Specification For Approval

( ) Preliminary Specification

(●) Final Specification

Customer	
Model	IM240DBN2B
Supplier	LG INNOTEK CO. LTD

Approved by APPEAL		Proposed by LG Innotek	
APPROVED BY	SIGNATURE	APPROVED BY	SIGNATURE
DESIGNED BY	SIGNATURE	DESIGNED BY	SIGNATURE
		H. Y. Yang	

VER.1.0 June. 12. 2007

Revision History

(A sheet refers to the sheet number after revision)

Date	Rev.	Sheet (New)	Contents of Modification
2007- 06- 12	0.0		
2007- 06- 26	1.0	30	Outline Dimension

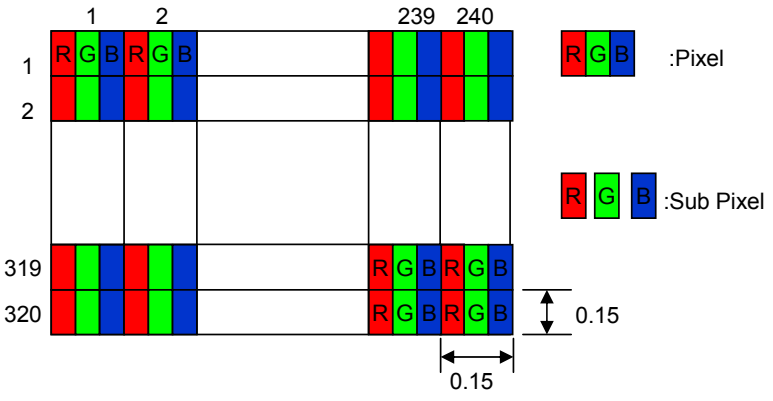
1. General Description

The IM240DBN2B model is a Color TFT(Main) supplied by LG Innotek.
This Module has a 2.36 inch diagonally measured active display area with 240X320 resolution.
Each pixel is divided into Red, Green and Blue sub-pixels and dots which are arranged in vertical stripes.
Main LCD color is determined with 262,000 Color signal for each pixel.
The IM240DBN2B has been designed to apply the interface method that enables low power, high speed, and high contrast.
The IM240DBN2B is intended to support applications where thin thickness, wide viewing angle , low power are critical factors and graphic displays are important.

2. General Features

Item	Main Display	Remark
Display Mode	Normally Black, Transmissive LCD	
Viewing Direction	6 O' Clock	
Driving Method	A-Si TFT Active Matrix	
Input Signals	8, 9, 16, 18 Bit CPU, RGB I/F Parallel	
Outside Dimensions	68.5mm(H) x 42.62mm(W) x 3.6mm(D)(Typ.)	
Active Area	36.0mm(H) x 48.0mm(W)	
Number of Pixels	240 ×RGB ×320 Pixels	Note 1)
Pixel Pitch	0.150mm(H) X 0.150mm(W)	Note 1)
Pixel Arrangement	RGB Vertical stripes	Note 1)
Drive IC	R61505U	
Touch panel	Resistive – 4wire	

Note 1)



3. Absolute Maximum Ratings

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

ITEM	Symbol	Min.	Typ.	Max.	Unit	Remark
Power input voltage	SYS-Vcc	-0.3	2.8	4.0	V	
Supply for logic	Vdd	-0.3	2.8	4.0	V	
Driving voltage	Vbat	-	3.7	-	V	
LED Forward current	I_F	-	-	25	mA	Per piece of LED
LED Reverse voltage	V_R	-	-	5	V	Per piece of LED
LED Permissible Loss	P_D	-	-	120	mW	Per piece of LED
Storage Humidity	Hstg	10	-	90	%RH	Note 1,2)
Storage temperature	T_{STG}	-30	-	70	˚C	Note 1,2)
Operating Ambient Humidity	H_{OP}	10	-	90	%RH	Note 1,2)
Operating Ambient Temperature	T_{OP}	-20	-	60	˚C	Note 1,2)

Note 1) Temp. ≤ 60℃ , 90% RH MAX.

Temp. 〉60℃ , Absolute humidity shall be less than 90% RH at 60℃

Note 2) The diagram below indicates the peripheral environment of the module.

The wet bulb temperature should be kept under 39 ˚C and there should be no compensation

If the LSI is used above these absolute maximum ratings, it may become permanently damaged.

4. Electrical Specification 1)

4.1 Main Window Display (TFT LCD)

(N = 10 / Ta=25℃)

Properties		Sym.	Min	Typ.	Max	Unit	Note
Power Supply for Analog		Vci	2.5	2.8	3.3	V	
Supply Voltage for Logic		Vdd	1.65	2.8	3.3	V	
Logic Signal Input Voltage		VIdL	Vss	-	0.2Vdd	V	2)
		VIdH	0.8Vdd	-	Vdd	V	2)
Input Leak Current		IIL	-1	-	1	μA	Vi=Vdd or GND
Current Consumption	Vci	Ivci	-	9	13	mA	Using LGIT Initial
	LED Driving	Ibat	-	80	90	mA	
Power Consumption	260K	P_{260K}	-	25	36	mW	3) Only panel
	Standby Mode	P_{STY}	-	0.003	0.01	mW	

Note :

1. The recommended operating conditions refers to a range in which operation of this product is guaranteed. Should this range is exceeded, the operation cannot be guaranteed even if the values may be within the absolute maximum ratings.
   Accordingly, please make sure that the module is used within this range.
   And these current values are measured under the condition that all device are stopped, each component is stable and Logic signal is input.

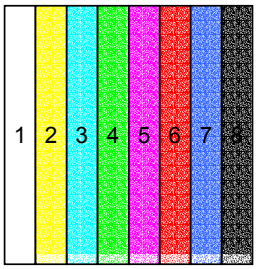
2. All the unused input terminals have to be connected to VDD or VSS. Please select appropriate one which meet the function required by unused terminal.

3. Power Consumption
   1) Display IC standstills while LCD is in the standby mode.
   Standby mode means Vdd is supplied and display IC has been reset.
   And these values are not peak current but constant current.

   2) Input Vcc voltage : 2.8V ± 0.1V
   - Test Equipment : Oscilloscope TDS5104 (Maker : Tektronix)

   3) Measure the current after set up a current meter on Vcc Line.
   - Test Equipment : Multi-tester 85Ⅲ (Maker : FLUKE)
   - Display Tester : J600(Using recommended LGIT Initial code)
   - Resolving Power : 1/100 mA

   4) Measure Power consumption of the display pattern, the “Color-Bar”.
   (These peak value is White pattern in whole area)
   1. White
   2. Yellow
   3. Light blue
   4. Green
   5. Purple
   6. Red
   7. Blue
   8. Black



5. 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 500mm from the LCD surface at a viewing angle of Φ and θ equal to 0 °.

5.1 Main LCD (TFT)

Ta = 25 (Ambient temperature)

Spec	Parameter	Symbol	Condition	Values			Unit	Notes
				Min	Typ	Max		
With Backlight LED ON	Contrast Ratio	C/R	θ =0°	250	350	-		Fig.1
	Luminance	BP	θ=0°	150	200	-	cd/m^2	Fig. 2
	Luminance Uniformity	ΔL	θ =0°	75	80	-	%	Fig. 2
	Response Time	Tr+Tf	θ =0°	-	35	100	ms	Fig. 2
	Viewing Angle	9시	CR>5	-	80	-	°	Fig.4
		3시		-	80	-	°	
		12시		-	80	-	°	
		6시		-	80	-	°	
	CIE Color Coordinate 1931	Wx	θ =0°	0.28	0.31	0.34		Fig. 1
		Wy		0.28	0.31	0.34		
		Rx	θ =0°	0.59	0.62	0.65		
		Ry		0.33	0.36	0.39		
		Gx	θ =0°	0.28	0.31	0.34		
		Gy		0.57	0.60	0.63		
		Bx	θ =0°	0.12	0.15	0.18		
		By		0.03	0.06	0.09		
Color Gamut			θ =0°	50	60	-	%	Fig. 1

Notes :

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

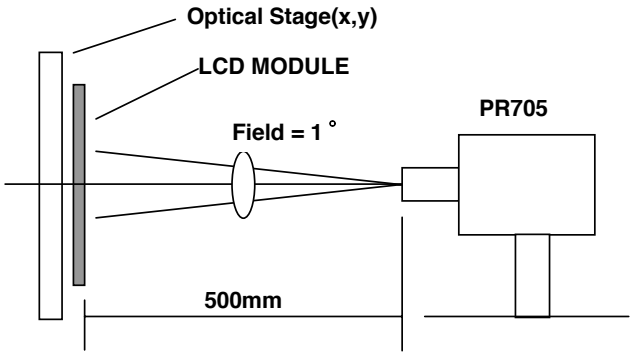
$$\text{Contrast Ratio} = \frac{\text{Surface Luminance with all white pixels}}{\text{Surface Luminance with all black pixels}}$$

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. Response time is the time required for the display to transition from white to black (Rising 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 LCD surface. For more information see FIG 4.

FIG. 1. Optical Characteristic Measurement Equipment and Method



<Transmissive Mode>

- Measurement System (Measurement Procedure A) With backlight turned on
- Measuring Instrument: PR705 made by PHOTO RESEARCH
- Measuring Field : 1°
- Environment: Inside a darkroom

Fig. 2. Measurement Points for Luminance

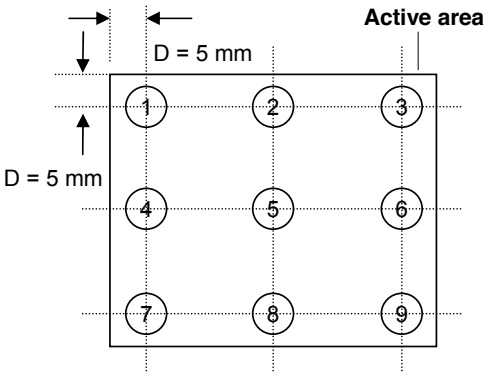
◀ Luminance Uniformity

Use (1) (Measurement Procedure A) under Measurement System with the backlight turned on, the luminance uniformity should be obtained from the next expression, when white raster (white : gradation level L63) is displayed: (* LED Current = 20mA)

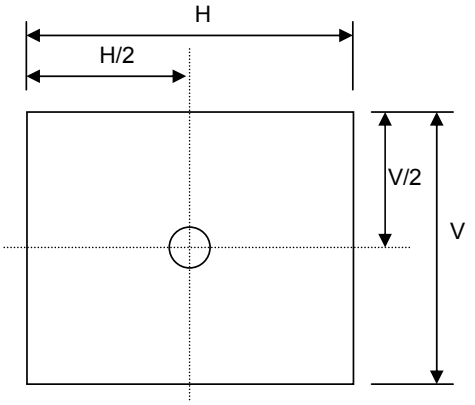
$$\text{Luminance Uniformity} = \frac{[\text{Luminance(AVR)} - (\text{Luminance(Max)} - \text{Luminance(min)})]}{\text{Luminance(AVR)}}$$

▶ Luminance

Use (1) (Measurement Procedure A) under Measurement System with the backlight turned on to measure the luminance when white raster (white: gradation level L63) is displayed.



<Measuring point for luminance uniformity>



<Measuring point for luminance>

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”.

- Rising Time(Tr) : Full White 90% → Full White 10% Transmittance.
- Falling Time(Tf) : Full White 10% → Full White 90% Transmittance.

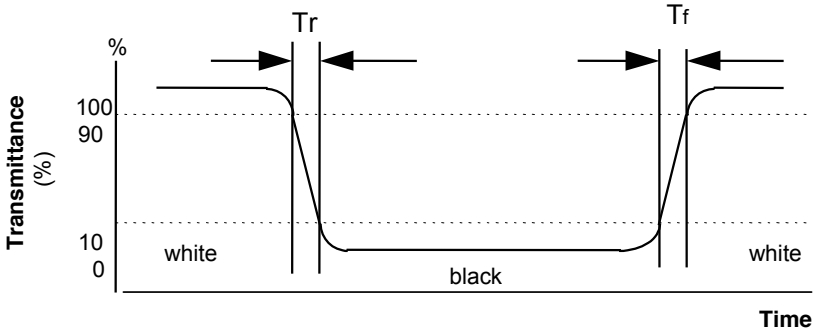
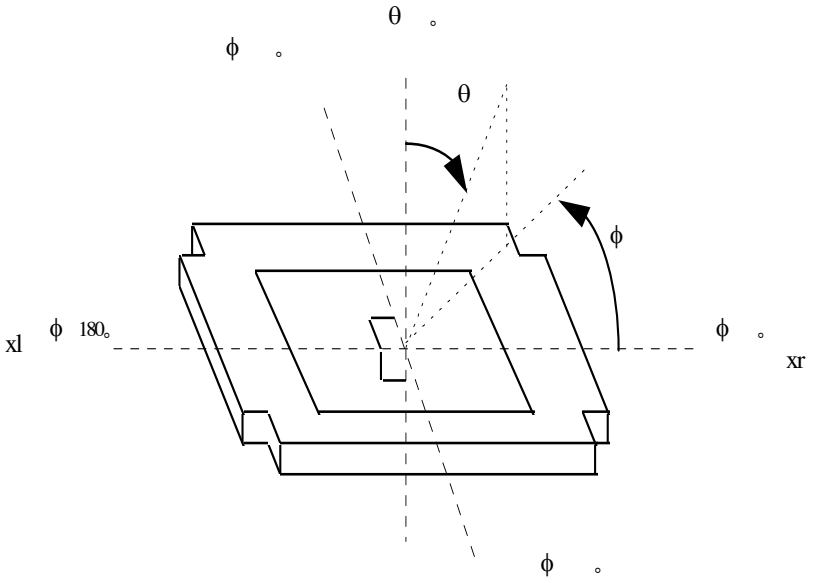


FIG. 4. The definition of viewing angle

Use Fig. 1 (Measurement Procedure A) under Measurement System to measure the contrast from the measuring direction specified by the conditions under item chapter 5.

<dimension of viewing angle range>



6. Touch Panel Specifications

6.1 Electrical & Optical Characteristics

Characteristics	Min	Typ.	Max	Unit	Note
Linearity	-1.5	-	1.5	%	
Terminal resistance	200	-	900	Ω	X (Film side)
	200	-	900	Ω	Y (Film side)
Insulation resistance	20	-	-	MΩ	@25V
Response Time	-	-	10	ms	
Light Transmittance	-	83	-	%	JIS-K7105

6.2 Mechanical & Reliability Characteristics

Characteristics	Min	Typ.	Max	Unit	Note
Activation force	-	-	80	g	(1)
Surface Hardness	3	-	-	H	JIS-K5600
Surface Scratching Test	100,000	-	-	straight line	(2)
Surface Touch Test	1,000,000	-	-	Touches	(3)
Flexible tail peeling strength	400	-	-	g/cm	(4)

Note (1) Input with stylus or finger(R0.8)

(2) Scratch straight line on the Film with a POM pen

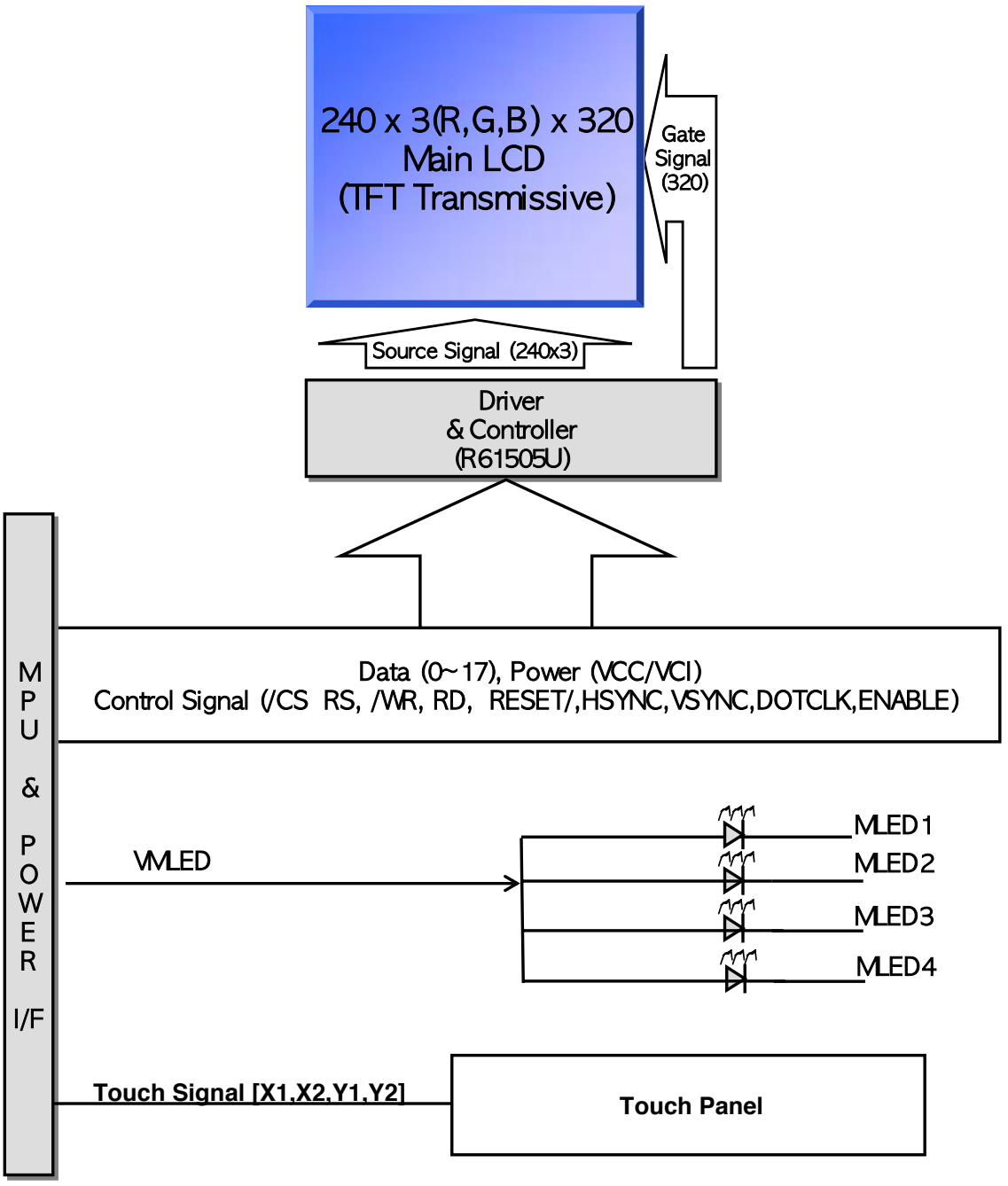
Force : 250gf, Speed : 60mm/sec, Contact range : 20mm, POM pen : 0.8R Polyacetal stylus

(3) Pit on the Film with a R8.0mm Silicon rubber.

Force : 250gf, Speed : 2 times/sec

(4) Put at 90° deg. In the direction of X, Speed : 50mm/min

7. Block Diagram



8. Pin Description

8.1. Input Signal and Power : Pin Description (Input Pin : 45Pin FPC PAD)

<table>
<tr><th>Pin no.</th><th>Name</th><th>Description</th><th colspan="7">Remark</th></tr>
<tr><td>1</td><td>GND</td><td>GROUND</td><td colspan="7">-</td></tr>
<tr><td rowspan="5">2
3</td><td rowspan="5">IM3
IM0</td><td rowspan="5">BUS OPTION</td><td>IM3</td><td>IM2
(- GND)</td><td>IM1
(- IOVcc)</td><td>IM0</td><td>Interface Mode</td><td>DB Pin</td><td>Colors</td></tr>
<tr><td>0</td><td>0</td><td>1</td><td>0</td><td>80- system
16- bit Interface</td><td>DB 17- 10
DB 8- 1</td><td>262, 144</td></tr>
<tr><td>0</td><td>0</td><td>1</td><td>1</td><td>80- system
8- bit Interface</td><td>DB 17- 10</td><td>262, 144</td></tr>
<tr><td>1</td><td>0</td><td>1</td><td>0</td><td>80- system
18- bit Interface</td><td>DB 17- 0</td><td>262, 144</td></tr>
<tr><td>1</td><td>0</td><td>1</td><td>1</td><td>80- system
9- bit Interface</td><td>DB 17- 9</td><td>262, 144</td></tr>
<tr><td>4</td><td>#RESET</td><td>RESET</td><td colspan="7">Initializes the R61505U when it is low.</td></tr>
<tr><td>5</td><td>VSYNC</td><td>VSYNC</td><td colspan="7">Frame synchronous signal for RGB interface operation. Low active.</td></tr>
<tr><td>6</td><td>HSYNC</td><td>HSYNC</td><td colspan="7">Line synchronous signal for RGB interface operation. Low active.</td></tr>
<tr><td>7</td><td>DOTCLK</td><td>DOT CLOCK</td><td colspan="7">Dot clock signal for RGB interface operation.
The data input timing is on the rising edge of DOTCLK</td></tr>
<tr><td>8</td><td>DEN</td><td>DATA ENABLE</td><td colspan="7">L : accessible (select)
H : Not accessible (Not select)</td></tr>
<tr><td>9</td><td>GND</td><td>GROUND</td><td colspan="7">-</td></tr>
<tr><td>10</td><td>DB17</td><td rowspan="18">DATA</td><td colspan="7" rowspan="18">* 18- bit parallel bi- directional data bus for 80- system interface operation (Amplitude : IOVcc- IOGND)
8- bit I/F : DB17- DB10 are used
9-bit I/F : DB17-DB9 are used
16-bit I/F : DB17-DB10 and DB8-1 are used
18-bit I/F : DB17-DB0 are used

* 18-bit parallel bi-directional data bus for RGB interface operation (Amplitude : IOVcc-IOGND)
6-bit I/F : DB17-DB12 are used
16-bit I/F : DB17-DB13 and DB11-1 are used
18-bit I/F : DB17-DB0 are used</td></tr>
<tr><td>11</td><td>DB16</td></tr>
<tr><td>12</td><td>DB15</td></tr>
<tr><td>13</td><td>DB14</td></tr>
<tr><td>14</td><td>DB13</td></tr>
<tr><td>15</td><td>DB12</td></tr>
<tr><td>16</td><td>DB11</td></tr>
<tr><td>17</td><td>DB10</td></tr>
<tr><td>18</td><td>DB9</td></tr>
<tr><td>19</td><td>DB8</td></tr>
<tr><td>20</td><td>DB7</td></tr>
<tr><td>21</td><td>DB6</td></tr>
<tr><td>22</td><td>DB5</td></tr>
<tr><td>23</td><td>DB4</td></tr>
<tr><td>24</td><td>DB3</td></tr>
<tr><td>25</td><td>DB2</td></tr>
<tr><td>26</td><td>DB1</td></tr>
<tr><td>27</td><td>DB0</td></tr>
</table>

Pin no.	Name	Description	Remark
28	GND	GROUND	-
29	FMARK	FRAME MARK	Frame head pulse signal, which is used when writing data to the internal RAM
30	GND	GROUND	-
31	#RD	READ ENABLE	Low active
32	#WR	WRITE ENABLE/SERIAL CLOCK	Low active
33	RS	RESISTER SELECT	L : select Index or status register H : select control register
34	#CS	CHIP SELECT	L : the R61505U is selected and accessible H : the R61505U is not selected and not accessible
35	IOVCC	1.8V for IO	Power supply to the interface pins : RESET*,CS*,WR,RD*,RS, DB17-0,VSYNC,HSYNC,DOTCLK,ENABLE
36	VCC	2.8V for LCD	Power supply to internal logic regulator circuit : Vcc=2.5v~3.3v, Vcc≥ IOVcc
37	VCC		
38	GND	GROUND	-
39	LED(CA)	BLU	Cathode of BLU
40	LED(CA)		
41	LED(CA)		
42	LED(CA)		
43	LED(AN)		Anode of BLU
44	LED(AN)		
45	GND	GROUND	-

8.2. Relation between Input Signal and Color

		R0	R1	R2	R3	R4	R5	G0	G1	G2	G3	G4	G5	B0	B1	B2	B3	B4	B5	
BASIC COLOR	BLACK	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	1	1	1	1	1	1	-
	GREEN	0	0	0	0	0	0	1	1	1	1	1	1	0	0	0	0	0	0	-
	CYAN	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	-
	RED	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	-
	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	-
GRAY SCALE OF RED	BLACK	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	R0
	DARK	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	R1
	.	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	R2
	.	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	R3~R60
	.	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	
	.	1	0	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	R61
	LIGHT	0	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	R62
	RED	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	R63
GRAY SCALE OF GREEN	BLACK	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	G0
	DARK	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	G1
	.	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	G2
	.	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	G3~G60
	.	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	
	.	0	0	0	0	0	0	1	0	1	1	1	1	0	0	0	0	0	0	G61
	LIGHT	0	0	0	0	0	0	0	1	1	1	1	1	0	0	0	0	0	0	G62
	GREEN	0	0	0	0	0	0	1	1	1	1	1	1	0	0	0	0	0	0	G63
GRAY SCALE OF BLUE	BLACK	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	B0
	DARK	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	B1
	.	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	B2
	.	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	B3~B60
	.	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	
	.	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	1	1	1	B61
	LIGHT	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	B62
	BLUE	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	B63

Note) Gray definition

Rn : RED Gray, Gn : GREEN Gray, Bn : BLUE Gray (n = Gray Level)

Input Signal : 0 = Low level voltage, 1 = High level voltage

9. REGISTER VALUE

9.1. Command Description(1)

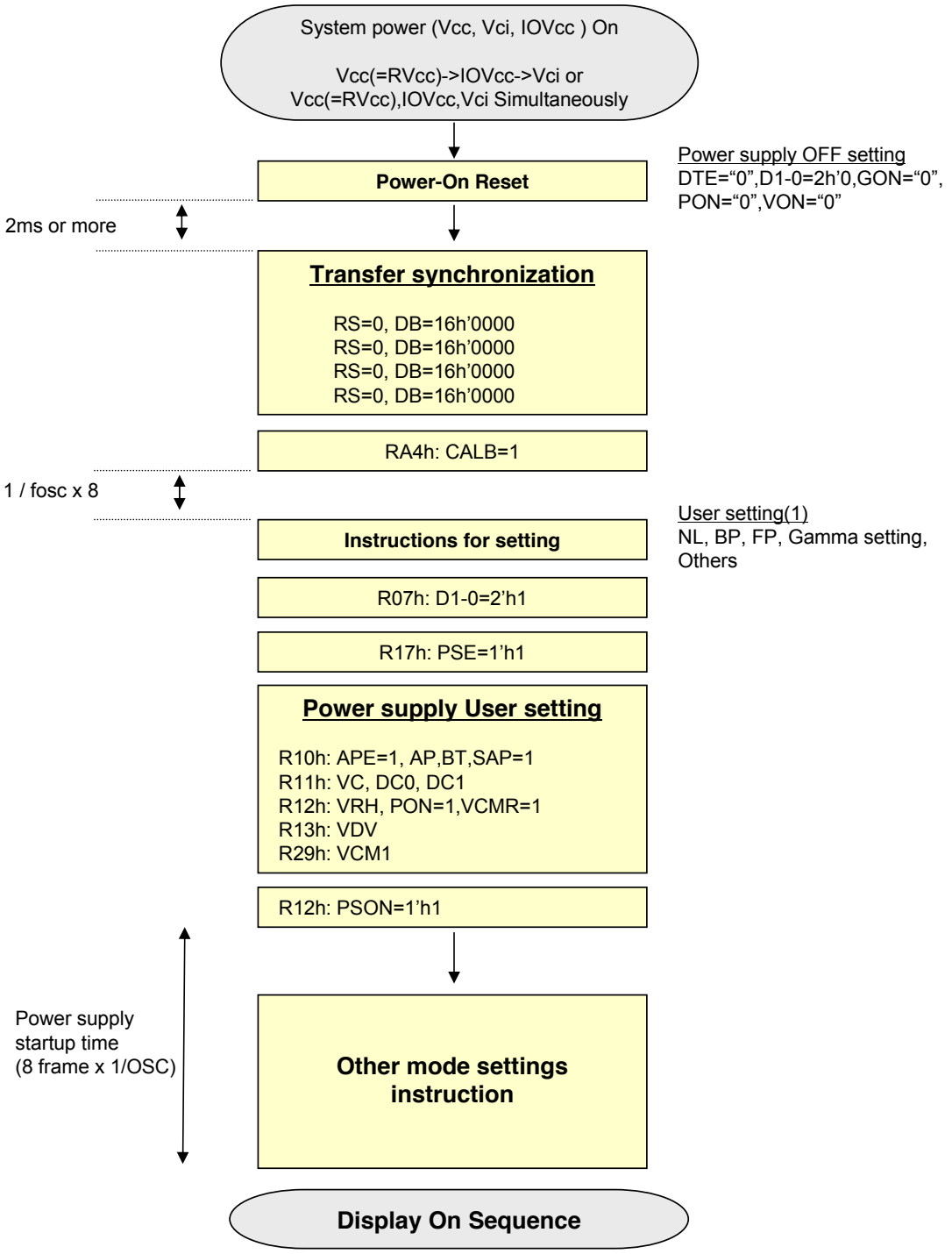
Register No.	Register	Initial Value	Etc.
RA4h	Start Oscillation	0001h	Display Control1
R07h	Display Control (1)	0000h	
R12h	Power Control (3)	0000h	
R08h	Display Control (2)	0404h	
R30h	Gamma Control (1)	0007h	Gamma Control
R31h	Gamma Control (2)	0000h	
R32h	Gamma Control (3)	0700h	
R33h	Gamma Control (4)	0303h	
R34h	Gamma Control (5)	0303h	
R35h	Gamma Control (6)	0707h	
R36h	Gamma Control (7)	1F1Fh	
R37h	Gamma Control (8)	0401h	
R38h	Gamma Control (9)	0700h	
R39h	Gamma Control (10)	0707h	
R3Ah	Gamma Control (11)	0303h	
R3Bh	Gamma Control (12)	0303h	
R3Ch	Gamma Control (13)	0700h	
R3Dh	Gamma Control (14)	0C0Ch	
R07h	Display Control (1)	0101h	Power Control
R17h	Power Control (5)	0001h	
R10h	Power Control (1)	16B0h	
R11h	Power Control (2)	0007h	
R12h	Power Control (3)	0119h	
R13h	Power Control (4)	0F00h	
R29h	EPROM Read Data (2)	0018h	
R12h	Power Control (3)	0139h	

9. REGISTER VALUE

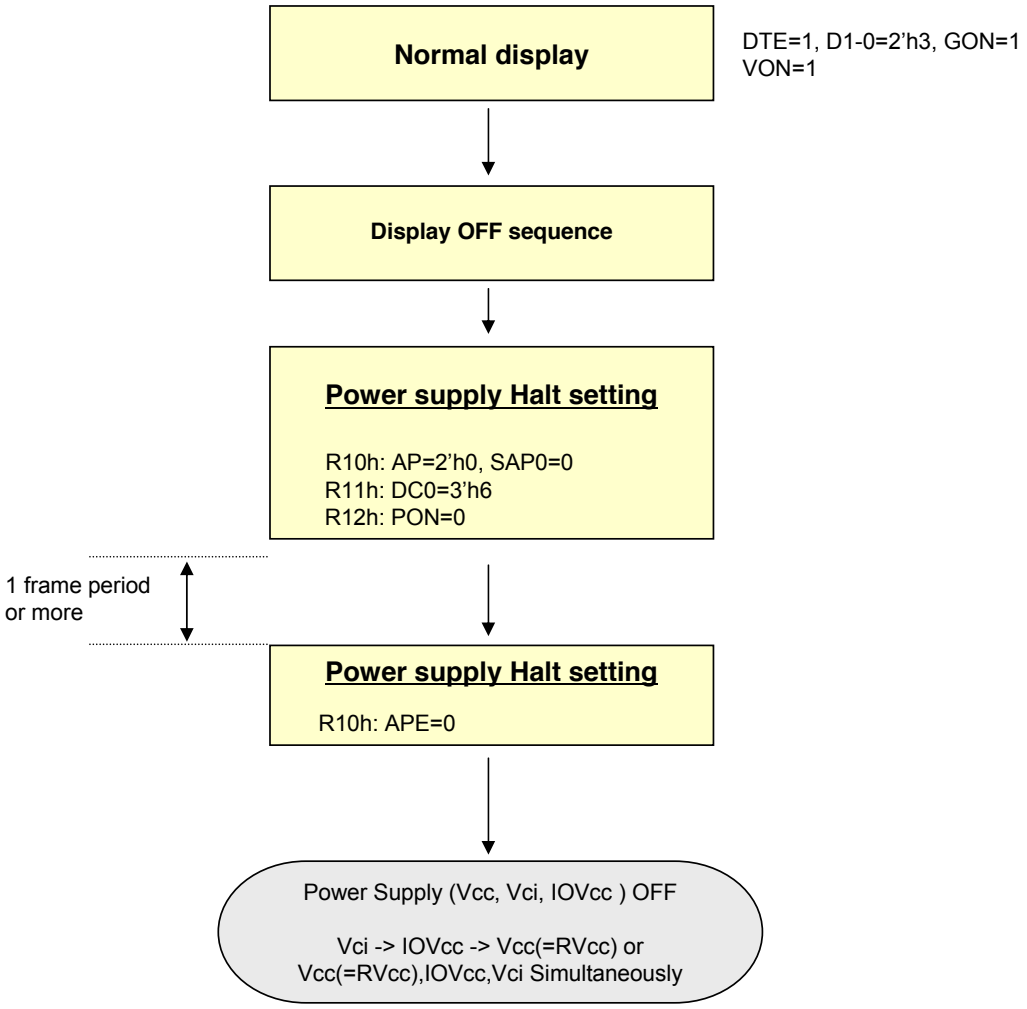
9.1. Command Description(2)

Register No.	Register	Initial Value	Etc.
R01h	Driver Output Control1	0500h	
R02h	Liquid crystal drive waveform	0700h	
R03h	Entry Mode	1030h	
R04h	Resize control	0000h	
R09h	Display Control (3)	0020h	
R50h	Horizontal RAM Address Start Position	0000h	Window address Control
R51h	Horizontal RAM Address End Position	00EFh	
R52h	Vertical RAM Address Start Position	0000h	
R53h	Vertical RAM Address End Position	013Fh	
R60h	Driver Output Control	2700h	Base Display Control
R61h	Base Image display control	0000h	
R90h	Panel interface control 1	0010h	
R92h	Panel interface control 2	0100h	
R93h	Panel interface control 3	0002h	
R20h	RAM Address Set (Horizontal)	0000h	RAM Access
R21h	RAM Address Set (Vertical)	0000h	
R22h	RAM Data Write/Read	-	

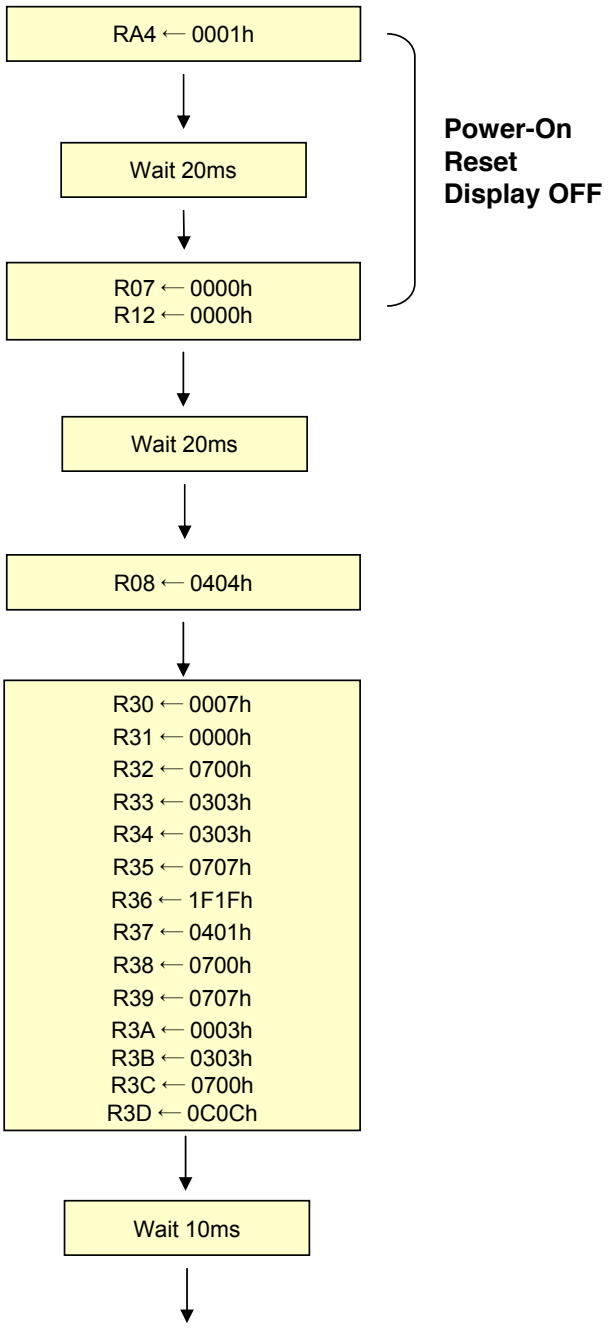
9.2. Power on Sequence



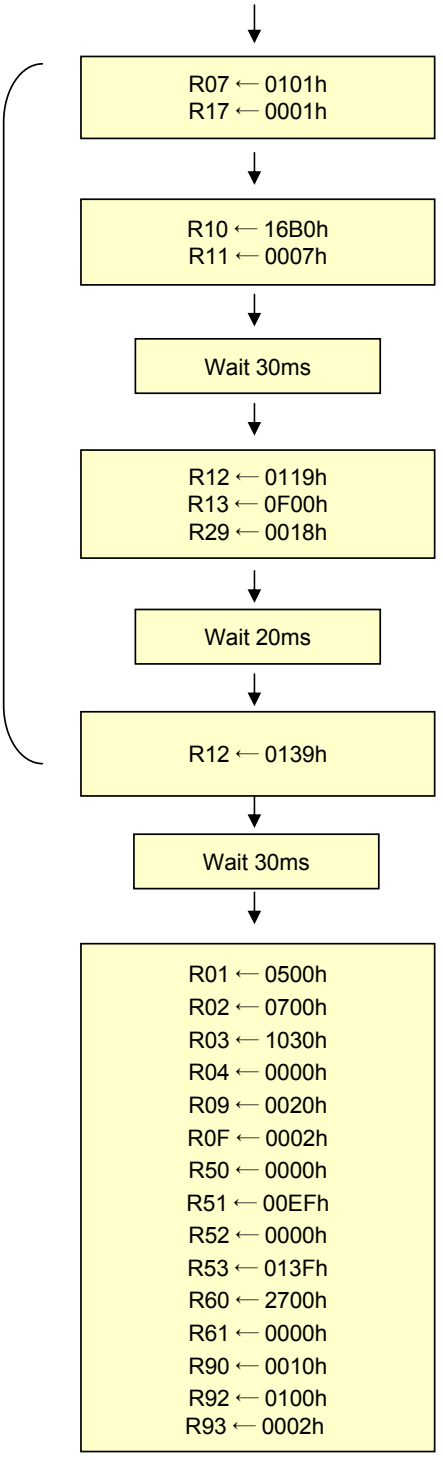
9.3. Power off sequence



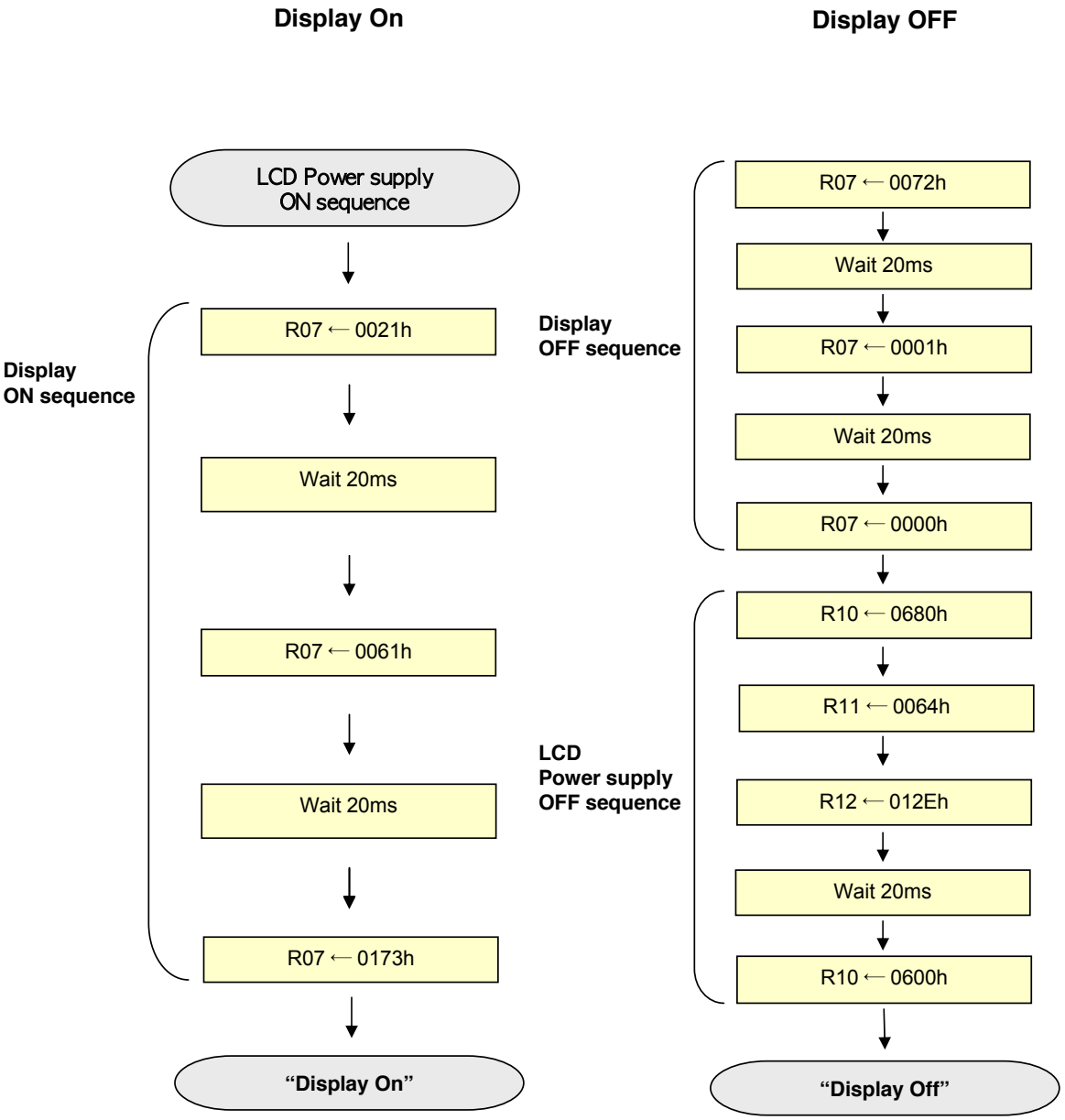
9.4. LCD initial sequence



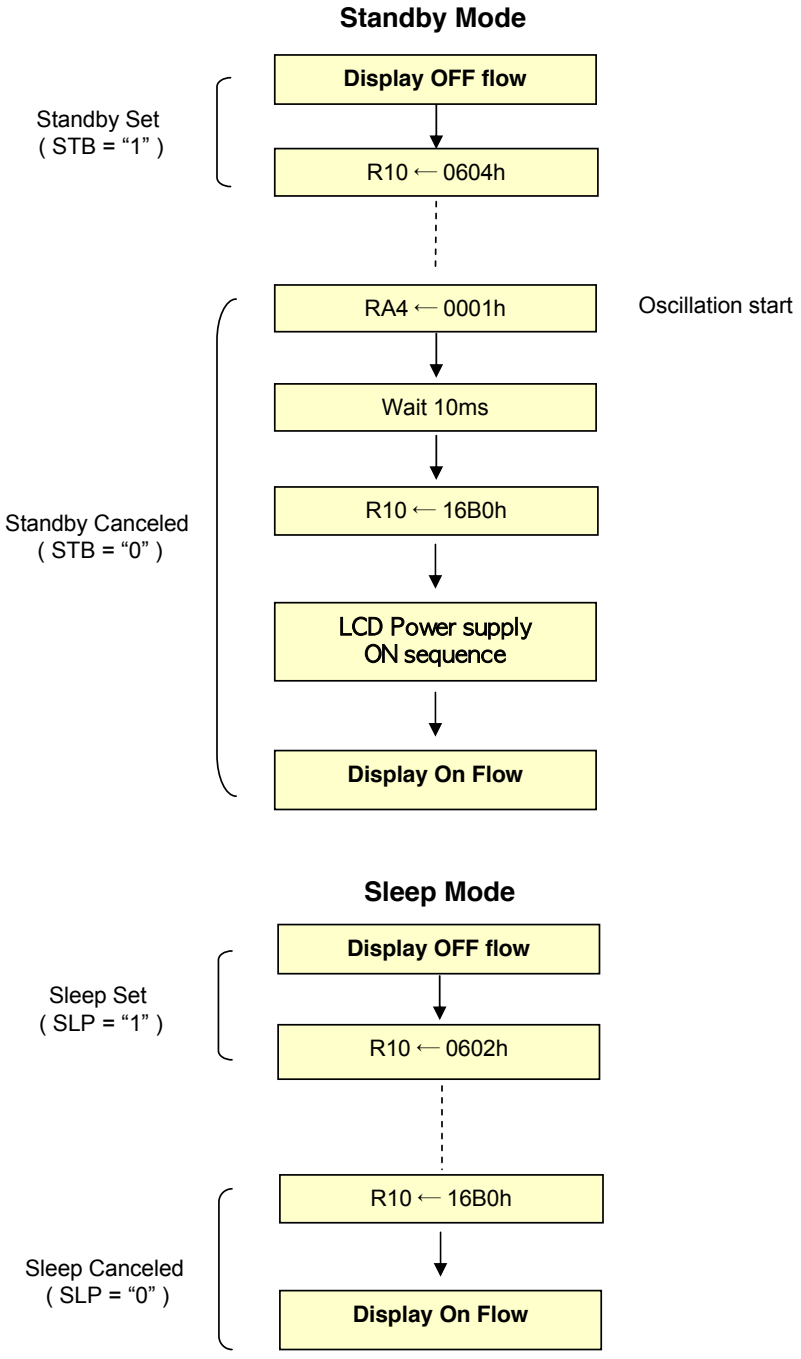
LCD Power supply ON sequence



9.5. Display On / Off flow

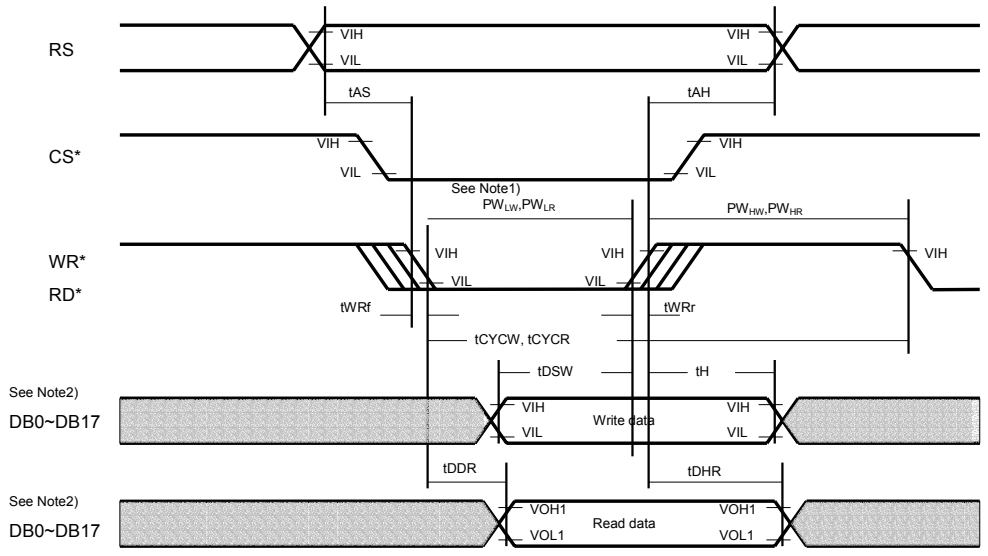


9.6. Standby & Sleep mode set



10. Timing characteristics

10.1.1 80-system bus interface operation



Note 1) PWLW and PWLR are determined by the overlap period when CS* is “LOW” and WR* or RD* is “LOW”

Note 2) Unused DB pins must be fixed to “Vcc” or “GND”

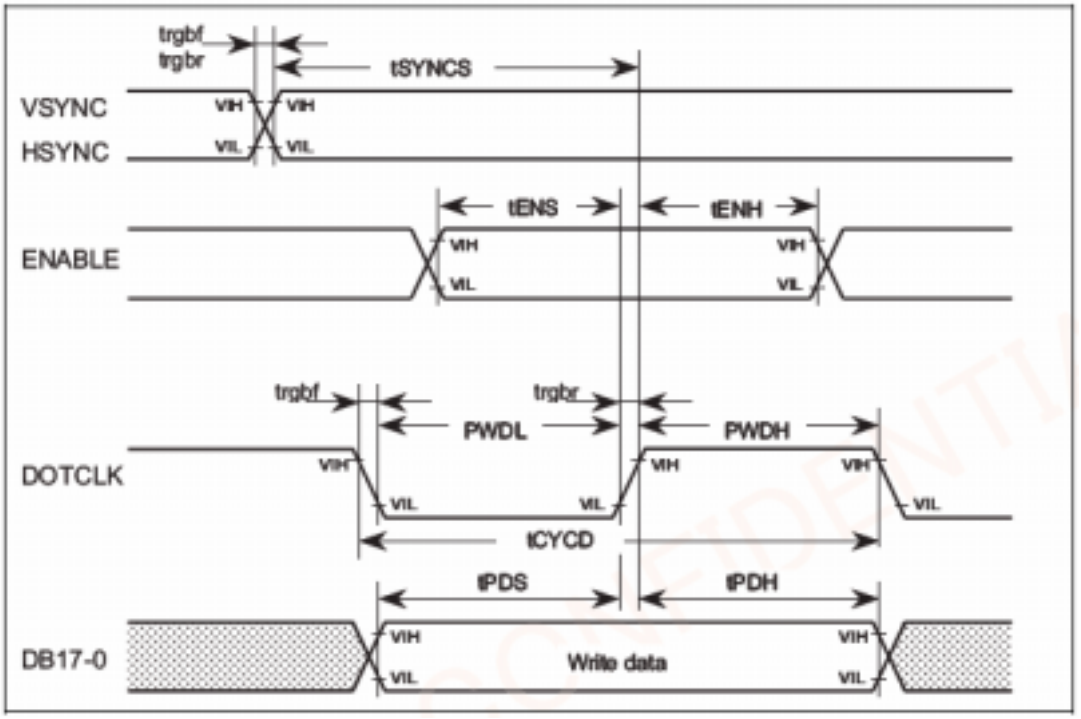
10.1.2 Timing Characteristics

Normal Write Mode (HWM=0) (IOVcc = 1.65~3.3V, Vcc = RVcc = 2.4~3.3V)

Item		Symbol	Unit	Timing diagram	Min	Typ	Max
Bus cycle time	Write	t_{CYCW}	ns	9.1.1	120	-	-
	Read	t_{CYCR}	ns	9.1.1	400	-	-
Enable “Low” level pulse width	Write	PW_{LW}	ns	9.1.1	100	-	-
	Read	PW_{LR}	ns	9.1.1	200	-	-
Enable “High” level pulse width	Write	PW_{HW}	ns	9.1.1	100	-	-
	Read	PW_{HR}	ns	9.1.1	200	-	-
Enable rise/fall time		$t_{WRr,WRf}$	ns	9.1.1	-	-	25
Setup time	Write(RS~CS*, WR*)	t_{AS}	ns	9.1.1	0	-	-
	Read(RS~CS*, RD*)			9.1.1	10	-	-
Address hold time		t_{AH}	ns	9.1.1	2	-	-
Write data setup time		t_{DSW}	ns	9.1.1	25	-	-
Write data hold time		t_{HWR}	ns	9.1.1	5	-	-
Read data delay time		t_{DDR}	ns	9.1.1	-	-	150
Read data hold time		t_{DHR}	ns	9.1.1	5	-	-

10. Timing characteristics

10.2.1 RGB interface operation

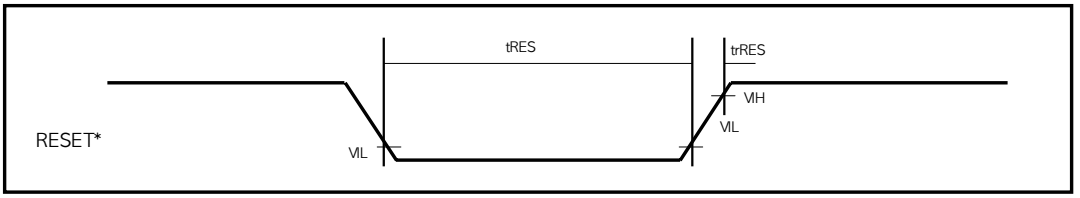


10.2.2 Timing Characteristics

18 bit RGB interface (HWM=1) (IOVcc = 1.65~3.3V, Vcc = RVcc = 2.4~3.3V)

Item	Symbol	Unit	Timing diagram	Min	Typ	Max
VSYNC/HSYNC Setup time	tSYNC	ns	9.2.1	0	-	1
ENABLE setup time	tENS	ns	9.2.1	10	-	-
ENABLE hold time	tENH	ns	9.2.1	20	-	-
DOTCLK low-level pulse width	PW_{DL}	ns	9.2.1	40	-	-
DOTCLK high-level pulse width	PW_{DH}	ns	9.2.1	40	-	-
DOTCLK cycle time	tCYCD	ns	9.2.1	100	-	-
DATA setup time	tPDS	ns	9.2.1	10	-	-
DATA hold time	tPDH	ns	9.2.1	40	-	-
DOTCLK,VSYNC and HSYNC rise/fall time	trgbr, trgbf	ns	9.2.1	-	-	25

10.3 Reset Operation



(Vdd = 2.8V, Ta=25℃)

Item	Symbol	Unit	Timing diagram	Min	Typ	Max
Reset low-level width	t_{RES}	㎳	Page 23	1	-	-
Read rise time	tr_{RES}	㎲	Page 23	-	-	10

11. Reliability and Inspection Standard

11.1 Reliability

No	Test Item	Test Conditions	Remark
1	High Temperature Operation	70℃ , 96 Hr	
2	Low Temperature Operation	-10℃ , 96 Hr	
3	High Temperature and High Humidity Storage	40℃ , 90% RH, 96 Hr	
4	Low Temperature Storage	-20℃ , 24 Hr	V
5	Thermal Shock	-30℃ , 80℃ (30Min) 5clcye	
6	Temperature Humidity Cycle	25℃ (5Min)/25% → -20℃ (30Min)/0% → 25℃ (5Min)/25% →70℃ (30Min)/80% 5 cycle	
7	Electrostatic Discharge test (No operation)	In accordance with EIAJED-4701C-111 0Ohm ,200pF, ± 200V 3 times discharge	

11.2 Fault Judgment Criteria

After Completing the reliability tests, leave the samples under the room temperature and (25℃ , 40%RH) for the following inspection items.

(1) No clearly visible defects or deterioration of display quality allowed.
(2) Contrast ratio should be at least 50% of initial value.
(3) No function-related abnormalities.
(4) Current consumption must not exceed 2 times of initial value.
(5) R, G and B color area must be at least 70% of initial value.

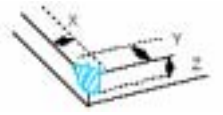
11.3 Inspection Standard

11.3.1 Inspection Standard for Main LCD

No	Item	Criterion for Defects	Defect type
1	Non Lighting	Nothing	Major
2	Irregular Operation	Nothing	Major
3	Short	Nothing	Major
4	Open	Nothing	Major

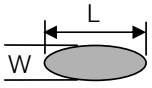
No	Item	Definition & Criterion for Defects		Defect type
5	Line defect	Definition : Black,white or color line 3 or more dot defects on a strait line Criteria : None		Minor
6	Back Light	① No light is rejectable ② Flickering and abnormal lighting are rejectable ※ In case of the model with back light (E/L, LED)		Major
7	Bright dot	Definition	Acceptable number	Minor
		Visible through 5% ND filter	0	
8	Dark dot	Definition	Acceptable number	Minor
		Dark dot at VLCD = 2.5V	0	
9	Foreign maters Size : ϕ=Average diameter	Size ϕ (mm)	Acceptable number	Minor
		$\phi \leq 0.10$ $0.10 < \phi \leq 0.15$ $0.20 < \phi$	Ignore 2 1	
10	Stains on LCD Panel Surface	Stains which cannot be removed even when wiped lightly with a soft cloth or similar cleaning too are rejectable.		Minor
11	Rust in Bezel	Rust which is visible in the bezel is rejectable.		Minor

11.3.2 Inspection Standard for Touch Panel

No	Item	Criterion for Defects(mm)		Quantity (ea)	Defect type
1	Dots (Black/White)	$\phi \leq 0.25$ $0.25< \phi \leq 0.35$ $0.35< \phi$		Ignore 4 0	Minor
2	Lines (Black/White)	$W \leq 0.05$ $0.05 < W$	$L \leq 5$ $5< L$	Ignore 0	Minor
3	Scratches	$W \leq 0.05$ $0.05 < W$	$L \leq 5$ $5< L$	Ignore 0	Minor
4	Newton's Ring	$(a+b)/2 \leq 10mm$ $10mm < (a+b)/2$ *Measurement items of 2nd Newton's ring		1 0 (Total No $\leq$ 1)	Minor
5	PET bubbles	$\phi \leq 0.40$ $0.40 < \phi$		Ignore 0	Minor
6	Dent	$\phi \leq 0.20$ $0.20 < \phi$		Ignore 0	Minor
7	Bagginess	 Bagginess Gauge Max 0.4mm:Film Edge ~Center Touch Panel			Minor
8	Corner breakage	 X $\leq$2.0mm and Y $\leq$2.0mm and Z $\leq$Thickness It is ignored			Minor
9	Side breakage	 X $\leq$2.0mm and Y $\leq$2.0mm and Z $\leq$Thickness It is ignored			Minor
10	Progressive	 It is regarded as defective			Minor

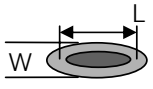
▶ **Remarks** *(The Distance between any allowable defects must be larger than 5mm)*

Dots :



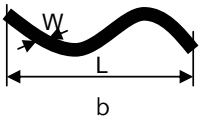
ϕ=(W+L)/2

Bubble/Dent :

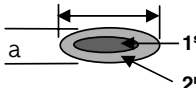


ϕ=(W+L)/2

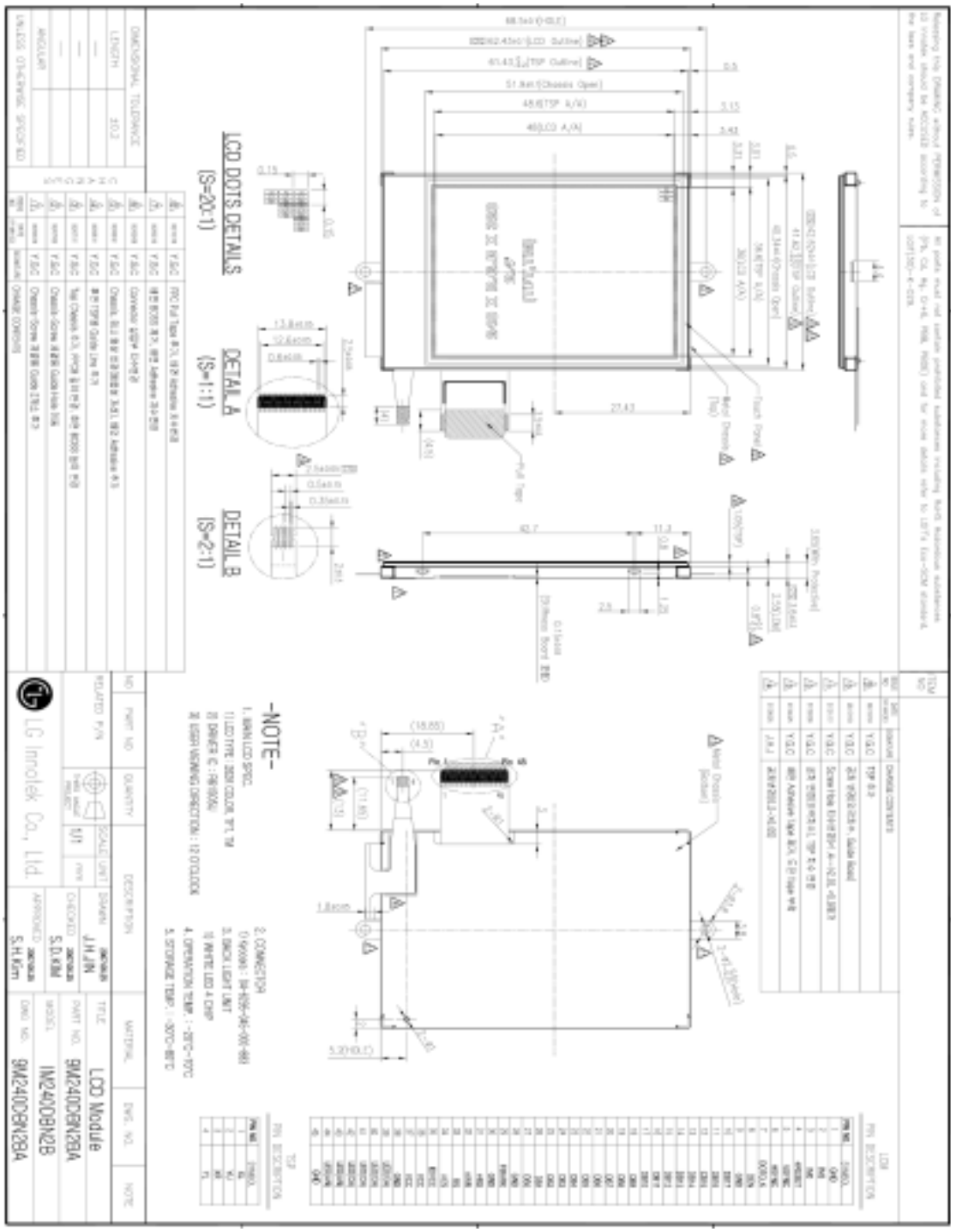
Lines/Scratchs :



Newton's ring :

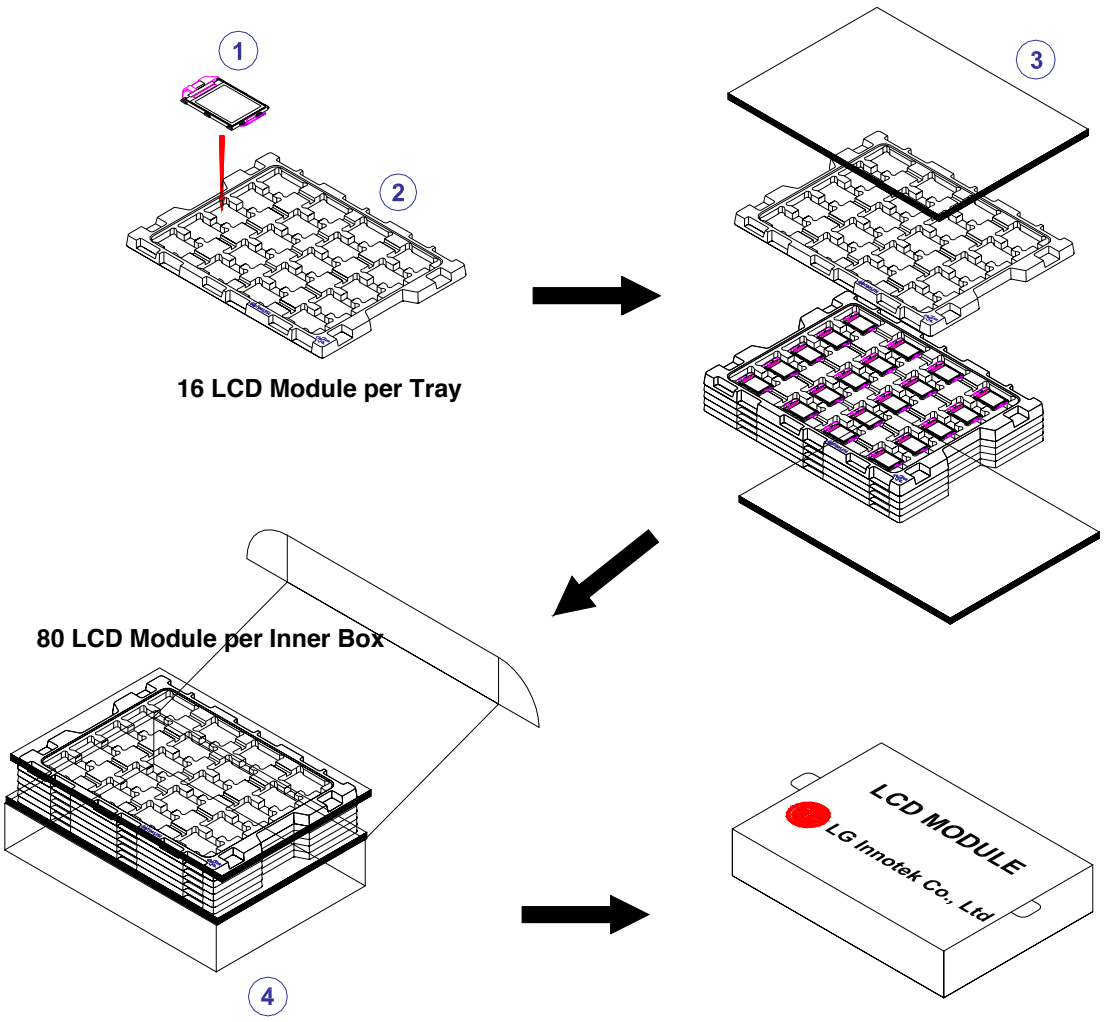


12. Outline Dimension



13. Packaging

13.1 Inner Box Ass'y

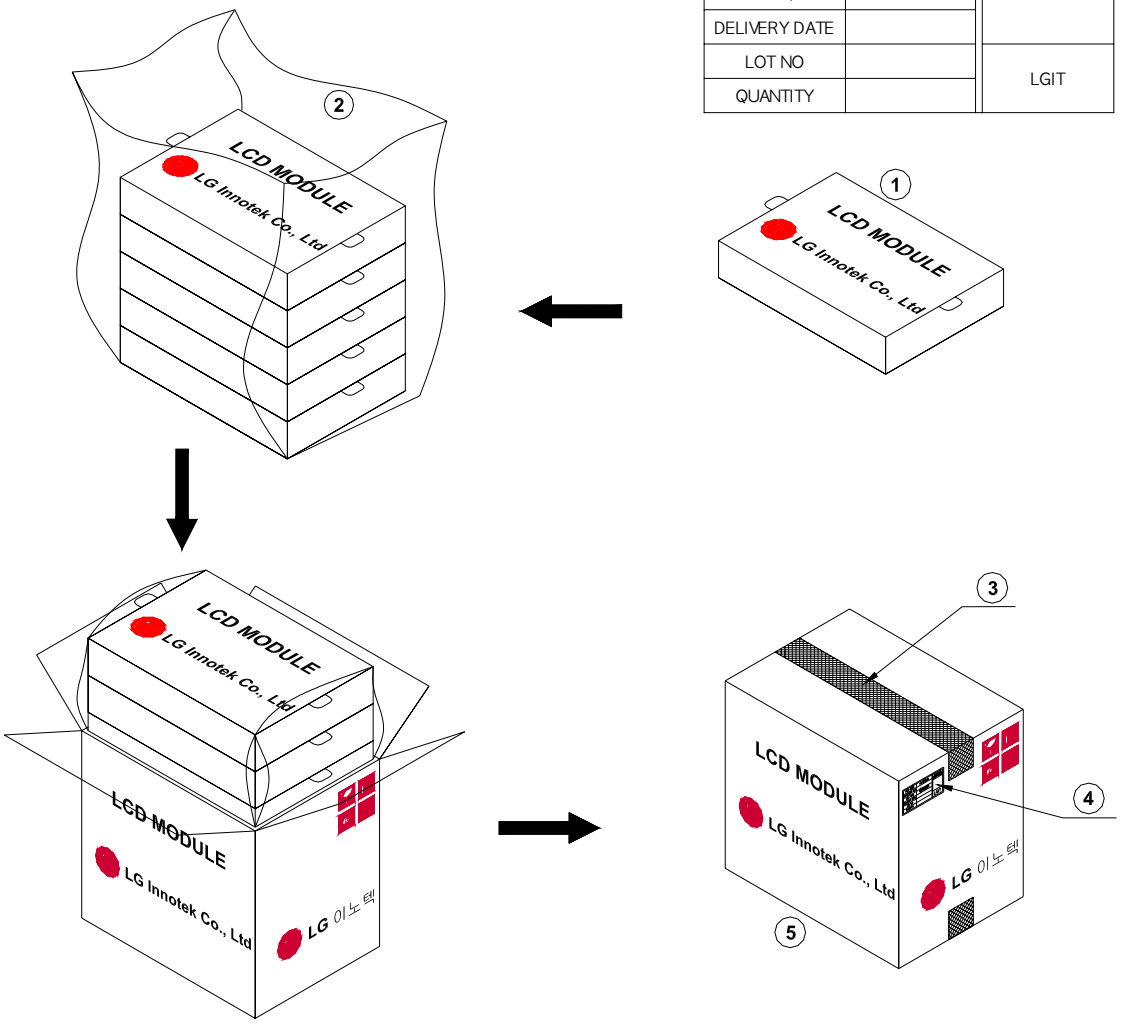


NO	ITEM	Quantity	SIZE
1	LCD MODULE	80	68.5(W) X 42.62(H) X 3.6(D)
2	PACKING TRAY	6	380(W) X 278(H)
3	PE-FORM	2	390(W) X 280(H) X 5(D)
4	INNER BOX	1	410(W) X 292 (H) X 78(D) (Out Line)

13.2 Carton Box Ass'y

※ Label Mark ;

PART NAME	LCD MODULE	INSPECTION CONFIRMATION
CUSTOMER P/N		
LGIT P/N		
DELIVERY DATE		
LOT NO		LGIT
QUANTITY		



NUM	ITEM	Quantity	SIZE
1	INNER BOX	5	410(W) X 292 (H) X 78(D) (Out Line)
2	PE-BAG	1	750(W) X 900(H) X 0.02(t)
3	OPP TAPE	1	-
4	LABEL	1	125(W) X 66(H)
5	CARTON BOX	1	435(W) X 320(H) X 435(D) (Out Line)

13.3 Designation of Lot Mark

Lot Mark

A	B	C	D	E

A : YEAR

B : MONTH

C, D : DATE

E : MAKER CODE

Note:

1. YEAR(A)

YEAR	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Mark	3	4	5	6	7	8	9	0	1	2

2. MONTH(B)

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. DATE(C,D)

1~31

4. MAKER CODE(E)

Caution AND Handling Precaution

To avoid causing extended damages such as accidents resulting in injury or death, fire accidents, or social damages or social damages if the LCD module fails, LG Innotek Display Technology is always endeavor to maintain sufficient quality of the LCD module in process of designing and manufacturing.

Please pay attention to the followings when you use this TFT LCD Module.

Safety

1) DISASSEMBLING OR MODIFICATION

Do not disassemble or modify the modules. Sensitive parts inside LCD module may be damaged, and dusts or scratches may mar the displays. Toshiba Matsushita Display Technology does not warrant the modules, if customer disassembled or modified them.

2) BREAKAGE OF LCD PANEL

Do not Ingest liquid crystal material, Do not Inhale this material, and Do not Permit this material to contact the skin, if glass of LCD panel is broken. If liquid crystal material contacts the skin, mouth or clothing, take the following actions immediately.

In case contact to the eye or mouth, rinse with large amount of running water for more than 15 minutes. In case contact to the skin or clothing, wipe it off immediately and wash with soap and large amount of running water for more than 15 minutes. The skin or closing may be damaged if liquid crystal material is left adhered. In case ingestion, rinse out the mouth well with water. After spewing up by drinking large amount of water, get medical treatment.

3) GLASS OF LCD PANEL

Be careful with chips of Grass that may cause injuring fingers or skin, when the glass is broken.

4) ABSOLUTE MAXIMUM RATINGS

Do not exceed the absolute maximum rating values under the worst probable conditions caused by the supply voltage variation, input voltage variation, variation in parts' constants, environmental temperature, etc., otherwise LCD module may be damaged.

5) POWER PROTECTION CIRCUIT

Employ protection circuit for power supply, whenever the specification specifies it.
A suitable protection circuit should be applied, based on each system design.
A fuse is not fitted to this module. Therefore, without a suitable power-supply protection device, dust or partial circuit failure may cause overheating and/or burning , which may lead to injury.

6) DISPOSAL

Always comply with all applicable environmental regulations, when disposing of the LCD.

7) EDGES OF PARTS

Be careful with edges of glass parts and metal frame, it may cause injuring.
For designing the system, give special consideration that the wiring and parts do not touch those edges.

8) RECOMMENDED OPERATING CONDITIONS

Don't exceed “the recommended operation conditions” in this specification. The performance and quality of the LCD module are warranted only when the LCD module is used within “the recommended operation conditions”. To use the LCD module over “the recommended operation conditions” may have bad influence on the characteristics and reliability of the LCD module and may shorten the life of the LCD module.

Therefore, when designing the whole set, not to be over “the recommended operation conditions”, you should fully take care of supply voltage change, characteristic of connection parts, serge of input-and-output line , and surrounding temperature.

Installation in Assembly

1. ESD (ELECTRO-STATIC DISCHARGE) PREVENTION

The circuit used in LCD module is very sensitive to ESD. The following caution should be taken when installing LCD module to an enclosure of the system in order to prevent damage of circuit used in LCD module.

1) HUMIDITY

Ambient humidity of working area is recommended to be higher than 50%(RH) in order to avoid ESD.

2) GROUNDING

- Person handling LCD modules should be grounded with wrist band.
- Tools like soldering iron and screw drivers and working benches should be grounded.
- Grounded electro-conductive mats are recommended to be covered on the floor of working area and surface of working benches.
- The grounding should be done through a resister of 0.5~1Mohms in order to prevent spark of ESD.

3) Be careful with touching metal portion of testing instruments in order to prevent unnecessary ESD.

4) Do not touch the electrode area of PCB and electrical parts like LSI, capacitor, connector pin, etc.

5) IONIZER

Using ionizer (an antistatic blower) is recommended at working area in order to reduce electro-static voltage.

6) REMOVING PROTECTION FILM

When removing protection film from LCD panel, peel off the tag slowly (more than one second) while blowing with ionizer toward the peeling face to minimize ESD which may damage electrical circuit.

2. DUST AND STAIN PREVENTION

1) WORKING AREA

Reduce dust level in working area. Especially the level of metal particle should be decreased, otherwise electrical circuit in LCD module may be damaged due to short circuit by metal particles.

2) FINGER PRINT

Use finger stalls or soft and dust-free gloves in order to keep clean appearance of LCD module when handled for incoming inspection and assembly.

3) PROTECTION FILM

LCD module may be shipped with "protection film" on LCD panel in order to prevent from scratches and dust. It is recommended to remove the film at later process of assembling.

4) WIPING OFF DUST ON THE PANEL

When LCD panel becomes dirty, wipe the panel surface off softly with absorbent cotton or another soft cloth. If necessary, breathe upon the panel surface and then wipe off immediately and softly again. Be careful not to spill organic solvents into the inside of LCD module. The solvents may damage driver IC and PCB area used inside module. The polarizer laminated to LCD panel and adhesives may be damaged by the solvents, so do not use any organic solvents for wiping off LCD panel.

5) ADHESIVE ON LCD PANEL

Be careful not to attach adhesive, grease, etc., on LCD panel, because it is difficult to remove them without any damages on LCD panel.

6) WATER SPOTS ON THE PANEL

Avoid the dewing or water condensation.
Wipe off a spot or spots of water or mist on LCD panel softly with absorbent cotton or another cloth as soon as possible if happened, otherwise discoloration or stain may be caused. And, damage may occur if water penetrates the inside.

3. INSTALLING LCD MODULE TO THE ENCLOSURE

1) INSTALLING LCD MODULE TO THE ENCLOSURE

Do not bend or twist LCD module even momentarily when the LCD module is installed into the system. Bending or twisting the LCD module may cause permanent damage.
When the FPC is bent, the radius of FPC curvature must be more than value of recommendation to prevent bending and twisting forces from affecting the connection of FPC.
Even temporary bending or twisting sometimes causes damage.

2) INTERFACE

Do not fasten screws, with catching interface FPC between LCD module and the enclosure.
This may cause bending of LCD module, or become the cause of a failure by damaging FPC.

4. MECHANICAL FORCES

1) CARRY

Hold the side of the plastic frame when you carry an LCD module by hand. If an LCD is carried using the FPC, it is likely to be damaged and the LCD will then malfunction. If you turn on the LCD with a broken FPC, it may cause smoke or burning.
Protection (eg gloves) for fingers and hands is recommended to avoid injury by broken glass.

2) STRONG MECHANICAL SHOCK

Avoid strong mechanical shock, such as dropping the LCD from the work bench, or knocking it against a hard object.
These may cause the glass panel to crack, or cause other mis-operation.

3) EXCESSIVE FORCE

Avoid applying excessive force, like pushing the surface of LCD panel. This may cause scratches or breakage of the panel, or a failure of the module.

4) SCRATCHES ON THE PANEL

Do not put heavy object such as tools, books, etc., and do not pile up LCD modules.
Be careful not to touch the surface of the polarizer with any hard and sharp object. These parts are so sensitive and can easily be scratched, even if protected by a film.

5)Connector

When inserting or disconnecting the connector into a connector of the LCD module, care should be taken to ensure that no strong external force is applied to the connector on the LCD module side.
A strong external force applied to the connector or the FPC may damage their connections.
When assembling a module into a system, pay extra attention to ensure that no part such as the FPC etc. should be caught between the case of the system and the module. Make sure that the input signal connector of a module is securely and correctly connected to the connector on the system, not skewed, or incompletely connected.
Inputting a signal etc. into the module with connectors incorrectly inserted may cause a circuit component or components to malfunction.

6) FPC

When inserting or disconnecting the connector of the LCD module into a connector of the system, care should be taken to ensure that no strong external force is applied to the FPC on the LCD module side. A strong external force applied to the FPC may damage their connections.
When assembling a module into a system, pay extra attention to ensure that no part such as the FPC etc. should be caught between the case of the system and the module.
Make sure that the input signal connector of a module is securely and correctly connected to the connector on the system, not skewed, or incompletely connected. Inputting a signal etc. into the module with connectors incorrectly inserted may cause a circuit component or components to malfunction. Be careful not to pull or damage the FPC cables, to avoid mechanical damage in FPC and connection part of FPC and cell.

5. OPERATION

1) POWER SUPPLY

Power supplies should always be turned off during the assembly process.
Do not connect or disconnect the power cables and connectors with power applied to LCD module. This may cause damage to the LCD module circuit.
In operating module at the inspection process, and so on, the supply voltage and signals of driving device must satisfy the sequence of power supplies and signals described in this specifications.

2) GAS

Do not expose the LCD module to any gas which is not normally contained in the atmosphere, it may cause mis-operation or defects.

3) USED FOR LONG TERM

When a LCD module is used for a long term, the characteristics of LCD module might be changed and it may be out of the standard of “4.3 Optical Specifications” due to LED discoloration.
LED has the characteristics of shifting optical characteristics by the long term use.

Transportation and Storage

1) TEMPERATURE

Do not store LCD modules in a high temperature and high humidity condition, higher than 35ºC and 70%(RH) for a long term, meaning about one month or more, otherwise this may deteriorate the quality of the display. When you unavoidably store LCD modules for a long time, store between 0 and 35ºC, with a relative humidity 70% or lower.

2) LOW TEMPERATURE

Be careful not to leave it where the temperature is below specified storage temperature because the liquid crystal of the display panel may be damaged.

3) ULTRA VIOLET RAY

Store LCD module without exposure to direct sunlight or fluorescent lamps in order to prevent the module from strong ultra violet ray.

4) CLEANLINESS

Keep the LCD module in clean place, because any dust, hard particle may damage the polarizer, or dust invades the inside of the LCD module.

5) CONDENSATION OF WATER

The modules should be stored under a condition where no condensation of water is allowed. It may cause mis-operation or defects. Be especially careful not to make a module work under the condition that condensation of water appears.

6) PACKAGING

When you must re-package a LCD module after it has been removed from the original packaging, it is recommended to re-pack using the original package box and package material.