



NanoPower Battery

Datasheet

Lithium Ion 18650 cells for space flight products

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2 Introduction

When choosing batteries for a satellite mission it is important to make sure that they can withstand the hostile environment encountered in space. The GomSpace batteries provide flight heritage and extensive testing and are chosen specifically for their suitability in satellite missions.

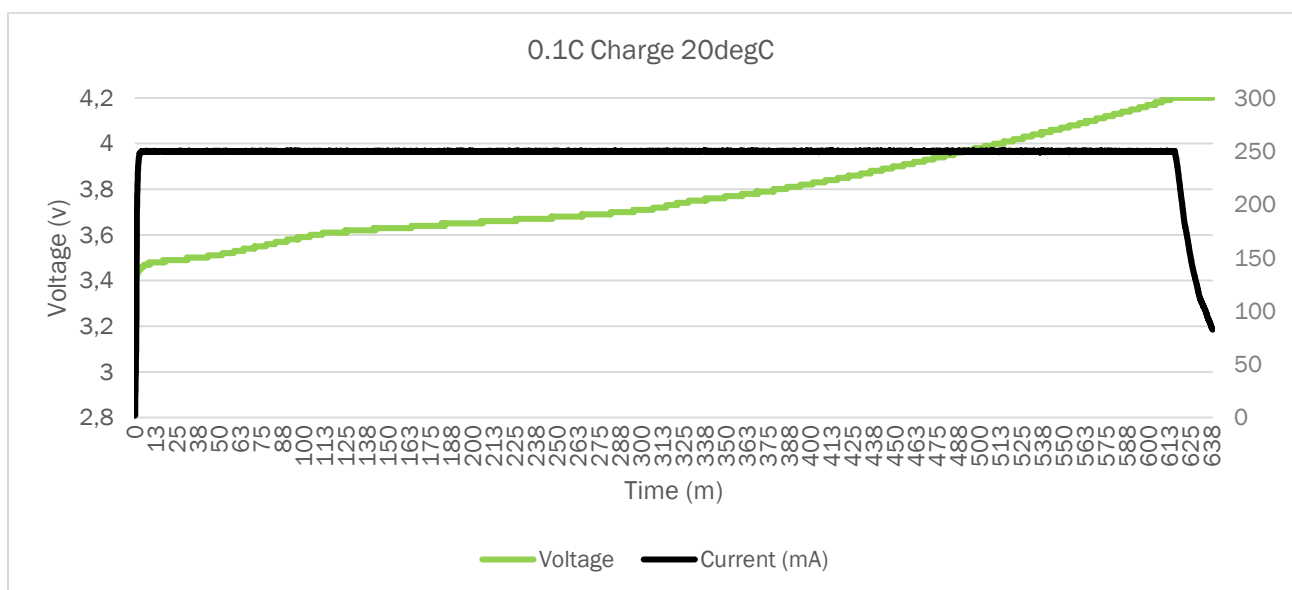
3 Specifications

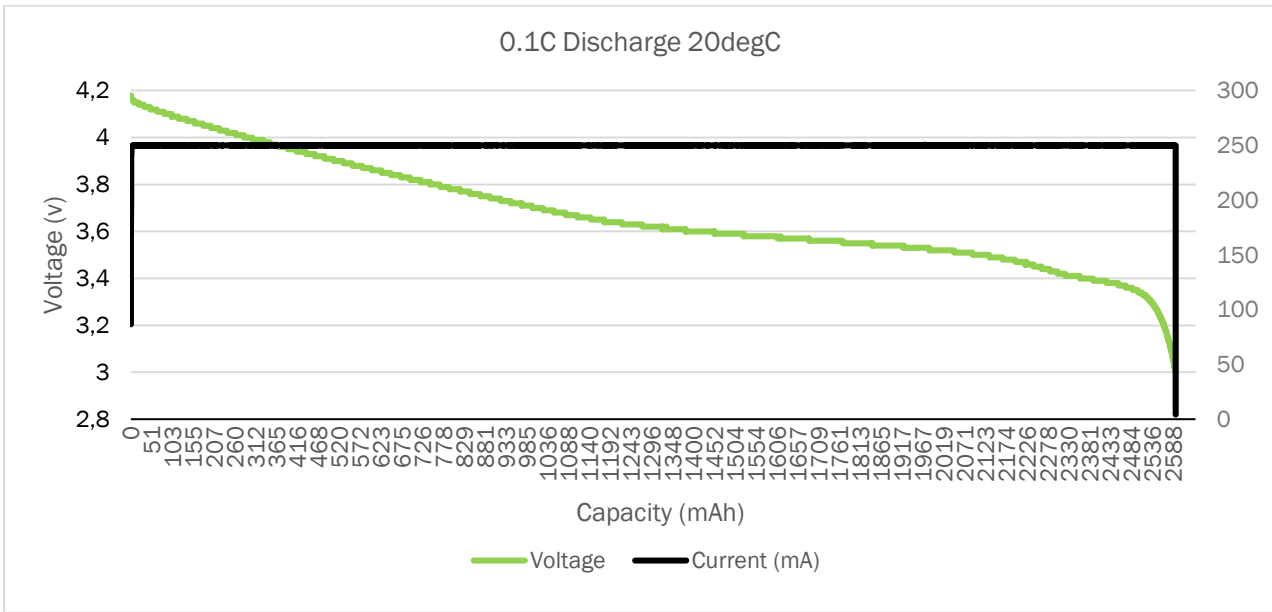
The battery available from GomSpace are lithium ion and from the rugged and space proven 18650 form factor.

Currently GomSpace offer the following cell:

- 3.7 V@2600 mAh cells: Very high capacity and thoroughly tested cell

Parameter	Condition	Min.	Typ.	Max	Unit
Voltage		3.0	3.7	4.2	V
Current - Charge	0 – +45 °C		1000	2500	mA
Current - Discharge	-20 – +5 °C +5 – +60 °C		1000	1250 3750	mA mA
Temperature - Storage	80% recovery after: 3 months 12 months	-20 -20		45 20	°C °C
Temperature - Operating	Charge Discharge	0 -20		45 60	°C °C
Internal impedance				70	mΩ
Cycle Life (20% capacity loss)	DOD: 100%, Temp 25°C Charge/discharge: 1C/1C		350		cycles





4 Battery Cycle Life

The cycle life of any rechargeable battery depends on a number of factors, but most importantly the Depth-Of-Discharge (DOD) of the cycles, temperature, charge/discharge current and End of Charge Voltage (EOCV). General rules are that:

- The lower the DOD, the better the cycle life.
- The lower the temperature, the better the cycle life.
- The lower the charge/discharge current, the better the cycle life.
- The lower the EOCV, the better the cycle life.

4.1 3.7 V batteries

Depth-Of-Discharge [% used]	80% remaining capacity 25°C, +1C/-1C, 4.2 V EOCV [cycles]	65% remaining capacity 25°C, +1C/-1C, 4.2 V EOCV [cycles]
100%	350	430
50%	1000	1200
25%	1700	2100

A lowering of EOCV to 4.1 V (equivalent to a State-Of-Charge (SOC) reduction of about 10%) can be expected to yield a doubling of the cycle life. An increase of temperature to 45°C can be expected to yield a reduction of cycle life by 20%.

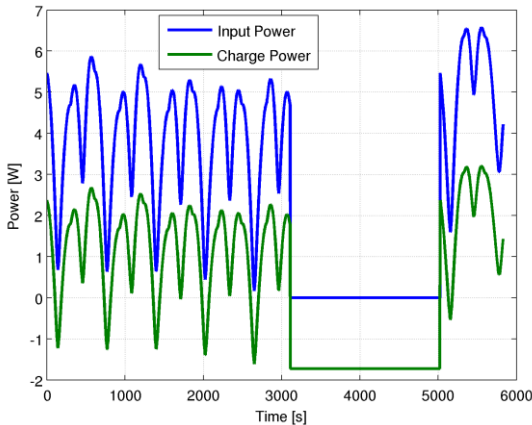
4.2 Mission example

An example for SOC for a 2U satellite with a P31u power supply is shown below and it can be seen that only a 3% discharge is necessary to keep the spacecraft going. With such a mission design the DOD is very small and the cycle life of the batteries is correspondingly long.

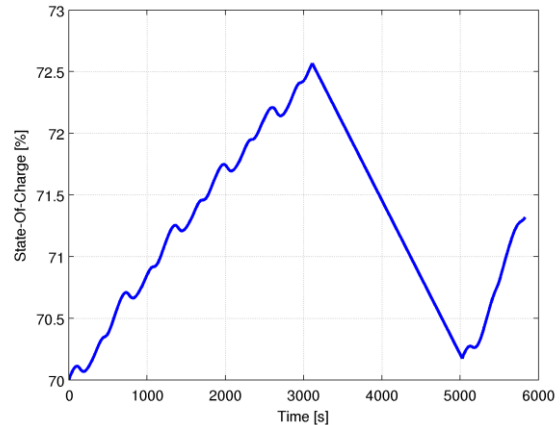
In-Orbit power simulation:

2U-cubesat in 640 km orbit with eclipse, tumbling on all axis.

Standard P31u with 2600 mAh batteries. 1.6 W constant power usage.



Input power from the solar panels and the charge power available for the batteries.



State of charge on the batteries

5 Storage

For prolonged storage, it is recommended to charge batteries to nominal voltage and keep temperatures lower than 25°C (preferably 0 - 10°C). Expected permanent storage loss is shown in the following table.

Storage Temperature	Permanent loss after 1 year (Storage at 50% charge)	Permanent loss after 1 year (Storage at 100% charge)
5°C	2%	5%
25°C	5%	20%
40°C	15%	35%

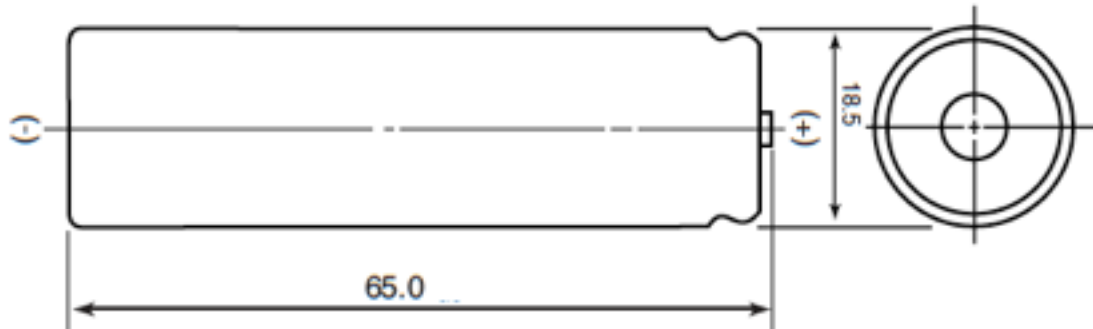
6 Tabs

All GomSpace batteries can be delivered with welded tabs in any configuration.

7 Physical Dimensions

Dimensions are given in mm and are common for all GomSpace batteries.

Mass: 48 g



8 Disclaimer

The information in this document is subject to change without notice and should not be construed as a commitment by GomSpace. GomSpace assumes no responsibility for any errors that may appear in this document.

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