

1. General Description

This EPROM-Based 8-bit micro-controller uses a fully static CMOS technology process to achieve higher speed and smaller size with the low power consumption and high noise immunity. On chip memory includes 1K words of ROM, and 41 bytes of static RAM.

2. Features

The followings are some of the features on the hardware and software :

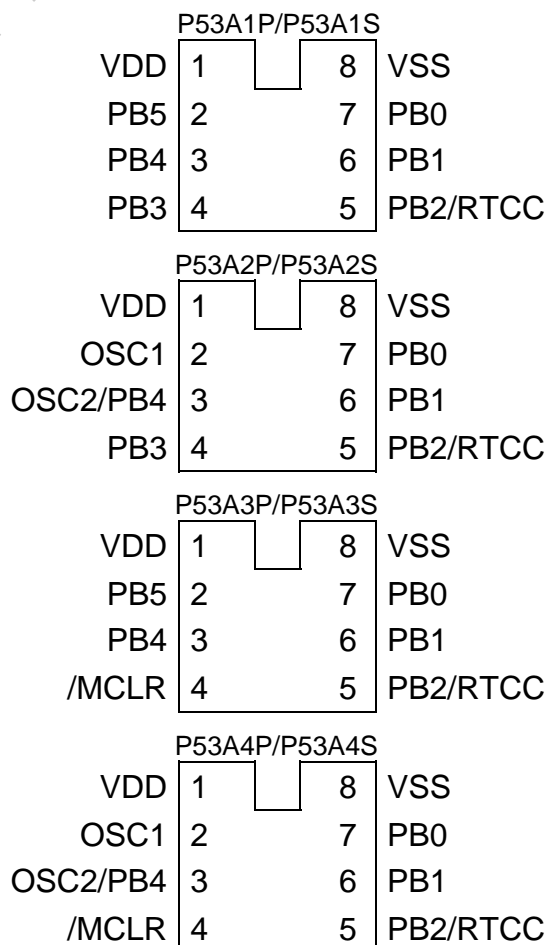
- ◆ Fully COMS static design
- ◆ 8-bit data bus
- ◆ On chip EPROM size : 1 K words
- ◆ Internal RAM size : 47 bytes
(41 general purpose registers, 6 special registers)
- ◆ 36 single word instructions
- ◆ 14-bit instructions
- ◆ 2-level stacks
- ◆ Operating voltage : 2.5 V ~ 5.0 V
- ◆ Operating frequency : 0 ~ 20 MHz
- ◆ The most fast execution time is 200 ns under 20 MHz in all single cycle instructions except the branch instruction
- ◆ Addressing modes include direct, indirect and relative addressing modes
- ◆ Power-on Reset
- ◆ Sleep Mode for power saving
- ◆ 5 types of oscillator can be selected by programming option:
INTRC – Internal 4 MHz RC oscillator
RC – Low cost RC oscillator
LFXT – Low frequency crystal oscillator
XTAL – Standard crystal oscillator
HFXT – High frequency crystal oscillator

- ◆ 3 oscillator start-up time can be selected by programming option:
20 ms, 40 ms, 80 ms
- ◆ 8-bit real time clock/counter(RTCC) with 8-bit programmable prescaler
- ◆ On-chip RC oscillator based Watchdog Timer(WDT)
- ◆ Wake-up from sleep on pin change

3. Applications

The application areas of this P53(D) range from appliance motor control and high speed automotive to low power remote transmitters/receivers, small instruments, chargers, toy, automobile and PC peripheral ... etc.

4. Pin Assignment



5. Pin Function Description

Pin Name	I/O	Function Description
PB0,PB1,PB3~PB5	I/O	Port B, TTL input level, PB3 input only.
RTCC/PB2	I/O	Real Time Clock/Counter, Schmitt Trigger input levels.
/MCLR	I	Master Clear, Schmitt Trigger input levels.
OSC1	I	Oscillator Input
OSC2	O	Oscillator Output
V _{dd}		Power supply
V _{ss}		Ground

6. Memory Map

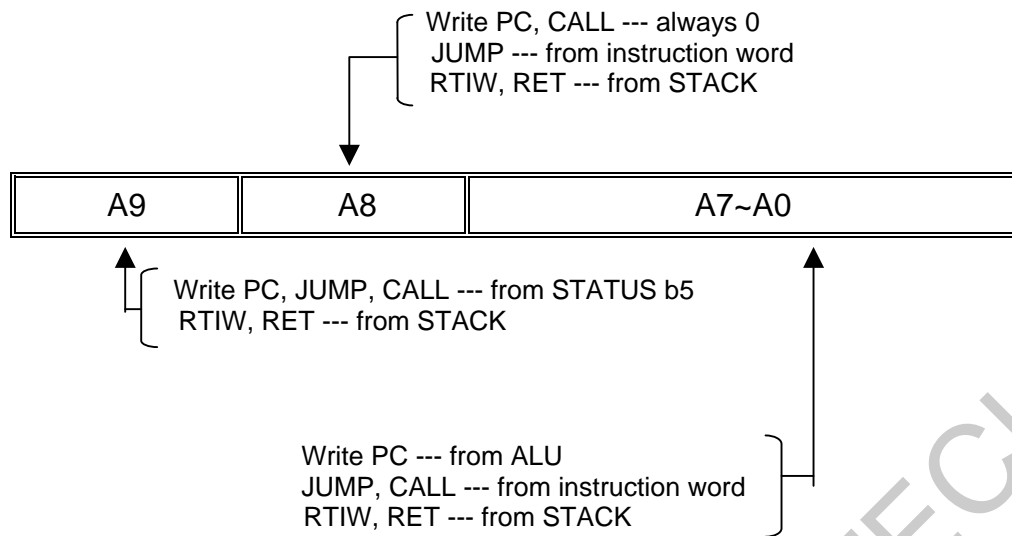
(A) Register Map

Address	Description
BANK0	
00	Indirect Addressing Register
01	RTCC
02	PC
03	STATUS
04	MSR
06	Port B
07~1F	General purpose registers
BANK1	
30~3F	General purpose registers

(1) IAR (Indirect Address Register) : R0

(2) RTCC (Real Time Counter/Counter Register) : R1

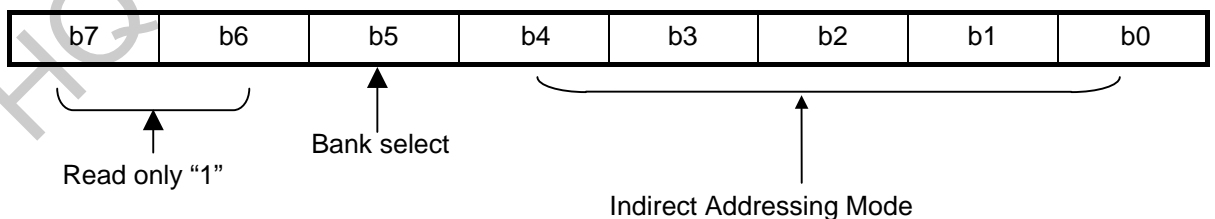
(3) PC (Program Counter) : R2



(4) STATUS (Status register) : R3

Bit	Symbol	Function
0	C	Carry bit
1	HC	Half Carry bit
2	Z	Zero bit
3	PF	Power down bit
4	TF	WDT Timer overflow Flag bit
5	PAGE	ROM page select bit
6	---	Unimplemented
7	PCWUF	Pin change wake up from sleep

(5) MSR (Memory Bank Select Register) : R4



(6) PORT B : R6

PB5~PB0, I/O Register, PB3 input only.

(7) TMR (Time Mode Register)

Bit	Symbol	Function		
2—0	PS2—0	Prescaler Value	RTCC rate	WDT rate
		0 0 0	1 : 2	1 : 1
		0 0 1	1 : 4	1 : 2
		0 1 0	1 : 8	1 : 4
		0 1 1	1 : 16	1 : 8
		1 0 0	1 : 32	1 : 16
		1 0 1	1 : 64	1 : 32
		1 1 0	1 : 128	1 : 64
1 1 1	1 : 256	1 : 128		
3	PSC	Prescaler assignment bit : 0 — RTCC 1 — Watchdog Timer		
4	TCE	RTCC signal Edge : 0 — Increment on low-to-high transition on RTCC pin 1 — Increment on high-to-low transition on RTCC pin		
5	TCS	RTCC signal set : 0 — Internal instruction cycle clock 1 — Transition on RTCC pin		
6	PBPHB	PortB pull-high : 0 — Enable 1 — Disable		
7	PBWUB	PortB wake-up : 0 — Enable 1 — Disable		

(8) CPIO B (Control Port I/O Mode Register)

The CPIO register is “write-only”
=“0”, I/O pin in output mode;
=“1”, I/O pin in input mode.

(9) Configurable options for EPROM (Set by writer) :

Oscillator Type	Oscillator Start-up Time
INTRC Oscillator	20ms,40ms,80ms
RC Oscillator	20ms,40ms,80ms
HFXT Oscillator	20ms,40ms,80ms
XTAL Oscillator	20ms,40ms,80ms
LFXT Oscillator	20ms,40ms,80ms

Watchdog Timer control
Watchdog timer disable all the time
Watchdog timer enable all the time

Power-edge Detect
PED Disable
PED Enable

Security state
Security Disable
Security Enable

(B) Program Memory

Address	Description
000-3FF	Program memory
000	The starting address of power on, external reset or WDT time-out reset.

8. Reset Condition for all Registers

Register	Address	Power-On Reset	/MCLR Reset	WDT Reset
IAR	00h	xxxx xxxx	uuuu uuuu	uuuu uuuu
RTCC	01h	xxxx xxxx	uuuu uuuu	uuuu uuuu
PC	02h	0000 0000	0000 0000	0000 0000
STATUS	03h	0001 1xxx	#00# #uuu	#00# #uuu
MSR	04h	111x xxxx	110u uuuu	11uu uuuu
PORT B	06h	--xx xxxx	--uu uuuu	--uu uuuu

Note : u=unchanged, x=unknown, - =unimplemented, read as "0"

#= value depends on the condition of the following table

Condition	Status: bit 7	Status: bit 4	Status: bit 3
/MCLR reset (not during SLEEP)	0	u	u
/MCLR reset during SLEEP	0	1	0
WDT reset (not during SLEEP)	0	0	1
WDT reset during SLEEP	0	0	0
Wake-up from SLEEP on pin change	1	1	0

9. Oscillator start up timer condition :

Oscillator Type	Porwer-on reset	Subsequent resets
INTRC,RC	20ms,40ms,80ms	300us
HF,XT,LF	20ms,40ms,80ms	20ms,40ms,80ms

10. Electrical Characteristics

*Note: Temperature=25°C

1.Operation Current :

(1) HF (C=10p) , WDT - enable

	4M	10M	20M	Sleep	Sleep , WDT-disable
2.5V	240uA	450uA	900uA	3uA	1uA
3.0V	290uA	580uA	1.2mA	8uA	1uA
4.0V	500uA	950uA	1.9mA	16uA	1uA
5.0V	900uA	1.6mA	2.8mA	30uA	1uA

These parameters are for reference only.

(2) XT (C=10p) , WDT - enable

	1M	4M	10M	Sleep	Sleep , WDT-disable
2.5V	100uA	180uA	350uA	3uA	1uA
3.0V	150uA	300uA	600uA	8uA	1uA
4.0V	300uA	500uA	900uA	16uA	1uA
5.0V	500uA	800uA	1.2mA	30uA	1uA

These parameters are for reference only.

(3) LF (C=20p) , WDT - enable

	32K(C=50p)	455K	1M	Sleep	Sleep , WDT-disable
2.5V	20uA	N/A	80uA	3uA	1uA
3.0V	30uA	100uA	120uA	8uA	1uA
4.0V	70uA	160uA	200uA	16uA	1uA
5.0V	140uA	260uA	300uA	30uA	1uA

These parameters are for reference only.

(4) RC , WDT – enable ; @Vdd = 5.0V

C(f)	R(Ohm)	Freq.	Current	Sleep , WDT-disable
3p	4.7k	11.7M	1.6mA	1uA
	10k	5.6M	1mA	1uA
	47k	1.3M	360uA	1uA
	100k	576K	260uA	1uA
	300k	200K	200uA	1uA
	470k	110K	200uA	1uA
20p	4.7k	5.8M	900uA	1uA
	10k	2.9M	560uA	1uA
	47k	630K	270uA	1uA
	100k	300K	230uA	1uA
	300k	102K	200uA	1uA
	470k	60K	200uA	1uA
100p	4.7k	2.1M	450uA	1uA
	10k	1M	310uA	1uA
	47k	228K	150uA	1uA
	100k	110K	230uA	1uA
	300k	38K	200uA	1uA
	470k	22K	200uA	1uA
300p	4.7k	862K	290uA	1uA
	10k	423K	240uA	1uA
	47k	92K	200uA	1uA
	100k	43K	200uA	1uA
	300k	15K	200uA	1uA
	470k	9K	200uA	1uA

These parameters are for reference only.

(5) RC , WDT – enable ; @Vdd = 3.0V

C(f)	R(Ohm)	Freq.	Current	Sleep , WDT-disable
3p	4.7k	11.6M	760uA	1uA
	10k	6.2M	460uA	1uA
	47k	1.5M	150uA	1uA
	100k	708K	100uA	1uA
	300k	245K	100uA	1uA
	470k	138K	100uA	1uA
20p	4.7k	6.5M	400uA	1uA
	10k	3.4M	230uA	1uA

	47k	792K	100uA	1uA
	100k	374K	100uA	1uA
	300k	128K	100uA	1uA
	470k	78K	100uA	1uA
100p	4.7k	2.7M	190uA	1uA
	10k	1.4M	110uA	1uA
	47k	348K	100uA	1uA
	100k	178K	100uA	1uA
	300k	52K	100uA	1uA
	470k	32K	100uA	1uA
300p	4.7k	1.3M	110uA	1uA
	10k	680K	100uA	1uA
	47k	170K	100uA	1uA
	100k	63K	100uA	1uA
	300k	24K	100uA	1uA
	470k	16K	100uA	1uA

These parameters are for reference only.

(6) INRC 4MHz

	Current
2.5V	360uA
3.0V	480uA
4.0V	640uA
5.0V	800uA

These parameters are for reference only.

(7) WDT current

	SLEEP
2.5V	3uA
3.0V	8uA
4.0V	16uA
5.0V	30uA

These parameters are for reference only.

2. Supply Voltage

	Min	Max
Vdd	2.5V	5.0V

These parameters are for reference only.

3. Input Voltage (Vdd = 5V)

	Port	Min	Max
Vil	TTL	Vss	1.0V
	Schmitt trigger	Vss	0.6V
Vih	TTL	2.2V	Vdd
	Schmitt trigger	4.0V	Vdd

These parameters are for reference only.

Input Voltage (Vdd = 3V)

	Port	Min	Max
Vil	TTL	Vss	0.6V
	Schmitt trigger	Vss	0.5V
Vih	TTL	1.7V	Vdd
	Schmitt trigger	2.3V	Vdd

These parameters are for reference only.

4. Output Voltage (Vdd = 5V)

	PB	Condition
Voh	3.5V	Ioh = -20mA
Vol	0.8V	Iol = 20mA
Voh	4.2V	Ioh = -5mA
Vol	0.6V	Iol = 5mA

These parameters are for reference only.

Output Voltage (Vdd = 3V)

	PB	Condition
Voh	1.7V	Ioh = -10mA
Vol	0.9V	Iol = 20mA
Voh	2.1V	Ioh = -5mA
Vol	0.6V	Iol = 5mA

These parameters are for reference only.

5. Subsequent reset time

	Int/Ext RC	LF
5.0V	300us	18ms

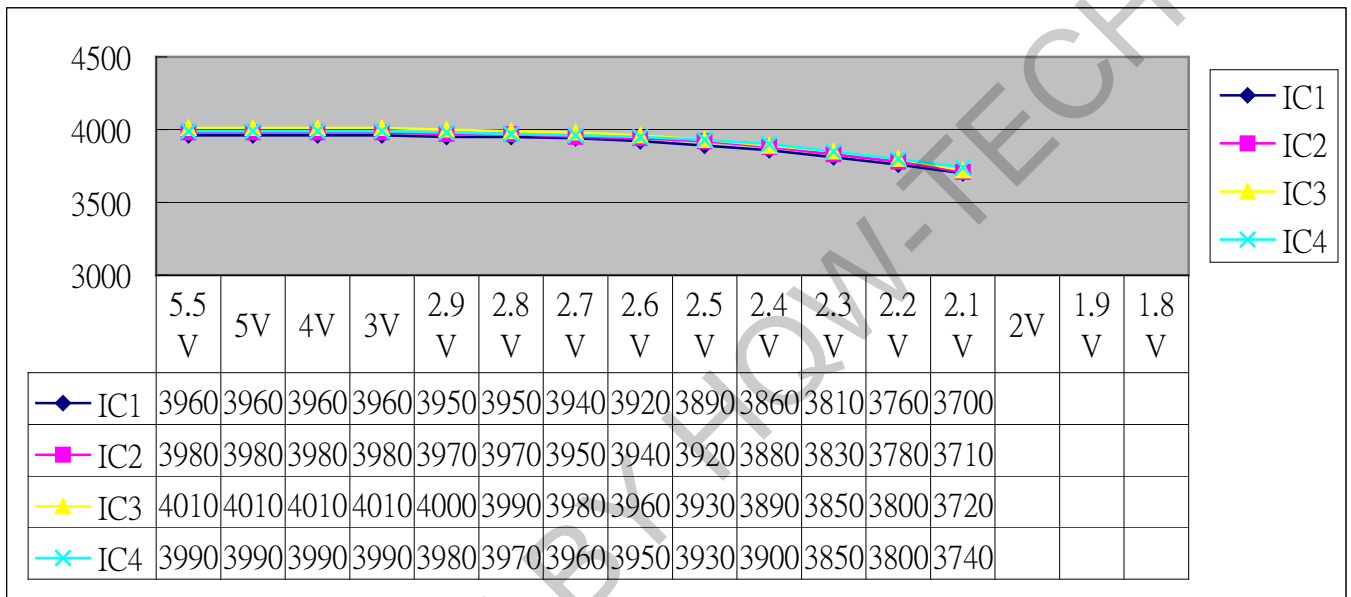
These parameters are for reference only.

6. The basic WDT time-out cycle time

	Time
2.5V	24ms
3.0V	21ms
4.0V	19ms
5.0V	18ms

These parameters are for reference only.

7. Voltage & Internal RC



These parameters are for reference only.

8. Pull high resistor

Vdd	5V	3V
PB0, PB1	20K Ohm	40K Ohm
PB3/MCLR/B	280K Ohm	700K Ohm

These parameters are for reference only.



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