



A/D MCU



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General Description

The MCU provides cost effective for ADC application。 It designs by LSI high technology with low power process。

Features

- ◇ Use 4-bit CPU core
- ◇ Operating Voltage :
 - (TTU621C/TTU622C)Mask type : 2.2v-5.5v (fsys=4Mhz), 3.3v-5.5v (fsys=8Mhz)
 - (TTR621C/TTR622C)OTP type : 2.2v-5.5v (fsys=4Mhz), 3.3v-5.5v (fsys=8Mhz)
- ◇ Oscillator type (Mask Option)
 - Resonator oscillator 1M-8Mhz(external capacitor)
 - Built-in RC oscillator external resistor, internal capacitor (400K-4Mhz)
 - External clock input(OSCH)
 - (TTU622C/TTR622C)External 32768Hz crystal oscillator
 - Internal RC oscillator 16Khz
- ◇ (TTU621C/TTR621C)user ROM 2K*16, RAM 128*4, (TTU622C/TTR622C)user ROM 4K*16, RAM 256*4
- ◇ Built-in (TTU621C/TTR621C) 2 stacks, (TTU622C/TTR622C) 4 stacks
- ◇ Built-in a time base with internal interrupt
- ◇ Built-in watch dog timer
- ◇ Built-in Programming frequency divider function for buzzer function
- ◇ Stop function and sleep function feature to reduce power consumption
- ◇ (TTU621C/TTR621C)Built-in 1 set 8-bit Timer/counter with auto-reload
- ◇ (TTU622C/TTR622C)Built-in 2 set 8-bit Timer/counter with auto-reload (share with 16-bit Timer/counter)
- ◇ (TTU621C/TTR621C)Built-in 1 set 8-bit PWM
- ◇ (TTU622C/TTR622C)Built-in 2 set 8-bit PWM
- ◇ Low voltage reset function
- ◇ (TTU621C/TTR621C)Built-in 8 bits ADC 4 channels (with internal interrupt function, conversion time is 72us @4Mhz) (8-bit resolution and 7-bit accuracy)
- ◇ (TTU622C/TTR622C)Built-in 8 bits ADC 8 channels (with internal interrupt function, conversion time is 64us @4Mhz) (8-bit resolution and 7-bit accuracy)
- ◇ (TTU621C/TTR621C)13 I/O ports, (TTU622C/TTR622C)23 I/O ports
- ◇ Provide external reset pin and internal reset pin
- ◇ Provide (TTU621C/TTR621C)18-pin DIP/SOP, (TTU622C/TTR622C) 24/28-pin SDIP/SOP

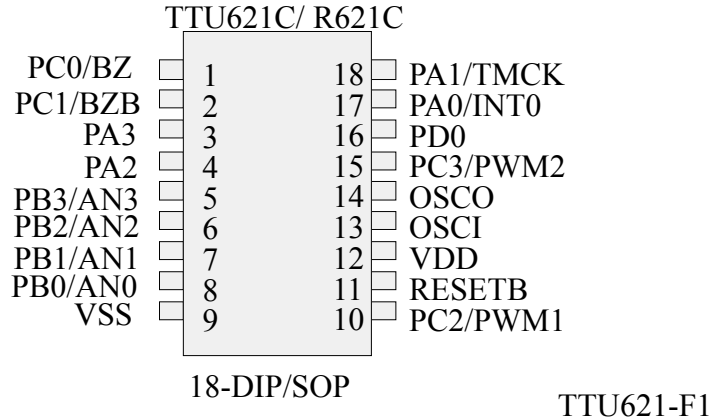
Application

- Electric appliances controller
- Consumer products
- Toy controller

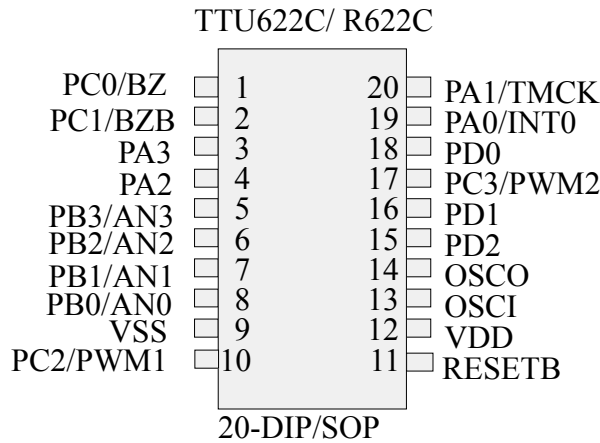


.Pin Assignment

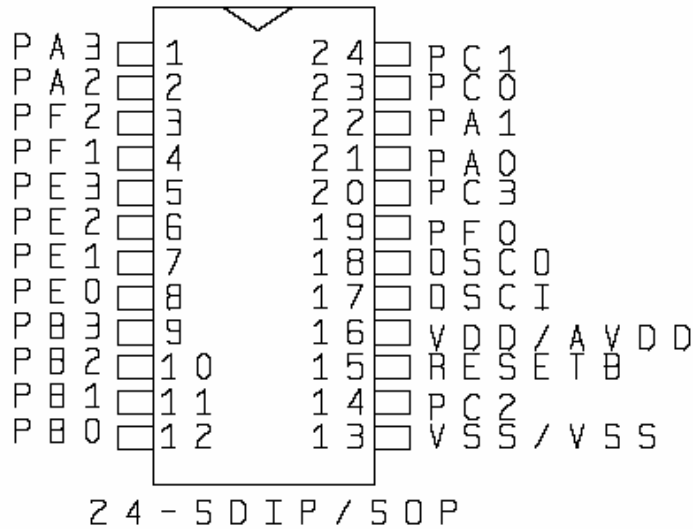
(TTU621C/TTR621C)



(TTU622C/TTR622C)

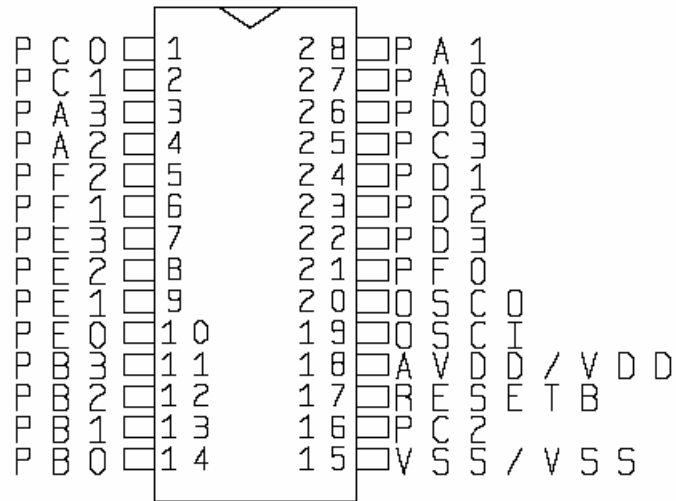


T T U 6 2 2 C / R 6 2 2 C





T T U 6 2 2 C / R 6 2 2 C



2 8 S D I P / 5 0 P

**.Pin Description**

(TTU621C/TTR621C)

Name	I/O	Description	pins
PA0/INT0	I/O	General purpose I/O port, hysteresis input, pull high 100Kohm @3v selected by software, there can be selected as external interrupt input function	1
PA1/ TMCK	I/O	General purpose I/O port, hysteresis input, pull high 100Kohm @3v selected by software, there can be selected as external wake-up function or external clock input for Timer/Counter1 circuit	1
PA2-PA3	I/O	General purpose I/O port, hysteresis input, pull high 100Kohm @3v selected by software, there can be selected as external wake-up function	2
PD0	I/O	General purpose I/O port, hysteresis input, pull high 100Kohm @3v selected by software, there can be selected as external wake-up function	1
RSTB	I	External reset pin, low active	1
VSS	P	Digital ground pin	1
VSS	P	Analog ground pin	1
PB0/AN0 PB1/AN1 PB2/AN2 PB3/AN3	I/O	General purpose I/O port, hysteresis input, pull high 100Kohm @3v selected by software, with wake up function selected by software programming(falling edge trigger). There can be selected as an A/D input, the I/O function and pull-high resistor are disabled automatically.	4
PC0/BZ PC1/BZB	I/O	General purpose I/O port, hysteresis input, pull high 100Kohm @3v selected by software, with wake up function selected by software programming(falling edge trigger). Ther can be selected as buzzer function select by software programming.	2
PC2/PWMA1 PC3/PWMA2	I/O	General purpose I/O port, hysteresis input, pull high 100Kohm @3v selected by software, with wake up function selected by software programming (falling edge trigger). Ther can be selected as PWM function select by software programming.	2
VDD	P	Analog power pin	1
VDD	P	Digital power pin	1
OSCI	I	Crystal type: crystal input RC type: RC oscillator input External clock input	1
OSCO	O	Crystal type: crystal output RC type: Oscillator frequency divided by 2 is available on OSCO to synchronize other logic or used for testing purpose.	1
Total Pin			20

Note – Please notice input pin pull low/high or output pin driving current capacity in this table.



(TTU622C/TTR622C)

Name	I/O	Description	pins
PA0/INT0	I/O	General purpose I/O port, hysteresis input, pull high 100Kohm @5v selected by software, there can be selected as external interrupt input function	1
PA1/ TMCK	I/O	General purpose I/O port, hysteresis input, pull high 100Kohm @5v selected by software, it can be selected as external wake-up function or external clock input for Timer/Counter1 circuit	1
PA2/RTCI PA3/RTCO	I/O	General purpose I/O port, hysteresis input, pull high 100Kohm @5v selected by software, there can be selected as external wake-up function. Ther can be selected as 32768Hz crystal oscillator function programed by mask option	2
RSTB/ VPP	I	External reset pin, hysteresis input, without pull high, low active	1
VSS	P	Digital ground pin	1
VSS	P	Analog ground pin	1
PB0/AN0 PB1/AN1 PB2/AN2 PB3/AN3	I/O	General purpose I/O port, hysteresis input, pull high 100Kohm @5v selected by software, with wake up function selected by software programming(falling edge trigger). There can be selected as an A/D input, the I/O function and pull-high resistor are disabled automatically.	4
PE0/AN4 PE1/AN5 PE2/AN6 PE3/AN7	I/O	General purpose I/O port, hysteresis input, pull high 100Kohm @5v selected by software, with wake up function selected by software programming(falling edge trigger). There can be selected as an A/D input, the I/O function and pull-high resistor are disabled automatically.	4
VDD	P	Analog power pin	1
VDD	P	Digital power pin	1
PC0/BZ PC1/BZB	I/O	General purpose I/O port, hysteresis input, pull high 100Kohm @5v selected by software, with wake up function selected by software programming(falling edge trigger). Ther can be selected as buzzer function select by software programming.	2
PC2/PWMA1 PC3/PWMA2	I/O	General purpose I/O port, hysteresis input, pull high 100Kohm @5v selected by software, with wake up function selected by software programming (falling edge trigger). Ther can be selected as PWM function select by software programming.	2
PF0/PWMB1 PF1/PWMB2	I/O	General purpose I/O port, hysteresis input, pull high 100Kohm @5v selected by software, with wake up function selected by software programming (falling edge trigger). Ther can be selected as PWM function select by software programming.	2
PF2	I/O	General purpose I/O port, hysteresis input, pull high 100Kohm @5v selected by software, there can be selected as external wake-up function	1
OSCI	I	Crystal type: crystal input RC type: RC oscillator input External clock input	1
OSCO	O	Crystal type: crystal output RC type: Oscillator frequency divided by 2 is available on OSCO to synchronize other logic or used for testing purpose.	1
PD0-PD3	I/O	General purpose I/O port, hysteresis input, pull high 100Kohm @5v selected by software, there can be selected as external wake-up function	4
Total Pin			30

Note – Please notice input pin pull low/high or output pin driving current capacity in this table.



.AC / DC Characteristics

.Absolutely max. ratings

ITEM	SYMBOL	RATING	UNIT
Operating Temperature	Top	-20°C - +95°C	°C
Storage Temperature	Tsto	-50°C - +125°C	°C
Supply Voltage	VDD	6.0	V
Voltage to input terminal	Vin	Vss-0.3 to Vdd+0.3	V

.D.C. Characteristics

(Condition : Ta= 25 ± 3 °C, RH ≤ 65 %, VDD =+ 3V, VSS=0V)

Item	Symb ol	Condition	min. °	typ °	Max. °	unit
Operating voltage	VDD1	(TTU621C/TTU622C)Fsys=4Mhz	2.2	3.0	5.5	V
Operating voltage	VDD1	(TTR621C/TTR622C)Fsys=4Mhz	2.0	3.0	5.5	V
Operating voltage	VDD2	Fsys=8Mhz	3.0	5.0	5.5	V
Power consumption current	I _{OPR1}	System clock at 8Mhz resonator, No load, @5.0V, ADC off		4.0	8.0	mA
Power consumption current	I _{OPR2}	System clock at 4Mhz resonator, No load, @5.0V, ADC off		2.5	5.0	mA
Power consumption current	I _{OPR3}	System clock at 4Mhz RC oscillator, No load, @5.0V, ADC off		2.5	5.0	mA
Power consumption current	I _{OPR4}	System clock at 32Khz crystal oscillator, No load, @3.0V, ADC off		20	40	uA
ADC power consumption	I _{AD1}	Additional power consumption when ADC use(ADC clock is 1Mhz and VDD=3V)		0.5	1	mA
ADC power consumption	I _{AD2}	Additional power consumption when ADC use(ADC clock is 1Mhz and VDD=5V)		1.5	3	mA
Halt current	I _{st2}	System halt, No load @3.0V, WDT disable			1	uA
Input low voltage for input and I/O port	V _{IL1}		0		0.3VDD	V
Input high voltage for input and I/O port	V _{IH1}		0.7VDD		VDD	V
Input low voltage for RESB pin	V _{IL2}		0		0.4VDD	V
Input high voltage for RESB pin	V _{IH2}		0.9VDD		VDD	V
I/O port sink current	I _{OL1}	V _{OL} =0.1VDD, @5.0V	4	8	16	mA
I/O port source current	I _{OH1}	V _{OH} =0.9VDD, @5.0V	2	4	8	mA
Pull high resistance	R _{UP}	@5V	100	150	200	Kohm
Resonator oscillator sustain voltage	V _{SU}		2.3			V

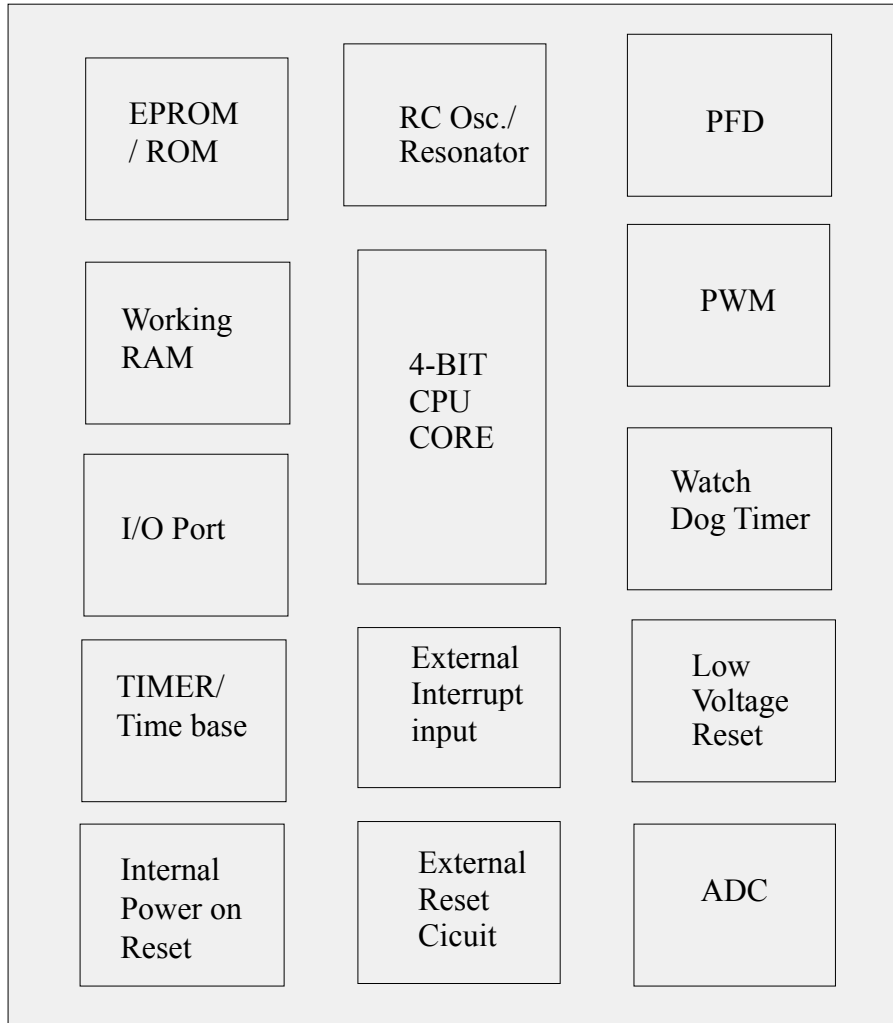


LVR current	I_{LVR}	@ 3.0V		70	100	uA
A/D input voltage	V_{ADI}	(Vref=VDD)	0		VDD	V
A/D conversion error	E_{ADC}	When VDD from 2.7V-5.5V		±0.5	±1	LSB

.A.C. Characteristics

Item	Symbol	Condition	min.	typ.	Max.	unit
System clock1	f_{SYS1}	Resonator oscillator @3.0v		4		MHz
System clock2	f_{SYS2}	RC oscillator @3.0v, external resistor		4		MHz
Watch dog clock	f_{WDT}	(internal oscillator circuit)	8	16	32	Khz
External reset low pulse width	t_{RES}		1			us
ADC conversion time	t_{ADC}	At 4Mhz system clock, ADC clock is 1MHZ		64		us

.Block Diagram



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Function Description

1 Map of memory and I/Os (TTU621C/TTR621C)

000H	(DP1)
001H	A
002H	TB1
003H	TB2
004H	TB3
005H	DPL
006H	DPM
007H	DPH
008H	PS
009H	INTF
00AH	INTC
00BH	PA0&CTL
00CH	PAC
00DH	PA
00EH	PBC
00FH	PB
010H	PCC
011H	PC
012H	PDC
013H	PD
014H	Reserved
015H	
016H	TBC/BZC
017H	TMR1L
018H	TMR1H
019H	TMR1C
01AH	PWM1DL
01BH	PWM1DH
01CH	ADL
01DH	ADH
01EH	ADCTL0
01FH	ADCTL1
020H	
	RAM
09FH	
0A0H	Reserved
11FH	
120H	PWMC
121H	AD-SEL0
12AH	PWMCK
FFFH	Reserved

Data memory map

000	Reset vector
001	INTB vector
002	
	On-chip program memory
7FF	
800	
FFF	Reserved

Program memory map

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(TTU622C/TTR622C)

000H	(DP1)
001H	A
002H	TB1
003H	TB2
004H	TB3
005H	DPL
006H	DPM
007H	DPH
008H	PS
009H	INTF
00AH	INTC
00BH	PA0&CTL
00CH	PAC
00DH	PA
00EH	PBC
00FH	PB
010H	PCC
011H	PC
012H	PDC
013H	PD
014H	PEC
015H	PE
016H	TBC/BZC
017H	TMR1L
018H	TMR1H
019H	TMR1C
01AH	PWM1DL
01BH	PWM1DH
01CH	ADL
01DH	ADH
01EH	ADCTL0
01FH	ADCTL1
020H	RAM
11FH	
120H	PWMC
121H	AD-SEL0
122H	AD-SEL1
123H	PFC
124H	PF
125H	PWM2DL
126H	PWM2DH
127H	TMR2L
128H	TMR2H
129H	TMR2C
12AH	PWMCK
FFFH	Reserved

Data memory map

000	Reset vector
001	INTB vector
002	
	On-chip program memory
FFF	

Program memory map

SU622C-G1



2I/O MAP TABLE

Address	Resister	Bit3	Bit2	Bit1	Bit0	Initial state
008H	PS	X	H/L	SLEEP	STOP	u100
		X	R/W	R/W	R/W	
009H	INTF	PA0F	TMR1F	TMR2F	TBF	0000
		R/W	R/W	R/W	R/W	
00AH	INTC	PA0IE	TMR1IE	TMR2IE	TBIE	0000
		R/W	R/W	R/W	R/W	
00BH	PA0&CTL	RF1	RF0	LVREN	LVRC	0010
		R/W	R/W	R/W	R/W	
00CH	PAC	PAC3	PAC2	PAC1	PAC0	1111
		R/W	R/W	R/W	R/W	
00DH	PA	PA3	PA2	PA1	PA0	1111
		R/W	R/W	R/W	R/W	
00EH	PBC	PBC3	PBC2	PBC1	PBC0	1111
		R/W	R/W	R/W	R/W	
00FH	PB	PB3	PB2	PB1	PB0	1111
		R/W	R/W	R/W	R/W	
010H	PCC	PCC3	PCC2	PCC1	PCC0	1111
		R/W	R/W	R/W	R/W	
011H	PC	PC3	PC2	PC1	PC0	1111
		R/W	R/W	R/W	R/W	
012H	PDC	PDC3	PDC2	PDC1	PDC0	1111
		R/W	R/W	R/W	R/W	
013H	PD	PD3	PD2	PD1	PD0	1111
		R/W	R/W	R/W	R/W	
014H	PEC	PEC3	PEC2	PEC1	PEC0	1111
		R/W	R/W	R/W	R/W	
015H	PE	PE3	PE2	PE1	PE0	1111
		R/W	R/W	R/W	R/W	
016H	TBC/BZC	BZEN	TB2	TB1	TB0	0000
		R/W	R/W	R/W	R/W	
017H	TMR1L	TMR1_3	TMR1_2	TMR1_1	TMR1_0	0000
		R/W	R/W	R/W	R/W	
018H	TMR1H	TMR1_7	TMR1_6	TMR1_5	TMR1_4	0000
		R/W	R/W	R/W	R/W	
019H	TMR1C	TM1LD	T1CK1	T1CK0	TM1EN	0000
		R/W	R/W	R/W	R/W	
01AH	PWMADL	DTY13	DTY12	DTY11	DTY10	0000
		R/W	R/W	R/W	R/W	
01BH	PWMADH	DTY17	DTY16	DTY15	DTY14	0000
		R/W	R/W	R/W	R/W	
01CH	ADL	AD3	AD2	AD1	AD0	0000



		R	R	R	R	
01DH	ADH	AD7	AD6	AD5	AD4	0000
		R	R	R	R	
01EH	ADCTL0	ADEN	CH2	CH1	CH0	0000
		R/W	R/W	R/W	R/W	
01FH	ADCTL1	ADIE	ADF	ADCK1	ADCK0	0000
		R/W	R/W	R/W	R/W	
120H	PWMC	PWMA2EN	PWMA1EN	PWMA2DC	PWMA1DC	0000
		R/W	R/W	R/W	R/W	
121H	AD-SEL0	AN3/PB3	AN2/PB2	AN1/PB1	AN0/PB0	0000
		R/W	R/W	R/W	R/W	
122H	AD-SEL1	AN7/PE3	AN6/PE2	AN5/PE1	AN4/PE0	0000
		R/W	R/W	R/W	R/W	
123H	PFC	X	PFC2	PFC1	PFC0	u111
		X	R/W	R/W	R/W	
124H	PF	X	PF2	PF1	PF0	u111
		X	R/W	R/W	R/W	
125H	PWMBDL	DTY23	DTY22	DTY21	DTY20	0000
		R/W	R/W	R/W	R/W	
126H	PWMBDH	DTY27	DTY26	DTY25	DTY24	0000
		R/W	R/W	R/W	R/W	
127H	TMR2L	TMR2_3	TMR2_2	TMR2_1	TMR2_0	0000
		R/W	R/W	R/W	R/W	
128H	TMR2H	TMR2_7	TMR2_6	TMR2_5	TMR2_4	0000
		R/W	R/W	R/W	R/W	
129H	TMR2C	TM2LD	T2CK1	T2CK0	TM2EN	0000
		R/W	R/W	R/W	R/W	
12AH	PWMCK	CK2_S1	CK2_S0	CK1_S1	CK1_S0	0000
		R/W	R/W	R/W	R/W	

3 SYSTEM CONTROL REGISTER

Address	Resister	Bit3	Bit2	Bit1	Bit0	Initial state
008H	PS	X	H/L	SLEEP	STOP	1100
		X	R/W	R/W	R/W	

STOP : high active. (All oscillator circuit is not active.)

SLEEP : high active.

Operating mode	SLEEP(high active)	STOP(high active)
Function status		
Oscillator	Operating	Stopped
CPU internal status	Retain the status	
Memory, Flag, Register, I/O	Retain the status	
Program counter	Hold the executed address	
Timer/Counter/ Time base timer	Operated	Stopped & Retain
Watch-dog enable	Retain the status	
Release Condition(and clear STOP or SLEEP flag)	PA0-INT/ PA&PB & PC&PD &PE&PF port Wake-up / ADC-INT/ TMR1-INT/ TMR2-INT/ TB-INT	PA0-INT/ PA&PB &PC&PD &PE&PF port Wake-up

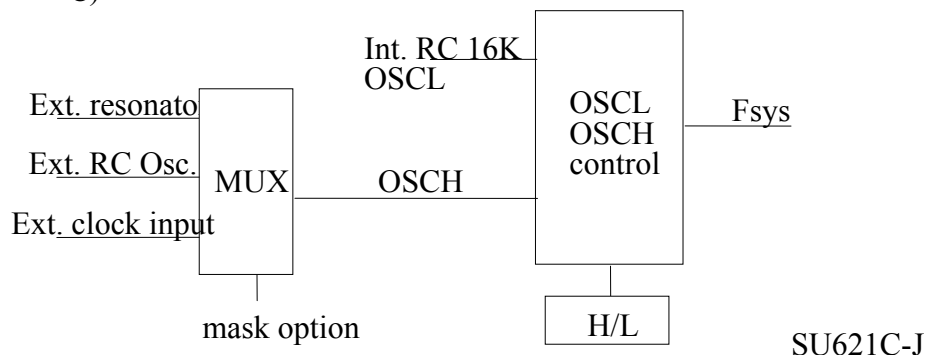
4 SYSTEM CLOCK CONTROL REGISTER

Address	Resister	Bit3	Bit2	Bit1	Bit0	Initial state
008H	PS	X	H/L	SLEEP	STOP	u100
		X	R/W	R/W	R/W	

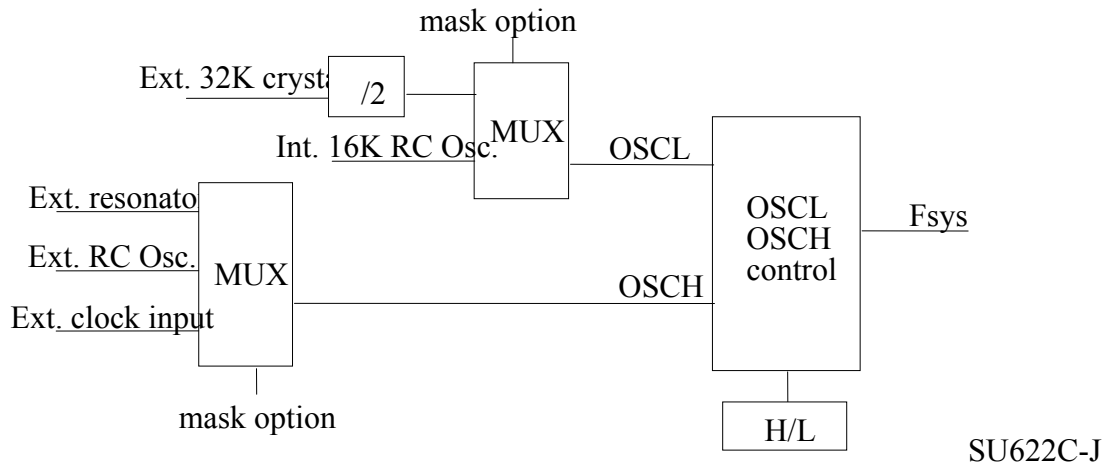
H/L : Oscillator speed control register.

FLAG	FUNCTION
H/L	Low : oscillator low speed mode (OSCL) High : oscillator high speed mode (OSCH)

(TTU621C/TTR621C)



(TTU622C/TTR622C)



SU622C-J

- * 如果選 RTC(Ext. 32K crystal) 時, Int. 16KRC Osc. 要 Off。
 - * OSCL is always on except STOP=high。
 - * 如果進入 SLEEP MODE 時, 若是 H/L 停在 low speed mode, 此時 OSCH 要 off。
 - * 在 External RC oscillator mode 時, OSCO pin 會輸出 RC Osc. 頻率除以二的 clock 輸出。
- * RTC oscillation stable time needs 0.5sec ~2 sec that depends on operating voltage and IC process.

Low Voltage Reset

Address	Resister	Bit3	Bit2	Bit1	Bit0	Initial state
00BH	PA0&CTL	RF1	RF0	LVREN	LVRC	0010
		R/W	R/W	R/W	R/W	

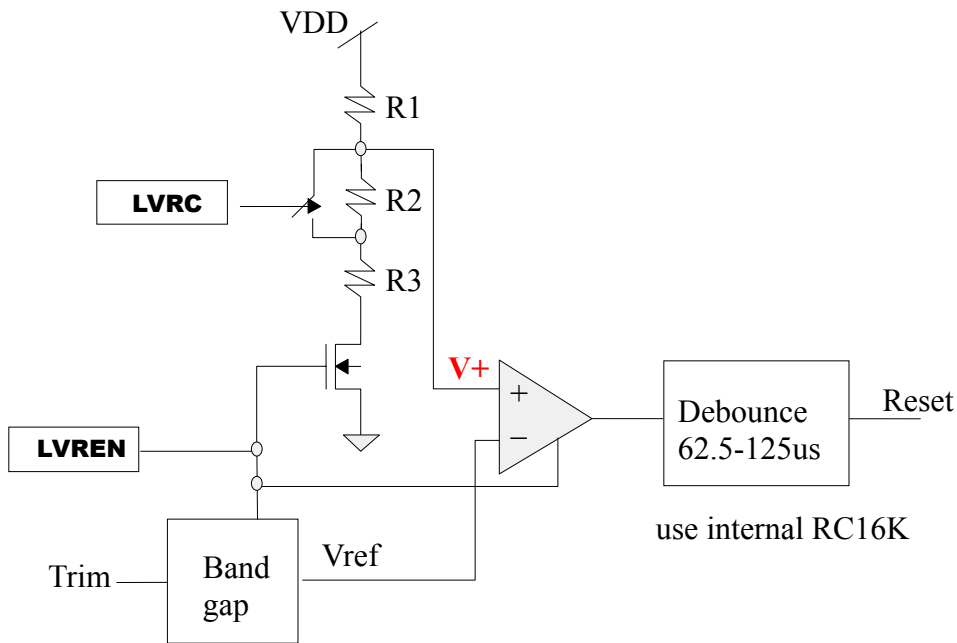
FLAG	FUNCTION
LVREN	Low : disable LVR function High : enable LVR function
LVRC	Low : select V+ level for LVR when LVREN=1 TTU622 : LVR 的偵測電壓為 $VDD < 2.4V \pm 10\%$ TTR622 : LVR 的偵測電壓為 $VDD < 2.2V \pm 10\%$ High : select V+ level for LVR when LVREN=1 LVR 的偵測電壓為 : $VDD < 3.0V \pm 10\%$

(TTU622C)

- LVR 的偵測電壓為：
- $VDD < 2.4V \pm 10\%$
 - $VDD < 3.0V \pm 10\%$

(TTR622C)

- LVR 的偵測電壓為：
- $VDD < 2.2V \pm 10\%$
 - $VDD < 3.0V \pm 10\%$



SU621C-3

5 I/O REGISTER

A. Port A

Address	Resister	Bit3	Bit2	Bit1	Bit0	Initial state
009H	INTF	PA0F	TMR1F	TMR2F	TBF	0000
		R/W	R/W	R/W	R/W	
00AH	INTC	PA0IE	TMR1IE	TMR2IE	TBIE	0000
		R/W	R/W	R/W	R/W	
00BH	PA0&CTL	RF1	RF0	LVREN	LVRC	0010
		R/W	R/W	R/W	R/W	
00CH	PAC	PAC3	PAC2	PAC1	PAC0	1111
		R/W	R/W	R/W	R/W	
00DH	PA	PA3	PA2	PA1	PA0	1111
		R/W	R/W	R/W	R/W	

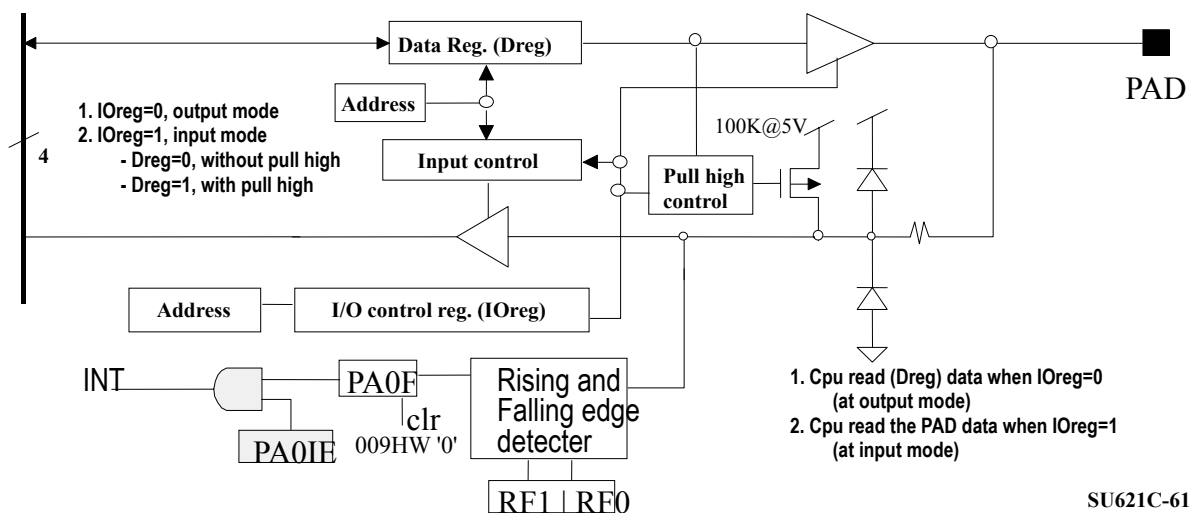
PAC : 是控制 I/O mode, 為 high 時, 是 input mode。

PA0 在 input mode 時, 有 interrupt 功能(rising and falling edge trigger), 當系統進入 STOP or SLEEP mode 時, 可以用此 PIN 來 wake up。

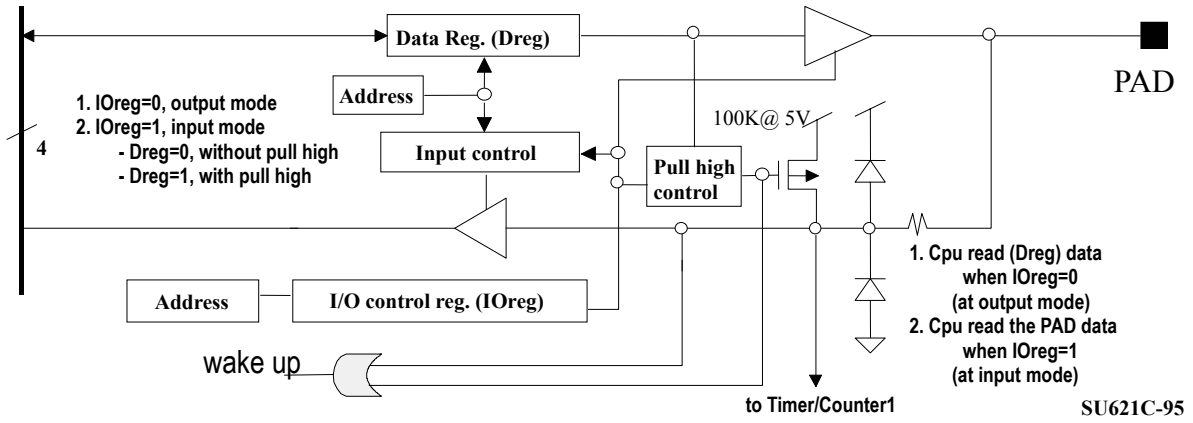
PA0F : 此 flag 會被 write bit "0" 時 clear 為 "0", 但是不會被 write bit "1" 時 set 為 "1"。

RF0/RF1 : 控制 interrupt 的 trigger 方式。

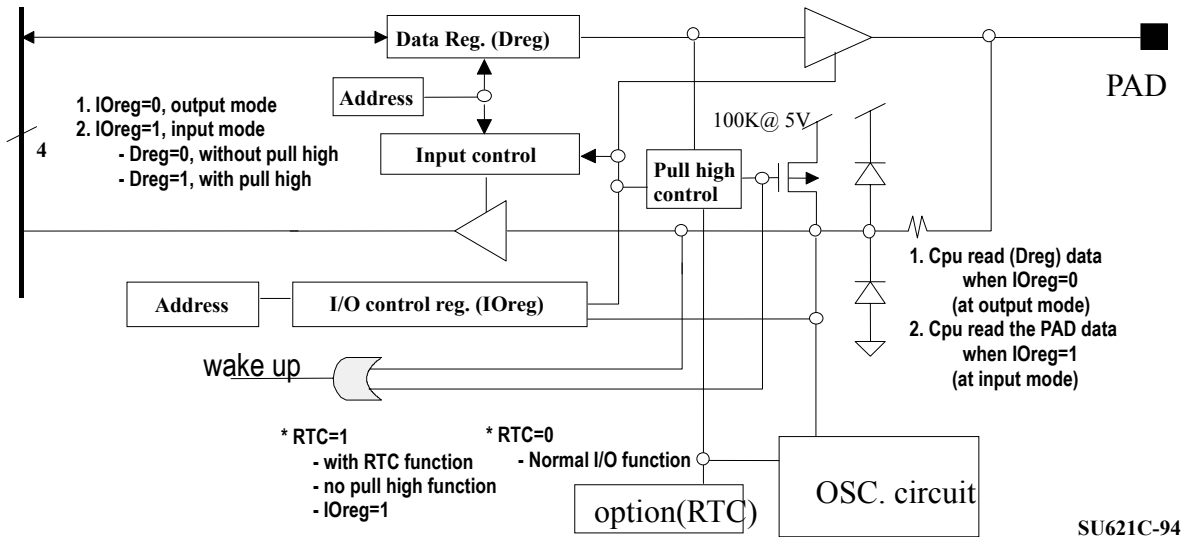
RF1	RF0	Trigger
0	0	falling edge
0	1	rising edge
1	0	falling & rising edge
1	1	falling & rising edge



PA1 : 為 I/O port data, 在 input mode 時, (Dreg) 可以控制是否有 pull high function, 若此 pin 有 pull high function 時, 就有 wake up function, 如下圖。此 pin 亦可當作 Timer/Counter 的 clock input。



PA2/PA3 : 爲 I/O port data, 在 input mode 時, (Dreg) 可以控制是否有 pull high function, 若此 pin 有 pull high function 時, 就有 wake up function, 如下圖。也可以經由 mask option 來選擇爲是 32768Hz crystal oscillator pin。

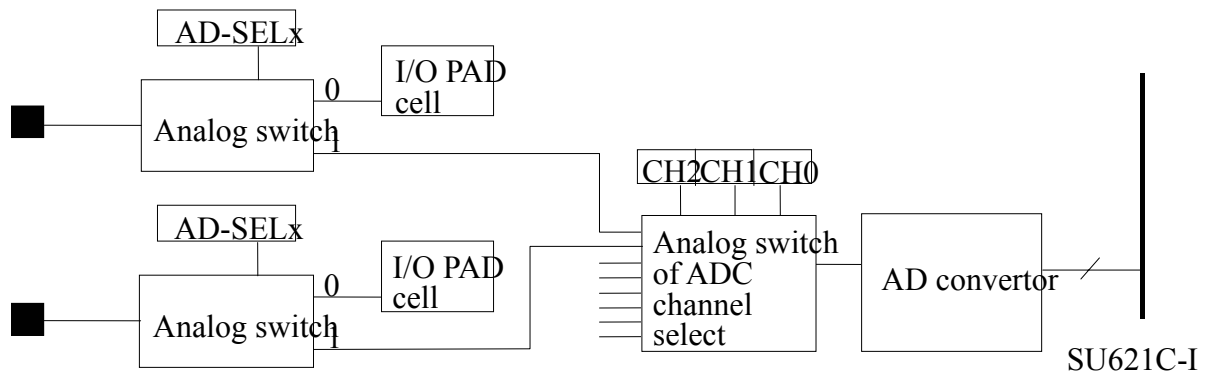
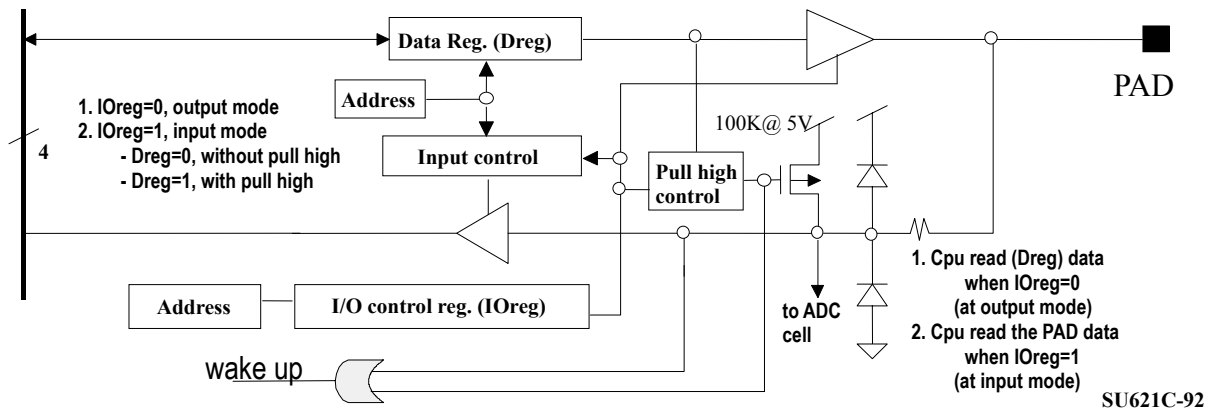


B. Port B & Port E

Address	Register	Bit3	Bit2	Bit1	Bit0	Initial state
00EH	PBC	PBC3	PBC2	PBC1	PBC0	1111
		R/W	R/W	R/W	R/W	
00FH	PB	PB3	PB2	PB1	PB0	1111
		R/W	R/W	R/W	R/W	
014H	PEC	PEC3	PEC2	PEC1	PEC0	1111
		R/W	R/W	R/W	R/W	
015H	PE	PE3	PE2	PE1	PE0	1111
		R/W	R/W	R/W	R/W	
01EH	ADCTL0	ADEN	CH2	CH1	CH0	0000
		R/W	R/W	R/W	R/W	
01FH	ADCTL1	ADIE	ADF	ADCK1	ADCK0	0000
		R/W	R/W	R/W	R/W	
121H	AD-SEL0	AN3/PB3	AN2/PB2	AN1/PB1	AN0/PB0	0000
		R/W	R/W	R/W	R/W	
122H	AD-SEL1	AN7/PE3	AN6/PE2	AN5/PE1	AN4/PE0	0000
		R/W	R/W	R/W	R/W	

PBC/ PEC : 是控制 I/O mode, 為 high 時, 是 input mode。

PB/ PE : 為 I/O port data, 在 input mode 時(AD-SELx=0), (Dreg) 可以控制是否有 pull high function, 若此 pin 有 pull high function 時, 就有 wake up function, 如下圖。



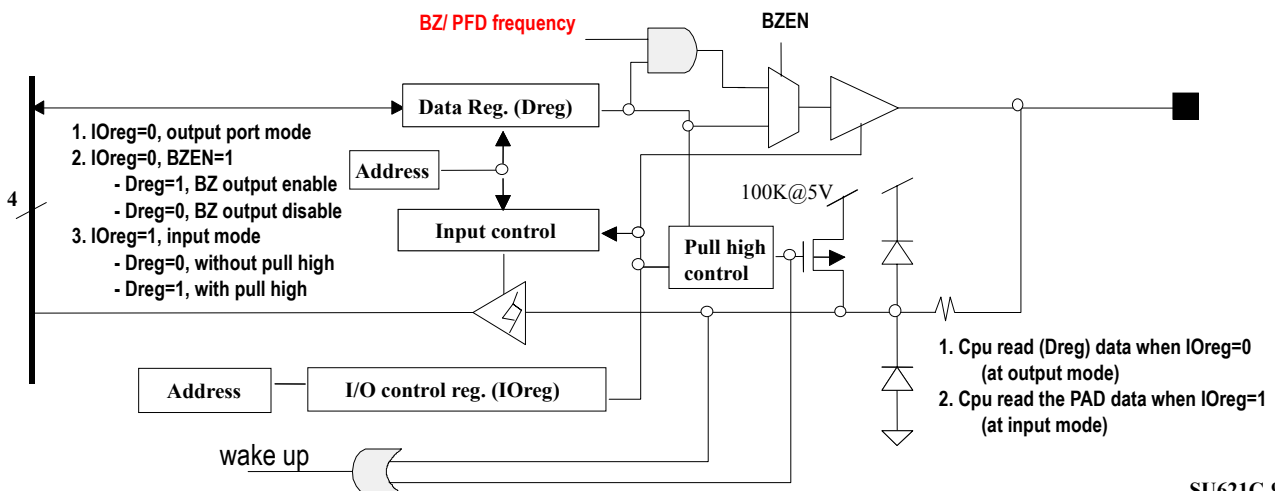
CH2	CH1	CH0	ADC channel selection
0	0	0	AN0
0	0	1	AN1
0	1	0	AN2
0	1	1	AN3
1	0	0	AN4
1	0	1	AN5
1	1	0	AN6
1	1	1	AN7

C. Port C/ Port F

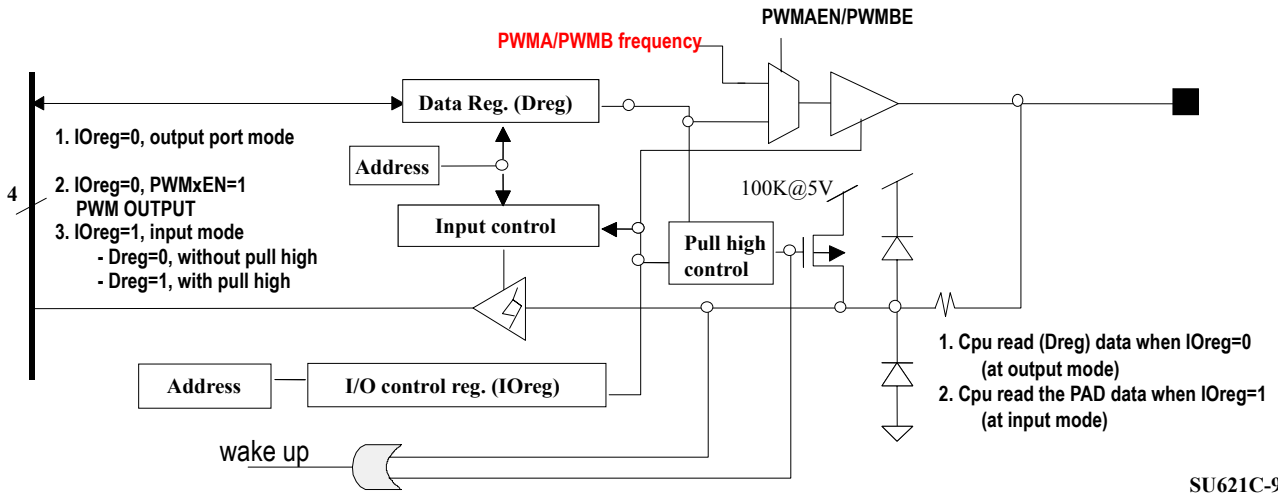
Address	Resister	Bit3	Bit2	Bit1	Bit0	Initial state
010H	PCC	PCC3	PCC2	PCC1	PCC0	1111
		R/W	R/W	R/W	R/W	
011H	PC	PC3	PC2	PC1	PC0	1111
		R/W	R/W	R/W	R/W	
016H	TBC/BZC	BZEN	TB2	TB1	TB0	0000
		R/W	R/W	R/W	R/W	
120H	PWMC	PWMBEN	PWMAEN	PWMBDC	PWMADC	0000
		R/W	R/W	R/W	R/W	
123H	PF	X	PF2	PF1	PF0	u111
		X	R/W	R/W	R/W	
124H	PFC	X	PFC2	PFC1	PFC0	u111
		X	R/W	R/W	R/W	

PCC/ PFC：是控制 I/O mode，為 high 時，是 input mode。

PC：為 I/O port data，在 input mode 時，(Dreg) 可以控制是否有 pull high function，若此 pin 有 pull high function 時，就有 wake up function。在 output mode & BZEN=1 時，(Dreg) 可以控制是否有為 Buzzer/ PFD 輸出（當 Dreg=1 時輸出頻率，當 Dreg=0 時輸出為 low），如下圖。在 output mode & PWMxEN=1 時，如果(IOreg=0)為 PWM 輸出，如果(IOreg=1)則為 input mode。



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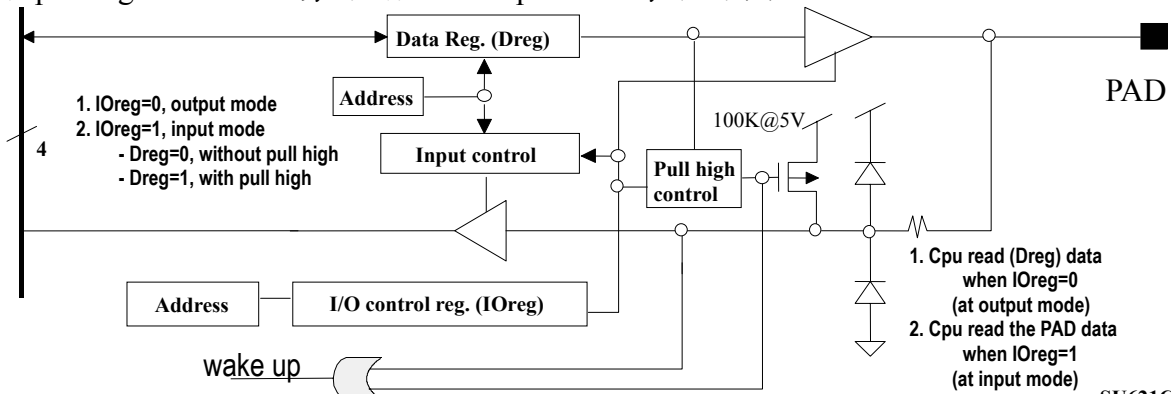
FLAG	FUNCTION
BZEN	LOW : PC0/PC1 without buzzer function HIGH : PC0/PC1 with buzzer function and enable buzzer frequency output through PC0 pad
PWMAEN	LOW : PC2/ PC3 without PWM function, I/O function only HIGH : PC2/ PC3 with PWM function or input function are controlled as below: - If (IOreg)=0 then enable PWMA frequency output through pad - If (IOreg)=1 then at input function mode
PWMBEN	LOW : PF0/ PF1 without PWM function, I/O function only HIGH : PF0/ PF1 with PWM function or input function are controlled as below: - If (IOreg)=0 then enable PWMB frequency output through pad - If (IOreg)=1 then at input function mode

D. Port D

Address	Register	Bit3	Bit2	Bit1	Bit0	Initial state
012H	PDC	PDC3	PDC2	PDC1	PDC0	1111
		R/W	R/W	R/W	R/W	
013H	PD	PD3	PD2	PD1	PD0	1111
		R/W	R/W	R/W	R/W	

PDC : 是控制 I/O mode, 為 high 時, 是 input mode。

PD : 為 I/O port data, 在 input mode 時, (Dreg) 可以控制是否有 pull high function, 若此 pin 有 pull high function 時, 就有 wake up function, 如下圖。



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6 A/D function description

Address	Resister	Bit3	Bit2	Bit1	Bit0	Initial state
01CH	ADL	AD3	AD2	AD1	AD0	0000
		R	R	R	R	
01DH	ADH	AD7	AD6	AD5	AD4	0000
		R	R	R	R	
01EH	ADCTL0	ADEN	CH2	CH1	CH0	0000
		R/W	R/W	R/W	R/W	
01FH	ADCTL1	ADIE	ADF	ADCK1	ADCK0	0000
		R/W	R/W	R/W	R/W	

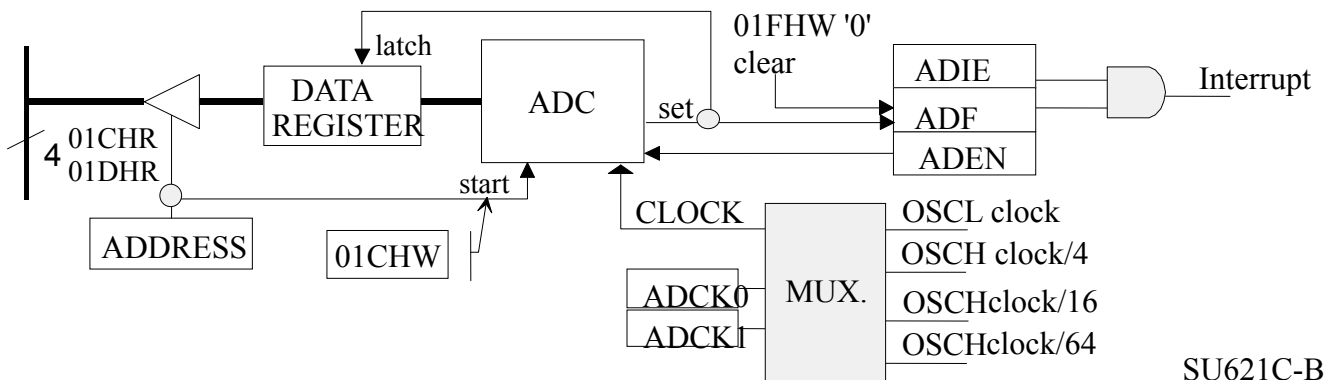
ADL/ADH : (AD0-AD7) 是 A/D 的 DATA。

如果對此 01CH PORT 做 WRITE 的動作時，要讓 ADC START CONVERSION。

如果對此 01DH PORT 做 WRITE 的動作時，要讓 CPU SLEEP & ADC START CONVERSION。

ADCTL0/ADCTL1 : 是 A/D 的 CONTROL REGISTER。

FLAG	FUNCTION
ADIE	LOW : Disable internal interrupt HIGH : Enable internal interrupt
ADF	LOW : Normal mode HIGH : A/D conversion complete flag。此 flag 會被 write bit “0” 時 clear 為 “0”，但是不會被 write bit “1” 時 set 為 “1”
ADEN	LOW : Disable A/D HIGH : Enable A/D
CH2 CH1 CH0	(CH2/CH1/CH0) 000 : select AN0 input, 001 : select AN1 input, 010 : select AN2 input, 011 : select AN3 input, 100 : select AN4 input, 101 : select AN5 input, 110 : select AN6 input, 111 : select AN7 input.
ADCK1 ADCK0	(ADCK1/ ADCK0) 00 : select OSCL clock, 01 : select OSCH clock/4, 10 : select OSCH clock/16, 11 : select OSCH clock/64.



SU621C-B1

當 ADC 完成 conversion 後，才 latch “ADL” 和 “ADH” 的 data。

7 8-bit and 16-bit Timer/Counter function description

Address	Resister	Bit3	Bit2	Bit1	Bit0	Initial state
009H	INTF	PA0F	TMR1F	TMR2F	TBF	0000
		R/W	R/W	R/W	R/W	
00AH	INTC	PA0IE	TMR1IE	TMR2IE	TBIE	0000
		R/W	R/W	R/W	R/W	
017H	TMR1L	TMR1_3	TMR1_2	TMR1_1	TMR1_0	0000
		R/W	R/W	R/W	R/W	
018H	TMR1H	TMR1_7	TMR1_6	TMR1_5	TMR1_4	0000
		R/W	R/W	R/W	R/W	
019H	TMR1C	TM1LD	T1CK1	T1CK0	TM1EN	0000
		R/W	R/W	R/W	R/W	
127H	TMR2L	TMR2_3	TMR2_2	TMR2_1	TMR2_0	0000
		R/W	R/W	R/W	R/W	
128H	TMR2H	TMR2_7	TMR2_6	TMR2_5	TMR2_4	0000
		R/W	R/W	R/W	R/W	
129H	TMR2C	TM2LD	T2CK1	T2CK0	TM2EN	0000
		R/W	R/W	R/W	R/W	

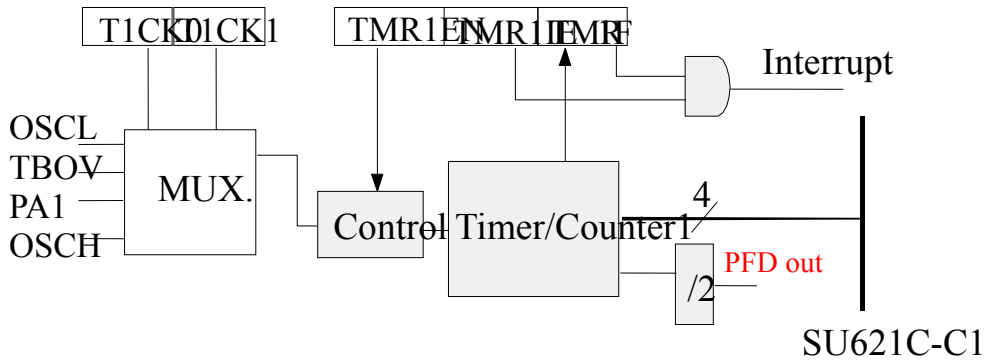
INTF : TMR1F/ TMR2F 是 Timer/Counter 的 overflow flag. (此 flag 會被 write bit “0” 時 clear 為 “0”, 但是不會被 write bit “1” 時 set 為 “1”)

INTC : TMR1IE/TMR2IE 是控制 TMR1F/TMR2F 要不要產生 interrupt.

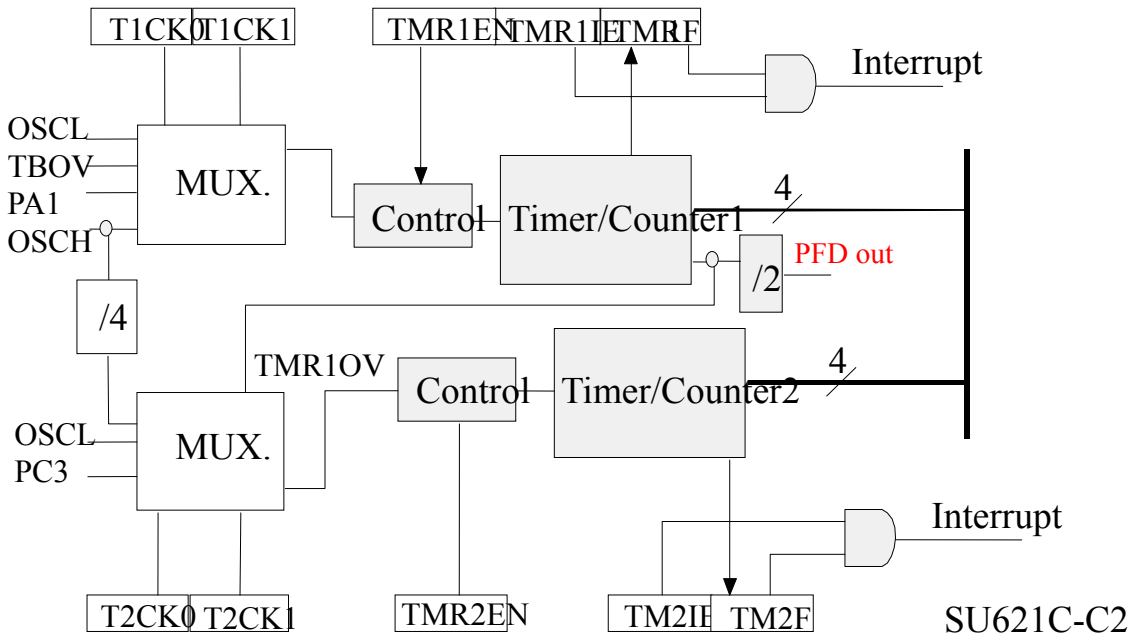
TMR1L/ TMR1H/ TMR2L/ TMR2H : Timer/Counter data, Timer/Counter 的 data 可以 R/W. Overflow 時會 set interrupt flag (TMR1F/TMR2F)

FLAG	FUNCTION
TM1EN	Low : stop Timer/Counter1 High : start Timer/Counter1
TM2EN	Low : stop Timer/Counter2 High : start Timer/Counter2
TM1LD	Low : without Auto-reload function(Timer/Counter1) High : with Auto-reload function(Timer/Counter1)
TM2LD	Low : without Auto-reload function(Timer/Counter2) High : with Auto-reload function(Timer/Counter2)
T1CK1/ T1CK0	(T1CK1/ T1CK0) 00 : select OSCH clock 01 : select time base timer clock(OSCL) 10 : select PA1 external input clock 11 : select time base timer overflow(TBOV)
T2CK1/ T2CK0	(T2CK1/ T2CK0) 00 : select OSCH clock/4 01 : select time base timer clock(OSCL) 10 : select PC3 external input clock 11 : select time base timer overflow(TMR1OV)

(TTU621C/TTR621C)



(TTU622C/TTR622C)



8 PWM CONTROL CIRCUIT

Address	Resister	Bit3	Bit2	Bit1	Bit0	Initial state
01AH	PWMADL	DTY13	DTY12	DTY11	DTY10	0000
		R/W	R/W	R/W	R/W	
01BH	PWMADH	DTY17	DTY16	DTY15	DTY14	0000
		R/W	R/W	R/W	R/W	
120H	PWMC	PWMBEN	PWMAEN	PWMBDC	PWMADC	0000
		R/W	R/W	R/W	R/W	
125H	PWMBDL	DTY23	DTY22	DTY21	DTY20	0000
		R/W	R/W	R/W	R/W	
126H	PWMBDH	DTY27	DTY26	DTY25	DTY24	0000
		R/W	R/W	R/W	R/W	
12AH	PWMCK	CK2_S1	CK2_S0	CK1_S1	CK1_S0	0000
		R/W	R/W	R/W	R/W	

PWMADL, PWMADH, PWMBDL, PWMBDH: 控制 PWM 的 duty. (register option 2 modes)

FLAG	FUNCTION
PWMAEN	Low : disable PWMA output High : enable PWMA output
PWMBEN	Low : disable PWMB output High : enable PWMB output
PWMADC	Low : PWM circuit in 4 duty mode when PWMAEN is high state High : PWM circuit in 2 duty mode when PWMAEN is high state
PWMBDC	Low : PWM circuit in 4 duty mode when PWMBEN is high state High : PWM circuit in 2 duty mode when PWMBEN is high state
CK1_S1/ CK1_S0	Select PWMA input clock (CK1_S1/CK1_S0) 00 : external high frequency, 01: external high frequency/4 10 : external high frequency/16, 11: external high frequency/64
CK2_S1/ CK2_S0	Select PWMB input clock (CK2_S1/CK2_S0) 00 : external high frequency, 01: external high frequency/4 10 : external high frequency/16, 11: external high frequency/64

4 duty cycle mode :

DTY*7	DTY*6	DTY*5	DTY*4	DTY*3	DTY*2	DTY*1	DTY*0	4 Duty Cycles
0	0	0	0	0	0	0	0	0/64+0/64+0/64+0/64
0	0	0	0	0	0	0	1	1/64+0/64+0/64+0/64
0	0	0	0	0	0	1	0	1/64+1/64+0/64+0/64
0	0	0	0	0	0	1	1	1/64+1/64+1/64+0/64
0	0	0	0	0	1	0	0	1/64+1/64+1/64+1/64
...
0	1	0	0	0	0	0	1	17/64+16/64+16/64+16/64
0	1	0	0	0	0	1	0	17/64+17/64+16/64+16/64
0	1	0	0	0	0	1	1	17/64+17/64+17/64+16/64
0	1	0	0	0	1	0	0	17/64+17/64+17/64+17/64
...



1	0	0	0	0	0	0	1	33/64+32/64+32/64+32/64
1	0	0	0	0	0	1	0	33/64+33/64+32/64+32/64
1	0	0	0	0	0	1	1	33/64+33/64+33/64+32/64
1	0	0	0	0	1	0	0	33/64+33/64+33/64+33/64
...
1	1	0	0	0	0	0	1	49/64+48/64+48/64+48/64
1	1	0	0	0	0	1	0	49/64+49/64+48/64+48/64
1	1	0	0	0	0	1	1	49/64+49/64+49/64+48/64
1	1	0	0	0	1	0	0	49/64+49/64+49/64+49/64
...
1	1	1	1	1	1	0	0	63/64+63/64+63/64+63/64
1	1	1	1	1	1	0	1	64/64+63/64+63/64+63/64
1	1	1	1	1	1	1	0	64/64+64/64+63/64+63/64
1	1	1	1	1	1	1	1	64/64+64/64+64/64+63/64

2 duty cycle mode :

DTY*7	DTY*6	DTY*5	DTY*4	DTY*3	DTY*2	DTY*1	DTY*0	2 Duty Cycles
0	0	0	0	0	0	0	0	0/128+0/128
0	0	0	0	0	0	0	1	1/128+0/128
0	0	0	0	0	0	1	0	1/128+1/128
0	0	0	0	0	0	1	1	2/128+1/128
0	0	0	0	0	1	0	0	2/128+2/128
...
0	1	0	0	0	0	0	1	33/128+32/128
0	1	0	0	0	0	1	0	33/128+33/128
0	1	0	0	0	0	1	1	34/128+33/128
0	1	0	0	0	1	0	0	34/128+34/128
...
1	0	0	0	0	0	0	1	65/128+64/128
1	0	0	0	0	0	1	0	65/128+65/128
1	0	0	0	0	0	1	1	66/128+65/128
1	0	0	0	0	1	0	0	66/128+66/128
...
1	1	0	0	0	0	0	1	97/128+96/128
1	1	0	0	0	0	1	0	97/128+97/128
1	1	0	0	0	0	1	1	98/128+97/128
1	1	0	0	0	1	0	0	98/128+98/128
...
1	1	1	1	1	1	0	0	126/128+126/128
1	1	1	1	1	1	0	1	127/128+126/128
1	1	1	1	1	1	1	0	127/128+127/128
1	1	1	1	1	1	1	1	128/128+127/128

9 Time Base Timer

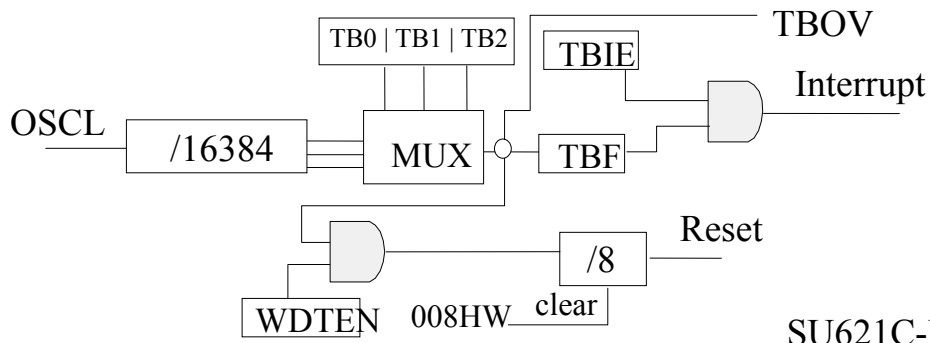
Address	Resister	Bit3	Bit2	Bit1	Bit0	Initial state
009H	INTF	PA0F	TMR1F	TMR2F	TBF	0000
		R/W	R/W	R/W	R/W	
00AH	INTC	PA0IE	TMR1IE	TMR2IE	TBIE	0000
		R/W	R/W	R/W	R/W	
016H	TBC/BZC	BZEN	TB2	TB1	TB0	0000
		R/W	R/W	R/W	R/W	

TBF : Time base timer overflow flag. (此 flag 會被 write bit “0” 時 clear 為 “0”，但是不會被 write bit “1” 時 set 為 “1”)

TBIE : Time base timer interrupt enable control register.

TB0/ TB1/ TB2 : Time base timer input clock source select register.

TB2	TB1	TB0	O/P
0	0	0	128HZ
0	0	1	64HZ
0	1	0	32HZ
0	1	1	16HZ
1	0	0	8HZ
1	0	1	4HZ
1	1	0	2HZ
1	1	1	1HZ



注意：在 RTC mode，若有使用 Time base timer 功能，在 power on 後和每次在 Stop mode wake-up 起來之後，一定要先下 “read 008H (008HR)” 的動作，否則其頻率會不準確。

*** RTC oscillation stable time needs 0.5 sec ~2 sec that depends on operating voltage and IC process.**

10 Watch Dog Timer

Address	Resister	Bit3	Bit2	Bit1	Bit0	Initial state
008H	PS	X	H/L	SLEEP	STOP	u100
		X	R/W	R/W	R/W	

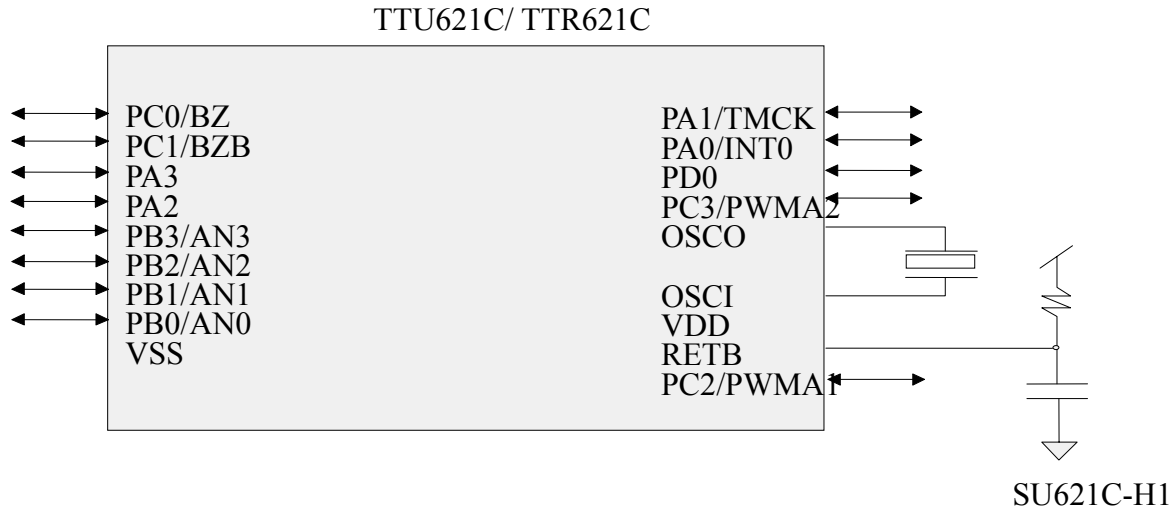
可以使用 008HW 來 clear WDT，如上圖。

RESET PLAN

Reset 方式有 3 種：

- A. INTERNAL RESET
- B. EXTERNAL RESET (ACTIVE LOW)
- C. LVR RESET (單邊 reset, high voltage to low voltage)

.Application Diagram



.Mask option table

Function	Option	U621C	R621C	U622C	R622C
Oscillator type	<input type="checkbox"/> Resonator。 <input type="checkbox"/> RC oscillator。	mask	mask	mask	mask
Time base clock selection	<input type="checkbox"/> External 32K crystal oscillator。 <input type="checkbox"/> Internal RC oscillator。	X	X	mask	mask
LVR control	<input type="checkbox"/> LVR disable <input type="checkbox"/> LVR enable	mask	mask	mask	mask
Buzzer frequency selection	<input type="checkbox"/> 2KHZ。 <input type="checkbox"/> 4KHZ。 <input type="checkbox"/> 6KHZ。 <input type="checkbox"/> PFD。	mask	mask	mask	mask

. RC oscillator Resistor vs. Frequency table

電阻 (Ω)	電壓(V)	頻率(Hz)
51K	5	7.3M
56K	5	6.6M
62K	5	6.1M
68K	5	5.4M
75K	5	4.7M
82K	5	4.4M
91K	5	4.1M
100K	5	3.7M
120K	5	3.1M
150K	5	2.4M
160K	5	2.3M
180K	5	2.0M
200K	5	1.8M
220K	5	1.7M
240K	5	1.6M
300K	5	1.2M
510K	5	714K
1M	5	368K

. ORDER INFORMATION

(TTU621C/TTR621C)

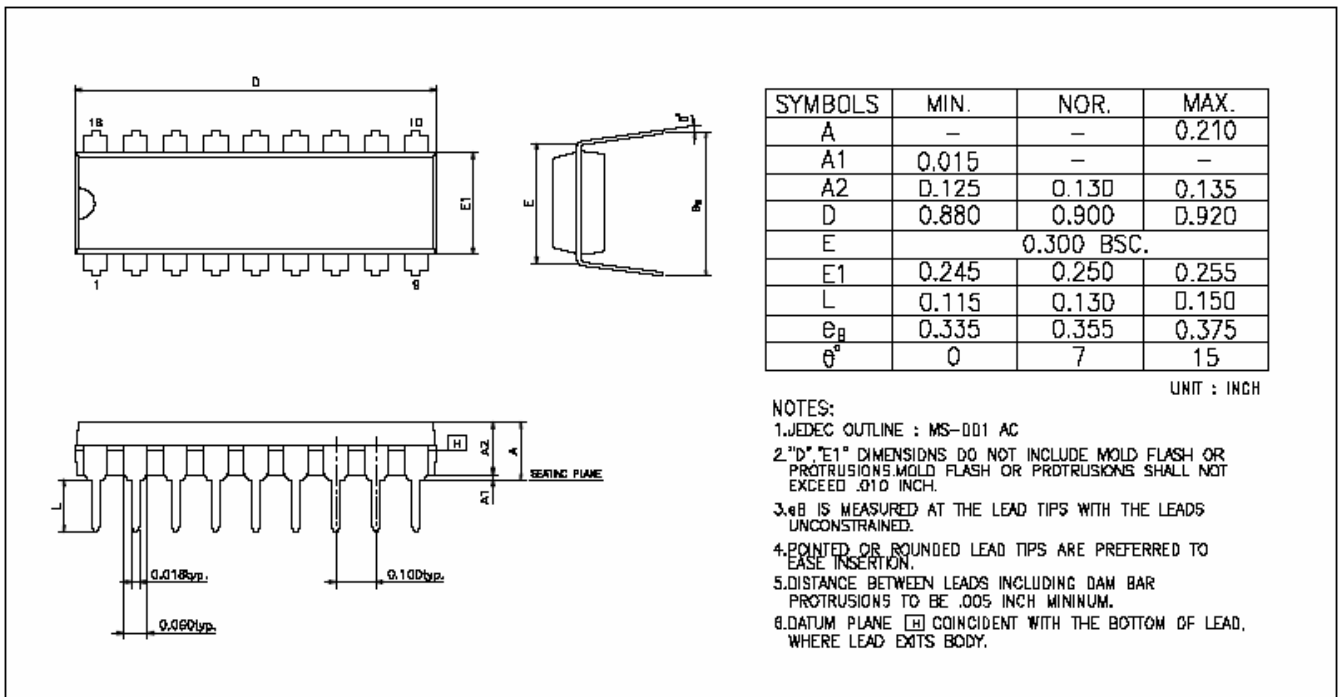
- a. Package form : TTU621C
- b. Chip form : TCU621C
- c. Wafer base : TDU621C

(TTU622/TTR622)

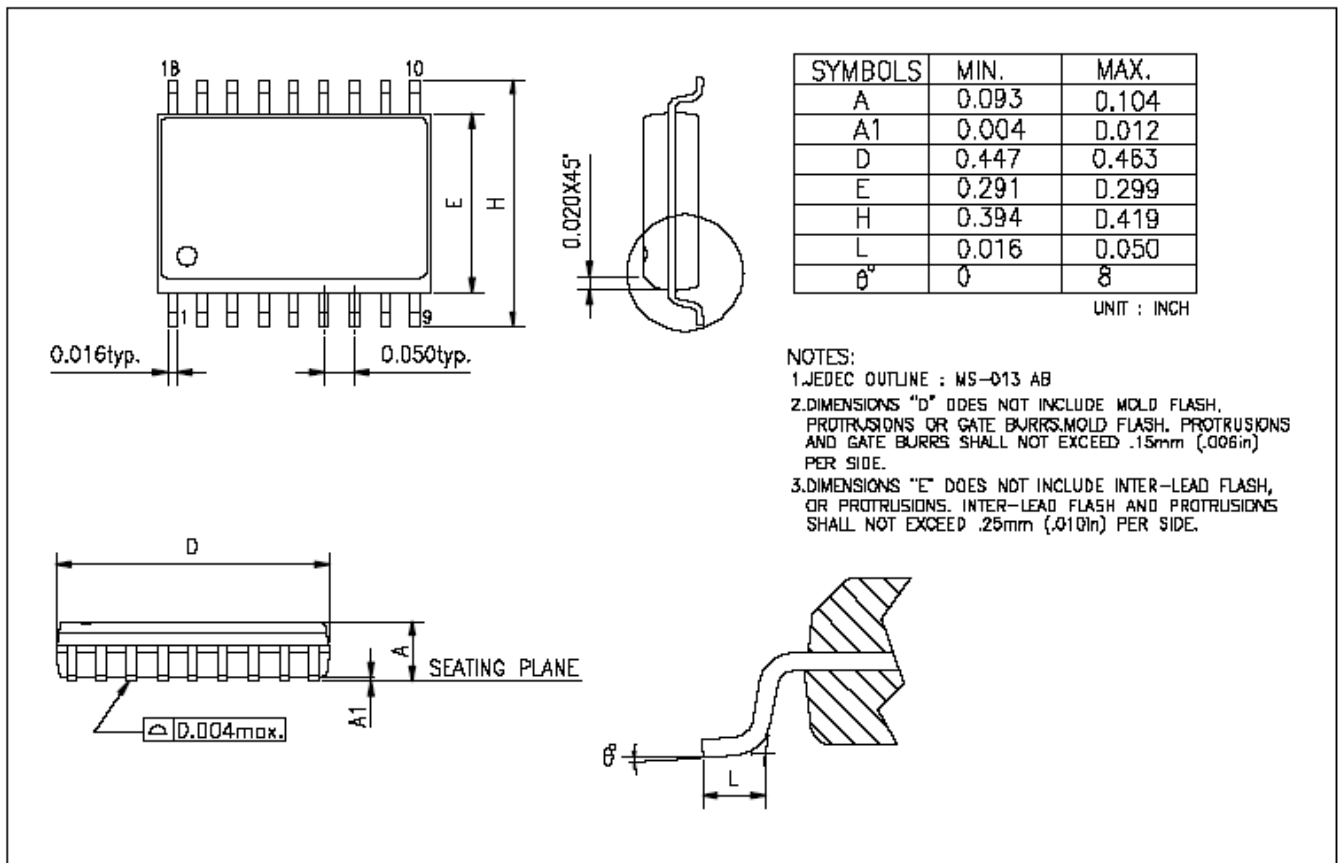
- a. Package form : TTU622C
- b. Chip form : TCU622C
- c. Wafer base : TDU622C

Package Information

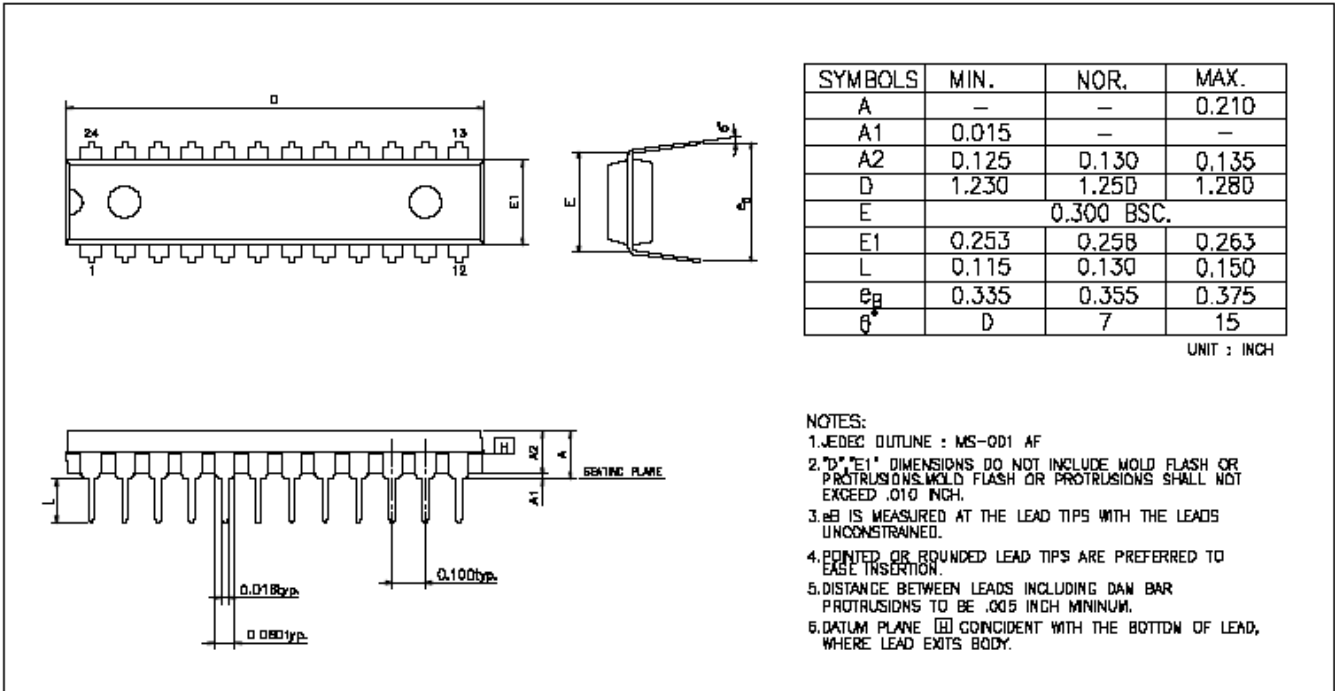
(18-DIP)



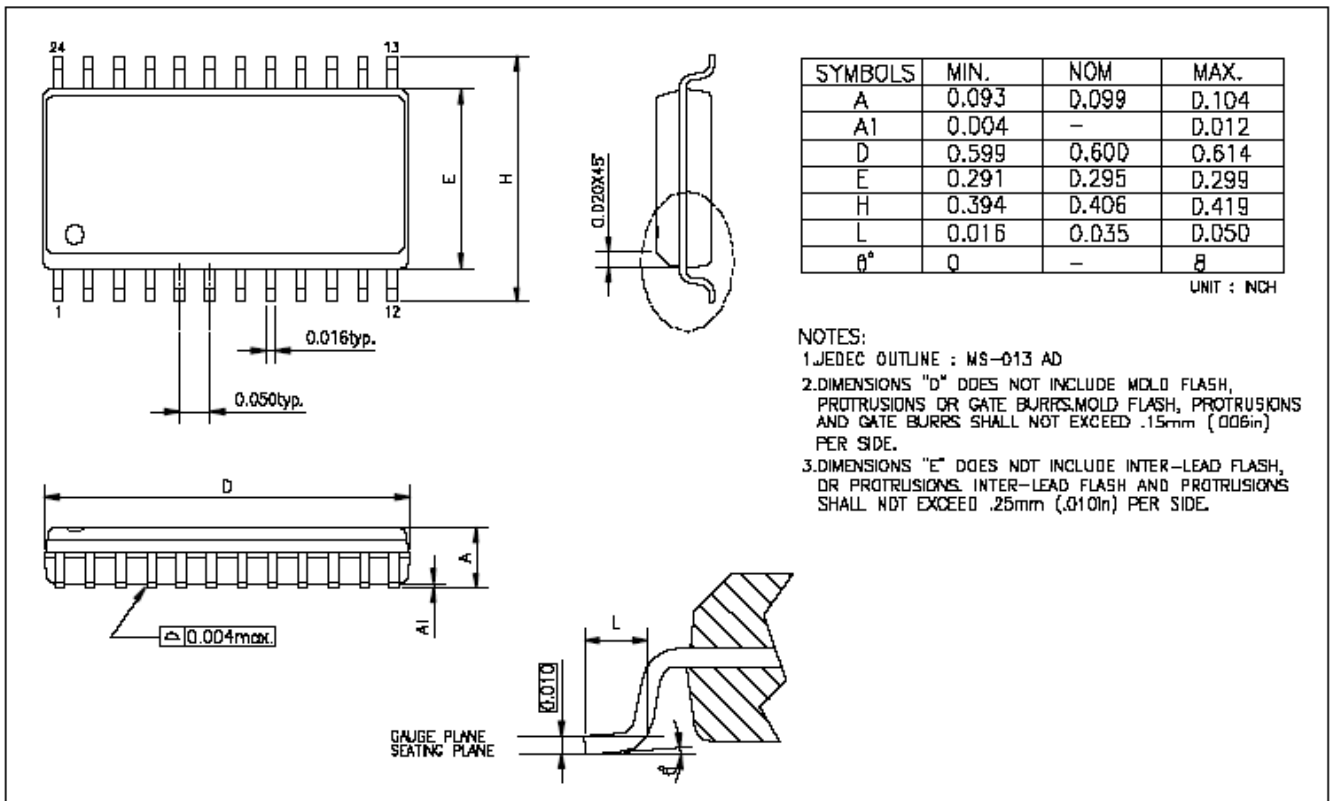
(18-SOP)



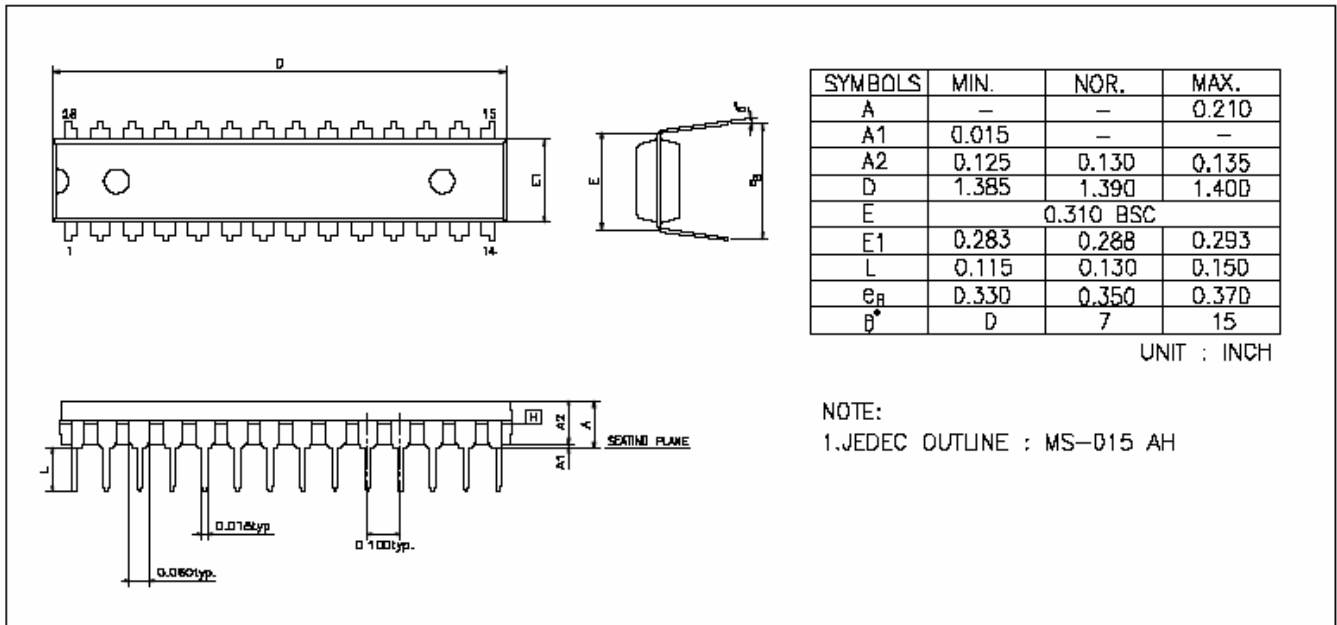
(24-SKINNY DIP)



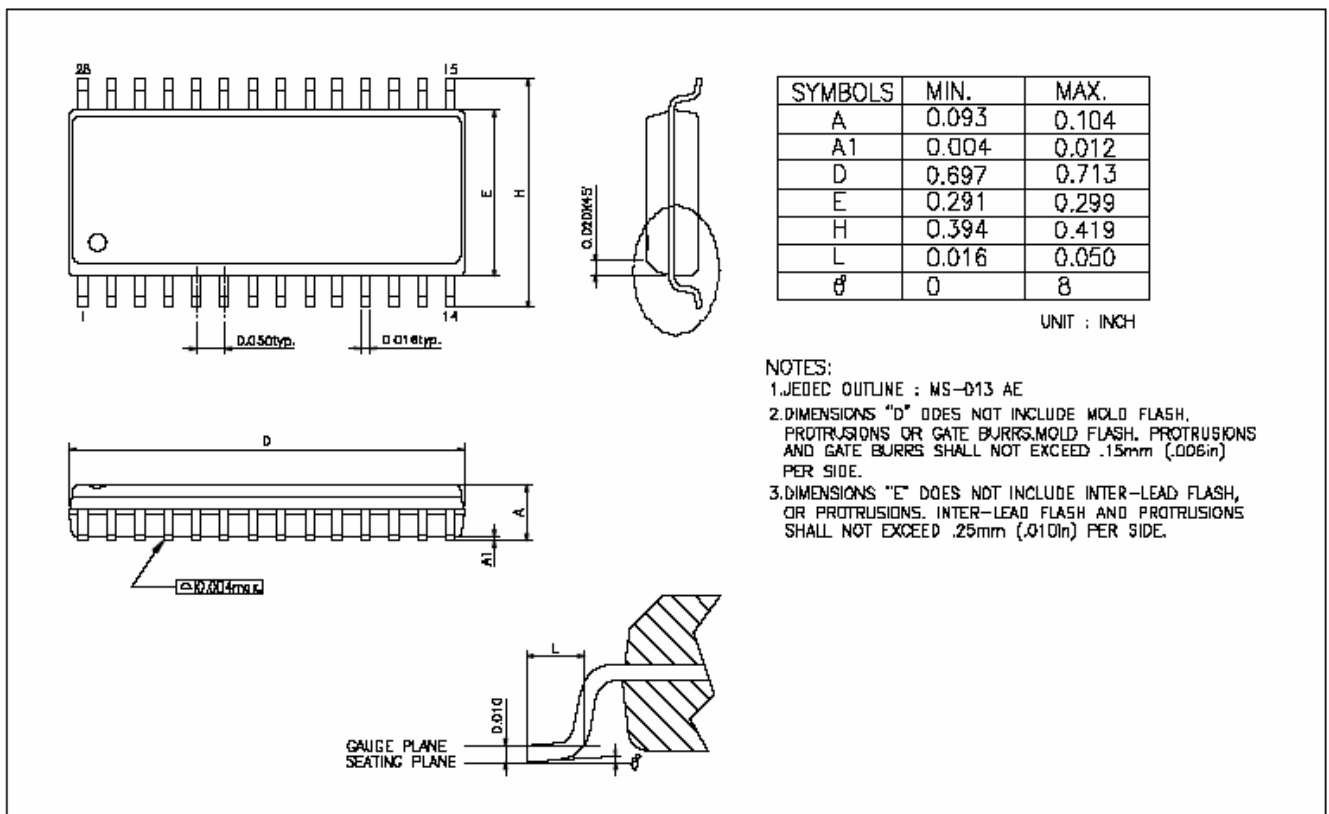
(24-SOP)



(28-SKINNY DIP)



(28-SOP)



Revise History

- 2005/9/26 p.15 & p.27 RTC OST 0.5 sec ~2 sec
- 2006/5/29 p10,p11,p12,p16,p17
 P10,p11 : Map of memory and I/Os add PWMCK
 p12,p16,p17: update PA0&CTL register initial state
 p16 : update LVRC register function description and graph
- 2006/06/02 p.25, p.27
 PWMAEN→PWMBEN
 WDT/4→WDT/8
- 2006/07/05 p.3, p.7
 Update operating voltage
 Update pull high resistance
- 2006/10/05 p.29
 Update RC oscillator Resistor vs. Frequency table
- 2006/11/30 p.8
 Update A.C. Characteristics. Watch dog clock from 8K to 32KHz.
- 2007/5/28 p.20, p.21 : update PC PF graph and description
 p.7 : Iopr1, Iopr2, Iopr3, Iol1, Ioh1 @3V→ 5V
- 2007/0702 p.7 : update D.C. Characteristics.
 p.29 : update RC oscillator Resistor vs. Frequency table
- 2007/10/01 p.4 : add 20pin DIP/SOP package
- 2010/06/11 p.8: update Absolutely max. ratings , Operating Temperature +70°C→ +95°C