



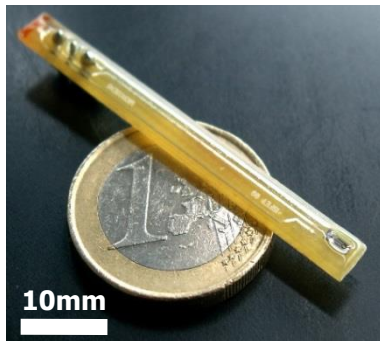
M I C R O S E N S

Product Data Sheet

## MSFET-3330 pH sensor

### MICROSENS Miniature pH Sensing Element

Ta<sub>2</sub>O<sub>5</sub> gate Ion Sensitive Field Effect transistor (ISFET)



- The ISFET devices are realized with microelectronic technology compatible with CMOS processes.
- Ta<sub>2</sub>O<sub>5</sub> 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:

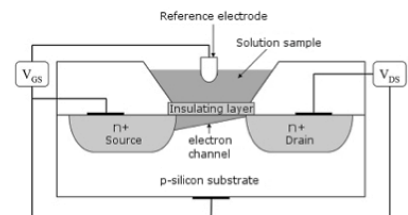
- Ta<sub>2</sub>O<sub>5</sub> Insulating gate
- Single supply, low power, small size

#### 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

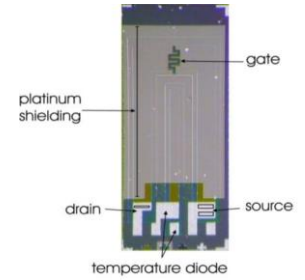
- Sensor base materials: Silicon, Polysilicon
- Technology: 4" planar CMOS process

### Selective membrane

- pH-sensitive material: Ta<sub>2</sub>O<sub>5</sub>

### Sensor dimensions:

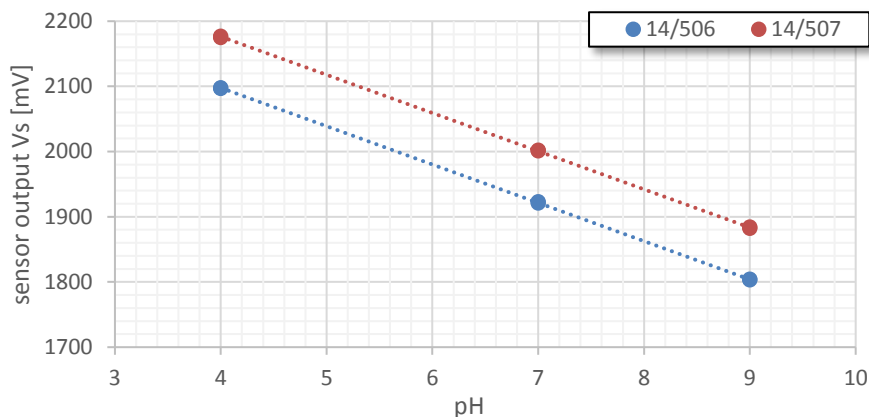
	Width	Length	Height	Unit
Chip dimensions	1.2	3	0.3	mm
Packaged sensor	5	50	1 - 2	mm



## pH Sensor Characteristics

### DC Specifications:

	min	typical	max	Unit
V <sub>ds</sub>		0.5		V
I <sub>ds</sub>		0.1		mA
Sensitivity (ΔVs/pH)	-50	-55.0	-59.2	mV/pH



### Ta<sub>2</sub>O<sub>5</sub> gate ISFET pH sensitivity

Ag/AgCl reference electrode: mini DriRef (WPI), V<sub>ds</sub> = 0.5V, I<sub>ds</sub> = 100μA, Slope = -58.8 mV/pH

### pH Sensor Specifications

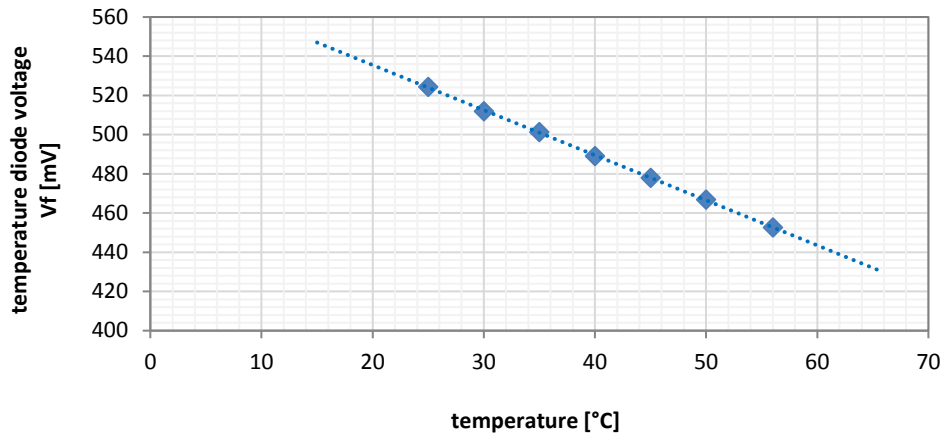
<b>Sensitivity:</b>	55 mV/pH unit
<b>Range:</b>	pH 1 ... pH 12
<b>Accuracy:</b>	0.05 pH
<b>Operating temperature:</b>	0°C ... 80°C
<b>Response time:</b>	depends on application. In a flow-through cell configuration the response time is below 1s.

### 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.

## Temperature Sensor Characteristics

### Temperature Diode Response:



Temperature response of the integrated temperature diode  
( $I_f = 0.1\text{mA}$ )

### Temperature Sensor Specifications

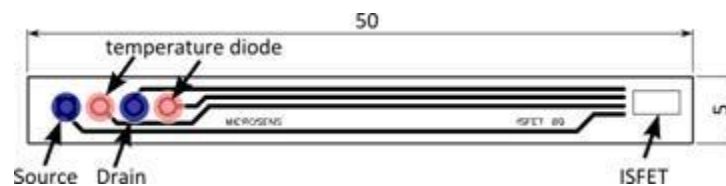
<b>Sensitivity:</b>	-2.5 mV/degC
<b>Range:</b>	0 ... 85°C
<b>Response time:</b>	< 1s

#### Note:

The temperature diode can be accessed through the designated connections of the sensing module. When using the temperature diode for measurements, it is important to set the potential of the diode's anode to the same value as the ISFET source in order to avoid leakage currents inside the sensor chip. We recommend to activate the temperature diode only for short measurements in order to avoid influencing the pH measurement via leakage currents.

## Sensor connections

### Connections of the packaged sensor



When the temperature measurement is not needed the contacts of the temperature diode can be left open.

## Reference-electrode

For stable measurements an Ag/AgCl Reference electrode is required. Submerged in the same volume as the packaged ISFET chip, it acts as gate electrode and provides a stable reference potential.

## 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.

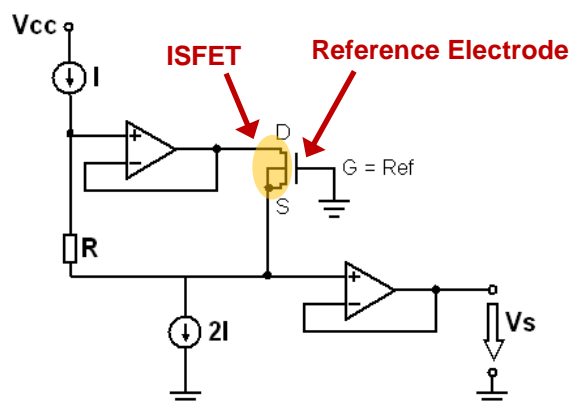
### Cleaning recommendations:

- 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



### Operating mode:

The circuit configuration is used to keep a constant drain current ( $I_{DS}$ ) for the ISFET operation providing an output voltage ( $V_S$ ) linearly depending on pH.