PHOENIX DISPLAY INTERNATIONAL, INC.

PHOENIX DISPLAY INTERNATIONAL, INC

SPECIFICATION FOR LCD MODULE

CUSTOMER	
PART NUMBER	PDI236MZQO-01
DESCRIPTION	2.36" TFT 480 x 234
VERSION	1.0
ISSUE DATE	12-29-2013

COMPANY ADDRESS：
Phoenix Display International, Inc.
6150 W. Gila Springs Place, Unit 2
Chandler, AZ 85226
USA
www.phoenixdisplay.com
(630) 359-5700 office
(630) 359-5701 fax

Records of Revision

DATE	REF.PAGE PARAGRAPH DRAWING No.	REVISED No.	SUMMARY	REMARK
2013-12-29		1.0	First Released	

Contents

1	Introduction----------	4
2	General specification----------	5
3	Mechanical drawing----------	6
4	Absolute maximum ratings----------	7
5	Electrical characteristics----------	7
6	Optical characteristics ----------	8
7	Pin Assignment ----------	12
8	Block diagram ----------	15
9	LCM quality criteria----------	16

1. Introduction

1.1 Scope of application

This specification applies to the Negative type TFT transmissive dot matrix LCD module.
This LCD module should be designed for mobile phone use.
LCD specification: Dots 480x234.
As to basic specification of the driver IC, refer to the IC (OTA5182A) specification and datasheet.

1.2 Structure:

Double display structure:
TFT Module + FPC +BL
FULL 262k Color 2.36inch TFT LCD size for main LCD;
One bare chip with gold bump (COG) TECH;
8 BITS RGB interface;

1.3 TFT features:

Structure: TFT PANNEL+IC+FPC+BL;
Transmissive Type LCD
480 dot-source and 234 dot-gate outputs;
White LED back light;
8 BITS RGB interface;

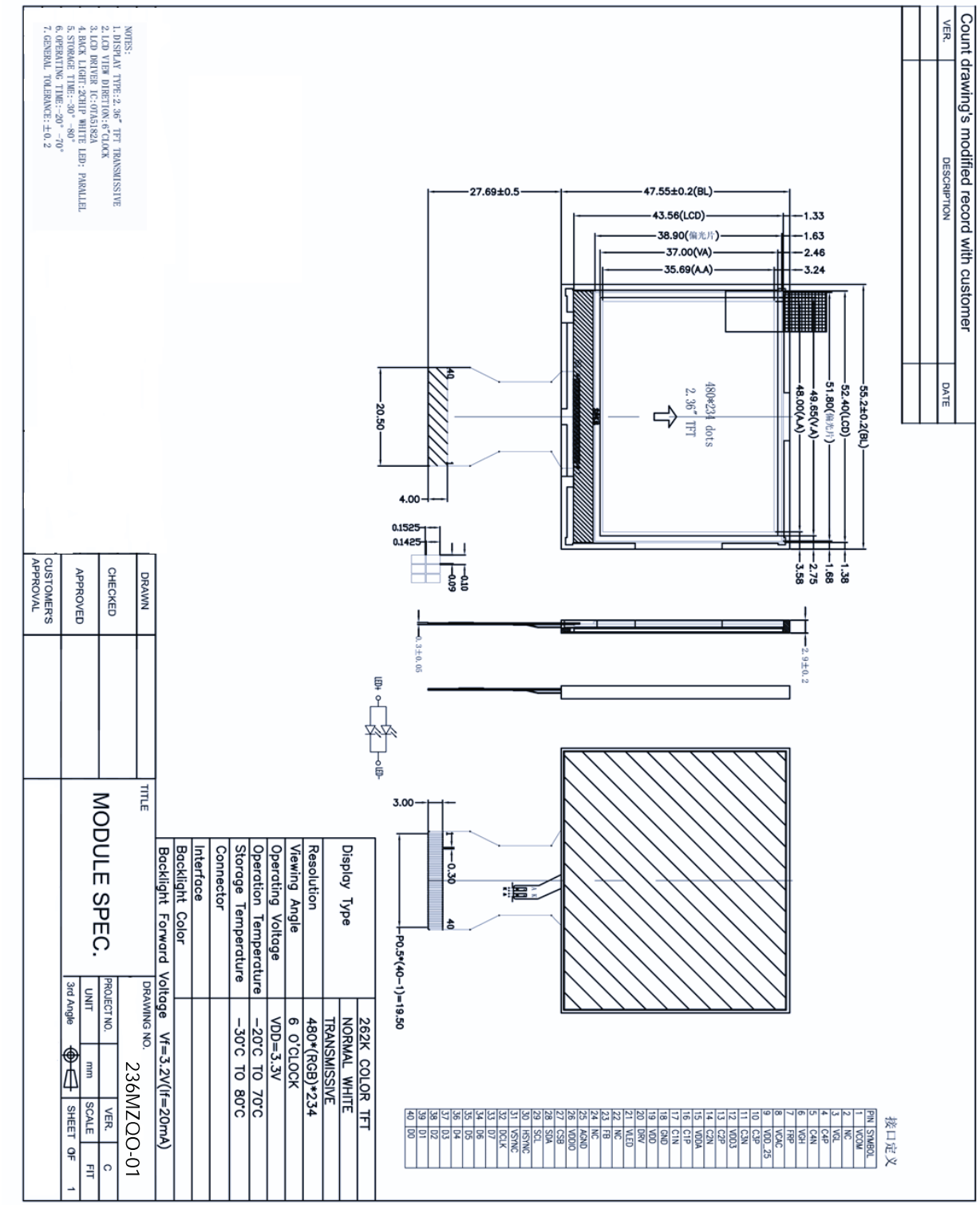
1.4 Applications:

Mobile phone
PSP
PDA
GPS
Etc…

2. General specification

ITEM	Standard value	UNIT
LCD Type	TFT Transmissive	---
Driver element	a-Si TFT Active matrix	
Number of Dots	480*234	Dots
Pixel Arrangement	RGB Delta Stripe	
Active Area	48.0 *35.685	mm
Viewing Area (W*H)	/	mm
Viewing Direction	6 O'clock	
Driver IC	OTA5182A	
Module Size(W*H*T)	55.2x47.55x2.9	mm
Approx. Weight	TBD	g
Back Light	White LED	
System interface	8 BITS RGB interface	

3. Mechanical drawing



4. ABSOLUTE MAXIMUM RATINGS

Parameter	Symbol	Min	Max	Unit
Supply voltage for logic	V_{CC}	-0.3	3.3	V
Input voltage for logic	V_{IN}	-0.5	V_{CC} +0.3	V
Supply current (One LED)	I_{LED}		30	mA
Operating temperature	T_{OP}	-10	+60	°C
Storage temperature	T_{ST}	-20	+70	°C

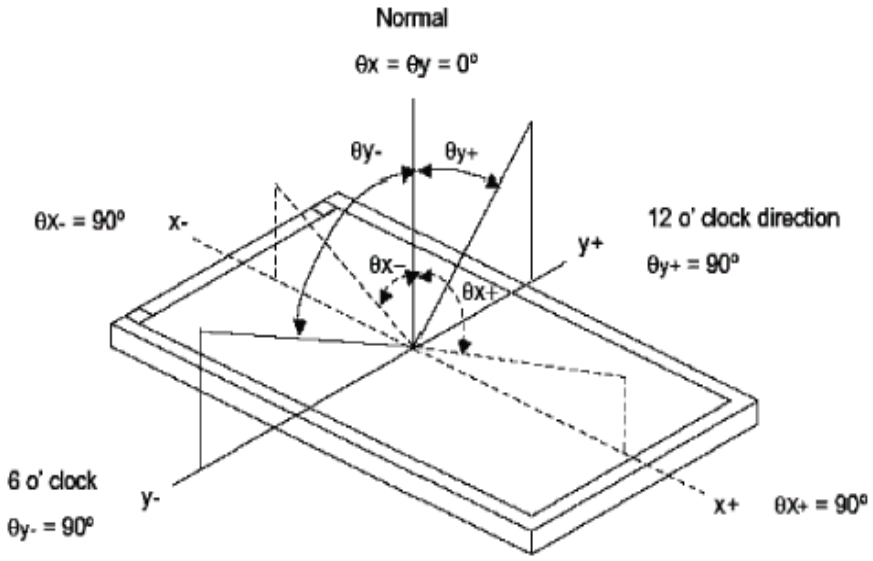
5. ELECTRICAL CHARACTERISTICS

Item	Symbol	Min	Typ	Max	Unit	Applicable terminal
Supply voltage for logic	V_{CC}	3.0	3.3	3.6	V	V_{DD}
Input voltage	V_{IL}	-0.3	-	0.2 V_{DD}	V	
	V_{IH}	0.8 V_{CC}	-	V_{CC}	V	
Input leakage current	I_{LKG}				μA	
LED Forward voltage	V_f	3.0	3.2	3.4	V	--
Input backlight current	I_{LED}	-	20	25	mA	With One LED

6. OPTICAL CHARACTERISTICS

ITEM		SYMBOL	CONDITIONS	SPECIFICATIONS			UNIT	NOTE
				MIN.	TYP.	MAX		
Brightness		B	Viewing normal angle	---	100	--	Cd/m^2	All left side data are based on wasam's product reference only
Contrast Ratio		CR		250	350	--	--	
Response Time		Tr+Tf		--	50	70	ms	
CIE Color coordinate	Red	X_R		--	0.633			
		Y_R			0.329			
	Green	X_G		--	0.297			
		Y_G			0.577			
	Blue	X_B		--	0.133			
		Y_B			0.129			
	White	X_W		--	0.294			
		Y_W			0.334			
Viewing Angle	Hor.	θ_{X+}	Center CR>=10	40	45	--	Deg.	
		θ_{X-}		40	45	--		
	Ver.	θ_{Y+}		30	35	--		
		θ_{Y-}		10	15			
Uniformity	Un			80	85		%	

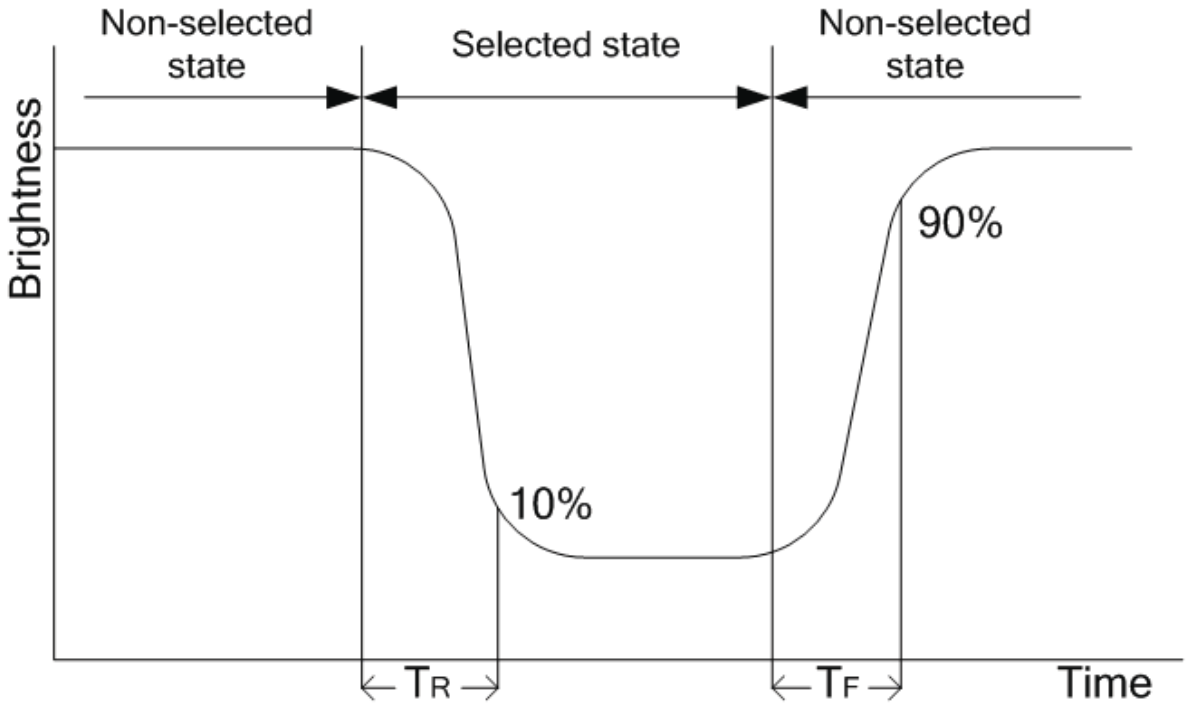
Note 1 : Definition of Viewing Angle θ_x and θ_y :



Note 2: Definition of contrast ratio CR:

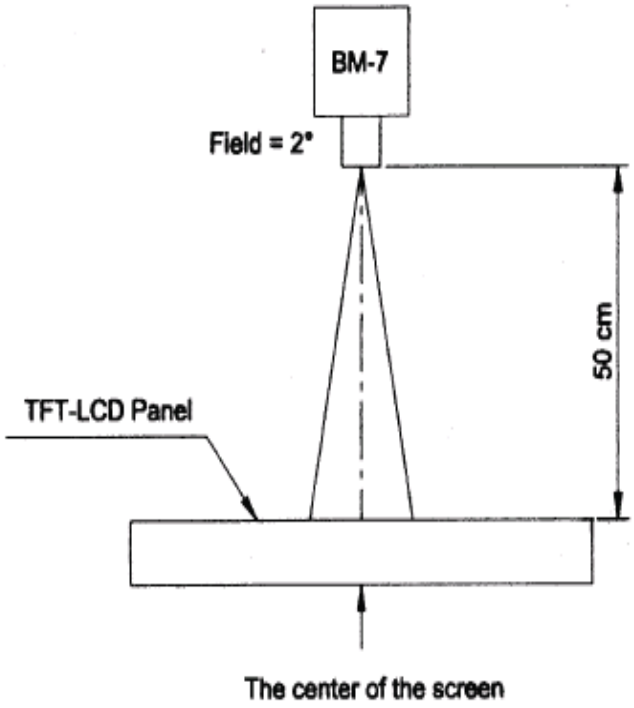
$$CR = \frac{\text{Brightness of non-selected dots (white)}}{\text{Brightness of selected dots (black)}}$$

Note 3: Definition of response time (T_R, T_F)

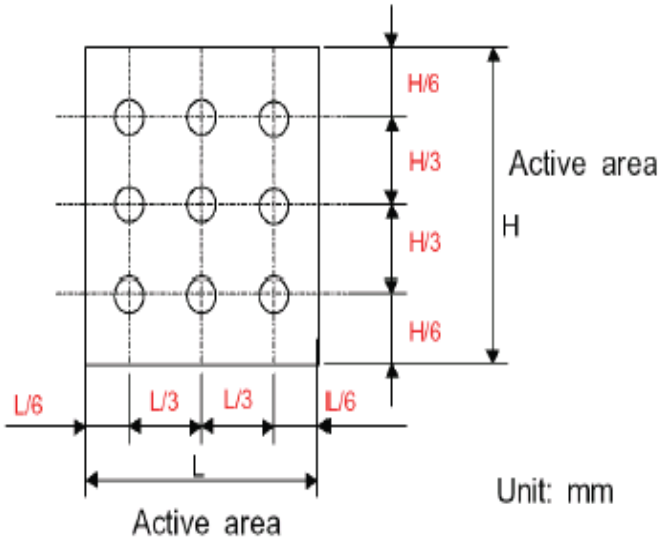

Non-selected state
Selected state
Non-selected state
Brightness
90%
10%
TR
TF
Time

: The brightness test equipment setup

20mA Field=2° (As measuring "black" image, field=2° is the best testing condition)



Note 4 :



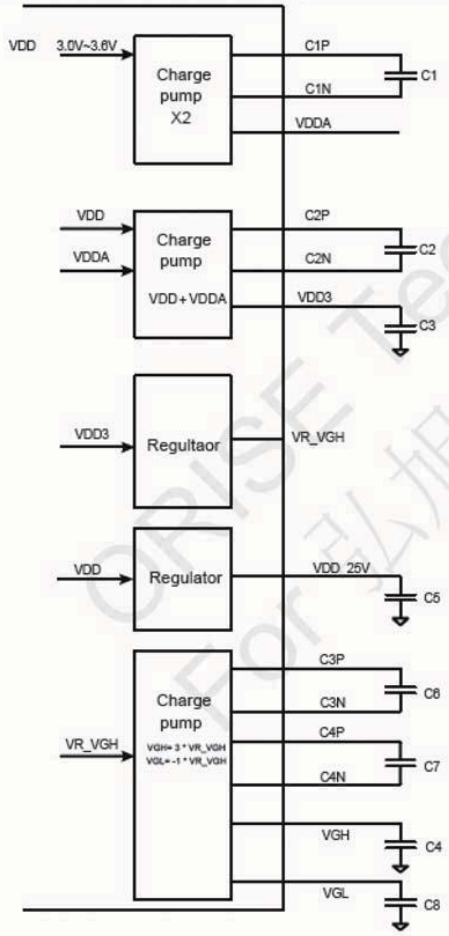
7. MCU Interface Pin Function

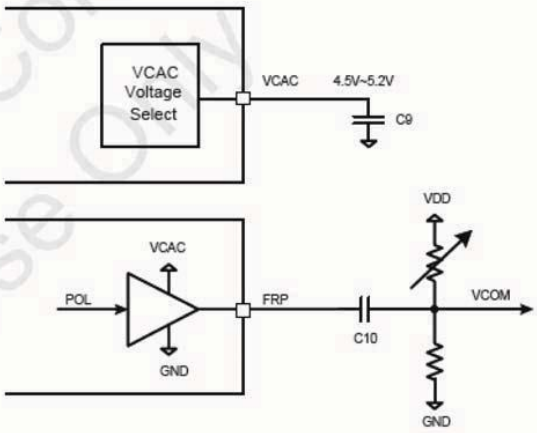
NO.	SYMBOL	Description	I/O
1	VCOM	Common	Power supply
2	NC	Not Connect	
3	VGL	Power supply for gate off voltage.	
4	C4P	Pins to connect capacitance for power circuitry.	
5	C4N	Pins to connect capacitance for power circuitry.	
6	VGH	Power supply for gate on voltage.	
7	FRP	Frame polarity output for VCOM.	
8	VCAC	Define the amplitude of the VCOM wing.	
9	VDD_25V	Intermediate voltage for charge Pump.Please connect the capacitor between VDD_25V and GND.	
10	C3P	Pins to connect capacitance for power circuitry.	
11	C3N	Pins to connect capacitance for power circuitry.	
12	VDD3	Charge-pump circuit reference voltage. Please connect the capacitor between VDD3 and GND.	
13	C2P	Pins to connect capacitance for power circuitry.	
14	C2N	Pins to connect capacitance for power circuitry.	
15	VDDA	Power supply voltage of source driver liquid crystal drive circuit. Please connect the capacitor between VDDA and GND.	I
16	C1P	Pins to connect capacitance for power circuitry.	I
17	C1N	Pins to connect capacitance for power circuitry.	
18	GND	Power ground	
19	VDD	Power supply for analog circuit blocks (3.0~ 3.6 V)	

20	DRV	Gate signal for the power transistor of the boost converter	
21	VLED	Supply voltage for LED backlight	
22	NC		
23	FB	Main boost regulator feedback input	I
24	NC		I
25	AGND	Power ground	I
26	VDDIO	Power supply for interface logic circuits (1.8 ~ 3.6V)	I
27	CSB	Serial communication chip select (“Low” enable).	I
28	SDA	Serial communication data input.	
29	SCL	Serial communication clock input.	
30	HSYNC	Line synchronizing signal for RGB interface operation.	
31	VSYNC	Frame synchronizing signal for RGB interface operation.	
32	DCLK	Dot clock signal for RGB interface operation.	
33~40	D7~D0	Data Input	

.

Note1:VCOM=+5.0 Vp-p.(Typ.)
Note2: The external capacitor is required on those pins as following.





Note: (1) Value of wiring resistance at pins except VDD, GND, C1P~C4N must be <7ohm

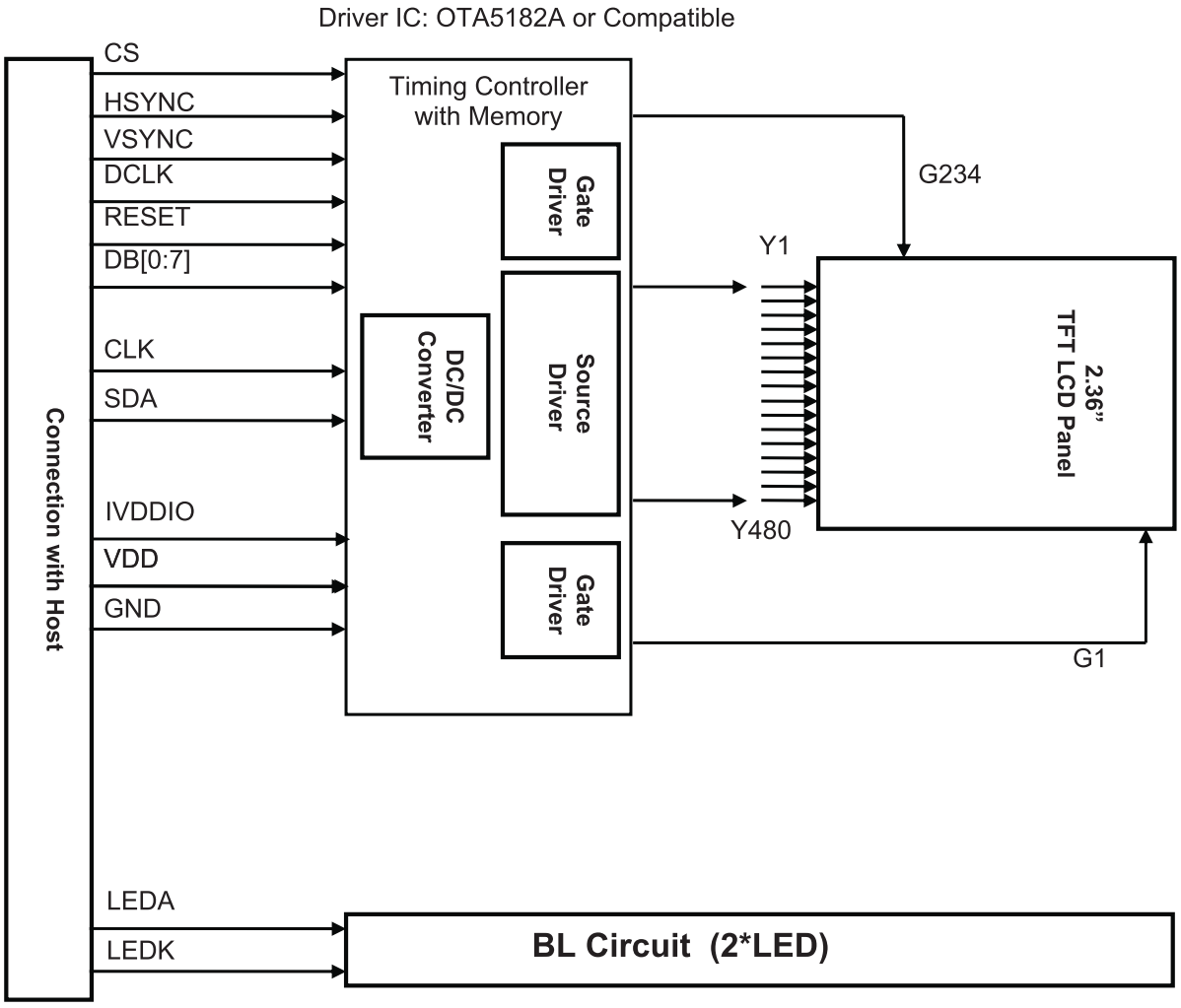
(2) Suggestion Capacitors value and types

Capacitor no.	Withstanding voltage(V)	CAP (uF)	Cap. Type
C1,C5,C9,C10	10	1 to 4.7	X5R/Y5V
C2,C3,C6,C7	16	1 to 4.7	X5R/Y5V
C4	25	1 to 4.7	Only X5R
		2.2 to 4.7	X5R/Y5V
C8	25	0.47 to 4.7	X5R/Y5V

Note3: VDD, VDDIO=+3.3V (Typ.)
Note4: Outputs the control signal of switching regulator for LED. Duty cycle varies according to FB input voltage
Note5: Feedback signal of switching signal for LED. It controls DRV output duty cycle with 0.6V input level sense.
Note6: Horizontal sync signal, it is a “L “active signal.
Note7: Vertival sync signal, it is a “Low “active signal.
Note8: Dot clock signal for RGB interface, timing for data loading defined at rising edge.

ORISE Tech Confidential
For 联旭 Use Only

8. BLOCK DIAGRAM



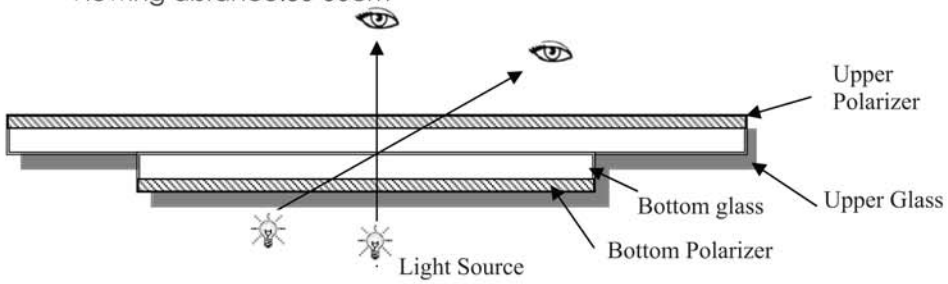
9.LCM Quality Criteria

9.1 VISUAL & FUNCTION INSPECTION STANDARD

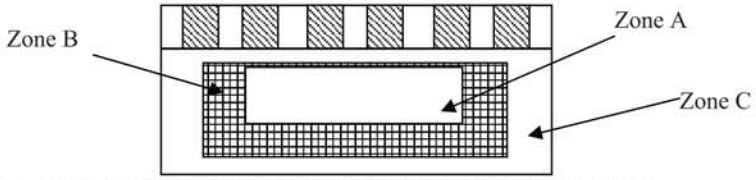
9.1.1 Inspection conditions

Inspection performed under the following conditions is recommended.

Temperature : 25±5℃
Humidity : 65%±10%RH
Viewing Angle : Normal viewing Angle.
Illumination: Single fluorescent lamp (300 to 700Lux)
Viewing distance:30-50cm



9.1.2 Definition



Zone A : Effective Viewing Area(Character or Digit can be seen)
Zone B : Viewing Area except Zone A
Zone C : Outside (Zone A+Zone B) which can not be seen after assembly by customer .)
Note:

As a general rule ,visual defects in Zone C can be ignored when it doesn't effect product function

or appearance after assembly by customer.

9.1.3 Sampling Plan

According to GB/T 2828-2003 ; , normal inspection, Class II
AQL:

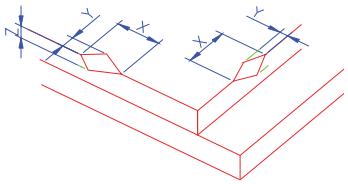
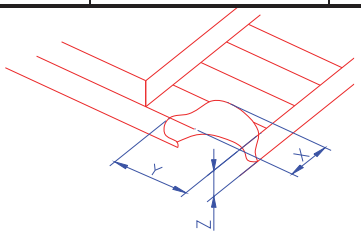
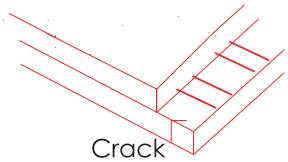
Major defect	Minor defect
0.65	1.5

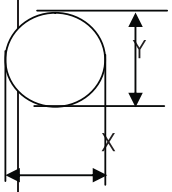
LCD: Liquid Crystal Display , TP: Touch Panel , LCM: Liquid Crystal Module

No	Items to be inspected	Criteria	Classification of defects
1	Functional defects	1) No display, Open or miss line 2) Display abnormally, Short 3) Backlight no lighting, abnormal lighting. 4) TP no function	Major
2	Missing	Missing component	
3	Outline dimension	Overall outline dimension beyond the drawing is not allowed	
4	Color tone	Color unevenness, refer to limited sample	Minor
5	Soldering appearance	Good soldering , Peeling off is not allowed.	
6	LCD/Polarizer/TP	Black/White spot/line, scratch, crack, etc.	

9.1.4 Criteria (Visual)

<table>
<tr><th>Number</th><th>Items</th><th>Criteria(mm)</th></tr>
<tr><td rowspan="3">1.0 LCD Crack/Broken

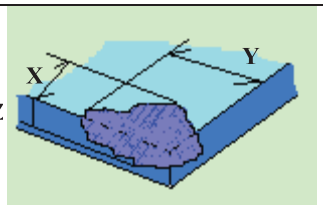
NOTE:
X: Length
Y: Width
Z: Height
L: Length of ITO,
T: Height of LCD</td><td>(1) The edge of LCD broken</td><td> 
<table><tr><th>X</th><th>Y</th><th>Z</th></tr><tr><td>≤3.0mm</td><td><Inner border line of the seal</td><td>≤T</td></tr></table></td></tr>
<tr><td>(2)LCD corner broken</td><td> 
<table><tr><th>X</th><th>Y</th><th>Z</th></tr><tr><td>≤3.0mm</td><td>≤L</td><td>≤T</td></tr></table></td></tr>
<tr><td>(3) LCD crack</td><td> 
Crack
Not allowed</td></tr>
</table>

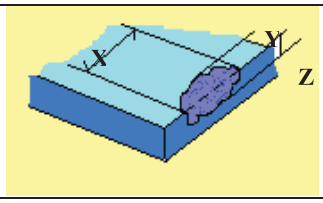
<table>
<tr><th>Number</th><th>Items</th><th>Criteria (mm)</th></tr>
<tr><td>2.0</td><td>Spot defect
 

Φ=(X+Y)/2</td><td>① light dot（LCD/TP/Polarizer black/white spot , light dot, pinhole, dent, stain）
<table>
<tr><th rowspan="2">Zone
Size (mm)</th><th colspan="3">Acceptable Qty</th></tr>
<tr><th>A</th><th>B</th><th>C</th></tr>
<tr><td>Φ≤0.10</td><td colspan="2">Ignore</td><td rowspan="4">Ignore</td></tr>
<tr><td>0.10<Φ≤0.15</td><td colspan="2">3(distance≧10mm)</td></tr>
<tr><td>0.15<Φ≤0.2</td><td colspan="2">1</td></tr>
<tr><td>0.2<Φ</td><td colspan="2">0</td></tr>
</table>
②Dim spot（LCD/TP/Polarizer dim dot, light leakage、dark spot）
<table>
<tr><th rowspan="2">Zone
Size (mm)</th><th colspan="3">Acceptable Qty</th></tr>
<tr><th>A</th><th>B</th><th>C</th></tr>
<tr><td>Φ≤0.1</td><td colspan="2">Ignore</td><td rowspan="4">Ignore</td></tr>
<tr><td>0.1<Φ≤0.2</td><td colspan="2">2(distance≧10mm)</td></tr>
<tr><td>0.2<Φ≤0.3</td><td colspan="2">1</td></tr>
<tr><td>Φ＞0.3</td><td colspan="2">0</td></tr>
</table>
③ Polarizer accidented spot
<table>
<tr><th rowspan="2">Zone
Size (mm)</th><th colspan="3">Acceptable Qty</th></tr>
<tr><th>A</th><th>B</th><th>C</th></tr>
<tr><td>Φ≤0.2</td><td colspan="2">Ignore</td><td rowspan="3">Ignore</td></tr>
<tr><td>0.2<Φ≤0.5</td><td colspan="2">2(distance≧10mm)</td></tr>
<tr><td>Φ>0.5</td><td colspan="2">0</td></tr>
</table></td></tr>
<tr><td></td><td>Line defect (LCD/TP /Polarizer black/white line, scratch, stain)</td><td>
<table>
<tr><th rowspan="2">Width(mm)</th><th rowspan="2">Length(mm)</th><th colspan="3">Acceptable Qty</th></tr>
<tr><th>A</th><th>B</th><th>C</th></tr>
<tr><td>Φ≤0.03</td><td>Ignore</td><td colspan="2">Ignore</td><td rowspan="3">Ignore</td></tr>
<tr><td>0.03<W≤0.05</td><td>L≤3.0</td><td colspan="2">N≤2</td></tr>
<tr><td>0.05<W≤0.08</td><td>L≤2.0</td><td colspan="2">N≤2</td></tr>
<tr><td>0.08<W</td><td colspan="4">Define as spot defect</td></tr>
</table></td></tr>
</table>

<table>
<tr><td>3.0</td><td>Polarizer Bubble</td><td colspan="3">
<table>
<tr><td rowspan="2">Zone
Size (mm)</td><td colspan="3">Acceptable Qty</td></tr>
<tr><td>A</td><td>B</td><td>C</td></tr>
<tr><td>Φ≤0.2</td><td colspan="2">Ignore</td><td rowspan="4">Ignore</td></tr>
<tr><td>0.2<Φ≤0.4</td><td colspan="2">2(distance≧10mm)</td></tr>
<tr><td>0.4<Φ≤0.6</td><td colspan="2">1</td></tr>
<tr><td>0.6<Φ</td><td colspan="2">0</td></tr>
</table>
</td></tr>
<tr><td>4.0</td><td>SMT</td><td colspan="3">According to IPC-A-610C class Ⅱ standard . Function defect and missing part are major defect ,the others are minor defect.</td></tr>
<tr><td rowspan="3">5.0</td><td rowspan="3">TP Related</td><td>TP bubble/ accidented spot</td><td colspan="2">
<table>
<tr><td rowspan="2">Size Φ(mm)</td><td colspan="3">Acceptable Qty</td></tr>
<tr><td>A</td><td>B</td><td>C</td></tr>
<tr><td>Φ≤0.1</td><td colspan="2">Ignore</td><td rowspan="4">Ignore</td></tr>
<tr><td>0.1<Φ≤0.2</td><td colspan="2">2</td></tr>
<tr><td>0.2<Φ≤0.3</td><td colspan="2">1</td></tr>
<tr><td>0.3<Φ</td><td colspan="2">0</td></tr>
</table>
</td></tr>
<tr><td>Assembly deflection</td><td colspan="2">beyond the edge of backlight ≤0.15mm</td></tr>
<tr><td>Newton Ring</td><td>Newton Ring area>1/3 TP area NG

Newton Ring area≤1/3 TP area OK</td><td> 
</td></tr>
</table>

<table>
<tr>
<td></td>
<td></td>
<td>TP corner broken
X：length
Y：width
Z：height</td>
<td>
<table>
<tr><td>X</td><td>Y</td><td>Z</td></tr>
<tr><td>X≤3.0mm</td><td>Y≤3.0mm</td><td>Z<LCD thickness</td></tr>
</table>
* Circuitry broken is not allowed.
</td>
<td rowspan="2"> 
</td>
</tr>
<tr>
<td>TP edge broken
X：length
Y：width
Z：height</td>
<td>
<table>
<tr><td>X</td><td>Y</td><td>Z</td></tr>
<tr><td>X≤6.0mm</td><td>Y≤2.0mm</td><td>Z<LCD thickness</td></tr>
</table>
* Circuitry broken is not allowed.
</td>
</tr>
</table>



Criteria (functional items)

Number	Items	Criteria (mm)
1	No display	Not allowed
2	Missing segment	Not allowed
3	Short	Not allowed
4	Backlight no lighting	Not allowed
5	TP no function	Not allowed

9.2 RELIABILITY TEST

NO	ITEM	CONDTTION	STANDARD
1	High Temp. Storage	70℃, 12 hours	1. Functional test is OK. Missing Segment, short, unclear segment, non-display, display abnormally and liquid crystal leak are un-allowed. 2. No low temperature bubbles, end seal loose and fall, frame rainbow.
2	Low Temp. Storage	-20℃, 12 hours	
3	High Temp. Operation	60℃, 12 hours	
4	Low Temp. Operation	-10℃, 12 hours	
5	High temperature and high Humidity storage	40℃,90%RH ,12 hours	
6	Thermal and cold shock	Static state， -20℃（30 Min）~70℃（30 Min）~ -20℃（30Min）, packaging，10 cycles	
7	Vibration test	Packaging，Frequency : 10-55Hz Amplitude : 1.0mm， Each direction on X,Y axe 0.5 houre，circle 2 hours	1. Function test is OK. 2. No glass crack, chipped glass, end seal loose and fall, epoxy frame crack and so on. 3. No structure loose and fall.
8	Dropping test	Pack products into the carton box. Drop it from 80cm height to ground. Once for each side of the carton	

9.2.1 The reliability items will be fully performed in new sample qualification,

9.2.2 The reliability status will be tested as monitor during mass production. Individual reliability test shall be performed by lot , Moreover, the individual reliability item shall be decided according to reliability plan.

9.2.3 All samples are inspected after keeping in the room with normal temperature and humidity for 2 hours or above.

9.2.4 Vibration test: It is not necessary to test for those products without assembly frame , back light ,PCB and so on.

9.2.5 Dropping test : It is necessary for affirming new package.

9.2.6 For the high temperature and high humidity test, pure water of over 10 MΩ.cm should be used.

9.2.7 Each test item applies for test LCM only once .Then tested LCM cannot be used again in any other test item.

9.2.8 The quantity of LCM examination for each test item is 5pcs to 10pcs.

9.3 Safetv instructions

10.3.1 If the LCD panel breaks, be careful not to get any liquid crystal substance in your mouth.

9.3.2 If the liquid crystal substance touches your skin or clothes, please wash it off immediately by using soap and water.

9.4 Handling Precautions

9.4.1 Avoid static electricity damaging the LSI.

9.4.2 Do not remove the panel or frame from the module .

9.4.3 The polarizing plate of the display is very fragile . So, please handle it very carefully.

9.4.4 Do not wipe the polarizing plate with a dry cloth, as it may easily scratch the surface of the plate.

9.4.5 The color tone of display and background of LCM has the possibility to be changed in the storage temperature range.

9.4.6 Pay attention to the working environment, as the element may be destroyed by static electricity.

--Be sure to ground human body and electric appliance during work.

--Avoid working in a dry environment to minimize the generations of static electricity.

--Static electricity may be generated when the protective film is fast peeled off.

9.4.7 When soldering the terminal of LCM, make certain the AC power source of soldering iron does not leak.

9.4.8 If the display surface becomes contaminated ,breathe on the surface and gently wipe it with a soft-dry- clean cloth .If it is heavily contaminated ,moisten cloth with the following solvent(ex:Ethyl alcohol).Solvents other than those above-mentioned may damage the polarizer(Especially ,do not use them .ex: Warter / Ketone)

9.5 Operation instructions

9.5.1 It is recommended to drive the LCD within the specified voltage limits, try to adjust the operating voltage for the optimal contrast, the color and contrast of LCD panel will varies at different temperature.

9.5.2 Response time is greatly delayed at low 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.

9.5.3 If the display area is pushed hard during operation, the display will become abnormal.

9.5.4 Do not operate the LCD at the environments over the specified conditions, this may cause damage on the LCD and shorten the lifetime.

9.6 Storage instructions:

9.6.1 Store LCDs in a sealed polyethylene bag.

9.6.2 Store LCDs in a dark place, Do not expose to sunlight or fluorescent light. Keep the temperature between 0℃and 35℃.

9.6.3 Avoid the polarizer touch any other object, (It is recommended to store them in the container in which they were shipped.)

9.7 Limited Warranty

9.7.1 Phoenix Display will replace or repair any of its LCD modules,which are found to be defective.when inspected in accordance with LCM acceptance standards (copies available upon request) for a period of 12 months from ink- print date on product

9.7.2 Any defects must be returned to within 60 days since ship-out. Confirmation of such date shall be based on freight documents. The warranty liability of wasam limited to repair and/or replacement on defects above (7.1,7.2)

9.7.3 No warranty can be granted if the precautions stated above have been disregarded. The typical samples are as below:

-- LCD glass crack/break
--PCB outlet is damaged or modified.
--PCB conductors damaged.
--Circuit modified with by grinding, engraving or painting varnish.
--FPC crack

9.7.4 Modules must be returned with sufficient description of the failures of defects. Any connectors or cable installed by the customer must be removed completely without damaging the PCB outlet, conductors and terminals. Modules must be packed with the container in which they were shipped.



