

SIXTEENTH ANNUAL

BiTS™

Burn-in & Test Strategies Workshop

March 15 - 18, 2015

Hilton Phoenix / Mesa Hotel
Mesa, Arizona



Archive – Session 1

Session 1

Marc Mössinger
Session Chair

BiTS Workshop 2015 Schedule

Frontiers Day

Monday March 16 10:30 am

Putting MEMS to the Test

"Taking MEMS Test and Calibration to the Next Level' - An Integrated Platform Approach Driving Further MEMS Growth"

John Rychcik - Xcerra Corporation

"The Target for Consumer MEMS Testing Should Be Under 1 Cent Level"

Vesa Henttonen - Afore Oy

"MEMS IC Manufacturing Test Cost Effective Strategies"

Wendy Chen & Andrei Berar - KYEC

"BURst Pressure (BURP) Stress Test for MEMS Pressure Sensors"

Peter Jones & Ray Sessego - Freescale Semiconductor

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MEMS IC Manufacturing Test Cost Effective Strategies

Wendy Chen & Andrei Berar
KYEC



2015 BiTS Workshop
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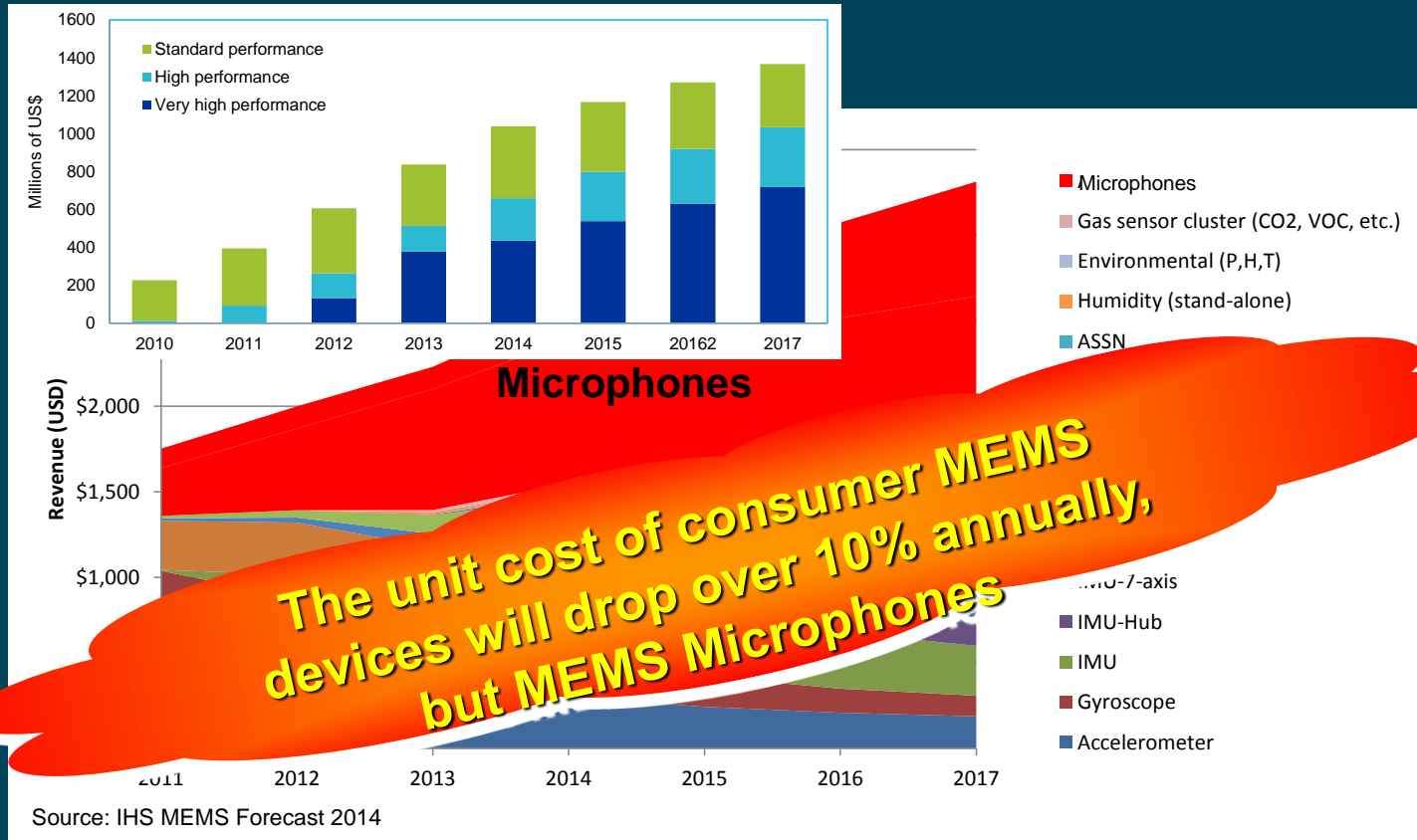
Content

- Market needs
- Change? New Concept, New Strategy
- The learning curve
- Summary

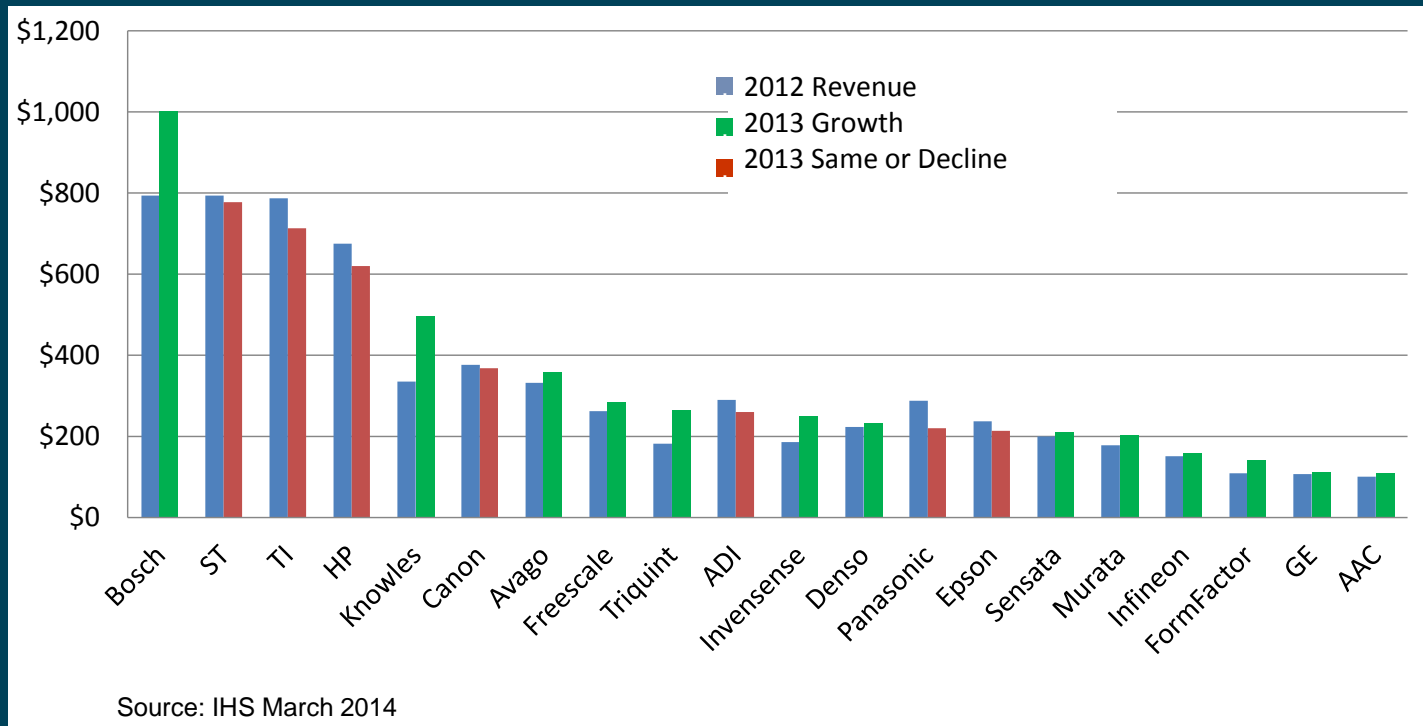


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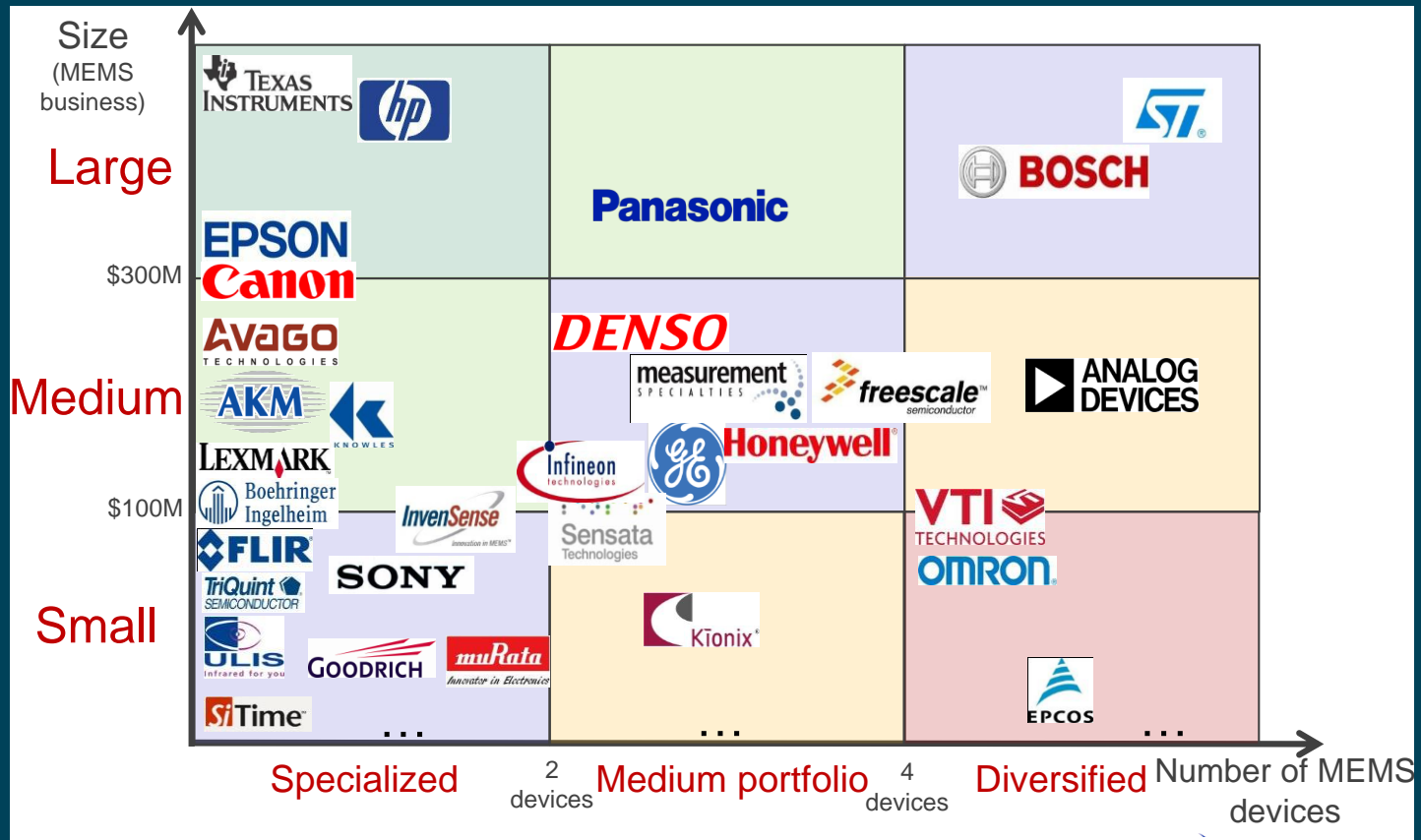
Consumer MEMS TAM



2013 Top 20 MEMS Suppliers



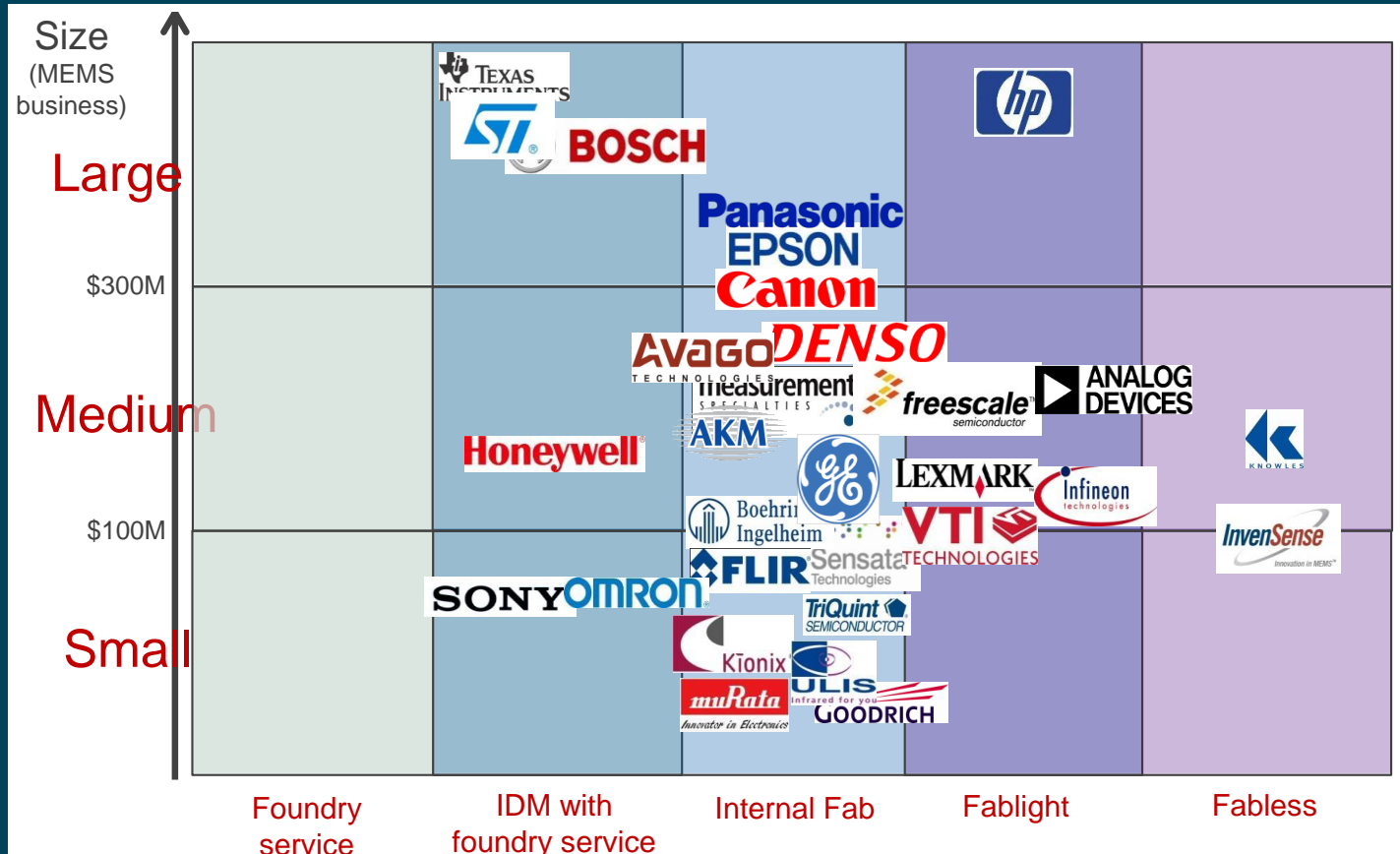
MEMS Business Portfolio



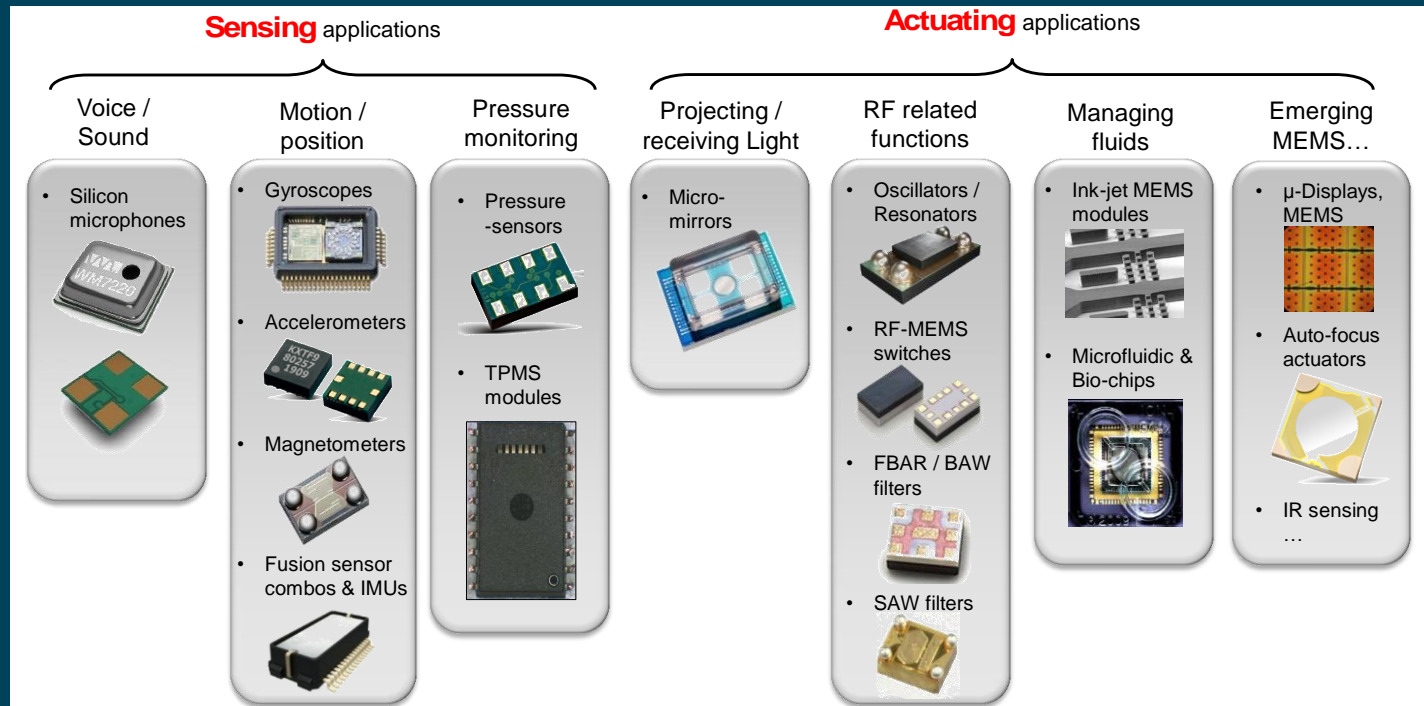
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Putting MEMS to the Test - Testing MEMS Devices

MEMS Business Model



MEMS – Sensors & Actuators

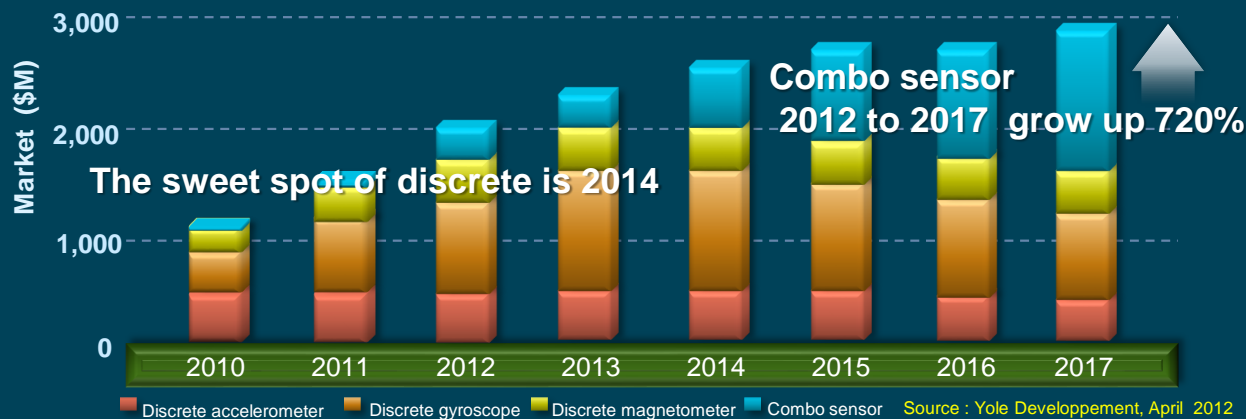


One Device – One Process - One package – One Test System

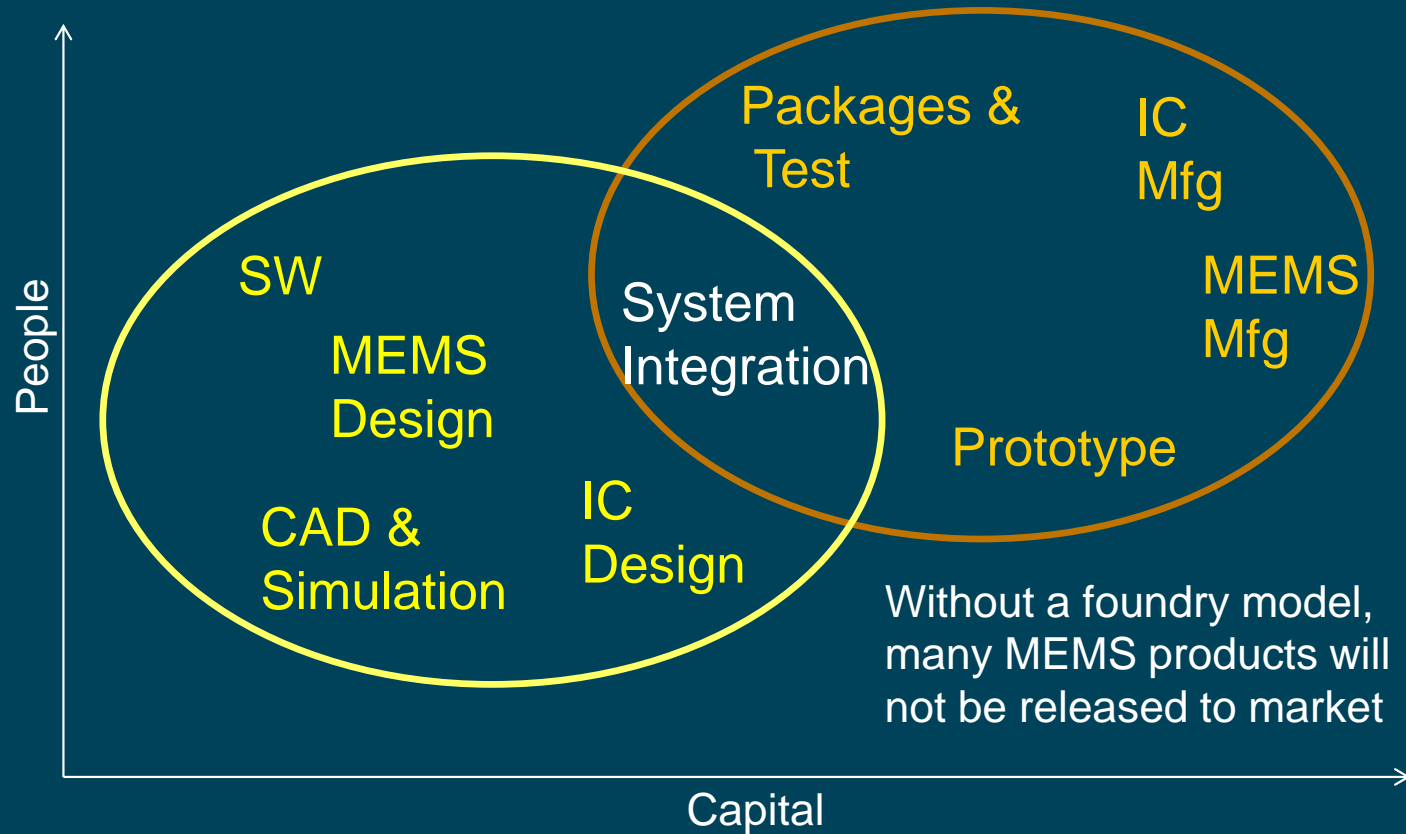
Test Cost to Support the ASP

- Extend test **Capacity** still making **Profit** ?
- Decide the **Investment** to reduce **Risk** ?
- Define a test strategy to test **Combo sensor** with **Multiplex Physical Stimulations**?

2010-2017 MEMS consumer motion sensor market (US\$M)

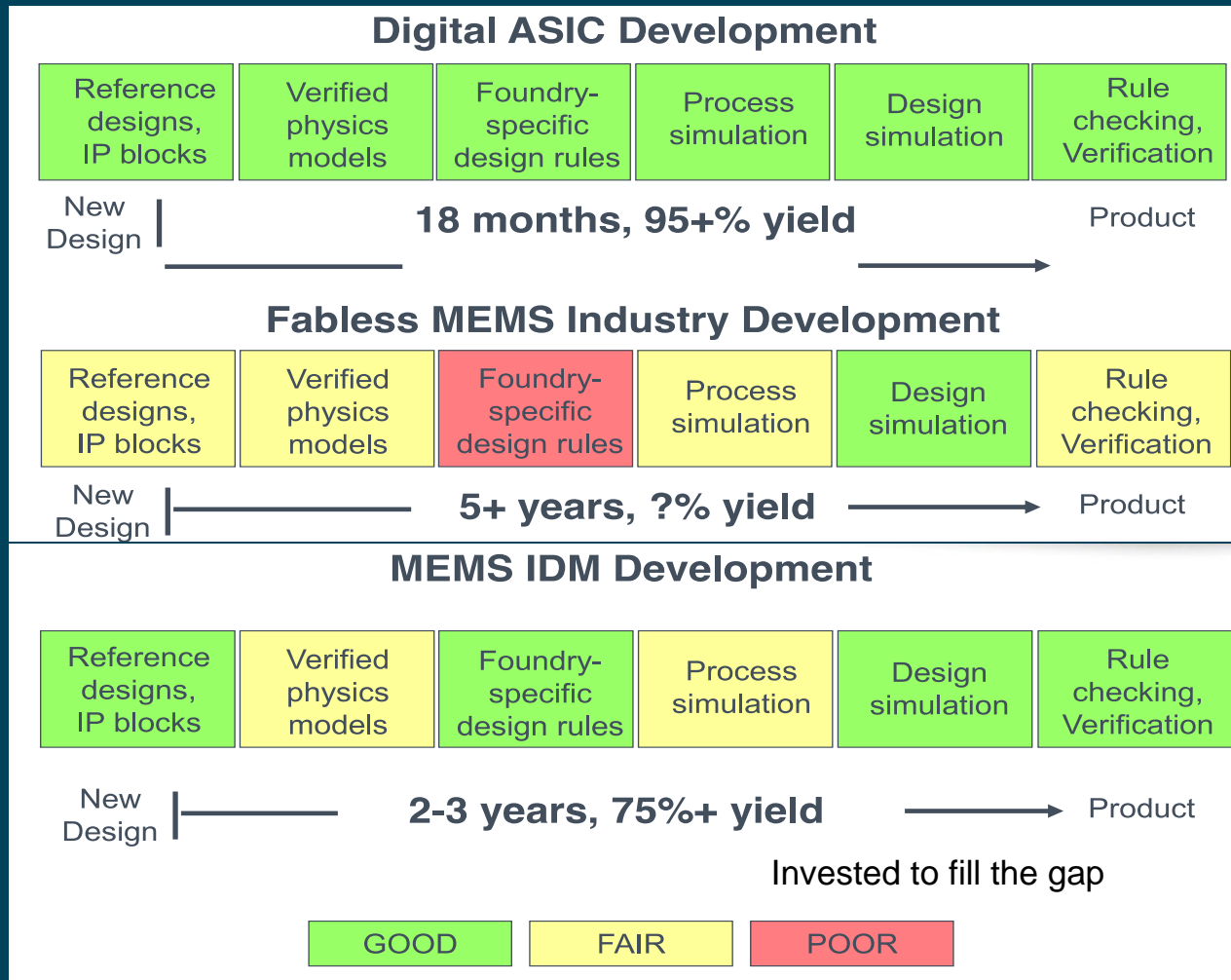


MEMS Foundry Model



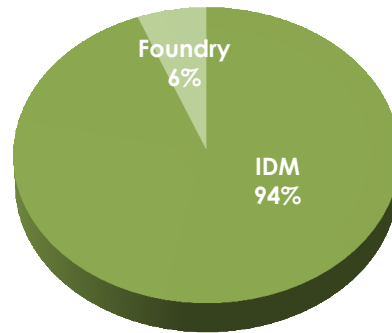
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Putting MEMS to the Test - Testing MEMS Devices



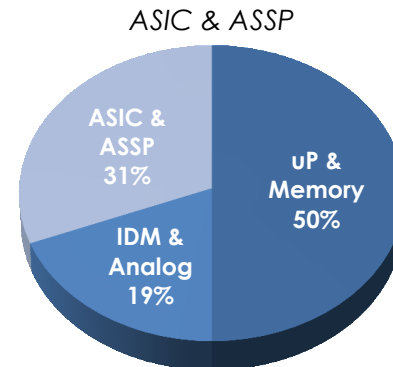
Changing the Model

Fabless Still Lags in the MEMS Space



- **Paradigm is extensive customization**
 - No standard processes
 - Limited CAD/EDA
 - No scalability of design
 - No multi-fab support
 - Custom package & test
 - Esoteric design expertise

Fabless Dominates in the IC Space



- **Leverages extensive standardization**
 - Processes
 - Sophisticated CAD/EDA
 - Scalable designs
 - Single Design – Multiple Fabs
 - OSAT Infrastructure
 - Widespread design expertise



Transfer Investment Risk

IDM and Design company started to outsource test requirements to Test Sub-Con to reduce investment risk.

The Cost of Testing Equipment

10 DOF

3,000,000US\$

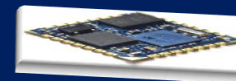


Depreciation 3years, OEE= 70%
Charge of testing 115.7 US\$ / hrs.

The Test cost of 10 DOF unit

- Test budget < 5% of ASP
- Drop 10%/ year

1.2US\$



Addressing the MEMS Testing Market

Market driving and Customer demand

- MEMS integrate CMOS process or 3DS which open a new manufacturing prediction.
- Lower test cost and Large flexible capacity requirements.

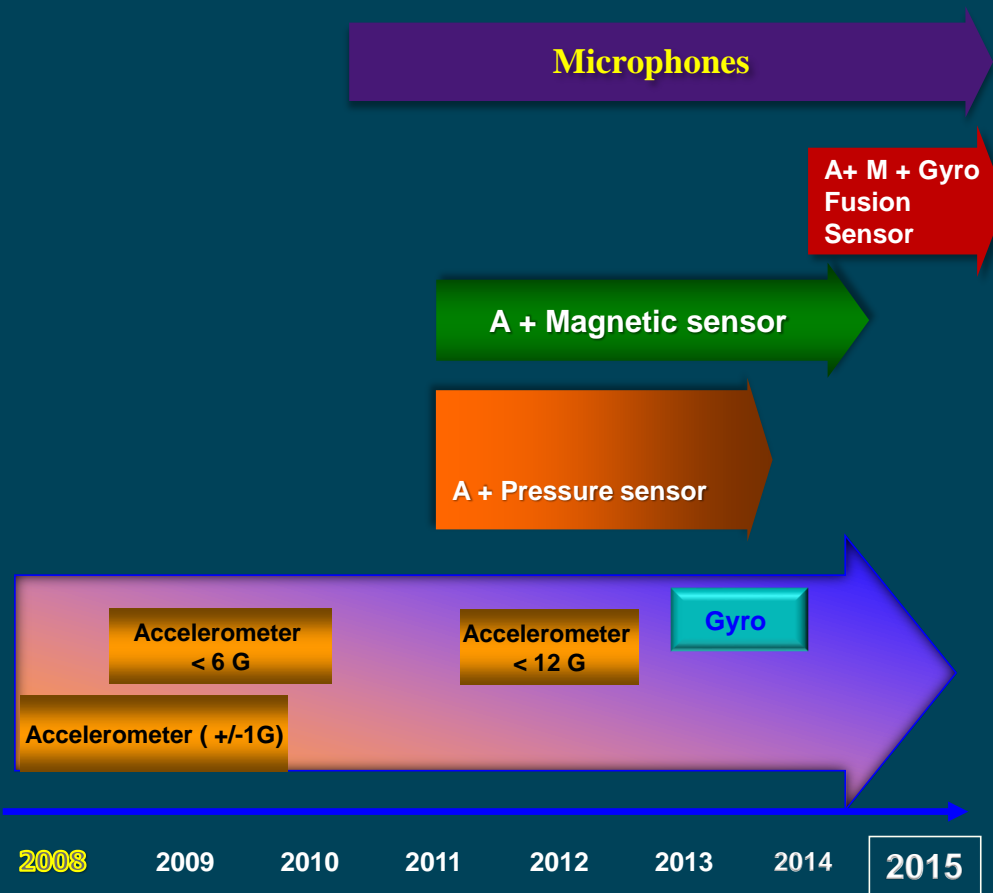
KYEC Strength

- **Fully utilize facilities.**
8” prober capacity could supply MEMS wafer probing to solve increasing ratio of 12” to 8” prober.

- **Good experiences on SOC testing.**

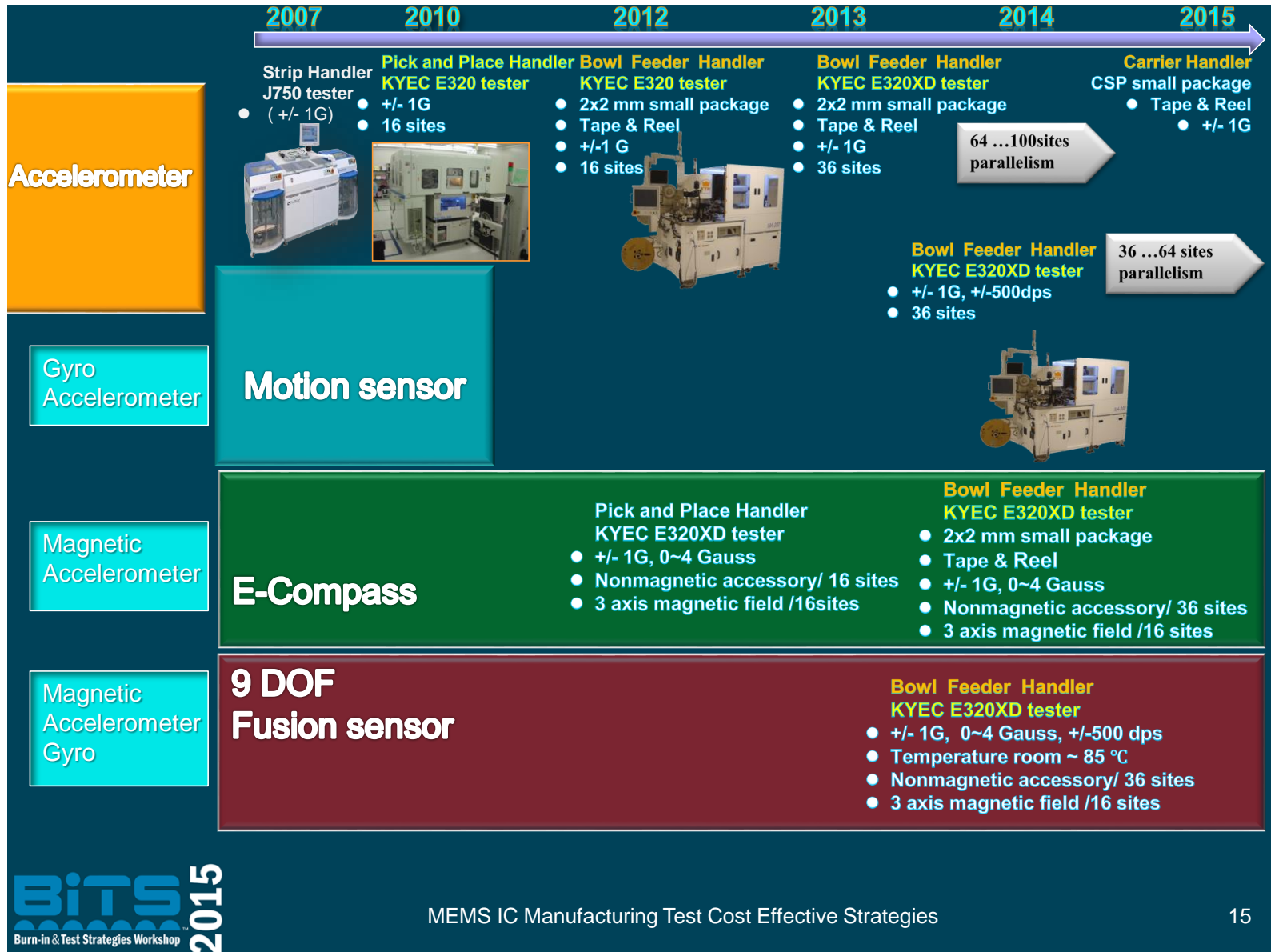
The trend of MEMS devices testing was similar to image sensor testing. KYEC is number one image sensor testing service provider. We could copy success model.

Executed Roadmap

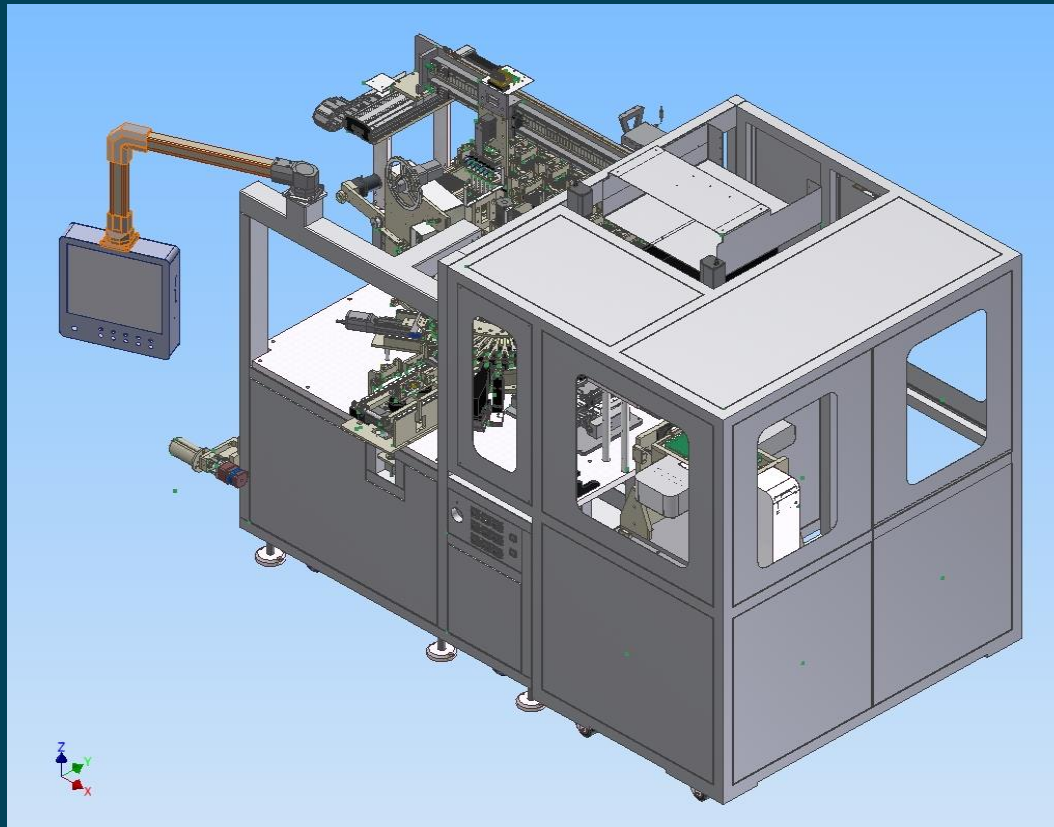


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Putting MEMS to the Test - Testing MEMS Devices

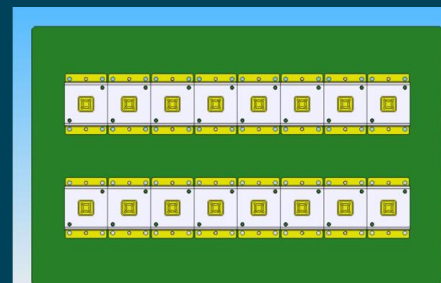
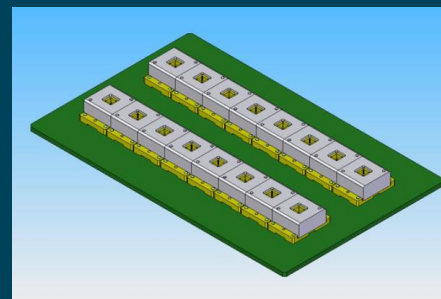
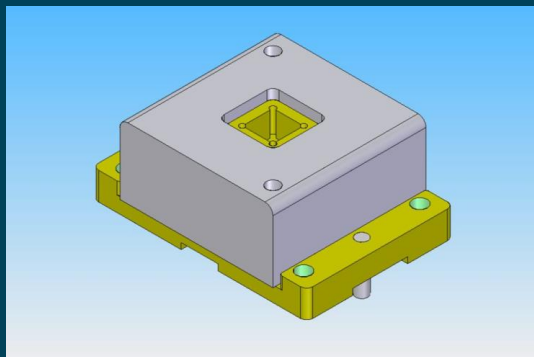
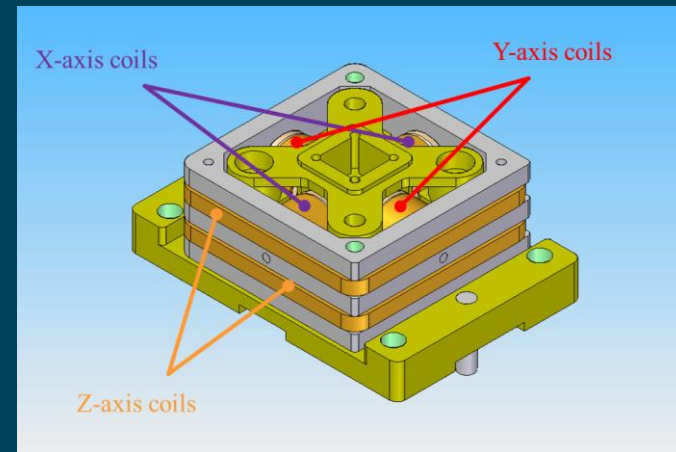


WLCSP Accelerometer Testing



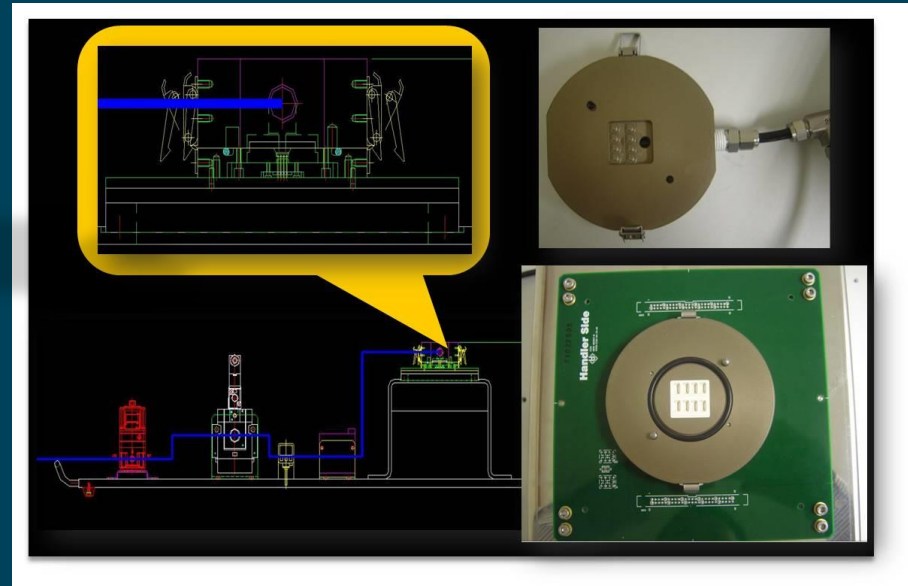
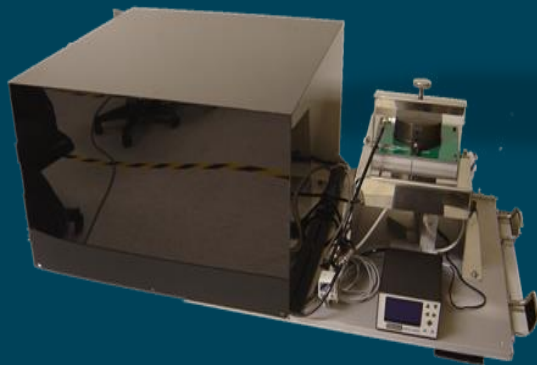
MEMS Magnetic Sensor Test Solution

- Magnetic fields are generated inside each socket by 3 independent Helmholtz pair coils (on X, Y, Z axis)
- The shielding around each socket stops external magnetic fields from entering the device area, while keeping the generated magnetic fields inside the area



MEMS Pressure Sensor Test Solution

- Testing environment including the vacuum chamber and the pressure control system. The vacuum chamber can produce pressure from -100 kPa to 600 kPa with the resolution of 0.1 kPa.
- PLCC and WLCSP two type of test socket had been developed.



MEMS Microphones Test Solutions

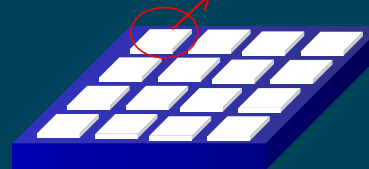
Pick & Place handler solution

- KYEC design Chamber and Kit
- Tester conign by customer

Chamber & Kit



Mini socket with chamber



Pick & Place handler solution

- KYEC design Chamber and Kit
- KYEC E320 Tester + PXI module
- 4 sites parallelism

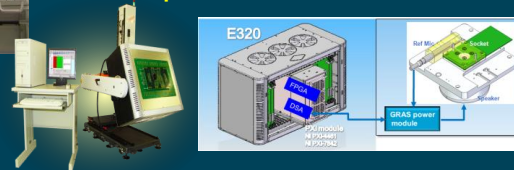
Test capability

- ✓ Digital and Analog MEMS Microphone
- ✓ Package size < 3x3 mm
- ✓ High SPL 130dB,
- ✓ Frequency range 10HZ~20KHZ
- ✓ S/N > 60 dB

Tester

Test capability

- ✓ Digital MEMS Microphone
- ✓ Package size > 3x3 mm
- ✓ High SPL 94dB,
- ✓ Frequency range 100HZ~6KHZ



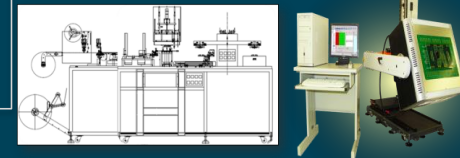
Handler

Test capability

- ✓ Digital and Analog MEMS Microphone
- ✓ Package size > 3x3 mm
- ✓ High SPL 120dB,
- ✓ Frequency range 100HZ~10KHZ

Superior handler solution

- Input : Bowl feeder / Tube
- Output : Tape & Reel
- KYEC design Chamber and Kit
- KYEC E320 Tester + PXI module
- 16 sites parallelism



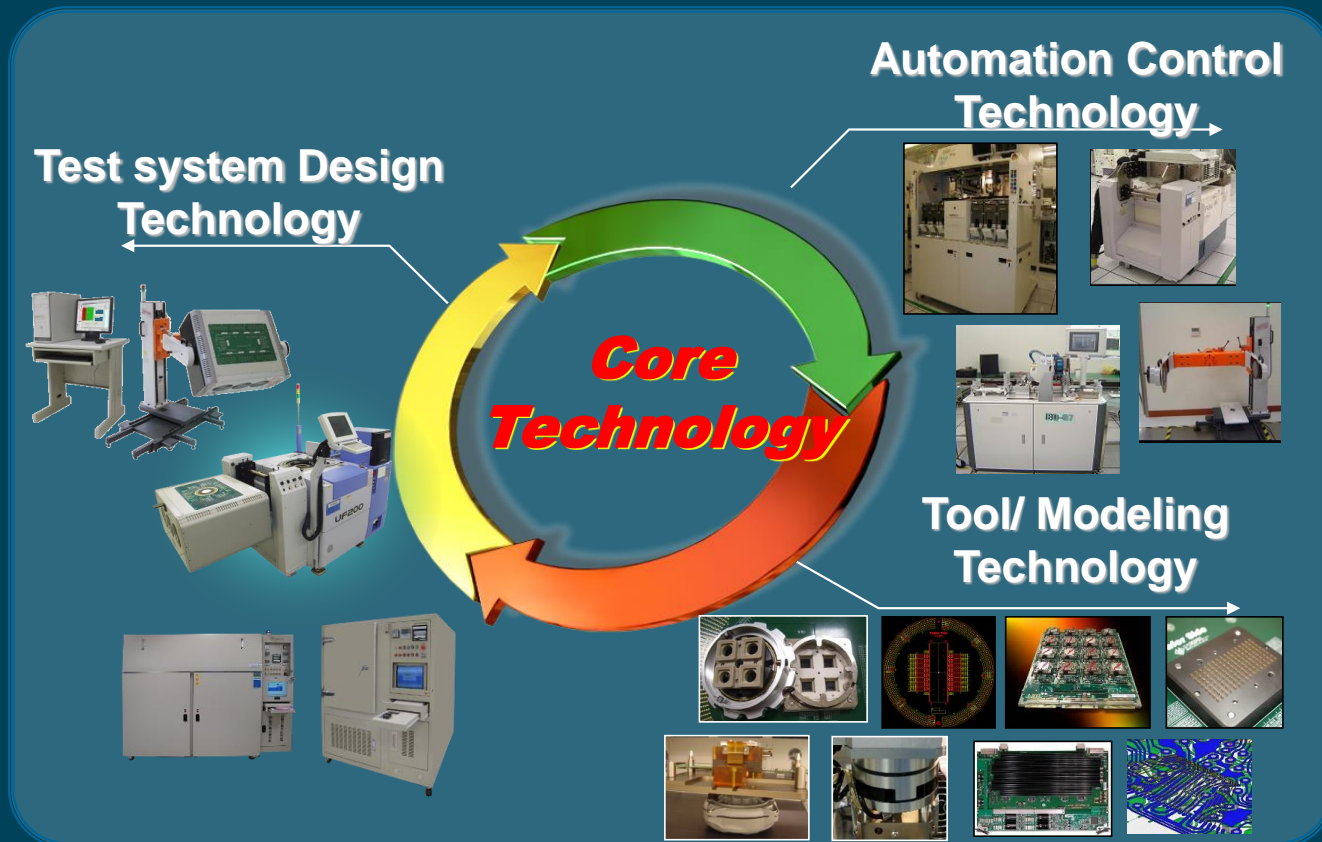
Sharing Capacity for MEMS testing

Sharing capacity of test equipment between MEMS devices and semiconductor IC

- Reduce risk of investment
- Share the testing resource (facilities, technology..)



KYEC's Contribution



Summary

MEMS revolution is coming

- Cost Down Force Supply Chain Model Change.
- The Innovation of Design and Process Benefit Test Cost Reduction.
- Changes and Challenges open new windows of Opportunities