ST Analog Solutions

High-performance operational amplifiers and comparators, the best choice for longevity, robustness and performance.
Photodiode current sensing

What is photodiode current sensing?
Photodiode current sensing is used in applications such as proximity sensors as well as ambient light or UV sensors in smart buildings.

What are the key parameters offered by ST products?
- Low input bias
- Nanopower
- Small SC70-5 package

The photodiode generates a reverse current proportional to the amount of light. This current, only a few μA, is converted into a voltage and amplified by an op amp.

Featured products

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www.st.com/opamps
Smoke detector

What is a smoke detector?
A smoke detector is used to sense smoke in smart buildings.

What are the key parameters offered by ST products?
- Low input bias
- Low power
- Tiny DFN8 package (2 x 2 x 0.6 mm)

Small smoke particles inside the chamber scatter light from the LED into the photodiode. The current generated by the photodiode is amplified by an op amp.

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<td>Micropower CMOS op amp</td>
<td>High-impedance factor (1.15 MHz for 45 μA) CMOS op amp</td>
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What is a CO detector?
A CO detector is used to sense the presence of carbon monoxide in smart buildings. EN 52191 is the approved standard for CO detector.

What are the key parameters offered by ST products?
• Very high precision
• Low input bias
• Low power
• Tiny DFN8 package (2 x 1 x 0.55 mm)

The sensor generates current proportionally to the detected gas concentration, about tens of nA per ppm. This current is converted into a voltage and amplified.

Featured products

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www.st.com/opamps
Photodiode current sensing
Smoke detector
CO detector
PIR detector
Steering angle sensor
Resistance temperature detector
Current measurement
Cylinder pressure sensor
ECG electrocardiography
Pulse oximeter sensor
Glucose meter
Blood pressure sensor
4-20 mA current loop
Thermopile
Force / pressure (strain gauge)
Potentiometer

What is a PIR detector?
Pyroelectric passive infrared (PIR) detectors are used to detect motion in automatic lighting and alarm systems in smart buildings.

What are the key parameters offered by ST products?
- Low input bias
- Nanopower
- Tiny QFN16 package

Ceramic elements in sensor detect body heat radiation about 10 µm wavelength and generate a charge which is transferred into voltage.

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<td>Nanopower 5 V CMOS op amp + Rail-to-rail 1.1 V dual nanopower comparator</td>
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Steering angle sensor

What is a steering angle sensor?
A steering angle sensor measures the steering wheel position angle in cars.

What are the key parameters offered by ST products?
- High output current
- High speed
- TSSOP14 package

The rotor of the resolver is excited by sine waves using an op amp. The phase between the signals induced into the coils on the stator corresponds to the angle of the resolver.

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<td>10 MHz, rail-to-rail, 16 V CMOS op amp</td>
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Resistance temperature detector

What is a RTD?
Resistance temperature detectors (RTD) are used to measure a wide range of temperatures and is often used in industrial environments. Generally made of platinum, their resistance is dependent on the temperature.

What are the key parameters offered by ST products?
- Low input bias
- Nanopower
- Small SC70-5 package

Two channels of the TSZ124 are used to source a constant current through the RTD. The two others are used to amplify the voltage across the RTD.

Featured product

TSZ124/HPT
Very-high-accuracy
(5 µV) zero-drift
micropower 5 V op amp

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Current measurement

What is current measurement?
Current measurement is used in all automotive fields. Sensor element: shunt resistor.

What are the key parameters offered by ST products?
- Very high precision
- High speed
- Small SOT23-5 package

The current flowing to the load causes a voltage drop on a shunt resistor. A differential amplifier is directly connected to shunt and amplifies the voltage drop on it.

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<td>16 MHz, rail-to-rail 16 V CMOS op amp</td>
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Cylinder pressure sensor

What is a cylinder pressure sensor?
A cylinder pressure sensor is used in the piezoelectric measurement of pressure inside automotive cylinders. Sensor element: piezoelectric pressure sensor.

What are the key parameters offered by ST products?
- Very high precision
- High speed
- Small SOT23-5 package
- 150 °C qualified products

The charge coming from the sensor is converted into a voltage thanks to the feedback capacitor.

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<td>10 MHz, rail-to-rail, 16 V CMOS op amp</td>
<td>High-temperature (150 °C) rail-to-rail input/output wide-bandwidth op amp</td>
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What is ECG (electrocardiography)?
ECG monitors measure heart rates. Sensor element: electrodes placed on the body.

What are the key parameters offered by ST products?
- Very high accuracy
- High CMRR
- Low power
- Tiny 16-lead QFN package (3 x 3 mm)

The heart produces small electrical signals with every beat. This signal can be acquired and amplified for monitoring heart activity.

Featured product

**PRECISION**

**TSZ124**
Very-high-accuracy (5 μV) zero-drift micropower 5 V op amp

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Pulse oximeter sensor

What is pulse oximetry?
Pulse oximetry is used to measure heart rate and oxygen saturation (SO₂). Sensor element: IR and red LEDs with photodiode.

What are the key parameters offered by ST products?
- Micropower
- Accuracy
- Small SC70-5 package

The IR and red LEDs emit light onto the user’s skin. By measuring the ratio of transmitted lights, the oxygen concentration can be calculated.

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<td>High-accuracy, micropower CMOS op amp</td>
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Glucose meter

What is a glucose meter?
A glucose meter measures how much glucose is in the blood. Sensor element: special single-use test strip with chemical compound that reacts with glucose.

What are the key parameters offered by ST products?
- Low input bias
- High precision
- Low power
- Tiny DFN8 package (2 x 1 mm)

Blood reacts with a chemical compound on the test strip. When a small voltage is applied, a reaction occurs that generates a small measurable current at the nA level.

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<td>High-accuracy (Vin below 200 μV) micropower (10 μA) CMOS op amp</td>
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What is a blood pressure sensor?
A blood pressure sensor is used to measure and monitor a person’s blood pressure. Sensor element: piezo-resistive sensors in a Wheatstone bridge.

What are the key parameters offered by ST products?
- Very high precision
- Low power
- Tiny 16-lead QFN package (3 x 3 mm)

When pressure is applied to a piezo-resistive sensor, it changes its resistivity. An op amp is used to amplify the voltage difference across the bridge circuit.

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<td>High-accuracy (</td>
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<td>200 μV) micropower</td>
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<tr>
<td>(10 μA) CMOS op amp</td>
<td>micropower 5 V op amp</td>
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4-20 mA current loop

What is a 4-20 mA current loop?
A 4-20 mA current loop is used to transfer analog values across long distances. Sensor element: any analog sensor.

What are the key parameters offered by ST products?
- Rail-to-rail output
- Low power
- High supply voltages up to 36 V

Analog voltage values are converted into current and transferred over long distances by two wires. A receiver can then simply measure the current on a shunt resistor.

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<tr>
<td>Low power, rail-to-rail output, 36 V op amp</td>
<td>Precision, rail-to-rail 16 V CMOS op amp</td>
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4-20 mA current loop
Force / pressure (strain gauge)
Potentiometer

What is a thermopile?
A thermopile converts thermal energy into electrical energy and is used in contactless temperature sensing applications. Sensor element: a set of thermocouples.

What are the key parameters offered by ST products?
- Very high accuracy
- Low power
- Tiny DFN8 package (2 x 1 mm)

A thermopile consists of a set of thermocouples in series and a reference cold junction resistive temperature sensor.

Featured product

TSZ124
Very-high-accuracy (5 µV) zero-drift micropower 5 V op amp

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Force/pressure
(strain gauge)

What is a strain gauge?
A strain gauge measures pressure, force or other mechanical constraints. Sensor element: resistive wires in a Wheatstone bridge.

What are the key parameters offered by ST products?
- Very high accuracy
- Wide bandwidth
- Low power
- Small SOT23-5 package

Mechanical constraints cause resistive variations of elements inside the sensor due to length modification. An op amp is used to amplify the voltage difference across the bridge circuit.

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<td>Precision, rail-to-rail 16 V CMOS op amp</td>
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What is a potentiometer?
A potentiometer is used in the measurement of angle or position. Sensor element: a resistive layer (usually carbon) with a slider.

What are the key parameters offered by ST products?
- Low power
- Small SOT23-5 package

Potentiometers have a variable output impedance therefore a buffer is used. Thanks to the buffer, high-impedance potentiometers can be used to reduce power consumption.

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