Bolymin, Inc.

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LCD MODULE SPECIFICATION

MODEL NO.
BG12864E series
VER03

FOR MESSRS:

_____

ON DATE OF:

_____

APPROVED BY:

_____

C O N T E N T S

Bolymin, Inc.

1. Numbering System

B	G	12864	E	-	-	-	-	-	xxx
0	1	2	3	4	5	6	7	8	9

0	Brand	Bolymin	
1	Module Type	C= character type G= graphic type P= TAB/TCP type	O= COG type F= COF type
2	Format	2002=20 characters, 4 lines 12232= 122 x 32 dots	
3	Version No.	A type	
4	LCD Color	G=STN/gray Y=STN/yellow-green C=color STN	B=STN/blue F=FSTN T=TN
5	LCD Type	R=positive/reflective P=positive/transflective	M=positive/transmissive N=negative/transmissive
6	Backlight type/color	L=LED array/ yellow-green H=LED edge/white R=LED array/red G=LED edge/yellow-green	D=LED edge/blue E=EL/white B=EL/blue C=CCFL/white
7	CGRAM Font (applied only on character type)	J=English/Japanese Font E=English/European Font	C=English/Cyrillic Font H=English/Hebrew Font
8	View Angle/ Operating Temperature	B=Bottom/Normal Temperature H=Bottom/Wide Temperature U=Bottom/Ultra wide Temperature	T=Top/Normal Temperature W=Top/Wide Temperature C=9H/Normal Temperature
9	Special Code	3=3 volt logic power supply n=negative voltage for LCD c=cable/connector xxx=to be assigned on data sheet	t=temperature compensation for LCD p=touch panel

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2. General Specification

(1) Mechanical Dimension

Item	Standard Value	Unit
Number of dots	128X64	dots
Module dimension (L*W*H)	75.0 x 52.7 x 8.4	mm
View area	60.0(W)X32.6(H)	mm
Active area	56.02(W)X27.5(H)	mm
Dot size	0.41(W)X0.41(H)	mm
Dot pitch	0.43(W)X0.43(H)	mm

(2) Controller IC: NT7107 / NT7108

(3) Temperature Range

	Normal	Wide	Ultra Wide
Operating	0 ~+50℃	-20 ~ +70℃	-30 ~ +80℃
Storage	-10 ~ +60℃	-30 ~ +80℃	-35 ~ +85℃

3. Absolute Maximum Ratings

Item	Symbol	Min	Typ	Max	Unit
Operating Temperature	T_{OP}	-30	—	+80	℃
Storage Temperature	T_{ST}	-35	—	+85	℃
Input Voltage	V_I	0	—	V_{CC}	V
Supply Voltage For Logic	V_{CC}	0	—	7	V
Supply Voltage For LCD	V_{CC}-V_{LCD}	8	—	17	V
Supply Voltage For LCD	V_{OUT}	—	—	-10	V

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4. Electrical Characteristics

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Supply Voltage For Logic	V_{DD}-V_{SS}	—	4.5	5.0	5.5	V
Supply Voltage For LCD	V_{DD}-V_0	Ta=-20℃ Ta=25℃ Ta=+70℃	— — —	9.8 8.5 7.5	— — —	V V V
Input High Vol	V_{IH}	—	2.0	—	V_{DD}	V
Input Low Vol	V_{IL}	—	0	—	0.8	V
Output High Vol	V_{OH}	—	2.4	—	—	V
Output Low Vol.	V_{OL}	—	—	—	0.4	V
Supply Current	I_{DD}	—	—	6.0	—	mA

5. Optical Characteristics

a. STN

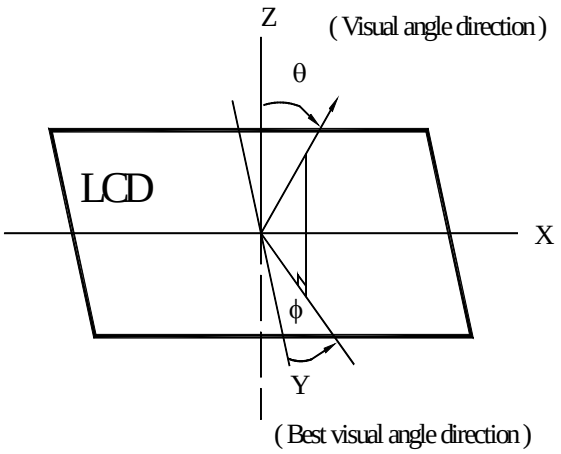
Item	Symbol	Condition	Min.	Typ.	Max.	Unit
View Angle	(V) θ	CR≧8	10		45	deg
	(H) ϕ	CR≧8	-30		30	deg
Contrast Ratio	CR	—		8		—
Response Time 25℃	T rise	—		100	150	ms
	T fall	—		150	200	ms

b. FSTN

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
View Angle	(V) θ	CR≧24	10		60	deg
	(H) ϕ	CR≧24	-45		45	deg
Contrast Ratio	CR	—		24		—
Response Time 25℃	T rise	—		100	150	ms
	T fall	—		150	200	ms

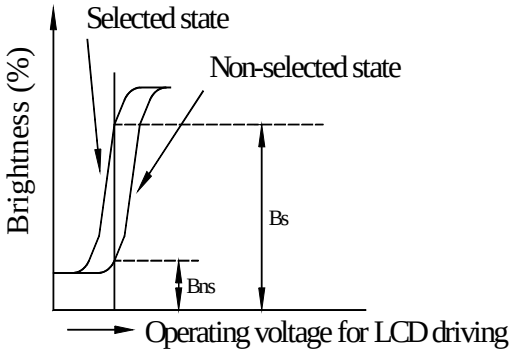
5.1 Definitions

■View Angles

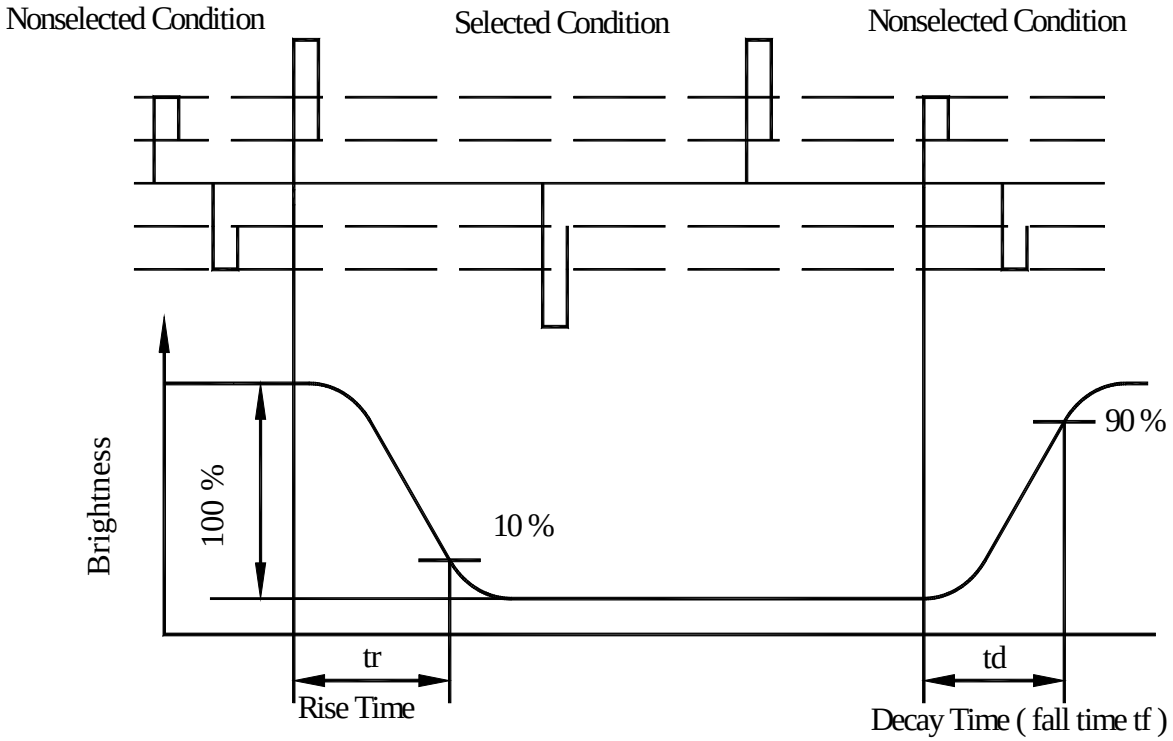


■Contrast Ratio

$$CR = \frac{\text{Brightness at selected state (BS)}}{\text{Brightness at non-selected state (Bns)}}$$



■Response time



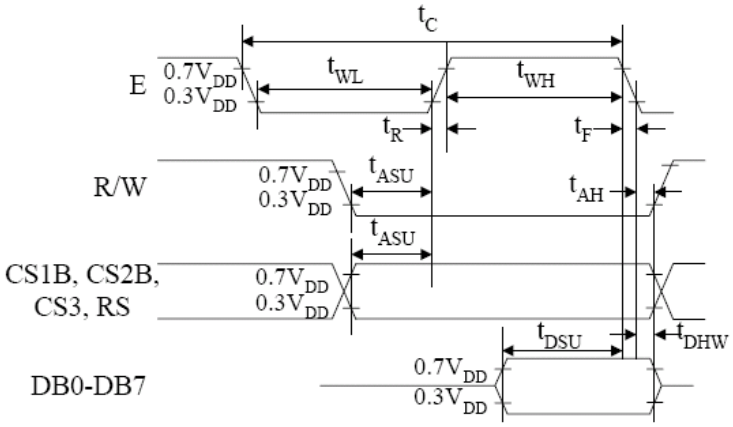
6. Interface Pin Function

Pin No.	Symbol	Level	Description
1	Vdd	5.0V	Supply voltage for logic (option +3V)
2	GND	0V	Ground
3	V_O	(Variable)	Operating voltage for LCD
4	DB0	H/L	Data bus line
5	DB1	H/L	Data bus line
6	DB2	H/L	Data bus line
7	DB3	H/L	Data bus line
8	DB4	H/L	Data bus line
9	DB5	H/L	Data bus line
10	DB6	H/L	Data bus line
11	DB7	H/L	Data bus line
12	/CS1	L	Chip Select for IC1
13	/CS2	L	Chip Select for IC2
14	/RST	L	Reset signal
15	R/W	H/L	H=Read mode , L=Write mode
16	D/I	H/L	H=Data register , L=Instruction register
17	E	H/L	Enable signal
18	Vee		Negative Voltage output –4.8V
19	A	—	Power supply for B/L (+)
20	K	—	Power supply for B/L (GND)

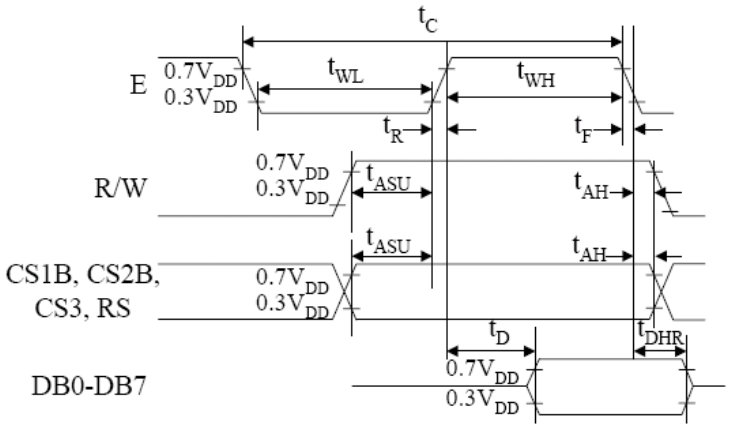
7. Timing Characteristics

MPU Interface

Characteristic	Symbol	Min	Typ	Max	Unit
E cycle	tc	1000	—	—	ns
E high level width	t_{WH}	450	—	—	ns
E low level width	t_{WH}	450	—	—	ns
E rise time	t_R	—	—	25	ns
E fall time	t_F	—	—	25	ns
Address set-up time	t_{ASU}	140	—	—	ns
Address hold time	t_{AH}	10	—	—	ns
Data set-up time	t_{DSU}	200	—	—	ns
Data delay time	t_D	—	—	320	ns
Data hold time (write)	t_{DHW}	10	—	—	ns
Data hold time (read)	t_{DHR}	20	—	—	ns



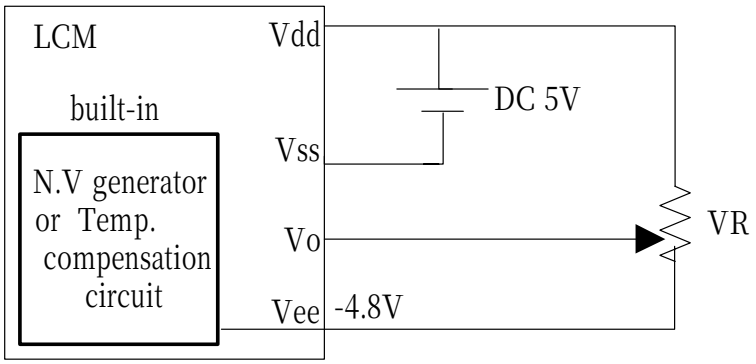
MPU Write Timing



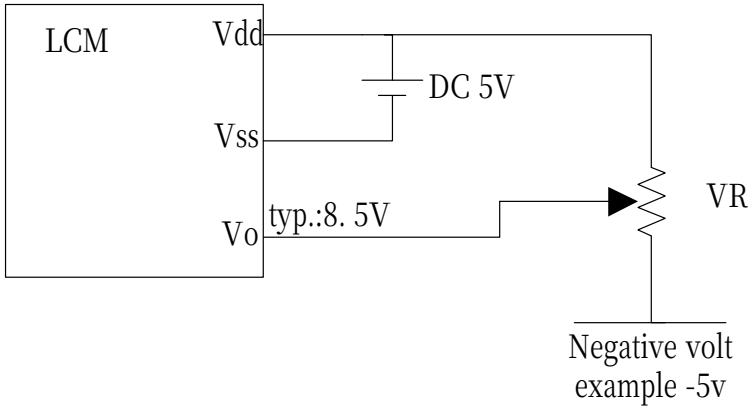
MPU Read Timing

8. Power Supply for LCD Module and LCD Operating Voltage a Adjustment

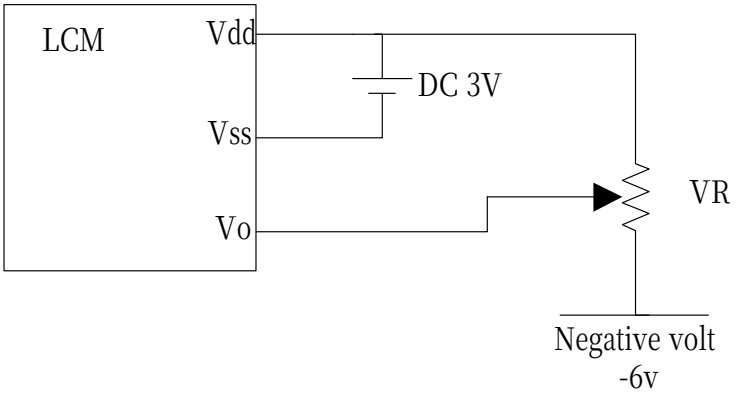
＊LCM operating on " DC 5V " input with built-in negative voltage



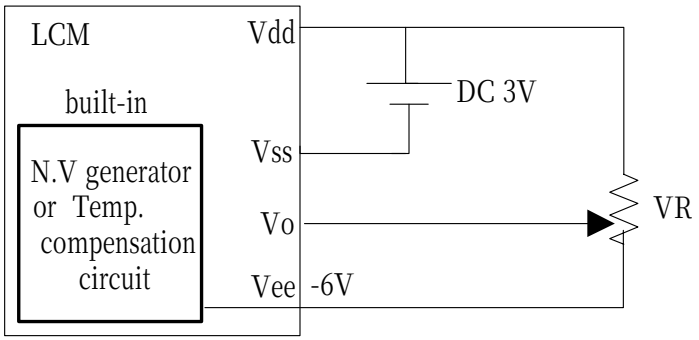
＊(Option) LCM operating on " DC 5V " input with external negative voltage



＊(Option) LCM operating on " DC 3V " input with external negative voltage



＊(Option) LCM operating on " DC 3V " input with built-in negative voltage



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9. Backlight Information

9.1 Specification

LED edge/bottom yellow-green

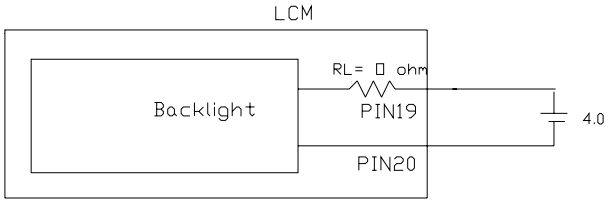
Parameter	Symbol	Min	Typ	Max	Unit	Test Condition
Supply Current	ILED	—	100/180	—	mA	V=4.2V
Supply Voltage	V	—	4.2	—	V	—
Reverse Voltage	VR	—	—	8	V	—
Luminous Intensity	IV	—	—	—	cd/m^2	ILED=100/180mA
Wave Length	λp	—	574	—	nm	ILED=100/180mA
Life Time		—	70000	—	Hr.	V≦4.2V
Color	Yellow-green					

(2) LED white / blue

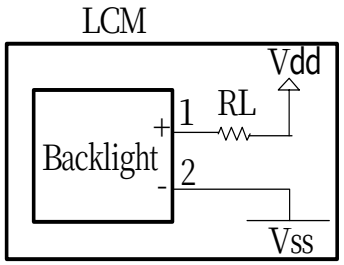
Parameter	Symbol	Min	Typ	Max	Unit	Test Condition
Supply Current	ILED	—	80	—	mA	V=3.2V
Supply Voltage	V	2.8	3.2	3.6	V	—
Reverse Voltage	VR	—	—	8	V	—
Luminous Intensity	IV	—	—	—	cd/m^2	ILED=80mA
Life Time		—	20000	—	Hr.	V≦3.2V
Color	White					

9.2 Backlight driving methods

a. LED edge/yellow-green B/L drive from pin19 (LED+) pin20 (LED-)

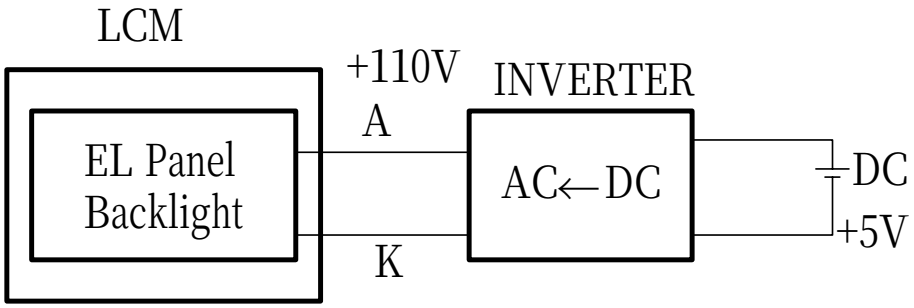


b.＊(Option) LED B/L drive from pin1 (Vdd) pin2 (V_{SS})



(1) Jump 1,2 Short
(2) Current Resistor required on RL
(3) Jump 19,20 open
(4) To be sure of enough current supply for both VDD + LED B/L

c. E/L B/L driven from A.K directly



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10. Display Control Instruction

The display control instructions control the internal state of the NT7108. Instruction is received from MPU to NT7108 for the display control. The following table shows various instructions.

Instruction	RS	R/W	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0	Function
Display ON/OFF	L	L	L	L	H	H	H	H	H	L/H	Controls the display on or off. Internal status and display RAM data are not affected. L:OFF, H:ON
Set Address	L	L	L	H	Y address (0~63)						Sets the Y address in the Y address counter.
Set Page (X address)	L	L	H	L	H	H	H	Page (0 ~7)			Sets the X address at the X address register.
Display Start Line	L	L	H	H	Display start line(0~63)						Indicates the display data RAM displayed at the top of the screen.
Status Read	L	H	BUSY	L	ON/OFF	RESET	L	L	L	L	Read status. BUSY L: Ready H: In operation ON/OFF L: Display ON H: Display OFF RESET L: Normal H: Reset
Write Display Data	H	L	Display Data								Writes data (DB0:7)into display data RAM. After writing instruction, Y address is increased by 1 automatically.
Read Display Data	H	H	Display Data								Reads data (DB0:7) from display data RAM to the data bus.

10.1 Detailed Explanation

DISPLAY ON/OFF

RS	R/W	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0
0	0	0	0	1	1	1	1	1	D

The display data appears when D is 1 and disappears when D is 0. Though the data is not on the screen with D=0, it remains in the display data RAM. Therefore, you can make it appear by changing D=0 into D=1.

SET ADDRESS (Y ADDRESS)

RS	R/W	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0
0	0	0	1	AC5	AC4	AC3	AC2	AC1	AC0

Y address (AC0-AC5) of the display data RAM is set in the Y address counter. An address is set by instruction and increased by 1 automatically by read or write operations of display data.

SET PAGE (X ADDRESS)

RS	R/W	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0
0	0	1	0	1	1	1	AC2	AC1	AC0

X address (AC0-AC2) of the display data RAM is set in the X address register. Writing or reading to or from MPU is executed in this specified page until the next page is set.

DISPLAY START LINE (Z ADDRESS)

RS	R/W	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0
0	0	1	1	AC5	AC4	AC3	AC2	AC1	AC0

Z address (AC0-AC5) of the display data RAM is set in the display start line register and displayed at the top of the screen. When the display duty cycle is 1/64 or others (1/32-1/64), the data of total line number of LCD screen, from the line specified by display start line instruction, is displayed.

.

STATUS READ

RS	R/W	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0
0	1	BUSY	0	ON/OFF	RESET	0	0	0	0

- BUSY
  When BUSY is 1, the Chip is executing internal operation and no instructions are accepted.
  When BUSY is 0, the Chip is ready to accept any instructions.
- ON/OFF
  When ON/OFF is 1, the display is OFF.
  When ON/OFF is 0, the display is ON.
- RESET
  When RESET is 1, the system is being initialized.
  In this condition, no instructions except s tatus read can be accepted.
  When RESET is 0, initializing has finished and the system is in usual operation condition.

WRITE DISPLAY DATA

RS	R/W	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0
1	0	D7	D6	D5	D4	D3	D2	D1	D0

Writes data (D0-D7) into the display data RAM. After writing instruction, Y address is increased by 1automatically.

READ DISPLAY DATA

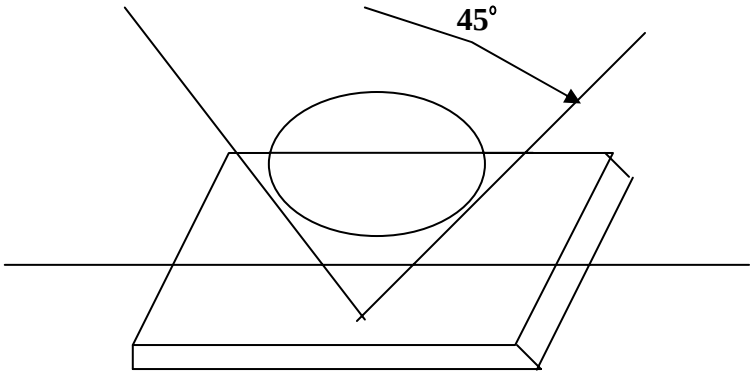
RS	R/W	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0
1	01	D7	D6	D5	D4	D3	D2	D1	D0

Reads data (D0-D7) into the display data RAM. After reading instruction, Y address is increased by 1automatically.

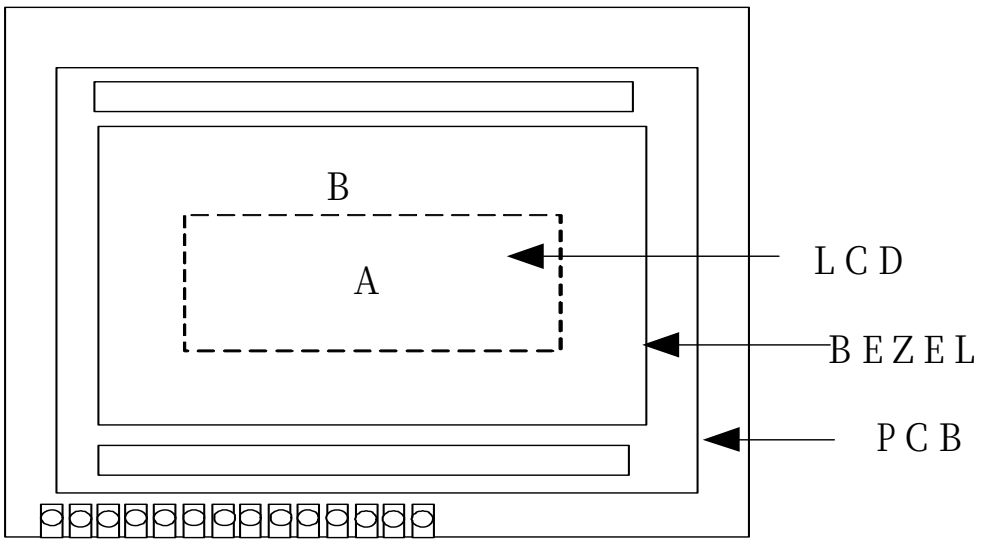
11. Quality Assurance

11.1 Inspection conditions

The LCD shall be inspected under 40W white fluorescent light.



Definition of applicable Zones



A : Display Area

B : Non-Display Area

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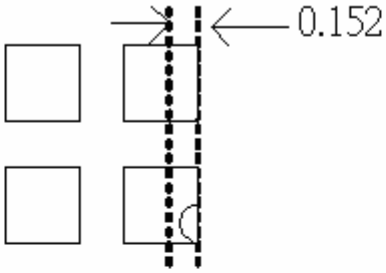
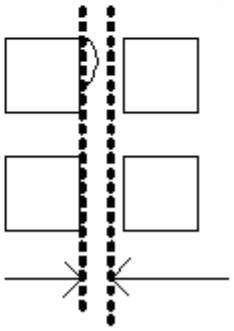
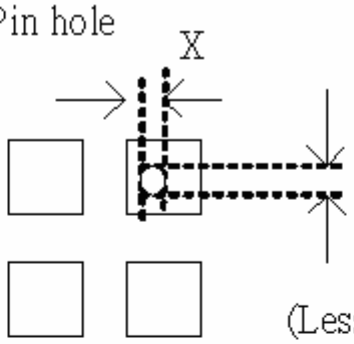
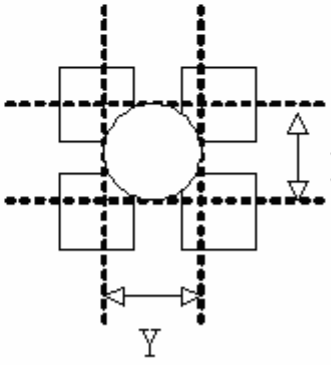
11.2 Inspection Parameters

<table>
<tr><th>NO.</th><th>Parameter</th><th>Criteria</th></tr>
<tr><td>1</td><td>Black or White spots</td><td>
<table>
<tr><th rowspan="2">Zone
Dimension</th><th colspan="2">Acceptable Number</th><th rowspan="2">Class Of Defects</th><th rowspan="2">Acceptable Level</th></tr>
<tr><th>A</th><th>B</th></tr>
<tr><td>D＜0.15</td><td>*</td><td>*</td><td rowspan="4">Minor</td><td rowspan="4">2.5</td></tr>
<tr><td>0.15≦D≦0.2</td><td>4</td><td>4</td></tr>
<tr><td>0.2≦D≦0.25</td><td>2</td><td>2</td></tr>
<tr><td>D≦0.3</td><td>0</td><td>1</td></tr>
</table>
D=(Long + Short)/2 *: Disregard
</td></tr>
<tr><td>2</td><td>Scratch, Substances</td><td>
<table>
<tr><th colspan="2">Zone
X(mm) Y(mm)</th><th colspan="2">Acceptable Number</th><th rowspan="2">Class Of Defects</th><th rowspan="2">Acceptable Level</th></tr>
<tr><th>A</th><th>B</th></tr>
<tr><td>*</td><td>0.04≧W</td><td>*</td><td>*</td><td rowspan="4">Minor</td><td rowspan="4">2.5</td></tr>
<tr><td>3.0≧L</td><td>0.06≧W</td><td>4</td><td>4</td></tr>
<tr><td>2.0≧L</td><td>0.08≧W</td><td>2</td><td>3</td></tr>
<tr><td>—</td><td>0.1＜W</td><td>0</td><td>1</td></tr>
</table>
X: Length Y: Width *: Disregard
Total defects should not exceed 4/module
</td></tr>
<tr><td>3</td><td>Air Bubbles (between glass & polarizer)</td><td>
<table>
<tr><th rowspan="2">Zone
Dimension</th><th colspan="2">Acceptable Number</th><th rowspan="2">Class Of Defects</th><th rowspan="2">Acceptable Level</th></tr>
<tr><th>A</th><th>B</th></tr>
<tr><td>D≦0.15</td><td>*</td><td>*</td><td rowspan="3">Minor</td><td rowspan="3">2.5</td></tr>
<tr><td>0.15＜D≦0.25</td><td>2</td><td>*</td></tr>
<tr><td>0.25＜D</td><td>0</td><td>1</td></tr>
</table>
*: Disregard
Total defects shall not excess 3/module.
</td></tr>
</table>

4	Uniformity	(1) Pixel shape (with Dent)  (2) Pixel shape (With Projection)  (3) Pin hole  (Less than 0.1mm is no counted) (4)Deformation  Total acceptable number : 1/pixel,5/cell

12. 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.	85℃ 96hrs	——
2	Low Temperature storage	Endurance test applying the high storage temperature for a long time.	-35℃ 96hrs	——
3	High Temperature Operation	Endurance test applying the electric stress (Voltage & Current) and the thermal stress to the element for a long time.	80℃ 96hrs	——
4	Low Temperature Operation	Endurance test applying the electric stress under low temperature for a long time.	-30℃ 96hrs	——
5	Humidity Test	Endurance test applying the high humidity storage for a long time.	40℃,90%RH 96hrs	——
6	Thermal Shock Test	Endurance test applying the low and high temperature cycle. -35℃ 25℃ 85℃ 30min 5min 30min 1 cycle	-35℃/ 85℃ 5 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	——

13.Outline Dimension