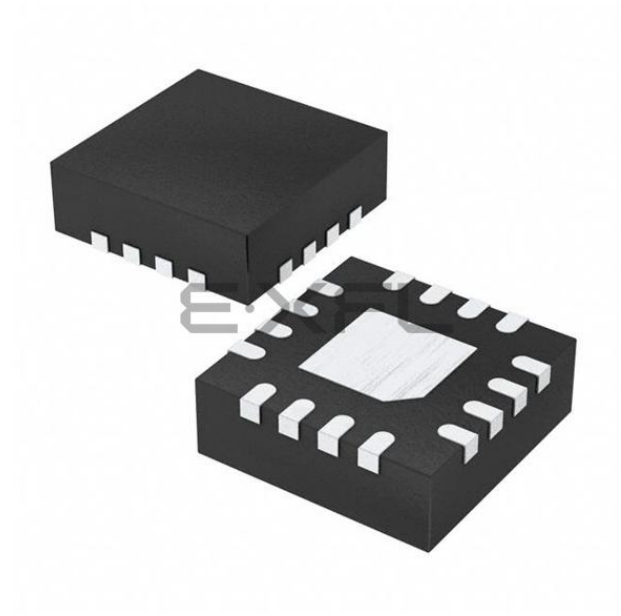

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What is "Embedded - Microcontrollers"?

"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	48MHz
Connectivity	I²C, LINbus, SPI, UART/USART, USB
Peripherals	Brown-out Detect/Reset, POR, PWM, WDT
Number of I/O	8
Program Memory Size	14KB (8K x 14)
Program Memory Type	FLASH
EEPROM Size	-
RAM Size	1K x 8
Voltage - Supply (Vcc/Vdd)	2.3V ~ 5.5V
Data Converters	-
Oscillator Type	Internal
Operating Temperature	-40°C ~ 85°C (TA)
Mounting Type	Surface Mount
Package / Case	16-VQFN Exposed Pad
Supplier Device Package	16-QFN (4x4)
Purchase URL	https://www.e-xfl.com/product-detail/microchip-technology/pic16f1454t-i-ml

PIC16(L)F145X

14/20-Pin, 8-Bit Flash USB Microcontroller Product Brief

High-Performance RISC CPU:

- C Compiler Optimized Architecture
- Only 49 Instructions
- 14 Kbytes Linear Program Memory Addressing
- 1024 bytes Linear Data Memory Addressing
- Operating Speed:
  - DC – 48 MHz clock input
  - DC – 83 ns instruction cycle
  - Selectable 3x or 4x PLL for specific frequencies
- 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) capable of accessing both data or program memory
  - FSRs can read program and data memory

Special Microcontroller Features:

- Operating Voltage Range:
  - 1.8V to 3.6V (PIC16LF145X)
  - 2.3V to 5.5V (PIC16F145X)
- Self-Programmable under Software Control
- Power-on Reset (POR)
- Power-up Timer (PWRT)
- Programmable Brown-Out Reset (BOR)
- Low-Power BOR (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

Universal Serial Bus (USB) Features:

- Self-tuning from USB host (eliminates need for external crystal)
- USB V2.0 Compliant SIE
- Low Speed (1.5 Mb/s) and Full Speed (12 Mb/s)
- Supports Control, Interrupt, Isochronous and Bulk Transfers
- Supports up to 8 Bidirectional Endpoints
- 512-Byte Dual Access RAM for USB
- Interrupt-on-Change (IOC) on D+/D- for USB Host Detection
- Configurable Internal Pull-up Resistors for use with USB

Low-Power Features PIC16LF145X with XLP:

- 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

Flexible Oscillator Structure:

- 16 MHz Internal Oscillator Block:
  - Factory calibrated to ±0.25%, typical
  - Software selectable frequency range from 16 MHz to 31 kHz
  - Tunable to 0.25% across temperature range
  - 48 MHz with 3x PLL
- 31 kHz Low-Power Internal Oscillator
- Clock Switching with run from:
  - Primary Oscillator
  - Secondary Oscillator (SOSC)
  - Internal Oscillator
- Clock Reference Output:
  - Clock Prescaler
  - CLKOUT

Analog Features(1):

- Analog-to-Digital Converter (ADC):
  - 10-bit resolution
  - Up to 9 external channels
  - Two internal channels:
    - Fixed Voltage Reference channel
    - DAC output channel
  - Auto acquisition capability
  - Conversion available during Sleep
- Two 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 one rail-to-rail resistive 5-bit DAC with positive reference selection

Note 1: Analog features are not available on PIC16(L)F1454 devices.

Peripheral Features:

- Up to 14 I/O Pins and three Input-only Pins:
  - 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
- Two 10-bit PWM modules
- Complementary Waveform Generator (CWG)**(1)**:
  - Up to four selectable signal sources
  - Selectable falling and rising edge dead-band control
  - Polarity control
  - Up to four auto-shutdown sources
  - Multiple input sources: PWM, Comparators
- Master Synchronous Serial Port (MSSP) with SPI and I^2C™ with:
  - 7-bit address masking
  - SMBus/PMBus™ compatibility
- Enhanced Universal Synchronous Asynchronous Receiver Transmitter (EUSART):
  - RS-232, RS-485 and LIN compatible
  - Auto-baud detect
  - Auto-wake-up on Start

Note 1: Not available on PIC16(L)F1454 devices.

PIC16(L)F145X Family Types

Device	Data Sheet Index	Program Memory Flash (words)	Data SRAM (bytes)	I/O's(2)	10-bit ADC (ch)	Comparators	DAC	Timers (8/16-bit)	PWM	EUSART	MSSP (I^2C™/SPI)	CWG	USB	Clock Reference	Debug(1)	XLP
PIC16(L)F1454	(1)	8192	1024	11	—	—	—	2/1	2	1	1	—	1	1	I/H	Y
PIC16(L)F1455	(1)	8192	1024	11	5	2	1	2/1	2	1	1	1	1	1	I/H	Y
PIC16(L)F1459	(1)	8192	1024	17	9	2	1	2/1	2	1	1	1	1	1	I/H	Y

Note 1: I - Debugging, Integrated on Chip; H - Debugging, Available using Debug Header; E - Emulation, Available using Emulation Header.

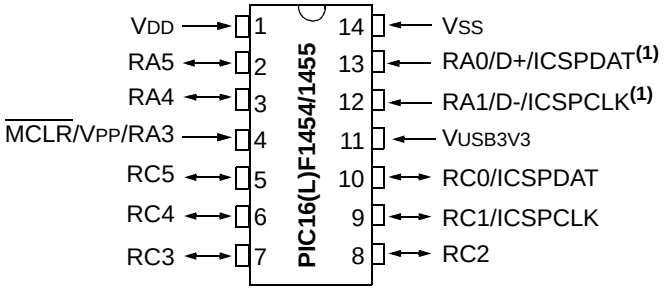
2: Three pins are input-only.

Data Sheet Index:

1: Future Product PIC16(L)F1454/1455/1459 Data Sheet, 14/20-Pin Flash, 8-Bit USB Microcontrollers.

FIGURE 1: 14-PIN PDIP, SOIC, TSSOP DIAGRAM FOR PIC16(L)F1454/1455

PDIP, SOIC, TSSOP

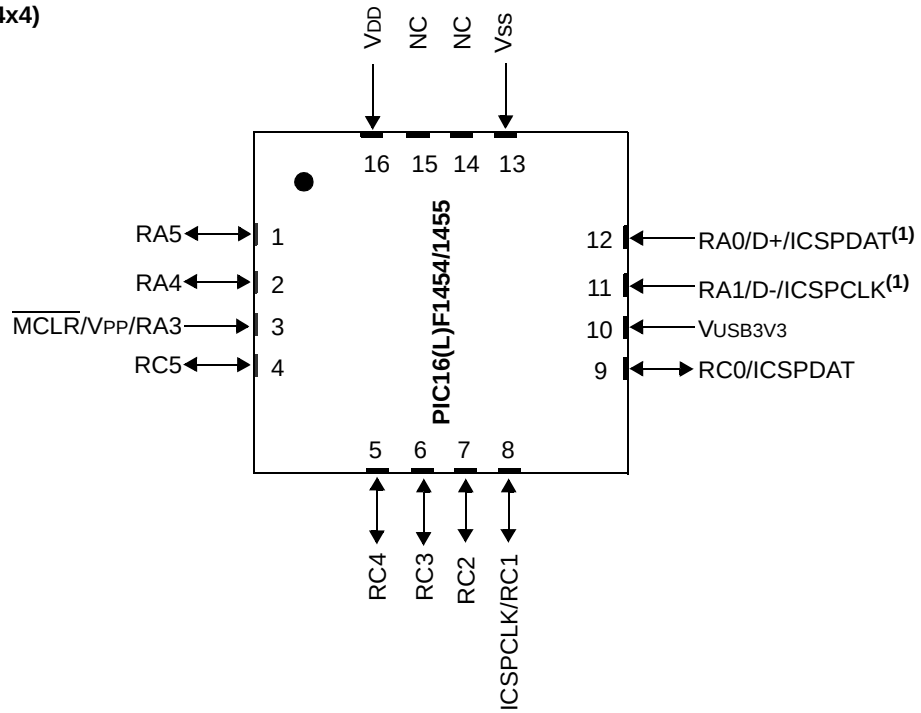


Note 1: LVP support for PIC18(L)F1XK50 legacy designs.

2: See Table 1 for location of all peripheral functions.

FIGURE 2: 16-PIN QFN DIAGRAM FOR PIC16(L)F1454/1455

QFN (4x4)

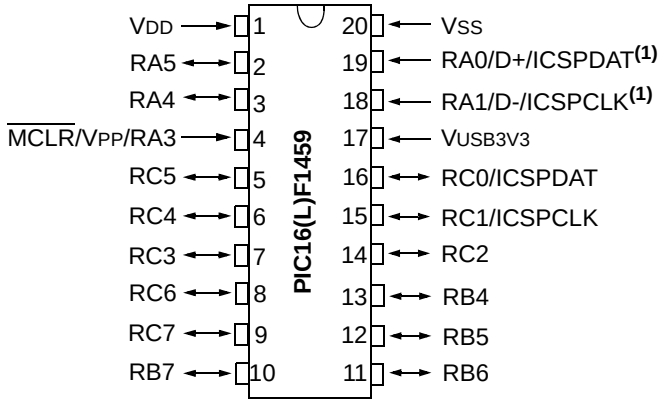


Note 1: LVP support for PIC18(L)F1XK50 legacy designs.

2: See Table 1 for location of all peripheral functions.

FIGURE 3: 20-PIN PDIP, SOIC, SSOP DIAGRAM FOR PIC16(L)F1459

PDIP, SOIC, SSOP

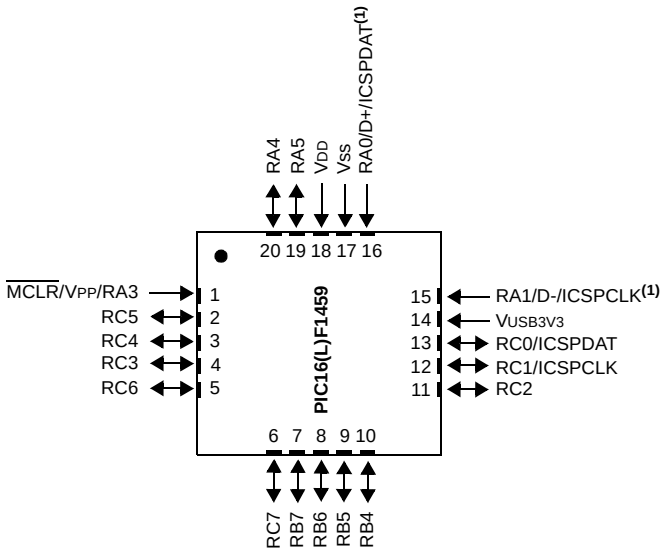


Note 1: LVP support for PIC18(L)F1XK50 legacy designs.

2: See Table 1 for location of all peripheral functions.

FIGURE 4: 20-PIN QFN DIAGRAM FOR PIC16(L)F1459

QFN (5x5)



Note 1: LVP support for PIC18(L)F1XK50 legacy designs.

2: See Table 1 for location of all peripheral functions.

TABLE 1: 14-PIN ALLOCATION TABLE (PIC16(L)F1454)

I/O	14-Pin PDIP/SOIC/TSSOP	16-Pin QFN	ADC	Reference	Comparator	Timer	CWG	USB	EUSART	PWM	MSSP	Interrupt	Basic
RA0	13	12	—	—	—	—	—	D+	—	—	—	IOC	ICSPDAT(3)
RA1	12	11	—	—	—	—	—	D-	—	—	—	IOC	ICSPCLK(3)
RA2	—	—	—	—	—	—	—	—	—	—	—	—	—
RA3	4	3	—	—	—	T1G(2)	—	—	—	—	$\overline{SS}$(2)	IOC	$\overline{MCLR}$ V_{PP}
RA4	3	2	—	—	—	SOSCO T1G(1)	—	—	—	—	SDO(2)	IOC	CLKOUT OSC2 CLKR(1)
RA5	2	1	—	—	—	SOSCI T1CKI	—	—	—	PWM2(2)	—	IOC	CLKIN OSC1
RC0	10	9	—	—	—	—	—	—	—	—	SCL SCK	—	ICSPDAT
RC1	9	8	—	—	—	—	—	—	—	—	SDA SDI	INT	ICSPCLK
RC2	8	7	—	—	—	—	—	—	—	—	SDO(1)	—	—
RC3	7	6	—	—	—	—	—	—	—	PWM2(1)	$\overline{SS}$(1)	—	CLKR(2)
RC4	6	5	—	—	—	—	—	—	TK CK	—	—	—	—
RC5	5	4	—	—	—	T0CKI	—	—	RX DT	PWM1	—	—	—
V_{DD}	1	16	—	—	—	—	—	—	—	—	—	—	V_{DD}
V_{SS}	14	13	—	—	—	—	—	—	—	—	—	—	V_{SS}
V_{USB3V3}	11	10	—	—	—	—	—	V_{USB3V3}	—	—	—	—	—

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.
3: LVP support for PIC18(L)F1XK50 legacy designs.

TABLE 2: 14-PIN ALLOCATION TABLE (PIC16(L)F1455)

I/O	14-Pin PDIP/SOIC/TSSOP	16-Pin QFN	ADC	Reference	Comparator	Timer	CWG	USB	EUSART	PWM	MSSP	Interrupt	Basic
RA0	13	12	—	—	—	—	—	D+	—	—	—	IOC	ICSPDAT(3)
RA1	12	11	—	—	—	—	—	D-	—	—	—	IOC	ICSPCLK(3)
RA2	—	—	—	—	—	—	—	—	—	—	—	—	—
RA3	4	3	—	—	—	T1G(2)	—	—	—	—	$\overline{SS}$(2)	IOC	$\overline{MCLR}$ V_{PP}
RA4	3	2	AN3	—	—	SOSCO T1G(1)	—	—	—	—	SDO(2)	IOC	CLKOUT OSC2 CLKR(1)
RA5	2	1	—	—	—	SOSCI T1CKI	—	—	—	PWM2(2)	—	IOC	CLKIN OSC1
RC0	10	9	AN4	V_{REF+}	C1IN+ C2IN+	—	—	—	—	—	SCL SCK	—	ICSPDAT
RC1	9	8	AN5	—	C1IN1- C2IN1-	—	$\overline{CWGFLT}$	—	—	—	SDA SDI	INT	ICSPCLK
RC2	8	7	AN6	DACOUT1	C1IN2- C2IN2-	—	—	—	—	—	SDO(1)	—	—
RC3	7	6	AN7	DACOUT2	C1IN3- C2IN3-	—	—	—	—	PWM2(1)	$\overline{SS}$(1)	—	CLKR(2)
RC4	6	5	—	—	C1OUT C2OUT	—	CWG1B	—	TK CK	—	—	—	—
RC5	5	4	—	—	—	T0CKI	CWG1A	—	RX DT	PWM1	—	—	—
V_{DD}	1	16	—	—	—	—	—	—	—	—	—	—	V_{DD}
V_{SS}	14	13	—	—	—	—	—	—	—	—	—	—	V_{SS}
V_{USB3V3}	11	10	—	—	—	—	—	V_{USB3V3}	—	—	—	—	—

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.
3: LVP support for PIC18(L)F1XK50 legacy designs.

TABLE 3: 20-PIN ALLOCATION TABLE (PIC16(L)F1459)

I/O	20-Pin PDIP/SOIC/SSOP	20-Pin QFN	ADC	Reference	Comparator	Timer	CWG	USB	EUSART	PWM	MSSP	Interrupt	Basic
RA0	19	16	—	—	—	—	—	D+	—	—	—	IOC	ICSPDAT(3)
RA1	18	15	—	—	—	—	—	D-	—	—	—	IOC	ICSPCLK(3)
RA2	—	—	—	—	—	—	—	—	—	—	—	—	—
RA3	4	1	—	—	—	T1G(2)	—	—	—	—	$\overline{SS}$(2)	IOC	$\overline{MCLR}$ V_{PP}
RA4	3	20	AN3	—	—	SOSCO T1G(1)	—	—	—	—	—	IOC	OSC2 CLKOUT CLKR(1)
RA5	2	19	—	—	—	SOSCI T1CKI	—	—	—	—	—	IOC	OSC1 CLKIN
RB4	13	10	AN10	—	—	—	—	—	—	—	SDA SDI	IOC	—
RB5	12	9	AN11	—	—	—	—	—	RX DX	—	—	IOC	—
RB6	11	8	—	—	—	—	—	—	—	—	SCL SCK	IOC	—
RB7	10	7	—	—	—	—	—	—	TX CK	—	—	IOC	—
RC0	16	13	AN4	V_{REF+}	C1IN+ C2IN+	—	—	—	—	—	—	—	ICSPDAT
RC1	15	12	AN5	—	C1IN1- C2IN1-	—	$\overline{CWGFLT}$	—	—	—	—	INT	ICSPCLK
RC2	14	11	AN6	DACOUT1	C1IN2- C2IN2-	—	—	—	—	—	—	—	—
RC3	7	4	AN7	DACOUT2	C1IN3- C2IN3-	—	—	—	—	—	—	—	CLKR(2)
RC4	6	3	—	—	C1OUT C2OUT	—	CWG1B	—	—	—	—	—	—
RC5	5	2	—	—	—	T0CKI	CWG1A	—	—	PWM1	—	—	—
RC6	8	5	AN8	—	—	—	—	—	—	PWM2	$\overline{SS}$(1)	—	—
RC7	9	6	AN9	—	—	—	—	—	—	—	SDO	—	—
V_{DD}	1	18	—	—	—	—	—	—	—	—	—	—	V_{DD}
V_{SS}	20	17	—	—	—	—	—	—	—	—	—	—	V_{SS}
V_{USB3V3}	17	14	—	—	—	—	—	V_{USB3V3}	—	—	—	—	—

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.
3: LVP support for PIC18(L)F1XK50 legacy designs.

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