

# Product Datasheet

## ESS Module

- Rated voltage 144VDC
- 62.5F capacitance
- Ultra-low ESR
- Stackable 19" rack design
- Laser welded connections
- Innovative cell management
- Integrated voltage and temperature monitoring
- CAN bus communication



### ELECTRICAL SPECIFICATIONS

Type	M35W-144-0063
Rated Voltage $V_R$	144.00 V
Surge Voltage $V_S^1$	148.80 V
Rated Capacitance $C^2$	62.5 F
Capacitance Tolerance <sup>3</sup>	0% / +20%
DC ESR <sup>2</sup>	12 mΩ
Leakage Current $I_L^4$	<25 mA
Constant Current ( $\Delta T = 15^\circ C$ ) <sup>5</sup> passive cooling	79 A
Constant Current ( $\Delta T = 15^\circ C$ ) <sup>5</sup> active air cooling 60 CFM	177 A
Max Current $I_{Max}^6$	2.6 kA
Short Current $I_S^7$	12 kA
Stored Energy $E^8$	180 Wh
Energy Density $E_d^9$	5.6 Wh/kg
Usable Power Density $P_d^{10}$	6.8 kW/kg
Impedance Match Power Density $P_{dMax}^{11}$	13.5 kW/kg

### THERMAL CHARACTERISTICS

Type	M35W-144-0063
Working Temperature	-40 ~ 65°C
Storage Temperature <sup>12</sup>	-40 ~ 70°C
Thermal Resistance $R_{Th}^{13}$ Passive cooling	0.2°C/W
Thermal Resistance $R_{Th}^{13}$ Active air cooling 60 CFM	0.04°C/W
Thermal Capacitance $C_{Th}^{14}$	36 kJ/°C

### LIFETIME CHARACTERISTICS

Type	M35W-144-0063
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	M35W-144-0063
Safety	RoHS, REACH
Vibration	Seismic Standard IEC 60068-3-3 Zone 3
Rated insulation voltage (maximum series voltage)	1kVDC according Railway Standard IEC 62497-1

## MONITORING AND CELL VOLTAGE MANAGEMENT (CMS)

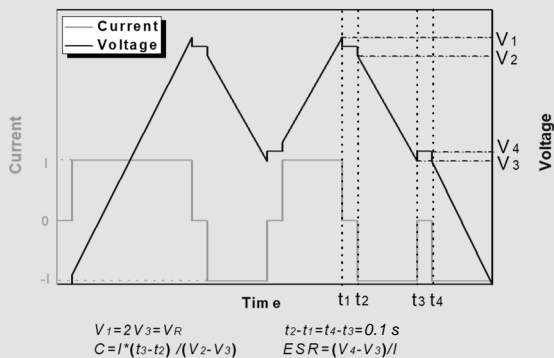
Type	M35W-144-0063
Connector	Phoenix MCV1.5/8-GF-3.81
Auxiliary power supply	24V ± 10% 5W
Cell Voltage Monitoring and Management <sup>19</sup>	Microprocessor based, individual cell balancing
Temperature Sensor	4x NTC (10kOhm @25°C)
Communication interface	CAN bus 2.0A

## PHYSICAL PARAMETERS

Type	M35W-144-0063
Mass M, typical	32 kg
Power Terminals	M8 <sup>20</sup>
Dimensions <sup>21</sup> Length	555 mm
Width	483 mm
Height	150 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:  $I_{MCC} = \sqrt{\Delta T / (ESR * R_{Th})}$
- Max current:  $I_{Max} = 0.5C * V_R / (\Delta t + ESR * C)$ , discharge from  $V_R$  to  $V_R/2$  in 1 second.
- Short current:  $I_S = V_R / ESR$
- Stored energy:  $E = 0.5C * V^2 / 3600$
- Energy density:  $E_d = E / M$
- Usable power density:  $P_d = 0.125V_R^2 / (ESR * M)$
- Impedance match power density:  $P_{dMax} = 0.25V_R^2 / (ESR * m)$
- Storage temperature: Storage in discharge state.
- Thermal resistance:  $R_{Th} = \Delta T / P$ , where  $P = ESR * I^2$
- 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.
- See detailed CMS datasheet and user manual.
- The maximum torque is 25Nm for M8.
- 19" rack module with a height of 4U



### 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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