PRELIMINARY SPECIFICATION

Date: July 23, 2004 Project Code: FT4010-A1

Customer / 客戶名稱 … … … …… … … …… … … … … … … …

Product No.

Customer's Signature(s) … … … …… … … …… … … … … … … …
客戶確認簽章：

… … … … … … … …… … … … … … … …

Prepared	Check-PT	Approval-PT	Check-QA	Final Approval

Version	Revision Remark	Date
A	Preliminary	2004/07/23
B		
C		
D		
E		
F		
G		
H		
I		

Table of Contents

1. Features

The 1.5” LCD module is an active matrix color TFT LCD module with Digital and Alalog Interface. LTPS(Low Temperature Poly Silicon)TFT technology is used. Vertical and horizontal drivers are built on the panel. NTSC and PAL format are compatible. Horizontal scan can be from left to right or from right to left and vertical scan can be from up to down or from down to up.

2. General Specifications

No.	Item	Specifications	Unit
1	Display Size (Diagonal)	1.5	Inch
2	Display Type	Transmissive	-
3	Outline Dimensions (HxVxT)	37.1 x 32.7 x 3.74	mm
4	Active Area (HxV)	31.22 x 22.815	mm
5	Number of Dots (HxV)	557 x 234	Dots
6	Dot Pitch (HxV)	0.056 x 0.0975	mm
7	Color Numbers	16 Million / Full Color	-
8	Color Arrangement	RGB Delta	-
9	Back Light	LED (White)	-
10	Weight	Approx. 9.3	g

3. Terminal Functions

3.1 TFT LCD Terminal

Pin No.	Symbol	I/O	Function	Remark
1	VCOM	I	Common Electrode Voltage	
2	CKV1	I	Vertical clock 1	
3	CKV2	I	Vertical clock 2	
4	STV	I	Vertical start signal	
5	XSTV	I	Inverted signal of STV	
6	VVDD	I	Power supply for vertical driver	
7	ENB	I	Enable signal	
8	XENB	I	Inverse signal of ENB	
9	CSV	I	UP/DOWN inverse control signal	Note3-1
10	VBB	O	Vertical driver output power voltage	
11	PCG	I	Precharge data signal	
12	XPCG	I	Inverted signal of PCG	
13	PCD	I	Precharge data signal for pixel	
14	B	I	Video signal (B)	
15	R	I	Video signal (R)	
16	G	I	Video signal (G)	
17	CSH	I	RIGHT/LEFT inverse control signal	Note3-2
18	VVEE	-	Vertical driver negative power supply voltage	
19	VSS	I	GND	
20	STH	I	Horizontal start signal	
21	XSTH	I	Inverse signal of STH	
22	HVDD	I	Power supply for horizontal driver	
23	CKH1	I	Horizontal clock 1	
24	CKH2	I	Horizontal clock 2	

Note3-1:

H: Normal scan

L: Reverse scan

Note3-2:
H: Normal scan

L: Reverse scan

3.2 LED Backlight Terminal

No.	Symbol	I/O	Function
1	V_F	I	LED Input Voltage
2	V_{FS}	I	GND for LED Backlight

4. Absolute Maximum Ratings

Item	Symbol	Min	MAX	Unit	Remark
Power Supply for Horizontal Driver	HVDD	-1.0	10.0	V	
Power Supply for Vertical Driver	VVDD	-1.0	10.0	V	
Vertical driver output power voltage	VBB	-6.0	-1.0	V	
Common Electrode Voltage	VCOM	-1.0	10.0	V	
Driving direction signal voltage	CSH, CSV	-1.0	11.0	V	
Horizontal driver/ Precharge data signal voltage	STH, XSTH, CKH1, CKH2, PCG, XPCG	-1.0	10.0	V	
Vertical Driver Input Voltage	STV, XSTV, CKV1, CKV2, ENB, XENB	-1.0	10.0	V	
Video / Precharge data signal for pixel input signal	G, R, B, PCD	-1.0	8.0	V	
Back Light Forward Current	I_F	-	25	mA	Note 4-1
Operating Temperature	Topr	-10	+60	℃	
Storage Temperature	Tstg	-30	+80	℃	

Note4-1: Ta=25℃

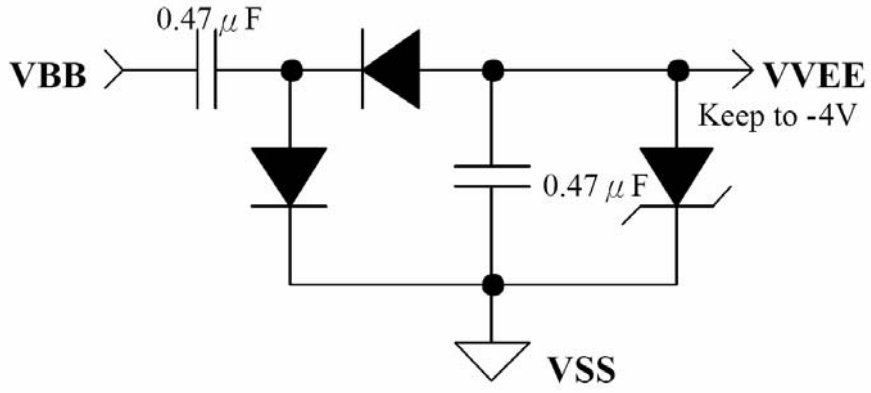
5. Electrical Characteristics

5.1 Driving TFT LCD Panel with Digital Interface

Item		Symbol	MIN	TYP	MAX	Unit	Remark
Power Supply for Horizontal Driver		HVDD	8.2	8.5	8.8	V	
Power Supply for Vertical Driver		VVDD	8.2	8.5	8.8	V	
Vertical driver output power voltage		VBB	-	-4.0	-	V	Note 5-1
Horizontal Driver Input Voltage	Low	VHIL	-0.3	0.0	0.3	V	
	High	VHIH	2.5	3.0	4.0	V	
Vertical Driver Input Voltage	Low	VVIL	-0.3	0.0	0.3	V	
	High	VVIH	2.5	3.0	4.0	V	
CSH, CSV	Low	VSIL	-0.3	0.0	0.3	V	
	High	VSIH	VDD	VDD	VDD	V	
Video Signal Center Voltage		VVC	2.4	2.6	2.8	V	Note 5-2
Video Signal Voltage	Black (H)	V block (H)	4.0	4.2	4.6		
	Black (L)	V block (L)	0.8	1.0	1.2		
	White-Black	V sig w-b	-	-	3.00	V	
Common Electrode Signal Center Voltage		VCOMc	(VVC-0.2) -0.2	(VVC-0.2)	(VVC-0.2) + 0.2	V	Note 5-3
Common Electrode Signal Center Range		VCOMp-p	-	3.8	-	V	Note 5-3
Panel Power Consumption		P	--	21	25	mW	

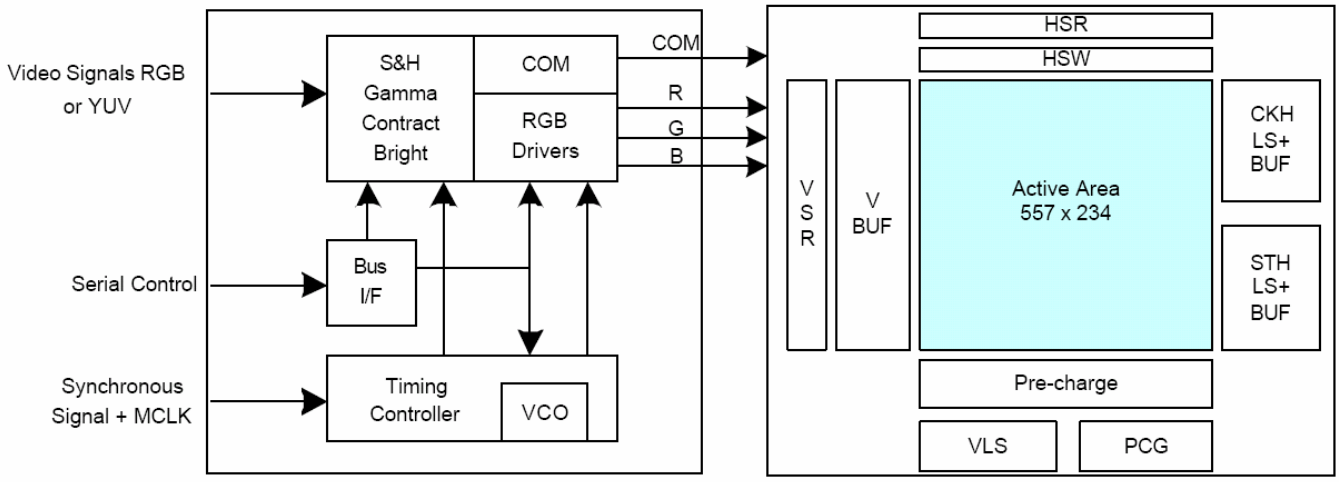
Note5-1: Negative power supply generator

To stabilize VBB output,VBB should be tied VSS through a zener diode with smoothing capacitor as the following diagram.



Note5-2: Video signal and precharge data signal shall be input symmetrically around VVC.
Note5-3: Set common electrode voltage to the optimum voltage.

5.1.1 Driving TFT LCD Panel Block Diagram

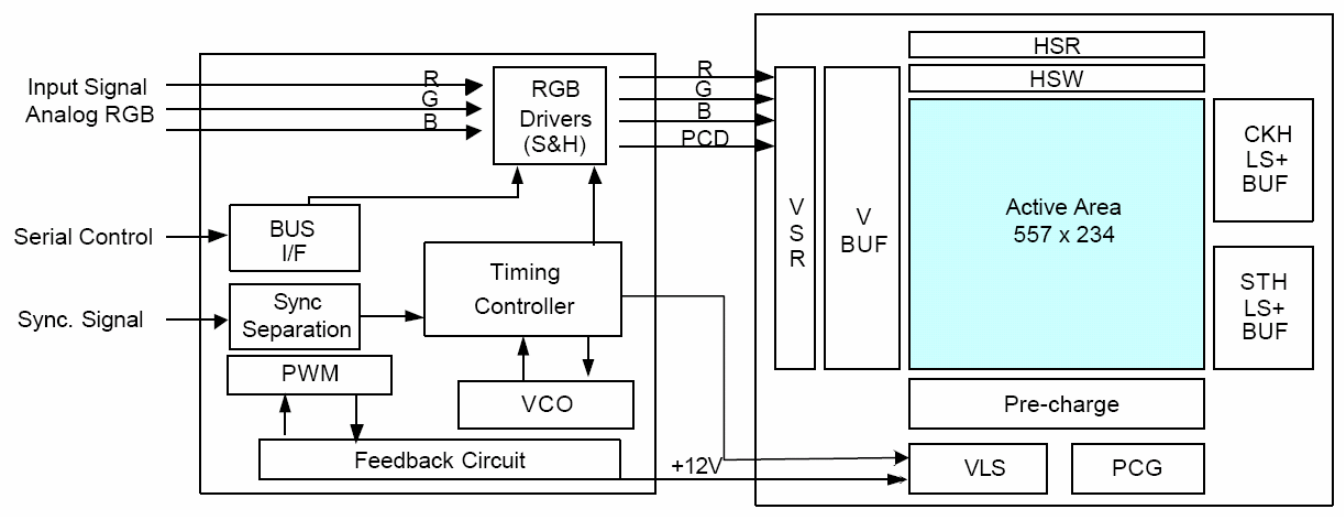


5.2 Driving TFT LCD Panel with Analog Interface

Item		Symbol	MIN	TYP	MAX	Unit	Remark
Power Supply for Vertical Driver		VVDD	11.7	12	12.3	V	
Power Supply for Horizontal Driver		HVDD	11.7	12	12.3	V	
Horizontal Driver Input Voltage	Low	VHIL	-0.3	0.0	0.3	V	
	High	VHIH	2.5	3.0	4.0	V	
Vertical Driver Input Voltage	Low	VVIL	-0.3	0.0	0.3	V	
	High	VVIH	2.5	3.0	4.0	V	
CSH, CSV	Low	VSIL	-0.3	0.0	0.3	V	
	High	VSIH	11.5	VDD	VDD	V	
Video Signal Center Voltage		VVC	5.0	5.2	5.4	V	Note 5-4
Video Input Voltage Range		VG, VR, VB	VCC-3.5	--	VVC+3.5	V	
Common Electrode Voltage		VCOM	--	VVC-0.2	--	V	Note 5-5

Note5-4: Video signal and precharge data signal shall be input symmetrically around WC.
Note5-5: Set common electrode voltage to the optimum voltage.

5.2.1 Driving TFT LCD Panel Block Diagram



5.3 Driving Backlight

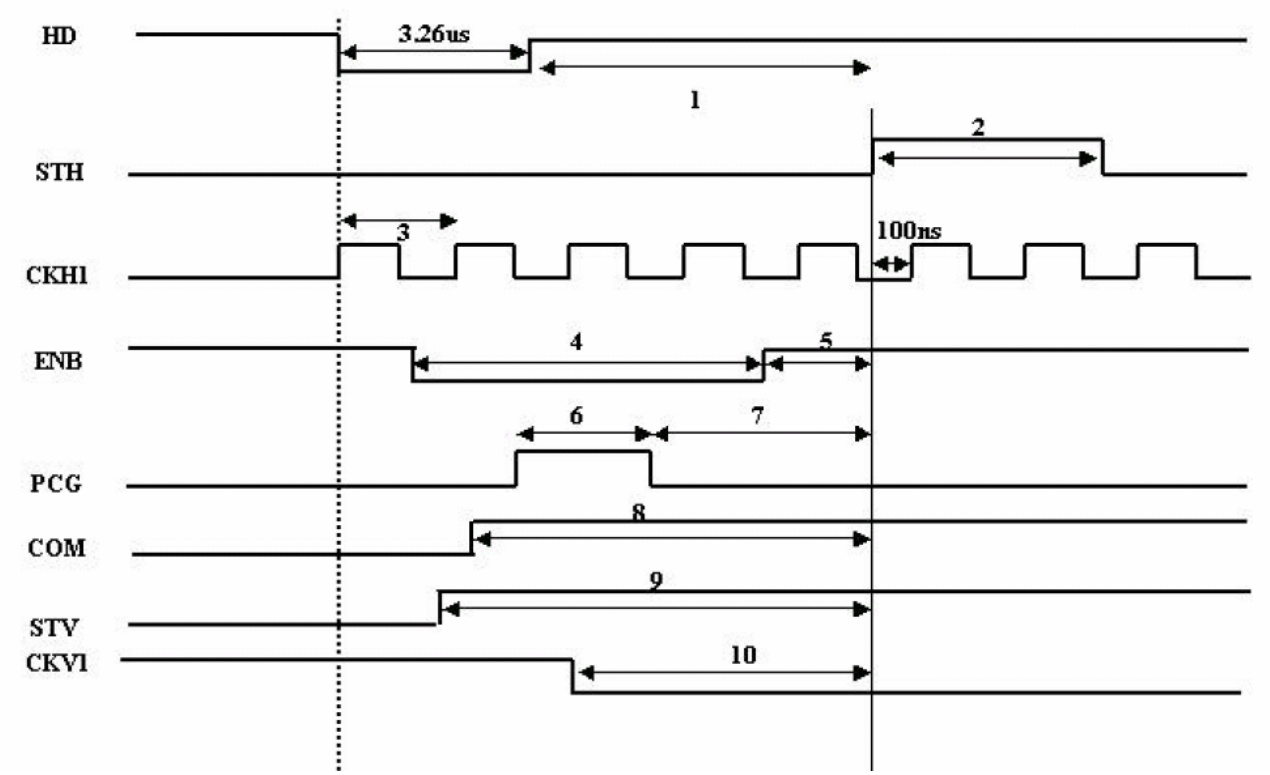
Item	Symbol	Min.	Typ.	Max.	Unit	Remark
Forward current	I_F	-	2.3	25	mA	-
Forward current voltage	V_F	-	7.2	-	V	-
Backlight Power Consumption	W_{BL}	-	165.6	-	mW	-

6. Timing Chart

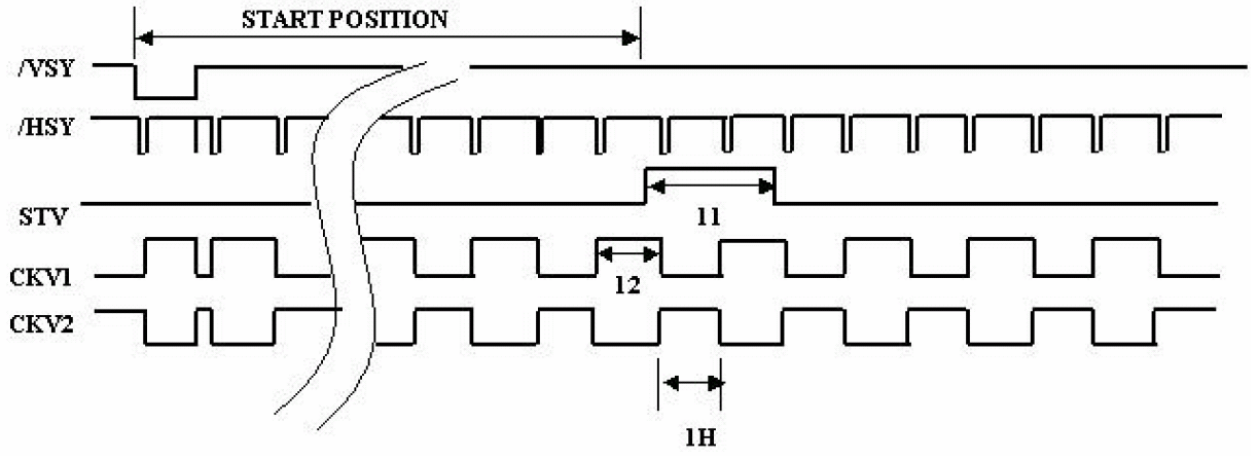
6.1 Timing Chart with Digital Interface

1	2	3	4	5	6	7	8	9	10	11	12
9.94 μs	1.18 μs	540ns	7.26 μs	1.06 μs	3.98 μs	1.62 μs	5.24 μs	8.04 μs	3.34 μs	127.1 μs	63.56 μs

6.1.1 Horizontal



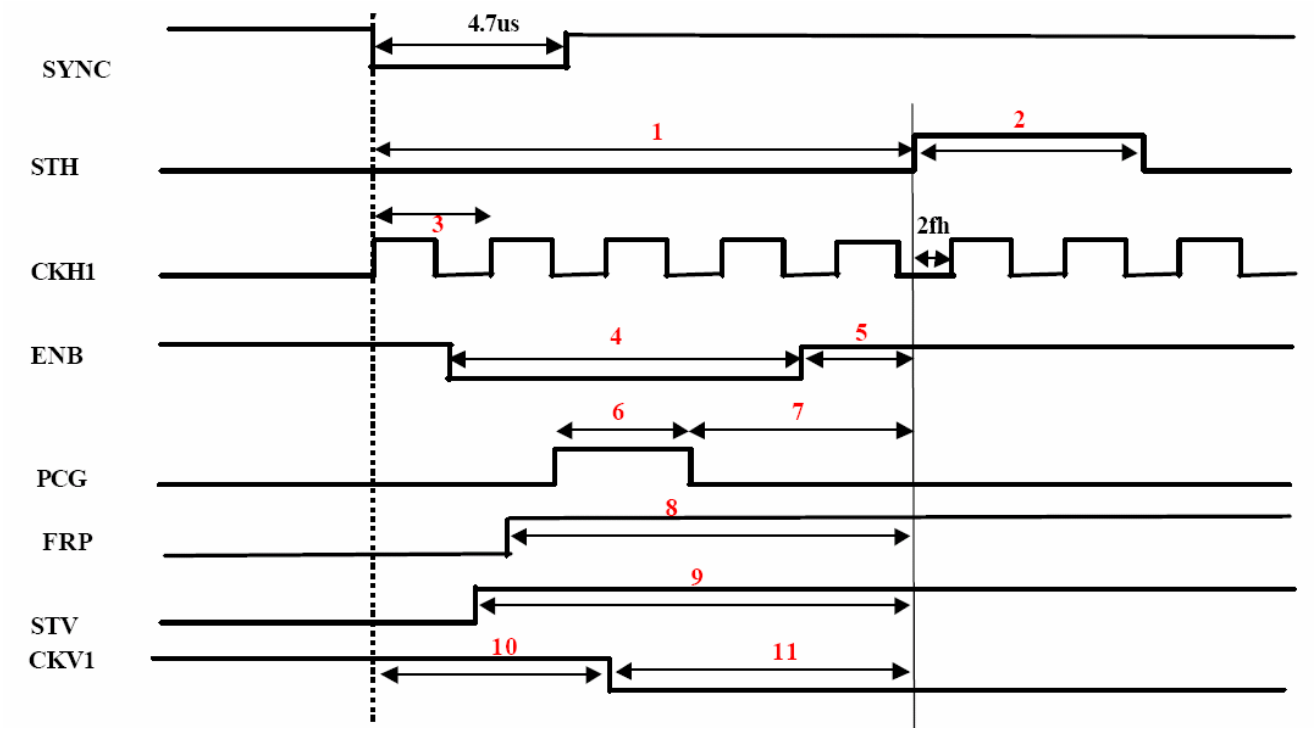
6.1.2 Vertical



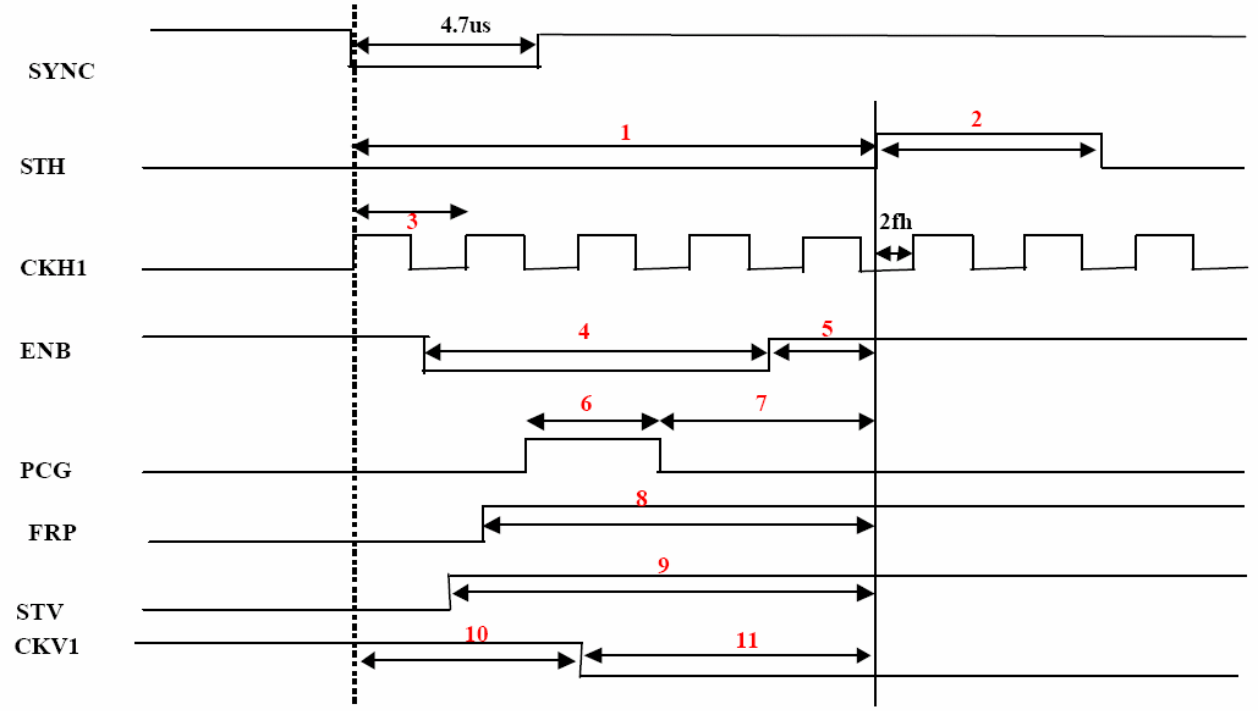
6.2 Timing Chart with Analog Interface
6.2.1 Horizontal

	NTSC Cycle(fh)	PAL Cycle(fh)	1(fh)	2(fh)	3(fh)	4(fh)	5(fh)	6(fh)	7(fh)	8(fh)	9(fh)	10(fh)	11(fh)
Odd Line	622 (t=102.2ns)	636 (t=100.6ns)	82.5	12	6	69	9.5	25	19.5	31.5	76.5	50	32.5
Even Line	622 (t=102.2nS)	636 (t=100.6nS)	81	12	6	69	8	25	18	30	75	50	32.5

(1) Odd Line.

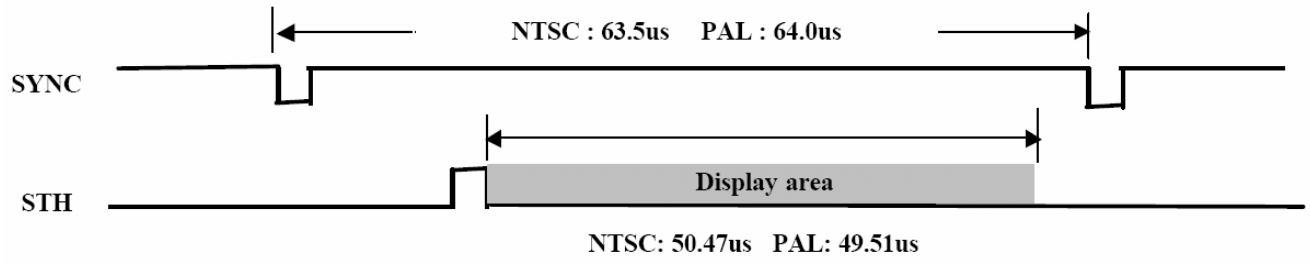


(2)Even Line.



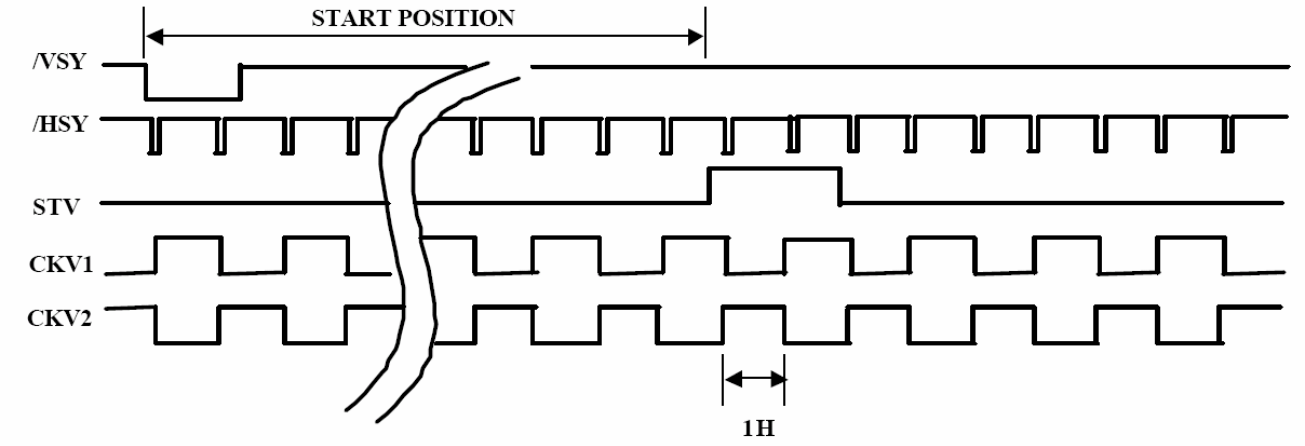
6.2.1 Vertical

(1)Display Area.



(2)Start Position.

	Odd Field	Even Field
NTSC	16	15
PAL	23	22



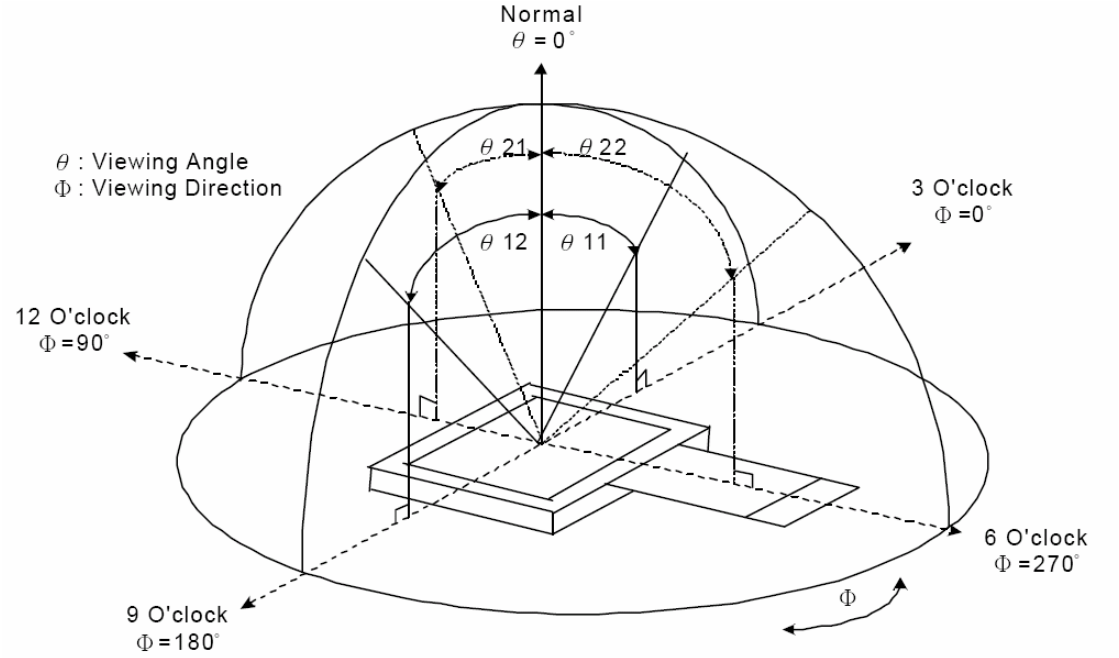
7. Optical Specifications

7.1 Optical Characteristics

Ta=25℃

Item		Symbol	Condition	MIN	TYP	MAX	Unit	Remarks
Viewing Angles		Θ11	CR = 10	35	40	--	Degree	Note 7-1
		Θ12		35	40	--		
		Θ21		15	20	--		
		Θ22		50	60	--		
Contrast Ratio		CR	Θ=0°	100	150	--		Note 7-2
Response Time	Rising	Tr		--	17	--	ms	Note 7-3
	Falling	Tf		--	30	--		
Luminance (I_F=23 mA)		L	Θ=0°	200	250	--	cd//m^2	Note 7-4
Chromaticity	White	x_W	Θ=0°	0.245	0.295	0.345		Note 7-5
		y_W	Θ=0°	0.260	0.310	0.360		

Note7-1: Viewing angle diagrams.

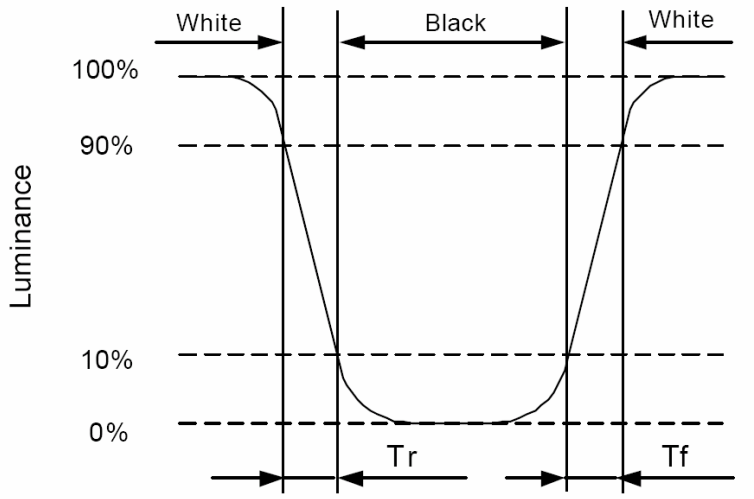


Note7-2: Contrast Ratio.

Contrast ratio is measured in optimum common electrode voltage.

$$CR = \frac{\text{Luminance with white image}}{\text{Luminance with black image}}$$

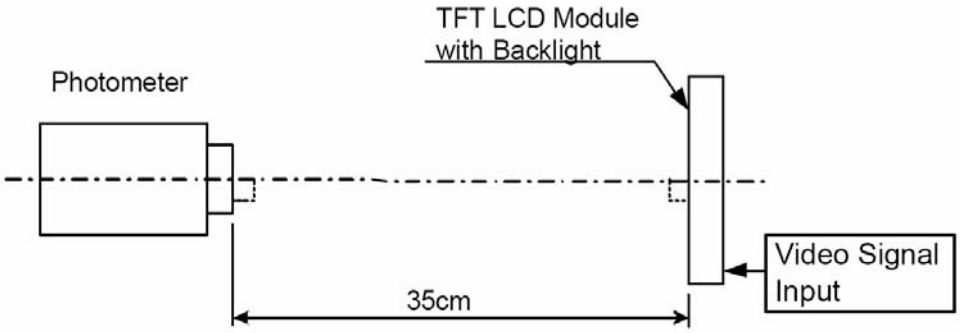
Note7-3: Definition of response time.



Note7-4: Luminance.
Test point: Display Center.
Note7-5: Chromaticity.
The same test condition as Note7-4.

7.2 Basic Measure Conditions

(1) Driving voltage:
Driving voltage with Digital Interface:
HVDD=8.5V , VVDD=8.5V
VVC=2.6V , VCOM=Optimum common electrode voltage
Driving voltage with Analog Interface:
HVDD=12.0V , VVDD=12.0V
VVC=5.2V , VCOM=Optimum common electrode voltage
(2) Ambient Temperature: Ta=25℃
(3) Testing Point: Measure in the display center point and the test angle θ =0°
(4) R , G , B signal input voltage
VG , VR , VB = VVC ± VAC (VAC: Signal Amplitude)
(5) LED Current: IF = 23 mA
(6) Testing Facility:
Environmental illumination = 10Lux



8. Reliability

No	Test Item	Condition
1	High Temperature Operation	Ta=+60℃, 240hrs
2	High Temperature & High Humidity Operation	Ta=+40℃, 95% RH, 240hrs
3	Low Temperature Operation	Ta=-10℃, 240hrs
4	High Temperature Storage (non-operation)	Ta=+80℃, 240hrs
5	Low Temperature Storage (non-operation)	Ta=-30℃, 240hrs
6	Thermal Shock (non-operation)	-30℃ ⟷ 80℃, 50 cycles 30 min 30 min
7	Resistance to Static Electricity Discharge (non-operation)	C=200pF, R=0Ω; Discharge: ±150V 3 times / Terminal
8	Surface Discharge (non-operation)	C=150pF, R=330Ω; Discharge: Air: ±15kV; Contact: ±8kV 5 times / Point; 5 Points / Panel
9	Vibration (non-operation)	Frequency: 10~55Hz; Amplitude: 1.5mm Sweep Time: 11min Test Time: 2 hrs for each direction of X, Y, Z
10	Shock (non-operation)	Acceleration: 100G; Period: 6ms Directions: ±X, ±Y, ±Z; Cycles: Twice

Ta: Ambient Temperature

9. Handling Cautions

9.1 ESD (Electrical Static Discharge) Strategy

ESD will cause serious damage of the panel, ESD strategy is very important in handling. Following items are the recommended ESD strategy

(1) In handling LCD panel, please wear non-charged material gloves. Connect the wrist conduction ring to the earth and the conducting shoes to the earth are necessary.

(2) The machine and working table for the panel should have ESD protection strategy.

(3) In handling the panel, using ionized air to decrease the charge in the environment is necessary.

(4) In the process of assembly the module, shield case should connect to the ground.

9.2 Environment

(1) Working environment of the panel should be in the clean room.

(2) The front polarizer is easy damaged. Handle it carefully and do not scratch it by sharp material.

(3) Panel has polarizer protective film in the surface. Please remove the protection film of polarizer slowly with ionized air to prevent the electrostatic discharge.

9.3 Others

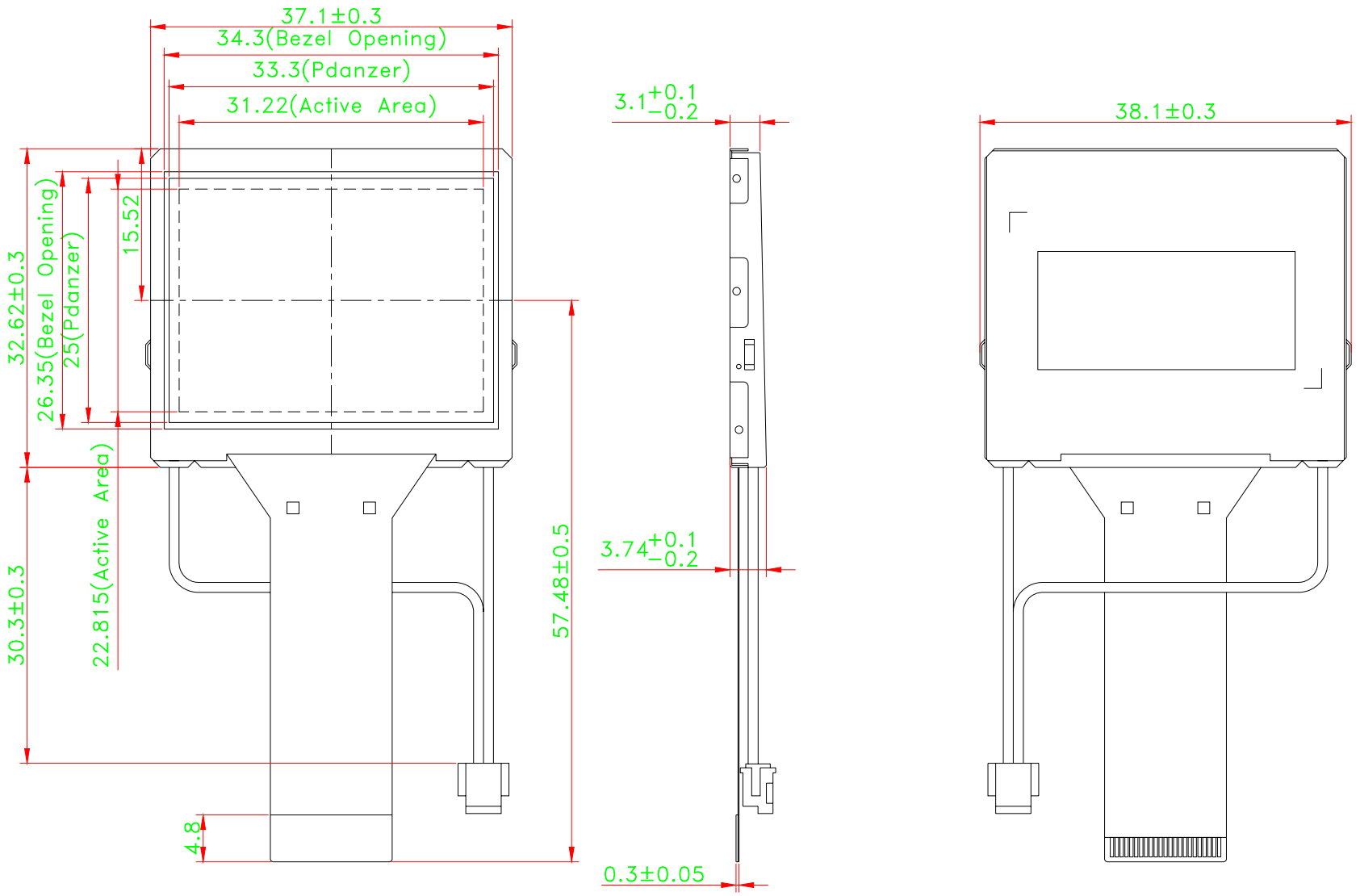
(1) Turn off the power supply before connecting and disconnecting signal input cable.

(2) The connection area of FPC and panel is very weak, do not handle panel only by FPC or bend FPC.

(3) Water drop on the surface or condensation as panel power on will corrode panel electrode.

(4) As the packing bag open, watch out the environment of the panel storage. High temperature and high humidity environment is prohibited.

(5) When the TFT LCD module is broken, please watch out whether liquid crystal leaks out or not. If your hand touches liquid crystal, wash your hand cleanly by water and soap as soon as possible.


37.1±0.3
34.3(Bezel Opening)
33.3(Pdanzer)
31.22(Active Area)
32.62±0.3
26.35(Bezel Opening)
25(Pdanzer)
15.52
22.815(Active Area)
30.3±0.3
4.8
57.48±0.5
3.1+0.1−0.2
3.74+0.1−0.2
0.3±0.05
38.1±0.3