

# XP™ 2.7V 50F Cell

Part No. ESHSR-0050C0-002R7UC

# Datasheet

## FEATURES

- Enhanced performance under adverse environmental conditions
- Patent pending improvements both in structure and in sealing
- Long lifetimes with up to 500,000 duty cycles
- Compliant with UL, RoHS, and REACH requirements
- Recommended Application:  
Actuators, Emergency Lighting, Telematics, Automotive, Security Equipment, Backup System, Smoke Detectors, Telematics, Automotive, Advanced Metering, and Others

## ELECTRICAL SPECIFICATIONS

Rated Voltage, $V_R$	<b>2.7 VDC</b>
Surge Voltage <sup>1</sup>	2.85 VDC
Rated Capacitance, $C^2$	<b>50 F</b>
Capacitance Tolerance	Min. / Max. -10% / +20%
	Average <sup>4</sup> +5% / +10%
Initial DC-ESR, $R_{DC}^3$	Max. 16 mΩ
	Average <sup>4</sup> <b>10 mΩ</b>
Maximum Leakage Current <sup>5</sup>	73 μA
Maximum Peak Current, Non-repetitive <sup>6</sup>	37.5 A

## TYPICAL LIFETIME CHARACTERISTICS

Projected DC Life at Room Temperature <sup>8</sup> (Continuous charging at $V_R$ and 25 ± 10 °C)	10 years
DC Life at Standard High Temperature <sup>8</sup> (Continuous charging at $V_R$ and 65°C)	1,500 hours
DC Life at De-Rated Voltage & Higher Temp. <sup>8</sup> (Continuous charging at 2.3V and 85°C)	1,500 hours
Projected Cycle Life at Room Temperature <sup>8</sup> (Constant current charge-discharge from $V_R$ to 1/2 $V_R$ at 25 ± 10 °C)	500,000 cycles
Biased Humidity Life (Continuous charging at $V_R$ , 60°C, and 90% RH)	<b>3,000 hours</b>
Shelf Life (Stored without charge at 25 ± 10 °C)	4 years

## TYPICAL THERMAL CHARACTERISTICS

Thermal Resistance, $R_{th}$ (Housing)	25 °C/W
Thermal Capacitance, $C_{th}$	11 J/°C
Usable Continuous Current ( $\Delta T = 15^\circ C$ ) <sup>9</sup>	6.1 A
Usable Continuous Current ( $\Delta T = 40^\circ C$ ) <sup>9</sup>	10.0 A

## DIMENSION & WEIGHT

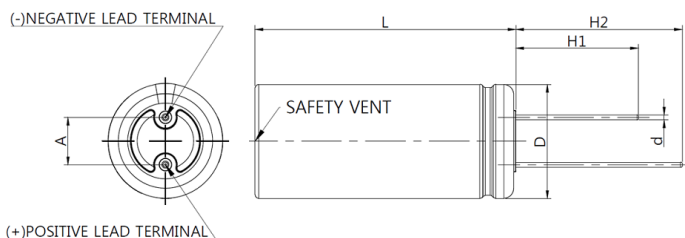
D (+0.5)	18.0 mm	H1 (Min.)	15.0 mm
L (±1.0)	41.0 mm	H2 (Min.)	19.0 mm
d (±0.05)	0.8 mm	A (±0.5)	7.5 mm
Nominal Weight	12.4 g		

## SAFETY & ENVIRONMENTAL

RoHS & REACH & UL	Compliant
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See Note on Mounting Recommendations<sup>10</sup>



## OPERATING ENVIRONMENT / POWER & ENERGY

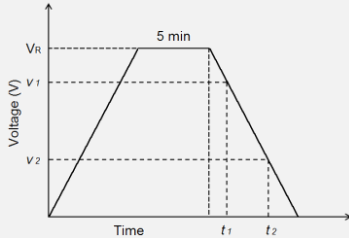
Operating Temperature Range	Standard (-40°C to 65°C)		Extended (-40°C to 85°C)	
Maximum Stored Energy, $E_{max}^7$	at 2.7V	50.6 mWh	at 2.3V	36.7 mWh
Gravimetric Specific Energy <sup>7</sup>	at 2.7V	4.0 Wh/kg	at 2.3V	2.9 Wh/kg
Usable Specific Power <sup>7</sup>	at 2.7V	4.4 kW/kg	at 2.3V	3.2 kW/kg
Impedance Match Specific Power <sup>7</sup>	at 2.7V	9.1 kW/kg	at 2.3V	6.6 kW/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 10 mA per farad to  $V_R$ .  
e.g. In case of 2.7V 50F cell,  $10 * 50 = 500$  mA
- > Constant voltage charge at  $V_R$  for 5 min.
- > Constant current discharge with 10 mA per farad to 0.1V.

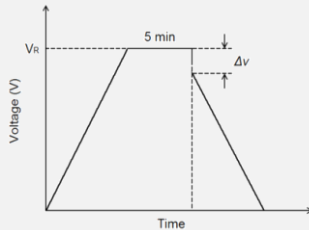


$$C = \frac{I \times (t_2 - t_1)}{v_1 - v_2}$$

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. Initial DC-ESR (Measurement Method)**

- > Constant current charge with 10 mA per farad to  $V_R$ .
- > Constant voltage charge at  $V_R$  for 5 min.
- > Constant current discharge with  $40 * C * V_R$  [mA] to 0.1V.  
e.g. In case of 2.7V 50F cell,  $40 * 50 * 2.7 = 5,400$  mA



$$ESR_{DC} = \frac{\Delta v}{I}$$

where  $ESR_{DC}$  is the DC-ESR ( $\Omega$ );  
 $\Delta v$  is the voltage drop during first 10ms of discharge (V);  
 $I$  is the absolute value of the discharge current (A)

**4. Average**

- > Typical percentage spread that may be present in one shipment.

**5. Maximum Leakage Current (Measurement Method)**

- > The capacitor is charged to its rated voltage  $V_R$  at 25°C.
- > Leakage current is the amount of current measured after 72 hours of continuous holding of the capacitor at  $V_R$ .

**6. Maximum Peak Current**

- > Current that can be used for 1-second discharging from the rated voltage to the half-rated voltage under the constant current discharging mode.

$$I = \frac{\frac{1}{2}V_R}{\Delta t / C + ESR_{DC}}$$

where  $I$  is the maximum peak current (A);  
 $V_R$  is the rated voltage (V);  
 $\Delta t$  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 ( $\Omega$ )

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

**7. Energy & Power (Based on IEC 62391-2)**

- > Maximum Stored Energy,  $E_{max}$  (Wh) =  $\frac{\frac{1}{2}CV_R^2}{3600}$
- > Gravimetric Specific Energy (Wh/kg) =  $\frac{E_{Max}}{Weight}$
- > Usable Specific Power (W/kg) =  $\frac{0.12V_R^2}{ESR_{DC} \times Weight}$
- > Impedance Match Specific Power (W/kg) =  $\frac{0.25V_R^2}{ESR_{DC} \times Weight}$

**8. DC Life and Cycle Life Test**

- > End-of-Life (EOL) Conditions:
  - Capacitance: -20% from the rated minimum value
  - DC-ESR: +100% from the specified maximum initial value
- > Capacitance and ESR measurements are taken at 25°C.

**9. Usable Continuous Current**

- > Maximum 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);  
 $\Delta T$  is the change in temperature ( $^{\circ}C$ );  
 $R_{th}$  is the thermal resistance ( $^{\circ}C/W$ );  
 $ESR_{DC}$  is the maximum DC-ESR ( $\Omega$ )

**10. Mounting Recommendations**

- > Provide properly spaced holes for mounting according to the specified cell dimension in order to minimize the terminal leads of the cell being mechanically stressed.
- > Do not place any through-holes directly underneath the cell or in the close proximity of the cell. Allow at least 5mm distance from any point on the outer diameter of the cell to the outer diameter of any through-hole.
- > Protective coating of components on the PCB is strongly recommended in order to reduce the risk of the components being damaged in an event of electrolyte leakage.
- > The recommended mounting orientation is with the terminal leads pointing upward.
- > Provide at least 2mm clearance from the safety vent and do not position anything near the safety vent that may be damaged by the vent rupture.
- > Assemble the cell on the PCB taking into account that the cell may not be completely hermetic during its lifetime. Electrolyte vapor and gases generated during normal operation may escape the package.
- > Soldering guide for small and medium size cells is available and can be found at [www.nesscap.com](http://www.nesscap.com) under Support -> Download.
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