Microchip PIC18F452 Hardware Overview
PIC Families

- A wide variety of RISC microcontrollers, with emphasis placed on software and hardware compatibility
  - PIC10CXXX/PIC10FXXX Family – Baseline 8-bit uCs (microcontrollers)
  - PIC12CXXX/PIC12FXXX Family: 8-pin, 12- or 14-bit instructions, up to 2K ROM, operate down to 2.5V – cost sensitive applications
  - PIC16C5X Family: Baseline PIC uC, 12-bit instructions, 14-, 18-, 20- and 28-pin packages, 8-bit timers, 2K ROM
  - PIC16CXXX/PIC16FXXX Family: 14-bit instructions, 18- to 68-pin packages, 8-bit timers, PWM, SSP, 12-bit A/D, 8K ROM
  - PIC18CXXX/PIC18FXXX: Advanced 8-bit uCs—Harvard architecture, 16 MIPS @ 64 MHz, A/D, 32 level stack, multiple interrupt sources, LVD and BOR.
8-bit RISC microcontroller
- Up to 64 MHz clock (16MIPS)
- Up to 128 KB FLASH program memory
- Up to 1024 B EEPROM
- Up to 3968 B RAM

Peripherals
- Up to 80 I/O pins
- Up to 16 Analog inputs
- 2V – 5V operation

- Volume pricing $3 to $12 ($AUD)
18FXXX Package Types

- Available in three package types, suitable for prototyping and production
- We will use PDIP-40, TQFP-44
- All cost < $20 in singles

- 18F2X2 are available in smaller packages – SOIC-28 and PDIP-28 (“skinny DIP”)
- These parts omit Port D and Port E
Modern CPU – 8-bit pipelined RISC processor, Harvard architecture, 10 MIPS

32K FLASH Memory, 1.5K SRAM    (1K = 1024)

Rich set of peripherals

- 4×Digital I/O ports with 25mA sink/source capacity
- 4×8/16-bit Timer/counters
- 2×Capture/Compare/PWM (CCP) modules
- 8×10-bit A/D channels
- Synchronous Serial Bus: SPI or I²C
- Parallel Slave Port
- USART, supports RS-232 or RS-485

Built-in development/production support
PIC18F452 - Overview of Features
PIC18F452 Features: CPU

- RISC processor, 77 instructions
  - Fully static design – 0 to 40 MHz clock
  - 8x8 single-cycle hardware multiply
  - Harvard architecture, two stage pipeline
  - 10 MIPS at 40 MHz clock
- Register-to-register & accumulator-based operations
- Code compatible with PIC 16Cxx, 17Cxx, 18Cxx
- Flexible clocking (8 modes) and resets (POR, BOR), low voltage detect, watchdog timer.
PIC18F452 Features: Architecture

Harvard Architecture
- Separate instruction and data busses
- Instructions (opcodes)
  - 16-bit wide instruction bus
  - 32K bytes FLASH program memory (where 1K = 1024)
- Data (operands & results)
  - 8-bit wide data bus
  - 1.5K bytes data RAM
- 256 bytes EEPROM
Definitions

- A *counter* counts (asynchronous) input pulses
- A *timer* counts pulses of a fixed, known frequency

Four timer/counters

- Timer1: 16-bit timer/counter
- Timer3: 16-bit timer/counter
- Timer0: 8/16-bit timer/counter with 8-bit prescale
- Timer2: 8/16-bit timer/counter with 8-bit period register (provides PWM time base)
PIC18F452 Features: CCP Modules

Two CCP (Capture/Compare/PWM) modules

- CCP pins can be configured as
  - **Capture**: time an external event with an accuracy of $T_{CY}/16$
  - **Compare**: generate an event at a known time, to an accuracy of $T_{CY}$
  - **PWM**: generate PWM output with 1- to 10-bit resolution.

- With a 10 MHz clock, resolution $T_{CY}/16 = 25$ns
PIC18F452 Features: Serial I/O

MSSP (Master Synch Serial Port) implements one of:

- Three-wire Serial Peripheral Interface (SPI)
  - Supports all 4 SPI modes
- Two-wire I²C Bus
  - Supports all master and slave modes

USART (Universal Synchronous/Asynchronous Receiver/Transmitter) serial port
  - Supports RS-232 or RS-485
PIC18F452 Features: A/D, PSP

Analogue to Digital Conversion
- Eight channels of 10-bit A/D  (five on 28-pin devices)

PSP (Parallel Slave Port)  (not on 28-pin devices)
- Interface through an 8-bit parallel bus
- Can build very sophisticated “semi-custom” ICs
PIC18F452: Other Features

- Reprogrammable:
  - FLASH memory – 100,000 erase/write cycles
  - EEPROM – 1,000,000 erase/write cycles

- Code security

- Power-up features:
  - POR (Power-on reset)
  - PWRT (Power-up timer)
  - OST (Oscillator start-up timer)

- Watchdog timer with on-chip RC oscillator

- Low-power sleep mode (<20μA)

- Built-in development/production support
  - In-circuit hardware debugger via 2 pins
  - In-circuit serial programmable via 2 pins