TopSun

TopSun Optronics, Inc.

PRODUCT SPECIFICATION

Preliminary

MODEL: TS57ND2B-01

VERSION: 1.0

ISSUED DATE: 2006/05/08

CUSTOMER'S APPROVAL	
BY	
DATE	

TOPSUN OPTRONICS, INC.	
PREPARED BY	DATE
APPROVED BY	DATE

Note:

1. TopSun Optronics reserves the right to make changes without further notice to any products herein to improve reliability, function or design.
2.

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Revisions

Revision	Description	Date
1.0	Initial Release	2006/05/08

1. General Description and Features

The TS57ND2B-01 is a transmissive type color active matrix liquid crystal display (LCD) which uses amorphous thin film transistor (TFT) as switching devices. This product is composed of a TFT LCD panel, driver ICs, a driving PCB, a backlight unit, and a touch panel. The panel accepts 24-bit parallel RGB input display data which is able to display 16 million colors. It also features in wide viewing angle, wide operating temperature range, high color gamma, fast response time, and high contrast ratio. Besides, its slim bezel also makes it fit in most modern stylish designs.

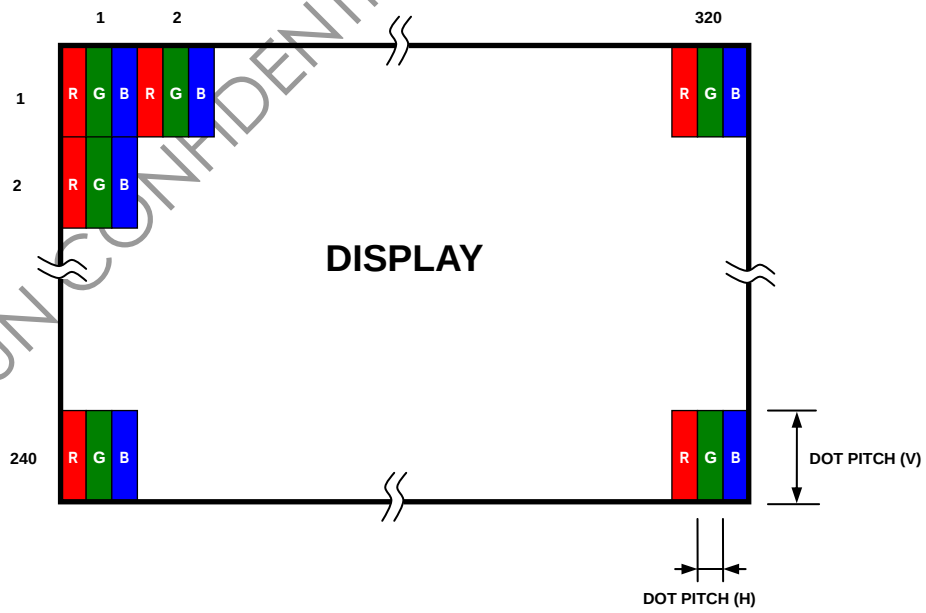
1.1. Applications

- Video Phone
- GPS Application
- Game Machine

1.2. General Specifications

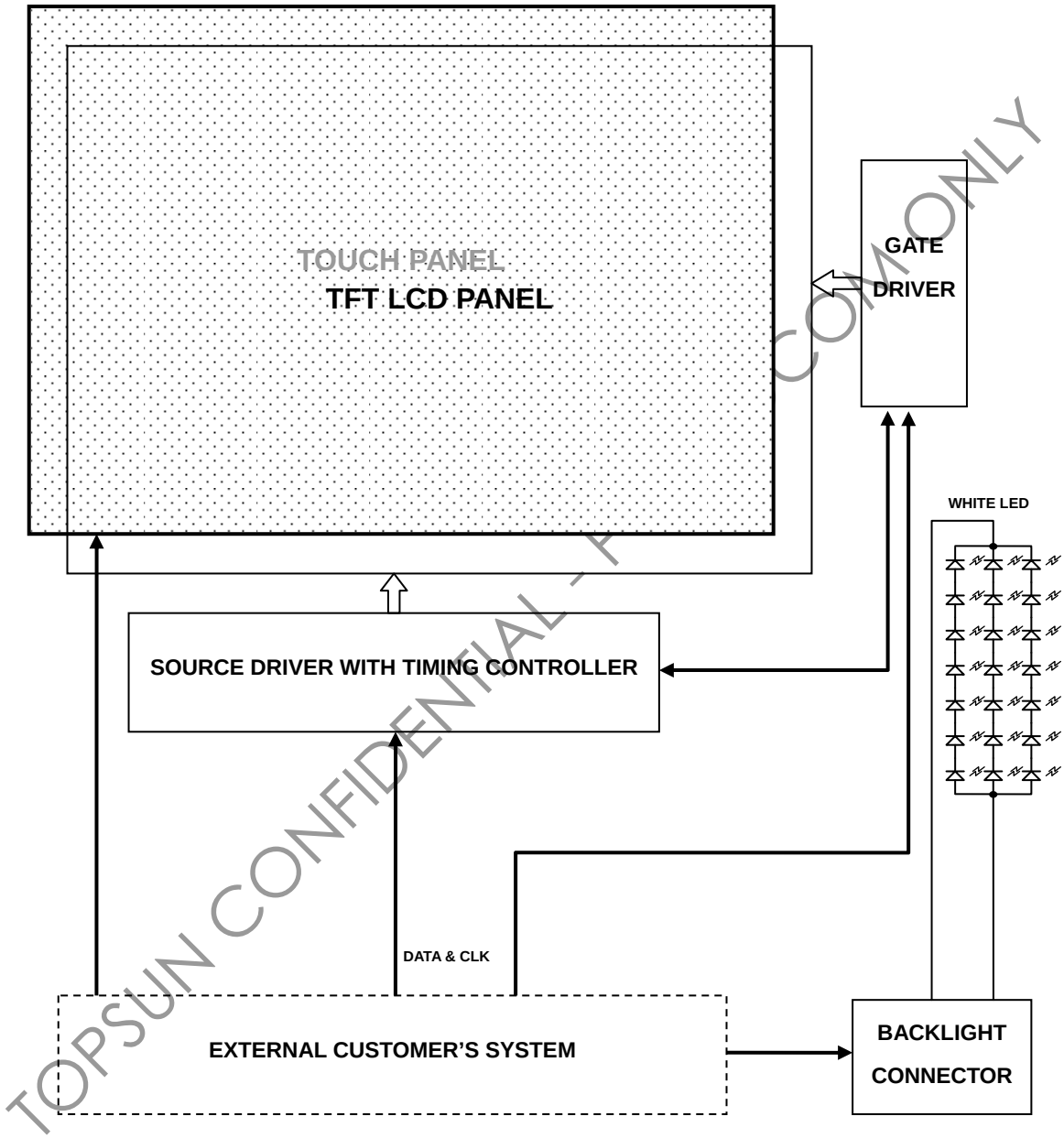
No.	Item	Description	Unit
1	Screen Size(diagonal)	5.7	inch
2	Resolution	320 (H) x RGB x 240 (V)	pixel
3	Dot Pitch	0.120 (H) x 0.360 (V)	mm
4	Active Area	115.20 (H) x 86.40 (V)	mm
5	Outline Dimension	125.00(W) x 98.80 (H) x 7.26(MAX.)	mm
6	Display Mode	Normally white/transmissive	
7	Pixel Arrangement	RGB-stripe	
8	Input Interface	24-bit parallel RGB	
9	Surface Treatment	Anti-glare (AG)	
10	Weight	128	g
11	Operating Temperature Range	-20 (T_a) ~ 70 (T_a)	℃
12	View Angle(U/D/R/L)	60/45/60/60	degree
13	Brightness	300	cd/m^2
14	Light Source	LED	
15	NTSC Rate	58	%

Note: T_a means ambient temperature.



Pixel Arrangement

2. Functional Block Diagram



3. Electrical Specifications

3.1. Pin Descriptions

3.1.1. Input Interface FPC Pin Descriptions

No.	Symbol	I/O	Description	Note
1	DGND	I	Digital Ground	
2	VDD	I	Digital Power. Connected to 3.3V.	
3	VDD	I	Digital Power. Connected to 3.3V.	
4	DGND	I	Digital Ground	
5	VGL	I	Negative Power for Gate Driver. TFT gate off voltage.	
6	DGND	I	Digital Ground	
7	VGH	I	Positive Power for Gate Driver. TFT gate on voltage.	
8	DGND	I	Digital Ground	
9	UD	I	UP/DOWN Scan Control. Screen vertical flip selection.	Note 1
10	LR	I	LEFT/RIGHT Scan Control. Screen horizontal flip selection.	Note 1
11	RESERVED	-	Reserved for Internal use. Leave this pin unconnected.	
12	RESERVED	-	Reserved for Internal Use. Leave this pin unconnected.	
13	RESERVED	-	Reserved for Internal Use. Leave this pin unconnected.	
14	POL	O	Polarity Output. Line inversion polarity control signal. Usually used for the VCOM buffer input.	
15	DGND	I	Digital Ground	
16	B7	I	Blue Data (MSB)	
17	B6	I	Blue Data	
18	B5	I	Blue Data	
19	B4	I	Blue Data	
20	B3	I	Blue Data	
21	B2	I	Blue Data	
22	B1	I	Blue Data	
23	B0	I	Blue Data (LSB)	
24	DGND	I	Digital Ground	
25	G7	I	Green Data (MSB)	
26	G6	I	Green Data	

No.	Symbol	I/O	Description	Note
27	G5	I	Green Data	
28	G4	I	Green Data	
29	G3	I	Green Data	
30	G2	I	Green Data	
31	G1	I	Green Data	
32	G0	I	Green Data (LSB)	
33	AGND	I	Analog Ground	
34	AVDD	I	Analog Power	
35	AVDD	I	Analog Power	
36	AGND	I	Analog Ground	
37	R7	I	Red Data (MSB)	
38	R6	I	Red Data	
39	R5	I	Red Data	
40	R4	I	Red Data	
41	R3	I	Red Data	
42	R2	I	Red Data	
43	R1	I	Red Data	
44	R0	I	Red Data (LSB)	
45	DE	I	Display Data Enable Signal Input. Pull low if unused.	
46	CLK	I	Clock Signal Input. Latching data at the rising edge.	
47	HS	I	Horizontal Synchronization Signal Input	
48	VS	I	Vertical Synchronization Signal Input	
49	VCOM	I	Common Electrode Driving Input	
50	DGND	I	Digital Ground	

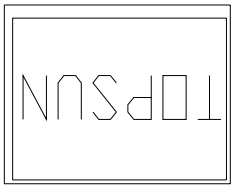
Note:

1. The UD and LR control the display direction of the panel. The settings of UD and LR are as following:

UD=DVDD, LR=GND

UD=DVDD, LR=DVDD

UD=GND, LR=GND



UD=GND, LR= DVDD

2. The connector for the input FPC is FH12-50S-0.5SH (HIROSE) or equivalent.

3.1.2. Backlight Connector Pin Descriptions

Pin No.	Symbol	Description	Wire Color
1	VLEDA	Backlight LED Anode.	Red
2	VLEDC	Backlight LED Cathode.	Black

Note: The mating connector of the backlight connector BHSR-02VS-01 (JST) or equivalent.

3.1.3. Touch Panel Pin Descriptions

Pin No.	Name	Position
1	Y1	Left
2	X2	Down
3	Y2	Right
4	X1	Up

Note: The connector for the touch panel FPC is KYOCERA 6232 series (04-6232-104-102-800) or equivalent.

3.1.4. Relationship Between Displayed Color and Input Data

Color		Input Color Data																							
		Red								Green								Blue							
		MSB							LSB	MSB							LSB	MSB							LSB
		R7	R6	R5	R4	R3	R2	R1	R0	G7	G6	G5	G4	G3	G2	G1	G0	B7	B6	B5	B4	B3	B2	B1	B0
Basic Colors	Black	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red(255)	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Green(255)	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0
	Blue(255)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1
	Cyan	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	Magenta	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1
	Yellow	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0
	White	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Red	Red(0) Dark	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red(1)	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red(2)	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	Red(253)	1	1	1	1	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red(254)	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red(255) Bright	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Green	Green(0) Dark	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Green(1)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
	Green(2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	Green(253)	0	0	0	0	0	0	0	0	1	1	1	1	1	1	0	1	0	0	0	0	0	0	0	0
	Green(254)	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0
	Green(255) Bright	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0
Blue	Blue(0) Dark	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Blue(1)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	Blue(2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	Blue(253)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	0	1
	Blue(254)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	0
	Blue(255) Bright	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1

3.2. Absolute Maximum Ratings

Item	Symbol	Values		Unit	Note
		Min.	Max.		
Digital Power Supply Voltage	V_{DD}	-0.3	7.0	V	
Analog Power Supply Voltage	AV_{DD}	-0.3	7.0	V	
Gate Driver Positive Supply Voltage	V_{GH}	-0.3	18.0	V	
Gate Driver Negative Supply Voltage	V_{GL}	-18.0	0.3	V	
Input Logic Signal Voltage	V_I	-0.3	VDD+0.3	V	Note 1
Backlight LED Reverse Voltage	V_R	-35.0	-	V	Note 3
Backlight LED Forward Current	I_F	-	90	mA	Note 3
Operation Temperature	T_{op}	-20	70	℃	Note 2
Storage Temperature	T_{st}	-30	80	℃	

Note:

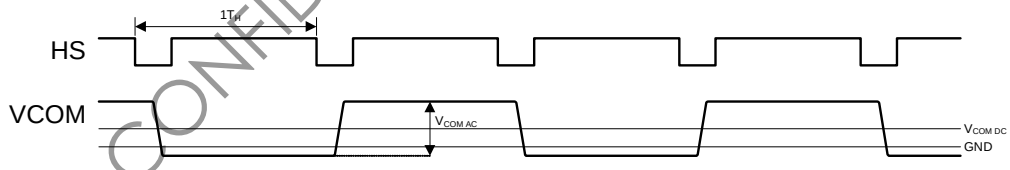
1. V_I implies CLK, R0~R7, G0~G7, B0~B7, HS, VS, DE, LR, UD.
2. The maximum operation temperature is set for the panel surface temperature. The minimum operation temperature is set for the ambient temperature.
3. The ratings are measured from the backlight anode pin to the backlight cathode pin.

3.3. Electrical Characteristics

3.3.1. Panel Typical Operating Conditions (T_a=25°C)

Item	Symbol	Values			Unit	Note
		Min.	Typ.	Max.		
Digital Power Supply Voltages	V_{DD}	3.0	3.3	3.6	V	
Digital Supply Current Consumption	I_{VDD}	-	2	-	mA	
Analog Power Supply Voltage	AV_{DD}	4.75	5.0	5.25	V	
Analog Supply Current Consumption	I_{AVDD}	-	5	-	mA	
Gate Driver Positive Supply Voltage	V_{GH}	13.5	15	16.5	V	
Gate Driver Positive Supply Current	I_{GH}	-	0.044	-	mA	
Gate Driver Negative Supply Voltage	V_{GL}	-11.0	-10	-9.0	V	
Gate Driver Negative Supply Current	I_{GL}	-	-0.044	-	mA	
Common Electrode Driving Voltage	$V_{COM\ DC}$	-	1.5	-	V	DC Level
	$V_{COM\ AC}$	-	5	-		AC Swing
Input Logic Signal High Threshold	V_{IH}	$0.7V_{DD}$	-	-	V	
Input Logic Signal Low Threshold	V_{IL}	-	-	$0.3V_{DD}$	V	

Note: The VCOM waveform is as below.



3.3.2. Backlight Unit Typical Operating Conditions

Item	Symbol	Condition	Values			Unit	Note
			Min.	Typ.	Max.		
Backlight Power Consumption	P_{LED}	T_a=25°C, I_F=60mA	1.26	1.43	1.60	W	
Backlight Forward Current	I_F	T_a=25°C	-	60	-	mA	

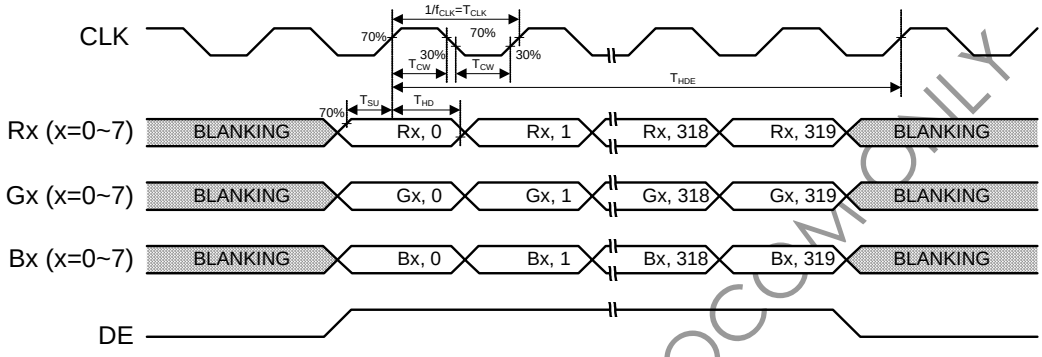
3.4. AC Timing

3.4.1. AC Timing Characteristics

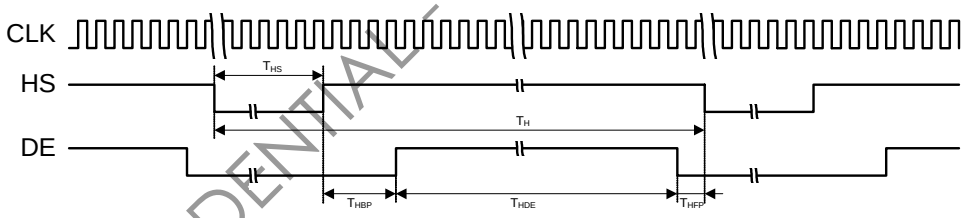
Item	Symbol	Values			Unit	Note
		Min.	Typ.	Max.		
CLK Period	T_{CLK}	-	156	-	ns	
CLK High Width	T_{WCL}	72	-	-	ns	
CLK Low Width	T_{WCH}	72	-	-	ns	
CLK Rise Time	T_{rCLK}	-	-	6	ns	
CLK Fall Time	T_{fCLK}	-	-	6	ns	
Data Setup Time	T_{SU}	12	-	-	ns	For CLK
Data Hold Time	T_{HD}	12	-	-	ns	For CLK
Data Rise Time	T_{rD}	-	-	10	ns	
Data Fall Time	T_{fD}	-	-	10	ns	
HS Setup Time	T_{SH}	12	-	-	ns	For CLK
HS Hold Time	T_{HH}	12	-	-	ns	For CLK
HS Period	T_H	406	408	432	T_{CLK}	
HS Pulse Width	T_{HS}	5	30	-	T_{CLK}	
HS Rise Time	T_{rH}	-	-	700	ns	
HS Fall Time	T_{fH}	-	-	300	ns	
VS Setup Time	T_{SV}	3	-	-	T_{CLK}	For HS
VS Hold Time	T_{HV}	3	-	-	T_{CLK}	For HS
VS Period	T_V	262	262	280	T_H	
VS Pulse Width	T_{VS}	1	3	5	T_H	
VS Rise Time	T_{rV}	-	-	700	ns	
VS Fall Time	T_{fV}	-	-	1.5	ns	
DE Setup Time	T_{SE}	12	-	-	ns	For CLK
DE Hold Time	T_{HE}	12	-	-	ns	For CLK
Horizontal Display Time	T_{HDE}	-	320	-	T_{CLK}	
Vertical Display Time	T_{VDE}	-	240	-	T_H	
Horizontal Back Porch	T_{HBP}	68	68	-	T_{CLK}	
Horizontal Front Porch	T_{HFP}	-	20	-	T_{CLK}	
Vertical Back Porch	T_{VBP}	20	20	-	T_H	
Vertical Front Porch	T_{VFP}	-	2	-	T_H	

3.4.2. AC Timing Diagrams

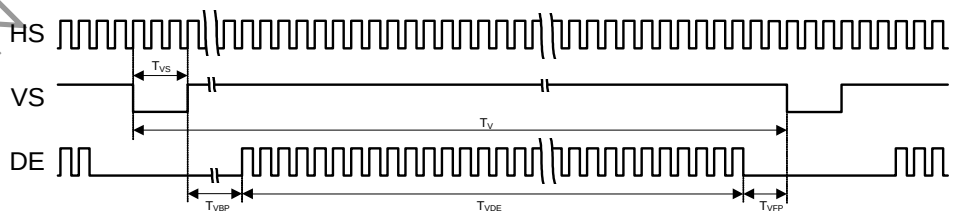
3.4.2.1. Data Clock Timing



3.4.2.2. Horizontal Timing

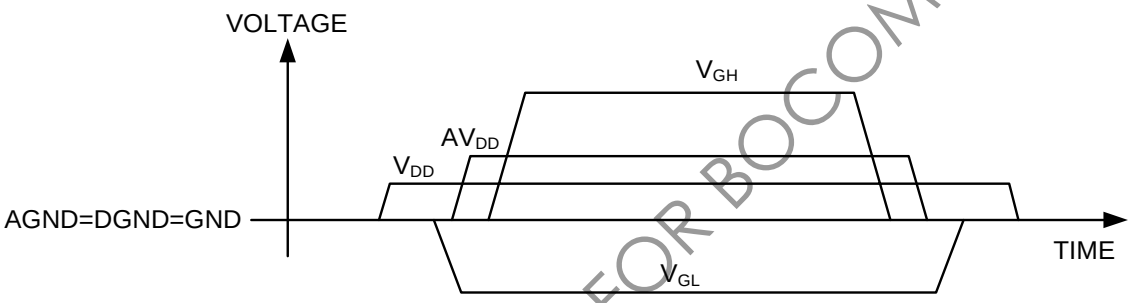


3.4.2.3. Vertical Timing



4. Power Sequence

The LCD panel adopts high voltage driver ICs, so it could be damaged permanently if a wrong power on/off sequence is used. When power on the LCD, V_{DD} should go up firstly, and then turn V_{GL}, AV_{DD}, and finally V_{GH}. Turn off the LCD panel with the reversed order. Or shut off all the power supplies simultaneously.



5. Optical Specifications

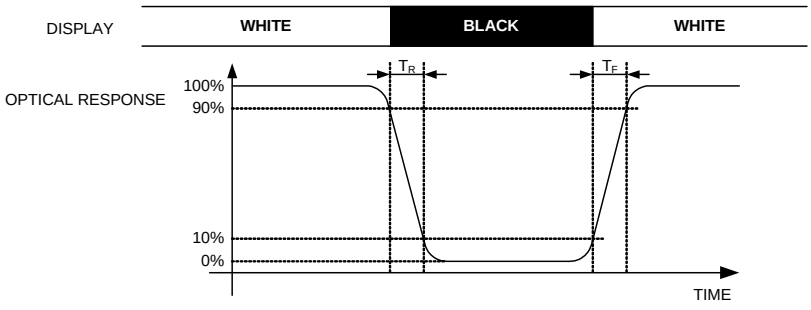
The following items are measured under stable conditions. The optical characteristics should be measured in dark room or equivalent state with the methods shown in Note 1.

Item		Symbol	Condition	Min.	Typ.	Max.	Unit	Note
Brightness				270	300	-	cd/m²	
Response Time		T_R	Θ=0	-	15	30	ms	Note 2
		T_F		-	35	50	ms	
Contrast Ratio		CR	At optimized viewing angle	350	400	-	-	Note 3
Color Chromaticity	White	W_x	Θ=0	0.26	0.31	0.36	-	Note 4
		W_y		0.28	0.33	0.38		
Viewing Angle	Hor.	Θ_R	CR≧10	55	60	-	degree	Note 5
		Θ_L		55	60	-		
	Ver.	φ_H		55	60	-		
		φ_L		40	45	-		

T_a=25±2℃, I_F=60mA

Note:

1. Test equipment setup:
   After stabilizing and leaving the panel alone at a given temperature for 15 minutes, the measurement should be executed. Measurement should be executed in a stable, windless, and dark room. Optical specifications are measured by Topcon BM-5A-10000 with a viewing angle of 2° at a distance of 50cm and normal direction.
2. Definition of response time: T_R and T_F
   The figure below is the output signal of the photo detector.



3. Definition of contrast ratio:

$$\text{Contrast ratio (CR)} = \frac{\text{Brightness measured when LCD is at “white state”}}{\text{Brightness measured when LCD is at “black state”}}$$

White $V_i=V_{i50\%}$+/-1.5V

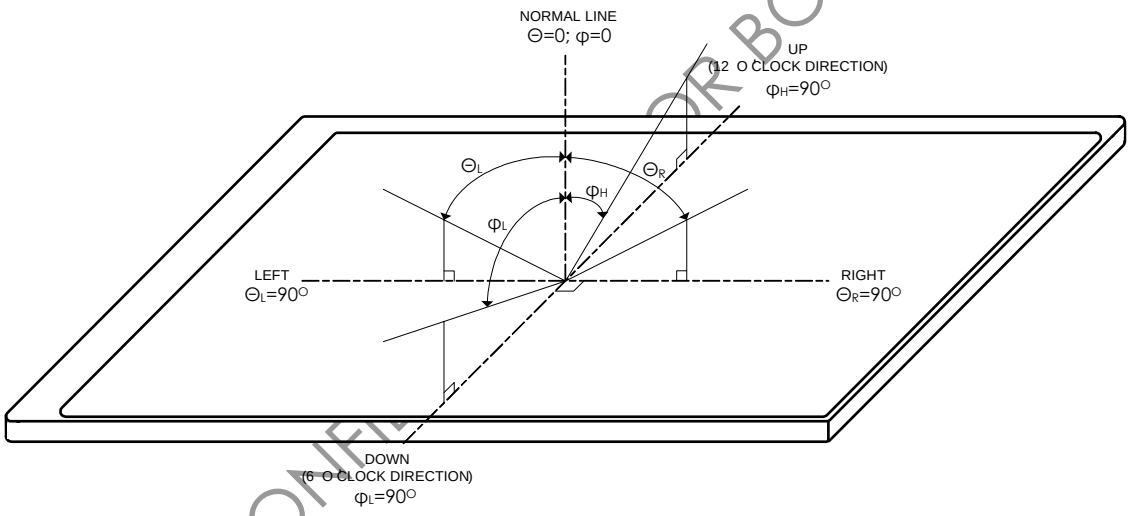
Black $V_i=V_{i50\%}$-/+2.0V

”+/-” means that the analog input signal swings in phase with V_{COM} signal.

”-/+” means that the analog input signal swings out of phase with V_{COM} signal.

$V_{i50\%}$: The analog input voltage when transmission is 50%

4. The 100% transmission is defined as the transmission of LCD panel when all the input terminals of module are electrically opened.
5. Measured at the center area of the panel when all the input terminals of LCD panel are electrically opened.
6. Definition of viewing angle:



6. Touch Panel Specifications

6.1. Electronic Characteristics

Item	Min.	Typ.	Max.	Unit	Note
Linearity	-	-	1.5	%	
Terminal Resistance	50	-	300	Ω	X (Film side)
	340	-	950	Ω	Y (Film side)
Insulation Resistance	20	-	-	MΩ	At DC 25V, 60 sec
Chattering	-	-	10	ms	ON/OFF
Transparency	-	80	-	%	Anti-Glare
Haze Rate	6	-	-	%	

Note：

Do not operate it with anything except a polyacetal pen (tip R0.8 mm or less) or a finger, especially those with hard or sharp tips such as a ball point pen or a pencil.

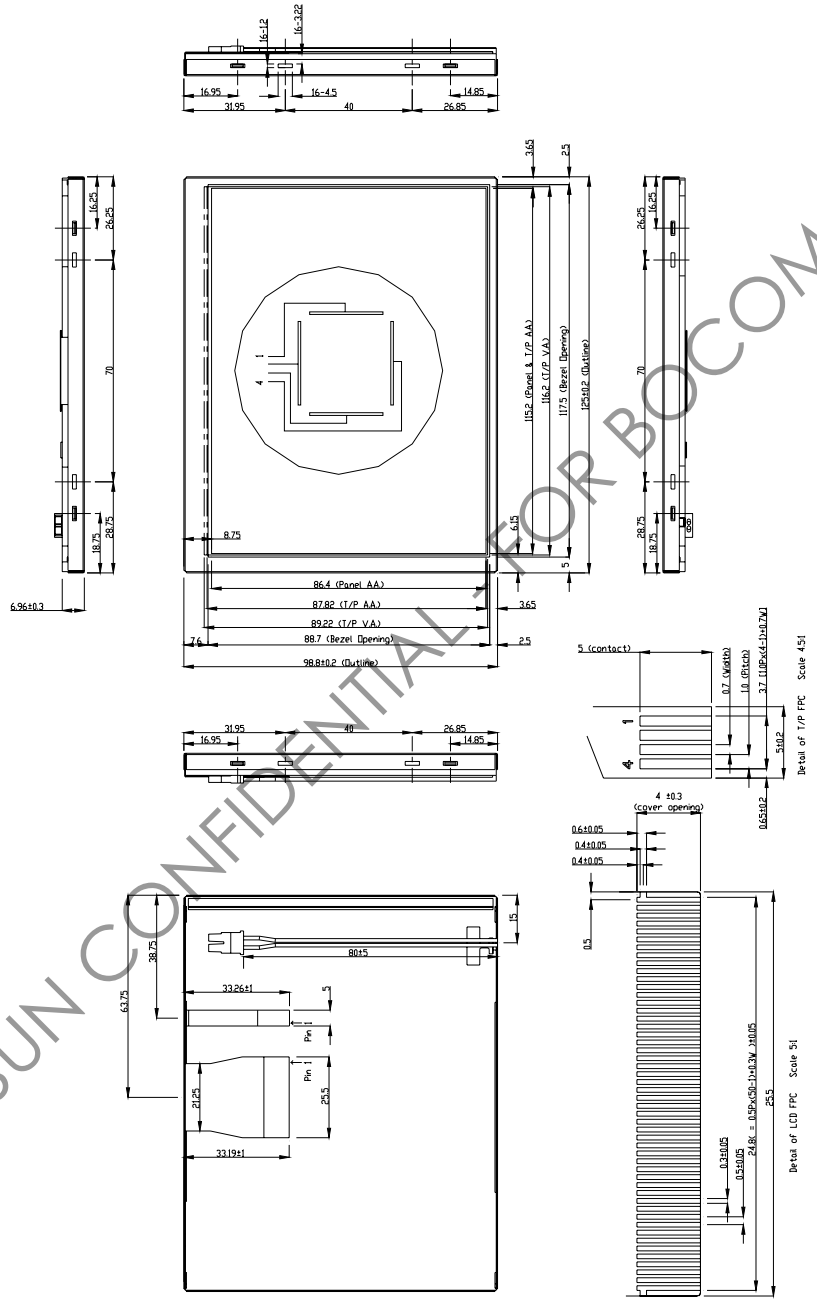
6.2. Mechanical & Reliability Characteristics

Item	Min.	Max.	Unit	Note
Activation Force	-	100	g	Note 1
Durability-Surface Scratching	100,000	-	Characters	Note 2, 4
Durability-Surface Pitting	1,000,000	-	Touches	Note 3, 4
Surface Hardness	3	-	H	JIS K5400 ASTM D3363

Note：

1. Stylus pen input: R0.8 mm polyacetal pen or finger.
2. Measurement for surface area:
   Scratch 100,000 times straight lines on the film with a stylus change every 20,000 times.
   Force= 150 gf. Speed= 60 mm/sec.
   Stylus= R0.8 mm polyacetal tip.
3. Pit 1,000,000 times on the film with a R8.0 mm silicon rubber.
4. The area between the touch panel AA (T/P AA) and the touch panel VA (T/P VA) is not able to stand for pitting or any scratching. Users should avoid touching or any scratching on this area.

7. Mechanical Dimensions



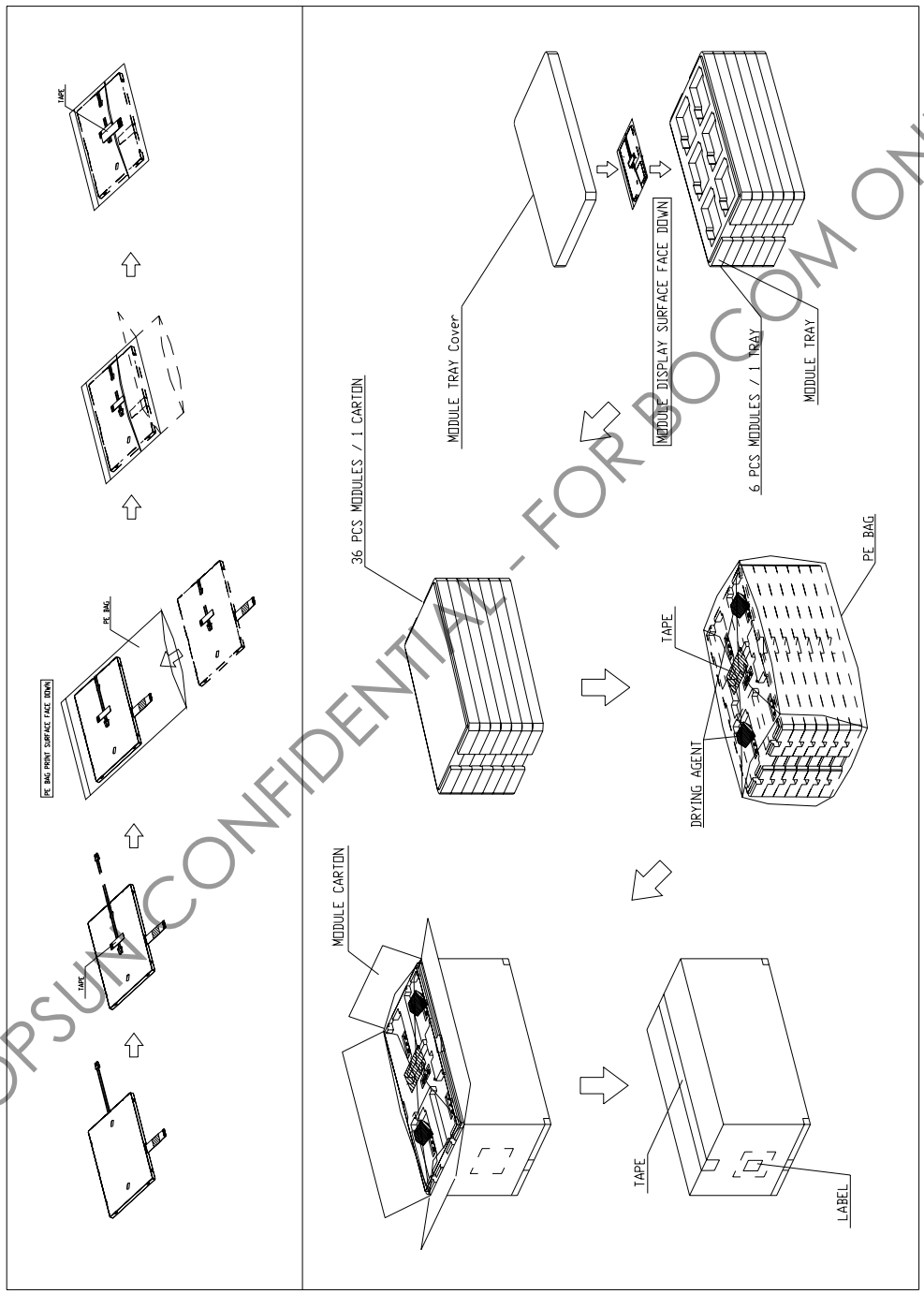
8. Reliability Test Items

Test Item	Test Condition
High Temperature Operation	70°C(T_a) for 240 hours.
High Temperature and High Humidity Operation	60°C, 90%RH for 240 hours
Low Temperature Operation	-20°C(T_a) for 240 hours
High Temperature Storage	80°C(T_a) for 240 hours
Low Temperature Storage	-30°C(T_a) for 240 hours
Thermal Shock	-20°C(0.5Hr) ~ +70°C(0.5Hr) for 200 cycles
Mechanical Shock	Shock Level : 100G Waveform : Half sinusoidal wave Shock Time : 6ms Number of Shocks : 3 times for each ±X, ±Y, ±Z direction
Vibration	Sweep: 10Hz ~ 55Hz Amplitude: 1.5mm Sweep Time: 1min Vibration: Sinusoidal wave, 4Hrs for Y directions. 1.5Hrs for each direction of X, Z
Electrostatic Discharge	Contact/Air: ±8KV/±15KV 150pF, 330Ω

Note:

1. The test samples have recovery time for 2 hours at room temperature before the function check. In the standard conditions, there is no display function NG issue occurred.
2. All the cosmetic specifications are judged before the reliability stress.
3. T_a: Ambient Temperature.

9. Package



10. Handling Precautions

10.1. Safety

The liquid crystal in the LCD is poisonous. Keep away from your mouth and eyes. If the liquid crystal contacts with your skin, mouth or clothes, use soap to wash it off immediately.

10.2. Handling

i. The LCD panel is made by thin glass. Prevent the panel from mechanical shock or putting excessive force on its surface.

ii. The polarizer attached on the display is very easy to be damaged, handle it with special attention.

iii. To avoid contamination on the display surface, do not touch the display surface with bare hands.

iv. The transparent electrodes may be disconnected if you use the LCD panel under dew-condensing environment.

v. The characteristics of the semiconductor devices may be affected when they are exposed to light, possibly resulting in malfunctioning of the ICs. To prevent such malfunctioning of the ICs, make sure the application and the mounting of the panel are designed so that the IC is not directly exposed to light.

10.3. Static Electricity

Ground soldering iron tips, tools and testers when you operate. Also ground your body when handling the products and store the products in an anti-electrostatic container.

10.4. Storage

Store the products in a dark place where the temperature is within the range of 25±10℃ and with low humidity (65%RH or less). Do not store the LCD product in an atmosphere containing organic solvents or corrosive gases.

10.5. Cleaning

Do not wipe the polarizer with dry cloth, as it might cause scratch. Wipe the polarizer with a soft cloth soaked with petroleum IPA. Other chemical might damage the panel.