



About the SD186ED Demonstration Board

The AMD® SD186ED Demonstration Board was designed as an exceptionally small, low-cost product for demonstration of the AMD Am186™ED microcontroller. See page ix for a block diagram of the board.

The SD186ED demonstration board is a stand-alone evaluation platform for the Am186ED microcontroller. The Am186ED microcontroller integrates peripherals such as twelve 16-bit memory chip-select controllers; serial controllers; 32 programmable I/Os, three timers, an interrupt controller, and a watchdog timer to increase system functionality while reducing overall cost. The memory controller supports a glueless connection to SRAM, DRAM, EPROM, Flash memory, and pseudo-static RAM. The Am186ED microcontroller also features an innovative bus design that frees the processor to run at nearly twice the speed of standard 80C186 processors while using commodity memory devices.

The SD186ED demonstration board is designed with a 104-pin Am186 expansion interface that provides access to the Am186ED microcontroller signals. The Am186 expansion interface facilitates prototyping with external devices by using the SD186ED demonstration board as the minimal system core of a design.

The SD186ED demonstration board highlights the Am186ED microcontroller's serial ports, glueless interface to DRAM and Flash memory, and the expansion interface to peripheral attachments. A complete description of the board can be found in Chapter 2, "SD186ED Demonstration Board Functional Description."

Theory of Operation

The SD186ED demonstration board demonstrates the basic processor functionality and features of the Am186ED microcontroller and the simplicity of its system design. As a stand-alone platform, the board enables users to test the Am186ED microcontroller's performance and functionality. The minimal number of components on the board exhibits the integration present in the processor, including interrupt, DMA, memory, and serial control units.

SD186ED Demonstration Board Features

The SD186ED demonstration board provides the following features:

- Am186ED 40-MHz microcontroller
- E86™ family boot monitor (E86MON™) board-resident utility

Information on invoking and using the E86MON software is provided in the *E86MON™ Software User's Manual* included in your kit.

- 4 Mbit DRAM
- 4 Mbit Am29F400-70 Flash memory
- Am186 104-pin expansion interface
- Two RS-232 serial ports with DB-9 connectors
- Activity LED indicators for PIO signals
- Power-on LED indicator
- Reset circuitry

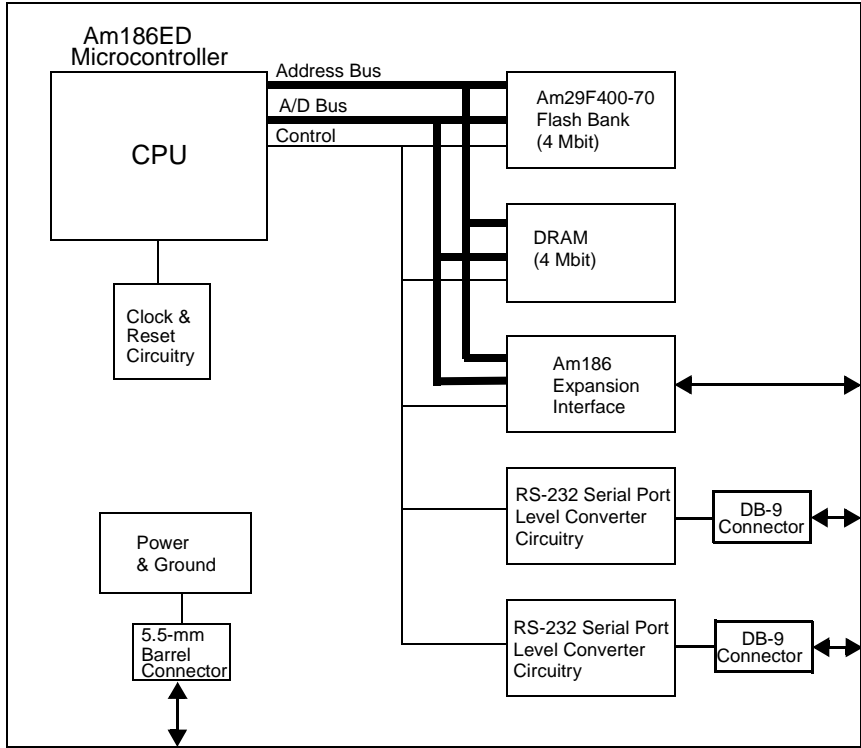


Figure 0-1. SD186ED Demonstration Board Block Diagram

SD186ED Demonstration Board Documentation

The *SD186ED Demonstration Board User's Manual* provides information on the design and function of the SD186ED demonstration board. Detailed instructions for invoking and using the E86MON software are provided in the *E86MON™ Software User's Manual* included in your kit. The SD186ED demonstration board is shipped with the E86MON software installed in the on-board Flash memory.

About This Manual

Chapter 1, “Quick Start” provides implementation and installation information for the demonstration board and instructions for invoking the E86MON software. Detailed information on using the E86MON software is provided in the *E86MON™ Software User's Manual* included in your kit.

Chapter 2, “SD186ED Demonstration Board Functional Description” contains descriptions of the basic sections of the SD186ED demonstration board: layout, processor, Flash memory, DRAM, serial ports, power and signal LED indicators, clock and reset logic, expansion interface, and power-supply circuitry.

Chapter 3, “Product Support” provides information on reaching and using the AMD Corporate Applications technical support services, product information available through AMD's World Wide Web and FTP sites, and support tools for the embedded E86 family.

Appendix A, “Layout Diagram, Schematics, and Board Bill of Materials” contains a board layout drawing along with schematics and a Bill of Materials (BOM) for the SD186ED demonstration board.

Suggested Reference Material

- *Am186™ED Microcontroller Data Sheet*
Advanced Micro Devices, order number 21336
- *Am186™ED Microcontroller User's Manual*
Advanced Micro Devices, order number 21335
- *Am186™ and Am188™ Family Instruction Set Manual*
Advanced Micro Devices, order number 21076
- *Flash Memory Products Data Book*
Advanced Micro Devices, order number 11796
- *FusionE86SM Catalog*
Advanced Micro Devices, order number 19255

For current application notes and technical bulletins, see our World Wide Web page at <http://www.amd.com>.

Documentation Conventions

The Advanced Micro Devices *SD186ED Demonstration Board User's Manual* uses the conventions shown in Table 0-1 (unless otherwise noted). These same conventions are used in all the E86 family support product manuals.

Table 0-1. Notational Conventions

Symbol	Usage
Boldface	Indicates that characters must be entered exactly as shown, except that the alphabetic case is only significant when indicated.
Typewriter face	Indicates computer text input or output in an example or listing.

Chapter 1



Quick Start

This chapter provides information that will help you quickly set up and start using the SD186ED demonstration board.

The SD186ED demonstration board is supported by the E86MON board-resident debugger. The E86MON software enables you to load, run, and debug programs on the SD186ED demonstration board. For detailed information on using the E86MON software, refer to the *E86MON™ Software User's Manual* included in your kit.

For information on how to:

- Connect the SD186ED demonstration board to a PC, see page 1-2
- Invoke the E86MON software, see page 1-4
- Troubleshoot installation problems, see page 1-5
- Locate related sources of information, see page 1-6

Connecting to a PC

Follow the steps below to connect the SD186ED demonstration board to your PC.

Installation Requirements

The items listed below are necessary to install and run the SD186ED demonstration board:

- PC with an available COM port
- Terminal emulation software (such as Microsoft® Windows® Terminal or ProComm Plus) that supports ASCII file transfers, software flow control (Xon/Xoff), and *send break* capability.
- Power source for universal power supply

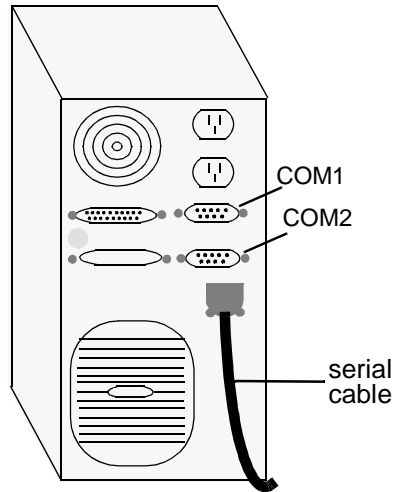
Board Installation



CAUTION: As with all computer equipment, the SD186ED demonstration board may be damaged by electrostatic discharge (ESD). Please take proper ESD precautions when handling any board.

1. Remove the board from the shipping carton. Visually inspect the board to verify that it was not damaged during shipment.

2. Connect the demonstration board's DB-9 serial port to an available COM port. Use the serial cable included in the SD186ED demonstration board kit and note that a DB-9 to DB-25 serial connector adapter is provided if your host system requires it. The pinout of the demonstration board's serial connector is shown on page 2-8.



DANGER: Make sure the power supply is *not* plugged into an electrical outlet before connecting it to the SD186ED demonstration board.

3. Connect the power supply to the barrel connector on the SD186ED demonstration board.
4. Apply power to the board by connecting the power supply to an electrical outlet. Once the board is powered up, the LEDs (D1-D8) should flash in an oscillating pattern.



CAUTION: If using your own power supply, ensure that it is a 5-V supply. Using a 9-V supply will permanently damage the board.

5. Invoke the terminal emulation program at 19200 baud, no parity, 8 data bits, and 1 stop bit; enable the software flow control (Xon/Xoff), if supported.
6. Reset the board by depressing and releasing the RESET switch (see location in Figure 2-1 on page 2-3). The LEDs on the board (D1-D8) will flash in an oscillating pattern for three seconds, as they did upon power up.

During the three-second period while the LEDs are oscillating, type an **a** in the terminal window to ensure that the E86MON software uses the correct baud rate. When the E86MON software receives an **a**, it adjusts its baud rate (if necessary) and displays the welcome message and prompt.

If you type a character other than an **a**, or type no character at all, the E86MON software still displays the welcome message and prompt, but may be using an incorrect baud rate. Depressing and releasing the RESET switch gives you another opportunity to type an **a**.

7. To display the version of the monitor and the commands available, type **?** and press Enter.

For detailed information about using the E86MON software, refer to the *E86MON™ Software User's Manual* included in your kit.

Table 1-1. Installation Troubleshooting

Problem	Solution
Nothing happens when pushing the RESET button.	Sometimes it is difficult to make a good connection when pushing the small RESET button. If all else fails, remove the power supply from the AC electrical outlet and disconnect and reconnect the power supply. The LEDs will flash in an oscillating pattern when the reset is successful
The computer does not respond with the E86MON software prompt.	Reset the board by pressing the RESET switch and typing an a while the LEDs are flashing in an oscillating pattern. If this does not work, verify the power, check the cables, etc.
After typing a during reset, the terminal emulation software displays unreadable characters.	Check the baud rate setting for the terminal emulation software. It should be set to 19200. Also check the word length (8), stop bits(1), and parity(N), and turn off any hardware flow control.
After a processor reset, the LEDs do not flash in the expected oscillating pattern.	Check that the power LED is on and the correct voltage is supplied to the board. Ensure that the polarity of the power connector is correct.
The terminal emulation program locks up the software or PC.	Check the COM port connection with the target board. Make sure that the same COM port is selected in the terminal emulation software. In some PCs if the correct COM port is not specified, the software will fail to function—it will lock in a continuous loop waiting for an answer from the incorrect serial port.
The power LED does not turn on with power.	Immediately disconnect the power supply. Ensure that the polarity of the power connector is correct. This is a very serious failure of the hardware. If the power source is connected incorrectly, the board will be permanently damaged.
There is a problem you cannot resolve.	Contact the AMD Corporate Applications technical support services (See Chapter 3, “Product Support” for phone numbers and more information.)

For More Information...

If you need more information about:

- SD186ED demonstration board hardware,
see Chapter 2, “SD186ED Demonstration Board Functional Description”
- E86MON software,
see the *E86MON™ Software User’s Manual* included in your kit.
- Problems with the demonstration board or the E86MON software,
see Chapter 3, “Product Support”
- SD186ED demonstration board layout and schematics,
see Appendix A, “Layout Diagram, Schematics, and Board Bill of Materials”
- the Am186ED microcontroller,
see the *Am186™ ED Microcontroller Data Sheet* included in your kit.
- the Am186ED microcontroller,
see the *Am186™ ED Microcontroller User’s Manual* included in your kit.

Chapter 2



SD186ED Demonstration Board Functional Description

The SD186ED demonstration board provides a completely stand-alone microcontroller-based evaluation platform in a low-cost, exceptionally small form-factor product. The SD186ED demonstration board was designed to meet the needs of customers working with the Am186ED microcontroller.

Read the following sections to learn more about the SD186ED demonstration board hardware:

- “Layout and Placement” on page 2-2
- “Am186ED Microcontroller Implementation” on page 2-4
- “ROM Space” on page 2-6
- “DRAM” on page 2-6
- “RS-232 Serial Ports” on page 2-7
- “Clock and Reset Logic” on page 2-8
- “Am186 Expansion Interface” on page 2-8
- “PIO Activity LED Indicators” on page 2-11
- “Power Supply” on page 2-12

Layout and Placement

The design of the SD186ED demonstration board emphasizes ease of use and small size. Refer to Figure 2-1 on page 2-3 for board layout and component placement.

The SD186ED demonstration board has the Flash and DRAM memory devices directly below the processor (U3, U4). This placement keeps the memory devices as close as possible to the processor to minimize noise and trace reflections. The 40-MHz fundamental mode crystal (Y1) is located above the processor. The expansion interface (J2 and J3) is located at the bottom of the board for easy connection and access. Finally, the 5.5-mm power-supply barrel connector (J1) is positioned in the upper, left corner of the board.

The RS-232 serial interfaces are positioned on the right of the board. Please note that the board features two serial ports (P1 and P2), which are driven by the two asynchronous serial interfaces on the Am186ED microcontroller.

Table 2-1. SD186ED Demonstration Board Parts List

Part Number	Description	For more information, see
D1–D14	Power and signal LEDs	Page 2-11
J1	Power connector	Page 2-12
J2–J3	Am186 expansion interface	Page 2-9
U1	Voltage supply supervisor (TI TL7705A)	Page 2-9
U2	Am186ED 40-MHz microcontroller	Page 2-4
U3	Flash	Page 2-6
U4	DRAM	Page 2-6
U5–U6	RS-232 driver/receiver devices (MAX232)	Page 2-7
Y1	40-MHz fundamental mode crystal	Page 2-9

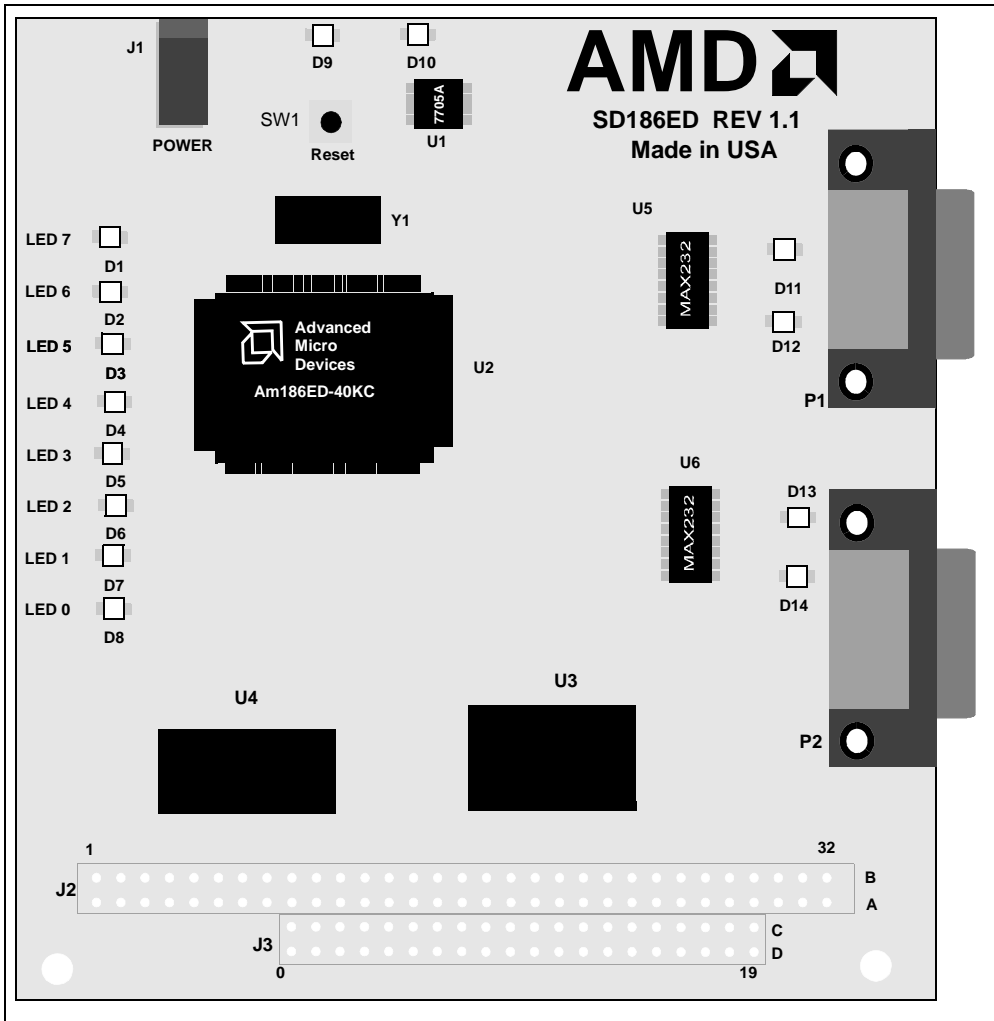


Figure 2-1. SD186ED Demonstration Board Layout

Am186ED Microcontroller Implementation

The SD186ED demonstration board supports the AMD Am186ED microcontroller. The board is shipped with an Am186ED microcontroller that operates at 40 MHz. Although not supported by the on-board crystal, the Am186ED microcontroller is also available in 20-, 25-, and 33-MHz operating frequencies.

The Am186ED microcontroller is designed to meet the most common requirements of embedded products developed for the office automation, mass storage, communications, and general embedded markets. Specific applications include disk drive controllers, hand-held and desktop terminals, fax machines, line cards, printers, photocopiers, feature phones, cellular phones, PBXs, multiplexers, modems, and industrial control. Refer to the *Am186™ED Microcontroller Data Sheet* for more information on the specific features of the Am186ED microcontrollers.

See Figure 2-2 on page 2-5 for a block diagram detailing the Am186ED microcontroller's functionality.

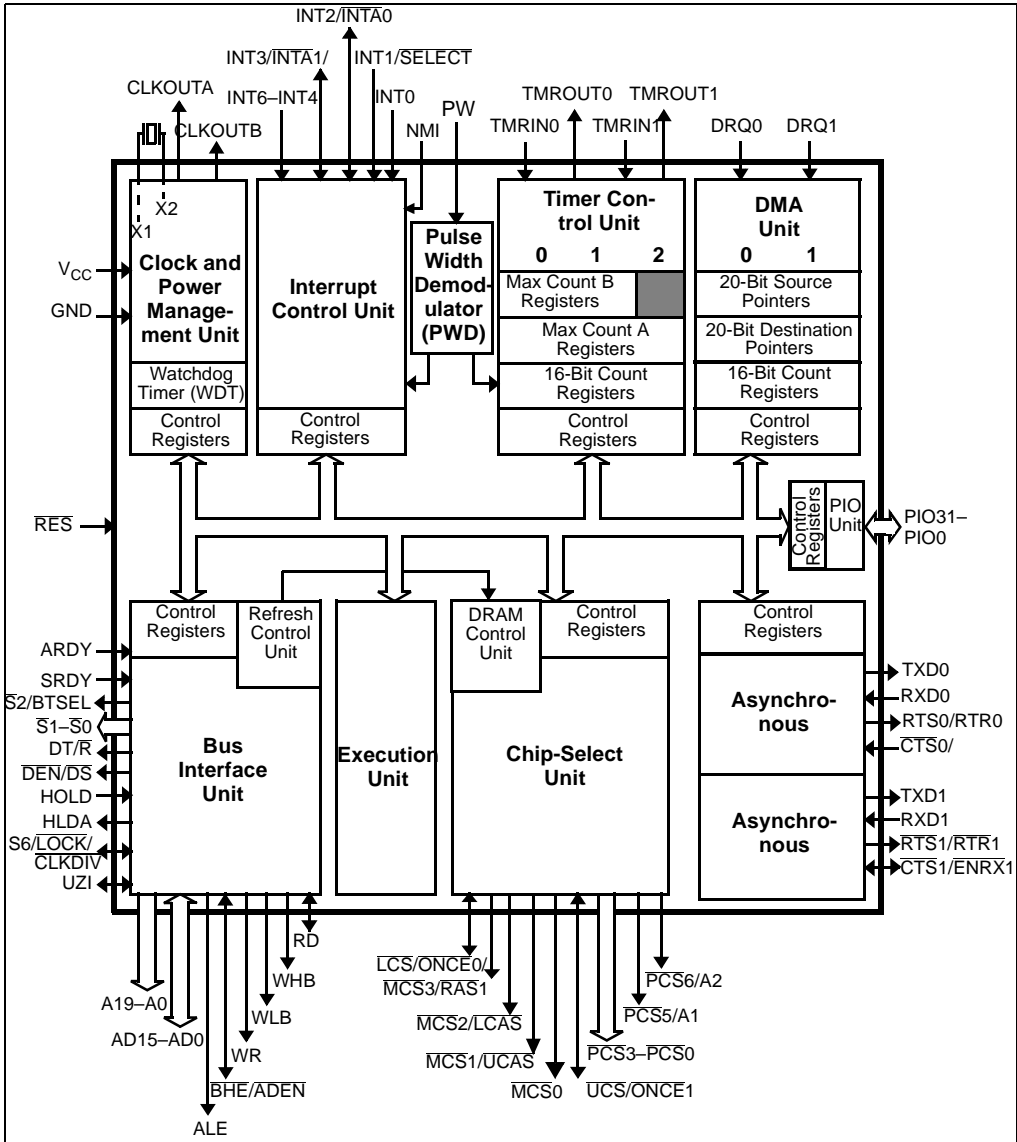


Figure 2-2. Am186ED Microcontroller Block Diagram

ROM Space

The SD186ED demonstration board contains on-board ROM space for use by the E86MON software and application code. This ROM space is implemented as an Am29F400 70-ns Flash memory.

The Flash memory is mapped to the upper region of addressable memory at 80000h to FFFFFh. This range represents the top sector in the Flash memory. The Flash memory is organized as 256K x 16 bits and is connected to the \overline{UCS} (Upper Memory Chip Select) signal of the microcontroller. After a valid reset, the Am186ED microcontroller fetches the first instruction from the Flash memories by asserting \overline{UCS} and driving the address bus with the value FFFF0h.

The E86MON software enables you to program the Flash memory with specific types of .HEX files. Intel .HEX and Intel extended .HEX format files are supported. This software functionality is provided to eliminate the need to remove the Flash memories. Do not attempt to remove the TSOP Flash or DRAM devices (U3 and U4) because doing so may cause damage to the board.

DRAM

The SD186ED demonstration board utilizes DRAM for its read/write storage. The board provides 256 Kbyte of DRAM using a 70-ns device that is mapped from 0h to 3FFFFh. The DRAM device is organized as 256K x 16 bits and is attached to the \overline{LCS} (Lower Memory Chip Select) signal of the microcontroller. For every access to the above address range, the Am186ED microcontroller will assert \overline{LCS} .

NOTE: DRAM available to you includes 400h to 7F000h. See the *E86MON™ Software User's Manual* included in your kit for more information.

RS-232 Serial Ports

The SD186ED demonstration board provides two on-board RS-232 serial ports (P1, P2) that are directly driven by the Am186ED microcontroller. The serial ports are equipped with DB-9 DCE connectors. The pin assignment for the DB-9 connectors is shown in Figure 2-3 on page 2-7.

Traditionally, PCs have Data Terminal Equipment (DTE) ports which connect directly to the Data Communication Equipment (DCE) port on the SD186ED demonstration board. A null modem cable is not required to connect a DTE port with a DCE port.

The RS-232 specification calls for signals that are driven at non-TTL levels. Single-chip RS-232 driver/receiver devices (MAX232, U5 and U6) are used to convert to and from the required voltages.

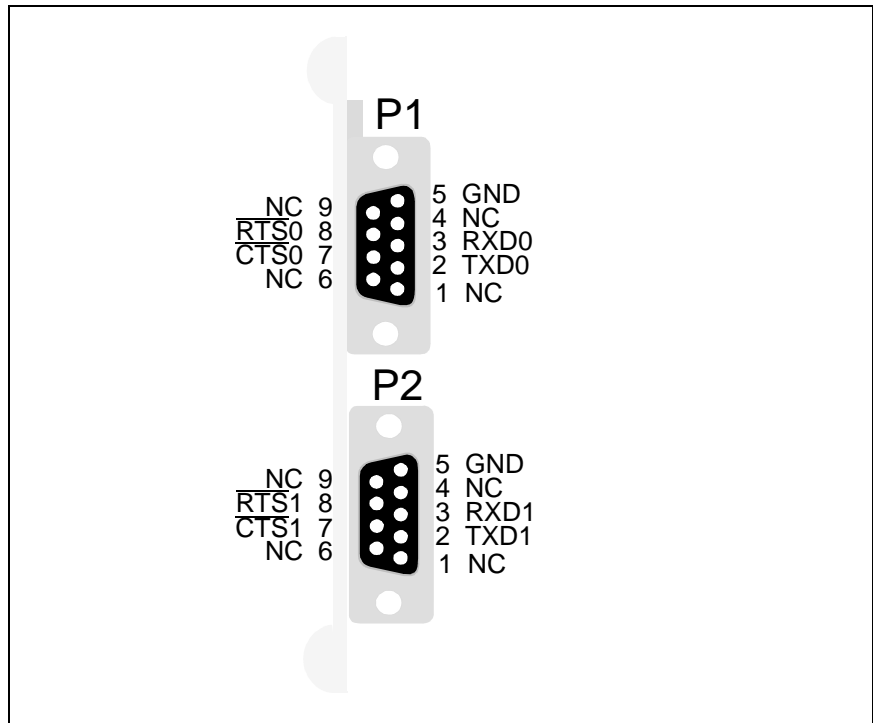


Figure 2-3. DB-9 Serial Connector Pinout

Clock and Reset Logic

The Am186ED microcontroller can be configured for either 1x or ½x clock mode. As configured on the SD186ED demonstration board, the microcontroller is in 1x clock mode. The input is generated by a 40-MHz fundamental mode crystal (Y1) that is connected to the X1/X2 inputs of the microcontrollers, resulting in a 40-MHz system clock.

System reset is controlled by a voltage supply supervisor (TI TL7705A, U1). This device generates the processor's reset input, asserting the Am186ED microcontroller's $\overline{\text{RES}}$ pin for 13 ms when the RESET switch is depressed. The voltage supply supervisor also holds reset active when the power falls below 4.75 V.

Am186 Local Bus Expansion Interface

The SD186ED demonstration board supports the PC/104 form-factor expansion-type connector for additional prototyping and testing. The traditional PC/104 signals are not present on the board; however, the Am186 expansion interface enables you to attach wirewrap or prototype boards that have the same standard physical interface. The pinout of the expansion interface is shown in the figures that follow.

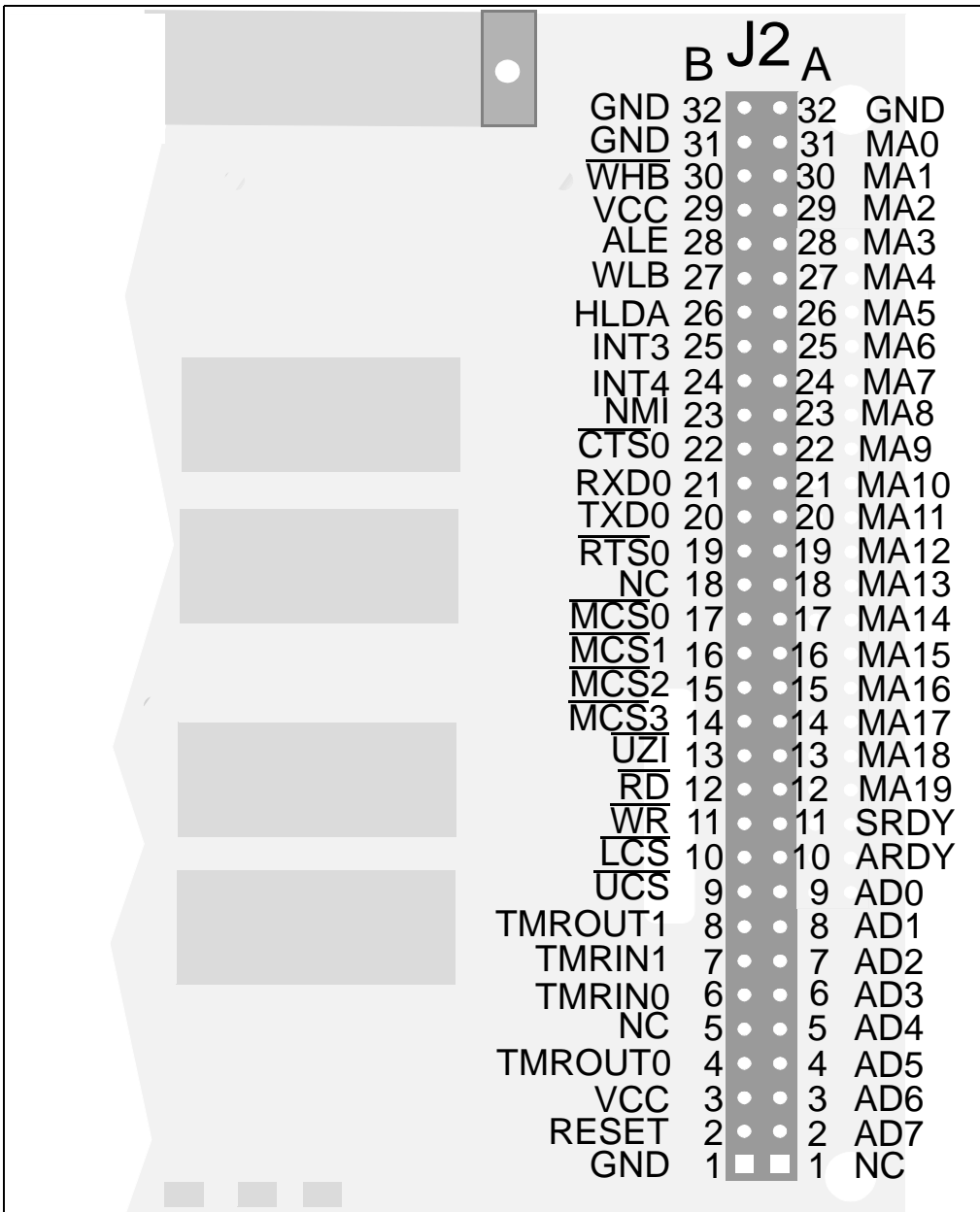


Figure 2-4. Am186 Expansion Interface Pinout (J2)

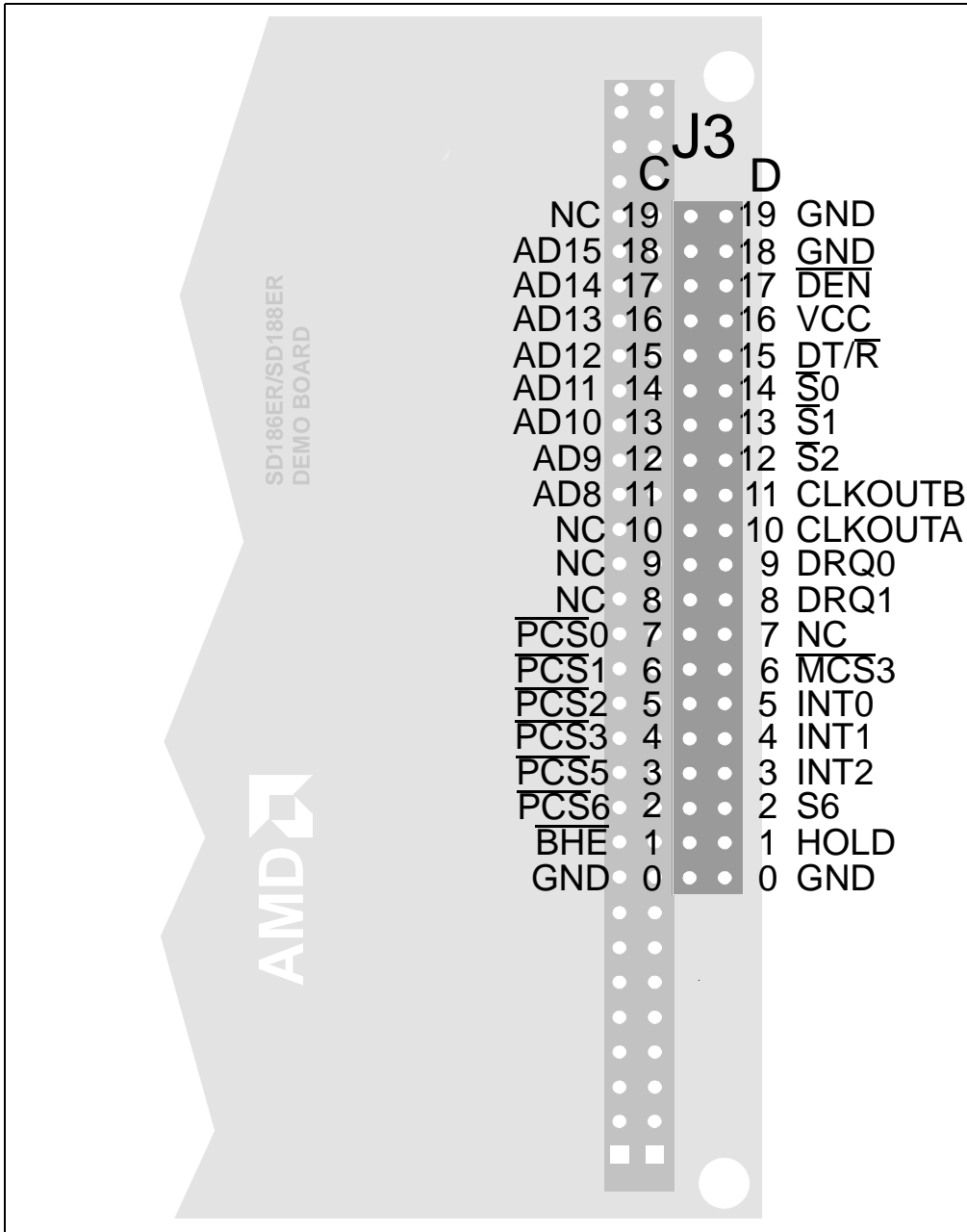


Figure 2-5. Am186 Expansion Interface Pinout (J3)

PIO Activity LED Indicators

The SD186ED demonstration board uses on-board, LED indicators to show activity on the upper eight programmable I/O (PIO) signals from the Am186ED microcontroller. Table 2-2 shows which PIO signal is represented by each LED.

Table 2-2. PIO LED Indicator Interface

LED	PIO Pin Name	PIO Register Bit Number
D1	MCS0	15
D2	DRQ1	14
D3	DEN	5
D4	DT/R	4
D5	PCS5	3
D6	PCS6	2
D7	TMROUT1	1
D8	TMRIN1	0

Power Supply

When used as a stand-alone board, the SD186ED demonstration board requires an input power supply of 5.0 V DC, $\pm 5\%$, 250 mA.

When adding components to the SD186ED demonstration board via the Am186 expansion interface, additional power may be necessary.

The power supply connector is a 5.5-mm barrel connector where the center post is V_{CC} and the outer ring is GND, as shown in Figure 2-6.

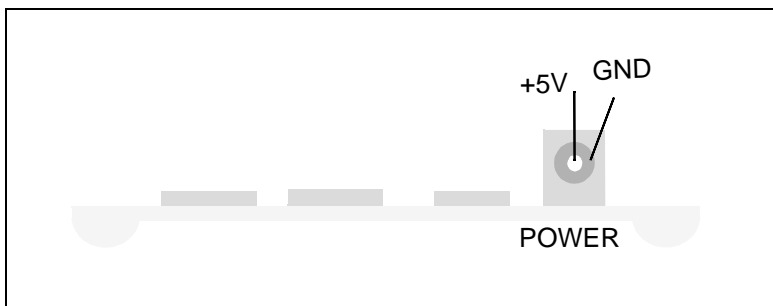


Figure 2-6. Power Supply Polarity



CAUTION: Use the 5-V universal power supply included with the kit. Using a 9-V supply will permanently damage the board.

Chapter 3



Product Support

This chapter provides information on:

- Reaching and using the AMD Corporate Applications technical support services, on page 3-2
- Product information available through AMD's World Wide Web and FTP sites, on page 3-4
- Support tools for the E86 family, on page 3-5

Note that AMD does not support source code changes to the E86MON software, or the running of the E86MON software on demonstration boards other than the AMD SD186/SD188 family and the Net186 demonstration boards. The E86MON software source code is provided to customers "as is".

AMD Corporate Applications Technical Support Services

Technical support for the E86 family of microcontrollers and corresponding support products is available via e-mail, online (BBS and WWW), and through telephone or fax.

E-Mail Support

Please include your name, company, telephone and fax numbers, AMD product requiring support, and question or problem in all e-mail correspondence.

In the USA and Canada, send mail to:

`HW.Support@amd.com`

In Europe and the UK, send mail to:

`euro.tech@amd.com`

Online Support

AMD offers technical support on our WWW site and through our bulletin board services. See “Product Support” on page 3-4 for more on what our WWW and FTP sites have to offer.

WWW Technical Support

Go to AMD’s home page at <http://www.amd.com> and click on “Service” for the latest AMD technical support phone numbers, software, and Frequently Asked Questions.

Bulletin Board Support

Country	Number
USA and Canada	(408) 749-4659
UK and Europe	44-(0) 1276-803-211

Telephone and Fax Support

Telephone assistance is available in the U.S. from 8:00 A.M. to 5:00 P.M. Pacific time, Monday through Friday (except major holidays). In Europe, assistance is available during U.K. business hours. Contact the hotlines at one of the following telephone or fax numbers.

Direct Dial Numbers

Country	Number
USA and Canada	Tel.: (408) 749-5703 Fax: (408) 749-4753
Japan	Tel.: (03) 3346-7550 Fax: (03) 3346-9828
Far East Asia	Fax: (852) 2956-0599
Germany	Tel.: 089 450 53199
UK and Europe	Tel.: 44-(0) 1276-803-299 Fax: 44-(0) 1276-803-298

Toll-Free Numbers

Country	Number
USA and Canada	(800) 222-9323
France	0590-8621
Italy	1678-77224
Japan	0031-11-1163

Product Support

AMD's WWW and FTP sites are described below. Questions, requests, and input concerning these sites can be sent via e-mail to **webmaster@amd.com**.

WWW Site

A subset of the AMD WWW pages, the embedded processor pages are frequently updated and include general product information, technical documentation, and support and tool information. To access these pages, go to the AMD home page at **<http://www.amd.com>** and click on "Embedded Processors" or access the pages directly at **<http://www.amd-embedded.com>**.

The "Embedded Processors" home page is divided into four sections:

- "What's New" announces new E86 family products, and highlights new applications using our products.
- "Product Overviews" briefly describes all the microprocessors and microcontrollers in the E86 family, and describes how these parts are ideal in specific focus markets.
- "Support and Tools" provides information about the tools that support our processors, and offers online benchmarking tools.
- "Technical Documentation" provides the *Available Literature List* of datasheets, application notes, user's manuals, and promotional literature, and describes how to order these documents. Many are also available online in PDF form. (To access the Literature Ordering Center via telephone, call one of the numbers listed on the back cover of your manual).
- "Demo Board Updates" provides a link to the AMD FTP site where the latest E86MON software releases are available.

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FTP Site

In addition to the documentation on our WWW pages, AMD provides software through an anonymous FTP site. To download the software, ftp to **ftp.amd.com** and log on as “anonymous” using your e-mail address as a password. Or via your web browser, go to **ftp://ftp.amd.com**. Software relating to the E86 family can be found in the **/pub/epd/e86/** directory.

Third-Party Development Support Products

The FusionE86SM Program of Partnerships for Application Solutions provides the customer with an array of products designed to meet critical time-to-market needs. Products and solutions available from the AMD FusionE86 partners include emulators, hardware and software debuggers, board-level products, and software development tools, among others. The *FusionE86SM Catalog*, order# 19255 and the *FusionE86SM CD*, order# 21058, describe these solutions.

In addition, mature development tools and applications for the x86 platform are widely available in the general marketplace.

Appendix A



Layout Diagram, Schematics, and Board Bill of Materials

This appendix contains a board layout diagram, schematics, and the bill of materials (BOM) for the SD186ED demonstration board.

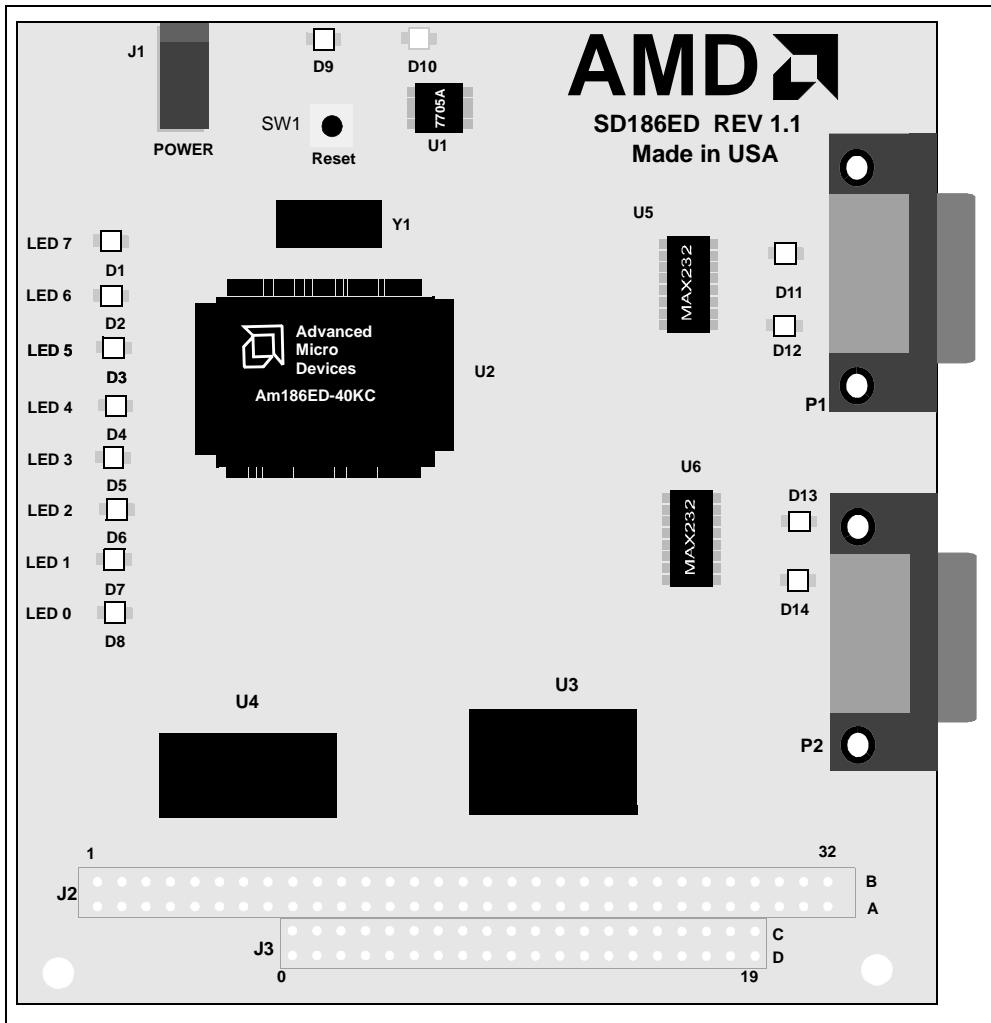


Figure A-1. SD186ED Demonstration Board Layout

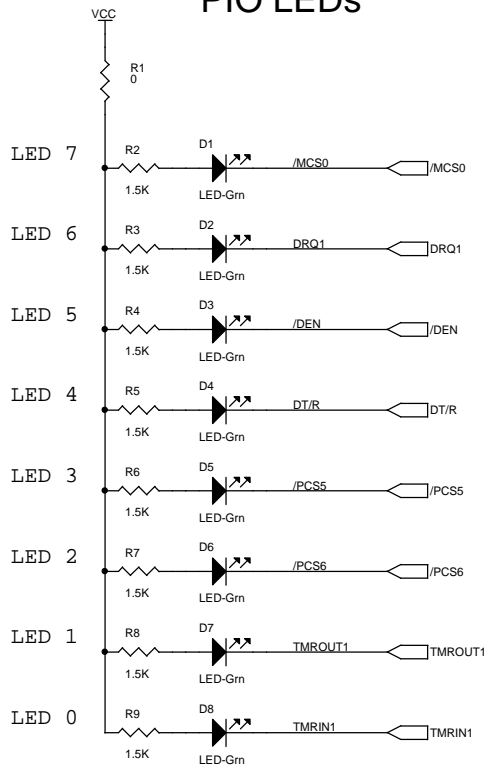
Schematics

The SD186ED Demonstration Board schematics have been blocked out to separate functionality of the design onto separate pages as follows:

- Page A-4 contains the power connector, decoupling capacitors and the PIO LEDs
- Page A-5 contains the Am186ED microcontroller, clock, and reset circuitry
- Page A-6 contains the Flash device and the DRAM device
- Page A-7 contains the serial ports and corresponding LEDs
- Page A-8 contains the Am186 bus interface and signal termination

Note that these schematics and design are subject to change.

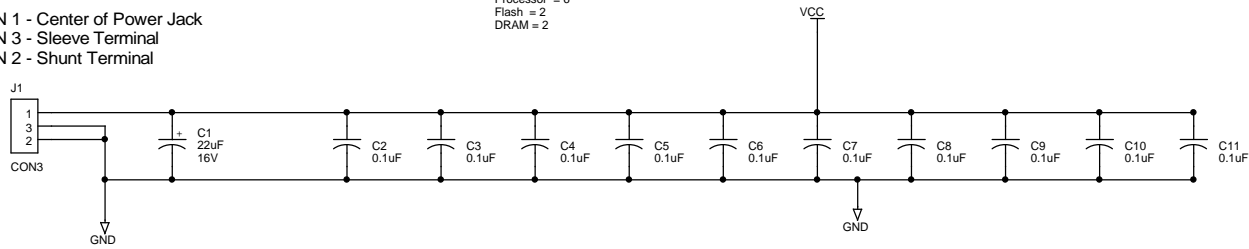
PIO LEDs



Power decoupling Capacitors

Processor = 6
Flash = 2
DRAM = 2

PIN 1 - Center of Power Jack
PIN 3 - Sleeve Terminal
PIN 2 - Shunt Terminal

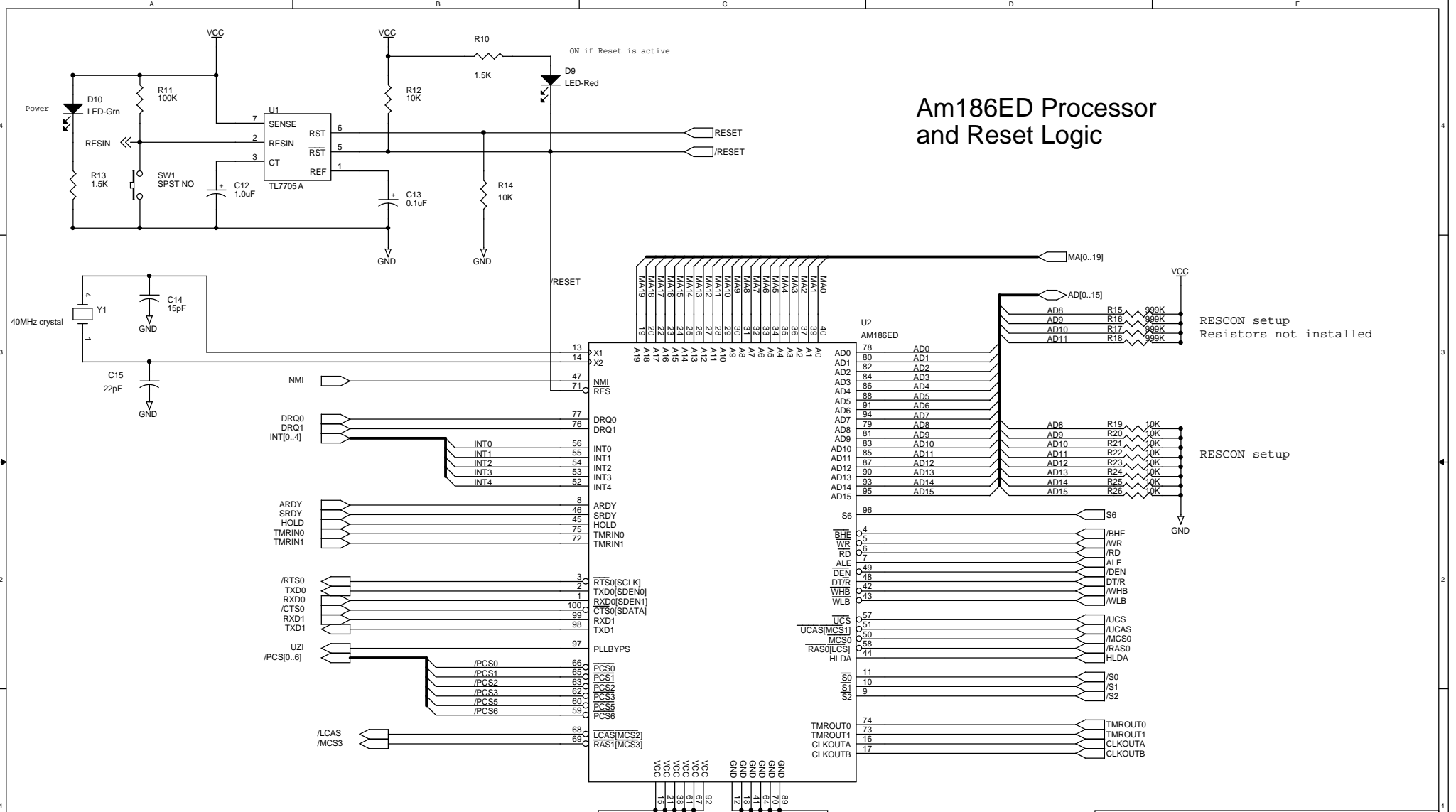


Link
PIOLEDs&caps.sch
processor.sch
memory.sch
serial.sch
busif.sch



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AMD SD186ED Demonstration Kit		
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B	1094-01-001-0401	1.1
Date:	Friday, May 02, 1997	Sheet 1 of 5

Am186ED Processor and Reset Logic



RESCON setup
Resistors not installed

RESCON setup

AMD Advanced Micro Devices
Designed by Paragon Innovations, Inc.

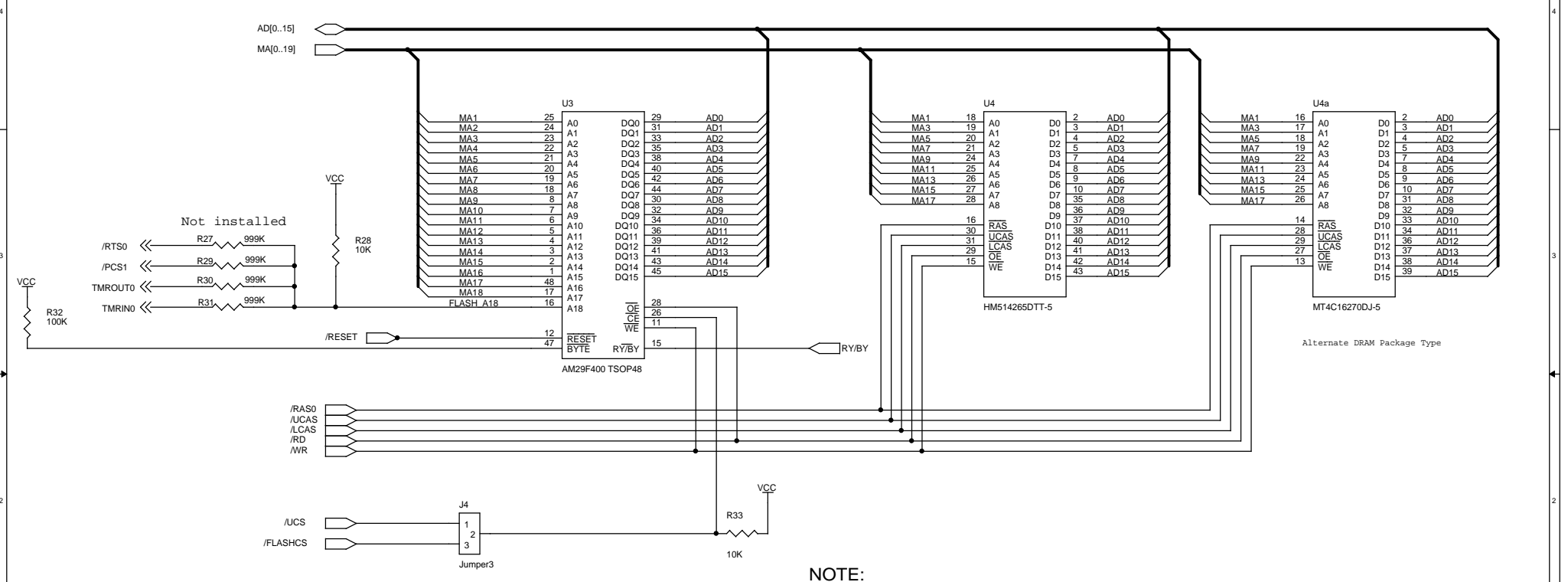
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Size B	Document Number 1094-01-001-0401	Rev 1.1
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Date: Friday, May 02, 1997 Sheet 2 of 5

Flash/ROM Device

256Kx16 DRAM Device



NOTE:
 Switch position is Normally connected to /UCS
 If the optional daughter programming board is connected,
 then the switch position is connected to /FLASHCS

NOTE:
 Pullup for switch transition and
 missing daughter card

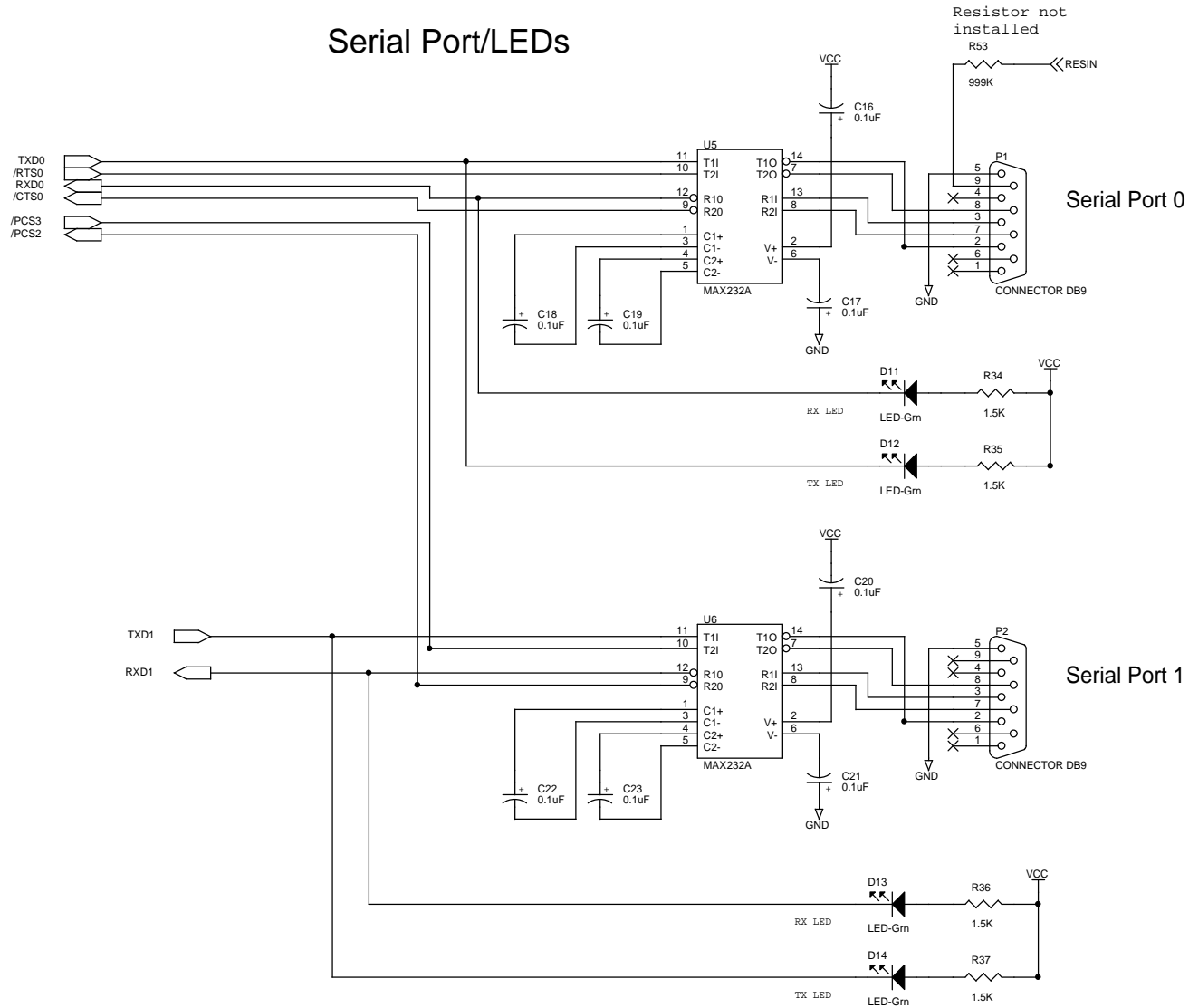
AMD Advanced Micro Devices
 Designed by Paragon Innovations, Inc.


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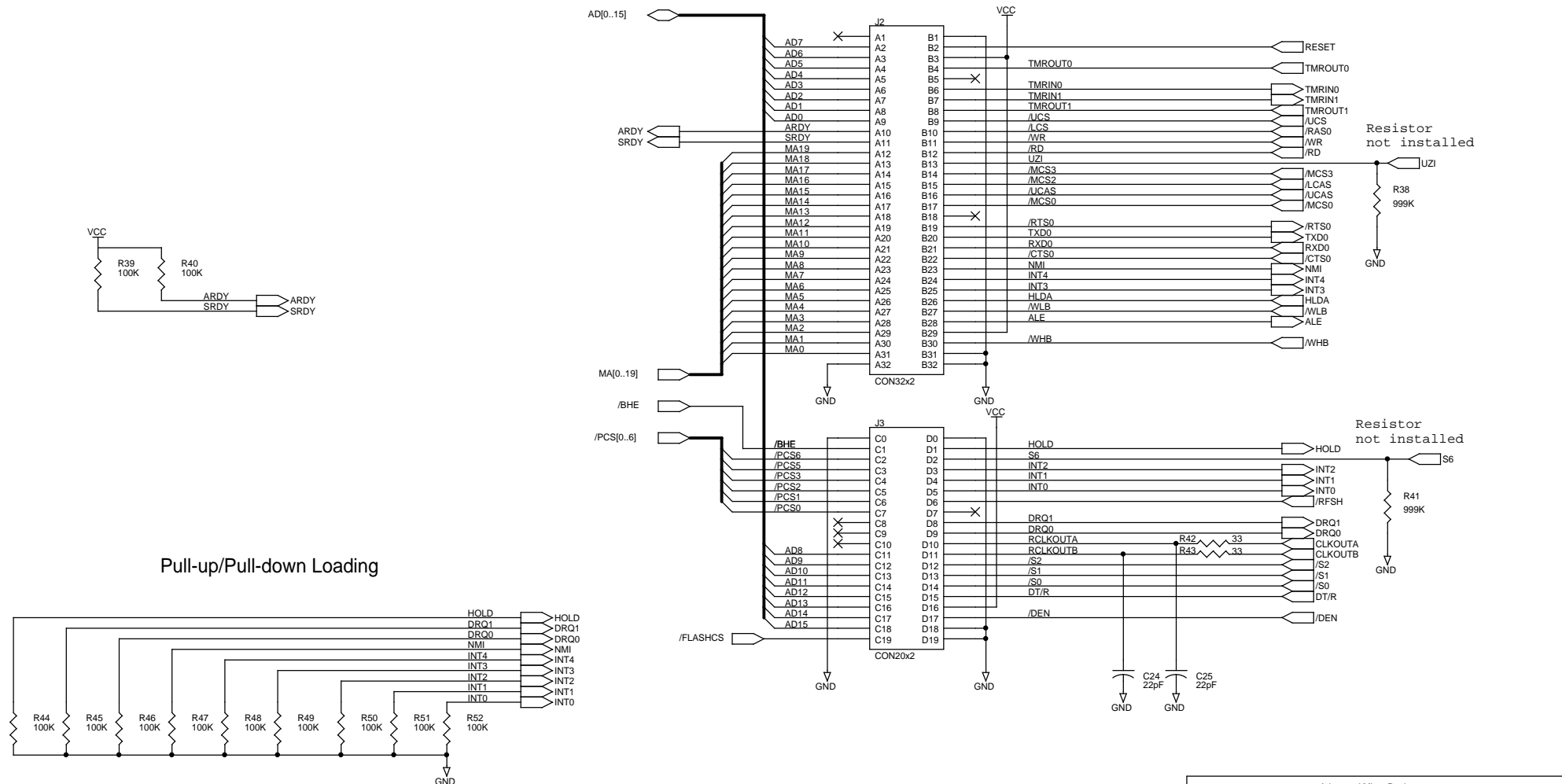
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Serial Port/LEDs

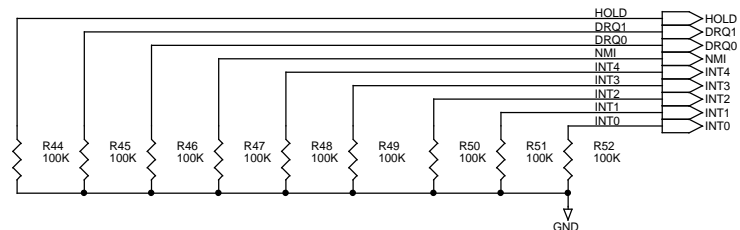


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Title		
AMD SD186ED Demonstration Kit		
Size	Document Number	Rev
B	1094-01-001-0401	1.1
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Local Bus Connectors



Pull-up/Pull-down Loading



AMD Advanced Micro Devices
 Designed by Paragon Innovations, Inc.

Title: AMD SD186ED Demonstration Kit

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Date: Friday, May 02, 1997 Sheet 5 of 5

Bill of Materials (BOM)

Table A-1. SD186ED Demonstration Board BOM

Qty	Ref	Description	MFG1	Part No 1
1	C1	22 MFd, SMT7343, Tantalum, 16 V, 20%	Any	
1	C12	1.0 MFd, SMT3216, Tantalum, 16 V, 20%	Any	
1	C14	15 PFd, SMT0805, Ceramic, 100 V, 10%	Any	
3	C15, C24–C25	22 PFd, SMT0805, Ceramic, 100 V, 10%	Any	
19	C2–C11, C13, C16–C23	0.1 MFd, SMT0805, Ceramic, 50 V, 10%	Any	
13	D1–D8, D10–D14	LED, Green, SMT	HP	HLMP-7040 Opt11
1	D9	LED, Red, SMT	HP	HLMP-7000 Opt11
1	J1	Power Jack, 2.4 mm, Right Angle	Switchcraft	RAPC-712
1	J2	Conn, 64-Pin Header, 32 x 2, Male, 0.1	Molex	10-88-1641
1	J3	Conn, 40-Pin Header, 20 x 2, Male, 0.1	Molex	10-88-1401
2	P1, P2	DB9, Female, Right Angle, PCB	Kycon	K22-E9S-N
1	R1	0K Ohms, SMT0805, 0.1 W, 100 V, 5%	Any	
25	R11, R14, R1–R26, R28, R32–R33, R39–R40, R43–R52	100K Ohms, SMT0805, 0.1 W, 100 V, 5%	Any	
1	R12	10K Ohms, SMT0805, 0.1 W, 100V, 5%	Any	
14	R2–R10, R13, R3–R37	1.5K Ohms, SMT0805, 0.1 W, 100 V, 5%	Any	
1	R42	33 Ohms, SMT0805, 0.1 W, 10 0V, 5%	Any	
1	SW1	Reset Switch, SPST Moment (SMT-J lead)	C & K	KT11P3JM
1	U1	Reset Controller, SMT	TI	TL7705ACD
1	U2	Am186ED-40KC Microcontroller	AMD	Am186ED-40KC
1	U3	256K x 16 Flash, 70 ns (SMT)	AMD	Am29F400-70E
1	U4	256K x 16 DRAM, EDO, 50 ns (SMT)	Hitachi	HM514265DTT-5
2	U5, U6	RS-232 Driver, narrow SMT	Sipex	SP232ACN
1	Y1	40.0-MHz, High Frequency Quartz Crystal, 50 ppm	Epson	MA-306-40.0MHz



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