

AT91SAM7S-EK Evaluation Board

User Guide





Table of Contents

Section 1

Overview	1-1
1.1 Scope	1-1
1.2 Deliverables	1-1
1.3 AT91SAM7S-EK Evaluation Board	1-1

Section 2

Setting Up the AT91SAM7S-EK Board	2-1
2.1 Electrostatic Warning	2-1
2.2 Requirements	2-1
2.3 Powering Up the Board	2-1
2.4 Getting Started	2-1
2.5 AT91SAM7S-EK Block Diagram	2-2

Section 3

Board Description	3-1
3.1 AT91SAM7S64 Microcontroller	3-1
3.2 AT91SAM7S64 Block Diagram	3-3
3.3 Memory	3-3
3.4 Clock Circuitry	3-3
3.5 Reset Circuitry	3-4
3.6 Power Supply Circuitry	3-4
3.7 Remote Communication	3-4
3.8 Analog Interface	3-4
3.9 User Interface	3-4
3.10 Debug Interface	3-4
3.11 Expansion Slot	3-4
3.12 Wrapping User Area	3-4

Section 4

Configuration Straps	4-1
4.1 Configuration Strap	4-1

Section 5

Schematics	5-1
5.1 Schematics	5-1





Section 1

Overview

-
- 1.1 Scope**
- The AT91SAM7S-EK evaluation board enables the evaluation of and code development for applications running on an AT91SAM7Sxx device.
- This document describes the evaluation board fitted with an AT91SAM7S64. Evaluation boards may be shipped with an AT91SAM7S128 or an AT91SAM7S256 device. It is important to note that both of these are **fully compatible** with the AT91SAM7S64 and can be used for evaluation of the AT91SAM7S64.
- This guide focuses on the AT91SAM7S-EK board as an evaluation platform.
-
- 1.2 Deliverables**
- 1.2.1 Standard Version AT91SAM7S-EK VAR**
- The AT91SAM7S-EK package contains the following items:
- An AT91SAM7S-EK board
 - One A/B-type USB cable
 - One CD-ROM containing summary and full datasheets, datasheets with electrical and mechanical characteristics, application notes and getting started documents for all development boards and AT91 microcontrollers. An AT91 software package with C and assembly listings is also provided. This allows the user to begin evaluating the AT91 ARM® Thumb® 32-bit microcontroller quickly.
- 1.2.2 Extended Version AT91SAM7S-EK IAR**
- The extended version of the AT91SAM7S-EK package contains the items in Section 1.2.1 as well as:
- J-LINK ICE interface with its A/B-type USB cable
 - IAR Evaluation CD-ROM
-
- 1.3 AT91SAM7S-EK Evaluation Board**
- The board, for the Standard or Extended Version, is generally equipped with an AT91SAM7S64 (64-pin PQFP package) together with the following:
- USB device port interface
 - Two serial communication ports

- One Atmel Crypto memory
- JTAG/ICE debug interface
- Four buffered analog inputs
- Four general-purpose LEDs and Pushbuttons
- Expansion connector
- Prototyping area

Note: The user can also evaluate the AT91SAM7S32 with this board. A 48-pin TQFP footprint has been provided for this purpose. To do so, the user must unsolder the AT91SAM7S64 microcontroller (IC4) and fit the AT91SAM7S32 on the 48-pin TQFP footprint (IC5).

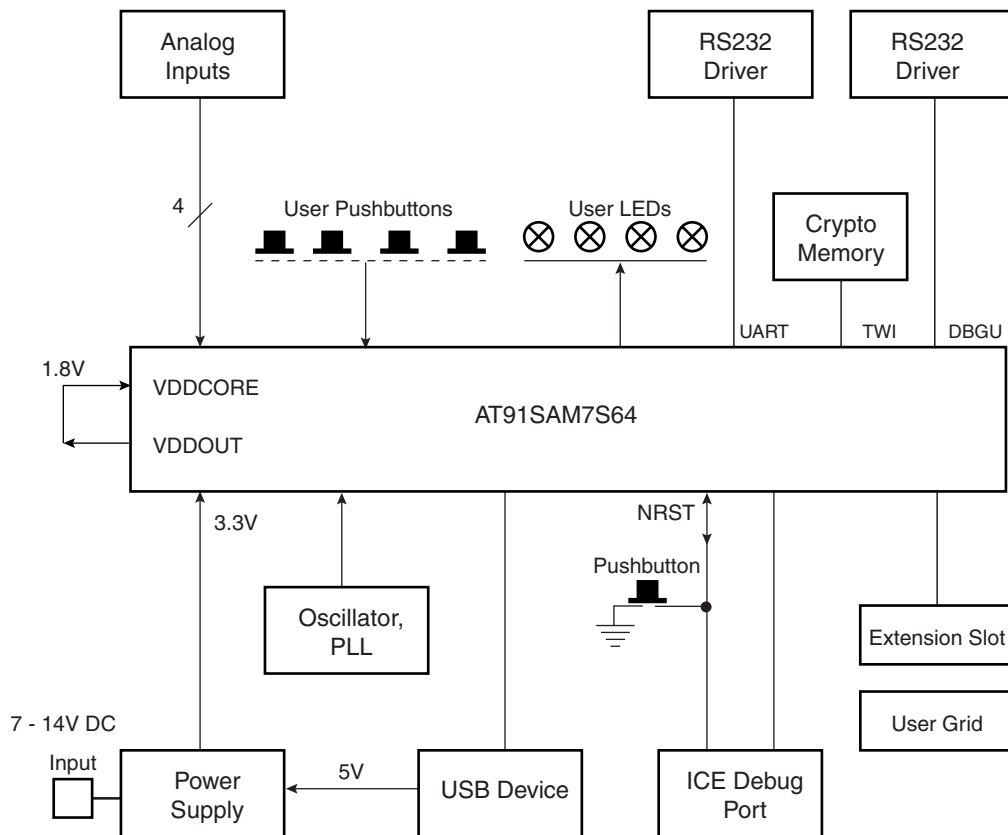


Section 2

Setting Up the AT91SAM7S-EK Board

-
- 2.1 Electrostatic Warning** The AT91SAM7S-EK evaluation 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 element.
-
- 2.2 Requirements** In order to set up the AT91SAM7S-EK evaluation board, the following items are needed:
- The AT91SAM7S-EK evaluation board itself.
 - Optional DC power supply capable of supplying 7V to 12V at 0,5A.
-
- 2.3 Powering Up the Board** AT91SAM7S-EK is self-powered by the USB port. If the USB port is not used, the card can be supplied by an external DC power supply via the 2.1 mm socket (J1). The polarity of the power supply is not critical.
- The regulator allows the input voltage range to be from 7V to 12V.
-
- 2.4 Getting Started** The AT91SAM7S-EK evaluation board is delivered with a CD-ROM containing all necessary information and step-by-step procedures for working with the most common development toolchains. Please refer to this CD-ROM, or to the AT91 web site, <http://www.atmel.com/products/AT91/>, for the most up-to-date information on getting started with the AT91SAM7S-EK.
- The IAR kit version provides IAR tools and evaluation CR-ROM to get started.

2.5 **AT91SAM7S-EK Block Diagram** *Figure 2-1. Block Diagram for AT91SAM7S-EK Board*





Section 3

Board Description

3.1 AT91SAM7S64 Microcontroller

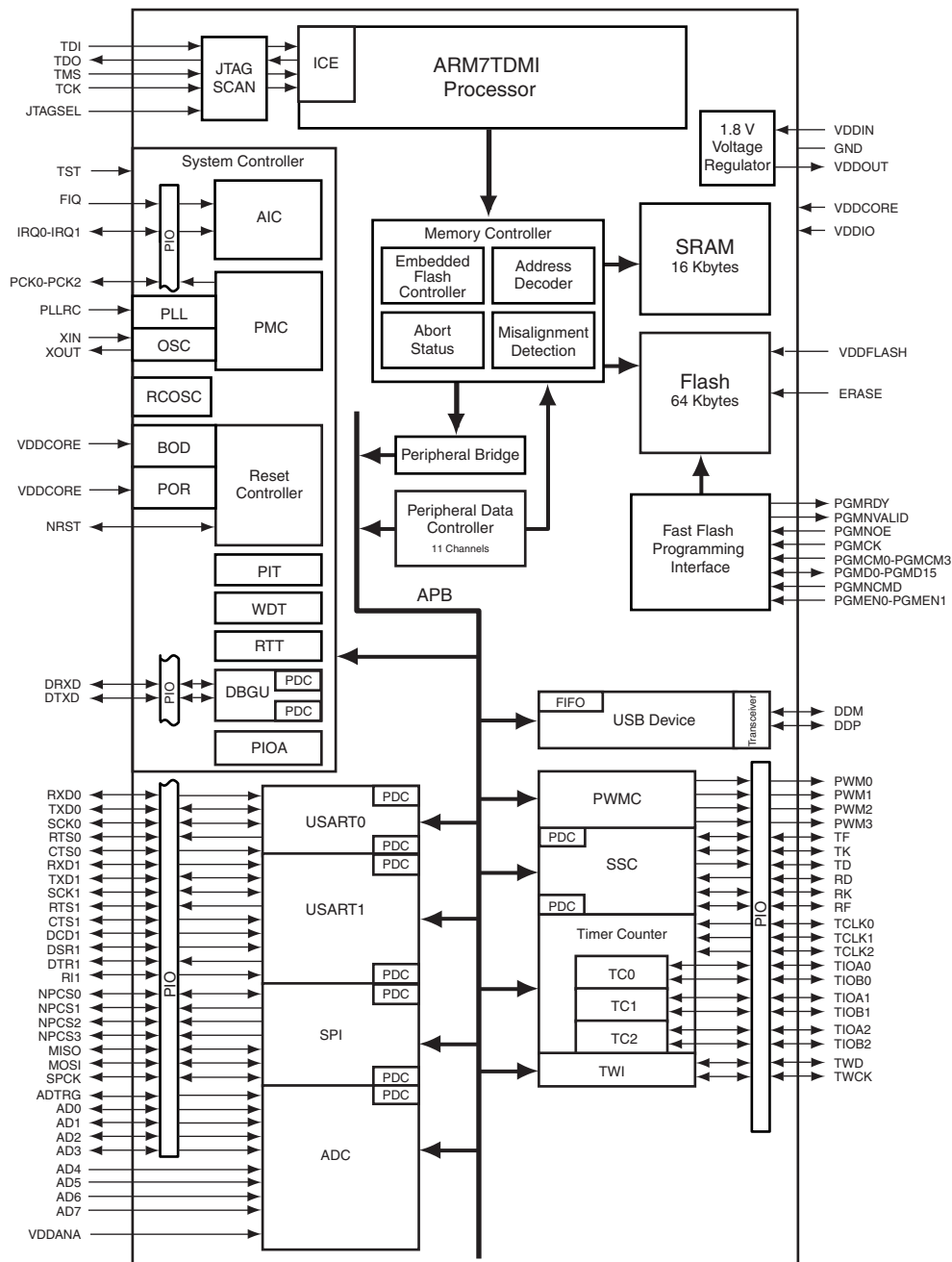
- Incorporates the ARM7TDMI® ARM® Thumb® Processor
 - High-performance 32-bit RISC Architecture
 - High-density 16-bit Instruction Set
 - Leader in MIPS/Watt
 - Embedded ICE In-circuit Emulation, Debug Communication Channel Support
- 64 Kbytes of Internal High-speed Flash, Organized in 512 Pages of 128 Bytes
 - Single Cycle Access at Up to 30 MHz in Worst Case Conditions, Prefetch Buffer Optimizing Thumb Instruction Execution at Maximum Speed
 - Page Programming Time: 4 ms, Including Page Auto-erase, Full Erase Time: 10 ms
 - 10,000 Write Cycles, 10-year Data Retention Capability, Sector Lock Capabilities, Flash Security Bit
 - Fast Flash Programming Interface for High Volume Production
- 16 Kbytes of Internal High-speed SRAM, Single-cycle Access at Maximum Speed
- Memory Controller (MC)
 - Embedded Flash Controller, Abort Status and Misalignment Detection
- Reset Controller (RSTC)
 - Based on Power-on Reset and Low-power Factory-calibrated Brown-out Detector
 - Provides External Reset Signal Shaping and Reset Source Status
- Clock Generator (CKGR)
 - Low-power RC Oscillator, 3 to 20 MHz On-chip Oscillator and one PLL
- Power Management Controller (PMC)
 - Software Power Optimization Capabilities, Including Slow Clock Mode (Down to 500 Hz) and Idle Mode
 - Three Programmable External Clock Signals
- Advanced Interrupt Controller (AIC)
 - Individually Maskable, Eight-level Priority, Vectored Interrupt Sources
 - Two External Interrupt Sources and One Fast Interrupt Source, Spurious Interrupt Protected
- Debug Unit (DBGU)
 - 2-wire UART and Support for Debug Communication Channel interrupt, Programmable ICE Access Prevention
- Periodic Interval Timer (PIT)
 - 20-bit Programmable Counter plus 12-bit Interval Counter
- Windowed Watchdog (WDT)

- 12-bit key-protected Programmable Counter
- Provides Reset or Interrupt Signals to the System
- Counter May Be Stopped While the Processor is in Debug State or in Idle Mode
- Real-time Timer (RTT)
 - 32-bit Free-running Counter with Alarm
 - Runs Off the Internal RC Oscillator
- One Parallel Input/Output Controller (PIOA)
 - Thirty-Two Programmable I/O Lines Multiplexed with up to Two Peripheral I/Os
 - Input Change Interrupt Capability on Each I/O Line
 - Individually Programmable Open-drain, Pull-up resistor and Synchronous Output
- Eleven Peripheral Data Controller (PDC) Channels
- One USB 2.0 Full Speed (12 Mbits per second) Device Port
 - On-chip Transceiver, 328-byte Configurable Integrated FIFOs
- One Synchronous Serial Controller (SSC)
 - Independent Clock and Frame Sync Signals for Each Receiver and Transmitter
 - I²S Analog Interface Support, Time Division Multiplex Support
 - High-speed Continuous Data Stream Capabilities with 32-bit Data Transfer
- Two Universal Synchronous/Asynchronous Receiver Transmitters (USART)
 - Individual Baud Rate Generator, IrDA Infrared Modulation/Demodulation
 - Support for ISO7816 T0/T1 Smart Card, Hardware Handshaking, RS485 Support
 - Full Modem Line Support on USART1
- One Master/Slave Serial Peripheral Interface (SPI)
 - 8- to 16-bit Programmable Data Length, Four External Peripheral Chip Selects
- One Three-channel 16-bit Timer/Counter (TC)
 - Three External Clock Inputs, Two Multi-purpose I/O Pins per Channel
 - Double PWM Generation, Capture/Waveform Mode, Up/Down Capability
- One Four-channel 16-bit PWM Controller (PWMC)
- One Two-wire Interface (TWI)
 - Master Mode Support Only, All Two-wire Atmel EEPROMs Supported
- One 8-channel 10-bit Analog-to-Digital Converter, Four Channels Multiplexed with Digital I/Os
- IEEE 1149.1 JTAG Boundary Scan on All Digital Pins
- 5V-tolerant I/Os, including Four High-current Drive I/O lines, Up to 16 mA Each
- Power Supplies
 - Embedded 1.8V Regulator, Drawing up to 100 mA for the Core and External Components
 - 1.8V or 3.3V VDDIO I/O Lines Power Supply, Independent 3.3V VDDFLASH Flash Power Supply
 - 1.8V VDDCORE Core Power Supply with Brown-out Detector
 - 3.3V VDDANA Analog Voltage Supply
- Fully Static Operation: Up to 55 MHz at 1.65V and 85° C Worst Case Conditions
- Available in a 64-lead TQFP Package



3.2 AT91SAM7S64 Block Diagram

Figure 3-1. AT91SAM7S64 Block Diagram



- 3.3 Memory**
- 64 Kbytes of Internal High-speed Flash
 - 16 Kbytes of Internal High-speed SRAM
 - External Atmel Crypto Memory

- 3.4 Clock Circuitry**
- 18.432 MHz standard crystal for the embedded oscillator



-
- 3.5 Reset Circuitry**
- Internal bi-directional reset controller with brown out detector
 - External reset pushbutton
-
- 3.6 Power Supply Circuitry**
- USB powered. The dynamic power consumption on VDDCORE is less than 50 mA at full speed when running out of the Flash. The total current drawn by all the I/O lines cannot exceed 150 mA.
 - External power can be applied via the 2.1mm connector to the regulator in either polarity because of the diode-rectifying circuit (CR3 to CR6). The minimum voltage required is 7V. The board has a voltage regulator providing +3.3V. The regulator allows the input voltage to be from 7V to 14V (REG1).
 - The two power supplies are separated from each other, thanks to the diodes CR1 and CR2.
 - On-chip embedded VDDCORE 1.8V regulator
-
- 3.7 Remote Communication**
- Two serial interface via RS-232 DB9 male sockets
 - DBGU COM Port
 - UART COM Port with RTS/CTS handshake control possibility (USART 0)
 - USB V2.0 Full-speed Compliant, 12 Mbits per Second (UDP)
-
- 3.8 Analog Interface**
- Four Analog inputs (0V to 3.3V) via J7, J8, J9, J10 footprints
-
- 3.9 User Interface**
- Four Pushbuttons via general PIO lines
 - Four LEDs via high current PIO lines
-
- 3.10 Debug Interface**
- 20-pin JTAG/ICE interface connector
 - DBGU COM Port
-
- 3.11 Expansion Slot**
- One expansion footprint connector (J5) gives access to all the microcontroller's signals. All I/Os of the AT91SAM7S64 are routed to this connector. This allows the developer to check the integrity of the components and to extend the features of the board by adding external hardware components or boards.
-
- 3.12 Wrapping User Area**
- This allows the developer to fit additional components for prototyping use.



Section 4

Configuration Straps

4.1 Configuration Strap

Table 4-1 gives details on configuration straps on the AT91SAM7S-EK evaluation board and their default settings.

Table 4-1. Configuration Straps

Designation	Default Setting	Feature
JP1	Closed	Enables the use of the remote DP pull-up (USB)
JP2	Closed	Enables the use of the VBUS detect (USB)
JP3	Opened	Disable external VCC on the expansion connector J5 (pin 1, 2)
JP4	Closed	The System Reset signal (NRST) is connected to the ICE/JTAG socket (J4, pin 15).
JP5	Opened	Do not use: Factory test mode
JP6	Closed	Enables the use of the CTS signal (UART)
JP7	Closed	Enables the use of the TXD signal (UART)
JP8	Closed	Enables the use of the RTS signal (UART)
JP9	Closed	Enables the use of the RXD signal (UART)
JP10	Closed	Enables the use of the Crypto Memory (TWCK)
JP11	Closed	Enables the use of the RXD signal (DBGU)
JP12	Closed	Enables the use of the TXD signal (DBGU)
JP13 ⁽¹⁾	Closed	VDDFLASH Jumper
JP14 ⁽¹⁾	Closed	VDDIO Jumper
JP15	Closed	Enables the use of the User LED (DS1)
JP16	Closed	Enables the use of the User LED (DS2)
JP17	Closed	Enables the use of the User LED (DS3)
JP18	Closed	Enables the use of the User LED (DS4) and Crypto Memory (TWD)
JP19	Opened	Select ICE mode or JTAG mode (Closed)
JP20 ⁽¹⁾	Closed	VDDANA Jumper

Table 4-1. Configuration Straps

Designation	Default Setting	Feature
JP21 ⁽¹⁾	Closed	VDDPLL Jumper
JP22 ⁽¹⁾	Closed	VDDIN Jumper
JP23 ⁽¹⁾	Closed	VDDCORE Jumper
JP24	Closed	Enables the use of the EXT_AD0 (Analog Input 0)
JP25	Closed	Enables the use of the EXT_AD1 (Analog Input 1)
JP26	Closed	Enables the use of the EXT_AD2 (Analog Input 2)
JP27	Closed	Enables the use of the EXT_AD3 (Analog Input 3)
TP1	N.A	GND Test point
TP3	N.A	GND Test point
TP5	N.A	GND Test point
TP6	N.A	GND Test point

Note: 1. These jumper footprints are provided for power consumption measurement use. By default, they are closed. To use this feature, the user has to open the strap by cutting it before soldering a jumper and inserting an anmeter.



Section 5

Schematics

5.1 Schematics

This section contains the following schematics:

- Board Layout And Silkscreen Printing - Top View
- 64-pin SAM7 Microcontroller (dual footprint)
- 48-pin SAM7 Microcontroller
- Power Supply
- ICE/EXT Connectors
- Device Interface
- PIO
- User PAD Grid

Figure 5-1. Board Layout And Silkscreen Printing - Top View

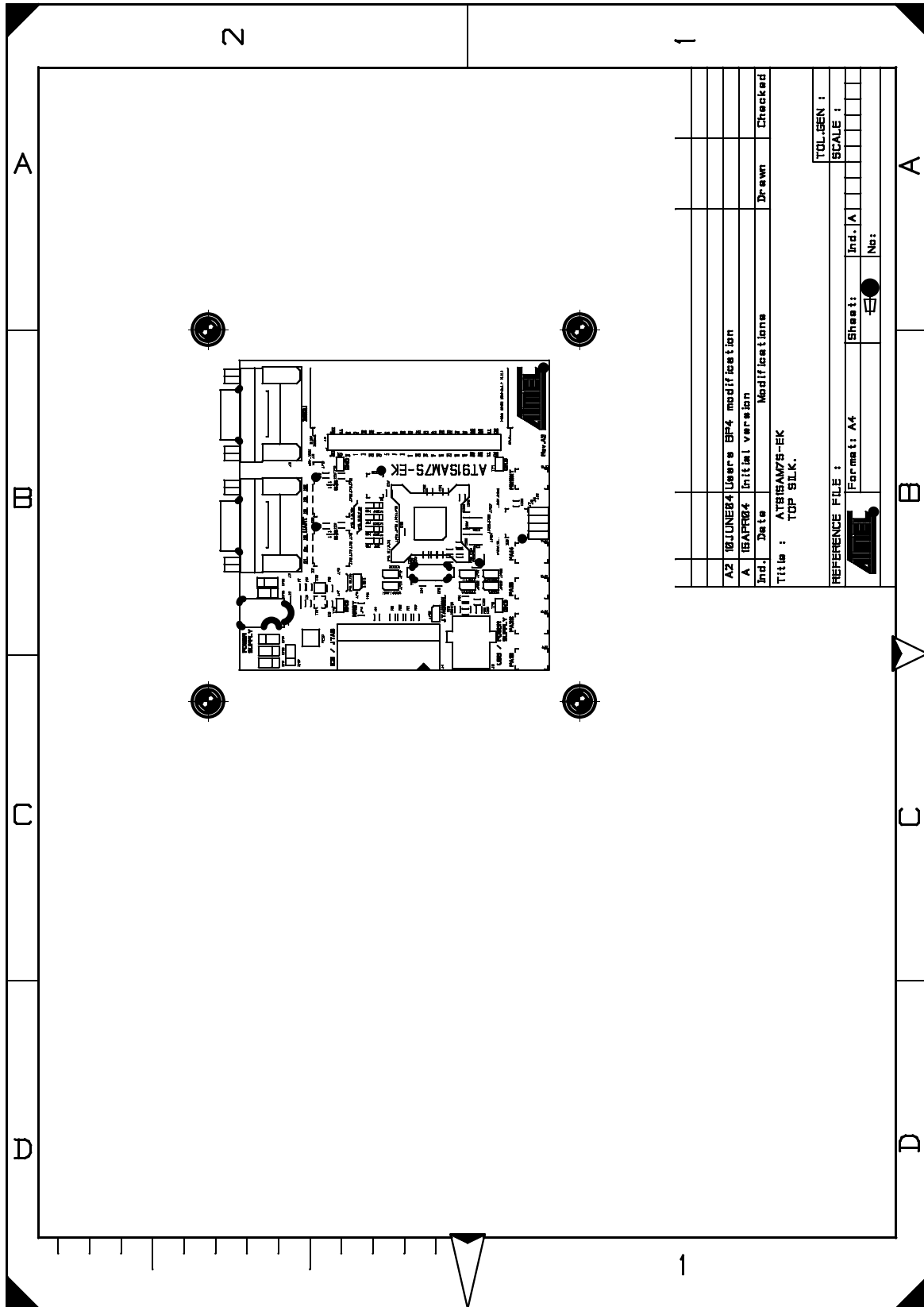
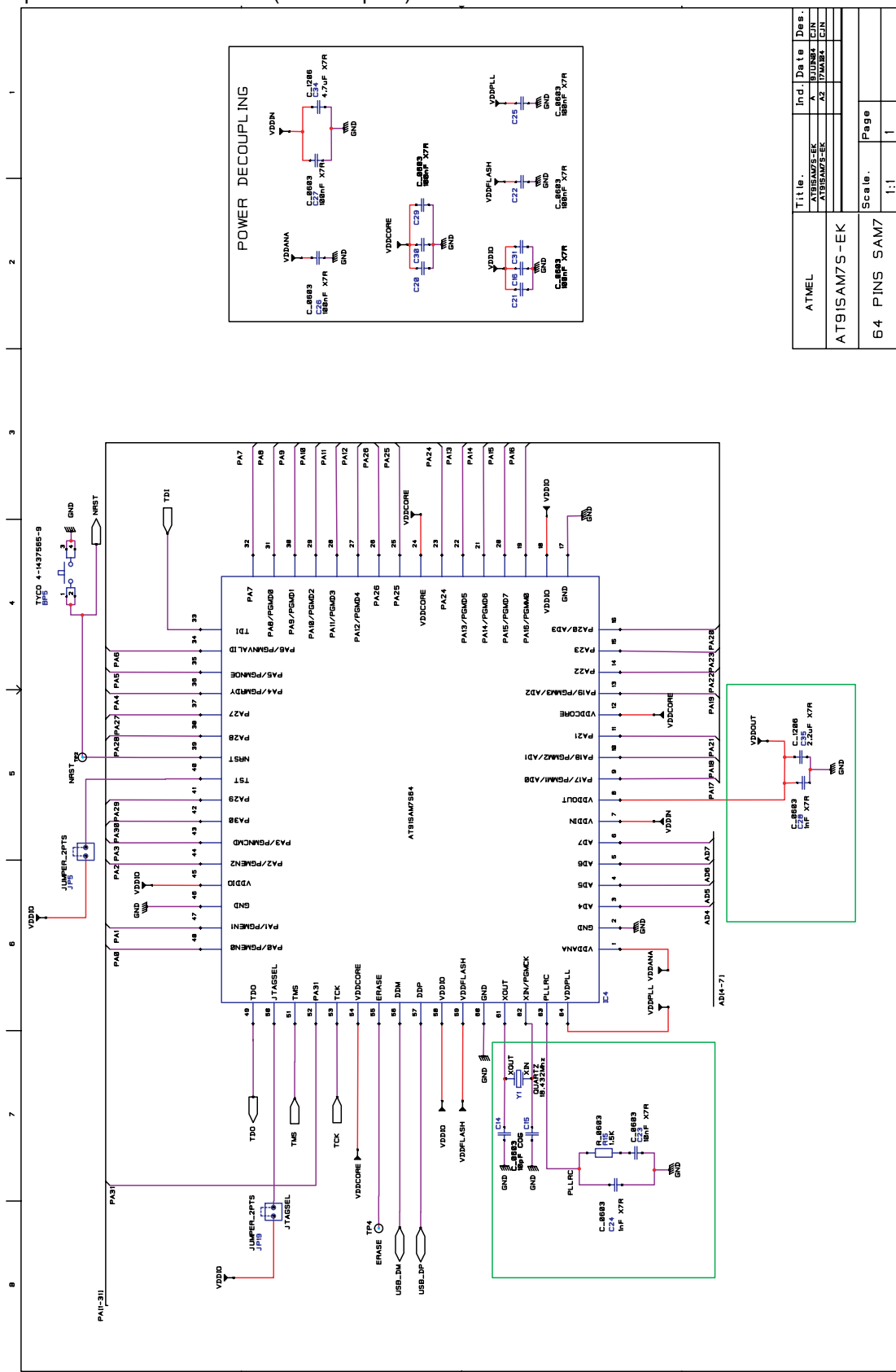


Figure 5-2. 64-pin SAM7 Microcontroller (dual footprint)



Title.		Ind.	Date	Des.
AT91SAM7S-EK		A	01/08/04	CJN
AT91SAM7S-EK		Z2	07/08/04	CJN
64 PINS SAM7				
Scale.		Page		
1:1		1		



Figure 5-3. 48-pin SAM7 Microcontroller

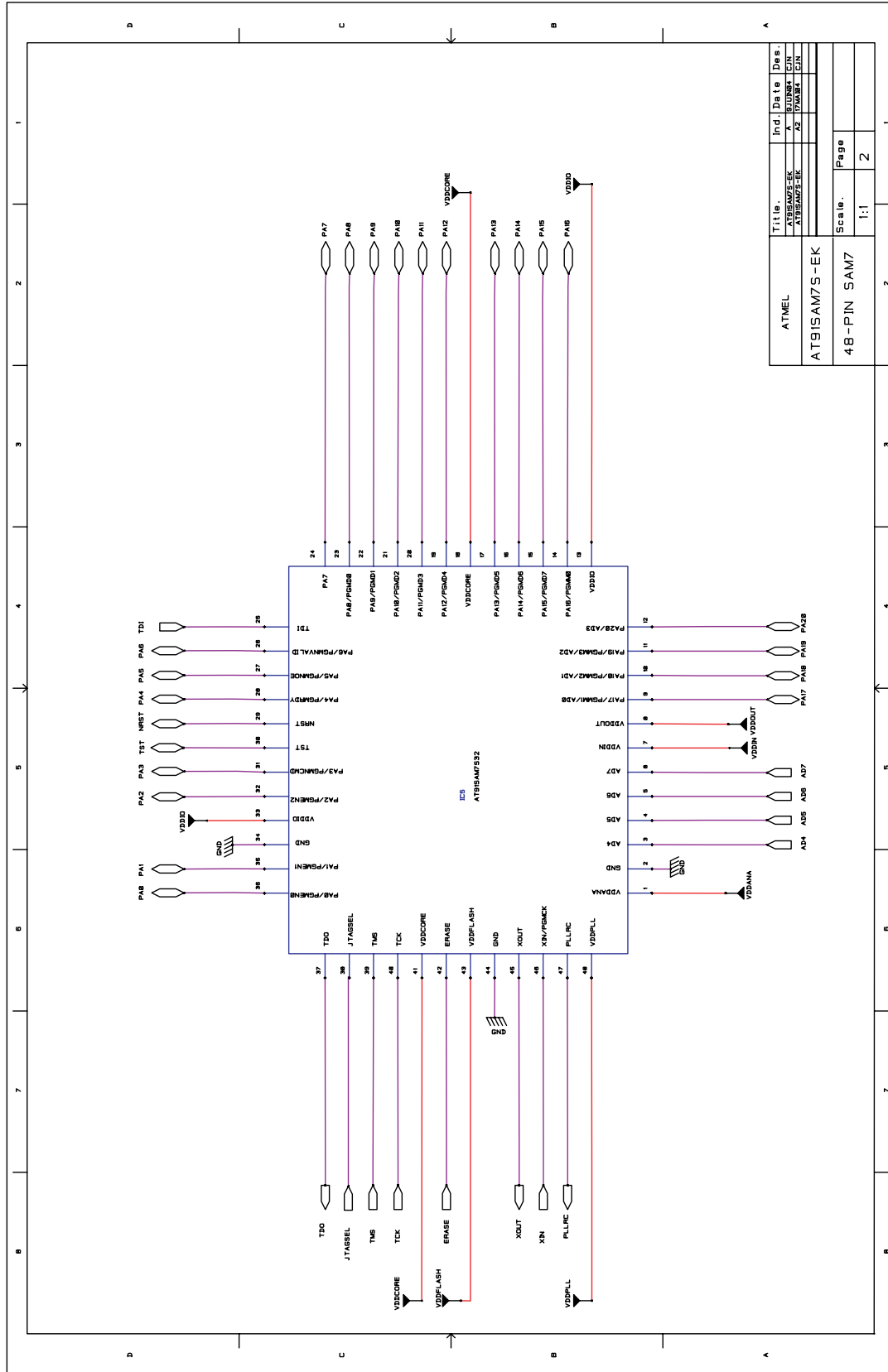


Figure 5-4. Power Supply

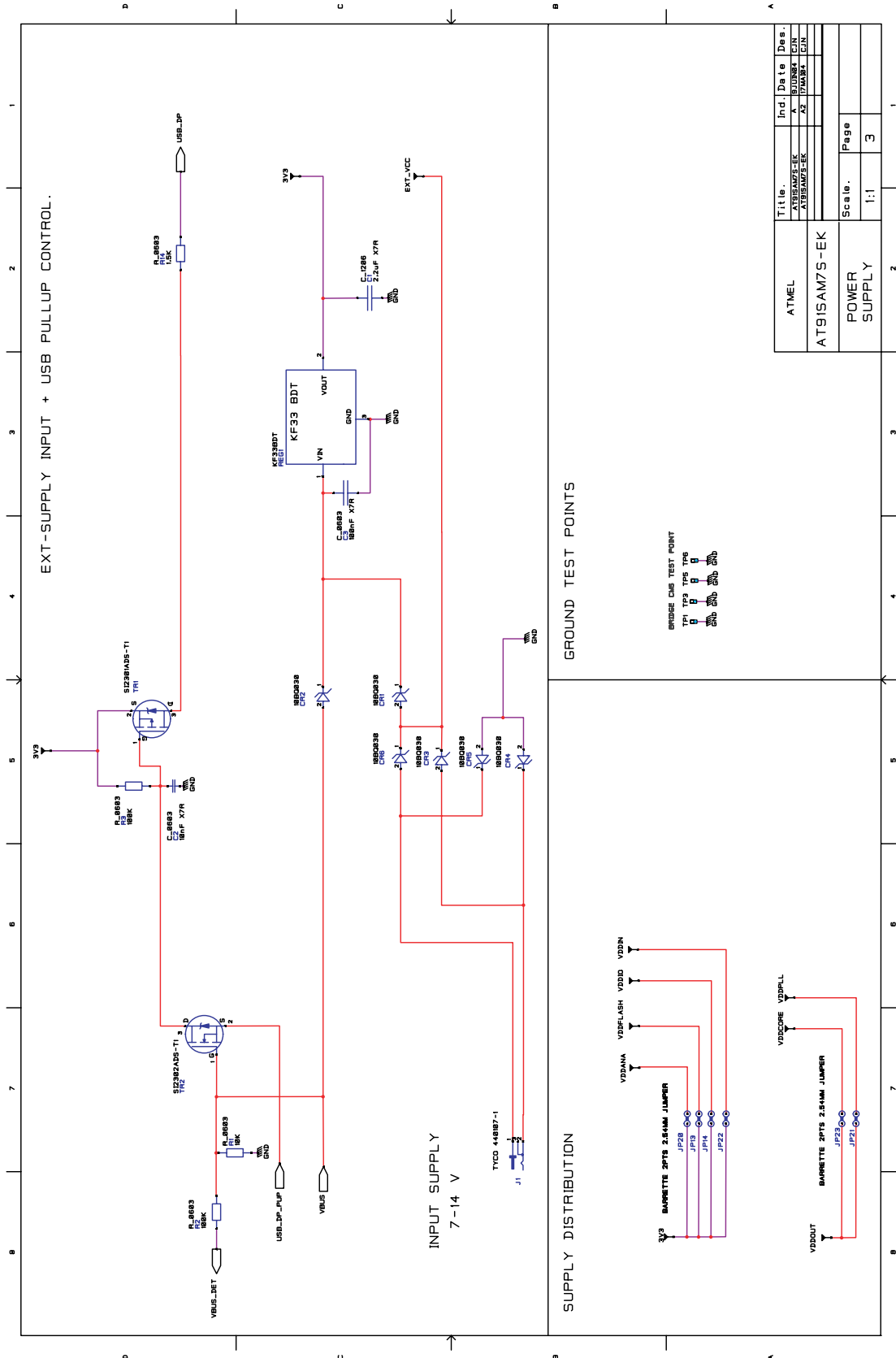
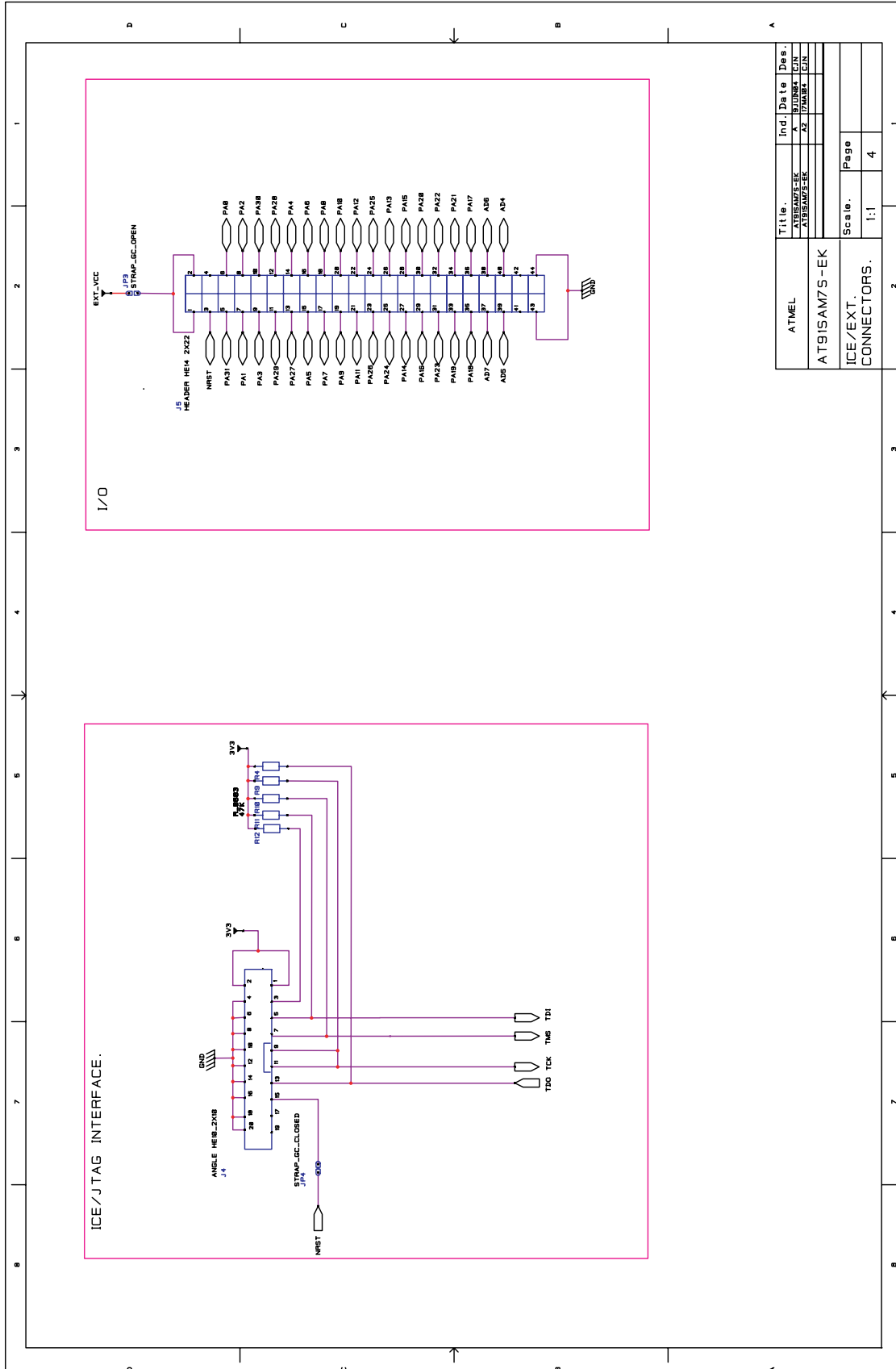


Figure 5-5. ICE/EXT Connectors



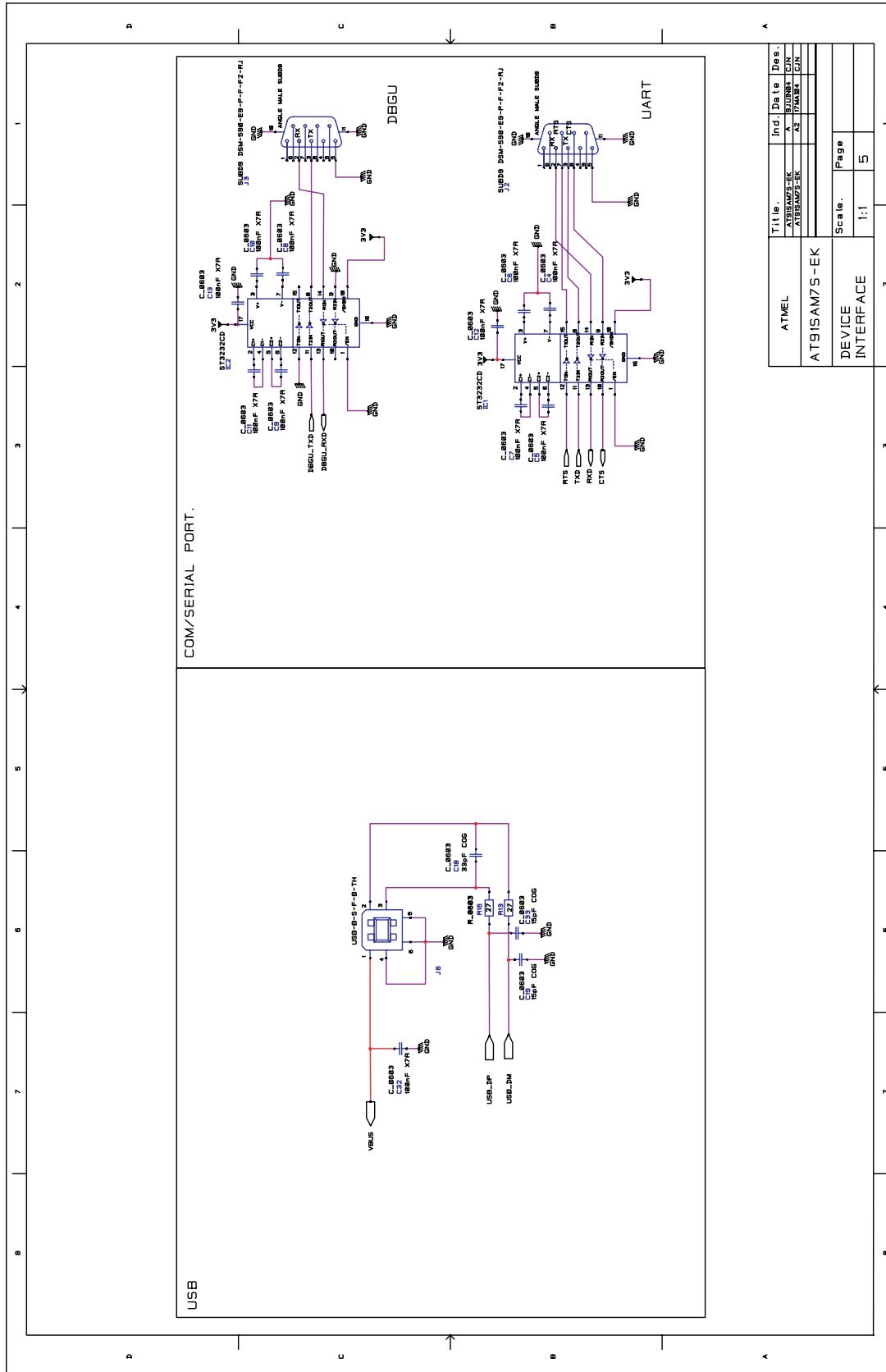
Title	Ind. Date	Des.
AT91SAM7S-EK	X	BOARD CH
AT91SAM7S-EK	X	BOARD CH

Page
4

Scale
1:1



Figure 5-6. Device Interface



Title	Ind	Date	Des
AT91SAM7S-EK	A	BUMBA	CJN
AT91SAM7S-EK	A2	1/24/04	SEN

AT91SAM7S-EK	Page
DEVICE INTERFACE	1:1 5

Figure 5-7. PIO

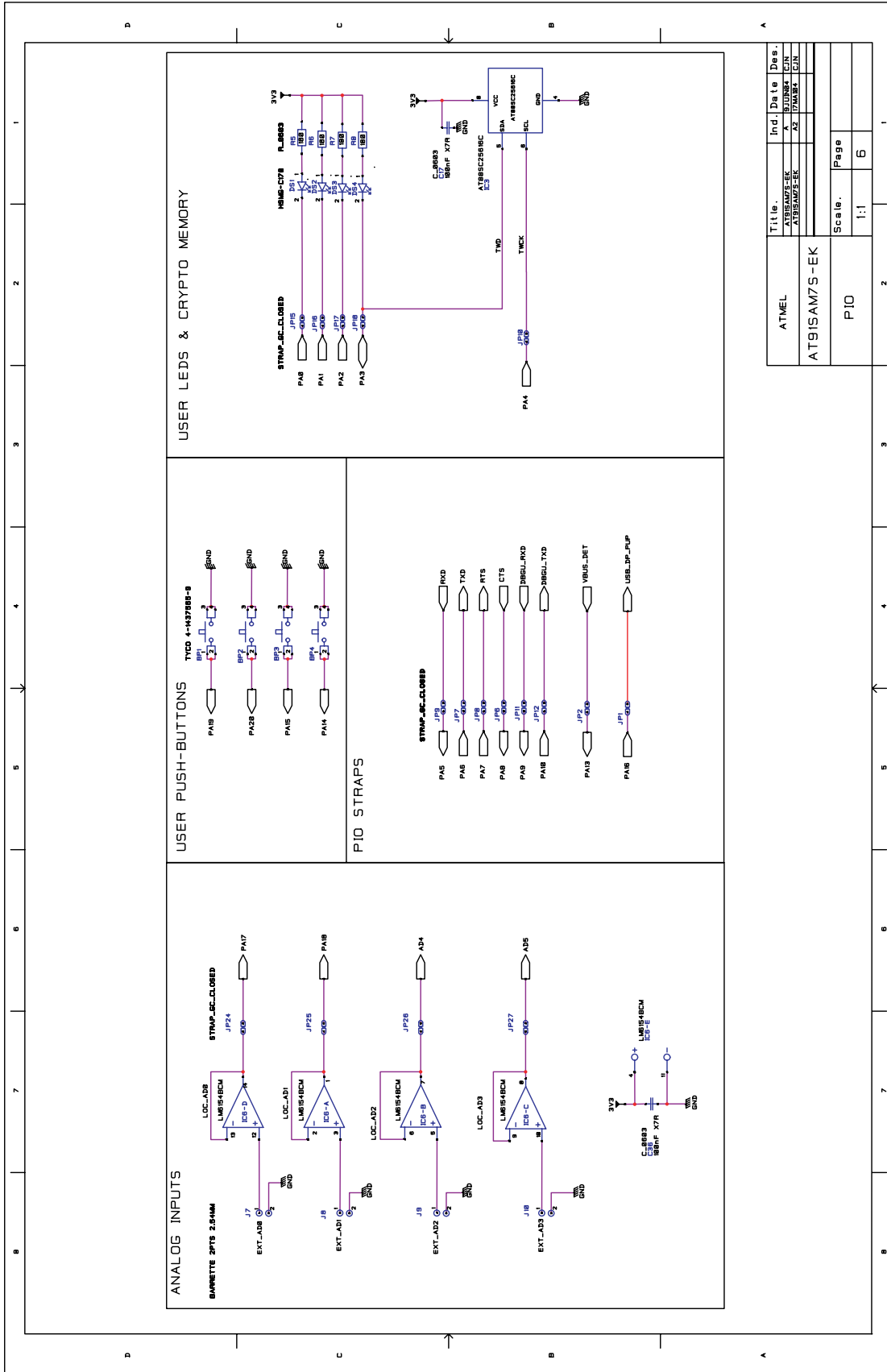
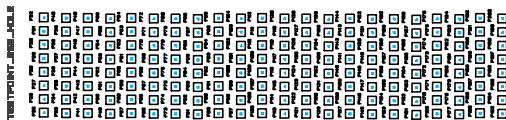
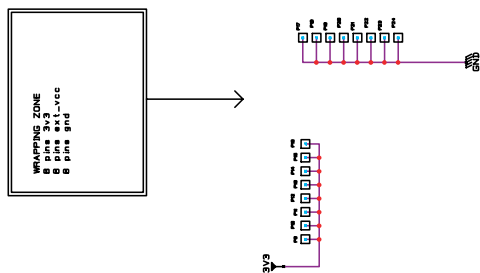


Figure 5-8. User PAD Grid



Title	Ind.	Date	Des.
ATMEL	A	8/20/04	CJN
AT91SAM7S-EK	A2	12/04/04	CJN
AT91SAM7S-EK			
USER PAD GRID			
Scale:	Page		
1:1	7		
2		1	





Atmel Corporation

2325 Orchard Parkway
San Jose, CA 95131, USA
Tel: 1(408) 441-0311
Fax: 1(408) 487-2600

Regional Headquarters

Europe

Atmel Sarl
Route des Arsenaux 41
Case Postale 80
CH-1705 Fribourg
Switzerland
Tel: (41) 26-426-5555
Fax: (41) 26-426-5500

Asia

Room 1219
Chinachem Golden Plaza
77 Mody Road Tsimshatsui
East Kowloon
Hong Kong
Tel: (852) 2721-9778
Fax: (852) 2722-1369

Japan

9F, Tonetsu Shinkawa Bldg.
1-24-8 Shinkawa
Chuo-ku, Tokyo 104-0033
Japan
Tel: (81) 3-3523-3551
Fax: (81) 3-3523-7581

Atmel Operations

Memory

2325 Orchard Parkway
San Jose, CA 95131, USA
Tel: 1(408) 441-0311
Fax: 1(408) 436-4314

Microcontrollers

2325 Orchard Parkway
San Jose, CA 95131, USA
Tel: 1(408) 441-0311
Fax: 1(408) 436-4314

La Chantrerie
BP 70602
44306 Nantes Cedex 3, France
Tel: (33) 2-40-18-18-18
Fax: (33) 2-40-18-19-60

ASIC/ASSP/Smart Cards

Zone Industrielle
13106 Rousset Cedex, France
Tel: (33) 4-42-53-60-00
Fax: (33) 4-42-53-60-01

1150 East Cheyenne Mtn. Blvd.
Colorado Springs, CO 80906, USA
Tel: 1(719) 576-3300
Fax: 1(719) 540-1759

Scottish Enterprise Technology Park
Maxwell Building
East Kilbride G75 0QR, Scotland
Tel: (44) 1355-803-000
Fax: (44) 1355-242-743

RF/Automotive

Theresienstrasse 2
Postfach 3535
74025 Heilbronn, Germany
Tel: (49) 71-31-67-0
Fax: (49) 71-31-67-2340

1150 East Cheyenne Mtn. Blvd.
Colorado Springs, CO 80906, USA
Tel: 1(719) 576-3300
Fax: 1(719) 540-1759

Biometrics/Imaging/Hi-Rel MPU/ High Speed Converters/RF Datacom

Avenue de Rochepleine
BP 123
38521 Saint-Egreve Cedex, France
Tel: (33) 4-76-58-30-00
Fax: (33) 4-76-58-34-80



Disclaimer: The information in this document is provided in connection with Atmel products. No license, express or implied, by estoppel or otherwise, to any intellectual property right is granted by this document or in connection with the sale of Atmel products. **EXCEPT AS SET FORTH IN ATMEL'S TERMS AND CONDITIONS OF SALE LOCATED ON ATMEL'S WEB SITE, ATMEL ASSUMES NO LIABILITY WHATSOEVER AND DISCLAIMS ANY EXPRESS, IMPLIED OR STATUTORY WARRANTY RELATING TO ITS PRODUCTS INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTY OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE, OR NON-INFRINGEMENT. IN NO EVENT SHALL ATMEL BE LIABLE FOR ANY DIRECT, INDIRECT, CONSEQUENTIAL, PUNITIVE, SPECIAL OR INCIDENTAL DAMAGES (INCLUDING, WITHOUT LIMITATION, DAMAGES FOR LOSS OF PROFITS, BUSINESS INTERRUPTION, OR LOSS OF INFORMATION) ARISING OUT OF THE USE OR INABILITY TO USE THIS DOCUMENT, EVEN IF ATMEL HAS BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGES.** Atmel makes no representations or warranties with respect to the accuracy or completeness of the contents of this document and reserves the right to make changes to specifications and product descriptions at any time without notice. Atmel does not make any commitment to update the information contained herein. Atmel's products are not intended, authorized, or warranted for use as components in applications intended to support or sustain life.

© Atmel Corporation 2004. All rights reserved. Atmel®, logo and combinations thereof, and DataFlash® are the registered trademarks, and Everywhere You AreSM is the trademark of Atmel Corporation or its subsidiaries. ARM®, Thumb®, ARM7DMI® and ARM Powered® are the registered trademarks of ARM, Ltd. Other terms and product names may be the trademarks of others.

Literature Requests

www.atmel.com/literature



Printed on recycled paper.