UM2448
User manual

STLINK-V3SET debugger/programmer for STM8 and STM32

Introduction

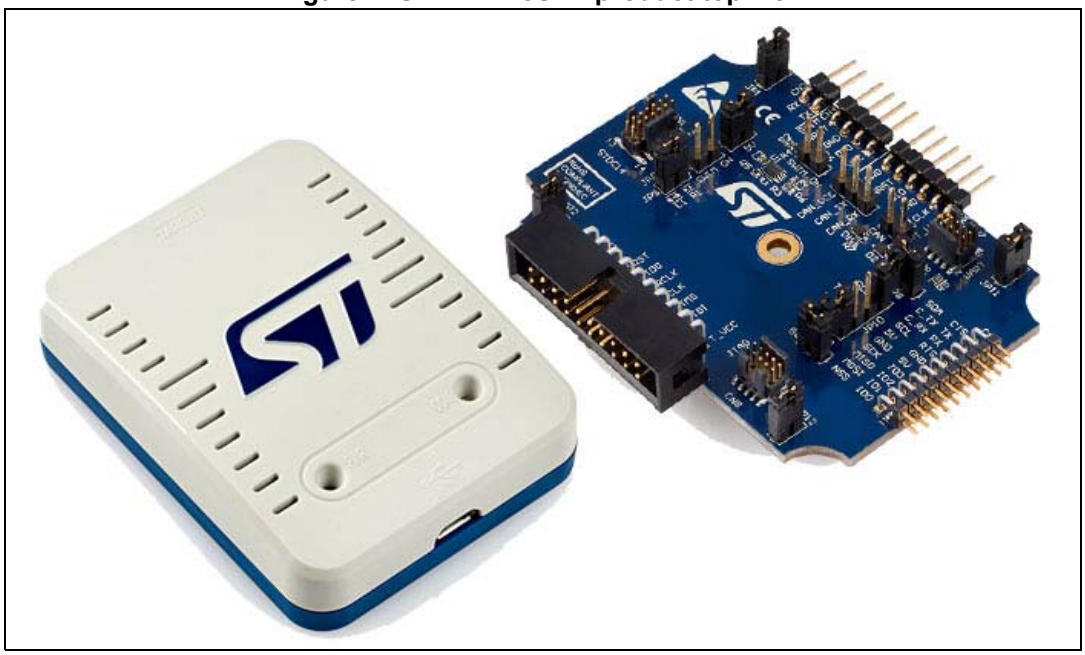
The STLINK-V3SET is a standalone modular debugging and programming probe for the STM8 and STM32 microcontrollers. This product is composed of the main module and the complementary adapter board. It supports the SWIM and JTAG/SWD interfaces for communication with any STM8 or STM32 microcontroller located on an application board.

The STLINK-V3SET provides a Virtual COM port interface allowing the host PC to communicate with the target microcontroller through one UART. It also provides bridge interfaces to several communication protocols allowing, for instance, the programming of the target through the bootloader.

The STLINK-V3SET can provide a second Virtual COM port interface allowing the host PC to communicate with the target microcontroller through another UART, called the bridge UART. Bridge UART signals, including optional RTS and CTS, are only available on the MB1440 adapter board. The second Virtual COM port activation is done through a reversible firmware update, which also disables the mass-storage interface used for drag-and-drop flash programming.

The modular architecture of STLINK-V3SET enables the extension of its main features through additional modules such as the adapter board for different connectors, the B-STLINK-VOLT board for voltage adaptation, and the B-STLINK-ISOL board for voltage adaptation and galvanic isolation.

Figure 1. STLINK-V3SET product top view



Picture is not contractual.

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  - 3 V to 3.6 V application voltage support and 5 V tolerant inputs (extended down to 1.65 V with the B-STLINK-VOLT or B-STLINK-ISOL board)
  - Flat cables STDC14 to MIPI10 / STDC14 / MIPI20 (connectors with 1.27 mm pitch)
  - JTAG communication support
  - SWD and serial wire viewer (SWV) communication support
- SWIM-specific features (only available with adapter board MB1440):
  - 1.65 V to 5.5 V application voltage support
  - SWIM header (2.54 mm pitch)
  - SWIM low-speed and high-speed modes support
- Virtual COM port (VCP) specific features:
  - 3 V to 3.6 V application voltage support on the UART interface and 5 V tolerant inputs (extended down to 1.65 V with the B-STLINK-VOLT or B-STLINK-ISOL board)
  - VCP frequency up to 16 MHz
  - Available on STDC14 debug connector (not available on MIPI10)
- Multipath bridge USB to SPI/UART/I^2C/CAN/GPIOs specific features:
  - 3 V to 3.6 V application voltage support and 5 V tolerant inputs (extended down to 1.65 V with the B-STLINK-VOLT or B-STLINK-ISOL board)
  - Signals available on adapter board only (MB1440)
- Drag-and-drop flash programming of binary files
- Two-color LEDs: communication, power

Note: The STLINK-V3SET product does not provide the power supply to the target application.

B-STLINK-VOLT is not required for STM8 targets, for which voltage adaptation is performed on the baseline adapter board (MB1440) provided with the STLINK-V3SET.

2 General information

The STLINK-V3SET embeds an STM32 32-bit microcontroller based on the Arm®(a) Cortex®-M processor.

3 Ordering information

To order the STLINK-V3SET or any additional board (provided separately), refer to *Table 1*.

Table 1. Ordering information

Order code	Board reference	Description
STLINK-V3SET	MB1441(1) MB1440(2)	STLINK-V3 modular in-circuit debugger and programmer for STM8 and STM32
B-STLINK-VOLT	MB1598	Voltage adapter board for STLINK-V3SET
B-STLINK-ISOL	MB1599	Voltage adapter and galvanic isolation board for STLINK-V3SET

1. Main module.
2. Adapter board.

a. Arm is a registered trademark of Arm Limited (or its subsidiaries) in the US and/or elsewhere.

4 Development environment

4.1 System requirements

- Multi-OS support: Windows® 10, Linux® 64-bit, or macOS®(a)(b)(c)
- USB Type-A or USB Type-C® to Micro-B cable

4.2 Development toolchains

- IAR Systems® - IAR Embedded Workbench®(d)
- Keil® - MDK-ARM(d)
- STMicroelectronics - STM32CubeIDE

5 Conventions

Table 2 provides the conventions used for the ON and OFF settings in the present document.

Table 2. ON/OFF convention

Convention	Definition
Jumper JPx ON	Jumper fitted
Jumper JPx OFF	Jumper not fitted
Jumper JPx [1-2]	Jumper must be fitted between Pin 1 and Pin 2
Solder bridge SBx ON	SBx connections closed by 0-ohm resistor
Solder bridge SBx OFF	SBx connections left open

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b. Linux® is a registered trademark of Linus Torvalds.

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d. On Windows® only.

6 Quick start

This section describes how to start development quickly using the STLINK-V3SET.

Before installing and using the product, accept the evaluation product license agreement from the www.st.com/epla web page.

The STLINK-V3SET is a standalone modular debugging and programming probe for STM8 and STM32 microcontrollers.

- It supports protocols SWIM, JTAG, and SWD to communicate with any STM8 or STM32 microcontroller.
- It provides a Virtual COM port interface allowing the host PC to communicate with the target microcontroller through one UART
- It provides bridge interfaces to several communication protocols allowing, for instance, the programming of the target through the bootloader.

To start using this board, follow the steps below:

1. Check that all items are available inside the box (V3S + 3 flat cables + adapter board and its guide).
2. Install/update the IDE/STM32CubeProgrammer to support the STLINK-V3SET (drivers).
3. Choose a flat cable and connect it between the STLINK-V3SET and the application.
4. Connect a USB Type-A to Micro-B cable between the STLINK-V3SET and the PC.
5. Check that the PWR LED is green and the COM LED is red.
6. Open the development toolchain or STM32CubeProgrammer (STM32CubeProg) software utility.

For more details, refer to the www.st.com/stlink-v3set website.

7 STLINK-V3SET functional description

7.1 STLINK-V3SET overview

The STLINK-V3SET is a standalone modular debugging and programming probe for the STM8 and STM32 microcontrollers. This product supports many functions and protocols for debugging, programming, and communicating with one or several targets. The STLINK-V3SET package includes complete hardware with the main module for high performance and an adapter board for added functions to connect with wires or flat cables anywhere in the application.

This module is fully powered by the PC. If the COM LED blinks red, refer to the technical note *Overview of ST-LINK derivatives* (TN1235) for details.

7.1.1 Main module for high performance

This configuration is the preferred one for high performance. It only supports STM32 microcontrollers. The working voltage range is 3 to 3.6 V.

Figure 2. Probe top side

The protocols and functions supported are:

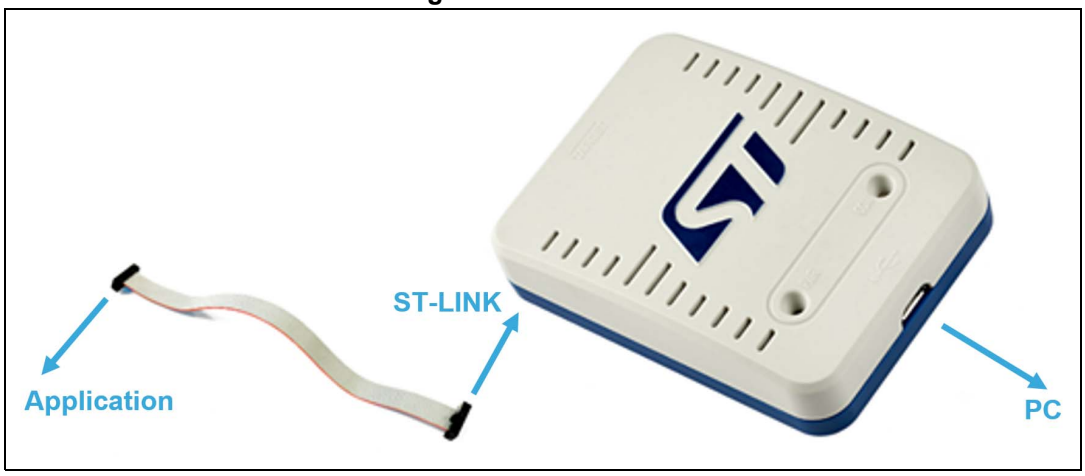
- SWD (up to 24 MHz) with SWO (up to 16 MHz)
- JTAG (up to 21 MHz)
- VCP (from 732 bps to 16 Mbps)

A 2x7-pin 1.27 mm pitch male connector is located in the STLINK-V3SET for connection to the application target. Three different flat cables are included in the packaging to connect

with standard connectors MIPI10/ARM10, STDC14, and ARM20 (refer to *Section 9: Flat ribbons on page 28*).

See *Figure 3* for connections:

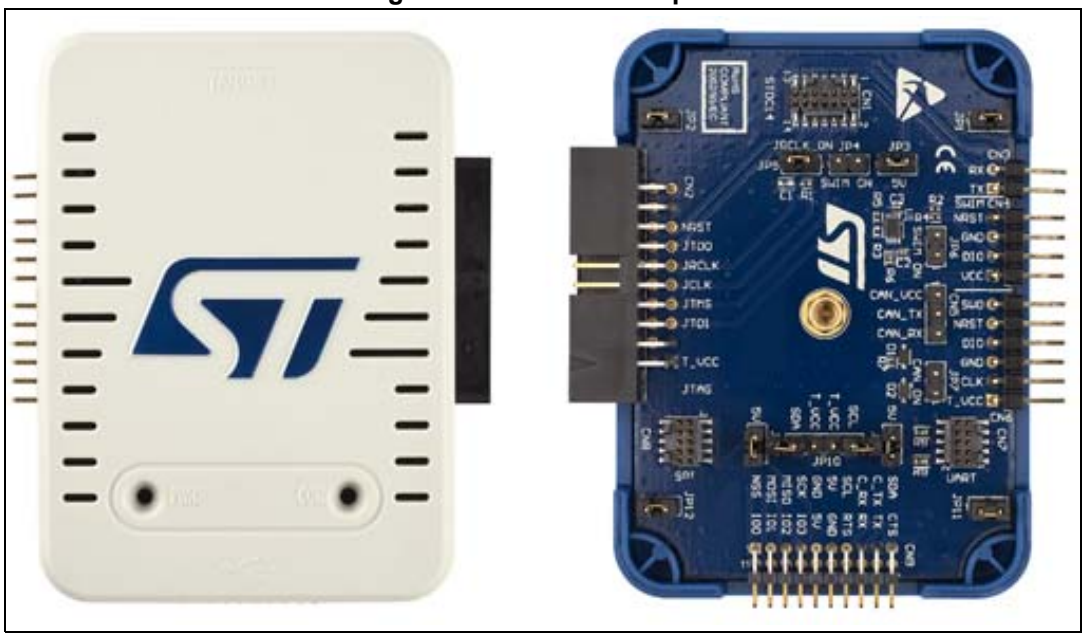
Figure 3. Connections



7.1.2 Adapter configuration for added functions

This configuration favors the connection to targets using wires or flat cables. It is composed of MB1441 and MB1440. It supports debugging, programming, and communicating with STM32 and STM8 microcontrollers.

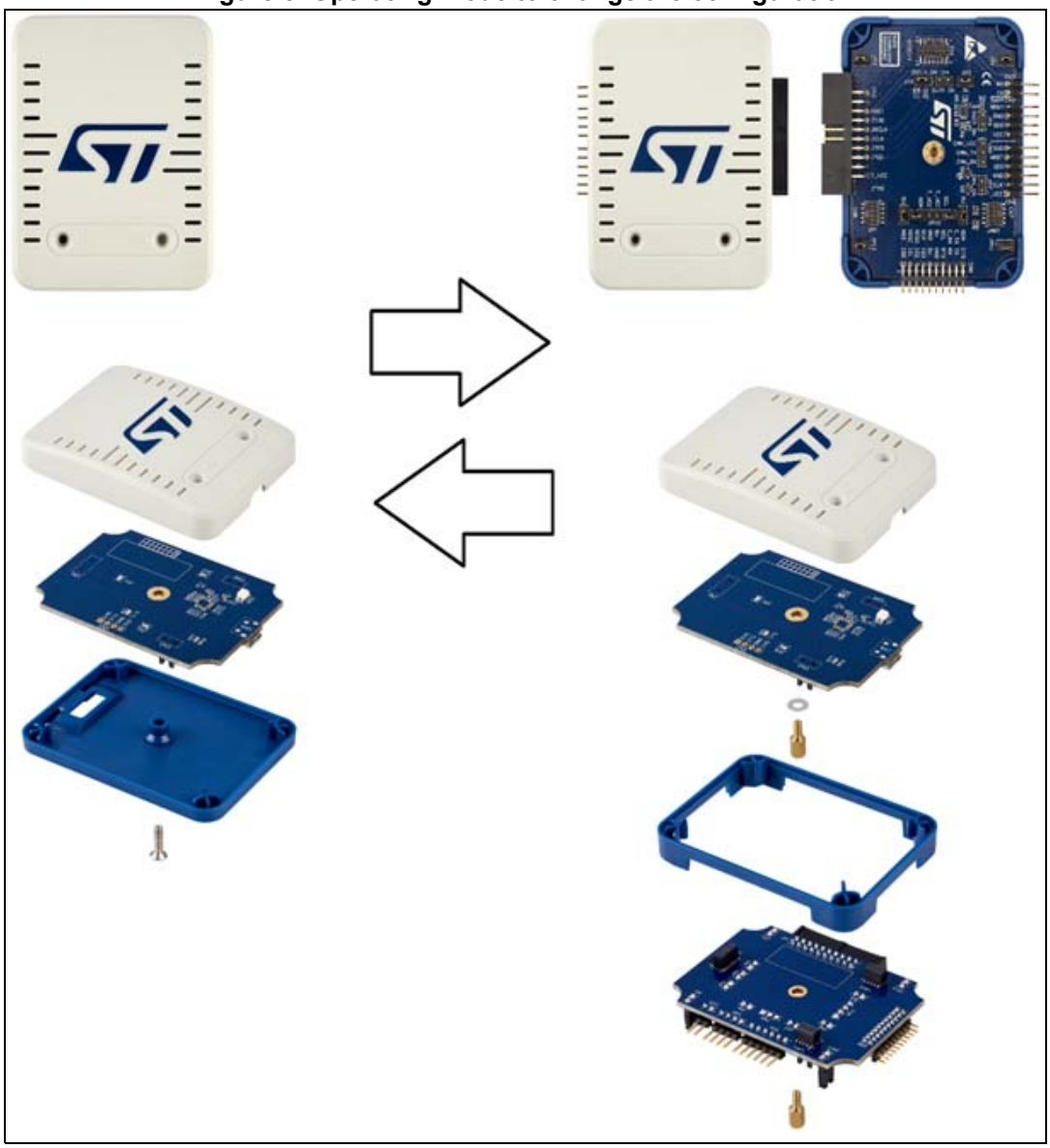
Figure 4. Probe with adapter



7.1.3 How to build the adapter configuration for added functions

See the operating mode below to build the adapter configuration from the main module configuration and back.

Figure 5. Operating mode to change the configuration



7.2 Hardware layout

The STLINK-V3SET product is designed around the STM32F723 microcontroller (176-pin in a UFBGA package). The hardware board pictures (*Figure 6* and *Figure 7*) show the two boards included in the package in their standard configurations (components and jumpers). *Figure 8*, *Figure 9*, and *Figure 10* help users locate the features on the boards. The mechanical dimensions of the STLINK-V3SET product are shown in *Figure 11* and *Figure 12*.

Figure 6. Hardware board MB1441

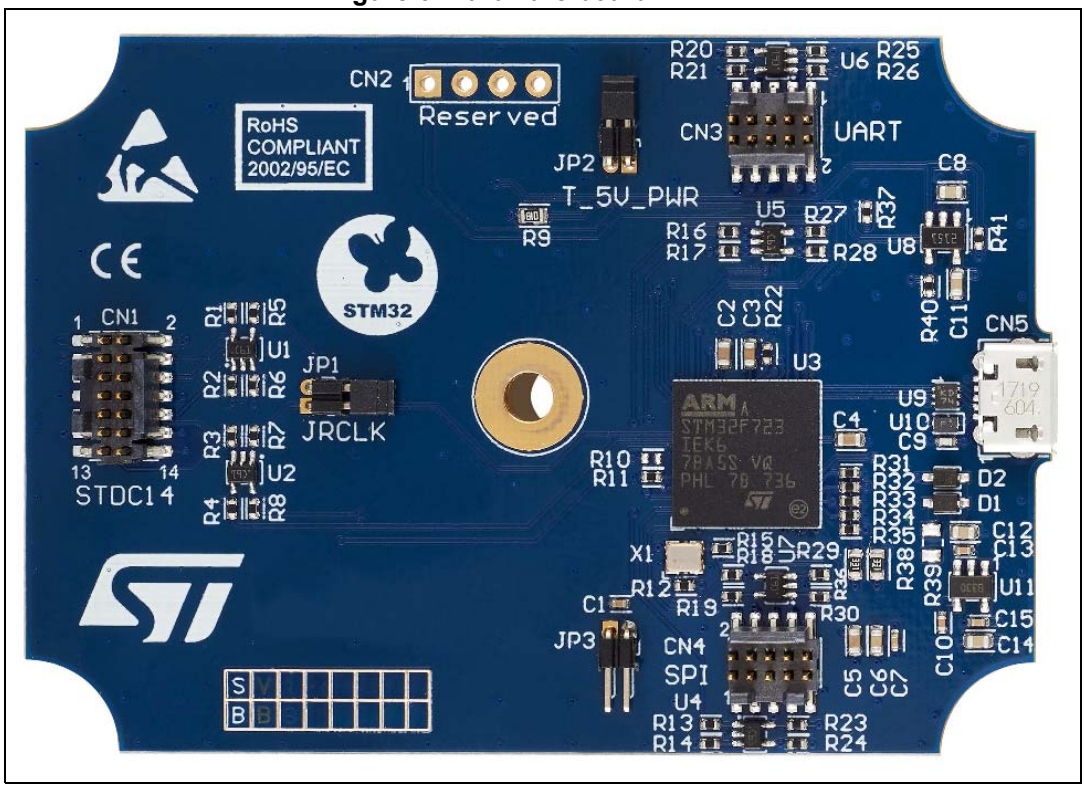


Figure 7. Hardware board MB1440

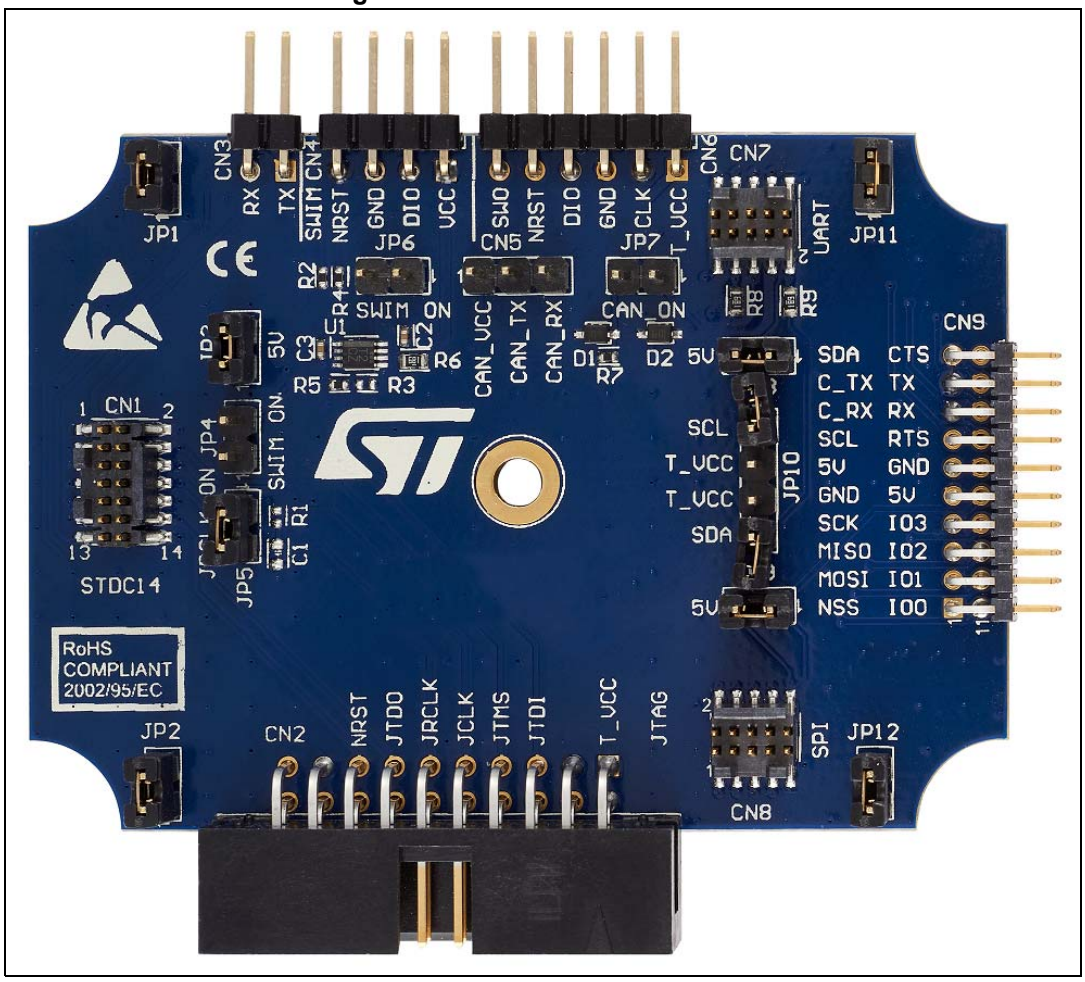


Figure 8. MB1441 top layout

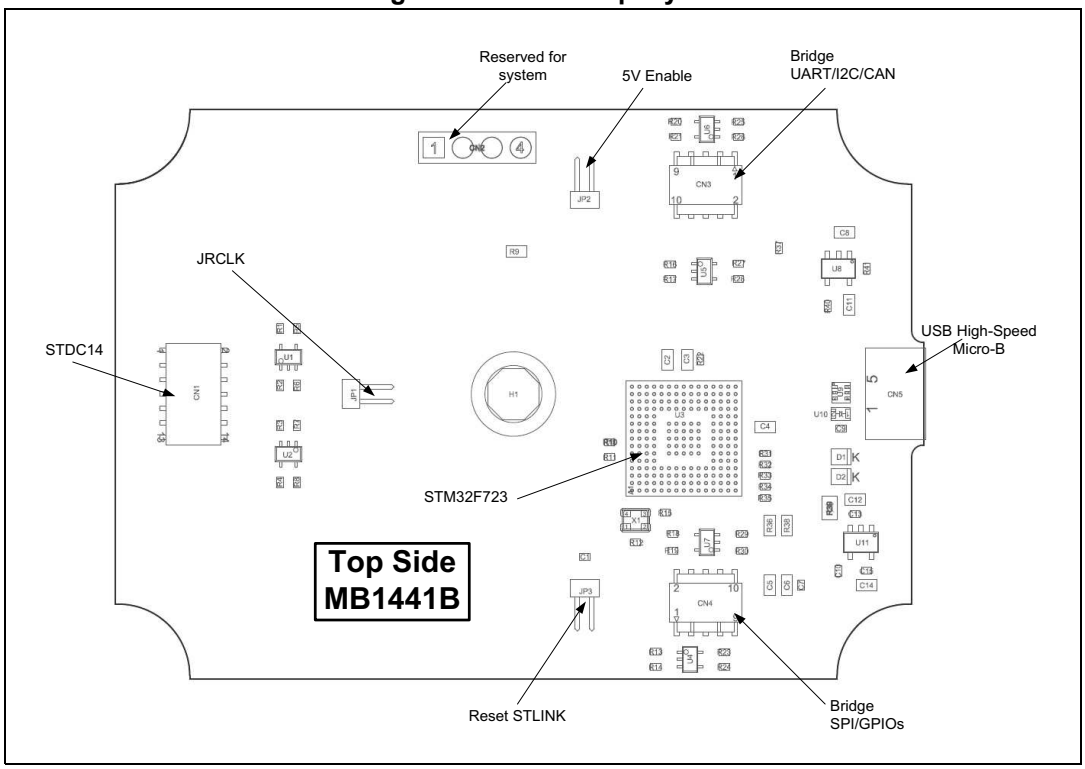


Figure 9. MB1441 bottom layout

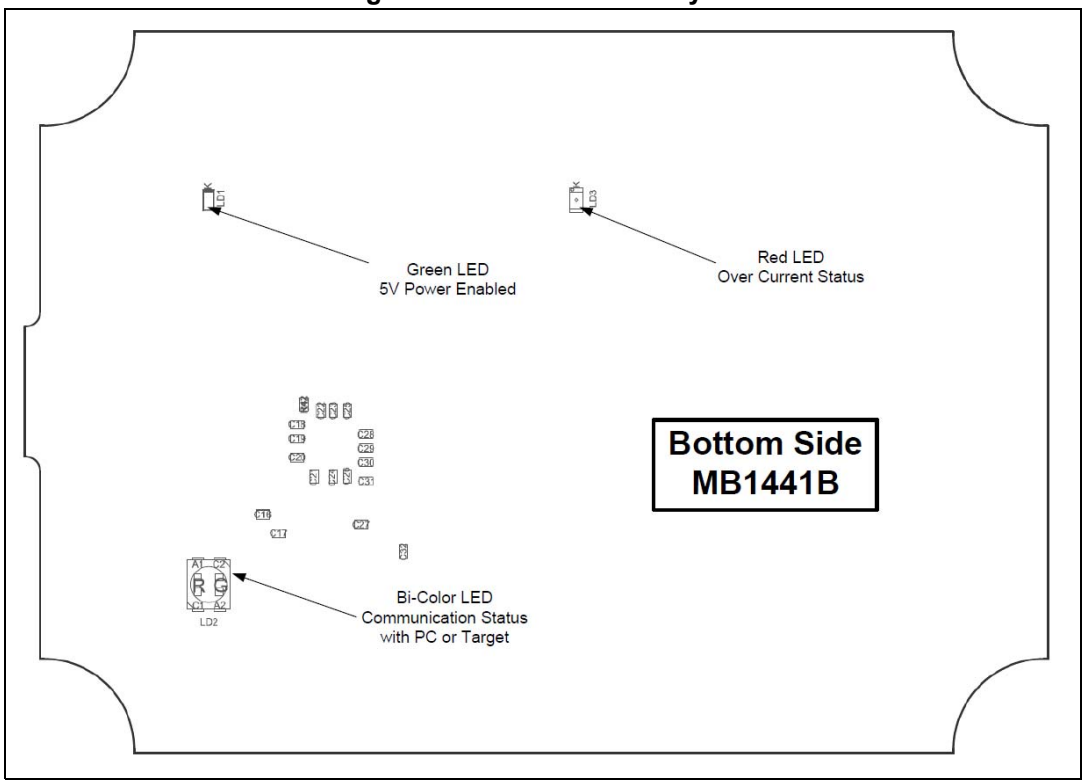


Figure 10. MB1440 top layout

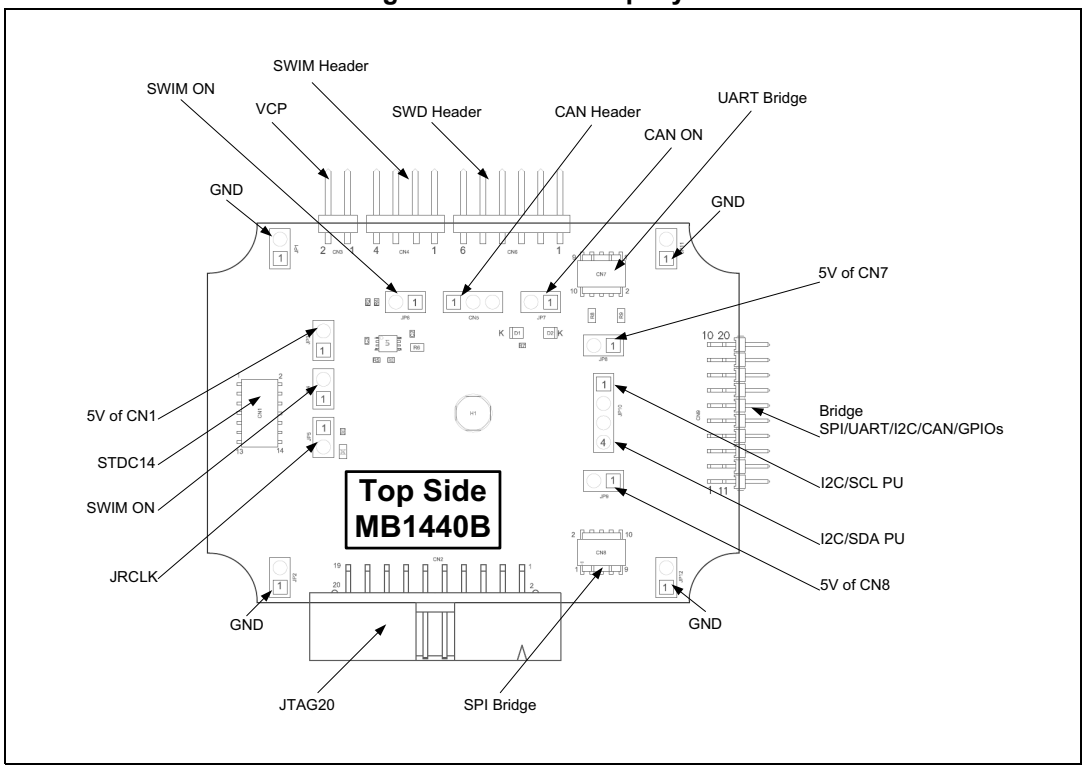


Figure 11. MB1441 mechanical drawing

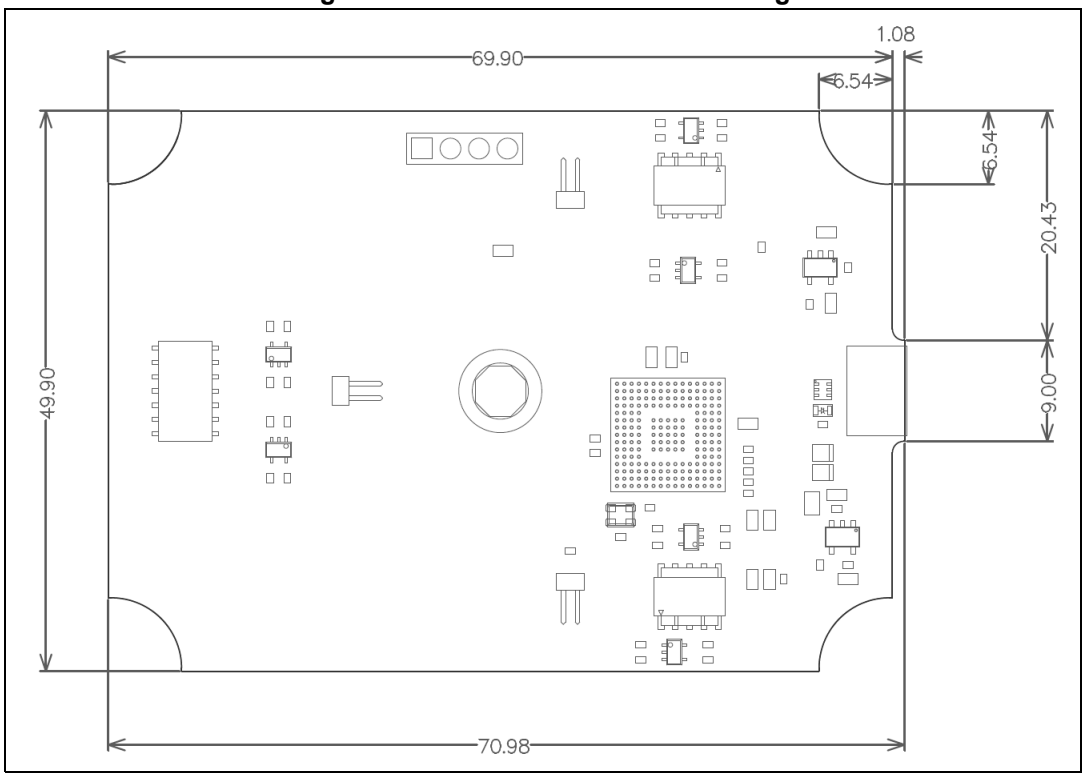
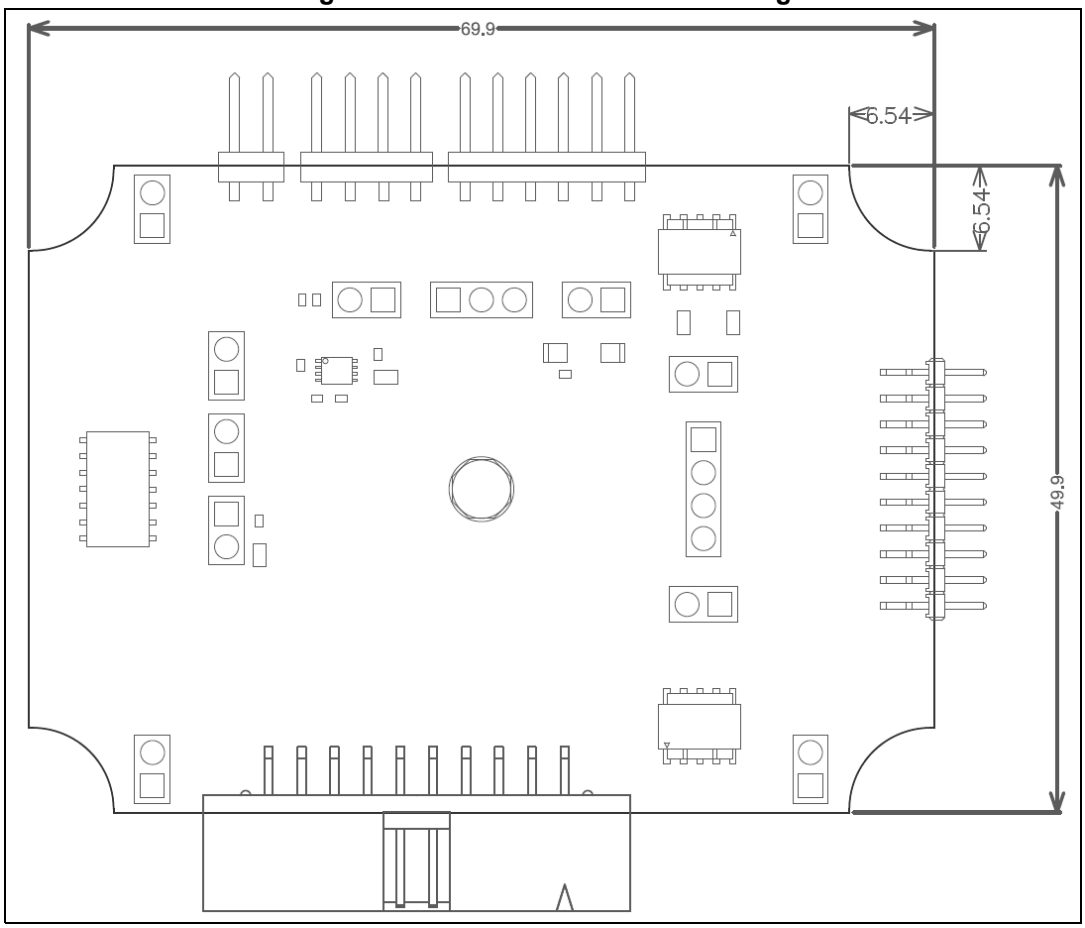


Figure 12. MB1440 mechanical drawing



7.3 STLINK-V3SET functions

All functions have been designed for high performance: all signals are 3.3 V compatible except the SWIM protocol, which supports a voltage range of 1.65 to 5.5 V. The following description concerns the two boards MB1441 and MB1440 and indicates where to find the functions on the boards and connectors. The main module for high performance only includes the MB1441 board. The adapter configuration for added functions includes both the MB1441 and MB1440 boards.

7.3.1 SWD with SWV

SWD protocol is a Debug/Program protocol used for STM32 microcontrollers with SWV as a trace. The signals are 3.3 V compatible and can perform up to 24 MHz. This function is available on MB1440 CN1, CN2, and CN6, and MB1441 CN1.

For details regarding the baud rate, refer to *Section 14.2*.

7.3.2 JTAG

The JTAG protocol is a Debug/Program protocol used for STM32 microcontrollers. The signals are 3.3 V compatible and can perform up to 21 MHz. This function is available on MB1440 CN1 and CN2, and MB1441 CN1.

The STLINK-V3SET does not support the chaining of devices in JTAG (daisy chain).

For correct operation, the STLINK-V3SET microcontroller on the MB1441 board requires a JTAG return clock. By default, this return clock is provided through the closed jumper JP1 on MB1441, but might also be externally provided through pin 9 of CN1 (This configuration might be necessary to reach high JTAG frequencies; in this case, JP1 on MB1441 must be opened). In case of use with the B-STLINK-VOLT extension board, the JTAG clock loopback must be removed from the STLINK-V3SET board (JP1 opened). For the correct functioning of JTAG, the loopback must be done either on the B-STLINK-VOLT extension board (JP1 closed) or on the target application side.

7.3.3 SWIM

SWIM protocol is a Debug/Program protocol used for STM8 microcontrollers. JP3, JP4, and JP6 on the MB1440 board must be ON to activate the SWIM protocol. JP2 on the MB1441 board must also be ON (default position). The signals are available on the MB1440 CN4 connector and a voltage range of 1.65 to 5.5 V is supported.

Note that a 680 Ω pull up to VCC, pin 1 of MB1440 CN4, is provided on DIO, pin 2 of MB1440 CN4, and consequently:

- No additional external pull-up is required.
- VCC of MB1440 CN4 must be connected to V_{target}.

7.3.4 Virtual COM port (VCP)

The serial interface VCP is directly available as a Virtual COM port of the PC, connected to STLINK-V3SET USB connector CN5. This function can be used for STM32 and STM8 microcontrollers. The signals are 3.3 V compatible and can perform from 732 bps to 16 Mbps. This function is available on MB1440 CN1 and CN3, and MB1441 CN1. T_VCP_RX (or RX) signal is the Rx for the target (Tx for the STLINK-V3SET) and T_VCP_TX (or TX) signal is the Tx for the target (Rx for the STLINK-V3SET).

A second Virtual COM port might be activated, as detailed later in *Section 7.3.5* (Bridge UART).

For details regarding the baud rate, refer to *Section 14.2*.

7.3.5 Bridge functions

The STLINK-V3SET provides a proprietary USB interface allowing communication with any STM8 or STM32 target with several protocols: SPI, I^2C, CAN, UART, and GPIOs. This interface might be used to communicate with the target bootloader, but might also be used for customized needs through its public software interface.

All bridge signals can be simply and easily accessed on CN9 using wire clips, with the risk that signal quality and performance are lowered, especially for SPI and UART. This depends, for instance, on the quality of the wires used, on the fact that the wires are shielded or not, and on the layout of the application board.

Bridge SPI

SPI signals are available on MB1440 CN8 and CN9. To reach a high SPI frequency, it is recommended to use a flat ribbon on MB1440 CN8 with all unused signals tied to the ground on the target side.

Bridge I²C

I²C signals are available on MB1440 CN7 and CN9. The adapter module also provides optional 680 Ω pull-ups, which can be activated by closing JP10 jumpers. In that case, the T_VCC target voltage must be provided to any of the MB1440 connectors accepting it (CN1, CN2, CN6, or JP10 jumpers).

Bridge CAN

CAN logic signals (Rx/Tx) are available on MB1440 CN9. They can be used as input for an external CAN transceiver. It is also possible to connect directly the CAN target signals to MB1440 CN5 (target Tx to CN5 Tx, target Rx to CN5 Rx), provided that:

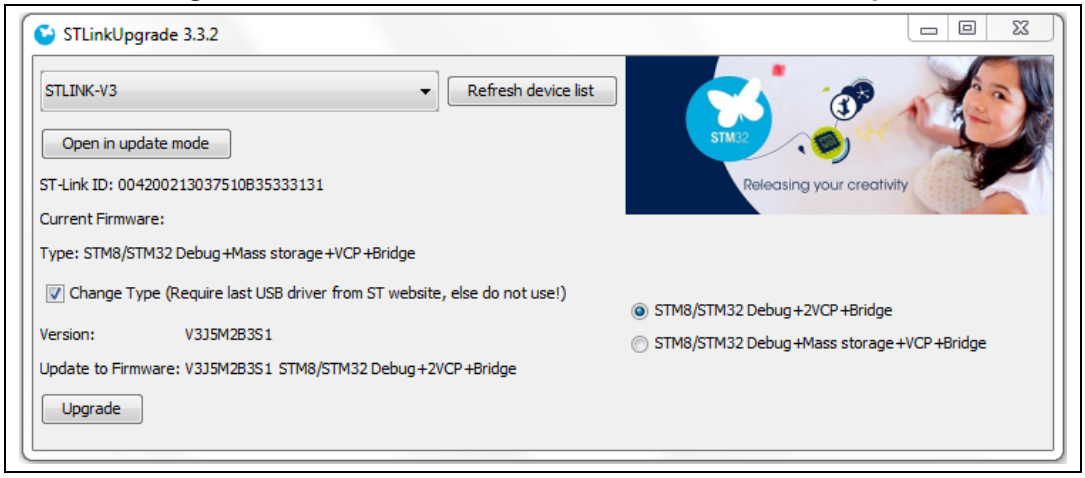
1. JP7 is closed, meaning CAN is ON.
2. CAN voltage is provided to CN5 CAN_VCC.

Bridge UART

UART signals with hardware flow control (CTS/RTS) are available on MB1440 CN9 and MB1440 CN7. They need dedicated firmware to be programmed on the main module before being used. With this firmware, a second Virtual COM port is available and the mass-storage interface (used for Drag-and-drop flash programming) disappears. The firmware selection is reversible and is done by *STLinkUpgrade* applications as shown in *Figure 13*. The hardware flow control might be activated by physically connecting UART_RTS and/or UART_CTS signals to the target. If not connected, the second Virtual COM port works without hardware flow control. Note that the hardware flow control activation/deactivation cannot be configured by software from the host side on a Virtual COM port; consequently configuring a parameter related to that on the host application does not affect the system behavior.

To reach a high UART frequency, it is recommended to use a flat ribbon on MB1440 CN7 with all unused signals tied to the ground on the target side.

Figure 13. Firmware selection for a second Virtual COM port



For details regarding the baud rate, refer to *Section 14.2*.

Bridge GPIOs

Four GPIO signals are available on MB1440 CN8 and CN9. Basic management is provided by the public ST bridge software interface.

7.3.6 LEDs

PWR LED: red light indicates that 5 V is enabled (only used when a daughterboard is plugged).

COM LED: refer to the technical note *Overview of ST-LINK derivatives* (TN1235) for details.

7.4 Jumper configuration

Table 3. MB1441 jumper configuration

Jumper	State	Description
JP1	ON	JTAG clock loopback done on board
JP2	ON	Provides 5 V power on connectors, required for SWIM usage, B-STLINK-VOLT, and B-STLINK-ISOL boards.
JP3	OFF	STLINK-V3SET reset. Can be used to enforce STLINK-V3SET UsbLoader mode

Table 4. MB1440 jumper configuration

Jumper	State	Description
JP1	Not used	GND
JP2	Not used	GND
JP3	ON	Getting 5 V power from CN12, required for SWIM usage.
JP4	OFF	Disables SWIM input
JP5	ON	JTAG clock loopback done on board
JP6	OFF	Disables SWIM output
JP7	OFF	Closed to use CAN through CN5
JP8	ON	Provides 5 V power to CN7 (internal use)
JP9	ON	Provides 5 V power to CN10 (internal use)
JP10	OFF	Closed to enable I^2C pull-ups
JP11	Not used	GND
JP12	Not used	GND

8 Board connectors

11 user connectors are implemented on the STLINK-V3SET product and are described in this paragraph:

- 2 user connectors are available on the MB1441 board:
  - CN1: STDC14 (STM32 JTAG/SWD and VCP)
  - CN5: USB Micro-B (connection to the host)
- 9 user connectors are available on the MB1440 board:
  - CN1: STDC14 (STM32 JTAG/SWD and VCP)
  - CN2: Legacy Arm 20-pin JTAG/SWD IDC connector
  - CN3: VCP
  - CN4: SWIM
  - CN5: bridge CAN
  - CN6: SWD
  - CN7, CN8, CN9: bridge

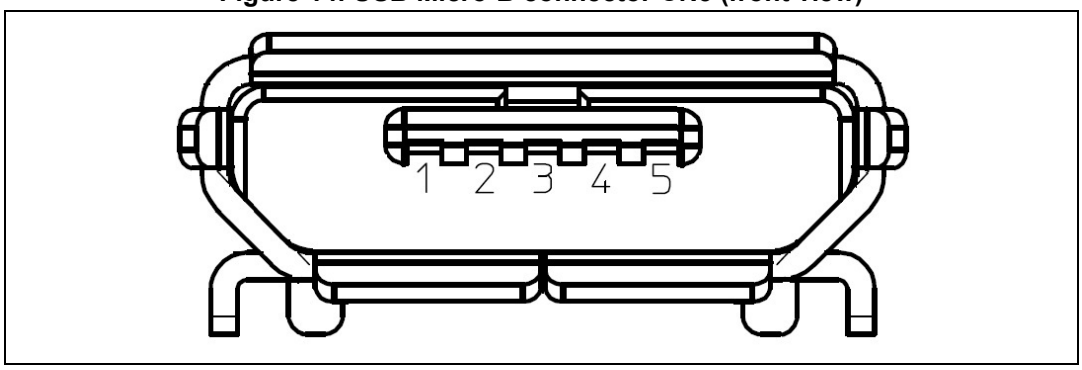
Other connectors are reserved for internal use and are not described here.

8.1 Connectors on MB1441 board

8.1.1 USB Micro-B

The USB connector CN5 is used to connect the embedded STLINK-V3SET to the PC.

Figure 14. USB Micro-B connector CN5 (front view)



The related pinout for the USB ST-LINK connector is listed in *Table 5*.

Table 5. USB Micro-B connector pinout CN5

Pin number	Pin name	Function
1	VBUS	5 V power
2	DM (D-)	USB differential pair M
3	DP (D+)	USB differential pair P

Table 5. USB Micro-B connector pinout CN5 (continued)

Pin number	Pin name	Function
4	ID	-
5	GND	GND

8.1.2 STDC14 (STM32 JTAG/SWD and VCP)

The STDC14 connector (CN4) allows the connection to an STM32 target using the JTAG or SWD protocol, respecting (from pin 3 to pin 12) the ARM10 pinout (Arm® Cortex® debug connector). But it also advantageously provides two UART signals for the Virtual COM port. The related pinout for the STDC14 connector is listed in *Table 6*.

Table 6. STDC14 connector pinout CN1

Pin number	Description	Pin number	Description
1	Reserved(1)	2	Reserved(1)
3	T_VCC(2)	4	T_JTMS/T_SWDIO
5	GND	6	T_JCLK/T_SWCLK
7	GND	8	T_JTDO/T_SWO(3)
9	T_JRCLK(4)/NC(5)	10	T_JTDI/NC(5)
11	GNDDetect(6)	12	T_NRST
13	T_VCP_RX(7)	14	T_VCP_TX(2)

1. Do not connect to the target.
2. Input for STLINK-V3SET.
3. SWO is optional, required only for Serial Wire Viewer (SWV) trace.
4. Optional loopback of T_JCLK on the target side, required if loopback is removed on the STLINK-V3SET side.
5. NC means not required for the SWD connection.
6. Tied to GND by STLINK-V3SET firmware; might be used by the target for detection of the tool.
7. Output for STLINK-V3SET

The used connector is SAMTEC FTSH-107-01-L-DV-K-A.

8.2 Connectors on MB1440 board

8.2.1 STDC14 (STM32 JTAG/SWD and VCP)

The STDC14 CN1 connector on MB1440 replicates the STDC14 CN1 connector from the MB1441 main module. Refer to *Section 8.1.2* for details.

8.2.2 Legacy Arm 20-pin JTAG/SWD IDC connector

The CN2 connector allows the connection to an STM32 target in the JTAG or SWD mode. Its pinout is listed in *Table 7*. It is compatible with the pinout of ST-LINK/V2, but the STLINK-V3SET does not manage the JTAG TRST signal (pin 3).

Table 7. Legacy Arm 20-pin JTAG/SWD IDC connector CN2

Pin number	Description	Pin number	Description
1	T_VCC(1)	2	NC
3	NC	4	GND(2)
5	T_JTDI/NC(3)	6	GND(2)
7	T_JTMS/T_SWDIO	8	GND(2)
9	T_JCLK/T_SWCLK	10	GND(2)
11	T_JRCLK(4)/NC(3)	12	GND(2)
13	T_JTDO/T_SWO(5)	14	GND(2)
15	T_NRST	16	GND(2)
17	NC	18	GND(2)
19	NC	20	GND(2)

1. Input for STLINK-V3SET.
2. At least one of these pins must be connected to the ground on the target side for correct behavior (connecting all is recommended for noise reduction on the ribbon).
3. NC means not required for the SWD connection.
4. Optional loopback of T_JCLK on the target side, required if loopback is removed on the STLINK-V3SET side.
5. SWO is optional, required only for Serial Wire Viewer (SWV) trace.

8.2.3 Virtual COM port connector

The CN3 connector allows the connection of a target UART for the Virtual COM port function. The debug connection (through JTAG/SWD or SWIM) is not required at the same time. However, a GND connection between STLINK-V3SET and the target is required and must be ensured in some other way in case no debug cable is plugged. The related pinout for the VCP connector is listed in *Table 8*.

Table 8. Virtual COM port connector CN3

Pin number	Description	Pin number	Description
1	T_VCP_TX(1)	2	T_VCP_RX(2)

1. Input for STLINK-V3SET. Must be connected to UART_TX on target.
2. Output for STLINK-V3SET. Must be connected to UART_RX on target.

8.2.4 SWIM connector

The CN4 connector allows the connection to an STM8 SWIM target. The related pinout for the SWIM connector is listed in *Table 9*.

Table 9. SWIM connector CN4

Pin number	Description
1	T_VCC(1)
2	SWIM_DATA
3	GND
4	T_NRST

1. Input for STLINK-V3SET.

8.2.5 CAN connector

The CN5 connector allows the connection to a CAN target without a CAN transceiver. The related pinout for this connector is listed in *Table 10*.

Table 10. CAN connector CN5

Pin number	Description
1	T_CAN_VCC(1)
2	T_CAN_TX
3	T_CAN_RX

1. Input for STLINK-V3SET.

8.2.6 SWD connector

The CN6 connector allows the connection to an STM32 target in SWD mode through wires. It is not recommended for high performance. The related pinout for this connector is listed in *Table 11*.

Table 11. SWD (wires) connector CN6

Pin number	Description
1	T_VCC(1)
2	T_SWCLK
3	GND
4	T_SWDIO
5	T_NRST
6	T_SWO(2)

1. Input for STLINK-V3SET.
2. Optional, required only for Serial Wire Viewer (SWV) trace.

8.2.7 UART/I^{2}C/CAN bridge connector

Some bridge functions are provided on the CN7 2x5-pin 1.27 mm pitch connector. The related pinout is listed in *Table 12*. This connector provides CAN logic signals (Rx/Tx), which can be used as input for an external CAN transceiver. Prefer using the MB1440 CN5 connector for CAN connection otherwise.

Table 12. UART bridge connector CN7

Pin number	Description	Pin number	Description
1	UART_CTS	2	I2C_SDA
3	UART_TX(1)	4	CAN_TX(1)
5	UART_RX(2)	6	CAN_RX(2)
7	UART_RTS	8	I2C_SCL
9	GND	10	Reserved(3)

1. TX signals are outputs for STLINK-V3SET and inputs for the target.
2. RX signals are inputs for STLINK-V3SET and outputs for the target.
3. Do not connect to the target.

8.2.8 SPI/GPIO bridge connector

Some bridge functions are provided on the CN82x5-pin 1.27 mm pitch connector. The related pinout is listed in *Table 13*.

Table 13. SPI bridge connector CN8

Pin number	Description	Pin number	Description
1	SPI_NSS	2	Bridge_GPIO0
3	SPI_MOSI	4	Bridge_GPIO1
5	SPI_MISO	6	Bridge_GPIO2
7	SPI_SCK	8	Bridge_GPIO3
9	GND	10	Reserved(1)

1. Do not connect to the target.

8.2.9 Bridge 20-pin connector

All bridge functions are provided on a 2x10-pin connector with a 2.0 mm pitch CN9. The related pinout is listed in *Table 14*.

Table 14. Bridge connector CN9

Pin number	Description	Pin number	Description
1	SPI_NSS	11	Bridge_GPIO0
2	SPI_MOSI	12	Bridge_GPIO1
3	SPI_MISO	13	Bridge_GPIO2
4	SPI_SCK	14	Bridge_GPIO3
5	GND	15	Reserved(1)
6	Reserved(1)	16	GND
7	I2C_SCL	17	UART_RTS
8	CAN_RX(2)	18	UART_RX(2)

Table 14. Bridge connector CN9 (continued)

Pin number	Description	Pin number	Description
9	CAN_TX(3)	19	UART_TX(3)
10	I2C_SDA	20	UART_CTS

1. Do not connect to the target.
2. RX signals are inputs for STLINK-V3SET and outputs for the target.
3. TX signals are outputs for STLINK-V3SET and inputs for the target.

9 Flat ribbons

The STLINK-V3SET provides three flat cables allowing the connection from the STDC14 output to:

- STDC14 connector (1.27 mm pitch) on target application: pinout detailed in *Table 6*. Reference Samtec FFSD-07-D-05.90-01-N-R.
- ARM10-compatible connector (1.27 mm pitch) on target application: pinout detailed in *Table 15*. Reference Samtec ASP-203799-02.
- ARM20-compatible connector (1.27 mm pitch) on target application: pinout detailed in *Table 16*. Reference Samtec ASP-203800-02.

Table 15. ARM10-compatible connector pinout (target side)

Pin number	Description	Pin number	Description
1	T_VCC(1)	2	T_JTMS/T_SWDIO
3	GND	4	T_JCLK/T_SWCLK
5	GND	6	T_JTDO/T_SWO(2)
7	T_JRCLK(3)/NC(4)	8	T_JTDI/NC(4)
9	GNDDetect(5)	10	T_NRST

1. Input for STLINK-V3SET.
2. SWO is optional, required only for Serial Wire Viewer (SWV) trace.
3. Optional loopback of T_JCLK on the target side, required if loopback is removed on the STLINK-V3SET side.
4. NC means not required for the SWD connection.
5. Tied to GND by STLINK-V3SET firmware; might be used by the target for detection of the tool.

Table 16. ARM20-compatible connector pinout (target side)

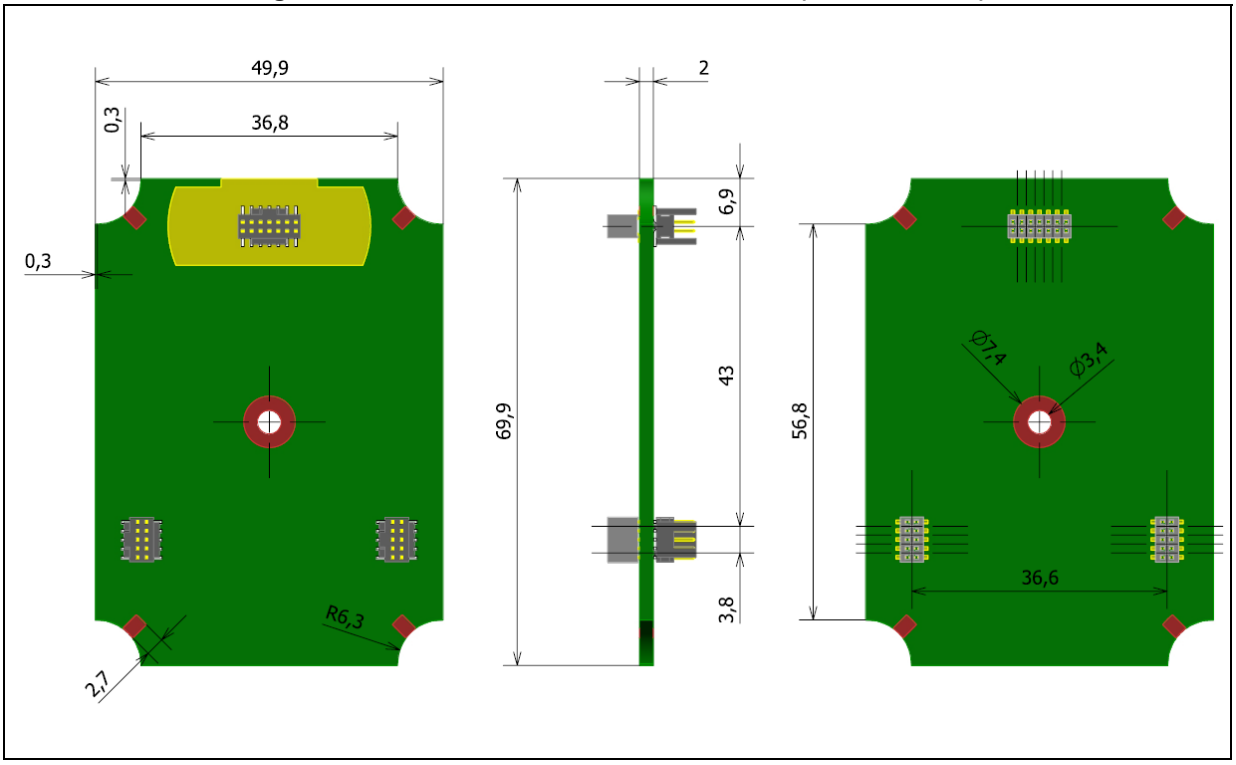
Pin number	Description	Pin number	Description
1	T_VCC(1)	2	T_JTMS/T_SWDIO
3	GND	4	T_JCLK/T_SWCLK
5	GND	6	T_JTDO/T_SWO(2)
7	T_JRCLK(3)/NC(4)	8	T_JTDI/NC(4)
9	GNDDetect(5)	10	T_NRST
11	NC	12	NC
13	NC	14	NC
15	NC	16	NC
17	NC	18	NC
19	NC	20	NC

1. Input for STLINK-V3SET.
2. SWO is optional, required only for Serial Wire Viewer (SWV) trace.
3. Optional loopback of T_JCLK on the target side, required if loopback is removed on the STLINK-V3SET side.

4. NC means not required for the SWD connection.
5. Tied to GND by STLINK-V3SET firmware; might be used by the target for detection of the tool.

10 Mechanical information

Figure 15. MB1441 mechanical dimensions (in millimeters)



11 Software configuration

11.1 Supporting toolchains (not exhaustive)

Table 17 gives a list of the first toolchain version supporting the STLINK-V3SET product.

Table 17. Toolchain versions supporting STLINK-V3SET

Toolchain	Description	Minimum Version
STM32CubeProgrammer	ST Programming tool for ST microcontrollers	1.1.0
SW4STM32	Free IDE on Windows, Linux, and macOS	2.4.0
IAR EWARM	Third-party debugger for STM32	8.20
Keil MDK-ARM	Third-party debugger for STM32	5.26
STVP	ST Programming tool for ST microcontrollers	3.4.1
STVD	ST Debugging tool for STM8	4.3.12

Note: Some of the very first toolchain versions supporting the STLINK-V3SET (in runtime) might not install the complete USB driver for STLINK-V3SET (especially the STLINK-V3SET bridge USB interface description might miss). In that case, either the user switches to a more recent version of the toolchain or updates the ST-LINK driver from www.st.com (see Section 11.2).

11.2 Drivers and firmware upgrade

The STLINK-V3SET requires drivers to be installed on Windows and embeds firmware that needs to be updated from time to time to benefit from new functionality or corrections. Refer to the technical note *Overview of ST-LINK derivatives* (TN1235) for details.

11.3 STLINK-V3SET frequency selection

The STLINK-V3SET can run internally at 3 different frequencies:

- High-performance frequency
- Standard frequency, compromising between performance and consumption
- Low-consumption frequency

By default, the STLINK-V3SET starts at a high-performance frequency. It is the responsibility of the toolchain provider to propose or not the frequency selection at the user level.

11.4 Mass-storage interface

The STLINK-V3SET implements a virtual mass-storage interface allowing the programming of an STM32 target flash memory with the drag-and-drop action of a binary file from a file explorer. This ability requires the STLINK-V3SET to identify the connected target before

enumerating it on the USB host. As a consequence, this functionality is available only if the target is connected to the STLINK-V3SET before the STLINK-V3SET is plugged into the host. This functionality is not available for STM8 targets.

The ST-LINK firmware programs the dropped binary file, at the beginning of the flash, only if it is detected as a valid STM32 application according to the following criteria:

- The reset vector points to an address in the target flash area,
- The stack pointer vector points to an address in any of the target RAM areas.

If all these conditions are not respected, the binary file is not programmed and the target flash keeps its initial contents.

11.5 Bridge interface

The STLINK-V3SET implements a USB interface dedicated to bridging functions from USB to SPI/I^2C/CAN/UART/GPIOs of the ST microcontroller target. This interface is first used by STM32CubeProgrammer to allow target programming through the SPI/I^2C/CAN bootloader.

A host software API is provided to extend the use cases.

12 B-STLINK-VOLT board extension description

12.1 Features

- 1.65 V to 3.3 V voltage adapter board for STLINK-V3SET
- Input/output level shifters for STM32 SWD/SWV/JTAG signals
- Input/output level shifters for VCP Virtual COM port signals (UART)
- Input/output level shifters for bridge signals (SPI/UART/I^2C/CAN/GPIOs)
- Closed casing when using STDC14 connector (STM32 SWD, SWV, and VCP)
- Connection compatible with STLINK-V3SET adapter board (MB1440) for STM32 JTAG and bridge

12.2 Connection instructions

12.2.1 Closed casing for STM32 debug (STDC14 connector only) with B-STLINK-VOLT

1. Remove the USB cable from STLINK-V3SET.
2. Unscrew the casing bottom cover of the STLINK-V3SET or remove the adapter board (MB1440).
3. Remove the JP1 jumper from the MB1441 main module and place it on the JP1 header of the MB1598 board.
4. Put the plastic edge in place to guide the B-STLINK-VOLT board connection to the STLINK-V3SET main module (MB1441).
5. Connect the B-STLINK-VOLT board to the STLINK-V3SET main module (MB1441).
6. Close the casing bottom cover.

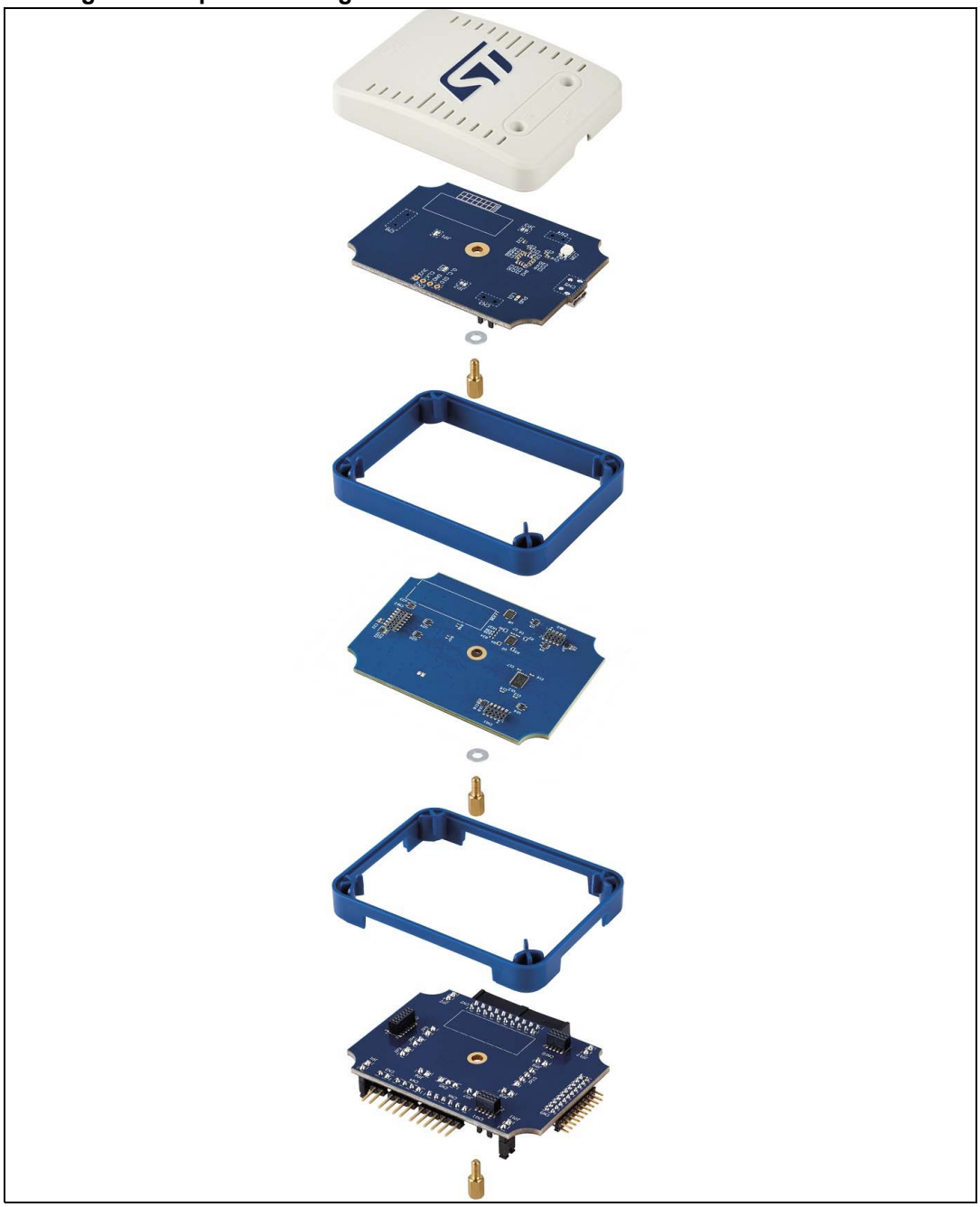
Figure 16. Closed casing for STM32 debug with B-STLINK-VOLT

The STDC14 CN1 connector on the B-STLINK-VOLT board replicates the STDC14 CN1 connector from the MB1441 main module. Refer to *Section 8.1.2* for details.

12.2.2 Opened casing for access to all connectors (through MB1440 adapter board) with B-STLINK-VOLT

1. Remove the USB cable from STLINK-V3SET.
2. Unscrew the casing bottom cover of the STLINK-V3SET or remove the adapter board (MB1440).
3. Remove the JP1 jumper from the MB1441 main module and place it on the JP1 header of the MB1598 board.
4. Put the plastic edge in place to guide the B-STLINK-VOLT board connection to the STLINK-V3SET main module (MB1441).
5. Connect the B-STLINK-VOLT board to the STLINK-V3SET main module (MB1441).
6. [optional] Screw the B-STLINK-VOLT board to ensure good and stable contact.
7. Plug the MB1440 adapter board into the B-STLINK-VOLT board in the same way that it was previously plugged into the STLINK-V3SET main module (MB1441).

Figure 17. Opened casing for access to all connectors with B-STLINK-VOLT



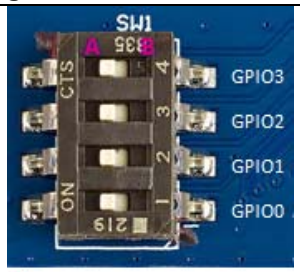
For connector description, refer to *Section 8.2*.

12.3 Selection of bridge GPIO direction

The level-shifter components on the B-STLINK-VOLT board require manually configuring the direction of bridge GPIO signals. This is possible through the SW1 switch on the bottom of the board. Pin 1 of SW1 is for bridge GPIO0 and pin 4 of SW1 is for bridge GPIO3. By default, the direction is the target output/ST-LINK input (selectors on the ON/CTS3 side of

SW1). It can be changed for each GPIO independently into the target input/ST-LINK output direction by moving the corresponding selector on the ‘1’, ‘2’, ‘3’, or ‘4’ side of SW1. Refer to *Figure 18*.

Figure 18. B-STLINK-VOLT



12.4 Jumper configuration

Caution: Always remove the JP1 jumper from the STLINK-V3SET main module (MB1441) before stacking the B-STLINK-VOLT board (MB1598). This jumper can be used on the MB1598 board to provide the return JTAG clock required for correct JTAG operations. If the JTAG clock loopback is not done at the B-STLINK-VOLT board level through JP1, it must be done externally between CN1 pins 6 and 9.

Table 18. MB1598 jumper configuration

Jumper	State	Description
JP1	ON	JTAG clock loopback done on board

12.5 Target voltage connection

The target voltage must always be provided to the board for proper operation (input for B-STLINK-VOLT). It must be provided to pin 3 of the CN1 STDC14 connector, either directly on MB1598 or through the MB1440 adapter board. In case of use with the MB1440 adapter board, the target voltage can be provided either through pin 3 of CN1, pin 1 of CN2, pin 1 of CN6, or pins 2 and 3 of JP10 on the MB1440 board. The expected range is 1.65 to 3.3 V.

12.6 Board connectors

12.6.1 STDC14 (STM32 JTAG/SWD and VCP)

The STDC14 CN1 connector on the MB1598 board replicates the STDC14 CN1 connector from the MB1441 board. Refer to *Section 8.1.2* for details.

12.6.2 UART/I^{2}C/CAN bridge connector

The UART/I^{2}C/CAN bridge CN7 connector on the MB1598 board replicates the UART/I^{2}C/CAN bridge CN7 connector from the MB1440 board. Refer to *Section 8.2.7* for details.

12.6.3 SPI/GPIO bridge connector

The SPI/GPIO bridge CN8 connector on the MB1598 board replicates the SPI/GPIO bridge CN8 connector from the MB1440 board. Refer to *Section 8.2.8* for details.

13 B-STLINK-ISOL board extension description

13.1 Features

- 1.65 V to 3.3 V voltage adapter and galvanic isolation board for STLINK-V3SET
- 2.5 kV RMS galvanic isolation
- Input/output isolation and level shifters for STM32 SWD/SWV/JTAG signals
- Input/output isolation and level shifters for VCP Virtual COM port signals (UART)
- Input/output isolation and level shifters for bridge signals (SPI/UART/I^2C/CAN/GPIOs)
- Closed casing when using STDC14 connector (STM32 SWD, SWV, and VCP)
- Connection compatible with STLINK-V3SET adapter board (MB1440) for STM32 JTAG and bridge

13.2 Connection instructions

13.2.1 Closed casing for STM32 debug (STDC14 connector only) with B-STLINK-ISOL

1. Remove the USB cable from STLINK-V3SET.
2. Unscrew the casing bottom cover of the STLINK-V3SET or remove the adapter board (MB1440).
3. Remove the JP1 jumper from the MB1441 main module and place it on the JP2 header of the MB1599 board.
4. Put the plastic edge in place to guide the B-STLINK-ISOL board connection to the STLINK-V3SET main module (MB1441).
5. Connect the B-STLINK-ISOL board to the STLINK-V3SET main module (MB1441).
6. Close the casing bottom cover.

Figure 19. Closed casing for STM32 debug with B-STLINK-ISOL

The STDC14 CN1 connector on the B-STLINK-ISOL board replicates the STDC14 CN1 connector from the MB1441 main module. Refer to *Section 8.1.2* for details.

13.2.2 Opened casing for access to all connectors (through MB1440 adapter board) with B-STLINK-ISOL

1. Remove the USB cable from STLINK-V3SET
2. Unscrew the casing bottom cover of the STLINK-V3SET or remove the adapter board (MB1440)
3. Remove the JP1 jumper from the MB1441 main module and place it on the JP2 header of the MB1599 board
4. Put the plastic edge in place to guide the B-STLINK-ISOL board connection to the STLINK-V3SET main module (MB1441)
5. Connect the B-STLINK-ISOL board to the STLINK-V3SET main module (MB1441)

Caution: Do not screw the B-STLINK-ISOL board to the STLINK-V3SET main module with a metal screw. Any contact of the MB1440 adapter board with this screw short-circuits the grounds and might cause damage.

6. Plug the MB1440 adapter board into the B-STLINK-ISOL board in the same way that it was previously plugged into the STLINK-V3SET main module (MB1441)

Figure 20. Opened casing for access to all connectors with B-STLINK-ISOL

For connector description, refer to *Section 8.2*.

13.3 Bridge GPIO direction

On the B-STLINK-ISOL board, the direction of bridge GPIO signals is fixed by hardware:

- GPIO0 and GPIO1 are the target input and ST-LINK output.
- GPIO2 and GPIO3 are the target output and ST-LINK input.

13.4 Jumper configuration

Jumpers on the B-STLINK-ISOL board (MB1599) are used to configure the return JTAG clock path required for correct JTAG operations. The highest is the JTAG clock frequency, the closest to the target must be the loopback.

1. Loopback is done at STLINK-V3SET main module (MB1441) level: MB1441 JP1 is ON, while MB1599 JP2 is OFF.
2. Loopback is done at B-STLINK-ISOL board (MB1599) level: MB1441 JP1 is OFF (very important potentially not to degrade the MB1599 board), while MB1599 JP1 and JP2 are ON.
3. Loopback is done at the target level: MB1441 JP1 is OFF (very important not potentially to degrade the MB1599 board), MB1599 JP1 is OFF and JP2 is ON. Loopback is done externally between CN1 pins 6 and 9.

Caution: Always ensure that either the JP1 jumper from the STLINK-V3SET main module (MB1441), or the JP2 jumper from the B-STLINK-ISOL board (MB1599) is OFF, before stacking them.

13.5 Target voltage connection

The target voltage must always be provided to the board to work correctly (input for B-STLINK-ISOL). It must be provided to pin 3 of the CN1 STDC14 connector, either directly on MB1599 or through the MB1440 adapter board. In case of use with the MB1440 adapter board, the target voltage can be provided either through pin 3 of CN1, pin 1 of CN2, pin 1 of CN6, or pin 2 and pin 3 of JP10 of the MB1440 board. The expected range is 1.65 to 3.3 V.

13.6 Board connectors

13.6.1 STDC14 (STM32 JTAG/SWD and VCP)

The STDC14 CN1 connector on the MB1599 board replicates the STDC14 CN1 connector from the MB1441 main module. Refer to *Section 8.1.2* for details.

13.6.2 UART/I^{2}C/CAN bridge connector

The UART/I2C/CAN bridge CN7 connector on the MB1599 board replicates the UART/I2C/CAN bridge CN7 connector from the MB1440 board. Refer to *Section 8.2.7* for details.

13.6.3 SPI/GPIO bridge connector

The SPI/GPIO bridge CN8 connector on the MB1599 board replicates the SPI/GPIO bridge CN8 connector from the MB1440 board. Refer to *Section 8.2.8* for details.

14 Performance figures

14.1 Global overview

Table 19 gives an overview of the achievable maximal performances with the STLINK-V3SET on different communication channels. Those performances are also depending on the overall system context (target included), so they are not guaranteed to be always reachable. For instance, a noisy environment or the connection quality can impact system performance.

Table 19. Achievable maximal performance with STLINK-V3SET on different channels

Board	Target voltage	Maximum frequency (in MHz)						
		SWD	JTAG	SWV	VCP	SPI	I^2C	CAN
STLINK-V3SET	3.3	24	21	16	16	24	1	1
STLINK-V3SET + B-STLINK-VOLT	3.3	8	12	12	10	12	1	1
STLINK-V3SET + B-STLINK-VOLT	1.8	8	8	12	10	12	1	1
STLINK-V3SET + B-STLINK-ISOL	3.3	8	8	12	10	6	1	1
STLINK-V3SET + B-STLINK-ISOL	1.8	8	8	12	10	6	1	1

14.2 Baud rate computing

Some interfaces (VCP and SWV) are using the UART protocol. In that case, the baud rate of STLINK-V3SET must be aligned as much as possible with the target one.

Below is a rule allowing the user to compute the baud rate achievable by the STLINK-V3SET probe:

- In high-performance mode: 384 MHz / prescaler with prescaler = [24 to 31] then 192 MHz / prescaler with prescaler = [16 to 65535]
- In standard mode: 192 MHz/prescaler with prescaler = [24 to 31] then 96 MHz / prescaler with prescaler = [16 to 65535]
- In low consumption mode: 96 MHz / prescaler with prescaler = [24 to 31] then 48 MHz / prescaler with prescaler = [16 to 65535]

Note that the UART protocol does not guarantee data delivery (all the more without hardware flow control). Consequently, at high frequencies, the baud rate is not the only parameter impacting the data integrity. The line load rate and the capability of the receiver to process all the data also affect the communication. With a heavily loaded line, some data loss might occur at the STLINK-V3SET side above 12 MHz.

15 STLINK-V3SET, B-STLINK-VOLT, and B-STLINK-ISOL product information

15.1 Product marking

The stickers located on the top or bottom side of all PCBs provide product information:

- First sticker: product order code and product identification, generally placed on the main board featuring the target device.
  Example:

  Product order code
  Product identification

- Second sticker: board reference with revision and serial number, available on each PCB.
  Example:

  MBxxxx-Variant-yzz
  syywwxxxxx

On the first sticker, the first line provides the product order code, and the second line the product identification.

On the second sticker, the first line has the following format: *“MBxxxx-Variant-yzz”*, where *“MBxxxx”* is the board reference, *“Variant”* (optional) identifies the mounting variant when several exist, *"y"* is the PCB revision and *"zz"* is the assembly revision, for example B01. The second line shows the board serial number used for traceability.

Parts marked as *"ES"* or *"E"* are not yet qualified and therefore not approved for use in production. ST is not responsible for any consequences resulting from such use. In no event will ST be liable for the customer using any of these engineering samples in production. ST’s Quality department must be contacted prior to any decision to use these engineering samples to run a qualification activity.

"E" or *"ES"* marking examples of location:

- On the targeted STM32 that is soldered on the board (for an illustration of STM32 marking, refer to the STM32 datasheet *Package information* paragraph at the *www.st.com* website).
- Next to the evaluation tool ordering part number that is stuck or silk-screen printed on the board.

Some boards feature a specific STM32 device version, which allows the operation of any bundled commercial stack/library available. This STM32 device shows a *"U"* marking option at the end of the standard part number and is not available for sales.

To use the same commercial stack in their applications, the developers might need to purchase a part number specific to this stack/library. The price of those part numbers includes the stack/library royalties.

15.2 STLINK-V3SET product history

Table 20. Product history

Order code	Product identification	Product details	Product change description	Product limitations
STLINK-V3SET	LKV3SET$AT1	Boards: – MB1141 B-01 (main module) – MB1140 B-01 (adapter board)	Initial revision	No limitation
	LKV3SET$AT2	Boards: – MB1141 B-01 (main module) – MB1140 B-01 (adapter board)	Added cable for bridge signals out of the CN9 MB1440 adapter board connector	No limitation
	LKV3SET$AT3	Boards: – MB1141 B-01 (main board) – MB1140 B-01 (adapter board)	Replaced metal screws with nylon screws	No limitation
	LKV3SET$AT4	Boards: – MB1141-B-01 (main module) – MB1140-C-01 (adapter board)	Adapter board revision changed	No limitation
B-STLINK-VOLT	BSTLINKVOLT$AZ1	Board: – MB1598 A-01 (voltage adapter board)	Initial revision	No limitation
B-STLINK-ISOL	BSTLINKISOL$AZ1	Board: – MB1599 B-01 (voltage adapter and galvanic isolation board)	Initial revision	Do not screw the B-STLINK-ISOL board to the STLINK-V3SET main module with a metal screw, especially if you intend to use the MB1440 adapter board. Any contact of the MB1440 adapter board with this screw short-circuits the grounds and might cause damage. Use only nylon fastener screws or do not screw.

15.3 Board revision history

Table 21. Board revision history

Board reference	Board variant and revision	Board change description	Board limitations
MB1441 (main module)	B-01	Initial revision	No limitation
MB1440 (adapter board)	B-01	Initial revision	Care must be taken if used with MB1599 board revision B-01: refer to MB1599 board revision B-01 limitations
	C-01	The revision C-01 removes the metal layer generating shortcut when it is screwed on a MB1599 B-01 board with metal screws.	No limitation

Table 21. Board revision history (continued)

Board reference	Board variant and revision	Board change description	Board limitations
MB1598 (voltage adapter board)	A-01	Initial revision	The target voltage cannot be provided through the bridge connectors CN7 and CN8 while required for bridge functions. The target voltage must be provided either through CN1 or through the MB1440 adapter board (refer to *Section 12.5: Target voltage connection*).
MB1599 (voltage adapter and galvanic isolation board)	B-01	Initial revision	The target voltage cannot be provided through the bridge connectors CN7 and CN8 while required for bridge functions. The target voltage must be provided either through CN1 or through the MB1440 adapter board. Refer to *Section 13.5: Target voltage connection*. Do not screw the B-STLINK-ISOL board to the STLINK-V3SET main module with a metal screw, especially if you intend to use the MB1440 adapter board. Any contact of the MB1440 adapter board with this screw short-circuits the grounds and might cause damage. Use only nylon fastener screws or do not screw.

Appendix A Federal Communications Commission (FCC)

15.3 FCC Compliance Statement

15.3.1 Part 15.19

Part 15.19

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

Part 15.21

Any changes or modifications to this equipment not expressly approved by STMicroelectronics may cause harmful interference and void the user's authority to operate this equipment.

Part 15.105

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates uses and can radiate radio frequency energy and, if not installed and used in accordance with the instruction, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception which can be determined by turning the equipment off and on, the user is encouraged to try to correct interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

Note: Use a USB cable with a length lower than 0.5 m and ferrite on the PC's side.

Other certifications

- EN 55032 (2012) / EN 55024 (2010)
- CFR 47, FCC Part 15, Subpart B (Class B Digital Device) and Industry Canada ICES-003 (Issue 6/2016)
- Electrical Safety qualification for CE marking: EN 60950-1 (2006+A11/2009+A1/2010+A12/2011+A2/2013)
- IEC 60650-1 (2005+A1/2009+A2/2013)

Note: The sample examined must be powered by a power supply unit or auxiliary equipment complying with standard EN 60950-1: 2006+A11/2009+A1/2010+A12/2011+A2/2013, and must be safety extra low voltage (SELV) with limited power capability.

Revision history

Table 22. Document revision history

Date	Revision	Changes
6-Sep-2018	1	Initial release.
8-Feb-2019	2	Updated: – *Section 8.3.4: Virtual COM port (VCP)*, – *Section 8.3.5: Bridge functions*, – *Section 9.1.2: STDC14 (STM32 JTAG/SWD and VCP)*, and – *Section 9.2.3: Virtual COM port connector* explaining how Virtual COM ports are connected to the target.
20-Nov-2019	3	Added: – Second Virtual COM port chapter in *Introduction*, – *Figure 13* in *Section 8.3.5* Bridge UART, and – *Figure 15* in the new section of *Mechanical information*.
19-Mar-2020	4	Added: – *Section 12: B-STLINK-VOLT board extension description.*
5-Jun-2020	5	Added: – *Section 12.5: Target voltage connection* and – *Section 12.6: Board connectors*. Updated: – *Section 1: Features*, – *Section 3: Ordering information*, – *Section 8.2.7: UART/I²C/CAN bridge connector*, and – *Section 13: STLINK-V3SET and B-STLINK-VOLT information*.
5-Feb-2021	6	Added: – *Section 13: B-STLINK-ISOL board extension description*, – *Figure 19* and *Figure 20*, and – *Section 14: Performance figures*. Updated: – *Introduction*, – *Ordering information*, – *Figure 16* and *Figure 17*, and – *Section 15: STLINK-V3SET, B-STLINK-VOLT, and B-STLINK-ISOL information*. All modifications linked to the latest B-STLINK-ISOL board for voltage adaptation and galvanic isolation

Table 22. Document revision history (continued)

Date	Revision	Changes
7-Dec-2021	7	Added: – *Section 15.2.2: Product identification LKV3SET$AT2* and – Reminder not to use metal screws to avoid damages in *Figure 20*, *Section 15.4.1*, and *Section 15.5.4*. Updated: – *Features*, – *System requirements*, and – *Section 7.3.4: Virtual COM port (VCP)*.
28-Nov-2023	8	Added: – *Product history* and *Board revision history* tables Updated: – *Product marking*