

Introduction

The AT32-Video-EV evaluation board is designed to achieve faster data acquisition and application through video sensor, thus speeding up development cycles.

The evaluation board is built around a QVGA CMOS image sensor — BF3901 (BYD brand), and a 2.4-inch TFT LCD touch display. Standard Arduino™ Uno R3 connectors are intended for connection to the ARTERY AT-START evaluation board or other compatible boards. Through image processing control mechanism, the AT32-Video-EV board is aiming at driving various applications such as QR code scanning, image recognition and gesture control.

Figure 1. AT32-Video-EV board outlook



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1 Hardware layout and configuration

The AT32-Video-EV evaluation board consists of an Arduino connectors board (blue) and a BF3901 camera module board (red). The video evaluation board can be linked to the AT-START evaluation board through Arduino™ connectors. The microcontroller on the AT-START evaluation board acquires images from the BF3901CS sensor via SPI bus. And such images, either directly or after being processed with image algorithms or noise reduction, are transmitted to LCD touch display via another SPI bus. Such SPI bus can access to LCD touch data as well.

The camera module board is equipped with high-brightness white LEDs to ensure luminance at dark places. The buzzer on the Arduino connectors board comes with optional sound indication function for image identification, QR code scanning, gesture recognition and other operations.

This document takes the AT-START-F403A evaluation board as an example of describing various features of the AT32-Video-EV board. The AT-START-F403A board features a microcontroller AT32F403AVGT7 and standard Arduino™ Uno R3 extension connectors that can be used to interface with the AT32-Video-EV board.

Figure 2 shows the hardware configuration of the AT32-Video-EV board.

Figure 3 to *Figure 6* show these features on the Arduino connectors board and BF3901 camera module board.

Figure 2. Hardware block diagram

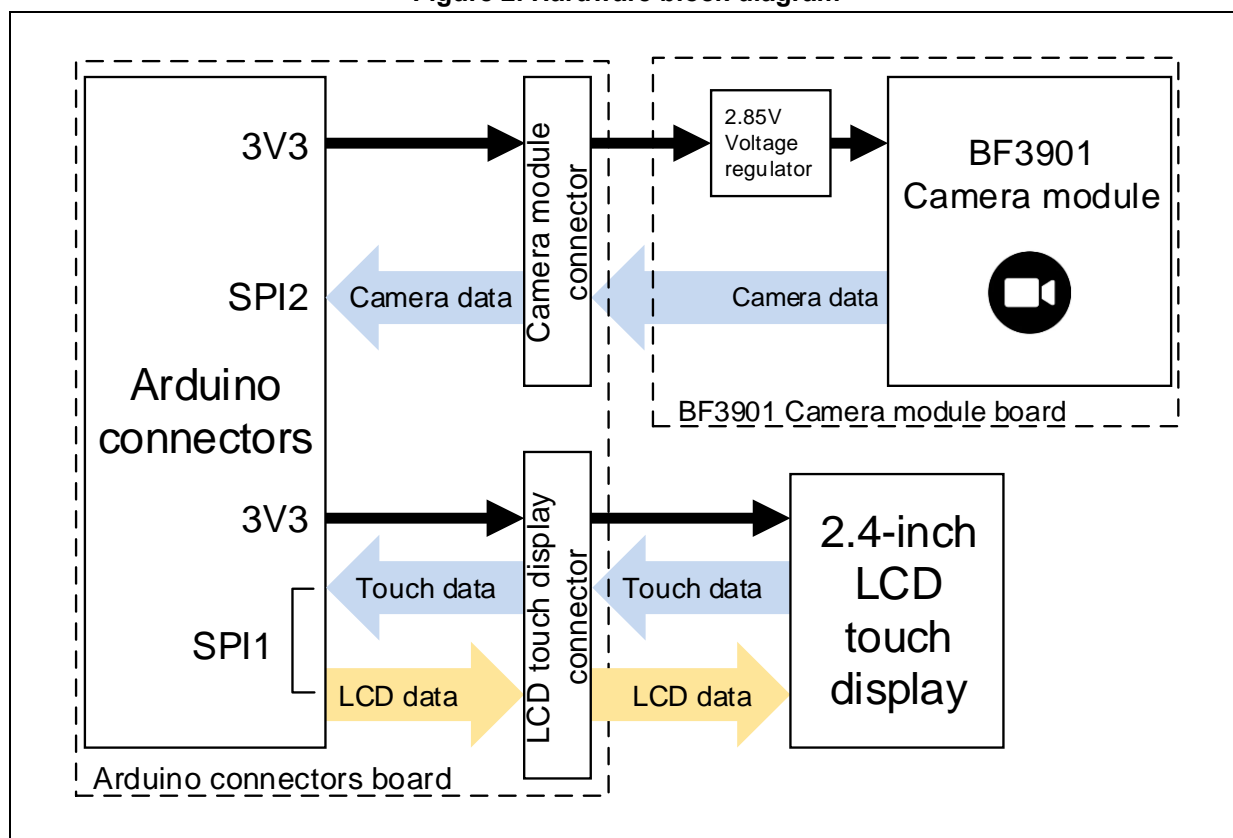


Figure 3. Arduino connectors board top view

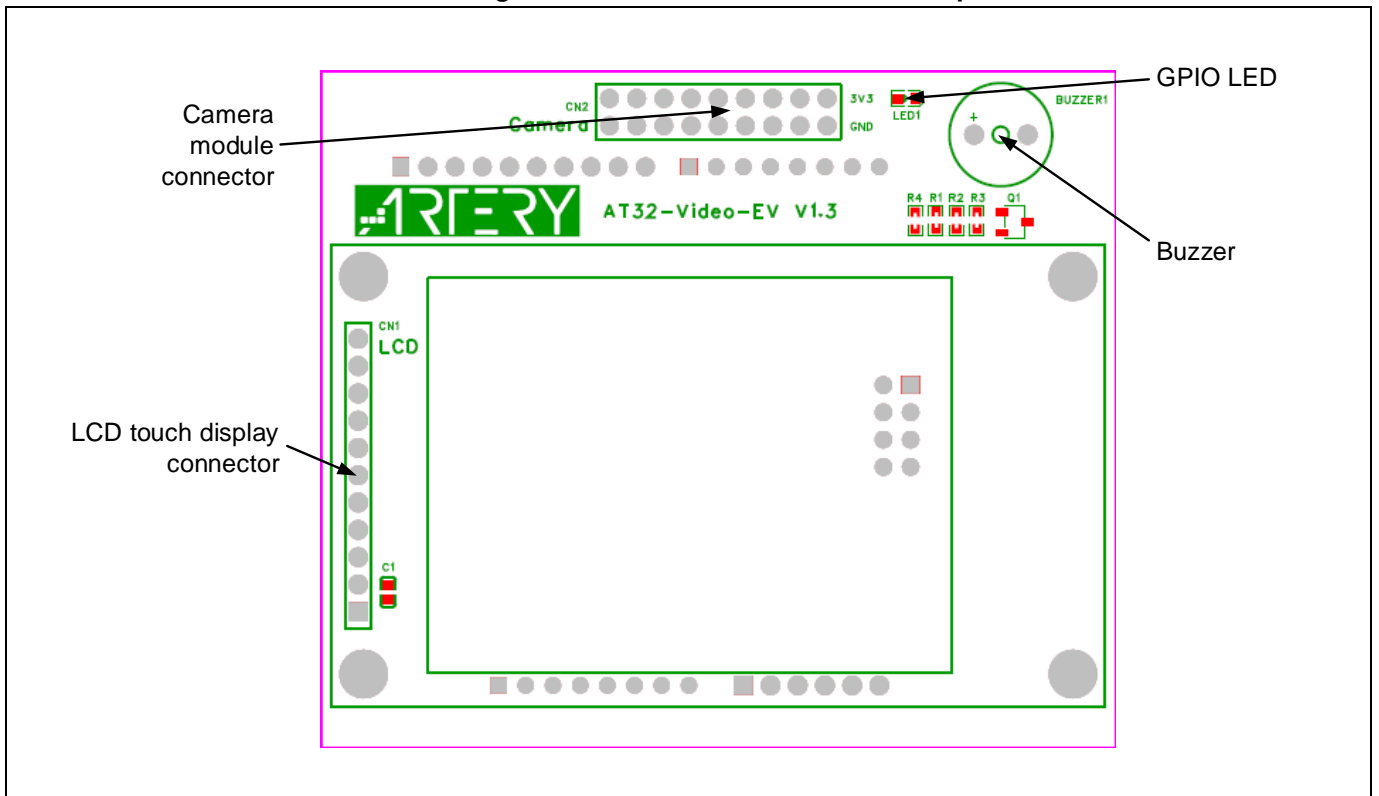


Figure 4. Arduino connectors board bottom view

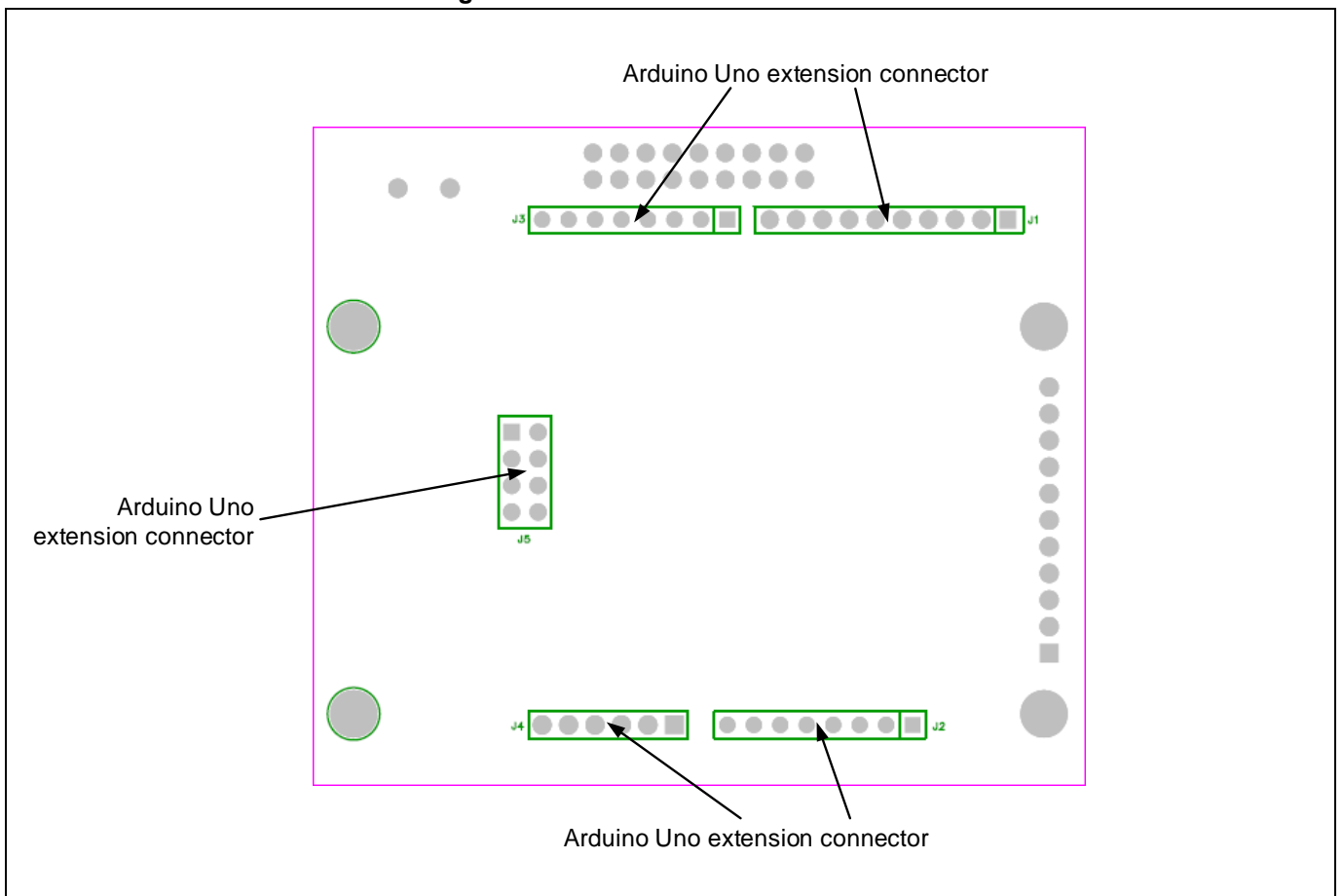


Figure 5. BF3901 camera module board top view

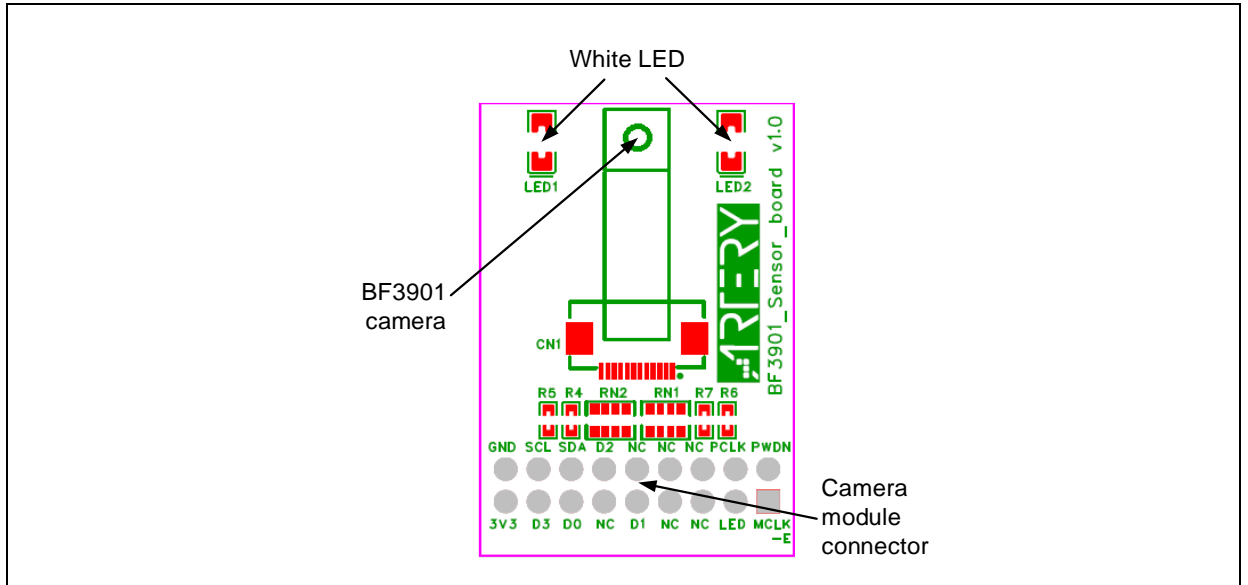
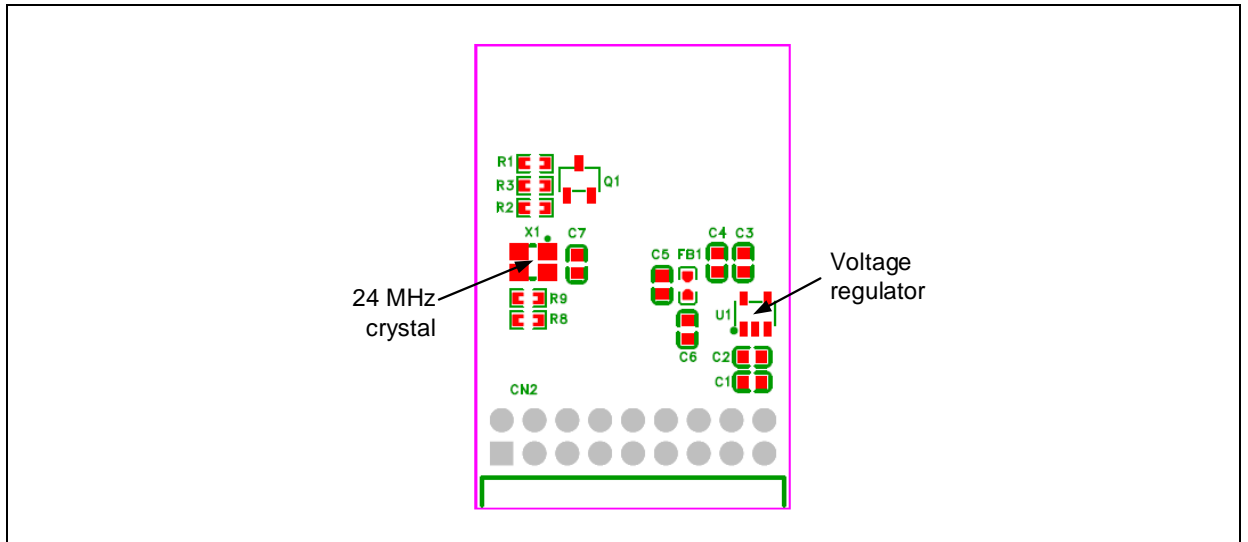


Figure 6. BF3901 camera module board bottom layout



2 Arduino connectors

Table 1. Arduino™ Uno R3 connectors definition

Connector	Pin No.	Arduino pin name	AT32F403A pin name	Function	Description
J2 (power supply)	1	NC	-	-	-
	2	IOREF	-	3.3 V reference	-
	3	RESET	NRST	External reset	-
	4	3.3V	-	3.3 V input/output	Power supply for LCD screen and input for voltage regulator on camera module board
	5	5V	-	5 V input/output	Power supply for buzzer
	6	GND	-	Ground	Ground
	7	GND	-	Ground	Ground
	8	VIN	-	7~12 V input/output	-
J4 (analog input)	1	A0	PA0	ADC123_IN0	PA0 is connected to LCD screen CS
	2	A1	PA1	ADC123_IN1	PA1 is connected to LCD touch CS
	3	A2	PA4	ADC12_IN4	PA4 is connected to stylus touch interrupt pin
	4	A3	PB0	ADC12_IN8	PB0 is connected to Arduino buzzer
	5	A4	PC1 or PB9	ADC123_IN11 or I2C1_SDA	-
	6	A5	PC0 or PB8	ADC123_IN10 or I2C1_SCL	-
J3 (logic input/output low bytes)	1	D0	PA3	USART2_RX	-
	2	D1	PA2	USART2_TX	-
	3	D2	PA10	-	-
	4	D3	PB3	TMR2_CH2	-
	5	D4	PB5	-	PB5 is connected to image sensor D1 (reserved for further use)
	6	D5	PB4	TMR3_CH1	PB4 is connected to Arduino LED1 green
	7	D6	PB10	TMR2_CH3	I2C2_SCL is connected to image sensor SCLK
	8	D7	PA8	-	CLKOUT is connected to image sensor XCLK
J1 (logic input/output high bytes)	1	D8	PA9	-	PA9 is connected to LCD backlight BLK
	2	D9	PC7	TMR3_CH2	PC7 is connected to D/C select on LCD display
	3	D10	PA15 or PB6	SPI1_CS or TMR4_CH1	PA15 is connected to RST on LCD
	4	D11	PA7	TMR3_CH2 or SPI1_MOSI	SPI1_MOSI is connected to LCD display and touch MOSI
	5	D12	PA6	SPI1_MISO	SPI1_MISO is connected to LCD display and touch MISO
	6	D13	PA5	SPI1_SCK	SPI1_SCK is connected to LCD display and touch CLK
	7	GND	-	Ground	Ground
	8	AREF	-	VREF+ input/output	-
	9	SDA	PB9	I2C1_SDA	PB9 is connected to white LED on camera module
	10	SCL	PB8	I2C1_SCL	PB9 is connected to PDN on image sensor

Connector	Pin No.	Arduino pin name	AT32F403A pin name	Function	Description
J5 (others)	1	MISO	PB14	SPI2_MISO	SPI2_MISO is connected to HREF/D2 on image sensor
	2	5V	-	5 V input/output	-
	3	SCK	PB13	SPI2_SCK	SPI2_SCK is connected to VCLK on image sensor
	4	MOSI	PB15	SPI2_MOSI	SPI2_MOSI is connected to D0 on image sensor
	5	RESET	NRST	External reset	-
	6	GND	-	Ground	Ground
	7	NSS	PB12	SPI2_CS	SPI2_CS is connected to VSYNC/D3 on image sensor
	8	PB11	PB11	-	I2C2_SDA is connected to SDA on image sensor

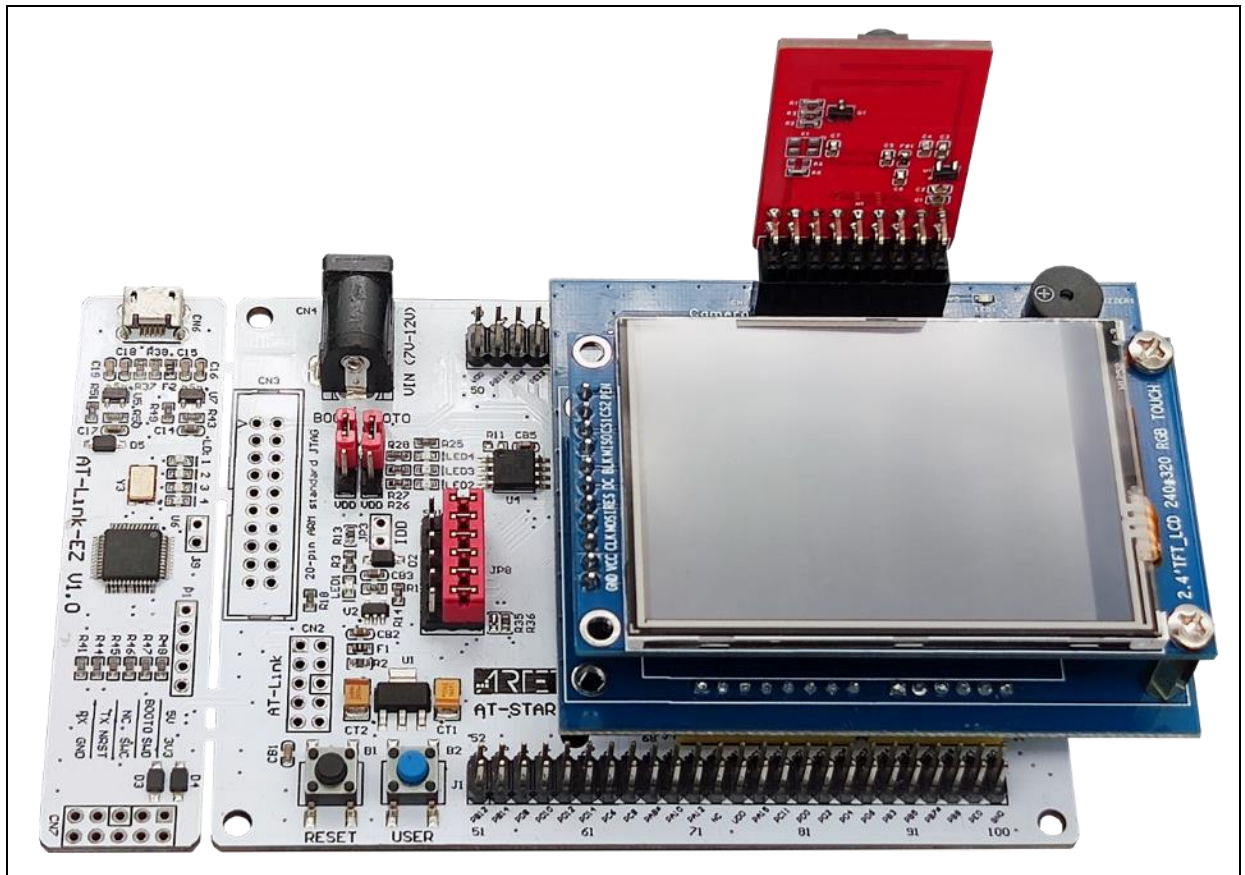
3 How to use AT32-Video-EV

Connect the Arduino connectors board on AT32-Video-EV board to the BF3901 camera module board, and interface the combined board with the AT-START board through Arduino connectors (following the connectors arrangement) during which the camera should face forward. After successful connection, the final PCB board can be provided with 5 V and 3.3 V power (refer to the descriptions of [Section Power supply](#) of the AT-START user manual for details). Now it is ready to use the AT32-Video-EV board.

Note: *Special attention should be paid to the interfacing direction between Arduino connectors board and the camera module board because there is no Fool Proof design here. Power supply can be switched on only after correct connection between both parts.*

The main clock input source of this device is clocked by the XCLK pin of the BF3901 camera module. It is CLKOUT output (PA8) from the microcontroller, by default. Besides, the 24 MHz crystal (not mounted) on the camera module board can also be an option. It is possible for users to adjust R8 and R9 solder bridges.

Figure 7. AT32-Video-EV combined with AT-START-F403A



4 Schematics

Figure 8. Schematic diagram of Arduino connecting board

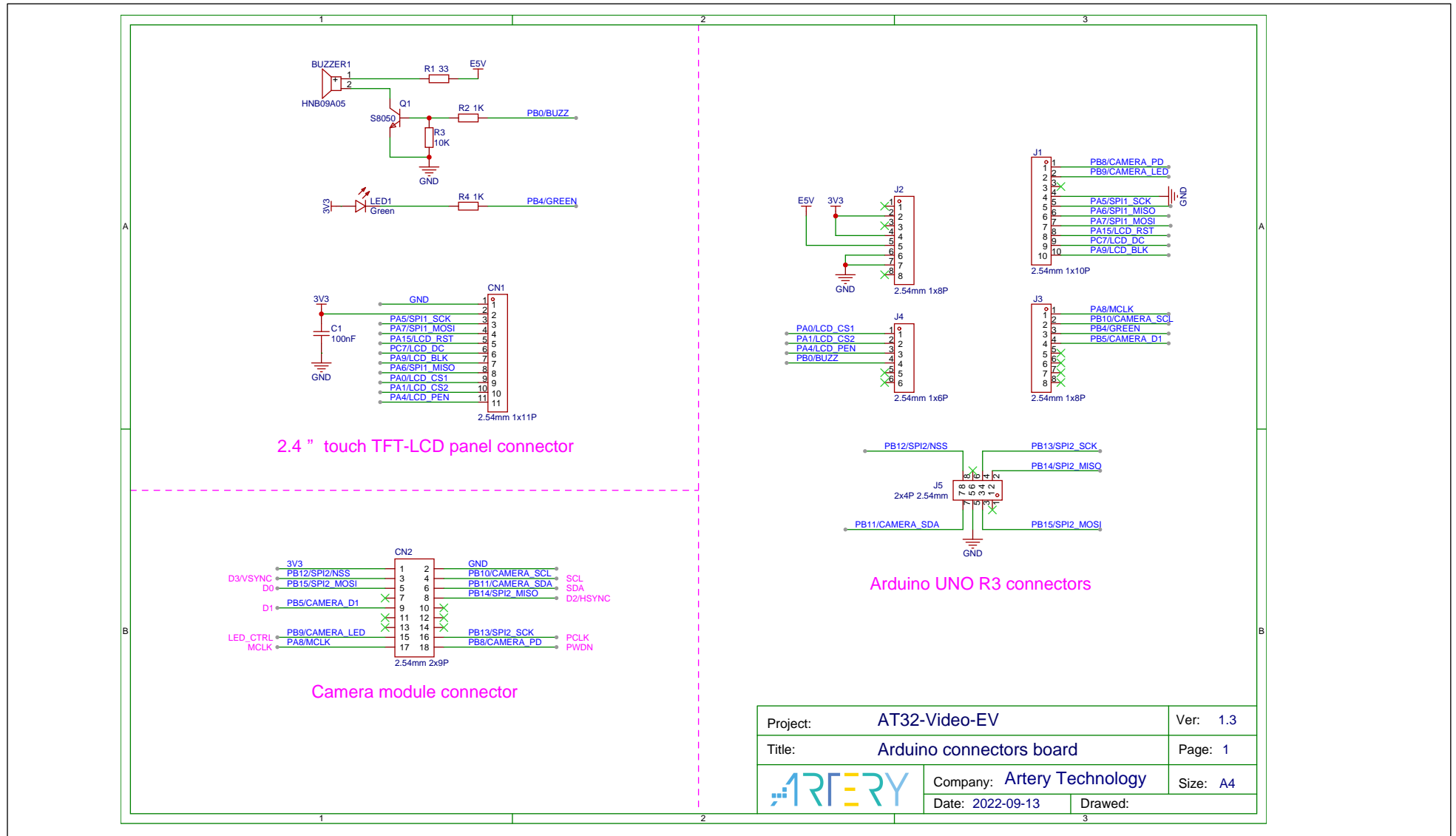
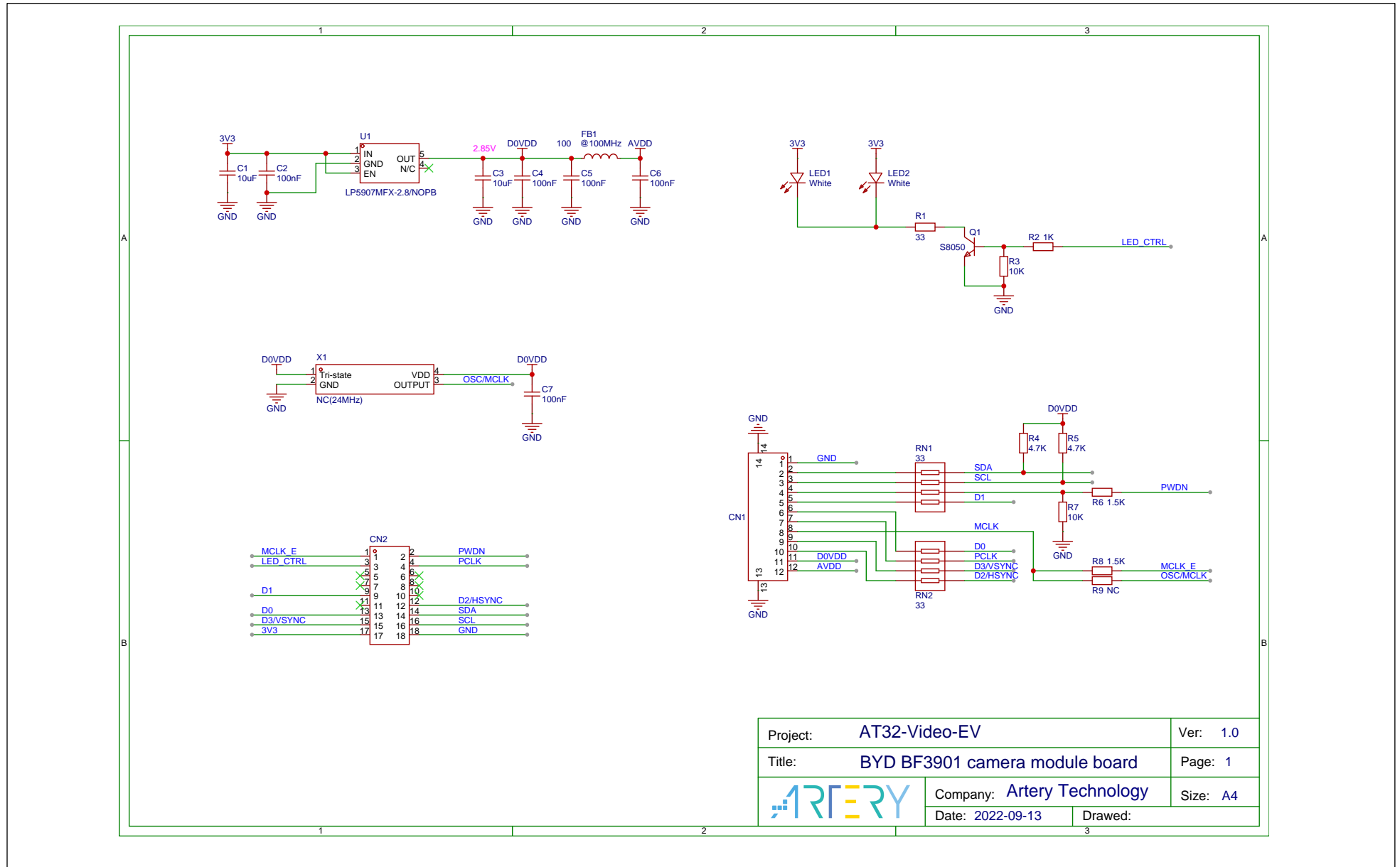


Figure 9. Schematic diagram of BF3901 camera module board



5 Revision history

Table 2. Document revision history

Date	Revision	Changes
2018.7.26	1.0	Initial release
2018.8.24	1.10	1. Changed the revision code of this document to three-digital format. The first two digital refers to hardware version, and the last digital refers to document version update. 2. Added LCD touch display and updated hardware version to V1.1
2020.10.10	1.20	Added buzzer and updated hardware version to V1.2
2022.9.13	1.30	Optimized PCB board layout and added white LEDs, and updated hardware version to V1.2

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