



# ST Analog cards

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

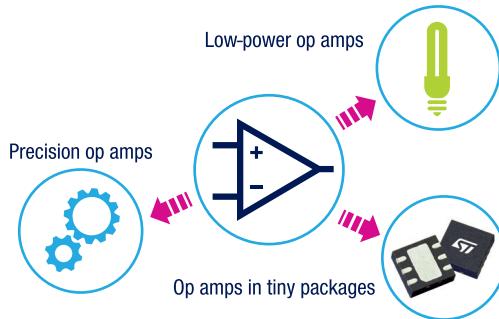


# ST Analog cards

## ST op amps & comparators at a glance

40 years experience in analog design  
50 billion units manufactured since 1980  
300 standard analog references available  
More than 200 automotive-grade devices available  
Leading supplier for space products  
1.5 billion units manufactured per year (40 units/s)  
High reliability: 0.05 ppm for automotive-grade, 1 ppm for industrial-grade

The main features of our growing portfolio are:



## ST op amps mobile application



The ST op amps app makes selecting the best component for your application easy!



Download from the App Store or Google Play



To learn more, download datasheets and application notes or order samples at [www.st.com/opamps](http://www.st.com/opamps)

# Photodiode current sensing



Photodiode  
current  
sensing

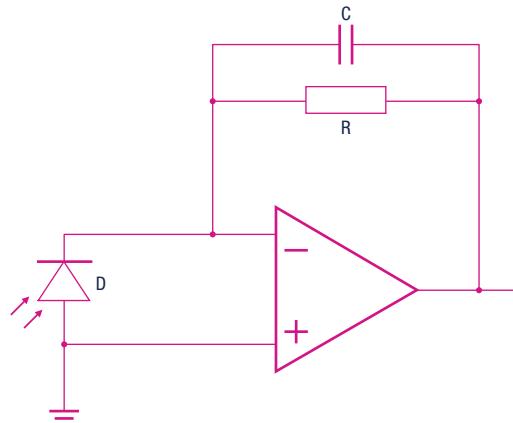
## What is photodiode current sensing?

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  $\mu$ A, 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

# Smoke detector



Smoke  
detector



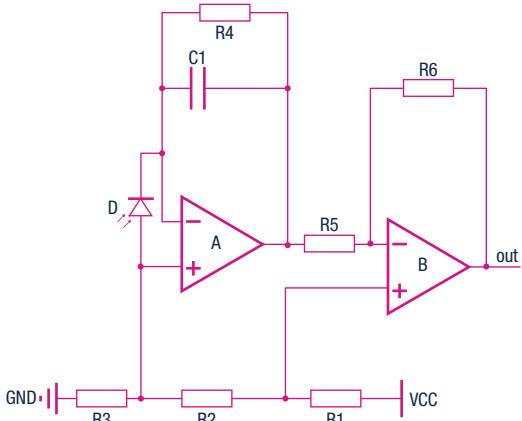
## What is a smoke detector?

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  $\mu$ A)  
CMOS op amp

# CO detector



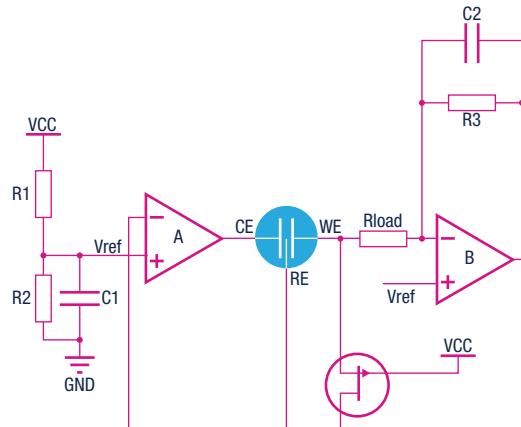
## What is a CO detector?

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

# PIR detector



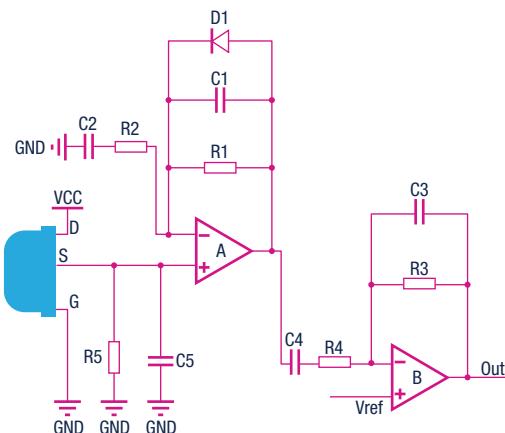
## What is a PIR detector?

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  $\mu\text{m}$  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

# Steering angle sensor



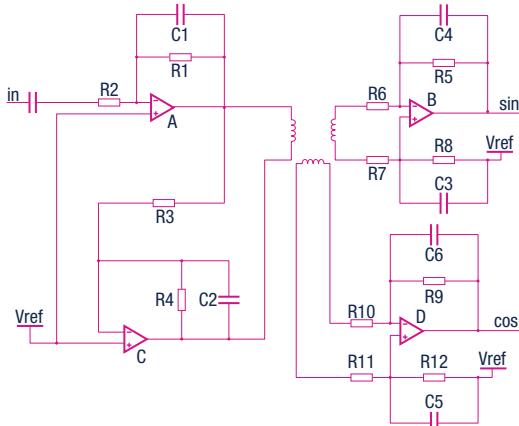
## What is a steering angle sensor?

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

Steering  
angle  
sensor

# Resistance temperature detector



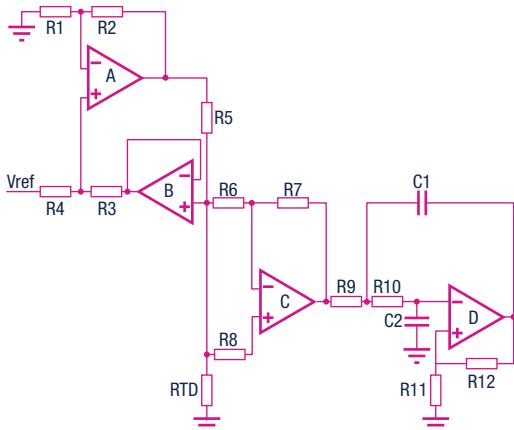
## What is a RTD?

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  $\mu$ V) zero-drift  
micropower 5 V op amp

[www.st.com/opamps](http://www.st.com/opamps)

Resistance  
temperature  
detector

# Current measurement



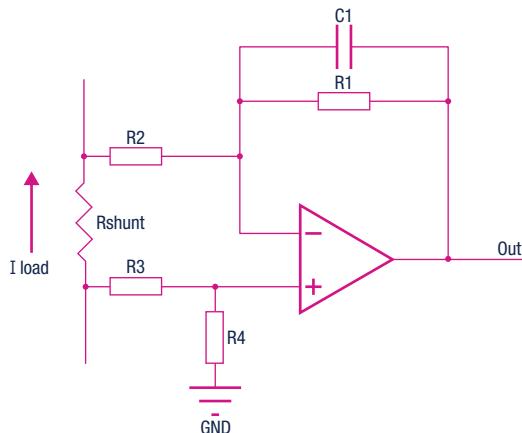
## What is current measurement?

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  $\mu$ V) zero-drift micropower 5 V op amp

### WIDE-BAND



#### TSX9291IYLT

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

[www.st.com/opamps](http://www.st.com/opamps)

# Cylinder pressure sensor



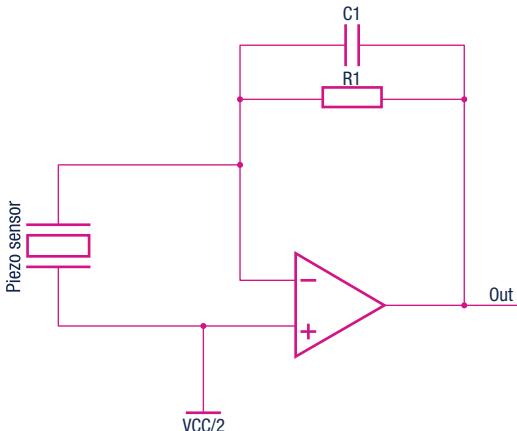
## What is a cylinder pressure sensor?

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

[www.st.com/opamps](http://www.st.com/opamps)



Cylinder  
pressure  
sensor

# ECG electrocardiography



## What is ECG (electrocardiography)?

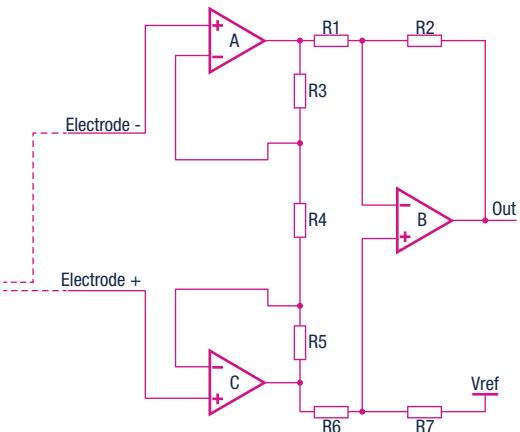
ECG monitors measure heart rates.

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  $\mu$ V) zero-drift  
micropower 5 V op amp

[www.st.com/opamps](http://www.st.com/opamps)

# Pulse oximeter sensor



## What is pulse oximetry?

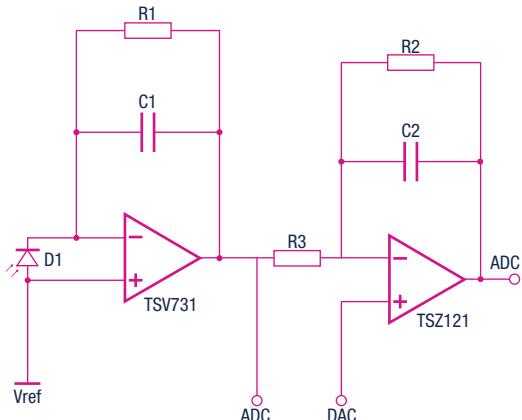
Pulse oximetry is used to measure heart rate and oxygen saturation ( $SO_2$ ).

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  $\mu$ V) zero-drift  
micropower 5 V op amp

### WIDE-BAND



#### TSV731

High-accuracy,  
micropower CMOS  
op amp



[www.st.com/opamps](http://www.st.com/opamps)

# Glucose meter



## What is a glucose meter?

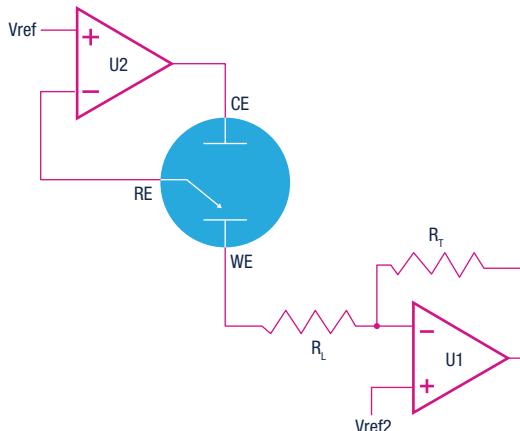
A glucose meter measures how much glucose is in the blood.

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



Glucose  
meter

### LOW-POWER



TSV612

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

### PRECISION



TSV712

High-accuracy (Vio below  
200  $\mu$ V) micropower  
(10  $\mu$ A) CMOS op amp

# Blood pressure sensor



## What is a blood pressure sensor?

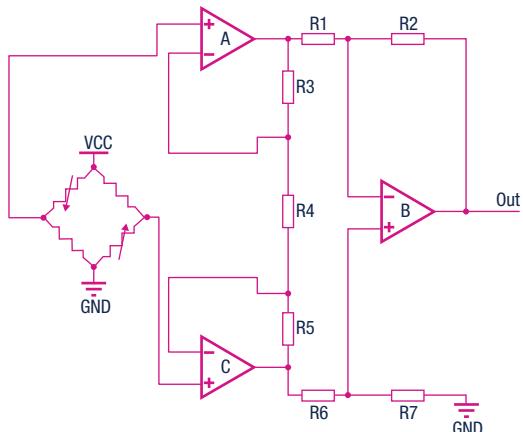
A blood pressure sensor is used to measure and monitor a person's blood pressure.

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  $\mu$ V) micropower (10  $\mu$ A) CMOS op amp

### PRECISION



#### TSZ124

Very-high-accuracy (5  $\mu$ V) zero-drift micropower 5 V op amp

# 4-20 mA current loop



4-20 mA  
current loop

## What is a 4-20 mA current loop?

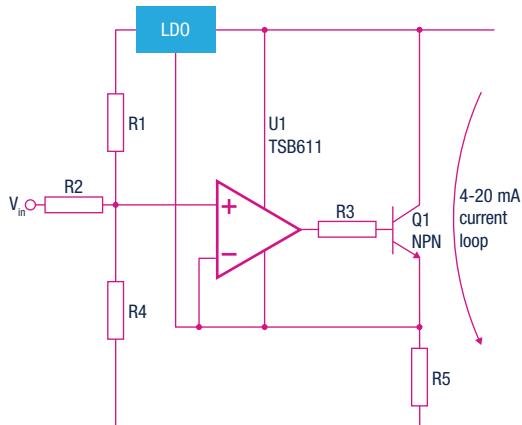
A 4-20 mA current loop is used to transfer analog values across long distances.

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



# Thermopile



## What is a thermopile?

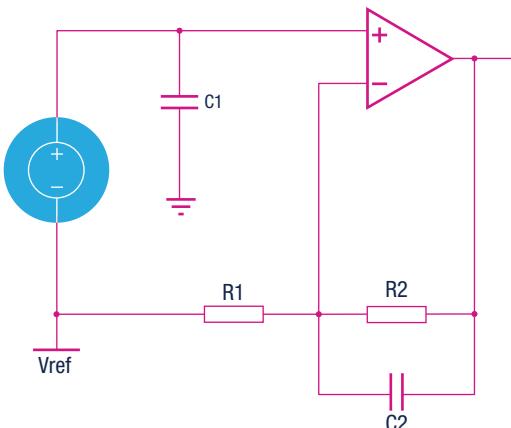
A thermopile converts thermal energy into electrical energy and is used in contactless temperature sensing applications.

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  $\mu$ V) zero-drift  
micropower 5 V op amp

[www.st.com/opamps](http://www.st.com/opamps)

Force/pressure  
(strain gauge) 

# Force/pressure (strain gauge)



## What is a strain gauge?

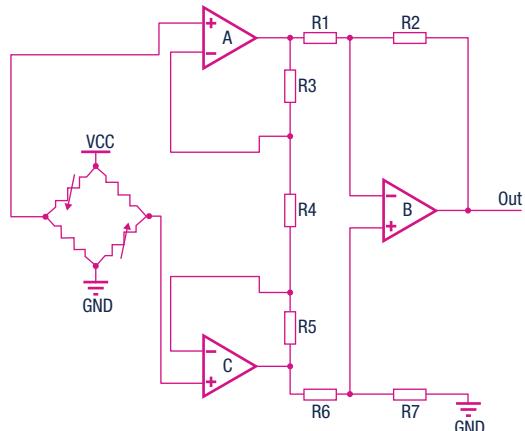
A strain gauge measures pressure, force or other mechanical constraints.

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  $\mu$ A)  
CMOS op amp

### PRECISION



#### TSZ124

Very-high-accuracy  
(5  $\mu$ V) zero drift,  
micropower 5 V op amp

### WIDE-BAND



#### TSX712

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



# Potentiometer



## What is a potentiometer?

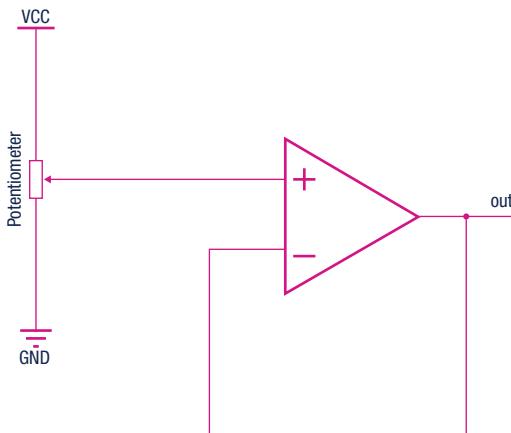
A potentiometer is used in the measurement of angle or position.

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

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