LCD MODULE SPECIFICATION
FOR CUSTOMER'S APPROVAL

Product Model : WYM12864K37G

VERSION:1.0

OPTIONAL SPECIFICATION		
LCD	☐Normal Temperature（-10～50℃） ☐Wide Temperature（-20～+70℃） ☐Super Wide Temperature（-30～+80℃）	
	☐Yellow&Green ☐Blue ☐Gray ☐Black & White	
Backlight	LED Backlight	☐White light ☐Green light ☐Yellow&Green light ☐Blue light
DC to DC Circuit	☐Build-in ☐Not Build-in	
Controller	☐Build-in ☐Not Build-in	

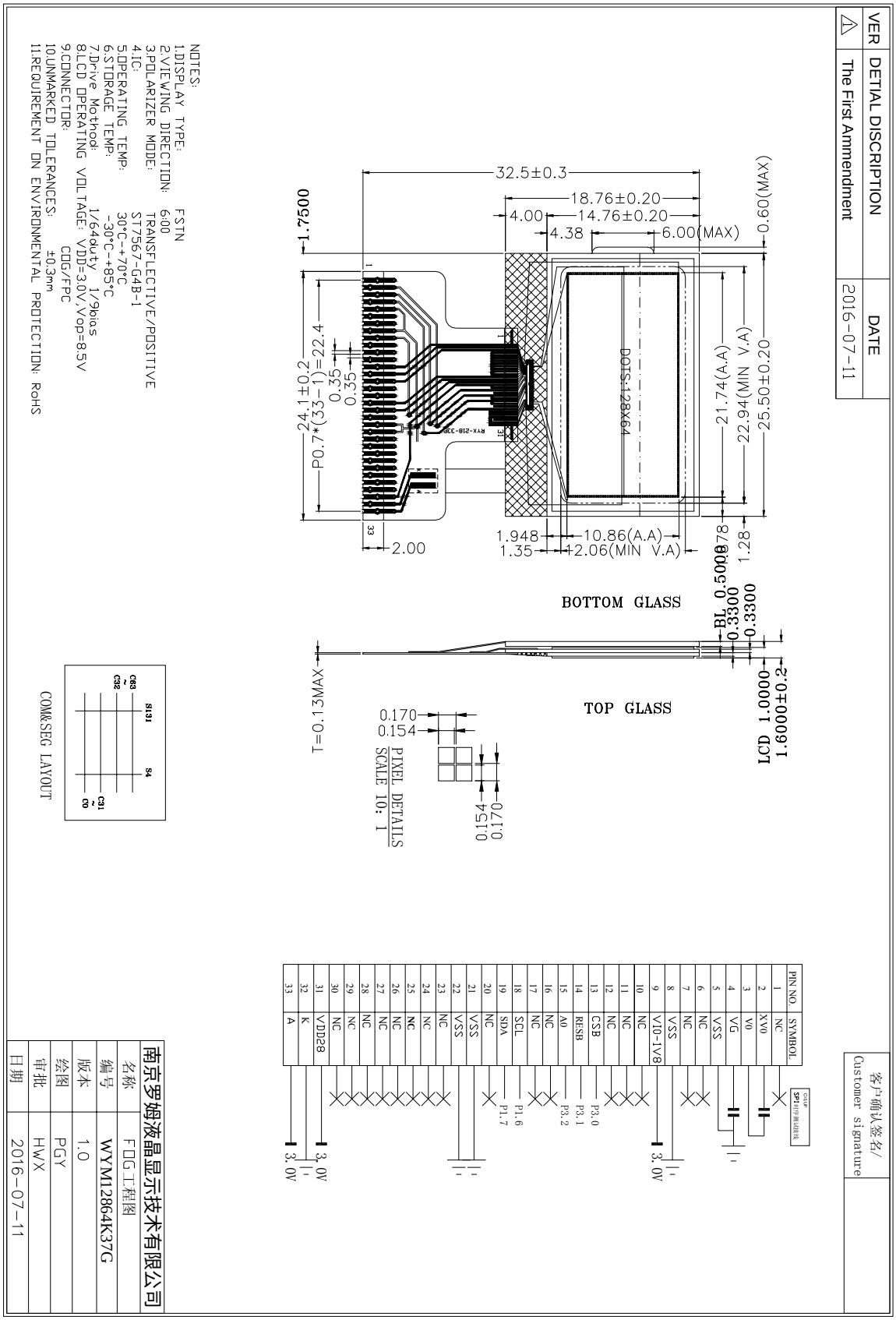
RECORD OF REVISION

Version	Revision Date	Contents	Editor
1.0	2016 12 02	New Release	SMX

1. PHYSICAL DATA

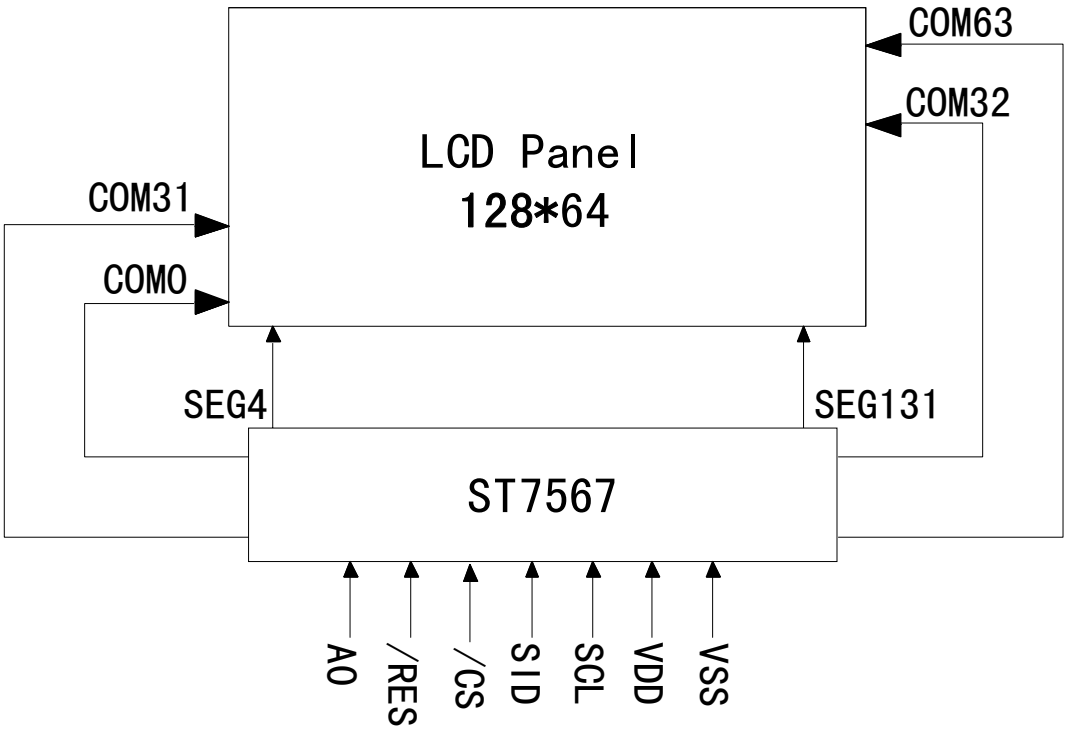
Item	Contents	Unit
LCD type	FSTN	---
LCD duty	1/64	---
LCD bias	1/9	---
Viewing direction	6	o'clock
Module size (W×H×T)	25.5 × 18.76×1.6（MAX）	mm
Number of dots(W×H)	128 × 64	dots
Dot Size(W×H))	0.154×0.154	mm
Dot Pitch(W×H))	0.17×0.17	mm

2. EXTERNAL DIMENSIONS



PIN NO.	Symbol	Level	Description
1	**NC**	---	No connection.
2	**XVO**	---	the LCD driving voltage for common circuits at positive frame
3	**VO**	---	the LCD driving voltage for common circuits at negative frame.
4	**VG**	---	the LCD driving voltage for segment circuits.
5	**VSS**	0V	Ground.
6-7	**NC**	---	No connection.
8	**VSS**	0V	Ground.
9	**VIO-1V8**	+3V	Power supply.
10-12	**NC**	---	No connection.
13	**CSB**	H/L	Chip select.
14	**RST**	H/L	Hardware reset input pin.
15	**A0**	H/L	It determines whether the access is related to data or command. A0="H" : Indicates that signals on D[7:0] are display data. A0="L" : Indicates that signals on D[7:0] are command.
16-17	**NC**	---	No connection.
18	**SCL**	H/L	Serial clock signal.
19	**SDA**	H/L	Serial data input.
20	**NC**	---	No connection.
21-22	**VSS**	0V	Ground.
23-30	**NC**	---	No connection.
31	**VDD**	+3V	Power supply.
32	**K**	0V	Back light Power Negative supply
33	**A**	+3V	Back light Power Positive supply

3. BLOCK DIAGRAM



4. ABSOLUTE MAXIMUM RATINGS

(1)Electrical Absolute Ratings

Item	Symbol	Min.	Max.	Unit	Note
Power Supply for Logic	V_{DD}-V_{SS}	0	3.6	Volt	Note 1
Power Supply for LCD	V_{LCD}	0	9.0	Volt	
Input Voltage	V_I	0	V_{DD}	Volt	
Current for LED backlight	ILED		40	mA	

Note 1 : Operator should be grounded during handling LCM

（2）Environmental Absolute Maximum Ratings

Item	Normal Temperature				Wide Temperature			
	Operating		Storage		Operating		Storage	
	Min.	Max,	Min.	Max,	Min.	Max,	Min.	Max,
Ambient Temperature	0℃	+50℃	-10℃	+60℃	-20℃	+70℃	-30℃	+80℃
Humidity(without condensation)	Note 2,4		Note 3,5		Note 4,5		Note 4,6	

Note 2 Ta≦50℃: 80% RH max
Ta>50℃: Absolute humidity must be lower than the humidity of 85%RH at 50℃
Note 3 Ta at -20℃ will be<48hrs at 70℃will be <120hrs when humidity is higher than 75%.
Note 4 Background color changes slightly depending on ambient temperature. This phenomenon is reversible.
Note 5 Ta≦70℃: 75RH max
Ta>70℃: absolute humidity must be lower than the humidity of 75%RH at 70℃
Note 6 Ta at -20℃ will be <48hrs, at 80 ℃ will be <120hrs when humidity is higher than 75%.

5. ELECTRICAL CHARACTERISTICS

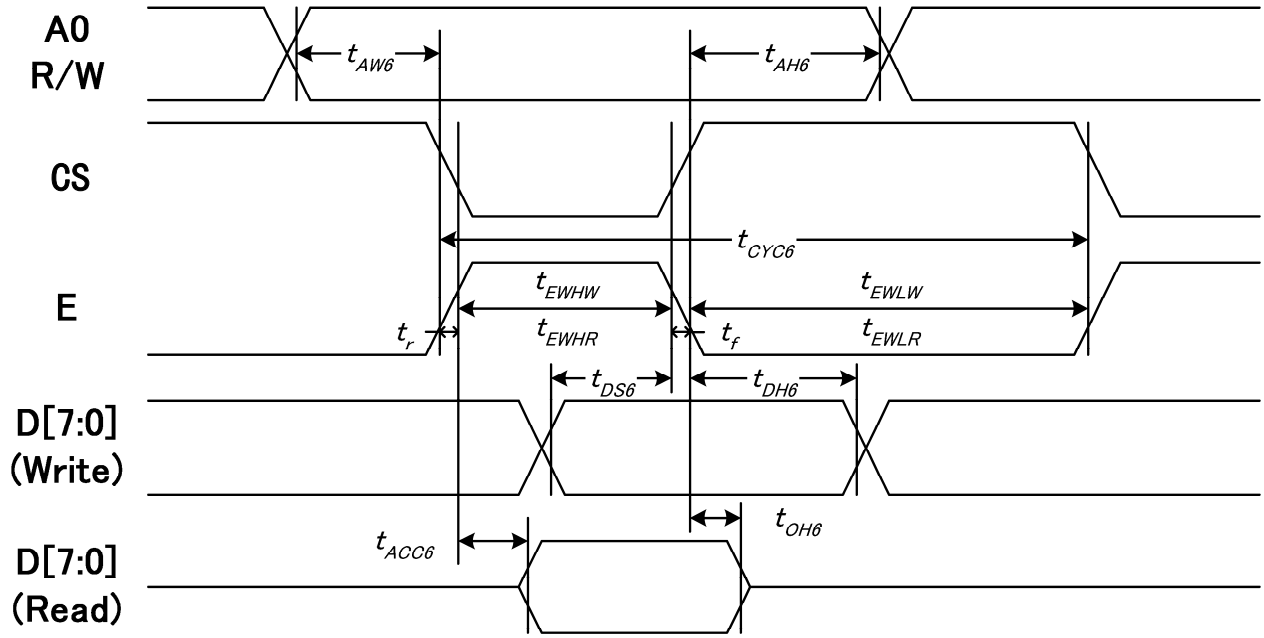
DC Characteristics (VDD=3.0V;VSS=0V; Ta=-10～60℃)

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Power Supply for Logic	V_{DD}-V_{SS}	---	---	3.0	3.47	Volt
Input Voltage	V_{IL}	---	VSS	---	0.3V_{DD}	Volt
	V_{IH}	---	0.7V_{DD}	---	V_{DD}	Volt
Output Voltage	V_{OH}	I_{OUT} =+1mA	0.8V_{DD}	---	V_{DD}	Volt
	V_{OL}	I_{OUT} = -1mA	VSS	---	0.2V_{DD}	Volt
LCM Recommend LCD Module Driving Voltage	V_{LCD}	T_a＝0℃	---	---	---	Volt
		T_a＝25℃	8.0	8.5	9.0	
		T_a＝50℃	---	---	---	
Power Supply Current for LCM	I_{DD}(B/L OFF)	---	0.8	1	TBD	mA
Power Supply for LED Backlight	V_{BLA}- V_{BLK}	Ta=25℃	---	3.0	3.2	V

AC Characteristics
System Bus Timing for 6800 Series MPU

Item	Signal	Symbol	Condition	Min.	Max.	Unit
Address setup time	A0	tAW6		0	—	ns
Address hold time		tAH6		10	—	

System cycle time	E	tCYC6		240	—	
Enable L pulse width (WRITE)		tEWLW		80	—	
Enable H pulse width (WRITE)		tEWHW		80	—	
Enable L pulse width (READ)		tEWLR		80	—	
Enable H pulse width (READ)		tEWHR		140		
Write data setup time	D[7:0]	tDS6		40	—	
Write data hold time		tDH6		10	—	
Read data access time		tACC6	CL = 16 pF	—	70	
Read data output disable time		tOH6	CL = 16 pF	5	50	

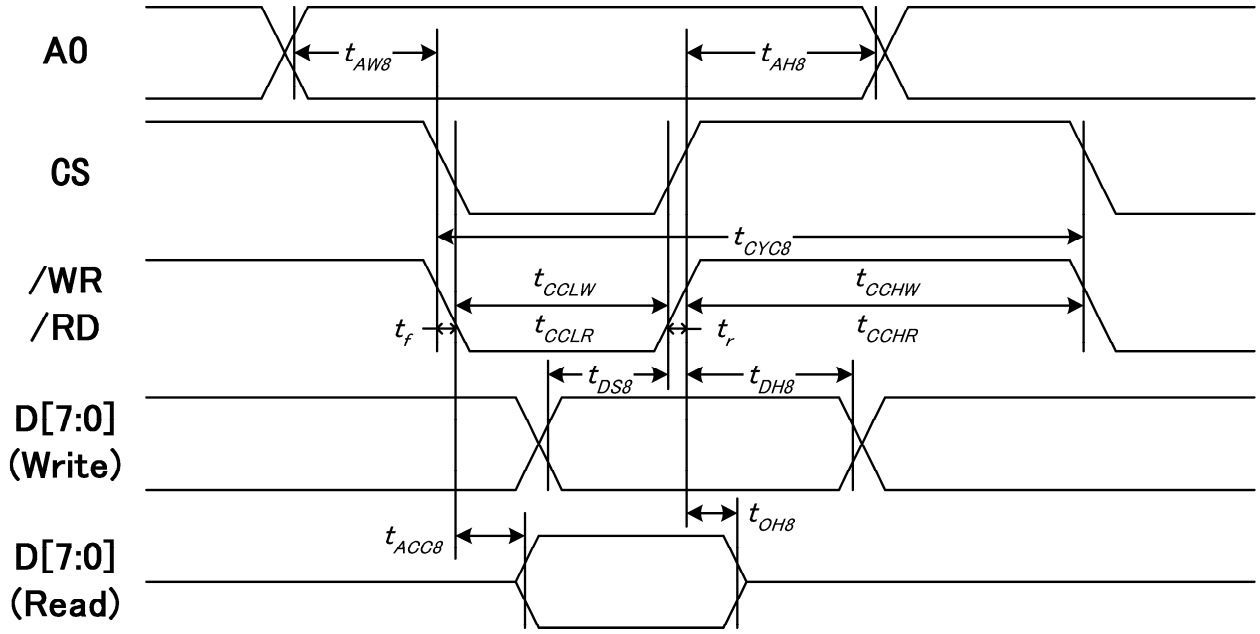


System Bus Timing for 8080 Series MPU

(VDD=3.3V, Ta=25℃)

Item	Signal	Symbol	Condition	Min.	Max.	Unit
Address setup time	A0	tAW8		0	—	ns
Address hold time		tAH8		10	—	
System cycle time	/WR	tCYC8		240	—	
/WR L pulse width (WRITE)		tCCLW		80	—	
/WR H pulse width (WRITE)		tCCHW		80	—	

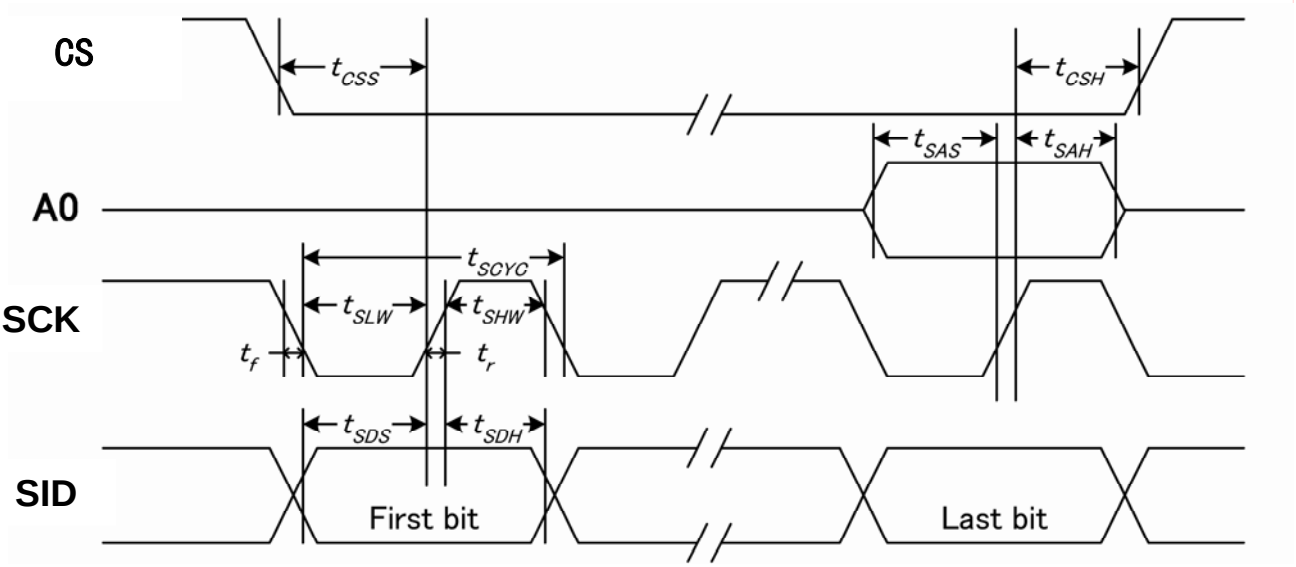
/RD L pulse width (READ)	RD	tCCLR		140	—	
/RD H pulse width (READ)		tCCHR		80		
WRITE Data setup time	D[7:0]	tDS8		40	—	
WRITE Data hold time		tDH8		20	—	
READ access time		tACC8	CL = 16 pF	—	70	
READ Output disable time		tOH8	CL = 16 pF	5	50	



System Bus Timing for 4-Line Serial Interface

Item	Signal	Symbol	Condition	Min.	Max.	Unit
Serial clock period	SCK	tSCYC		50	---	ns
SCLK “H” pulse width		tSHW		25	---	
SCLK “L” pulse width		tSLW		25	---	
Address setup time	A0	tSAS		20	---	
Address hold time		tSAH		10	---	
Data setup time	SID	tSDS		20	---	

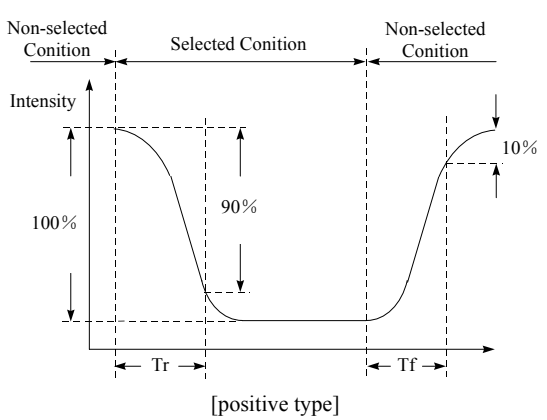
Data hold time		tSDH		10	---	
CS-SCLK time	CS	tCSS		20	---	
CS-SCLK time		tCSH		40	---	



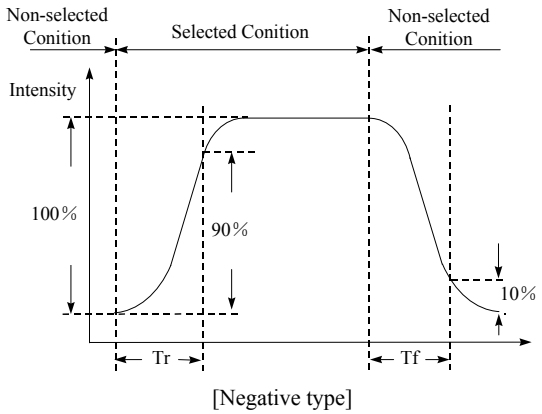
6. ELECTRO-OPTICAL CHARACTERISTICS

Item	Symbol	Condition	Min.	Typ.	Max.	Unit	note
Viewing angle range	θ_f (12 o'clock)	When Cr≧2	35	---	---	Degree	Note 2 Note 3 Note 4
	θ_b (6 o'clock)		30	---	---		
	θ_l (9 o'clock)		30	---	---		
	θ_r (3 o'clock)		30	35	---		
Rise Time	T_r	V_{DD}-V_0=8.7V Ta=25℃		112		mS	Note 1
Fall Time	T_f			250			
Contrast	Cr		---	5. 4	---		

[Note 1] Definition of Response Time (Tr, Tf)



[positive type]

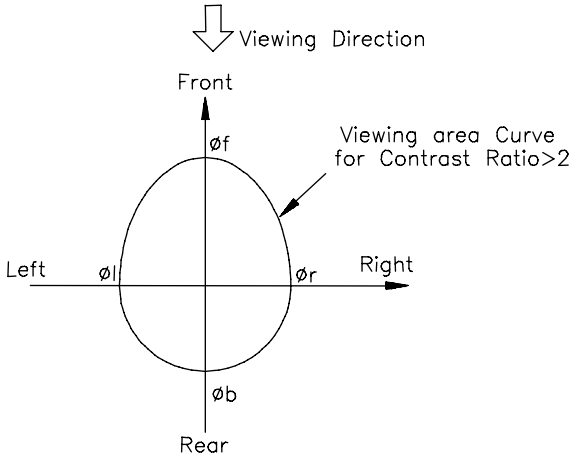


[Negative type]

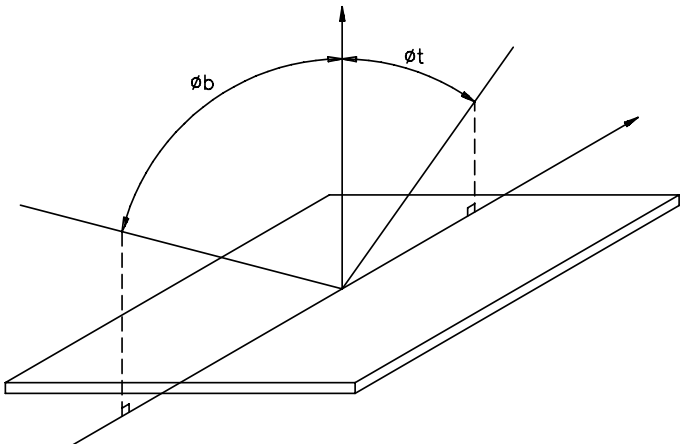
Conditions:

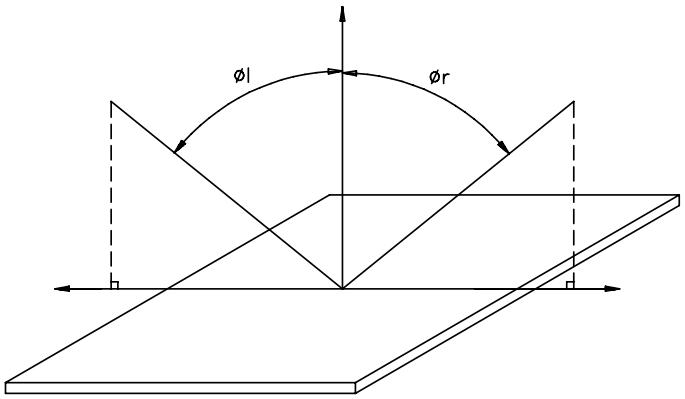
Operating Voltage : Vop
Frame Frequency : 64 Hz
Viewing Angle(θ , φ): 0° , 0°
Driving Wave form : 1/N duty, 1/a bias

[Note 2] Definition of Viewing Direction

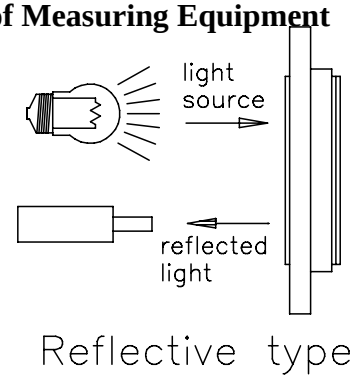


[Note 3] Definition of viewing angle

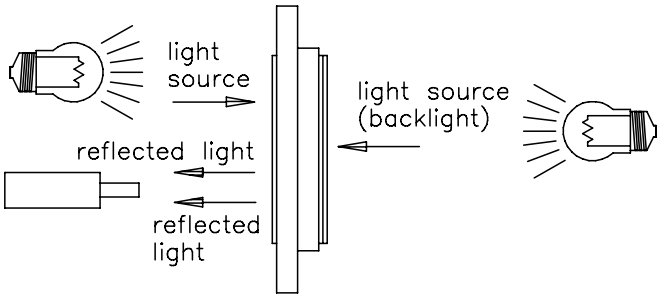




[Note 4] Description of Measuring Equipment



Reflective type



Transflective type

7. OPERATING PRINCIPLES & METHODS

INSTRUCTION	A0	R/W	COMMAND BYTE								DESCRIPTION
			D7	D6	D5	D4	D3	D2	D1	D0	
(1) Display ON/OFF	0	0	1	0	1	0	1	1	1	D	D=1, display ON D=0, display OFF
(2) Set Start Line	0	0	0	1	S5	S4	S3	S2	S1	S0	Set display start line
(3) Set Page Address	0	0	1	0	1	1	Y3	Y2	Y1	Y0	Set page address
(4) Set Column Address	0	0	0	0	0	1	X7	X6	X5	X4	Set column address (MSB)
	0	0	0	0	0	0	X3	X2	X1	X0	Set column address (LSB)
(5) Read Status	0	1	0	MX	D	RST	0	0	0	0	Read IC Status

(6) Write Data	1	0	D7	D6	D5	D4	D3	D2	D1	D0	Write display data to RAM
(7) Read Data	1	1	D7	D6	D5	D4	D3	D2	D1	D0	Read display data from RAM
(8) 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
(9) Inverse Display	0	0	1	0	1	0	0	1	1	INV	INV =1, inverse display INV =0, normal display
(10) All Pixel ON	0	0	1	0	1	0	0	1	0	AP	AP=1, set all pixel ON AP=0, normal display
(11) 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)
(12)Read-modify-Write	0	0	1	1	1	0	0	0	0	0	Column address increment: Read:+0 , Write:+1
(13) END	0	0	1	1	1	0	1	1	1	0	Exit Read-modify-Write mode
(14) RESET	0	0	1	1	1	0	0	0	1	0	Software reset
(15) COM Direction	0	0	1	1	0	0	MY	-	-	-	Set output direction of COM MY=1, reverse direction MY=0, normal direction
(16) Power Control	0	0	0	0	1	0	1	VB	VR	VF	Control built-in power circuit ON/OFF
(17) Regulation Ratio	0	0	0	0	1	0	0	RR2	RR1	RR0	Select regulation resistor ratio
(18) 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	
(19) Set Booster	0	0	1	1	1	1	1	0	0	0	Double command!! Set booster level: BL=0: 4X BL=1: 5X
	0	0	0	0	0	0	0	0	0	BL	
(20) Power Save	0	0	Compound Command								Display OFF + All Pixel ON
(21) NOP	0	0	1	1	1	0	0	0	1	1	No operation
(22) Test	0	0	1	1	1	1	1	1	1	-	Do NOT use. Reserved for testing.

NOTE: For more detail information, please refer to the ST7567's specification.

8. RELIABILITY

Environmental Test				
No.	**Test Item**	**Content of Test**	**Test Condition**	**Applicable Standard**
1	High temperature storage	Endurance test applying the high storage temperature for a long time.	80 °C 200 hrs	------
2	Low temperature storage	Endurance test applying the low storage temperature for a long time.	-30 °C 200 hrs	------
3	High temperature operation	Endurance test applying the electric stress (Voltage & Current) and the thermal stress	70 °C 200 hrs	------

		to the element for a long time.		
4	Low temperature operation	Endurance test applying the electric stress under low temperature for a long time.	-20 °C 200 hrs	------
5	High temperature / Humidity storage	Endurance test applying the high temperature and high humidity storage for a long time.	70 °C , 90 %RH 96 hrs	MIL-202E-103B JIS-C5023
6	High temperature / Humidity operation	Endurance test applying the electric stress (Voltage & Current) and temperature / humidity stress to the element for a long time.	50 °C , 90 %RH 96 hrs	MIL-202E-103B JIS-C5023
7	Temperature cycle	Endurance test applying the low and high temperature cycle. -10°C 30min ⇌ 25°C 5min. ⇌ 60°C 30min 1 cycle	-10°C / 60°C 10 cycles	------
Mechanical Test				
8	Vibration test	Endurance test applying the vibration during transportation and using.	10~22Hz → 1.5mmp-p 22~500Hz → 1.5G Total 0.5hrs	MIL-202E-201A JIS-C5025 JIS-C7022-A-10
9	Shock test	Constructional and mechanical endurance test applying the shock during transportation.	50G half sign wave 11 msedc 3 times of each direction	MIL-202E-213B
10	Atmospheric pressure test	Endurance test applying the atmospheric pressure during transportation by air.	115 mbar 40 hrs	MIL-202E-105C
Others				
11	Static electricity test	Endurance test applying the electric stress to the terminal.	VS=800V , RS=1.5 kΩ CS=100 pF 10 time	MIL-883B-3015.1

Inspection after test: Inspection after 2～4 hours storage at room temperature ,the sample shall be free from defects:

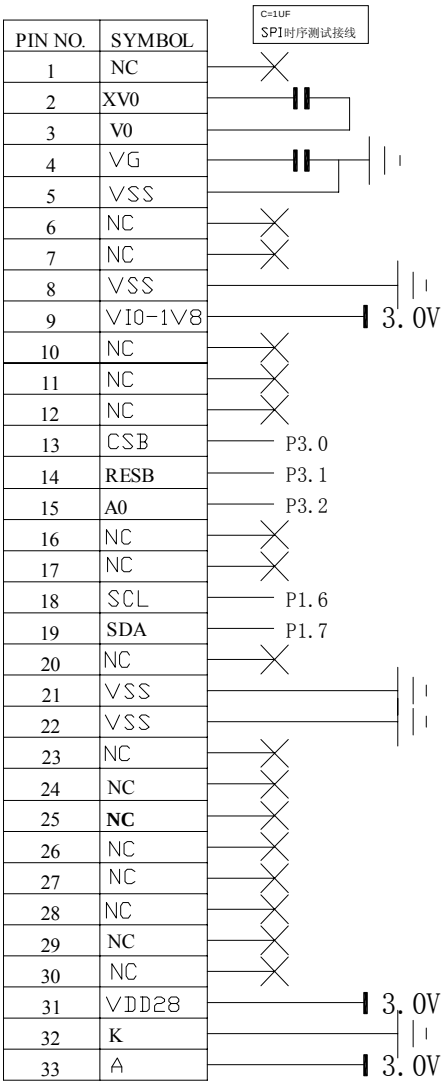
1. Air bubble in the LCD.
2. Sealleak
3. Non-display.
4. Missing segments.
5. Glass crack.
6. Current Idd is twice higher than initial value.

9. QUALITY GUARANTEE

No	Item	Criteria
1	inclusions (black spot, white spot, dust)	(1)round type diameter mm(a*) no of defect* a≦0.20 neglect 0.20＜a≦0.35 5max 0.35＜a none (2)linear type **length mm(l) width mm(W) no. of defect** na W≦0.03 neglect l≦3 0.03＜W≦0.08 6 3＜l 0.08＜W none
2	scratch	1.scratch on protective film is permitted. 2.scratch on polarizer shall be as follow: (1)round type diameter mm(a*) no of defect a≦0.15 neglect 0.15＜a≦0.20 2 max 0.20＜a none (2)linear type be judged bye 1.-(2) linear type
3	dent	diameter ＜ 1.5mm
4	bubble	not exceeding 0.5mm average diameter is acceptable between glass and polarizing film
5	pin hole	(a+b)/2 ≦ 0.15mm maximum number: ignored 0.15＜(a+b)/2≦0.20mm maximum number:10
6	dot width	design width ±15%
7	dot defect	(a+b)/2≦0.20mm maximum number: ignored 0.20＜(a+b)/2≦0.30mm maximum number:5 x=width
8	contrast irregularity(spot)	diameter spec no of defect a≦0.50mm neglect 0.50＜a≦0.75 5 0.75＜a≦1.00 3 1.00＜a none
9	color tone and uniformity	obvious uneven color is not permitted

10. Interface circuit and driving programme on LCM of dots matrix series .

（1）The Serial interface circuit:



（2）The serial programme of testing for the module

```
//C12864B图形点阵液晶模块参考程序
//控制IC:ST7565R/ST7567
//占用IC直线:S4-S131 C0-C63
//点阵数:128*64
#include <reg52.h>
#include <intrins.h>

#define uchar                                   unsigned char
#define uint                                    unsigned int
#define ulong                                   unsigned long

sbit lcm_si =P1^7;
sbit lcm_scl=P1^6;
```

```
sbit lcm_a0 =P3^2;                                   //L:command; H:data
sbit lcm_res=P3^1;                                   //L有效
sbit lcm_cs1=P3^0;                                   //L有效

uchar code tab1[]={
/*------------------------------------------------------------------------------
;  源文件 / 文字 : F:\招财猫12864.bmp
;  宽×高（像素）: 128×64
------------------------------------------------------------------------------*/
0xFF,0x03,0x01,0x01,0x01,0x01,0x01,0x01,0x01,0x01,0x01,0x01,0x01,0x01,0x01,0x01,
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0xC0,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x80,0xC0,
0xE0,0x70,0x38,0x9C,0xCC,0xCC,0x18,0x30,0x60,0xC0,0x80,0x00,0x00,0x00,0x00,0xFF,
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0xF1,0x01,0xE3,0x27,0x0E,0xFC,0x60,0x00,0x00,0x11,0x21,0x1F,0x00,0x00,0x00,0x3F,
0x11,0x11,0x11,0x11,0x11,0x3F,0x00,0x00,0x00,0x60,0xFC,0x0E,0x27,0xE3,0x01,0xF1,
0x11,0xF1,0x33,0xF2,0xFF,0x03,0x00,0x00,0x0F,0x0F,0x8F,0x8F,0x8F,0x8F,0x80,0x40,
0x83,0x27,0x4E,0x0E,0x0E,0x0E,0x0E,0x0E,0x0E,0x0E,0x0E,0x0E,0x4E,0x2F,0x87,0x43,
0x80,0x80,0x9E,0x9F,0x9F,0x1F,0x1F,0x1E,0x00,0x00,0x07,0xDC,0xE0,0x00,0x00,0xFF,
0xFF,0xF8,0xFF,0x0F,0x00,0x00,0x00,0x00,0x00,0x00,0x38,0x44,0x92,0xBA,0xBA,0x92,
0x45,0x38,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x38,
0x45,0x92,0xBA,0xBA,0x92,0x44,0x38,0x00,0x00,0x00,0x00,0x01,0x0F,0xFC,0xE1,0x00,
0x01,0x00,0x00,0x00,0x0E,0xFF,0xC0,0x00,0x00,0xFE,0x4A,0x4A,0x4A,0xFE,0x00,0x08,
0x08,0x08,0xC8,0x38,0xFF,0x08,0x08,0x00,0x00,0xC0,0xFF,0x0E,0x00,0x00,0x00,0x01,
0x00,0xE1,0xFC,0x0F,0x01,0x00,0x00,0x00,0x00,0x38,0x44,0x92,0xBA,0xBA,0x92,0x45,
0x38,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x38,0x45,
0x92,0xBA,0xBA,0x92,0x44,0x38,0x00,0x00,0x00,0x00,0x00,0x00,0x0F,0xFF,0xF8,0xFF,
0xFF,0x1F,0xFF,0xFC,0xC0,0x00,0x04,0xA8,0x48,0x48,0x48,0x48,0x48,0x48,0x48,0x48,
0x48,0x90,0x00,0x00,0x00,0x00,0x00,0x38,0xFC,0xF8,0x38,0x38,0x00,0x00,0x00,0x00,
0x00,0x48,0x24,0x24,0x24,0xA4,0xA4,0xA4,0xA4,0xA4,0x52,0x00,0x80,0x7F,0x1F,0x00,
0x00,0x18,0x00,0x00,0xF8,0xFD,0xFF,0x5C,0x00,0x23,0x1A,0x02,0x02,0x0B,0x30,0x04,
0x02,0x11,0x20,0x20,0x1F,0x00,0x00,0x00,0x5C,0xFF,0xFD,0xF8,0x00,0x00,0x18,0x00,
0x00,0x1F,0x7F,0x80,0x00,0x52,0xA4,0xA4,0xA4,0xA4,0xA4,0x24,0x24,0x24,0x48,0x00,
0x00,0x00,0x00,0x00,0x38,0x38,0xF8,0xFC,0x38,0x00,0x00,0x00,0x00,0x00,0x90,0x48,
0x48,0x48,0x48,0x48,0x48,0x48,0x48,0x48,0xA8,0x04,0x00,0xC0,0xFC,0xFF,0x1F,0xFF,
0xFF,0x00,0x00,0x01,0x07,0x0F,0xFE,0xF8,0xF1,0xE1,0xC1,0xC1,0x81,0x01,0x01,0x02,
0x22,0x34,0x30,0x30,0x18,0x18,0x0E,0x03,0x01,0x00,0x03,0x04,0x08,0x18,0x30,0x30,
0x30,0x80,0x82,0x81,0xC1,0xC0,0xE0,0xE0,0xF0,0xF0,0x7C,0x3E,0x03,0x00,0x00,0x00,
0x00,0x00,0x00,0x00,0xF0,0x3D,0x07,0x00,0x00,0x24,0x2C,0x92,0x56,0xE9,0x04,0xC4,
0x44,0x5F,0xC4,0x44,0x5F,0xC4,0x04,0x00,0x00,0x07,0x3D,0xF0,0x00,0x00,0x00,0x00,
0x00,0x00,0x00,0x03,0x3E,0x7C,0xF0,0xF0,0xE0,0xE0,0xC0,0xC1,0x81,0x82,0x80,0x30,
```

```
0x30,0x30,0x18,0x08,0x04,0x03,0x00,0x01,0x03,0x0E,0x18,0x18,0x30,0x30,0x34,0x22,
0x02,0x01,0x01,0x81,0xC1,0xC1,0xE1,0xF1,0xF8,0xFE,0x0F,0x07,0x01,0x00,0x00,0xFF,
0xFF,0x00,0x00,0x00,0x30,0x3E,0x07,0x01,0x03,0x07,0x0F,0x0F,0x0F,0x0F,0x3F,0x1F,
0x3F,0x3E,0x3E,0x3E,0x3E,0x3E,0x3E,0x3E,0x3E,0x3E,0x3F,0x3F,0x3F,0x3F,0x3F,0x1F,
0x3F,0x3F,0x3F,0x3F,0x1F,0x1F,0x3F,0x3F,0x3F,0x1E,0x00,0x00,0x00,0x00,0x00,0x00,
0x00,0x00,0x3E,0x3F,0x36,0x00,0x00,0x00,0x00,0x09,0x09,0x14,0x22,0x1F,0x00,0x3F,
0x12,0x12,0x1F,0x12,0x12,0x3F,0x00,0x00,0x00,0x00,0x00,0x36,0x3F,0x3E,0x00,0x00,
0x00,0x00,0x00,0x00,0x00,0x00,0x1E,0x3F,0x3F,0x3F,0x1F,0x1F,0x3F,0x3F,0x3F,0x3F,
0x1F,0x3F,0x3F,0x3F,0x3F,0x3F,0x3E,0x3E,0x3E,0x3E,0x3E,0x3E,0x3E,0x3E,0x3E,0x3F,
0x1F,0x3F,0x0F,0x0F,0x0F,0x0F,0x07,0x03,0x01,0x07,0x3E,0x30,0x00,0x00,0x00,0xFF,
0xFF,0xC0,0x80,0x80,0x80,0x80,0x80,0x80,0x80,0x80,0x80,0x80,0x80,0x80,0x80,0x80,
0x80,0x80,0x80,0x80,0x80,0x80,0x80,0x80,0x80,0x80,0x80,0x80,0x80,0x80,0x80,0x80,
0x80,0x80,0x80,0x80,0x80,0x80,0x80,0x80,0x80,0x80,0x80,0x80,0x80,0x80,0x80,0x80,
0x80,0x80,0x80,0x80,0x80,0x80,0x80,0x80,0x80,0x80,0x80,0x80,0x80,0x80,0x80,0x80,
0x80,0x80,0x80,0x80,0x80,0x80,0x80,0x80,0x80,0x80,0x80,0x80,0x80,0x80,0x80,0x80,
0x80,0x80,0x80,0x80,0x80,0x80,0x80,0x80,0x80,0x80,0x80,0x80,0x80,0x80,0x80,0x80,
0x80,0x80,0x80,0x80,0x80,0x80,0x80,0x80,0x80,0x80,0x80,0x80,0x80,0x80,0x80,0x80,
0x80,0x80,0x80,0x80,0x80,0x80,0x80,0x80,0x80,0x80,0x80,0x80,0x80,0x80,0xC0,0xFF};

uchar code tab2[]={
/*--------------------------------------------------------------------------------
;  源文件 / 文字 : E:\12864.bmp
;  宽×高（像素）: 128×64
--------------------------------------------------------------------------------*/
0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,
0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,
0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,
0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,
0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,
0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,
0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,
0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,
0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,
0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,
0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,
0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,
0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,
0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,
0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,
0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,
0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,
0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,
0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,
0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,
0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,
0x80,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,
0x80,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,
0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,
0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,
0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x04,0x04,0xFE,0x00,0x00,0x00,
0x00,0x00,0x0C,0x02,0x82,0x42,0x22,0x1C,0x00,0x00,0x9C,0x62,0x22,0x22,0x62,0x9C,
0x00,0x90,0x90,0x60,0xFC,0x60,0x90,0x90,0x00,0x00,0xF8,0x44,0x22,0x22,0x26,0xC0,
0x00,0x00,0xE0,0x90,0x88,0xFE,0x80,0x80,0x00,0x00,0x00,0x00,0xF0,0x10,0x10,0x10,
0x1F,0x12,0x12,0x12,0xF2,0x02,0x00,0x00,0x00,0xFF,0x01,0x19,0xE7,0x00,0x32,0x2E,
0x23,0xFA,0x22,0x22,0x22,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,
```

```
0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,
0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,
0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x04,0x04,0x07,0x04,0x04,0x00,
0x00,0x00,0x06,0x05,0x04,0x04,0x04,0x06,0x00,0x00,0x03,0x04,0x04,0x04,0x04,0x03,
0x00,0x00,0x00,0x00,0x03,0x00,0x00,0x00,0x00,0x00,0x03,0x04,0x04,0x04,0x04,0x03,
0x00,0x00,0x00,0x00,0x04,0x07,0x04,0x04,0x00,0x00,0x10,0x0C,0x01,0x01,0x05,0x19,
0x01,0x05,0x19,0x01,0x05,0x18,0x00,0x00,0x00,0x1F,0x01,0x02,0x01,0x01,0x01,0x01,
0x01,0x1F,0x01,0x01,0x01,0x01,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,
0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,
0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,
0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,
0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,
0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,
0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,
0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,
0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,
0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,
0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,
0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,
0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,
0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,
0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,
0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,
0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,
0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,
0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,
0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,
0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,
0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,
0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,
0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,
0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,
0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00};

//..........延时n毫秒..........
void delay_n_ms(uint ms)
{
        uint i,j;
        for(i=0;i<ms;i++)
                for(j=0;j<123;j++);
}
//..........串口写..........
void serial_write(uchar lcm_cmd_or_data)
{
        uchar i;
        lcm_scl=1;
        lcm_cs1=0;
        for(i=0;i<8;i++)
        {
                if((lcm_cmd_or_data&0x80)==0x80)
                        lcm_si=1;
                else
                        lcm_si=0;
                lcm_scl=0;
                _nop_();
```

```
            _nop_();
            lcm_scl=1;
            lcm_cmd_or_data=lcm_cmd_or_data<<1;
        }
        lcm_cs1=1;
}
//.....写命令.....
void send_cmd(uchar lcm_cmd)
{
        lcm_a0=0;
        serial_write(lcm_cmd);
}
//.....写数据到DDRAM.....
void send_data(uchar lcm_data)
{
        lcm_a0=1;
        serial_write(lcm_data);
}
//.....写页地址.....
void set_page_address(uchar page_addr)
{
        send_cmd(page_addr|0xb0);
}
//.....写列地址.....
void set_column_address(uchar clm_addr)
{
        send_cmd((clm_addr>>4)|0x10);       //送列地址高四位
        send_cmd(clm_addr&0x0f);            //送列地址低四位
}
//.....初始化.....
void lcm_init(void)
{
        delay_n_ms(5);
        lcm_res=0;
        delay_n_ms(20);
        lcm_res=1;
        delay_n_ms(20);
        send_cmd(0xa0);
        send_cmd(0xc8);
        send_cmd(0xa2);
        send_cmd(0x2c);
        send_cmd(0x2e);
        send_cmd(0x2f);
        send_cmd(0x25);
        send_cmd(0x04);
        send_cmd(1);          //25&28&38
        send_cmd(0xaf);
        send_cmd(0xe0);
        send_cmd(0x40);
}
//.....显示点阵.....
void disp_lattice(uchar lcm_data1,uchar lcm_data2)
{
        uchar i,j;
        for(i=0;i<8;i++)
```

```
                                        {
                                                set_page_address(i);
                                                set_column_address(0x04);
                                                for(j=0;j<64;j++)
                                                {
                                                        send_data(lcm_data1);
                                                        send_data(lcm_data2);
                                                }
                                        }
}
//.....显示图形.....
void disp_graphics(uchar code *gph)
{
                                        uchar i,j;
                                        for(i=0;i<8;i++)
                                        {
                                                set_page_address(i);
                                                set_column_address(0x04);
                                                for(j=0;j<128;j++)
                                                {
                                                        send_data(*(gph+i*128+j));
                                                }
                                        }
}
//.....主程序.....
void main(void)
{
                                        lcm_init();
                                        while(1)
                                        {
                                                disp_graphics(tab1);
                                                delay_n_ms(1000);
                                                disp_graphics(tab2);
                                                delay_n_ms(1000);

                                                disp_lattice(0xff,0xff);
                                                delay_n_ms(1000);

                                                disp_lattice(0x55,0x55);
                                                delay_n_ms(1000);
                                                disp_lattice(0xaa,0xaa);
                                                delay_n_ms(1000);

                                                disp_lattice(0xff,0x00);
                                                delay_n_ms(1000);
                                                disp_lattice(0x00,0xff);
                                                delay_n_ms(1000);
                                        }
}
```

11. USING LCD MODULES

11-1. Liquid Crystal Display Modules

LCD is composed of glass and polarizer. Pay attention to the following items when handling.

(1) Please keep the temperature within specified range for use and storage. Polarization degradation, bubble generation or polarizer peel-off may occur with high temperature and high humidity.

(2) Do not touch, push or rub the exposed polarizers with anything harder than an HB pencil lead (glass, tweezers, etc.).

(3) N-hexane is recommended for cleaning the adhesives used to attach front/rear polarizers and reflectors made of organic substances which will be damaged by chemicals such as acetone, toluene, ethanol and isopropylalcohol.

(4) When the display surface becomes dusty, wipe gently with absorbent cotton or other soft material like chamois soaked in petroleum benzin. Do not scrub hard to avoid damaging the display surface.

(5) Wipe off saliva or water drops immediately, contact with water over a long period of time may cause deformation or color fading.

(6) Avoid contacting oil and fats.

(7) Condensation on the surface and contact with terminals due to cold will damage, stain or dirty the polarizers. After products are tested at low temperature they must be warmed up in a container before coming is contacting with room temperature air.

(8) Do not put or attach anything on the display area to avoid leaving marks on.

(9) Do not touch the display with bare hands. This will stain the display area and degradate insulation between terminals (some cosmetics are determinated to the polarizers).

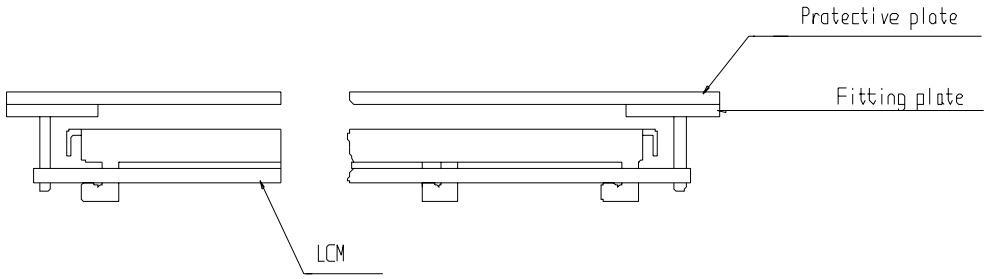
(10) As glass is fragile. It tends to become or chipped during handling especially on the edges. Please avoid dropping or jarring.

11-2.Installing LCD Modules

The hole in the printed circuit board is used to fix LCM as shown in the picture below. Attend to

the following items when installing the LCM.

(1) Cover the surface with a transparent protective plate to protect the polarizer and LC cell.



(2) When assembling the LCM into other equipment, the spacer to the bit between the LCM and the fitting plate should have enough height to avoid causing stress to the module surface, refer to the individual specifications for measurements. The measurement tolerance should be ±0.1mm.

11-3. Precaution for Handing LCD Modules

Since LCM has been assembled and adjusted with a high degree of precision, avoid applying excessive shocks to the module or making any alterations or modifications to it.

(1) Do not alter, modify or change the shape of the tab on the metal frame.

(2) Do not make extra holes on the printed circuit board, modify its shape or change the positions of components to be attached.

(3) Do not damage or modify the pattern writing on the printed circuit board.

(4) Absolutely do not modify the zebra rubber strip (conductive rubber) or heat seal connector.

(5) Except for soldering the interface, do not make any alterations or modifications with a soldering iron.

(6) Do not drop, bend or twist LCM.

LCM is easy to be damaged. Please note below and be careful for handling.

Correct handling:

As above picture, please handle with anti-static gloves around LCM edges.

Incorrect handling:

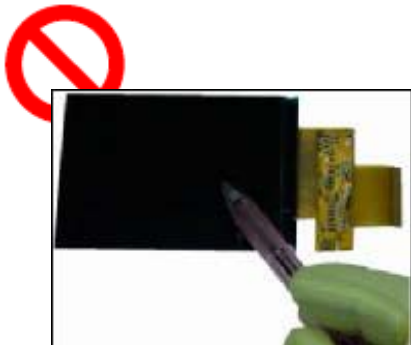
Please don’t touch IC directly.

Please don’t stack LCM.

Please don’t hold the surface of panel.

Please don’t stretch interface of output, such as FPC cable.

Please don’t hold the surface of IC.



Please don’t operate with sharp stick such as pens。

11-4.Electro-Static Discharge Control

Since this module uses a CMOS LSI, the same careful attention should be paid to electrostatic discharge as for an ordinary CMOS IC.

(1) Make certain that you are grounded when handing LCM.

(2) Before remove LCM from its packing case or incorporating it into a set, be sure the module and your body have the same electric potential.

(3) When soldering the terminal of LCM, make certain the AC power source for the soldering iron does not leak.

(4) When using an electric screwdriver to attach LCM, the screwdriver should be of ground potentiality to minimize as much as possible any transmission of electromagnetic waves produced sparks coming from the commutator of the motor.

(5) As far as possible make the electric potential of your work clothes and that of the work bench the ground potential.

(6) To reduce the generation of static electricity be careful that the air in the work is not too dried. A relative humidity of 50%-60% is recommended.

11-5. Precaution for soldering to the LCM

(1) Observe the following when soldering lead wire, connector cable and etc. to the LCM.

- Soldering iron temperature : 280°C ± 10°C.
- Soldering time : 3-4 sec.
- Solder : eutectic solder.

If soldering flux is used, be sure to remove any remaining flux after finishing to soldering operation. (This does not apply in the case of a non-halogen type of flux.) It is recommended that you protect the LCD surface with a cover during soldering to prevent any damage dur to flux spatters.

(2) When soldering the electroluminescent panel and PC board, the panel and board should not be detached more than three times. This maximum number is determined by the temperature and

time conditions mentioned above, though there may be some variance depending on the temperature of the soldering iron.

(3) When remove the electoluminescent panel from the PC board, be sure the solder has completely melted, the soldered pad on the PC board could be damaged.

11-6.Precautions for Operation

(1) Viewing angle varies with the change of liquid crystal driving voltage (VO). Adjust VO to show the best contrast.

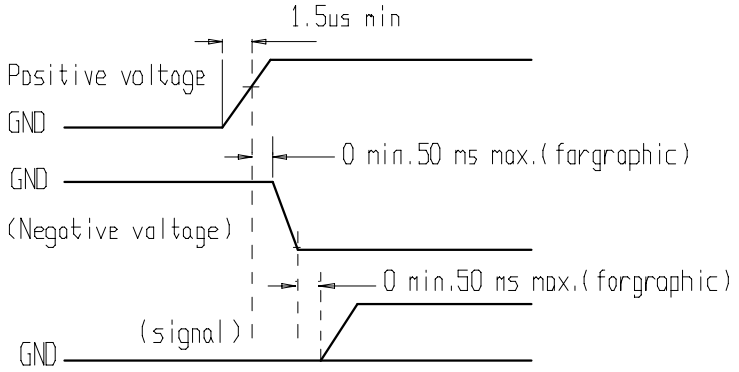
(2) Driving the LCD in the voltage above the limit shortens its life.

(3) Response time is greatly delayed at temperature below the operating temperature range. However, this does not mean the LCD will be out of the order. It will recover when it returns to the specified temperature range.

(4) If the display area is pushed hard during operation, the display will become abnormal. However, it will return to normal if it is turned off and then back on.

(5) Condensation on terminals can cause an electrochemical reaction disrupting the terminal circuit. Therefore, it must be used under the relative condition of 40°C , 50% RH.

(6) When turning the power on, input each signal after the positive/negative voltage becomes stable.



11-7. Storage

When storing LCDs as spares for some years, the following precaution are necessary.

(1) Store them in a sealed polyethylene bag. If properly sealed, there is no need for dessicant.

(2) Store them in a dark place. Do not expose to sunlight or fluorescent light, keep the temperature between 0°C and 35°C.

(3) The polarizer surface should not come in contact with any other objects. (We advise you to store them in the container in which they were shipped.)

(4) Environmental conditions :

- Do not leave them for more than 168hrs. at 60°C.
- Should not be left for more than 48hrs. at -20°C.

11-8. Safety

(1) It is recommended to crush damaged or unnecessary LCDs into pieces and wash them off with solvents such as acetone and ethanol, which should later be burned.

(2) If any liquid leakes out of a damaged glass cell and comes in contact with the hands, wash off thoroughly with soap and water.

11-9.Return LCM under warranty

No warranty can be granted if the precautions stated above have been disregarded. The typical examples of violations are :

- Broken LCD glass.
- PCB eyelet's damaged or modified.
- PCB conductors damaged.

- Circuit modified in any way, including addition of components.
- PCB tampered with by grinding, engraving or painting varnish.
- soldering to or modifying the bezel in any manner.

Module repairs will be invoiced to the customer upon mutual agreement. Modules must be returned with sufficient description of the failures or defects. Any connectors or cable installed by the customer must be removed completely without damaging the PCB eyelet's, conductors and terminals.