

## Product Datasheet

### 96V 93F ultracapacitor module

- Rated voltage 96VDC 93F capacitance
- High cycle life of 1 million cycles
- Laser welded internal connections
- Robust and vibration proof design
- Passive cell balancing
- Temperature monitoring



#### ELECTRICAL SPECIFICATIONS

Type	M13W-096-0093
Rated Voltage $V_R$	96 V
Surge Voltage $V_S^1$	99.2 V
Rated Capacitance $C^2$	93 F
Capacitance Tolerance <sup>3</sup>	0% / +20%
DC ESR <sup>2</sup>	<10 mΩ
Leakage Current $I_L^4$	<50mA
Constant Current ( $\Delta T = 15^\circ C$ ) <sup>5</sup>	62 A
Max Current $I_{Max}^6$	2.3 kA
Short Current $I_S^7$	9.6 kA
Stored Energy $E^8$	119Wh
Energy Density $E_d^9$	6 Wh/kg
Usable Power Density $P_d^{10}$	5.5 kW/kg
Matched Impedance Power Density $P_{dMax}^{11}$	11.5 kW/kg

#### THERMAL CHARACTERISTICS

Type	M13W-096-0093
Working Temperature	-40 ~ 65 °C
Storage Temperature <sup>12</sup>	-40 ~ 70 °C
Thermal Resistance $R_{Th}^{13}$	0.4 °C/W
Thermal Capacitance $C_{Th}^{14}$	21'000 J/°C

#### LIFETIME CHARACTERISTICS

Type	M13W-096-0093
DC Life at High Temperature <sup>15</sup>	1500 hours
DC Life at RT <sup>16</sup>	10 years
Cycle Life <sup>17</sup>	1'000'000 cycles
Shelf Life <sup>18</sup>	4 years

#### SAFETY & ENVIRONMENTAL SPECIFICATIONS

Type	M13W-096-0093
Safety	RoHS, REACH
Vibration	ISO 16750-3 Table14
Shock	IEC60068-2-28, 29

#### MONITORING AND CELL VOLTAGE MANAGEMENT

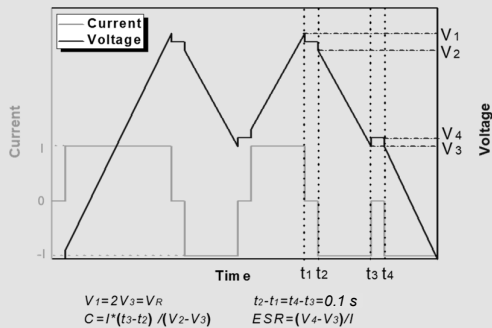
Type	M13W-096-0093
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Internal Temperature Sensor	2x NTC 10kΩ @25°C
Temperature Interface	Analog
Connector	Harting Han 8D male
Cell Voltage Monitoring and Management	Passive

PHYSICAL PARAMETERS	
Type	M13W-096-0093
Mass M	20.1 kg
Terminals	M10 <sup>19</sup> (Option: Harting connectors, see picture)
Dimensions <sup>20</sup> Length	520 mm
Width	260 mm
Height	185 mm

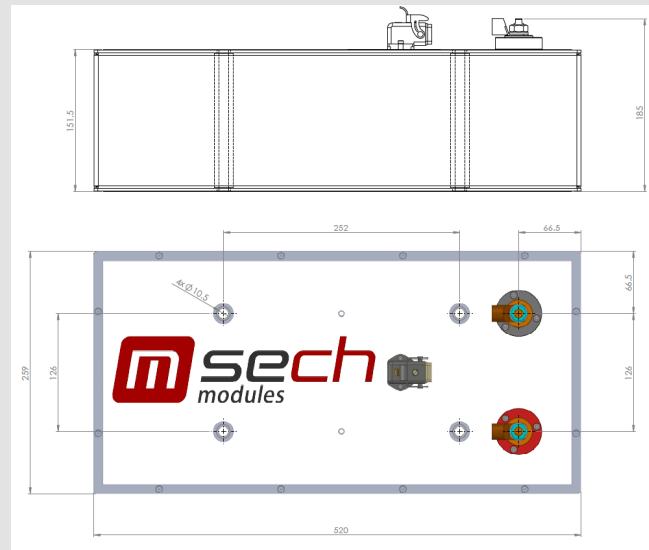
### NOTES:

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



- Capacitance tolerance: Typical tolerance is +5%~+10%.
- 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.
- Max constant working current:  $I_{MCC} = \sqrt{\Delta T / (ESR \cdot R_{Th})}$
- Max current:  $I_{Max} = 0.5C \cdot V_R / (\Delta t + ESR \cdot C)$ , discharge from  $V_R$  to  $V_R/2$  in 1 second.
- Short circuit current:  $I_S = V_R / ESR$
- Stored energy:  $E = 0.5C \cdot V^2 / 3600$
- Energy density:  $E_d = E / M$
- Usable power density:  $P_d = (0.12V_R^2 / ESR) / M$
- Matched impedance power density:  $P_{dMax} = (0.25V_R^2 / ESR) / M$
- Storage in discharge state.
- Thermal resistance:  $R_{Th} = \Delta T / P$ , where  $P = ESR \cdot I^2$
- Thermal capacitance is indicated for the whole module.

- DC life at high temperature: Hold the capacitor charged at rated voltage at 65°C for 1500h. The capacitance shall be >80% of the rated value, the ESR shall be <200% of the rated value. 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.
- 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).
- Shelf life: Discharged and no load applied at RT.
- The maximum torque is 25Nm
- Dimensions:



### 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

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