

Product Specification

SPECIFICATION FOR APPROVAL

- () Preliminary Specification
- (●) Final Specification

Title	3.5" QVGA Transflective TFT- LCD
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BUYER	
MODEL	

SUPPLIER	LG.Philips LCD CO., Ltd.
*MODEL	LH350Q01
SUFFIX	A1

*When you obtain standard approval, please use the above model name without suffix

SIGNATURE	DATE
_____ / _____	_____
_____ / _____	_____
_____ / _____	_____
고객 Field에서 Panel 신뢰성 관련 문제발생시 개선품 재승인 요망.	
Please return 1 copy for your confirmation with your signature and comments.	

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1. General Description

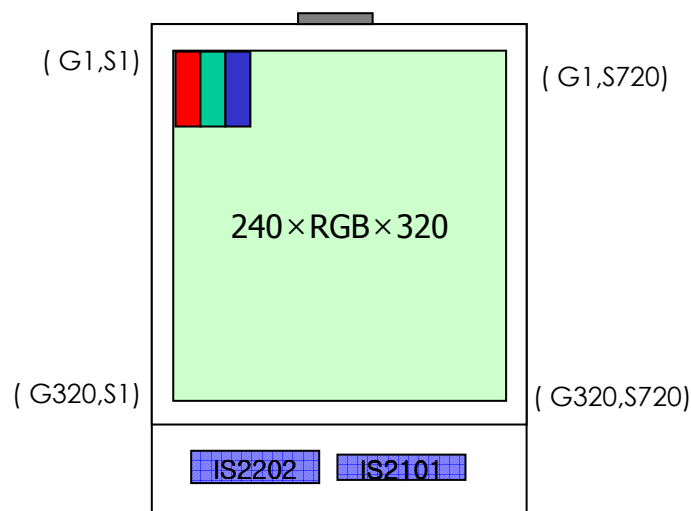
The LH350Q01-A1 is a Color transfective LCD and active Matrix Liquid Crystal Display with amorphous silicon TFT (Thin Film Transistor). It is a transfective LCD⁽¹⁾ display operating in the normally white mode. This TFT-LCD has 3.5 inch diagonally measured active display area with QVGA resolution(240 ×RGB× 320 pixels) and consists Of 0.45mm glass substrate , TFT panel with embossing technology.In addition,each pixel is divided into transmissive area and reflective area. Gray scale or the brightness of the sub-pixel color is determined with a 6-bit gray scale signal for each dot. This panel with built-in Driver IC applying for 260K colors. Optimum viewing angle is 6 O'clock.

(Ref. No. 1 : Transfective type means that has a function of transmissive and reflective mode in a body and it is able to use at indoor or outdoor under dark and sunlight at all.)

General specifications

Active screen size	3.5 inch (88.9mm) diagonal
Outline Dimension	58.84(H) x80.82(V) x 0.9(D) mm(Typ.) , only panel without polarizer
Pixel Pitch	0.0745 mm x RGB X 0.2235mm
Pixel format	240×RGB×320 Pixels (RGB stripes arrangement)
Color depth	6-bit, 262,000colors
Transmittance (with POL)	5.0%
Weight	10.1g (typ.)± 10% (without POL)
Rubbing Direction	6 O'clock
Display operating mode	Normally White (ECB mode, Transfective LCD)

Pixel configuration



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2. Absolute Maximum Ratings

The following conditions are maximum values which, if exceeded, may cause operation or damage to the product.

Table 1. ABSOLUTE MAXIMUM RATINGS

Parameter	symbol	Values		Units	Notes
		Min.	Max.		
Power Input Voltage *1)	V_{CC}	-0.3	4.0	Vdc	At $25 \pm 5^{\circ}\text{C}$
Operating Temperature	T_{OP}	-20	60	$^{\circ}\text{C}$	1
Storage Temperature	T_{ST}	-30	80	$^{\circ}\text{C}$	1
Operating Ambient Humidity *2)	H_{OP}	10	90	%RH	*3)
Storage Humidity *2)	H_{ST}	10	90	%RH	*4)

Notes:

*1) Liquid Crystal driving voltage.

Due to the characteristics of LC Material, this voltage vary with environmental temperature.

*2) Non-condensation.

*3) Temp. $\leq 60^{\circ}\text{C}$, 90% RH MAX.

*4) Temp. $> 60^{\circ}\text{C}$, Absolute humidity shall be less than 90% RH at 60°C

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3. Optical characteristics

Optical characteristics are determined after the unit has been 'ON' and stable for approximately 30 minutes in a dark environment at 25 °C. The values specified are at an approximate distance 50cm from the LCD surface at a viewing angle of Φ and θ equal to 0°.

Measurement condition : Refer to next pages (C - light source , Halogen Lamp, with polarizer)

Ta = 25°C (Ambient temperature)

	Parameter	Symbol	Condition	Min	Typ	Max	Unit	Remarks
B/L on	Transmittance	T	$\theta=0^\circ$	4.0	5.0	-	%	Fig.1
	Contrast ratio	CR	$\theta=0^\circ$	80	100	-		Fig.1
	Response time	Tr	$\theta=0^\circ$	-	10	20	ms	Fig.3
		Tf		-	30	40	ms	
	Viewing angle	$\Phi 0, \Phi 180$	CR>2	45	50	-	°	Fig.5
		$\Phi 90$		45	50	-	°	
		$\Phi 270$		50	55	-	°	
	Color chromaticity	Rx	$\theta=0^\circ$	0.49	0.54	0.59		Fig.1
		Ry		0.29	0.34	0.39		
		Gx		0.27	0.32	0.37		
Gy		0.51		0.56	0.61			
Bx		0.12		0.17	0.22			
By		0.09		0.17	0.19			
Wx		0.26		0.31	0.36			
Wy		0.29		0.33	0.39			
B/L off	Reflectance	R	$\theta=0^\circ$	5.5	8	-	%	Fig.2
	Response time	Tr	$\theta=0^\circ$		10	15	ms	Fig.3
		Tf			20	30	ms	
	White chromaticity	x	$\theta=0^\circ$	-	TBD	-		Fig.1
y		-		TBD	-			

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Notes : 1. Contrast Ratio(CR) is defined mathematically as :

$$\text{Contrast Ratio} = \frac{\text{Surface Luminance with all white pixels}}{\text{Surface Luminance with all black pixels}}$$

2. Surface luminance is the center point across the LCD surface 500mm from the surface with all pixels displaying white. For more information see FIG 1.

3. The variation in surface luminance , δ WHITE is determined by measuring L_{ON} at each test position 1 through 5, and then dividing the maximum L_{ON} of 5 points luminance by minimum L_{ON} of 5 points luminance. For more information see FIG 4.

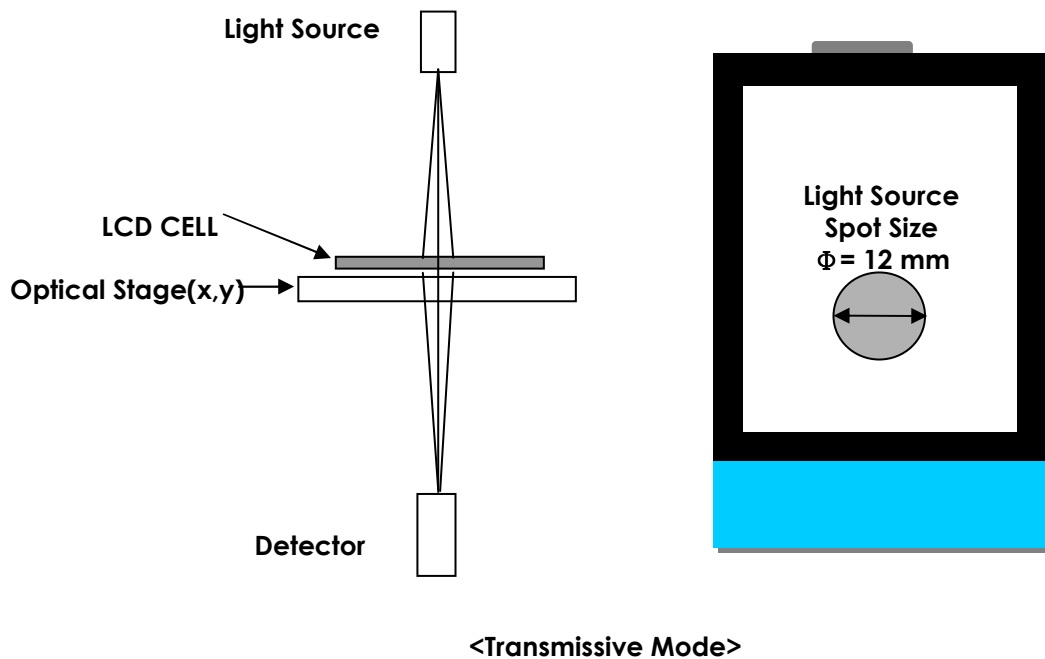
$$\delta \text{ WHITE} = \text{Minimum}(L_{ON1}, L_{ON2}, \dots, L_{ON5}) / \text{Maximum}(L_{ON1}, L_{ON2}, \dots, L_{ON5})$$

4. Response time is the time required for the display to transition from White to black(Rise Time, T_{rR}) and from black to white(Decay Time, T_{rD}). For additional information see FIG 3.

5. Viewing angle is the angle at which the contrast ratio is greater than 5. The angles are determined for the horizontal or x axis and the vertical or y axis with respect to the z axis which is normal to the LCD surface. For more information see FIG 5.

FIG. 1 Optical Characteristic Measurement Equipment and Method

A measurement device is Otsuka luminance meter LCD7000.



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FIG. 2 Measuring method for optical characteristics in Reflective mode

A measurement device is Otsuka luminance meter LCD7000 (with luminosity correction system)

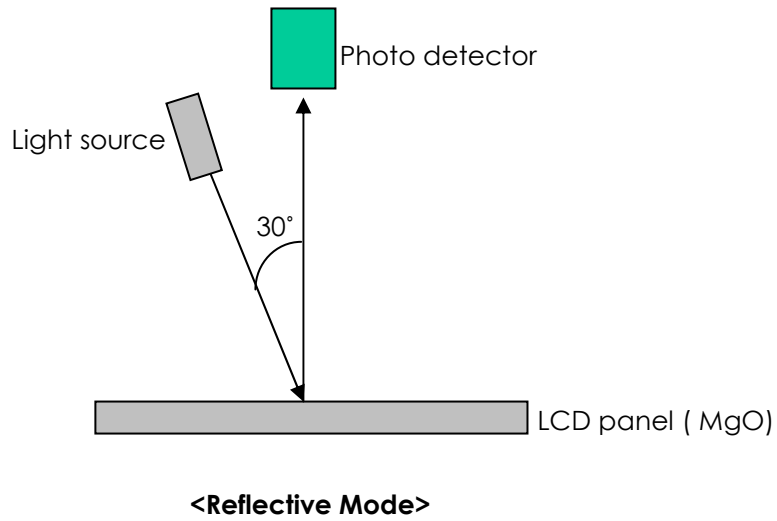
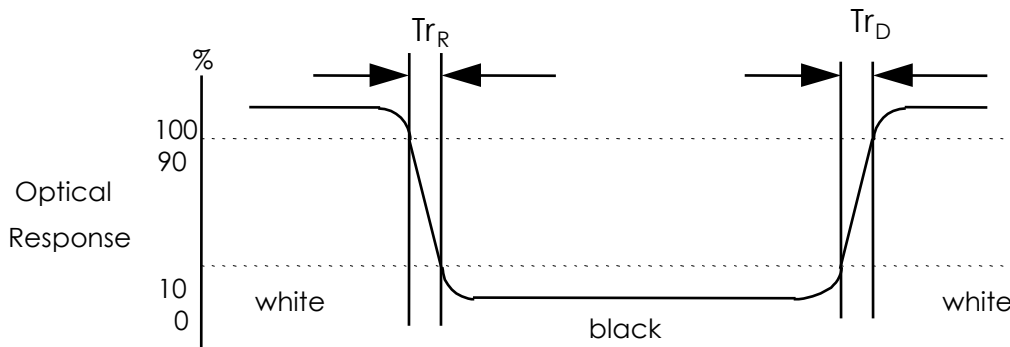


FIG. 3 The definition of Response Time

The response time is defined as the following figure and shall be measured by switching the input signal for "black" and "white".



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FIG. 4 The definition of Transmittance variation

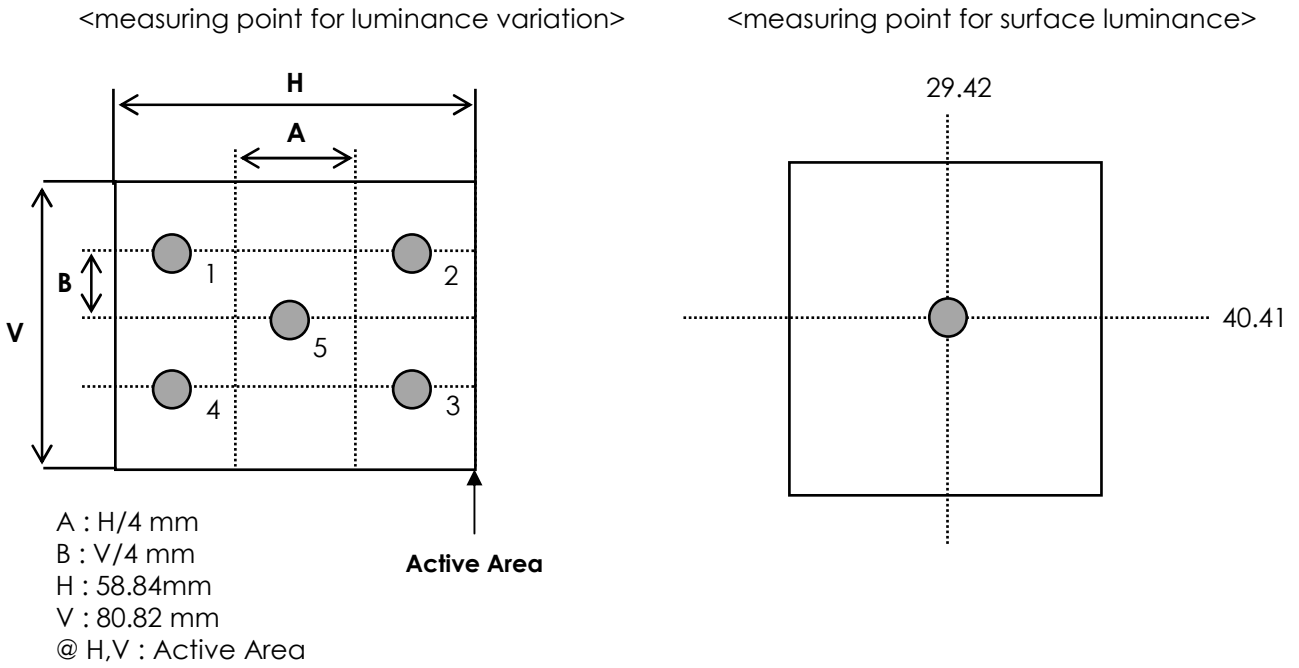
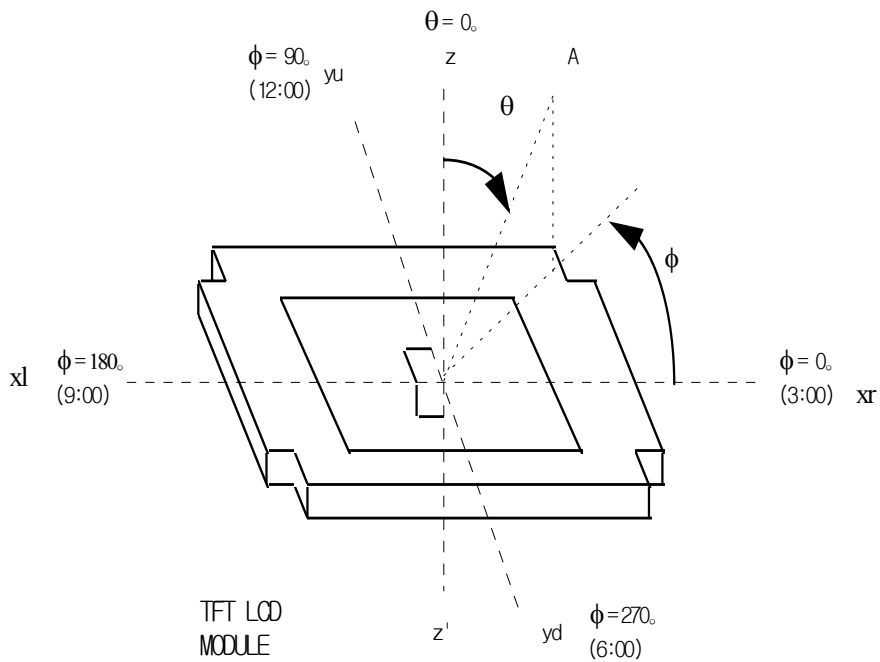


FIG. 5 The definition of viewing angle

<dimension of viewing angle range>

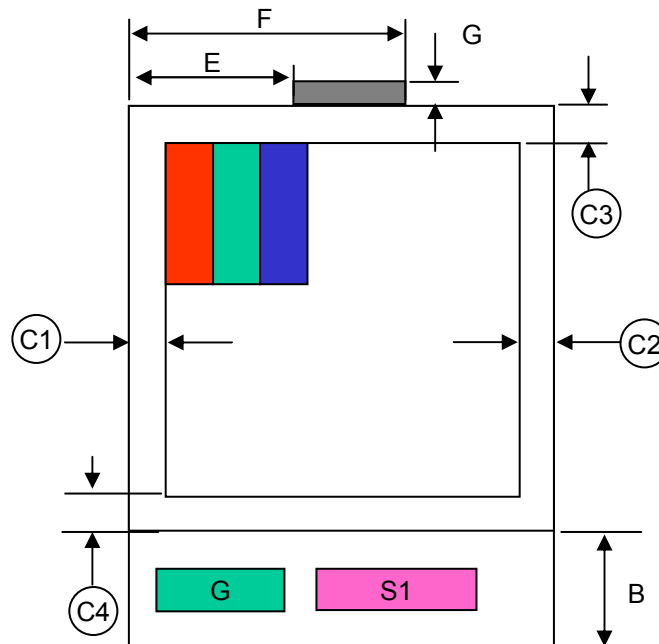


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4. Mechanical Characteristics

The contents provide general mechanical characteristics for the model LH350Q01-A1. In addition the figures in the following page are detailed mechanical drawing of the LCD.

Item	Symbol	Specification	Units	Margin
Active Area		53.64(H) × 71.52(V)	mm	
Upper PANEL Size		58.84(H) × 76.22(V)	mm	±0.2
Lower PANEL Size		58.84(H) × 80.82 (V)	mm	±0.2
Panel Thickness		0.90	mm	±0.05
Length of Gate/Source Pad	B	4.6	mm	±0.2
Length of Cell Area	C	2.6(C1,C2), 2.0(C3),2.7(C4)	mm	±0.1
Glass edge ~ End seal	E	19.42(min.)	mm	
Glass edge ~ End seal edge	F	39.42(max)	mm	
Height of End seal	G	0.6(max)	mm	
Weight		10.1	g	±10%



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5. Reliability Test

Reliability test conditions (Polarizer characteristics null , Reliability test do as a Module state)

No.	Test Items	Test conditions
1	High temperature storage	T = 80℃ for 240hr
2	Low temperature storage	T = -30℃ for 240hr
3	High temperature operating	T = 60℃ for 240hr
4	Low temperature operating	T = -20℃ for 240hr
5	High temp. and High Humidity storage	T = 60℃ / 90% for 240hr (But no condensation of dew)
6	High temp. and High Humidity operating	T = 60℃ /90% for 240hr (But no condensation of dew)
7	Packing Drop	76cm 1 Coner/3 Edge/6 Face
8	Packing Vibration	Frequency range : 10Hz ~ 55Hz Stroke : 1.5mm , Sweep : 10Hz~55Hz XYZ 2 hours for each direction

Checking items

▶ NO.1 ~NO.8

There should be no change which might affect the practical display function when the display quality test is conducted under normal operating condition.

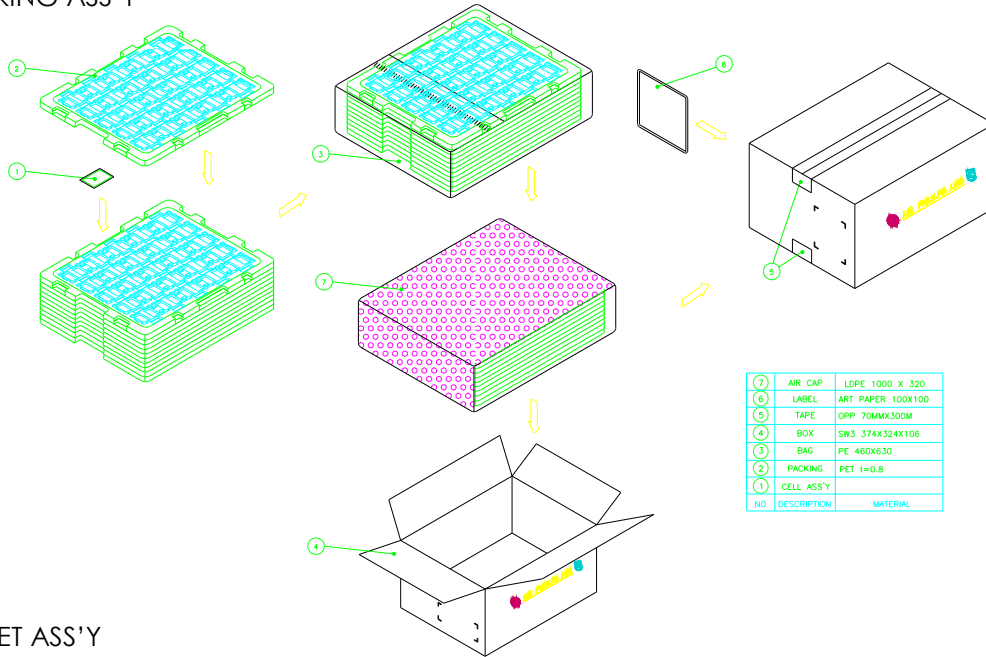
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6. Packing Form

a) Package quantity in one box : 216 pcs(18tray × 12 pcs)

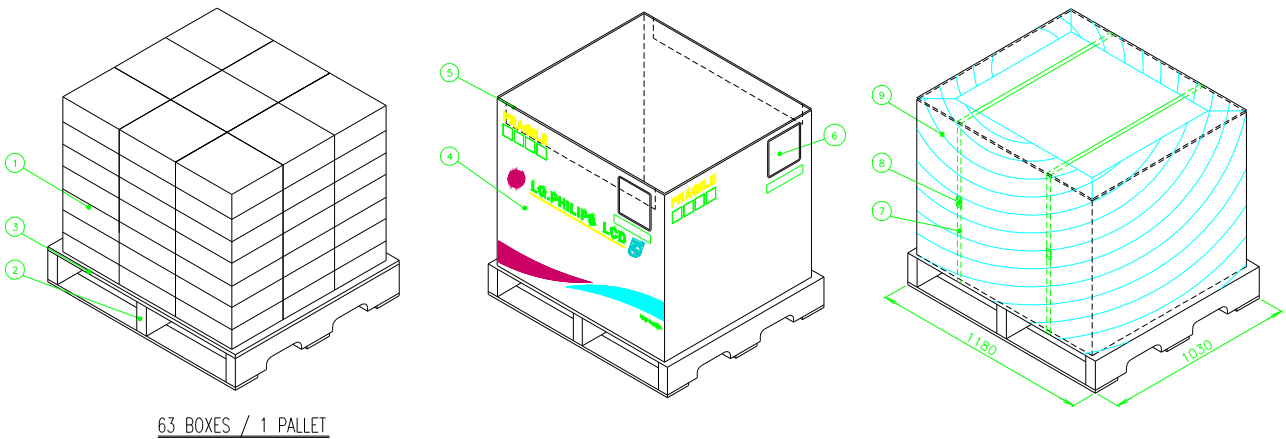
b) Box Size : 386mm X 334mm X 130mm

6-1) PACKING ASS'Y



(7)	AIR CAP	LDPE 1000 X 320
(6)	LABEL	ART PAPER 100X100
(5)	TAPE	DPP 70MMX300M
(4)	BOX	SW3 374X324X106
(3)	BAG	PE 460X630
(2)	PACKING	PET t=0.8
(1)	CELL ASS'Y	
NO	DESCRIPTION	MATERIAL

6-2) PALLET ASS'Y



63 BOXES / 1 PALLET

45	(9)	WRAP, FILM	LDPE
2	(8)	BAND, CLIP	STEEL
10	(7)	BAND, PACKING	P.P
4	(6)	LABEL	ART PAPER
1	(5)	ANGLE, COVER	PAPER
1	(4)	ANGLE, PACKING	PAPER
1	(3)	SHEET	PAPER
1	(2)	PALLET	WOOD
63	(1)	PACKING ASS'Y	
Q'TY	NO	DESCRIPTION	MATERIAL

7. PRECAUTIONS

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

7-1. MOUNTING PRECAUTIONS

- 1) When the surface becomes dusty, please wipe gently with absorbent cotton or other soft materials.
- 2) 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 .
- 3) Do not leave at the high temperature and high humidity in long time.
- 4) Do not leave the TFT-LCD panel from direct sunlight.
- 5) Do not contact with water to avoid Metal corrosion.
- 6) **The TFT-LCD Panel shall be installed flat, without twisting or bending**

7-2. OPERATING PRECAUTIONS

- (1) The spike noise causes the mis-operation of circuits. It should be lower than following voltage :
 $V=\pm 200\text{mV}$ (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) **The TFT-LCD shall be operated within the temperature limits specified. when you operate the LCD panel at below(beyond) the limit specified,It may cause damage or image degradation. This phenomenon may not recover.**

7-3. 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.

7-4. PRECAUTIONS FOR STRONG LIGHT EXPOSURE

Strong light exposure causes degradation of color filter.

7-5. STORAGE

When storing TFT-LCD panel as spares for a long time, the following precautions are necessary.

- (1) Store them in a dark place. Do not expose to sunlight or fluorescent light. Keep the temperature between 5°C and 35°C at normal humidity.
- (2) The TFT-LCD glass surface should not come in contact with any other object.
It is recommended that they be stored in the container in which they were shipped.
- (3) As TFT-LCD panels are packed in a vacuum with PE bag in Nitrogen gas environment , Customer should keep them as the way which were shipped to ensure 3 months warranty for storage.

If customer open package in order to do inspection or any purpose ,
The warranty for storage should be shortened less than 1 month.

7-6. HANDLING PRECAUTIONS FOR TFT-LCD Glass

Be careful when TFT-LCD panel is broken.(TFT-LCD is made of glass)