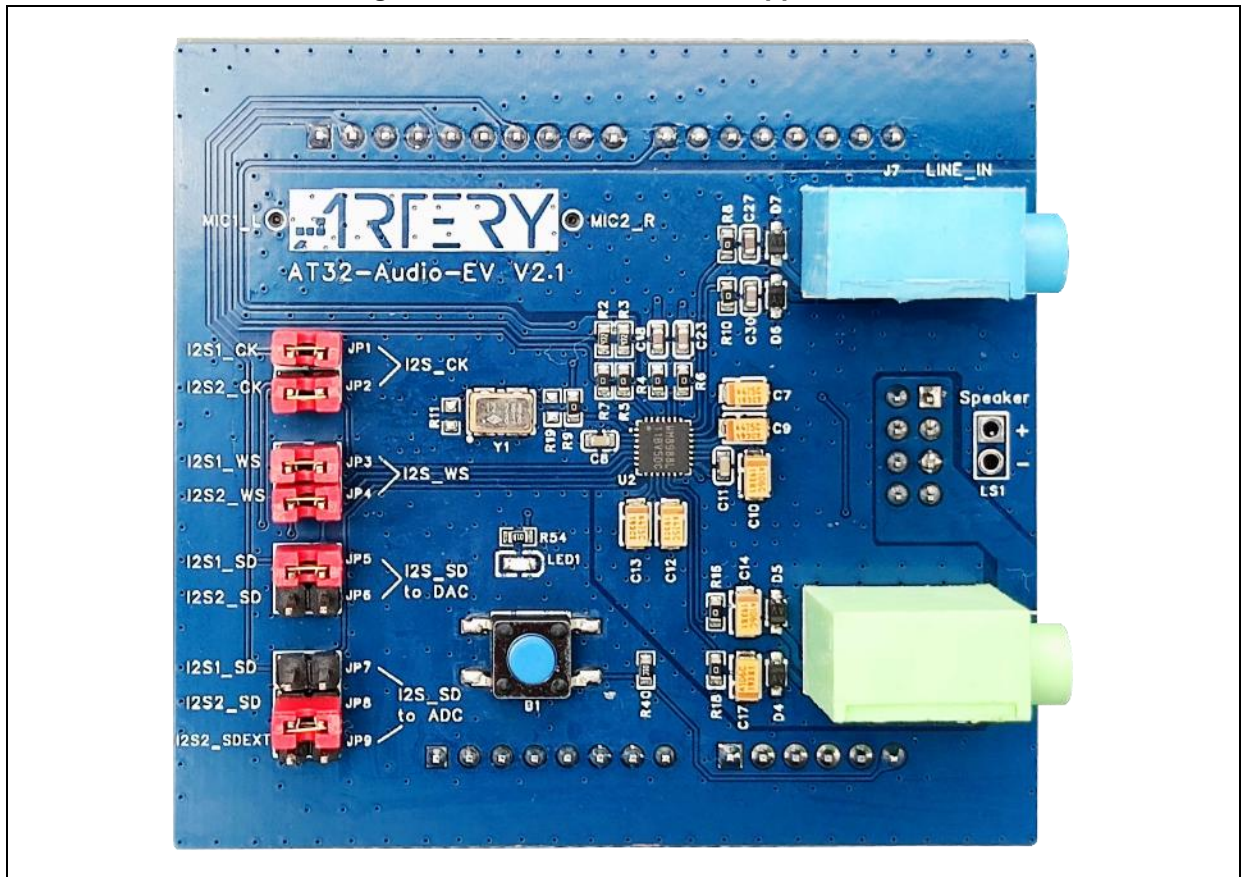


Introduction

The AT32-Audio-EV evaluation board is designed to speed up development cycles of Audio application solutions. This evaluation board is built on WM8988 stereo CODEC from Cirrus Logic, dual MIC, headphone interface, audio amplifier and other peripherals. It offers standard Arduino™ Uno R3 connectors that are intended to connect with ARTERY's AT-START board or other compatible boards. The AT32-Audio-EV evaluation board can be used for application development such as multimedia playback, telephones and noise reduction.

Figure 1. AT32-Audio-EV board appearance



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1 Hardware layout and configuration

The AT32-Audio-EV evaluation board is connected with the AT-START board through Arduino™ connectors. The microcontroller available on the AT-START board is capable of communicating with WM8988 via I²C bus to send commands and set parameters. It also interacts with WM8988 via I²S bus to access and transmit audio data. The WM8988 can be used to obtain audio signals with MIC or LINE_IN connector, and to play audio signals sent from MCU through LINE_OUT connected to headphone or through audio amplifier TC8002D connected to a speaker. The AT32-Audio-EV board embeds a 128 Mb SPI Flash to store audio data.

The AT-START board is equipped with a MCU (ARTERY) and standard Arduino™ Uno R3 extension connectors that are used to connect with the AT32-Audio-EV evaluation board.

Figure 2 presents the hardware configuration of the AT32-Audio-EV evaluation board.

Figure 3 and *Figure 4* show their respective locations on the AT32-Audio-EV evaluation board.

Figure 2. Hardware block diagram

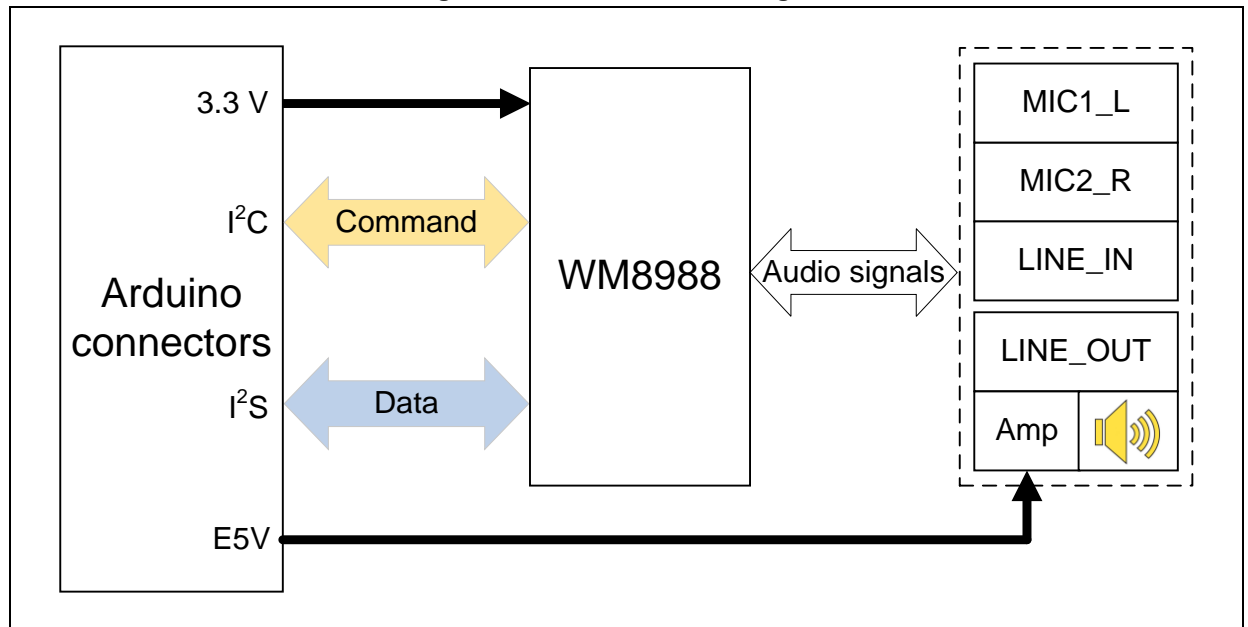


Figure 3. Top layer layout

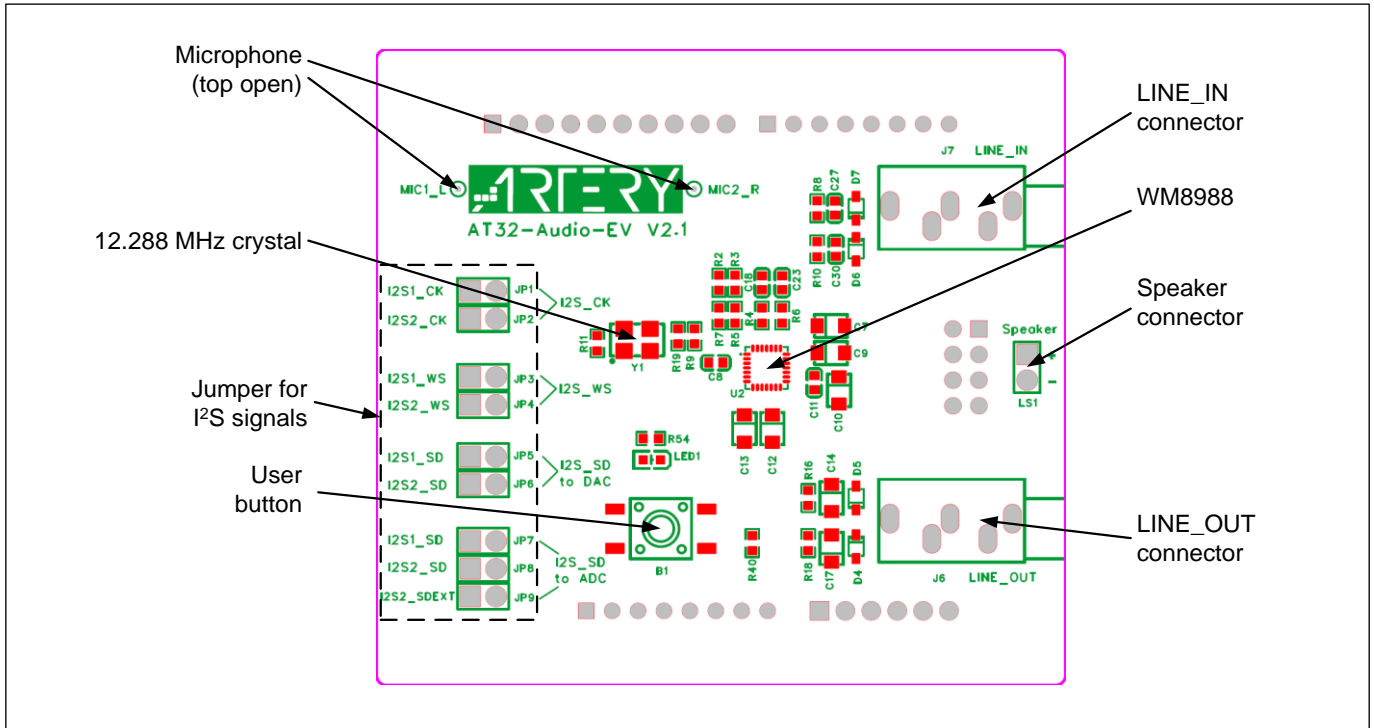
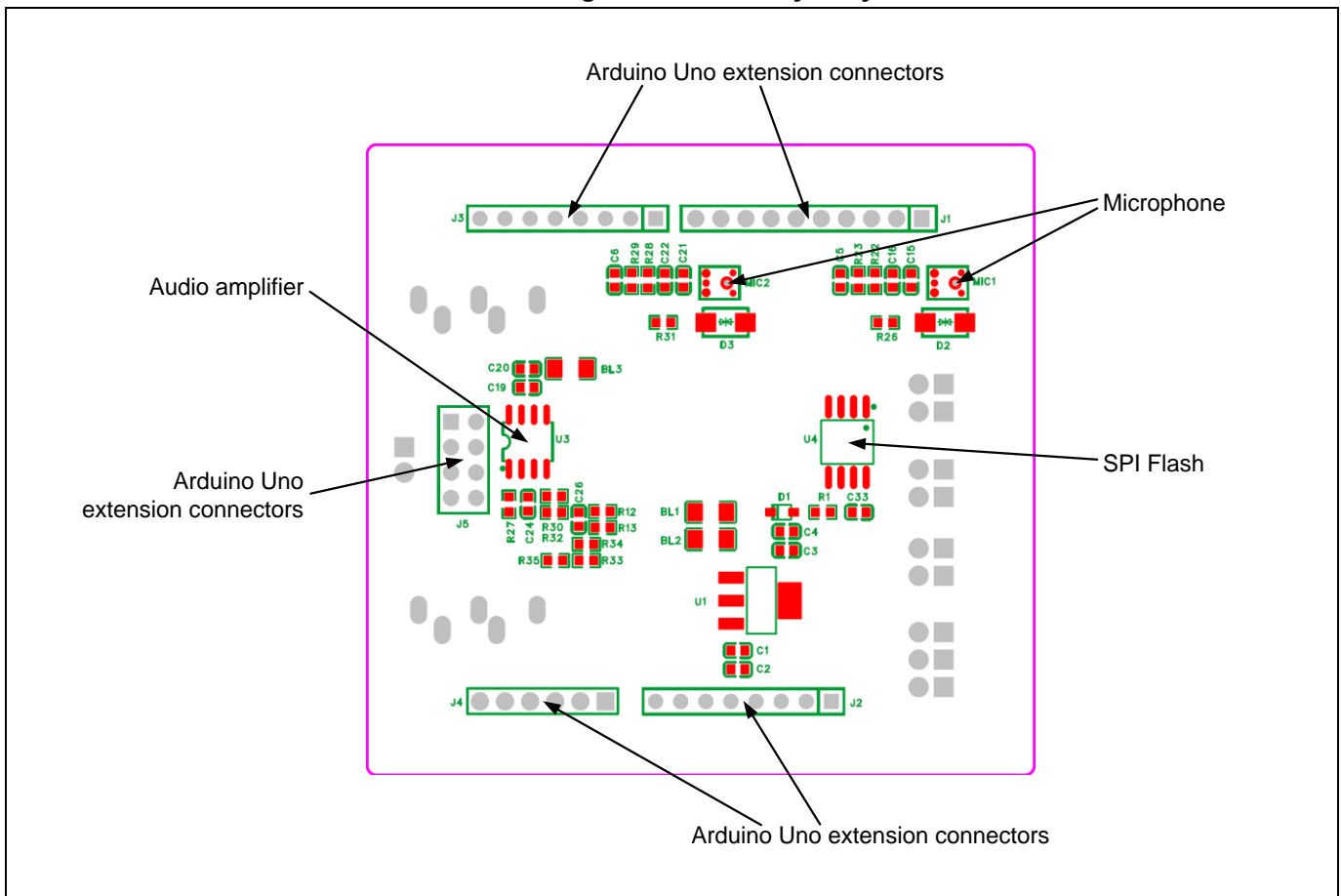


Figure 4. Bottom layer layout



2 Arduino connectors

Table 1. Arduino™ Uno R3 connectors definition

Connector	Pin No.	Arduino pin name	Function
J2 (power supply)	1	NC	-
	2	IOREF	3.3 V reference voltage
	3	RESET	-
	4	3.3V	3.3 V power supply
	5	5V	5 V power supply
	6	GND	Ground
	7	GND	Ground
	8	VIN	-
J4 (analog input)	1	AN0	-
	2	AN1	PWM output
	3	AN2	The first I2S_WS is connected to LRC via JP3
	4	AN3	This GPIO is connected to the CTRL pin of audio amplifier. Its pull-up is disabled by default.
	5	AN4	-
	6	AN5	This GPIO is connected to user button, active high
J3 (logic input/output low byte)	1	D0	-
	2	D1	-
	3	D2	-
	4	D3	SPI_SCK is connected to CLK pin of SPI Flash
	5	D4	SPI_MOSI is connected to DI pin of SPI Flash
	6	D5	SPI_MISO is connected to DO pin of SPI Flash
	7	D6	-
	8	D7	CLKOUT is connected to MCLK pin by default
J1 (logic input/output high byte)	1	D8	-
	2	D9	-
	3	D10	SPI_CS is connected to #CS pin of SPI Flash
	4	D11	The first I2S_SD is connected to DACDAT via JP5, or ADCDAT via JP7
	5	D12	-
	6	D13	The first I2S_CK is connected to BCLK via JP1
	7	GND	Ground
	8	AREF	-
	9	SDA	I2C_SDA is connected to SDIN pin
	10	SCL	I2C_SCL is connected to SCLK pin

Connector	Pin No.	Arduino pin name	Function
J5 (for others)	1	MISO	I2S_SDEXT is connected to ADCDAT via JP9
	2	5V	5 V power supply
	3	SCK	The second I2S_CK is connected to BCLK via JP2
	4	MOSI	The second I2S_SD is connected to DACDAT via JP6, or ADCDAT via JP8
	5	RESET	-
	6	GND	-
	7	NSS	The second I2S_WS is connected to LRC via JP4
	8	GPIO	-

3 How to use AT32-Audio-EV

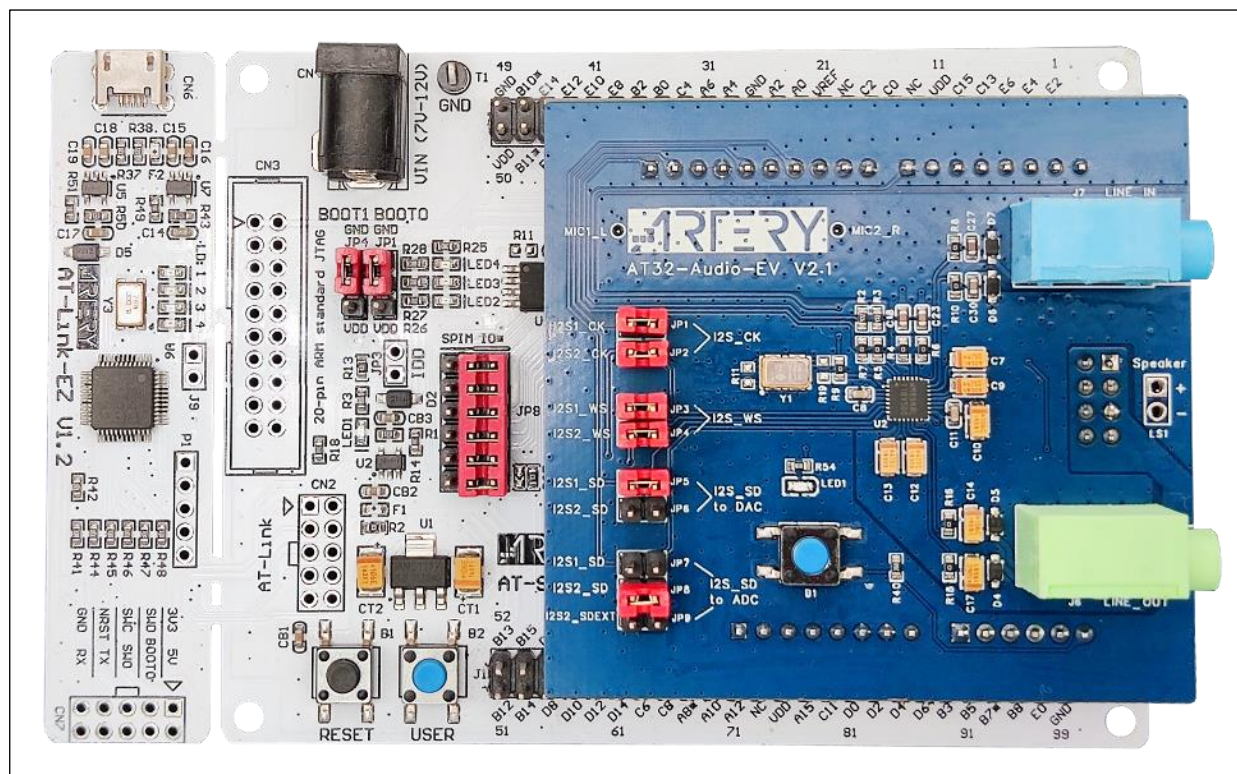
Plug the AT32-Audio-EV evaluation board into the AT-START board through Arduino connectors and supply 5 V or 3.3 V to the AT-START board (refer to the section [Power supply sources](#) of the AT-START user manual for details). It is now ready to use the AT32-Audio-EV evaluation board. Note that when connecting the AT32-Audio-EV board to the AT-START board, it is necessary to make sure of disconnection of pins used in the AT32-Audio-EV from those circuits on AT-START board (such as USB and Ethernet PHY) to avoid mutual disturbance. This can be done by de-soldering corresponding resistors on the AT-START board.

The specific I²S signals used to connect with WM8988 should be selected depending on the AT-START board you are using. It is important to ensure that JP1~JP9 (short or open) are properly set according to actual needs.

The MCLK pin of the WM8988 is used as the main clock input of this device. It is from the CLKOUT (PA8) output from the microcontroller by default. Alternatively, there is a 12.288 MHz oscillator on the board to be used as a main clock source. It is possible for the user to adjust R9 and R19 resistors according to needs. Some of the AT-START boards, however, are not equipped with CLKOUT clock. In this case, the user has to use the oscillator on the AT32-Audio-EV board.

The speaker output is from LOUT2 channel of the CODEC chip, by default. To use ROUT2, LOUT1 or PWM output, the user can adjust R13 and R33~35 solder bridge according to actual needs.

Figure 5. AT32-Audio-EV evaluation board combined with AT-START



4 Revision history

Table 2. Document revision history

Date	Revision	Changes
2019.6.4	1.0	Initial release
2020.9.8	2.00	<ol style="list-style-type: none"> 1. Changed the revision code of the document into a three-digit format. The first two digits refer to hardware version, and the last digit refers to the document version code 2. Simplified circuit by applying a single CODEC 3. Added SPI to store audio data 4. Added on-board 12.288 MHz oscillator 5. Optimized I²S signal select, changing solder bridge to jumper
2022.9.15	2.10	<ol style="list-style-type: none"> 1. Corrected wrong routing of SDIN and SCLK of WM8988 2. Corrected I2S2_SDEXT connected to J5's PB14 pin and disconnected from PB11 3. Replaced power amplifier with TC8002D 4. Replaced LINE_IN/LINE_OUT 3.5 mm connectors
2024.4.22	2.11	<ol style="list-style-type: none"> 1. Removed Schematic section from the document 2. Removed AT-START-F403A pin names and only maintained pin function description to avoid misunderstanding when using other AT-START board than AT32F403A 3. Changed the "IMPORTANT NOTICE" at the end of the document

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