

FEATURES

- » High performance product with low RC time constant
- » Long lifetimes with over 1,000,000 duty cycles
- » Rated capacitance of 650F
- » Threaded terminals for easy integration
- » Compliant with RoHS and REACH requirements



* Image is not to scale

SPECIFICATIONS

Electrical		ESHSR-0650C0-002R7A5T
Rated Voltage (V_R) at 65°C		2.7 VDC
Surge Voltage ¹		2.85 VDC
Rated Capacitance ²		650 F
Capacitance Tolerance	Max.	-0% / +20%
	Avg. ⁴	+5% / +12%
DC-ESR, Initial ³	Max.	0.60 mΩ
	Avg. ⁴	0.28 mΩ
Max. Leakage Current ⁵		1.5 mA
Maximum Continuous Current	at $\Delta T = 15^\circ\text{C}$	68 A
	at $\Delta T = 40^\circ\text{C}$	112 A
Maximum Peak Current, Non-repetitive ⁶		630 A
Max. Stored Energy (E_{max}) at V_R ⁷		0.6 Wh
Usable Specific Power ⁷		6.9 kW/kg
Impedance Match Specific Power ⁷		14.4 kW/kg
Max. Gravimetric Specific Energy ⁷		3.1 Wh/kg

Temperature	
Operating Temperature Range	-40 ~ 65°C ($\Delta\text{CAP} < 5\%$ and $\Delta\text{ESR} < 100\%$ of initial value measured at 25°C)
Storage Temperature Range	-40 ~ 70°C (storage without charge)

Life	
Endurance (at V_R and 65°C) ^{8,9}	1,500 hours
Room Temperature (at V_R and 25°C) ⁸	10 years
Cycle Life (at 25°C) ⁸	1,000,000 cycles (Estimated value when cycled from V_R to $1/2V_R$ using constant current of 65A with 10 second rest between charge and discharge steps)
Shelf Life	2 years (Stored without charge at under 70°C and under 40% RH)

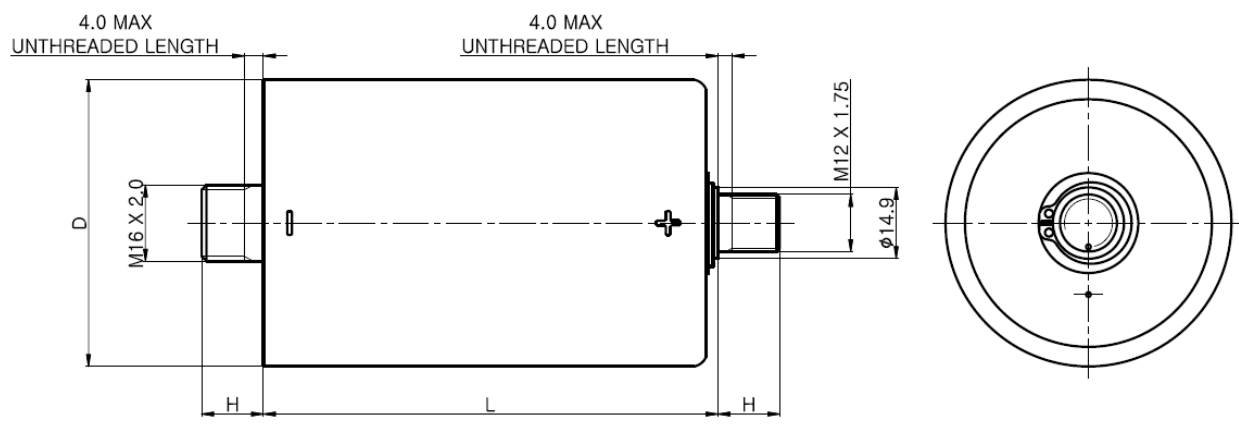
Safety & Certification	
RoHS	Compliant
REACH	Compliant
UL	Complies to 810A, Certificate No.: BBBG2.MH46340

THERMAL

Characteristics	ESHSR-0650C0-002R7A5T
Typical Thermal Resistance, R_{th} (Housing)	5.3 °C/W
Typical Thermal Capacitance, C_{th}	170 J/°C
Cont. Current to $\Delta T = 15^{\circ}C$	68 A
Cont. Current to $\Delta T = 40^{\circ}C$	112 A

PHYSICAL

Drawing



See Note on Mounting¹⁰

Dimensions	ESHSR-0650C0-002R7A5T
D (± 0.2)	60.2 mm
L (± 0.3)	52.5 mm
H (± 0.125)	13.0 mm
Nominal Weight	210 g

Shock & Vibration	
Shock Specification	SAE J2464
Vibration Specification	ISO 16750-3 (Table 14)

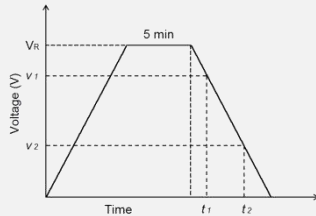
NOTE

1. Surge Voltage

- > Absolute maximum voltage, not repeated and for no longer than 1 second.

2. Rated Capacitance

- > Constant current charge with 10mA/F to V_R
- > Constant voltage charge at V_R for 5min
- > Constant current discharge with 10mA/F to 0.1V

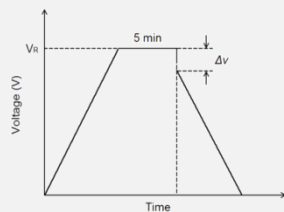


$$C = \frac{I \times (t_2 - t_1)}{v_1 - v_2}$$

Where 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);
 I is the absolute value of the discharging current (A).

3. ESR (Equivalent Series Resistance)

- > ESR_{DC}
 - Constant current charge to V_R
 - Constant voltage charge at V_R for 5min
 - Constant current discharge to 0.1V



$$R_d = \frac{\Delta v}{I}$$

Where R_d is the ESR_{DC} (Ω);
 Δv is the voltage drop for 10ms (V);
 I is the discharge current (A).

4. Average (or Typical)

- > Percentage spread that may be present in one shipment

5. Leakage Current

- > The capacitor is charged to the rated voltage at 25°C.
- > Leakage current is the current at 72 hours that is required to keep the capacitor charged at the rated voltage

6. Max. Current

- > Current for 1sec discharging from rated voltage to half rated voltage under constant current discharging mode.

$$I_{Max.} (A) = \frac{\frac{1}{2}V_R}{\Delta t / C + R_d}$$

Where Δt is the discharge time (sec) and Δt is 1 sec in this case;
 C is the capacitance (F);
 R_d is the ESR_{DC} (Ω);
 V_R is the rated voltage (V).

- > Max. Current **should not** be used in normal operation and is only provided as a reference value.

7. Energy & Power

- > Max. Stored Energy at $V_R = \frac{1}{2}CV_R^2$

Where C is the capacitance (F);
 V_R is the rated voltage (V).

- > Usable Specific Power, IEC 62391-2 (W/kg) = $\frac{0.12 \cdot V^2}{ESR_{DC} \cdot Mass}$

- > Impedance Match Specific Power (W/kg) = $\frac{0.25 \cdot V^2}{ESR_{DC} \cdot Mass}$

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

8. Lifetime

- > End-of-Life Conditions
 - Capacitance: -30% from rated min. value
 - ESR: +100% from max. ESR value

9. Endurance

- > Conditions
 - Temperature: $65 \pm 2^\circ C$
 - Test duration : 1500 (+48/-0) h
 - Applied voltage: $V_R \pm 0.02V$
 - Capacitance and ESR measurement are made at 25°C

10. Mounting

- > Mounting should be designed in such a way as to not place undue mechanical stress on the terminals
- > Do not exceed the max torque value of 8Nm when assembling threaded type cells.
- > Provide adequate spacing in between cells to ensure required insulation strength for the application.
- > Provide clearance above the safety vent and do not position anything above the safety vent that may be damaged by vent rupture.
- > Welding recommendation for weldable cells available on www.nesscap.com under Support > Download.

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