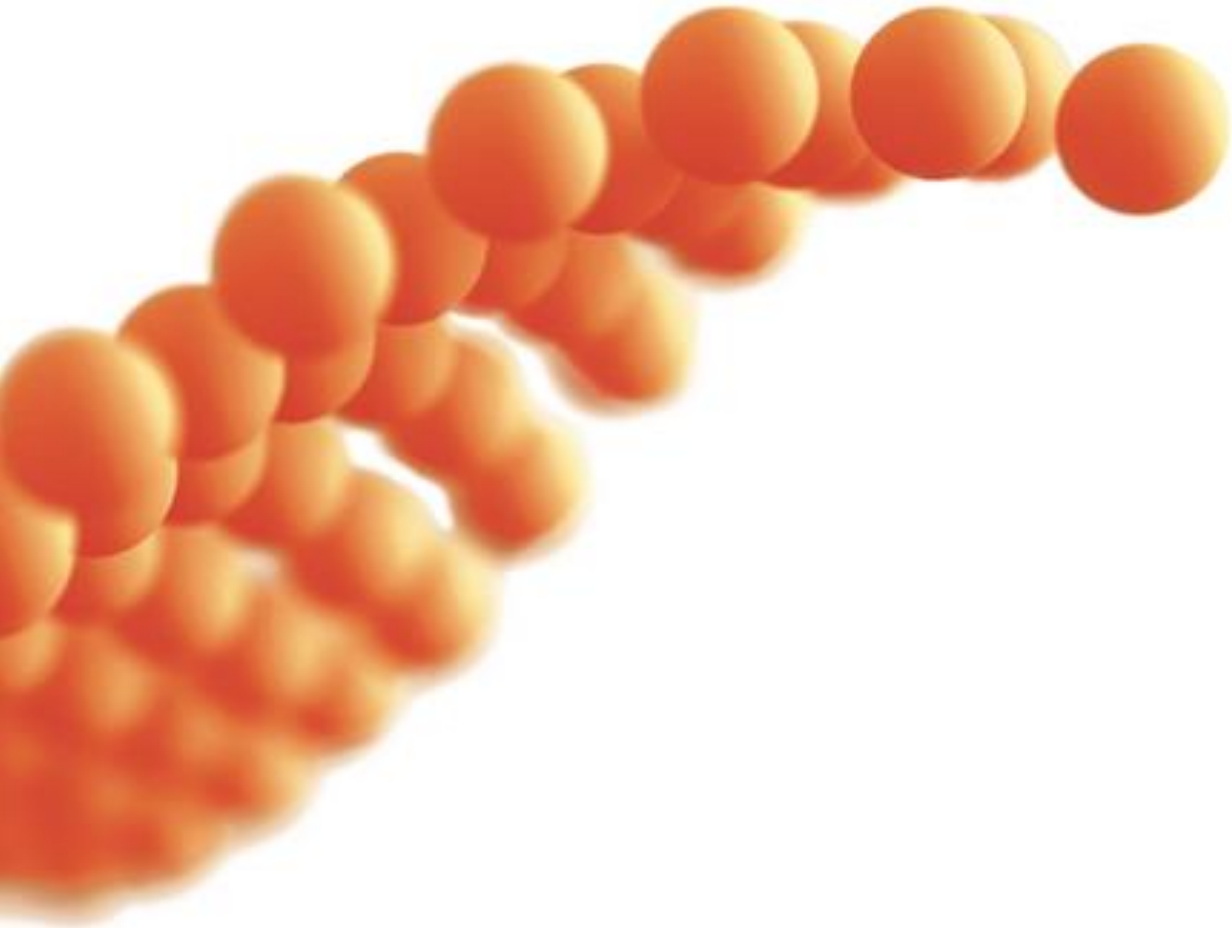
Sensing the nanoworld

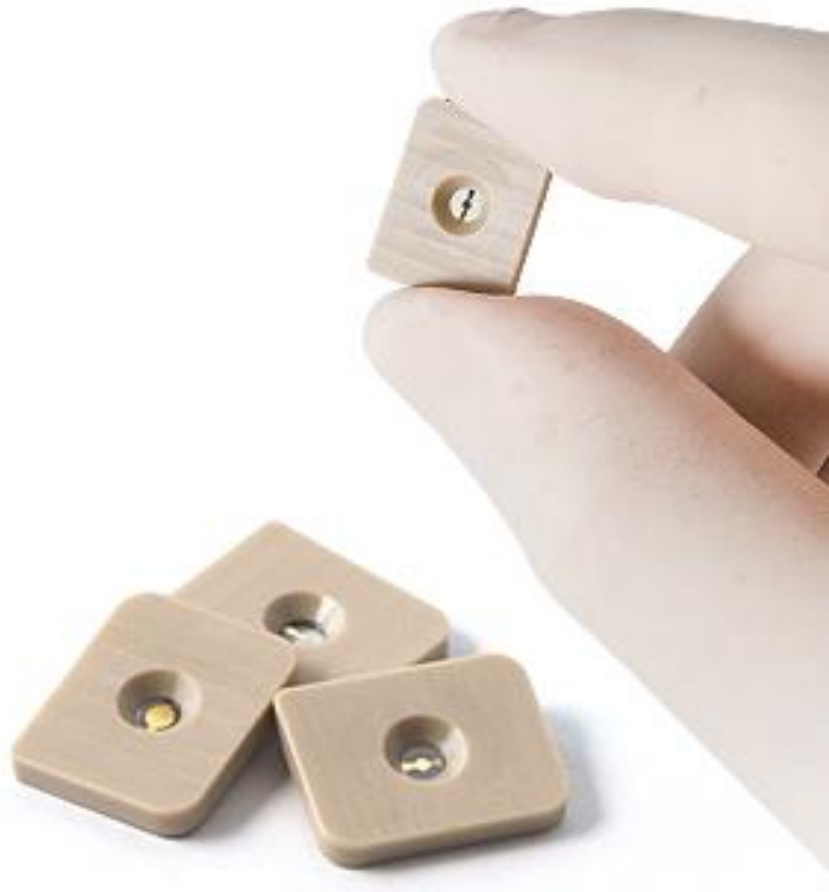


AWSensors

Scientific Technology

AWSensors designs, manufactures, and markets the **most versatile** scientific instruments for **acoustic wave sensor characterization.** AWS technology gives you access to a **wider experimental landscape than any other system on the market** in terms of frequency- and sensitivity range, flexibility, and value-for-money, thanks to its **PATENTED HIGHLY SENSITIVE QCMD TECHNOLOGY.**

AWSensors equipment is tailored to research applications in fields that include biomedicine; analytical-, bioanalytical-, biophysical- and interfacial chemistry; energy storage, battery research and catalysis; soft matter physics.



KEY BENEFITS

- **High sensitivity** – proprietary **high-frequency QCM** sensors.
- **Real time, label-free** detection of the amount of material.
- Analysis of organization of material at **solid-liquid** and **solid-gas interfaces.**
- Seamless integration of different sensors and/or different operation modes in one instrument for exhaustive interface characterization.
- **User friendly** systems, with **integrated temperature, fluidics, and potentiostat control.**
- **Parallelization** with **multi-channel** systems.
- **Modular** and **customizable** design to fit a variety of budgets and user needs.

AWSensors PRODUCTS

AWSensors Instruments

X1 Single Channel QCMD

X4 Advanced Multichannel QCMD

FCU: flow control unit

FCU-Pro Advanced Flow Control Unit

Cells

For AWSensors Equipment

Flow cells

In-batch cells

Immersion probe cells

For Impedance/Network Analyzers

Flow cells

In-batch cells

Immersion probe cells

Sensors & Sensors coatings

HFF-QCM sensors

QCM sensors

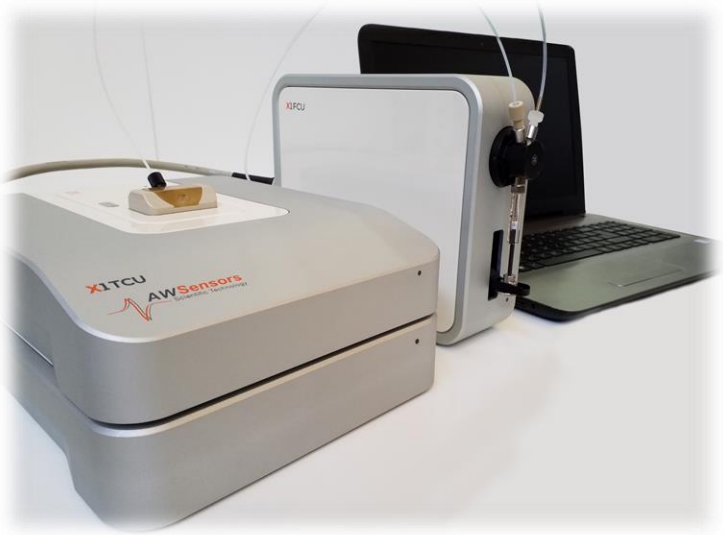
LOVE-SAW sensors

Custom products

Get in touch with us directly to discuss your specific needs.

X1 Single Channel QCMD

Single channel Quartz Crystal Microbalance with Dissipation (QCMD) measurements on multiple overtones. The system offers superior sensitivity in frequency and dissipation for measuring the amount of material and characterizing the properties of submolecular films in a wide range of applications, including biosensors and electrochemistry. Its high acquisition rate allows monitoring fast kinetics, such as electrochemical transients. Measurements in air, gas and liquid are possible with a variety of acoustic sensors (classical and High-Fundamental Frequency QCM sensors and LOVE-SAW sensors). Modular design consisting of optional Temperature Control Unit (TCU) and Flow Control Unit (FCU) and FCU-Pro fits a variety of budgets and needs.



The first in the nanosensing race

Fast and highly sensitive

- Allows high fundamental frequency operation to achieve low limits of detection.
- The highest time resolution and mass sensitivity in the market.

Versatility

- Measurements in gas and in liquids.
- A range of measurement cells for measuring under flow conditions or under stagnant conditions.
- A wide range of sensors, including classical QCM, HFF-QCM, and Love-SAW.
- Up to 7 overtones simultaneous measurements for 5 MHz classical QCM.

Modularity

- Allows flexible solutions, adaptable for various budgets and applications.
- Sleek, space-saving and lightweight design.

Integration, robustness and comfort

- Comfortable handling and robust measurements with quick-lock cells.
- Integrated temperature and flow control.
- Integrated software control of the experimental features (AWS Suite).
- Integrated potentiostat control for electrochemical measurements (AWS Suite).

X1 Single Channel QCMD system

Modules

A remote Cell Station (CS) helps give the device its compact footprint and enables use in glove boxes. Temperature Control Unit (TCU) is available for enhanced stability and Flow Control Unit (FCU) allows comfortable semi-automatic fluid exchange and sample loading on top of the sensor.

BCU: Base Control Unit

CS: Cell Station

TCU: Temperature Control Unit

FCU: Flow Control Unit

Basic package: X1 BCU + CS

X1 BCU + CS + TCU

X1 BCU + CS + FCU

X1 BCU + CS + TCU + FCU

X1 Single Channel QCMD

AWSensors
Scientific Technology

Technical Specifications

Measurement channels (cell units)	1
Type of sensors	• HFF-QCM (50,100,150 MHz) • Classical QCM (1 inch and 14 mm; 5,9,10 MHz) • Love-SAW (120 MHz)
Measurement modes	• High resolution (single and multiple overtones) • Tracking (single and multiple overtones)
Number of overtones	Up to 7 (fundamental + 6 overtones). Measurements possible up to 13^{th} harmonic.
Frequency range	4 MHz – 160 MHz
Max. Frequency resolution	0.1 Hz
Frequency accuracy	± 0.5 Hz
Temperature control range	15 ºC to 45 ºC
Temperature stability	± 0.05 ºC
Max. Time resolution	250 measurement points(samples) per second
Mass sensitivity	8 pg/cm^2 (in air), 0.6 ng/cm^2 (in liquid)
Dissipation sensitivity	1.71x10^{-10} (in air), 3.5x10^{-8} (in liquid)

X4 Advanced Multichannel QCMD system

AWSensors
Scientific Technology

The X4 is an Advanced Quartz Crystal Microbalance with Dissipation (QCMD) instrument for simultaneous measurements of multiple overtones in up to four channels. This system retains the measuring capabilities of the X1 while offering the user four times the productivity.

Low- and High-Fundamental Frequency QCM sensors and LOVE-SAW sensors can be tested simultaneously in a single experiment for the same application and equal conditions. Temperature Control is integrated in the instrument and independently controlled in each channel via the AWS Suite software. The X4 can be connected to a Flow Control Unit (FCU) or FCU-Pro to generate liquid flow over your sensors surfaces, or to multiple FCUs for more versatile flow configurations.

Speed-up your work

High throughput

- Up to 4 simultaneous measurements for 4 different sensors (with multiple overtones)
- Sleek, space-saving and lightweight design.

Fast and highly sensitive

- Allows high frequency fundamental operation to achieve low limits of detection.
- The highest time resolution and mass sensitivity in the market.

Versatility

- Measurements in gas and in liquids.
- A range of measurement cells for measuring under flow conditions or under stagnant conditions.
- A wide range of sensors, including classical QCM, HFF-QCM, and Love-SAW.
- Up to 7 overtones simultaneous measurements for 5 MHz classical QCM.

Integration, robustness and comfort

- Comfortable handling and robust measurements with quick-lock cells.
- Integrated channel-independent temperature and flow control.
- Integrated software control of the experimental features (AWS Suite).
- Integrated potentiostat control for electrochemical measurements (AWS Suite).

FCUs

Technical Specifications

	Standard Flow Option	Smooth Flow Option
Components	• A positive displacement syringe pump • A 2-port Distribution Valve	
Flow rate range (µL/min)	0.625-290000	0.03125-21250
Syringe volume options (µL)	12.5, 25, 50, 100, 125, **250***, 500, 1000, 1250, 2500, 5000 *Default syringe	
Flow range with default syringe (µL/min)	12.5 – 14500	0.625 – 1062.5
Dimensions (H x W x D) (cm)	19.5 x 7.0 x 25.0	
Weight (kg)	0.75	

Optional Flow Kits

Cleaning kit	For proper tubing and system cleaning (includes chemicals and flow elements)
Small volume experiment kit	For small volume samples injection (less than 1000 µL)

A flexible, software-controlled flow system

FCU-Pro Advanced Flow Control Unit

AWSensors
Scientific Technology

The FCU-Pro is an advanced version of the FCU. It was designed for improved injection control and for handling multiple carrier fluids.
Multiple fluids are handled with a 6 port Distribution Valve, an in-line Degasser keeps bubble trouble at bay, and the Injection Valve with a fixed volume sample loop allows precise sample delivery for reproducible measurements.

Flow-through modular unit for flow operation and sample injection

Integration

- Fully integrated with AWSensors X1 and X4 systems.
- Control and monitoring with AWS Suite Software.

Modularity and versatility

- Sleek, space-saving, and lightweight design.
- Basic configuration with 1 channel which can be extended to more channels when acquiring additional FCU-Pro units.
- Fluidics can be combined in different configurations series and parallel flow configurations working with the X4.

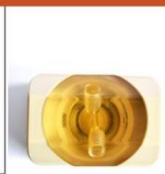
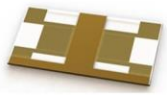
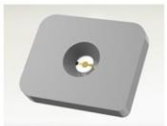
Quality

- FPLC industry-standard components.

Robustness and comfort

- In-line degasser for avoiding bubble generation.
- Semi-automatic injection of samples.

Wide range of Cells

APPLICATION	AWSensors CELLS					
	IN-FLOW	IN-BATCH	EQCM	EQCM/FLOW	Li CELL	PROBE
SENSOR						
 QCM 14mm WRAPPED	✓	✓	✓	✓	✓	✓
 QCM 1'' WRAPPED	✗	✓	✓	✗	✗	✓
 LOVE-SAW	✓	✓	✓	✗	✗	✗
 HFF-QCM	✓	✓	✓	✓	✗	✗

For AWSensors Equipment

Various ways to set up experiments with multiple combinations of sensor types for a **broad range of applications**.

Our patented **Quick-Lock assembly** design makes for a fast and easy assembly method, for more reliable and reproducible measurements.

For Impedance / Network Analyzers

Measurement cells adapted to work with standard impedance and network analyzers featuring the benefits of our patented Quick-Lock design.

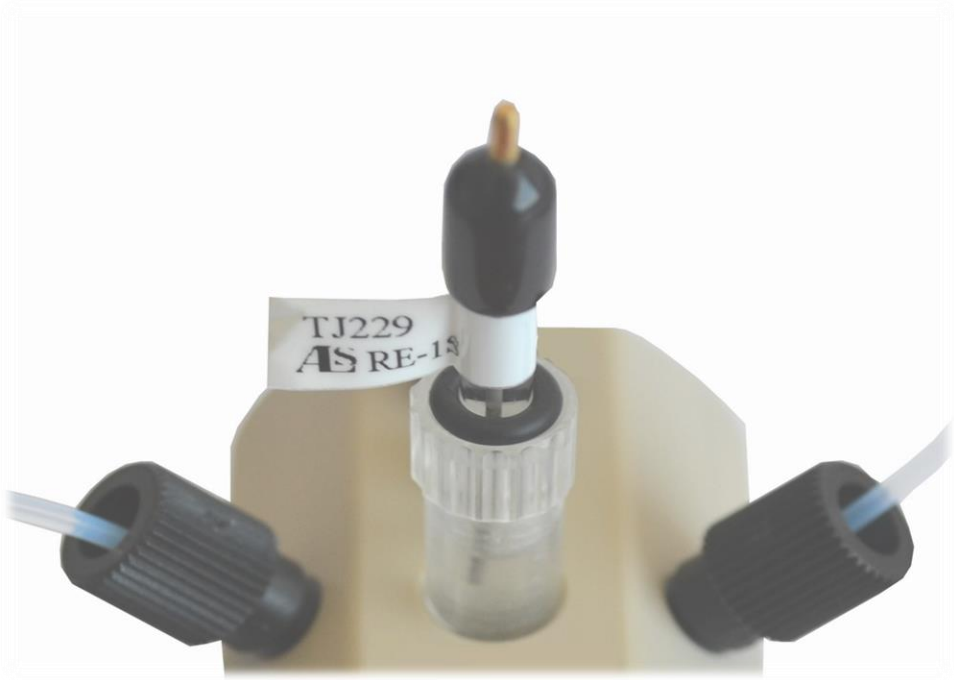
Affordable way to test different acoustic wave sensor technologies.

QCM Flow Cells

Product Specifications

Sensors:	Cells available for: • HFF-QCM (50,100,150 MHz) • Classical QCM (14 mm, wrapped electrodes; 5,10 MHz) • Love-SAW (120 MHz)
Assembly mechanism:	Quick-Lock, our patented design that ensures rapid and straight-forward handling and reproducible measurements (available for classical QCM and HFF-QCM sensors). For Love-SAW sensors, thumbscrew assembly.
Type of measurements:	Measurements in applications requiring a flow of liquid passing over the sensor surface.
Materials:	Cell base: Aluminum Cell cover: PEEK, PSU Seal: FFKM O-ring or PDMS gasket
Volume:	From only 5.5 µL for AWS HFF-QCM sensors to 44 µL for QCM 14mm.
Dimensions (mm):	33 (L) x 47 (W) x 33 (H)

EQCM Flow Cells



Product Specifications

Sensors:	Cells available for: • HFF-QCM (50,100,150 MHz) • Classical QCM (14 mm, wrapped electrodes; 5,10 MHz)
Type of measurements:	For EQCM measurements under flow conditions
Assembly mechanism:	Quick-Lock, our patented design that ensures rapid and straight-forward handling and reproducible measurements (available for classical QCM and HFF-QCM sensors).
Materials:	Cell base: Aluminum Cell cover: PEEK O-ring: FFKM Electrode holder: PMP + porous glass
Volume:	From only 5.5 µL for AWS HFF-QCM sensors to 35 µL for QCM 14mm.
Dimensions (mm):	47(L) x 33 (W) x 33,75 (H)

QCM In-batch Cells

Product Specifications

Sensors:	Cells available for: • HFF-QCM (50,100,150 MHz) • Classical QCM (14 mm / 1 inch, wrapped electrodes; 5,9,10 MHz) • Love-SAW (120 MHz)
Assembly mechanism:	Quick-Lock, our patented design that ensures rapid and straight-forward handling and reproducible measurements (available for classical QCM and HFF-QCM sensors). For Love-SAW sensors, thumbscrew assembly.
Type of measurements:	For measurements in stagnant conditions
Materials:	Cell base: Aluminum Cell cover: PEEK, PTFE Seal: FFKM O-ring or PDMS gasket
Dimensions (mm):	47(L) x 33 (W) x 33 (H)

EQCM In-batch Cells

Product Specifications

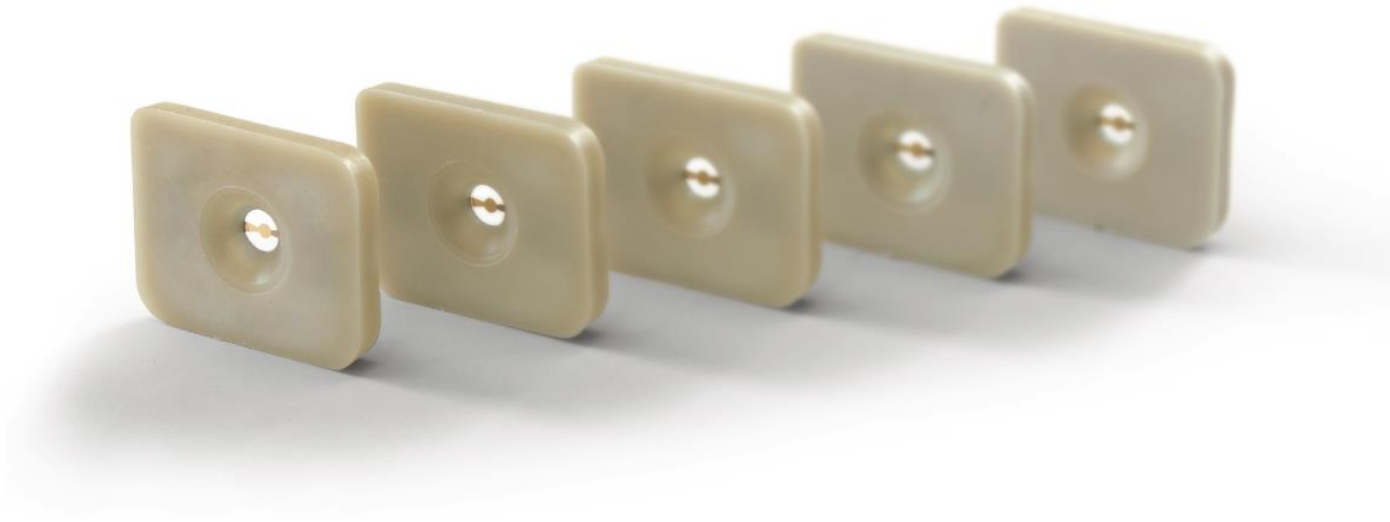
Sensors:	Cells available for: • HFF-QCM (50,100,150 MHz) • Classical QCM (14 mm / 1 inch, wrapped electrodes; 5,9,10 MHz) • Love-SAW (120 MHz)
Assembly mechanism:	Quick-Lock, our patented design that ensures rapid and straight-forward handling and reproducible measurements (available for classical QCM and HFF-QCM sensors). For Love-SAW sensors, thumbscrew assembly.
Type of measurements:	For electrochemical measurements in stagnant conditions
Materials:	Cell base: Aluminum Cell cover: PEEK, PTFE O-ring: FFKM Electrodes holder: PTFE
Dimensions (base): **Dimensions (electrodes holder):**	47(L) x 33 (W) x 44 (H) mm 28 (D) x 48 (H) mm

IMMERSION PROBE CELL

Product Specifications

Sensors:	Cells available for: • Classical QCM (14 mm / 1 inch, wrapped electrodes; 5 and 9 MHz)
Assembly mechanism:	Q-Lock assembly, a proprietary design to ensure faster and easier assembly and more reliable and reproducible measurements
Type of measurements:	For immersion in liquid to make EQCM or QCM measurements with external instruments such as impedance analyzers
Materials:	Body: PEEK O-ring: FFKM
Electrical connector:	SMA
Vial volume (mm):	46,4 (ID) x 50 (OD) x 72 (H)

AWS HFF-QCM sensors



Product Specifications

Resonant frequency:	• 150 MHz fundamental frequency • 100 MHz fundamental frequency • 50 MHz fundamental frequency
Design:	AWS HFF sensors are based on high fundamental frequency AT-cut quartz crystal resonators manufactured through inverted mesa technology. Mounting on a PPS support provides robustness and reliability.
Chip material:	PPS
Electrode layout:	Keyhole
Electrodes material:	Cr/Au
Surface finish:	Polished (optically clear < 1 µm)
Electrodes diameter:	1 mm (50, 100 MHz); 0.5 mm (150 MHz)

QCM sensors

Compatible with AWSensors and other QCM systems

Product Specifications

Materials:	• AT-cut quartz material • Other materials, such as Gallium Orthophosphate ($GaPO_4$) or Langasite ($La_3Ga_5SiO_{14}$) available upon request
Blank diameter:	• 14 mm • 1 inch (25.4 mm)
Electrode layout:	• Wrapped (contacts on one side) • Keyhole (contacts in both sides)
Resonant frequency:	• 5 MHz and 9 MHz (1 inch wrapped) • 5 MHz and 10 MHz (14 mm wrapped) • 9 MHz (14 mm keyhole)
Electrodes material:	• Cr/Au and Ti/Au • SiO_2 • Pt • C • Fe *Contact us about the current availability of other metals and coatings
Surface finish:	• Polished • Rough

LOVE - SAW sensors

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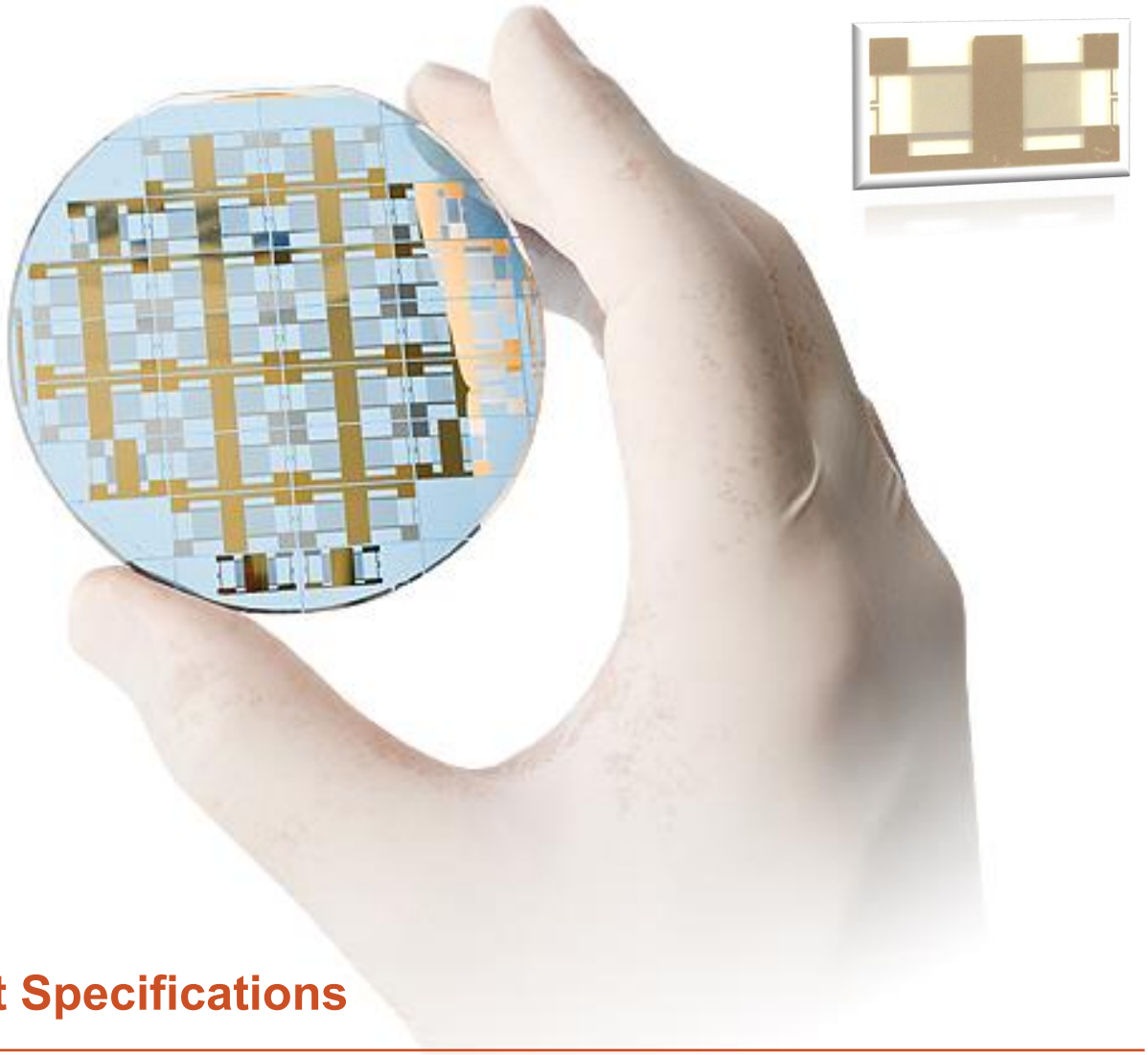


Product Specifications

Resonant frequency:	120 MHz fundamental frequency
Design:	LOVE-Mode SAW (surface acoustic wave) sensors are based on AT-Cut quartz substrate and have a special design that allows easy connection and removing.
Electrodes material:	Cr/Au
Surface finish:	Polished (optically clear < 1 µm)
Blank dimensions:	17.0 mm x 8.5 mm
Dimensions of the sensitive area:	3.5 mm x 4.5 mm

Custom products

Our dedicated engineering and scientific teams are able to provide customized solutions that address our customers' specific needs:

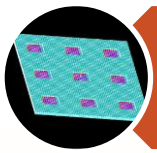
Extreme Temperatures

Controlled atmospheres (glove box cells)

Integrated fluidics, electronics, and software

Closed loop process control

Sampling robot integration



Finite Element Method Simulations

CONTACT US

Just e-mail or call us to tell us about your needs

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