LCD Module

Product Specification
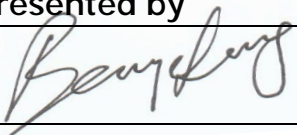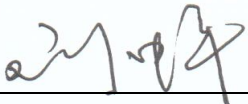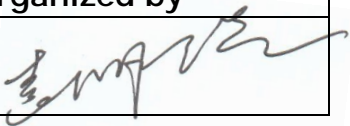
For Customer： _____

Module No.： TST350MTQI-02

For Customer's Acceptance ：

Approved by	Comment

Team Source Display ：

Presented by	Reviewed by	Organized by

This module uses ROHS material
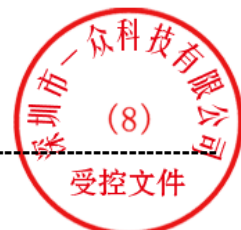
Records of Revision

DATE	REF. PAGE PARAGRAPH DRAWING No.	REVISED No.	SUMMARY	REMARK
2012-10-24		01	FIRST ISSUE	
2012-11-27	P6	02	Modify mechanical drawing	

Contents

1. Introduction

1.1 Scope of application
   This specification applies to the Negative type TFT transflective dot matrix LCD module.
LCD specification: Dots 240xRGBx320.
As to basic specification of the driver IC, refer to the IC (ILI9341) specification and datasheet.

1.2 Structure:
Double display structure:
TFT Module + FPC +BL
262K FULL Dithering Color3.5 inch TFT LCD size for main LCD;
One bare chip with gold bump (COG) TECH;

1.3 TFT features:
Structure: TFT PANNEL+IC+FPC+BL;
Transflective Type LCD
240 dot-source and 320 dot-gate outputs;
White LED back light;

1.4 Applications:
Mobile phone
   PSP
   PDA
   GPS
   Etc…

2. General specification

ITEM	Standard value	UNIT
LCD Type	TFT Transflective	---
Driver element	a-Si TFT	
Number of Dots	240*(RGB)*320	Dots
Pixel Arrangement	RGB Vertical Stripe	
Active Area	53.64x71.52	mm
Viewing Area (W*H)	/	mm
Viewing Direction	6 0' clock	
Driver IC	ILI9341	
LCM Module Size(W*H*T)	64.0x85.0x3.0MAX	mm
Approx. Weight	TBD	g
Back Light	6 White LEDS	
System interface	RGB 18 bit+SPI	

3. Mechanical drawing
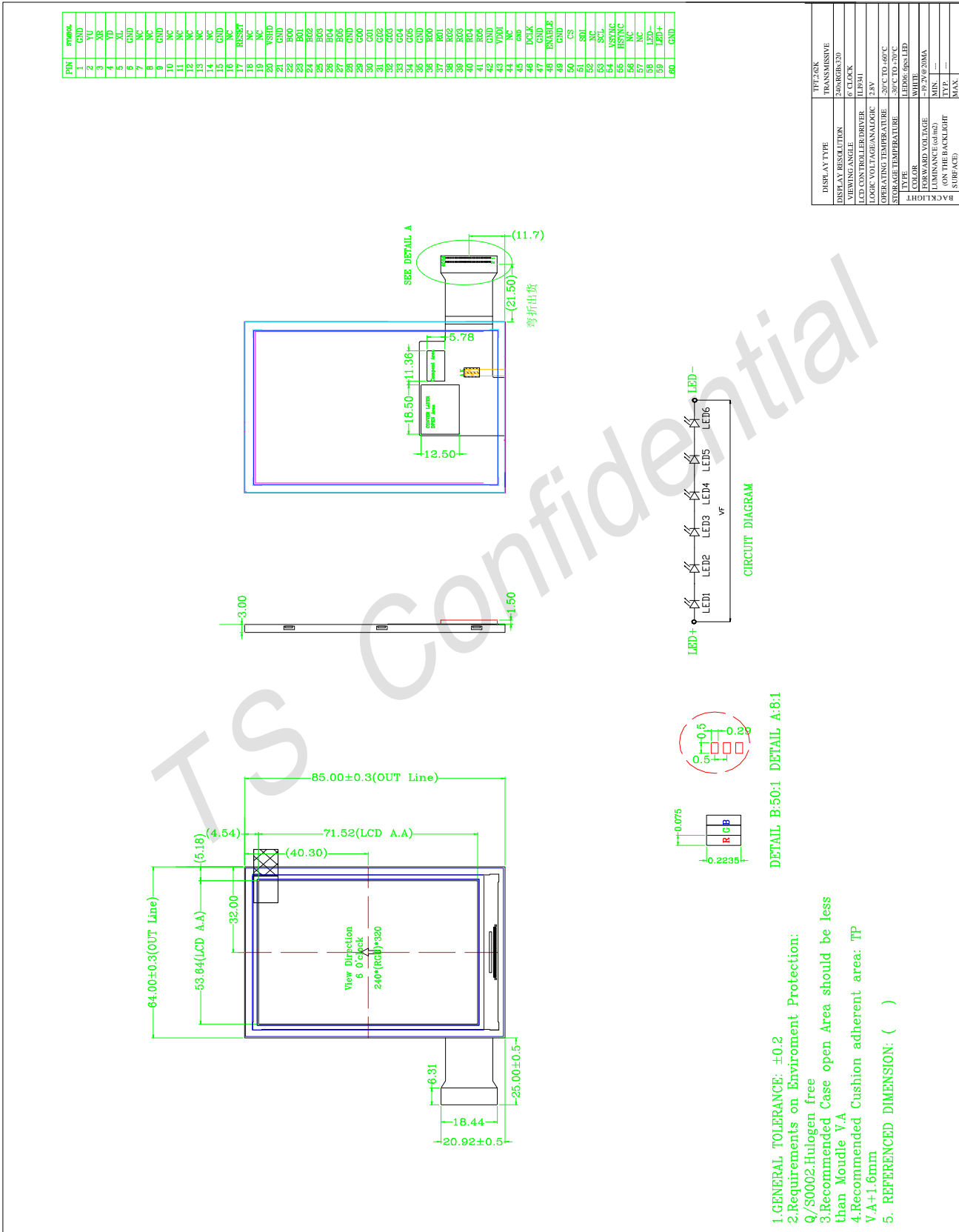
4. ABSOLUTE MAXIMUM RATINGS

DRIVING TFT LCD PANEL

Item	Symbol	Min	Max	Unit
Supply voltage	VSHD	-0.3	4.6	V
Driver Supply voltage	VGH-VGL	-0.3	+32	V
Logic Supply voltage	VDDI	-0.3	4.6	V
Operating temperature	T_{OP}	-20	+70	℃
Storage temperature	T_{ST}	-30	+80	℃

5. ELECTRICAL CHARACTERISTICS

BACKLIGHT

Item	Symbol	Min	Typ	Max	Unit	REMARK
Forward Current	IF		20		mA	
Forward voltage	V_{BL}	18	19.2	21	V	With 6 LEDS
Backlight Power Consumption	W_{BL}		390	600	mW	
CIE	X	0.240		0.300		IF=20 mA
	Y	0.240		0.300		
LIFE TIME			25000		HRS	

TFT LCD PANEL

Item	Symbol	Min	TYP	Max	Unit	REMARK
Supply voltage	VSHD	2.3	2.8	3.3	V	
Logic Supply voltage	VDDI	1.65	2.8	3.3	V	

6. Data input timing
6.1 Signal AC Timing

(VSHD=2.5~3.2V,Ta=25℃)

Parameter	Description	Min	Max	Unit
tSYNCS	VSYNC/HSYNC setup time	15		ns
tSYNCH	VSYNC/HSYNC	15		ns
tENS	ENAB	15		ns
tENH	ENAB	15		ns
tPOS	Data	15		ns
tPDH	Data	15		ns
PWDH	DCLK high-level period	15		ns
PWDL	DCLK low-level period	15		ns
tCYCD	DCLK cycle time	100		ns
trgbr , trgbf	DCLK,HSYNC,VSYNC rise/fall		15	ns

Table 6.1 RGB Interface Characteristics
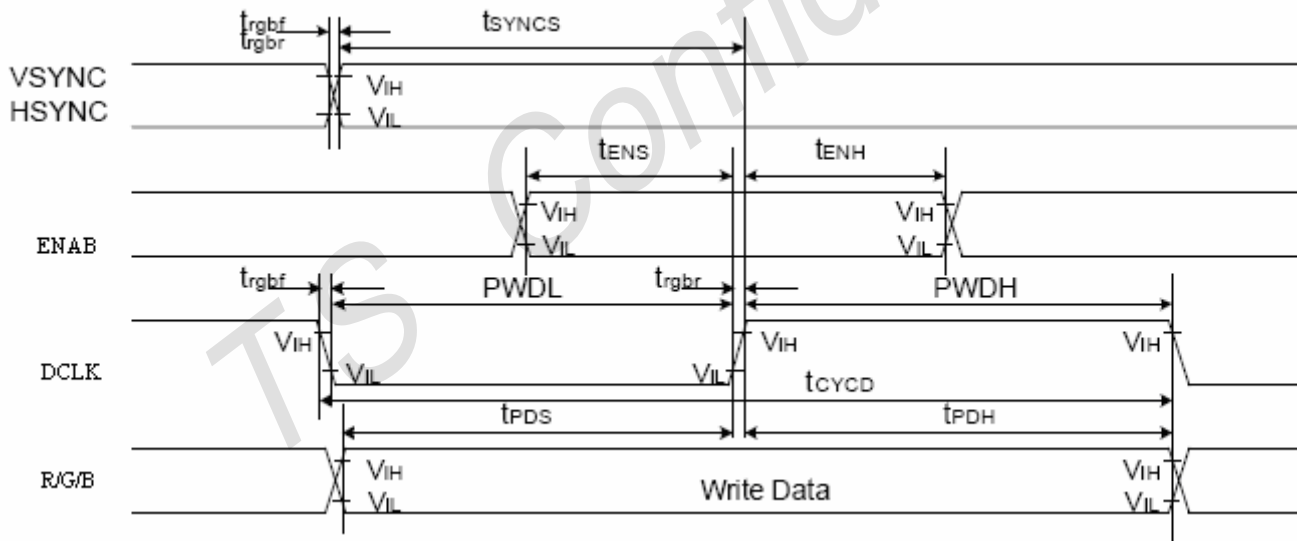
Fig.6-1 RGB Interface Timing
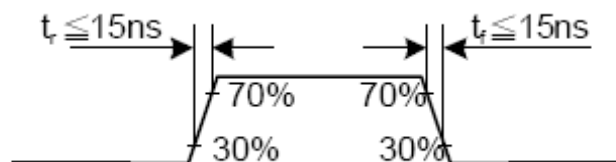
Fig.6-2 Input signal's rise and fall times

6.2 Recommend RGB Interface Timing

(VSHD=2.5~3.2V,Ta=25℃)

Parameter	Symbol	Symbol	Min	Typ	Max	Unit
DCLK	DCLK frequency	fDCYC		5.64	10	MHz
	DCLK period	tDCYC	100	177.15		ns
HSYNC	Horizontal	Thd		240		DCLK
	1horizontalline	Th		310		
	Horizontal blank	Thb	56	60		
	Horizontal front porch	Thfp	2	10	16	
VSYNC	Vertical display area	Tvd		320		Line
	Vsync period time	Tv		328		
	Vsync blank	Tvb	2	4		
	Vsync Front porch	Tvfp	2	4		

Tab.6-2 Recommend Input Timing (DCLK, HSYNC, VSYNC, ENAB)
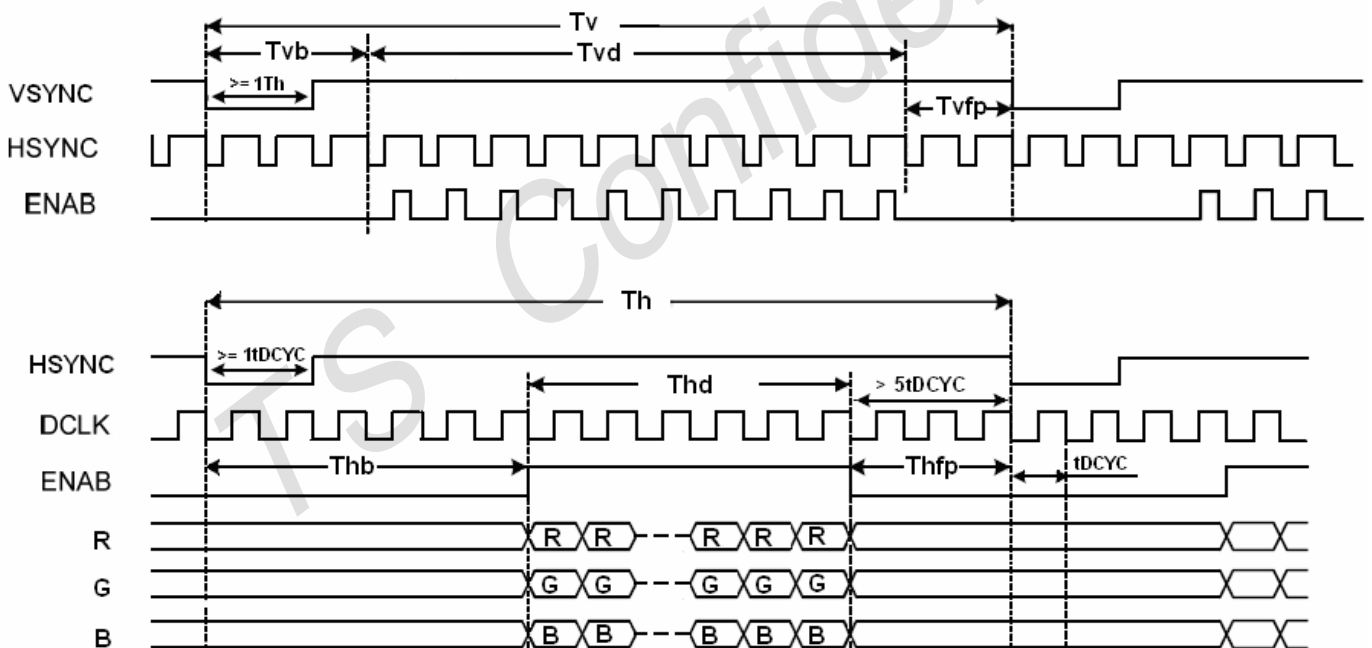
Fig.6-3 Recommend RGB Interface Timing
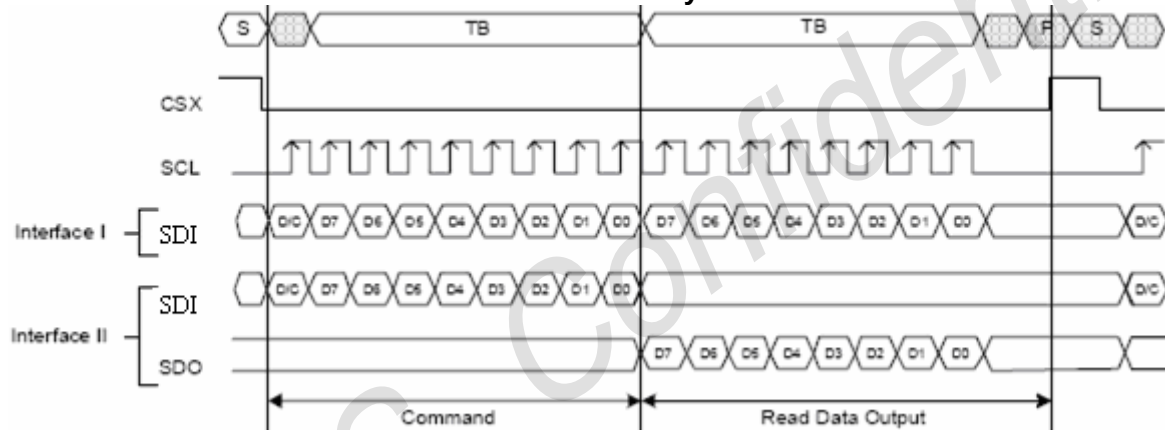
6.2   3-Wire 9-BIT Serial Interface
6.2.1 3-Wire 9-Bit data serial interface write mode
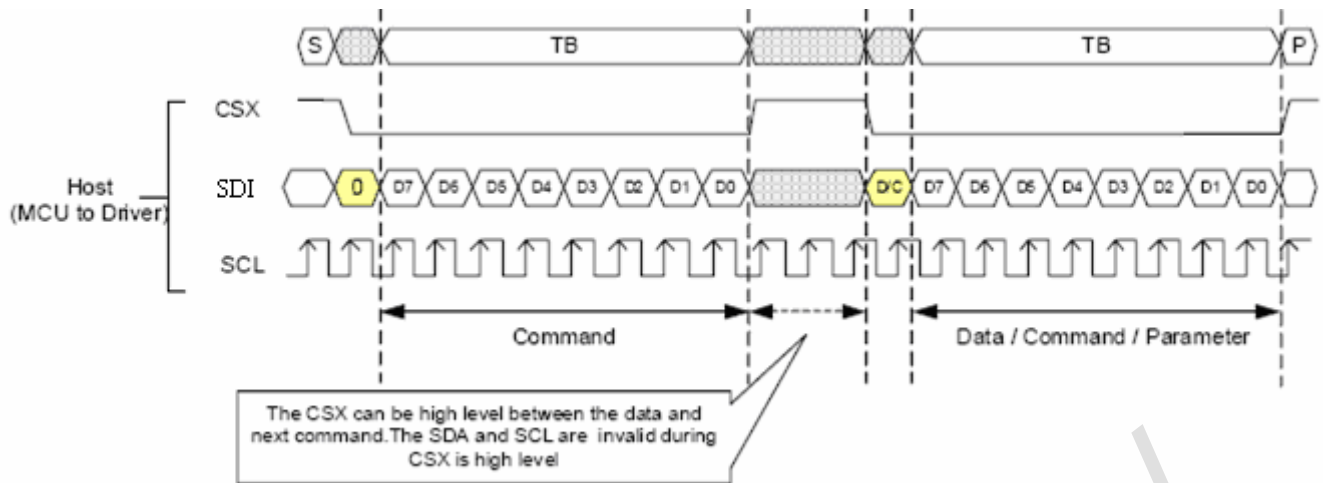
Figure.6-4 3-Wire 9-Bit Serial Interface I Bus Protocol, Write to Register or Display RAM
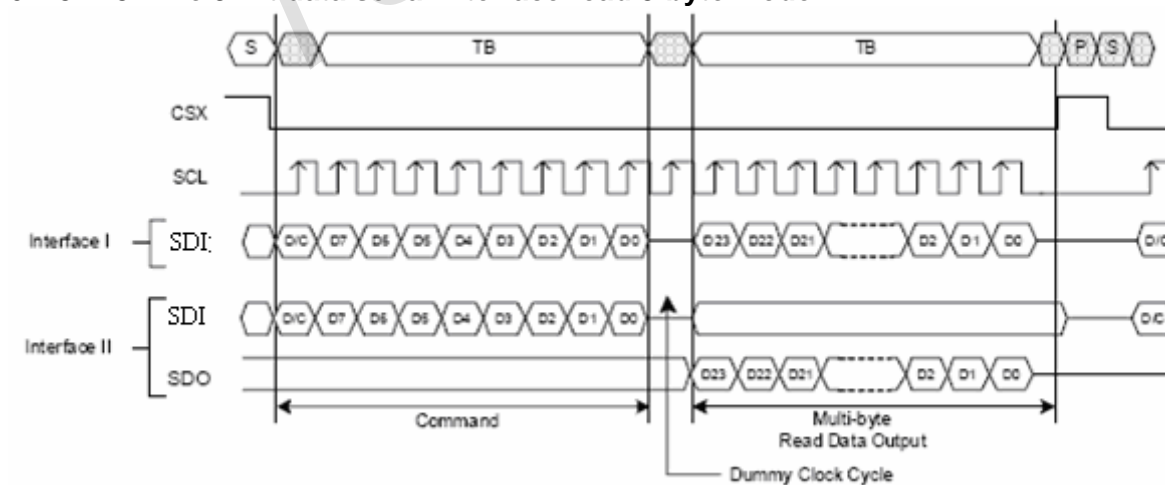Note: D/C =0, Transfer Command; D/C =1, Transfer Data.
6.2.2   3-Wire 9-Bit data serial interface read 1-byte mode

Figure. 6-5 3-Wire 9-Bit Serial Interface I/II Bus Protocol, Read 1-Byte From Register
Note: D/C=0, Transfer Command; D/C=1, Transfer Data
6.2.3   3-Wire 9-Bit data serial interface read 3-byte mode

Figure. 6-6   3-Wire 9-Bit Serial Interface I/II Bus Protocol, Read 3-Byte From Register
Note: D/C=0, Transfer Command; D/C=1, Transfer Data.

6.2.4   3-Wire 9-Bit serial interface Timing

(VSHD=2.5~3.2V,Ta=25℃)

Parameter	Symbol	Conditions	Min	Max	Unit	Remark
Serial Clock Cycle(Write)	tscycw	SCL	100		ns	
SCL "H" pluse width(Write)	tshw	SCL	40		ns	
SCL "L" pluse width(Write)	tslw	SCL	40		ns	
Data setup time(Write)	tsds	SDI	30		ns	
Data hold time(Write)	tsdh	SDI	30		ns	
Serial Clock Cycle(Read)	tscycr	SCL	150		ns	
SCL "H" pluse width(Read)	tshr	SCL	60		ns	
SCL "L" pluse width(Read)	tslr	SCL	60		ns	
Access time	tacc	SDO(Read)	10		ns	
Output disable time	toh	SDO(Read)	10	50	ns	
CS "H" pluse width	tchw	CS	40		ns	
CS-SCL time	tcss	CS(write)	60		ns	
	tcsh	CS(write)	65		ns	

Tab.6-3 AC Characteristics of 3-Wire 9-Bit Serial Interface
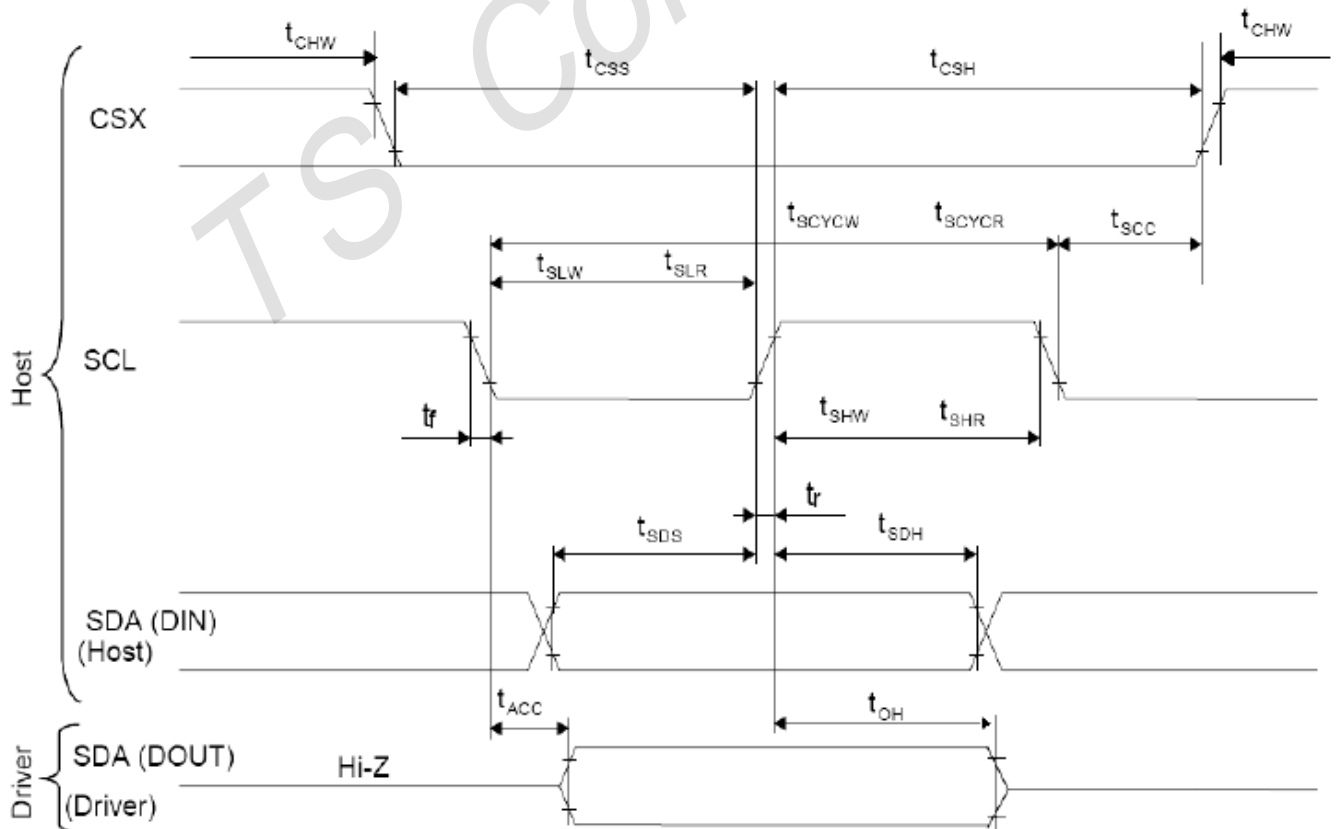
Fig.6-7 AC Characteristics of 3-Wire 9-Bit Serial Interface timing

6.3 Reset Timing

Parameter	Symbol	MIN	TYP	MAX	Unit	Remark
RESET	tRW	10			us	
	tRT			5	ms	note 1
				120	ms	note 2

Tab.6-4 Reset input timing

Note1: When Reset applied during Sleep In Mode.
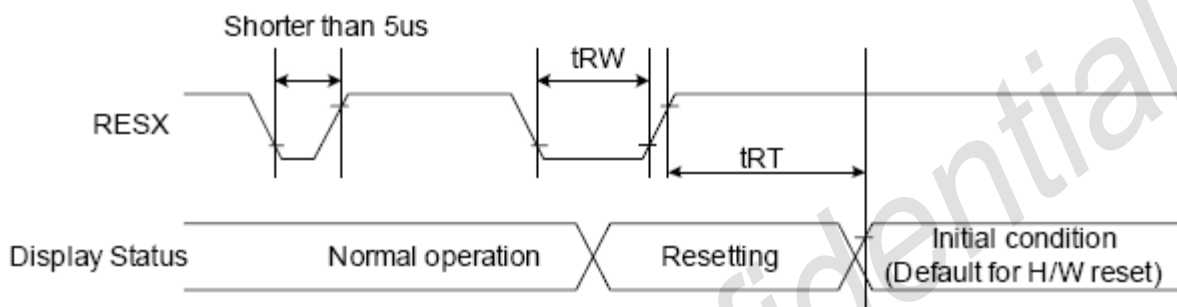Note2: When Reset applied during Sleep Out Mode.

Fig.6-8 Reset timing

7. OPTICAL CHARACTERISTICS   Ta=25℃

ITEM		SYMBOL	CONDITIONS	SPECIFICATIONS			UNIT	NOTE
				MIN.	TYP.	MAX		
Brightness		B		80	90	--	Cd/m^2	
Contrast Ratio		CR		100	150	--	--	
Response Time		Tr+Tf			35		ms	
CIE Color coordinate	Red	X$_R$	Viewing normal angle	--	0.624			All left side data are based on TIANMA's product reference only
		Y$_R$			0.368			
	Green	X$_G$		--	0.35			
		Y$_G$			0.55			
	Blue	X$_B$		--	0.143			
		Y$_B$			0.119			
	White	X$_W$		--	0.310			
		Y$_W$			0.320			
Viewing Angle	Hor.	θ_{X+}	Center CR>=10		40	--	Deg.	
		θ_{X-}			45	--		
	Ver.	θ_{Y+}			55	--		
		θ_{Y-}			40			
Uniformity		Un		80	90		%	

Note 1 : Definition of Viewing Angle θ x and θ Y :
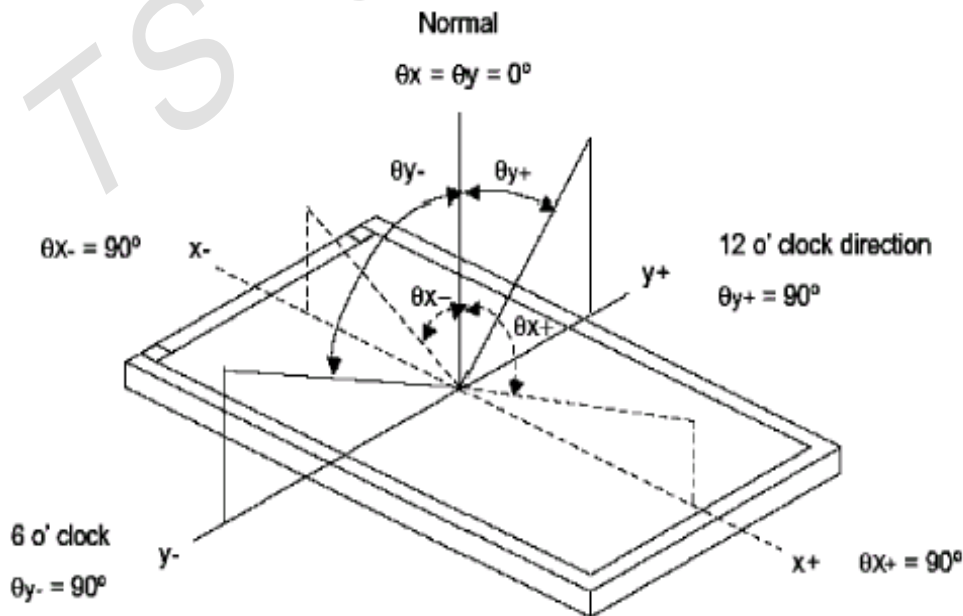
Note 2: Definition of contrast ratio CR:

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

Note 3: Definition of response time (T_R, T_F)
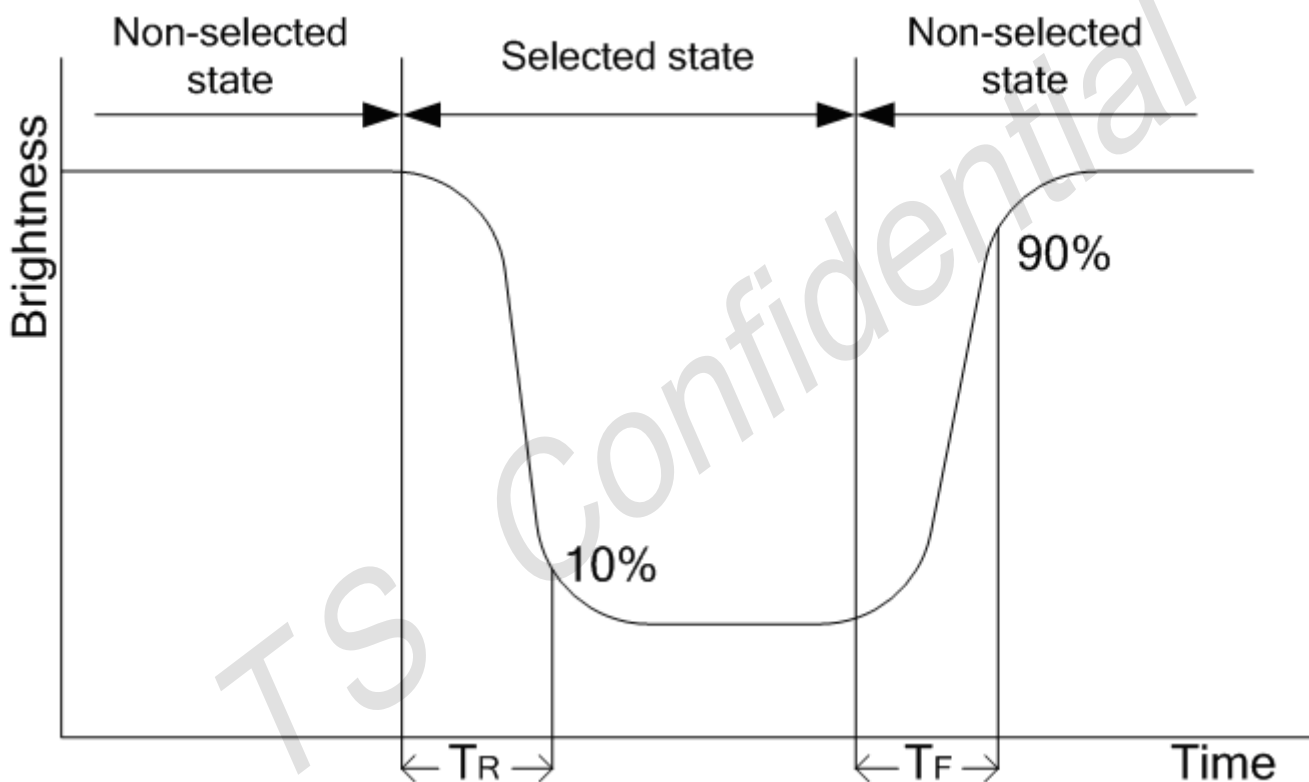
: The brightness test equipment setup
   20mA   Field=2° (As measuring "black" image, field=2° is the best testing condition)

Note 4 :

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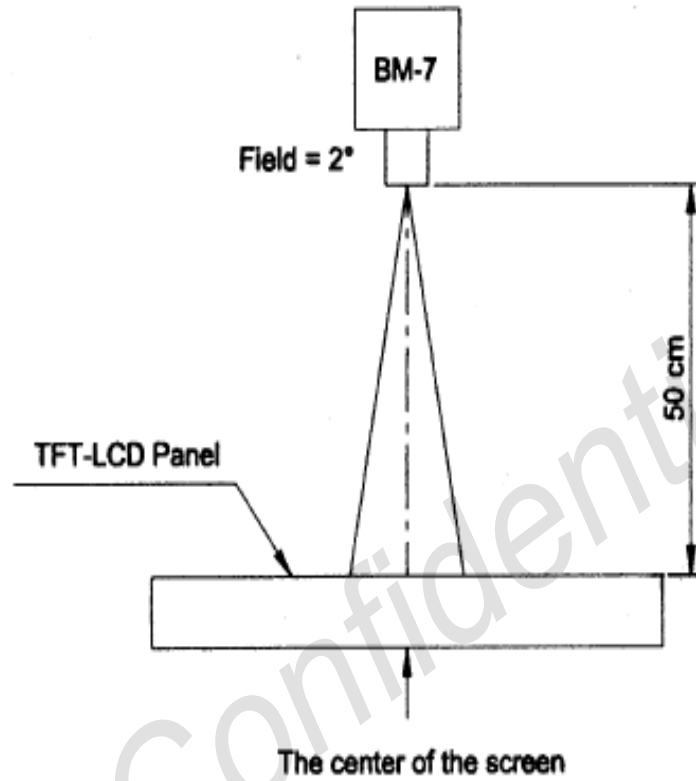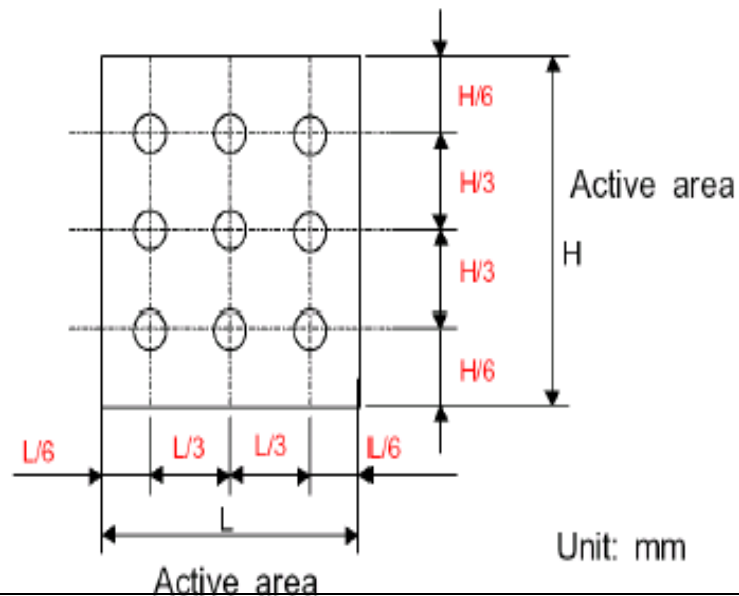
8. Interface Pin Function

. Table 2: Pin assignment

Pin No.	Symbol	Description
1	GND	Ground
2	YU	TP YU
3	XR	TP XR
4	YD	TP YD
5	XL	TP XL
6	GND	Ground
7	NC	NO CONNECT
8	NC	NO CONNECT
9	GND	Ground
10	NC	NO CONNECT
11	NC	NO CONNECT
12	NC	NO CONNECT
13	NC	NO CONNECT
14	NC	NO CONNECT
15	GND	Ground
16	NC	NO CONNECT
17	RESET	Reset(Low active)
18	NC	NO CONNECT
19	NC	NO CONNECT
20	VSHD	Analog Supply Voltage 2.8V
21	GND	Ground
22	B0	Blue data input(LSB)
23	B1	Blue data input
24	B2	Blue data input
25	B3	Blue data input
26	B4	Blue data input
27	B5	Blue data input(MSB)
28	GND	Ground
29	G0	Green data input(LSB)
30	G1	Green data input
31	G2	Green data input
32	G3	Green data input
33	G4	Green data input
34	G5	Green data input(MSB)
35	GND	Green data input

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36	R0	Red data input(LSB)
37	R1	Green data input
38	R2	Green data input
39	R3	Green data input
40	R4	Green data input
41	R5	Red data input(MSB)
42	GND	Ground
43	VDDI	Logic Supply Voltage 2.8V
44	NC	NO CONNECT
45	GND	Ground
46	DCLK	Pixel clock signal in RGB mode
47	GND	Ground
48	ENABLE	Data enable
49	GND	Ground
50	CS	Chip select input(Low enable)
51	SDI	Serial data input
52	NC	NO CONNECT
53	SCL	Serial interface clock input
54	VSYNC	Vertical SYNC input
55	HSYNC	Horizontal sync in RGB mode
56	NC	NO CONNECT
57	NC	NO CONNECT
58	LED-	Power supply for LED(Low voltage)
59	LED+	Power supply for LED(High voltage)
60	GND	Ground

Note:
1. The PIN connect is :AXK6F60347YG.

9. BLOCK DIAGRAM

CL

Driver IC:ILI9341 or Compatible
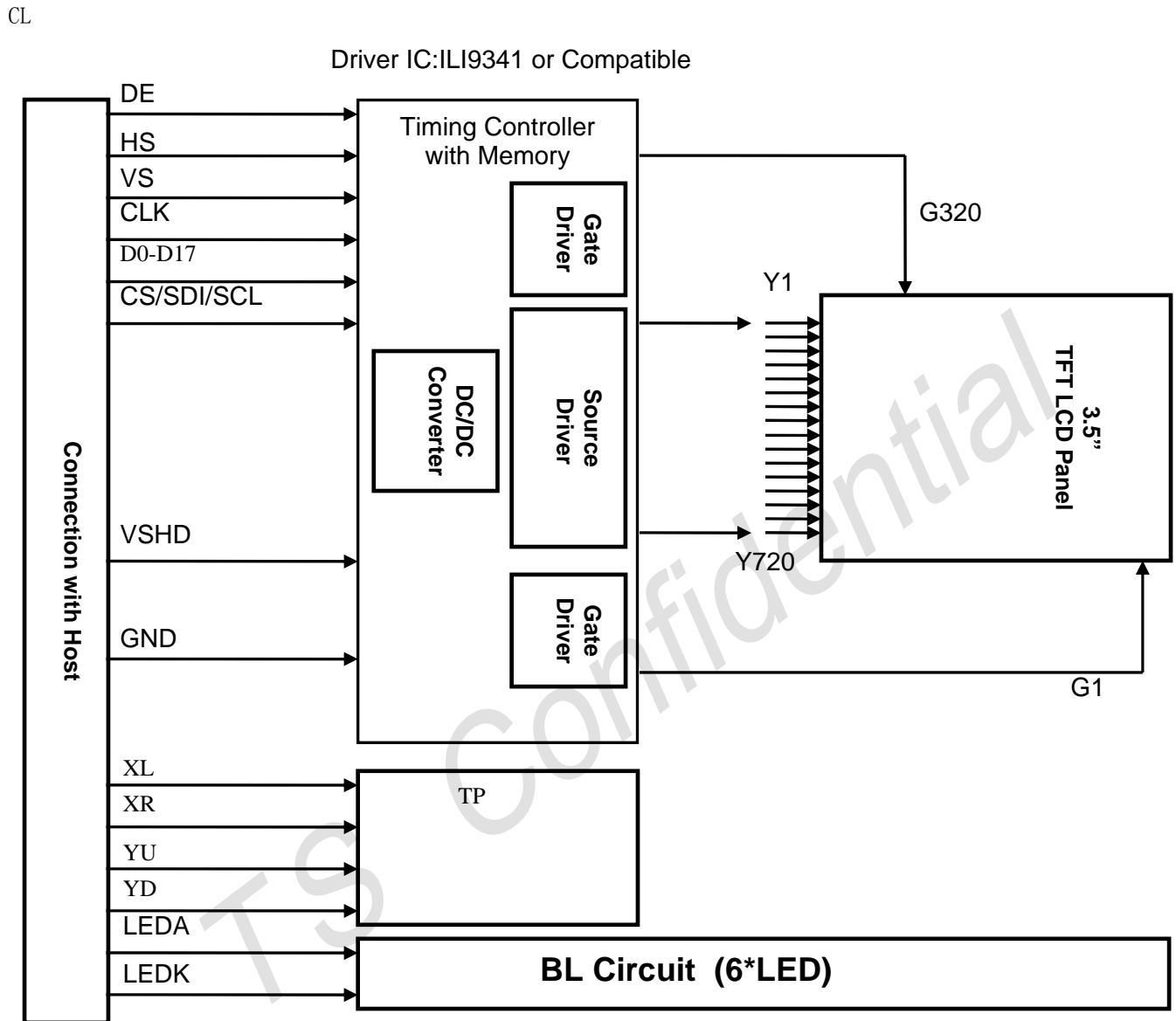
10. LCM Quality Criteria

10.1 VISUAL & FUNCTION INSPECTION STANDARD

10.1.1 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
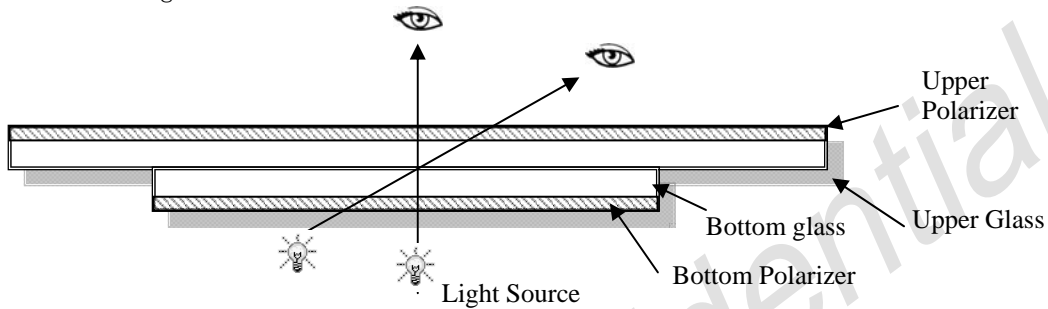
10.1.2 Definition
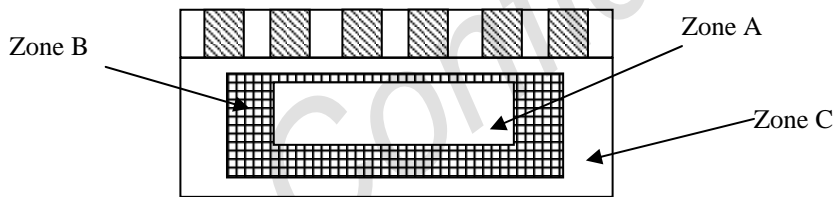
Zone A : Effective Viewing Area(Character or Digit can be seen)

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.

10.1.3 Sampling Plan

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

AQL:
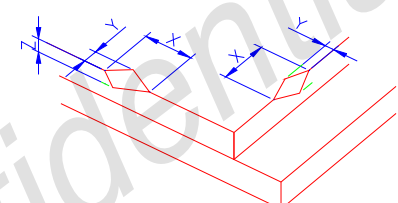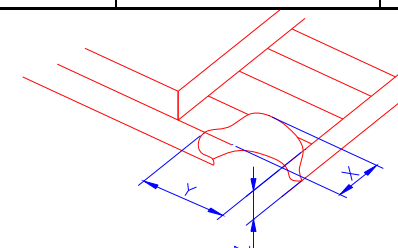
Major defect	Minor defect
0.65	1.5
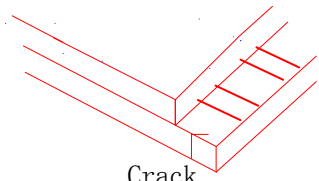
LCD: Liquid Crystal Display , TP: Touch Panel , LCM: Liquid Crystal Module
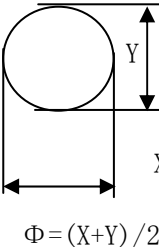
No	Items to be inspected	Criteria	Classification of defects

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.	
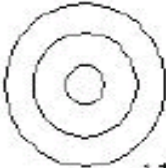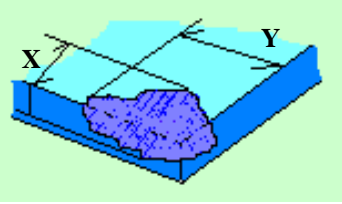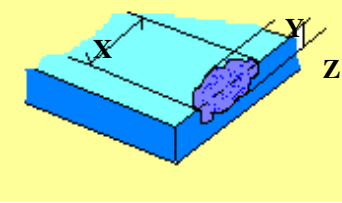
10.1.4 Criteria (Visual)

Number	Items	Criteria(mm)
1.0 LCD Crack/Broken NOTE: X: Length Y: Width Z: Height L: Length of ITO, T: Height of LCD	(1) The edge of LCD broken	 | X	Y	Z
---	---	---
≤3.0mm	<Inner border line of the seal	≤T	
	(2)LCD corner broken	 | X	Y	Z
---	---	---
≤3.0mm	≤L	≤T	

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(3) LCD crack		Crack Not allowed

Number	Items	Criteria (mm)			
2.0	Spot defect	① light dot (LCD/TP/Polarizer black/white spot , light dot, pinhole, dent, stain)			

Φ＝(X+Y)/2

Zone Size (mm)	Acceptable Qty		
	A	B	C
Φ≤0.10	Ignore		Ignore
0.10＜Φ≤0.15	3(distance≧10mm)		
0.15＜Φ≤0.2	1		
0.2＜Φ	0		

②Dim spot (LCD/TP/Polarizer dim dot, light leakage、dark spot)

Zone Size (mm)	Acceptable Qty		
	A	B	C
Φ≤0.1	Ignore		Ignore
0.1＜Φ≤0.2	2(distance≧10mm)		
0.2＜Φ≤0.3	1		
Φ＞0.3	0		

③ Polarizer accidented spot

Zone Size (mm)	Acceptable Qty		
	A	B	C
Φ≤0.2	Ignore		Ignore
0.2＜Φ≤0.5	2(distance≧10mm)		
Φ＞0.5	0		

Line defect (LCD/TP /Polarizer black/white line, scratch, stain)	Width(mm)	Length(mm)	Acceptable Qty		
			A	B	C
	Φ≤0.03	Ignore	Ignore		Ignore
	0.03<W≤0.05	L≤3.0	N≤2		
	0.05<W≤0.08	L≤2.0	N≤2		
	0.08<W	Define as spot defect			

3.0	Polarizer Bubble	Size (mm) / Zone	Acceptable Qty		
			A	B	C
		Φ≤0.2	Ignore		Ignore
		0.2<Φ≤0.4	2(distance≧10mm)		
		0.4<Φ≤0.6	1		
		0.6<Φ	0		

4.0	SMT	According to IPC-A-610C class II standard . Function defect and missing part are major defect ,the others are minor defect.

		TP bubble/ accidented spot	Size Φ(mm)	Acceptable Qty		
				A	B	C
			Φ≤0.1	Ignore		Ignore
			0.1<Φ≤0.2	2		
			0.2<Φ≤0.3	1		
			0.3<Φ	0		
		Assembly deflection	beyond the edge of backlight ≤0.15mm			

5.0	TP Related			
		Newton Ring	Newton Ring area>1/3 TP area NG Newton Ring area≤1/3 TP area OK	
		TP corner broken X：length Y：width Z：height		

X	Y	Z
X≤3.0mm	Y≤3.0mm	Z<LCD thickness
* Circuitry broken is not allowed.		

X	Y	Z
X≤6.0mm	Y≤2.0mm	Z<LCD thickness
* Circuitry broken is not allowed.		

TP edge broken
X：length
Y：width
Z：height

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

10.2 RELIABILITY TEST

NO	ITEM	CONDTTION	STANDARD
1	High Temp. Storage	70℃, 240 hours	1. Functional test

2	Low Temp. Storage	-30℃, 240 hours	
3	High Temp. Operation	60℃, 240 hours	
4	Low Temp. Operation	-20℃, 240 hours	
5	High temperature and high Humidity storage	40℃,90%RH ,240 hours	
6	Thermal and cold shock	Static state, -30℃ (30 Min) ~70℃ (30 Min) ~ -30℃ (30Min) , packaging, 20 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	

NOTE：

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

10.2.2 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.

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

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

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

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

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

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

10.3 Safety instructions

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

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

10.4 Handling Precautions

10.4.1 Avoid static electricity damaging the LSI.

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

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

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

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

10.4.6 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.

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

10.4.8 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)

10.5 Operation instructions

10.5.1 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.

10.5.2 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.

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

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

10.6 Storage instructions:

10.6.1 Store LCDs in a sealed polyethylene bag.

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

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

10.7 Limited Warranty

10.7.1 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

10.7.2 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)

10.7.3 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.
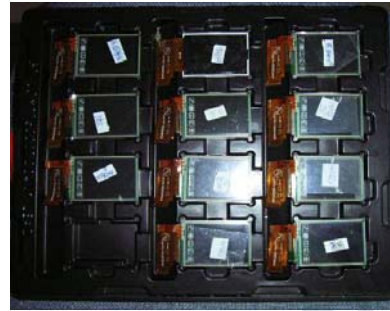
--PCB conductors damaged.

--Circuit modified with by grinding, engraving or painting varnish.

--FPC crack

10.7.4 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.

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11.   Packing method