

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 ³	0% / +30%
ESR ² (DC, 10 Hz)	<1.6 m Ω
ESR ² (AC, 1 kHz)	<1.2 m Ω
Leakage Current, typical I_L^4	<1.2 mA
Self-discharge Rate, typical ⁵	<20%
Constant Current ($\Delta T = 15^\circ\text{C}$) ⁶	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 ¹³	-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 ¹⁶	1000 hours
DC Life at RT ¹⁷	10 years
Cycle Life ¹⁸	1'000'000 cycles
Shelf Life ¹⁹	4 years

SAFETY & ENVIRONMENTAL SPECIFICATIONS

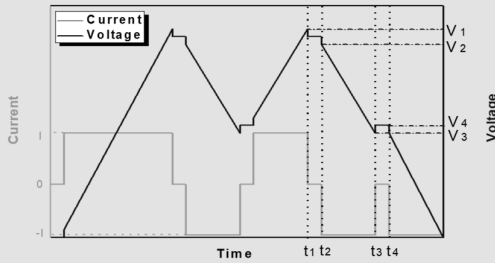
Type	C33S-3R0-0310
Safety	RoHS, REACH and UL810A
Vibration	IEC 60068-2-64 Category 1 (table A.5/ A.6)
Shock	IEC 60068-2-27, 100g 6ms

PHYSICAL PARAMETERS

Type	C33S-3R0-0310
Mass, typical M	63 g
Terminals (leads)	Solderable ²¹
Dimensions ²⁰ 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.



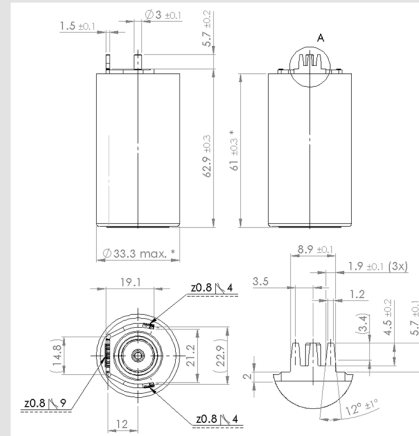
$$V_1 = 2V_3 = V_R \quad t_2 - t_1 = t_4 - t_3 = 0.1 \text{ s}$$

$$C = I \cdot (t_3 - t_2) / (V_2 - V_3) \quad ESR = (V_4 - V_3) / I$$

- 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

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- Dimensions, potential indication, recommended PCB drilling pattern:



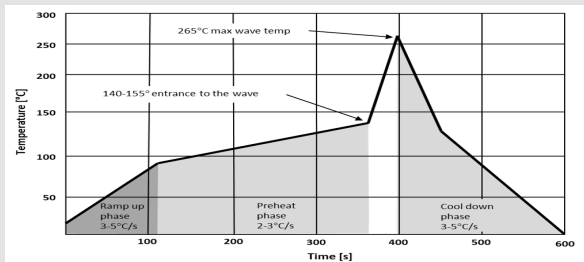
Standard markings:

- + 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°-5° C/sec. Max
Conveyor Speed:	40-50 cm/min