



HY11P33
Datasheet
8-Bit RISC-like Mixed Signal Microcontroller
Embedded 4x20 LCD Driver
18-Bit Σ ADC

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1. 特點

- 8 位元加強型精簡指令集，共有 66 個指令
包含硬體乘法指令及查表指令
- 2.2V to 3.6V 工作電壓範圍，-40~85°C 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
- 4KWord OTP (One Time Programmable)
Type 程式記憶體，256Byte 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 $\Sigma\Delta$ ADC 類比數位轉換器
 - 內置 PGA (Programmable Gain
Amplifier) 及可有 1/4、1/2、1、.....128
倍多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
- 可選擇不同的數據輸出速率，最高可
達 1.95ksps
- 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 具 10mA 穩壓電壓源輸
出能力
- 4x20 LCD 液晶驅動器
 - 1/4 Duty、1/3 Bias
 - 內建 Charge Pump 穩壓線路，可提供
4 種 LCD 偏壓
- 8-bit Timer A
- 8-bit Timer C 模組具 PWM/PFD 波形產生
功能
- Built-In EPROM (BIE)
- Support 6 stack level.

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Embedded 18-Bit $\Sigma\Delta$ ADC
8-Bit RISC-like Mixed Signal Microcontroller

2. 引腳定義

2.1 HY11P33 LQFP64 引腳圖

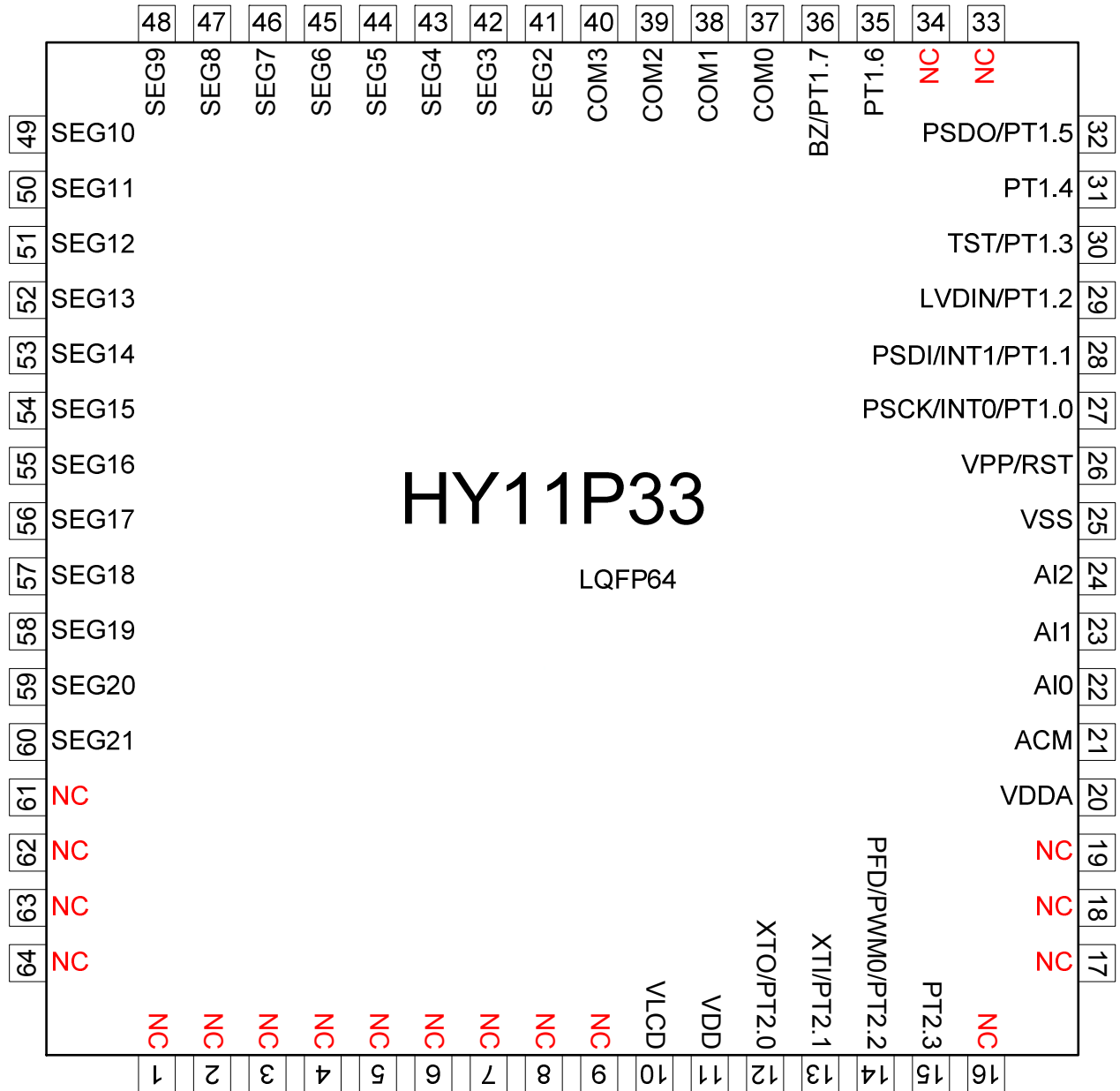


圖 2-1 HY11P33 LQFP64 引腳圖

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 HY11P33 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

編號	引腳名稱	引腳特性		功能說明
	HY11P33	緩衝	緩衝	
1	NC	O	A	LCD 的 Segment 輸出
2	NC	O	A	LCD 的 Segment 輸出
3	NC	O	A	LCD 的 Segment 輸出
4	NC	O	A	LCD 的 Segment 輸出
5	NC	O	A	LCD 的 Segment 輸出
6	NC	O	A	LCD 的 Segment 輸出
7	NC	O	A	LCD 的 Segment 輸出
8	NC	O	A	LCD 的 Segment 輸出
9	NC	-	-	未使用
10	VLCD	P	P	LCD 的電壓源
11	VDD	P	P	晶片工作電壓源
12	PT2.0/XTO	I/O	S	數位輸入/輸出
		A	A	外接振盪器輸出端
13	PT2.1/XTI	I/O	S	數位輸入/輸出
		A	A	外接振盪器輸入端
14	PT2.2/PWM0/PFD	I/O	C	數位輸入/輸出
		O	C	PWM 輸出接口
		O	C	PFD 輸出接口
15	PT2.3	I/O	S	數位輸入/輸出
16	NC	-	-	未使用
17	NC	-	-	未使用
18	NC	-	-	未使用
19	NC	-	-	未使用
20	VDDA	P	P	穩壓器輸出,類比電路電壓源
21	ACM	P	P	內部類比電路共地引腳
22	AI0	A	A	類比輸入通道
23	AI1	A	A	類比輸入通道
24	AI2	A	A	類比輸入通道
25	VSS	P	P	晶片工作電壓源接地端

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26	RST/VPP	I P	S P	復位晶片 EPROM 讀/寫時的電壓源
27	PT1.0/INT0/PSCK	I I I	S S S	數位輸入 中斷源 INT0 OTP 讀/寫介面 SCK 接口
28	PT1.1/INT1/PSDI	I I I	S S S	數位輸入 中斷源 INT1 OTP 讀/寫介面 SDI 接口
29	PT1.2/LVDIN	I A	S A	數位輸入 LVD 外部信號輸入接口
30	PT1.3/TST	I I	S S	數位輸入 測試模式致能輸入（未開放）
31	PT1.4	I/O	S	數位輸入/輸出
32	PT1.5/PSDO	I/O O	S C	數位輸入/輸出 OTP 讀/寫介面 SDO 接口
33	NC	-	-	未使用
34	NC	-	-	未使用
35	PT1.6	I/O	S	數位輸入/輸出
36	PT1.7/BZ	I/O O	S C	數位輸入/輸出 蜂鳴器輸出端
37	COM0	O	A	LCD 的 COM 輸出
38	COM1	O	A	LCD 的 COM 輸出
39	COM2	O	A	LCD 的 COM 輸出
40	COM3	O	A	LCD 的 COM 輸出
41	SEG2	O	A	LCD 的 Segment 輸出
42	SEG3	O	A	LCD 的 Segment 輸出
43	SEG4	O	A	LCD 的 Segment 輸出
44	SEG5	O	A	LCD 的 Segment 輸出
45	SEG6	O	A	LCD 的 Segment 輸出

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46	SEG7	O	A	LCD 的 Segment 輸出
47	SEG8	O	A	LCD 的 Segment 輸出
48	SEG9	O	A	LCD 的 Segment 輸出
49	SEG10	O	A	LCD 的 Segment 輸出
50	SEG11	O	A	LCD 的 Segment 輸出
51	SEG12	O	A	LCD 的 Segment 輸出
52	SEG13	O	A	LCD 的 Segment 輸出
53	SEG14	O	A	LCD 的 Segment 輸出
54	SEG15	O	A	LCD 的 Segment 輸出
55	SEG16	O	A	LCD 的 Segment 輸出
56	SEG17	O	A	LCD 的 Segment 輸出
57	SEG18	O	A	LCD 的 Segment 輸出
58	SEG19	O	A	LCD 的 Segment 輸出
59	SEG20	O	A	LCD 的 Segment 輸出
60	SEG21	O	A	LCD 的 Segment 輸出
61	NC	O	A	LCD 的 Segment 輸出
62	NC	O	A	LCD 的 Segment 輸出
63	NC	O	A	LCD 的 Segment 輸出
64	NC	O	A	LCD 的 Segment 輸出

表 2-1 引腳定義與功能說明

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Embedded 18-Bit $\Sigma\Delta$ ADC
8-Bit RISC-like Mixed Signal Microcontroller

3. 應用電路

3.1 橋式感測器 I

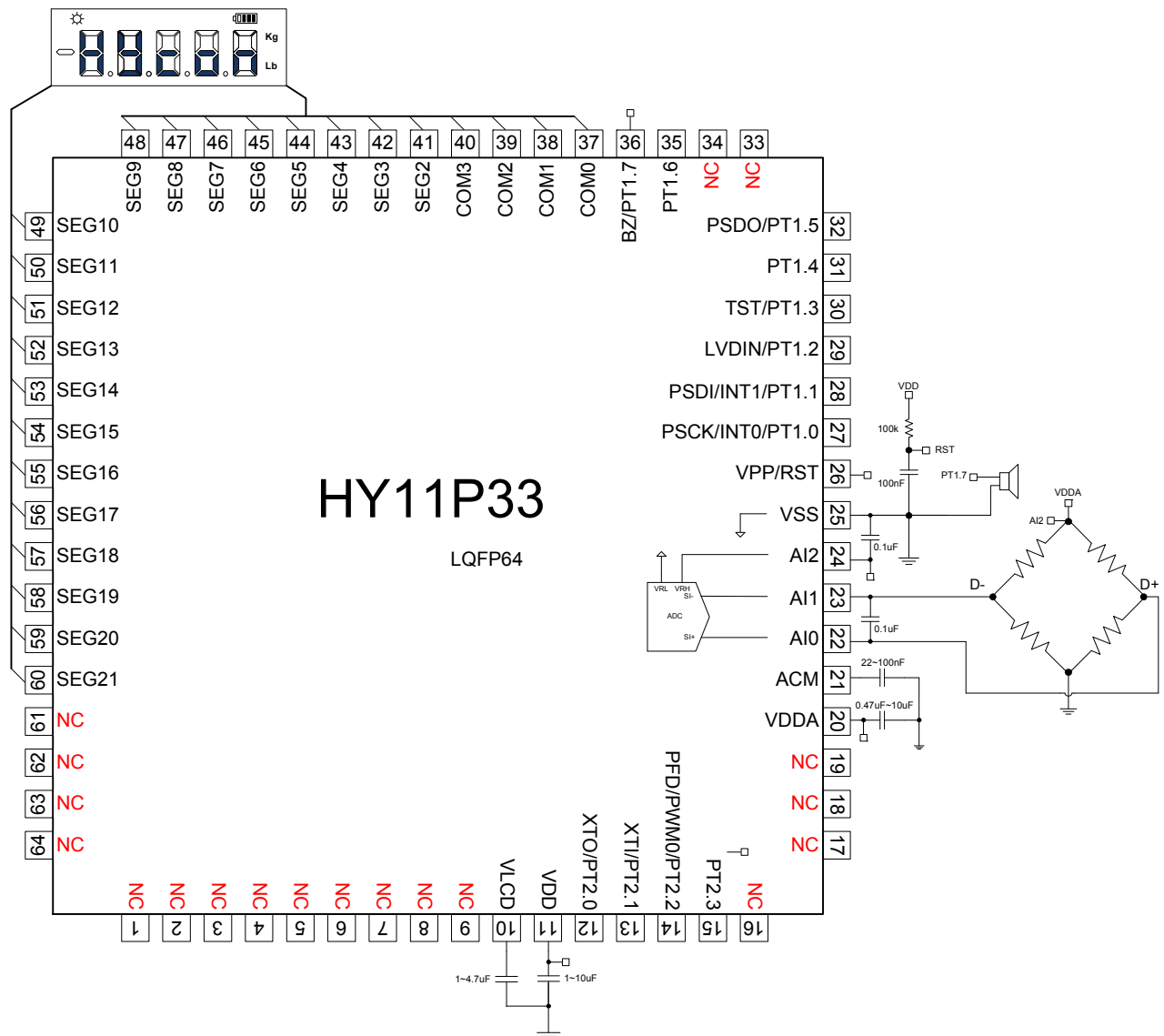
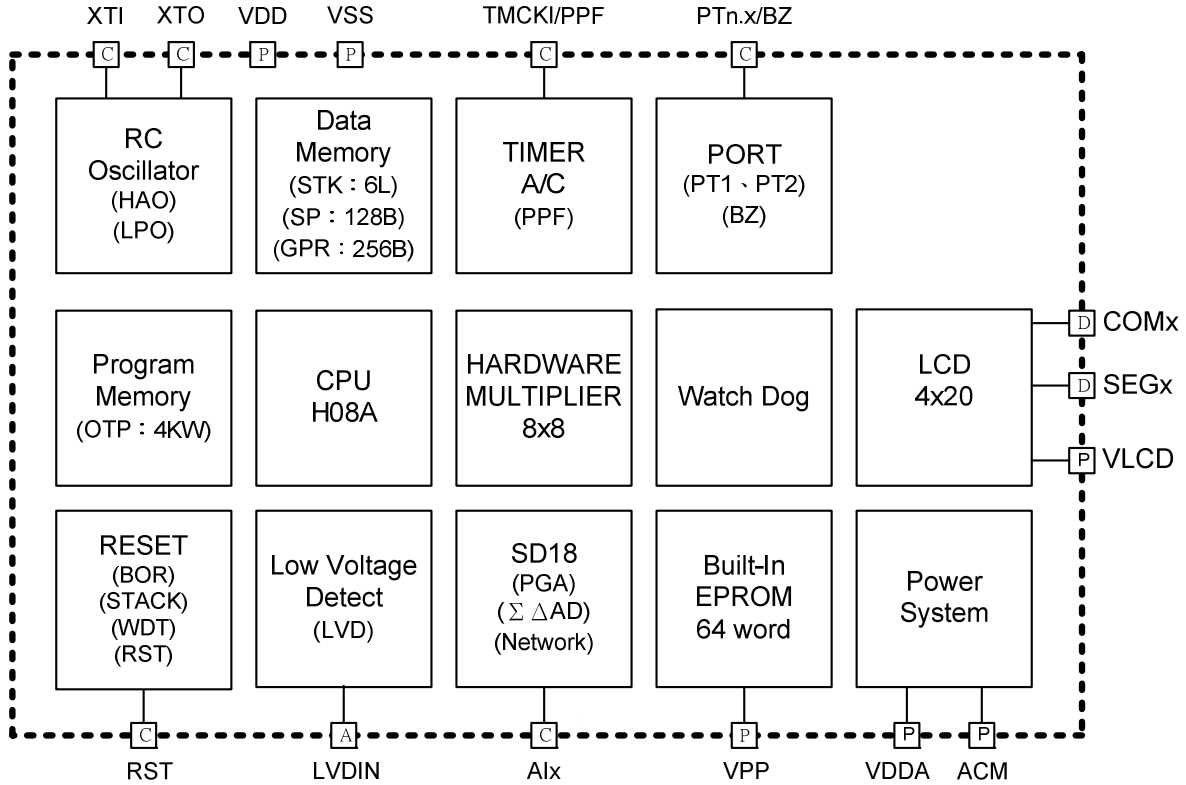


圖 3-1 橋式感測器應用電路

註：Load Cell 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 内部方块圖



P Power Pad
 D Digital Pad
 A Analog Pad
 C Common I/O Pad

圖 4-1 HY11P33 内部方块圖

4.2 相關說明與支援文件

晶片功能相關使用說明書

DS-HY11P33-Vxx	HY11P33 說明書
UG-HY11S14-Vxx	HY11Pxx 系列使用說明書
APD-CORE002-Vxx	H08A 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-HY11P33-Vxx	HY11P33 個別產品的裸片打線資訊

4.3 SD18 Network

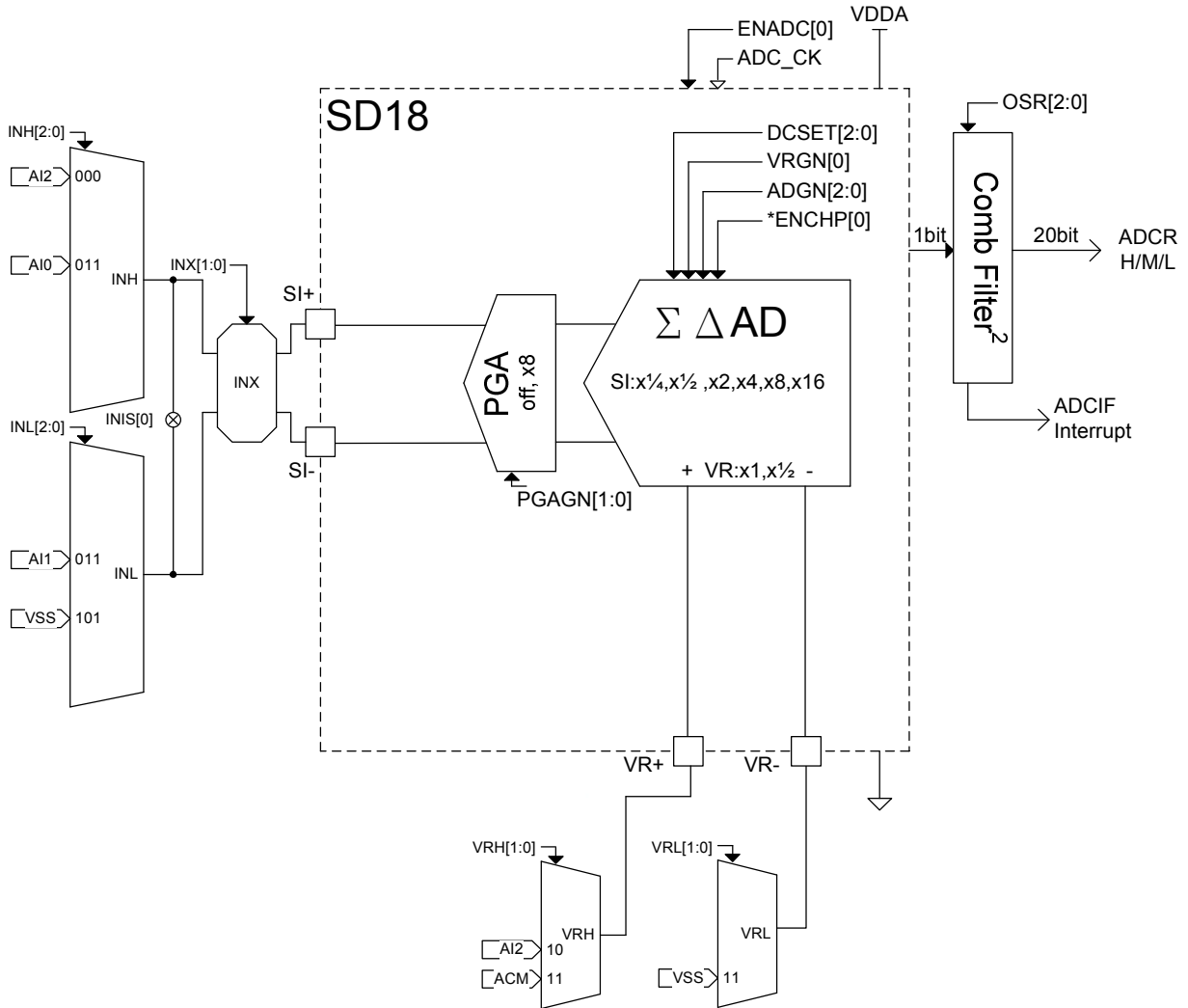


圖 4-2 SD18 Network

5. 暫存器列表

"0"no use,"**"read/write,"w"write,"r"read,"r0"only read 0,"r1"only read 1,"w0"only write 0,"w1"only write 1 "u"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	*****											
01H	POINC0	Contents of FSR0 to address data memory value of FSR0 post-incremented								N/A	N/A	*****											
02H	PODEC0	Contents of FSR0 to address data memory value of FSR0 post-decremented								N/A	N/A	*****											
03H	PRINC0	Contents of FSR0 to address data memory value of FSR0 pre-incremented								N/A	N/A	*****											
04H	PLUSW0	Contents of FSR0 to address data memory value of FSR0 offset by W								N/A	N/A	*****											
05H	INDF1	Contents of FSR1 to address data memory value of FSR0 not changed								N/A	N/A	*****											
06H	POINC1	Contents of FSR1 to address data memory value of FSR0 post-incremented								N/A	N/A	*****											
07H	PODEC1	Contents of FSR1 to address data memory value of FSR0 post-decremented								N/A	N/A	*****											
08H	PRINC1	Contents of FSR1 to address data memory value of FSR0 pre-incremented								N/A	N/A	*****											
09H	PLUSW1	Contents of FSR1 to address data memory value of FSR0 offset by W								N/A	N/A	*****											
0FH	FSR0H									FSR0[8]xu	*****										
10H	FSR0L	Indirect Data Memory Address Pointer 0 Low Byte,FSR0[7:0]								xxxx xxxx	uuuu uuuu	*****											
11H	FSR1H									FSR1[8]xu	*****										
12H	FSR1L	Indirect Data Memory Address Pointer 1 Low Byte,FSR1[7:0]								xxxx xxxx	uuuu uuuu	*****											
16H	TOSH									TOS[11]	TOS[10]	TOS[9]	TOS[8]00000000	*****							
17H	TOSL	Top-of-Stack Low Byte (TOS<7:0>)								0000 0000	0000 0000	*****											
18H	STKPTR	STKFL	STKUN	STKOV	STKPRT[2:0]								000_000	000_000	r,rw,rw0_~r,r,r								
1AH	PCLATH	PC[11]								PC[10]	PC[9]	PC[8]00000000	*****								
1BH	PCLATL	PC Low Byte for PC<7:0>								0000 0000	0000 0000	*****											
1DH	TBLPTRH	TBLPTR[11]								TBLPTR[10]	TBLPTR[9]	TBLPTR[8]00000000	*****								
1EH	TBLPTRL	Program Memory Table Pointer Low Byte (TBLPTR<7:0>)								0000 0000	0000 0000	*****											
1FH	TBLDH	Program Memory Table Latch High Byte								0000 0000	0000 0000	*****											
20H	TBLDL	Program Memory Table Latch Low Byte								0000 0000	0000 0000	*****											
21H	PRODH	Product Register of Multiply High Byte								xxxx xxxx	uuuu uuuu	r,r,r,r,r,r,r											
22H	PRODL	Product Register of Multiply Low Byte								xxxx xxxx	uuuu uuuu	r,r,r,r,r,r,r											
23H	INTE1	GIE	ADCIE	TMCIE	TMAIE								WDTIE	E1IE	E0IE	000_0000	000_0000	*****					
26H	INTF1	ADCIF								TMCIF	TMAIF	WDTIF	E1IF	E0IF	.00_0000	.00_0000	*****						
29H	WREG	Working Register								xxxx xxxx	uuuu uuuu	*****											
2AH	BSRCN									BSR[0]00	*****										
2BH	STATUS	C								DC	N	OV	Zxxxxuuuu	*****							
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_0000	*****	
30H	PWRCN	ENVDDA	VDDAX[1:0]=11								ENACM									0xx0_....	0xx0_....	*****	
31H	MCKCN1	ADCS[2:0]								ADCK	XTHSP	XTSP	ENXT	ENHAO	0000_0001	0000_0001	*****						
32H	MCKCN2	LSCCK								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											
3AH	ADCRM	ADC conversion memory Middle Byte								xxxx xxxx	uuuu uuuu	r,r,r,r,r,r,r											
3BH	ADCRL	ADC conversion memory Low Byte								0	0	0	0	xxxx_0000	uuuu_0000	r,r,r,r,r0,r0,r0							
3CH	ADCCN1	ENADC	ENCHP								PGAGN[1:0]	ADGN[2:0]								0.00_0000	0.00_0000	*****	
3DH	ADCCN2	INBUF=0								VRBUF=0	VREGN	DCSET[2:0]								..xx_0000	..xx_0000	*****	
3EH	ADCCN3	OSR[2:0]								OSR[3]								000_..0	000_..0	*****			
3FH	AINET1	INH[2:0]=XX0 or XX1(AI2 or AI0)								INL[2:0]=0XX or 1XX(AI1 or VSS)								INIS	xx00_xx0x	xx00_xx0x	*****		
40H	AINET2	VRH[1:0]=X0 or X1(AI2 or ACM)								INX[1:0]	VRL[1:0]=11(VSS)								xx00_xx0x	xx00_xx0x	*****		
41H	TMACN	ENTMA	TMACK	TMAS[1:0]								ENWDT	WDT[2:0]								0000_0000	0000_0000	***** w1,***
42H	TMAR	TimerA data register								xxxx xxxx	uuuu uuuu	r,r,r,r,r,r,r											
46H	TMCCN	ENTMC	TMCC[1:0]								TMCS[1:0]								0000_0000	0000_0000	*****		
47H	PRC	TimerC programmable register								1111_1111	1111_1111	*****											
48H	TMCR	TimerC register								0000_0000	0000_0000	r,r,r,r,r,r,r											
4FH	PWMCN	ENPWM	ENPFD	PWMRL[1:0]								0000_....	0000_....	*****									
51H	PWMR	PWM MSB Byte register								xxxx xxxx	uuuu uuuu	*****											
52H	LCDCN1	ENLCD	LC DPR	VLCDX[1:0]								LCDBF	LCDBI[1:0]=10								0000_0xxx	0000_0xxx	*****
53H	LCDCN2	LCDBL	LCDMX[1:0]=11								0xxx_0xxx	0xxx_0xxx	*****										
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	*****											
5AH	LCD6	Segment SEG14@[3:0] and SEG15@[7:4] data register of LCD								xxxx xxxx	uuuu uuuu	*****											
5BH	LCD7	Segment SEG16@[3:0] and SEG17@[7:4] data register of LCD								xxxx xxxx	uuuu uuuu	*****											
5CH	LCD8	Segment SEG18@[3:0] and SEG19@[7:4] data register of LCD								xxxx xxxx	uuuu uuuu	*****											
5DH	LCD9	Segment SEG20@[3:0] and SEG21@[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_....	*****							
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]							00000000	*****			
72H	PT1M2	PM1_7[0]								0_....	0_....	*****											
74H	PT2									PT2.3	PT2.2	PT2.1	PT2.0xxxxuuuu	*****							
75H	TRISC2									TC2.3	TC2.2	TC2.1	TC2.000000000	*****							
77H	PT2PU									PU2.3	PU2.2	PU2.1	PU2.000000000	*****							
78H	PT2M1	PM2_2[1]								PM2_2[0]	.00_....	.00_....	*****										
80H ~ FFH	GPR0	General Purpose Register as 128Byte								xxxx xxxx	uuuu uuuu	*****											
100H~17FH	GPR1	General Purpose Register as 128Byte								xxxx xxxx	uuuu uuuu	*****											

圖 5-1a HY11P33 暫存器列表

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"r" no use, "w" read/write, "w" write, "r" read, "r0" only read 0, "r1" only read 1, "w0" only write 0, "w1" only write 1
"u" 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
195H	BICTRL					VPP_HIGH		BIEWR	BIERD	1000 d000	1000 d000	- - - - *r0***
197H	BIEPTRL	0	0			BIE_ADDR[5:0]				0000 0000	0000 0000	w0,w0,*****
198H	BIEDH	BIE_DATA[15:8]								xxxx xxxx	xxxx xxxx	*****
199H	BIEDL	BIE_DATA[7:0]								xxxx xxxx	xxxx xxxx	*****

圖 5-1b HY11P33 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°C to 150°C
(programmed device)	-40°C to 85°C
Total power dissipation	0.5w
Maximum output current sink by any PORT1 to PORT2 I/O pin	25mA

6.1 Recommended operating conditions

$T_A = -40^\circ\text{C} \sim 85^\circ\text{C}$, 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	Watch crystal	$V_{DD} = 2.2\text{V}$, ENXT[0]=1	XTSP[0]=0, XTHSP[0]=0	32.768K		Hz	
	Oscillator	Ceramic resonator		XTSP[0]=1, XTHSP[0]=0	450K	8M		
	Frequency	Crystal		XTSP[0]=1, XTHSP[0]=0	1M	8M		

6.2 Internal RC Oscillator

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

Sym.	Parameter	Test Conditions	Min.	Typ.	Max.	unit
HAO	High Speed Oscillator frequency	ENHAO[0]=1	1.6	2.0	2.4	MHz
LPO	Low Power Oscillator frequency	V _{DD} supply voltage be enable LPO	22	28	35	KHz

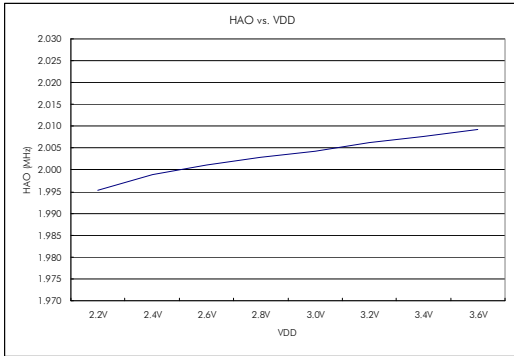


Figure 6.2-1 HAO vs. VDD

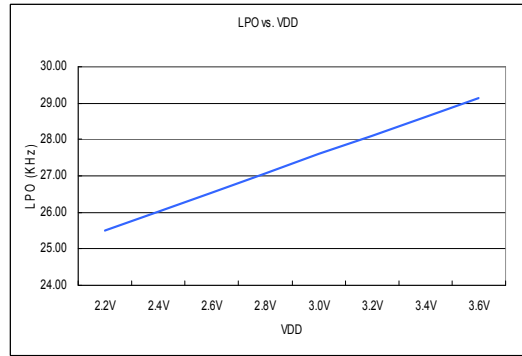


Figure 6.2-2 LPO vs. VDD

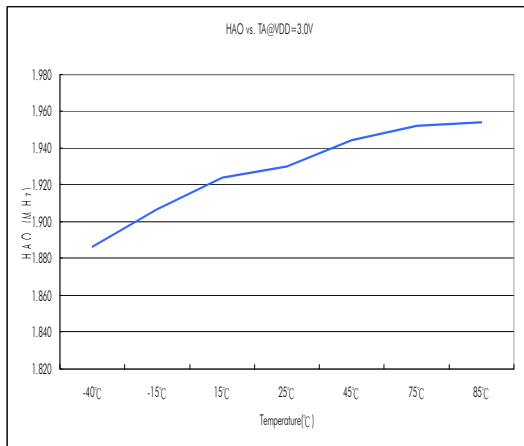


Figure 6.2-3 HAO vs. Temperature

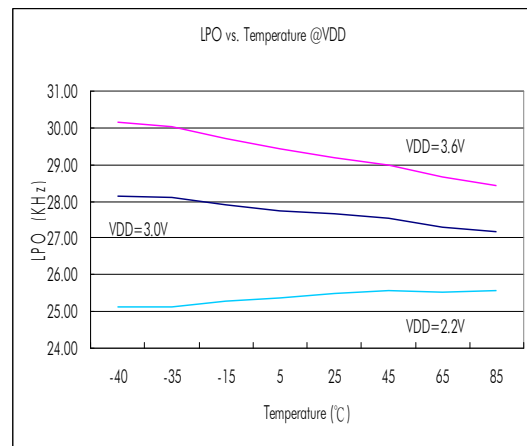


Figure 6.2-4 LPO vs. Temperature

6.3 Supply current into VDD excluding peripherals current

$T_A = 25^\circ\text{C}, V_{DD} = 3.0\text{V}, \text{OSC_LPO} = 28\text{KHz}$, 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	2	mA
I_{AM2}	Active mode 2	OSC_CY = off, OSC_HAO = 2MHz, CPU_CK = 2MHz		0.32	0.55	mA
I_{AM3}	Active mode 3	OSC_CY = off, OSC_HAO = 2MHz, CPU_CK = 1MHz		0.18	0.3	mA
I_{LP1}	Low Power 1	OSC_CY = 32768Hz, OSC_HAO = off, CPU_CK = 16384Hz		7	12	μA
I_{LP2}	Low Power 2	OSC_CY = off, OSC_HAO = off, CPU_CK = LPO, Idle state		1.65	3	μA
I_{LP3}	Low Power 3	OSC_CY = off, OSC_HAO = off, CPU_CK = off, Sleep state		0.65	1.2	μA

OSC_CY : External Oscillator frequency.

OSC_HAO : Internal High Accuracy Oscillator frequency.

CPU_CK : CPU core work frequency.

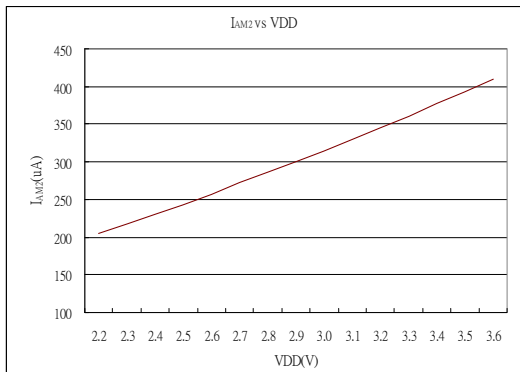


Figure 6.3-1 I_{AM2} vs. VDD

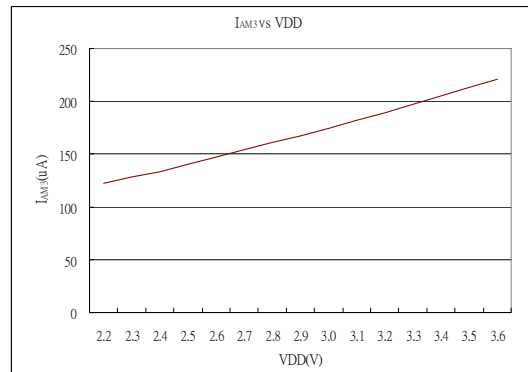


Figure 6.3-2 I_{AM3} vs. VDD

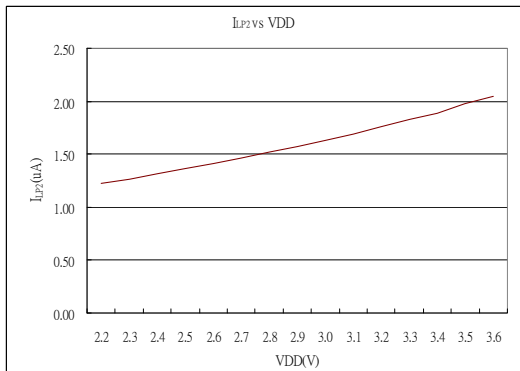


Figure 6.3-3 I_{LP2} vs. VDD

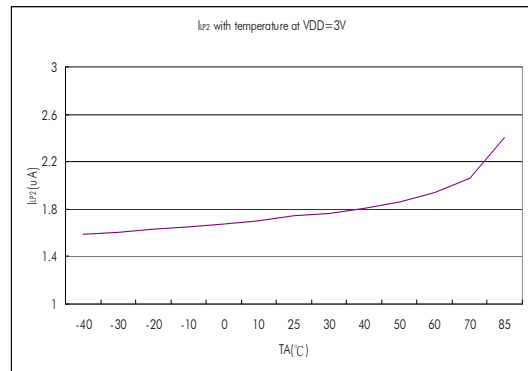


Figure 6.3-4 I_{LP2} vs. Temperature

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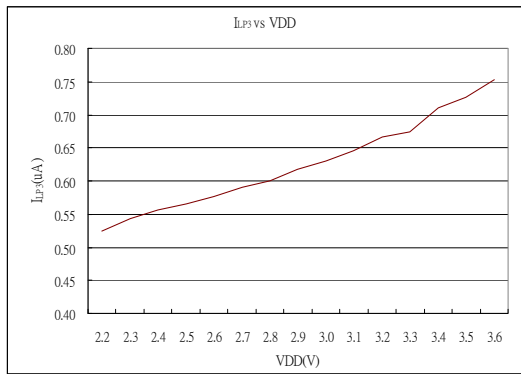


Figure 6.3-5 I_{LP3} vs. VDD

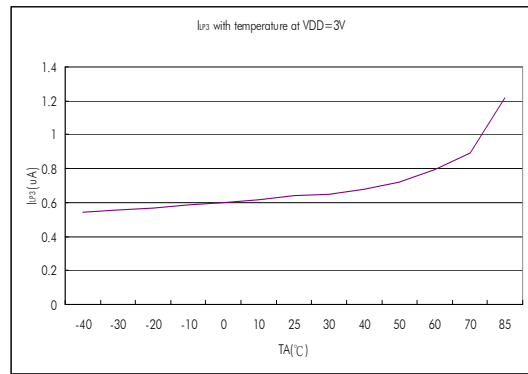


Figure 6.3-6 I_{LP3} vs. Temperature

6.4 Port1~2

T_A = 25°C, 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(V _{IH} - V _{IL})			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			V _{SS} +0.3	

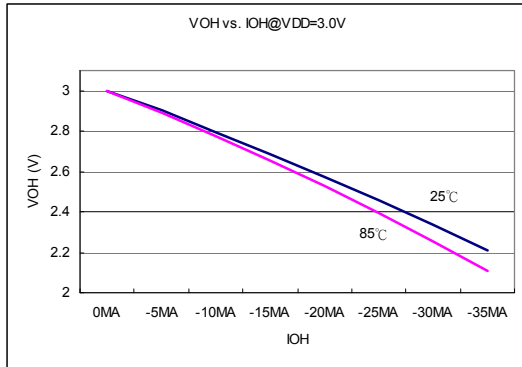


Figure 6.4-1 V_{OH} vs. I_{OH} @V_{DD}=3.0V

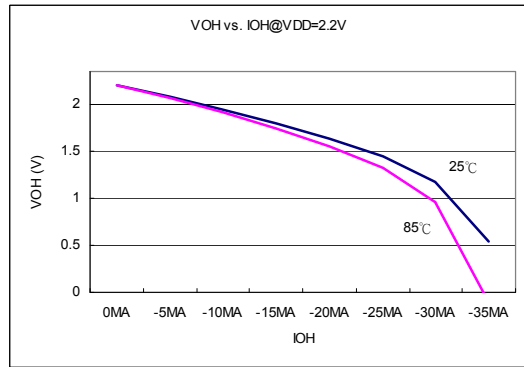


Figure 6.4-2 V_{OH} vs. I_{OH} @V_{DD}=2.2V

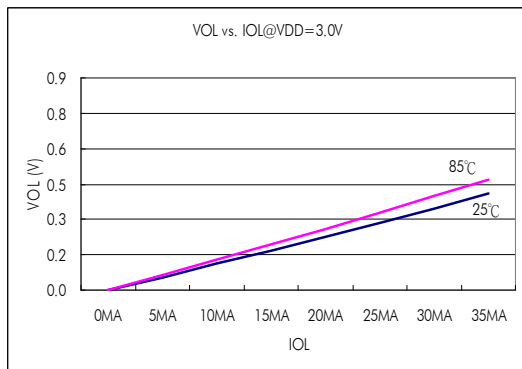


Figure 6.4-3 V_{OL} vs. I_{OL}@V_{DD}=3.0V

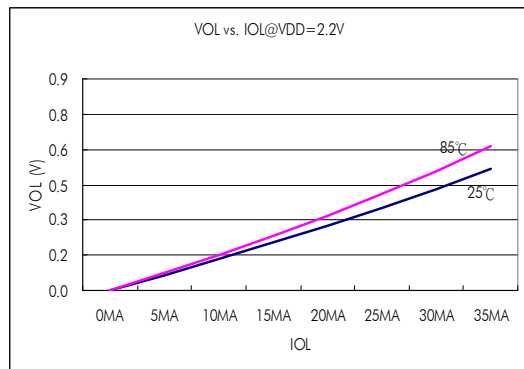


Figure 6.4-4 V_{OL} vs. I_{OL}@V_{DD}=2.2V

6.5 Reset(Brownout, External RST pin, 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→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	$T_A = -40^\circ\text{C} \sim 85^\circ\text{C}$		100		ppm/ $^\circ\text{C}$	
	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							

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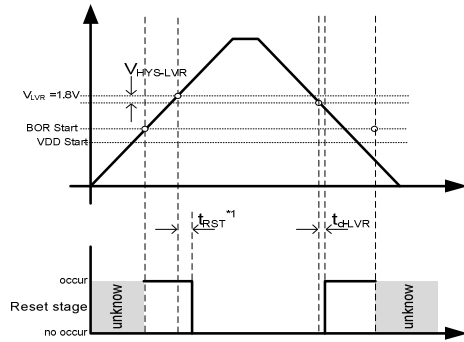


Figure 6.5-1 BOR reset diagram

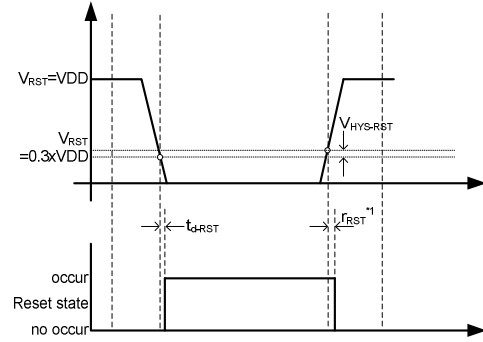


Figure 6.5-2 RST reset diagram

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

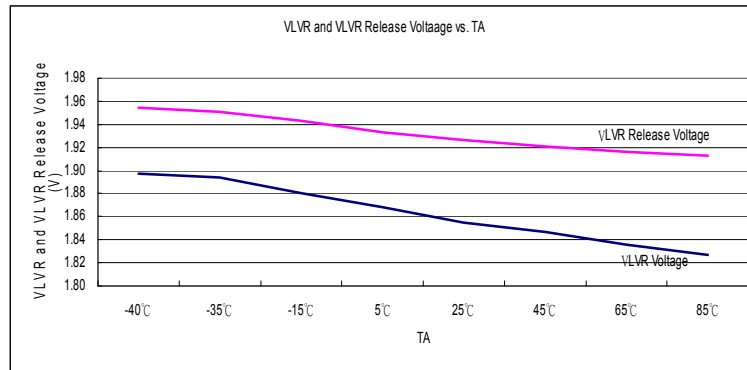


Figure 6.5-3 LVR vs. Temperature

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}	$I_L = 0\text{mA}$	VDDAX[1:0]=00b	22			μA
	Select VDDA output voltage	$I_L = 0.1\text{mA}$, $V_{DD} \geq V_{DDA} + 0.25\text{V}$	VDDAX [1:0]=11b	2.4			V
	Dropout voltage	$I_L = 10\text{mA}$	VDDAX [1:0]=11b	250			mV
	Temperature drift		VDDAX [1:0]=11b	$T_A = -40^\circ\text{C} \sim 85^\circ\text{C}$	50		ppm/ $^\circ\text{C}$
	V_{DD} Voltage drift	$I_L = 0.1\text{mA}$		$V_{DD} = 2.5\text{V} \sim 3.6\text{V}$	± 0.2		%/V
ACM	ACM operation current, I_{ACM}	$I_L = 0\text{mA}$		20			μA
	Output voltage, V_{ACM}	ENACM[0]=1	$I_L = 0\mu\text{A}$	1.0			V
	Output voltage with Load		$I_L = \pm 200\mu\text{A}$	0.98	1.02		V_{ACM}
	Temperature drift	ENACM[0]=1,	$T_A = -40^\circ\text{C} \sim 85^\circ\text{C}$	50			ppm/ $^\circ\text{C}$
	VDDA Voltage drift	$I_L = 10\mu\text{A}$		100			$\mu\text{V}/\text{V}$

VDDA : Adjust Voltage Regulator
ACM : Analog Common Mode Voltage

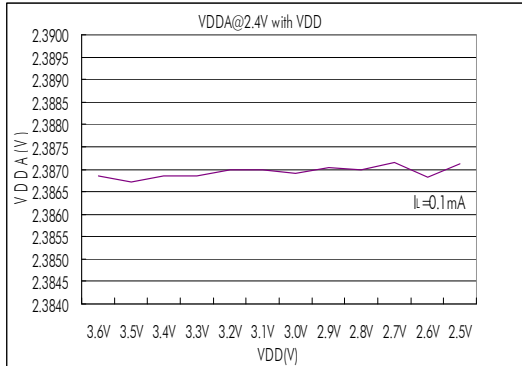


Figure 6.6-1 VDDA $I_L=0.1\text{mA}$ vs. VDD

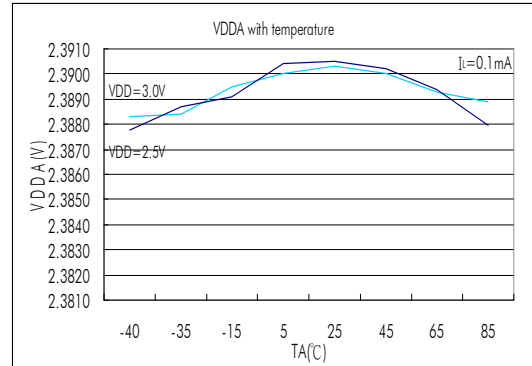


Figure 6.6-2 VDDA $I_L=0.1\text{mA}$ vs. Temperature

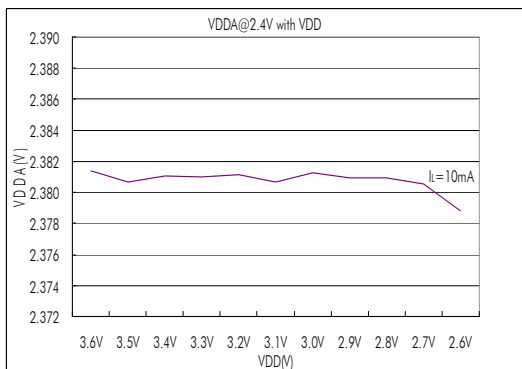


Figure 6.6-3 VDDA $I_L=10\text{mA}$ vs. VDD

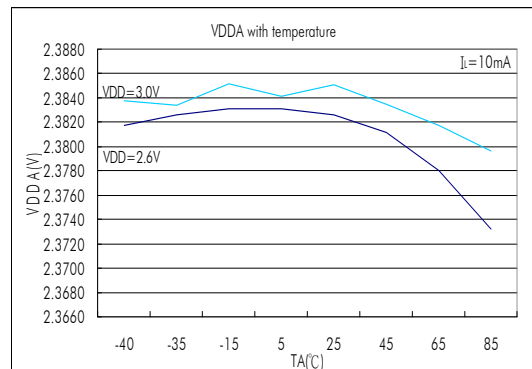


Figure 6.6-4 VDDA $I_L=10\text{mA}$ vs. Temperature

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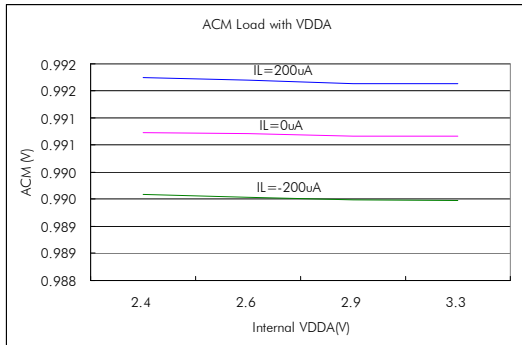


Figure6.6-5 ACM Load vs. VDDA

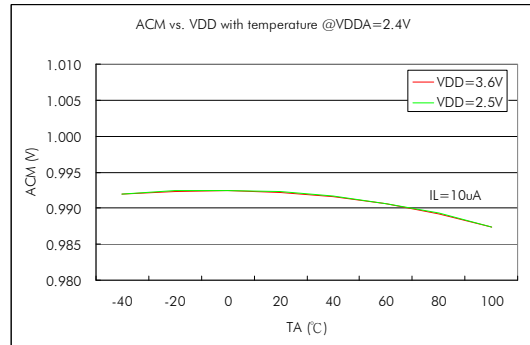


Figure6.6-6 ACM vs. Temperature

6.7 LCD

$T_A = 25^\circ\text{C}, V_{DD} = 3.0\text{V}, C_{VLCD} = 4.7\mu\text{F}$, 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	$V_{DD} = 2.2\text{V}$	10		uA	
			$V_{DD} = 3.0\text{V}$				
VLCD	Supply Voltage at VLCD pin	LCDPR[0]=0	2.2		3.6	V	
	Embedded Charge Pump output voltage at VLCD pin	$V_{DD} = 2.2\text{V}$, LCDPR[0]=1, $C_{VLCD} = 4.7\mu\text{F}$	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	$f_{LCD} = 128\text{Hz}, VLCD = 3.05\text{V}$		10		k Ω	

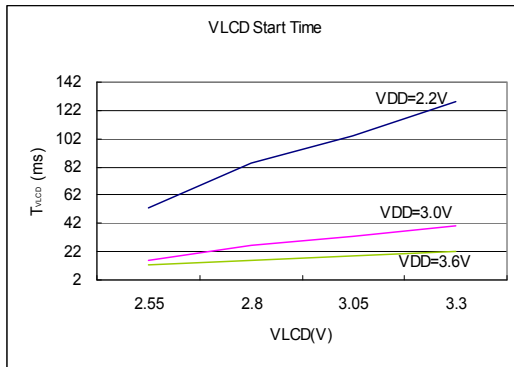


Figure6.7-1 LCD start time

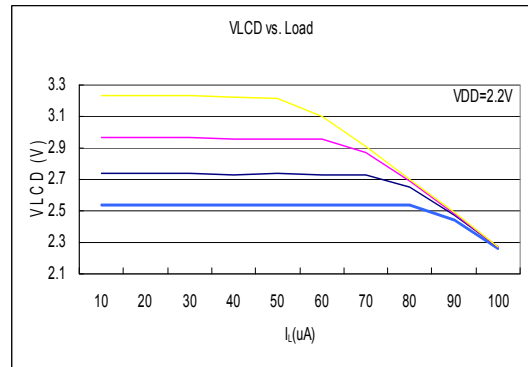


Figure6.7-2 VLCD vs. I_L @VDD=2.2V

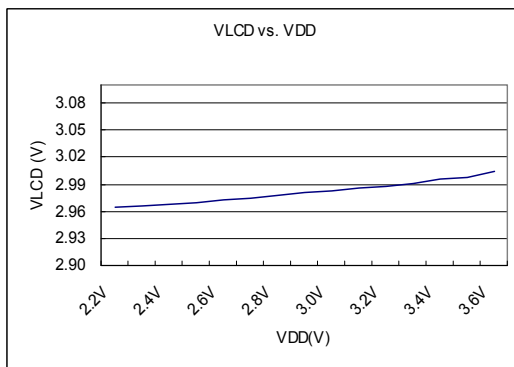


Figure6.7-3 VLCD vs. VDD

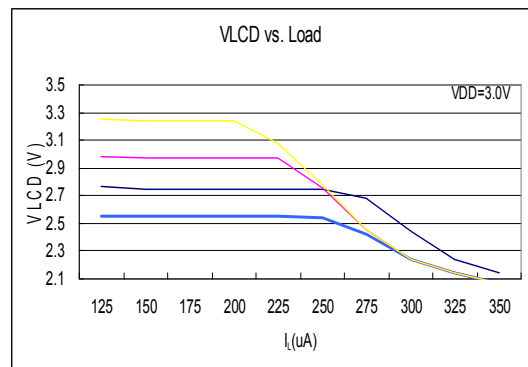


Figure6.7-4 VLCD vs. I_L @VDD=3.0V

6.8 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	ENVDDA[0]=0		2.4		3.6	V
f_{SD18}	Modulator sample frequency, ADC_CK			25	250	300	KHz
	Over Sample Ratio, OSR			128 ^{*1}		32768	
I_{SD18}	Operation supply current without PGA	ENADC[0]=1 INBUF[0]=0, VRBUF[0]=0	GAIN =4, ADC_CK=250KHz		120		μA

*1, OSR=128, setting by ADCCN3[OSR3] bit.
OSR[3:0]=1010b, OSR=128; OSR[3:0]=0xxx, OSR=256 ~ 32768
OSR[3:0]=1xxxb can't set by user

6.8.1 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	ENVDDA[0]=0		2.4		3.6	V
I_{PGA}	Operation supply current	PGAGN[1:0]=<11>			320		μA
G_{PGA}	Gain temperature drift	$T_A = -40^\circ\text{C} \sim 85^\circ\text{C}$	GAIN=128		15		ppm/ $^\circ\text{C}$

6.8.2 SD18, performance II ($f_{SD18}=250\text{KHz}$)

$T_A = 25^\circ\text{C}, V_{DD} = 3.0\text{V}, V_{DDA} = 2.9\text{V}, V_{VR} = 1.0\text{V}, \text{GAIN} = 1$ without PGA, unless otherwise noted

Sym.	Parameter	Test Conditions		Min.	Typ.	Max.	unit
INL	Integral Nonlinearity(INL)	$V_{DDA} = 2.4\text{V}, V_{VR} = 1.0\text{V}, \Delta\text{SI} = \pm 200\text{mV}$			± 0.003	± 0.01	%FSR
		$V_{DDA} = 2.4\text{V}, V_{VR} = 1.0\text{V}, \Delta\text{SI} = \pm 450\text{mV}$					
	No Missing Codes ³	ADC_CK=250KHz, OSR[2:0]=010b		19			Bits
G_{SD18}	Temperature drift Gain 1~x16 (INBUF[0]=0b,)	INBUF[0]=0b, VRBUF[0]=0b	$T_A = -40^\circ\text{C} \sim 85^\circ\text{C}$		10		ppm/ $^\circ\text{C}$
E_{OS}	Offset error of Full Scale Rang input voltage range with Chopper without PGA	$\Delta\text{AI} = 0\text{V}$ $\Delta\text{VR} = 0.9\text{V}$	Gain=2			1	%FSR
	Offset error temperature drift with chopper without PGA	DCSET[2:0]=<000> * ΔAI is external short	GAIN=1		2		$\mu\text{V}/^\circ\text{C}$
			GAIN=2		1		
			GAIN=4		0.5		
GAIN=16		0.15					

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$T_A = 25^\circ\text{C}, V_{DD} = 3.0\text{V}, V_{DDA}=2.9\text{V}, V_{VR}=1.0\text{V}, \text{GAIN}=1$ without PGA, unless otherwise noted

Sym.	Parameter	Test Conditions	Min.	Typ.	Max.	unit
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=1		90	dB
		$V_{CM}=0.7\text{V}$ to 1.7V , $V_{VR}=1.0\text{V}$, without PGA	$V_{SI}=0\text{V}$, GAIN=16		75	
PSRR	DC power supply rejection	$V_{DDA}=3.0\text{V}, \Delta V_{DDA}=\pm 100\text{mV}$, $V_{VR}=1.0\text{V}, V_{SI}=1.2\text{V}, V_{SII}=1.2\text{V}$,	GAIN=1	75		dB
			PGA=off			
			GAIN=16 PGA=8			

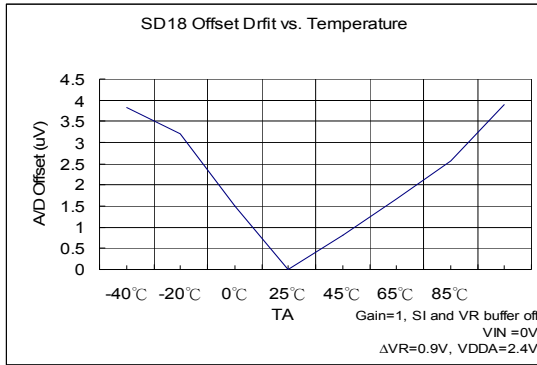


Figure 6.8-1(a) SD18 Offset Temperature drift

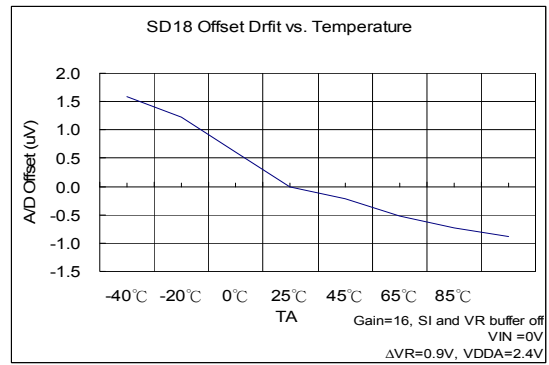


Figure 6.8-1(b) SD18 Offset Temperature drift

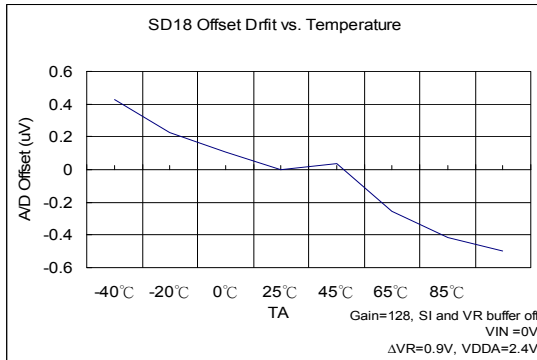


Figure 6.8-1(c) SD18 Offset Temperature drift

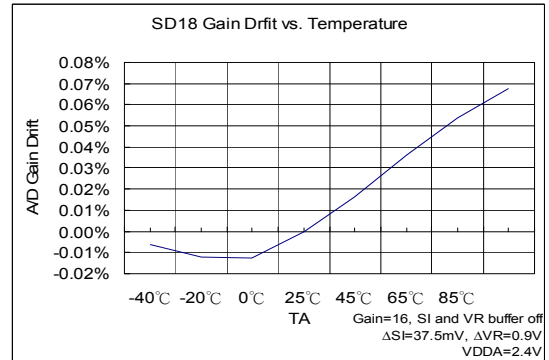


Figure 6.8-2(a) SD18 Gain drift with temperature

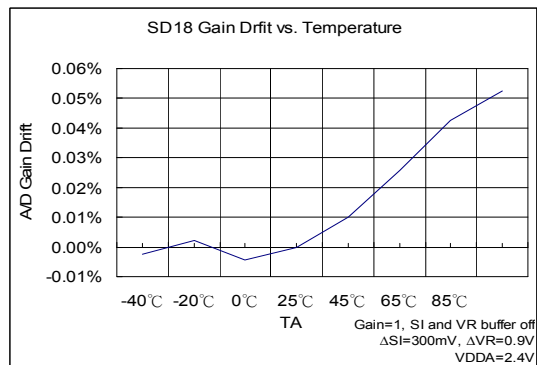


Figure 6.8-2(b) SD18 Gain drift with temperature

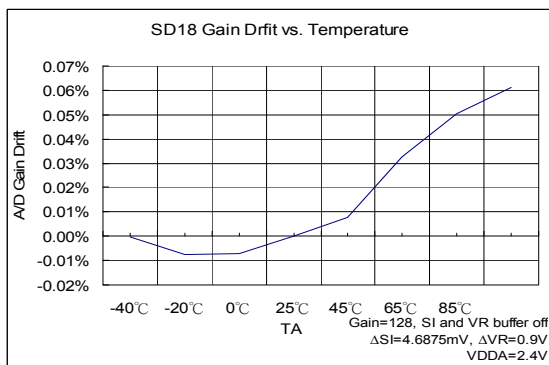


Figure 6.8-2(c) SD18 Gain drift with temperature

6.8.3 SD18 Noise Performance

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

HY11P33 針對 SD18 提供了重要的輸入雜訊規格。Table6.8-3(a), Table6.8-3(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。

ENOB(RMS) with OSR/GAIN at A/D Clock=250Khz, VDDA=2.4V, VREF=1.2V														
Max. Vin(mV) =0.9*VREF ⁽¹⁾	OSR				128	256	512	1024	2048	4096	8192	16384	32768	
	Output rate(HZ)				1953	977	488	244	122	61	31	15	8	
	Gain	=	PGA	×	ADGN									
±2400	0.25	=	1	×	0.25	14.43	16.07	17.20	17.86	18.29	18.66	18.98	19.13	19.30
±2160	0.5	=	1	×	0.5	14.34	16.05	17.13	17.84	18.26	18.62	18.90	19.13	19.27
±1080	1	=	1	×	1	14.38	16.06	17.11	17.72	18.13	18.53	18.88	19.05	19.22
±540	2	=	1	×	2	14.40	15.98	16.96	17.59	18.01	18.45	18.79	19.01	19.17
±270	4	=	1	×	4	14.39	15.88	16.82	17.39	17.85	18.28	18.65	18.95	19.13
±135	8	=	1	×	8	14.27	15.75	16.58	17.15	17.60	18.04	18.45	18.78	19.02
±68	16	=	1	×	16	14.14	15.51	16.18	16.73	17.21	17.70	18.15	18.52	18.83
±8	128	=	8	×	16	13.04	13.83	14.32	14.87	15.38	15.86	16.36	16.84	17.28

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

Table6.8-3(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				128	256	512	1024	2048	4096	8192	16384	32768	
	Output rate(HZ)				1953	977	488	244	122	61	31	15	8	
	Gain	=	PGA	×	ADGN									
±2400	0.25	=	1	×	0.25	362.92	139.77	64.33	40.65	30.04	23.35	18.70	16.75	14.92
±2160	0.5	=	1	×	0.5	193.22	70.82	33.83	20.60	15.37	12.00	9.86	8.38	7.61
±1080	1	=	1	×	1	94.14	35.38	17.16	11.17	8.40	6.34	5.01	4.44	3.92
±540	2	=	1	×	2	46.23	18.59	9.48	6.13	4.57	3.35	2.66	2.28	2.05
±270	4	=	1	×	4	23.37	9.98	5.20	3.51	2.54	1.89	1.46	1.18	1.05
±135	8	=	1	×	8	12.66	5.47	3.06	2.06	1.51	1.11	0.84	0.67	0.56
±68	16	=	1	×	16	6.93	3.23	2.02	1.38	0.99	0.70	0.51	0.40	0.32
±8	128	=	8	×	16	1.86	1.29	0.91	0.63	0.44	0.32	0.22	0.16	0.12

Table6.8-3(b) SD18 RMS Noise Table

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

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

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

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

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

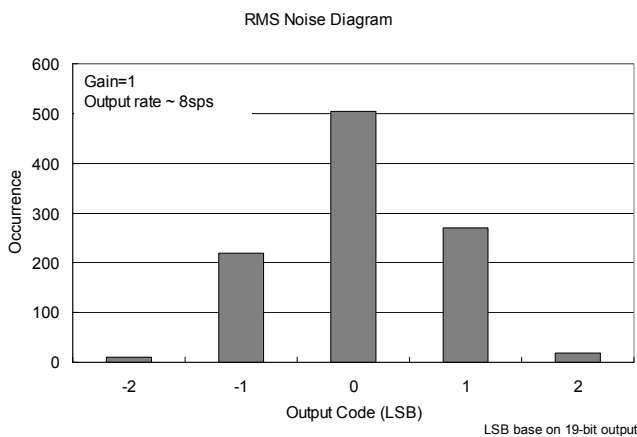


Figure6.8-3(a) RMS Noise Diagram

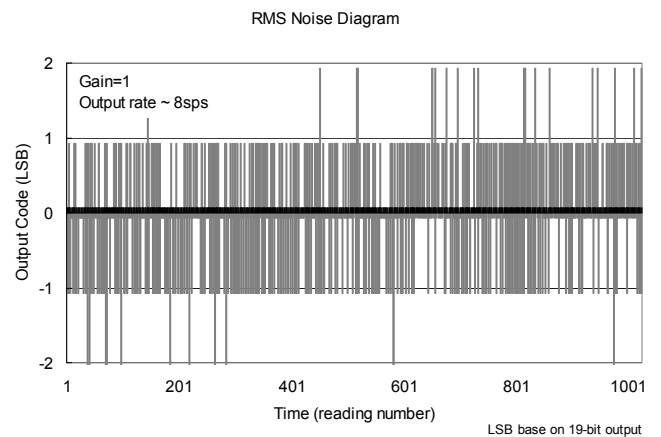


Figure6.8-3(b) Output Code Diagram

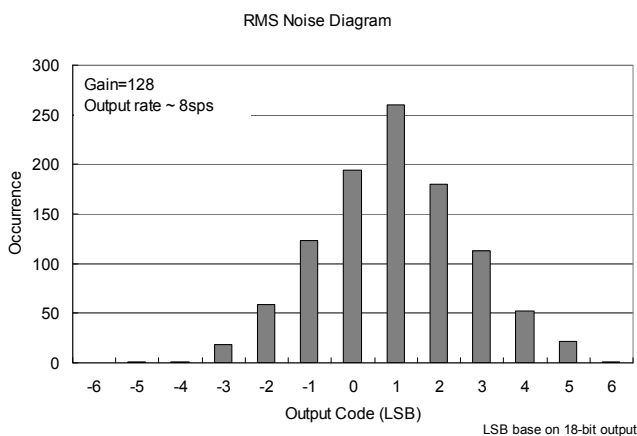


Figure6.8-3(c) RMS Noise Diagram

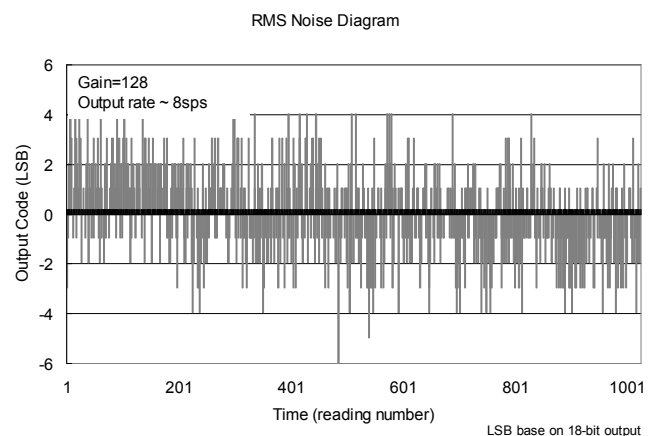


Figure6.8-3(d) Output Code Diagram

HY11P33

Embedded 18-Bit $\Sigma\Delta$ ADC
8-Bit RISC-like Mixed Signal Microcontroller

6.9 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			6.0	6.5	V
I_{BIE}	Operation supply current			5		mA
V_{SS}	Supply Voltage			0		V

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					
HY11P33-D000	Die	-	D	000	000	-	200	Green ⁴	-
HY11P33-L064	LQFP	64	L	064	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：您的需求是不帶程式碼的空白片且需要的產品是裸片出貨，晶片型號為 HY11P33。則下單品名為 HY11P33-D000

例如：您的代客燒錄服務申請的程式碼編號為 008，晶片型號為 HY11P33，且需要的產品是裸片出貨。則下單品名為 HY11P33-D000-008

例如：您的需求是晶片型號為 HY11P33，不帶程式碼的空白片且需要的產品是封裝片 LQFP64 出貨，則下單品名為 HY11P33-L064，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：您的需求是晶片型號為 HY11P33，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 LQFP64 出貨，則下單品名為 HY11P33-L064-009，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):

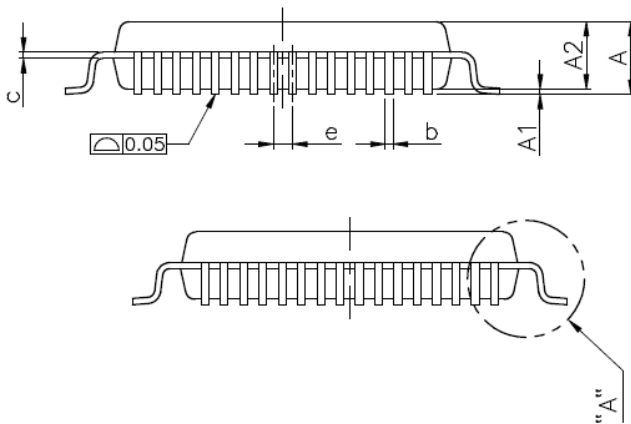
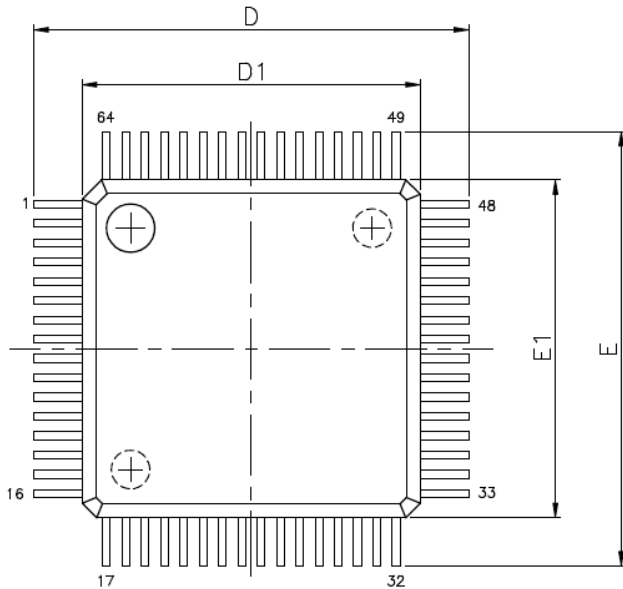
HYCON 產品皆為 Green Product，符合 RoHS 指令以及無鹵素規定(Br/Cl<0.1%)

HY11P33

Embedded 18-Bit $\Sigma\Delta$ ADC
8-Bit RISC-like Mixed Signal Microcontroller

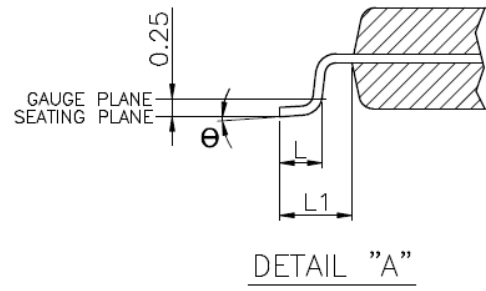
8. 封裝型式資訊

8.1 LQFP64(L064)



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
b	0.13	0.18	0.23
c	0.09	—	0.20
D	9.00 BSC		
D1	7.00 BSC		
e	0.40 BSC		
E	9.00 BSC		
E1	7.00 BSC		
L	0.45	0.60	0.75
L1	1.00 REF		
θ	0°	3.5°	7°



JEDEC MS-026 compliant

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	修改文件全部內容
V03	4	修正產品特點-刪除內建低壓燒錄控制電路特性
V04	11	修正 SD18 Network