Agile value chain for medium volumes, custom MEMS, manufacturing, packaging and integration

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MEMS market: a continuous growth over 20 years

- Dominated by IDMs (ST, TI, Qorvo…) and vertically integrated companies (Bosch, Denso, Panasonic, Honeywell…)
- Driven by IoT, consumer and automotive
Specialty Products:
The (often) hidden side of MEMS

- IoT, Mobile devices
- Automotive
- IT & peripherals
- Aerospace & Defense
- Instrumentation
- Process control
- Petroleum
- Pharma research
- Medical diagnostic
- Medical devices
- Telecoms Networks
- …..
Specialty Products: Adding value for systems

- The component is key: differentiation at the system level => Core system function with high value-add
With some barriers of entry

Investments of several millions of dollars required.

1 to 3 years to set up specific manufacturing technologies.

2 to 5 years for product performance improvement and qualification phases.

From concept to product, including design, development, optimization and qualification.

Developing and validating a custom MEMS process flow takes time.

But even more to achieve the right specification and qualify the product (package, IC, testing...) and the system!
Specialty Products:
Diversity of Fabless Customers / Foundry relation

- **Components / modules providers**
  - Most expertises in house (MEMS & IC design, Application…)
  - Outsource Capex-heavy or non strategic elements
  - Use their established supply chains (packaging, electronics…)

- **System providers / OEMs**
  - Application experts in house but limited/no design capabilities
  - Wafer / components fabs out of core business
  - Looking for buying « functions » easy to integrate

- System providers and Component/module providers often need different MEMS manufacturing partner
Specialty Products:
High complexity development management with volumes not always attractive for each entity

MEMS Design Partner
MEMS Foundry
MEMS testing
Assembly
ASIC Design House
ASIC test house
package supplier
Specification & requirements
Sensor/Actuator performances & reliability
Final test calibration
IC Foundry
Final test calibration
Sensor/Actuator performances & reliability
Specification & requirements
ASIC Design House
ASIC test house
package supplier
MEMS Foundry
MEMS testing
MEMS Design Partner

Specification & requirements
Specialty Products: High complexity supply chain management

- Multiple manufacturing partners - Multiple risks / constraints
  - Responsibility spread across the supply chain
  - Long cycle times => delay in identifying problem route cause
  - Expertises needed to manage quality and reliability

- MEMS Foundry
- MEMS testing
- Assembly
- ASIC test house
- IC Foundry
- Final test calibration
- Customer
A better model for an OEM: One knowledgeable and responsible partner working in tight interaction with them and its ecosystem.
A DIFFERENT PATH TO CUSTOM MEMS COMPONENT FOR OEMs
Facts and figures

- Listed on Alternext Paris since February 2015
- Tronics (Dallas)
- Tronics (Grenoble)
- 90 employees including 55 engineers and scientists
- 2014 revenue: $20 M
- 15 years of R&D
- 25 active patent families
- Leading customer references
- Production sites in US and Europe
- Distributors in Japan, China, Israel
- Listed on Alternext Paris since February 2015
Full Service MEMS Foundry

Tronics co-designs, manufactures and sells custom MEMS products and some standard products for OEMs in high growth markets.

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Tronics designs, manufactures and sells custom MEMS products and some standard products for OEMs in high growth markets.
2 production units serving different customer topology

PRODUCTION UNIT EUROPE
Grenoble, France

- Small to Medium volumes MEMS wafer fab
  6” fab, class 10 - 1,000
  600 m² of clean room
  Capacity: 10,000 wafers/year (10 masks level)
- Assembly, packaging and test line
  200m² of clean room for assembly
  200m² of test and characterization lab
- Ability to serve OEMs and non-MEMS expert customers (problem solving)

PRODUCTION UNIT NORTH AMERICA
Dallas – Texas (shared facility)

- Medium to High volumes MEMS wafer fab
  6” fab, class 10 - 1,000
  1,800 m² of clean room
  Capacity: 50,000 wafers/year (10 masks level)
- Serving component and module makers w/wo process knowledge
A different path for OEMs

From engineering ...

- Co-design and electro-mechanical simulation
- Process flow definition and engineering
- Support and management of IC supply
- Package design and assembly
- Characterization, Test and Qualification

... to manufacturing

ECOSYSTEM

Academic & Industrial providers

MANAGEMENT OF SUPPLY CHAIN – DELIVERY OF TESTED ELEMENTS
SHORT FEED-BACK LOOP FOR BETTER CONTROL OF SUPPLY CHAIN
Specialty products management exemples

SMD VWLP with integrated getter (1mTorr) (in house, balling outsourced)

MEMS VWLP & IC assembly (in house design+fab, IC management)

Oil-filled titanium packaged pressure sensor (in house design & manufacture)

3D integration of ICs on custom MEMS (management of IC supply and flip-chip)
Conclusion

- MEMS remain complex miniature system

- Standard products are not always the option for system innovation and differentiation => specialty products

- Strong barrier of entry for OEMs with small / medium volume requirements and limited supply chain management expertise

- Simplification of supply chain and single point of responsibility reduces development time and production risks

- Delivering tested function is a must and requires an agile supply chain management with a mix of in-house capabilities and connection with the ecosystem (academic & industrial)