

Time-saving embedded tools

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# Audio Xover Click





#### PID: MIKROE-4104

**Audio Xover Click** is an analog active crossover solution for two-way loudspeakers. The primary purpose of the crossover circuit in a loudspeaker is to split an incoming audio signal into frequency bands that are passed to the speaker or "driver" best suited. Audio Xover Click is based on <u>Microchip's MCP6H012</u> operational amplifier with rail-to-rail output operation, connected in configuration for 2nd order Butterworth filter for both low pass and high pass filters. With a frequency response independent of the dynamic changes in a driver's electrical characteristics and individual channel cutoff frequency selection it's great solution for crossover.

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

## How does it work

Audio Xover Click enhances audio systems by efficiently managing frequency distribution across speakers. It uses three precise Butterworth filters, based on Microchip's <u>MCP6H012</u> operational amplifiers, each dedicated to a specific speaker, with adjustable cutoff frequencies of 120Hz, 90Hz, and 70Hz. Butterworth filters are highly regarded for their maximally flat frequency response within the passband, ensuring the sharpest possible roll-off without any peaking. This performance is achieved using a second-order, two-pole design with a damping ratio of 0.707. Audio Xover Click enhances sound quality in home audio systems, ensures highfidelity reproduction in professional PA systems and recording studios, and optimizes car speaker performance for a balanced audio experience.

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As is well known, audio crossovers play a crucial role in audio systems, splitting an audio signal into multiple frequency ranges. This separation allows each frequency range to be directed to drivers (speakers) designed for those specific frequencies, such as woofers for low frequencies, mid-range drivers for middle frequencies, and tweeters for high frequencies. Unlike passive crossovers, which divide an amplified signal among various drivers, active crossovers like those implemented in the Audio Xover Click split the audio signal before amplification. This method directs the signal to multiple power amplifiers, each linked to a specific driver type.

One significant advantage of active crossovers is their independence from amplifier power levels. Since active crossovers handle the signal before it enters the amplifier, they are unaffected by the amplifiers' power. Additionally, active crossovers are less sensitive to temperature variations, ensuring consistent performance and accuracy. Another benefit is channel isolation; if one amplifier channel clips in an active crossover system, the distortion only affects that particular channel, leaving the other channels unaffected.

This Click board<sup>™</sup> can be operated only with a 5V logic voltage level. The board must perform appropriate logic voltage level conversion before using MCUs with different logic levels. Also, it comes equipped with a library containing functions and an example code that can be used as a reference for further development.

# Specifications

Туре	Signal Processing			
Applications	Ideal for home audio systems, professional PA systems, recording studios, and automotive audio systems			
On-board modules	No IC			
Key Features	Three precise Butterworth filters, individual channel cutoff frequency selection, maximal flat frequency response with sharp roll-off, frequency response independent of the dynamic changes in a driver's electrical characteristics, power amplifiers are directly connected to the speaker drivers, operate exclusively with a 5V logic voltage level, and more			

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Interface	GPIO
Feature	No ClickID
Compatibility	mikroBUS™
Click board size	L (57.15 x 25.4 mm)
Input Voltage	5V

# **Pinout diagram**

This table shows how the pinout on Audio Xover Click corresponds to the pinout on the mikroBUS<sup>m</sup> socket (the latter shown in the two middle columns).

Notes	Pin	● ● mikro* ● ● ● BUS			n.	Pin	Notes
	NC	1	AN	PWM	16	NC	
	NC	2	RST	INT	15	NC	
Shutdown	SDN	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
PWR	LED GREEN	-	Power LED Indicator
SL1	LHP	Left	Left channel high pass cutoff frequency selector; Left: 120Hz
SW1	SLP	Left	Subwoofer channel low pass cutoff frequency selector; Middle: 90Hz
SR1	RHP	Left	Right channel high pass cutoff frequency selector; Right: 70Hz

# **Audio Xover Click electrical specifications**

Description	Min	Тур	Max	Unit
Supply Voltage	-	5	-	V

# Software Support

We provide a library for the Audio Xover Click on our <u>LibStock</u> page, as well as a demo application (example), developed using MIKROE <u>compilers</u>. The demo can run on all the main MIKROE <u>development boards</u>.

#### **Library Description**

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Library contains function for enable and disable module.

Key functions:

 void audioxover\_set\_mode( uint8\_t state ) - This function set CS pin on 1 ( ENABLE ) and 0 ( DISABLE )

#### Examples description

The application is composed of three sections :

- System Initialization Initializes all necessary GPIO pins
- Application Initialization Initializes driver init
- Application Task Enable and disable module every one seconds.

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

Other MIKROE Libraries used in the example:

• LOG(UART) Library

#### Additional notes and informations

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

## mikroSDK

This Click board<sup> $\mathbb{M}$ </sup> is supported with <u>mikroSDK</u> - MIKROE Software Development Kit. To ensure proper operation of mikroSDK compliant Click board<sup> $\mathbb{M}$ </sup> demo applications, mikroSDK should be downloaded from the <u>LibStock</u> and installed for the compiler you are using.

For more information about mikroSDK, visit the official page.

#### Resources

<u>mikroBUS</u>™

<u>mikroSDK</u>

Click board<sup>™</sup> Catalog

Click Boards™

**Downloads** 

Audio Xover click example on Libstock

Audio Xover click 2D and 3D files v100

#### MCP6H01 datasheet

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Audio Xover click schematic v100

Audio Xover click 2D and 3D files v101

Audio Xover click schematic v101

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