

R2F+LCD MCU



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. General Description:

The MCU provides high cost-performance for thermometer application. It designs by LSI high technology with low power CMOS process.

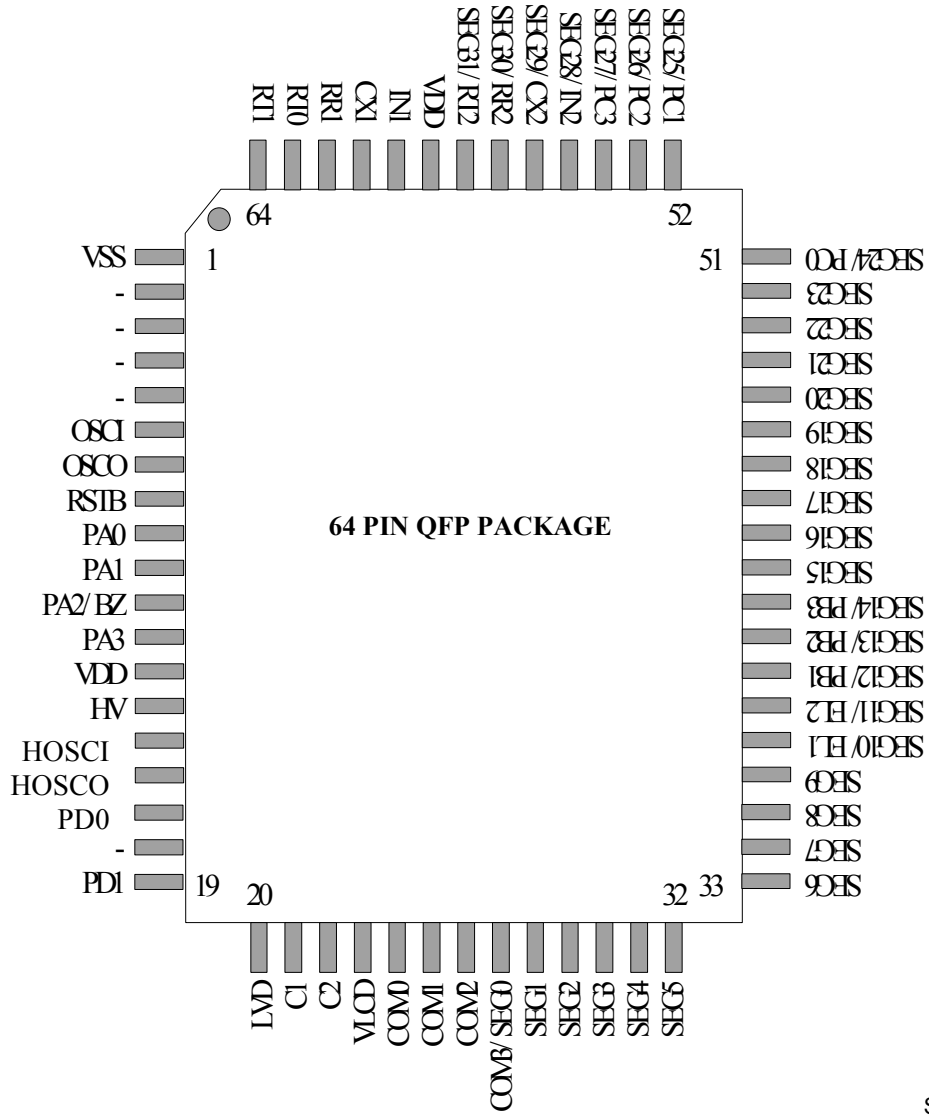
. Features:

- ◇ Use 4 bits microprocessor core
- ◇ Operating Voltage:
 - (TTU711/ TTU712) 2.2v-5.5v
 - (TTR712) 2.4v-5.5v
- ◇ Low speed oscillator:
 - 32768Hz Crystal oscillator (內建電容，有快速起振功能，當讀 PS resistor 後，切換為正常 mode)
 - RC oscillator(from 32/64/128/256Khz，外掛電阻)(MASK OPTION),
- ◇ High speed system oscillator:
 - Built-in internal RC oscillator (~ 4MHz)
 - external adjustable type RC oscillator (150K~ 4MHz)
 - 400KHz ~ 8MHz resonator/crystal oscillator
- ◇ R2F Oscillator
 - 10Khz-100Khz RC oscillator
- ◇ User ROM (TTU711)1K*16, RAM 64*4，(TTU712/TTR712) 4K*16, RAM 128*4
- ◇ Built-in (TTU711) 2 stacks，(TTU712/ TTR712)4 stacks
- ◇ Built-in 12-bit programmable timer with internal overflow interrupt
- ◇ Built-in 12-bit counter for R2F circuit
- ◇ Built-in watch dog timer
- ◇ Built-in time base timer
- ◇ Built-in EL control timing
- ◇ Built-in Buzzer output (2Khz/4Khz/5.3Khz) from low speed clock
- ◇ Built-in low battery detect function (LVD with enable ctrl)
- ◇ Provide (TTU711) 4 I/O ports, 4 input ports, (TTU712/ TTR712) 10 I/O ports, 4 input ports
- ◇ LCD (TTU711) 4COM/14SEG，or 3COM/15SEG，1/2 bias (TTU712/ TTR712) 4COM/31SEG or 3COM/32SEG, 1/4 duty (frame frequency is 64Hz)，1/3 duty (frame frequency is 86Hz)，1/3 bias for R-type bias, 1/2 bias for C-type bias selected by mask option
- ◇ Provide internal/external reset function
- ◇ Provide 64 pin QFP package (TTR712)

. Application:

- (TTU711) 快速體溫計 (4 秒)
- (TTU711) 室內外溫度計
- (TTU711) 室內溫度計 + CLOCK
- (TTU712/ TTR712)室內外溫度計 + 濕度計 + CLOCK

. Pin Assignment



SU711-H

. Pin Description (TTU711)

Name	I/O	Description	pins
HOSCI/OSCR	I	Resonator/crystal oscillator input terminal or RC oscillator input	1
HOSCO/OSC4	O	Resonator/crystal oscillator output terminal or RC oscillator clock/4 output	1
PA0	I/O	General purpose I/O port, has interrupt function, hysteresis input(pull high 100Kohm@3.0V with software control)	1
PA1	I/O	General purpose I/O port(pull high 100Kohm@3.0V with software control)	1
PA2/BZ, PA3	I/O	General purpose I/O port, has interrupt function, hysteresis input(pull high 100Kohm@3.0V with software control) orbuzzer output selected by mask option (搭配 option table 使用，若是選擇 Buzzer frequency 『No BZ function』 則 PA2 為 I/O 功能，否則為 BZ function)	2
GND	P	Ground pin	1
OSCI/ OSCO	I,O	Oscillator pin (for 32768Hz crystal oscillator or external RC oscillator 32K-256Khz)	2
VDD	P	Power pin	1
PB0/ RT1	I	R2F oscillator pin or general purpose input port(hysteresis input) selected by <u>mask</u> option	1
RT0/ RR/ CX	O	R2F oscillator pin	3
IN	I	R2F oscillator pin	1
SEG14/PB1, SEG13/PB2, SEG12/PB3,	O, I	LCD segment output pin or general input port(hysteresis input) selected by <u>mask</u> option	3
SEG11/EL2, SEG10/EL1	O	LCD segment output pin or EL output pin selected by <u>mask</u> option	2
SEG9-1	O	LCD segment output pin	9
COM3/SEG0	O	LCD common output pin or segment output pin selected by <u>mask</u> option	1
COM0-COM2	O	LCD common output pin	3
VLCD	P	LCD power pin	1
C1-C2	I/O	Charge pump pin	2
RSTB	I	External reset pin, low active, pull high 100Kohm@3.0V, hysteresis input	1
LVD	I/O	Low voltage detector pin	1
		Total	36

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

. Pin Description (TTU712/ TTR712)

Name	I/O	Description	pins
PD0-PD1	I/O	General purpose I/O port, hysteresis input (pull high 100Kohm@3.0V with software control)	2
PA0	I/O	General purpose I/O port, has interrupt function, hysteresis input(pull high 100Kohm@3.0V with software control)	1
PA1	I/O	General purpose I/O port, hysteresis input (pull high 100Kohm@3.0V with software control)	1
PA2/BZ, PA3	I/O	General purpose I/O port, hysteresis input(pull high 100Kohm@3.0V with software control) or buzzer output selected by mask option (搭配 option table 使用，若是選擇 Buzzer frequency 『No BZ function』 則 PA2 為 I/O 功能，否則為 BZ function)	2
OSCHI	I	High speed oscillator input pad	1
OSCHO	O	High speed oscillator output pad	1
GND	P	Ground pin	1
OSCI/ OSCO	I,O	Oscillator pin(for 32768Hz crystal oscillator or external RC oscillator 32K-256Khz)	2
VDD	P	Power pin	1
HV	P	OTP power pin, normal is floating	1
PB0/RT1	I	R2F oscillator pin or general purpose input port(hysteresis input) selected by <input type="checkbox"/> mask option	1
RT0/ RR1/ CX1	O	R2F oscillator pin	3
IN1	I	R2F oscillator pin	1
SEG31/RT2, SEG30/RR2, SEG29/CX2	O	R2F oscillator pin or LCD pin selected by mask option	3
SEG28/IN2	O,I	R2F oscillator pin or LCD pin selected by mask option	1
SEG27/PC3 SEG26/PC2 SEG25/PC1 SEG24/PC0	O I/O	LCD segment output pin or general purpose I/O port (pull high 100Kohm@3.0V with software control) (hysteresis input) selected by mask option	4
SEG23-SEG15	O	LCD segment output pin	9
SEG14/PB3 SEG13/PB2 SEG12/PB1,	O, I	LCD segment output pin or general input port(hysteresis input) selected by <input type="checkbox"/> mask option	3
SEG11/EL2, SEG10/EL1	O	LCD segment output pin or EL output pin selected by <input type="checkbox"/> mask option	2
SEG9-SEG1	O	LCD segment output pin	9
COM3/SEG0	O	LCD common output pin or segment output pin selected by <input type="checkbox"/> mask option	1
COM2-COM0	O	LCD common output pin	3
VLCD	P	LCD power pin	1
C1-C2	I/O	Voltage halfer pin	2
RSTB	I	External reset pin, low active, pull high 100Kohm@3.0V, hysteresis input	1
LVD	I/O	Low voltage detector pin	1
Total			56

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

. AC / DC Characteristics

1 Absolutely max. ratings

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

ITEM	SYMBOL	RATING	UNIT
Operating Temperature	Top	-20°C - +70°C	°C
Storage Temperature	Tsto	-50°C - +125°C	°C
Supply Voltage	VDD	5.5	V
Voltage to input terminal	Vin	Vss-0.3 to Vdd+0.3	V

2 D.C. Characteristics

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

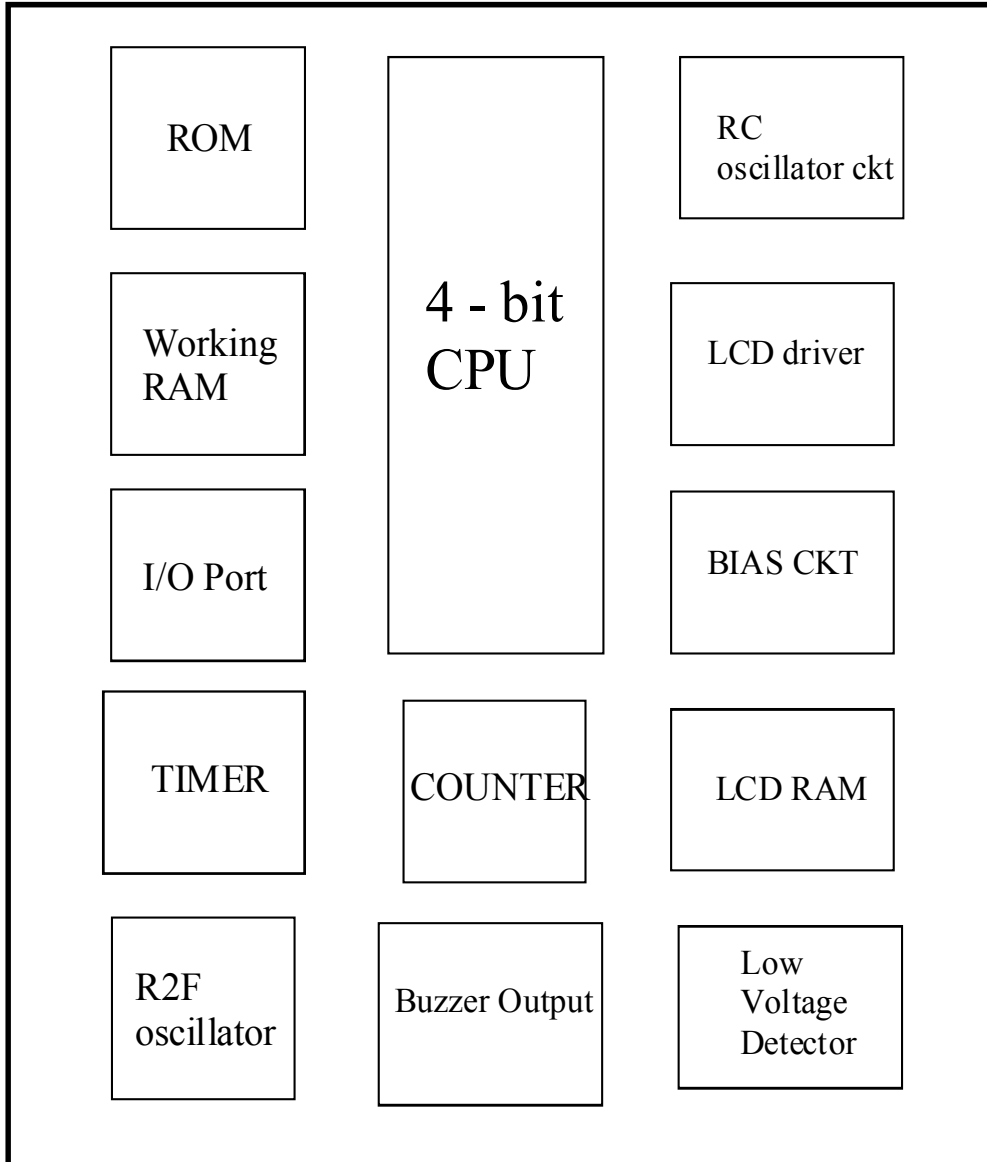
Item	Symb ol	Condition	min.	typ.	Max.	unit
Operating voltage	VDD	(TTU712)	2.2	3.0	5.5	V
Operating voltage	VDD	(TTR712)	2.4	3.0	5.5	V
Power consumption current	I _{OPR1}	System clock at 32Khz RC oscillator and R2F oscillator (20Khz), LCD off, No load, @3.0V		50	100	uA
Power consumption current	I _{OPR2}	System clock at 32Khz Crystal oscillator and R2F oscillator (20Khz) , LCD off, No load, @3.0V		50	100	uA
Stand by current	I _{st}	System halt, No load, RC oscillator off, LCD off, LVD off, @3.0V			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		0.35VDD	V
Input high voltage for RESB pin	V _{IH2}		0.7VDD		VDD	V
PA0-3/ PC0-3 port sink current	I _{OL1}	V _{OL} =0.1VDD, @3.0V	8			mA
PA0-3/ PC0-3 port source current	I _{OH1}	V _{OH} =0.9VDD, @3.0V	4			mA
EL1 port source current	I _{OH2}	V _{OH} =1.5V@3.0V		6		mA
EL1 port sink current	I _{OL2}	V _{OL} =0.6V@3.0V		3		mA
EL2 port source current	I _{OH3}	V _{OH} =1.5V@3.0V		10		mA
EL2 port sink current	I _{OL3}	V _{OL} =0.6V@3.0V		3		mA
LCD R-type bias current	I _{bias}	VDD=5V, VEE = 4.5V	10	20	30	uA
Segment output impedance	R _{seg}	VLCD = 2.7V		15	30	Kohm
Common output impedance	R _{com}	VLCD = 2.7V		2.5	5	Kohm

3 A.C. Characteristics

(Condition : $T_a = 25 \pm 3 \text{ }^\circ\text{C}$, $RH \leq 65 \%$, $VDD = +3V$, $VSS = 0V$)

Item	Symbol	Condition	min.	typ.	Max.	unit
System clock	f_{SYS1}	RC oscillator @3.0v (32Khz)		32		KHz
External reset low pulse width	t_{RES}		1			us
Wake up input		Low active pulse width t_{wkup} , Application de-bounce should be manipulated by user' software	1			us

. Block Diagram



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. Function Description

1 Map of memory and I/Os
(TTU711)

000H	(DP1)
001H	A
002H	TB1
003H	TB2
004H	TB3
005H	DPL
006H	DPM
007H	DPH
008H	PS
009H	INTF
00AH	INTC
00BH	PA
00CH	PAC
00DH	PB
00EH	RFC
00FH	CT0
010H	CT1
011H	CT2
012H	TMR1
013H	TMR2
014H	TMR3
015H	CTL1
016H	CTL2
017H	Reserved
01FH	
020H	RAM
09FH	
0A0H	LCD RAM
0BFH	
0C0H	
FFFH	Reserved

Data memory map

000H	Reset vector
001H	INTB vector
002H	
	On-chip program memory
3FFH	
400H	
	Reserved
FFFH	

Program memory map

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(TTU712/ TTR712)

000H	(DP1)
001H	A
002H	TB1
003H	TB2
004H	TB3
005H	DPL
006H	DPM
007H	DPH
008H	PS
009H	INTF
00AH	INTC
00BH	PA
00CH	PAC
00DH	PB
00EH	RFC
00FH	CT0
010H	CT1
011H	CT2
012H	TMR1
013H	TMR2
014H	TMR3
015H	CTL1
016H	CTL2
017H	PC
018H	PCC
019H	PD/PDC
01AH	Reserved
01FH	
020H	RAM
09FH	
0A0H	LCD RAM
0BFH	
0C0H	
FFFH	Reserved

Data memory map

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

Program memory map

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2 CONTROL REGISTER TABLE

Address	Resister	Bit3	Bit2	Bit1	Bit0	Initial state
008H	PS	WDTEN	H/L	SLEEP	STOP	1100
		R/W	R/W	R/W	R/W	
009H	INTF	TBF	RFF	TMRF	PA0F	0000
		R/W	R/W	R/W	R/W	
00AH	INTC	TBIE	RFIE	TMRIE	PA0IE	0000
		R/W	R/W	R/W	R/W	
00BH	PA	PA3	PA2	PA1	PA0	1111
		R/W	R/W	R/W	R/W	
00CH	PAC	PAC3	PAC2	PAC1	PAC0	1111
		R/W	R/W	R/W	R/W	
00DH	PB	PB3	PB2	PB1	PB0	uuuu
		R	R	R	R	
00EH	RFC	TMREN	ST1	ST0	RFEN	0000
		R/W	R/W	R/W	R/W	
00FH	CT0	CT 3	CT 2	CT 1	CT 0	0000
		R/W	R/W	R/W	R/W	
010H	CT1	CT 7	CT 6	CT 5	CT 4	0000
		R/W	R/W	R/W	R/W	
011H	CT2	CT B	CT A	CT 9	CT 8	0000
		R/W	R/W	R/W	R/W	
012H	TMR1	TMR 3	TMR 2	TMR 1	TMR 0	0000
		R/W	R/W	R/W	R/W	
013H	TMR2	TMR 7	TMR 6	TMR 5	TMR 4	0000
		R/W	R/W	R/W	R/W	
014H	TMR3	TMR B	TMR A	TMR 9	TMR 8	0000
		R/W	R/W	R/W	R/W	
015H	CTL1	ELEN	CHS	CTS	TMRS	0000
		R/W	R/W	R/W	R/W	
016H	CTL2	LVDFEN/LVDF	LCDON	TB1	TB0	0011
		R/W	R/W	R/W	R/W	
017H	PC	PC3	PC2	PC1	PC0	1111
		R/W	R/W	R/W	R/W	
018H	PCC	PCC3	PCC2	PCC1	PCC0	1111
		R/W	R/W	R/W	R/W	
019H	PD/PDC	PDC1	PDC0	PD1	PD0	1111
		R/W	R/W	R/W	R/W	

Special function register:

Address	Register	R/W	Bit3	Bit2	Bit1	Bit0	Initial state
016H	CTL2	R	LVDF	LCDON	TB1	TB0	0011
		W	LVDFEN	LCDON	TB1	TB0	0011

3 SYSTEM CONTROL REGISTER

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

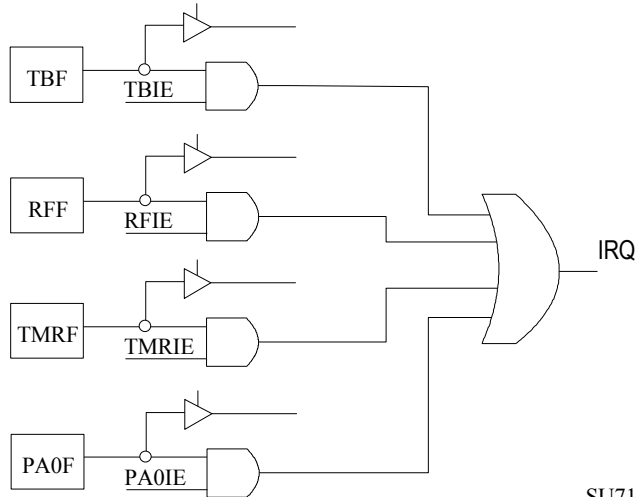
STOP : high active ◦

SLEEP : high active ◦

Function status \ Operating mode	SLEEP(high active)	STOP(high active)
Oscillator	Operating	Stopped
CPU internal status	Retain the status	
Memory, Flag, Register, I/O	Retain the status	
Program counter	Hold the executed address	
LCD	LCD display Retain	LCD display OFF
Timer/ Counter	Operated	Stopped & Retain
Watch-dog Timer	Retain the status	Retain the status
Release Condition(and clear STOP or SLEEP flag)	PA0-INT, TMR-INT, CT-INT	PA0-INT

- 有 INT 就做 wake up 的動作 ◦

IRQ 示意圖 :



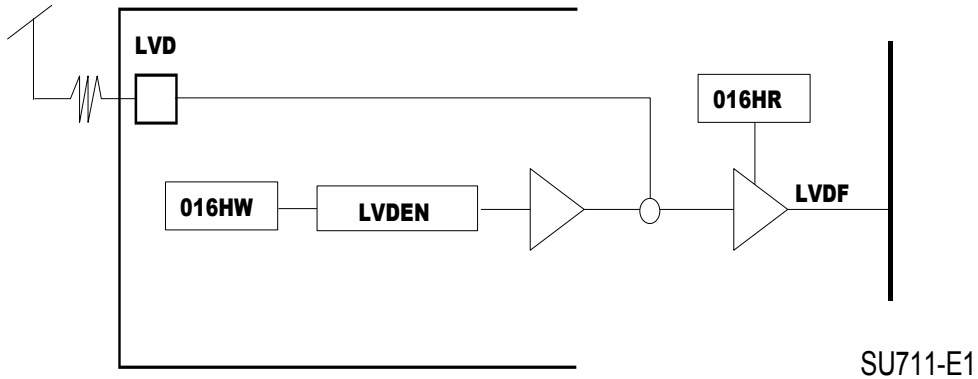
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4 Low voltage detector

Address	Register	R/W	Bit3	Bit2	Bit1	Bit0	Initial state
016H	CTL2	R	LVDF	LCDON	TB1	TB0	0011
		W	LVDEN	LCDON	TB1	TB0	0011

LVDEN：控制 Low voltage detect circuit，為 high 時，是 enable LVD circuit。

LVDF：LVD PAD 外接電阻到 VDD，可以偵測低電壓，當低電壓產生時，read LVDF 會為 high。



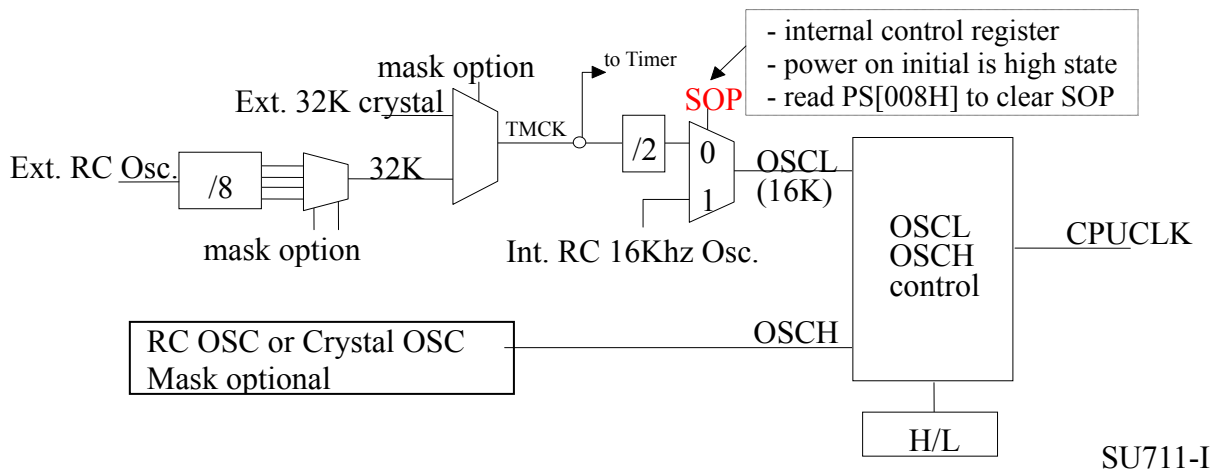
5 SYSTEM CLOCK CONTROL REGISTER

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

H/L：system clock source high/low speed control register

- 外掛的 RC oscillator (32/64/128/256Khz) or 32K crystal oscillator (OSCL)
- 內建 RC oscillator(4Mhz) (OSCH)
- * 當 H/L = 『0』時，system clock source 選擇 OSCL。
- * 當 H/L = 『1』時，system clock source 選擇 OSCH。
- * High speed oscillator offers 3 kinds oscillator type

The terminals of high speed oscillator	OSCHI Oscillator input pad	OSCHO Oscillator output pad
Crystal mode	Input terminal	Output terminal
Exyernal RC OSC mode	External R	OSCH/4
Built-in RC OSC mode	N.C.	OSCH/4



* 當 Power on reset/ Internal reset/ WDT reset 時，系統的 OST (oscillator stable time) 是用 Int. RC 16Khz 除 1024 後，CPU 才啓動。

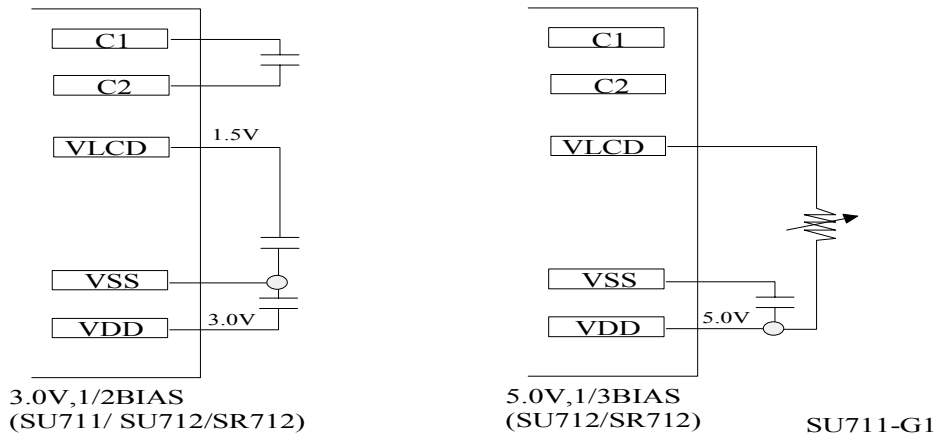
* 當由 STOP mode 起來，系統的 OST 是用 Int. RC 16Khz 除 8 後，CPU 才啓動。此時如果有用 32K crystal，software 需要等 0.5sec，才能做 read PS[008H] (切換 OSCL 的 clock source，而且控制 32 crystal 的振盪模式爲省電模式)，以確保 32K crystal 的振盪穩定性，而且有省電的效果。如果是用外部 RC oscillator 的話，就不用等待，可以直接做 read PS[008H]。

6 LCD CONTROL REGISTER

Address	Resister	Bit3	Bit2	Bit1	Bit0	Initial state
008H	PS	WDTEN	H/L	SLEEP	STOP	1100
		R/W	R/W	R/W	R/W	
016H	CTL2	LVDEN/F	LCDON	TB1	TB0	0011
		R/W	R/W	R/W	R/W	

LCDON : high active。為控制 LCD on or off mode, low state enter LCD off mode，此時要把 pump circuit disable 或是 LCD R-Bias Off，COM/SEG 都拉到 VDD。

(TTU712) (TTR712)有 mask option 選擇是 C-type 或是 R-type bias，為 R-type bias，此時的 LCD power 是由 VLCD pin 輸入。



7 I/O REGISTER

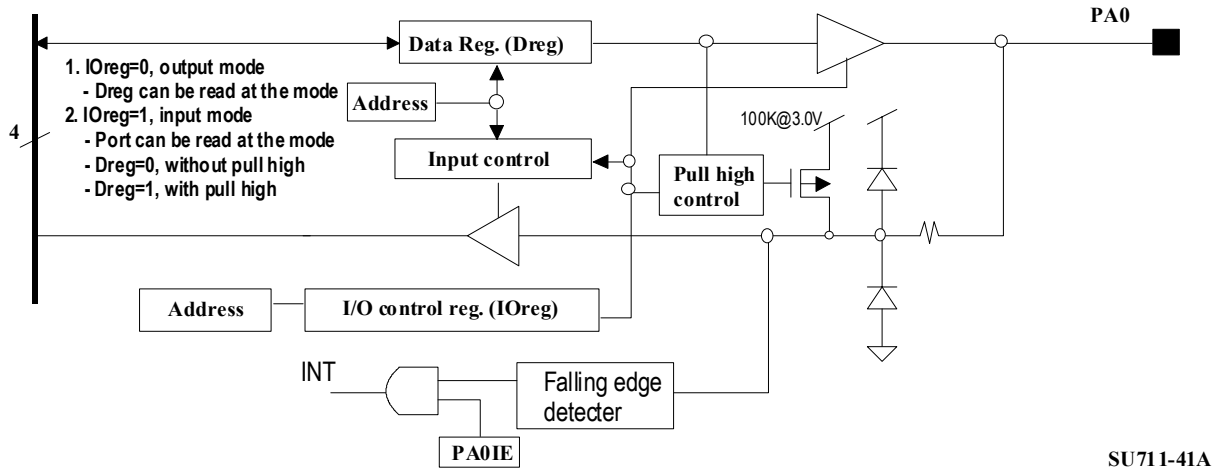
A. Port A

Address	Resister	Bit3	Bit2	Bit1	Bit0	Initial state
009H	INTF	TBF	RFF	TMRF	PA0F	0000
		R/W	R/W	R/W	R/W	
00AH	INTC	TBIE	RFIE	TMRIE	PA0IE	0000
		R/W	R/W	R/W	R/W	
00BH	PA	PA3	PA2	PA1	PA0	1111
		R/W	R/W	R/W	R/W	
00CH	PAC	PAC3	PAC2	PAC1	PAC0	1111
		R/W	R/W	R/W	R/W	

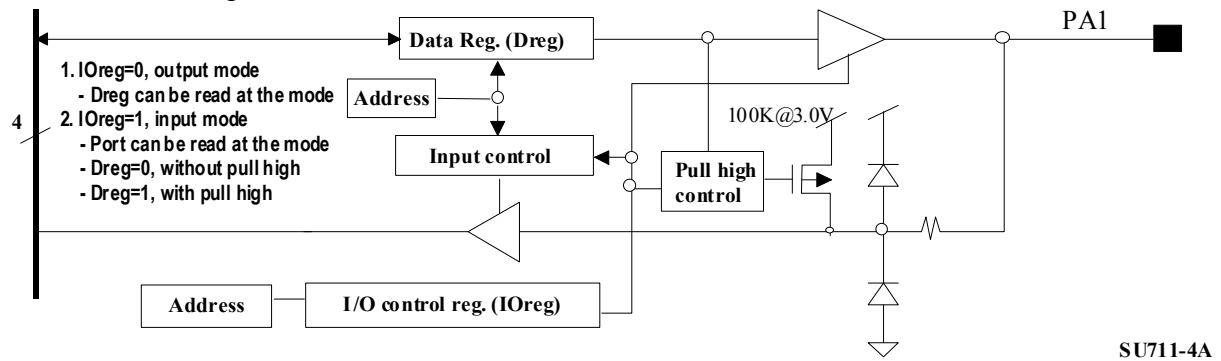
PA : PA0 有 interrupt 功能(falling edge trigger)，當系統進入 STOP or SLEEP mode 時，可以用此 PIN 來 wake up，此時會 set PA0F flag，而此 flag 會被 009H write bit “0” 時 clear 為 “0”，但是不會被 009H write bit “1” 時 set 為 “1”（這是要保護 INT flag 被誤寫為“1”）。wake-up function 會被 PA0IE disable。

PAC0-PAC1：控制 PA0-1 的 I/O 和 Pull high function。Default 為 high，是 input mode，此時的 (Dreg) register 可以控制 port 是否要 pull high，如附圖。

所有有 pull high 控制的 I/O，其 (Dreg) register 在 power on initial 是 high state。

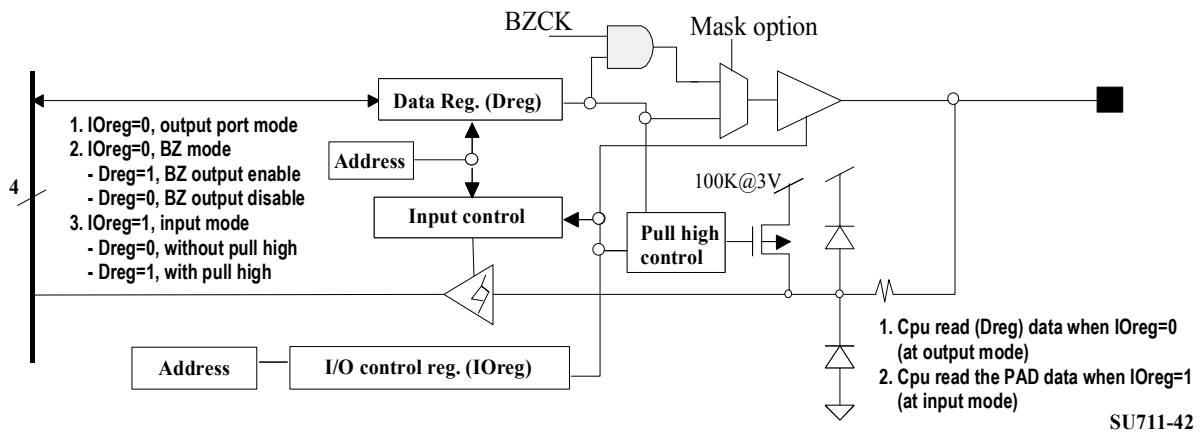


PA1/PA3 : I/O port 的 data。



PA2 : I/O port 的 data。

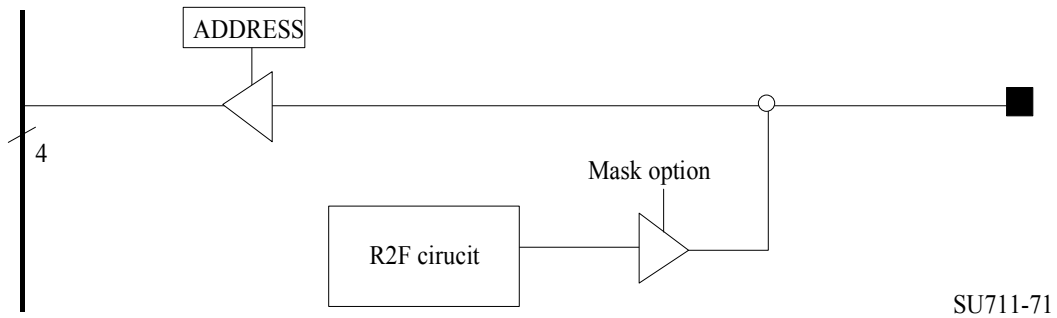
PAC2 : 控制 PA2 general input function with pull high function(Dreg control) or Buzzer output function。Default 爲 high，是 input mode，此時的 (Dreg)register 可以控制 port 是否要 pull high，如附圖。



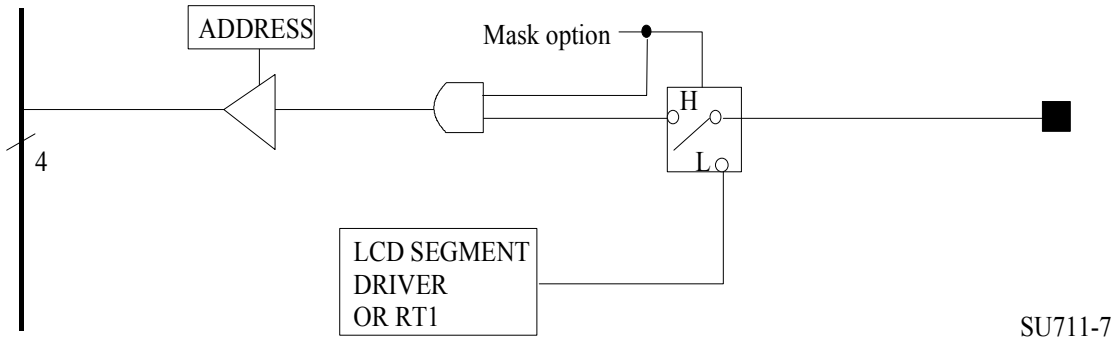
B. Port B

Address	Resister	Bit3	Bit2	Bit1	Bit0	Initial state
00DH	PB	PB3	PB2	PB1	PB0	uuuu
		R	R	R	R	

PB0：是 input port 的 data register，可以經由 mask option 選擇為 RT1 的功能。



PB1, PB2, PB3：是 input port 的 data register，當 mask option 選擇為 LCD segment 的功能時，此時 PBx 被 read 會為 low。

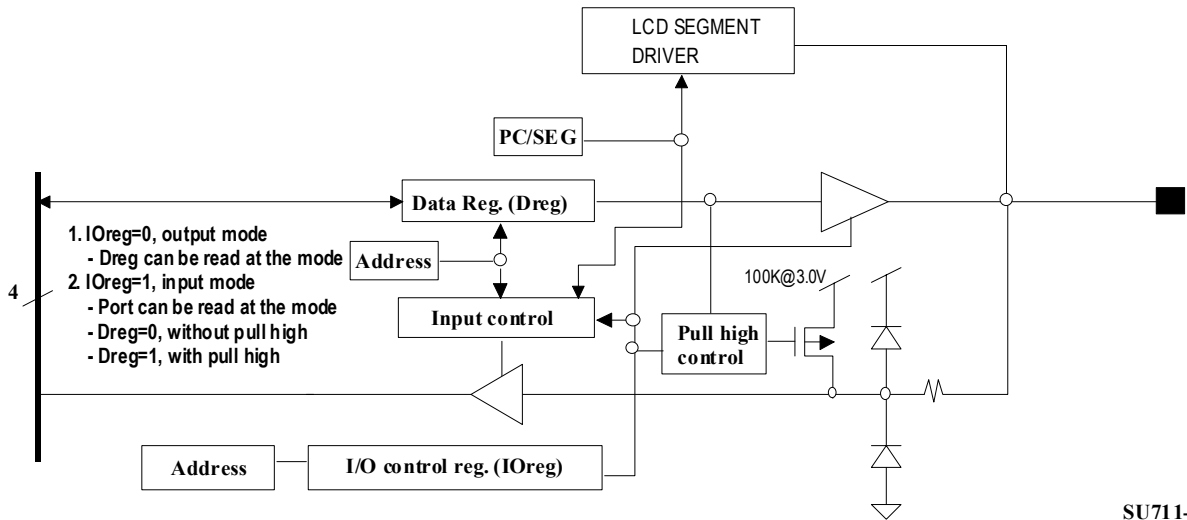


C. Port C/D (TTU712/TTR712)

Address	Resister	Bit3	Bit2	Bit1	Bit0	Initial state
017H	PC	PC3	PC2	PC1	PC0	1111
		R/W	R/W	R/W	R/W	
018H	PCC	PCC3	PCC2	PCC1	PCC0	1111
		R/W	R/W	R/W	R/W	
019H	PD/PDC	PDC1	PDC0	PD1	PD0	1111
		R/W	R/W	R/W	R/W	

PC/PD : I/O port 的 data 。

PCC/PDC : 控制 PC0-3 的 I/O 和 Pull high function 。Default 爲 high ，是 input mode ，此時的 (Dreg) register 可以控制 port 是否要 pull high ，如附圖。



SU711-43A

8 RFC/TMR circuit

Address	Resister	Bit3	Bit2	Bit1	Bit0	Initial state
009H	INTF	TBF	RFF	TMRF	PA0F	0000
		R/W	R/W	R/W	R/W	
00AH	INTC	TBIE	RFIE	TMRIE		0000
		R/W	R/W	R/W	R/W	
00DH	PB	PB3	PB2	PB1	PB0	uuuu
		R	R	R	R	
00EH	RFC	TMREN	ST1	ST0	RFEN	0000
		R/W	R/W	R/W	R/W	
00FH	CT0	CT 3	CT 2	CT 1	CT 0	0000
		R/W	R/W	R/W	R/W	
010H	CT1	CT 7	CT 6	CT 5	CT 4	0000
		R/W	R/W	R/W	R/W	
011H	CT2	CT B	CT A	CT 9	CT 8	0000
		R/W	R/W	R/W	R/W	
012H	TMR1	TMR 3	TMR 2	TMR 1	TMR 0	0000
		R/W	R/W	R/W	R/W	
013H	TMR2	TMR 7	TMR 6	TMR 5	TMR 4	0000
		R/W	R/W	R/W	R/W	
014H	TMR3	TMR B	TMR A	TMR 9	TMR 8	0000
		R/W	R/W	R/W	R/W	
015H	CTL1	ELEN	CHS	CTS	TMRS	0000
		R/W	R/W	R/W	R/W	

RFC：控制 R2F/ TIMER/ COUNTER 的 function。

PB0：是 input port 的 data register，當 mask option 選擇為 RT1 的功能時，此時 PB0 被 read 會為 low。

CT0/ CT1/CT2：R2F counter data

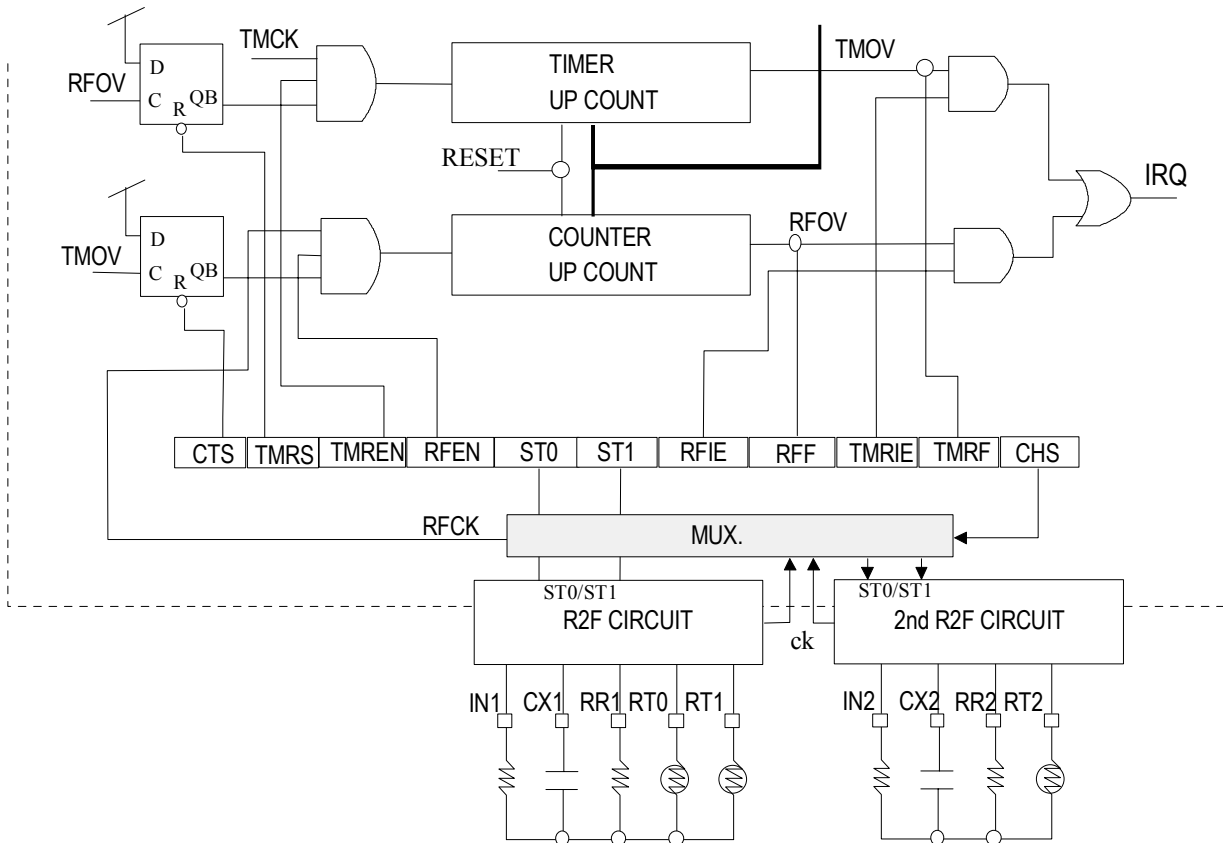
TMR1/ TMR2/ TMR3：Timer data。

CTL：CTS/ TMRS 是控制 TIMER 或是 COUNTER 的 clock 停止輸入了，主要是避免軟體執行的誤差。

TIMER 設計是沒有 auto reload 功能，在 overflow 後，其後的 TIMER 就做 free run。在使用時，硬體設計是取補數方式來做，所以使用者在軟體的搭配上，就不用取補數了。

FLAG	FUNCTION
RFEN	Low : stop counter High : start counter
CHS	low : select 1 st channel high : select 2 nd channel
ST1/ ST0	(ST1/ST0) 00: disable R2F circuit (IN pin 要拉到 low) (ST1/ST0) 01: enable R2F circuit (RR1@CHS=0/ RR2@CHS=1) (ST1/ST0) 10: enable R2F circuit (RT0@CHS=0/ RT2@CHS=1) (ST1/ST0) 11: enable R2F circuit (RT1@CHS=0)
TMREN	Low : stop timer High : start timer
TMRF	Low: normal state High: after overflow，此 flag 會被 009H write bit “0” 時 clear 為 “0”，但是不會被 009H write bit “1” 時 set 為 “1”（這是要保護 INT flag 被誤寫為”1”）。
RFF	Low: normal state High: after overflow，此 flag 會被 009H write bit “0” 時 clear 為 “0”，但是不會被 009H write bit “1” 時 set 為 “1”（這是要保護 INT flag 被誤寫為”1”）。

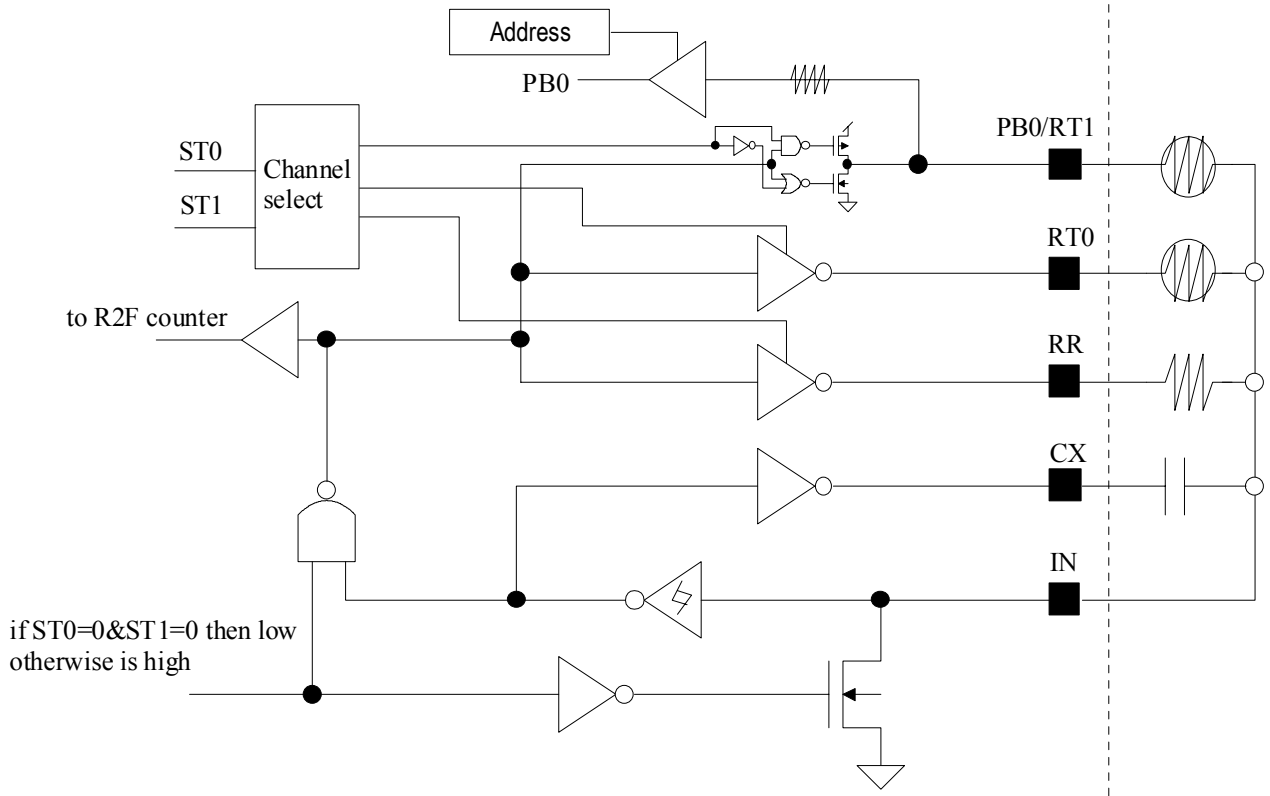
TMRIE	low : disable interrupt function high : enable interrupt function
RFIE	low : disable interrupt function high : enable interrupt function
TMRS	low : normal state high : disable TIMER clock input when COUNTER overflow
CTS	low : normal state high : disable COUNTER clock input when TIMER overflow



SU711-A1

建議使用步驟：

1. 使用前先 set TMRS 後，再 enable TMREN。
2. 若 TMRS 為 low ，time overflow 時會 set TMOV，且若 TMRIE 為 high state，會有 CPU interrupt 產生，同時 TIMER 會繼續 run。
3. 等待 TMRS set 為 high state 時，若 RFOV 為 high state 時（當 COUNTER overflow），會去 stop TMCK 輸入。
4. 若要重新開始，TMREN 和 TMRS 需先 clear 為 low state，然後設定 TMRS 為 high state 後，再來 set TMREN。



SU711-6

在量測很寬的溫度範圍應用時，RT1 也可以當作另一個 reference resistor 使用，以讓高低溫各有一個參考電阻，以提高量測的精確度。

9 TIMER BASE CONTROL REGISTER

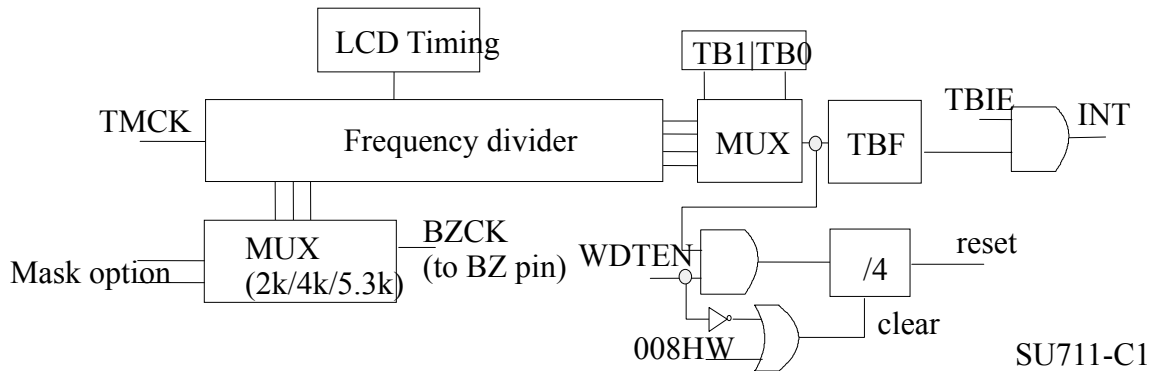
Address	Resister	Bit3	Bit2	Bit1	Bit0	Initial state
009H	INTF	TBF	RFF	TMRF	PA0F	0000
		R/W	R/W	R/W	R/W	
00AH	INTC	TBIE	RFIE	TMRIE	PA0IE	0000
		R/W	R/W	R/W	R/W	
016H	CTL2	LVDEN/F	LCDON	TB1	TB0	0011
		R/W	R/W	R/W	R/W	

TBF : high active , time base overflow flag , 此 flag 會被 009H write bit “0” 時 clear 為 “0” , 但是不會被 009H write bit “1” 時 set 為 “1” (這是要保護 INT flag 被誤寫為”1”)。

TBIE : high active , time base interrupt control pin 。

TB1/TB0 : 選擇 Time base timer 的 clock source 。

TB1	TB0	O/P
0	0	1KHZ
0	1	64HZ
1	0	8HZ
1	1	1HZ

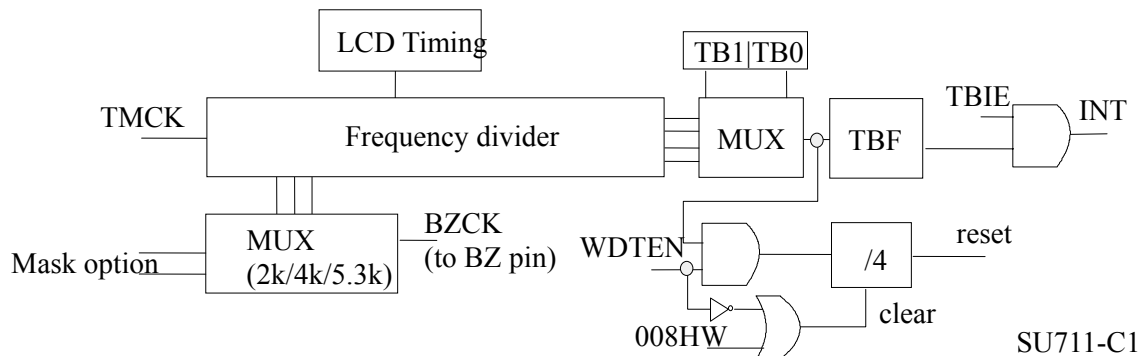


注意：若有使用 Time base timer 功能，在 power on 後和每次在 Stop mode wake-up 起來之後，一定要先下 “read 008H (008HR)” 的動作，否則其頻率會不準確。

10 WDT CONTROL REGISTER

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

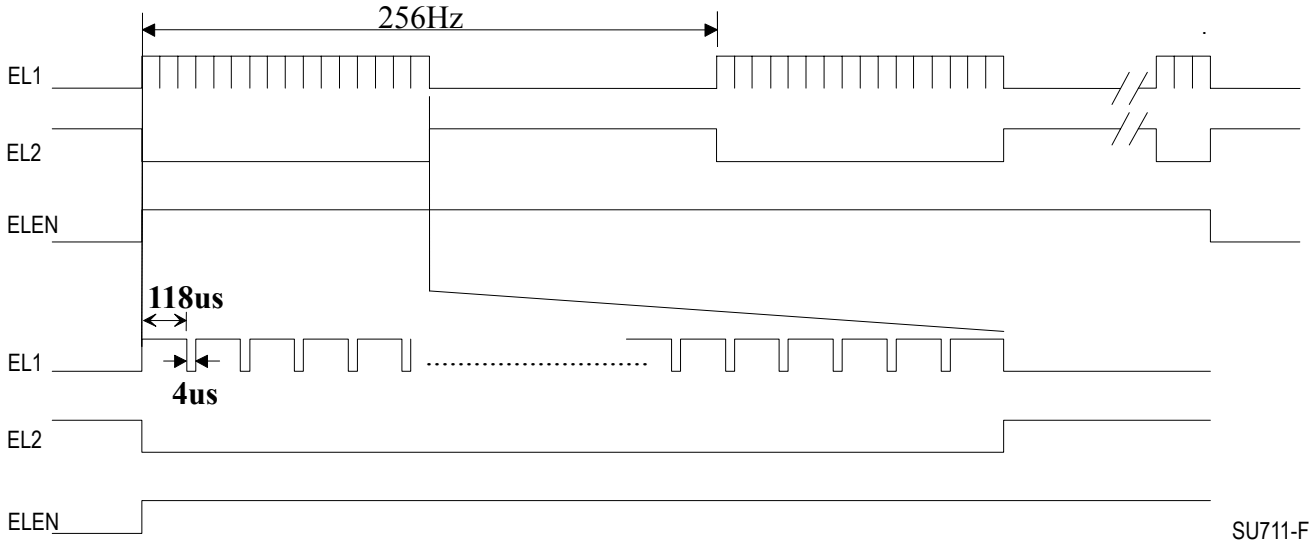
WDTEN : high active 。 008HW or WDTEN=0 會 clear WDT counter 。



11 EL timing

Address	Resister	Bit3	Bit2	Bit1	Bit0	Initial state
015H	CTL1	ELEN	CHS	CTS	TMRS	0000
		R/W	R/W	R/W	R/W	

ELEN：控制 EL timing output 的 function。ELEN=0 時，EL1=EL2=0。
 使用 EL function 時，需要事先切換到 high speed mode (H/L=1)。



SU711-F



12 LCD RAM

(TTU711)

With COM3 table:

	0A0H	0A1H	0A2H	0A3H	0A4H	0A5H	0A6H	0A7H	0A8H	0A9H	0AAH	0ABH	0ACH	0ADH	0AEH
COM0	D0	D0	D0	D0	D0	D0	D0	D0	D0	D0	D0	D0	D0	D0	D0
COM1	D1	D1	D1	D1	D1	D1	D1	D1	D1	D1	D1	D1	D1	D1	D1
COM2	D2	D2	D2	D2	D2	D2	D2	D2	D2	D2	D2	D2	D2	D2	D2
COM3	D3	D3	D3	D3	D3	D3	D3	D3	D3	D3	D3	D3	D3	D3	D3
	SEG0	SEG1	SEG2	SEG3	SEG4	SEG5	SEG6	SEG7	SEG8	SEG9	SEG10	SEG11	SEG12	SEG13	SEG14

Without COM3 table:

	0A0H	0A1H	0A2H	0A3H	0A4H	0A5H	0A6H	0A7H	0A8H	0A9H	0AAH	0ABH	0ACH	0ADH	0AEH
COM0	D0	D0	D0	D0	D0	D0	D0	D0	D0	D0	D0	D0	D0	D0	D0
COM1	D1	D1	D1	D1	D1	D1	D1	D1	D1	D1	D1	D1	D1	D1	D1
COM2	D2	D2	D2	D2	D2	D2	D2	D2	D2	D2	D2	D2	D2	D2	D2
COM3	D3	D3	D3	D3	D3	D3	D3	D3	D3	D3	D3	D3	D3	D3	D3
	SEG0	SEG1	SEG2	SEG3	SEG4	SEG5	SEG6	SEG7	SEG8	SEG9	SEG10	SEG11	SEG12	SEG13	SEG14

SU711-9



(TTU712/ TTR712)

With COM3 table:

	0A0H	0A1H	0A2H	0A3H	0A4H	0A5H	.....	0BAH	0BBH	0BCH	0BDH	0BEH	0BFH
COM0	D0	D0	D0	D0	D0	D0		D0	D0	D0	D0	D0	D0
COM1	D1	D1	D1	D1	D1	D1	.....	D1	D1	D1	D1	D1	D1
COM2	D2	D2	D2	D2	D2	D2		D2	D2	D2	D2	D2	D2
COM3	D3	D3	D3	D3	D3	D3	.....	D3	D3	D3	D3	D3	D3
	SEG0	SEG1	SEG2	SEG3	SEG4	SEG5	.....	SEG26	SEG27	SEG28	SEG29	SEG30	SEG31

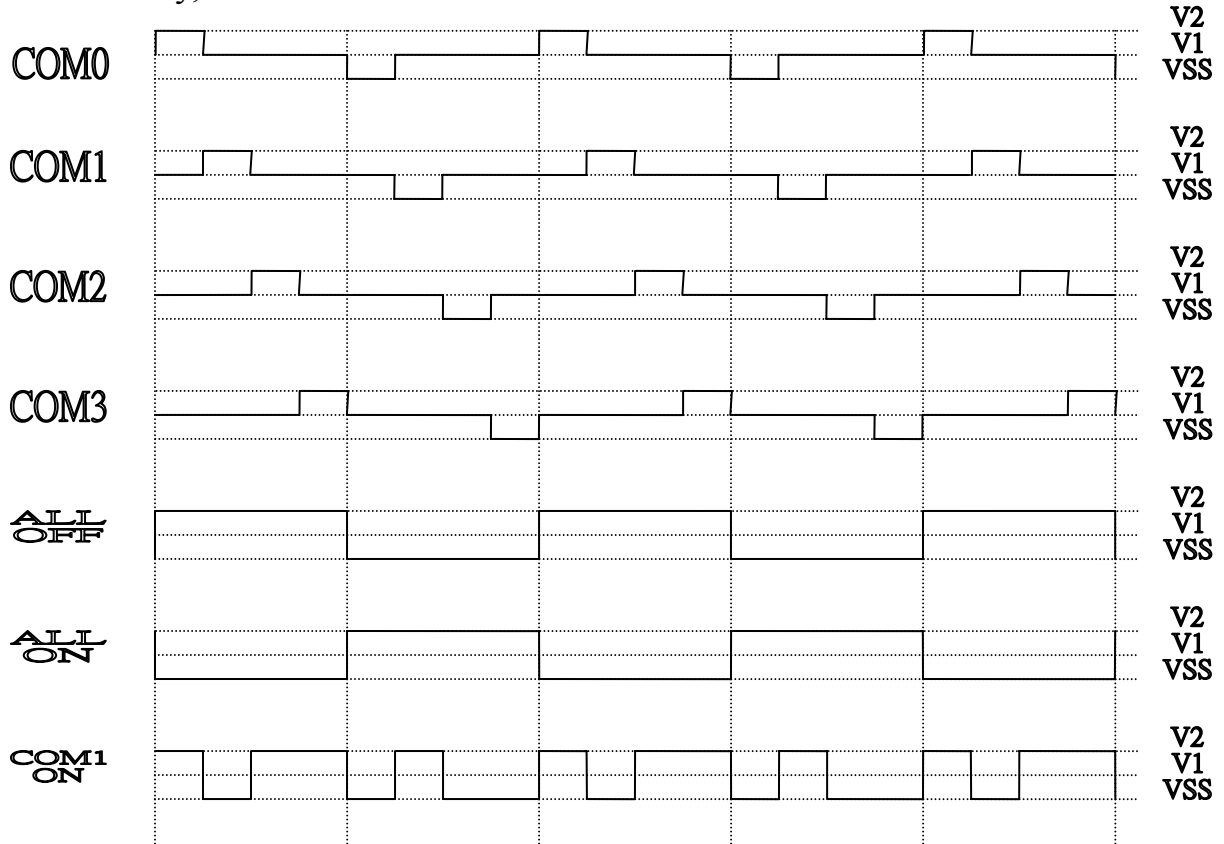
Without COM3 table:

	0A0H	0A1H	0A2H	0A3H	0A4H	0A5H	.....	0BAH	0BBH	0BCH	0BDH	0BEH	0BFH
COM0	D0	D0	D0	D0	D0	D0	D0	D0	D0	D0	D0	D0	D0
COM1	D1	D1	D1	D1	D1	D1	D1	D1	D1	D1	D1	D1	D1
COM2	D2	D2	D2	D2	D2	D2	D2	D2	D2	D2	D2	D2	D2
COM3	D3	D3	D3	D3	D3	D3	D3	D3	D3	D3	D3	D3	D3
	SEG0	SEG1	SEG2	SEG3	SEG4	SEG5	.....	SEG26	SEG27	SEG28	SEG29	SEG30	SEG31

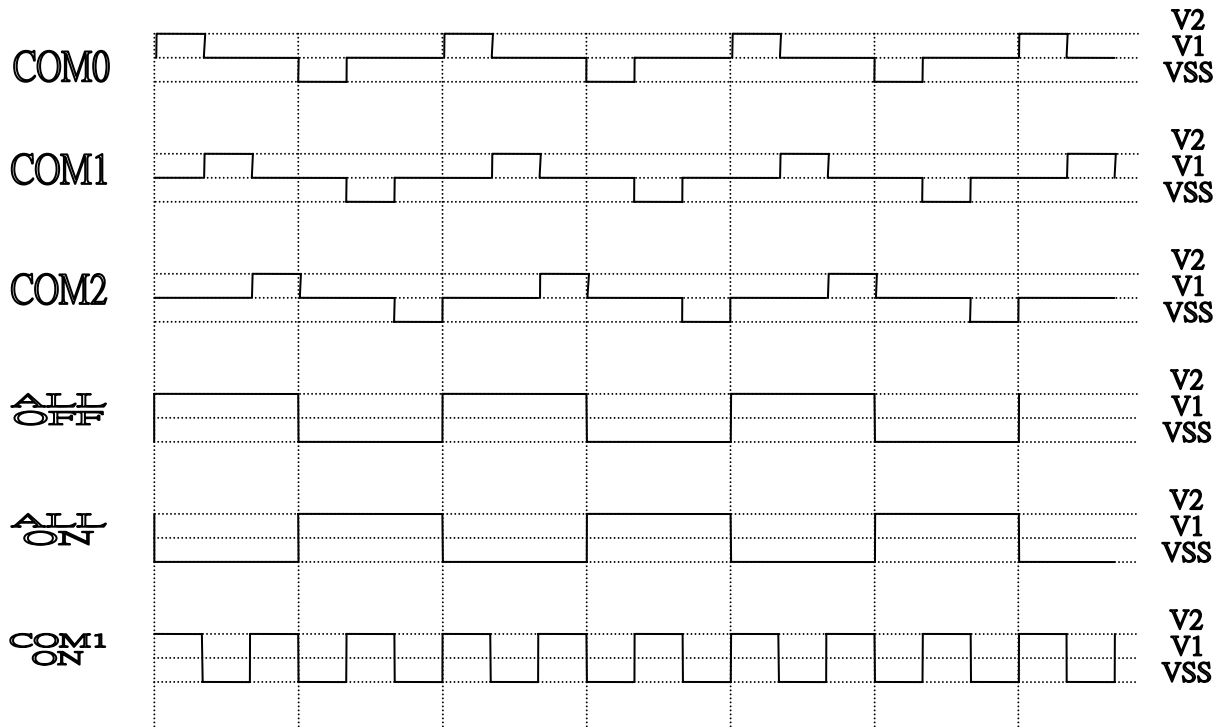
SU711-91

13 LCD PATTERN

A. 1/4 duty, 1/2 bias

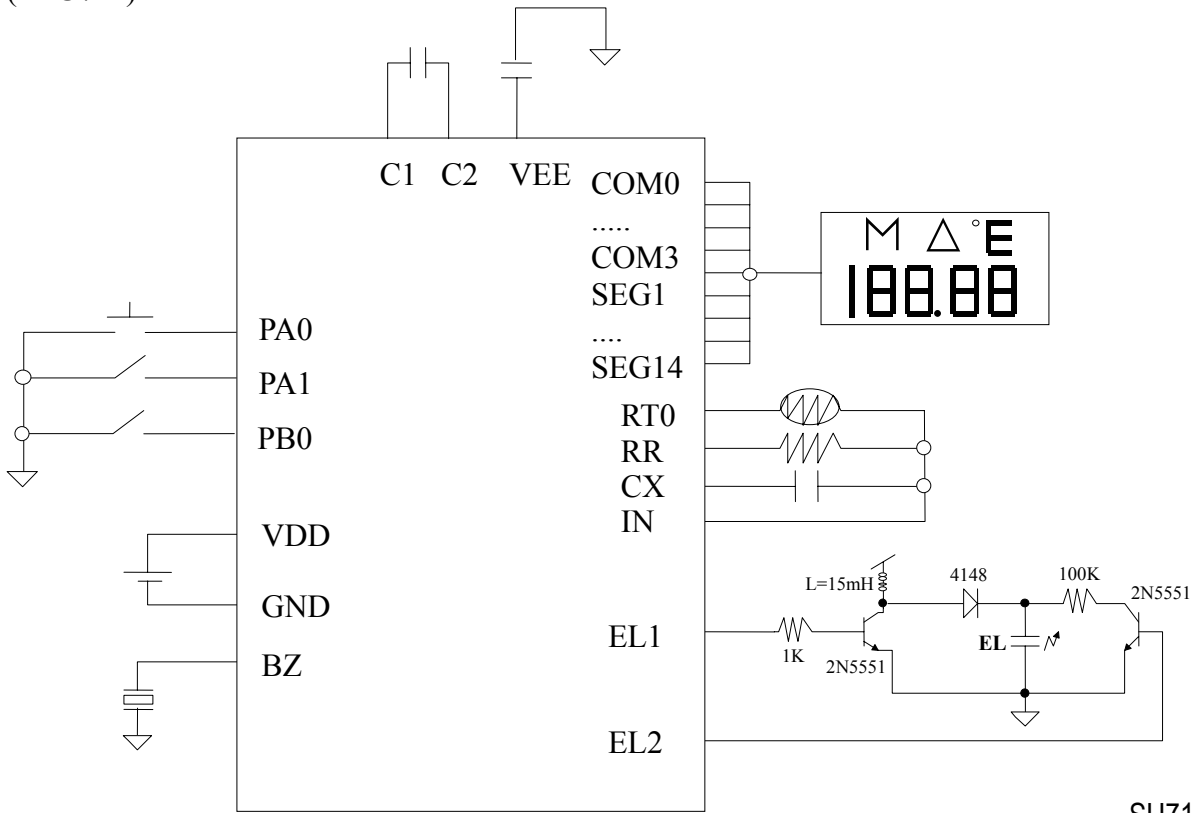


B. 1/3 duty, 1/2 bias



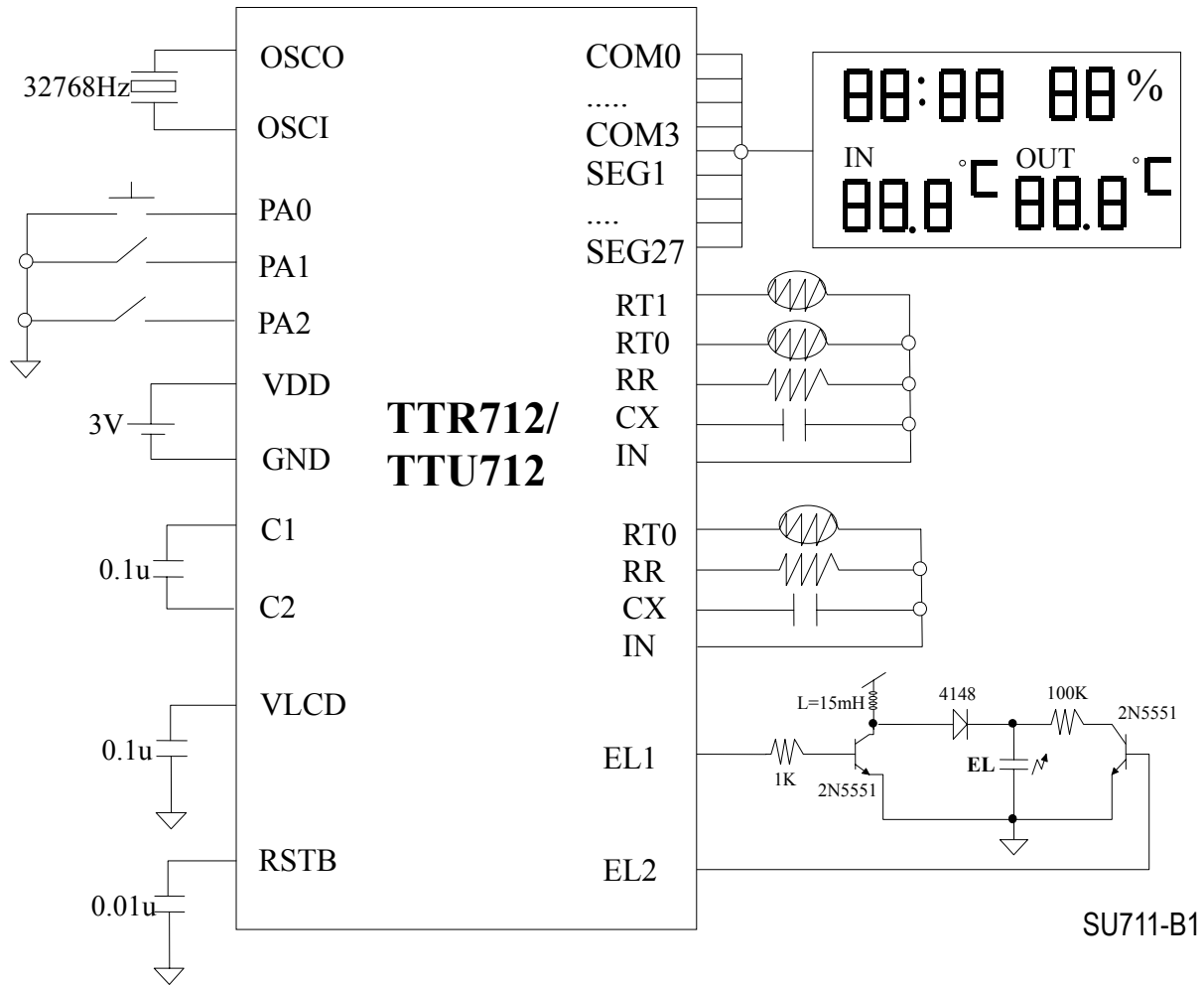
. Application Circuit

(TTU711)



SU711-B2

(TTU712/ TTR712)



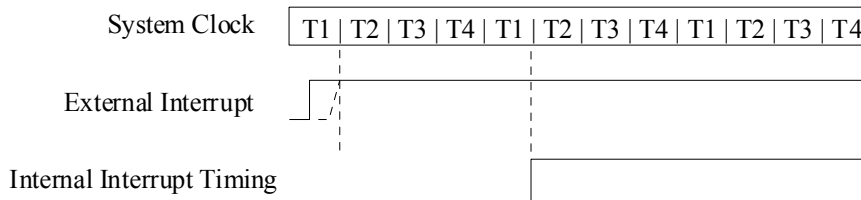
. Mask Option Table

Function	Option	U711	U712	R712
Crystal or RC oscillator type(OSCH)	<input type="checkbox"/> Crystal/Resonator <input type="checkbox"/> External R RCOSC <input type="checkbox"/> Built-in RCOSC	mask	mask	mask
Crystal or RC oscillator type(OSCL)	<input type="checkbox"/> 32K crystal ◦ <input type="checkbox"/> RC oscillator ◦	mask	mask	mask
RC oscillator type(OSCL)	<input type="checkbox"/> 32Khz ◦ <input type="checkbox"/> 64Khz ◦ <input type="checkbox"/> 128Khz ◦ <input type="checkbox"/> 256Khz ◦	mask	mask	mask
PB port / LCD pin	<input type="checkbox"/> PB3/ <input type="checkbox"/> SEG14 ◦ <input type="checkbox"/> PB2/ <input type="checkbox"/> SEG13 ◦ <input type="checkbox"/> PB1/ <input type="checkbox"/> SEG12 ◦ <input type="checkbox"/> PB0/ <input type="checkbox"/> RT1 ◦	mask	mask	mask
EL function	<input type="checkbox"/> Yes/ <input type="checkbox"/> No ◦	mask	mask	mask
LCD duty select	<input type="checkbox"/> COM3(1/4 duty)/ <input type="checkbox"/> SEG0 ◦ (1/3 duty)	mask	mask	mask
Buzzer frequency	<input type="checkbox"/> No BZ function ◦ <input type="checkbox"/> 2K ◦ <input type="checkbox"/> 4K ◦ <input type="checkbox"/> 5.3K ◦	mask	mask	mask
PC port / LCD pin	<input type="checkbox"/> PC3/ <input type="checkbox"/> SEG27 ◦ <input type="checkbox"/> PC2/ <input type="checkbox"/> SEG26 ◦ <input type="checkbox"/> PC1/ <input type="checkbox"/> SEG25 ◦ <input type="checkbox"/> PC0/ <input type="checkbox"/> SEG24 ◦	X	mask	mask
Using R2F 2 nd channel	<input type="checkbox"/> Yes/ <input type="checkbox"/> No ◦	X	mask	mask
LCD bias type	<input type="checkbox"/> C-type/ <input type="checkbox"/> R-type ◦	X	mask	mask
High speed oscillator mode	<input type="checkbox"/> Crystal oscillator <input type="checkbox"/> external RC oscillator <input type="checkbox"/> Built-in RC oscillator	X	mask	mask

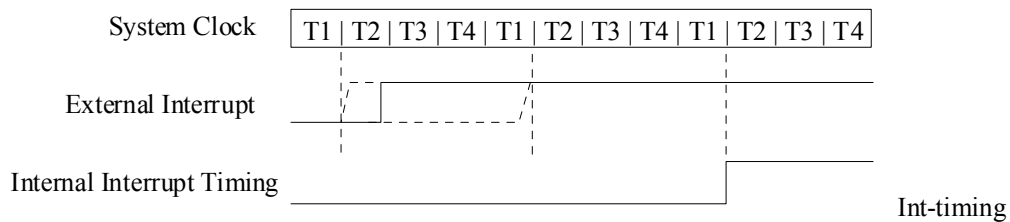
. Application Note

1. 若是使用此 RT1 PIN 來量測室內外溫度時，建議用此 PIN 來量測室外溫度。若是在溫濕度計應用，建議用此 PIN 來量測溫度。
2. 所有 Interrupt flag 只能被 software write “0” (clear)，而不能被 software write “1” (set)。
3. 進入 interrupt 的時機，會決定是否要執行完下一個 PC counter(PC+1) 的指令後，才進入副程式，或是執行完目前指令後，就進入副程式，其狀況有二，如下：

CASE A :



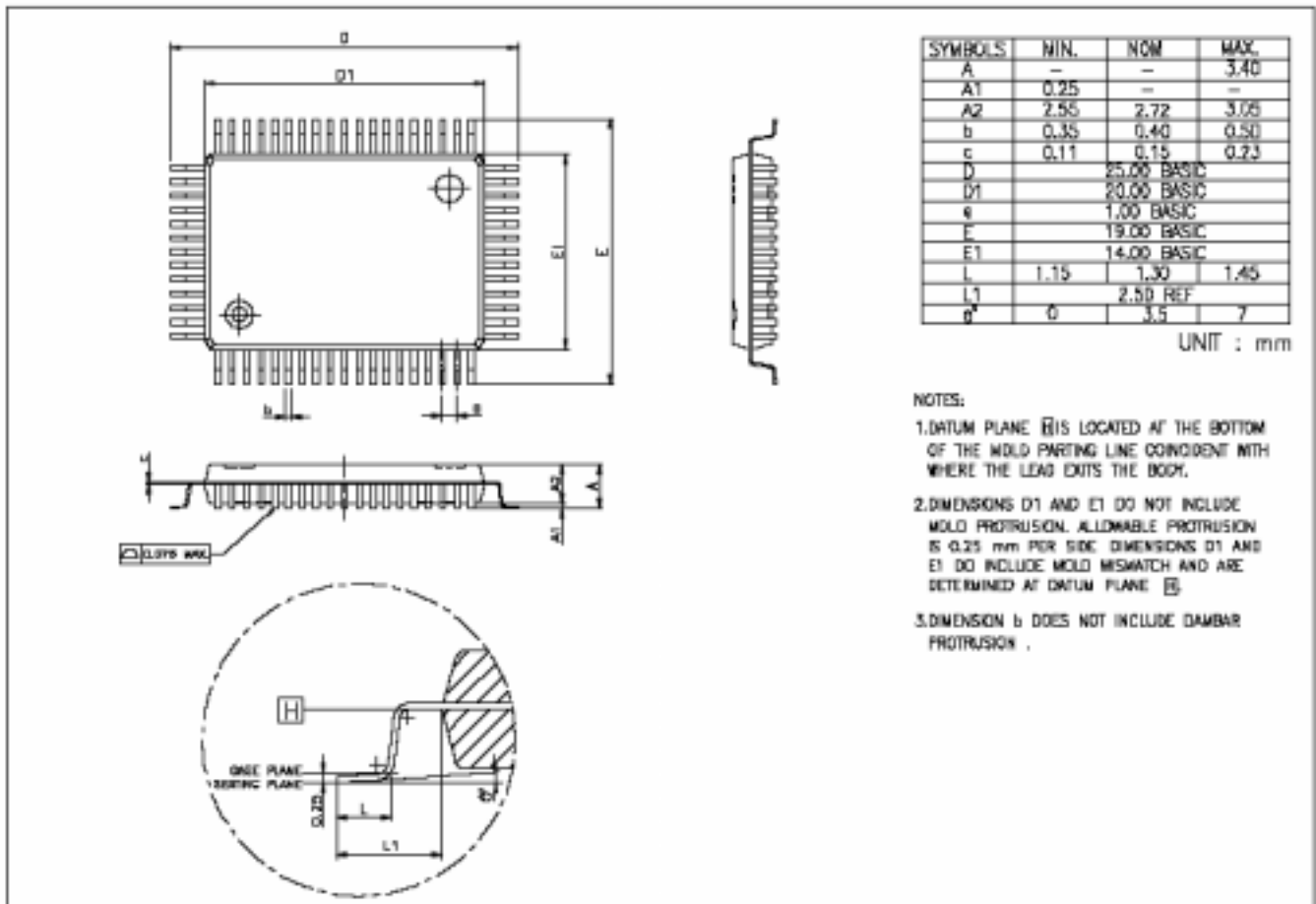
CASE B :



. Order Information

	Project Number Name			
Package form	TTR712	TTU712	TTR711	TTU711
Chip form	不支援	TCU712	不支援	TCU711
Wafer base	TDR712	TDU712	TDR711	TDU711
Schedule	2004/5/31	2004/9/30	2004/5/31	2005/3/31

. Package Information



. Revise History

1. 2004/03/31
 - 修正所有 I/O port 的 power on initial state(都為 high)
 - 增加 PACKAGE INFORMATION
 - 修改 ORDER INFORMATION
2. 2004/07/22
 - 增加 function 示意圖
 - 增加 TIMER/COUNTER 說明
3. 2005/01/21
 - 修改 Page 16 , VLCD2 為 VLCD
 - 把 TTU712 獨立出來
4. 2005/3/23
 - TB0, TB1 default 00-→ 11
 - OSCH: a. resonator/crystal type b. external R type c. Built-in type (4MHz)
 - OSCH mask option
5. 2005/9/9
 - 修改 P.7,15,31 High speed Oscillator
 - 修改 P.9 Wake up input pulse
6. 2005/11/18
 - 修改 P.4 Pin Assignment