



PRODUCT SPECIFICATION

2.8 INCH TFT LCD PANEL

MODEL: HS028WPB-TS4000

Customer Approval:

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Contents

1	1. Product Features-----	4
2	2. Physical Specifications -----	4
3	3. Product Drawings -----	5
4	4.1 The Interface Definition-----	6
	4.2 Reference circuit -----	7
5	5. Absolute Maximum Ratings -----	7
6	6. Electrical Characteristics -----	8
7	7. Optical Characteristics -----	8
8	8. Block Diagram -----	10
9	9. LCM Quality Criteria -----	11
10	9.1 Visual & Function Inspection Standard-----	11
11	9.1.1 Inspection conditions-----	11
12	9.1.2 Definition-----	11
13	9.1.3 Sampling Plan-----	12
14	9.1.4 Criteria (Visual)-----	13
15	9.1.5 Criteria (functional items)-----	15
16	9.2 Reliability Test-----	16
17	9.3 Safety instructions-----	17
18	9.4 Handling Precautions-----	17
19	9.5 Operation instructions-----	17
20	9.6 Storage instructions-----	18
21	9.7 Limited Warranty-----	18
22	10. Packing method-----	19

1. Product Features

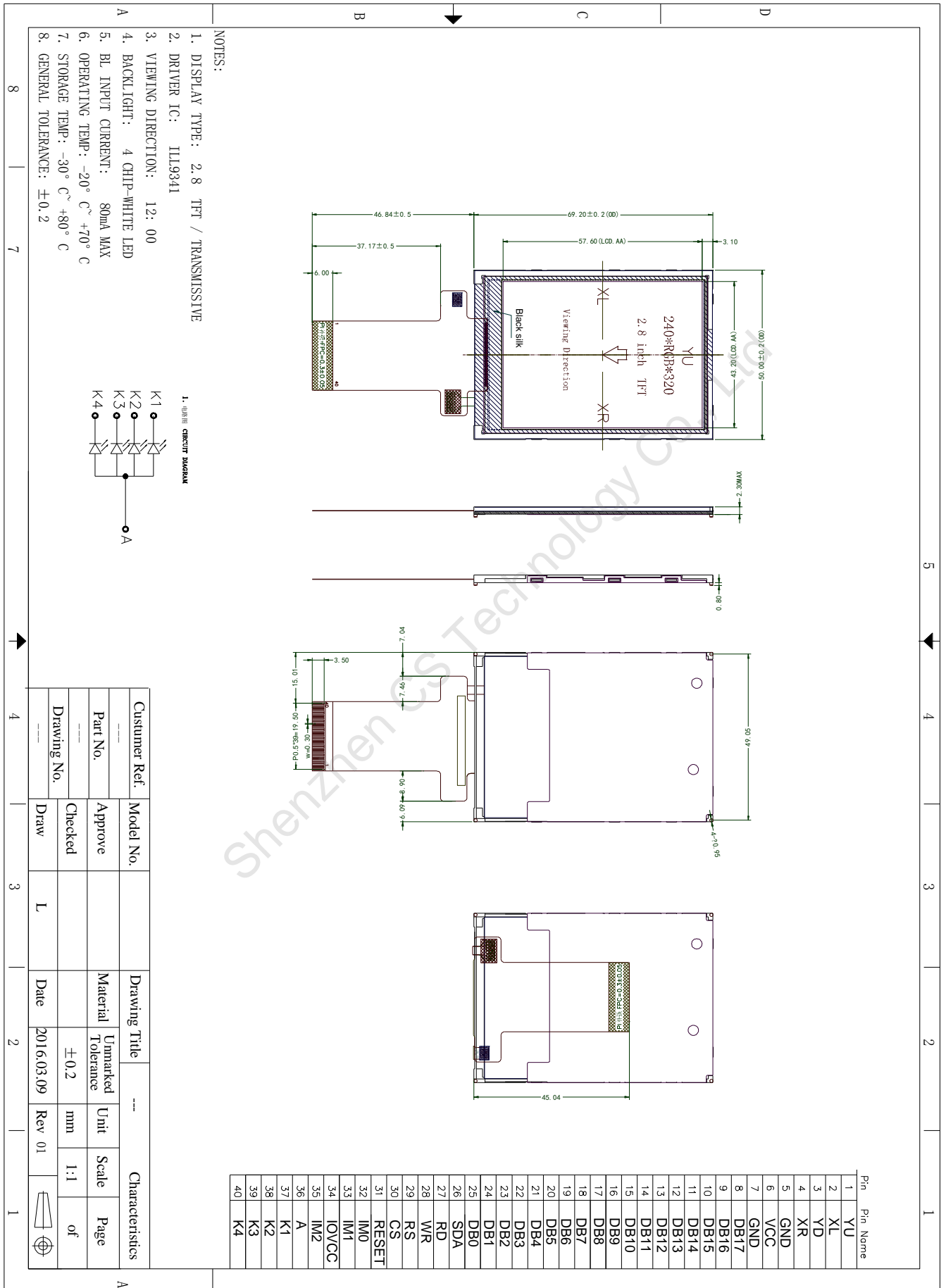
No	Item	Description
1	Model	HS028WPB-TS4000
2	Display Type	2.8 inch TFT Normally White
3	Resolution	240*RGB*320
4	Color	65K/262K
5	View Angle	12 O'CLOCK
6	Driver IC	ILI9341
7	Interface Types	MCU8Bit/16Bit/SPI
8	Connection mode	0.5mm 40Pin (plug in)
9	Backlight	In parallel 4 LED
10	Power consumption	90mA@3.3V
11	Brightness	300cd/m ²
12	Touch Panel	Without or RTP

2. Physical Specifications

No	Item	Specification	Units
1	Outline Dimension	50.0*69.2*2.3	mm
2	Active Area Dimension	43.20*57.6	mm
3	Resolution	240*3RGB*320	/
4	Pixel Pitch	0.060(H) × 0.180(V)	mm
5	Structure Type	COG+FPC+BL (note)	/

Note: COG: Chip On Glass (LCD+IC); BL: Backlight; TP: Touch Panel

3. Product Drawings



4.1 The Interface Definition

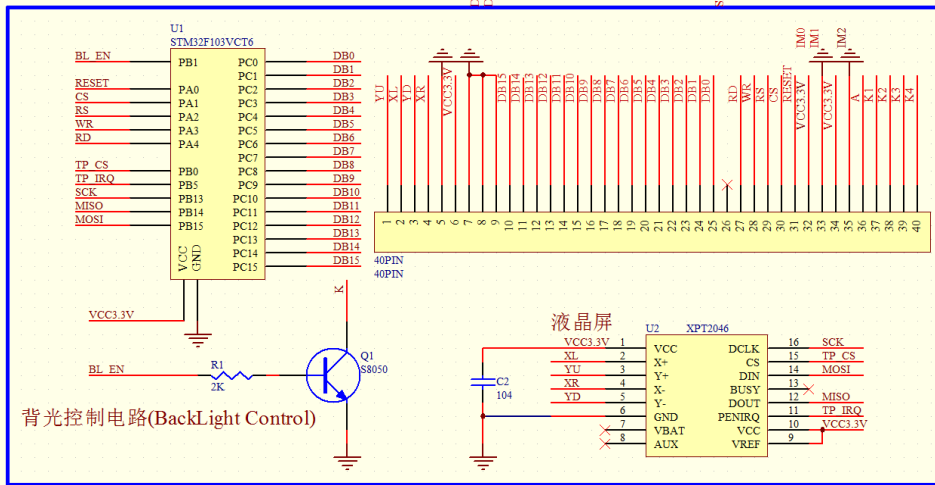
PIN NO.	SYMBOL	Description	Input/output (I/O)
1	YU	电阻触摸 Touch panel YU	0
2	XL	电阻触摸 Touch panel XL	0
3	YD	电阻触摸 Touch panel YD	0
4	XR	电阻触摸 Touch panel XR	0
5	GND	电源地 (Power Ground)	Power supply
6	VCC	模拟电路供电 (Power supply 3.3V)	Power supply
7	GND	电源地 (Power Ground)	Power supply
8-25	DB17-DB0	数据接口 (Data bus)	I/O
26	SDA	串行数据口(Serial input Data BUS)	I/O
27	/RD	读允许信号 (Read signal)	I
28	WR	写允许信号 (Write signal) /串行接口寄存器选择(data/command selection)	I
29	RS	寄存器选择信号: 0 命令; 1: 参数/数据 (Command/data select pin) /串行接口时钟 (serial interface clock)	I
30	/CS	液晶驱动片选信号 (Chip select pin)	I
31	/RESET	液晶驱动复位信号 (Reset signal)	I
32	IM0	接口位数选择 (Interface mode select)	Note1
33	IM1	接口位数选择 (Interface mode select)	Note1
34	IOVCC	逻辑电路供电 (Power supply 1.8V/3.3V)	Power supply
35	IM2	接口位数选择 (Interface mode select)	Note1
36	A	背光正极(Back light anode)	Power supply
37-40	K1-K4	背光负极(Back light cathode)	Power supply

Note1:

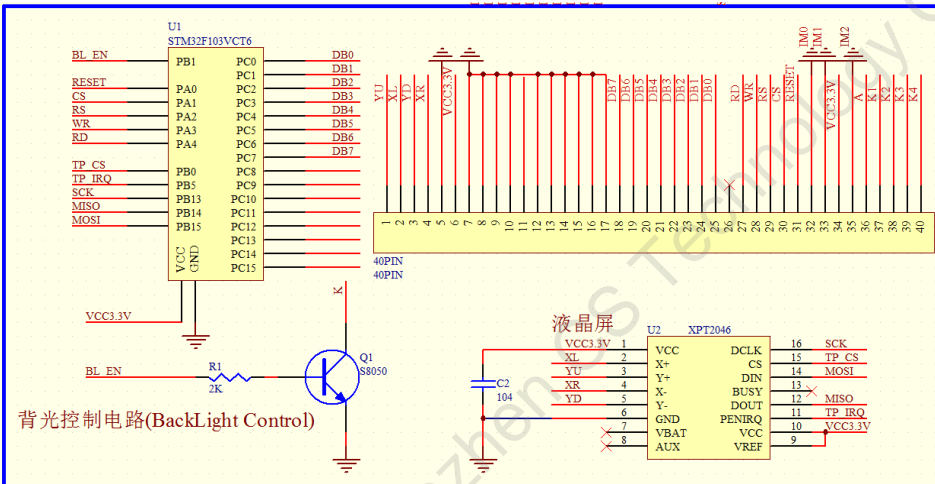
IM2	IM1	IM0	MPU Interface Mode	Data pin
0	0	0	80-8bit parallel I/F	DB[7:0]
0	0	1	80-16bit parallel I/F	DB[15:0]
0	1	0	80-9bit parallel I/F	DB[8:0]
0	1	1	80-18bit parallel I/F	DB[17:0],
1	0	1	3-line 9bit serial I/F	SDA: in/out
			2 data lane serial I/F	SDA: in/out WRX: in
1	1	0	4-line 8bit serial I/F	SDA: in/out

4.2 Reference circuit

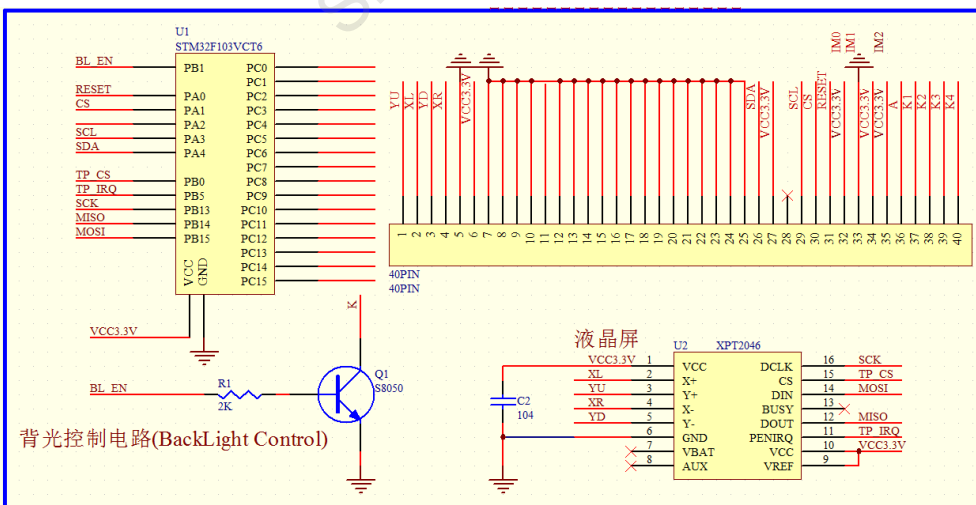
16BIT Reference circuit (If no need touch, P1-P4 NC, XPT2046 NC)



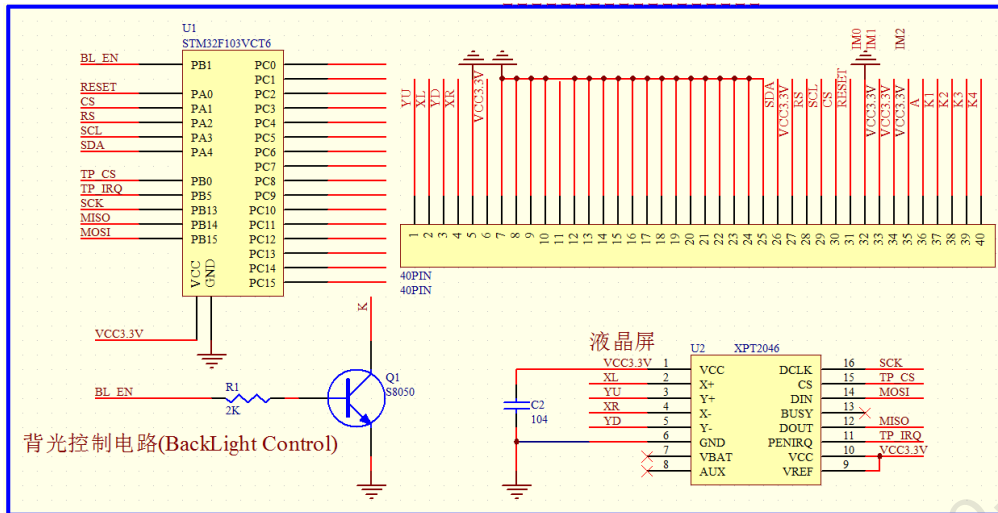
8BIT Reference circuit (If no need touch, P1-P4 NC, XPT2046 NC)



3WSPI Reference circuit (If no need touch, P1-P4 NC, XPT2046 NC)



4WSPI Reference circuit (If no need touch, P1-P4 NC, XPT2046 NC)



5. Absolute Maximum Ratings

Item	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}	15	20	mA
Operating temperature	T_{OP}	-20	+70	°C
Storage temperature	T_{ST}	-30	+80	°C

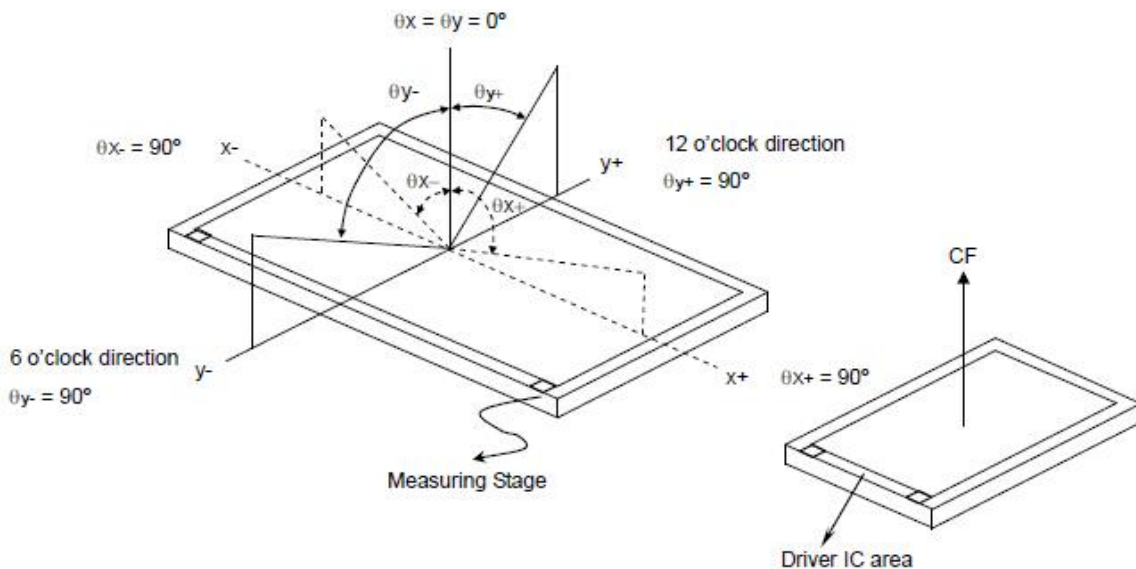
6. Electrical Characteristics

Item	Symbol	Min	Typ	Max	Unit	Applicable terminal
Supply voltage for logic	V_{CC}	2.5	2.8	3.3	V	V_{DD}
	IOVCC	1.65	1.8	3.3	V	I/O Voltage
Input voltage	V_{IL}	-0.3	-	$0.2 V_{DD}$	V	
	V_{IH}	$0.8 V_{CC}$	-	V_{CC}		
Input leakage current	I_{LKG}				μA	
LED Forward voltage	V_f	3.0	3.2	3.4	V	--
Input backlight current	I_{LED}	-	15	--	mA	With One LED

7. Optical Characteristics

Item	Symbol	Conditions	Specifications			Unit	Note
			Min	Typ	Max		
Brightness	B	Viewing normal angle	--	300	--	Cd.cm ²	
Contrast Ratio	CR		400	500	--	--	
ResponTime	Tr		--	30	60	Msec	
	Tf		--	30	60		
CIE Color coordinate	Red	X _R	-0.02	0.655	+0.02		
		Y _R		0.332			
	Green	X _G		0.314			
		Y _G		0.574			
	Blue	X _B		0.137			
		Y _B		0.135			
	White	X _W		0.305			
		Y _W		0.341			
Viewing Angle	Hor.	θ_{x+}	Center	40	65	--	Deg.
		θ_{x-}	CR>=10	40	65	--	
	Ver.	θ_{y+}		40	65	--	
		θ_{y-}		10	45	--	
Uniformity	Un			--	81	--	%

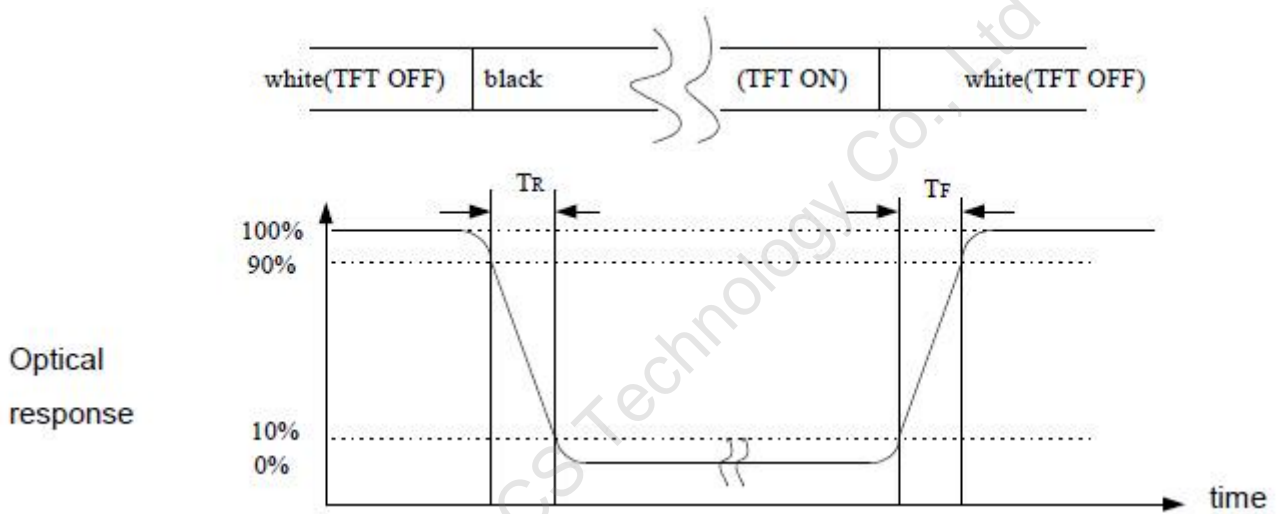
Note 1: Definition of Viewing Angle:



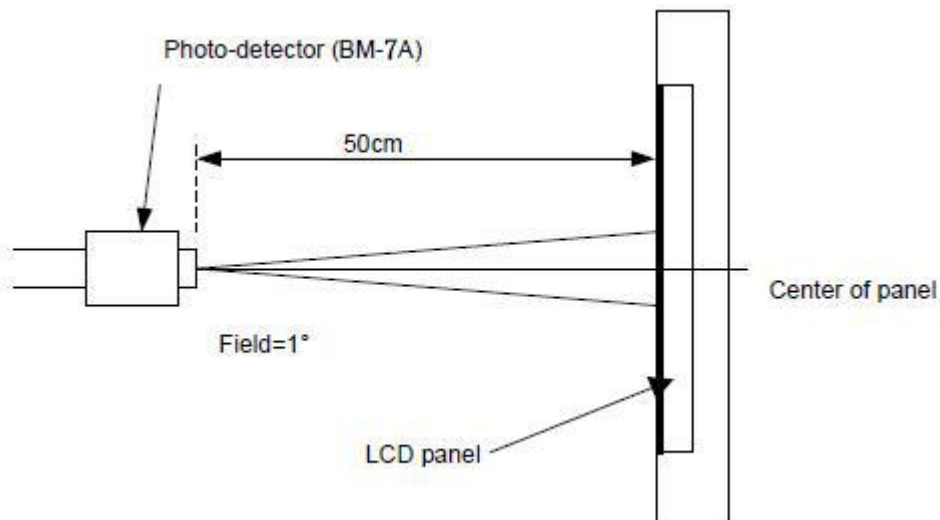
Note 2: Definition of contrast ratio CR:

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

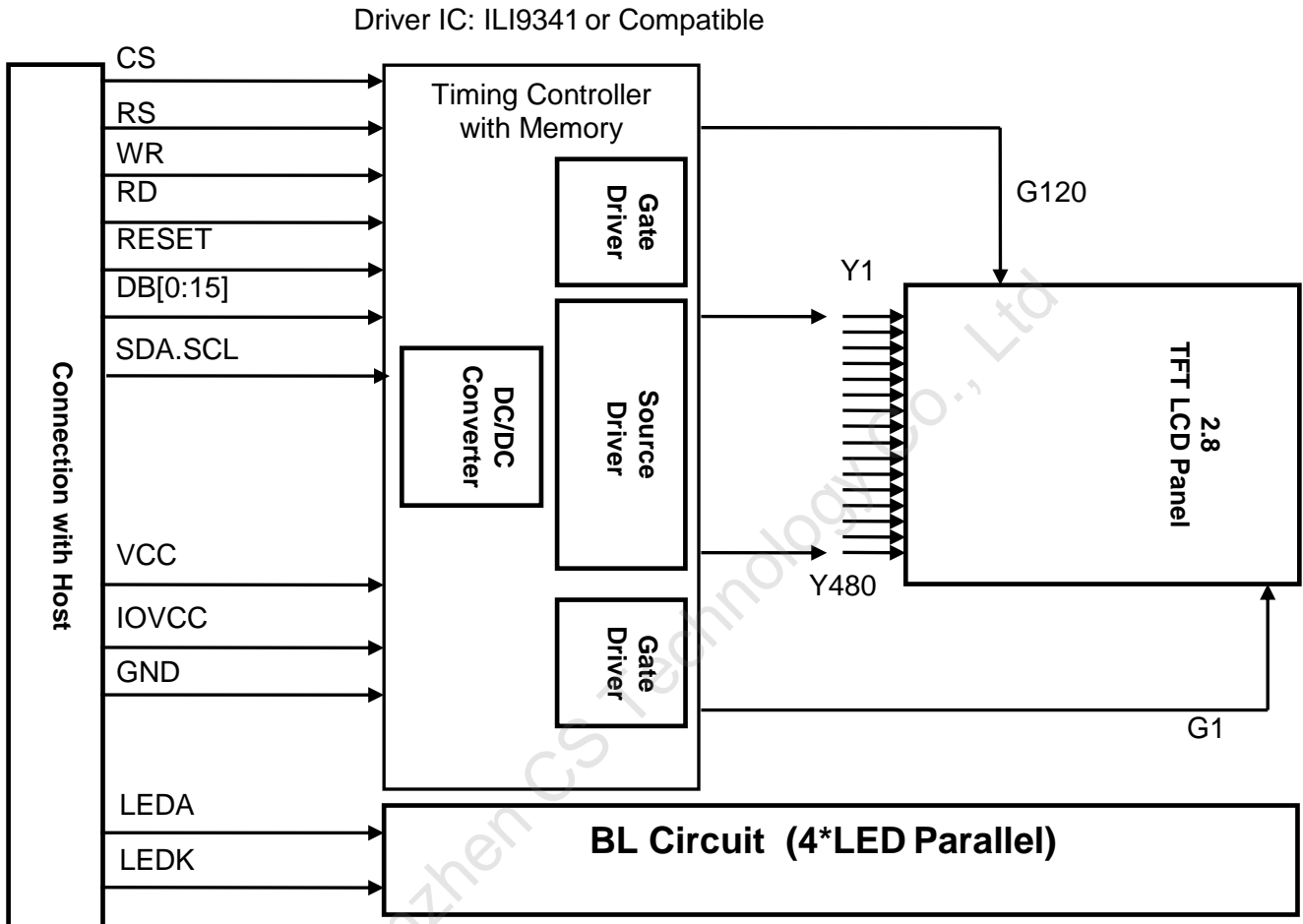
Note 3: Definition of response time (T_R, T_F)



Note 4: Definition of optical measurement setup



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.

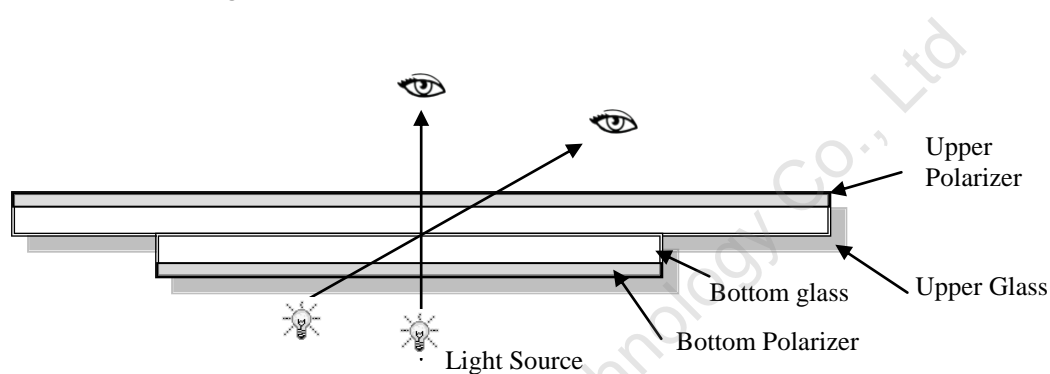
Temperature : $25 \pm 5^\circ\text{C}$

Humidity : $65\% \pm 10\% \text{RH}$

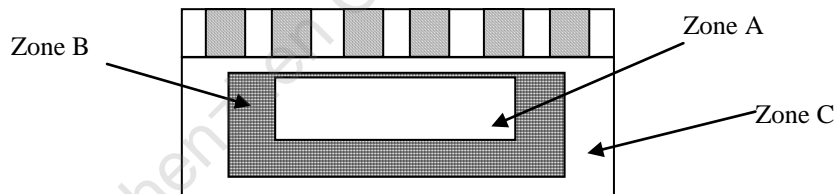
Viewing Angle : Normal viewing Angle.

Illumination: Single fluorescent lamp (300 to 700Lux)

Viewing distance: 30-50 cm



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

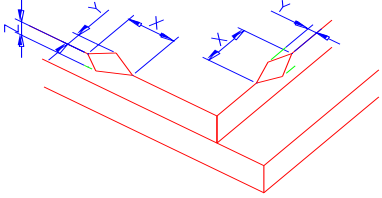
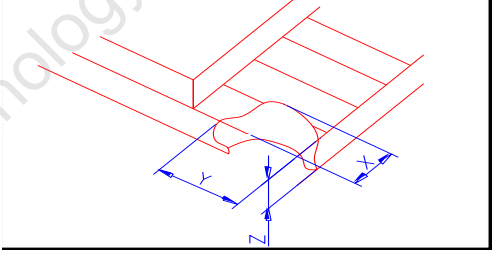
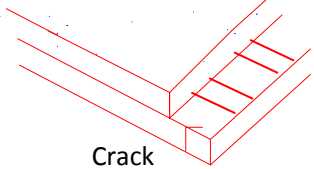
AQL:

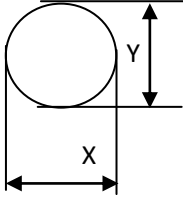
Major defect	Minor defect
0.65	1.5

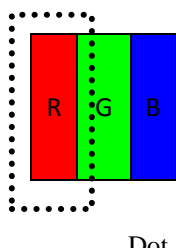
LCD: Liquid Crystal Display , TP: Touch Panel , LCM: Liquid Crystal Module

No	Items to be inspected	Criteria	Classification of defects
1	Functional defects	1. No display 2. Display abnormally 3. Missing vertical, horizontal segment 4. Short circuit 5. Back-light no lighting,lickering and abnormal lighting 6. Cross Talk 7. Noise 8. Color contrast	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	Black/White spot/line, scratch, crack, etc.	

9.1.4 Criteria (Visual)

Number	Items	Criteria(mm)						
1.0 LCD Crack/Broken NOTE: X: Length Y: Width Z: Height L: Length of ITO, T: Height of LCD	The edge of LCD broken	 <table border="1" data-bbox="842 719 1386 878"> <thead> <tr> <th>X</th> <th>Y</th> <th>Z</th> </tr> </thead> <tbody> <tr> <td>≤1.5mm</td> <td><Inner border line of the seal</td> <td>≤T</td> </tr> </tbody> </table>	X	Y	Z	≤1.5mm	<Inner border line of the seal	≤T
	X	Y	Z					
	≤1.5mm	<Inner border line of the seal	≤T					
LCD corner broken	 <table border="1" data-bbox="903 1229 1326 1303"> <thead> <tr> <th>X</th> <th>Y</th> <th>Z</th> </tr> </thead> <tbody> <tr> <td>≤1.5mm</td> <td>≤1.0mm</td> <td>≤T</td> </tr> </tbody> </table>	X	Y	Z	≤1.5mm	≤1.0mm	≤T	
X	Y	Z						
≤1.5mm	≤1.0mm	≤T						
LCD crack	 <p style="text-align: center;">Crack Not allowed</p>							

Number	Items	Criteria (mm)																							
2.0	Spot defect  $\Phi=(X+Y)/2$	light dot (LCD/TP/Polarizer black/white spot, light dot, pinhole, dent, stain) <table border="1"> <thead> <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> </thead> <tbody> <tr> <td>$\Phi \leq 0.10$</td> <td colspan="3">Ignore</td> </tr> <tr> <td>$0.10 < \Phi \leq 0.15$</td> <td colspan="3">2</td> </tr> <tr> <td>$0.15 < \Phi \leq 0.2$</td> <td colspan="3">1</td> </tr> <tr> <td>$0.2 < \Phi$</td> <td colspan="3">0</td> </tr> </tbody> </table>	Zone Size (mm)	Acceptable Qty			A	B	C	$\Phi \leq 0.10$	Ignore			$0.10 < \Phi \leq 0.15$	2			$0.15 < \Phi \leq 0.2$	1			$0.2 < \Phi$	0		
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		Dim spot (LCD/TP/Polarizer dim dot, light leakage, dark spot) <table border="1"> <thead> <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> </thead> <tbody> <tr> <td>$\Phi \leq 0.1$</td> <td colspan="3">Ignore</td> </tr> <tr> <td>$0.1 < \Phi \leq 0.2$</td> <td colspan="3">2</td> </tr> <tr> <td>$0.2 < \Phi \leq 0.3$</td> <td colspan="3">1</td> </tr> <tr> <td>$\Phi > 0.3$</td> <td colspan="3">0</td> </tr> </tbody> </table>	Zone Size (mm)	Acceptable Qty			A	B	C	$\Phi \leq 0.1$	Ignore			$0.1 < \Phi \leq 0.2$	2			$0.2 < \Phi \leq 0.3$	1			$\Phi > 0.3$	0		
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	Line defect (LCD/Polarizer black/white line, scratch, stain)	<table border="1"> <thead> <tr> <th>Width(mm)</th> <th>Length(mm)</th> <th>Acceptable Qty</th> </tr> </thead> <tbody> <tr> <td>$\Phi \leq 0.03$</td> <td>Ignore</td> <td>Ignore</td> </tr> <tr> <td>$0.03 < W \leq 0.05$</td> <td>$L \leq 2.0$</td> <td>1</td> </tr> <tr> <td>$0.05 < W$</td> <td colspan="2">0</td> </tr> </tbody> </table>	Width(mm)	Length(mm)	Acceptable Qty	$\Phi \leq 0.03$	Ignore	Ignore	$0.03 < W \leq 0.05$	$L \leq 2.0$	1	$0.05 < W$	0												
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$0.05 < W$	0																								
3.0	Polarizer scratch	<table border="1"> <thead> <tr> <th>Width(mm)</th> <th>Length(mm)</th> <th>Acceptable Qty</th> </tr> </thead> <tbody> <tr> <td>$W \leq 0.03$</td> <td>Ignore</td> <td>Ignore</td> </tr> <tr> <td>$0.03 < W \leq 0.05$</td> <td>$L \leq 2$</td> <td>2</td> </tr> <tr> <td>$0.05 < W \leq 0.10$</td> <td>$L \leq 1$</td> <td>1</td> </tr> <tr> <td colspan="2">$W > 0.10\text{mm}$ or $L > 2\text{mm}$</td> <td>0</td> </tr> </tbody> </table>	Width(mm)	Length(mm)	Acceptable Qty	$W \leq 0.03$	Ignore	Ignore	$0.03 < W \leq 0.05$	$L \leq 2$	2	$0.05 < W \leq 0.10$	$L \leq 1$	1	$W > 0.10\text{mm}$ or $L > 2\text{mm}$		0								
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$W > 0.10\text{mm}$ or $L > 2\text{mm}$		0																							

	Polarizer Bubble	<table border="1"> <tr> <th>Zone Size (mm)</th> <th>Acceptable Qty</th> </tr> <tr> <td>$\Phi \leq 0.1$</td> <td>Ignore</td> </tr> <tr> <td>$0.1 < \Phi \leq 0.2$</td> <td>2</td> </tr> <tr> <td>$0.2 < \Phi \leq 0.3$</td> <td>1</td> </tr> <tr> <td>$0.3 < \Phi$</td> <td>0</td> </tr> </table>	Zone Size (mm)	Acceptable Qty	$\Phi \leq 0.1$	Ignore	$0.1 < \Phi \leq 0.2$	2	$0.2 < \Phi \leq 0.3$	1	$0.3 < \Phi$	0				
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$0.2 < \Phi \leq 0.3$	1															
$0.3 < \Phi$	0															
4.0	SMT	According to the <Acceptability of electronic assemblies> IPC-A-610C class 2 standard. Component missing or function defect are Major defect, the others are Minor defect.														
5.0	TFT	<table border="1"> <thead> <tr> <th>distinguish</th> <th>type</th> <th>Acceptable Qty</th> </tr> </thead> <tbody> <tr> <td rowspan="2">Bright dot</td> <td>Any color window</td> <td>0</td> </tr> <tr> <td>Adjacent Bright dot</td> <td>0</td> </tr> <tr> <td rowspan="2">Dark dot</td> <td>Dark dot</td> <td>1</td> </tr> <tr> <td>Adjacent Dark dot</td> <td>0</td> </tr> </tbody> </table> <p>Note: the red (R), green (G), blue (B) 3 points constitute a pixel</p>	distinguish	type	Acceptable Qty	Bright dot	Any color window	0	Adjacent Bright dot	0	Dark dot	Dark dot	1	Adjacent Dark dot	0	
distinguish	type	Acceptable Qty														
Bright dot	Any color window	0														
	Adjacent Bright dot	0														
Dark dot	Dark dot	1														
	Adjacent Dark dot	0														

9.1.5 Criteria (functional items)

Items	Criteria
No display	Not allowed
Display abnormally	Not allowed
Missing vertical, horizontal	Not allowed
Segment	Not allowed
Short circuit	Not allowed
Back-light no lighting,	Not allowed
Flickering and abnormal lighting	Not allowed
Cross-Talk	Not allowed
Noise	Not allowed
Color contrast	Not allowed
The LCD surface dirt	If you cannot use smudgy surface air clean and clear, coco is not acceptable
Components off	Not allowed
FPC&PCB undesirable	Not allowed
Iron frame deformation	Not allowed

9.2 Reliability Test

ITEM	Condition	Sample size	Criterion
High Temp. Storage	+80°C ± 2°C, 120 hrs	5pcs	Inspection after 2~4hours 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. The surface shall be free from damage. 6. Contrast must be no more than 10% by the linearity tester. 7. Power must be no more than 10% by the linearity tester.
Low Temp. Storage	-30°C ± 2°C, 120 hrs	5pcs	
High Temp. Operation	+70°C ± 2°C, 72 hrs	5pcs	
Low Temp. Operation	-20°C ± 2°C, 72 hrs	5pcs	
Humidity operation	40°C, 90%RH, 72 hrs	5pcs	
Humidity storage	70°C, 90%RH, 72 hrs	5pcs	
Temp humidity cycles	25°C → Calefaction/3hrs → 60°C/9hrs → Descend temp/3hrs 25°C/9hrs → 90%RH Total:10 cycles	5pcs	
Thermal shock	-30°C/30min → 80°C/30mins Total:10 cycles	5pcs	
Vibration	Amplitude between 10 and 150Hz:3G(100m/s)/2hrs for each direction(X,Y,Z)	1Carton-box	After testing, there are no any defective appearances or electrical properties.
Drop test	1.5m, 10times	1Carton-box	
ESD	1.Contact discharge method ± 6KV, 150pF/330Ω 10times	5pcs	1. After testing, there are no any defective appearances or electrical properties. 2. It can be acceptable when all defective ESD disappears in the RESET.
	2.Air discharge method ± 8KV, 150pF/330Ω 10times	5pcs	

9.3 Safety instructions

- 9.3.1 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 Customers do structural design, please ensure the cabinet window size smaller than the touch screen VA unilateral 0.3mm. Foam window size larger than 0.2mm unilateral touchscreen V.A
- 9.4.2 Avoid static electricity damaging the LSI.
- 9.4.3 Do not remove the panel or frame from the module .
- 9.4.4 The polarizing plate of the display is very fragile . So, please handle it very carefully.
- 9.4.5 Do not wipe the polarizing plate with a dry cloth, as it may easily scratch the surface of the plate.
- 9.4.6 The color tone of display and background of LCM has the possibility to be changed in the storage temperature range.
- 9.4.7 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.
- 9.4.8 When soldering the terminal of LCM, make certain the AC power source of soldering iron does not leak.
- 9.4.9 Humid environment may cause a bad ITO glass corrosion, in use, make sure the humidity is below 50%.
- 9.4.10 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°C and 35°C

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 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 was am limited to repair and/or replacement on defects above (9.1,9.2)

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.



10. Packing method

Package picture:

