



HY15P43
Datasheet
8-Bit RISC-like Mixed Signal Microcontroller
Embedded 8x8 LED Driver
18-Bit Σ ADC

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1. 特點

- 8 位元 H08A 加強型精簡指令集，共有 66 個指令包含硬體乘法指令及查表指令
- 2.2V to 5.5V 工作電壓範圍，-40~85°C 工作溫度範圍。
- 支援外部石英震盪器 1MHZ~4MHZ/32768HZ 及內部高精度 RC 震盪器 2MHZ/4MHZ，多種 CPU 工作時脈切換選擇，可讓使用者達到最佳省電規劃
 - 運行模式
 - 待機模式
 - 休眠模式
- 5KWord OTP Type 程式記憶體，128Byte 資料記憶體
- Brownout detector 及 Watch dog Timer，可防止 CPU 進入死機模式。
- 8 個七段顯示驅動器
 - 支援 LED 顯示控制寄存器
 - 共陰極或是共陽極驅動支援
 - 單一位元設定可以閃爍字節顯示
 - 12 個 LED 埠可設定為數位輸出埠
 - 支援 Non-Overlap 掃描方式
- 18bit 全差動輸入 $\Sigma\Delta$ ADC 類比數位轉換器
 - 內置 PGA (Programmable Gain Amplifier) 可有 128 倍輸入信號放大倍率選擇
 - 內置輸入零點調整，可針對不同應用增加其量測範圍
 - 可選擇不同的數據輸出速率，最高可達 15.6ksps
 - 內置絕對溫度感測器
- LVD 低電壓檢測功能具 14 段檢測電壓設置與外部輸入電壓檢測功能
- 類比電壓源 VDDA 具 10mA 穩壓電壓源輸出能力，快速啟動功能，可提供傳感器驅動電壓
- 8-bit Timer A
- 16-bit Timer B 模組具 Compare/PWM 功能
- 串列通訊 EUART，SPI，I2C 模組
- Built-In EPROM (BIE)，內建 2.75V 低壓燒錄控制電路
- Support 6 stack level.

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2. 引腳定義

2.1. LQFP 7x7 48L 引腳圖

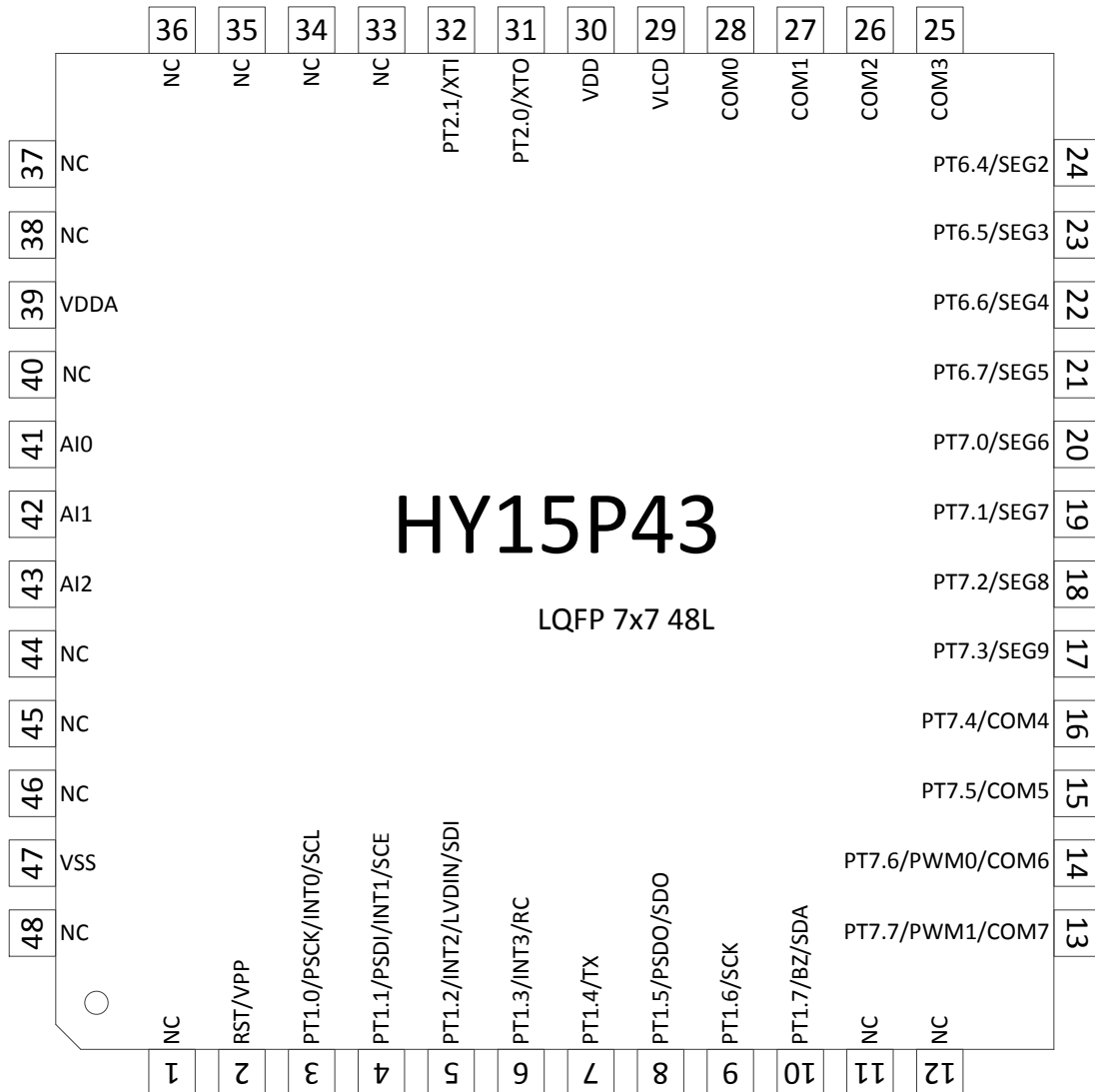


圖 2-1 HY15P43 LQFP 7x7 48L 引腳圖

2.2. TSSOP28 引腳圖

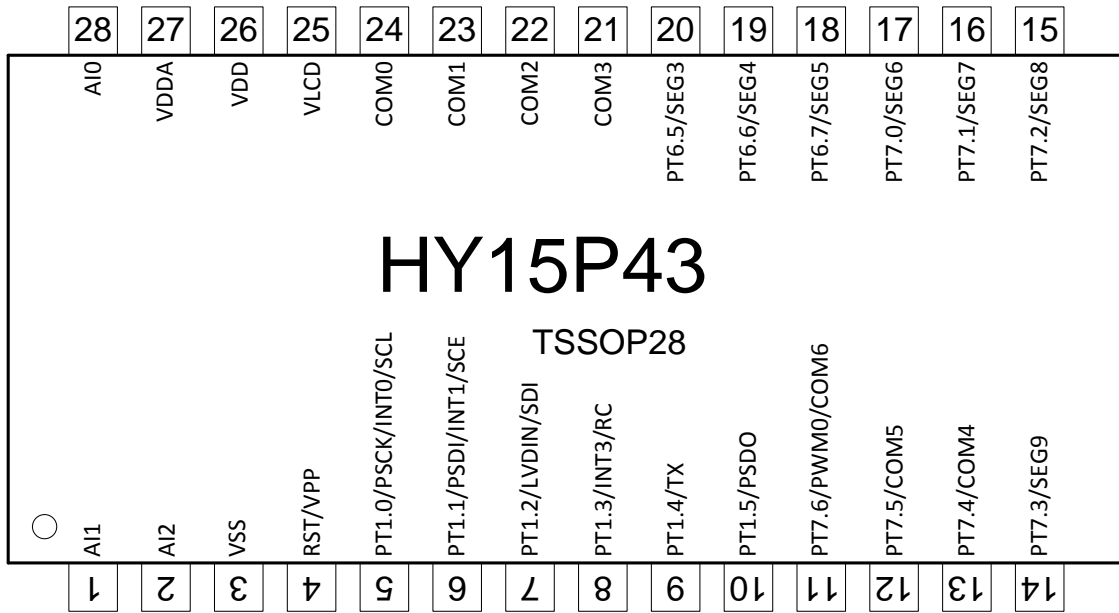


圖 2-2 HY15P43 TSSOP28 引腳圖

註 1：VPP與RST復用同一接口，非燒錄OTP時禁止輸入高電壓

2.3. I/O 定義與說明

“I/O”輸入/輸出,“I”輸入,“O”輸出,“S”史密斯觸發,“C”CMOS 特性兼容輸出與輸入,“P”電壓源,“A”類比通道

LQFP48 引腳編號	TSSOP28 引腳編號	引腳名稱	引腳特性		功能說明	
			格式	緩衝		
2	4	RST/VPP	RST	I	S	復位晶片
			VPP	P	P	OTP讀/寫時的電壓源
3	5	PT1.0/INT0/PSCK/SCL	PT1.0	I/O	S	數位輸入/輸出
			INT0	I	S	中斷源INT0
			PSCK	I	S	OTP讀/寫介面接口
			SCL	I/O	S	I2C 通訊介面引腳
4	6	PT1.1/INT1/PSDI/SCE	PT1.1	I/O	S	數位輸入/輸出
			INT1	I	S	中斷源INT1
			PSDI	I	S	OTP讀/寫介面接口
			SCE	I/O	S	SPI 通訊介面接口
5	7	PT1.2/INT2/LVDIN/SDI	PT1.2	I/O	S	數位輸入
			INT2	I	S	中斷源INT2
			LVDIN	A	A	LVD外部信號輸入接口
			SDI	I/O	S	SPI通訊介面接口
6	8	PT1.3/INT3/RC	PT1.3	I/O	S	數位輸入
			INT3	I	S	中斷源INT3
			RC	I	S	EUART通訊介面接口
7	9	PT1.4/TX	PT1.4	I/O	S	數位輸入/輸出
			TX	O	S	EUART通訊介面接口
8	10	PT1.5/PSDO/SDO	PT1.5	I/O	S	數位輸入/輸出
			PSDO	O	C	OTP讀/寫介面接口
			SDO	I/O	S	SPI 通訊介面接口
9	-	PT1.6/SCK	PT1.6	I/O	S	數位輸入/輸出
			SCK	I/O	S	SPI通訊介面接口
10	-	PT1.7/BZ/SDA	PT1.7	I/O	S	數位輸入/輸出

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		BZ	O	C	蜂鳴器輸出端
		SDA	I/O	S	I2C 通訊介面引腳
13	-	PT7.7/PWM1/COM7			
		PT7.7	O	S	數位輸出
		PWM1	O	C	PWM1 輸出接口
		COM7	O	C	LED COM 輸出
14	11	PT7.6/PWM0/COM6			
		PT7.6	O	S	數位輸出
		PWM0	O	C	PWM0 輸出接口
		COM6	O	C	LED COM 輸出
15	12	PT7.5/COM5			
		PT7.5	O	S	數位輸出
		COM5	O	C	LED COM 輸出
16	13	PT7.4/COM4			
		PT7.4	O	S	數位輸出
		COM4	O	C	LED COM 輸出
17	14	SEG9/PT7.3			
		SEG9	O	A	LED Segment輸出
		PT7.3	O	S	數位輸出
18	15	SEG8/PT7.2			
		SEG8	O	A	LED Segment輸出
		PT7.2	O	S	數位輸出
19	16	SEG7/PT7.1			
		SEG7	O	A	LED Segment輸出
		PT7.1	O	S	數位輸出
20	17	SEG6/PT7.0			
		SEG6	O	A	LED Segment輸出
		PT7.0	O	S	數位輸出
21	18	SEG5/PT6.7			
		SEG5	O	A	LED Segment輸出
		PT6.7	O	S	數位輸出
22	19	SEG4/PT6.6			
		SEG4	O	A	LED Segment輸出
		PT6.6	O	S	數位輸出
23	20	SEG3/PT6.5			
		SEG3	O	A	LED Segment輸出
		PT6.5	O	S	數位輸出
24	-	SEG2/PT6.4			

		SEG2 PT6.4	O O	A S	LED Segment輸出 數位輸出
25	21	COM3	O	A	LED COM輸出
26	22	COM2	O	A	LED COM輸出
27	23	COM1	O	A	LED COM輸出
28	24	COM0	O	A	LED COM輸出
29	25	VLCD	P	P	BIE電壓源
30	26	VDD	P	P	晶片工作電壓源
31	-	PT2.0/XTO	I/O A	S A	數位輸入/輸出 外接振盪器輸出端
32	-	PT2.1/XTI	I/O A	S A	數位輸入/輸出 外接振盪器輸入端
39	27	VDDA	P	P	穩壓器輸出，類比電路電壓源
41	28	AI0	A	A	類比輸入通道
42	1	AI1	A	A	類比輸入通道
43	2	AI2	A	A	類比輸入通道
47	3	VSS	P	P	晶片工作電壓源接地端
Others	Others	NC	-	-	未使用

表 2-1 引腳定義與功能說明

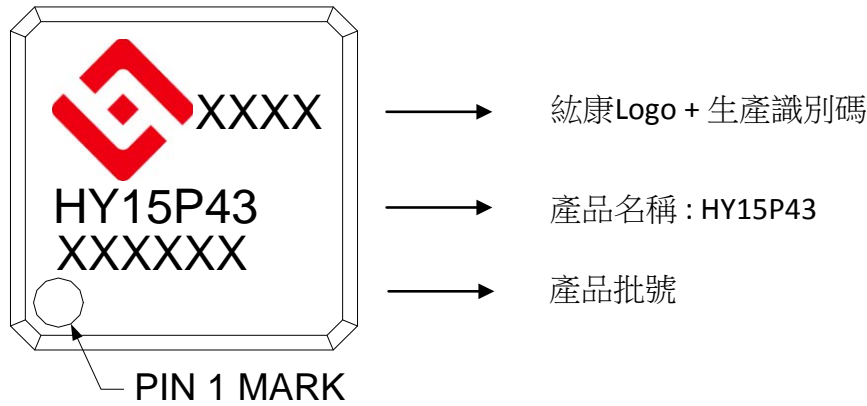
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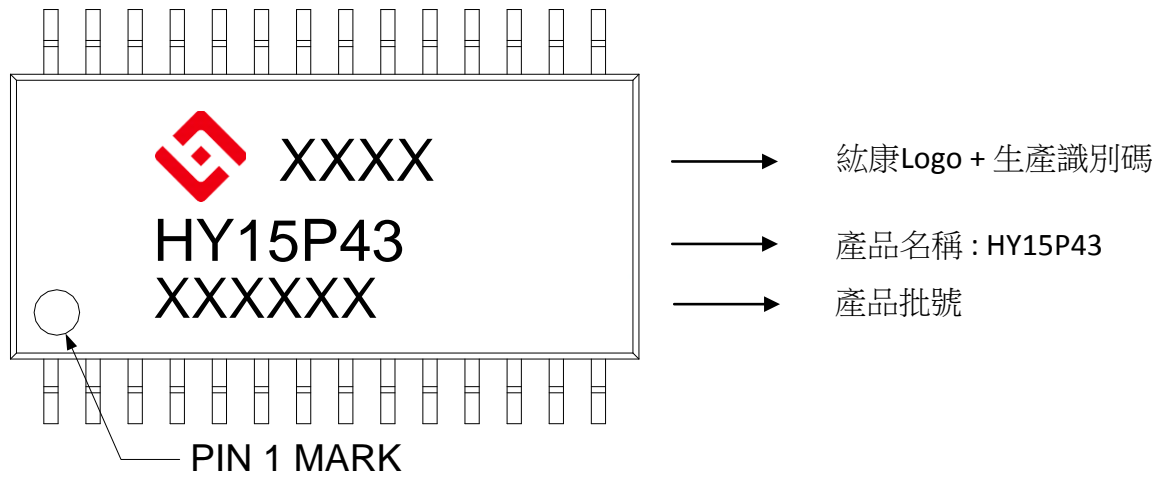
8-Bit RISC-like Mixed Signal Microcontroller

2.4. 封裝片標記信息

2.4.1. LQFP 封裝片標記信息



2.4.2. TSSOP28 封裝片標記信息



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3. 應用電路

3.1. 橋式感測器 LED 顯示

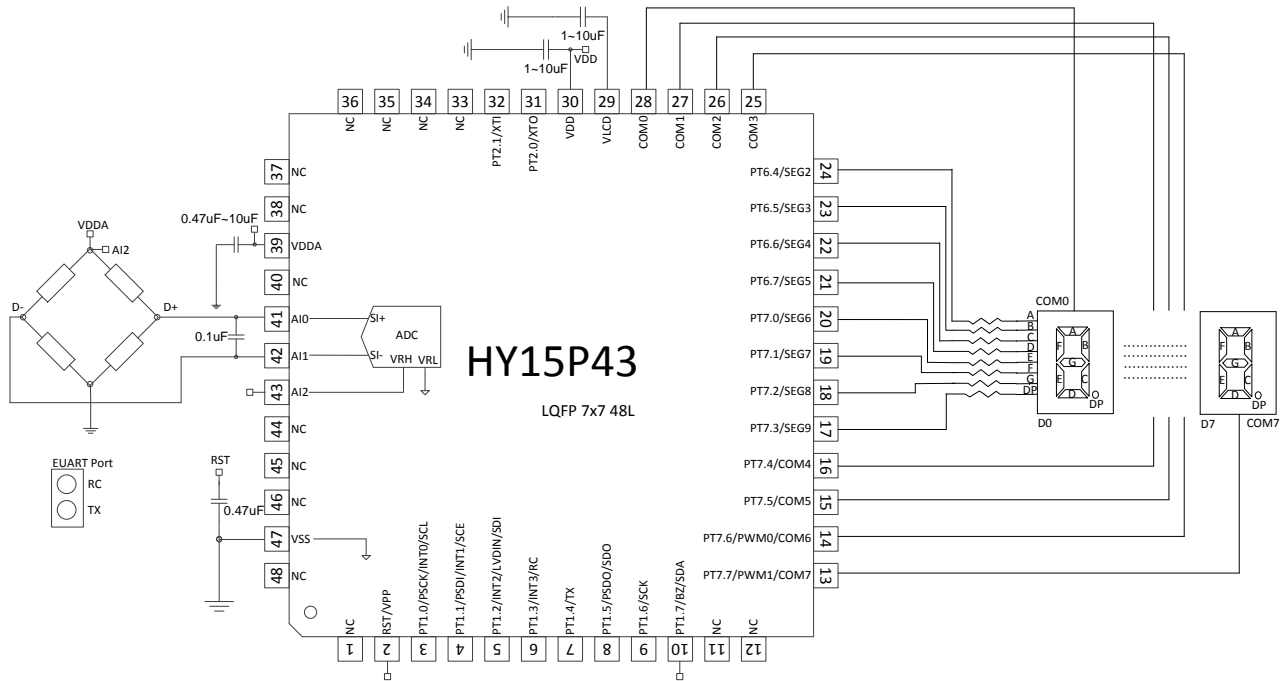


圖 3-1 橋式感測器 LED 顯示應用電路

4. 功能概述

4.1. 內部方塊圖

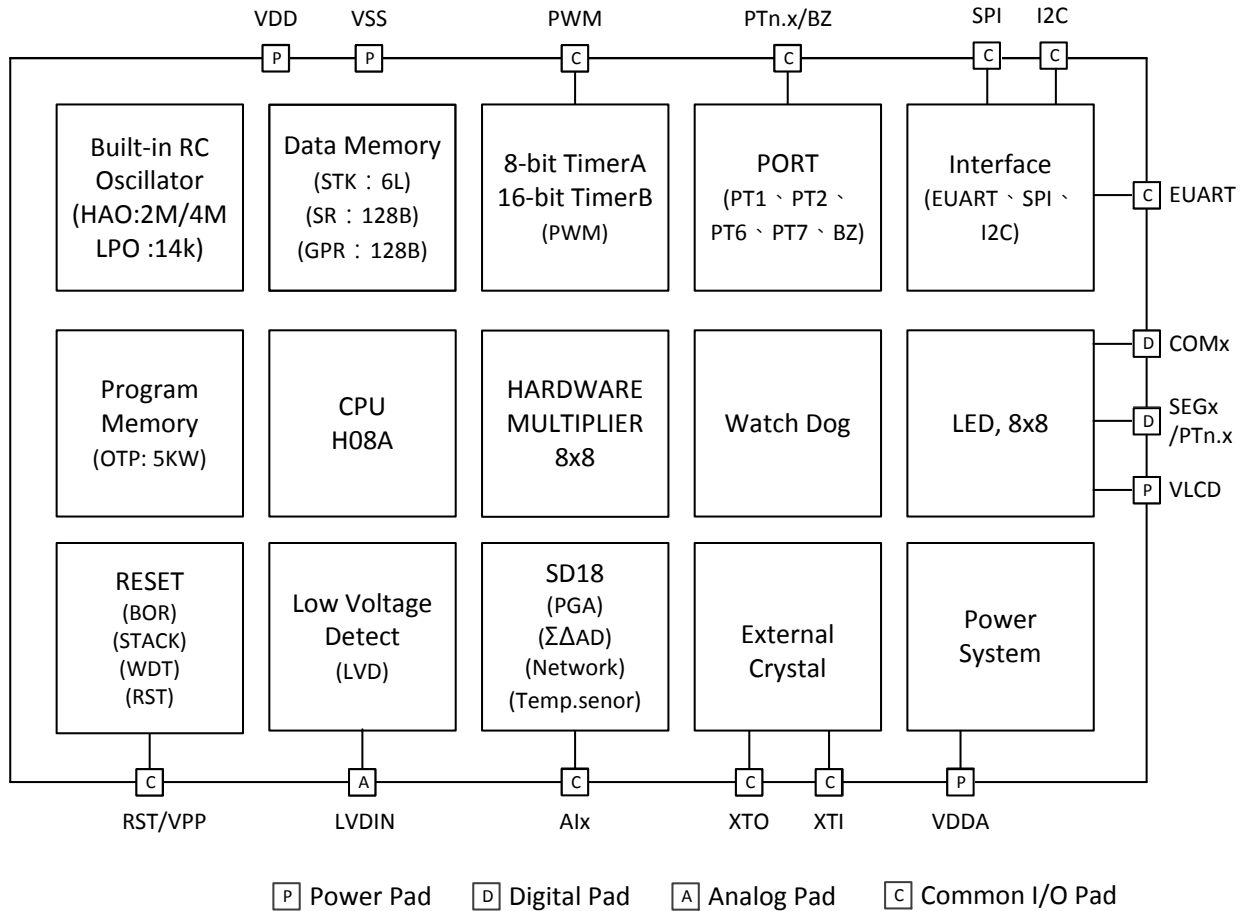


圖 4-1 HY15P43 內部方塊圖

4.2. 相關說明與支援文件

晶片功能相關使用說明書

DS-HY15P43

HY15P43 說明書

UG-HY15S50

HY15S50 使用說明書

APD-CORE002

H08A 指令集說明書

開發工具相關使用說明書

APD-HY15PIDE001

HY15P 系列開發工具軟體使用說明書

APD-HY15PIDE002

HY15P 系列開發工具硬體使用說明書

APD-OTP001

OTP 燒錄引腳資訊

產品生產相關使用說明書

APD-HY15PIDE004

HY15P 系列生產線專用燒錄器說明書

BDI-HY15P43

HY15P43 個別產品的裸片打線資訊

4.3. Clock System

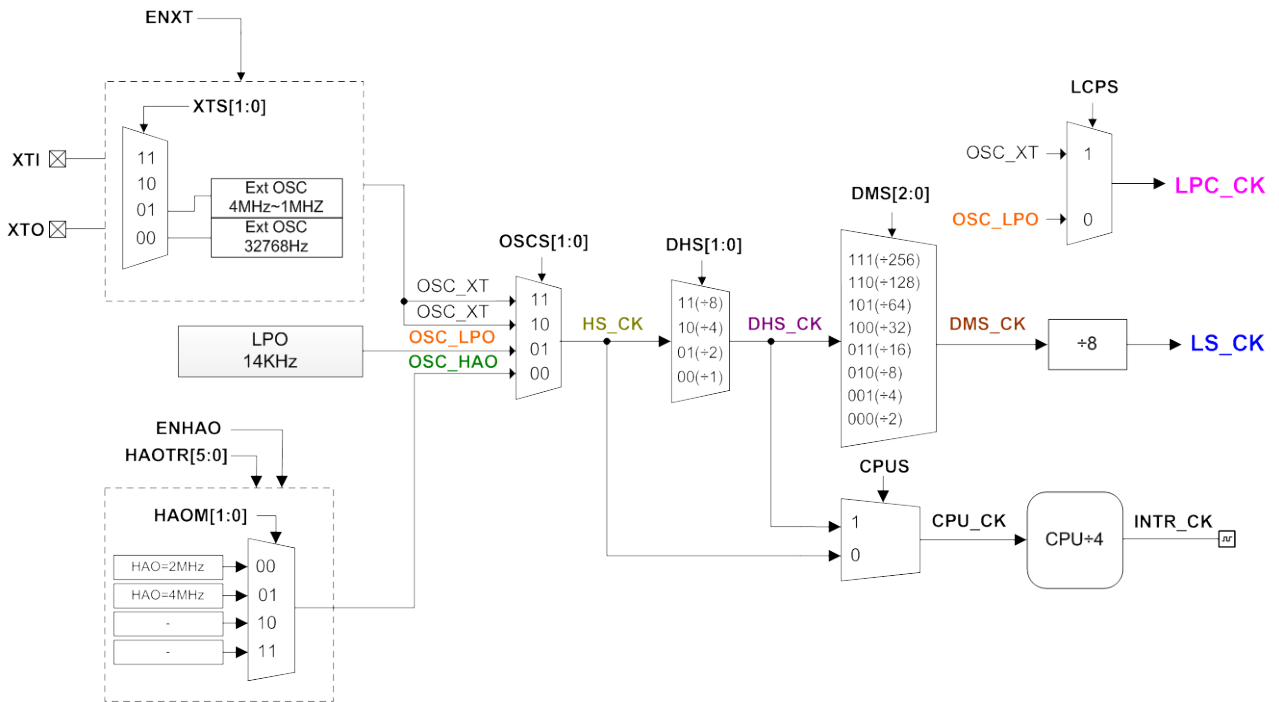


圖 4-2 Clock System 方塊圖(一)

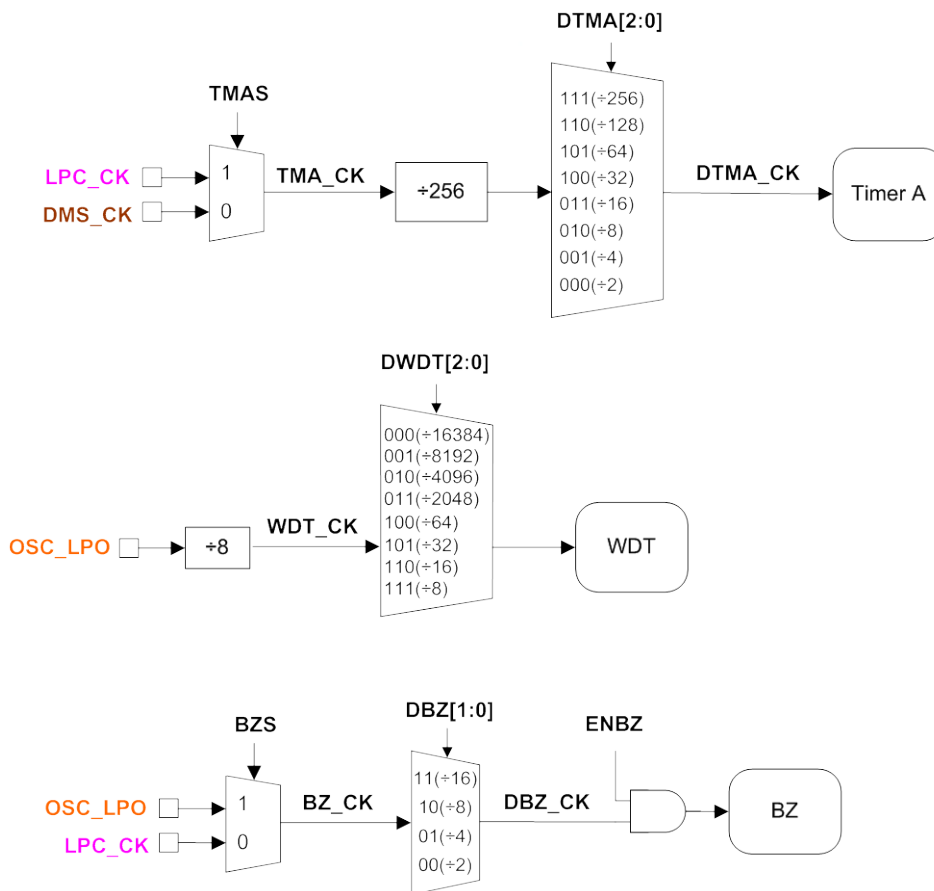


圖 4-3 Clock System 方塊圖(二)

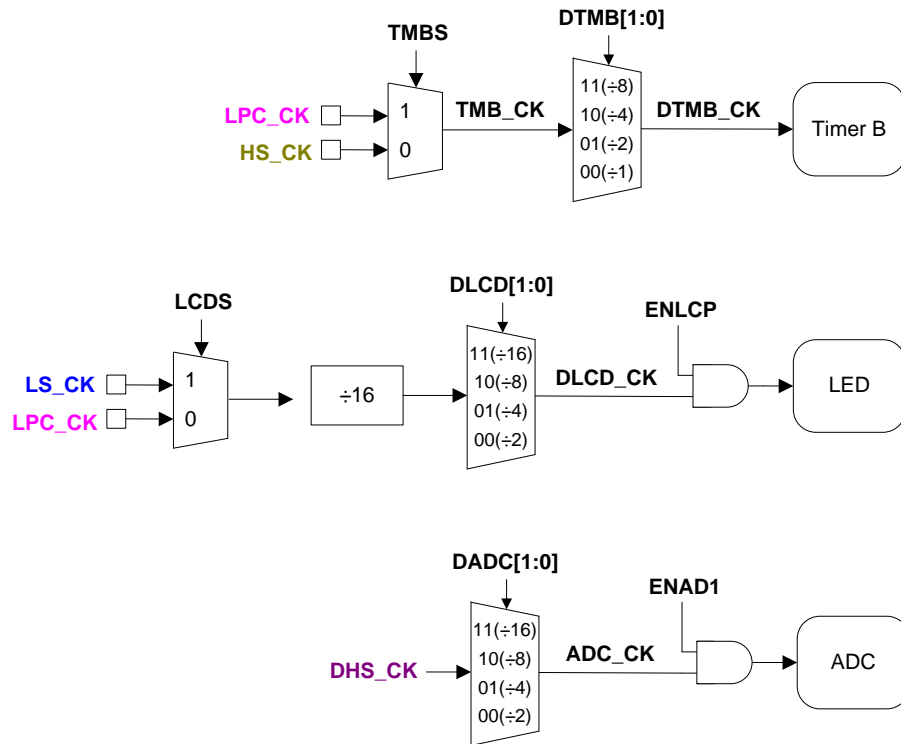


圖 4-4 Clock System 方塊圖(三)

4.4. Low Voltage Detect(LVD)

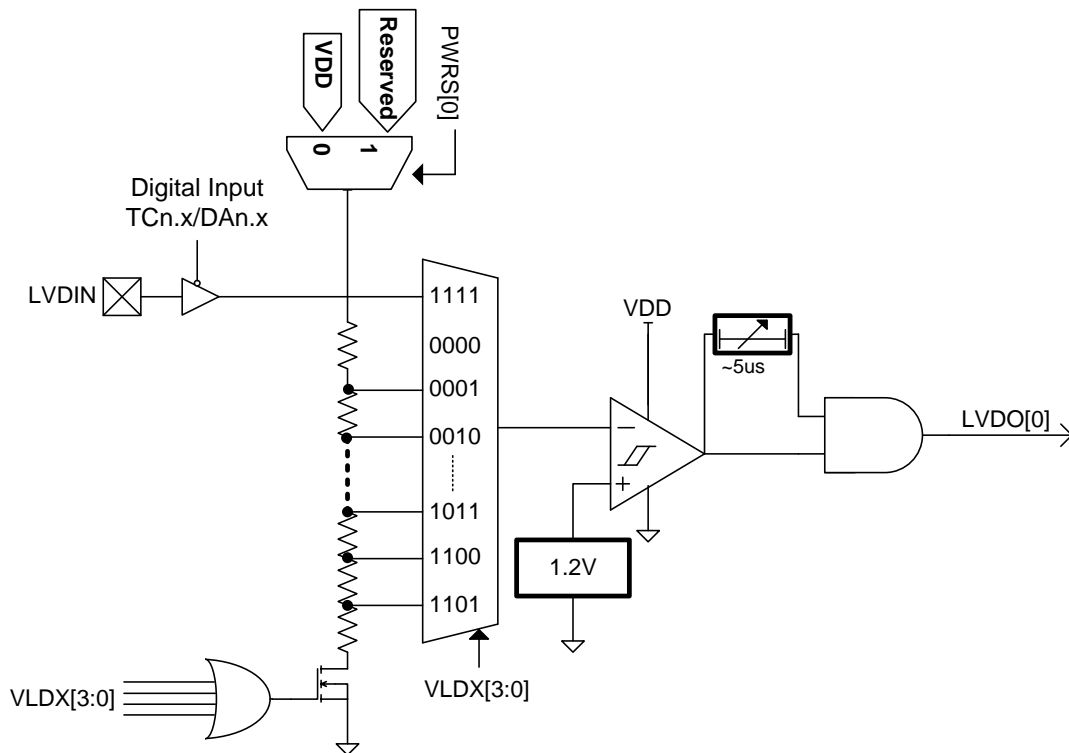


圖 4-5 Low Voltage Detect 方塊圖

4.5. Reset

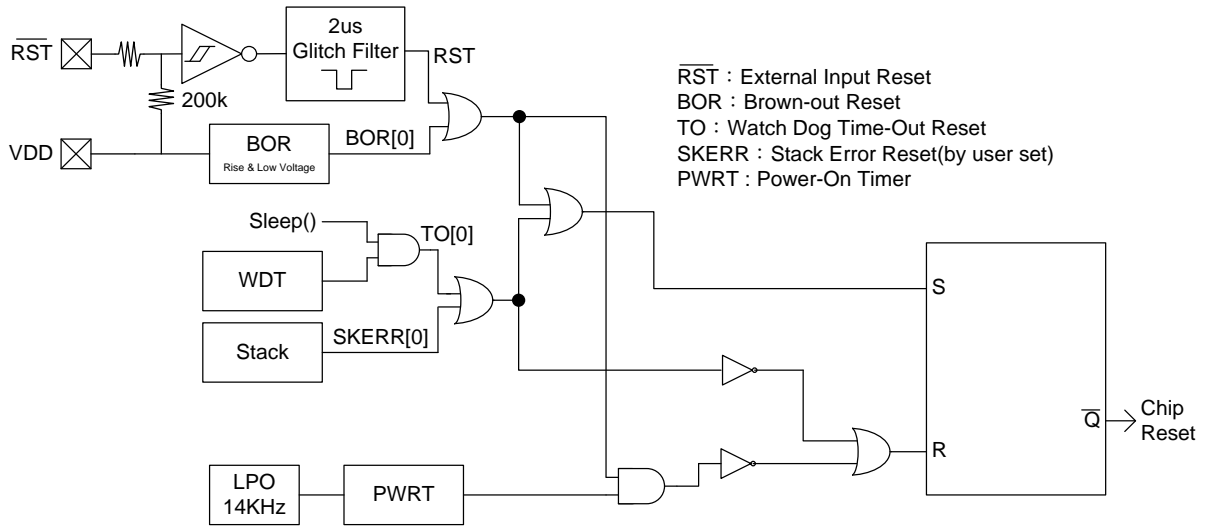


圖 4-6 Reset 方塊圖

4.6. Power System

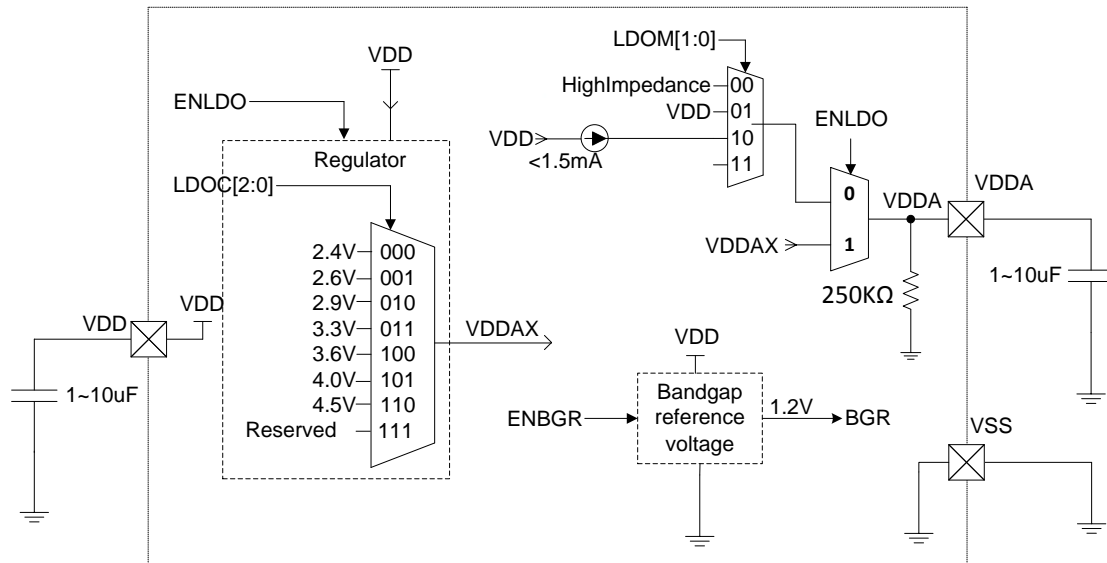


圖 4-7 Power System 方塊圖

4.7. SD18 Network

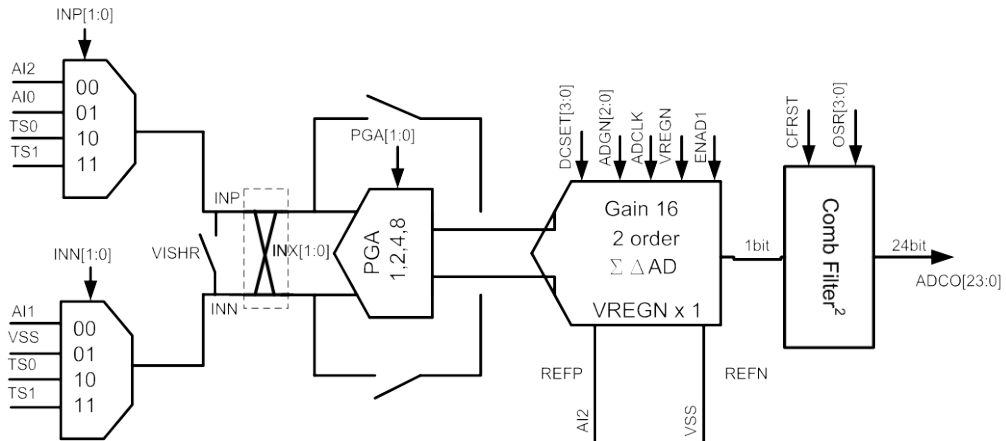


圖 4-8 SD18 Network 方塊圖

4.8. GPIO

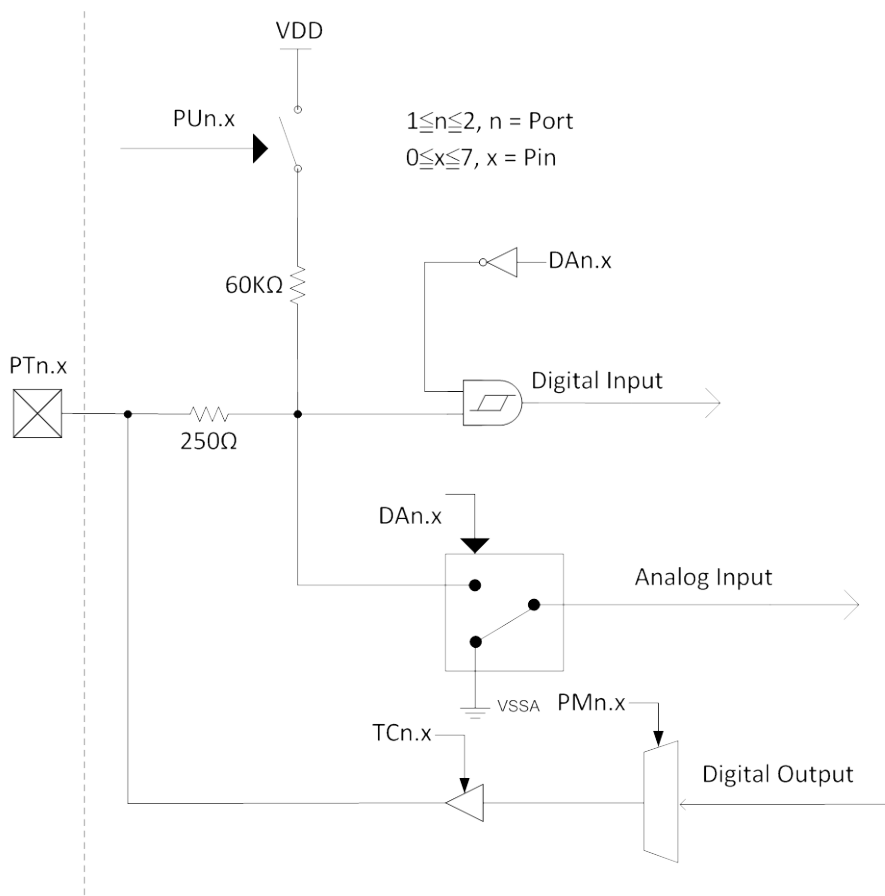


圖 4-9 GPIO 方塊圖

4.9. Watch Dog

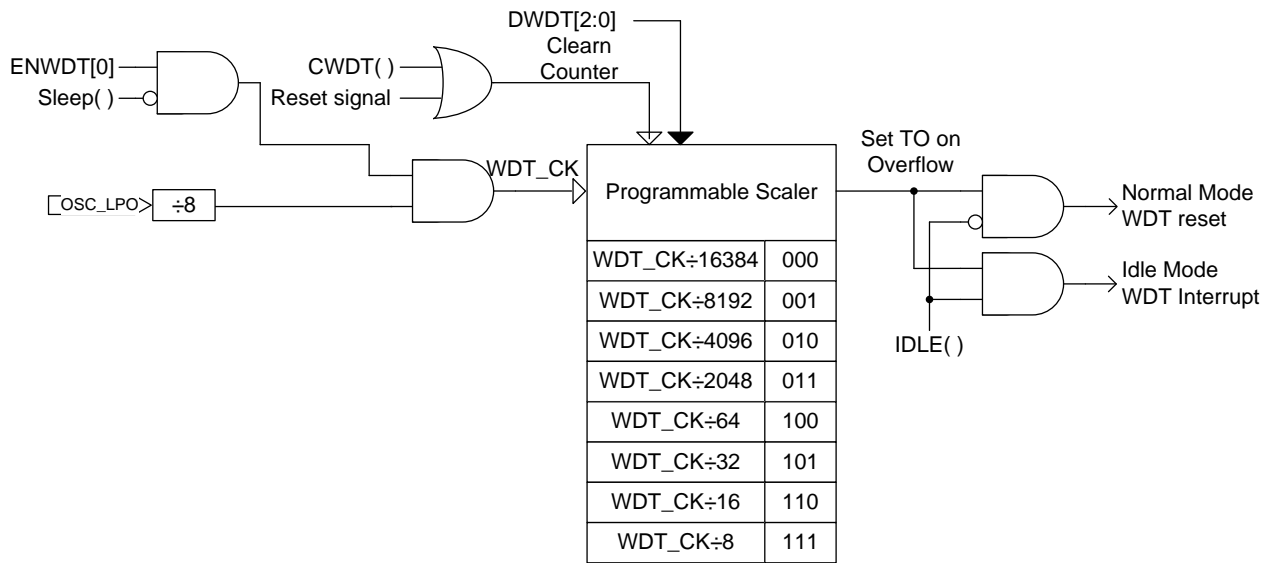


圖 4-10 Watch Dog 方塊圖

4.10.8-bit Timer A

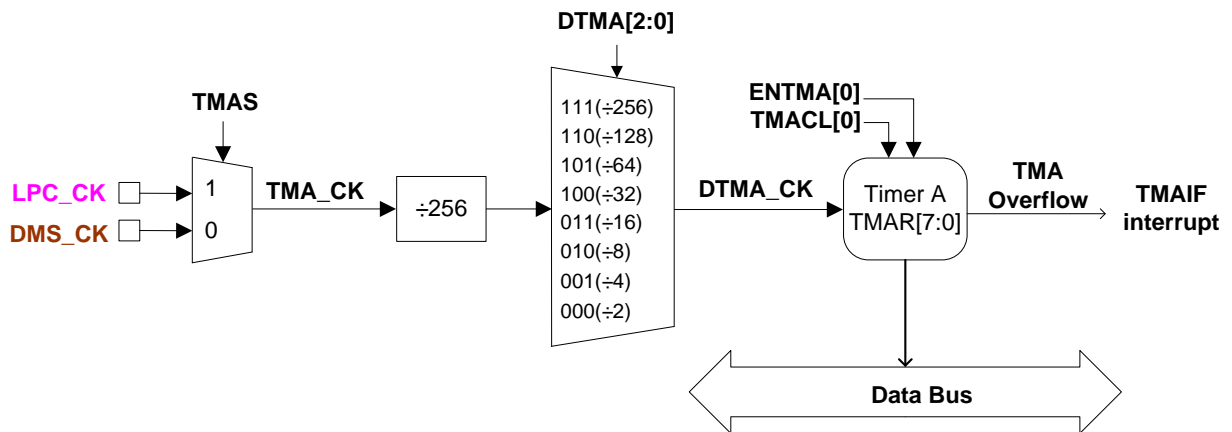


圖 4-11 8-bit Timer A 方塊圖

4.11. 16-bit Timer B

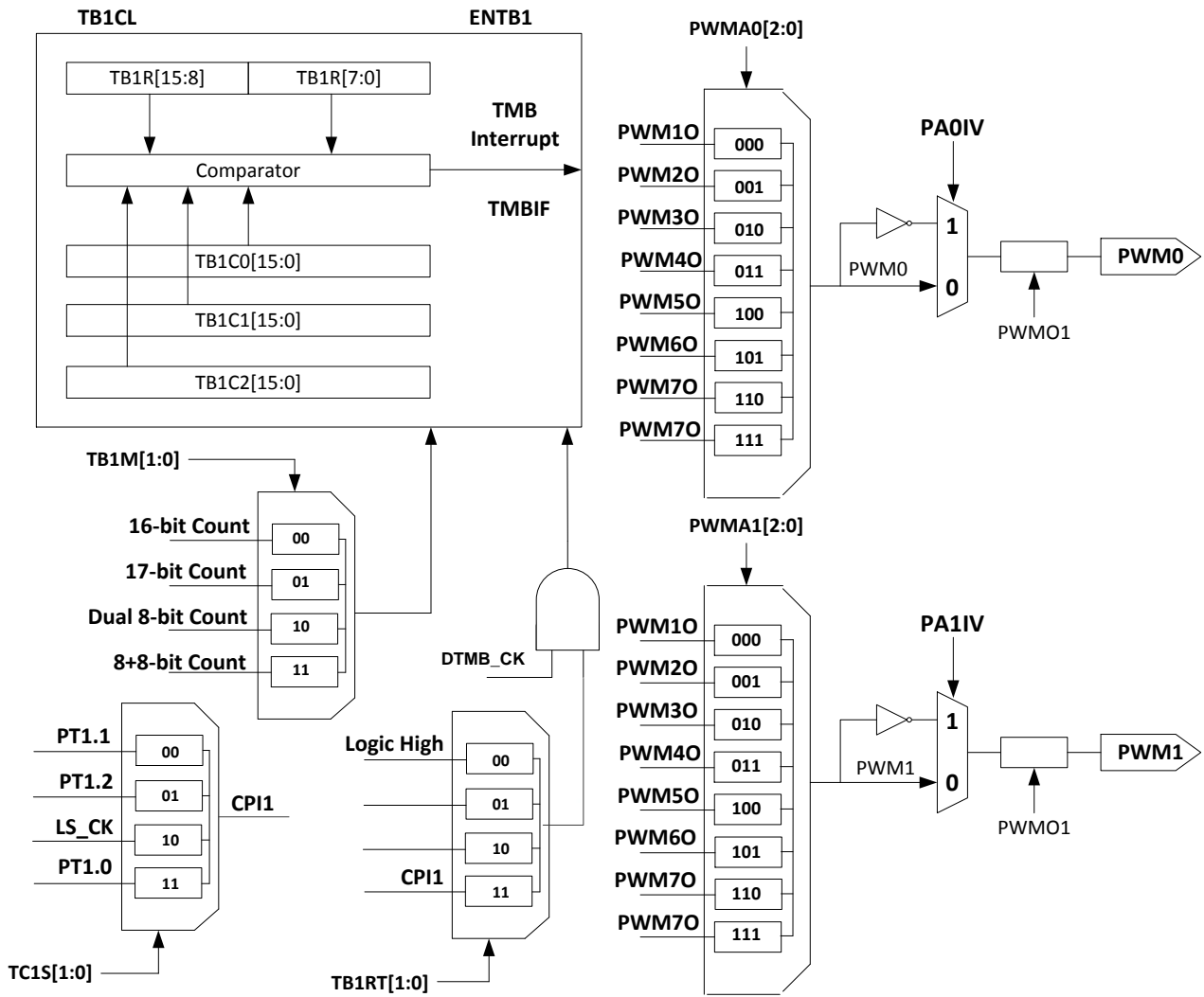


圖 4-12 16-bit Timer B 方塊圖

4.12. LED

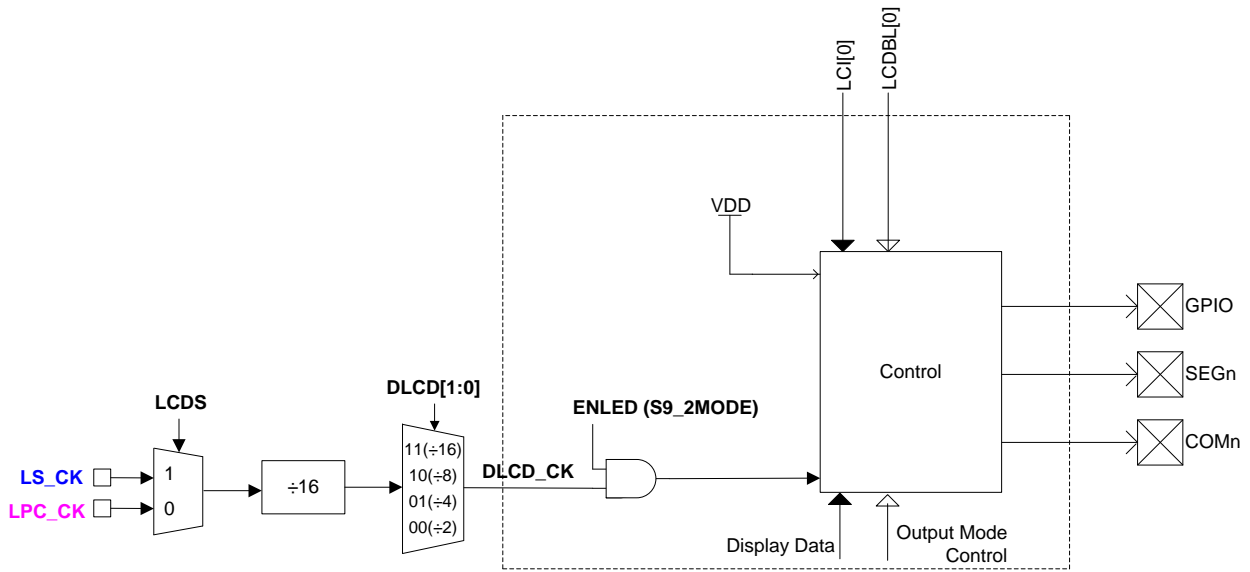


圖 4-13 LED 方塊圖

4.13. EUART

EUART TRANSMIT BLOCK DIAGRAM

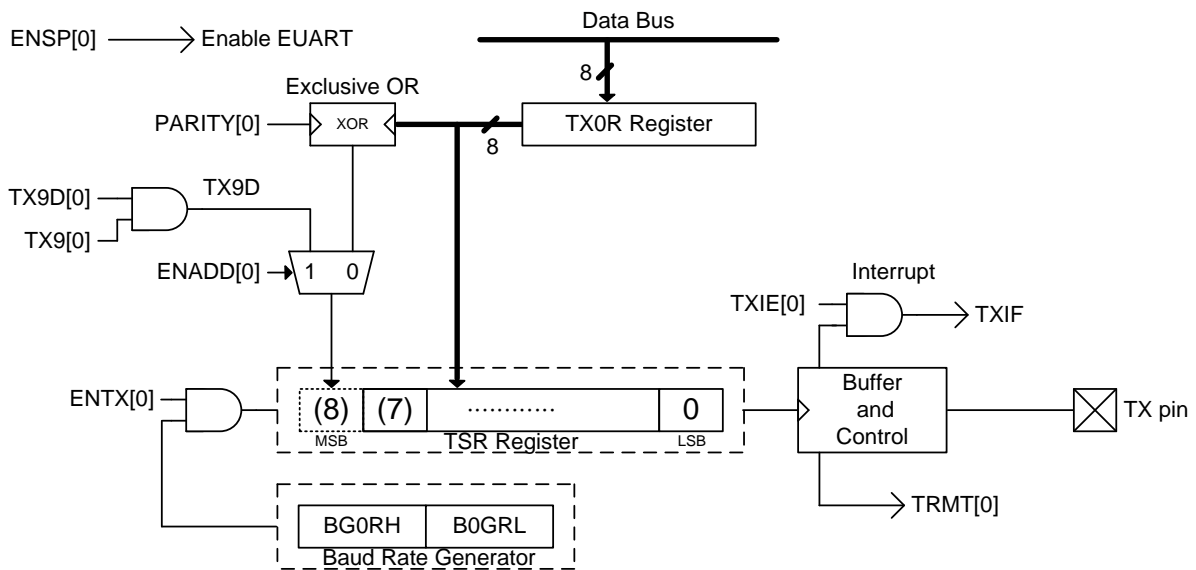
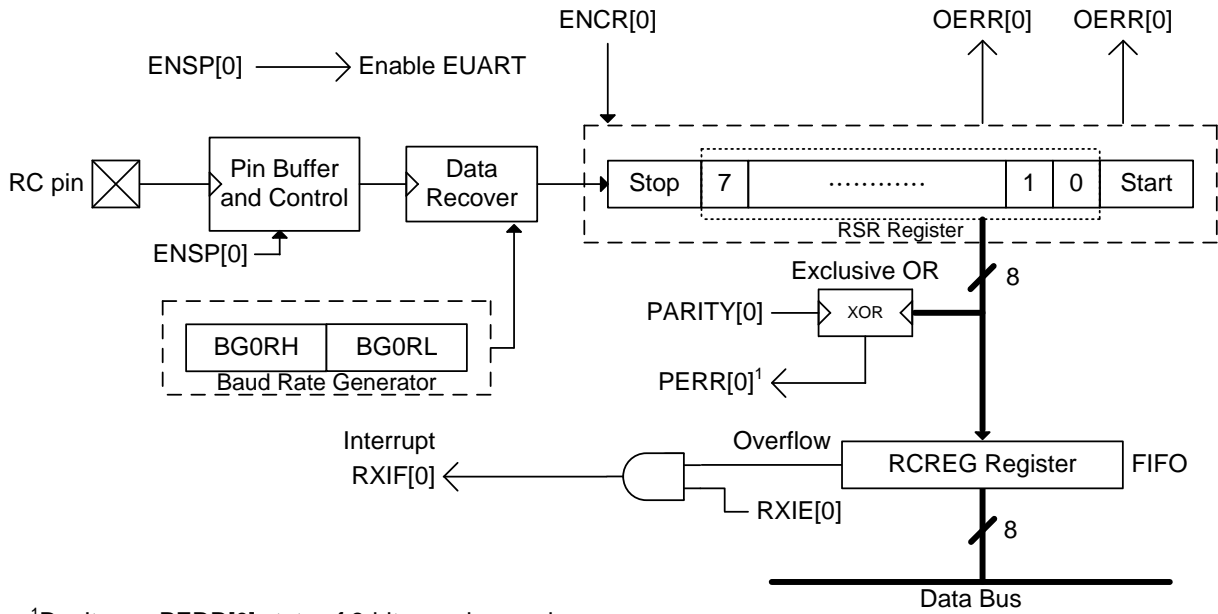


圖 4-14 EUART 傳送方塊圖

EUART 8-BITS RECEIVE BLOCK DIAGRAM



¹Don't care PERR[0] state of 8-bits receive mode

圖 4-15 EUART 8-bits 接收方塊圖

4.14. SPI

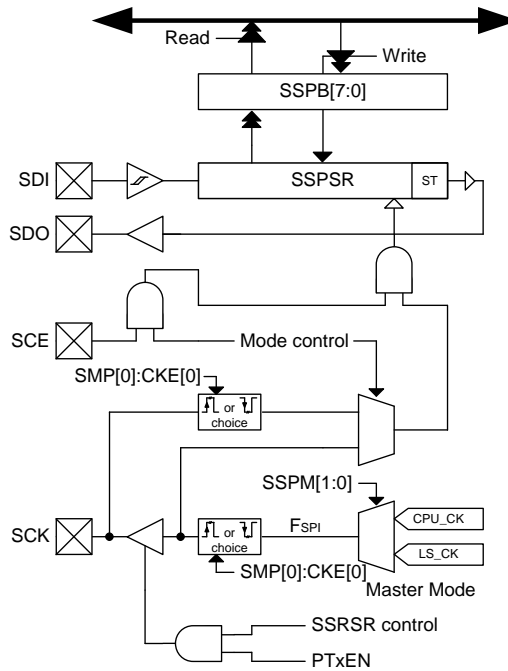


圖 4-16 SPI 方塊圖

4.15. I2C

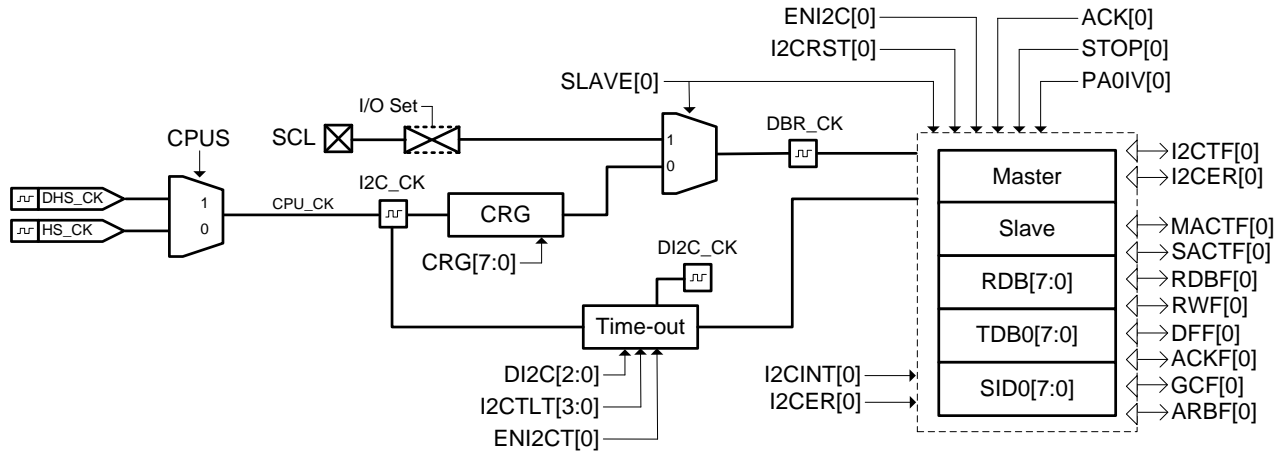


圖 4-17 I2C 方塊圖

5. 暫存器列表

“-”no use, “*”read/write, “w”write, “r”read, “r0”only read 0, “r1”only read 1, “w0”only write 0, “w1”only write 1
“\$”for event status, “x”unimplemented bit, “x”unknown, “u”unchanged, “d”depends on condition

Address	Name	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	ARST	IRST	R/W
000h	INDF0	Contents of FSR0 to address data memory value of FSR0 not changed								xxxx xxxx	uuuu uuuu	*r0*
001h	POINC0	Contents of FSR0 to address data memory value of FSR0 post-incremented								xxxx xxxx	uuuu uuuu	*r0*
002h	PODEC0	Contents of FSR0 to address data memory value of FSR0 post-decremented								xxxx xxxx	uuuu uuuu	*r0*
003h	PRINC0	Contents of FSR0 to address data memory value of FSR0 pre-incremented								xxxx xxxx	uuuu uuuu	*r0*
004h	PLUSW0	Contents of FSR0 to address data memory value of FSR0 offset by W								xxxx xxxx	uuuu uuuu	*r0*
005h	INDF1	Contents of FSR1 to address data memory value of FSR0 not changed								xxxx xxxx	uuuu uuuu	*r1*
006h	POINC1	Contents of FSR1 to address data memory value of FSR0 post-incremented								xxxx xxxx	uuuu uuuu	*r1*
007h	PODEC1	Contents of FSR1 to address data memory value of FSR0 post-decremented								xxxx xxxx	uuuu uuuu	*r1*
008h	PRINC1	Contents of FSR1 to address data memory value of FSR1 pre-incremented								xxxx xxxx	uuuu uuuu	*r1*
009h	PLUSW1	Contents of FSR1 to address data memory value of FSR0 offset by W								xxxx xxxx	uuuu uuuu	*r1*
00Fh	FSR0H	-	-	-	-	-	-	-	FSR0[8]	... xxxx	... uuuu	*r0*
010h	FSR0L	Indirect Data Memory Address Pointer 0 Low Byte, FSR0[7:0]								xxxx xxxx	uuuu uuuu	*r0*
011h	FSR1H	-	-	-	-	-	-	-	FSR1[8]	... .xxx	... .uuu	*r1*
012h	FSR1L	Indirect Data Memory Address Pointer 0 Low Byte, FSR1[7:0]								xxxx xxxx	uuuu uuuu	*r1*
016h	TOSH	-	-	-	-	TOS[11]	TOS[10]	TOS[9]	TOS[8]	..xx xxxx	..uu uuuu	*r0*
017h	TOSL	Top-of-Stack Low Byte (TOS<7:0>)								xxxx xxxx	uuuu uuuu	*r0*
018h	SKCN	SKFL	SKUN	SKOV	-	-	SKPRT[2:0]		000.0000	u\$\$.\$\$\$	rw0,rw0,rw0,-	*r0*
01Ah	PCLATH	-	-	-	-	PC[11]	PC[10]	PC[9]	PC[8]	..00 0000	..00 0000	*r0*
01Bh	PCLATL	PC Low Byte for PC<7:0>								0000 0000	0000 0000	*r0*
01Dh	TBLPTRH	-	-	-	Program Memory Table Pointer High Byte (TBLPTR<12:8>)					..xx xxxx	..uu uuuu	*r0*
01Eh	TBLPTRL	Program Memory Table Pointer Low Byte (TBLPTR<7:0>)								xxxx xxxx	uuuu uuuu	*r0*
01Fh	TBLDH	Program Memory Table Latch High Byte								xxxx xxxx	uuuu uuuu	*r0*
020h	TBLDL	Program Memory Table Latch Low Byte								xxxx xxxx	uuuu uuuu	*r0*
021h	PRODH	Product Register of Multiply High Byte								xxxx xxxx	uuuu uuuu	*r0*
022h	PRODL	Product Register of Multiply Low Byte								xxxx xxxx	uuuu uuuu	*r0*
023h	INTE0	GIE	-	ADIE	WDTIE	TB1IE	TMAIE	E1IE	E0IE	0000 0000	0uuu uuuu	*r0*
024h	INTE1	-	SPIE	TXIE	RCIE	I2CERIE	I2CIE	E3IE	E2IE	0000 0000	uuuu uuuu	*r0*
026h	INTF0	-	-	ADIF	WDTIF	TB1IF	TMAIF	E1IF	E0IF	..00 0000	..uu uuuu	*r0*
027h	INTF1	-	SPIIF	TXIF	RCIF	I2CERIF	I2CIF	E3IF	E2IF	0000 0000	uuuu uuuu	*r0*
029h	WREG	Working Register								xxxx xxxx	uuuu uuuu	*r0*
02Ah	BSRCN	-	-	-	-	-	-	-	BSR[0]	... xxxx	... uuuu	*r0*
02Bh	MSTAT	-	-	-	C	DC	N	OV	Z	...x xxxx	...u uuuu	*r0*
02Ch	PSTAT	BOR	PD	TO	IDL	RST	SKERR	-	-	\$000 \$00.	u\$\$u u\$\$u.	rw0,rw0,rw0,rw0,rw0,rw0,-
02Eh	BIECN	1	ENBVD		VPPHV	ENBCP	BIEWR	BIERD	1... \$000	1... \$uuu	r1,r1,r1,r1,r1,r1,r1,r1	
02Fh	BIEARH	IFR & eIFR	1		1	1	1	1	1	0... xxxx	u... uuuu	*r0*
030h	BIEARL	BIE Address Register as BIEAL[5:0]								xxxx xxxx	uuuu uuuu	*r0*
031h	BIEDRH	BIE High Byte Data Register								xxxx xxxx	uuuu uuuu	*r0*
032h	BIEDRL	BIE Low Byte Data Register								xxxx xxxx	uuuu uuuu	*r0*
033h	PWRCN	ENBGR	LDOC[2:0]		LDOM[0]	LDOM	ENLDO	CSFON	0000 0000	uuuu u00u	*r0*	
034h	OSCCN0	OSCS[1:0]		DHS[1:0]	DMS[2:0]		CUPS	0000 0000	uuuu uuuu	*r0*		
035h	OSCCN1	LCPS	DADC[1:0]		DTMB[1:0]		TMBS	LCDS	0000 0000	uuuu uu.	*r0*	
036h	OSCCN2	DLCD[1:0]		ENXT	XTS[1:0]		HAOM0	ENHAO	0000 0011	uuuu uu11	*r0*	
037h	WDTCN	ENBZ	BZS	ENWDT		DWDWT[2:0]		0000 0000	uuuu \$000	*r0*		
038h	TMACN	ENTMA	TMACL	TMAS	DTMA[2:0]		-	-	0000 00..	u0uu uu..	*r0*	
039h	TMAR	TMA counter Register								0000 0000	uuuu uuuu	rw0,rw0,rw0,rw0,rw0,rw0,rw0
03Ah	AD1H	ADC1 conversion high byte data register								..00 0000	..uu uuuu	*r0*
03Bh	AD1M	ADC1 conversion middle byte data register								0000 0000	uuuu uuuu	*r0*
03Ch	AD1L	ADC1 conversion low byte data register								0000 0000	uuuu uuuu	*r0*
03Dh	AD1CN0	ENAD1	-	-	OSR[3:0]			CMFR	000. 0000	uuu. uuuu	*r0*	
03Eh	AD1CN1	-	-	VREGN	PGAGN[1:0]		ADGN[2:0]		xxxx xxxx	uuuu uuuu	*r0*	
03Fh	AD1CN2	-	-	-	DCSET[3:0]			xxxx xxxx	uuuu uuuu	*r0*		
040h	AD1CN3	-	-	INP[1:0]		-	INN[1:0]		xxxx xxxx	uuuu uuuu	*r0*	
041h	AD1CN4	-	VRH[0]	-	-	INX[1:0]		-	INIS	0010 0000	uuuu uuuu	*r0*
042h	AD1CN5	-	-	-	-	-	ENTPS	TPSCH	0000 0000	uuuu uuuu	*r0*	

表 5-1 資料記憶體列表

“-”no use,“*”read/write,“w”write,“r”read,“r0”only read 0,“r1”only read 1,“w0”only write 0,“w1”only write 1
 “\$”for event status,“.”unimplemented bit,“x”unknown,“u”unchanged,“d”depends on condition

Address	Name	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	ARST	IRST	R/W	
043h	CSFCN0	SKRST	x	HAOTR[5:0]						.....0	....u*	
045h	LVDCN	-	-	PWRS	LVDS[3:0]				LVDO	0000 0000	uuuu uuuu*	
04Eh	TB1Flag	-	-	PWM6A	PWM5A	PWM4A	PWM3A	PWM2A	PWM1A	..00 0000	..uu uuuu	..r,r,r,r,r,r	
04Fh	TB1CN0	ENTB1	TB1M[1:0]		TB1RT[1:0]		TB1CL	-	-	0000 0000	uuuu u0uu	.....,rw1,*
050h	TB1CN1	PA1IV	PWMA1[2:0]			PA0IV	PWMA0[2:0]			0000 0000	uuuu uuuu*	
051h	TB1RH	TimerB1 counter Register [15:8]								xxxx xxxx	uuuu uuuu	r,r,r,r,r,r,r	
052h	TB1RL	TimerB1 counter Register [7:0]								xxxx xxxx	uuuu uuuu	r,r,r,r,r,r,r	
053h	TB1COH	TimerB1 counter Condition Register [15:8]								xxxx xxxx	uuuu uuuu*	
054h	TB1COL	TimerB1 counter Condition Register [7:0]								xxxx xxxx	uuuu uuuu*	
055h	TB1CH	TimerB1 counter Condition Register [15:8]								xxxx xxxx	uuuu uuuu*	
056h	TB1CL	TimerB1 counter Condition Register [7:0]								xxxx xxxx	uuuu uuuu*	
057h	TB1C2H	TimerB1 counter Condition Register [15:8]								xxxx xxxx	uuuu uuuu*	
058h	TB1C2L	TimerB1 counter Condition Register [7:0]								xxxx xxxx	uuuu uuuu*	
059h	TCCN0	-	TC1S[1:0]		-	-	-	-	-	0000 0000	uuuu uuuu*	
05Eh	SSPCN0	ENSSP	CKP	CKE	SMP	-	-	SSPM[1:0]		0000 ..00	uuuu ..uu*	
05Fh	SSPSTA	SSPBY	SSPOV	-	-	-	-	-	BF	00...00	uu...uu*	
060h	SSPBUF	SSP Receive/Transmit Buffer Register								xxxx xxxx	uuuu uuuu*	
061h	CFG	-	-	-	-	-	I2CRST	ENI2CT	ENI2C	0000 0000	....uuuu*	
062h	ACT	SLAVE	ADR10	SLAVE24	I2CER	START	STOP	I2CINT	ACK	0000 0000	uuuu uuuu*	
063h	STA	MACTF	SACTF	RDBF	RWF	DFE	ACKF	GCF	ARBF	0001 0000	uuuu uuuu*	
064h	CRG	CRG[7:0]								0000 0000	uuuu uuuu*	
065h	TOC	I2CTF	DI2C[2:0]			I2CTLTL[3:0]				0000 0000	uuuu uuuu*	
066h	RDB	RDB[7:1]							RDB[0]	xxxx xxxx	uuuu uuuu*	
067h	TDB0	TDB0[7:1]							TDB0[0]	xxxx xxxx	uuuu uuuu*	
068h	SID0	SID0[7:1].The corresponding address of the 7-bit mode or address 10-bit mode 15-9bit								SID0V[0]	0000 0000	uuuu uuuu*
069h	UROCN	ENSP	ENTX	TX9	TX9D	PARITY	-	-	WUE	0000 0..0	uuuu u..u*	
06Ah	UROSTA	-	RC9D	PERR	FERR	OERR	RCIDL	TRMT	ABDOVF	..00 0010	..uu uuuu	..r,r,r,r,r,r,rw0	
06Bh	BA0CN	-	-	-	-	ENCR	RC9	ENADD	ENABD	.... 0000	.... uuuu*	
06Ch	BG0RH	-	-	-	Baud Rate Generator Register High Byte					...x xxxx	.... uuuu*	
06Dh	BG0RL	Baud Rate Generator Register Low Byte								xxxx xxxx	uuuu uuuu*	
06Eh	TX0R	UART Transmit Register								xxxx xxxx	uuuu uuuu*	
06Fh	RCREG	UART Receive Register								xxxx xxxx	uuuu uuuu	r,r,r,r,r,r,r	
070h	PT1	PT1.7	PT1.6	PT1.5	PT1.4	PT1.3	PT1.2	PT1.1	PT1.0	xxxx xxxx	xxxx xxxx*	
071h	TRISC1	TC1.7	TC1.6	TC1.5	TC1.4	TC1.3	TC1.2	TC1.1	TC1.0	0000 0000	uuuu uuuu*	
072h	PT1DA	-	-	-	-	-	DA1.2	-	-	0000 0000	uuuu uuuu*	
073h	PT1PU	PU1.7	PU1.6	PU1.5	PU1.4	PU1.3	PU1.2	PU1.1	PU1.0	0000 0000	uuuu uuuu*	
074h	PT1M1	-	-	-	-	INTEG1[1:0]		INTEG0[1:0]		0000 0000	uuuu uuuu*	
075h	PT1M2	-	PM1.7[0]	-	PM1.6[0]	-	PM1.5[0]	-	PM1.4[0]	xxxx xxxx	xxxx xxxx*	
076h	PT1INT	INTEG7	INTEG6	INTEG5	INTEG4	INTEG3	INTEG2	-	-	0000 0000	uuuu uuuu*	
077h	PT2	-	-	-	-	-	-	PT2.1	PT2.0	0000 0000	uuuu uuuu*	
078h	TRISC2	-	-	-	-	-	-	TC2.1	TC2.0	0000 0000	uuuu uuuu*	
07Ah	PT2PU	-	-	-	-	-	-	PU2.1	PU2.0	0000 0000	uuuu uuuu*	
080h ~ 017Fh	General Purpose Register as 256Byte								uuuu uuuu	uuuu uuuu*		
180h	LCDCN1	ENLCP	LCDV[2:0]			ENLB	SEL_PCLK	PWMO1	-	0000 00..	uuuu uu..*	
181h	LCDCN2	S9_2MODE		S13M	S12M	S11M	S10M	LCDL	LCI	0000 00..	uuuu uu..*	
182h	LED0	Display (LED) and GPIO data register 0								xxxx xxxx	uuuu uuuu*	
183h	LED1	Display (LED) and GPIO data register 1								xxxx xxxx	uuuu uuuu*	
184h	LED2	Display (LED) and GPIO data register 2								xxxx xxxx	uuuu uuuu*	
185h	LED3	Display (LED) and GPIO data register 3								xxxx xxxx	uuuu uuuu*	
186h	LED4	Display (LED) and GPIO data register 4								xxxx xxxx	uuuu uuuu*	
187h	LED5	Display (LED) and GPIO data register 5								xxxx xxxx	uuuu uuuu*	
188h	LED6	Display (LED) data register 6								xxxx xxxx	uuuu uuuu*	
189h	LED7	Display (LED) data register 7								xxxx xxxx	uuuu uuuu*	

表 5-2 資料記憶體列表(續)

6. 電氣特性

Absolute Maximum Ratings :

Absolute maximum ratings over operating free-air temperature (unless otherwise noted)

Voltage applied at V _{DD} to V _{SS}	-0.2 V to 6.0 V
Voltage applied to any pin	-0.2 V to V _{DD} + 0.3 V
Voltage applied to RST/VPP pin	-0.2 V to 8.5 V
Diode current at any device terminal	±2 mA
Storage temperature, Tstg: (unprogrammed device)	-55°C to 125°C
(programmed device)	-40°C to 85°C
Total power dissipation.	0.5w
Maximum output current sink by any I/O pin.	10mA

6.1. Recommended operating conditions

T_A = -40°C ~ 85°C, unless otherwise noted

Sym.	Parameter		Test Conditions	Min.	Typ.	Max.	unit	
V _{DD}	Supply Voltage		All digital peripherals and CPU	2.2		5.5	V	
V _{DDA}	Supply Voltage		Analog peripherals	2.4		4.5		
V _{SS}	Supply Voltage			0		0		
XT	External Oscillator Frequency	Watch crystal	V _{DD} = 2.2V, ENXT[0]=1	XTS[1:0]=0x		32768	Hz	
		Ceramic resonator		XTS[1:0]=10		450K		4M
		Crystal		XTS[1:0]=11		1M		4M

6.2. Internal RC Oscillator

T_A = 25°C, VDD = 3.0V, unless otherwise noted

Sym.	Parameter	Test Conditions	Min.	Typ.	Max.	unit
HAO	High Speed Oscillator frequency	ENHAO[0]=1, HAOM[1:0]=00	-20%	2	+20%	MHz
		ENHAO[0]=1, HAOM[1:0]=01	-20%	4	+20%	MHz
LPO	Low Power Oscillator frequency	VDD supply voltage be enable LPO	-20%	14.5	+20%	KHz

6.3. Supply current into VDD excluding peripherals current

$T_A = 25^\circ\text{C}, V_{DD} = 3.3\text{V}, \text{OSC_LPO} = 14.5\text{KHz}$, unless otherwise noted

Sym.	Parameter	Test Conditions	Min.	Typ.	Max.	unit
I _{AM1}	Active mode 1	OSC_CY = off, OSC_HAO = 4MHz, CPU_CK = 4MHz		310	620	uA
I _{AM2}	Active mode 2	OSC_CY = off, OSC_HAO = 2MHz, CPU_CK = 2MHz		200	400	uA
I _{AM3}	Active mode 3	OSC_CY = off, OSC_HAO = 2MHz, CPU_CK = 1MHz		150	300	uA
I _{LP1}	Low Power 1	OSC_CY = 32768Hz, OSC_HAO = off, CPU_CK = LPO, Idle state		3	5	uA
I _{LP2}	Low Power 2	OSC_CY = off, OSC_HAO = off, CPU_CK = LPO, Idle state		1.1	2.5	uA
I _{LP3}	Low Power 3	OSC_CY = off, OSC_HAO = off, CPU_CK = off, Sleep state		0.4	1.5	uA

OSC_CY : External Oscillator frequency.

OSC_HAO : Internal High Accuracy Oscillator frequency.

CPU_CK : CPU core work frequency.

$T_A = 25^\circ\text{C}, V_{DD} = 5.5\text{V}, \text{OSC_LPO} = 14.5\text{KHz}$, unless otherwise noted

Sym.	Parameter	Test Conditions	Min.	Typ.	Max.	unit
I _{AM1}	Active mode 1	OSC_CY = off, OSC_HAO = 4MHz, CPU_CK = 4MHz		500	1000	uA
I _{AM2}	Active mode 2	OSC_CY = off, OSC_HAO = 2MHz, CPU_CK = 2MHz		320	640	uA
I _{AM3}	Active mode 3	OSC_CY = off, OSC_HAO = 2MHz, CPU_CK = 1MHz		270	540	uA
I _{LP1}	Low Power 1	OSC_CY = 32768Hz, OSC_HAO = off, CPU_CK = LPO, Idle state		5.5	15	uA
I _{LP2}	Low Power 2	OSC_CY = off, OSC_HAO = off, CPU_CK = LPO, Idle state		2.1	5	uA
I _{LP3}	Low Power 3	OSC_CY = off, OSC_HAO = off, CPU_CK = off, Sleep state		0.5	2	uA

OSC_CY : External Oscillator frequency.

OSC_HAO : Internal High Accuracy Oscillator frequency.

CPU_CK : CPU core work frequency.

6.4. Port 1~2, 6~7

$T_A = 25^\circ\text{C}, V_{DD} = 3.0\text{V}$, unless otherwise noted

Sym.	Parameter	Test Conditions	Min.	Typ.	Max.	unit
Input voltage and Schmitt trigger and leakage current and timing						
V _{IH}	High-Level input voltage				0.7*VDD	V
V _{IL}	Low-Level input voltage		0.3*VDD			
V _{hys}	Input Voltage hysteresis(V _{IH} - V _{IL})			0.3*VDD		V
I _{LKG}	Leakage Current				0.1	uA
R _{PU}	Port pull high resistance			60		kΩ
Output voltage and current and frequency						
V _{OH}	High-level output voltage	VDD<4V, I _{OH} =10mA,	V _{DD} -0.4			V
		VDD>=4V, I _{OH} =15mA,	V _{DD} -0.4			
V _{OL}	Low-level output voltage	VDD<4V, I _{OL} =-10mA	V _{SS} +0.3			V
		VDD>=4V, I _{OL} =-15mA	V _{SS} +0.3			
I _{OH}	High-level output source current (SEG and COM port)	VDD=3V, V _{OH} =V _{DD} -0.4	10			mA
		VDD=4V, V _{OH} =V _{DD} -0.4	15			
I _{OL}	Low-level output sink current (SEG port only)	VDD=3V, V _{OL} =V _{SS} +0.3	10			mA
		VDD=4V, V _{OL} =V _{SS} +0.4	20			
I _{OL}	Low-level output sink current (COM port only)	VDD=3V, V _{OL} =V _{SS} +0.3	20			mA
		VDD=4V, V _{OL} =V _{SS} +0.4	40			

6.5. Reset(Brownout, Low Voltage Detect)

$T_A = 25^\circ\text{C}$, $V_{DD} = 3.0\text{V}$, unless otherwise noted

Sym.	Parameter	Test Conditions	Min.	Typ.	Max.	unit			
BOR	Pulse length needed to accepted reset internally, t_{d-LVR}		2			us			
	V_{DD} Start Voltage to accepted reset internally (L \rightarrow H), V_{LVR}		1.6	1.85	2.1	V			
	Hysteresis, $V_{HYS-LVR}$			30		mV			
RST	Pulse length needed as RST/VPP pin to accepted reset internally, t_{d-RST}		2			us			
	Input Voltage to accepted reset voltage			1.1		V			
	Reset release voltage			2		V			
LVD	Operation current, I_{LVD}			10		uA			
	External input voltage to compare reference voltage		1.15	1.2	1.25	V			
	Compare reference voltage temperature drift	$T_A = -40^\circ\text{C} \sim 85^\circ\text{C}$		50		ppm/ $^\circ\text{C}$			
	Detect V_{DD} voltage rang by user option, V_{SVS} $VLDx[3:0]=1110b$		-0.1V	4.0	+0.1V	V			
	Detect V_{DD} voltage rang by user option, V_{SVS} $VLDx[3:0]=1101b$			3.6					
	Detect V_{DD} voltage rang by user option, V_{SVS} $VLDx[3:0]=1100b$			3.3					
	Detect V_{DD} voltage rang by user option, V_{SVS} $VLDx[3:0]=1011b$			3.0					
	Detect V_{DD} voltage rang by user option, V_{SVS} $VLDx[3:0]=1010b$			2.9					
	Detect V_{DD} voltage rang by user option, V_{SVS} $VLDx[3:0]=1001b$			2.8					
	Detect V_{DD} voltage rang by user option, V_{SVS} $VLDx[3:0]=1000b$			2.7					
	Detect V_{DD} voltage rang by user option, V_{SVS} $VLDx[3:0]=0111b$			2.6					
	Detect V_{DD} voltage rang by user option, V_{SVS} $VLDx[3:0]=0110b$			2.5					
	Detect V_{DD} voltage rang by user option, V_{SVS} $VLDx[3:0]=0101b$			2.4					
	Detect V_{DD} voltage rang by user option, V_{SVS} $VLDx[3:0]=0100b$			2.3					
	Detect V_{DD} voltage rang by user option, V_{SVS} $VLDx[3:0]=0011b$			2.2					
	Detect V_{DD} voltage rang by user option, V_{SVS} $VLDx[3:0]=0010b$			2.1					
	Detect V_{DD} voltage rang by user option, V_{SVS} $VLDx[3:0]=0001b$			2.0					
BOR : Brownout Reset LVR : Low Voltage Reset of BOR LVD : Low Voltage Detect RST : External Reset pin									

6.6. Power System

$T_A = 25^\circ\text{C}$, $V_{DD} = 3.0\text{V}$, unless otherwise noted

Sym.	Parameter	Test Conditions		Min.	Typ.	Max	unit	
VDDA	VDDA operation current, I_{VDDA}	$I_L = 0\text{mA}$	LDOC[2:0]=000b		12		μA	
	Select VDDA output voltage	$I_L = 0.1\text{mA}$, $V_{DD} \geq V_{VDDA} + 0.25\text{V}$	LDOC [2:0]=000b	-5%		+5%	2.4	V
			LDOC [2:0]=001b				2.6	V
			LDOC [2:0]=010b				2.9	V
			LDOC [2:0]=011b				3.3	V
			LDOC [2:0]=100b				3.6	V
			LDOC [2:0]=101b				4.0	V
			LDOC [2:0]=110b				4.5	V
			Dropout voltage				$I_L = 10\text{mA}$	LDOC [2:0]=000b		250		mV
	Temperature drift	LDOC [2:0]=000b $I_L = 10\mu\text{A}$	$T_A = -40^\circ\text{C} \sim 85^\circ\text{C}$		50		ppm/ $^\circ\text{C}$	
V_{DD} Voltage drift	LDOC [2:0]=000b	$V_{DD} = 2.2\text{V} \sim 5.5\text{V}$		± 0.2		%/V		
VDDA : Adjust Voltage Regulator								

6.7. SD18, Power Supply and recommended operating conditions

$T_A = 25^\circ\text{C}$, $V_{DD} = 3.0\text{V}$, $V_{DDA}=2.4\text{V}$, unless otherwise noted

Sym.	Parameter	Test Conditions		Min.	Typ.	Max.	unit
V_{SD18}	Supply Voltage at VDDA	ENLDO[0]=0		2.4		4.5	V
f_{SD18}	Modulator sample frequency, ADC_CK			250	500		KHz
	Over Sample Ratio, OSR			64		65536	
I_{SD18}	Operation supply current without PGA	ENAD1 [0]=1	GAIN =16, ADC_CK= 500KHz		200		μA

6.7.1. PGA, Power Supply and recommended operating conditions

$T_A = 25^\circ\text{C}$, $V_{DD} = 3.0\text{V}$, $V_{DDA}=2.4\text{V}$, unless otherwise noted

Sym.	Parameter	Test Conditions		Min.	Typ.	Max.	unit
V_{PGA}	Supply Voltage at VDDA	ENLDO [0]=0		2.4		4.5	V
I_{PGA}	Operation supply current	PGAGN[1:0]=<11>			450		μA
G_{PGA}	Gain temperature drift	$T_A = -40^\circ\text{C} \sim 85^\circ\text{C}$	GAIN=128		15		$\text{ppm}/^\circ\text{C}$

6.7.2. SD18, performance

$T_A = 25^\circ\text{C}$, $V_{DD} = 3.6\text{V}$, $V_{DDA}=2.4\text{V}$, $V_{VR} = \text{AI2}(\text{short to VDDA})/2$, GAIN=16 with PGA=8, $f_{SD18}=500\text{KHz}$, unless otherwise noted

Sym.	Parameter	Test Conditions		Min.	Typ.	Max.	unit
INL	Integral Nonlinearity(INL)	$V_{DDA}=2.4\text{V}$, $V_{VR} = \text{AI2}/2$, $\Delta\text{SI}=\pm 200\text{mV}$			± 0.003	± 0.01	%FSR
		$V_{DDA}=2.4\text{V}$, $V_{VR} = \text{AI2}/2$, $\Delta\text{SI}=\pm 450\text{mV}$					
G_{SD18}	Temperature drift Gain x16	$T_A = -40^\circ\text{C} \sim 85^\circ\text{C}$			10		$\text{ppm}/^\circ\text{C}$
E_{OS}	Offset error of Full Scale Rang input voltage range with PGA=8	$\Delta\text{AI}=0\text{V}$ $\Delta\text{VR}=1.2\text{V}$	GAIN=16			1	%FSR
	Offset error temperature drift with PGA=8	DCSET[3:0]=<0000> * ΔAI is external short	GAIN=16		0.15		$\mu\text{V}/^\circ\text{C}$
CM_{SD18}	Common-mode rejection	$V_{CM}=0.7\text{V}$ to 1.7V , $V_{VR} = 1.0\text{V}$, without PGA	$V_{SI}=0\text{V}$, GAIN=16		75		dB
PSRR	DC power supply rejection	$V_{DDA}=3.0\text{V}$, $\Delta V_{DDA} = \pm 100\text{mV}$, $V_{VR}=1.0\text{V}$, $V_{SI}=1.2\text{V}$, $V_{SI-}=1.2\text{V}$,	GAIN=16 PGA=8		75		dB

6.7.3. SD18 Noise Performance

$T_A = 25^\circ\text{C}, V_{DD} = 3.0\text{V}, V_{DDA}=2.4\text{V}$, unless otherwise noted

HY15P43 針對 SD18 提供了重要的輸入雜訊規格。Table 6.8-3(a), Table 6.8-3(b) 列出典型的雜訊規格表與 Gain, Output rate, 及單端最大輸入電壓等關係。測試條件設定在外部輸入訊號短路，參考電壓為 1.2V，取樣 1024 筆資料。

<i>ENOB(RMS) with OSR/GAIN at A/D Clock=500KHz, VDDA=2.4V, VREF=1.2V</i>																
Max. Vin(mV) =0.9*VREF ⁽¹⁾	OSR					64	128	256	512	1024	2048	4096	8192	16384	32768	65536
	Output rate(HZ)					7813	3906	1953	977	488	244	122	61	31	15	8
	Gain	=	PGA	x	ADGN											
±67.5	16	=	1	x	16	9.50	13.96	14.92	15.48	16.03	16.50	16.98	17.49	17.91	18.38	18.87
±33.75	32	=	2	x	16	9.49	13.45	14.18	14.67	15.20	15.72	16.21	16.67	17.20	17.68	18.04
±16.875	64	=	4	x	16	9.49	13.14	13.87	14.34	14.85	15.27	15.84	16.31	16.79	17.33	17.75
±8.435	128	=	8	x	16	9.49	12.69	13.32	13.73	14.27	14.76	15.31	15.79	16.36	16.88	17.24

(1) Max. Vin (mV) is the max. input voltage of single end to ground (VSS).

Table 6.8-3(a) SD18 ENOB Table

<i>RMS Noise(uV) with OSR/GAIN at A/D Clock=500KHz, VDDA=2.4V, VREF=1.2V</i>																
Max. Vin(mV) =0.9*VREF	OSR					64	128	256	512	1024	2048	4096	8192	16384	32768	65536
	Output rate(HZ)					7813	3906	1953	977	488	244	122	61	31	15	8
	Gain	=	PGA	x	ADGN											
±67.5	16	=	1	x	16	207.05	9.42	4.84	3.28	2.25	1.62	1.16	0.82	0.61	0.44	0.31
±33.75	32	=	2	x	16	103.99	6.68	4.05	2.88	1.99	1.39	0.99	0.72	0.50	0.36	0.28
±16.875	64	=	4	x	16	51.99	4.15	2.51	1.81	1.27	0.95	0.64	0.46	0.33	0.23	0.17
±8.435	128	=	8	x	16	26.11	2.83	1.84	1.38	0.95	0.67	0.46	0.33	0.22	0.16	0.12

Table 6.8-3(b) SD18 RMS Noise Table

The RMS noise are referred to the input. The Effective Number of Bits (ENOB(RMS Bit)) is defined as:

$$ENOB(RMS) = \frac{\ln\left(\frac{FSR}{RMS\ Noise}\right)}{\ln(2)}$$

$$RMS\ Noise = \frac{\left(2 \times VREF \times \sqrt{\sum_{k=1}^{1024} (ADO[k] - Average)^2}\right)}{2^{23}}$$

Where FSR (Full - Scale Range) = $2 \times VREF / \text{Gain}$.

$$Average = \frac{\sum_{k=1}^{1024} (ADO[k])}{1024}$$

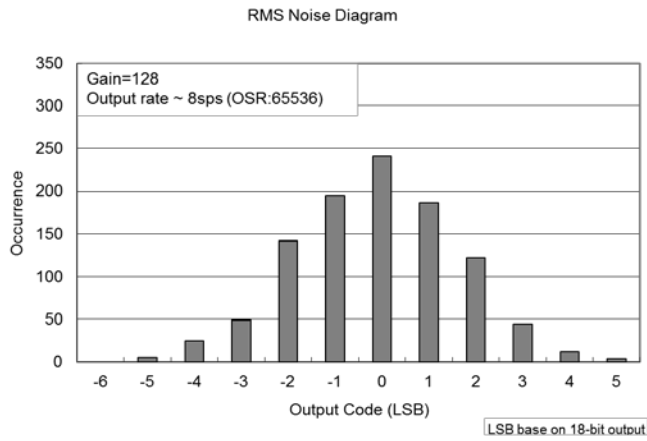


Figure6.8-3(a) RMS Noise Diagram

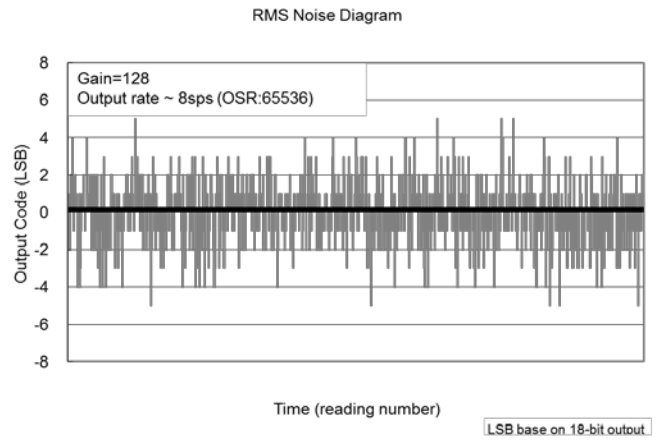


Figure6.8-3(b) Output Code Diagram

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6.8. Build-In EPROM(BIE)

$T_A = 25^\circ\text{C}, V_{DD} = 3.0\text{V}$, unless otherwise noted

Sym.	Parameter	Test Conditions	Min.	Typ.	Max.	unit
V_{BIE}	Supply Voltage at VPP PIN			8.5	8.75	V
I_{BIE}	Operation supply current			3		mA
V_{SS}	Supply Voltage			0		V

When connecting to the external V_{BIE} power source to program the BIE block, users can use the instruction to program the words one by one into the BIE block.

6.9. Build-In EPROM(BIE) Low voltage control circuit

$T_A = 25^\circ\text{C}, V_{DD} = 3.05\text{V}$, unless otherwise noted

Sym.	Parameter	Test Conditions	Min.	Typ.	Max.	unit
T_O	Operation temperature range		0	25	40	$^\circ\text{C}$
V_{DD}	Operation supply Voltage		2.75		5.5	V
V_{SS}	Supply Voltage			0		V

When the 2.75V low voltage programming control circuit is activated, users can program the BIE block without connecting to the external V_{BIE} power source.

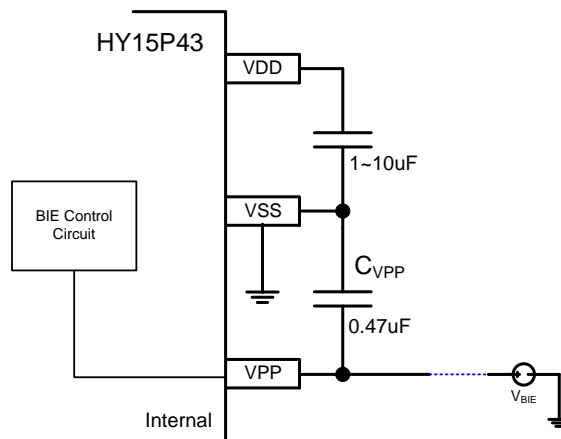


圖 6-1 BIE typical application 方塊圖

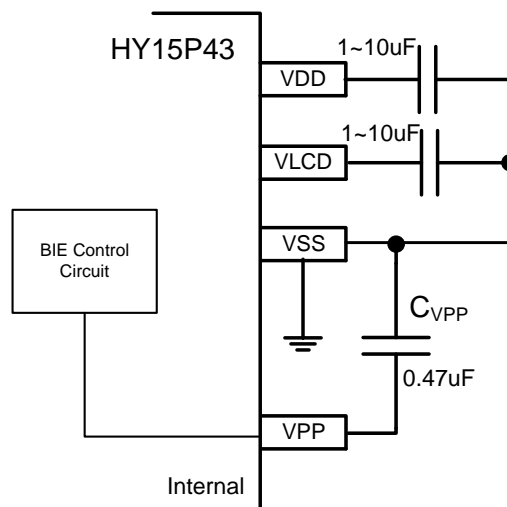


圖 6-2 BIE typical application use low voltage control circuit 方塊圖

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7. 訂貨資訊

下單品名 ¹	封裝型式	引腳數	封裝型式		程式碼	出貨包裝 形式	個裝 數量	材料 組成	MSL ³
			描述方式		編號 ²				
HY15P43-D000	Die	-	D	000	000	-	250	Green ⁴	-
HY15P43-T028	TSSOP	28	T	028	000	Tube	50	Green ⁴	MSL-3
HY15P43-T028	TSSOP	28	T	028	000	Tape & Reel	4000	Green ⁴	MSL-3
HY15P43-L048	LQFP	48	L	048	000	Tray	250	Green ⁴	MSL-3

¹ 產品名稱 - 封裝型式描述方式 - 程式碼編號 (空白片 / 標準品 / 代客燒錄碼)

例如：您的 HY15P43 代客燒錄服務申請的程式碼編號為 008，且需要的產品是裸片出貨。則下單品名為 HY15P43-D000-008

例如：您的需求是 HY15P43 不帶程式碼的空白片且需要的產品是裸片出貨。則下單品名為 HY15P43-D000

例如：您的需求是 HY15P43 不帶程式碼的空白片且需要的產品是封裝片 LQFP 7x7 48L 出貨，則下單品名為 HY15P43-L048，且需以 Tray 出貨，則除下單品名外，請特別註明出貨包裝形式為 Tray

例如：您的 HY15P43 代客燒錄服務申請的程式碼編號為 009，而需求的產品是封裝片 TSSOP 出貨，則下單品名為 HY15P43-T028-009，且需以 Tape & Reel 出貨，則除下單品名外，請特別註明出貨包裝形式為 Tape & Reel

² 程式碼編號

“001”~“999” 為標準品或代客燒錄申請的程式碼編號，而空白晶片不帶此碼。

³ MSL:

濕度敏感性等級係依據 IPC/JEDEC J-STD-020 的規範加以試驗分級，並參考 IPC/JEDEC J-STD-033 的標準處理、包裝、運輸與使用。

⁴ Green (RoHS & no Cl/Br):

HYCON 產品皆為 Green Product，符合 RoHS 指令以及無鹵素規定。

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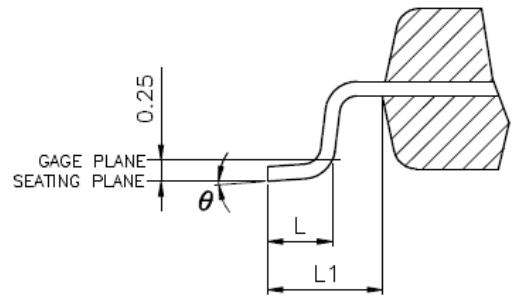
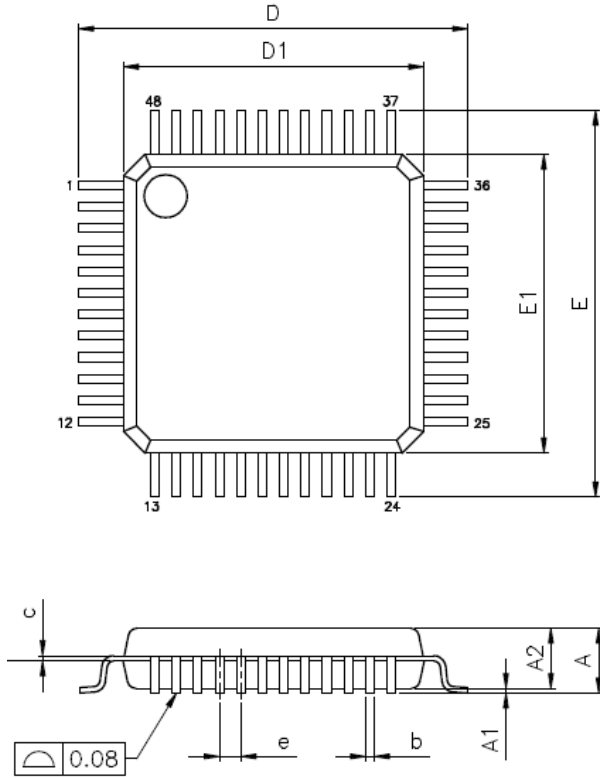
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8. 封裝型式資訊

8.1. LQFP 7x7 48L(L048)

8.1.1. Package Dimensions



SYMBOLS	MIN.	NOM.	MAX.
A	--	--	1.60
A1	0.05	--	0.15
A2	1.35	1.40	1.45
b	0.17	0.22	0.27
c	0.09	--	0.20
D	9.00 BSC		
D1	7.00 BSC		
E	9.00 BSC		
E1	7.00 BSC		
e	0.50 BSC		
L	0.45	0.60	0.75
L1	1.00 REF		
θ	0°	3.5°	7°

Note:

1. All dimensions refer to JEDEC OUTLINE MS-012.
2. Do not include Mold Flash or Protrusions.
3. Unit: mm.

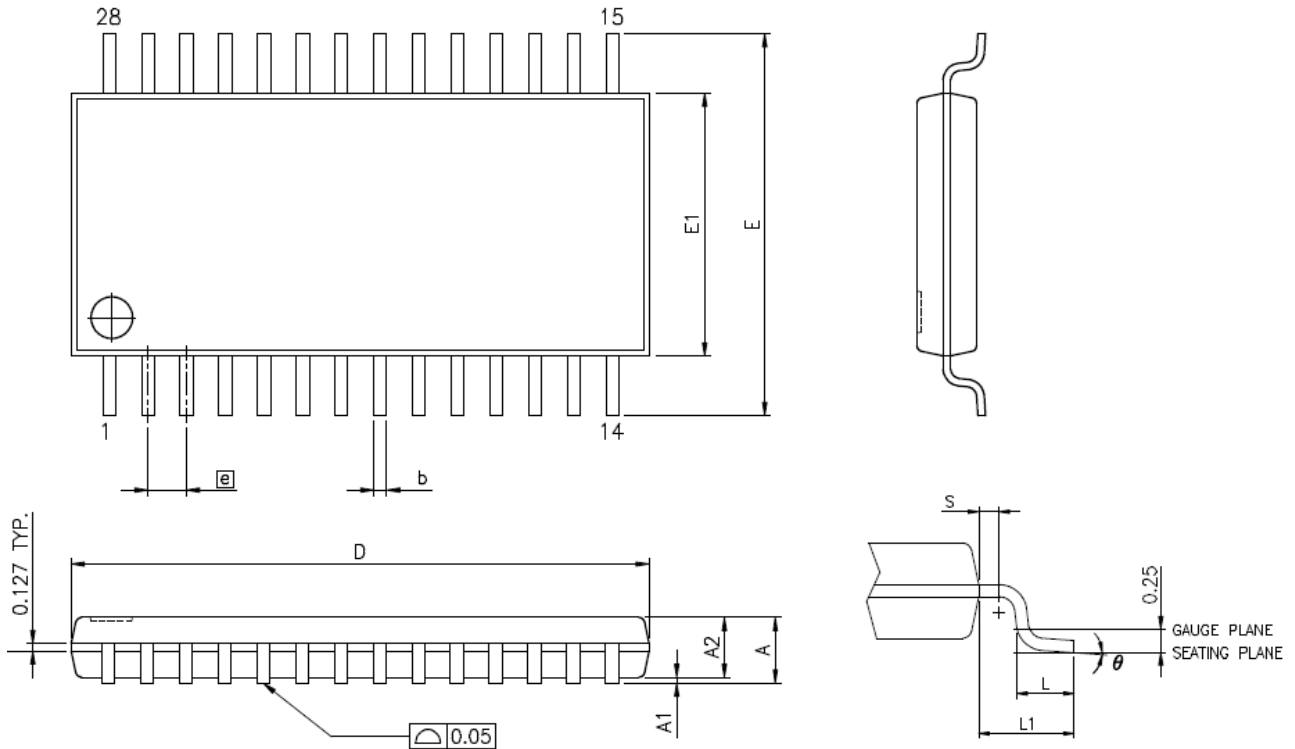
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8.2. TSSOP28(T028)

8.2.1. Package Dimensions



SYMBOLS	MIN.	NOM.	MAX.
A	—	—	1.20
A1	0.00	—	0.15
A2	0.80	1.00	1.05
b	0.19	—	0.30
D	9.60	9.70	9.80
E1	4.30	4.40	4.50
E	6.40 BSC		
e	0.65 BSC		
L1	1.00 REF		
L	0.45	0.60	0.75
S	0.20	—	—
θ	0°	—	8°

Note:

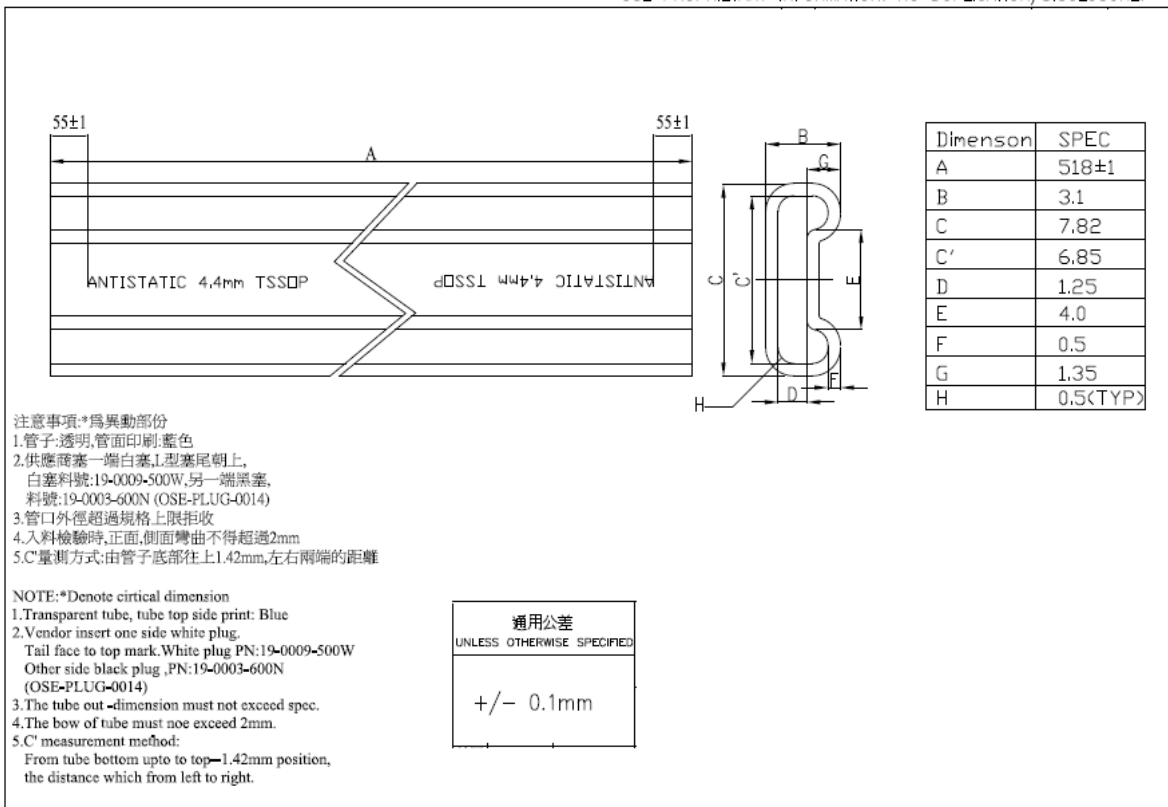
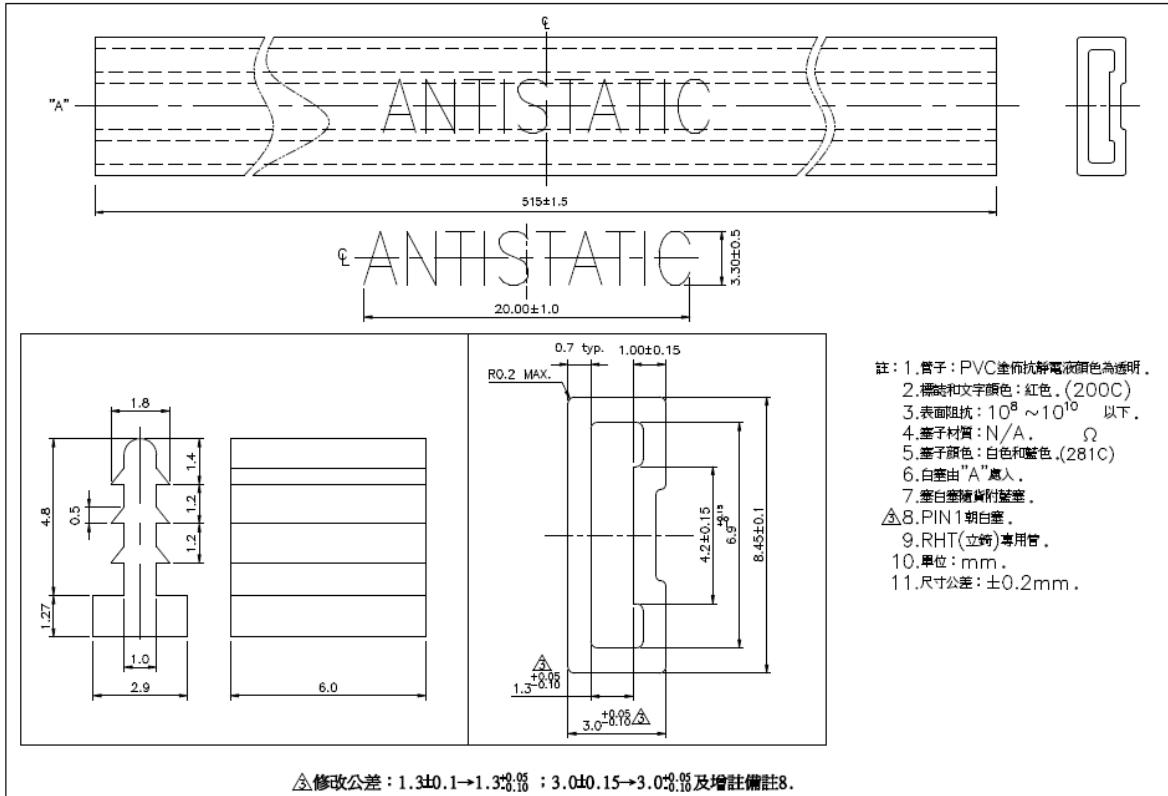
1. All dimensions refer to JEDEC OUTLINE MO-153.
2. Do not include Mold Flash or Protrusions.
3. Unit: mm.

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8.2.2. Tube Information



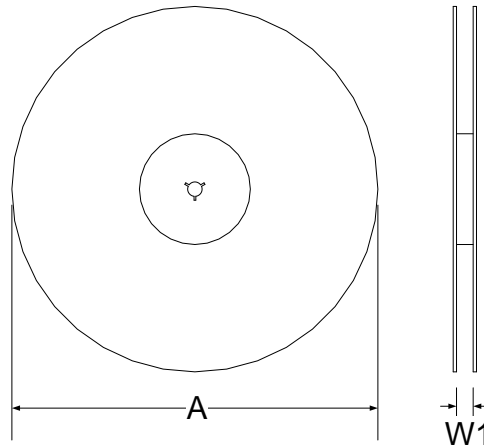
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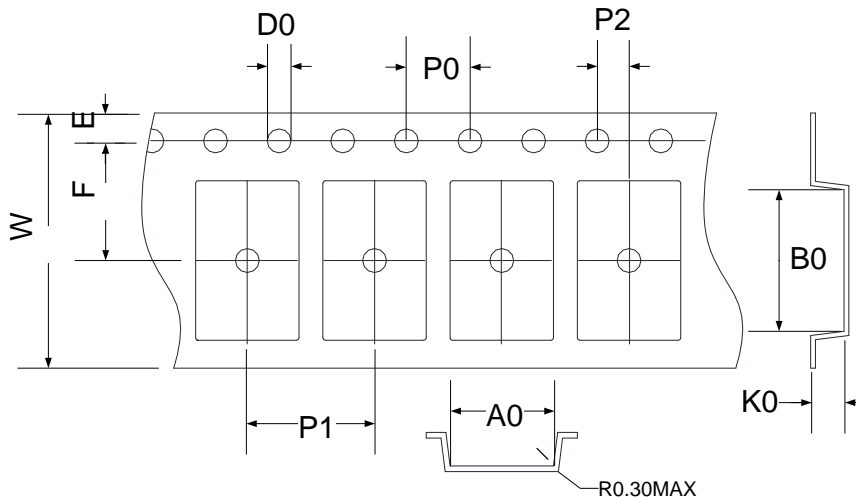
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8.2.3. Tape & Reel Information

8.2.3.1. Reel Dimensions



8.2.3.2. Carrier Tape Dimensions

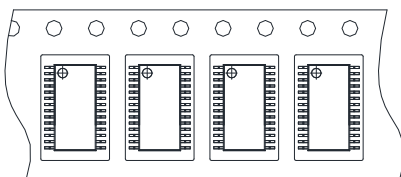


SYMBOLS	Reel Dimensions		Carrier Tape Dimensions									
	A	W1	A0	B0	K0	P0	P1	P2	E	F	D0	W
Spec.	330	16.5	6.80	10.20	1.60	4.00	8.00	2.00	1.75	7.50	1.50	16.00
Tolerance	+6/-3	+1.5/-0	±0.10	±0.10	±0.10	±0.10	±0.10	±0.10	±0.10	±0.10	+0.1/-0	±0.30

Unit : mm

Note: 10 Sprocket hole pitch cumulative tolerance is ± 0.20 mm.

8.2.3.3. Pin1 direction



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9. 附錄 A

9.1. HY15P 系列產品差異比較表

ITEM	HY15P43	HY15P53
Display Mode	LED Mode only	LCD/LED Mode
COM port, sink current (VDD=4V)	40mA	20mA

10. 修訂記錄

以下描述本文件差異較大的地方，而標點符號與字形的改變不在此描述範圍。

版本	頁數	變更摘要	修訂日期
V01	ALL	初版發行	2016/03/30
V02	7	修改 TSSOP28 引腳圖	2016/06/30
	8 ~ 10	修改 TSSOP28 引腳定義與說明	
V03	P15, P17	1. 統一「LCD 倍壓電路控制器」名稱為 ENLCP。 2. 統一「SD18 啓用控制器」名稱為 ENAD1。	2016/08/12
	P17, P29	1. VREGN 只能設為 0b = x1。 2. VRH 只能設為 0b = A12。	
	P23	統一「電源干擾復位旗標」名稱為 BOR。	