SCC LE Series

Low ESR Cylindrical SuperCapacitors



The new series of cylindrical electrochemical double-layer capacitors offers excellent pulse power handling characteristics based on the combination of very high capacitance and very low ESR. Used by themselves or in conjunction with primary or secondary batteries, they provide extended back up time, longer battery life, and provide instantaneous power pulses as needed. Offers great solutions to Hold Up, Energy Harvesting, and Pulse Power Applications.

FEATURE

- Cap Values from 1F - 850F
- High pulse power capability
- Low ESR
- Low Leakage Current

APPLICATIONS

- Power Holdup Modules
- Energy Harvesting
- UPS/Industrial
- Robotic Power
- High Pulse Current Applications

HOW TO ORDER

SCC	W	50	B	127	S	S	B	LE	–
Series	**Diameter**	**Case Length**	**Voltage Code**	**Capacitance Code**	**Tolerance**	**Lead Format**	**Package**	**Series Code**	**Custom Code**
SuperCap Cylindrical	R = 8mm S = 10mm U = 16mm V = 18mm W = 22mm N = 25mm X = 30mm Y = 35mm	Two digits represent case length in mm, 1K = 105mm 1A = 115mm	B = 2.7V	1st two digits represent significant figures 3rd digit represents multiplier (number of zeros to follow) in µF	S = +30%/-10% **	R = Radial S = Solder Pin L = Weldable Pin 3P = 3-Prong Solder Pin	B = Bulk A = Ammo* T = Tray	LE = Low ESR	XX***

* Inquire about availability for Radial Leads only
**Inquire about availability for other tolerances
***Inquire about availability for Bend and Trimming

QUALITY INSPECTION

Parts are tested for Life Cycle, high temperature load life, temperature characteristics, vibration resistance, and humidity characteristics. See page 2 for more information.

TERMINATION

These SuperCapacitors are compatible with hand soldering and wave soldering processes, so long as appropriate precautions are followed. See "Soldering recommendations" on page 5 for more information.

OPERATING TEMPERATURE

-40°C to +65°C @ 2.7V
-40°C to +85°C @ 2.3V

LEAD-FREE
LEAD-FREE COMPATIBLE COMPONENT

RoHS COMPLIANT

For RoHS compliant products, please select correct termination style.

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SCC LE Series

Low ESR Cylindrical SuperCapacitors

RATINGS & PART NUMBER REFERENCE

Part Number	Diameter (mm)	Length (mm)	Rated Capacitance (F)	Capacitance Tolerance	DCL Max @ 72 Hrs (µA)	ESR Max @ 1000 Hz (mΩ)	Max DC ESR_{ss} (mΩ)	Peak Current (A)	Power Density (W/kg)	Max Energy (Wh)	Energy Density (Wh/kg)
Radial Lead											
SCCR12B105SRBLE	8	12	1	+30%/-10%	6	120	170	1.15	5506.1	0.0010	1.07
SCCR20B335SRBLE	8	20	3.3	+30%/-10%	12	60	75	3.57	8129.5	0.0033	2.30
SCCS20B505SRBLE	10	20	5	+30%/-10%	15	45	55	5.29	7516.1	0.0051	2.41
SCCS30B106SRBLE	10	30	10	+30%/-10%	30	27	30	10.38	9440.9	0.0101	3.27
SCCU25B256SRBLE	16	25	25	+30%/-10%	60	15	18	23.28	6665.7	0.0253	3.47
SCCV40B506SRBLE	18	40	50	+30%/-10%	75	12	13	40.91	5173.3	0.0506	3.89
Solder Pin Lead											
SCCW50B127SSBLE	22	50	120	+30%/-10%	300	6	9	82.65	4050	0.1215	4.50
SCCN50B187SSBLE	25	50	180	+30%/-10%	600	7	10	86.79	2955	0.1823	6.16
SCCX50B227SSBLE	30	50	220	+30%/-10%	620	5	6.5	128.02	3038	0.2228	4.64
*SCCY68B407SSBLE	35	68	400	+30%/-10%	1000	3	3.5	245.45	3352	0.4050	4.66
3-Prong Solder Pin											
*SCCX66B307S3PBLE	30	66	300	+30%/-10%	1000	1.6	2.5	257.96	6139	0.3038	4.05
*SCCY66B367S3PBLE	35	66	360	+30%/-10%	1300	2.0	2.5	255.79	3763	0.3645	3.92
*SCCY69B407S3PBLE	35	69	400	+30%/-10%	1300	1.3	2.1	346.15	6719	0.4050	4.35
*SCCY83B507S3PBLE	35	83	500	+30%/-10%	1500	1.2	2.0	402.99	6480	0.5063	5.06
*SCCY1KB707S3PBLE	35	105	700	+30%/-10%	1900	1.1	1.8	513.59	5608	0.7088	5.45
*SCCY1AB857S3PBLE	35	115	850	+30%/-10%	2200	1.0	1.7	577.79	5096	0.8606	5.82
Weldable Pin Lead											
*SCCY71B407SLBLE	35	71	400	+30%/-10%	1300	1.3	1.8	313.95	5461	0.4050	4.55
*SCCY73B407SLBLE	35	73	400	+30%/-10%	1000	1.8	2.5	270.00	3845	0.4050	4.45
*SCCY83B507SLBLE	35	83	500	+30%/-10%	1500	1.0	1.6	375.00	5110	0.5063	4.73
*SCCY85B607SLBLE	35	83	600	+30%/-10%	1500	1.6	1.8	389.42	4459	0.6075	5.57
*SCCY1KB707SLBLE	35	105	700	+30%/-10%	1900	0.9	1.5	468.98	4986	0.7088	5.86
*SCCY1AB857SLBLE	35	115	850	+30%/-10%	2200	0.9	1.3	545.13	4547	0.8606	5.82

*Availability and lead times will be evaluated on a case-by-case basis; please contact KYOCERA AVX for more details.
All parts are rated for operation at 2.7V up to 65 ℃. With appropriate derating to 2.3V, operation can be extended to 85 ℃.

QUALIFICATION TEST SUMMARY

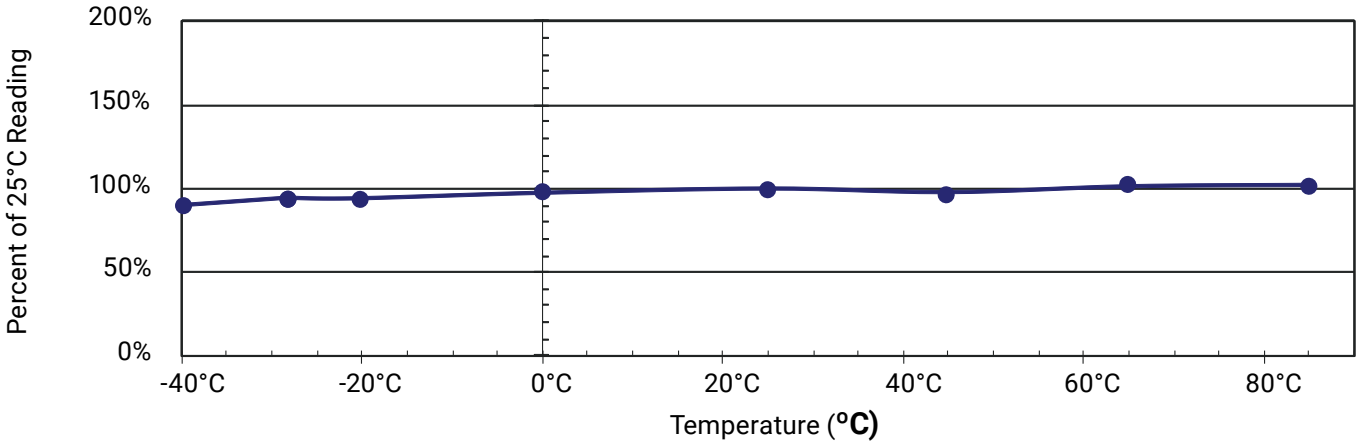
Test	Test Method	Parameter	Limits
Life Cycle	Capacitors are cycled between rated voltage and half-rated voltage under constant current at +25°C for 500,000 cycles	Capacitance ESR Appearance	≥70% of spec value ≤200% of spec value No remarkable defects
High Temperature Load Life	Temperature: +65°C Voltage: Rated Voltage Test Duration: 1,000 hours	Capacitance ESR Appearance	≥70% of spec value ≤200% of spec value No remarkable defects
Storage Temperature Characteristics	Storage Duration: 2 years No Load Temperature: +35°C	Capacitance ESR Appearance	≥70% of spec value ≤200% of spec value No remarkable defects
Vibration Resistance	Amplitude: 1.5mm Frequency: 10 ~ 55Hz Direction: X, Y, Z for 2 hours each	Capacitance ESR Appearance	≥70% of spec value ≤200% of spec value No remarkable defects
Humidity	Voltage: Rated Voltage RH: 90% Temperature: +60°C Test Duration: 1,000 hours	Capacitance ESR Appearance	≥70% of spec value ≤200% of spec value No remarkable defects

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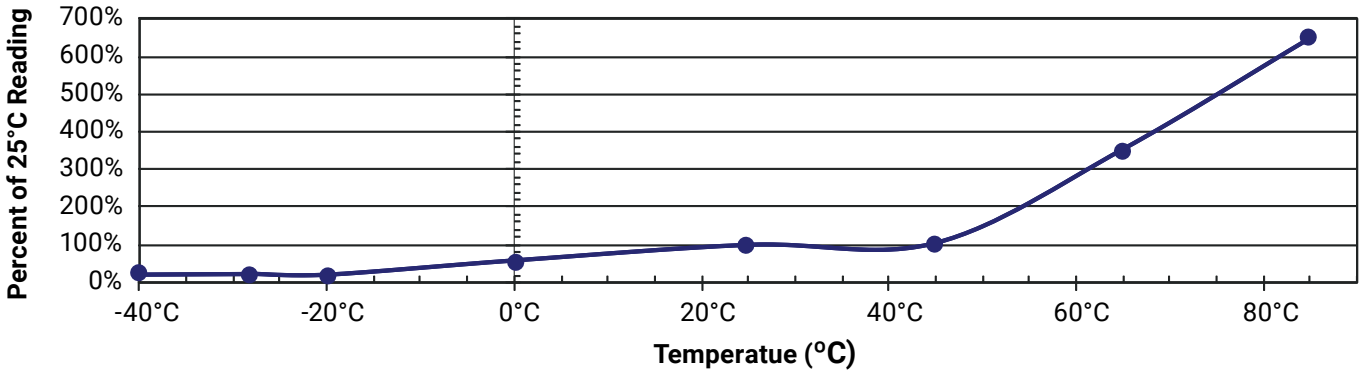
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QUALITY AND RELIABILITY

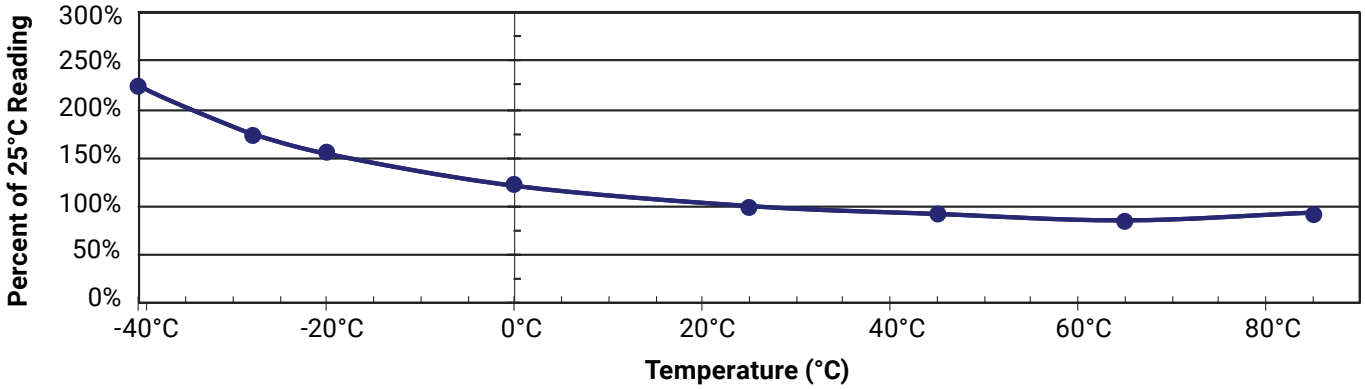
CAPACITANCE VS. TEMPERATURE



LEAKAGE CURRENT VS. TEMPERATURE



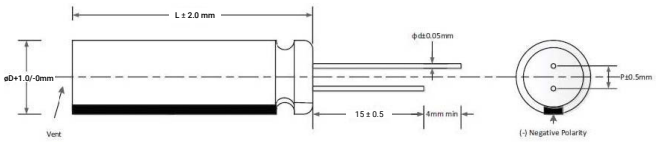
EQUIVALENT SERIES RESISTANCE VS. TEMPERATURE



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MECHANICAL SPECIFICATIONS

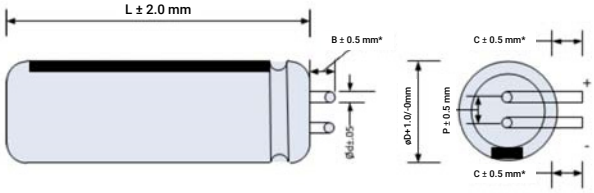
RADIAL LEAD TYPE



D (mm)	P (mm)	d (mm)
6.3	2.3	0.6
8	3.2	0.6
10	5.0	0.6
12.5	5.5	0.6*
16	7.3	0.8
18	8.0	0.8

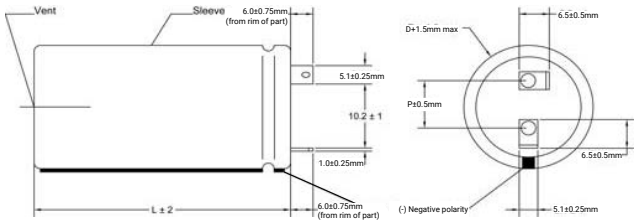
*For parts with Diameter (D)=12.5mm:
If Length ≤ 30mm, Lead Diameter (d)=0.6mm
If Length ≥ 35mm, Lead Diameter (d)=0.8mm

RADIAL BENT LEAD TYPE[1]



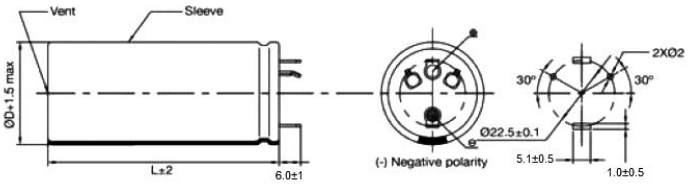
*Request availability on custom B and C dimensions
[1] Bent Leads only available in Tray packaging

SOLDER PIN TYPE 2-PIN 120F, 180F, 220F PARTS



Cap (F)	D (mm)	L (mm)	P (mm)
120	22	50	8.0
180	25	50	10.0
220	30	50	10.0

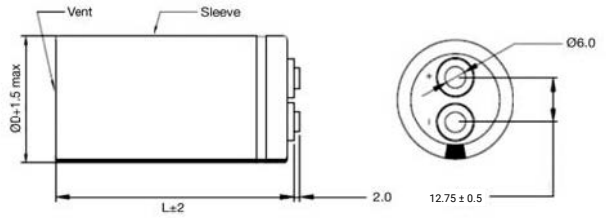
SOLDER PIN TYPE 4-PIN 400F PART



D (mm)	L (mm)
35	68

WELDABLE PIN TYPE 2-PIN 400F, 600F PARTS

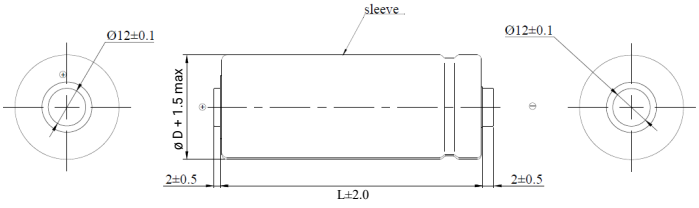
(Note exact PNs in table)



PN	D (mm)	L (mm)
SCCY73B407SLBLE	35	73
SCCY85B607SLBLE	35	83

WELDABLE PIN TYPE AXIAL 400F - 850F PARTS

(Note exact PNs in table)



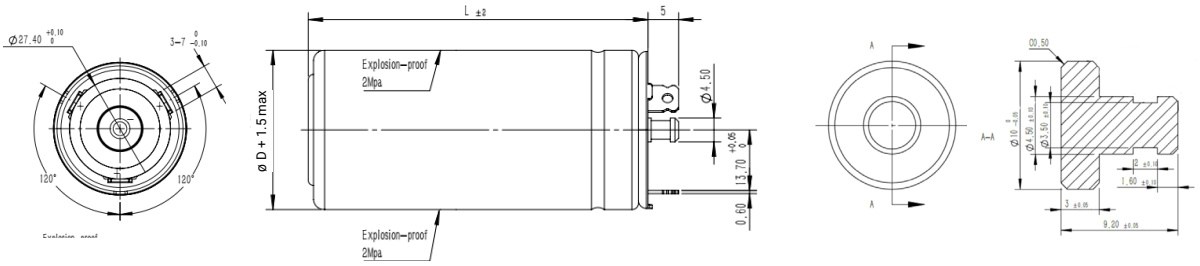
PN	Cap (F)	D (mm)	L (mm)
SCCY83B607SLBLE	600	35	83
SCCY1KB707SLBLE	700	35	105
SCCY1AB857SLBLE	850	35	115

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MECHANICAL SPECIFICATIONS CONTINUED

3-PRONG SOLDER PIN



Cap (F)	D (mm)	L (mm)
300	30	66
360	35	66
400	35	69
500	35	83
600	35	83
700	35	105
800	35	115

Precautionary Warning!

If these 3-Prong Solder Pin parts are used in series-connected module assembly, these parts utilize the outer aluminum casing as the positive connection. Do not use parts if the shrink wrap is split open or if the casing is exposed. Maintain proper part spacing in module designs, as part-to-part potential can create a deadly situation (i.e. try to avoid having part one very close to part 20 or higher, and so on). It is recommended to have the tops of parts covered with insulation material to avoid inadvertent shorting in module designs. If you have any questions please contact KYOCERA AVX.

SOLDERING RECOMMENDATIONS

When soldering SuperCapacitors to a PCB, the temperature & time that the body of the SuperCapacitor sees during soldering can have a negative effect on performance. We advise following these guidelines:

- Do not immerse the SuperCapacitors in solder. Only the leads should come in contact with the solder.
- Ensure that the body of the SuperCapacitor is never in contact with the molten solder, the PCB or other components during soldering.
- Excessive temperatures or excessive temperature cycling during soldering may cause the safety vent to burst or the case to shrink or crack, potentially damaging the PCB or other components, and significantly reduce the life of the capacitor.

PRECAUTION: For all products with shrink wrap sleeves, washing in any type of cleaning agent is prohibited. During all soldering processes, it's recommended to protect the shrink wrap from any kind of liquid (including but not limited to: water, strong acid, strong alkali, strong oxidizing solutions, and strong solvents) to avoid the risk of damage, cracking, and fading of the outer shrink wrap.

HAND SOLDERING

Keep distance between the SuperCapacitor body and the tip of the soldering iron and the tip should never touch the body of the capacitor. Contact between SuperCapacitor body and soldering iron will cause extensive damage to the SuperCapacitor, and change its electrical properties. It is recommended that the soldering iron temperature should be less than 350°C, and contact time should be limited to less than 4 seconds. Too much exposure to terminal heat during soldering can cause heat to transfer to the body of the SuperCapacitor, potentially damaging the electrical properties of the SuperCapacitor.

WAVE SOLDERING/ SELECTIVE WAVE SOLDERING

Only use wave soldering or selective wave soldering on Radial type SuperCapacitors. The PCB should be preheated only from the bottom and for less than 60 seconds, with temperature at, or below, 100°C on the top side of the board for PCBs equal to or greater than 0.8 mm thick.

Wave Soldering		
Solder Temperature (°C)	**Suggested Solder Time (s)**	**Maximum Solder Time (s)**
220	7	9
240	7	9
250	5	7
260	3	5

Selective Wave Soldering		
Solder Temperature (°C)	**Suggested Solder Time (s)**	**Maximum Solder Time (s)**
290	2	4

WELDING RECOMMENDATIONS

When weld-assembling modules, it is recommended using 2mm thick 1060 aluminum.

For WELDABLE PIN TYPE 2-PIN cells, it is recommended to use 0.6 optical fiber 600W laser welding machine. These cells need 30 weld points.

For WELDABLE PIN TYPE AXIAL cells, the same parameters are recommended, however these cells need 60 weld points.

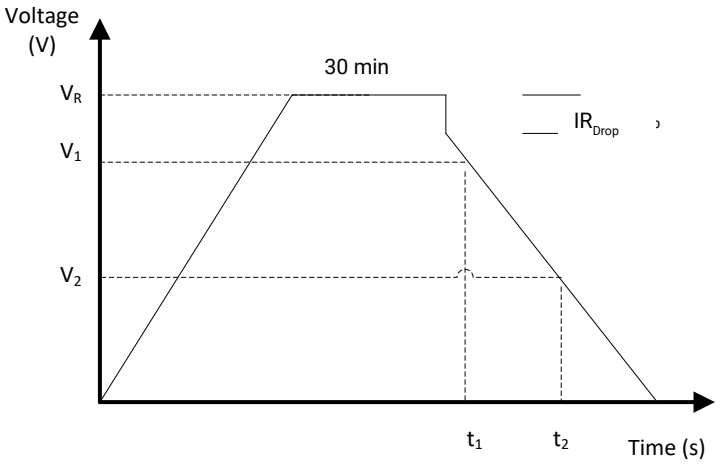
Be sure to refer to page 4 for exact pin type and mechanical dimensions of respective weldable pin cells.

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TEST METHODS

IEC CAPACITANCE/ESR TEST METHOD (10ms METHOD)

Procedure: Charge module under constant current to rated voltage at room temperature, then hold 30 minutes on charge under constant voltage. After 30 minutes, discharge under constant current (as shown in chart below), recording voltage at V_1, V_2, and time intervals at t_1 and t_2. Use the capacitance formula to determine cap value.



I – Discharge Current, $4 \times C \times V_R$ (mA)

V_R – Rated Voltage (V)

V_1 – Initial Test Voltage, 80% Of V_R (V)

V_2 – Final Test Voltage, 40% Of V_R (V)

t_1 – Initial Test Time (s)

T_2 – Final Test Time (s)

$$C = \frac{I \times (t_2 - t_1)}{V1 - V2}$$

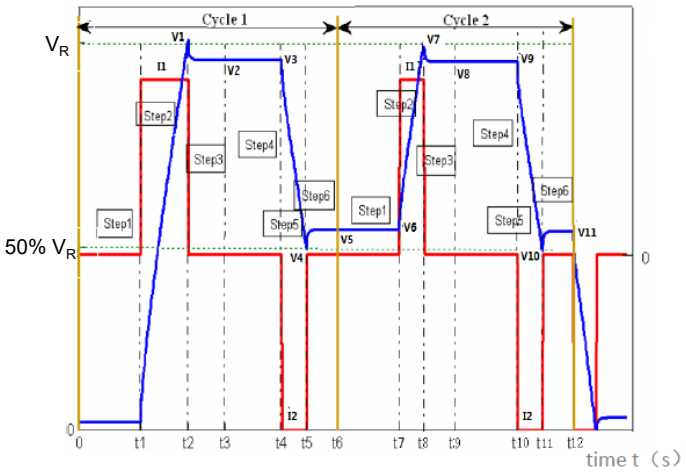
$$DC\ ESR_{10ms} = \frac{V3_{10ms}}{I}$$

DC ESR MEASUREMENT (5s METHOD)

A six-step ESR_{DC} test method is illustrated to the right and carried out as follows:

- Rest 10 Seconds
- Charge under constant current (I_1) to rated voltage (V_R)
- Rest 5 seconds
- Rest 10 seconds, record V_3 and t_4
- Discharge under constant current (I_2) to half rated voltage, Record I_2, V_4, And t_5
- Rest 5 seconds, record V_5 And t_6

Repeat steps 1-6 recording I, V, And t accordingly, finally discharging to below 0.1V under constant current (I_2).



Formulas to calculate:

- Two cycle discharge capacitances: $C_{dch1} = I_2 \times \frac{(t_5 - t_4)}{V_3 - V_4}$; $C_{dch2} = I_2 \times \frac{(t_{11} - t_{10})}{(V_9 - V_{10})}$
- Discharge capacitance: $C_{dch} = \frac{(C_{dch1} + C_{dch2})}{2}$
- Two cycle discharge DC ESR: $ESR_{dch1} = \frac{(V_5 - V_4)}{I_2}$; $ESR_{dch2} = \frac{(V_{11} - V_{10})}{I_2}$
- Discharge DC ESR: $DC\ ESR_{5s} = \frac{(ESR_{dch1} + ESR_{dch2})}{2}$

Note: $I_1 = I_2 = 75mA/F$, the rated capacitance in the chart means discharge capacitance, and DC ESR (ESR_{DC}) means discharge DC resistance.

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TEST METHODS (continued)

MAXIMUM CONTINUOUS CURRENT

- This is the maximum current when temperature rise of the supercapacitor during its operation is less than 15°C

MAXIMUM PEAK CURRENT

- This is the maximum current during 1 second time interval (dt)

WATT DENSITY

- Watt Density = $(0.12*V^2 / R_{DC}) / mass$

ENERGY DENSITY

- Energy Density = $(½ CV^2) / (3600*mass)$

POLARITY AND REVERSE VOLTAGE

For product consistency and optimum performance, it is recommended that the capacitor be connected with polarity indicated. Reversing polarity could result in permanent damage to the circuit including much higher leakage current for a short duration of time and the life time of the supercapacitors will be reduced.

LIFE TIME AND TEMPERATURE PERFORMANCE

The life of a supercapacitor is impacted by a combination of operating voltage and the operating temperature according to the following Time to Failure equation:

$$t \propto V^n \times e^{\left(\frac{-Q}{kT}\right)}$$

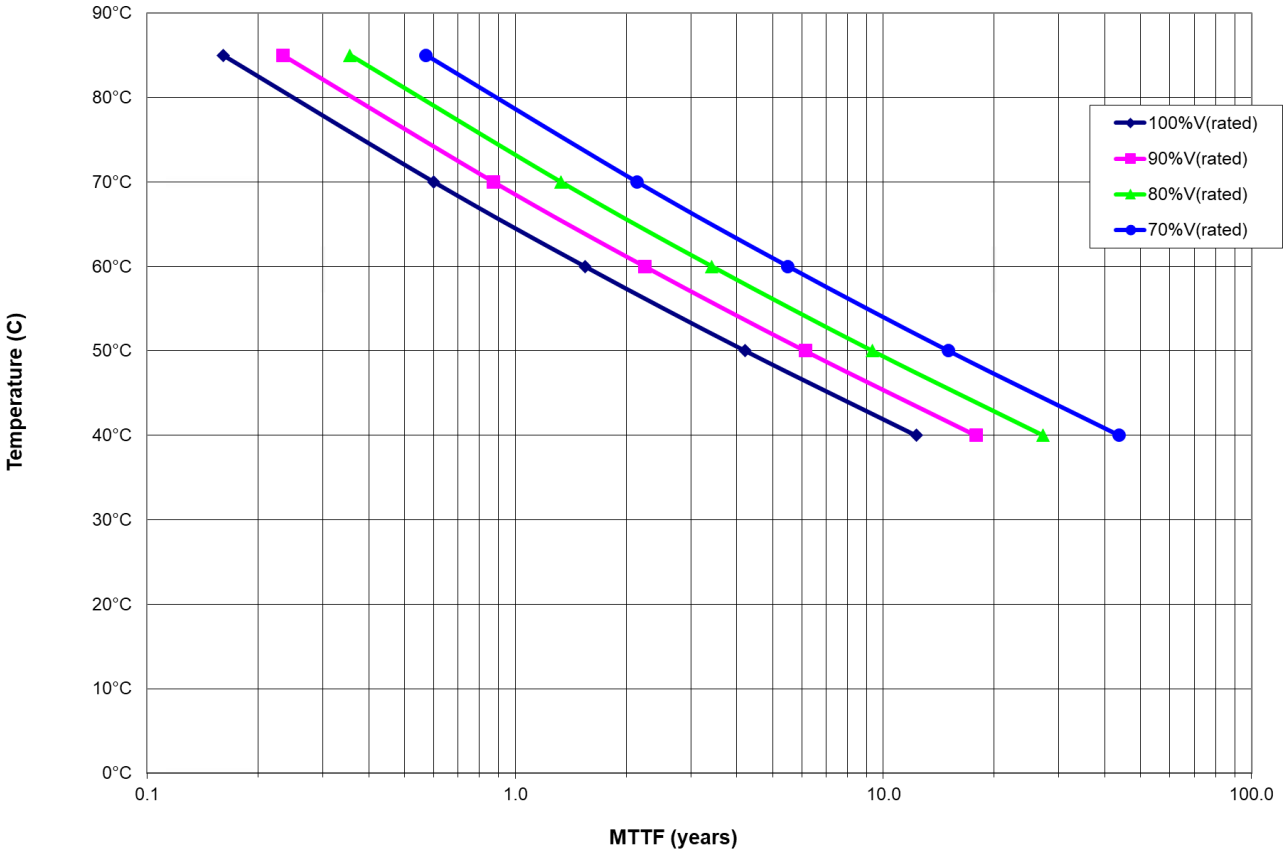
where V is the operating voltage, Q is the activation energy in electron volts (eV), k is the Boltzmann constant in eV, and T is the operating temperature in Kelvin (K). Typical values for the voltage exponent, n, is between 2.5-3.5, and Q is between 1.0-1.2 eV in the normal operating temperature range of -40° to 65°C.

The industry standard for supercapacitor end of life is when the equivalent series resistance, ESR, increases to 200% of the specified value and the capacitance drops by 30% from specified value. Typically a supercapacitor shows an initial “jump” in the ESR value and then levels off. If the supercapacitors are exposed to excessive temperatures the ESR will show a continuous degradation (increase). In the extreme case, if the temperature or voltage are substantially higher than the rated specifications, this could result in the part venting and the product showing a faster degradation of capacitance and ESR, which may be many times the specified value.

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ESTIMATED LIFETIME AT VARIOUS VOLTAGES

SCC SERIES



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SAFETY RECOMMENDATIONS

WARNINGS

- To Avoid Short Circuit, after usage or test, SuperCapacitor voltage needs to discharge to ≤ 0.1V
- Do not Apply Overvoltage, Reverse Charge, Burn or Heat Higher than 150°C, explosion-proof valve may break open
- Do not Press, Damage or disassemble the SuperCapacitor, housing could heat to high temperature causing Burns
- If you observe Overheating or Burning Smell from the capacitor disconnect Power immediately, and do not touch

EMERGENCY APPLICATIONS

- If Housing is Leaking:
  - Skin Contact: Use soap and water thoroughly to wash the area of the skin
  - Eye Contact: Flush with flowing water or saline, and immediately seek medical treatment
  - Ingestion: Immediately wash with water and seek medical treatment

TRANSPORTATION

Not subjected to US DOT or IATA regulations
UN3499, <10Wh, Non-Hazardous Goods
International shipping description –
"Electronic Products – Capacitor"

REGULATORY

- UL 810A
- RoHS Compliant
- REACH Compliant
- Halogen free according to IEC 61249-2-21: 2003 and IPC/JEDEC-J-STD-709

STORAGE

Capacitors may be stored within the temperature range of -40°C to +70°C with humidity < 60%. Lower storage temperature is preferred as it extends the shelf life of the capacitor.

Optimum storage conditions are as follows:

- 25°C and RH ≤ 60% without voltage applied
- Not in direct sunlight
- Not in direct contact with water, salt oil or other chemicals
- Not in direct contact with corrosive materials, acids, alkalis, or toxic gases
- Not in dusty environments
- Not in environments with shock and vibration conditions

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