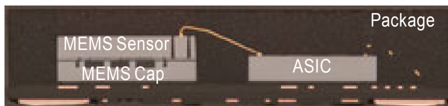
World's first inertial MEMS using Through-Silicon-Via technology

Although the MEMS sector has been growing steadily for a long time, the biggest challenge for many companies in the near term is reducing the footprints without affecting component functionalities. Through-Silicon Via was adopted as one possible solution to achieve this and recently STMicroelectronics became the first company to use it in a consumer inertial MEMS.

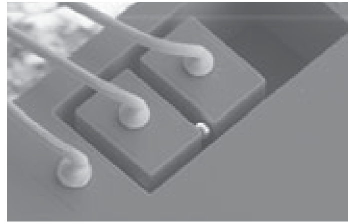
Technology analysis

The teardown of a NOKIA phone revealed a MEMS motion sensor using Through-Silicon Via technology. The component is a 3-axis digital output accelerometer, manufactured by STMicroelectronics and it seems to be a special version of the LIS302DL. The MEMS and ASIC were wire bonded together and mounted side-by-side in the package, as indicated in the figure below. STMicroelectronics uses an approach similar to the standard THELMA process but adds major changes



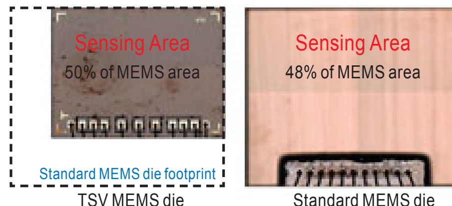
Component cross section
(Courtesy of System Plus Consulting)

to manufacture this component. The new TSV technology allows the shrink of the MEMS die by removing the area initially reserved for I/O pads.



TSV SEM view
(Courtesy of System Plus Consulting)

A simple calculation shows that the MEMS die area is reduced by about 25 % compared to the standard MEMS die.

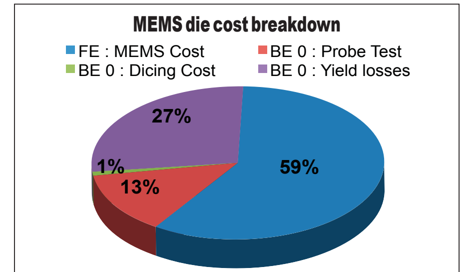


Die size comparison
(Courtesy of System Plus Consulting)

We believe that this component is the first element of a new motion sensor family using TSV. The goal is not only to shrink the die area but also prepare the way for a 3D integration of multiple dies stacked on the ASIC.

Cost analysis

The main part of the manufacturing cost is due to the front end. TSV specific steps represent 20 % of the wafer cost, thus increasing the final wafer cost comparing to the standard wafer.



MEMS Cost Breakdown
(Courtesy of System Plus Consulting)

The full reverse costing reports combining technological analysis of the devices and detailed manufacturing cost is already available.

Recent reverse costing reports

- STMicro LSM330DLC: MEMS 6DoF IMU
- Wispry MEMS RF Antenna Tuner
- EPCOS T4060: MEMS microphone
- TI MicroSiP™ embedded die Package

System Plus Consulting develops Costing Tools and performs on demand Reverse Costing studies of Semiconductors (from Integrated Circuits to Power Devices, from Single Chip Packages to MEMS and MultiChip Modules) & of Electronic Boards and Systems.

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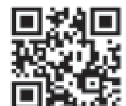

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