



Small Wireless equipment for Energy harvest

1. Overview

Many sensor nodes are required to collect a lot of information on various places, objects, and people. However, the larger the number of batteries, the more important issues are management of the lifetime of primary batteries, time and effort for replacement, disposal of used primary batteries, so there are high expectations for energy harvesting that does not require replacement of primary batteries. Energy harvest is often used in combination with electric storage devices because the energy generated is not stable from harvester, and the electric storage devices are required that reliably charging with the generated weak energy under various environments, lower losing energy, Reliability that can be used for a long time is required.

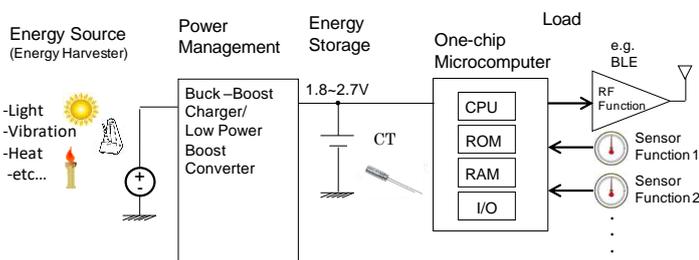


Fig.1 Block diagram

2. Comparison of electric storage device

Compared with Supercapacitor and conventional Lithium ion secondary batteries, CT series have optimal characteristic for energy harvest.

Table.1 comparison with storage devices for energy harvest

	Super capacitor	CT series	Conventional LiB
1) Long lifecycles	◎	○	×
2) Energy loss of storage	×	○	○
3) High output & discharge characteristic at low temperature	◎	○	×
4) Quick restart	×	○	○
5) Over-discharge durability	◎	○	×
6) Energy density	×	○	◎

1) Long life cycles

The capacity retention rate of CT04120 is decreased several % with condition of 5000 cycles from full charge to 50% discharge.

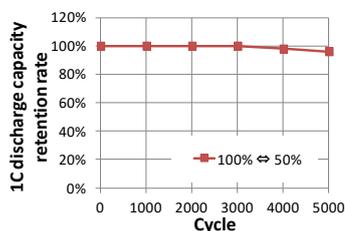


Fig.2 cycle characteristic

2) Energy loss of storage

CT series have low energy loss of storage and keep charged energy longtime. The leakage current is equivalent to 0.17μA after 90 days, The capacity retention is over 85%.and also CT series can be charged with 5μA of small current.

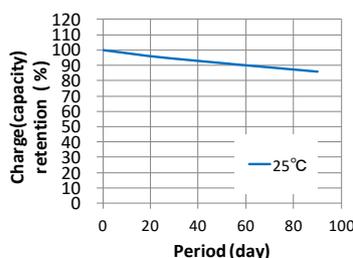


Fig.3 storage characteristic at 25°C

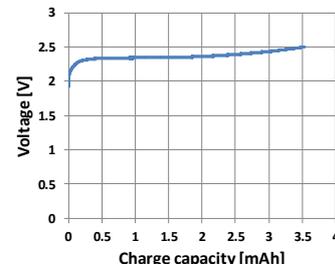


Fig.4 charge characteristic with 5μA

3) High output & Discharge characteristic at low temperature

CT series have superior high output characteristic, provide necessary energy with wireless communication such as BLE, UWB, Zigbee, LoRa, Sigfox, Z-Wave, EnOcean. It is also possible to output 30mA / 10msec / interval 30sec (CT04120, 3mAh) even in low temperature environment such as -20 °C.

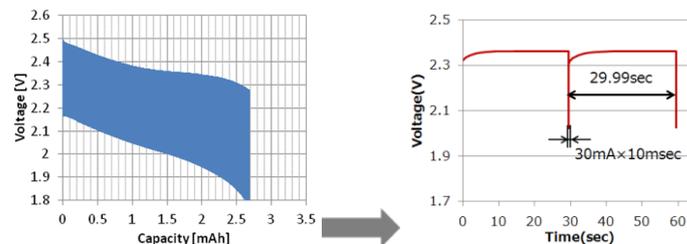


Fig.5 discharge characteristic at -20°C Low temperature (30mA×10msec/Interval 30sec discharge)

4) Quick restart

If CT series are discharged completely, Because the voltage rises by charging a small amount of energy. CT series can reduce system restart time and eliminate the need for a primary battery for precharging

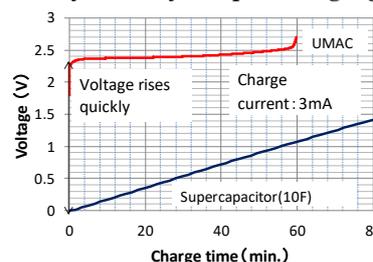


Fig.6 Charge voltage characteristic from 0V between CT04120 and Supercapacitor

5) Over-discharge durability

The electric storage devices may be in an over-discharged state due to inventory storage or inability to generate power and be charged. However, compared to a general lithium-ion secondary battery, CT series do not easily deteriorate even in an over-discharged state. The circuit configuration can be simplified.

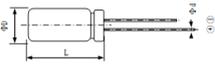
6) High energy density

CT series and lithium-ion secondary batteries have several tens of times the volumetric energy density compared to Super capacitors, so the equipment can be downsized.

3. Application

Various sensor nodes powered by energy harvesters, beacons, smart houses, smart buildings, smart agriculture, tracking (asset, cargo, livestock), monitoring systems, patient monitors, etc.

4. Product Lineup

Product name	CT04120	Dimensions		
Nominal Voltage	2.3V	ΦD	4mm	
Charge Voltage	2.7V	L	12mm	
End of discharge Voltage	1.8V	Φd	0.45mm	
Capacity	3mAh	F	1.5mm	
		Operating temp	-20~70°C	

5. Support

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