

# Data Sheets

## PIC18F1220/1320

### Low-Power Features

- Power Managed Modes
  - Run: CPU on, peripherals on
  - Idle: CPU off, peripherals on
  - Sleep: CPU off, peripherals off
- Power Consumption Modes
  - PRI\_RUN: 150  $\mu$ A, 1 MHz, 2 V
  - PRI\_IDLE: 37  $\mu$ A, 1 MHz, 2 V
  - SEC\_RUN: 14  $\mu$ A, 32 kHz, 2 V
  - SEC\_IDLE: 5.8  $\mu$ A, 32 kHz, 2 V
  - RC\_RUN: 110  $\mu$ A, 1 MHz, 2 V
  - RC\_IDLE: 52  $\mu$ A, 1 MHz, 2 V
  - Sleep: 0.1  $\mu$ A, 1 MHz, 2 V
- Timer1 Oscillator: 1.1  $\mu$ A, 32 kHz, 2 V
- Watchdog Timer: 2.1  $\mu$ A
- Two-Speed Oscillator Start-Up

### Oscillators

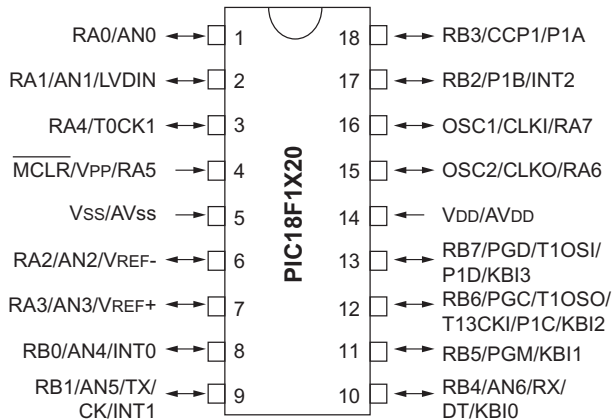
- Four Crystal Modes:
  - LP, XT, HS: up to 25 MHz
  - HSPLL: 4–10 MHz (16–40 MHz internal)
- Two External RC Modes, up to 4 MHz
- Two External Clock Modes, up to 40 MHz
- Internal Oscillator Block:
  - 8 user-selectable frequencies: 31, 125, 250, and 500 kHz, 1, 2, 4, and 8 MHz
  - 125 kHz to 8 MHz calibrated to 1%
  - Two modes select one or two I/O pins
  - OSCTUNE—Allows user to shift frequency
- Secondary Oscillator Using Timer1 at 32 kHz
- Fail-Safe Clock Monitor
  - Allows for safe shutdown if peripheral clock stops

## Peripheral Highlights

- High Current Sink/Source 25/25 mA
- Three External Interrupts
- Enhanced Capture/Compare/PWM (ECCP) module:
  - One, two, or four PWM outputs
  - Selectable polarity
  - Programmable dead time
  - Auto-shutdown and auto-restart
- Compatible 10-Bit, up to 13-Channel Analog-to-Digital Converter Module (A/D) with Programmable Acquisition Time
- Enhanced USART Module:
  - Supports RS-485, RS-232, and LIN 1.2
  - Auto-wake-up on start bit
  - Auto-baud detect

## Special Microcontroller Features

- 100,000 Erase/Write Cycle Enhanced Flash Program Memory Typical
- 1,000,000 Erase/Write Cycle Data EEPROM Memory Typical
- Flash/Data EEPROM Retention: >40 years
- Self-Programmable Under Software Control
- Priority Levels for Interrupts
- $8 \times 8$  Single-Cycle Hardware Multiplier
- Extended Watchdog Timer (WDT):
  - Programmable period from 41 ms to 131 s
  - 2% stability over VDD and temperature
- Single-Supply 5V In-Circuit Serial Programming™ (ICSP™) via Two Pins
- In-Circuit Debug (ICD) via Two Pins
- Wide Operating Voltage Range: 2.0–5.5V



PIC18F1220/1320 pin connections.

## PIC18F2220/2320/4220/4320

### Low-Power Features

- Power Managed Modes:
  - Run: CPU on, peripherals on
  - Idle: CPU off, peripherals on
  - Sleep: CPU off, peripherals off
- Power Consumption Modes:
  - PRI\_RUN: 150  $\mu$ A, 1 MHz, 2 V
  - PRI\_IDLE: 37  $\mu$ A, 1 MHz, 2 V
  - SEC\_RUN: 14  $\mu$ A, 32 kHz, 2 V
  - SEC\_IDLE: 5.8  $\mu$ A, 32 kHz, 2 V
  - RC\_RUN: 110  $\mu$ A, 1 MHz, 2 V
  - RC\_IDLE: 52  $\mu$ A, 1 MHz, 2 V
  - Sleep: 0.1  $\mu$ A, 1 MHz, 2 V
- Timer1 Oscillator: 1.1  $\mu$ A, 32 kHz, 2 V
- Watchdog Timer: 2.1  $\mu$ A
- Two-Speed Oscillator Start-Up

### Oscillators

- Four Crystal Modes:
  - LP, XT, HS: up to 25 MHz
  - HSPLL: 4–10 MHz (16–40 MHz internal)
- Two External RC Modes, up to 4 MHz
- Two External Clock Modes, up to 40 MHz
- Internal Oscillator Block:
  - 8 user-selectable frequencies: 31, 125, 250, and 500 kHz, 1, 2, 4, and 8 MHz
  - 125 kHz to 8 MHz calibrated to 1%
  - Two modes select one or two I/O pins
  - OSCTUNE—Allows user to shift frequency
- Secondary Oscillator Using Timer1 at 32 kHz
- Fail-Safe Clock Monitor
  - Allows for safe shutdown if peripheral clock stops

### Peripheral Highlights

- High Current Sink/Source 25/25 mA
- Three External Interrupts
- Up to 2 Capture/Compare/PWM (CCP) Modules:
  - Capture is 16-bit, max. resolution is 6.25 ns (TCY/16)
  - Compare is 16-bit, max. resolution is 100 ns (TCY)
  - PWM output: PWM resolution is 1–10-bit
- Enhanced Capture/Compare/PWM (ECCP) Module:
  - One, two, or four PWM outputs
  - Selectable polarity

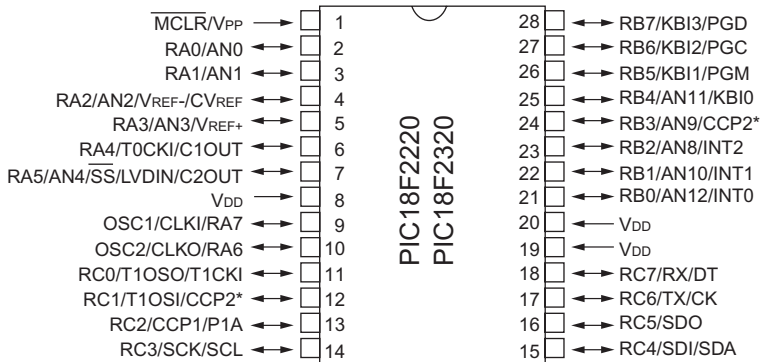
Programmable dead time

Auto-shutdown and auto-restart

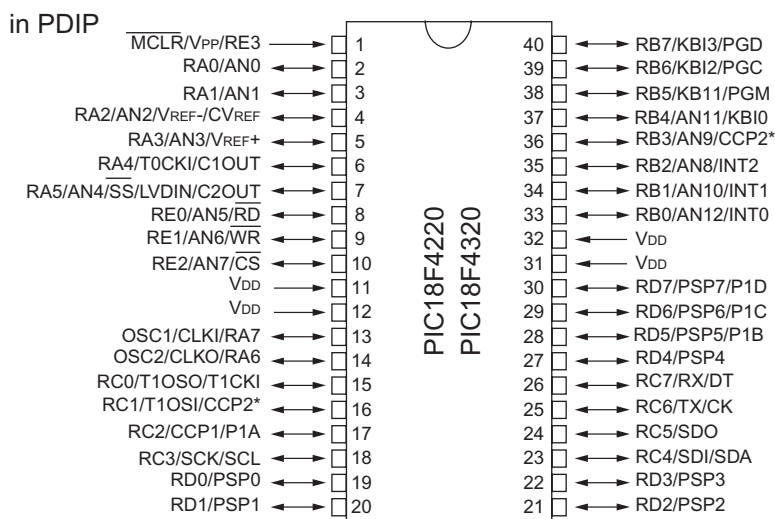
- Compatible 10-Bit, up to 13-Channel Analog-to-Digital Converter module (A/D) with Programmable Acquisition Time
- Dual Analog Comparators
- Addressable USART Module:  
RS-232 operation using internal oscillator block (no external crystal required)

## Special Microcontroller Features

- 100,000 Erase/Write cycle Enhanced Flash Program Memory Typical
- 1,000,000 Erase/Write Cycle Data EEPROM Memory Typical
- Flash/Data EEPROM Retention: >40 years
- Self-Programmable Under Software Control
- Priority Levels for Interrupts
- 8×8 Single-Cycle Hardware Multiplier
- Extended Watchdog Timer (WDT):  
Programmable period from 41 ms to 131 s  
2% stability over  $V_{DD}$  and temperature
- Single-supply 5V In-Circuit Serial Programming™ (ICSP™) via Two Pins
- In-Circuit Debug (ICD) via Two Pins
- Wide Operating Voltage Range: 2.0–5.5V



PIC18F2220/2320 pin connections.



PIC18F4220/4320 pin connections.

## PIC18F2420/2520/4420/4520

### Power Management Features

- Run: CPU On, Peripherals On
- Idle: CPU Off, Peripherals On
- Sleep: CPU Off, Peripherals Off
- Ultra Low 50  $\mu$ A Input Leakage
- Run Mode Currents Down to 11  $\mu$ A Typical
- Idle Mode Currents Down to 2.5  $\mu$ A Typical
- Sleep Mode Current Down to 100 nA Typical
- Timer1 Oscillator: 900  $\mu$ A, 32 kHz, 2 V
- Watchdog Timer: 1.4  $\mu$ A, 2 V Typical
- Two-Speed Oscillator Start-Up

### Flexible Oscillator Structure

- Four Crystal Modes, up to 40 MHz
- 4x Phase Lock Loop (PLL)—Available for Crystal and Internal Oscillators
- Two External RC Modes, up to 4 MHz
- Two External Clock Modes, up to 40 MHz

- **Internal Oscillator Block:**
  - Fast wake from sleep and idle, 1 s typical
  - 8 use-selectable frequencies, from 31 kHz to 8 MHz
  - Provides a complete range of clock speeds
  - From 31 kHz to 32 MHz when used with PLL
  - User-tunable to compensate for frequency drift
- **Secondary Oscillator Using Timer1 at 32 kHz**
- **Fail-Safe Clock Monitor:**
  - Allows for safe shutdown if peripheral clock stops

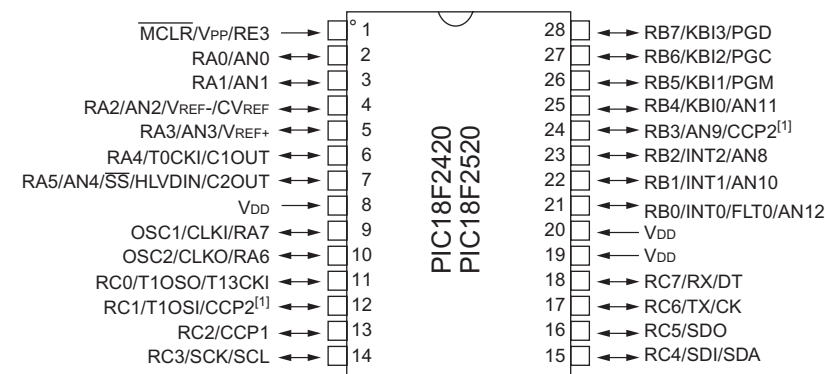
## Peripheral Highlights

- High Current Sink/Source 25/25 mA
- Three Programmable External Interrupts
- Four Input Change Interrupts
- Upto2 Capture/Compare/PWM (CCP) Modules, One with Auto-Shutdown (28-pin devices)
- Enhanced Capture/Compare/PWM (ECCP) Module (40/44-pin devices only):
  - One, two, or four PWM outputs
  - Selectable polarity
  - Programmable dead time
  - Auto-shutdown and auto-restart
- Master Synchronous Serial Port (MSSP) Module
  - Supporting 3-wire SPI (all 4 modes) and I2C™
  - Master and slave modes
- Enhanced Addressable USART Module:
  - Supports RS-485, RS-232, and LIN/J2602
  - RS-232 operation using internal oscillator block (no external crystal required)
  - Auto-wake-up on start bit
  - Auto-baud detect
- 10-Bit, up to 13-Channel Analog-to-Digital (A/D) Converter Module:
  - Auto-acquisition capability
  - Conversion available during sleep
- Dual Analog Comparators with Input Multiplexing
- Programmable 16-Level High/Low-Voltage
- Detection (HLVD) Module:
  - Supports interrupt on High/Low-Voltage Detection

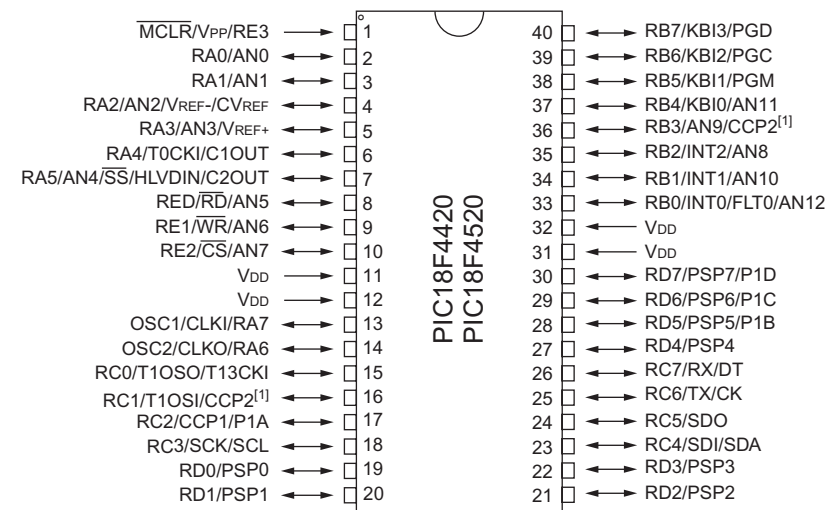
## Special Microcontroller Features

- C Compiler Optimized Architecture:
  - Optional extended instruction set designed to optimize re-entrant code
- 100,000 Erase/Write Cycle Enhanced Flash Program Memory Typical

- 1,000,000 Erase/Write Cycle Data EEPROM Memory Typical
- Flash/Data EEPROM Retention: 100 Years Typical
- Self-Programmable under Software Control
- Priority Levels for Interrupts
- 8×8 Single-Cycle Hardware Multiplier
- Extended Watchdog Timer (WDT):
  - Programmable period from 4 ms to 131 s
- Single-Supply 5V In-Circuit Serial Programming™ (ICSP™) via Two Pins
- In-Circuit Debug (ICD) via Two Pins
- Wide Operating Voltage Range: 2.0–5.5V
- Programmable Brown-Out Reset (BOR) With Software Enable Option



PIC18F2420/2520 pin connections.



PIC18F4420/4520 pin connections.

## ELECTRICAL CHARACTERISTICS OF THE PIC18F1220/1320

(which are similar to the other PICs specified.)

### Absolute Maximum Ratings.

Ambient temperature under bias.....	-40 to +125°C
Storage temperature.....	-65 to +150°C
Voltage on any pin with respect to $V_{SS}$ (except $V_{DD}$ , MCLR and RA4) .....	-0.3 to ( $V_{DD} + 0.3$ V)
Voltage on $V_{DD}$ with respect to $V_{SS}$ .....	-0.3 to + 5.5 V
Voltage on MCLR with respect to $V_{SS}$ .....	0 to + 13.25 V
Voltage on RA4 with respect to $V_{SS}$ .....	0 to + 8.5 V
Total power dissipation (Note 2).....	1.0 W
Maximum current out of $V_{SS}$ pin.....	300 mA
Maximum current into $V_{DD}$ pin.....	250 mA
Input clamp current, $I_{in}$ ( $V_I < 0$ or $V_I > V_{DD}$ ) .....	$\pm 20$ mA
Output clamp current, $I_{ok}$ ( $V_O < 0$ or $V_O > V_{DD}$ ) .....	$\pm 20$ mA
Maximum output current sunk by any I/O pin .....	25 mA
Maximum output current sourced by any I/O pin .....	25 mA
Maximum current sunk by all ports.....	200 mA
Maximum current sourced by all ports.....	200 mA

Note 2: Power dissipation is calculated as follows:

$$P_{dis} = V_{DD} \times (I_{DD} - \sum I_{OH}) + \sum (V_{DD} - V_{OH}) \times I_{OH} + \sum (V_{OL} \times I_{OL})$$

- 1: Voltage spikes below  $V_{SS}$  at the MCLR/ $V_{PP}$  pin, inducing currents greater than 80 mA, may cause latch-up. Thus, a series resistor of 50–100  $\Omega$  should be used when applying a “low” level to the MCLR/ $V_{PP}$  pin, rather than pulling this pin directly to  $V_{SS}$ .

Further details of the specifications can be seen on the device User Guides obtainable from Microchip on

[www.Microchip.Com](http://www.Microchip.Com)