

## Product Datasheet

### 33mm $\varnothing$ Ultracapacitors

- Rated voltage 3VDC
- 310F capacitance
- Highest power density based on ultra-low ESR
- High cycle life of 1 million cycles
- Hermetically sealed cell
- Most ruggedized cell based on all laser welded design
- Radial terminals for PCB mounting



#### ELECTRICAL SPECIFICATIONS

Type	C33S-3R0-0310
Rated Voltage $V_R$	3.00 V
Surge Voltage $V_S^1$	3.10 V
Rated Capacitance $C^2$	310 F
Capacitance Tolerance <sup>3</sup>	0% / +30%
ESR <sup>2</sup> (DC, 10 Hz)	<1.6 m $\Omega$
ESR <sup>2</sup> (AC, 1 kHz)	<1.2 m $\Omega$
Leakage Current, typical $I_L^4$	<1.2 mA
Self-discharge Rate, typical <sup>5</sup>	<20%
Constant Current ( $\Delta T = 15^\circ\text{C}$ ) <sup>6</sup>	29 A
Max Current $I_{Max}^7$	311 A
Short Current $I_S^8$	1.875 kA
Stored Energy $E^9$	0.39 Wh
Energy Density $E_d^{10}$	6.15 Wh/kg
Usable Power Density $P_d^{11}$	10.71 kW/kg
Matched Impedance Power Density $P_{dMax}^{12}$ , 10 Hz ESR	22.3 kW/kg
Matched Impedance Power Density $P_{dMax}^{12}$ , 1 kHz ESR	29.8 kW/kg

#### THERMAL CHARACTERISTICS

Type	C33S-3R0-0310
Working Temperature	-40 ~ 65°C
Storage Temperature <sup>13</sup>	-40 ~ 55°C
Thermal Resistance $R_{Th}^{14}$	10.9 K/W
Thermal Capacitance $C_{Th}^{15}$	60 J/K

#### LIFETIME CHARACTERISTICS

Type	C33S-3R0-0310
DC Life at High Temperature, 3V and 65°C <sup>16</sup>	1000 hours
DC Life at RT <sup>17</sup>	10 years
Cycle Life <sup>18</sup>	1'000'000 cycles
Shelf Life <sup>19</sup>	4 years

#### SAFETY & ENVIRONMENTAL SPECIFICATIONS

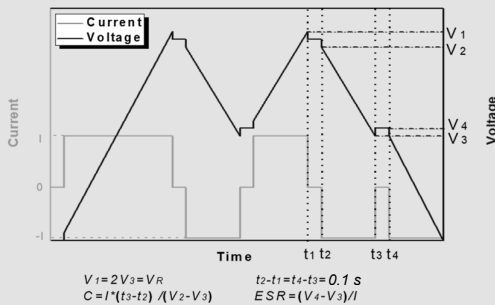
Type	C33S-3R0-0310
Safety	RoHS, REACH and UL810A
Vibration	IEC 60068-2-64 Category 1 (table A.5/ A.6)
Shock	IEC 60068-2-27, 100g 6ms

## PHYSICAL PARAMETERS

<b>Type</b>	<b>C33S-3R0-0310</b>
Mass, typical M	63 g
Terminals (leads)	Solderable <sup>21</sup>
Dimensions <sup>20</sup> Height	68.8 mm
Diameter	33 mm

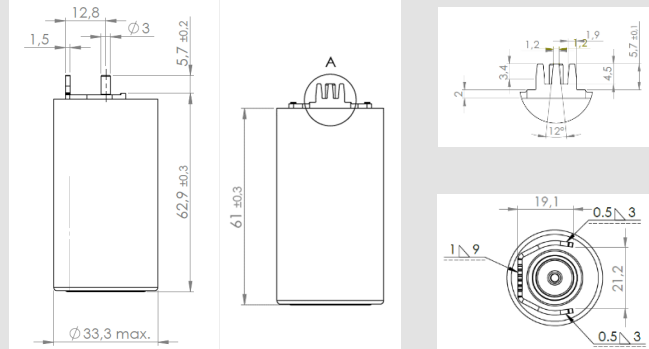
## NOTES:

- Surge voltage  $V_S$ : Absolute maximum voltage, non-repetitive. The duration must not exceed 1 second.
- Capacitance C: The test current is 0.1 A/F, if the calculated current is  $>100A$ , then apply 100A.



- Capacitance tolerance: Initially +10%~+30%.
- Leakage current measurement procedure: 1) Charge the capacitor to the  $V_R$  with a constant current (0.1 A/F, if the calculated current is  $>100A$ , then apply 100A). 2) Hold the voltage at  $V_R$  for 72h. 3) The current to maintain  $V_R$  after 72 h is the leakage current.
- Self-discharge rate measurement procedure: 1) Charge the capacitor to  $V_R$  with a constant current (0.1 A/F, if the calculated current  $>100A$ , then apply 100A). 2) Hold the voltage at  $V_R$  for 8h. 3) Floating for 72h. 4) Measure the voltage after 72 h.
- Max constant working current:  $I_{MCC} = \sqrt{\Delta T / (ESR * R_{Th})}$
- Max current:  $I_{Max} = 0.5C * V_R / (\Delta t + ESR * C)$ , discharge from  $V_R$  to  $V_R/2$  in 1 second.
- Short current:  $I_S = V_R / ESR$
- Stored energy:  $E = 0.5C * V^2 / 3600$
- Energy density:  $E_d = E / M$
- Usable power density:  $P_d = (0.12V_R^2 / ESR) / M$
- Matched impedance power density:  $P_{dMax} = (0.25V_R^2 / ESR) / M$
- Storage temperature: Storage in discharge state
- Thermal resistance:  $R_{Th} = \Delta T / P$ , where  $P = ESR * I^2$
- Thermal capacitance: For the whole capacitor
- DC life at high temperature: Hold the capacitor charged at specified voltage and temperature. The capacitance shall be  $>80\%$  of the rated value, the ESR shall be  $<200\%$  of the rated value.
- DC life at RT: Hold the capacitor charged at rated voltage at room temperature RT, the capacitance shall be  $>80\%$  of the rated value, the ESR shall be  $<200\%$  of the rated value.
- Cycle life: Charge and discharged the capacitor in the range between  $V_R$  and  $V_R/2$ . 5 seconds waiting period between charge and discharge. The constant test current is 0.1 A/F (if the calculated current  $>100A$ , then apply 100A).
- Shelf life: Discharged and no load applied at RT.

- Dimensions, PCB drilling pattern and potential indication:



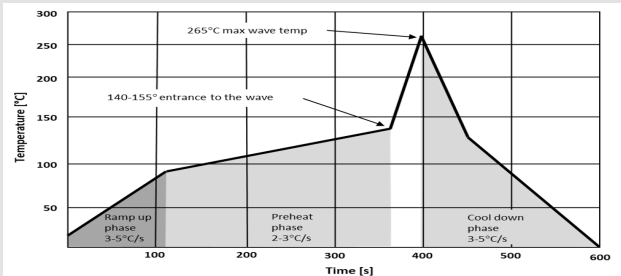
### Standard markings:

- + Name of manufacturer, part number, serial number
- + Rated voltage and capacitance, positive terminals, warning marking
- + Stored energy in watt-hours

### Mounting recommendations:

- + Mounting without applying undue mechanical stress on the terminals
- + Provide adequate spacing in between cells to secure required insulation strength
- + Provide clearance around the safety vent and do not position anything next to the safety vent that may be damaged in an event of vent rupture

- Recommended wave soldering profile for printed circuit assembly with use of lead-free alloy:



Total soldering process time from room temperature to peak temperature 265°C and cool down is 10 minutes max. The time to reach the required temperatures depends on the design of the application and on the power of pre-heating section of the soldering machine. All temperatures are measured on the cell leads on top of the PCB. Recommended thickness for PCB = 2.4 to 3.2 mm.

Solder:	Lead-free (Sn96.5/Ag 3.0/Cu0.5) liquidus point 217°C
Recommended Flux	Kester 979T
Ramp Up Rate:	3°-5° C/sec. Max
Preheat:	140° to 155° C 2°-3° C/sec on top of board
Temperature entrance into wave:	140° to 155° C on top of board
Ramp to peak temp:	200°C/sec
Peak Temp:	265°C for 1.5 to 5 sec. Max
Cool Down Rate:	3°C-5°C /sec. Max
Conveyor Speed:	40-50 cm/min

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