ST-LINK in-circuit debugger/programmer
for STM8 and STM32 microcontrollers

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 STMicroelectronic's for the STM8,

● ATOLLIC, IAR and KEIL Integrated Development Environments for the STM32.

Figure 1.   ST-LINK in-circuit debugger/programmer
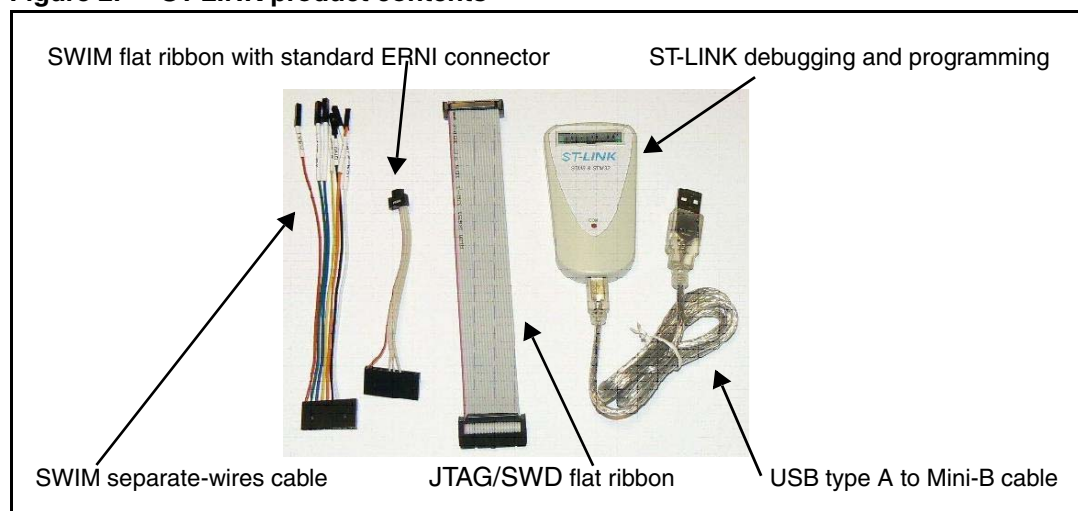
Contents

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

SWIM flat ribbon with standard ERNI connector · ST-LINK debugging and programming · SWIM separate-wires cable · JTAG/SWD flat ribbon · USB type A to Mini-B cable

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

---

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

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.

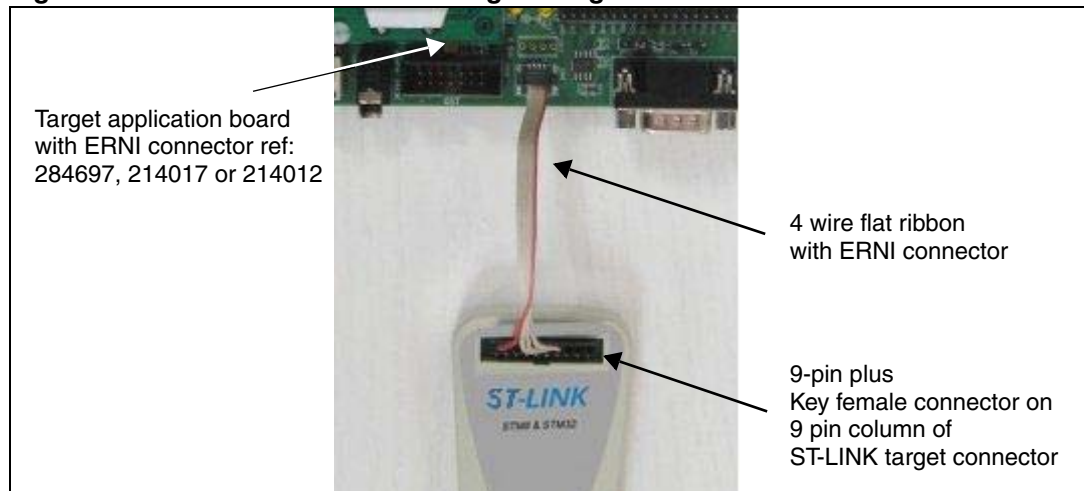**Figure 4.   ST-LINK connection to target using a standard SWIM connector**

Target application board
with ERNI connector ref:
284697, 214017 or 214012

4 wire flat ribbon
with ERNI connector

9-pin plus
Key female connector on
9 pin column of
ST-LINK target connector

Figure 5.   Key detail on connectors

Safety key on SWIM connectors

Safety key on ST-LINK target connector pin 16

SWIM connector plugged on ST-LINK target even pins
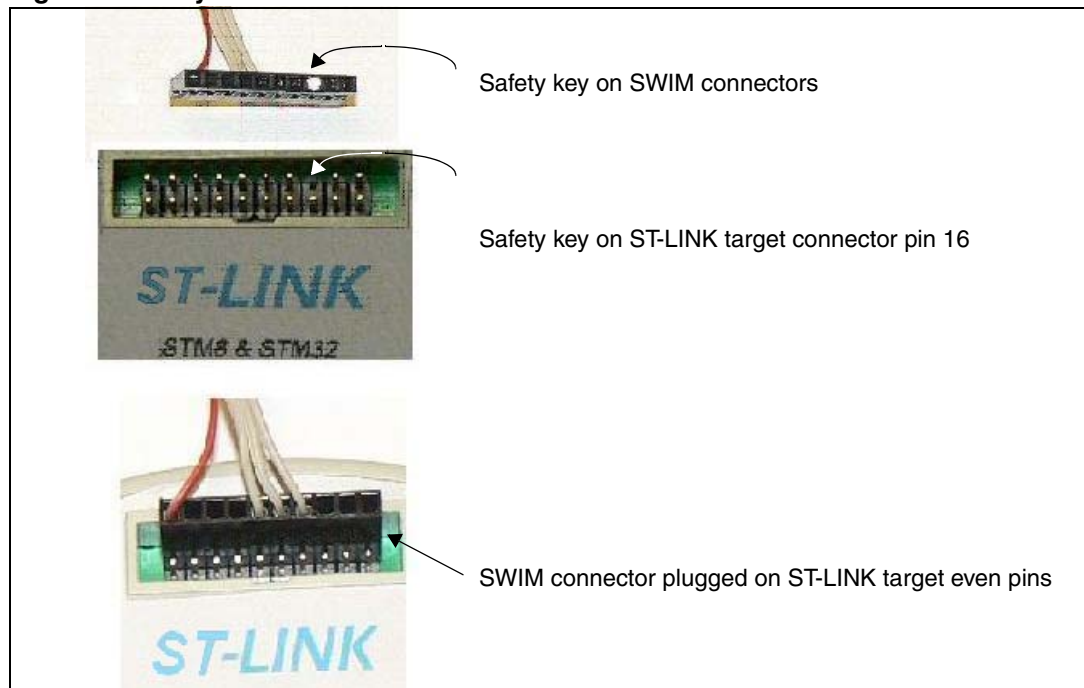
Table 1.   SWIM flat ribbon connections

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

Viewed from above PCB
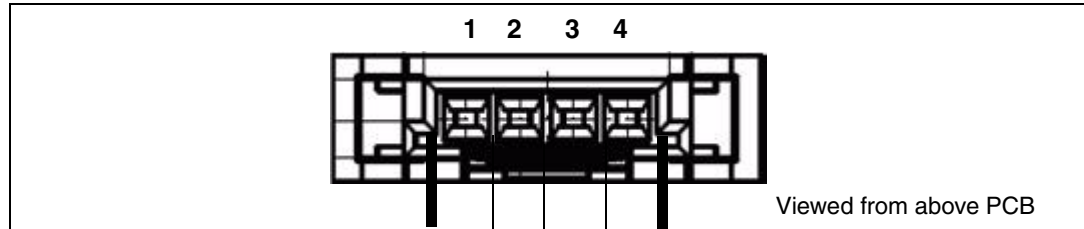
2.1.2   SWIM separate-wires cable

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		
Blue	UART-TX	Unused	Reserved (not connected on target)
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).

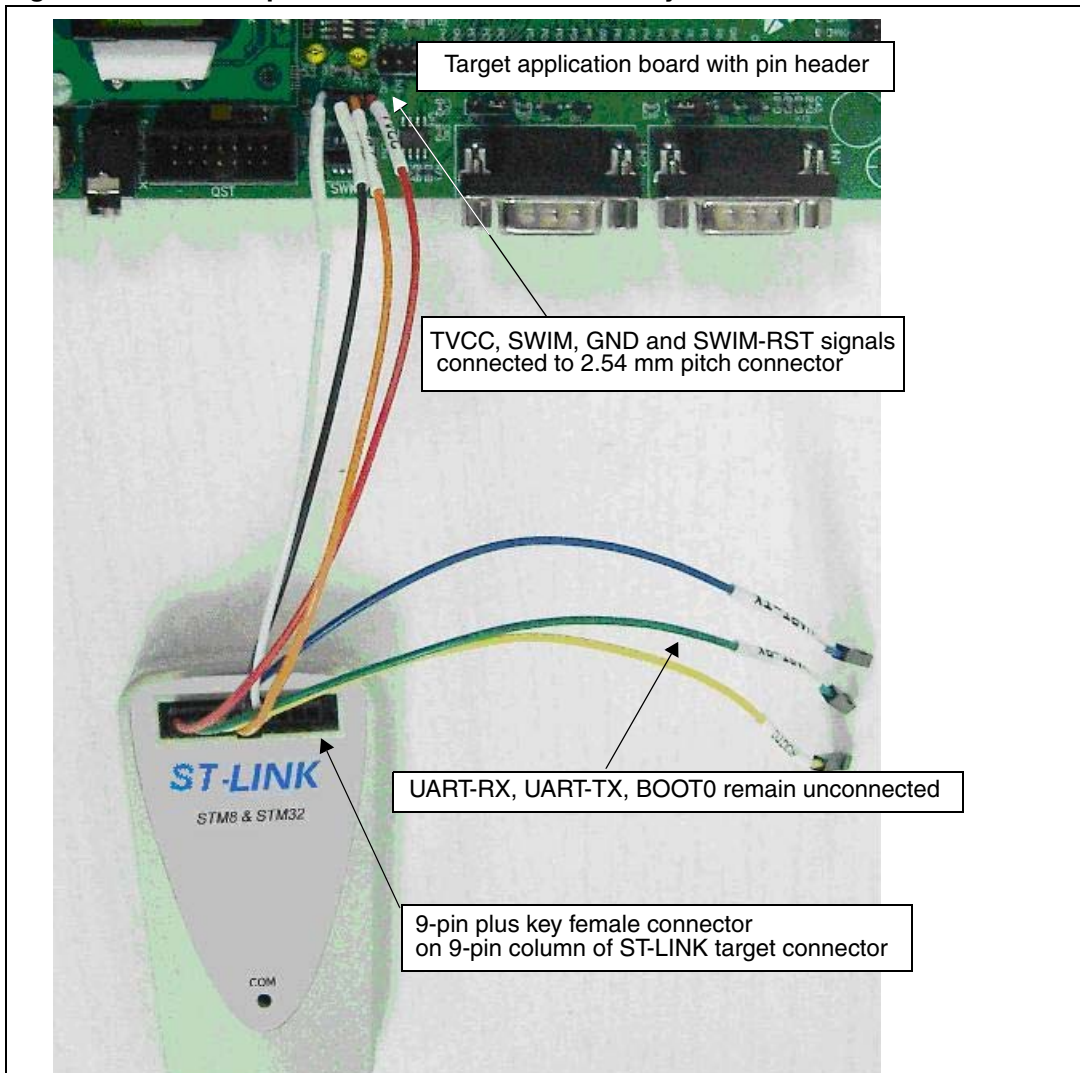**Figure 7.   SWIM separate-wires cable connector layout**

Target application board with pin header

TVCC, SWIM, GND and SWIM-RST signals connected to 2.54 mm pitch connector

UART-RX, UART-TX, BOOT0 remain unconnected

9-pin plus key female connector on 9-pin column of ST-LINK target connector

Figure 8.   SWIM cable connection detail

Key on SWIM connectors

SWIM cable connected on ST-LINK target connector even pins
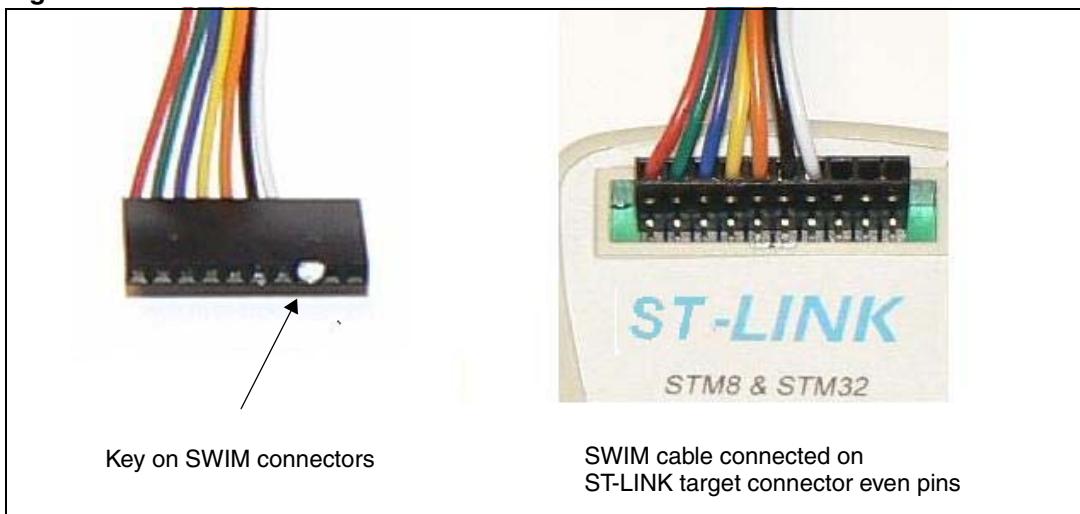
2.2 Connection with STM32 applications

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 TDO, SWO	TDI
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 TDI	TDO
14	SWIM-RST	Unused	GND
15	RESET	RESET	RESET (optional)
16	KEY	No 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

Target application board

20-pin female JTAG/SWD connector
of flat ribbon on target

20-wire JTAG/SWD flat ribbon

20-pin female connector for flat ribbon on ST-LINK
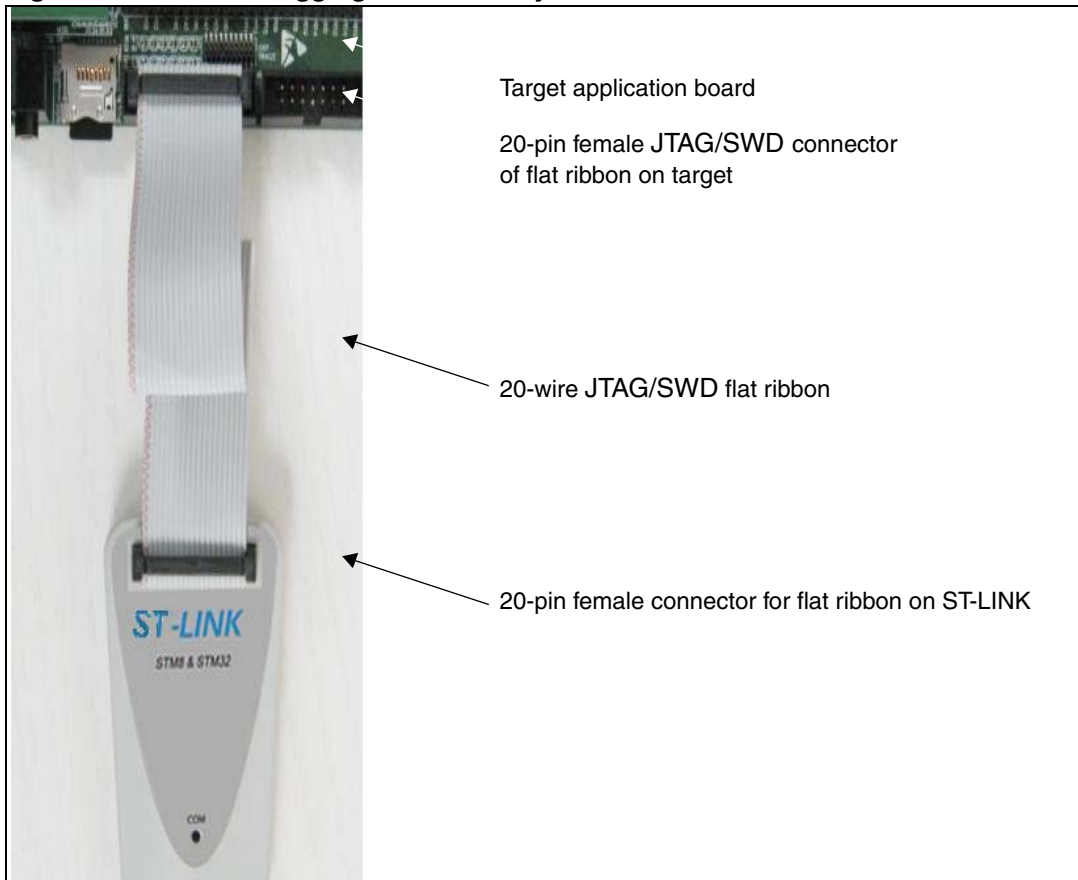
Figure 10.   Debugging connector layout on ST-LINK and flat cable
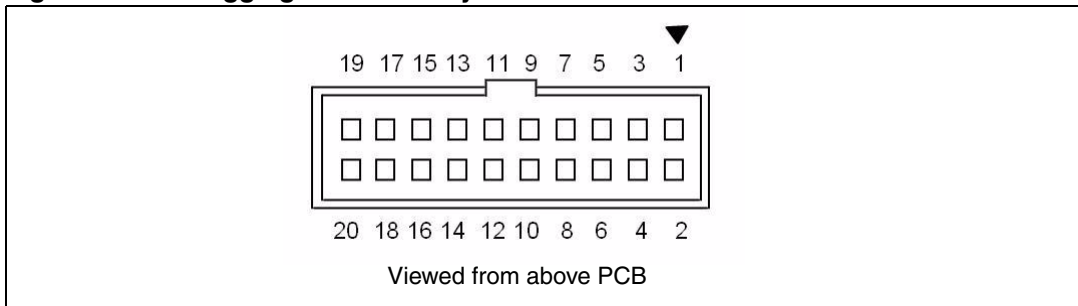
The pinout of the target male connector is given in *Table 3*.

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 USB driver on Windows XP

On Windows XP, ST-LINK requires the WinUSB driver to be installed. If the toolset installed it automatically, the file *winusb.dll* is present in the WINSYSDIR directory (typically *C:\Windows\system32*).

If the toolset setup did not install it automatically, the driver can be found on www.st.com:

1. Connect to www.st.com.
2. In the search tab, part number field, look for ST-LINK.
3. Click on the Generic Part Number column's hyperlink to ST-LINK.
4. In the Design support tab, SW DRIVERS section, click on the icon to download *st-link_usbdriver.zip*.
5. Unzip and run *ST-Link_USBdriver.exe*.

3.2 For STM8 application development

Please refer to:

● ST Visual Develop (STVD) tool chain
● ST Visual Programmer (STVP) for programming STM8 Flash microcontrollers

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.

3.3 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®/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
● www.iar.com
● www.keil.com

4 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. Added third party Atollic and SWD support. Added *Section 2.3*.
27-Apr-2011	4	Updated *Table 3: JTAG cable connections*
04-Oct-2011	5	Added *Section 3.1*

Please Read Carefully: