SPECIFICATIO
FOR
LCD Module
TS7235T-3

MODULE:	**（TS7235T-3 V1.3）**
CUSTOMER:	

TZD	**INITIAL**	
PREPARED BY	**覃锦伟**	**2014.2.12**
DATE CHECKED BY	**罗教平**	**2014.2.12**
APPROVED BY	**陈春志**	**2014.2.12**

CUSTOMER	**INITIAL**	**DATE**
APPROVED BY		

REVISION STATUS

Version	Revise Date	Page	Content	Modified by
V1.0	2013.5.20	-	First Issued.	
V1.1	2013.7.22		Improve the viewing angle in polarizer	Second Issued.
V1.2	2013.8.19		改温度要求	
V1.3	2014.2.12	5	改温度要求	

TABLE OF CONTENTS

1. General Description

*** DESCRIPTION**

TS7235T-3 is a color active matrix TFT (Thin Film Transistor) LCD (liquid crystal display) that uses amorphous silicon TFT as a switching device. This model is composed of a Transmissive type TFT-LCD Panel, driver circuit, back-light unit. The resolution of a 3.5" TFT-LCD contains 320 x 480 pixels, and can display up to 262K colors.

*** Features**

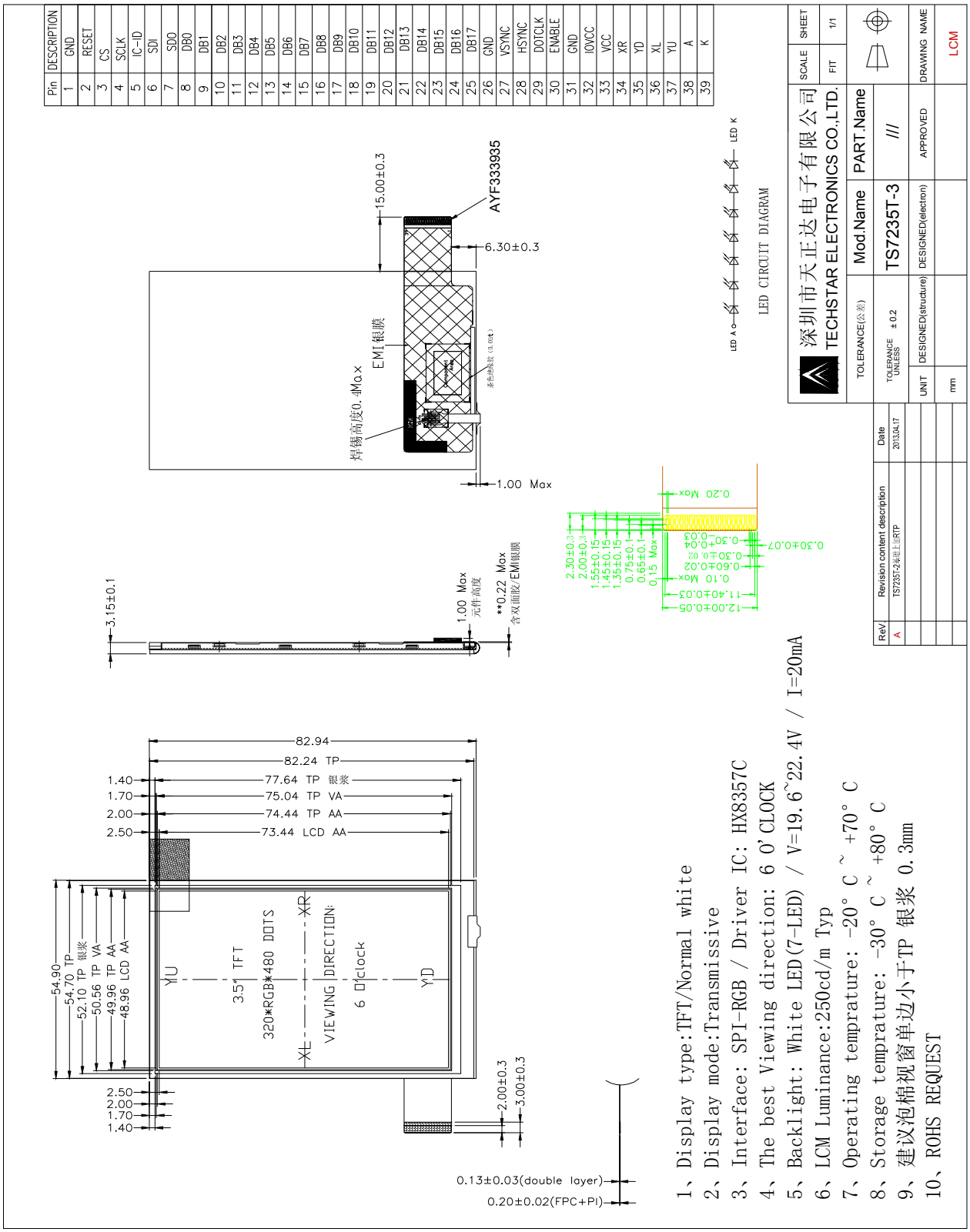
-Low Input Voltage: VCC: 2.5~3.3V; IOVCC: 1.65~3.3V
-Display Colors of TFT LCD: 262K colors
- Interface: RGB 18bit
-Internal Power Supply Circuit.

General Information Items	Specification	Unit	Note
	Main Panel		
Display area(AA)	48.96 (H) *73.44 (V)	mm	-
Driver element	a-Si TFT active matrix	-	-
Display colors	262K	colors	-
Number of pixels	320(RGB) *480	dots	-
Pixel arrangement	RGB vertical stripe	-	-
Pixel pitch	0.153(H) *0.153(V)	mm	-
Viewing angle	6:00	o'clock	-
Drive IC	HX8357-C01	-	-
Display mode	Transmissive/ Normally White	-	-
Operating temperature	-20～+70(不带TP温度)	℃	-
Storage temperature	-30～+80（不带TP温度)	℃	-

Mechanical Information

Item		Min.	Typ.	Max.	Unit	Note
Module size	Horizontal(H)	-	54.9	-	mm	
	Vertical(V)	-	82.94	-	mm	
	Depth(D)	-	3.15	-	mm	±0.1
Weight		-	TBD	-	g	-

2. MECHANICAL SPECIFICATION



3. PIN DESCRIPTION

Pin NO.	Symbol	Level	Function
1	GND	L	Ground
2	RESET	H/L	Hardware reset pin
3	CS	H/L	Chip select input pin
4	SCLK	H/L	Serial clock input pin
5	IC-ID		No connect
6	SDI	H/L	Data input pin in serial mode
7	SDO	H/L	Serial data output. If SDO_EN=0, DOUT is not use. If SDO_EN=1, DOUT is serial data output. Let it to open in MPU interface mode.
8-25	DB0-DB17	H/L	**Data bus DB00-DB17**
26	GND	L	Ground
27	VSYNC	H/L	Vertical sync input with negative polarity.
28	HSYNC	H/L	Horizontal sync input with negative polarity.
29	DOTCLK	H/L	Clock signal for data latching and internal
30	ENABLE	H/L	Input data enable control. Internally pulled low
31	GND	L	Ground
32	IOVCC	H	Power supply(1.65-3.3V)
33	VCC	H	Power supply(2.5-3.3V)
34	XR	H/L	Touch panel PIN
35	YD	H/L	Touch panel PIN
36	XR	H/L	Touch panel PIN
37	YU	H/L	Touch panel PIN
38	A	H	Backlight+
39	K	L	Backlight-

4. ELECTRICAL CHARACTERISTICS

4.1 ABSOLUTE MAXIMUM RATINGS

Item	Symbol	Values		Unit	Remark
		Min	Max.		
Supply Voltage for Logic circuit	IOVCC	-0.3	4.6	V	
	VCC	-0.3	4.6	V	

4.2 DC ELECTRICAL CHARACTERISTICS

4.2.1 OPERATING CONDITIONS

Typical Operating Conditions (Ta=25℃)

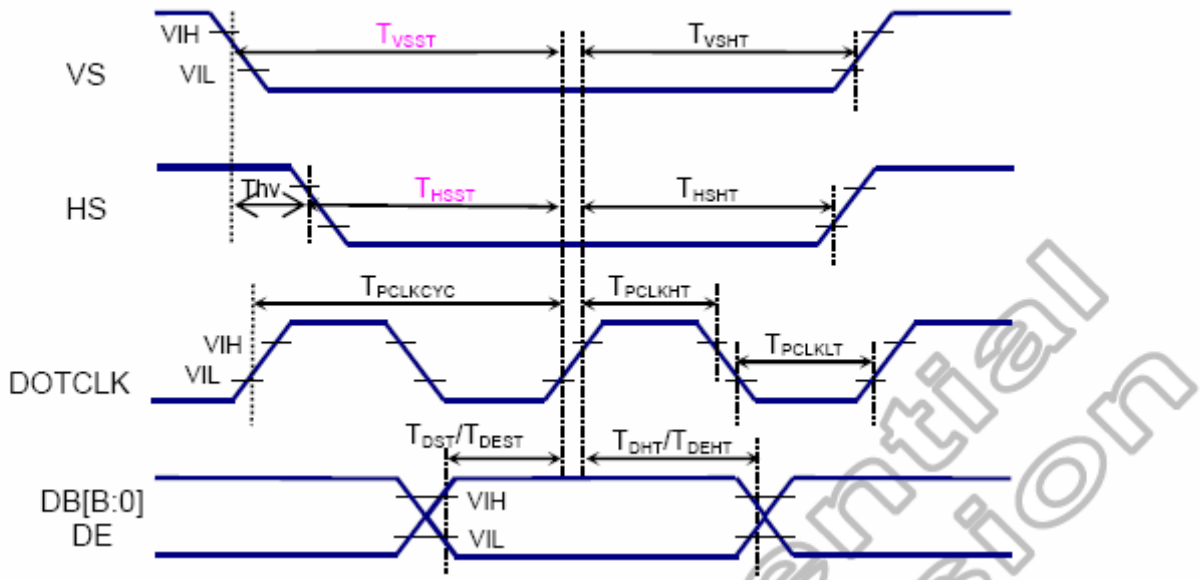
Item	Symbol	Values			Unit	Remark
		Min	Typ	Max.		
Driver Operating voltage	VCC	2.5	2.8	3.3	V	
IO Operating voltage	IOVCC	1.65	1.8	3.3	V	
Normal mode Current consumption	I_{CC}	-	10	13	mA	V_{CC}=2.8V
TFT Gate ON Voltage	V_{GH}	14	15	18.5	V	
TFT Gate OFF Voltage	V_{GL}	-16.5	-10.5	-9.5	V	

4.2.2 BACKLIGHT UNIT (GND=0V)

Item	Symbol	Values			Unit	Remark
		Min	Typ	Max.		
Forward supply Voltage	V_f	19	19.6	22.4	V	
Forward supply Current	I_f	-	20	-	mA	
LCM Luminance	L_V	270	300	-	cd/m2	I_B=20mA
Life Time			50000		HR	I_B=20mA
Uniformity	/	80			%	-

4.3 TIMING CHARACTERISTICS

4.3 .1 RGB System Interface

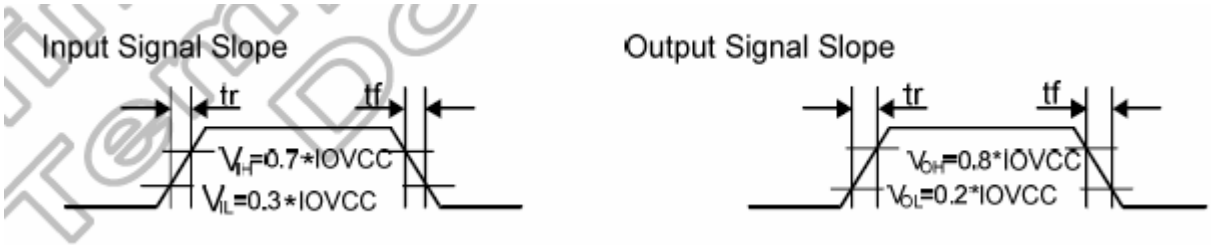


(VSSA=0V, IOVCC=1.65V to 3.3V, VCI=2.3V to 3.3V, T_A = -30 to 70℃)

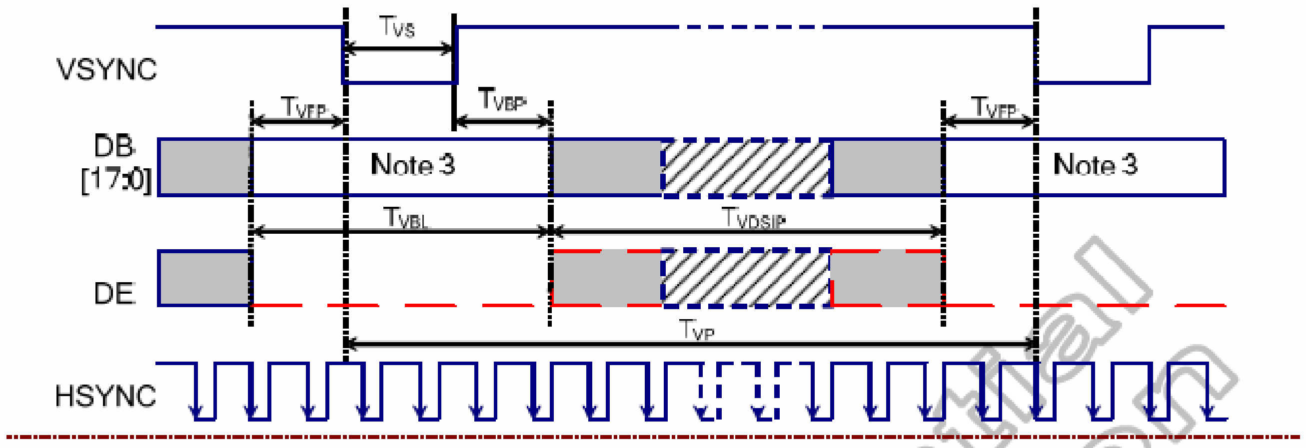
Item	Symbol	Condition	Spec.			Unit
			Min.	Typ.	Max.	
Pixel low pulse width	T_{CLKLT}		15	-	-	ns
Pixel high pulse width	T_{CLKHT}		15	-	-	ns
Vertical Sync. set-up time	T_{VSST}		15	-	-	ns
Vertical Sync. hold time	T_{VSSHT}		15	-	-	ns
Horizontal Sync. set-up time	T_{HSST}		15	-	-	ns
Horizontal Sync. hold time	T_{VSSHT}		15	-	-	ns
Data Enable set-up time	T_{DEST}		15	-	-	ns
Data Enable hold time	T_{DEHT}		15	-	-	ns
Data set-up time	T_{DST}		15	-	-	ns
Data hold time	T_{DHT}		15	-	-	ns
Phase difference of sync signal falling edge	Thv		0	-	320	Dotclk

Note: The input signal rise time and fall time (tr, tf) is specified at 15 ns or less.

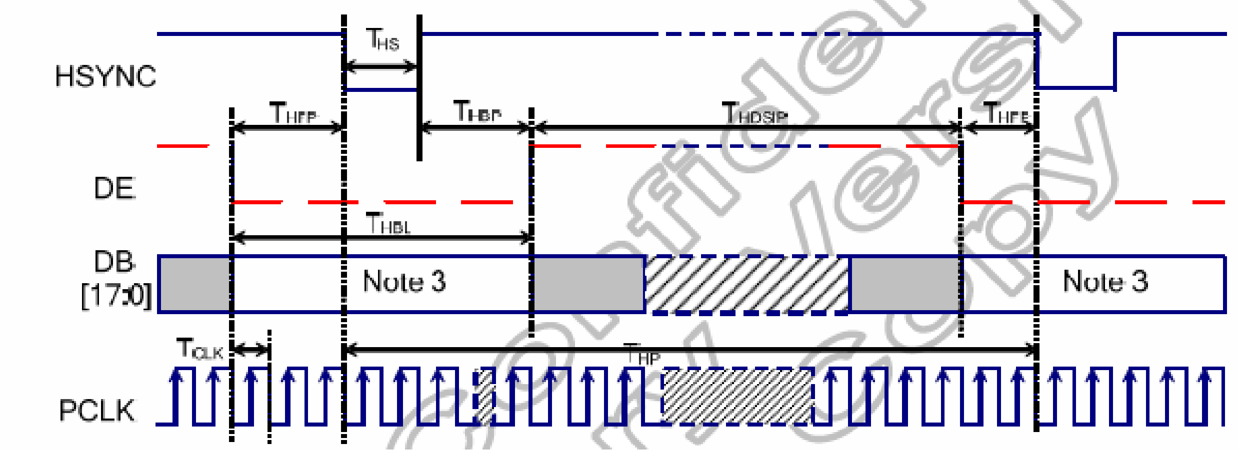
DPI interface characteristics-1



Vertical Timing for RGB I/F



Horizontal Timing for RGB I/F



General timings for RGB I/F-2

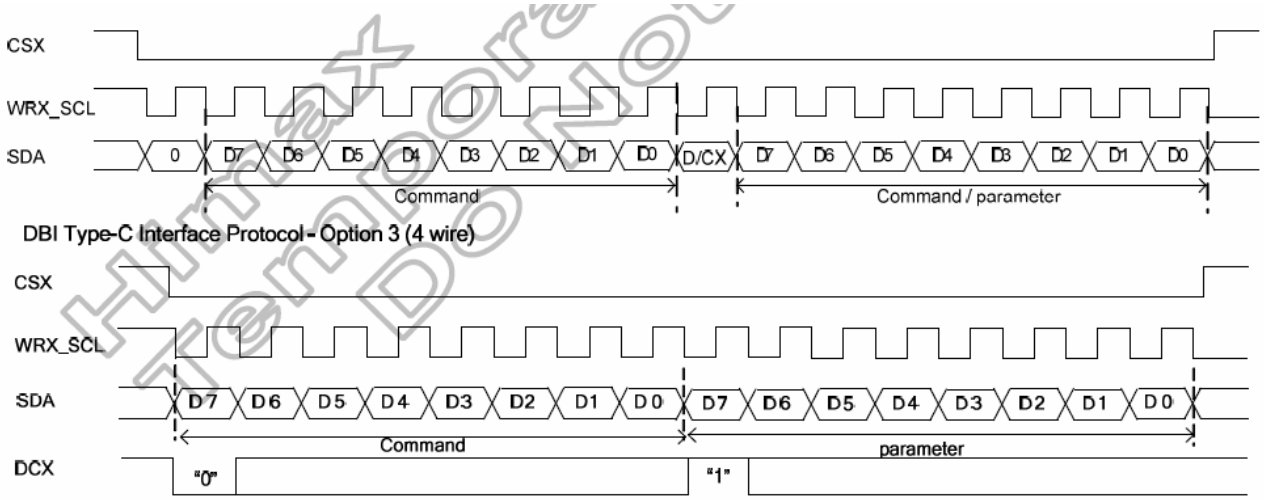
Item	Symbol	Condition	Specification			Unit
			Min	Type.	Max	
Vertical Timing						
Vertical cycle period	T_{VP}	-	486	-	-	HS
Vertical low pulse width	T_{VS}	-	2	-	-	HS
Vertical front porch	T_{VFP}	-	2	-	-	HS
Vertical back porch	T_{VBP}	-	2	-	-	HS
Vertical blanking period	T_{VBL}	T_{VBP} + T_{VFP}	6	-	-	HS
Vertical active area	T_{VDISP}	-	-	480	-	HS
			-		-	HS
					-	HS
Vertical refresh rate	T_{VRR}	Frame rate	50	60	70	Hz
Horizontal Timing						
Horizontal cycle period	T_{HP}	-	326	-	-	DOTCLK
Horizontal low pulse width	T_{HS}	-	2	-	-	DOTCLK
Horizontal front porch	T_{HFP}	-	2	-	-	DOTCLK
Horizontal back porch	T_{HBP}	-	2	-	-	DOTCLK
Horizontal blanking period	T_{HBL}	T_{HBP} + T_{HFP}	6	-	-	DOTCLK
Horizontal active area	T_{HDISP}	-	-	320	-	DOTCLK
Pixel clock cycle TVRR=60Hz	f_{CLKCYC}	-	9	-	-	MHz

Note: (1) IOVCC=1.65 to 3.3V, VCI=2.3 to 3.3V, VSSA=VSSD=0V, Ta=-30 to 70℃ (to +85℃ no damage)

(2) Data lines can be set to "High" or "Low" during blanking time – Don't care.

(3) HP is multiples of PCLK.

Serial data write mode



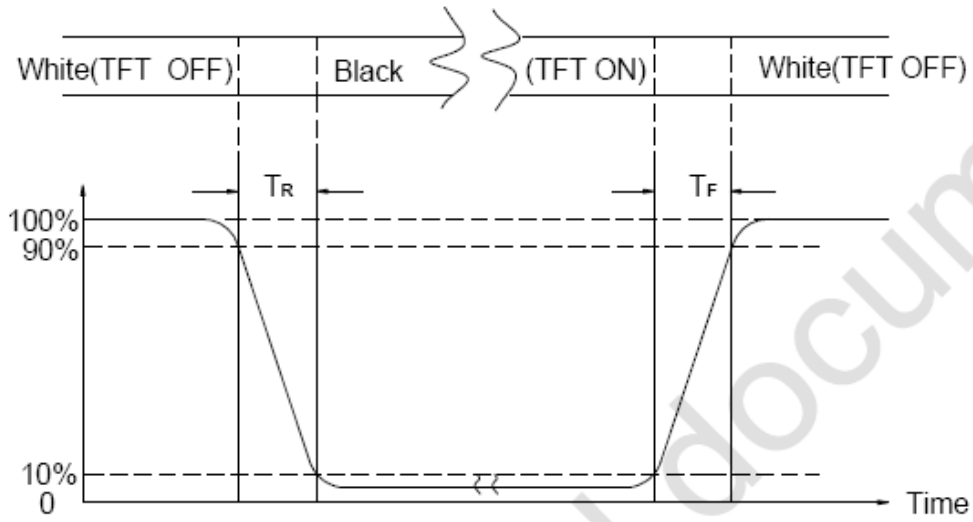
5. OPTICAL CHARACTERISTICS

The following items are measured under stable conditions. The optical characteristics should be measured in a dark room or equivalent state with the methods shown in Note.1.

Response Time			30 (Typ.)	ms	With IVO requirement driving condition, Refer to Section Note A,B
Contrast Ratio			500 (Typ.)	-	
Viewing Angle			Up-down : 70/60 (Typ.), Left-right : 70/70 (Typ.)	deg.	Viewing Angle base on Using EWV polarizer Reference Only
Chromaticity	NTSC Ratio		60% (Typ.)	%	With reference backlight spectrum, see in 12(with reference polarizer)
CF only Chromaticity	Red	Rx	0.637 ±0.02	-	Under C light (Viewing normal angle $\Theta_X = \Theta_Y = 0°$)
		Ry	0.338 ±0.02		
	Green	Gx	0.289 ±0.02		
		Gy	0.589 ±0.02		
	Blue	Bx	0.136 ±0.02		
		By	0.143 ±0.02		
	White	Wx	0.300±0.02		
		Wy	0.340±0.02		
Panel Transmittance			5.1%(min) 5.5% (Typ.)	%	
Color Filter Structure			Stripe RGB	-	-

Note: A. Definition Of Response Time (T_R, T_F)

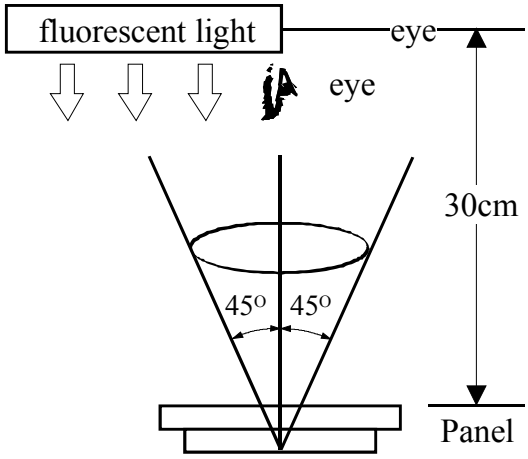
Figure 1 Definition of Response Time



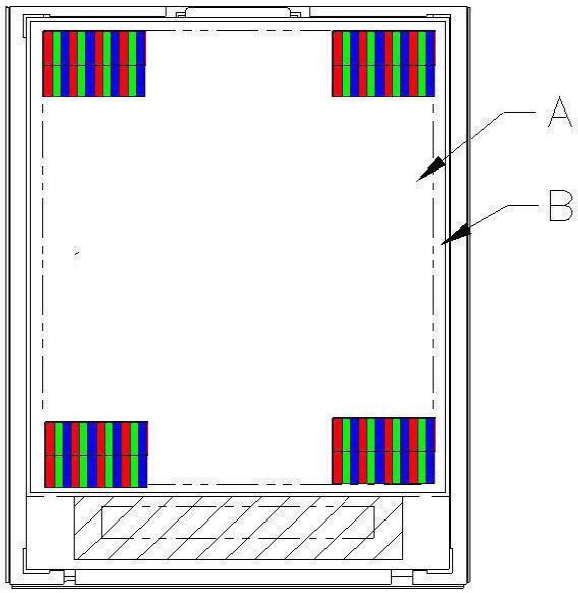
6. Quality Specifications

6.1 Inspection Condition

(1) Inspect under 300~500Lux fluorescent light, leaving 30~35cm between panels and eyes, and between panels and lights.
(2) Inspection condition is 23±5°C, 50±20%RH maximum.

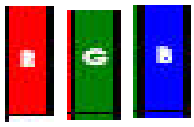
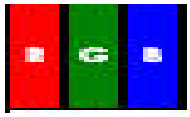


6.2 Definition of Area



A Area : Viewing area.
B Area : Out of viewing.(outside viewing area)

6.3 INSPECTION SPECIFICATION

NO	Item	Acceptable specification	Judgment Criterion
1	Electrical Testing	**1-1 sub pixel classification** ● Sub Pixel: Number of sub pixel doesn't exceed one dot.	N≦1
		 **Sub Pixel (Dot)** **a> Dark dot ----one Allowed** **b> Bright dot ---- one Allowed**	
		● Pixel : Three dots link together doesn't exceed ones	N≦0
		 **Pixel**	
		1-2 Leakage to light ● Leakage to light be not allowed.	N=0
		1-3 Picture to shake ● Picture had shake, twinkle and noise etc. instable of defect that be not allowed.	N=0
		1-4 Function ● No display or No function. ● Source Line, Gate Line. ● Contrast Ratio ● Current consumption exceeds product specifications. ● Display malfunction.	N=0
2	Mechanical Dimension	2-1 Mechanical Dimension exceeds product specifications. 2-2 Out of frame and boss of plastic changed shape that be not allowed.	N=0

<table>
<tr><th>NO</th><th>Item</th><th>Acceptable specification</th><th>Judgment Criterion</th></tr>
<tr><td>3</td><td>Cosmetic Inspection</td><td>

3-1 Blemish: Line shapes of defect

<table>
<tr><th>Length</th><th>Width</th><th>Acceptable number</th><th>Mini. space</th></tr>
<tr><td>---</td><td>W≦0.03</td><td>Ignore</td><td rowspan="3">5 m m</td></tr>
<tr><td>L≦2.5</td><td>0.03<W≦0.05</td><td>3</td></tr>
<tr><td>L≦2.5</td><td>0.05<W≦0.1</td><td>2</td></tr>
<tr><td>--</td><td>W＞0.1</td><td>Not allowed</td><td>---</td></tr>
</table>

L: length(mm)
W: width(mm)

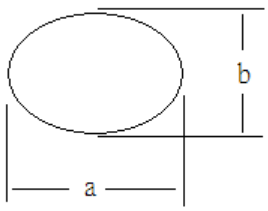
3-2 Blemish: dot shapes of defect.

<table>
<tr><th>Dimension</th><th>Acceptable number</th><th>Mini. Space</th></tr>
<tr><td>Φ≦0.10</td><td>Ignore</td><td>---</td></tr>
<tr><td>0.10＜Φ≦0.15</td><td>2</td><td rowspan="2">5 m m</td></tr>
<tr><td>0.15＜Φ≦0.25</td><td>1</td></tr>
<tr><td>Φ＞0.25</td><td>0</td><td>---</td></tr>
</table>

3-3 Polarizer Bubble

<table>
<tr><th>Dimension</th><th>Acceptable number</th><th>Mini. Space</th></tr>
<tr><td>Φ≦0.20</td><td>Ignore</td><td>---</td></tr>
<tr><td>0.20＜Φ≦0.30</td><td>2</td><td>15 m m</td></tr>
<tr><td>Φ＞0.30</td><td>0</td><td>---</td></tr>
</table>

Foreign Substances



Φ=(a+b)/2

</td><td></td></tr>
</table>

<table>
<tr><th>NO</th><th>Item</th><th>Acceptable specification</th><th>Judgment Criterion</th></tr>
<tr><td>3</td><td>Cosmetic Inspection</td><td>
3-4 Scratch
● Sensate scratch not allowed.
● Impassive scratch as below.
Unit:mm
<table>
<tr><th>Length</th><th>Width</th><th>Acceptable number</th><th>Mini. space</th></tr>
<tr><td>-----</td><td>W≦0.03</td><td>Ignore</td><td rowspan="3">5 m m</td></tr>
<tr><td>L≦2.5</td><td>0.03<W≦0.05</td><td>3</td></tr>
<tr><td>L≦2.5</td><td>0.05<W≦0.1</td><td>2</td></tr>
<tr><td>----</td><td>0.1＜W</td><td>Not allowed</td><td rowspan="2">---</td></tr>
<tr><td>L>2.5</td><td>----</td><td>Not allowed</td></tr>
</table>
</td><td></td></tr>
<tr><td>4</td><td>Package</td><td>4-1 Mixed product types
4-2 Shipping q’ty should be the same as “shipping notice form” q’ty.
4-3 Outer box can’t broken.</td><td>N=0</td></tr>
</table>

7. RELIABILITY

Test Item	Test Condition
High Temperature Operation	70℃ for 24 hours （不带 TP 温度）
Low Temperature Operation	-20℃ for 24 hours（不带 TP 温度）
High Temperature Storage	80℃ for 24 hours（不带 TP 温度）
Low Temperature Storage	-30℃ for 24 hours（不带 TP 温度）
High Temperature Operation Humidity Operation	50℃, 95%RH for 48 hours
Thermal Shock	-30°storage one hour,rise to 70° within 15s,high temperature one hour, drop to 30° within 15s, circulate ten repeatedly
Vibration Test (No Operation)	Frequency: 10~55Hz Amplitude:1.0mm Sweep Time: 11min Test Period: 6 Cycles for each direction of X, Y, Z
Static electricity test	Touch 6KV,air touch 10KV

8. HANDLING PRECAUTION

8.1 SAFETY

(1) Do not swallow any liquid crystal, even if there is no proof that liquid stal is poisonous.
(2) If the LCD panel breaks, be careful not to get liquid crystal to touch your skin.
(3) If skin is exposed to liquid crystal, wash the area thoroughly with alcohol or soap.

8.2 STORAGE CONDITIONS

(1) Store the panel or module in a dark place where the temperature is 23±5℃ and thehumidity is below 50±20%RH.
(2) Store in anti-static electricity container.
(3) Store in clean environment, free from dust, active gas, and solvent.
(4) Do not place the module near organics solvents or corrosive gases.
(5) Do not crush, shake, or jolt the module.

8.3 HANDLING PRECAUTIONS

(1) Avoid static electricity which can damage the CMOS LSI.
(2) The polarizing plate of the display is very fragile. So, please handle it very carefully.
(3) Do not give external shock.
(4) Do not apply excessive force on the surface.
(5) Do not wipe the polarizing plate with a dry cloth, as it may easily scratch the surface of plate.
(6) Do not use ketonics solvent & Aromatic solvent, use with a soft cloth soaked with acleaning naphtha solvent.
(7) Do not operate it above the absolute maximum rating.
(8) Do not remove the panel or frame from the module.

8.4 WARRANTY

The period is within twelve months since the date of shipping out under normal using and storage conditions.