S-Power 2S datasheet

Contents

1 S-Power

The S-Power has been developed to provide an environmentally friendly supercapacitor component. It has excellent cycling and power capabilities and is thus well suited for applications demanding repeated rapid discharging- and charging.

1.1 Features

- Non-toxic and environmentally friendly
- Compact and slim
- High capacitance
- High power density
- Low leakage current
- Solderable tabs
- Mountable on curved surfaces

1.2 Ratings

Capacitance	1.2	F
Capacitance tolerance	-20 to 20	%
Rated voltage	2.7	VDC
Operating temperature	-20 to 65	°C

Table 1 Ratings table

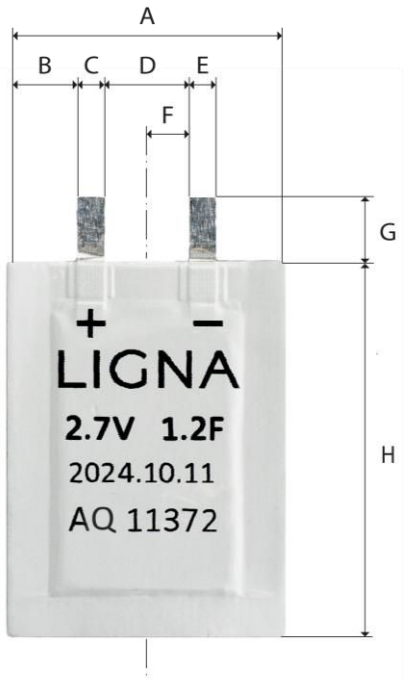
2 Specifications

The data in this section applies to article id(s): AQ, AS

Note! Before working with the cell, it is strongly recommended to read and understand the S-Power handling instructions. These instructions are always provided when cells are ordered.

2.1 Physical

The cell is currently available in one format, as illustrated in Figure 1, however it can be customized on demand (for larger delivery volumes). The cell dimensions and weight can be found in Table 2.



Cell measures [mm]	
A: 30	E: 3
B: 7	F: 5
C: 3	G: 7.6
D: 10	H: 42

Tolerances
C: ±0.1
A, E, F, H: ± 0.4
B, D, G: ± 0.8

Maximum thickness: 0.45
Terminal thickness: 0.1

Figure 1 S-Power layout

Parameter	Denotation	Typical value	Unit
Width	A	30	mm
Height	H	42	mm
Thickness		≤ 0.45	mm
Terminal thickness		0.1	mm
Mass	m	0.6	g

Table 2 Physical data

2.2 Electrical

Typical electrical specifications at room temperature are presented in Table 3. Note that specifications in this table are subject to change. Please check with our sales representatives before ordering.

Parameter	Denotation	Typical value	Unit
Rated voltage [1]	V_R	2.7	V (DC)
Rated capacitance [2]	C	1.2	F
Internal resistance [2]	DCESR	1.5	Ω
Equivalent series resistance [3]	ESR	500	mΩ
Leakage current initial[4] Leakage current after 5 days @ V_R	DCL	5 < 2	µA µA
Max. non-repetitive peak current [5]	I_{peak}	0.58	A
Charge retention [6]		92	%
Max energy [7]	E_{max}	1.2	mWh
Cycle life [8]		>250 000	cycles

Table 3 Electrical specifications

Table 3 notes:

1 At higher voltages lifetime and cycle life will be reduced while leakage increases.

2 Rated capacitance and internal resistance are all determined based on IEC 62391-1:2022 method A, see [1]:

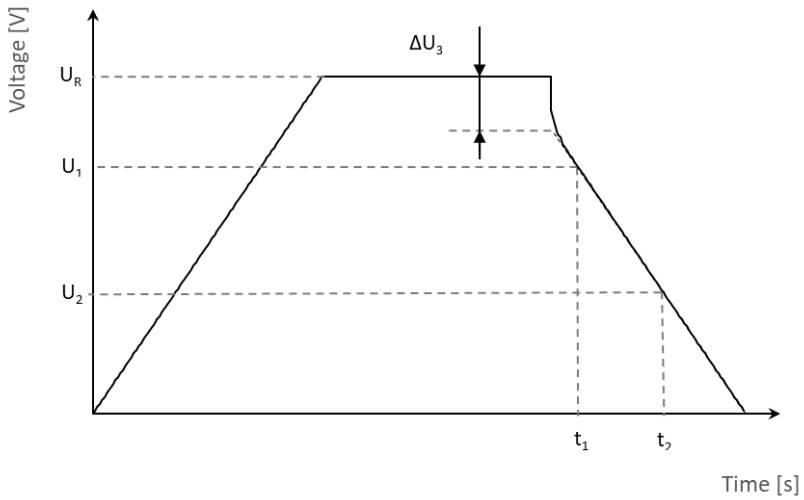


Figure 2 Charge/discharge characteristics between capacitor terminals in capacitance and internal resistance measurement

- U_1 is the measuring start voltage (V).
- U_2 is the measuring end voltage (V).
- t_1 is the time at which the terminal voltage of the capacitor reaches the value U_1 from the start of the discharge.
- t_2 is the time at which the terminal voltage of the capacitor reaches the value U_2 from the start of the discharge.
- ΔU_3 is the voltage drop, see standard for details how it is derived.
- Capacitance, C, is measured by charging at constant current I_{CCC} = 35.5 mA to V_R; followed by charging at constant voltage $V_C = V_R$ for 30 min; and finally discharging using constant current I_{CCD} = 13 mA. $U_1 = 0.8 \cdot U_R$ and $U_2 = 0.4 \cdot U_R$.

$$C = I_{CCD} \frac{t_2 - t_1}{U_1 - U_2} \, [F]$$

- Internal resistance, DCESR, is measured by charging at constant current I_{CCC} = 35.5 mA to V_R; followed by charging at constant voltage $V_C = V_R$ for 30 min; and finally discharging using constant current I_{CCD} = 130 mA.

$$DCESR = \frac{\Delta U_3}{I_{CCD}} \, [\Omega]$$

[3] ESR measured at 1 kHz and I_{RMS}= 2.0 mA.

[4] Leakage current, DCL, measured after biasing at V_R for 8 h. Observe that the initial current can be higher.

[5] I_{peak} is the current required to discharge the cell from V_R to $V_R/2$ in 1 s. Observe that it is not recommended to use this current for continuous operation.

[6] Remaining charge measured after:
a) 8 hours constant voltage charge followed by 24 h self-discharge.
b) 24 hours constant voltage charge followed by 7 days self-discharge.

[7] Max energy: $E_{max} = (\frac{1}{2} C \cdot V_R^2)/3.6 \, [mWh]$

[8] Cycle life can vary significantly for various applications and thus each case should be studied individually. A cycle is defined by constant current charge to V_R followed by discharge to $1/3V_R$. Cycle life is determined based on capacitance and ESR. When capacitance has decreased by more than 20 % or ESR has increased by more than 100 % the cell is considered to have reached its end-of-life.

2.2.1 Capacitance vs temperature

Figure 3 illustrates how the capacitance varies with operating temperature. Data has been collected by cycling the cell for two temperature cycles; 20 -> -20 -> 60 -> 20 °C. The cell is allowed to soak for 30 min at each temperature before any electrical characterization is performed. Data in Figure 3 belongs to the second cycle, when increasing temperature from -20 to 60 °C.

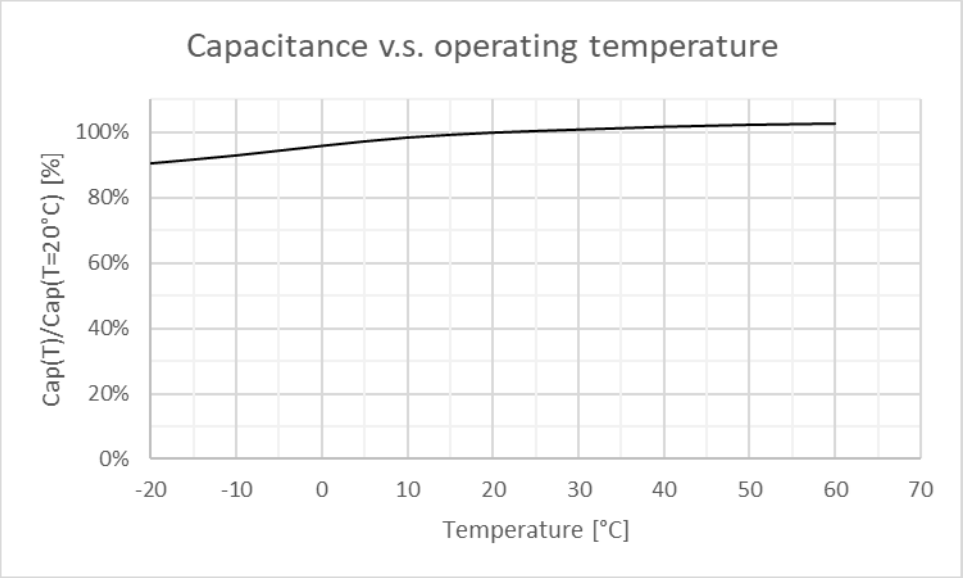


Figure 3 Capacitance vs. operating temperature

2.2.2 ESR vs temperature

The equivalent series resistance and its dependency on operating temperature is shown in Figure 4. The data is gathered using the same test and temperature protocol as for capacitance vs. temperature, presented in the previous section.

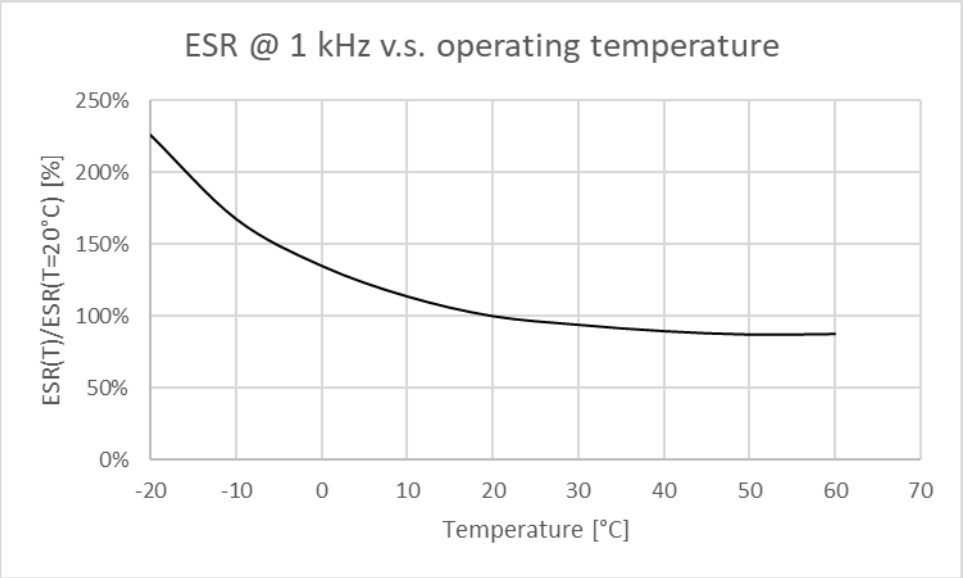


Figure 4 ESR vs. operating temperature

2.2.3 Leakage current

The leakage current measured while charging the cell at V_R for 7 days is presented in Figure 5.

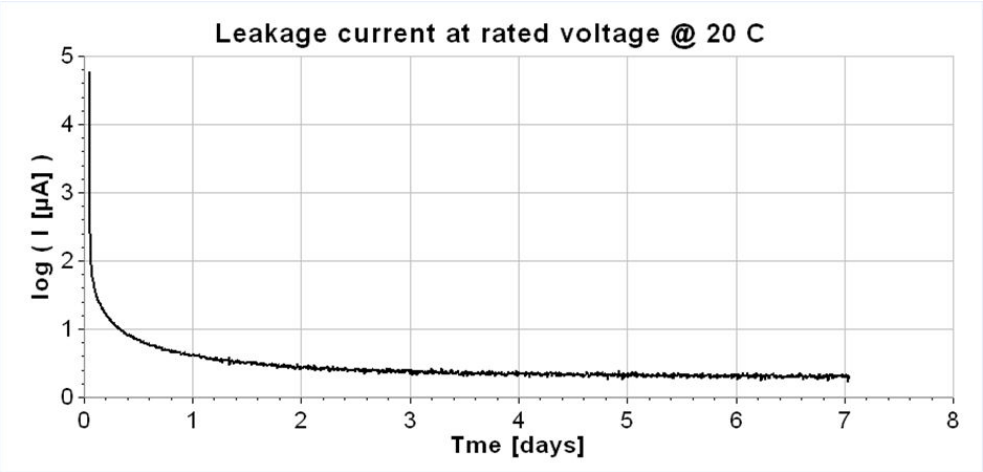


Figure 5 Leakage current at 20 °C

2.2.4 Charge retention

Charge retention measured after 24 h constant voltage charge at V_R is illustrated in Figure 6.

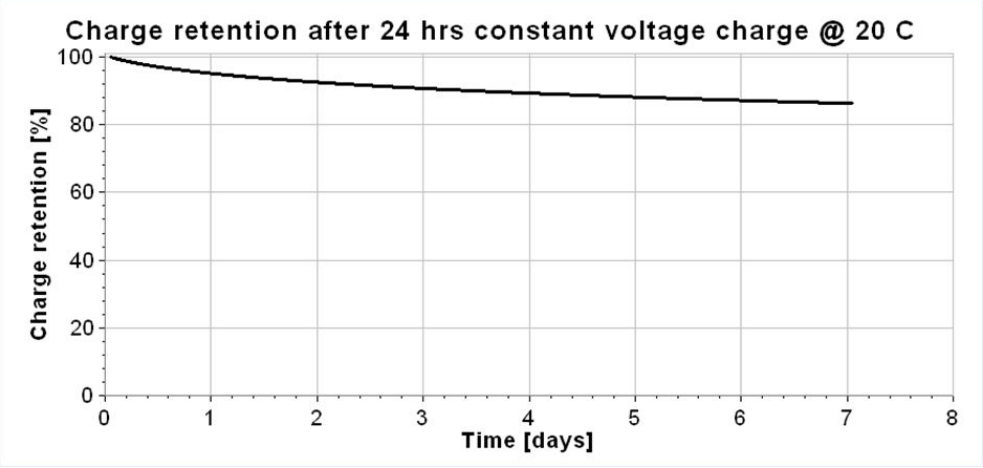


Figure 6 Charge retention at 20 °C

2.3 Environmental specifications

The operating environmental specifications are presented in Table 4 below.

It is recommended to store the cell at controlled indoor conditions below 30 °C. Longer exposure times to elevated temperatures may have a negative impact on lifetime. Rapid changes in temperature can cause condensation and shall consequently be avoided.

Parameter	Denotation	Conditions	Min	Typical	Max	Unit
Operating temperature	T_{op}		-20	RT	60 **	°C
Operating rel. humidity	RH_{op}	None condensing	0	45	85 *	%

Table 4 Environmental specifications

3 References

[1] IEC 62391-1:2022 - Fixed electric double-layer capacitors for use in electric and electronic equipment - Part 1: Generic specification