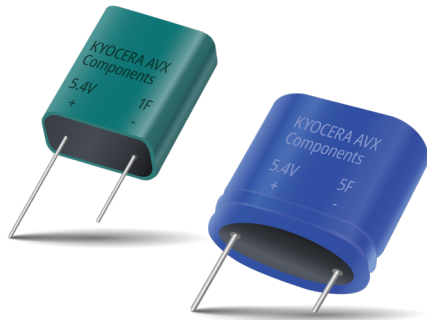


SCM Series

Series-Connected Super Capacitor Modules



This new series of electrochemical, double-layer, series-connected SuperCapacitor modules 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, pulse power applications, and battery replacement.

FEATURES

- High Pulse Power Capability
- Low ESR
- Low Leakage Current
- Plastic, Moisture Resistant Version

APPLICATIONS

- Camera Flash Systems
- Energy Harvesting
- GSM/GPRS Pulse Applications
- UPS/Industrial
- Wireless Alarms
- Remote Metering
- Scanners
- Toys and Games

HOW TO ORDER

| | | | | | | | | | |
|------------------------------|--|--|---|---|---|---|----------------------------------|---|---|
| SCM | R | 14 | C | 474 | P | R | B | A | 0 |
| Series SuperCap Module | Diameter Q = 6.3mm R = 8mm / 9.5mm** S = 10mm T = 12.5mm U = 16mm | Case Length Two digits represent case length in mm | Voltage Code C = 5.0V D = 5.4V F = 5.5V G = 7.5V H = 6.0V J = 8.1V L = 9.0V | Capacitance Code 1st two digits represent significant figures 3rd digit represents multiplier (number of zeros to follow) | Tolerance P = +100%/-0% S = +30%/-10% | Package/Lead Format R = Shrink Wrap/Radial S = Plastic/Radial | Package B = Bulk T = Tray* | Balancing A = Unbalanced B = Passive Balanced | Lead Orientation 0 = Straight Leads 1 = Bent Leads* |
| | | | | | | | | *Inquire about availability **Plastic/Radial version | |

QUALITY INSPECTION

Parts are tested for life cycle, high temperature load life, temperature characteristics, vibration resistance, and humidity characteristics. See pages 2-5 for more information.

TERMINATION

These SuperCapacitors are compatible with hand soldering and wave soldering processes, so long as appropriate precautions are followed. See 12 for more information.



For RoHS compliant products, please select correct termination style.

5.4V/5.0V Series-Connected SuperCapacitors Modules

| 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) |
|----------------------------------|---------------|-------------|-----------------------|-----------------------|-------------------|------------------------|-----------------------|------------------------|-------------------|------------------|----------------------|-----------------|------------------------|
| Shrink Wrap / Radial Lead | | | | | | | | | | | | | |
| SCMQ14C474PRBA0 | 6.3 | 14 | 0.47 | +100%/-0% | 5.0/4.2* | 65/85* | 3 | 400 | 1000 | 0.80 | 2143 | 0.0016 | 1.17 |
| SCMQ14C474PRTA0 | 6.3 | 14 | 0.47 | +100%/-0% | 5.0/4.2* | 65/85* | 3 | 400 | 1000 | 0.80 | 2143 | 0.0016 | 1.17 |
| SCMQ14D474PRBB0 | 6.3 | 14 | 0.47 | +100%/-0% | 5.4/4.6* | 65/85* | 6 | 400 | 1000 | 0.86 | 2499 | 0.0019 | 1.36 |
| SCMQ14D474PRTB0 | 6.3 | 14 | 0.47 | +100%/-0% | 5.4/4.6* | 65/85* | 6 | 400 | 1000 | 0.86 | 2499 | 0.0019 | 1.36 |
| SCMR14C474PRBA0 | 8 | 14 | 0.47 | +100%/-0% | 5.0/4.2* | 65/85* | 5 | 300 | 1000 | 0.80 | 1429 | 0.0016 | 0.78 |
| SCMR14D474PRBB0 | 8 | 14 | 0.47 | +100%/-0% | 5.4/4.6* | 65/85* | 6 | 300 | 1000 | 0.86 | 1666 | 0.0019 | 0.91 |
| SCMR18C105PRBA0 | 8 | 18 | 1 | +100%/-0% | 5.0/4.2* | 65/85* | 8 | 200 | 720 | 1.45 | 1667 | 0.0035 | 1.39 |
| SCMR18D105PRBB0 | 8 | 18 | 1 | +100%/-0% | 5.4/4.6* | 65/85* | 10 | 200 | 720 | 1.57 | 1944 | 0.0041 | 1.62 |
| SCMR22C155PRBA0 | 8 | 22 | 1.5 | +100%/-0% | 5.0/4.2* | 65/85* | 10 | 190 | 580 | 2.01 | 1669 | 0.0052 | 1.68 |
| SCMR22D155PRBB0 | 8 | 22 | 1.5 | +100%/-0% | 5.4/4.6* | 65/85* | 15 | 190 | 580 | 2.17 | 1946 | 0.0061 | 1.96 |
| SCMS22C255PRBA0 | 10 | 22 | 2.5 | +100%/-0% | 5.0/4.2* | 65/85* | 20 | 140 | 360 | 3.29 | 1852 | 0.0087 | 1.93 |
| SCMS22D255PRBB0 | 10 | 22 | 2.5 | +100%/-0% | 5.4/4.6* | 65/85* | 25 | 140 | 360 | 3.55 | 2113 | 0.0101 | 2.20 |
| SCMT22C505PRBA0 | 12.5 | 22 | 5 | +100%/-0% | 5.0/4.2* | 65/85* | 25 | 100 | 150 | 7.14 | 2740 | 0.0174 | 2.38 |
| SCMT22D505PRBB0 | 12.5 | 22 | 5 | +100%/-0% | 5.4/4.6* | 65/85* | 30 | 100 | 150 | 7.71 | 3069 | 0.0203 | 2.66 |
| SCMT32C755SRBA0 | 12.5 | 32 | 7.5 | +30%/-10% | 5.0/4.2* | 65/85* | 65 | 70 | 160 | 8.52 | 1953 | 0.0260 | 2.71 |
| SCMT32D755SRBB0 | 12.5 | 32 | 7.5 | +30%/-10% | 5.4/4.6* | 65/85* | 70 | 70 | 160 | 9.20 | 2209 | 0.0304 | 3.07 |

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

OPERATING TEMPERATURE RANGE

-40°C to +65°C @ 5.4V Balanced, 5.0V Unbalanced
 -40°C to +85°C @ 4.6V Balanced, 4.2V Unbalanced

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 | ≤30% 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 | ≤30% 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 | ≤30% 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 | ≤30% 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 | ≤30% of spec value ≤200% of spec value No remarkable defects |

| 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) |
|----------------------------------|---------------|-------------|-----------------------|-----------------------|-------------------|------------------------|-----------------------|------------------------|-------------------|------------------|----------------------|-----------------|------------------------|
| Shrink Wrap / Radial Lead | | | | | | | | | | | | | |
| SCMQ14F474PRBA0 | 6.3 | 14 | 0.47 | +100%/-0% | 5.5/4.6* | 65/85* | 6 | 500 | 3000 | 0.54 | 864 | 0.0020 | 1.41 |
| SCMQ14H474PRBB0 | 6.3 | 14 | 0.47 | +100%/-0% | 6.0/5.0* | 65/85* | 7 | 500 | 3000 | 0.59 | 1029 | 0.0024 | 1.68 |
| SCMR14F474PRBA0 | 8 | 14 | 0.47 | +100%/-0% | 5.5/4.6* | 65/85* | 6 | 380 | 1720 | 0.71 | 1005 | 0.0020 | 0.94 |
| SCMR14H474PRBB0 | 8 | 14 | 0.47 | +100%/-0% | 6.0/5.0* | 65/85* | 7 | 380 | 1720 | 0.78 | 1196 | 0.0024 | 1.12 |
| SCMR18F105PRBA0 | 8 | 18 | 1 | +100%/-0% | 5.5/4.6* | 65/85* | 9 | 250 | 720 | 1.60 | 2017 | 0.0042 | 1.68 |
| SCMR18H105PRBB0 | 8 | 18 | 1 | +100%/-0% | 6.0/5.0* | 65/85* | 11 | 250 | 720 | 1.74 | 2400 | 0.0050 | 2.00 |
| SCMR22F155PRBA0 | 8 | 22 | 1.5 | +100%/-0% | 5.5/4.6* | 65/85* | 12 | 200 | 560 | 2.24 | 2091 | 0.0063 | 2.03 |
| SCMR22H155PRBB0 | 8 | 22 | 1.5 | +100%/-0% | 6.0/5.0* | 65/85* | 18 | 200 | 560 | 2.45 | 2488 | 0.0075 | 2.42 |
| SCMS22F255PRBA0 | 10 | 22 | 2.5 | +100%/-0% | 5.5/4.6* | 65/85* | 24 | 180 | 340 | 3.72 | 2373 | 0.0105 | 2.33 |
| SCMS22H255PRBB0 | 10 | 22 | 2.5 | +100%/-0% | 6.0/5.0* | 65/85* | 30 | 180 | 340 | 4.05 | 2762 | 0.0125 | 2.72 |
| SCMS32F505PRBA0 | 10 | 32 | 5 | +100%/-0% | 5.5/4.6* | 65/85* | 30 | 120 | 150 | 7.86 | 3580 | 0.0210 | 3.11 |
| SCMS32H505PRBB0 | 10 | 32 | 5 | +100%/-0% | 6.0/5.0* | 65/85* | 36 | 120 | 150 | 8.57 | 4235 | 0.0250 | 3.68 |
| SCMT22F505PRBA0 | 12.5 | 22 | 5 | +100%/-0% | 5.5/4.6* | 65/85* | 30 | 120 | 150 | 7.86 | 3176 | 0.0210 | 2.76 |
| SCMT32F755SRBA0 | 12.5 | 32 | 7.5 | +30%/-10% | 5.5/4.6* | 65/85* | 78 | 90 | 120 | 10.86 | 3151 | 0.0315 | 3.28 |
| SCMT32H755SRBB0 | 12.5 | 32 | 7.5 | +30%/-10% | 6.0/5.0* | 65/85* | 84 | 90 | 120 | 11.84 | 3600 | 0.0375 | 3.75 |
| SCMU33F156SRBA0 | 16 | 33 | 15 | +30%/-10% | 5.5/4.6* | 65/85* | 85 | 35 | 50 | 23.57 | 4033 | 0.0630 | 3.50 |
| SCMU33F156SRBB0 | 16 | 33 | 15 | +30%/-10% | 5.5/4.6* | 65/85* | 90 | 35 | 50 | 23.57 | 3946 | 0.0630 | 3.43 |
| Plastic / Radial Lead | | | | | | | | | | | | | |
| SCMR14F474PSBA0 | 9.5 | 16 | 0.47 | +100%/-0% | 5.5/4.6* | 65/85* | 6 | 380 | 1720 | 0.71 | 541 | 0.0020 | 0.51 |
| SCMR14H474PSBB0 | 9.5 | 16 | 0.47 | +100%/-0% | 6.0/5.0* | 65/85* | 7 | 380 | 1720 | 0.78 | 644 | 0.0024 | 0.60 |
| SCMR18F105PSBA0 | 9.5 | 20 | 1 | +100%/-0% | 5.5/4.6* | 65/85* | 9 | 250 | 720 | 1.60 | 1096 | 0.0042 | 0.91 |
| SCMR18H105PSBB0 | 9.5 | 20 | 1 | +100%/-0% | 6.0/5.0* | 65/85* | 11 | 250 | 720 | 1.74 | 1304 | 0.0050 | 1.09 |
| SCMR22F155PSBA0 | 9.5 | 24 | 1.5 | +100%/-0% | 5.5/4.6* | 65/85* | 12 | 200 | 560 | 2.24 | 1179 | 0.0063 | 1.15 |
| SCMR22H155PSBB0 | 9.5 | 24 | 1.5 | +100%/-0% | 6.0/5.0* | 65/85* | 18 | 200 | 560 | 2.45 | 1403 | 0.0075 | 1.36 |

OPERATING TEMPERATURE RANGE

-40°C to +65°C @ 6.0V Balanced, 5.5V Unbalanced
 -40°C to +85°C @ 5.0V Balanced, 4.6V Unbalanced

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 | ≤30% 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 | ≤30% 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 | ≤30% 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 | ≤30% 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 | ≤30% of spec value ≤200% of spec value No remarkable defects |

7.5V Series-Connected Super Capacitor Modules

| 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) |
|----------------------------------|---------------|-------------|-----------------------|-----------------------|-------------------|------------------------|-----------------------|------------------------|-------------------|------------------|----------------------|-----------------|------------------------|
| Shrink Wrap / Radial Lead | | | | | | | | | | | | | |
| SCMR14G334SRBA0 | 8 | 14 | 0.33 | +30%/-10% | 7.5/6.4* | 65/85* | 6 | 450 | 900 | 0.95 | 2419 | 0.0026 | 0.83 |
| SCMR14G334SRBB0 | 8 | 14 | 0.33 | +30%/-10% | 7.5/6.4* | 65/85* | 7 | 450 | 900 | 0.95 | 2419 | 0.0026 | 0.83 |
| SCMR18G604SRBA0 | 8 | 18 | 0.6 | +30%/-10% | 7.5/6.4* | 65/85* | 9 | 225 | 450 | 1.77 | 3947 | 0.0047 | 1.23 |
| SCMR18G604SRBB0 | 8 | 18 | 0.6 | +30%/-10% | 7.5/6.4* | 65/85* | 11 | 225 | 450 | 1.77 | 3846 | 0.0047 | 1.20 |
| SCMR22G105SRBA0 | 8 | 22 | 1 | +30%/-10% | 7.5/6.4* | 65/85* | 10 | 180 | 360 | 2.76 | 4076 | 0.0078 | 1.70 |
| SCMR22G105SRBB0 | 8 | 22 | 1 | +30%/-10% | 7.5/6.4* | 65/85* | 15 | 180 | 360 | 2.76 | 3989 | 0.0078 | 1.66 |

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

OPERATING TEMPERATURE RANGE

-40°C to +65°C @ 7.5V
 -40°C to +85°C @ 6.4V

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 | ≤30% 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 | ≤30% 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 | ≤30% 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 | ≤30% 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 | ≤30% of spec value ≤200% of spec value No remarkable defects |

9.0V/8.1V Series-Connected Super Capacitor Modules

| 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) |
|----------------------------------|---------------|-------------|-----------------------|-----------------------|-------------------|------------------------|-----------------------|------------------------|-------------------|------------------|----------------------|-----------------|------------------------|
| Shrink Wrap / Radial Lead | | | | | | | | | | | | | |
| SCMR14J334SRBA0 | 8 | 14 | 0.33 | +30%/-10% | 8.1/6.9* | 65/85* | 6 | 500 | 2850 | 0.69 | 897 | 0.0030 | 0.98 |
| SCMR14J334SRBB0 | 8 | 14 | 0.33 | +30%/-10% | 8.1/6.9* | 65/85* | 7 | 500 | 2850 | 0.69 | 869 | 0.0030 | 0.95 |
| SCMR14L334SRBB0 | 8 | 14 | 0.33 | +30%/-10% | 9.0/7.6* | 65/85* | 7 | 500 | 2850 | 0.77 | 1072 | 0.0037 | 1.17 |
| SCMR18J604SRBA0 | 8 | 18 | 0.6 | +30%/-10% | 8.1/6.9* | 65/85* | 9 | 400 | 1080 | 1.47 | 1934 | 0.0055 | 1.45 |
| SCMR18J604SRBB0 | 8 | 18 | 0.6 | +30%/-10% | 8.1/6.9* | 65/85* | 12 | 400 | 1080 | 1.47 | 1869 | 0.0055 | 1.40 |
| SCMR18L604SRBB0 | 8 | 18 | 0.6 | +30%/-10% | 9.0/7.6* | 65/85* | 12 | 400 | 1080 | 1.64 | 2308 | 0.0068 | 1.73 |
| SCMR22J105SRBA0 | 8 | 22 | 1 | +30%/-10% | 8.1/6.9* | 65/85* | 12 | 350 | 840 | 2.20 | 1986 | 0.0091 | 1.93 |
| SCMR22J105SRBB0 | 8 | 22 | 1 | +30%/-10% | 8.1/6.9* | 65/85* | 15 | 350 | 840 | 2.20 | 1894 | 0.0091 | 1.84 |
| SCMR22L105SRBB0 | 8 | 22 | 1 | +30%/-10% | 9.0/7.6* | 65/85* | 18 | 350 | 840 | 2.45 | 2338 | 0.0113 | 2.27 |
| Plastic / Radial Lead | | | | | | | | | | | | | |
| SCMR14J334SSBA0 | 9.5 | 16 | 0.33 | +30%/-10% | 8.1/6.9* | 65/85* | 6 | 500 | 2850 | 0.69 | 498 | 0.0030 | 0.54 |
| SCMR14L334SSBB0 | 9.5 | 16 | 0.33 | +30%/-10% | 9.0/7.6* | 65/85* | 7 | 500 | 2850 | 0.77 | 598 | 0.0037 | 0.65 |
| SCMR18J604SSBA0 | 9.5 | 20 | 0.6 | +30%/-10% | 8.1/6.9* | 65/85* | 9 | 400 | 1080 | 1.47 | 1063 | 0.0055 | 0.80 |
| SCMR18L604SSBB0 | 9.5 | 20 | 0.6 | +30%/-10% | 9.0/7.6* | 65/85* | 12 | 400 | 1080 | 1.64 | 1286 | 0.0068 | 0.96 |
| SCMR22J105SSBA0 | 9.5 | 24 | 1 | +30%/-10% | 8.1/6.9* | 65/85* | 12 | 350 | 840 | 2.20 | 1129 | 0.0091 | 1.10 |
| SCMR22L105SSBB0 | 9.5 | 24 | 1 | +30%/-10% | 9.0/7.6* | 65/85* | 18 | 350 | 840 | 2.45 | 1361 | 0.0113 | 1.32 |

OPERATING TEMPERATURE RANGE

-40°C to +65°C @ 9.0V Balanced, 8.1V Unbalanced
 -40°C to +85°C @ 7.6V Balanced, 6.9V Unbalanced

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 | ≤30% 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 | ≤30% 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 | ≤30% 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 | ≤30% 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 | ≤30% of spec value ≤200% of spec value No remarkable defects |

QUALITY AND RELIABILITY

CAPACITANCE VS. TEMPERATURE



LEAKAGE CURRENT VS. TEMPERATURE



EQUIVALENT SERIES RESISTANCE VS. TEMPERATURE



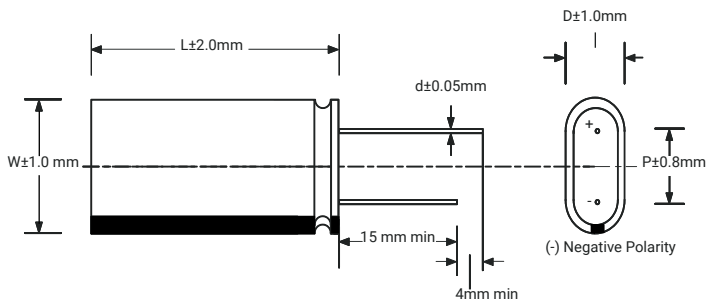
SCM Series

Series-Connected Super Capacitor Modules



MECHANICAL SPECIFICATIONS

5.4V, 6.0V SHRINK WRAP TYPE - STRAIGHT LEADS



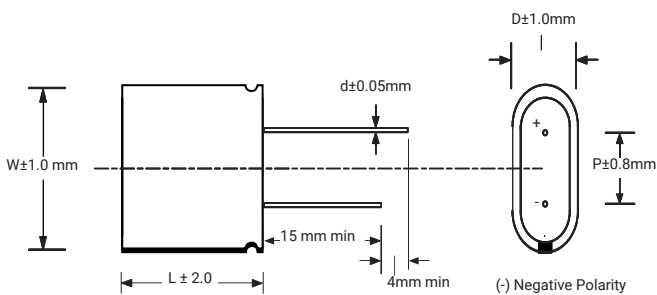
5.4V, 6.0V SHRINK WRAP TYPE - BENT LEADS



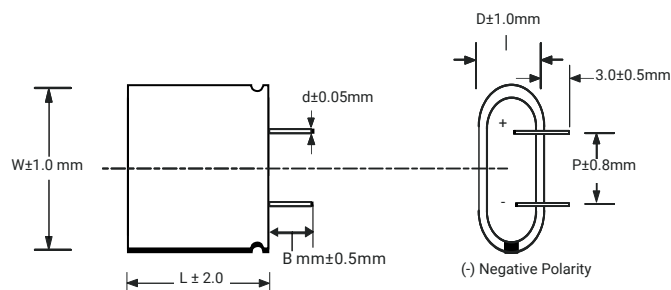
| Cap (F) | D (mm) | W (mm) | L (mm) | P (mm) | d (mm) | B (mm)* |
|---------|--------|--------|--------|--------|--------|---------|
| 0.47 | 6.3 | 13.6 | 14.0 | 9.0 | 0.6 | 2.0 |
| 0.47 | 8.0 | 16.0 | 14.0 | 11.5 | 0.6 | 2.0 |
| 1 | 8.0 | 16.0 | 18.0 | 11.5 | 0.6 | 2.0 |
| 1.5 | 8.0 | 16.0 | 22.0 | 11.5 | 0.6 | 2.0 |
| 2.5 | 10.0 | 20.0 | 22.0 | 15.5 | 0.6 | 2.0 |
| 5 | 10.0 | 20.0 | 32.0 | 15.5 | 0.6 | 2.0 |
| 5 | 12.5 | 25.0 | 22.0 | 18.0 | 0.6 | 2.0 |
| 7.5 | 12.5 | 25.0 | 32.0 | 18.0 | 0.6 | 2.0 |
| 15 | 16.0 | 32.0 | 33.0 | 23.7 | 0.8 | 2.0 |

*for version with bent leads

7.5V, 9.0V SHRINK WRAP TYPE - STRAIGHT LEADS



7.5V, 9.0V SHRINK WRAP TYPE - BENT LEADS



| Cap (F) | D (mm) | W (mm) | L (mm) | P (mm) | d (mm) | B (mm)* |
|---------|--------|--------|--------|--------|--------|---------|
| 0.33 | 8.0 | 24.0 | 14.0 | 13.5 | 0.6 | 2.0 |
| 0.6 | 8.0 | 24.0 | 18.0 | 13.5 | 0.6 | 2.0 |
| 1 | 8.0 | 24.0 | 22.0 | 13.5 | 0.6 | 2.0 |

*for version with bent leads

MECHANICAL SPECIFICATIONS

6.0V PLASTIC TYPE - STRAIGHT LEADS



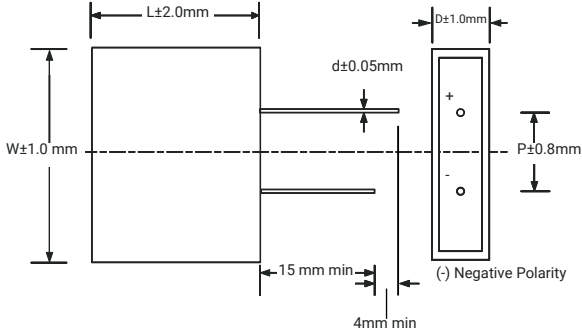
6.0V PLASTIC TYPE - BENT LEADS



| Cap (F) | D (mm) | W (mm) | L (mm) | P (mm) | d (mm) | B (mm)* |
|---------|--------|--------|--------|--------|--------|---------|
| 0.47 | 9.5 | 18.5 | 16.0 | 11.5 | 0.6 | 2.0 |
| 1 | 9.5 | 18.5 | 20.0 | 11.5 | 0.6 | 2.0 |
| 1.5 | 9.5 | 18.5 | 24.0 | 11.5 | 0.6 | 2.0 |

*for version with bent leads

9.0V PLASTIC TYPE - STRAIGHT LEADS



9.0V Plastic Type - Bent Leads



| Cap (F) | D (mm) | W (mm) | L (mm) | P (mm) | d (mm) | B (mm)* |
|---------|--------|--------|--------|--------|--------|---------|
| 0.33 | 9.5 | 26.6 | 16.0 | 13.5 | 0.6 | 2.0 |
| 0.6 | 9.5 | 26.6 | 20.0 | 13.5 | 0.6 | 2.0 |
| 1 | 9.5 | 26.6 | 24.0 | 13.5 | 0.6 | 2.0 |

*for version with bent leads

TEST METHODS

IEC CAPACITANCE TEST METHOD

Procedure: Charge module under constant current to rated voltage at room temperature, then hold 10 minutes on charge under constant voltage. After 10 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)

$$C = \frac{I \times (t_2 - t_1)}{V_1 - V_2}$$

DC ESR MEASUREMENT

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 2 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: $ESR_{dch} = \frac{(ESR_{dch1} + ESR_{dch2})}{2}$

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 = $(0.12 \cdot V^2 / R_{DC}) / \text{mass}$

ENERGY DENSITY

- Energy Density = $(\frac{1}{2} CV^2) / (3600 \cdot \text{mass})$

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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Expected Lifetime at Various Voltages
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