AT4 - AT91SAM3 series implementation

This course covers AT91SAM3S, AT91SAM3U and AT91SAM3N ARM-based MCU family

Objectives

- This course has 5 main objectives:
  - Describing the hardware implementation and highlighting the pitfalls
  - Describing the ARM Cortex-M3 core architecture
  - Becoming familiar with the IDE and low level programming
  - Describing the units which are interconnected to other modules, such as clocking, interrupt controller and DMA controller, because the boot program generally has to modify the setting of these units
  - Describing independent I/O modules and their drivers.

- Note that this course has been designed from the architecture of the most complex AT91SAM3 device, the AT91SAM3S4C.
- Consequently, a chapter has been designed by Acsys for each possible integrated IP.
  - According to the actual reference chosen by the customer, some chapters may be removed.

- Products and services offered by ACSYS:
  - ACSYS is able to assist the customer by providing consultancies. Typical expertises are done during board bringup, hardware schematics review, software debugging, performance tuning.
  - ACSYS has also an expertise in FreeRTOS porting and uIP /LWIP stack or Interniche stack integration.

This document is necessary to tailor the course to specific customer needs and to define the exact schedule.

Prerequisites and related courses

- This course provides an overview of the ARM Cortex-M3 core. Our course reference RM2 - Cortex-M3 implementation course details the operation of this core.
- The following courses could be of interest:
  - USB Full Speed High Speed and USB On-The-Go, reference IP2 - USB 2.0course
  - SD / MMC, reference IS2 - eMMC 5.0course

Course Environment

- Theoretical course
  - PDF course material (in English) supplemented by a printed version for face-to-face courses.
  - Online courses are dispensed using the Teams video-conferencing system.
  - The trainer answers trainees' questions during the training and provide technical and pedagogical assistance.
- At the start of each session the trainer will interact with the trainees to ensure the course fits their expectations and correct if needed

Target Audience

- Any embedded systems engineer or technician with the above prerequisites.

Evaluation modalities

- The prerequisites indicated above are assessed before the training by the technical supervision of the traineein his company, or by the trainee himself in the exceptional case of an individual trainee.
- Trainee progress is assessed by quizzes offered at the end of various sections to verify that the trainees have assimilated the points presented
- At the end of the training, each trainee receives a certificate attesting that they have successfully completed the course.
  - In the event of a problem, discovered during the course, due to a lack of prerequisites by the trainee a different or additional training is offered to them, generally to reinforce their prerequisites,in agreement with their company manager if applicable.

Plan

ARCHITECTURE OF AT91SAM3 MCUs

- ARM core based architecture
- Description of AT91SAM3N, AT91SAM3U and AT91SAM3S SoC architecture
- Clarifying the internal data and instruction paths: AHB-lite interconnect, peripheral buses, AHB-to-APB bridge
- Integrated memories
- SoC mapping

THE ARM CORTEX-M3 CORE

- V7-M core family
- Core architecture
- Programming
- Exception behavior, exception return
- Basic interrupt operation, micro-coded interrupt mechanism
- Memory Protection Unit

BECOMING FAMILIAR WITH THE IDE

- Acsys covers 3 IDEs: Keil, IAR and GCC / Lauterbach.
- Thus the customer has just to indicate which one he has chosen.
- Getting started with the IDE
- Parameterizing the compiler / linker
- Creating a project from scratch
- C start program

PROGRAMMING AND DEBUGGING

- Debug architecture
- Programming

RESET, POWER AND CLOCKING

- Power control
- Reset controller
- Clocking
- Low power modes

INTERNAL INTERCONNECT

- Bus matrix
- Peripheral DMA Controller (PDC)
- DMA Controller (DMAC), AT91SAM3U

HARDWARE IMPLEMENTATION

- Power pins
- Pinout
- GPIO module

INTEGRATED MEMORIES

- Embedded flash memory
- Internal SRAM
- Internal ROM

MEMORY INTERFACE

- High Speed MultiMedia Card Interface
- Static Memory Controller

TIMERS

- Timer counter
- PWM
- Real-time Timer
- Real-time Clock
- Watchdog timer

ANALOG MODULES

- 12-bit Analog-to-Digital Converter and Programmable Gain Amplifier
- 12-bit Analog-to-Digital Converter, ADC12B, AT91SAM3U
- 12-bit Digital-to-Analog Converter
- Analog Comparator Controller

SECURITY AND INTEGRITY

- Cyclic Redundancy Check Calculation Unit
- Chip Identifier

CONNECTIVITY AND COMMUNICATION

- SPI
- Synchronous Serial Controller
- UART
- USART
- Two-Wire Interface
- USB Device FS
- USB Device HS, AT91SAM3U
- ISO7816 smartcard interface

Renseignements pratiques

Duration : 5 days
Cost : 1950 € HT