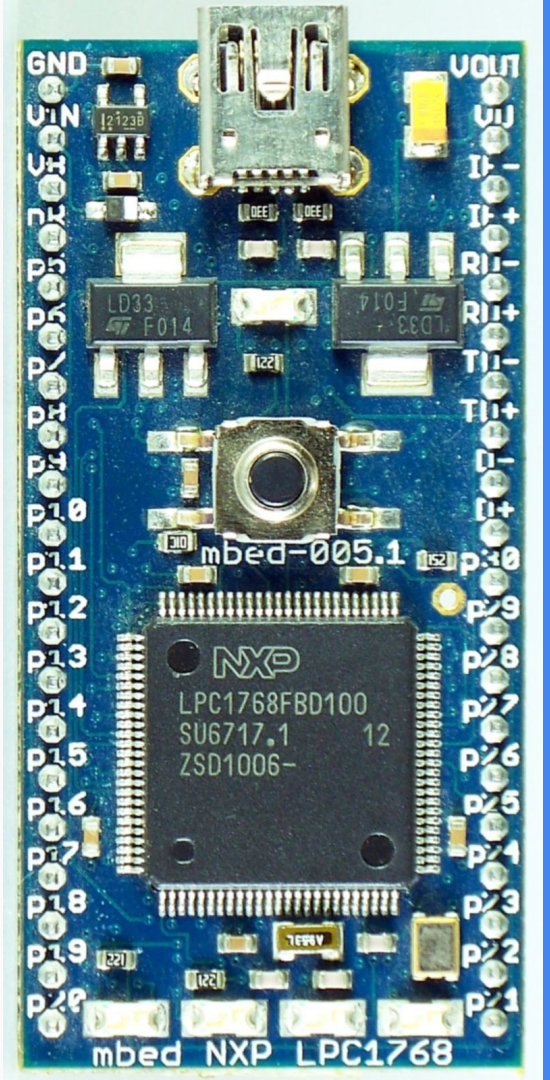
Architecture Study: mbed

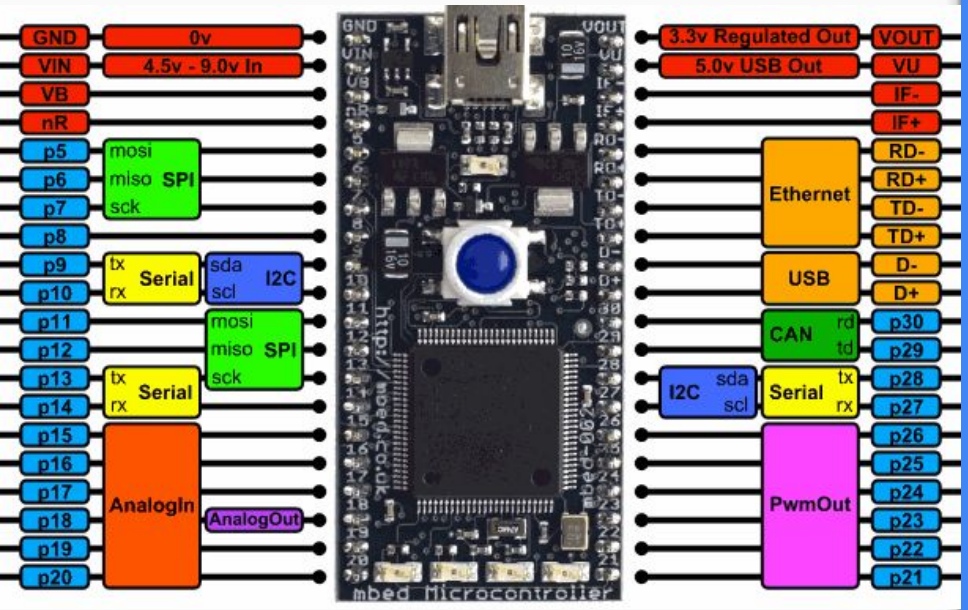
SY303 - Cyber Systems Architecture

mbed



- Description
- Features
- Architecture
- Memory Map
- Instruction Set Architecture

Description



- Designed for embedded applications
- Low power consumption
- Enhanced debug features
- Slew of peripheral options
  - 2 Controller Area Network (CAN) channels
  - Ethernet
  - USB
  - Universal Asynchronous Receiver/Transmitters (UARTs)

LPC 1768

MBED MICROCONTROLLER

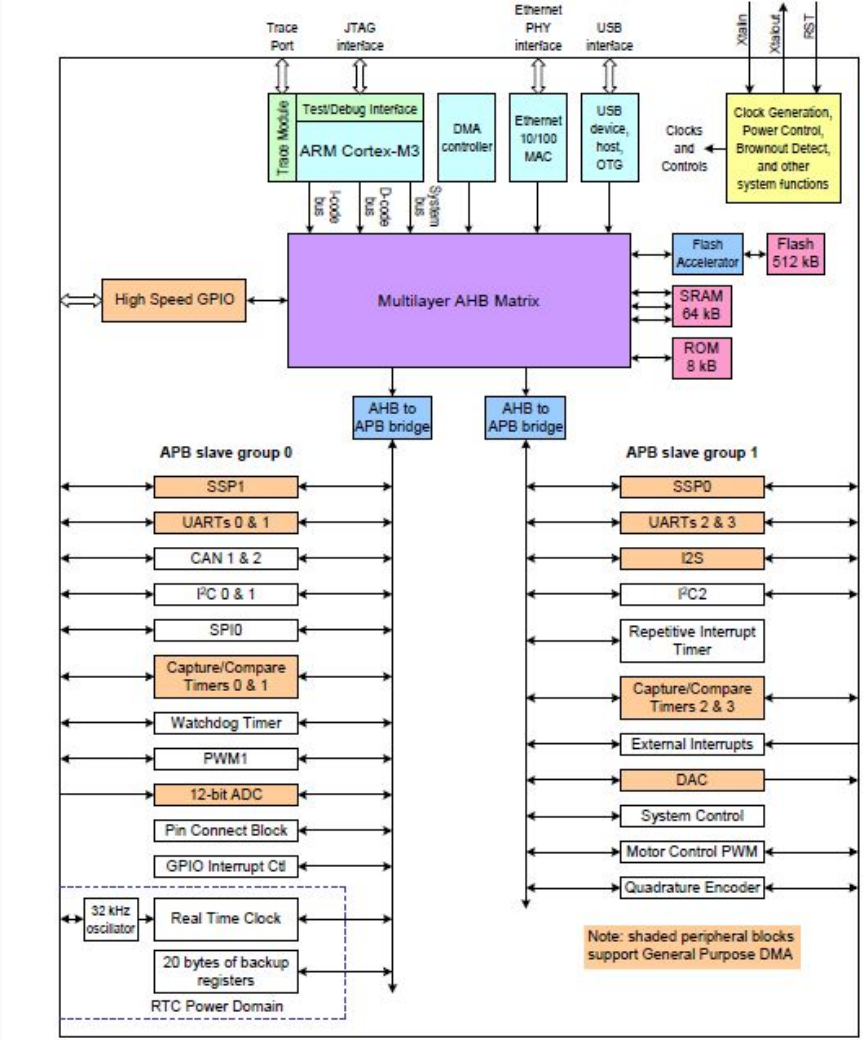


Fig 1. LPC1768 simplified block diagram

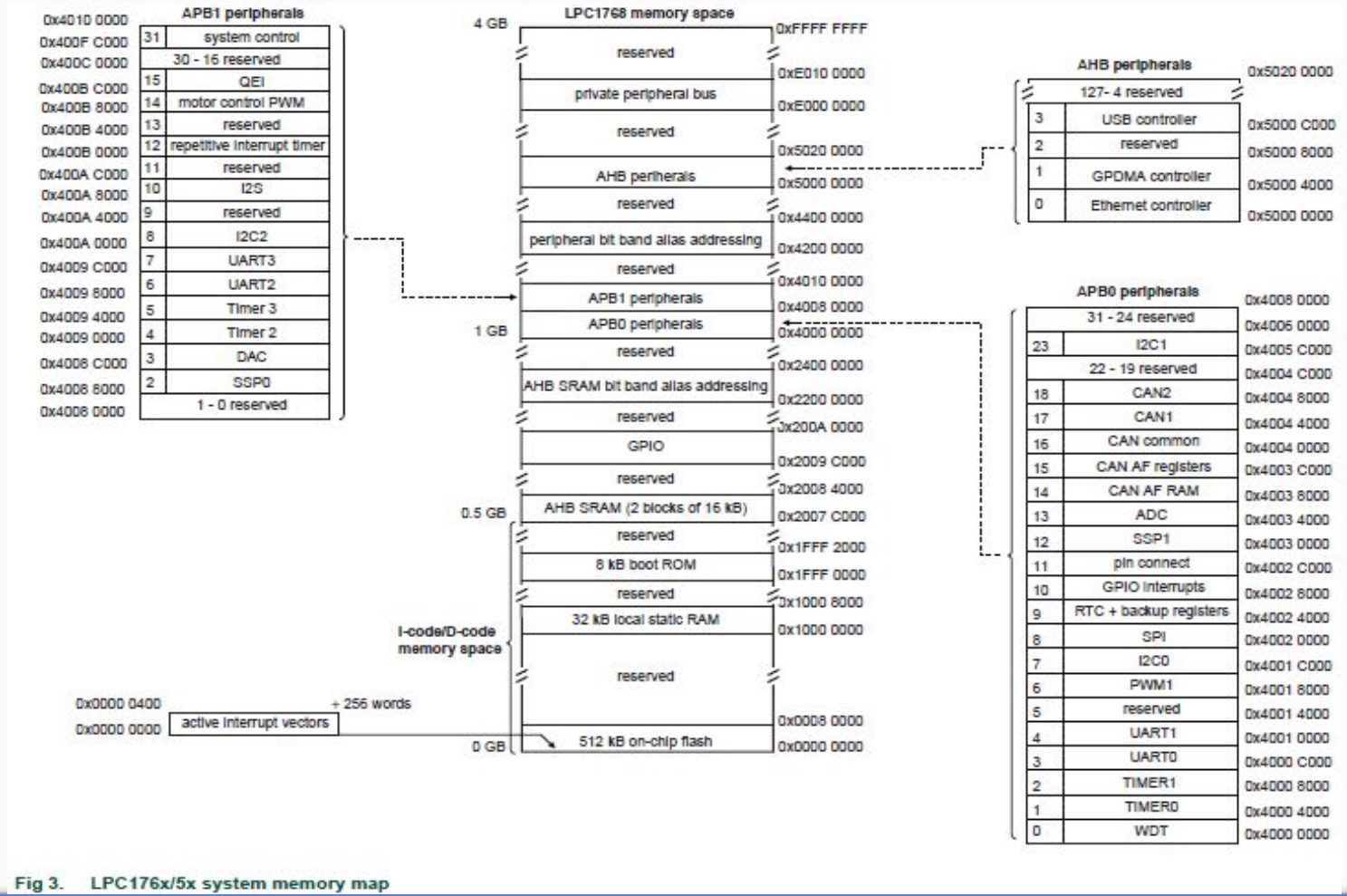


Fig 3. LPC176x/5x system memory map

Memory Map

Features

- On-line programming!
- 8 Region Memory Protection Unit (MPU)
- Nested Vectored Interrupt Controller (NVIC)
- Direct Memory Access (DMA) controller
- Power-On Reset

Features

- 12 bit Analog-to-Digital Converter (ADC)
- 10 bit Digital-to-Analog Converter (DAC)
- Real-Time Clock (RTC)
- Repetitive Interrupt Timer
- JTAG Debug Interface
- Non-Maskable Interrupt Input

Architecture

- ARM Cortex-M3
- Up to 100 MHz
- 3-stage pipeline
- Harvard Architecture
  - Separate instruction/data buses
- Prefetch Unit
  - Speculative branching

Architecture

- 70 GPIO pins
- Advanced High-Performance Bus (AHB) Matrix
  - System Bus
  - Instruction Fetch (I-code) Bus
  - Data Access (D-code) Bus
- Advanced Peripheral Bus (APB)
- 512kB flash memory
- 64kB SRAM

Processor

- Cortex-M3
- Harvard Architecture
- NVIC
  - 256 Interrupt Priority Levels
  - Fast Interrupt Service Routines
- Power efficient sleep modes
- Debug & Trace
- MPU

Instruction Set Architecture

- ARM Thumb
- 32-bit Instructions
- Privilege Levels
- Main and Process Stacks
  - Full Descending
- Registers
  - 13 General Purpose
  - 8 Program Control
  - 4 System Control
- Little Endian Data Access

Homework

Thursday

1. Discuss this introduction and seek out additional resources
2. Each student choose a feature to research
    a. Write 2-3 paragraphs Discussion Board entry on it for Tuesday

Tuesday

1. Present on your feature
    a. Up to 5 min
2. Choose a different feature to analyze and write a question (and answer!) for
    a. Make that question a comment on the original discussion board

1. Review all Discussion Board entries and associated questions.
2. Vote on best question (not yours!)

Features To Research

- ❏ Nested Vectored Interrupt Controller
- ❏ General Purpose I/O
- ❏ Ethernet
- ❏ USB
- ❏ Universal Asynchronous Receiver Transmitter (UART)
- ❏ Controller Area Network (CAN)
- ❏ I^2S Bus
- ❏ System Tick Timer
- ❏ Pulse Width Modulator
- ❏ Quadrature Encoder Interface
- ❏ Real Time Clock
- ❏ Watchdog Timer
- ❏ Analog to Digital Converter
- ❏ Digital to Analog Converter
- ❏ General Purpose DMA
- ❏ Flash Memory
- ❏ JTAG / Debugging
- ❏ SRAM
- ❏ I^2C Bus
- ❏ Memory Protection Unit (MPU)