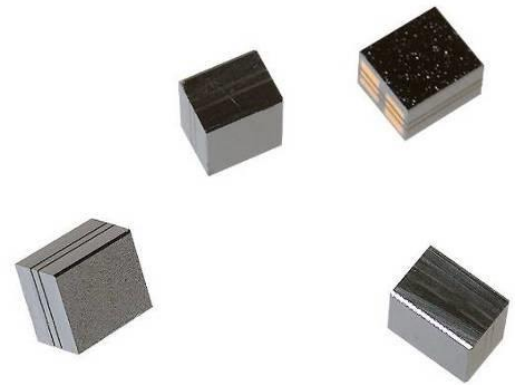


## Measuring of Acceleration, Inclination and Vibration:

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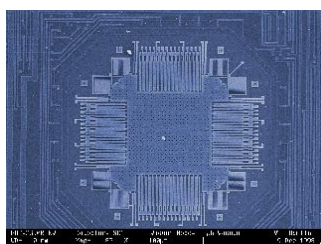
### Advantages of improved bulk micro machined Technology

- Micro g resolution (e.g.  $7\mu\text{g}/\sqrt{\text{Hz}}$  noise in differential Series)
- Low Power consumption (used e.g. in pace maker with down to Nano Ampere)
- Excellent long term stability: (e.g.  $0,62\text{mg} \approx 0,036^\circ$  stability for 10 years, calculated from HTB tests)
- Excellent temperature stability (e.g.  $1..2\text{mg}$  from  $-5...70^\circ\text{C}$  for differential Series)
- More than 20'000g shock performance, no parameter drift, hysteresis effects not measurable
- Mechanical vibration and resonance frequencies discrimination

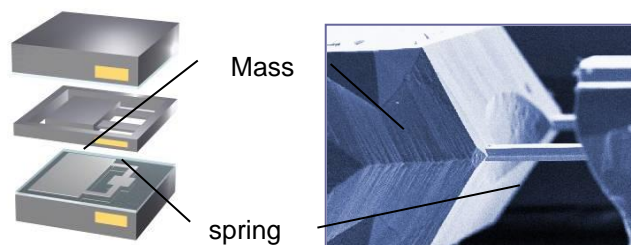


Sensing element in „advanced bulk micromachined Technology“

### Differences of the two MEMS-Technologies:



Often used “Surface micro machined” Technology with very thin structures



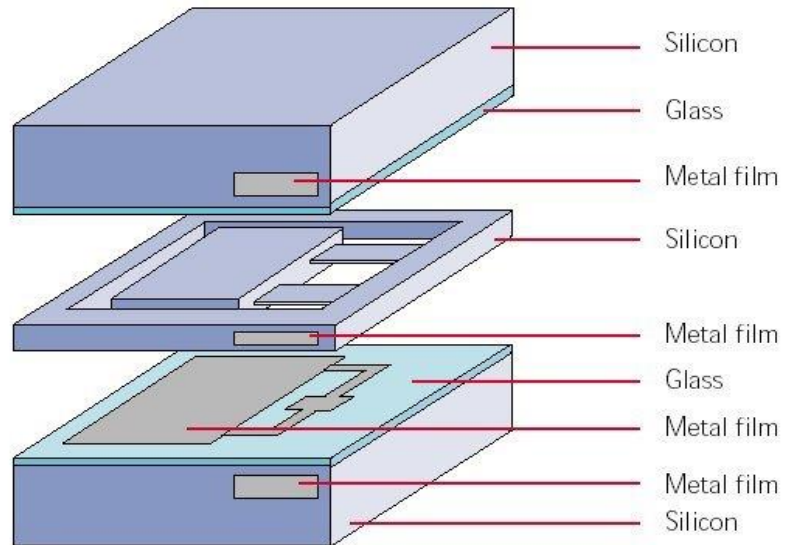
Improved bulk micro machined

## Description of bulk micromachined Technology:

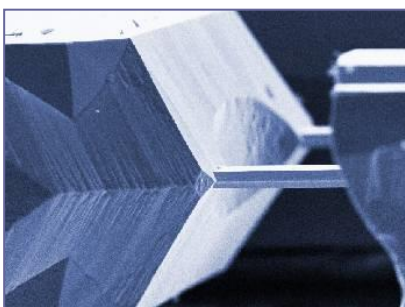
- Real 3D structures: small size high accuracy multi-axis elements (features similar in all three directions)

1-axis bulk micromachined sensing element

- Hermetic (glass) sealed sensing elements: No particles or chemicals can get in the element
- This improved bulk micro machined technology is a optimized combination of etching (wet and dry), capping (wafer bonding, glass insulation, feed-through structures), contacting (electrodes: solderable, wire bondable)

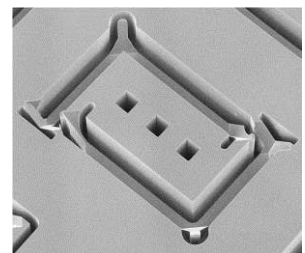


- Large proof mass in an accelerometer resulting from utilizing the whole or a significant part of the thickness of a silicon wafer – this means high acceleration-to-force conversion ratio, giving large signal and consequently good signal-to-noise and signal-to-unwanted effects ratio



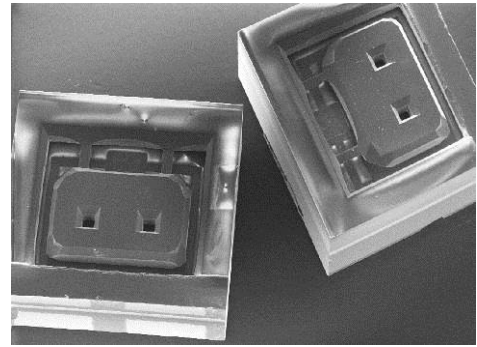
Proofmass under Electromicroscopce

- Large parallel plate capacitance and high capacitance dynamics – same effects as above, makes capacitive measurement and low current consumption easy

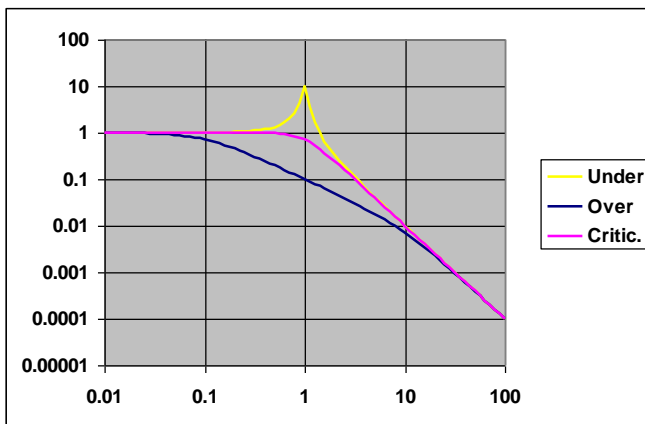


- Flexible proof mass, membrane and spring designs – best performance at smallest size
- High shock (~ 50 000g) and over-range capability (no breakage / no stiction) as well as the absence of mechanical hysteresis or plastic deformation resulting from the use of single crystal silicon and advanced designs – this makes the sensors robust at installation/maintenance as well as in use

- High isolation resistance and low stray capacitance – enables ultra low power consumption, easy linear capacitive measurement, increases dynamic range (large signal / good signal to noise ratio)



- High stiffness, high inertia and Q-value in vibrating structures resulting from well defined springs, large proof mass, high amplitude and low internal pressure – ideal technology for vibrating gyros



- Optimized frequency behaviour (controlled damping) – enables robust low frequency accelerometers or inclinometers for harsh vibrating environments or wide flat frequency response

**Example of our products based on this Bulk-Micromachined-Technology:**



Rugged IP67/68 Sensor  
 4...20mA and RS485  
 output



economic & small Sensor  
 0.5....4,5 (-4...+4V) output  
 lot of different ranges



customized sensor  
 please ask for your  
 our optimal sensor solution.