Low-pressure MEMS Sensors;

the next generation of accuracy, stability and performance

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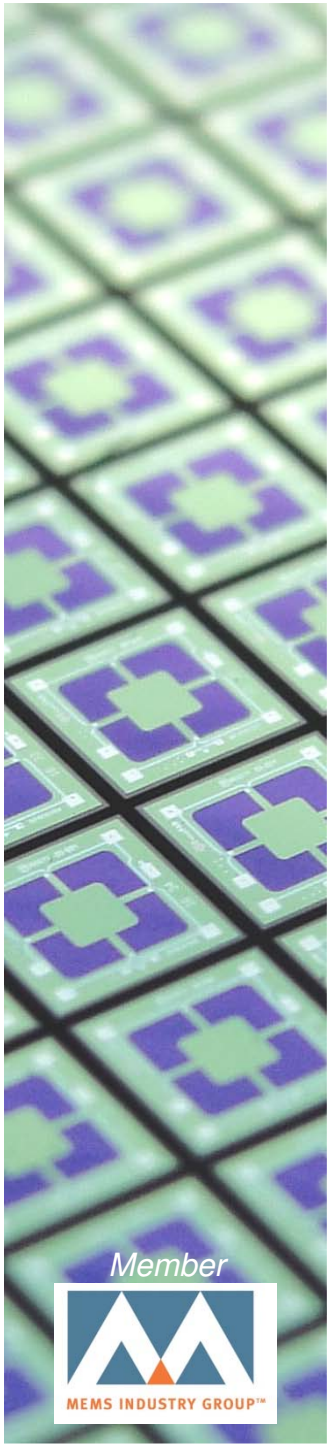
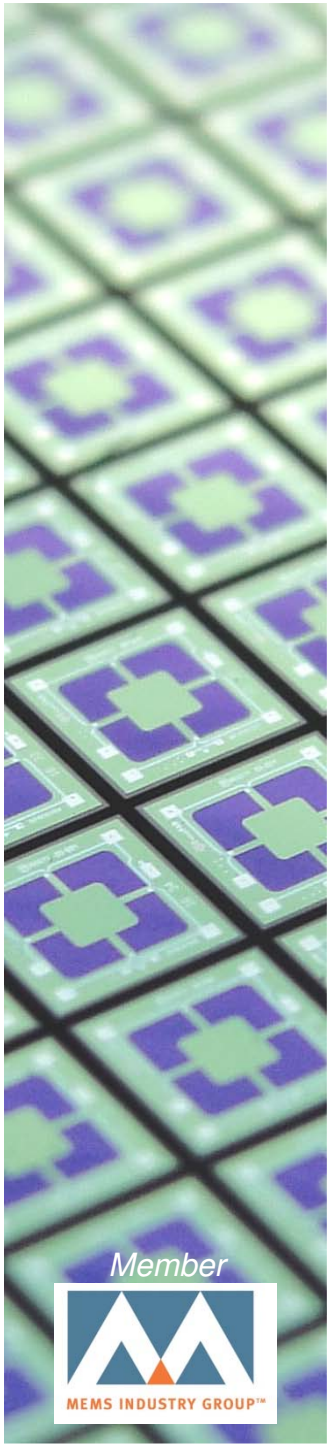
Introduction

- Focus on performance
- Comparison to typical parts
  - 2.5 mbar FS with 0.5% zero-stability
  - up to 40X more stable zero
  - MEMS technology applied to achieve accuracy
- Enable new markets
  - drift
  - resolution
  - Accuracy
- Overcome limits in existing applications
- System level component

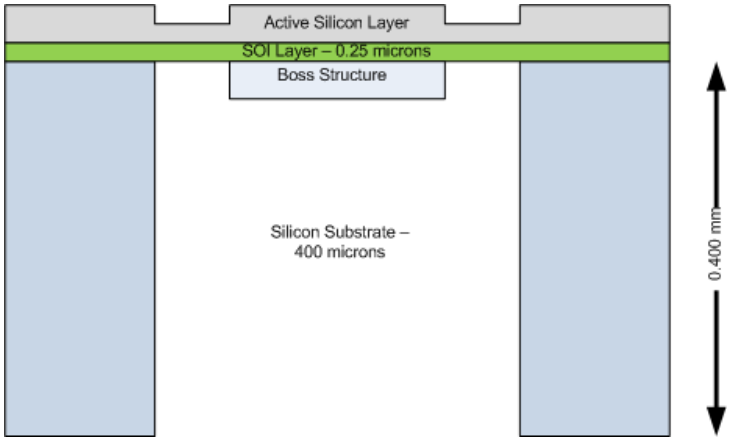


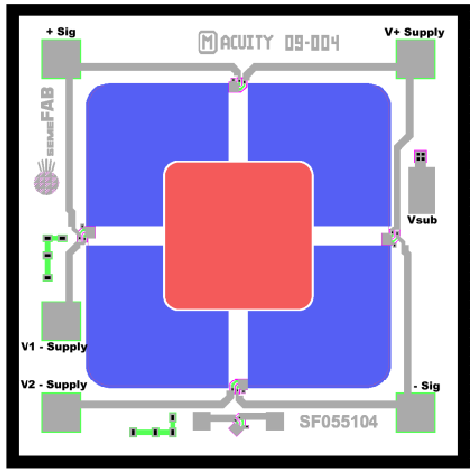
Product strategy

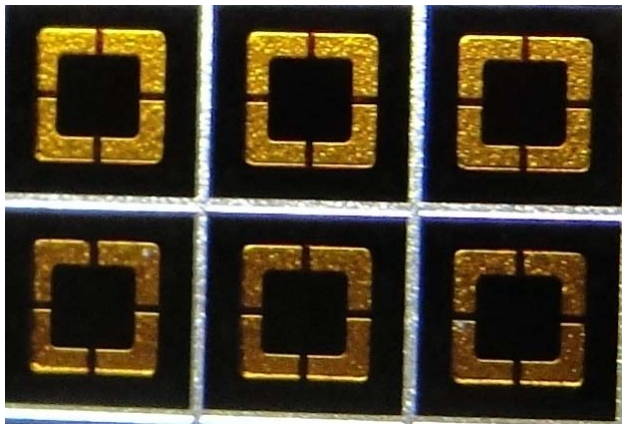
- value added performance at customer and system level
- not just reduction in manufacturing cost
- MEMS components trend toward lower percentage of system cost
- Addresses growth of high-value niche system level markets

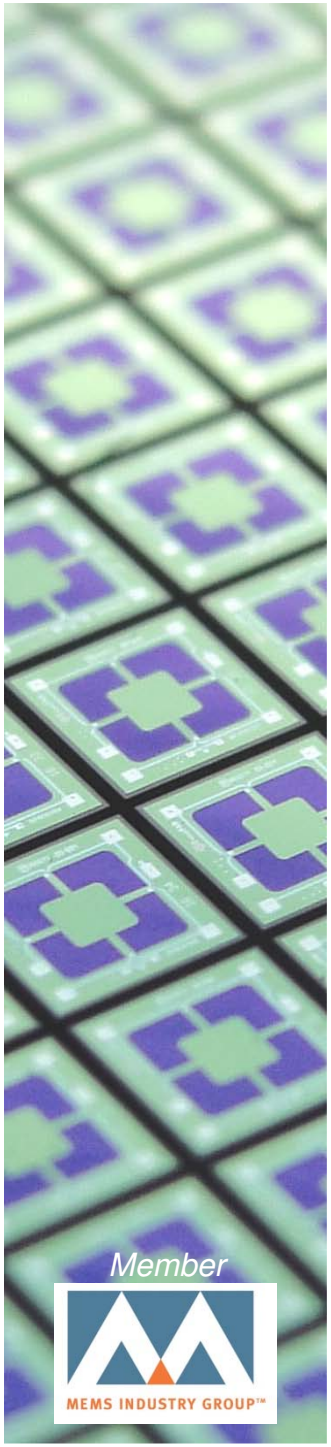


Cross-Section

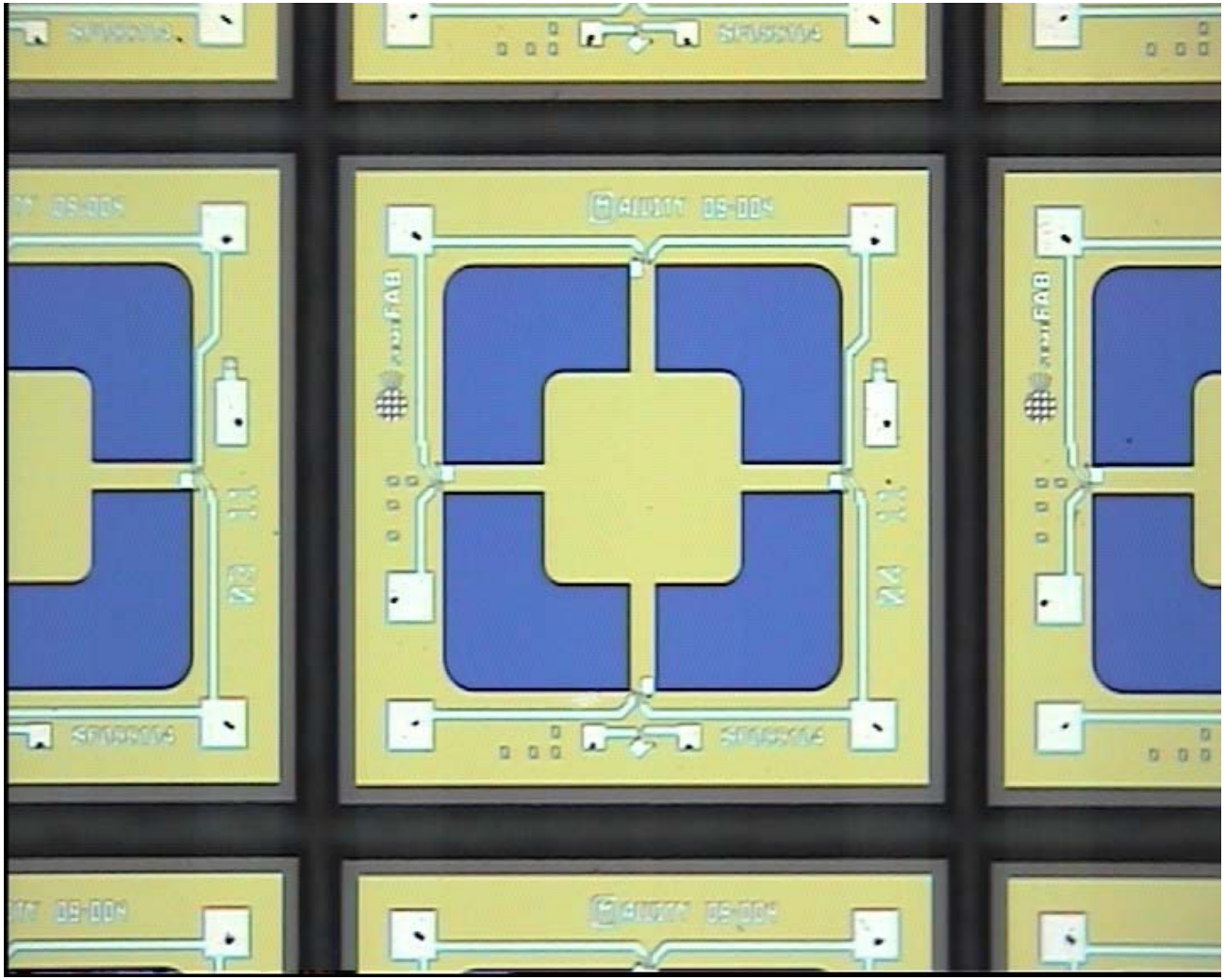


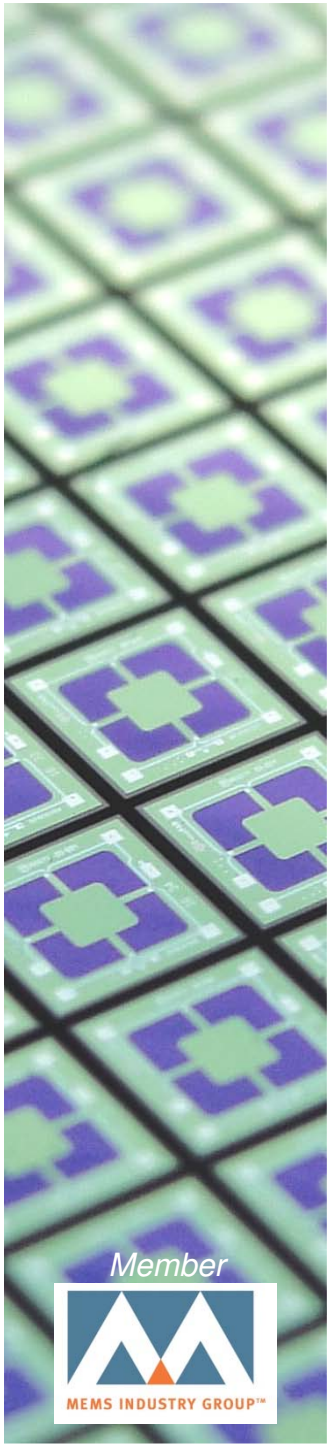






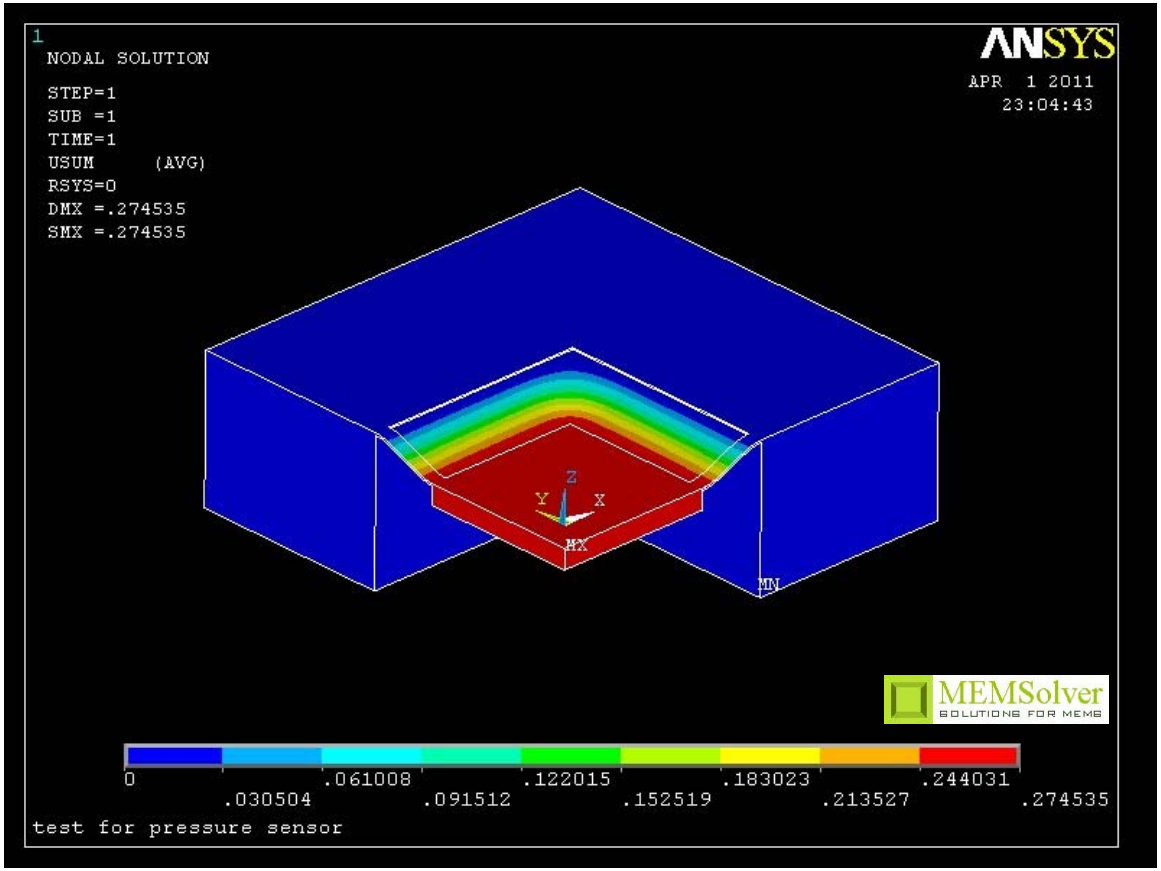
Micro-Photograph



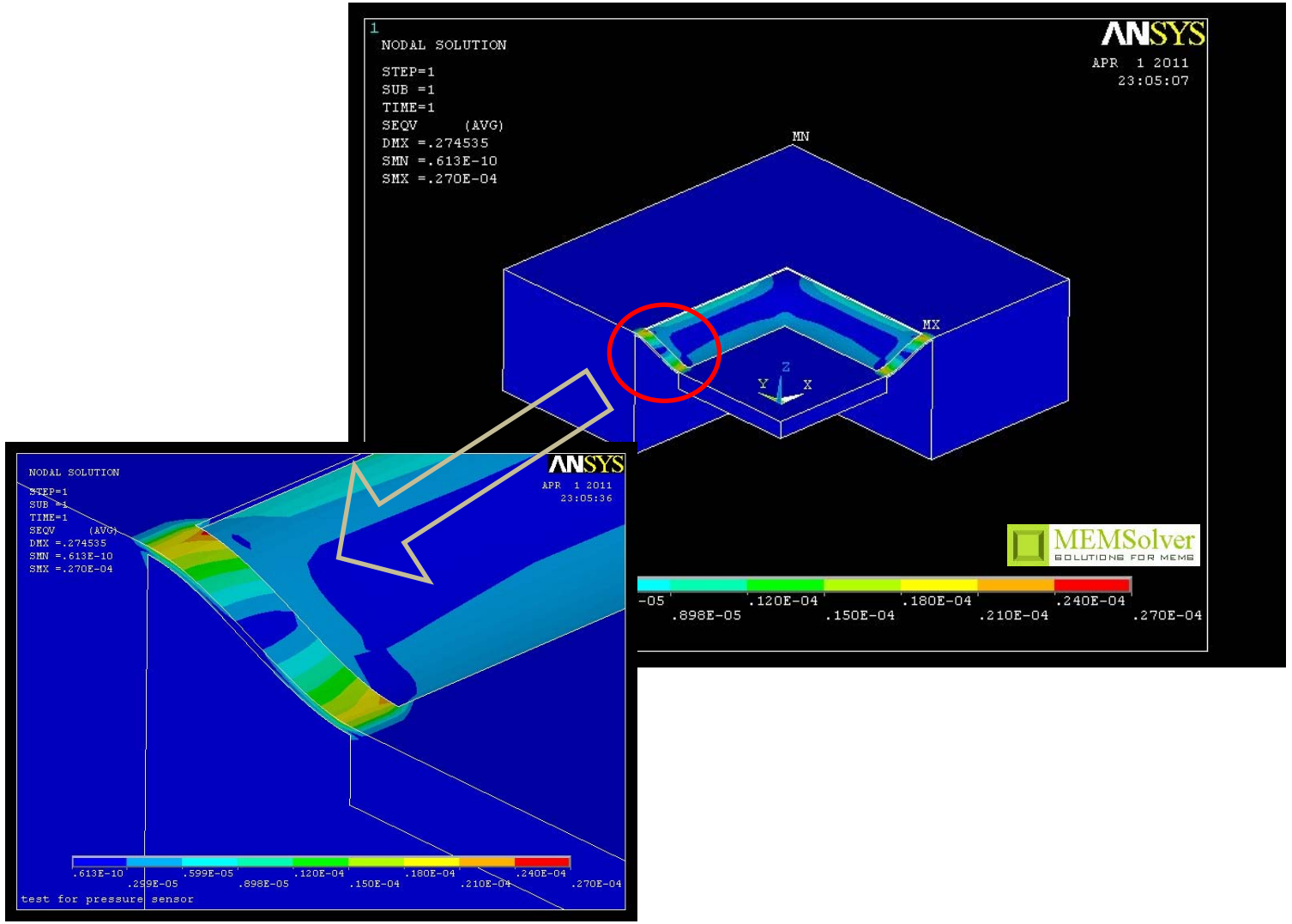


Stress Model of AC3050

- Displacement with 6.6 mBar applied



Von Mises Stress in AC3050



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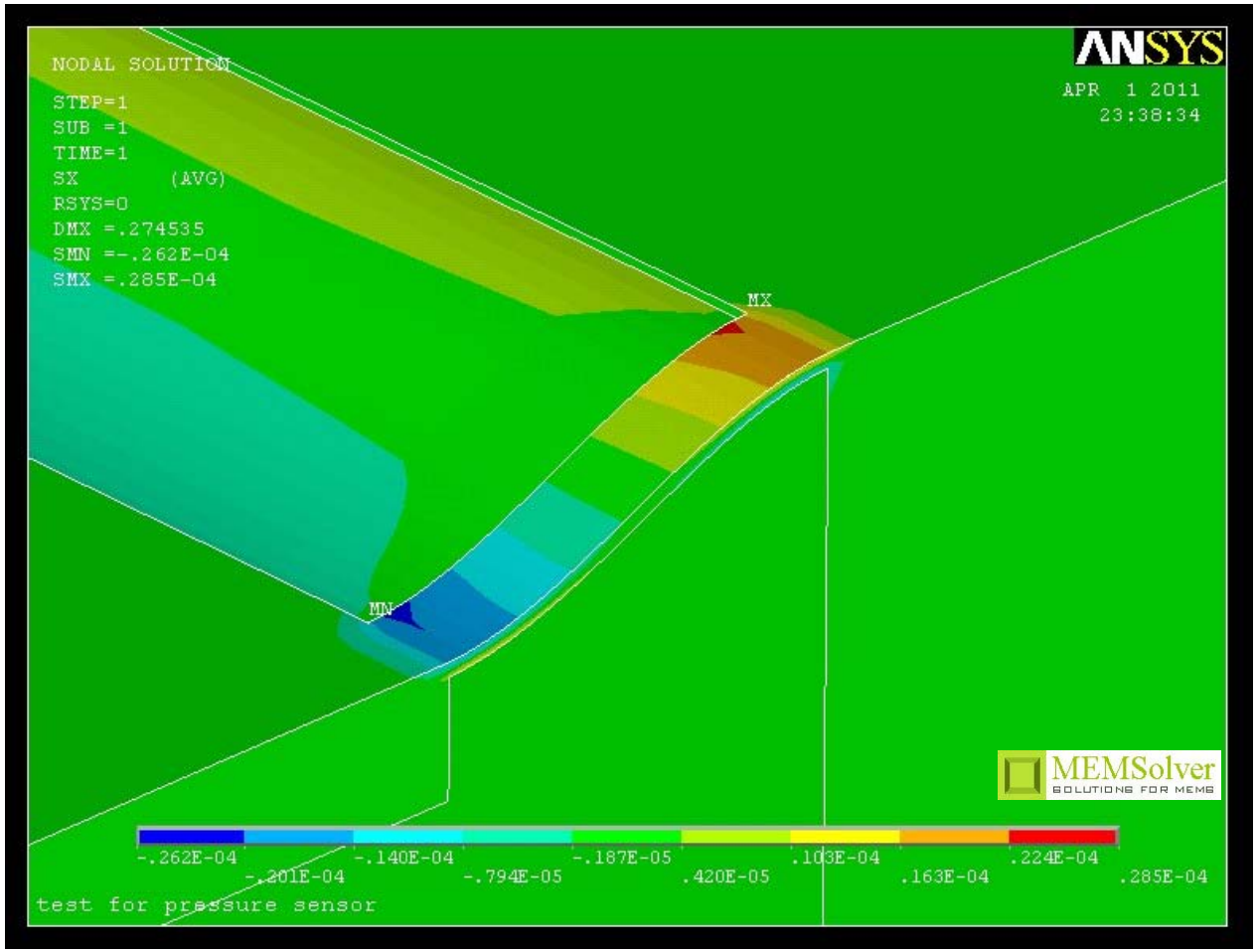
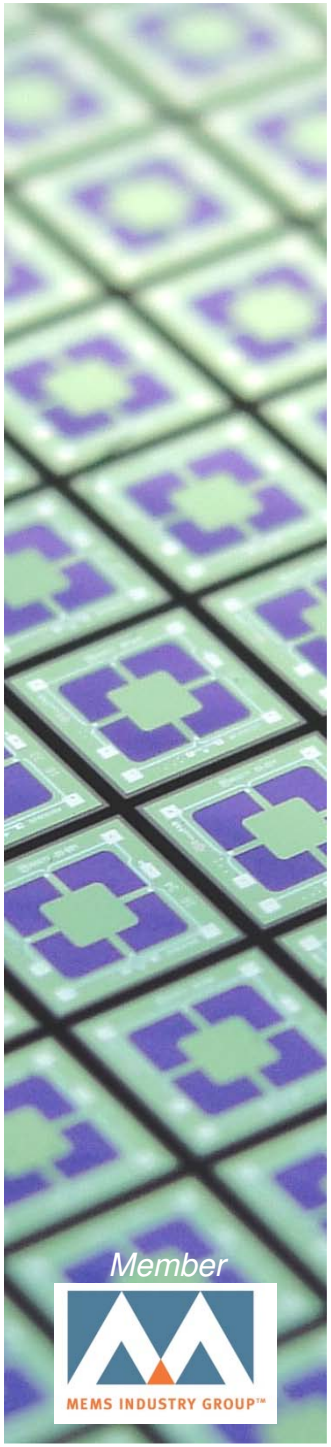
Close-up of X-Stress



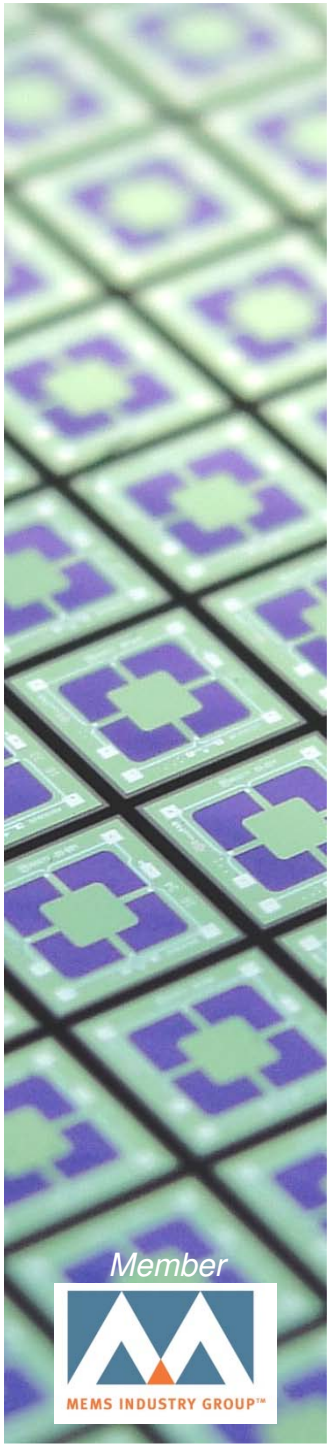
Performance Improvements

- Zero stability
- Product uniformity -- eliminate "flyers"
- Reduced position sensitivity
- Reduced moisture and ion sensitivity



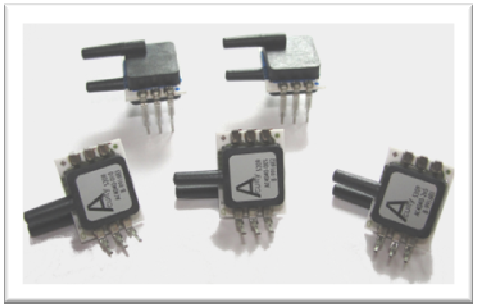
Structural Improvements

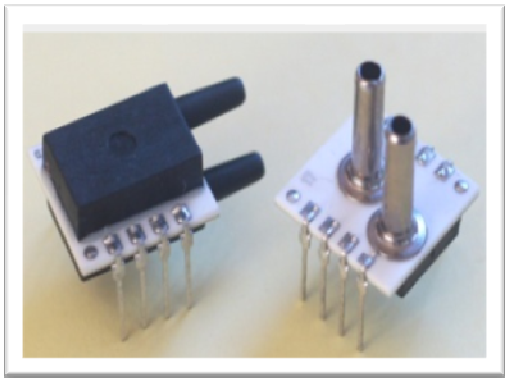
- Mechanical stress amplification
  - 20 to 40X increase in signal for pressure stress
  - Reduces relative parasitic stress
- Fully dry process
  - Stable sense resistors and surface
- Vertical walls
  - Top/ bottom symmetry
  - Parasitic stress isolation
  - Improves diaphragm to area ratio / package and substrate stress
- Elimination of edge fractures and stress initiation points
  - Long term drift
  - Die size / package and substrate stress
- Eliminates glass constraint
  - Amorphous material / drift
  - Die height / assembly
  - Edge stress / fracture

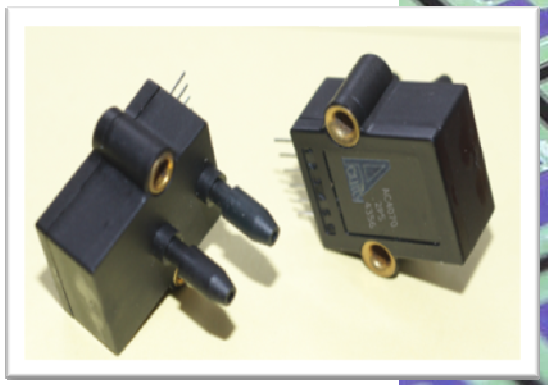


Typical First Level Packages

- OEM system components
- Fully calibrated, amplified, digital outputs







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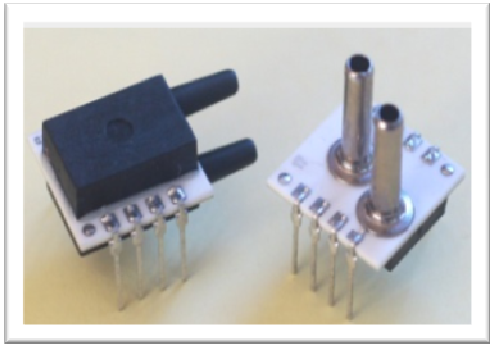
Application Example – Industrial Monitoring

- Closed loop control of material and gas flow
- Determining trends instead of limit switches -- predictive systems
- Stable zero separates pressure trends from zero drift



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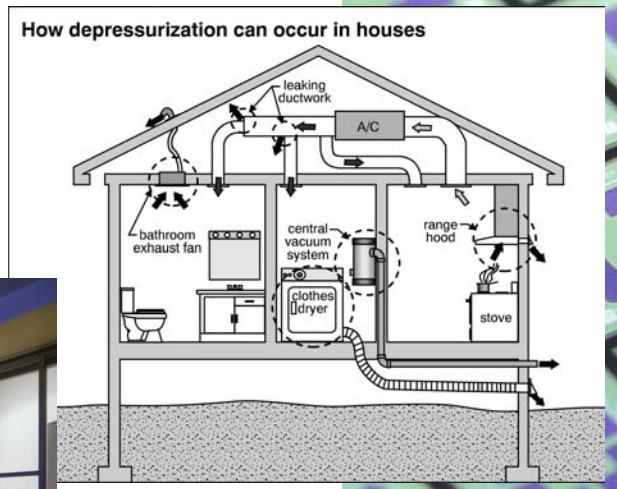
Application Example – HVAC and Air-handling

- Adequate ventilation
- Energy conservation -- equalizing pressure between rooms
- Control of air-delivery
- Filter monitoring



Application Example – Medical Respiration

- Sleep apnea monitoring, respiration, inhalation
- Stable zero, no recalibration
- Remote modules -- patient mobility
- Home use, cost savings

Summary

- Next generation focus on performance
- MEMS manufacturing a tool to achieve performance
- Addresses growth of high-value niche system level markets