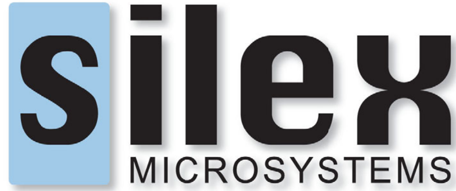
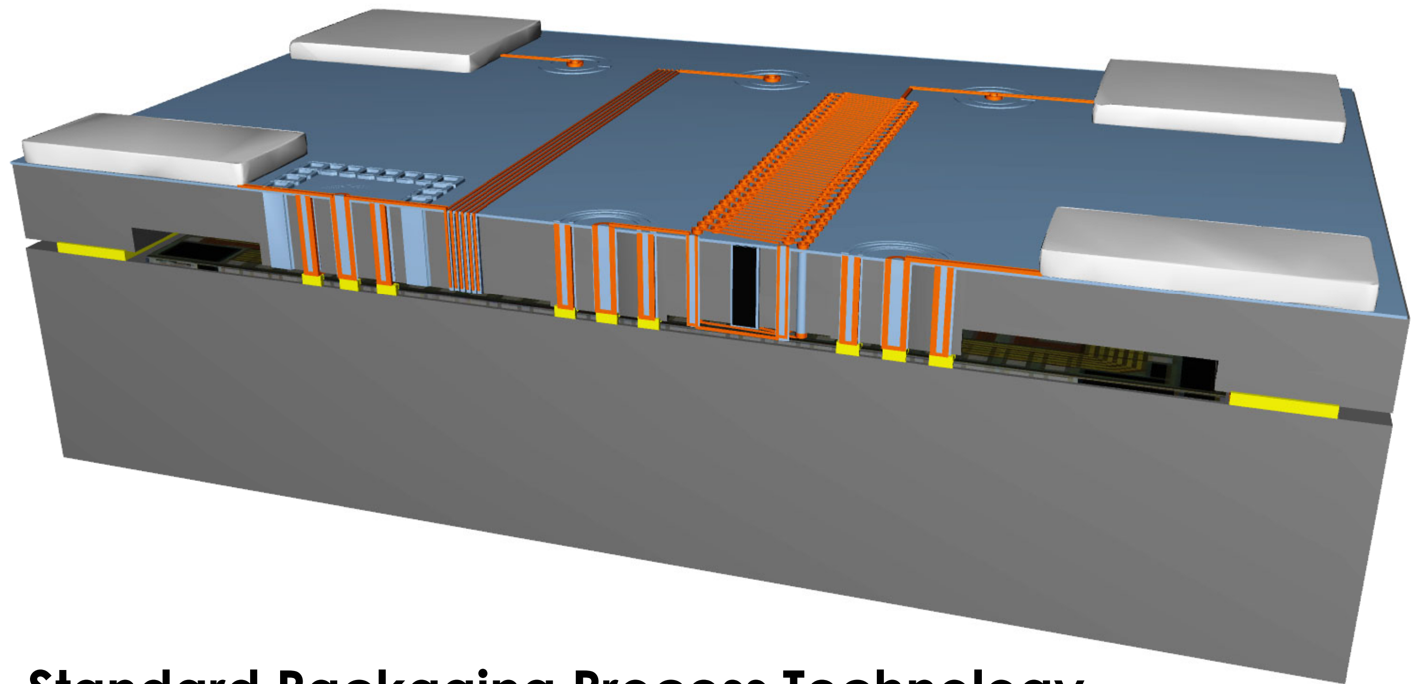


Functional Capping™

of MEMS and CMOS



Standard Packaging Process Technology

Silex Microsystems, a pure play MEMS foundry with state-of-the-art MEMS processing technologies and volume manufacturing capability, presents in this article its innovative standardized technologies for solving packaging and interconnect challenges related to commercialization of MEMS devices.

Silex -Your Silicon Via Expert

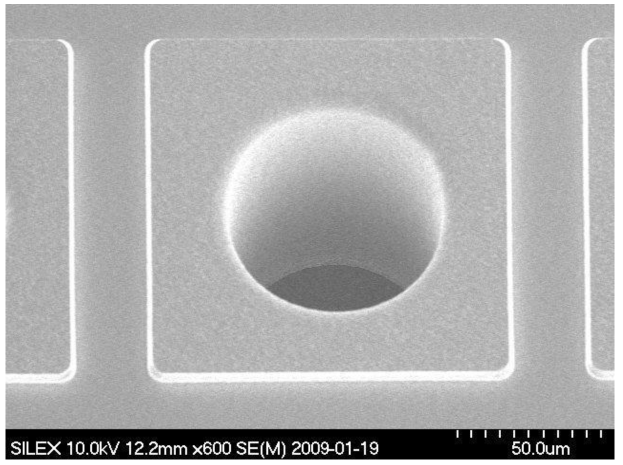
Silex Microsystems first offered its doped silicon based Through Silicon Via process (Sil-Via™) to its foundry customers in 2003, a technology that has now made its way into a wide range of MEMS devices, from high end optical MEMS mirror applications to consumer electronic devices being manufactured in millions. The Through Silicon Via process developed by Silex offers sub 50 µm pitch for through wafer connections in up to 600 µm thick substrates and is a feature of Silex Through Silicon Insulator process (TSI™) that creates dielectric separation by etching and refilling trenches throughout the full thickness of a wafer. This well tuned process also enables very high density integration of vias with well over 100,000 individual vias in a 6" wafer.

Silex -Your Wafer Bonding Expert

A common implementation of the Sil-Via™ technology is to form the electrical interconnect into a hermetically sealed device. In order to serve foundry customers with such requirements, Silex has developed an unparalleled expertise in solving difficult wafer bonding process challenges. This wafer bonding heritage in combination with the expertise in via processing has enabled Silex to take a leading position in the development of novel and ground-breaking technologies in the area of capping and interconnect. Silex Wafer Level – Micro Scale Packing (WL-MSP™) process platform is used for packaging of discrete devices, going beyond the capabilities of LTCC and HTCC technologies.

Silex -Your Metal Via Expert

In order to support requirements from foundry customers with low resistivity interconnect specifications (RF MEMS), Silex has over the past years worked on developing a metal-via process suitable to meet the stringent requirements of sub 50 mOhm total through wafer via resistance in combination with tough



Top-view SEM picture of a metal via.

demands on hermeticity. Silex new 8" line is boasting a world leading equipment installation base that combined with Silex processing expertise offers the best metal via solutions available today. A key focus during the development of the metal via process was to avoid micro crack development in the interface between the metal conductor and wafer. Silex has developed several means of mitigating the risk of micro cracks while at the same time enabling low total resistance and void free filling of the via plug. Silex offers its Met-Via™ technology using Au or Cu as conducting material.

Silex - Your SOI Capping Expert

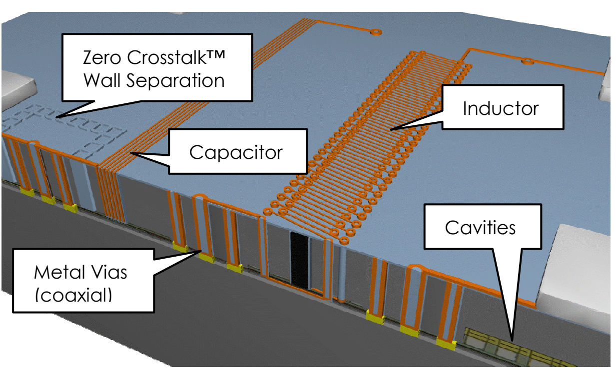
Silex has extended its IP portfolio to cover a novel method of using the device layer of an SOI wafer as a means to secure a robust creation of a cap with integrated metal vias and other functions (Functional Capping™). The cap wafer is created by front side processing of an SOI device layer with a thickness of typically 100 to 200 µm. Temperature budget is fairly unrestricted as there is no CMOS present in this wafer, which will allow a proper build and refilling of the created via functions and will also enable the possibility to incorporate added functionality. In addition to metal vias, such added functionalities may include cavities for moving MEMS parts, Integrated Passive Devices (IPD) and also Silex patented Zero Crosstalk™ function that integrates buried vertical through wafer walls into the cap wafer to reduce signal cross talk and allows total dielectric separation of entire regions of the cap. Following bonding of the cap wafer to the MEMS or CMOS wafer, the handle of the SOI wafer is released and the exposed backside of the device layer is completed with metal routing and UBM metallization.

Silex - Your Expert MEMS Foundry

Silex Microsystems offers MEMS foundry manufacturing services in its fully equipped and state-of-the-art 6" and 8" wafer fabs. With a team of skilled MEMS experts, Silex helps its customers to quickly take their design concepts to working prototypes and the following volume manufacturing. Since the company was founded in year 2000, Silex has successfully completed well over 100 MEMS products with more than 75 customers around the globe. Following the trend of the IC foundries, Silex is also continuously working on developing standardized MEMS foundry processes, leveraging intellectual property and know-how to complement the foundry manufacturing offer. An example of such MEMS expertise is this presented through wafer via and capping technology that enables true wafer level packaging and MEMS designs with significantly reduced form factor.

Silex - Your 8" MEMS Foundry

The recent expansion with another 8" wafer fab in its facilities in Sweden testifies of Silex strong financial position and commitment to providing a future proof volume supply to its foundry customers. Silex 8" MEMS fab is equipped with state-of-the-art MEMS processing equipment, such as EVG Gemini wafer bonders and Semitool Paragon plating systems, particularly adapted to providing the capping technologies presented in this article.



Schematic cross section of a Functional Capping™ substrate.

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