

Introduction

The ST7-EMU3 series emulators are the third generation of high-end emulators for ST7. They are designed to provide a complete range of advanced debugging features. In addition, they contain all the adapters, connectors and sockets you need to emulate any devices in the supported ST7 sub-family while connected to your application board in place of the target microcontroller.

Your ST7MDTU3-EMU3 probe is the component of the ST7-EMU3 emulator kit that contains target-emulating hardware. It connects to your PC via the ST Micro Connect box and it can connect to your application board in place of your ST7 via the provided connection accessories.

The EMU3 probe's target emulation board (TEB) contains the hardware that allows you to emulate a specific MCU or family of MCUs. This allows you to emulate a wide range of ST7 microcontrollers with one EMU3 emulator. For this reason, the ST7MDTU3-EMU3 Target Emulation Board is delivered either as part of the ST7MDTU3-EMU3 emulator kit, or independently in the ST7MDTU3-TEB kit.

Table 1. MCUs emulated by the ST7MDTU3-EMU3 emulator

RPN	CPN	Supported MCUs
ST7-EMU3	ST7MDTU3-EMU3	ST7260 and ST7263B

If you want to emulate ST7 MCUs other than those listed above, you need only change the TEB in your EMU3 emulator. You will find more information about available TEBs and the MCUs they support in the ST Product and Tool Selection Guide.

For information about changing your TEB, refer to [Appendix B: Changing the TEB in your EMU3 probe on page 17](#).

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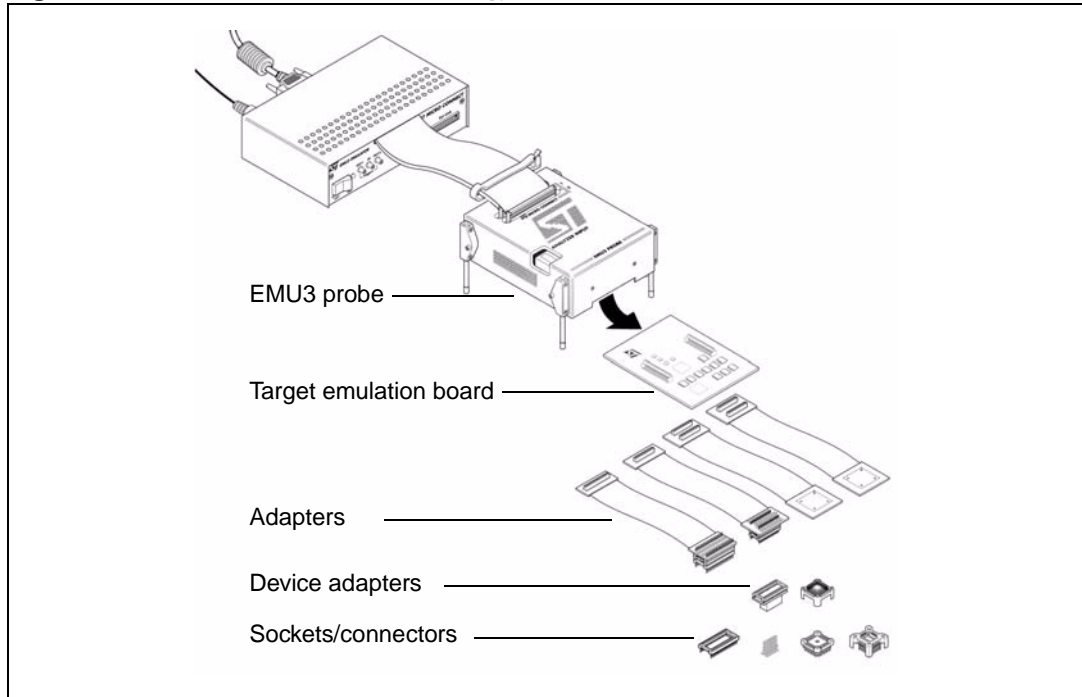
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1 Overview

1.1 Terminology

Figure 1. ST7MDTxxx-EMU3 terminology



1.2 About the user manuals

This manual will help you set up your EMU3 probe. You will find information about:

- Connecting your probe to your application in place of your microcontroller
- Emulation features
- Installing the ST7MDTU3-TEB

For information about the software and additional hardware intended for use with your emulator, refer to the following documents that are included with your emulator:

- *ST7 Visual Develop User Manual* - build and debug your application software
- *ST7-EMU3 Emulator User Manual* - set up instructions for your EMU3 emulator
- *ST7263B or ST7260 Datasheet* - information specific to your ST7 microcontroller

Because of the modularity of the EMU3 probe, this guide comes with the following products:

- ST7MDTU3-TEB, which only contains the target emulation board (TEB).

ST7MDTU3-EMU3 emulator kit (with ST7MDTU3-TEB already integrated).

2 Delivery checklist

The EMU3 probe is typically delivered as part of the ST7MDTU3-EMU3 emulator. The emulator contains all the components required to connect to your host PC (refer to the delivery check list in your *ST7-EMU3 Emulator User Manual*), as well as the probe and connection accessories listed below.

Owners of other versions of EMU3 emulators can configure them to emulate the ST7260 and ST7263B sub-families with the ST7MDTU3-TEB.

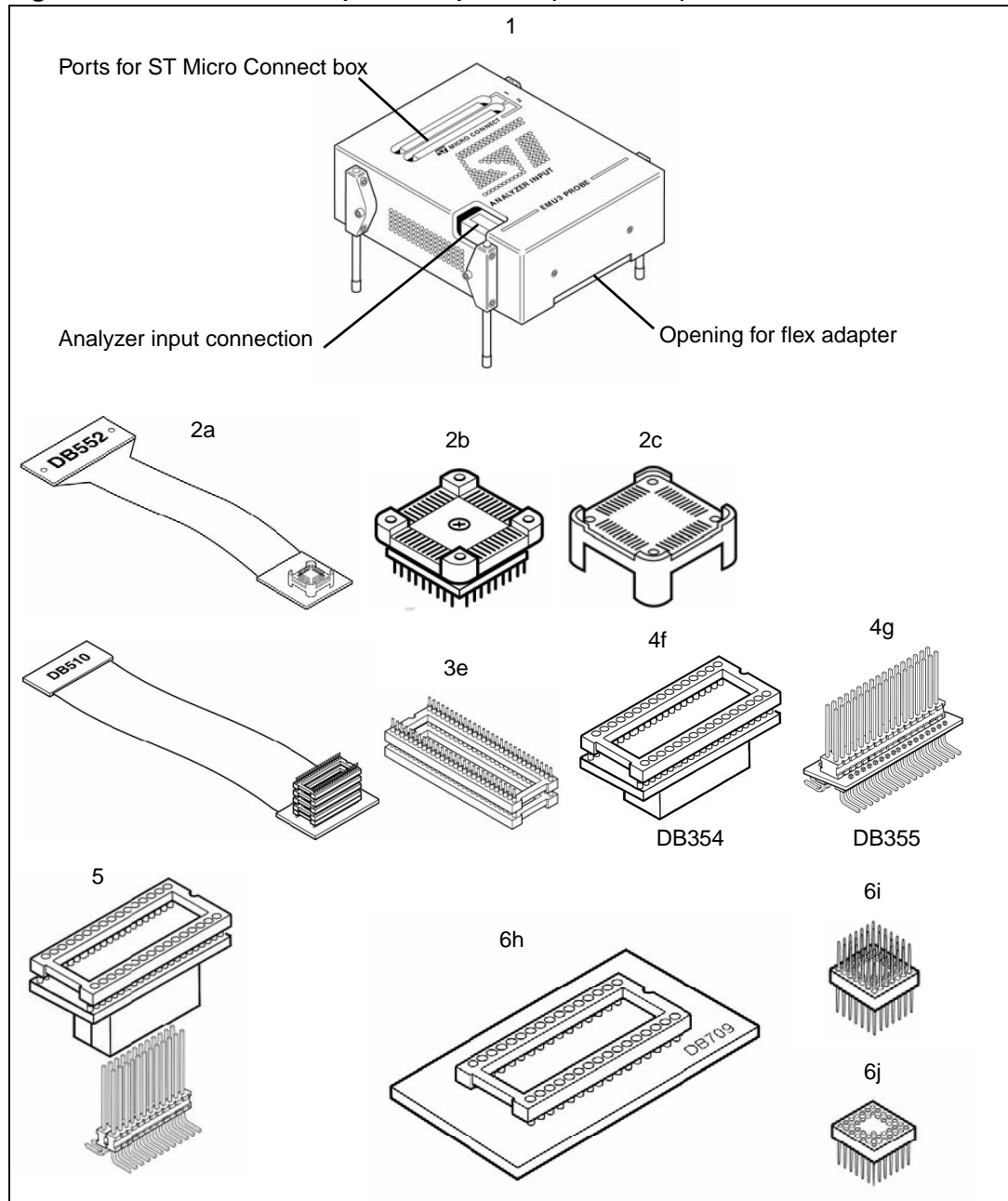
The ST7MDTU3-EMU3 probe includes (refer to [Figure 2](#)):

1. The EMU3 probe with ports for connection to the ST Micro Connect box, as well as an analyzer input connection. The MDTU3-TEB (ref. DB599) is already installed in the probe.
2. Connection accessories for the TQFP48 (7 x 7) package:
 - a) A flex adapter with TQFP48 (7 x 7) connector (ref. DB552), for connection between the EMU3 probe and the socket on your application board.
 - b) One TQFP48 (7 x 7) socket to solder to your application board.
 - c) One TQFP48 (7 x 7) socket cover.
3. Connection accessories for the SDIP32 package:
 - d) A flex adapter with SDIP32 connector (ref. DB510), for connection between the EMU3 probe and the socket on your application board.
 - e) One SDIP32 socket to solder to your application board.
4. Connection accessories for the SO34 package:
 - f) One SDIP32-SO34 adapter (ref. DB354)
 - g) One SO32-SO34 device adapter (ref. DB355) to solder to the application board.
5. One SDIP32-SO24 device adapter (ref. DB601) with connection pins (ref. 9083610) to solder to the application board.
6. Connection accessories for the QFN40 package:
 - h) One SDIP32-QFN40 device adapter (ref. DB709)
 - i) One Ironwood QFN40 male/male connector (Ironwood ref. C6402MF) for the QFN40 device adapter.
 - j) One Ironwood QFN40 male/female connector (Ironwood ref. C6403MF) to solder to the application board.

The ST7MDTU3-EMU3 probe also comes with two zero insertion force (ZIF) adapters which are not shown in [Figure 2](#). These adapters allow you to install a microcontroller in an SO34 or SO24 package on your application board without unsoldering the connection pins used by your emulator. See [Section 3.4](#) and [Section 3.5](#) for details.

7. One SO34 ZIF/32 adapter (ref. DB606A) for installing a device in SO34 package on the emulator connection on your application board.
8. One SO24 ZIF adapter (ref. DB608A) for installing a device in SO24 package on the emulator connection on your application board.

Figure 2. ST7MDTU3-EMU3 probe components (not to scale)



The ST7MDTU3-EMU3 TEB is delivered with:

- An MDTU3-target emulation board (ref. DB599).
- All items described in lines 2-7 of the ST7MDTU3-EMU3 probe check list (see [Figure 2](#)).

If you have bought the ST7MDTU3-EMU3 TEB kit, you will need to install the TEB in your EMU3 probe as described in on [Appendix B on page 17](#).

3 Connecting your emulator to an application board

Your EMU3 probe serves as the hardware interface between your emulator and your application board. Your probe comes with the sockets/connectors and device adapters you will need to connect to the MCU socket on your application board.

To help you get started with your ST7MDTU3-EMU3 emulator, the following sections tell you how to connect to your application board using the provided flex adapters, sockets and device adapters.

3.1 Choosing and installing the flex adapter on the TEB

The target MCUs that are emulated by the MDTU3-EMU3 probe exist in various microcontroller packages—four different packages in total. To connect the emulator to your application board, you must choose a flex adapter and the corresponding device adapters and connectors based on your device's package.

[Table 2](#) shows the flex adapter, device adapter and on-application connector that is required for each package. For the purpose of identification, the reference number is printed on the flex adapter's packaging and on the reverse side of the plug that connects it to the MDTU3-TEB.

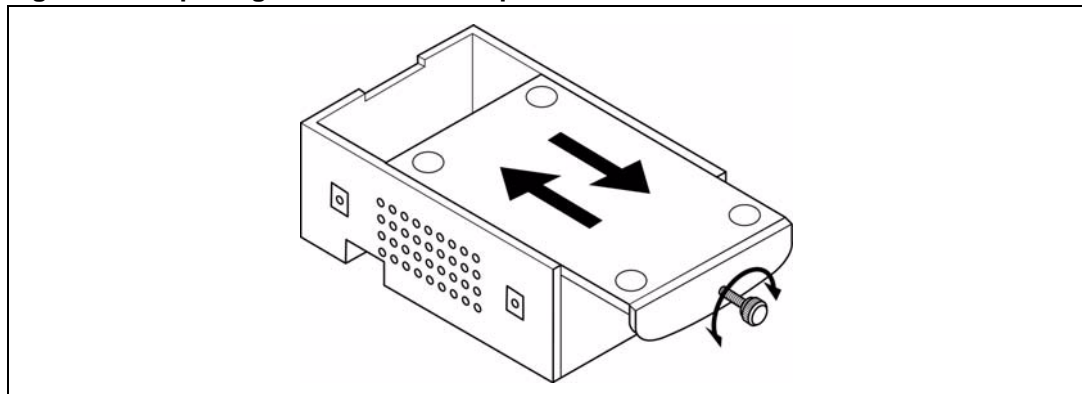
Table 2. Target MCU packages and their application connectors

Package	Flex adapter	Device adapter	Soldered on application board
SDIP32	DB510	none	SDIP32 socket
SO34	DB510	DB354	DB355
SO24	DB510	DB601	A set of 24 connection pins
TQFP48 (7 x 7)	DB552	none	TQFP48 (7 x 7) socket
QFN40	DB510	DB709	Ironwood QFN40 male/female connector and male/male connector

Once you have selected the flex connector, to install it:

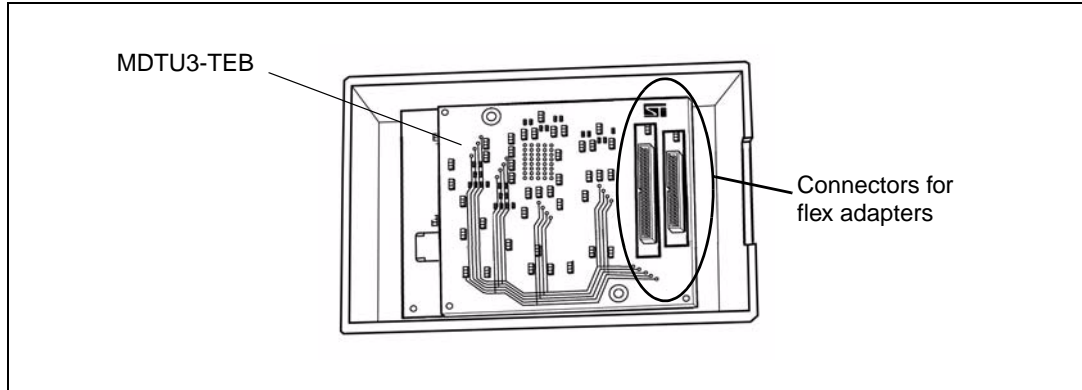
1. Turn your probe upside-down, unscrew the retaining screw and slide the bottom out as shown in [Figure 3](#).

Figure 3. Opening the bottom of the probe



2. Identify the connector on the MDTU3-TEB for your flex adapter. Your TEB has a 60-pin connector for the TQFP48 (7x7) flex adapter and a 40-pin connector for the SDIP32 flex adapter (see [Figure 4](#)).

Figure 4. Identifying the socket for your flex adapter

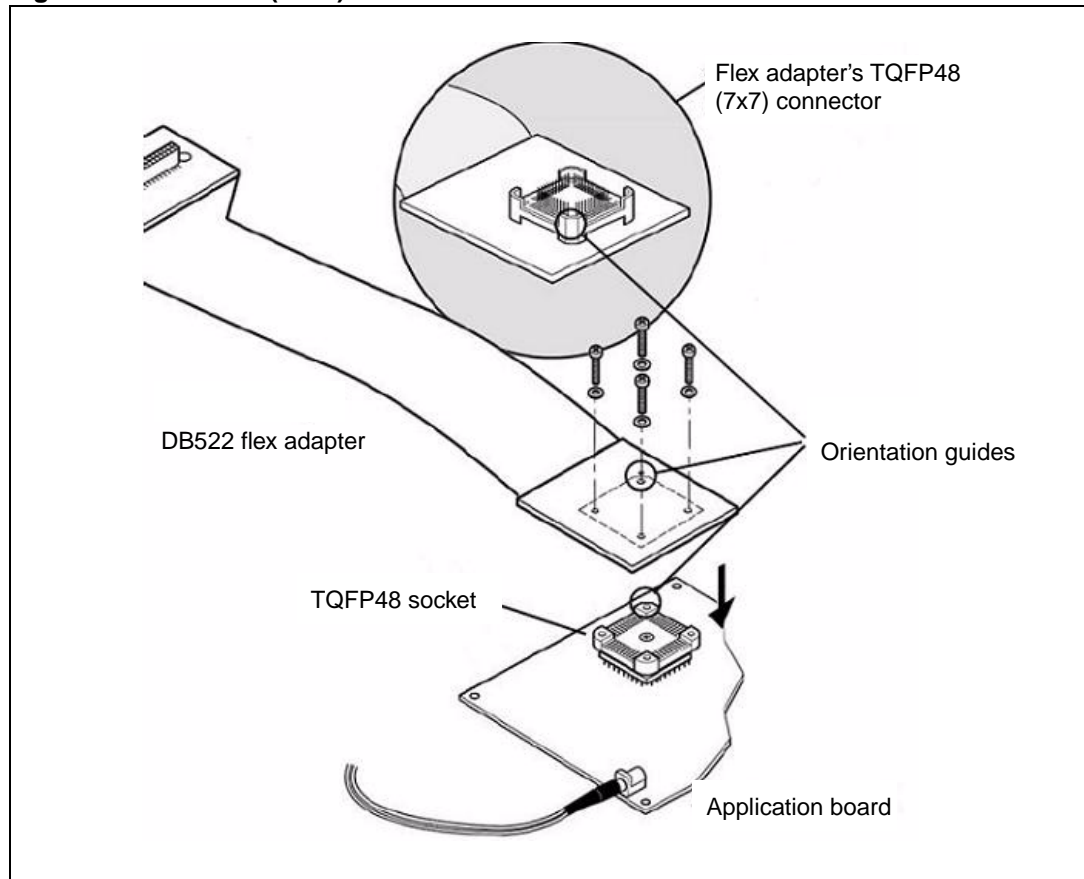


3. Insert the flex adapter's plug into the connector on the TEB.
4. Replace the bottom panel of the probe housing so that the flex adapter passes through the slot provided and tighten the retaining screw.
5. Reconnect the probe to the ST Micro Connect box by connecting the two 80-pin flat cables to the ST Micro Connect connection ports on the top face of the probe housing.
6. Continue by connecting your flex adapter to your application board. A procedure for each package type is provided in the following sections:
 - [Connection for TQFP48 \(7 x 7\) microcontroller package on page 9](#),
 - [Connection for SDIP32 microcontroller package on page 10](#),
 - [Connection for SO34 microcontroller packages on page 11](#),
 - [Connection for SO24 microcontroller package on page 12](#),
 - [Connection for QFN40 microcontroller package on page 13](#).

3.2 Connection for TQFP48 (7 x 7) microcontroller package

1. Solder the TQFP48 (7 x 7) socket onto your application board.
2. Connect the male TQFP48 (7 x 7) socket on the application board to the DB522 flex adapter as shown in [Figure 5](#). To help you orient the flex adapter and the socket, one corner of the socket and the flex adapter's connector are cut at a 45° angle. Align these corners.
3. Carefully insert the socket's pins into the flex adapter's connector and fasten with the four provided screws.

Figure 5. TQFP48 (7 x 7) connection scheme

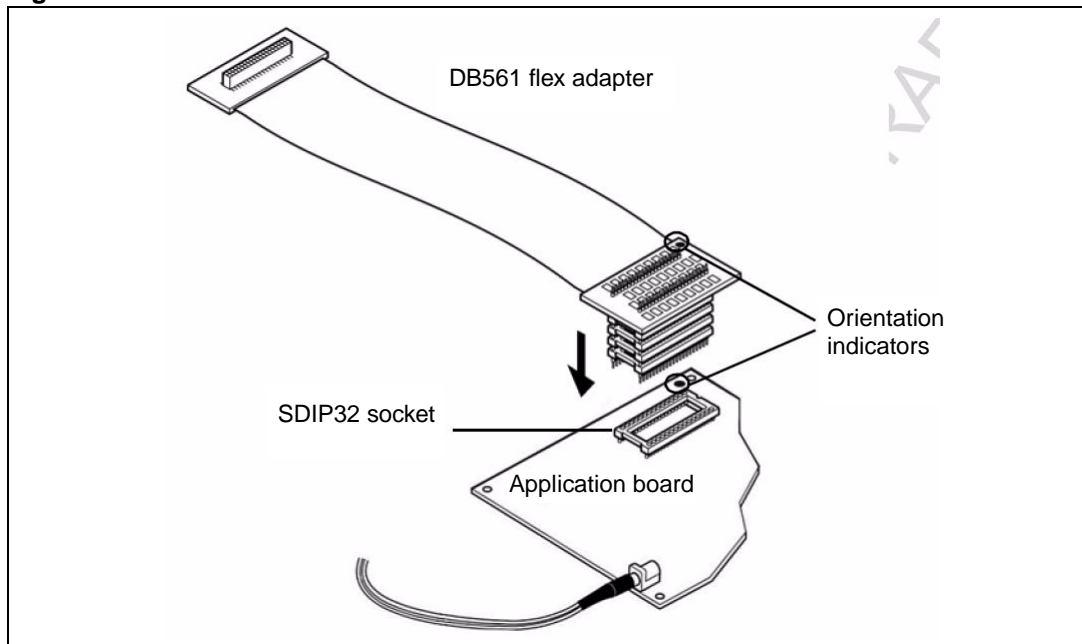


Note: When securing the flex adapter to the TQFP48 (7x7) socket, do not over-tighten the screws. The screws should be just tight enough to secure the connection, where as over-tightening may damage the pins and cause connection failures.

3.3 Connection for SDIP32 microcontroller package

1. Solder the SDIP32 socket onto your application board.
2. Orient the flex adapter's SDIP32 connector to the socket by aligning its orientation indicator (pin 1) with the indicator on your application board.
3. Insert the pins of the SDIP32 connector on the flex adapter into the socket on your application board as shown in [Figure 6](#).

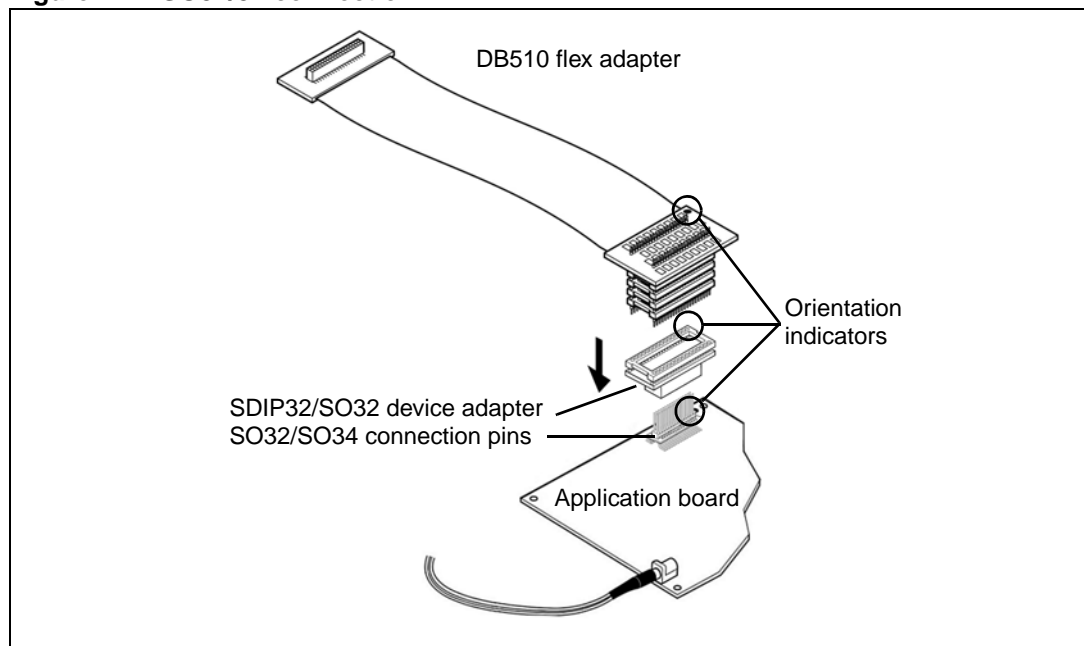
Figure 6. SDIP32 connection



3.4 Connection for SO34 microcontroller packages

1. Solder the SO32/SO34 connection pins onto your application board in place of your microcontroller (see [Figure 7](#)).
2. Align the orientation indicator on the SDIP32 connector with the indicator on the SDIP32/SO32 device adapter. Then insert the pins of the SDIP32 flex adapter into the SDIP32/SO32 device adapter.
3. Align the orientation indicator on the SDIP32/SO32 adapter (ref. DB354) with the pin 1 indicator on the application board, then insert the connection pins on your application board into the SDIP32/SO32 device adapter (see [Figure 7](#)).

Figure 7. SO34/32 connection



SO34 ZIF/32 adapter

In addition to the accessories for connecting your probe to your application board, your probe includes an adapter with an SO34 ZIF socket. With this adapter you can install a programmed ST7 on your application board using the same connection that is used to connect your probe.

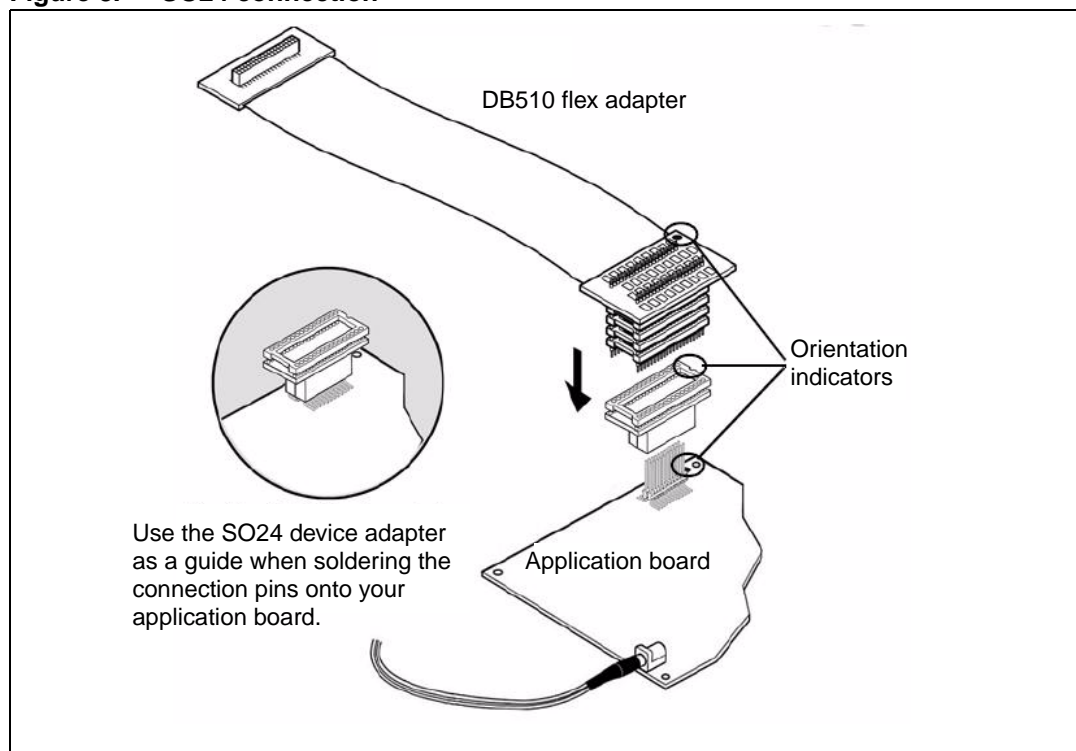
To use the SO34 ZIF/32 adapter (Ref. DB606A):

1. Disconnect the probe connection leaving the connection pins soldered to your application board.
2. Install your programmed microcontroller in the ZIF socket on the SO34 ZIF/32 adapter, making sure that the pin 1 indicator on your ST7 corresponds to pin 1 on the SO34 ZIF socket.
3. Install the SO34 ZIF/32 adapter on the SO32/SO34 adapter that is soldered on your application board. Be careful to orient the pin 1 indicator on the adapter with the indicator on your application board.

3.5 Connection for SO24 microcontroller package

1. Solder the connection pins to your application board in place of your microcontroller. Use the SDIP32/SO24 device adapter (ref.DB601) as a guide when soldering. This will ensure that the pins are parallel and correctly spaced so that your probe can be connected and disconnected without damaging the pins.
2. Align the orientation indicator on the SDIP32 connector with the indicators on the SDIP32/SO24 device adapter, as shown in [Figure 8](#). Then insert the pins of the SDIP32 connector into the device adapter.
3. Align the orientation indicator on the SDIP32/SO24 device adapter with the pin 1 indicator on the application board and insert the pins into the device adapter.

Figure 8. SO24 connection



SO24 ZIF adapter

In addition to the accessories for connecting your probe to your application board, your probe includes an adapter with an SO24 ZIF socket. With this adapter you can install a programmed ST7 on your application board using the same connection pins that are used to connect to your probe.

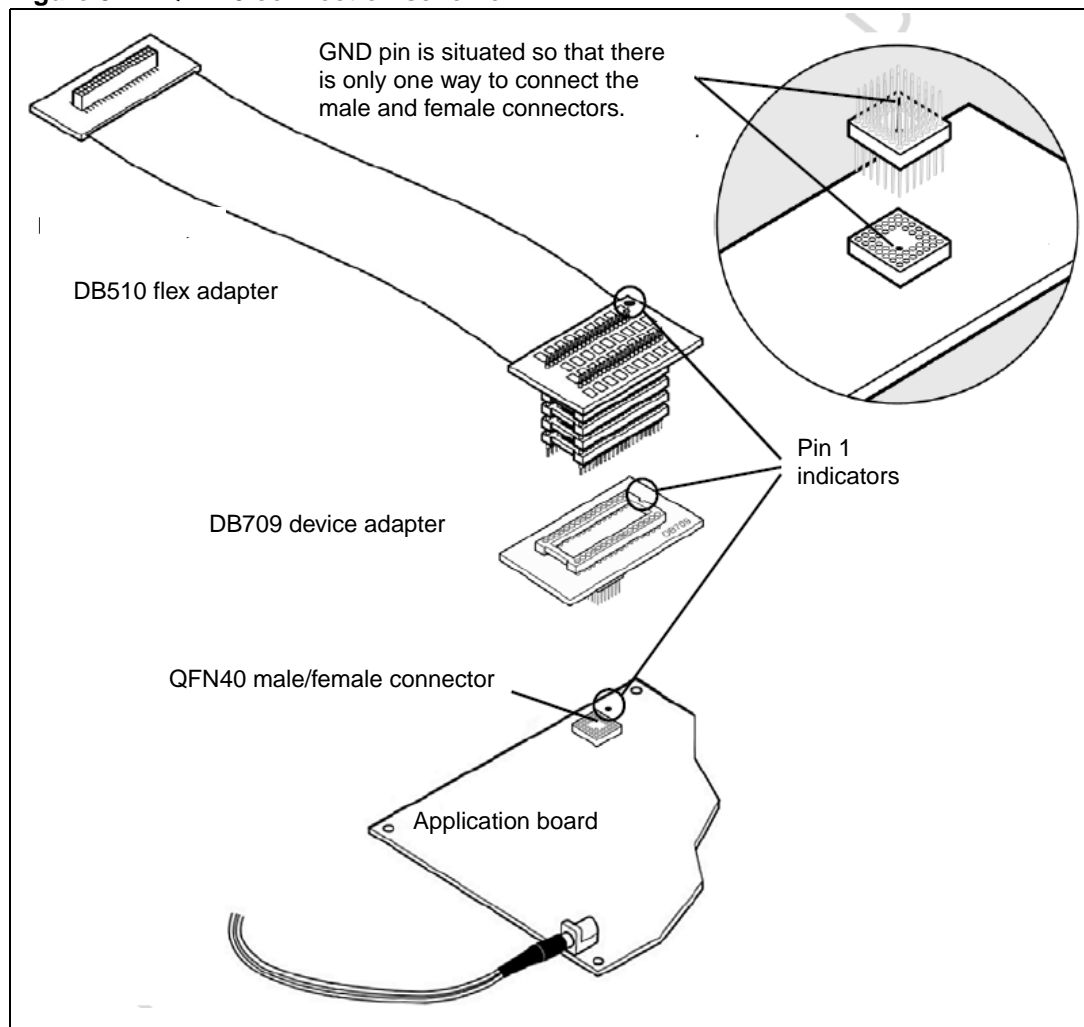
To use the SO24 ZIF adapter (Ref. DB608A):

1. Disconnect the probe connection leaving the connection pins soldered to your application board.
2. Install your programmed microcontroller in the ZIF socket on the SO24 ZIF adapter:
3. Install the SO24 ZIF adapter on the connection pins on your application board. Be careful to orient the pin 1 indicator on the adapter with the indicator on your application board.

3.6 Connection for QFN40 microcontroller package

1. Solder the QFN40 male/female connector onto your application board.
2. Insert the pins of the QFN40 male/male connector into the female connector on the QFN40 device adapter (DB709), as shown in the detail in [Figure 9](#).
3. Orient the pins of the SDIP32 connector on the flex adapter (DB510) to the QFN40 device adapter by aligning its orientation indicator (pin 1) with the indicator on the device adapter. Insert the pins into the connector on the device adapter, as shown in [Figure 9](#).
4. Orient the assembled flex adapter/device adapter by aligning the orientation indicators (pin 1) with the indicator on your application board. Insert the pins into the female QFN40 connector on your application board, as shown in [Figure 9](#).

Figure 9. QFN40 connection scheme



To install your programmed microcontroller on your application board during development, a zero insertion force socket (Ironwood ref. C6400MF) can be connected on the QFN40 male/male connector in place of the emulator.

4 Emulation characteristics

4.1 On-chip peripherals configuration

You can configure certain on-chip peripherals in ST7 Visual Develop's **MCU Configuration** dialog box so that the EMU3 probe accurately emulates your target device. The on-chip peripheral options available for configuration for the ST7MDTU3-EMU3 emulator are described in this section.

For a more information about peripheral configuration options for your MCU, refer to your ST7263B Datasheet or ST72F60 Datasheet.

4.1.1 MCU

In STVD7's **MCU Selection** window, choose the MCU that you are using in your application. A complete and up-to-date listing of supported MCU's for your ST7MDTU3-EMU3 emulator is provided in the current version of the STVD7 Release Notes.

4.1.2 Clock

The two standard clock frequency options for the ST7MDTU3-EMU3 emulator are 24 MHz and 12 MHz (see [Other_freq_kHz](#)). In the configurable options you can choose either 24 MHz or `Other_freq_kHz`, which is used to set the clock frequency to 12 MHz.

4.1.3 Other_freq_kHz

This feature allows you to configure the probe's Programmable Clock system to generate a frequency at 12 MHz. The ST7MDTU3-EMU3 probe does not allow you to set a frequency other than 12 MHz.

4.1.4 OSC24_12 oscillator selection

This option determines what factor to divide the oscillator frequency by, in order to obtain a signal at 6 MHz for the USB interface. The options are:

24MHz: Tells the probe that the clock frequency is set to 24MHz, which is divided by 4 to obtain the 6 MHz required by the USB interface.

12MHz: Tells the probe that the clock frequency is set to 12MHz, which is divided by 2 to obtain the 6 MHz required by the USB interface.

4.1.5 WDG HALT (Watchdog halt)

There are two options for WDG HALT: Reset or No Reset. When the Watchdog is enabled in Reset mode, and a Halt instruction is encountered in the executable code, a chip reset is performed.

4.1.6 WDG.SW (hardware or software Watchdog)

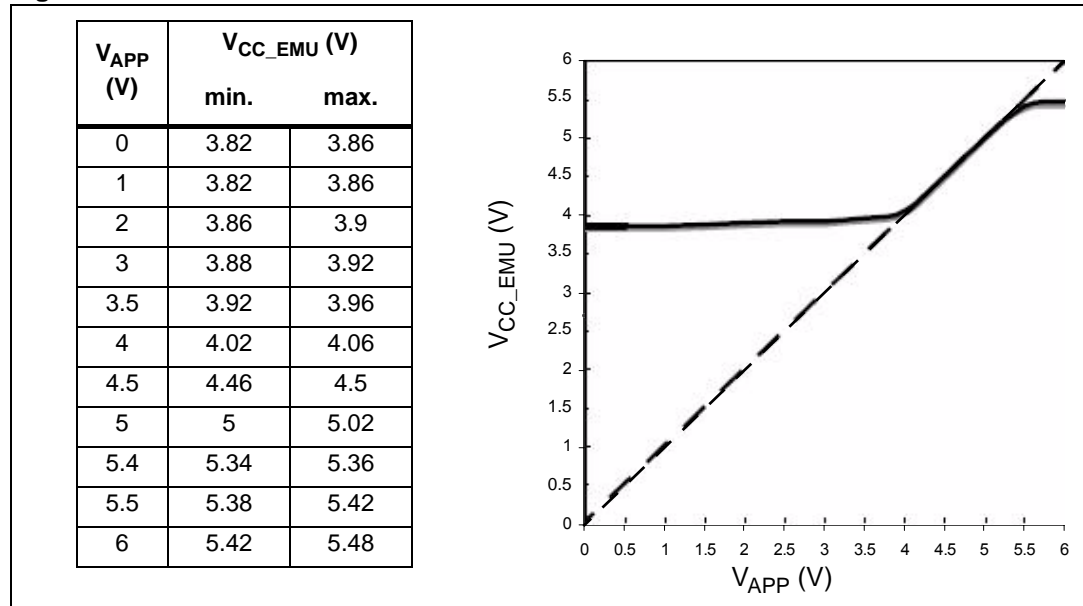
This option allows you to choose whether the watchdog timer is enabled by software or by hardware.

4.2 Emulator electrical characteristics

This section details the specific power follower characteristics of the ST7MDTU3-EMU3 emulator.

The application power supply follower converts the application voltage V_{APP} to a voltage within the range of 4.0 V and 5.25 V. The curve plotted on the graph below shows how the value of V_{CC_EMU} evolves with the value of V_{APP} .

Figure 10. Power follower behavior



Note: This data is provided only as a design guideline and is not tested with each emulator.

4.3 Functional limitations and discrepancies

Some MCU's may present specific limitations and discrepancies. You will find information specific to your MCU and your hardware configuration in STVD7's Discrepancies window. For more information refer to the STVD7 User Manual.

Current consumption on unconnected pads: For I/O port pads, any pads not connected to external pins will be in input pull-up configuration after a reset. These pads must be kept in a reset state to avoid current consumption.

ST72F63B Datasheet or *ST72F60 Datasheet* - information specific to your ST7 microcontroller.

Due to the modularity of the EMU3 probe, this guide is delivered with the following products:

- ST7MDTU3-TEB, which only contains the target emulation board (TEB).
- ST7MDTU3-EMU3 emulator kit (with ST7MDTU3-TEB already integrated).

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 rear 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 rear 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.

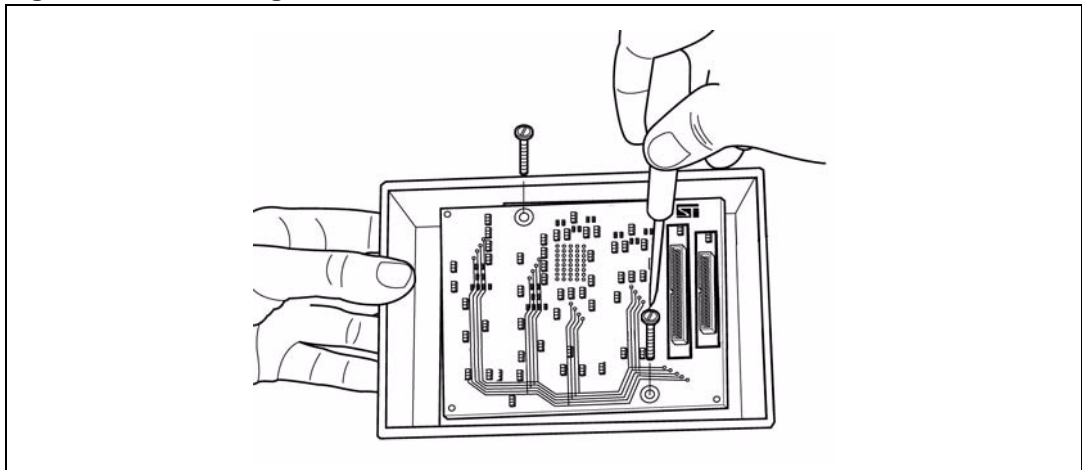
Appendix B Changing the TEB in your EMU3 probe

Each EMU3 probe has a modular design that is made up of three emulation boards. Two boards, the Common Emulation Board (CEB) and the Dedicated Emulation Board (DEB) are identical for all ST7-EMU3 probes. However, the third board, the Target Emulation Board (TEB), is specific to an ST7 MCU, or a family of ST7 MCUs. Therefore, what makes each EMU3 probe distinct and defines its emulation capabilities, is the type of TEB it contains.

The EMU3 probe has been designed to work with many different Target Emulation Boards (TEBs). This appendix tells you how to replace the TEB in your EMU3 probe.

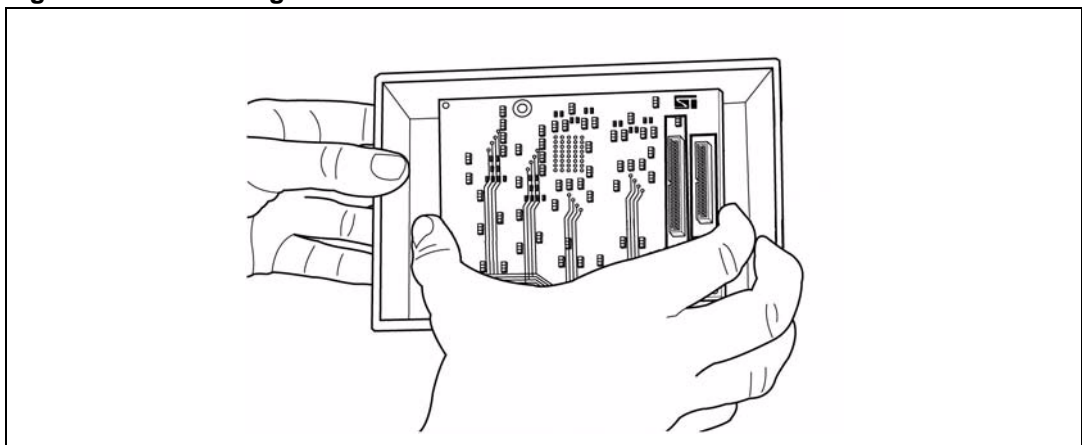
1. Turn the EMU3 probe upside-down, unscrew the retaining screw and slide the bottom out as shown in [Figure 3](#).
2. Remove the two screws that secure the TEB to the other probe boards as shown in [Figure 11](#).

Figure 11. Removing the TEB screws



3. Remove the target emulation board that is currently in the probe by gripping the edge of the board and pulling it straight out (see [Figure 12](#)). Store it somewhere safe and static-free for future use.

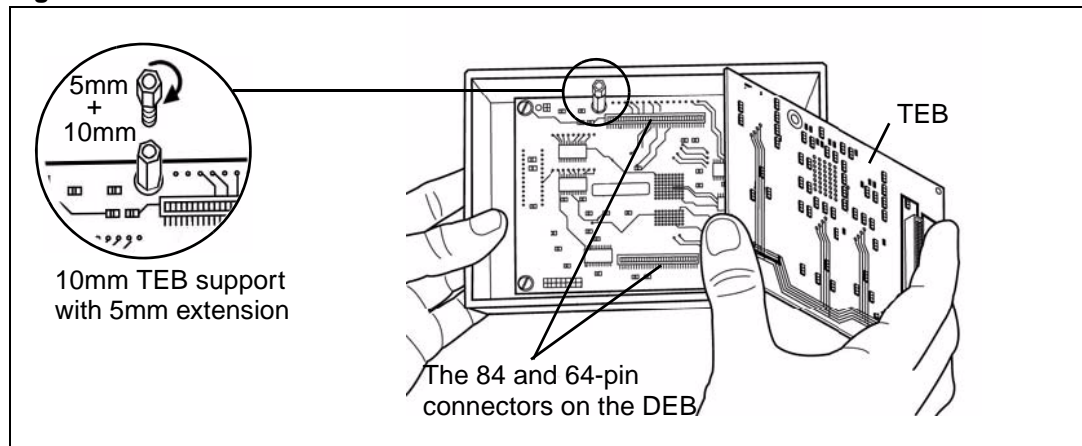
Figure 12. Removing the TEB



The board under the TEB – the Dedicated Emulation Board (DEB), should now be visible (see [Figure 13](#)).

- Identify the top and bottom faces of the TEB you wish to install. The bottom face is distinguished by the presence of two or more flex adapter connectors placed side by side. The top face is distinguishable by two DEB connectors along the long edges of the TEB. There is one 84-pin connector and one 64-pin connector, which match the DEB connectors shown in [Figure 13](#).

Figure 13. DEB and TEB connectors



- Install the replacement TEB in the EMU3 probe by inserting the male 84-pin/64-pin connectors into the TEB's female 84-pin/64-pin connectors (refer to [Figure 12](#)). Because the connectors are asymmetric, there is only one possible connection scheme.

Note: For some TEBs, the microcontroller is mounted on a support and not soldered directly to the board. In this case the TEB's 84-pin and 64-pin connectors have an additional height of 5mm to allow enough room for the microcontroller. To compensate you will need to add a 5mm extension to the 10mm support on the DEB, as shown in [Figure 12](#) on page 20. The 5mm extensions are provided with your TEB and screw into the 10mm supports. However, remember that if you install a TEB with surface mounted microcontroller later, you will have to remove the 5mm extensions.

- Once the TEB is firmly in place, refasten the two screws that fix the TEB to the DEB, as shown in [Figure 11](#). Take care not to over-tighten the screws.
- Connect the appropriate flex adapter for your MCU package, as described in Section 2: [Connecting your emulator to an application board on page 7](#).
- Replace the bottom panel of the probe housing such that the flex adapter feeds through the slot provided.
- Reconnect the probe to the ST Micro Connect box by connecting the two 80-pin flat cables to the ST Micro Connect connection ports on the top face of the probe housing. For details, refer to the *ST7 EMU3 Emulator User Manual*.

If this is the first time that you have installed a new TEB in your EMU3 probe, your emulator and probe firmware will be updated automatically by STVD7 when you start a debug session. For more information, refer to the *STVD7 User Manual*.

Appendix C 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. Phone numbers for major sales regions are provided on the www.st.com web site.

From the www.st.com site, select **Products > Microcontrollers** to obtain a complete online selection guide, 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.

C.1 Software updates

All our latest software and related documentation are available for download from the STMicroelectronics internet site, www.st.com.

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

C.2 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 STMicroelectronics development tools is available on the STMicroelectronics internet site, www.st.com.

C.2.1 Sockets

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

C.2.2 Connectors

Complete documentation and ordering information for SAMTEC connectors is provided on their internet site.

C.3 Getting prepared before you call

Collect the following information about the product before contacting STMicroelectronics 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 emulators box. The order code will depend on the region in which it was ordered (i.e. the UK, Continental Europe or the USA).
4. Serial number: The serial number is found located on the rear panel of the ST Micro Connect box and is also listed on the Global Reference card provided with the emulator.
5. TEB (target emulation board) hardware and firmware versions: The hardware and firmware versions can be found by opening an STVD7 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 you are using in your application.

Appendix D Revision history

Date	Revision	Changes
02-Apr-2004	1	Initial release.
04-Oct-2006	2	Added ST72F60x to supported families. Added QFN40 connection description and accessories
19-Feb-2009	3	Added a table showing root part number to cover page. Added Chapter 1 for information which no longer fitted on the cover page. No technical changes made.

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