STice advanced emulation system
for ST microcontrollers

Introduction

Thank you for choosing STMicroelectronics for your microcontroller application.

The STice is the advanced in-circuit emulation system from STMicroelectronics. Its advanced debugging features in emulation configuration are complemented by an additional in-circuit programming/debugging configuration, code coverage and profiling, extensive trace capabilities and configurable advanced breakpoints, to make it the ideal tool for start-to-finish support of microcontroller application development.

The STice is a modular emulation system made up of a main emulation board (MEB) that provides interface and emulation resources common to all emulated MCU families and a STice (TEB) that provides the emulation resources for a specific family of microcontrollers. It may also include a peripheral emulation board (PEB) that provides emulation resources specific to an emulated peripheral for a microcontroller family.

The STice includes all the emulation boards that you need to emulate in real time any microcontroller in a given family, while the systems' modularity provides unprecedented capability to adapt the STice to emulate new microcontroller families.

Table 1.   Device summary

Part number[1]	Contents
STice CB-STice	STice emulation system
CF/Stice_Connect CB-CF/FPxxx	Connection flex
AD/Stice_Connect CB-AD/xxxxx-xxx CB-AD-ICD/ICP	Connection adapter for target device package or SWIM connector
AS/Stice_Connect CB-AS/xxxxxx	Adapter socket

1. Part numbers with the CB prefix are now **obsolete**.

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1 Introduction

1.1 STice in emulation configuration

In emulation configuration, the STice connects to your PC through a USB interface, and to your application board in place of your target microcontroller using:

● Connection flex (CF/Stice_Connect) – flexible cable (60 or 120 pins depending on the target MCU) that relays signals from the STice to your application board.

● Connection adapter (AD/Stice_Connect) – adapts the connection flex to the target microcontroller footprint or the SWIM connector on your application board.

● Adapter socket (AS/Stice_Connect) – socket that solders to your application board in place of your MCU and receives the connection adapter.

These accessories are not included with the STice emulation system. To determine exactly what you need to order for any supported microcontroller, refer to the online product selector on the microcontroller support web site on *www.st.com*.

Figure 1.   STice in emulation configuration

Free ST toolset
STVD and STVP running on your PC drive STice

1. STice
includes all emulation resources, MEB, TEB, and PEB

2. CF/Stice_Connect
Connection flex to connect to application board

3. AD/Stice_Connect
Connection adapter to adapt connection cable to MCU

4. **AS/Stice_Connect**
Adapter socket on application board to plug in emulator in place of MCU
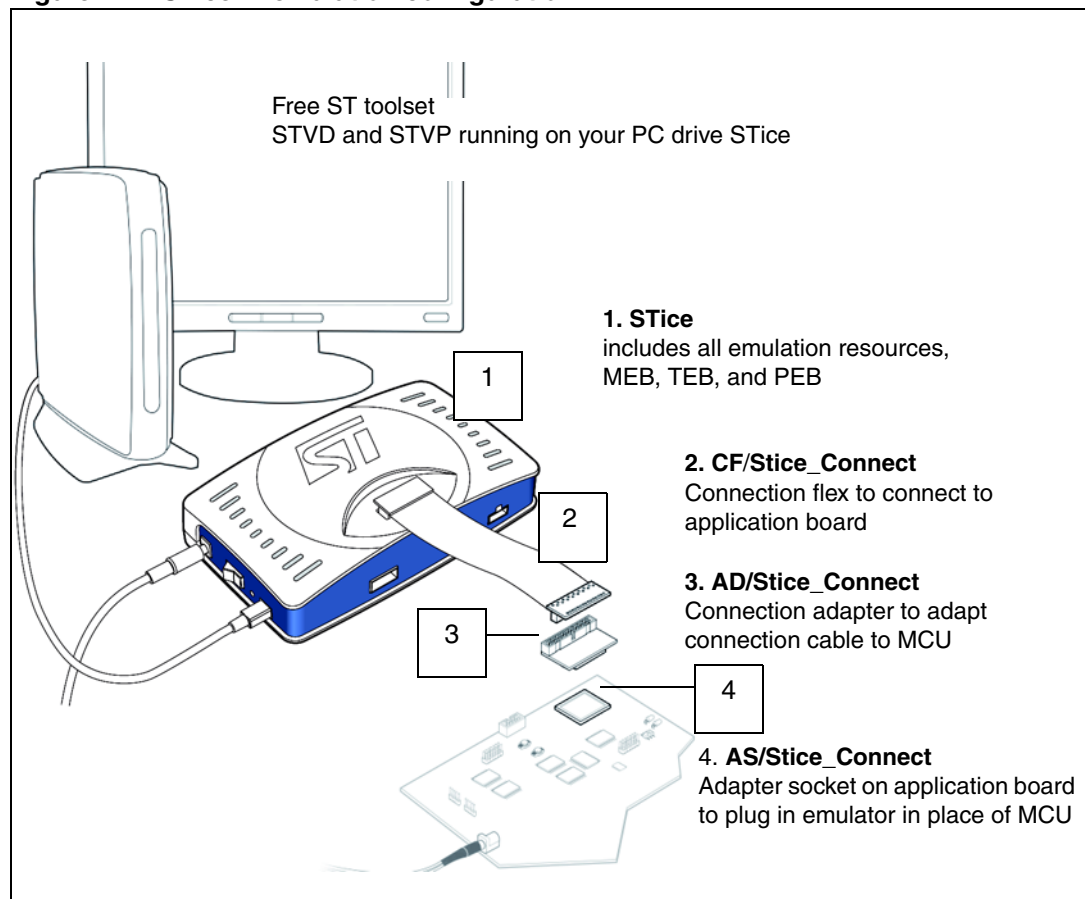
1.2 STice in in-circuit debugging/programming configuration

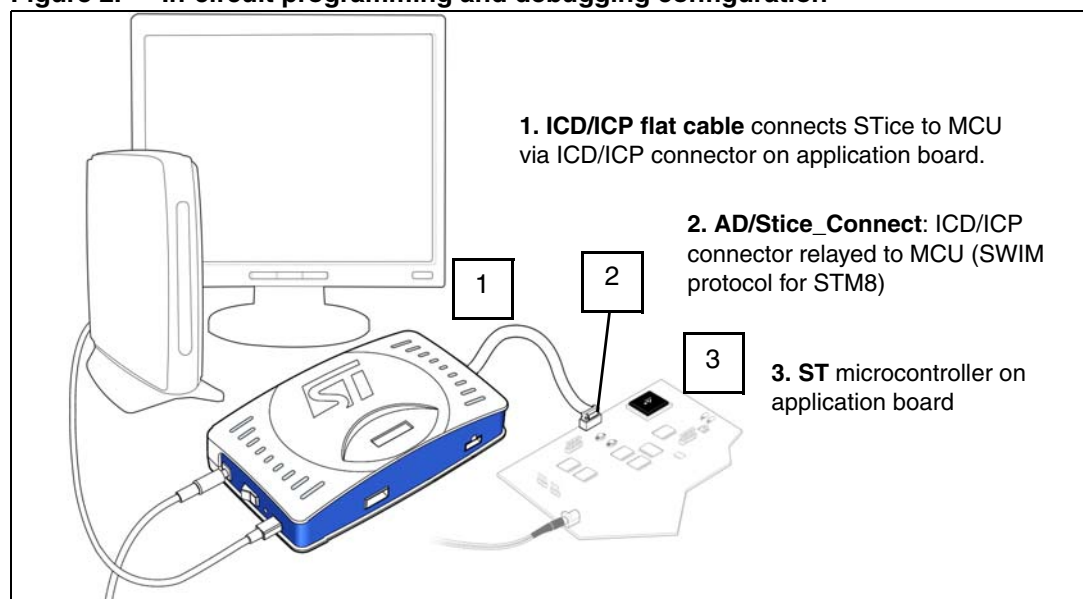In the in-circuit debugging/programming configuration, STice allows you to program your application to your microcontroller and debug the application while it runs on the MCU on your application board. Using STice, you can in-circuit program and debug a wide range of microcontrollers. It supports the single wire interface module (SWIM) protocol for STM8.

In both the emulation and the in-circuit programming/debugging configuration, STice is driven by the ST Visual Develop (STVD) integrated development environment running on your host PC, which provides total control of advanced application building, debugging and programming features from a single easy-to-use interface.

To use STice in ICD/ICP configuration, you need to buy the AD-ICD/ICP adapter kit (see *Table 3 on page 9*).

Figure 2.   In-circuit programming and debugging configuration

1. ICD/ICP flat cable connects STice to MCU via ICD/ICP connector on application board.

2. AD/Stice_Connect: ICD/ICP connector relayed to MCU (SWIM protocol for STM8)

3. ST microcontroller on application board

1.3 About the user manuals

This manual helps you set up your emulator and connect it to your PC. It contains:

● Quick setup instructions for the emulation and the in-circuit programming/debugging configurations
● A detailed description of product features

For information about other hardware and the software intended for use with your emulator, refer to the following documents:

● STice Connection Accessories User Guide – for instructions regarding the connection accessories for connecting your emulator to your application board
● ST Visual Develop (STVD) on-line help – building and debugging your application
● ST Visual Programmer (STVP) on-line help – programming your application to your microcontroller
● Microcontroller Datasheet – for microcontroller specific information

2 Getting started

Your STice can be configured for emulation, as well as in-circuit debugging and programming of your microcontroller. To help you get started, the following sections provide:
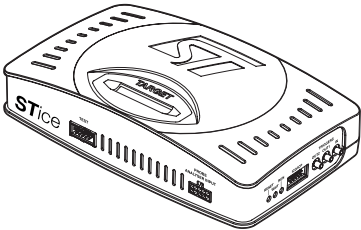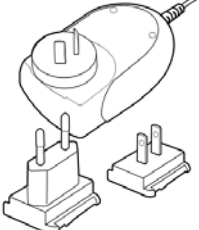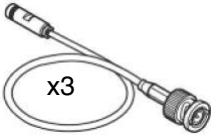
● *Section 2.1* – a checklist of components included with your emulator
● *Section 2.2* – quick set up instructions for the emulation configuration
● *Section 2.3* – quick set up instructions for the in-circuit programming/debugging configuration

2.1 Delivery check list

Your STice emulation system comes with (refer to *Table 2*):

1. STice main unit containing the main emulation board and target emulation board. It will also contain a peripheral emulation board if required for your microcontroller.
2. DC power supply for your emulator.
3. Three trigger cables.
4. 10-wire, analyzer-input cable.
5. USB cable for emulator-PC connection (mini USB2) standard A to mini-B plug.
6. Microcontroller Development Tools CD-ROM: all the software you need to run STice, including STVD integrated development environment + STVP programming interface.
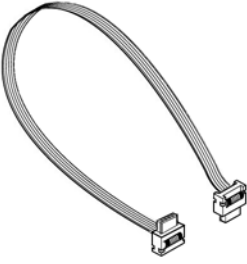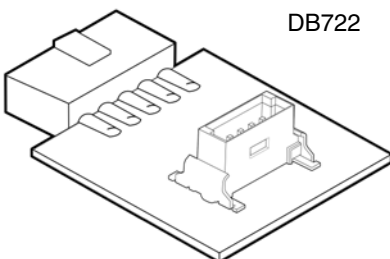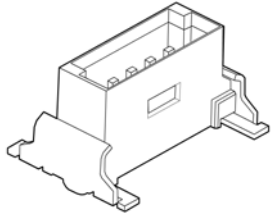
Table 2.   Parts delivered with the STice (not to scale)

The following accessories are provided in the AD-ICD/ICP kit (ICD adapter for the STice) which must be ordered separately (refer to *Table 3*):

1. Flat cable for SWIM programming/debugging for an STM8 microcontroller (CA112, ERNI reference 839032).

2. 30 cm 10-wire HE10 flat cable (CA058).

3. Connectors for SWIM cable: (a) connection board for connecting to the STice (DB722), and (b) ERNI connector (ERNI reference 214017) for connecting to application board.

Table 3.   AD-ICD/ICP parts to be ordered separately (not to scale)

The following connection accessories are also ordered separately.

● **Connection flex** (CF/Stice_Connect)

● **Connection adapter** (AD/Stice_Connect)

● **Adapter socket** (AS/Stice_Connect)

The online product selector on the microcontroller support site on *www.st.com* indicates exactly what to order for your MCU.

2.2 Quick setup for emulation configuration

Figure 3. Connection for emulation
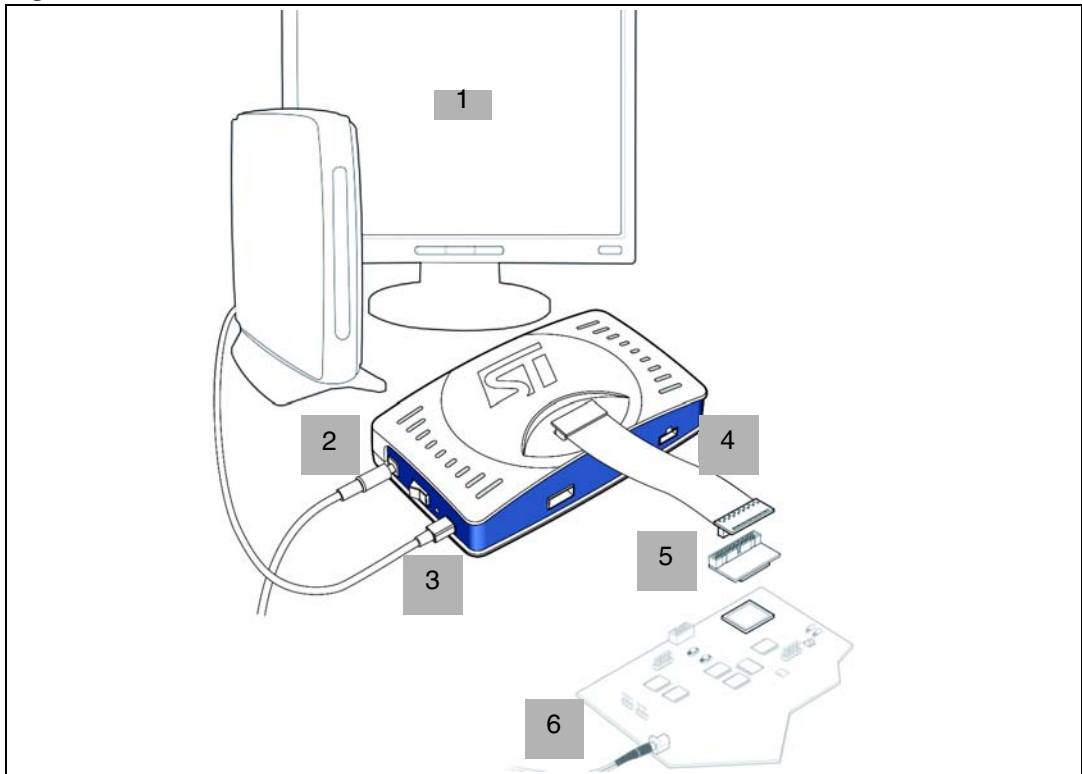
1. Install STVD on your host PC from the provided CD-ROM.
2. Check the STice power switch is off, then connect the power supply.
3. Connect the USB cable to your STice and to your host PC. Your PC automatically identifies the new hardware when the STice is powered on.
4. Plug the connection flex into the target port on your STice and into the connection adapter.
5. Plug the connection adapter into the adapter socket on your application board in place of your microcontroller.
6. Connect your application board's power supply.
7. Power up your STice then your application board.

Caution: Never have your application board powered on while the STice is powered off. This can cause serious damage to the STice.

2.3   Quick setup for in-circuit programming/debugging

Figure 4.   **Connection for ICD/ICP**
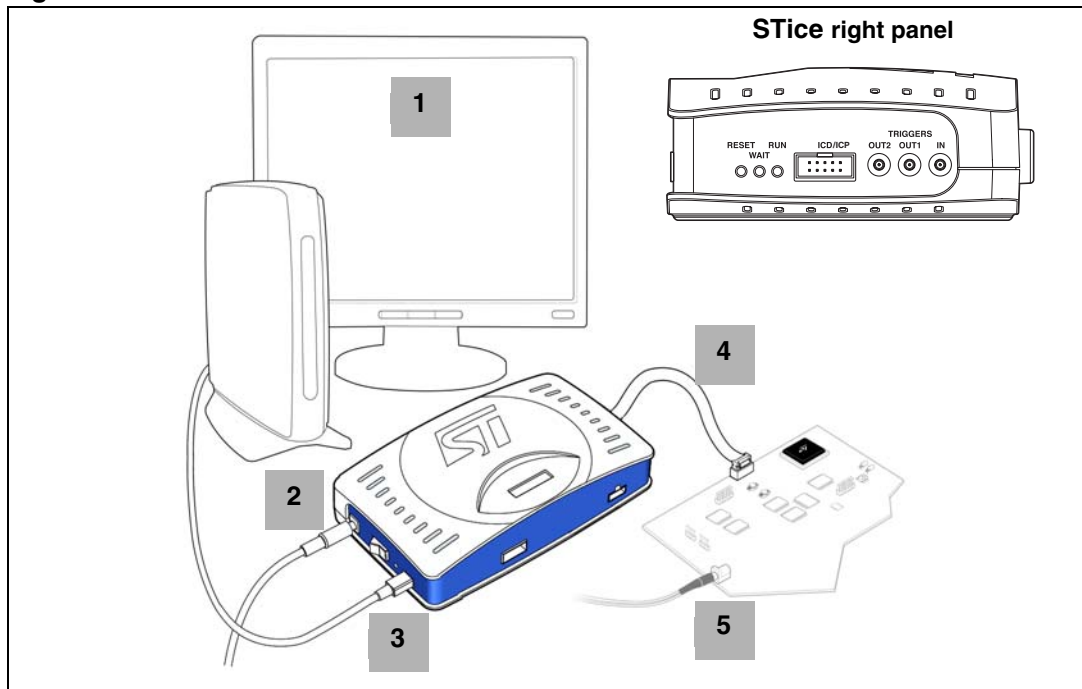
1.   Install STVD on your host PC from the provided CD-ROM.
2.   Check the STice power switch is off, then connect the power supply.
3.   Connect the USB cable to STice and to your host PC. Your PC automatically identifies the new hardware when the STice is powered on.
4.   For an STM8 microcontroller using the SWIM protocol:
   a)   Connect the SWIM connector board to the STice ICD/ICP port.
   b)   Connect the SWIM cable to the SWIM connector board.
   c)   Connect the SWIM cable to the ERNI connector on the application board where your microcontroller is installed. Information about the SWIM connection for ICD/ICP is provided in *Section 4.2 on page 19*.
5.   Connect your application board's power supply.
6.   Power up your emulator, then your application board.

3 Emulation configuration

In the emulation configuration, STice provides you with a full range of emulation features to make debugging and fine tuning your application fast and easy. The following sections provide information about the emulation configuration, including descriptions of:

● *Section 3.1* – supported emulation features
● *Section 3.2* – emulator characteristics
● *Section 3.4* – firmware updating
● *Section 3.4* – product limitations and discrepancies

3.1 Supported emulation features

● Application profiling for execution time or number of executions at instruction, source code or function level.
● Coverage analysis on **code** (at instruction, source code and function levels) or **data** (for memory locations or variables) for the entire memory space.
● **Advanced breakpoints** based on a 4-level logical sequencer that allows you to perform specific actions upon the occurrence of an event or series of events. Advanced breakpoint functionality provides flexibility of use, permits simple or multi-level breakpoint conditions, control of trace recording and triggering of output signals.
● Full access to entire microcontroller memory. Read/write privileges on the entire data memory space. The granularity of memory mapping is 1 byte.
● 128K x 288-bit real-time trace (address, data and control buses).
● **Read/write on the fly** feature allows you to non-intrusively read or write to the entire data memory (except hardware registers) while executing your application.
● 9 external input triggers, which are recorded in the trace and can be used as signal events in the advanced breakpoints. Input triggers include:
  – An input trigger via SUB-click connector
  – 8 input triggers on analyzer input
● 2 output triggers via SUB-click connectors.
● Programmable internal CPU clock with frequency up to 50 MHz, depending on your microcontroller (refer to your microcontroller's datasheet).
● Easily upgradable – STice PLDs and firmware are updated automatically by STVD.
● 1.65 to 5.5 V operating voltage, depending on your microcontroller (See *Section 3.2.5: Application power supply follower on page 16*).
● USB 2.0 connection to the host PC supporting high-speed data transmission.

3.2 Emulator characteristics

The STice is a common hardware target interface and emulator for a range of STM8 microcontrollers. It provides the connection ports (USB, emulator to target, triggers, analyzer input, etc.) and contains all active communication and emulation resources. The following sections provide a description of the emulator features.

Figure 5.   STice
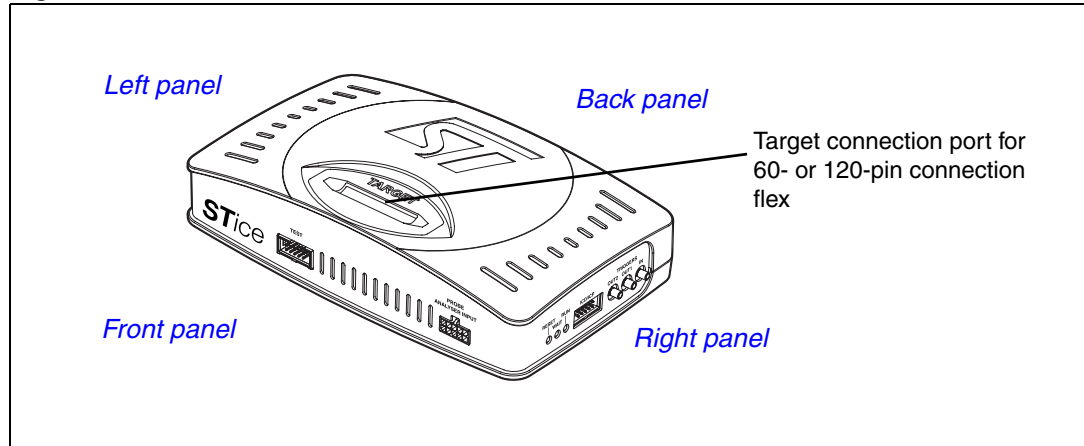
The target connection port on top of the STice connects to the connection flex, which relays the emulator to your application board.

The modularity of the STice allows upgrades in order to support new microcontroller families. More information about available target emulation and peripheral emulations boards is available on the microcontroller product selector.

3.2.1   Physical characteristics

Left panel

● *Power supply* connector
● On/off switch
● Power LED
● USB connector

Figure 6.   Left side panel
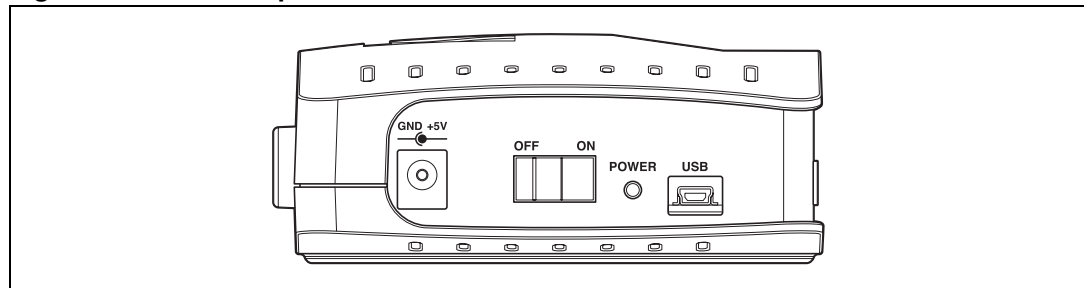
Right panel

● Three status LEDs
    – **Reset (Red)** indicates that the chip is being reset.
    – **Wait (Yellow)** indicates that emulator is in *halt* or *wait for interrupt* mode.
    – **Run (Green)** indicates that the application is running
● 10-pin in-circuit programming/debugging connector (type HE10)
● Two output triggers (see *Output and input triggers*)
● Input trigger (see *Output and input triggers*)

Figure 7. Right side panel
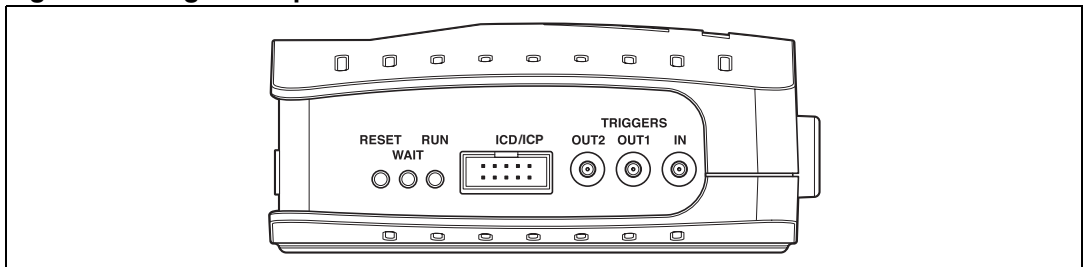
Front panel

● 10-pin probe analyzer input connector (see *Section 3.2.4 on page 16*)
● Test connector (reserved)

Back panel

● External link connector (reserved)
● Sliding door to access mode switch (reserved). Switch must be in **Emul** position.

Figure 8. Front panel
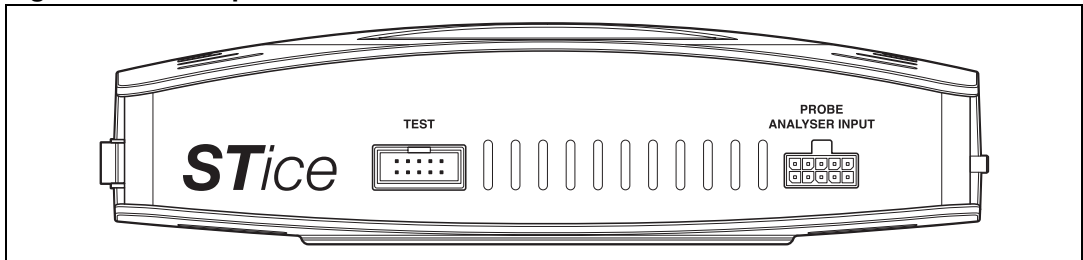
Note: Do not use the TEST connector on the front panel for in-circuit debugging. The connector for ICD is located on the right panel, as shown in Figure 9.

Figure 9. Back panel
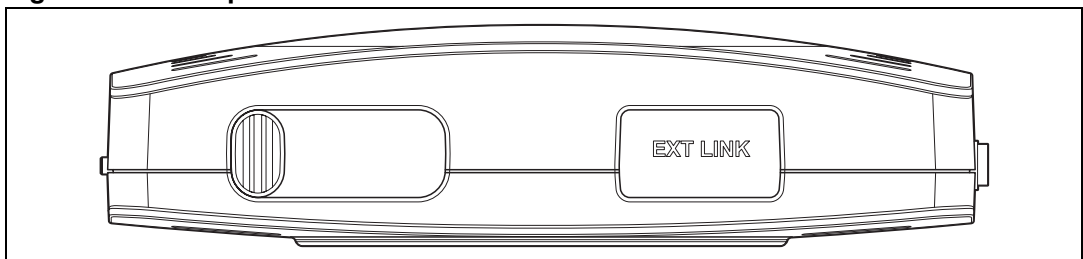
3.2.2 Power supply

The emulator **power supply** connects to the power supply connector on the left panel of the emulator (see *Figure 6*). The provided universal power supply includes three interchangeable plugs and has the following electrical characteristics:

AC voltage: 110 V to 240 V

Frequency: 47 to 63 Hz

3.2.3 Output and input triggers

Your emulator has two output triggers (OUT1, OUT2), and one input trigger (IN), which are available via SUB-click connectors located on the right panel (see *Figure 7*). Both input and output signals are at TTL level.

Advanced breakpoints in STVD allow you to define an event based on input signals and program signals to the output triggers.

The following trigger output modes (schematically represented in *Figure 10*) are supported:

- *output a pulse* – where a signal of value 1 is sent during exactly one CPU cycle.
- *toggle* – where the signal value is changed from 0 to 1 or from 1 to 0.
- *set the output high* – where the output signal is set equal to 1.
- *set the output low* – where the output signal is set equal to 0.

Several examples of how to program advanced breakpoints to control the sending of signals to the output triggers are given in the STVD online help and user manual.

Figure 10. Output trigger action modes
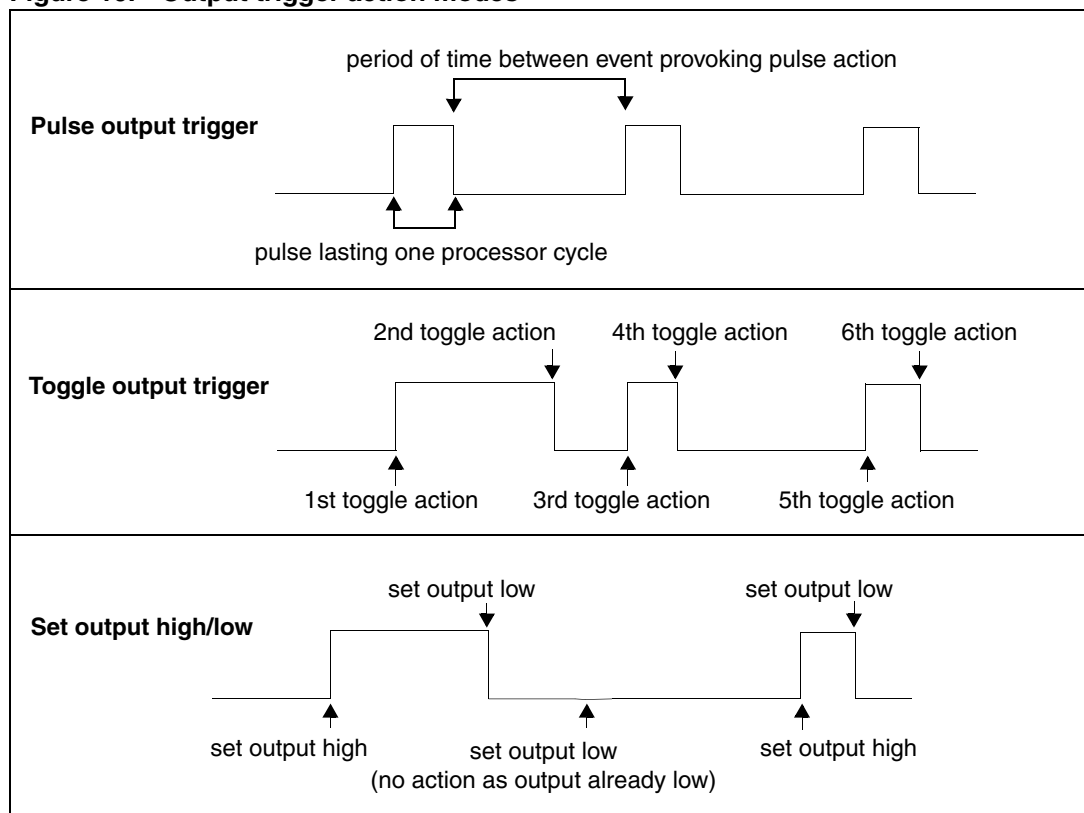
3.2.4 Analyzer input connector

An analyzer input connector is located on the emulator front panel (see *Figure 8*). The analyzer input connector allows you to use 8 external input signals (TTL level).

The connector has ten pins—two ground pins (pin 9 and pin 10) and eight input signal pins (1-8), as shown in *Figure 11*.

Figure 11. Analyzer probe input connections (front view)
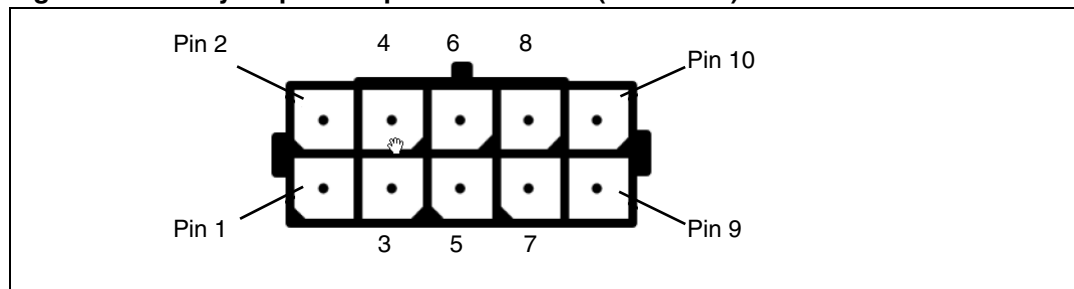
A specially adapted 10-wire cable is included to connect your application or an external device (such as an oscilloscope or multi-meter) to these inlets. Each wire is color-coded as summarized in *Table 4*.

Table 4. Correspondence between analyzer input pin and wiring

Analyzer input pin	Signal	Wire color
1	Input 1	Red
2	Input 0	Brown
3	Input 3	Yellow
4	Input 2	Orange
5	Input 5	Blue
6	Input 4	Green
7	Input 7	Grey
8	Input 6	Purple
9	GND	Black
10	GND	Black

3.2.5 Application power supply follower

Your emulator is equipped with an automatic power supply follower, which converts internal emulation voltage to the voltage of the application. The application voltage must be within the range supported by the emulator.

The emulator's internal power supply regulator supports a V_{DD} voltage up to 5.5 V, and down to 1.65 V. The lower limit may be higher as it depends on the microcontroller that you are emulating. For more information about the supported V_{DD} range for your microcontroller, refer to your microcontroller datasheet.

3.3 Automatic firmware updates

The STice is designed so that its firmware can be updated automatically. Firmware may require updating if you have changed the target emulation board (TEB) or if you have updated your version of STVD. The update is done automatically if you start a debugging session and STVD detects an old firmware version. For more information, refer to the STVD online help.

3.4 Emulator functional limitations and discrepancies

3.4.1 Voltage limitation for I^{2}C peripheral

For all supported microcontrollers, if the I^{2}C peripheral is used, you must limit the pull-up resistor to 1.5 kOhms.

3.4.2 Limitations and discrepancies for specific MCUs or families of MCUs

Specific MCUs or families of MCUs may be subject to emulation limitations or discrepancies. You will find information about these specific limitations in the STVD Discrepancies window. For more information refer to the STVD online help.

4 In-circuit programming/debugging configuration

In the in-circuit programming (ICP) / in-circuit debugging (ICD) configuration, STice provides the capability to program your application to your microcontroller and to debug your application as it runs on the microcontroller on your application board. The following sections provide information about:

● *Section 4.1* – Setting up the STice to operate in ICD/ICP configuration
● *Section 4.2* – SWIM connection for ICD/ICP of an STM8 microcontroller

4.1 Setting up the system for in-circuit programming/debugging

The STice features an in-circuit programming/debugging (ICD/ICP) port that allows you to take advantage of the single wire interface module (SWIM) protocol for STM8 to program an application to the microcontroller on your application board and debug the application while it runs on the target device.

Figure 12. In-circuit programming/debugging configuration
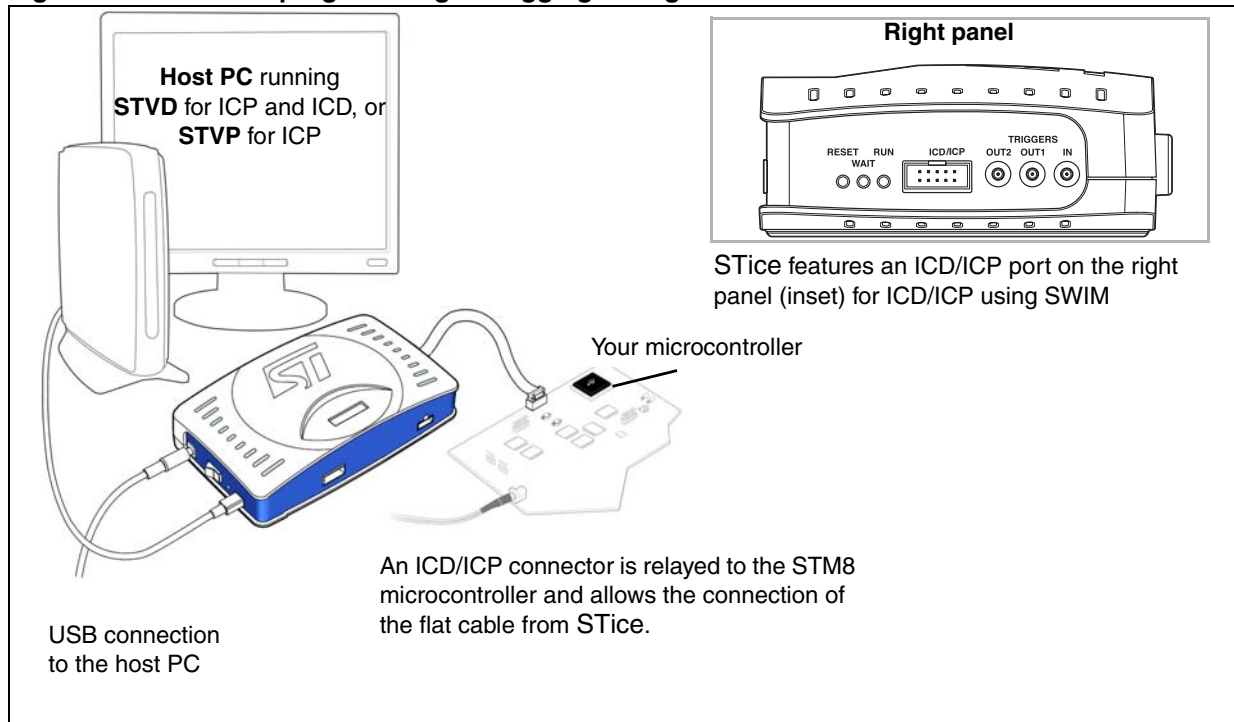
During application development, STVD software running on your PC provides an integrated development environment that allows you to debug your application while it runs on your microcontroller. For more information about in-circuit debugging with STVD, refer to the STVD online help provided with your software package.

STVD also provides a microcontroller programming interface that supports in-circuit programming of STM8, or you can use the ST Visual Programming (STVP) interface, which provides a full-featured graphical interface for verifying memory sectors, checking the settings of the option bytes and programming the MCU. For more information about programming with STVP, refer to the STVP online help.

4.2 SWIM connection for in-circuit programming/debugging

The major advantage of the SWIM protocol for in-circuit debugging (ICD) and programming (ICP) is that signals are exchanged with the microcontroller on a single pin.

To use the SWIM protocol for ICD/ICP of an STM8 microcontroller, your application hardware design must include an ICD/ICP connector for SWIM (4-pin ERNI connector). This connector must be relayed to the microcontroller in accordance with the SWIM protocol if your application integrates an STM8 microcontroller.

These connection requirements are summarized in *Table 5* and in *Figure 13*.

Table 5. SWIM signals

STM8 pin name	Function	SWIM connector pin
VDD	Target voltage sense	pin 1: VAPP
SWIM	SWIM data	pin 2: ISDATA
VSS	Ground voltage	pin 3: GND
NRST	Target system reset	pin 4: Reset

The 4-pin flat cable provided for ICD/ICP when using the SWIM protocol is 20 centimeters long (maximum length). On the application board, the maximum distance allowable between the MCU and the SWIM connector is 5 centimeters. For further information about SWIM, refer to your STM8 microcontroller datasheet.

Figure 13. SWIM connections on application board
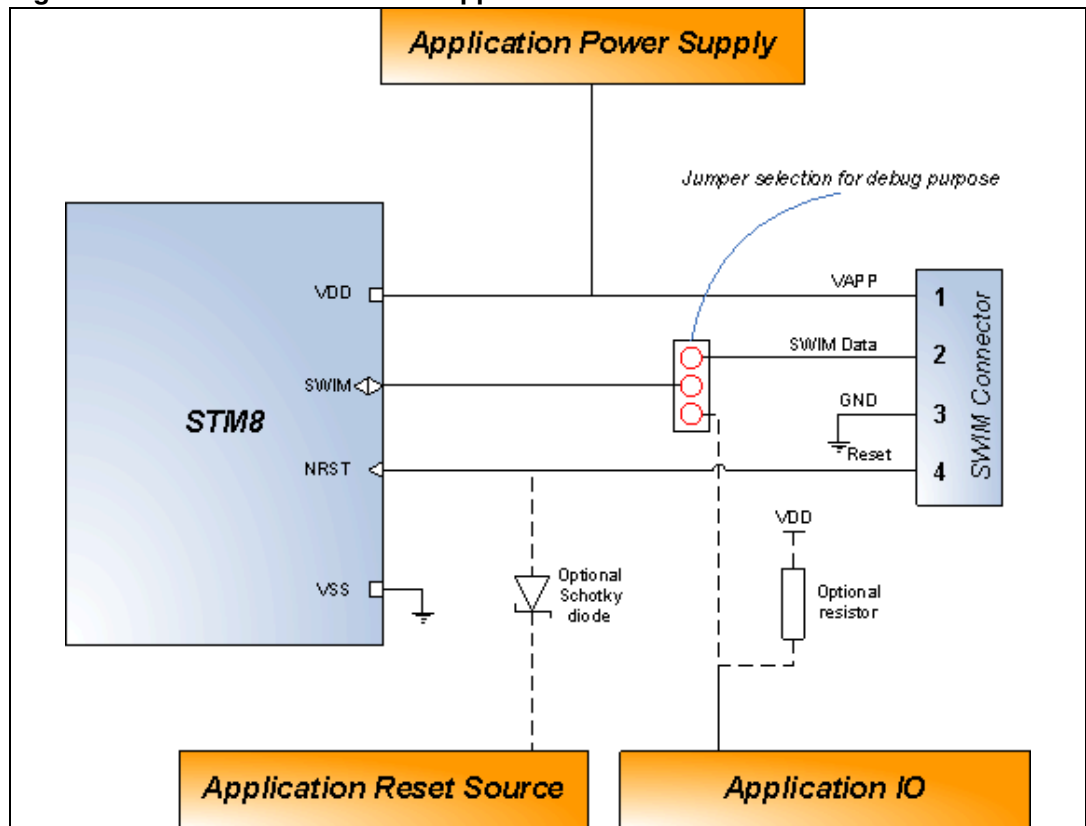
Appendix A EMC conformity and safety requirements

This product respects the EMC requirements of the European guideline 89/336/EEC under the following conditions:

● Any tester, equipment, or tool used at any production step, or for any manipulation of semiconductor devices, must have its shield connected to ground.

● All provided ferrites must be attached as described in the hardware installation instructions of the relevant user manual.

● The product must be placed on a conductive table top, made of steel or clean aluminum, grounded through a ground cable. Before every contact with the emulator, the operator must touch the surface of the grounded worktable just behind the back panel of the emulator. All manipulation of finished goods must be done at such a grounded worktable.

● The worktable must be free of all non-antistatic plastic objects.

● It is recommended that you wear an antistatic wrist or ankle strap, connected to the antistatic floor covering or to the grounded equipment.

● If no antistatic wrist or ankle strap is worn, before each manipulation of the powered-on tool, you must touch the surface of the grounded worktable just behind the back panel of the emulator.

● It is recommended that antistatic gloves or finger coats be worn.

● It is recommended that nylon clothing be avoided while performing any manipulation of parts.

Appendix B   Product support

If you experience any problems with this product, or if you need spare parts or repairs, contact the distributor or the STMicroelectronics sales office where you purchased the product.

In addition, on the ST microcontrollers support site at *www.st.com*, you will find a complete listing of ST sales offices and distributors, as well as documentation, software downloads and user discussion groups to help you answer questions and stay up to date with our latest product developments.

B.1   Getting assistance

For more information, application notes, FAQs and software updates for all the ST microcontroller families, check the CD-ROM or the microcontroller support web site on *www.st.com*.

For assistance on all ST microcontroller subjects, or for help using your emulator, refer to the web site to find the ST sales office closest to you. We'll be glad to help you.

B.2   Software updates

All our latest software and related documentation are available for download from the ST microcontrollers support site at *www.st.com*. For information about firmware and hardware revisions, call your nearest distributor or ST sales office.

If you are using software from a third-party tool provider, please refer to the third-party for software product support and downloads.

B.3   Hardware spare parts

Your development tool comes with the hardware you need to set it up, connect it to your PC and connect to your application. However, some components can be bought separately if you need additional ones. You can order extra components, such as sockets and adapters, from STMicroelectronics, from the component manufacturer or from a distributor.

To help you find what you need, a listing of accessories for ST development tools is available on the ST microcontrollers support site at *www.st.com*.

B.4   Sockets

Complete documentation and ordering information for P/TQFP sockets from Yamaichi, Ironwood, CAB, Enplas and Erni are provided at their respective Internet sites.

B.5   Connectors

Complete documentation and ordering information for SAMTEC connectors is provided on the SAMTEC Internet site.

B.6 Getting prepared before you call

Collect the following information about the product before contacting ST or your distributor:

1. Name of the company where you purchased the product.
2. Date of purchase.
3. Order code: Refer to the side your emulator's box. The order code is similar to STice-SYS001.
4. Serial number: The serial number is located on the bottom of the STice box and is also listed on the Global Reference card provided with the emulator. This number is the serial number for the MEB.
5. TEB (target emulation board) hardware and firmware versions: The hardware and firmware versions can be found by opening an STVD session, entering the debug context and selecting *Help>About* from the main menu. The TEB version numbers are given in the *Target box* – scroll downwards until you find the TEB version (hardware) and TEB PLD version (firmware).
6. Target device: The sales type of the ST microcontroller that you are using in your application.

Appendix C   Glossary

Table 6.   Glossary

Term	Definition
Debug module	An microcontroller hardware peripheral that is able to manage instruction stepping, complex breakpoints and abort for in-circuit debugging.
DIL	Dual in-line. A type of device package with two rows of pins for thru-hole mounting. Sometimes also called DIP (Dual In-line Package).
EEPROM	Electrically erasable programmable read-only memory. A non-volatile type of memory that can be erased and reprogrammed by program instructions. Since no special power supplies or ultra-violet light source is needed, the contents of this kind of memory can be changed without removing the MCU from the application system.
Footprint	The dimensions of the location of a component on a printed circuit board or in a socket. It depends on the number of pins, their size, type and positioning. The footprint of each microcontroller is specified in the datasheet in the section titled *Package Mechanical Data.*
I^2C	Inter-integrated circuit. A protocol for a bus that can be connected to multiple integrated circuits and that allows any one of them to initiate data transfer.
ICD	In-circuit debugging. The capability to debug an application on a FLASH device using on-chip resources (Debug Module, MTC), made possible by the SWIM or ICC protocol.
ICP	In-circuit programming. The capability to program to microcontroller Flash memory while the target device is installed on an application board, made possible by the SWIM or ICC protocol.
LQFP	Low-profile quad flat package. A family of integrated circuit packages for surface mounted assembly. This type of package has a square, flat shape and pins on all four sides.
LVD	Low voltage detection. A microcontroller feature that allows you to simulate what occurs when the MCU detects that the supply voltage is below a given threshold.
MCU	A microcontroller is a complete computer system, including a CPU, memory, a clock oscillator and I/O on a single integrated circuit.
MEB	Main emulation board. One of three emulation boards that make up the STice. The MEB contains communication and emulation resources that are common to a microcontroller family. This board provides the link between the Host PC and the Target Emulation Board.
OTP	One time programmable. Also referred to as OTPROM (One Time Programmable Read-Only Memory). A non-volatile type of memory that can be programmed but cannot be erased. An OTP ROM is an EPROM MCU that is packaged in an opaque plastic package—it is called a one-time programmable MCU because there is no way to expose the EPROM to a UV light source.
PC	Program counter. The CPU register that holds the address of the next instruction or operand that the CPU will use.
PEB	Peripheral emulation board. An optional printed circuit board that connects to a Target Emulation Board (TEB) and provides emulation resources for certain specialized microcontroller peripherals. The PEB, like the TEB, allows the connection of the emulator to your application board.

Table 6. Glossary (continued)

Term	Definition
PLD	Programmable logic device. An integrated circuit that can be programmed to perform complex functions.
PQFP	Plastic quad flat package. A family of integrated circuit packages for surface mounted assembly. This type is packaged in plastic, has a square flat shape and pins on all four sides.
RC network	Resistor-capacitor network. A combination of resistors and capacitors in a circuit that are typically used to control or minimize voltage spikes.
Read/write on the fly	A feature that allows you to perform a non-intrusive read or write of a variable during emulation (i.e. while program running). The variable may be 8, 16 or 32 bits in size and can be located anywhere in the emulation memory (up to 64 kilobytes) except for the hardware register (peripherals) and internal system (A, X, Y, PC, CC and SP). The *Read/Write on the Fly* option is available in both the Memory window and Watch window of STVD.
SDIP	Shrink dual in-line package. A type of device package with two rows of pins for thru-hole mounting.
SO	Small outline. A type of device package with two rows of pins for SMD or socket mounting.
STVD	ST visual develop. A software package know as an Integrated Development Environment (IDE) that allows you to compile and edit application code and to debug STM8 and ST7 applications using either a built-in simulator, an in-circuit debugger or an emulator.
STVP	ST visual programmer. A software application that allows you to program Flash microcontrollers using an in-circuit programming (ICP) connection and any ICP capable programming board, emulator or in-circuit programmer/debugger.
SWIM	Single wire interface module protocol. A device communication protocol that makes it possible to download programs to the microcontroller's RAM and execute them. This protocol enables in-circuit programming and, coupled with the microcontroller's debug module, makes it possible to in-circuit debug applications via a single wire hardware interface.
Target device	The microcontroller that you have chosen for your application and that you will emulate or program.
TEB	Target emulation board. A printed circuit board with connector pins that, when plugged into the Main Emulation Board (MEB), allows you to connect the emulation to the MCU socket on your application board for debugging. It may also have a Peripheral Emulation Board (PEB) mount on it, in order to emulate certain specialized microcontroller peripherals.
TQFP	Thin quad flat package. A family of integrated circuit packages for surface mounted assembly. This type of package has a square, flat shape and pins on all four sides.
TTL	Transistor to transistor logic. A bipolar technology where a transistor output is connected directly to the transistor input of the next stage, rather than connecting through a resistor or diode.
User application board	Your printed circuit board, which includes a connector/socket for the ST microcontroller that you have chosen to use.

Revision history

Table 7. Document revision history

Date	Revision	Changes
20-Mar-2008	1	Initial release.
14-May-2010	2	Modified note in *Table 1* as CB-xxx parts are now obsolete. Added *Chapter 1* (was previously cover pages).
08-Nov-2010	3	Updated for part numbers that changed: – AS/xxxxxx became AS/Stice_Connect – AD/xxxxxx-xxx and AD-ICD/ICP became AD/Stice_Connect – CF/FPxxx became CF/Stice_Connect

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