SPECIFICATIONS FOR LCD MODULE

MODEL NO.
BO12864D1-FPHNW$
VER.01

FOR MESSRS:

_____

ON DATE OF:

_____

APPROVED BY:

_____

BOLYMIN, INC.
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History of Version

Version	Contents	Date	Note
01	NEW VERSION	2020/11/11	SPEC.

BOLYMIN

C O N T E N T S

BOLYMIN

1. Numbering System

B	O	12864	D1	-	F	P	H	N	W		$	
0	1	2	3		4	5	6	7	8	9	10	11

0	Bolymin	B				
1	Module Type	C	Character type	P	TAB /TCP type	
		F	COF type	R	Color STN	
		G	Graphic type	L	OLED	
		O	COG type	Z	Customize	
2	Format	2004	20 character type,4lines			
		12232	122 × 32 dots			
3	Version No.	A				
	-					
4	LCD Color	B	STN / Blue, OLED/Blue	H	HTN	
		C	Color	T	TN	
		F	FSTN	Y	STN/Yellow-green	
		G	STN/Grey	D	OLED/Blue+Yellow	
		A	OLED/Blue+Yellow+Green	E	OLED/Yellow	
		L	OLED/Green	R	OLED/RED	
		W	OLED/White	J	ASTN	
		K	DFSTN	V	VA LCD	
5	LCD Type	R	Positive/reflective	M	Positive/ transmissive	
		P	Positive/transflective	N	Negative/ transmissive	
		T	Negative/ transflective			
6	Backlight type/color	L	(LED)Array/yellow-green	G	(LED)Edge/yellow-green	
		M	(LED)Array/amber	H	(LED)Edge/white	
		R	(LED)Array/red	D	(LED)Edge/blue	
		U	(LED)Array/blue	E	(EL)white	
		W	(LED)Array/white	B	(EL)blue	
		C	(CCFL)white	F	(LED)Array/RGB	
		Y	(LED)Array/yellow	N	No backlight	
		O	(LED)Array/orange	K	(LED)Edge/green	
		A	(LED)Edge/amber	Q	(LED)Edge/red	
		J	(LED)Array/green	I	(LED)Edge/RGB	
		Z	(LED)Array Red/YG	P	(LED)Edge/orange	

		S	(LED)edge/RGW	T	(LED)edge red/green
		V	EL blue/green`	X	(LED) Edge white / red
7	CGRAM Font	J	English/Japanese Font	C	English/Cyrillic Font
		G	Chinese (Simple)	H	English/Hebrew Font
		E	English/European Font	B	English/Japanese/European
		F	Chinese (Traditional)	N	Without Font
		Z	Z=Chinese(simple)+Chinese (traditional)+Japanese+Korean	K	Korean (only for BG16032A BG24064C)
		A	English/Arabic Font	D	Chinese (simple/traditional) English/Japanese
		B	English/Japanese/European	N	None
8	View Angle /Operation Temperature	B	6:00 /Normal Temperature	W	12:00 /Wide Temperature
		H	6:00 /Wide Temperature	E	12:00 /Ultra Temperature
		C	9:00 /Normal Temperature	U	6:00/Ultra wide Temperature
		T	12:00 /Normal Temperature	F	9:00/Ultra wide Temperature
		G	3:00 /Wide Temperature	D	9:00 /Wide Temperature
		I	3H/ Ultra Wide Temperature 3:00		
9	Special Code	N	Negative voltage for LCD	T	Negative voltage and Temperature compensation for LCD
		P	Touch panel	3/5	3/5 voltage logic power supply
10	RoHS	$			
11					

2. Handling Precaution

2.1 Precaution in use of LCD Module

2.1.1. LCD panel is made of glass. Avoid excessive mechanical shock or applying strong pressure and/or sharp tools on the surface of display area.

2.1.2. The polarizer placed on the display surface is easily scratched and damaged. Extreme care should be taken when handling it. To clean dust or dirt off the display surface, wipe gently with cotton, or other soft material soaked with isopropyl alcohol, ethyl alcohol, do not use water, ketone or aromatics to clear display surface, and never scrub it hard.

2.1.3. Keep LCD panels away from direct sunlight. The storage environment should be dust-free, clean, dry, temperature is 25℃±10℃ and the humidity is below 55% RH.

2.1.4. Do not input any signal before power is turned on.

2.1.5. 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.

2.1.6. It's important to control soldering temperature and time. RoHS compliant materials might need higher temperature and time, but try to keep temperature under 350℃ and time in 3-5 sec.

2.1.7. EL is manufactured from the organic film, and is easily affected by temperature, humidity and other environmental impact. Long time storage might cause low quality of the case. Therefore, please start production in 3 months after reception of the LCM. If in any case, long time storage over 3 months is necessary, please keep EL in vacuum package or at least in humidity < 35% RH, and temperature 25℃±10℃.

Note: 2.1.7. is applied to EL backlight only.

2.2 Static Electricity Precautions:

2.2.1. The LCD module contains a C-MOS LSI. People who operate the LCM should wear ESD protection equipment to prevent ESD hurt on products.

2.2.2. 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.

2.2.3. Do not touch the connection terminals of the display with bare hand; it will cause disconnection or defective insulation of terminals.

2.2.4. The modules should be kept in anti-static bags or trays for storage.

2.2.5. Only properly grounded soldering irons should be used.

2.2.6. If an electric screwdriver is used, it should be grounded and shielded to prevent sparks.

2.2.7. The normal static prevention measures should be observed for work clothes and working benches.

2.2.8. Since dry air(almost low RH) is inductive to static, a humidity of 50-60% RH is recommended in assembly line.

2.3 Operation Precautions:

2.3.1. DC voltage applied on LCM causes electrochemical reactions, which will deteriorate the display over time. The applied pulse waveform should be a symmetric waveform such that no DC component remains. Be sure to use the specified operating voltage.

2.3.2. LCD driving voltage should be kept within specified range; excess voltage will shorten display life, while less voltage may not turn on LCM.

2.3.3. LCM response time will be extremely delayed in low operating temperature(such as -20℃) than in room operating temperature. Therefore, higher LCD driving voltage is required in low operating temperature; On the other hand, in high operating temperature (such as +70℃) LCD shows dark background color, therefore lower LCD driving voltage is required. Be sure to use the specified LCD driving voltage in different operating temperature.

2.4 Safety:

2.4.1 If the LCD panel breaks, be careful not to get the liquid crystal to touch your skin. If the liquid crystal touches your skin or clothes, please wash it off immediately by using soap and water.

2.5 WARRANTY POLICY

Bolymin .Will provide one-year warranty for the products only if under specification operating conditions.
If there are functional defects found during the period of warranty, the defective products would be replaced on a one-to-one basis.
Bolymin would not be responsible for any direct/indirect liabilities consequential to any parties.

2.6 MTBF

2.6.1 .By specific test condition, MTBF based on 30℃normal operation temperature is 50,000hours.

2.6.2 Test Condition:

2.6.2.1 Supply Voltage for LCM: Typical Vdd

2.6.2.2 CC (Constant Current) mode and typical current is applied for LED.

2.6.2.3 Run-Patterns: by Bolymin's test program that has defined patterns and cyclic period.

2.6.2.4 Humidity: 60%RH

2.6.3 Test Criteria:

Attenuation of average brightness: ≦ 50%

Increasing of current consumption for LCM/Backlight: ≦ 20%

Display function at room temperature: Normal

Appearance: Normal

3. General Specification

(1) Mechanical Dimension

Item	Dimension	Unit
Number of Dots	128 x 64	dots
Module dimension (L x W x H)	52.0x 92.5 x 4.65-LED B/L	mm
View area	48.0 x 31.0	mm
Active area	44.77x 27.49	mm
Dot size	0.32x 0.4	mm
Dot pitch	0.35 x 0.43	mm

(2) Controller IC: ST7541i controller

4. Absolute Maximum Ratings

4.1 Electrical Absolute Maximum Ratings

(Vss=0V, Ta=25℃)

Item	Symbol	Min	Max	Unit
Supply Voltage For Logic	Vdd-Vss	1.8	3.3	V
Supply Voltage For LCD	Vo-Vss	3.5	15	V

4.2 Environmental Absolute Maximum Ratings

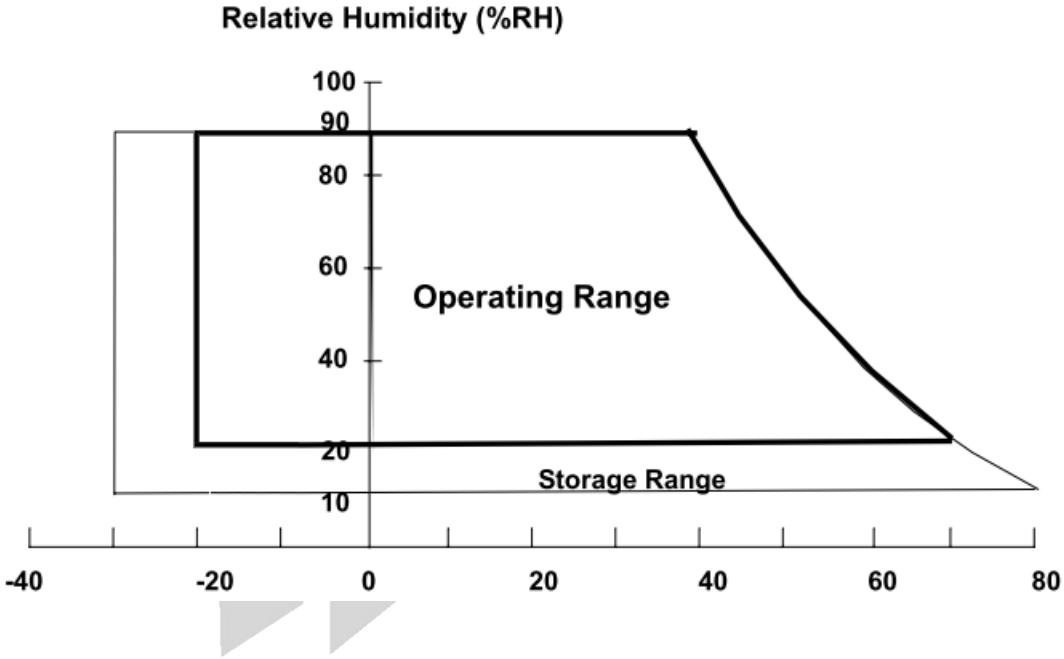
Item	Symbol	Min	Max	Unit	Note
Operating Temperature	TOP	-20	70	℃	(1)
Storage Temperature	TST	-30	80	℃	(1)

Note (1)

(a) 90 %RH Max. (Ta <= 40 ºC).

(b) Wet-bulb temperature should be 39 ºC Max. (Ta > 40 ºC).

(c) No condensation.



5. Electrical Characteristics

Item	Symbol	Condition	Min	Typ	Max	Unit
Supply Voltage For Logic	Vdd-Vss	—	1.8	3.0	3.3	V
Supply Voltage For LCD	Vo-Vss	Ta=25℃	8.7	9.0	9.3	V
Input High Volt.	V_{IH}	—	0.7*Vdd	—	Vdd	V
Input Low Volt.	V_{IL}	—	Vss	—	0.3*Vdd	V
Output High Volt.	V_{OH}	—	0.7*Vdd	—	Vdd	V
Output Low Volt.	V_{OL}	—	Vss	—	0.3*Vdd	V
Supply Current	Idd	Vdd=3.0V	—	0.5	—	mA
LCM Surface Luminance Ta=25℃	L	I_{LED}=60mA Display all OFF	63	94	—	cd/m^2

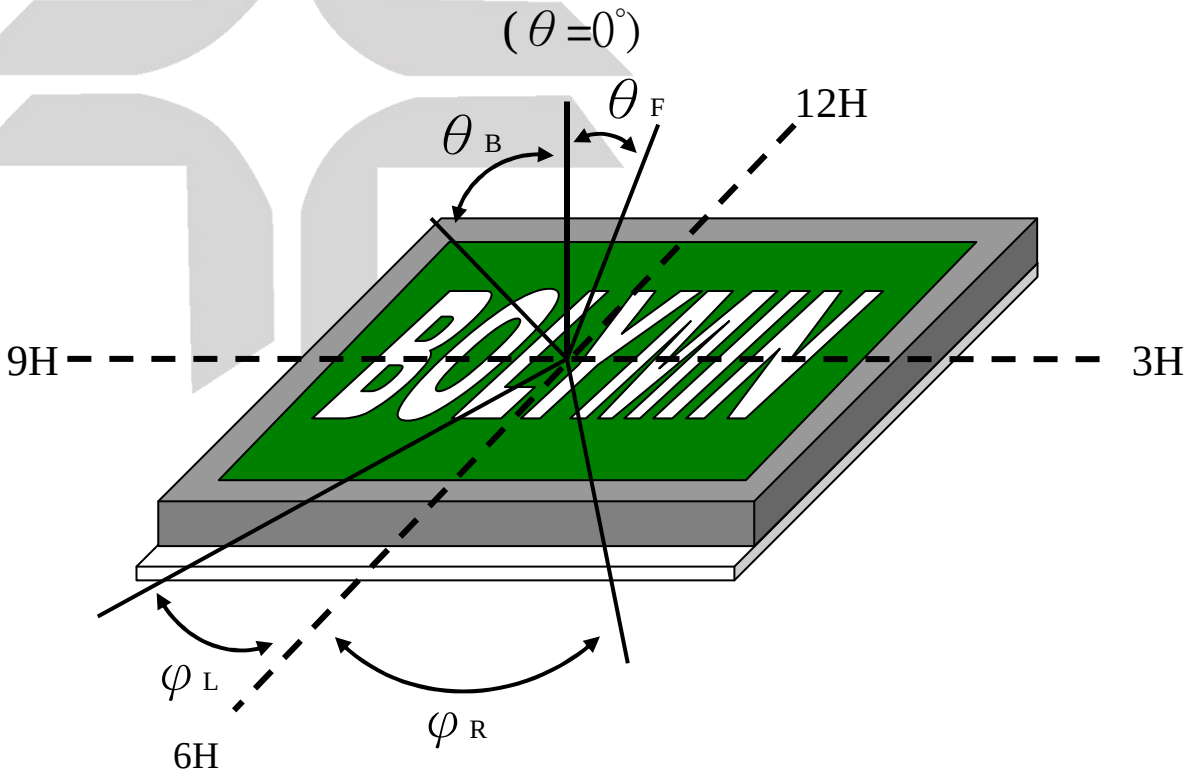
※Optimum LCD driving voltage value, referring to above mentioned range, is changed due to different batch of LCD glass.

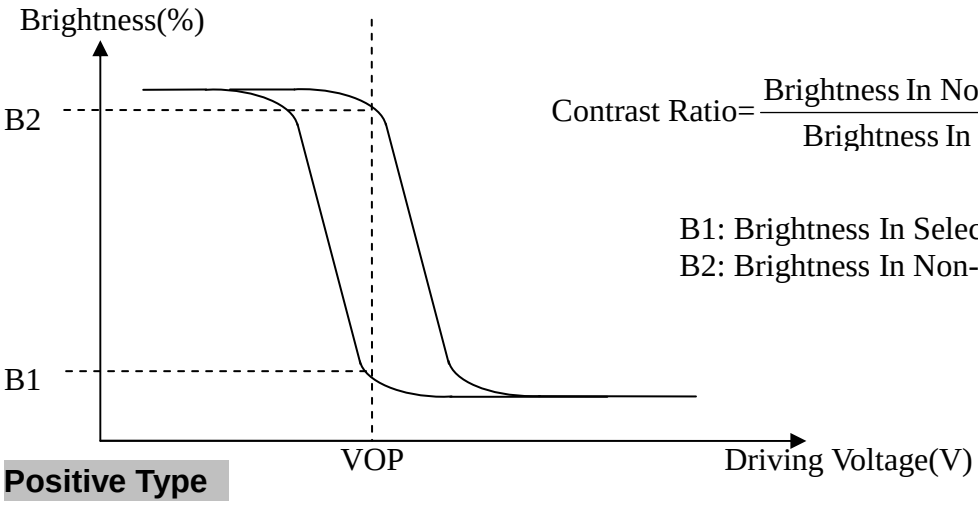
6. Optical Characteristics

a. FSTN

(Ta=25℃)

Item	Symbol	Min.	Typ.	Max.	Unit
View Angle (CR>=2)	θ_F	-	38	-	deg
	θ_B	-	36	-	deg
	φ_L	-	45	-	deg
	φ_R	-	40	-	deg
Contrast Ratio	CR	-	5	-	-
Response Time 25℃	T rise	-	200	400	ms
	T fall	-	250	400	ms

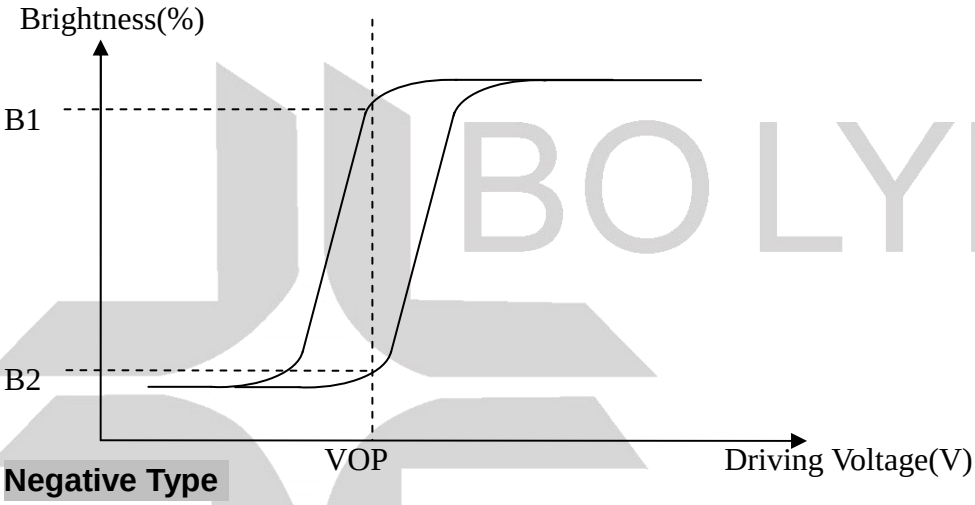




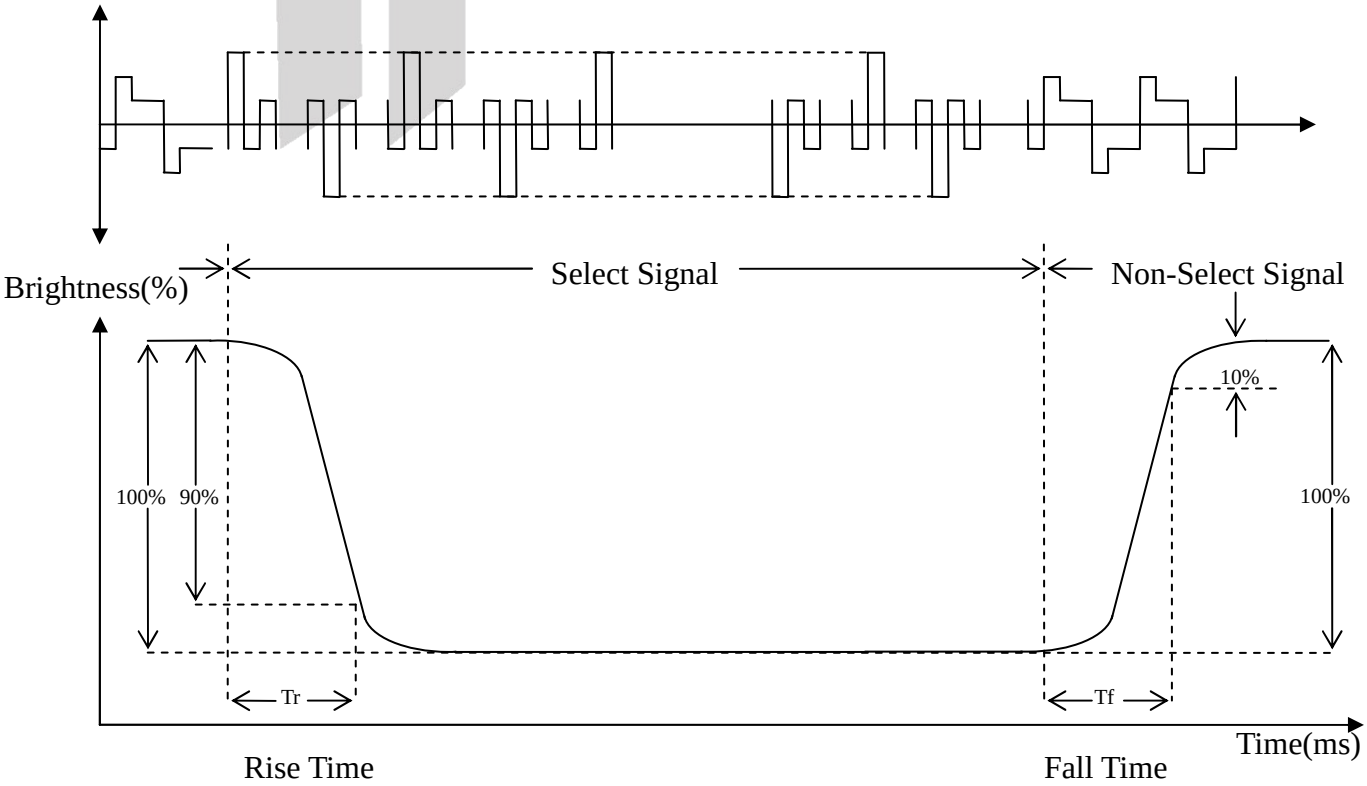
$$\text{Contrast Ratio} = \frac{\text{Brightness In Non - Select Signal}}{\text{Brightness In Select Signal}}$$

B1: Brightness In Select Signal
B2: Brightness In Non-Select Signal

Positive Type



Negative Type



7. Interface Pin Function

Pin No.	Symbol	Level	Description
1	GND	-	Ground
2	VDD	-	Power supply(3.3V)
3	DB7	-	Data bus
4	DB6	-	Data bus
5	DB5	-	Data bus
6	DB4	-	Data bus
7	DB3	-	Data bus
8	DB2	-	Data bus
9	DB1	-	Data bus
10	DB0	-	Data bus
11	E	-	Enable signal
12	R/W	-	H : read L : write
13	A0	-	H: data , L: Instruction
14	/RES	-	Reset. H: Disable L: Enable
15	/CS	-	H: chip selected L: chip unselected
16	GND	-	Ground

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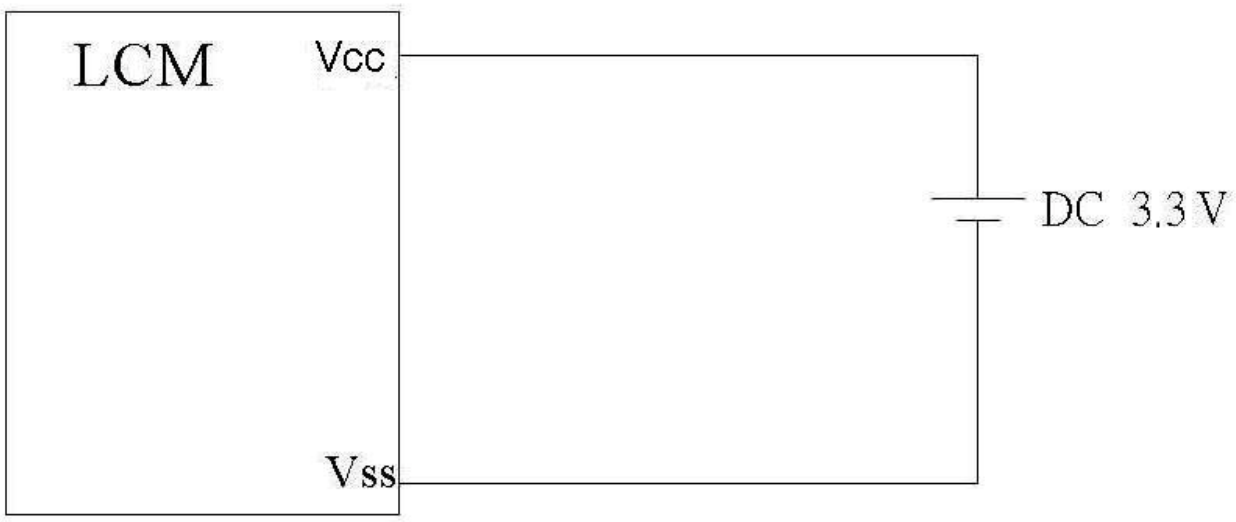
8. Power supply for LCD Module



9. Backlight information

9.1 Specification

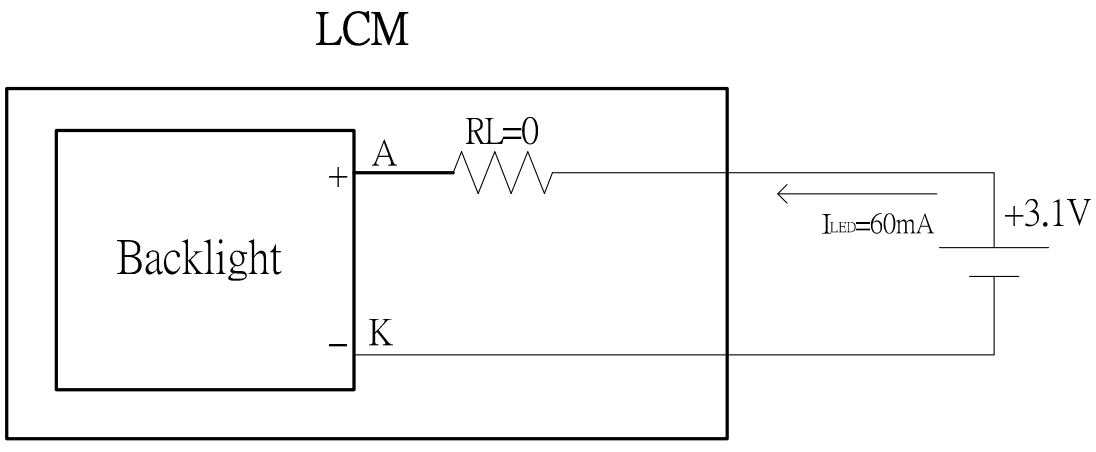
(1) LED edge / White

Parameter	Symbol	Min	Typ	Max	Unit	Test Condition
Supply Current	ILED	—	60		mA	V=3.1V
Supply Voltage	V	2.9	3.1	3.3	V	ILED=60mA
Reverse Voltage	VR	—	—	5	V	
CIE	X	0.26	—	0.31		ILED=60mA
	Y	0.27	—	0.32	Hr.	ILED=60mA
Color	White					

9.2 Backlight driving methods

a. LED B/L drive from A,K direct

a.1 edge / white



10. Quality Assurance

10.1 **Inspection conditions**

1. The LCD shall be inspected under 20~40W white fluorescent light.
2. Checking Direction shall be in the 40 degree from perpendicular line of specimen surface.
3. Checker shall see over 30 cm.
4. Inspect about 5 seconds for each side.
5. Defect that is located at outside of VA and doesn't affect function is ignored.

10.2 **Inspection Parameters**

<table>
<tr><th>NO.</th><th>Parameter</th><th>Criteria</th></tr>
<tr><td>1</td><td>Black or White spots (Particle)</td><td>
<table>
<tr><th>Zone / Dimension</th><th>Acceptable Number</th><th>Class Of Defects</th><th>Acceptable Level</th></tr>
<tr><td>D≦0.10</td><td>Disregard</td><td rowspan="4">Minor</td><td rowspan="4">2.5</td></tr>
<tr><td>0.10＜D≦0.2</td><td>4</td></tr>
<tr><td>0.2＜D≦0.3</td><td>2</td></tr>
<tr><td>0.3＜D</td><td>0</td></tr>
</table>
D=(Long + Short)/2
Total defects should not exceed 5/module
Defect that is located at outside of AA and doesn't affect function is ignored.
</td></tr>
<tr><td>2</td><td>Scratch, Substances</td><td>
<table>
<tr><th colspan="2">Zone</th><th rowspan="2">Acceptable Number</th><th rowspan="2">Class Of Defects</th><th rowspan="2">Acceptable Level</th></tr>
<tr><th>X(mm)</th><th>Y(mm)</th></tr>
<tr><td>—</td><td>0.05≧W</td><td>Disregard</td><td rowspan="4">Minor</td><td rowspan="4">2.5</td></tr>
<tr><td>4.0≧L</td><td>0.05≧W</td><td>4</td></tr>
<tr><td>3.0≧L</td><td>0.1≧W</td><td>2</td></tr>
<tr><td>—</td><td>0.1＜W</td><td>0</td></tr>
</table>
X: Length Y: Width
Total defects should not exceed 5/module
Defect that is located at outside of AA and doesn't affect function is ignored.
</td></tr>
</table>

<table>
<tr>
<td>3</td>
<td>Air Bubbles (between glass & polarizer)</td>
<td>
<table>
<tr><th>Zone / Dimension</th><th>Acceptable Number</th><th>Class Of Defects</th><th>Acceptable Level</th></tr>
<tr><td>D≦0.2</td><td>Disregard</td><td rowspan="3">Minor</td><td rowspan="3">2.5</td></tr>
<tr><td>0.2＜D≦0.5</td><td>3</td></tr>
<tr><td>0.5＜D</td><td>0</td></tr>
</table>
Total defects shall not excess 3/module.
Defect that is located at outside of AA and doesn’t affect function is ignored.
Bobble is sawn only under reflection light is disregarded.
</td>
</tr>
<tr>
<td>4</td>
<td>Displaying Pattern</td>
<td>
1. Incomplete or broken line is not allowed.
2. Pinholes
<table>
<tr><th>Dimension Φ(mm)</th><th>Criteria</th><th>Class Of Defects</th><th>Acceptable Level</th></tr>
<tr><td>Φ＜0.1</td><td>Disregard</td><td rowspan="4">Minor</td><td rowspan="4">2.5</td></tr>
<tr><td>0.1＜Φ≦0.2</td><td>2</td></tr>
<tr><td>0.2＜Φ≦0.25</td><td>1</td></tr>
<tr><td>0.25＜Φ</td><td>0</td></tr>
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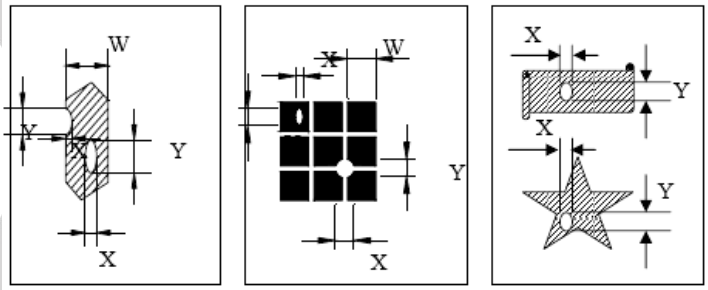

Ø=(X+Y)/2
3. Deformation
<table>
<tr><th>Dimension Φ(mm)</th><th>Criteria</th><th>Class Of Defects</th><th>Acceptable Level</th></tr>
<tr><td>Φ＜0.15</td><td>Disregard</td><td rowspan="3">Minor</td><td rowspan="3">2.5</td></tr>
<tr><td>Φ≦0.25 and X≦1/2D</td><td>3</td></tr>
<tr><td>Φ＞0.25and X＞1/2D</td><td>0</td></tr>
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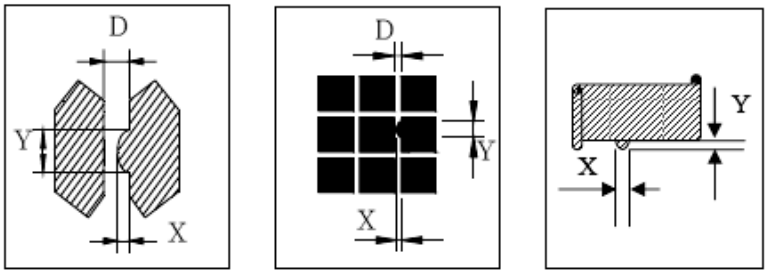


D：間距 Ø=(X+Y)/2
</td>
</tr>
</table>

Other Inspection standard reference Bolymin standard.

11. Reliability

■Content of Reliability Test

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℃ 96 hrs	——
2	Low Temperature storage	Endurance test applying the high storage temperature for a long time.	-30℃ 96 hrs	——
3	High Temperature Operation	Endurance test applying the electric stress (Voltage & Current) and the thermal stress to the element for a long time.	70℃ 96 hrs	——
4	Low Temperature Operation	Endurance test applying the electric stress under low temperature for a long time.	-20℃ 96 hrs	——
5	Humidity Test	Endurance test applying the high humidity storage for a long time.	40℃,90%RH 96hrs	——
6	Temperature cycle (Non-operation)	Endurance test applying the low and high temperature cycle. -30℃ 80℃ 30min 30min 1 cycle	-30℃/80℃ 10 cycles	——
7	Vibration test	Endurance test applying the vibration during transportation and using.	Total Fixed Amplitude:1.5mm Vibration Frequency :10~55Hz One cycle 60 seconds to 3 direction of X,Y,Z for each 15minutes	——

※Assess after placing at normal temperature and humidity for 4 hour。No abnormalities in functions and appearance。

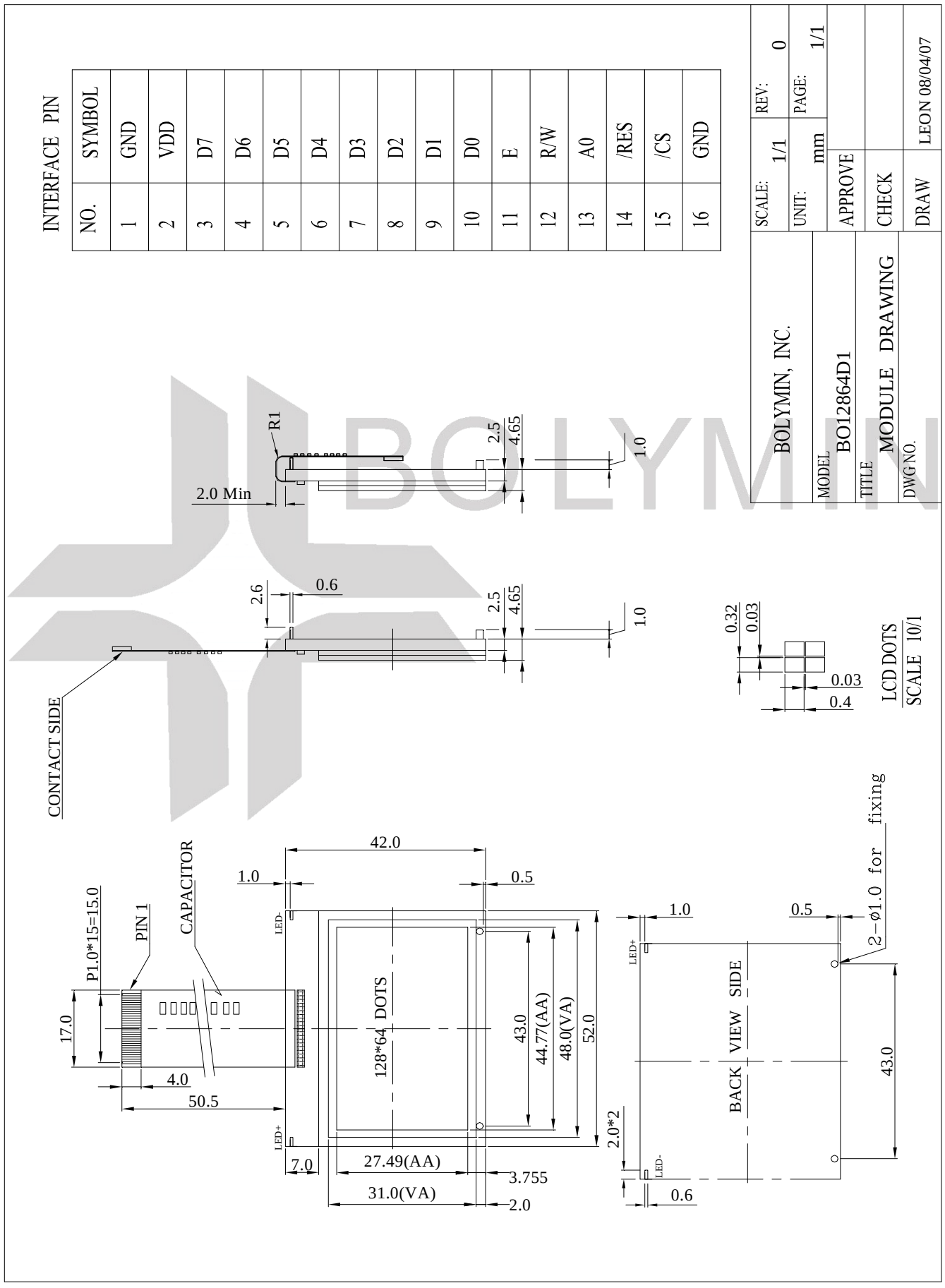
12. Appendix (Drawing , ST7541I controller data)

12.1 Drawing

INTERFACE PIN

NO.	SYMBOL
1	GND
2	VDD
3	D7
4	D6
5	D5
6	D4
7	D3
8	D2
9	D1
10	D0
11	E
12	R/W
13	A0
14	/RES
15	/CS
16	GND

SCALE: 1/1	REV: 0	BOLYMIN, INC.	
UNIT: mm	PAGE: 1/1	MODEL	BO12864D1
APPROVE		TITLE	MODULE DRAWING
CHECK		DWG NO.	
DRAW	LEON 08/04/07		



12.2 ST7541i controller data

12.2.1. Instruction table

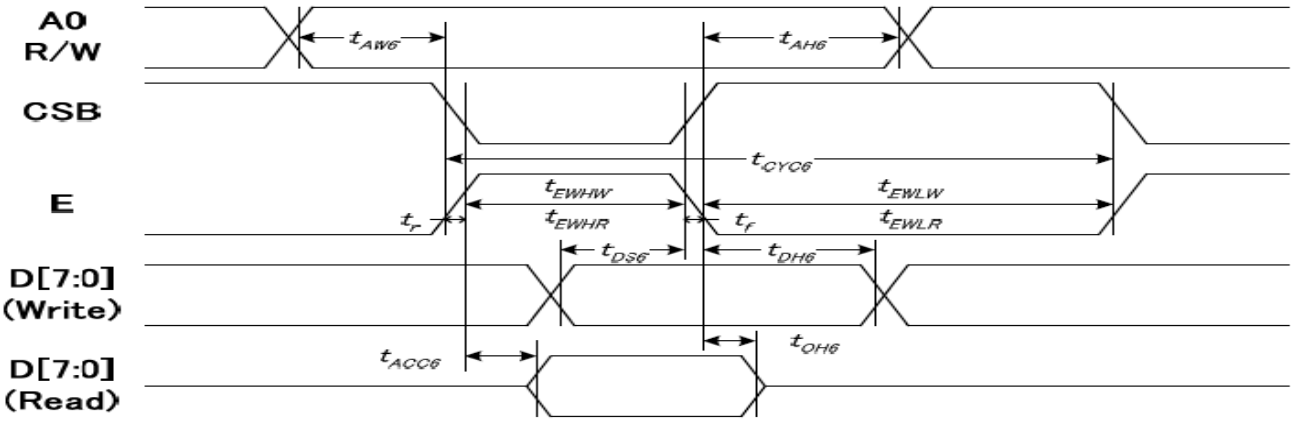
Instruction	A0	R/W	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0	Description
Mode Set	0	0	0	0	1	1	1	0	0	0	2-byte command Set FR (Frame Rate) and BE (Booster Efficiency)
	0	0	FR3	FR2	FR1	FR0	0	BE	x'	0	
Read display data	1	1	Read data								Read data into DDRAM
Write display data	1	0	Write data								Write data into DDRAM
Read status	0	1	BUSY	ON	RES	MF2	MF1	MF0	DS1	DS0	Read the internal status
ICON control ON/OFF	0	0	1	0	1	0	0	0	1	ICON	ICON=0: ICON disable ICON=1: ICON enable & set page address to 16
Set page address	0	0	1	0	1	1	P3	P2	P1	P0	Set page address
Set column address MSB	0	0	0	0	0	1	0	Y7	Y6	Y5	Set column address MSB
Set column address LSB	0	0	0	0	0	0	Y4	Y3	Y2	Y1	Set column address LSB
Set Read-modify-Write	0	0	1	1	1	0	0	0	0	0	DDRAM address control: Read: No change Write: column address +1
Reset Read-modify-Write	0	0	1	1	1	0	1	1	1	0	Release read-modify-write
Display ON/OFF	0	0	1	0	1	0	1	1	1	D	D=0: Display OFF D=1: Display ON
Set Initial Display Line	0	0	0	1	0	0	0	0	x'	x'	2-byte command Specify the initial display line to realize vertical scrolling
	0	0	x'	S6	S5	S4	S3	S2	S1	S0	
Set Initial COM0	0	0	0	1	0	0	0	1	x'	x'	2-byte command Specify the first COM0 to move display window
	0	0	x'	C6	C5	C4	C3	C2	C1	C0	
Set Partial Display Duty	0	0	0	1	0	0	1	0	x'	x'	2-byte command Set partial display line number
	0	0	L7	L6	L5	L4	L3	L2	L1	L0	
Set N-line Inversion	0	0	0	1	0	0	1	1	x'	x'	2-byte command Set N-line inversion register
	0	0	x'	x'	x'	N4	N3	N2	N1	N0	
Release N-line Inversion	0	0	1	1	1	0	0	1	0	0	Exit N-line inversion mode
Reverse Display ON/OFF	0	0	1	0	1	0	0	1	1	REV	REV=0: normal display REV=1: reverse display
Entire Display ON/OFF	0	0	1	0	1	0	0	1	0	EON	EON=0: normal display EON=1: entire display ON

Instruction	A0	R/W	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0	Description
Power Control	0	0	0	0	1	0	1	VC	VR	VF	Set power circuits ON/OFF
Select DC-DC step-up	0	0	0	1	1	0	0	1	DC1	DC0	Select built-in booster step
Select Regulator Register	0	0	0	0	1	0	0	R2	R1	R0	Select the internal resistance ratio of the regulator resistor
Select Electronic Volume	0	0	1	0	0	0	0	0	0	1	2-byte command
	0	0	x'	x'	EV5	EV4	EV3	EV2	EV1	EV0	Adjust contrast level
Select LCD bias	0	0	0	1	0	1	0	B2	B1	B0	Select LCD bias
High Power Mode	0	0	1	1	1	1	0	1	1	1	2-byte command
	0	0	0	0	0	1	1	0	1	0	Enable High Power Mode
High Power Mode Control	0	0	1	1	1	1	0	0	1	1	2-byte command
	0	0	0	0	0	0	1	1	0	1	Controls high driving mode
SHL select	0	0	1	1	0	0	SHL	x'	x'	x'	COM bi-directional selection SHL=0: normal direction SHL=1: reverse direction
ADC select	0	0	1	0	1	0	0	0	0	ADC	SEG bi-direction selection ADC=0: normal direction ADC=1: reverse direction
Oscillator ON	0	0	1	0	1	0	1	0	1	1	Start the built-in oscillator
Set power save mode	0	0	1	0	1	0	1	0	0	P	P=0: normal mode P=1: sleep mode
Release power save mode	0	0	1	1	1	0	0	0	0	1	Release power save mode
RESET	0	0	1	1	1	0	0	0	1	0	Software reset Refer to RESET CIRCUIT
Set display data length (DDL)	x'	x'	1	1	1	0	1	0	0	0	2-byte command
	x'	x'	D7	D6	D5	D4	D3	D2	D1	D0	Specify the number of data bytes. (3-Line SPI only)
Set FRC/PWM mode	0	0	1	0	0	1	0	FRC	PWM1	PWM0	FRC: 1=3FRC, 0=4FRC PWM[1:0]: (0,0)=(0,1)=9PWM (1,0)=12PWM (1,1)=15PWM
NOP	0	0	1	1	1	0	0	0	1	1	No operation
Test Instruction	0	0	1	1	1	1	x'	x'	x'	x'	Don't use this instruction

Instruction	A0	R/W	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0	Description
White palette ($1^{st}/2^{nd}$ frame)	0	0	1	0	0	0	1	0	0	0	Set white mode palette
set PWM pulse width	0	0	WB3	WB2	WB1	WB0	WA3	WA2	WA1	WA0	$1^{st}/2^{nd}$ frame
White palette ($3^{rd}/4^{th}$ frame)	0	0	1	0	0	0	1	0	0	1	Set white mode palette
set PWM pulse width	0	0	WD3	WD2	WD1	WD0	WC3	WC2	WC1	WC0	$3^{rd}/4^{th}$ frame
Light palette ($1^{st}/2^{nd}$ frame)	0	0	1	0	0	0	1	0	1	0	Set light gray mode palette
set PWM pulse width	0	0	LB3	LB2	LB1	LB0	LA3	LA2	LA1	LA0	$1^{st}/2^{nd}$ frame
Light palette ($3^{rd}/4^{th}$ frame)	0	0	1	0	0	0	1	0	1	1	Set light gray mode palette
set PWM pulse width	0	0	LD3	LD2	LD1	LD0	LC3	LC2	LC1	LC0	$3^{rd}/4^{th}$ frame
Dark palette ($1^{st}/2^{nd}$ frame)	0	0	1	0	0	0	1	1	0	0	Set dark gray mode palette
set PWM pulse width	0	0	DB3	DB2	DB1	DB0	DA3	DA2	DA1	DA0	$1^{st}/2^{nd}$ frame
Dark palette ($3^{rd}/4^{th}$ frame)	0	0	1	0	0	0	1	1	0	1	Set dark gray mode palette
set PWM pulse width	0	0	DD3	DD2	DD1	DD0	DC3	DC2	DC1	DC0	$3^{rd}/4^{th}$ frame
Black palette ($1^{st}/2^{nd}$ frame)	0	0	1	0	0	0	1	1	1	0	Set black mode palette
set PWM pulse width	0	0	BB3	BB2	BB1	BB0	BA3	BA2	BA1	BA0	$1^{st}/2^{nd}$ frame
Black palette ($3^{rd}/4^{th}$ frame)	0	0	1	0	0	0	1	1	1	1	Set black mode palette
set PWM pulse width	0	0	BD3	BD2	BD1	BD0	BC3	BC2	BC1	BC0	$3^{rd}/4^{th}$ frame

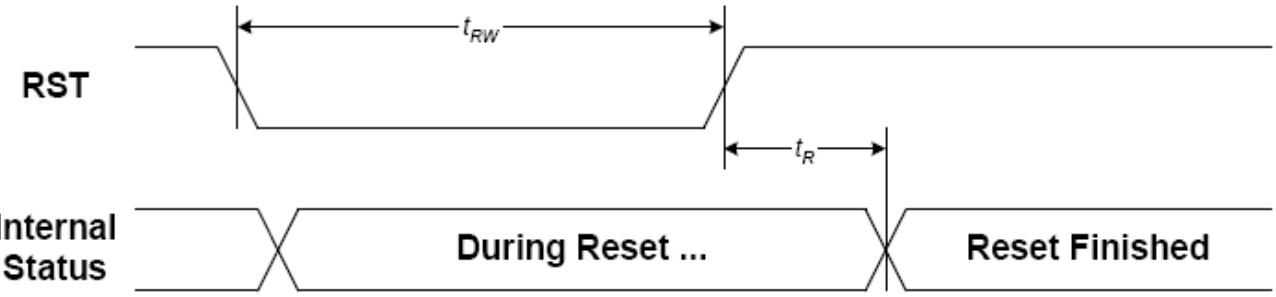
12.2.2 . Timing characteristics

6800 series



Item	Signal	Symbol	Condition	Rating		Units
				Min.	Max.	
Address hold time	A0, R/W	tAH6		0	—	ns
Address setup time		tAW6		0	—	
System cycle time		tCYC6		400	—	
Enable L pulse width (WRITE)	E	tEWLW		220	—	
Enable H pulse width (WRITE)		tEWHW		180	—	
Enable L pulse width (READ)		tEWLR		220	—	
Enable H pulse width (READ)		tEWHR		180	—	
WRITE Data setup time	D0 to D7	tDS6		40	—	
WRITE Data hold time		tDH6		15	—	
READ access time		tACC6	CL = 100 pF	—	140	
READ Output disable time		tOH6	CL = 100 pF	10	100	

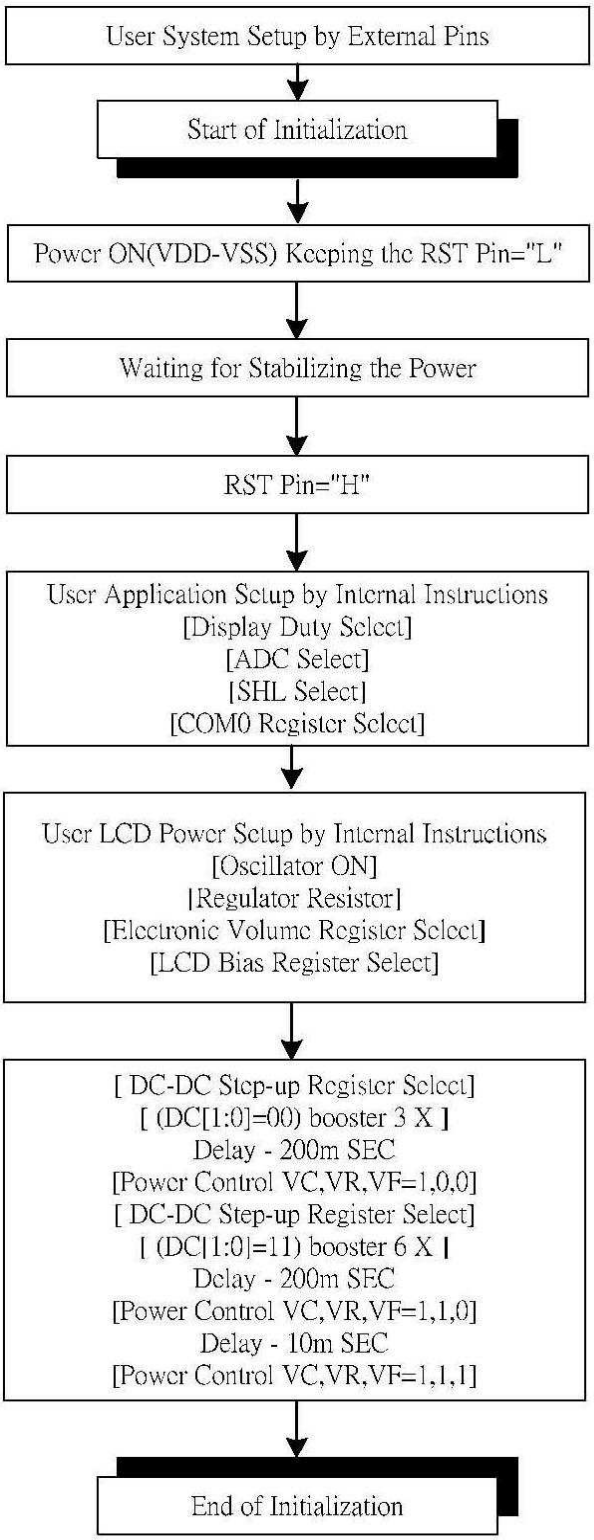
Reset Timing



Item	Signal	Symbol	Condition	Rating			Units
				Min.	Typ.	Max.	
Reset time		tR		—	—	1.5	us
Reset "L" pulse width	RST	tRW		1.5	—	—	us

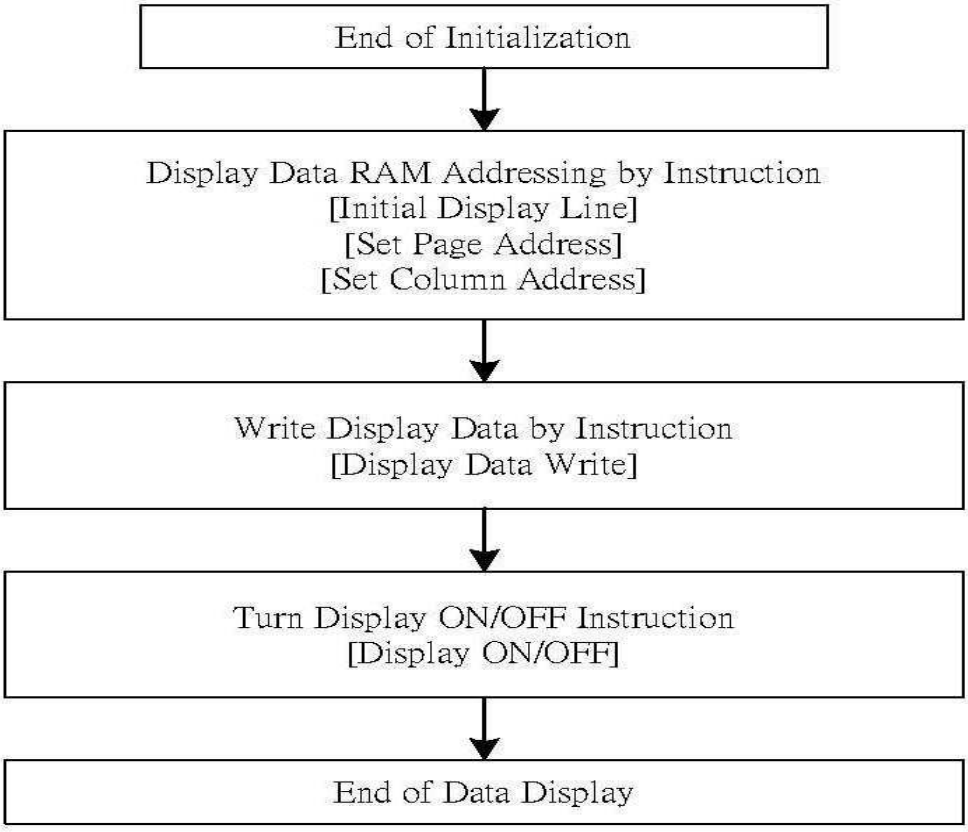
12.2.3 . Initializing by Instruction

Referential Instruction Setup Flow: Initializing with the built-in Power Supply Circuits



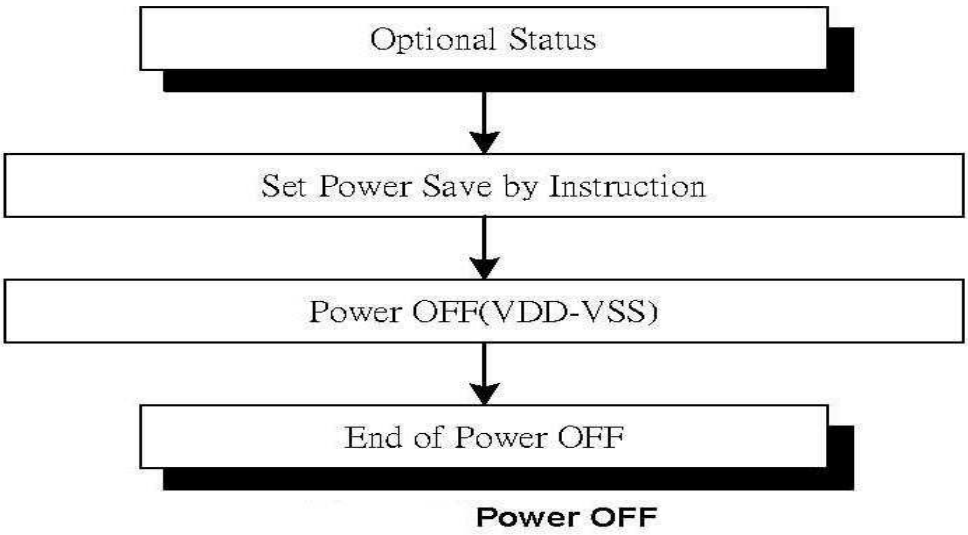
Initializing with the Built-in Power Supply Circuits

Referential Instruction Setup Flow: Data Displaying



Data Displaying

Referential Instruction Setup Flow: Power OFF



Power OFF