



## **Antennas: Technologies & New Product Developments**

## **Super Capacitors for Pulse Power Applications**

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**FAE Team Manager**

# AVX FEATURES



## BALANCING

Necessary when connecting two or more cells in series



## MOISTURE RESISTANCE

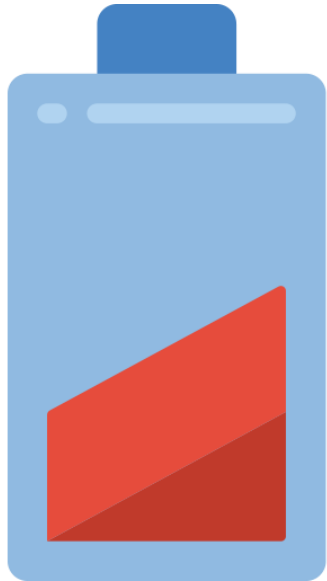
Ways to combat humidity. Avoiding Moisture Exposure during Manufacturing and Moisture Ingress during operating life



## CUSTOMIZATION

Ways to satisfy the customer needs

# BATTERY DISADVANTAGES



- **Temperature Range**

  - **Primary Batteries**

    - Alkaline batteries are usually bound by 0°C to 60°C

    - Certain lithium-metal batteries can survive a little south of -30°C and upwards of 70°C

  - **Secondary Batteries (Rechargeable Batteries)**

    - Typical Li-ion secondary batteries are rated for -20°C to 55°C usage

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- **Cycle Life Limitation**

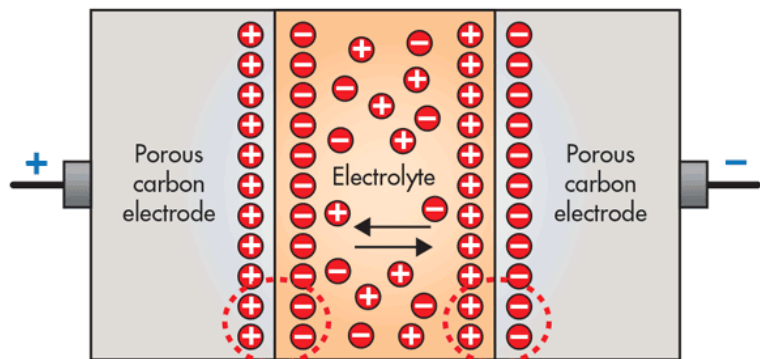
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- **Time to Recharge (Downtime)**

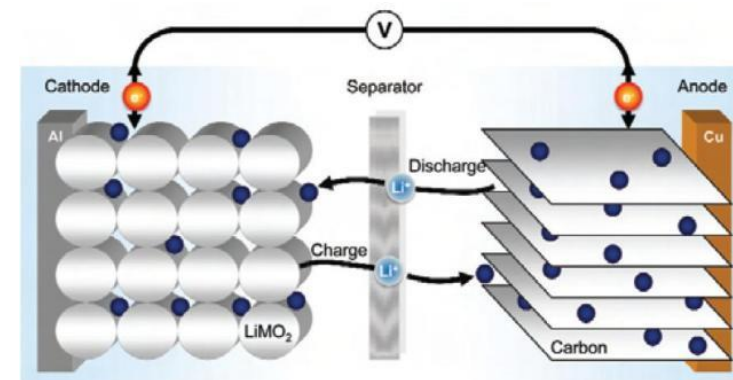
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- **High Internal Resistance (ESR)**

# SuperCapacitor Vs. Battery



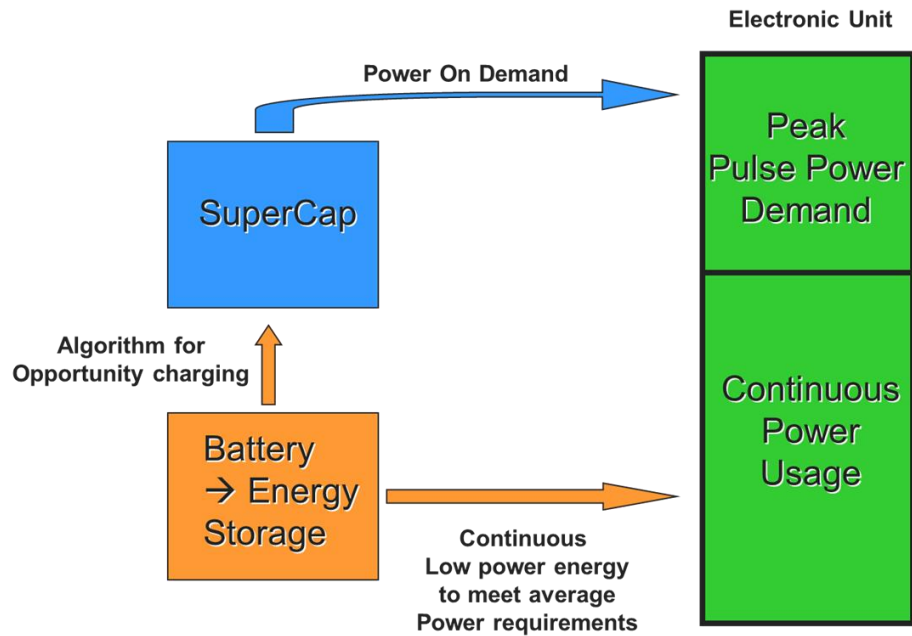
Electric double-layer capacitor (EDLC)



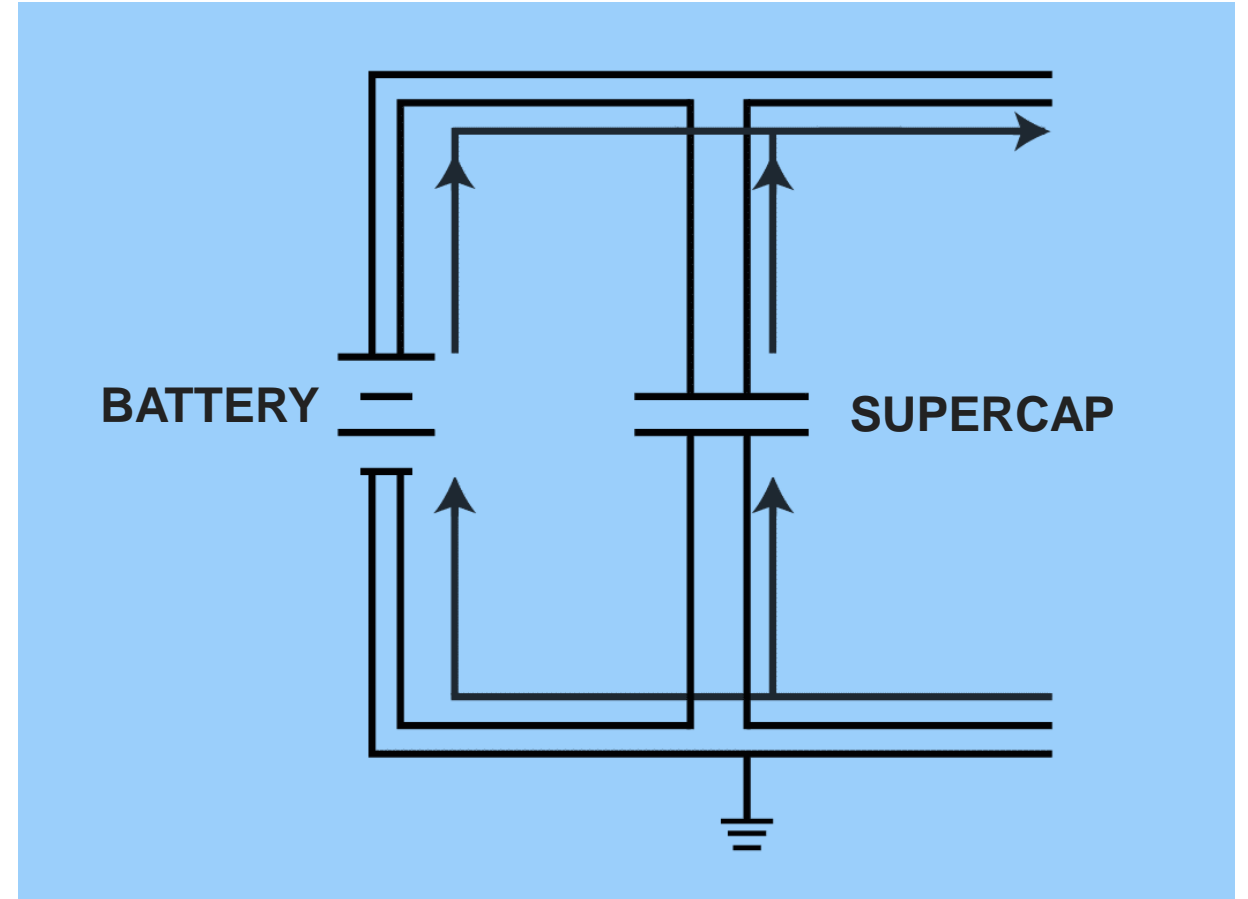
PARAMETER / CHARACTERISTIC	SUPERCAPACITOR	LI-ION BATTERY
Charge Time	1 To 10 Seconds	10 To 60 Minutes
Charge Cycle Life	1 Million	>500
Cell Voltage	2.1 To 3.3 Volts	3.6 To 4.2 Volts
Specific Energy (Wh/Kg)	5	100 To 200
Specific Power (W/Kg)	~10,000	1000 To 3000
Charge Temperature Range	-55°C To +90°C	0°C To +45°C
Discharge Temperature Range	-55°C To +90°C	-20°C To +60°C

Supercapacitor – Battery Comparison

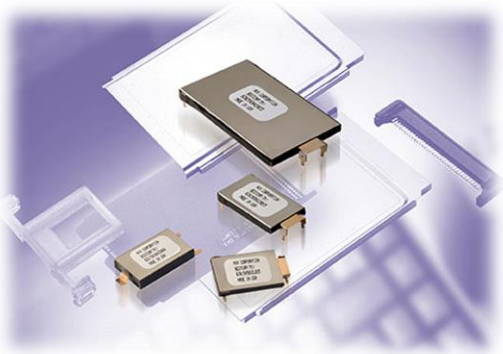
# APPLICATION OF SUPERCAPACITORS



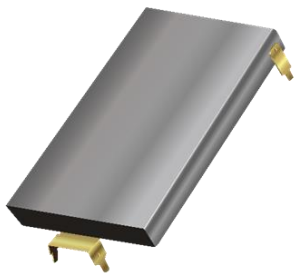
The SuperCapacitor is placed in parallel with the battery to “absorb” repetitive spikes in current (pulse power) or provide a large amount of current for peak power assist. The ultra-low ESR characteristics of SuperCapacitors make them ideal for these applications, relieving the battery of this “current strain,” thus lengthening life time.



# BestCap® – BZ & BW Series

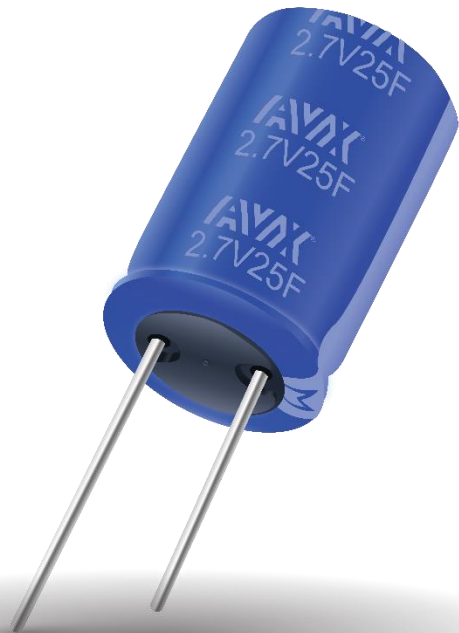


- BestCap® is a low ESR pulse Supercapacitor build with the non-hazardous proton activated polymer system with H<sub>2</sub>O based electrolyte
- Capacitance range: 6.8mF to 1000mF
- Voltage range: 3.6V to 20V
- Operating temperature range: -20°C to +70°C (select values offer -40°C to +75°C)
- ESR: 25mΩ to 600mΩ
- BestCap® has the most “capacitor-like” frequency response of all Supercaps and has low ESR and low profile characteristics



# SCC SERIES

## SINGLE-CELL CYLINDRICALS



### Features

- Acetonitrile (ACN) based electrolyte technology
- Provide instantaneous power pulses, extended back-up time, and longer battery life
- Capacitance range: 1F to 3000F
- 2.7V & 3.0V rated voltage
- Operating Temp Range: -40°C to +85°C
- Low ESR Design
- Low Cost



# SCC LE SERIES SINGLE-CELL CYLINDRICALS



## Features

- Very Low ESR Design
- Acetonitrile (ACN) based electrolyte technology
- Provide instantaneous power pulses, extended back-up time, and longer battery life
- Capacitance range: 1F to 850F
- 2.7V rated voltage
- Operating Temp Range: -40°C to +85°C

## NEW RELEASES:

### RATINGS & PART NUMBER REFERENCE

AVX Part Number	Diameter (mm)	Length (mm)	Rated Capacitance (F)	Capacitance Tolerance	Rated Voltage (V)	Rated Temperature (°C)	DCL Max @ 72 Hrs (µA)	ESR Max @ 1000 Hz (mΩ)	ESR Max @ DC (mΩ)	Peak Current (A)	Power Density (W/kg)	Max Energy (Wh)	Energy Density (Wh/kg)
<b>Radial Lead</b>													
SCCR12B105PRBLE	8	12	1	+100%/-0%	2.7/2.3*	65/85*	6	140	325	1.02	2833	0.0010	1.07
SCCR20B335PRBLE	8	20	3.3	+100%/-0%	2.7/2.3*	65/85*	12	60	145	3.01	4161	0.0033	2.30
SCCS20B505PRBLE	10	20	5	+100%/-0%	2.7/2.3*	65/85*	15	27	65	5.19	6943	0.0051	2.41
SCCS30B106PRBLE	10	30	10	+100%/-0%	2.7/2.3*	65/85*	30	20	55	8.71	5131	0.0101	3.27
SCCU25B256SRBLE	16	25	25	+30%/-10%	2.7/2.3*	65/85*	60	15	25	20.77	4793	0.0253	3.47
SCCV40B506SRBLE	18	40	50	+30%/-10%	2.7/2.3*	65/85*	75	9	15	38.57	4486	0.0506	3.89
<b>Solder Pin Lead</b>													
SCCW50B127SSBLE	22	50	120	+30%/-10%	2.7/2.3*	65/85*	300	6	8	82.65	4050	0.1215	4.50
SCCN50B187SSBLE	25	50	180	+30%/-10%	2.7/2.3*	65/85*	600	7	10	86.79	2955	0.1823	6.16
SCCX50B227SSBLE	30	50	220	+30%/-10%	2.7/2.3*	65/85*	620	5	6	128.02	3038	0.2228	4.64
SCCY68B407SSBLE	35	68	400	+30%/-10%	2.7/2.3*	65/85*	1000	2.2	2.2	245.45	3352	0.4050	4.66
<b>3-Prong Solder Pin</b>													
SCCX66B307S3PBLE	30	66	300	+30%/-10%	2.7/2.3*	65/85*	1000	1.6	1.9	257.96	6139	0.3038	4.05
SCCY66B367S3PBLE	35	66	360	+30%/-10%	2.7/2.3*	65/85*	1300	2.0	2.5	255.79	3763	0.3645	3.92
SCCY69B407S3PBLE	35	69	400	+30%/-10%	2.7/2.3*	65/85*	1300	1.3	1.4	346.15	6719	0.4050	4.35
SCCY83B507S3PBLE	35	83	500	+30%/-10%	2.7/2.3*	65/85*	1500	1.2	1.35	402.99	6480	0.5063	5.06
SCCY83B607S3PBLE	35	83	600	+30%/-10%	2.7/2.3*	65/85*	1500	1.18	1.33	450.50	6090	0.6075	5.63
SCCY1K8707S3PBLE	35	105	700	+30%/-10%	2.7/2.3*	65/85*	1900	1.1	1.2	513.59	5608	0.7088	5.45
SCCY1A8857S3PBLE	35	115	850	+30%/-10%	2.7/2.3*	65/85*	2200	1.0	1.16	577.79	5096	0.8606	5.82
<b>Weldable Pin Lead</b>													
SCCY71B407SLBLE	35	71	400	+30%/-10%	2.7/2.3*	65/85*	1300	1.3	1.8	313.95	5461	0.4050	4.55
SCCY73B407SLBLE	35	73	400	+30%/-10%	2.7/2.3*	65/85*	1000	1.8	2.5	270.00	3845	0.4050	4.45
SCCY83B507SLBLE	35	83	500	+30%/-10%	2.7/2.3*	65/85*	1500	1	1.6	375.00	5110	0.5063	4.73
SCCY83B607SLBLE	35	83	600	+30%/-10%	2.7/2.3*	65/85*	1500	1	1.6	413.27	5110	0.6075	5.68
SCCY85B607SLBLE	35	83	600	+30%/-10%	2.7/2.3*	65/85*	1500	1.6	1.8	389.42	4459	0.6075	5.57
SCCY1K8707SLBLE	35	105	700	+30%/-10%	2.7/2.3*	65/85*	1900	0.9	1.45	468.98	4986	0.7088	5.86
SCCY1A8857SLBLE	35	115	850	+30%/-10%	2.7/2.3*	65/85*	2200	0.8	1.3	545.13	4547	0.8606	5.82



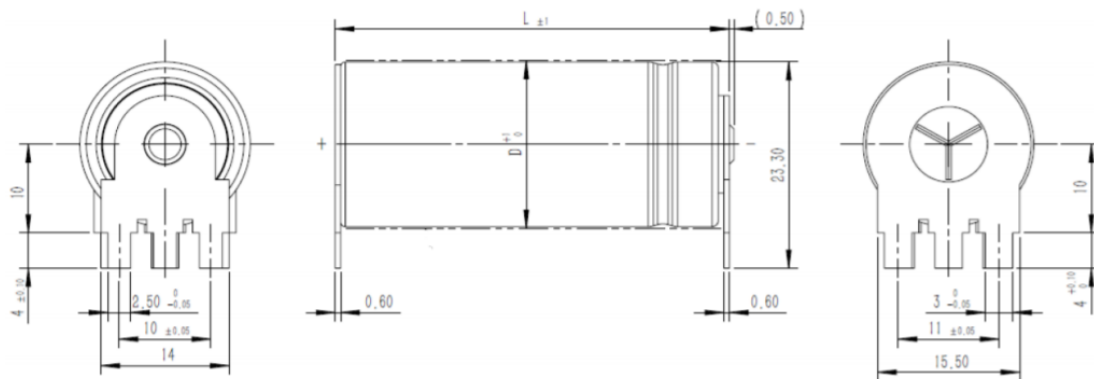
# SCC LE SERIES SINGLE-CELL CYLINDRICALS

**NEW!**  
In Axial format

**NEW RELEASES:** Super low ESR in Axial format  
First samples available of 50F, 25F and 100F will follow soon

AVX Part Number	Diameter (mm)	Length (mm)	Capacitance (F)	Capacitance Tolerance	Rated Voltage (V)	Rated Temperature (°C)	DCL Max @ 72 Hrs (µA)	ESR Max @ 1000 Hz (mΩ)	ESR Max @ DC (mΩ)	Peak Current (A)	Power Density (W/kg)	Max Energy (Wh)	Energy Density (Wh/kg)
Axial													
SCCV45B506SABLE	18	45	50	+30%/-10%	2.7/2.3*	65/85*	75	3	6	51.92	10675	0.0506	3.71

\*with appropriate voltage derating operating temperature can be extended to 85°C



Cap (F)	D	L
50	18	45

all dimensions in mm

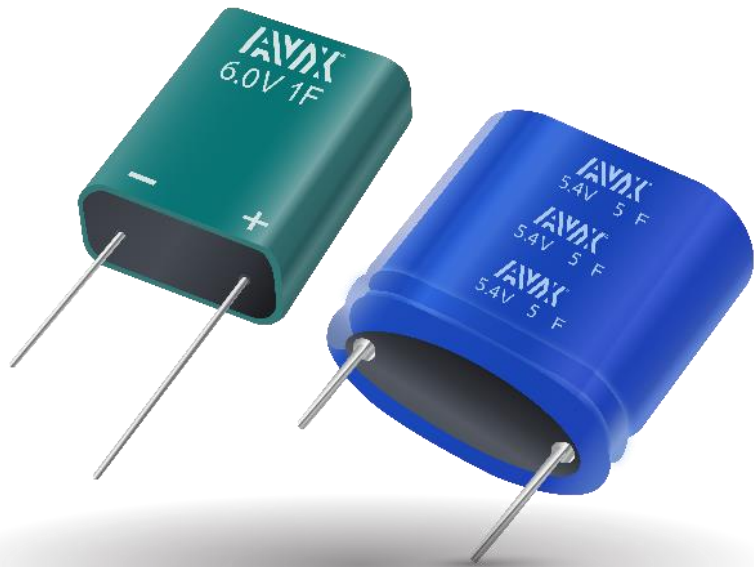
Vs 20mOhm at standard SCC product  
and 15mOhm at standard SCC LE series

**Remember:**

$$\Delta V_{total} = I * ESR + I * \Delta t / C$$

# Modules - SCM SERIES

## SERIES-CONNECTED SuperCapacitor cells



### Features

- Catalogue parts
- Feature very high capacitance, low ESR, and low leakage current
- Capacitance range: 0.33F to 7.5F
- Voltage range: 5.0V to 9.0V
- Operating temperature range: -40°C to +85°C
- Available in Balanced or Unbalanced versions
- Offer High Reliability SCM Series parts in Epoxy filled plastic package passing 85°C/85% R.H. and therefore featuring moisture ingress resistance for longer lifetime performance

# Modules - SCM SERIES

## CUSTOMIZED

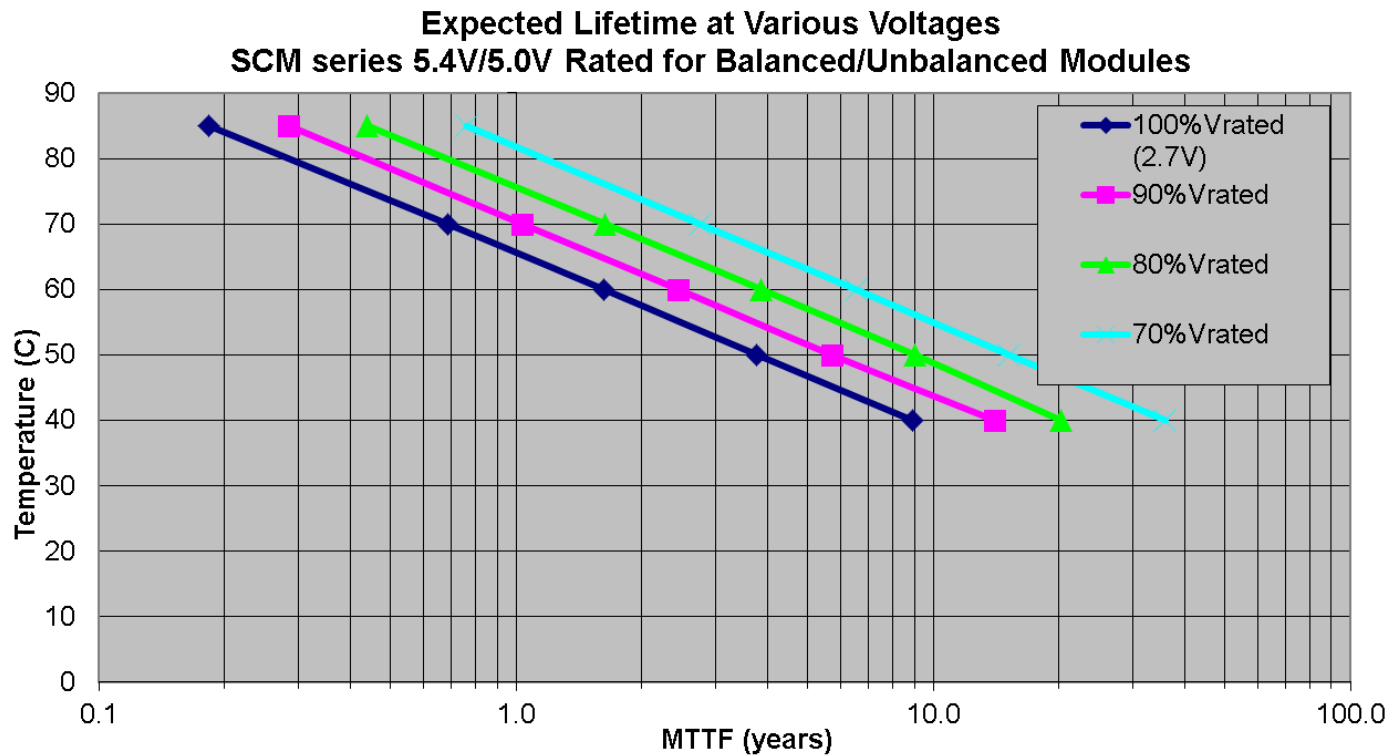


- Customizable by placing so many cells in series/parallel combination to attain higher working voltages/capacitance as per customer requirements
- Customizable terminals / bent leads / tray or ammo pack / different pitch are possible per customer request
- With Housing / Naked Design



# Understanding Life Time of SuperCapacitors

- Lifetime is a function of voltage and temperature
- From internal testing and “rule of thumb,” we know that life time doubles for every 10°C lower operating temperature, and again doubles for every 0.1-0.2V lower operating voltage



**AVX Utilizes MTTF  
Lifetime charts like  
this in its SuperCap  
Datasheets**

### BENEFITS OF USING IDC CONNECTOR

[Click Here To Learn More](#)

Reliable cold-welding technology

Proven technology for connection of electrolytic capacitors and inductors in automotive industry

Low cost SMD pick & place components

No impact on SuperCap ESR

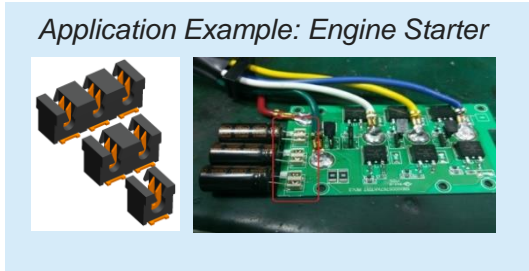
Good shock / vibration performance  
(Referring to test report 202-01-073)

Stable gas tight connection which makes potting possible  
(Referring to test report 202-01-078)

**Good match with capacitor**

Referring to test report 202-01-079

All mentioned reports can be made available on request



d (mm)	Recommended IDC connector / contact
0.8	00-9176-00x-011-x06
	70-9176-001-511-006

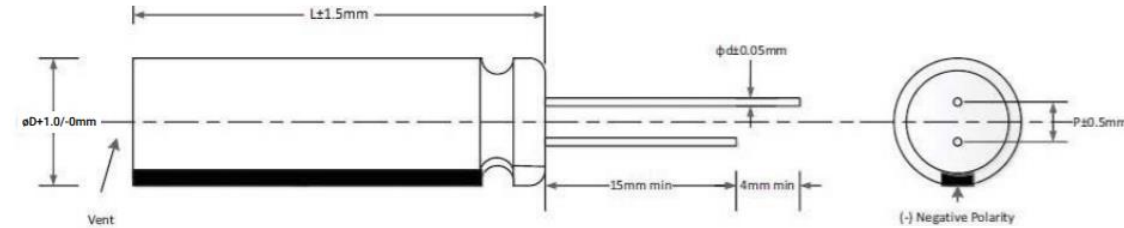
d (mm)	Recommended IDC connector / contact
0.6	00-9176-00x-022-x06
	00-9176-00x-853-x06
	70-9176-001-522-006
	70-9176-001-422-006

## Bring AVX Supercaps on PCB with AVX IDC connection termination

### MECHANICAL SPECIFICATIONS

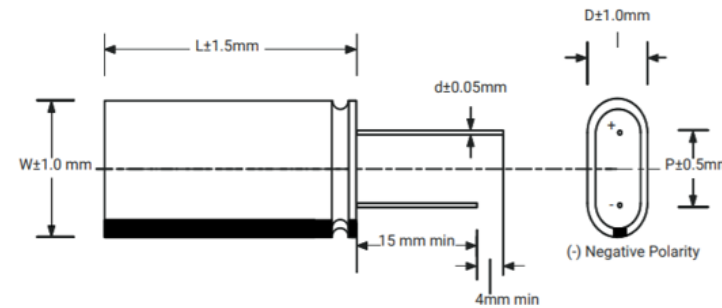
### SCC Series

RADIAL LEAD TYPE 1F – 100F



### SCM Series

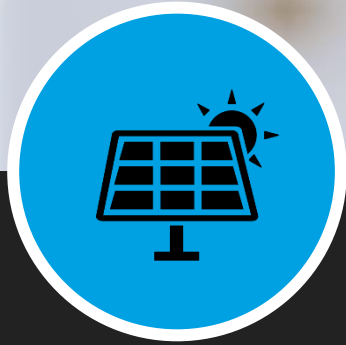
### MECHANICAL SPECIFICATIONS



D (mm)	P (mm)	d (mm)
6.3	2.3	0.6
8	3.5	0.6
10	5.0	0.6
12.5	5.5	0.6
16	7.5	0.8
18	8	0.8

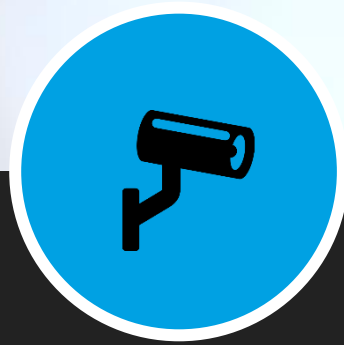
Cap (F)	D (mm)	W (mm)	L (mm)	P (mm)	d (mm)
0.47	6.3	13.6	14.0	9.0	0.6
0.47	8.0	16.0	14.0	11.5	0.6
1	8.0	16.0	18.0	11.5	0.6
1.5	8.0	16.0	22.0	11.5	0.6
2.5	10.0	20.0	22.0	15.5	0.6
5	10.0	20.0	32.0	15.5	0.6
5	12.5	25.0	22.0	18.0	0.6
7.5	12.5	25.0	32.0	18.0	0.6
15	16.0	32.0	33.0	23.7	0.8

# TYPICAL APPLICATIONS



## ENERGY HARVESTING

- Storage of regenerative energy
- More efficient harvesting than batteries due to lower ESR.
- Stored energy is then used to power the application and creates autonomous systems with very low maintenance requirements.



## PULSE POWER

- Repetitive high current pulses, aiding the battery, which is not able to service such pulses alone.



## POWER BACKUP / HOLD-UP

- Delivery of steady current for necessary time period
  - to shutdown the device in a controlled way.
  - To provide emergency power to a load in case of input power source fails



# TYPICAL APPLICATIONS

## Pulse Power



Metering: Gas, electricity, ....



Door Lock Systems



Asset Tracking



Handheld Devices



Fire Detectors

## Power Backup



Pitch Control in Windmill

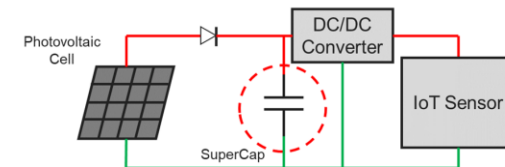


Data storage in eSSD



UPS

## Energy Harvesting



Solar Panel Charging Stations

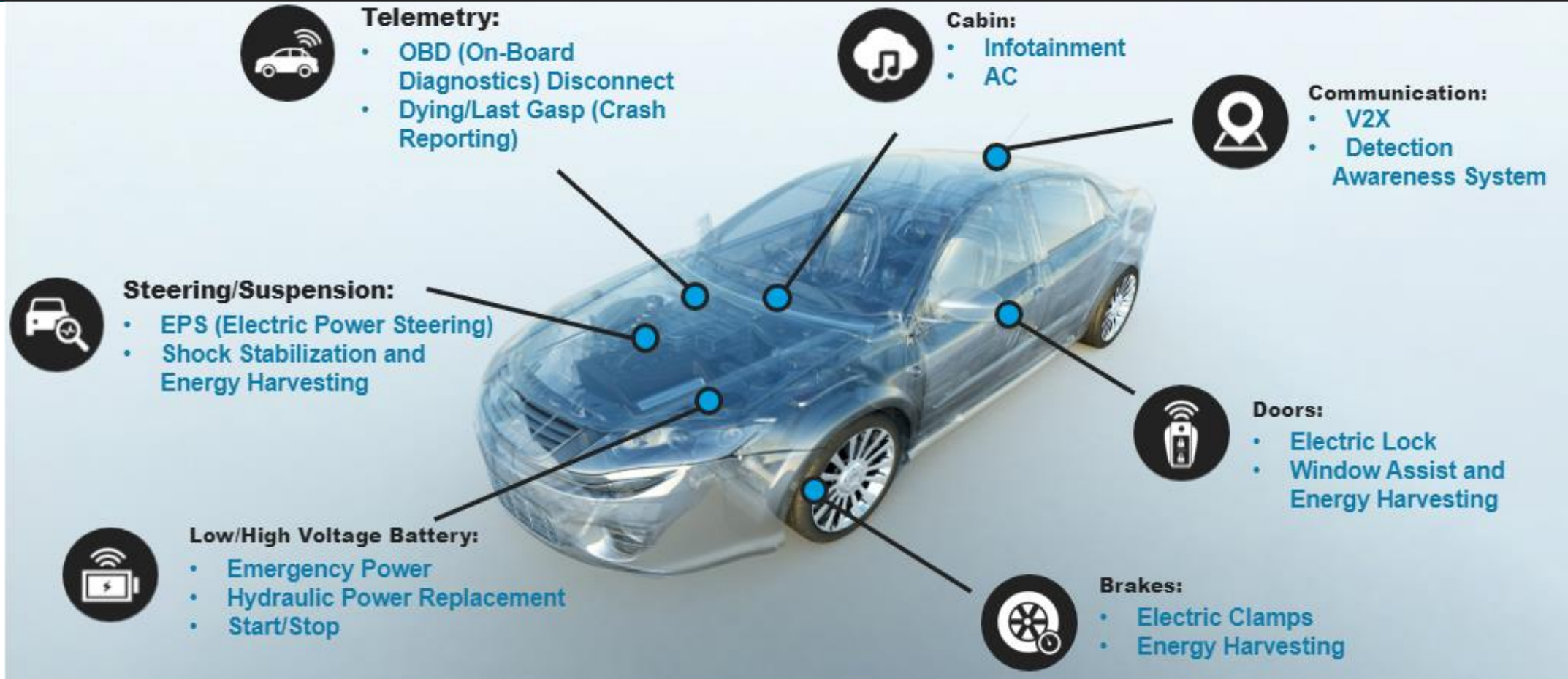


Elevator



Transportation/ Industrial Equipment

# POTENTIAL APPLICATIONS FOR SUPER CAPACITORS IN AUTOMOTIVE



- Factory certification according to IATF-16949 finished
- Parts qualification based on AEC-Q200 planned for 3Q CY2021

### SuperCap New Design/Sizing Request Form

Date: _____	Company: _____	NDA Received: Yes/No _____
Program Name: _____		Application: _____
Customer Contact: _____		
Email: _____		Phone: _____
AVX Sales Contact: _____		AVX FAE/FSE Contact: _____
Email: _____		Phone: _____
Annual Usage: _____	Target Price: _____	Expected Life of Program _____
Date Samples Needed: _____	Qual Package Required: _____	Mass Production Date: _____
Opportunity Type:		
<input checked="" type="radio"/> New Design	Competitor: _____	
<input type="radio"/> Existing Design / Cross	Competitor P/N: _____	
Component Type Preferred by Customer:		
<input checked="" type="radio"/> Cylindrical Part SCC	<input type="radio"/> Cylindrical Module Part SCM	<input type="radio"/> New Custom Module
<input type="radio"/> Prismatic Part	<input type="radio"/> BestCap	
Standard Components Requirements:		
Operating Temp Range - Min _____ Max _____ Avg _____		Daily Charge Cycles: _____
Charge:	Starting/Charge Voltage (V): _____	Peak Voltage (V): _____
	Charge Current(A): _____	Peak Current (I): _____
	Power (W): _____	Time(s): _____
Discharge:	End/Cutoff Voltage(V): _____	Peak Current (I): _____
	Discharge Current (I): _____	Time (s): _____
	Power (W) _____	
Lifetime Expectations(Y): _____	Lifetime Expectations (Cycles): _____	
Maximum Dimensions: _____ X _____ X _____ mm (L x W x H)		
NOTES / Comments: _____		

## Key things to know before selection!

- Identifying the operating temperature range (most critical)
- Operating voltage of the application
- Importance of equivalent series resistance (ESR) and leakage current (LC) in the design
- Expected life time
- Understanding the application: energy harvesting, pulse power, power hold-up, .....
- Expectations of cost – is it feasible?



# SuperCaps New Releases Plan CY2021

## Parameters

83F / 48V

130F / 56V

58F / 16V

5,8F / 160V

63F / 125V

## Modules



## SCP SERIES PrizmaCap™



## Features

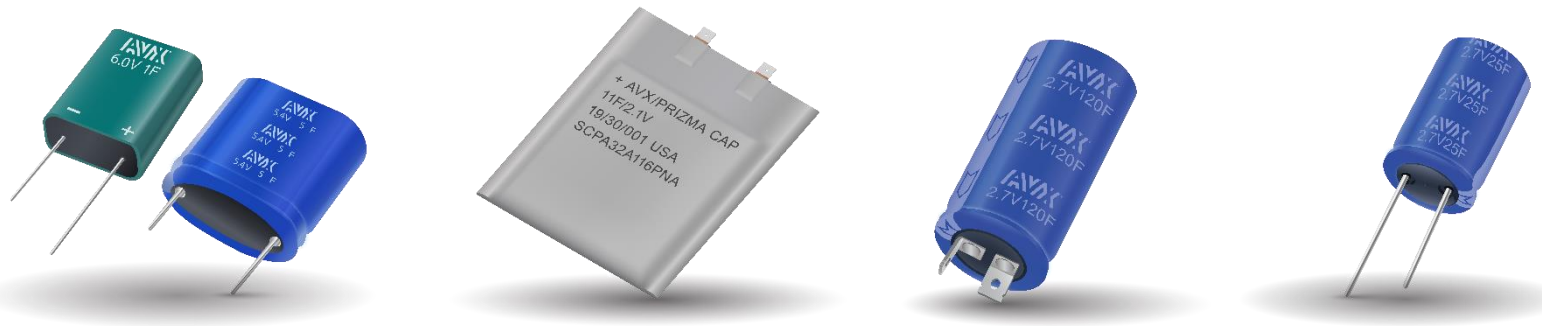
- Prismatic SuperCapacitors
- PC-based electrolyte technology
- Planned Capacitance range: 1F, 6F, 11F, 25F, 50F
- Rated Voltage of single cell: 2.1V
- Custom capabilities
- Low profile design down to 0.5mm thickness possible

# AVX ADVANTAGE

- AVX is a leading worldwide manufacturer and supplier of a broad line of passive electronic components, Antennas, Sensors and Interconnect solutions.
- Since 1997, AVX has been researching, designing, and manufacturing Supercapacitors.
- AVX offer a wide range of SuperCap range with high reliability performance and is committed to further new product introduction in this technology
- AVX has 3 Manufacturing sites for Supercapacitors Worldwide - Greenville (SC), Juarez (Mexico), Chengdu (China).



[Click Here To Learn More](#)



# THANK YOU.



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