

## Product Datasheet

### 60mm $\varnothing$ Ultracapacitors – threaded type

- Rated voltage 3VDC
- 1500F up to 3000F capacitance
- Ultra-low ESR, especially 'P' type cell
- High cycle life of 1 million cycles
- Excellent DC life performance
- Threaded terminals M12
- Very high energy and power density



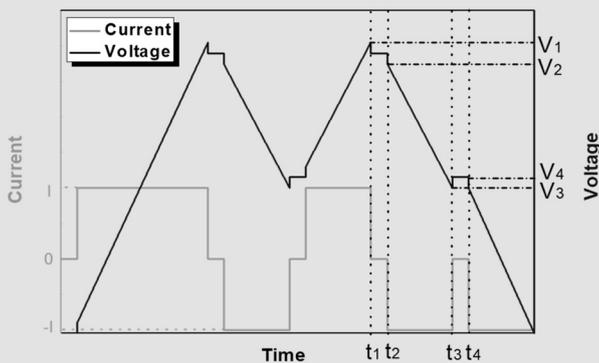
ELECTRICAL SPECIFICATIONS				
Type	C60T-3R0-1500	C60T-3R0-2000	C60T-3R0-3000	C60T-3P0-3000
Rated Voltage $V_R$	3.00 V	3.00 V	3.00 V	3.00 V
Surge Voltage $V_S^1$	3.10 V	3.10 V	3.10 V	3.10 V
Rated Capacitance $C^2$	1500 F	2000 F	3000 F	3000 F
Capacitance Tolerance $^3$	-0% / +20%	-0% / +20%	-0% / +20%	0% / +20%
ESR $^2$ (DC)	<0.45 m $\Omega$	<0.34 m $\Omega$	<0.23 m $\Omega$	<0.15 m $\Omega$
ESR $^2$ (AC, 1 kHz)	<0.39 m $\Omega$	<0.3m $\Omega$	<0.2 m $\Omega$	<0.12 m $\Omega$
Leakage Current $I_L^4$	<7 mA	<8 mA	<12 mA	<12.0 mA
Self-discharge Rate $^5$	<20%	<20%	<20%	<20%
Constant Current ( $\Delta T = 15^\circ C$ ) $^6$	85 A	105 A	145 A	180 A
Max Current $I_{Max}^7$	1.3 kA	1.8 kA	2.8 kA	3.1 kA
Short Current $I_S^8$	6.7 kA	8.8 kA	13 kA	20.0 kA
Stored Energy $E^9$	1.8 Wh	2.5 Wh	3.75 Wh	3.75 Wh
Energy Density $E_d^{10}$	6.5 Wh/kg	7.2 Wh/kg	7.7 Wh/kg	7.6 Wh/kg
Usable Power Density $P_d^{11}$	8.3 kW/kg	9.2 kW/kg	9.7 kW/kg	14.5 kW/kg
Matched Impedance Power Density $P_{dMax}^{12}$ , 10 Hz ESR	17.2 kW/kg	19.1 kW/kg	20.2 kW/kg	30.3 kW/kg
Matched Impedance Power Density $P_{dMax}^{12}$ , 1 kHz ESR	19.9 kW/kg	21.6 kW/kg	22.1 kW/kg	37.9 kW/kg
THERMAL CHARACTERISTICS				
Type	C60T-3R0-1500	C60T-3R0-2000	C60T-3R0-3000	C60T-3P0-3000
Working Temperature	-40 ~ 65°C	-40 ~ 65°C	-40 ~ 65°C	-40 ~ 65°C
Storage Temperature $^{13}$	-40 ~ 70°C	-40 ~ 70°C	-40 ~ 70°C	-40 ~ 70°C
Thermal Resistance $R_{Th}^{14}$	4.6 K/W	4.0 K/W	3.1 K/W	3.1 K/W
Thermal Capacitance $C_{Th}^{15}$	335 J/K	414 J/K	580 J/K	589 J/K
LIFETIME CHARACTERISTICS				
Type	C60T-3R0-1500	C60T-3R0-2000	C60T-3R0-3000	C60T-3P0-3000
DC Life at High Temperature $^{16}$	1500 hours	1500 hours	1500 hours	1500 hours
DC Life at RT $^{17}$	10 years	10 years	10 years	10 years
Cycle Life $^{18}$	1'000'000 cycles	1'000'000 cycles	1'000'000 cycles	1'000'000 cycles
Shelf Life $^{19}$	4 years	4 years	4 years	4 years
SAFETY & ENVIRONMENTAL SPECIFICATIONS				
Type	C60T-3R0-1500	C60T-3R0-2000	C60T-3R0-3000	C60T-3P0-3000
Safety	RoHS, REACH, and UL810	RoHS, REACH and UL810	RoHS, REACH and UL810	RoHS, REACH and UL810
Vibration	IEC 60068-2-64	IEC 60068-2-64	IEC 60068-2-64	IEC 60068-2-64
Shock	IEC 60068-2-27	IEC 60068-2-27	IEC 60068-2-27	IEC 60068-2-27

## PHYSICAL PARAMETERS

Type	C60T-3R0-1500	C60T-3R0-2000	C60T-3R0-3000	C60T-3P0-3000
Mass M	290 g	347 g	484 g	495 g
Terminals	Threaded <sup>21</sup>	Threaded <sup>21</sup>	Threaded <sup>21</sup>	Threaded <sup>21</sup>
Dimensions <sup>20</sup>	Height L	85 mm	102 mm	138 mm
	Diameter	60 mm	60 mm	60 mm

## NOTES:

- Surge voltage  $V_S$ : Absolute maximum voltage, non-repetitive. The duration must not exceed 1 second.
- Capacitance C: The test current is 0.075 A/F, if the calculated current is >100A, then apply 100A.

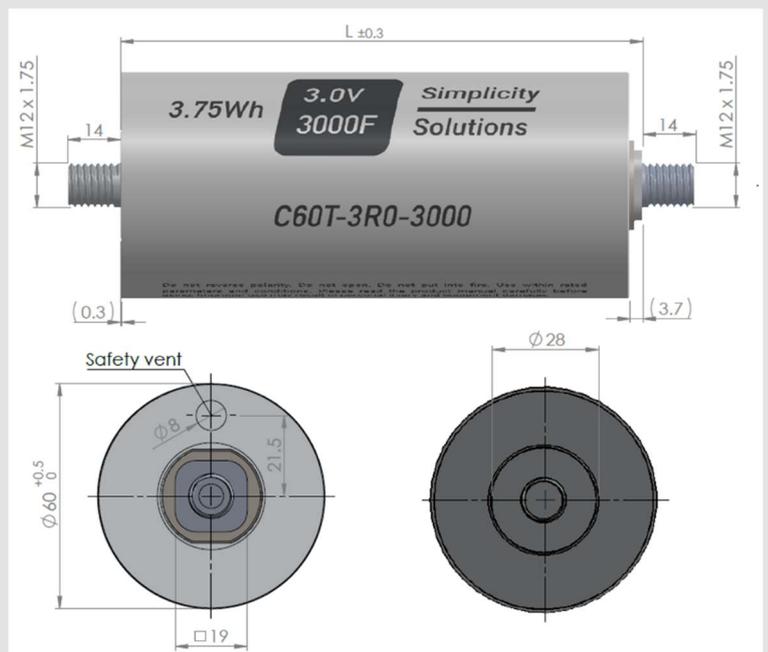


$$V_1 = 2V_3 = V_R \quad t_2 - t_1 = t_4 - t_3 = 0.1 \text{ s}$$

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

- Capacitance tolerance: Typical tolerance is +5%~+10%.
- Leakage current measurement procedure: 1) Charge the capacitor to the  $V_R$  with a constant current (0.075 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 (0.075 A/F, if the calculated current >100A, then apply 100A). 2) Hold the voltage at  $V_R$  for 3h. 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 at RT.
- Thermal resistance:  $R_{Th} = \Delta T / P$ , where  $P = ESR * I^2$
- Thermal capacitance is indicated for the whole product.
- DC life at high temperature: Hold the capacitor charged at rated voltage at 65°C for 1500h. 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 0.075 A/F (if the calculated current >100A, then apply 100A).
- Shelf life: Discharged and no load applied at RT.
- Dimensions C60T-3R0 (drawing shows 3000F only):



- The maximum torque for threaded terminal is 12 Nm.

### Standard markings:

- + Name of manufacturer, part number, serial number
- + Rated voltage and capacitance, negative and 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 above the safety vent that may be damaged in an event of vent rupture

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