



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!



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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 | | 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 | | 7.1 kW/kg |
| Impedance Match Specific Power ⁷ | | 14.8 kW/kg |
| Max. Gravimetric Specific Energy ⁷ | | 3.2 Wh/kg |

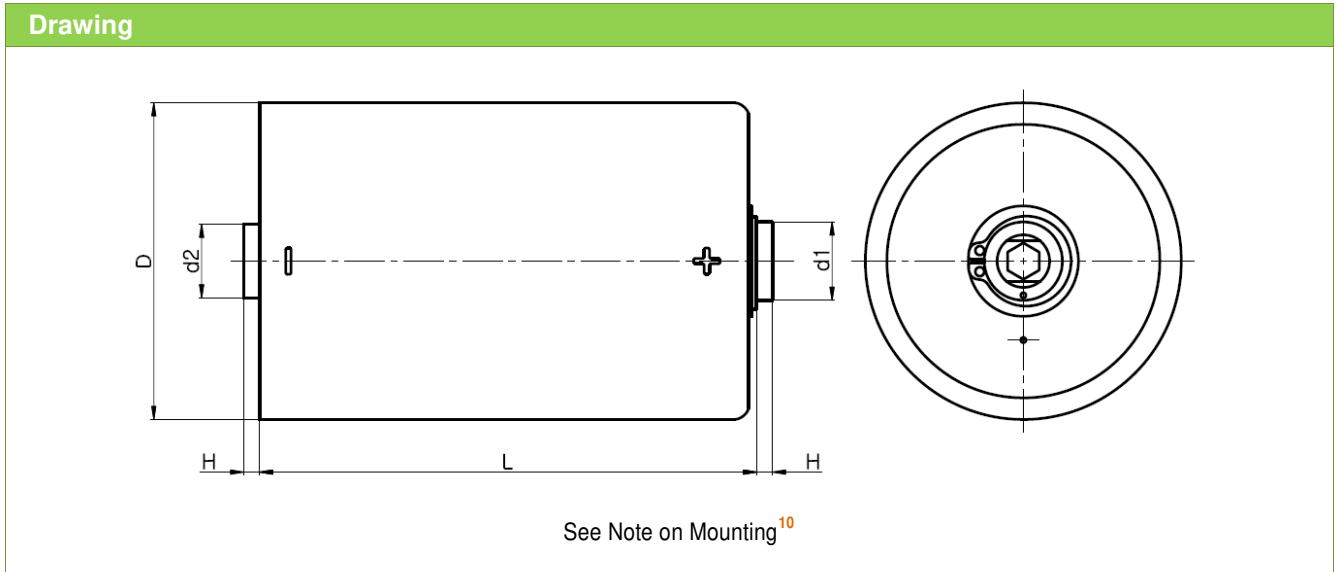
| Temperature | |
|-----------------------------|--|
| Operating Temperature Range | -40 ~ 65°C ($\Delta\text{CAP} < 5\%$ and $\Delta\text{ESR} < 100\%$ of initial value measured at 25°C) |
| Storage Temperature Range | -40 ~ 70°C (storage without charge) |

| 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 | ESH5R-0650C0-002R7A5 |
|--|----------------------|
| Typical Thermal Resistance, R_{th} (Housing) | 5.3 °C/W |
| Typical Thermal Capacitance, C_{th} | 170 J/°C |
| Cont. Current to $\Delta T = 15^{\circ}\text{C}$ | 68 A |
| Cont. Current to $\Delta T = 40^{\circ}\text{C}$ | 112 A |

PHYSICAL


| Dimensions | ESH5R-0650C0-002R7A5 |
|-------------------|----------------------|
| D (± 0.2) | 60.2 mm |
| L (± 0.3) | 51.5 mm |
| H (± 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) |

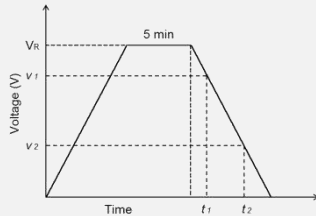
NOTE

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

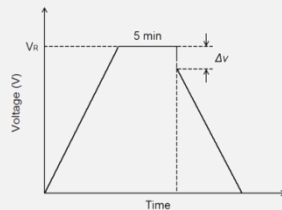


$$C = \frac{I \times (t_2 - t_1)}{v_1 - v_2}$$

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 $V_R = \frac{\frac{1}{2}CV_R^2}{3600}$

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 under Support > Download.

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