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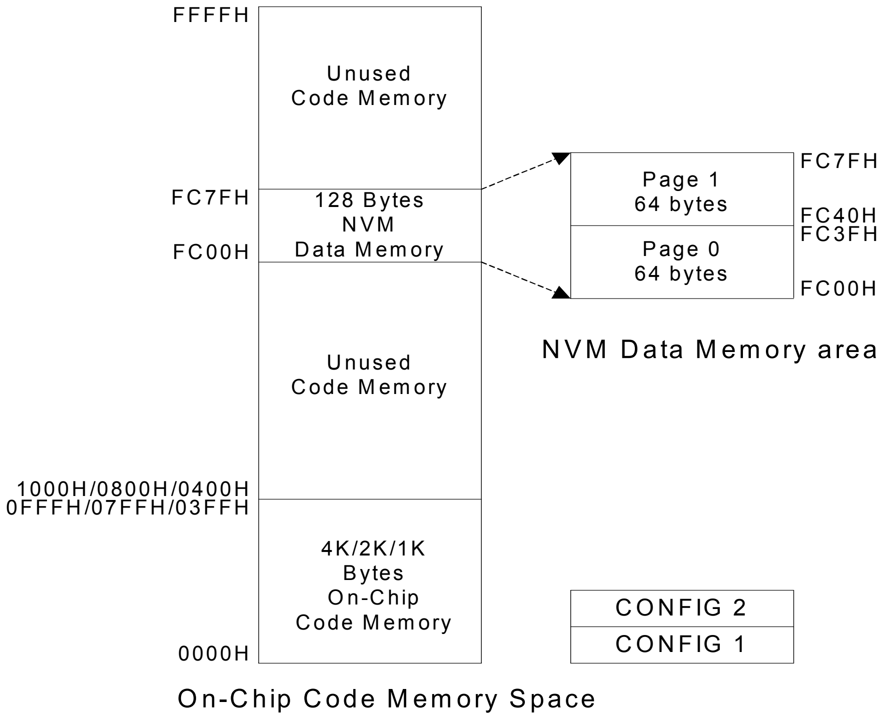
Applications of "Embedded - Microcontrollers"

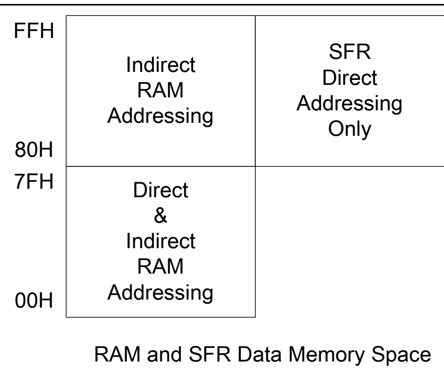
Details	
Product Status	Obsolete
Core Processor	8051
Core Size	8-Bit
Speed	20MHz
Connectivity	I²C, UART/USART
Peripherals	Brown-out Detect/Reset, LED, LVD, POR, PWM, WDT
Number of I/O	18
Program Memory Size	2KB (2K x 8)
Program Memory Type	FLASH
EEPROM Size	-
RAM Size	128 x 8
Voltage - Supply (Vcc/Vdd)	2.7V ~ 5.5V
Data Converters	A/D 4x10b
Oscillator Type	Internal
Operating Temperature	-40°C ~ 85°C (TA)
Mounting Type	Surface Mount
Package / Case	20-SOIC (0.295", 7.50mm Width)
Supplier Device Package	-
Purchase URL	https://www.e-xfl.com/product-detail/nuvoton-technology-corporation-america/w79e822asg



W79E823/W79E822/W79E821 Memory Map

Register Map

As mentioned before the W79E82X series have separate Program and Data Memory areas. The on-chip **256/128** bytes scratch pad RAM is in addition to the external memory. There are also several Special Function Registers (SFRs) which can be accessed by software. The SFRs can be accessed only by direct addressing, while the on-chip RAM can be accessed by either direct or indirect addressing.



W79E825/W79E824 RAM and SFR Memory Map

8. SPECIAL FUNCTION REGISTERS

The W79E82X series uses Special Function Registers (SFRs) to control and monitor peripherals and their Modes. The SFRs reside in the register locations 80-FFh and are accessed by direct addressing only. Some of the SFRs are bit addressable. This is very useful in cases where we wish to modify a particular bit without changing the others. The SFRs that are bit addressable are those whose addresses end in 0 or 8. The W79E82X series contain all the SFRs present in the standard 8052. However some additional SFRs are added. In some cases the unused bits in the original 8052, have been given new functions. The list of the SFRs is as follows.

Table 1 Special Function Register Location Table

F8	IP1							
F0	B						P0ID	IP1H
E8	IE1							
E0	ACC	ADCCON	ADCH					
D8	WDCON	PWMPL	PWM0L	PWM1L	PWMCON1	PWM2L	PWM3L	PWMCON2
D0	PSW	PWMPH	PWM0H	PWM1H		PWM2H	PWM3H	PWMCON3
C8							NVMCON	NVMDAT
C0	I2CON	I2ADDR					NVMADDR	TA
B8	IP0	SADEN			I2DAT	I2STATUS	I2CLK	I2TIMER
B0		P0M1	P0M2	P1M1	P1M2	P2M1	P2M2	IP0H
A8	IE	SADDR			CMP1	CMP2		
A0	P2	KBI	AUXR1					
98	SCON	SBUF						
90	P1					DIVM		
88	TCON	TMOD	TL0	TL1	TH0	TH1	CKCON	
80	P0	SP	DPL	DPH				PCON

Note: 1. The SFRs in the column with dark borders are bit-addressable

2. The table is condensed with eight locations per row. Empty locations indicate that these are no registers at these addresses. When a bit or register is not implemented, it will read high.

Continued.

BIT	NAME	FUNCTION
5	BOI	Brown Out Interrupt: 0: Disable Brownout Detect Interrupt function and it will cause chip reset when BOF is set. 1: This prevents Brownout Detection from causing a chip reset and allows the Brownout Detect function to be used as an interrupt.
4	LPBOV	Low Power Brown Out Detect control: 0: When BOD is enable, the Brown Out detect is always turned on by normal run or Power Down mode. 1: When BOD is enable, the 1/16 time will be turned on Brown Out detect circuit by Power Down mode. When uC is in Power Down mode, the BOD will enable internal RC OSC(2MHz~0.5MHZ)
3	SRST	Software reset: 1: reset the chip as if a hardware reset occurred.
2	ADCEN	0: Disable ADC circuit. 1: Enable ADC circuit.
1	0	Reserved
0	DPS	Dual Data Pointer Select 0: To select DPTR of standard 8051. 1: To select DPTR1

INTERRUPT ENABLE

Bit:	7	6	5	4	3	2	1	0
	EA	EADC	EBO	ES	ET1	EX1	ET0	EX0

Mnemonic: IE Address: A8h

BIT	NAME	FUNCTION
7	EA	Global enable. Enable/Disable all interrupts.
6	EADC	Enable ADC interrupt.
5	EBO	Enable Brown Out interrupt.
4	ES	Enable Serial Port interrupt.
3	ET1	Enable Timer 1 interrupt.
2	EX1	Enable external interrupt 1.
1	ET0	Enable Timer 0 interrupt.
0	EX0	Enable external interrupt 0.

SLAVE ADDRESS

Bit:	7	6	5	4	3	2	1	0
	SADDR.7	SADDR.6	SADDR.5	SADDR.4	SADDR.3	SADDR.2	SADDR.1	SADDR.0

Mnemonic: SADDR Address: A9h

Interrupt High Priority 1

Bit:	7	6	5	4	3	2	1	0
	-	-	PPWMH	PWDIH	PC2H	PC1H	PKBH	PI2H

Mnemonic: IP1H Address: F7h

BIT	NAME	FUNCTION
7	-	Reserved.
6	-	Reserved.
5	PPWMH	1: To set interrupt high priority of PWM's brake is highest priority level.
4	PWDIH	1: To set interrupt high priority of Watchdog is highest priority level.
3	PC2H	1: To set interrupt high priority of Comparator 2 is highest priority level.
2	PC1H	1: To set interrupt high priority of Comparator 1 is highest priority level.
1	PKBH	1: To set interrupt high priority of Keypad is highest priority level.
0	PI2H	1: To set interrupt high priority of I2C is highest priority level.

Interrupt Priority 1

Bit:	7	6	5	4	3	2	1	0
	-	-	PPWM	PWDI	PC2	PC1	PKB	PI2

Mnemonic: IP1 Address: F8h

BIT	NAME	FUNCTION
7	-	Reserved.
6	-	Reserved.
5	PPWM	1: To set interrupt priority of PWM's external brake is higher priority level.
4	PWDI	1: To set interrupt priority of Watchdog is higher priority level.
3	PC2	1: To set interrupt priority of Comparator 2 is higher priority level.
2	PC1	1: To set interrupt priority of Comparator 1 is higher priority level.
1	PKB	1: To set interrupt priority of Keypad is higher priority level.
0	PI2	1: To set interrupt priority of I2C is higher priority level.

11. RESET CONDITIONS

The user has several hardware related options for placing the W79E82X series into reset condition. In general, most register bits go to their reset value irrespective of the reset condition, but there are a few flags whose state depends on the source of reset. The user can use these flags to determine the cause of reset using software.

11.1 External Reset

The device continuously samples the RST pin at state C4 of every machine cycle. Therefore the RST pin must be held for at least 2 machine cycles to ensure detection of a valid RST low. The reset circuitry then synchronously applies the internal reset signal. Thus the reset is a synchronous operation and requires the clock to be running to cause an external reset.

Once the device is in reset condition, it will remain so as long as RST is 0. Even after RST is deactivated, the device will continue to be in reset state for up to two machine cycles, and then begin program execution from 0000h. There is no flag associated with the external reset condition. However since the other two reset sources have flags, the external reset can be considered as the default reset if those two flags are cleared.

11.2 Power-On Reset (POR)

The software must clear the POR flag after reading it. Otherwise it will not be possible to correctly determine future reset sources. If the power fails, i.e. falls below Vrst, then the device will once again go into reset state. When the power returns to the proper operating levels, the device will again perform a power on reset delay and set the POR flag.

11.3 Watchdog Timer Reset

The Watchdog timer is a free running timer with programmable time-out intervals. The user can clear the watchdog timer at any time, causing it to restart the count. When the time-out interval is reached an interrupt flag is set. If the Watchdog reset is enabled and the watchdog timer is not cleared, then 512 clocks from the flag being set, the watchdog timer will generate a reset. This places the device into the reset condition. The reset condition is maintained by hardware for two machine cycles. Once the reset is removed the device will begin execution from 0000h.

11.4 Reset State

Most of the SFRs and registers on the device will go to the same condition in the reset state. The Program Counter is forced to 0000h and is held there as long as the reset condition is applied. However, the reset state does not affect the on-chip RAM. The data in the RAM will be preserved during the reset. However, the stack pointer is reset to 07h, and therefore the stack contents will be lost. The RAM contents will be lost if the V_{DD} falls below approximately 2V, as this is the minimum voltage level required for the RAM to operate normally. Therefore after a first time power on reset the RAM contents will be indeterminate. During a power fail condition, if the power falls below 2V, the RAM contents are lost.

After a reset most SFRs are cleared. Interrupts and Timers are disabled. The Watchdog timer is disabled if the reset source was a POR. The SFRs have FFh written into them which puts the port pins in a high state.

The WDCON SFR bits are set/cleared in reset condition depending on the source of the reset.

	External reset	Watchdog reset	Power on reset
WDCON	0x0x0xx0B	0x0x01x0B	01000000B

The WTRF bit WDCON.2 is set when the Watchdog timer causes a reset. A power on reset will also clear this bit. The EWRST bit WDCON.1 is cleared by power on resets. This disables the Watchdog timer resets. A watchdog or external reset does not affect the EWRST bit.

12.2 Priority Level Structure

There are four priority levels for the interrupts, highest, high, low and lowest. The interrupt sources can be individually set to either high or low levels. Naturally, a higher priority interrupt cannot be interrupted by a lower priority interrupt. However there exists a pre-defined hierarchy amongst the interrupts themselves. This hierarchy comes into play when the interrupt controller has to resolve simultaneous requests having the same priority level. This hierarchy is defined as shown below; the interrupts are numbered starting from the highest priority to the lowest.

Priority structure of interrupts

SOURCE	FLAG	PRIORITY LEVEL
External Interrupt 0	IE0	1(highest)
Brownout Detect	BOF	2
Watchdog Timer	WDIF	3
Timer 0 Overflow	TF0	4
I2C Interrupt	SI	5
ADC Interrupt	ADCI	6
External Interrupt 1	IE1	7
KBI Interrupt	KBF	8
Comparator 1 Interrupt	CMF1	9
Timer 1 Overflow	TF1	10
Comparator 2 Interrupt	CMF2	11
Serial Port	RI + TI	12
PWM	BKF	13 (lowest)

The interrupt flags are sampled every machine cycle. In the same machine cycle, the sampled interrupts are polled and their priority is resolved. If certain conditions are met then the hardware will execute an internally generated LCALL instruction which will vector the process to the appropriate interrupt vector address. The conditions for generating the LCALL are

1. An interrupt of equal or higher priority is not currently being serviced.

2. The current polling cycle is the last machine cycle of the instruction currently being execute.

3. The current instruction does not involve a write to IE, IE1, IP0, IP0H, IP1 or IPH1 registers and is not a RETI.

If any of these conditions are not met, then the LCALL will not be generated. The polling cycle is repeated every machine cycle, with the interrupts sampled in the same machine cycle. If an interrupt flag is active in one cycle but not responded to, and is not active when the above conditions are met, the denied interrupt will not be serviced. This means that active interrupts are not remembered; every polling cycle is new.

The processor responds to a valid interrupt by executing an LCALL instruction to the appropriate service routine. This may or may not clear the flag which caused the interrupt. In case of Timer interrupts, the TF0 or TF1 flags are cleared by hardware whenever the processor vectors to the appropriate timer service routine. In case of external interrupt, INT0 and INT1, the flags are cleared only if they are edge triggered. In case of Serial interrupts, the flags are not cleared by hardware. The Watchdog timer interrupt flag WDIF has to be cleared by software. The hardware LCALL behaves exactly like the software LCALL instruction. This instruction saves the Program Counter contents onto the Stack, but does not save the Program Status Word PSW. The PC is reloaded with the vector address of that interrupt which caused the LCALL. These address of vector for the different sources are as follows

Vector locations for interrupt sources

SOURCE	VECTOR ADDRESS	SOURCE	VECTOR ADDRESS
External Interrupt 0	0003h	Timer 0 Overflow	000Bh
External Interrupt 1	0013h	Timer 1 Overflow	001Bh
Serial Port	0023h	Brownout Interrupt	002Bh
I2C Interrupt	0033h	KBI Interrupt	003Bh
Comparator 2 Interrupt	0043h	-	004Bh
Watchdog Timer	0053h	ADC Interrupt	005Bh
Comparator 1 Interrupt	0063h	-	006Bh
PWM Brake Interrupt	0073h	-	007Bh

Four-level interrupt priority

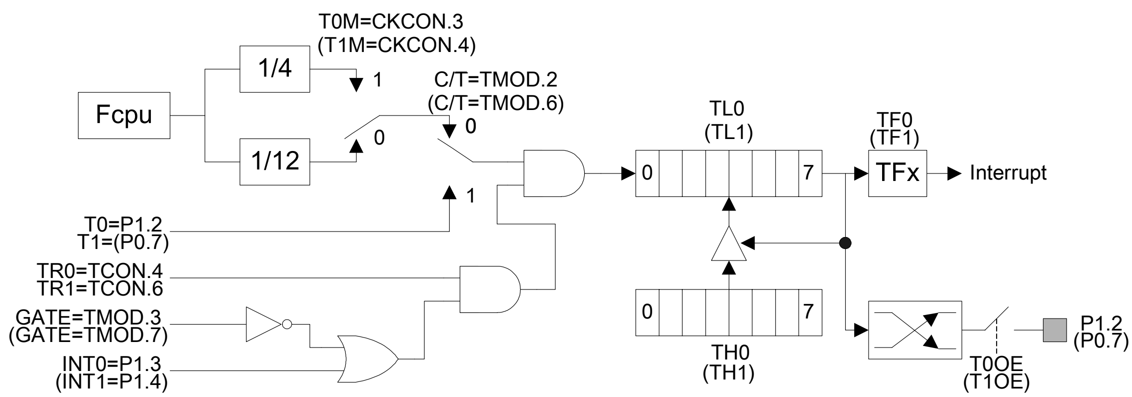
PRIORITY BITS		INTERRUPT PRIORITY LEVEL
IPXH	IPX	
0	0	Level 0 (lowest priority)
0	1	Level 1
1	0	Level 2
1	1	Level 3 (highest priority)

The vector table is not evenly spaced; this is to accommodate future expansions to the device family.

Execution continues from the vectored address till an RETI instruction is executed. On execution of the RETI instruction the processor pops the Stack and loads the PC with the contents at the top of the stack. The user must take care that the status of the stack is restored to what is was after the hardware LCALL, if the execution is to return to the interrupted program. The processor does not notice anything if the stack contents are modified and will proceed with execution from the address put back into PC. Note that a RET instruction would perform exactly the same process as a RETI instruction, but it would not inform the Interrupt Controller that the interrupt service routine is completed, and would leave the controller still thinking that the service routine is underway.

13.5 MODE 2

In Mode 2, the timer/counter is in the Auto Reload Mode. In this mode, TLx acts as a 8-bit count register, while THx holds the reload value. When the TLx register overflows from FFh to 00h, the TFx bit in TCON is set and TLx is reloaded with the contents of THx, and the counting process continues from here. The reload operation leaves the contents of the THx register unchanged. Counting is enabled by the TRx bit and proper setting of GATE and $\overline{INTx}$ pins. As in the other two modes 0 and 1 mode 2 allows counting of either clock cycles (clock/12 or clock/4) or pulses on pin Tn.



Timer 0/1 Mode 2 : 8-bit Auto-reload Mode

Timer/Counter Mode 2.

13.6 MODE 3

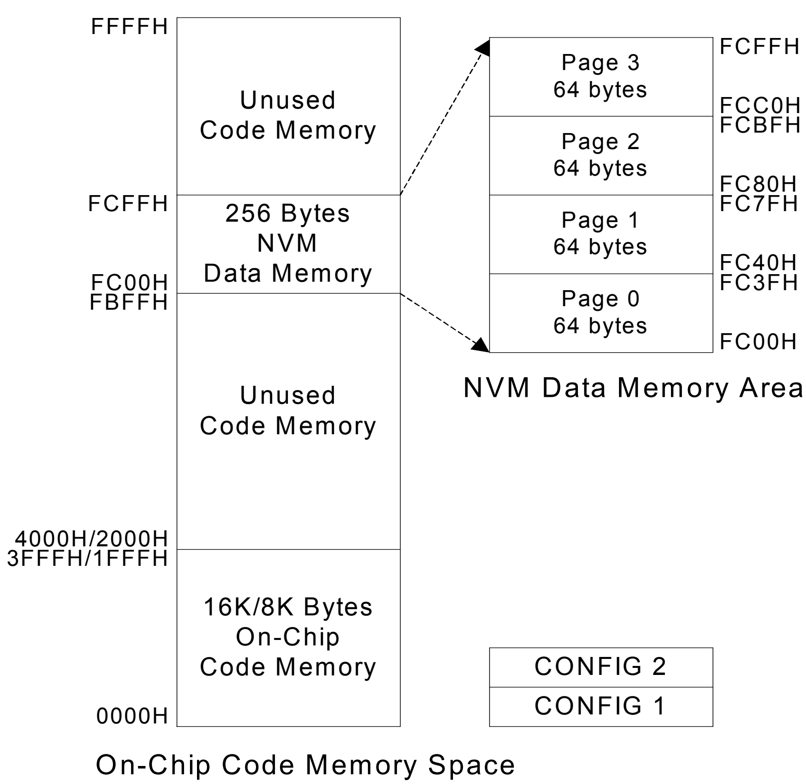
Mode 3 has different operating methods for the two timer/counters. For timer/counter 1, mode 3 simply freezes the counter. Timer/Counter 0, however, configures TL0 and TH0 as two separate 8 bit count registers in this mode. The logic for this mode is shown in the figure. TL0 uses the Timer/Counter 0 control bits $C/\overline{T}$, GATE, TR0, $\overline{INT0}$ and TF0. The TL0 can be used to count clock cycles (clock/12 or clock/4) or 1-to-0 transitions on pin T0 as determined by C/T (TMOD.2). TH0 is forced as a clock cycle counter (clock/12 or clock/4) and takes over the use of TR1 and TF1 from Timer/Counter 1. Mode 3 is used in cases where an extra 8 bit timer is needed. With Timer 0 in Mode 3, Timer 1 can still be used in Modes 0, 1 and 2., but its flexibility is somewhat limited. While its basic functionality is maintained, it no longer has control over its overflow flag TF1 and the enable bit TR1. Timer 1 can still be used as a timer/counter and retains the use of GATE and INT1 pin. In this condition it can be turned on and off by switching it out of and into its own Mode 3. It can also be used as a baud rate generator for the serial port.

14. NVM MEMORY

The W79E82X series have NVM data memory of **256/128** bytes for customer's data store used. The NVM data memory has **four/two** pages area and each page has 64 bytes as below figure. The **Page 0** address is from **FC00h ~ FC3Fh**, **Page 1** address is from **FC40h ~ FC7Fh**, **Page 2** address is from **FC80h ~ FCBFh**, and **Page 3** address is from **FCC0h ~ FCFFh**.

The NVM memory can be read/write by customer program to access. Read NVM data is by MOVC A,@A+DPTR instruction, and write data is by SFR of NVMADDR, NVMDAT and NVMCON. Before write data to NVM memory, the page must be erased by set page address which low byte address of On-Chip Code Memory space will decode and enable page(n) on NVMADDR, then set EER of NVMCON.7 will automatically hold fetch program code and PC Counter, and execute page erase. After finished, this bit will be cleared by hardware. The erase time is ~ 5ms.

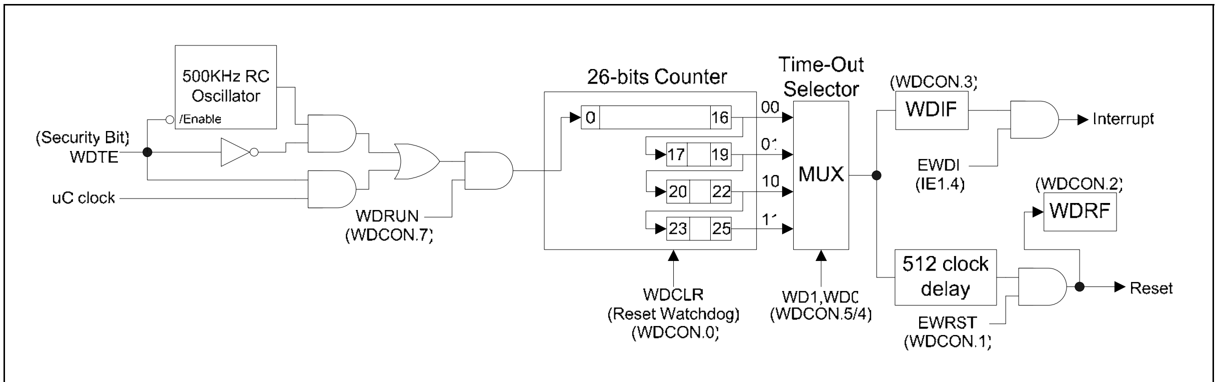
By write data to NVM memory, user must set address and data to NVMADDR and NVMDAT, therefore set EWR of NVMCON.6 to write data, then uC will hold program code and PC Counter, then write data to mapping address, after finished, this bit will be cleared by hardware, the uC will continue execute next instruction. The program time is ~50us.



W79E825/W79E824 Memory Map

15. WATCHDOG TIMER

The Watchdog Timer is a free-running Timer which can be programmed by the user to serve as a system monitor, a time-base generator or an event timer. It is basically a set of dividers that divide the system clock. The divider output is selectable and determines the time-out interval. When the time-out occurs a flag is set, which can cause an interrupt if enabled, and a system reset can also be caused if it is enabled. The interrupt will occur if the individual interrupt enable and the global enable are set. The interrupt and reset functions are independent of each other and may be used separately or together depending on the users software.

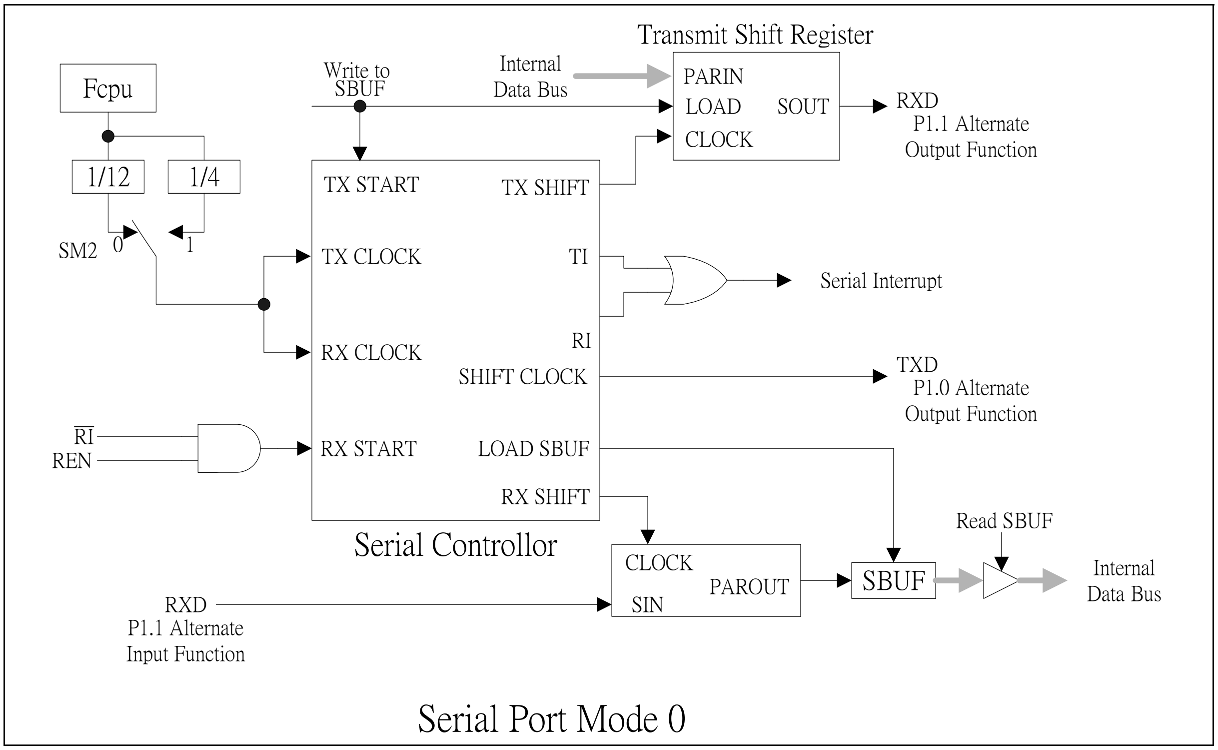


Watchdog Timer

The Watchdog Timer should first be restarted by using WDCLR. This ensures that the timer starts from a known state. The WDCLR bit is used to restart the Watchdog Timer. This bit is self clearing, i.e. after writing a 1 to this bit the software will automatically clear it. The Watchdog Timer will now count clock cycles. The time-out interval is selected by the two bits WD1 and WD0 (WDCON.5 and WDCON.4). When the selected time-out occurs, the Watchdog interrupt flag WDIF (WDCON.3) is set. After the time-out has occurred, the Watchdog Timer waits for an additional 512 clock cycles. If the Watchdog Reset EWRST (WDCON.1) is enabled, then 512 clocks after the time-out, if there is no WDCLR, a system reset due to Watchdog Timer will occur. This will last for two machine cycles, and the Watchdog Timer reset flag WDRF (WDCON.2) will be set. This indicates to the software that the Watchdog was the cause of the reset.

When used as a simple timer, the reset and interrupt functions are disabled. The timer will set the WDIF flag each time the timer completes the selected time interval. The WDIF flag is polled to detect a time-out and the WDCLR allows software to restart the timer. The Watchdog Timer can also be used as a very long timer. The interrupt feature is enabled in this case. Every time the time-out occurs an interrupt will occur if the global interrupt enable EA is set.

The main use of the Watchdog Timer is as a system monitor. This is important in real-time control applications. In case of some power glitches or electro-magnetic interference, the processor may begin to execute errant code. If this is left unchecked the entire system may crash. Using the watchdog timer interrupt during software development will allow the user to select ideal watchdog reset locations. The code is first written without the watchdog interrupt or reset. Then the Watchdog interrupt is enabled to identify code locations where interrupt occurs. The user can now insert instructions to reset the Watchdog Timer, which will allow the code to run without any Watchdog Timer



Serial Port Mode 0

The TI flag is set high in C1 following the end of transmission of the last bit. The serial port will receive data when REN is 1 and RI is zero. The shift clock (TxD) will be activated and the serial port will latch data on the rising edge of shift clock. The external device should therefore present data on the falling edge on the shift clock. This process continues till all the 8 bits have been received. The RI flag is set in C1 following the last rising edge of the shift clock on TxD. This will stop reception, till the RI is cleared by software.

16.2 MODE 1

In Mode 1, the full duplex asynchronous mode is used. Serial communication frames are made up of 10 bits transmitted on TXD and received on RXD. The 10 bits consist of a start bit (0), 8 data bits (LSB first), and a stop bit (1). On received, the stop bit goes into RB8 in the SFR SCON. The baud rate in this mode is variable. The serial baud can be programmed to be 1/16 or 1/32 of the Timer 1 overflow. Since the Timer 1 can be set to different reload values, a wide variation in baud rates is possible.

Transmission begins with a write to SBUF. The serial data is brought out on to TxD pin at C1 following the first roll-over of divide by 16 counter. The next bit is placed on TxD pin at C1 following the next rollover of the divide by 16 counter. Thus the transmission is synchronized to the divide by 16 counter and not directly to the write to SBUF signal. After all 8 bits of data are transmitted, the stop bit is transmitted. The TI flag is set in the C1 state after the stop bit has been put out on TxD pin. This will be at the 10th rollover of the divide by 16 counter after a write to SBUF.

bit is the stop bit, which is 1 in case of a valid frame. If SM2 is 1, then RI is set only if a valid frame is received and the received byte matches the Given or Broadcast address.

The Master processor can selectively communicate with groups of slaves by using the Given Address. All the slaves can be addressed together using the Broadcast Address. The addresses for each slave are defined by the SADDR and SADEN SFRs. The slave address is an 8-bit value specified in the SADDR SFR. The SADEN SFR is actually a mask for the byte value in SADDR. If a bit position in SADEN is 0, then the corresponding bit position in SADDR is don't care. Only those bit positions in SADDR whose corresponding bits in SADEN are 1 are used to obtain the Given Address. This gives the user flexibility to address multiple slaves without changing the slave address in SADDR.

The following example shows how the user can define the Given Address to address different slaves.

Slave 1:

SADDR	1010 0100
SADEN	1111 1010
Given	1010 0x0x

Slave 2:

SADDR	1010 0111
SADEN	1111 1001
Given	1010 0xx1

The Given address for slave 1 and 2 differ in the LSB. For slave 1, it is a don't care, while for slave 2 it is 1. Thus to communicate only with slave 1, the master must send an address with LSB = 0 (1010 0000). Similarly the bit 1 position is 0 for slave 1 and don't care for slave 2. Hence to communicate only with slave 2 the master has to transmit an address with bit 1 = 1 (1010 0011). If the master wishes to communicate with both slaves simultaneously, then the address must have bit 0 = 1 and bit 1 = 0. The bit 3 position is don't care for both the slaves. This allows two different addresses to select both slaves (1010 0001 and 1010 0101).

The master can communicate with all the slaves simultaneously with the Broadcast Address. This address is formed from the logical OR of the SADDR and SADEN SFRs. The zeros in the result are defined as don't cares In most cases the Broadcast Address is FFh. In the previous case, the Broadcast Address is (1111111X) for slave 1 and (11111111) for slave 2.

The SADDR and SADEN SFRs are located at address A9h and B9h respectively. On reset, these two SFRs are initialized to 00h. This results in Given Address and Broadcast Address being set as XXXX XXXX(i.e. all bits don't care). This effectively removes the multiprocessor communications feature, since any selectivity is disabled.

20. I/O PORT CONFIGURATION

The W79E82X series have three I/O ports, port 0, port 1 and port 2. All pins of I/O ports can be configured to one of four types by software except P1.5 is only input pin. When P1.5 is configured reset pin by RPD=0 in the CONFIG 1 register, the W79E82X series can support 15 pins by use Crystal. If used on-chip RC oscillator the P1.5 is configured input pin, the W79E82X series can be supported up to 18 pins. The I/O ports configuration setting as below table.

I/O port configuration table

PXM1.Y	PXM2.Y	PORT INPUT/OUTPUT MODE
0	0	Quasi-bidirectional
0	1	Push-Pull
1	0	Input Only (High Impedance) P2M1.PxS=0, TTL input P2M1.PxS=1, Schmitt input
1	1	Open Drain

All port pins can be determined to high or low after reset by configure PRHI bit in the CONFIG1 register. After reset, these pins are in quasi-bidirectional mode. The port pin of P1.5 only is a Schmitt trigger input.

Enabled toggle outputs from Timer 0 and Timer 1 by ENT0 and ENT1 on P2M1 register, the output frequency of Timer 0 or Timer 1 is by Timer overflow.

Each I/O port of the W79E82X series may be selected to use TTL level inputs or Schmitt inputs by P(n)S bit on P2M1 register, where n is 0, 1 or 2. When P(n)S is set to 1, Ports are selected Schmitt trigger inputs on Port(n). The P2.0(XTAL2) can be configured clock output when used on-chip RC or external Oscillator is clock source, and the frequency of clock output is divided by 4 on on-chip RC clock or external Oscillator.

20.1 Quasi-Bidirectional Output Configuration

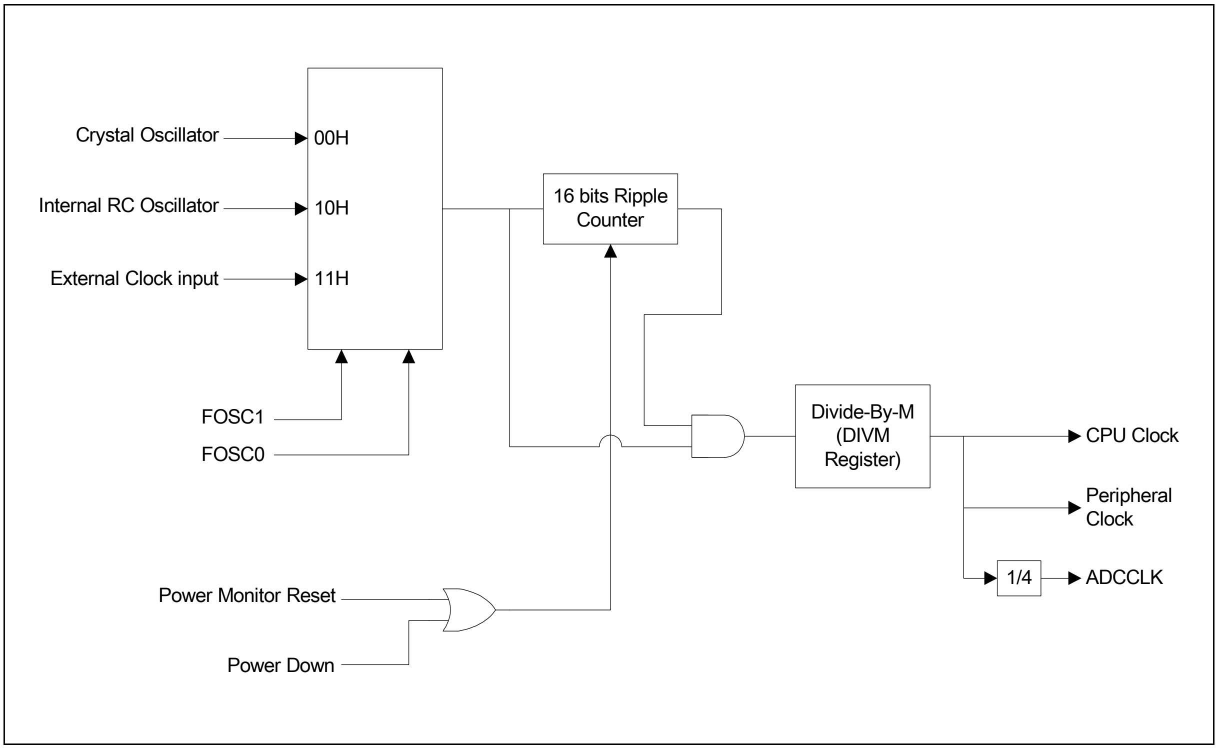
After chip was power on or reset, the all ports output are this mode, and output is common with the 8051. This mode can be used as both an input and output without the need to reconfigure the port.

When the pin is pulled low, it is driven strongly and able to sink a fairly large current. These features are somewhat similar to an open drain output except that there are three pull-up transistors in the quasi-bidirectional output that serve different purposes.

This mode has three pull-up resisters that are “strong” pull-up, “weak” pull-up and “very weak” pull-up. The “strong” pull-up is used fast transition from logic “0” change to logic “1”, and it is fast latch and transition. When port pins is occur from logic “0” to logic “1”, the strong pull-up will quickly turn on two CPU clocks to pull high then turn off.

21. OSCILLATOR

The W79E82X series provides three oscillator input option. These are configured at CONFIG register (CONFIG1) that include On-Chip RC Oscillator Option, External Clock Input Option and Crystal Oscillator Input Option. The Crystal Oscillator Input frequency may be supported from 4MHz to 20MHz, and without capacitor or resister.



21.1 On-Chip RC Oscillator Option

The On-Chip RC Oscillator is fixed at 6MHz +/- 25% frequency to support clock source. When FOSC1, FOSC0 = 10H, the On-Chip RC Oscillator is enabled. A clock output on P2.0 (XTAL2) may be enabled when On-Chip RC oscillator is used.

21.2 External Clock Input Option

The clock source pin (XTAL1) is from External Clock Input by FOSC1, FOSC0 = 11H, and frequency range is form 0Hz up to 20MHz. A clock output on P2.0 (XTAL2) may be enabled when External Clock Input is used.

The W79E82X series supports a clock output function when either the on-chip RC oscillator or the external clock input options is selected. This allows external devices to synchronize to the W79E82X serial. When enabled, via the ENCLK bit in the P2M1 register, the clock output appears on the XTAL2/CLKOUT pin whenever the on-chip oscillator is running, including in Idle Mode. The frequency of the clock output is 1/4 of the CPU clock rate. If the clock output is not needed in Idle Mode, it may be turned off prior to entering Idle mode, saving additional power. The clock output may also be enabled when the external clock input option is selected.

21.3 CPU Clock Rate select

The CPU clock of W79E82X series may be selected by the DIVM register. If DIVM = 00H, the CPU clock is running at 4 CPU clock pre machine cycle, and without any division from source clock (Fosc). When the DIVM register is set to N value, the CPU clock is divided by 2(DVIM+1), so CPU clock frequency division is from 4 to 512. The user may use this feature to set CPU at a lower speed rate for reducing power consumption. This is very similar to the situation when CPU has entered Idle mode. In addition this frequency division function affect all peripheral timings as they are all sourcing from the CPU clock(Fcpu).

22. POWER MONITORING FUNCTION

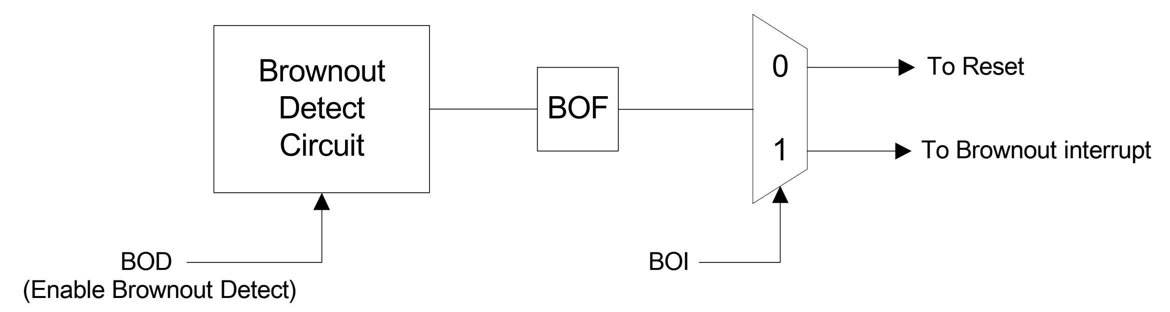
Power-On Detect and Brownout are two additional power monitoring functions implemented in W79E82X to prevent incorrect operation during power up and power drop or loss.

22.1 Power On Detect

The Power–On Detect function is a designed to detect power up after power voltage reaches to a level where Brownout Detect can work. After power on detect, the POR (PCON.4) will be set to “1” to indicate an initial power up condition. The POR flag will be cleared by software.

22.2 Brownout Detect

The Brownout Detect function is detect power voltage is drops to brownout voltage level, and allows preventing some process work or indicate power warming. The W79E82X series have two brownout voltage levels to select by BOV (CONFIG1.4). If BOV =0 that brownout voltage level is 3.8V, If BOV = 1 that brownout voltage level is 2.5V. When the Brownout voltage is drop to select level, the brownout detector will detect and keeps this active until VDD is returns to above brownout Detect voltage. The Brownout Detect block is as follow.



Drownout Detect Block

When Brownout Detect is enabled by BOD (AUXR1.6), the BOF (PCON.5) flag will be set that it cause brownout reset or interrupt, and BOF will be cleared by software. If BOI (AUXR1.5) is set to “1”, the brownout detect will cause interrupt via the EA (IE.7) and EBO (IE.5) bits is set.

In order to guarantee a correct detection of Brownout, The VDD fail time must be slower than 50mV/us, and rise time is slower than 2mV/us to ensure a proper reset.

25.2.4 The I2C Clock Baud Rate Bits, I2CLK

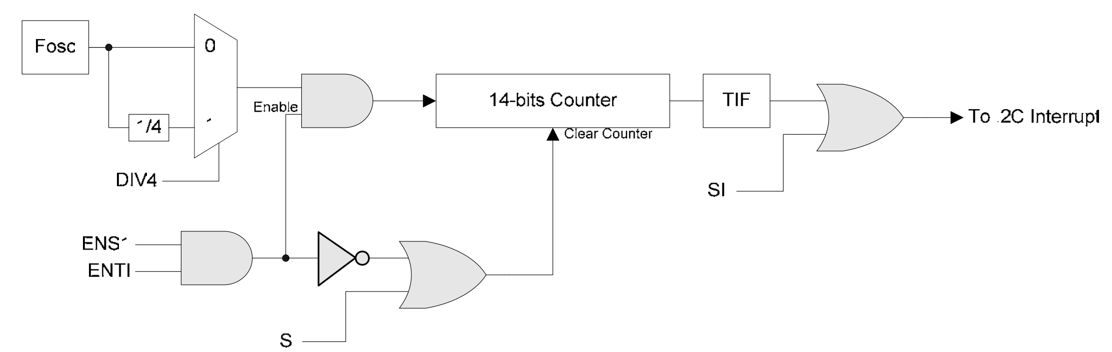
The data baud rate of I2C is determines by I2CLK register when SIO1 is in a master mode. It is not important when SIO1 is in a slave mode. In the slave modes, SIO1 will automatically synchronize with any clock frequency up to 400 KHz from master I2C device.

The data baud rate of I2C setting is Data Baud Rate of I2C = Fcpu / (I2CLK+1). The Fcpu=Fosc/4. If Fosc = 16MHz, the I2CLK = 40(28H), so data baud rate of I2C = 16MHz /(4X (40 +1)) = 97.56Kbits/sec. The block diagram is as below figure.

Bit:	7	6	5	4	3	2	1	0
	I2CLK.7	I2CLK.6	I2CLK.5	I2CLK.4	I2CLK.3	I2CLK.2	I2CLK.1	I2CLK.0

Mnemonic: I2CLK Address: BEh

BIT	NAME	FUNCTION
7 ~ 0	I2CLK	The I2C clock baud rate bits.



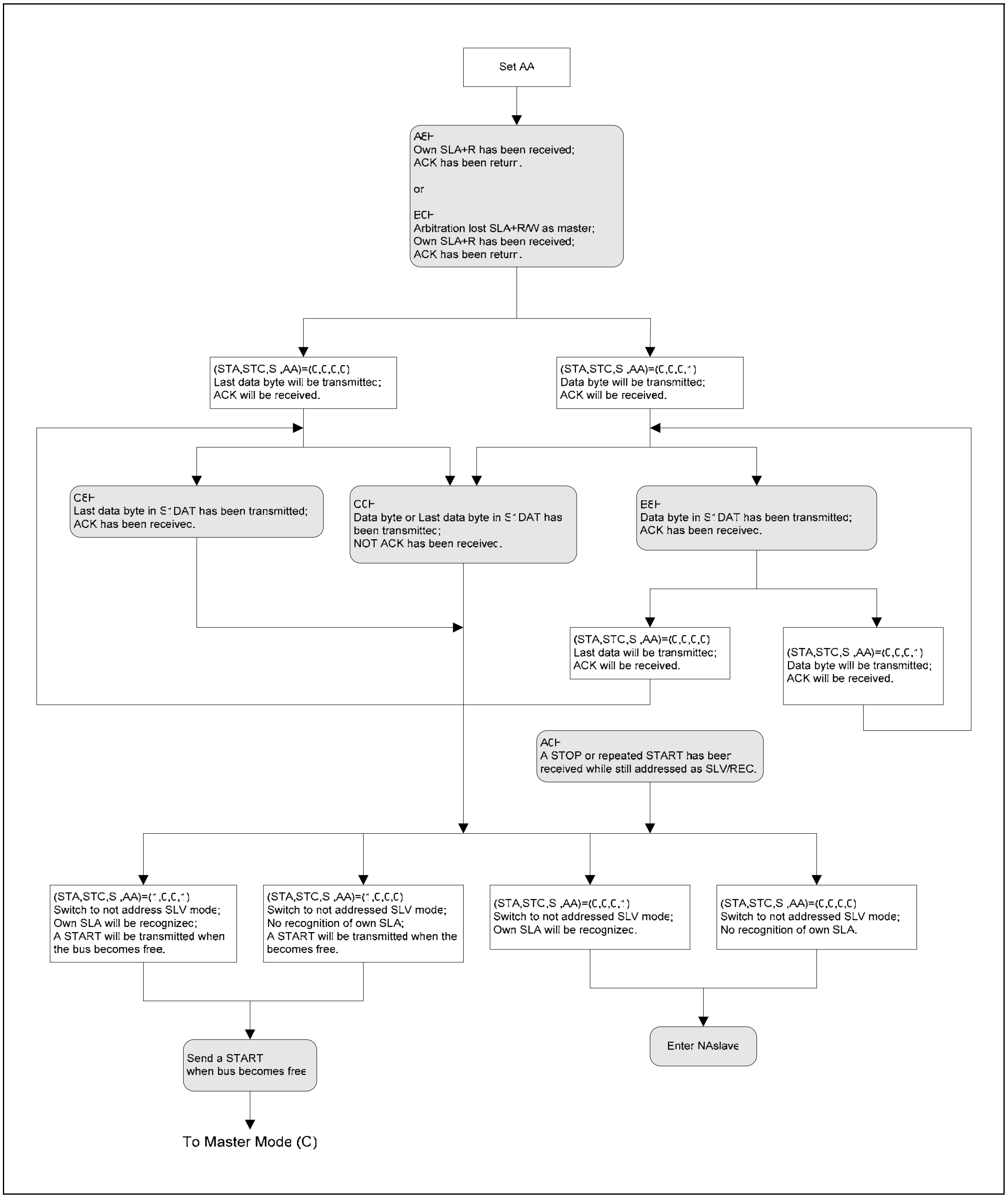
I2C Timer Count Block Diagram

25.2.5 The Status Register, I2STATUS

I2STATUS is an 8-bit read-only register. The three least significant bits are always 0. The five most significant bits contain the status code. There are 23 possible status codes. When I2STATUS contains F8H, no serial interrupt is requested. All other I2STATUS values correspond to defined SIO1 states. When each of these states is entered, a status interrupt is requested (SI = 1). A valid status code is present in I2STATUS one machine cycle after SI is set by hardware and is still present one machine cycle after SI has been reset by software.

In addition, state 00H stands for a Bus Error. A Bus Error occurs when a START or STOP condition is present at an illegal position in the format frame. Examples of illegal positions are during the serial transfer of an address byte, a data byte or an acknowledge bit.

Slave Transmitter Mode



27. CONFIG BITS

The W79E82X series have two CONFIG bits(CONFIG1, CONFIG2) that must be define at power up and can not be set after the program start of execution. Those features are configured through the use of two flash EPROM bytes, and the flash EPROM can be programmed and verified repeatedly. Until the code inside the Flash EPROM is confirmed OK, the code can be protected. The protection of flash EPROM (CONFIG2) and those operations on it are described below. The data of these bytes may be read by the MOVC instruction at the addresses.

27.1 CONFIG1

CONFIG 1 :

7	6	5	4	3	2	1	0	
WDTE	RPD	PRHI	BOV	-	-	Fosc1	Fosc0	CONFIG Bit

WDTE: Watchdog Timer clock source Bit.
RPD: Reset Pin Disable Bit.
PRHI: Port Reset High or Low Bit.
BOV: Brownout voltage select Bit.
Fosc1: CPU oscillator type select Bit 1.
Fosc0: CPU oscillator type select Bit 0.

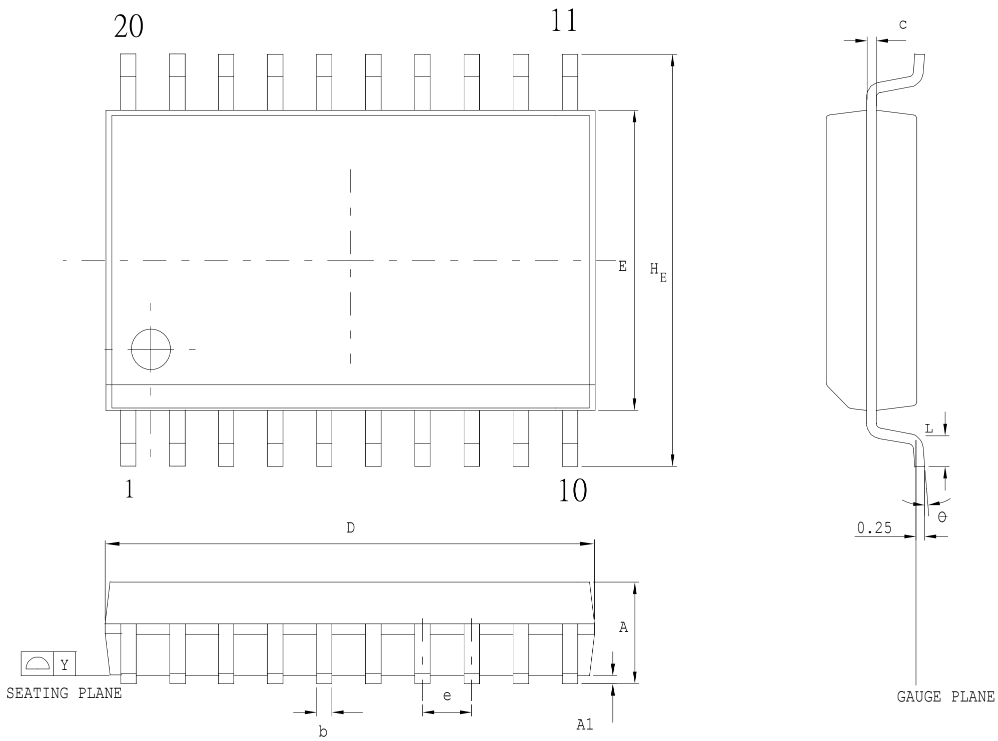
CONFIG Register 1

BIT	NAME	FUNCTION
7	WDTE	Clock source of Watchdog Timer select bit: 0: The internal RC oscillator clock is for Watchdog Timer clock used. 1: The uC clock is for Watchdog Timer clock used.
6	RPD	Reset Pin Disable bit: 0: Enable Reset function of Pin 1.5. 1: Disable Reset function of Pin 1.5, and it to be used as an input port pin.
5	PRHI	Port Reset High or Low bit: 0: Port reset to low state. 1: Port reset to high state.
4	BOV	Brownout Voltage Select bit: 0: Brownout detect voltage is 3.8V. 1: Brownout detect voltage is 2.5V.

34. PACKAGE DIMENSIONS

34.1 20-pin SO

20L SOP-300mil



Control demensions are in milmeters .

SYMBOL	DIMENSION IN MM		DIMENSION IN INCH	
	MIN.	MAX.	MIN.	MAX.
A	2.35	2.65	0.093	0.104
A1	0.10	0.30	0.004	0.012
b	0.33	0.51	0.013	0.020
c	0.23	0.32	0.009	0.013
E	7.40	7.60	0.291	0.299
D	12.60	13.00	0.496	0.512
e	1.27 BSC		0.050 BSC	
H_E	10.00	10.65	0.394	0.419
Y	—	0.10	—	0.004
L	0.40	1.27	0.016	0.050
θ	0	8	0	8