

MSFET-3330x pH sensor with integrated reference electrode

Ta₂O₅ gate Ion Sensitive Field Effect transistor (ISFET)



- The ISFET devices are realized with microelectronic technology compatible with CMOS processes.
- Ta₂O₅ insulating gate ISFET devices measure the pH value in a wide range from basic to acidic solutions
- Module dimension:
50 mm x 5 mm x 2 mm

Special Features:

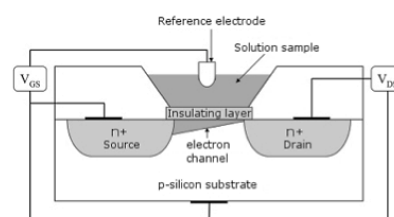
- Ta₂O₅ Insulating gate
- Single supply, low power, small size
- Integrated Ag/AgCl reference electrode

Applications:

- Pre-calibrated module for portable systems
- Water Quality monitoring
- Environment control
- Security, industrial process control

Sensing principle:

The sensitive element is a Field Effect Transistor, whose metal gate is replaced by a Reference Electrode and the solution of interest.



MSFET 3330 Integrated Sensor

Base structure

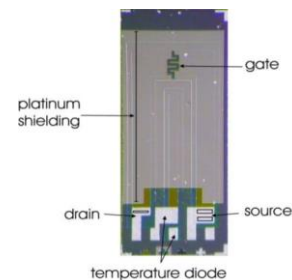
- Sensor base materials: Silicon, Polysilicon
- Technology: 4" planar CMOS process

Selective membrane

- pH-sensitive material: Ta_2O_5

Sensor dimensions:

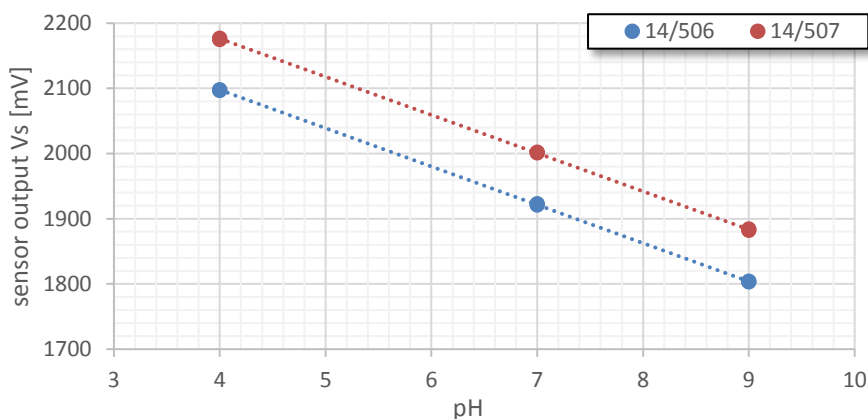
	Width	Length	Height	Unit
Chip dimensions	1.2	3	0.3	mm
Packaged sensor	5	50	1 - 2	mm



pH Sensor Characteristics

DC Specifications:

	min	typical	max	Unit
V_{ds}		0.5		V
I_{ds}		0.1		mA
Sensitivity ($\Delta V_s/pH$)	-50	-55.0	-59.2	mV/pH



Ta_2O_5 gate ISFET pH sensitivity

Ag/AgCl reference electrode: mini DriRef (WPI), $V_{ds} = 0.5V$, $I_{ds} = 100\mu A$, Slope = -58.8 mV/pH

pH Sensor Specifications

Sensitivity:	55 mV/pH unit
Range:	pH 1 ... pH 12
Accuracy:	0.05 pH
Operating temperature:	0°C ... 80°C
Response time:	depends on application. In a flow-through cell configuration the response time is below 1s.

Note:

The measured value for pH 7 may vary when the reference electrode is changed. Therefore it might be necessary to recalibrate the ISFET output before measurements.

Sensor connections

Connections of the packaged sensor

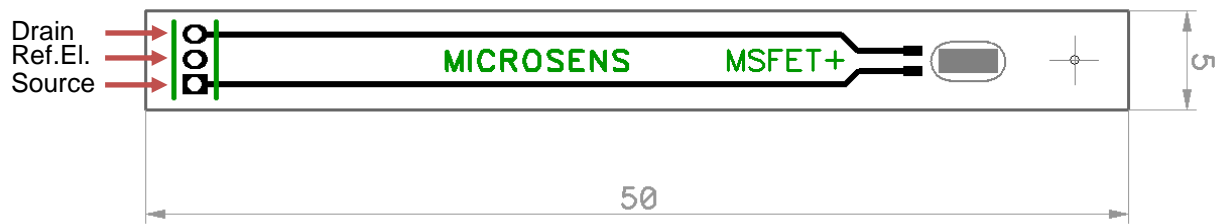


Figure 1 : Schematics of the ISFET on its PCB. "Source", "Drain" and "Ref.El." connect to the respective ISFET connector of the interface electronics.

The standard connector is not water tight. Upon special request the connection can be made waterproof.

Handling Recommendations

Recommended Operating Conditions:

- The ISFET is sensitive to light, it is then preferably operated out of direct light as calibration is normally performed in the dark.

Cleaning recommendations:

- Rinse with DI water
- Let dry in air (dust free environment)
 - Alternatively: blow dry
- Avoid:
 - Rinsing with solvent (acetone, ethanol, isopropanol)
 - Rinsing with detergents
 - Drying with blotting tissues

Important precautions:

- Avoid any electrostatic discharge at the ISFET connections when handling in air. As a precaution the sensor module should be powered down, when the sensor is removed from the solution.
- Switch off the sensor electronics before disconnecting the sensor.
- Store the sensor under dry conditions. Avoid excessive illumination.
- Avoid contact with high concentrations of solvents (acetone, ethanol, isopropanol) or detergents.

Measurement circuit recommendation

The measurement circuits need to provide a constant voltage V_{ds} and a constant drain current (I_{ds}) to the ISFET. The output voltage ($V_s - V_g$) is then linearly depending on pH or targeted ions.

MICROSENS offers different interface solutions for the MSFET3330, ranging from stand-alone USB powered digital interfaces to small analog benchtop modules. We will be happy to help you select the best suited interface for your application.