



# Strategy of SAW MEMS Business Division of TDK-EPC

# Passive components activities at a glance

TDK Corporation is a leading electronics company. Its passive electronic components are marketed under the product brands, TDK and EPCOS.

Key info (Fiscal year 2013, ending March 31)	
Core business	<b>Electronic components, modules and systems</b>
Headquarters	<b>Tokyo, Japan Munich, Germany</b>
Sales	<b>JPY 380 billion EUR 3.5 billion</b>
Sites	<b>Approx. 40 with more than 50 plants</b>
Employees	<b>46,000</b>

Evolution	
<b>1935</b>	TDK (Tokyo Denki Kagaku Kogyo = Tokyo Electric & Chemical Industries) established in Japan to manufacture and commercialize ferrites
<b>1999</b>	EPCOS founded in Germany, emerging from Siemens Matsushita Components, a joint venture of Siemens Passive Components with Matsushita
<b>2009</b>	TDK-EPC Corporation established by combination of TDK's electronic components business with the EPCOS group

**Product brands**




# Systems, Acoustics, Waves Business Group at a glance

## Key data

Headquarters **Munich, Germany**

Number of plants **8**

Employees total **4,300**

Management **Christian Block**  
CEO & CTO

**Augustin Baumer**  
CFO

**Otto Graf**  
COO

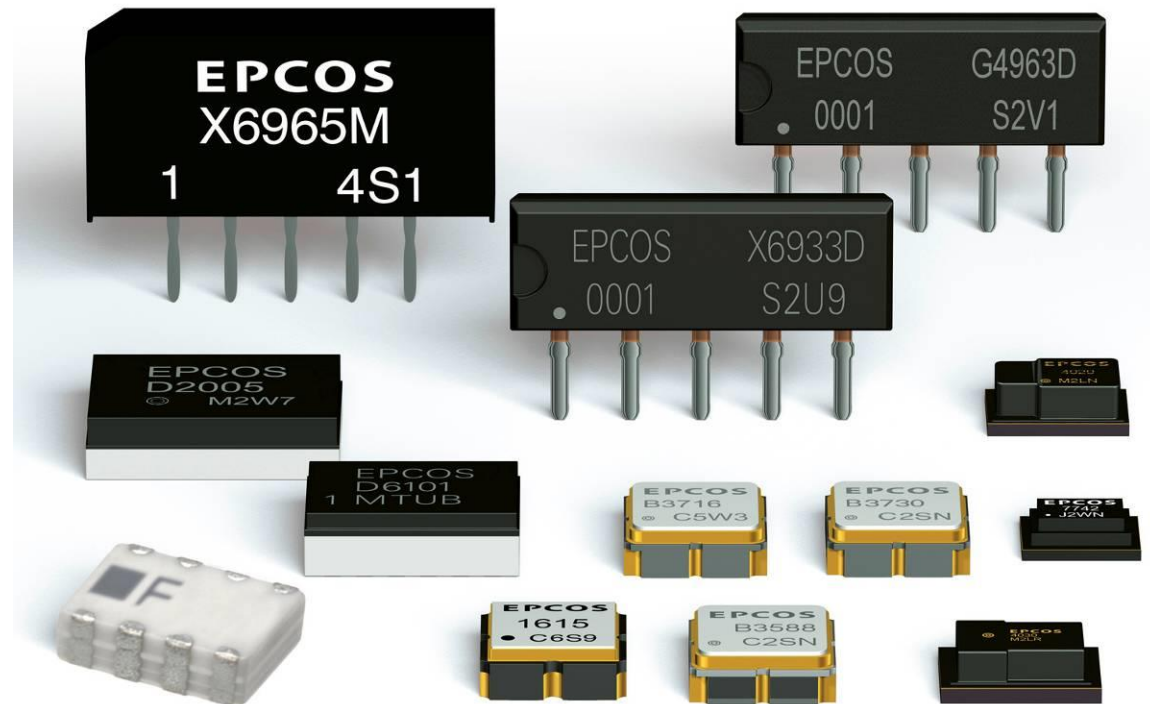
**Kohei Wada**  
Deputy General  
Manager

## Portfolio

- SAW and BAW filter products for
  - Mobile communication devices
  - Telecommunication infrastructure
  - Automotive electronics
  - Industrial electronics
  - Multimedia products
- Modules for cellular and connectivity
- Power Management Modules
- ESD/EMI substrates for lighting
- MEMS microphones
- MEMS pressure sensors
- Multilayer and
- Thin-film HF components
- Dielectric components
- Isolators and circulators

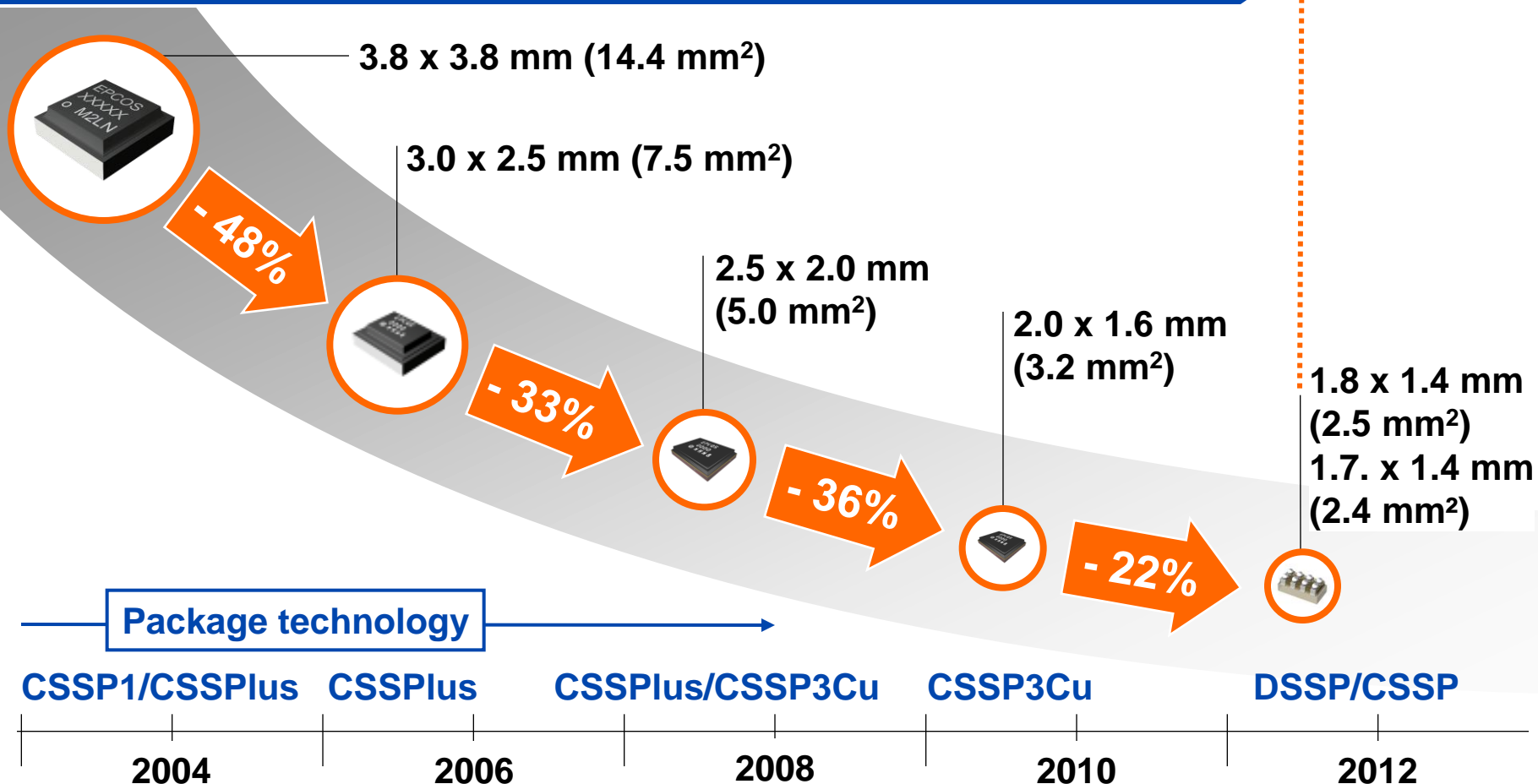
# Comprehensive product portfolio

- SAW and BAW filter products for
  - Mobile communication devices
  - Telecommunication infrastructure
  - Multimedia products
  - Automotive electronics
  - Industrial electronics
- RF modules
- ESD/EMI modules
- MEMS products
- Multilayer HF components
- Dielectric components
- Isolators and circulators



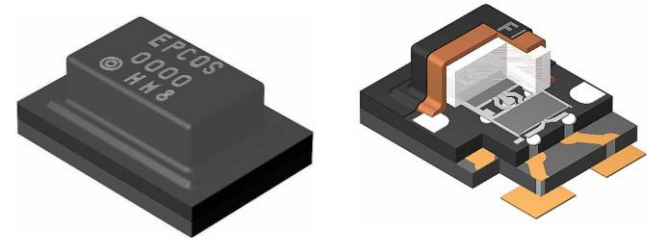
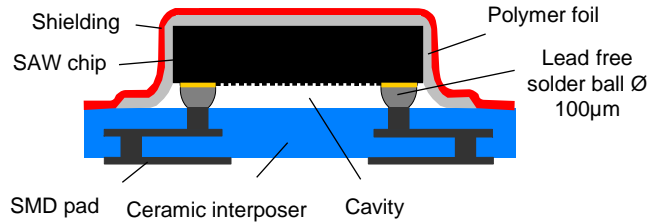
# Miniaturization exemplified by EPCOS SAW duplexers

More than 80% package size reduction

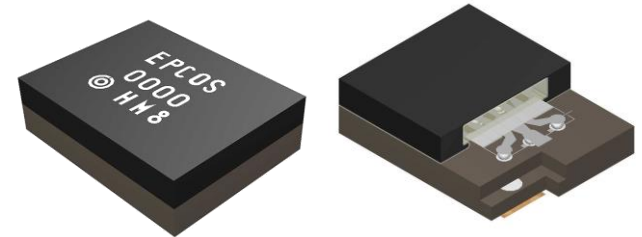
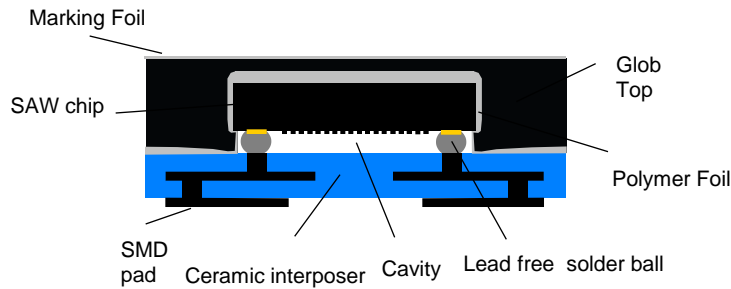


# CSSP/DSSP packaging platforms

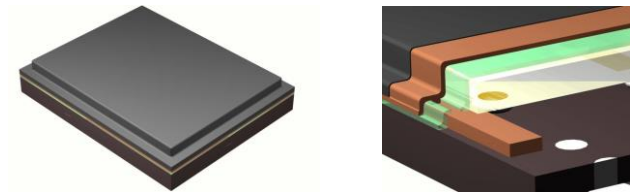
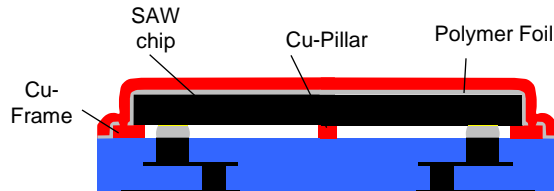
## CSSPlus



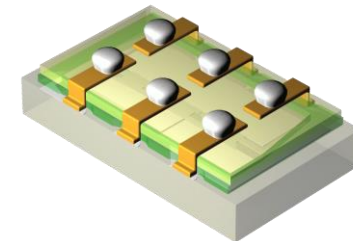
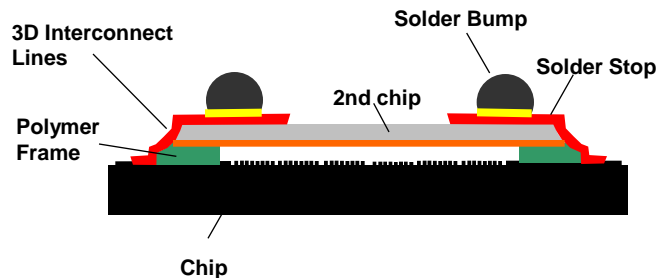
## CSSP3



## CSSP3 Cu frame



## DSSP



# **MEMS Devices where Cavity Packages are the Key Success Factor**

**MEMS Microphones**

**Pressure Sensors**

**Pressure/Humidity Combo Sensor**

.....

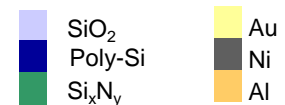
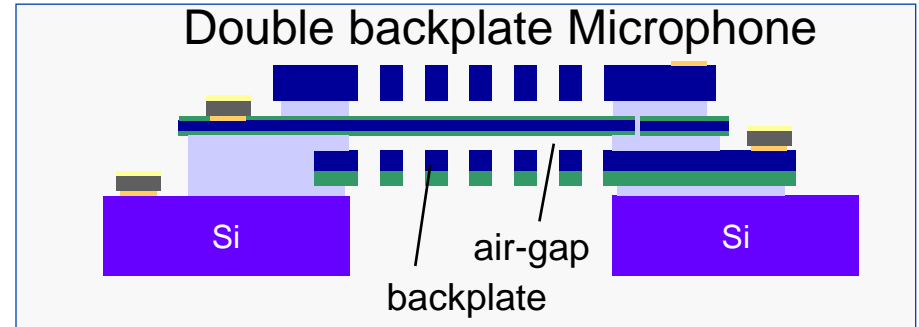
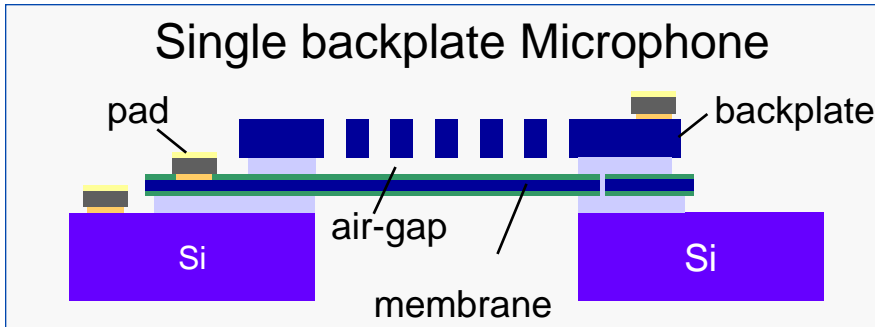


# **MEMS Microphones**

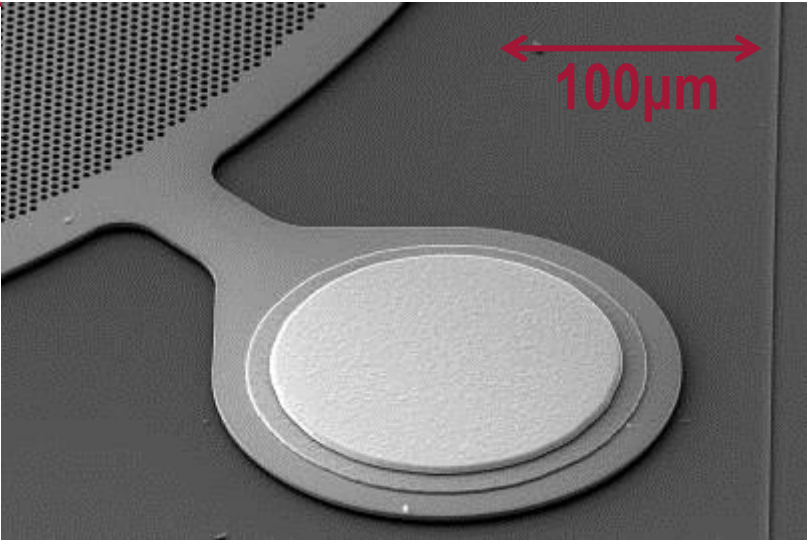
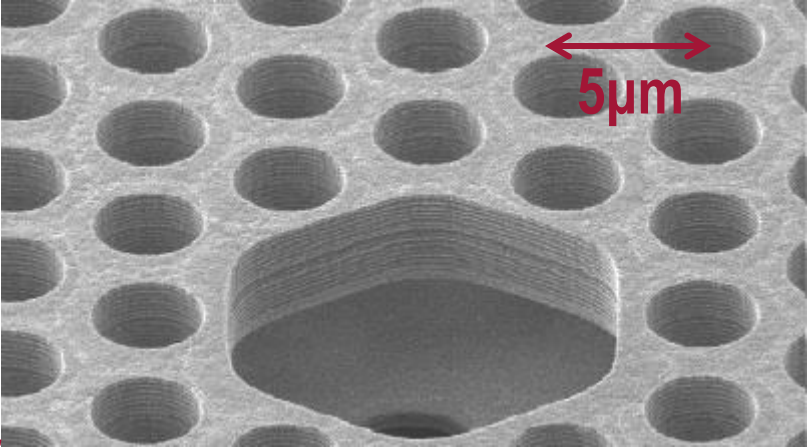
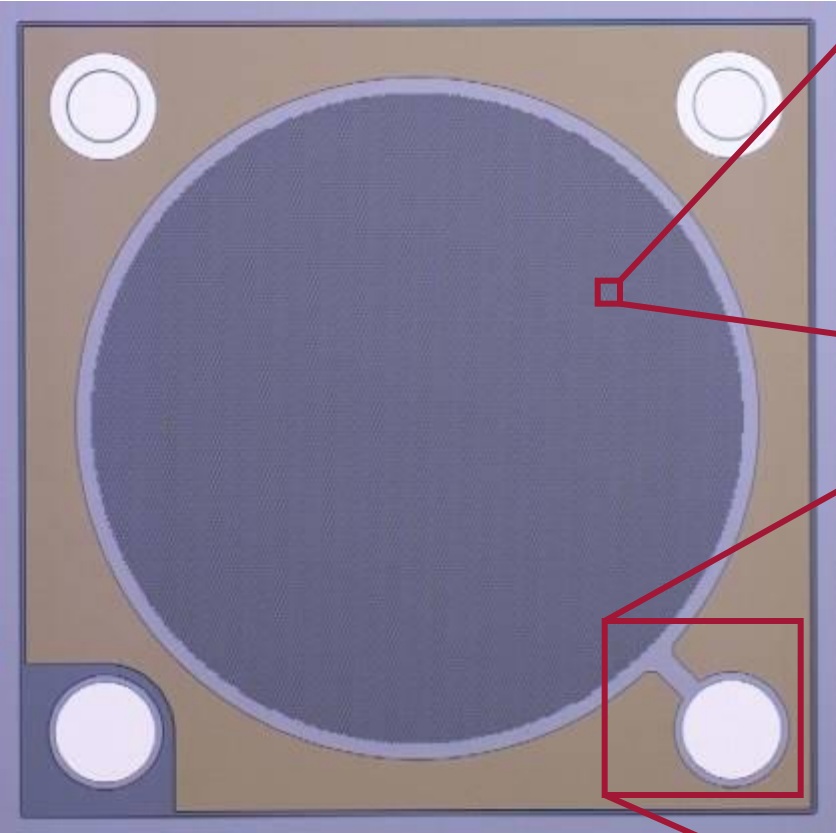


# EPCOS MEMS Microphone Transducers

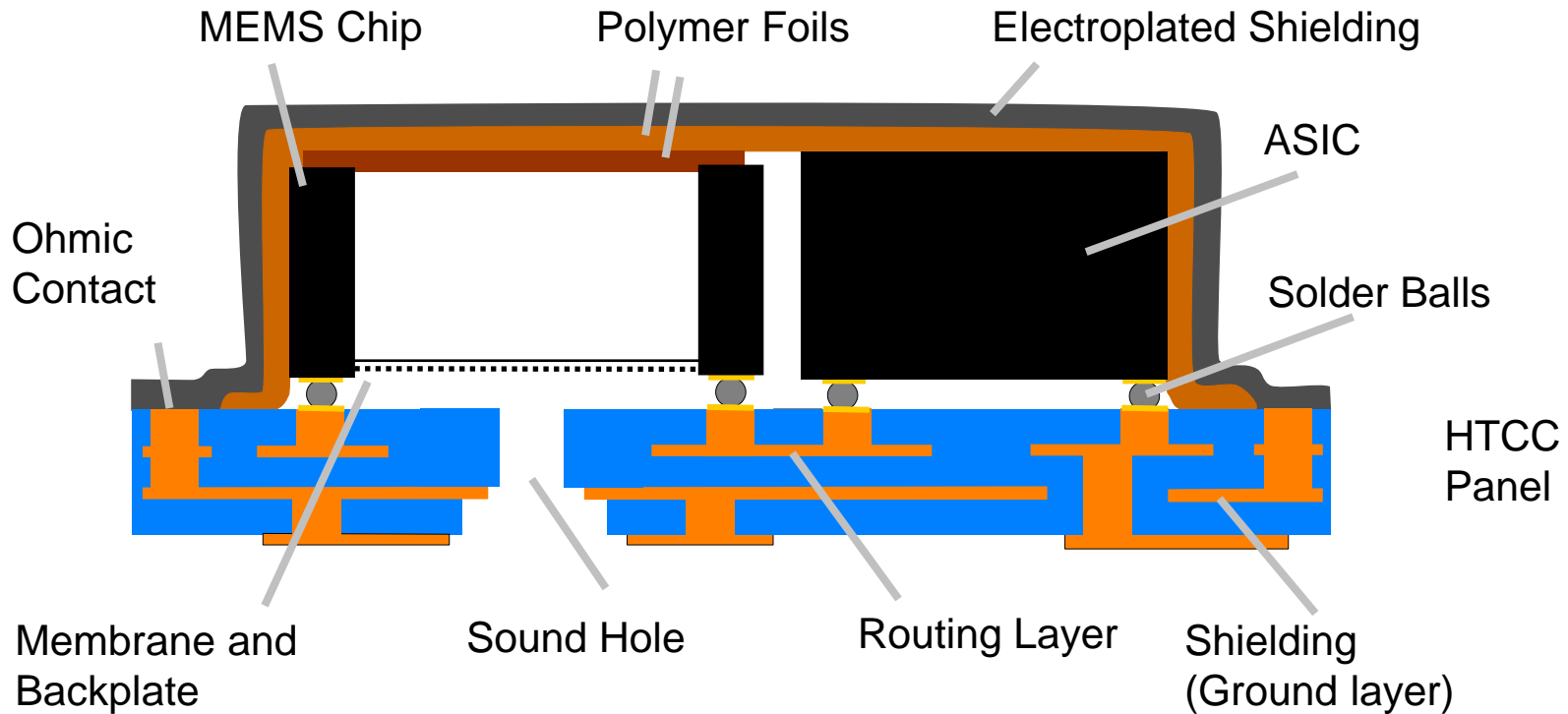
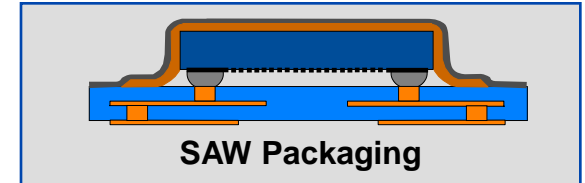
- Fully suspended pre-stressed membrane
- Tuning by selectively etching  $\text{Si}_x\text{N}_y$  layer at the end of the process sequence
- Single backplate technology for lowest cost
- Double backplate technology for highest Performance (SNR, THD at high SPL levels)



# MEMS Microphone Chip

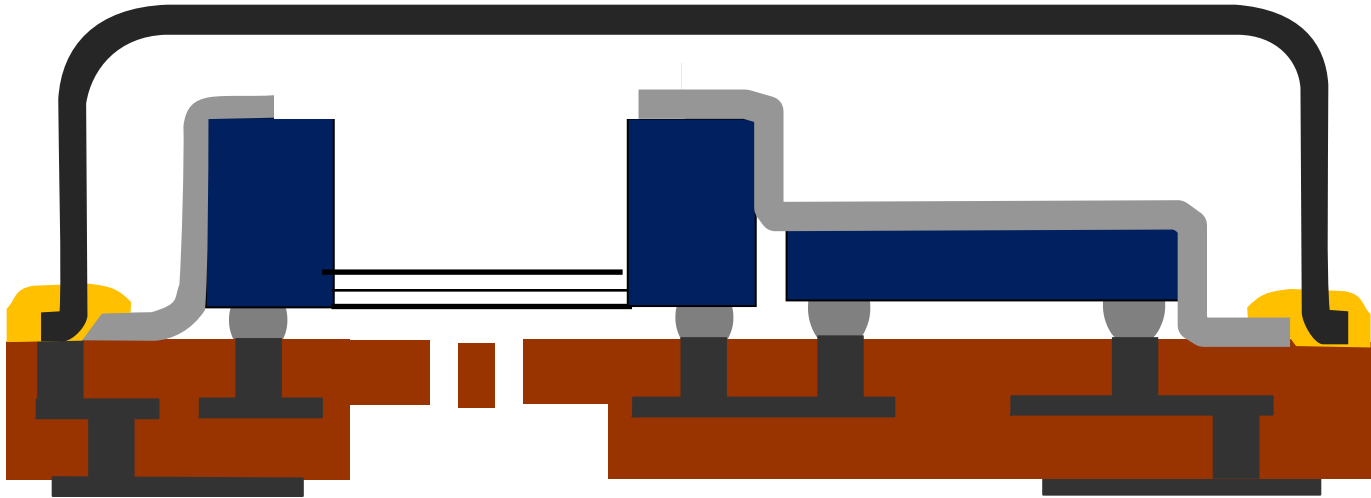


# EPCOS CSMP (Chip Size MEMS Package)



**Drawing not to scale!**

# EPCOS CSMP (Metal Lid Version)



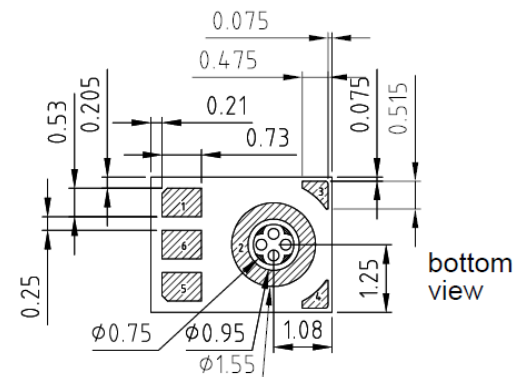
- Increased acoustic backvolume for highest SNR (Signal to Noise Ratio)
- Double backplate MEMS for lowest THD (Total Harmonic Distortion) at high SPL levels

**Drawing not to scale!**

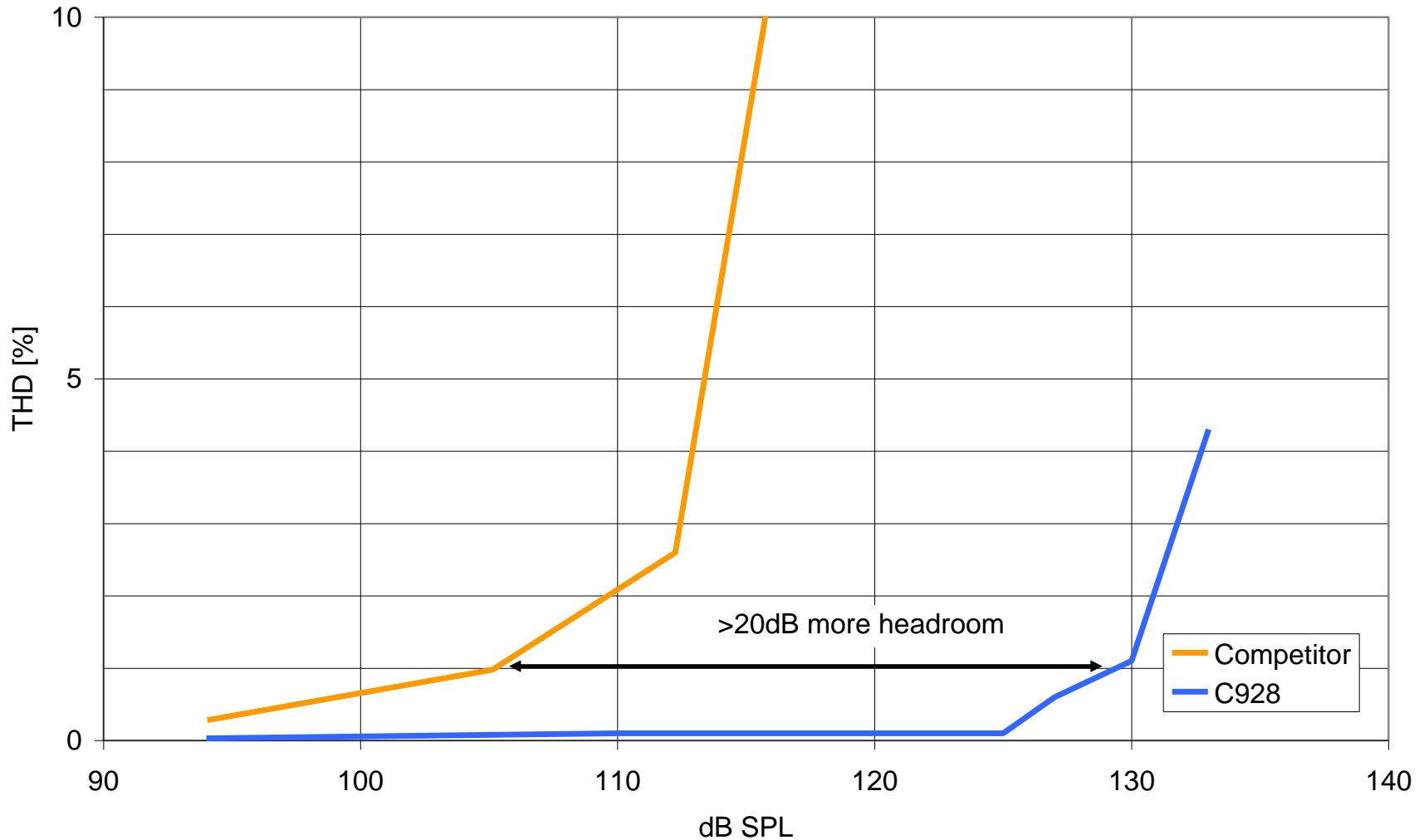
# C928 HDR MEMS microphone

## Innovative product with top performance

- High SNR: 66dB(A) 20Hz ... 20kHz – ideal for hands free and noise cancelling applications
- Low distortion: 10% at 136 dB SPL – ideal for high quality live music recording
- High dynamic range (HDR): >100dB dynamic range
- Flat frequency response – natural sound
- High power supply rejection: 70 dB
- True balanced output – ideal for EMI protection
- Standard footprint 3.35x2.5x1 mm (bottom port)



# C928 HDR MEMS Microphone THD Performance



# Customer benefit

## Key Advantages of CSMP™ Package

- Smallest size
- Smallest front-volume for top-ported microphones resulting in flat frequency response
- Reliable, proven mature backend process → reliable product; scalable processes
- Very high RF Immunity (CSMP™ shielding)
- Small holes (Ø 100µm bottom port; Ø 50µm top port) → protection against dust particles (IP5x)

## Key Advantages of Microphone

- Strong portfolio (flat frequency response; 66dB(A) SNR; High Dynamic Range)
- Very high power supply rejection: 70dB
- Superior test concept (fully automated; high repeatability; wideband noise measurement)
- Very low current consumption: down to 80 µA (analogue)
- Application support



# Pressure Sensors



# Pressure Sensors for Navigation Systems

Typical vertical accuracy is only

- 15m (SiRFstar III) for GPS and
- <8m (35m for single band) for Galileo

not sufficient for car navigation in urban areas

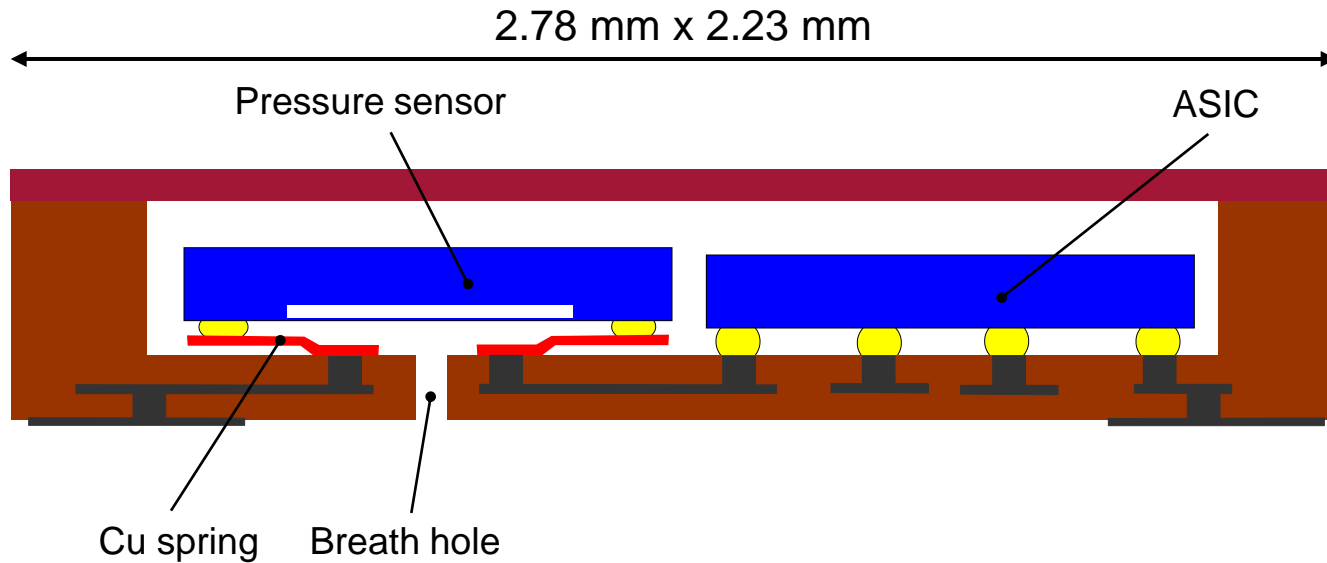


# Pressure Sensors for Location based Services & Indoor Navigation



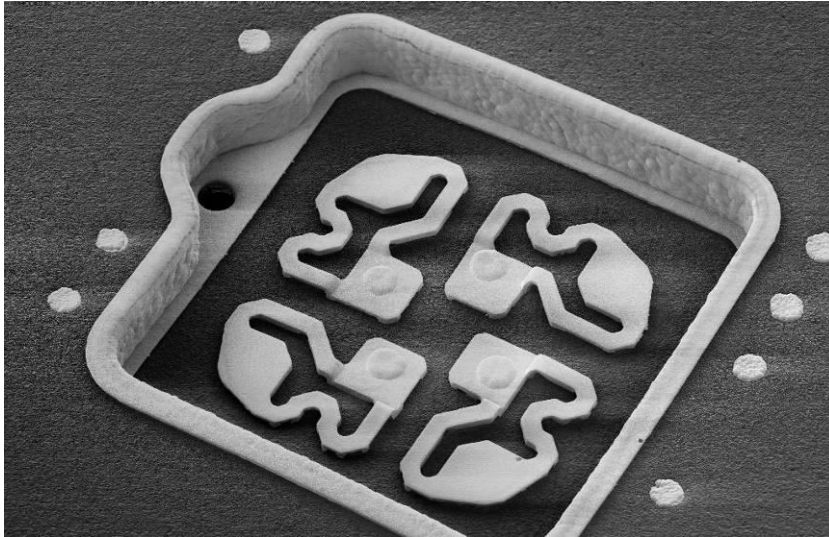
# Digital Pressure Sensor

Key Success Factor : Packaging Technology

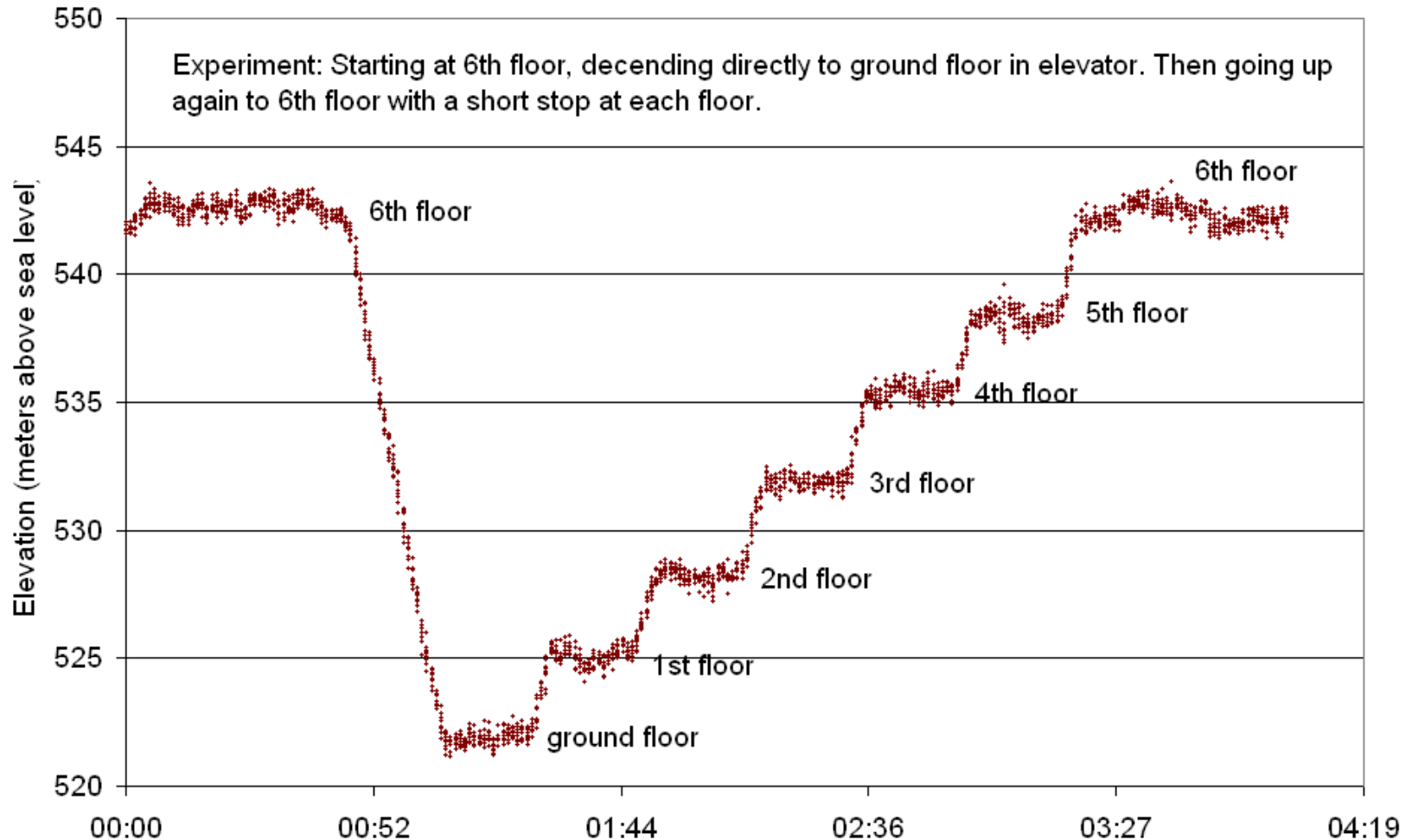




# Spring contacts for Pressure Sensor



# Example: Height measurement





[www.tdk-epc.com](http://www.tdk-epc.com)