FEATURES
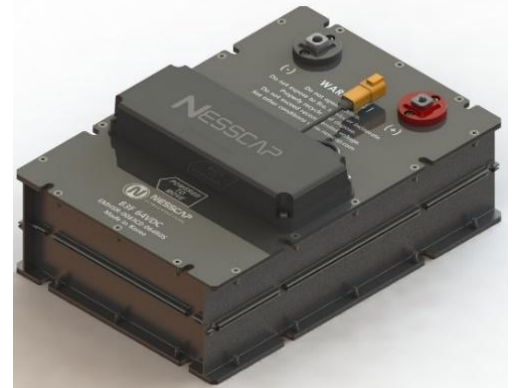
- » *Rated voltage of 64V and capacitance of 83F*
- » *High power module with ultra-low ESR*
- » *Exceptional shock and vibration resistance*
- » *Long lifetimes with up to 1 million duty cycles*
- » *Integrated UMU (Ultracapacitor Management Unit) for effective cell balancing and monitoring*
- » *Typical applications:*
  - *Wind turbine*
  - *Industrial UPS and DVR*

* Image is not to scale

SPECIFICATIONS

ELECTRICAL		EMHSR-0083C0-064R0S
Rated Voltage, V_R		**64 V_{DC}**
Surge Voltage[1]		68 V_{DC}
Rated Capacitance[2]		**83 F**
Capacitance Tolerance	Maximum	0% / +20%
	Average[4]	+5% / +10%
DC-ESR (Equivalent Series Resistance)[3]	Maximum	9.5 mΩ
	Average[4]	4.9 mΩ
Typical Leakage Current[5]	Under 48V	4.2 mA
	Over 48V	44 ~ 58 mA
Maximum Peak Current, Non-repetitive[6]		1,400 A
Maximum Stored Energy, E_{max}[7]		47.2 Wh
Gravimetric Specific Energy[7]		2.7 Wh/kg
Usable Specific Power[7]		3.0 kW/kg
Impedance Match Specific Power[7]		6.3 kW/kg

TEMPERATURE	
Operating Temperature Range	-40 ~ 65°C (ΔCAP<5% and ΔESR<100% of initial value measured at 25°C)
Storage Temperature Range	-40 ~ 70°C (storage without charge)

| LIFE	
Endurance (at V_R and 65°C)[8]	1,500 hours
Room Temperature (at V_R and 25°C)[8]	10 years
Cycle Life (at 25°C)[9]	1,000,000 cycles
Shelf Life	2 years (stored without charge at under 70°C and 40% RH)

PHYSICAL	
Output Terminals	M8 screw holes (positive) / M10 screw holes (negative)
Insulation Coordination	IEC 61287-1 (Category: OV II) Rated insulation voltage: 1kV DC or 2.8kV AC (at 50Hz, 10 sec) Rated impulse withstand voltage: 6kV DC
Protection Degree	IEC 60529 (IP 65) Dust-tight and protected against water jets
Vibration Specification	SAE J2380
Shock Specification	SAE J2464

SPECIFICATIONS (Cont'd)

UMU / MONITORING	
Cell Balancing	Active single cell balancing
Voltage Monitoring	5V, high and low over-voltage logic signal
Temperature Monitoring	Resistance via NTC thermistor (10kΩ at 25℃)
Signal Output	Deutsch 4-pin water-proof connector

THERMAL	
Typical Thermal Resistance, R_{th} (Temperature Sensor Output)	0.2 °C/W
Typical Thermal Capacitance, C_{th}	15,000 J/°C
Maximum Continuous Current (ΔT = 15°C)[10]	80 A
Maximum Continuous Current (ΔT = 40°C)[10]	140 A

SAFETY	
RoHS	Compliant
REACH	Cell-level compliant

DRAWING
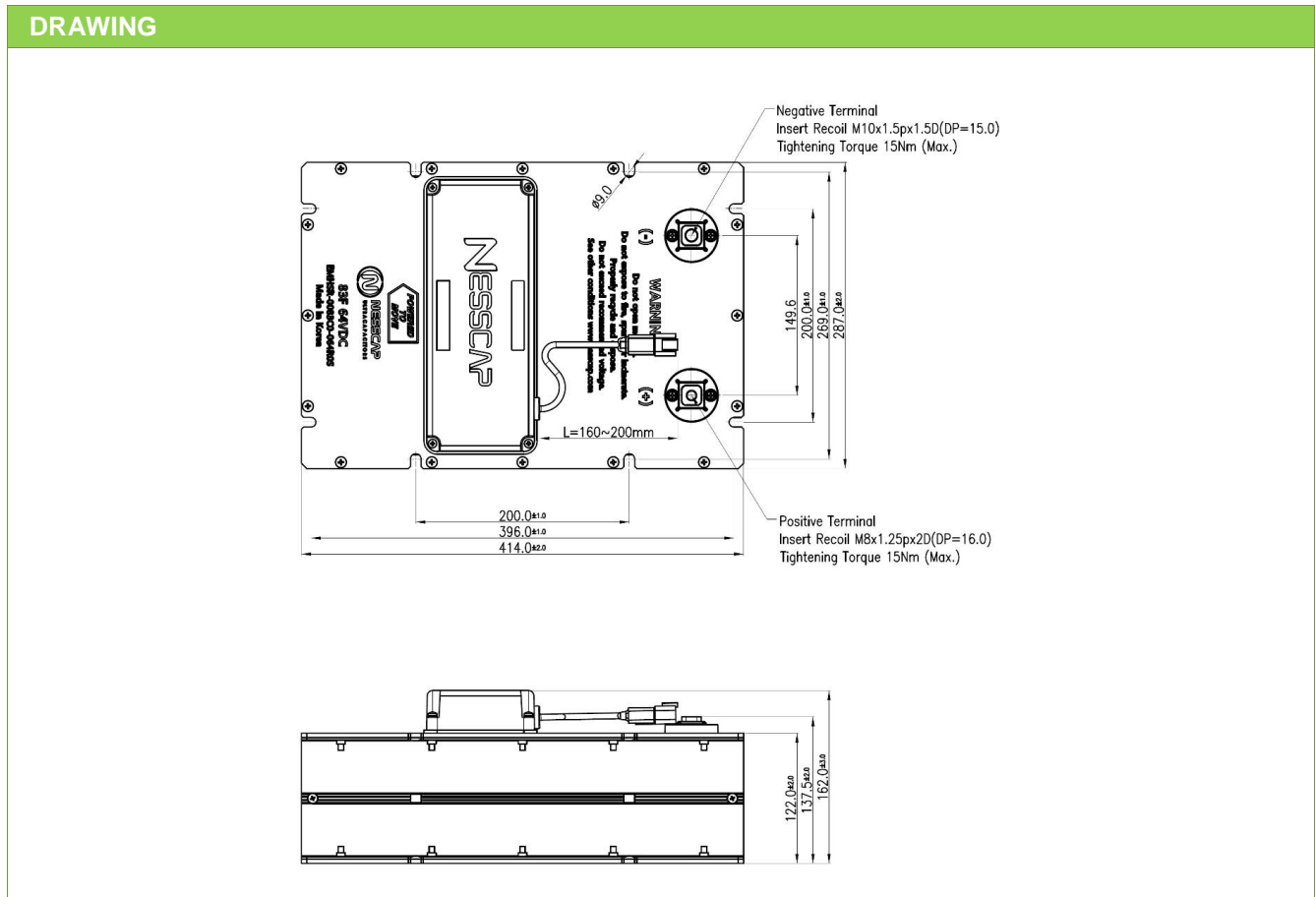
| DIMENSION & WEIGHT					
Length (±2.0)	Width (±2.0)	H1 (±2.0)	H2 (±2.0)	H3 (±3.0)	Nominal Weight
414.0	287.0	122.0	137.5	162.0	17 kg

NOTE

1. **Surge Voltage**

   > Absolute maximum voltage, non-repetitive. The duration must not exceed 1 second.

2. **Rated Capacitance (Measurement Method)**

   > Constant current charge with 4CV [mA] to V_R.
   e.g. In case of 64V-83F module, $4 \times 83 \times 64 = 21{,}200mA = 21A$
   > Constant voltage charge at V_R for 5min.
   > Constant current discharge with 4CV [mA] to 9.6V.
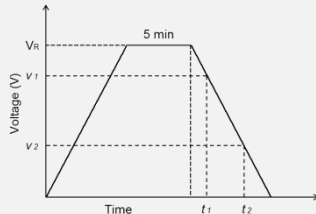

   $$C = \frac{I \times (t_2 - t_1)}{v_1 - v_2}$$

   where C is the capacitance (F);
   I is the absolute value of the discharge current (A);
   v_1 is the measurement starting voltage, $0.8 \times V_R$ (V);
   v_2 is the measurement end voltage, $0.4 \times V_R$ (V);
   t_1 is the time from discharge start to reach v_1 (s);
   t_2 is the time from discharge start to reach v_2 (s);

3. **DC-ESR (Measurement Method)**

   > Constant current charge with 4CV [mA] to to V_R.
   > Constant voltage charge at V_R for 5min.
   > Constant current discharge with 100A to 60V.
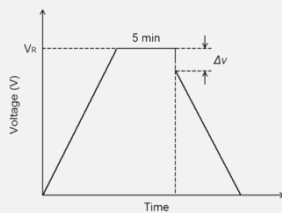
   $$ESR_{DC} = \frac{\Delta v}{I}$$

   where ESR_{DC} is the DC-ESR (Ω);
   Δv is the voltage drop during first 10ms of discharge (V);
   I is the absolute value of the discharge current (A)

4. **Average**

   > Typical value or percentage spread that may be present in one Shipment

5. **Typical Leakage Current (LC)**

   > LC under 48V (2V per cell) is equal to the LC of the cell measured at the cell's rated voltage and at room temperature after 72 hours.
   > LC over 48V (2V per cell) is the sum of the LC of the cell and the bypass current created by the active balancing circuit.

6. **Maximum Peak Current**

   > Current for 1-second discharging from the rated voltage to the half rated voltage under the constant current discharging mode

   $$I = \frac{½V_R}{\Delta t \;/\; C + ESR_{DC}}$$

   where I is the maximum peak current (A);
   V_R is the rated voltage (V);
   Δt is the discharge time (sec); $\Delta t = 1$ sec in this case;
   C is the rated capacitance (F);
   ESR_{DC} is the maximum DC-ESR (Ω);

   > The stated maximum peak current should **not** be used in normal operation and is only provided as a reference value.

7. **Energy & Power**

   > Maximum Stored Energy, E_{max} (Wh) $= \dfrac{½CV_R{}^2}{3600}$

   > Gravimetric Specific Energy (Wh/kg) $= \dfrac{E_{Max}}{Weight}$

   > Usable Specific Power (W/kg) $= \dfrac{0.12V_R{}^2}{ESR_{DC} \times Weight}$

   > Impedance Match Specific Power (W/kg) $= \dfrac{0.25V_R{}^2}{ESR_{DC} \times Weight}$

8. **Endurance and Room Temperature DC Life**

   > Test Conditions:
   - Temperature: $65 \pm 2°C$, $25 \pm 2°C$
   - Applied Voltage: $V_R \pm 0.02V$

   > End-of-Life Conditions:
   - Capacitance: -20% from the rated minimum value
   - DC-ESR: +100% from the rated maximum value

   > Capacitance and ESR measurements are taken at 25°C

9. **Cycle Life**

   > Test Conditions (1-minute cycle at room temperature):
   - Constant current charge from $1/2V_R$ to V_R.
   - Constant current discharge from V_R to $1/2V_R$.
   - Repeat the cycle for the desired number of times.

10. **Maximum Continuous Current**

   > Current which can be used within the allowed temperature range under the constant current discharging mode

   $$I = \sqrt{\frac{\Delta T}{R_{th} \times ESR_{DC}}}$$

   where I is the maximum continuous current (A);
   ΔT is the change in temperature (°C);
   R_{th} is the thermal resistance (°C/W);
   ESR_{DC} is the DC-ESR (Ω)

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