# FM6 - MPC5777M implementation

*This course covers the NXP Qorivva MPC5777M microcontroller*

## OBJECTIVES

- *This course has the following objectives:*
  - *Clarifying the architecture of the SoC, especially the split between the computanional shell and the IO complex*
  - *Providing all informations required to design a board based on MPC5777M, detailing clocking, power management and reset sequence*
  - *Describing and implementing the safety mechanisms, explaining the purpose of each unit involved in error management*
  - *Distributing interrupts to the 3 CPUs and relying on eDMA channels to transfer data between IO part and e200z7 RAMs*
- *Indicating the capabilities of debug related units, particularly the trace and watchpoint units*
  - *Detailing the communication modules, such as FlexRAY, CAN and Ethernet controllers.*
- *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.*
  - *A lot of companies developing avionics systems are trusting AC6.*

*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 training@ac6-training.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*
  - *Ethernet, reference cours N1 - Ethernet and switching.*

## 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.*

# Course Outline

## ARCHITECTURE OF MPC5777M

- *Block diagram*
- *Computational shell*
- *Peripheral domain*
- *Memory hierarchy*

## SAFETY MECHANISMS

- *Overview*
- *Cyclic Redundancy Check (CRC) Unit*
- *Memory Error Management Unit (MEMU)*
- *Indirect Memory Access (IMA)*
- *Fault Collection and Control Unit (FCCU)*
- *Self-Test Control Unit (STCU2)*
- *Register Protection (REG_PROT)*

## CORE COMPLEX OVERVIEW

- *e200z720n3, e200z719, and e200z425n3 cores*
- *Microarchitecture summary*

## EMBEDDED MEMORIES

- *Platform RAM controller*
- *Flash memory controller, flash organization*
- *Decorated Storage Memory Controller*

## HARDWARE IMPLEMENTATION

- *Power supplies and reference voltages, power-up sequence*
- *Reset Generation Module*
- *GPIO multiplexing*
- *Clocking*
- *External Bus Interface*
- *Power Management Controller digital interface*
- *Wakeup Unit (WKPU)*

## SYSTEM MODULES

- *Interconnect parameterizing, introduction to AHB and APB buses*
- *Sharing exclusive resources: SEMA42 unit*
- *Interrupt controllers, 64 priority levels*
- *eDMA controller*
- *Timers*

## SECURITY

- *Overview*
- *Password and Device Security Module (PASS)*
- *Tamper Detection Module (TDM)*

## ANALOG MODULES

- *Overview of the integrated ADCs, sample transfer to memory using DMA channels*
- *Sigma-Delta Analog-to-Digital Converter*
- *Successive Approximation Register Analog-to-Digital Converter*
- *Temperature Sensor, calculating device temperature*

## COMMUNICATION MODULES

- *CAN subsystem*
- *Serial Interprocessor Interface (SIPI)*
- *LVDS Fast Asynchronous Serial Transmission (LFAST)*
- *Fast Ethernet Controller (FEC)*
- *FlexRay*
- *Deserial Serial Peripheral Interface*
- *Inter-Integrated Circuit*
- *Peripheral Sensor Interface (PSI5)*
- *SENT Receiver (SRX)*
- *LINFlexD*

## CALIBRATION AND DEBUG MODULES

- *Core debug support*
- *e200z425n3 Core Debug Support*
- *e200z720n3 Core Debug Support*
- *Debug and Calibration Interface*
- *JTAG Controllers*
- *Sequence Processing Unit (SPU)*
- *Development Trigger Semaphore (DTS)*
- *Nexus Aurora Router (NAR)*
- *GTM Development Interface*
- *Emulation and Debug Device Introduction*