Product Specification

SPECIFICATION
FOR
APPROVAL

( ) Preliminary Specification
(●) Final Specification

Title	3.5” (320 X RGB X 240) TFT- LCD

BUYER	**ADT**
MODEL	

SUPPLIER	LG.Philips LCD CO.,Ltd.
MODEL	LB035Q01
SUFFIX	TJ01

SIGNATURE	**DATE**
/	
/	
/	

APPROVED BY	**DATE**
C. S. Kyeong /G. Manager	
REVIEWED BY	
S. J. Kim / Manager	
PREPARED BY	
T. W. Jung / Engineer	

Product Engineering Dept.
LG. Philips LCD Co., Ltd

Contents

RECORD OF REVISIONS

Revision No	Revision Date	Page	Description	Note
0.0	Feb. 20. 2007	-	First Draft (Preliminary)	

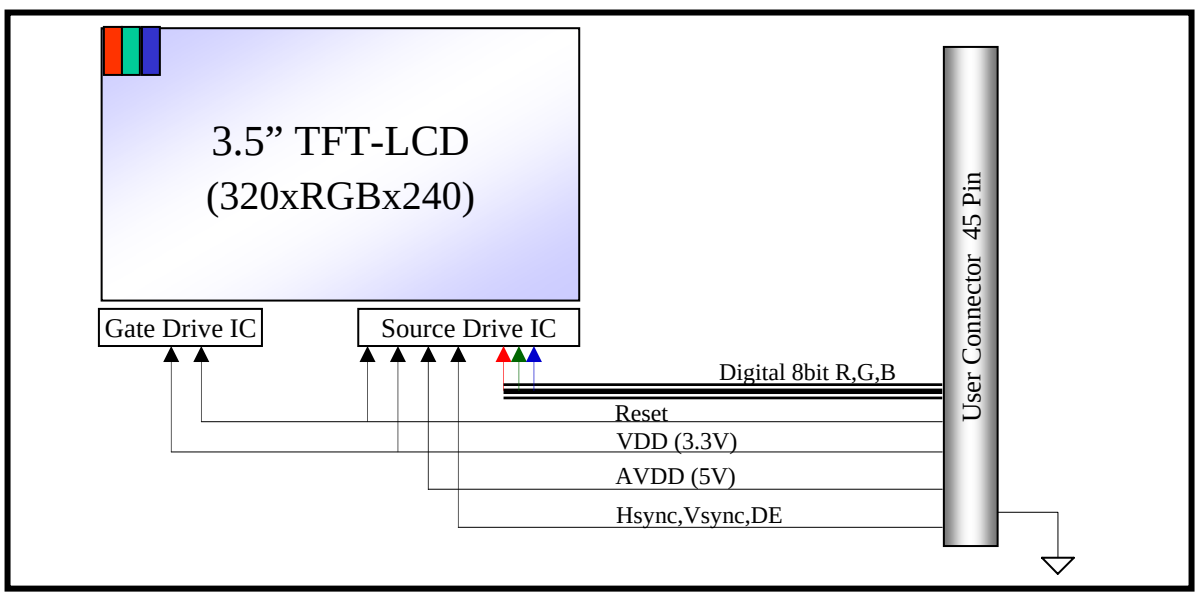
1. General Description

1-1. Description

The LB035Q1-TJ01 is a Board Assembly Product of TFT LCD without any extra system.
This module utilizes amorphous silicon thin film transistors and a 4:3 aspect ratio. A 3.5” active matrix liquid crystal display allows 16M colors to be displayed.
This product is intended to support displays. [PND (Portable Navigation Display), VoIP (Voice over Internet Protocol) Phone, PMP (Portable Multimedia Player) and others]

1-2. Features

•Utilizes a panel with a 4:3 aspect ratio suitable for use in wide-screen systems.
•The most suitable viewing direction is in the 6 o’clock.
•By adopting an active matrix drive, a picture with high contrast is realized.
•A thin, light and compact module is accomplished through the use of COG mounting technology.
•By adopting a high aperture panel, high transmittance color filter and high transmission polarizing plates, transmittance ratio is realized.
•This module contains the Timing controller in the drive IC.



1-3. General Specification

ITEM	SPECIFICATION	REMARK
Signal Interface	Digital Interface (TTL)	-
Display Technology	a-Si TFT active matrix	-
Display Mode	TN / Transmissive / Normally White	-
Active Screen Size	3.5 inches	Diagonal
Outline Dimension	78.1[H] x 62.95[V]	[mm]
Active Area	70.08[H] x 52.56[V]	[mm]
Number of dots	320[H] x RGB x 240[V]	-
Color depth	8 Bit, 16M colors	-
Pixel Pitch	0.255 x 0.255	[mm]
Viewing Direction	6o'clock	12 o'clock (Good viewing)
Color Filter Array	RGB Vertical Stripe	-
Weight	17	g
Surface Treatment	Hard Coating Treatment	-

2. Interface Connections

This LCD employs one interface connection for the operation of module.
The pin configuration for the connector is shown in the table below.

Pin	Symbol	Description	I/O	Remark
1	LED_K	LED_CATHODE	I	
2	LED_K	LED_CATHODE	I	
3	LED_A	LED_ANODE	O	
4	LED_A	LED_ANODE	O	
5	GND	GROUND	-	
6	/RESET	RESET	I	LOW ACTIVE
7	VCC	DIGITAL VOLTAGE	I	3.3V
8	D27	BLUE DATA (MSB)	I	
9	D26	BLUE DATA	I	
10	D25	BLUE DATA	I	
11	D24	BLUE DATA	I	
12	D23	BLUE DATA	I	
13	D22	BLUE DATA	I	
14	D21	BLUE DATA	I	
15	D20	BLUE DATA (LSB)	I	
16	D17	BLUE DATA (MSB)	I	
17	D16	GREEN DATA	I	
18	D15	GREEN DATA	I	
19	D14	GREEN DATA	I	
20	D13	GREEN DATA	I	
21	D12	GREEN DATA	I	
22	D11	GREEN DATA	I	
23	D10	GREEN DATA (LSB)	I	
24	VDD	ANALOG POWER	I	5V
25	GND	GROUND	-	
26	D07	RED DATA (MSB)	I	
27	D06	RED DATA	I	
28	D05	RED DATA	I	
29	D04	RED DATA	I	
30	D03	RED DATA	I	
31	D02	RED DATA	I	
32	D01	RED DATA	I	
33	D00	RED DATA (LSB)	I	

Product Specification

Pin	Symbol	Description	I/O	Remark
34	DOTCLK	PIXEL CLOCK	I	
35	HSYNC	HORIZONTAL SYNC SIGNAL	I	
36	VSYNC	VERTICAL SYNC SIGNAL	I	
37	DE	DATA ENABLE	I	
38	VCC	DIGITAL VOLTAGE	I	
39	GND	GROUND	-	
40	TOUCH Y+	TSP HORIZONTAL POSITIVE VOLTAGE	I	
41	TOUCH Y-	TSP VERTICAL NEGATIVE VOLTAGE	I	
42	TOUCH X+	TSP HORIZONTAL POSITIVE VOLTAGE	I	
43	TOUCH X-	TSP VERTICAL NETATIVE VOLTAGE	I	
44	GND	GROUND	-	
45	GND	GROUND	-	

LCD Connector: FPC 45Pin (0.5mm Pitch), Mating Connector: Kyocera 04-6240-045-003-800 or equivalent.

3. Absolute Maximum Ratings

The followings are maximum values which, if exceeded, may cause faulty operation or damage to the unit.

($T_a = 25^{\circ}C$, Vss = 0V)

Parameter	Symbol	Min	Max	Unit	Notes
LC Operating Voltage	Vop	3.0	3.6	V	
Logic Voltage	VDD	-0.3	8.0	V	
Power circuit Supply Voltage	VDC	-0.3	8.0	V	
Power Supply Voltage	VGH-VGL	-0.3	45	V	
Power Supply Voltage	VDD-VCL	-0.3	10.0	V	
Input Voltage	V_I	-0.5	VDD+0.5	V	
Operating Temperature (Ambient Temperature)	T_a	-20	70	℃	[Note3-1,2,3,4]
Storage Temperature	T_{st}	-30	80	℃	[Note3-1,2]

[Note 3-1] This rating applies to all parts of the module and should not be exceeded.
[Note 3-2] Maximum wet-bulb temperature is 52℃. Condensation of dew must be avoided as electrical current leaks will occur, causing a degradation of performance specifications.
[Note 3-3] The operating temperature only guarantees operation of the circuit and doesn't guarantee all the contents of Electro-optical specification.
[Note 3-4] Ambient temperature when the backlight is lit (reference value).

4. Electrical Characteristics

4-1. Recommended Operating Conditions

TFT-LCD Panel Driving Section

($T_a = 25^{\circ}C$, Vss = 0V)

PARAMETER	SYMBOL	MIN.	TYP.	MAX.	UNIT	REMARK
Digital Supply Voltage	VDD	3.0	3.3	3.6	V	
Analog Supply Voltage	AVDD	4.8	5.0	5.2	V	
Frame Frequency	fFRAME	60	70	80	Hz	
Dot Clock	fclk	-	6.4	-	MHz	
Logic Input Voltage	V_{IH}	0.8*VDD	-	VDD	V	
	V_{IL}	VSS	-	0.2*VDD	V	
Logic Output Voltage	V_{OH}	VDD-0.3	-	VDD	V	
	V_{OL}	VSS	-	VSS+0.3	V	
Power Consumption	P	-	-	65	mW	

4-2. Timing Characteristics of input signals

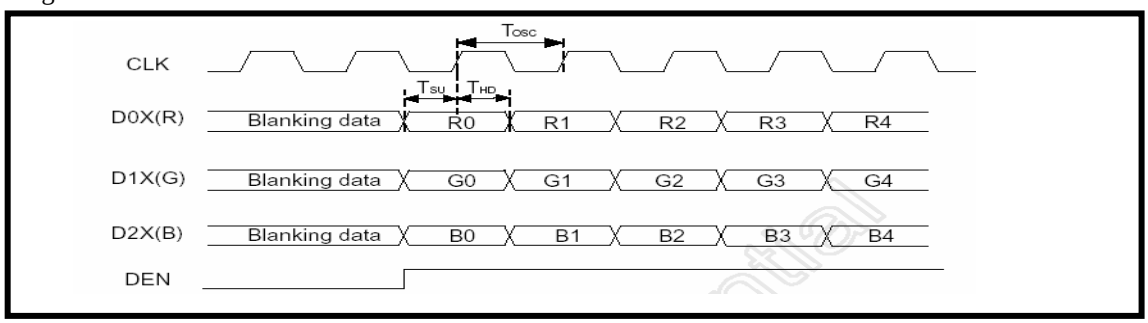
($T_a = 25^{\circ}C$, Vss = 0V)

PARAMETER	SYMBOL	Mn.	Typ.	Max.	Unit	REMARK
Data Setup Time	T_{SU}	12	-	-	ns	
Data Hold Time	T_{HD}	12	-	-	ns	
IHS Period	T_H	-	408	-	T_{OSC}	
IHS Pulse Width	T_{HS}	-	30	-	T_{OSC}	
IHS Setup Time	T_{Cr}	12	-	-	ns	
IHS Hold Time	T_{Cf}	12	-	-	ns	
IVS Pulse Width	T_{VS}	1	3	5	T_H	
IVS Setup Time	T_{Vr}	12	-	-	ns	
IVS Hold Time	T_{Vf}	12	-	-	us	
IVS-DEN Time	T_{VSE}	-	18	-	T_H	NTSC
	T_{VSE}	-	26	-	T_H	PAL
IHS-DEN Time	T_{HE}	36	68	88	T_{OSC}	
DEN Pulse Width	T_{FP}	-	320	-	T_{OSC}	
DEN-STH Time	T_{DES}	-	1	-	T_{OSC}	
IVS Period	-	-	262.5	-	T_H	NTSC
	-	-	312.5	-	T_H	PAL

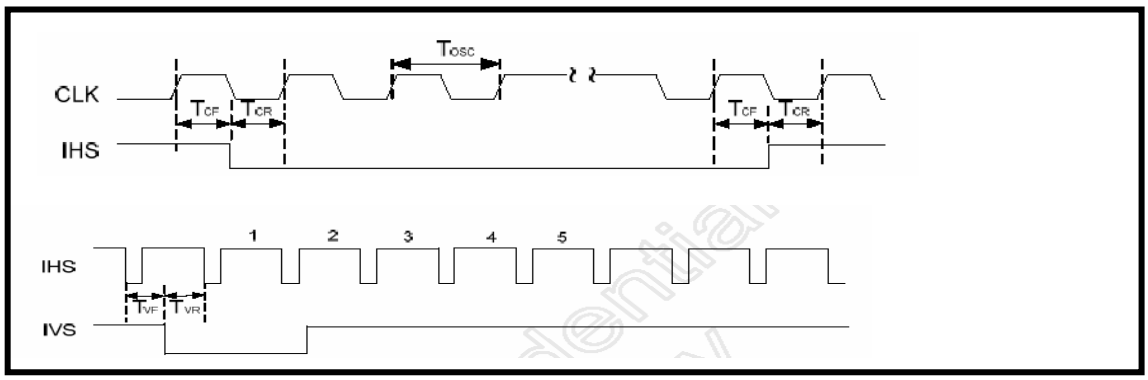
Note) 1st Data start from 68th CLK after IHS falling.

4-3. RGB Data Interface Timing Figure

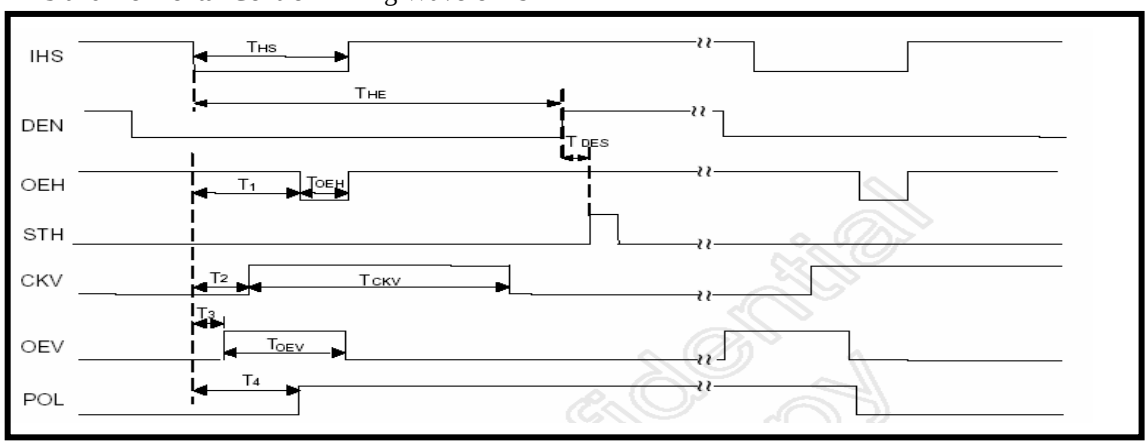
Digital Parallel RGB



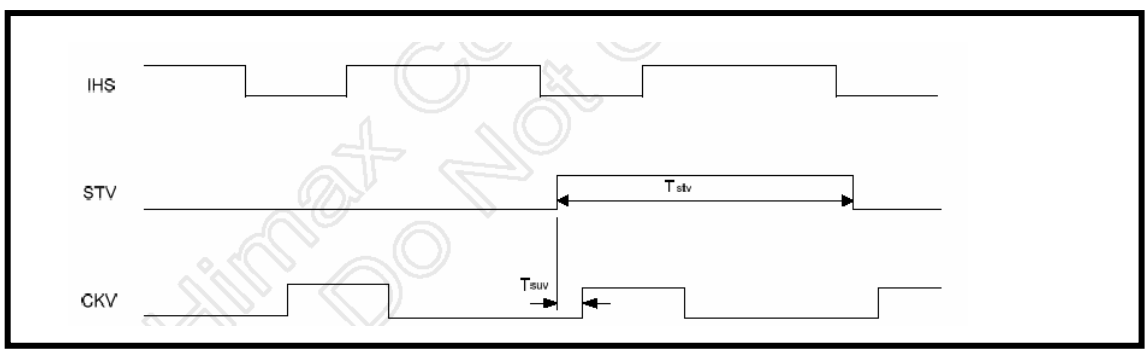
Clock and Sync Waveform



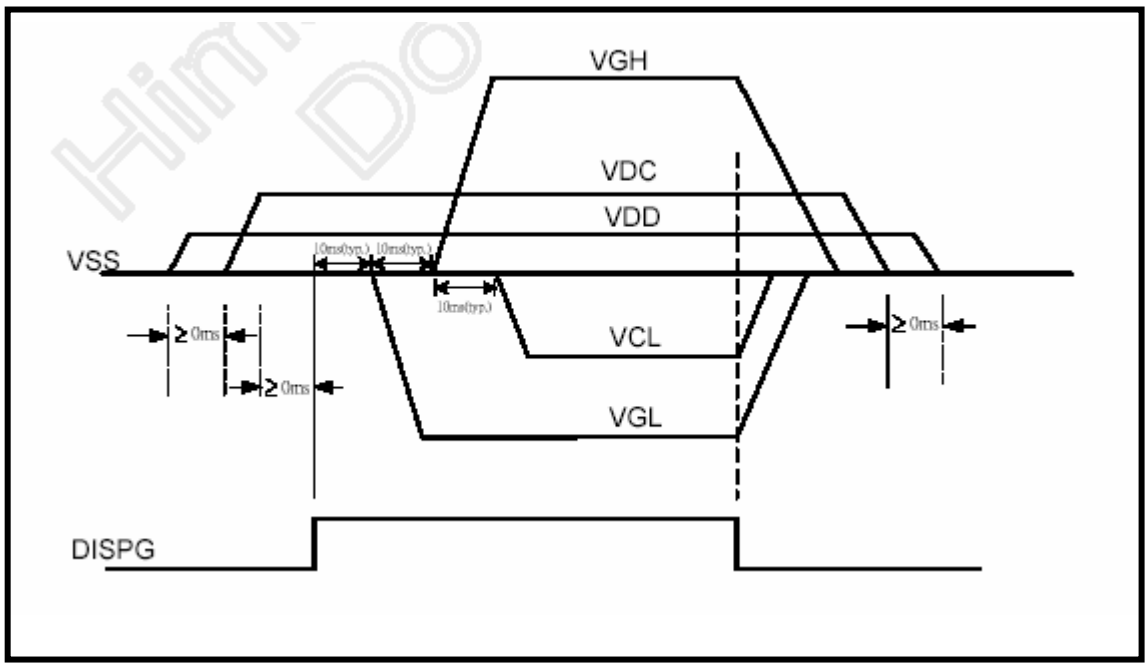
IHS and Horizontal Control Timing Waveforms



IHS and Vertical Shift Clock Timing Waveforms



4-4. Power On/Off Sequence



Note) To prevent the device damage from latch up, the power ON/OFF sequence is shown above.
The sequence of VGL,VGH and VCL is controlled by HX8655 itself.

5. Optical Characteristics

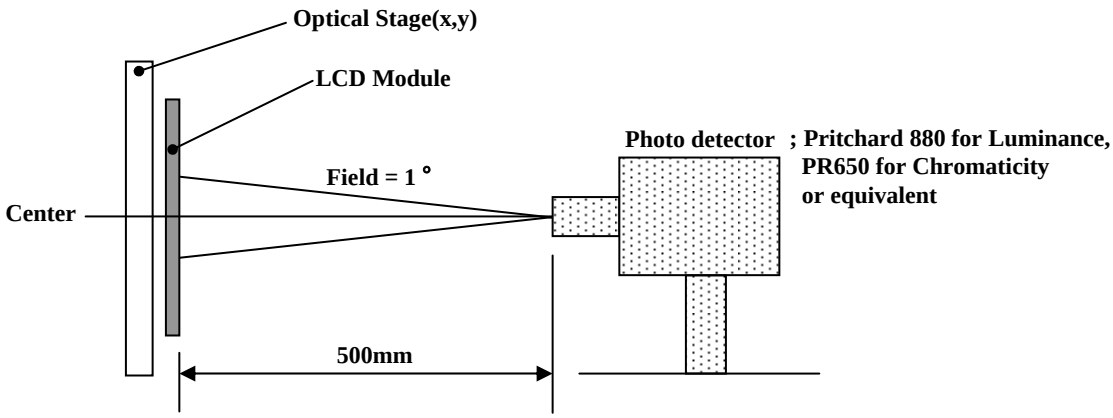
5-1. TFT LCD Module

$T_a = 25^{\circ}C$

PARAMETER		SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNIT	REMARK
Luminance Uniformity		U	Center	-	1.2	1.4	-	[Note5-1]
Contrast Ratio		CR	Optimal	200	300	-	-	[Note5-2]
Viewing Angle	**Hor.**	θ_L	CR > 10	-	40	-	Degrees	[Note5-2] [Note5-3] PR-880
		θ_R		-	40	-		
	Ver.	θ_U		-	15	-		
		θ_D		-	35	-		
Response Time	**Rising**	$T_r + T_f$	$\theta = 0^{\circ}$	-	30	40	msec	[Note5-4] PR-880
	Falling							

Note) All electro-optical characteristics are measured under backlight condition.
But, the following conditions are just “Internal Conditions for Quality Test” of LG.Philips LCD.

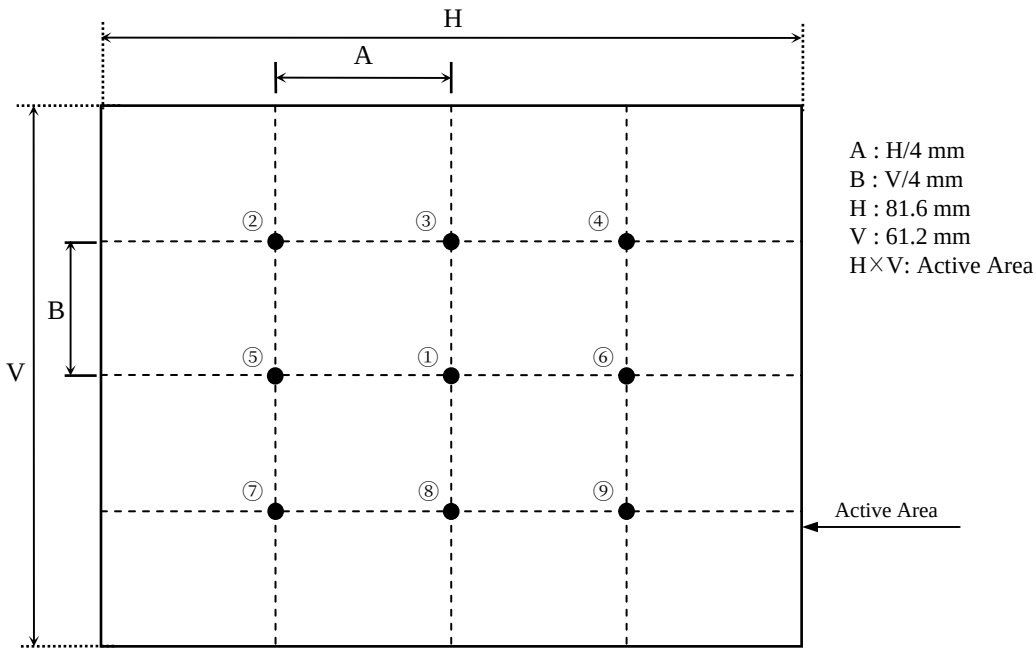
[Test Equipment Set Up]



- Measuring Condition ;
  -Measuring surroundings : Dark Room
  -Measuring temperature : T_a=25℃
  -Adjust operating voltage to get optimum contrast at the center of the display.
  -Measured value at the center point of LCD panel after more than 30 minutes while backlight turning on.

[Note 5-1]

Luminance Uniformity= Maximum of 9points (①~⑨) / Minimum of 9points (①~⑨)
Luminance Uniformity(%) = Minimum of 9points (①~⑨) / Maximum of 9points (①~⑨) x 100



[Note 5-2]

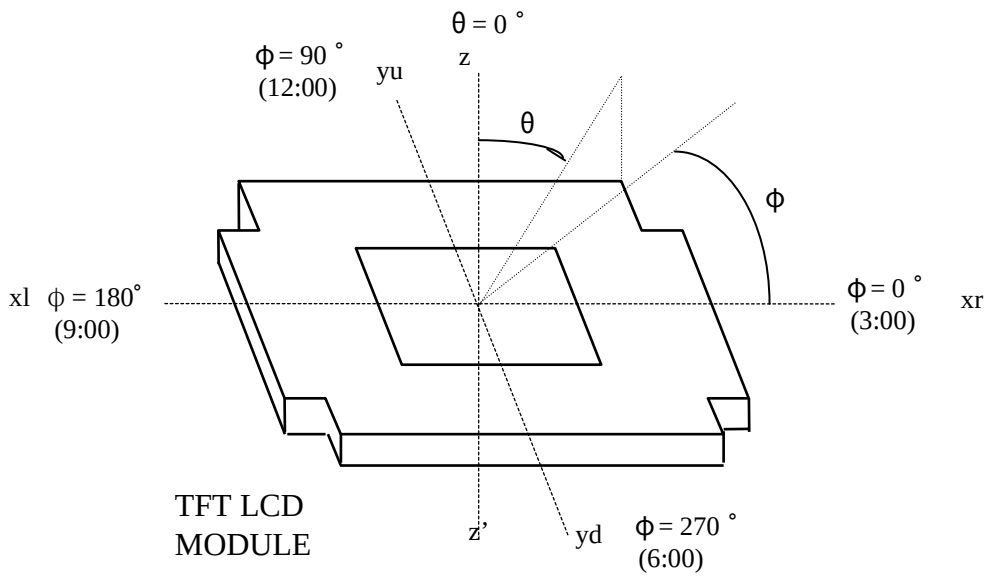
Contrast ratio is defined as follows ;

$$\text{Contrast Ratio(CR)} = \frac{\text{Photo detector output with LCD being “white”}}{\text{Photo detector output with LCD being “black”}}$$

[Note 5-3]

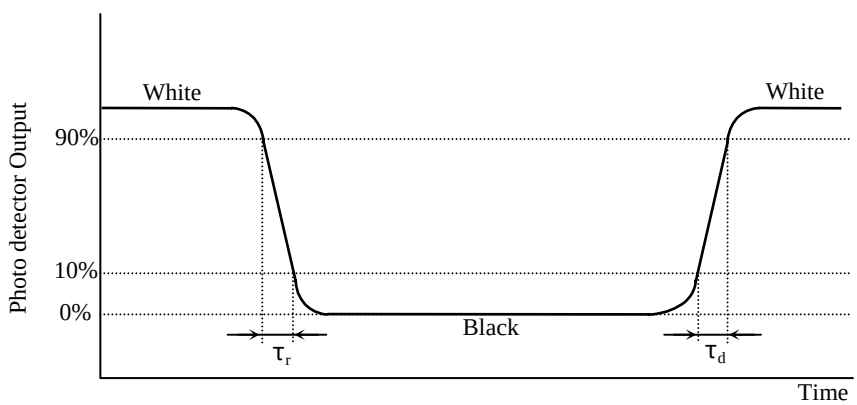
Viewing angle range is defined as follows;

<Dimension of viewing angle range>



[Note 5-4]

Response time is obtained by measuring the transition time of photo detector output, when input signals are applied so as to make the area “black” to and from “white”.



6. Mechanical Characteristics

PARAMETER	SPECIFICATION		UNIT	REMARK
Outline Dimension	Width	78.10	mm	Tolerance (±0.2)
	Height	62.95	mm	
	Depth	1.53	mm	
Bezel Area	Width	72.88	mm	
	Height	55.36	mm	
Active Display Area	Width	70.08	mm	
	Height	52.56	mm	
Weight	17		g	
Surface Treatment	Hard Coating			

7. Color Input Data Reference

Colors & Gray Scale	Gray Scale Levels	Data Signal																							
		RED								GREEN								BLUE							
		R0	R1	R2	R3	R4	R5	R6	R7	G0	G1	G2	G3	G4	G5	G6	G7	B0	B1	B2	B3	B4	B5	B6	B7
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
Blue	--	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1
Green	--	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0
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
Red	--	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
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
Black	R0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Darker	R1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	R2	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
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		:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
Brighter	R253	1	0	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	R254	0	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Red	R255	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Black	G0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Darker	G1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	G2	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
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Brighter	G253	0	0	0	0	0	0	0	0	1	0	1	1	1	1	1	1	0	0	0	0	0	0	0	0
	G254	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0
Green	G255	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0
Black	B0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Darker	B1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
	B2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
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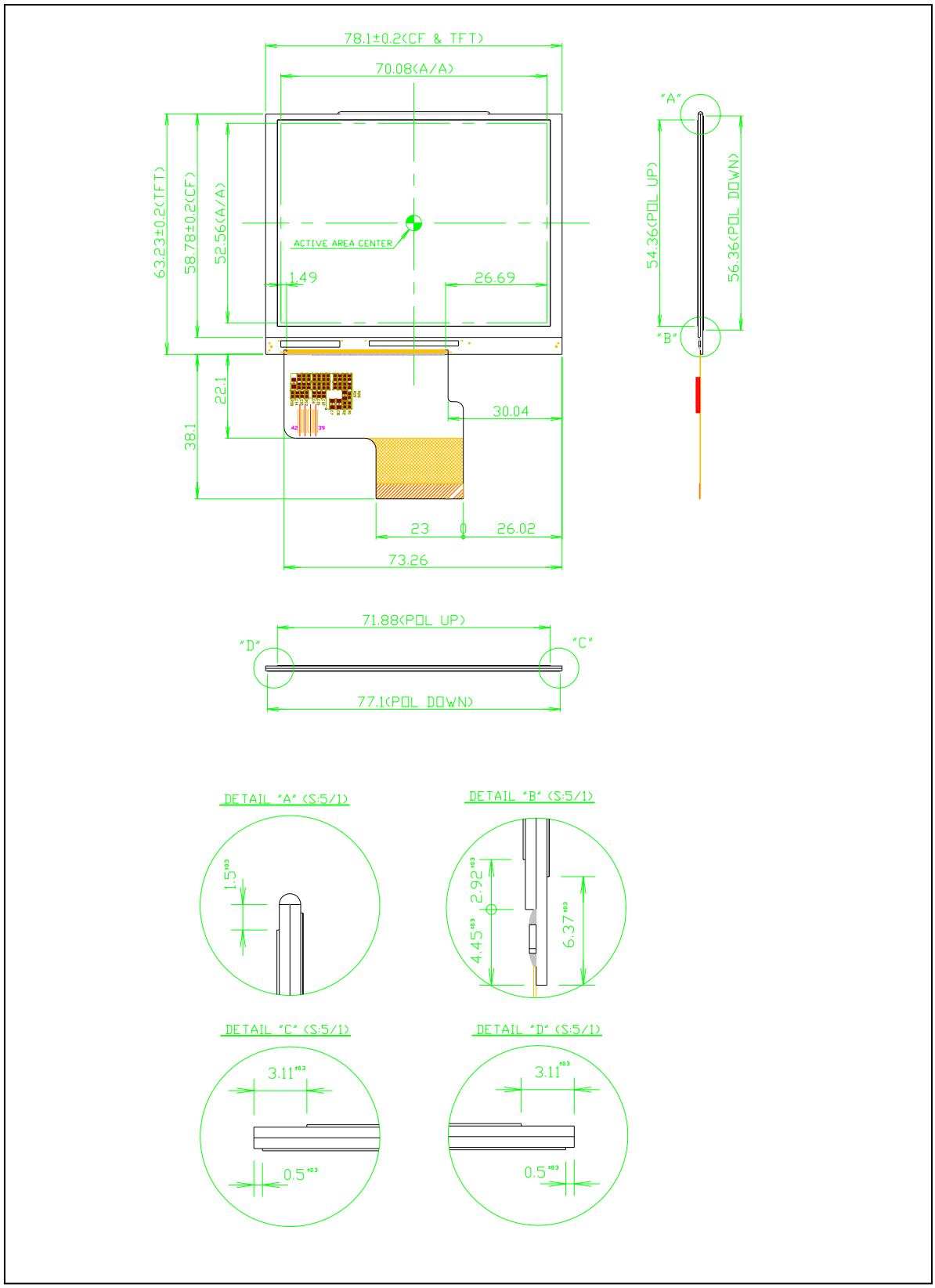
		:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
Brighter	B253	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	1	1	1	1	1
	B254	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1
Blue	B255	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1

8. Reliability Test

NO	TEST ITEMS	CONDITION	REMARK
1	High Temperature Storage Test	Ta = 80℃ 240h	[Note 9-1,2,3]
2	Low Temperature Storage Test	Ta = -30℃ 240h	[Note 9-1,2,3]
3	High Temperature Operation Test	Ta = 70℃ 240h	[Note 9-1,2,3]
4	Low Temperature Operation Test	Ta = -20℃ 240h	[Note 9-1,2,3]
5	High Temperature and High Humidity Operation Test	Ta = 60℃ 90%RH 240h	[Note 9-1,2,3]
6	Thermal Shock Test	-30℃(0.5h) ~ 70℃(0.5h) / 50 cycles	[Note 9-1,2,3]

[Note 9-1] T_a = Ambient Temperature
[Note 9-2] In the Reliability Test, Confirm performance after leaving in room temp.
[Note 9-3] In the standard condition, there shall be no practical problems that may affect the display function.

9. Outline Dimension



10. Packing

10-1. Packing Form

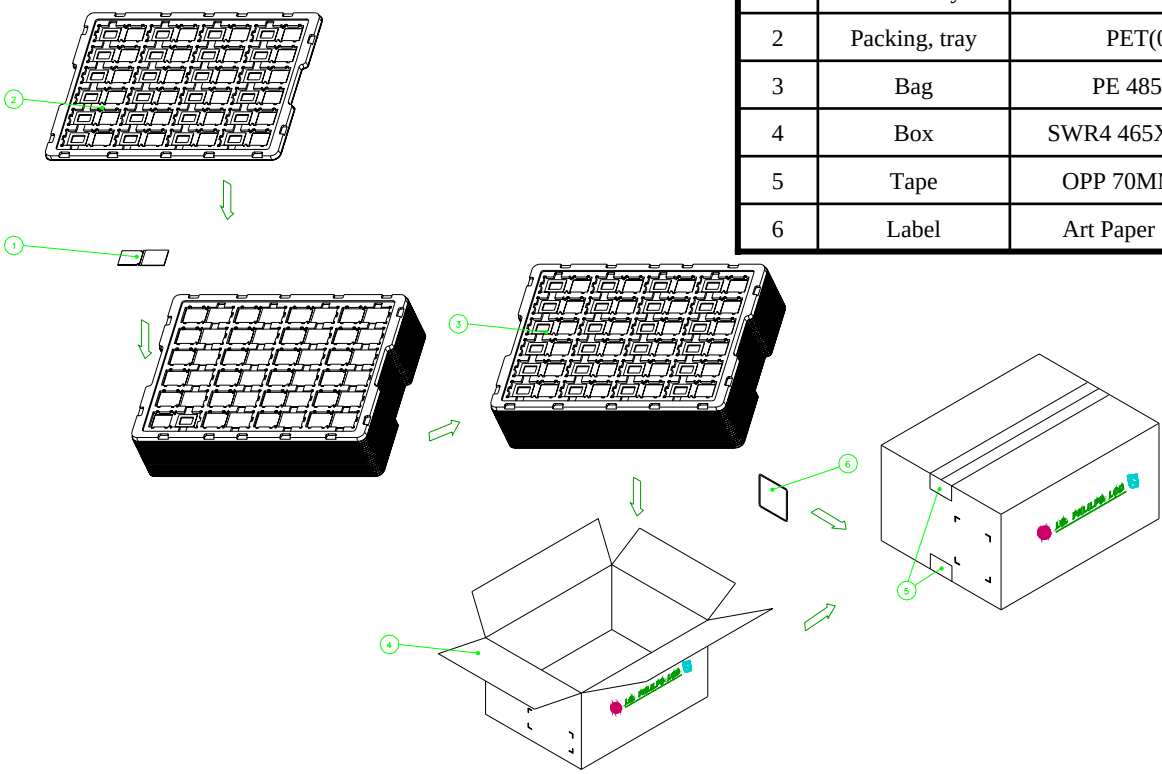
a) Package quantity in one box : 180 pcs

b) Box Size : 475mm X 348mm X 136mm

c) 1Box = tray 20 + 1 tray(dummy , top) = 21 tray

(1) Packing Ass'y

NO.	Description	Material
1	Unit ass'y	
2	Packing, tray	PET(0.8t)
3	Bag	PE 485X762
4	Box	SWR4 465X338X118
5	Tape	OPP 70MMx300m
6	Label	Art Paper 100x100



11. Marking & Others

11-1. Designation of Lot Mark

13-1-1 Lot Mark

A	B	C	D	E	F	G	H	I	J	K	L	M

A,B,C : SIZE (INCH)
D : YEAR
E : MONTH
F : FACTORY CODE
G : ASSEMBLY CODE
H ~ M : SERIAL NO.

[Note]

1. YEAR

Year	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Mark	1	2	3	4	5	6	7	8	9	0

2. MONTH

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Mark	1	2	3	4	5	6	7	8	9	A	B	C

3. FACTORY CODE

Factory Code	LPL Gumi	LPL Nanjing	HEESUNG
Mark	K	C	D

4. SERIAL NO.

Mark	100001~199999, 200001~299999, 300001~399999, …., A00001~A99999, ….., Z00001~Z99999

13-1-2 Location of Lot Mark

Serial No. is printed on the label. The label is attached to the backside of the LCD module.
This is subject to change without prior notice.

12. Precautions

Please pay attention to the following when you use this TFT LCD module.

12-1. Mounting Precautions

<1> You may mount a module using four corner sides.
<2> You should consider the mounting structure so that uneven force(ex. Twisted stress) is not aplied to the module.
And the case on which a module is mounted should have sufficient strength so that external force is not transmitted directly to the module.
<3> Please attach a transparent protective plate to the surface in order to protect the polarizer.
Transparent protective plate should have sufficient strength in order to the resist external force.
<4> You should adopt radiation structure to satisfy the temperature specification.
<5> Acetic acid type and chlorine type materials for the cover case are not desirable because the former generates corrosive gas of attacking the polarizer at high temperature and the latter causes circuit break by electro-chemical reaction.
<6> Do not touch, push or rub the exposed polarizers with glass, tweezers or anything harder than HB pencil lead. And please do not rub with dust clothes with chemical treatment.
Do not touch the surface of polarizer for bare hand or greasy cloth.(Some cosmetics deteriorate the polarizer.)
<7> When the surface becomes dusty, please wipe gently with absorbent cotton or other soft materials like chamois soaks with petroleum benzine. Normal-hexane is recommended for cleaning the adhesives used to attach front / rear polarizers. Do not use acetone and toluene because they cause chemical damage to the polarizer.
<7> Wipe off saliva or water drops as soon as possible. Their long time contact with polarizer causes deformations and color fading.
<8> Do not open the case because inside circuits do not have sufficient strength.
<9> The metal case of a module should be contacted to electrical ground of your system.

12-2. Operating Precautions

<1> The spike noise causes the disoperation of circuits. It should be lower than following voltage
V=±200mV(Over and under shoot voltage)
<2> Response time depends on the temperature.(In lower temperature, it becomes longer.)
<3> Brightness depends on the temperature. (In lower temperature, it becomes lower.)
And in lower temperature, response time(required time that brightness is stable after turned on) becomes longer.
<4> Be careful for condensation at sudden temperature change. Condensation makes damage to polarizer or electrical contacted parts. And after fading condensation, smear or spot will occur.
<5> When fixed patterns are displayed for a long time, remnant image is likely to occur.
<6> Module has high frequency circuits. Sufficient suppression to the electromagnetic interference shall be done by system manufacturers. Grounding and shielding methods may be important to minimized the interference.

12-3. Electrostatic Discharge Control

Since a module is composed of electronic circuits, it is not strong to electrostatic discharge.
Make certain that treatment persons are connected to ground through wrist band etc.
And don't touch interface pin directly.

12-4. Precautions For Strong Light Exposure

Strong light exposure causes degradation of polarizer and color filter.

12-5. Storage

When storing modules as spares for a long time, the following precautions are necessary.
<1> Store them in a dark place. Do not expose the module to sunlight or fluorescent light. Keep the temperature between 5°C and 35°C at normal humidity.
<2> The polarizer surface should not come in contact with any other object.
<3> The warranty for storage of the color TFT-LCD module shall be in compliance with the Incoming Inspection standard.

12-6. Handling Precautions For Protection Film

<1> When the protection film is peeled off, static electricity is generated between the film and polarizer. This should be peeled off slowly and carefully by people who are electrically grounded and with well ion-blown equipment or in such a condition, etc.
<2> The protection film is attached to the polarizer with a small amount of glue. If some stress is applied to rub the protection film against the polarizer during the time you peel off the film, the glue is apt to remain on the polarizer.
Please carefully peel off the protection film without rubbing it against the polarizer.
<3> When the module with protection film attached is stored for a long time, sometimes there remains a very small amount of glue still on the polarizer after the protection film is peeled off.
<4> You can remove the glue easily. When the glue remains on the polarizer surface or its vestige is recognized, please wipe them off with absorbent cotton waste or other soft material like chamois soaked with normal-hexane.

13. Production Center

<1> Panel : LG Philips LCD (Gumi, Korea)
<2> Board Assembly : LPLNJ (Nanjing, China)
<3> Shipping Place : LG Philips LCD(Gumi, Korea)