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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	32MHz
Connectivity	I²C, LINbus, SPI, UART/USART
Peripherals	Brown-out Detect/Reset, POR, PSMC, PWM, WDT
Number of I/O	24
Program Memory Size	3.5KB (2K x 14)
Program Memory Type	FLASH
EEPROM Size	256 x 8
RAM Size	256 x 8
Voltage - Supply (Vcc/Vdd)	2.3V ~ 5.5V
Data Converters	A/D 11x12b; D/A 1x8b
Oscillator Type	Internal
Operating Temperature	-40°C ~ 85°C (TA)
Mounting Type	Surface Mount
Package / Case	28-SSOP (0.209", 5.30mm Width)
Supplier Device Package	28-SSOP
Purchase URL	https://www.e-xfl.com/product-detail/microchip-technology/pic16f1782-i-ss

PIC16(L)F1782/1783

28-Pin 8-Bit Advanced Analog Flash Microcontroller Product Brief

High-Performance RISC CPU:

- Only 49 Instructions
- Operating Speed:
  - DC – 32 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

Extreme Low-Power (XLP) Management:

- Standby Current (PIC16LF1782/1783):
  - 50 nA @ 1.8V, typical
- Watchdog Timer Current (PIC16LF1782/1783):
  - 500 nA @ 1.8V, typical
- Timer1 (32.768 kHz Real-Time Clock) Oscillator Current (PIC16LF1782/1783):
  - 500 nA @ 1.8V, typical
- Operating Current (PIC16LF1782/1783):
  - 4 μA @ 32 kHz, 1.8V, typical
- Operating Current (PIC16LF1782/1783):
  - 150 μA @ 1 MHz, 1.8V, typical

Memory Features:

- Up to 4 KW Flash Program Memory:
  - Self-programmable under software control
  - Programmable code protection
  - Programmable write protection
- 256 Bytes of Data EEPROM
- Up to 512 Bytes of RAM

High-Performance PWM Controller:

- Two Programmable Switch Mode Controller (PSMC) modules:
  - Digital and/or analog feedback control of PWM frequency and pulse begin/end times
  - 16-bit Period, Duty Cycle and Phase
  - 16 ns clock resolution
  - Supports single PWM, complimentary, push-pull and three-phase modes of operation
  - Dead-band control with 8-bit counter
  - Auto-shutdown and restart
  - Leading and falling edge blanking
  - Burst mode

Analog Peripheral Features:

- Analog-to-Digital Converter (ADC):
  - Fully differential 12-bit converter
  - 100 ksps conversion rate
  - 11 single-ended channels
  - 5 differential channels
  - Positive and negative reference selection
- 8-bit Digital-to-Analog Converter (DAC):
  - Output available externally
  - Positive and negative reference selection
  - Internal connections to comparators, op amps, Fixed Voltage Reference (FVR) and ADC
- Three High-Speed Comparators:
  - 30 ns response time
  - Rail-to-rail inputs
  - Software selectable hysteresis
  - Internal connection to op amps, FVR and DAC
- Two Operational Amplifiers:
  - Rail-to-rail inputs/outputs
  - High/Low selectable Gain Bandwidth Product
  - Internal connection to DAC and FVR
- Fixed Voltage Reference (FVR):
  - 1.024V, 2.048V and 4.096V output levels
  - Internal connection to ADC, Comparators and DAC

Digital Peripheral Features:

- Timer0: 8-Bit Timer/Counter with 8-Bit Programmable Prescaler
- Enhanced Timer1:
  - 16-bit timer/counter with prescaler
  - External Gate Input mode
  - Dedicated low-power 32 kHz oscillator driver
- Timer2: 8-bit timer/counter with 8-bit period register, prescaler and postscaler
- Two Capture/Compare/PWM modules (CCP):
  - 16-bit Capture, maximum resolution 12.5 ns
  - 16-bit Compare, max resolution 31.25 ns
  - 10-bit PWM, max frequency 32 kHz
- Master Synchronous Serial Port (SSP) 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

Oscillator Features:

- Operate up to 32 MHz from Precision Internal Oscillator:
  - Factory calibrated to ±1%, typical
  - Software selectable frequency range from 32 MHz to 31 kHz
- 31 kHz Low-Power Internal Oscillator
- 32.768 kHz Timer1 Oscillator:
  - available as system clock
  - Low power RTC
- External Oscillator Block with:
  - 4 crystal/resonator modes up to 32 MHz using 4x PLL
  - 3 external clock modes up to 32 MHz
- 4x Phase-Locked Loop (PLL)
- Fail-Safe Clock Monitor:
  - Detect and recover from external oscillator failure
- Two-Speed Start-up:
  - Minimize latency between code execution and external oscillator start-up

I/O Features:

- Up to 24 I/O Pins and 1 Input-only Pin:
  - High current sink/source for LED drivers
  - Individually programmable interrupt-on-change pins
  - Individually programmable weak pull-ups
  - Individual input level selection
  - Slew rate control on selected output pins
  - Open drain outputs on selected output pins

General Microcontroller Features:

- Power-Saving Sleep mode
- Power-on Reset (POR)
- Power-up Timer (PWRT)
- Oscillator Start-up Timer (OST)
- Brown-out Reset (BOR) with Selectable Trip Point
- Extended Watchdog Timer (WDT)
- In-Circuit Serial Programming™ (ICSP™)
- In-Circuit Debug (ICD)
- Enhanced Low-Voltage Programming (LVP)
- Operating Voltage Range:
  - 1.8V to 3.6V (PIC16LF1782/1783)
  - 2.3V to 5.5V (PIC16F1782/1783)

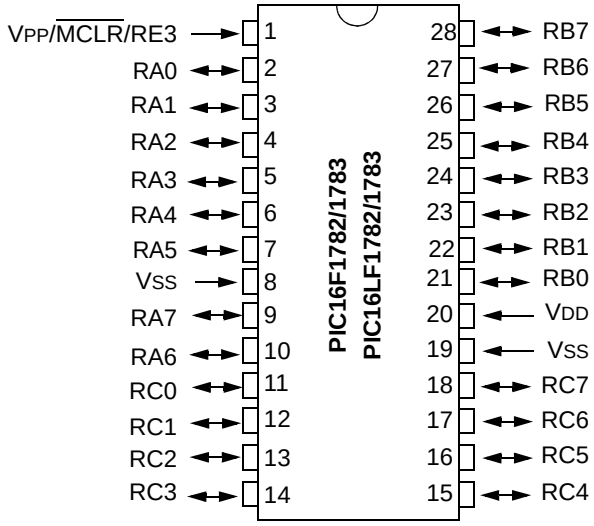
TABLE 1: PIC16(L)F1782/1783 FAMILY TYPES

Device	Program Memory Flash (words)	Data EEPROM (bytes)	SRAM (bytes)	I/Os	12-bit A/D (ch)	Comparators	Operational Amplifiers	8-bit DAC	Timers 8/16-bit	Programmable Switch Mode Controllers (PSMC)	CCP	EUSART	MSSP (I^2C™/SPI)
PIC16F1782	2048	256	256	25	11	3	2	1	2/1	2	2	1	1
PIC16LF1782	2048	256	256	25	11	3	2	1	2/1	2	2	1	1
PIC16F1783	4096	256	512	25	11	3	2	1	2/1	2	2	1	1
PIC16LF1783	4096	256	512	25	11	3	2	1	2/1	2	2	1	1

Note: Pin details are subject to change.

FIGURE 1: 28-PIN DIAGRAM FOR PIC16(L)F1782/1783

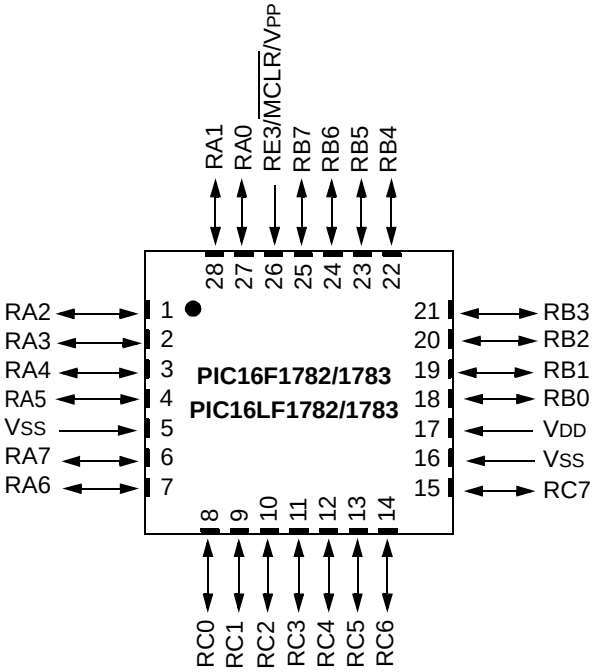
SPDIP, SOIC, SSOP



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

FIGURE 2: 28-PIN DIAGRAM FOR PIC16(L)F1782/1783

UQFN



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

TABLE 2: 28-PIN ALLOCATION TABLE (PIC16(L)F1782/1783)

I/O	28-Pin SPDIP, SOIC, SSOP	28-Pin QFN	ADC	Reference	Comparator	Operation Amplifiers	8-bit DAC	Timers	PSMC	CCP	EUSART	MSSP	Interrupt	Pull-up	Basic
RA0	2	27	AN0+ AN0-	—	C1IN0- C2IN0- C3IN0-	—	—	—	—	—	—	—	IOC	Y	—
RA1	3	28	AN1+ AN1-	—	C1IN1- C2IN1- C3IN1-	OPA1OUT	—	—	—	—	—	—	IOC	Y	—
RA2	4	1	AN2+ AN2-	VREF-	C1IN0+ C2IN0+ C3IN0+	—	DAC1OUT1 DAC1VREF-	—	—	—	—	—	IOC	Y	—
RA3	5	2	AN3+ AN3-	VREF+(1)	C1IN1+	—	DAC1VREF+	—	—	—	—	—	IOC	Y	—
RA4	6	3	—	—	C1OUT	OPA1IN+	—	T0CKI	—	—	—	—	IOC	Y	—
RA5	7	4	AN4+ AN4-	—	C2OUT(1)	OPA1IN-	—	—	—	—	—	$\overline{SS}$	IOC	Y	—
RA6	10	7	—	—	C2OUT(1)	—	—	—	—	—	—	—	IOC	Y	OSC2/ CLKOUT
RA7	9	6	—	VREF+(1)	—	—	—	—	PSMC1CLK PSMC2CLK	—	—	—	IOC	Y	OSC1/ CLKIN
RB0	21	18	AN12+ AN12-	—	C2IN1+	—	—	—	PSMC1IN PSMC2IN	CCP1(1)	—	—	INT/ IOC	Y	—
RB1	22	19	AN10+ AN10-	—	C1IN3- C2IN3- C3IN3-	OPA2OUT	—	—	—	—	—	—	IOC	Y	—
RB2	23	20	AN8+ AN8-	—	—	OPA2IN-	—	—	—	—	—	—	IOC	Y	CLKR
RB3	24	21	AN9+ AN9-	—	C1IN2- C2IN2- C3IN2-	OPA2IN+	—	—	—	CCP2(1)	—	—	IOC	Y	—
RB4	25	22	AN11+ AN11-	—	C3IN1+	—	—	—	—	—	—	—	IOC	Y	—
RB5	26	23	AN13+ AN13-	—	C3OUT	—	—	T1G	—	—	—	SDO(1)	IOC	Y	—
RB6	27	24	—	—	—	—	—	—	—	—	TX(1) CK(1)	SDI(1) SDA(1)	IOC	Y	ICSPCLK
RB7	28	25	—	—	—	—	DAC1OUT2	—	—	—	RX(1) DT(1)	SCK(1) SCL(1)	IOC	Y	ICSPDAT
RC0	11	8	—	—	—	—	—	T1OSO T1CKI	PSMC1A	—	—	—	IOC	Y	—
RC1	12	9	—	—	—	—	—	T1OSI	PSMC1B	CCP2(1)	—	—	IOC	Y	—
RC2	13	10	—	—	—	—	—	—	PSMC1C	CCP1(1)	—	—	IOC	Y	—
RC3	14	11	—	—	—	—	—	—	PSMC1D	—	—	SCK(1) SCL(1)	IOC	Y	—
RC4	15	12	—	—	—	—	—	—	PSMC1E	—	—	SDI(1) SDA(1)	IOC	Y	—
RC5	16	13	—	—	—	—	—	—	PSMC1F	—	—	SDO(1)	IOC	Y	—
RC6	17	14	—	—	—	—	—	—	PSMC2A	—	TX(1) CK(1)	—	IOC	Y	—
RC7	18	15	—	—	—	—	—	—	PSMC2B	—	RX(1) DT(1)	—	IOC	Y	—
RE3	1	26	—	—	—	—	—	—	—	—	—	—	IOC	Y	$\overline{MCLR}$/ VPP
VDD	20	17	—	—	—	—	—	—	—	—	—	—	—	—	VDD
VSS	8, 19	5, 16	—	—	—	—	—	—	—	—	—	—	—	—	VSS

Note 1: Pin functions can be assigned to one of two pin locations via software.

NOTES:

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