AT43DK325 USB Controller Development Kit for AT43USB325/6

User Guide Revision 1.0

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Section 1

Introduction

Congratulations on your purchase of the AT43DK325 USB Development Kit. The AT43DK325 is a complete starter kit and development system for Atmel's AT43USB325x family of AVR® based USB microcontrollers (MCUs). It provides all of the necessary hardware and firmware components to facilitate rapid prototyping and firmware development of the AT43USB325x applications.

1.1 Features

The AT43DK325 Development Kit consists of the following:

- Development Board for the AT43USB325/6 USB MCUs featuring
  - An AT43USB325 full-speed USB controller programmable as a compound device, a hub only device or a function only device
  - One internal and four external downstream HUB ports
  - 512 bytes on-chip program SRAM
  - 16 Kbytes program memory
  - Parallel interface to PC for In-System firmware programming
  - Pin header connectors for access to all available GPIO pins
- Hardware design files (schematics and PCB layout)
- USB 2.0 compliant USB firmware library
- USB Wizard firmware source code generation utility
- In-System Programming tool
- Complete user's guide

1.2 Device Support

The AT43DK325 Development Kit and the accompanying software tools are intended to support firmware development and prototyping for the AT43USB325/6 family of USB keyboard function controllers, including the

- AT43USB325E/M
- AT43USB326

Binary compatibility across the AT43USB325/6 family ensures that only one set of development tools (development kit, compilers, etc.) is needed for all of the AT43USB3xx based applications. Firmware written for one member of the family can be

re-used for another member without modification as long as only features available on both parts are used.

1.3 Documentation

The AT43DK325 Development Kit is accompanied by the following two documents:

- *AT43DK325 User's Guide*
- *USB Wizard User Guide*

Atmel recommends its customers to read the *AT43DK325 User's Guide* prior to reading the *USB Wizard User Guide*.

1.4 Free Downloads

The latest version of the USB Wizard can be found in the USB section of the Atmel web site at **http://www.atmel.com**. Please refer to the same section for up-to-date information on new USB product announcements, software releases and tool upgrades.

Section 2

Getting Started

2.1 Electrostatic Warning

The AT43DK325 Development Board is shipped in protective anti-static packaging. The board must not be subjected to high electrostatic potentials. A grounding strap or similar protective device should be worn when handling the board. Avoid touching the component pins or any other metallic elements.

2.2 Unpacking the System

The AT43DK325 Development Kit is supplied with the following:

- AT43DK325 Development Board
- 2-meter Fully Rated USB Cable
- Male-male DB25 Parallel Cable
- Atmel USB CD-ROM with Software and Documentation

Please contact your local Atmel distribution or E-mail usb@atmel.com if any of the aforementioned items is missing from the package.

2.3 System Requirements

The minimum hardware and software requirements are:

- 486 processor (Pentium® is recommended)
- 128 MB RAM
- 10 MB free hard disk space
- Windows® 98/2000/ME/XP
- Parallel printer port

2.4 Software Requirements

The following third party softwares are needed to access and modify the documents and source code in the CD-ROM:

- *OrCAD Capture*® from **www.orcad.com** for the .dsn file
- *IAR* or *GNU C Compiler* for the sample C source code
- *Microsoft*® *Word* from **www.microsoft.com** for the .doc files
- *Acrobat*® *Reader*® from **www.adobe.com** for the .pdf files
- *Winzip*® from **www.winzip.com** to open the .zip files

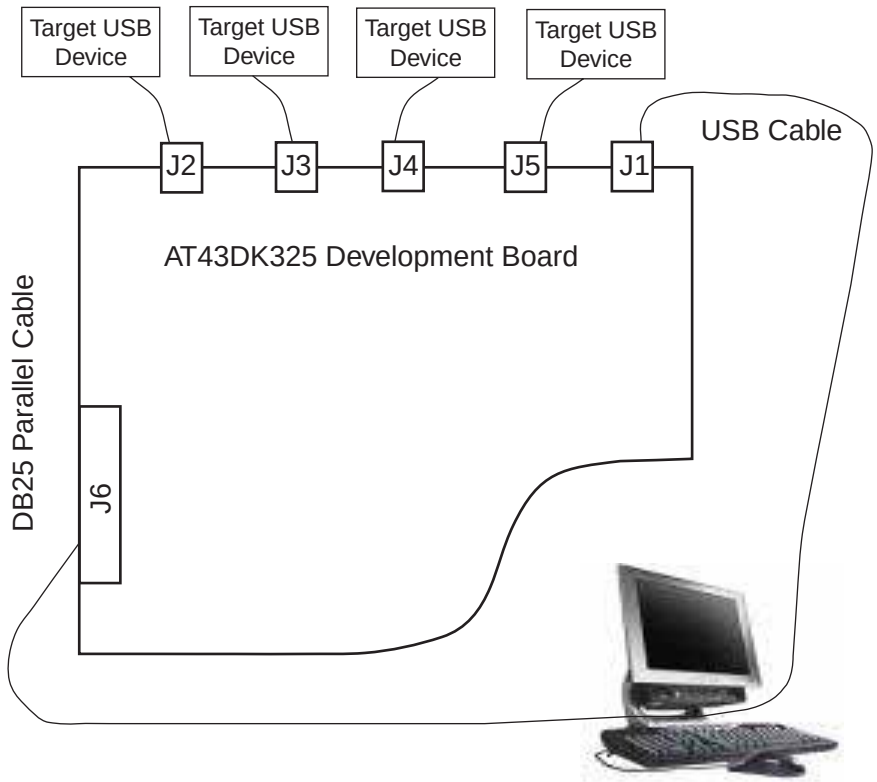
2.5 Connecting the Hardware

Atmel has taken great care in creating a reliable demonstration kit for its customers. The AT43DK325 Development Board is USB bus powered and requires no external power supplies. In order to ensure proper operation, the supplied components in the kit must be used in the setup shown in Figure 2-1. Atmel does NOT recommend substitution of these components.

Connect the AT43DK325 Development Board as follows:

1. Verify that Jumper JP9 is closed.
2. Connect the USB cable from J1 Series B USB receptacle on the Development Board to the USB Series A receptacle on the PC.
3. Connect the DB25 parallel cable from J6 on the Development Board to the parallel port on the PC.

Figure 2-1. Connection to the AT43DK325



2.6 CD-ROM Contents

The CD-ROM has a top directory **\325_evx** where **x** indicates the version of the firmware. All the directory paths used in this User Guide fall under this top directory. There are three major subdirectories:

- ***BOARD***: hardware design documentation
- ***Docs*****:** datasheets, tutorial, and user's guide
- ***USBWizard*****:** USB Wizard software tool and examples

2.6.1 USB Wizard Utility

USB Wizard is a GUI based development tool that facilitates rapid USB application development for the AT43USBxxx family of AVR USB controllers. It allows the user to generate firmware templates in ANSI C for USB and AVR peripherals with few clicks of the mouse.

The utility is located in *\USBWizard\USBWizard* directory. This directory contains the USB Wizard executable and other dependencies files.

Please refer to the *Readme* file on the release CD for installing instructions. The USB Wizard executable file is supported on Windows® 98/2000/ME/XP.

Source code generated by the USB Wizard cannot be programmed directly into the on-board SEEPROM device. It must be compiled and linked first. The USB Wizard currently supports IAR and GCC compilers.

Refer to the Atmel “USB Wizard User Guide” and “USB Wizard: Application Examples and Demos” for detailed descriptions of this utility.

Figure 2-2. USB Wizard Application Window

2.6.2 Code Base Directory

This is the directory where the code base needed by USB Wizard is located. The name of this directory is *USBWizard**Codebase*. There are two main groups of code base within this directory. The first one is *IARbase*, which provides necessary code for IAR. The second one is *GCCbase* which contains the code for the GCC compiler. The following is a brief summary of the directory tree of this code base.

```
Code base
      |
      |------------ IARbase
      |                  |
      |                  |------ AT43USB35x
      |                  |------ AT43USB326
      |                  |------ AT43USB325E
      |
|------------ GCCbase
                |
                |------ AT43USB35x
                |------ AT43USB326
                |------ AT43USB325E
```

2.6.3 Application Examples

The application examples are also included within this package. They are located in the *USBWizard**Examples*\ directory. This directory contains USB Wizard configuration files (*.usw files) and the corresponding C files for the application examples. There are five subdirectories in this directory:

1. Hub_Disabled
2. OCR1A
3. OCR1B
4. PWM_ADC_GPIO
5. SPI

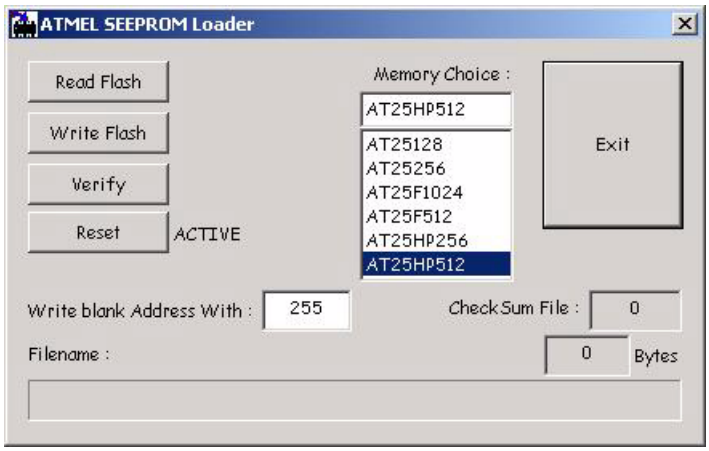
2.6.4 In - System Programming Tool

The SEEPROM Loader allows developers to program the SEEPROM device through the standard parallel port. The tool is located in the *USBWizard**ISP*\ directory.

Please refer to the *Readme* file for installation instructions.

Please read Section 4 of this document or Section 3 of Atmel's "USB Wizard: Application Examples and Demos" on how to use this utility.

Figure 2-3. SEEPROM Loader Tool Window



2.6.5 Binary Files for Uploading

The ready-made programmable binary files for loading are located on the CD-ROM in the *\USBWizard\Binary* directory. The files have extension *.hex. They are located under three subdirectories:

1. OCR1A
2. OCR1B
3. PWM_ADC_GPIO

2.7 Checking the Hardware

The Development Board comes with a preprogrammed application. Connect the USB Upstream port of the Development Board to the downstream port of the Host (i.e.: PC). Then, check its existence in the **Device Manager** of the **System Control Panel** window. If the Development Board is working properly, it should show up in the PC as a HID compliant device.

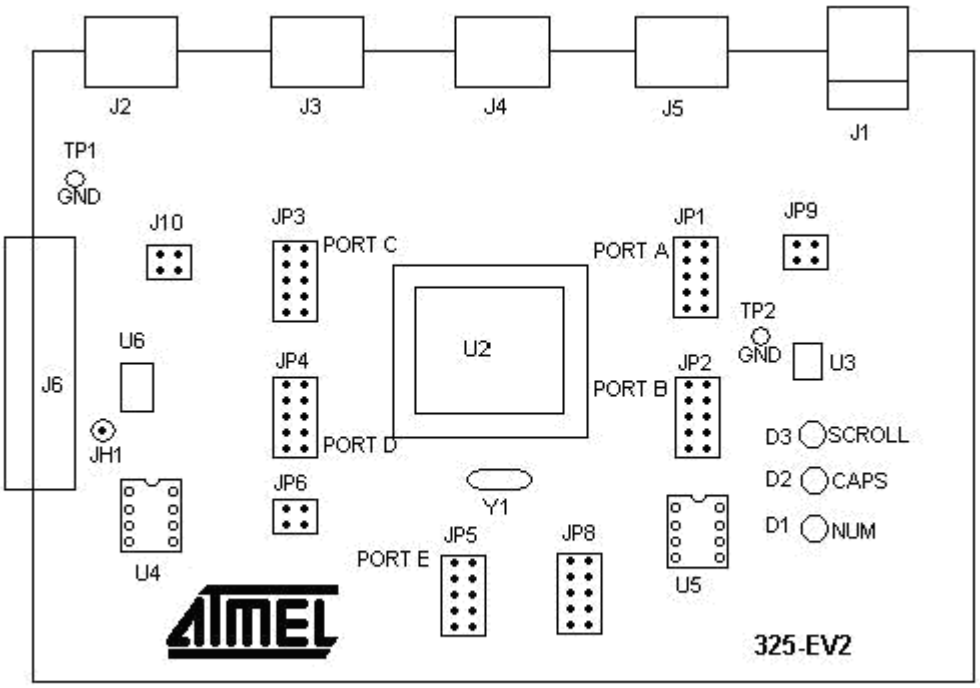
Another way to check the proper functioning of the board is to connect a USB device such as a mouse to one of the downstream USB hub ports on the Development Board. The Development Board is functioning properly if the mouse is detected by the PC.

Section 3

Hardware Description

The following hardware description explains the Development Board in detail. The Development Board schematic can be found in Section 6.2 on page 6-3.

Figure 3-1. Simple Block Diagram of the DK325 Board



3.1 LEDs (D1 to D3)

The AT43DK325 Development Kit includes 3 green LEDs. The anode pin of each LED is connected to the VBUS.

3.2 5x2 Header JP8

Pins 2, 4, and 6 of this jumper are connected to the cathode pin of each LED. To turn on the LEDs, JP8 should be pulled low and pins 2, 4, and 6 must be connected to pins 1, 3

and 5 with jumpers. On keyboard applications, LEDs can be used to identify Scroll, Caps, and Num.

3.3 DB25 Female Parallel Port Connector J6

This parallel port connector is used to download the firmware from the PC to the SEEPROM in socket U4. Further explanations on setting up the board for downloading the firmware to the SEEPROM is available in “USB Wizard: Application Examples and Demos” for the AT43USB325 and Demos documentation.

3.4 8-pin IC Socket U4

The SEEPROM device is plugged into this 8-pin socket. This board is supplied with an Atmel SEEPROM.

3.5 Programmable Logic Device U6

This Development Board uses an ATF16V8CZ Electrical Erasable PLD (EE PLD). This device controls the data flow to and from the SEEPROM during firmware downloading and during the booting process upon power-up or reset.

3.6 4x2 Header General Purpose I/O PORT A/JP1

This header provides external access to PORT A of the AT43USB325. Each pin header, labelled “0” - “7”, corresponds to the PORT A pin of the same number.

3.7 4x2 Header General Purpose I/O PORT B/JP2

This header provides external access to PORT B of the AT43USB325. Each pin header, labelled “0” - “7”, corresponds to the PORT B pin of the same number.

3.8 4x2 Header General Purpose I/O PORT C/JP3

This header provides external access to PORT C of the AT43USB325. Each pin header, labelled “0” - “7”, corresponds to the PORT C pin of the same number.

3.9 4x2 Header General Purpose I/O PORT D/JP4

This header provides external access to PORT D of the AT43USB325. Each pin header, labelled “0” - “7”, corresponds to the PORT D pin of the same number.

3.10 4x2 Header General Purpose I/O PORT E/JP5

This header provides external access to PORT E of the AT43USB325. Each pin header, labelled “0” - “7”, corresponds to the PORT E pin of the same number.

3.11 2x2 Header General Purpose I/O JP6

External access to PORT F is available at this header. In the 43USB325E, Port F only has 4 pins marked as PF0 to PF3. These pins are used to download firmware from the SEEPROM to the internal SRAM upon reset or power-up. Once firmware is downloaded, PF0 will remain high while PF1-PF3 will be available as general purpose I/Os.

PF3 also has an alternate function as an input capture pin for a Timer/Counter1 feature. Note that PF0 is not available for general purpose I/O.

3.12 Solid State Power Switch U3

This switch is used to support ganged power switching. This board uses Micrel MIC2026-2BM.

3.13 Header GND TP1 and TP2

This pin provides ground voltage reference.

3.14 2x2 Header JP9

The Development Board supports ganged power switching to the available USB ports using a Micrel MIC2026-2BM solid state power switch. The PDX0 and PDX1 must be connected to this switch by installing a jumper to this header. By default, two jumpers are installed at this header. If the system is not used, PDX0 and PDX1 are available as general purpose I/Os.

3.15 Header JH1

This pin is also used as an input capture pin for the Timer/Counter1 feature.

3.16 USB External Downstream Port J2, J3, J4, and J5 Connectors

These connectors provide downstream connection to USB devices. There are 5 downstream ports. Port 1 is permanently used by the embedded function and is not visible. On this board, J2, J3, J4 and J5 correspond to embedded USB hub ports 5, 4, 3 and 2 respectively. The power source of these ports is controlled by power switch U3.

3.17 USB Upstream Port J1 Connector

This connector provides upstream connection to the host or to another hub.

3.18 Programmable Microcontroller U2

This board comes with the AT43USB325E microcontroller.

3.19 2x2 Header JP10

Pin 1 on this header is connected to both VSS1 and VSS2 of U2 (microcontroller), while pin 2 and pin 4 are connected to the TEST and SYSCLK pins of U2 respectively. No connection to pin 3 of this header.

3.20 Two-wire Serial EEPROM U5

This board includes a two-wire Serial EEPROM for extra memory. The device plugged into this socket is the AT24C02A. Please refer to the ATC024A datasheet for more information about this device.

Section 4

SEEPROM Loader

SEEPROM Loader is an Atmel software tool used to program the SEEPROM via generic parallel ports. This section describes the tool briefly.

4.1 Setting Up the Board

Before starting the In-System Programming, please verify the following configurations:

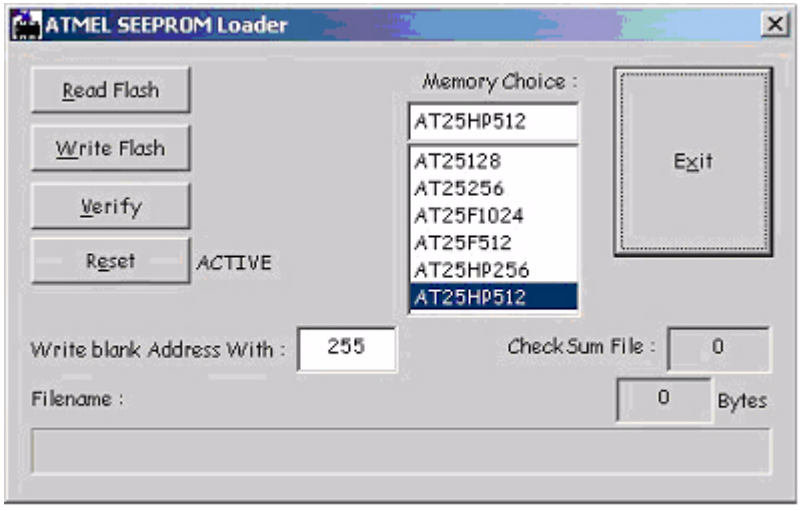
1. The SEEPROM is properly plugged into U4.
2. No jumpers are installed on JP6.
3. The upstream USB port is connected to the PC. This connection is needed for board's power source.
4. J6 connector is connected to the parallel port on the PC.

4.2 Loading Code

After setting up the board, the next step is to download the firmware. This development kit comes with application firmware that has been properly formatted for the SEEPROM. The files are located in the subdirectories under the directory \USBWizard\Binary\. Those files can be written into the EEPROM as follows:

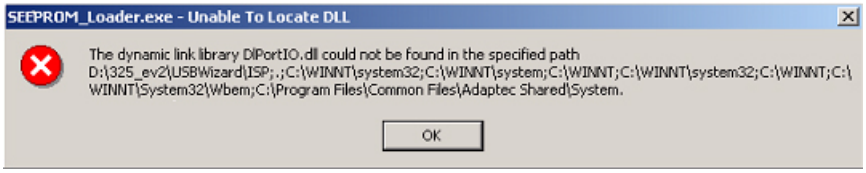
1. Open *SEEPROM Loader.exe*. It is located in the \USBWizard\ISP\ directory on the CD-ROM.

Figure 4-1. SEEPROM Loader Application



The following error message may appear in a pop-up window indicating that an extra DLL file needs to be downloaded and installed.

Figure 4-2. Error Message of Running SEEPROM_Loader.exek

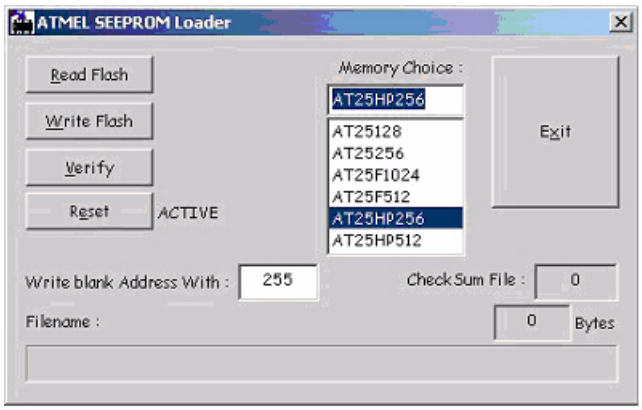


The SEEPROM loader uses the DriverLINXT parallel port driver DLPortIO.DLL which provides the Win32 DLL hardware I/O functions. Window® NT® and 2000 users also require the DLPortIO.SYS kernel mode driver. Both of these drivers are copyrighted by Scientific Software Tools, Inc. (*www.driverlinx.com*). To download the drivers, perform the following steps:

1. Go to *http://www.driverlinx.com/DownLoad/dnload.htm*
2. Click on **Windows 95/NT Port I/O Driver**
3. Download the **.exe** file.

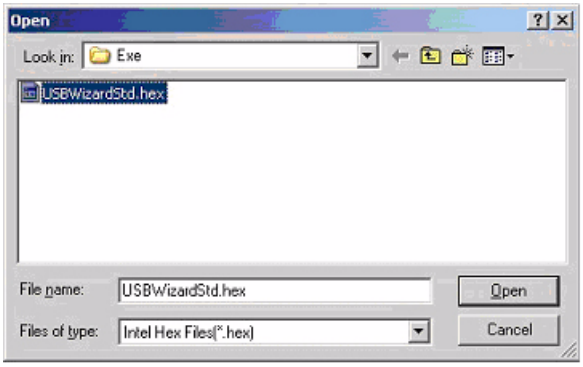
2. Before selecting the memory, click on **Reset** to bring the device to the Active reset state. Then select the memory from **Memory Choice:** list box.

Figure 4-3. Selecting Memory Flash



3. Click on **Write Flash** button. Figure 4-4 will appear.

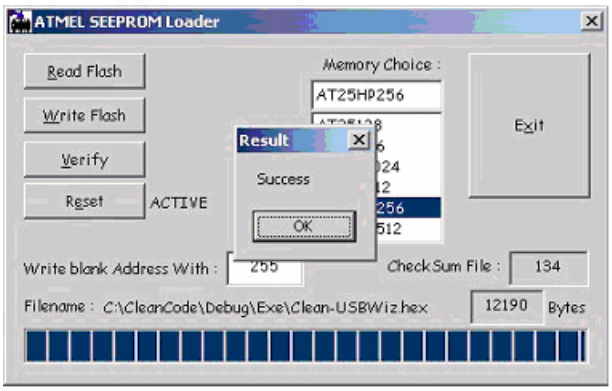
Figure 4-4. Selecting the File



4. Locate the *.hex file to be downloaded, and then click **Open** to start downloading. If successful, a message box will be displayed stating that the download was a success. Select only one of the *.hex files located in the subdirectories under *\USBWizard\Binary* directory.
5. Once a successful download is complete, a message box will appear, as shown in Figure 4-5.
6. Click **OK** to close the message box.
7. Disconnect the DB25 parallel cable from the J6 connector, then disconnect and reconnect the board's USB upstream port to reset the evaluation board.

   Another way to reset the board is to click on the **Reset** to make the board stay in a Non-active reset state. And then, disconnect and reconnect the board's USB upstream port.

Figure 4-5. A Successful Download



8. Clicking **Exit** terminates the application.

Section 5

Technical Support

For technical support, please e-mail **usb@atmel.com** with the following information:

- The revision number of the AT43DK355 Development Board
- The version number of the USB Wizard
- A detailed description of the problem

Alternatively, fill out an online support form available in the **Product Section** of the Atmel web site at **http://www.atmel.com**.

Section 6

Appendix

6.1 AT43USB325 Bill of Materials (BOM)

Table 6-1.

AT43USB325 Security Keyboard/Hub				
AT43USB325_EV2 Revision: 1.0				
Bill Of Materials - November 15, 2002				
Item	**Qty**	**Reference**	**Part**	**Supplier**
1	2	C1, C29	0.01 UF, cer 0805, Panasonic ECU-V1H103KBG	Digikey PCC103BNCT-ND
2	8	C2, C3, C9, C11, C13, C15, C31, C33	0.1 UF, cer 0805,Panasonic ECJ-2VB1E104K	Digikey PCC1828CT-ND
3	5	C4, C6, C26, C32, C35	0.001 UF, cer 0805, Panasonic ECU-V1H102KBG	Digikey PCC102BNCT-ND
4	2	C5, C34	0.33 UF, cer 0805, Panasonic ECJ-2YB1C334K	Digikey PCC1817CT-ND
5	4	C10, C12, C14, C16	220 UF, el D, Panasonic ECE-V0JA221WP	Digikey PCE3310CT-ND
6	10	C17, C18, C19, C20, C21, C22, C23, C24, C27, C28	47 pF, cer 0603, Panasonic ECJ-1VC1H470J	Digikey PCC470ACVCT
7	1	C25	4.7 UF, el A, Panasonic ECE-V1ES4R7SR	Digikey PCE3065CT-ND
8	3	D1, D2, D3	LED, Green	Jameco 34606, XC209G
9	1	JH1	Header 1x1	
10	6	JP1, JP2, JP3, JP4, JP5, JP8	Header 5X2	Jameco 67820 923810R
11	3	JP6, JP9, JP10	Header 2X2	Jameco 115027 923804R
12	1	J1	USB-B, AMP 787780-1	Digikey 787780-1
13	4	J2, J3, J4, J5	USB-A, AMP 787616-1	Digikey 787616-1
14	1	J6	CONNECTOR, D-SUB .318RT 25P-F	Jameco 15181, 1008-25
15	11	L2, L3, L4, L5, L6, L7, L8, L9, L10, L11, L12	Ferrite Bead, Stewart HI1206N800R-00	Digikey 240-1010-1-ND
16	1	R1	100, 0805 Panasonic ERJ-6GEYJ101V	Digikey P100ACT-ND

Table 6-1.

AT43USB325 Security Keyboard/Hub				
AT43USB325_EV2 Revision: 1.0				
Bill Of Materials - November 15, 2002				
Item	**Qty**	**Reference**	**Part**	**Supplier**
17	10	R2, R3, R6, R7, R10, R11, R14, R15, R19, R20	27, 0805 Panasonic ERJ-6GEYJ270V	Digikey P27ACT-ND
18	12	R4, R5, R8, R9, R12, R13, R16, R17, R23, R24, R25, R26	15K, 0805 Panasonic ERJ-6GEYJ153V	Digikey P15KACT-ND
19	1	R18	1.5K, 0805 Panasonic ERJ-6GEYJ152V	Digikey P1.5KACT-ND
20	1	R21	1M, 0805 Panasonic ERJ-6GEYJ105V	Digikey P1.0MACT-ND
21	3	R22, R28, R31	100K, 0805 Panasonic ERJ-6GEYJ104V	Digikey P100KACT-ND
22	4	R27, R29, R30, R32	2.2K, 0805 Panasonic ERJ-6GEYJ222V	Digikey P2.2KACT-ND
23	1	U1	AT43USB325E-AC	Atmel
24	1	U2	AT43USB325E-JC, SMT PLCC 68-Pin socket	Jameco 152696
25	1	U3	MIC2026-2BM	Micrel
26	1	U4	AT25HP256-10PC, PDIP 8-Pin socket	Jameco 51570
27	1	U5	AT24C02A-10PC, PDIP 8-Pin socket	Jameco 51570
28	1	U6	ATF16V8CZ TSSOP	Atmel
29	1	Y1	6.000 MHz Thru-Hole Crystal, CTS ATS060	Digikey CTX405-ND

6.2 AT43DK325 Schematics

Figure 6-1. AT43DK325 Schematic (1 of 5)

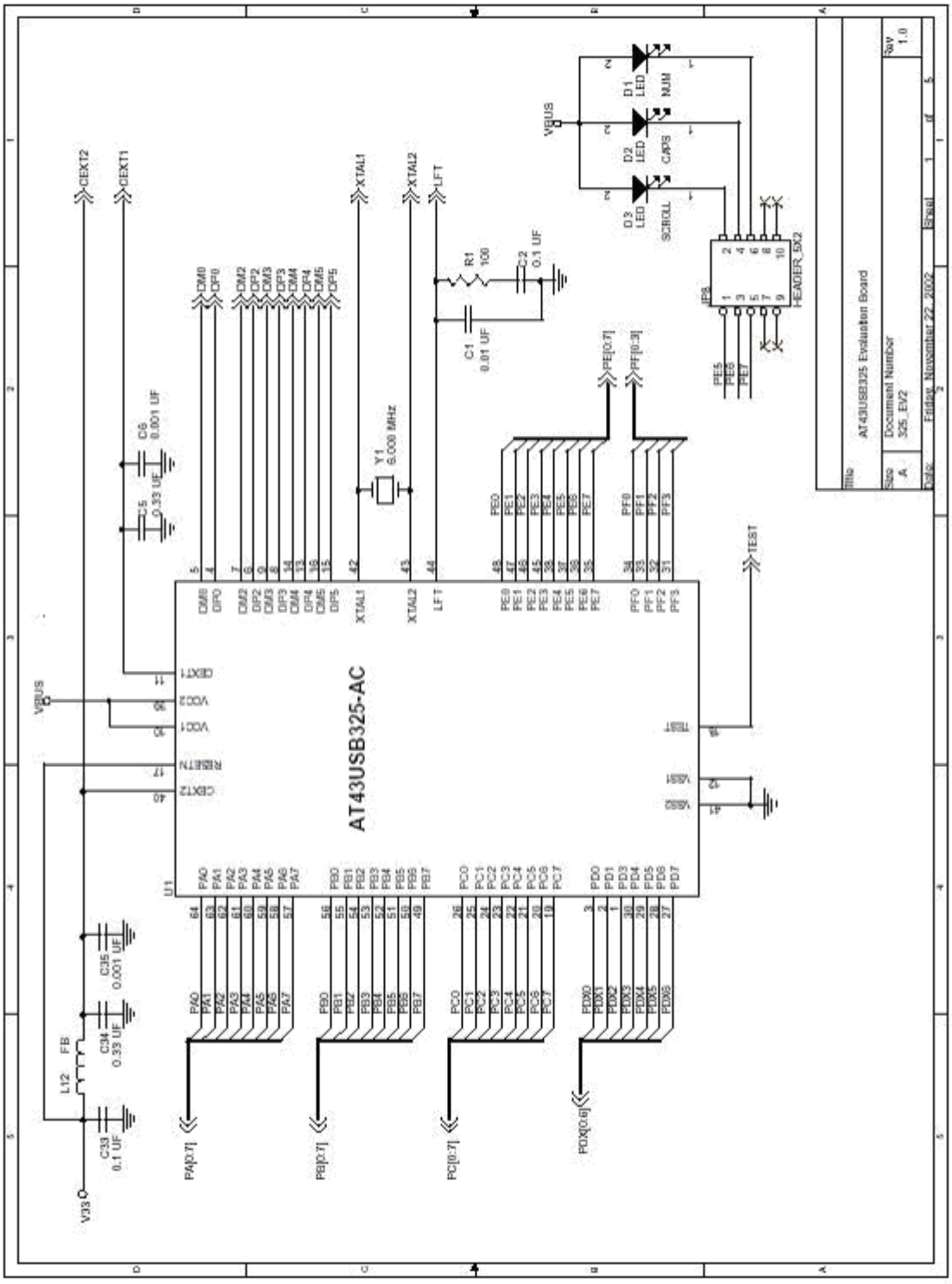


Figure 6-2. AT43DK325 Schematic (2 of 5)

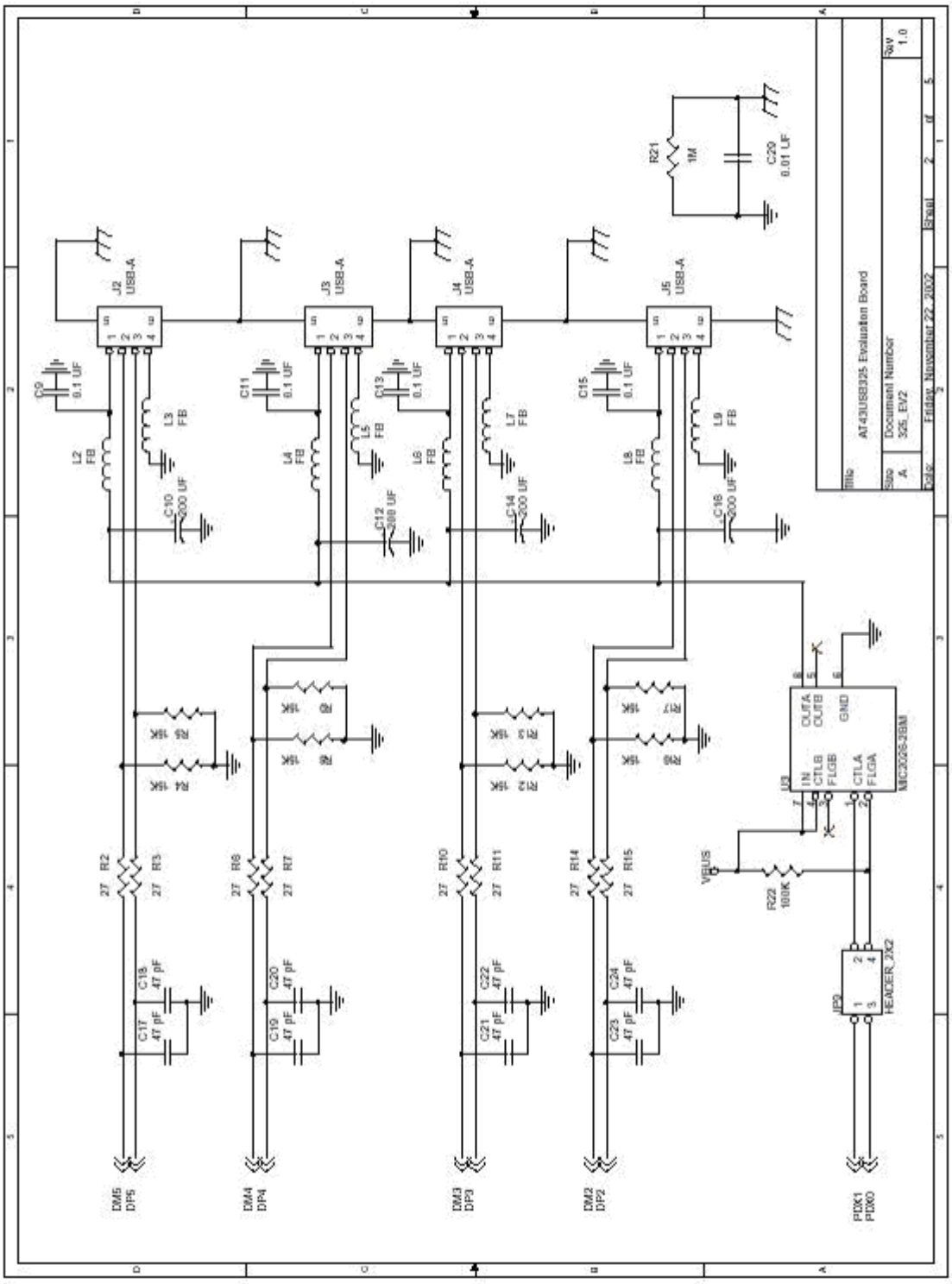


Figure 6-3. AT43DK325 Schematic (3 of 5)

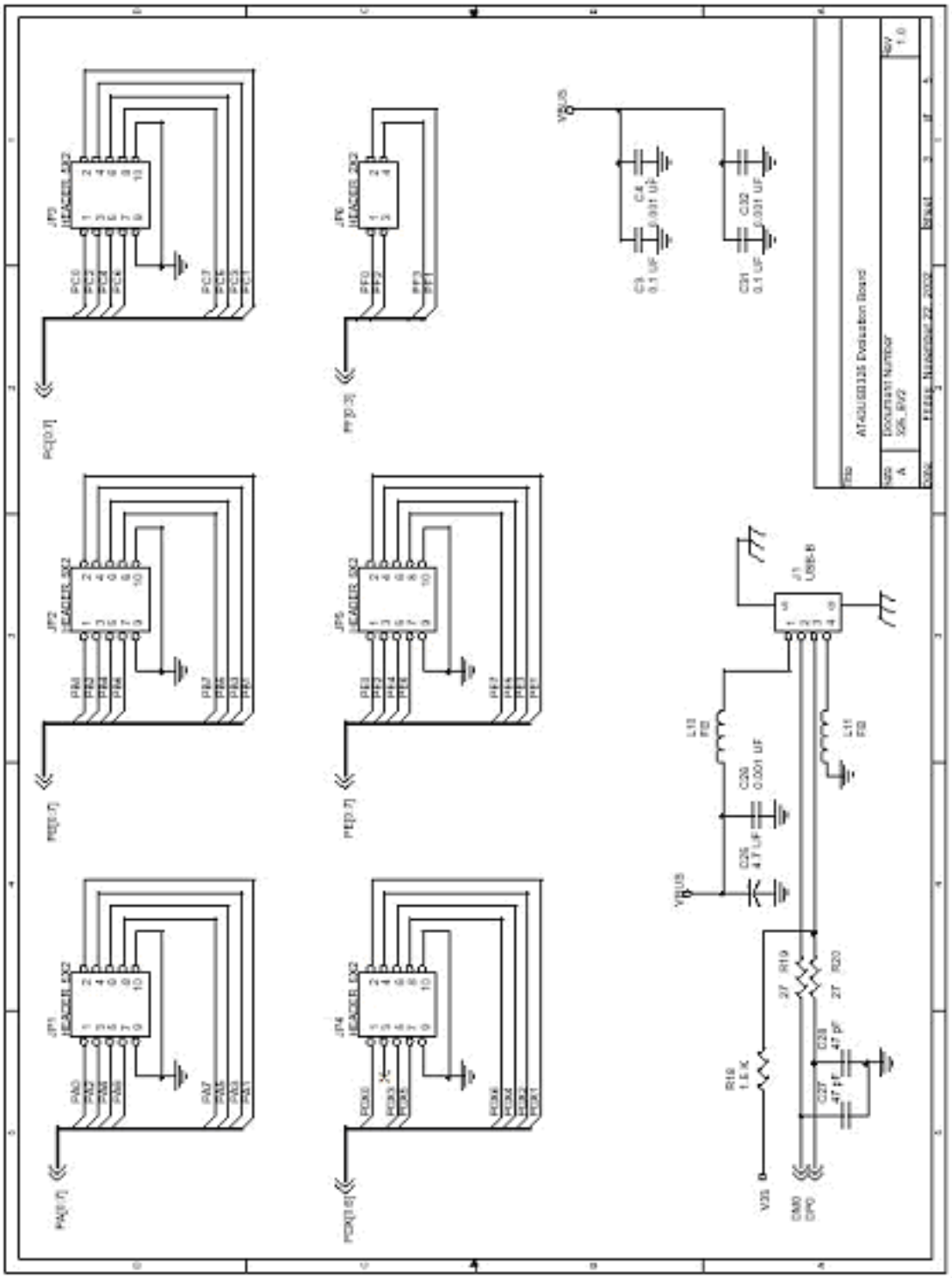


Figure 6-4. AT43DK325 Schematic (4 of 5)

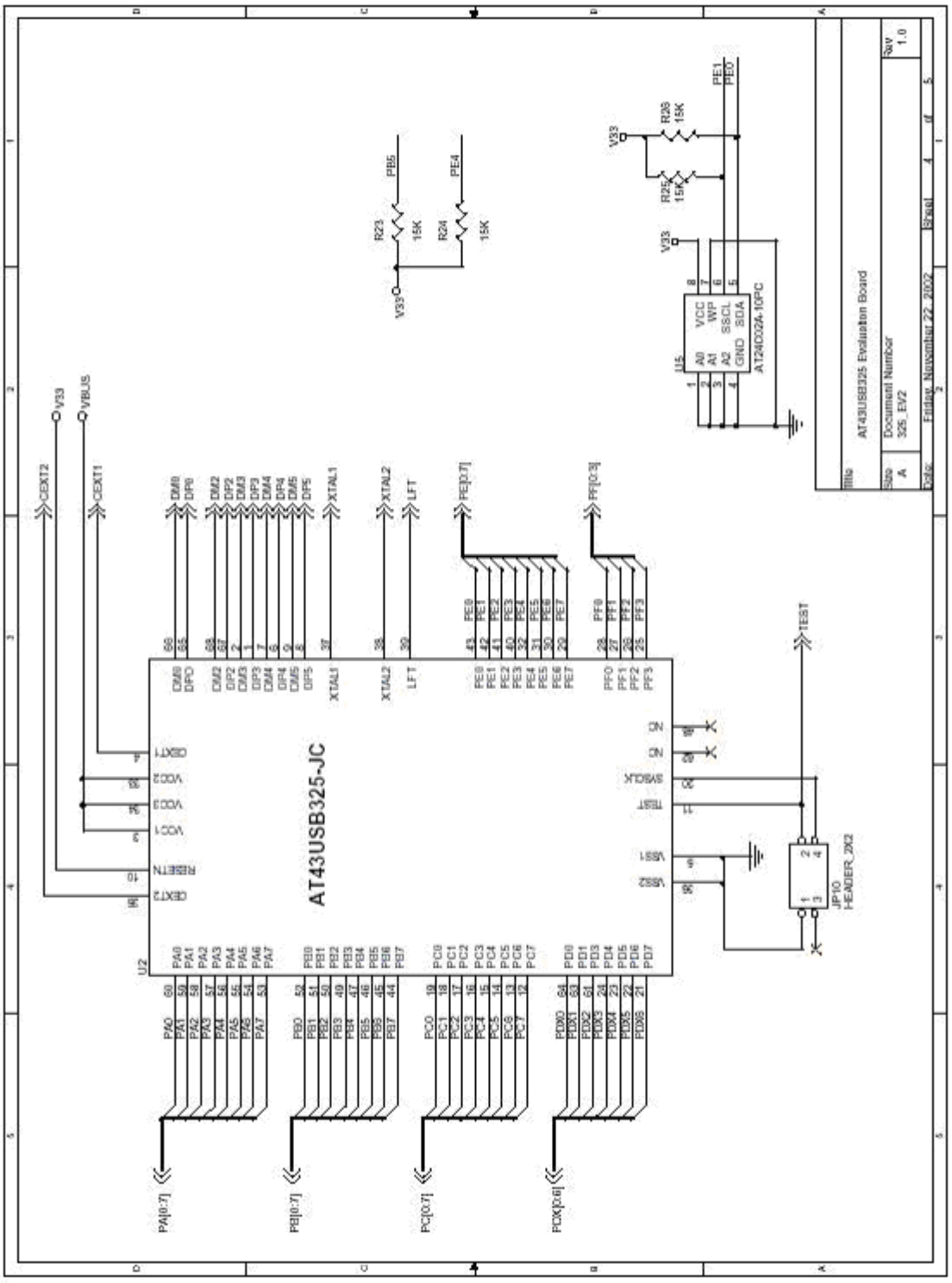
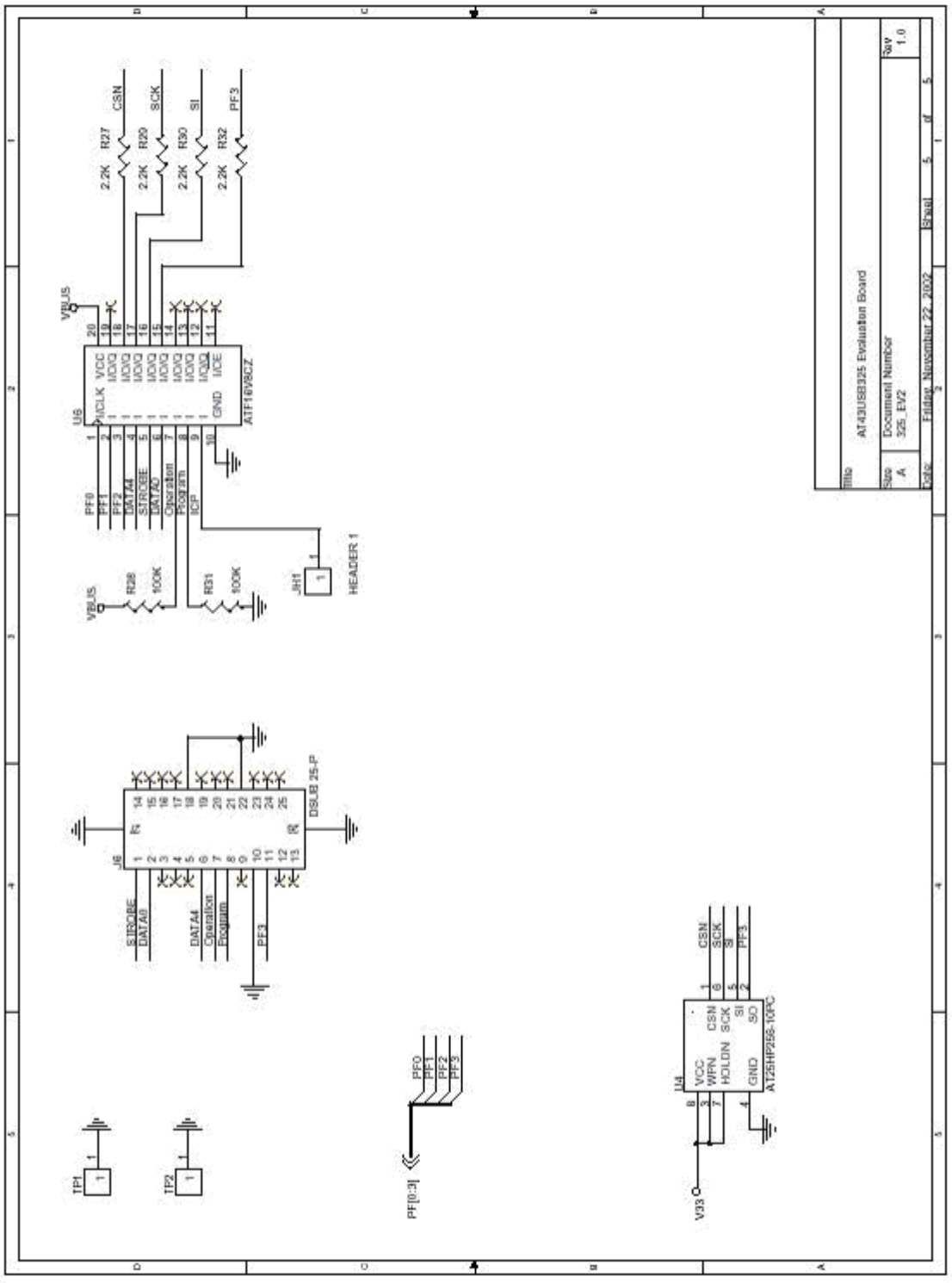


Figure 6-5. AT43DK325 Schematic (5 of 5)



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