



Chipsmall Limited consists of a professional team with an average of over 10 year of expertise in the distribution of electronic components. Based in Hongkong, we have already established firm and mutual-benefit business relationships with customers from,Europe,America and south Asia,supplying obsolete and hard-to-find components to meet their specific needs.

With the principle of “Quality Parts,Customers Priority,Honest Operation,and Considerate Service”,our business mainly focus on the distribution of electronic components. Line cards we deal with include Microchip,ALPS,ROHM,Xilinx,Pulse,ON,Everlight and Freescale. Main products comprise IC,Modules,Potentiometer,IC Socket,Relay,Connector.Our parts cover such applications as commercial,industrial, and automotives areas.

We are looking forward to setting up business relationship with you and hope to provide you with the best service and solution. Let us make a better world for our industry!



## Contact us

Tel: +86-755-8981 8866 Fax: +86-755-8427 6832

Email & Skype: info@chipsmall.com Web: www.chipsmall.com

Address: A1208, Overseas Decoration Building, #122 Zhenhua RD., Futian, Shenzhen, China



## 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		<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 $\Delta T = 15^\circ\text{C}$	68 A
	at $\Delta T = 40^\circ\text{C}$	112 A
Maximum Peak Current, Non-repetitive <sup>6</sup>		630 A
Max. Stored Energy ( $E_{\text{max}}$ ) at $V_R$ <sup>7</sup>		0.6 Wh
Usable Specific Power <sup>7</sup>		6.9 kW/kg
Impedance Match Specific Power <sup>7</sup>		14.4 kW/kg
Max. Gravimetric Specific Energy <sup>7</sup>		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) <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)

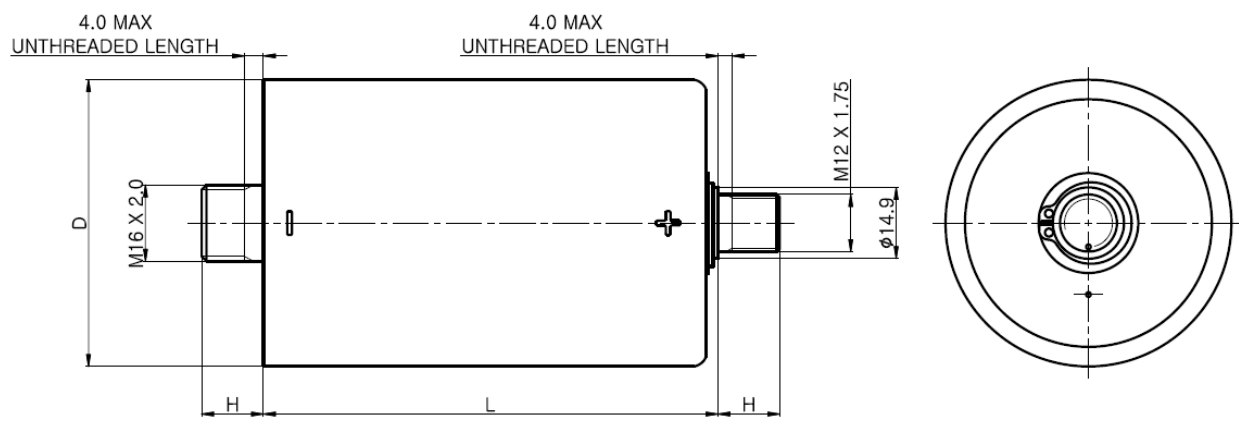
Safety & Certification	
RoHS	Compliant
REACH	Compliant
UL	Complies to 810A, Certificate No.: BBBG2.MH46340

**THERMAL**

Characteristics	ESHSR-0650C0-002R7A5T
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 Mounting<sup>10</sup>

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

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



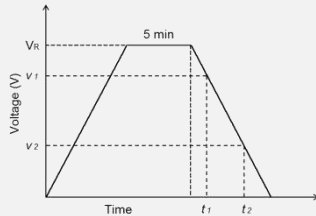
## NOTE

### 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

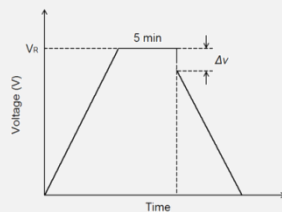


$$C = \frac{I \times (t_2 - t_1)}{v_1 - v_2}$$

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);  
 $\Delta v$  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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 <b>Nesscap Energy Inc.</b> Suite 3800, Royal Bank Plaza, South Tower, 200 Bay Street, P.O. Box 84, Toronto, Ontario, M5J 2Z4 <b>CANADA</b>	 <b>Nesscap Energy Inc.</b> S24040 Camino Del Avion #A118, Monarch Beach, California, 92629 <b>USA</b>	 <b>Nesscap Co., Ltd.</b> 17, Dongtangiheung-ro 681beon-gil, Giheung-gu, Yongin-si, Gyeonggi-do <b>REPUBLIC OF KOREA</b>	 <b>Nesscap China</b> Room 1608, Block N, Cangson Building, Chegonmiao, Futian District, Shenzhen City, P.R.C <b>CHINA</b>	 <b>Nesscap Energy EASTERN EUROPE</b> 10A, prospect 60-letiya Oktyabrya Moscow, 117036 <b>RUSSIA</b>	 <b>Nesscap Energy GmbH</b> Beerengarten 4 D-86938 Schondorf <b>GERMANY</b>
<a href="mailto:marketing@nesscap.com">marketing@nesscap.com</a>			<a href="mailto:info@nesscap-energy.de">info@nesscap-energy.de</a>		