TFT LCD Specification

Model Name: **TD022SREC6**

Customer Signature
Date

Table of Contents

Record of Revision

Rev	Issued Date	Description
1.0	Apr. 10 2006	New issue
1.1	Jun 22 2006	Modify the 『Mechanical Drawing』.

1. FEATURES

The 2.2"(5.6 cm) LCD module is an trans-flective active matrix color TFT LCD module. LTPS (Low Temperature Poly Silicon) TFT technology is used. Vertical and horizontal drivers are built on the panel.

2. GENERAL SPECIFICATIONS

Item	Description	Unit
Display Size (Diagonal)	2.2 (5.6)	Inch (cm)
Display Type	Trans-flective	
Active Area (HxV)	33.84 x 45.12	mm
Number of Dots (HxV)	240 x RGB x 320	dot
Dot Pitch (HxV)	0.047 x 0.141	mm
Color Arrangement	RGB Stripe	
Color Numbers	65536 (bit: R=5, G=6, B=5)	
Outline Dimension (HxVxT)	40.6 x 56.6 x 2.91	mm
Weight	TBD	g

* Exclude FPCa and protrusions.

3. INPUT/OUTPUT TERMINALS

No.	Pin Name	I/O	Description	Note
1	/RESETB	I	When /RESETB is L,an internal reset is performed	
2	TB	I	Data shift direction select	Note 1
3	RL	I	Source shift direction select	Note 2
4	NC	-	NC	
5	GND	-	Ground	
6	MCLK	I	The pixel clock signal of the RGB interface	
7	GND	-	Ground	
8	GND	-	Ground	
9	GND	-	Ground	
10	B1	I	RGB data Bit B1	
11	B2	I	RGB data Bit B2	
12	B3	I	RGB data Bit B3	
13	B4	I	RGB data Bit B4	
14	B5	I	RGB data Bit R5(MSB)	
15	GND	-	Ground	
16	G0	I	RGB data Bit G0	
17	G1	I	RGB data Bit G1	
18	G2	I	RGB data Bit G2	
19	G3	I	RGB data Bit G3	
20	G4	I	RGB data Bit G4	
21	G5	I	RGB data Bit G5(MSB)	
22	GND	-	Ground	
23	R1	I	RGB data Bit R1	
24	R2	I	RGB data Bit R2	
25	R3	I	RGB data Bit R3	
26	R4	I	RGB data Bit R4	
27	R5	I	RGB data Bit B5(MSB)	
28	GND	I	Ground	
29	HSYNC	I	The horizontal sync signal of the RGB interface	
30	VSYNC	I	The vertical sync signal of the RGB interface	
31	DE	I	Data Enable	
32	GND	-	Ground	
33	DVDD	-	Power supply	

No.	Pin Name	I/O	Description	Note
34	DVDD	-	Power supply	
35	LED+	-	LED+	
36	LED+	-	LED+	
37	LED-	-	LED-	
38	LED-	-	LED-	
39	GND	-	Ground	

Note1:   **Note2:**
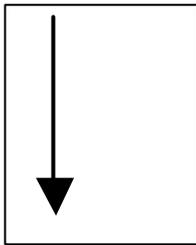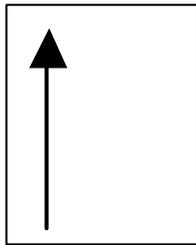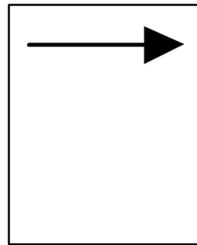
TB = H	TB = L	RL = H	RL = L
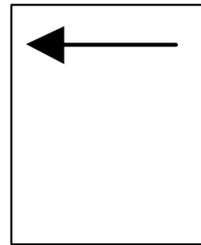
4. ABSOLUTE MAXIMUM RATINGS

Parameter	Symbol	Ratings	Unit
Maximum supply voltage	DVDD	-0.3 ~ +3.6	V
DC/DC Input voltage	DVDD	-0.3 to DVDD +0.3	V

(Ta=+25℃,VSS=0V)

5. ELECTRICAL CHARACTERISTICS

Allowable Operation condition (Ta=-20 ~ +60℃ , VSS=0)

Parameter		Symbol	Conditions	Ratings			Unit
				MIN	TYP	MAX	
Supply Voltage (DC/DC)		DVDD		2.5	2.8	3.6	V
Logic high-level input		Vih		0.7 DVDD	—	DVDD	V
Logic low-level input		Vil		0	—	0.3 DVDD	V
Leakage Current		iL		-1	—	1	A
Input Signal Voltage	H_{SYNC} V_{SYNC} signals	HS VS		1.6	2.8	3.6	V
	Data Signals	R,G, B		1.6	2.8	3.6	V
	Clock signal	CLK		1.6	2.8	3.6	V
Power consumption	Normal mode	Pwr	With loading	—	3.5	—	mW

Power On sequence

Line FP BP 1 2 ··· 319 320 FP BP 1 2 ··· 319 320 FP BP 1 2 ··· 319 320 FP BP 1 2 ··· 319 320 FP BP

DVDD

SD 1u

Display start st the 10th falling edge of VSYNC after SD falling (first 1

RESETB 10us

RGB interface

VSYN 10th 11th

(Note 1) There is no current leakage from "DVDD" rising to "RESETB" rising.

S001~24 White Normal Display

Power Off sequence

RESETB

RGB interface input

VSYNC 2 Frame

Line No. 317 318 319 320 FP BP 1 2 3 318 319 320 FP BP 1 2 3

DVDD Min 3 Frame

SD

S001-240 White White

Min. 10 ms 1 us

5.1 Driving TFT LCD panel block diagram

HS VS MCLK
RESETB

Register Control → Timing Control

1.8V   4.2V

Gamma Buffer

RGB(5:6:5)

2.8V

DC/DC

Level Shift

10V

QVGA

39 pin
0.3 pitch
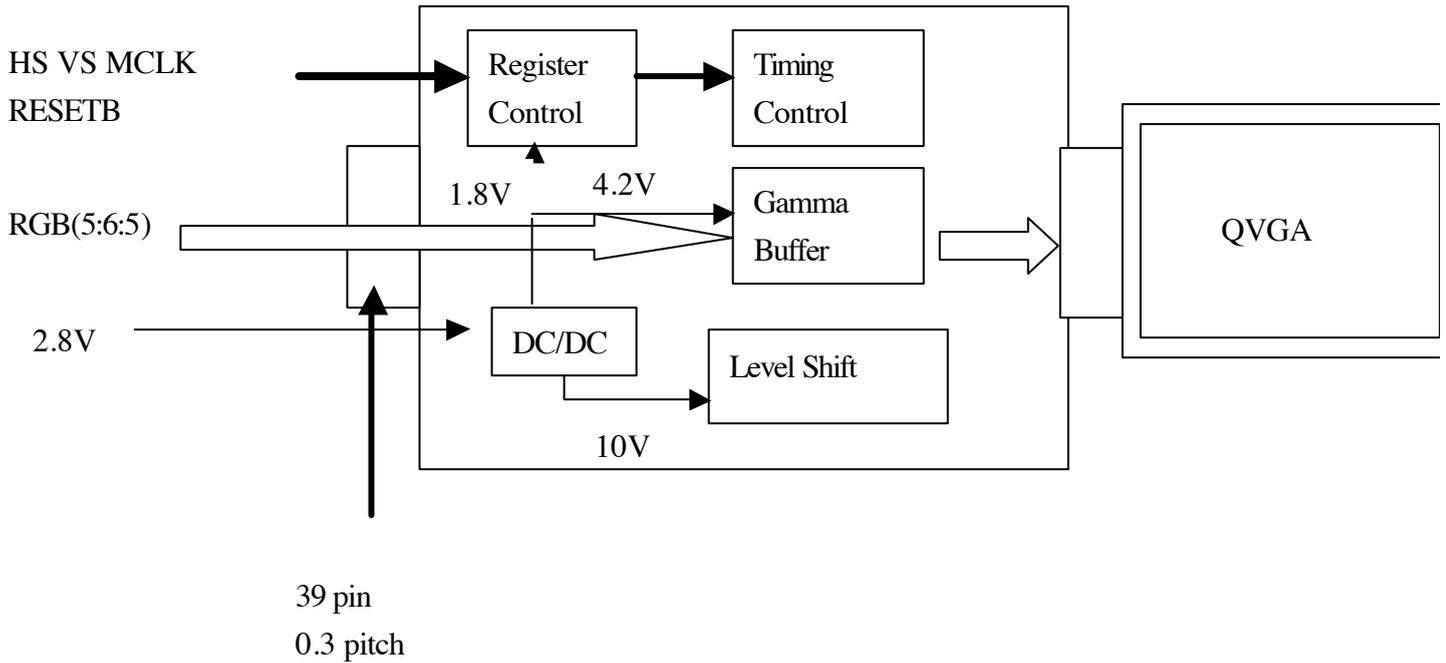
5.2 Driving Backlight

Ta=25℃

Item	Symbol	MIN	TYP	MAX	Unit	Remark
Forward Current	I_F	--	15	TBD	mA	
Forward Current Voltage	V_F	--	14.4	--	V	Note 5-2
Backlight Power Consumption	W_{BL}	--	216	--	mW	

Note 5-2: LEDx4

LED   LED

+   -

(35,36)   (37,38)
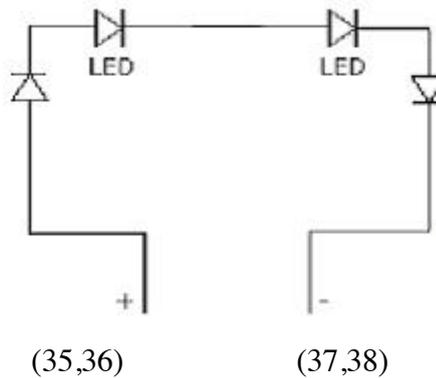
6. Input timing chart

6.1 Vertical Timing chart

VS

HS

VFP   VS   VBP   VFP

DE

VBL   VDISP

RGB[5:0]

VP
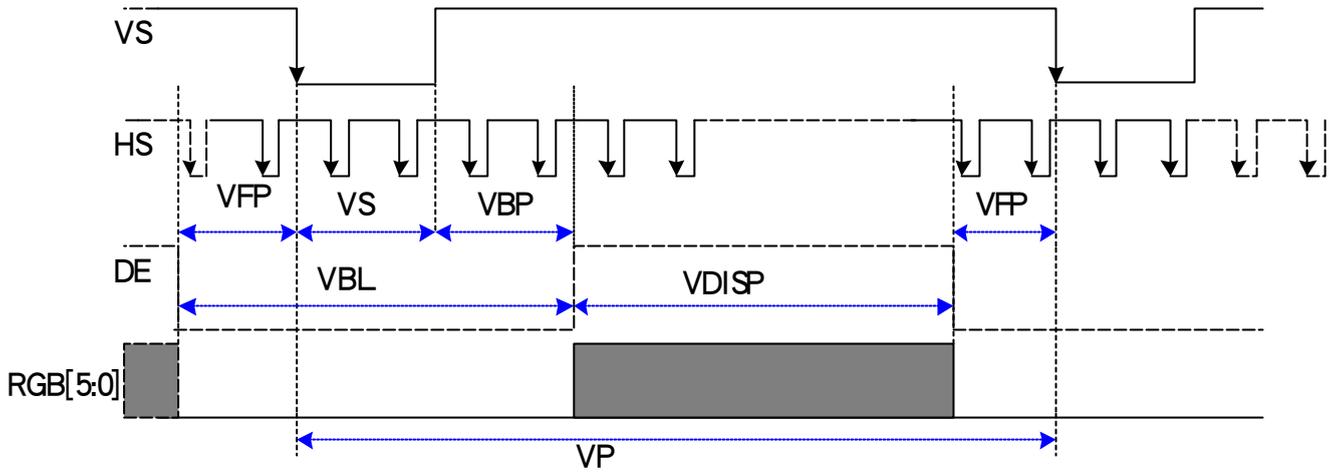
6.2 Horizontal Timing chart

HS

*1 CLK

HFP   HS   HBP   HFP

DE

HBL   HDISP

RGB[5:0]

HP
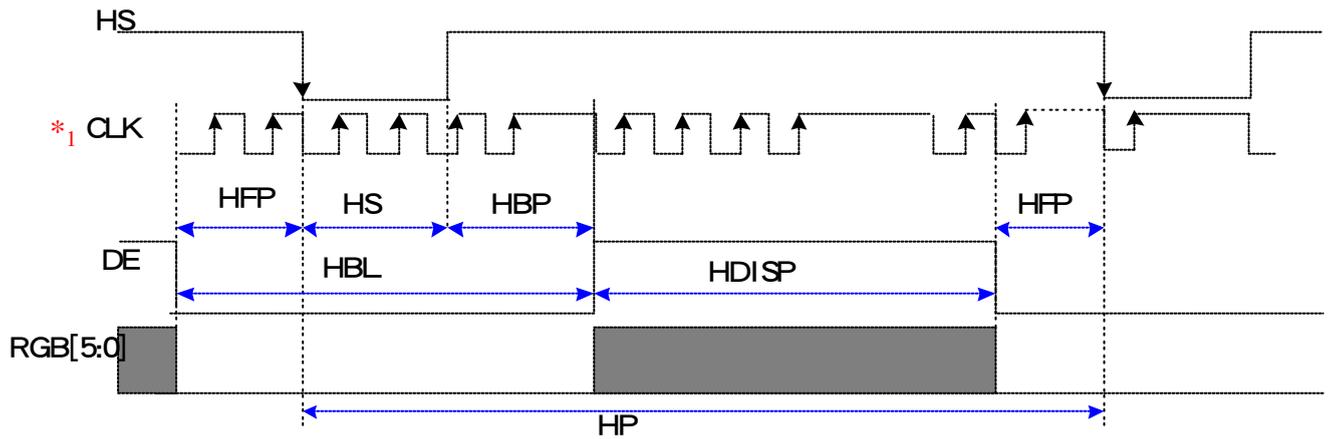
1. The frequency of CLK should be continued whether in display or blank region to ensure IC operating normally.

6.3. Setup/ Hold Timing chart
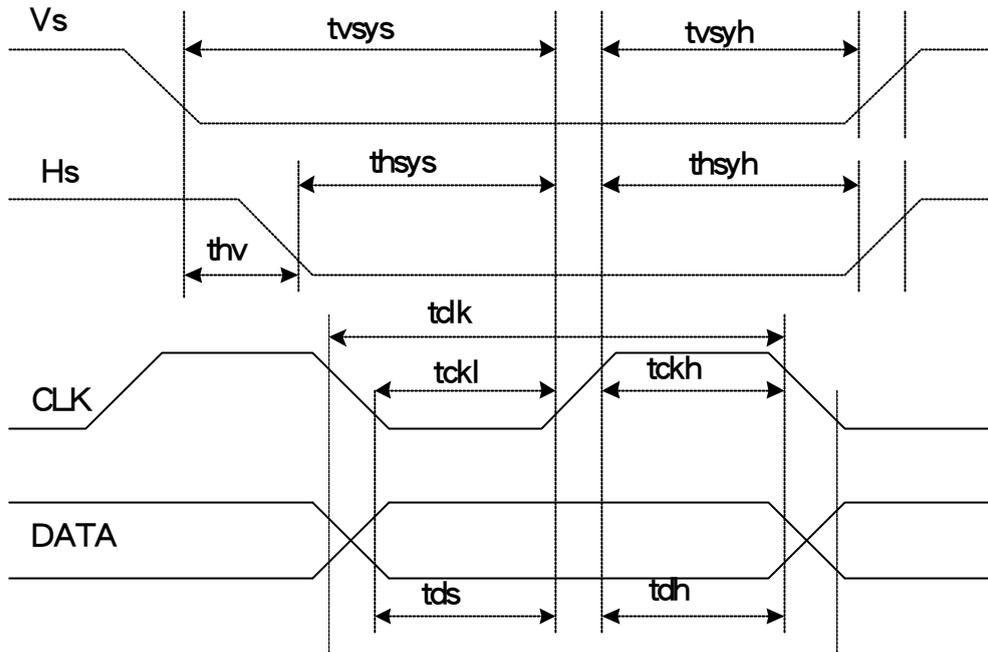
Phase difference of Sync.

Maximum Timing chart：
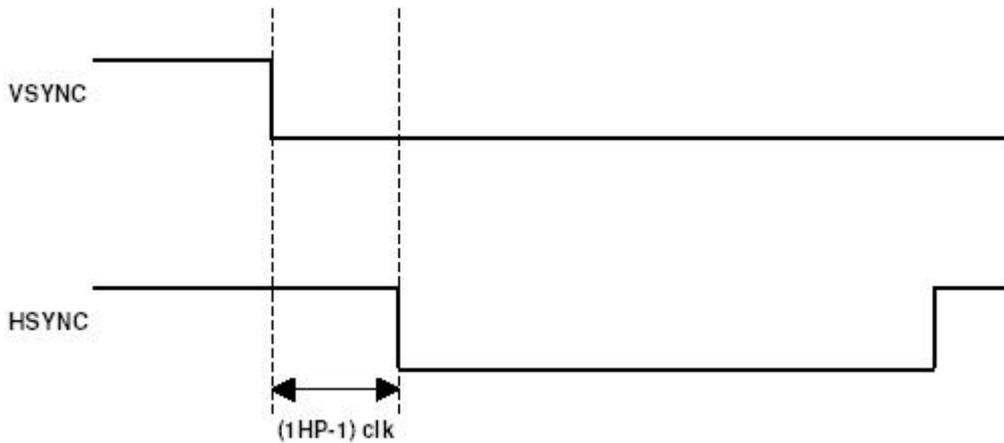
Minimum Timing chart:
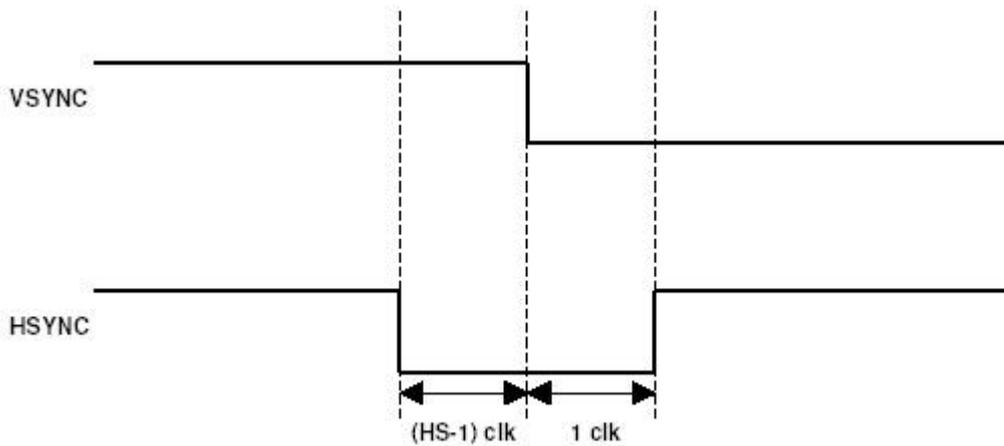
6.4 AC Characteristics:

Parameter	Symbol	Conditions	Ratings			Unit
			MIN	TYP	MAX	
Vertical Sync. Setup time	tvsys		20	—	—	ns
Vertical Sync. Hold time	tvsyh		20	—	—	ns
Horizontal Sync. Setup time	thsys		20	—	—	ns
Horizontal Sync. Hold time	thsyh		20	—	—	ns
Phase difference of Sync. Signal Falling edge	thv		-(HS-1)	—	1HP-1	clk
Clock "L" Period	tckl		30	50	70	%
Clock "H" Period	tckh		30	50	70	%
Data setup time	tds		20	—	—	ns
Data Hold time	tdh		20	—	—	ns
Digital logic input	Trise/Tfall				15	ns

7. OPTICAL CHARACTERISTICS

7.1. Transmissive Mode (T = 25 deg C, T=0°, Backlight ON)

Item	Symbol		Condition	MIN	TYP	MAX	Unit	Remarks
Viewing Angles	T 11(L)		CR = 10	45	55	-	Degree	Note 7-1
	T12(R)			35	45	-		
	T21(D)			50	60			
	T22(U)			35	45	-		
Chromaticity	White	X	T=0°	0.26	0.31	0.36	-	Note 7-3
		Y		0.27	0.32	0.37		
	Red	X		0.54	0.59	0.64		
		Y		0.29	0.34	0.39		
	Green	X		0.27	0.32	0.37		
		Y		0.52	0.57	0.62		
	Blue	X		0.09	0.14	0.19		
		Y		0.08	0.13	0.18		
	NTSC		T=0°	43	50	-	%	Note 7-3
Contrast Ratio	CR		T=0°	120	150	-	-	Note 7-2
Uniformity (9 point)	Uf		T=0°	75	80		%	Note 7-7
Luminance	L		T=0°	145	195	-	Cd/m^2	Note 7-4

7.2. Reflective Mode (T = 25 deg C, T=0°, Backlight off)

Item	Symbol		Condition	MIN	TYP	MAX	Unit	Remarks
Viewing Angles	T 11(L)		CR = 2	70	75	-	-	Note 7-1 (system A)
	T12(R)			70	75	-		
	T21(D)			70	75	-		
	T22(U)			65	75	-		
Chromaticity	White	X	T=0°	0.25	0.30	0.35	-	Note 7-5
		Y		0.29	0.34	0.39		
	Red	X		0.33	0.38	0.43		
		Y		0.29	0.34	0.39		
	Green	X		0.24	0.29	0.34		
		Y		0.35	0.40	0.45		
	Blue	X		0.14	0.19	0.24		
		Y		0.15	0.20	0.25		
	NTSC		T=0°	4.5	6.5	-	%	Note 7-5
Contrast Ratio	CR		T=0°	5.0	8.0	-	-	Note 7-2
Response time	(Tr+Tf)/2		T=0°	-	7	14	-	Note7-8
Diffuse reflectance of display driven white	R_w		T=0°	2.5	3.5	-	%	Note7-9
Reflectance (Point light source)	R_{10}		T =10° F =270°	12	20	-	%	Note7-6

7.2.1   Ambient Temperature: Ta=25℃

7.2.2   Testing Point: Measure in the display center point and the test angleΘ=0˚

Measuring System A (Autronic-Melchers DMS-series)

7.3 Basic measure condition

    7.3.1 Driving voltage

        VDD= 12.0V, VEE=-6.5V

    7.3.2 Ambient temperature: Ta=25°C

    7.3.3 Testing point: measure in the display center point and the test angle T=0°

    7.3.4 Testing Facility

   Environmental illumination: = 1 Lux

A. System A

    Set up:

    a. Device: Autronic-Melchers DMS-series

    b. Detector: Spectrometer (or photometer)

    c. Light source: DMS hemisphere without secular reflection (temperature stage), standard distance 3mm

    d. Labsphere standard diffuse reflective white sample (SRS-99-020)

    e. Detector angle: perpendicular (?= viewing direction, $\theta=0°$); the hemisphere slit position is at ? =90

    f. Detector position: screen center (x=0, y=0)

    g. Spectrometer evaluation light source: D65
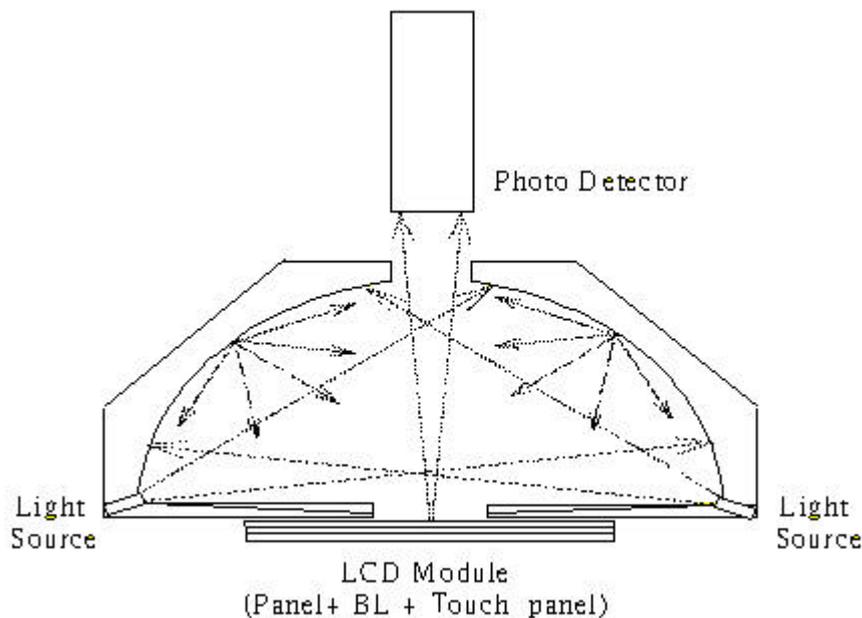
B. System B
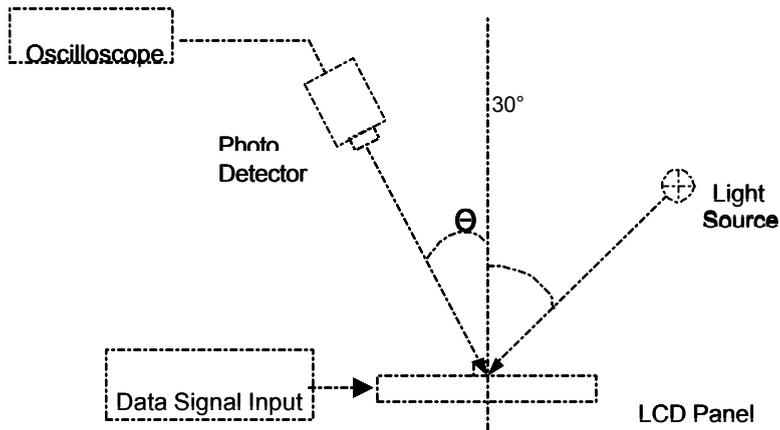
C. System C
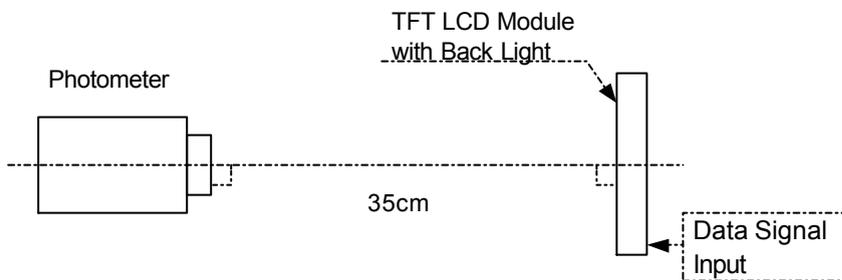
Note 7-1: Viewing angle diagrams:
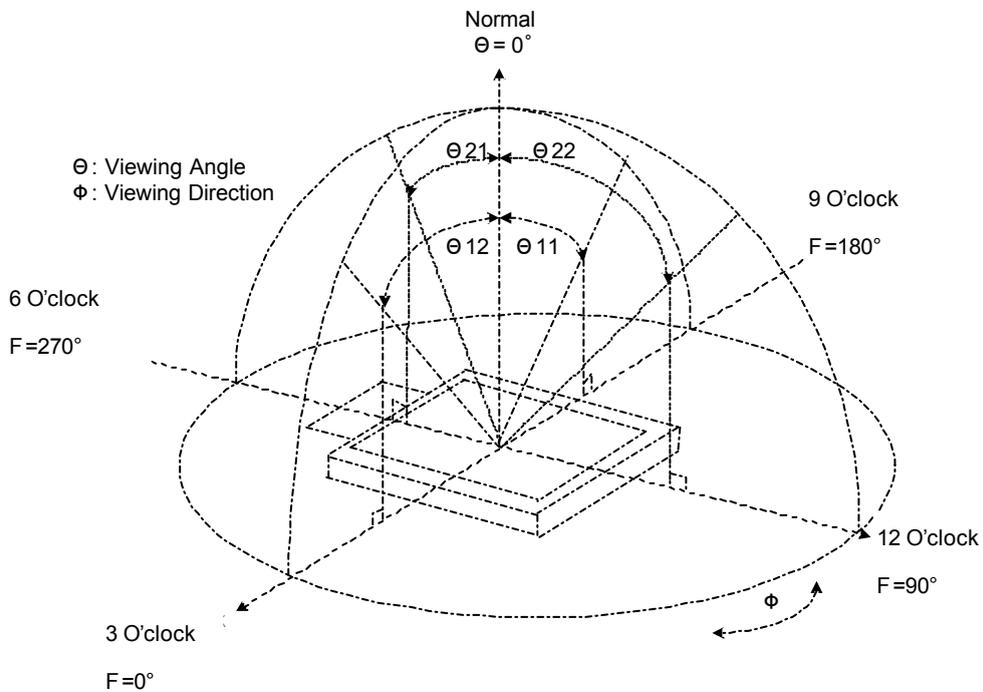
Note 7-2: Contrast ratio in back light on (Measure System C)

Contrast ratio in back light off (Measure System A)

Contrast ratio is measured in optimum common electrode voltage.

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

Note 7-3: White chromaticity as back light on: (Measure System C)

Note 7-4: Luminance: (Measure System C)

Test Point: Display Center

LED Current I_F = 15 mA

Note 7-5 White chromaticity as back light off: (Measure System A)

Note 7-6: Reflection ratio (R) (Measure System B)

In the measuring system B, calculate the reflection ratio by the following formula.

$$\text{Reflection ratio(R)} = \frac{\text{Light detected level of refection by the LCD module}}{\text{Light detected level of refection by the standard white}}$$

Notes 7-7: Definition of uniformity: Light on backlight 9 minutes before test.

$$\text{Uniformity (Lu)} = \frac{\text{Minimum Luminance of 9 test points}}{\text{Maximum Luminance of 9 test points}} \times 100\%$$

Note 7-8:Definition of response time: (Measure System A)
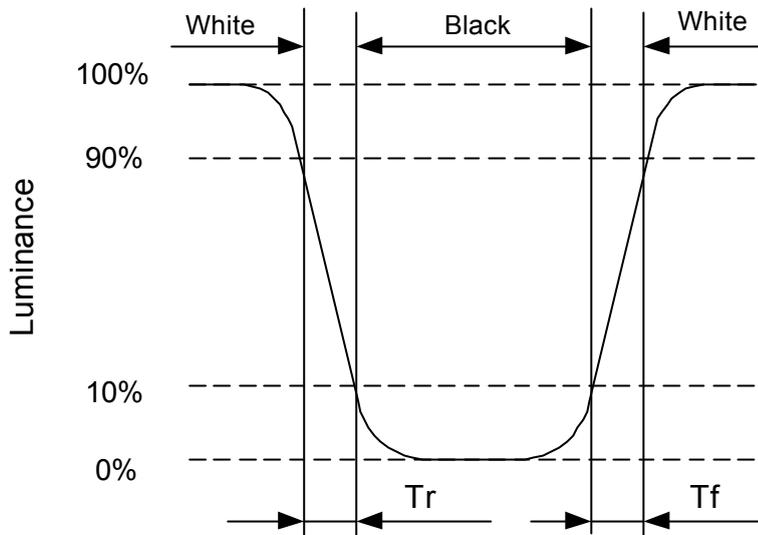
Note7-9: Diffuse reflectance of display driven white:

In the measuring system A, calculate the reflection ratio by the following formula.

$$\text{Reflection ratio(R)} = \frac{\text{Light detected level of refection by the LCD module (White pattern)}}{\text{Light detected level of refection by the standard white}}$$

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	Ta=+80℃, 240hrs
5	Low Temperature Storage	Ta=-20℃, 240hrs
6	Thermal Shock (non-operation)	-40℃(45min)←→85℃(45min) , 30 cycles
7	Vibration (non-operation)	Frequency: 10~55Hz; Amplitude: 1.5mm Sweep Time: 11min Test Time: 2 hrs for each direction of X, Y, Z
8	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

9.1.1 In handling LCD panel, please wear non-charged material gloves. Connector the wrist conduction ring to the earth and the conducting shoes to the earth is necessary.

9.1.2 The machine and working table for the panel should have ESD protection strategy.

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

9.1.4 In the process of assembly the module, shield case should connect to the ground.

9.2 Environment

9.2.1 Working environment of the panel should be in the clean room.

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

9.2.3 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

9.3.1 Turn off the power supply before connecting and disconnecting signal input cable.

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

9.3.3 Water drop on the surface or condensation as panel power on will corrode panel electrode.

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

9.3.5 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.

10. MECHANICAL DRAWING
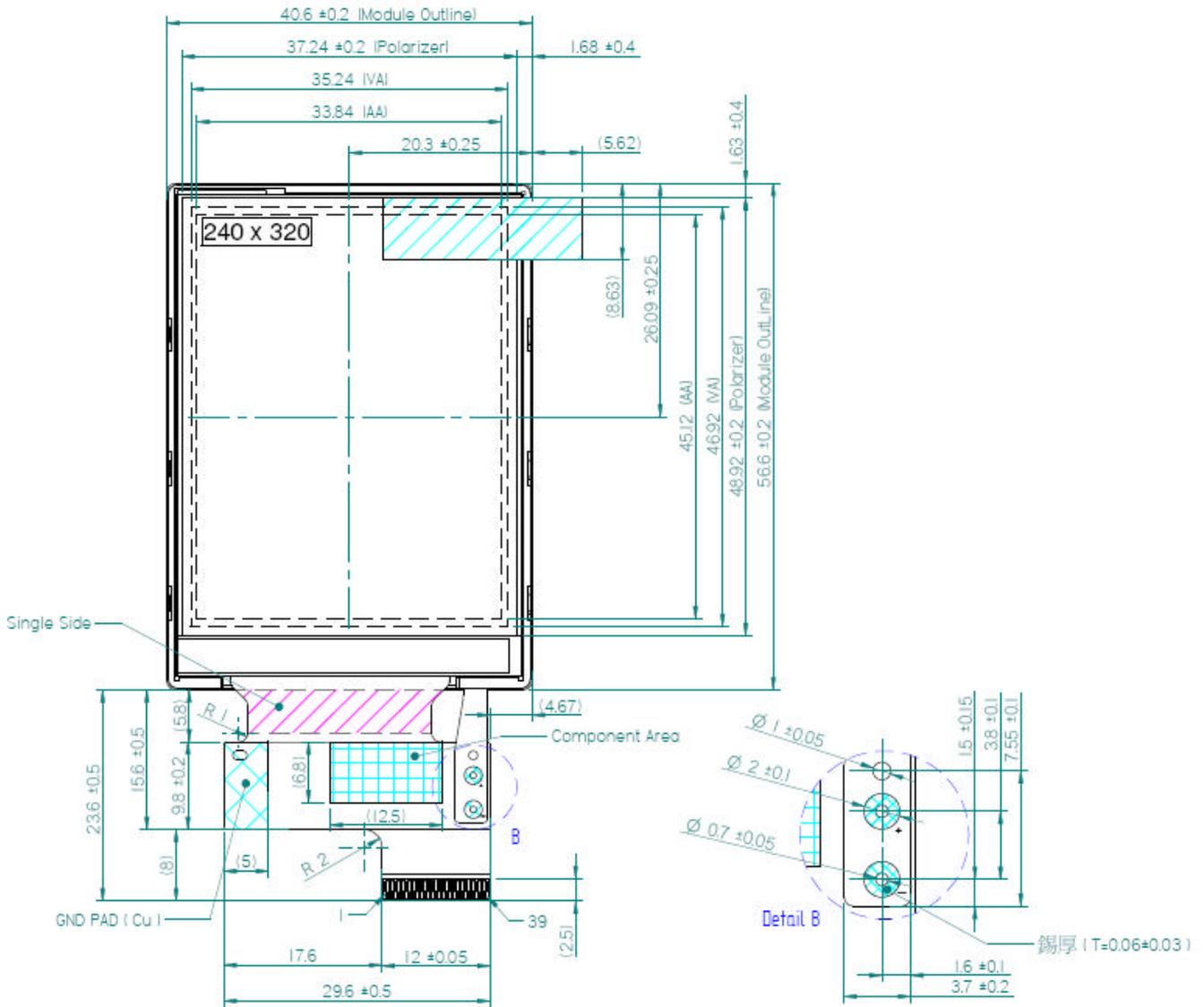
(Not including protection film and labels)

TESA 4872 t=0.08mm

R 0.65

2.91 ±0.2

(35.3)

4.6

3.5

(10)

31

Module Label (≒0.1mm)

(30)

(52.75)

(0.8)

3.5

5 ±0.3

GND PAD(Cu)

白線

Sitffener

11. PACKING DRAWING

① Module display face Down
12 pcs/Tray

Rotation Tray

② Empty Tray 1 pcs

Desiccant 2 pcs

Module in Tray
Stacking=20 Layers

③

Fixed by adhesion tape

LDPE bag

Package Unit

④ Cardboard 1 pcs

Cardboard 1 pc

Carton

⑤

Toppoly Logo tape sealing

Total module Q'ty:240 pcs/Box

Carton specification:350mmx270mmx208mm

TD022SREC5 Module delivery packing method

11.1 Module packed into tray cavity (with Module display face down), and stacking tray of reverse 180 degree in order.

11.2 Stacking the production on tray with 20 layers and with 1 empty tray above the stacking tray unit, and put 2 Desiccant on the empty tray.

11.3 Stacking tray unit put into the LDPE bag and fix by adhesive tape.

11.4 Put 1 pcs cardboard inside the carton bottom, then pack the package unit into the carton, finally put 1 pcs cardboard above the package unit

11.5 Sealing the Carton with Toppoly Logo adhesive tape.