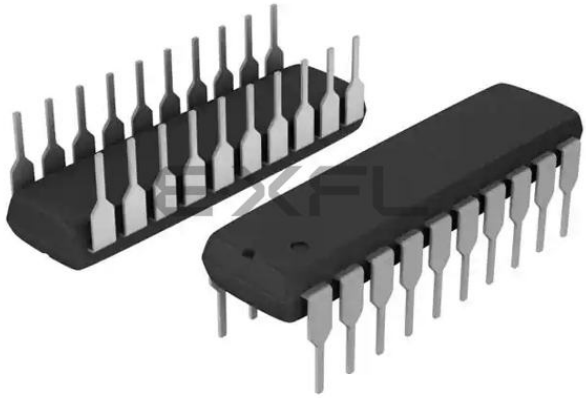

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Connectivity	I²C, UART/USART
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Program Memory Size	8KB (8K x 8)
Program Memory Type	FLASH
EEPROM Size	256 x 8
RAM Size	256 x 8
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Oscillator Type	Internal
Operating Temperature	-40°C ~ 85°C (TA)
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Supplier Device Package	-
Purchase URL	https://www.e-xfl.com/product-detail/nuvoton-technology-corporation-america/n79e824adg

0	PX0	1: To set interrupt priority of External interrupt 0 is higher priority level.

SLAVE ADDRESS MASK ENABLE

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

Mnemonic: SADEN Address: B9h

BIT	NAME	FUNCTION
7-0	SADEN [7:0]	This register enables the Automatic Address Recognition feature of the Serial port 0. When a bit in the SADEN is set to 1, the same bit location in SADDR will be compared with the incoming serial data. When SADEN is 0, then the bit becomes a "don't care" in the comparison. This register enables the Automatic Address Recognition feature of the Serial port 0. When all the bits of SADEN are 0, interrupt will occur for any incoming address.

I2C DATA REGISTER

Bit:	7	6	5	4	3	2	1	0
	I2DAT.7	I2DAT.6	I2DAT.5	I2DAT.4	I2DAT.3	I2DAT.2	I2DAT.1	I2DAT.0

Mnemonic: I2DAT Address: BCh

BIT	NAME	FUNCTION
7-0	I2DAT.[7:0]	The data register of I2C.

I2C STATUS REGISTER

Bit:	7	6	5	4	3	2	1	0
	B7	B6	B5	B4	B3	B2	B1	B0

Mnemonic: I2STATUS Address: BDh

BIT	NAME	FUNCTION
7-0	I2STATUS.[7:0]	The status register of I2C: 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 I2C 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, states 00H stands for a Bus Error. A Bus Error occurs when a START or STOP condition is present at an illegal position in the formation frame. Example of illegal position are during the serial transfer of an address byte, a data byte or an acknowledge bit.

I2C BAUD RATE CONTROL REGISTER

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

PWM 1 HIGH BITS REGISTER

Bit:	7	6	5	4	3	2	1	0
	-	-	-	-	-	-	PWM1.9	PWM1.8

Mnemonic: PWM1H Address: D3h

BIT	NAME	FUNCTION
7~2	-	Reserved.
1~0	PWM1.[9:8]	The PWM 1 High Bits Register bit 9~8.

PWM 2 HIGH BITS REGISTER

Bit:	7	6	5	4	3	2	1	0
	-	-	-	-	-	-	PWM2.9	PWM2.8

Mnemonic: PWM2H Address: D5h

BIT	NAME	FUNCTION
7~2	-	Reserved.
1~0	PWM2.[9:8]	The PWM 2 High Bits Register bit 9~8.

PWM 3 HIGH BITS REGISTER

Bit:	7	6	5	4	3	2	1	0
	-	-	-	-	-	-	PWM3.9	PWM3.8

Mnemonic: PWM3H Address: D6h

BIT	NAME	FUNCTION
7~2	-	Reserved.
1~0	PWM3.[9:8]	The PWM 3 High Bits Register bit 9~8.

PWM CONTROL REGISTER 3

Bit:	7	6	5	4	3	2	1	0
	-	-	-	-	-	-	-	BKF

Mnemonic: PWMCON3 Address: D7h

BIT	NAME	FUNCTION
7-6	-	Reserved.
0	BKF	The external brake pin Flag. 0: The PWM is not brake. 1: The PWM is brake by external brake pin. It will be cleared by software.

WATCHDOG CONTROL

Bit:	7	6	5	4	3	2	1	0
	WDRUN	POR	WD1	WD0	WDIF	WTRF	EWRST	WDCLR

Mnemonic: WDCON Address: D8h

<table>
<tr><th>BIT</th><th>NAME</th><th>FUNCTION</th></tr>
<tr><td>7</td><td>WDRUN</td><td>0: The Watchdog is stopped.
1: The Watchdog is running.</td></tr>
<tr><td>6</td><td>-</td><td>Reserved.</td></tr>
<tr><td>5</td><td>WD1</td><td rowspan="2">Watchdog Timer Time-out Select bits. These bits determine the time-out period of the watchdog timer. The reset time-out period is 512 clocks longer than the watchdog time-out.

<table>
<tr><th>WD1</th><th>WD0</th><th>Interrupt time-out</th><th>Reset time-out</th></tr>
<tr><td>0</td><td>0</td><td>2^{17}</td><td>2^{17} + 512</td></tr>
<tr><td>0</td><td>1</td><td>2^{20}</td><td>2^{20} + 512</td></tr>
<tr><td>1</td><td>0</td><td>2^{23}</td><td>2^{23} + 512</td></tr>
<tr><td>1</td><td>1</td><td>2^{26}</td><td>2^{26} + 512</td></tr>
</table></td></tr>
<tr><td>4</td><td>WD0</td></tr>
<tr><td>3</td><td>WDIF</td><td>Watchdog Timer Interrupt Flag
0: If the interrupt is not enabled, then this bit indicates that the time-out period has elapsed. This bit must be cleared by software.
1: If the watchdog interrupt is enabled, hardware will set this bit to indicate that the watchdog interrupt has occurred.</td></tr>
<tr><td>2</td><td>WTRF</td><td>Watchdog Timer Reset Flag
1: Hardware will set this bit when the watchdog timer causes a reset. Software can read it but must clear it manually. A power-fail reset will also clear the bit. This bit helps software in determining the cause of a reset. If EWRST = 0, the watchdog timer will have no affect on this bit.</td></tr>
<tr><td>1</td><td>EWRST</td><td>0: Disable Watchdog Timer Reset.
1: Enable Watchdog Timer Reset.</td></tr>
<tr><td>0</td><td>WDCLR</td><td>Reset Watchdog Timer
This bit helps in putting the watchdog timer into a know state. It also helps in resetting the watchdog timer before a time-out occurs. Failing to set the EWRST before time-out will cause an interrupt, if EWDI (EIE.4) is set, and 512 clocks after that a watchdog timer reset will be generated if EWRST is set. This bit is self-clearing by hardware.</td></tr>
</table>

The WDCON SFR is set to 0x000000B on a reset. WTRF (WDCON.2) is set to a 1 on a Watchdog timer reset, but to a 0 on power on/down resets. WTRF (WDCON.2) is not altered by an external reset. EWRST (WDCON.1) is set to 0 on a Power-on reset, reset pin reset, and Watch Dog Timer reset.

All the bits in this SFR have unrestricted read access. WDRUN, WD0, WD1, EWRST, WDIF and WDCLR require Timed Access procedure to write. The remaining bits have unrestricted write accesses. Please refer TA register description.

```
TA      REG     C7H
WDCON   REG     D8H
MOV     TA, #AAH            ; To access protected bits
MOV     TA, #55H
SETB    WDCON.0             ; Reset watchdog timer
ORL     WDCON, #00110000B   ; Select 26 bits watchdog timer
MOV     TA, #AAH
MOV     TA, #55H
ORL     WDCON, #00000010B   ; Enable watchdog
```

PWMP COUNTER LOW BITS REGISTER

Bit:	7	6	5	4	3	2	1	0
	PWMP.7	PWMP.6	PWMP.5	PWP.4	PWMP.3	PWMP.2	PWMP.1	PWMP.1

Mnemonic: PWMPL Address: D9h

BIT	NAME	FUNCTION
7~0	PWMP.[7:0]	PWM Counter Low Bits Register.

PWM0 LOW BITS REGISTER

Bit:	7	6	5	4	3	2	1	0
	PWM0.7	PWM0.6	PWM0.5	PWM0.4	PWM0.3	PWM0.2	PWM0.1	PWM0.1

Mnemonic: PWM0L Address: DAh

BIT	NAME	FUNCTION
7~0	PWM0.[7:0]	PWM 0 Low Bits Register.

PWM1 LOW BITS REGISTER

Bit:	7	6	5	4	3	2	1	0
	PWM1.7	PWM1.6	PWM1.5	PWM1.4	PWM1.3	PWM1.2	PWM1.1	PWM1.0

Mnemonic: PWM1L Address: DBh

BIT	NAME	FUNCTION
7~0	PWM1.[7:0]	PWM 1 Low Bits Register.

PWM CONTROL REGISTER 1

Bit:	7	6	5	4	3	2	1	0
	PWMRUN	Load	CF	CLRPWM	PWM3I	PWM2I	PWM1I	PWM0I

Mnemonic: PWMCON1 Address: DCh

BIT	NAME	FUNCTION
7-0	ACC.[7:0]	The A or ACC register is the standard 8052 accumulator

ADC CONTROL REGISTER

Bit:	7	6	5	4	3	2	1	0
	ADC.1	ADC.0	ADCEX	ADCI	ADCS	RCCLK	AADR1	AADR0

Mnemonic: ADCCON Address: E1h

BIT	NAME	FUNCTION
7	ADC.1	The ADC conversion result.
6	ADC.0	The ADC conversion result.
5	ADCEX	Enable STADC-triggered conversion 0: Conversion can only be started by software (i.e., by setting ADCS). 1: Conversion can be started by software or by a rising edge on STADC (pin P1.4).
4	ADCI	ADC Interrupt flag: This flag is set when the result of an A/D conversion is ready. This generates an ADC interrupt, if it is enabled. The flag may be cleared by the ISR. While this flag is 1, the ADC cannot start a new conversion. ADCI can not be set by software.
3	ADCS	ADC Start and Status: Set this bit to start an A/D conversion. It may also be set by STADC if ADCEX is 1. This signal remains high while the ADC is busy and is reset right after ADCI is set. Notes: 1. It is recommended to clear ADCI ***before*** ADCS is set. However, if ADCI is cleared and ADCS is set at the same time, a new A/D conversion may start on the same channel. 2. Software clearing of ADCS will abort conversion in progress. 3. ADC cannot start a new conversion while ADCS or ADCI is high.
2	RCCLK	0: The CPU clock is used as ADC clock. 1: The internal RC clock is used as ADC clock.
1	AADR1	The ADC input select. See table below.
0	AADR0	The ADC input select. See table below.

The ADCI and ADCS control the ADC conversion as below:

ADCI	ADCS	ADC STATUS
0	0	ADC not busy; A conversion can be started.
0	1	ADC busy; Start of a new conversion is blocked.
1	0	Conversion completed; Start of a new conversion requires ADCI = 0.
1	1	This is an internal temporary state that user can ignore it.

Continued

OP-CODE	HEX CODE	BYTES	N79E825 SERIES MACHINE CYCLE	N79E825 SERIES CLOCK CYCLES	8032 CLOCK CYCLES	N79E825 SERIES VS. 8032 SPEED RATIO
ADDC A, direct	35	2	2	8	12	1.5
ADDC A, #data	34	2	2	8	12	1.5
SUBB A, R0	98	1	1	4	12	3
SUBB A, R1	99	1	1	4	12	3
SUBB A, R2	9A	1	1	4	12	3
SUBB A, R3	9B	1	1	4	12	3
SUBB A, R4	9C	1	1	4	12	3
SUBB A, R5	9D	1	1	4	12	3
SUBB A, R6	9E	1	1	4	12	3
SUBB A, R7	9F	1	1	4	12	3
SUBB A, @R0	96	1	1	4	12	3
SUBB A, @R1	97	1	1	4	12	3
SUBB A, direct	95	2	2	8	12	1.5
SUBB A, #data	94	2	2	8	12	1.5
INC A	04	1	1	4	12	3
INC R0	08	1	1	4	12	3
INC R1	09	1	1	4	12	3
INC R2	0A	1	1	4	12	3
INC R3	0B	1	1	4	12	3
INC R4	0C	1	1	4	12	3
INC R5	0D	1	1	4	12	3
INC R6	0E	1	1	4	12	3
INC R7	0F	1	1	4	12	3
INC @R0	06	1	1	4	12	3
INC @R1	07	1	1	4	12	3
INC direct	05	2	2	8	12	1.5
INC DPTR	A3	1	2	8	24	3
DEC A	14	1	1	4	12	3
DEC R0	18	1	1	4	12	3
DEC R1	19	1	1	4	12	3
DEC R2	1A	1	1	4	12	3
DEC R3	1B	1	1	4	12	3

Continued

OP-CODE	HEX CODE	BYTES	N79E825 SERIES MACHINE CYCLE	N79E825 SERIES CLOCK CYCLES	8032 CLOCK CYCLES	N79E825 SERIES VS. 8032 SPEED RATIO
MOV A, R5	ED	1	1	4	12	3
MOV A, R6	EE	1	1	4	12	3
MOV A, R7	EF	1	1	4	12	3
MOV A, @R0	E6	1	1	4	12	3
MOV A, @R1	E7	1	1	4	12	3
MOV A, direct	E5	2	2	8	12	1.5
MOV A, #data	74	2	2	8	12	1.5
MOV R0, A	F8	1	1	4	12	3
MOV R1, A	F9	1	1	4	12	3
MOV R2, A	FA	1	1	4	12	3
MOV R3, A	FB	1	1	4	12	3
MOV R4, A	FC	1	1	4	12	3
MOV R5, A	FD	1	1	4	12	3
MOV R6, A	FE	1	1	4	12	3
MOV R7, A	FF	1	1	4	12	3
MOV R0, direct	A8	2	2	8	12	1.5
MOV R1, direct	A9	2	2	8	12	1.5
MOV R2, direct	AA	2	2	8	12	1.5
MOV R3, direct	AB	2	2	8	12	1.5
MOV R4, direct	AC	2	2	8	12	1.5
MOV R5, direct	AD	2	2	8	12	1.5
MOV R6, direct	AE	2	2	8	12	1.5
MOV R7, direct	AF	2	2	8	12	1.5
MOV R0, #data	78	2	2	8	12	1.5
MOV R1, #data	79	2	2	8	12	1.5
MOV R2, #data	7A	2	2	8	12	1.5
MOV R3, #data	7B	2	2	8	12	1.5
MOV R4, #data	7C	2	2	8	12	1.5
MOV R5, #data	7D	2	2	8	12	1.5
MOV R6, #data	7E	2	2	8	12	1.5
MOV R7, #data	7F	2	2	8	12	1.5
MOV @R0, A	F6	1	1	4	12	3

Continued

OP-CODE	HEX CODE	BYTES	N79E825 SERIES MACHINE CYCLE	N79E825 SERIES CLOCK CYCLES	8032 CLOCK CYCLES	N79E825 SERIES VS. 8032 SPEED RATIO
MOV @R1, A	F7	1	1	4	12	3
MOV @R0, direct	A6	2	2	8	12	1.5
MOV @R1, direct	A7	2	2	8	12	1.5
MOV @R0, #data	76	2	2	8	12	1.5
MOV @R1, #data	77	2	2	8	12	1.5
MOV direct, A	F5	2	2	8	12	1.5
MOV direct, R0	88	2	2	8	12	1.5
MOV direct, R1	89	2	2	8	12	1.5
MOV direct, R2	8A	2	2	8	12	1.5
MOV direct, R3	8B	2	2	8	12	1.5
MOV direct, R4	8C	2	2	8	12	1.5
MOV direct, R5	8D	2	2	8	12	1.5
MOV direct, R6	8E	2	2	8	12	1.5
MOV direct, R7	8F	2	2	8	12	1.5
MOV direct, @R0	86	2	2	8	12	1.5
MOV direct, @R1	87	2	2	8	12	1.5
MOV direct, direct	85	3	3	12	24	2
MOV direct, #data	75	3	3	12	24	2
MOV DPTR, #data 16	90	3	3	12	24	2
MOVC A, @A+DPTR	93	1	2	8	24	3
MOVC A, @A+PC	83	1	2	8	24	3
MOVX A, @R0	E2	1	2 - 9	8 - 36	24	3 - 0.66
MOVX A, @R1	E3	1	2 - 9	8 - 36	24	3 - 0.66
MOVX A, @DPTR	E0	1	2 - 9	8 - 36	24	3 - 0.66
MOVX @R0, A	F2	1	2 - 9	8 - 36	24	3 - 0.66
MOVX @R1, A	F3	1	2 - 9	8 - 36	24	3 - 0.66
MOVX @DPTR, A	F0	1	2 - 9	8 - 36	24	3 - 0.66
PUSH direct	C0	2	2	8	24	3
POP direct	D0	2	2	8	24	3
XCH A, R0	C8	1	1	4	12	3
XCH A, R1	C9	1	1	4	12	3

9.1 Instruction Timing

This section is important because some applications use software instructions to generate timing delays. It also provides more information about timing differences between the N79E825 series and the standard 8051/52.

In N79E825 series, each machine cycle is four clock periods long. Each clock period is called a state, and each machine cycle consists of four states: C1, C2 C3 and C4, in order. Both clock edges are used for internal timing, so the duty cycle of the clock should be as close to 50% as possible to avoid timing conflicts.

The N79E825 series does one op-code fetch per machine cycle, so, in most instructions, the number of machine cycles required is equal to the number of bytes in the instruction. There are 256 available op-codes. 128 of them are single-cycle instructions, so many op-codes are executed in just four clocks period. Some of the other op-codes are two-cycle instructions, and most of these have two-byte op-codes. However, there are some instructions that have one-byte instructions yet take two cycles to execute. One important example is the MOVX instruction.

In the standard 8052, the MOVX instruction is always two machine cycles long. However, in the N79E825 series each machine cycle is made of only 4 clock periods compared to the 12 clock periods for the standard 8052. Therefore, even though the number of categories has increased, each instruction is at least 1.5 to 3 times faster than the standard 8052 in terms of clock periods.

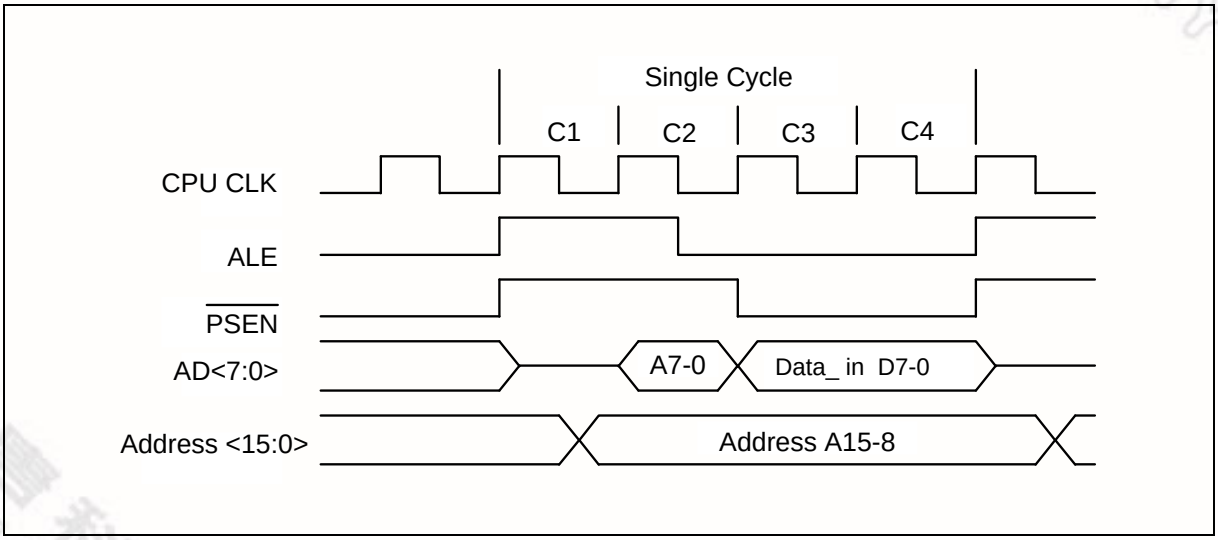

Figure 9-1: Single Cycle Instruction Timing

13 PROGRAMMABLE TIMERS/COUNTERS

The N79E825 series have two 16-bit programmable timer/counters and one programmable Watchdog Timer. The Watchdog Timer is operationally quite different from the other two timers. It's timer/counters have additional timer 0 or timer 1 overflow toggle output enable feature as compare to conventional timer/counters. This timer overflow toggle output can be configured to automatically toggle T0 or T1 pin output whenever a timer overflow occurs.

13.1 Timer/Counters 0 & 1

The N79E825 series have two 16-bit Timer/Counters. Each of these Timer/Counters has two 8 bit registers which form the 16 bit counting register. For Timer/Counter 0 they are TH0, the upper 8 bits register, and TL0, the lower 8 bit register. Similarly Timer/Counter 1 has two 8 bit registers, TH1 and TL1. The two can be configured to operate either as timers, counting machine cycles or as counters counting external inputs.

When configured as a "Timer", the timer counts clock cycles. The timer clock can be programmed to be thought of as 1/12 of the system clock or 1/4 of the system clock. In the "Counter" mode, the register is incremented on the falling edge of the external input pin, T0 for Timer 0, and T1 for Timer 1. The T0 and T1 inputs are sampled in every machine cycle at C4. If the sampled value is high in one machine cycle and low in the next, then a valid high to low transition on the pin is recognized and the count register is incremented. Since it takes two machine cycles to recognize a negative transition on the pin, the maximum rate at which counting will take place is 1/8 of the master clock frequency. In either the "Timer" or "Counter" mode, the count register will be updated at C3. Therefore, in the "Timer" mode, the recognized negative transition on pin T0 and T1 can cause the count register value to be updated only in the machine cycle following the one in which the negative edge was detected.

The "Timer" or "Counter" function is selected by the "$C/\overline{T}$" bit in the TMOD Special Function Register. Each Timer/Counter has one selection bit for its own; bit 2 of TMOD selects the function for Timer/Counter 0 and bit 6 of TMOD selects the function for Timer/Counter 1. In addition each Timer/Counter can be set to operate in any one of four possible modes. The mode selection is done by bits M0 and M1 in the TMOD SFR.

13.1.1 Time-Base Selection

The N79E825 series can operate like the standard 8051/52 family, counting at the rate of 1/12 of the clock speed, or in turbo mode, counting at the rate of 1/4 clock speed. The speed is controlled by the T0M and T1M bits in CKCON, and the default value is zero, which uses the standard 8051/52 speed.

13.1.2 Mode 0

In Mode 0, the timer/counter is a 13-bit counter. The 13-bit counter consists of THx (8 MSB) and the five lower bits of TLx (5 LSB). The upper three bits of TLx are ignored. The timer/counter is enabled when TRx is set and either GATE is 0 or $\overline{INTx}$ is 1. When $C/\overline{T}$ is 0, the timer/counter counts clock cycles; when $C/\overline{T}$ is 1, it counts falling edges on T0 (P1.2 for Timer 0) or T1 (P0.7 for Timer 1). For clock cycles, the time base may be 1/12 or 1/4 clock speed, and the falling edge of the clock increments the counter. When the 13-bit value moves from 1FFFh to 0000h, the timer overflow flag TFx is set, and an interrupt occurs if enabled. This is illustrated in next figure below.

In "Timer" mode, if output toggle enable bit of P2M1.T0OE or P2M1.T1OE is enabled, T0 or T1 output pin will toggle whenever a timer overflow occurs.

13.1.4 Mode 2

In Mode 2, the timer/counter is in the Auto Reload Mode. In this mode, TLx acts as 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 $\overline{\text{INTx}}$ 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.

In "Timer" mode, if output toggle enable bit of P2M1.T0OE or P2M1.T1OE is enabled, T0 or T1 output pin will toggle whenever a timer overflow occurs.

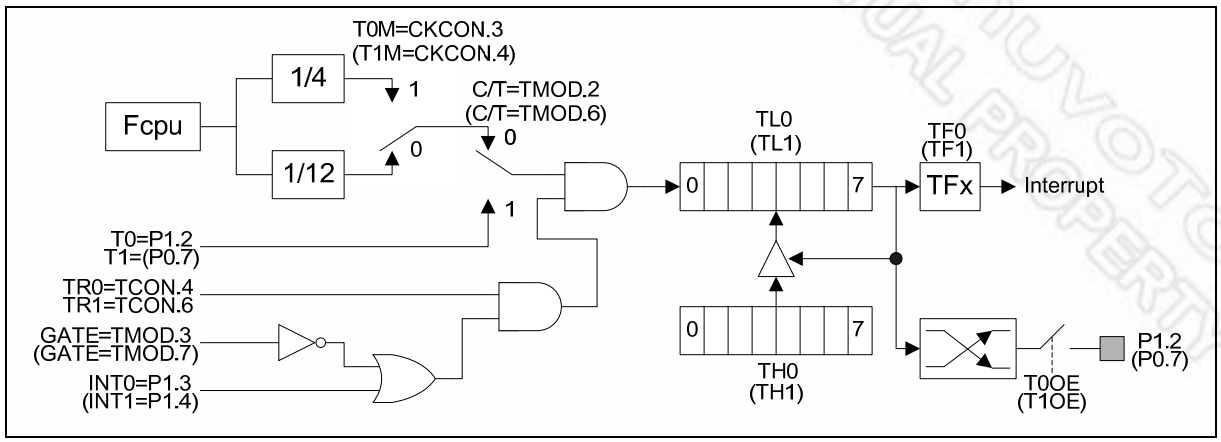

Figure 13-3: Timer/Counter 0 & 1 in Mode 2

13.1.5 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, $\overline{\text{INT0}}$ 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.

In "Timer" mode, if output toggle enable bit of P2M1.T0OE or P2M1.T1OE is enabled, T0 or T1 output pin will toggle whenever a timer overflow occurs.

16 SERIAL PORT (UART)

Serial port in the N79E825 series is a full duplex port. The N79E825 series provide the user with additional features such as the Frame Error Detection and the Automatic Address Recognition. The serial ports are capable of synchronous as well as asynchronous communication. In Synchronous mode the N79E825 series generate the clock and operates in a half duplex mode. In the asynchronous mode, full duplex operation is available. This means that it can simultaneously transmit and receive data. The transmit register and the receive buffer are both addressed as SBUF Special Function Register. However any write to SBUF will be to the transmit register, while a read from SBUF will be from the receiver buffer register. The serial port can operate in four different modes as described below.

16.1 MODE 0

This mode provides synchronous communication with external devices. In this mode serial data is transmitted and received on the RXD line. TXD is used to transmit the shift clock. The TxD clock is provided by the N79E825 series whether the device is transmitting or receiving. This mode is therefore a half duplex mode of serial communication. In this mode, 8 bits are transmitted or received per frame. The LSB is Transmitted/Received first. The baud rate is fixed at 1/12 or 1/4 of the oscillator frequency. This Baud Rate is determined by the SM2 bit (SCON.5). When this bit is set to 0, then the serial port runs at 1/12 of the clock. When set to 1, the serial port runs at 1/4 of the clock. This additional facility of programmable baud rate in mode 0 is the only difference between the standard 8051 and the N79E825 series.

The functional block diagram is shown below. Data enters and leaves the Serial port on the RxD line. The TxD line is used to output the shift clock. The shift clock is used to shift data into and out of the N79E825 series and the device at the other end of the line. Any instruction that causes a write to SBUF will start the transmission. The shift clock will be activated and data will be shifted out on the RxD pin till all 8 bits are transmitted. If SM2 = 1, then the data on RxD will appear 1 clock period before the falling edge of shift clock on TxD. The clock on TxD then remains low for 2 clock periods, and then goes high again. If SM2 = 0, the data on RxD will appear 3 clock periods before the falling edge of shift clock on TxD. The clock on TxD then remains low for 6 clock periods, and then goes high again. This ensures that at the receiving end the data on RxD line can either be clocked on the rising edge of the shift clock on TxD or latched when the TxD clock is low.

16.3 MODE 2

This mode uses a total of 11 bits in asynchronous full-duplex communication. The functional description is shown in the figure below. The frame consists of one start bit (0), 8 data bits (LSB first), a programmable 9th bit (TB8) and a stop bit (0). The 9th bit received is put into RB8. The baud rate is programmable to 1/32 or 1/64 of the oscillator frequency, which is determined by the SMOD bit in PCON SFR. 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 the 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 9 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 11th rollover of the divide-by-16 counter after a write to SBUF. Reception is enabled only if REN is high. The serial port actually starts the receiving of serial data, with the detection of a falling edge on the RxD pin. The 1-to-0 detector continuously monitors the RxD line, sampling it at the rate of 16 times the selected baud rate. When a falling edge is detected, the divide- by-16 counter is immediately reset. This helps to align the bit boundaries with the rollovers of the divide-by-16 counter. The 16 states of the counter effectively divide the bit time into 16 slices. The bit detection is done on a best of three bases. The bit detector samples the RxD pin, at the 8th, 9th and 10th counter states. By using a majority 2 of 3 voting system, the bit value is selected. This is done to improve the noise rejection feature of the serial port.

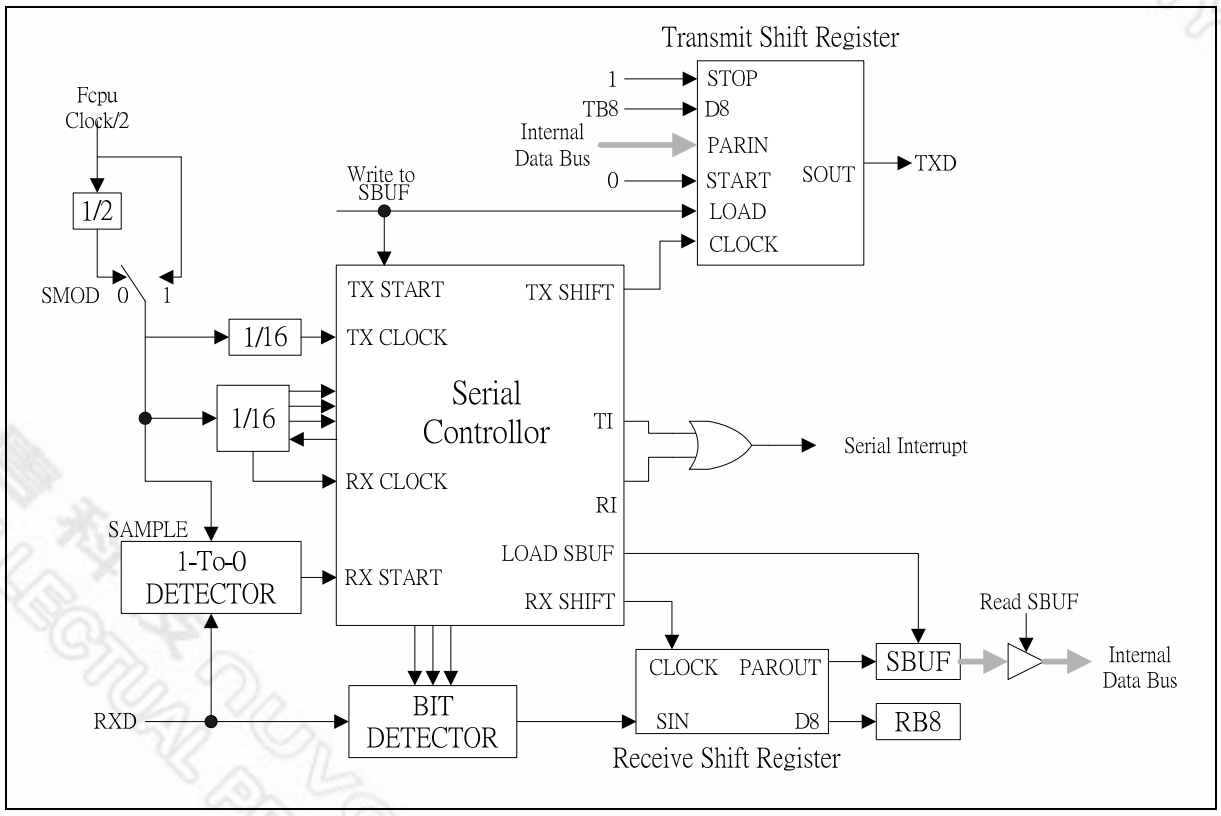

Figure 16-3: Serial Port Mode 2

17 TIME ACCESS PROCTECTION

The N79E825 series have a new feature, like the Watchdog Timer which is a crucial to proper operation of the system. If left unprotected, errant code may write to the Watchdog control bits resulting in incorrect operation and loss of control. In order to prevent this, the N79E825 series have a protection scheme which controls the write access to critical bits. This protection scheme is done using a timed access.

In this method, the bits which are to be protected have a timed write enable window. A write is successful only if this window is active, otherwise the write will be discarded. This write enable window is open for 3 machine cycles if certain conditions are met. After 3 machine cycles, this window automatically closes. The window is opened by writing AAh and immediately 55h to the Timed Access (TA) SFR. This SFR is located at address C7h. The suggested code for opening the timed access window is

```
TA      REG   0C7h              ;Define new register TA, located at 0C7h
        MOV   TA, #0AAh
        MOV   TA, #055h
```

When the software writes AAh to the TA SFR, a counter is started. This counter waits for 3 machine cycles looking for a write of 55h to TA. If the second write (55h) occurs within 3 machine cycles of the first write (AAh), then the timed access window is opened. It remains open for 3 machine cycles, during which the user may write to the protected bits. Once the window closes the procedure must be repeated to access the other protected bits.

Examples of Timed Assessing are shown below.

Example 1: Valid access

```
        MOV     TA, #0AAh           ;3 M/C  Note: M/C = Machine Cycles
        MOV     TA, #055h           ;3 M/C
        MOV     WDCON, #00h         ;3 M/C
```

Example 2: Valid access

```
        MOV     TA, #0AAh           ;3 M/C
        MOV     TA, #055h           ;3 M/C
        NOP                         ;1 M/C
        SETB    EWRST               ;2 M/C
```

Example 3: Valid access

```
        MOV     TA, #0AAh           ;3 M/C
        MOV     TA, #055h           ;3 M/C
        ORL     WDCON, #00000010B   ;3M/C
```

Example 4: Invalid access

```
        MOV     TA, #0AAh           ;3 M/C
        MOV     TA, #055h           ;3 M/C
        NOP                         ;1 M/C
        NOP                         ;1 M/C
```

```
CLR     EWT                     ;2 M/C
```

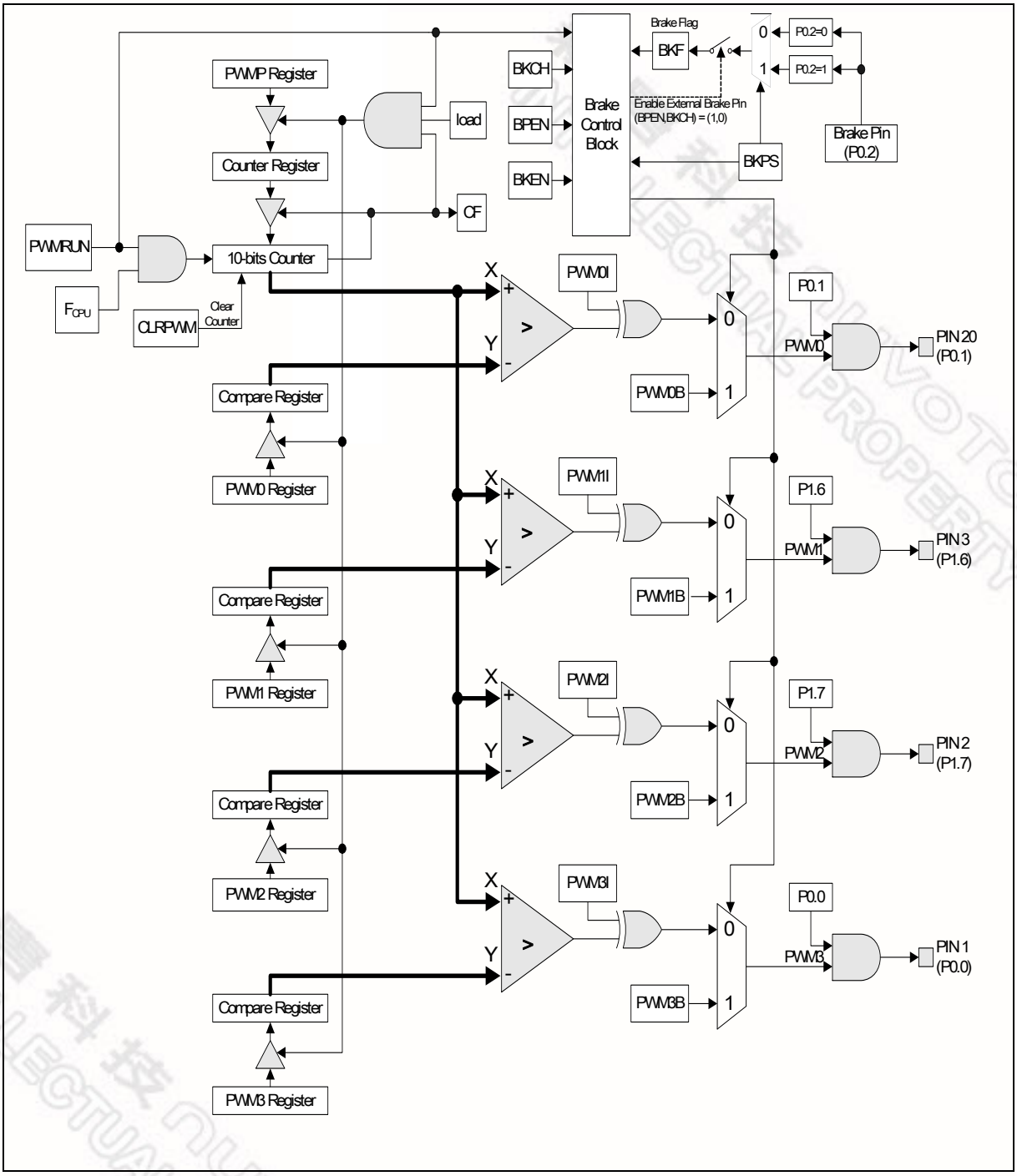

Figure 23-1: N79E825/824 PWM Block Diagram

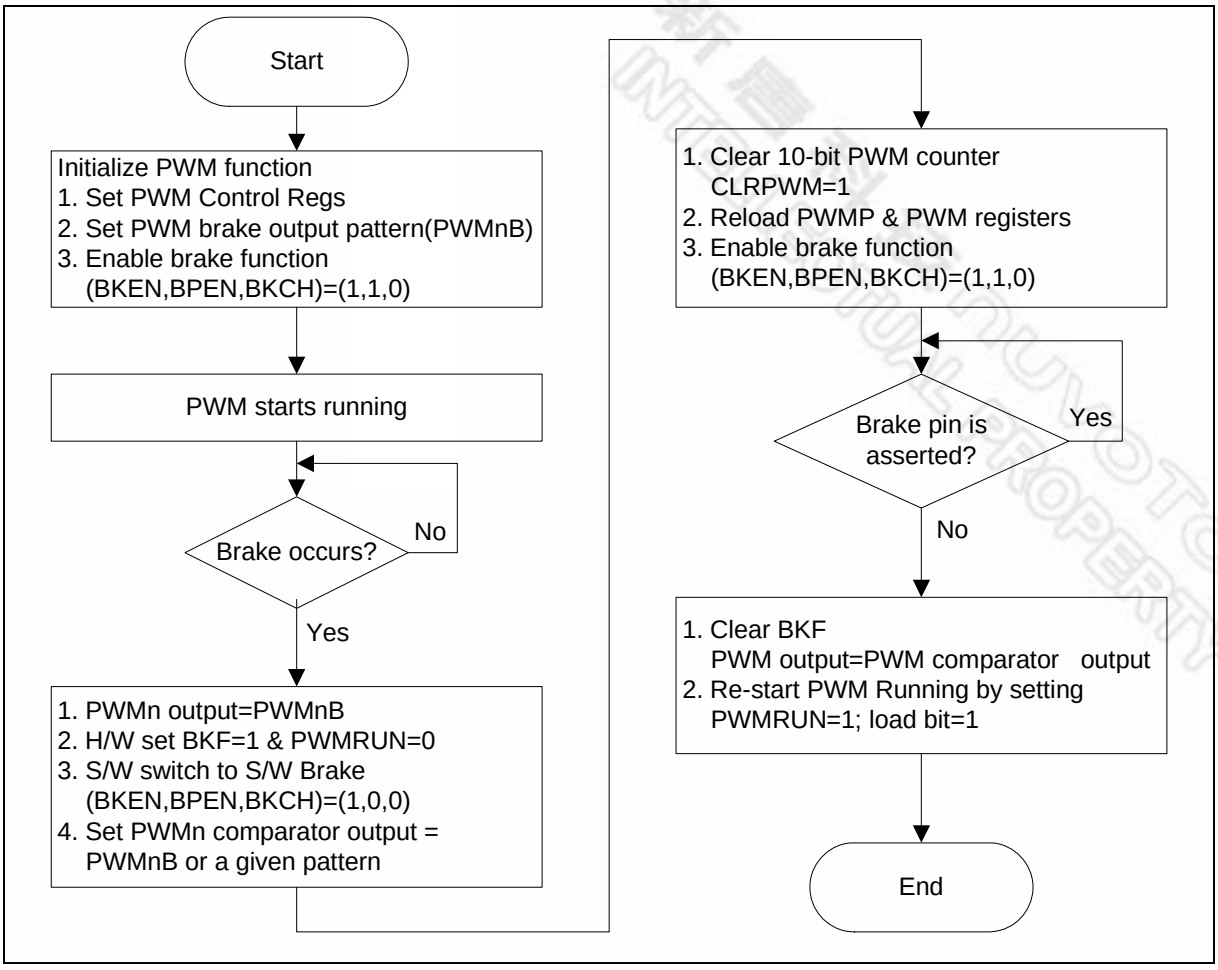

Figure 23-2: PWM Brake Function

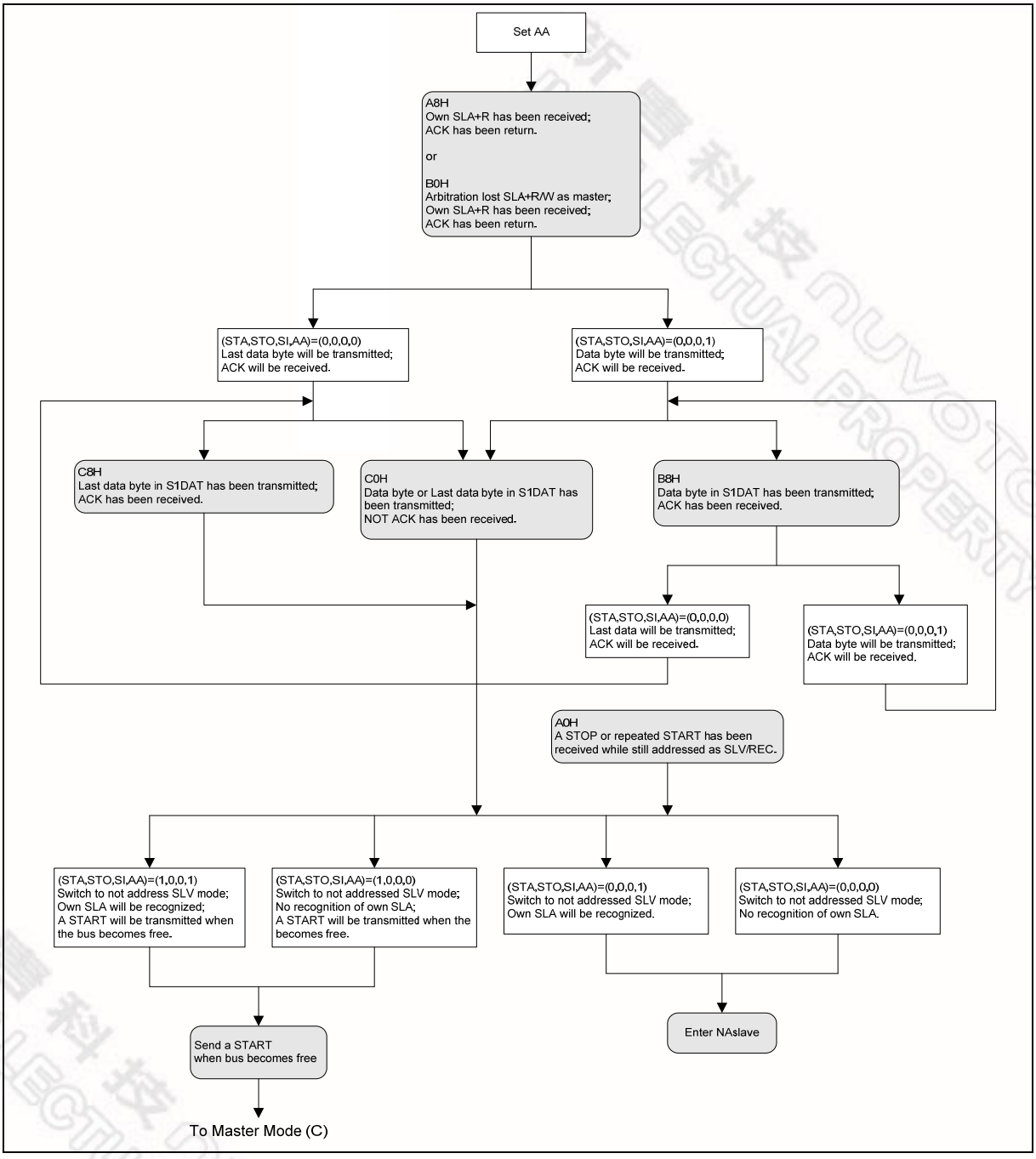

Figure 25-6: Slave Transmitter Mode

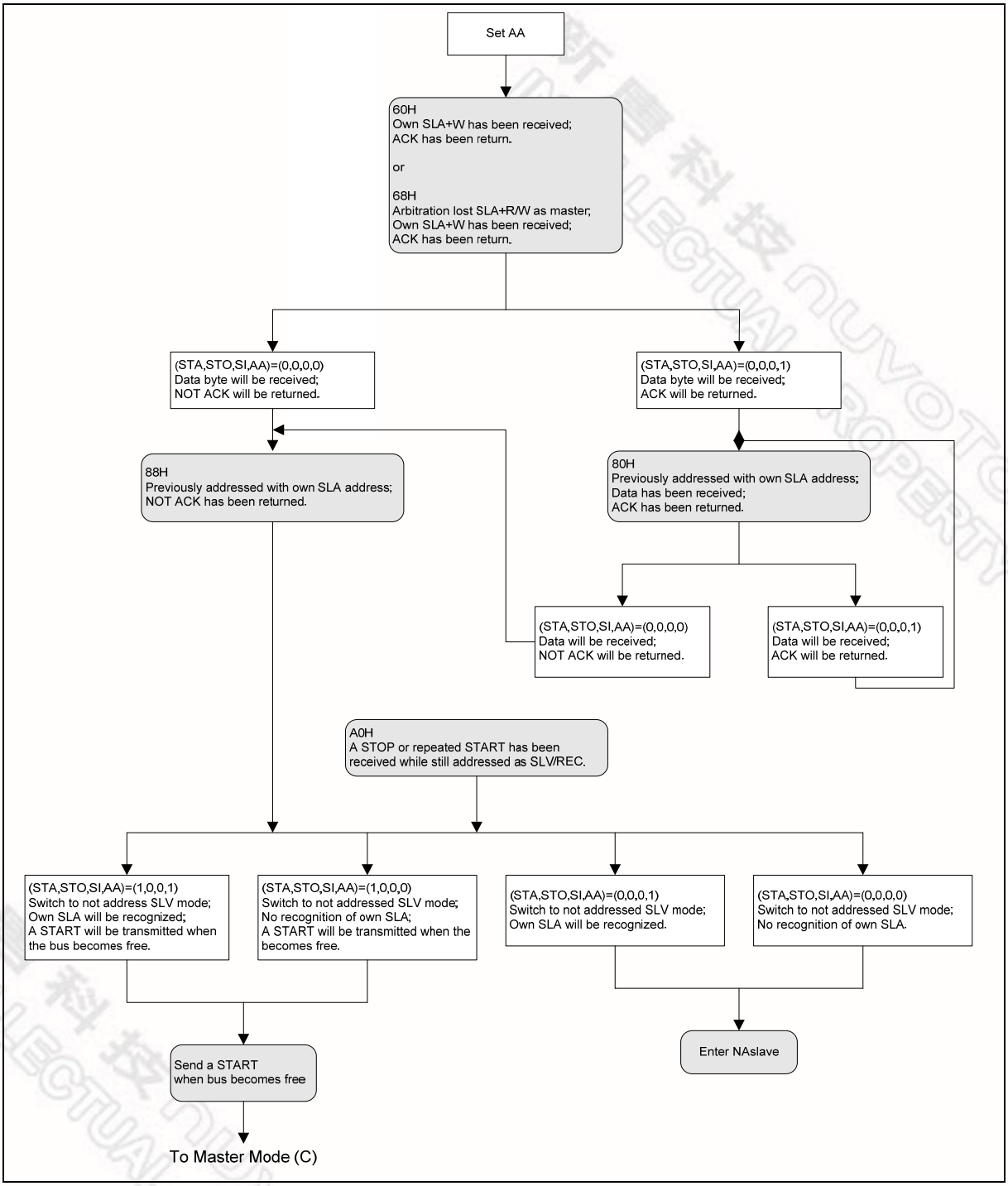

Figure 25-7:Slave Receiver Mode

BIT 7	BIT 6	FUNCTION DESCRIPTION
1	1	Both security of **16KB/8KB/4KB/2KB** program code and **256** Bytes data area are unlocked. They can be erased, programmed or read by Writer or ICP.
0	1	The **16KB/8KB/4KB/2KB** program code area is locked. It can't be read by Writer or ICP.
1	0	Don't support (Invalid).
0	0	Both security of **16KB/8KB/4KB/2KB** program code and **256** Bytes data area are locked. They can't be read by Writer or ICP.