

# ***TFT-Display Datenblatt***

Modell LH350Q31-FD01

## **Kurzdaten**

Hersteller	LG Display
Diagonale	3,5" / 8,9cm
Format	4:3
Auflösung	240x320
Backlight	LED / 250cd/m <sup>2</sup>
Interface	RGB
Touchscreen	ja
Temperatur	-20...+70°C (Betrieb)

**Product Specification**

**SPECIFICATION  
FOR  
APPROVAL**

- ( ) Preliminary Specification  
(●) Final Specification

<b>Title</b>	<b>3.5" (240xRGBx320) TFT LCD</b>
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BUYER	HP
MODEL	

SUPPLIER	LG.Philips LCD Co., Ltd.
*MODEL	LH350Q31
SUFFIX	FD01

\*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.K. Shin / Manager	 2007.08.29
<b>REVIEWED BY</b>	
H.S. Ha / Engineer	 2007.08.29
<b>PREPARED BY</b>	
S.H. Cho / Engineer	 2007.08.29

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



**Product Specification**

**RECORD OF REVISIONS**

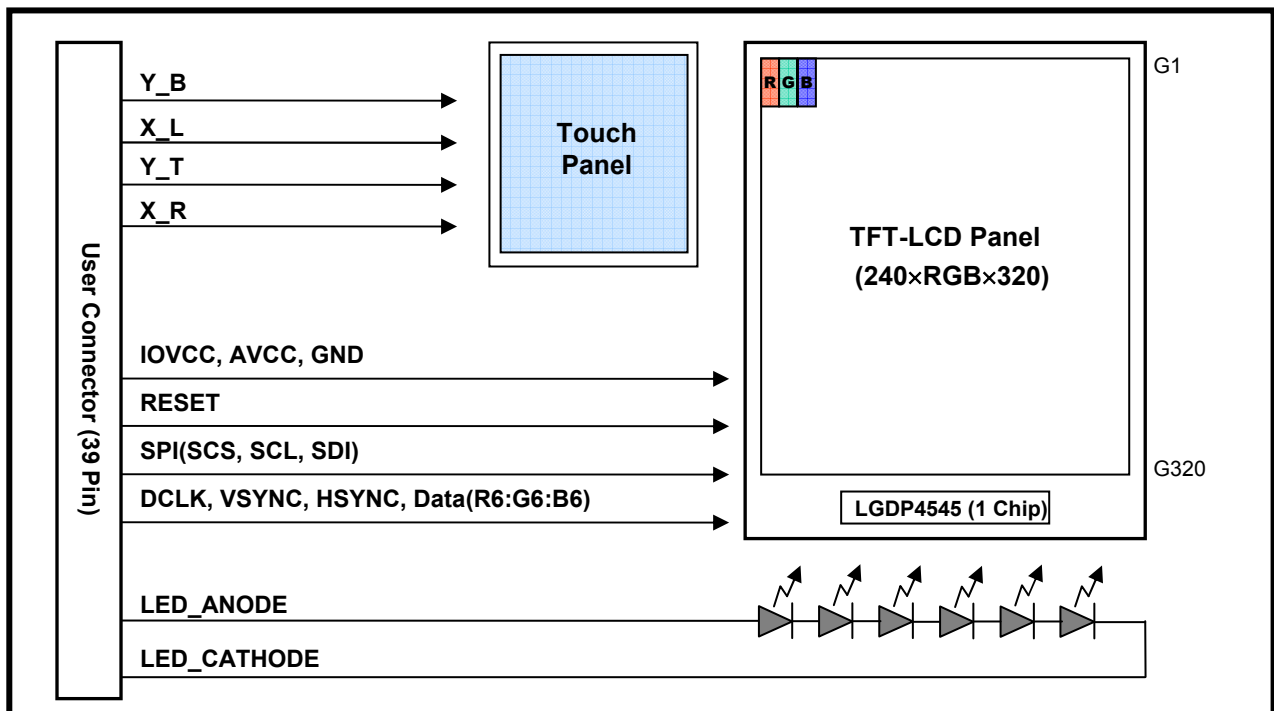
Revision No.	Revision Date	Page	Description
0.0	Apr. 6, 2007	-	First draft
0.1	May. 2 . 2007	6	Changed the AVCC(Typ.) to 3.0V
		10	Revised the RGB timing characteristics. Changed the PCLK to 5.7MHz
		21	Changed the power supply setting values
		22	Changed the initial setting values
0.2	May.28. 2007	4	New added weight of general feature
		19	Changed the outline dimension
0.3	June. 26. 2007	7	Added the Touch Panel test method (Electrical Spec.)
		15	Newly defined the RGB Chromaticity characteristics
		19	Revised the Mechanical characteristics. (Tolerance change : $\pm 0.20 \rightarrow \pm 0.15$ )
		24	Added the Touch Panel high temperature storage & operation condition
0.4	June. 28. 2007	25	Added the Touch Panel test method (Reliability Spec.)
		25	Revised the Touch Panel durability (scratching & pitting)
0.5	July. 20. 2007	6	Newly added the Power Consumption (Typ)
		14	Newly added the Reflective CR 3:1 (Typ) Newly added White Chromaticity (Typ)
		15	Changed the Transmissive CR 200:1(Typ) to 120:1(Typ)
		20	Newly added the Forbidden Area
1.0	Aug. 27. 2007	6	Newly added the Power Consumption (Max)
		14	Changed the Reflectivity 4% (Typ)
			Changed the Reflective CR 4:1 (Typ)
			Changed the White Chromaticity (Typ)
		22	Newly added the Display On/Off Sequence
		23	Changed the Power supply setting values
		24	Changed the Display initial setting values
		25	Updated ESD Test condition
26	Changed Touch Panel Reliability Test		
27	Changed Box Label size		

**Product Specification**

**1. GENERAL DESCRIPTION**

The LH350Q31 is a Color Active Matrix Liquid Crystal Display with Light Emission Diode(LED) backlight unit. The matrix employs a-Si Thin Film Transistor as the active element. It is a transmissive type display operating in the normally white mode. This module is a diagonal 3.5 inch with the portrait typed qVGA (240xRGBx320) resolution. Each pixel is divided into red, green and blue sub-pixels or dots which are arranged in vertical stripes.

**Block Diagram**



**General Features**

Item	Unit	Description	Remarks
Active screen size	Inch	3.5	Diagonal
Display Type	-	Transmissive	Normally White
Outline Dimension	mm	60.7(H) x 84.0(V) x 3.3(T) (typ.)	w/o FPC
Pixel Pitch	mm	0.219(H) x 0.219(V)	
Pixel format	-	240 x RGB x 320	RGB Vertical Stripe
Number of Color	-	262,144	
Interface	-	SPI + 18bit RGB	
Power Consumption	mW	441(typ.)	LCD Panel + B/L
Brightness	cd/m <sup>2</sup>	250(typ.)	with T/P @ 20mA (6 LEDs)
Viewing Direction	o'clock	7	Non-inversion Direction
Weight	g	33.5(typ.)	

**Product Specification**

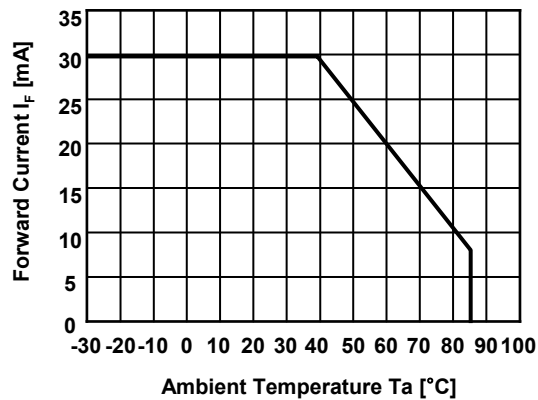
**2. ABSOLUTE MAXIMUM RATINGS**

If used the beyond absolute maximum ratings, this device can permanently be damaged.  
It is strongly recommended to use this device at a condition for normal operation.

Parameter	Symbol	Values		Unit	Remarks
		Min.	Max.		
Analog Power Supply Voltage	AVCC	-0.3	4.5	V	at 25 °C
IO Power Supply Voltage	IOVCC	-0.3	4.5	V	at 25 °C
LED Power Consumption	P <sub>LED</sub>	-	120	mW	Note 1
LED Current	I <sub>LED</sub>	-	30	mA	Note 1
Operating Temperature	Top	-20	70	°C	Note 2
Storage Temperature	Tst	-30	80	°C	Note 2
Storage Humidity	Hst	10	90	%RH	Note 2

Notes:

1. Applies to each LED individually. Please refer to the Fig. 2-1 for allowable forward current.
2. Wet bulb temperature should be 49 °C Max, and no condensation of water.



**Fig. 2-1**

**Product Specification**
**3. ELECTRICAL SPECIFICATIONS**
**3-1. ELECTRICAL CHARACTERISTICS**
*(GND=0V, Ta=25 °C)*

Parameter	Symbol	Values			Unit	Notes
		Min.	Typ.	Max.		
Analog Power Supply Voltage	AVCC	2.9	3.0	3.1	V	
I/O Power Supply Voltage	IOVCC	1.7	1.8	1.9	V	
“H”Level Input Voltage	V <sub>IH</sub>	0.8IOVCC	-	IOVCC	V	Note 1
“L”Level Input Voltage	V <sub>IL</sub>	-0.3	-	0.2IOVCC	V	Note 1
Power Consumption	P <sub>Nor</sub>	-	45	60	mW	Note 2
Power Consumption	P <sub>Stb</sub>	-	3	20	uW	Note 3

**Notes:**

1. Applicable to Data(R6G6B6), DCLK, HSYNC, VSYNC, RESET, SCL, SDI, SCS signals
2. The specified current and power consumption are under the conditions at AVCC = 3.0V, IOVCC=1.8V and fv=61 Hz, Full Black pattern is displayed and fv is the frame frequency.
3. Power & Display off state.

**3-2. BACKLIGHT UNIT**

The edge-lighting type of back light unit consists of 6 LEDs which are connected in serial.

*(GND=0V, Ta=25 °C)*

Parameter	Symbol	Values			Unit	Notes
		Min.	Typ.	Max.		
LED Current	I <sub>LED</sub>	-	20	30	mA	
LED Forward Voltage	V <sub>LED</sub>	-	19.8		V	

**3-3. TOUCH PANEL**
*(GND=0V, Ta=25 °C)*

Parameter	Min.	Typ.	Max.	Unit	Remarks
Linearity	-1.5	-	1.5	%	Note 1
Terminal Resistance	100	-	900	Ω	X-axis
	100	-	900	Ω	Y-axis
Insulation Resistance	20	-	-	MΩ	DC 25V
Voltage	-	5	7	V	DC
Chattering	-	-	20	ms	DC 5V, 100kΩ
Transparency	78	80	-	%	Note 2



**Product Specification**

[Note 1] Measurement of Linearity

Condition	Item
Pen Diameter	R0.8mm
Material	Poly-acetal resin
Pressure	0.150kg
Pitch	Film: 10mm
	Glass: 10mm

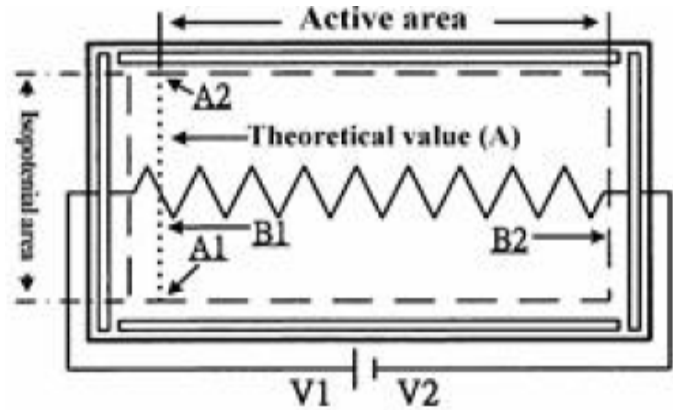


Fig 3.1 Measurement of Linearity

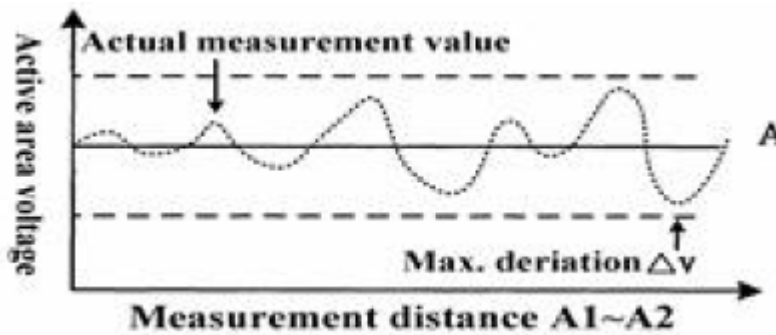


Fig 3.2 Linearity Calculate way

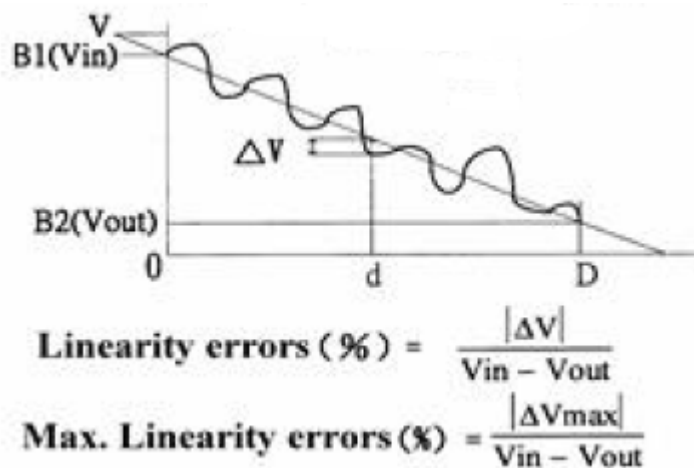


Fig 3.3 Linearity measurement theory diagram

Note 2 : Measurement by spectrophotometer MINOLTA CM\_3500d



## Product Specification

### 3-4. PIN ASSIGNMENT

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

*[Mating connector: FH23-39S-0.3SHW(HIROSE) or equivalent]*

Pin No.	Symbol	I/O	Description
1	GND	Power	Ground Reference (0V)
2	IOVCC	Power	I/O Power Supply
3	AVCC	Power	Analog Power Supply
4	GND	Power	Ground Reference (0V)
5	B0	I	Blue Data
6	B1	I	Blue Data
7	B2	I	Blue Data
8	B3	I	Blue Data
9	B4	I	Blue Data
10	B5	I	Blue Data (MSB)
11	G0	I	Green Data
12	G1	I	Green Data
13	G2	I	Green Data
14	G3	I	Green Data
15	G4	I	Green Data
16	G5	I	Green Data (MSB)
17	R0	I	Red Data
18	R1	I	Red Data
19	R2	I	Red Data
20	R3	I	Red Data
21	R4	I	Red Data
22	R5	I	Red Data (MSB)
23	GND	Power	Ground Reference (0V)
24	VSYNC	I	Vertical Sync Signal
25	HSYNC	I	Horizontal Sync Signal
26	GND	Power	Ground Reference (0V)
27	DCLK	I	Dot Clock
28	GND	Power	Ground Reference (0V)
29	SDI	I	Serial Data Input
30	SCL	I	Serial Data Clock
31	SCS	I	Serial Chip Select
32	RESET	I	LCD Reset
33	GND	Power	Ground Reference (0V)
34	X_R	Analog	Touch Panel X-Right
35	Y_B	Analog	Touch Panel Y-Bottom
36	X_L	Analog	Touch Panel X-Left
37	Y_T	Analog	Touch Panel Y-Top
38	LED_C	I	LED Cathode
39	LED_A	I	LED Anode

**Product Specification**

**3-5. COLOR INPUT DATA REFERENCE**

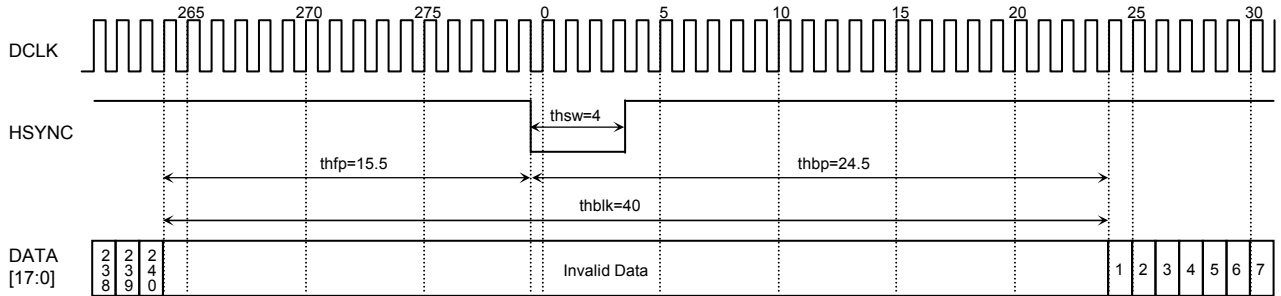
Display Colors		Data Signal																	
		R 5	R 4	R 3	R 2	R 1	R 0	G 5	G 4	G 3	G 2	G 1	G 0	B 5	B 4	B 3	B 2	B 1	B 0
Basic Color	Black	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0
	Green	0	0	0	0	0	0	1	1	1	1	1	1	0	0	0	0	0	0
	Blue	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1
	Cyan	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1
	Magenta	1	1	1	1	1	1	0	0	0	0	0	0	1	1	1	1	1	1
	Yellow	1	1	1	1	1	1	1	1	1	1	1	1	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
Red Gray Scale	Black	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Darker ↑	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
		0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
		•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
	Brighter ↓	1	1	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0
		1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0
Red	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	
Green Gray Scale	Black	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Darker ↑	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
		0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
		•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
	Brighter ↓	0	0	0	0	0	0	1	1	1	1	0	1	0	0	0	0	0	0
		0	0	0	0	0	0	1	1	1	1	1	0	0	0	0	0	0	0
Green	0	0	0	0	0	0	1	1	1	1	1	1	0	0	0	0	0	0	
Blue Gray Scale	Black	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Darker ↑	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
		•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
	Brighter ↓	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	0	1
		0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	0
Blue	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	

**Product Specification**

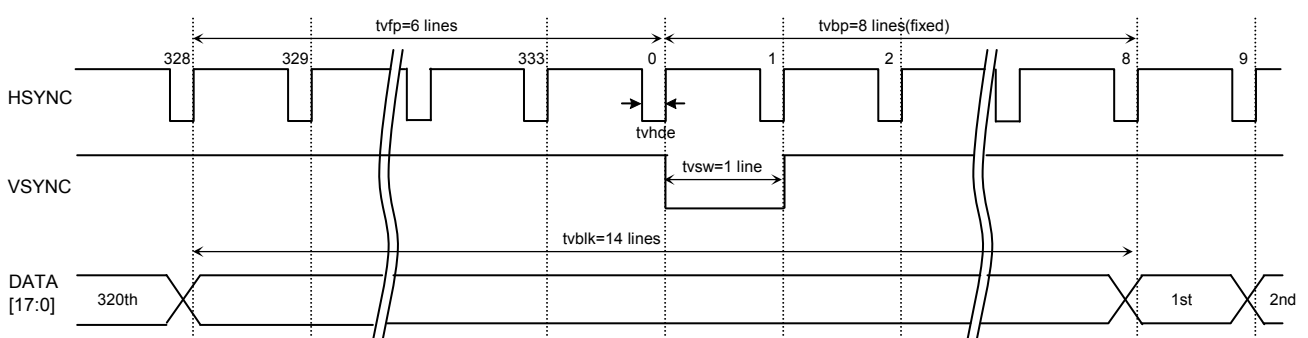
**3-6. SIGNAL TIMING SPECIFICATIONS**

**3-6-1. RGB Interface**

**Horizontal Timing**

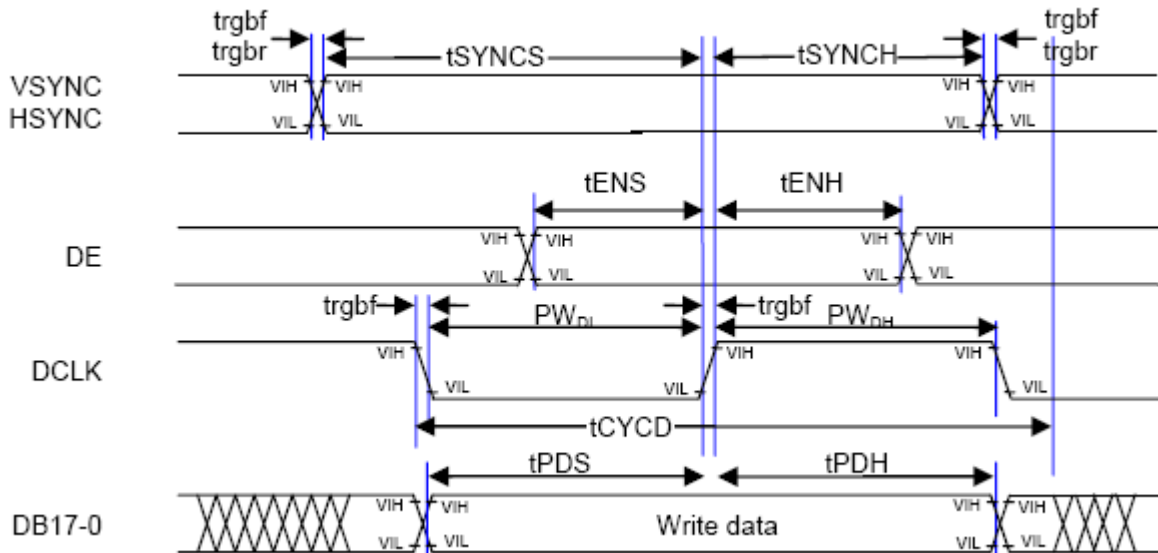


**Vertical Timing**



**RGB Timing Parameters**

Item	Symbol	Min.	Typ.	Max.	Unit	Remarks
Hsync low pulse width	thsw	4	4	8	clk	
Vsync low pulse width	tvsw	1	1	4	line	
Number of Horizontal		272	280	288	clk	
Horizontal blanking period	thblk	32	40	48	clk	
Hsync falling edge -> 1 <sup>st</sup> data start	thbp	-	24.5	-	clk	
Hsync front porch	thfp	7.5	15.5	23.5	clk	
Number of vertical		332	334	336	line	
Vertical blanking period	tvblk	12	14	16	line	
Vsync falling edge ->1 <sup>st</sup> data start	tvbp	-	8	-	line	
Vsync front porch	tvfp	4	6	8	line	
Vsync falling edge ->Hsync falling edge	tvhde	-5	-4	100	clk	

**Product Specification**
**RGB Timing waveform**

**RGB Timing characteristics**

Item	Symbol	Min.	Typ.	Max.	Unit	Remarks
Input clock voltage	V <sub>IL</sub>	-0.3	-	0.2IOVCC	V	
	V <sub>IH</sub>	0.8IOVCC	-	IOVCC	V	
Vertical frequency	f <sub>v</sub>	58	61	64	Hz	
Horizontal frequency	f <sub>h</sub>	19.5	20.4	21.2	kHz	
DCLK frequency	f <sub>ch</sub>	5.6	5.7	5.8	MHz	
DCLK pulse width	t <sub>clk</sub>	172	175	178	ns	
DCLK Low/High pulse width	PW <sub>DL</sub> , PW <sub>DH</sub>	32	0.5t <sub>clk</sub>	-	ns	
DCLK cycle time	t <sub>CYCD</sub>	80	-	-	ns	
Hsync setup time	t <sub>SYNCS</sub>	20	-	-	ns	
Hsync hold time	t <sub>SYNCH</sub>	20	-	-	ns	
Data setup time	t <sub>PDS</sub>	20	-	-	ns	
Data hold time	t <sub>PDH</sub>	20	-	-	ns	
Fast clock rise time	trgbr	-	-	25	ns	Note 1
Fast clock fall time	trgbf	-	-	25	ns	Note 1

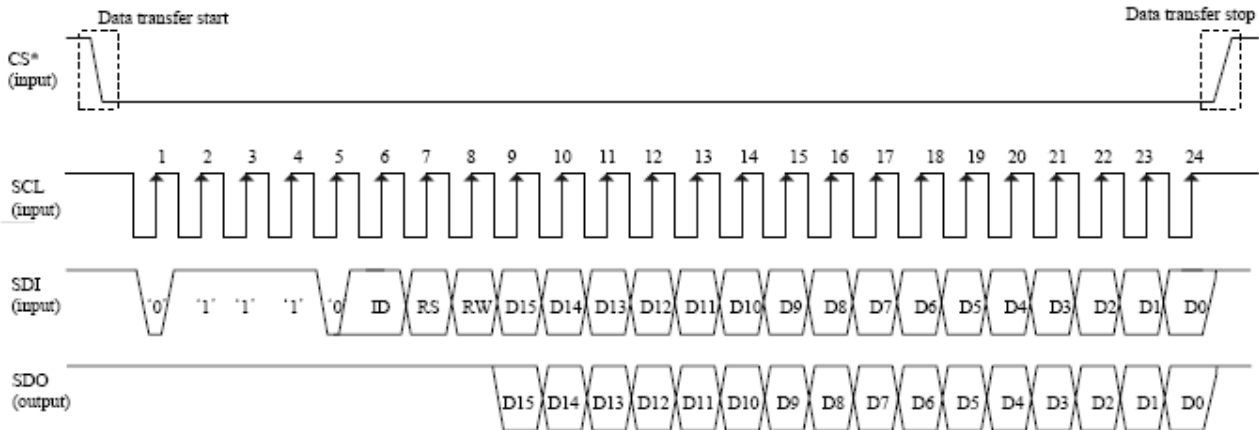
Notes: 1. DCLK, HSYNC

**Product Specification**

**3-6-2. Serial Peripheral Interface(SPI)**

The Serial Peripheral Interface(SPI) is available via the chip select line(CS\*), the serial transfer clock line(SCL), the serial data input(SDI), and the serial data output(SDO).

***Data transfer in SPI mode***



***Register Selection***

RS	R/W	Function
0	0	Set an index register
0	1	Read a status
1	0	Write an instruction
1	1	Read an instruction

***Start byte format***

Transferred bits	1	2	3	4	5	6	7	8
Start byte format	Device ID code						RS	R/W
	0	1	1	1	0	0		

ID bit

Note: ID bit is selected '0'

**Product Specification**

***Serial Peripheral Interface Timing Characteristics***

Item		Symbol	Unit	Min	Typ	Max
Serial clock cycle time	Write (received)	$t_{SCYC}$	ns	100	-	20000
	Read (transmitted)			350	-	20000
Serial clock "High" level pulse width	Write (received)	$t_{SCH}$	ns	40	-	-
	Read (transmitted)			150	-	-
Serial clock "Low" level pulse width	Write (received)	$t_{SCL}$	ns	40	-	-
	Read (transmitted)			150	-	-
Serial clock rise/fall time		$t_{ser}, t_{sef}$	ns	-	-	20
Chip select setup time		$t_{CSU}$	ns	20	-	-
Chip select hold time		$t_{CH}$	ns	60	-	-
Serial input data setup time		$t_{SISU}$	ns	30	-	-
Serial input data hold time		$t_{SIH}$	ns	30	-	-
Serial output data setup time		$t_{SOD}$	ns	-	-	130
Serial output data hold time		$t_{SOH}$	ns	5	-	-

**Product Specification**

**4. OPTICAL CHARACTERISTICS**

**4-1. Optical Characteristics – Backlight Off**

Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit	Remarks
Reflectivity	R	Optimal		4		%	Note 1 (Diffuse light)
White Chromaticity	Wx			0.326			Note 1 (Spot light)
	Wy			0.333			
Contrast ratio	CR	Optimal		4			Note 2
Viewing angle Range	$\theta$ UP	CR $\geq$ 2		50		°(degree)	Note 3
	$\theta$ DOWN			50		°(degree)	Note 3
	$\theta$ LEFT			50		°(degree)	Note 3
	$\theta$ RIGHT			50		°(degree)	Note 3
Response time	Tr + Tf	$\theta = 0^\circ$ Ta = 25 °C		40		ms	Note 4



**Product Specification**
**4-2. Optical Characteristics – Backlight On**

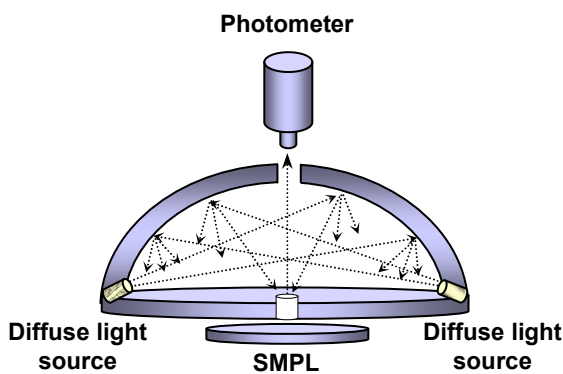
Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit	Remarks
Brightness	Y	$I_{LED}=20mA$	200	250		cd/m <sup>2</sup>	Note 1 [PR880]
Contrast ratio	CR	Optimal	100	120		-	Note 2
Viewing angle range	$\theta$ UP	CR $\geq 5$	40	45		°(degree)	Note 3
	$\theta$ DOWN		40	45		°(degree)	Note 3
	$\theta$ LEFT		40	45		°(degree)	Note 3
	$\theta$ RIGHT		40	45		°(degree)	Note 3
Response time	Tf + Tr	$\theta = 0^\circ$ Ta = 25 °C		35	50	ms	Note 4
Brightness Uniformity	Y	$I_{LED}=20mA$	75			%	Note 5 [PR880]
White Chromaticity	Wx	$\theta = 0^\circ$ Ta = 25 °C	0.260	0.310	0.360		Note 1 [PR650]
	Wy		0.280	0.330	0.380		
Red Chromaticity	Rx		0.560	0.610	0.660		
	Ry		0.300	0.350	0.400		
Green Chromaticity	Gx		0.290	0.340	0.390		
	Gy		0.530	0.580	0.630		
Blue Chromaticity	Bx		0.105	0.155	0.205		
	By		0.060	0.110	0.160		
Color Gamut	NTSC			50		%	

**Product Specification**

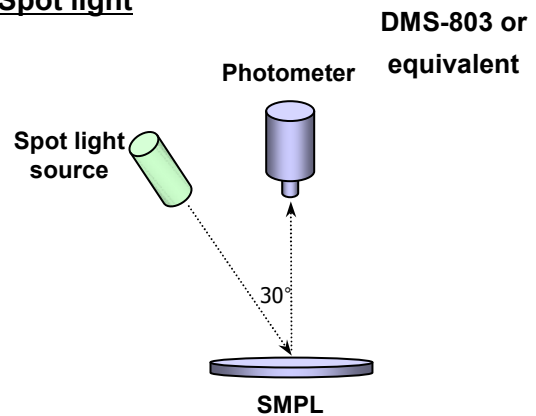
[Note 1] Optical Test Equipment Setup

Optical characteristics are determined after the unit has been 'ON' and stable for approximately 10 minutes in a dark environment at 25°C. The values specified are at an approximate distance 50cm from the LCD surface. In case of backlight on, measured on the center area of the panel by PHOTO RESEARCH photometer PR-880 & PR650 or Equivalent. In case of backlight off, measured on the center area of the panel by DMS-803

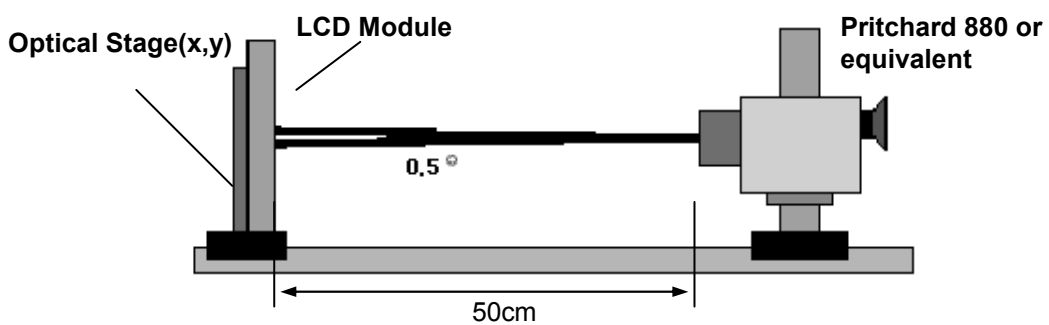
**Diffuse light**



**Spot light**



**Fig 4.1 Backlight Off (Optical Characteristic Measurement Equipment and Method)**



**Fig 4.2 Backlight On (Optical Characteristic Measurement Equipment and Method)**

**Product Specification**

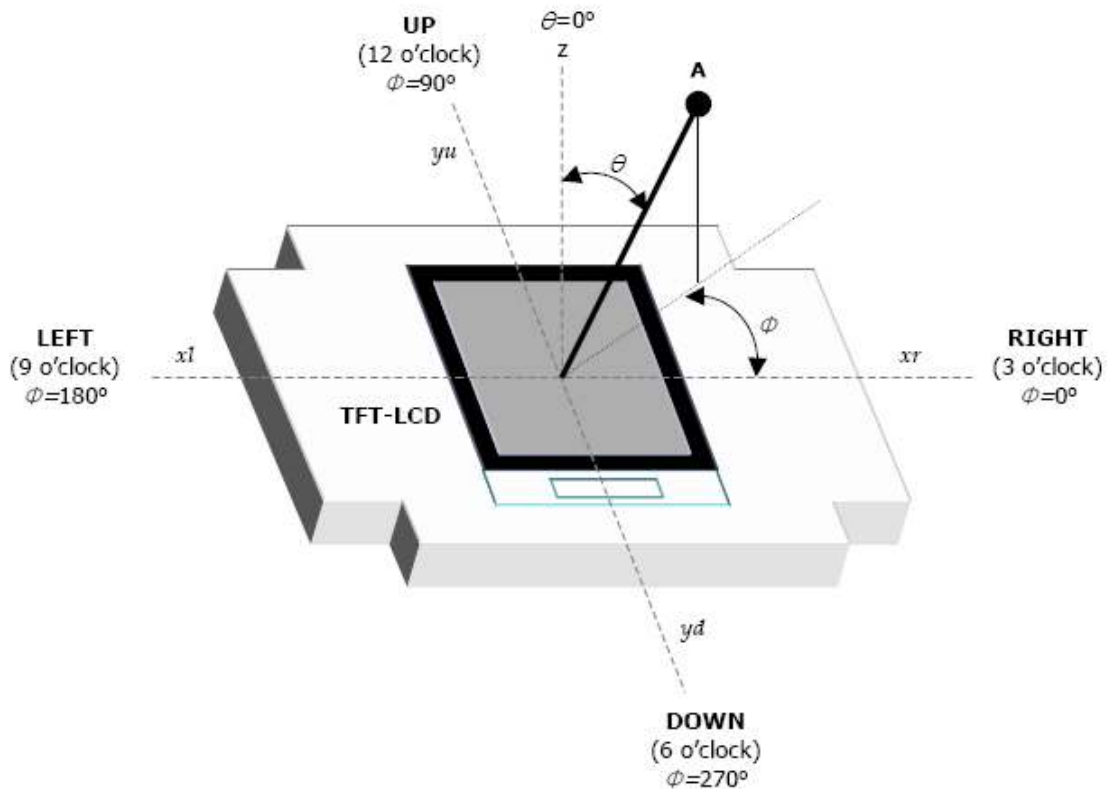
[Note 2]

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 3]

Viewing angle range is defined as follows;

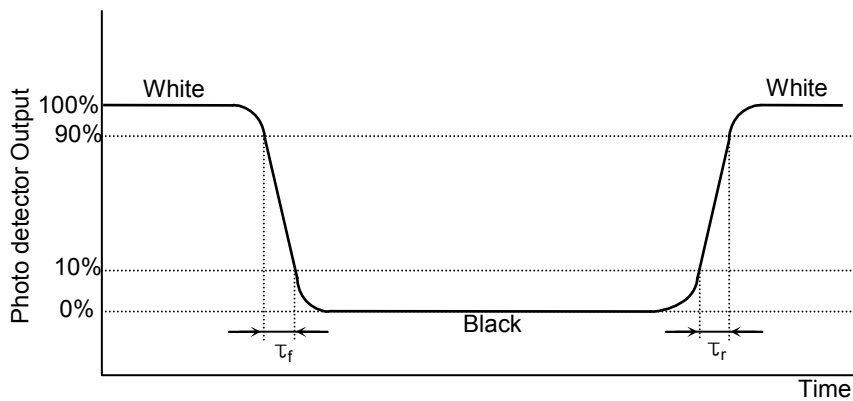


**Fig 4.3 Viewing Angle**

**Product Specification**

[Note 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”.

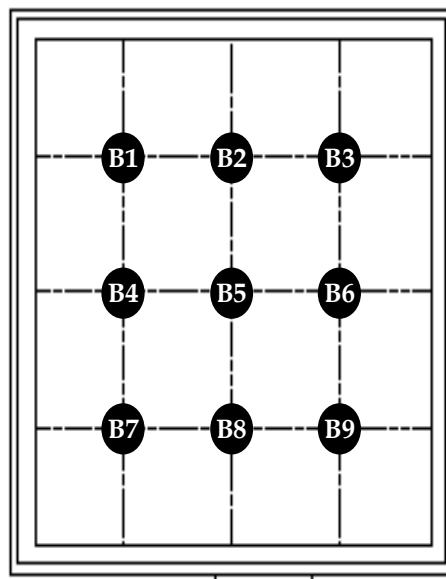


**Fig 4.4 Response Time Definition**

[Note 5]

The brightness measurement is taken at point B5.

$$\text{Brightness Uniformity} = \frac{\text{Minimum Photo detector output for B1-B9 with all pixels white}}{\text{Maximum Photo detector output for B1-B9 with all pixels white}} \times 100$$



**Fig 4.5 Brightness measurement points**

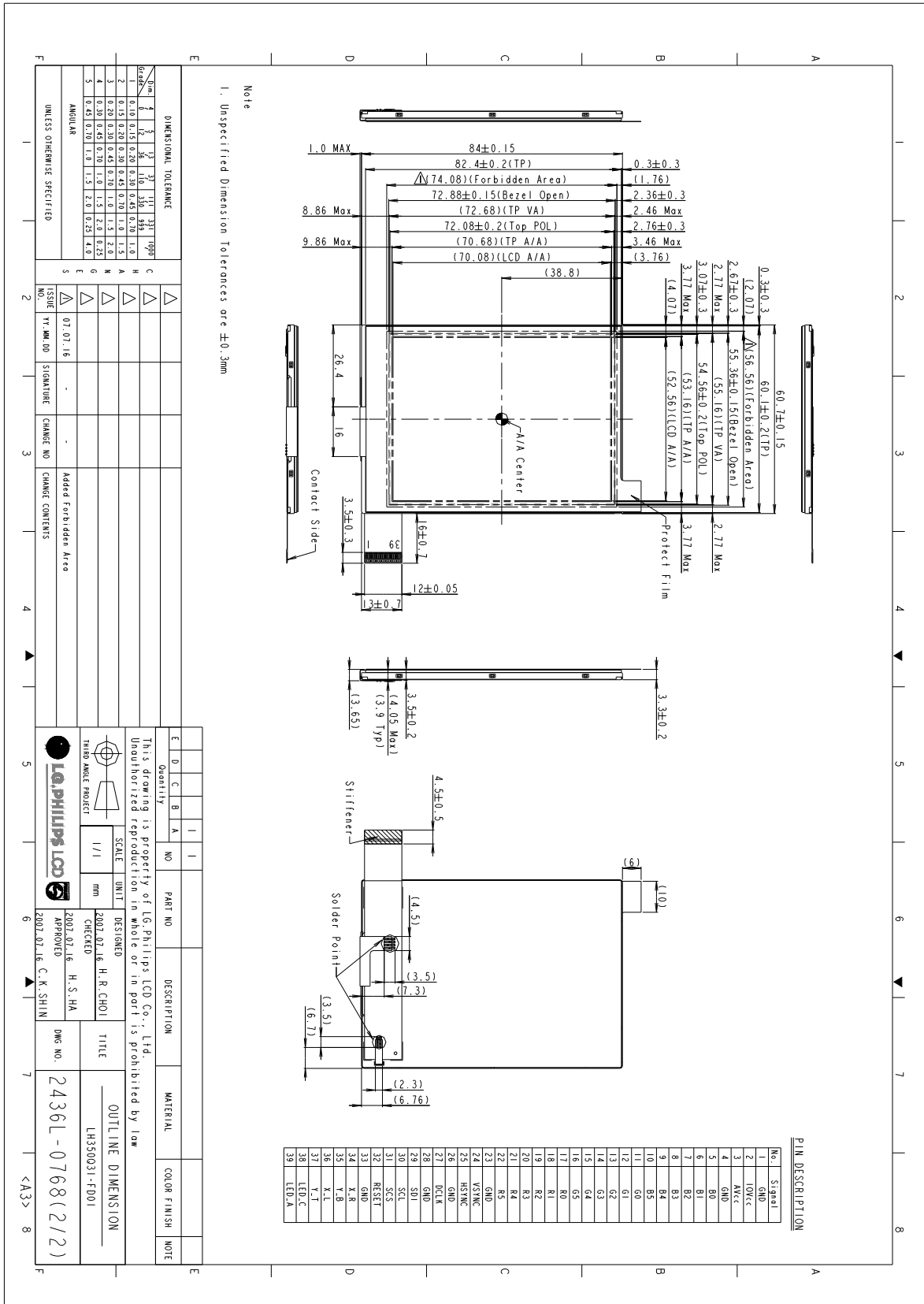
**Product Specification****5. MECHANICAL CHARACTERISTICS**

The contents provide general mechanical characteristics for the model LH350Q31.  
In addition the figures in the next page are detailed mechanical drawing of the LCD.

Dimension	Min.	Typ.	Max.	Unit
Horizontal (H)	60.55	60.70	60.85	mm
Vertical (V)	83.85	84.00	84.15	mm
Thickness (T)	3.1	3.3	3.5	mm

Product Specification

[ Outline Dimension ]

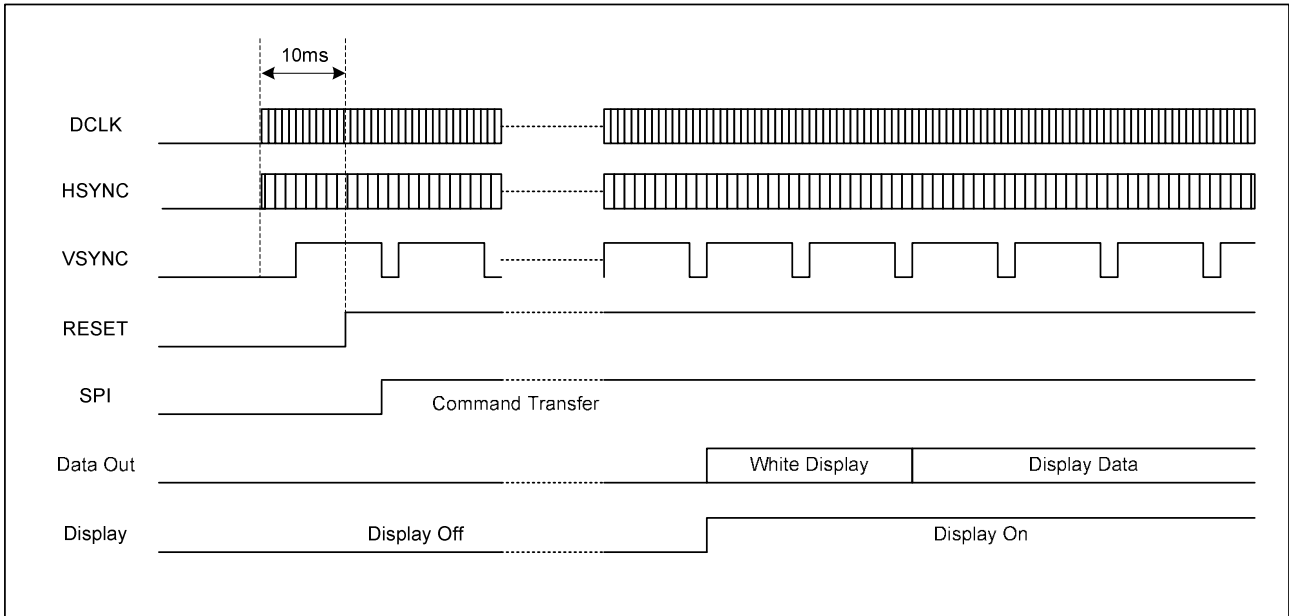




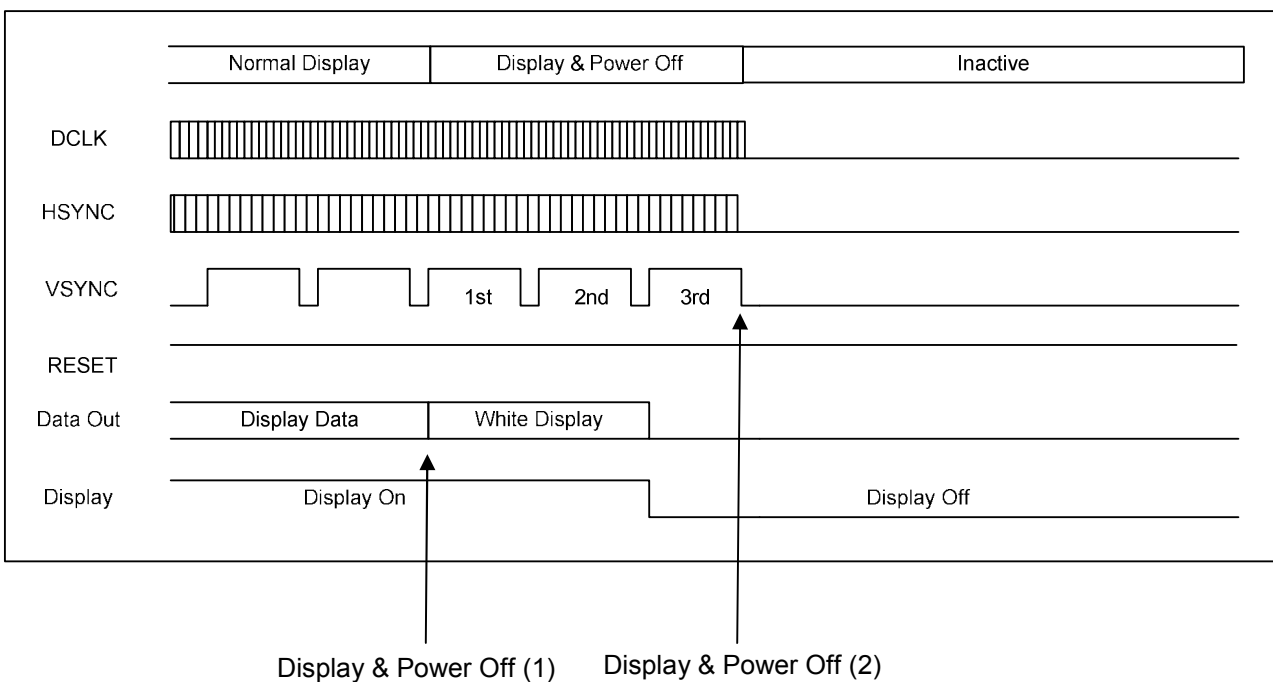


**Product Specification**

***Display On Sequence***



***Display Off Sequence***



**Product Specification**

***Power On***

Step	Register Setting		Operation	Remarks
	Register	Data		
1	IOVCC, AVCC simultaneously			Power On
2	1ms Delay or more			
3	RESET 10ms			Note 1
4	10ms Delay or more			

**Notes:**

1. DCLK should be input prior to H/W RESET

***Power Supply Setting***

Step	Register Setting		Operation	Remarks
	Register	Data		
1	700004	720070	SPI Enable	
2	700000	72626C	Resolution Control	
3	700006	720020	Instruction before power supply(1)	
4	700008	72034A	Instruction before power supply(2)	
5	700009	72002B	Instruction before power supply(3)	
6	70000A	720E0A	Instruction before power supply(4)	
7	70000B	72045B	Instruction before power supply(5)	

**Product Specification**

***Display Initial Setting***

Step	Register Setting		Operation	Remarks
	Register	Data		
1	700001	7202A7	RGB Timing Control	
2	70000D	720302	Gamma Control(1)	
3	70000E	720404	Gamma Control(2)	
4	70000F	720203	Gamma Control(3)	
5	700010	720402	Gamma Control(4)	
6	700011	720302	Gamma Control(5)	
7	700012	720404	Gamma Control(6)	
8	700013	720203	Gamma Control(7)	
9	700014	720402	Gamma Control(8)	
10	700015	721D04	Gamma Control(9)	
11	700016	720305	Gamma Control(10)	
12	700017	720401	Gamma Control(11)	
13	700018	720104	Gamma Control(12)	
14	700019	720401	Gamma Control(13)	
15	70001A	720104	Gamma Control(14)	

***Power & Display On***

Step	Register Setting		Operation	Remarks
	Register	Data		
1	700006	720030	Power & Display On	Note 1
200ms Delay or more				

Notes :

1. Vsync should be input prior to Power & Display On.

***Power & Display Off***

Step	Register Setting		Operation	Remarks
	Register	Data		
1	700006	720020	Display & Power Off (1)	Note 1
60ms Delay or more				
2	700006	720120	Display & Power Off (2)	
20ms Delay or more				

Notes :

1. More than 3 Vsycns should be input after Display & Power Off(1).



**Product Specification**

7-2. TOUCH PANEL RELIABILITY TEST

PARAMETER	MIN.	TYP.	MAX.	UNIT	REMARK
Activation force	-	-	80	g	R0.8mm polyacetal Pen or Finger
Durability (Surface scratching)	Write 150,000			Characters	Note 1
Durability (Surface pitting)	1,000,000			Touches	Note 2
Surface hardness	3	-	-	H	Judgment ref.JIS-K5400

[Note 1] Measurement for Surface area

- Force : 250gf
- Speed : 60m/sec
- Stylus : R0.8 poly-acetal resin
- Judgment  
Terminal Resistance : According to section 3-3  
Linearity : According to section 3-3

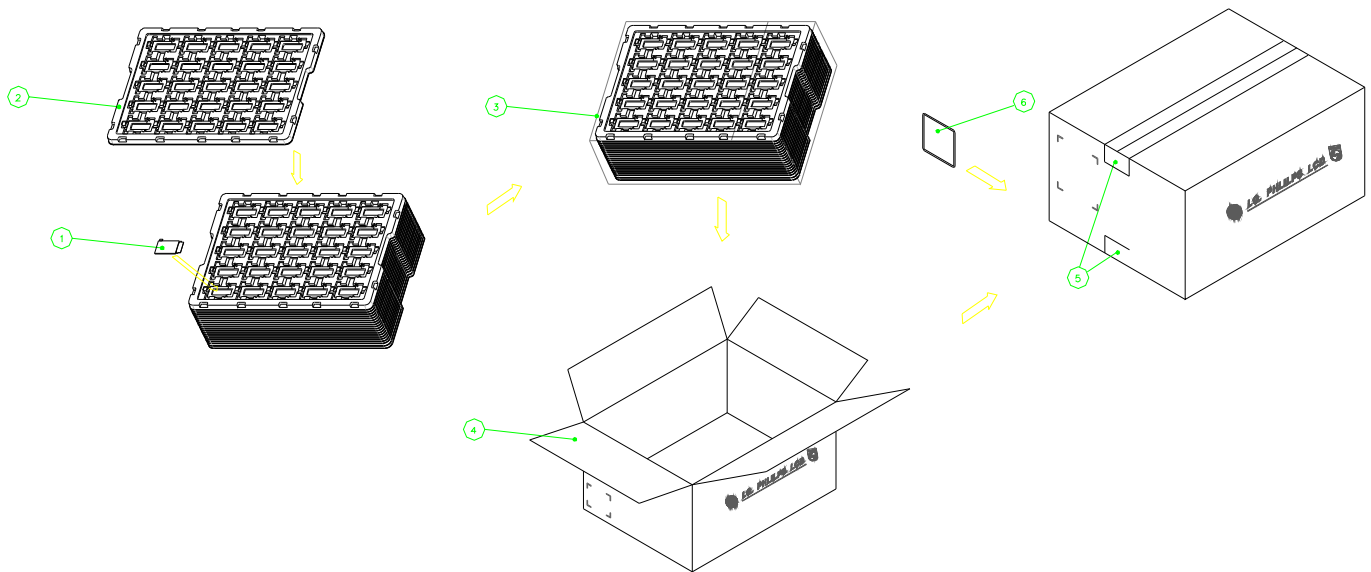
[Note 2] Pit 1,000,000 times on the Film with a R0.8 Poly-acetal resin

- Force : 250gf
- Frequency : 5Hz
- Judgment  
Terminal Resistance : According to section 3-3  
Linearity : According to section 3-3

**Product Specification**

**8. PACKING**

- a) Package quantity in one box : 240 pcs
- b) Box Size : 475mm X 348mm X 210mm
- c) 1Box = 20(Full tray) + 1 (dummy / top tray) = 21 tray



No.	Description	Material
1	Module	
2	Packing, tray	PET(0.8t)
3	Bag	PE 560x830
4	Box	SWR4
5	Tape	OPP 70MMx300m
6	Label	Art Paper 100x70

## Product Specification

### 9. PRECAUTIONS

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

#### 9-1. ASSEMBLY PRECAUTIONS

- (1) 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 resist external force.
- (2) You should adopt radiation structure to satisfy the temperature specification.
- (3) 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.
- (4) 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.)
- (5) When the surface becomes dusty, please wipe gently with absorbent cotton or other soft materials like chamois soaked with petroleum benzine. Normal-hexane is recommended for cleaning the adhesives used to attach front / rear polarizers. Do not use acetone, toluene and alcohol because they cause chemical damage to the polarizer.
- (6) Wipe off saliva or water drops as soon as possible. Their long time contact with polarizer causes deformations and color fading.
- (7) Do not open the case because inside circuits do not have sufficient strength.
- (8) The metal case of a module should be contacted to electrical ground of your system.

#### 9-2. 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) 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 minimize the interference.



## Product Specification

### 9-3. 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.

### 9-4. PRECAUTIONS FOR STRONG LIGHT EXPOSURE

Strong light exposure causes degradation of polarizer and color filter.

### 9-5. 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.  
It is recommended that they be stored in the container in which they were shipped.

### 9-6. 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.