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Pressure 13 Click

PID: MIKROE-4294

Pressure 13 Click is a compact add-on board that contains an integrated pressure sensor for manifold air pressure measurement applications. This board features the KP229E2701, a miniaturized analog manifold air pressure sensor based on a capacitive principle from Infineon. This sensor converts the pressure of 10 kPa to 300 kPa into an analog output signal, a voltage range of 0.40 V to 4.65 V. Also, the manifold pressure data can be used to compute diagnostics of leakages and malfunctions of the exhaust gas recirculation valve. The high accuracy and the high sensitivity of the KP229E2701 make this Click board™ a perfect choice for advanced automotive applications as well as in industrial and consumer applications.

Pressure 13 Click is supported by a mikroSDK compliant library, which includes functions that simplify software development. This Click board™ comes as a fully tested product, ready to be used on a system equipped with the mikroBUS™ socket.

How does it work?

Pressure 13 Click is based on the KP229E2701, a miniaturized analog absolute pressure sensor based on a capacitive principle from Infineon. The pressure is detected by an array of capacitive surface micromachined sensor cells (a monolithic integrated signal conditioning circuit implemented in BiCMOS technology). The sensor cell output is amplified, temperature compensated, and linearized to obtain an output voltage that is proportional to the applied pressure. The manifold air pressure (MAP) is a principal parameter to compute the air-fuel ratio provided to the engine for lower emission due to better combustion and increased efficiency. For cost-sensitive engine systems, a MAP sensor shows the potential to complement or even substitute mass airflow (MAF) sensors.

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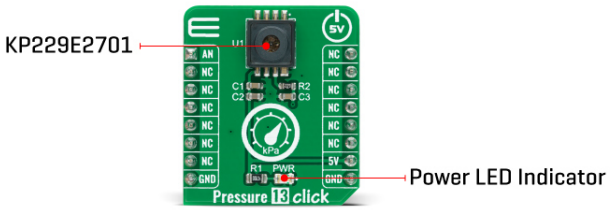

The accuracy of the KP229E2701 sensor is influenced by the supply voltage (ratiometric error) as well as by pressure, temperature, and aging effects. All parameters needed for the complete calibration algorithm - such as offset, gain, temperature coefficients of offset and gain, and linearization parameters - are determined after the assembly. These parameters are stored in an integrated E²PROM protected with forwarding error correction (a one-bit error is detected and corrected, errors of more than one bit are detected, and the output signal is switched to ground potential).

In automotive applications where high production volumes are custom, there is substantial interest in precision, low-cost, and fully integrated sensors. That’s why the manifold pressure data can be used to compute diagnostics of leakages and malfunctions of the exhaust gas recirculation valve.

Pressure 13 Click communicates with MCU using only one GPIO pin routed on the AN pin of the mikroBUS™ socket. The KP229E2701 sensor possesses several digital pins used only during calibration and test. That’s why it’s recommended and done to leave these pins floating. The output circuit acts as a low-pass decoupling filter between the sensor output and the A/D input of the MCU because it’s recommended to protect the pressure sensor against overload and electromagnetic interferences.

This Click board™ is designed to be operated only with a 5V logic voltage level. A proper logic voltage level conversion should be performed before the Click board™ is used with MCUs with different logic levels. However, the Click board™ comes equipped with a library that contains easy to use functions and an example code that can be used as a reference for further development.

Specifications

Type	Pressure
Applications	Can be used for advanced automotive applications as well as in industrial and consumer applications.
On-board modules	Pressure 13 Click is based on the KP229E2701, a miniaturized analog absolute pressure sensor based on a capacitive principle from Infineon.

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Key Features	Low power consumption, high precision pressure sensing (± 2.5 kPa), ratiometric analog output, large temperature range, automotive qualified, and more.
Interface	Analog
ClickID	No
Compatibility	mikroBUS™
Click board size	S (28.6 x 25.4 mm)
Input Voltage	5V

Pinout diagram

This table shows how the pinout on Pressure 13 Click corresponds to the pinout on the mikroBUS™ socket (the latter shown in the two middle columns).

Notes	Pin	mikroBUS				Pin	Notes
Analog Pressure Signal Output	**AN**	1	AN	PWM	16	NC	
	NC	2	RST	INT	15	NC	
	NC	3	CS	RX	14	NC	
	NC	4	SCK	TX	13	NC	
	NC	5	MISO	SCL	12	NC	
	NC	6	MOSI	SDA	11	NC	
	NC	7	3.3V	5V	10	**5V**	Power Supply
Ground	**GND**	8	GND	GND	9	**GND**	Ground

Onboard settings and indicators

Label	Name	Default	Description
LD1	PWR	-	Power LED Indicator

Pressure 13 Click electrical specifications

Description	Min	Typ	Max	Unit
Supply Voltage	4.5	-	5.5	V
Ambient Operating Pressure Range	10	-	300	kPa
Accuracy	-	±3.75	-	kPa
Maximum Output Current	-1	-	1	mA
Analog Output Voltage	0.4	-	4.65	V
Operating Temperature Range	-40	-	140	°C

Software Support

We provide a library for the Pressure 13 Click on our LibStock page, as well as a demo application (example), developed using MikroElektronika compilers. The demo can run on all the main MikroElektronika development boards.

Library Description

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The library covers all the necessary functions to control Pressure 13 click board.

Key functions:

- void pressure13_gpio_driver_init(pressure13_obj_t gpio_obj) - Function initializes GPIO driver for the desired MIKROBUS1.

Examples description

The application is composed of three sections :

- System Initialization - Initializes GPIO and start to write log.
- Application Initialization - Initialization driver enables - GPIO, initializes ADC, also write log.
- Application Task - (code snippet) This is an example which demonstrates the use of Pressure 13 Click board. Measured and display ADC, Vout (V) and pressure data (mBar). Results are being sent to the Usart Terminal where you can track their changes. All data logs on usb uart for aproximetly every 5 sec.

- void calculate_pressure (void) - Calculate Voltage Reference and Pressure.

The full application code, and ready to use projects can be found on our LibStock page.

Other mikroE Libraries used in the example:

- ADC
- UART
- Conversions

Additional notes and informations

Depending on the development board you are using, you may need USB UART click, USB UART 2 click or RS232 click to connect to your PC, for development systems with no UART to USB interface available on the board. The terminal available in all MikroElektronika compilers, or any other terminal application of your choice, can be used to read the message.

mikroSDK

This Click board™ is supported with mikroSDK - MikroElektronika Software Development Kit. To ensure proper operation of mikroSDK compliant Click board™ demo applications, mikroSDK should be downloaded from the LibStock and installed for the compiler you are using.

For more information about mikroSDK, visit the official page.

Resources

mikroBUS™

mikroSDK

Click board™ Catalog

Click boards™

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Downloads

Pressure 13 click 2D and 3D files

KP229E2701 datasheet

Pressure 13 click example on Libstock

Pressure 13 click schematic