



HY14E10M

Datasheet

Digital Pressure Sensor Platform

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1. 特點

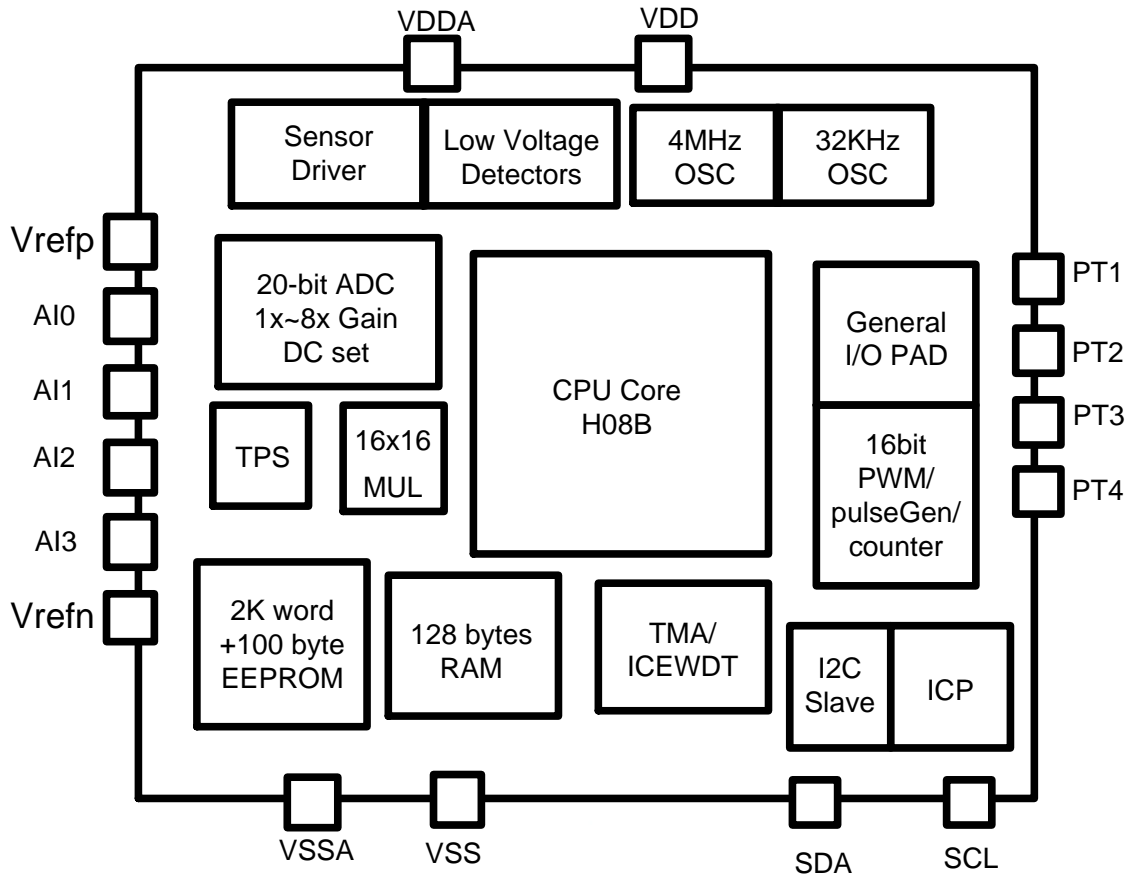
- 用於整合式壓阻壓力傳感器
 - 內建一個 20 位元 ADC，用於電壓和溫度測量
 - 內建一個 PGA 輸入信號放大
- 較寬的工作電壓範圍: 2.0V ~ 5.5V
- 內建 2K words EEPROM
 - 支援線上燒錄
 - 100,000 燒錄次數
- 128 bytes SRAM
- 16bit x 16bit 硬體乘法器
- I²C 從機通訊界面
- 4 個通用 I/O 埠(PT0/PT1 支援輸入中斷功能)
- 16-bit PWM
- 2 線式 JTAG 開發介面(與 I²C 共用)
- 可程式感測器驅動電壓
- 只有 VDD 外部電容是必需的
- 內建 VDDA LDO(選擇性啟動)
- 兩組類比多工輸入
- 較寬工作溫度範圍: -40°C ~ +125°C

功能列表

| Model No. | VDD | System Clock | Program Memory (word) | SRAM (byte) | ADC ENOB (bit x ch) | Sample Rate (sps) | TPS | I/O | Timer (bit x ch) | PWM (bit x ch) | Serial I/F | Package |
|-----------|-----------|--------------|-----------------------|-------------|---------------------|-------------------|-----|-----|-------------------------|-------------------------|------------------------|-----------------|
| HY14E10M | 2.0V~5.5V | 32KHz~4MHz | 2K | 128 | 19bit x 4 | 60~7.8K | yes | 4 | 8-bit x 1 16-bit x 1 | 8-bit x 1 16-bit x 1 | I ² C Slave | QFN16 SSOP16 |

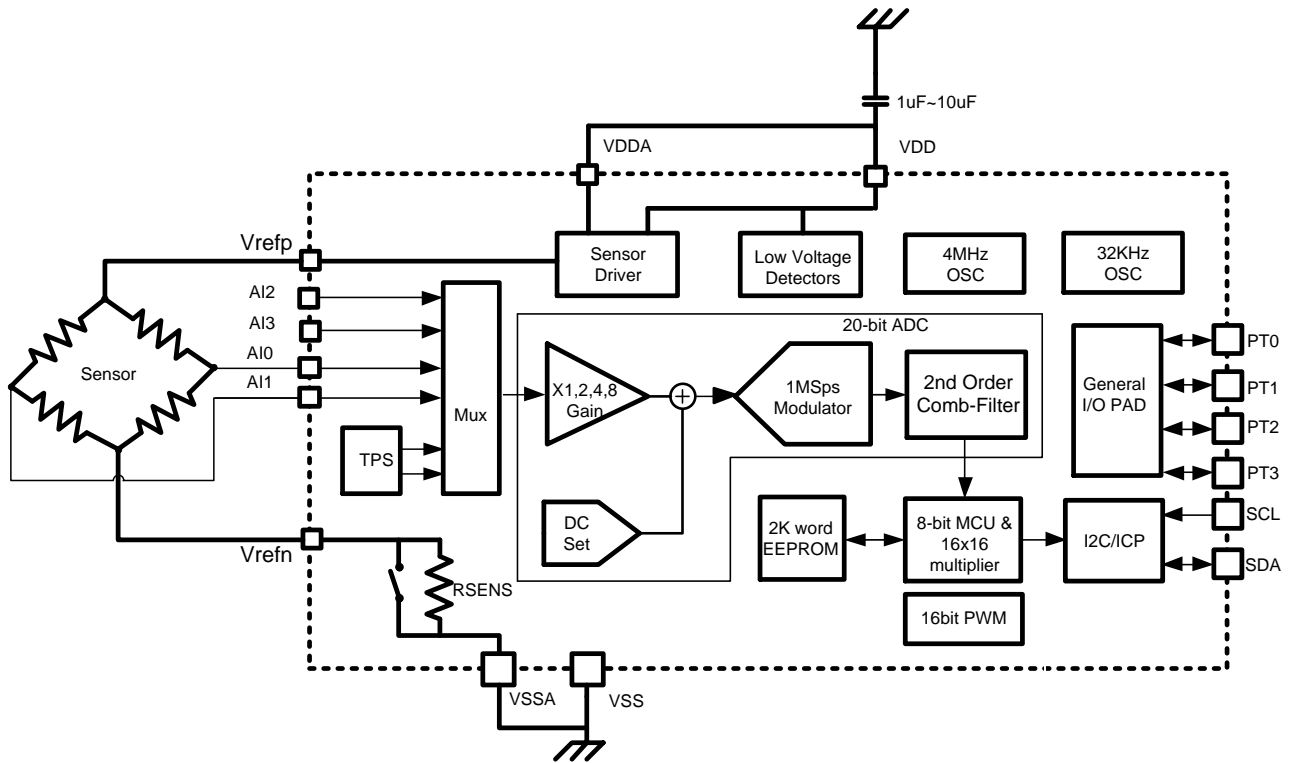
2. 功能概述

2.1. 內部方塊圖



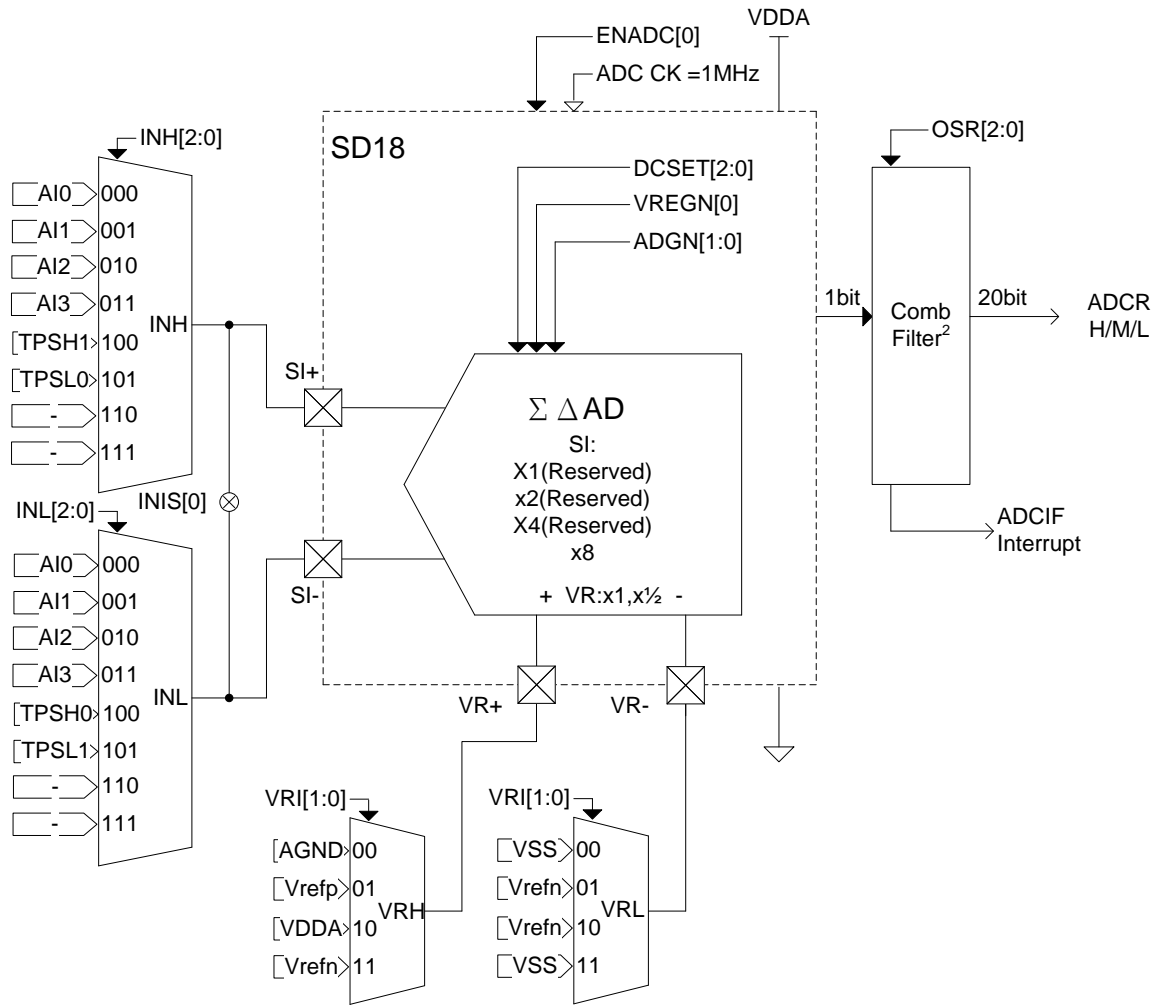
Note : 在電壓放大倍率 x1/x2/x4 為 Reserved · 建議使用 8 倍放大倍率。

2.2. 應用電路



Note : 在電壓放大倍率 x1/x2/x4 為 Reserved , 建議使用 8 倍放大倍率。

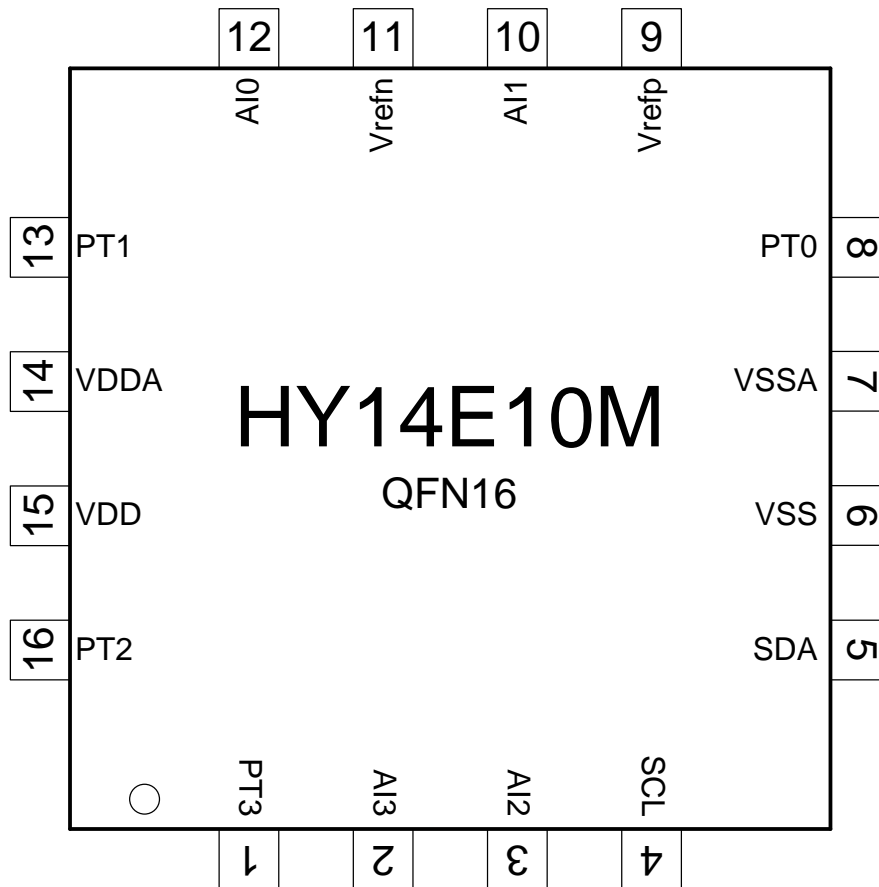
2.3. SD18 Network



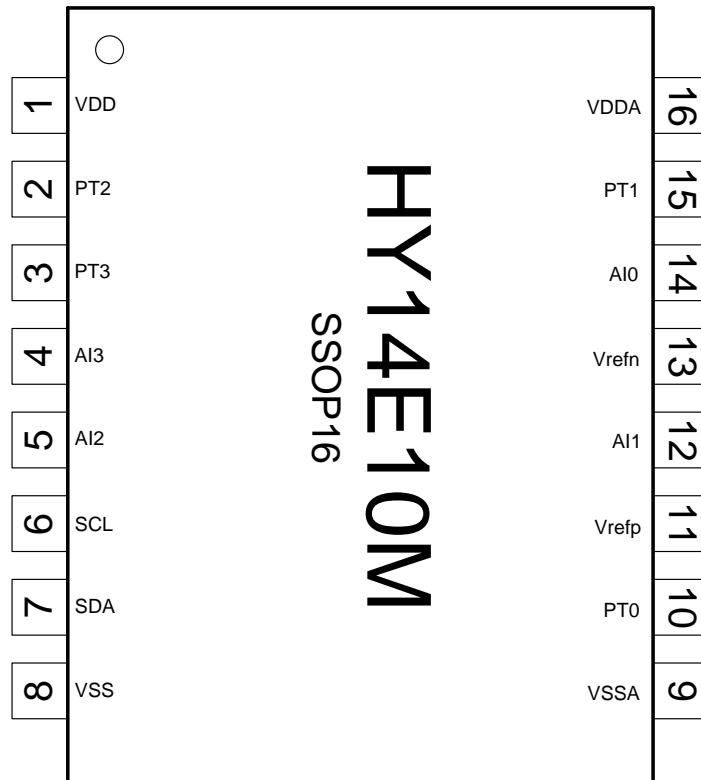
Note : 在電壓放大倍率 x1/x2/x4 為 Reserved，建議使用 8 倍放大倍率。

3. 包裝與引腳定義

3.1. QFN16(N016)引腳圖



3.2. SSOP16(E016)引腳圖



3.3. 引腳定義說明

| N016 | E016 | Pin | Characteristic | | Description |
|------|------|-------|----------------|------|---|
| | | Name | I/O | Type | |
| 11 | 13 | Vrefn | O | A | Sense Ground. Used to ground resistive bridge sensor. |

| | | | | | |
|----|----|-------|-----|---|--|
| 12 | 14 | AI0 | I | A | Sensing Input 0. Used for analog input to ADC multiplexer |
| 13 | 15 | PT1 | I/O | S | Digital Input/Output Port 1 Used as general digital input or output pad. It has level change interrupt |
| 14 | 16 | VDDA | I | P | Analog Power Supply. A 2.0V ~ 5.5V voltage input. (Short with VDD by wire bonding or LDO output option) |
| 15 | 1 | VDD | I | P | Power Supply. A 2.0V ~ 5.5V voltage input. Connect a 1uF capacitor to VSS. |
| 16 | 2 | PT2 | I/O | S | Digital Input/Output Port 2 Used as general digital input or output pad. It has level change interrupt |
| 1 | 3 | PT3 | I/O | S | Digital Input/Output Port 3 Used as general digital input or output pad |
| 2 | 4 | AI3 | I | A | Sensing Input 3. Used for analog input to ADC multiplexer |
| 3 | 5 | AI2 | I | A | Sensing Input 2. Used for analog input to ADC multiplexer |
| 4 | 6 | SCL | I | C | I2C Serial Clock Input. Slave I2C communication clock line |
| 5 | 7 | SDA | I/O | D | I2C Serial Data Input/Output Slave I2C communication data line. Open-drain output. Use with an external pull-up resistor |
| 6 | 8 | VSS | I | P | Device Ground. |
| 7 | 9 | VSSA | I | P | Device Analog Ground. |
| 8 | 10 | PT0 | I/O | S | Digital Input/Output Port 0 Used as general digital input or output pad |
| 9 | 11 | Vrefp | O | A | Power Supply. Used to power resistive bridge sensor. |
| 10 | 12 | AI1 | I | A | Sensing Input 1. Used for analog input to ADC multiplexer |

"I/O" Input/Output, "I" Input, "O" Output, "D" Digital Open-Drain, "S" Schmitt Trigger, "C" CMOS, "P" Power, "A" Analog

4. 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 | | | | | | | | | | | | |
| Address | File Name | Bit7 | Bit6 | Bit5 | Bit4 | Bit3 | Bit2 | Bit1 | Bit0 | A-RESET | R/W | |
| 00H | INDF0 | Contents of FSR0 to address data memory value of FSR0 not changed | | | | | | | | | N/A | ***** |
| 0FH | FSR0H | | | | | | | | |X |* | |
| 10H | FSR0L | Indirect Data Memory Address Pointer 0 Low Byte, FSR0[7:0] | | | | | | | | | xxxx xxxx | ***** |
| 16H | TOSH | - | - | - | - | - | TOS[10] | TOS[9] | TOS[8] | ... 0000 |* | |
| 17H | TOSL | Top-of-Stack Low Byte (TOS<7:0>) | | | | | | | | | 0000 0000 | ***** |
| 18H | STKPTR | STKFL | STKUN | STKOV | - | - | STKPR[2:0] | | | 000..000 | r,rw0,rw0,-,r,r,r | |
| 1AH | PCLATH | - | - | - | - | - | PC[10] | PC[9] | PC[8] | ... 0000 |* | |
| 1BH | PCLATL | PC Low Byte for PC<7:0> | | | | | | | | | 0000 0000 | ***** |
| 1DH | TBLPTRH | TBLW+ | TBLW | TBLR+ | TBLR | TBLPTR[11] | TBLPTR[10] | TBLPTR[9] | TBLPTR[8] | ... 0000 |* | |
| 1EH | TBLPTRL | Program Memory Table Pointer Low Byte (TBLPTR<7:0>) | | | | | | | | | 0000 0000 | ***** |
| 20H | TBLDL | Program Memory Table Latch Low Byte | | | | | | | | | 0000 0000 | ***** |
| 23H | INTE0 | GIE | ADCIE | TMBIE | TMAIE | LVD_BE | LVDE | E1IE | E0IE | 000.0000 | ***** | |
| 24H | INTE1 | I2CW7IE | I2CW6IE | I2CW5IE | I2CW4IE | I2CW3IE | I2CW2IE | I2CW1IE | I2CW0IE | 000.0000 | ***** | |
| 25H | INTE2 | - | - | - | - | - | I2CW10IE | I2CW9IE | I2CW8IE | 000.0000 | ***** | |
| 26H | INTF0 | - | ADCIF | TMBIF | TMAIF | LVD_BF | LVDF | E1IF | E0IF | 000.0000 | w0 | |
| 27H | INTF1 | I2CW7IF | I2CW6IF | I2CW5IF | I2CW4IF | I2CW3IF | I2CW2IF | I2CW1IF | I2CW0IF | 000.0000 | w0 | |
| 28H | INTF2 | - | - | - | - | - | I2CW10IF | I2CW9IF | I2CW8IF | 000.0000 | w0 | |
| 29H | WREG | Working Register | | | | | | | | | xxxx xxxx | ***** |
| 2BH | STATUS | - | - | - | C | - | - | - | Z | ...X xxxx |* | |
| 2CH | PSTATUS | BOR | PD | - | IDLE | ICP_Crst | STK_ERR | I2C_RST | I2C_GC_RST | 000d..0. | rw0,rw0,rw0,rw0,-,rw0,-,- | |
| 2DH | ADCR0H | ADC[19:12] | | | | | | | | | xxxx xxxx | ***** |
| 2EH | ADCR0M | ADC[11:4] | | | | | | | | | xxxx xxxx | ***** |
| 2FH | ADCR0L | ADC[3:0] | | | | 0 | 0 | 0 | 0 | 0 | xxxx xxxx | ***** |
| 30H | ADCR1H | ADC[19] | ADC[19] | ADC[19] | ADC[19] | ADC[19] | ADC[18] | ADC[17] | ADC[16] | xxxx xxxx | ***** | |
| 31H | ADCR1M | ADC[15:8] | | | | | | | | | xxxx xxxx | ***** |
| 32H | ADCR1L | ADC[7:0] | | | | | | | | | xxxx xxxx | ***** |
| 33H | PWRCN0 | ENBGR | ENTPS | ENSDR | INIS | TPSL | ENLDO | ENLVD | ENADC | 000.0000 | ***** | |
| 34H | PWRCN1 | ADHV | SDRV[1:0] | | LVDV[1:0] | | LDOV[1:0] | | | 000.0000 | ***** | |
| 35H | ADCCN0 | OSR[2:0] | | | VREGN | ADG[1:0] | | SACM[1:0] | | | 000.0000 | ***** |
| 36H | ADCCN1 | INL[2:0] | | | INH[2:0] | | | VRI[1:0] | | | 000.0000 | ***** |
| 37H | ADCCN2 | DCSET[2:0] | | | TCR[1:0] | | - | - | ADRST | 000.0000 | ***** | |
| 38H | CLKCN | - | - | - | HAOM[1:0] | | CPUCKS | ENHAO | ENLPO | 000.0011 | ***** | |
| 39H | AL_MO0 | LSB for multiplexer input A / LSB for multiplexer output | | | | | | | | | xxxx xxxx | ***** |
| 3AH | AH_MO1 | MSB for multiplexer input A / 15-8 bit multiplexer output | | | | | | | | | xxxx xxxx | ***** |
| 3BH | BL_MO2 | LSB for multiplexer input B / 23-16 bit multiplexer output | | | | | | | | | xxxx xxxx | ***** |
| 3CH | BH_MO3 | MSB for multiplexer input B / MSB for multiplexer output | | | | | | | | | xxxx xxxx | ***** |
| 3DH | PT0 | - | - | PT0EG[1:0] | | ENPWM10 | PU0 | TC0 | PT0IO | 000.0000 | ***** | |
| 3EH | PT1 | - | - | PT1EG[1:0] | | ENPWM00 | PU1 | TC1 | PT1IO | 000.0000 | ***** | |
| 3FH | PT2 | - | - | - | - | ENPWM10 | PU2 | TC2 | PT2IO | 000.0000 | ***** | |
| 40H | PT3 | - | - | - | - | ENPWM00 | PU3 | TC3 | PT3IO | 000.0000 | ***** | |

表 4-1 資料記憶體列表

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

| Address | File Name | Bit7 | Bit6 | Bit5 | Bit4 | Bit3 | Bit2 | Bit1 | Bit0 | A-RESET | R/W |
|-----------|-----------|--|-----------|------|-----------|------|------|------|---------|---------------|-----------------|
| 41H | LSB_SEL | SEL_FLAG[7:0] | | | | | | | | 0000 0000 | ***** |
| 42H | I2C_CMD | TIP | scu_L3 | SP | 0 | 0 | 0 | 0 | EN_SCLO | 0000 0000 | RRRRRRRW |
| 43H | I2C_O0 | I2C Data Output Buffer 0 | | | | | | | | xxxx xxxx | w |
| 44H | I2C_O1 | I2C Data Output Buffer 1 | | | | | | | | xxxx xxxx | w |
| 45H | I2C_O2 | I2C Data Output Buffer 2 | | | | | | | | xxxx xxxx | w |
| 46H | I2C_O3 | I2C Data Output Buffer 3 | | | | | | | | xxxx xxxx | w |
| 47H | I2C_O4 | I2C Data Output Buffer 4 | | | | | | | | xxxx xxxx | w |
| 48H | I2C_O5 | I2C Data Output Buffer 5 | | | | | | | | xxxx xxxx | w |
| 49H | I2C_O6 | I2C Data Output Buffer 6 | | | | | | | | xxxx xxxx | w |
| 4AH | I2C_O7 | I2C Data Output Buffer 7 | | | | | | | | xxxx xxxx | w |
| 4BH | I2C_I0 | I2C Data Input Buffer 0 | | | | | | | | xxxx xxxx | r |
| 4CH | I2C_I1 | I2C Data Input Buffer 1 | | | | | | | | xxxx xxxx | r |
| 4DH | I2C_I2 | I2C Data Input Buffer 2 | | | | | | | | xxxx xxxx | r |
| 4EH | I2C_I3 | I2C Data Input Buffer 3 | | | | | | | | xxxx xxxx | r |
| 4FH | I2C_I4 | I2C Data Input Buffer 4 | | | | | | | | xxxx xxxx | r |
| 50H | I2C_I5 | I2C Data Input Buffer 5 | | | | | | | | xxxx xxxx | r |
| 51H | I2C_I6 | I2C Data Input Buffer 6 | | | | | | | | xxxx xxxx | r |
| 52H | I2C_I7 | I2C Data Input Buffer 7 | | | | | | | | xxxx xxxx | r |
| 53H | I2C_I8 | I2C Data Input Buffer 8 | | | | | | | | xxxx xxxx | r |
| 54H | I2C_I9 | I2C Data Input Buffer 9 | | | | | | | | xxxx xxxx | r |
| 55H | I2C_I10 | I2C Data Input Buffer 10 | | | | | | | | xxxx xxxx | r |
| 56H | TMACN | ENTMA | TMACL | TMAS | DTMA[2:0] | | | - | - | 0000 \$000 | **** rw1,*** |
| 57H | TMAR | TMAR[7:0] | | | | | | | | 0000 0000 | r,r,r,r,r,r,r,r |
| 58H | TB1CN0 | ENTMB | TB1M[1:0] | | DTMB[1:0] | | - | - | TMBCL | 0000 0000 | ***** |
| 59H | TB1C0L | TimerB1 counter Condition Register0 [7:0] | | | | | | | | xxxx xxxx | ***** |
| 5AH | TB1C0H | TimerB1 counter Condition Register0 [15:8] | | | | | | | | xxxx xxxx | ***** |
| 5BH | TB1C1L | TimerB1 counter Condition Register1 [7:0] | | | | | | | | xxxx xxxx | ***** |
| 5CH | TB1C1H | TimerB1 counter Condition Register1 [15:8] | | | | | | | | xxxx xxxx | ***** |
| 5EH | EE_CTRL | EN_TBL | PGM | 0 | 0 | 0 | 0 | 0 | 0 | 0,1,1,1,1,0,0 | |
| 80H ~ FFH | GPR0 | General Purpose Register as 128Byte | | | | | | | | xxxx xxxx | |

表 4-2 資料記憶體列表(續)

5. 電氣特性

5.1. Absolute Maximum Ratings

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

| | |
|--|-----------------------------------|
| Voltage applied at VDD to VSS(VSSA) | -0.3 V to 6.5 V |
| Voltage applied at VDDA to VSS(VSSA) | -0.3 V to V _{DD} + 0.3 V |
| Voltage applied to any pin | -0.3 V to V _{DD} + 0.3 V |
| Storage temperature range, Tstg: (unprogrammed device) | -55°C to 150°C |
| (programmed device) | -40°C to 85°C |
| Operating temperature range | -40°C to 125°C |

5.2. Power System

Typical values are at TA = 25°C and VDD = 3.0V.

| Sym. | Parameter | Test Conditions | Min. | Typ. | Max. | unit |
|-----------------|--------------------------------|---|------------------------------|------------------------------|------------------------------|-------|
| V _{DD} | Supply Voltage | | 2.0 | | 5.5 | V |
| SDR | Temperature drift | VDD=VDDA=3.6V, TA=-40°C~125°C | | 100 | | ppm/C |
| | Driving Current | VDD – Vs > 0.15 | | | 1000 | uA |
| | Sensor Drive Voltage | SDRV[1:0]=00 SDRV[1:0]=01 SDRV[1:0]=10 SDRV[1:0]=11 | 1.50 2.05 2.65 3.65 | 1.65 2.20 2.80 3.80 | 1.80 2.35 2.95 3.95 | V |
| RSENS | Internal Resistance for sensor | RSENS=00b, 0.0 Kohm RSENS =01b, 2.5 Kohm RSENS =01b, 5.0 Kohm RSENS =01b, 7.5 Kohm | 2.25 4.5 6.75 | 0 2.5 5 7.5 | 2.75 5.5 8.25 | Kohm |
| | Temperature drift | RSENS =01b, 2.5 Kohm | | | 400 | ppm/C |
| VDDA LDO | Current | VDDA = 1.65 | | 12 | | uA |
| | Temperature drift | VDD=3.6V, TA=-40°C~125°C | | 100 | | ppm/C |
| | C load | | 100 | | 10,000 | nF |
| | R load | | | 10K | | KOhm |
| | VDDA LDO Voltage | LDOV[1:0]=01 LDOV[1:0]=10 LDOV[1:0]=11 | 2.15 2.75 3.65 | 2.30 2.90 3.80 | 2.45 3.05 3.95 | V |

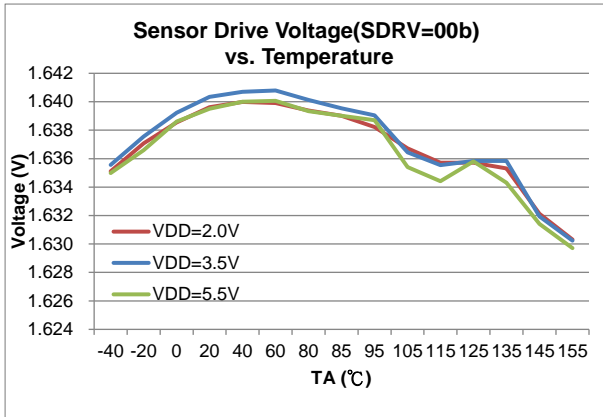


Figure 5.2-1(a) SDR vs. Temperature

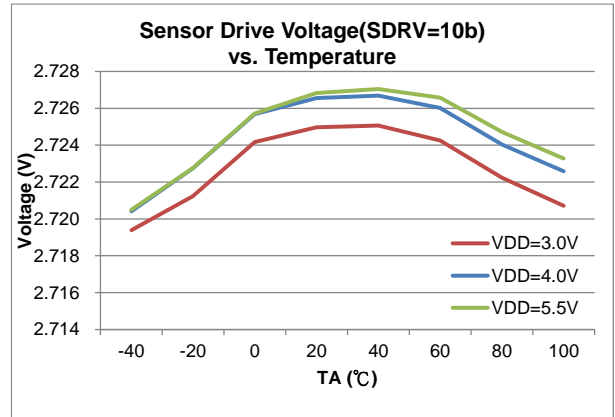


Figure 5.2-1(c) SDR vs. Temperature

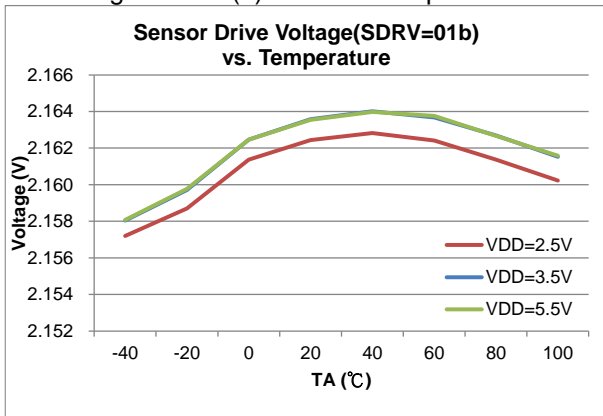


Figure 5.2-1(b) SDR vs. Temperature

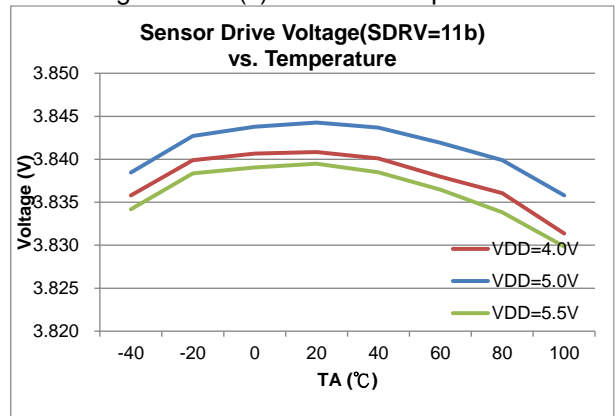


Figure 5.2-1(d) SDR vs. Temperature

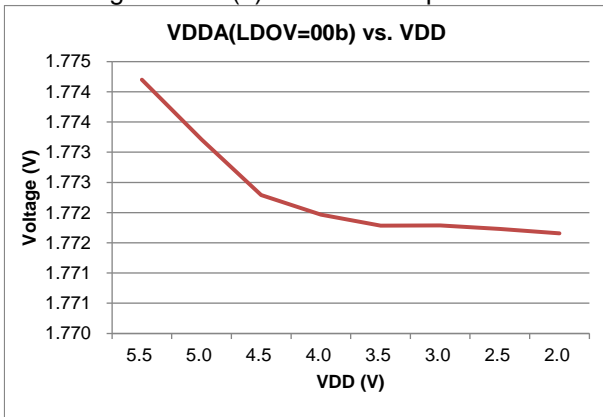


Figure 5.2-2(a) VDDA vs. VDD

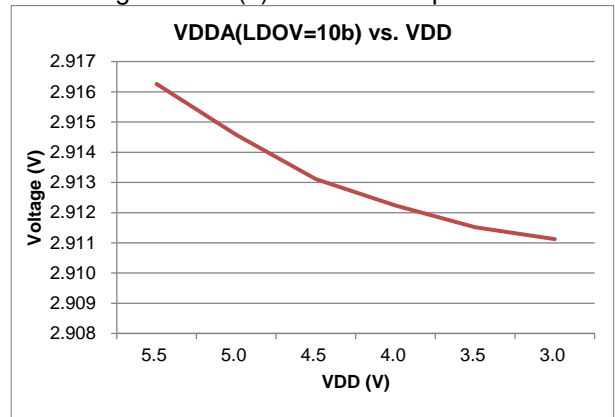


Figure 5.2-2(c) VDDA vs. VDD

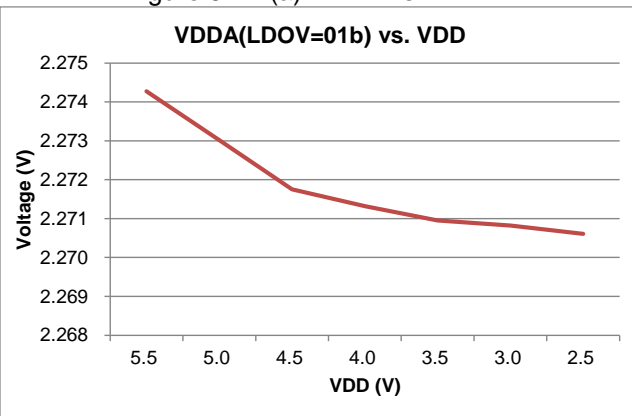


Figure 5.2-2(b) VDDA vs. VDD

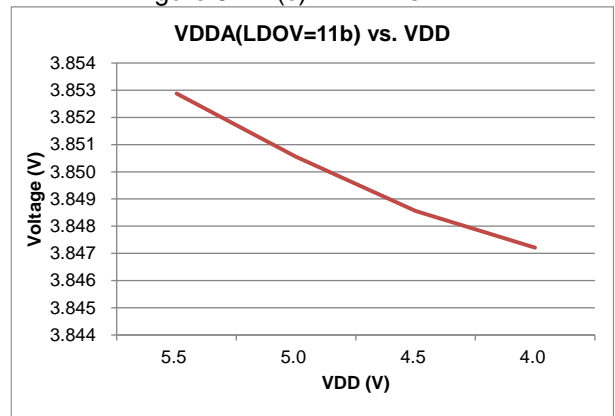


Figure 5.2-2(d) VDDA vs. VDD

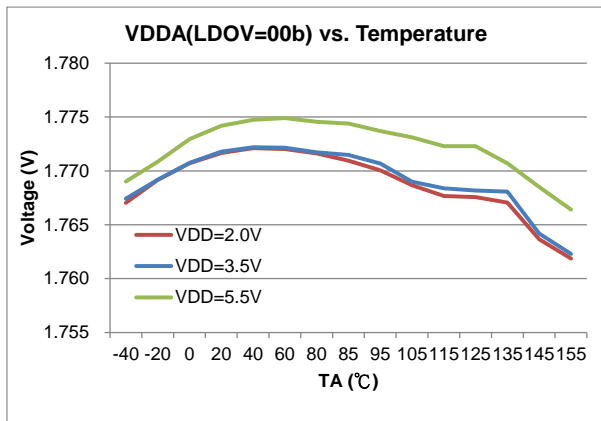


Figure 5.2-3(a) VDDA vs. Temperature

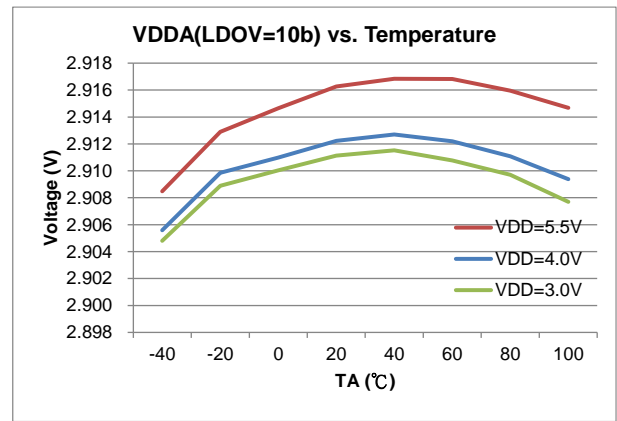


Figure 5.2-3(c) VDDA vs. Temperature

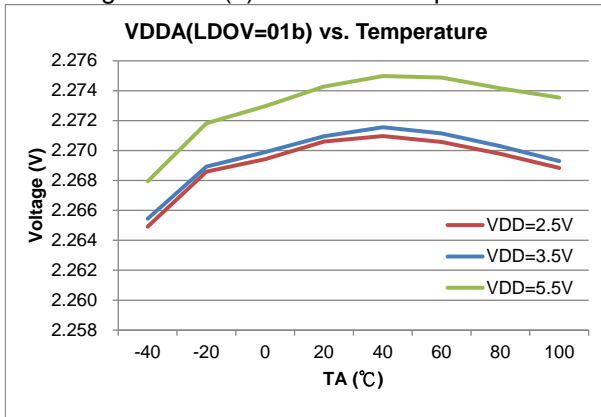


Figure 5.2-3(b) VDDA vs. Temperature

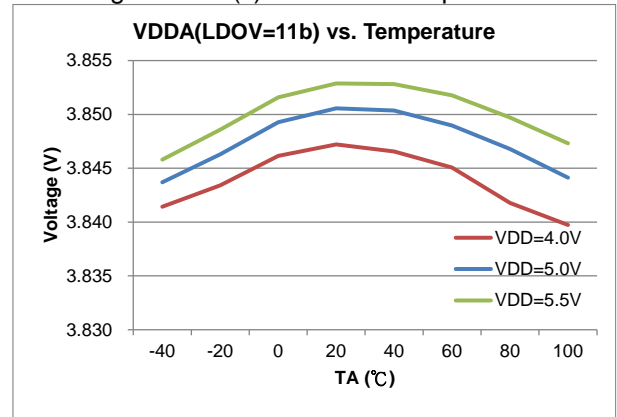


Figure 5.2-3(d) VDDA vs. Temperature

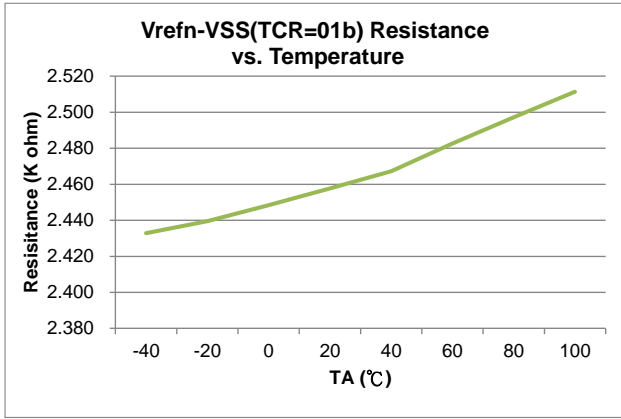


Figure 5.2-4(a) Vrefn resistance vs. Temperature

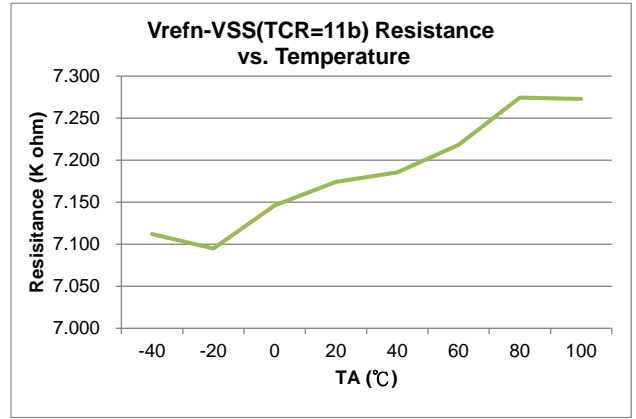


Figure 5.2-4(c) Vrefn resistance vs. Temperature

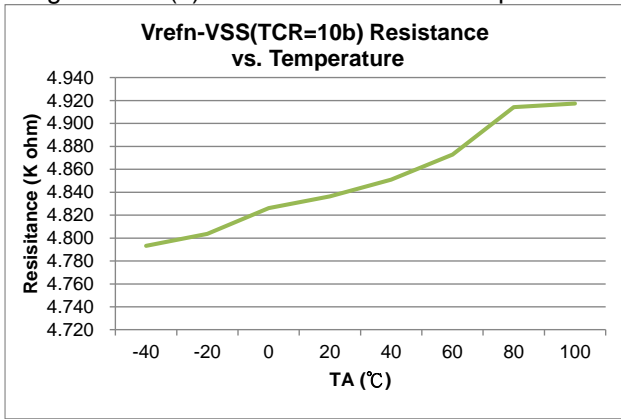


Figure 5.2-4(b) Vrefn resistance vs. Temperature

5.3. ΣΔADC, Power Supply and recommended operating conditions

Typical values are at TA = 25°C and VDD = 3.0V

| Sym. | Parameter | Test Conditions | Min. | Typ. | Max. | unit |
|------|--------------------|---|--------------|---------------|--------------|-------|
| | Input Range | Vr = Vrefp – Vrefn Gain = AD Gain x Ref Gain | - 0.8Vr/Gain | | + 0.8Vr/Gain | V |
| | Resolution | Total gain = 8 | | 20 | | bit |
| | INL | OSR = 16384 | | ±0.003 | ±0.01 | %FSR |
| | Gain drift | VDD=VDDA=3.6V, OSR = 16384, Gain=8, ADC VR=external 2.048V/2. TA=-40°C~125°C | | 30 | | ppm/C |
| | | VDD=VDDA=3.6V, OSR = 16384, Gain=8, ADC VR=internal AGND/1. TA=-40°C~125°C | | 50 | | ppm/C |
| | Offset drift | VDD=VDDA=3.6V, OSR = 16384, Gain=8 | | | 1 | %FSR |
| | Noise | Gain= 8 @ 8192 | | 1 | | uV |
| | | Gain=8 @ 128 | | 15 | | |
| | Current | | | | 350 | uA |
| | Offset | | | 0.2 | 1 | mV |
| | Sampling Rate | | 0.9 | 1 | 1.1 | MS/s |
| | Input Gain | | | | 8 | V/V |
| | ADC DC input shift | Vref = Vrefp – Vrefn | | Vref/(4*gain) | | V |

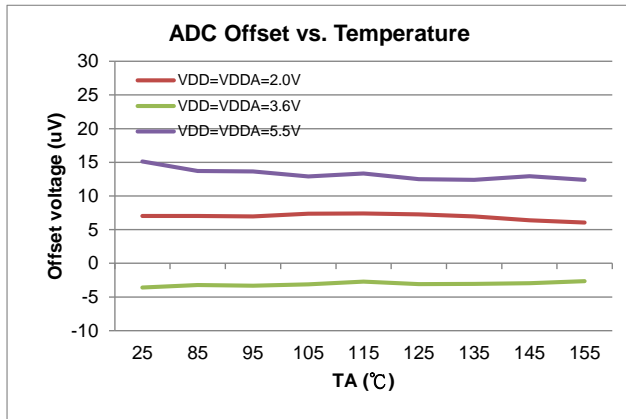


Figure 5.3-1 ADC Offset vs. Temperature

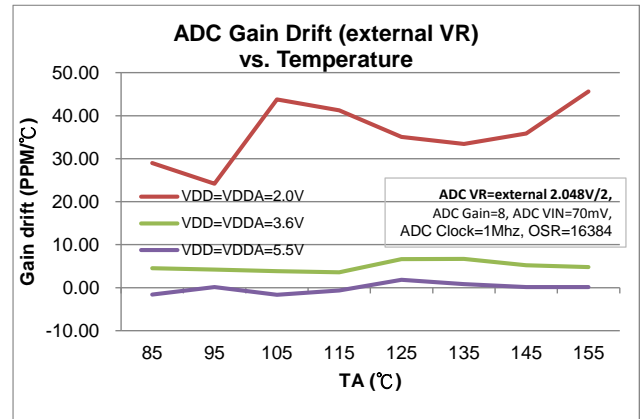
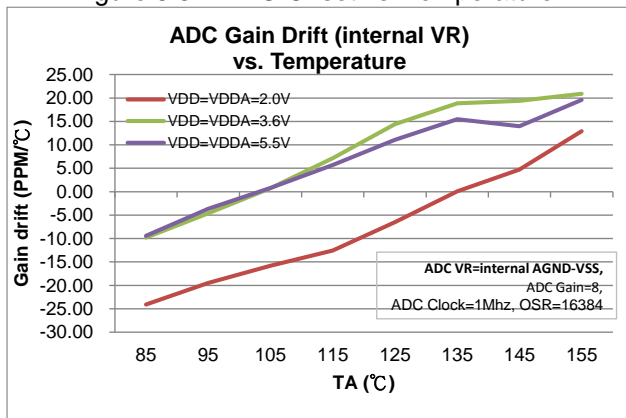


Figure 5.3-2 ADC Gain drift vs. Temperature
 Figure 5.3-3 ADC Gain drift vs. Temperature



5.4. Temperature sensor

Typical values are at TA = 25°C and VDD = 3.0V.

| Sym. | Parameter | Test Conditions | Min. | Typ. | Max. | unit |
|------|--------------------------------|--|------|------|------|-------|
| | Resolution | After 2 points calculation; Monotonic | - | 0.01 | - | °C |
| | Temperature Sensor Slope | | - | 121 | - | uV/°C |
| | Relative accuracy | | +1 | - | -1 | uV/°C |
| KT | Absolute Temperature Scale 0°K | | | | | °C |

5.5. Reset(Brownout, Low Voltage Detect)

Typical values are at TA = 25°C and VDD = 3.0V.

| Sym. | Parameter | Test Conditions | Min. | Typ. | Max. | unit |
|------|-----------------------|--|----------------------|----------------------|----------------------|-------|
| LVD | Current | Including R | 7.5 | | | uA |
| | Temperature drift | TA=-40°C~85°C | 100 | | | ppm/C |
| | Low Voltage Detection | LVDV[1:0]=01 LVDV[1:0]=10 LVDV[1:0]=11 | 2.15 2.75 3.65 | 2.30 2.90 3.80 | 2.45 3.05 3.95 | V |
| BOR | Detect Voltage | | 1.4 | 1.6 | 1.8 | V |
| | Current | | 1 3 | | | uA |

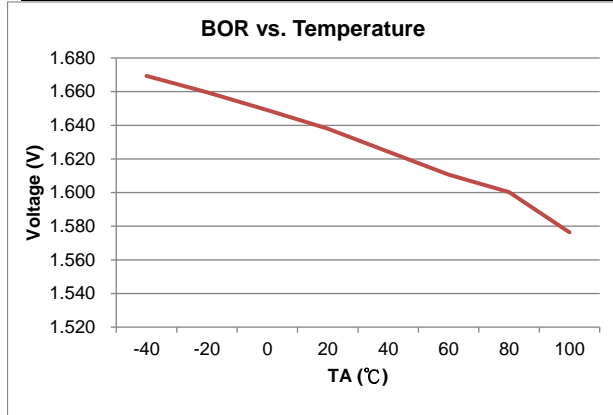


Figure 5.5-1 BOR vs. Temperature

5.6. Internal RC Oscillator

Typical values are at TA = 25°C and VDD = 3.0V.

| Sym. | Parameter | Test Conditions | Min. | Typ. | Max. | unit |
|------|---------------------------------|------------------------------|------|------|------|-------|
| LPO | Low Power Oscillator frequency | VDD=2.0~5.5V, TA=-40°C~125°C | 27.2 | 32 | 40.0 | KHz |
| | Temperature drift | VDD=3.6V, TA=-40°C~125°C | 200 | | | ppm/C |
| | Current | | 1.5 | | | uA |
| HAO | High Speed Oscillator frequency | VDD=2.0~5.5V, TA=-40°C~85°C | 3.92 | 4 | 4.08 | MHz |
| | | VDD=2.0~5.5V, TA=-40°C~125°C | 3.60 | 4 | 4.40 | |
| | Current | | 25 | | | uA |
| | Temperature drift | VDD=3.6V, TA=-40°C~125°C | 300 | | | ppm/C |

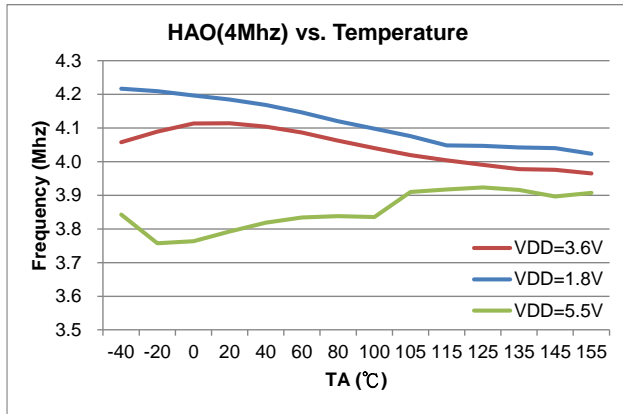


Figure 5.6-1 4Mhz HAO Frequency vs. Temperature

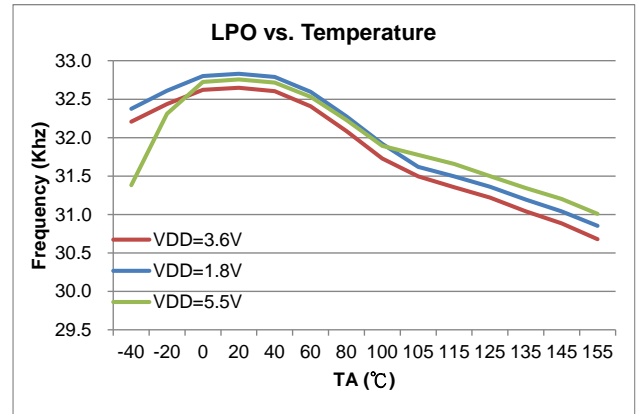


Figure 5.6-2 LPO Frequency vs. Temperature

5.7. Supply current

TA = 25°C, VDD = 3.6V, OSC_LPO = 32KHz, unless otherwise noted.

| Sym. | Parameter | Test Conditions | Min. | Typ. | Max. | unit |
|------|------------------|---|------|------|------|------|
| IAM | Active mode | OSC_HAO = 4MHz, CPU_CK = 4MHz | | 800 | | uA |
| ILP1 | Low power mode 1 | OSC_HAO = off, CPU_CK = LPO | | 6.5 | | uA |
| ILP2 | Low power mode 2 | OSC_HAO = off, CPU_CK = LPO, idle mode | | 1.65 | | uA |
| ILP3 | Low power mode 3 | OSC_HAO = off, CPU_CK = off, sleep mode | | 0.7 | | uA |

TA = 25°C, VDD = 5.5V, OSC_LPO = 32KHz, unless otherwise noted.

| Sym. | Parameter | Test Conditions | Min. | Typ. | Max. | unit |
|------|------------------|---|------|------|------|------|
| IAM | Active mode | OSC_HAO = 4MHz, CPU_CK = 4MHz | | 1100 | 2000 | uA |
| ILP1 | Low power mode 1 | OSC_HAO = off, CPU_CK = LPO | | 11 | 25 | uA |
| ILP2 | Low power mode 2 | OSC_HAO = off, CPU_CK = LPO, idle mode | | 2.5 | 6 | uA |
| ILP3 | Low power mode 3 | OSC_HAO = off, CPU_CK = off, sleep mode | | 1 | 3 | uA |

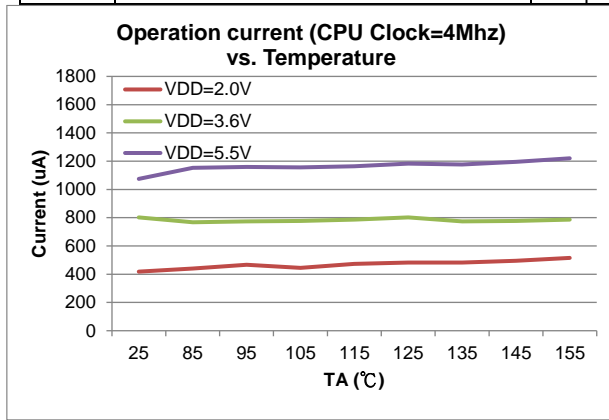


Figure 5.7-1 IAM vs. Temperature

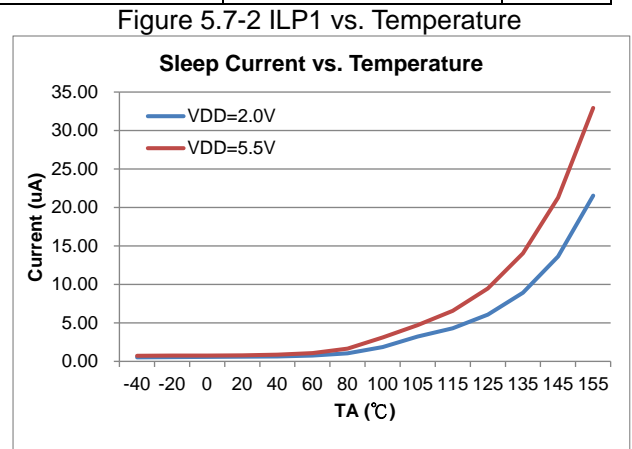


Figure 5.7-2 ILP1 vs. Temperature

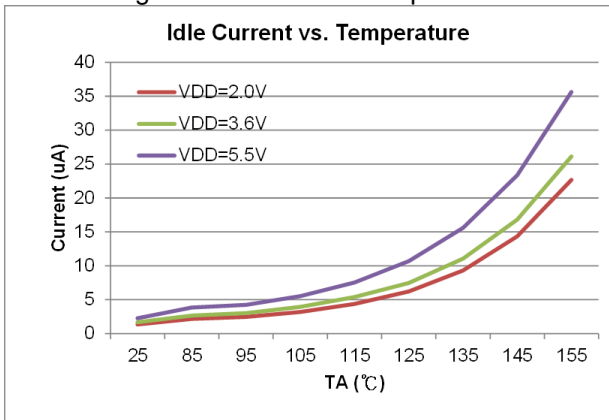


Figure 5.7-3 ILP2 vs. Temperature

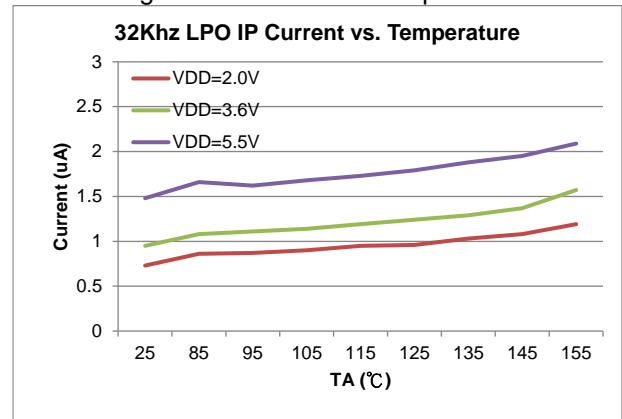
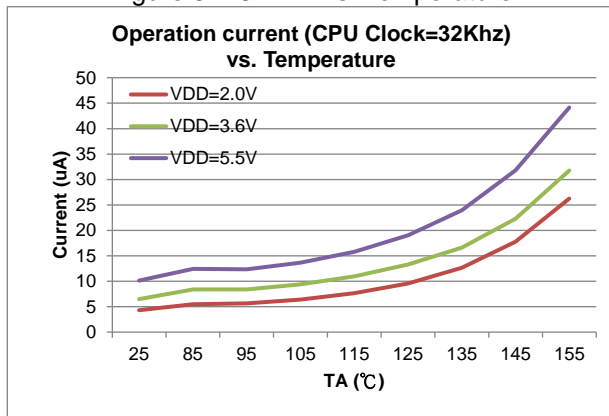


Figure 5.7-4 ILP3 vs. Temperature

Figure 5.7-5 LPO IP current vs. Temperature



5.8. Port

Typical values are at TA = 25°C and VDD = 3.0V.

| Sym. | Parameter | Test Conditions | Min. | Typ. | Max. | unit |
|------------------|-----------------------------------|---------------------|-----------|------|-----------|------|
| I ² C | I ² C interface speed | | | | 1 | MHz |
| | SDA Output logic low (Open-drain) | IOL = 3mA | - | - | VDD X 0.2 | V |
| | SDA, Output logic high | IOH = -50µA | VDD X 0.9 | - | - | V |
| | SDA, SCL Input logic low | | - | - | VDD X 0.2 | V |
| | SDA, SCL Input logic high | | VDD X 0.8 | - | - | V |
| | SDA, SCL Digital input hysteresis | | - | 0.4 | - | V |
| I/O | Sink | VDD = 3V, I/O= 0.3V | 5 | | | mA |
| | Source | VDD = 3V, I/O= 2.7V | 5 | | | mA |
| | Input H | VDD = 3V | 1.6 | | | V |
| | Input L | VDD = 3V | | | 1.3 | V |

5.9. ΣΔADC Performance

HY14E10M 針對 SD18 提供了重要的輸入雜訊規格。Table5.8-1 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(Vrefp-Vrefn)/2，取樣 1024 筆資料。

| <i>HY14E10M ENOB(RMS) with OSR/GAIN at A/D Clock=1Mhz, VR=(Vrefp-Vrefn)/2</i> | | | | | | | | | | | |
|---|-----------------|------|-----|------|------|------|------|------|------|------|-------|
| Max. Vin(mV) =0.9*VREF (1) | OSR | | | 128 | 256 | 512 | 1024 | 2048 | 4096 | 8192 | 16384 |
| | Output rate(HZ) | | | 7813 | 3906 | 1953 | 977 | 488 | 244 | 122 | 61 |
| | VDD | GAIN | SDR | | | | | | | | |
| ±157 | 3.3 | 8 | 2.8 | 14.3 | 15.9 | 16.3 | 16.4 | 16.4 | 17.1 | 17.3 | 18.7 |
| <i>HY14E10M RMS Noise(uV) with OSR/GAIN at A/D Clock=1Mhz, VR=(Vrefp-Vrefn)/2</i> | | | | | | | | | | | |
| Max. Vin(mV) =0.9*VREF (1) | OSR | | | 128 | 256 | 512 | 1024 | 2048 | 4096 | 8192 | 16384 |
| | Output rate(HZ) | | | 7813 | 3906 | 1953 | 977 | 488 | 244 | 122 | 61 |
| | VDD | GAIN | SDR | | | | | | | | |
| ±157 | 3.3 | 8 | 2.8 | 16.8 | 5.7 | 4.2 | 4.1 | 4.1 | 2.4 | 2.1 | 0.8 |

Table5.8-1 SD18 ENOB and RMS Noise Table

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

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

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

Where FSR (Full - Scale Range) = 2 × VREF/Gain.

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

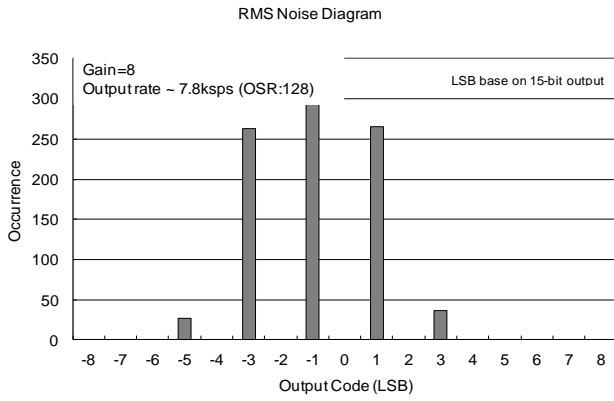


Figure5.9-1(a) RMS Noise Diagram

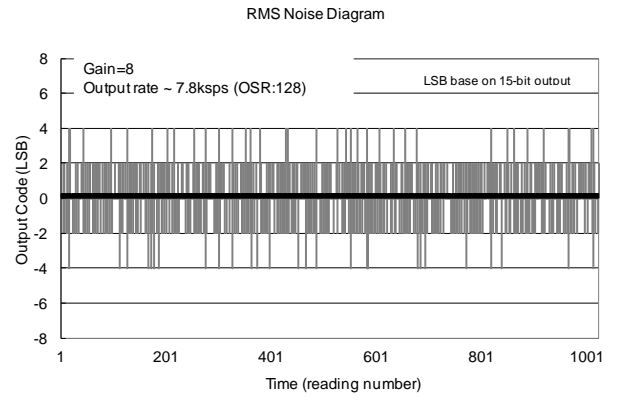


Figure5.9-1(b) Output Code Diagram

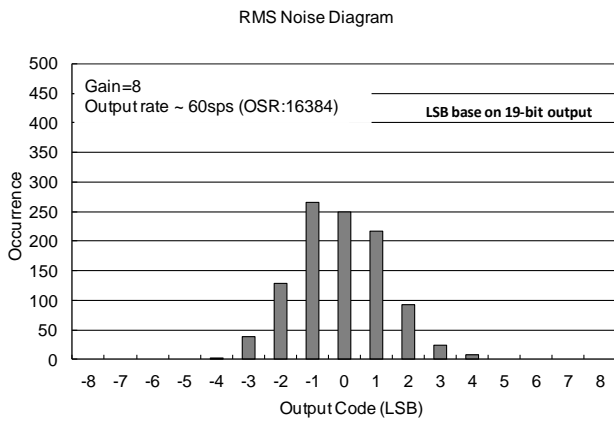


Figure5.9-2(a) RMS Noise Diagram

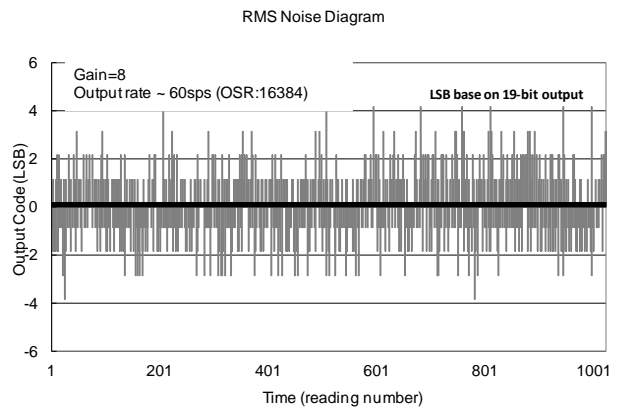


Figure5.9-2(b) Output Code Diagram

6. 訂貨資訊

| 下單品名 ^{1,5} | 封裝型式 | 引腳數 | 封裝型式 | | 程式碼 編號 ² | 出貨包裝 形式 | 個裝 數量 | 材料 組成 | MSL ³ | 操作溫度 範圍 |
|---------------------|------|-----|------|-----|------------------------|-------------|----------|--------------------|------------------|-------------|
| | | | 描述方式 | | | | | | | |
| HY14E10M-D000 | Die | - | D | 000 | 000 | - | 250 | Green ⁴ | - | -40°C~125°C |
| HY14E10M-E016 | SSOP | 16 | E | 016 | 000 | Tube | 100 | Green ⁴ | MSL-3 | -40°C~125°C |
| HY14E10M-E016 | SSOP | 16 | E | 016 | 000 | Tape & Reel | 2500 | Green ⁴ | MSL-3 | -40°C~125°C |
| HY14E10M-N016 | QFN | 16 | N | 016 | 000 | Tape & Reel | 3000 | Green ⁴ | MSL-3 | -40°C~125°C |

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，對溫度要求為-40°C ~ 125°C。則下單品名為 HY14E10M-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，對溫度要求為-40°C ~ 125°C。則下單品名為 HY14E10M-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 QFN16 出貨，則下單品名為 HY14E10M-N016，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 SSOP 出貨，則下單品名為 HY14E10M-E016-008，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。

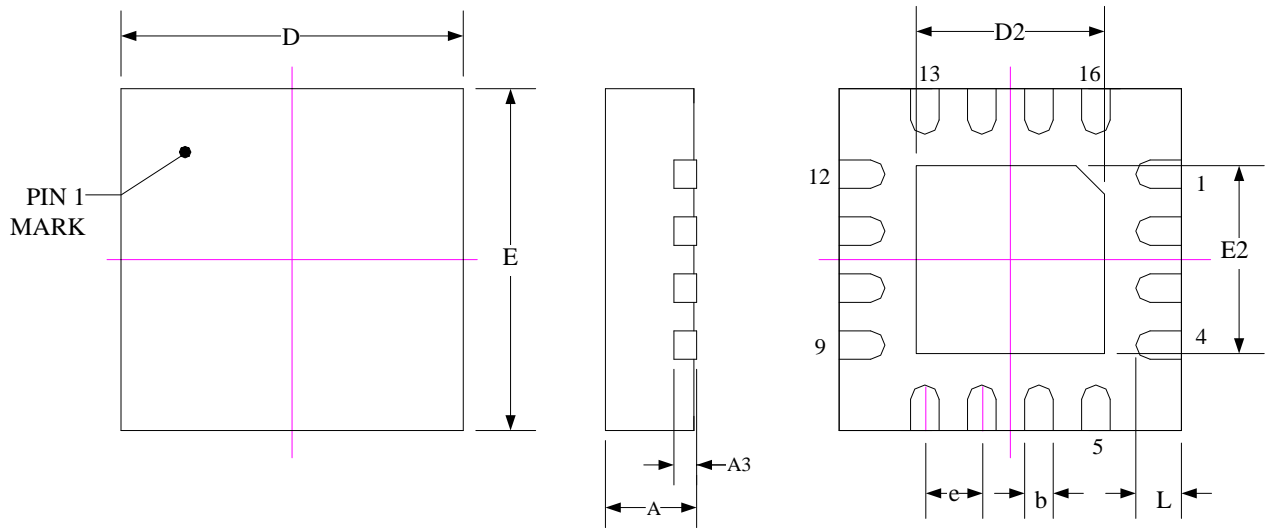
⁵ 下單品名:

HY14E10M 表示晶片溫度操作範圍為-40°C~125°C，而晶片燒錄範圍仍為-40°C~85°C。

7. 封裝型式資訊

7.1. QFN16(N016)

7.1.1. Package Outline Drawing QFN16(3x3x0.75)

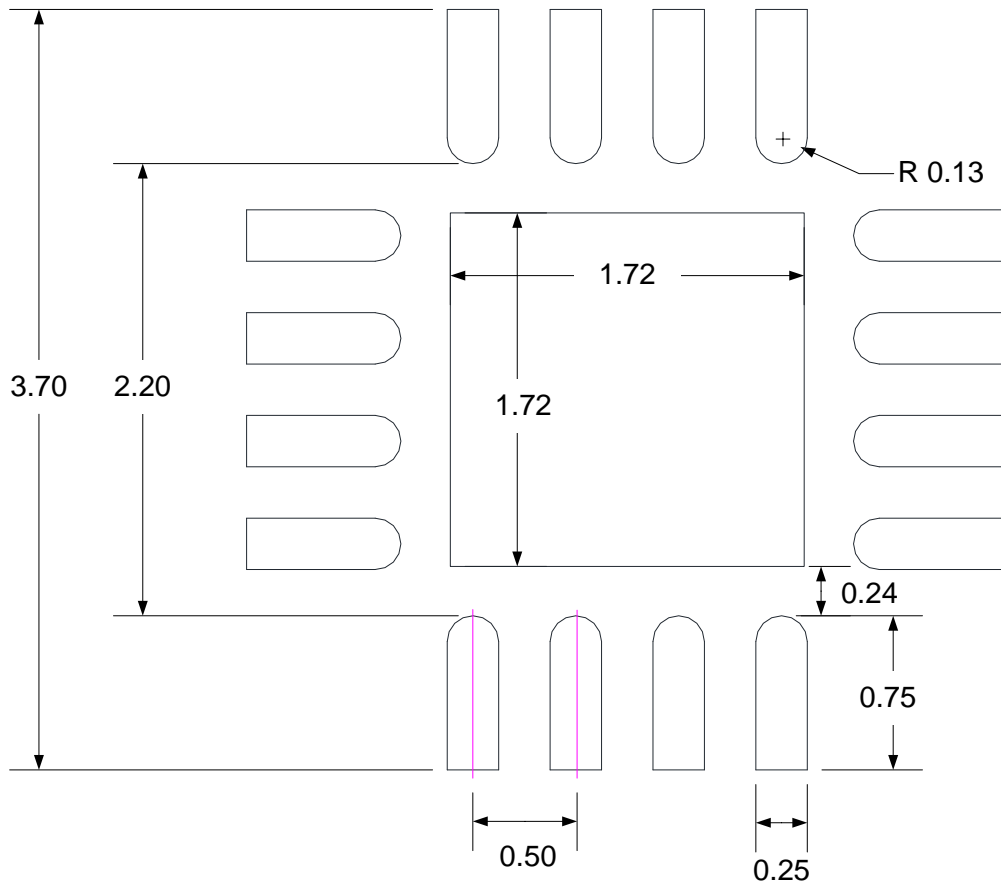


| SYMBOLS | MIN | NOM | MAX |
|---------|------------|-------|-------|
| A | 0.70 | 0.75 | 0.80 |
| A3 | 0.203 REF. | | |
| b | 0.20 | 0.25 | 0.30 |
| D | 2.925 | 3.000 | 3.075 |
| E | 2.925 | 3.000 | 3.075 |
| D2 | 1.625 | 1.725 | 1.825 |
| E2 | 1.625 | 1.725 | 1.825 |
| L | 0.30 | 0.35 | 0.40 |
| e | 0.50 BASIC | | |

Note:

1. All dimensions refer to JEDEC OUTLINE MO-220.
2. Unit : mm
3. https://www.hycontek.com/hy_mcu/QFN_DFN_PCB.pdf

7.1.2. Land Pattern Design Recommendations QFN16(3x3x0.75)

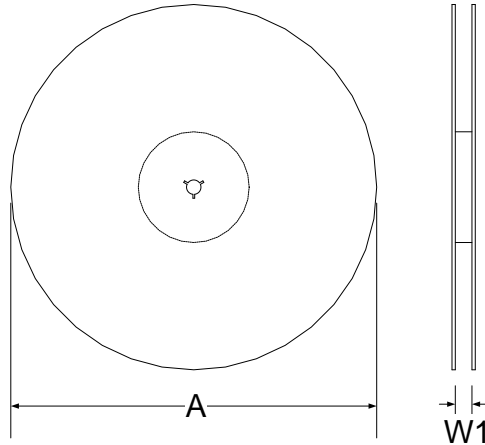


Note:

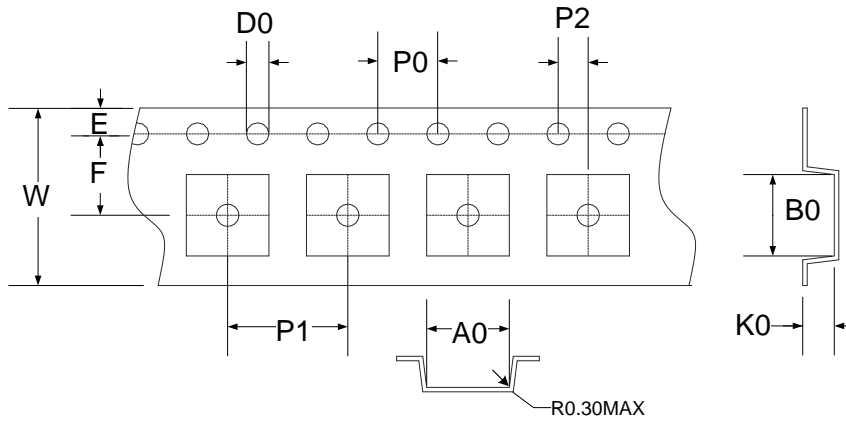
1. Publication IPC-7351 is recommended for alternate designs
2. Unit : mm
3. https://www.hycontek.com/hy_mcu/QFN_DFN_PCB.pdf

7.1.3. Tape & Reel Information QFN16(3x3x0.75)

1. Reel Dimensions



2. Carrier Tape Dimensions

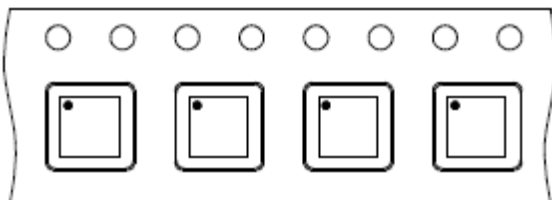


| SYMBOLS | Reel Dimensions | | Carrier Tape Dimensions | | | | | | | | | |
|-----------|-----------------|---------|-------------------------|-------|-------|-------|-------|-------|-------|-------|---------|-------|
| | A | W1 | A0 | B0 | K0 | P0 | P1 | P2 | E | F | D0 | W |
| Spec. | 330 | 12.5 | 3.30 | 3.30 | 1.10 | 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 |

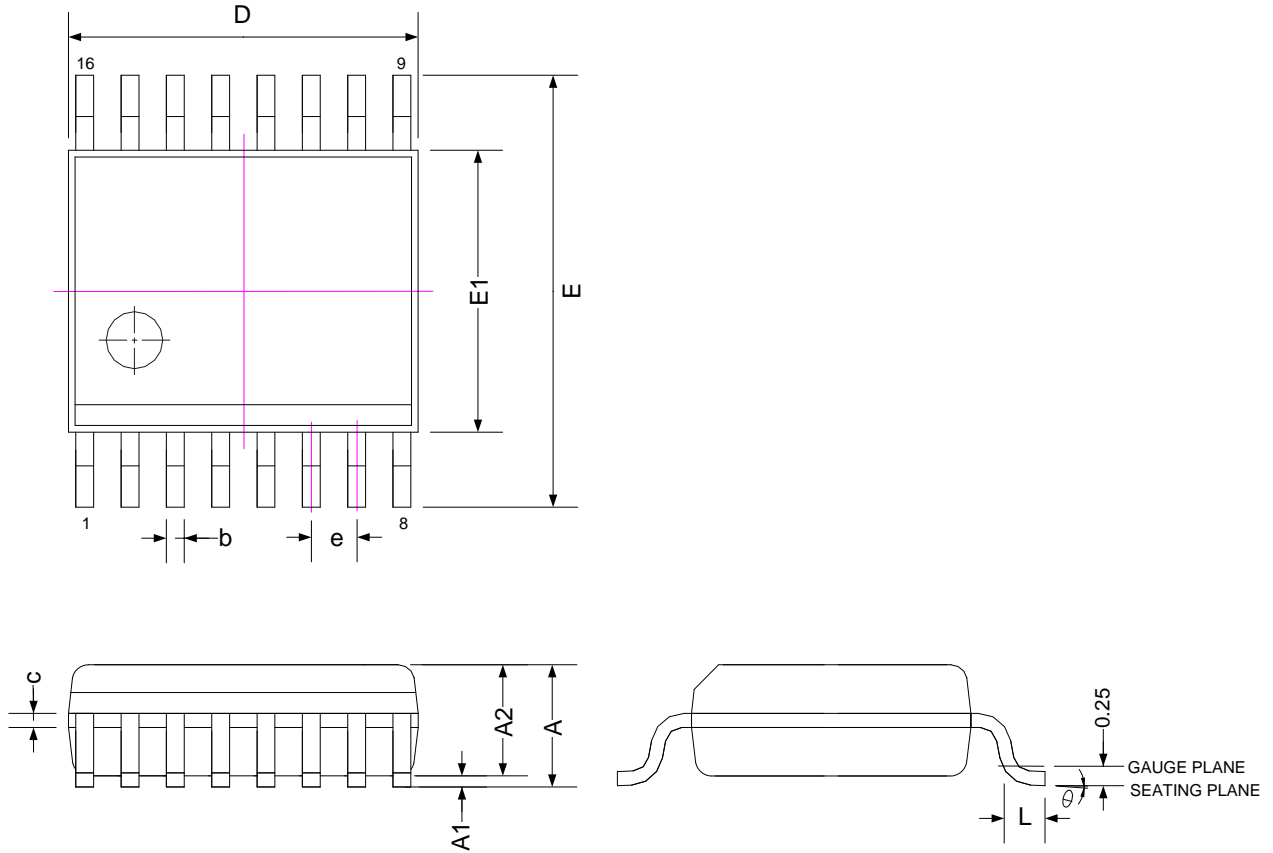
Note: 10 Sprocket hole pitch cumulative tolerance is ±0.20mm.

Unit: mm

3. Pin1 direction



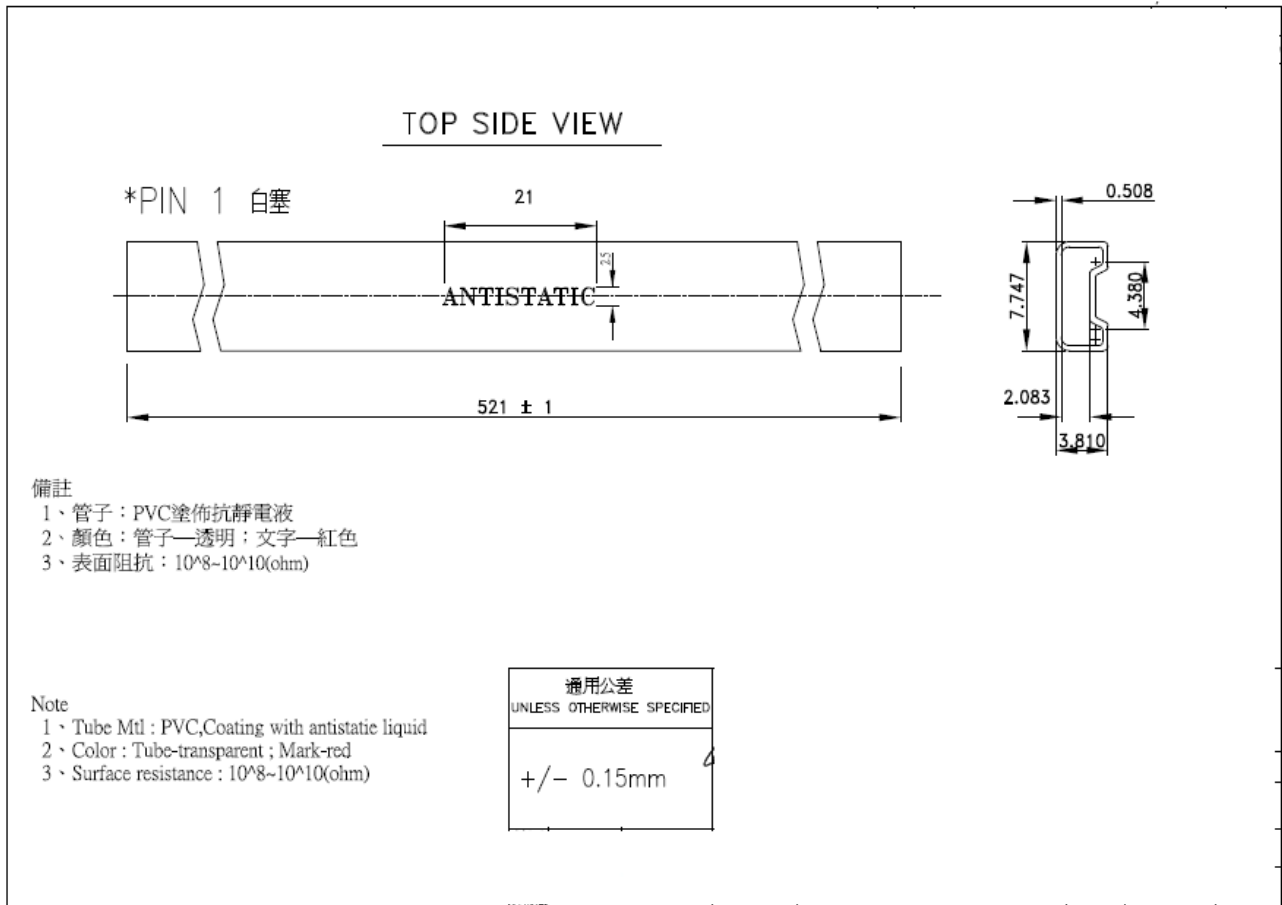
7.2. SSOP16(E016)
7.2.1. Package Outline Drawing SSOP16(150mil)



| 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 |

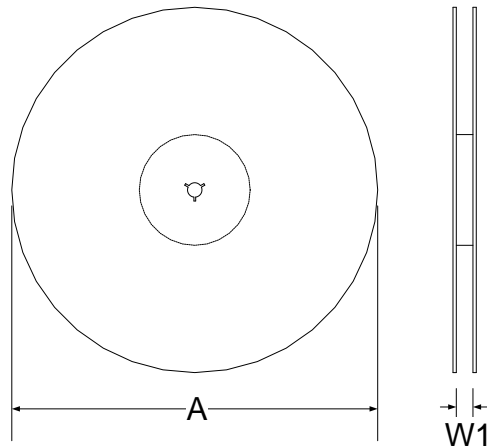
- Note:
1. All dimensions refer to JEDEC OUTLINE MO-137.
 2. Do not include Mold Flash or Protrusions.
 3. Unit: mm

7.2.2. Tube Dimensions SSOP16(150mil)

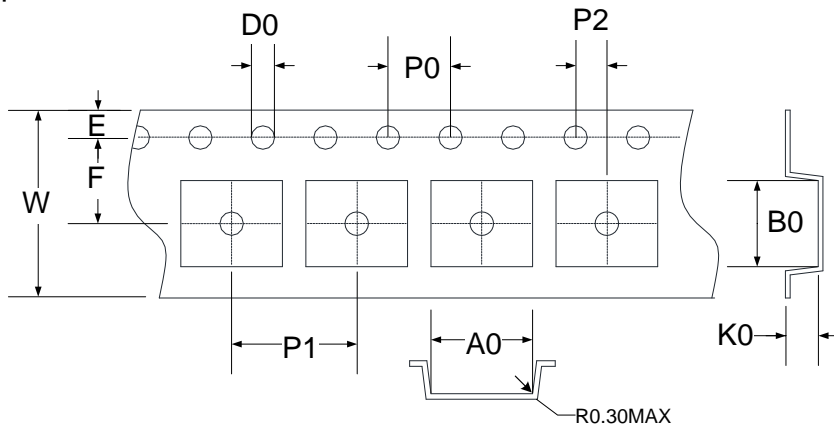


7.2.3. Tape & Reel Information SSOP16(150mil)-Type 1

1. Reel Dimensions



2. Carrier Tape Dimensions

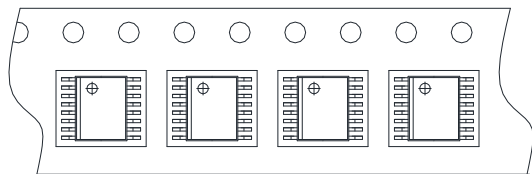


| SYMBOLS | Reel Dimensions | | Carrier Tape Dimensions | | | | | | | | | |
|-----------|-----------------|---------|-------------------------|-------|-------|-------|-------|-------|-------|-------|---------|-------|
| | A | W1 | A0 | B0 | K0 | P0 | P1 | P2 | E | F | D0 | W |
| Spec. | 330 | 12.5 | 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.

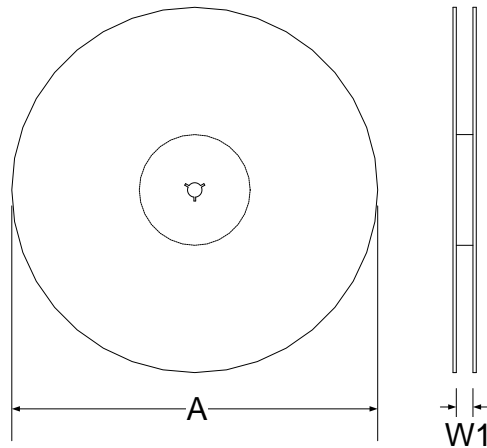
Unit: mm

3. Pin1 direction

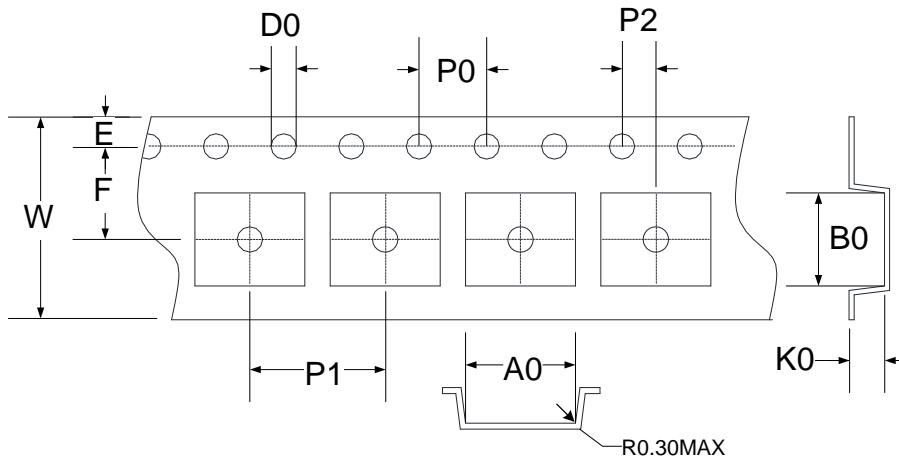


7.2.4. Tape & Reel Information SSOP16(150mil) -Type 2

1. Reel Dimensions



2. Carrier Tape Dimensions

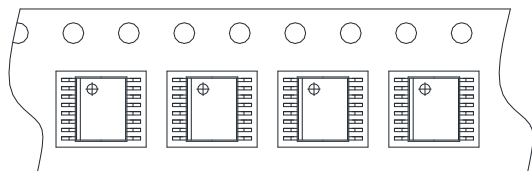


| SYMBOLS | Reel Dimensions | | Carrier Tape Dimensions | | | | | | | | | |
|-----------|-----------------|---------|-------------------------|-------|-------|-------|-------|-------|-------|-------|---------|-------|
| | A | W1 | A0 | B0 | K0 | P0 | P1 | P2 | E | F | D0 | W |
| Spec. | 330 | 12.5 | 6.50 | 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

3. Pin1 direction



8. 修訂記錄

以下描述本檔差異較大的地方，而標點符號與字形的改變不在此描述範圍。

| 版次 | 頁次 | 摘要 |
|-----|-----|-------------------------------------|
| V01 | All | 初版發行 |
| V02 | All | 刪除 2MHz 及 8MHz 的 HAO 規格 |
| | 5 | 新增功能列表 |
| | 14 | 修正 5.2 章節中的 SDR 及 VDDA LDO 規格 |
| | 20 | 修正 5.5 章節中的 LVD 規格 |
| | 21 | 修正 5.6 章節中的 LPO 及 4MHz HAO 規格 |
| V03 | 7 | 標示 VDD 建議電容大小 |
| | 15 | 增加 RSENS 規格 |
| | 23 | 增加 VDD=5V 時 Supply current 規格 |
| | 23 | 增加 VDD=3.6V 時 Supply current MAX 規格 |
| V04 | 26 | 更新 QFN16 產品的 Tape & Reel 包裝之個裝數量 |