UM0621
User manual

STM3210E-LK learning kit

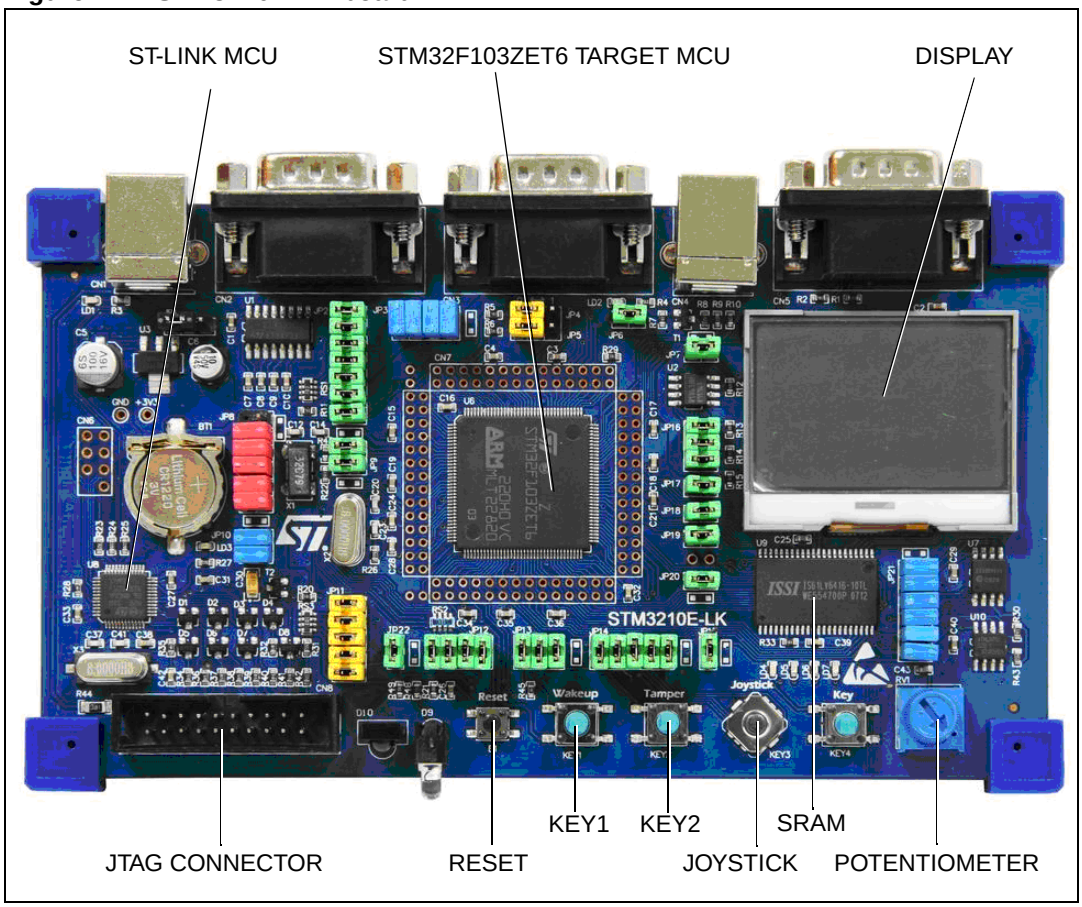
Introduction

The STM3210E-LK is a version of the STM32-LK learning kit for the STM32F103ZET6 (LQFP144) microcontroller. The STM32F103ZET6 is high density STM32 microcontroller based on the Cortex-M3 core, with 512 Kbytes of embedded Flash memory and a rich set of on-chip peripherals. The STM3210E-LK learning kit has an embedded ST-LINK JTAG emulator allowing it to be used as an evaluation and demonstration board with all required functions for:

- Emulation
- Debugging
- Flash programming

Interfaces and peripherals provided are: USB, CAN, USART, LCD, ADC, SRAM, NOR Flash, NAND Flash, input keys and joystick.

Figure 1. STM3210E-LK board



Contents

1 Overview

1.1 Features

- Supports IAR EWARM IDE
- Supports ARM RVMDK IDE
- Learning kit for STM32F103xCDE series ST Cortex M3 MCU
- Hardware and software architecture reference design
- Embedded ST-LINK for debug and programming STM32 target MCU

1.2 Product package

Table 1. Product package list

Item	Quantity
STM3210E-LK board	1
USB A-B type cable	1
DB9F/F RS-232 cable	1
Product CD-ROM	3
Package list	1
Quick start sheet	1

1.3 Functions

1.3.1 Emulator

- Embedded ST-LINK emulator, supports all STM32F10x series Cortex-M3
- USB 2.0 full speed, USB power supply
- Supports emulation of the on-board hardware and an external user system
- Download speed >2 kB/s
- Adaptive target system JTAG voltage level is 3.3 V
- The emulator can provide 5 V power (>100 mA) to the target system through pin 19 of the JTAG interface

1.3.2 Evaluation system

- STM32F103ZET6 ST Cortex-M3
- One 128 KB FSMC SRAM
- One 512 KB FSMC NOR Flash
- One 128 MB FSMC NAND Flash
- One 8 MB SPI Flash
- Two RS232 (DB9) connectors, with jumpers to disconnect them from the STM32
- One CAN (DB9) connector, with jumpers to disconnect it from the STM32
- Two B type USB connectors, with jumpers to disconnect them from the STM32
- One SD card socket, with jumpers to disconnect it from the STM32
- 8 MHz main clock oscillator with removable oscillator socket for optional 4~16 MHz
- 32 kHz oscillator, fixed
- One 128*64 dot-matrix LCD Module
- One I^2C interface EEPROM, with jumpers to disconnect it from the STM32
- Four LEDs
- One channel potentiometer which can input an analog signal
- One 5-direction joystick
- Two GPIO user keys
- One RESET key
- Power supply selection:
  - Powered by ST-LINK USB (CN1 connector)
  - Powered by target MCU USB (CN4 connector)
- IR LED transmitter and receiver

2 Connectors and jumpers

Figure 2. Connector and jumper locations (top view)

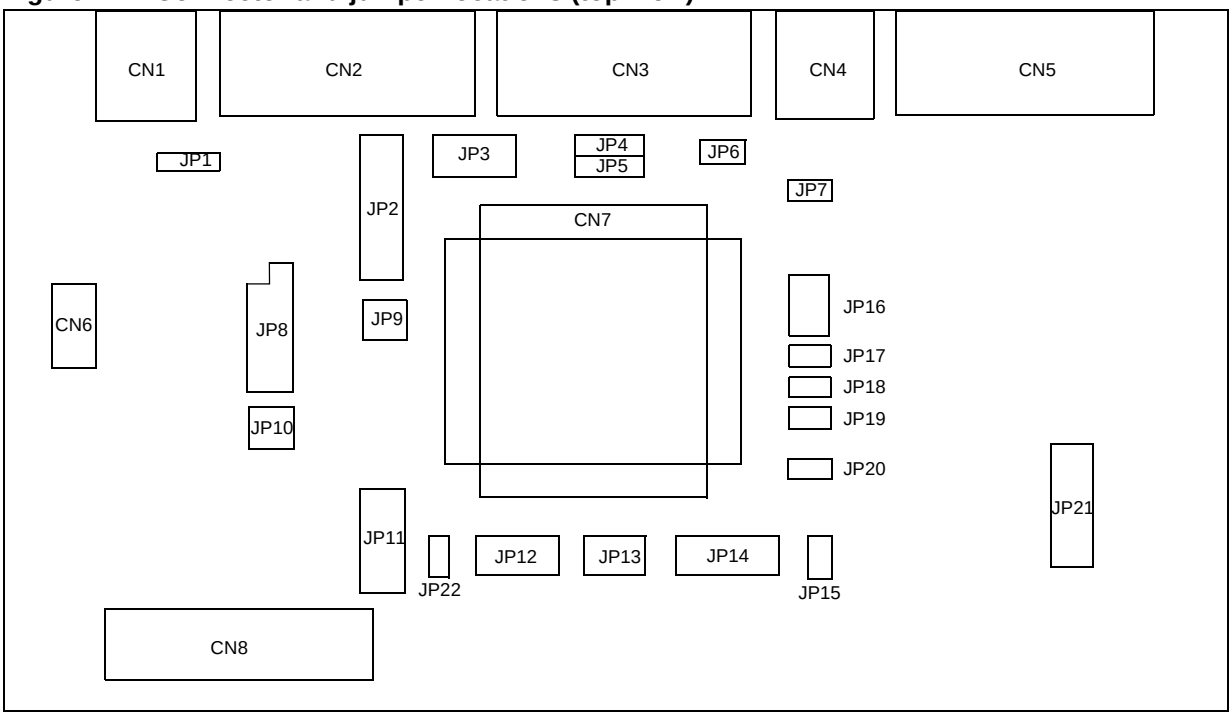
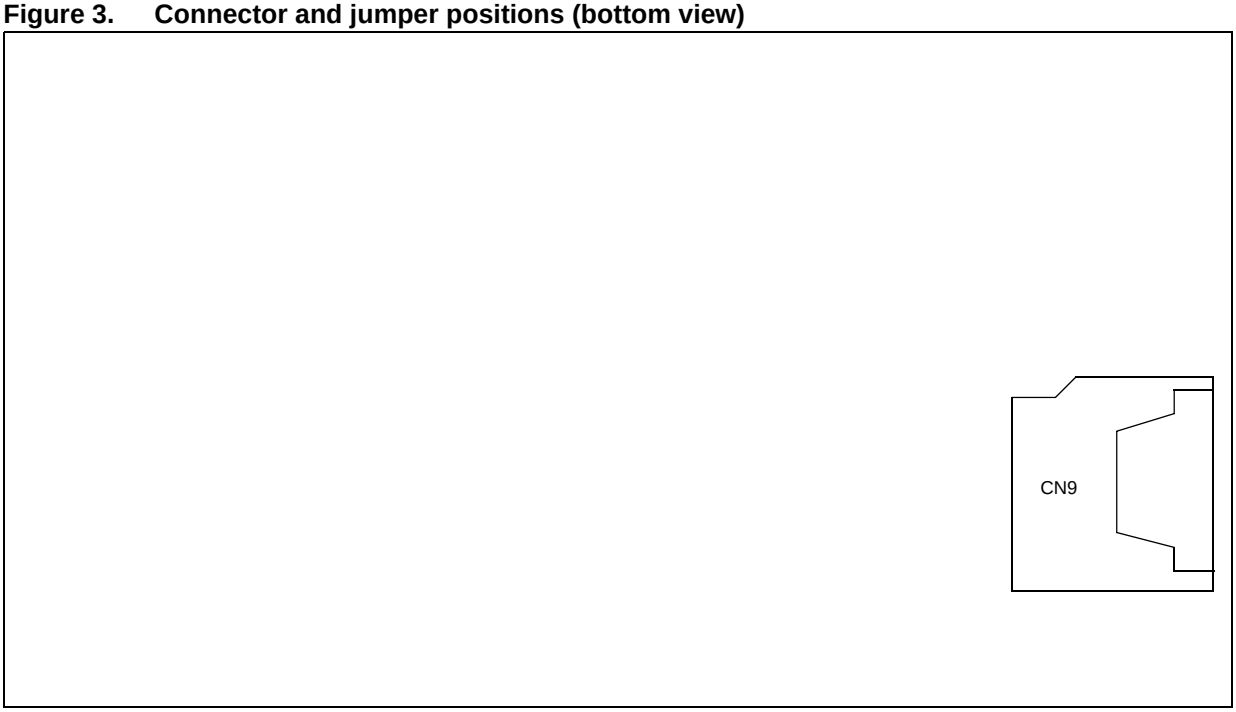


Figure 3. Connector and jumper positions (bottom view)



2.1 Connectors

Table 2. Connectors

Connector	PCB marking	Description
CN1	ST-LINK	ST-LINK USB connector, provides power when JP1 installed on the left 2 pins
CN2	USART1	RS-232 connector 0, connected via JP3 to target MCU
CN3	USART2	RS-232 connector 1, connected via JP3 to target MCU
CN4	USB	USB device connector, connected via JP6 to target MCU
CN5	CAN	CAN connector (DB9), connected via JP16 to target MCU
CN6	JTAG	JTAG interface for ST-LINK (reserved for factory test purposes)
CN7	MCU	External holes around target MCU for 112 I/Os, can be redefined by user
CN8	External JTAG	ST-LINK JTAG external interface, connected via JP11 to target MCU (for debugging/programming target MCU)
CN9	SD Card	SD Card socket, connected via JP2 & JP10 to the target MCU

2.2 Jumpers

Figure 4 shows all the jumpers on the STM3210E-LK. They are further described in two tables:

- Jumpers listed in *Table 3* can be used to connect to or disconnect the peripherals on STM3210E-LK from the STM32 target MCU.
- Jumpers listed in *Table 4* can be used to set different operating modes.

Figure 4. Jumper settings

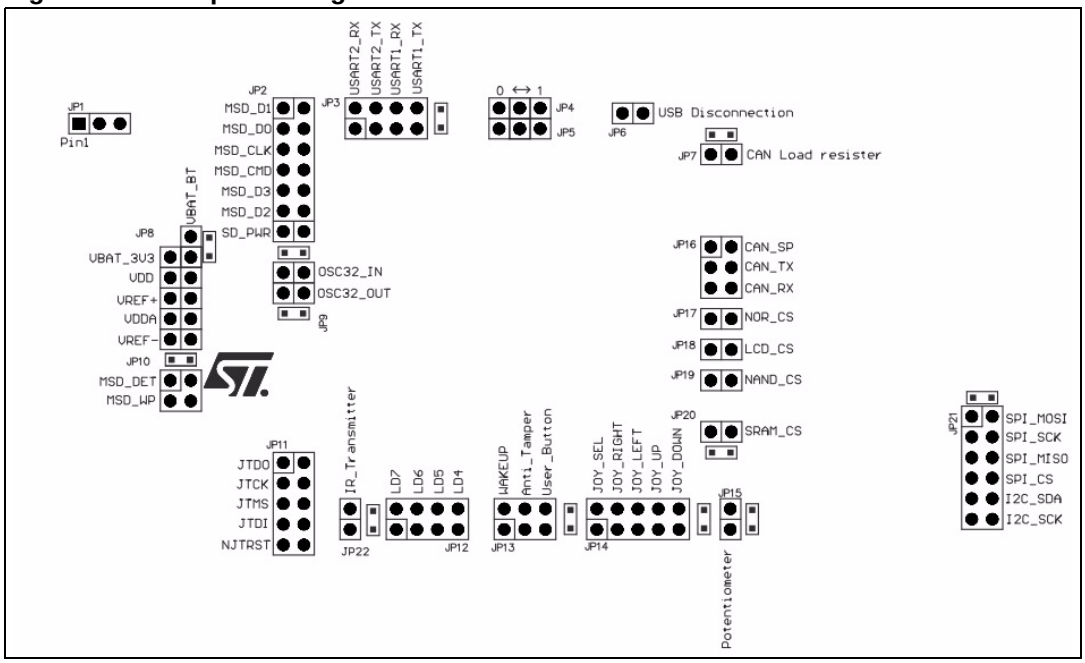


Table 3. Jumpers for disconnecting peripherals from STM32

Jumper	Peripheral	Signals	STM32 I/Os	Description
JP2	SD card	MSD_D1	PC9	SD CARD Data Input
		MSD_D0	PC8	Data Signal 0
		MSD_CLK	PC12	SD CARD Clock
		MSD_CMD	PD2	SD CARD Command
		MSD_D3	PC11	SD CARD Data signal
		MSD_D2	PC10	SD CARD Data signal
		SD_PWR	PB5	SD card power control
JP10		MSD_DET	PC2	MSD DET
		MSD_WP	PC3	MSD WP
JP3	USART	USART1_TX	PA9	USART1 Send
		USART1_RX	PA10	USART1 Receive
		USART2_TX	PA2	USART2 Send
		USART2_RX	PA3	USART2 Receive

Table 3. Jumpers for disconnecting peripherals from STM32 (continued)

Jumper	Peripheral	Signals	STM32 I/Os	Description
JP8	MCU power	VBAT	VBAT	STM32 MCU VBAT
		VDDA	VDDA	STM32 MCU VDDA
		VDD	VDD	STM32 MCU VDD
		VREF+	VREF+	STM32 MCU VREF+
		VREF-	VREF-	STM32 MCU VREF-
JP9	32 kHz_Osc	OSC32_IN	PC14	32K Oscillator input
		OSC32_OUT	PC15	32K Oscillator output
JP11	JTAG	JTDO	PB3	Data Input
		JTCK	PA14	JTCK
		JTMS	PA13	JTMS
		JTDI	PA15	JTDI
		NJTRST	PB4	JTRST
JP12	LEDs	LD7	PF6	LD7
		LD6	PF7	LD6
		LD5	PF8	LD5
		LD4	PF9	LD4
JP13	Keys	User_Button	PB10	KEY4
		Anti_Tamper	PC13	KEY2
		Wakeup	PA0	KEY1
JP14	Joystick	JOY_DOWN	PB15	Down
		JOY_UP	PB14	Up
		JOY_LEFT	PB13	Left
		JOY_RIGHT	PB12	Right
		JOY_SEL	PB11	Select
JP15	Potentiometer	Potentiometer	PC4	ADC Input
JP16	CAN	CAN_TX	PB9	CAN Send
		CAN_RX	PB8	CAN Receive
		CAN_SP		CAN adjustable slope control (see *Table 4* for details)
JP17	NOR Flash	NOR_CS	PG9	NOR Flash Enable
JP18	LCD	LCD_CS	PG12	LCD Enable
JP19	NAND	NAND_CS	PD7	NAND Flash Enable
JP20	SRAM	SRAM_CS	PG10	SRAM Enable

Table 3. Jumpers for disconnecting peripherals from STM32 (continued)

Jumper	Peripheral	Signals	STM32 I/Os	Description
JP21	EEPROM & Flash	I2C_SCK	PB6	I2C SCK
		I2C_SDA	PB7	I2C SDA
		SPI_CS	PB2	SPI Enable
		SPI_MISO	PA6	SPI Data Input
		SPI_SCK	PA5	SPI Clock
		SPI_MOSI	PA7	SPI Data Output
JP22	IR transmitter	IR transmitter	PB1	IR transmitter

Table 4. Jumpers for setting operating modes

Jumper	Function	Configuration	Description
JP1	Power Mode	Fit jumper to 1<->2 (left)	Board powered by USB cable connected to CN1
		Fit jumper to 2<->3 (right)	Board powered by USB cable connected to CN4
JP4 & JP5	Boot option	JP5 set to “0”	STM32 Boot from Flash
		JP5 set to “1” & JP4 set to “1”	STM32 Boot from SRAM
		JP5 set to “1” & JP4 set to “0”	STM32 Boot from bootloader in System Flash
JP6	USB disconnection	Open	USB disconnection feature disabled
		Close	USB disconnection feature enabled
JP7	CAN load resistor	Open	CAN load resistor is disabled
		Close	CAN load resistor is enabled
JP16 (pins 1 & 2)	CAN adjustable slope control	Open	Slow speed operation
		Close	Normal operation

3 Software installation

3.1 Embedded ST-LINK driver installation

The STM3210E-LK box contains the CDs for both IAR and Keil IDEs. You can select either one according to your requirements. The embedded ST-LINK on STM3210E-LK is supported by the IDE from both IAR and Keil and can be used to debug and program the board. Install one of the IDEs by following the steps listed below:

1. Install IAR IDE EWARM or Keil IDE RVMDK from the CDs delivered in the STM3210E-LK box.
2. Select ST-LINK as the debugger in the IDE.

3.2 Demonstration program

The ST CD available in the STM3210E-LK box includes the Demo software and Software library with example programs for some on-board peripherals. It will help you get started quickly with STM32.

4 Connecting power to the board

To start the demo without any debugging tool, the board must be powered on. There are two ways of doing this.

Note: Jumper JP6 must always be installed in either case.

To run the demo with an IAR or Keil IDE and ST-LINK, the first method must be used. With this method both the on-board ST-LINK and the STM32F103 target MCU are powered by the USB cable connected to the **CN1** connector.

Method 1:

Two USB cables are needed when using this power-on method.

1. Place jumper JP1 in position 1-2.
2. Power on the board by attaching a USB cable to connector **CN1**.
3. After power on, the demo program starts.
4. Then, attach another USB cable to connector **CN4** to demonstrate the USB mass storage application.

Method 2:

This method requires only one USB cable. This cable is also used by the USB mass storage application.

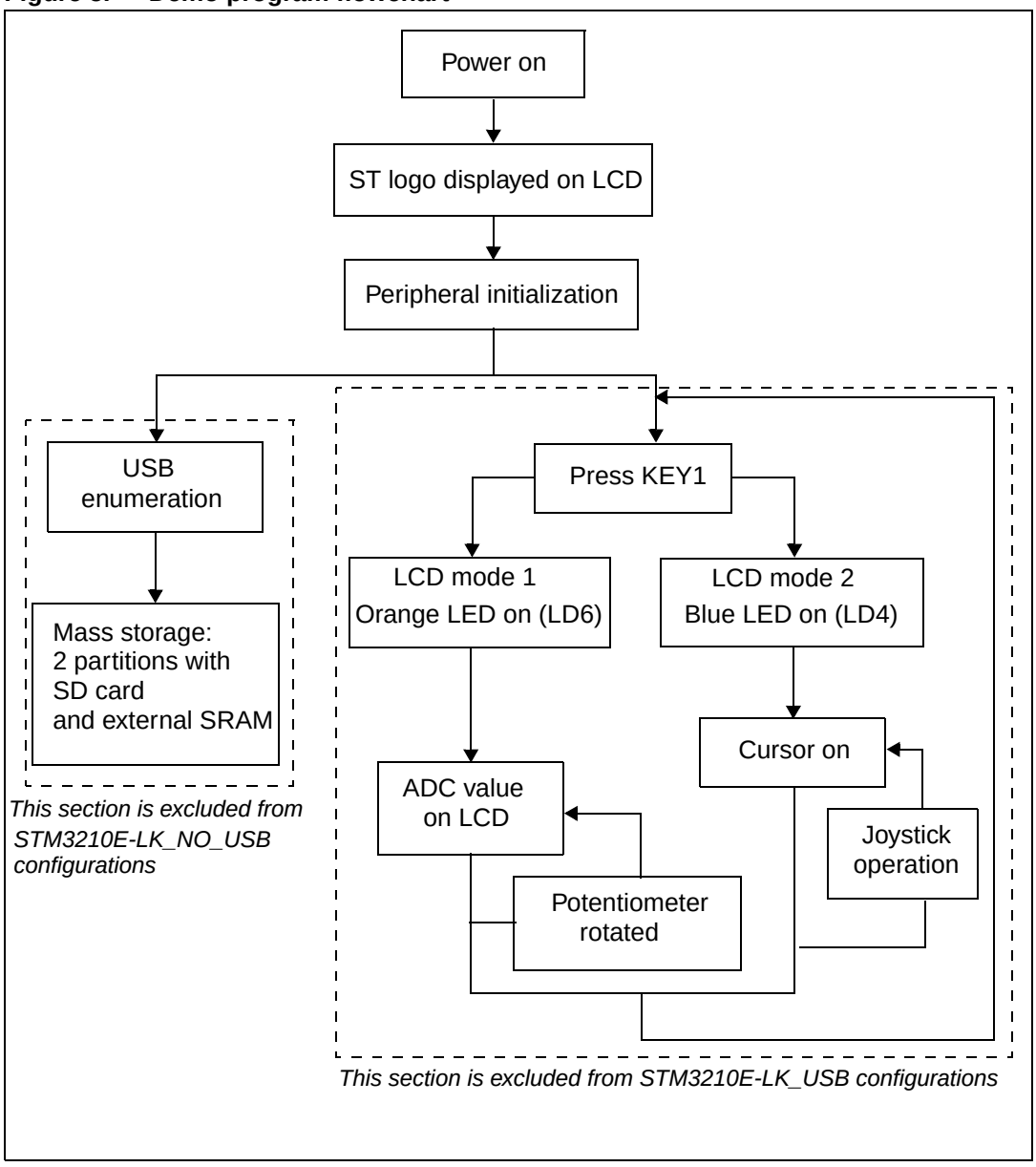
1. Place jumper JP1 in position 2-3.
2. Power on the board by attaching a USB cable to connector **CN4**.
3. After power on, the demo program starts.

5 Operating the demo program

To use the demo, refer to the flowchart in *Figure 5* and to the following procedure:

1. After power on, the ST logo is displayed on the LCD
2. There are two LCD demos, you can switch between them by pressing KEY1
3. Press KEY1 once to enter mode 1.
   a) The orange LED (LD6) lights up to indicate mode 1.
   b) In this mode, you can modify the input voltage to the target MCU's analog to digital converter by rotating the potentiometer. The converted value is displayed on the LCD.

Figure 5. Demo program flowchart



4. Press KEY1 a second time to enter mode 2.
   a) The blue LED (LD4) lights up to indicate mode 2.
   b) In this mode, you can operate the joystick.
   – First, press in the joystick. A small block ‘cursor’ is displayed in the center of the LCD screen.
   – You can move this cursor in 4 directions using the joystick.
   – Pressing in the joystick makes the cursor return to the center of the screen. Always press in the joystick before moving the cursor in a new direction.
5. Press KEY1 again to enter mode1 again, and so on.
6. After 5 seconds, if no joystick movement or potentiometer change is detected, the LCD goes into screen saver mode and displays the ST logo. You can still see which mode you are in from the status of the LEDs.
7. A USB mass storage device is also implemented by the demo program with two storage partitions on two different media, one on an SD card and one on external SRAM through the FSMC (flexible static memory controller) of the STM32F103E.

Note: For RVMDK tool users, there are 3 project targets with different configurations that can be chosen freely in the drop-down menu. These are "STM3210E-LK_FULL", "STM3210E-LK-NO_USB" and "STM3210E-LK-USB". The 1st configuration has full functionality and can be used by full version RVMDK users, while the other 2 have limited functionality, as their names suggest, and can be used by evaluation version RVMDK users.

For STM3210E-LK_FULL configuration, all parts in the flowchart are present.

For STM3210E-LK_NO_USB configuration, parts surrounded by the dotted line rectangle on the left are not present.

For STM3210E-LK_USB configuration, parts surrounded by the dotted line rectangle on the right are not present.

6 Troubleshooting

6.1 Limitation with reset from IDE during debugging

As most IDEs (including IAR) only perform a software reset, they cannot reset the MCU thoroughly. After an IDE reset, parts of the board hardware may be in an uncertain state and this may lead to errors in some cases. For example a reset from the IDE may not reset the LCD properly.

Workaround

When debugging with IAR or MDK, to restart debugging without re-programming the chip and by using the IAR or MDK debugger reset:

- Use `break` to stop the program and `reset` the program counter (PC) to main and let it run again.
- To do this press the RESET key on the STM3210E-LK board after stopping the program with a `break` and before making a program counter (PC) `reset`.

6.2 Analog/digital conversion (ADC) errors

Correct ADC conversion may be disturbed by USB communication and when an SD card is installed on the board as a removable USB mass storage device. When the SD card is plugged in, this effects the quality of the ADC power source. To prevent this the STM3210E-LK board would need additional on-board filtering and power separation. The demo firmware has a software filtering function, if this is not sufficient, use the workaround described below.

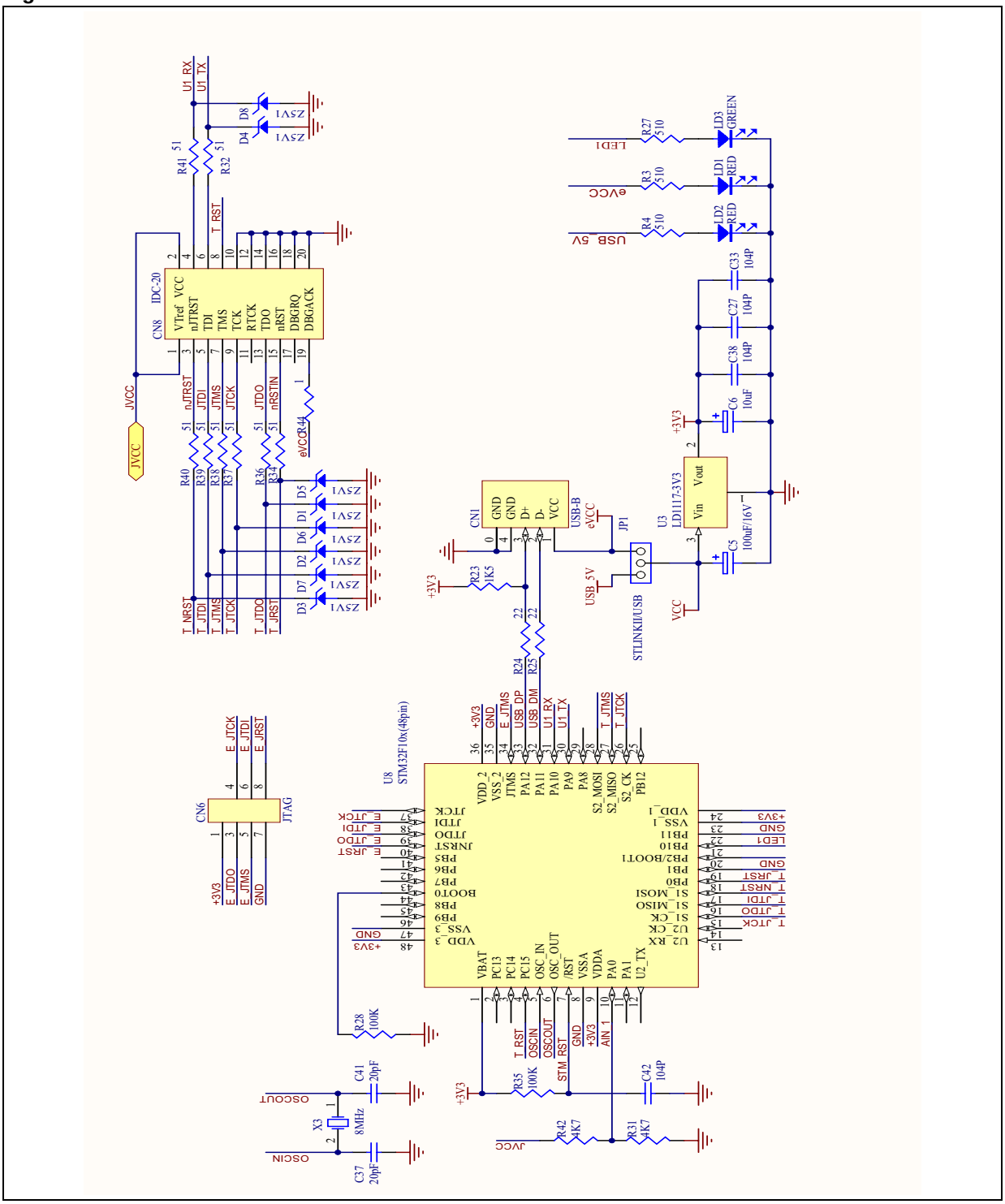
Workaround

Connect power to the STM3210E-LK board using the first method described in *Section 4 on page 12*. In this case you power on the board using a USB cable on connector CN1 and run the ADC part of the demo before attaching the USB cable to CN4 to run the USB mass storage part of the demo.

7 Schematics

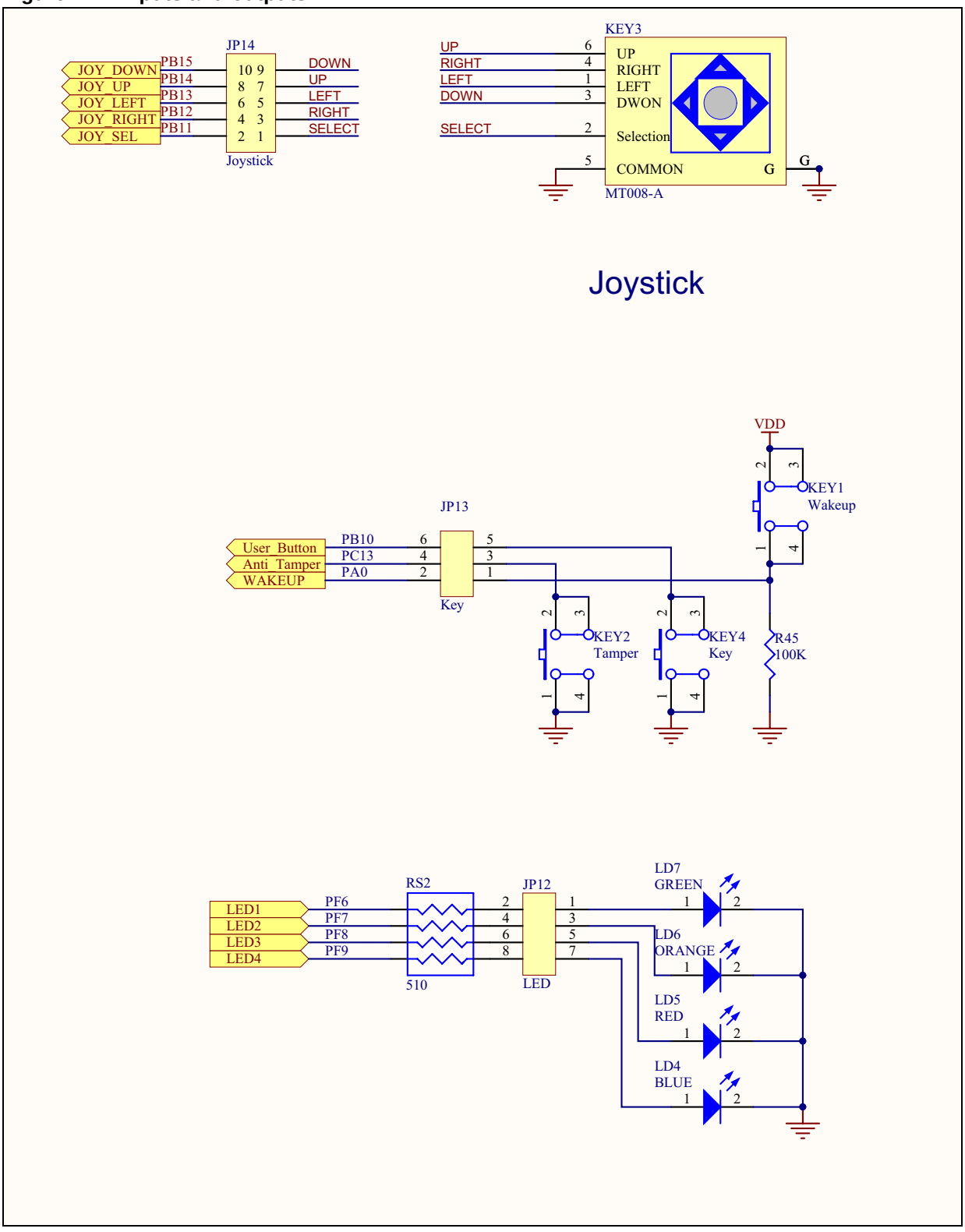
7.1 Embedded ST-LINK

Figure 6. ST-LINK



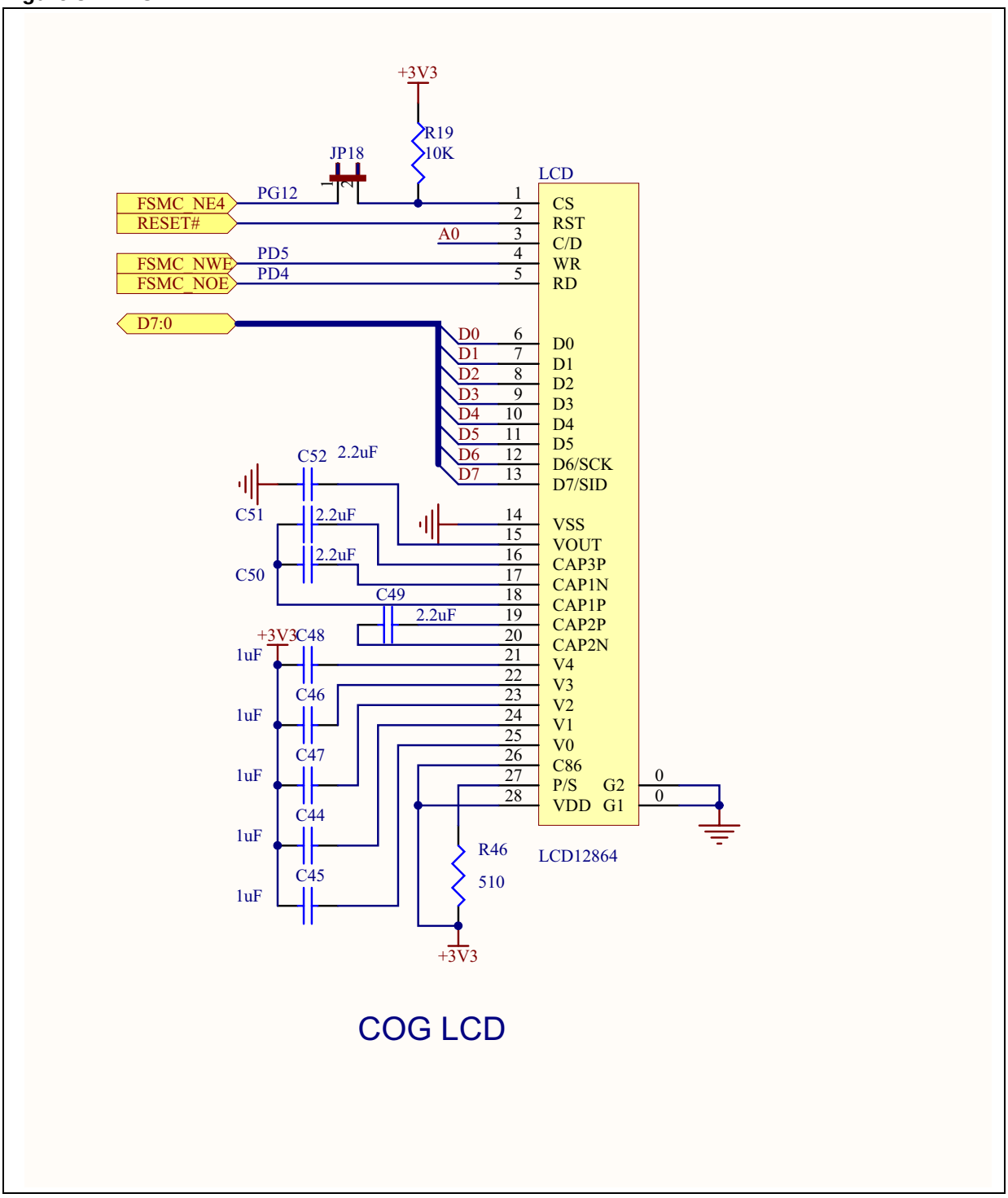
7.2 Inputs and outputs

Figure 7. Inputs and outputs



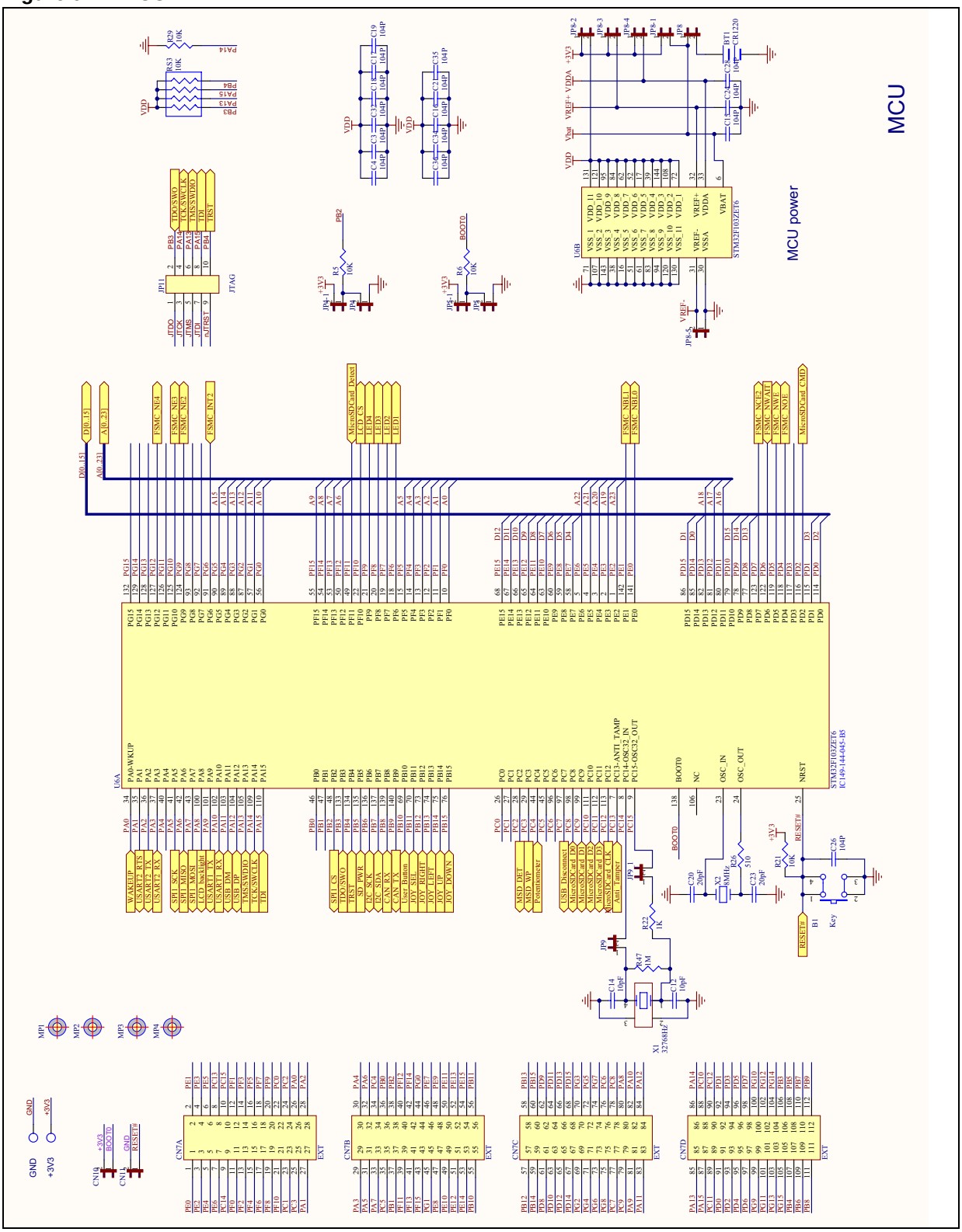
7.3 LCD

Figure 8. LCD



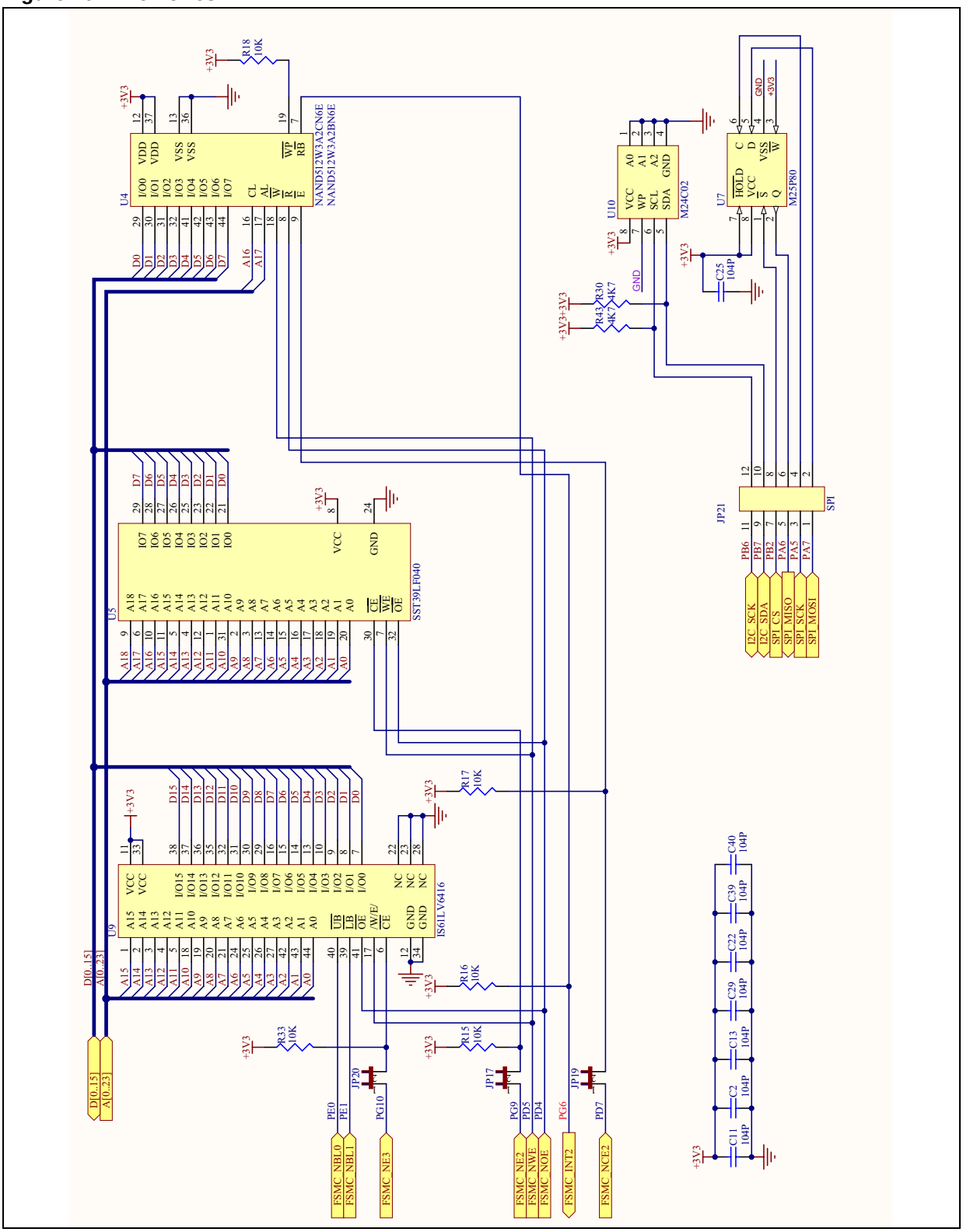
7.4 MCU

Figure 9. MCU



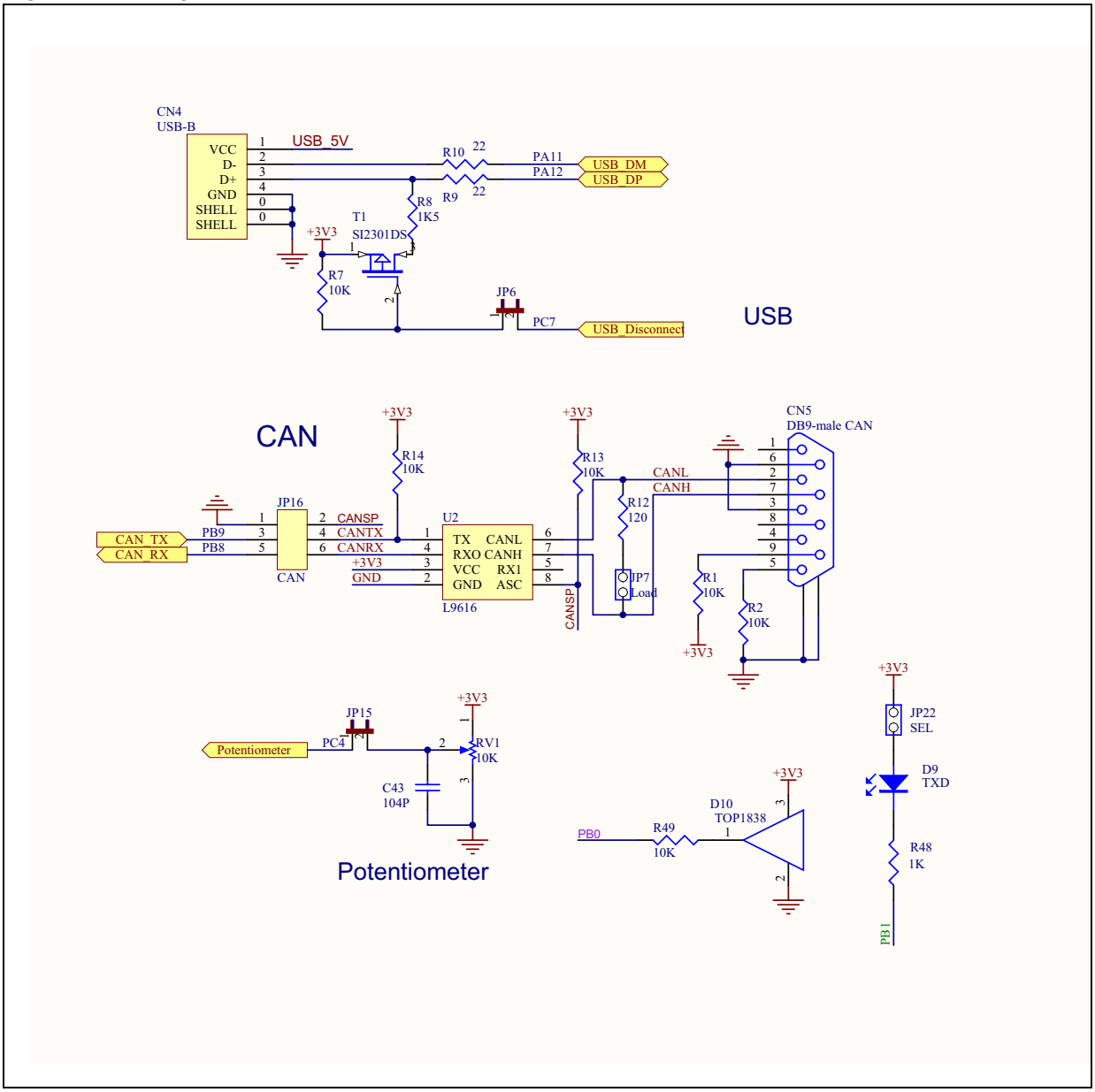
7.5 Memories

Figure 10. Memories



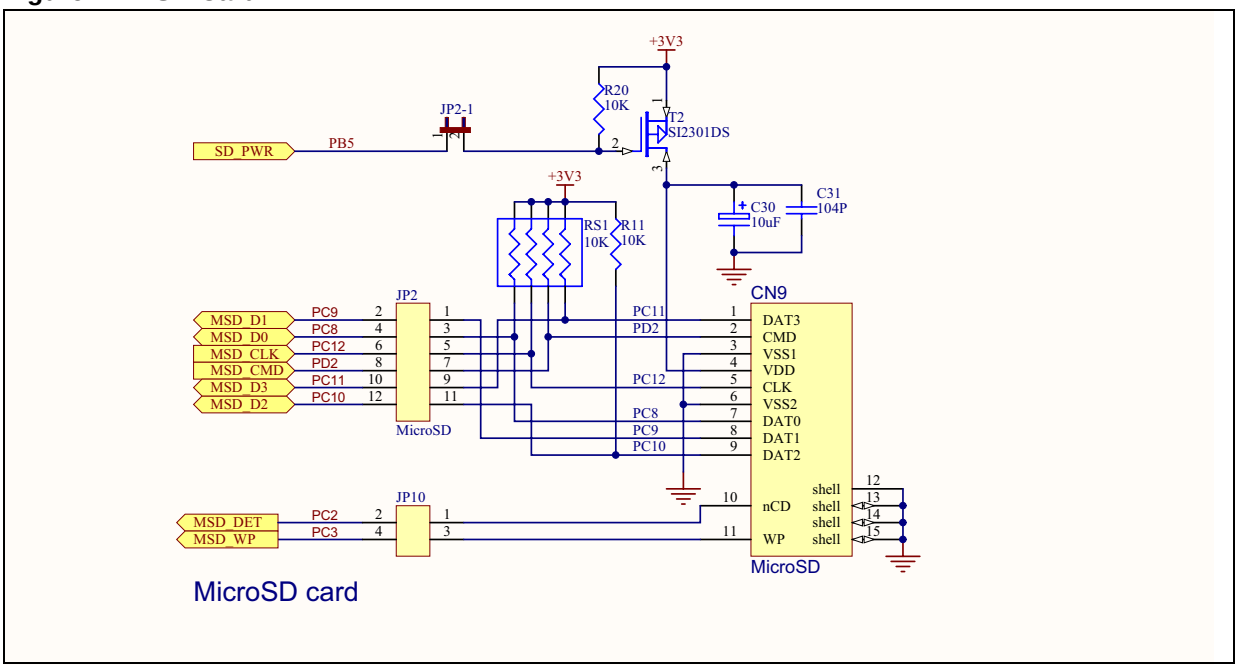
7.6 Peripherals

Figure 11. Peripherals



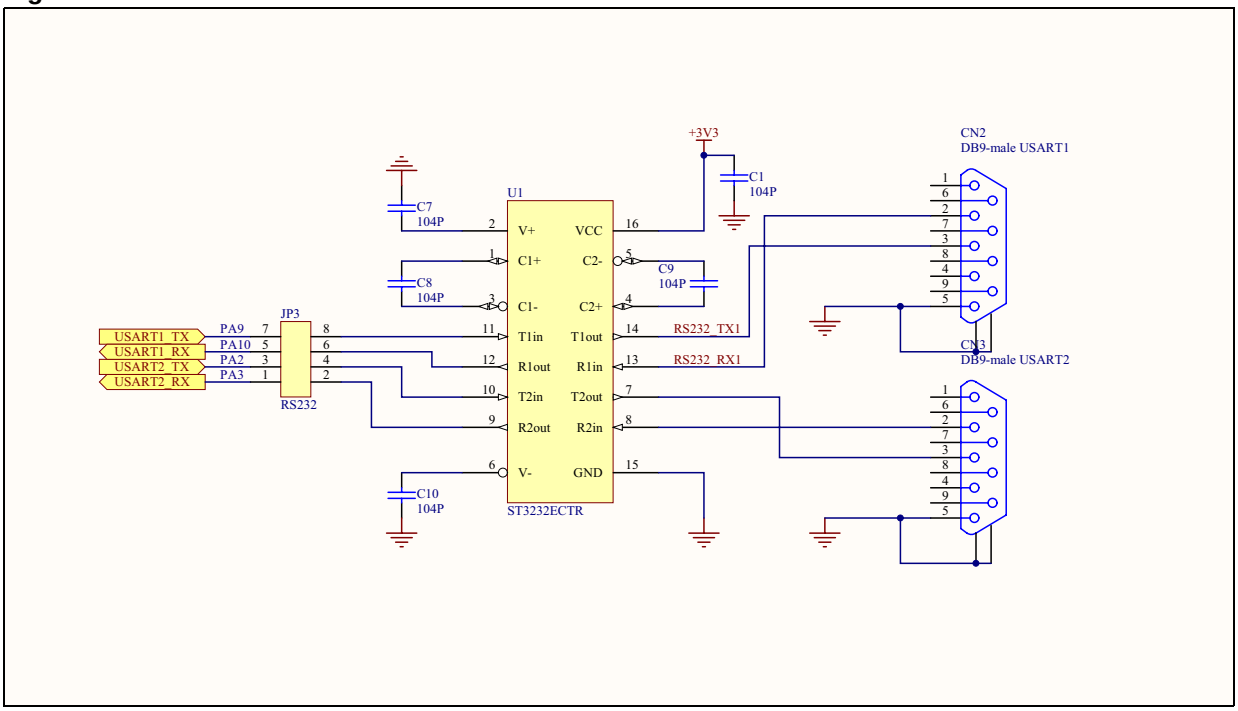
7.7 SD Card

Figure 12. SD Card



7.8 UART

Figure 13. UART



Revision history

Table 5. Document revision history

Date	Revision	Changes
13-Jan-2009	1	Initial release.

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