

Chapter 2. PIC 16F877 Microcontroller - Overview

1. PIC 16F877 Architecture

PIC 16F877 is a 40-pin 8-Bit CMOS FLASH Microcontroller from Microchip. The core architecture is high-performance RISC CPU with only 35 single word¹ instructions. Since it follows the RISC architecture, all single cycle instructions take only one instruction cycle except for program branches which take two cycles. 16F877 comes with 3 operating speeds with 4, 8, or 20 MHz clock input. Since each instruction cycle takes four operating clock cycles, each instruction takes 0.2 μ s when 20MHz oscillator is used.

It has two types of internal memories: program memory and data memory. Program memory is provided by 8K words (or 8K*14 bits) of FLASH Memory, and data memory has two sources. One type of data memory is a 368-byte RAM (random access memory) and the other is 256-byte EEPROM (Electrically erasable programmable ROM).

The core feature includes interrupt capability up to 14 sources, power saving SLEEP mode, and single 5V In-Circuit Serial Programming (ICSP) capability. The sink/source current, which indicates a driving power from I/O port, is high with 25mA. Power consumption is less than 2 mA in 5V operating condition.

The peripheral features include:

- (a) 3 time blocks: Timer0 for 8-bit timer/counter; Timer1 for 16-bit timer/counter; and Timer2: 8-bit timer/counter with 8-bit period register, prescaler and postscaler.
- (b) Two Capture, Compare, PWM modules for capturing, comparing 16-bit, and PWM generation with 10-bit resolution.
- (c) 10-bit multi-channel (max 8) Analog-to-Digital converter module.
- (d) Synchronous Serial Port (SSP) with SPI (Master Mode) and I²C² (Master/Slave)
- (e) Universal Synchronous Asynchronous Receiver Transmitter (USART/SCI) with 9-bit address detection
- (f) Parallel Slave Port (PSP) 8-bits wide, with external RD, WR and CS controls
- (g) I/O ports.

The key feature of 16F877 is summarized below:

FLASH Program Memory (14-bit word)	8K Words
Data Memory (RAM)	368 Bytes
Data Memory (EEPROM)	256 Bytes
Interrupts	14
I/O Ports	Ports A, B, C, D, E
Timers	3
Capture/Compare/PWM Modules	2
Serial Communications	MSSP, USART

¹ The 'word' here is not the usual term we use to indicate 2 bytes (or 16 bits). The 'word' in PIC could be 12, 14, or any number of bits. For 16F877, the word means a size of 14 bits.

² I²C stands for Inter-IC bus.

Parallel Communications	PSP
10-bit Analog-to-Digital Module	8 channels
Instruction Set	35 Instructions

2. Pin and Package

There are three package types are available: DIP, PLCC, and QFP. This book assumes that we all use the DIP because of its best fit to breadboard or proto-board.



Fig 1. PIC 16F877 IC Package: DIP