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AT91SAM7S-EK Evaluation Board

User Guide

Table of Contents

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 AT91SAM7S256.

This guide focuses on the AT91SAM7S-EK board as an evaluation platform for the AT91SAM7S family.

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 DVD-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.

1.3 AT91SAM7S-EK Evaluation Board

The board is generally equipped with an AT91SAM7S256 (64-pin PQFP package) together with the following:

- USB device port interface
- Two serial communication ports
- 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 AT91SAM7S256 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 0.5 A.

Note: The AT91SAM7S-EK is not delivered with the JTAG/ICE interface required to start evaluating the device.

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.

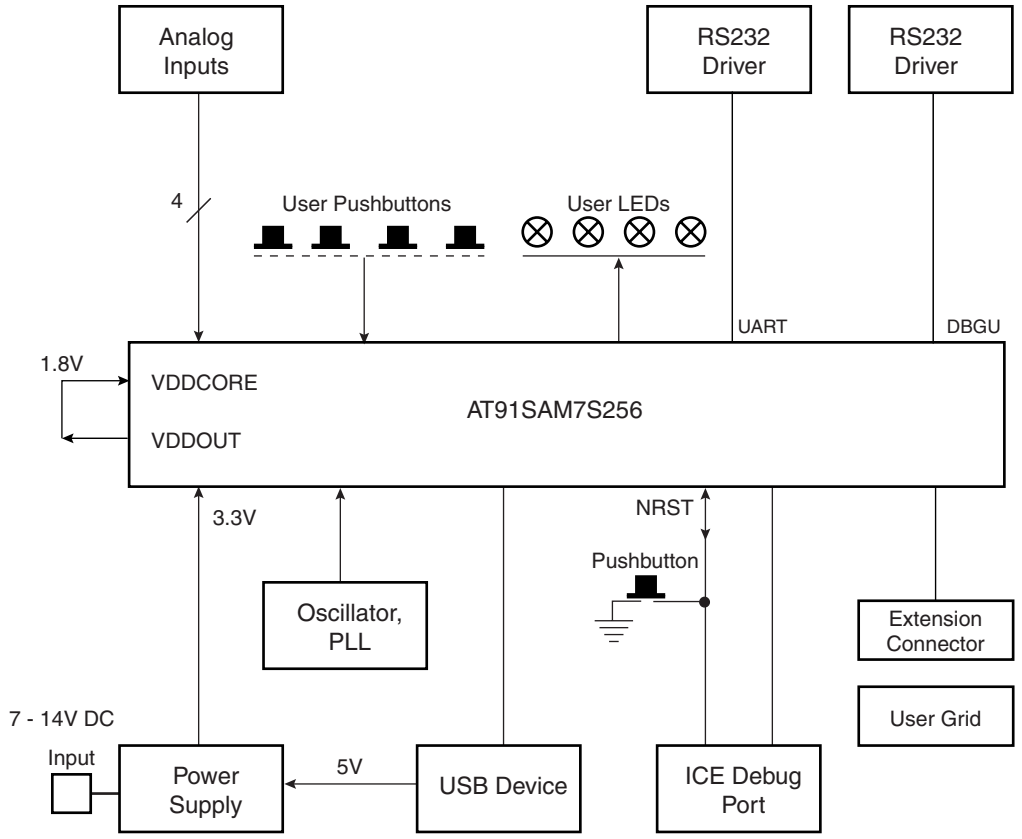
The regulator allows the input voltage range to be from 7V to 12V.

2.4 Getting Started

The AT91SAM7S-EK evaluation board is delivered with a DVD-ROM containing all necessary information and step-by-step procedures for working with the most common development toolchains. Please refer to this DVD-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.

2.5 AT91SAM7S-EK Block Diagram

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



Section 3

Board Description

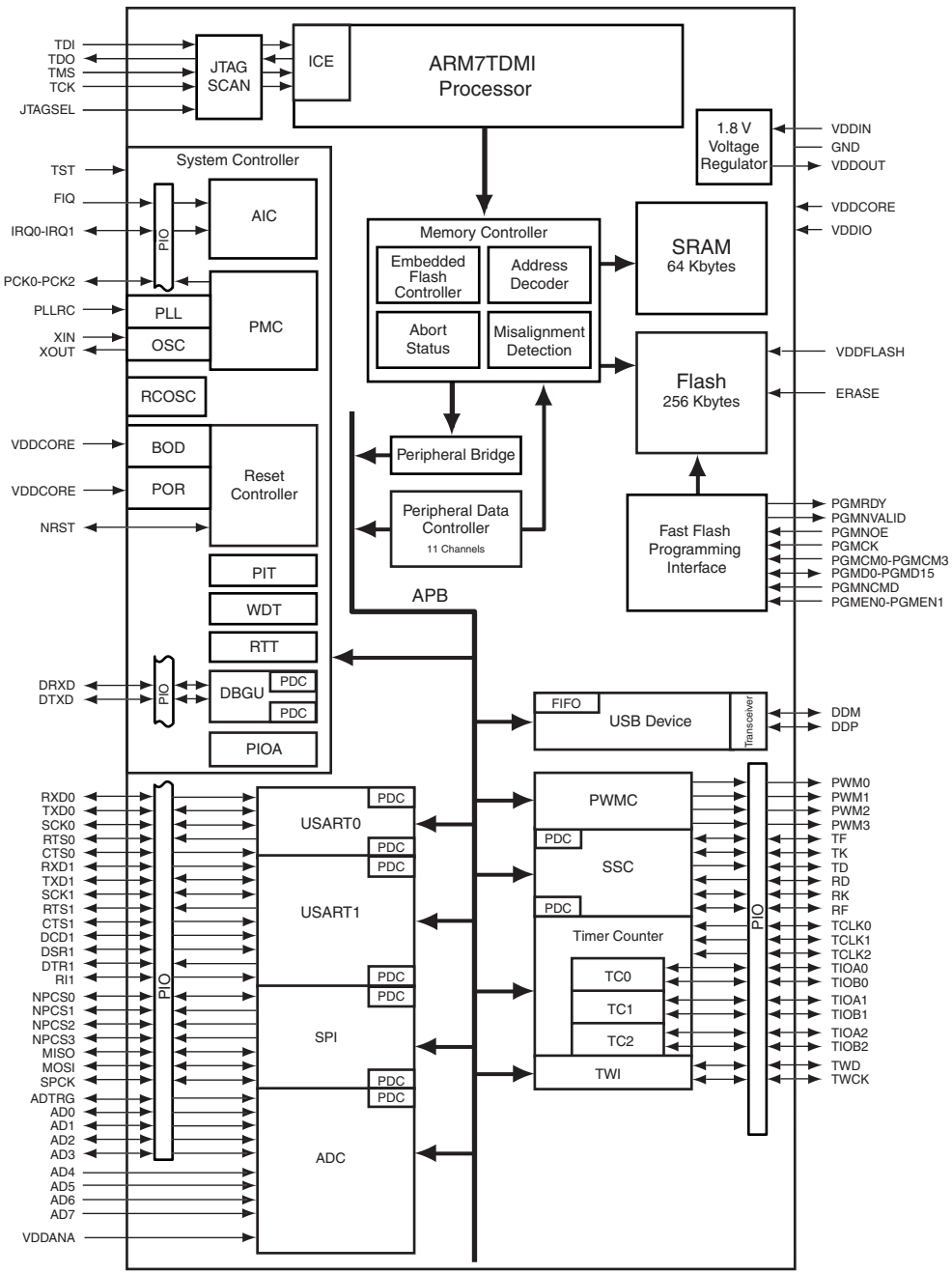
3.1 AT91SAM7S256 Microcontroller

- Incorporates the ARM7TDMI® ARM® Thumb® Processor
  - High-performance 32-bit RISC Architecture
  - High-density 16-bit Instruction Set
  - Leader in MIPS/Watt
  - EmbeddedICE™ In-circuit Emulation, Debug Communication Channel Support
- 256 Kbytes of Internal High-speed Flash, Organized in 1024 Pages of 256 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
- 64 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
  - Manchester Encoder/Decoder
  - 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 AT91SAM7S256 Block Diagram

Figure 3-1. AT91SAM7S256 Block Diagram



3.3 Memory

- 256 Kbytes of internal high-speed Flash
- 64 Kbytes of internal high-speed SRAM

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 200 mA.
- External power can be applied via the 2.1 mm 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 by 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 Connector

One expansion connector (J5) gives access to all the microcontroller's signals.

All I/Os of the AT91SAM7S256 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	
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)
JP19	Opened	Select ICE mode or JTAG mode (Closed)
JP20(1)	Closed	ADVREFP Jumper
JP21(1)	Closed	VDDPLL Jumper

Table 4-1. Configuration Straps

Designation	Default Setting	Feature
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_AD4 (Analog Input 4)
JP27	Closed	Enables the use of the EXT_AD5 (Analog Input 5)
JP28	Opened	Erases all internal Flash memory when the board is powered. To do so, the user must close J28 for at least 10 ms.
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 jumpers are dedicated to power consumption measurement use. The user has to open the jumper and insert an anmeter.
If these jumpers are not populated (previous revisions of the kit), the related straps are wired on board. In this case and in order to use the power consumption measurement feature, the user has to open the strap by cutting it before soldering a jumper and inserting an anmeter.

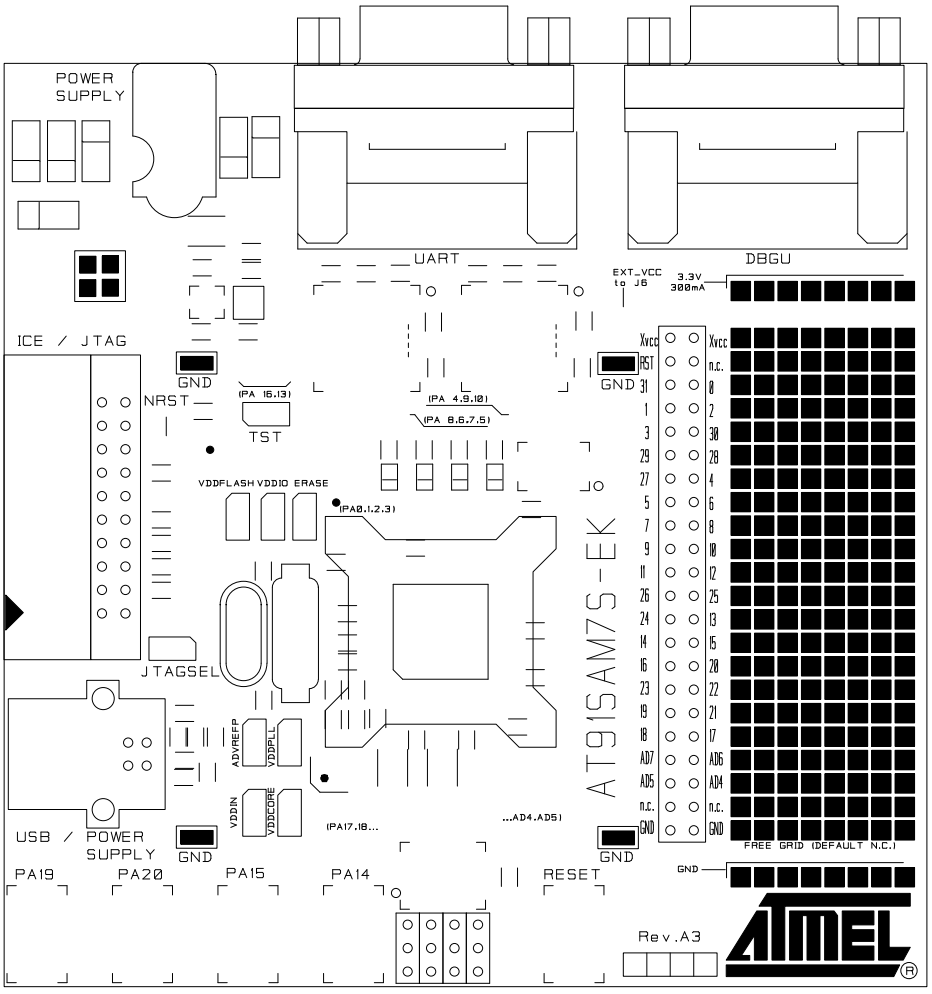
Section 5

Schematics

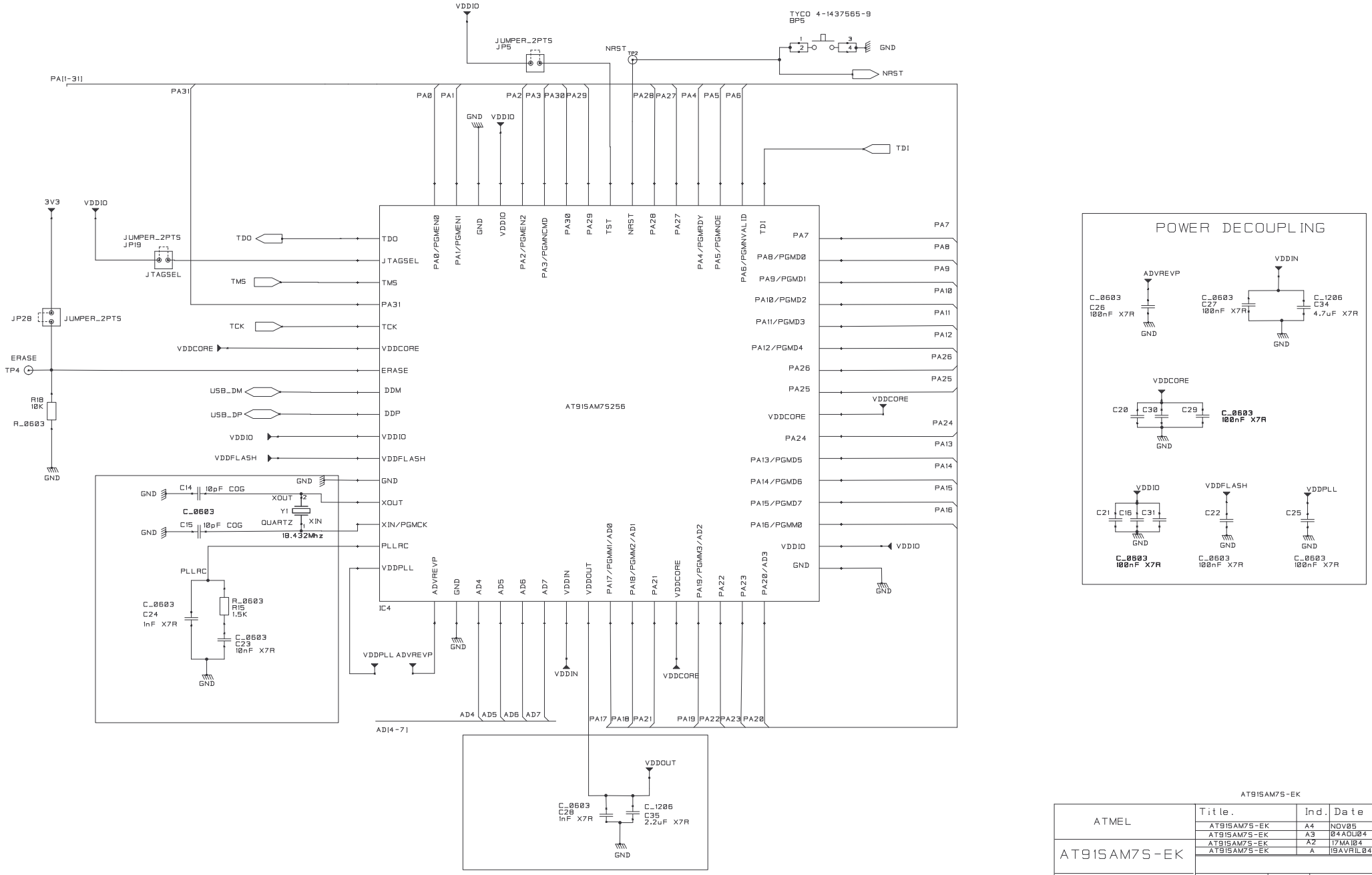
5.1 Schematics

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



A3	4 AUG 04	
A2	9 JUNE04	
A	15APR04	Initial version



AT91SAM7S-EK

	Title.	Ind.	Date	Des.
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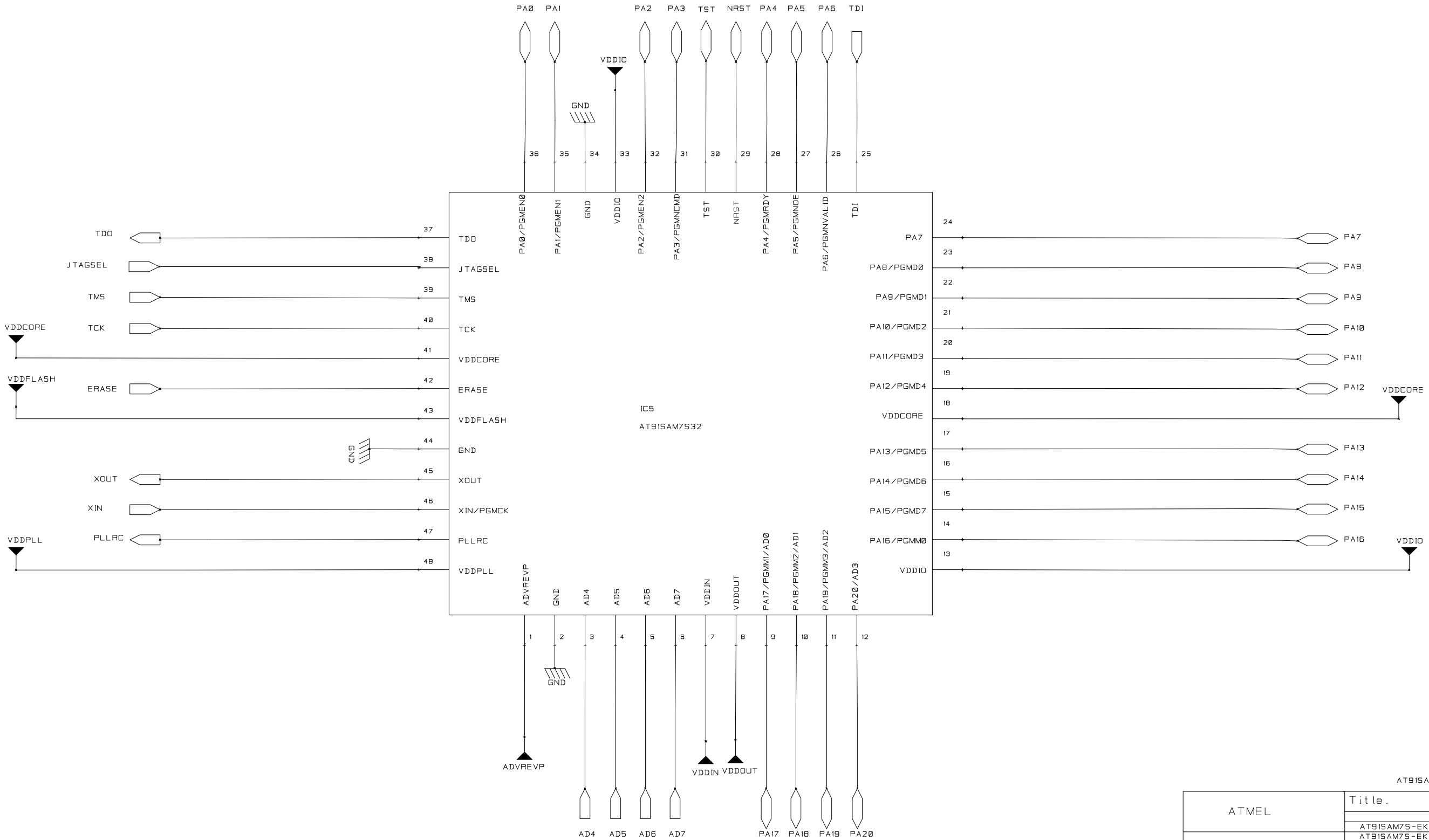
	AT91SAM7S-EK	A3	04AOU04	CJN
AT91SAM7S-EK	AT91SAM7S-EK	A2	17MAI04	CJN
	AT91SAM7S-EK	A	19AVRIL04	CJN
64 PINS SAM7	Scale. 1:1	Page 1		

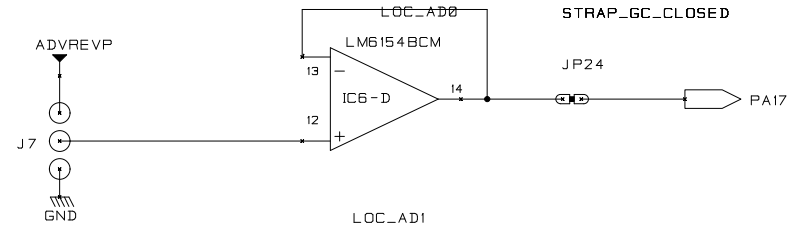


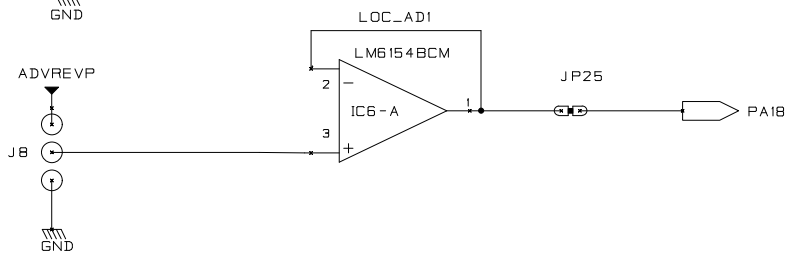
AT91SAM7S-EK

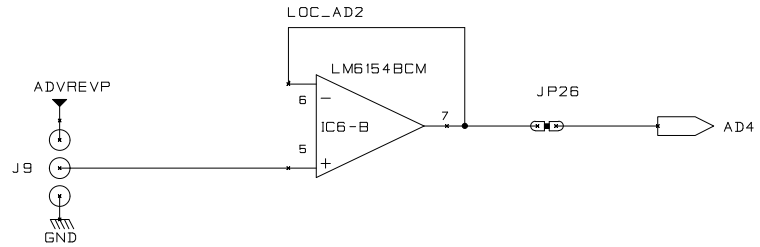
ATMEL	Title.	Ind.	Date	Des.
	AT91SAM7S-EK	A3	04AOU04	CJN
	AT91SAM7S-EK	A2	17MAI04	CJN
AT91SAM7S-EK	AT91SAM7S-EK	A	19AVRIL04	CJN
48-PIN SAM7	Scale. 1:1	Page 2		

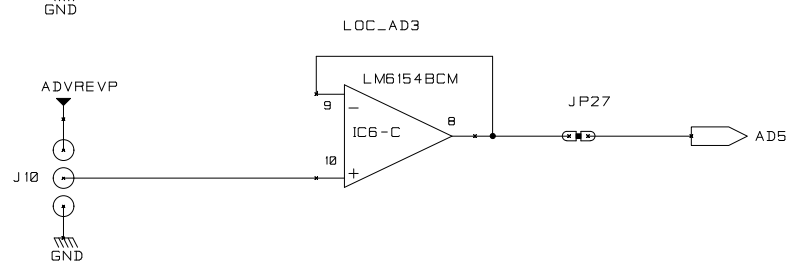
ANALOG INPUTS

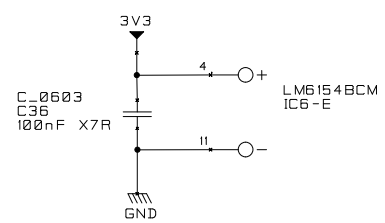
BARRETTE 3PTS 2.54MM



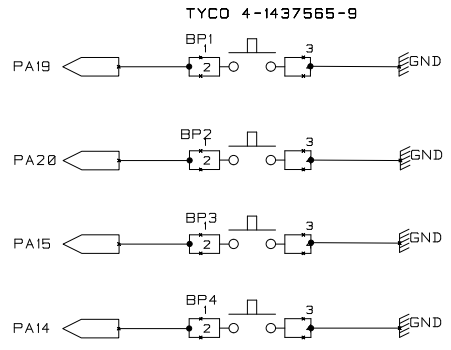




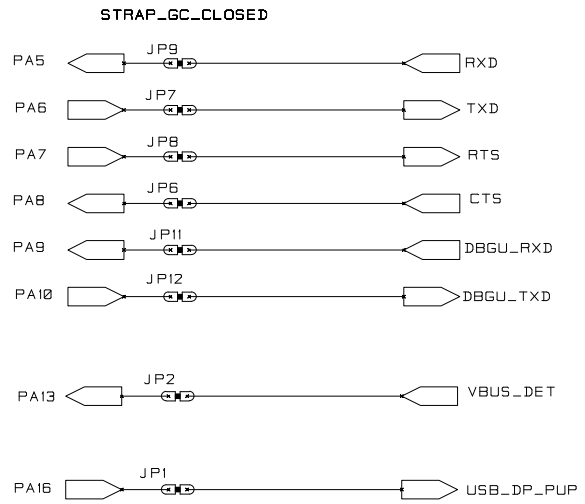




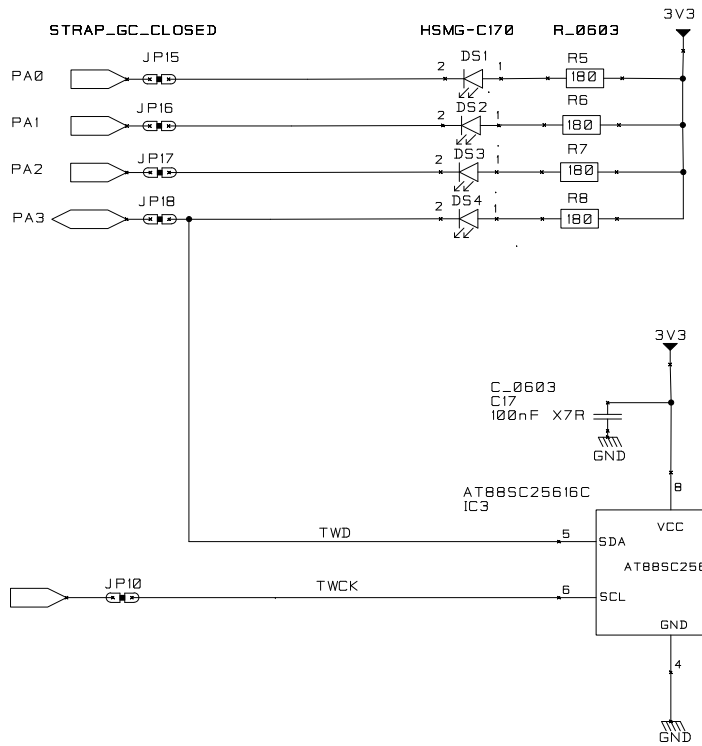
USER PUSH-BUTTONS



PIO STRAPS



USER LEDS & CRYPTO MEMORY



AT91SAM7S-EK

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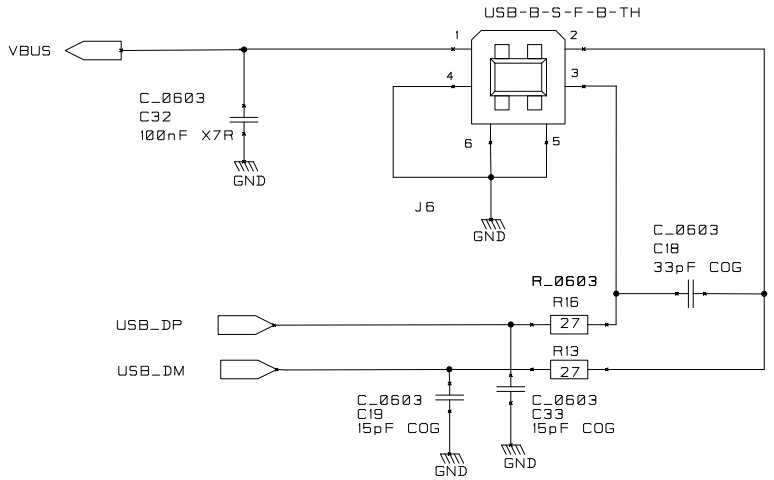
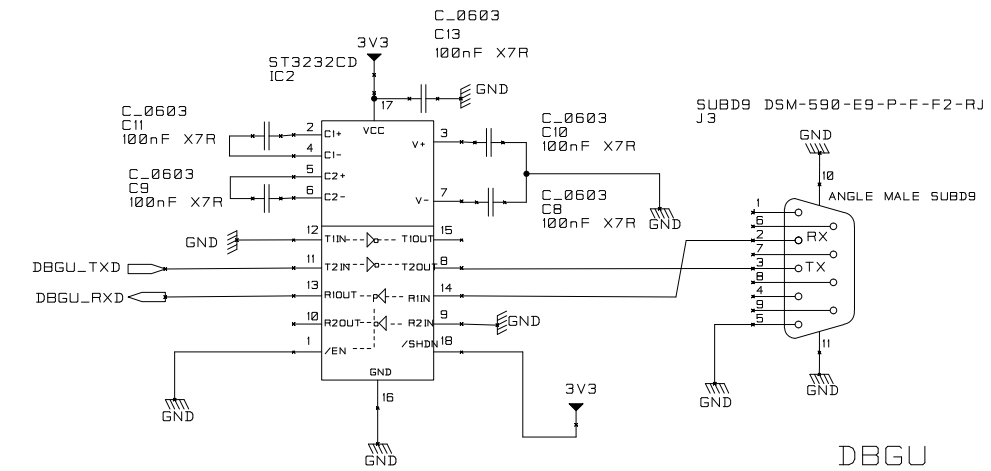
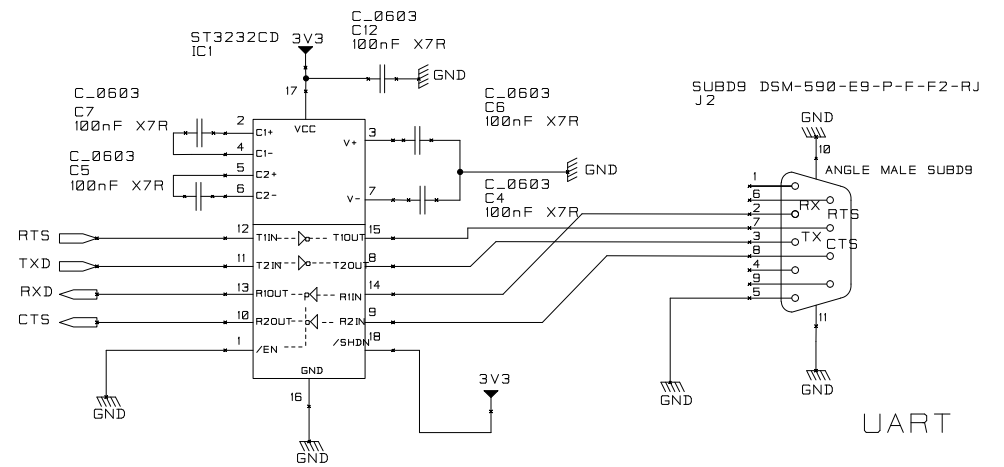
	AT91SAM7S-EK	A2	17MA104	CJN
AT91SAM7S-EK	AT91SAM7S-EK	A	19AVRIL04	CJN
PIO	Scale.	Page		
	1:1	6		

USB



COM/SERIAL PORT.





AT91SAM7S-EK

	Title.		Ind.	Date	Des.
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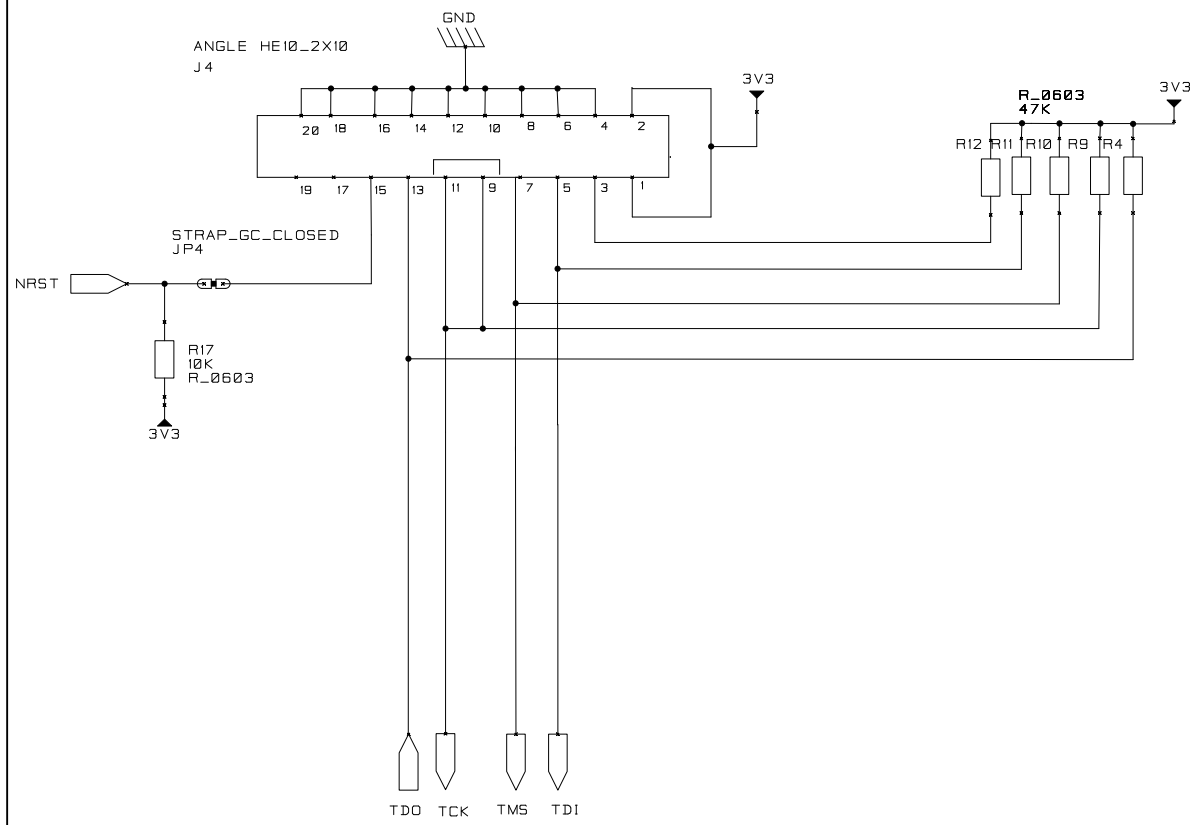
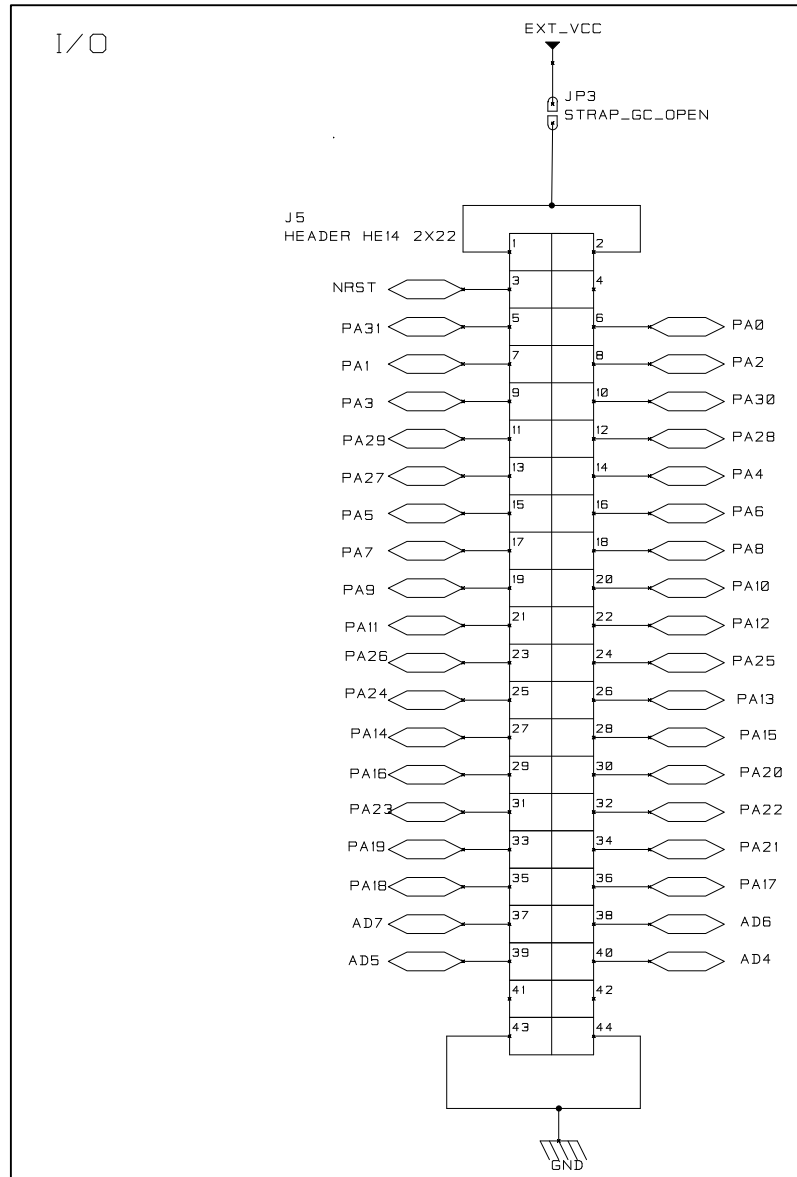
	AT91SAM7S-EK		A2	17MA104	CJN
AT91SAM7S-EK	AT91SAM7S-EK		A	19AVRIL04	CJN
DEVICE INTERFACE	Scale.	Page			
	1:1	5			

ICE/JTAG INTERFACE.



I/O



AT91SAM7S-EK

ATMEL	Title.		Ind.	Date	Des.
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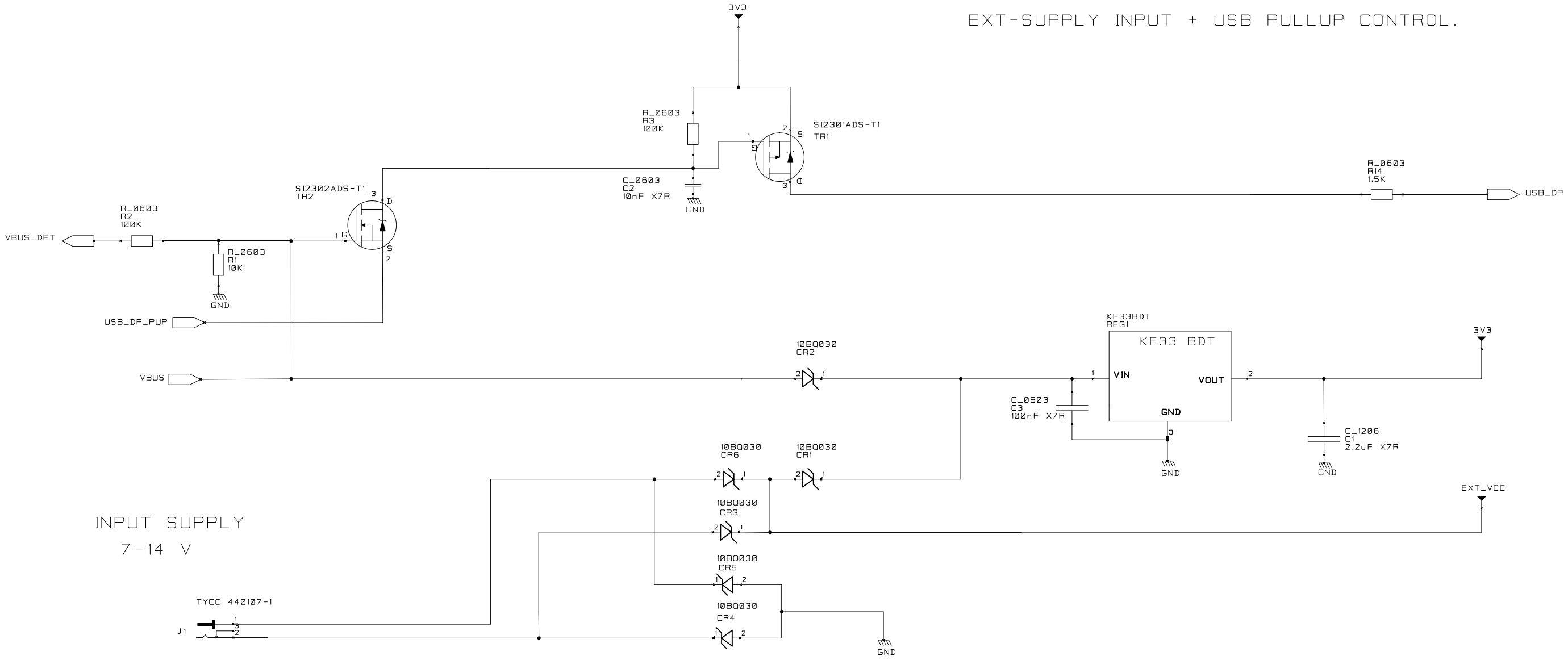
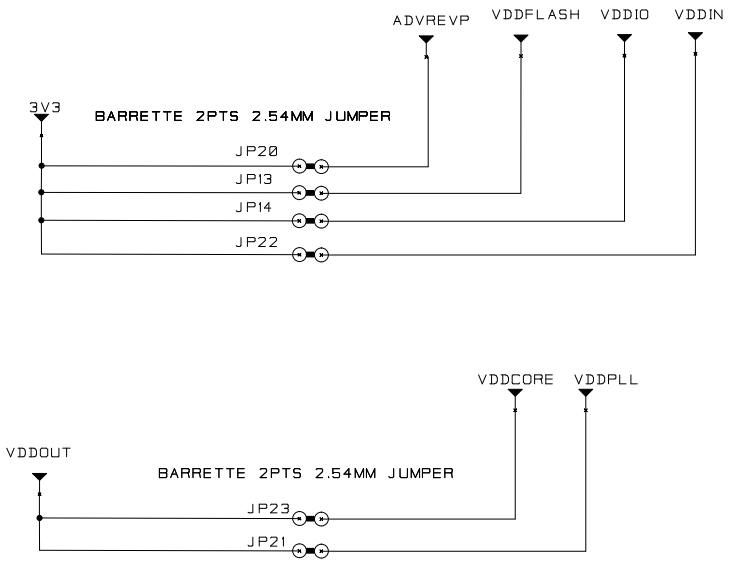
	AT91SAM7S-EK		A2	17MA104	CJN
	AT91SAM7S-EK		A	19AVRIL04	CJN
AT91SAM7S-EK					
ICE/EXT. CONNECTORS.	Scale.	Page			
	1:1	4			

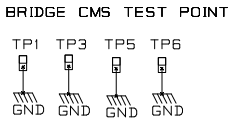
EXT-SUPPLY INPUT + USB PULLUP CONTROL.



SUPPLY DISTRIBUTION



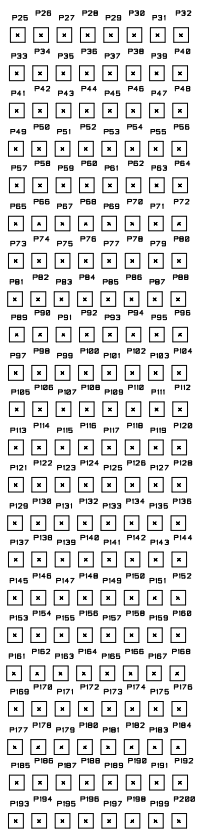
GROUND TEST POINTS



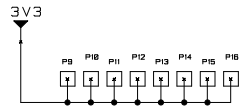
AT91SAM7S-EK

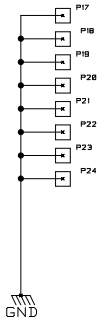
ATMEL	Title.	Ind.	Date	Des.
	AT91SAM7S-EK	A3	04AOU04	CJN
	AT91SAM7S-EK	A2	17MA104	CJN
AT91SAM7S-EK	AT91SAM7S-EK	A	19AVRIL04	CJN
POWER SUPPLY	Scale. 1:1	Page 3		

TESTPOINT_050_HOLE



WRAPPING ZONE
8 pins 3v3
8 pins ext_vcc
8 pins gnd





AT91SAM7S-EK

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	AT91SAM7S-EK	A2	17MA104	CJN
AT91SAM7S-EK	AT91SAM7S-EK	A	19AVRIL04	CJN
USER PAD GRID	Scale.	Page		
	1:1	7		

Section 6

Revision History

6.1 Revision History

Table 6-1.

Document	Comments	Change Request Ref.
6112A	First issue.	
6112B	New schematics.	1457
6112C	Corrected features for JP26 and JP27 in Table 4-1, "Configuration Straps". Corrected device label in 64-pin SAM7 schematic.	3849 2734