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**HY11P23**  
**Datasheet**  
**8-Bit RISC-like Mixed Signal Microcontroller**  
**Embedded Low Noise Amplifier**  
**18-Bit  $\Sigma\Delta$ ADC**

## 目錄

<b>1. 特點</b> .....	<b>5</b>
<b>2. 引腳定義</b> .....	<b>6</b>
2.1 LQFP32 引腳圖 .....	6
2.2 QFN32 引腳圖 .....	6
2.3 SSOP28 引腳圖 .....	7
2.4 I/O 引腳定義 (LQFP32/QFN32) .....	8
2.5 I/O 引腳定義 (SSOP28) .....	11
<b>3. 應用電路</b> .....	<b>13</b>
3.1 四組橋式感測器 I .....	13
3.2 四組橋式感測器 II .....	14
3.3 4-20mA 電流錶頭(兩線式) .....	15
<b>4. 功能概述</b> .....	<b>16</b>
4.1 內部方塊圖 .....	16
4.2 相關說明與支援文件 .....	16
4.3 SD18 Network .....	17
4.4 Low Noise OPAMP Network .....	18
<b>5. 暫存器列表</b> .....	<b>19</b>
<b>6. 電氣特性</b> .....	<b>21</b>
6.1 Recommended operating conditions .....	21
6.2 Internal RC Oscillator .....	22
6.3 Supply current into VDD excluding peripherals current .....	23

# **HY11P23**

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



6.4	Port1~5.....	25
6.5	Reset(Brownout, External RST pin, Low Voltage Detect).....	26
6.6	Power System.....	28
6.7	Low Noise OPAMP.....	30
6.8	SD18,Power Supply and recommended operating conditions.....	31
<b>7.</b>	<b>訂貨資訊.....</b>	<b>37</b>
<b>8.</b>	<b>封裝型式資訊.....</b>	<b>38</b>
8.1	LQFP32(L032).....	38
8.2	QFN32(NS32).....	39
8.3	SSOP28(E028, 209mil).....	40
<b>9.</b>	<b>修訂記錄.....</b>	<b>42</b>

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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°C ~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@32KHz
  - 休眠模式 1uA
- 4KWord OTP (One Time Programmable) Type 程式，256Byte 資料
- Brownout and 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 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 倍以上輸入倍率不適用)
  - 內置絕對溫度感測器
- 超低輸入雜訊(<1uVpp)運算放大器，可提供高輸出阻抗小訊號的放大及小電流的電壓轉換
- 1.0V, 1.2V 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
- 8-bit Timer A
- 16-bit Timer B 模組具 Capture/Compare 功能
- 8-bit Timer C 模組具 PWM/PFD 波形產生功能
- 串列通訊 SPI、EUART 模組
- Support 6 stack level

Device No.	Package	ADC* (SD 18)	LNOP*	I/O	Program Memory (word)	Data Memory (byte)	Serial Interface	Timer*	Instruction Set*	Stack Level
HY11P23-L032	LQFP32	10	1	22	4k	256	SPI+EUART	A,B,C	H08A	6
HY11P23-NS32	QFN32	10	1	22	4k	256	SPI+EUART	A,B,C	H08A	6
HY11P23-E028	SSOP28	7	-	19	4k	256	SPI+EUART	A,B,C	H08A	6

備註說明：

ADC：SD 18意指Sigma Delta ADC，18-bit  $\Sigma\Delta$  ADC。

LNOP：LNOP意指為低雜訊運算放大器。

Timer：Timer A(8-bit)具有多段中斷時間設置；

Timer B(16-bit)具備Capture/Compare功能；

Timer C(8-bit)具備PWM/PFD功能。

Instruction Set：指令集於H08A具有8x8硬體乘法器、16-bit查表指令、條件跳躍指令、堆疊操作指令、等。

# HY11P23

Embedded 18-Bit  $\Sigma$ ADC

8-Bit RISC-like Mixed Signal Microcontroller

## 2. 引腳定義

### 2.1 LQFP32 引腳圖

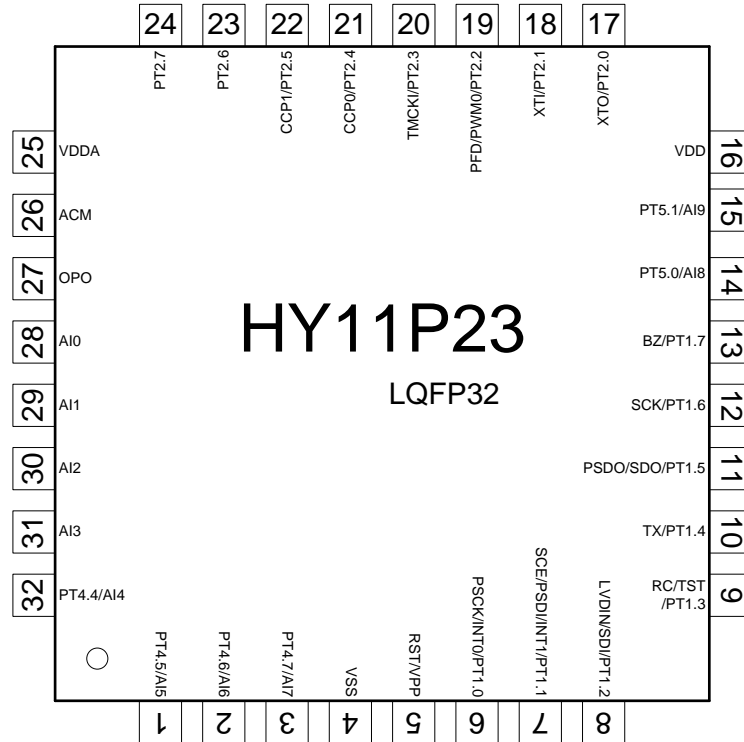


圖 2-1 HY11P23 LQFP32 引腳圖

### 2.2 QFN32 引腳圖

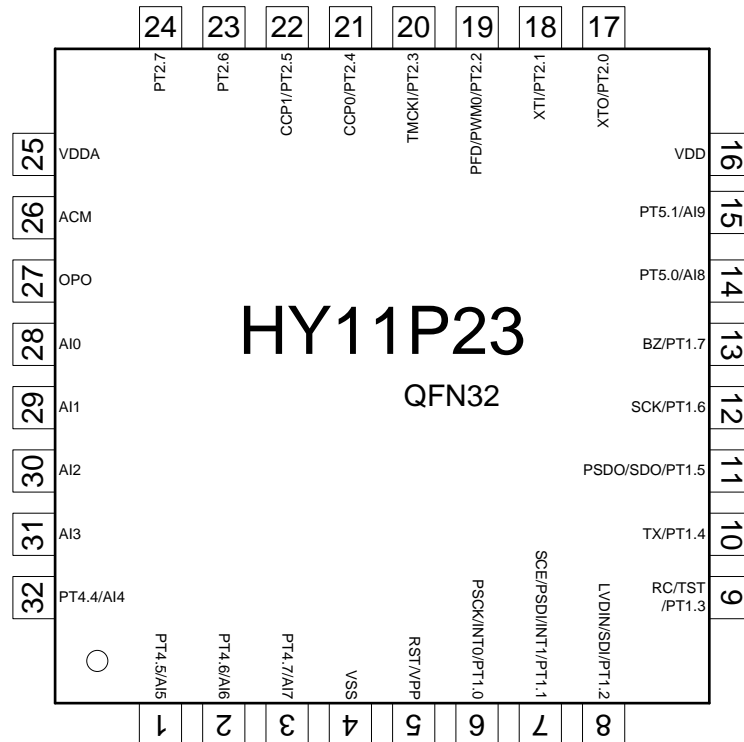


圖 2-2 HY11P23 QFN32 引腳圖

# HY11P23

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

## 2.3 SSOP28 引腳圖

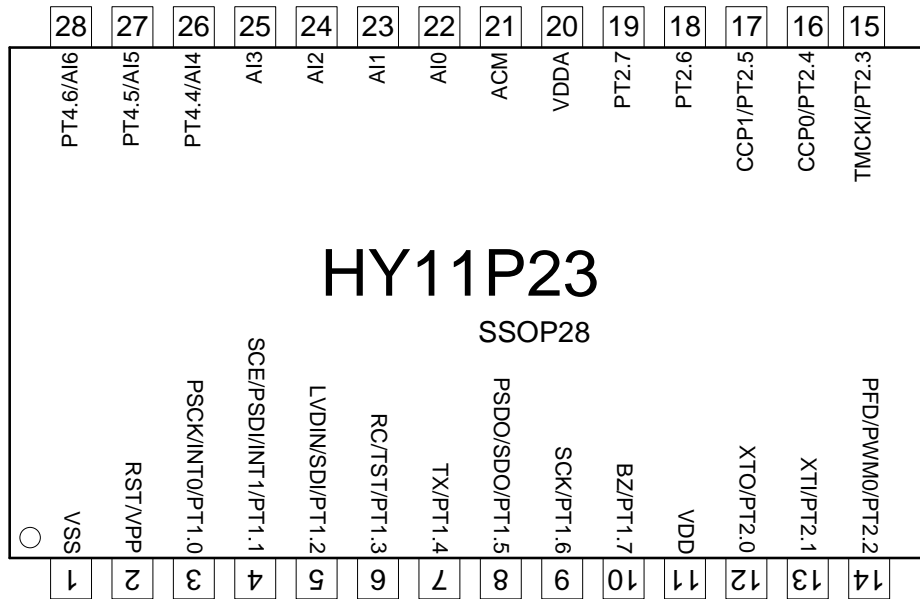


圖 2-3 HY11P23 SSOP28 引腳圖

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

## 2.4 I/O 引腳定義 (LQFP32/QFN32)

“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	PT4.5/AI5	PT4.5	I	C	數位輸入 類比輸入通道
		AI5	A	A	
2	PT4.6/AI6	PT4.6	I	C	數位輸入 類比輸入通道
		AI6	A	A	
3	PT4.7/AI7	PT4.7	I	C	數位輸入 類比輸入通道
		AI7	A	A	
4	VSS		P	P	晶片工作電壓源接地端
5	RST/VPP	RST	I	S	復位晶片 EPROM 讀/寫時的電壓源
		VPP	P	P	
6	PT1.0/INT0/PSCK	PT1.0	I	S	數位輸入 中斷源 INT0 OTP 讀/寫介面 SCK 接口
		INT0	I	S	
		PSCK	I	S	
7	PT1.1/INT1/PSDI/SCE	PT1.1	I	S	數位輸入 中斷源 INT1 OTP 讀/寫介面 SDI 接口 SPI 通訊介面 SCE 接口
		INT1	I	S	
		PSDI	I	S	
		SCE	I/O	S	
8	PT1.2/SDI/LVDIN	PT1.2	I	S	數位輸入 SPI 通訊介面 SDI 接口 LVD 外部信號輸入接口
		SDI	I/O	S	
		LVDIN	A	A	
9	PT1.3/TST/RC	PT1.3	I	S	數位輸入 EUART 通訊介面 RC 接口 測試模式致能輸入 (未開放)
		RC	I/O	S	
		TST	I	S	
10	PT1.4/TX	PT1.4	I/O	S	數位輸入/輸出 EUART 通訊介面 TX 接口
		TX	I/O	S	
11	PT1.5/PSDO/SDO				



# HY11P23

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

		PT1.5	I/O	S	數位輸入/輸出
		PSDO	I/O	C	OTP 讀/寫介面 SDO 接口
		SDO	I/O	S	SPI 通訊介面 SDO 接口
12	PT1.6/SCK	PT1.6	I/O	S	數位輸入/輸出
		SCK	I/O	S	SPI 通訊介面 SCK 接口
13	PT1.7/BZ	PT1.7	I/O	S	數位輸入/輸出
		BZ	O	C	蜂鳴器輸出端
14	PT5.0/AI8	PT5.0	I	C	數位輸入
		AI8	A	A	類比輸入通道
15	PT5.1/AI9	PT5.1	I	C	數位輸入
		AI9	A	A	類比輸入通道
16	VDD		P	P	晶片工作電壓源
17	PT2.0/XTO	PT2.0	I/O	S	數位輸入/輸出
		XTO	A	A	外接振盪器輸出端
18	PT2.1/XTI	PT2.1	I/O	S	數位輸入/輸出
		XTI	A	A	外接振盪器輸入端
19	PT2.2/PWM0/PFD	PT2.2	I/O	C	數位輸入/輸出
		PWM0	O	C	PWM 輸出接口
		PFD	O	C	PFD 輸出接口
20	PT2.3/TMCKI	PT2.3	I/O	S	數位輸入/輸出
		TMCKI	I	S	TIMERC 時脈源輸入接口
21	PT2.4/CCP0	PT2.4	I/O	S	數位輸入/輸出
		CCP0	I	S	捕捉/比較模式信號接口
22	PT2.5/CCP1	PT2.5	I/O	S	數位輸入/輸出
		CCP1	I	S	捕捉/比較模式信號接口
23	PT2.6		I/O	C	數位輸入/輸出
24	PT2.7		I/O	C	數位輸入/輸出
25	VDDA		P	P	穩壓器輸出，類比電路電壓源

# HY11P23

Embedded 18-Bit  $\Sigma\Delta$ ADC

8-Bit RISC-like Mixed Signal Microcontroller

26	ACM	P	P	內部類比電路共地引腳
27	OPO	A	A	運算放大器輸出
28	AI0	A	A	類比輸入通道
29	AI1	A	A	類比輸入通道
30	AI2	A	A	類比輸入通道
31	AI3	A	A	類比輸入通道
32	PT4.4/AI4	I A	C A	數位輸入 類比輸入通道

表 2-1 引腳定義與功能說明

## 2.5 I/O 引腳定義 (SSOP28)

“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	VSS	P	P	晶片工作電壓源接地端
2	RST	I	S	復位晶片
	VPP	P	P	EPROM 讀/寫時的電壓源
3	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
4	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
	SCE	I/O	S	SPI 通訊介面 SCE 接口
5	PT1.2	I	S	數位輸入
	SDI	I/O	S	SPI 通訊介面 SDI 接口
	LVDIN	A	A	LVD 外部信號輸入接口
6	PT1.3	I	S	數位輸入
	RC	I/O	S	EUART 通訊介面 RC 接口
	TST	I	S	測試模式致能輸入 (未開放)
7	PT1.4	I/O	S	數位輸入/輸出
	TX	I/O	S	EUART 通訊介面 TX 接口
8	PT1.5	I/O	S	數位輸入/輸出
	PSDO	I/O	C	OTP 讀/寫介面 SDO 接口
	SDO	I/O	S	SPI 通訊介面 SDO 接口
9	PT1.6	I/O	S	數位輸入/輸出
	SCK	I/O	S	SPI 通訊介面 SCK 接口
10	PT1.7	I/O	S	數位輸入/輸出
	BZ	O	C	蜂鳴器輸出端
11	VDD	P	P	晶片工作電壓源

12	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
13	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
14	PT2.2/PWM0/PFD	PT2.2 PWM0 PFD	I/O O O	C C C	數位輸入/輸出 PWM 輸出接口 PFD 輸出接口
15	PT2.3/TMCKI	PT2.3 TMCKI	I/O I	S S	數位輸入/輸出 TIMERC 時脈源輸入接口
16	PT2.4/CCP0	PT2.4 CCP0	I/O I	S S	數位輸入/輸出 捕捉/比較模式信號接口
17	PT2.5/CCP1	PT2.5 CCP1	I/O I	S S	數位輸入/輸出 捕捉/比較模式信號接口
18	PT2.6		I/O	C	數位輸入/輸出
19	PT2.7		I/O	C	數位輸入/輸出
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	AI3		A	A	類比輸入通道
26	PT4.4/AI4	PT4.4 AI4	I A	C A	數位輸入 類比輸入通道
27	PT4.5/AI5	PT4.5 AI5	I A	C A	數位輸入 類比輸入通道
28	PT4.6/AI6	PT4.6 AI6	I A	C A	數位輸入 類比輸入通道

表 2-2 引腳定義與功能說明

### 3. 應用電路

#### 3.1 四組橋式感測器 I

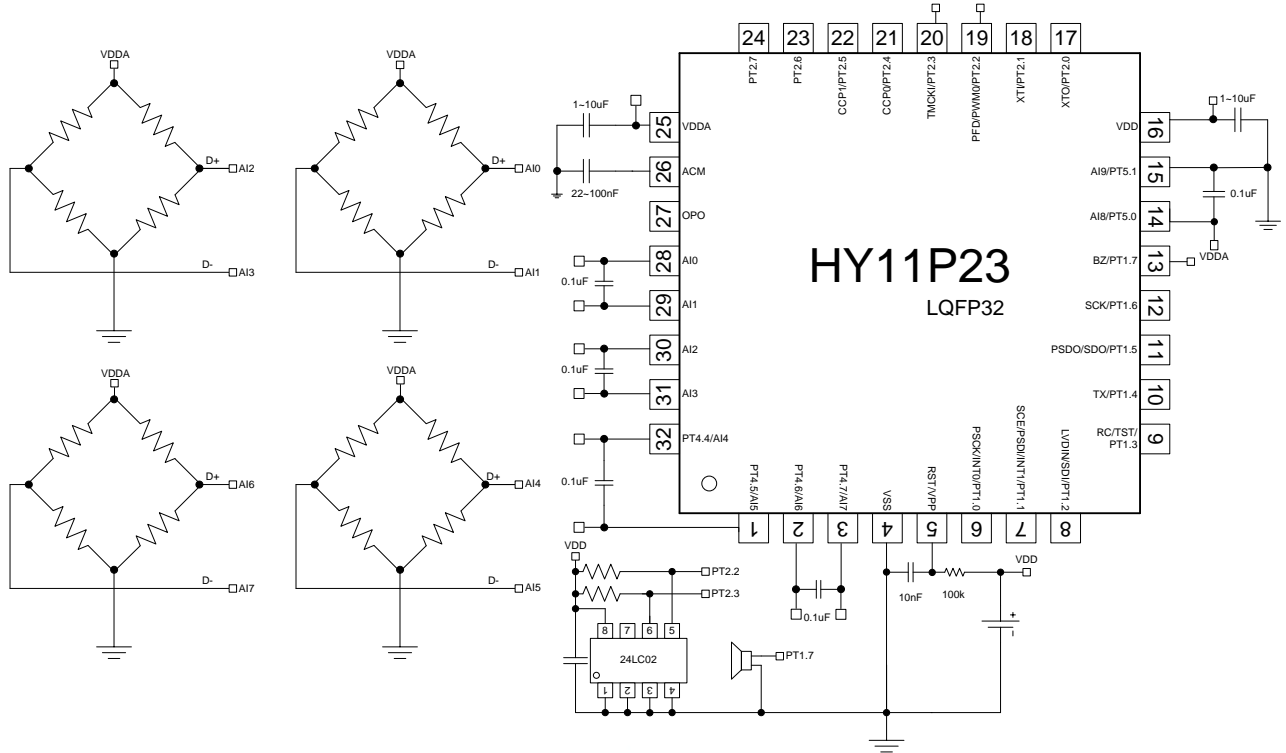


圖 3-1 橋式感測器應用電路

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

### 3.2 四組橋式感測器 II

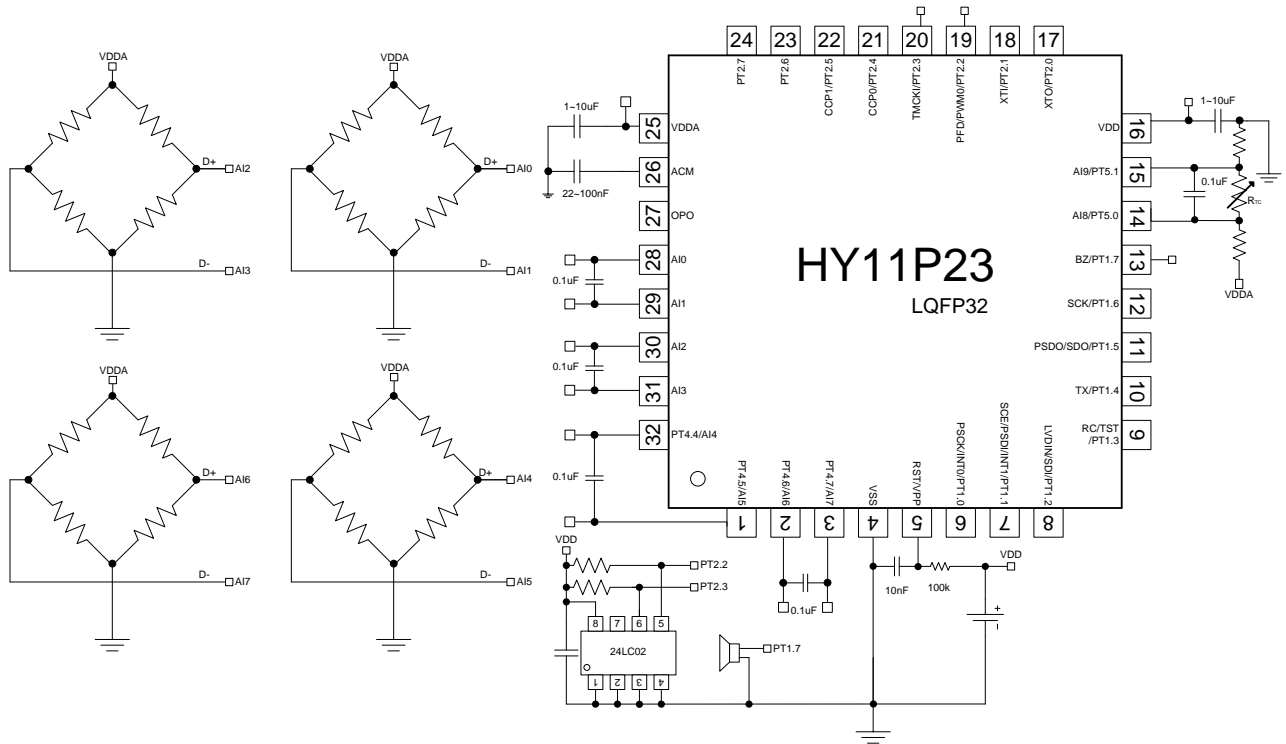


圖 3-2 具溫度補償的橋式感測器應用電路

註：使用溫度補償電阻 NTC 基本線路

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

# HY11P23

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



### 3.3 4-20mA 電流錶頭(兩線式)

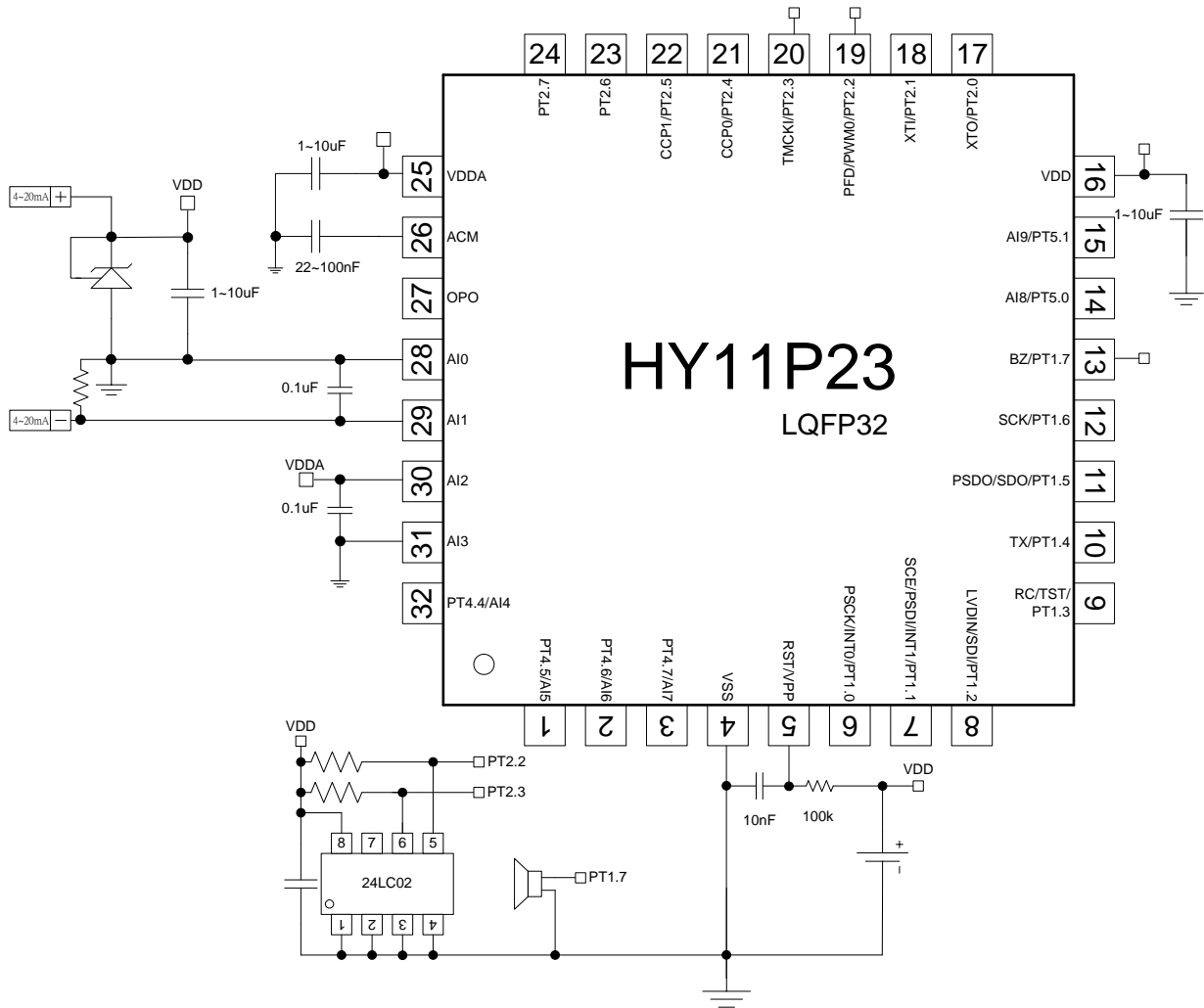
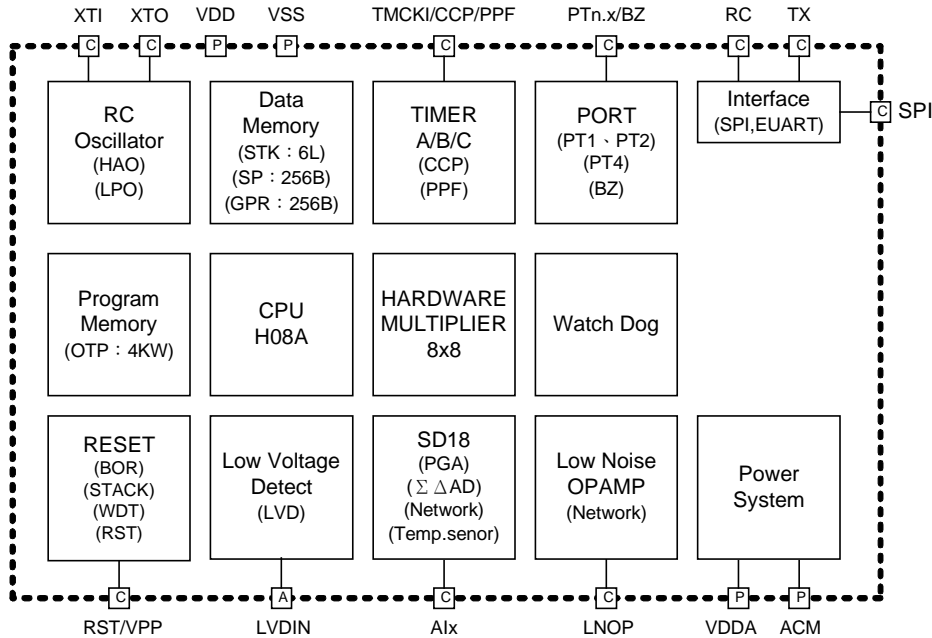


圖 3-3 毋須外接電源的 4-20mA 錶頭

## 4. 功能概述

### 4.1 內部方塊圖



□ Power Pad □ Digital Pad □ Analog Pad □ Common I/O Pad

圖 4-1 HY11P23 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-HY11P23-Vxx HY11P23 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-HY11P23-Vxx HY11P23 個別產品的裸片打線資訊



### 4.3 SD18 Network

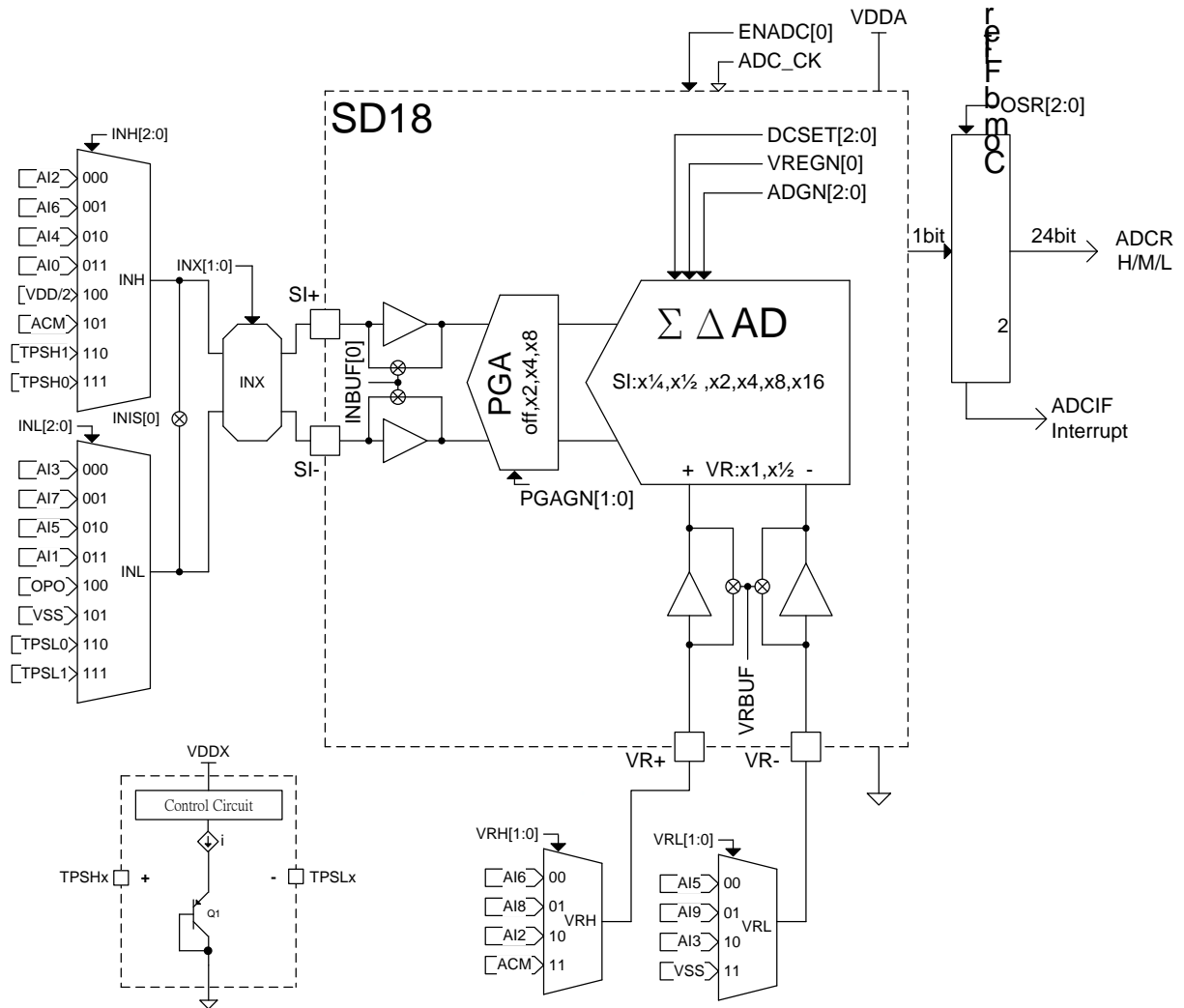


圖 4-2 SD18 Network

註：HY11P23-E028 不具有 OPO/AI7/AI8/AI9 引腳

## 4.4 Low Noise OPAMP Network

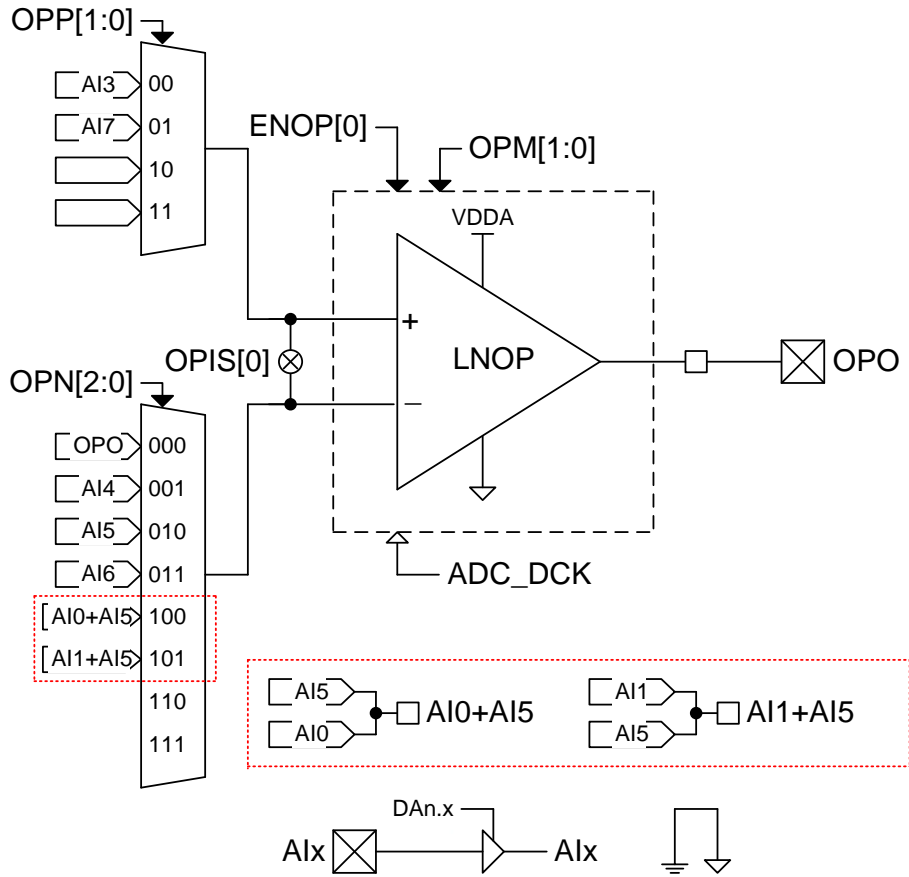


圖 4-3 Low Noise OPAMP Network

註：HY11P23-E028 不具有 Low Noise OPAMP 功能

### 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 “.”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									....x	....u	.....*				
10H	TBLPTRL	Indirect Data Memory Address Pointer 0 Low Byte, FSR0[7:0]								xxxx xxxx	uuuu uuuu	*****				
11H	FSR1H									....x	....u	.....*				
12H	FSR1L	Indirect Data Memory Address Pointer 1 Low Byte, FSR1[7:0]								xxxx xxxx	uuuu uuuu	*****				
16H	TOSH									....0000	....0000	.....*				
17H	TOSL	Top-of-Stack Low Byte (TOS<7:0>)								0000 0000	0000 0000	*****				
18H	STKPTR	STKFL	STKUN	STKOV				STKPRT[2]	STKPRT[1]	STKPRT[0]	000..000	000..000	r,rw0,rw0,-,r,r,f			
1AH	PLATH									PC[11]	PC[10]	PC[9]	PC[8]	....0000	....0000	.....*
1BH	PLATL	PC Low Byte for PC<7:0>								0000 0000	0000 0000	*****				
1DH	TBLPTRH									TBLPTR[11]	TBLPTR[10]	TBLPTR[9]	TBLPTR[8]	....0000	....0000	.....*
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,f r,r,r,f				
22H	PRODL	Product Register of Multiply Low Byte								xxxx xxxx	uuuu uuuu	r,r,r,f r,r,r,f				
23H	INTE1	GIE	ADCIE	TMCIE	TMBIE	TMAIE	WDTIE	E1IE	E0IE	0000 0000	0000 0000	*****				
24H	INTE2	TXIE	RCIE				SSPIE	CCP1IE	CCP0IE	....0000	....0000	.....*				
26H	INTF1	ADCIF	TMCIF	TMBIF	TMAIF	WDTIF	E1IF	E0IF	..000 0000	..000 0000	.....*					
27H	INTF2	TXIF	RCIF				SSPIF	CCP1IF	CCP0IF	....0000	....0000	.....*				
29H	WREG	Working Register								xxxx xxxx	uuuu uuuu	*****				
2AH	BSRCN									....0000	....0000	.....*				
2BH	STATUS	C DC N OV Z								...x xxxx	...u uuuu	.....*				
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	.....*				
30H	PWRCN	ENVDDA	VDDAX[1:0]		ENACK				0000 ....	0000 ....	.....*					
31H	MCKCN1	ADCS[2:0]		ADCK	XTHSP	XTSP	ENXT	ENHAO	0000 0001	0000 0001	*****					
32H	MCKCN2			LSCK	HCK	HSS[1:0]		CPUCK[1:0]	..00 0000	..00 0000	.....*					
33H	MCKCN3									....0000	....0000	.....*				
37H	OPCN1	ENOP	OPM[1:0]		OPP[1:0]		OPN[2:0]		0000 0000	0000 0000	*****					
39H	ADCRH	ADC conversion memory HighByte								xxxx xxxx	uuuu uuuu	r,r,r,f r,r,r,f				
3AH	ADCRM	ADC conversion memory Middle Byte								xxxx xxxx	uuuu uuuu	r,r,r,f r,r,r,f				
3BH	ADCRH	ADC conversion memory Low Byte								xxxx xxxx	uuuu uuuu	r,r,r,f r,r,r,f				
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	000..000	.....*				
3FH	AINET1	INH[2:0]			INL[2:0]			INIS	OPIS	0000 0000	0000 0000	*****				
40H	AINET2	VRH[1:0]			INX[1:0]		VRL[1:0]		..000 000.	..000 000.	.....*					
41H	TMACN	ENTMA	TMACK	TMAS[1:0]		ENWDT	WDTIS[2:0]		0000 0000	0000 0000	***** w1,***					
42H	TMAR	TimerA data register								xxxx xxxx	uuuu uuuu	r,r,r,f r,r,r,f				
43H	TMBCN	ENTMB	TMBCK	TMBS[1:0]		TMBSYC	TMBR2R		0000 00..	0000 00..	*****					
44H	TMBRH	TimerB High Byte data register								xxxx xxxx	uuuu uuuu	*****				
45H	TMBRL	TimerB Low Byte data register								xxxx xxxx	uuuu uuuu	*****				
46H	TMCCN	ENTMC	TMCCK[1:0]		TMCS1[2:0]		TMCS0[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,f r,r,r,f				
49H	CCPCN	CCP1M[3:0]				CCP0M[3:0]				0000 0000	0000 0000	*****				
4AH	CCPORH	CCP0 High Byte data register								xxxx xxxx	uuuu uuuu	*****				
4BH	CCP0RL	CCP0 Low Byte data register								xxxx xxxx	uuuu uuuu	*****				
4CH	CCP1RH	CCP1 High Byte data register								xxxx xxxx	uuuu uuuu	*****				
4DH	CCP1RL	CCP1 Low Byte data register								xxxx xxxx	uuuu uuuu	*****				
4EH	PASC	PASF	PASCF[1:0]							0.00 ....	0.00 ....	.....*				
4FH	PWMCN	ENPWM	ENPFD	PWMRL[1:0]						0000 ....	0000 ....	.....*				
51H	PWMR	PWM MSB Byte register								xxxx xxxx	uuuu uuuu	*****				

表 5-1(a) HY11P23 暫存器列表

# HY11P23

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

“-”no use, “\*”read/write, “w”write, “r”read, “r0”only read 0, “r1”only read 1, “w0”only write 0, “w1”only 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		
5EH	SSPCON1	SSPEN	CKP	CKE	SMP	—	—	SSPM<1:0>		0000 ..00	uuuu ..uu	* ** * * r r r r		
60H	SSPSTA	SSPBUY	SSPOV							BF	00.. ..0	00.. ..0	r r r r r r r r	
61H	SSPBUF	SSP Receive Buffer/Transmit Register									xxxx xxxx	uuuu uuuu	* ** * * r r r r	
63H	URCON	ENSP	ENTX	TX9	TX9D	PARITY			WUE	0000 0..0	0000 0..0	* ** * * r r r r		
64H	URSTA		RC9D	PERR	FERR	OERR	RCIDL	TRMT	ABDOVF	.000 0110	.000 0110	- r r r r r r r r w0		
65H	BAUDCON					ENCR	RC9	ENADD	ENABD	... 0000		... 0000	- r r r r r r r r	
66H	BRGRH	Baud Rate Generator Register High Byte									...x xxxx	...u uuuu	- r r r r r r r r	
67H	BRGRL	Baud Rate Generator Register Low Byte									xxxx xxxx	uuuu uuuu	* ** * * r r r r	
68H	TXREG	UART Transmit Register									xxxx xxxx	uuuu uuuu	* ** * * r r r r	
69H	RCREG	UART Receive Register									xxxx xxxx	uuuu uuuu	r r r r r r r r	
6AH	PT4	PT4.7	PT4.6	PT4.5	PT4.4							xxxx ....	uuuu ....	r r r r r r r r
6BH	PT4DA	DA4.7	DA4.6	DA4.5	DA4.4							1111 ....	1111 ....	* ** * * r r r r
6CH	PT4PU	PU4.7	PU4.6	PU4.5	PU4.4							0000 ....	0000 ....	* ** * * r r r r
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 ....	* ** * * r r r r
6FH	PT1DA							DA1.2				.... .0.	.... .0.	- r r r r r r r r
70H	PT1PU	PU1.7	PU1.6	PU1.5	PU1.4	PU1.3	PU1.2	PU1.1	PU1.0	0000 0000	0000 0000	* ** * * r r r r		
71H	PT1M1					INTEG1[1:0]		INTEG0[1:0]			.... 0000	.... 0000	- r r r r r r r r	
72H	PT1M2			PM1.7[0]	PM1.6[0]	PM1.5[0]		PM1.4[0]			.0.0 .0.0	.0.0 .0.0	- r r r r r r r r	
74H	PT2	PT2.7	PT2.6	PT2.5	PT2.4	PT2.3	PT2.2	PT2.1	PT2.0	xxxx xxxx	uuuu uuuu	* ** * * r r r r		
75H	TRISC2	TC2.7	TC2.6	TC2.5	TC2.4	TC2.3	TC2.2	TC2.1	TC2.0	0000 0000	0000 0000	* ** * * r r r r		
77H	PT2PU	PU2.7	PU2.6	PU2.5	PU2.4	PU2.3	PU2.2	PU2.1	PU2.0	0000 0000	0000 0000	- r r r r r r r r		
78H	PT2M1			PM2.2[1]	PM2.2[0]					..00 ....	..00 ....	- r r r r r r r r		
79H	PT2M2	PWMTR[1:0]				PM2.5[1]	PM2.5[0]	PM2.4[1]	PM2.4[0]	00.. 0000	00.. 0000	* ** * * r r r r		
192H	PT5							PT5.1	PT5.0	.... ..xx	.... ..uu	- r r r r r r r r		
193H	PT5DA							DA5.1	DA5.0	.... ..11	.... ..11	- r r r r r r r r		
194H	PT5PU							PU5.1	PU5.0	.... ..00	.... ..00	- r r r r r r r r		
80H – FFH	GENERAL PURPOSE REGISTER @ 128Byte									xxxx xxxx	uuuu uuuu	* ** * * r r r r		
100H–17FH	GENERAL PURPOSE REGISTER @ 128Byte									xxxx xxxx	uuuu uuuu	* ** * * r r r r		

圖 5-1(b) HY11P23 暫存器列表(續)

## 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 .....	$\pm 2$ 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 PORT3 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

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

Sym.	Parameter	Test Conditions	Min.	Typ.	Max.	unit
HAO	High Speed Oscillator frequency	ENHAO[0]=1	1.7	2.0	2.3	MHz
LPO	Low Power Oscillator frequency	$V_{DD}$ supply voltage be enable LPO	22	28	35	KHz

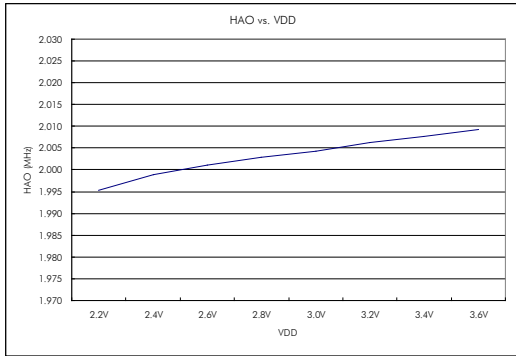


Figure 6.2-1 HAO vs. VDD

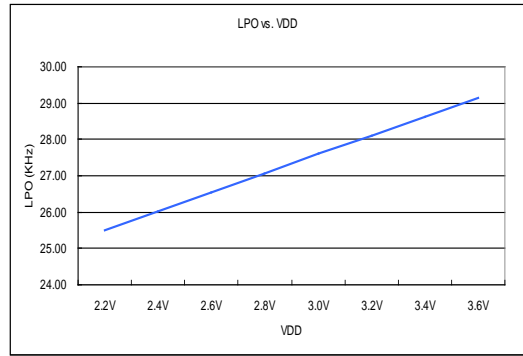


Figure 6.2-2 LPO vs. VDD

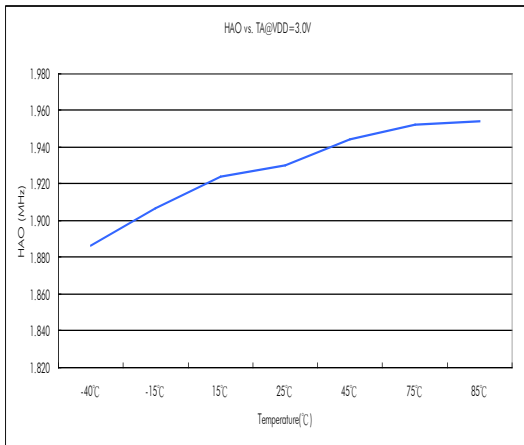


Figure 6.2-3 HAO vs. Temperature

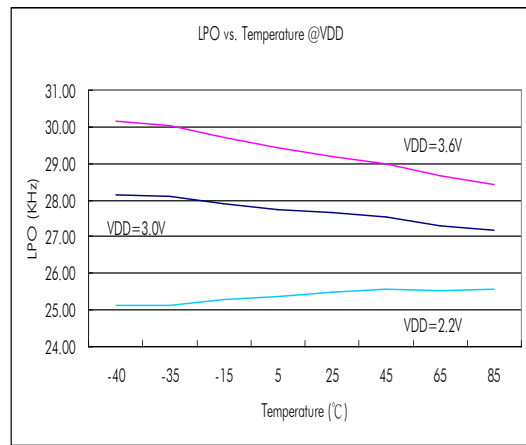


Figure 6.2-4 LPO vs. Temperature

### 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	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.

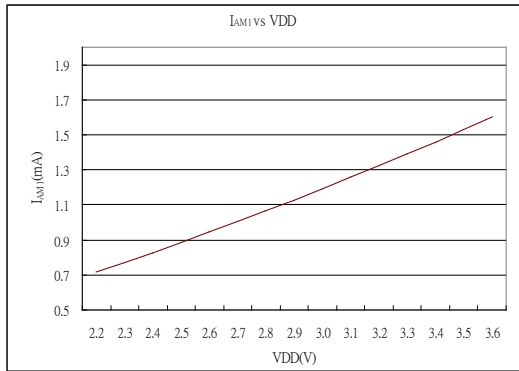


Figure 6.3-1  $I_{AM1}$  vs. VDD

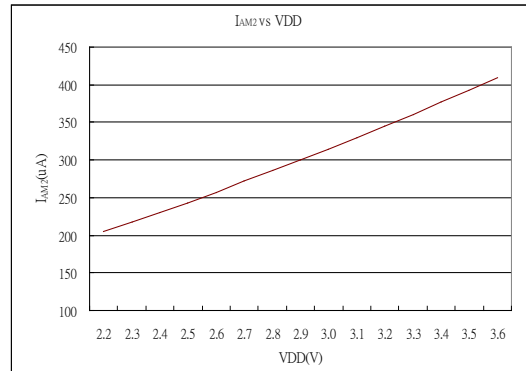


Figure 6.3-2  $I_{AM2}$  vs. VDD

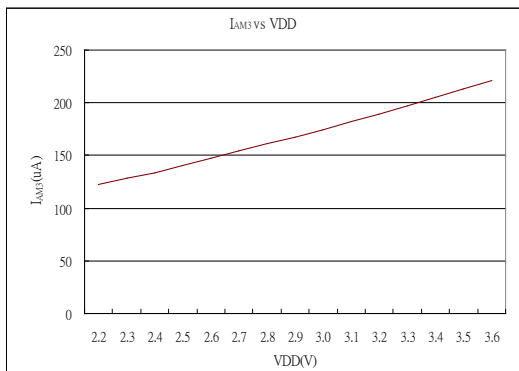


Figure 6.3-3  $I_{AM3}$  vs. VDD

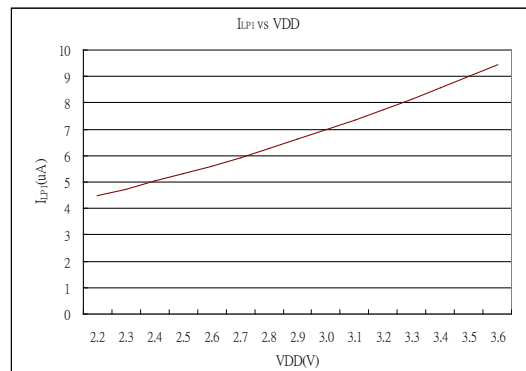


Figure 6.3-4  $I_{LP1}$  vs. VDD

# HY11P23

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

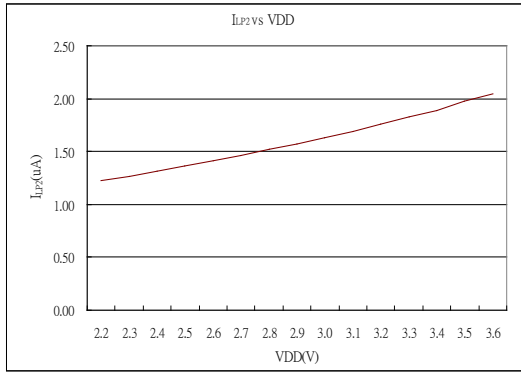


Figure 6.3-5 I<sub>LP2</sub> vs. VDD

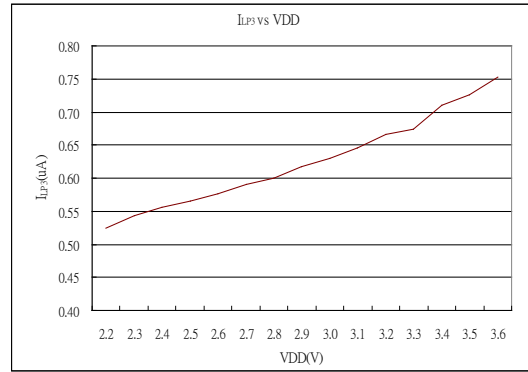


Figure 6.3-6 I<sub>LP3</sub> vs. VDD

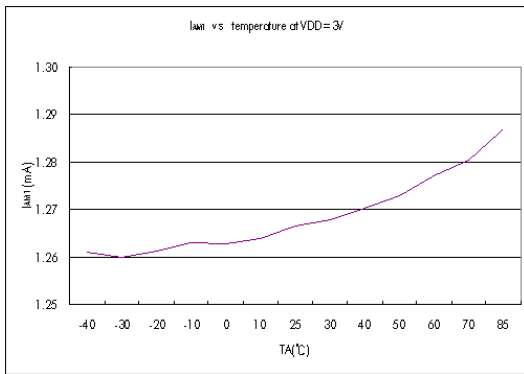


Figure 6.3-7 I<sub>AM1</sub> vs. Temperature

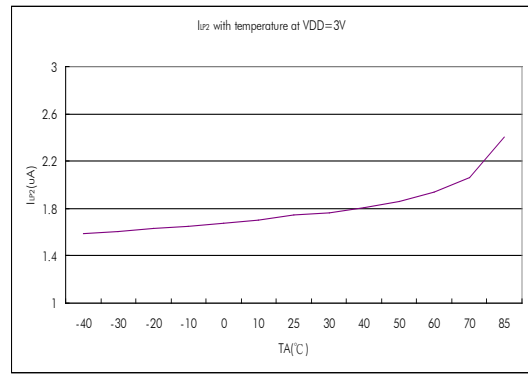


Figure 6.3-8 I<sub>LP2</sub> vs. Temperature

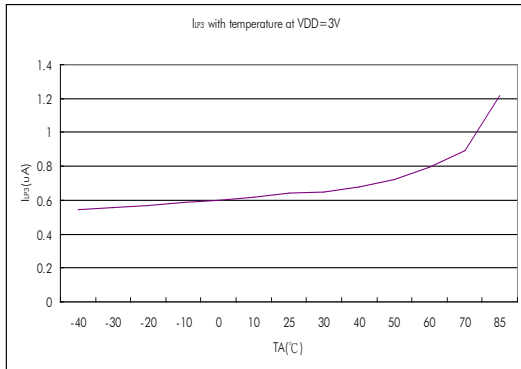


Figure 6.3-9 I<sub>LP3</sub> vs. Temperature



### 6.4 Port1~5

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

Sym.	Parameter	Test Conditions	Min.	Typ.	Max.	unit
<b>Input voltage and Schmitt trigger and leakage current and timing</b>						
$V_{IH}$	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	$\mu\text{A}$
$R_{PU}$	Port pull high resistance			180		$\text{k}\Omega$
<b>Output voltage and current and frequency</b>						
$V_{OH}$	High-level output voltage	$I_{OH}=10\text{mA}$	$V_{DD} - 0.3$			V
$V_{OL}$	Low-level output voltage	$I_{OL}=-10\text{mA}$	$V_{SS} + 0.3$			

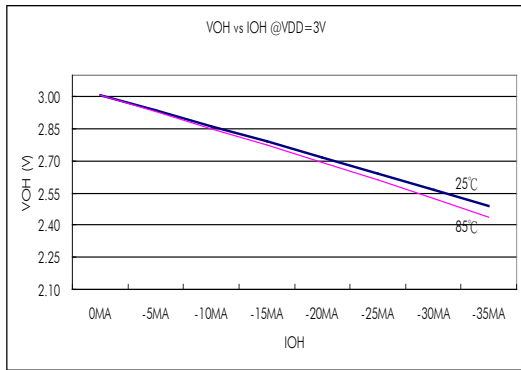


Figure 6.4-1  $V_{OH}$  vs.  $I_{OH}$  @  $V_{DD}=3.0\text{V}$

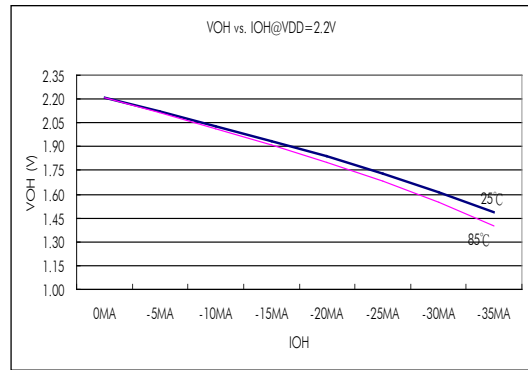


Figure 6.4-2  $V_{OH}$  vs.  $I_{OH}$  @  $V_{DD}=2.2\text{V}$

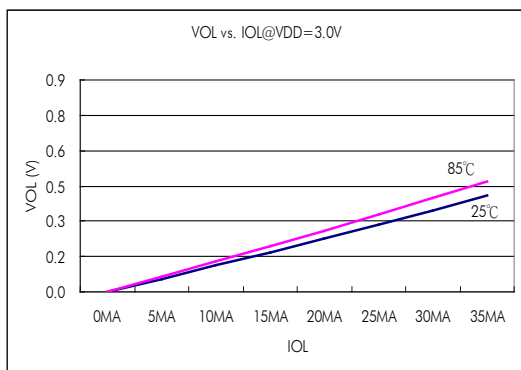


Figure 6.4-3  $V_{OL}$  vs.  $I_{OL}$  @  $V_{DD}=3.0\text{V}$

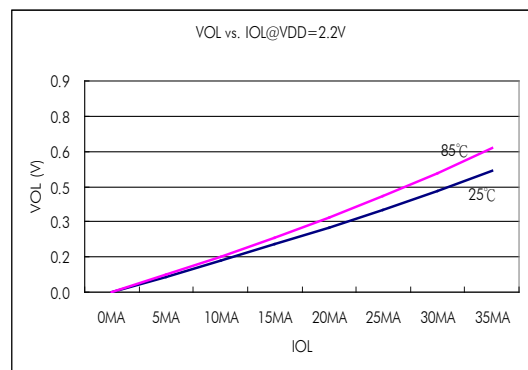


Figure 6.4-4  $V_{OL}$  vs.  $I_{OL}$  @  $V_{DD}=2.2\text{V}$

### 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, $V_{LVD} VLDx[3:0]=1110b$			3.3		V	
	Detect $V_{DD}$ voltage rang by user option, $V_{LVD} VLDx[3:0]=1101b$			3.2			
	Detect $V_{DD}$ voltage rang by user option, $V_{LVD} VLDx[3:0]=1100b$			3.1			
	Detect $V_{DD}$ voltage rang by user option, $V_{LVD} VLDx[3:0]=1011b$			3.0			
	Detect $V_{DD}$ voltage rang by user option, $V_{LVD} VLDx[3:0]=1010b$			2.9			
	Detect $V_{DD}$ voltage rang by user option, $V_{LVD} VLDx[3:0]=1001b$			2.8			
	Detect $V_{DD}$ voltage rang by user option, $V_{LVD} VLDx[3:0]=1000b$			2.7			
	Detect $V_{DD}$ voltage rang by user option, $V_{LVD} VLDx[3:0]=0111b$			2.6			
	Detect $V_{DD}$ voltage rang by user option, $V_{LVD} VLDx[3:0]=0110b$			2.5			
	Detect $V_{DD}$ voltage rang by user option, $V_{LVD} VLDx[3:0]=0101b$			2.4			
	Detect $V_{DD}$ voltage rang by user option, $V_{LVD} VLDx[3:0]=0100b$			2.3			
	Detect $V_{DD}$ voltage rang by user option, $V_{LVD} VLDx[3:0]=0011b$			2.2			
	Detect $V_{DD}$ voltage rang by user option, $V_{LVD} VLDx[3:0]=0010b$			2.1			
	Detect $V_{DD}$ voltage rang by user option, $V_{LVD} VLDx[3:0]=0001b$			2.0			
BOR : Brownout Reset LVR : Low Voltage Reset of BOR LVD : Low Voltage Detect RST : External Reset pin							

# HY11P23

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

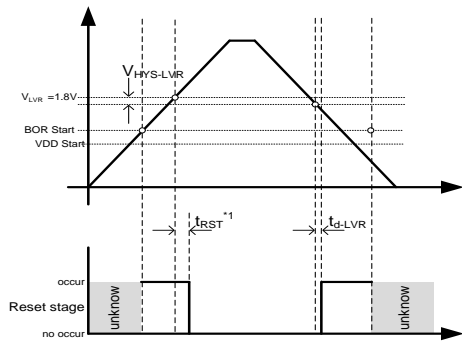


Figure 6.5-1 BOR reset diagram

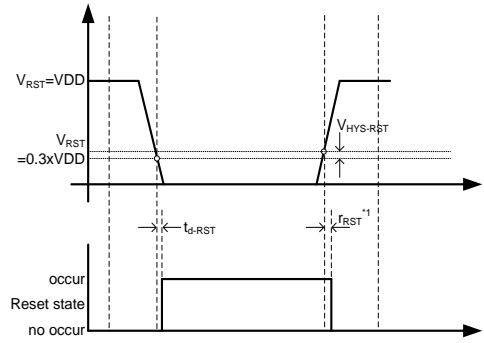


Figure 6.5-2 RST reset diagram

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

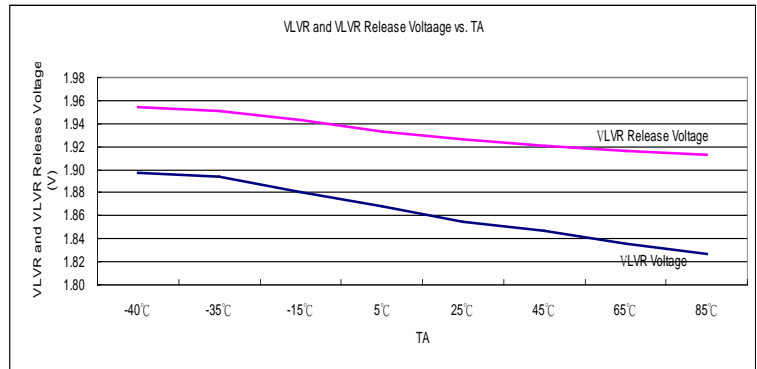


Figure 6.5-3 LVR vs. Temperature

### 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			$\mu\text{A}$
	Select VDDA output voltage	$I_L = 0.1\text{mA}$ , $V_{DD} \geq V_{DDA} + 0.2\text{V}$	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	$I_L = 10\text{mA}$	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	$T_A = -40^\circ\text{C} \sim 85^\circ\text{C}$	50			ppm/ $^\circ\text{C}$	
$V_{DD}$ Voltage drift	$I_L = 0.1\text{mA}$	$V_{DD} = 2.5\text{V} \sim 3.6\text{V}$	$\pm 0.2$			%/V	
ACM	ACM operation current, $I_{ACM}$	$I_L = 0\text{mA}$		20			$\mu\text{A}$
	Output voltage, $V_{ACM}$	ENACM[0]=1, *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		$V_{ACM}$
	Output voltage, $V_{ACM}$	ENACM[0]=1, *2	$I_L = 0\mu\text{A}$	1.2			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/ $^\circ\text{C}$
	$V_{DDA}$ Voltage drift	$I_L = 10\mu\text{A}$		100			$\mu\text{V}/\text{V}$

VDDA : Adjust Voltage Regulator  
ACM : Analog Common Mode Voltage

\*1:  $V_{ACM} = 1.0\text{V}$  is just for VDDAX[1:0]=1xb mode. (at A/D differential voltage reference < 1.4V)  
\*2:  $V_{ACM} = 1.2\text{V}$  is just for VDDAX[1:0]=0xb mode. (at A/D differential voltage reference > 1.4V)

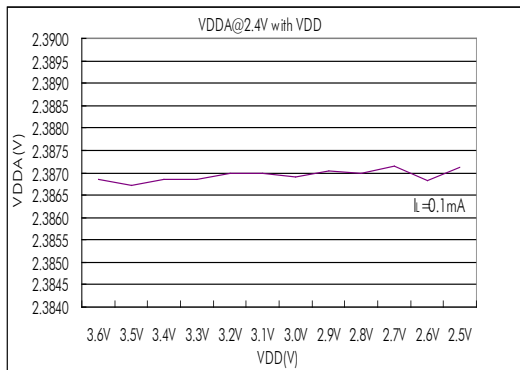


Figure6.6-1 VDDA  $I_L=0.1\text{mA}$  vs. VDD

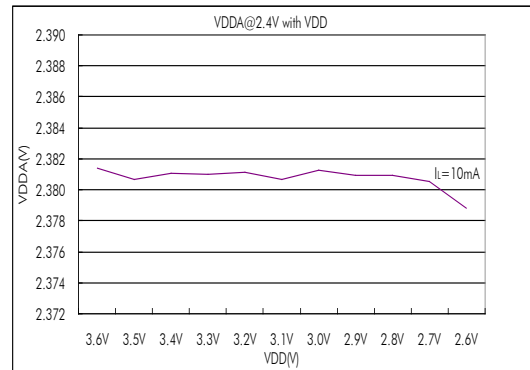


Figure6.6-2 VDDA  $I_L=10\text{mA}$  vs. VDD

# HY11P23

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

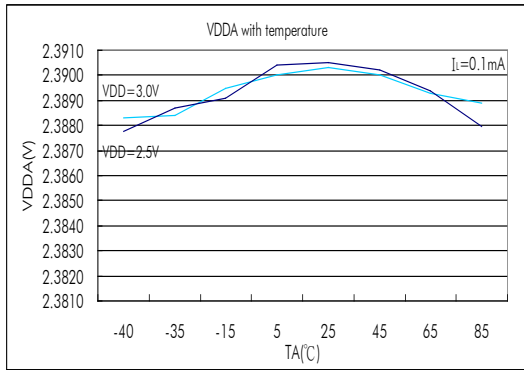


Figure 6.6-3 VDDA  $I_L=0.1\text{mA}$  vs. Temperature

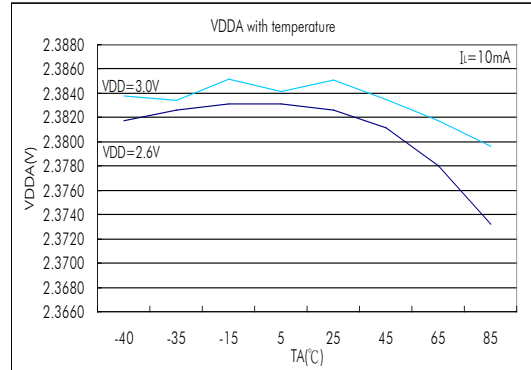


Figure 6.6-4 VDDA  $I_L=10\text{mA}$  vs. Temperature

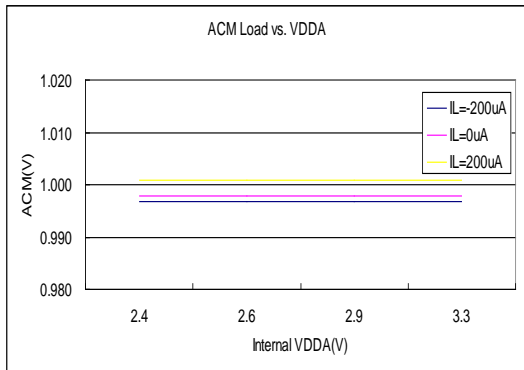


Figure 6.6-5 ACM Load vs. VDDA (a)

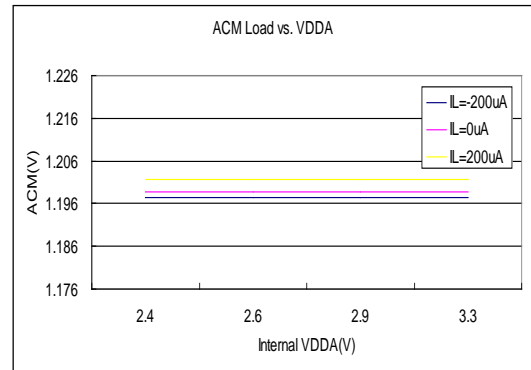


Figure 6.6-5 ACM Load vs. VDDA (b)

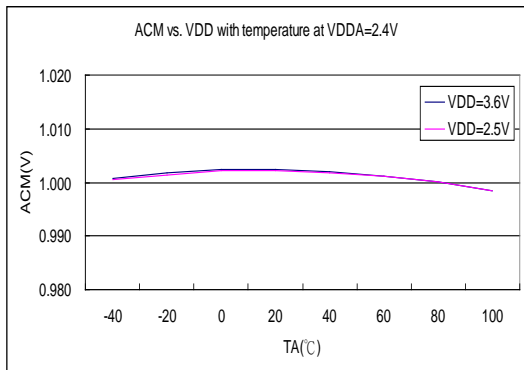


Figure 6.6-6 ACM vs. Temperature (a)

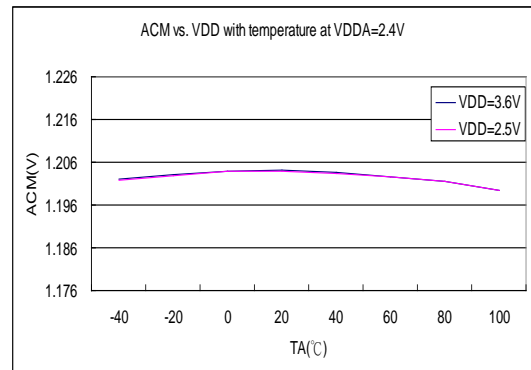


Figure 6.6-6 ACM vs. Temperature (b)

## 6.7 Low Noise OPAMP

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

Sym.	Parameter	Test Conditions		Min.	Typ.	Max.	unit
$V_{LNOF}$	Supply voltage at VDDA	ENVDDA[0]=0		2.4		3.6	V
$I_{LNOF}$	Operation supply current		OPM[1:0]=xxb		200		$\mu\text{A}$
$V_{OS-OP}$	Input offset voltage without chopper.		OPM[1:0]=1xb	-2		2	mV
	Input offset voltage with chopper		OPM[1:0]=0xb		20		$\mu\text{V}$
	Input offset voltage temperature drift.	OPM[1:0]=00b OPM[1:0]=10	$T_A=-40^\circ\text{C} \sim 85^\circ\text{C}$		0.1 2		$\mu\text{V}/^\circ\text{C}$
$V_{OLR}$	Unit gain load regulation	$V_O=1.2\text{V}$ , $V_{DDA}=2.4\text{V}$	$I_L=+1\text{mA}$ $I_L=-1\text{mA}$		0.1		$\%V_O$
CMVR	Common-mode voltage input range		OPM[1:0]=xxb	0.1		$V_{DDA}-1.1$	V
CMRR	Common-mode rejection ratio		OPM[1:0]=xxb		90		dB

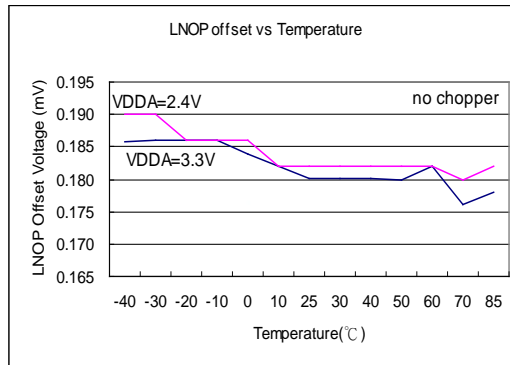


Figure6.7-1 LNOP Offset Temperature

### 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			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

$T_A = 25^\circ\text{C}, V_{DD} = 3.0\text{V}, V_{DDA} = 2.4\text{V}$ , 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]=<01> or <1x>			320		uA
$G_{PGA}$	Gain temperature drift	$T_A = -40^\circ\text{C} \sim 85^\circ\text{C}$	GAIN=128		5		ppm/°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)	$V_{DDA} = 2.4\text{V}, V_{VR} = 1.0\text{V}, \Delta\text{SI} = \pm 200\text{mV}$		$\pm 0.003$		$\pm 0.01$	%FSR
		$V_{DDA} = 2.4\text{V}, V_{VR} = 1.0\text{V}, \Delta\text{SI} = \pm 450\text{mV}$					
	No Missing Codes <sup>3</sup>	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	$T_A = -40^\circ\text{C} \sim 85^\circ\text{C}$	2		ppm/°C	
		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	$\Delta\text{AI} = 0\text{V}$ $\Delta\text{VR} = 0.9\text{V}$ DCSET[2:0]=<000>	Gain=2	1		%FSR	
	Offset error of Full Scale Rang input voltage range with Chopper without PGA and Buffer(INBUF, VRBUF)	* $\Delta\text{AI}$ is external short	Gain=2	1			

# HY11P23

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

CM <sub>SD18</sub>	Offset temperature drift with chopper without PGA and Buffer (INBUF,VRBUF).		GAIN=1	2	uV/°C
			GAIN=2	1	
			GAIN=4	0.5	
	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 <sub>SD18</sub>	Common-mode rejection	V <sub>CM</sub> =0.7V to 1.7V, V <sub>VR</sub> =1.0V, without PGA	V <sub>SI</sub> =0V, GAIN=1	
V <sub>CM</sub> =0.7V to 1.7V, V <sub>VR</sub> =1.0V, without PGA			V <sub>SI</sub> =0V, GAIN=16	75	
PSRR	DC power supply rejection	V <sub>D</sub> DA=3.0V, $\Delta$ V <sub>D</sub> DA=±100mV, V <sub>VR</sub> =1.0V, V <sub>SI</sub> =1.2V, V <sub>SI</sub> =1.2V,	GAIN=1 PGA=off	75	dB
			GAIN=16 PGA=8		

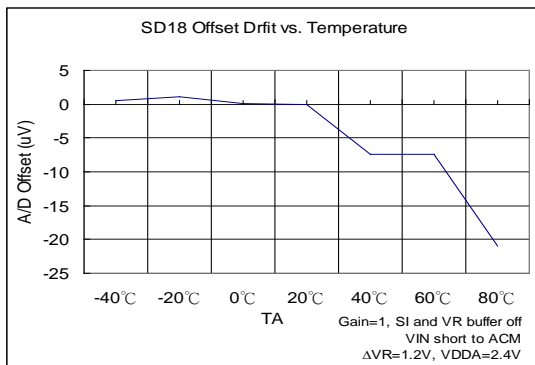


Figure 6.8-1(a) SD18 Offset Temperature drift

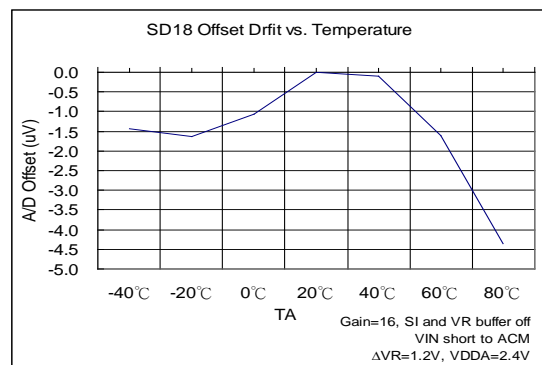


Figure 6.8-1(b) SD18 Offset Temperature drift

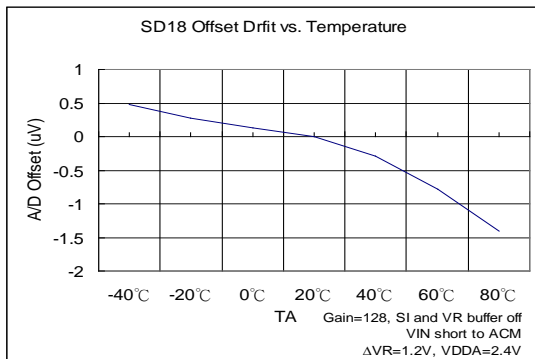


Figure 6.8-1I SD18 Offset Temperature drift

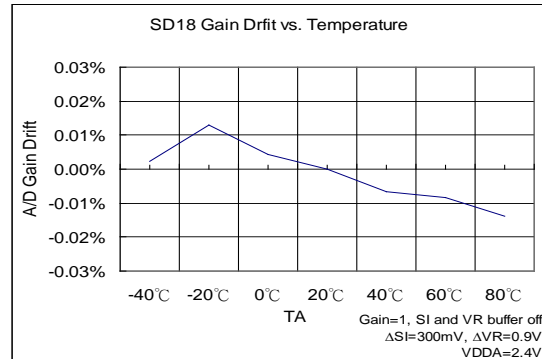


Figure 6.8-2(a) SD18 Gain drift with temperature



# HY11P23

Embedded 18-Bit  $\Sigma\Delta$ ADC

8-Bit RISC-like Mixed Signal Microcontroller

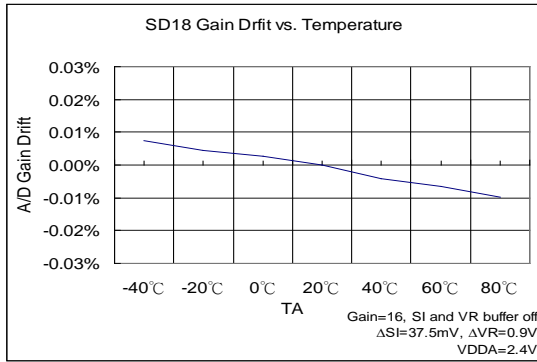


Figure6.8-2(b) SD18 Gain drift with temperature

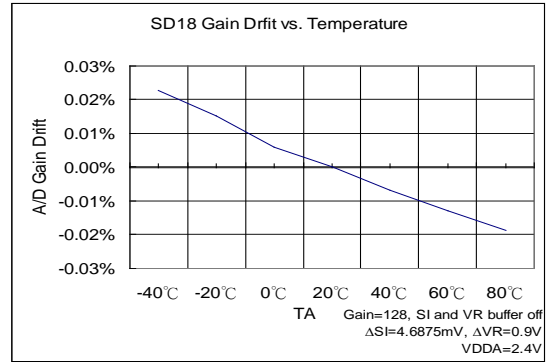


Figure6.8-2(c) SD18 Gain drift with temperature

### 6.8.3 SD18, Temperature sensor

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

Sym.	Parameter	Test Conditions	Min.	Typ.	Max.	unit
$TC_S$	Sensor temperature drift			178		$\mu\text{V}/^\circ\text{C}$
KT	Absolute Temperature Scale $0^\circ\text{K}$	INBUF[0]=1		-289		$^\circ\text{C}$
$TC_{ERR}$	One point calibrate error temperature	Calibration at $25^\circ\text{C}$ of $-40^\circ\text{C} \sim 85^\circ\text{C}$		$\pm 2$		$^\circ\text{C}$

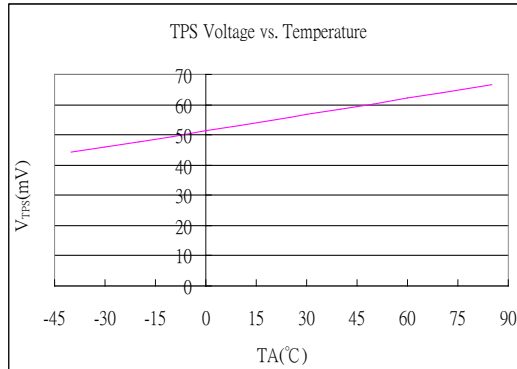


Figure 6.8-3 TPS output voltage vs. temperature drift

### 6.8.4 SD18 Noise Performance

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

HY11P23 針對 SD18 提供了重要的輸入雜訊規格。Table 6.8-4(a), Table 6.8-4(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。

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

Table 6.8-4(a) SD18 ENOB Table

# HY11P23

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



<i>RMS Noise(uV) with OSR/GAIN at A/D Clock=250Khz, VDDA=2.4V, VREF=1.2V</i>													
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	x									ADGN
$\pm 2400$	0.25	=	1	x	0.25	121.08	57.40	38.74	26.66	18.39	13.21	9.49	6.98
$\pm 2160$	0.5	=	1	x	0.5	61.63	29.23	19.21	13.51	9.78	7.02	5.12	3.91
$\pm 1080$	1	=	1	x	1	32.21	15.70	10.25	7.31	5.19	3.77	2.80	2.13
$\pm 540$	2	=	1	x	2	16.59	8.54	5.91	4.06	2.86	2.06	1.48	1.12
$\pm 270$	4	=	1	x	4	9.00	4.84	3.33	2.37	1.67	1.19	0.87	0.65
$\pm 135$	8	=	1	x	8	5.04	2.97	2.02	1.44	1.01	0.73	0.51	0.39
$\pm 68$	16	=	1	x	16	3.03	1.84	1.29	0.92	0.70	0.46	0.33	0.24
$\pm 34$	32	=	2	x	16	2.61	1.81	1.27	0.89	0.62	0.45	0.32	0.23
$\pm 17$	64	=	4	x	16	1.66	1.13	0.80	0.56	0.41	0.29	0.20	0.14
$\pm 8$	128	=	8	x	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:

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

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

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

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

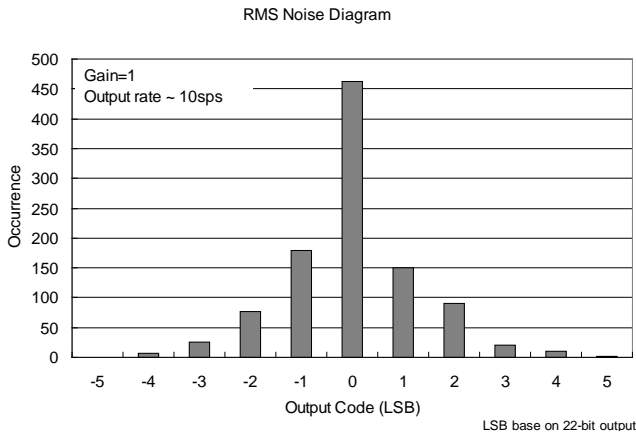


Figure6.8-4(a) RMS Noise Diagram

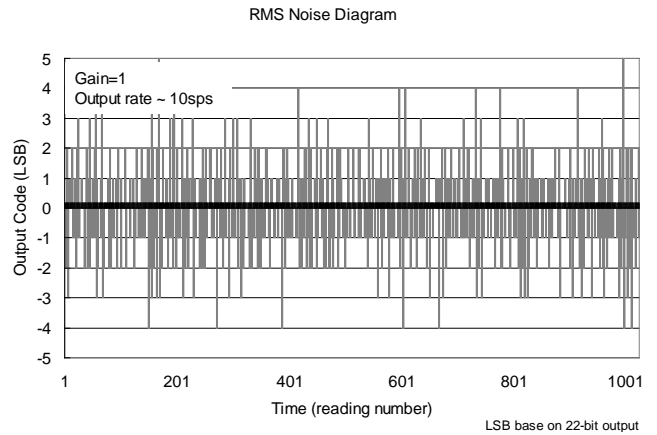


Figure6.8-4(b) Output Code Diagram

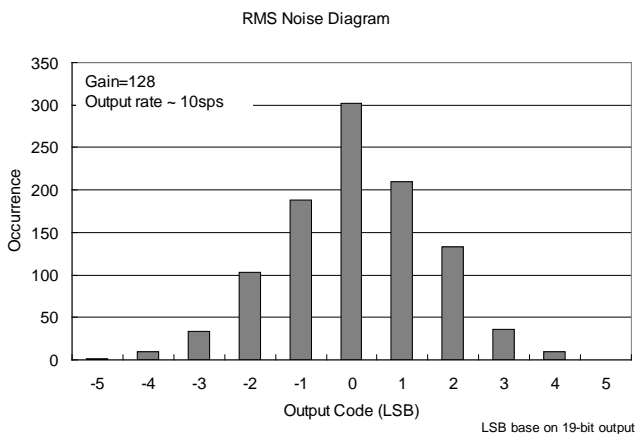


Figure6.8-4(c) RMS Noise Diagram

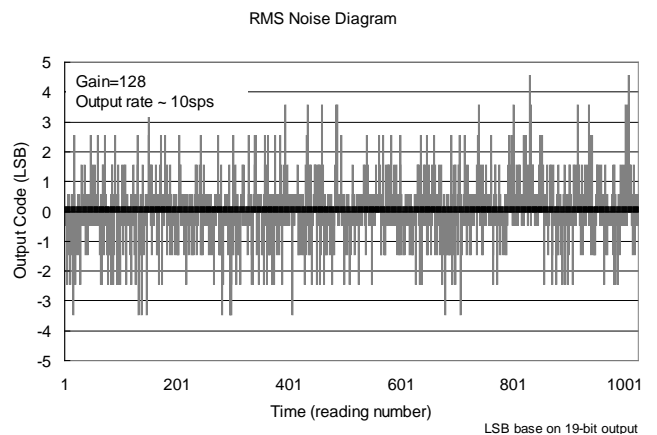


Figure6.8-4(d) Output Code Diagram

## 7. 訂貨資訊

下單品名 <sup>1</sup>	封裝型式	引腳數	封裝型式		程式碼 編號 <sup>2</sup>	出貨包裝 形式	個裝 數量	材料 組成	MSL <sup>3</sup>
			描述方式						
HY11P23-D000	Die	-	D	000	000	-	200	Green <sup>4</sup>	-
HY11P23-L032	LQFP	32	L	032	000	Tray	250	Green <sup>4</sup>	MSL-3
HY11P23-NS32	QFN	32	N	032	000	Tray	490	Green <sup>4</sup>	MSL-3
HY11P23-E028	SSOP	28	E	028	000	Tube	48	Green <sup>4</sup>	MSL-3
HY11P23-E028	SSOP	28	E	028	000	Tape & Reel	2000	Green <sup>4</sup>	MSL-3

<sup>1</sup> 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 HY11P23-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 HY11P23-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 LQFP32 出貨，則下單品名為 HY11P23-L032，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 QFN32 出貨，則下單品名為 HY11P23-NS32-009，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

<sup>2</sup> 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。

<sup>3</sup> 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。

<sup>4</sup> Green (RoHS & no Cl/Br):

HYCON 產品皆為 Green Product，符合 RoHS 指令，REACH 高關注物質(SVHC) 以及無鹵素規定(Br<900ppm or Cl<900ppm or (Br+Cl)<1500ppm)。

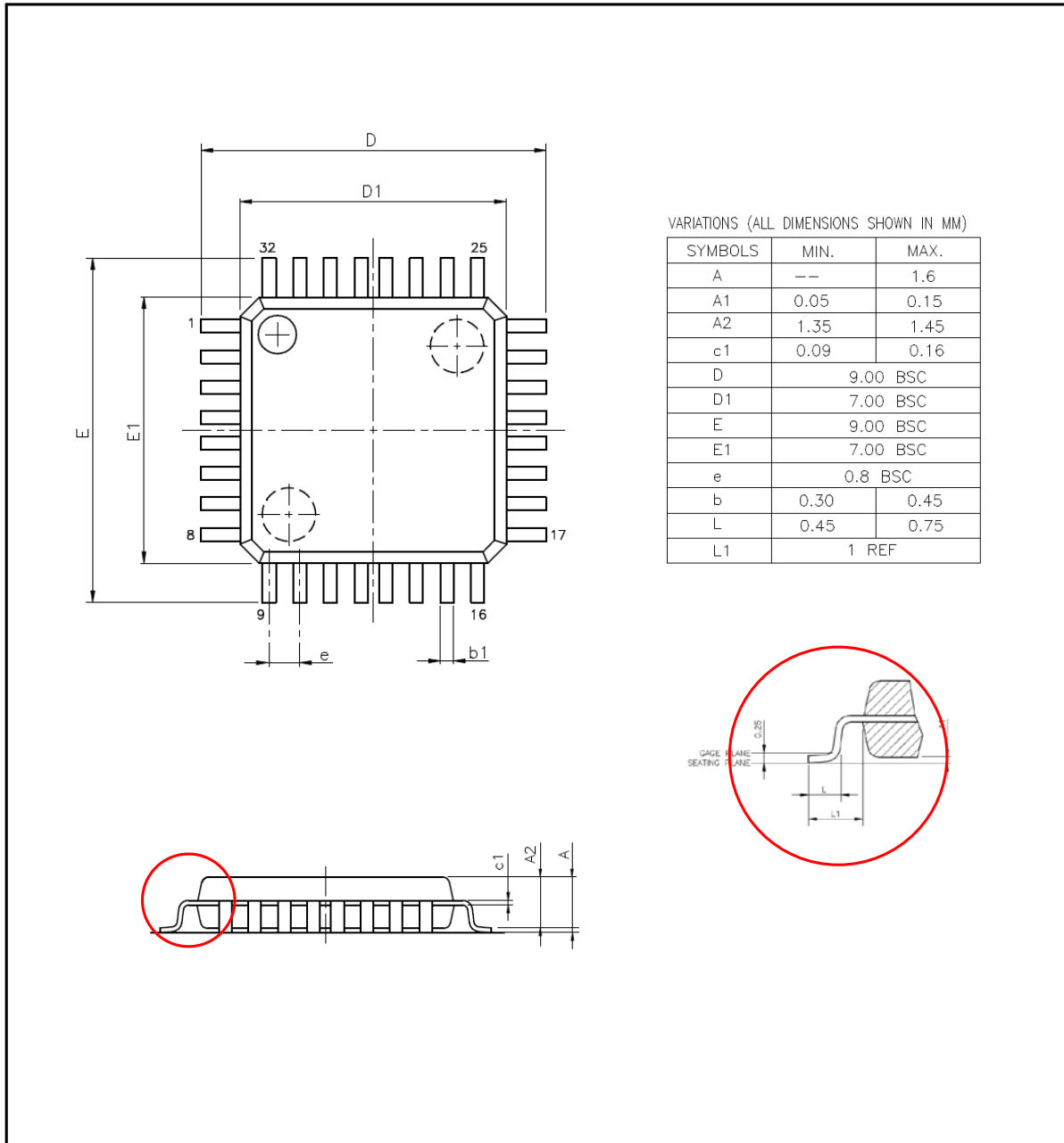
# HY11P23

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

## 8. 封裝型式資訊

### 8.1 LQFP32(L032)

#### 8.1.1 Package Dimensions



Note:

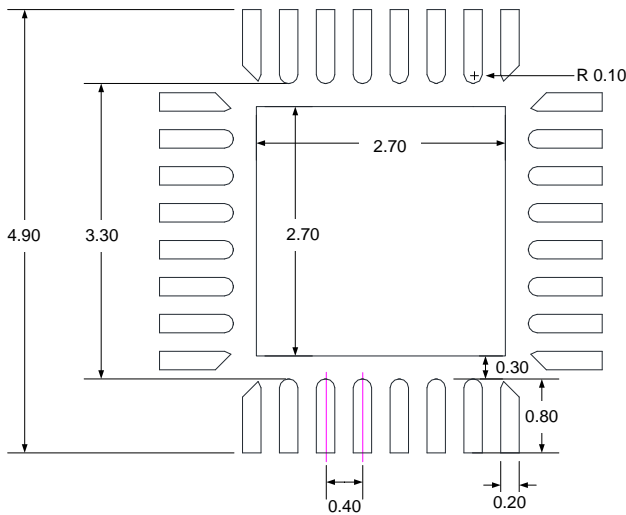
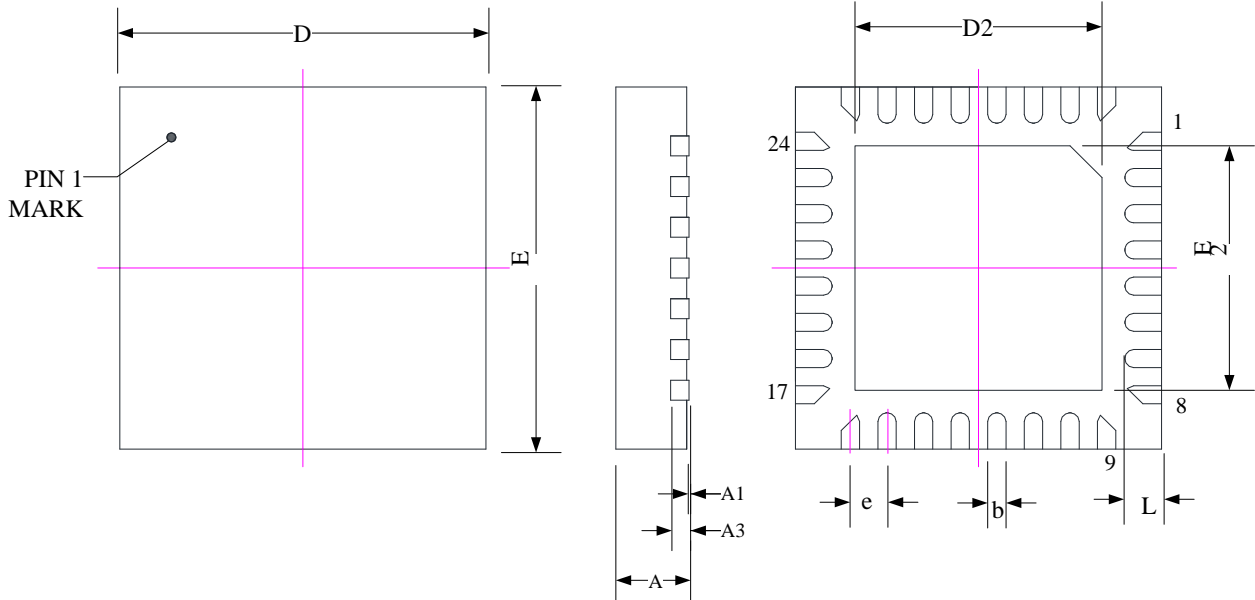
1. All dimensions refer to JEDEC OUTLINE MS-026.
2. Do not include Mold Flash or Protrusions.
3. Unit : mm

# HY11P23

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

## 8.2 QFN32(NS32)

### 8.2.1 Package Dimensions



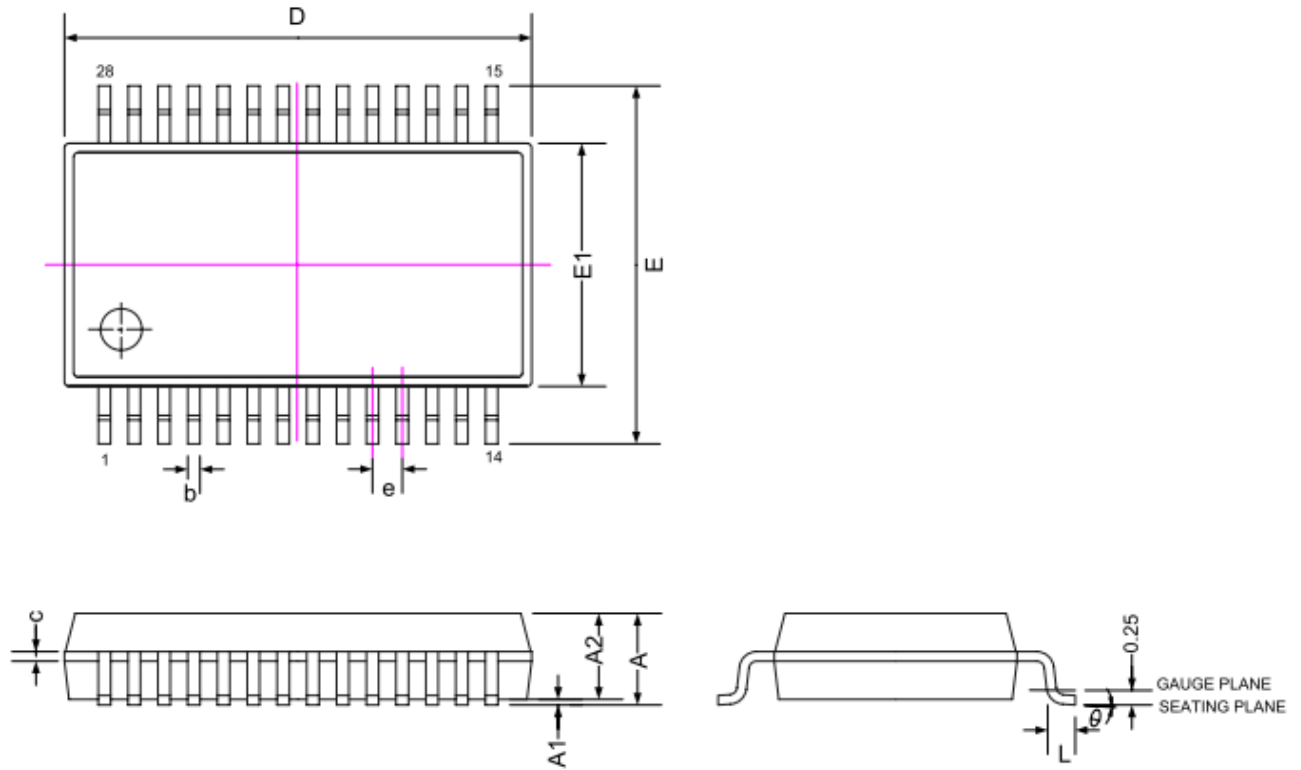
SYMBOLS	MIN	NOM	MAX
A	0.50	0.55	0.60
A1	0.00	0.02	0.05
A3	0.15 REF.		
b	0.15	0.20	0.25
D	3.90	4.00	4.10
E	3.90	4.00	4.10
D2	2.65	2.70	2.75
E2	2.65	2.70	2.75
L	0.25	0.30	0.35
e	0.40 BASIC		

#### Note:

1. All dimensions refer to JEDEC OUTLINE MO-220.
2. Unit : mm
3. <http://www.hycontek.com/attachments/MSP/OJTI-HM-2013-002.pdf>

## 8.3 SSOP28(E028, 209mil)

### 8.3.1 Package Dimensions



SYMBOLS	MIN	NOM	MAX
A	-	-	2.00
A1	0.05	-	-
A2	1.65	1.75	1.85
b	0.22	-	0.38
c	0.09	-	0.25
D	10.05	10.20	10.50
E1	5.00	5.30	5.60
E	7.65	7.80	7.90
L	0.55	0.75	0.95
e	0.65 BASIC		
$\theta^\circ$	0	4	8

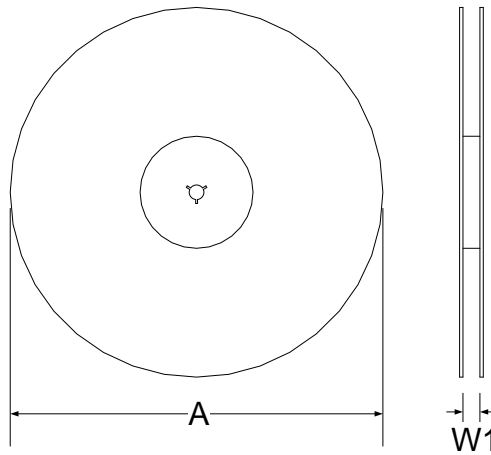
**Note:**

1. All dimensions refer to JEDEC OUTLINE MO-150.
2. Do not include Mold Flash or Protrusions.
3. Unit : mm

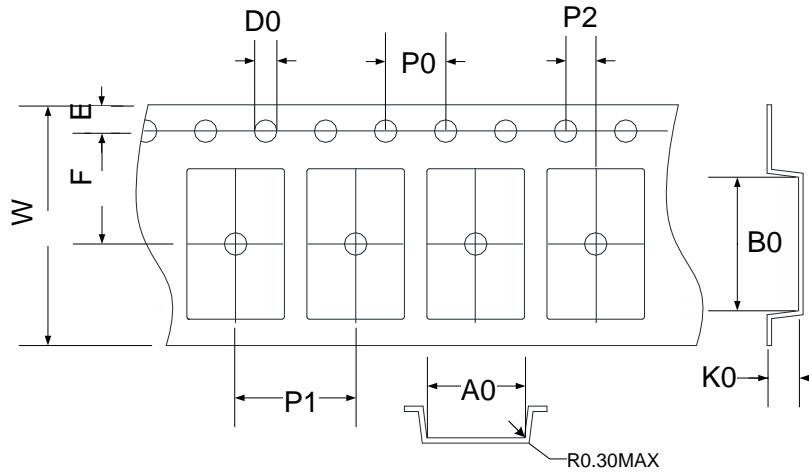


## 8.3.2 Tape & Reel Informations

### 8.3.2.1 Reel Dimensions



### 8.3.2.2 Carrier Tape Dimension

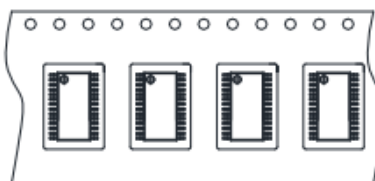


SYMBOLS	Reel Dimensions		Carrier Tape Dimensions									
	A	W1	A0	B0	K0	P0	P1	P2	E	F	D0	W
Spec.	330	24.5	8.40	10.65	2.40	4.00	12.00	2.00	1.75	11.50	1.50	24.00
Tolerance	+6/-3	+1.5/-0	±0.10	±0.10	±0.10	±0.10	±0.10	±0.10	±0.10	±0.10	+0.1/-0	±0.30

Unit: mm

Note: 10 Sprocket hole pitch cumulative tolerance is  $\pm 0.20$ mm.

### 8.3.2.3 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	ALL	全面變更內容
V04	5~8	修訂 2 章節；變更引腳圖與調整引腳定義順序
	9~11	修訂 3 章節；編修與增加應用電路
	13~14	修訂 4.3 章節；修訂暫存器名稱
	30	修訂 7 章節；轉為中文資訊且編修欄位與內容
	32	新增 9 章節；文件修訂記錄
V05	5~6	修訂 I/O 定義相關圖示與表，增加 INT2 (PT1.2) 與 INT3 (PT1.3) 外部中斷功能
	9~11	
V06	4	修訂 68 個指令成 67 個指令，特點內容修改
	6~8	I/O 引腳定義內容修改
	13~14	暫存器內容修改
	24	Input offset voltage temperature drift.規格修改
	25	增加 $G_{SD18}$ Temperature Drift 內容說明
V07	4	修訂章節內容
	6~7	修訂章節內容
	9~11	修訂電路圖內容
	14	修訂章節內容
	22~23	修訂章節內容
	25~27	修訂章節內容
V08	13	修訂章節內容
V09	4	修訂章節內容
	7	修訂章節內容
	22~23	修訂章節內容
V10	5	刪除 P-DIP32 封裝型式，增加 QFN32 封裝型式
	29	刪除 HY11P23-P032 訂貨資訊，增加 QFN32 訂貨資訊
	31	刪除 HY11P23-P032 封裝型式資訊，增加 QFN32 封裝型式資訊
V11	4	修訂特點內容
	5	增加註 3 內容說明
	9~11	修訂應用電路圖，增加 RST 的 RC 電路
V12	13	增加 SD18 Network 章節
	23	修訂 Power System 溫飄規格
	29~30	增加 SD18 Noise Performance 章節

# HY11P23

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

V13	4	修改 1.特點內容
	16	修改 6.電氣特性內容
	31	修改 RMS Noise Diagram
V14	24	修改圖片背景顏色
	13	修改圖 4-2 INH/INL
	34	修正封裝形式資訊
V15	12	修改開發工具相關使用說明書編號
	32	增加訂貨資訊內容
V16	6	增加 I/O 引腳定義 (LQFP32/QFN32)
	14	增加 Low Noise OPAMP Network
V17	4	增加比較表說明
	6,10~11	增加 SSOP28 封裝引腳訊息
	7	修改引腳描述內容
	36	增加訂貨資訊內容
	39	增加封裝形式資訊
V18	21	調整 HAO 規格
V19	ALL	刪除 QFN32(N032)封裝訊息，增加 QFN32(NS32)封裝訊息
	37	更新 Green(RoHS & no Cl/Br)
	41	新增 SSOP28(E028) Tape & Reel Information