



SPECIFICATION

MODULE NO.: HEM6448-01B

Rev: 02

Date: 2015-08-10

APPROVED	CHECKED	PREPARED

Customer Approval:	<input type="checkbox"/> Accept
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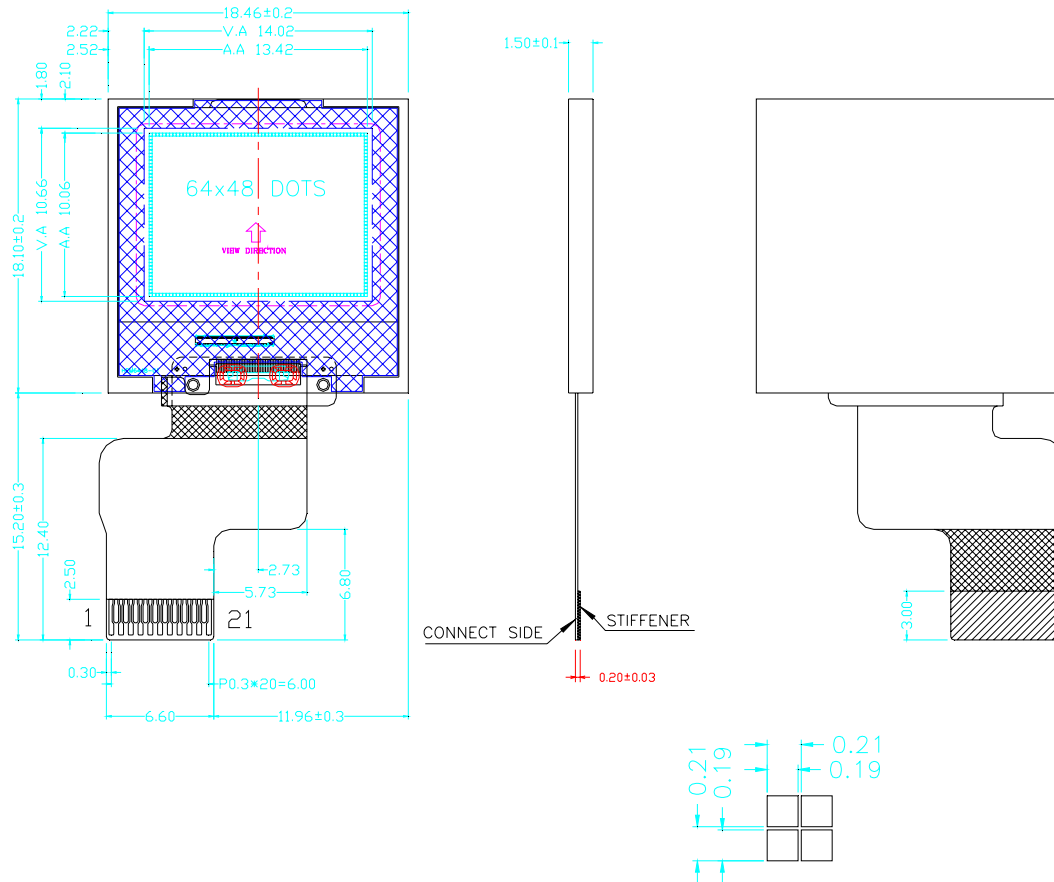
History of Version

Date	Ver	Description	PREPARED	Checked
2015/08/05	01	New sample	XQC	--
2015/08/10	02	Fpc 补强处厚度改 0.2mm	XQC	

CONTENTS

1. Dimensional Outline	1
2. Functions & Features	1
3. Mechanical Specifications	1
4. Block Diagram	2
5. Power Supply	3
6. Pin Description	4
7. Maximum Absolute Limit	4
8. Electrical Characteristics	4
9. Control and Display Command	6
10. Quality Specifications	7

1.DIMENSIONAL OUTLINE



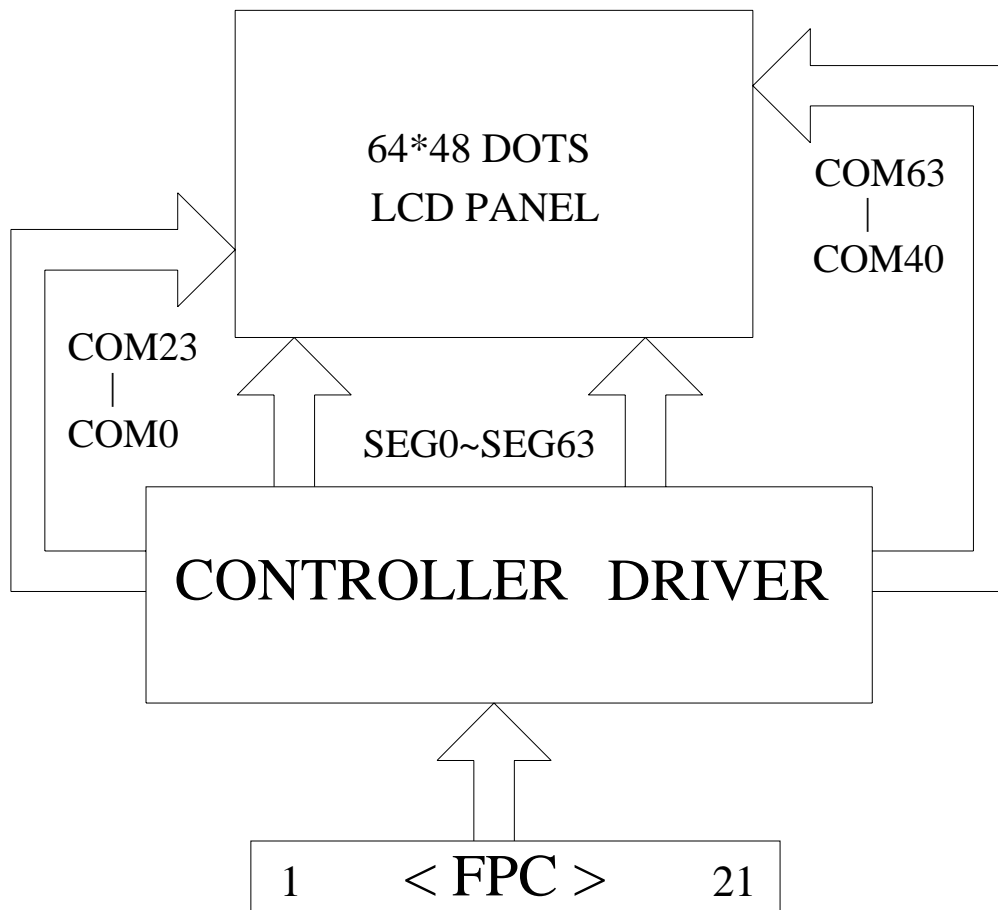
2.FUNCTIONS & FEATURES

2-1. Format	: 64X48 Dots
2-2. LCD mode	: FSTN, NEGATIVE, Transmissive Mode
2-3. Viewing direction	: 6 o'clock
2-4. Driving scheme	: 1/49 Duty cycle, 1/6 Bias
2-5. Low power operation	: Power supply voltage range (V_{DD}): 1.8V
2-6. VLCD adjustable for best contrast	: LCD driving voltage (V_{OP}): 6.5V
2-7. Operating temperature	: -10°C~60°C
2-8. Storage temperature	: -20°C~70°C

3.MECHANICAL SPECIFICATIONS

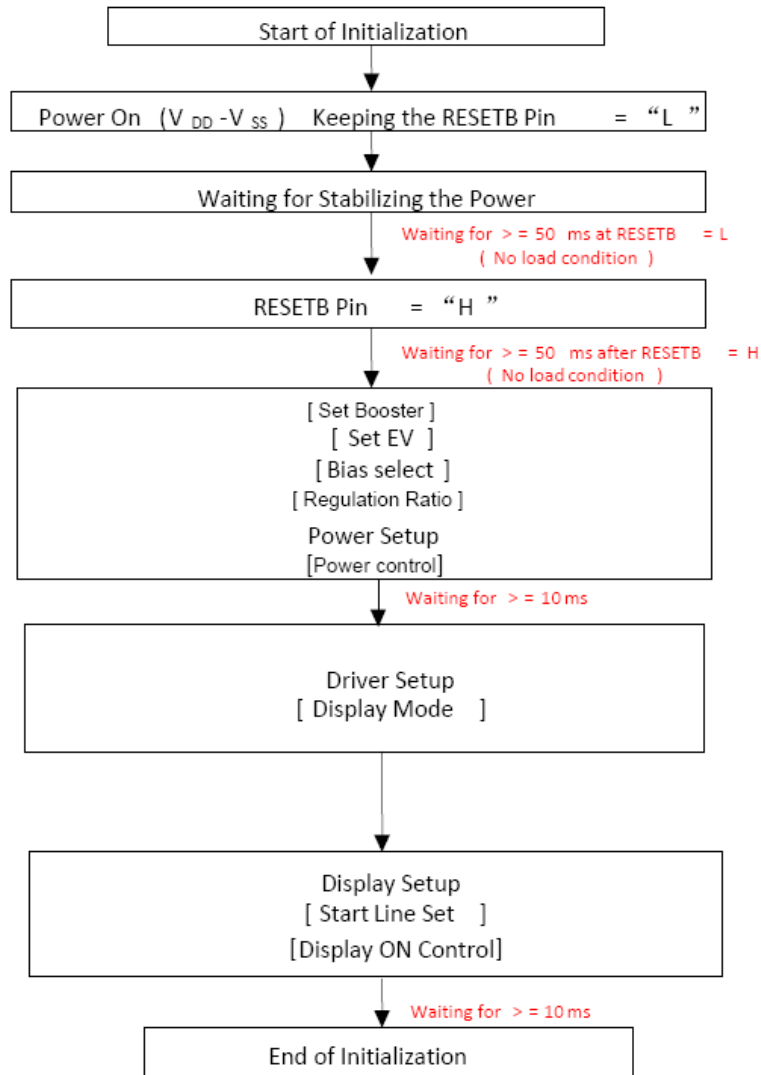
3-1. Module size	: 18.46mm(L)*18.1mm(W)*1.5mm(H)
3-2. Viewing area	: 14.02mm(L)*10.66mm(W)
3-3. Dot pitch	: 0.21mm(L)*0.21mm(W)
3-4. Dot size	: 0.19mm(L)*0.19mm(W)

4.BLOCK DIAGRAM



5. POWER SUPPLY

Power on Sequence (VDD1=VDD2=1.8V)



APPLICATION WITH VDD1=VDD2=1.8V

When VDD1/VDD2=1.8V, It needs new equation to calculate the V₀ voltage:

$$V_0 = RR \cdot 1.9 \cdot (99 + CT) / 162$$

NOTE: V₀ < 7.5, AND CT < 49 is necessary to keep equation accurate and linear

Booster and RR and CT could adjust and get enough V₀ for LCD DRIVER.

6. PIN DESCRIPTION

Pin no.	Symbol	Function
1,2,9,15,16	VSS	Ground
3	V0	LCD driving voltage.
4~7,17~19	NC	--
8	VDD	Power for LCD +1.8V.
10	CSB	Chip Select , When CSB= "L", chip is selected
11	RESB	When RESB= "L", the settings are initialized
12	A0(D/C)	Select register data when A0= "H", and instruction when A0= "L"
13	SCK	Serial clock input terminal
14	SDA	Serial data input terminal
20	K-	Backlight Ground.
21	A+	Backlight Power +3.0V, If=15mA

7.MAXIMUM ABSOLUTE LIMIT (T=25°C)

Item	Symbol	Standard value	Unit
Power supply voltage for logic	V _{DD}	-0.3~7	V
LCD Power supply voltage	V ₀	-0.3~13.5	V
Input voltage range	V _{in}	-0.3~V _{dd} +0.3	V
Operating temperature	T _{opr}	-10~+60	°C
Storage temperature	T _{stg}	-20~+70	°C

Notes

1. Stresses above those listed under Limiting Values may cause permanent damage to the device.
2. Parameters are valid over operating temperature range unless otherwise specified. All voltages are with respect to VSS unless otherwise noted.

8.ELECTRICAL CHARACTERISTICS

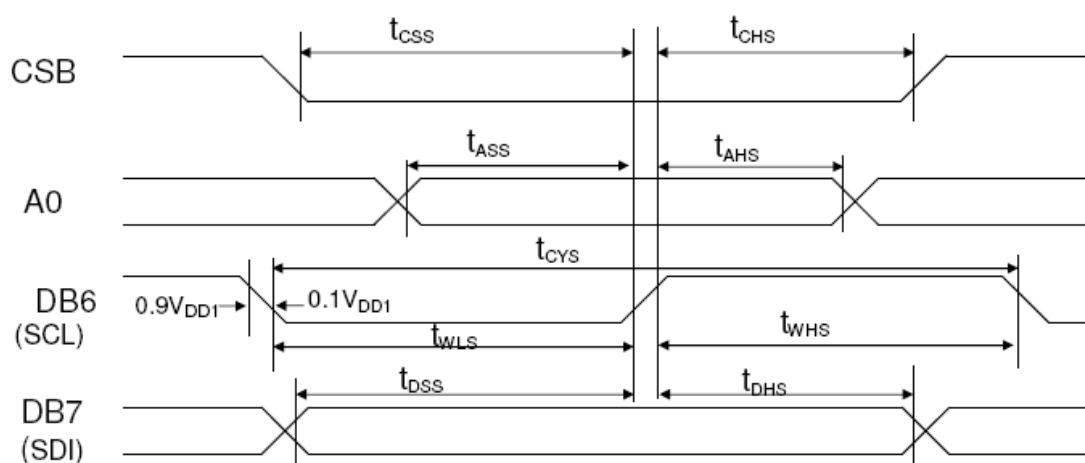
8-1 DC Characteristics

Item	Symbol	Min	Typ	Max	Unit	Test condition
Operating voltage	V _{DD}	1.8	-	3.6	V	-
Voltage regulator operation voltage	V ₀	4.0	-	13.5	V	-
Dynamic current consumption	I _{DD}	-	300	400	μA	V _{DD} =3.0V, V ₀ =8.5V, 5x booster, 1/9bias, display pattern: snow(Static), Ta=25°C
Display OFF	I _{DD}	-	95	190	μA	V _{DD} =3.0V, V ₀ =8.5V, 5x booster, 1/9bias, Ta=25°C
Power down	I _{DD}	-	1	5	μA	V _{DD} =3.0V, Ta=25°C

High-level-Input voltage	V_{IHC}	$0.8V_{DD1}$	-	V_{DD1}	V	MPU Interface
Low-level Input voltage	V_{ILC}	VSS1	-	$0.2V_{DD1}$	V	
High-level output voltage	V_{OHC}	$0.8V_{DD1}$	-	V_{DD1}	V	$I_{OUT}=1mA, VDD1=1.8V$
low-level output voltage	V_{OLC}	VSS1	-	$0.2V_{DD1}$	V	$I_{OUT}=-1mA, VDD1=1.8V$
Input leakage current	I_{IKG}	-1.0	-	1.0	μA	MPU Interface
LCD driving voltage	V_{LCD}	6.2	6.5	6.8	V	--

8-2 AC Characteristics

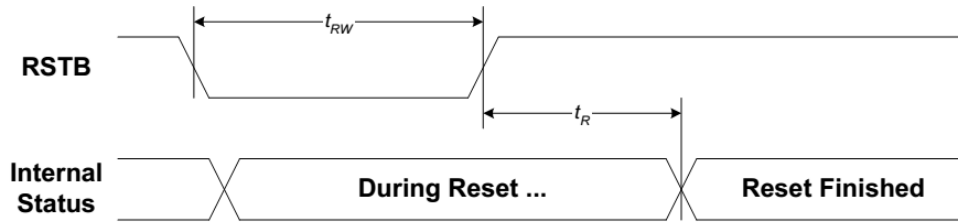
4-SPI



($V_{DD1} = 2.4 \sim 3.6V, T_a = -30 \sim 80^{\circ}C$)

Item	Signal	Symbol	Min.	Typ.	Max.	Unit	Remark
Serial clock cycle	DB6 (SCL)	t_{CYS}	200	-	-	ns	
SCL high pulse width		t_{WHS}	90	-	-		
SCL low pulse width		t_{WLS}	90	-	-		
Address setup time	A0	t_{ASS}	45	-	-	ns	
Address hold time		t_{AHS}	45	-	-		
Data setup time	DB7 (SDI)	t_{DSS}	45	-	-	ns	
Data hold time		t_{DHS}	45	-	-		
CSB setup time	CSB	t_{CSS}	90	-	-	ns	
CSB hold time		t_{CHS}	90	-	-		

Hardware Reset Timing



(VDD1 = 1.8V , Ta =25°C)

Item	Symbol	Condition	Min.	Max.	Unit
Reset time	tR		—	3.0	us
Reset "L" pulse width	tRW		3.0	—	

9.CONTROL AND DISPLAY COMMAND

NO.	INSTRUCTION	A0	RW	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0	Description
1	Display on/off	0	0	1	0	1	0	1	1	1	DON	DON=1, display ON DON=0, display OFF
2	Set start line	0	0	0	1	ST5	ST4	ST3	ST2	ST1	ST0	Set Display start line
3	Set page address	0	0	1	0	1	1	AY3	AY2	AY1	AY0	Set page address
4	Set column address	0	0	0	0	0	0	AX3	AX2	AX1	AX0	Set column address
		0	0	0	0	0	1	AX7	AX6	AX5	AX4	
5	Write data	1	0	D7	D6	D5	D4	D3	D2	D1	D0	Write display data to RAM
6	Read data	1	1	D7	D6	D5	D4	D3	D2	D1	D0	Read display data from RAM
7	SEG direction	0	0	1	0	1	0	0	0	0	MX	Set scan direction of SEG MX=1, reverse direction MX=0, normal direction
8	Inverse display	0	0	1	0	1	0	0	1	1	INV	INV =0, normal display,INV =1, inverse display
9	ALL pixel on	0	0	1	0	1	0	0	1	0	AP	AP=1, set all pixel ON AP=0, normal display
10	Bias select	0	0	1	0	1	0	0	0	1	BS	Select bias setting,0=1/9; 1=1/7 (at 1/65 duty)
11	Read-modify-Write	0	0	1	1	1	0	0	0	0	0	Column address increment: Read:+0 , Write:+1
12	END	0	0	1	1	1	0	1	1	1	0	Exit Read-modify-Write mode
13	RESET	0	0	1	1	1	0	0	0	1	0	Software reset
14	COM Direction	0	0	1	1	0	0	MY	0	0	0	Set output direction of COM MY=1, reverse direction MY=0, normal direction
15	Power control	0	0	0	0	1	0	1	VB	VR	VF	Control built-in power circuit ON/OFF
16	Regulation Ratio	0	0	0	0	1	0	0	RR2	RR1	RR0	Select regulation resistor ratio
17	SET EV	0	0	1	0	0	0	0	0	0	1	Double command!! Set electronic volume (EV) level
		0	0	0	0	EV5	EV4	EV3	EV2	EV1	EV0	
18	Set Booster	0	0	1	1	1	1	1	0	0	0	Double command!! Set booster level: BL=0: 5X BL=1: 4X
				0	0	0	0	0	0	0	0	
19	Power save	Compound Command										Display OFF + All Pixel ON
20	Nop	0	0	1	1	1	0	0	0	1	1	No operation (dummy command)
21	Spi4 Read Ram	0	0	0	0	1	1	0	1	1	1	spi read ram data command

10. Precaution for using LCD/ICM

LCD/LCM is assembled and adjusted with a high degree of precision. Do not attempt to make any alteration or modification. The followings should be noted.

General Precautions:

1. LCD panel is made of glass. Avoid excessive mechanical shock or applying strong pressure onto the surface of display area.
2. The polarizer used on the display surface is easily scratched and damaged. Extreme care should be taken when handling. To clean dust or dirt off the display surface, wipe gently with cotton, or other soft material soaked with isopropyl alcohol, ethyl alcohol or trichlorotrifluoroethane, do not use water, ketone or aromatics and never scrub hard.
3. Do not tamper in any way with the tabs on the metal frame.
4. Do not make any modification on the PCB without consulting HES.
5. When mounting a LCM, make sure that the PCB is not under any stress such as bending or twisting. Elastomer contacts are very delicate and missing pixels could result from slight dislocation of any of the elements.
6. Avoid pressing on the metal bezel, otherwise the elastomer connector could be deformed and lose contact, resulting in missing pixels and also cause rainbow on the display.
7. Be careful not to touch or swallow liquid crystal that might leak from a damaged cell. Any liquid crystal adheres to skin or clothes, wash it off immediately with soap and water.

Static Electricity Precautions:

1. CMOS-LSI is used for the module circuit; therefore operators should be grounded whenever he/she comes into contact with the module.
2. Do not touch any of the conductive parts such as the LSI pads; the copper leads on the PCB and the interface terminals with any parts of the human body.
3. Do not touch the connection terminals of the display with bare hand; it will cause disconnection or defective insulation of terminals.
4. The modules should be kept in anti-static bags or other containers resistant to static for storage.
5. Only properly grounded soldering irons should be used.
6. If an electric screwdriver is used, it should be grounded and shielded to prevent sparks.
7. The normal static prevention measures should be observed for work clothes and working benches.
8. Since dry air is inductive to static, a relative humidity of 50-60% is recommended.

Soldering Precautions:

1. Soldering should be performed only on the I/O terminals.
2. Use soldering irons with proper grounding and no leakage.
3. Soldering temperature: $280^{\circ}\text{C} \pm 10^{\circ}\text{C}$
4. Soldering time: 3 to 4 second.

5. Use eutectic solder with resin flux filling.
6. If flux is used, the LCD surface should be protected to avoid spattering flux.
7. Flux residue should be removed.

Operation Precautions:

1. The viewing angle can be adjusted by varying the LCD driving voltage V_o .
2. Since applied DC voltage causes electro-chemical reactions, which deteriorate the display, the applied pulse waveform should be a symmetric waveform such that no DC component remains. Be sure to use the specified operating voltage.
3. Driving voltage should be kept within specified range; excess voltage will shorten display life.
4. Response time increases with decrease in temperature.
5. Display color may be affected at temperatures above its operational range.
6. Keep the temperature within the specified range usage and storage. Excessive temperature and humidity could cause polarization degradation, polarizer peel-off or generate bubbles.
7. For long-term storage over 40°C is required, the relative humidity should be kept below 60%, and avoid direct sunlight.

Limited Warranty

HES LCDs and modules are not consumer products, but may be incorporated by HES's customers into consumer products or components thereof, HES does not warrant that its LCDs and components are fit for any such particular purpose.

1. The liability of HES is limited to repair or replacement on the terms set forth below. HES will not be responsible for any subsequent or consequential events or injury or damage to any personnel or user including third party personnel and/or user. Unless otherwise agreed in writing between HES and the customer, HES will only replace or repair any of its LCD which is found defective electrically or visually when inspected in accordance with HES general LCD inspection standard . (Copies available on request)
2. No warranty can be granted if any of the precautions state in handling liquid crystal display above has been disregarded. Broken glass, scratches on polarizer mechanical damages as well as defects that are caused accelerated environment tests are excluded from warranty.
3. In returning the LCD/LCM, they must be properly packaged; there should be detailed description of the failures or defect.