Created Date	2008-06-06 14:57 (Korea Time)
Requested by	KANGHUI KH (LGEND R&D.R&D 2 GROUP / assist manager ,)
Subject	[LGE Approval_Formal] LGD 17"W Plus2 EAJ52959401/EAJ52963701 CAS_IIS

EDMS Attributes				
	Biz Map	Procure Materials and Services > Develop Procurement Strategy		
	Team Map			
	Doc Type	Approval	**Retention**	5 Year
	Info Type			
	Security Grade	Internal use (Only)	**Doc Language**	English / Other language only

New Development Component Information
Chassis : LM76D
Model : L177WSB
Hazardous Substances : Phase1()   Phase2()   Phase3()   RoHS(●)
Section   : New (●) Limit()   Revision()   4M()
                Murual Approval( ) from( )
Relibility test   : Needless()   Need(Test Report No: ●)
Class Name : LCD Monitor Module
Part Number : EAJ52959401/EAJ52963701
Maker   : LG Display(구. LG Philips)
Specification : LM171WX3-TLC1/2 WXGA 17.1INCH 1440X900 250CD COLOR 72% 16/10 800:1 LGD(LPL) 17"W R/Time :8ms, Color Depth:16.7M. V/Angle:170/150
Key parts List : S-IC:Lusem,T-con:Siliconworks, Polarizer:LGC, Lamp:Wooree ETI , C/F:LGC, B/Light A'ssy: HEESUNG,User Connector:UJU, Module site: TLC1:GM/TLC2:NJ
Development History :LGD 17"W Plus2 New module development.

★Safety Standard Parts [안전규격부품 List]
Power Cord, Power Plug, X / Y-Capacitor, Power Switch, Fuse, SMPS Trans, Stand-By Trans, Photo coupler,
Insulation (절연) Resistor, Discharge (방전)Resistor, Fusing Resistor, FBT,CPT, CPT Socket, DY, D-Coil,
Line Filter, PCB Material, Front / Back-cover Material, Relay(1-2차간), Varistor, Adaptor, PSU(Power supply unit)
★EMC Standard Parts [전파규격 부품 List]
Power Plug, Line Filter, X-Capacitor, Y-Capacitor, SMPS Trans, Tuner, Saw-Filter, Shield Case, Oscillator, Pattern Change
★Green [유해물질 확인사항]
 This item must meet the standards of LG Electronics for six major substances as designated by RoHS for control.

Approval Line	Approval Type	Status	Approved Date	Approved by / Comment
	Approval	Approved	2008-06-06 15:18	정동원 (DD전략구매모듈그룹 / 차장) Comment 확인 함. W1752모델은 Tool이 LGESP로 이관으로 W1752모델 난징 연구소 검토 완료되었으므로, 지급으로 현지 PQ 진행 요망.
	Approval	Approved	2008-06-10 13:00	손경조 (DD규격그룹 / 선임연구원) Comment 확인합니다.
	Approval	Approved	2008-06-10 13:43	이상욱 (DD규격그룹 / 책임연구원) Comment 확인합니다
	Approval	Approved	2008-06-11 16:47	김철회 (LGEND R&D.MECHANIC GROUP / 주임연구원) Comment 확인합니다
	Approval	Approved	2008-06-11 19:38	정길식 (MNT기구개발그룹 / 책임연구원) Comment 확인합니다.
	Approval	Approved	2008-06-12 10:36	김종태 (LGEND R&D.R&D 1 GROUP / 책임연구원) Comment ok
	Approval	Approved	2008-06-12 10:42	정의훈 (DD전략구매모듈그룹 / 부장) Comment 확인함

장원기 (MNT회로개발그룹 / 책임연구원)
정동원 (DD전략구매모듈그룹 / 차장)
박동호 (LGEND PRODUCTION.PURCHASING GROUP / 부장)
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송성호 (MNT회로개발그룹 / 선임연구원)
이상훈 (MNT회로개발그룹 / 책임연구원)
신동석 (Display부품품질보증그룹 / 대리)
허희준 (MNT R&D기획그룹 / 주임연구원)

CC	홍준원 (Display부품품질보증그룹 / 대리) 신준호 (MNT회로개발그룹 / 주임연구원) 김부영 (MNT R&D기획그룹 / 주임연구원) 권영국 (MNT회로개발그룹 / 주임연구원) 이성수 (DD규격그룹 / 연구원) 김진태 (Display부품품질보증그룹 / 부장) 황동선 (MNT회로개발그룹 / 책임연구원) 김종태 (LGEND R&D.R&D 1 GROUP / 책임연구원) 정의훈 (DD전략구매모듈그룹 / 부장) 최용석 (LGESP R&D MNT / 책임연구원) 홍의성 (LGEND R&D VP / 책임연구원) 박일준 (MNT기구개발그룹 / 책임연구원) 배권일 (LGEND R&D.R&D 2 GROUP / 책임연구원) 차상호 (DD규격그룹 / 책임연구원) 이문희 (MNT기구개발그룹 / 책임연구원) 박우근 (Display모듈조달그룹 / 차장) 김명욱 (LGEND R&D.R&D 1 GROUP / 책임연구원) 배덕호 (LGEND R&D.MECHANIC GROUP / 책임연구원) 김학준 (LGESP Suprimentos MNT / 차장) 김돈학 (DD전략구매모듈그룹 / 차장) 박강식 (Display부품품질보증계 / 기정) 이규호 (Display부품품질보증계 / 기정) 유범종 (Display부품품질보증계 / 기장) 박철진 (Display부품품질보증계 / 기정) LIUJIUBIAO LJB (SQA GROUP / senior manager B) LIYINGZE LYZ (LGEND PRODUCTION.PURCHASING GROUP / senior manager B) NICHUNGEN NCG (LGEND R&D.MECHANIC GROUP / senior manager B) SHENPING SP (LGEND PRODUCTION.PURCHASING GROUP / officer 1) ZHOUPINQUAN ZPQ (LGEND R&D.R&D 1 GROUP / manager a) LIXIAODONG LXD (LGEND R&D.R&D 2 GROUP / manager b) ZULIQIANG ZLQ (LGEND R&D.R&D SUPPORT GROUP / manager a) LIUJINGYAO LJY (LGEND R&D.MECHANIC GROUP / assist manager) DONGJIAN DJ (SQA GROUP / Operator3) LITIANBAI LTB (LGEND R&D.R&D 1 GROUP / assistant manager) CAODALIN CDL (LGEND R&D.R&D 1 GROUP / assist manager) YINGUANGJUAN YGJ (LGEND PRODUCTION.PURCHASING GROUP / officer 1) KANGHUI KH (LGEND R&D.R&D 2 GROUP / assist manager) YUANYUAN YY (LGEND R&D.R&D 1 GROUP / officer 1) SHIHUI SH (SQA GROUP / officer 1) QINGYONG QY (LGEND R&D.R&D SUPPORT GROUP / officer 1) PENGWEIHUA PWH (LGEND R&D.R&D 1 GROUP / officer 1) 이대용 (Display부품품질보증계 / 주임) LIZHENGRONG LZR (SQA GROUP /)
EDMS Doc Link	
Attached Local Files	🗒 standard document.zip 🗒 RoHS document.zip 🗒 Final CAS & IIS_LM171WX3-TLC.zip 🗒 optical & reliability & EMI & key part.zip 🗒 T-con fuse spec.pdf

LG Display

Product Specification

SPECIFICATION
FOR
APPROVAL

(   )   Preliminary Specification

(◆)   Final Specification

Title	17.1" WXGA+ TFT LCD
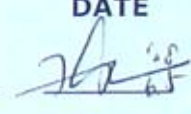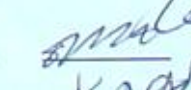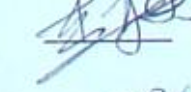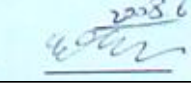
BUYER	LGE
MODEL	-

SUPPLIER	LG. Display Co., Ltd.
*MODEL	LM171WX3
SUFFIX	TLC1

*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
H.S. KIM / G.Manager	
REVIEWED BY	
C.K. LEE / Manager [C]	
J. H. LEE / Manager [M]	
Y.S. LEE / Manager [P]	
PREPARED BY	
S.Y. KIM / Engineer	2008.6.5

Product Engineering Dept.
LG Display Co., Ltd

Product Specification

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RECORD OF REVISIONS

Revision No	Date	Page	Description
Ver 0.0	**Apr. 02, 2008**		**Preliminary Specifications**
Ver 0.1	**Apr. 15, 2008**	**27**	**Updated the mechanical drawing : Rear view**
Ver 1.0	**Jun. 04, 2008**		**Final Specifications**
		6	**Corrected the typo : The Power Supply Input Current Max.**
			Corrected the typo : Permissive Power Input Ripple
		15	**Updated the backlight connectorand its line color**
		26	**Updated the mechanical drawing : Front view**
		27	**Updated the mechanical drawing : Rear view**

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1. General Description

LM171WX3-TLC1 is a Color Active Matrix Liquid Crystal Display with an integral Cold Cathode Fluorescent Lamp(CCFL) backlight system. The matrix employs a-Si Thin Film Transistor as the active element. It is a transmissive type display operating in the normally white mode. It has a 17.1 inch diagonally measured active display area with WXGA+ resolution (1440 vertical by 900 horizontal pixel array) Each pixel is divided into Red, Green and Blue sub-pixels or dots which are arranged in vertical stripes. Gray scale or the brightness of the sub-pixel color is determined with a 8-bit gray scale signal for each dot, thus, presenting a palette of more than 16,7M colors with Advanced-FRC(Frame Rate Control). It has been designed to apply the interface method that enables low power, high speed, low EMI. FPD Link or compatible must be used as a LVDS(Low Voltage Differential Signaling) chip. It is intended to support applications where thin thickness, wide viewing angle, low power are critical factors and graphic displays are important. In combination with the vertical arrangement of the sub-pixels, the LM171WX3-TLC1 characteristics provide an excellent flat panel display for office automation products such as monitors.
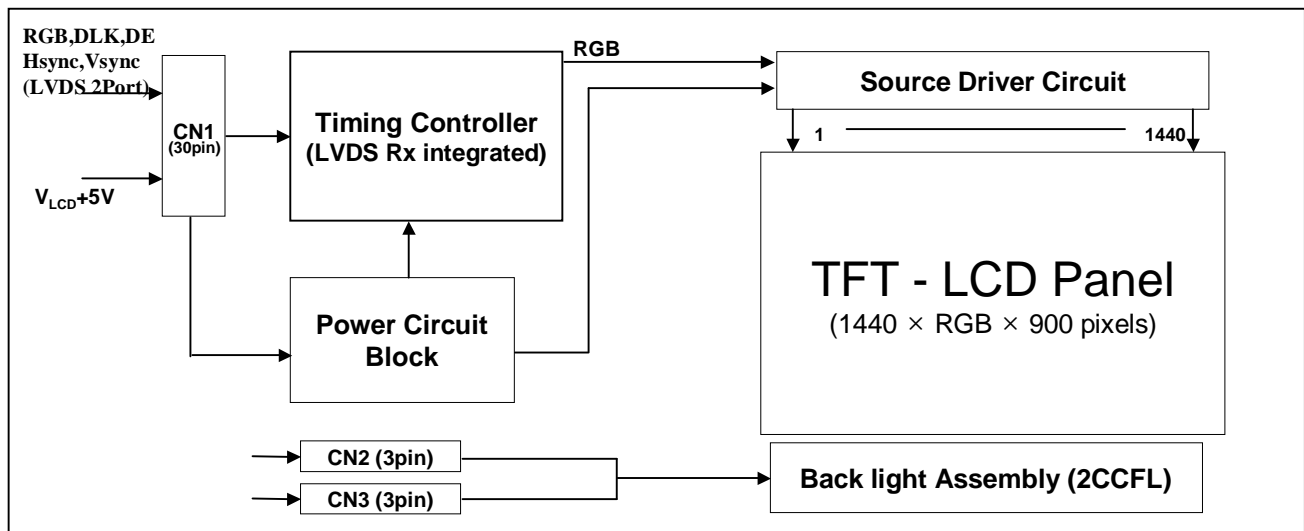
Figure 1. Block diagram

General Features

Active screen size	17.1 inch (43.3019cm) diagonal
Outline Dimension	389.2(H)x254.5(V)x11.5(D) mm (Typ.)
Pixel Pitch	0.255mm x 0.255mm
Pixel Format	1440 horiz. by 900 vert. Pixels. RGB stripe arrangement
Display Colors	16.7M colors
Luminance, white	250 cd/m^2(Typ. Center 1 point)
Power Consumption	13.2 Watts(Typ.) (2.88 Watt@VLCD, 10.32 Watt@250cd/[Lamp=8mA])
Weight	1360g (Typ.)
Display operating mode	Transmissive mode, normally white
Surface treatments	Hard coating (3H), Anti-glare treatment of the front polarizer

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2. Absolute maximum ratings

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

Table 1. Absolute Maximum Ratings

Parameter	Symbol	Values		Units	Notes
		Min.	Max.		
Power Supply Input Voltage	V_{CC}	-0.3	$+5.5$	V_{dc}	At 25℃
Operating Temperature	T_{OP}	0	$+50$	℃	1
Storage Temperature	T_{ST}	-20	$+60$	℃	1
Operating Ambient Humidity	H_{OP}	10	$+90$	%RH	1
Storage Humidity	H_{ST}	10	$+90$	%RH	1

Note : 1. Temperature and relative humidity range are shown in the figure below.
Wet bulb temperature should be 39 °C Max, and no condensation of water.

Figure 2. Temperature and relative humidity

LG Display

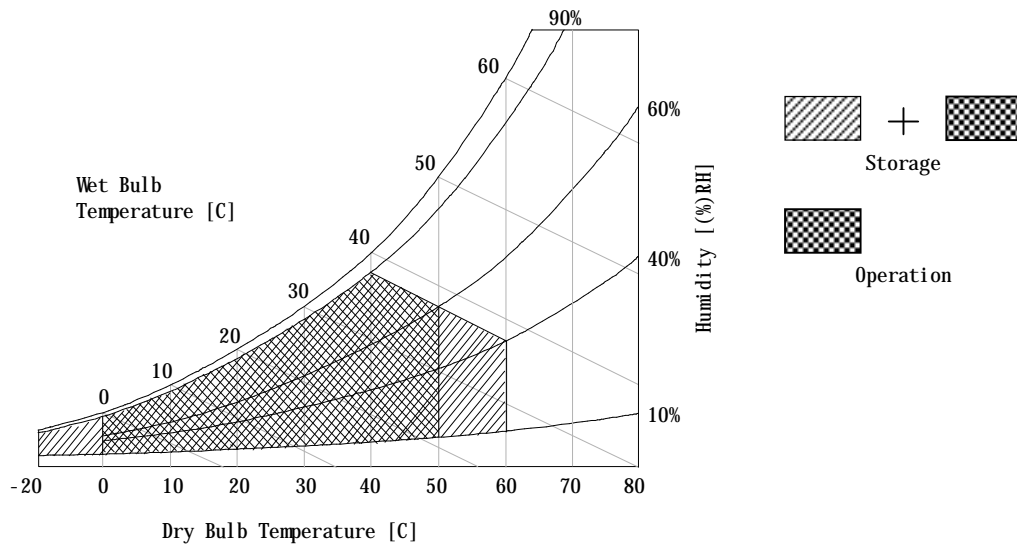| Product Specification |

3. Electrical specifications

3-1. Electrical characteristics

The LM171WX3-TLC1 requires two power inputs. One is employed to power the LCD electronics and to drive the TFT array and liquid crystal. Another which powers the CCFL, is typically generated by an inverter. The inverter is an external unit to the LCD.

Table 2. Electrical Characteristics

Parameter	Symbol	Values			Units	Notes
		Min.	Typ.	Max.		
MODULE :						
Power Supply Input Voltage	V_{CC}	4.5	5.0	5.5	V	
Permissive Power Input Ripple	V_{RF}	-	-	200	mV	12
Power Supply Input Current	I_{CC}	-	575	878	mA	1
Differential Impedance	Zm	90	100	110	ohm	
Power Consumption	Pc_{TYP}	-	2.88	3.3	Watts	1
	Pc_{MAX}	-	3.38	4.39	Watts	
Rush Current	I_{RUSH}	-	-	3	A	2
LAMP for each CCFL:						
Operating Voltage	V_{BL}	615 (@9.0mA)	645 (@8.0mA)	815 (@2.5mA)	V_{RMS}	3
Operating Current	I_{BL}	2.5	8.0	9.0	mA_{RMS}	
Established Starting Voltage	V_S					4
at 25 °C		-	-	1000	V_{RMS}	
at 0 °C		-	-	1250	V_{RMS}	
Operating Frequency	f_{BL}	40	60	70	kHz	5
Discharge Stabilization Time	T_S	-	-	3	Minutes	6
Power Consumption	P_{BL}	-	10.32	11.35	Watts	7
Life Time		40,000	-	-	Hrs	8

Note. The design of the inverter must have specifications for the lamp in LCD Assembly. The performance of the Lamp in LCM, for example life time or brightness, is extremely influenced by the characteristics of the DC-AC Inverter. So all the parameters of an inverter should be carefully designed so as not to produce too much leakage current from high-voltage output of the inverter. When you design or order the inverter, please make sure unwanted lighting caused by the mismatch of the lamp and the inverter(no lighting,flicker,etc) never occurs.When you confirm it,the LCD Assembly should be operated in the same condition as installed in your instrument.

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Note. Do not attach a conducting tape to lamp connecting wire. If the lamp wire attach to conducting tape,
TFT-LCD Module have a low luminance and the inverter has abnormal action because leakage current
occurs between lamp wire and conducting tape.

1. The specified current and power consumption are under the V_{CC}=5.0V, 25°C, f_V (frame frequency)
=60Hz condition. Mosaic and max power pattern shown in the [Figure 3] is displayed.

2. The duration of rush current is about 5ms. And V_{CC} rise time is 500us $\pm$ 20%.

3. Operating voltage is measured under 25℃.The variance of the voltage is ±10%.

4. The voltage above V_s should be applied to the lamps for more than 1 second
for start-up.(when no load condition.)
(Inverter open lamp voltage must be more than lamp starting voltage.)
Otherwise, the lamps may not be turned on. The used lamp current is the lamp typical current.

5. The output of the inverter must have symmetrical(negative and positive) voltage waveform and
symmetrical current waveform.(Unsymmetrical ratio is less than 10%) Please do not use the inverter
which has unsymmetrical voltage and unsymmetrical current and spike wave.
Lamp frequency may produce interference with horizontal synchronous frequency and as a result this
may cause beat on the display.Therefore lamp frequency shall be as away as possible from the
horizontal synchronous frequency and from its harmonics in order to prevent interference.

6. Let's define the brightness of the lamp after being lighted for 5 minutes as 100%.
T_s is the time required for the brightness of the center of the lamp to be not less than 95%.
The used lamp current is the lamp typical current.

7. The lamp power consumption shown above does not include loss of external inverter under 25℃.
The used lamp current is the lamp typical current.

8. The life time is determined as the time at which brightness of lamp is 50% compared to that of initial
value at the typical lamp current on condition of continuous operating at 25 ±2℃.

9. Requirements for a system inverter design, which is intended to have a better display performance,
a better power efficiency and a more reliable lamp.
It shall help increase the lamp lifetime and reduce its leakage current.
a. The unbalance rate of the inverter waveform should be 10% below;
b. The distortion rate of the waveform should be within $\sqrt{2}$ ±10%;
c. The ideal sine wave form shall be symmetric in positive and negative polarities.
d. It should be measured with lamp currents of high voltage side.
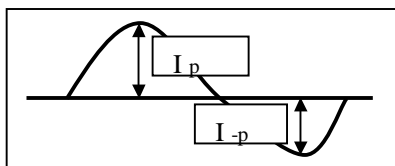
* Asymmetry rate = | I$_p$ – I$_{–p}$ | / I$_{rms}$ x 100%

* Distortion rate = I$_p$ (or I$_{–p}$) / I$_{rms}$

10. Inverter open voltage must be more than lamp starting voltage.

11. The inverter which is combined with this LCM, is highly recommended to connect coupling(ballast)
condenser at the high voltage output side. When you use the inverter which has not coupling(ballast)
condenser, it may cause abnormal lamp lighting because of biased mercury as time goes.

12. Permissive power ripple should be measured under VCC=5.0V, 25°C, fV(frame frequency)=MAX
condition and At that time, we recommend the bandwidth configuration of oscilloscope is to be under
20Mhz. See the next page.

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• **Permissive Power input ripple (**VCC=5.0V, 25°C fV (frame frequency)=MAX condition**)**
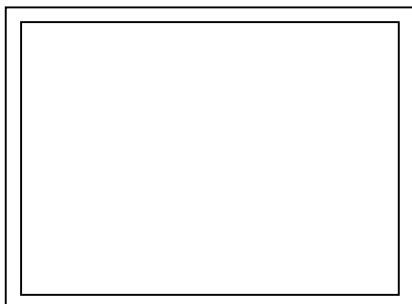
White pattern

Black pattern

• **Power consumption (**VCC=5.0V, 25°C, fV(frame frequency= 60Hz condition**)**

Typical power Pattern

Max power Pattern

[Figure 3] Mosaic pattern & Black Pattern for power consumption measurement

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3-2. Interface Connections

Interface chip must be used LVDS, part No. SN75LVDS83 (Tx, Texas Instrument) or compatible.
This LCD employs a interface connection, a 30 pin connector is used for the module electronics interface.
Two 3pin connectors are used for the integral backlight system. The electronics interface connector is
a model IS100-L30O-C23 manufactured by UJU .
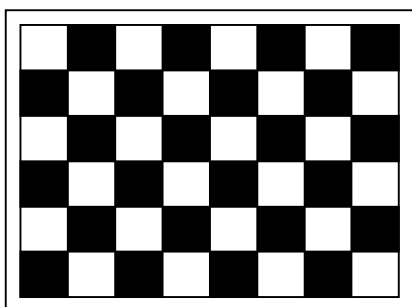And mating connector is FI-X30H and FI-X30HL or it's compatible manufactured by JAE.
The pin configuration for the connector is shown in the table 3 and the signal mapping with LVDS transmitter
is shown in the table 4.

Table 3. Module connector pin configuration

Pin No	Symbol	Description
1	RXO0-	Minus signal of 1st channel 0 (LVDS)
2	RXO0+	Plus signal of 1st channel 0 (LVDS)
3	RXO1-	Minus signal of 1'st channel 1 (LVDS)
4	RXO1+	Plus signal of 1'st channel 1 (LVDS)
5	RXO2-	Minus signal of 1'st channel 2 (LVDS)
6	RXO2+	Plus signal of 1'st channel 2 (LVDS)
7	GND	Ground
8	RXOC-	Minus signal of 1'st clock channel (LVDS)
9	RXOC+	Plus signal of 1'st clock channel (LVDS)
10	RXO3-	Minus signal of 1'st channel 3 (LVDS)
11	RXO3+	Plus signal of 1'st channel 3 (LVDS)
12	RXE0-	Minus signal of 2'nd channel 0 (LVDS)
13	RXE0+	Plus signal of 2'nd channel 0 (LVDS)
14	GND	Ground
15	RXE1-	Minus signal of 2'nd channel 1 (LVDS)
16	RXE1+	Plus signal of 2'nd channel 1 (LVDS)
17	GND	Ground
18	RXE2-	Minus signal of 2'nd channel 2 (LVDS)
19	RXE2+	Plus signal of 2'nd channel 2 (LVDS)
20	RXEC-	Minus signal of 2'nd clock channel (LVDS)
21	RXEC+	Plus signal of 2'nd clock channel (LVDS)
22	RXE3-	Minus signal of 2'nd channel 3 (LVDS)
23	RXE3+	Plus signal of 2'nd channel 3 (LVDS)
24	GND	Ground
25	NC	No Connection
26	NC	No Connection
27	PWM_out	Reference signal for inverter control
28	V$_{LCD}$	Power Supply +5.0V
29	V$_{LCD}$	Power Supply +5.0V
30	V$_{LCD}$	Power Supply +5.0V

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CN1

#1   #30

1'st signal pairs

2'nd signal pairs

PWM_out

Power(5V)

Rear view of LCM

#1   #30
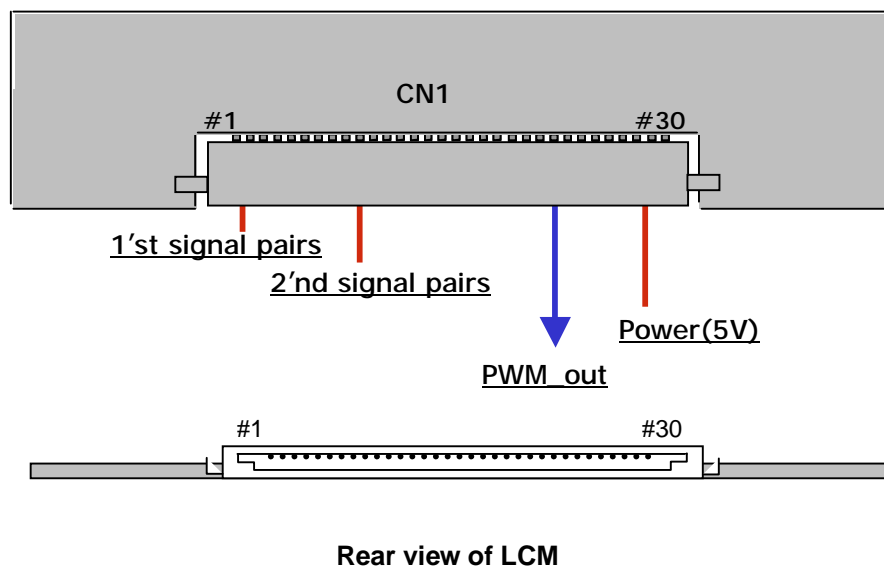
[Figure 4] Connector diagram

Notes: 1. All GND(ground) pins should be connected together and should also be
connected to the LCD's metal frame.

2. All V_{CC}(power input) pins should be connected together.

3. All NC pins should be separated from other signal or power.

4. PWM_OUT signal controls the burst frequency of a inverter.
This signal is synchronized with vertical frequency,

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### Table 4. Required signal assignment for Flat Link (TI:SN75LVDS83) Transmitter

Pin	Pin Name	Require Signal	Pin	Pin Name	Require Signal
1	VCC	Power Supply for TTL Input	29	GND	Ground pin for TTL
2	D5	TTL Input(R7)	30	D26	TTL Input(DE)
3	D6	TTL Input(R5)	31	TxCLKIN	TTL Level clock Input
4	D7	TTL Input(G0)	32	PWR DWN	Power Down Input
5	GND	Ground pin for TTL	33	PLL GND	Ground pin for PLL
6	D8	TTL Input(G1)	34	PLL VCC	Power Supply for PLL
7	D9	TTL Input(G2)	35	PLL GND	Ground pin for PLL
8	D10	TTL Input(G6)	36	LVDS GND	Ground pin for LVDS
9	VCC	Power Supply for TTL Input	37	TxOUT3+	Positive LVDS differential data output3
10	D11	TTL Input(G7)	38	TxOUT3-	Negative LVDS differential data output3
11	D12	TTL Input(G3)	39	TxCLKOUT+	Positive LVDS differential clock output
12	D13	TTL Input(G4)	40	TxCLKOUT-	Negative LVDS differential clock output
13	GND	Ground pin for TTL	41	TxOUT2+	Positive LVDS differential data output2
14	D14	TTL Input(G5)	42	TxOUT2-	Negative LVDS differential data output2
15	D15	TTL Input(B0)	43	LVDS GND	Ground pin for LVDS
16	D16	TTL Input(B6)	44	LVDS VCC	Power Supply for LVDS
17	VCC	Power Supply for TTL Input	45	TxOUT1+	Positive LVDS differential data output1
18	D17	TTL Input(B7)	46	TxOUT1-	Negative LVDS differential data output1
19	D18	TTL Input(B1)	47	TxOUT0+	Positive LVDS differential data output0
20	D19	TTL Input(B2)	48	TxOUT0-	Negative LVDS differential data output0
21	GND	Ground pin for TTL Input	49	LVDS GND	Ground pin for TTL
22	D20	TTL Input(B3)	50	D27	TTL Input(R6)
23	D21	TTL Input(B4)	51	D0	TTL Input(R0)
24	D22	TTL Input(B5)	52	D1	TTL Input(R1)
25	D23	TTL Input(RSVD)	53	GND	Ground pin for TTL
26	VCC	Power Supply for TTL Input	54	D2	TTL Input(R2)
27	D24	TTL Input(HSYNC)	55	D3	TTL Input(R3)
28	D25	TTL Input(VSYNC)	56	D4	TTL Input(R4)

Notes : 1. Refer to LVDS Transmitter Data Sheet for detail descriptions.
2. 7 means MSB and 0 means LSB at R,G,B pixel data

Product Specification

LVDS Input characteristics

1. DC Specification

$$\# |V_{ID}| = |(LVDS+) - (LVDS-)|$$
$$\# V_{CM} = \{(LVDS+) + (LVDS-)\}/2$$
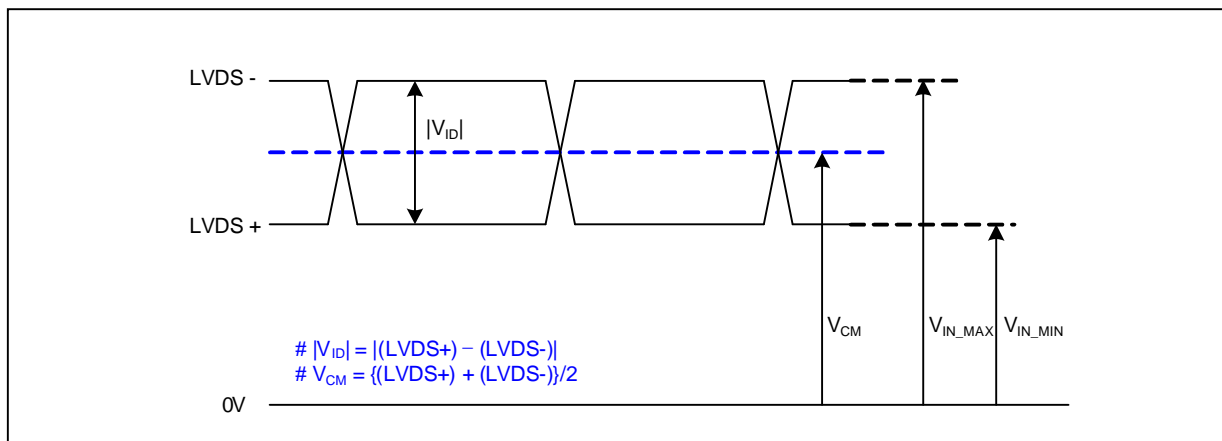
Description	Symbol	Min	Max	Unit	Notes
LVDS Differential Voltage	$|V_{ID}|$	100	600	mV	-
LVDS Common mode Voltage	V_{CM}	0.6	1.8	V	-
LVDS Input Voltage Range	V_{IN}	0.3	2.1	V	-

2. AC Specification

$t_{SKEW}(F_{clk} = 1/T_{clk})$
1) 85MHz > Fclk $\geq$ 65MHz : -400 ~ +400
2) 85MHz > Fclk $\geq$ 65MHz : -600 ~ +600
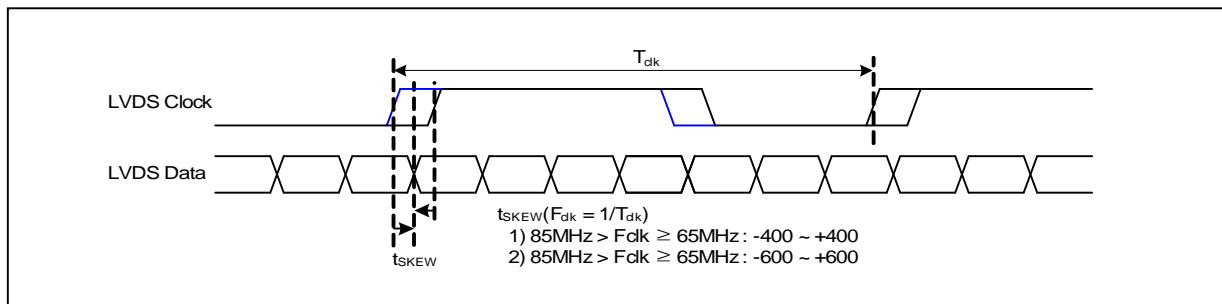
Description	Symbol	Min	Max	Unit	Notes
LVDS Clock to Data Skew Margin	t_{SKEW}	- 400	+ 400	ps	85MHz > Fclk $\geq$ 65MHz
	t_{SKEW}	- 600	+ 600	ps	65MHz > Fclk $\geq$ 25MHz
LVDS Clock to Clock Skew Margin (Even to Odd)	t_{SKEW_EO}	- 1/7	+ 1/7	T_{clk}	-
Maximum deviation of input clock frequency during SSC	F_{DEV}	-	$\pm$ 3	%	-
Maximum modulation frequency of input clock during SSC	F_{MOD}	-	200	KHz	-

Product Specification
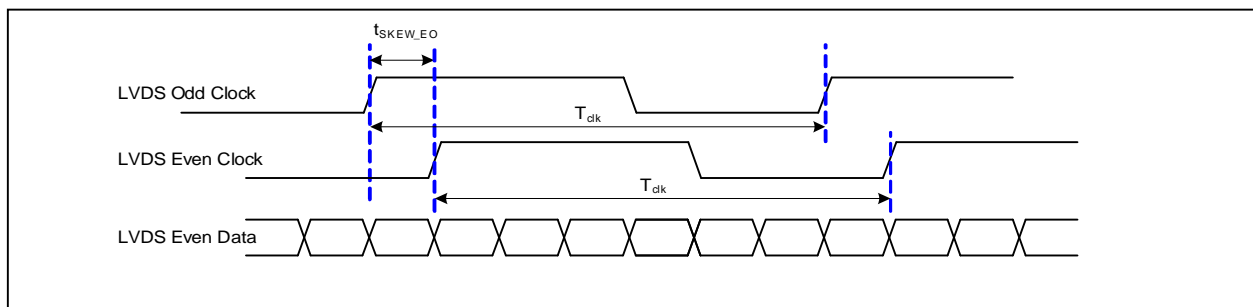
< Clock skew margin between channel >
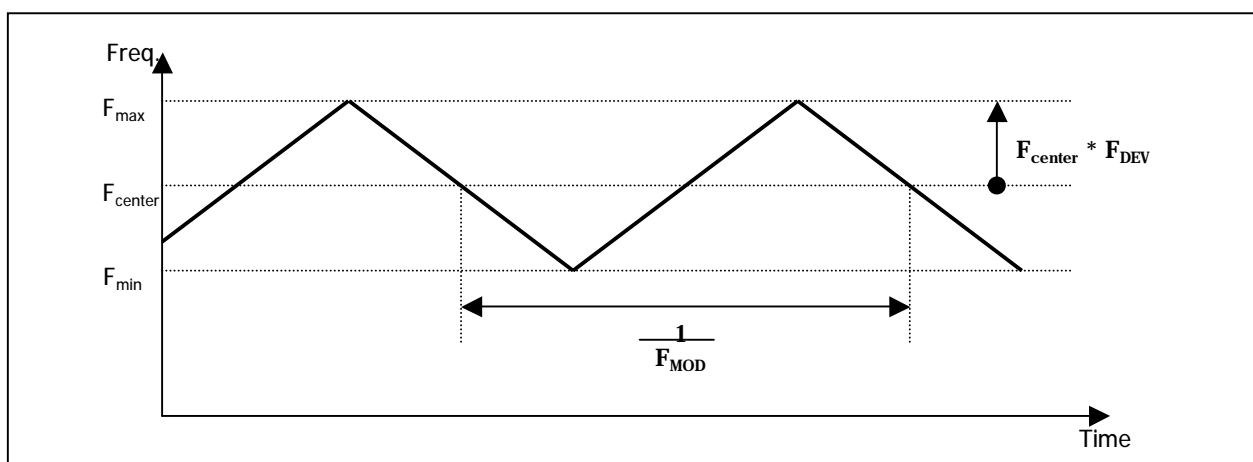
< Spread Spectrum >

3. Data Format
   1) LVDS 2 Port
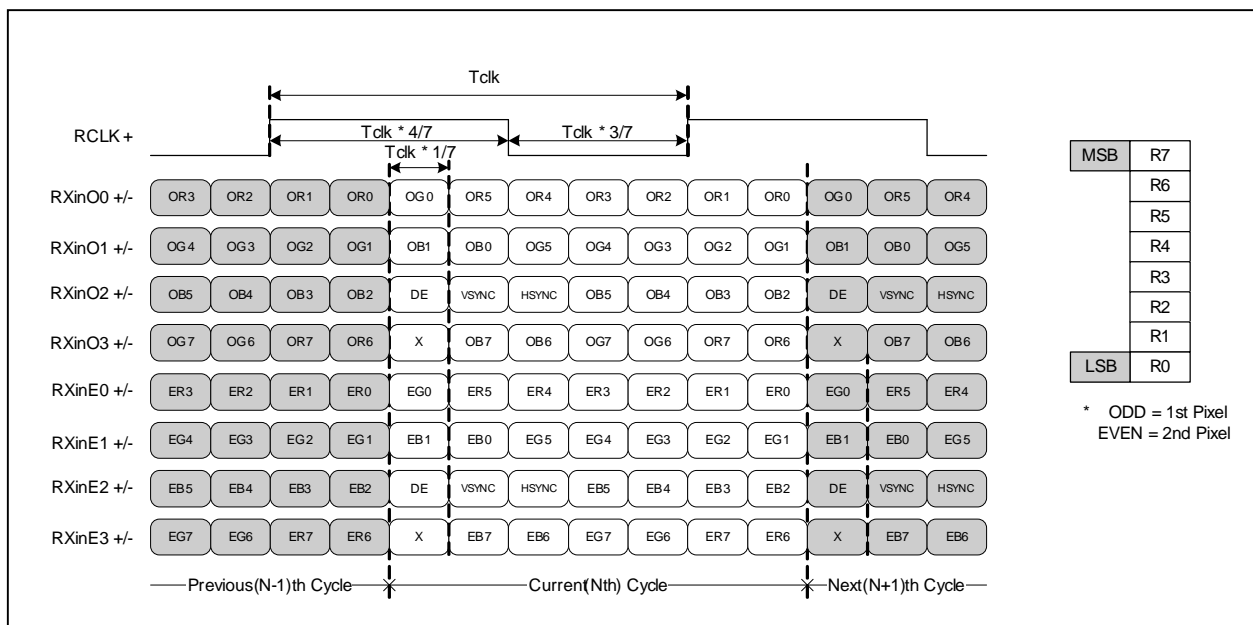
< LVDS Data Format >

Product Specification

2) LVDS 1 Port

RCLK+													
RA+/-	R3	R2	R1	R0	G0	R5	R4	R3	R2	R1	R0	G0	R5	R4
RB+/-	G4	G3	G2	G1	B1	B0	G5	G4	G3	G2	G1	B1	B0	G5
RC+/-	B5	B4	B3	B2	DE	VSYNC	HSYNC	B5	B4	B3	B2	DE	VSYNC	HSYNC
RD+/-	G7	G6	R7	R6	X	B7	B6	G7	G6	R7	R6	X	B7	B6

——Previous (N-1)th Cycle ——— ———Current (Nth) Cycle ——— ——Next (N+1)th Cycle ——
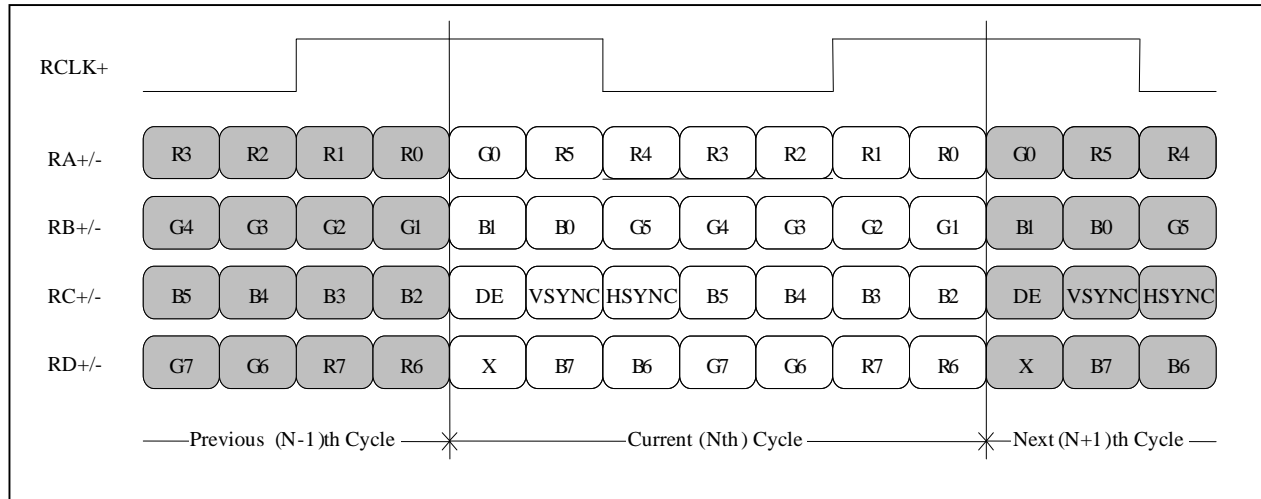
Product Specification

The backlight interface connector is a model 20015HS-03LB (YEONHO, 3Pin Locking).
The mating connector part number is 20015WR-05LD (YEONHO) or equivalent.
The pin configuration for the connector is shown in the table 5.

Table 5. Backlight connector pin configuration

Pin	Symbol	Description	Notes
1	HV	Power supply for lamp (high)	LCD : 20015HS-03LB (YEONHO, 3pin locking)
2	NC	No connect	
3	LV	Power supply for lamp (Low)	

Notes : 1. The high voltage side terminal is colored Pink. The low voltage side terminal is Black.
2. The backlight ground should be common with LCD metal frame.
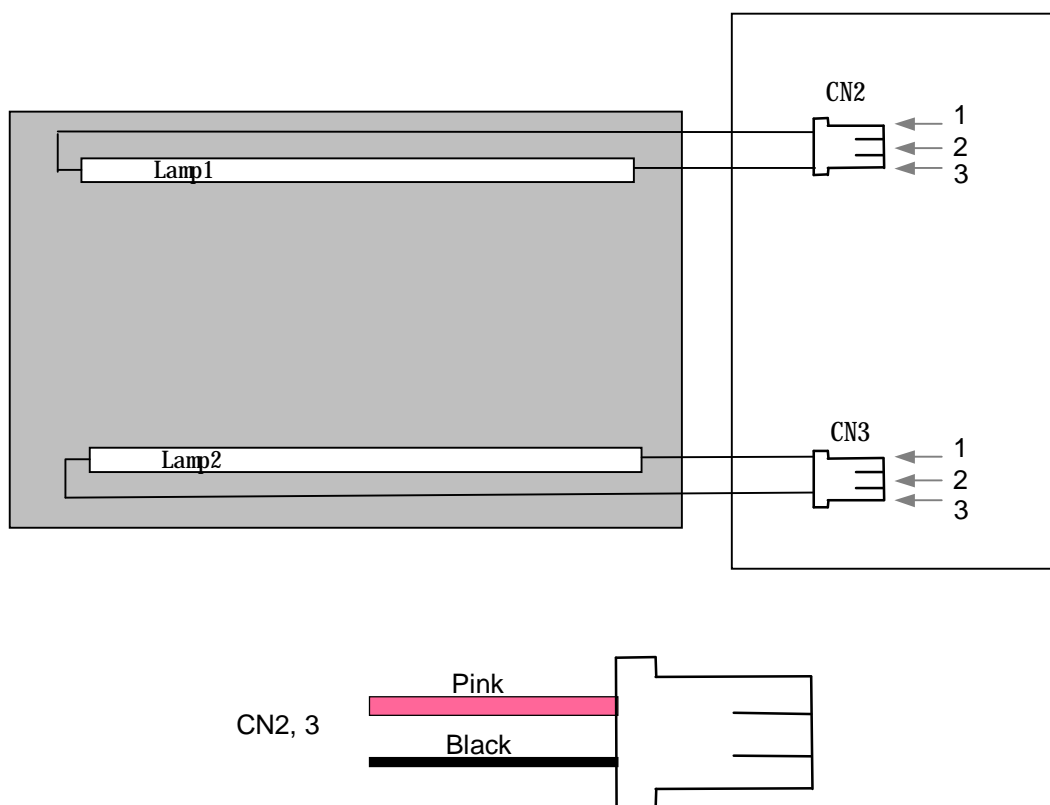
[Figure 5] Backlight connector view

Product Specification

3-3. Signal Timing Specifications

This is the signal timing required at the input of the LVDS Transmitter. All of the interface signal timing should be satisfied with the following specifications for it's proper operation.

Table 6. Timing table

ITEM	Symbol		Min	Typ	Max	Unit	Note
DCLK	Period	t_{CLK}	22.53	18.78	14.63	ns	Pixel frequency : Typ.106.5MHz
	Frequency	f_{CLK}	43.375	53.25	68.375	MHz	
Hsync	Period	t_{HP}	936	952	968	t_{CLK}	
	Width	t_{WH}	72	76	76	t_{CLK}	
Vsync	Period	t_{VP}	929	934	942	t_{HP}	
	Frequency	f_V	50	60	75	Hz	
	Width	t_{WV}	6	6	6	t_{HP}	
DE (Data Enable)	Horizontal Valid	t_{HV}	720	720	720	t_{CLK}	
	Horizontal Back Porch	t_{HBP}	108	116	124		
	Horizontal Front Porch	t_{HFP}	36	40	48		
	-	-	-	-	-		
	Vertical Valid	t_{VV}	900	900	900	t_{HP}	
	Vertical Back Porch	t_{VBP}	20	25	33		
	Vertical Front Porch	t_{VFP}	3	3	3		
	-	-	-	-	-		

Notes : 1. DE Only mode operation
2. $t_{HFP} + t_{WH} + t_{HBP} < (1/2) t_{HV}$
3. $t_{VFP} + t_{WV} + t_{VBP} < t_{H\_max} / t_{v\_min}$
4. tHFP, tWH and tHBP should be any times of a character number (8).
5. No variation of the total number of Hsync and DE in a frame is required for normal operation.
6. No variation of the total number of clock in a Hsync period for t_{VBP} is required for normal operation.

Product Specification

3-4. Signal Timing Waveforms
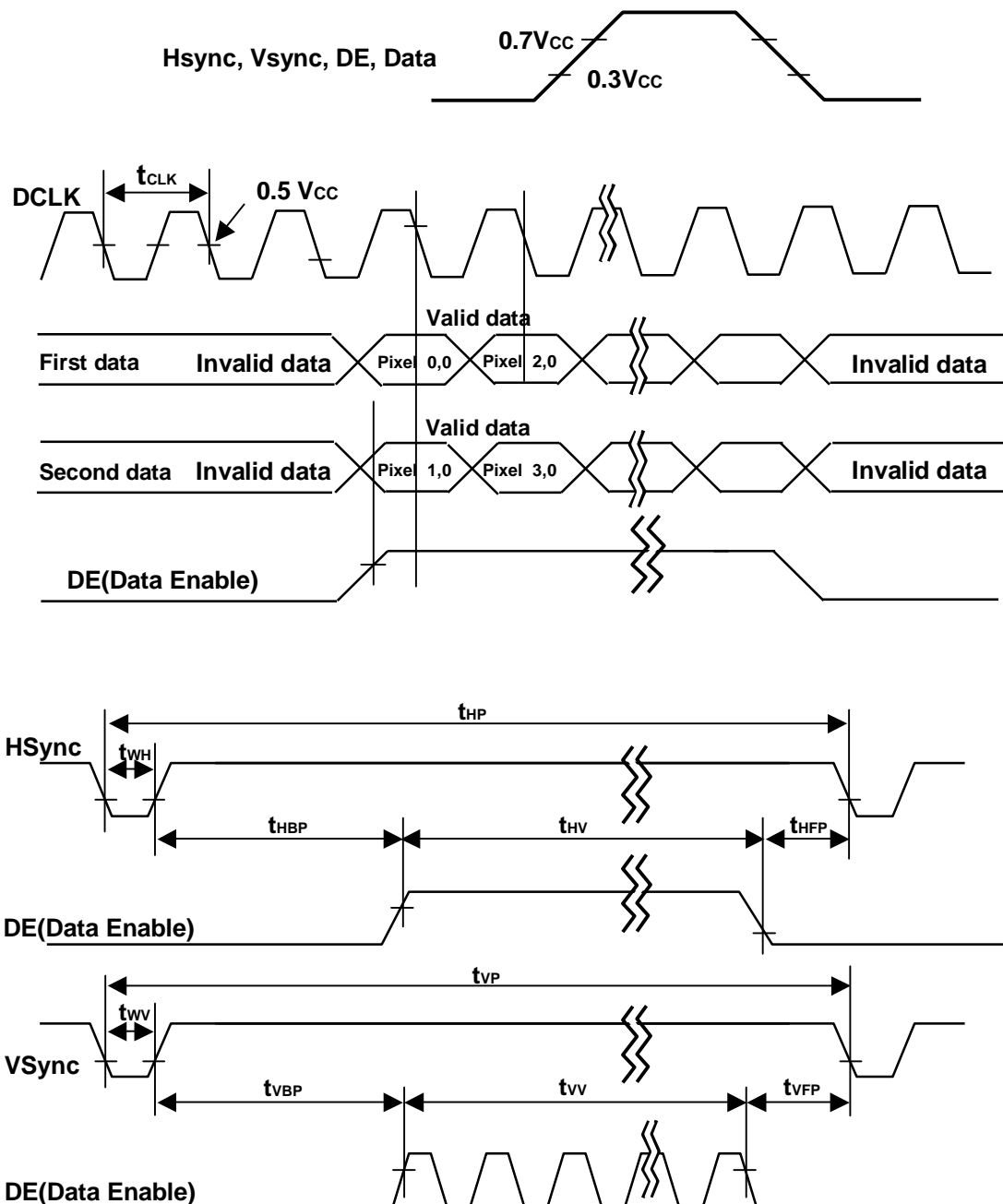
[Figure 6] Signal timing waveforms

Product Specification

3-5. Color Input Data Reference

The brightness of each primary color(red,green and blue) is based on the 8-bit gray scale data input for the color ; the higher the binary input, the brighter the color. The table below provides a reference for color versus data input.

Table 7. Color data reference

| Color		Red MSB R7	R6	R5	R4	R3	R2	R1	LSB R0	Green MSB G7	G6	G5	G4	G3	G2	G1	LSB G0	Blue MSB B7	B6	B5	B4	B3	B2	B1	LSB B0
Basic colors	Black	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red(255)	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Green(255)	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0
	Blue(255)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1
	Cyan	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	Magenta	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1
	Yellow	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0
	White	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Red	Red(000) dark	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red(001)	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red(002)	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	Red(253)	1	1	1	1	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red(254)	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red(255) bright	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Green	Green(000)dark	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Green(001)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
	Green(002)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	Green(253)	0	0	0	0	0	0	0	0	1	1	1	1	1	1	0	1	0	0	0	0	0	0	0	0
	Green(254)	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0
	Green(255)bright	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0
Blue	Blue(000) dark	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Blue(001)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	Blue(002)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	Blue(253)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	0	1
	Blue(254)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	0
	Blue(255) bright	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1

Product Specification

3-6. Power Sequence
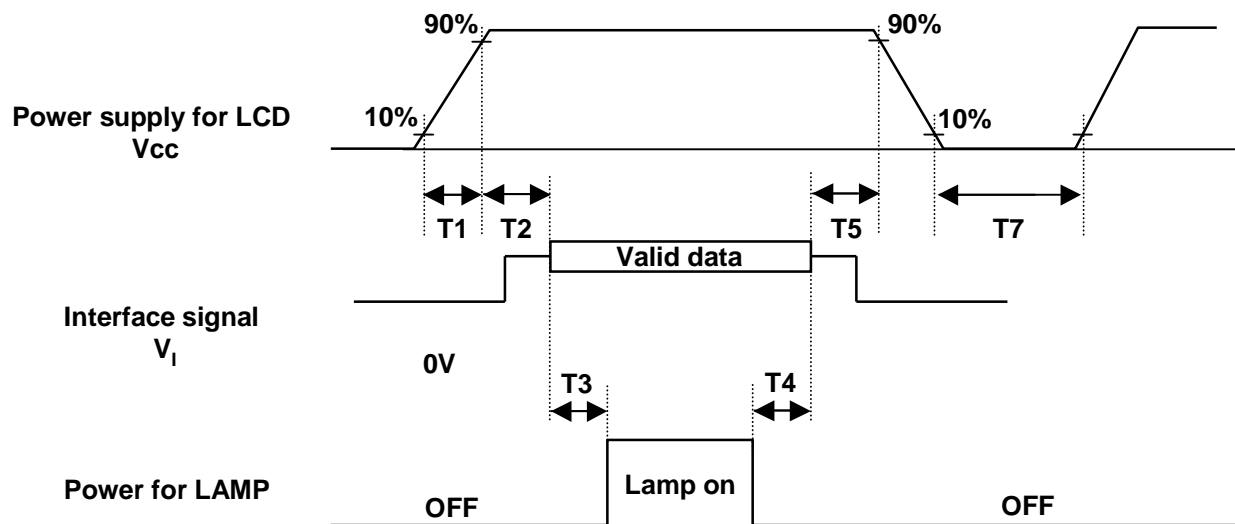
[Figure 7] Power sequence

Table 8. Power sequence time delay

Parameter	Values			Units
	Min.	Typ.	Max.	
T_1	0.5	-	10	ms
T_2	0.01	-	50	ms
T_3	500	-	-	ms
T_4	200	-	-	ms
T_5	0.01	-	50	ms
T_7	500	-	-	ms

Notes : 1. Please avoid floating state of interface signal at invalid period.
      2. When the interface signal is invalid, be sure to pull down the power supply for LCD V_{CC} to 0V.
      3. Lamp power must be turn on after power supply for LCD and interface signals are valid.

3-7. V$_{CC}$ Power Dip Condition
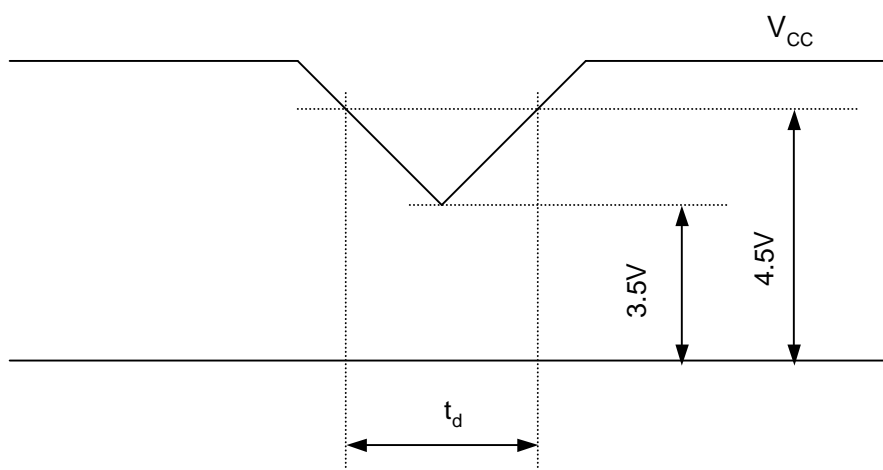
[Figure 8] Power dip condition

1) Dip condition

$3.5V \leq V_{CC} < 4.5V$, $t_d \leq 20ms$

2) $V_{CC} < 3.5V$

V_{CC}-dip conditions should also follow the Power On/Off conditions for supply voltage.

LG Display

| Product Specification |

4. Optical Specifications

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 measured at an approximate distance 50cm from the LCD surface at a viewing angle of Φ and θ equal to 0 °.

Figure. 9 presents additional information concerning the measurement equipment and method.
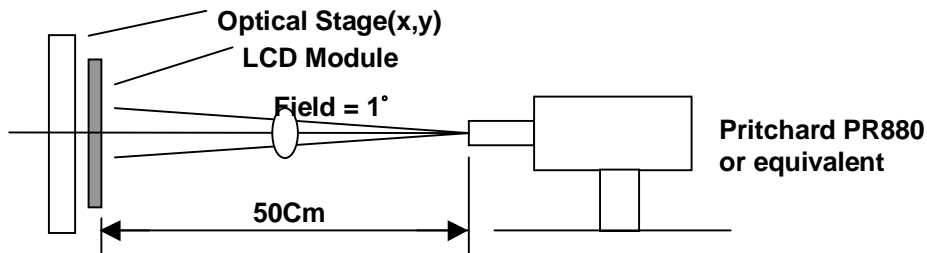
[Figure 9] Optical characteristic measurement equipment and method

Table 9. Optical characteristics (Ta=25 °C, V_{CC}=5.0V, f_V=60Hz Dclk=106.5MHz, I_{BL}=8.0mArms)

| Parameter	Symbol	Values			Units	Notes
		Min.	Typ.	Max.		
Contrast ratio	CR	500	800	-		1
Surface luminance, white	L_{WH}	200	250	-	cd/m^2	2
Luminance uniformity	$\triangle I_9$	75	-	-	%	3
Response time	Tr		8		ms	4
Rise time	Tr_R	-	2	5		
Decay time	Tr_D	-	6	11		
CIE color coordinates						
Red	XR		0.609			
	YR		0.339			
Green	XG		0.307			
	YG	Typ	0.592	Typ		
Blue	XB	-0.03	0.150	+0.03		
	YB		0.095			
White	XW		0.313			
	YW		0.329			
Viewing angle (by CR ≥ 10)						5
X axis, right(ϕ=0°)	θr	70	85	-	degree	
X axis, left (ϕ=180°)	θl	70	85	-		
Y axis, up (ϕ=90°)	θu	60	65	-		
Y axis, down (ϕ=270°)	θd	70	85	-		
Viewing angle (by CR ≥ 5)						
X axis, right(ϕ=0°)	θr	75	88		degree	
X axis, left (ϕ=180°)	θl	75	88			
Y axis, up (ϕ=90°)	θu	70	85			
Y axis, down (ϕ=270°)	θd	70	85			
Relative brightness				1.7		6
Luminance uniformity - Angular dependence (TCO'99)		-	-			Figure 10
Crosstalk				1.5		Figure 13
Gray scale		1.9	2.2	2.5	%	

Product Specification

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 50cm from the surface with all pixels displaying white. For more information see [Figure 10].
When I_{BL}=8.0mA, L_{WH}=200cd/m^2(Min.) 250cd/m^2(Typ.)

3. The uniformity in surface luminance , $\triangle I_9$ is determined by measuring L_{ON} at any point in test area. But the management of $\triangle I_9$ is determined by measuring Lon at each test position 1 through 9, and then dividing the maximum L_{ON} of 9 points luminance by minimum L_{ON} of 9 points luminance. For more information see [Figure 10].
   $\triangle I_9$= Minimum (L_{ON1},L_{ON2}, ….. L_{ON9}) ÷ Maximum (L_{ON1},L_{ON2}, ….. L_{ON9}) ×100 (%)

4. Response time is the time required for the display to transition from white to black(Rise Time, Tr_R) and from black to white(Decay Time, Tr_D). For additional information see [Figure 11].
The sampling rate is 2,500 sample/sec.

5. 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 Figure 12 .

6. Gray scale specification

Table 10. Gray scale

Gray level	Luminance(%) (Typ.)
L0	0.12
L31	1.2
L63	4.57
L95	11.3
L127	21.4
L159	35.2
L191	52.8
L223	74.4
L255	100

Product Specification

Figure 10. Luminance measuring point

<Measuring point for luminance variation>   <Measuring point for surface luminance>

H : 367.2 mm
V : 229.5 mm
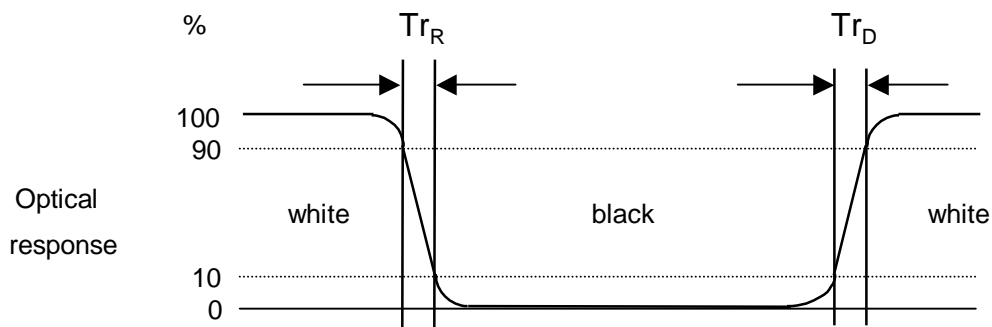@ H,V : Active Area

Active Area
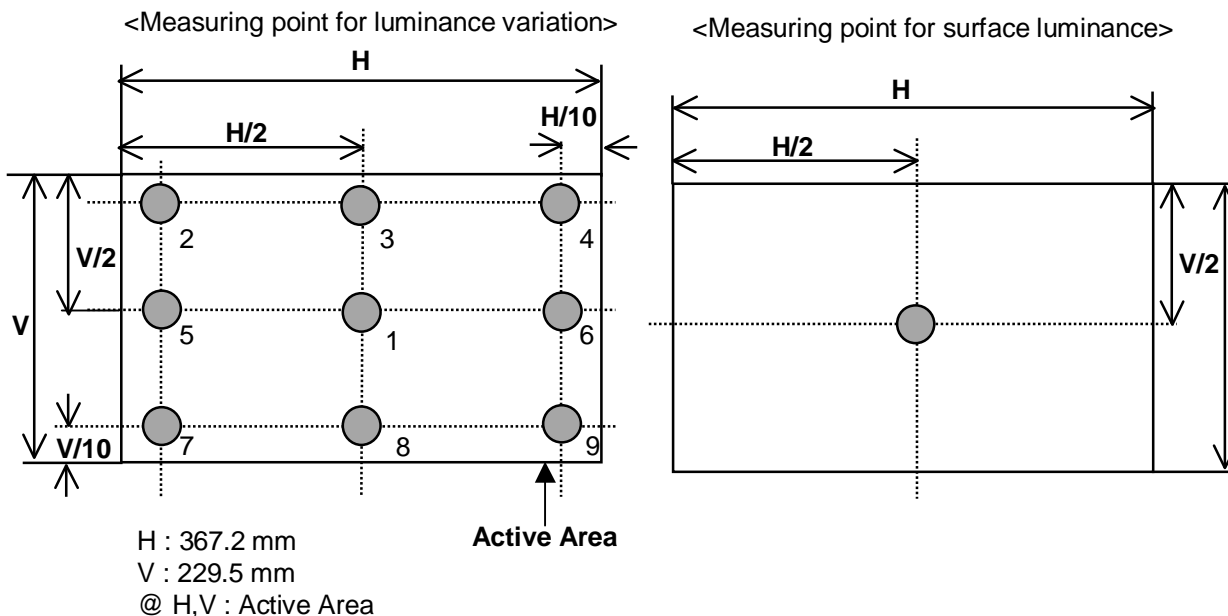
< Luminance Uniformity - angular – dependence (L_R& T_B)

TCO '99 Luminance uniformity – angular dependence, is the capacity of the VDU to present the same luminance level independently of the viewing direction. The angular-dependent luminance uniformity is calculated as the ratio of maximum luminance to minimum luminance in the specified measurement areas.

Test pattern : 80% white pattern
Test point : 2-point
Test distance : D * 1.5 = 65.0㎝
Test method : $L_R = ((L_{max.+30deg.} / L_{min.+30deg.})$
$+ (L_{max.-30deg.} / L_{min.-30deg.})) / 2$
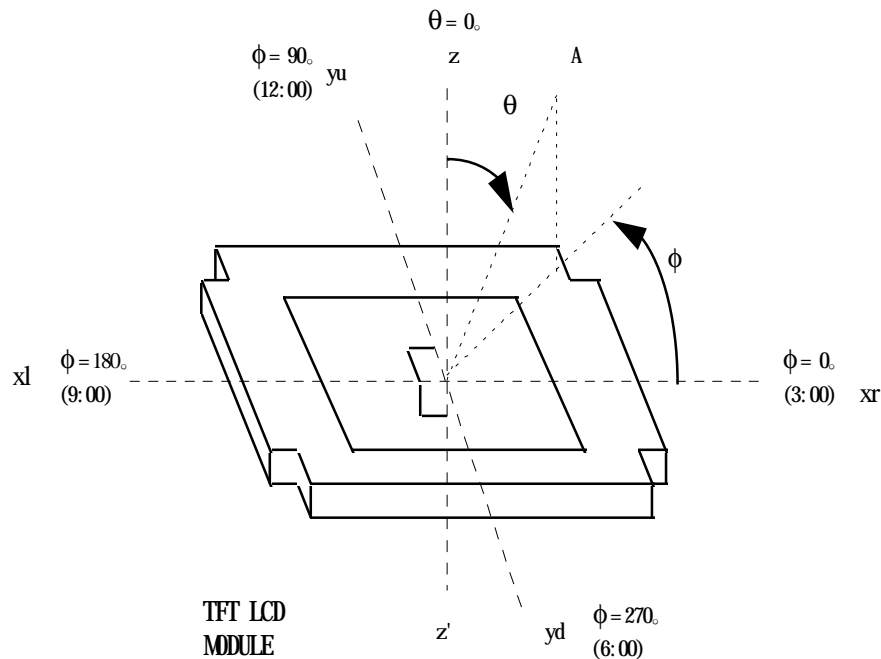$T_B = ((L_{max.+15deg.} / L_{min.+15deg.})$
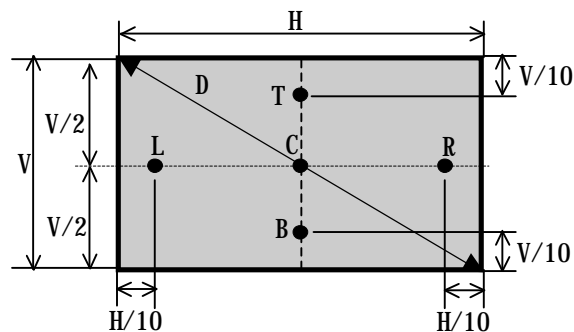
Figure 11. Response time

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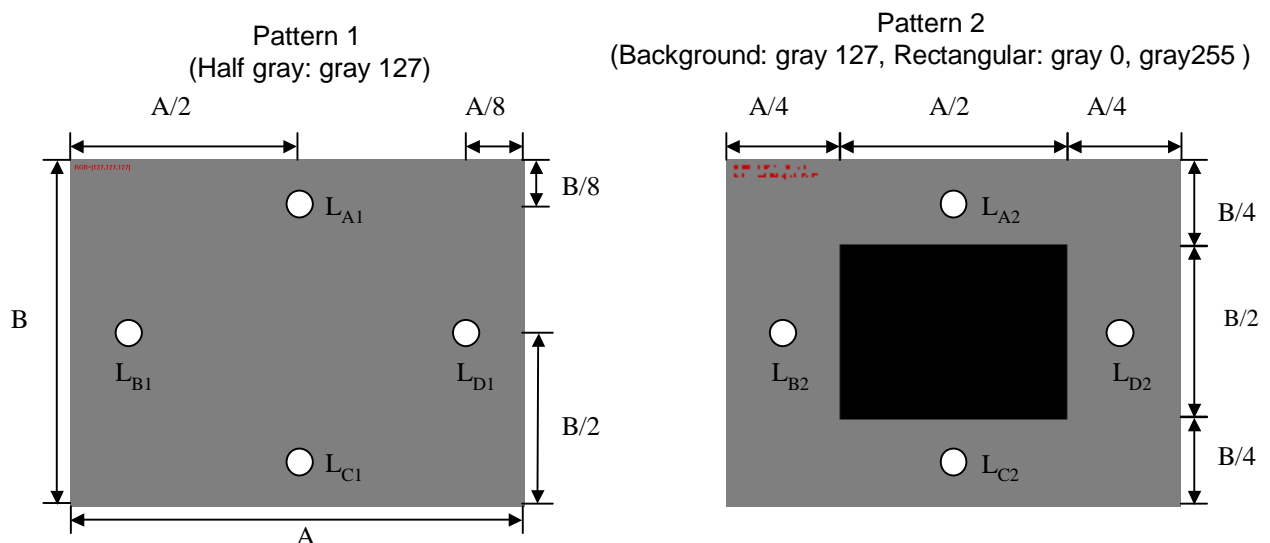
Tr_R Tr_D

%
100
90

Optical
response

white   black   white

10
0

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Product Specification

Figure 12. Viewing angle

<Dimension of viewing angle range>

Figure 13. Crosstalk

The equation of crosstalk : $(\vert L_{A[or\ C]2}-L_{A[or\ C]1}\vert /L_{A[or\ C]1}) \times 100(\%)$ [Vertical],
$(\vert L_{B[or\ D]2}-L_{B[or\ D]1}\vert /L_{B[or\ D]1}) \times 100(\%)$ [Horizontal]

Pattern 1
(Half gray: gray 127)

Pattern 2
(Background: gray 127, Rectangular: gray 0, gray255)

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Product Specification

5. Mechanical Characteristics

Table 11. provides general mechanical characteristics for the model LM171WX3-TLC1. Please refer to Figure 14,15 regarding the detailed mechanical drawing of the LCD.

Table 11. Mechanical characteristics

Outline Dimension	Horizontal	389.2mm
	Vertical	254.5mm
	Depth	11.5mm
Bezel Area	Horizontal	370.6 mm
	Vertical	232.9 mm
Active Display Area	Horizontal	367.2mm
	Vertical	229.5mm
Weight	1360 g(Typ.), 1,430 g(Max.)	
Surface Treatment	Hard coating(3H) Anti-glare(12%) treatment of the front polarizer	

Figure 14. Front view

SECTION   A-A
SCALE   2/1

SECTION   B-B
SCALE   2/1
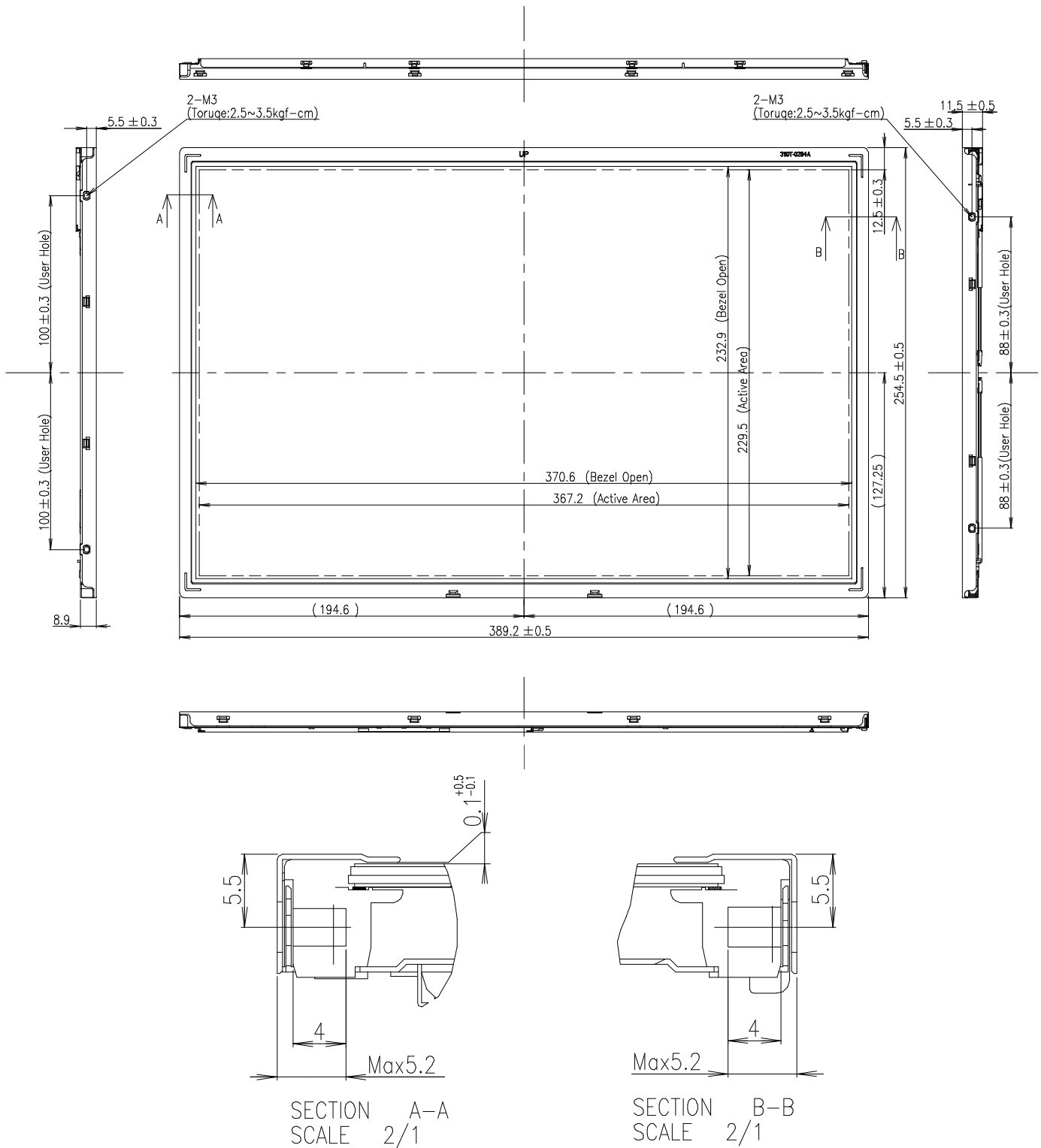
Figure 15. Rear view
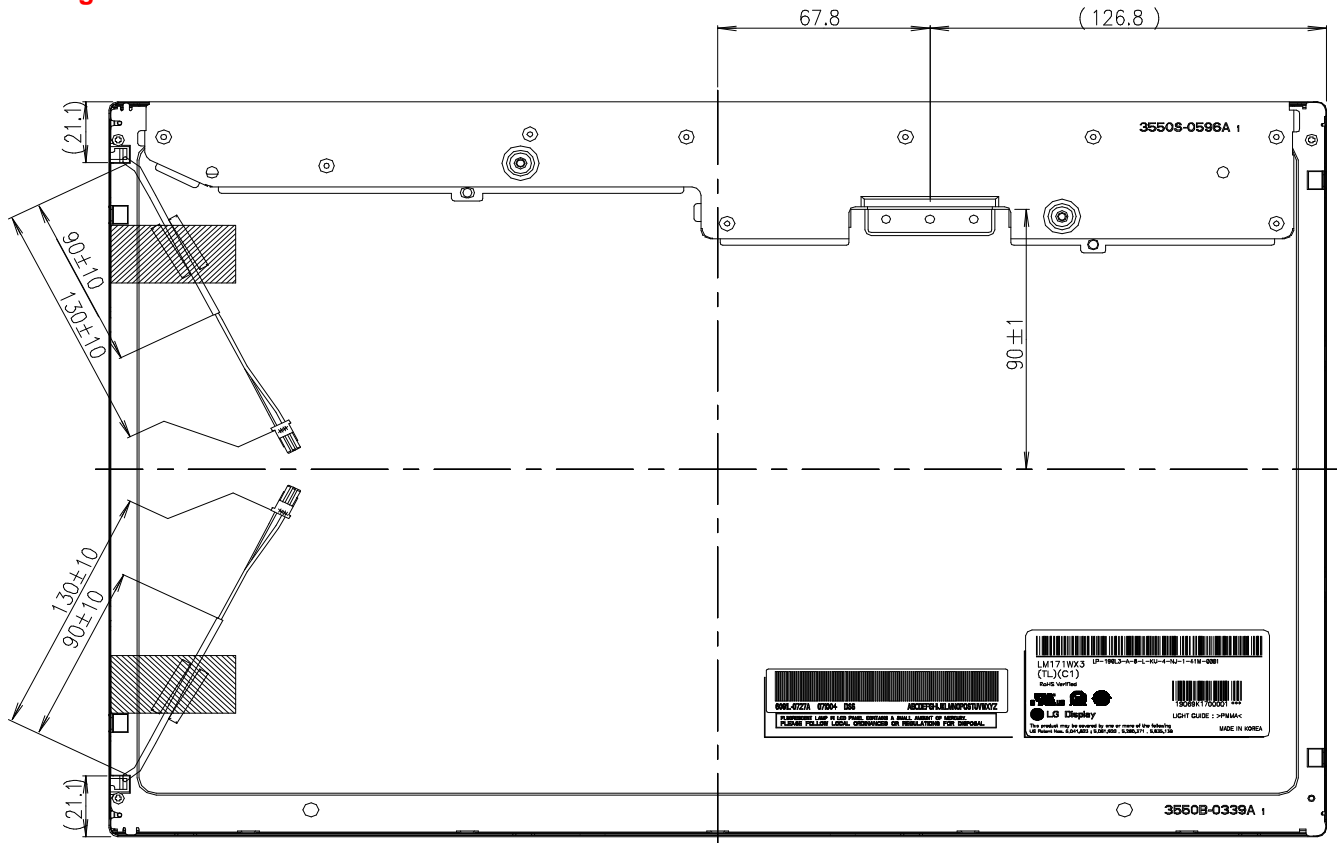
NOTES

1. Unspecified tolerances to be ±0.5
2. Backlight wires and contraction tubes are excluded from outline dimensions.
3. Tilt and partial disposition tolerance of display area as following.
    (1) Y-Direction : |A-B| ≤ 1.0
    (2) X-Direction : |C-D| ≤ 1.0
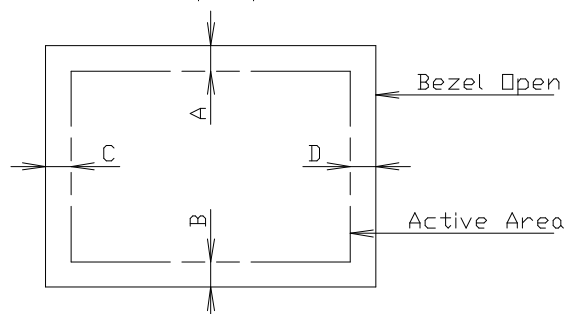
4. Do not wind conductive tape around the backlight wires.
5. Lamp Connector Specification.
    : YEONHO 20015HS-03LB Only.
6. I/F Connector Specification : AL230F-ALG1D-P or Equivalent.

Product Specification

6. Reliability

Table 12. Environment test condition

No.	Test item	Conditions
1	High temperature storage test	Ta= 60°C 240h
2	Low temperature storage test	Ta= -20°C 240h
3	High temperature operation test	Ta= 50°C 50%RH 240h
4	Low temperature operation test	Ta= 0°C 240h
5	Vibration test (non-operating)	Wave form : random Vibration level : 1.0G RMS Bandwidth : 10-300Hz Duration : X,Y,Z, 30 min. 　　　　　　　 One time each direction
6	Shock test (non-operating)	Shock level : 120G Waveform : half sine wave, 2ms Direction : $\pm$X, $\pm$Y, $\pm$Z 　　　　　　　 One time each direction
7	Altitude storage / shipment	0 - 40,000 feet(12,192m)

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

Product Specification

7. International Standards

7-1. Safety

a) UL 60950-1:2003, First Edition, Underwriters Laboratories, Inc.,
Standard for Safety of Information Technology Equipment.
b) CAN/CSA C22.2, No. 60950-1-03 1st Ed. April 1, 2003, Canadian Standards Association,
   Standard for Safety of Information Technology Equipment.
c) EN 60950-1:2001, First Edition,
   European Committee for Electrotechnical Standardization(CENELEC)
   European Standard for Safety of Information Technology Equipment.
d) RoHS, Directive 2002/95/EC of the European Parliament and of the council of 27 January 2003

7-2. EMC

a) ANSI C63.4 "Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electrical Equipment in the Range of 9kHZ to 40GHz. "American National Standards Institute(ANSI), 1992
b) C.I.S.P.R "Limits and Methods of Measurement of Radio Interface Characteristics of Information Technology Equipment." International Special Committee on Radio Interference.
c) EN 55022 "Limits and Methods of Measurement of Radio Interface Characteristics of Information Technology Equipment." European Committee for Electrotechnical Standardization.(CENELEC), 1998
(Including A1: 2000)

8. Packing

8-1. Designation of Lot Mark

a) Lot Mark

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

A,B,C : SIZE(INCH)   D : YEAR
E : MONTH   F ~ M : SERIAL NO.

Note
   1. YEAR

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

   2. MONTH

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

b) Location of Lot Mark

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

8-2. Packing Form

a) Package quantity in one box : 12 pcs
b) Box size : 359mm X 330mm X 458mm.

Product Specification

9. Precautions

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

9-1. Mounting Precautions

(1) You must mount a module using holes arranged in four corners or four sides.
(2) You should consider the mounting structure so that uneven force(ex. twisted stress) is not applied to the module.
   And the case on which a module is mounted should have sufficient strength so that external force is not transmitted directly to the module.
(3) Please attach a transparent protective plate to the surface in order to protect the polarizer.
   Transparent protective plate should have sufficient strength in order to the resist external force.
(4) You should adopt radiation structure to satisfy the temperature specification.
(5) Acetic acid type and chlorine type materials for the cover case are not describe because the former generates corrosive gas of attacking the polarizer at high temperature and the latter causes circuit break by electro-chemical reaction.
(6) Do not touch, push or rub the exposed polarizers with glass, tweezers or anything harder than HB pencil lead. And please do not rub with dust clothes with chemical treatment.
   Do not touch the surface of polarizer for bare hand or greasy cloth.(Some cosmetics are determined to the polarizer.)
(7) When the surface becomes dusty, please wipe gently with absorbent cotton or other soft materials like chamois soaks with petroleum benzene. 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.
(8) Wipe off saliva or water drops as soon as possible. Their long time contact with polarizer causes deformations and color fading.
(9) Do not open the case because inside circuits do not have sufficient strength.

9-2. 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) Module has high frequency circuits. Sufficient suppression to the electromagnetic interference shall be done by system manufacturers. Grounding and shielding methods may be important to minimized the interference.
(7) Please do not give any mechanical and/or acoustical impact to LCM. Otherwise, LCM can not be operated its full characteristics perfectly.
(8) A screw which is fastened up the steels should be a machine screw (if not, it causes metal foreign material and deal LCM a fatal blow)

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) The protection film is attached to the bezel with a small masking tape.
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) 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 Bezel after the protection film is peeled off.
(3) You can remove the glue easily. When the glue remains on the Bezel or its vestige is recognized, please wipe them off with absorbent cotton waste or other soft material like chamois soaked with normal-hexane.

<u>Warranty for Non-Inclusion of Hazardous Substances
in Products (ver.4.1)</u>

Our company hereby warrants and guarantees that all of or part of products,
including, but not limited to, the peripherals, accessories or (including your
subsidiaries and affiliated company) directly or packages, manufactured and/ or
delivered to your company indirectly by our company (including our subsidiaries
or affiliated companies) are free from any of the substances listed in your
company's Technology Standard or its subsequent revision, including the
following articles,

1. Our company actually cooperates with environment-friendly policy
pushed by your company and follows the total abolition schedule of Pb, Cd,
Cr+6, Hg, PBB and PBDEs proposed by Hazardous substances
management standard in your company

2. Our company don't excessively enclose to the noxious material including
Cd, Pb in products and parts supporting to the department of DID in LG
electronics. If the environmental accident is occurred by our company's
mistake and insufficient improvement, acts on our company's responsibility

3. Our company ensure that all of information submitted to your company is
not arbitrary estimation and is to the exact document based on reliable
data.

By attached Data, Our company warrants this products comfirm to
following requirements.(Check each applicable item)

☑ Pb Free Soldering   ☑ Pb Free   ☑ RoHS Free   ☑ TCO '03

Definition :
■ Pb Free Soldering : Parts must meet DID's Heat resistance condition.
            (Reflow Type:250℃,10sec, Flow Type : 260℃,10sec)
■ Pb Free : Lead wire plating is Pb Free(Pb content < 1,000ppm) and
            Inner contact point and Body itselt don't contain Pb(Pb content < 1,000ppm)
■ RoHS Free : Part does not contain Pb,Cd,Cr+6,Hg,PBBs and PBDEs(Cd<100ppm,Others<1,000ppm)
            and supplier must submit evidences(ICP,AAS,UV-Vis,GC) certificated by authorised agency
■ TCO '03 : Part meet TCO 03 and LG electronics requirement
            (Cd<5ppm, Pb<50ppm, Hg<2ppm, Cr+6,PBBs,PBDEs<100)

Company name : *LG. philips LCD*

Date   : *Jan. 11. 2021.*

Representative : *Mun-Cheal Jeang*

Signature   :