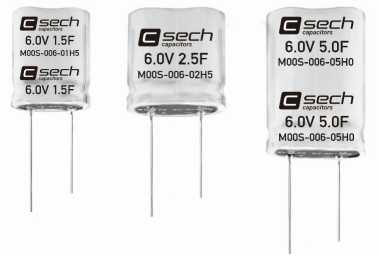
Product Datasheet

Small cell ultracapacitors – 6V Module type



- Rated voltage 6VDC
- 1.5 up to 5F capacitance
- High capacitance and low ESR
- High cycle life of 500'000 cycles
- Excellent DC life performance
- Wetting proof design

ELECTRICAL SPECIFICATIONS			
Type	**M00S-006-01C5 M00S-006-01S5 M00S-006-01H5**	**M00S-006-02C5 M00S-006-02S5 M00S-006-02H5**	**M00S-006-05C0 M00S-006-05S0 M00S-006-05H0**
Rated Voltage V_R @ -40 - +65°C	6.00 V	6.00 V	6.00 V
Rated Voltage V_R @ -40 - +85°C	5.00 V	5.00 V	5.00 V
Rated Capacitance C [2]	1.5 F	2.5 F	5 F
Capacitance Tolerance [3]	-10% / +20%	-10% / +20%	-10% / +20%
ESR, 1kHz [2] (Typical Values)	90 mΩ (82 mΩ)	80 mΩ (54 mΩ)	50 mΩ (32 mΩ)
ESR, DC [2] (Typical Values)	140 mΩ (126 mΩ)	90 mΩ (78 mΩ)	80 mΩ (60 mΩ)
Leakage Current IL [4]	0.015 mA	0.020 mA	0.060 mA
Max Peak Current I_{Max} [5]	3.72 A	6.12 A	10.71 A
Usable Continuous Current I_S [6]	1.2 A	2.0 A	3.0 A
Stored Energy E [7]	7.5 mWh	12.5 mWh	25 mWh
Energy Density E_d [8]	1.79 Wh/kg	2.23 Wh/kg	3.13 Wh/kg
Matched Impedance Power, Density P_{dMax} [9]	15.3 kW/kg	17.9 kW/kg	21.0 kW/kg

THERMAL CHARACTERISTICS			
Type	**M00S-006-01C5 M00S-006-01S5 M00S-006-01H5**	**M00S-006-02C5 M00S-006-02S5 M00S-006-02H5**	**M00S-006-05C0 M00S-006-05S0 M00S-006-05H0**
Working Temperature	-40 ~ 65°C	-40 ~ 65°C	-40 ~ 65°C
Temperature Characteristics	Capacitance change within ±5% of value at RT, ESR change within ±150% of value at RT		
Thermal Resistance R_{Th} [10]	74 K/W	42K/W	21K/W

LIFETIME CHARACTERISTICS			
Type	**M00S-006-01C5 M00S-006-01S5 M00S-006-01H5**	**M00S-006-02C5 M00S-006-02S5 M00S-006-02H5**	**M00S-006-05C0 M00S-006-05S0 M00S-006-05H0**
DC Life at HT @ 65°C [11]	1000 hours		
DC Life at HT @ 85°C [11]	1000 hours @ max. 5.0V		
DC Life at RT [12]	10 years		
Cycle Life [13]	500'000 cycles		
Shelf Life [14]	3 years		

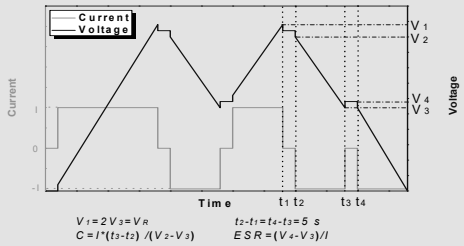
SAFETY & ENVIRONMENTAL SPECIFICATIONS			
Type	**M00S-006-01C5 M00S-006-01S5 M00S-006-01H5**	**M00S-006-02C5 M00S-006-02S5 M00S-006-02H5**	**M00S-006-05C0 M00S-006-05S0 M00S-006-05H0**
Safety	RoHS, REACH and UL810		
Shock and vibration	MIL-STD-202, Method 213, Fig. 1, condition C; Method 204 (acc. AEC-Q200)		

PHYSICAL PARAMETERS

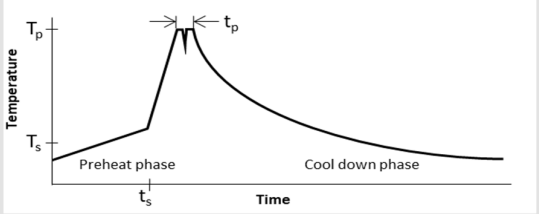
Type		M00S-006-01C5 M00S-006-01S5 M00S-006-01H5	M00S-006-02C5 M00S-006-02S5 M00S-006-02H5	M00S-006-05C0 M00S-006-05S0 M00S-006-05H0
Mass M		4.2 g	5.6 g	8.0 g
Terminals (wire leads)		Solderable, tinned copper-ply wire[16]		
Dimensions[17] L x W x D		22.0 x 17.0 x 8.5 mm	22.0 x 21.0 x 10.5 mm	32.0 x 21.0 x 10.5
Lead distance P	Type **C**	5.5 mm	5.5 mm	5.5 mm
	Type **S**	15.5 mm	15.5 mm	15.5 mm
	Type **H**	10.5 mm	10.5 mm	10.5 mm
Lead diameter d		0.6 mm	0.6 mm	0.6 mm

NOTES:

1. Surge voltage V_S: Absolute maximum voltage, non-repetitive. The duration must not exceed 1 second.
2. Capacitance C: The test current is 0.075 A/F, if the calculated current is >100A, then apply 100A.



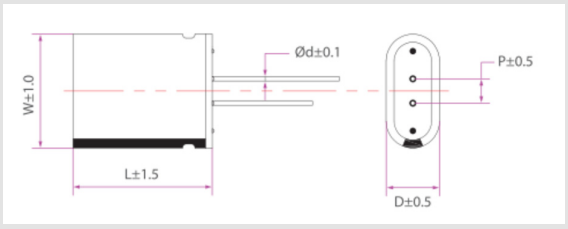
3. Capacitance tolerance: Typical tolerance is +5%~+10%.
4. Leakage current measurement procedure: 1) Charge the capacitor to the V_R with a constant current (0.075 A/F, if the calculated current is >100A, then apply 100A). 2) Hold the voltage at V_R for 72h. 3) The current to maintain V_R after 72 h is the leakage current.
5. Max current: $I_{Max} = 0.5C * V_R/(\Delta t + ESR * C)$, discharge from V_R to V_R/2 in 1 second.
6. Max constant working current: $I_{MCC} = \sqrt{\Delta T/(ESR * R_{Th})}$
7. Stored energy: $E = 0.5C * V^2/3600$
8. Energy density: $E_d = E/M$
9. Matched impedance power density: $P_{dMax} = (0.25V_R^2/ESR)/M$
10. Thermal resistance ($\Delta T = 15°C$): $R_{Th} = \Delta T/P$, where P = ESR * I^2
11. DC life at high temperature HT: At 65°C hold the capacitor charged at rated voltage for 1000h or at 85°C at max. 2.5V for 1000h. The capacitance shall be >70% of the rated value, the ESR shall be <200% of the rated value.
12. DC life at RT: Hold the capacitor charged at rated voltage at room temperature RT, the capacitance shall be >80% of the rated value, the ESR shall be <200% of the rated value.
13. Cycle life: Charge and discharged the capacitor in the range between V_R and V_R/2. 5 seconds waiting period between charge and discharge. The constant test current is 0.075 A/F (if the calculated current >100A, then apply 100A).
14. Storage temperature: Storage in discharge state, <35°C
15. Shelf life: Stored uncharged at RT, <50% RH
16. Wave solder profile



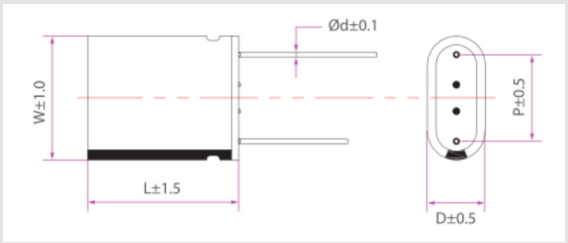
Profile feature	Standard SnPb	Pb free
Preheat/soak temperature T_s	100°C	100°C
Preheat/soak time t_s	60 s	60 s
Peak temperature T_p	220 – 260°C	250 – 260°C
Time to peak temperature t_p	10s max, 5s max/wave	10s max, 5s max/wave
Ramp-down rate	2-5 K/s	2-5 K/s
Time solder process (RT to RT)	4 min	4 min

17. Dimensions:

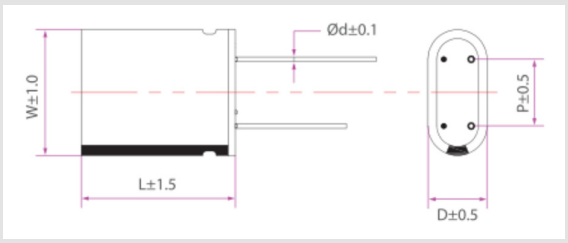
Module Type **C**



Module Type **S**



Module Type **H**



Notes:

Standard markings:
- Name of manufacturer, part number, serial number
- Rated voltage and capacitance, negative and positive terminals, warning marking
- Stored energy in watt-hours

Mounting recommendations:
- Mounting without applying undue mechanical stress on the terminals
- Provide adequate spacing in between cells to secure required insulation strength
- Provide clearance around the safety vent and do not position anything above the safety vent that may be damaged in an event of vent rupture