Product Specification

SPECIFICATION
FOR
APPROVAL

(●) Preliminary Specification
(   ) Final Specification

Title	2.36" qVGA TFT-LCD

BUYER	
MODEL	

SUPPLIER	LG.Philips LCD Co., Ltd.
*MODEL	LH240Q29
SUFFIX	SH01

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

SIGNATURE	DATE
_____/_____	_____
_____/_____	_____
_____/_____	_____

Please return 1 copy for your confirmation with your signature and comments.

APPROVED BY	DATE
C. S. Kyeong / Team Leader	_____
REVIEWED BY	
W. C. Lee / Part Leader	_____
S. S. Hwang / Part Leader	_____
PREPARED BY	
S. H. Joe / Associate Research Engineer	_____

Small & Medium Displays Panel Design Team.
LG.Philips LCD Co., Ltd.

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RECORDS OF REVISIONS

Revision No	Revision No	Page	DESCRIPTION
Ver. 0.0	Mar. 28, 2007		Ver0.0 was Released.

Ver. 1.0	Jun. 04, 2007	6 page	1. VGH is changed
			   - Min 13.5
			   - Typ. 15.5
			   - Max 17.5
			2. VGL is changed
			   - Min -13
			   - Typ. -11
			   - Max −9
			3. Vom is changed
			   - VcomH 3.7V
			   - VcomL −1.1V
			4. ΔVp Max is changed
			   − ΔVp max 1.8V

		11 page	Upper GLS size is fixed 45.20 → 52.10 Ver1.0 was Released.

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1. General Description

The **LH240Q29-SH01** model is a Thin Film Transistor- Liquid Crystal Display without polarizer.
The matrix compose a-Si Thin Film Transistor as a active element.
It is a transmissive type display operating in the normally black mode. This TFT-LCD has 2.36 **inch**
diagonally measured active display area with qVGA resolution(240×RGB×320 pixels).
Each pixel is divided into Red, Green and Blue sub-pixels or dots which are arranged in vertical stripes.
The LH240Q29-SH01 has been designed to apply the interface method that enables low power.
The LH240Q29-SH01 is intended to support applications where thin thickness, low power are critical factors
and graphic display are important. In combination with the vertical arrangement of the sub-pixels, the
LH240Q29-SH01 characteristics provide a high quality display for mobile phone application.
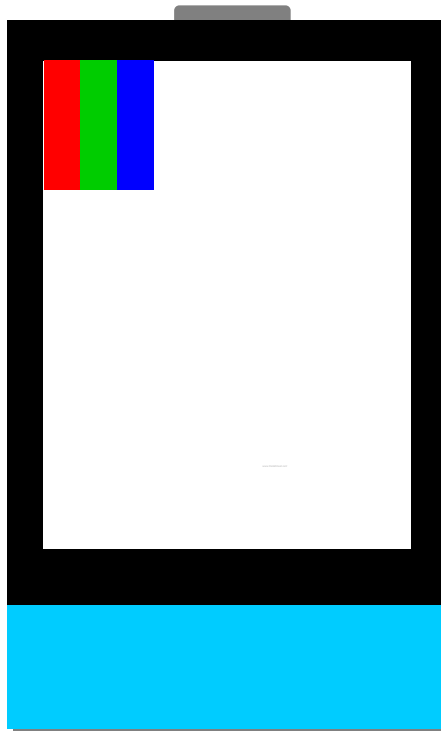
General Features

Active Screen Size	2.36 inch diagonal
Outline Dimension	40.00 (H) x 55.70 (V) x 0.5 (D) mm(Typ.) , Only panel without polarizer
Pixel Pitch	0.050 mm x 0.150 mm
Pixel Format	240×RGB×320 Pixels (RGB Stripes Arrangement)
Color Gamut	68%(Typ.) , Only CF
Transmittance (with POL)	4.9 % (Typ.) at 4.9 V
Weight (without POL)	2.6 g (Typ.)± 0.26g
Rubbing Direction	80/80/80/80 deg (U/D/L/R @ C/R>10)
D-IC	R61505U
Display Operating Mode	Transmissive Mode, Normally black

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2. Absolute Maximum Ratings

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

Table 1. ABSOLUTE MAXIMUM RATINGS

Parameter	Symbol	Value		Unit	Notes
		Min.	Max.		
LC Operating Voltage *1)	V_{OP}	4.6 (Typ.)		V	@ 25±5 ℃
Operating Temperature	T_{OP}	-20	70	℃	
Storage Temperature	T_{ST}	-30	85	℃	
Operating Ambient Humidity *2)	H_{OP}	10	*3)	%RH	
Storage Humidity *2)	H_{ST}	10	*4)	%RH	

Notes:

*1) Liquid Crystal driving voltage.
Due to the characteristics of LC Material, this voltage vary with environmental temperature.

*2) Non-condensation.

*3) Temp. ≤ 60℃ , 90% RH MAX.

*4) Temp. ＞60℃ , Absolute humidity shall be less than 90% RH at 60℃

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3. Electrical Specifications

Table 2. Recommend Parameters for Electrical Characteristics

@ 25 ± 5°C

Parameter	Symbol	Value			Unit	Notes
		Min.	Typ.	Max.		
TFT Gate ON Voltage	VGH *1)	13.5	15.5	17.5	V	
TFT Gate OFF Voltage	VGL *2)	-13	-11	-9	V	
TFT Common Electrode Voltage	VcomH	-	3.7	-	V	*3)
	VcomL	-	-1.1	-	V	
TFT Kick-Back Voltage Max.	$\triangle V_p$ Max	0.6	-	1.8	V	
TFT Kick-Back Voltage Min.	$\triangle V_p$ Min					

Notes:

*1) VGH is TFT Gate Operating Voltage.

*2) VGL is TFT Gate Operating Voltage
      The low voltage level of VGL signal must be fluctuated with same phase as Vcom,
         in case of Cadd (Storage on Gate) structure.
      The storage capacitance structure of LH240Q29-SH01 is Cst (Storage on Common)

*3) Vcom must be adjusted to optimize display quality: Cross-talk, Contrast Ratio and etc.

We just kindly recommend the setting-voltage as the reference value.

**In order to get the optimized display quality, the setting-voltage should be changed
as based on customer's developing condition.**
(The display quality could be changed by customer's setting-voltage.)

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4. Optical Specification

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
50 cm from the TFT-LCD surface at a viewing angle of Φ and θ equal to 0 °.

Measurement condition: Refer to next pages (LED back light with 20 mA/1 ea)
*1): with Polarizer
*2): Only Color Filter glass

| Parameter	Symbol	Values			Unit	Notes
		Min	Typ	Max		
*1) Threshold Voltage	Vsat	4.6	4.7	4.8	V	Fig.2
	Vth	1.9	2.0	2.1	V	
*1) Transmittance	T(%)	-	4.9	-	%	Fig.1
*1) Contrast Ratio	C/R	-	400	-		
*1) Response Time	Tr+Tf	-	40	60	msec	Fig.3
*2) CIE Color Coordinate	Rx	0.622	0.642	0.662		
	Ry	0.296	0.316	0.336		
	Gx	0.269	0.289	0.309		
	Gy	0.564	0.584	0.604		
	Bx	0.118	0.138	0.158		
	By	0.067	0.087	0.107		
	Wx	0.294	0.314	0.334		
	Wy	0.313	0.333	0.353		
*1) Viewing Angle	Θl	-	80	-	Degree	C/R>10 Fig.4
	Θr	-	80	-		
	Θu	-	80	-		
	Θd	-	80	-		

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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 TFT-LCD surface 500 mm from the surface with all pixels displaying white. For more information see FIG 1.

3. Response time is the time required for the display to transition from white to black(Rise Time, Tr) and from black to white(Falling Time, Tf). For additional information see FIG 3.

4. Viewing angle is the angle at which the contrast ratio is greater than 10. 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 TFT-LCD surface. For more information see FIG 4.

5. Optimum contrast is obtained by adjusting the TFT-LCD Threshold voltage(Vth & Vsat)

FIG. 1 Optical Characteristic Measurement Equipment and Method

DMS 803 System

Detector

LCD CELL

Optical Stage(x,y)

Light Source

Light Source Spot Size
$\Phi = 3$ mm

<Transmissive Mode>
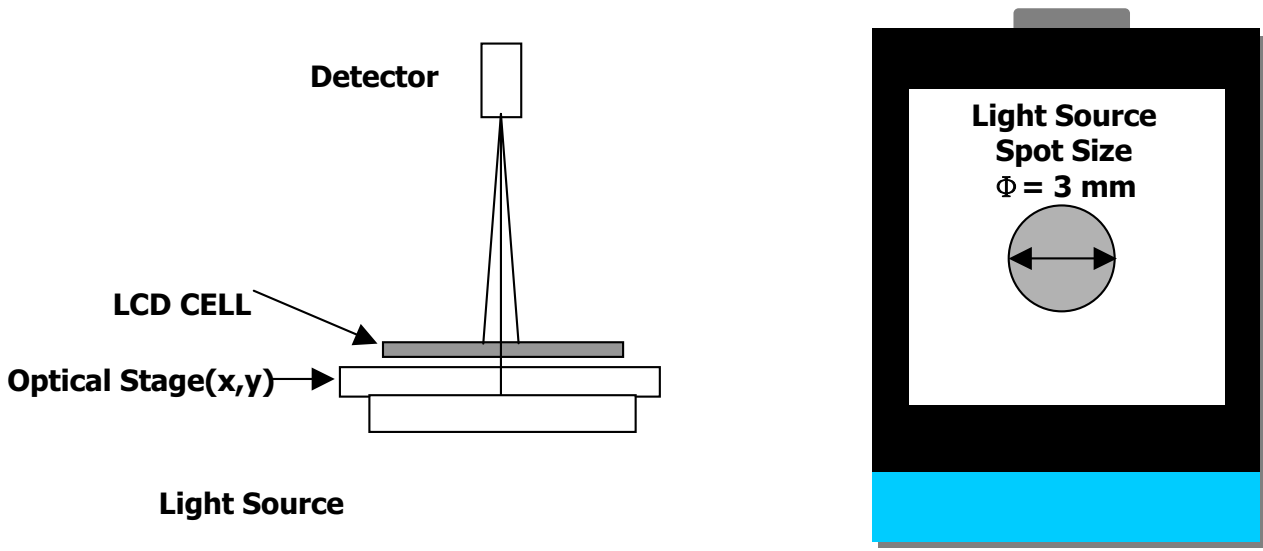
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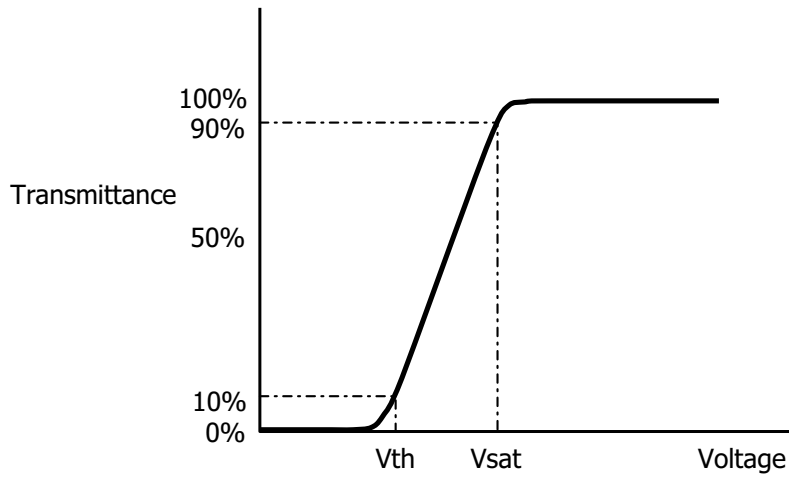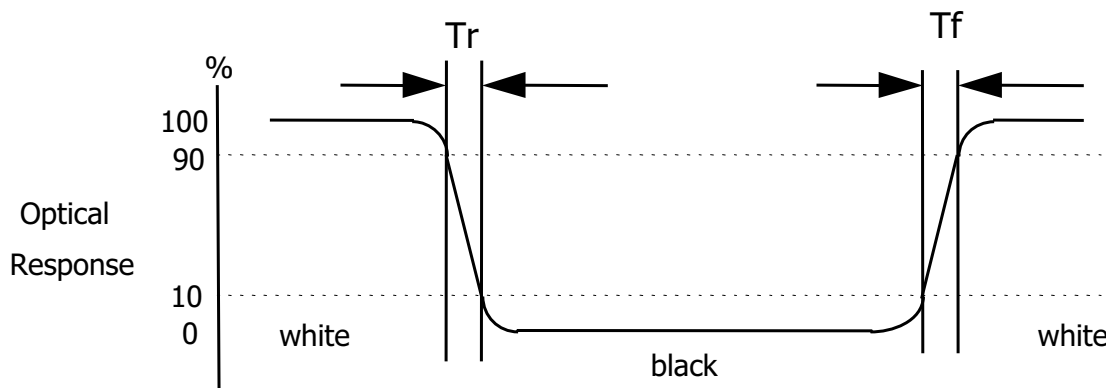
FIG. 2 The definition of Vth and Vsat

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".
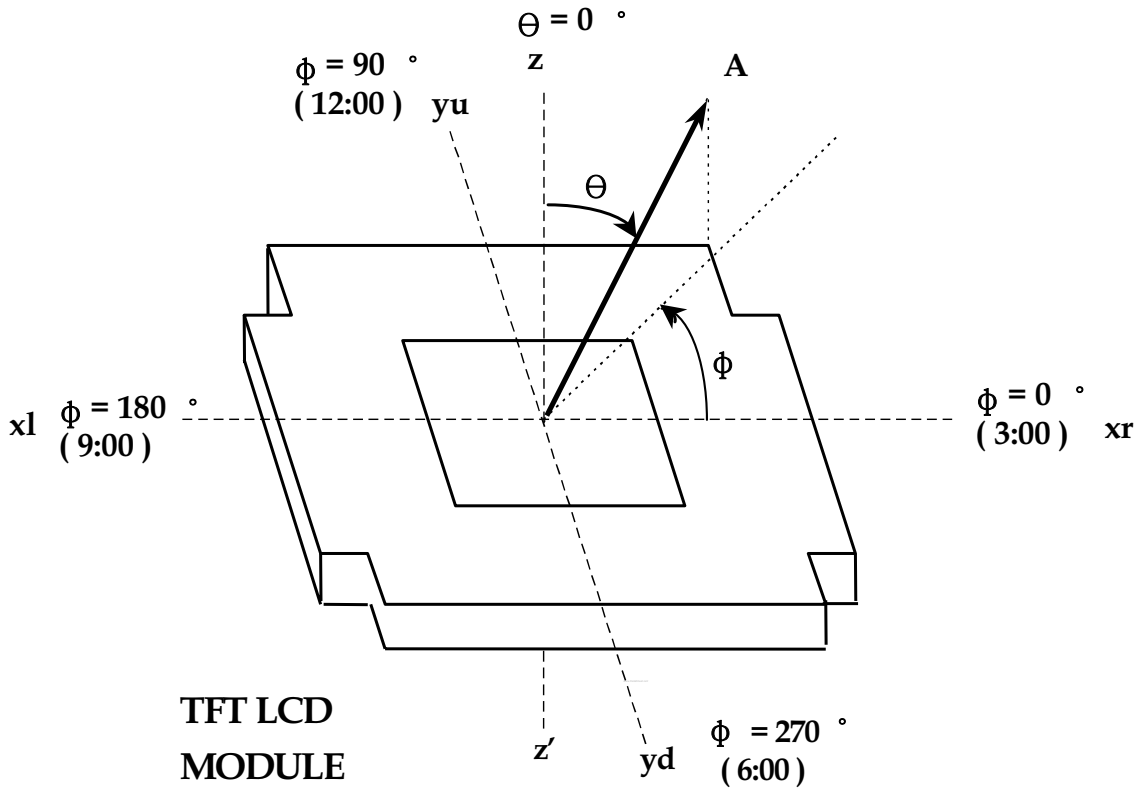

* Voltage conditions for Response time
Vgate : 22V DC
Vdata : 0V~4.5V DC
Vcom : 0V (Ground)

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FIG. 4 The definition of viewing angle

<dimension of viewing angle range>

$\Theta = 0$ °
z

$\phi = 90$ °
(12:00) yu

A

Θ

ϕ

$\phi = 180$ °
xl (9:00)

$\phi = 0$ °
(3:00) xr

TFT LCD
MODULE

z' yd

$\phi = 270$ °
(6:00)

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5. Mechanical Characteristics

The contents provide general mechanical characteristics for the model **LH240Q29-SH01**. In addition the figures in the following page are detailed mechanical drawing of the TFT-LCD.

Parameter	Symbol	Specification	Unit	Notes
Active Area	A	36.00	mm	
	B	48.00	mm	
Upper Glass Size	C	40.00±0.2	mm	
	D	52.10±0.2	mm	
Bottom Glass Size	E	40.00±0.2	mm	
	F	55.70±0.2	mm	
Panel thickness	T	0.5±0.05	mm	
Cell Margin	G	2.00±0.1	mm	
	H	2.10±0.1	mm	
	I	2.00±0.1	mm	
	J	2.00±0.1	mm	
COG PAD Area	K	3.60±0.2	mm	
End Seal Size	L	10.00	mm	Max.
Glass Edge to End Seal	M	15.00	mm	Min.
Glass Edge to End Seal Edge	N	25.00	mm	Max.
Upper Glass Edge to D-IC	P	0.62±0.1	mm	
Bottom Glass Edge to D-IC	O	1.70±0.1	mm	
D-IC to FPC	Q	0.5	mm	
FPC to Glass Edge	R	1.2±0.1	mm	
End Seal Height	S	0.3	mm	Max.
FPC Length	U	25.20	mm	
FPC Pad Length(Metal)	V	0.8	mm	
FPC Pad(metal area) to Glass Edge	W	0.4±0.1	mm	
Weight		2.6±0.26	g	

FIG. 5 Outline Dimension of TFT-LCD Cell

'a' Detail
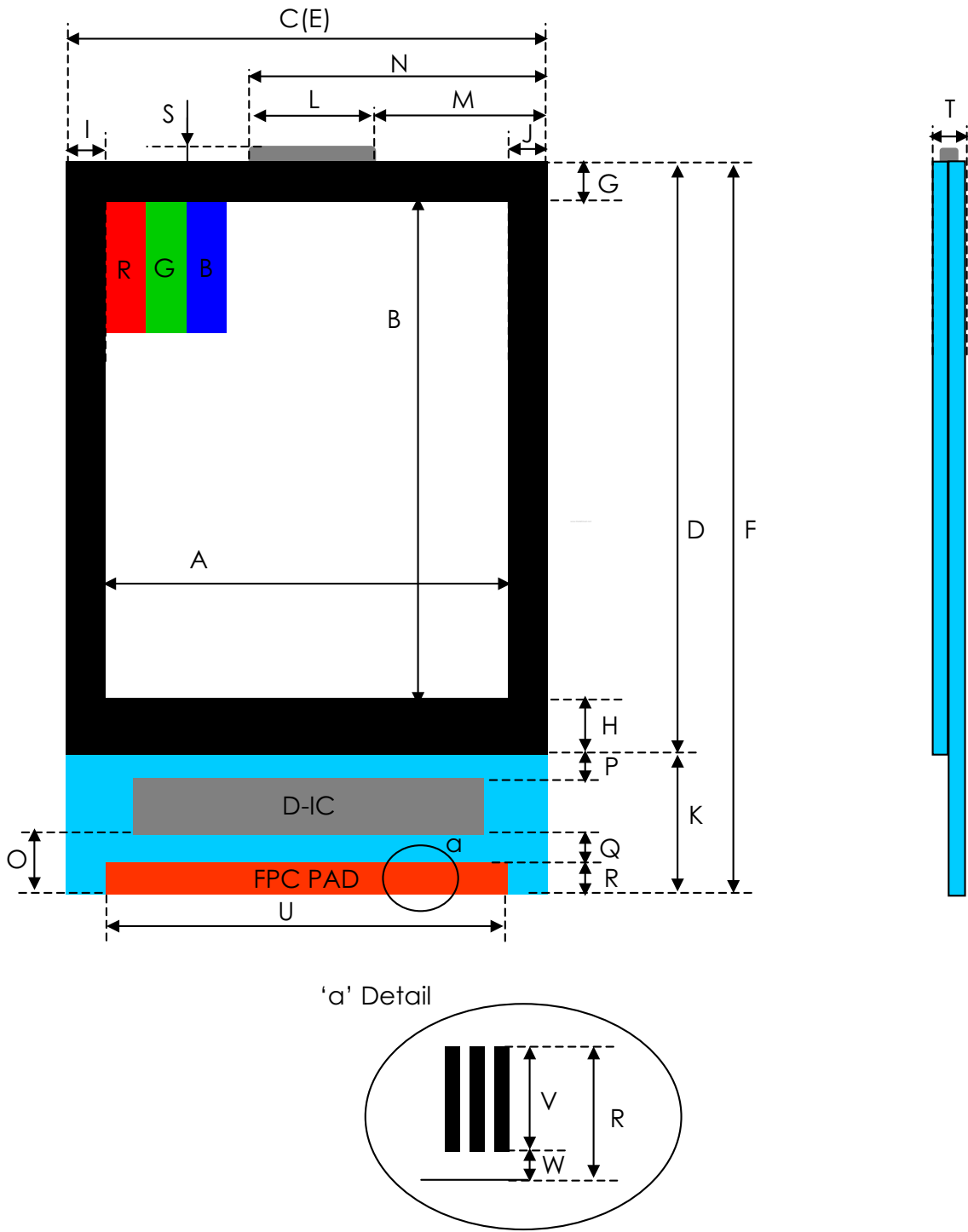
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6. Reliability Test

Absolute Maximum Conditions

No.	Parameter	Condition
1	Operating Temperature	-20 ~ 70℃
2	Storage Temperature	-30 ~ 85℃

Reliability test conditions (Polarizer characteristics null)

No.	Test Items	Test Condition	
1	High Temperature Storage	T = 85℃ for 500hr	Module (Without Contamination)
2	Low Temperature Storage	T = -30℃ for 500hr	
3	High Temperature Operating	T = 70℃ for 500hr	
4	Low Temperature Operating	T = -20℃ for 500hr (But no condensation of dew)	
5	High Temp. and High Humidity Operating	T = 60℃ /95% for 500hr (But no condensation dew)	
6	Thermal Shock	-30 ~ 85℃, 100cycle	
7	Packing Shock	1coner, 3edge, 6face / 76cmDrop	Packing
8	Packing Vibration	Random 1.5Grms Z direction 1hr	

※ 1) No.1~ No.6 : No guarantee for panel, only for module with the above test conditions.

   2) No.7~ No.8 : Refer to 7-1) Packing Ass'y on page 14.

Result Evaluation Criteria

TFT- LCD Panel should be at room temperature for 2 hours when the display quality test is over.
There should be no particular change which might affect the practical display function
and the display quality test should be conducted under normal operating condition.
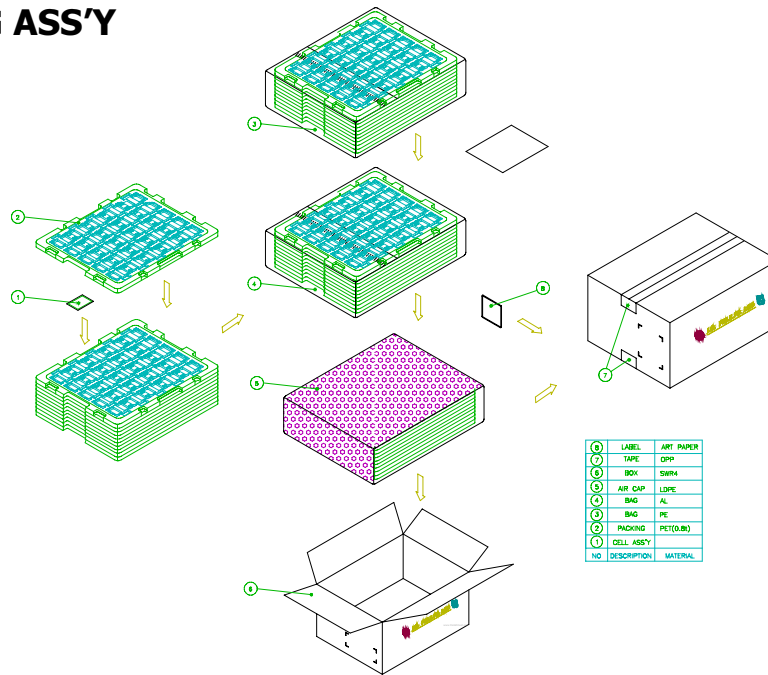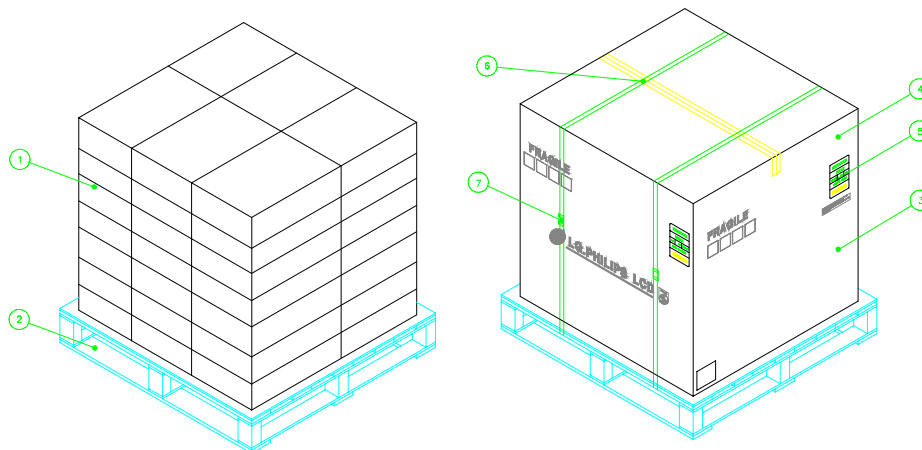
7. Packing Form

a) Package quantity in one box : 375 pcs

b) Box Size : 393mm X 339mm X 135mm

7-1) PACKING ASS'Y

NO	DESCRIPTION	MATERIAL
8	LABEL	ART PAPER
7	TAPE	OPP
6	BOX	SWR4
5	AIR CAP	LDPE
4	BAG	AL
3	BAG	PE
2	PACKING	PET(0.8t)
1	CELL ASS'Y	

7-2) PALLET ASS'Y

42 BOXES / 1 PALLET

NO	DESCRIPTION	MATERIAL
7	BAND, CLIP	STEEL
6	BAND, PACKING	P.P
5	LABEL	YUPO PAPER
4	ANGLE, COVER	DW3
3	ANGLE, PACKING	DW 3
2	PALLET	STEEL
1	PACKING ASS'Y	

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8. PRECAUTIONS

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

8-1. MOUNTING PRECAUTIONS

1) When the surface becomes dusty, please wipe gently with absorbent
   cotton or other soft materials.
2) Since a TFT-LCD Panel 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

8-2. OPERATING PRECAUTIONS

1) The spike noise causes the mis-operation of circuits. It should be lower than following voltage :
   $V=\pm200mV$(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 TFT-LCD panel
   at below(beyond) the limit specified,It may cause damage or image degradation.
   This phenomenon may not recover.

8-3. 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.

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8-4. PRECAUTIONS FOR STRONG LIGHT EXPOSURE

Strong light exposure causes degradation of color filter. It may not recover

8-5. 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 and Al bag in Nitrogen gas environment,

**Customer is required to keep the product under a good condition(25 degree, 50%)
to prevent any of unwanted damage from the moisture, and chemicals, etc.
And recommended to use it in a short-time period, after it's unpacked.**

8-6. HANDLING PRECAUTIONS FOR TFT-LCD Glass

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