

Photodiode current
sensing

Smoke detector

CO detector

PIR detector

Steering angle sensor

Resistance temperature
detector

Current measurement

Cylinder pressure
sensor



ST Analog Solutions

High-performance operational amplifiers and comparators, the
best choice for **longevity**, **robustness** and **performance**.

ECG
electrocardiography

Pulse oximeter sensor

Glucose meter

Blood pressure sensor

4-20 mA current loop

Thermopile

Force / pressure
(strain gauge)

Potentiometer

Photodiode current sensing

Smoke detector

CO detector

PIR detector

Steering angle sensor

Resistance temperature detector

Current measurement

Cylinder pressure sensor

Photodiode current sensing



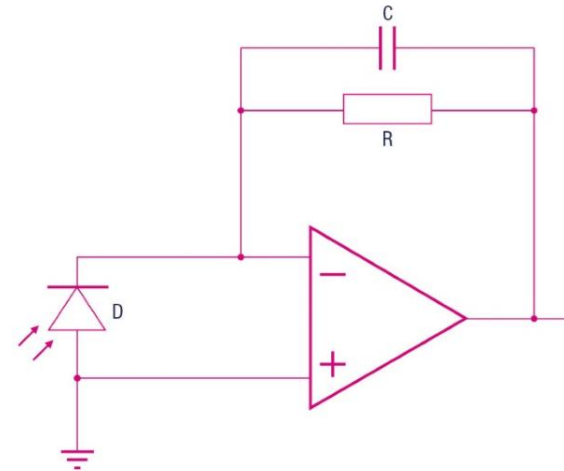
What is photodiode current sensing?

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

LOW-POWER



TSU101
Nanopower 5 V CMOS op amp

PRECISION



TSX711
Precision, rail-to-rail 16 V CMOS op amp

WIDE-BAND



TSV631
Micropower CMOS op amp

ECG
electrocardiography

Pulse oximeter sensor

Glucose meter

Blood pressure sensor

4-20 mA current loop

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Force / pressure
(strain gauge)

Potentiometer

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CO detector

PIR detector

Steering angle sensor

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Current measurement

Cylinder pressure sensor

Smoke detector



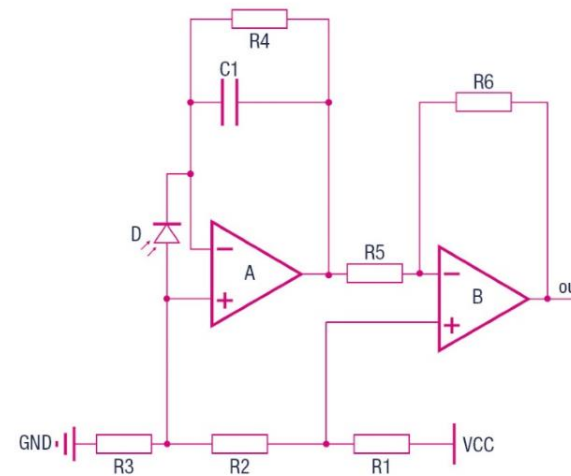
What is a smoke detector?

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.



Featured products

LOW-POWER



TSV6292

Micropower CMOS op amp

WIDE-BAND



TSV522

High merit factor
(1.15 MHz for 45 μ A)
CMOS op amp

ECG
electrocardiography

Pulse oximeter sensor

Glucose meter

Blood pressure sensor

4-20 mA current loop

Thermopile

Force / pressure
(strain gauge)

Potentiometer

Photodiode current sensing

Smoke detector

CO detector

PIR detector

Steering angle sensor

Resistance temperature detector

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ECG
electrocardiography

Pulse oximeter sensor

Glucose meter

Blood pressure sensor

4-20 mA current loop

Thermopile

Force / pressure
(strain gauge)

Potentiometer



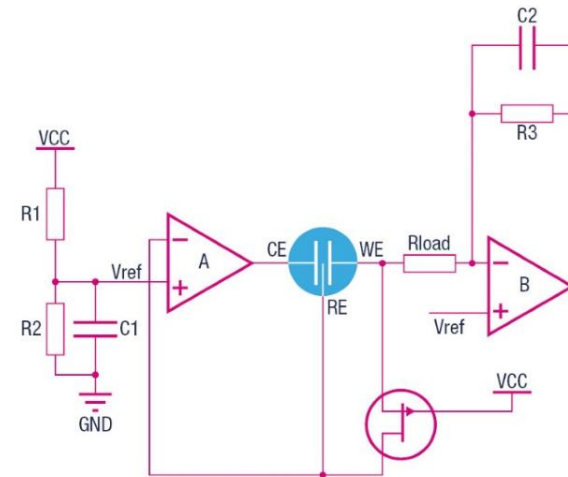
What is a CO detector?

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

LOW-POWER



TSU102

Nanopower 5 V CMOS
op amp

PRECISION



TSZ122

Micropower zero-drift
5 V op amp

WIDE-BAND



TSV732

High-accuracy,
micropower CMOS
op amp

www.st.com/opamps

Photodiode current sensing

Smoke detector

CO detector

PIR detector

Steering angle sensor

Resistance temperature detector

Current measurement

Cylinder pressure sensor

PIR detector



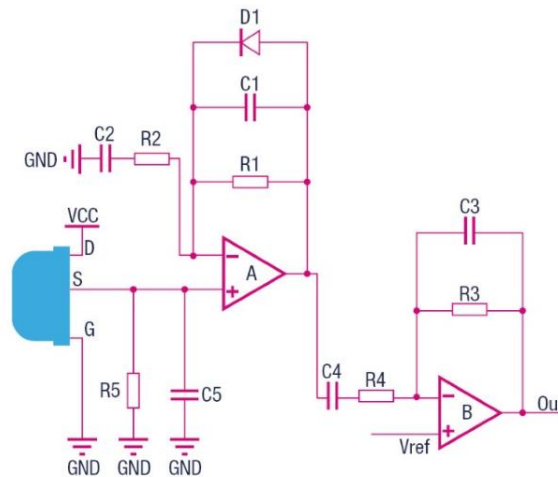
What is a PIR detector?

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.



Featured products

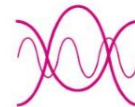
LOW-POWER



TSU104

Nanopower 5 V CMOS
op amp

ALTERNATIVE



TSU102

Nanopower 5 V CMOS
op amp

+

TS882

Rail-to-rail 1.1 V dual
nanopower comparator

ECG
electrocardiography

Pulse oximeter sensor

Glucose meter

Blood pressure sensor

4-20 mA current loop

Thermopile

Force / pressure
(strain gauge)

Potentiometer

Photodiode current sensing

Smoke detector

CO detector

PIR detector

Steering angle sensor

Resistance temperature detector

Current measurement

Cylinder pressure sensor

Steering angle sensor



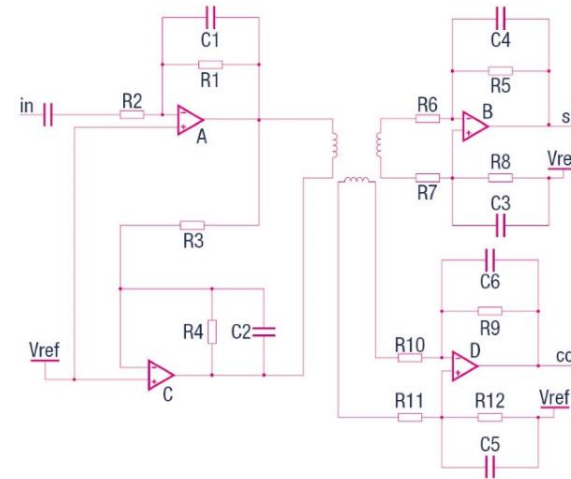
What is a steering angle sensor?

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 inducted into the coils on the stator corresponds to the angle of the resolver.



Featured products

LOW-POWER



TSX564IYPT

High output current
16 V CMOS op amp

WIDE-BAND



TSX922IYDT

High output current,
10 MHz, rail-to-rail,
16 V CMOS op amp

ECG
electrocardiography

Pulse oximeter sensor

Glucose meter

Blood pressure sensor

4-20 mA current loop

Thermopile

Force / pressure
(strain gauge)

Potentiometer

Photodiode current sensing

Smoke detector

CO detector

PIR detector

Steering angle sensor

Resistance temperature detector

Current measurement

Cylinder pressure sensor

Resistance temperature detector



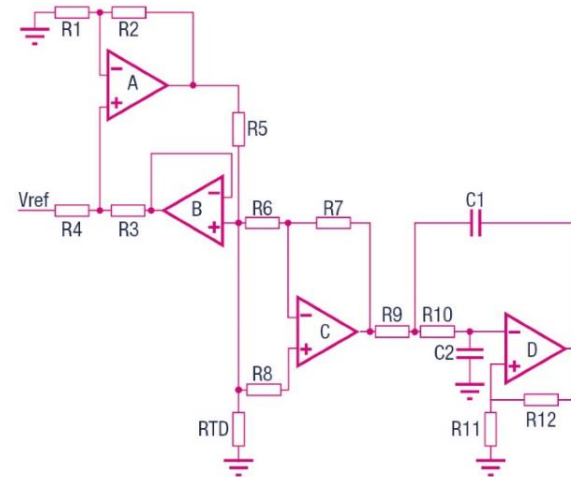
What is a RTD?

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

PRECISION



TSZ124IYPT

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

www.st.com/opamps

ECG
electrocardiography

Pulse oximeter sensor

Glucose meter

Blood pressure sensor

4-20 mA current loop

Thermopile

Force / pressure
(strain gauge)

Potentiometer

Photodiode current sensing

Smoke detector

CO detector

PIR detector

Steering angle sensor

Resistance temperature detector

Current measurement

Cylinder pressure sensor

Current measurement



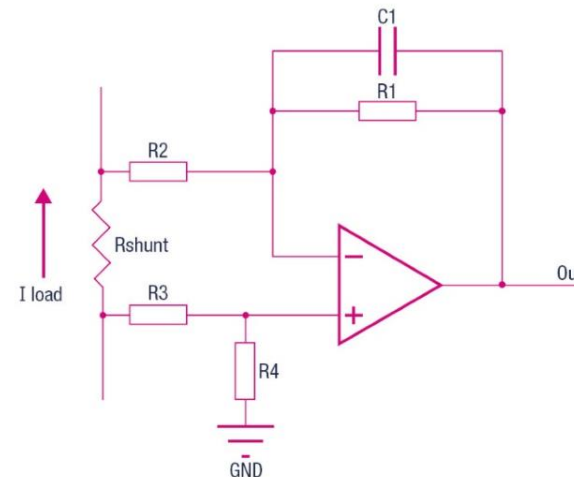
What is current measurement?

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.



Featured products

LOW-POWER



TSX7191IYLT

Low-power, precision,
rail-to-rail, 9.0 MHz,
16 V op amp

PRECISION



TSZ121IYLT

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

WIDE-BAND



TSX9291IYLT

16 MHz, rail-to-rail
16 V CMOS op amp

ECG
electrocardiography

Pulse oximeter sensor

Glucose meter

Blood pressure sensor

4-20 mA current loop

Thermopile

Force / pressure
(strain gauge)

Potentiometer

Photodiode current sensing

Smoke detector

CO detector

PIR detector

Steering angle sensor

Resistance temperature detector

Current measurement

Cylinder pressure sensor

Cylinder pressure sensor



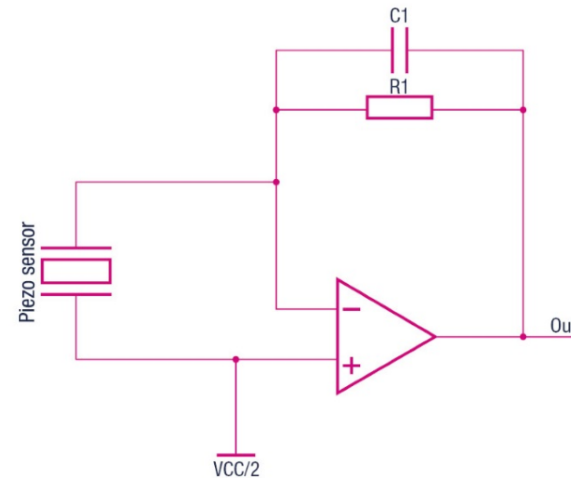
What is a cylinder pressure sensor?

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.



Featured products

WIDE-BAND



TSX922IYDT

10 MHz, rail-to-rail,
16 V CMOS op amp

WIDE-BAND



TSV912HYDT

High-temperature (150 °C)
rail-to-rail input/output
wide-bandwidth op amp

ECG
electrocardiography

Pulse oximeter sensor

Glucose meter

Blood pressure sensor

4-20 mA current loop

Thermopile

Force / pressure
(strain gauge)

Potentiometer

Photodiode current sensing

Smoke detector

CO detector

PIR detector

Steering angle sensor

Resistance temperature detector

Current measurement

Cylinder pressure sensor

ECG electrocardiography



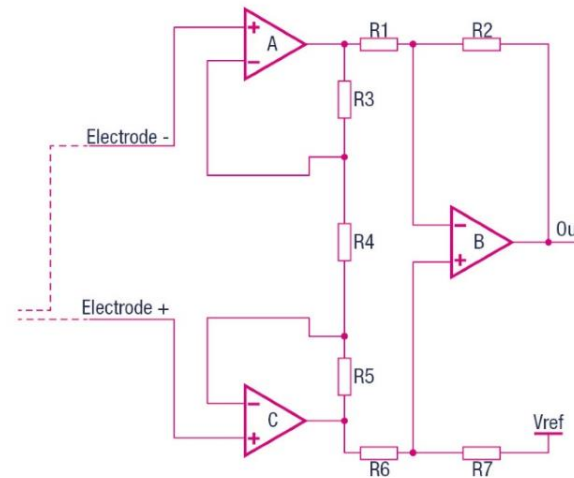
What is ECG (electrocardiography)?

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 μ V) zero-drift
micropower 5 V op amp

www.st.com/opamps

ECG
electrocardiography

Pulse oximeter sensor

Glucose meter

Blood pressure sensor

4-20 mA current loop

Thermopile

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(strain gauge)

Potentiometer

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PIR detector

Steering angle sensor

Resistance temperature detector

Current measurement

Cylinder pressure sensor

Pulse oximeter sensor



What is pulse oximetry?

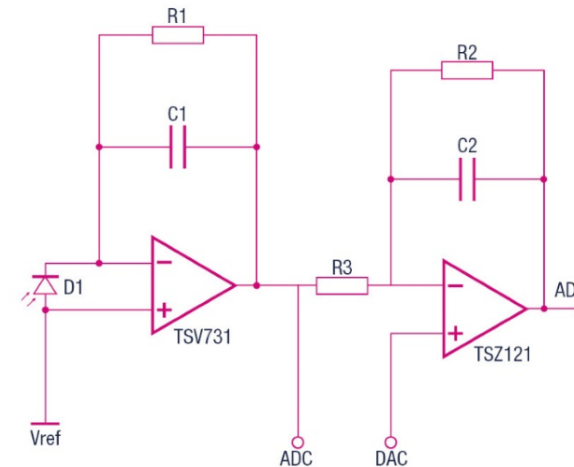
Pulse oximetry is used to measure heart rate and oxygen saturation (SO_2).

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.



Featured products

PRECISION



TSZ121

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

WIDE-BAND



TSV731

High-accuracy,
micropower CMOS
op amp

ECG
electrocardiography

Pulse oximeter sensor

Glucose meter

Blood pressure sensor

4-20 mA current loop

Thermopile

Force / pressure
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Potentiometer

Photodiode current sensing

Smoke detector

CO detector

PIR detector

Steering angle sensor

Resistance temperature detector

Current measurement

Cylinder pressure sensor

Glucose meter



What is a glucose meter?

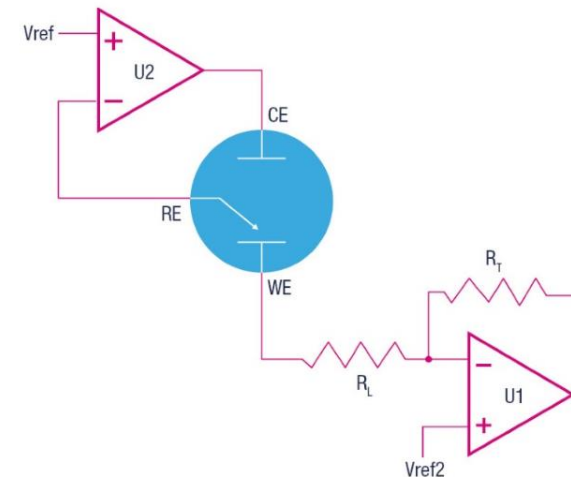
A glucose meter measures how much glucose is in the blood.

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.



Featured products

LOW-POWER



TSV612

Micropower rail-to-rail input/output CMOS op amp

PRECISION



TSV712

High-accuracy (V_{io} below 200 μV) micropower (10 μA) CMOS op amp

ECG
electrocardiography

Pulse oximeter sensor

Glucose meter

Blood pressure sensor

4-20 mA current loop

Thermopile

Force / pressure
(strain gauge)

Potentiometer

Photodiode current sensing

Smoke detector

CO detector

PIR detector

Steering angle sensor

Resistance temperature detector

Current measurement

Cylinder pressure sensor

Blood pressure sensor



What is a blood pressure sensor?

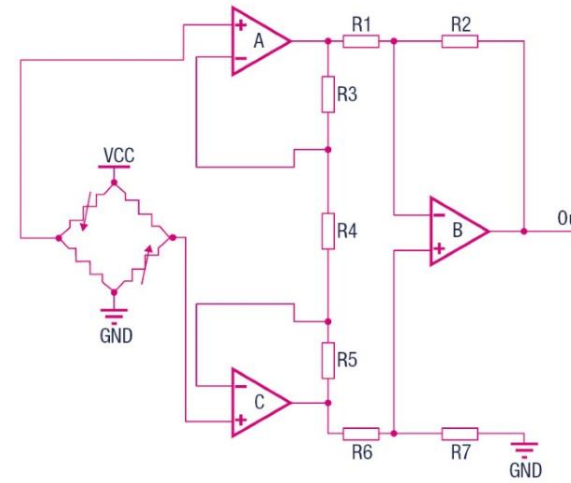
A blood pressure sensor is used to measure and monitor a person's blood pressure.

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.



Featured products

LOW-POWER



TSV714

High-accuracy (V_{io} below 200 μV) micropower (10 μA) CMOS op amp

PRECISION



TSZ124

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

ECG
electrocardiography

Pulse oximeter sensor

Glucose meter

Blood pressure sensor

4-20 mA current loop

Thermopile

Force / pressure
(strain gauge)

Potentiometer

Photodiode current sensing

Smoke detector

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PIR detector

Steering angle sensor

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electrocardiography

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Glucose meter

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4-20 mA current loop

Thermopile

Force / pressure
(strain gauge)

Potentiometer

4-20 mA current loop



What is a 4-20 mA current loop?

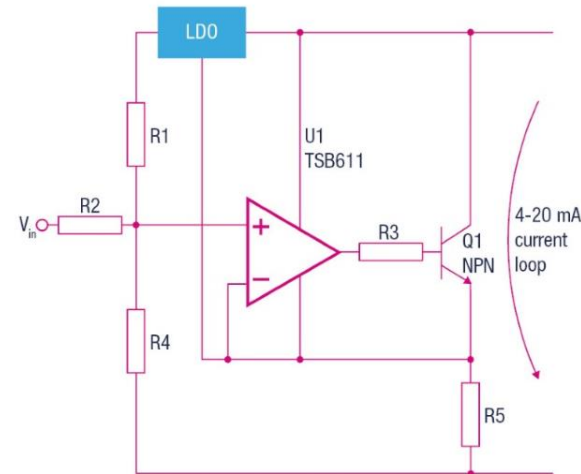
A 4-20 mA current loop is used to transfer analog values across long distances.

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.



Featured products

LOW-POWER



TSB611

Low power, rail-to-rail output, 36 V op amp

PRECISION



TSX711

Precision, rail-to-rail 16 V CMOS op amp

HIGH-VOLTAGE



TSB572

Low-power, rail-to-rail input/output 36 V op amp

Photodiode current sensing

Smoke detector

CO detector

PIR detector

Steering angle sensor

Resistance temperature detector

Current measurement

Cylinder pressure sensor

Thermopile



What is a thermopile?

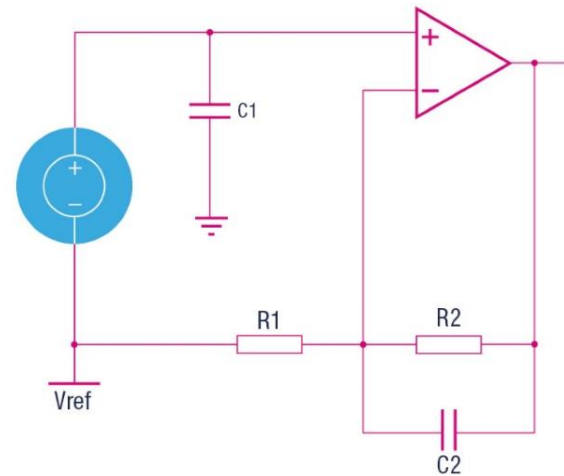
A thermopile converts thermal energy into electrical energy and is used in contactless temperature sensing applications.

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

PRECISION



TSZ124

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

www.st.com/opamps

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Resistance temperature detector

Current measurement

Cylinder pressure sensor

Force/pressure (strain gauge)



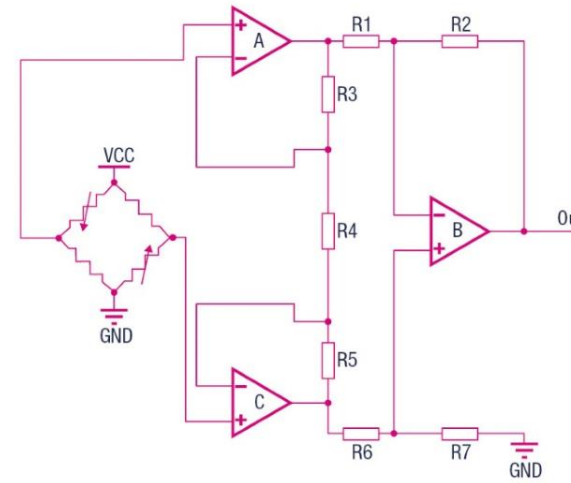
What is a strain gauge?

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.



Featured products

LOW-POWER



TSV714

High-accuracy,
micropower (10 μ A)
CMOS op amp

PRECISION



TSZ124

Very-high-accuracy
(5 μ V) zero drift,
micropower 5 V op amp

WIDE-BAND



TSX712

Precision, rail-to-rail
16 V CMOS op amp

ECG
electrocardiography

Pulse oximeter sensor

Glucose meter

Blood pressure sensor

4-20 mA current loop

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(strain gauge)

Potentiometer

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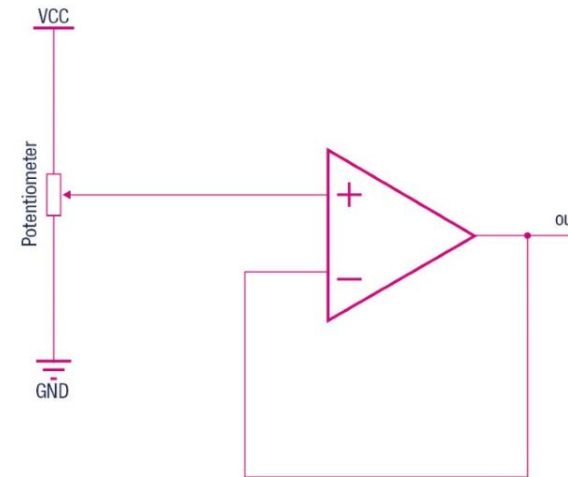
What is a potentiometer?

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.



Featured products

LOW-POWER



TSV611

Micropower rail-to-rail input/output CMOS op amp

HIGH-VOLTAGE



TSX711

Precision, rail-to-rail 16 V CMOS op amp

ECG
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Potentiometer