



## FF3 - MCF532X implementation

*This course covers MCF532X ColdFire MCUs, for instance the MCF5329*

### Objectives

- The course details the low level programming of the V3 core.
- An example of SDRAM controller initialization is provided.
- Interfacing with external devices is explained.
- The interrupt controller is viewed in detail.
- DMA transfers terminated by interrupt is studied.
- A programming example has been developed for each internal peripheral (USB, CAN, serial, I2C, timer).
- The course details the various operating modes supported by the Fast Ethernet Controller, particularly the frame filtering logic.
- This course has been delivered several times to companies developing industrial and medical equipments.

A lot of programming examples have been developed by ACSYS to explain the boot sequence and the operation of complex peripherals, such as Fast Ethernet.

- They have been developed with CodeWarrior compiler and are executed under CodeWarrior debugger.

A more detailed course description is available on request at [formation@ac6-formation.com](mailto:formation@ac6-formation.com)

### Prerequisites

- Experience of a 32 bit processor or DSP is mandatory.

### Related courses

- Ethernet and switching, reference cours [N1 - Ethernet and switching](#)
- USB 2.0, reference cours [IP2 - USB 2.0](#)
- CAN bus, reference cours [IA1 - CAN bus](#)

### Environnement du cours

- Cours théorique
  - Support de cours au format PDF (en anglais) et une version imprimée lors des sessions en présentiel
  - Cours dispensé via le système de visioconférence Teams (si à distance)
  - Le formateur répond aux questions des stagiaires en direct pendant la formation et fournit une assistance technique et pédagogique
- Au début de chaque demi-journée une période est réservée à une interaction avec les stagiaires pour s'assurer que le cours répond à leurs attentes et l'adapter si nécessaire

### Audience visée

- Tout ingénieur ou technicien en systèmes embarqués possédant les prérequis ci-dessus.

# Plan du cours

## INTRODUCTION TO MCF532X

### Overview

- Differences between ColdFires and 68K processors
- 5329 block diagram, differences between 5327, 5328 and 5329
- Internal data paths
- Crossbar switch module
- Memory mapped I/O organization

## PROCESSOR CORE

### V3 CORE

- V3 core pipeline
- Addressing modes
- Branch instructions
- Data transfer instructions
- Mac instructions
- Control instructions
- Stack management, subroutine call and return
- C to assembly interface, organization of the stack frame
- Exception management : vector table, priority, masking
- Internal SRAM
- Cache basics
- Cache operation, software control
- V3 core pipeline
- Addressing modes
- Branch instructions
- Data transfer instructions
- Mac instructions
- Control instructions
- Stack management, subroutine call and return
- C to assembly interface, organization of the stack frame
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- Internal SRAM
- Cache basics
- Cache operation, software control
- Debug facilities

## PLATFORM

### HARDWARE IMPLEMENTATION

- Clocking, power management
- Chip configuration module
- Reset control module
- System control module
- Real Time Clock
- Flexbus
- Data transfer sequence

- Burst cycles
- Bus error management
- General Purpose Input / Output module
- DRAM / SDRAM basics
- The 532X SDRAM controller

## **INTERRUPT CONTROLLERS AND TIMER MODULES**

- Vectorized vs auto-vectorized mode
- Interrupt processing sequence
- Prioritization between interrupt controllers
- Low power wake-up operation
- The software watchdog
- Edge port module
- PWM module
- Programmable interrupt timer modules
- DMA timers

## **THE eDMA CONTROLLER**

- EDMA microarchitecture
- Initialization
- Channel linking
- Transfer error management

## **INTEGRATED I/Os**

## **LIQUID CRYSTAL DISPLAY CONTROLLER**

- LCD screen format
- Graphic window on screen
- Display data mapping
- Black-and-White operation
- Color generation
- Frame Rate modulation control

## **COMMUNICATION CONTROLLERS**

- The UART Module
- The SSI,
- The QSPI,
- The I2C controller
- The FlexCAN controller
- The Fast Ethernet Controller, Ethernet basics, addressing, frame format, clock recovery, MII hardware interface, auto-negotiation, buffer management, buffer chaining, address filtering, use of hash tables, full duplex operation, flow control, receive and transmit sequences, error management
- The USB Host module, USB basics, EHCI specification, functional description
- The USB On-The-Go module, ULPI interface, connection of an external PHY, device data structures, device operational model, deviations from the EHCI specification

## **CRYPTOGRAPHY MODULES**

- Message Digest Hardware Accelerator
- Random Number Generation
- Symmetric key hardware accelerator, introduction to data encryption standards
- Data flow, management of input and output FIFOs
- Algorithms : AES, DES, 3DES

- Cipher modes : ECB, CBC, CTR