

Introduction to:

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***Rocket
MEMS***

GET THE CHIPS YOU NEED
Semi-custom MEMS Devices



AMFITZGERALD
& ASSOCIATES

Overview

- ***RocketMEMS™***: What is it?
- ***RocketMEMS™*** vs. Custom MEMS Development
- How ***RocketMEMS™*** works
- Features
- Moving forward and Next steps
- Questions & Answers



Your Situation

You need a pressure sensor.

Nothing on the market fits your needs.

Your options:

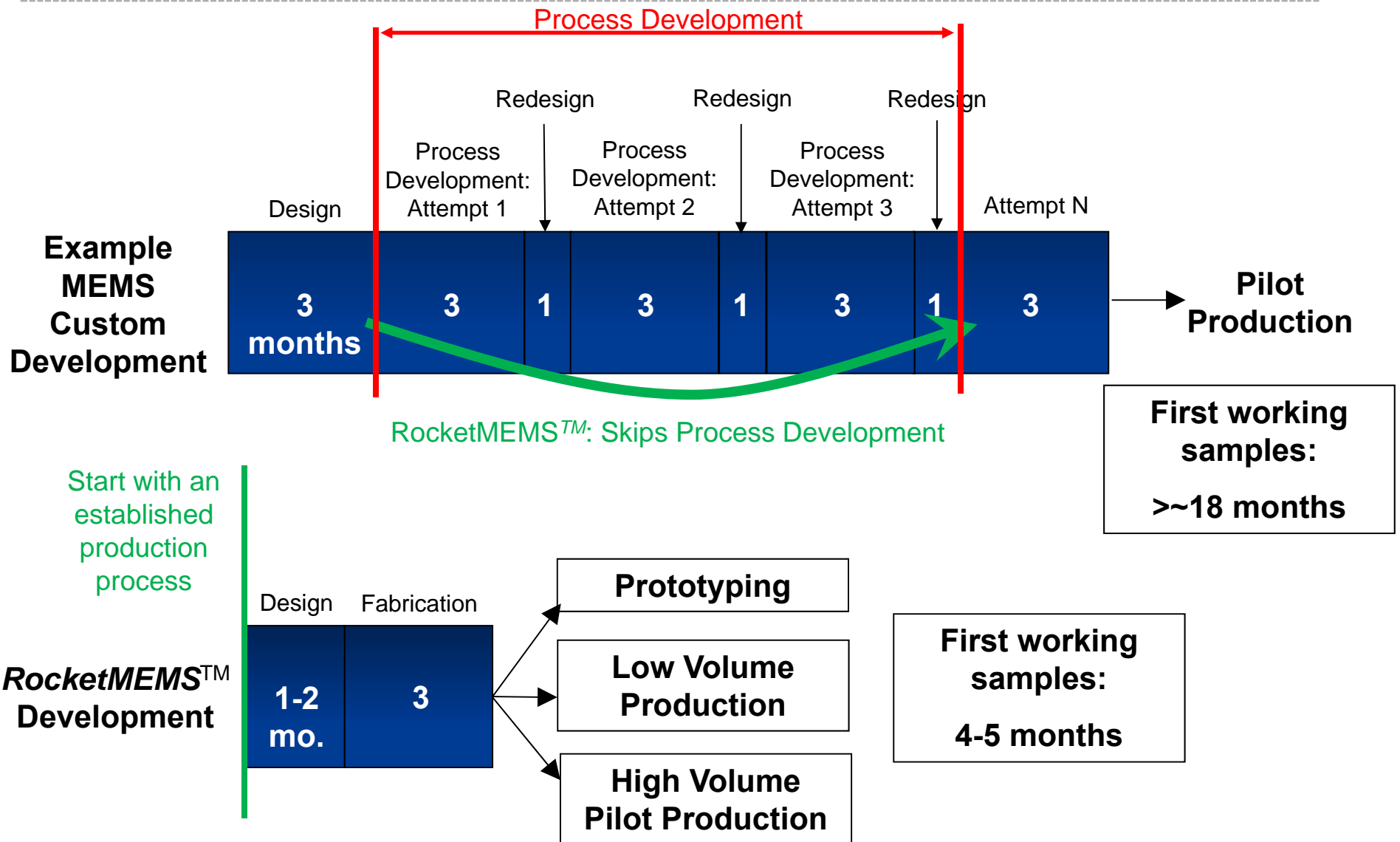
- Work with the sensor-that-doesn't-quite-fit**
- Develop a custom pressure sensor**
- Abandon the application**

The *RocketMEMS™* option

***RocketMEMS™* delivers:**

- **Semi-custom bare silicon die pressure sensors**
- **Reduced cost**
- **Reduced time to market**
- **Reduced risk**
- **Scale die volumes to fit your needs**
 - **From prototyping to large volume production**

RocketMEMS™ vs. Custom Development



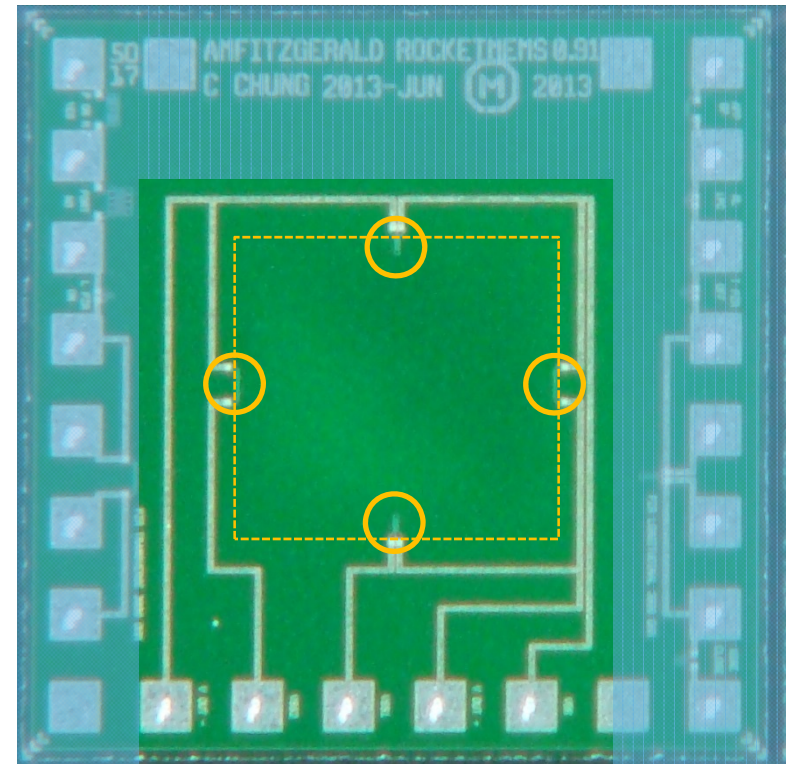
RocketMEMS™: Design House-Foundry Cooperation



- **Fixed, stable, fully characterized production process modules**
- **ISO certified, qualified foundry**
- **No process development**
- **Many pressure sensor needs may be met without changing the process**

***RocketMEMS™*: Start with a great architecture**

- **Single crystal silicon membrane**
 - Strong, high quality, stable material
 - Intrinsically free of hysteresis and creep
 - High burst pressure
- **Silicon-on-Insulator (SOI) wafers**
 - Precise membrane thickness
 - Consistent uniformity from device-to-device, run-to-run
- **Piezoresistive transduction**
 - Well understood
 - High sensitivity
- **Low cost readout electronics**
 - Simple Wheatstone bridge circuit
- **100% test coverage, all known good die for all guaranteed specifications**



***RocketMEMS™* pressure sensor die (2 x 2 mm) with test structures**

What can be customized with RocketMEMS?

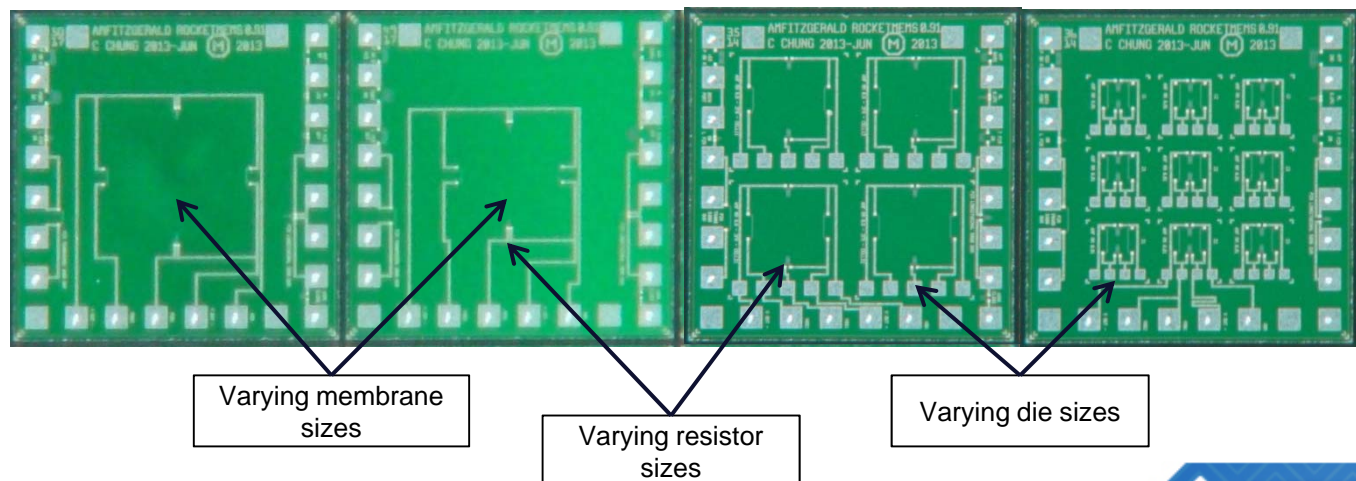
Customizable:

- Pressure range
- Sensitivity
- Bridge resistance
- Bridge architecture
 - Full vs. Half bridge
- Die size and thickness
- Bondpad location and size

Not customizable:

- Very high or low resistances
- Very wide dynamic range
- Very high sensitivities
- Very low noise

Examples of various
RocketMEMS™
pressure sensors
(with test structures)



Range of performance specifications

	Medical	Consumer Electronics	Industrial or Aerospace
Pressure range, absolute (atm)	0.5 - 1.5 (380-1140 mmHg)	0.2 – 2	0.2 – 10 (3.0-150 psi)
Resistor value (KΩ)	1 – 10	1 – 10	1 – 10
Chip length (mm)	0.6 – 2	0.5 – 2	0.33 – 2
Thickness (mm)	0.3 - 1	0.3 - 1	0.3 - 1

Please note:

These are example specifications for these example applications.
These are not the boundaries of the *RocketMEMS*[™] process.

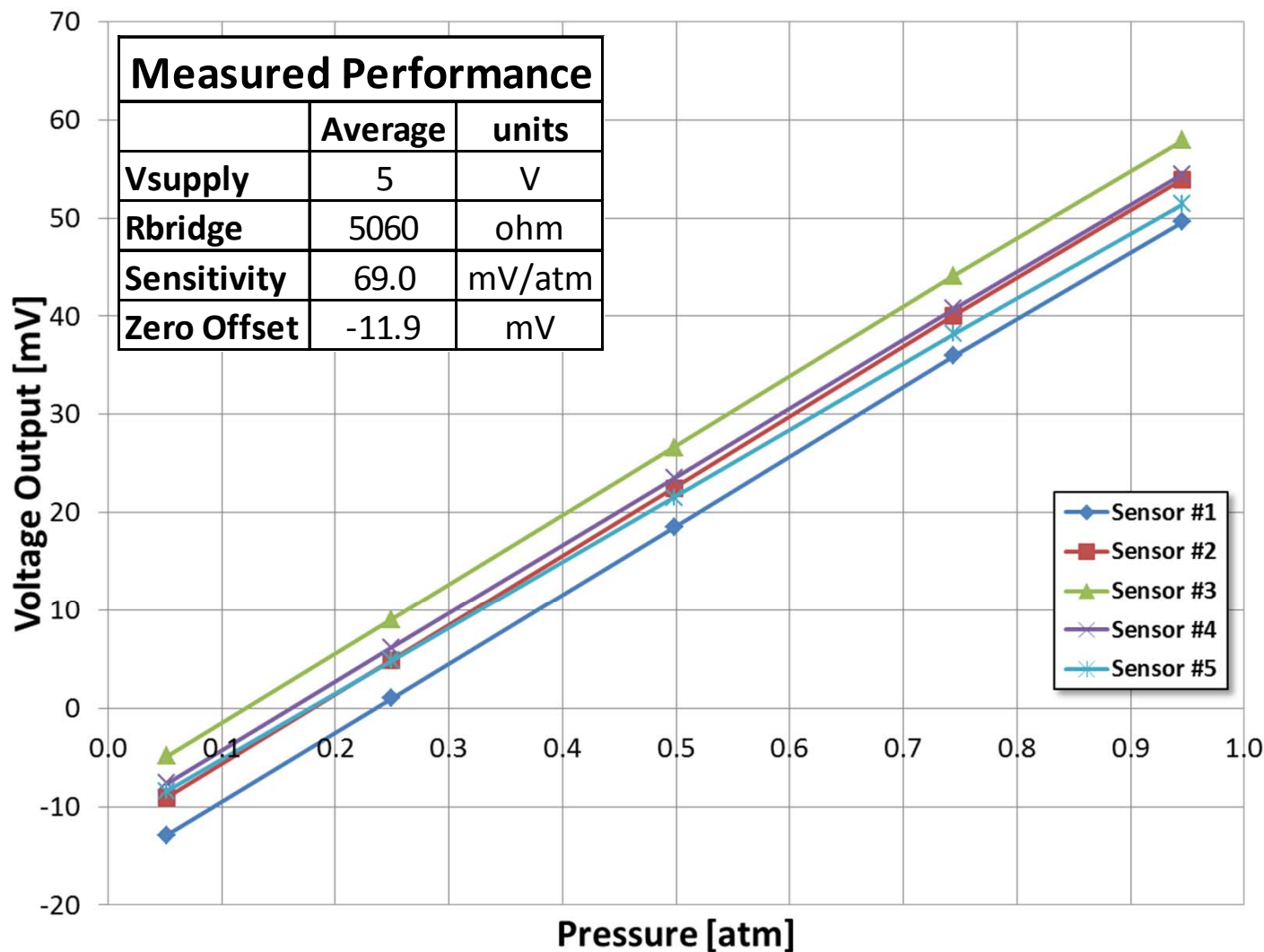
Pressure sensor applications – some examples

Medical	Consumer	Industrial or Aerospace
Blood pressure cuff Flow measurement Monitors Spirometer CPAP machine Catheters Endoscopes Infusion pumps Physical therapy	Altimeter (height) Weather (barometers) Appliances Wrist watches Sports equipment	Hydraulic systems Fuel gauge HVAC systems Engine control Exhaust management Pitot tubes Monitors

RocketMEMS™ Reference Pressure Sensor

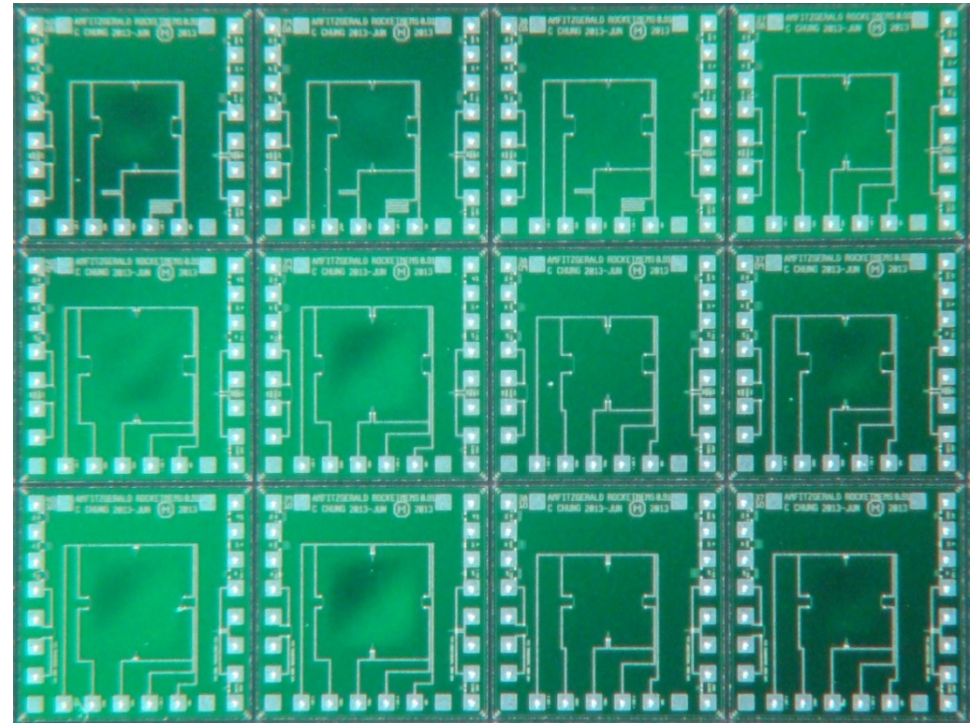
Measured Performance Data

Uncompensated, Unamplified Pressure Response of
RocketMEMS Reference Pressure Sensors



Die Volume: Scaling from Prototyping to Production

- **RocketMEMS™** die volumes scale with your needs
- **Scalable production volumes:**
 - Rapid Prototyping
 - 500+ devices
 - Low Volume Production
 - 10,000+ devices/year
 - High Volume Production
 - Millions of devices/year
- **Multiple designs on a run**
 - Multi-Project Wafer (MPW)
- **RocketMEMS™: a low-risk path to high volume production**
 - Prototype on MPW runs
 - High volume dedicated runs at Silex



Multi-Project Wafer: Many different chip designs are processed on the same wafer

RocketMEMS™: A philosophy

“Design for Verified Process”

No process development

- **Other MEMS sensor types to be added to *RocketMEMS* soon**



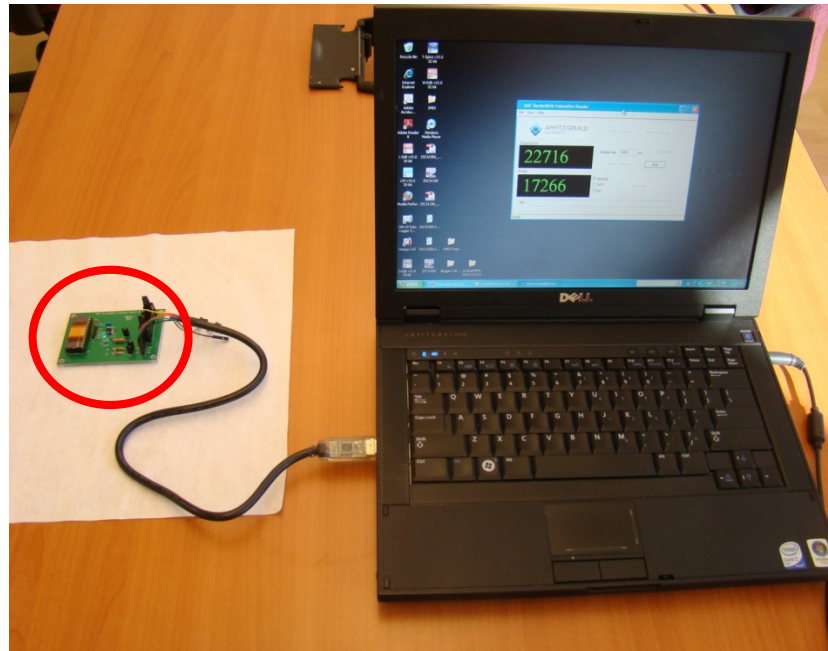
***RocketMEMS™*: How it works**

- **Customer provides specification**
- **AMFitzgerald designs pressure sensors**
- **Silex Microsystems fabricates the chips**
- **Customer receives bare pressure sensor die in 4-5 months**
 - **100% tested, all known-good die**
 - **Unique to *RocketMEMS***
 - **On tape or in gel packs**

Options: Readout electronics, ASIC, Packaging:

- **We can offer support and recommendations**

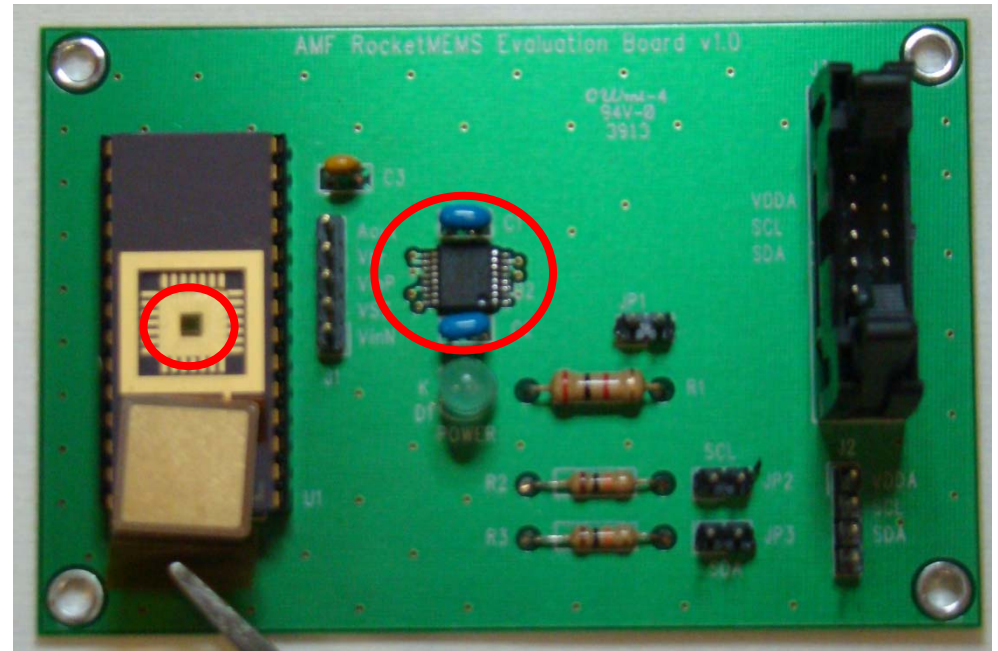
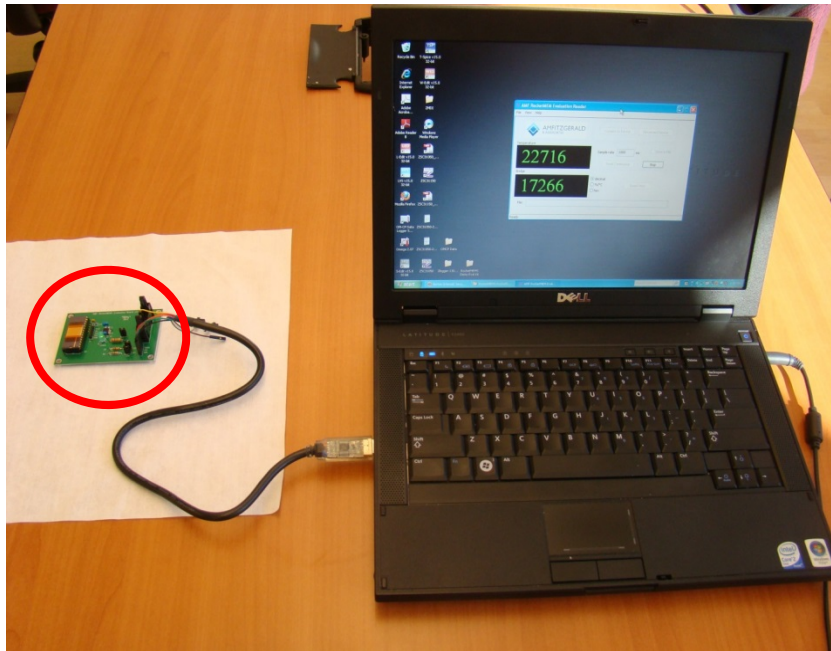
Plug and Play Evaluation Kit with ZMDI ASIC



Kits include:

***RocketMEMS™* Pressure sensor**
Readout with ZMDI ASIC and Board
Board-to-PC USB Cable
Software and Manual

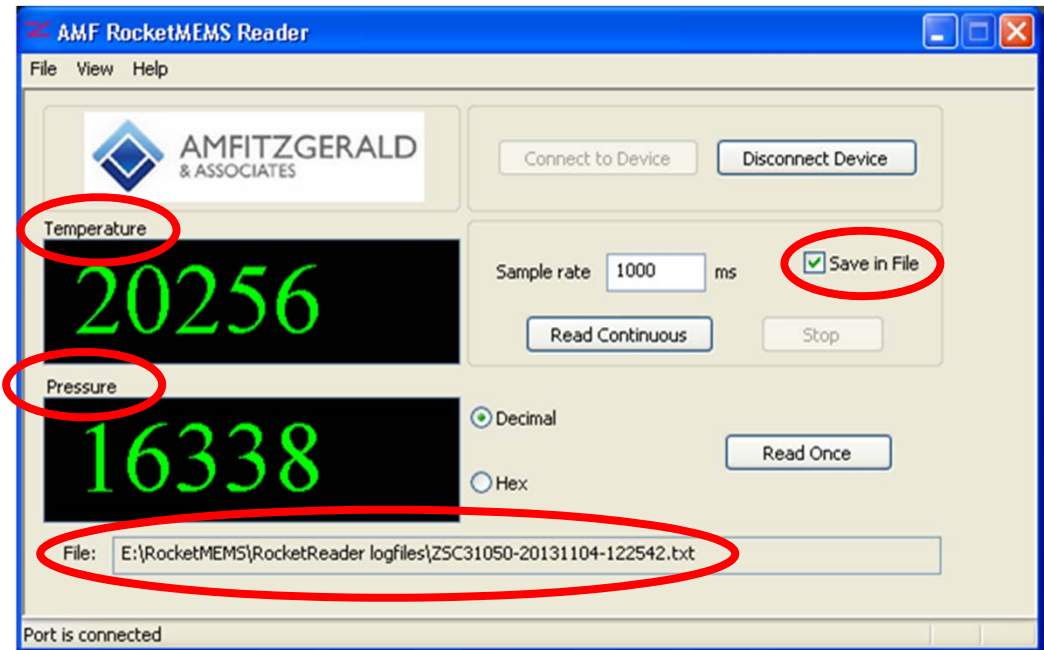
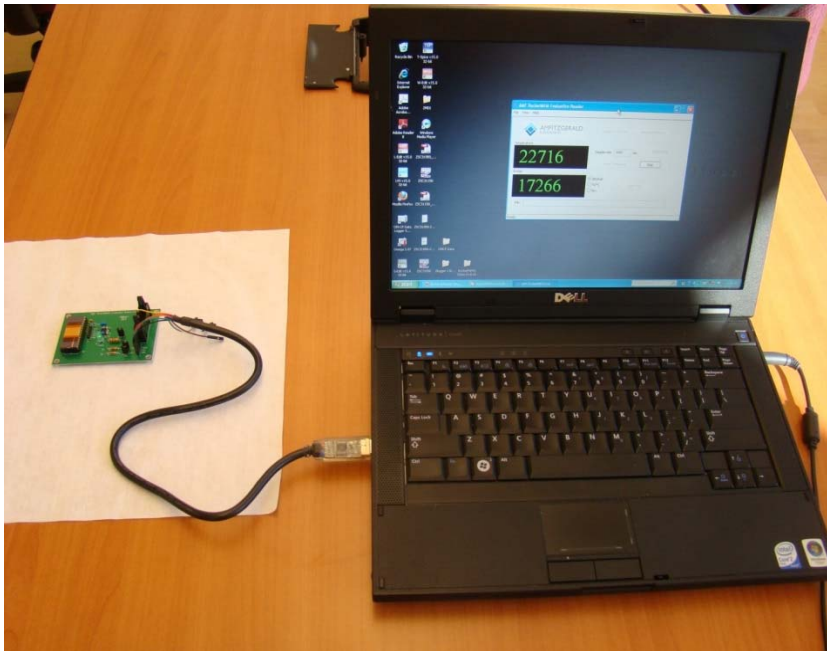
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Silex: the world leader in MEMS Manufacture



Accelerometers

Gyros

Pressure Sensors

Cantilevers

Touch Membranes

Flow Sensors

Filter Structures

CMOS Interposers

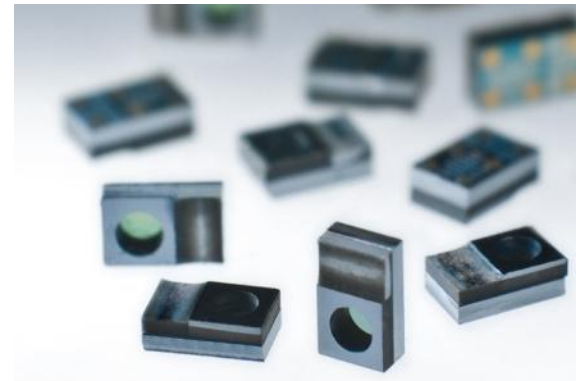
Needles

uBatteries

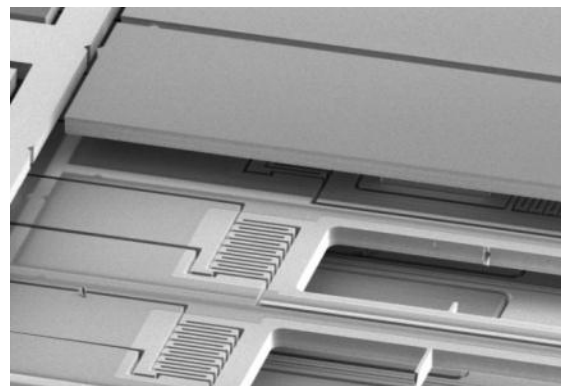
IR Sensors



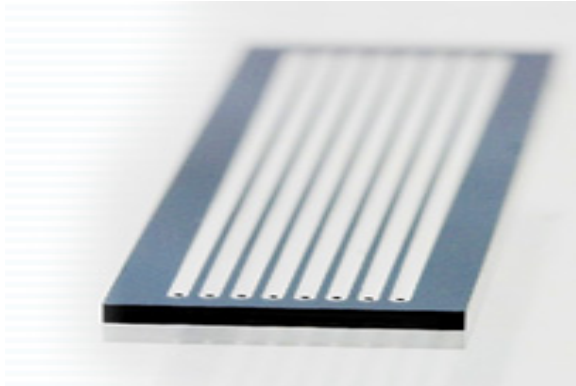
Pressure sensors for measuring blood pressure in coronary arteries



Microphones for mobile telephones



Mirrors for optical switching



Lab-on-chip for DNA analysis

Cell/DNA Analysis

Microphones

RF Switches

Lab-on-Chips

Print Heads

Drug Delivery Devices

Mirrors

Optical Benches

Oscillators

- Dedicated MEMS foundry with 12 years of volume MEMS production experience
 - Over 350 projects
 - Over 100 international customers
 - Work with over 50% of world's top 30 MEMS companies
- Bringing Innovation in Technology
 - Sil-Via® TSVs in consumer applications since 2006
 - Silicon interposers for all-silicon 2.5G packaging since 2006
 - Advanced wafer level packaging
 - Met-Via® Thick wafer metal TSVs since 2010
- Custom process integration to support the needs of MEMS innovators worldwide



AMFitzgerald Company Information

- **MEMS product development firm**
 - Global clientele
 - Over 125 clients served to date
 - Startups to Fortune 100 companies
- **Headquarters in Burlingame, California**
 - Silicon Valley, near SFO airport
- **Consistent growth since founding**
 - Founded in 2003
- **Active member of the MEMS Industry Group**

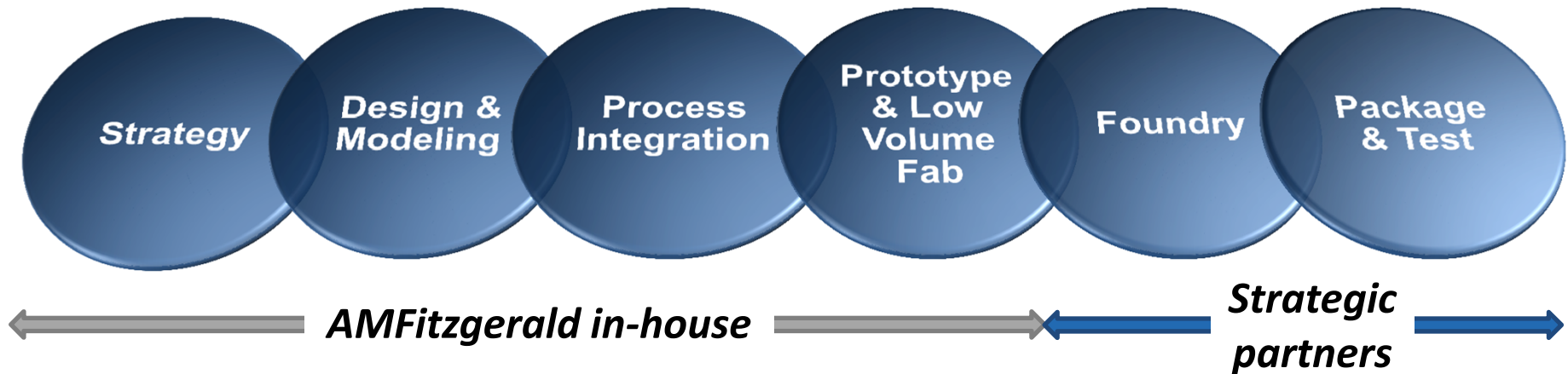


Headquarters in Burlingame, CA



AMFitzgerald: Your Partner in MEMS Product Development

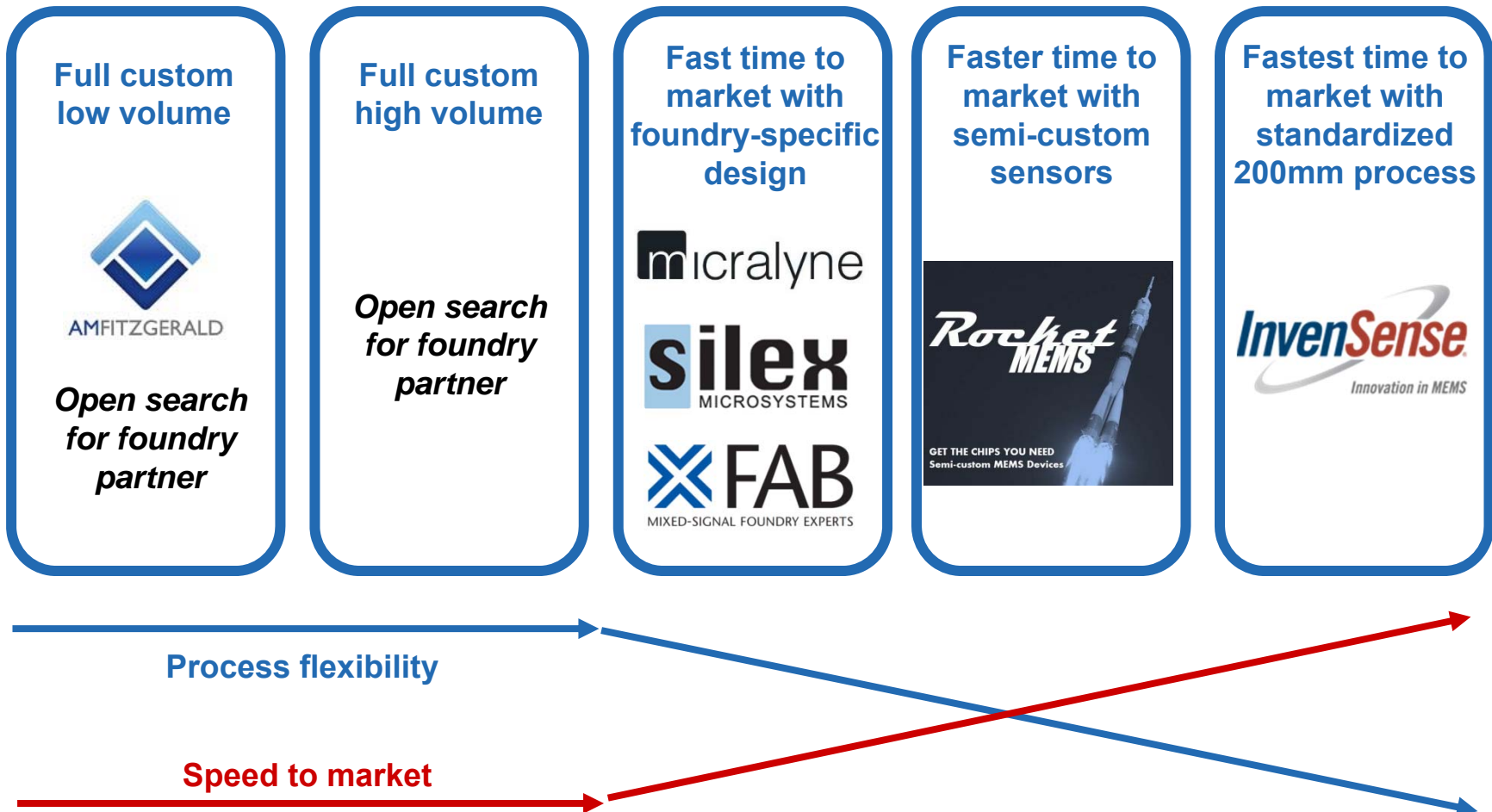
A complete supply chain from concept to production



- MEMS development from start to finish
- Multi-disciplinary, expert engineering team
- Design and process integration for volume production
- In-house prototype fabrication, easy transition to production partners

Production solutions

A menu to satisfy different customer needs





Semi-custom Silicon Pressure Sensors

- Reduced cost
- Reduced risk
- Reduced time to market
- Scalable production volumes

For Inquiries, Die Samples, Evaluation Kits

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