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What is "Embedded - Microcontrollers"?

"Embedded - Microcontrollers" refer to small, integrated circuits designed to perform specific tasks within larger systems. These microcontrollers are essentially compact computers on a single chip, containing a processor core, memory, and programmable input/output peripherals. They are called "embedded" because they are embedded within electronic devices to control various functions, rather than serving as standalone computers. Microcontrollers are crucial in modern electronics, providing the intelligence and control needed for a wide range of applications.

Applications of "Embedded - Microcontrollers"

Details	
Product Status	Active
Core Processor	PIC
Core Size	8-Bit
Speed	20MHz
Connectivity	-
Peripherals	Brown-out Detect/Reset, POR, PWM, WDT
Number of I/O	5
Program Memory Size	1.75KB (1K x 14)
Program Memory Type	FLASH
EEPROM Size	-
RAM Size	64 x 8
Voltage - Supply (Vcc/Vdd)	1.8V ~ 3.6V
Data Converters	A/D 4x10b
Oscillator Type	Internal
Operating Temperature	-40°C ~ 85°C (TA)
Mounting Type	Surface Mount
Package / Case	8-TSSOP, 8-MSOP (0.118", 3.00mm Width)
Supplier Device Package	8-MSOP
Purchase URL	https://www.e-xfl.com/product-detail/microchip-technology/pic12lf1501t-i-ms

PIC12(L)F1501/PIC16(L)F150X

8/14/20-Pin, 8-Bit Flash Microcontrollers Product Brief

High-Performance RISC CPU:

- C Compiler Optimized Architecture
- Only 49 Instructions
- Up to 14 Kbytes Linear Program Memory Addressing
- Up to 512 bytes Linear Data Memory Addressing
- Operating Speed:
  - DC – 20 MHz clock input
  - DC – 125 ns instruction cycle
- Interrupt Capability with Automatic Context Saving
- 16-Level Deep Hardware Stack with Optional Overflow/Underflow Reset
- Direct, Indirect and Relative Addressing modes:
  - Two full 16-bit File Select Registers (FSRs)
  - FSRs can read program and data memory

Flexible Oscillator Structure:

- 16 MHz Internal Oscillator Block:
  - Factory calibrated to ±1%, typical
  - Software selectable frequency range from 16 MHz to 31 kHz
- 31 kHz Low-Power Internal Oscillator
- Three External Clock modes up to 20 MHz

Special Microcontroller Features:

- Operating Voltage Range:
  - 1.8V to 3.6V (PIC12LF1501/PIC16LF150X)
  - 2.3V to 5.5V (PIC12F1501/PIC16F150X)
- Self-Programmable under Software Control
- Power-on Reset (POR)
- Power-up Timer (PWRT)
- Programmable Low-Power Brown-Out Reset (LPBOR)
- Extended Watchdog Timer (WDT):
  - Programmable period from 1 ms to 256s
- Programmable Code Protection
- In-Circuit Serial Programming™ (ICSP™) via Two Pins
- Enhanced Low-Voltage Programming (LVP)
- Power-Saving Sleep mode:
  - Low-Power Sleep mode
  - Low-Power BOR (LPBOR)
- Integrated Temperature Indicator

Low-Power Features (PIC12LF1501/PIC16LF150X):

- Standby Current:
  - 20 nA @ 1.8V, typical
- Watchdog Timer Current:
  - 300 nA @ 1.8V, typical
- Operating Current:
  - 30 μA/MHz @ 1.8V, typical
- Timer1 Oscillator:
  - 600 nA @ 32 kHz, 1.8V, typical (PIC16LF1508/09 devices only)

Peripheral Features:

- Analog-to-Digital Converter (ADC):
  - 10-bit resolution
  - Up to 12 external channels
  - 2 internal channels:
    - Fixed Voltage Reference channel
    - Temperature Indicator channel
  - Auto acquisition capability
  - Conversion available during Sleep
- Up to 2 Comparators:
  - Rail-to-rail inputs
  - Power mode control
  - Software controllable hysteresis
- Voltage Reference module:
  - Fixed Voltage Reference (FVR) with 1.024V, 2.048V and 4.096V output levels
  - Up to 1 rail-to-rail resistive 5-bit DAC with positive and negative reference selection
- Up to 17 I/O Pins and 1 Input-only Pin:
  - High current sink/source 25 mA/25 mA
  - Individually programmable weak pull-ups
  - Individually programmable interrupt-on-change (IOC) pins
- Timer0: 8-Bit Timer/Counter with 8-Bit Programmable Prescaler
- Enhanced Timer1:
  - 16-bit timer/counter with prescaler
  - External Gate Input mode
- Timer2: 8-Bit Timer/Counter with 8-Bit Period Register, Prescaler and Postscaler
- Four 10-bit PWM modules
- Up to 1 Master Synchronous Serial Port (MSSP) with SPI and I^2C™ with:
  - 7-bit address masking
  - SMBus/PMBus™ compatibility
- Up to 1 Enhanced Universal Synchronous Asynchronous Receiver Transmitter (EUSART):
  - RS-232, RS-485 and LIN compatible

  - Auto-baud detect
  - Auto-wake-up on Start
- Up to 4 Configurable Logic Cell (CLC) modules:
  - Up to 16 selectable input source signals
  - Four inputs per module
  - Software control of combinational/sequential logic/state/clock functions
  - AND/OR/XOR/D Flop/D Latch/SR/JK
  - External or internal inputs/outputs
  - Operation while in Sleep
- Numerically Controlled Oscillator (NCO):
  - 20-bit accumulator
  - 16-bit increment
  - True linear frequency control
  - High-speed clock input
  - Selectable Output modes
    - Fixed Duty Cycle (FDC)
    - Pulse Frequency Modulation (PFM)
- Complementary Waveform Generator (CWG):
  - Up to 8 selectable signal sources
  - Selectable falling and rising edge dead-band control
  - Polarity control
  - Up to 4 auto-shutdown sources
  - Multiple input sources: PWM, CLC, NCO

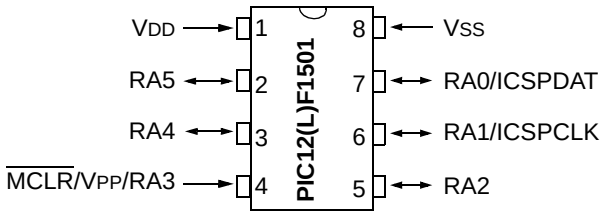
TABLE 1: PIC12(L)F1501/PIC16(L)F150X FAMILY TYPES

Device	Program Memory Flash (words)	SRAM (bytes)	I/Os	10-bit A/D (ch)	Comparators	DAC	Timers 8/16-bit	PWM	EUSART	MSSP	CWG	CLC	NCO	ICD	XLP
PIC12F1501 PIC12LF1501	1024	64	6	4	1	1	2/1	4	—	—	1	2	1	—	—
PIC16F1503 PIC16LF1503	2048	128	12	8	2	1	2/1	4	—	1	1	2	1	—	—
PIC16F1507 PIC16LF1507	2048	128	18	12	—	—	2/1	4	—	—	1	2	1	—	—
PIC16F1508 PIC16LF1508	4096	256	18	12	2	1	2/1	4	1	1	1	4	1	V3	X
PIC16F1509 PIC16LF1509	8192	512	18	12	2	1	2/1	4	1	1	1	4	1	V3	X

Note: Pin details are subject to change.

FIGURE 1: 8-PIN PDIP, SOIC, MSOP, DFN DIAGRAM FOR PIC12(L)F1501

PDIP, SOIC, MSOP, DFN (2X3)



Note: See Table 2 for location of all peripheral functions.

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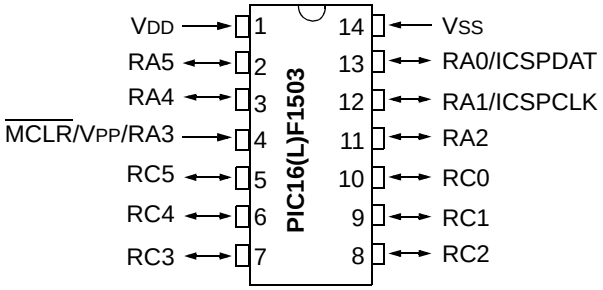
FIGURE 2: 14-PIN PDIP, SOIC, TSSOP DIAGRAM FOR PIC16(L)F1503

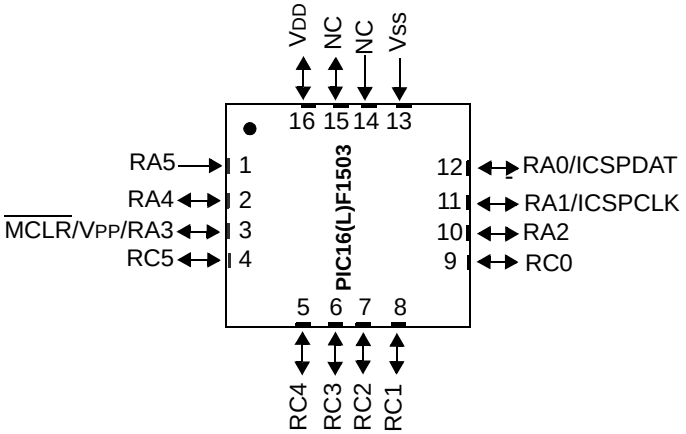
PDIP, SOIC, TSSOP



Note: See Table 3 for location of all peripheral functions.

FIGURE 3: 16-PIN QFN DIAGRAM FOR PIC16(L)F1503

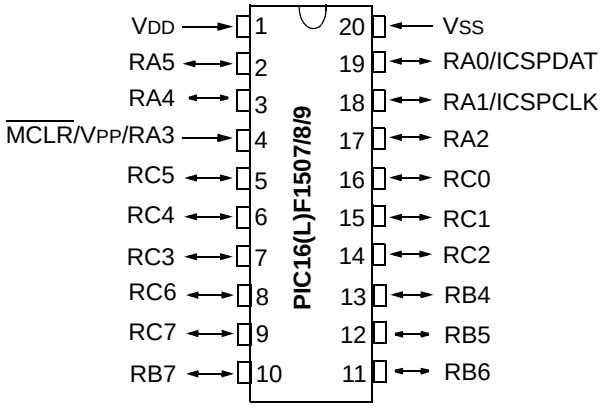
QFN (3x3)



Note: See Table 3 for location of all peripheral functions.

FIGURE 4: 20-PIN PDIP, SOIC, SSOP DIAGRAM FOR PIC16(L)F1507/8/9

PDIP, SOIC, SSOP

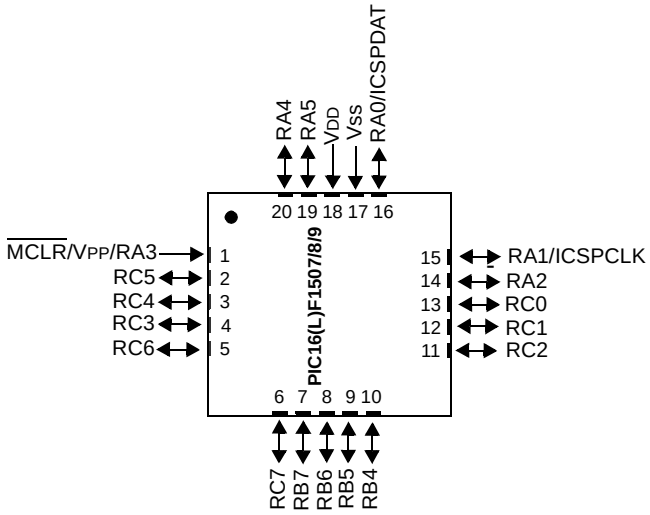


Note 1: See Table 4 for location of all PIC16(L)F1507 peripheral functions.

2: See Table 5 for location of all PIC16(L)F1508/9 peripheral functions

FIGURE 5: 20-PIN QFN DIAGRAM FOR PIC16(L)F1507/8/9

QFN (4x4)



Note 1: See Table 4 for location of all PIC16(L)F1507 peripheral functions.

2: See Table 5 for location of all PIC16(L)F1508/9 peripheral functions

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TABLE 2: 8-PIN ALLOCATION TABLE (PIC12(L)F1501)

I/O	8-Pin PDIP/SOIC/MSOP/DFN	ADC	Reference	Comparator	Timer	CWG	NCO	CLC	PWM	Interrupt	Basic
RA0	7	AN0	DACOUT1	C1IN+	—	CWGB(1)	—	CLC2IN1	PWM2	IOC	ICSPDAT
RA1	6	AN1	VREF+	C1IN0-	—	—	NCOOUT(1)	CLC2IN0	—	IOC	ICSPCLK
RA2	5	AN2	DACOUT2	C1OUT	T0CKI	CWGA(1) $\overline{\text{CWGFLT}}$	—	CLC1OUT(1)	PWM1	INT IOC	—
RA3	4	—	—	—	T1G(2)	—	—	CLC1IN0	—	IOC	$\overline{\text{MCLR}}$ VPP
RA4	3	AN3	—	C1IN1-	T1G(1)	CWGB(2)	—	CLC1OUT(2)	PWM3	IOC	CLKOUT
RA5	2	—	—	—	T1CKI	CWGA(2)	NCOCLK NCOOUT(2)	CLC2OUT CLC1IN1	PWM4	IOC	CLKIN
VDD	1	—	—	—	—	—	—	—	—	—	VDD
VSS	8	—	—	—	—	—	—	—	—	—	VSS

Note 1: Default location for peripheral pin function. Alternate location can be selected using the APFCON register.
2: Alternate location for peripheral pin function selected by the APFCON register.

TABLE 3: 14-PIN ALLOCATION TABLE (PIC16(L)F1503)

I/O	14-Pin PDIP/SOIC/TSSOP	16-Pin QFN	ADC	Reference	Comparator	Timer	CWG	NCO	CLC	PWM	MSSP	Interrupt	Basic
RA0	13	12	AN0	DACOUT1	C1IN+	—	—	—	—	—	—	IOC	ICSPDAT
RA1	12	11	AN1	VREF+	C1IN0- C2IN0-	—	—	—	—	—	—	IOC	ICSPCLK
RA2	11	10	AN2	DACOUT2	C1OUT	T0CKI	$\overline{\text{CWGFLT}}$	—	CLC1OUT(1)	PWM3	—	INT IOC	—
RA3	4	3	—	—	—	T1G(2)	—	—	CLC1IN0	—	$\overline{\text{SS}}$(2)	IOC	$\overline{\text{MCLR}}$ VPP
RA4	3	2	AN3	—	—	T1G(1)	—	NCOOUT(2)	—	—	SDO(2)	IOC	CLKOUT
RA5	2	1	—	—	—	T1CKI	—	NCOCLK	CLC1IN1	—	—	IOC	CLKIN
RC0	10	9	AN4	—	C2IN+	—	—	—	CLC2OUT	—	SCL SCK	—	—
RC1	9	8	AN5	—	C1IN1- C2IN1-	—	—	NCOOUT(1)	—	PWM4	SDA SDI	—	—
RC2	8	7	AN6	—	C1IN2- C2IN2-	—	—	—	—	—	SDO(1)	—	—
RC3	7	6	AN7	—	C1IN3- C2IN3-	—	—	—	CLC2IN0	PWM2	$\overline{\text{SS}}$(1)	—	—
RC4	6	5	—	—	C2OUT	—	CWGB	—	CLC2IN1	—	—	—	—
RC5	5	4	—	—	—	—	CWGA	—	CLC1OUT(2)	PWM1	—	—	—
VDD	1	16	—	—	—	—	—	—	—	—	—	—	VDD
VSS	14	13	—	—	—	—	—	—	—	—	—	—	VSS

Note 1: Default location for peripheral pin function. Alternate location can be selected using the APFCON register.
2: Alternate location for peripheral pin function selected by the APFCON register.

TABLE 4: 20-PIN ALLOCATION TABLE (PIC16(L)F1507)

I/O	20-Pin PDIP/SOIC/SSOP	20-Pin QFN	ADC	Reference	Timer	CWG	NCO	CLC	PWM	Interrupt	Basic
RA0	19	16	AN0	—	—	—	—	—	—	IOC	ICSPDAT
RA1	18	15	AN1	VREF+	—	—	—	—	—	IOC	ICSPCLK
RA2	17	14	AN2	—	T0CKI	$\overline{\text{CWGFLT}}$	—	CLC1OUT(1)	PWM3	INT IOC	—
RA3	4	1	—	—	—	—	—	CLC1IN0	—	IOC	$\overline{\text{MCLR}}$ VPP
RA4	3	20	AN3	—	T1G	—	—	—	—	IOC	CLKOUT
RA5	2	19	—	—	T1CKI	—	NCOCLK	—	—	IOC	CLKIN
RB4	13	10	AN10	—	—	—	—	—	—	IOC	—
RB5	12	9	AN11	—	—	—	—	—	—	IOC	—
RB6	11	8	—	—	—	—	—	—	—	IOC	—
RB7	10	7	—	—	—	—	—	—	—	IOC	—
RC0	16	13	AN4	—	—	—	—	CLC2OUT	—	—	—
RC1	15	12	AN5	—	—	—	NCOOUT(1)	—	PWM4	—	—
RC2	14	11	AN6	—	—	—	—	—	—	—	—
RC3	7	4	AN7	—	—	—	—	CLC2IN0	PWM2	—	—
RC4	6	3	—	—	—	CWGB	—	CLC2IN1	—	—	—
RC5	5	2	—	—	—	CWGA	—	CLC1OUT(2)	PWM1	—	—
RC6	8	5	AN8	—	—	—	NCOOUT(2)	—	—	—	—
RC7	9	6	AN9	—	—	—		CLC1IN1	—	—	—
VDD	1	18	—	—	—	—	—	—	—	—	VDD
VSS	20	17	—	—	—	—	—	—	—	—	VSS

Note 1: Default location for peripheral pin function. Alternate location can be selected using the APFCON register.
2: Alternate location for peripheral pin function selected by the APFCON register.

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TABLE 5: 20-PIN ALLOCATION TABLE (PIC16(L)F1508/9)

I/O	20-Pin PDIP/SOIC/SSOP	20-Pin QFN	ADC	Reference	Comparator	Timer	CWG	NCO	CLC	PWM	EUSART	MSSP	Interrupt	Basic
RA0	19	16	AN0	DACOUT1	C1IN+	—	—	—	—	—	—	—	IOC	ICSPDAT ICDDAT
RA1	18	15	AN1	VREF+	C1IN0- C2IN0-	—	—	—	CLC4IN1	—	—	—	IOC	ICSPCLK ICDCLK
RA2	17	14	AN2	DACOUT2	C1OUT	T0CKI	$\overline{\text{CWGFLT}}$	—	CLC1OUT(1)	PWM3	—	—	INT IOC	—
RA3	4	1	—	—	—	T1G(2)	—	—	CLC1IN0	—	—	$\overline{\text{SS}}$(2)	IOC	$\overline{\text{MCLR}}$ VPP
RA4	3	20	AN3	—	—	T1OSCO T1G(1)	—	—	—	—	—	—	IOC	OSC2 CLKOUT
RA5	2	19	—	—	—	T1OSCI T1CKI	—	NCOCLK	—	—	—	—	IOC	OSC1 CLKIN
RB4	13	10	AN10	—	—	—	—	—	CLC3IN0	—	—	SDA SDI	IOC	—
RB5	12	9	AN11	—	—	—	—	—	CLC4IN0	—	RX DX	—	IOC	—
RB6	11	8	—	—	—	—	—	—	—	—	—	SCL SCK	IOC	—
RB7	10	7	—	—	—	—	—	—	CLC3OUT	—	TX CK	—	IOC	—
RC0	16	13	AN4	—	C2IN+	—	—	—	CLC2OUT	—	—	—	—	—
RC1	15	12	AN5	—	C1IN1- C2IN1-	—	—	NCOOUT(1)	—	PWM4	—	—	—	—
RC2	14	11	AN6	—	C1IN2- C2IN2-	—	—	—	—	—	—	—	—	—
RC3	7	4	AN7	—	C1IN3- C2IN3-	—	—	—	CLC2IN0	PWM2	—	—	—	—
RC4	6	3	—	—	C2OUT	—	CWGB	—	CLC4OUT CLC2IN1	—	—	—	—	—
RC5	5	2	—	—	—	—	CWGA	—	CLC1OUT(2)	PWM1	—	—	—	—
RC6	8	5	AN8	—	—	—	—	NCOOUT(2)	CLC3IN1	—	—	$\overline{\text{SS}}$(1)	—	—
RC7	9	6	AN9	—	—	—	—	—	CLC1IN1	—	—	SDO	—	—
VDD	1	18	—	—	—	—	—	—	—	—	—	—	—	VDD
VSS	20	17	—	—	—	—	—	—	—	—	—	—	—	VSS

Note 1: Default location for peripheral pin function. Alternate location can be selected using the APFCON register.
2: Alternate location for peripheral pin function selected by the APFCON register.

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