

Stereax[®] M50 miniature Solid State Battery FAQs

Q: *What are the key areas in medical applications that need to consider battery technology?*

A: IoT has moved into the medical space to address the need for more proactive patient healthcare. This has created a demand for remote patient monitoring with mobile and small devices enabling data collection to be shared back to the medical carers. These devices need to be small in size, robust, have a low cost of ownership and provide long battery life. Implantables (neuro-stimulation, cardiac rhythm monitoring, leadless pace makers, insulin pumps, blood pressure monitors) or small on the body devices (contact lenses, smart dental braces, glucose sensors) are typical applications for Stereax M50. Stereax batteries can be used in conjunction with energy harvesters to power these devices or can be charged wirelessly.

Q: *Can Stereax batteries be used in ingestible monitoring solutions?*

A: Stereax is based on solid state battery technology, which has less risk of leakage, making it safer to use. In addition, it is likely that the Stereax battery will be packaged inside a small container with the rest of the electronics, designers of these devices will need to have them tested in full package.

Q: *Is the body turning into a network of sensors?*

A: The wireless body area network (WBAN) - sensors can be either implanted, digested or worn by the user and can all be networked. This enables the different vital signs to be looked at together giving a more holistic view of what is going on with a patient. Like other networks it has a centralised control point (normally held externally).

Q: *What energy harvesting can be used to charge these sensors and how does it work with Stereax?*

A: The body offers a range of energy harvesting opportunities but a lot of these are still at the early stage of development and Stereax batteries are more likely going to be recharged wirelessly. Yet, the movement of the lungs, the beating of the heart and temperature gradients between skin and ambient air are all areas of development in terms of human body energy harvesting.

Q: *You talk about the size of the Stereax M50 – what are the actual dimensions of it?*

A: The Stereax M50 measures 10.75 mm x 3.75 mm and 0.6 mm thickness. Ilika is currently developing the technology to thin Stereax batteries down to about 250µm, and since this is a mature technology within the semi-conductor industry, we are expecting Stereax batteries to be much thinner in the next few months. Stereax M50 is an example of micro-batteries that Ilika can develop and customize for OEMs. Stereax micro-batteries can be configured into a variety of shapes and sizes (mm-scale) dependent on the need of the end application. It offers a flexible solution that is driven by the needs of the end device rather than the device shape size being dictated by the size and shape of the battery.

Q: *What is the capacity of Stereax M50 and what can you power with such low capacity?*

A: The Stereax M50 has a capacity of 50 µAh, which is enough to power a small sensing device which may require a few µW of average current. However, we have found that most implantables will require more energy than 50 µAh per day, and in general 0.5-1 mAh is a sweet spot for implantables that include some sensors, some memory and some communication, and needs to work for a couple of days between recharges. Here the Stereax M50 can be considered as the starting block of a larger battery, constructed for example by stacking several M50 or similar batteries with different dimensions.

Q: *Can these batteries be stacked?*

A: Yes, we can stack cells for customers.

Q: *Is the battery voltage similar to current lithium batteries?*

A: Stereax batteries use similar cathodes to current lithium batteries but use different material for the anode. The anode in Stereax M50 is silicon. Output voltage is between 3.0 and 4.0 V. Nominal voltage is 3.5 V.

Q: *What is the output power?*

A: Because SSBs are made by depositing thin films, this has the advantage of providing high relative peak power (because the lithium ions can travel fast through the thin layers). Typically, up to 10 C can be achieved continuously (i.e. 0.5 mA for M50), although the de-rating at this fast rate is about -20% in terms of capacity and cycle life. Higher peak current of 20 C can be achieved for short periods, typically milliseconds.

Q: *What is the operating temperature?*

A: The Stereax M50 is ideally suited to work at body temperature, 37°C, but can work between -20 °C and 80 °C and for limited periods of time to 100 °C.

Q: *Is it limited to prismatic cell form factor?*

A: The form factor is not prismatic, but flat, 0.6 mm thick, square, rectangular, circular... footprint. The form factor can be flexible, depending on the end device requirements. We will study the possibility of creating any shape.

Q: *How thin can a Stereax battery be?*

A: Stereax M50 is currently 0.6 mm thick, but we are going through the final stage of qualification of an even thinner version of this battery, only 250 µm thick.

Q: *Where can I buy Stereax M50?*

A: Ilika's business model is to license the IP to enable the manufacturing and integration of Stereax M50. Please contact Ilika if you are interested in integrating this or other customised batteries in your application.