



HY11P54

Datasheet

8-Bit RISC-like Mixed Signal Microcontroller
Embedded 4x32 LCD Driver
Low Noise Amplifier
18-Bit $\Sigma\Delta$ ADC

Table of Contents

1. FEATURES	5
2. PIN DEFINITION	6
2.1. HY11P54 LQFP100 Pin Diagram.....	6
2.2. HY11P54 LQFP64 Pin Diagram.....	7
2.3. HY11P54 QFN48 Pin Diagram	8
2.4. HY11P54 I/O Description	9
3. APPLICATION CIRCUIT	13
3.1. Bridge Sensor	13
4. FUNCTION OUTLINE	14
4.1. Internal Block Diagram.....	14
4.2. Related Description and Supporting Documents	14
4.3. SD18 Network	15
4.4. LNOP2 Network	16
5. REGISTER LIST	17
6. ELECTRICAL CHARACTERISTICS.....	19
6.1. Recommended Operating Conditions.....	19
6.2. Internal RC Oscillator	20
6.3. Supply Current into VDD Excluding Peripherals Current.....	21
6.4. Port1~2.....	23
6.5. Reset (Brownout, External RST Pin, Low Voltage Detect)	24
6.6. Power System	26
6.7. LCD	28

HY11P54

Embedded 18-Bit $\Sigma\Delta$ ADC

8-Bit RISC-like Mixed Signal Microcontroller



6.8. Low Noise OPAMP 2.....	29
6.9. SD18, Power Supply and Recommended Operating Conditions	30
6.9.1. PGA, Power Supply and recommended operating conditions	30
6.9.2. SD18, performance.....	30
6.9.3. SD18 Noise Performanc	32
6.10. Build-In EPROM(BIE).....	34
6.11. Build-In EPROM(BIE) Low voltage control circuit.....	34
7. ORDERING INFORMATION	35
8. PACKAGE INFORMATION	36
8.1. LQFP64(L064)	36
8.2. LQFP100(L100)	37
8.3. QFN48(NS48)	38
9. REVISION RECORD.....	39

Attention :

1. HYCON Technology Corp. reserves the right to change the content of this datasheet without further notice. For most up-to-date information, please constantly visit our website: <http://www.hycontek.com> .
2. HYCON Technology Corp. is not responsible for problems caused by figures or application circuits narrated herein whose related industrial properties belong to third parties.
3. Specifications of any HYCON Technology Corp. products detailed or contained herein stipulate the performance, characteristics, and functions of the specified products in the independent state. We does not guarantee of the performance, characteristics, and functions of the specified products as placed in the customer's products or equipment. Constant and sufficient verification and evaluation is highly advised.
4. Please note the operating conditions of input voltage, output voltage and load current and ensure the IC internal power consumption does not exceed that of package tolerance. HYCON Technology Corp. assumes no responsibility for equipment failures that resulted from using products at values that exceed, even momentarily, rated values listed in products specifications of HYCON products specified herein.
5. Notwithstanding this product has built-in ESD protection circuit, please do not exert excessive static electricity to protection circuit.
6. Products specified or contained herein cannot be employed in applications which require extremely high levels of reliability, such as device or equipment affecting the human body, health/medical equipments, security systems, or any apparatus installed in aircrafts and other vehicles.
7. Despite the fact that HYCON Technology Corp. endeavors to enhance product quality as well as reliability in every possible way, failure or malfunction of semiconductor products may happen. Hence, users are strongly recommended to comply with safety design including redundancy and fire-precaution equipments to prevent any accidents and fires that may follow.
8. Use of the information described herein for other purposes and/or reproduction or copying without the permission of HYCON Technology Corp. is strictly prohibited.

1. Features

- 8-bit RISC, 66 instructions included.
- Operating voltage range: 2.2V to 3.6V, operation temperature range: -40°C~85°C.
- External Crystal Oscillator and Internal High Precision RC Oscillator, 6 CPU clock rates enable users to have the most power-saving plan.
 - Active Mode 300uA@2MHz
 - Standby Mode 3uA@32KHz
 - Sleep Mode 1uA
- 8K Word OTP (One Time Programmable) Type program memory, 256 Byte Data Memory.
- Brownout detector and Watch dog Timer, prevents CPU from Crash.
- 18-bit fully differential input Sigma-Delta Analog-to-Digital Converter (A/D).
 - Build-in PGA (Programmable Gain Amplifier) 1/4x~1/2x~1x...128x input signal gain selection.
 - Build-in Input zero point adjustment can increase measurement range according to different application.
 - Diverse data output rate. Max. 1.95ksps.
- Ultra-Low input noise (<1uVpp) OPAMP provides high output impedance small signal amplification and low current voltage transformation.
- 1.0V low temperatures drift parameter internal analog circuit common ground that equips with Push-Pull drive ability to provide sensor driving voltage.
- LVD low voltage detection function has 14 steps of voltage detect configuration and external input voltage detectable function.
- VDDA 2.4V with 10mA low dropout regulator function.
- 4x32 LCD driver
 - 1/4 Duty 1/3 Bias.
 - Embedded Charge Pump Regulated Circuit with 4 LCD Bias Voltage.
- 8-bit Timer A.
- 8-bit Timer C Module generates PWM/PFD waveform.
- Built-in EPROM (BIE), 3.05V low voltage programming control circuit.
- Serial Communication SPI and EUART Module.
- Support 6 stack level.

Model No.	ADC	Program	Data	Build-IN		TPS	RTC	I/O	LCD		Serial	
		Memory	Memory	EPROM	OPAMP				Segment	PWM	Interface	Pin
		(word)	(byte)	(word)								
HY11P54-L100	9-CH	8k	256	64,LV	1	-	Y	13xl + 12xIO	4x32	1-CH	EUART	LQFP 100
HY11P54-L064	7-CH	8k	256	64,LV	1	-	Y	10xl + 10xIO	4x30	1-CH	EUART	LQFP 64
HY11P54-NS48	8-CH	8k	256	64,LV	1	-	Y	11xl + 11xIO	-	1-CH	EUART	QFN 48

HY11P54

Embedded 18-Bit $\Sigma\Delta$ ADC

8-Bit RISC-like Mixed Signal Microcontroller

2. Pin Definition

2.1. HY11P54 LQFP100 Pin Diagram

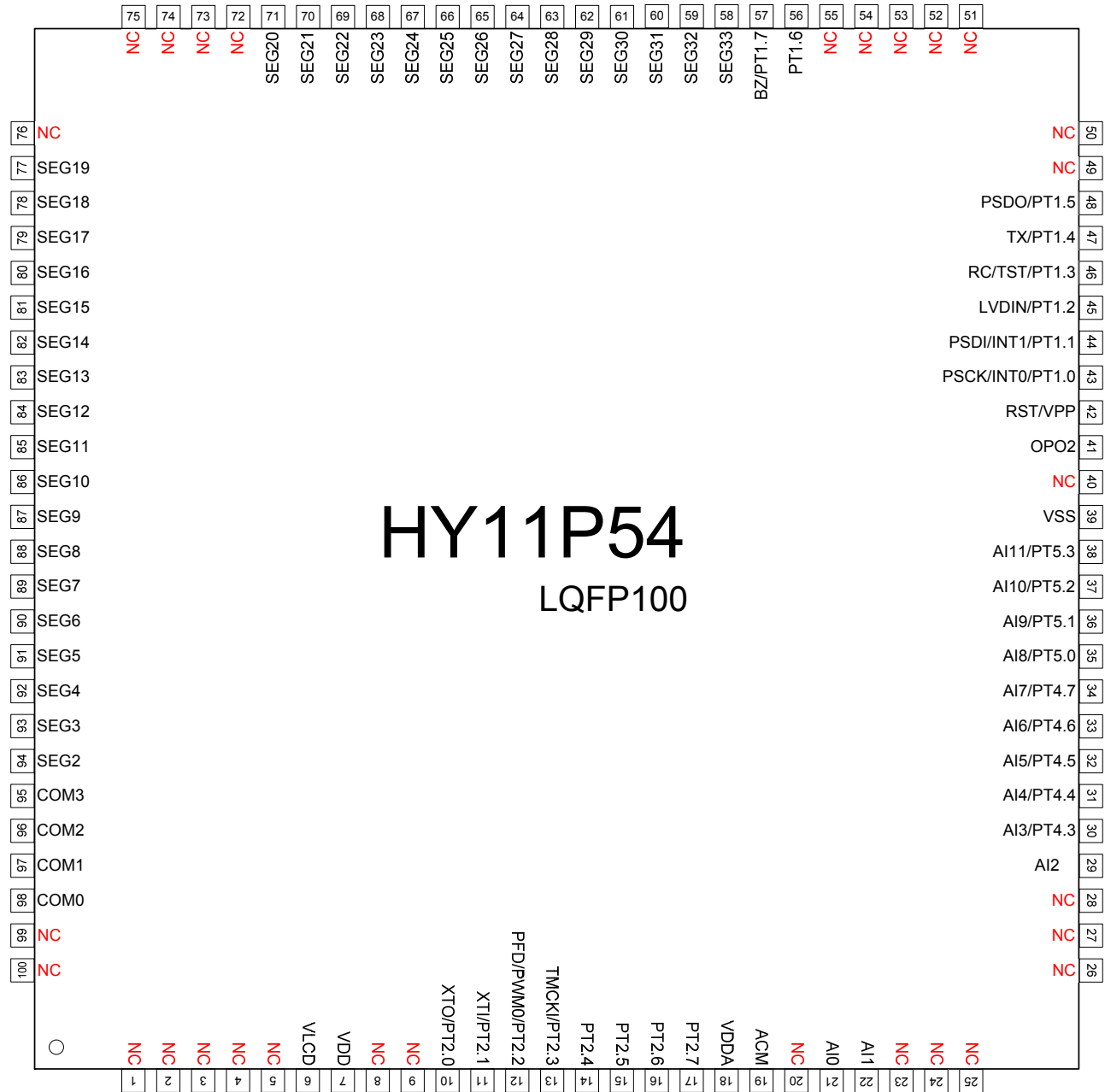


Figure 2-1 HY11P54 LQFP100 Pin Diagram

2.2. HY11P54 LQFP64 Pin Diagram

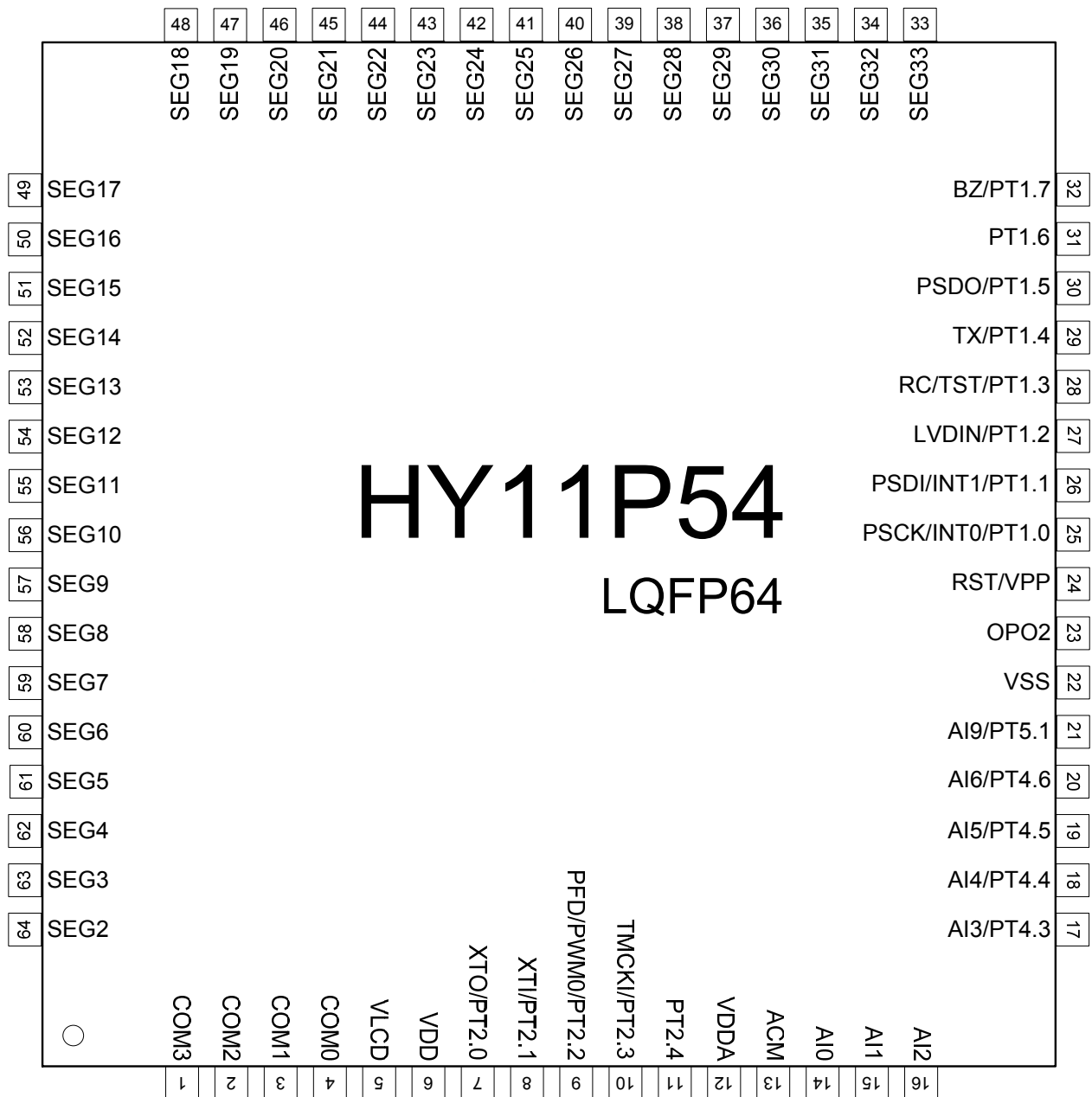


Figure 2-2 HY11P54 LQFP64 Pin Diagram

HY11P54

Embedded 18-Bit $\Sigma\Delta$ ADC

8-Bit RISC-like Mixed Signal Microcontroller

2.3. HY11P54 QFN48 Pin Diagram

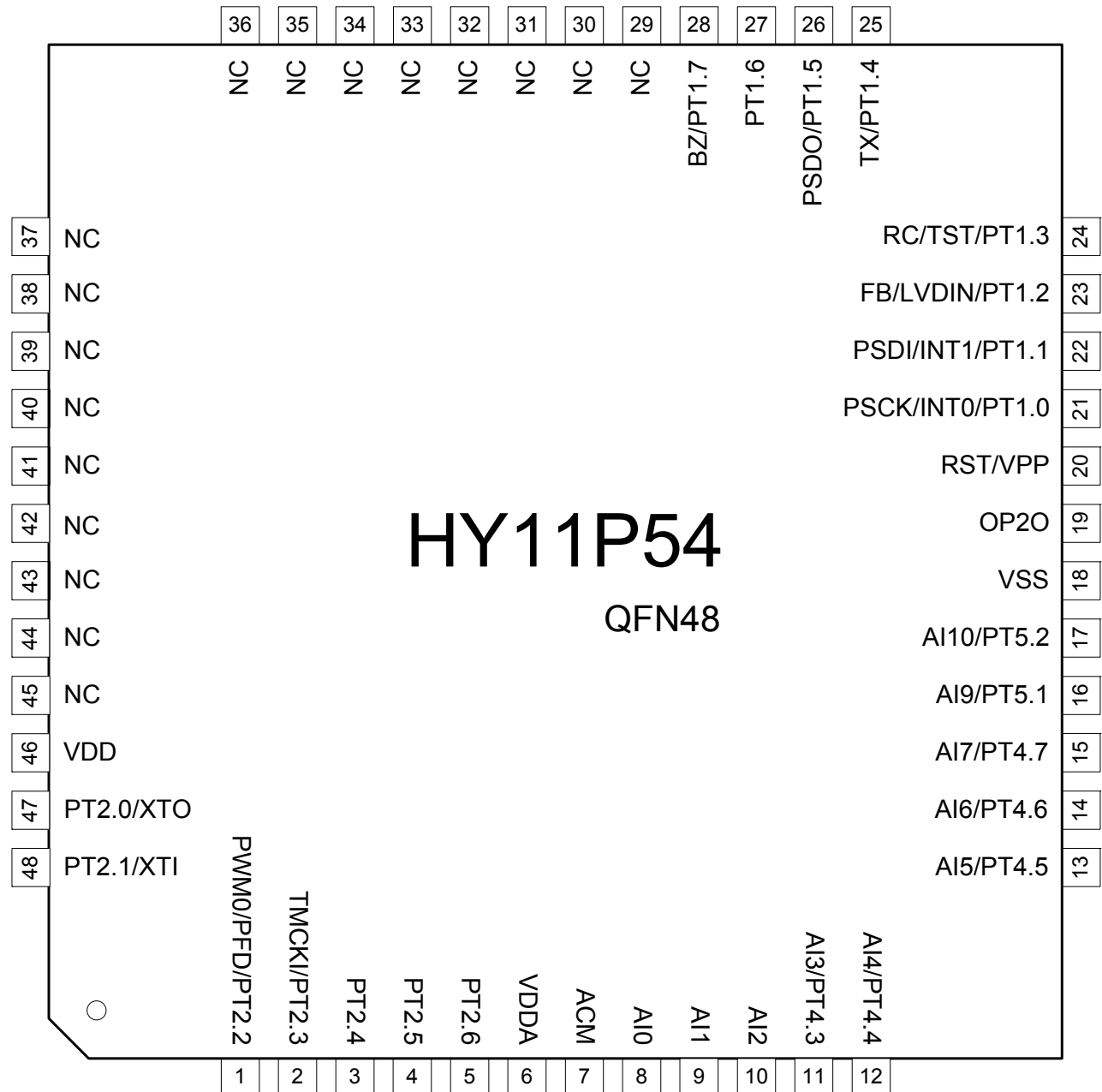


Figure 2-3 HY11P54 QFN48 Pin Diagram

Note 1 : VPP and RST use the same pin. Input voltage cannot exceed 5.8V when not programming EPROM.

Note 2 : TST and PT1.3 use the same pin. Input voltage cannot exceed Vdd+0.3V while operating.

Note 3 : If PT1.3 is not configured as external button pin, it will enhance the anti-interference ability.

HY11P54

Embedded 18-Bit Σ ADC

8-Bit RISC-like Mixed Signal Microcontroller



2.4. HY11P54 I/O Description

"I/O" input/output, "I" input, "O" output, "S" Smith Trigger, "C" CMOS features compatible input/output, "P" power supply, "A" analog channel

QFN48 Pin NO.	LQFP64 Pin NO.	LQFP100 Pin NO.	Pin Name	Pin Characteristic		Description
			HY11P54	Pin Type	Buffer Type	
-	5	6	VLCD	P	P	Power supply for LCD
46	6	7	VDD	P	P	Power supply for IC operation
47	7	10	PT2.0/XTO PT2.0 XTO	IO A	S A	Digital I/O External oscillator output
48	8	11	PT2.1/XTI PT2.1 XTI	I/O A	S A	Digital I/O External oscillator output
1	9	12	PT2.2/PWM0/PFD PT2.2 PWM0 PFD	I/O O O	C C C	Digital I/O PWM output PFD output
2	10	13	PT2.3/TMCKI PT2.3 TMCKI	I/O I	S S	Digital I/O TIMERC clock source input
3	11	14	PT2.4	I/O	S	Digital I/O
4	-	15	PT2.5	I/O	S	Digital I/O
5	-	16	PT2.6	I/O	S	Digital I/O
-	-	17	PT2.7	I/O	S	Digital I/O
6	12	18	VDDA	P	P	Regulator output, analog circuit power source
7	13	19	ACM	P	P	Internal analog circuit command ground pin
8	14	21	AI0	A	A	Analog channel pin
9	15	22	AI1	A	A	Analog channel pin
10	16	29	AI2	A	A	Analog channel pin
11	17	30	PT4.3/AI3			

HY11P54

Embedded 18-Bit Σ ADC

8-Bit RISC-like Mixed Signal Microcontroller



			PT4.3 AI3	I A	S A	Digital I/O Analog channel pin
12	18	31	PT4.4/AI4 PT4.4 AI4	I A	S A	Digital I/O Analog channel pin
13	19	32	PT4.5/AI5 PT4.5 AI5	I A	S A	Digital I/O Analog channel pin
14	20	33	PT4.6/AI6 PT4.6 AI6	I A	S A	Digital I/O Analog channel pin
15	-	34	PT4.7/AI7 PT4.7 AI7	I A	S A	Digital I/O Analog channel pin
-	-	35	PT5.0/AI8 PT5.0 AI8	I A	S A	Digital I/O Analog channel pin
16	21	36	PT5.1/AI9 PT5.1 AI9	I A	S A	Digital I/O Analog channel pin
17	-	37	PT5.2/AI10 PT5.2 AI10	I A	S A	Digital I/O Analog channel pin
-	-	38	PT5.3/AI11 PT5.3 AI11	I A	S A	Digital I/O Analog channel pin
18	22	39	VSS	P	P	Grounding pin for IC operation voltage
19	23	41	OPO2	A	A	OP output
20	24	42	RST/VPP RST VPP	I P	S P	Reset IC EPROM Programming voltage input
21	25	43	PT1.0/INT0/PSCK PT1.0 INT0 PSCK	I I I	C S S	Digital input Interrupt input INT0 OTP programming

HY11P54

Embedded 18-Bit Σ ADC

8-Bit RISC-like Mixed Signal Microcontroller



						interface SCK
22	26	44	PT1.1/INT1/PSDI PT1.1 INT1 PSDI	I I I	C S S	Digital input Interrupt input INT1 OTP programming interface SDI
23	27	45	PT1.2/LVDIN PT1.2 LVDIN	I A	C A	Digital input LVD external signal input port
24	28	46	PT1.3/TST/RC PT1.3 TST RC	I I I	C S S	Digital input Test Mode input pin (invalid) EUART communication interface RC
25	29	47	PT1.4/TX PT1.4 TX	I/O I	C S	Digital I/O EUART communication interface TX
26	30	48	PT1.5/PSDO PT1.5 PSDO	I/O O	S C	Digital I/O OTP programming interface SDO
27	31	56	PT1.6 PT1.6	I/O	S	Digital I/O
28	32	57	PT1.7/BZ PT1.7 BZ	I/O O	S C	Digital I/O Buzzer output
-	33	58	SEG33	O	A	Segment output for LCD
-	34	59	SEG32	O	A	Segment output for LCD
-	35	60	SEG31	O	A	Segment output for LCD
-	36	61	SEG30	O	A	Segment output for LCD
-	37	62	SEG29	O	A	Segment output for LCD
-	38	63	SEG28	O	A	Segment output for LCD
-	39	64	SEG27	O	A	Segment output for LCD
-	40	65	SEG26	O	A	Segment output for LCD

HY11P54

Embedded 18-Bit $\Sigma\Delta$ ADC

8-Bit RISC-like Mixed Signal Microcontroller



-	41	66	SEG25	O	A	Segment output for LCD
-	42	67	SEG24	O	A	Segment output for LCD
-	43	68	SEG23	O	A	Segment output for LCD
-	44	69	SEG22	O	A	Segment output for LCD
-	45	70	SEG21	O	A	Segment output for LCD
-	46	71	SEG20	O	A	Segment output for LCD
-	47	77	SEG19	O	A	Segment output for LCD
-	48	78	SEG18	O	A	Segment output for LCD
-	49	79	SEG17	O	A	Segment output for LCD
-	50	80	SEG16	O	A	Segment output for LCD
-	51	81	SEG15	O	A	Segment output for LCD
-	52	82	SEG14	O	A	Segment output for LCD
-	53	83	SEG13	O	A	Segment output for LCD
-	54	84	SEG12	O	A	Segment output for LCD
-	55	85	SEG11	O	A	Segment output for LCD
-	56	86	SEG10	O	A	Segment output for LCD
-	57	87	SEG9	O	A	Segment output for LCD
-	58	88	SEG8	O	A	Segment output for LCD
-	59	89	SEG7	O	A	Segment output for LCD
-	60	90	SEG6	O	A	Segment output for LCD
-	61	91	SEG5	O	A	Segment output for LCD
-	62	92	SEG4	O	A	Segment output for LCD
-	63	93	SEG3	O	A	Segment output for LCD
-	64	94	SEG2	O	A	Segment output for LCD
-	1	95	COM3	O	A	Segment output for LCD
-	2	96	COM2	O	A	Segment output for LCD
-	3	97	COM1	O	A	Segment output for LCD
-	4	98	COM0	O	A	Segment output for LCD
-	-	Others	NC	-	-	Not connect

Table 2-1 Pin Definition and Function Description

3. Application Circuit

3.1. Bridge Sensor

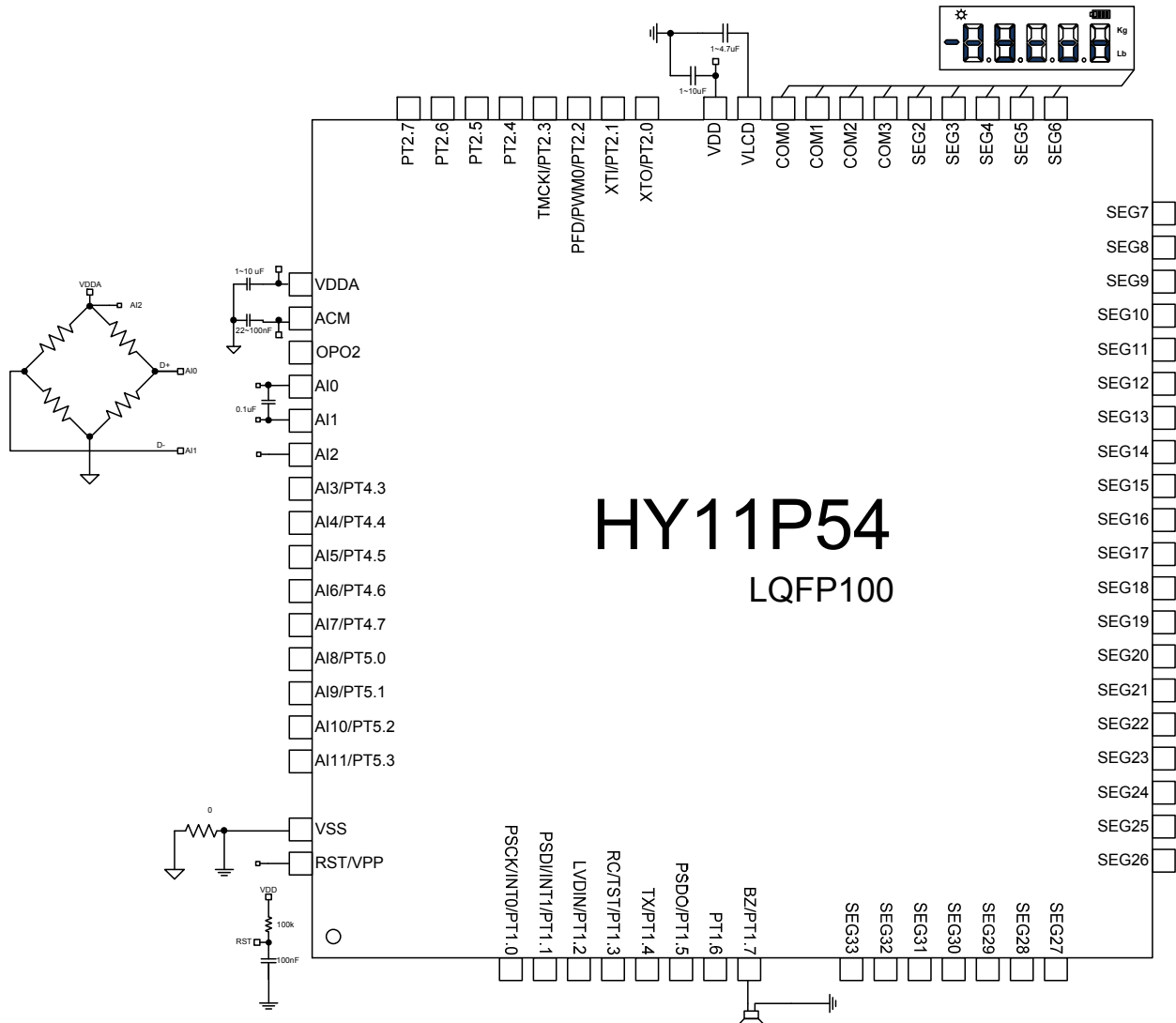


Figure 3-1 Application Circuit of Compensation Bridge Sensor

Note : DCSET[2:0] can conduct bias adjustment of Load Cell zero point voltage address.

4. Function Outline

4.1. Internal Block Diagram

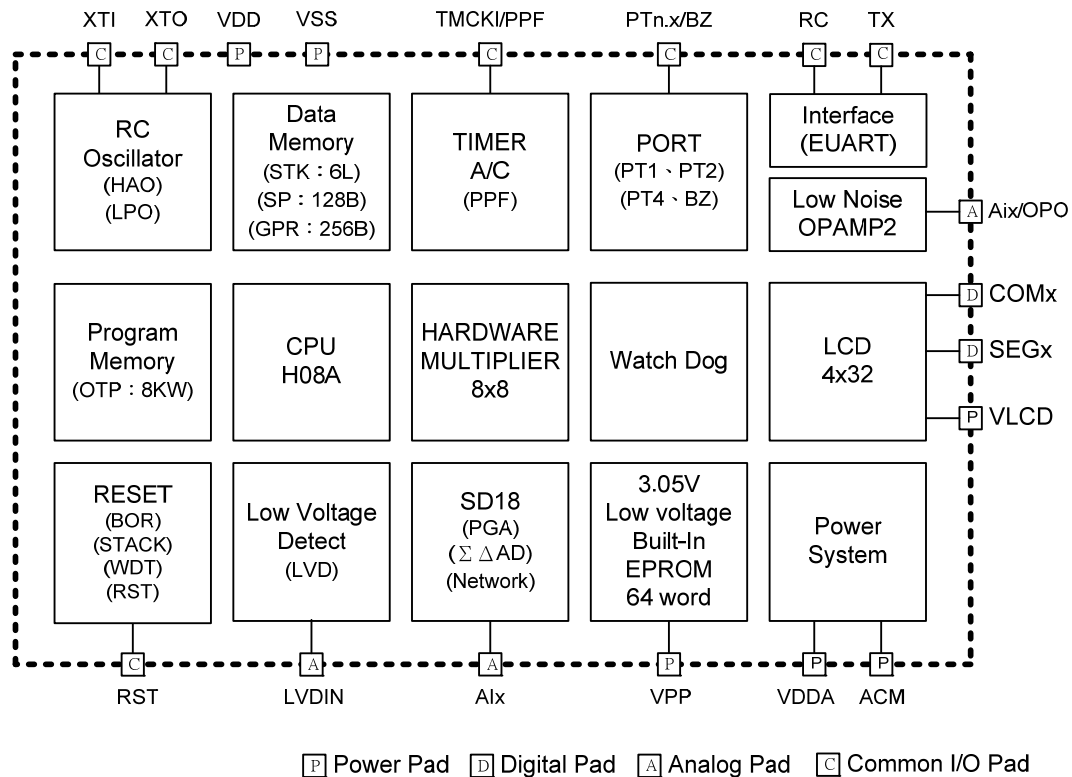


Figure 4-1 HY11P54 Internal Block Diagram

4.2. Related Description and Supporting Documents

IC Function Related Operating Instruction

DS-HY11P54-Vxx	HY11P54 Data Sheet
UG-HY11S14-Vxx	HY11Pxx Series Users' Manual
APD-CORE002-Vxx	H08A Instruction Description

Development Tool Related Operating Instruction

APD-HYIDE006-Vxx	HY11xxx Series Development Tool Software Instruction Manual
APD-HYIDE005-Vxx	HY11xxx Series Development Tool Hardware Instruction Manual
APD-OTP001-Vxx	OTP Products Programming Pin Manual

Product Production Related Operating Instruction

APD-HYIDE004-Vxx	HY1xxxx Series Production Line Specialized Programmer Manual
BDI-HY11P54-Vxx	HY11P54 Individual Product Die Bonding Information

4.3. SD18 Network

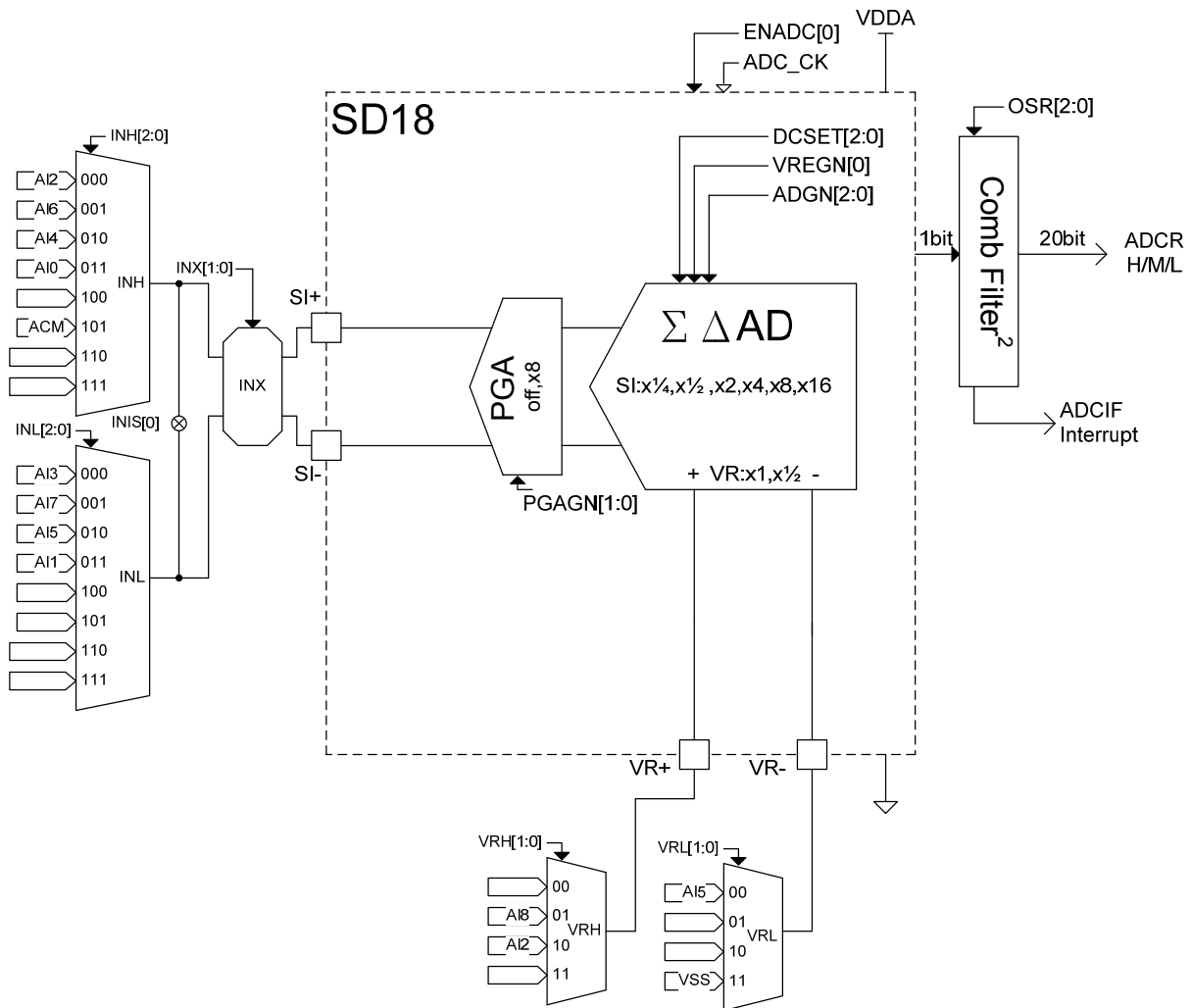


Figure 4-2 SD18 Network

4.4. LNOP2 Network

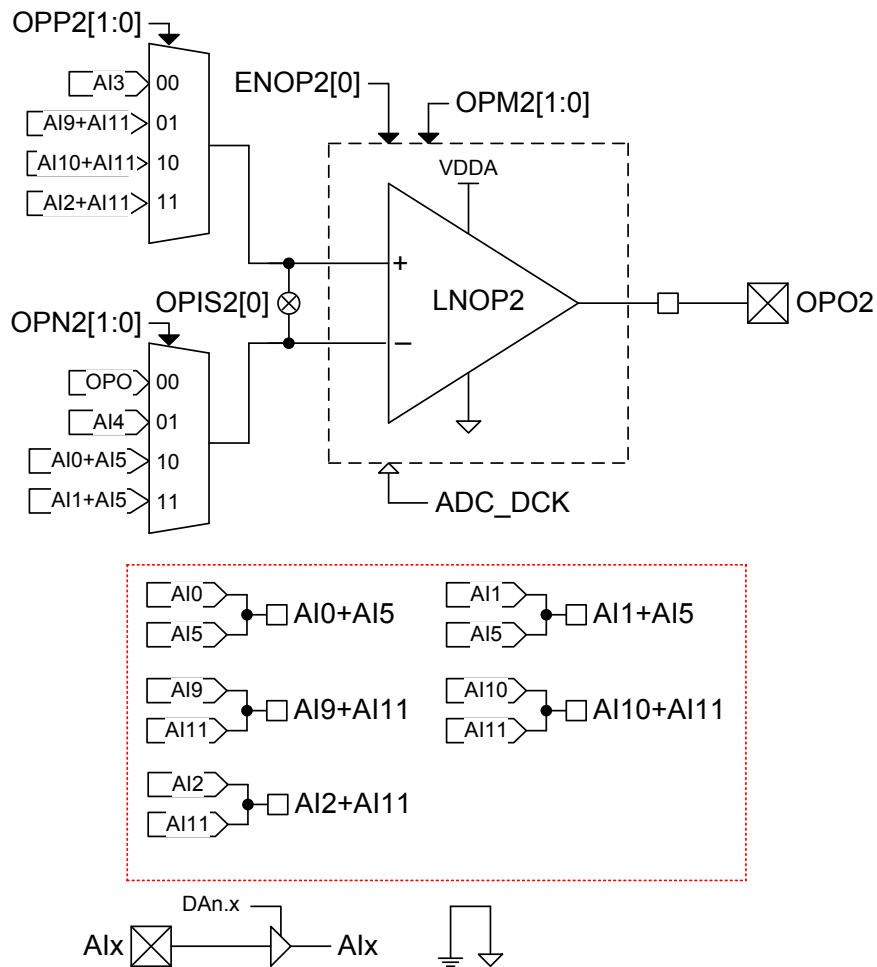


Figure 4-3 Low Noise OPAMP2 Network

5. Register List

"r":no use,"w":read/write,"w":write,"r":read,"r0":only read 0,"r1":only read 1,"w0":only write 0,"w1":only write 1 ".":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 memoryvalue of FSR0 not changed								N/A	N/A	*****
01H	POINC0	Contents of FSR0 to address data memoryvalue of FSR0 post-incremented								N/A	N/A	*****
02H	PODEC0	Contents of FSR0 to address data memoryvalue of FSR0 post-decremented								N/A	N/A	*****
03H	PRINC0	Contents of FSR0 to address data memoryvalue of FSR0 pre-incremented								N/A	N/A	*****
04H	PLUSW0	Contents of FSR0 to address data memoryvalue of FSR0 offset by W								N/A	N/A	*****
05H	INDF1	Contents of FSR1 to address data memoryvalue of FSR0 not changed								N/A	N/A	*****
06H	POINC1	Contents of FSR1 to address data memoryvalue of FSR0 post-incremented								N/A	N/A	*****
07H	PODEC1	Contents of FSR1 to address data memoryvalue of FSR0 post-decremented								N/A	N/A	*****
08H	PRINC1	Contents of FSR1 to address data memoryvalue of FSR0 pre-incremented								N/A	N/A	*****
09H	PLUSW1	Contents of FSR1 to address data memoryvalue of FSR0 offset by W								N/A	N/A	*****
0FH	FSR0H								FSR0[8]	x	u	*****
10H	FSR0L	Indirect Data Memory Address Pointer 0 Low Byte,FSR0[7:0]								xxxx xxxx	uuuu uuuu	*****
11H	FSR1H								FSR1[8]	x	u	*****
12H	FSR1L	Indirect Data Memory Address Pointer 1 Low Byte,FSR1[7:0]								xxxx xxxx	uuuu uuuu	*****
16H	TOSH					TOS[11]	TOS[10]	TOS[9]	TOS[8]	0000	0000	*****
17H	TOSL	Top-of-Stack Low Byte (TOS<7:0>)								0000 0000	0000 0000	*****
18H	STKPTR	STKFL	STKUN	STKOV				STKPRT[2:0]		000..000	000..000	r,rw 0,rw 0,-r,r,r
1AH	PCLATH					PC[11]	PC[10]	PC[9]	PC[8]	0000	0000	*****
1BH	PCLATL	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,r,r,r,r,r
22H	PRODL	Product Register of Multiply Low Byte								xxxx xxxx	uuuu uuuu	r,r,r,r,r,r,r,r
23H	INTE1	GIE	ADCFE	TMCFE		TMAIE	WDTIE	E1IE	EDIE	000..000	000..000	*****
24H	INTE2	TXIE	RCIE							00..0000	00..0000	*****
26H	INTF1		ADCFIF	TMCFIF		TMAIF	WDTIF	E1IF	EDIF	00..0000	00..0000	*****
27H	INTF2	TXIF	RCIF							00..0000	00..0000	*****
29H	WREG	Working Register								xxxx xxxx	uuuu uuuu	*****
2AH	BSR0N								BSR[0]	0	0	*****
2BH	STATUS				C	DC	N	OV	Z	..x xxxx	..u uuuu	*****
2CH	PSTATUS	PD	TO	IDLEB	BOR		SKBRR			000d..0..	000d..0..	rw 0,rw 0,rw 0,-rw 0,-rw 0,-rw 0,-rw 0
2DH	LVDON		LVDIFG	LVD	LVDON	VLDX[3:0]				..000 0000	..000 0000	*****
30H	PWRCN	ENVDDA	VDDAX[1:0]=11			ENACM		ENLEDP		0xx0..0..	0xx0..0..	*****
31H	MCKCN1	ADCS[2:0]			ADCOCK	XTHSP	XTSP	ENXT	ENHAO	0000 0001	0000 0001	*****
32H	MCKCN2			LSCK	HSCK	HSS[1:0]		CPCLK[1:0]		..00 0000	..00 0000	*****
33H	MCKCN3	LCDS[2:0]				PERCK	BZS[2:0]		000..0000	000..0000	*****	
39H	ADCRH	ADC conversion memory HighByte								xxxx xxxx	uuuu uuuu	r,r,r,r,r,r,r,r
3AH	ADCRM	ADC conversion memory Middle Byte								xxxx xxxx	uuuu uuuu	r,r,r,r,r,r,r,r
3BH	ADCRLL	ADC conversion memory Low Byte								xxxx 0000	uuuu 0000	r,r,r,r,r,r,r,r
3CH	ADCCN1	ENADC		ENCHP	PGAGN[1:0]		ADGN[2:0]		0.00 0000	0.00 0000	*****	
3DH	ADCCN2			INBUF=0	VRBUF=0	VREGN	DCSET[2:0]		..xx 0000	..xx 0000	*****	
3EH	ADCCN3	OSR[2:0]						OSR[3]	000..0..	000..0..	*****	
3FH	AINET1	IN[2:0]				INL[2:0]		INIS	0000 000x	0000 000x	*****	
40H	AINET2		VRH[1:0]			INX[1:0]		VRL[1:0]	xx00 xx0x	xx00 xx0x	*****	
41H	TMACN	ENTMA	TMAK	TMA5[1:0]		ENWDT	WDT5[2:0]		0000 0000	0000 0000	*****w 1,...	
42H	TMAR	TimerA data register								xxxx xxxx	uuuu uuuu	r,r,r,r,r,r,r,r
46H	TMCCN	ENTMC	TMCCX[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,r,r,r,r,r
4FH	PWMCN	ENPVM	ENFFD	PWMRL[1:0]					0000 ...	0000 ...	*****	
51H	PWMR	PWM MSB Byte register								xxxx xxxx	uuuu uuuu	*****
52H	LCDCN1	ENLCD	LCDFR	VLCDX[1:0]		LCDBF	LCDB[1:0]=10		0000 0xxx	0000 0xxx	*****	
53H	LCDCN2	LCDBL	LCDBM[1:0]=11						0xxx xxxx	0xxx xxxx	*****	
54H	LCD0	Segment SEG2@[3:0] and SEG3@[7:4] data register of LCD								xxxx xxxx	uuuu uuuu	*****
55H	LCD1	Segment SEG4@[3:0] and SEG5@[7:4] data register of LCD								xxxx xxxx	uuuu uuuu	*****
56H	LCD2	Segment SEG6@[3:0] and SEG7@[7:4] data register of LCD								xxxx xxxx	uuuu uuuu	*****
57H	LCD3	Segment SEG8@[3:0] and SEG9@[7:4] data register of LCD								xxxx xxxx	uuuu uuuu	*****
58H	LCD4	Segment SEG10@[3:0] and SEG11@[7:4] data register of LCD								xxxx xxxx	uuuu uuuu	*****
59H	LCD5	Segment SEG12@[3:0] and SEG13@[7:4] data register of LCD								xxxx xxxx	uuuu uuuu	*****
5AH	LCD6	Segment SEG14@[3:0] and SEG15@[7:4] data register of LCD								xxxx xxxx	uuuu uuuu	*****
5BH	LCD7	Segment SEG16@[3:0] and SEG17@[7:4] data register of LCD								xxxx xxxx	uuuu uuuu	*****
5CH	LCD8	Segment SEG18@[3:0] and SEG19@[7:4] data register of LCD								xxxx xxxx	uuuu uuuu	*****
5DH	LCD9	Segment SEG20@[3:0] and SEG21@[7:4] data register of LCD								xxxx xxxx	uuuu uuuu	*****
63H	URCON	ENSP	ENTX	TX9	TX9D	PARITY			WUE	0000 0..0	0000 0..0	*****
64H	URSTA		RC9D	FERR	FERR	OERR	RCIDL	TRMT	ABDOVF	..000 0110	..000 0110	r,r,r,r,r,r,rw 0
65H	BAUDCON					ENCR	RC9	BNADD	BNABD	0000	0000	*****
66H	BRGRH	Baud Rate Generator Register High Byte								..x xxxx	..u uuuu	*****
67H	BRGRL	Baud Rate Generator Register Low Byte								xxxx xxxx	uuuu uuuu	*****
68H	TXREG	UART Transmit Register								xxxx xxxx	uuuu uuuu	*****
69H	RXREG	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	PT4.3				xxxx x...	uuuu u...	*****
6BH	PT4DA	DA4.7	DA4.6	DA4.5	DA4.4	DA4.3	DA4.2	DA4.1	DA4.0	1111 1111	1111 1111	*****
6CH	PT4PU	PU4.7	PU4.6	PU4.5	PU4.4	PU4.3				0000 0...	0000 0...	*****
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,r,r,r,r
6EH	TRISC1	TC1.7	TC1.6	TC1.5	TC1.4					0000	0000	*****
70H	PT1PU	PU1.7	PU1.6	PU1.5	PU1.4	PU1.3	PU1.2	PU1.1	PU1.0	0000 0000	0000 0000	*****

Table 5-1a HY11P54 Register List

HY11P54

Embedded 18-Bit Σ ADC

8-Bit RISC-like Mixed Signal Microcontroller



"r":no use,"w":read/write,"r":write,"r":read,"r0":only read 0,"r1":only read 1,"w0":only write 0,"w1":only write 1 "u":unimplemented bit,"x":unknown,"u":unchanged,"d":depends on condition													
Address	File Name	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0	A-RESET	I-RESET	R/W	
71H	PT1M1					INTEG1[1:0]		INTEG0[1:0]		 0000	 0000	r,r,r,r,r,r,r,r	
72H	PT1M2		PM1.7[0]						PM1.4[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,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,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	
80H ~ FFH	GPR0	General Purpose Register as 128Byte								xxxx xxxx	uuuu uuuu	*****	
100H~17FH	GPR1	General Purpose Register as 128Byte								xxxx xxxx	uuuu uuuu	*****	
180H	LCD10	Segment SEG22@[3:0] and SEG23@[7:4] data register of LCD								xxxx xxxx	uuuu uuuu	*****	
181H	LCD11	Segment SEG24@[3:0] and SEG25@[7:4] data register of LCD								xxxx xxxx	uuuu uuuu	*****	
182H	LCD12	Segment SEG26@[3:0] and SEG27@[7:4] data register of LCD								xxxx xxxx	uuuu uuuu	*****	
183H	LCD13	Segment SEG28@[3:0] and SEG29@[7:4] data register of LCD								xxxx xxxx	uuuu uuuu	*****	
184H	LCD14	Segment SEG30@[3:0] and SEG31@[7:4] data register of LCD								xxxx xxxx	uuuu uuuu	*****	
185H	LCD15	Segment SEG32@[3:0] and SEG33@[7:4] data register of LCD								xxxx xxxx	uuuu uuuu	*****	
192H	PT5					PT5.3	PT5.2	PT5.1	PT5.0	 xxxx	 uuuu	r,r,r,r,r,r,r,r	
193H	PT5DA					DA5.3	DA5.2	DA5.1	DA5.0	 1111	 1111	*****	
194H	PT5PU					PU5.3	PU5.2	PU5.1	PU5.0	 0000	 0000	*****	
195H	BIECTRLA					VFP_HIGH		BIEWR		1000 d000	1000 d000	r,r,r,r,r0,r,r	
196H	BIEPTRHA	SBMSEL				BIE_ADDR[10:8]					1000 0000	1000 0000	w0,w0,W0,W0,W0,W0,W0,W0
197H	BIEPTRLA	0	0			BIE_ADDR[5:0]					0000 0000	0000 0000	w0,w0,w0,w0,w0,w0,w0,w0
198H	BIEDHA	BIE_DATA[15:8]								xxxx xxxx	xxxx xxxx	*****	
199H	BIEDLA	BIE_DATA[7:0]								xxxx xxxx	xxxx xxxx	*****	
19BH	OPCN2	ENOP2	OPM2[1:0]		OPIS2[0]		OPP2[1:0]		OPN2[1:0]	0000 0000	0000 0000	*****	

Table 5-1b HY11P54 Register List

6. Electrical Characteristics

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

Voltage applied at V_{DD} to V_{SS} -0.2 V to 4.0 V

Voltage applied to any pin -0.2 V to $V_{DD} + 0.3$ V

Voltage applied to RST/VPP pin -0.2 V to 6.9 V

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

Diode current at any device terminal. ± 2 mA

Storage temperature, Tstg: (unprogrammed device) -55°C to 150°C
(programmed device) -40°C to 85°C

Total power dissipation. 0.5W

Maximum output current sink by any PORT1 to PORT2 I/O pin. 25mA

6.1. Recommended Operating Conditions

$T_A = -40^\circ\text{C} \sim 85^\circ\text{C}$, unless otherwise noted

Sym.	Parameter		Test Conditions		Min.	Typ.	Max.	unit
V_D D	Supply Voltage		All digital peripherals and CPU		2.2		3.6	V
			Analog peripherals		2.4		3.6	
V_S s	Supply Voltage				0		0	
X T	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	1.6	2.0	2.4	MHz
LPO	Low Power Oscillator frequency	V_{DD} supply voltage be enable LPO	22	28	35	KHz

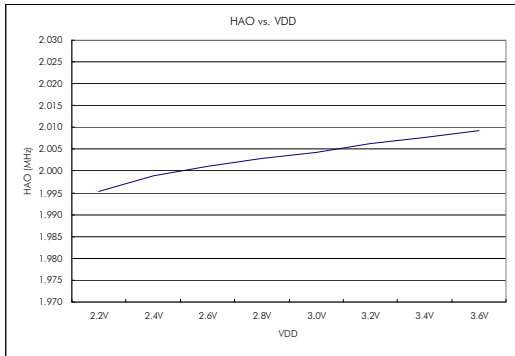


Figure 6.2-1 HAO vs. VDD

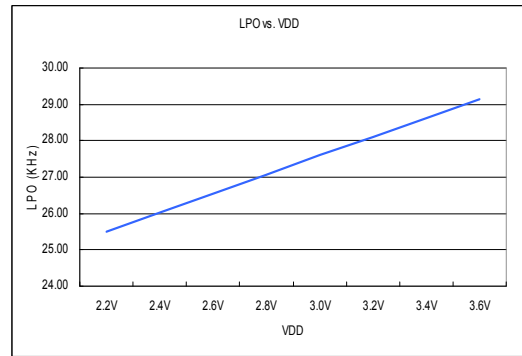


Figure 6.2-2 LPO vs. VDD

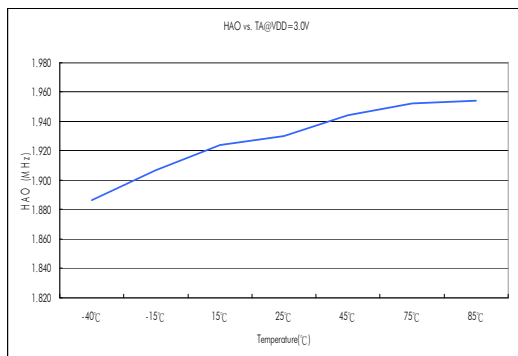


Figure 6.2-3 HAO vs. Temperature

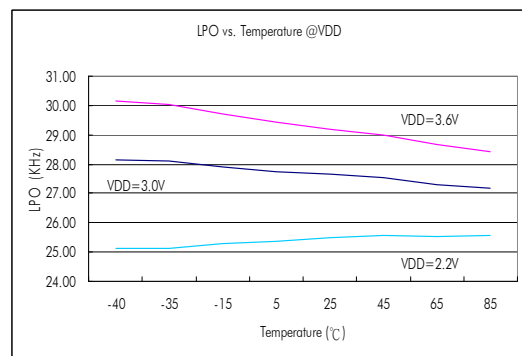


Figure 6.2-4 LPO vs. Temperature

6.3. Supply Current into VDD Excluding Peripherals Current

$T_A = 25^\circ\text{C}$, $V_{DD} = 3.0\text{V}$, $\text{OSC_LPO} = 28\text{KHz}$, unless otherwise noted

Sym.	Parameter	Test Conditions	Min.	Typ.	Max.	unit
I_{AM1}	Active mode 1	OSC_CY = 8MHz, OSC_HAO = off, CPU_CK = 8MHz		1.34	2	mA
I_{AM2}	Active mode 2	OSC_CY = off, OSC_HAO = 2MHz, CPU_CK = 2MHz		0.36	0.55	mA
I_{AM3}	Active mode 3	OSC_CY = off, OSC_HAO = 2MHz, CPU_CK = 1MHz		0.2	0.3	mA
I_{LP1}	Low Power 1	OSC_CY = 32768Hz, OSC_HAO = off, CPU_CK = 16384Hz		7	12	μA
I_{LP2}	Low Power 2	OSC_CY = off, OSC_HAO = off, CPU_CK = LPO, Idle state		1.65	3	μA
I_{LP3}	Low Power 3	OSC_CY = off, OSC_HAO = off, CPU_CK = off, Sleep state		0.65	1.2	μA

OSC_CY : External Oscillator frequency.

OSC_HAO : Internal High Accuracy Oscillator frequency.

CPU_CK : CPU core work frequency.

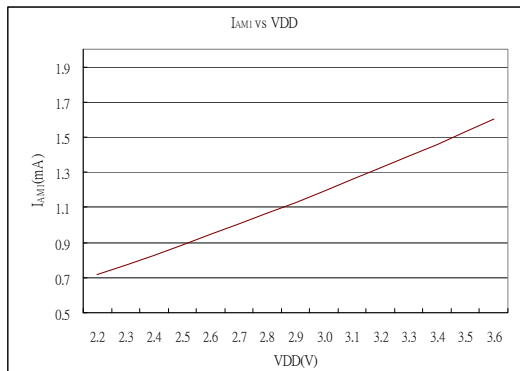


Figure 6.3-1 I_{AM1} vs. VDD

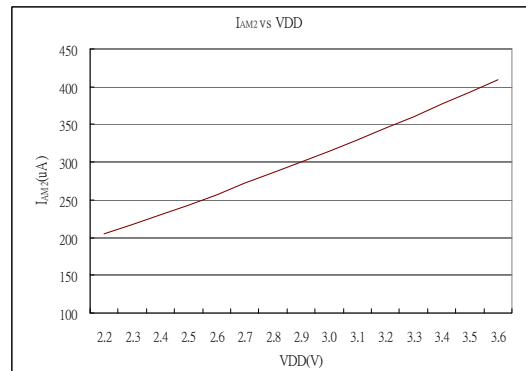


Figure 6.3-2 I_{AM2} vs. VDD

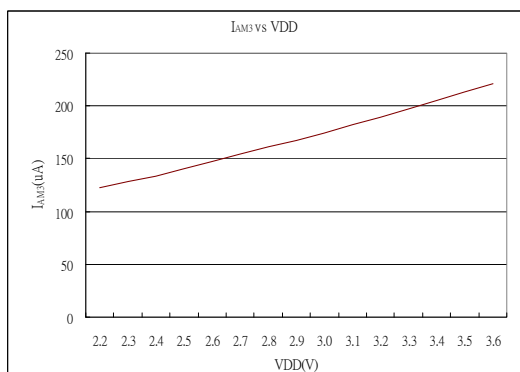


Figure 6.3-3 I_{AM3} vs. VDD

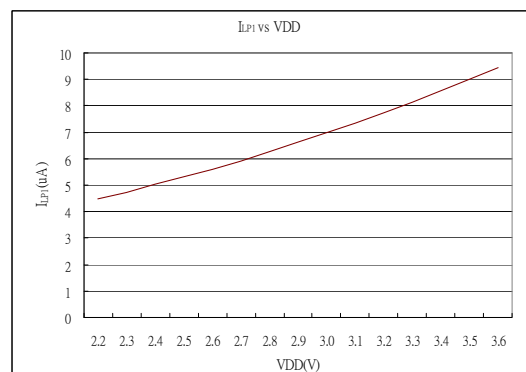


Figure 6.3-4 I_{LP1} vs. VDD

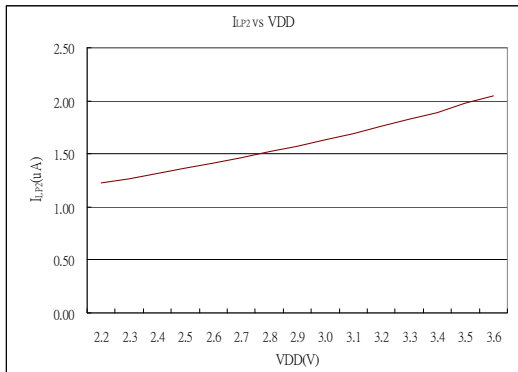


Figure 6.3-5 I_{LP2} vs. VDD

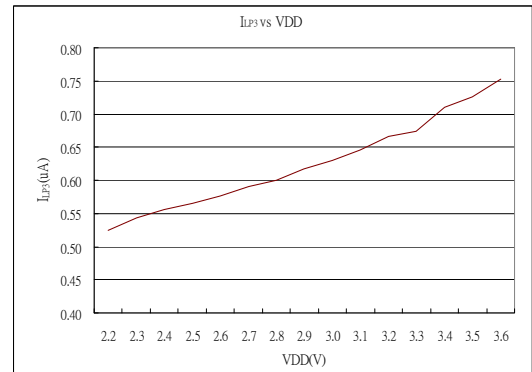


Figure 6.3-6 I_{LP3} vs. VDD

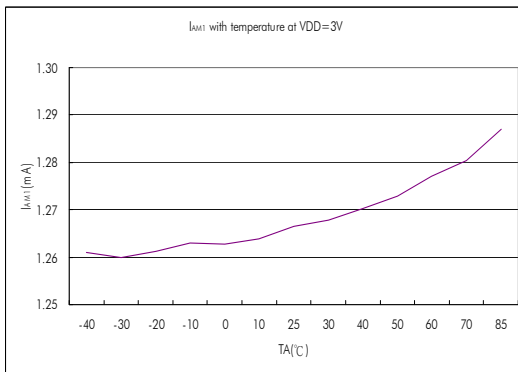


Figure 6.3-7 I_{AM1} vs. Temperature

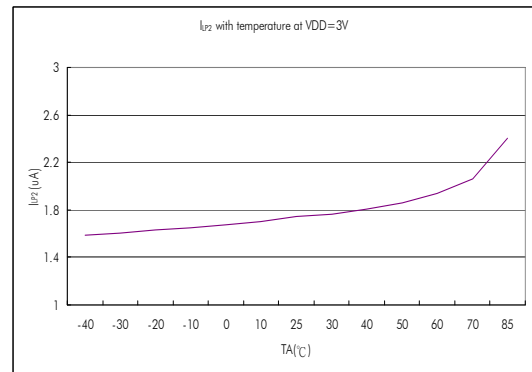


Figure 6.3-8 I_{LP2} vs. Temperature

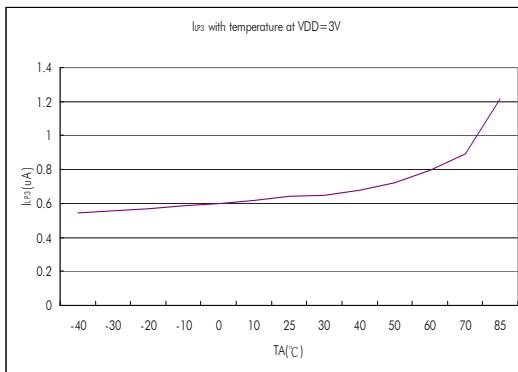


Figure 6.3-9 I_{LP3} vs. Temperature

6.4. Port1~2

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

Sym.	Parameter	Test Conditions	Min.	Typ.	Max.	unit
Input voltage and Schmitt trigger and leakage current and timing						
V_{IH}	High-Level input voltage				2.1	V
V_{IL}	Low-Level input voltage		0.9			
V_{hys}	Input Voltage hysteresis($V_{IH} - V_{IL}$)			0.8		V
I_{LKG}	Leakage Current				0.1	μA
R_{PU}	Port pull high resistance			180		$k\Omega$
Output voltage and current and frequency						
V_{OH}	High-level output voltage	$I_{OH}=10\text{mA}$	$V_{DD} - 0.3$			V
V_{OL}	Low-level output voltage	$I_{OL}=-10\text{mA}$	$V_{SS} + 0.3$			

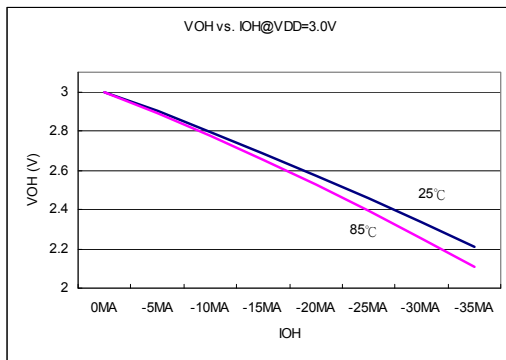


Figure 6.4-1 V_{OH} vs. I_{OH} @ $V_{DD}=3.0\text{V}$

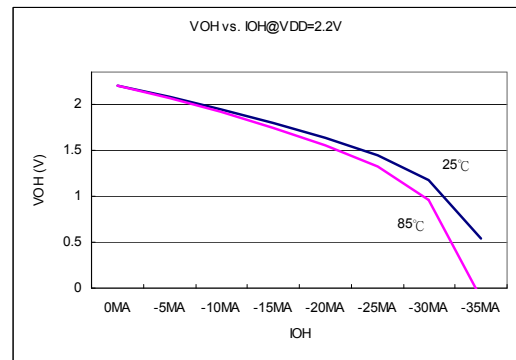


Figure 6.4-2 V_{OH} vs. I_{OH} @ $V_{DD}=2.2\text{V}$

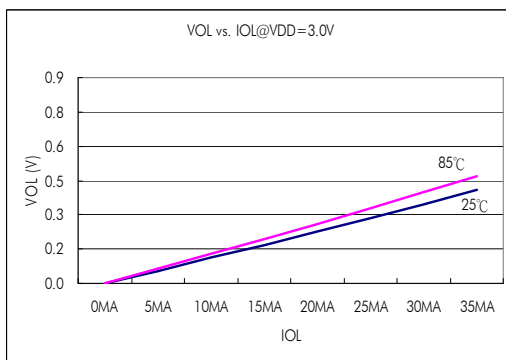


Figure 6.4-3 V_{OL} vs. I_{OL} @ $V_{DD}=3.0\text{V}$

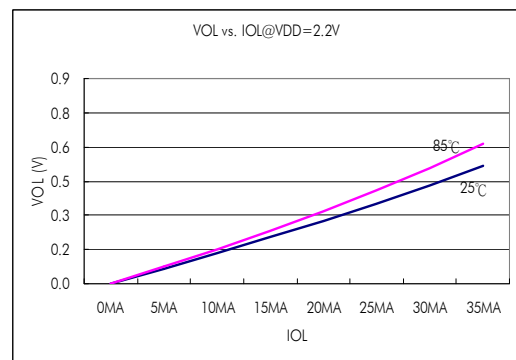


Figure 6.4-4 V_{OL} vs. I_{OL} @ $V_{DD}=2.2\text{V}$

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	$T_A = -40^{\circ}C \sim 85^{\circ}C$	100			ppm/°C	
	Detect V_{DD} voltage rang by user option, V_{SVS} $VLDx[3:0]=1110b$		3.3			V	
	Detect V_{DD} voltage rang by user option, V_{SVS} $VLDx[3:0]=1101b$		3.2				
	Detect V_{DD} voltage rang by user option, V_{SVS} $VLDx[3:0]=1100b$		3.1				
	Detect V_{DD} voltage rang by user option, V_{SVS} $VLDx[3:0]=1011b$		3.0				
	Detect V_{DD} voltage rang by user option, V_{SVS} $VLDx[3:0]=1010b$		2.9				
	Detect V_{DD} voltage rang by user option, V_{SVS} $VLDx[3:0]=1001b$		2.8				
	Detect V_{DD} voltage rang by user option, V_{SVS} $VLDx[3:0]=1000b$		2.7				
	Detect V_{DD} voltage rang by user option, V_{SVS} $VLDx[3:0]=0111b$		2.6				
	Detect V_{DD} voltage rang by user option, V_{SVS} $VLDx[3:0]=0110b$		2.5				
	Detect V_{DD} voltage rang by user option, V_{SVS} $VLDx[3:0]=0101b$		2.4				
	Detect V_{DD} voltage rang by user option, V_{SVS} $VLDx[3:0]=0100b$		2.3				
	Detect V_{DD} voltage rang by user option, V_{SVS} $VLDx[3:0]=0011b$		2.2				
	Detect V_{DD} voltage rang by user option, V_{SVS} $VLDx[3:0]=0010b$		2.1				
	Detect V_{DD} voltage rang by user option, V_{SVS} $VLDx[3:0]=0001b$		2.0				
BOR : Brownout Reset							
LVR : Low Voltage Reset of BOR							
LVD : Low Voltage Detect							
RST : External Reset pin							

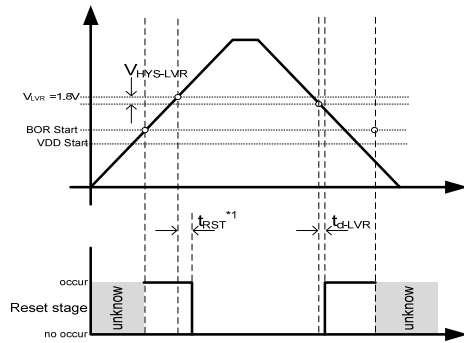


Figure 6.5-1 BOR reset diagram

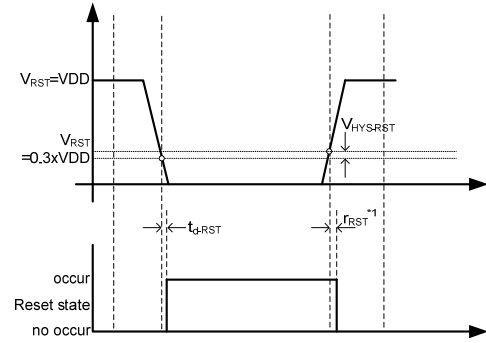


Figure 6.5-2 RST reset diagram

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

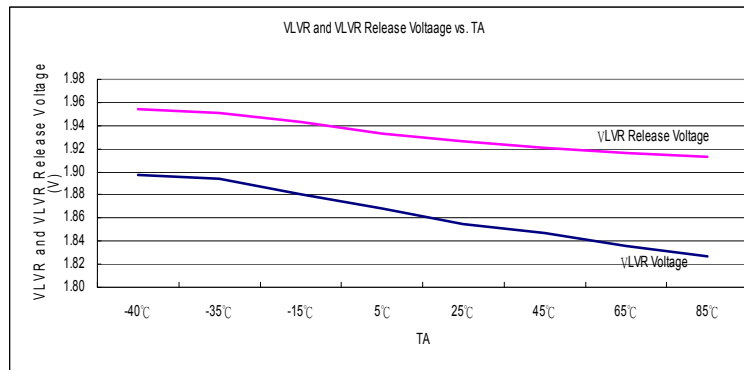


Figure 6.5-3 LVR vs. Temperature

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 = 0mA	VDDAX[1:0]=00b	22			uA
	Select VDDA output voltage	I _L = 0.1mA, VDD ≥ VDDA+0.25V	VDDAX [1:0]=11b	2.4			V
	Dropout voltage	I _L = 10mA	VDDAX [1:0]=11b	250			mV
	Temperature drift	VDDAX [1:0]=11b	T _A =-40℃~85℃	50			ppm/℃
	V _{DD} Voltage drift	I _L = 0.1mA	V _{DD} =2.5V~3.6V	±0.2			%/V
ACM	ACM operation current, I _{ACM}	I _L = 0mA		20			uA
	Output voltage ,V _{ACM}	ENACM[0]=1	I _L = 0uA	1.0			V
	Output voltage with Load		I _L = ±200uA	0.98		1.02	V _{ACM}
	Temperature drift	ENACM[0]=1,	T _A =-40℃~85℃	50			ppm/℃
	VDDA Voltage drift	I _L = 10uA		100			uV/V
VDDA : Adjust Voltage Regulator							
ACM : Analog Common Mode Voltage							

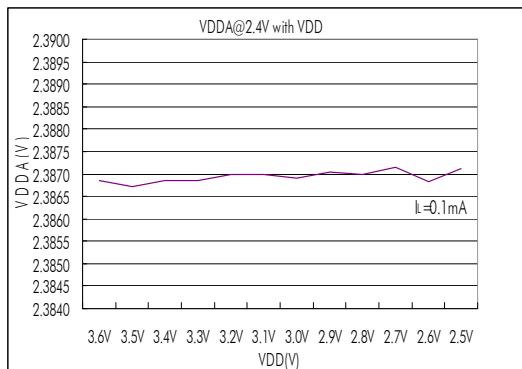


Figure 6.6-1 VDDA $I_L = 0.1\text{mA}$ vs. VDD

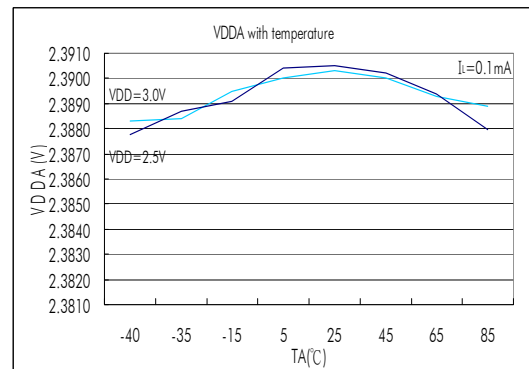


Figure 6.6-2 VDDA $I_L = 0.1\text{mA}$ vs. Temperature

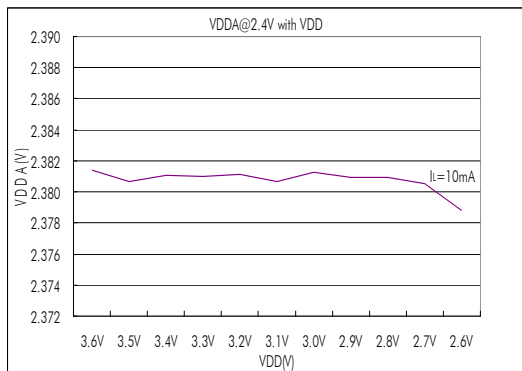


Figure 6.6-3 VDDA $I_L = 10\text{mA}$ vs. VDD

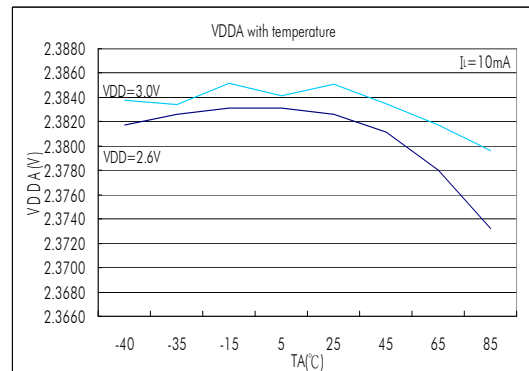


Figure 6.6-4 VDDA $I_L = 10\text{mA}$ vs. Temperature

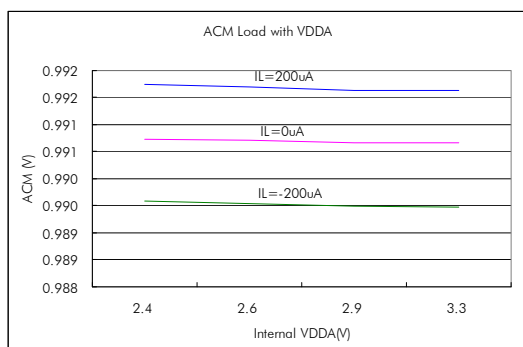


Figure6.6-5 ACM Load vs. VDDA

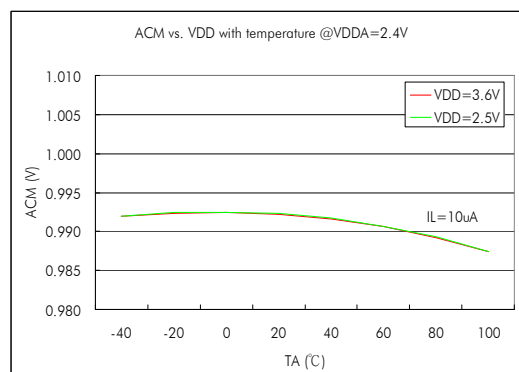


Figure6.6-6 ACM vs. Temperature

6.7. LCD

$T_A = 25^\circ\text{C}$, $V_{DD} = 3.0\text{V}$, $C_{VLCD} = 4.7\mu\text{F}$, unless otherwise noted.

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

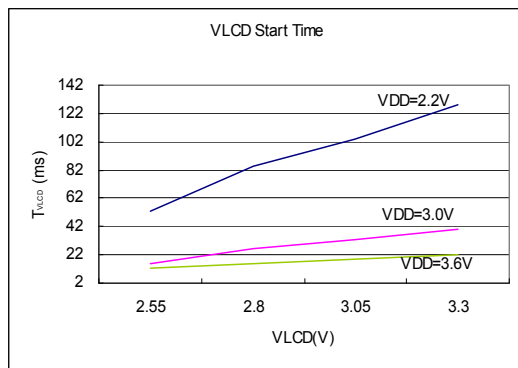


Figure 6.7-1 LCD start time

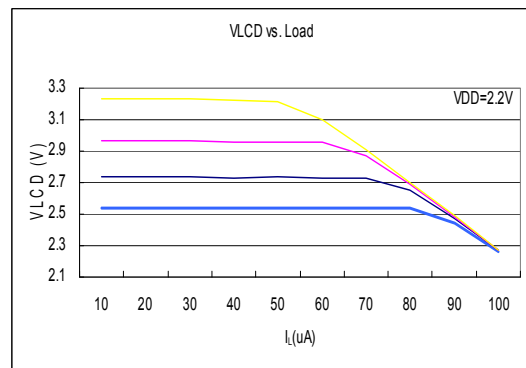


Figure 6.7-2 VLCD vs. IL @ VDD=2.2V

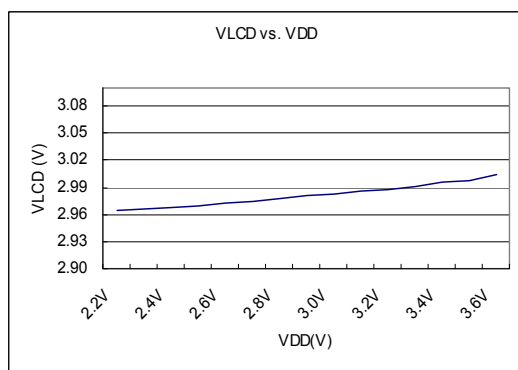


Figure 6.7-3 VLCD vs. VDD

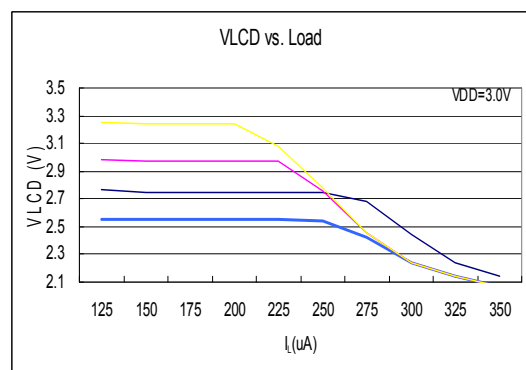


Figure 6.7-4 VLCD vs. IL @ VDD=3.0V

6.8. Low Noise OPAMP 2

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

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

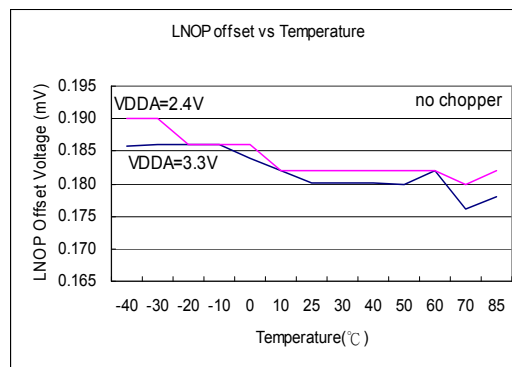


Figure 6.8-1 LNOP2 Offset Temperature

6.9. SD18, Power Supply and Recommended Operating Conditions

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

Sym.	Parameter	Test Conditions		Min.	Typ.	Max.	Unit
V_{SD18}	Supply Voltage at VDDA	ENVDDA[0]=0		2.4		3.6	V
f_{SD18}	Modulator sample frequency, ADC_CK			25	250	300	KHz
	Over Sample Ratio, OSR			128 ^{*1}		32768	
I_{SD18}	Operation supply current without PGA	ENADC[0]=1 INBUF[0]=0, VRBUF[0]=0	GAIN =4, ADC_CK=250KHz		120		uA

*1, OSR=128, setting by ADCCN3[OSR3] bit.

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

OSR[3:0]=1xxxb can't set by user

6.9.1. 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

6.9.2. SD18, performance

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

Sym.	Parameter	Test Conditions		Min.	Typ.	Max.	unit
INL	Integral Nonlinearity(INL)	VDDA=2.4V,V _{VR} =1.0V,ΔSI=±200mV		±0.003		±0.01	%FSR
		VDDA=2.4V,V _{VR} =1.0V,ΔSI=±450mV					
	No Missing Codes ³	ADC_CK=250KHz,OSR[2:0]=010b		19			Bits
G _{SD18}	Temperature drift Gain 1~x16 (INBUF[0]=0b,)	INBUF[0]=0b,VRBUF[0]=0b		T _A = -40℃ ~ 85℃		10	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	
	GAIN=1		2		uV/℃		
	GAIN=2		1				
	GAIN=4		0.5				
	Offset error temperature drift with chopper without PGA		GAIN=16	0.15			

$T_A = 25^\circ\text{C}, V_{DD} = 3.0\text{V}, V_{DDA}=2.4\text{V}, V_{VR}=1.0\text{V}, \text{GAIN}=1$ without PGA, unless otherwise noted

Sym.	Parameter	Test Conditions		Min.	Typ.	Max.	unit
CM _{SD18}	Common-mode rejection	V _{CM} =0.7V to 1.7V, V _{VR} =1.0V,without PGA	V _{SI} =0V, GAIN=1	90		dB	
		V _{CM} =0.7V to 1.7V, V _{VR} =1.0V, without PGA	V _{SI} =0V, GAIN=16	75			
PSRR	DC power supply rejection	VDDA=3.0V,ΔVDDA=±100mV, V _{VR} =1.0V, V _{SI} =1.2V,V _{SI-} =1.2V,	GAIN=1 PGA=off	75		dB	
			GAIN=16 PGA=8				

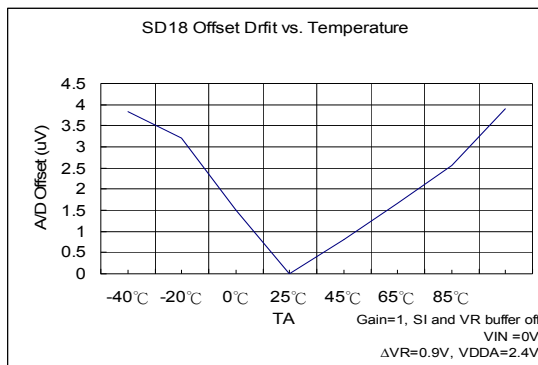


Figure 6.9-1(a) SD18 Offset Temperature drift

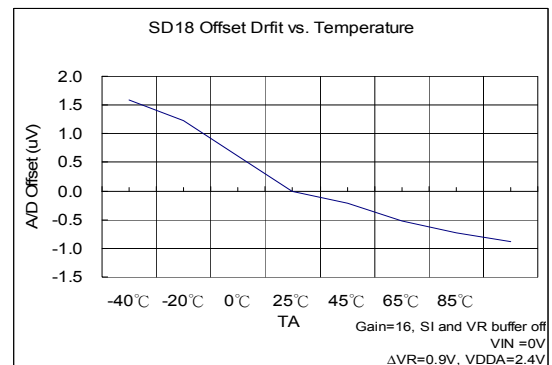


Figure 6.9-1(b) SD18 Offset Temperature drift

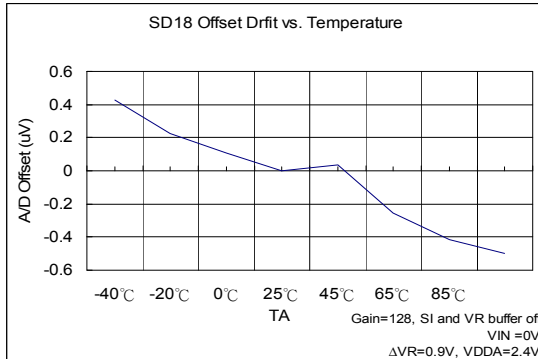


Figure 6.9-1(c) SD18 Offset Temperature drift

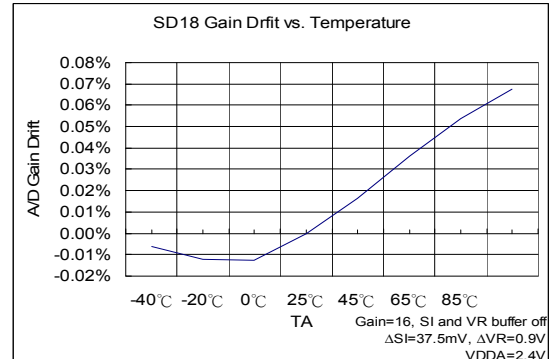


Figure 6.9-2(b) SD18 Gain drift with Temperature

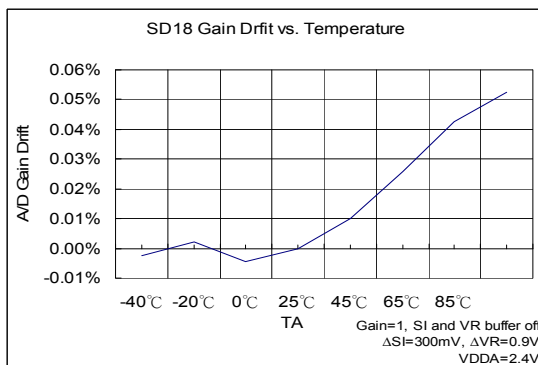


Figure 6.9-2(a) SD18 Gain drift with Temperature

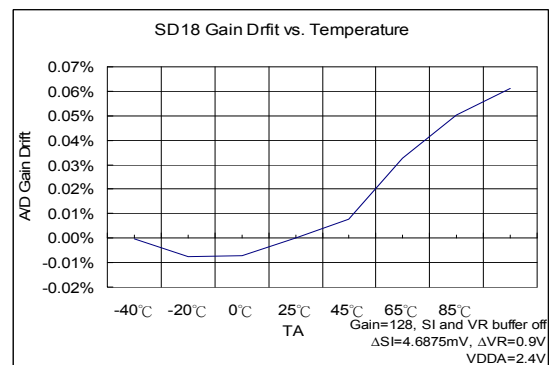


Figure 6.9-2(c) SD18 Gain drift with Temperature

6.9.3. SD18 Noise Performance

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

HY11P54 provides important input noise specification that aims at SD18. Table 6.9-4(a) and Table 6.9-4(b) lists out the relations of typical noise specification, gain, output rate and maximum input voltage of single end. Test conditions are external input signal short, voltage reference: 1.2V and 1024 records were sampled.

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	x	ADGN									
±2400	0.25	=	1	x	0.25	14.43	16.07	17.20	17.86	18.29	18.66	18.98	19.13	19.30
±2160	0.5	=	1	x	0.5	14.34	16.05	17.13	17.84	18.26	18.62	18.90	19.13	19.27
±1080	1	=	1	x	1	14.38	16.06	17.11	17.72	18.13	18.53	18.88	19.05	19.22
±540	2	=	1	x	2	14.40	15.98	16.96	17.59	18.01	18.45	18.79	19.01	19.17
±270	4	=	1	x	4	14.39	15.88	16.82	17.39	17.85	18.28	18.65	18.95	19.13
±135	8	=	1	x	8	14.27	15.75	16.58	17.15	17.60	18.04	18.45	18.78	19.02
±68	16	=	1	x	16	14.14	15.51	16.18	16.73	17.21	17.70	18.15	18.52	18.83
±8	128	=	8	x	16	13.04	13.83	14.32	14.87	15.38	15.86	16.36	16.84	17.28

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

Table 6.9-4(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	x	ADGN									
±2400	0.25	=	1	x	0.25	362.92	139.77	64.33	40.65	30.04	23.35	18.70	16.75	14.92
±2160	0.5	=	1	x	0.5	193.22	70.82	33.83	20.60	15.37	12.00	9.86	8.38	7.61
±1080	1	=	1	x	1	94.14	35.38	17.16	11.17	8.40	6.34	5.01	4.44	3.92
±540	2	=	1	x	2	46.23	18.59	9.48	6.13	4.57	3.35	2.66	2.28	2.05
±270	4	=	1	x	4	23.37	9.98	5.20	3.51	2.54	1.89	1.46	1.18	1.05
±135	8	=	1	x	8	12.66	5.47	3.06	2.06	1.51	1.11	0.84	0.67	0.56
±68	16	=	1	x	16	6.93	3.23	2.02	1.38	0.99	0.70	0.51	0.40	0.32
±8	128	=	8	x	16	1.86	1.29	0.91	0.63	0.44	0.32	0.22	0.16	0.12

Table 6.9-4(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) = $2 \times \text{VREF}/\text{Gain}$.

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

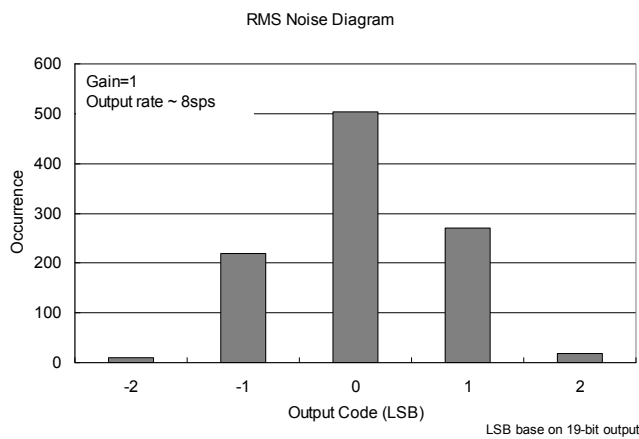


Figure 6.9-4(a) RMS Noise Diagram

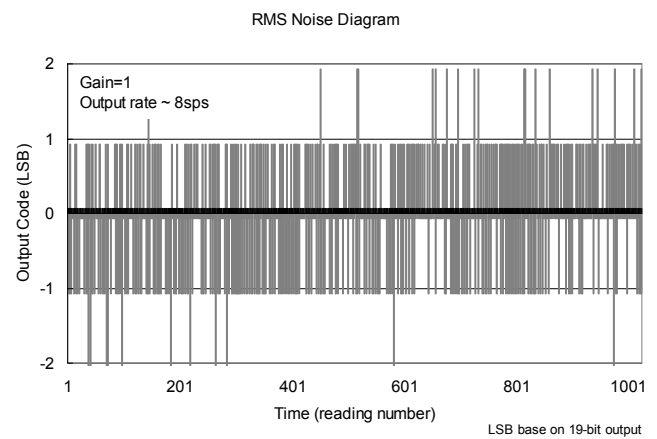


Figure 6.9-4(b) Output Code Diagram

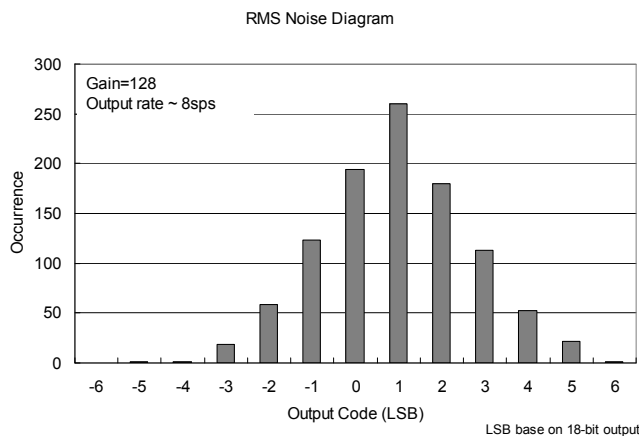


Figure 6.9-4(c) RMS Noise Diagram

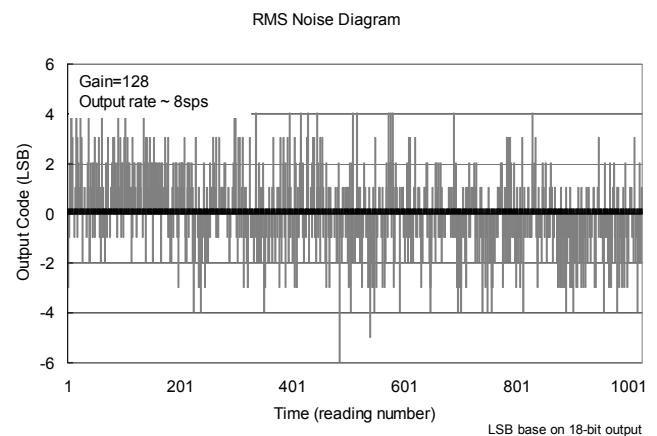


Figure 6.9-4(d) Output Code Diagram

6.10. Build-In EPROM(BIE)

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

Sym.	Parameter	Test Conditions	Min.	Typ.	Max.	unit
V_{BIE}	Supply Voltage			6.0	6.5	V
I_{BIE}	Operation supply current			5		mA
V_{SS}	Supply Voltage			0		V

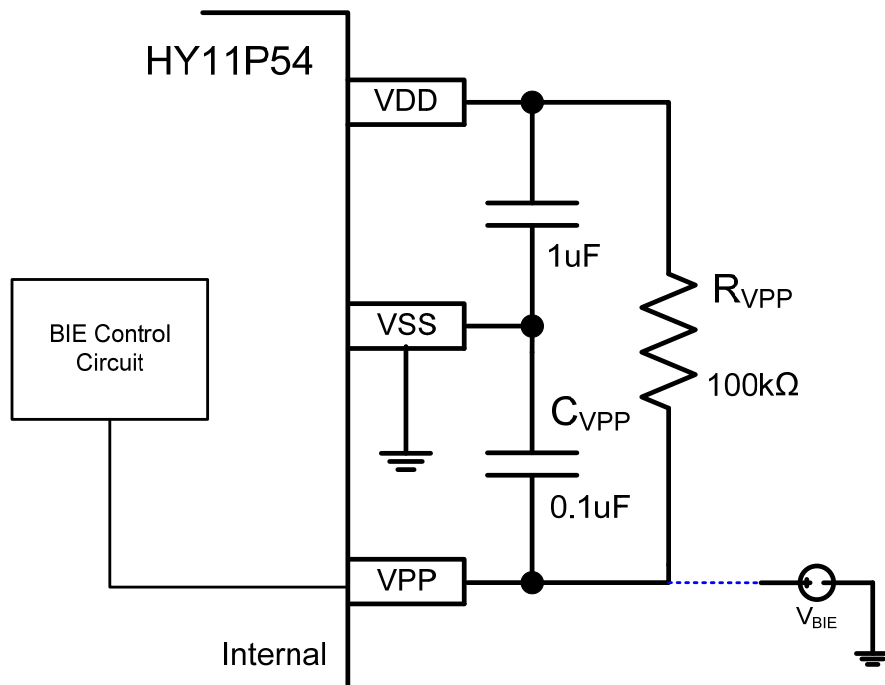
When using external VBIE power to write BIE zone, one word can be written in a time via instruction in BIE zone.

6.11. Build-In EPROM(BIE) Low voltage control circuit

$T_A = 25^\circ\text{C}$, $V_{DD} = 3.05\text{V}$, unless otherwise noted

Sym.	Parameter	Test Conditions	Min.	Typ.	Max.	unit
T_O	Operation temperature range		0	25	40	$^\circ\text{C}$
V_{DD}	Operation supply Voltage		3.05		3.4	V
V_{SS}	Supply Voltage			0		V

Starts 3.05V low programming voltage control circuit, it is not necessary to connect V_{BIE} power to program BIE zone.



BIE typical application

7. Ordering Information

Device No. ¹	Package Type	Pins	Package Drawing		Code ² Code ²	Shipment Packing Type	Unit Q'ty	Material Composition	MSL ³
HY11P54-D000	Die	-	D	000	000	-	100	Green ⁴	-
HY11P54-L064	LQFP	64	L	064	000	Tray	250	Green ⁴	MSL-3
HY11P54-L100	LQFP	100	L	100	000	Tray	90	Green ⁴	MSL-3
HY11P54-NS48	QFN	48	N	S48	000	Tray	490	Green ⁴	MSL-3

¹ **Device No.: Model No. – Package Type Description – Code** (Blank Code/ Standard/ Customized Programming Code)

Ex: Your customized programming code is 008 and you require die shipment.

The device No. will be HY11P54-D000-008

Ex: You request blank code in die package.

The device No. will be HY11P54-D000.

Ex: You request blank code in LQFP 100 package.

The device No. will be HY11P54-L100.

And please clearly indicate the shipment packing type when placing orders.

Ex: Your customized programming code is 009 and you require products in LQFP 100 package. The device No. will be HY11P54-L100-009. And please clearly indicate the shipment packing type when placing orders.

² **Code:**

“001”~ “999” is standard or customized programming code. Blank code does not have these numbers.

³ **MSL:**

The Moisture Sensitivity Level ranking conforms to IPC/JEDEC J-STD-020 industry standard categorization. The products are processed, packed, transported and used with reference to IPC/JEDEC J-STD-033.

⁴ **Green (RoHS & no Cl/Br):**

HYCON products are Green products that compliant with RoHS directive and are Halogen free (Br/Cl<0.1%).

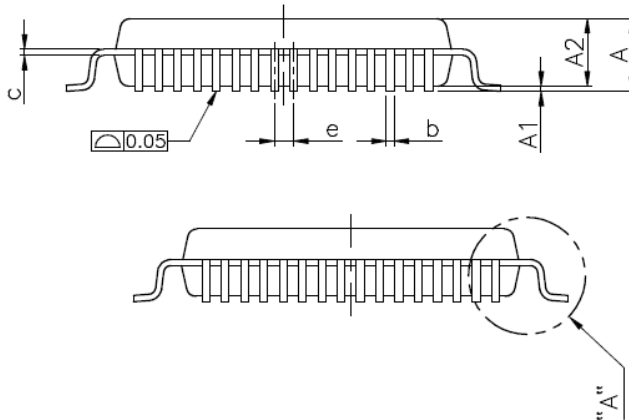
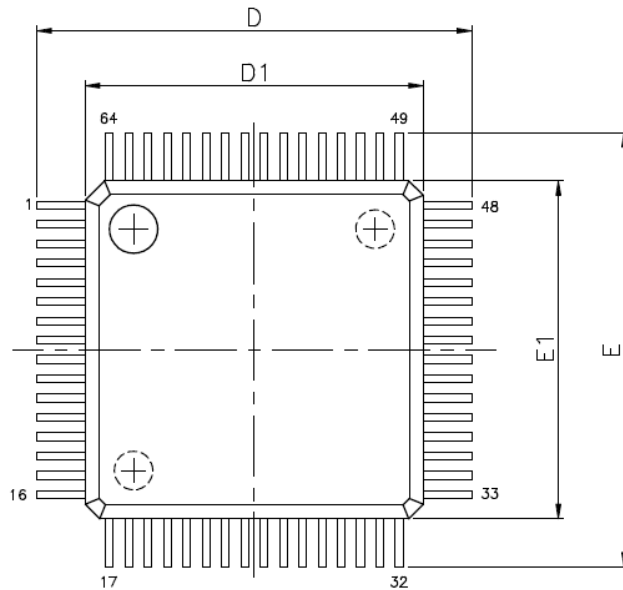
HY11P54

Embedded 18-Bit $\Sigma\Delta$ ADC

8-Bit RISC-like Mixed Signal Microcontroller

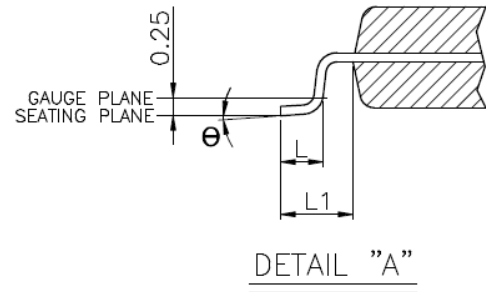
8. Package Information

8.1. LQFP64(L064)



VARIATIONS (ALL DIMENSIONS SHOWN IN MM)

SYMBOLS	MIN.	NOM.	MAX.
A	—	—	1.60
A1	0.05	—	0.15
A2	1.35	1.40	1.45
b	0.13	0.18	0.23
c	0.09	—	0.20
D	9.00 BSC		
D1	7.00 BSC		
e	0.40 BSC		
E	9.00 BSC		
E1	7.00 BSC		
L	0.45	0.60	0.75
L1	1.00 REF		
θ	0°	3.5°	7°



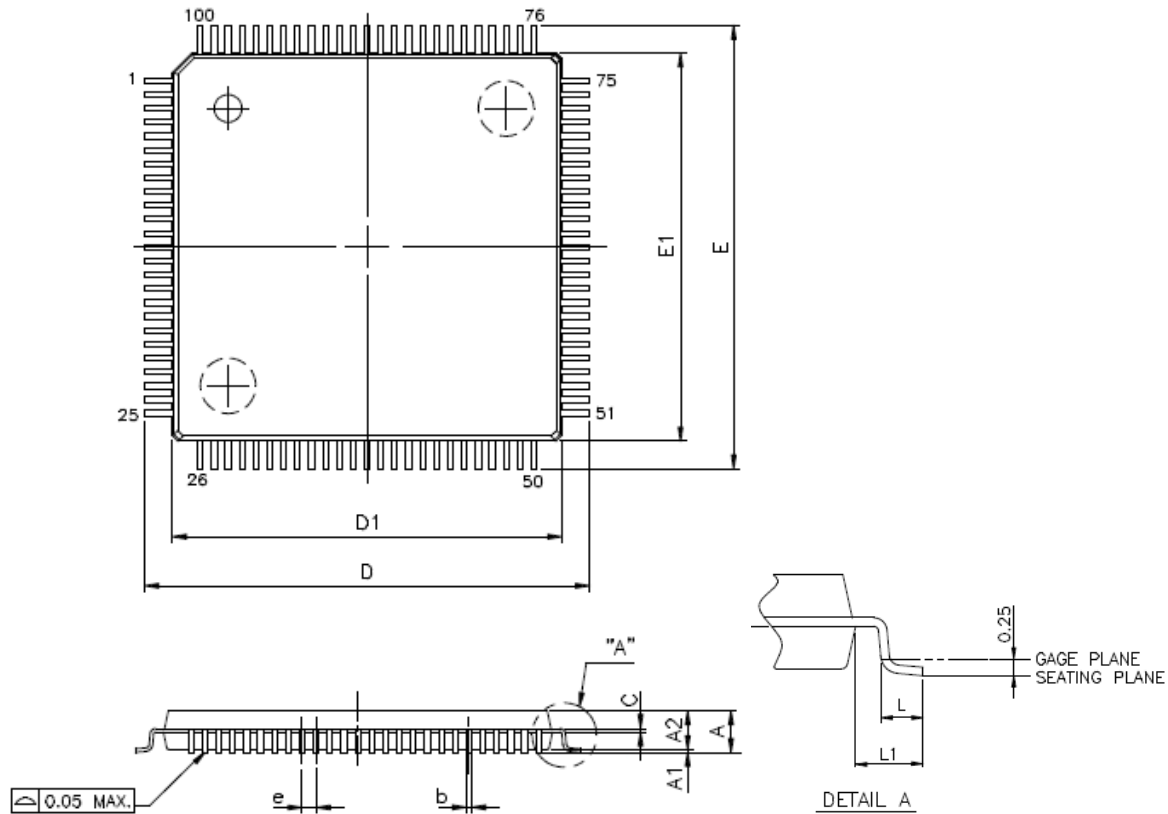
JEDEC MS-026 compliant

HY11P54

Embedded 18-Bit $\Sigma\Delta$ ADC

8-Bit RISC-like Mixed Signal Microcontroller

8.2. LQFP100(L100)



SYMBOLS	MIN.	NOM.	MAX.
A	--	--	1.60
A1	0.05	--	0.15
A2	1.35	1.40	1.45
b	0.17	0.20	0.27
c	0.09	0.127	0.20
D	16.00 BSC		
D1	14.00 BSC		
E	16.00 BSC		
E1	14.00 BSC		
e	0.50 BSC		
L	0.45	0.60	0.75
L1	1.00 REF		

Note:

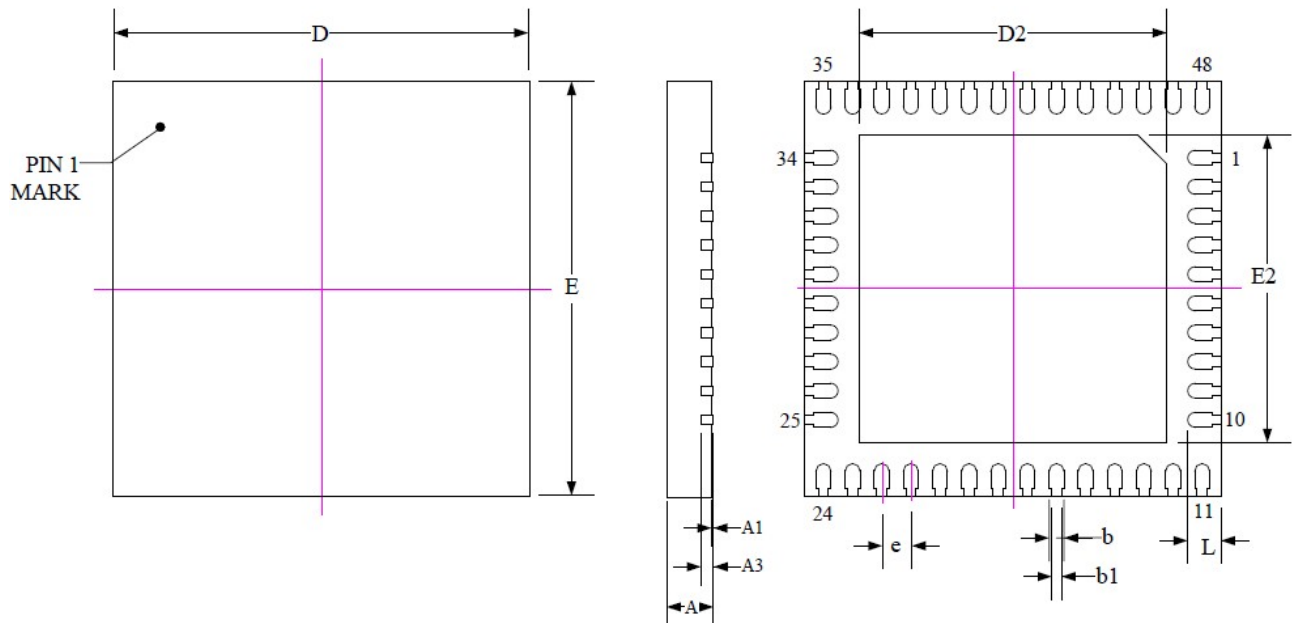
1. All dimensions refer to JEDEC OUTLINE MS-026.
2. Do not include Mold Flash or Protrusions.

HY11P54

Embedded 18-Bit $\Sigma\Delta$ ADC

8-Bit RISC-like Mixed Signal Microcontroller

8.3. QFN48(NS48)



SYMBOLS	MIN	NOM	MAX
A	0.50	0.55	0.60
A1	0.00	0.02	0.05
A3	0.15 REF.		
b	0.13	0.18	0.23
b1	0.07	0.12	0.17
D	5.00 BSC		
E	5.00 BSC		
D2	3.65	3.70	3.75
E2	3.65	3.70	3.75
L	0.35	0.40	0.45
e	0.35 BSC		

9. Revision Record

Major differences are stated thereafter:

Version	Page	Revision Summary
V06	All	First edition
V07	3,5,35,38	QFN Series Pin Code Name Change