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# **ST7MDTU2-EMU2B HDS2 Series Emulator User Manual**

Release 2.1

**April 2001**



Ref: DOC-ST7MDTU2-EMU2B



#### **INSTRUCTIONS FOR USE—WARNING**

This product is conform to the 89/336/EEC Directive. It complies with the ITE EN55022 standard for EMC emissions and generic 50082-1 (1992 edition) immunity standards.

**This product is an FCC Class-A apparatus. In a residential environment, it may cause radioelectrical disturbances.**

In addition, some parts of this emulator are not contained in an outer casing; consequently, it cannot be immune against electrostatic discharges (ESD). It should therefore be handled only in static safe working areas. Please refer to *Appendix : EMC Conformity and Safety Requirements* on page 63 for relevant safety information.

**USE IN LIFE SUPPORT DEVICES OR SYSTEMS MUST BE EXPRESSLY AUTHORIZED.**

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2. A critical component is any component of a life support device or system whose failure to perform can reasonably be expected to cause the failure of the life support device or system, or to affect its safety or effectiveness.

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## 1 INTRODUCTION

Thanks for choosing ST7! This manual will help you get started with the ST7MDTU2-EMU2B emulator kit.

The ST7MDTU2-EMU2B emulator allows you to control the execution of programs that you have written for the ST7262x and ST7261x families of MCUs (see list below) and assists you in debugging your application hardware as well as your software. The ST7MDTU2-EMU2B kit comes with a new debugger software package—STVD7 (ST7 Visual Debug)—which contains all of the necessary resources to help you design, develop and debug ST7 application software running in a real environment.

*Note:* If you come across any terms or abbreviations you do not understand, you can check their meaning in the Glossary on page 69.

First off, check that the ST7 MCU that you have picked for your application is in the list of devices supported by this version of the ST7MDTU2-EMU2B emulator:

Supported Devices
ST 72621 J4 ST 72621 J2
ST 72621 L4 ST 72622 L2
ST 72621 K4 ST 72622 K2
ST 72623 F2
ST 72611 F1 ST 72F611 F1 ST 72P611 F4

*Note:* While all of the above devices are supported in the current version of this emulator kit, not all features are available. On this emulator release, you can select between only two MCU targets which approximate the above devices, and which support all MCU package types. Please refer to Emulation functional limitations and discrepancies on page 61 for a description of the limitations on the current release of this emulator kit.

The Emulator Package is made up of two main parts:

- The Hardware Development System (**ST7-HDS2**), which is the common mainframe to all ST7 emulators.

- The **ST7MDTU2-Active Probe**, dedicated to the family, which constitutes the physical link between the emulator and your application.

*Note:* When receiving the ST7MDTU2-EMU2B development tool, please refer to the Delivery checklist on page 11 to confirm that all of the contents of the package are present.

The emulator performs two main functions:

- It replaces the microcontroller in the application, by means of an emulation probe that is plugged into the application in place of the emulated MCU.
- It controls the internal data bus of the emulated microcontroller, providing arbitration and tracing capabilities on all accesses to any of the following resources:
  - ST7-HDS2 resources,
  - ST7MDTU2-Active Probe resources,
  - Application resources.

Therefore, you can have the emulator running your software in the application just as the emulated MCU would do, and have extensive tracing and control capabilities (i.e. keeping track of what the MCU does, and making it react in a specific way upon defined conditions).

In this way, it is possible to fully emulate microcontroller resources.

## 1.1 Emulator configuration

*Figure 1* shows a general configuration for the ST7MDTU2-EMU2B emulator kit. The main ST7-HDS2 box is connected to your PC via the parallel port. Two flat cables connect the ST7-HDS2 box to the ST7MDTU2-Active Probe, to which a device adapter can be fixed so that you can connect the emulator to your application board.

*Note:* This illustration in Figure 1 shows the TQFP44 MCU package configuration—you can however set up the emulator kit to emulate any of the following MCU packages: TQFP44, SDIP42, SDIP32, SO34, PDIP20 or SO20.

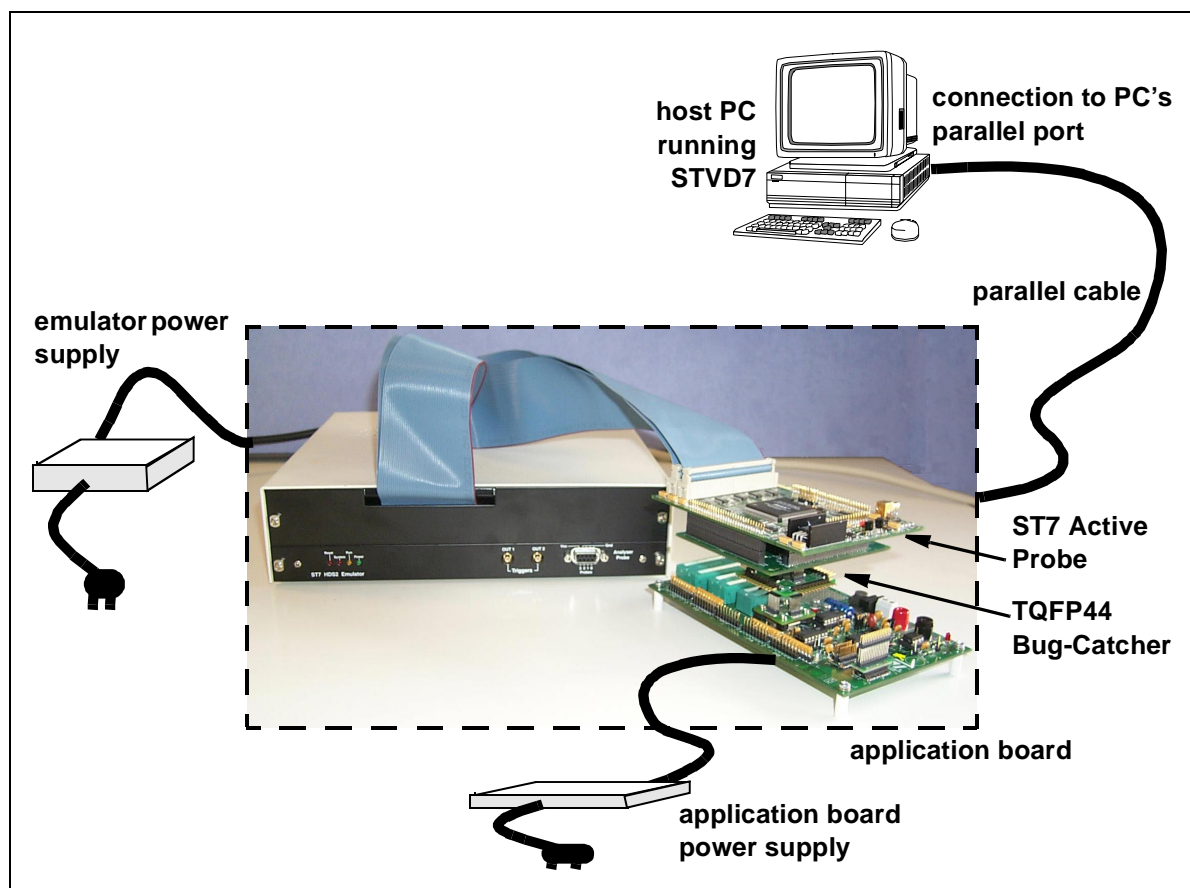


Figure 1: ST7MDTU2-EMU2B general configuration

## 1.2 Emulator operation

The emulator is operated from a host PC using **STVD7**, a state-of-the-art, **integrated development environment**, from which you can configure and control the emulator, debug, edit and rebuild your application program. *Chapter 3: STVD7* on page 27, explains how to install STVD7 on your PC, and set up the emulator configuration so that you can begin your development session.

Through STVD7, your application software is downloaded into the emulator. The emulator performs a real-time emulation of the target device, thus allowing high performance testing and debugging of both application hardware and software.

When the program is fully debugged, the ST7 EPROM programming board (ref.: ST7MDTU2-EPB2 — not provided with this emulator kit) can be used to



program the emulation device with the Motorola S Record format file produced by the OBSEND formatter.

### 1.3 Software and documentation for the emulator kit

The “MCU on CD” CD-ROM contains:

- ST7 Tools, comprising the following software:
  - The source-level graphic debugger, STVD7, that operates with ST7-HDS2 Emulators and ST7 Development Kits or as a standalone ST7 simulator.
  - The ST7 Assembly chain, composed of an assembler, linker, librarian and formatter.
  - The ST7 Windows Epromer to program your MCU target devices.
- Third-party C compiler and toolchain demos (Hiware and Cosmic).
- ST7 application notes (with sources), training slides and exercises, this manual (in PDF version), and other useful reference documents in PDF format, such as:
  - Datasheets for the ST7 MCU family
  - *ST7 Programming Manual*
  - *ST7 Assembler-Linker User Manual*
  - *STVD7 User Manual*

### 1.4 About this manual....

Detailed instructions on how to install your emulator configuration is described in *Chapter 2: Getting Started* on page 11.

How to start debugging your application using your emulator and STVD7 is described in *Chapter 3: STVD7* on page 27.

The emulator kit's hardware features are described in *Chapter 4: Emulator Features* on page 51.

The following conventions are used in this manual:

**Bold text** highlights key terms, phrases and is used when referring to names of dialog boxes, windows and tabs within windows.

***Bold italic*** text denotes menu commands (or sequence of commands), options, buttons or checkboxes which you must click in order to perform an action.

*Italicized* text highlights document names, variable strings, column names and field names.

`code font` designates file names, programming commands, path names and any text you must type.

The > symbol is used in a sequence of commands to mean “then”. For example, to open an application in Windows, we would write: “Click ***Start>Programs>ST7 Tool Chain>....***”.

## 1.5 Getting assistance

For more information, application notes, FAQs and software updates on all the ST microcontroller families, check out the CD-ROM or our website:

**<http://mcu.st.com>**

For assistance on all ST microcontroller subjects, or if you need help with using your emulator, use the contact list provided in *Product Support* on page 71. We'll be glad to help you!



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## 2 GETTING STARTED

### 2.1 Your host PC system requirements

The ST7MDTU2-EMU2B HDS2 Emulator (both hardware and software components) has been designed to work with PCs meeting the following requirements:

- One of the following operating systems: Microsoft® Windows® 95, 98, 2000 or NT®.
- Intel® Pentium (or compatible) processor with minimum speed of 100 MHz.
- Minimum RAM of 32 MB.
- 21 MB of free hard disk space to install all of the ST7 tools.

### 2.2 Delivery checklist

The emulator kit (ref.: ST7MDTU2-EMU2B), is delivered with the following (refer to *Figure 2*):

- 1 One emulator box containing the ST7-HDS2 main board (ref.: MB176).
- 2 One parallel cable.
- 3 Two 50-wire flat cables to connect the ST7-HDS2 main board to the emulation probe.
- 4 One ST7MDTU2 generic emulation probe (ref.: DB401).
- 5 One TQFP44/SDIP42 Adapter Probe (ref.: DB444) with TQFP44 and SDIP42 pin sockets for these microcontroller packages.
- 6 One SDIP32/SO34/PDIP20/SO20 Adapter Probe (ref.: DB445) with SDIP32/SO34/PDIP20 and SO20 pin sockets for these microcontroller packages.
- 7 A TQFP44 Bug Catcher (ref.: DB400).
- 8 A Yamaichi QFP44 (10 x 10) socket (ref.: IC149-044-052-S5), with its cover, screws and washers.
- 9 A PDIP20/SO20 device adapter (ref.: DB447).
- 10 An SO34 device adapter (ref.: DB406).
- 11 Two SDIP42 device adapters.
- 12 Two cranked male-male connectors.
- 13 A TQFP44 socket adapter (ref.: DB508). (This fits between the TQFP44/SDIP42 Adapter Probe (ref.: DB444) and the QFP44 Yamaichi socket.)
- 14 One emulator power supply.
- 15 One analyser probe cable.

- 16 Two trigger cables.
- 17 Three ferrite clips.
- 18 This manual. (Not shown.)
- 19 The “MCU on CD” CD-ROM containing ST7 datasheets, user documentation and software, including STVD7 and the Windows Epromer.(Not shown.)



Figure 2: Main components of ST7MDTU2-EMU2B emulator kit

### 2.3 Installing the hardware

The ST7 HDS2 emulator is connected through the parallel port to a host PC running STVD7, and to your application board through ST7-Active Probe and device adapters. To connect your ST7 HDS2 emulator, you will have to follow these general steps (see *Figure 3*), which are described in detail in the following sections:

- 1 Connect the ST7 HDS2 to your PC using the parallel cable provided.
- 2 Connect the two flat cables of your ST7 HDS2 emulator to the emulation probe connectors.
- 3 Connect the appropriate device adapter (i.e. SO34 or SDIP32) to the emulation probe, then connect the device adapter to the matching socket on your application board.
- 4 Connect the power supply cable between the power supply block and the power connector located on the rear panel of your ST7 HDS2 emulator.
- 5 Power up the emulator and then connect your application power supply.

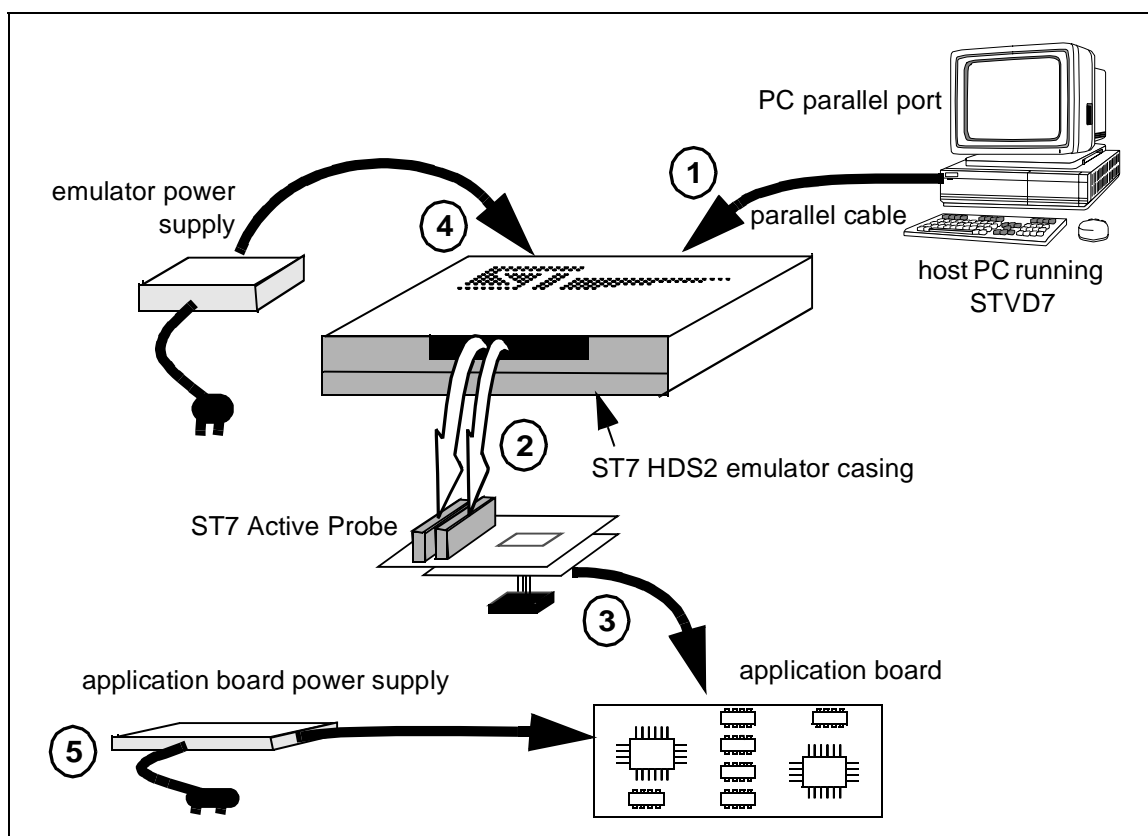


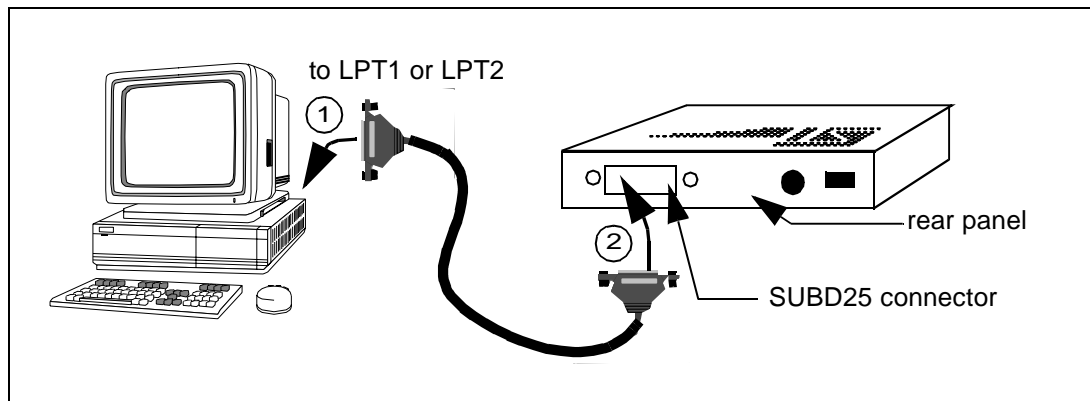
Figure 3: Emulator installation steps

**2.3.1 Step 1: Connecting the emulator to your PC**

- 1 Shutdown and power-off the PC that is to be connected to the emulator.
- 2 Connect one end of the parallel cable to the emulator’s rear panel 25-pin SUB-D connector and the other end to one of the PC’s parallel ports (LPT1 to LPT2)—refer to *Figure 4*.

*Note:* Centronics (or PC-AT or SPP), ECP and EPP parallel port configurations are supported by the emulator.

Be sure to use the parallel cable provided with the emulator—using a longer parallel cable may cause emulator malfunctions.

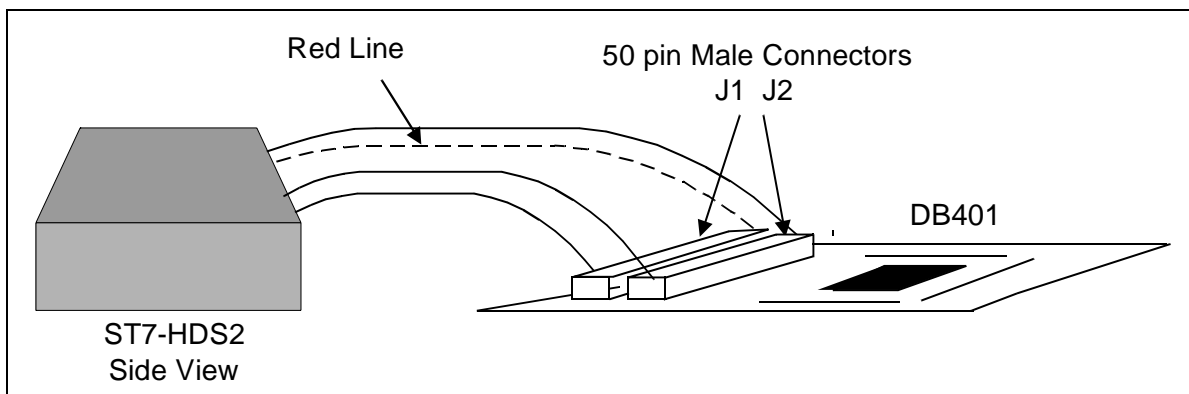


**Figure 4: Connecting the emulator to the PC**

**2.3.2 Step 2: Connecting the HDS2 and the probe**

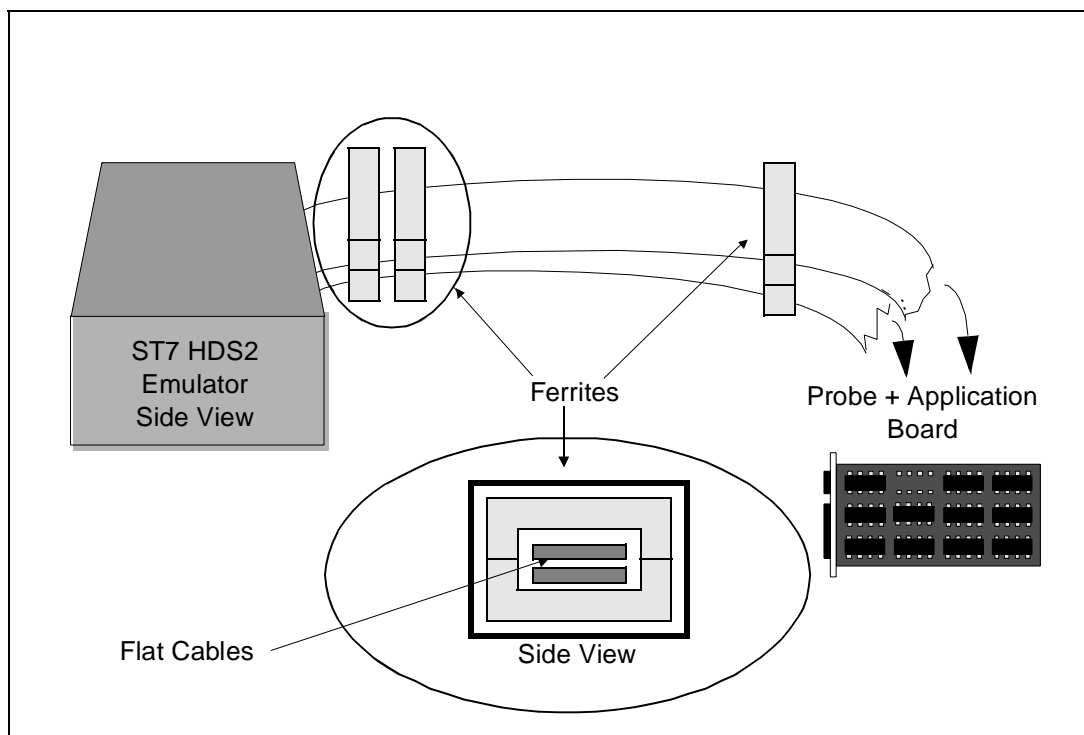
- 1 Ensure that the application and the emulator are **powered-off**.
- 2 Plug the two 50-wire flat cables into the J1 and J2 connections on the probe, as described below (refer also to *Figure 5*):

ST7-HDS2 emulator (ref.: MB176)	ST7MDTU2-Active Probe (ref.: DB401)
Upper cable	J2
Lower cable	J1



**Figure 5: Connecting the emulator to the ST7MDTU2 generic probe**

**3 EMC-compliant probes:** In order to work under an EMC-compliant environment, you will have to clip one or two EMC-ferrite on each 50-wire flat cable linking the probe to the emulator box. Place these ferrites as close to the emulator window as possible. Three ferrites are provided in the package. See *Figure 6* for an illustration of where to attach the ferrites.



**Figure 6: Making your probes EMC-compliant**

**2.3.3 Step 3: Connecting the probe to your application board**

The ST7MDTU2-Active Probe consists of two parts: a generic ST7 emulation probe connected to a package-specific adapter probe. There are two adapter



probes included in your emulator kit: one for use with the TQFP44 and SDIP42 packages, and another for use with the SDIP32, SO34, PDIP20 and SO20 packages.

In addition, the device adapter for each MCU package type is different. Some package types require you to solder special connectors onto your application board.

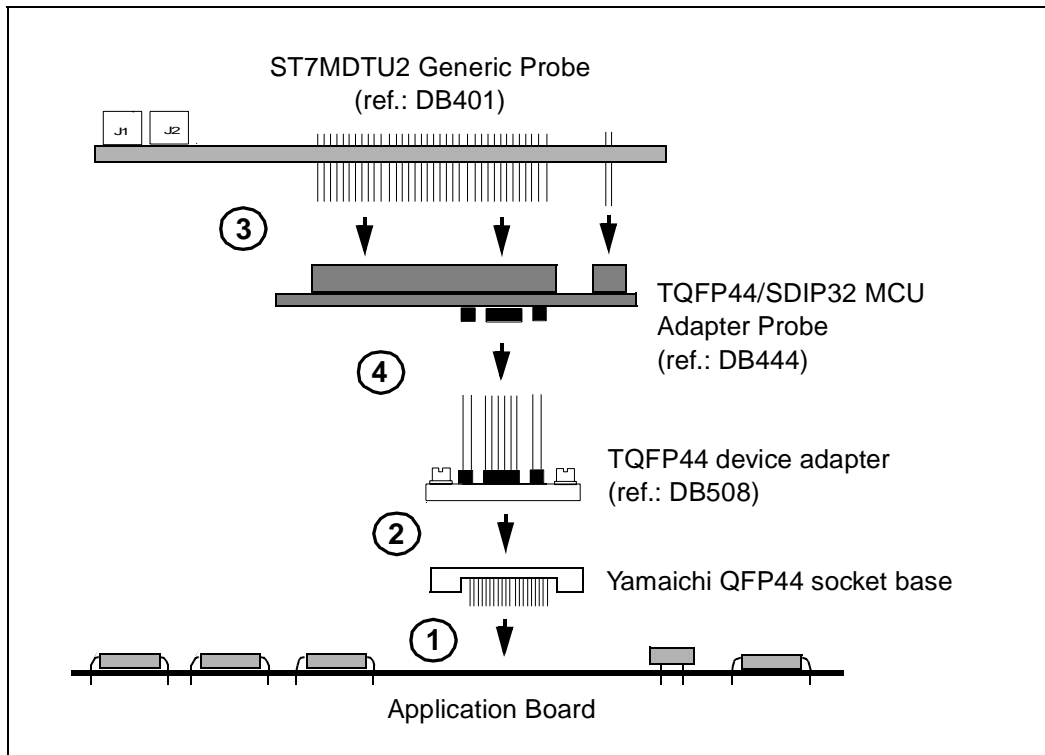
Therefore, depending on the MCU package you are using in your application, this step varies. Specific instructions for each MCU package follow as listed below:

- A. TQFP44 package—see *page 17*.
- B. SDIP42 package—see *page 19*.
- C. SO34 package—see *page 20*.
- D. SDIP32 package—see *page 22*.
- E. PDIP20 package—see *page 23*.
- F. SO20 package—see *page 24*.

**Note:** *You can use your emulator kit with STVD7 without an application board—however the emulation probes must be connected to the HDS2 emulator. To do this, connect the ST7MDTU2 generic probe (ref.: DB401) to the adapter probe for the MCU package(s) you are using (i.e. either DB444 or DB445)—instructions follow.*

**A) If you are using the TQFP44 package, follow these steps (refer to *Figure 7*):**

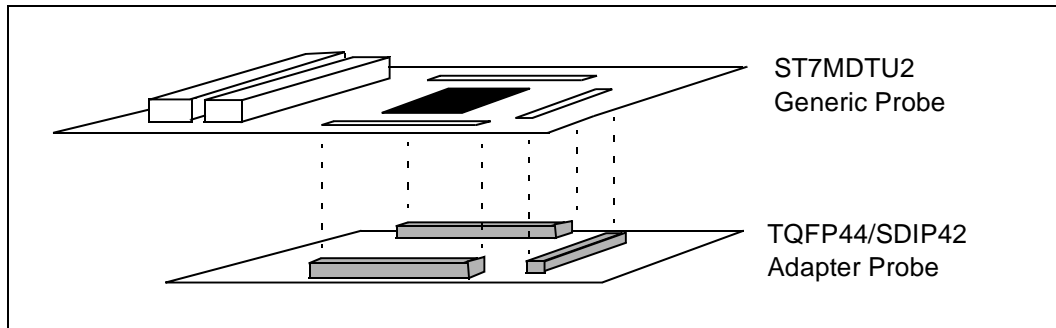
- 1 Solder the Yamaichi socket base of the TQFP44 device adapter (ref.: DB332) onto your application board. For footprint information, please refer to *TQFP44 footprint issues* on page 68.



**Figure 7: TQFP44 MCU package connections**

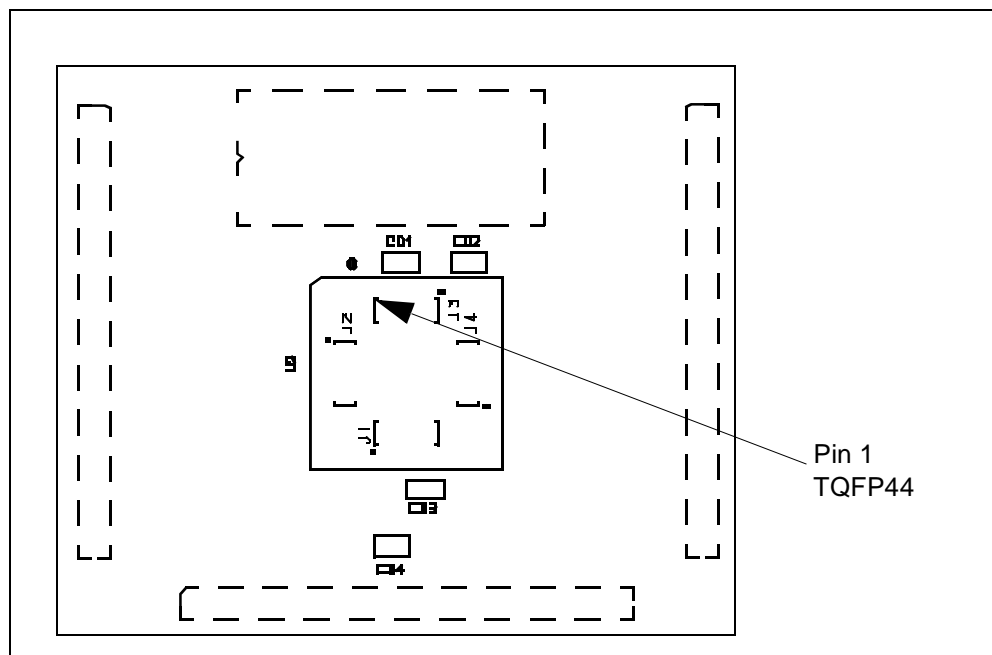
- 2 Place the TQFP44 device adapter upon the socket base, aligning pin 1 of the device adapter with pin 1 on the Yamaichi QFP44 socket. Pin 1 is indicated by a chamfer and an arrow on the TQFP44 device adapter and by a little arrow on the socket. You may fix the adapter onto the socket base with screws provided with the Yamaichi socket.

- 3 Connect the TQFP44/SDIP42 Adapter Probe (ref.: DB444) to the ST7 generic probe (ref.: DB401) (see *Figure 8* for a close-up view of this step).



**Figure 8: Connecting the TQFP44/SDIP42 adapter probe to the ST7MDTU2 generic probe**

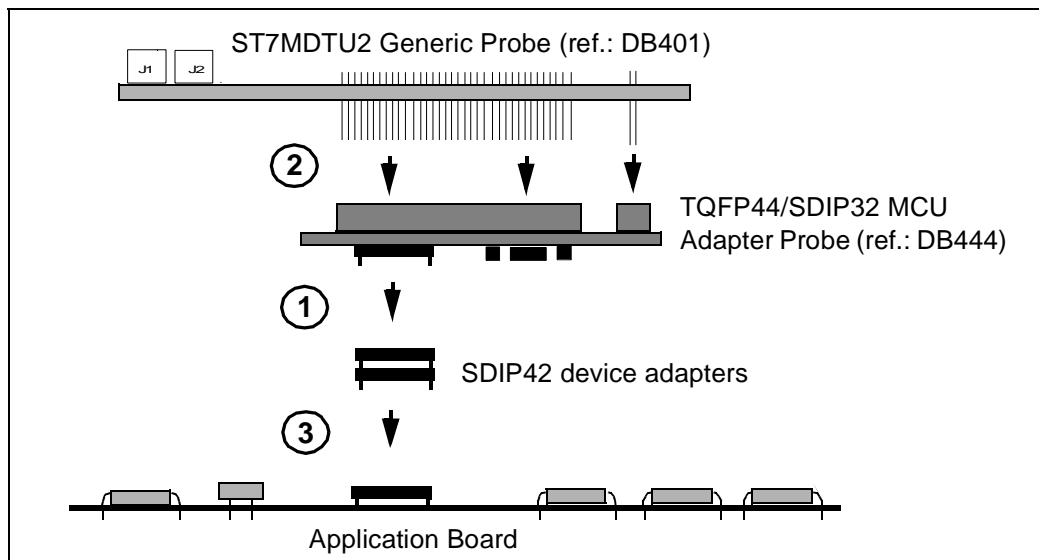
- 4 Now connect the joined generic and adapter probes to the TQFP44 device adapter, by inserting the male pins of the device adapter into the female connectors on the underside of the TQFP44/SDIP42 Adapter Probe. Take care to align pin 1 of the device adapter with pin 1 on the underside of the adapter probe. (On the TQFP44/SDIP42 MCU Adapter Probe (ref.: DB444), pin 1 is indicated by a little arrow—see *Figure 9*.)



**Figure 9: TQFP44 Pin 1 Location on TQFP44/SDIP42 adapter probe (ref.: DB444)**

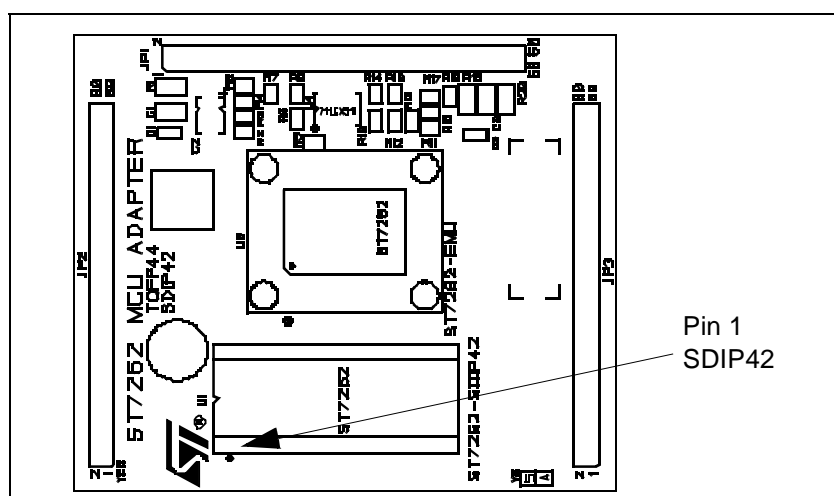
**B) If you are using the SDIP42 MCU package, follow these steps (see *Figure 10*):**

- 1 Connect the two SDIP42 device adapters together, and then connect them to the SDIP42 socket (U1) on the bottom of the TQFP44/SDIP42 Adapter Probe (ref.: DB444).



**Figure 10: SDIP42 MCU package connections**

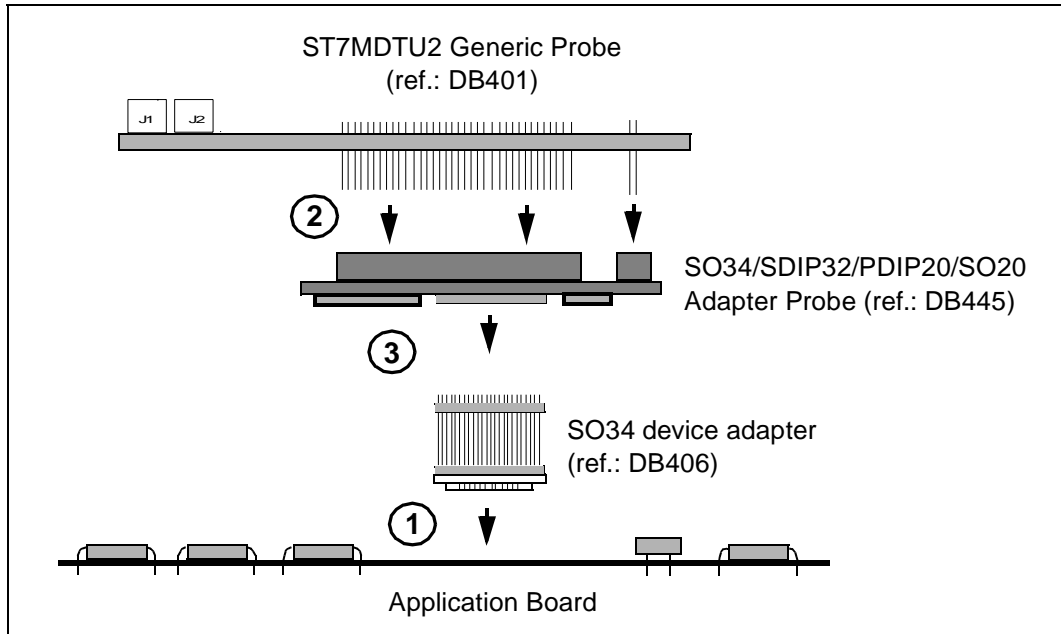
- 2 Connect the TQFP44/SDIP42 adapter probe to the ST7MDTU2 Generic Probe (ref.: DB401) (refer to *Figure 8* for a close-up view of this step).
- 3 Connect the probe to your application board by inserting the male pins of the SDIP42 device adapter (attached to the underside of the probe) into the SDIP42 socket on your application board. Take care to align pin 1 of the SDIP42 device adapter (indicated by a little arrow on the SDIP42 socket (U1) on the underside of the adapter probe) to pin1 of your application board socket.



**Figure 11: SDIP42 Pin 1 Location on TQFP44/SDIP42 adapter probe**

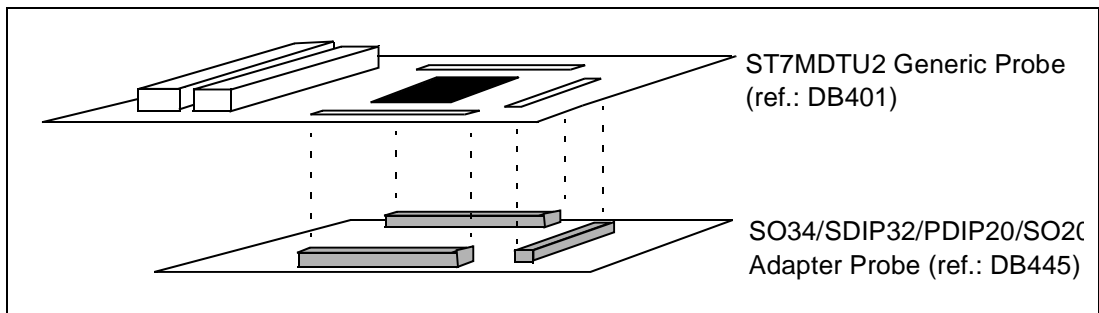
**C) If you are using the SO34 MCU package, follow these steps (see *Figure 12*):**

- 1 Solder the SO34 device adapter (ref.: DB406) to your application board.



**Figure 12: SO34 MCU package connections**

- 2 Connect the SO34/SDIP32/PDIP20/SO20 Adapter Probe (ref.: DB445) to the ST7MDTU2 Generic Probe (ref.: DB401) (see *Figure 13* for a close-up view of this step).



**Figure 13: Connecting the SO34/SDIP32/PDIP20/SO20 probe to the ST7MDTU2 generic probe**

- 3 Connect the probe to the SO34 device adapter, taking care to align pin 1 on the device adapter with the female pin 1 connector on the underside of the probe. On the SO34 device adapter, pin 1 is indicated by a chamfer on the adapter base. On the probe, pin 1 is indicated by a little arrow adjacent to the SO34 socket (U4)—refer to *Figure 14*.

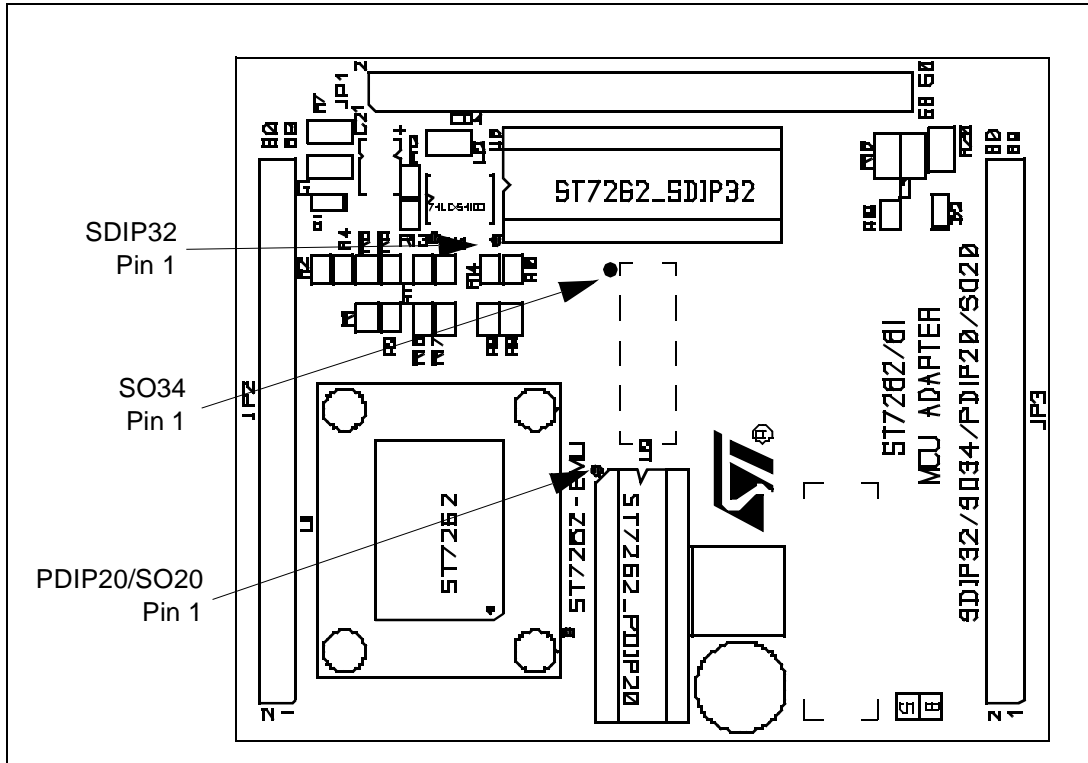
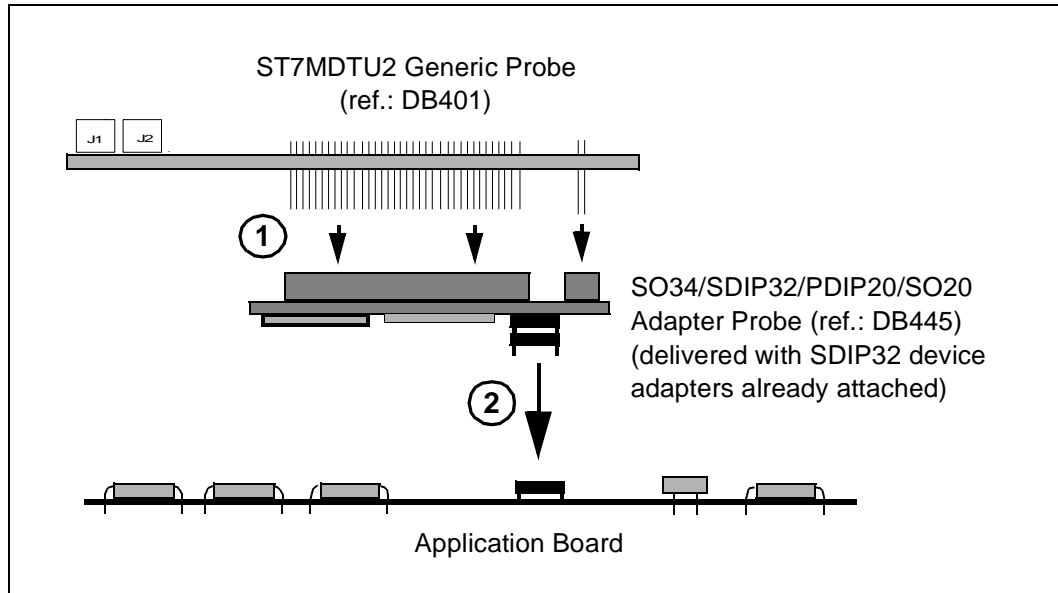


Figure 14: SO34/SDIP32/PDIP20/SO20 pin 1 location

**D) If you are using the SDIP32 MCU package, follow these steps (refer to *Figure 15*):**

- 1 Connect the SO34/SDIP32/PDIP20/SO20 Adapter Probe (ref.: DB445) to the ST7MDTU2 Generic Probe (ref.: DB401) (see *Figure 13* for a close-up view of this step).

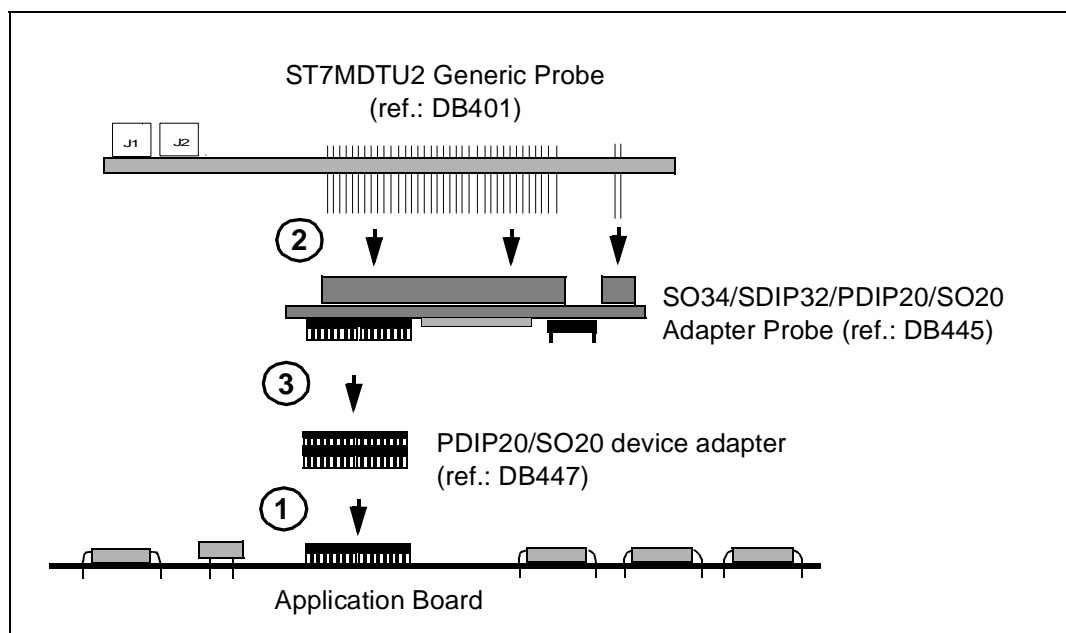


**Figure 15: SDIP32 MCU package connections**

- 2 Connect the SDIP32 device adapters (on the underside of the SO34/SDIP32/PDIP20/SO20 Adapter Probe) to the SDIP32 socket on your application board, taking care to align pin 1 on the device adapter with the female pin 1 connector on the socket. On the SDIP32 device adapter, pin 1 is indicated by a chamfer on the adapter base.

**E) If you are using the PDIP20 MCU package, follow these steps (refer to *Figure 16*):**

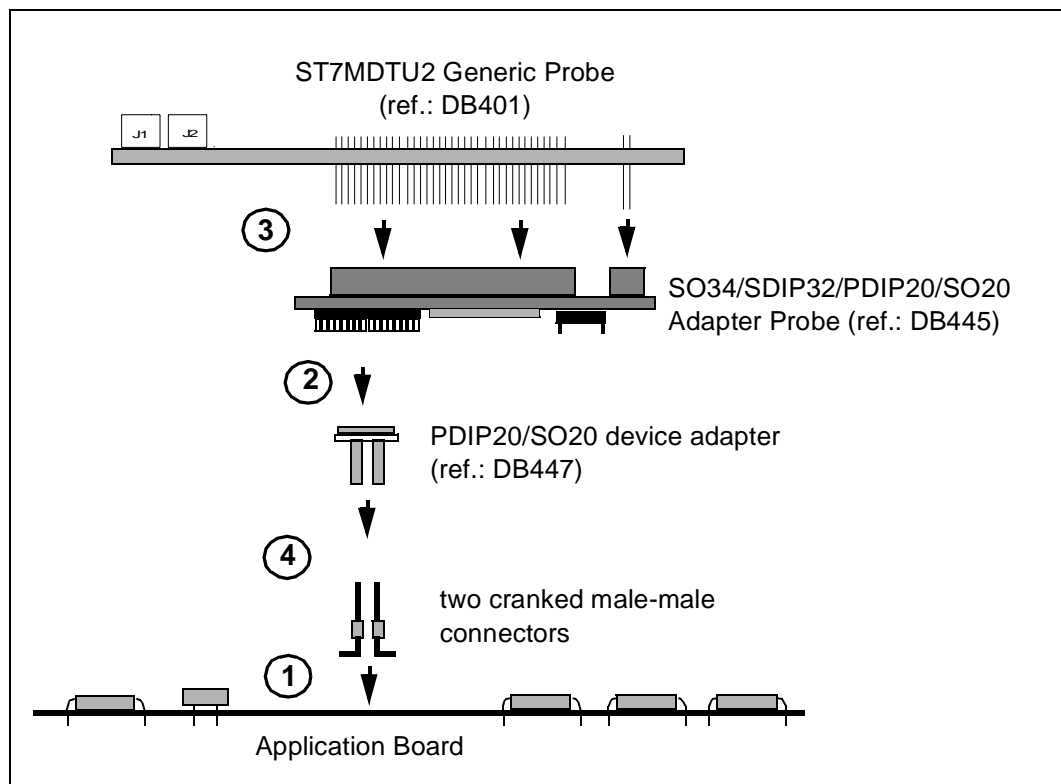
- 1 Connect the two PDIP20/SO20 device adapters (ref.: DB447) together and connect them to the PDIP20 socket on your application board.
- 2 Connect the SO34/SDIP32/PDIP20/SO20 Adapter Probe (ref.: DB445) to the ST7MDTU2 Generic Probe (ref.: DB401) (see *Figure 13* for a close-up view of this step).
- 3 Connect the probe to the PDIP20/SO20 device adapter (ref.: DB447), taking care to align the device adapter's female pin 1 connector with the male pin 1 on the underside of the probe. On the PDIP20/SO20 device adapter, the pin 1 position is indicated by a chamfer on the adapter base. On the probe, pin 1 is indicated by a little arrow adjacent to the PDIP20/SO20 socket (U3)—refer to *Figure 14*.

**Figure 16: PDIP20 MCU package connections**



**F) If you are using the SO20 MCU package, follow these steps (refer to *Figure 17*):**

- 1 Solder the two cranked male/male connectors onto your application board.
- 2 Connect the PDIP20/SO20 device adapter (ref.: DB447) to the PDIP20 socket (U3) on the underside of the SO34/SDIP32/PDIP20/SO20 Adapter Probe (ref.: DB445). Take care to align the device adapter's female pin 1 connector with the male pin 1 on the underside of the probe. On the PDIP20/SO20 device adapter, the pin 1 position is indicated by a chamfer on the adapter base. On the probe, pin 1 is indicated by a little arrow adjacent to the PDIP20/SO20 socket (U3)—refer to *Figure 14*.
- 3 Connect the SO34/SDIP32/PDIP20/SO20 Adapter Probe (ref.: DB445) to the ST7MDTU2 Generic Probe (ref.: DB401) (see *Figure 13* for a close-up view of this step).
- 4 Connect the PDIP20/SO20 device adapter (ref.: DB447) to the two cranked male/male connectors attached to your application board. Take care to align pin 1 on your application board with pin 1 of the PDIP20/SO20 device adapter.



**Figure 17: SO20 MCU package connections**

### 2.3.4 Step 4: Connecting the emulator power supply

**Warning:** Make sure that both the emulator and the application are OFF before making any connections.

- 1 Connect the external power supply provided with the emulator to the rear panel of the mainframe using a 5-pin DIN connector.
- 2 Plug the power supply into the mains using the supply cable provided.  
Mains voltage specifications:

<b>AC voltage:</b>	100 V to 240 V
<b>Frequency:</b>	50 to 60 Hz

### 2.3.5 Step 5: Powering up

- 1 Check the ST7 HDS2 operating voltage (110 V/220 V) indicated on the label on the power supply. Contact your dealer if this voltage does not correspond to your mains' power supply.
- 2 Power up the ST7 HDS2 emulator from the ON/OFF switch located on the rear panel. The LED labelled **Power** on the front panel should then light up.
- 3 Power up your application.

## 2.4 Debuggers supporting the ST7 HDS2 emulator series

The debuggers currently supporting the ST7 HDS2 emulator series are:

- STVD7 (STMicroelectronics)
- Hilight for ST7 (HIWARE)
- HI\_WAVE for ST7 (HIWARE)
- Zap for ST7 (COSMIC)

STVD7 is free software. It is available on the STMicroelectronics website.

The next chapter tells you how to configure your emulator and start debugging with STVD7.