

Introduction to:

***Rocket
MEMS***

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GET THE CHIPS YOU NEED
Semi-custom MEMS Devices



AMFITZGERALD
& ASSOCIATES

Agenda

- ***RocketMEMS™***: What is it?
- Comparison to custom
- How ***RocketMEMS™*** works
- Features
- Moving forward & Next steps...



You need a pressure sensor.

Nothing on the market fits your needs.

You could:

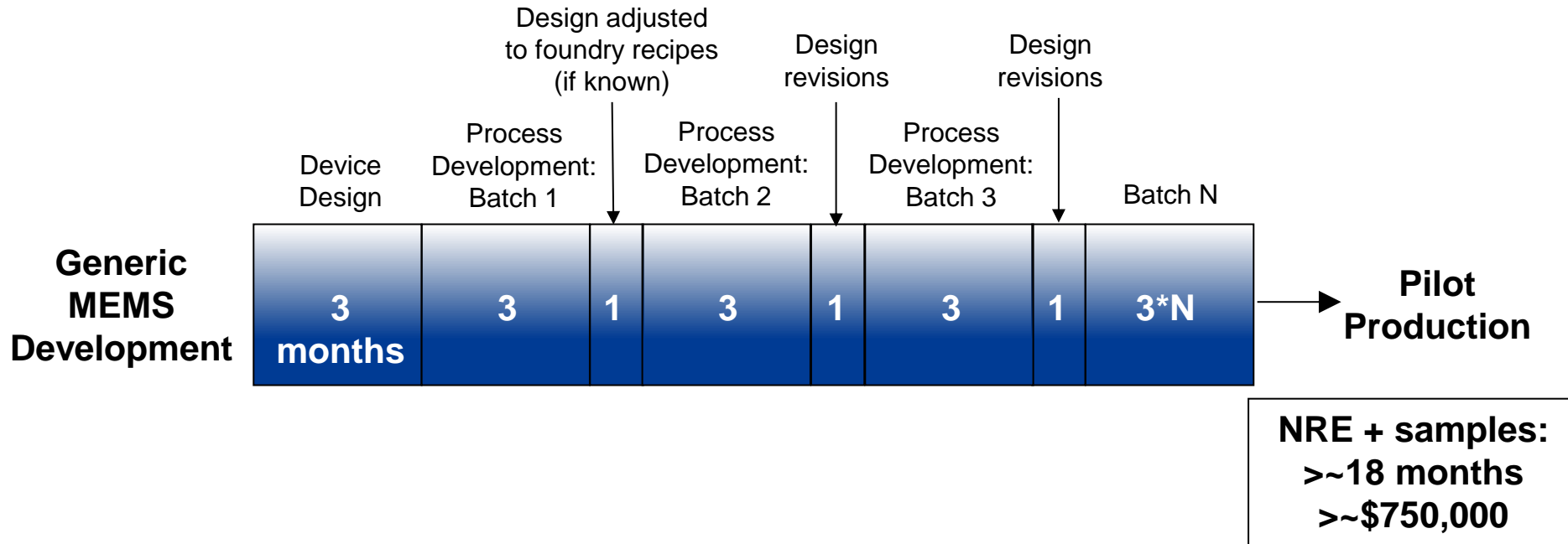
- Work with the sensor-that-doesn't-quite-fit**
- Develop a custom pressure sensor**
- Abandon the application**

The *RocketMEMS™* option

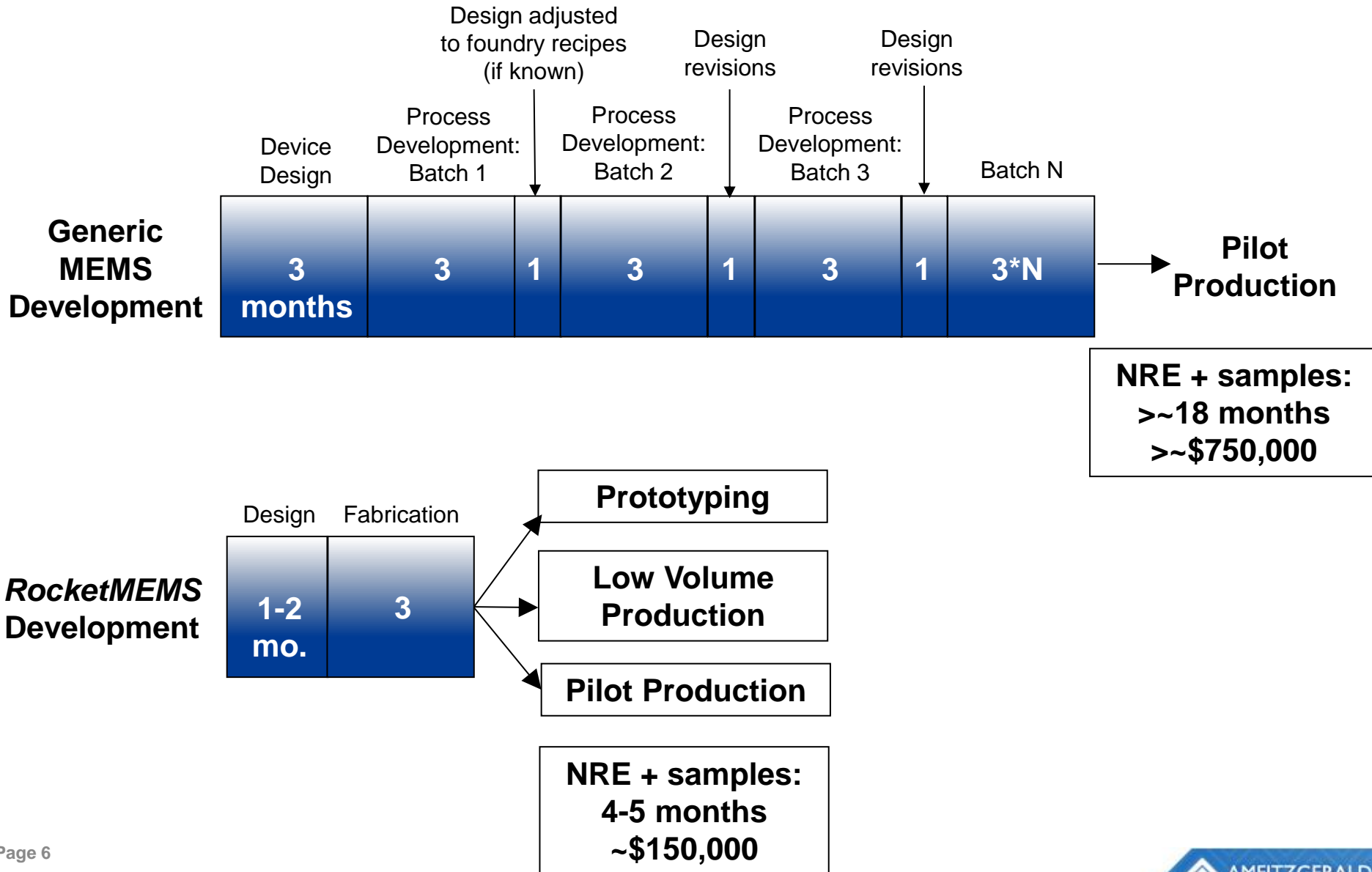
***RocketMEMS* delivers:**

- **Semi-custom silicon pressure sensors (bare die)**
- **Reduced cost**
- **Reduced time to market**
- **Reduced risk**
- **Pathway to large volume production**

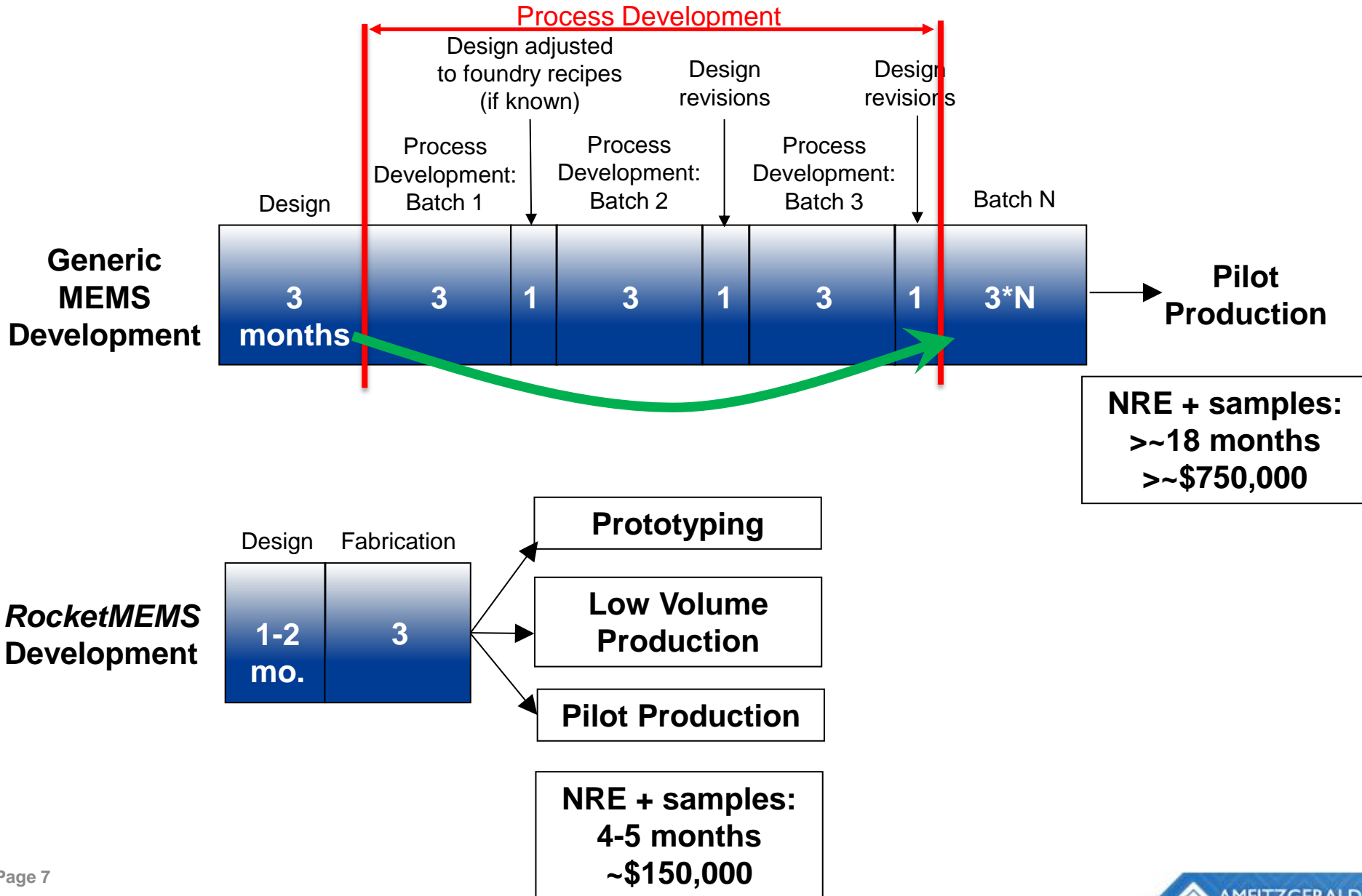
RocketMEMS vs. Custom development



RocketMEMS vs. Custom development



RocketMEMS vs. Custom development



RocketMEMS: Built on designer/foundry cooperation



+



Fixed, stable, established production process

- **True design for manufacture**
- **No process development**
- **Fully characterized production process**
- **ISO certified, qualified foundry**
- **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 & creep
 - High burst pressure
- **Silicon-on-Insulator (SOI) wafers**
 - Precise membrane thickness
 - Consistent uniformity from device-to-device, run-to-run
- **Piezoresistive sensor**
 - Well understood
 - High sensitivity
- **Simple Wheatstone bridge circuit**
 - Low cost readout electronics

What can be customized?

Customizable:

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

Not customizable:

- Very high or low resistances
- Very wide dynamic range
- Very high sensitivities
- Very low noise
 - i.e., decoupled from resistance

Range of performance specifications

	Medical	Consumer Electronics	Industrial or Aerospace
Pressure range, gauge or absolute (atm)	0.05 - 0.5 (38-380 mmHg)	0.1 – 2	0.1 – 10 (15-105 psi)
Resistor value (KΩ)	0.5 – 10	0.5 – 10	0.5 – 10
Edge length (mm)	1 – 4	0.5 – 4	0.33 – 6
Thickness (mm)	0.1 - 1	0.1 - 1	0.1 - 1

Please note: these are example specifications,
and not the boundaries of 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 Wristwatches Sports equipment	Hydraulic systems Fuel gauge HVAC systems Engine control Exhaust management Pitot tubes Monitors

Prototyping to high volume production

- Aggregate multiple designs on a run
- Can address rapid prototyping needs
 - 100+ devices
- Can address low-volume markets
 - 10,000+ devices/year
- ***RocketMEMS*** is a low-risk path to high volume production
 - > Millions of devices/year
 - Dedicated run at Silex Microsystems



“Design for Verified Process”

- **No process development**
- **Other processes**
- **Other devices**



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**
 - **on tape or in gel packs**

Options: Readout electronics, ASIC, Packaging:

- **We can offer support and recommendations**

Pricing

Create Design + First Batch	Price
250 chips	\$150,000
1000 chips	\$200,000
More?	Please inquire

Fabricate Existing Design	Price
Pricing depends on number of chips and chip size	\$5-\$30/chip

Silex: the world leader in MEMS Manufacture

Accelerometers

Gyros

Pressure Sensors

Cantilevers

Touch Membranes

Flow Sensors

Filter Structures

CMOS Interposers

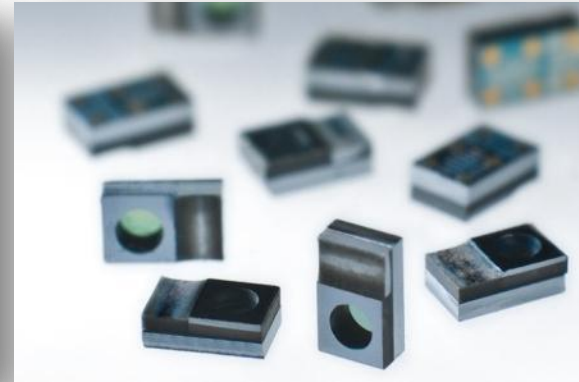
Needles

uBatteries

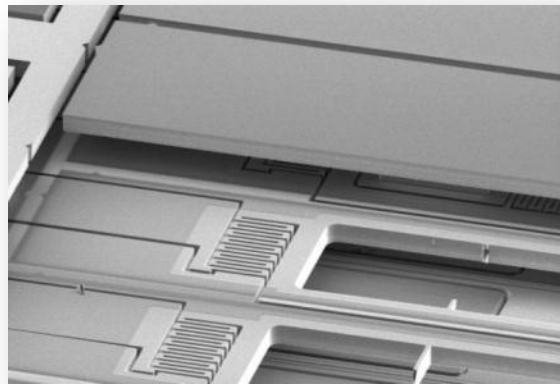
IR Sensors



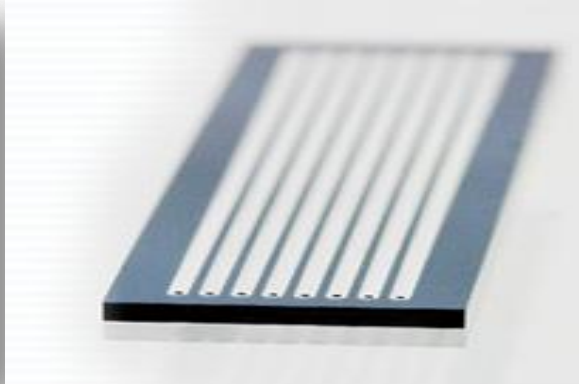
Pressure sensors for measuring blood pressure in coronary arteries



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 background

- **MEMS product development firm with global clientele**
- **Founded 2003 – 10th Anniversary!**
- **Burlingame, CA: in Silicon Valley, near SFO airport**
- **Consistent growth**
 - **Over 110 clients served to date, startups to Fortune 100 companies**
- **Active member of the MEMS Industry Group**



Headquarters in Burlingame, CA

For more information...

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