



# PIC16FR5X

## FlexROM™-Based 8-Bit CMOS Microcontroller Series

### Devices Included in this Data Sheet:

- PIC16FR54
- PIC16FR55
- PIC16FR56
- PIC16FR57

### High-Performance RISC CPU Features:

- Only 33 single word instructions to learn
- All instructions are single cycle (200 ns) except for program branches which are two-cycle
- Operating speed: DC - 20 MHz clock input  
DC - 200 ns instruction cycle

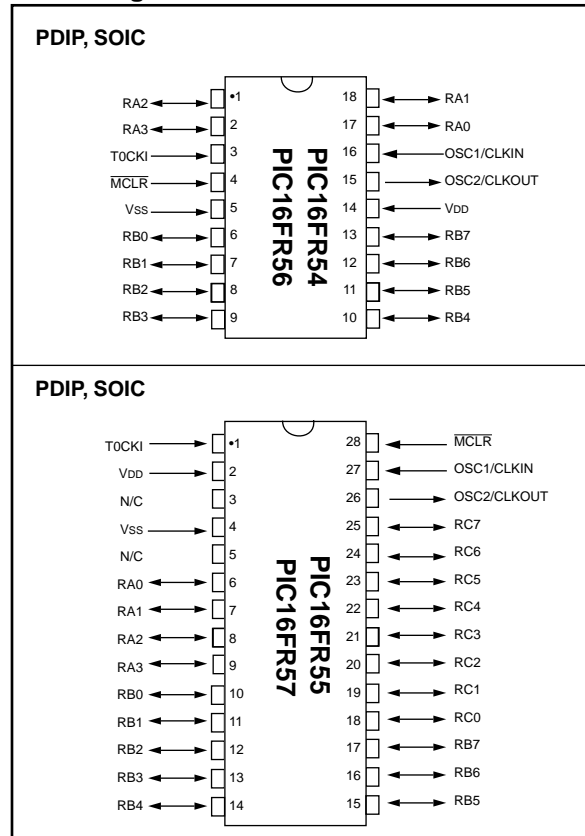
Device	Pins	I/O	FlexROM	RAM
PIC16FR54	18	12	512	25
PIC16FR55	28	20	512	24
PIC16FR56	18	12	1K	25
PIC16FR57	28	20	2K	72

- 12-bit wide instructions
- 8-bit wide data path
- Seven or eight special function hardware registers
- Two-level deep hardware stack
- Direct, indirect and relative addressing modes for data and instructions

### Peripheral Features:

- 8-bit real time clock/counter (Timer0) with 8-bit programmable prescaler
- Power-On Reset (POR)
- Device Reset Timer (DRT)
- Watchdog Timer (WDT) with its own on-chip RC oscillator for reliable operation
- Programmable code-protection
- Power saving SLEEP mode
- Selectable oscillator options:
  - RC: Low-cost RC oscillator
  - XT: Standard crystal/resonator
  - HS: High-speed crystal/resonator
  - LP: Power saving, low frequency crystal

### Pin Configurations

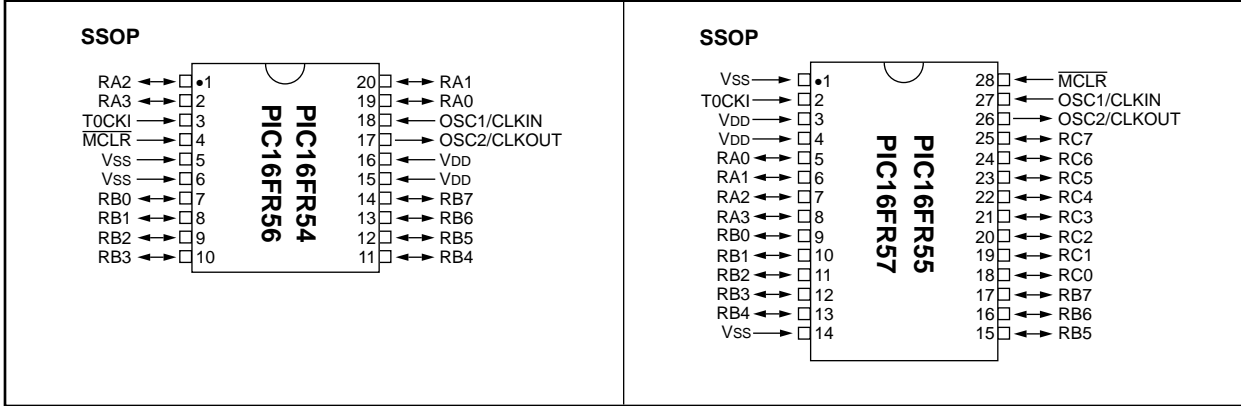


### CMOS Technology:

- Low-power, high-speed CMOS FlexROM technology
- Fully static design
- Wide-operating voltage range:
  - FlexROM Commercial/Industrial 2.5V to 6.25V
- Low-power consumption
  - < 2 mA typical @ 5.0V, 4 MHz
  - 15 µA typical @ 3.0V, 32 kHz
  - < 3 µA typical standby current (with WDT disabled) @ 3.0V, 0°C to 70°C

# PIC16FR5X

## Pin Diagrams (con't)



## 1.0 GENERAL DESCRIPTION

The PIC16FR5X from Microchip Technology is a family of low-cost, high performance, 8-bit, fully static, *FlexROM*-based CMOS microcontrollers. This family is pin and software compatible with the Enhanced PIC16FR5X family of devices. It employs a RISC architecture with only 33 single word/single cycle instructions. All instructions are single cycle (200 ns) except for program branches which take two cycles. The PIC16FR5X 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 PIC16FR5X 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 PIC16FR5X products are supported by a full-featured macro assembler, a software simulator, an in-circuit emulator, a 'C' compiler, fuzzy logic support tools, a low-cost development programmer, and a full featured programmer. All the tools are supported on IBM PC-AT<sup>®</sup> and compatible machines.

## 1.1 Applications

The PIC16FR5X 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 *FlexROM* 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 PIC16FR5X 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, coprocessor applications).

# PIC16FR5X

TABLE 1-1: PIC16FR5X FAMILY OF DEVICES

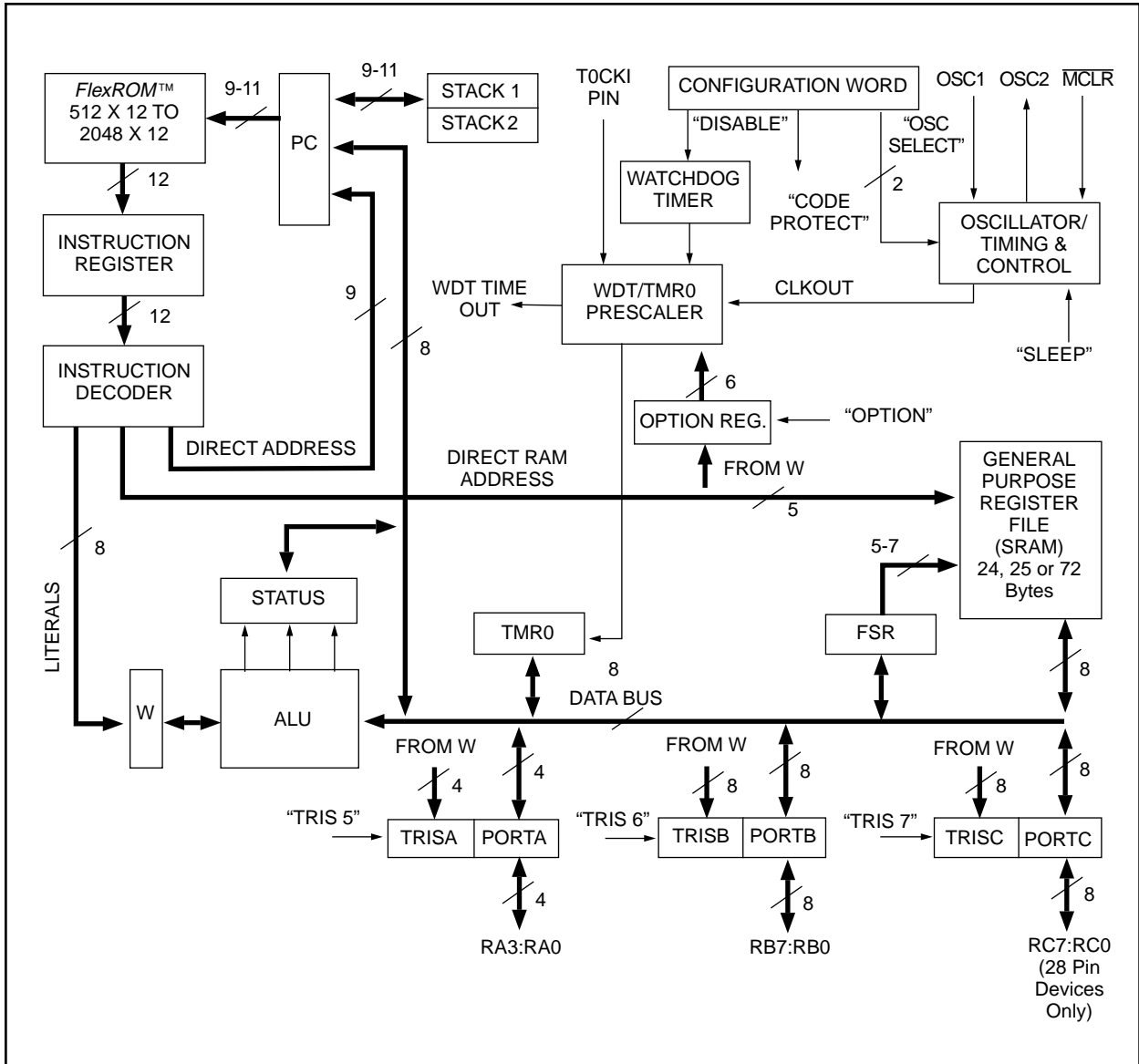
	Clock		Memory		Peripherals		Features	
	Maximum Frequency of Operation (MHz)	FlexROM Program Memory (words)	RAM Data Memory (bytes)	Timer Modules	I/O Pins	Voltage Range (Volts)	Number of Instructions	Packages
PIC16FR54	20	512	25	TMR0	12	2.5-6.25	33	18-pin DIP, SOIC; 20-pin SSOP
PIC16FR54A	20	512	25	TMR0	12	2.5-6.25	33	18-pin DIP, SOIC; 20-pin SSOP
PIC16FR55	20	512	24	TMR0	20	2.5-6.25	33	28-pin DIP, SOIC, SSOP
PIC16FR56	20	1K	25	TMR0	12	2.5-6.25	33	18-pin DIP, SOIC; 20-pin SSOP
PIC16FR57	20	2K	72	TMR0	20	2.5-6.25	33	28-pin DIP, SOIC, SSOP
PIC16FR58A	20	2K	73	TMR0	12	2.5-6.25	33	18-pin DIP, SOIC; 20-pin SSOP

All PIC16/17 Family devices have Power-On Reset, selectable Watchdog Timer, selectable code protect and high I/O current capability.

## 2.0 ARCHITECTURAL OVERVIEW

This section provides information on the architecture of the PIC16FR5X. For information on operation of the peripherals, electrical specifications, etc., please refer to the PIC16C5X data sheet.

**FIGURE 2-1: PIC16FR5X SERIES BLOCK DIAGRAM**



# PIC16FR5X

**TABLE 2-1: PIC16FR54/FR56 PINOUT DESCRIPTION**

Name	DIP, SOIC No.	SSOP No.	I/O/P Type	Input Levels	Description
RA0 RA1 RA2 RA3	17 18 1 2	19 20 1 2	I/O I/O I/O I/O	TTL TTL TTL TTL	Bi-directional I/O port
RB0 RB1 RB2 RB3 RB4 RB5 RB6 RB7	6 7 8 9 10 11 12 13	7 8 9 10 11 12 13 14	I/O I/O I/O I/O I/O I/O I/O	TTL TTL TTL TTL TTL TTL TTL	Bi-directional I/O port
T0CKI	3	3	I	ST	Clock input to Timer0. Must be tied to Vss or VDD, if not in use, to reduce current consumption.
MCLR	4	4	I	ST	Master clear (reset) input. This pin is an active low reset to the device.
OSC1/CLKIN	16	18	I	ST	Oscillator crystal input/external clock source input.
OSC2/CLKOUT	15	17	O	—	Oscillator crystal output. Connects to crystal or resonator in crystal oscillator mode. In RC mode, OSC2 pin outputs CLKOUT which has 1/4 the frequency of OSC1, and denotes the instruction cycle rate.
VDD	14	15,16	P	—	Positive supply for logic and I/O pins.
Vss	5	5,6	P	—	Ground reference for logic and I/O pins.

Legend: I = input, O = output, I/O = input/output,  
 P = power, — = Not Used,  
 TTL = TTL input, ST = Schmitt Trigger input

**TABLE 2-2: PIC16FR55/FR57 PINOUT DESCRIPTION**

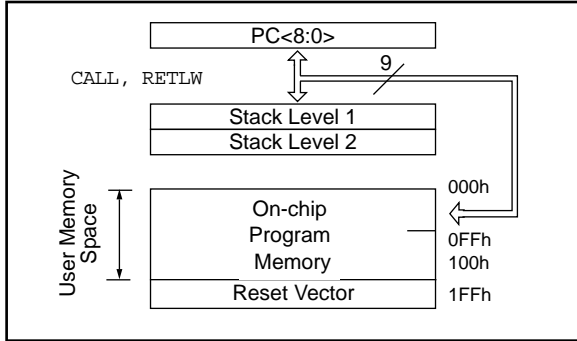
Name	DIP, SOIC No.	SSOP No.	I/O/P Type	Input Levels	Description
RA0 RA1 RA2 RA3	6 7 8 9	5 6 7 8	I/O I/O I/O I/O	TTL TTL TTL TTL	Bi-directional I/O port
RB0 RB1 RB2 RB3 RB4 RB5 RB6 RB7	10 11 12 13 14 15 16 17	9 10 11 12 13 15 16 17	I/O I/O I/O I/O I/O I/O I/O	TTL TTL TTL TTL TTL TTL TTL	Bi-directional I/O port
RC0 RC1 RC2 RC3 RC4 RC5 RC6 RC7	18 19 20 21 22 23 24 25	18 19 20 21 22 23 24 25	I/O I/O I/O I/O I/O I/O I/O	TTL TTL TTL TTL TTL TTL TTL	Bi-directional I/O port
TOCKI	1	2	I	ST	Clock input to Timer0. Must be tied to Vss or VDD, if not in use, to reduce current consumption.
$\overline{\text{MCLR}}$	28	28	I	ST	Master clear (reset) input. This pin is an active low reset to the device.
OSC1/CLKIN	27	27	I	ST	Oscillator crystal input/external clock source input.
OSC2/CLKOUT	26	26	O	—	Oscillator crystal output. Connects to crystal or resonator in crystal oscillator mode. In RC mode, OSC2 pin outputs CLKOUT which has 1/4 the frequency of OSC1, and denotes the instruction cycle rate.
VDD	2	3,4	P	—	Positive supply for logic and I/O pins.
VSS	4	1,14	P	—	Ground reference for logic and I/O pins.
N/C	3,5	—	—	—	Unused, do not connect

Legend: I = input, O = output, I/O = input/output,  
P = power, — = Not Used, TTL = TTL input,  
ST = Schmitt Trigger input

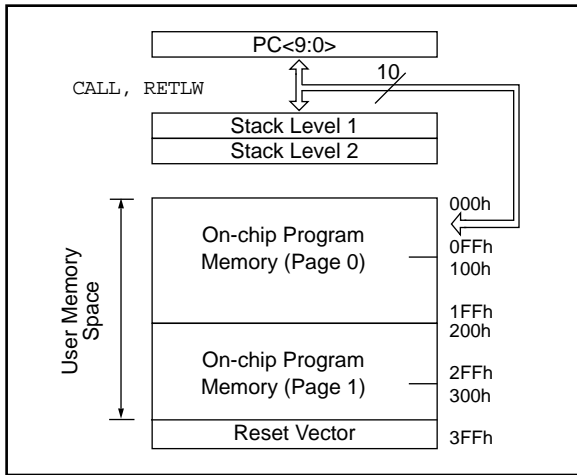
# PIC16FR5X

## 3.0 MEMORY ORGANIZATION

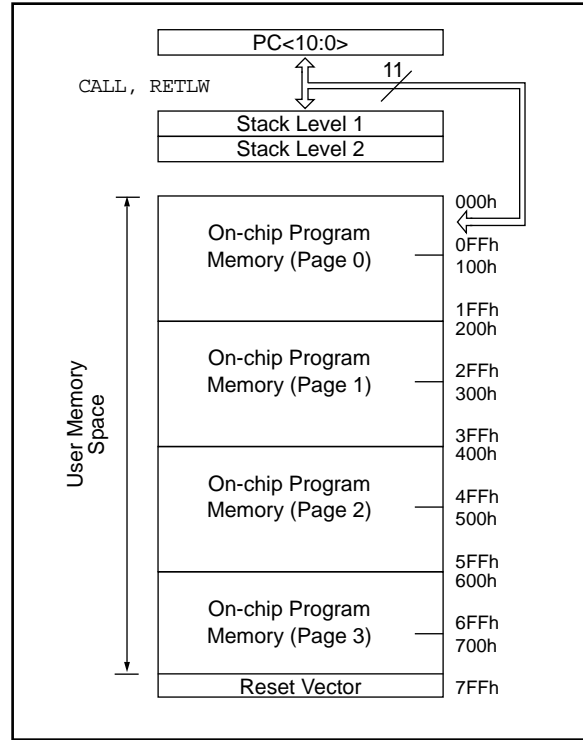
**FIGURE 3-1: PIC16FR54/FR55 PROGRAM MEMORY MAP AND STACK**



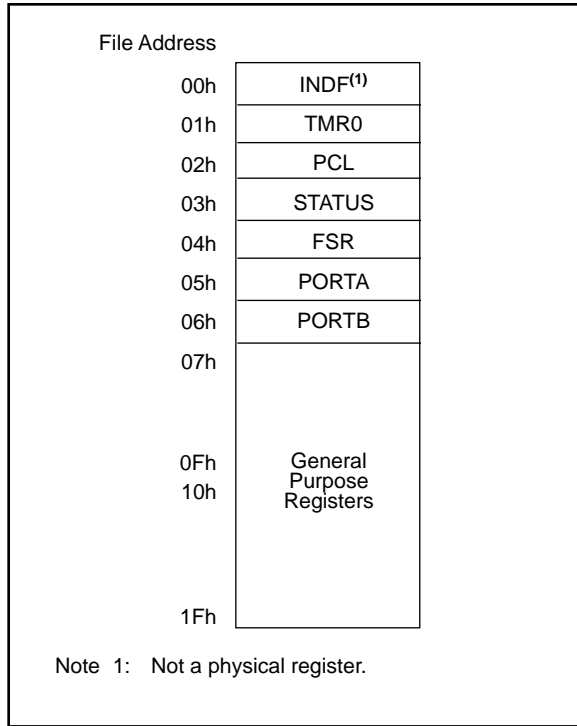
**FIGURE 3-2: PIC16FR56 PROGRAM MEMORY MAP AND STACK**



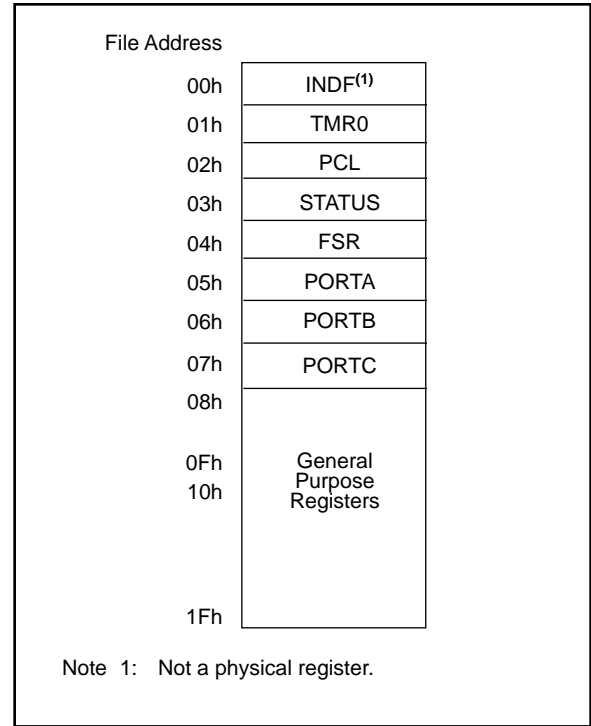
**FIGURE 3-3: PIC16FR57 PROGRAM MEMORY MAP AND STACK**



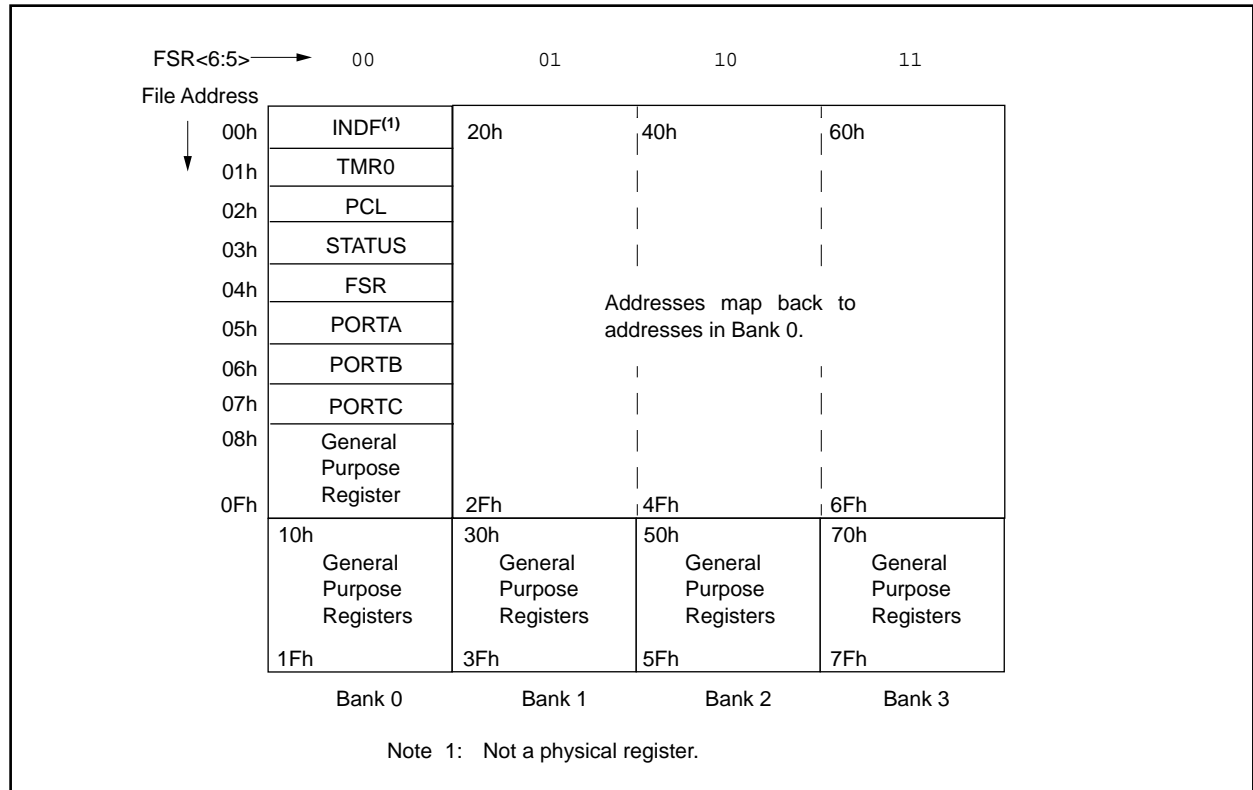
**FIGURE 3-4: PIC16FR54/FR56 REGISTER FILE MAP**



**FIGURE 3-5: PIC16FR55 REGISTER FILE MAP**



**FIGURE 3-6: PIC16FR57 REGISTER FILE MAP**



# PIC16FR5X

**TABLE 3-1: SPECIAL FUNCTION REGISTER SUMMARY**

Address	Name	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	Value on Power-On Reset	Value on MCLR and WDT Reset
N/A	TRIS	I/O control registers (TRISA, TRISB, TRISC)								1111 1111	1111 1111
N/A	OPTION	Contains control bits to configure Timer0 and Timer0/WDT prescaler								--11 1111	--11 1111
00h	INDF	Uses contents of FSR to address data memory (not a physical register)								xxxx xxxx	uuuu uuuu
01h	TMR0	8-bit real-time clock/counter								xxxx xxxx	uuuu uuuu
02h <sup>(1)</sup>	PCL	Low order 8 bits of PC								1111 1111	1111 1111
03h	STATUS	PA2	PA1	PA0	$\overline{TO}$	$\overline{PD}$	Z	DC	C	0001 1xxx	000q quuu
04h	FSR	Indirect data memory address pointer								1xxx xxxx	1uuu uuuu
05h	PORTA	—	—	—	—	RA3	RA2	RA1	RA0	---- xxxx	---- uuuu
06h	PORTB	RB7	RB6	RB5	RB4	RB3	RB2	RB1	RB0	xxxx xxxx	uuuu uuuu
07h <sup>(2)</sup>	PORTC	RC7	RC6	RC5	RC4	RC3	RC2	RC1	RC0	xxxx xxxx	uuuu uuuu

Legend: Shaded boxes = unimplemented or unused, — = unimplemented, read as '0' (if applicable)  
 x = unknown, u = unchanged, q = value depends on condition.

Note 1: The upper byte of the Program Counter is not directly accessible. See Section 4.5 of the PIC16C5X data sheet (DS30015M) for an explanation of how to access these bits.

2: File address 07h is a general purpose register on the PIC16FR54/FR56.

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For voice information (or calling from overseas), you may call (614) 723-1550 for your local CompuServe number.

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Device: **PIC16FR5X**

Literature Number: **DS40141A**

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## PIC16FR54/55/56/57 PRODUCT IDENTIFICATION SYSTEM

To order or obtain information (e.g., on pricing or delivery) refer to the factory or the listed sales office.

<u>PART NO.</u>	<u>-XX</u>	<u>X</u>	<u>/XX</u>	<u>XXX</u>
Device	Oscillator Type	Temperature Range	Package	Pattern
<b>Device</b>	PIC16FR54, PIC16FR54T <sup>(2)</sup> PIC16FR55, PIC16FR55T <sup>(2)</sup> PIC16FR56, PIC16FR56T <sup>(2)</sup> PIC16FR57, PIC16FR57T <sup>(2)</sup>			
<b>Oscillator Type</b>	RC = Resistor Capacitor LP = Low Power Crystal XT = Standard Crystal/Resonator HS = High Speed Crystal 10 = 10 MHz Crystal			
<b>Temperature Range</b>	b <sup>(1)</sup> = 0°C to +70°C (Commercial) I = -40°C to +85°C (Industrial)			
<b>Package</b>	P = PDIP SO = SOIC (Gull Wing, 300 mil body) SP = Skinny PDIP (28 pin, 300 mil body) SS = SSOP (209 mil body)			
<b>Pattern</b>	3-digit Pattern Code for <i>FlexROM</i> (blank otherwise)			

**Examples:**

a) PIC16FR54 - XT/P123 = "XT" oscillator, commercial temp., PDIP, pattern #123.

b) PIC16FR55 - XT/SO456 = "XT" oscillator, industrial temp., SOIC, pattern #456.

Note 1: b = blank  
2: T = in tape and reel - SOIC, SSOP packages only.

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Products supported by a preliminary Data Sheet may possibly have an errata sheet describing minor operational differences and recommended workarounds. To determine if an errata sheet exists for a particular device, please contact one of the following:

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Please specify which device, revision of silicon and Data Sheet (include Literature #) you are using.

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Microchip Technology  
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