

## Introduction

The ST-LINK is an in-circuit debugger and programmer for the STM8 and STM32 microcontroller families.

The SWIM and JTAG/SWD interface is used to communicate with the STM8 or STM32 microcontroller located on your own application board.

On the PC side, the USB full speed interface is used to communicate with:

- ST Visual Develop (STVD) or ST Visual Program (STVP) software from STMicroelectronics for the STM8,
- ATOLLIC, IAR and KEIL Integrated Development Environments for the STM32.

**Figure 1. ST-LINK**



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# 1 Overview

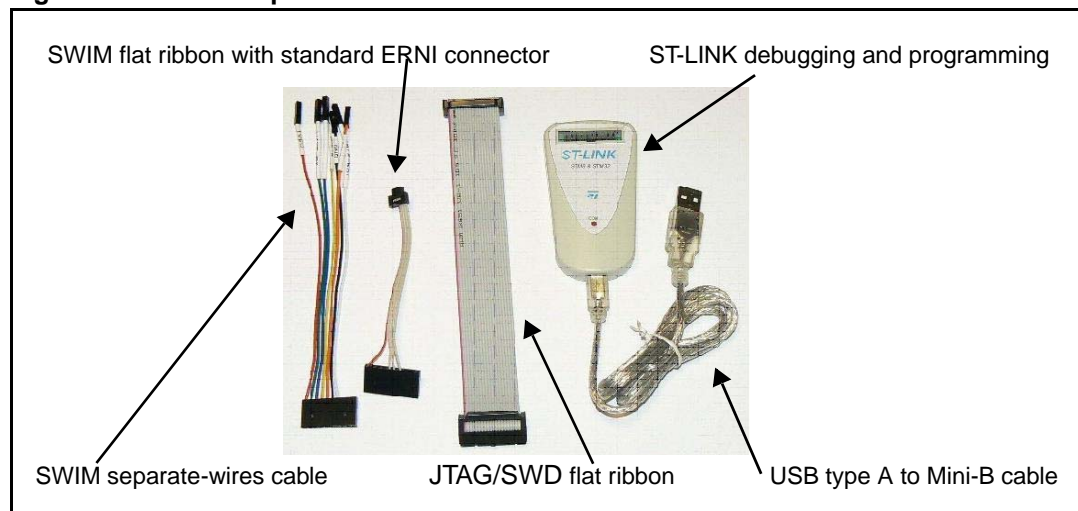
## 1.1 Features

- 5 V power supplied by USB connector.
- USB 2.0 full speed interface compatible.
- USB standard A to Mini-B cable provided.
- SWIM specific features:
  - 1.65 V to 5.5 V application voltage supported on SWIM interface.
  - SWIM low speed and high speed modes supported.
  - SWIM programming speed rate:  
9.7 Kbytes/s in low speed,  
12.8 Kbytes/s in high speed.
  - SWIM cable for connection to an application with an ERNI standard connector vertical (ref: 284697 or 214017) or horizontal (ref: 214012).
  - SWIM cable for connection to an application with pin headers or 2.54 mm pitch connector.
- JTAG/SWD specific features:
  - 3 V to 3.6 V application voltage supported on JTAG/SWD interface and 5 V tolerant inputs.
  - JTAG/SWD cable provided for connection to a standard JTAG 20-pin pitch 2.54 mm connector.
- Direct firmware update feature supported (DFU).
- Status LED which blinks during communication with PC.
- Operating temperature 0 to 50 °C.

## 1.2 Product contents

*Figure 2* shows the ST-LINK and the various cables delivered with the product.

**Figure 2. ST-LINK product contents**



## 2 Hardware layout and configuration

The ST-LINK is designed around the STM32F103C8 (ARM Cortex M3 controller in a TQFP48 package).

As illustrated in [Figure 3](#) the same connector is used for a SWIM, JTAG or SWD interface according to the cable connected to it.

**Figure 3. ST-LINK layout**



### 2.1 Connection with STM8 applications

For STM8 development the ST-LINK can be connected to the target board by two different cables depending on the connector available on your application board.

The target application voltage (VCC) must be in the range 1.63 V to 5.5 V maximum

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**Warning:** Voltages higher than 5.5 V may damage components on the board.

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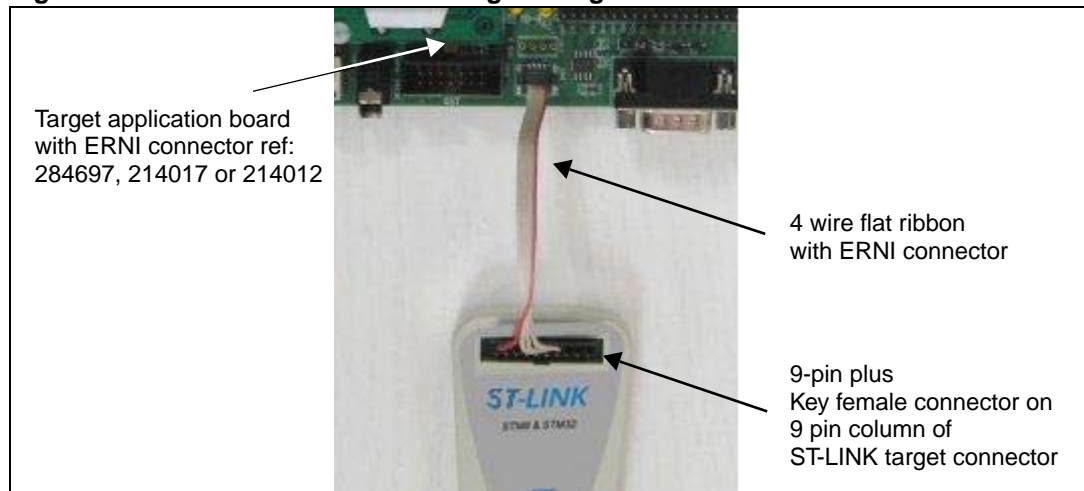
### 2.1.1 SWIM flat ribbon

Figure 4 shows you how to connect the ST-LINK if a standard 4-pin SWIM connector is present on your application board. The references of the connectors manufactured by ERNI which must be used on your application board are 284697, 214017 (vertical) or 214012 (horizontal).

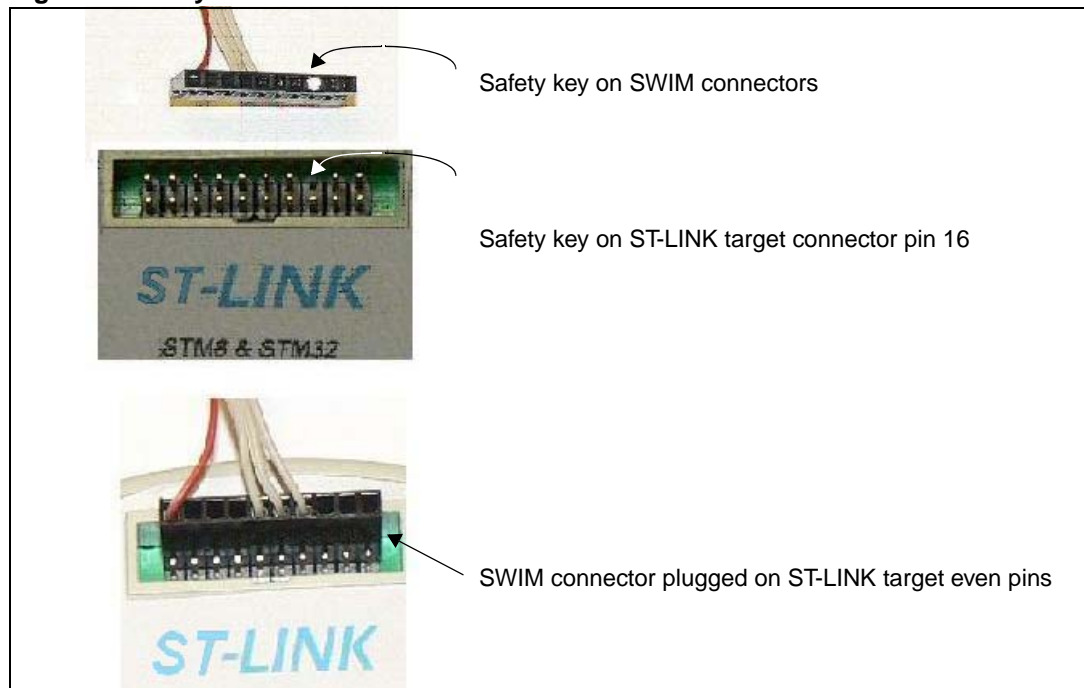
Figure 5 shows that pin 16 is missing on the ST-LINK target connector. This missing pin is used as a safety key on the cable connector to guarantee connection of the SWIM cable in the correct position on the target connector even pins, used for both SWIM and JTAG/SWD cables.

Figure 6 shows a SWIM debugging connector layout on flat ribbon.

**Figure 4. ST-LINK connection to target using a standard SWIM connector**



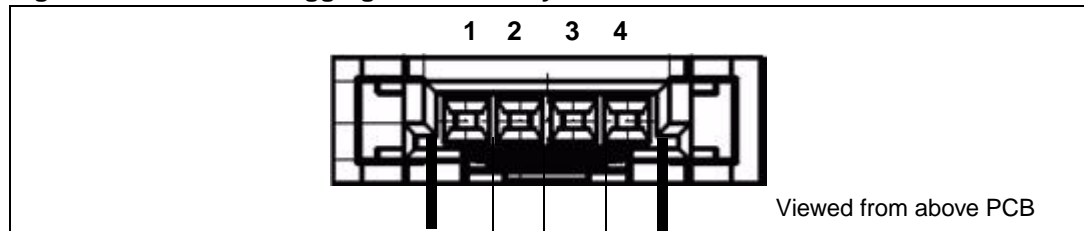
**Figure 5. Key detail on connectors**



**Table 1. SWIM flat ribbon connections**

| Pin N° | Name     | Function   | Target connection |
|--------|----------|------------|-------------------|
| 1      | TVCC     | Target VCC | MCU VCC           |
| 2      | SWIM     | SWIM       | MCU SWIM pin      |
| 3      | GND      | GROUND     | GND               |
| 4      | SWIM-RST | RESET      | MCU RESET pin     |

**Figure 6. SWIM debugging connector layout on flat ribbon**



### 2.1.2 SWIM separate-wires cable

As the SWIM separate-wires cable has independent connectors for all pins on one side, it is possible to connect the ST-LINK to an application board without a standard SWIM connector. On this flat ribbon all signals are referenced by a specific color and a label to ease the connection on target.

*Table 2* summarizes the signals present on this cable and their connection on the target board.

**Table 2. SWIM separate-wires cable connections**

| Color  | Cable pin name | Function   | Target connection                  |
|--------|----------------|------------|------------------------------------|
| Red    | TVCC           | Target VCC | MCU VCC                            |
| Green  | UART-RX        | Unused     | Reserved (not connected on target) |
| Blue   | UART-TX        |            |                                    |
| Yellow | BOOT0          |            |                                    |
| Orange | SWIM           | SWIM       | MCU SWIM pin                       |
| Black  | GND            | GROUND     | GND                                |
| White  | SWIM-RST       | RESET      | MCU RESET pin                      |

TVCC, SWIM, GND and SWIM-RST can be connected to a low cost 2.54 mm pitch connector or to pin headers available on the target board.

BOOT0, UART-TX and UART-RX are reserved for future developments.

*Figure 7* shows an example of connection to a 2.54 mm pitch connector on target. It shows how pin 16 is missing on the ST-LINK target connector. This missing pin is used as a safety key on the cable connector to guarantee connection of the SWIM cable in the right position on the target connector used for both SWIM and JTAG/SWD cables (even pins of the target connector).

Figure 7. SWIM separate-wires cable connector layout

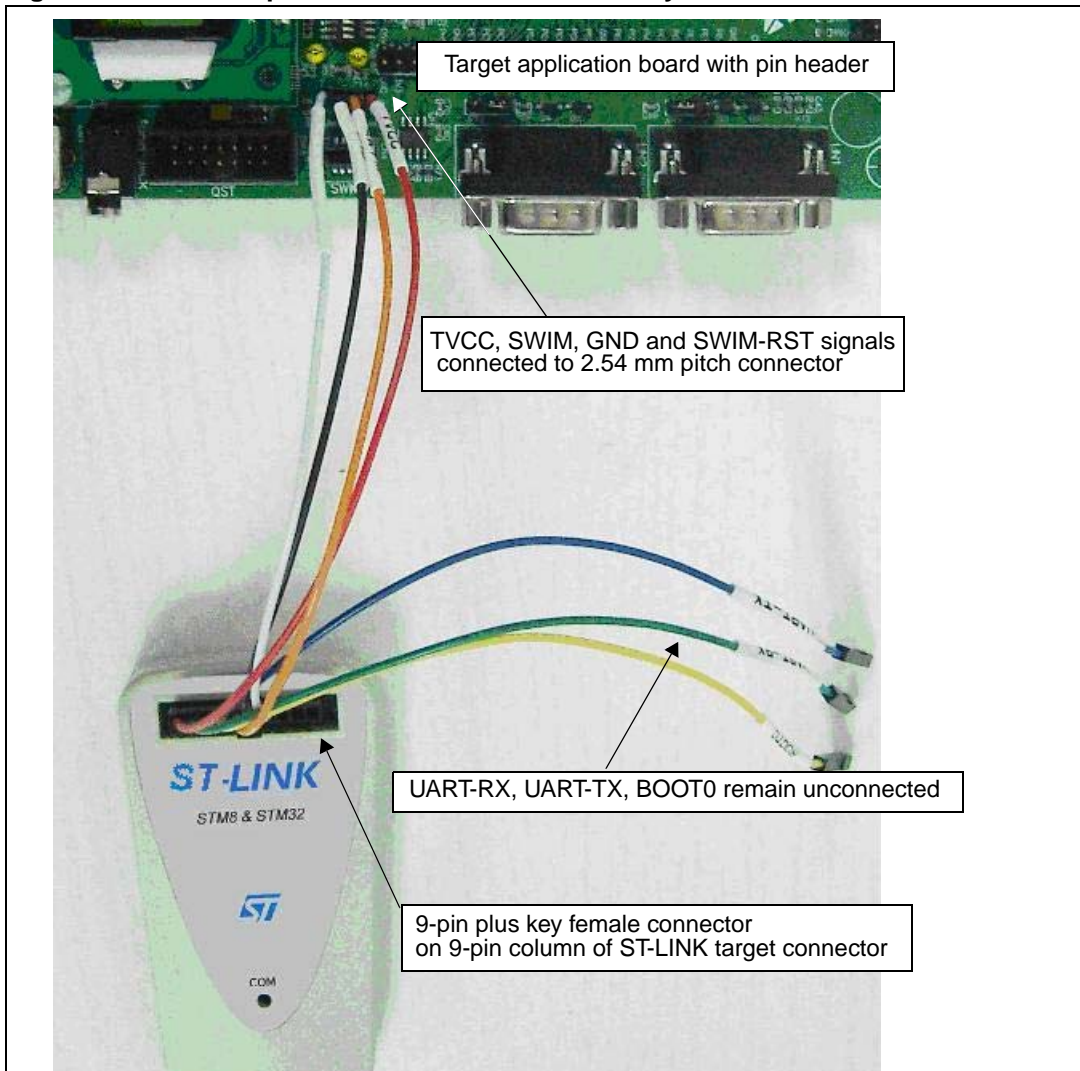
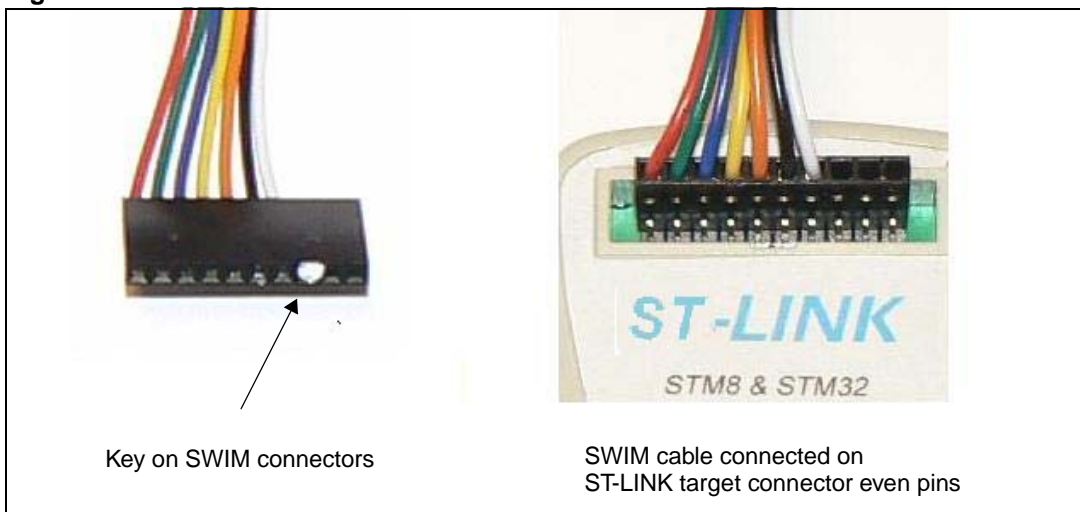


Figure 8. SWIM cable connection detail





## 2.2 Connection with STM32 applications

For STM32 developments the ST-LINK must be connected to the application using the standard 20-pin female-female JTAG flat ribbon provided.

[Table 3](#) summarizes signals names, functions and target connection signals of this cable.

**Table 3. JTAG cable connections**

| Pin N° | Name     | ST-LINK function | Target connection    |
|--------|----------|------------------|----------------------|
| 1      | TVCC     | Target VCC       | MCU VCC              |
| 2      |          |                  |                      |
| 3      | TRST     | GROUND           | GND                  |
| 4      | UART-RX  | Unused           | GND or not connected |
| 5      | TDI      | JTAG TDI         | TDO                  |
| 6      | UART-TX  | Unused           | GND or not connected |
| 7      | TMS      | JTAG TMS, SW IO  | TMS, SWIO            |
| 8      | BOOT0    | Unused           | GND or not connected |
| 9      | TCK      | JTAG TCK, SW CLK | TCK, SWCLK           |
| 10     | SWIM     | Unused           | GND or not connected |
| 11     | NC       | not connected    | not connected        |
| 12     | GND      | GROUND           | GND                  |
| 13     | TDO      | JTAG TDO         | TDI                  |
| 14     | SWIM-RST | Unused           | GND                  |
| 15     | RESET    | RESET            | RESET (optional)     |
| 16     | KEY      | not existing pin | not connected        |
| 17     | NC       | not connected    | not connected        |
| 18     | GND      | GROUND           | GND                  |
| 19     | VDD      | VDD (3.3V)       | not connected        |
| 20     | GND      | GROUND           | GND                  |

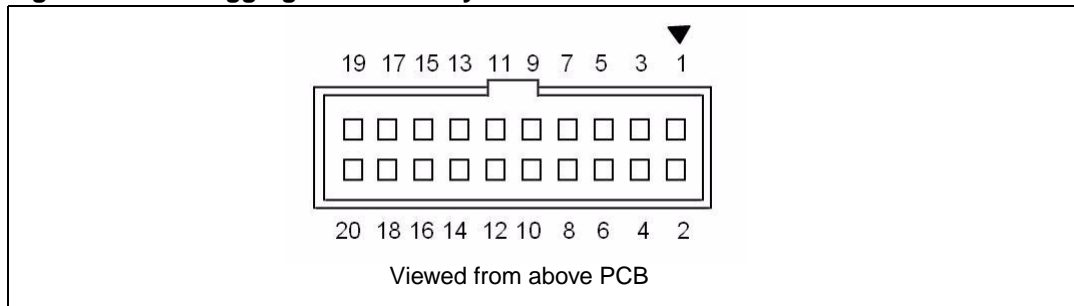
Observe that pin 16 is not present on the ST-LINK target connector in order to ensure connection of SWIM cables on even columns of this connector only.



**Figure 9. JTAG debugging flat ribbon layout**



**Figure 10. Debugging connector layout on ST-LINK and flat cable**



The pinout of the target male connector is given in [Table 3](#).

### 2.3 ST-LINK status

The red LED labelled COM on top of the ST-LINK shows the ST-LINK status (whatever the connection type).

- When the LED is ON; communication between the PC and ST-LINK has been initialized in SWIM or JTAG/SWD mode.
- When the LED is blinking; data is being exchanged between the target and the PC.
- When the LED is OFF; ST-LINK communication with the target has not been initialized.

## 3 Software configuration

### 3.1 For STM8 application development

Please refer to:

- ST Visual Develop (STVD) tool chain  
(ST web URL: <http://www.st.com/mcu/contentid-44-15-STVD.html>).
- ST Visual Programmer (STVP) for programming STM8 Flash microcontrollers  
(ST web URL: <http://www.st.com/mcu/contentid-47-15-STVP.html>).

The ST-LINK is listed in the ST toolchain and programmer environment as a target from STVD 4.1.0 and STVP 3.1.0.

### 3.2 For STM32 application development and Flash programming

Please refer to Atollic, IAR and Keil documentation and web sites.

ST-LINK is listed in Atollic, IAR and Keil integrated development environment as a debugging target from Atollic TrueSTUDIO<sup>®</sup>/STM32 V1.0.0, IAR EWARM 5.30 and Keil ARM MDK 3.30 and more recent versions.

For more information on the third party tools please visit:

- [www.atollic.com](http://www.atollic.com)
- [www.iar.com](http://www.iar.com)
- [www.keil.com](http://www.keil.com)

## Revision history

**Table 4. Document revision history**

| Date        | Revision | Changes   |
|-------------|----------|---|
| 12-Jan-2009 | 1        | Initial release.  |
| 19-Jan-2009 | 2        | Incorrect Rev number on cover page. No other modifications.   |
| 20-Nov-2009 | 3        | Replaced images to reflect new ST-LINK casing.<br>Added third party Atollic and SWD support.<br>Added <a href="#">Section 2.3</a> . |

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