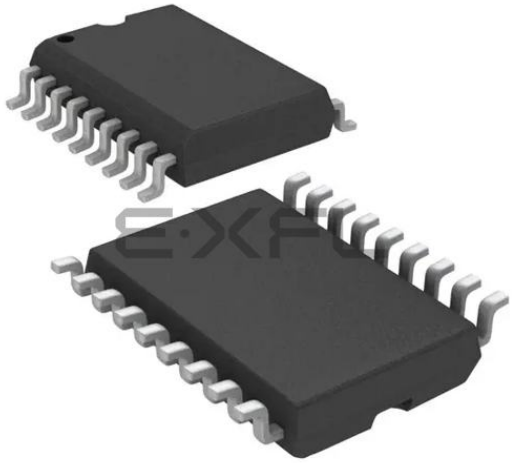

Welcome to E-XFL.COM

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	POR, WDT
Number of I/O	12
Program Memory Size	768B (512 x 12)
Program Memory Type	FLASH
EEPROM Size	-
RAM Size	25 x 8
Voltage - Supply (Vcc/Vdd)	2V ~ 5.5V
Data Converters	-
Oscillator Type	External
Operating Temperature	-40°C ~ 125°C (TA)
Mounting Type	Surface Mount
Package / Case	18-SOIC (0.295", 7.50mm Width)
Supplier Device Package	18-SOIC
Purchase URL	https://www.e-xfl.com/product-detail/microchip-technology/pic16f54t-e-so

1.0 GENERAL DESCRIPTION

The PIC16F5X from Microchip Technology is a family of low-cost, high-performance, 8-bit, fully static, Flash-based CMOS microcontrollers. It employs a RISC architecture with only 33 single-word/single-cycle instructions. All instructions are single cycle except for program branches which take two cycles. The PIC16F5X delivers performance an order of magnitude higher than its competitors in the same price category. The 12-bit wide instructions are highly symmetrical resulting in 2:1 code compression over other 8-bit microcontrollers in its class. The easy-to-use and easy-to-remember instruction set reduces development time significantly.

The PIC16F5X products are equipped with special features that reduce system cost and power requirements. The Power-on Reset (POR) and Device Reset Timer (DRT) eliminate the need for external Reset circuitry. There are four oscillator configurations to choose from, including the power-saving LP (Low Power) oscillator and cost saving RC oscillator. Power-saving Sleep mode, Watchdog Timer and code protection features improve system cost, power and reliability.

The PIC16F5X products are supported by a full-featured macro assembler, a software simulator, a low-cost development programmer and a full featured programmer. All the tools are supported on IBM PC and compatible machines.

1.1 Applications

The PIC16F5X series fits perfectly in applications ranging from high-speed automotive and appliance motor control to low-power remote transmitters/receivers, pointing devices and telecom processors. The Flash technology makes customizing application programs (transmitter codes, motor speeds, receiver frequencies, etc.) extremely fast and convenient. The small footprint packages, for through hole or surface mounting, make this microcontroller series perfect for applications with space limitations. Low-cost, low-power, high performance, ease of use and I/O flexibility make the PIC16F5X series very versatile, even in areas where no microcontroller use has been considered before (e.g., timer functions, replacement of “glue” logic in larger systems, co-processor applications).

TABLE 1-1: PIC16F5X FAMILY OF DEVICES

Features	PIC16F54	PIC16F57	PIC16F59
Maximum Operation Frequency	20 MHz	20 MHz	20 MHz
Flash Program Memory (x12 words)	512	2K	2K
RAM Data Memory (bytes)	25	72	134
Timer Module(s)	TMR0	TMR0	TMR0
I/O Pins	12	20	32
Number of Instructions	33	33	33
Packages	18-pin DIP, SOIC; 20-pin SSOP	28-pin DIP, SOIC; 28-pin SSOP	40-pin DIP, 44-pin TQFP

Note: All PIC® Family devices have Power-on Reset, selectable Watchdog Timer, selectable code-protect and high I/O current capability.

NOTES:

2.0 ARCHITECTURAL OVERVIEW

The high performance of the PIC16F5X family can be attributed to a number of architectural features commonly found in RISC microprocessors. To begin with, the PIC16F5X uses a Harvard architecture in which program and data are accessed on separate buses. This improves bandwidth over traditional von Neumann architecture where program and data are fetched on the same bus. Separating program and data memory further allows instructions to be sized differently than the 8-bit wide data word. Instruction opcodes are 12-bits wide, making it possible to have all single-word instructions. A 12-bit wide program memory access bus fetches a 12-bit instruction in a single cycle. A two-stage pipeline overlaps fetch and execution of instructions. Consequently, all instructions (33) execute in a single cycle except for program branches.

The PIC16F54 addresses 512 x 12 of program memory, the PIC16F57 and PIC16F59 addresses 2048 x 12 of program memory. All program memory is internal.

The PIC16F5X can directly or indirectly address its register files and data memory. All Special Function Registers (SFR), including the program counter, are mapped in the data memory. The PIC16F5X has a highly orthogonal (symmetrical) instruction set that makes it possible to carry out any operation on any register using any Addressing mode. This symmetrical nature and lack of ‘special optimal situations’ make programming with the PIC16F5X simple, yet efficient. In addition, the learning curve is reduced significantly.

The PIC16F5X device contains an 8-bit ALU and working register. The ALU is a general purpose arithmetic unit. It performs arithmetic and Boolean functions between data in the working register and any register file.

The ALU is 8-bits wide and capable of addition, subtraction, shift and logical operations. Unless otherwise mentioned, arithmetic operations are two's complement in nature. In two-operand instructions, typically one operand is the W (working) register. The other operand is either a file register or an immediate constant. In single operand instructions, the operand is either the W register or a file register.

The W register is an 8-bit working register used for ALU operations. It is not an addressable register.

Depending on the instruction executed, the ALU may affect the values of the Carry (C), Digit Carry (DC) and Zero (Z) bits in the STATUS Register. The C and DC bits operate as a borrow and digit borrow out bit, respectively, in subtraction. See the SUBWF and ADDWF instructions for examples.

A simplified block diagram is shown in Figure 2-1 with the corresponding device pins described in Table 2-1 (for PIC16F54), Table 2-2 (for PIC16F57) and Table 2-3 (for PIC16F59).

TABLE 2-1: PIC16F54 PINOUT DESCRIPTION

Name	Function	Input Type	Output Type	Description
RA0	RA0	TTL	CMOS	Bidirectional I/O pin
RA1	RA1	TTL	CMOS	Bidirectional I/O pin
RA2	RA2	TTL	CMOS	Bidirectional I/O pin
RA3	RA3	TTL	CMOS	Bidirectional I/O pin
RB0	RB0	TTL	CMOS	Bidirectional I/O pin
RB1	RB1	TTL	CMOS	Bidirectional I/O pin
RB2	RB2	TTL	CMOS	Bidirectional I/O pin
RB3	RB3	TTL	CMOS	Bidirectional I/O pin
RB4	RB4	TTL	CMOS	Bidirectional I/O pin
RB5	RB5	TTL	CMOS	Bidirectional I/O pin
RB6/ICSPCLK	RB6	TTL	CMOS	Bidirectional I/O pin
	ICSPCLK	ST	—	Serial Programming Clock
RB7/ICSPDAT	RB7	TTL	CMOS	Bidirectional I/O pin
	ICSPDAT	ST	CMOS	Serial Programming I/O
T0CKI	T0CKI	ST	—	Clock input to Timer0. Must be tied to VSS or VDD, if not in use, to reduce current consumption.
$\overline{MCLR}$/VPP	$\overline{MCLR}$	ST	—	Active-low Reset to device. Voltage on the $\overline{MCLR}$/VPP pin must not exceed VDD to avoid unintended entering of Programming mode.
	VPP	HV	—	Programming voltage input
OSC1/CLKIN	OSC1	XTAL	—	Oscillator crystal input
	CLKIN	ST	—	External clock source input
OSC2/CLKOUT	OSC2	—	XTAL	Oscillator crystal output. Connects to crystal or resonator in Crystal Oscillator mode.
	CLKOUT	—	CMOS	In RC mode, OSC2 pin can output CLKOUT, which has 1/4 the frequency of OSC1.
VDD	VDD	Power	—	Positive supply for logic and I/O pins
VSS	VSS	Power	—	Ground reference for logic and I/O pins

Legend: I = input, O = output, ST = Schmitt Trigger input, I/O = input/output, — = Not Used, TTL = TTL input, CMOS = CMOS output, XTAL = Crystal input/output, HV = High Voltage

TABLE 2-3: PIC16F59 PINOUT DESCRIPTION

Name	Function	Input Type	Output Type	Description
RA0	RA0	TTL	CMOS	Bidirectional I/O pin
RA1	RA1	TTL	CMOS	Bidirectional I/O pin
RA2	RA2	TTL	CMOS	Bidirectional I/O pin
RA3	RA3	TTL	CMOS	Bidirectional I/O pin
RB0	RB0	TTL	CMOS	Bidirectional I/O pin
RB1	RB1	TTL	CMOS	Bidirectional I/O pin
RB2	RB2	TTL	CMOS	Bidirectional I/O pin
RB3	RB3	TTL	CMOS	Bidirectional I/O pin
RB4	RB4	TTL	CMOS	Bidirectional I/O pin
RB5	RB5	TTL	CMOS	Bidirectional I/O pin
RB6/ICSPCLK	RB6	TTL	CMOS	Bidirectional I/O pin
	ICSPCLK	ST	—	Serial programming clock
RB7/ICSPDAT	RB7	TTL	CMOS	Bidirectional I/O pin
	ICSPDAT	ST	CMOS	Serial programming I/O
RC0	RC0	TTL	CMOS	Bidirectional I/O pin
RC1	RC1	TTL	CMOS	Bidirectional I/O pin
RC2	RC2	TTL	CMOS	Bidirectional I/O pin
RC3	RC3	TTL	CMOS	Bidirectional I/O pin
RC4	RC4	TTL	CMOS	Bidirectional I/O pin
RC5	RC5	TTL	CMOS	Bidirectional I/O pin
RC6	RC6	TTL	CMOS	Bidirectional I/O pin
RC7	RC7	TTL	CMOS	Bidirectional I/O pin
RD0	RD0	TTL	CMOS	Bidirectional I/O pin
RD1	RD1	TTL	CMOS	Bidirectional I/O pin
RD2	RD2	TTL	CMOS	Bidirectional I/O pin
RD3	RD3	TTL	CMOS	Bidirectional I/O pin
RD4	RD4	TTL	CMOS	Bidirectional I/O pin
RD5	RD5	TTL	CMOS	Bidirectional I/O pin
RD6	RD6	TTL	CMOS	Bidirectional I/O pin
RD7	RD7	TTL	CMOS	Bidirectional I/O pin
RE4	RE4	TTL	CMOS	Bidirectional I/O pin
RE5	RE5	TTL	CMOS	Bidirectional I/O pin
RE6	RE6	TTL	CMOS	Bidirectional I/O pin
RE7	RE7	TTL	CMOS	Bidirectional I/O pin
T0CKI	T0CKI	ST	—	Clock input to Timer0. Must be tied to VSS or VDD, if not in use, to reduce current consumption.
$\overline{MCLR}$/VPP	$\overline{MCLR}$	ST	—	Active-low Reset to device. Voltage on the $\overline{MCLR}$/VPP pin must not exceed VDD to avoid unintended entering of Programming mode.
	VPP	HV	—	Programming voltage input
OSC1/CLKIN	OSC1	XTAL	—	Oscillator crystal input
	CLKIN	ST	—	External clock source input
OSC2/CLKOUT	OSC2	—	XTAL	Oscillator crystal output. Connects to crystal or resonator in Crystal Oscillator mode.
	CLKOUT	—	CMOS	In RC mode, OSC2 pin outputs CLKOUT, which has 1/4 the frequency of OSC1.
VDD	VDD	Power	—	Positive supply for logic and I/O pins
VSS	VSS	Power	—	Ground reference for logic and I/O pins

Legend: I = input, O = output, ST = Schmitt Trigger input, I/O = input/output, — = Not Used, TTL = TTL input, CMOS = CMOS output, XTAL = Crystal input/output, HV = High Voltage