Subject: Electrical Characterization of CUBISIC SLP Capacitors

Exxelia Engineering Team, January 2021.

Objective: Describe the performance characteristics of CUBISIC SLP capacitors built in accordance with IEC 30 3001 for use in temperature (-55/+85°CC) applications.

Conclusions: Based on the results of this testing, the Exxelia Engineering Team is confident that CUBISIC SLP capacitors provide the following performance characteristics:

- High Reliability – Passed 2000 hr and beyond life tests at +85°C
- Very stable at low pressure and 25°C (1 torr for 100 hours)
- Rapid temperature cycling (100 cycles at -55 and 85°C)
- Vibration resistance (2 hours per axis at 30 or 50 g)
- Electrical characterisation at low and high temperatures (-55 to 85°C)

Discussion:

For the purposes of all testing in this report, initial characteristics were measured at 25°C as Capacitance at 100 Hz in microfarad, ESR (equivalent serie resistance) at 100 Hz in mOhm, impedance at 10 kHz in mOhm, and leakage current at nominal voltage after 5 min in microampere.

Electrical characteristics, except leakage current, have been measured between -55 and 85°C for frequencies between 20 Hz and 200 kHz.

Samples:

List of samples retained for electrical characterization or reliability test:

- 63 V 6800 µF 45x75x12 mm
- 80 V 4700 µF 45x50x12 mm
- 100 V 3300 µF 45x75x12 mm
- 350 V 470 µF 45x75x12 mm
- 400 V 330 µF 45x75x12 mm

Tests descriptions

Life test:

This life test is done at nominal voltage and 85°C during at least 2000 hours following IEC recommendations. For each intermediary measurement, capacitors are cooled at room temperature and are measured 16 hours at least after test interruption. This test was released with each sample.

Low pressure test:

This test was performed at room temperature at 1 torr during 100 hours. Capacitors were tested before and after storage at low pressure. Capacitors are not polarized during this test.

Rapid Temperature Cycling

Capacitor are submitted to a rapid temperature cycling, one cycle correspond to 30 min at -55°C and 30 min at 85°C for a total of 100 cycles. This test has been realised in accordance to IEC 60068-2-14 norms.

Vibration and shock resistance

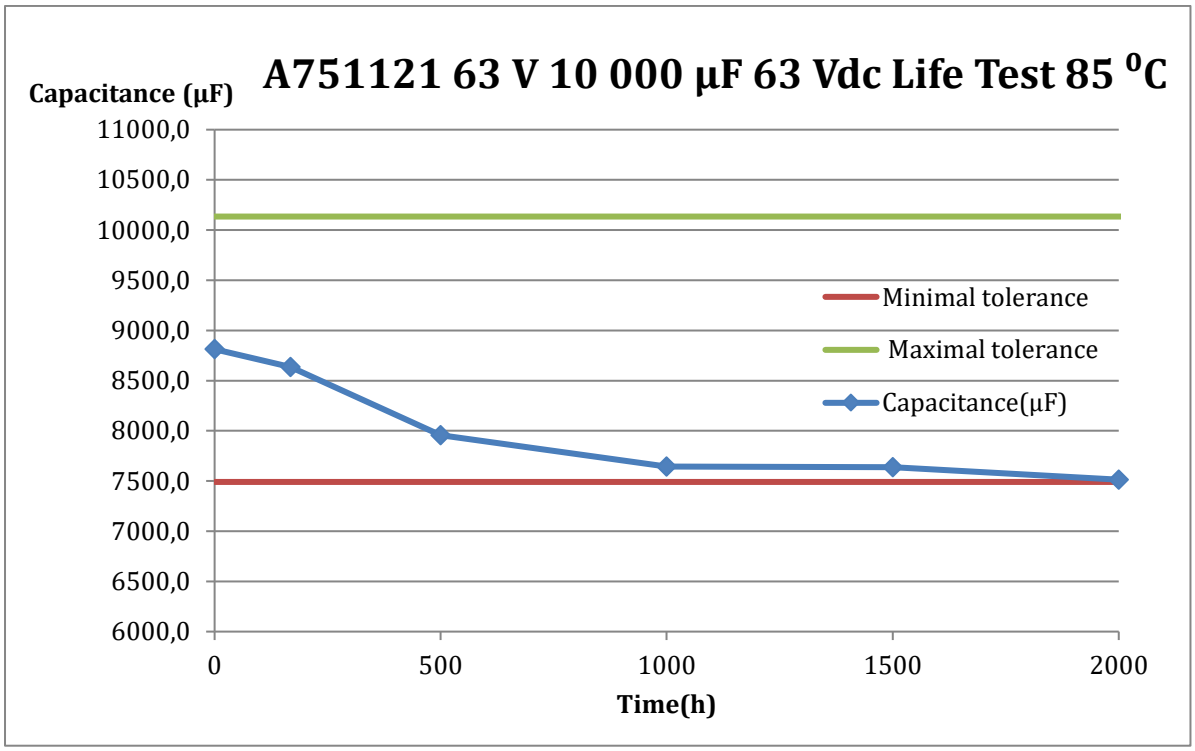
Resistance vibration and chocks were realised in accordance to IEC 68-2-6, IEC 68-2-27 and according to MIL 204-202. Vibration resistance duration was 2 hours per axes, 3x2 hours in total at 50 g for case size 50x45x12 and at 30 g for case size 75x45x12 mm.

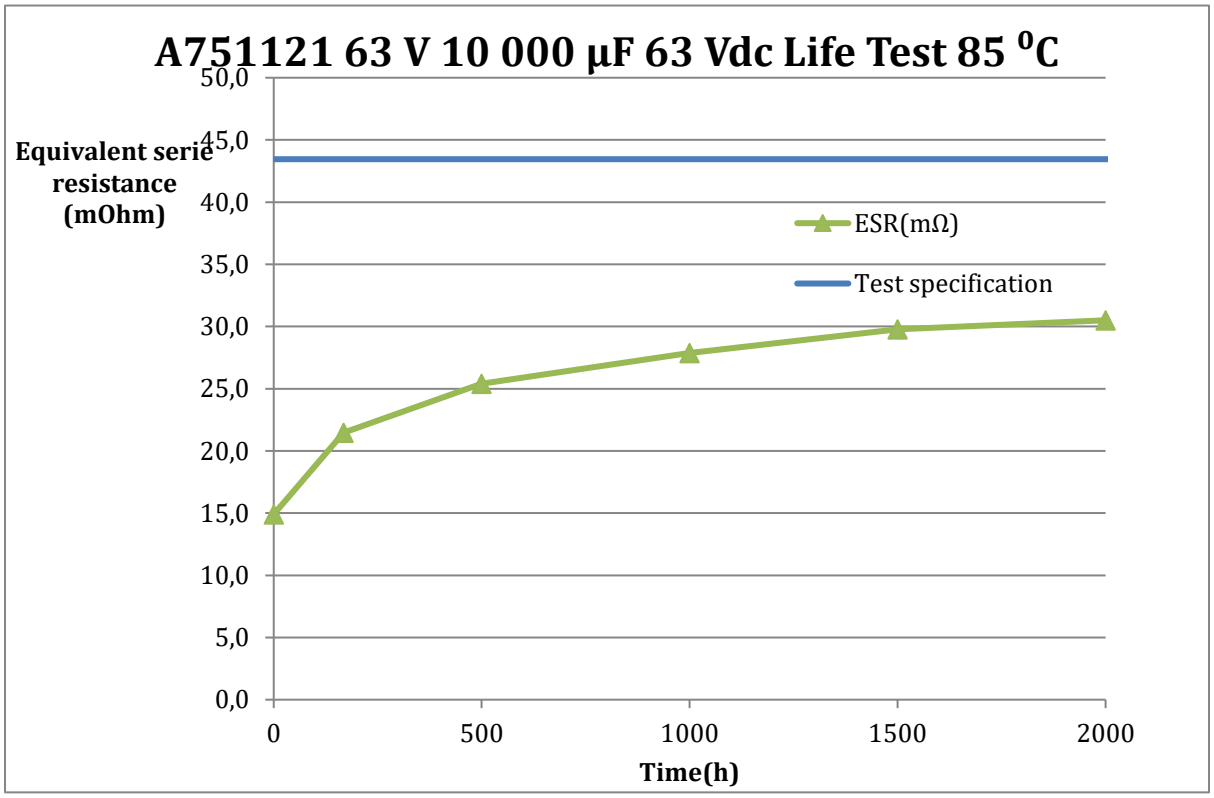
Electrical characterization at different temperatures and frequencies:

Characterizations have been performed at low and high temperatures (-55 and +85°C) and between 20 Hz and 100 kHz with unused components.

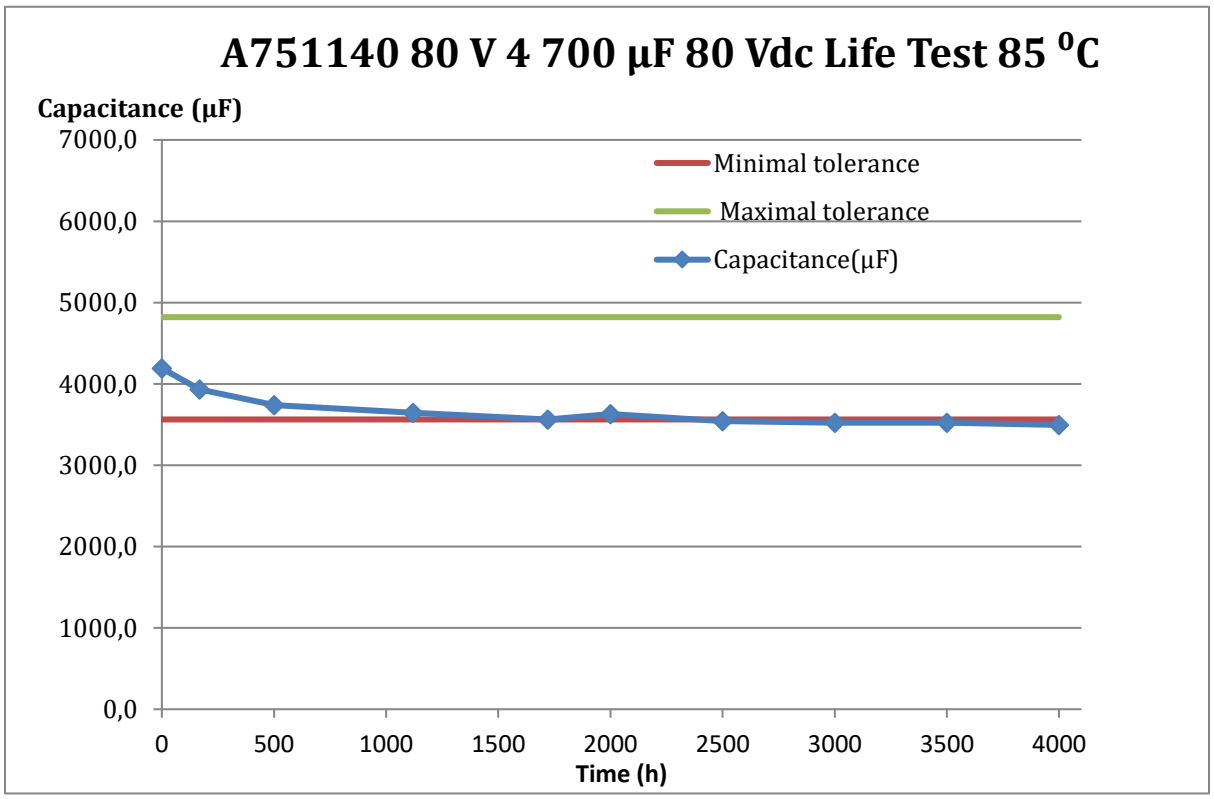
Test results

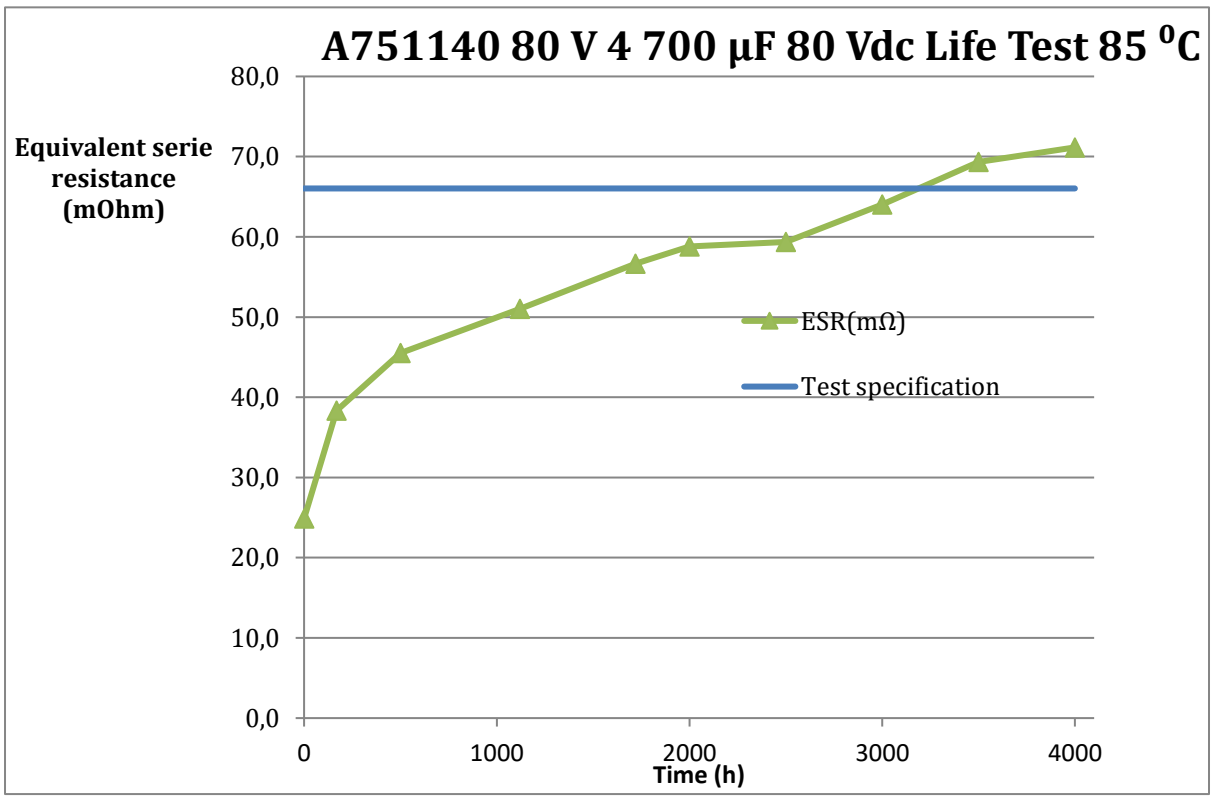
A751121 Life test at 85°C



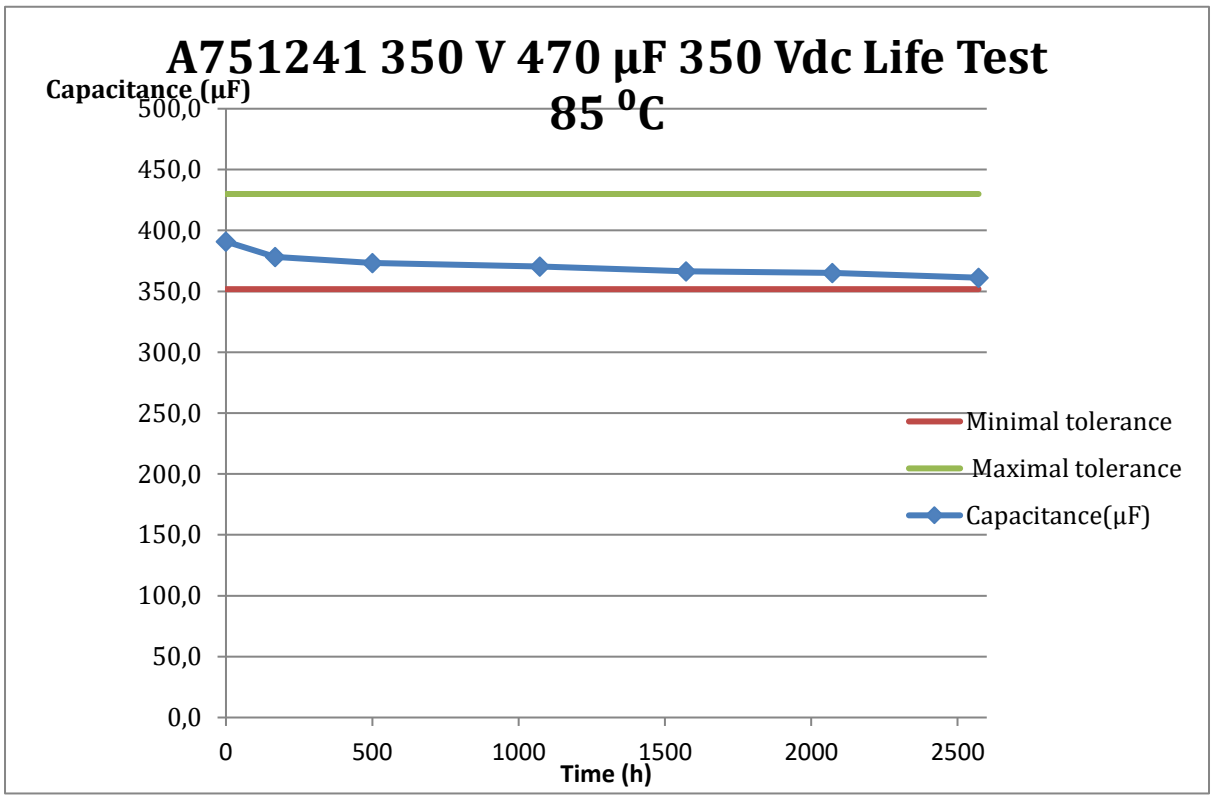


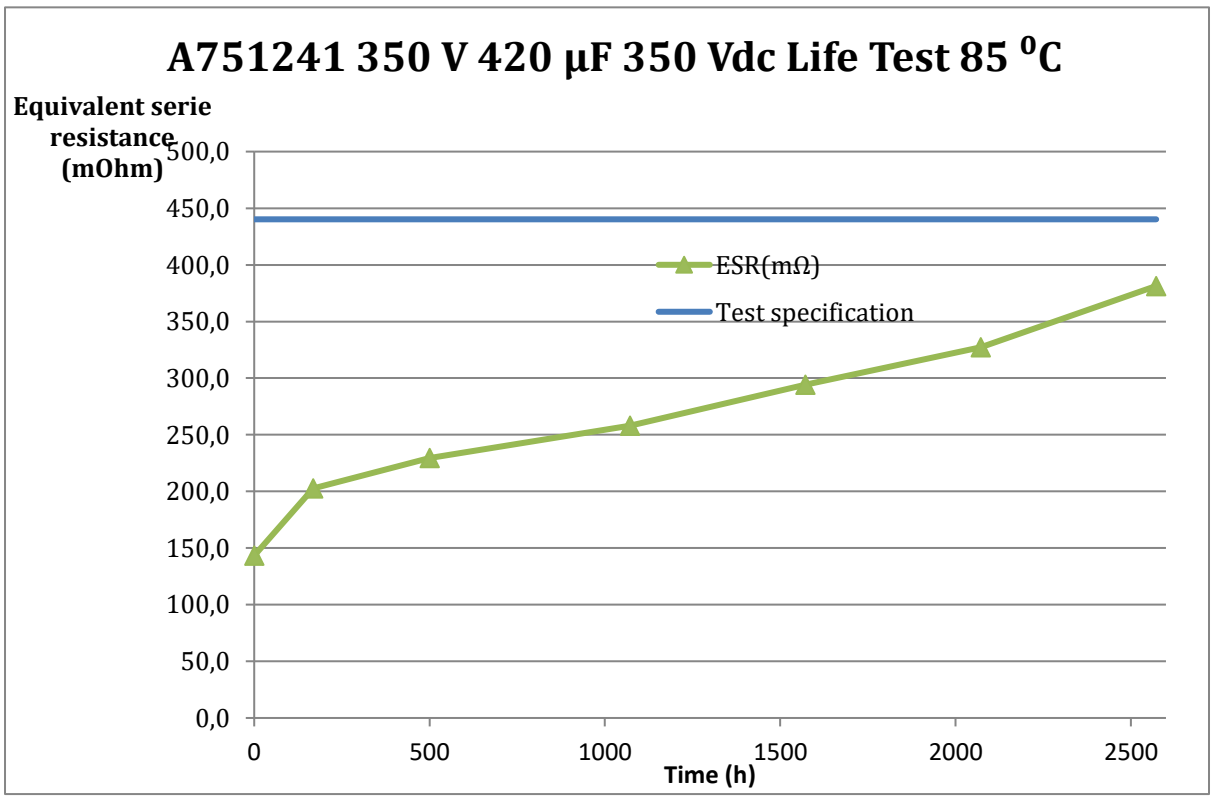
A751140 Life test at 85°C



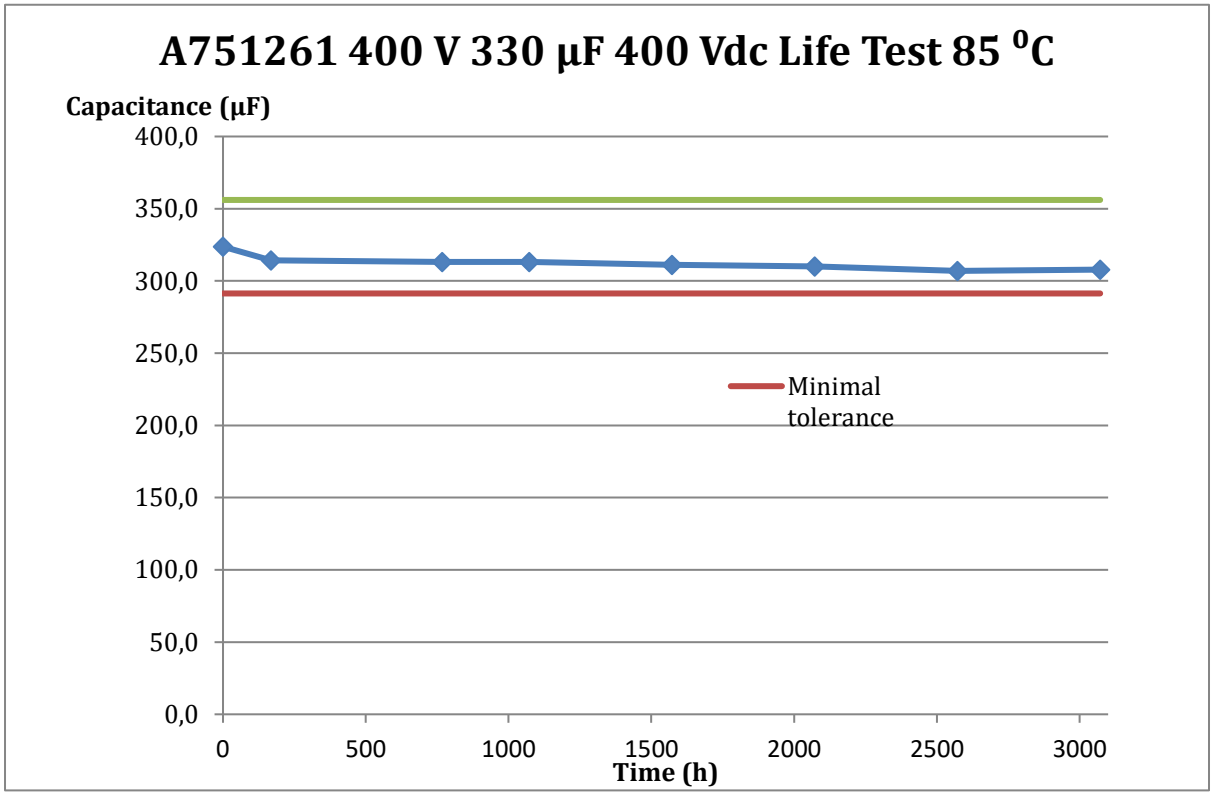


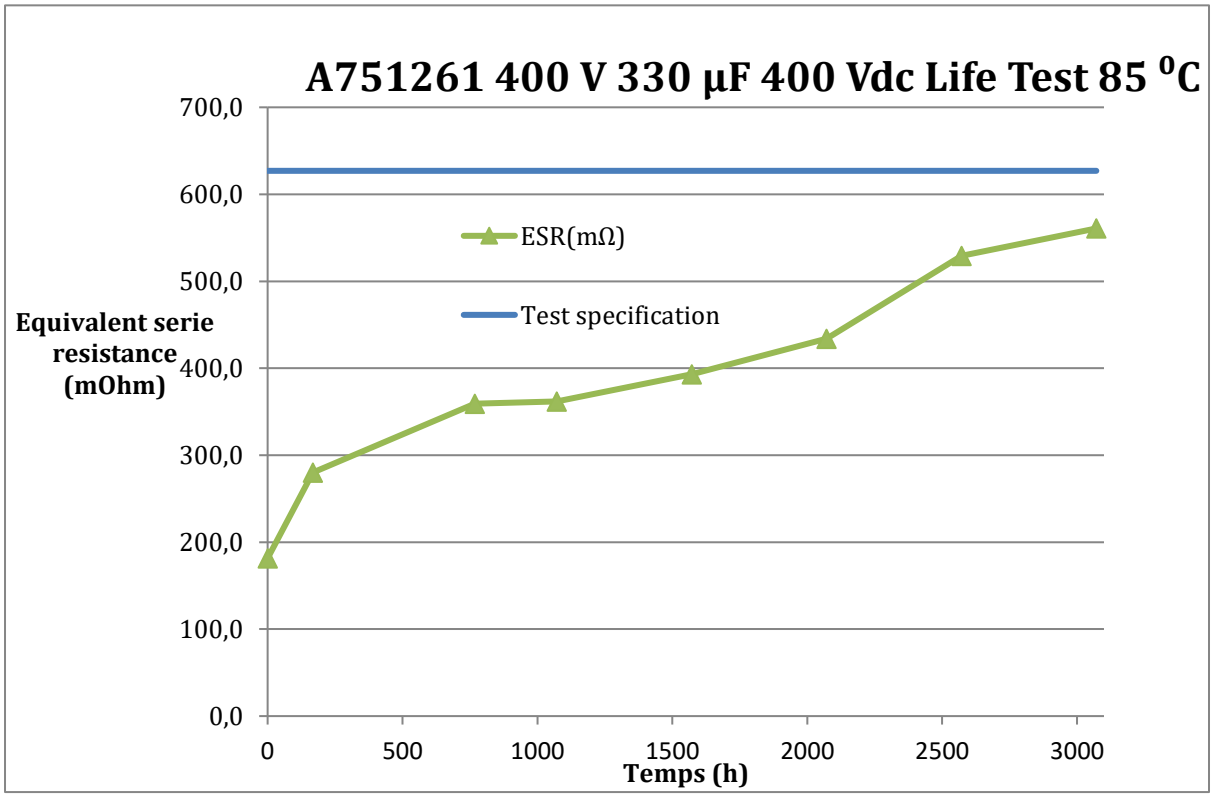
A751241 Life test at 85°C





A751261 Life test at 85°C





Low pressure test

A712140 80V 4 700 µF

Vaccum test				
	ΔC/C (%)	ESR (mOhm)	Leakage current (5 mn)	Weight (Δm/m)%
Average value	-0,5%	28	54	0
Permited value or drift	5%	51	1100	(indicative)

A751220- 250 V 470 µF

Vaccum test				
	ΔC/C (%)	ESR (mOhm)	Leakage current (5 mn)	Weight (Δm/m)%
Average value	0,1%	169	32	0,0
Permited value or drift	5%	339	400	(indicative)

A751220- 350 V 470 µF

Vaccum test				
	ΔC/C (%)	ESR (mOhm)	Leakage current (5 mn)	Weight (Δm/m)%
Average value	-0,4%	136	151	0,0
Permited value or drift	5%	339	300	(indicative)

Rapid Temperature Cycling

A712140 80V 4 700 µF

Rapid Temperature Cycling test			
	ΔC/C (%)	ESR (mOhm)	Leakage current (5 mn)
Average value	-0,5%	28	54
Permited value or drift	5%	51	1100

A751220- 250 V 470 µF

Rapid Temperature Cycling test			
	ΔC/C (%)	ESR (mOhm)	Leakage current (5 mn)
Average value	-0,6%	156	78
Permited value or drift	5%	339	400

A751220- 350 V 470 µF

Rapid Temperature Cycling test			
	ΔC/C (%)	ESR (mOhm)	Leakage current (5 mn)
Average value	-1,5%	198	557
Permited value or drift	5%	339	300

Vibration and shock resistance

Test shock resistance (50g/11ms) A751241-350V-470µF

Limites	Initial State	Final State	Initial State2	Final State3	ΔC/C
Limites	Capacitance (µF)	Capacitance (µF)	Tg (%)	Tg (%)	(%)
Sample number	470±20%	470±20%	8,0	8,0	±5%
12	394	389	3,3	3,4	-1,41%
13	394	390	3,4	3,5	-0,95%
14	390	386	3,7	3,8	-1,13%

Test vibration resistance 30 g (2mm 10-2000 Hz) A751241-350V-470µF

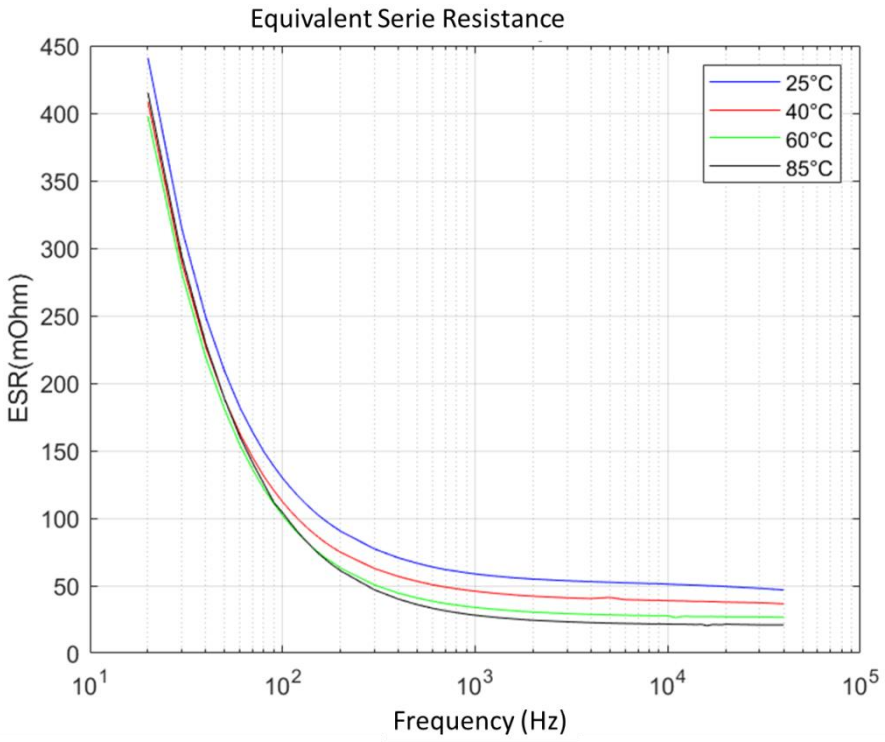
Limites	Initial State	Final State	Initial State2	Final State3	ΔC/C
Limites	Capacitance (µF)	Capacitance (µF)	Tg (%)	Tg (%)	(%)
Sample number	470±20%	470±20%	8,0	8,0	±5%
15	397	393	3,1	3,0	-0,82%
16	377	371	3,9	3,9	-1,57%
17	395	388	3,3	3,3	-1,76%

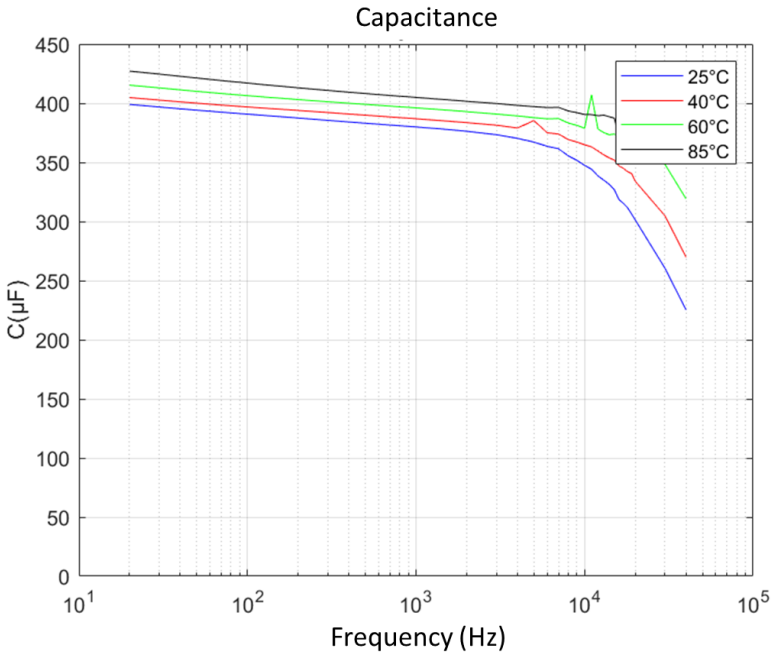
Test vibration resistance 50 g (3mm 10-2000 Hz) A751220-250V-470µF

Limites	Initial State	Final State	Initial State2	Final State3	ΔC/C
Limites	Capacitance (µF)	Capacitance (µF)	Tg (%)	Tg (%)	(%)
Sample number	470±20%	470±20%	9,0	9,0	±5%
1	430	427	4,2	4,3	-0,78%
2	428	426	4,3	5,7	-0,49%
3	433	430	3,4	3,3	-0,71%

Electrical characterization at different temperatures and frequencies:

CUBISIC SLP 350 V





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