

STLINK-V3MODS and STLINK-V3MINI mini debuggers/programmers for STM32

Introduction

The STLINK-V3MODS and STLINK-V3MINI are stand-alone debugging and programming mini probes for STM32 microcontrollers. These products are designed in a very low form factor and both offer high performance without any compromise to functions. They support the JTAG/SWD interfaces for the communication with any STM32 microcontroller located on an application board.

They provide a Virtual COM port interface allowing the host PC to communication with the target microcontroller through one UART. The STLINK-V3MODS also provides bridge interfaces to several communication protocols allowing for instance the programming of the target through bootloader.

The STLINK-V3MODS and STLINK-V3MINI are both proposed for different uses. The STLINK-V3MODS may be directly soldered on a host PCB including a STM32 application-based with its 2 x16-pin castellated vias connection, while the STLINK-V3MINI offers STDC14 connectivity with an included STDC14 to STDC14 flat cable.

Figure 1. STLINK-V3MODS product top view

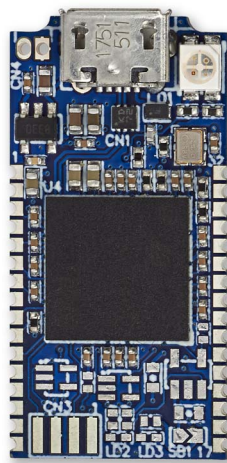
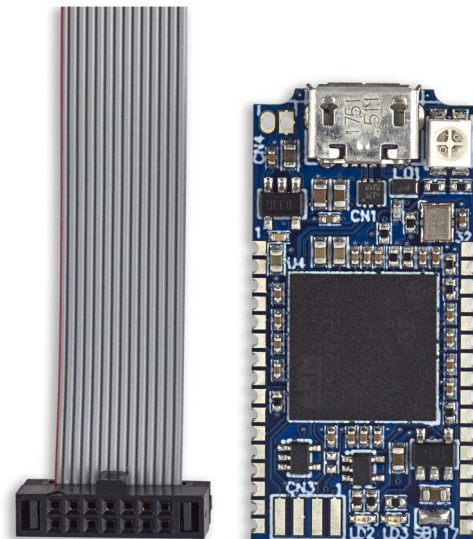


Figure 2. STLINK-V3MINI product top view



Pictures are not contractual.

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1 Features

Common features

- Stand-alone probe
- Approximately 15 x 30 mm high-density integration PCB
- Self-powered through a USB connector (Micro-B)
- USB 2.0 high-speed compatible interface
- Direct firmware update support (DFU)
- JTAG / serial wire debugging (SWD) specific features:
 - 3 V to 3.6 V application voltage support and 5 V tolerant inputs
 - JTAG communication support
 - SWD and serial wire viewer (SWV) communication 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
 - VCP frequency up to 15 MHz
- Drag-and-drop Flash programming
- Two color LEDs: communication, power

STLINK-V3MODS features

- Direct-to-PCB implementation by 2 x 16-pin 1.27mm edge castellated vias with all signals available in a minimum PCB required surface
- Multi-path bridge USB to SPI/UART/I2C/CAN/GPIOs specific features:
 - 3 V to 3.6 V application voltage support and 5 V tolerant inputs

STLINK-V3MINI features

- Delivered with 1.27 mm pitch STDC14 debug connector and STDC14 to STDC14 flat cable
- Includes STDC14 signals protection

Note: *STLINK-V3MODS and STLINK-V3MINI do not provide power supply to the target application.*

2 General information

The STLINK-V3MODS and STLINK-V3MINI embed an STM32 32-bit microcontroller based on the Arm^{®(a)} Cortex[®]-M processor.



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

3 System requirements

- Windows® OS (7, 8 and 10), Linux® 64-bit, or macOS®(a)
- USB Type-A to Micro-B cable

4 Development toolchains

- Keil® MDK-ARM(b)
- IAR™ EWARM(b)
- GCC-based IDEs

5 Ordering information

To order the STLINK-V3MODS and STLINK-V3MINI, refer to [Table 1](#).

Table 1. Ordering information

Order code	Description
STLINK-V3MODS	STLINK-V3 in-circuit debugger and programmer for STM32 (2 x 16-pin castellated vias)
STLINK-V3MINI	STLINK-V3 in-circuit debugger and programmer for STM32 (STDC14 connector)

6 Conventions

[Table 2](#) provides the conventions used for the ON and OFF settings in the present document.

Table 2. ON/OFF conventions

Convention	Definition
Jumper JPx ON	Jumper fitted
Jumper JPx OFF	Jumper not fitted

a. macOS® is a trademark of Apple Inc. registered in the U.S. and other countries.

b. On Windows® only.

Table 2. ON/OFF conventions (continued)

Convention	Definition
Solder bridge SBx ON	SBx connections closed by solder or 0 Ohm resistor
Solder bridge SBx OFF	SBx connections left open

7 Quick start

This section describes how to start a development quickly using the STLINK-V3MODS and STLINK-V3MINI.

Before installing and using these products, accept the Evaluation Product License Agreement from the www.st.com/epla web page.

The STLINK-V3MODS and STLINK-V3MINI are stand-alone debugging and programming probes for STM32 microcontrollers.

- They support protocols JTAG and SWD to communicate with any STM32 microcontroller.
- They provide a Virtual COM port interface allowing the host PC to communicate with the target microcontroller through one UART
- The STLINK-V3MODS provides bridge interfaces to several communication protocols allowing for instance the programming of the target through bootloader.

To start using STLINK-V3MINI, follow the steps below:

1. Check that the STDC14 to STDC14 flat cable is present inside the box.
2. Install/update the IDE/STM32CubeProgrammer to support the STLINK-V3MINI (drivers).
3. Connect the flat cable between the STLINK-V3MINI and the application.
4. Connect a USB Type-A to Micro-B cable between the STLINK-V3MINI and the PC.
5. Check that the PWR LED is green and the COM LED is red.
6. Open the development toolchain or STM32CubeProgrammer software utility. For more details, refer to the www.st.com/stlink-v3mini web site.

Using STLINK-V3MODS requires to be firstly soldered onto the destination application including the targeted STM32 microcontroller. Some recommendations are given here:

1. Reserve in the design the necessary PCB area under the STLINK-V3MODS by using the recommended PCB land pattern.
2. Apply the recommended reflow soldering profile, from *Soldering recommendations and package information for Lead-free ECOPACK microcontrollers (AN2639)*, and verify

that contacts between host board and module meet the IPC Specification (see IPC-A-610-F Acceptability of Electronic Assemblies).

3. Install/update the IDE/STM32CubeProgrammer to support the STLINK-V3MODS (drivers).
4. Power supply the application board.
5. Connect a USB Type-A to Micro-B cable between the STLINK-V3MODS and the PC.
6. Check that the PWR LED is green and the COM LED is red.
7. Open the development toolchain or STM32CubeProgrammer software utility. For more details, refer to the www.st.com/stlink-v3mods web site.

8 STLINK-V3MODS and STLINK-V3MINI functional description

8.1 STLINK-V3MODS and STLINK-V3MINI overview

The STLINK-V3MODS and STLINK-V3MINI are stand-alone debugging and programming mini probes for the STM32 microcontrollers. These products support many functions and protocols for debugging, programming or communicating with one or several targets.

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

8.2 High performance modules

The STLINK-V3MODS and STLINK-V3MINI support high performance configuration for STM32 microcontrollers. The working voltage range is from 3 V to 3.6 V.

The protocols and functions supported are:

- SWD with SWO (up to 24 MHz)
- JTAG (up to 21 MHz)
- VCP (from 720 bps to 15 Mbps)

A 2x7-pin male connector with 1.27 mm pitch is located in the STLINK-V3MINI for connection to the application target. An STDC14 to STDC14 connector is included in the packaging

Figure 3. STLINK-V3MINI connections

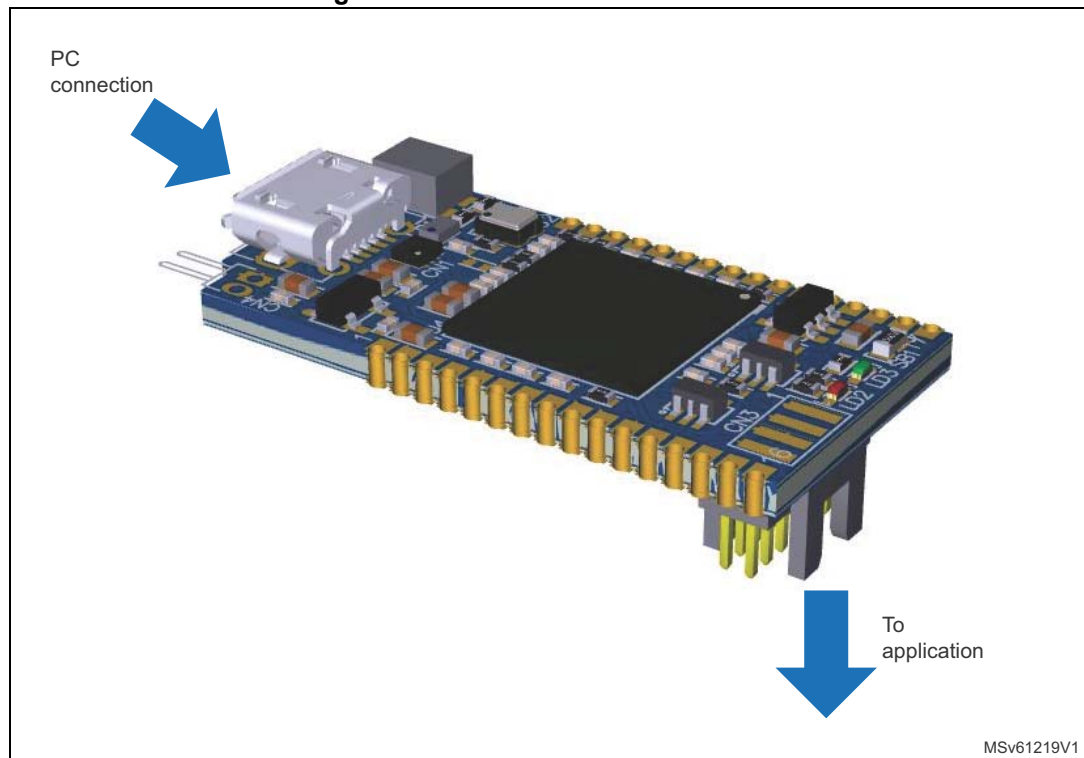
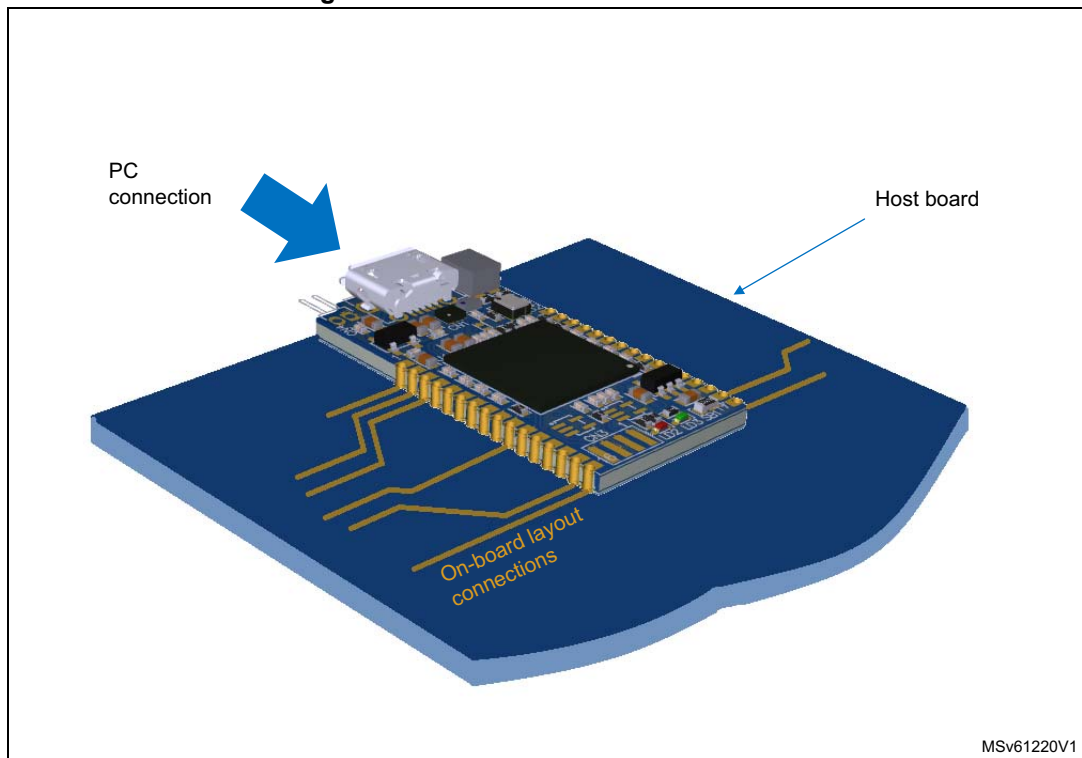


Figure 4. STLINK-V3MODS connections



For the STLINK-V3MODS, the connections are done with the host board by tracks.

8.3 Hardware layout

The STLINK-V3MODS and STLINK-V3MINI products are designed around the STM32F723 microcontroller (176-pin in UFBGA package). [Figure 5](#) shows the STLINK-V3MODS and [Figure 6](#) the STLINK-V3MINI. [Figure 7](#) and [Figure 8](#) show MB1467 top and bottom layouts which is the common board reference for STLINK-V3MODS and STLINK-V3MINI.

Figure 5. Hardware board STLINK-V3MODS

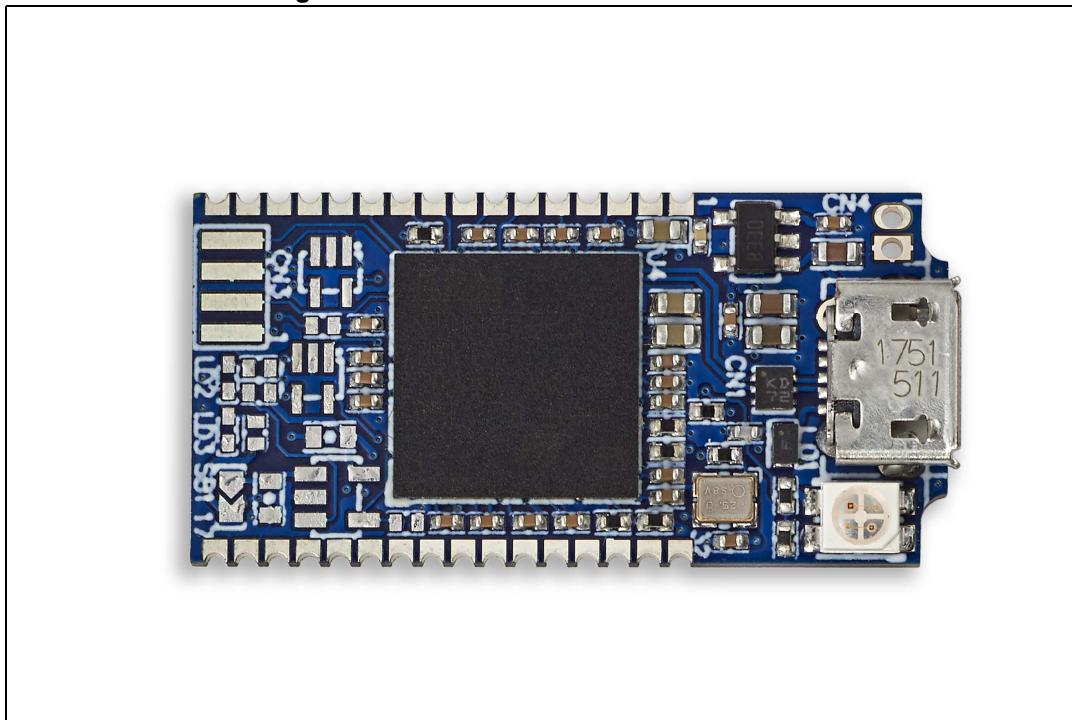


Figure 6. Hardware board STLINK-V3MINI

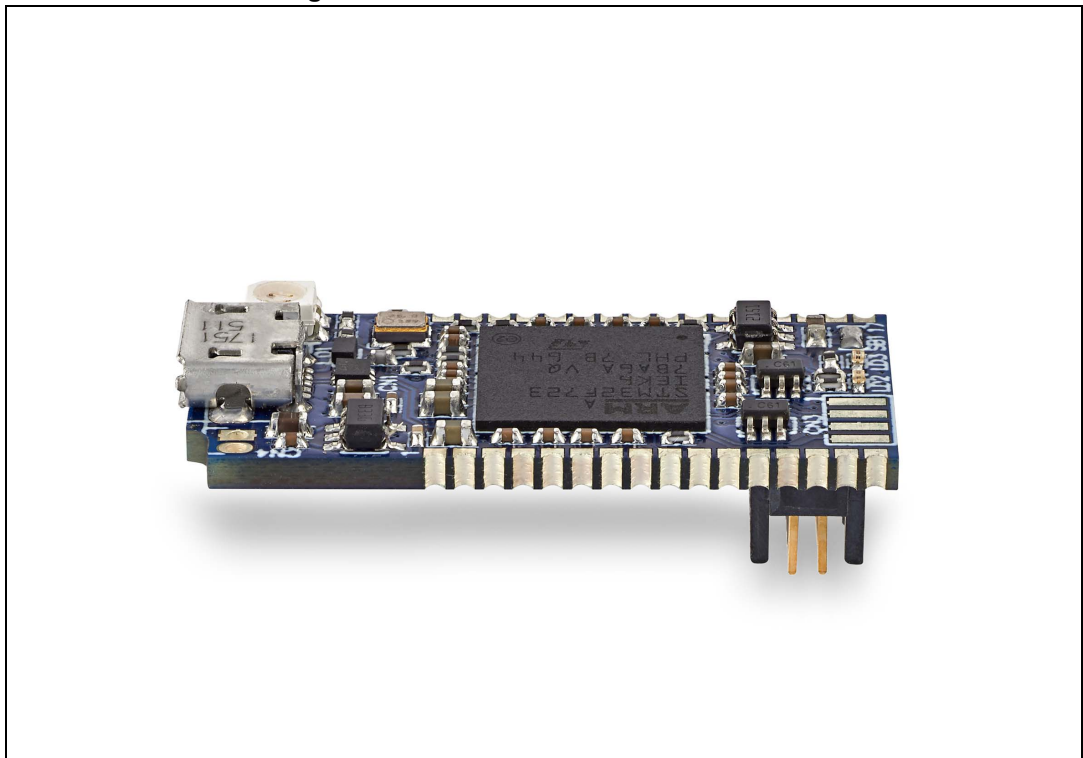


Figure 7. MB1467 top layout

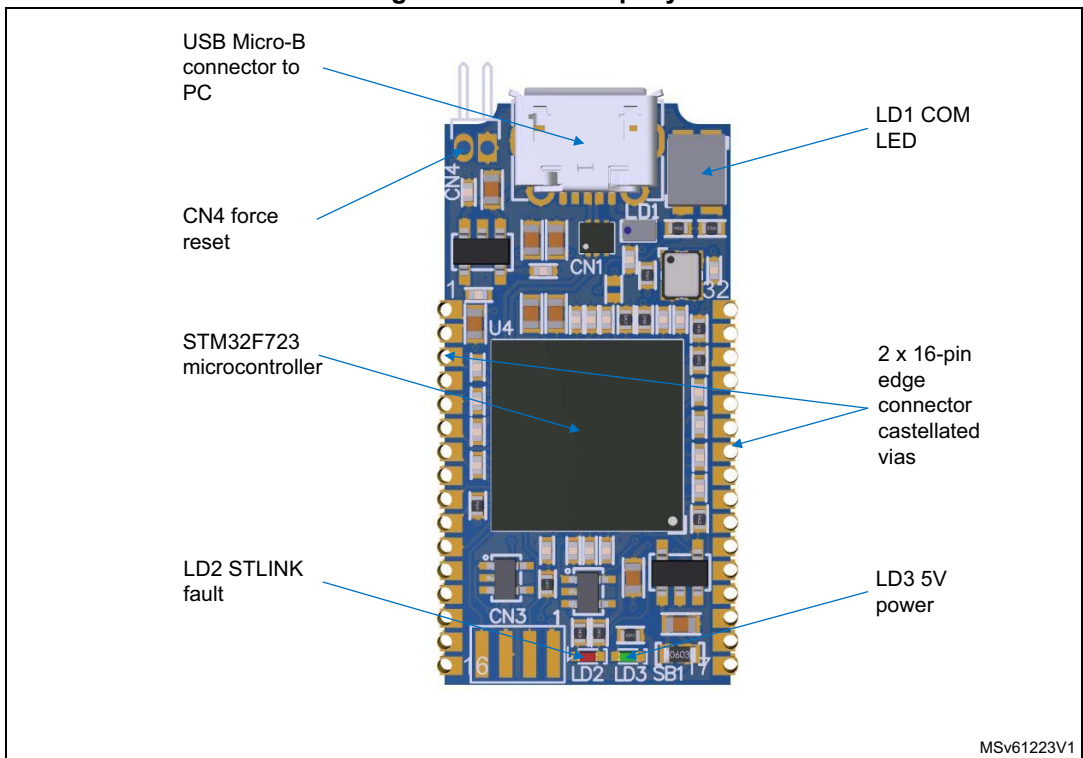


Figure 8. MB1467 bottom layout

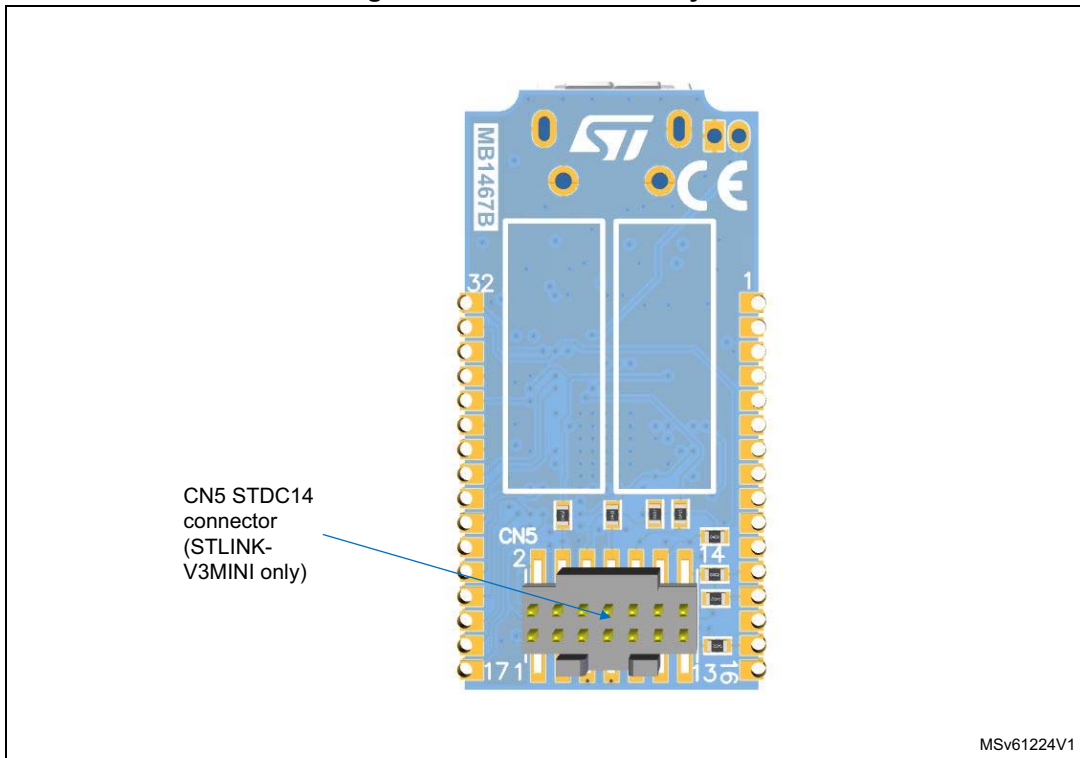
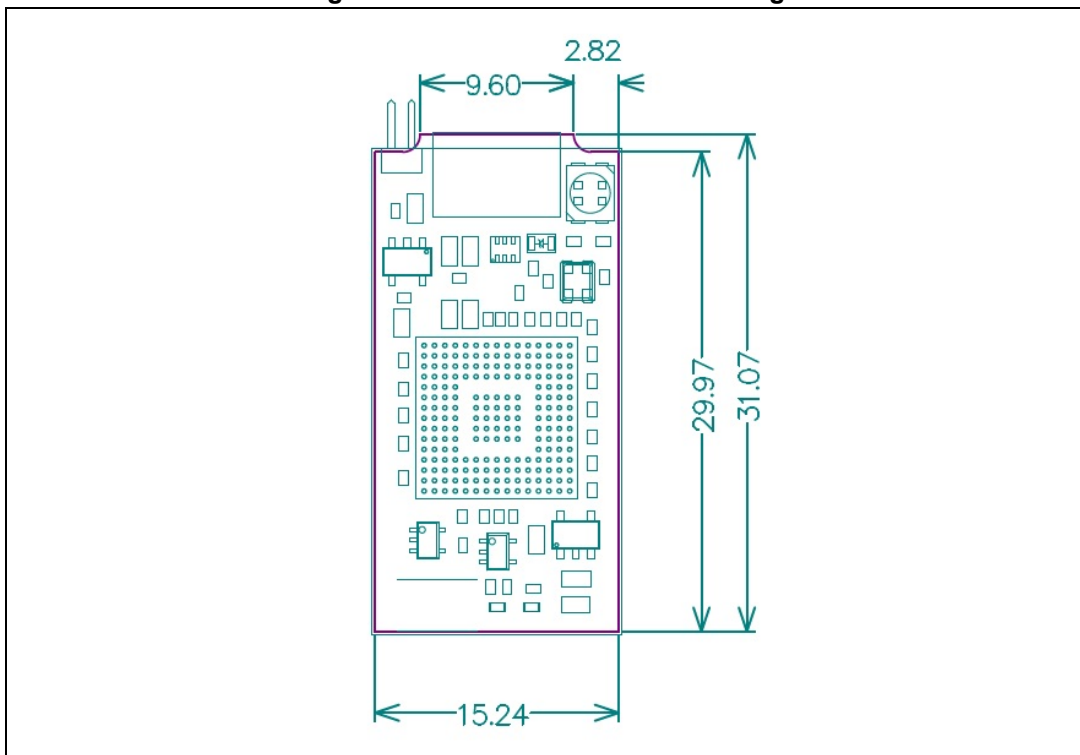


Figure 9. MB1467 mechanical drawing



8.4 STLINK-V3MODS and STLINK-V3MINI functions

All functions are designed for high performance: all signals are 3.3 V compatible. The following description concerns STLINK-V3MODS and STLINK-V3MINI except some mentioned sections and indicates where to find the functions on the boards and connectors.

8.4.1 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 may perform up to 24 MHz. This function is available on CN2 (STLINK-V3MODS) and CN5 (STLINK-V3MINI).

8.4.2 JTAG

JTAG protocol is a Debug/Program protocol used for STM32 microcontrollers. The signals are 3.3 V compatible and may perform up to 21 MHz. This function is available on CN2 (STLINK-V3MODS) and CN5 (STLINK-V3MINI).

8.4.3 Virtual COM port (VCP)

The serial interface VCP is directly available as a Virtual COM port of the PC, connected to STLINK-V3MODS and STLINK-V3MINI USB connector CN5. This function may be used for STM32 microcontrollers. The signals are 3.3 V compatible and may perform from 720 bps to 15 Mbps. This function is available on CN2 (STLINK-V3MODS) and CN5 (STLINK-V3MINI).

8.4.4 Bridge functions (STLINK-V3MODS only)

The STLINK-V3MODS provides a proprietary USB interface allowing the communication with an STM32 target with several protocols: SPI, I²C, CAN, UART and GPIOs. This interface may be used to communicate with the target bootloader, but may also be used for customized needs through its public software interface. All bridge signals are accessible on CN2.

Bridge SPI

SPI signals are available on CN2 pins 7, 14, 23 and 25.

Bridge I²C

I²C signals are available on CN2 pins 16 and 17. It is necessary to add externally 680 Ω pull-up resistors on the host application board.

Bridge CAN

CAN logic signals (Rx/Tx) are available on CN2 pins 9 and 10, they may be used as input for an external CAN transceiver.

Bridge UART

UART signals with hardware flow control (CTS/RTS) are available on CN2 pins 1 to 3 and 11. They need a dedicated firmware to be programmed on the main module before being used. Without this firmware, the Virtual COM port function must be used instead (no hardware flow control).

Bridge GPIOs

Four GPIO signals are available on CN2 pins 18 and 21. Basic management is provided by the public ST bridge software interface.

8.4.5 LEDs

PWR LED: red light indicates that 5 V is enabled.

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

FAULT LED: Indicates USB overcurrent request.

9 Board connectors

9.1 Connectors

Per convention, please refer to [Table 3](#) for I/O Type definition:

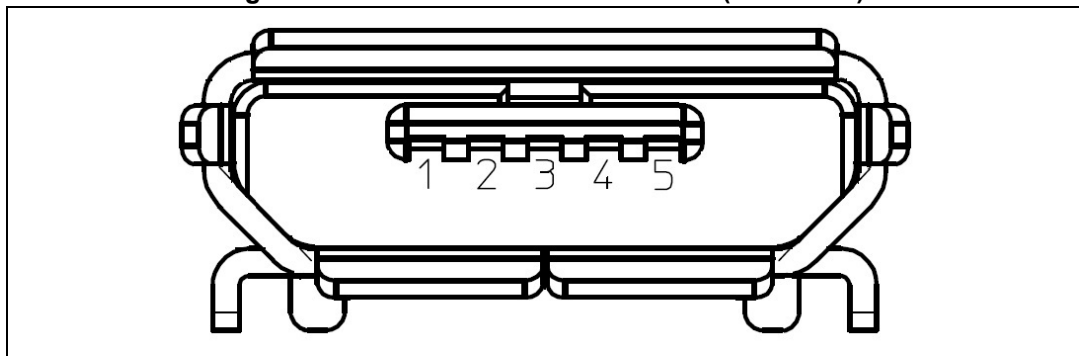
Table 3. I/O type definition

Type	Definition
S	Supply pin
I	Input only pin
O	Output only pin
I/O	Input/Output pin

9.1.1 USB Micro-B

The USB connector CN5 is used to connect the embedded STLINK-V3MODS or STLINK-V3MINI to the PC.

Figure 10. USB Micro-B connector CN1 (front view)



The related pinout for the USB ST-LINK connector is listed in [Table 4](#).

Table 4. 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
4	ID	-
5	GND	GND

9.1.2 32-pin edge connector for STLINK-V3MODS (STM32 JTAG/SWD, VCP and bridges)

Table 5. 32-pin edge connector for STLINK-V3MODS

Side	Pin #	Pin description	Type
LEFT	1	Bridge UART RX ⁽¹⁾	I
	2	Bridge UART CTS	I
	3	Bridge UART RTS	O
	4	T_JTMS/T_SWDIO	O
	5	GNDDetect ⁽²⁾	I
	6	T_JTDO/T_SWO ⁽³⁾	I
	7	Bridge SPI CLK	I/O
	8	GND	S
	9	Bridge CAN RX ⁽¹⁾	I
	10	Bridge CAN TX ⁽⁴⁾	O
	11	Bridge UART TX ⁽⁴⁾	O
	12	T_VCP_TX	I
	13	T_JCLK/T_SWCLK	O
	14	Bridge SPI NSS	I/O
	15	T_VCP_RX	O
	16	Bridge I2C SCL	O
RIGHT	17	Bridge I2C SDA	I/O
	18	Bridge GPIO0	I/O
	19	Bridge GPIO1	I/O
	20	Bridge GPIO2	I/O
	21	Bridge GPIO3	I/O
	22	Reserved ⁽⁵⁾	-
	23	Bridge SPI MISO	I/O
	24	GND	S
	25	Bridge SPI MOSI	I/O
	26	GND	S
	27	GND	S
	28	T_JTDI/NC ⁽⁶⁾	O
	29	GND	S
	30	T_VCC ⁽⁷⁾	I
	31	T_NRST	O
	32	T_SW_DIR	O

1. RX signals are inputs for STLINK-V3MODS, outputs for target.

2. Connect to GND on target, may be used by STLINK-V3MODS for detection of connection.
3. SWO is optional, required only for Serial Wire Viewer (SWV) trace.
4. TX signals are outputs for STLINK-V3MODS, inputs for target.
5. Do not connect on target.
6. NC means not required for SWD connection.
7. Input for STLINK-V3MODS.

9.1.3 STDC14 for STLINK-V3MINI (STM32 JTAG/SWD and VCP)

The STDC14 CN5 connector allows the connection to a STM32 target by means of 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 CN5

STDC14 Pin #	ARM10 Pin #	Pin description	Type
1	-	Reserved ⁽¹⁾	-
2	-	Reserved ⁽¹⁾	-
3	1	T_VCC ⁽²⁾	I
4	2	T_JTMS/T_SWDIO	O
5	3	GND	S
6	4	T_JCLK/T_SWCLK	O
7	5	GND	S
8	6	T_JTDO/T_SWO ⁽³⁾	I
9	7	T_JCLK	O
10	8	T_JTDI/NC ⁽⁴⁾	O
11	9	GNDDetect ⁽⁵⁾	I
12	10	T_NRST	O
13	-	T_VCP_RX	O
14	-	T_VCP_TX	I

1. Do not connect on target.
2. Input for STLINK-V3MINI.
3. SWO is optional, required only for Serial Wire Viewer (SWV) trace.
4. NC means not required for SWD connection.
5. Connect to GND on target, may be used by STLINK-V3MINI for detection of connection.

10 Software configuration

10.1 Supporting toolchains (not exhaustive)

[Table 7](#) gives a list of the first toolchain version supporting the STLINK-V3MODS and STLINK-V3MINI products.

Table 7. Toolchain versions supporting STLINK-V3MODS and STLINK-V3MINI

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

Note: Some of the very first toolchain versions supporting the STLINK-V3MODS and STLINK-V3MINI (in runtime) might not install the complete USB driver for STLINK-V3MODS and STLINK-V3MINI (especially the STLINK-V3MODS bridge USB interface description might miss). In that case, either use a more recent version of the toolchain, or update the STLINK-V3MINI driver from www.st.com (see [Section 10.2](#)).

10.2 Drivers and firmware upgrade

The STLINK-V3MODS and STLINK-V3MINI require drivers to be installed on Windows, and embed a firmware which needs to be updated from time to time in order to benefit from new functionality or corrections. Refer to the *Overview of ST-LINK derivatives* technical note (TN1235) for details.

10.3 STLINK-V3MODS and STLINK-V3MINI frequency selection

The STLINK-V3MODS and STLINK-V3MINI run internally at three different frequencies:

- high-performance frequency
- standard frequency, compromising between performance and consumption
- low-consumption frequency

By default, the STLINK-V3MODS and STLINK-V3MINI start in high-performance frequency. It is the responsibility of the toolchain provider to propose or not the frequency selection at user's level.

10.4 Mass storage interface

The STLINK-V3MODS and STLINK-V3MINI implement a virtual mass storage interface allowing the programming of an STM32 target flash memory with drag-and-drop action of a binary file from a file explorer. This ability requires the STLINK-V3MODS and STLINK-

V3MINI to identify the connected target before enumerating on the USB host. As a consequence, this functionality is available only if the target is connected to the STLINK-V3MODS and STLINK-V3MINI.

10.5 Bridge interface

The STLINK-V3MODS implements a USB interface dedicated to bridge functions from USB to SPI/I²C/CAN/UART/GPIOs of ST microcontroller target. This interface is firstly used by STM32CubeProgrammer in order to allow target programming through SPI/I²C/CAN bootloader.

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

11 STLINK-V3MODS and STLINK-V3MINI product revision history and limitations

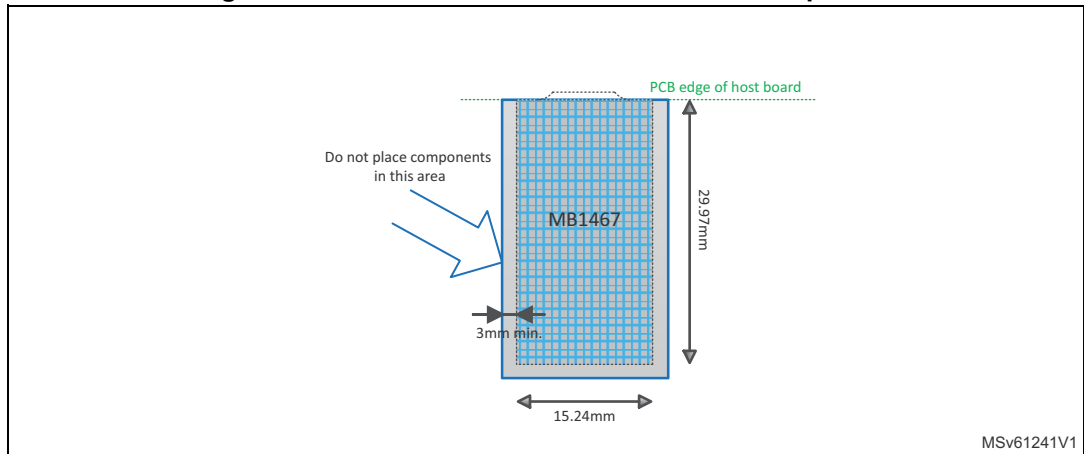
[Table 8](#) presents the history and limitations of the product.

Table 8. STLINK-V3MODS and STLINK-V3MINI product revision history and limitations

Product finish good	Product version	Board	Version	Revision details	Known limitations
LKV3MODS\$AT1	1	MB1467	B-01	-	-
LKV3MINI\$AT1	1	MB1467	B-01	-	-

Appendix A STLINK-V3MODS recommended land pattern

Figure 11. STLINK-V3MODS recommended land pattern



Appendix B Federal Communications Commission (FCC) and Industry Canada (IC) Compliance Statements

B.1 FCC Compliance Statement

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 A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

Responsible party (in the USA)

Terry Blanchard
Americas Region Legal | Group Vice President and Regional Legal Counsel, The Americas
STMicroelectronics, Inc.
750 Canyon Drive | Suite 300 | Coppell, Texas 75019
USA
Tel: +1 972-466-7845

B.2 IC Compliance Statement

This device complies with FCC and Industry Canada RF radiation exposure limits set forth for general population for mobile application (uncontrolled exposure). This device must not be collocated or operating in conjunction with any other antenna or transmitter.

Compliance Statement

Notice: This device complies with Industry Canada licence-exempt RSS standard(s). Operation is subject to the following two conditions: (1) this device may not cause interference, and (2) this device must accept any interference, including interference that may cause undesired operation of the device.

Industry Canada ICES-003 Compliance Label: CAN ICES-3 (A)/NMB-3(A).

Déclaration de conformité

Avis: Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes: (1) l'appareil ne doit pas produire de brouillage, et (2) l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

Étiquette de conformité à la NMB-003 d'Industrie Canada: CAN ICES-3 (A)/NMB-3(A).

Revision history

Table 9. Document revision history

Date	Revision	Changes
11-Apr-2019	1	Initial release.

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