From Full Custom to Generic Platforms: Solutions for Application Specific MEMS Components

Grenoble Day - Meijo University, Nagoya, Japan

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From Full custom to Generic Platforms, a Solution for Application Specific MEMS

- TRONICS Presentation
- Application specific MEMS: benefits & drawbacks
- MEMS Generic Platforms
- Conclusion
Tronics’ Goal and Mission Statement

To be the leading manufacturer of custom MEMS.

Fast transformation of customer concepts into market-ready MEMS

by

- providing technologies, production experience and solutions
- establishing supply chains for demanding applications
Global Business – Local Support

- San Francisco, CA
- Sunnyvale, CA
- Dallas, TX
- Grenoble, France
- Beijing
- Tokyo

- Green circle: MEMS Development & Volume Manufacturing
- Orange circle: Medical System Design
- Gray circle: Sales Offices

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Facts & Figures

- **History**
  - Creation in 1997 - Spin-off from CEA-Leti
  - Inheritance of SOI-MEMS technologies developed for Automotive

- **Sustainable and Profitable Growth**
  - Profitable since 2006
  - Strong cash position

- **Team**
  - 40 engineers, sales & admin
  - 25-150 qualified and experienced operations resources
US and European Operations

- Production Plant in Grenoble, France
  - 1.350m² building with room for expansion
  - 400m² MEMS clean rooms
  - 150mm wafer line + packaging and test

- Production Plant in Dallas, Texas
  - 13.000m² building with room for expansion
  - 1.850m² MEMS clean rooms
  - 150mm manufacturing line

- Dual manufacturing source
- 60k wafers scalable annual capacity + assembly
Key Know-How, Expertise and Solutions

- Leader in custom SOI MEMS and Experienced in MEMS on CMOS
- Expert in capacitive sensors and microfluidic/lab-on-chips
- Experienced in custom assembly/packaging, test and reliability of MEMS

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<th>High Aspect Ratio Thick-SOI MEMS</th>
<th>Capacitive sensors and interfaces</th>
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<td>Wafer Level Packaging &amp; Through Silicon Vias</td>
<td>High Vacuum Package</td>
<td>Custom packaging including implantable</td>
<td>Productization, test and qualification</td>
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Rigorous End-to-end
Custom Product Development and Industrialization

Design for manufacturing, Modelling and Simulation

Process and Technology Development & Qualification

ASIC Development Support and/or Management

Assembly and Packaging Development & Optimization

Product Characterization, Reliability and FMEA

Custom Testing and Calibration Protocol Development

Full service design and development

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Key Manufacturing Capabilities

With front side and backside patterning on SOI, glass & silicon wafers, our fabs offer a complete portfolio of equipment and process steps to fulfill an extensive range of MEMS development and manufacturing requirements.

- Double side lithography
- DRIE Deep Dry Etching
- RIE and Plasma Etching
- Wet Chemical Etching (KOH, TMAH, HF...)
- Poly, CMOS and Non-CMOS Thin Film Deposition & Plating
- Wafer Bonding (metallic, glass frit, SDB, anodic, adhesive)
- Metrology and Wafer Level Testing
- Thinning, Grinding, Polishing, Dicing
- Assembly and Packaging
- Functional Testing and Characterization

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Application specific MEMS
Benefits and drawbacks
Application specific MEMS

- Benefits
  - MEMS Fully optimized for the application
    - Form factor
    - Performances
    - Right unit cost
  - IP and supply Control

- But ...
Application specific MEMS

- Drawbacks
  - Long time to market
    - Several years
  - Development cost
    - Several 100k€ to M€ depending on the MEMS complexity

- How do I get the benefits of application specific MEMS without its drawbacks?
MEMS Generic platforms
What is a MEMS generic platform?

- A MEMS generic platform is a collection of proven processes and design elements:
  - Process Platform
  - Sensing Element Design
  - Electronic Interface
  - Packaging
  - Test and Calibration

- All tightly defined together
Benefits of MEMS generic platforms

- The generic platform enables application specific product
  - Customization and qualification to customer requirements

- The platform is based on a collection of existing building blocks
  - Reduced projects risk
  - Low cost of development

- Focused at shortening design cycle and time to market
  - Path to volume production in less than 1 year
TRONICS Generic MEMS Product Platforms

- TRIO: Three-axis accelerometer
- GYPRO: One-axis gyro sensor
- GNP: Absolute pressure chipset & sensors
μAGELLAN: INERTIAL PROCESS PLATFORM

- Single crystal Si 20, 40, or 60µm
- Vacuum or atmospheric Hermetic bonding
- Out-of plane electrodes & metal lines routing
- Sticking-free release
- Top & bottom Si wafers
- Au pads on the edge for wedge/ball bonding

➢ Technology platform for custom accelerometers and gyros

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TRIO: 3-AXIS ACCELEROMETER PLATFORM

Customizable 3D transducer
- Ultra-small and low cost
- Consumer and Automotive Grade
- From +/-2G to +/-1000G range

- Proven design available for customization
GYPRO: 1-AXIS GYROMETER PLATFORM

Customizable 1D Sensor

- Tested and calibrated sensors
- Robust & High performance
- Aerospace grade, scalable to Automotive
- From +/-100°/s to +/-1500°/s

- Platform Prototypes available in H2.2010
Inertial Platforms positioning

GYPRO
1-axis gyro

TRIO
3-axis accel

Guidance

Ammunitions

Navigation

Seismic

Price

Resolution/Range

Quantities

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Customizable Chipset & Sensors

- 16 bits ADC, SPI, I²C and RF output
- Low power and very low cost chipset
- Ti package for medical application

Platform demonstrators available
From Foundry to MEMS generic platforms

- Mems Process
- Mems design
- Mems test
- Packaging
- Calibration
- Interface Electronics
- Documentation
- Demo board

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Tronics’ Advantage

- Expertise and experience in transforming concepts into products and building supply chains for application specific MEMS components

- U.S. and Europe Operations
  - Local support
  - Broadest technology portfolio
  - Production back-up and scalability

- One-stop-shop service and MEMS solution provider
  - R&D prototyping to high-volume manufacturing
  - MEMS, electronic interface and custom packaging
  - Supply chain management

- Flexibility to adapt to customer domain and quality requirements

- Rigorous and reliable execution of projects

- MEMS on SOI and MEMS on CMOS expertises
TRONICS, your partner for application specific MEMS

THANK YOU