

## FM5 - MPC5674F implementation

This course covers NXP Qorivva MPC5673F and MPC5674F

### Objectives

- This course has 6 main objectives:
  - Detailing the hardware implementation of the MPC56XX
  - Parameterizing the internal interconnect and sophisticated eDMA controllers
  - Focusing on the various operation modes supported by the eQADC
  - Describing the timer units, including eTPU2
  - Describing the communication interfaces, including FlexCAN and FlexRay
  - Studying the debug capabilities offered by the Nexus interface.
- Products and services offered by AC6:
  - AC6 is able to assist the customer by providing consultancies
  - Typical expertises are done during board bringup, hardware schematics review, software debugging, performance tuning.

*They have been developed with Diab Data compiler and are executed with TRACE32 Lauterbach debugger.*

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

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

### Prerequisites and related courses

- Experience of a 32-bit processor or DSP is mandatory.
- Note that the e200z7 Power core is covered in a separate course reference cours [FCC3 - e200z7 implementation](#).
- The following courses could be of interest:
  - FlexRay, reference cours [IA2 - FlexRay 2.1](#)
  - 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.

### Modalités d'évaluation

- Les prérequis indiqués ci-dessus sont évalués avant la formation par l'encadrement technique du stagiaire dans son entreprise, ou par le stagiaire lui-même dans le cas exceptionnel d'un stagiaire individuel.
- Les progrès des stagiaires sont évalués par des quizz proposés en fin des sections pour vérifier que les stagiaires ont assimilé les points présentés

- En fin de formation, une attestation et un certificat attestant que le stagiaire a suivi le cours avec succès.
  - En cas de problème dû à un manque de prérequis de la part du stagiaire, constaté lors de la formation, une formation différente ou complémentaire lui est proposée, en général pour conforter ses prérequis, en accord avec son responsable en entreprise le cas échéant.

## Plan

### MPC5674F ARCHITECTURE

#### OVERVIEW

- Compatibility with MPC55XX family
- Memory mapping
- e200z7 core integration

### HARDWARE IMPLEMENTATION

#### POWER, RESET AND CLOCKING

- Power management controller
- Reset
- Clocking
- Boot assist module (BAM)

#### SYSTEM INTEGRATION UNIT

- Pad configuration control for each pad
- System reset monitoring and generation
- External interrupt pins
- General Purpose Input Output setting
- Internal peripheral multiplexing

#### EXTERNAL BUS INTERFACE

- Multiplexed address/data transfers
- Chip-select programming
- Burst support
- Dynamic calibration with up to 4 chip-selects

#### ANALOG-TO-DIGITAL CONVERTERS (eQADC)

- 64 analog channels, differential conversions
- ADC clock and conversion speed
- ADC calibration feature
- MAC unit and operand data format
- Variable gain amplification
- CFIFO0 streaming mode
- 8 decimation filters
- Temperature sensor
- Time stamp information
- Trigger sources
- External multiplexing
- Interrupt or DMA request generation

## **SOC PLATFORM**

### **INTERNAL INTERCONNECT**

- Crossbar switch
- Peripheral Bridge
- Memory Protection Unit

### **ERROR CORRECTION STATUS MODULE**

- Status information regarding platform memory errors

### **INTEGRATED MEMORIES**

- 256-KB on-chip SRAM
- 4-MB on-chip flash

### **INTERRUPT CONTROLLER**

- Priority-based preemptive scheduling
- Preemptive prioritized interrupt requests to processor
- Software-configurable priorities of ISR or tasks
- Software vector mode vs hardware vector mode

### **ENHANCED DIRECT MEMORY ACCESS CONTROLLER (eDMA)**

- DMA request assignments
- Transfer control descriptors
- Channel-to-channel linking mechanism
- Peripheral-paced hardware requests
- Channel arbitration
- Scatter/gather DMA processing
- Modulo feature

## **CONNECTIVITY**

### **ENHANCED SERIAL COMMUNICATION INTERFACES(eSCI)**

- Introduction to LIN specification
- Idle line detection
- LIN master node functionality
- Detection of bit errors, physical bus errors and checksum errors
- DMA support for both transmit and receive data

### **FLEXCAN MODULE**

- Hardware interface
- 64 message buffers of zero to eight bytes data length
- Individual Rx mask registers per message buffer
- Powerful Rx FIFO ID filtering
- Management of remote frames, overload frames
- Listen-only mode capability
- Time stamp based on 16-bit free-running timer

### **DESERIAL SERIAL PERIPHERAL INTERFACE (DSPI)**

- Serial Peripheral Interface (SPI) configuration

- Deserial Serial Interface (DSI) configuration
- Combining Serial Interface (CSI) configuration
- Enhanced Deserial Serial Interface (DSI) configuration
- Queued operation

## **DUAL-CHANNEL FLEXRAY CONTROLLER**

- Hardware interface
- FlexRay memory layout
- Message buffer concept
- Buffer locking scheme
- Message buffer states
- Individual message buffer reconfiguration supported
- Filtering on FrameID, ChannelID, MessageID
- Slot error counters

## **TIMERS**

### **SYSTEM TIMERS**

- System Timer Module
- Periodic Interrupt Timer, Real Timer Interrupt
- SWT

### **ENHANCED MODULAR INPUT OUTPUT SYSTEM (EMIOS200)**

- Shared time bases with the eTPU
- Output Pulse Width Modulation (OPWM) mode
- Input Pulse-Width Measurement (IPWM) mode
- Pulse/Edge Accumulation (PEA) mode
- Quadrature decode (QDEC) mode
- Windowed Programmable Time Accumulation (WPTA) mode
- Output Pulse Width and Frequency Modulation (OPWFM) mode
- Pulse-Width and Frequency Modulation Buffered (OPWFMB) mode
- Center Aligned Output Pulse Width Modulation with Dead Time (OPWMC) mode
- Center-Aligned Output PWM Buffered with Dead Time (OPWMCB) mode

### **eTPU2**

- Hardware interface
- Time base
- Event-triggered microengine
- Functions and threads
- Host interface
- Scheduling channel service requests
- Parameter sharing and coherency
- Implementing functions developed by NXP

## **GLOBAL FUNCTIONS, DEVELOPMENT AND DEBUG**

### **NEXUS DEBUG UNIT**

- Introduction to NEXUS specification
- Data trace via data write messaging and data read messaging
- Ownership trace via ownership trace messaging
- Program trace via branch trace messaging
- Watchpoint messaging via the auxiliary port
- Run-time access to the on-chip memory

## Renseignements pratiques

**Durée : 4 jours**

**Prix : 1950 € HT**