

## FEATURES

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



\* Image is not to scale

## SPECIFICATIONS

Electrical		ESHSR-0650C0-002R7A5
Rated Voltage ( $V_R$ ) at 65°C		<b>2.7 VDC</b>
Surge Voltage <sup>1</sup>		2.85 VDC
Rated Capacitance <sup>2</sup>		<b>650 F</b>
Capacitance Tolerance	Max.	-0% / +20%
	Avg. <sup>4</sup>	+5% / +12%
DC-ESR, Initial <sup>3</sup>	Max.	0.60 mΩ
	Avg. <sup>4</sup>	0.28 mΩ
Max. Leakage Current <sup>5</sup>		1.5 mA
Maximum Continuous Current	at $\Delta T = 15^\circ C$	68 A
	at $\Delta T = 40^\circ C$	112 A
Maximum Peak Current, Non-repetitive <sup>6</sup>		630 A
Max. Stored Energy ( $E_{max}$ ) at $V_R$ <sup>7</sup>		0.6 Wh
Usable Specific Power <sup>7</sup>		7.1 kW/kg
Impedance Match Specific Power <sup>7</sup>		14.8 kW/kg
Max. Gravimetric Specific Energy <sup>7</sup>		3.2 Wh/kg

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

Life	
Endurance (at $V_R$ and 65°C) <sup>8,9</sup>	1,500 hours
Room Temperature (at $V_R$ and 25°C) <sup>8</sup>	10 years
Cycle Life (at 25°C) <sup>8</sup>	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)

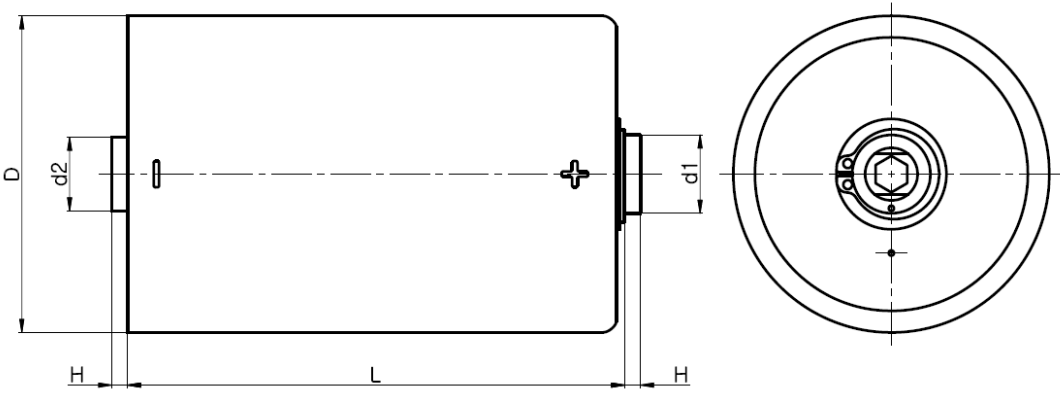
Safety & Certification	
RoHS	Compliant
REACH	Compliant
UL	Complies to 810A, Certificate No.: BBBG2.MH46340

**THERMAL**

Characteristics	ESHSR-0650C0-002R7A5
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 Mounting<sup>10</sup>

Dimensions	ESHSR-0650C0-002R7A5
D ( $\pm 0.2$ )	60.2 mm
L ( $\pm 0.3$ )	51.5 mm
H ( $\pm 0.125$ )	3.0 mm
d1 (-0.05)	14.9 mm
d2 (-0.05)	14.0 mm
Nominal Weight	205 g

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

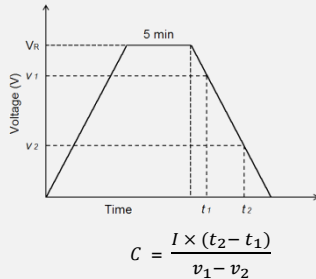
## NOTE

### 1. Surge Voltage

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

### 2. Rated Capacitance

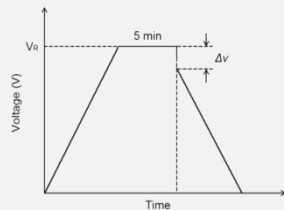
- > Constant current charge with 10mA/F to  $V_R$
- > Constant voltage charge at  $V_R$  for 5min
- > Constant current discharge with 10mA/F to 0.1V



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);  
 $\Delta v$  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  $\Delta t$  is the discharge time (sec) and  $\Delta t$  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  $V_R = \frac{\frac{1}{2}CV_R^2}{3600}$

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](http://www.nesscap.com) under Support > Download.

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