

Smart Mic Click



PID: MIKROE-4158

Smart Mic Click is a compact add-on board that provides wake-on-voice capabilities with secured privacy without compromising performance. This board features the IA611, an “Always-On” voice-wake acoustic processor from Knowles Electronics. The IA611 offers flexibility by supporting the most relevant audio and data interfaces and enables ultra-low-power voice and event detection, including voice UI supporting keywords, voice commands, and acoustic event detection. Its integrated programmable DSP is made available to 3rd party algorithms with 168kB of RAM, enabling unlimited creativity. This Click board™ represents an ideal solution to add a voice-enabled VUI or event detection into IoT products such as home sensors, appliances, lifestyle control devices, and security systems.

Smart Mic 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?

Smart Mic Click as its foundation uses the IA611, a flexible, low-power, and highly integrated voice and audio processor system from Knowles Electronics. The IA611 includes an advanced Knowles audio-optimized DSP sub-system that has been designed to calculate intensive audio-processing algorithms with low power consumption. It also consists of a System Control Unit (SCU) that handles power management states such as sleep mode and generates internal clock signals. The IA611, “Always-On” Acoustic Processor, features a voice wake and voice ID keyword detector, a three-second buffer, and Knowles’ proven high-performance acoustic SiSonic™ MEMS technology in a single package.

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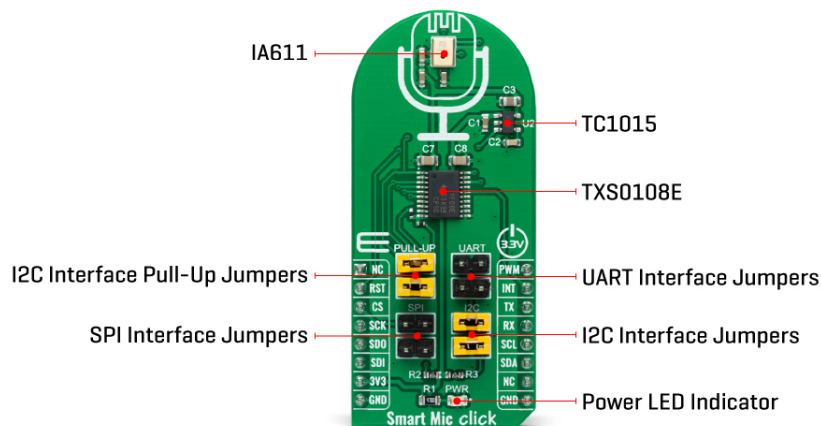
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The IA611 can be in one of the following operating modes. The Bootloader is a mode where after Power-Up, the IA611 waits for firmware download or use case setup. In Instruction mode, the IA611 is waiting for use case setup after firmware download, while in Open DSP Mode, the IA611 enables third-party algorithms. In Normal operational mode, the IA611 can be in software or hardware pass-through mode, which acts as a mic to the host.

The Voice Wake Mode allows low-power voice wake-up based on the detection of either a built-in keyword (OEM keyword), a user trained keyword (user keyword), or a user conditioned OEM keyword (Voice ID). In this mode, the IA611 monitors the microphone stream for acoustic activity, and when acoustic activity is detected, the IA611 automatically enters into a slightly higher power mode to analyze the speech utterance for the presence of the wake-up keyword. When a valid keyword is detected, the IA611 asserts an interrupt routed to the INT pin of the mikroBUS™ socket to trigger a complete system wake-up. If a keyword is not detected, the device returns to the ultra-low-power mode until the acoustic activity is detected again.

The IA611 implements various control interfaces, including UART, SPI, and an I2C slave interface with a control interface and audio interface port. Depending on the desired interface, the user needs to populate the selected jumper to activate that interface (SPI, I2C, or UART). Using an I2C interface, the user is given the option of additional activation of 4.7kΩ pull-up resistors on I2C lines, populating jumpers marked with PULL-UP.

The IA611 does not require a specific Power-Up sequence but requires a voltage of 1.8V for its supply and logic part to work correctly. Therefore, a small regulating LDO is used, the [TC1015](#), providing a 1.8V out of 3.3V mikroBUS™ power rail, alongside Enable feature through the EN pin routed to the RST pin of the mikroBUS™ socket offering a switch operation to turn ON/OFF power delivery to the TC1015. Since the sensor for operation requires a power supply of 1.8V, this Click board™ also features the [TXS0108E](#) voltage-level translator. The interface lines are routed to the voltage-level translator allowing this Click board™ to work with 3.3V MCUs properly.

This Click board™ can be operated only with a 3.3V logic voltage level. The board must perform appropriate logic voltage level conversion before using MCUs with different logic levels. However, the Click board™ comes equipped with a library containing functions and an example code that can be used, as a reference, for further development.

Specifications

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Type	Microphone
Applications	Can be used for a voice-enabled VUI or event detection into IoT products such as home sensors, appliances, lifestyle control devices, and security systems
On-board modules	IA611 - voice and audio processor system from Knowles Electronics
Key Features	Always-On Acoustic Processor, high accuracy voice wake and voice ID keyword recognition to wake-up system from a trigger phrase, various control interfaces and audio interface port, interrupt signal to the host when a Voice keyword trigger is detected, and more
Interface	I2C,SPI,UART
Feature	No ClickID
Compatibility	mikroBUS™
Click board size	L (57.15 x 25.4 mm)
Input Voltage	3.3V

Pinout diagram

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

Notes	Pin					Pin	Notes
	NC	1	AN	PWM	16	NC	
Enable	EN	2	RST	INT	15	INT	Interrupt
SPI Chip Select	CS	3	CS	RX	14	TX	UART TX
SPI Clock	SCK	4	SCK	TX	13	RX	UART RX
SPI Data OUT	SDO	5	MISO	SCL	12	SCL	I2C Clock
SPI Data IN	SDI	6	MOSI	SDA	11	SDA	I2C Data
Power Supply	3.3V	7	3.3V	5V	10	NC	
Ground	GND	8	GND	GND	9	GND	Ground

Onboard settings and indicators

Label	Name	Default	Description
LD1	PWR	-	Power LED Indicator
J1&J4	UART	Unpopulated	UART Interface Jumpers
J2&J5	I2C	Populated	I2C Interface Jumpers
J3&J6	SPI	Unpopulated	SPI Interface Jumpers
J7&J8	PULL-UP	Populated	I2C Interface Pull-Up Resistor Jumpers

Smart Mic Click electrical specifications

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Description	Min	Typ	Max	Unit
Supply Voltage	-	3.3	-	V
Sensitivity	-38	-37	-36	dBFS
Signal to Noise Ratio	-	-65.5	-	dB
Bandwidth	-	50	-	kHz
Operating Temperature Range	-10	+25	+50	°C

Software Support

We provide a library for the Smart Mic Click as well as a demo application (example), developed using MikroElektronika [compilers](#). The demo can run on all the main MikroElektronika [development boards](#).

Package can be downloaded/installed directly from NECTO Studio Package Manager(recommended way), downloaded from our [LibStock™](#) or found on [Mikroe github account](#).

Library Description

This library contains API for Smart Mic Click driver.

Key functions

- `smartmic_wait_keyword` This function waits for a keyword event and then reads it and returns the keyword ID number.
- `smartmic_download_keyword` This function downloads keyword models to the module.
- `smartmic_voice_make` This function performs voice make feature. It stops the route, then sets digital gain to 20db, sample rate to 16K, frame size to 16 ms, and finally it selects route 6 and configures algorithm parameters.

Example Description

This example demonstrates the use of Smart Mic Click board™ by programming it with 4 different keywords, and then waiting for a keyword event, parsing it and displaying on the USB UART.

The full application code, and ready to use projects can be installed directly from NECTO Studio Package Manager(recommended way), downloaded from our [LibStock™](#) or found on [Mikroe github account](#).

Other Mikroe Libraries used in the example:

- MikroSDK.Board
- MikroSDK.Log
- Click.SmartMic

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

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interface available on the board. UART terminal is available in all MikroElektronika [compilers](#).

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™](#)

Downloads

[Smart Mic click example on Libstock](#)

[IA611 datasheet](#)

[Smart Mic click 2D and 3D files](#)

[Smart Mic Click schematic](#)

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