HY11P12
Datasheet

8-Bit RISC-like Mixed Signal Microcontroller
Embedded 4x12 LCD Driver
18-Bit ΣΔADC

目錄

注意：

1、 本說明書中的內容，隨著產品的改進，有可能不經過預告而更改。請客戶及時到本公司網站下載更新 http://www.hycontek.com

2、 本規格書中的圖形、應用電路等，因第三方工業所有權引發的問題，本公司不承擔其責任。

3、 本產品在單獨應用的情況下，本公司保證它的性能、典型應用和功能符合說明書中的條件。當使用在客戶的產品或設備中，以上條件我們不作保證，建議客戶做充分的評估和測試。

4、 請注意輸入電壓、輸出電壓、負載電流的使用條件，使 IC 內的功耗不超過封裝的容許功耗。對於客戶在超出說明書中規定額定值使用產品，即使是瞬間的使用，由此所造成的損失，本公司不承擔任何責任。

5、 本產品雖內置防靜電保護電路，但請不要施加超過保護電路性能的過大靜電。

6、 本規格書中的產品，未經書面許可，不可使用在要求高可靠性的電路中。例如健康醫療器械、防災器械、車輛器械、車載器械及航空器械等對人體產生影響的器械或裝置，不得作為其部件使用。

7、 本公司一直致力於提高產品的品質和可靠度，但所有的半導體產品都有一定的失效概率，這些失效概率可能會導致一些人身事故、火災事故等。當設計產品時，請充分留意冗餘設計，採用安全指標，這樣可以避免事故的發生。

8、 本規格書中內容，未經本公司許可，嚴禁用於其他目的之轉載或複製。

1. 特點

- 8 位元精簡指令集，共有 46 個指令
- 2.2V to 3.6V 工作電壓範圍，-40~85℃工作溫度範圍.
- 外部石英震盪器及內部高精度 RC 震盪器，6 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 300uA@2MHz
  - 待機模式 3uA@28KHz
  - 休眠模式 1uA
- 2K Word OTP (One Time Programmable) 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.
- 18bit 全差動輸入 ΣΔADC 類比數位轉換器
  - 內置 PGA (Programmable Gain Amplifier) 及可有 1/4、1/2、1. …..128 倍 10 種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
  - 內置高阻抗輸入緩衝器(4 以上輸入倍率不適用)
  - 內置絕對溫度感測器
- 1.0V 的內部類比電路共地電壓源，具有 Push-Pull 驅動能力，可提供傳感器驅動電壓
- 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 可選擇 4 種不同輸出電壓，具 10mA 穩壓電壓源輸出能力
- 4x12 LCD 液晶驅動器
  - Static、1/2、1/3、1/4 Duty 及 1/3 Bias 軟體選擇
  - 內建 Charge Pump 穩壓線路，可提供 4 種 LCD 偏壓
- 8-bit Timer A
- Support 6 stack level

功能列表

Model No.	VDD	System Clock	Program Memory (word)	SRAM (byte)	ADC ENOB (bit x ch)	Sample Rate (sps)	TPS / RTC / Serial Interface	OPAMP (type x ch.)	I/O	LCD (com x seg) / Timer (bit x ch) / PWM (bit x ch)	Package
HY11P12	2.2V~3.6V	28KHz~8MHz	2K	128	20-bit x 4	8~977	Y / Y / -	-	4xI + 10xIO	4 x 12 / 8-bit x 1 / -	LQFP44

2. 引腳定義

2.1 LQFP44 引腳圖

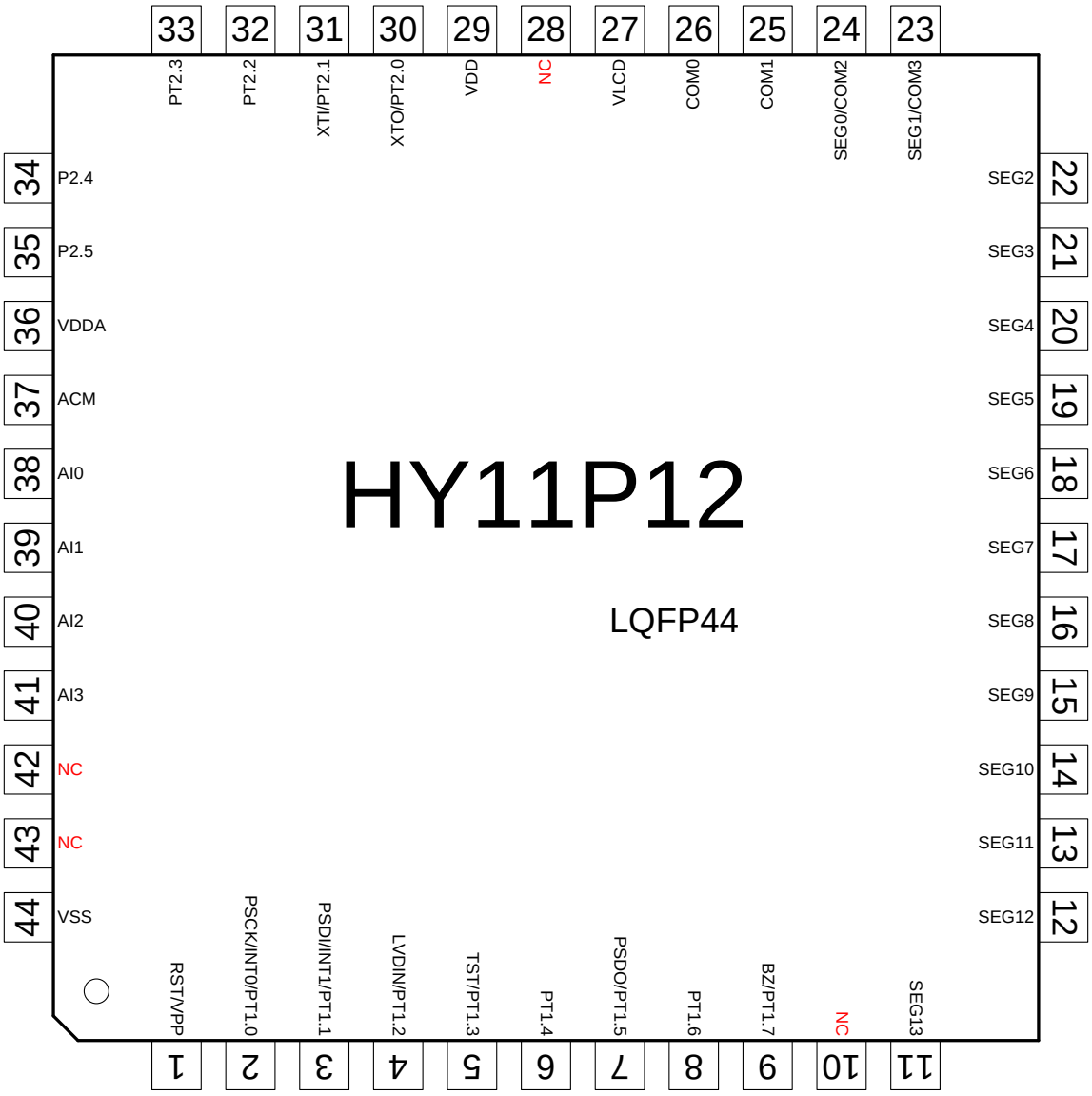


圖 2-1 HY11P12 LQFP44 引腳圖

註 1：VPP 與 RST 復用同一接口，非燒錄 EPROM 時禁止輸入電壓超過 5.8V

註 2：TST 與 PT1.3 復用同一接口，操作時禁止輸入電壓超過 Vdd+0.3V

註 3：若不將 PT1.3 設定成外部引腳按鍵，可以提升抗干擾能力

2.2 I/O 定義與說明(LQFP44)

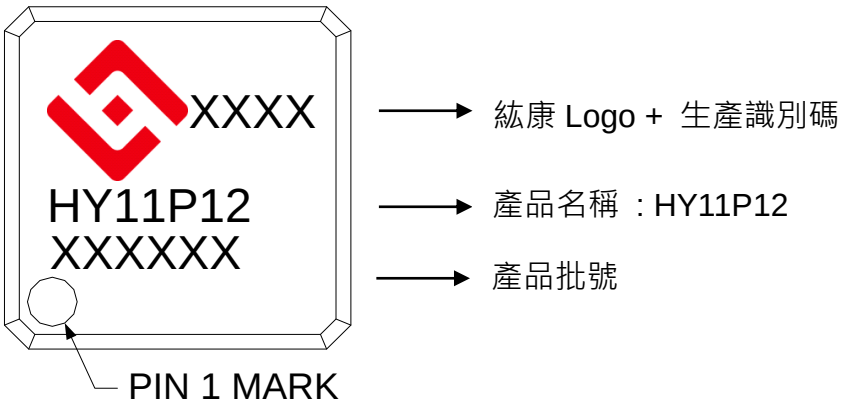
"I/O"輸入/輸出,"I"輸入,"O"輸出,"S"史密斯觸發,"C"CMOS 特性兼容輸出與輸入,"P"電壓源,"A"類比通道

編號	引腳名稱	引腳特性		功能說明
		格式	緩衝	
1	RST/VPP			
	RST	I	S	復位晶片
	VPP	P	P	EPROM 讀/寫時的電壓源
2	PT1.0/INT0/PSCK			
	PT1.0	I	S	數位輸入
	INT0	I	S	中斷源 INT0
	PSCK	I	S	OTP 讀/寫介面 SCK 接口
3	PT1.1/INT1/PSDI			
	PT1.1	I	S	數位輸入
	INT1	I	S	中斷源 INT1
	PSDI	I	S	OTP 讀/寫介面 SDI 接口
4	PT1.2/LVDIN			
	PT1.2	I	S	數位輸入
	LVDIN	A	A	LVD 外部信號輸入接口
5	PT1.3/TST			
	PT1.3	I	S	數位輸入
	TST	I	S	測試模式致能輸入（未開放）
6	PT1.4	I/O	S	數位輸入/輸出
7	PT1.5/PSDO			
	PT1.5	I/O	S	數位輸入/輸出
	PSDO	O	C	OTP 讀/寫介面 SDO 接口
8	PT1.6	I/O	S	數位輸入/輸出
9	PT1.7/BZ			
	PT1.7	I/O	S	數位輸入/輸出
	BZ	O	C	蜂鳴器輸出端
10	NC	-	-	未使用
11	SEG13	O	A	LCD 的 Segment 輸出
12	SEG12	O	A	LCD 的 Segment 輸出
13	SEG11	O	A	LCD 的 Segment 輸出
14	SEG10	O	A	LCD 的 Segment 輸出
15	SEG9	O	A	LCD 的 Segment 輸出
16	SEG8	O	A	LCD 的 Segment 輸出

17	SEG7	O	A	LCD 的 Segment 輸出
18	SEG6	O	A	LCD 的 Segment 輸出
19	SEG5	O	A	LCD 的 Segment 輸出
20	SEG4	O	A	LCD 的 Segment 輸出
21	SEG3	O	A	LCD 的 Segment 輸出
22	SEG2	O	A	LCD 的 Segment 輸出
23	COM3/SEG1	O	A	LCD 的 COM 與 Segment 共用輸出
24	COM2/SEG0	O	A	LCD 的 COM 與 Segment 共用輸出
25	COM1	O	A	LCD 的 COM 輸出
26	COM0	O	A	LCD 的 COM 輸出
27	VLCD	P	P	LCD 的電壓源
28	NC	-	-	未使用
29	VDD	P	P	晶片工作電壓源
30	PT2.0/XTO PT2.0 XTO	 I/O A	 S A	 數位輸入/輸出 外接振盪器輸出端
31	PT2.1/XTI PT2.1 XTI	 I/O A	 S A	 數位輸入/輸出 外接振盪器輸入端
32	PT2.2	I/O	C	數位輸入/輸出
33	PT2.3	I/O	S	數位輸入/輸出
34	PT2.4	I/O	S	數位輸入/輸出
35	PT2.5	I/O	S	數位輸入/輸出
36	VDDA	P	P	穩壓器輸出，類比電路電壓源
37	ACM	P	P	內部類比電路共地引腳
38	AI0	A	A	類比輸入通道
39	AI1	A	A	類比輸入通道
40	AI2	A	A	類比輸入通道
41	AI3	A	A	類比輸入通道
42	NC	-	-	未使用
43	NC	-	-	未使用
44	VSS	P	P	晶片工作電壓源接地端

表 2-1 LQFP44 引腳定義與功能說明

2.2.1 LQFP 封裝片標記信息



3. 應用電路

3.1 橋式感測器 I

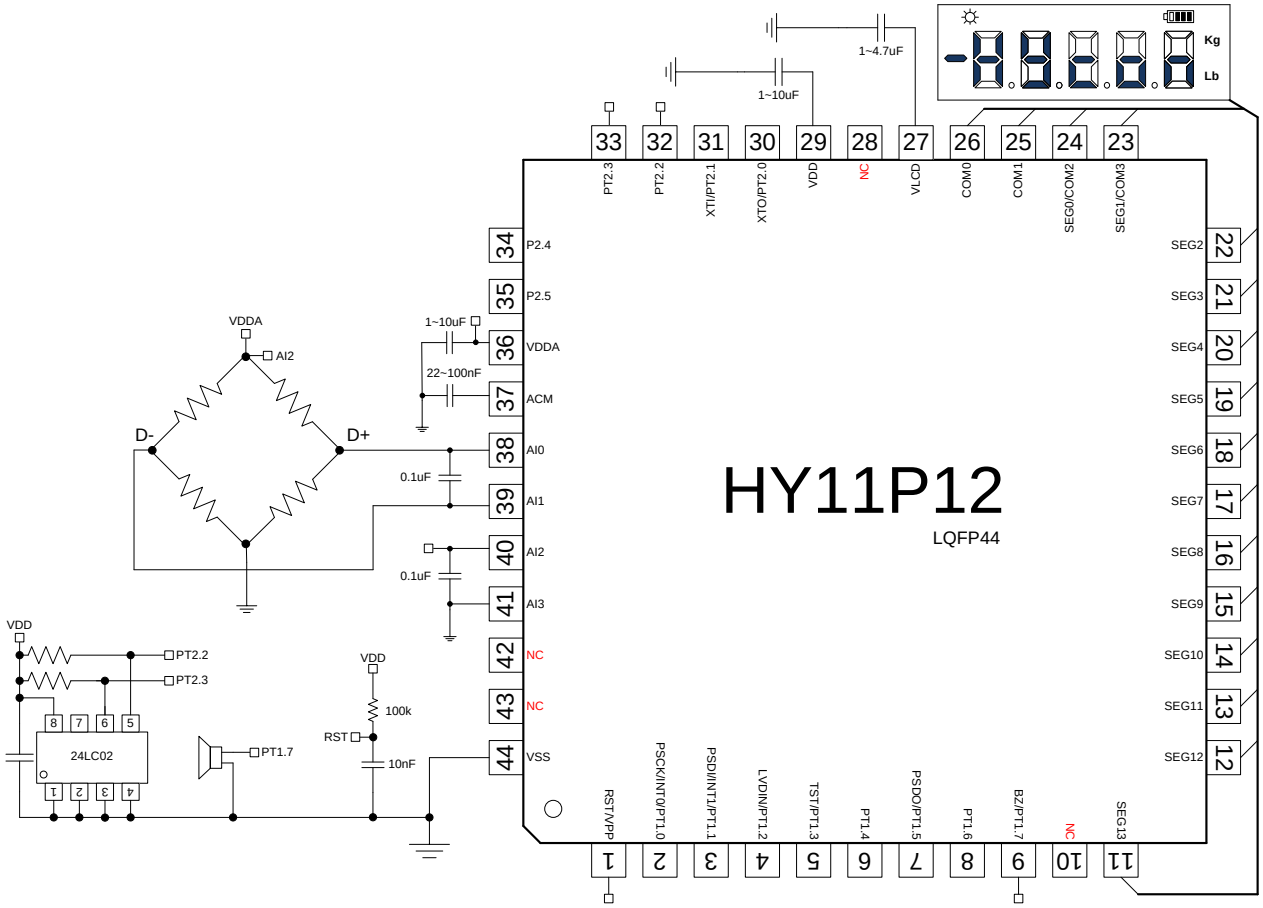


圖 3-1 橋式感測器應用電路

註：LoadCell 零點電壓位置可透過 DCSET[2:0] 進行偏壓調整。

3.2 橋式感測器 II

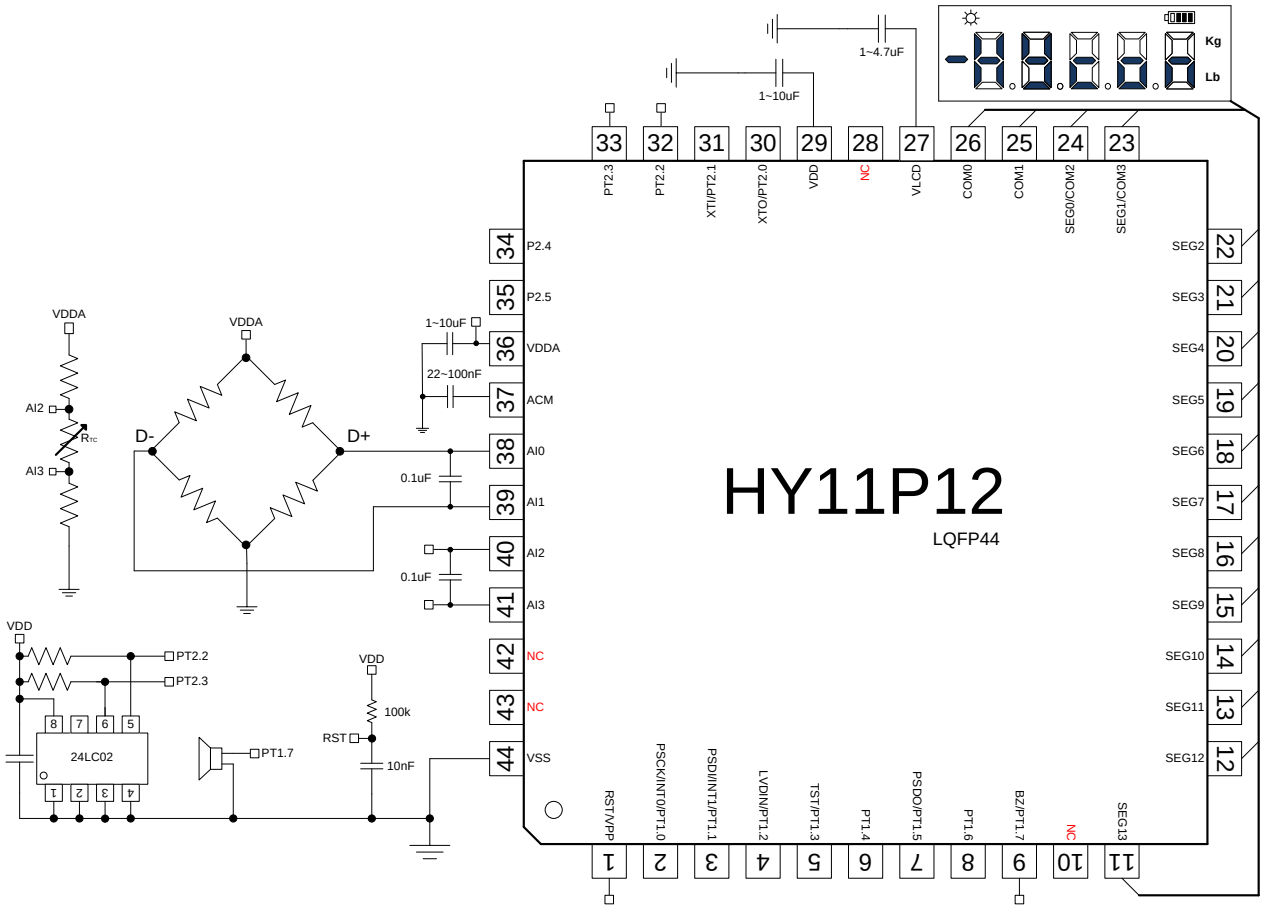


圖 3-2 具溫度補償的橋式感測器應用電路

註：使用外部參考電壓並設計溫度補償電阻 NTC 基本線路

註：關於 LoadCell 零點電壓位置可透過 DCSET[2:0] 進行偏壓調整。

4. 功能概述

4.1 內部方塊圖

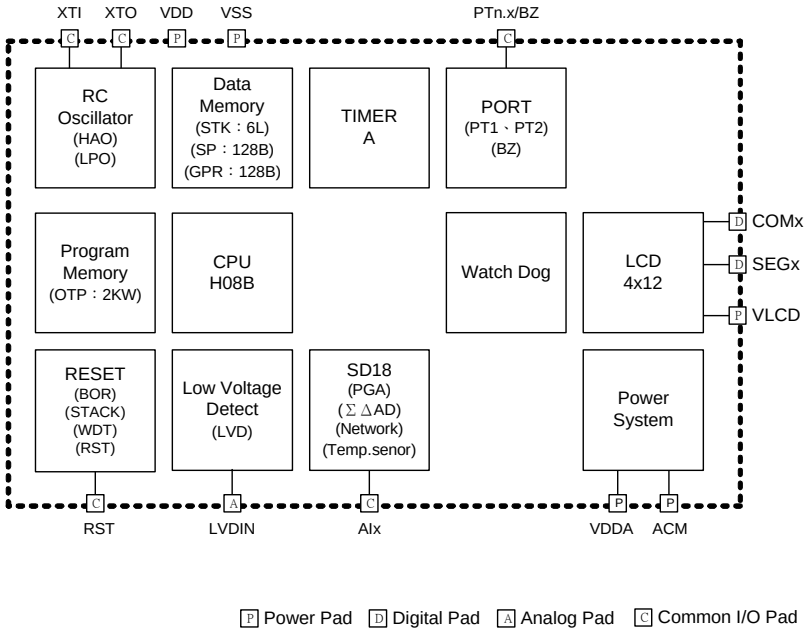


圖 4-1 HY11P12 內部方塊圖

4.2 相關說明與支援文件

晶片功能相關使用說明書

DS-HY11P12-Vxx	HY11P12 說明書
UG-HY11S14-Vxx	HY11Pxx 系列使用說明書
APD-CORE003-Vxx	H08B 指令說明書

開發工具相關使用說明書

APD-HYIDE006-Vxx	HY11xxx 系列開發工具軟體使用說明書
APD-HYIDE005-Vxx	HY11xxx 系列開發工具硬體使用說明書
APD-OTP001-Vxx	OTP 產品燒錄引腳說明書

產品生產相關使用說明書

APD-HYIDE004-Vxx	HY1xxxx 系列生產線專用燒錄器說明書
BDI-HY11P12-Vxx	HY11P12 個別產品的裸片打線資訊

4.3 SD18 Network

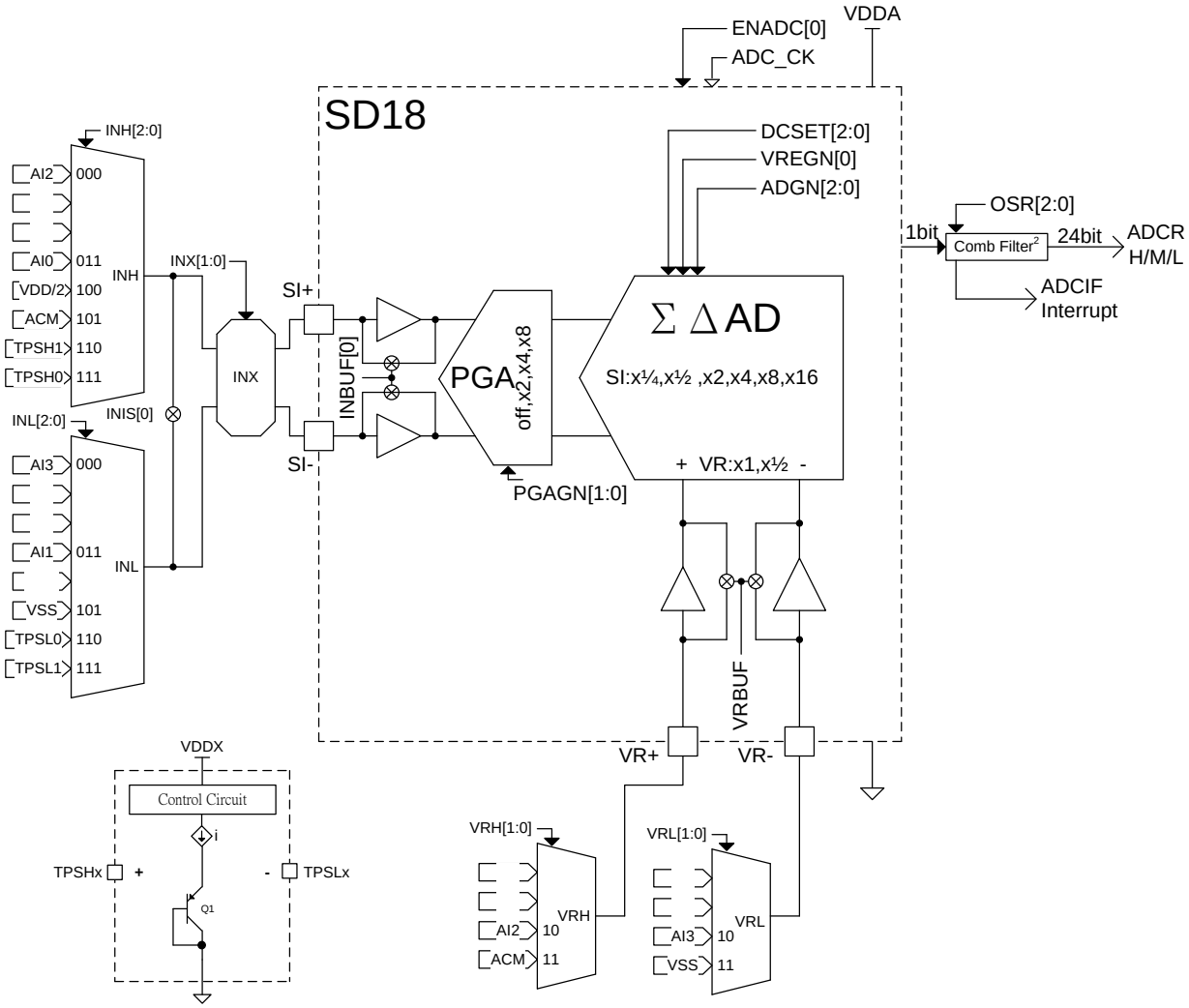


圖 4-2 SD18 Network

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"omly write 1												
"."unimplemented bit,"x"unknown,"u"unchanged,"d"depends on condition												
Address	**File Name**	**Bit7**	**Bit6**	**Bit5**	**Bit4**	**Bit3**	**Bit2**	**Bit1**	**Bit0**	**A-RESET**	**i-RESET**	**R/W**
00H	INDF0	Contents of FSR0 to address data memory˙ value of FSR0 not changed								N/A	N/A	*,*,*,*,*,*,*,*
05H	INDF1	Contents of FSR1 to address data memory˙ value of FSR0 not changed								N/A	N/A	*,*,*,*,*,*,*,*
10H	FSR0L	Indirect Data Memory Address Pointer 0 Low Byte,FSR0[7:0]								xxxx xxxx	uuuu uuuu	*,*,*,*,*,*,*,*
12H	FSR1L	Indirect Data Memory Address Pointer 1 Low Byte,FSR1[7:0]								xxxx xxxx	uuuu uuuu	*,*,*,*,*,*,*,*
18H	STKPTR	STKFL	STKUN	STKOV			STKPRT[2:0]			000. .000	000. .000	r,rw0,rw0,- -,r,r,r
1AH	PCLATH						PC[10]	PC[9]	PC[8]	.... .000	.... .000	-,-,-,- -,*,*,*
1BH	PCLATL	PC Low Byte for PC<7:0>								0000 0000	0000 0000	*,*,*,*,*,*,*,*
23H	INTE1	GIE	ADCIE			TMAIE	WDTIE	E1IE	E0IE	00.. 0000	00.. 0000	*,*,-,- *,*,*,*
26H	INTF1		ADCIF			TMAIF	WDTIF	E1IF	E0IF	.0.. 0000	.0.. 0000	-,*,-,- *,*,*,*
29H	WREG	Working Register								xxxx xxxx	uuuu uuuu	*,*,*,*,*,*,*,*
2BH	STATUS				C				Z	...x ...x	...u ...u	-,-,-,* -,-,-,*
2CH	PSTATUS	PD	TO	IDLEB	BOR		SKERR			000d .0..	uduu .d..	rw0,rw0,rw0,rw0 -,rw0,-,-
2DH	LVDCN		LVDFG	LVD	LVDON	VLDX[3:0]				.000 0000	.000 uuuu	-,*,r,r *,*,*,*
30H	PWRCN	ENVDDA	VDDAX[1:0]		ENACM					0000	0000	*,*,*,* -,-,-,-
31H	MCKCN1	ADCS[2:0]			ADCCK	XTHSP	XTSP	ENXT	ENHAO	0000 0001	0000 0001	*,*,*,*,*,*,*,*
32H	MCKCN2			LSCK	HSCK	HSS[1:0]		CPUCK[1:0]		..00 0000	..00 0000	-,-,*,*,*,*,*,*
33H	MCKCN3	LCDS[2:0]				PERCK	BZS[2:0]			000. 0000	000. 0000	*,*,*,- *,*,*,*
39H	ADCRH	ADC conversion memory HighByte								xxxx xxxx	uuuu uuuu	r,r,r,r r,r,r,r
3AH	ADCRM	ADC conversion memory Middle Byte								xxxx xxxx	uuuu uuuu	r,r,r,r r,r,r,r
3BH	ADCRL	ADC conversion memory Low Byte								xxxx xxxx	uuuu uuuu	r,r,r,r r,r,r,r
3CH	ADCCN1	ENADC	ENHIGN	ENCHP	PGAGN[1:0]		ADGN[2:0]			0000 0000	0000 0000	*,*,*,*,*,*,*,*
3DH	ADCCN2			INBUF	VRBUF	VREGN	DCSET[2:0]			..00 0000	..00 0000	-,-,*,*,*,*,*,*
3EH	ADCCN3	OSR[2:0]								000.	000.	*,*,*,- -,-,-,-
3FH	AINET1	INH[2:0]			INL[2:0]			INIS		0000 000.	0000 000.	*,*,*,*,*,*,*,-
40H	AINET2		VRH[1:0]		INX[1:0]		VRL[1:0]			.000 000.	.000 000.	-,*,*,*,*,*,*,-
41H	TMACN	ENTMA	TMACK	TMAS[1:0]		ENWDT	WDTS[2:0]			0000 0000	0000 0000	*,*,*,* w1,*,*,*
42H	TMAR	TimerA data register								xxxx xxxx	uuuu uuuu	r,r,r,r r,r,r,r
52H	LCDCN1	ENLCD	LCDPR	VLCDX[1:0]		LCDBF	LCDBI[1:0]			0000 000.	0000 000.	*,*,*,*,*,*,*,-
53H	LCDCN2	LCDBL	LCDMX[1:0]							000.	000.	*,*,*,- -,-,-,-
54H	LCD0	Segment SEG2@[3:0] and SEG3@[7:4] data register of LCD								xxxx xxxx	uuuu uuuu	*,*,*,*,*,*,*,*
55H	LCD1	Segment SEG4@[3:0] and SEG5@[7:4] data register of LCD								xxxx xxxx	uuuu uuuu	*,*,*,*,*,*,*,*
56H	LCD2	Segment SEG6@[3:0] and SEG7@[7:4] data register of LCD								xxxx xxxx	uuuu uuuu	*,*,*,*,*,*,*,*
57H	LCD3	Segment SEG8@[3:0] and SEG9@[7:4] data register of LCD								xxxx xxxx	uuuu uuuu	*,*,*,*,*,*,*,*
58H	LCD4	Segment SEG10@[3:0] and SEG11@[7:4] data register of LCD								xxxx xxxx	uuuu uuuu	*,*,*,*,*,*,*,*
59H	LCD5	Segment SEG12@[3:0] and SEG13@[7:4] data register of LCD								xxxx xxxx	uuuu uuuu	*,*,*,*,*,*,*,*
6DH	PT1	PT1.7	PT1.6	PT1.5	PT1.4	PT1.3	PT1.2	PT1.1	PT1.0	xxxx xxxx	uuuu uuuu	*,*,*,* r,r,r,r
6EH	TRISC1	TC1.7	TC1.6	TC1.5	TC1.4					0000	0000	*,*,*,* -,-,-,-
6FH	PT1DA						DA1.2			.... .0..	.... .0..	-,-,-,- -,*,-,-
70H	PT1PU	PU1.7	PU1.6	PU1.5	PU1.4	PU1.3	PU1.2	PU1.1	PU1.0	0000 0000	0000 0000	*,*,*,*,*,*,*,*
71H	PT1M1					INTEG1[1:0]		INTEG0[1:0]		 0000	 0000	-,-,-,- *,*,*,*
72H	PT1M2		PM1.7[0]							.0..	.0..	-,*,-,- -,-,-,-
74H	PT2			PT2.5	PT2.4	PT2.3	PT2.2	PT2.1	PT2.0	..xx xxxx	..uu uuuu	-,-,*,*,*,*,*,*
75H	TRISC2			TC2.5	TC2.4	TC2.3	TC2.2	TC2.1	TC2.0	..00 0000	..00 0000	-,-,*,*,*,*,*,*
77H	PT2PU			PU2.5	PU2.4	PU2.3	PU2.2	PU2.1	PU2.0	..00 0000	..00 0000	-,-,*,*,*,*,*,*
80H ~ FFH	GPR0	General Purpose Register as 128Byte								xxxx xxxx	uuuu uuuu	*,*,*,*,*,*,*,*

圖 5-1 HY11P12 暫存器列表

6. 電氣特性

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

Voltage applied at V_{DD} to V_{SS} . . . . −0.2 V to 4.0 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 6.9 V

Voltage applied to TST/PT1.3 pin . . . . −0.2 V to V_{DD} + 1 V

Diode current at any device terminal . . . . ±2 mA

Storage temperature, Tstg: (unprogrammed device) . . . . −55℃ to 150℃

(programmed device) . . . . −40℃ to 85℃

Total power dissipation. 0.5w

Maximum output current sink by any PORT1 to PORT3 I/O pin. 25mA

6.1 Recommended operating conditions

T_A = -40℃ ~ 85℃,unless otherwise noted

Sym.	Parameter		Test Conditions		Min.	Typ.	Max.	unit
V_{DD}	Supply Voltage		All digital peripherals and CPU		2.2		3.6	V
			Analog peripherals		2.4		3.6	
V_{SS}	Supply Voltage				0		0	
XT	External Oscillator Frequency	Watch crystal	V_{DD} = 2.2V, ENXT[0]=1	XTSP[0]=0, XTHSP[0]=0		32.768K		Hz
		Ceramic resonator		XTSP[0]=1, XTHSP[0]=0	450K		8M	
		Crystal		XTSP[0]=1, XTHSP[0]=0	1M		8M	

6.2 Internal RC Oscillator

T_A = 25℃,V_{DD} = 3.0V,unless otherwise noted

Sym.	Parameter	Test Conditions	Min.	Typ.	Max.	unit
HAO	High Speed Oscillator frequency	ENHAO[0]=1	1.8	2.0	2.2	MHz
LPO	Low Power Oscillator frequency	V_{DD} supply voltage be enable LPO	22	28	35	KHz

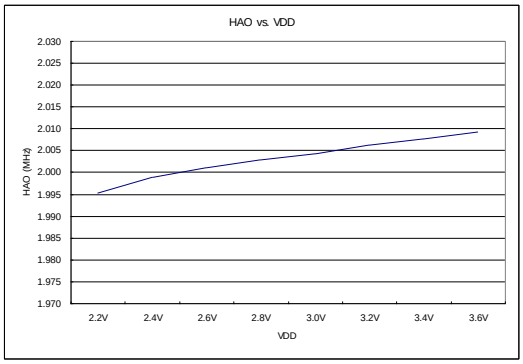


Figure 6.2-1 HAO vs. VDD

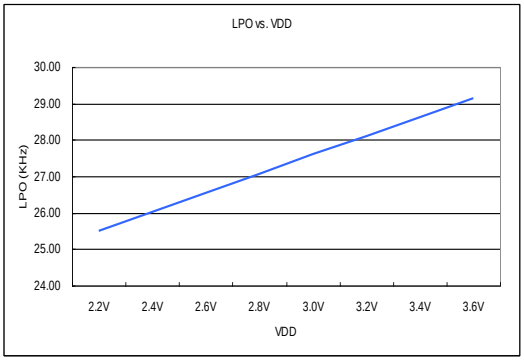


Figure 6.2-2 LPO vs. VDD

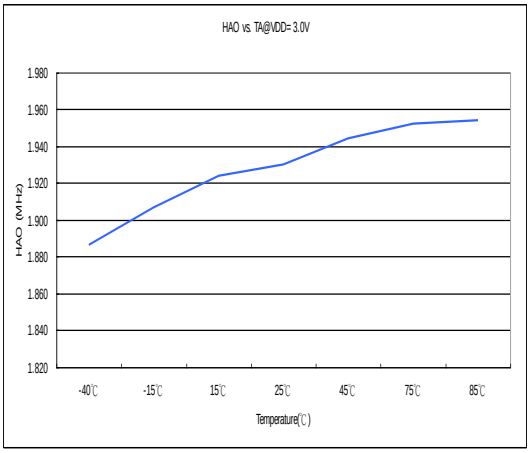


Figure 6.2-3 HAO vs. Temperature

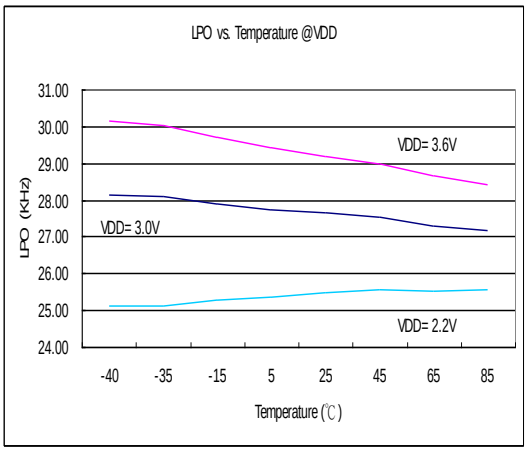


Figure 6.2-4 LPO vs. Temperature

6.3 Supply current into VDD excluding peripherals current

T_A = 25℃,V_{DD} = 3.0V,OSC_LPO = 28KHz,unless otherwise noted

Sym.	Parameter	Test Conditions	Min.	Typ.	Max.	unit
I_{AM1}	Active mode 1	OSC_CY = 8MHz, OSC_HAO = off, CPU_CK = 8MHz		1	2	mA
I_{AM2}	Active mode 2	OSC_CY = off, OSC_HAO = 2MHz, CPU_CK = 2MHz		0.28	0.55	mA
I_{AM3}	Active mode 3	OSC_CY = off, OSC_HAO = 2MHz, CPU_CK = 1MHz		0.165	0.3	mA
I_{LP1}	Low Power 1	OSC_CY = 32768Hz, OSC_HAO = off, CPU_CK = 16384Hz		7	12	uA
I_{LP2}	Low Power 2	OSC_CY = off, OSC_HAO = off, CPU_CK = LPO, Idle state		1.65	3	uA
I_{LP3}	Low Power 3	OSC_CY = off, OSC_HAO = off, CPU_CK = off, Sleep state		0.65	1.2	uA

OSC_CY：External Oscillator frequency.

OSC_HAO：Internal High Accuracy Oscillator frequency.

CPU_CK：CPU core work frequency.

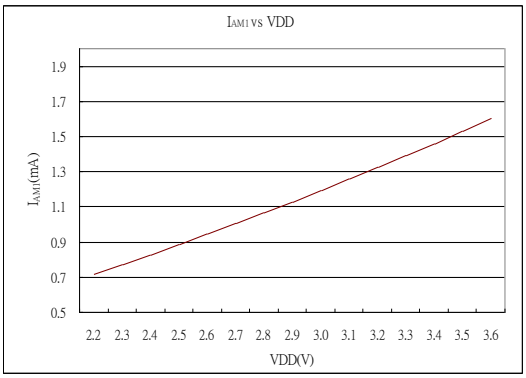


Figure 6.3-1 I_{AM1} vs. VDD

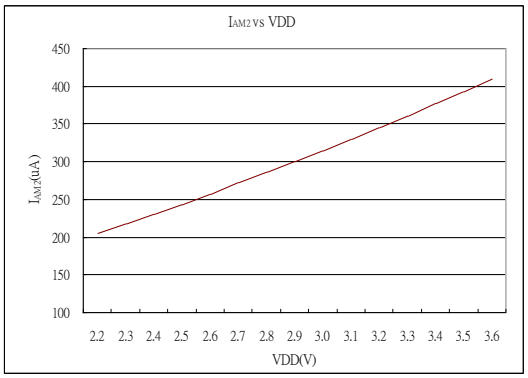


Figure 6.3-2 I_{AM2} vs. VDD

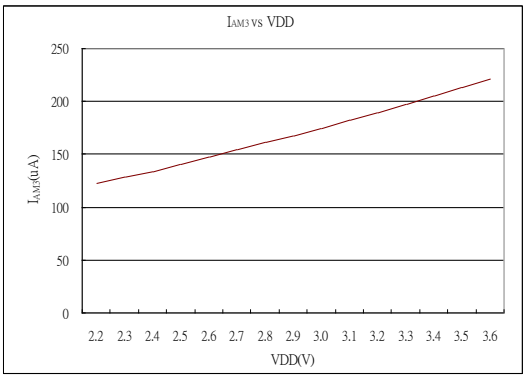


Figure 6.3-3 I_{AM3} vs. VDD

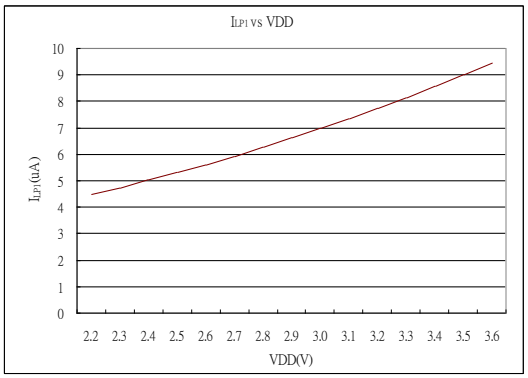


Figure 6.3-4 I_{LP1} vs. VDD

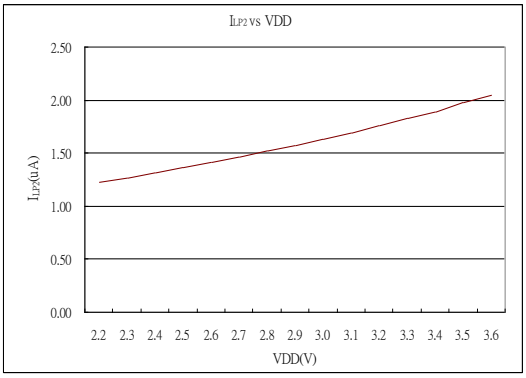


Figure 6.3-5 I_{LP2} vs. VDD

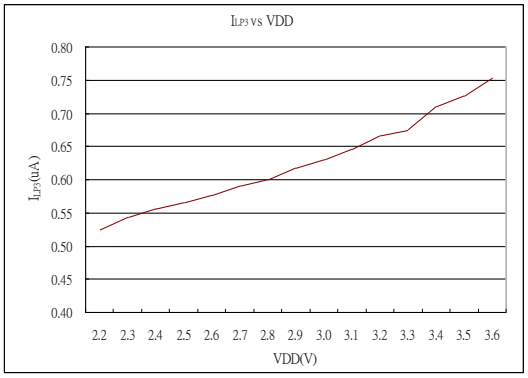


Figure 6.3-6 I_{LP3} vs. VDD

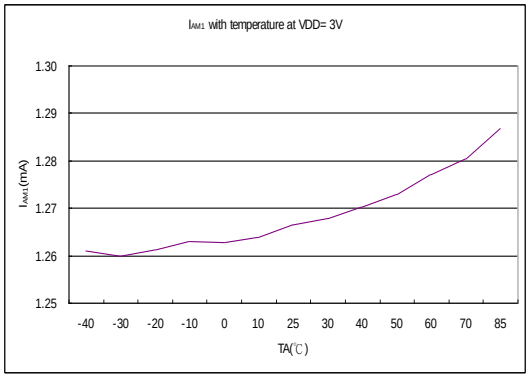


Figure 6.3-7 I_{AM1} vs. Temperature

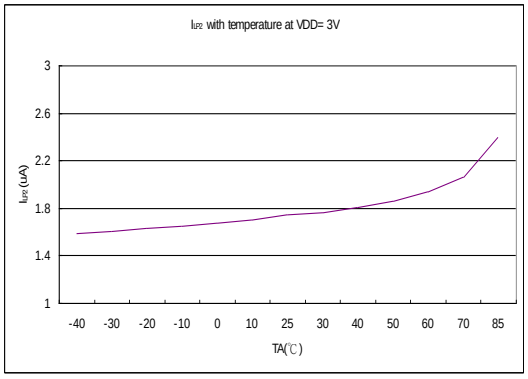


Figure 6.3-8 I_{LP2} vs. Temperature

.

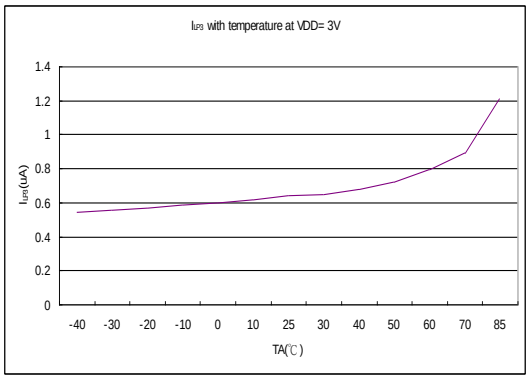


Figure 6.3-9 I_{LP3} vs. Temperature

6.4 Port1~2

T_A = 25℃,V_{DD} = 3.0V,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				2.1	V
V_{IL}	Low-Level input voltage		0.9			
V_{hys}	Input Voltage hysteresis(VIH - VIL)			0.8		V
I_{LKG}	Leakage Current				0.1	uA
R_{PU}	Port pull high resistance			180		kΩ
Output voltage and current and frequency						
V_{OH}	High-level output voltage	I_{OH}=10mA	V_{DD} -0.3			V
V_{OL}	Low-level output voltage	I_{OL}=-10mA			VSS +0.3	

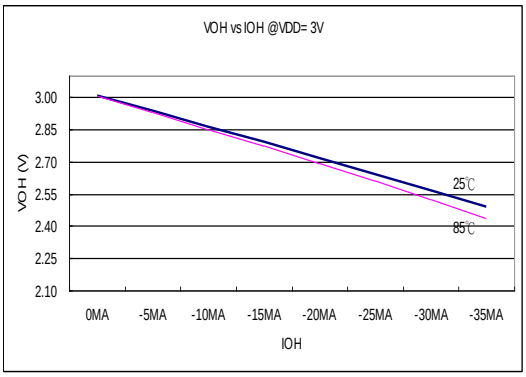


Figure 6.4-1 V_{OH} vs. I_{OH} @VDD=3.0V

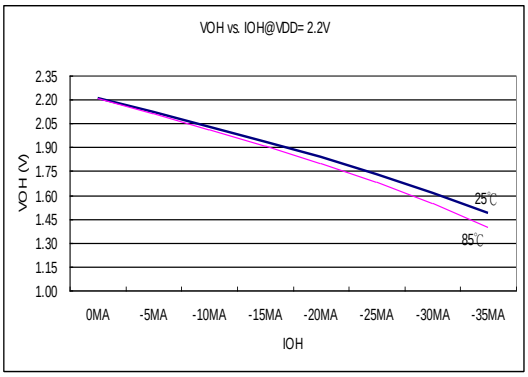


Figure 6.4-2 V_{OH} vs. I_{OH} @VDD=2.2V

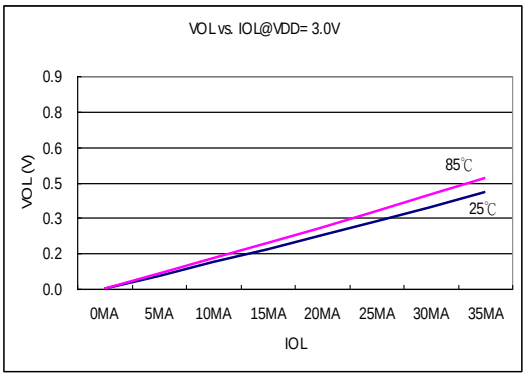


Figure 6.4-3 V_{OL} vs. I_{OL}@VDD=3.0V

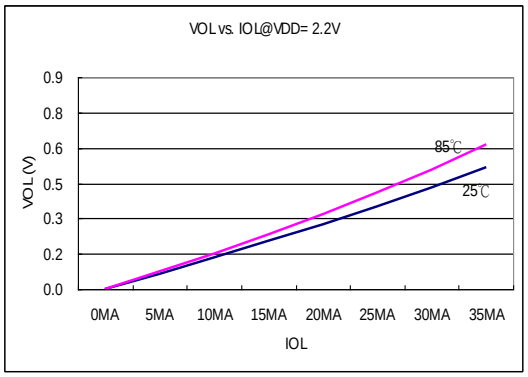


Figure 6.4-4 V_{OL} vs. I_{OL}@VDD=2.2V

6.5 Reset(Brownout, External RST pin, Low Voltage Detect)

T_A = 25℃,V_{DD} = 3.0V,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➔H),V_{LVR}		1.6	1.85	2.1	V
	Hysteresis, $V_{HYS-LVR}$			70		mV
RST	Pulse length needed as RST/VPP pin to accepted reset internally, t_{d-RST}		2			us
	Input Voltage to accepted reset internally		0.9			V
	Hysteresis, $V_{HYS-RST}$			0.8		V
LVD	Operation current, I_{LVD}			10	15	uA
	External input voltage to compare reference voltage			1.2		V
	Compare reference voltage temperature drift	T_A = -40℃ ~ 85 ℃		100		ppm/℃
	Detect V_{DD} voltage rang by user option, V_{SVS} VLDx[3:0]=1110b			3.3		V
	Detect V_{DD} voltage rang by user option, V_{SVS} VLDx[3:0]=1101b			3.2		
	Detect V_{DD} voltage rang by user option, V_{SVS} VLDx[3:0]=1100b			3.1		
	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

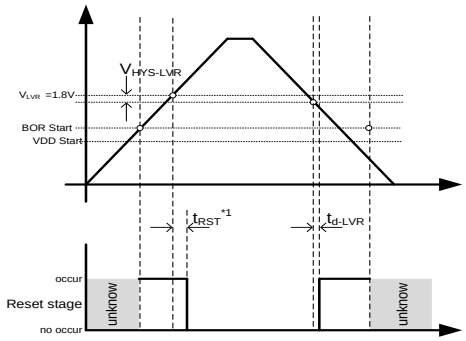


Figure6.5-1 BOR reset diagram

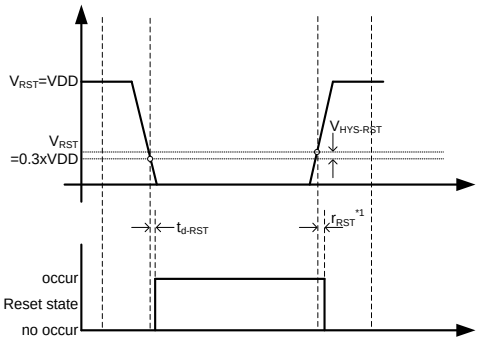


Figure6.5-2 RST reset diagram

*1 r_{RST}：Please see BOR Introduce of HY11Pxx series User's Guide (UG-HY11S14-Vxx).

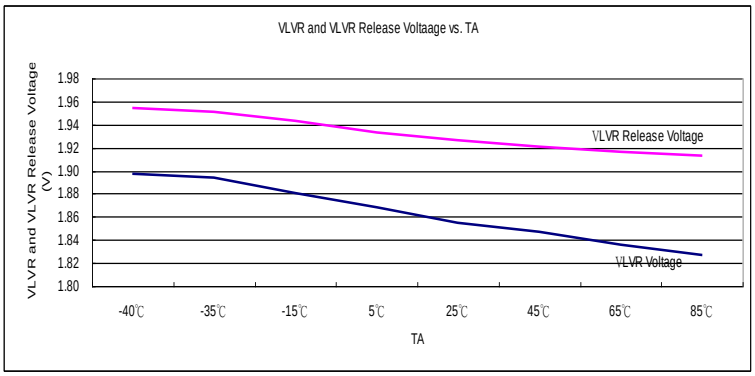


Figure6.5-3 LVR vs. Temperature

6.6 Power System

T_A = 25℃,V_{DD} = 3.0V,unless otherwise noted

Sym.	Parameter	Test Conditions		Min.	Typ.	Max.	unit
VDDA	VDDA operation current, I_{VDDA}	I_L = 0mA	VDDAX[1:0]=00b		22		uA
	Select VDDA output voltage	I_L = 0.1mA, VDD≧ VDDA+0.2V	VDDAX [1:0]=00b		3.3		V
			VDDAX [1:0]=01b		2.9		V
			VDDAX [1:0]=10b		2.6		V
			VDDAX [1:0]=11b		2.4		V
	Dropout voltage	I_L = 10mA	VDDAX [1:0]=00b		135		mV
			VDDAX [1:0]=01b		150		mV
			VDDAX [1:0]=10b		165		mV
			VDDAX [1:0]=11b		180		mV
	Temperature drift	VDDAX [1:0]=11b	T_A=-40℃~85℃		50		ppm/℃
	V_{DD} Voltage drift	I_L = 0.1mA	V_{DD}=2.5V~3.6V		±0.2		%/V
ACM	ACM operation current, I_{ACM}	I_L = 0mA			20		uA
	Output voltage ,V_{ACM}	ENACM[0]=1	I_L = 0uA		1.0		V
	Output voltage with Load		I_L = ±200uA	0.98		1.02	V_{ACM}
	Temperature drift	ENACM[0]=1, I_L = 10uA	T_A=-40℃~85℃		50		ppm/℃
	VDDA Voltage drift				100		uV/V
VDDA：Adjust Voltage Regulator ACM：Analog Common Mode Voltage							

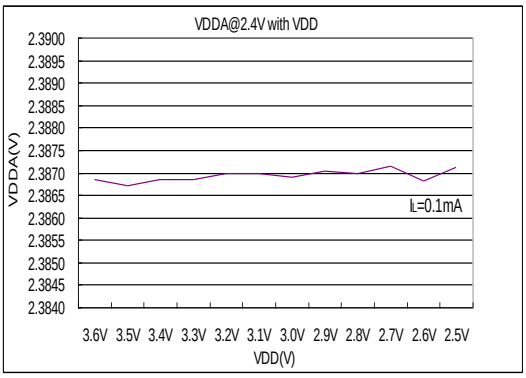


Figure6.6-1 VDDA I_L=0.1mA vs. VDD

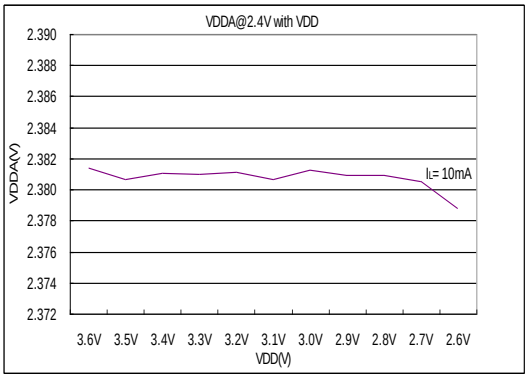


Figure6.6-2 VDDA I_L=10mA vs. VDD

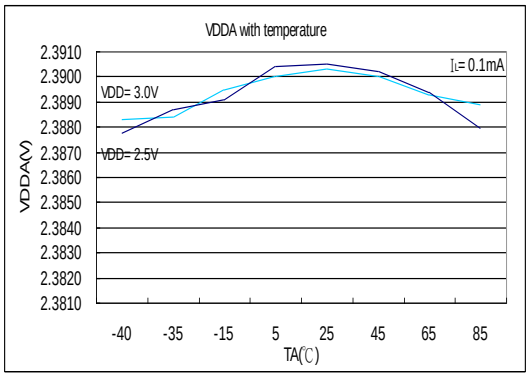


Figure6.6-3 VDDA I_L=0.1mA vs. Temperature

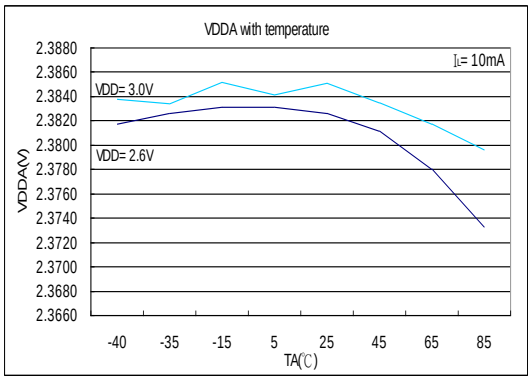


Figure6.6-4 VDDA I_L=10mA vs. Temperature

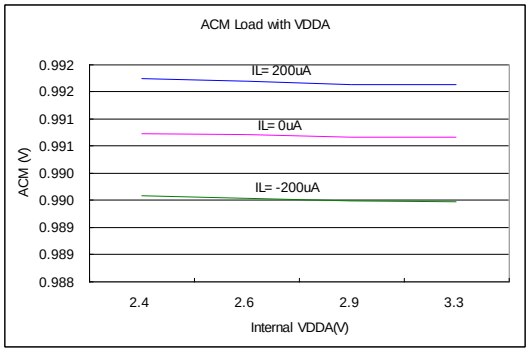


Figure6.6-5 ACM Load vs. VDDA

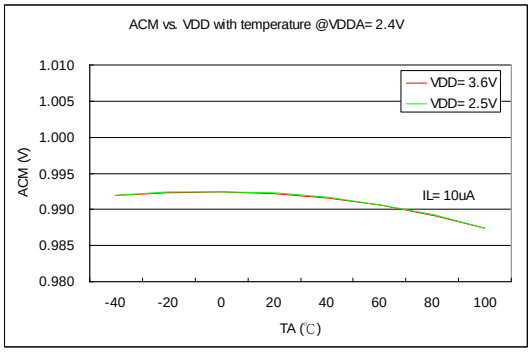


Figure6.6-6 ACM vs. Temperature

6.7 LCD

T_A = 25℃,V_{DD} = 3.0V, C_{VLCD} =4.7uF,unless otherwise noted.

Sym.	Parameter	Test Conditions		Min.	Typ.	Max.	unit
I_{LCD}	Operation supply current without output buffer.(all segment turn on)	LCDPR[0]=1	V_{DD} = 2.2V		10		uA
			V_{DD} = 3.0V				
VLCD	Supply Voltage at VLCD pin	LCDPR[0]=0		2.2		3.6	V
	Embedded Charge Pump output voltage at VLCD pin	V_{DD} = 2.2V, LCDPR[0]=1, C_{VLCD} =4.7uF	VLCDX[1:0]=11b	2.295	2.55	2.805	V
			VLCDX[1:0]=10b	2.52	2.8	3.08	
			VLCDX[1:0]=01b	2.745	3.05	3.355	
			VLCDX[1:0]=00b	2.97	3.3	3.63	
Z_{LCD}	Output impedance with LCD buffer	f_{LCD} =128Hz,VLCD=3.05V			10		kΩ

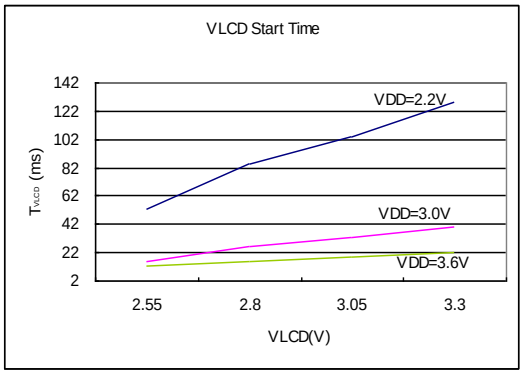


Figure6.7-1 LCD start time

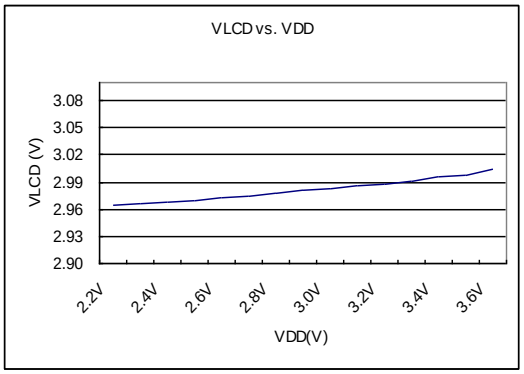


Figure6.7-2 VLCD vs. VDD

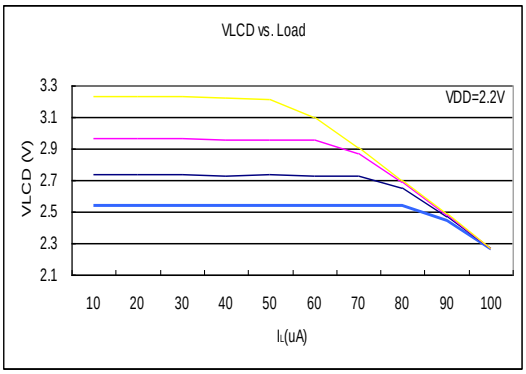


Figure6.7-3 VLCD vs. I_L @VDD=2.2V

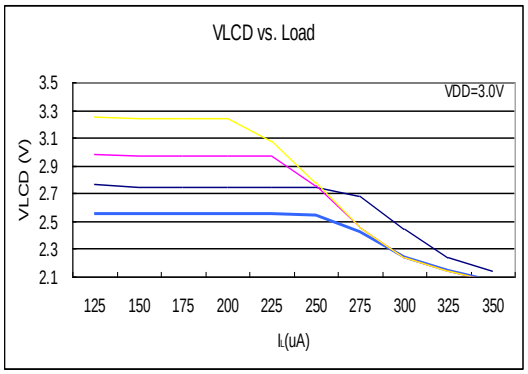


Figure6.7-4 VLCD vs. I_L @VDD=3.0V

6.8 SD18,Power Supply and recommended operating conditions

T_A = 25℃,V_{DD} = 3.0V, VDDA=2.4V,unless otherwise noted

Sym.	Parameter	Test Conditions		Min.	Typ.	Max.	unit
V_{SD18}	Supply Voltage at VDDA	ENVDDA[0]=0		2.4		3.6	V
f_{SD18}	Modulator sample frequency, ADC_CK			25	250	300	KHz
	Over Sample Ratio, OSR			256		32768	
I_{SD18}	Operation supply current without PGA	ENADC[0]=1 INBUF[0]=1,VRBUF[0]=0	GAIN =4, ADC_CK=250KHz		168		uA
		ENADC[0]=1 INBUF[0]=0,VRBUF[0]=1			150		
		ENADC[0]=1 INBUF[0]=0,VRBUF[0]=0			120		

6.8.1 PGA,Power Supply and recommended operating conditions

T_A = 25℃,V_{DD} = 3.0V, VDDA=2.4V,unless otherwise noted

Sym.	Parameter	Test Conditions		Min.	Typ.	Max.	unit
V_{PGA}	Supply Voltage at VDDA	ENVDDA[0]=0		2.4		3.6	V
I_{PGA}	Operation supply current	PGAGN[1:0]=<01>or<1x>			320		uA
G_{PGA}	Gain temperature drift	T_A = -40℃~ 85℃	GAIN=128		5		ppm/℃

6.8.2 SD18,performanceⅡ(fSD18=250KHz)

T_A = 25℃,V_{DD} = 3.0V, VDDA=2.9V,V_{VR}=1.0V,GAIN=1 without PGA, unless otherwise noted

Sym.	Parameter	Test Conditions			Min.	Typ.	Max.	unit
INL	Integral Nonlinearity(INL)	VDDA=2.4V,V_{VR}=1.0V,ΔSI=±200mV				±0.003	±0.01	%FSR
		VDDA=2.4V,V_{VR}=1.0V,ΔSI=±450mV						
	No Missing Codes[3]	ADC_CK=250KHz,OSR[2:0]=010b			23			Bits
G_{SD18}	Temperature drift **Gain 1~x16 (INBUF[0]=0b,)** **Gain 1~x4 (INBUF[0]=1b,)**	INBUF[0]=0b,VRBUF[0]=0b		T_A = -40℃~ 85℃		2		ppm/℃
		INBUF[0]=1b,VRBUF[0]=0b						
		INBUF[0]=0b,VRBUF[0]=1b						
		INBUF[0]=1b,VRBUF[0]=1b						
E_{OS}	Offset error of Full Scale Rang input voltage range with Chopper and Buffer(INBUF,VRBUF) without PGA	ΔAI=0V ΔVR=0.9V DCSET[2:0]=<000> *ΔAI is external short		Gain=2			1	%FSR
	Offset error of Full Scale Rang input voltage range with Chopper without PGA and Buffer(INBUF,VRBUF)			Gain=2			1	
	Offset temperature drift with			GAIN=1		2		uV/℃

	chopper without PGA and Buffer (INBUF,VRBUF).		GAIN=2	1	
			GAIN=4	0.5	
			GAIN=16	0.15	
	Offset temperature drift with chopper and Buffer (INBUF,VRBUF) without PGA.		GAIN=1	2	
			GAIN=2	1	
			GAIN=4	0.5	
	Offset temperature drift with chopper without Buffer (INBUF,VRBUF).		GAIN=128	0.02	
CM_{SD18}	Common-mode rejection	V_{CM}=0.7V to 1.7V, V_{VR}=1.0V,without PGA	V_{SI}=0V, GAIN=1	90	dB
		V_{CM}=0.7V to 1.7V, V_{VR}=1.0V, without PGA	V_{SI}=0V, GAIN=16	75	
PSRR	DC power supply rejection	VDDA=3.0V,ΔVDDA=±100mV, V_{VR}=1.0V, V_{SI}=1.2V,V_{SI-}=1.2V,	GAIN=1 PGA=off	75	dB
			GAIN=16 PGA=8		

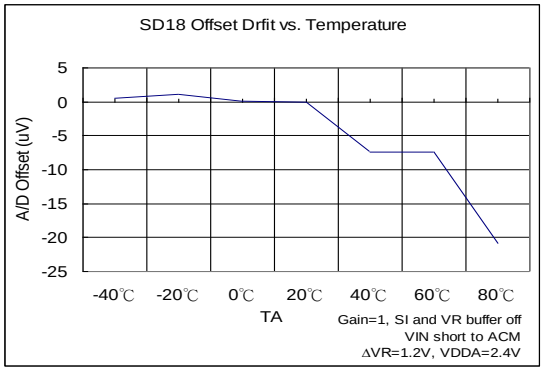


Figure6.8-1(a) SD18 Offset Temperature drift

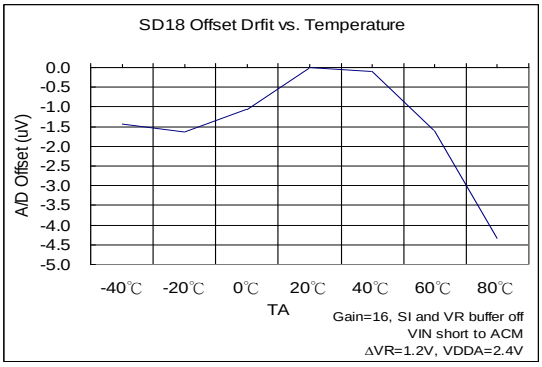


Figure6.8-1(b) SD18 Offset Temperature drift

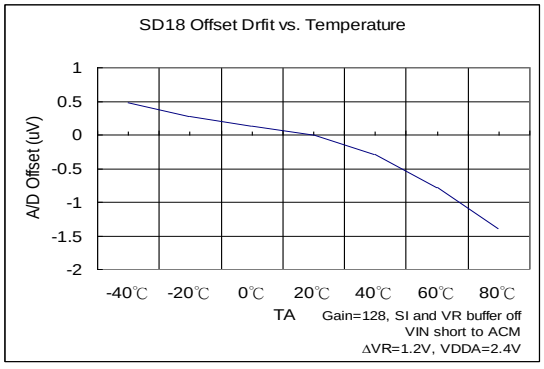


Figure6.8-1(c) SD18 Offset Temperature drift

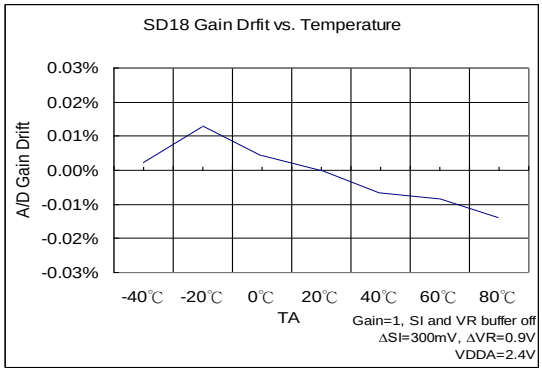


Figure6.8-2(a) SD18 Gain drift with temperature

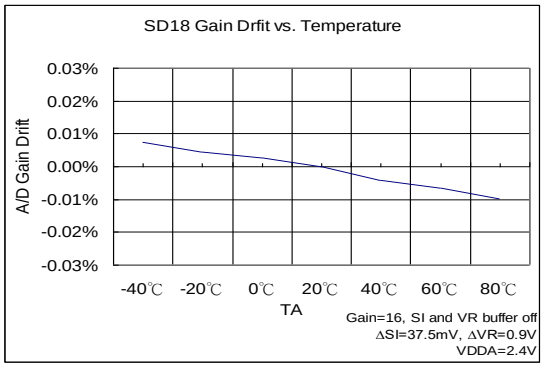


Figure6.8-2(b) SD18 Gain drift with temperature

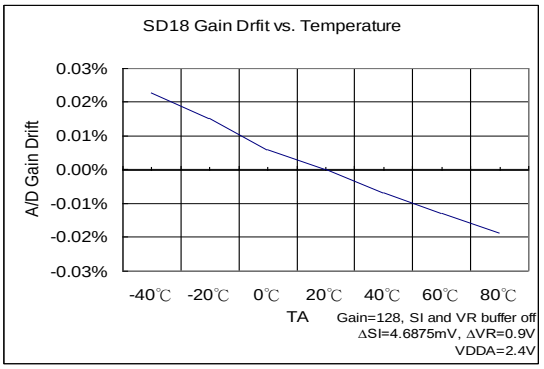


Figure6.8-2(c) SD18 Gain drift with temperature

6.8.3 SD18,Temperature sensor

T_A = 25℃,V_{DD} = 3.0V, VDDA=2.4V,unless otherwise noted

Sym.	Parameter	Test Conditions	Min.	Typ.	Max.	unit
TC_S	Sensor temperature drift	ΔVR=2.4V,VRGN[0]=1,		178		uV/℃
KT	Absolute Temperature Scale 0°K	INBUF[0]=1		-289		℃
TC_{ERR}	One point calibrate error temperature	Calibration at 25℃ of -40℃~85℃		±2		℃

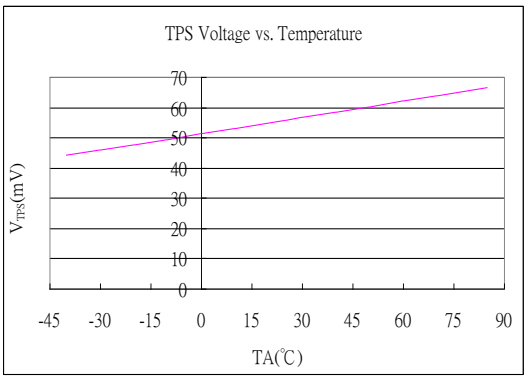


Figure6.8-3 TPS output voltage vs. temperature drift

6.8.4 SD18 Noise Performance

T_A = 25℃,V_{DD} = 3.0V, VDDA=2.4V,unless otherwise noted

HY11P12 針對 SD18 提供了重要的輸入雜訊規格。Table6.8-4(a), Table6.8-4(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。

ENOB(RMS) with OSR/GAIN at A/D Clock=250Khz, VDDA=2.4V, VREF=1.2V													
Max. Vin(mV) =0.9*VREF (1)	**OSR**					**256**	**512**	**1024**	**2048**	**4096**	**8192**	**16384**	**32768**
	Output rate(HZ)					**977**	**488**	**244**	**122**	**61**	**31**	**15**	**8**
	Gain	**=**	**PGA**	**×**	**ADGN**								
±2400	**0.25**	**=**	**1**	**×**	**0.25**	16.3	17.4	17.9	18.5	19.0	19.5	20.0	20.4
±2160	**0.5**	**=**	**1**	**×**	**0.5**	16.3	17.3	17.9	18.4	18.9	19.4	19.8	20.2
±1080	**1**	**=**	**1**	**×**	**1**	16.2	17.2	17.8	18.3	18.8	19.3	19.7	20.1
±540	**2**	**=**	**1**	**×**	**2**	16.1	17.1	17.6	18.2	18.7	19.2	19.6	20.0
±270	**4**	**=**	**1**	**×**	**4**	16.0	16.9	17.5	18.0	18.5	18.9	19.4	19.8
±135	**8**	**=**	**1**	**×**	**8**	15.9	16.6	17.2	17.7	18.2	18.7	19.2	19.6
±68	**16**	**=**	**1**	**×**	**16**	15.6	16.3	16.8	17.3	17.7	18.3	18.8	19.3
±34	**32**	**=**	**2**	**×**	**16**	14.8	15.3	15.9	16.4	16.9	17.4	17.8	18.3
±17	**64**	**=**	**4**	**×**	**16**	14.5	15.0	15.5	16.0	16.5	17.0	17.5	18.0
±8	**128**	**=**	**8**	**×**	**16**	14.0	14.6	15.1	15.6	16.0	16.6	17.0	17.5

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

Table6.8-4(a) SD18 ENOB Table

RMS Noise(uV) with OSR/GAIN at A/D Clock=250Khz, VDDA=2.4V, VREF=1.2V													
Max. Vin(mV) =0.9*VREF	**OSR**					**256**	**512**	**1024**	**2048**	**4096**	**8192**	**16384**	**32768**
	Output rate(HZ)					**977**	**488**	**244**	**122**	**61**	**31**	**15**	**8**
	Gain	**=**	**PGA**	**×**	**ADGN**								
±2400	**0.25**	**=**	**1**	**×**	**0.25**	121.08	57.40	38.74	26.66	18.39	13.21	9.49	6.98
±2160	**0.5**	**=**	**1**	**×**	**0.5**	61.63	29.23	19.21	13.51	9.78	7.02	5.12	3.91
±1080	**1**	**=**	**1**	**×**	**1**	32.21	15.70	10.25	7.31	5.19	3.77	2.80	2.13
±540	**2**	**=**	**1**	**×**	**2**	16.59	8.54	5.91	4.06	2.86	2.06	1.48	1.12
±270	**4**	**=**	**1**	**×**	**4**	9.00	4.84	3.33	2.37	1.67	1.19	0.87	0.65
±135	**8**	**=**	**1**	**×**	**8**	5.04	2.97	2.02	1.44	1.01	0.73	0.51	0.39
±68	**16**	**=**	**1**	**×**	**16**	3.03	1.84	1.29	0.92	0.70	0.46	0.33	0.24
±34	**32**	**=**	**2**	**×**	**16**	2.61	1.81	1.27	0.89	0.62	0.45	0.32	0.23
±17	**64**	**=**	**4**	**×**	**16**	1.66	1.13	0.80	0.56	0.41	0.29	0.20	0.14
±8	**128**	**=**	**8**	**×**	**16**	1.13	0.77	0.55	0.38	0.28	0.19	0.14	0.10

Table6.8-4(b) SD18 RMS Noise Table

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

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

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

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

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

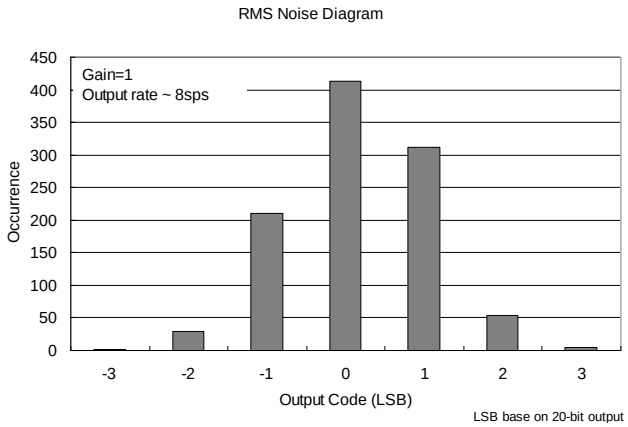


Figure6.8-4(a) RMS Noise Diagram

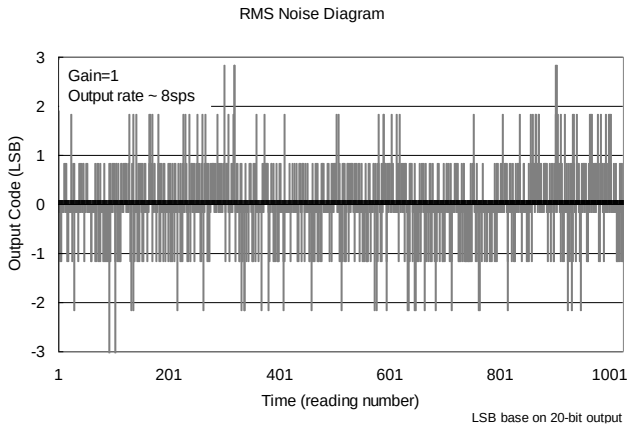


Figure6.8-4(b) Output Code Diagram

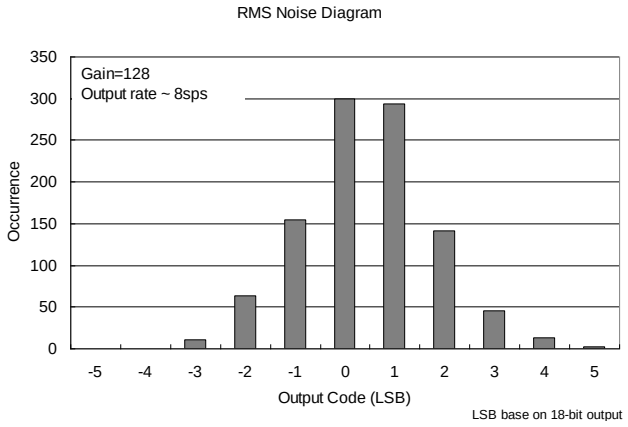


Figure6.8-4(c) RMS Noise Diagram

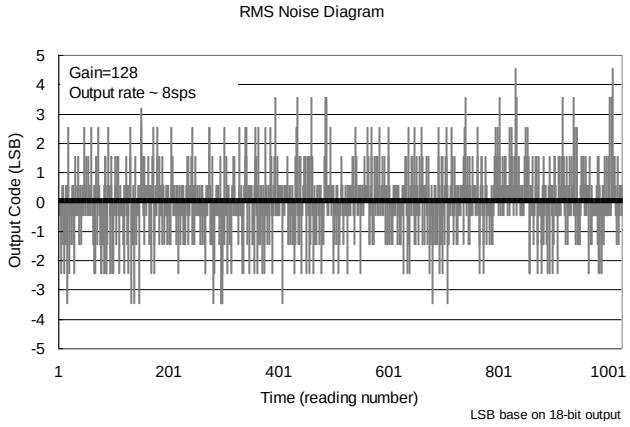


Figure6.8-4(d) Output Code Diagram

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]				
HY11P12-D000	Die	-	D	000	000	-	200	Green[4]	-
HY11P12-L044	LQFP	44	L	044	000	Tray	160	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 HY11P12-D000-008

例如：您的需求是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 HY11P12-D000

例如：您的需求是不帶程式碼的空白片且需要的產品是封裝片 LQFP44 出貨，則下單品名為 HY11P12-L044，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

[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。

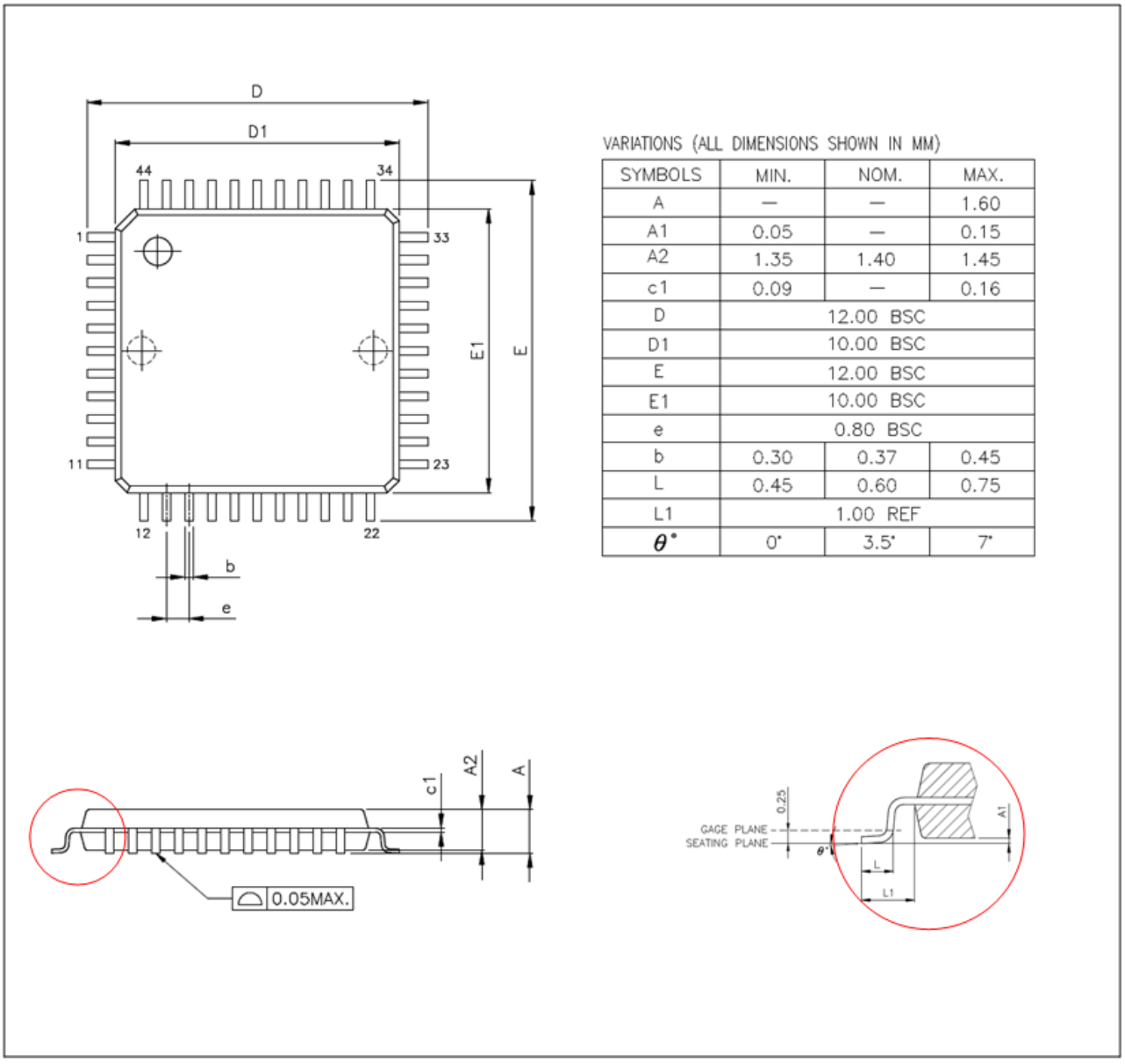
[4] **Green (RoHS & no Cl/Br):**

HYCON 產品皆為 Green Product，符合 RoHS 指令，REACH 高關注物質(SVHC)以及無鹵素相關規定。

8. 封裝型式資訊

8.1 LQFP44(L044)

8.1.1 Package Dimensions



VARIATIONS (ALL DIMENSIONS SHOWN IN MM)

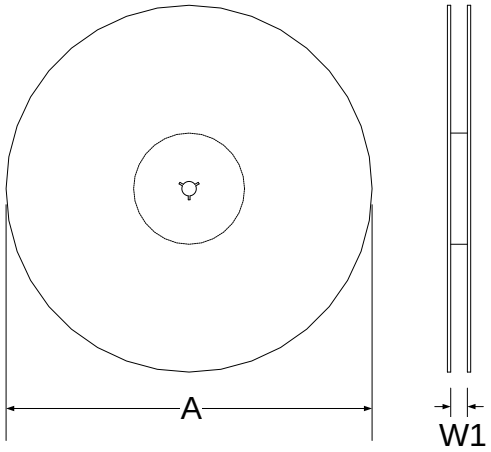
SYMBOLS	MIN.	NOM.	MAX.
A	—	—	1.60
A1	0.05	—	0.15
A2	1.35	1.40	1.45
c1	0.09	—	0.16
D		12.00 BSC	
D1		10.00 BSC	
E		12.00 BSC	
E1		10.00 BSC	
e		0.80 BSC	
b	0.30	0.37	0.45
L	0.45	0.60	0.75
L1		1.00 REF	
θ°	0°	3.5°	7°

JEDEC MS-026 compliant

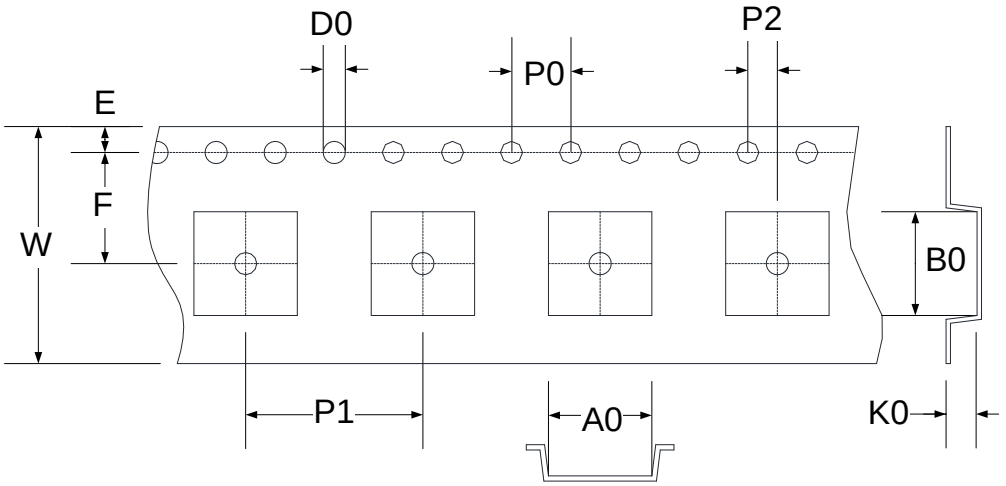
8.2 Tape & Reel Information

8.2.1 Reel Dimensions –Type1

Unit : mm



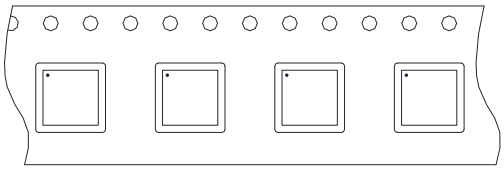
8.2.2 Carrier Tape Dimensions



SYMBOLS	Reel Dimensions		Carrier Tape Dimensions									
	A	W1	A0	B0	K0	P0	P1	P2	E	F	D0	W
Spec.	330	16.5	6.30	6.30	1.10	4.00	12.00	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

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

8.2.3 Pin1 direction



9. 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	頁次	變更摘要
V01	ALL	初版發行
V02	ALL	全面變更內容
V03	5～10	第 2、3、4 章節順序調整
	17	修訂 6.5 章節；移除關於 LVD 描述外部輸入比較電壓的規格以符合實際產品功能。
	24	修訂 7 章節；轉為中文資訊且編修欄位與內容
	26	新增 9 章節；文件修訂記錄
V04	4	修訂 48 個指令成 46 個指令，特點內容修改
	14	調整電流規格
	21	增加 G_{SD18}Temperature Drift 內容說明
V05	4	修訂特點內容
	6	修訂 I/O 定義與說明內容
	10	修訂暫存器列表
	17	修訂 Reset 內容
	19	修訂 Power System 內容
	20	修訂 Figure6.6-5, Figure6.6-6 ACM Chart
V06	6~7	修訂章節內容
	8~9	修訂電路圖
	22~24	修訂章節內容
V07	11	修訂章節內容
V08	1	修訂標題文字
	5	修訂引腳圖，增加 LVDIN 引腳
	8~9	修訂應用電路圖，增加 LVDIN 引腳
V09	4	修訂特點內容，刪除 1/2bias 說明
	5	增加註 3 內容說明
	8~9	修訂應用電路圖，增加 RST 的 RC 電路
	10	增加內部方塊圖中 LVDIN 引腳
V10	11	增加 SD18 Network 章節
	20	修訂 Power System 溫飄規格
	26~27	增加 SD18 Noise Performance 章節
V11	5	修改 1.特點內容
	9	修改圖 3-2 內容

	14	修改 6.電氣特性內容
	28	修改 RMS Noise Diagram
V12	3	刪除空白頁
	22	修改 I_{LCD} 電流規格
V13	6	增加 LQFP48 引腳圖
	12	修改圖 4-2 INH/INL
	30	增加訂貨資訊
	32	增加封裝型式資料
V14	11	修改開發工具相關使用說明書編號
	30	增加訂貨資訊內容
V15	8	增加 QFN48 引腳圖
	11~12	增加 I/O 定義與說明(LQFP48/QFN48)
	34	增加訂貨資訊
	37	增加封裝型式資訊
V16	13	新增封裝型式與正印說明
	35	更新 Green (RoHS & no Cl/Br)
	39	新增 Tape & Reel Information
V17	5	新增功能列表
	31	刪除封裝 LQFP48 與 QFN48