OLIMEX

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SAM7-P256 development board_____
Users Manual

Rev. F, August 2008
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INTRODUCTION:

Atmel's **AT91SAM7S256** is a member of a series of low pincount Flash microcontrollers based on the 32-bit ARM RISC processor. It features a 256 Kbyte high-speed Flash and a 64 Kbyte SRAM, a large set of peripherals, including a USB 2.0 device, and a complete set of system functions minimizing the number of external components. The device is an ideal migration path for 8-bit microcontroller users looking for additional performance and extended memory.

The embedded Flash memory can be programmed in-system via the JTAG-ICE interface or via a parallel interface on a production programmer prior to mounting. Built-in lock bits and a security bit protect the firmware from accidental overwrite and preserves its confidentiality.

The AT91SAM7S256 system controller includes a reset controller capable of managing the power-on sequence of the microcontroller and the complete system. Correct device operation can be monitored by a built-in brownout detector and a watchdog running off an integrated RC oscillator.

The AT91SAM7S256 is a general-purpose microcontroller. Its integrated USB Device port makes it an ideal device for peripheral applications requiring connectivity to a PC or cellular phone. Its aggressive price point and high level of integration pushes its scope of use far into the cost-sensitive, high-volume consumer market.

BOARD FEATURES:

- Microcontroller: **AT91SAM7S256** 16/32 bit ARM7TDMI™ with 256K Bytes Program Flash, 64K Bytes RAM, USB 2.0, RTT, 10 bit ADC 384 ksps, 2x UARTs, TWI (I2C), SPI, 3x 32bit TIMERS, 4x PWM, SSC, WDT, PDC (DMA) for all peripherals, up to 60MHz operation

- standard JTAG connector with ARM 2x10 pin layout for programming/debugging with ARM-JTAG

- USB connector

- Two channel RS232 interface and drivers

- SD/MMC card connector

- two buttons

- trimpot connected to ADC

- thermistor connected to ADC

- two status LEDs

- on board voltage regulator 3.3V with up to 800mA current

- single power supply: 6V AC or DC required

- power supply LED

- power supply filtering capacitor

- RESET circuit

- RESET button

- 18.432 Mhz crystal on socket

- extension headers for all microcontroller's ports

- PCB: FR-4, 1.5 mm (0,062"), soldermask, silkscreen component print

- Dimensions: 120 x 80 mm (4.7 x 3.15")

ELECTROSTATIC WARNING:

The **SAM7-P256** board is shipped in protective anti-static packaging. The board must not be subject to high electrostatic potentials. General practice for working with static sensitive devices should be applied when working with this board.

BOARD USE REQUIREMENTS:

Cables: The cable you will need depends on the programmer/debugger you use. If you use ARM-JTAG-EW, you will need USB A-B cable.

Hardware: Programmer/Debugger ARM-JTAG-EW or other compatible programming/debugging tool if you work with EW-ARM.

You can use also ARM-USB-OCD, ARM-USB-TINY, ARM-USB-TINY-H .

PROCESSOR FEATURES:

SAM7-P256 board use AT91 ARM Thumb-based microcontroller **AT91SAM7S256** from Atmel Corporation with these features:
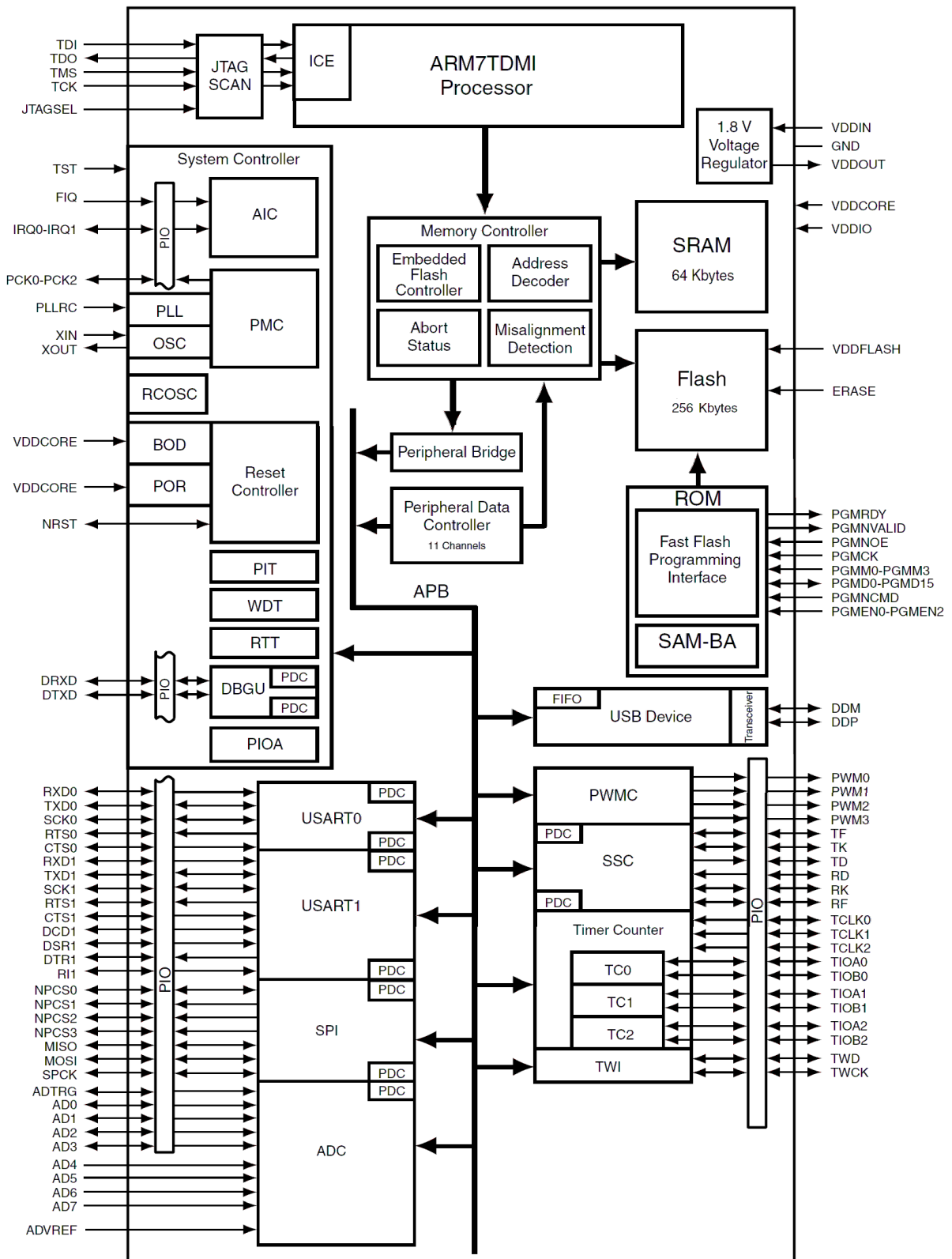

- High-performance 32-bit RISC Architecture

- High-density 16-bit Instruction Set

- Leader in MIPS/Watt

- EmbeddedICE™ In-circuit Emulation, Debug Communication Channel Support

- Internal High-speed Flash

  - 256 Kbytes Organized in 1024 Pages of 256 Bytes (Single Plane)

  - Single Cycle Access at Up to 30 MHz in Worst Case Conditions

  - Prefetch Buffer Optimizing Thumb Instruction Execution at Maximum Speed

  - Page Programming Time: 6 ms, Including Page Auto-erase, Full Erase Time: 15 ms

  - 10,000 Write Cycles, 10-year Data Retention Capability, Sector Lock Capabilities, Flash Security Bit

  - Fast Flash Programming Interface for High Volume Production

- Internal High-speed SRAM, Single-cycle Access at Maximum Speed

- 64 Kbytes
- 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 Source(s) 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
  - Mode for General Purpose 2-wire UART Serial Communication
- 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
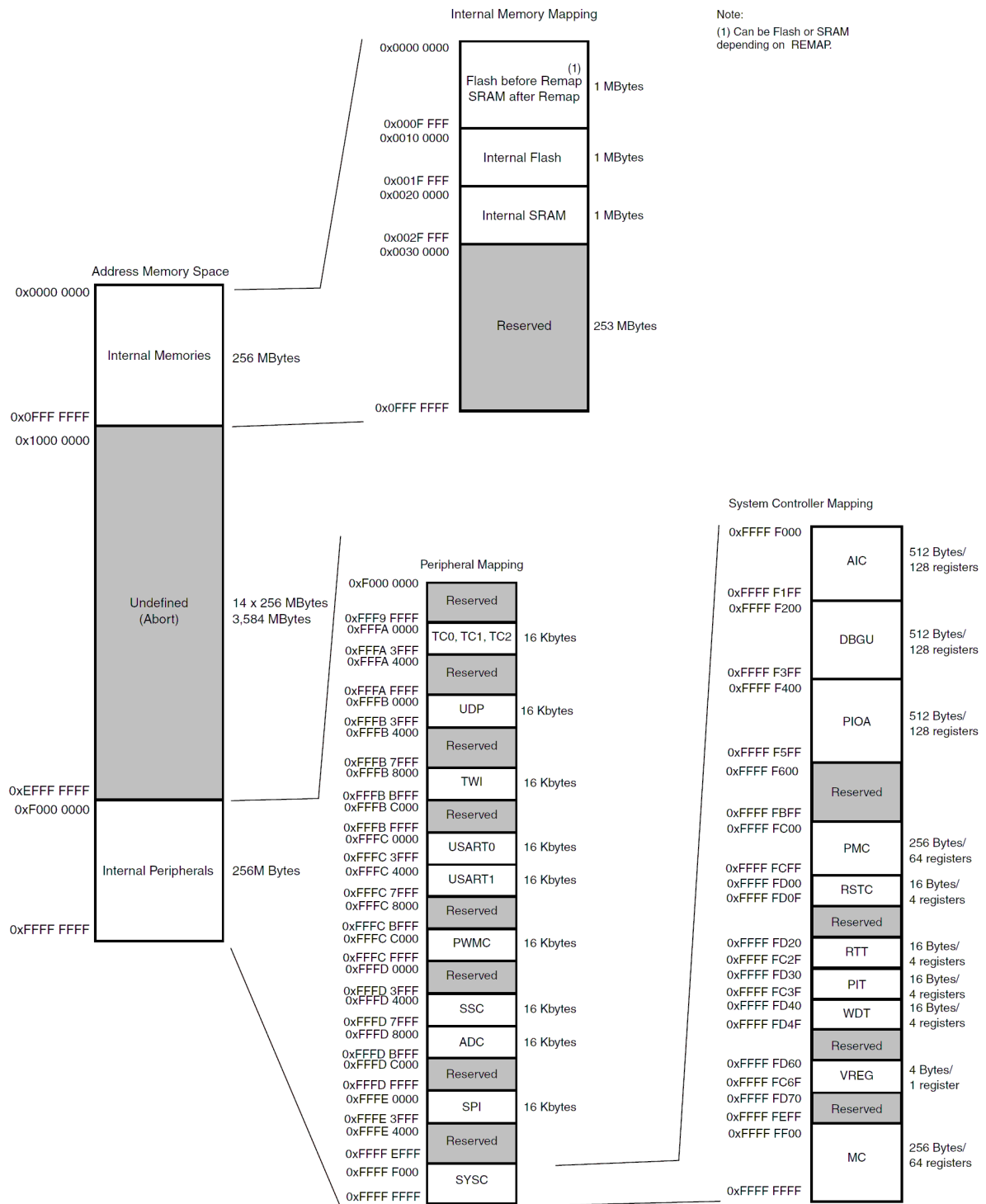
- Eleven Peripheral DMA Controller (PDC) Channels
- One USB 2.0 Full Speed (12 Mbits per Second) Device Port
    - On-chip Transceiver, 328-byte Configurable Integrated FIFOs
- One Synchronous Serial Controller (SSC)
    - Independent Clock and Frame Sync Signals for Each Receiver and Transmitter
    - 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 Input and 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 and I²C Compatible Devices Supported
- One 8-channel 10-bit Analog-to-Digital Converter, Four Channels Multiplexed with Digital I/Os
- SAM-BA™ Boot Assistant
    - Default Boot program
    - Interface with SAM-BA Graphic User Interface
- 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
    - 3.3V or 1.8V VDDIO I/O Lines Power Supply, Independent 3.3V VDDFLASH Flash Power Supply

Page 5

- 1.8V VDDCORE Core Power Supply with Brown-out Detector
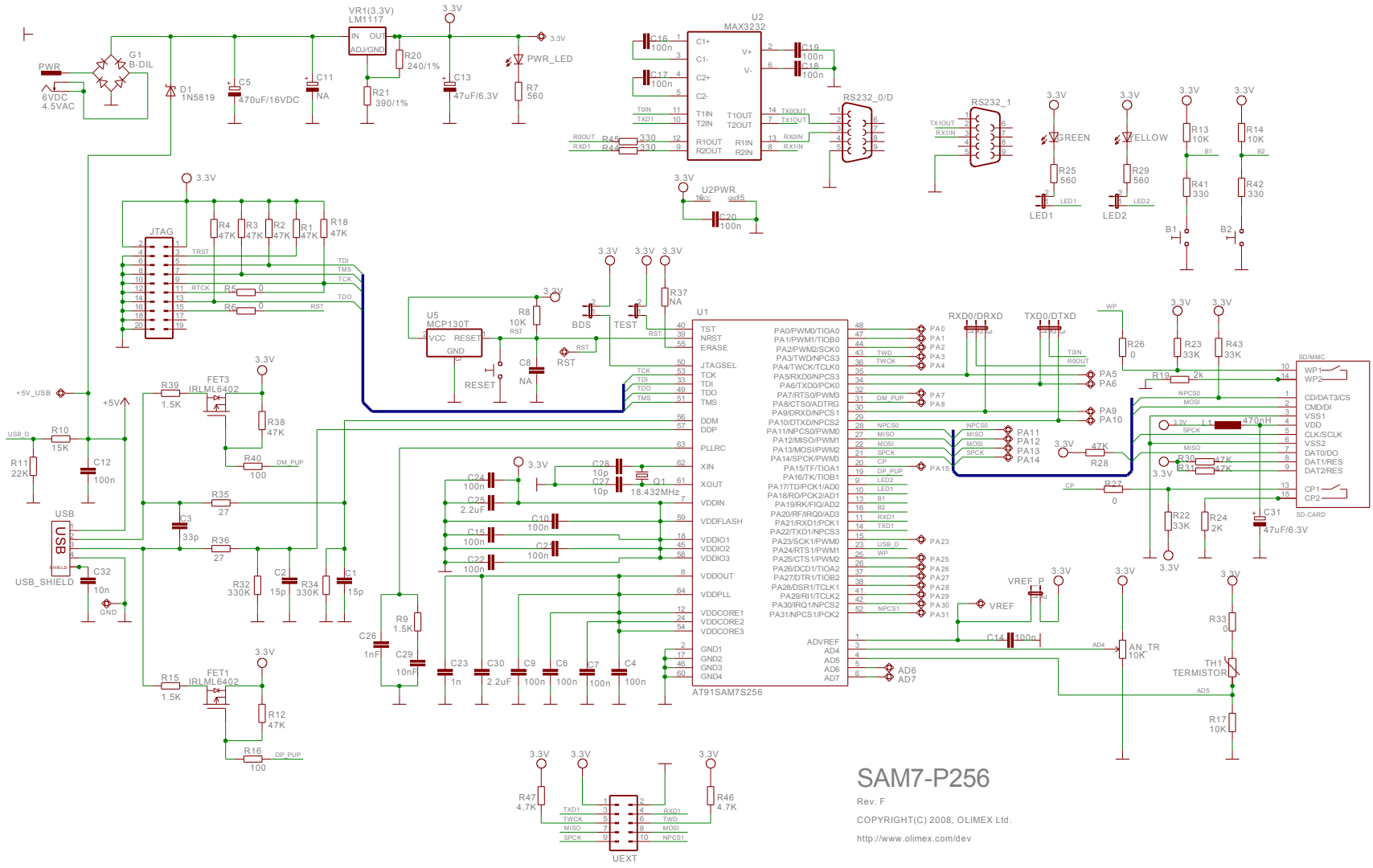- Fully Static Operation: Up to 55 MHz at 1.65V and 85°C Worst Case Condition

- Fully Static Operation: Up to 55 MHz at 1.65V and 85°C Worst Case Condition
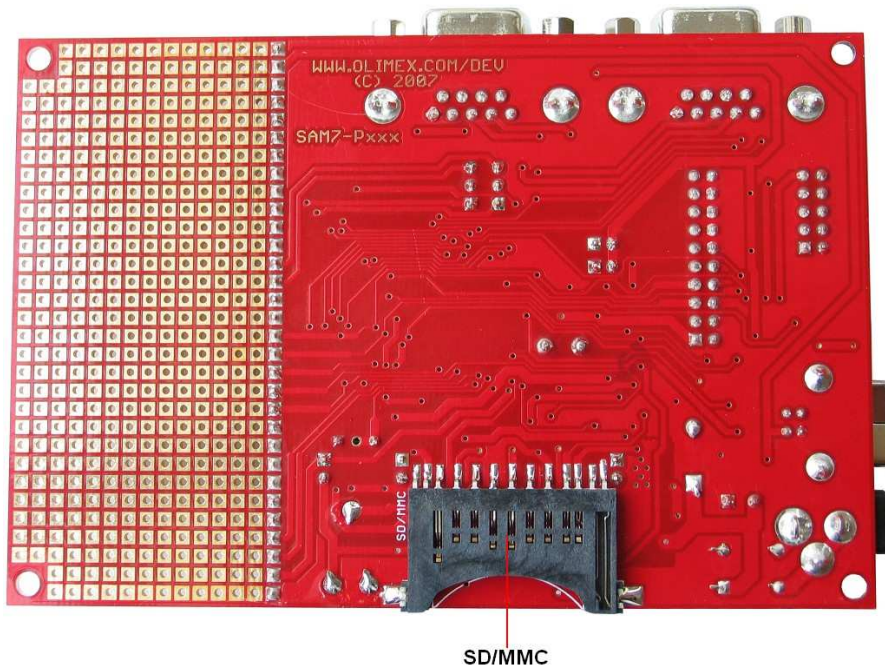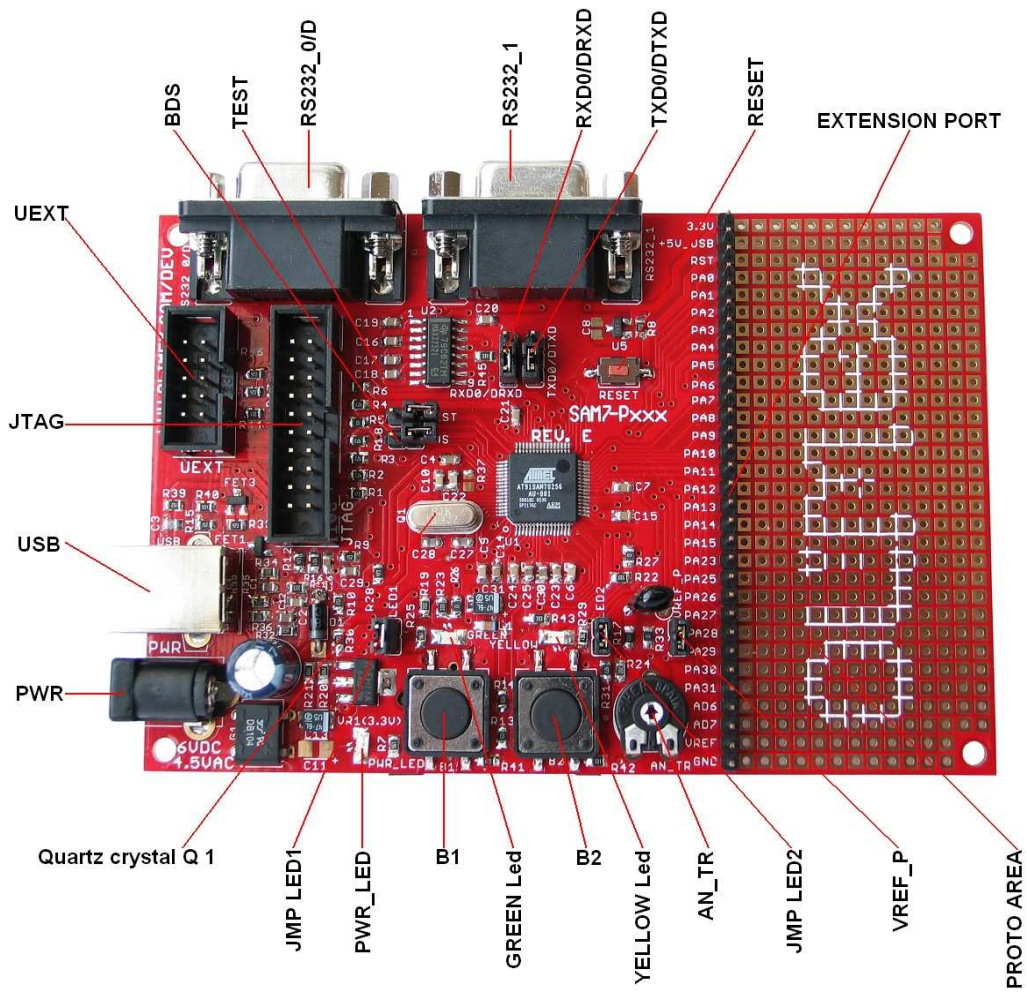
BLOCK DIAGRAM:

MEMORY MAP:

Internal Memory Mapping

0x0000 0000	
	(1) Flash before Remap SRAM after Remap — 1 MBytes
0x000F FFF 0x0010 0000	
	Internal Flash — 1 MBytes
0x001F FFF 0x0020 0000	
	Internal SRAM — 1 MBytes
0x002F FFF 0x0030 0000	
	Reserved — 253 MBytes
0x0FFF FFFF	

Note:
(1) Can be Flash or SRAM depending on REMAP.

Address Memory Space

0x0000 0000	Internal Memories — 256 MBytes
0x0FFF FFFF 0x1000 0000	
	Undefined (Abort) — 14 x 256 MBytes / 3,584 MBytes
0xEFFF FFFF 0xF000 0000	
	Internal Peripherals — 256M Bytes
0xFFFF FFFF	

Peripheral Mapping

Address	Block	Size
0xF000 0000	Reserved	
0xFFF9 FFFF 0xFFFA 0000	TC0, TC1, TC2	16 Kbytes
0xFFFA 3FFF 0xFFFA 4000	Reserved	
0xFFFA FFFF 0xFFFB 0000	UDP	16 Kbytes
0xFFFB 3FFF 0xFFFB 4000	Reserved	
0xFFFB 7FFF 0xFFFB 8000	TWI	16 Kbytes
0xFFFB BFFF 0xFFFB C000	Reserved	
0xFFFB FFFF 0xFFFC 0000	USART0	16 Kbytes
0xFFFC 3FFF 0xFFFC 4000	USART1	16 Kbytes
0xFFFC 7FFF 0xFFFC 8000	Reserved	
0xFFFC BFFF 0xFFFC C000	PWMC	16 Kbytes
0xFFFC FFFF 0xFFFD 0000	Reserved	
0xFFFD 3FFF 0xFFFD 4000	SSC	16 Kbytes
0xFFFD 7FFF 0xFFFD 8000	ADC	16 Kbytes
0xFFFD BFFF 0xFFFD C000	Reserved	
0xFFFD FFFF 0xFFFE 0000	SPI	16 Kbytes
0xFFFE 3FFF 0xFFFE 4000	Reserved	
0xFFFF EFFF 0xFFFF F000	SYSC	
0xFFFF FFFF		

System Controller Mapping

Address	Block	Size
0xFFFF F000	AIC	512 Bytes/ 128 registers
0xFFFF F1FF 0xFFFF F200	DBGU	512 Bytes/ 128 registers
0xFFFF F3FF 0xFFFF F400	PIOA	512 Bytes/ 128 registers
0xFFFF F5FF 0xFFFF F600	Reserved	
0xFFFF FBFF 0xFFFF FC00	PMC	256 Bytes/ 64 registers
0xFFFF FCFF 0xFFFF FD00 0xFFFF FD0F	RSTC	16 Bytes/ 4 registers
	Reserved	
0xFFFF FD20 0xFFFF FC2F	RTT	16 Bytes/ 4 registers
0xFFFF FD30 0xFFFF FC3F	PIT	16 Bytes/ 4 registers
0xFFFF FD40 0xFFFF FD4F	WDT	16 Bytes/ 4 registers
	Reserved	
0xFFFF FD60 0xFFFF FC6F	VREG	4 Bytes/ 1 register
0xFFFF FD70 0xFFFF FEFF	Reserved	
0xFFFF FF00	MC	256 Bytes/ 64 registers
0xFFFF FFFF		

VR1(3.3V)
LM1117
IN OUT
ADJ/GND

3.3V
3.3V

PWR_LED

PWR
6VDC
4.5VAC

G1
B-DIL

D1
1N5819

C5
470uF/16VDC

C11
NA

R20
240/1%

R21
390/1%

C13
47uF/6.3V

R7
560

U2
MAX3232
C16 100n
C1+
C1-
C2+
C2-
C17 100n
V+
V-
C19 100n
C18 100n
T1IN
TXD1
T2IN
T1OUT
T2OUT
TX0OUT
TX1OUT
R1OUT
RXD1
R2OUT
R1IN
R2IN
RX0IN
RX1IN

T0IN
TXD1
R0OUT
RXD1
R45 330
R44 330

RS232_0/D

RS232_1
TX1OUT
RX1IN

3.3V GREEN   3.3V YELLOW   3.3V   3.3V
R25 560   R29 560   R13 10K R14 10K
LED1   LED2   R41 330 R42 330
                              B1   B2

U2PWR
3.3V
Vcc gnd5
C20 100n

3.3V
JTAG
R4 47K R3 47K R2 47K R1 47K R18 47K
TRST
TMS
TCK
RTCK   R5 0
TDI
TDO
R6 0   RST

U5
MCP130T
VCC RESET
GND
RST
C8 NA
RESET

R8 10K
3.3V
BDS TEST
R37 NA
3.3V 3.3V 3.3V

U1
AT91SAM7S256
TST
NRST
ERASE
JTAGSEL
TCK
TDI
TDO
TMS
DDM
DDP
PLLRC
XIN
XOUT
VDDIN
VDDFLASH
VDDIO1
VDDIO2
VDDIO3
VDDOUT
VDDPLL
VDDCORE1
VDDCORE2
VDDCORE3
GND1
GND2
GND3
GND4
ADVREF
AD4
AD5
AD6
AD7

PA0/PWM0/TIOA0
PA1/PWM1/TIOB0
PA2/PWM2/SCK0
PA3/TWD/NPCS3
PA4/TWCK/TCLK0
PA5/RXD0/NPCS3
PA6/TXD0/PCK0
PA7/RTS0/PWM3
PA8/CTS0/ADTRG
PA9/DRXD/NPCS1
PA10/DTXD/NPCS2
PA11/NPCS0/PWM0
PA12/MISO/PWM1
PA13/MOSI/PWM2
PA14/SPCK/PWM3
PA15/TF/TIOA1
PA16/TK/TIOB1
PA17/TD/PCK1/AD0
PA18/RD/PCK2/AD1
PA19/RK/FIQ/AD2
PA20/RF/IRQ0/AD3
PA21/RXD1/PCK1
PA22/TXD1/NPCS3
PA23/SCK1/PWM0
PA24/RTS1/PWM1
PA25/CTS1/PWM2
PA26/DCD1/TIOA2
PA27/DTR1/TIOB2
PA28/DSR1/TCLK1
PA29/RI1/TCLK2
PA30/IRQ1/NPCS2
PA31/NPCS1/PCK2

PA0
PA1
PA2
PA3
PA4
PA5
PA6
PA7
PA8
PA9
PA10
PA11
PA12
PA13
PA14
PA15
PA23
PA25
PA26
PA27
PA28
PA29
PA30
PA31

RXD0/DRXD   TXD0/DTXD
TWD
TWCK
DM_PUP
DP_PUP
T0IN
R0OUT
NPCS0
MISO
MOSI
SPCK
CP
LED2
LED1
B1
B2
RXD1
TXD1
USB_D
WP
NPCS1

WP
3.3V 3.3V
R26 0
R23 33K
R43 33K
R19 2K
3.3V
SPCK
NPCS0
MOSI
L1 470nH
MISO
R28 47K
R30 47K
R31 47K
R27 0
CP
R22 33K
R24 2K
C31 47uF/6.3V

SD/MMC
WP1
WP2
CD/DAT3/CS
CMD/DI
VSS1
VDD
CLK/SCLK
VSS2
DAT0/DO
DAT1/RES
DAT2/RES
CP1
CP2
SD-CARD

VREF_P
VREF
C14 100n
AD4
AN_TR 10K
3.3V
TH1 TERMISTOR
R33 0
R17 10K
AD5

+5V_USB
USB_D
R10 15K
R11 22K
C12 100n

USB
USB SHIELD
USB_SHIELD
C32 10n
GND
C3 33p
R36 27
R35 27
C2 15p
R34 330K
C1 15p
R32 330K

R39 1.5K FET3 IRLML6402 3.3V
R38 47K
R40 100 DM_PUP
+5V

R15 1.5K FET1 IRLML6402 3.3V
R12 47K
R16 100 DP_PUP

3.3V
C24 100n
C28 10p
C27 10p
Q1 18.432MHz
C25 2.2uF
C10 100n
C15 100n
C21 100n
C22 100n
C26 1nF
R9 1.5K
C29 10nF
C23 1n
C30 2.2uF
C9 100n
C6 100n
C7 100n
C4 100n

UEXT
3.3V 3.3V 3.3V
R47 4.7K
R46 4.7K
TXD1
TWCK
MISO
SPCK
RXD1
TWD
MOSI
NPCS1

SAM7-P256

Rev. F

BOARD LAYOUT:

POWER SUPPLY CIRCUIT:

SAM7-P256 is typically power supplied with 6 VDC.

The programmed board power consumption is about 30 mA.

RESET CIRCUIT:

SAM7-P256 reset circuit includes U5 (MCP130T), R8 (10k), pin 15 of JTAG connector, pin 39 (NRST) of AT91SAM7S256 and RESET button.

CLOCK CIRCUIT:

Quartz crystal **Q1** 18.432 MHz is connected to AT91SAM7S256 pin 61 (XOUT) and pin 62 (XIN).

JUMPER DESCRIPTION:

Jumpers	Position	Description
Jumper BDS		Enable normal mode.
		The pin JTAGSEL is used to select the JTAG boundary scan.
Jumper TST		Enable normal mode.
		The pin TST is used for manufacturing test or fast programming mode.
Jumper RXD0/DRXD Jumper TXD0/DTXD		RS232_0 is not connected
		RS232_0 is connected to RXD0 and TXD0 (USART0)
		RS232_0 is connected to DRXD and DTXD which is used in programming mode - via COM Port.
Jumper LED_J		Green led is not connected.
		Green led connected to PA17 / TD / PCK1 / AD0 (PIN 9)
Jumper LED 1		Yellow led is not connected
		Yellow led connected to PA18 RD PCK2 AD1 (PIN 10)
Jumper VREF_P		ADVREF pin (PIN 1) is connected to VREF pin.
		ADVREF pin (PIN 1) is connected to 3.3V.

Description for programming via RS232_0/D COM port, when is SAM-BA software

The AT91SAM7S256 can be programmed via COM port using the SAM-BA™ software. Before being able to use SAM-BA, a recovery procedure, which consists of copying the SAM-BA Boot Assistant into Flash must be performed as follows:

1.   Power down the AT91SAM7S256

2.   Close jumper TST

3.   Power up the AT91SAM7S256

4.   Wait 10 sec

5.   Power down the AT91SAM7S256

6.   Remove jumper TST

7.   Power up the AT91SAM7S256

Note: For programming via COM port, you must set jumpers RXD0/DRXD and TXD0/DTXD, according to jumpers description above.

INPUT/OUTPUT:

Status Led (green) with name **GREEN** connected via jumper **LED1** to **AT91SAM7S256** pin 10 (PA18/RD/PCK2/AD1).

Status Led (yellow) with name **YELLOW** connected via jumper **LED2** to **AT91SAM7S256** pin 9 (PPA17/TD/PCK1/AD0).

Power-on LED (red) with name **PWR_LED** – this LED shows that +3.3V is applied to the board.

User button with name **B1** connected to **AT91SAM7S256** pin 13 (PA19/RK/FIQ/AD2).

User button with name **B2** connected to **AT91SAM7S256** pin 16 (PA20/RF/IRQ0/AD3).

User button with name **RESET** connected to **AT91SAM7S256** pin 39 (NRST).

Trimpot with name **AN_TR** connected to **AT91SAM7S256** pin 3 (AD4).

Thermistor with name **TH1** connected to **AT91SAM7S256** pin 4 (AD5).

EXTERNAL CONNECTORS DESCRIPTION:

RS232_0/D:

Pin #	Signal Name
1	NC
2	TX0OUT
3	RX0IN
4	NC
5	GND
6	NC
7	NC
8	NC
9	NC
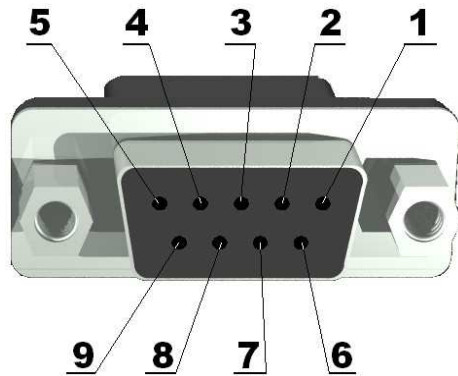
RS232_1:

Pin #	Signal Name
1	NC
2	TX1OUT
3	RX1IN
4	NC
5	GND
6	NC
7	NC
8	NC
9	NC
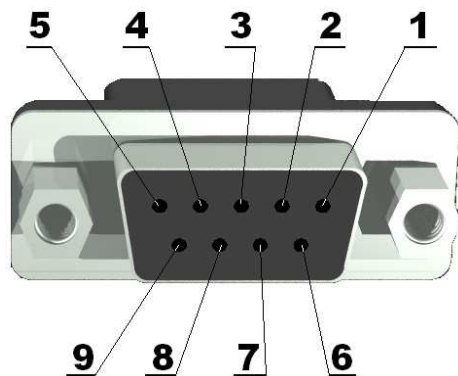
PWR JACK:

Pin #	Signal Name
1	Power Input
2	GND
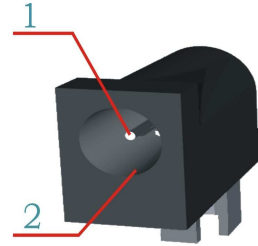
UEXT:

Pin #	Signal Name
1	3.3V
2	GND
3	TXD1
4	RXD1
5	TWCK
6	TWD
7	MISO
8	MOSI
9	SPCK
10	NPCS1
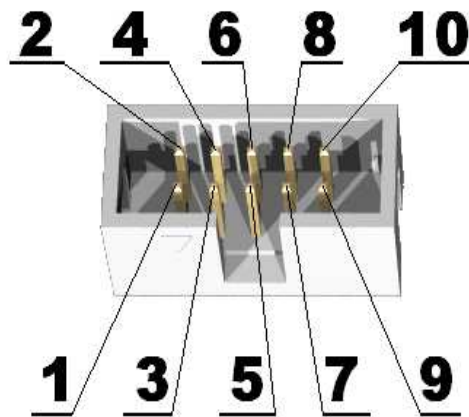
JTAG:

The JTAG connector allows the software debugger to talk via a JTAG (Joint Test Action Group) port directly to the core. Instructions may be inserted and executed by the core thus allowing AT91SAM7S256 memory to be programmed with code and executed step by step by the host software.

For more details refer to IEEE Standard 1149.1 - 1990 Standard Test Access Port and Boundary Scan Architecture and AT91SAM7S256 datasheets and users manual.
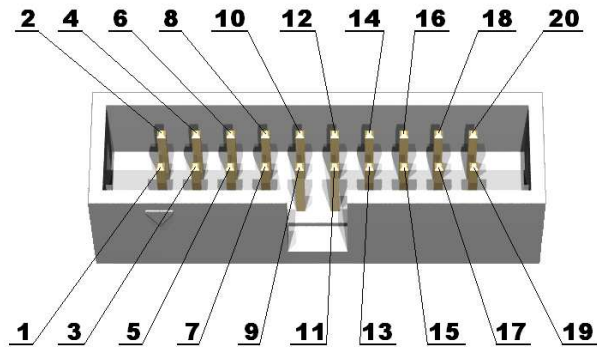
Pin #	Signal Name	Pin #	Signal Name
1	3.3V	2	3.3V
3	TRST	4	GND
5	TDI	6	GND
7	TMS	8	GND
9	TCK	10	GND
11	RTCK	12	GND
13	TDO	14	GND
15	RST	16	GND
17	NC	18	GND
19	NC	20	GND

USB

Pin #	Signal Name
1	+5V_USB
2	DDM
3	DDP
4	GND
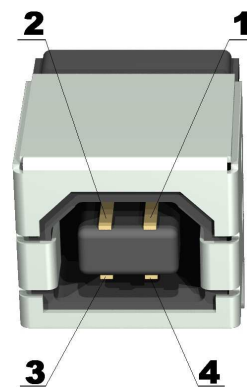
SD/MMC
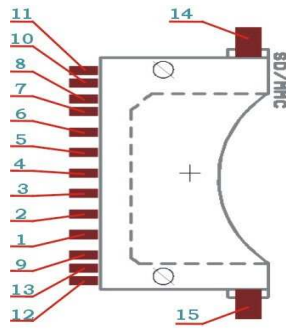
Pin #	Signal Name	Pin #	Signal Name
1	NPCS0	2	MOSI
3	GND (VSS1)	4	VDD
5	SPCK	6	GND (VSS2)
7	MISO	8	Via R30 (47k) to 3.3V
9	Via R31 (47k) to 3.3V	10	WP
11	Via R19 (2k) to GND	12	Via R24 (2k) to GND
13	CP	14	Via R19 (2k) to GND
15	Via R24 (2k) to GND		

EXTENSION PORT

```
      3.3V ▨
  +5V_USB ▨
       RST ▨
       PA0 ▨
       PA1 ▨
       PA2 ▨
       PA3 ▨
       PA4 ▨
       PA5 ▨
       PA6 ▨
       PA7 ▨
       PA8 ▨
       PA9 ▨
      PA10 ▨
      PA11 ▨
      PA12 ▨
      PA13 ▨
      PA14 ▨
      PA15 ▨
      PA23 ▨
      PA25 ▨
      PA26 ▨
      PA27 ▨
      PA28 ▨
      PA29 ▨
      PA30 ▨
      PA31 ▨
       AD6 ▨
       AD7 ▨
      VREF ▨
       GND ▨
```

MECHANICAL DIMENSIONS:
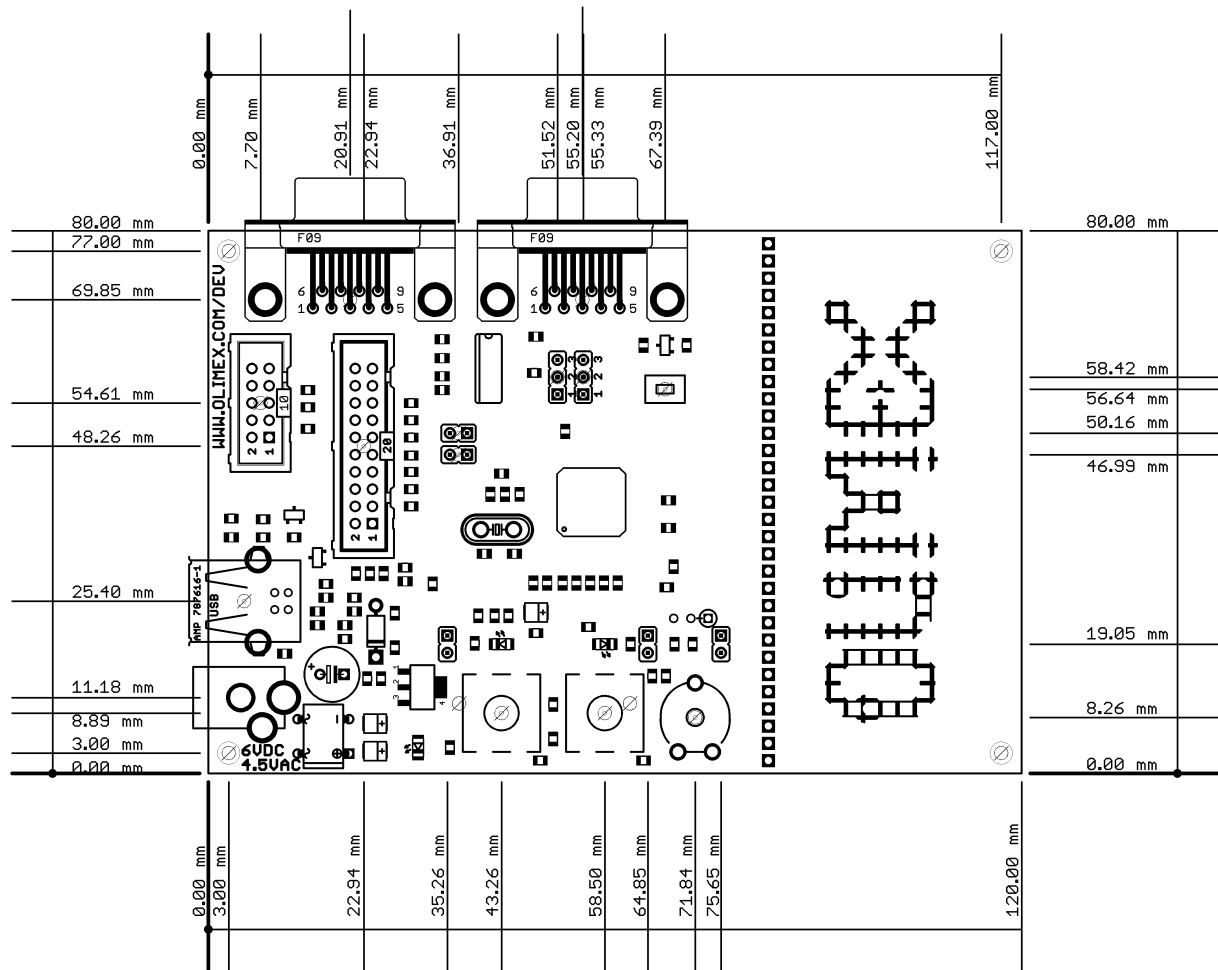
AVAILABLE DEMO SOFTWARE:

- SAM7-P256 blinking LED project and binary code for SAM-BA load

- SAM7-P256 sample mouse driver project

- UART routines project

- SD/MMC read/write routines project

- button read, temperature measurement project

- MOD-SMB380 read demo code for EW-ARM 4.11 with SAM7-P64/256 board

- USB virtual COM port for GCC+OpenOCD+Eclipse

- OpenOCD + Eclipse set of projects 1.00 include flash write make file for SAM7-P256

ORDER CODE:

SAM7-P256 - assembled and tested board

How to order?

You can order to us directly or by any of our distributors.
Check our web www.olimex.com/dev for more info.

Revision history:

Revision F, August 2008

Disclaimer: