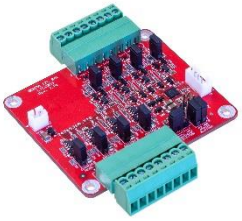
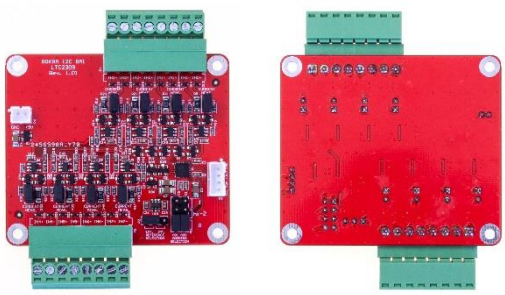
MAKE THINGS HAPPY !

I2C 8AI LTC2309



The **BOKRA I2C 8AI LTC2309** modules are analog input modules based on the 12-bit high-speed and low-power ADC LTC2309. Compatible with most types of microcontrollers (I^2C interface is used to communicate with them).

The **BOKRA I2C 8AI LTC2309** modules allow you to measure eight differential analog signals - both voltage and current. Used in the Analog Devices LTC2309 ADC module, it has 12 bits. The type of ADC used is SAR (sequential approximation ADC). Measurement speed - 14000 measurements per second. The range of voltage measurement is 0-5V. Measuring Current Range: 4-20mA. The ADC used in the module is characterized by low consumption: 1.5mW for a speed of 1000 measurements per second, 35µW in Sleep mode.



Input power: 5VDC. Possibility of using internal and external reference voltage.

On the website of the manufacturer of the ADC - Analog Devices - are some of the main applications:

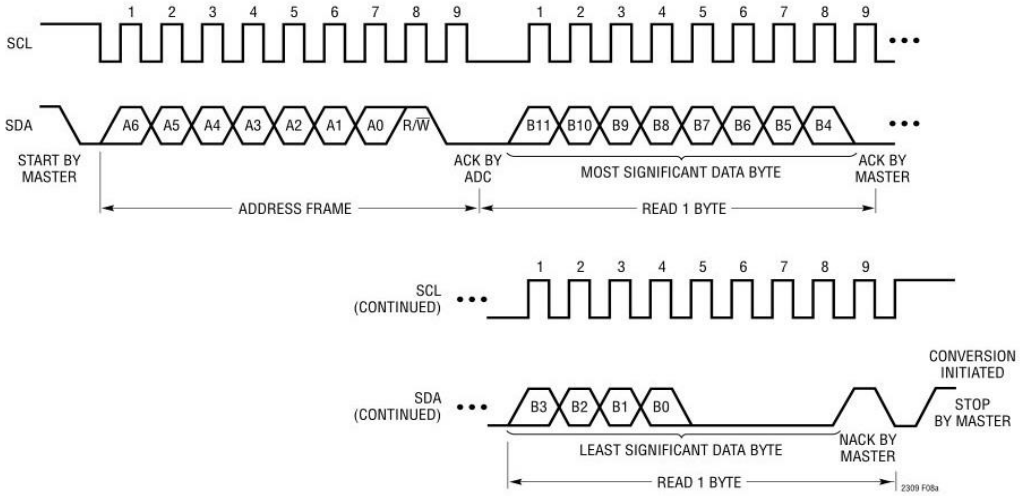
- Industrial Process Control
- Remote data acquisition
- Battery powered devices
- Motor and engine control
- IoT
- Voltage and current monitoring

BOKRA I2C 8AI LTC2309 features

- The type of ADC used is SAR (sequential approximation ADC)
- 8 differential analog input channels
- The range of voltage measurement is 0-5V
- Measuring Current Range: 4-20mA
- Measurement speed - 14000 measurements per second
- I^2C interface: 100Khz, 400Khz
- The addresses of the LTC2309 ADC on the I^2C are one of 9 possible addresses, another address is used to synchronize several LTC2309 ADCs.
- Compatible with most types of microcontrollers
- Input power: 5VDC
- The module size 65 x 56 mm. The format of the module corresponds to the popular format of the Raspberry Pi 3A+, which greatly simplifies its use with the Raspberry Pi.

Calculation of the measured voltage and current

The LTC2309 is a 12-bit ADC that transmits its data as two bytes with 12 significant bits (B11-B0).



Due to that, before any further processing, the 16-bit value received from LTC2309 must be shifted to the right for 4 bits. The result value is $X_{ADC.}$

Since the reference voltage (V_{REF}) is 4.096 V and number of ADC bits is N = 12 (this means the full scale ADC result is 0xFFF or 4095), the conversion result in volts is obtain by calculation:

$$V_{ADC} = \frac{X_{ADC}}{4095} \times 4.096V\ [V]$$

Obviously, the maximum voltage on the ADC input can be 4.096 V. On each ADC input, there is differential amplifier with gain of 0.75, so the V_{ADC} must be divided by 0.75 in order to calculate the input voltage of the channel.

$$V_{IN} = \frac{V_{ADC}}{0.75}\ [V]$$

Each **BOKRA I2C 8AI LTC2309** channel has its corresponding shunt jumper.

If jumper is disconnected, the channel is used to measure voltage between (+) and (-) terminal. The voltage range is unipolar, from 0 to +5V full scale (maximum measured voltage is 5.46 V).

If jumper is connected, the current sense resistor is connected between (+) and (-) terminal of that channel, so the channel is used to measure current. The current range is unipolar, from 0 to +20 mA full scale (maximum measured current is 24.8 mA). Voltage of the shunt resistor is as calculated (V_{IN}).

In order to calculate the measured current, the measured voltage must be divided by the current sense resistor resistance:

$$I_{IN} = \frac{V_{IN}}{R\ [k\Omega]}\ [mA]$$

Given the current sense resistor resistance is 220 Ω, the equation can be rewritten as:

$$I_{IN} = \frac{V_{IN}}{0.22\ [k\Omega]}\ [mA]$$

The following figure shows the **location of elements on the BOKRA I2C 8AI LTC2309 module**.

Power Supply - Via P6 Connector.

Communication with **BOKRA I2C 8AI LTC2309** via I^2C interface via an external P3 connector.

The P2 connector is used to select external or internal voltage reference.

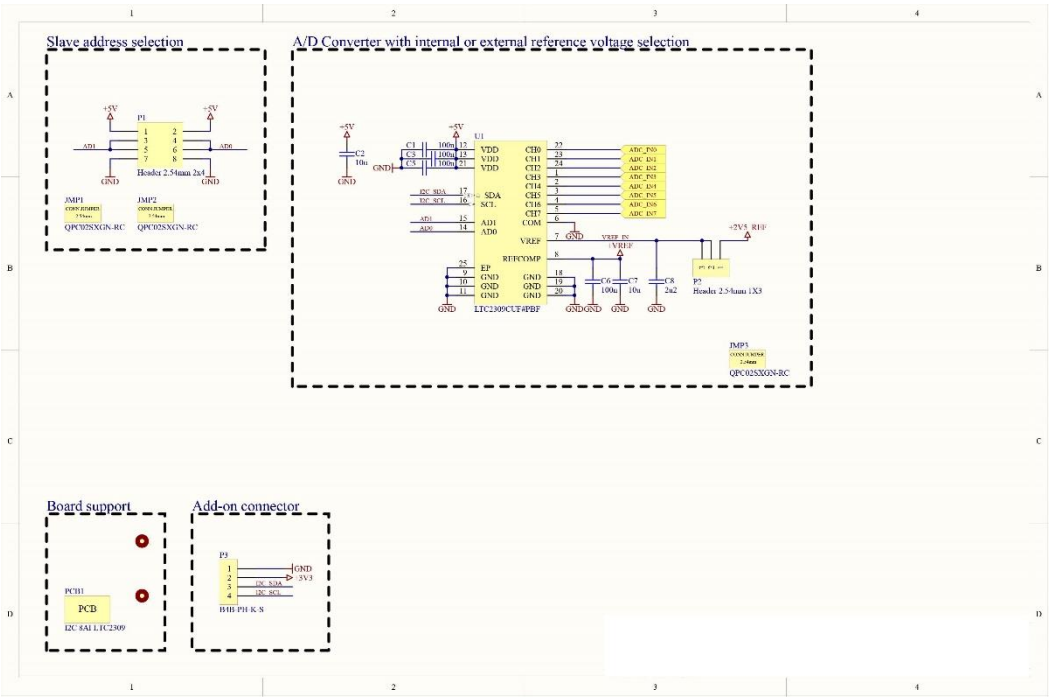
Each channel of the **BOKRA I2C 8AI LTC2309** has a corresponding bypass jumper (P7-P14).

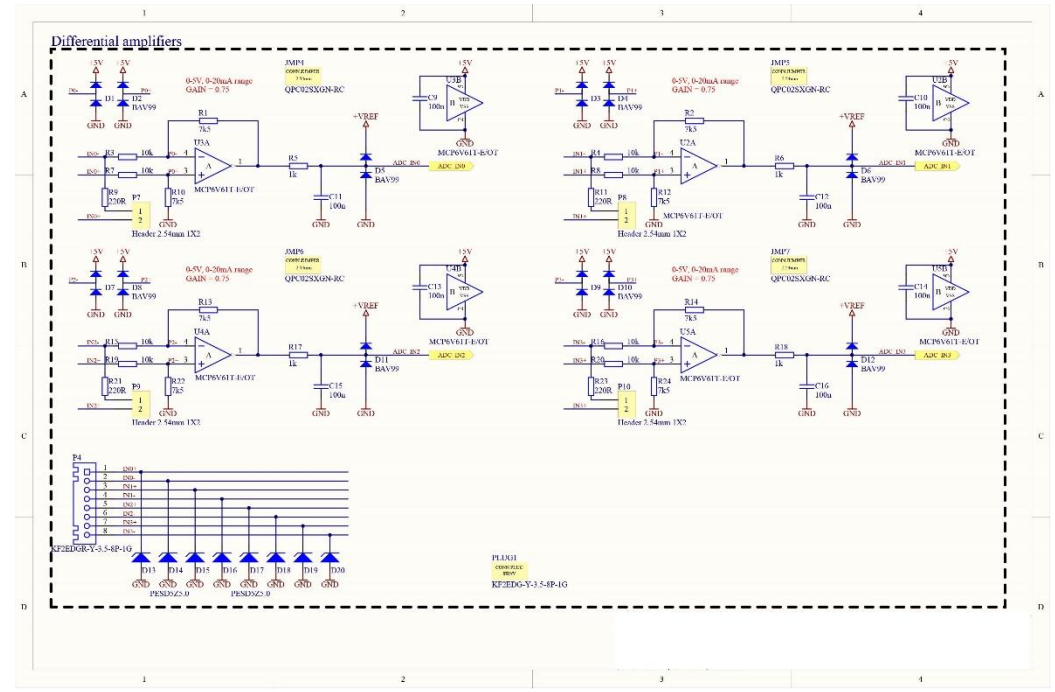
The LTC2309 ADC address on the I^2C interface is set using connector P1. It is determined by two digits (AD0 and AD1) in accordance with the following table:

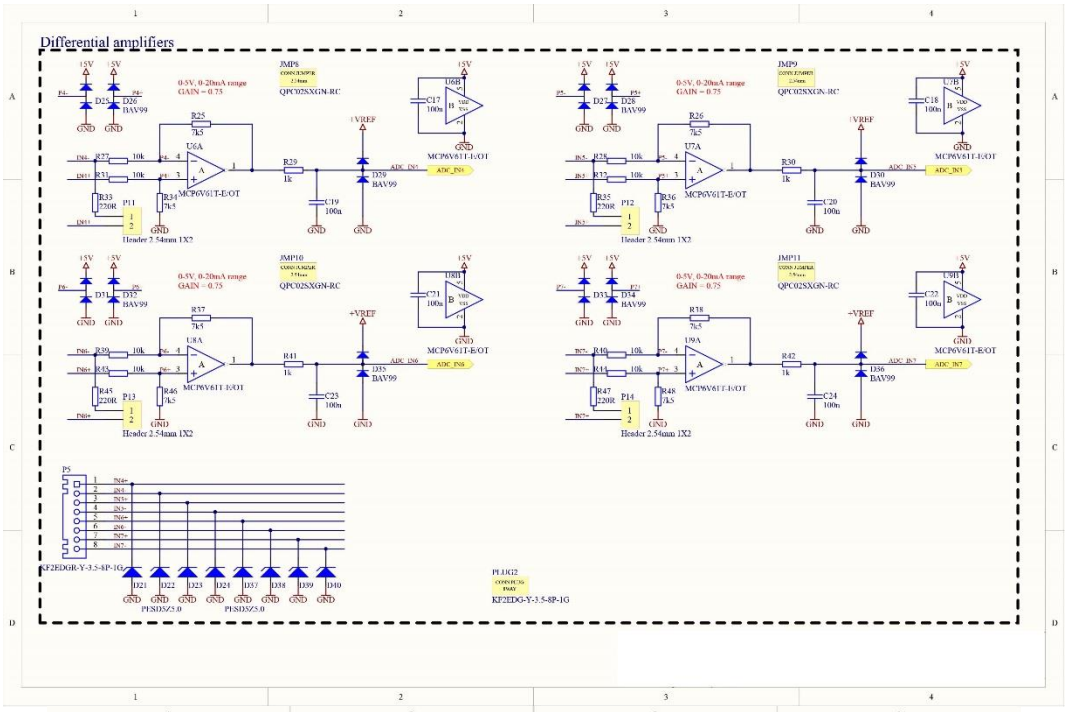
AD1	AD0	ADDRESS
LOW	LOW	0001000
LOW	Float	0001001
LOW	HIGH	0001010
Float	HIGH	0001011
Float	Float	0011000
Float	LOW	0011001
HIGH	LOW	0011010
HIGH	Float	0011011
HIGH	HIGH	0101000

In addition to the addresses listed in the table, the LTC2309 also contains a global address (1101011) that can be used to synchronize several LTC2309 or other ADCs with an I^2C interface from the LTC230X SAR series.

BOKRA I2C 8AI LTC2309 schematic:




Differential amplifiers
0-5V, 0-20mA range
GAIN = 0.75
QPC02SXGN-RC
MCP6V61T-E/OT
BAV99
Header 2.54mm 1X2
KF2EDGR-Y-3.5-8P-1G
PESD5Z5.0
PLUG1
KF2EDG-Y-3.5-8P-1G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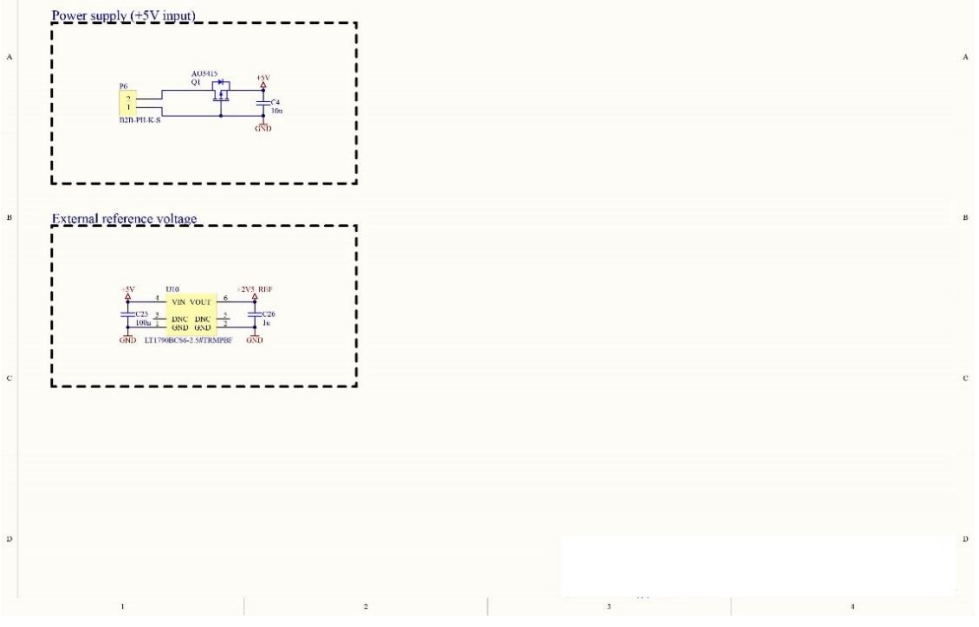
Power supply (+5V input)
AO3415
B2B-PH-K-S
External reference voltage
LT1790BCS6-2.5#TRMPBF