Low-side current sensing

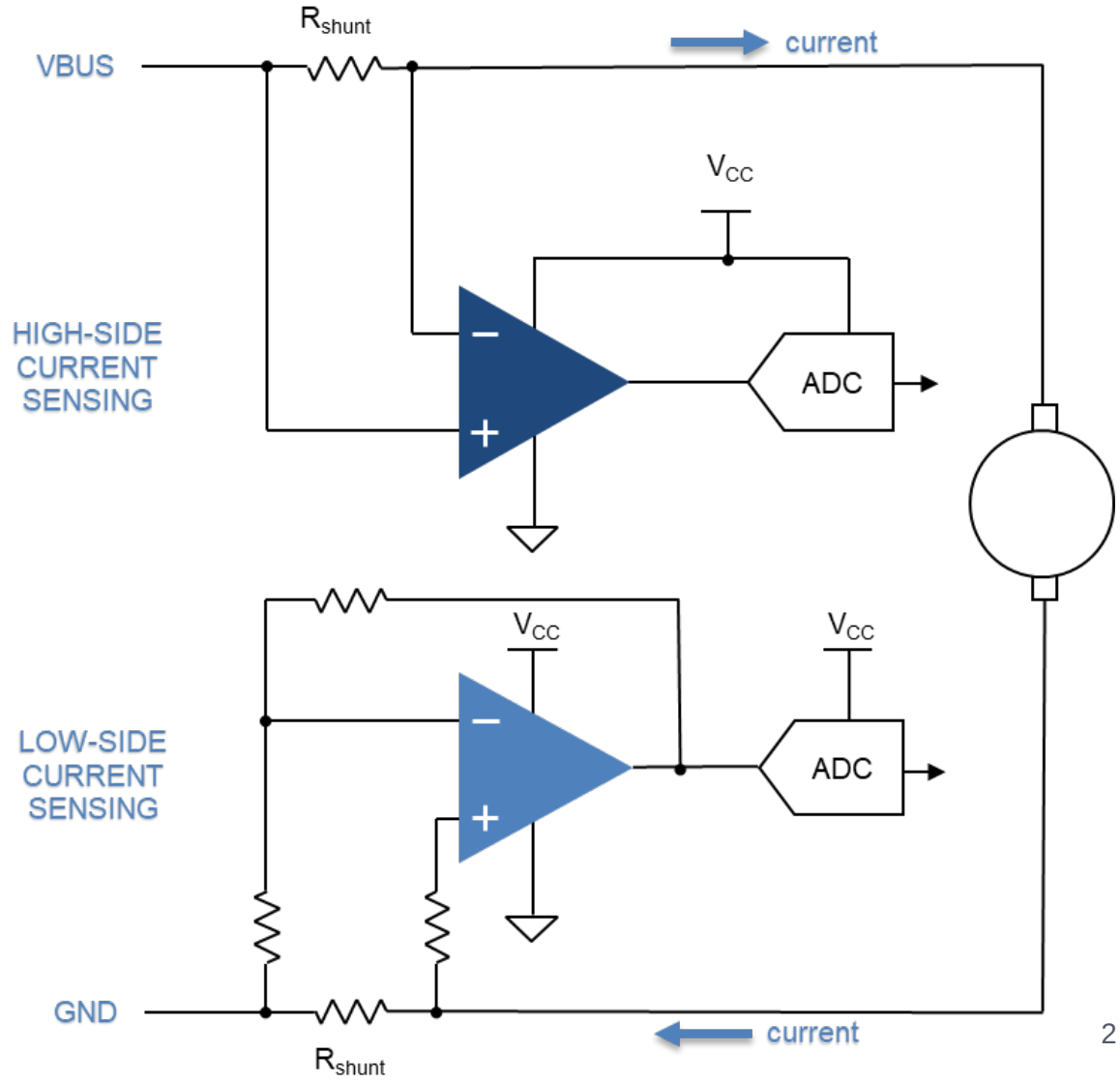
ST Op Amps

What is low-side current sensing?

What is the definition?

- Low-side current sensing is a technique used to measure the current flowing through a load by placing a sensing resistor between the load and ground.
- Low-side current sensing is widely used in power management, motor control, battery monitoring, and various electronic circuits.

Low-side current sensing is a simple, cost-effective method for current measurement



What is the basic principle of low-side current sensing?

What is the working principle?

1. **Placement of the shunt resistor:**

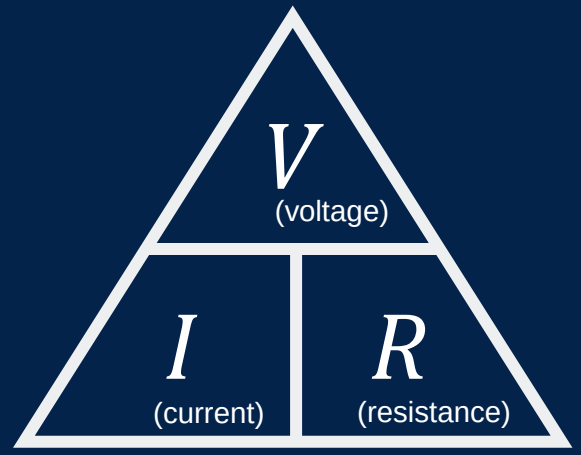
- In low-side current sensing, a shunt resistor (or sensing resistor) is placed between the load and ground (or the zero-voltage reference point).
- This means the shunt resistor is located on the "low" side of the circuit, i.e., between the load and ground.

2. **Voltage measurement**:

- The current flowing through the load also flows through the shunt resistor.
- By measuring the voltage drop across this shunt resistor, the current flowing through the load can be determined using Ohm's law: $I = \frac{V}{R}$, where I is the current, V is the voltage drop, and R is the value of the shunt resistor.

Ohm's law

The voltage drop across the sensing resistor is proportional to the current flowing through it.



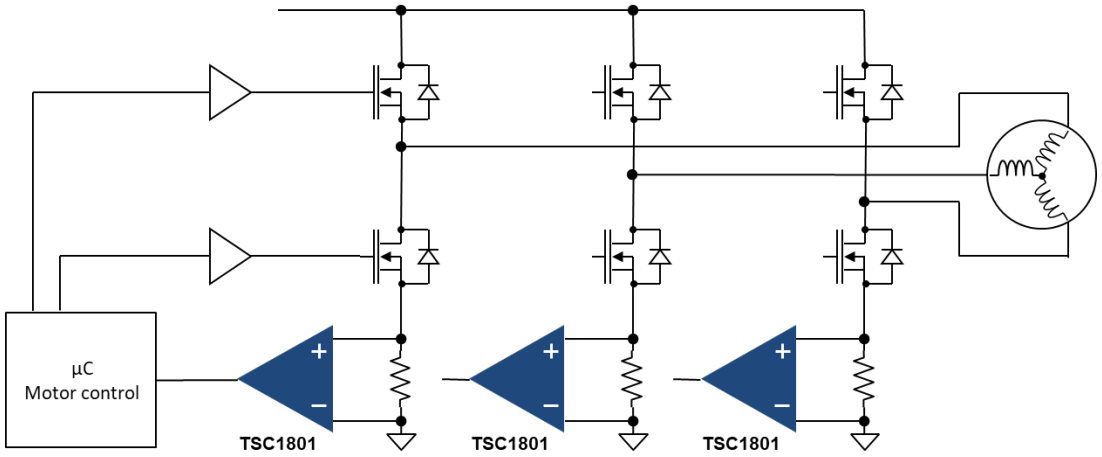
What are the advantages of low-side current sensing?

Simplicity: the configuration is relatively simple and requires few additional components.

Accuracy: since the measurement is ground-referenced, it's more immune to noise and electromagnetic interferences.

Cost-effective: uses inexpensive resistors and operational amplifiers.

Example: 3-phase motor-control with low-side current measurement by TSC1801.



Typical applications

Wide range of automotive and industrial applications thanks to a combination of high-performance parameters






- Industrial
- Automotive
- Low-side motor current control
- Solar-powered systems

Discover ST's low-side current sensing

Type	Category	Product	Channel			Grade		Bandwidth for a gain of 20	Max accuracy / Gain error
			Single	Dual	Quad	Industrial	Automotive		
Integrated gain	Current sense	**TSC1801**	TSC1801			YES	YES	2.1 MHz	200 µV / 0.1%
Standalone op amp	Precision 5 V	**TSV77 series**	TSV771	TSV772	TSV774	YES	YES	1 MHz	200 µV
	Precision 5 V	**TSV79 series**	TSV791	TSV792	TSV794	YES	YES	2.5 MHz	200 µV
	Zero drift 5 V	**TSZ15 series**	TSZ151	TSZ152		YES	YES	80 kHz	7 µV
	Zero drift 5 V	**TSZ18 series**	TSZ181	TSZ182		YES	YES	150 kHz	25 µV
	Zero drift 36 V	**TSB18 series**	TSB181	TSB1812		YES	YES	150 kHz	20 µV

Want to test low-side current sensing?

Discover the STEVAL-ISQ014V1

The STEVAL-ISQ014V1 evaluation board implements low-side current sensing, which involves placing a sense resistor between the load and the circuit ground. The voltage drop across this resistor is then amplified using a TSZ121 operational amplifier, enabling precise current measurement.

Need help?

Discover our user manual: How to use the product evaluation board STEVAL-ISQ014V1 for low-side current sensing with the TSZ121 operational amplifier

For more information:

st.com/low-side-current-sensing