HY10P40
Datasheet

8-Bit RISC-like Mixed Signal Microcontroller

Embedded 18-Bit ΣΔADC

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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-Bit RISC-like 微控制器，具有 46 條高性能指令集 H08B
- 24-Bit ΣΔADC 類比數位轉換器
  - 梳狀濾波器採二階設計，轉換頻率達 1.95Ksps
  - 取樣頻率 250KHz
  - 超取樣頻率設置 128～32768
  - 全差動輸入信號與測量範圍的零點調整
  - 信號放大 x1/4,x1/2,x1,x2,x4,x8,x16
  - 測量信號輸入通道 8ch
  - 低溫飄係數
- 內部電源系統
  - 內置 LDO 線性穩壓電源 VDDA
    - 內部類比電路或外部傳感器電壓源
    - 輸出可設置 2.4/2.7/3.0V，可外灌輸入電壓
    - 低操作功耗與低溫飄係數
  - 內置參考電壓源 ACM
    - 類比電路參考電壓源(1.2V)
    - 低操作功耗與低溫飄係數
- 計時器
  - Watch Dog
    - 復位事件與中斷事件
  - 8-bit Timer
    - 中斷事件
  - 16-bit Timer
    - 16-Bit PWM 輸出
    - 兩個 8-Bit PWM 輸出
    - 中斷事件
- 工作電壓與操作溫度範圍
  - V_{REGIN}：4V ~ 24V
  - V_{DD}：2.2V ～ 3.6V
  - - 40°C ～ 85°C
- 工作頻率
  - 內建高精度 HAO 震盪器 2MHz/4MHz/8MHz
  - 內建低功耗 LPO 震盪器 14KHz
- 記憶體型式
  - 2KW OTP 程式記憶體
  - 128B 資料記憶體
  - 6 層堆棧
  - Build-In EPROEM
    - VPP 工作電壓 6.0V
    - 64W EPROM 記憶體
- 引腳特色
  - 具 10mA 驅動能力
  - 自定義功能模組輸出引腳設計
- 復位機制
  - Power On Reset
  - Brown Out Reset
  - Watch Dog Reset
- I^2C 通訊介面

2. 引腳定義

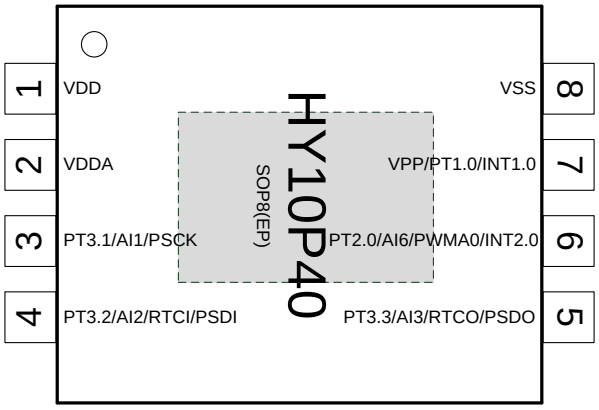


圖 2-1 HY10P40 SOP8(EP)引腳圖

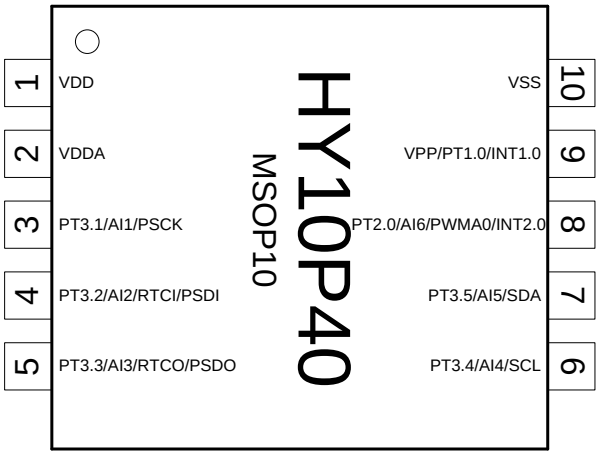


圖 2-2 HY10P40 MSOP10 引腳圖

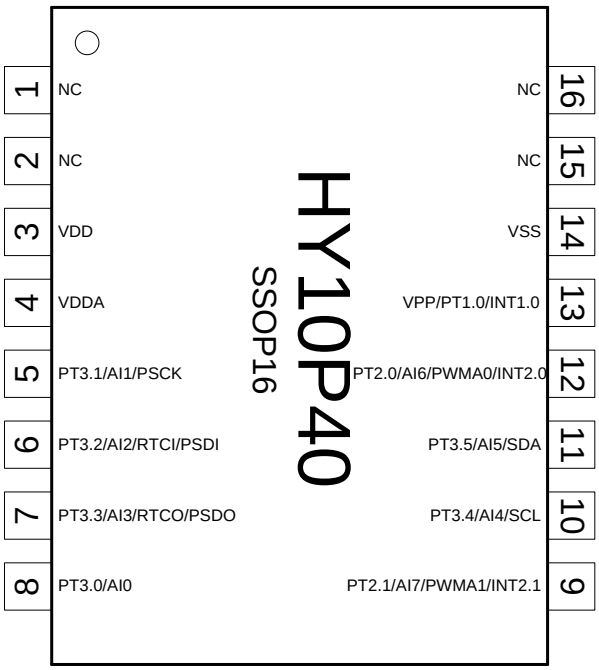


圖 2-3 HY10P40 SSOP16 引腳圖

2.1. 引腳定義說明

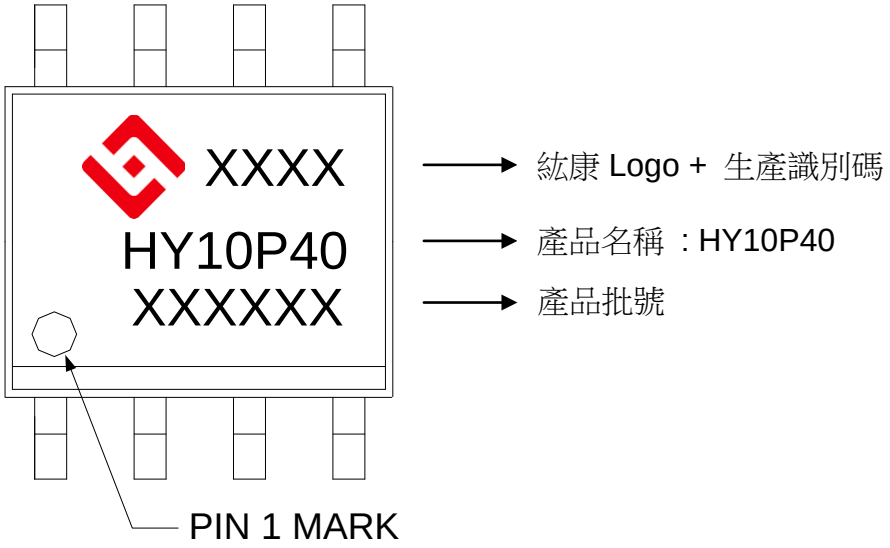
"I"：輸入,"O"：輸出,"A"：類比, "S"：史密斯觸發, "C"：CMOS I/O,"P"：電壓源,"/"：或,"X"：可忽略

封裝				引腳名稱	設計		描述
SSOP16	SSOP16	MSOP10	SOP8(EP)		型式	緩衝	
1	-	-	-	REGIN	P	P	Power Supply. Connect a 1uF ceramic capacitor to VSS.
2	-	-	-	REG33	P	P	Regulated Power Output. A 3.3V regulated voltage output.Only for device use. Connect a 4.7uF ceramic capacitor to VSS.
3	3	1	1	VDD	P	P	晶片工作電壓源接引腳
4	4	2	2	VDDA	P	P	LDO 線性穩壓電源輸出引腳
5	5	3	3	PT3.1	I/O	S/C	數位輸入 / 輸出引腳
				AI1	A	A	類比輸入通道
				PSCK	I	S	OTP 讀/寫介面 PSCK 接口
6	6	4	4	PT3.2	I/O	C	數位輸入 / 輸出引腳
				AI2	A	A	類比輸入通道
				RTCI	C	C	外接 RTC 震盪器引腳
				PSDI	I	S	OTP 讀/寫介面 PSDI 接口
7	7	5	5	PT3.3	I/O	C	數位輸入 / 輸出引腳
				AI3	A	A	類比輸入通道
				RTCO	C	C	外接 RTC 震盪器引腳
				PSDO	I/O	S	OTP 讀/寫介面 PSDO 接口
8	8	-	-	PT3.0	I/O	C	數位輸入 / 輸出引腳
				AI0	A	A	類比輸入通道
9	9	-	-	PT2.1	I/O	C	數位輸入 / 輸出引腳
				AI7	A	A	類比輸入通道
				PWMA1	O	C	TMB1 的 PWM1 輸出引腳
				INT2.1	I	S	外部中斷源(Falling Edge Trigger Interrupt)
10	10	6	-	PT3.4	I/O	C	數位輸入 / 輸出引腳
				AI4	A	A	類比輸入通道
				SCL	I/O	S	I2C 通訊介面引腳
11	11	7	-	PT3.5	I/O	C	數位輸入 / 輸出引腳
				AI5	A	A	類比輸入通道
				SDA	I/O	S	I2C 通訊介面引腳
12	12	8	6	PT2.0	I/O	C	數位輸入 / 輸出引腳
				AI6	A	A	類比輸入通道

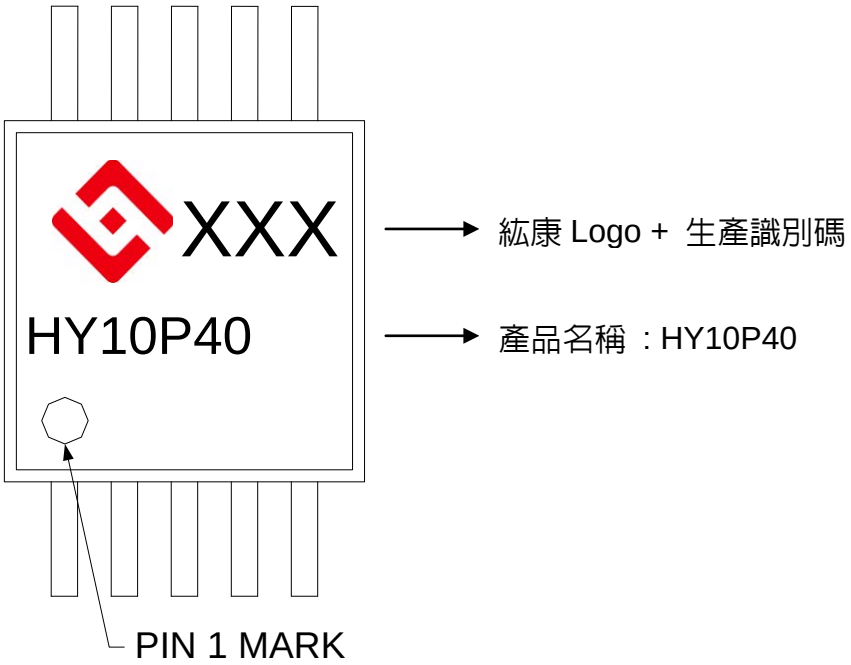
				PWMA0	O	C	TMB1 的 PWM0 輸出引腳
				INT2.0	I	S	外部中斷源(Falling Edge Trigger Interrupt)
13	**13**	**9**	**7**	PT1.0	I	S	數位輸入
				VPP	P	P	OTP 燒錄電壓引腳
				INT1.0	I	S	外部中斷源
14	**14**	**10**	**8**	VSS	P	P	晶片工作電壓源接地端引腳
15	**-**	**-**	**-**	REGVSS	P	P	Connect to VSS.
16	**-**	**-**	**-**	NC	X	X	-
-	**-**	**-**	**EP**	E-pad	P	P	晶片工作電壓源接地端引腳

表 2-1 引腳定義與功能說明

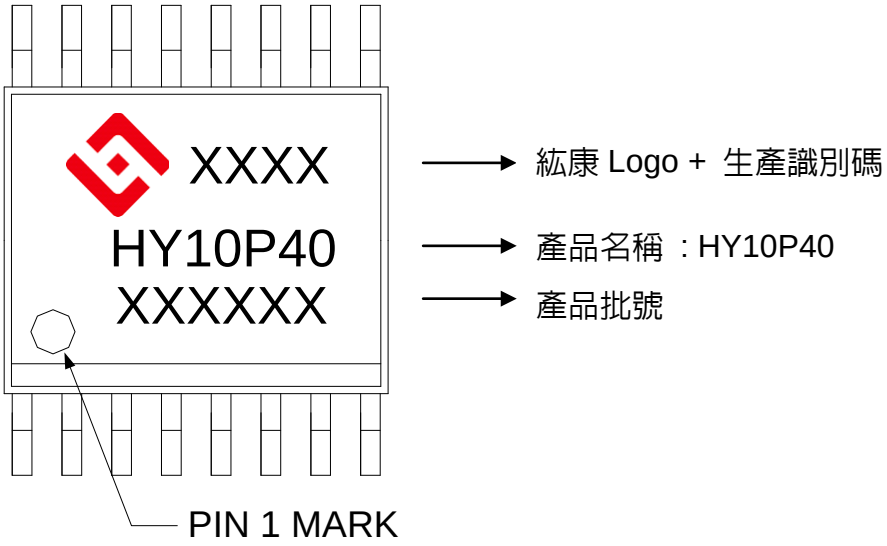
2.1.1. SOP 封裝片標記信息



2.1.2. MSOP 封裝片標記信息



2.1.3. SSOP 封裝片標記信息



3. 應用電路

3.1. PIR application (Pyroelectric infrared-detector)

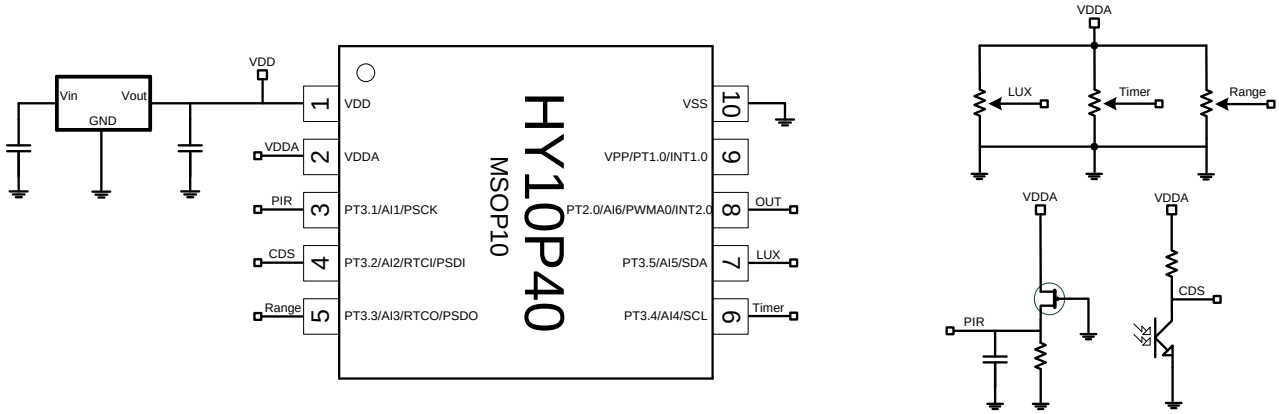


圖 3-1 PIR 應用電路

3.2. Smart Pressure sensor application

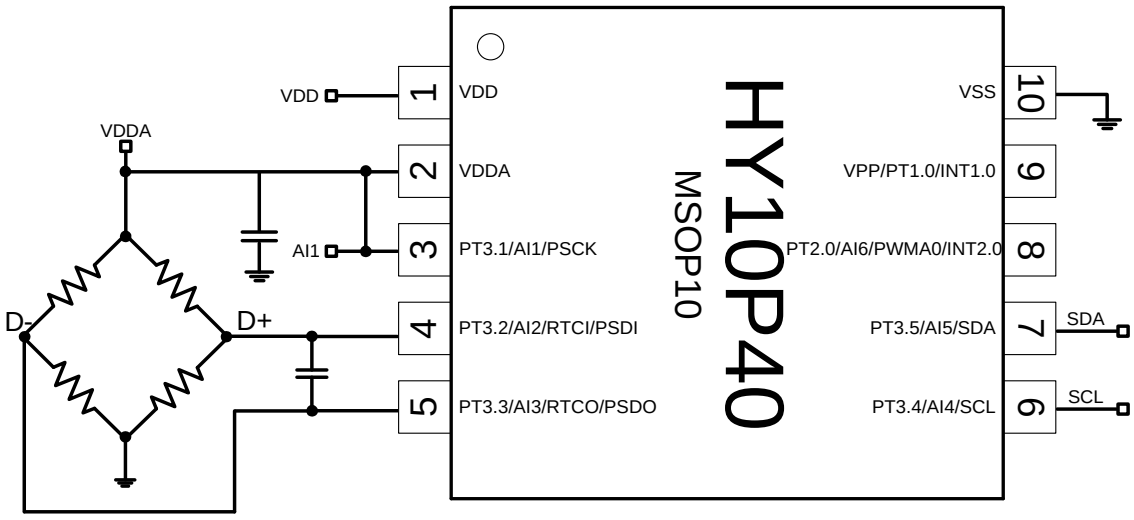


圖 3-2 Smart Pressure Sensor 應用電路

4. 功能概述

4.1. 內部方塊圖

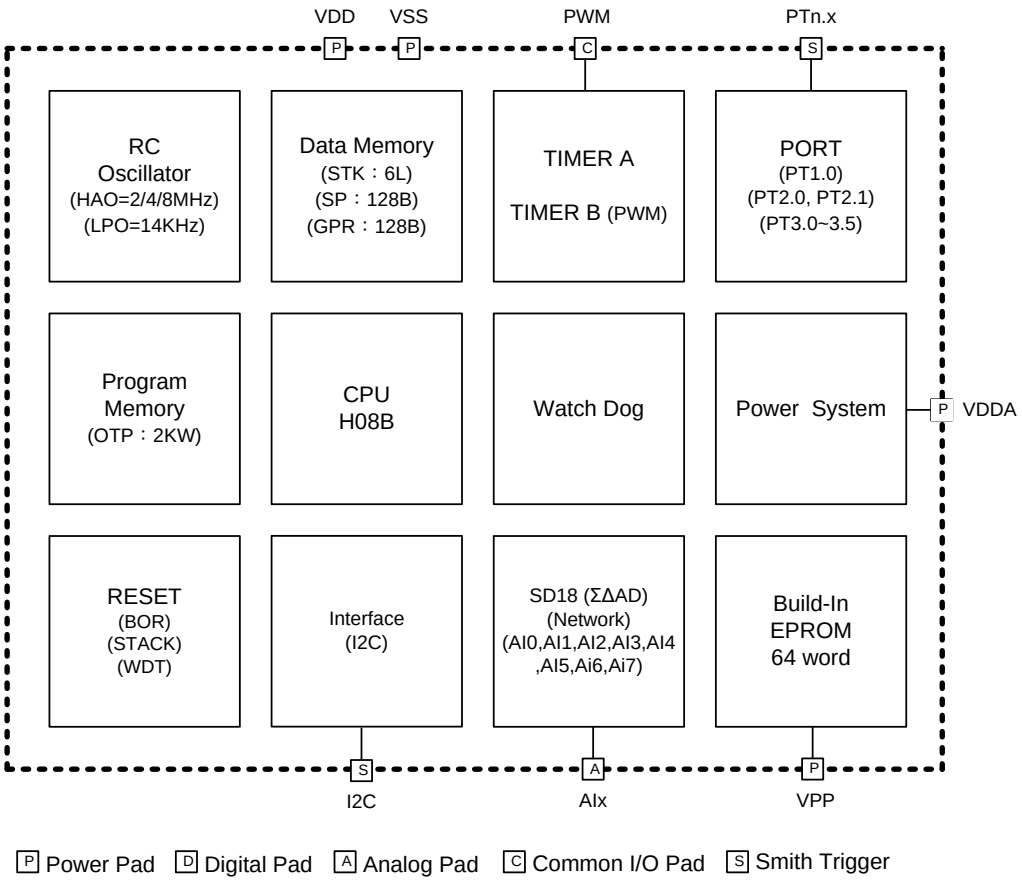


圖 4-1 HY10P40 內部方塊圖

4.2. 相關說明與支援文件

晶片功能相關使用說明書

DS-HY10P40	HY10P40 說明書
UG-HY10SXX	HY10Pxx 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-HYIDE00X-Vxx	HY10xxx 系列開發工具軟體使用說明書
APD-HYIDE00X-Vxx	HY10xxx 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-HY10P40-Vxx	HY10P40 個別產品的裸片打線資訊

4.3. SD18 Network

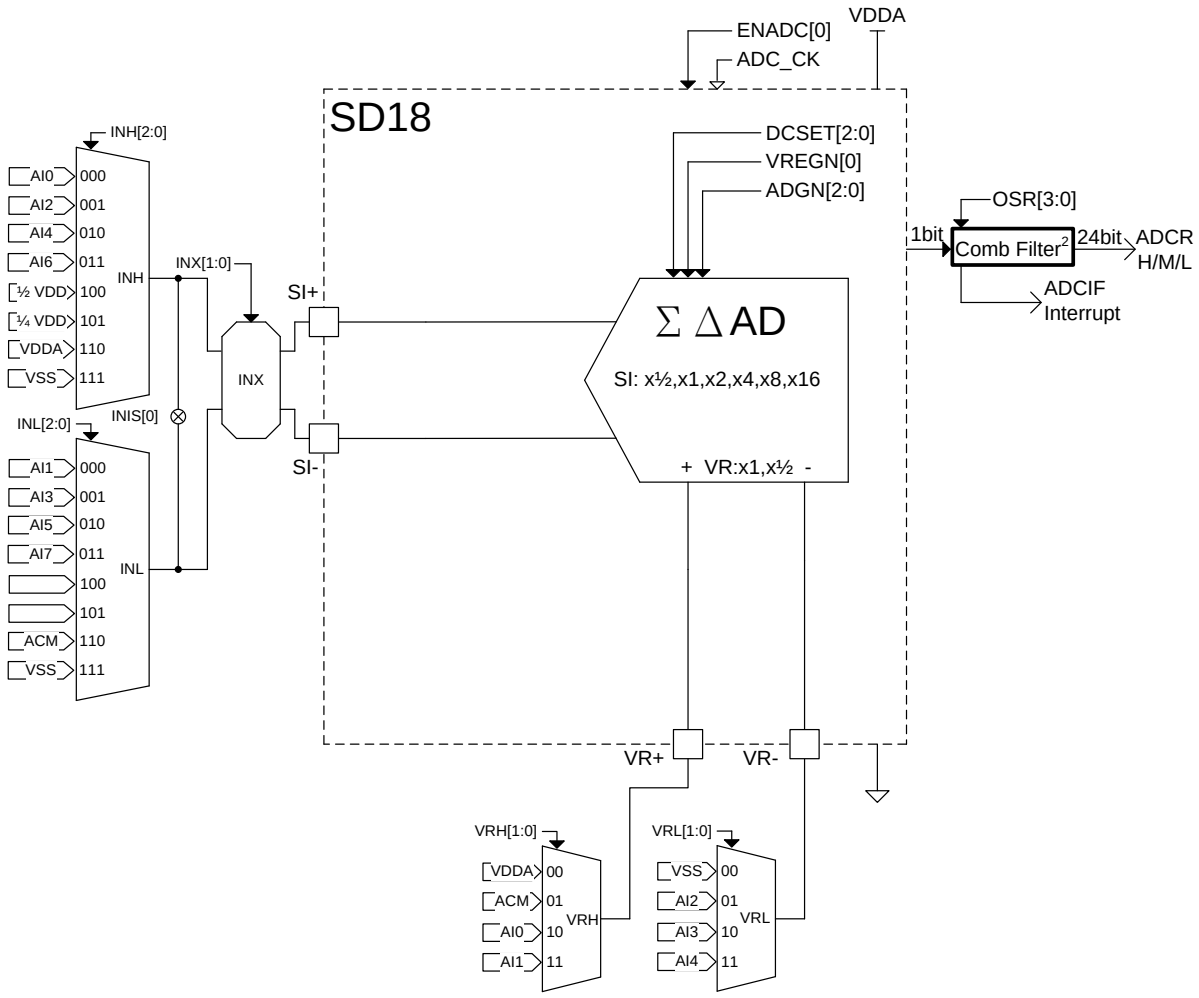


圖 4-2 SD18 Network

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"only write 1

"$"for event status,"."unimplemented bit,"x"unknown,"u"unchanged,"d"depends on condition

位址	名稱	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	A-RESET	I-RESET	R/W
000h	INDF0	Contents of FSR0 to address data memory–value of FSR0 not changed								xxxx xxxx	uuuu uuuu	*,*,*,*,*,*,*,*
001h	POINC0	Contents of FSR0 to address data memory–value of FSR0 post-incremented								xxxx xxxx	uuuu uuuu	*,*,*,*,*,*,*,*
002h	PODEC0	Contents of FSR0 to address data memory–value of FSR0 post-decremented								xxxx xxxx	uuuu uuuu	*,*,*,*,*,*,*,*
003h	PRINC0	Contents of FSR0 to address data memory–value of FSR0 pre-incremented								xxxx xxxx	uuuu uuuu	*,*,*,*,*,*,*,*
004h	PLUSW0	Contents of FSR0 to address data memory–value of FSR0 offset by W								xxxx xxxx	uuuu uuuu	*,*,*,*,*,*,*,*
010H	FSR0L	Indirect Data Memory Address Pointer 0 Low Byte,FSR0[7:0]								xxxx xxxx	uuuu uuuu	*,*,*,*,*,*,*,*
016h	TOSH	-	-	-	-	-	TOS[10]	TOS[9]	TOS[8]	…. xxxx	…. uuuu	-,-,-,- -,*,**
017h	TOSL	Top-of-Stack Low Byte (TOS<7:0>)								xxxx xxxx	uuuu uuuu	*,*,*,*,*,*,*,*
018h	STKPTR	SKFL	SKUN	SKOV	-	-	SKPRT[2:0]			000. .000	u$$. .$$$	rw0,rw0,rw0,- -,*,*,*
01Ah	PCLATH	-	-	-	-	-	PC[10]	PC[9]	PC[8]	…. .0000	…. 0000	-,-,-,- -,*,*,*
01Bh	PCLATL	PC Low Byte for PC<7:0>								0000 0000	0000 0000	*,*,*,*,*,*,*,*
023h	INTE0	GIE	ADIE	E21IE	WDTIE	TB1IE	TMAIE	E20IE	E10IE	0000 0000	0uuu uuuu	*,*,-,*,*,*,-,*
024h	INTE1	-	-	-	-	I2CERIE	I2CIE	-	-	0000 0000	uuuu uuuu	*,*,*,*,*,*,*,*
026h	INTF0	-	ADIF	E21IF	WDTIF	TB1IF	TMAIF	E20IF	E10IF	.000 0000	.uuu uuuu	*,*,-,*,*,*,-,*
027h	INTF1	-	-	-	-	I2CERIF	I2CIF	-	-	0000 0000	uuuu uuuu	*,*,*,*,r,r,*,*
029h	WREG	Working Register								xxxx xxxx	uuuu uuuu	*,*,*,*,*,*,*,*
02Bh	STATUS	-	-	-	C	-	-	-	Z	…x xxxx	...u uuuu	-,-,-,*,*,*,*,*
02Ch	PSTATUS	BOR	PD	TO	IDL	-	SKERR	-	-	$000 $00.	uu$u u$u.	rw0,rw0,rw0,rw0 rw0,rw0,rw0,-
02Eh	BIECN	-	-	-	-	VPPHV	-	BIEWR	BIERD	1… $.00	1... $.uu	r1,-,-,- r,-,*,*
02Fh	BIEARH	ENBIE	-	-	-	-	11-bit look-up Table as BIEAH[2:0]			0… xxxx	u… uuuu	*,-,-,- *,*,**
030h	BIEARL	BIE Address Register as BIEAL[5:0] or 11-bit look-up Table as BIEAL[7:0]								xxxx xxxx	uuuu uuuu	*,*,*,*,*,*,*,*
031h	BIEDRH	BIE High Byte Data Register								xxxx xxxx	uuuu uuuu	*,*,*,*,*,*,*,*
032h	BIEDRL	BIE Low Byte Data Register								xxxx xxxx	uuuu uuuu	*,*,*,*,*,*,*,*
033h	PWRCN	ENLDO[1:0]		VDDAX[1:0]		-	-	ADRST	CSFON	0000 0000	uuuu u00u	*,*,*,* *,wr0,wr0,*
034h	OSCCN0	OSCS[1:0]		DHS[1:0]		DMS[2:0]			CPUS	0000 0000	uuuu uuuu	*,*,*,*,*,*,*,*
035h	OSCCN1	-	-	ADCS[2:0]			DTMB[1:0]		TMBS	0000 0000	uuuu uuu.	*,*,*,*,*,*,*,-
036h	OSCCN2	-	-	-	-	HAOM[1:0]		ENHAO	LPO	.000 0011	.uuu uu11	.,*,*,*,*,*,*,r
037h	WDTCN	-	-	-		ENWDT	DWDT[2:0]			0000 0000	uuuu $000	-,*,*,* rw1,*,*,*
038h	TMACN	ENTMA	TMACL	TMAS	DTMA[2:0]			-	-	0000 00..	u0uu uu..	*,rw1,*,* *,*,-,-
039h	TMAR	TMA counter Register								0000 0000	uuuu uuuu	rw0,rw0,rw0,rw0 rw0,rw0,rw0,rw0
041h	CSFCN0	SKRST	-	HAOTR[5:0]						0.10 0000	u.uu uuuu	*,-,*,*,*,*,*,*
043h	ADCRH	ADC conversion memory HighByte								xxxx xxxx	uuuu uuuu	r,r,r,r r,r,r,r

044h	ADCRM	ADC conversion memory Middle Byte								xxxx xxxx	uuuu uuuu	r,r,r,r r,r,r,r
045h	ADCRL	ADC conversion memory Low Byte								xxxx xxxx	uuuu uuuu	r,r,r,r r,r,r,r
046h	ADCCN1	ENADC	ENHIGN	ENCHP	-	-	ADGN[2:0]			0000 0000	0000 0000	*,*,*,*,*,*,*,*
047h	ADCCN2	-	-	-	-	VREGN	DCSET[2:0]			 0000	 0000	-,-,-,- *,*,*,*
048h	ADCCN3	OSR[3:0]				-	-	-	-	000. ..0.	000. ..0.	*,*,*,- -,-,*,-
049h	AINET1	INH[2:0]			INL[2:0]			INIS	-	0000 000.	0000 000.	*,*,*,*,*,*,*,-
04Ah	AINET2	-	VRH[1:0]		INX[1:0]		VRL[1:0]		-	.000 000.	.000 000.	-,*,*,*,*,*,*,-
04Eh	TB1Flag	-	-	PWM6A	PWM5A	PWM4A	PWM3A	PWM2A	PWM1A	..00 0000	..uu uuuu	-,-,r,r r,r,r,r
04Fh	TB1CN0	ENTB1	TB1M[1:0]		TB1RT[1:0]		TB1CL	-	-	0000 0000	uuuu u0uu	*,*,*,*,*,rw1,*,*
050h	TB1CN1	PA1IV	PWMA1[2:0]			PA0IV	PWMA0[2:0]			0000 0000	uuuu uuuu	*,*,*,*,*,*,*,*
051h	TB1RH	TimerB1 counter Register [15:8]								xxxx xxxx	uuuu uuuu	r,r,r,r r,r,r,r
052h	TB1RL	TimerB1 counter Register [7:0]								xxxx xxxx	uuuu uuuu	r,r,r,r r,r,r,r
053h	TB1C0H	TimerB1 counter Condition Register [15:8]								xxxx xxxx	uuuu uuuu	*,*,*,*,*,*,*,*
054h	TB1C0L	TimerB1 counter Condition Register [7:0]								xxxx xxxx	uuuu uuuu	*,*,*,*,*,*,*,*
055h	TB1C1H	TimerB1 counter Condition Register [15:8]								xxxx xxxx	uuuu uuuu	*,*,*,*,*,*,*,*
056h	TB1C1L	TimerB1 counter Condition Register [7:0]								xxxx xxxx	uuuu uuuu	*,*,*,*,*,*,*,*
057h	TB1C2H	TimerB1 counter Condition Register [15:8]								xxxx xxxx	uuuu uuuu	*,*,*,*,*,*,*,*
058h	TB1C2L	TimerB1 counter Condition Register [7:0]								xxxx xxxx	uuuu uuuu	*,*,*,*,*,*,*,*
061h	CFG	Rsv.					I2CRST	ENI2CT	ENI2C	.... .000	.... .uuu	-,-,-,- -,*,*,*
062h	ACT	SLAVE	-	-	I2CER	START	STOP	I2CINT	ACK	0000 0000	uuuu uuuu	*,*,*,*,*,*,*,*
063h	STA	MACTF	SACTF	RDBF	RWF	DFF	ACKF	GCF	ARBF	0001 0000	uuuu uuuu	*,*,*,*,*,*,*,*
064h	CRG	CRG[7:0]								0000 0000	uuuu uuuu	*,*,*,*,*,*,*,*
065h	TOC	I2CTF	DI2C[2:0]			I2CTLT[3:0]				0000 0000	uuuu uuuu	*,*,*,*,*,*,*,*
066h	RDB	RDB[7:1]							RDB[0]	xxxx xxxx	uuuu uuuu	*,*,*,*,*,*,*,*
067h	TDB0	TDB0[7:1]							TDB[0]	xxxx xxxx	uuuu uuuu	*,*,*,*,*,*,*,*
068h	SID0	SID[7:1],The corresponding address of the 7-bit mode							SIDV[0]	0000 0000	uuuu uuuu	*,*,*,*,*,*,*,*
070h	PT1	-	-	-	-	-	-	-	PT10	xx.. ..xx	xx.. ..xx	*,*,-,- -,-,*,*
071h	TRISC1	-	-	-	-	-	-	-	-	0000 0000	uuuu uuuu	*,*,-,- -,-,*,*
072h	PT1DA	-	-	-	-	-	-	-	-	0000 0000	uuuu uuuu	-,-,-,- *,-,*,*
073h	PT1PU	-	-	-	-	-	-	-	-	0000 0000	uuuu uuuu	*,*,-,- -,-,*,*
074h	PT1EG	-	-	FPWMA1	FPWMA0	-	-	E0EG[1:0]		 0000	.... uuuu	-,-,-,- *,*,*,*
075h	PT2	-	-	-	-	-	-	PT21	PT20	xx	xx	-,-,-,- -,-,*,*
076h	TRISC2	-	-	-	-	-	-	TC21	TC20	00	.... ..uu	-,-,-,- -,-,*,*
077h	PT2DA	-	-	-	-	-	-	DA21	DA20	00	.... ..uu	-,-,-,- -,-,*,*
078h	PT2PU	-	-	-	-	-	-	PU21	PU20	00	.... ..uu	-,-,-,- -,-,*,*
079h	PT3	-	-	PT35	PT34	PT33	PT32	PT31	PT30	..xx xxxx	..xx xxxx	-,-,*,*,*,*,*,*
07Ah	TRISC3	-	-	TC35	TC34	TC33	TC32	TC31	TC30	..00 0000	..uu uuuu	-,-,*,*,*,*,*,*

07Bh	PT3DA	-	-	DA35	DA34	DA33	DA32	DA31	DA30	..00 0000	..uu uuuu	-,-,*,*,*,*,*,*
07Ch	PT3PU	-	-	PU35	PU34	PU33	PU32	PU31	PU30	..00 0000	..uu uuuu	-,-,*,*,*,*,*,*
080h ~ 0FFh	GPR0	General Purpose Register as 128Byte								uuuu uuuu	uuuu uuuu	*,*,*,*,*,*,*,*

6. 電器特性

6.1. Recommended operating conditions

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

Sym.	Parameter	Test Conditions	Min.	Typ.	Max.	unit
V_{REGIN}	Supply Voltage		4		24	V
V_{REG33}	Regulator Output Voltage	I_L≦3mA	3.3-1.5%		3.3V+1.5%	V
		4V ≦V_{REGIN}≦20V 3mA ≦I_{REGOUT}≦16mA	3.3-2.5%		3.3V+2.5%	
		4V ≦V_{REGIN}≦20V 3mA ≦I_{REGOUT}≦16mA T_A= -40 ℃ ~ +85℃	3.3-3.5%		3.3V+3.5%	
V_{REGVSS}	Supply Voltage	Connect to VSS	0		0	
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	

6.2. Internal RC Oscillator

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

Sym.	Parameter	Test Conditions	Min.	Typ.	Max.	unit
HAO(2.0MHz)	High Speed Oscillator frequency	ENHAO[0]=1	1.8	2.0	2.2	MHz
HAO(3.8MHz)	High Speed Oscillator frequency		3.42	3.8	4.18	MHz
HAO(7.0MHz)	High Speed Oscillator frequency		6.3	7.0	7.7	MHz
LPO	Low Power Oscillator frequency	V_{DD} supply voltage be enable LPO		14		KHz

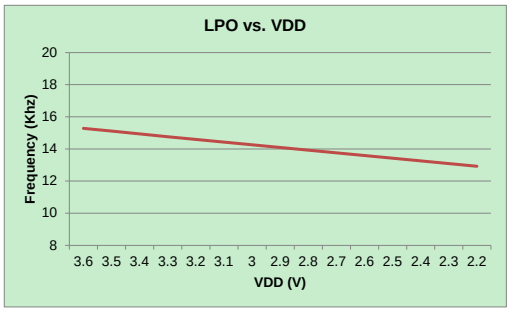


Figure 6.2-1 LPO vs. VDD

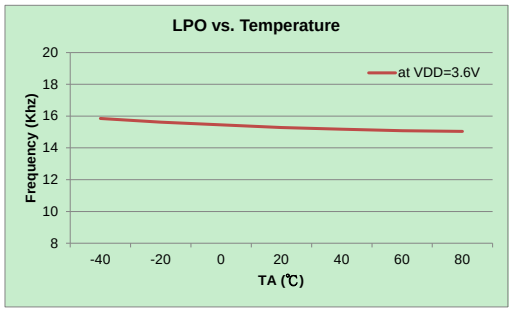


Figure 6.2-2 LPO vs. Temperature

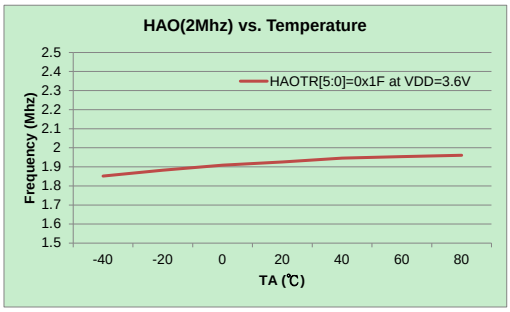


Figure 6.2-3 HAO(2.0MHz) vs. Temperature

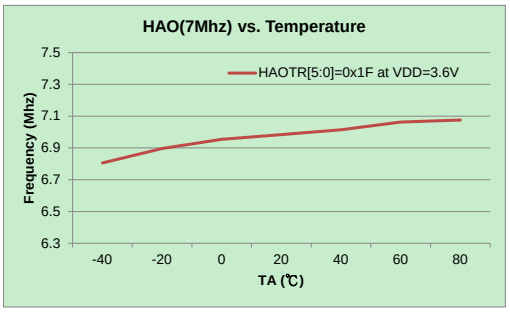


Figure 6.2-5 HAO(7.0MHz) vs. Temperature

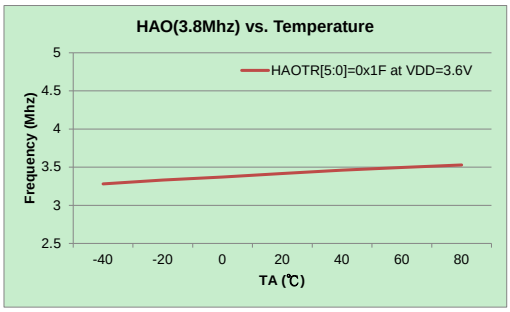


Figure 6.2-4 HAO(3.8MHz) vs. Temperature

6.3. Supply current into VDD excluding peripherals current

T_A = 25℃,V_{DD} = 3.0V,OSC_LPO = 14KHz,unless otherwise noted

Sym.	Parameter	Test Conditions	Min.	Typ.	Max.	unit
I_{AM1}	Active mode 1	OSC_CY = off, OSC_HAO = 8MHz, CPU_CK = 8MHz		0.78		mA
I_{AM2}	Active mode 2	OSC_CY = off, OSC_HAO =4MHz, CPU_CK = 4MHz		0.43		mA
I_{AM3}	Active mode 3	OSC_CY = off, OSC_HAO = 2MHz, CPU_CK = 2MHz		0.24		mA
I_{AM4}	Active mode 4	OSC_CY = off, OSC_HAO = 2MHz, CPU_CK = 1MHz		0.14		mA
I_{LP1}	Low Power 1	OSC_CY = off, OSC_HAO = off, CPU_CK = LPO,		2.5		uA
I_{LP2}	Low Power 2	OSC_CY = off, OSC_HAO = off, CPU_CK = LPO, Idle state		1.2		uA
I_{LP3}	Low Power 3	OSC_CY = off, OSC_HAO = off, CPU_CK = off, Sleep state		0.6		uA

OSC_HAO：Internal High Accuracy Oscillator frequency.

CPU_CK：CPU core work frequency.

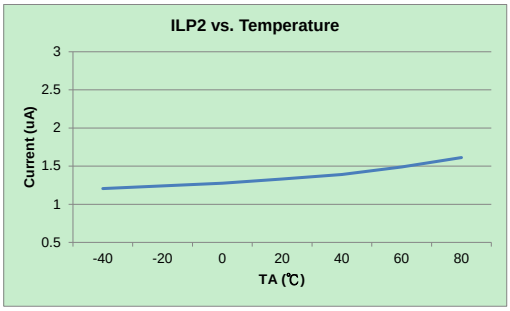


Figure 6.3-1 ILP2 vs. Temperature

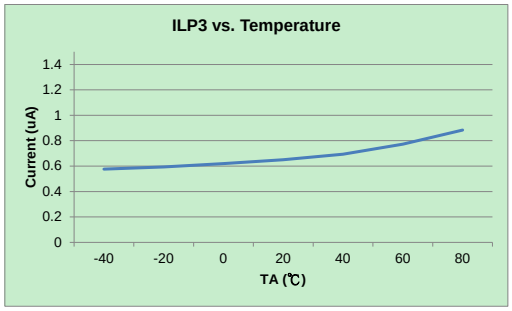


Figure 6.3-2 ILP3 vs. Temperature

6.4. Port1~3

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		0.7*VDD		VDD	V
V_{IL}	Low-Level input voltage		VSS		0.3*VDD	
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	

6.5. Rest(Brownout)

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

Sym.	Parameter	Test Conditions	Min.	Typ.	Max.	unit
BOR	Pulse length needed to accepted reset internally, $t_{d\text{-}LVR}$		2			us
	V_{DD} Start Voltage to accepted reset internally (L➔H), V_{LVR}		1.6	1.85	2.1	V
	Hysteresis, $V_{HYS\text{-}LVR}$			70		mV
BOR：Brownout Reset LVR：Low Voltage Reset of BOR						

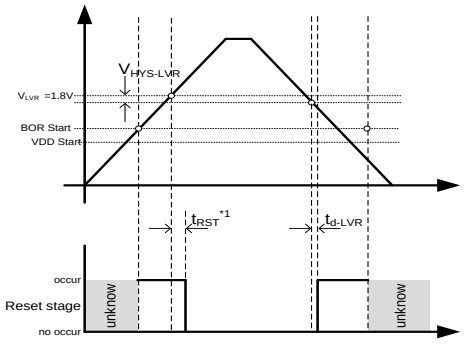


Figure6.5-1 BOR reset diagram

*1 rRST：Please see BOR Introduce of HY10Pxx series User's Guide (UG-HY10S00-Vxx).

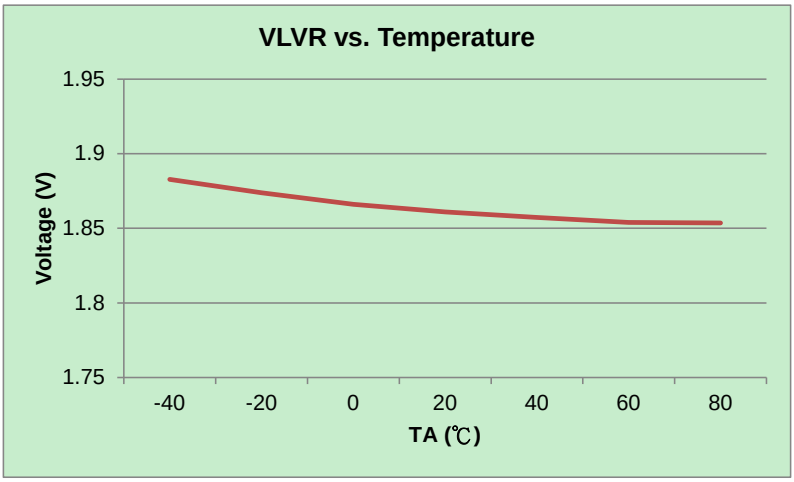


Figure6.5-3 LVR vs. Temperature

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	ENLDO[1:0]=11b		13		uA
	Select VDDA output voltage	I_L = 0.1mA, VDD≧VDDA+0.2V	VDDAX[1:0]=01b		3.0		V
			VDDAX[1:0]=10b		2.7		
			VDDAX[1:0]=11b		2.4		
	Dropout voltage	I_L = 10mA	VDDAX[1:0]=01b		150		mV
			VDDAX[1:0]=10b		165		
			VDDAX[1:0]=11b		180		
	Temperature drift	ENLDO[1:0]=11b, I_L = 0.1mA	T_A=-40℃~85℃		50		ppm/℃
	V_{DD} Voltage drift		V_{DD}=2.5V~3.6V		±0.2		%/V
ACM	Analog Common Mode Voltage ,V_{ACM}	ENADC[0]=1	I_L = 0uA		1.2		V
	Analog Common Mode Voltage with Load		I_L = ±200uA	0.98		1.02	V_{ACM}
	Temperature drift	ENADC[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							

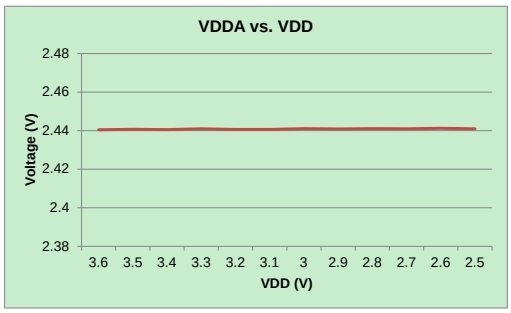


Figure6.6-1 VDDA vs. VDD

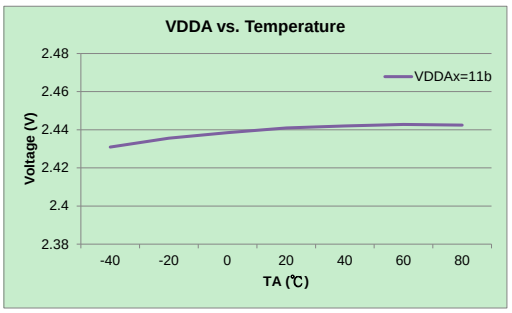


Figure6.6-2 VDDA vs. Temperature

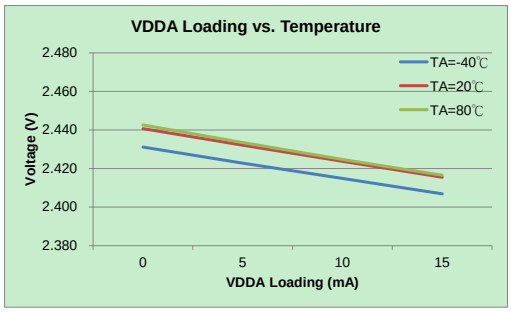


Figure6.6-3 VDDA Loading vs. Temperature

6.7. SD18, Power Supply and recommended operating conditions

T_A = 25 °C, VDD=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			128 *1		32768	
I_{SD18}	Operation supply current without PGA	ENADC[0]=1	GAIN =4, ADC_CK=250KHz		120		uA

*1, OSR=128, setting by ADCCN3[OSR[3]] bit.

OSR[3:0]=1010, OSR=128; OSR[3:0]=0xxx, OSR=256 ~ 32768

6.7.1. SD18, performance(fSD18=250KHz)

T_A = 25℃,V_{DD} = 3.0V, VDDA=3.0V,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=±450mV			±0.003	±0.01	%FSR
	No Missing Codes[3]	ADC_CK=250KHz,OSR[2:0]=010b		23			Bits
G_{SD18}	Temperature drift **Gain 1~x16**		T_A= -40 ℃		5		ppm/ ℃
E_{OS}	Offset error of Full Scale Rang input voltage range with Chopper without PGA	ΔAI=0V ΔVR=0.9V DCSET[2:0]=<000> *ΔAI is external short	Gain=2			1	%FSR
	Offset temperature drift with chopper without PGA		GAIN=1		2		uV/ ℃
			GAIN=2		1		
			GAIN=4		0.5		
			GAIN=16		0.15		
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,	V_{SI}=0V, GAIN=16		75		
PSRR	DC power supply rejection	VDDA=3.0V,ΔVDDA=±100mV, V_{VR}=1.0V, V_{SI}=V_{SI-}=1.2V,	GAIN=1 PGA=off		75		dB
			GAIN=16				

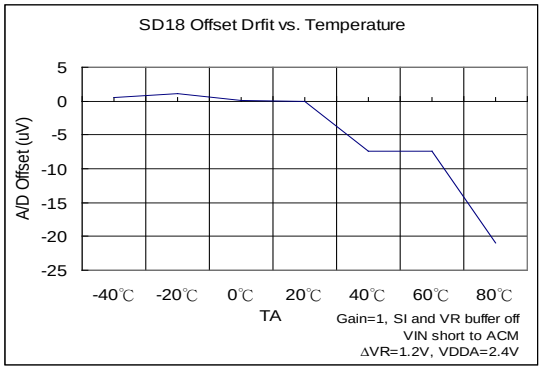


Figure6.7-1(a) SD18 Offset Temperature drift

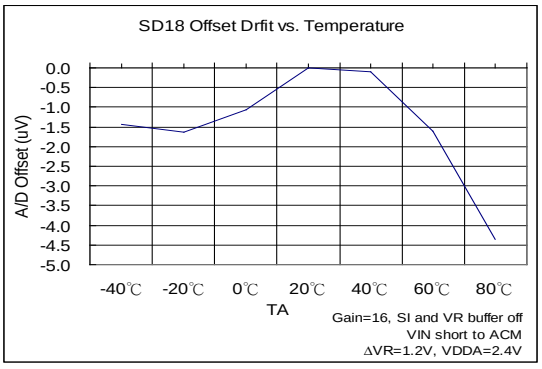


Figure6.7-1(b) SD18 Offset Temperature drift

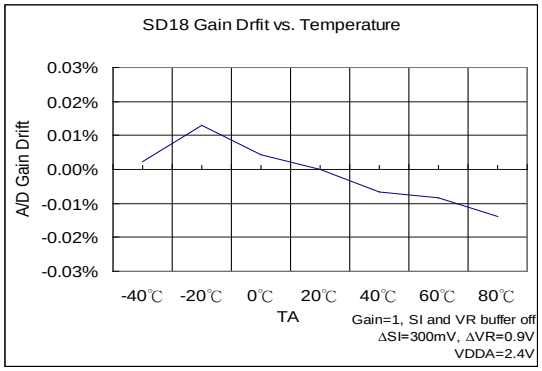


Figure6.7-2(a) SD18 Gain drift with temperature

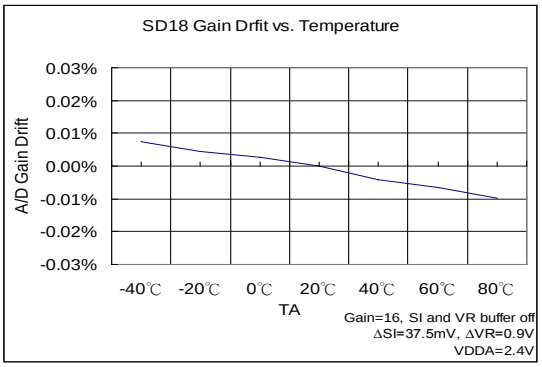


Figure6.7-2(b) SD18 Gain drift with temperature

6.7.2. SD18 Noise Performance

T_A = 25 °C, VDD=3.0V, VDDA=2.4V, unless otherwise noted

HY10P40 針對 SD18 提供了重要的輸入雜訊規格。Table6.7-4(a), Table6.7-4(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，ADC 參考電壓源為使用外部 VDDA 及外部 VSS 當參考電壓源網路，等效參考電壓為 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**									
±2160	**0.5**	**=**	**1**	**×**	**0.5**	14.39	16.14	16.96	17.27	17.44	17.66	18.08	19.52	19.73
±1080	**1**	**=**	**1**	**×**	**1**	14.38	16.04	16.85	17.18	17.42	17.76	18.89	19.85	20.22
±540	**2**	**=**	**1**	**×**	**2**	14.4	16.01	16.79	17.03	17.31	17.53	18.02	19.55	20.1
±270	**4**	**=**	**1**	**×**	**4**	14.42	15.91	16.57	16.94	17.14	17.39	17.69	18.61	19.81
±135	**8**	**=**	**1**	**×**	**8**	14.34	15.66	16.24	16.64	17.01	17.4	17.99	19.05	19.52
±68	**16**	**=**	**1**	**×**	**16**	14.22	15.3	15.88	16.34	16.85	17.41	17.85	18.53	19.01

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

Table6.7-4(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**					**128**	**256**	**512**	**1024**	**2048**	**4096**	**8192**	**16384**	**32768**
	Output rate(HZ)					**1953**	**977**	**488**	**244**	**122**	**61**	**31**	**15**	**8**
	Gain	**=**	**PGA**	**×**	**ADGN**									
±2160	**0.5**	**=**	**1**	**×**	**0.5**	226.11	67.48	38.23	30.84	27.40	23.43	17.59	6.46	5.58
±1080	**1**	**=**	**1**	**×**	**1**	113.68	36.14	20.60	16.42	13.86	10.94	5.00	2.58	1.99
±540	**2**	**=**	**1**	**×**	**2**	56.28	18.46	10.69	9.06	7.49	6.40	4.58	1.58	1.09
±270	**4**	**=**	**1**	**×**	**4**	27.72	9.85	6.25	4.82	4.20	3.53	2.88	1.52	0.66
±135	**8**	**=**	**1**	**×**	**8**	14.67	5.85	3.92	2.98	2.30	1.75	1.17	0.56	0.40
±68	**16**	**=**	**1**	**×**	**16**	7.95	3.76	2.52	1.83	1.29	0.87	0.64	0.40	0.29

Table6.7-4(b) SD18 RMS Noise Table

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

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

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

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

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

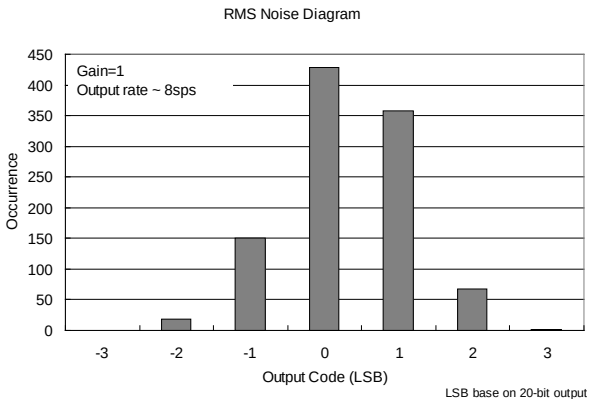


Figure6.7-4(a) RMS Noise Diagram

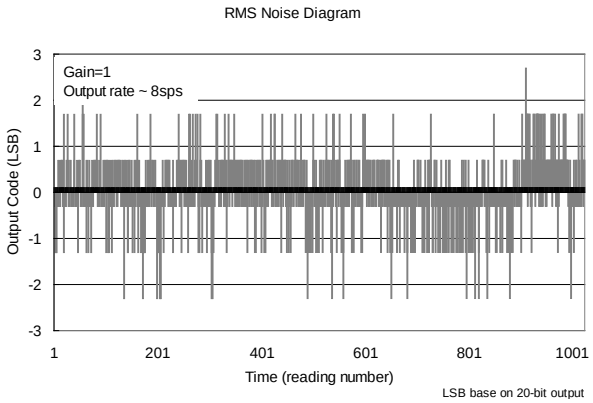


Figure6.7-4(b) Output Code Diagram

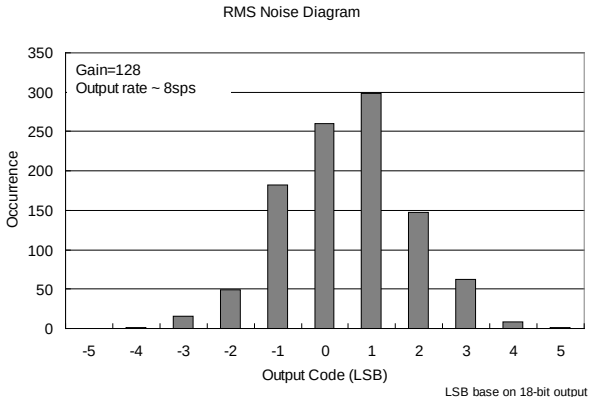


Figure6.7-4(c) RMS Noise Diagram(Gain=16)

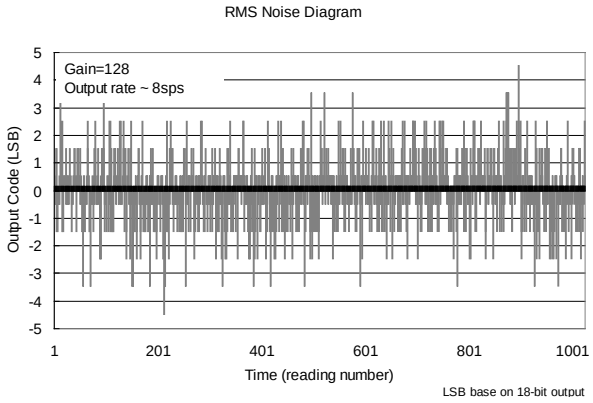


Figure6.7-4(d) Output Code Diagram(Gain=16)

6.8. Build-In EPROM(BIE)

T_A = 25 ℃, V_{DD} = 3.0V, 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	封裝型式描述方式		程式碼編號[2]	出貨包裝形式	個裝數量	材料組成	**MSL[3]**
HY10P40-D000	Die	-	D	000	000	-	250	Green[4]	-
HY10P40-SE08	SOP8(EP)	9	S	E08	000	Tube	100	Green[4]	MSL-3
HY10P40-SE08	SOP8(EP)	9	S	E08	000	Tape & Reel	2500	Green[4]	MSL-3
HY10P40-M010	MSOP	10	M	010	000	Tube	80	Green[4]	MSL-3
HY10P40-M010	MSOP	10	M	010	000	Tape & Reel	3000	Green[4]	MSL-3
HY10P40-E016	SSOP	16	E	016	000	Tube	100	Green[4]	MSL-3
HY10P40-E016	SSOP	16	E	016	000	Tape & Reel	2500	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 007，且需要的產品是裸片出貨。則下單品名為 HY10P40-D000-007

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 HY10P40-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 SSOP16 出貨，則下單品名為 HY10P40-E016，且需以 Tape & Reel 出貨，則除下單品名外，請特別註明出貨包裝形式為 Tape & Reel

例如：您的代客燒錄服務申請的程式碼編號為 008，而需求的產品是封裝片 SOP8(EP)出貨，則下單品名為 HY10P40-SE08-008，且需以 Tape & Reel 出貨，則除下單品名外，請特別註明出貨包裝形式為 Tape & Reel

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 MSOP10 出貨，則下單品名為 HY10P40-M010-009，且需以 Tube 出貨，則除下單品名外，請特別註明出貨包裝形式為 Tube

[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。

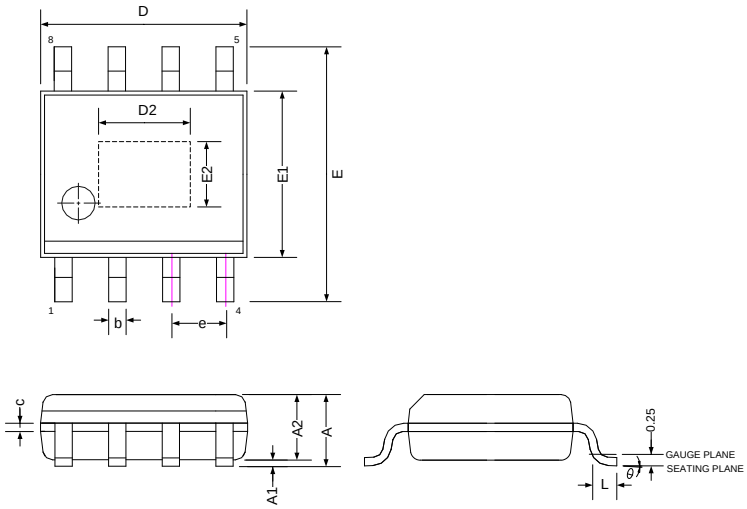
[4] **Green (RoHS & no Cl/Br)**

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. SOP8EP(SE08)

8.1.1. Package Dimensions



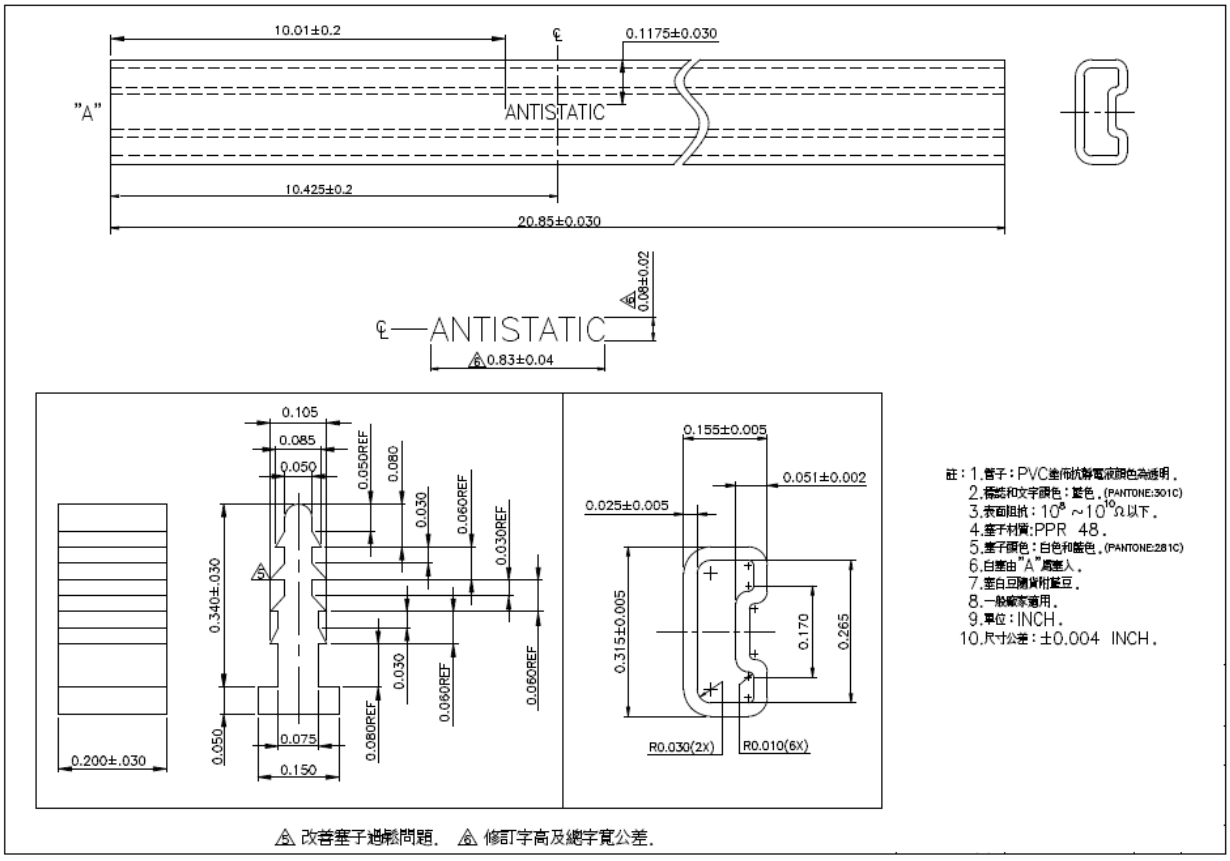
SYMBOLS	MIN	NOM	MAX
A	-	-	1.75
A1	0.10	-	0.25
A2	1.25	-	-
b	0.31	-	0.51
c	0.10	-	0.25
D	4.90 BSC		
E1	3.90 BSC		
E	6.00 BSC		
L	0.40	-	1.27
e	1.27 BSC		
θ°	0	-	8

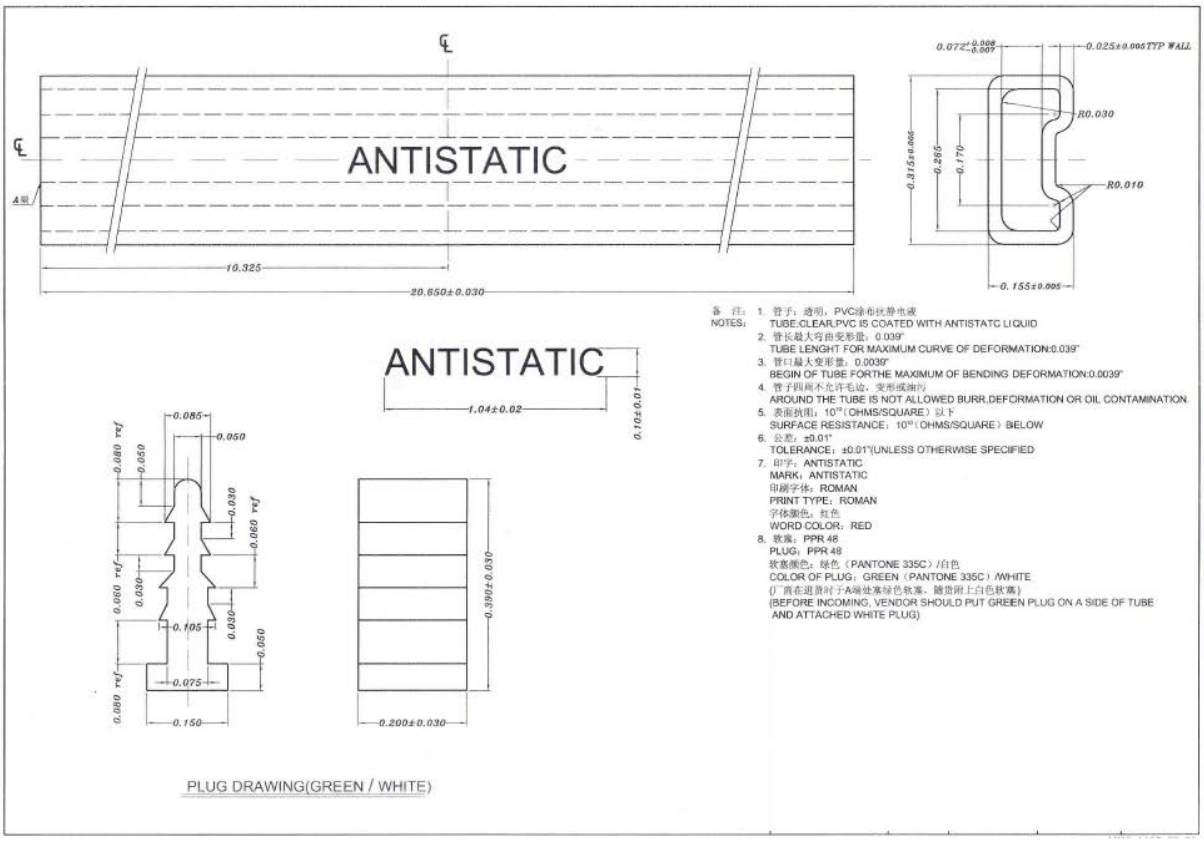
Exposed Pad (E-Pad) Dimension (mm)						
L/F Pad size	D2			E2		
	MIN	NOM	MAX	MIN	NOM	MAX
95*130mil	2.66	-	-	1.77	-	-
90*90mil	1.65	-	-	1.65	-	-

Note:

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

8.1.2. Tube Dimensions

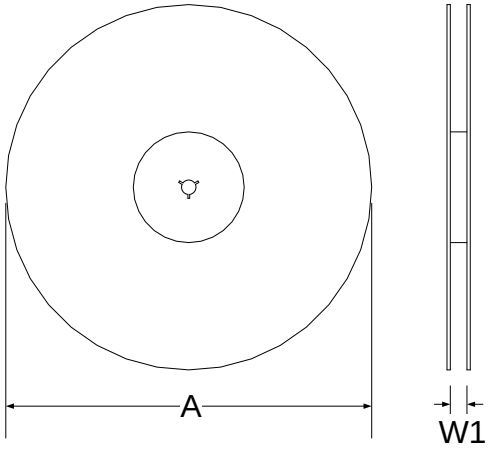




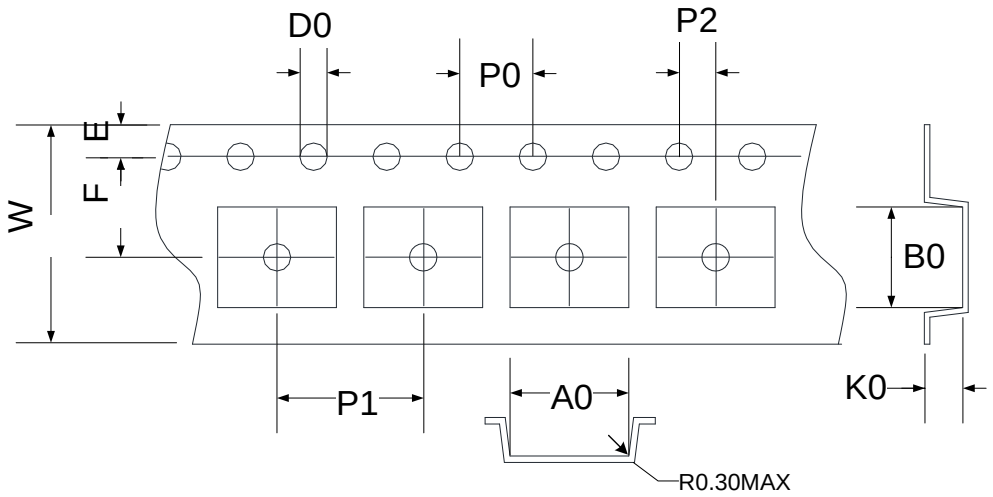
8.1.3. Tape & Reel Information

8.1.3.1. Reel Dimensions –Type1

Unit : mm



8.1.3.2. Carrier Tape Dimensions

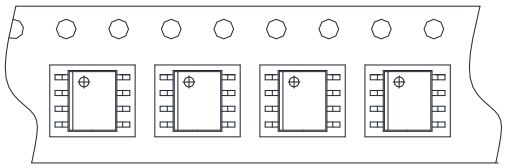


SYMBOLS	Reel Dimensions		Carrier Tape Dimensions									
	A	W1	A0	B0	K0	P0	P1	P2	E	F	D0	W
Spec.	330	12.5	6.90	5.40	2.00	4.00	8.00	2.00	1.75	5.50	1.50	12.00
Tolerance	+6/-3	+1.5/-0	±0.10	±0.10	±0.10	±0.10	±0.10	±0.05	±0.10	±0.05	+0.1/-0	±0.30

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

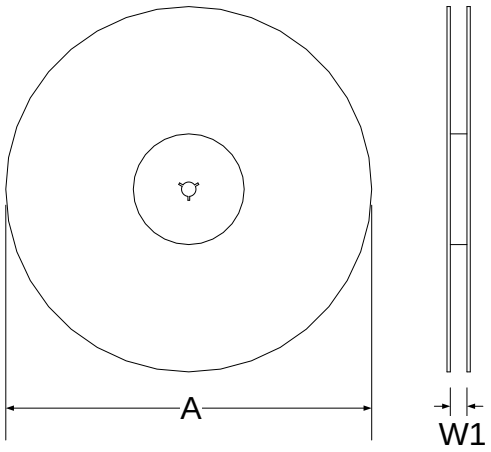
Unit : mm

8.1.3.3. Pin1 direction

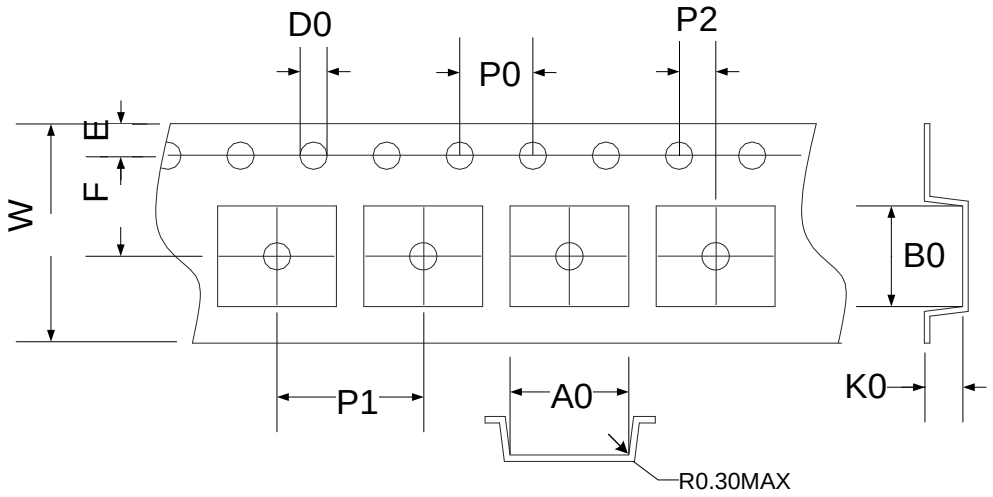


8.1.3.4. Reel Dimensions –Type2

Unit : mm



8.1.3.5. Carrier Tape Dimensions

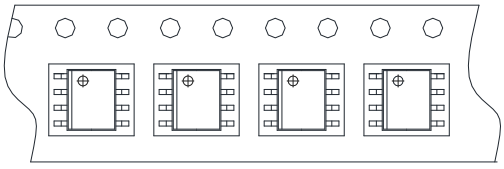


SYMBOLS	Reel Dimensions		Carrier Tape Dimensions									
	A	W1	A0	B0	K0	P0	P1	P2	E	F	D0	W
Spec.	330	12.5	6.50	5.20	2.10	4.00	8.00	2.00	1.75	5.50	1.50	12.00
Tolerance	+6/-3	+1.5/-0	±0.10	±0.10	±0.10	±0.10	±0.10	±0.05	±0.10	±0.05	+0.1/-0	±0.30

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

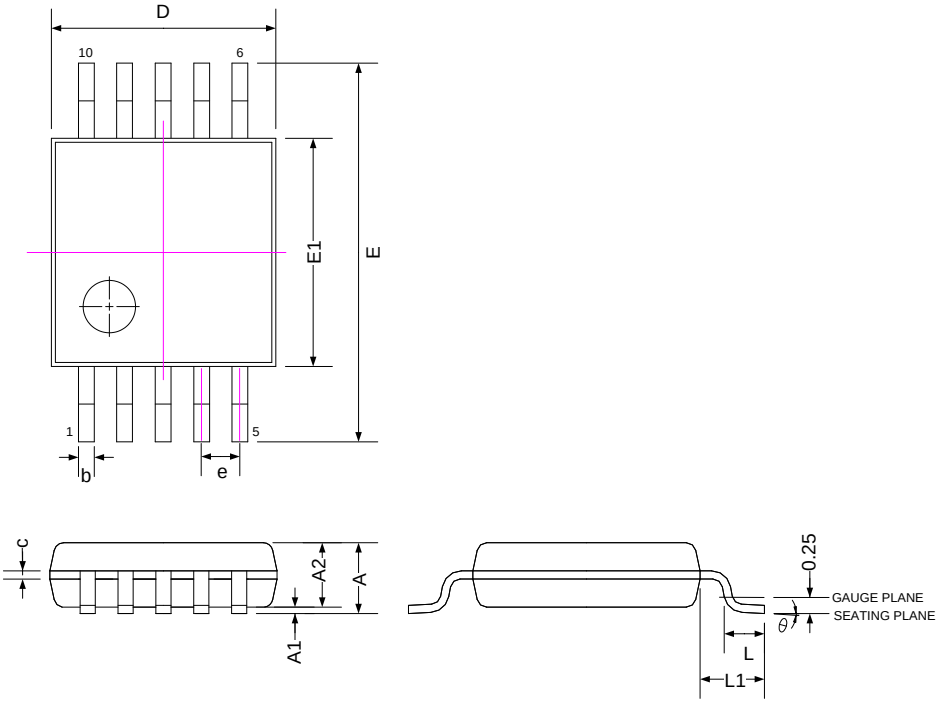
Unit : mm

8.1.3.6. Pin1 direction



8.2. MSOP10(M010)

8.2.1. Package Dimensions

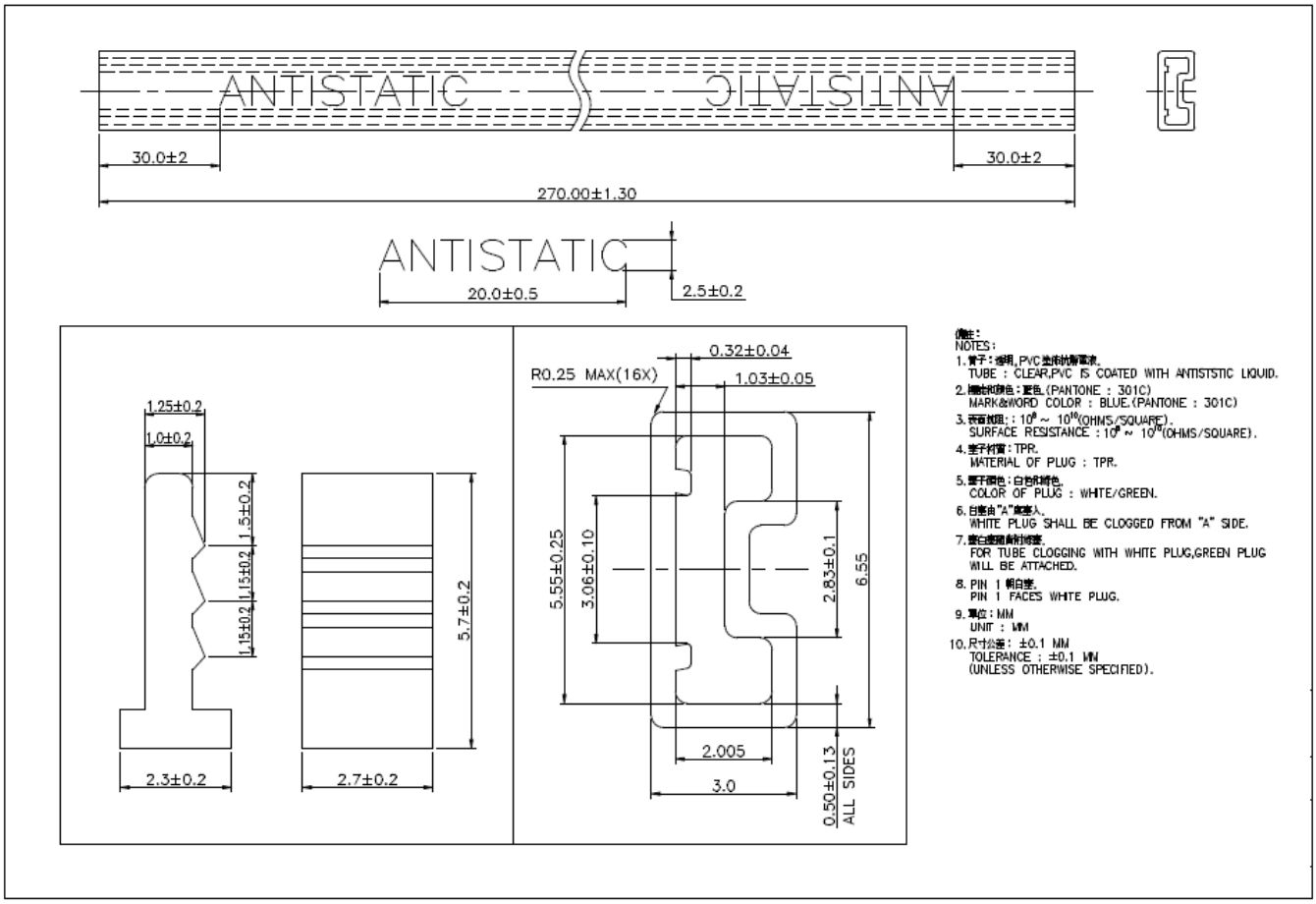


SYMBOLS	MIN	NOM	MAX
A	-	-	1.10
A1	0.00	0.10	0.15
A2	0.75	0.85	0.95
b	0.17	0.20	0.27
c	0.08	0.15	0.23
D	3.00 BASIC		
E1	3.00 BASIC		
E	4.90 BASIC		
L	0.40	0.60	0.80
L1	0.95 REF		
e	0.50 BASIC		
θ°	0	-	8

Note:

1. All dimensions refer to JEDEC OUTLINE MO -187.
2. Do not include Mold Flash or Protrusions.
3. Unit：mm.

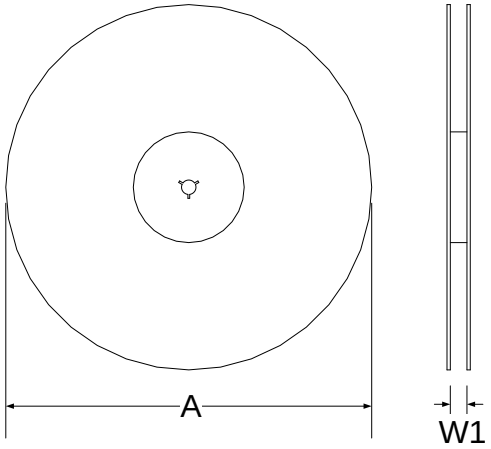
8.2.2. Tube Dimensions



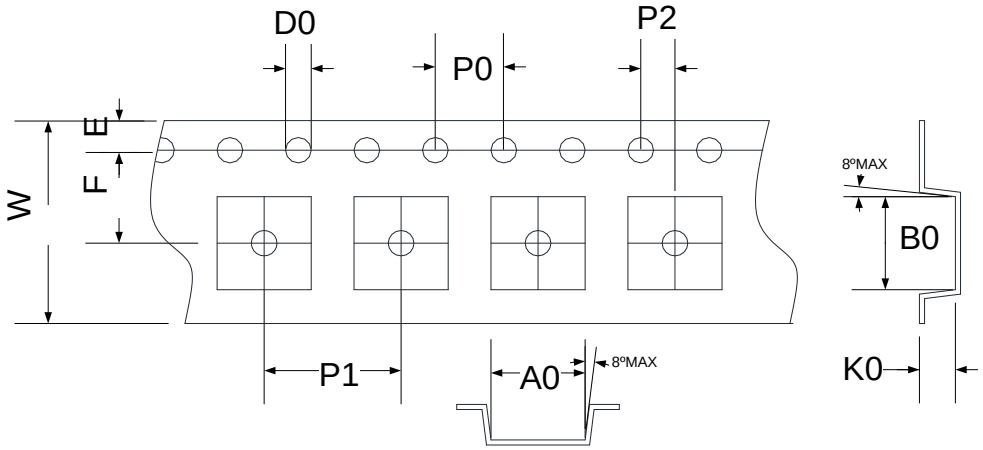
8.2.3. Tape & Reel Information

8.2.3.1. Reel Dimensions –Type1

Unit : mm



8.2.3.2. Carrier Tape Dimensions

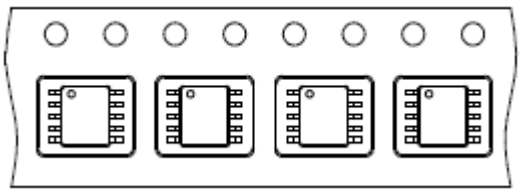


SYMBOLS	Reel Dimensions		Carrier Tape Dimensions									
	A	W1	A0	B0	K0	P0	P1	P2	E	F	D0	W
Spec.	330	12.5	5.30	3.40	1.40	4.00	8.00	2.00	1.75	5.50	1.50	12.00
Tolerance	±2.00	±1.50	±0.10	±0.10	±0.10	±0.10	±0.10	±0.05	±0.10	±0.05	+0.1/-0	±0.20

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

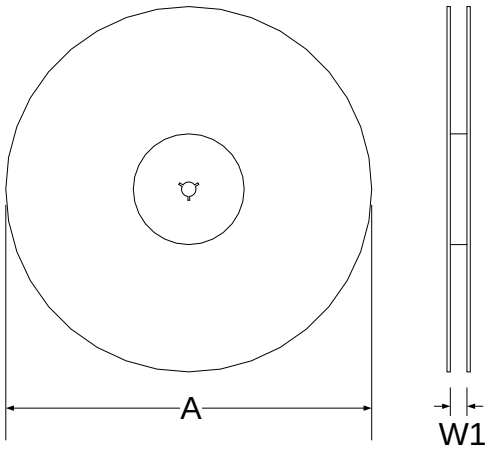
Unit : mm

8.2.3.3. Pin1 direction

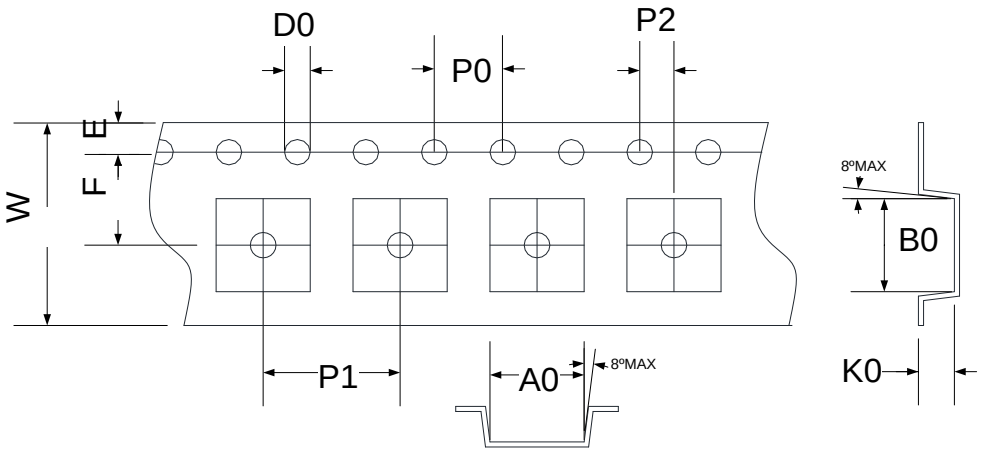


8.2.3.4. Reel Dimensions –Type2

Unit : mm



8.2.3.5. Carrier Tape Dimensions

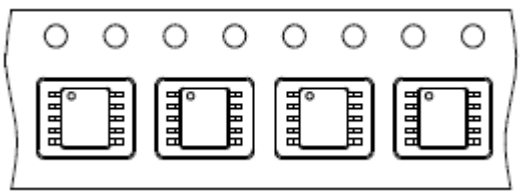


SYMBOLS	Reel Dimensions		Carrier Tape Dimensions									
	A	W1	A0	B0	K0	P0	P1	P2	E	F	D0	W
Spec.	330	12.5	5.20	3.30	1.20	4.00	8.00	2.00	1.75	5.50	1.50	12.00
Tolerance	±2.00	±1.50	±0.10	±0.10	±0.10	±0.10	±0.10	±0.05	±0.10	±0.05	+0.1/-0	±0.30

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

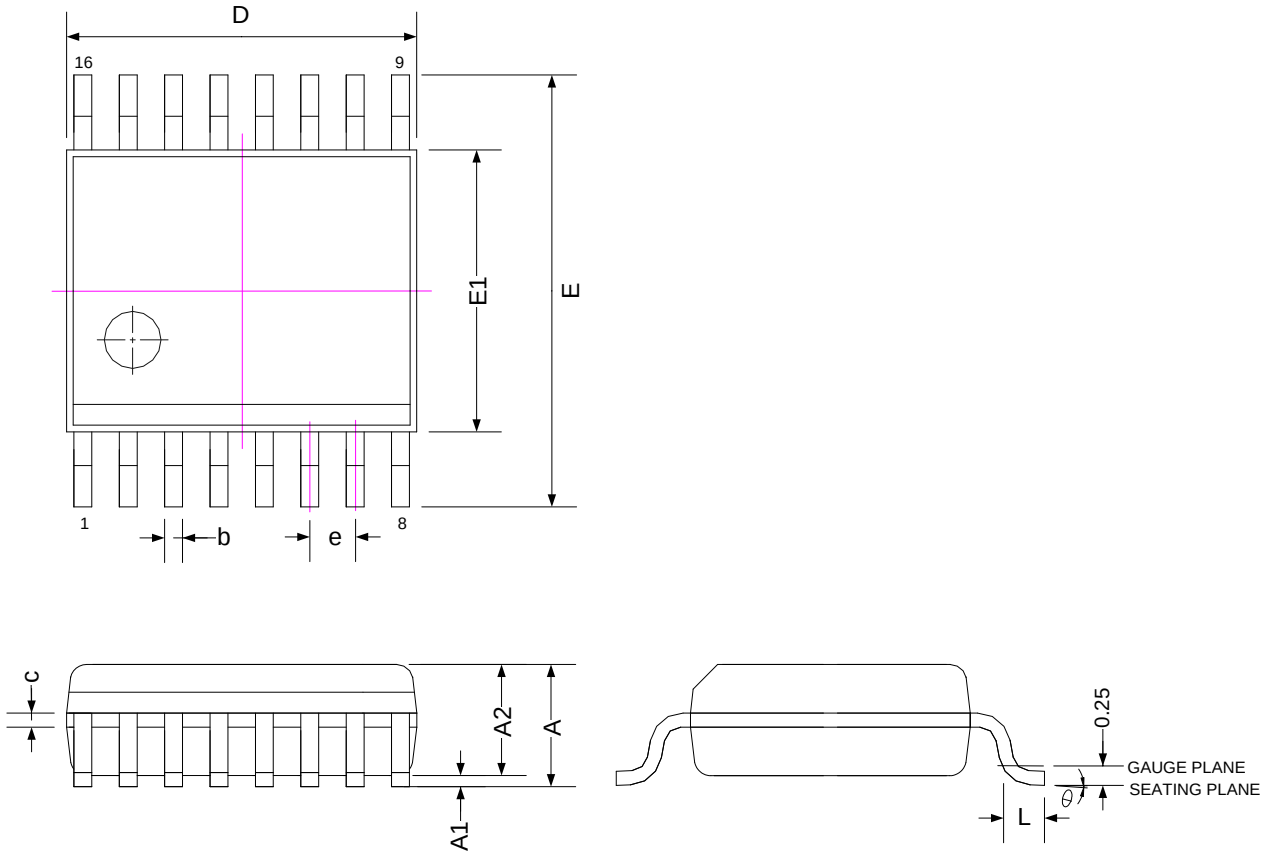
Unit : mm

8.2.3.6. Pin1 direction



8.3. SSOP16(E016)

8.3.1. Package Dimensions

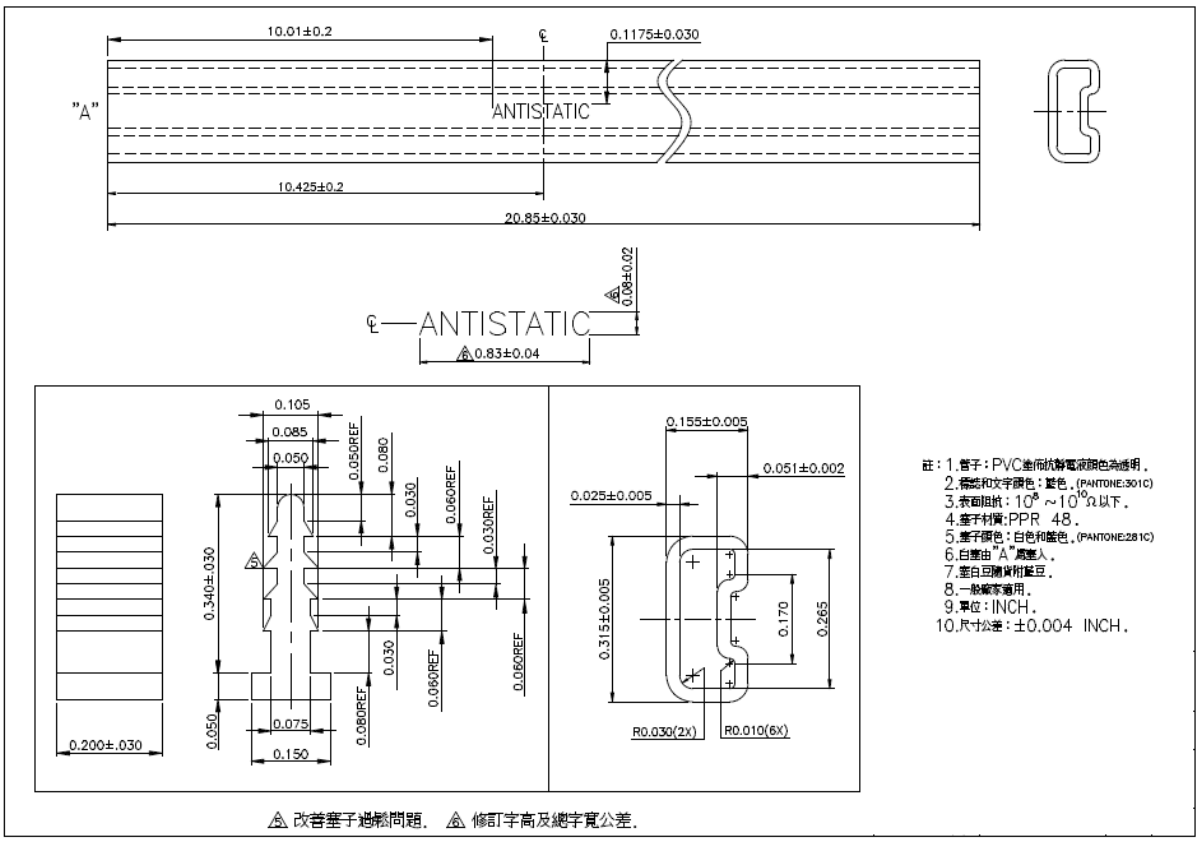


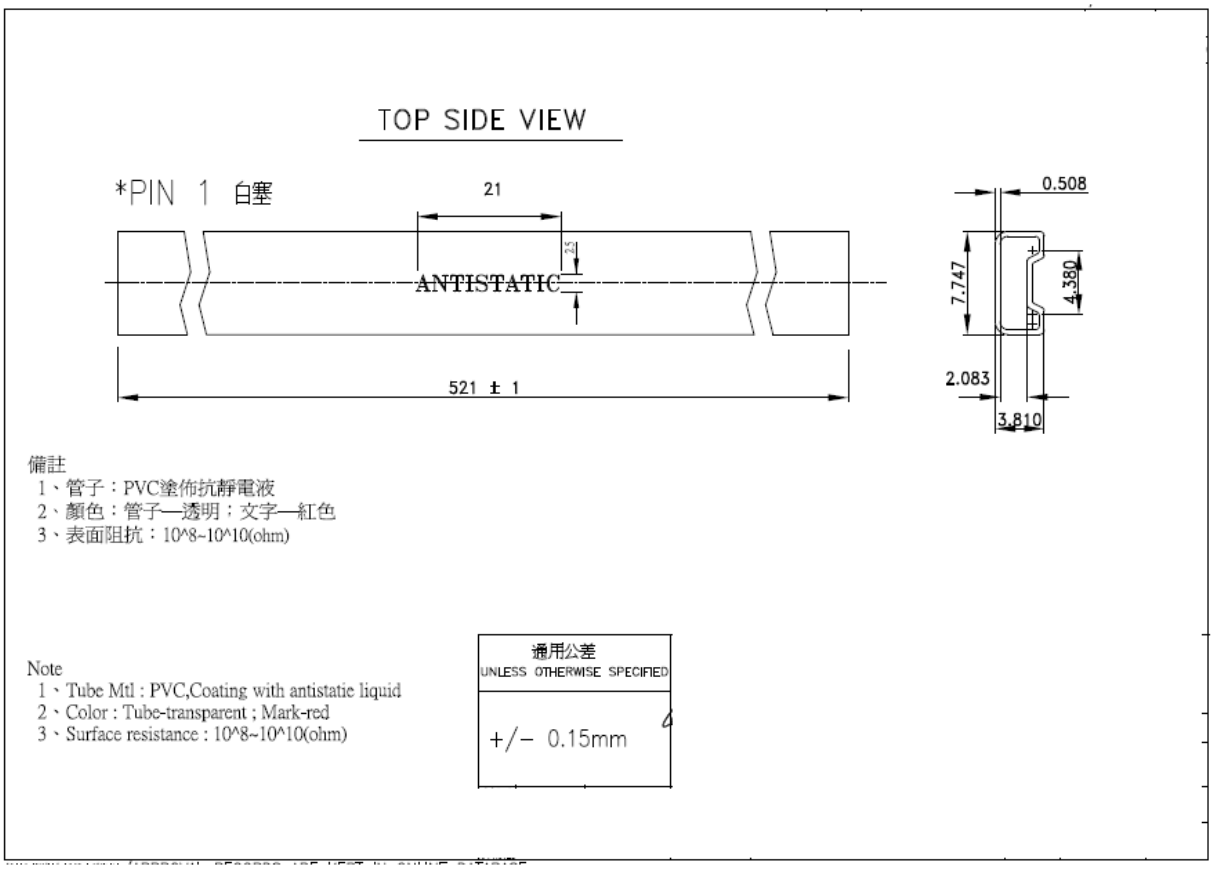
SYMBOLS	MIN	NOM	MAX
A	-	-	1.75
A1	0.10	0.15	0.25
A2	-	-	1.50
b	0.20	-	0.30
c	0.18	-	0.25
D	4.80	4.90	5.00
E1	3.81	3.91	3.99
E	5.79	5.99	6.20
L	0.41	-	1.27
e	0.635 BASIC		
θ°	0	-	8

Note:

1. All dimensions refer to JEDEC OUTLINE MO-137.
2. Do not include Mold Flash or Protrusions.
3. Unit : mm.

8.3.2. Tube Dimensions

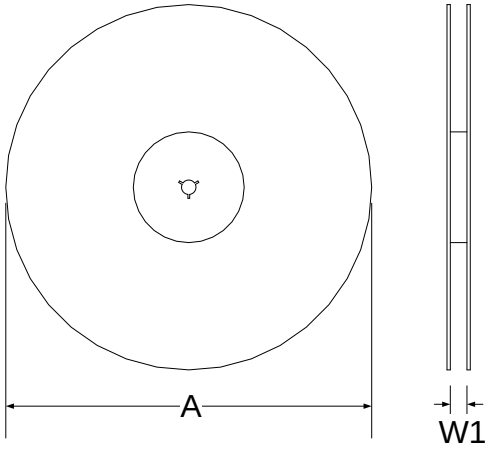




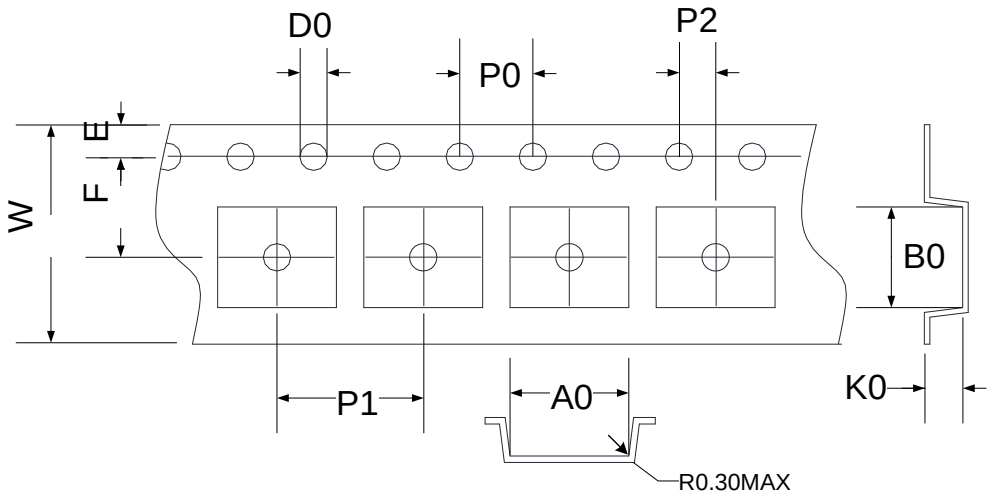
8.3.3. Tape & Reel Information

8.3.3.1. Reel Dimensions –Type1

Unit : mm



8.3.3.2. Carrier Tape Dimensions

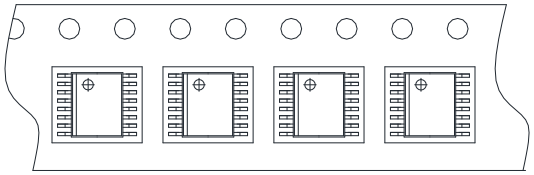


SYMBOLS	Reel Dimensions		Carrier Tape Dimensions									
	A	W1	A0	B0	K0	P0	P1	P2	E	F	D0	W
Spec.	330	12.5	6.90	5.40	2.00	4.00	8.00	2.00	1.75	5.50	1.50	12.00
Tolerance	+6/-3	+1.5/-0	±0.10	±0.10	±0.10	±0.10	±0.10	±0.05	±0.10	±0.05	+0.1/-0	±0.30

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

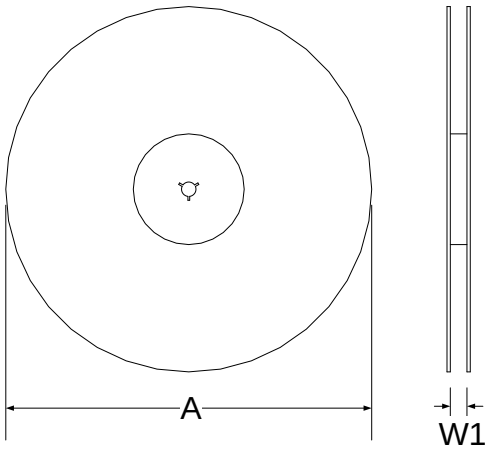
Unit : mm

8.3.3.3. Pin1 direction

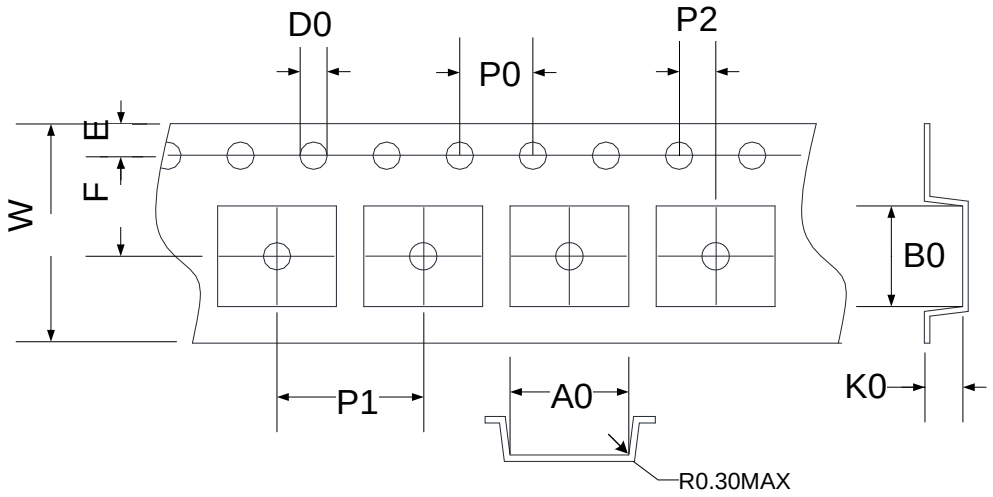


8.3.3.4. Reel Dimensions –Type2

Unit : mm



8.3.3.5. Carrier Tape Dimensions

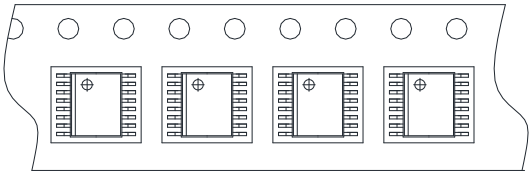


SYMBOLS	Reel Dimensions		Carrier Tape Dimensions									
	A	W1	A0	B0	K0	P0	P1	P2	E	F	D0	W
Spec.	330	12.5	6.50	5.20	2.10	4.00	8.00	2.00	1.75	5.50	1.50	12.00
Tolerance	+6/-3	+1.5/-0	±0.10	±0.10	±0.10	±0.10	±0.10	±0.05	±0.10	±0.05	+0.1/-0	±0.30

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

Unit : mm

8.3.3.6. 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	5	刪除 RTC(32.768KHz)內容
	5	VDDA 支援四種電壓輸出(2.4/2.7/3.0/3.3V)
	5	ADC Gain 存在 x1/4 倍模式
	5	刪除 REFO 內容，修改為 ACM
	5	刪除 8+8 PWM 輸出內容
	6	刪除 HY10P40B
	6	修正 HY10P40A-M010 為 HY10P40-M010
	6	新增 SOP8(EP)封裝, HY10P40-SE08
	7,8	修正引腳定義說明
	9,10	修正應用電路
	11	修正方塊圖(刪除 RTC)
	13~15	修正暫存器列表
	16	刪除 RTC 說明
	16	4Mhz 中心值調到 3.8Mhz; 8Mhz 中心值調到 7Mhz，上下限 10%
	17	修正 6.3 表格內容
	20	修正 6.6, 6.7 表格內容
	25	修正定貨資訊
	26	新增封裝 SOP8(EP)
V03	5	刪除 VDDA=3.3V 資訊
	5	修正 V_{REGIN} Max=24V
	6	刪除 DFN12 封裝資訊
	16	修正 V_{REGIN} Max=24V
	17	新增 Fig 6.2-1~Fig 6.2-5
	18	新增 Fig 6.3-1~Fig 6.3-2
	20	新增 Fig 6.5-3
	21	刪除 VDDA=3.3V 資訊
	21	新增 Figure6.6-1~Figure6.6-3
	26	修正訂貨資訊
	30	刪除 DFN 封裝資訊
V04	5	復位機制：刪除 RESET PIN
	6	修改封裝腳位名稱： VPP/RST/PT1.0/INT0 修改成 VPP/PT1.0/INT1.0

		PT2.0/AI6/PWMA0 修改成 PT2.0/AI6/PWMA0/INT2.0
		PT2.1/AI7/PWMA1 修改成 PT2.1/AI7/PWMA1/INT2.1
	7	新增 INT2.0 及 INT2.1：外部中斷源(Falling Edge Trigger Interrupt)
	8	刪除 RST
	9~10	移除 Reset 電路
		修改封裝腳位名稱：
		VPP/RST/PT1.0/INT0 修改成 VPP/PT1.0/INT1.0
		PT2.0/AI6/PWMA0 修改成 PT2.0/AI6/PWMA0/INT2.0
		PT2.1/AI7/PWMA1 修改成 PT2.1/AI7/PWMA1/INT2.1
	13	0x23h、0x26h：新增 E20IE、E21IE 及 E20IF、E21IF
		0x23h、0x26h：E0IE 及 E0IF 修改命名為 E10IE 及 E10IF
		0x2Ch：刪除 RST
		0x41h：刪除 EN_RST_PIN
	20	移除 External RST Pin 相關資訊
V05	24	更正 SD18 ENOB Table 及 SD18 RMS Noise Table
V06	6	移除 HY10P40H SSOP16 引腳圖
	10	移除 3.3. Charger Application Circuit
	25	移除 HY10P40H SSOP16 訂貨資訊
V07	9~10	新增封裝型式與正印說明
	28	更新 Green (RoHS & no Cl/Br)
	30	新增 Tube Dimensions
	31~32	新增 Tape & Reel Information
	34	新增 Tube Dimensions
	35~36	新增 Tape & Reel Information
	38	新增 Tube Dimensions
	39~40	新增 Tape & Reel Information