Battery management solutions for energy storage applications

Questions and answers

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Question 1

Why does the new generation AFE of the ADC have a higher total measurement error compared to the current generation? (3.5 mV instead of 2)

ADI achieve the 2mV total measurement error on current parts with multi-temperature testing and trim in production which is a multi-pass process in test which adds to the cost of the IC.

Depending on the end market the energy storage system is being designed for then there is a cost vs performance tradeoff at a system level for customers.

In order to allow for these tradeoffs we are offering new solutions with 2mv(ADBMS6830) and 3mV/5mV/10mV accuracy levels. (ADES1754/55/56)

Question 2

When will the new gen AFE be in production?

Parts will be available Q4CY23.

Question 3

Are OVC2 class 8kV also in the roadmap?
62477-1 and 60664-1 have new revisions

Yes it is. For the OVC2 (over voltage category 2) the transformers are tested with a 8 kV rated impulse withstand voltage, see table F1 in IEC 60664-1:2020. We plan to perform this test in the next couple of months.

Question 4

What is the reason behind the BMS Transformers for 1000 VDC working voltage having functional insulation and no reinforced insulation?

For reinforced insulation we use FIW wire. According to DIN EN IEC 61558-1 with FIW wire an additional mechanical separation (e.g. tape) is needed between the two transformer sides for reinforced insulation. This is very difficult to realize without increasing the leakage inductance or parasitic capacitance of the transformer. However, it is likely that we will test our 1000 VDC products for basic insulation instead.

Question 5

Do you have some reference designs for a BMS with firmware reference available?

ADI has evaluation board systems to allow customers to evaluate the BMS IC's these connect to a PC via an ISO SPI link to USB and we have PC software to allow monitoring of multiple BMS IC's in a stack.

For firmware drivers ADI can share basic drivers for the IC over myanalog.com , there are also open source options available such as foxBMS - The Most Advanced Open Source BMS Platform that ADI contribute to and will be updating with new releases.

Question 6

One concern that arises with communications is what will be the behavior of the cell management when communications break down, are there safety timeouts that will protect the cells from being depleted?

For energy storage systems it is common that the end system will need to be qualified to SIL 2 or SIL 3 compliance level depending on the application and battery chemistry. The exact implementation of this will depend on the system safety concept of the ESS unit as compliance is granted at an end product level.

As the ADI AFE were developed initially for automotive use, we can share safety manuals under NDA on many of our IC's and system safety concepts on implementation to ASIL D, and will be publishing an applications note on differences between transferring from ASIL to SIL.

In the newer generation AFEs such as the ADBMS6830 architecture, we use two separate ADC's per cell that enable us to monitor the Cell voltage and also separately the UV/OV limits for the Cells, and this architecture gives a heartbeat in range message on the bus, so if that is not received then the system can use this lack of signal as a safety timeout.

(Continued on next pg.)

Question 7

Can you explain what is partial discharge testing and why you are doing this for the release?

Partial discharges are localized dielectric breakdowns. Solid insulation in which partial discharges occur during operation is unreliable in the long run.

The test procedure for partial discharge test can be found in different norms. Below is an example from the IEC 60664-1 (pages 40-42), where $U_{test\ voltage}$ is the working voltage of the system.

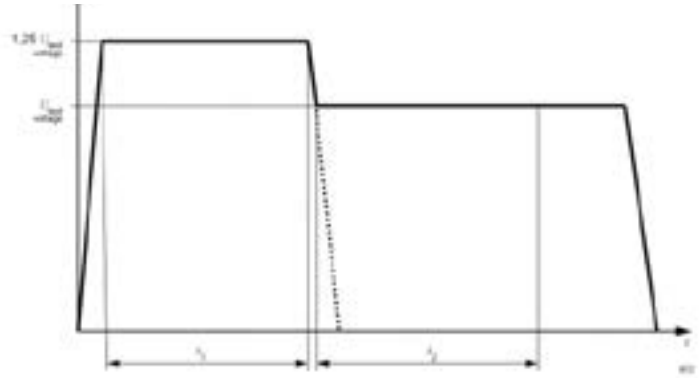

Figure 1: *Test Voltages*

The test is failed if the amount of partial discharges exceeds 10 pC (pico coulomb).