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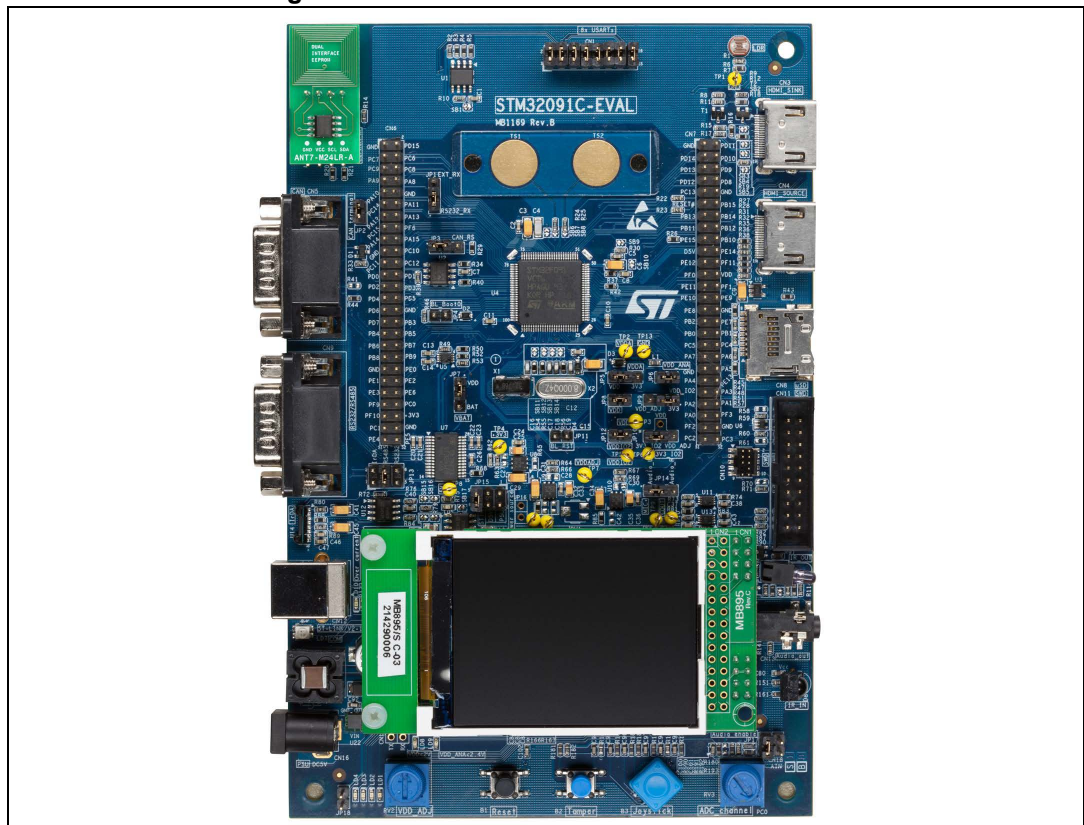
## Evaluation board with STM32F091VC MCU

### Introduction

The STM32091C-EVAL evaluation board is designed as a complete demonstration and development platform for STMicroelectronics ARM<sup>®</sup> Cortex<sup>®</sup>-M0 core-based STM32F091VCT6 microcontroller, with two I<sup>2</sup>Cs, two SPIs, eight USARTs, one CAN, 12-bit ADC, 12-bit DAC, two GP comparators, internal SRAM and 256-Kbyte Flash memory, Touch sensing, CEC and SWD debugging support.

The full range of hardware features on the board helps the user to evaluate all the peripherals (8x USARTs, RS-232, RS-485, Audio DAC, microphone ADC, Touch sensing buttons, TFT LCD, CAN, IrDA, IR LED, IR receiver, LDR, microSD card, CEC on two HDMI connectors, smartcard slot, RF-EEPROM and temperature sensor) and to develop applications. Extension headers make it possible to easily connect a daughterboard or wrapping board for a specific application. An ST-LINK/V2-1 is integrated on the board as an embedded in-circuit debugger and programmer for the STM32.

Figure 1. STM32091C-EVAL evaluation board



1. Picture not contractual.

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# 1 Overview

## 1.1 Features

- STM32F091VCT6 microcontroller with 256-Kbyte Flash memory and 32-Kbyte RAM
- Three 5 V power supply options: power jack, ST-LINK/V2-1 USB connector or daughterboard
- Stereo audio jack which supports headset with microphone connected to DAC and ADC of the STM32F091VCT6
- 2-Gbyte (or more) SPI interface microSD card
- I<sup>2</sup>C compatible serial interface temperature sensor
- RF-EEPROM
- RS-232 and RS-485 communication
- IrDA transceiver
- IR LED and IR receiver
- SWD debug support, ST-LINK/V2-1 embedded
- 240x320 TFT color LCD connected to SPI interface of STM32F091VCT6
- Joystick with 4-direction control and selector
- Reset, Tamper and user-buttons
- 4-color user LEDs and two LEDs as STM32 low-power alarm
- Extension connector for daughterboard or wrapping board
- STM32 voltage choice fixed 3.3 V or adjustable from 1.65 V to 3.6 V
- Touch sensing buttons
- RTC with backup battery
- CAN2.0A/B compliant connection
- Light dependent resistor (LDR)
- Potentiometer
- Two HDMI connectors with DDC and CEC
- Smartcard slot
- 8x USARTs chain connector

## 1.2 Demonstration software

Demonstration software is preloaded in the STM32F091VCT6 Flash memory for easy demonstration of the device peripherals in stand-alone mode. For more information and to download the latest version available, refer to the STM32091C-EVAL demonstration software available on the [www.st.com](http://www.st.com) website.

## 1.3 Order code

To order the evaluation board for the STM32F091VCT6 MCU, use the order code STM32091C-EVAL.

## 1.4 Delivery recommendations

Before using the board for the first time, the user should check that it has not been visibly damaged during the shipment, and that no components are unplugged or missing.

When the board is extracted from its plastic bag, check that no component remains in the bag.

The main components to verify are:

1. The 8 MHz crystal (X2) which may have been removed from its socket by a shock.
2. The microSD card which may have been ejected from the CN8 connector (right side of the board).
3. The dual-interface EEPROM board (ANT7-M24LR-A) which may have been unplugged from the CN2 connector (top left corner of the board).

For all information concerning the version of the MCU used on the board, its specification and possible related limitations, visit the ST web site [www.st.com](http://www.st.com) to download relevant datasheet and errata sheet.



## 2 Hardware layout and configuration

The STM32091C-EVAL evaluation board is designed around the STM32F091VCT6 (100-pin LQFP package). The hardware block diagram *Figure 2* illustrates the connection between the STM32F091VCT6 and the peripherals (8x USARTs, RS-232, RS-485, Audio DAC, microphone ADC, Touch sensing buttons, TFT LCD, CAN, IrDA, IR LED, IR receiver, LDR, microSD card, CEC on two HDMI connectors, smartcard slot, RF-EEPROM and Temperature sensor) and *Figure 3* helps the user to locate these features on the actual evaluation board. The *Figure 4* and the *Table 1* show the board mechanical dimensions.

**Figure 2. Hardware block diagram**

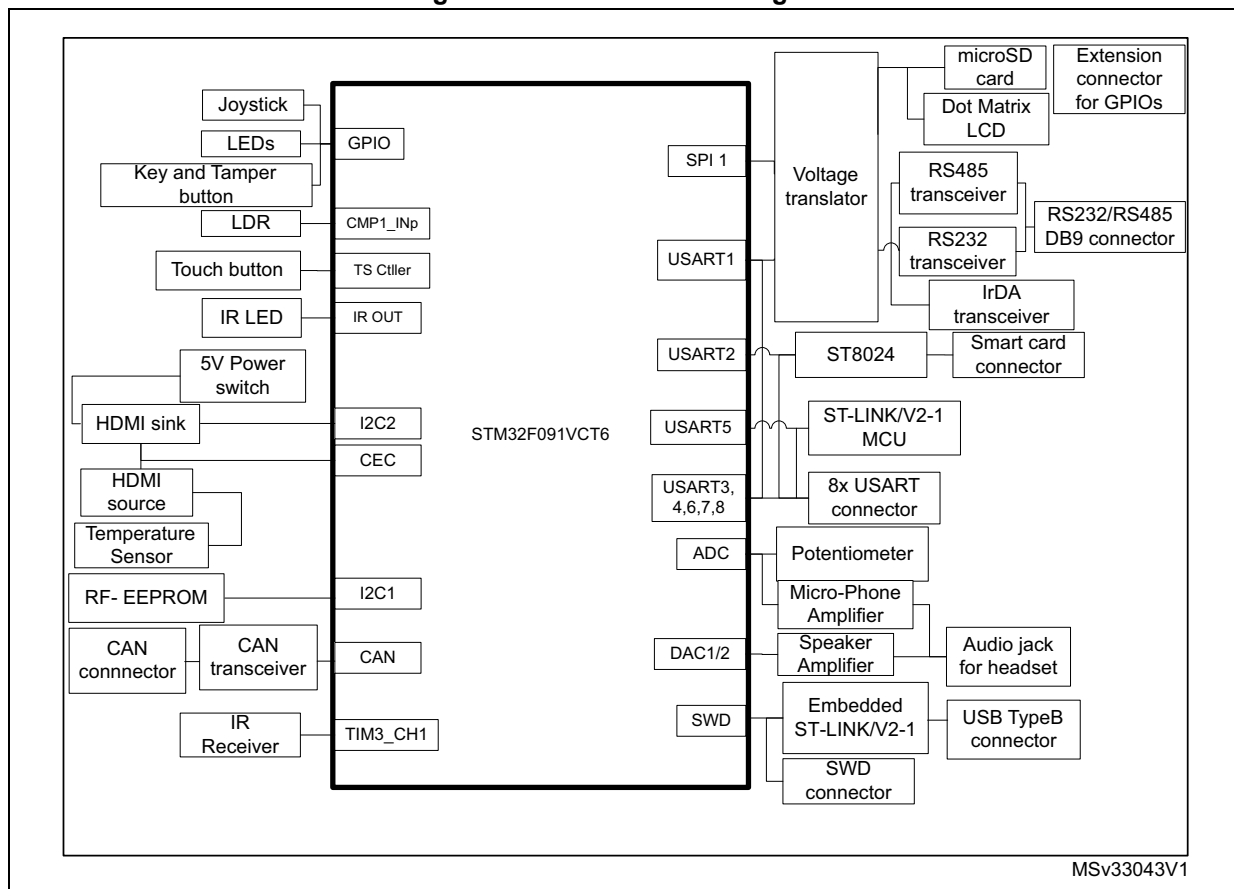


Figure 3. STM32091C-EVAL board layout

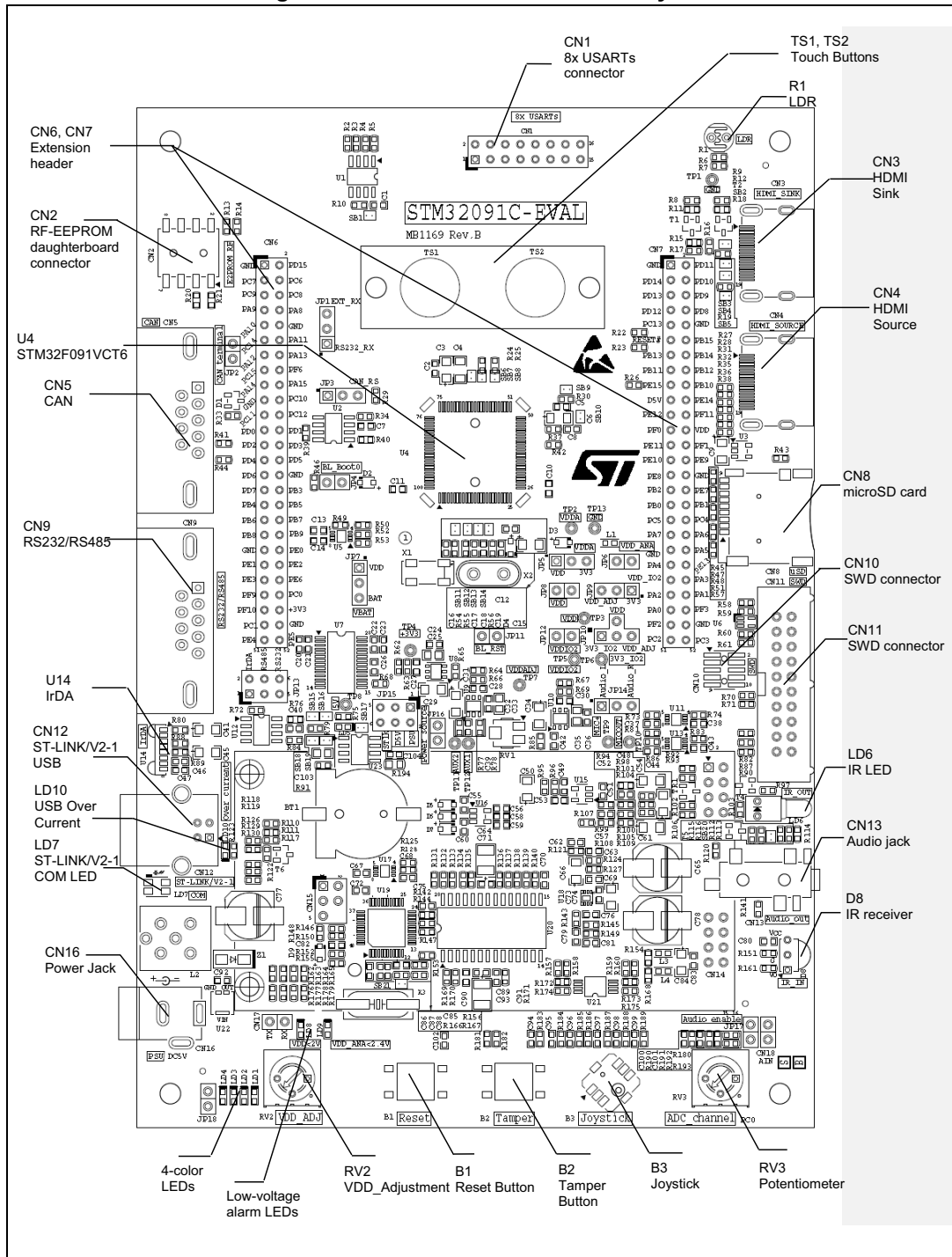


Figure 4. Mechanical dimensions

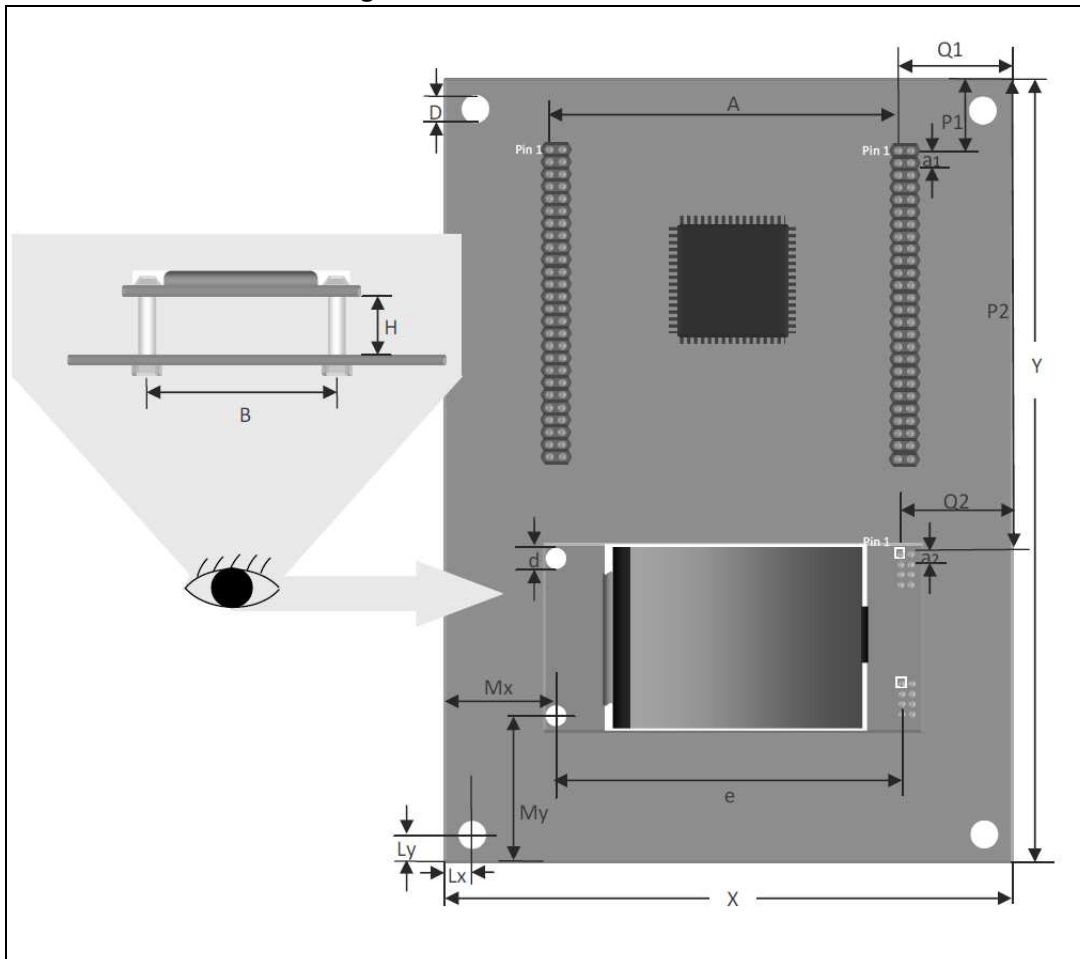


Table 1. Mechanical dimensions

Symbol	Size (mm)	Symbol	Size (mm)	Symbol	Size (mm)
A	68.58	e	77.44	P1	26.67
a1	2.54	H	11	P2	111.76
a2	2.54	Lx	5.715	Q1	24.12
B	36	Ly	5.715	Q2	17.70
D	3.5	Mx	19.08	X	114.3
d	3.2	My	23.81	Y	172.72

## 2.1 Embedded ST-LINK/V2-1

The ST-LINK/V2-1 programming and debugging tool is integrated on the STM32091C-EVAL evaluation board. Compared to ST-LINK/V2 the changes are listed below.

The new features supported on ST-LINK/V2-1 are:

- USB software re-enumeration
- Virtual COM port interface on USB
- Mass storage interface on USB
- USB power management request for more than 100 mA power on USB

This feature is no more supported on ST-LINK/V2-1:

- SWIM interface

For all general information concerning debugging and programming features common between V2 and V2-1 refer to the *ST-LINK/V2 in-circuit debugger/programmer for STM8 and STM32ST-LINK/V2 User manual (UM1075)*.

*Note: It is possible to power the board via CN12 (Embedded ST-LINK/V2-1 USB connector) even if an external tools is connected to CN10 (High density SWD connector) or CN11 (SWD connector).*

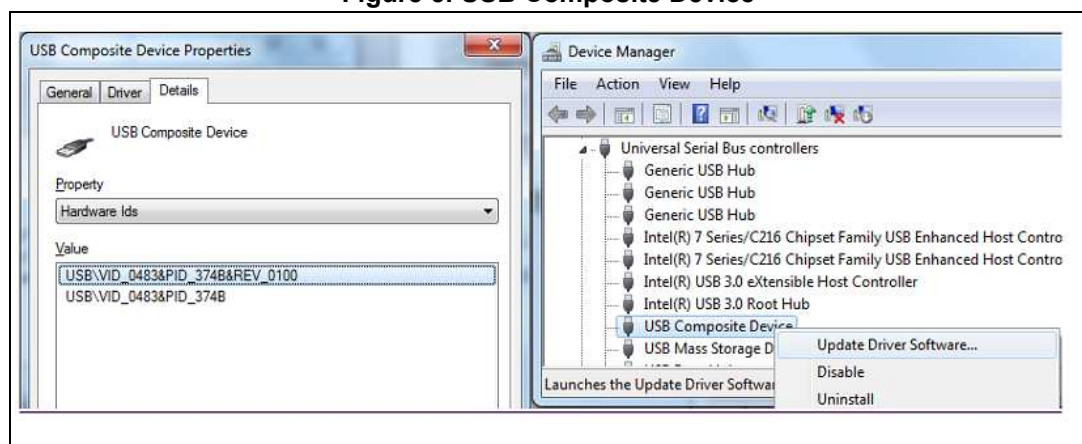
### 2.1.1 Drivers

The ST-LINK/V2-1 requires a dedicated USB driver, which can be found at the [www.st.com](http://www.st.com) website for Windows® 7 and 8. On Windows® XP the ST-LINK/V2-1 driver requires WinUsb to be installed before using the ST-LINK/V2-1 (either available from Microsoft website or included in the USB driver for ST-LINK/V2 for XP).

In case the STM32091C-EVAL evaluation board is connected to the PC before the driver is installed, some STM32091C-EVAL interfaces may be declared as “Unknown” in the PC device manager. In this case the user must install the driver files, and update the driver of the connected device from the device manager.

*Note: Prefer using the “USB Composite Device” handle for a full recovery.*

**Figure 5. USB Composite Device**



### 2.1.2 ST-LINK/V2-1 firmware upgrade

The ST-LINK/V2-1 embeds a firmware upgrade mechanism for in-situ upgrade through the USB port. As the firmware may evolve during the life time of the ST-LINK/V2-1 product (for example new functionalities, bug fixes, support for new microcontroller families), it is recommended to visit the [www.st.com](http://www.st.com) website before starting to use the STM32091C-EVAL board and periodically, in order to stay up-to-date with the latest firmware version.

## 2.2 Board power supply

STM32091C-EVAL evaluation board is designed to be powered by 5 V DC power supply and to be protected by PolyZen from wrong power plug-in event. It is possible to configure the evaluation board to use any of the following three sources for the power supply:

- 5 V DC power adapter connected to CN16 (the Power jack on the board showed as PSU on JP15 silkscreen and called E5V). The external power supply is not provided with the board.
- 5 V DC power from CN12 (the USB Type-B connector of ST-LINK/V2-1, that is showed as STlk on JP15 silkscreen and called U5V). If the USB enumeration succeeds (as explained below), the ST-LINK U5V power is enabled, by asserting the PWR\_EN pin. This pin is connected to a power switch (ST890), which powers the board. This power switch features also a current limitation to protect the PC in case of short-circuit on the board. If overcurrent (more than 600 mA) happens on board, the LED LD10 is lit.
- 5 V DC power from CN7 (the extension connector for daughterboard, that is showed as D5V on JP15 silkscreen).

STM32091C-EVAL evaluation board can be powered from ST-LINK USB connector CN12 (U5V), but only the ST-LINK part has the power before USB enumeration, because the host PC only provides 100 mA to the board at that time. During the USB enumeration, the STM32091C-EVAL board asks for the 300 mA power to the host PC. If the host is able to provide the required power, the enumeration finishes by a “SetConfiguration” command and then, the power transistor U23 (ST890) is switched ON, the red LED LD5 is turned ON, thus STM32091C-EVAL board can consume maximum 300 mA current, but not more. If the host is not able to provide the requested current, the enumeration fails. Therefore the ST890 (U23) remains OFF and the STM32 part including the extension board will not be powered. As a consequence the red LED LD5 remains turned OFF. In this case it is mandatory to use an external power supply as extra power supply.

E5V (from PSU) or D5V can be used as external power supply in case the current consumption of the STM32091C-EVAL board exceeds the allowed current on the USB. In this condition it is still possible to use the USB for communication, for programming or debugging only, but it is mandatory to power the board first using E5V or D5V, then connecting the USB cable to the PC. Proceeding this way the enumeration succeeds thanks to the external power source.

The following power sequence procedure must be respected:

4. Connect jumper JP15 for PSU or D5V side
5. Check that JP18 is removed
6. Connect the external power source to PSU or D5V (daughterboard mounted)
7. Check red LED LD5 is turned ON
8. Connect the PC to USB connector CN12

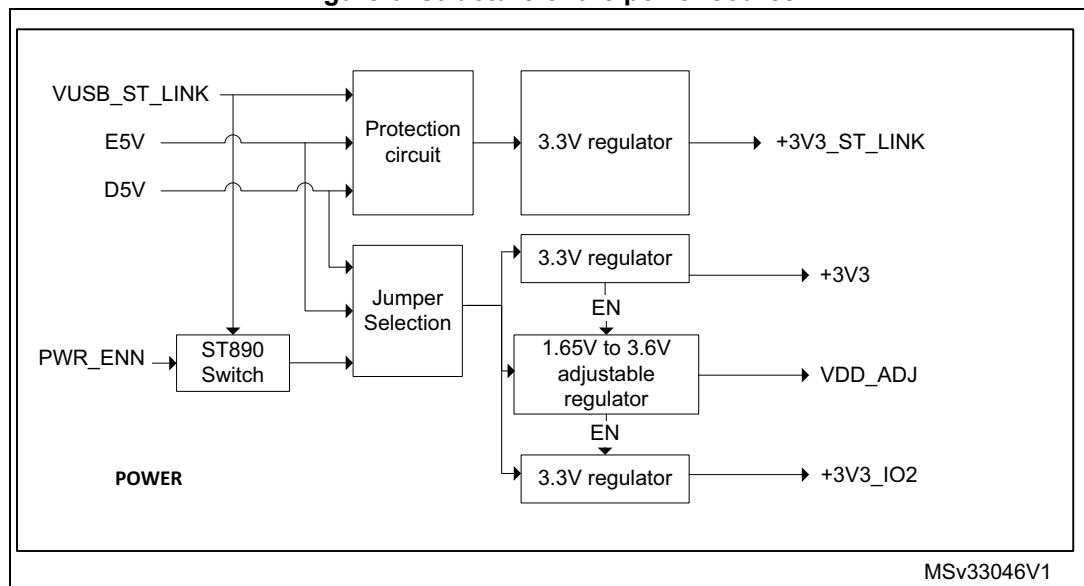
If this order is not respected, the board may be powered by VBUS first then E5V or D5V, and the following risks may be encountered:

1. If more than 300 mA current is needed by the board, the PC may be damaged or current can be limited by PC. As a consequence the board is not powered correctly.
2. 300 mA is requested at enumeration (since JP18 must be OFF), so there is risk that the request is rejected and the enumeration does not succeed if the PC cannot provide such current. Consequently the board is not powered (LED LD5 remains OFF).

*Note:* In case the board is powered by a USB charger, there is no USB enumeration, so the led LD5 remains set to OFF permanently and the board is not powered. Only in this specific case the jumper JP18 needs to be set to ON, to allow the board to be powered anyway.

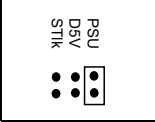
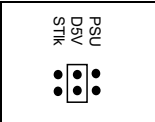
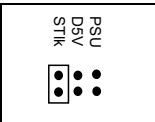
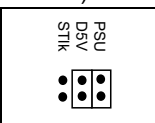
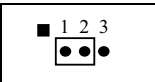
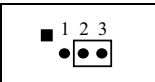
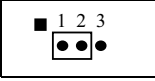
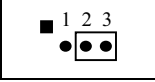
Figure 6 helps to understand the structure of the power source on the evaluation board.

**Figure 6. Structure of the power source**



The power source is selected by setting the related jumpers **JP15**, **JP7** and **JP10** as described in [Table 2](#).

**Table 2. Power source related jumpers**

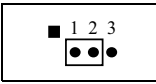
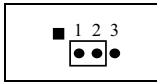
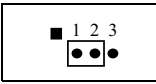
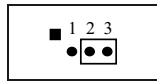
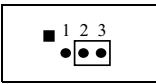
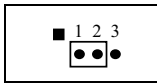
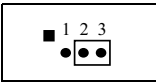
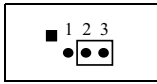
Jumper	Description
JP15	<p>JP15 is used to select one of the three possible power supply resources. For <b>power supply jack</b> (CN16) to the STM32091C-EVAL only, JP15 is set as shown to the right:</p> 
	<p>For power supply from the <b>daughterboard connectors</b> (CN7) to STM32091C-EVAL only, JP15 is set as shown to the right:</p> 
	<p>For power supply from USB (CN12) of ST-LINK/V2-1 to STM32091C-EVAL only, JP15 is set as shown to the right: (Default Setting)</p> 
	<p>For power supply from <b>power supply jack</b> (CN16) to both STM32091C-EVAL and daughterboard connected on CN6 and CN7, JP15 is set as shown to the right (<b>daughterboard must not have its own power supply connected</b>)</p> 
JP7	<p>The Vbat pin of STM32F091VCT6 is connected to VDD when JP7 is set as shown to the right (Default setting):</p> 
	<p>The Vbat pin of STM32F091VCT6 is connected to the 3 V battery when JP7 is set as shown to the right:</p> 
JP10	<p>The VDDIO2 pin of STM32F091VCT6 is connected to 3.3V when JP10 is set as shown to the right (Default setting):</p> 
	<p>The VDDIO2 pin of STM32F091VCT6 is connected to VDD_ADJ when JP10 is set as shown to the right:</p> 

## 2.3 STM32 power-mode configuration

Total three power modes are supported on the board that are configured by setting the related jumpers **JP5**, **JP6**, **JP8**, **JP9** and **JP12** as described in [Table 3](#) and in the Notes below.

- Mode1: The VDD and VDDA are connected together and powered by fixed 3.3 V.
- Mode2: The VDD and VDDA are connected together and powered by adjustable voltage from 1.65 V to 3.6 V.
- Mode3: The VDD is powered by adjustable voltage from 1.65 V to 3.6 V while VDDA is powered by fixed 3.3 V.

**Table 3. Power mode related jumpers**

Power mode	Power mode configuration		VDD_MCU Idd measurement (On JP8)
	JP9	JP5	
Mode1			OK
			NOT allowed
Mode2			OK
Mode3			NOT allowed

*Note:1 JP8 allows current measurement on VDD\_MCU. Current measurement is performed by replacing JP8 by an ammeter.*

*Note:2 JP12 allows current measurement on VDDIO2. Current measurement is performed by replacing JP12 by an ammeter.*

*Note:3 JP6 allows to connect analog power source VDD\_ANA to the STM32 VDDA. JP6 must be opened (to disconnect VDDA from all analog power VDD\_ANA which is connected to analog circuits on the board) for STM32 Idd measurement.*

*Note:4 LD8 is lit when VDD < 2V and in this case STM32 is not functional. LD9 is lit when VDDA < 2.4 V and in this case analogue parts in STM32F091VCT6 are not functional.*

The LED LD5 is lit when the STM32091C-EVAL evaluation board is powered by the 5 V correctly.

[Table 4](#) shows the low-voltage limitations that might apply depending on the characteristics of some peripheral components. Components might work incorrectly when the power level is lower than the limitation.



**Table 4. Low-voltage limitation**

Peripheral	Component	IO name	Low-voltage limitation
Audio amplifier	U18	Audio input	2.2 V (VDDA)
Microphone amplifier	U15	Audio output	2.7 V (VDDA)
CAN	CN5	CAN	3 V (VDDIO2)
Smartcard	CN19	USART2	2.7 V (VDD)

**CAUTION:**

1. JP8 and JP12 are not allowed to be opened; otherwise STM32F091VCT6 would be damaged due to a lack of power supply on its power pins.
2. Risk of explosion if battery is replaced by an incorrect type. Dispose of used batteries according to the instructions.

## 2.4 Clock source

Two clock sources are available on the STM32091C-EVAL evaluation board for STM32F091VCT6 and RTC embedded.

- X1, 32 KHz crystal for embedded RTC
- X2, 8 MHz crystal with socket for STM32F091VCT6 microcontroller, it can be removed from socket when internal RC clock is used.

See [Table 5](#) and [Table 6](#).

**Table 5. 32 KHz crystal X1 related solder bridges**

Jumper	Description
SB11	PC14 is connected to the 32KHz crystal when SB11 is open. (Default setting)
	PC14 is connected to extension connector CN6 when SB11 is closed. In such case R54 must be removed to avoid disturbance due to the 32 Khz quartz.
SB12	PC15 is connected to the 32 KHz crystal when SB12 is open. (Default setting)
	PC15 is connected to extension connector CN6 when SB12 is closed. In such case R55 must be removed to avoid disturbance due to the 32 Khz quartz.

**Table 6. 8MHz crystal X2 related solder bridges**

Jumper	Description
SB13	PF0 is connected to the 8 MHz crystal when SB13 is open. (Default setting)
	PF0 is connected to the extension connector CN7 when SB13 is closed. In such case C18 and X2 must be removed.

**Table 6. 8MHz crystal X2 related solder bridges (continued)**

SB14	PF1 is connected to 8MHz crystal when SB14 is open. (Default setting)
	PF1 is connected to extension connector CN7 when SB14 is closed. In such case R56 must be removed to avoid disturbance due to the 8 Mhz quartz.

## 2.5 Reset source

The reset signal of STM32091C-EVAL evaluation board is low active and the reset sources include:

- Reset button B1
- Debugging tools from SWD connector CN10 and CN11
- Daughterboard from CN7
- Embedded ST-LINK/V2-1
- RS-232 connector CN9 for ISP.

*Note:* The jumper JP11 must be closed for RESET handled by pin 8 of the RS-232 connector CN9 (CTS signal). Refer to [Section 2.8](#) for details.

## 2.6 Boot option

The STM32091C-EVAL evaluation board is able to boot from:

- Embedded user Flash
- System memory with boot loader for ISP
- Embedded SRAM for debugging

The boot option is configured by setting one jumper cap on CN7 between pin 22 and pin 24 and one option bit (see [Table 7](#)).

**Table 7. Boot related switch**

Switch configuration	bit12 in USER OPTION BYTES	Boot from
CN7 pin 22 and pin 24 opened	X	STM32091C-EVAL boot from User Flash. (Default setting)
CN7 pin 22 and pin 24 closed by jumper	0	STM32091C-EVAL boot from Embedded SRAM.
CN7 pin 22 and pin 24 closed by jumper	1	STM32091C-EVAL boot from System Memory.

The BOOT0 can also be configured via RS-232 connector CN9, as shown in [Table 8](#).

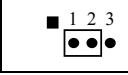
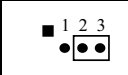
**Table 8. Boot0 related jumpers**

Jumper	Description
JP4	The Bootloader_BOOT0 is managed by pin 6 of the connector CN9 (RS-232 DSR signal) when JP4 is closed. This configuration is used for the bootloader application only. Default Setting: Not fitted

## 2.7 Audio

STM32091C-EVAL evaluation board supports stereo audio playback and microphone recording by an external headset connected on audio jack CN13. Audio play is connected to DAC output of the STM32F091VCT6 through an audio amplifier and microphone on headset is connected to ADC input of the STM32F091VCT6 through a microphone amplifier. Audio amplifier is enabled or disabled by setting JP17 and mono/stereo playback is selected by setting JP14, refer to [Table 9](#) for details.

**Table 9. Audio related jumpers**

Jumper	Description
JP17	Speaker amplifier U18 is enabled when JP17 is closed (Default setting)
	Speaker amplifier U18 is disabled when JP17 is open
JP14	Mono playback is enabled when JP14 is set as shown to the right (Default setting): 
	Stereo playback is enabled when JP14 is set as shown to the right: 

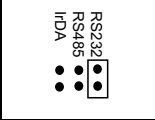
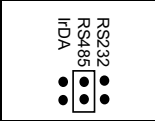
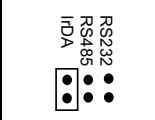
Audio amplifier operates correctly when VDDA > 2.2V and microphone amplifier operates correctly when VDDA > 2.7V.

## 2.8 RS-232, RS-485 and IrDA

The RS-232 (with hardware flow control CTS and RTS), the RS-485 and the IrDA communication are supported by the D-type 9-pins RS-232/RS-485 connectors CN9, and by the IrDA transceiver U14 which is connected to the USART1 of the STM32F091VCT6 on the STM32091C-EVAL evaluation board. The signal Bootloader\_RESET (shared with CTS signal) and the Bootloader\_BOOT0 (shared with DSR signal) are added on the RS-232 connector CN9 for ISP support.

USART1\_Rx is chosen by setting of JP13, refer to [Table 10](#) for details.

**Table 10. RS-232 and IrDA related jumpers**

Jumper	Description
JP13	RS232_RX is connected to RS-232 transceiver and RS-232 communication is enabled when JP13 is set as shown to the right (Default setting): 
	RS485_RX is connected to RS-485 transceiver and RS-485 communication is enabled when JP13 is set as shown to the right: 
	IrDA_RX is connected to IrDA transceiver and IrDA communication is enabled when JP13 is set as shown to the right: 

The RS-485 communication is supported by the RS-485 transceiver ST3485EBDR which is connected to pin 4 and pin 9 of D-type 9-pins connectors CN9 (share same connector with USART1), see [Table 11](#).

**Table 11. RS-485 related solder bridges**

Jumper	Description
SB15, SB18	The external failsafe biasing are enabled when solder bridges SB15 and SB18 are closed Default Setting: Not fitted
SB19	The bus termination is enabled when solder bridge SB19 is closed. Default Setting: Not fitted
SB16	The AC termination is disabled when solder bridge SB16 is closed for high baud rate communication. Default Setting: Not fitted

## 2.9 Touch sensing buttons

Two touch sensing buttons are supported on the STM32091C-EVAL evaluation board and they are connected to three capacitive sensing channels (PD[12:14]) in group8 with active shield being connected to two capacitive sensing channels (PB11 and PB12) in group6 (see [Table 12](#)).

**Table 12. Touch sensing buttons related solder bridges**

Solder Bridge	Description
SB7	PD13 is connected to touch slider when SB7 is open. (Default setting)
	PD13 is connected to extension connector CN7 when SB7 is closed. In such case R24 must be removed to avoid disturbance due to the touch button.
SB8	PD12 is connected to touch slider when SB8 is open. (Default setting)
	PD12 is connected to extension connector CN7 when SB8 is closed. In such case R25 must be removed to avoid disturbance due to the touch button.
SB6	PD14 is connected to sampling capacitor when SB6 is open. (Default setting)
	PD14 is connected to extension connector CN7 when SB6 is closed. In such case C4 must be removed to avoid disturbance due to the capacitor.
SB9	PB12 is connected to shield when SB9 is open. (Default setting)
	PB12 is connected to extension connector CN6 when SB9 is closed. In such case R30 must be removed to avoid disturbance due to the shield.
SB10	PB11 is connected to shield charge capacitor when SB10 is open. (Default setting)
	PB11 is connected to extension connector CN6 when SB10 is closed. In such case R37 must be removed to avoid disturbance due to the capacitor.

*Note: Touch sensing buttons are fully functional only when the STM32091C-EVAL board is powered on in power mode 1 (both VDD and VDDA are connected to fixed 3.3 V). It is potentially necessary to adjust the capacitor value of C8 and the firmware to adapt them to the voltage range from 1.65 V to 3.6 V of VDD on power-mode 2 and 3.*

## 2.10 microSD card

The 2-Gbyte (or more) microSD card connected to SPI1 port (Shared with color LCD) of the STM32F091VCT6 is available on the board. microSD card detection is managed by standard IO port PE11 and it should be set with internal pull-up.

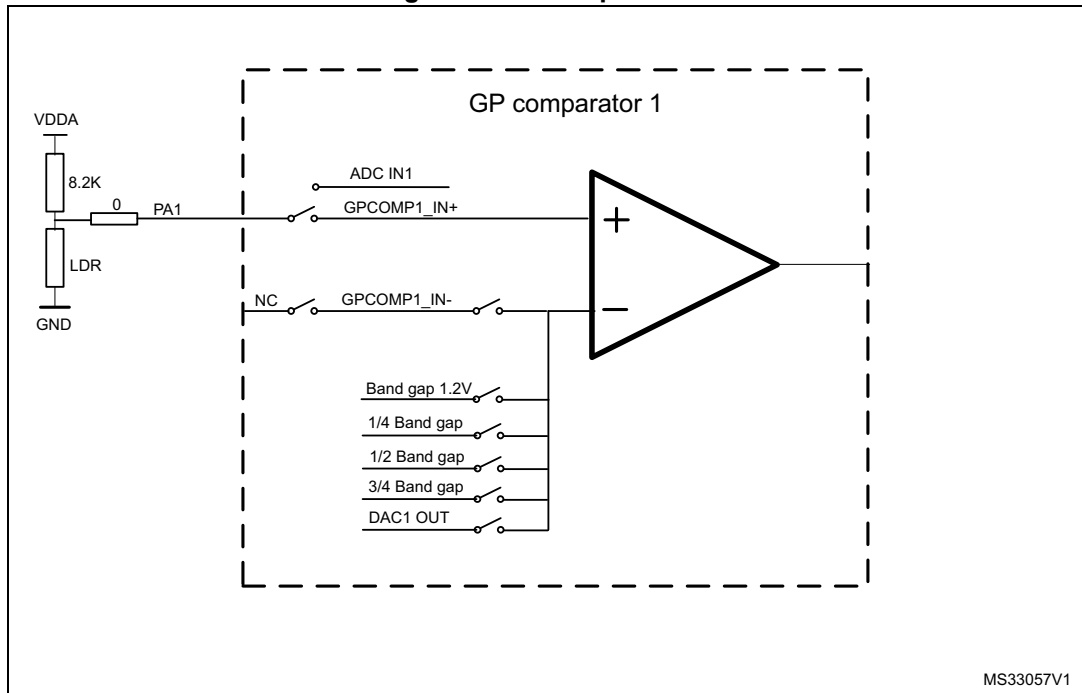
## 2.11 Analog input

The two-pin header CN18 and the 10K ohm potentiometer RV3 are connected to PC0 of STM32F091VCT6 as analog input. A low-pass filter is implemented by replacing R191 and C101 with the right value of resistor and capacitor as requested by end user’s application.

## 2.12 LDR (Light Dependent Resistor)

The VDDA is divided by resistor bridge of LDR VT90N1 and 8.2K resistor and connected to PA1 (COM1\_IN+/ADC IN1) as shown below in [Figure 7](#) on the STM32091C-EVAL evaluation board.

Figure 7. GP comparator 1



It is possible to compare LDR output with 1/4 band gap, 1/2 band gap, 3/4 band gap, band gap and DAC1 OUT and to connect LDR output to ADC IN1 for AD conversion.

## 2.13 Temperature sensor

A temperature sensor STLM75M2F is connected to I2C1 bus of the STM32F091VCT6, and share same I2C1 bus with RF-EEPROM and DDC on HDMI\_Source connector CN4.

I<sup>2</sup>C address of temperature sensor is 0b100100 (A0), A0 can be 0 or 1, depending on the setting of SB1, see [Table 13](#).

**Table 13. Temperature sensor or related solder bridge**

Solder Bridge	Description
SB1	I <sup>2</sup> C address A0 is 0 when SB1 is open (Default setting)
	I <sup>2</sup> C address A0 is 1 when SB1 is closed.

*Note:* The temperature result measured from STLM75M2F would be a little higher than the ambient temperature due to the power dissipation of the components on the board.

## 2.14 Smartcard

STMicroelectronics smartcard interface chip ST8024L is used on the STM32091C-EVAL evaluation board for asynchronous 1.8 V, 3 V and 5 V smartcards. It performs all supply protection and control functions based on the connections with the STM32F091VCT6 listed in [Table 14](#).

**Table 14. Connection between ST8024L and STM32F091VCT6**

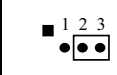
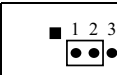
Signals of ST8024L	Description	Connect to STM32F091VCT6
5 V/3 V	smartcard power supply selection pin	PC2
I/OUC	STM32 data I/O line	PA2
XTAL1	Crystal or external clock input	PD7
OFF	Detect presence of a card, Interrupt to MCU	PC3
RSTIN	Card Reset Input from MCU	PA3
CMDVCC	Start activation sequence input (active low)	PA7
1.8V	1.8 V Vcc operation selection. Logic high selects 1.8 V operation and overrides any setting on the 5 V/3 V pin.	PC1

Smartcard operates correctly when VDD > 2.7 V.

## 2.15 CAN

STM32091C-EVAL evaluation board supports one channel of CAN2.0A/B compliant CAN bus communication based on 3.3 V CAN transceiver. The high-speed mode, standby mode and slope-control mode are available and selectable by setting JP3 (see [Table 15](#)).

Table 15. CAN related jumpers

Jumper	Description
JP3	CAN transceiver is working in standby mode when JP3 is set as shown to the right: 
	CAN transceiver is working in high-speed mode when JP3 is set as shown to the right: (default setting) 
	CAN transceiver is working in slope-control mode when JP3 is open.
JP2	CAN terminal resistor is enabled when JP2 is fitted. Default setting: Not fitted

CAN operates correctly when  $VDDIO2 > 3V$ .

## 2.16 RF-EEPROM

A RF-EEPROM module ANT7-M24LR-A is mounted on connector CN2 and connected to I2C1 bus of the STM32F091VCT6, this bus shares same I2C1 bus with the temperature sensor U1 and DDC on HDMI\_Source connector CN4.

The I<sup>2</sup>C address of the RF-EEPROM daughterboard is 0b1010000.

## 2.17 HDMI CEC

Two HDMI connectors CN3 and CN4 are available on the STM32091C-EVAL board.

- The connector CN3 is HDMI sink connector with:
  - DDC connected to I2C2 of the STM32F091VCT6
  - HPD controlled by I/O PD11 through transistor T1
  - CEC connected to PB10 through transistor T2
- The connector CN4 is HDMI source connector with:
  - DDC connected to I2C1 of the STM32F091VCT6 and shared with the temperature sensor and RF-EEPROM
  - HPD controlled by I/O PD10
  - CEC connected to PB10 through transistor T2
  - HDMI 5 V powered by power switch U3

The signals TDMS D+[0..2], TDMS\_CLK+, TDMS D-[0..2], TDMS\_CLK- on these two HDMI connectors are connected together.

The CEC injector mode is enabled by some PCB reworks for debugging purpose only:

- Remove resistors R15, R17, R19, R28, R31, R35 and R38.
- Close solder bridges SB2, SB3, SB4 and SB5.

*Note:* The I/O PD11 must be set in open-drain output mode by firmware when working as an HPD signal control on the HDMI sink connector CN3.



## 2.18 IR LED and IR receiver

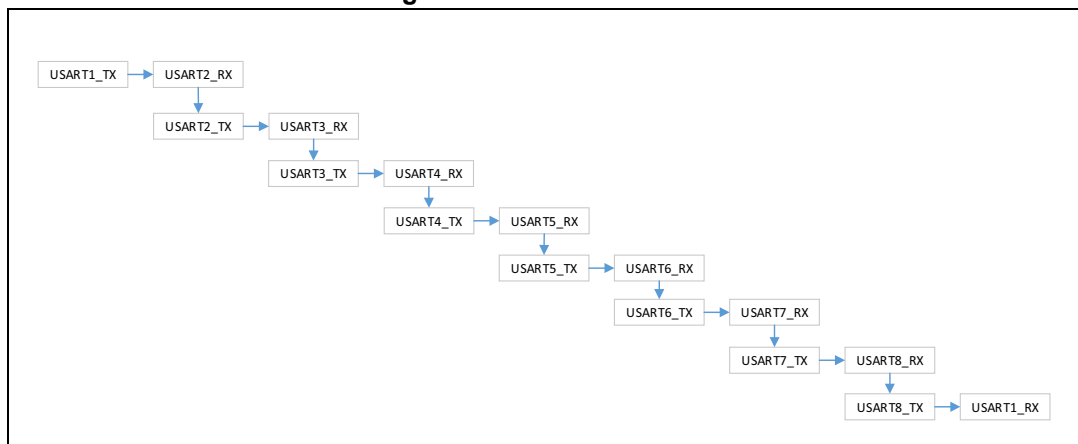
The IR receiver TSOP34836 is connected to PC6 of the STM32F091VCT6 and a current around 100 mA on IR LED is driven by PB9 through transistors T4 and T5 on the board.

*Note:* The IR LED may be driven by PB9 directly with 20 mA current when SB20 is closed and R116 is removed.

## 2.19 8x USARTs

USART chain could be routed to a 2\*8 header so that some jumpers could be used to connect them to demonstrate 8x USART channels in daisy chain. The data flow is showed in the below [Figure 8](#).

Figure 8. USART data flow



At the end both data sent at USART1\_TX and data received at USART\_RX can be compared and validated thanks to USARTs chain on CN1.

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**Warning:** USART1/4/8 belongs to VDDIO2 power domain and USART2/3/5/6/7 belongs to VDDIO power domain, so the same voltage level for VDDIO and VDDIO2 is needed, to demonstrate USART chain application on this header.

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## 2.20 Display and input devices

The 2.4" color TFT LCD connected to SPI1 port of the STM32F091VCT6 and 4-general-purpose-color LEDs (LD 1,2,3,4) are available as display device. The 4-direction joystick (B3) with selection key, which connects to PA0 and supports wakeup feature, and Tamper button (B2) are also available as input devices (see [Table 16](#)).

Table 16. LCD modules

2.4" TFT LCD connector CN14					
Pin	Description	Pin connection	Pin	Description	Pin connection
1	CS	PE10	9	VDD	3.3V
2	SCL	PE13	10	VCI	3.3V
3	SDI	PE15	11	GND	GND
4	RS	-	12	GND	GND
5	WR	-	13	BL_VDD	5 V
6	RD	-	14	BL_Control	5 V
7	SDO	PE14	15	BL_GND	GND
8	RESET	RESET#	16	BL_GND	GND

*Note:* The bi-directional voltage translator is implemented on SPI MOSI signal between the STM32F091VCT6 and the LCD to support 3-wires serial interface for various voltage level interface. The direction of this voltage translator is controlled by I/O PE9 (the I/O PE15 is working as MOSI when PE9 is high or as MISO when PE9 is LOW).