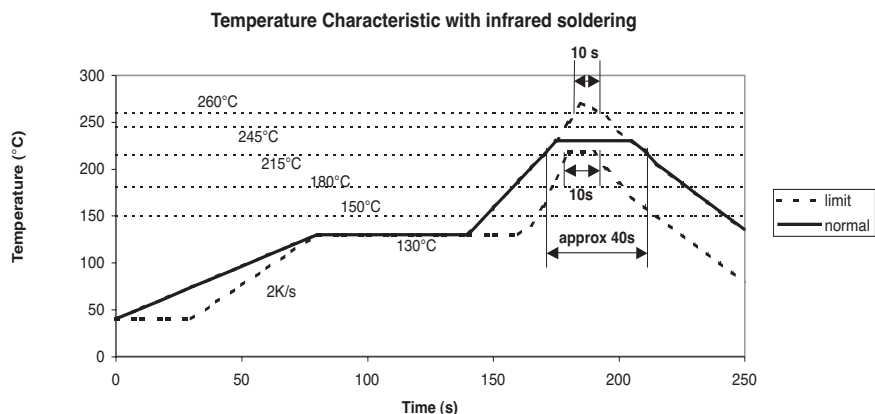
Typical examples of a soldering processes that will provide reliable joints without damage, are shown below.



Dimensions of the solder lands.





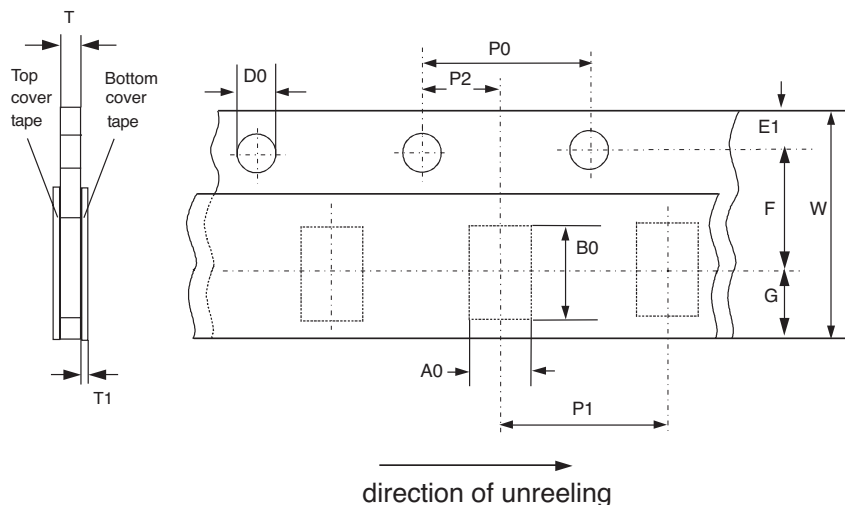


## PACKAGING

### TAPE SPECIFICATIONS

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

### PAPER TAPE



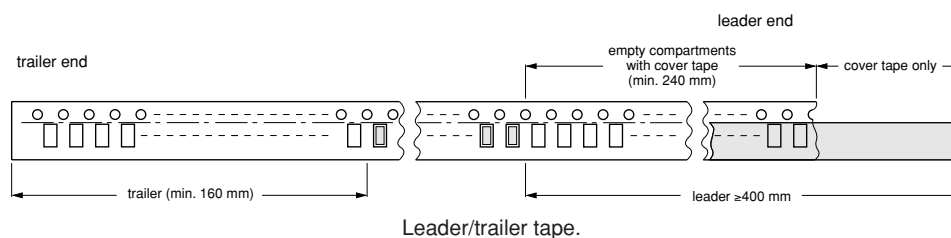
### DIMENSIONS OF PAPER TAPE in millimeters

PARAMETER	DIMENSION	TOLERANCE
A <sub>0</sub> ; note 1	0.65	±0.1
B <sub>0</sub> ; note 1	1.15	±0.1
D <sub>0</sub>	1.55	±0.05
P <sub>0</sub> ; note 2	2.00	±0.10
E <sub>1</sub>	1.75	±0.10
cumulative pitch over 10 positions	0.00	±0.1
P <sub>2</sub>	1.00	±0.05
	3.5	±0.05
T <sub>1</sub>	< 0.1	—
W	8	±0.2
T	0.8 max	—

### Notes

1. Measured 0.3 mm above base pocket.
2. P<sub>0</sub> 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 <sub>c</sub>	solderability	2 s at 235 °C	min. 95% of surface wetted
		resistance to soldering heat	10 s at 260 °C	$\Delta R/R < 5\%$