SPECIFICATION
FOR
APPROVAL

(   )   Preliminary Specification
(●)   Final Specification

Title	49.0" WUXGA TFT LCD

BUYER	General
MODEL	

SUPPLIER	LG Display Co., Ltd.
*MODEL	LD490EUE
SUFFIX	FHA1 (RoHS Verified)

APPROVED BY	SIGNATURE DATE
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Please return 1 copy for your confirmation with your signature and comments.	

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RECORD OF REVISIONS

| Revision No.	Revision Date	Page	Description

1. General Description

The LD490EUE is a Color Active Matrix Liquid Crystal Display with an integral Light Emitting Diode (LED) backlight system. The matrix employs a-Si Thin Film Transistor as the active element.

It is a transmissive display type which is operating in the normally black mode. It has a 48.50 inch diagonally measured active display area with WUXGA resolution (1080 vertical by 1920 horizontal pixel array). Each pixel is divided into Red, Green and Blue sub-pixels or dots which are arrayed in vertical stripes. Gray scale or the luminance of the sub-pixel color is determined with a 8-bit gray scale signal for each dot. Therefore, it can present a palette of more than 16.7Milion colors.

It has been designed to apply the 8-bit 2-port LVDS interface.

It is intended to support Commercial display where high brightness, super wide viewing angle, high color gamut, high color depth and fast response time are important.
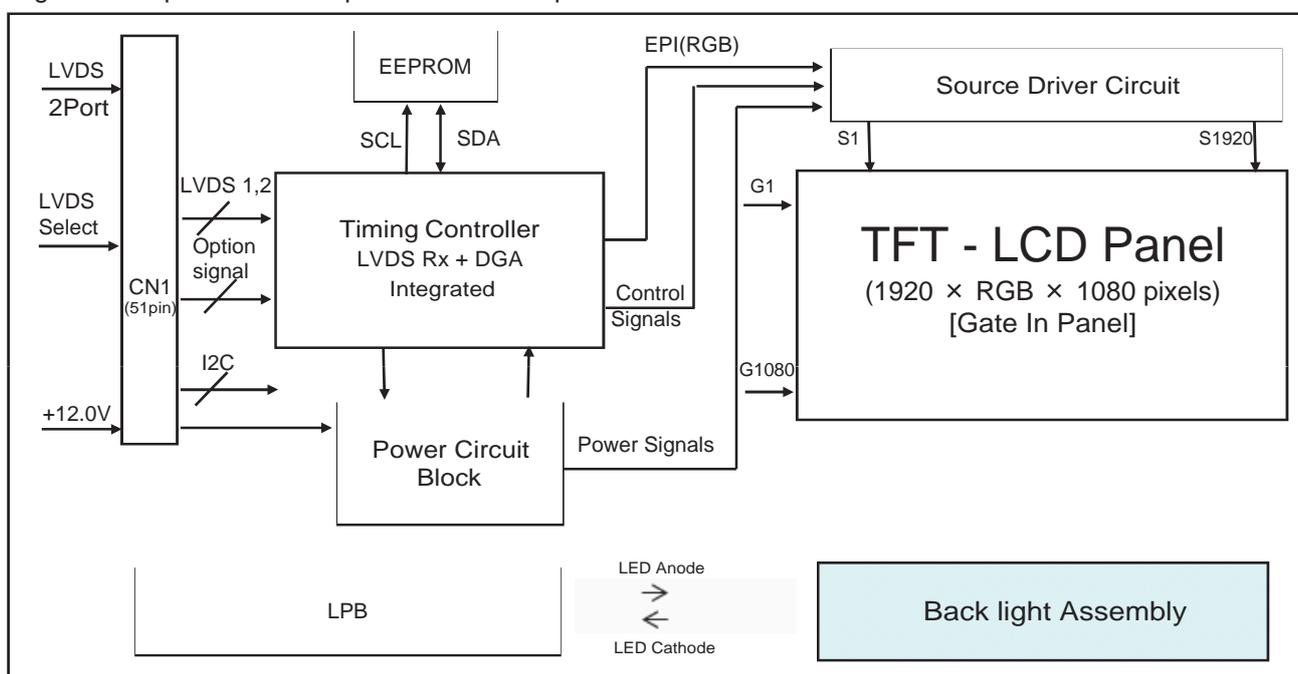
General Features

| Active Screen Size	48.50 inches(1232.0 mm) diagonal
Outline Dimension	1096.2(H) X 632.5(V) X 14.0(D_Body)(Typ.)
Pixel Pitch	0.55926 mm x 0.55926 mm
Pixel Format	1920 horiz. by 1080 vert. Pixels, RGB stripe arrangement
Color Depth	8bit, 16.7 Million colors
Luminance, White	700 cd/m^2 (Center 1point ,Typ.)
Viewing Angle (CR>10)	Viewing angle free (R/L 178 (Min.), U/D 178 (Min.))
Power Consumption	Total 51.3W (Typ.) [Logic= 4.3W(Typ.)/5.7W(Max.) , BLU : 47W(Typ.)/50W(Max.)]
Weight	10.8kg(Typ.) 11kg(Max.)
Display Mode	Transmissive mode, Normally black
Surface Treatment	Hard coating(3H), Anti-glare treatment of the front polarizer, Haze 1%(Typ.)
Possible Display Type	Landscape and Portrait Enabled

2. Absolute Maximum Ratings

The following items are maximum values which, if exceeded, may cause faulty operation or permanent damage to the LCD module.

Table 1. ABSOLUTE MAXIMUM RATINGS

Parameter		Symbol	Value		Unit	Note
			Min	Max		
Power Input Voltage	LCD Circuit	V_{LCD}	-0.3	+14.0	V_{DC}	1
LED Input Voltage	Forward Voltage	V_F	-	147.2	V_{DC}	
T-Con Option Selection Voltage		V_{LOGIC}	-0.3	+4.0	V_{DC}	
Operating Temperature		T_{OP}	0	+50	$^{\circ}C$	2,3
Storage Temperature		T_{ST}	-20	+60	$^{\circ}C$	
Panel Front Temperature		T_{SUR}	-	+68	$^{\circ}C$	4
Operating Ambient Humidity		H_{OP}	10	90	%RH	2,3
Storage Humidity		H_{ST}	10	90	%RH	

Notes

1. Ambient temperature condition (Ta = 25 ± 2 $^{\circ}C$)
2. Temperature and relative humidity range are shown in the figure below.
    Wet bulb temperature should be Max 39$^{\circ}C$, and no condensation of water.
3. Gravity mura can be guaranteed below 40$^{\circ}C$ condition.
4. The maximum operating temperatures is based on the test condition that the surface temperature
   of display area is less than or equal to 68$^{\circ}C$ with LCD module alone in a temperature controlled chamber.
   Thermal management should be considered in final product design to prevent the surface temperature of
   display area from being over 68$?$. The range of operating temperature may degraded in case of
   improper thermal management in final product design.
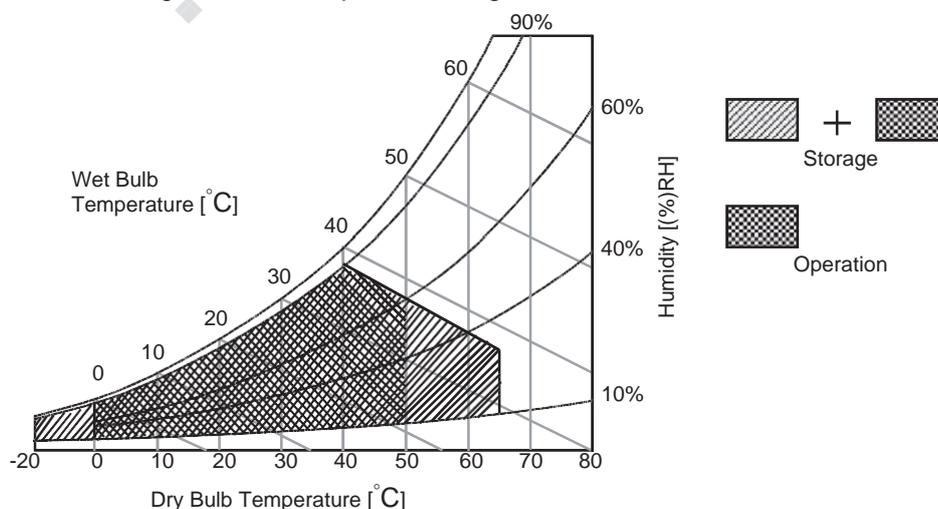
3. Electrical Specifications

3-1. Electrical Characteristics

It requires two power inputs. One is employed to power for the LCD circuit. The other Is used for the LED backlight and LED Driver circuit.

Table 2. ELECTRICAL CHARACTERISTICS

Parameter		Symbol	Value			Unit	Note
			Min	Typ	Max		
Circuit :							
Power Input Voltage		V$_{LCD}$	10.8	12.0(12.7)	14.0	V$_{DC}$	5
Power Input Current		I$_{LCD}$	-	360(350)	468	mA	1
			-	508(490)	660	mA	2
T-CON Option Selection Voltage	Input High Voltage	V$_{IH}$	1.62	-	1.98	V$_{DC}$	
	Input Low Voltage	V$_{IL}$	0	-	0.54	V$_{DC}$	
Power Consumption		P$_{LCD}$	-	4.3(4.4)	5.7	Watt	1
Rush current		I$_{RUSH}$	-	-	5.0	A	3

Note 1. The specified current and power consumption are under the V$_{LCD}$=12.0V, Ta=25 ± 2°C, f$_V$=60Hz condition, and mosaic pattern(8 x 6) is displayed and f$_V$ is the frame frequency.
  2. The current is specified at the maximum current pattern.
  3. The duration of rush current is about 2ms and rising time of power input is 0.5ms (min.).
  4. Ripple voltage level is recommended under ±5% of typical voltage
 5. VLCD Should be under the maximum voltage include the ripple

White : 255 Gray
Black :   0 Gray
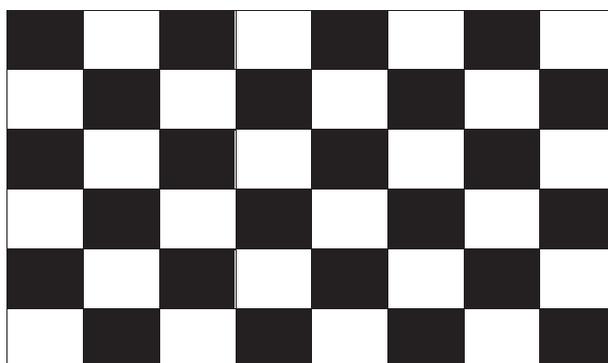
Mosaic Pattern(8 x 6)

Table 3. ELECTRICAL CHARACTERISTICS (Continue)

Parameter		Symbol	Values			Unit	Note
			Min	Typ	Max		
Backlight Assembly :							
Forward Current (one array)	Anode	$I_{F (anode)}$		170		mAdc	±5%
	Cathode	$I_{F (cathode)}$		170		mAdc	2, 3
Forward Voltage		V_F	129.2	138.2	147.2	Vdc	4
Forward Voltage Variation		AV_F			4.0	Vdc	5
Power Consumption		P_{BL}		47.0		W	6
Burst Dimming Duty		On duty	1		100	%	
Burst Dimming Frequency		1/T	95		182	Hz	8
LED Array : (APPENDIX-V)							
Life Time			30,000	50,000		Hrs	7

Notes : The design of the LED driver must have specifications for the LED array in LCD Assembly.
The electrical characteristics of LED driver are based on Constant Current driving type.
The performance of the LED in LCM, for example life time or brightness, is extremely influenced by the characteristics of the LED Driver. So, all the parameters of an LED driver should be carefully designed.
When you design or order the LED driver, please make sure unwanted lighting caused by the mismatch of the LED and the driver (no lighting, flicker, etc) has never been occurred. When you confirm it, the LCD–Assembly should be operated in the same condition as installed in your instrument.

1. Electrical characteristics are based on LED Array specification.
2. Specified values are defined for a Backlight Assembly. (IBL : 2 LED array, 170mA/LED array)
3. Each LED array has one anode terminal and one cathode terminals.
   The forward current(I_F) of the anode terminal is 170mA and it supplies 170mA into strings, respectively

(45 LED PKG / 1string)

Anode #1
Anode #2
Cathode #1 45 (LED String / 1 Array)
Cathode #2 45 (LED String / 1 Array)
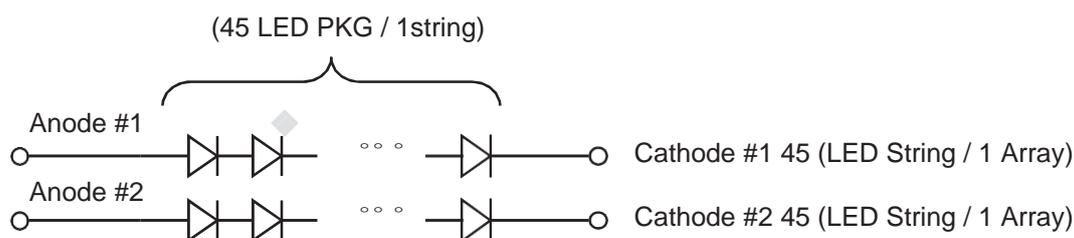
4. The forward voltage(V_F) of LED array depends on ambient temperature
5. AV_F means Max string VF – Min string VF in one Backlight. So V_F variation in a Backlight isn't over Max. 4.0V
6. Maximum level of power consumption is measured at initial turn on.
   Typical level of power consumption is measured after 1hrs aging at 25 ± 2°C.
7. The life time(MTTF) is determined as the time at which brightness of the LED is 50% compared to that of initial value at the typical LED current on condition of continuous operating at 25 ± 2°C, based on duty 100%.
8. The reference method of burst dimming duty ratio.
   It is recommended to use synchronous V-sync frequency to prevent waterfall
   (Vsync x 2 =Burst Frequency)
   Though PWM frequency is over 182Hz (max252Hz), function of backlight is not affected.

3-2. Interface Connections

This LCD module employs two kinds of interface connection, 51-pin connector is used for the module electronics.

3-2-1. LCD Module

- LCD Connector(CN1): FI-RE51S-HF(manufactured by JAE) or GT05P-51S-H38(manufactured by LSM)
                              or IS050-C51B-C39(manufactured by UJU)
- Mating Connector : FI-R51HL(JAE) or compatible

Table 4. MODULE CONNECTOR(CN1) PIN CONFIGURATION

No	Symbol	Description	No	Symbol	Description
1	NC or GND	No Connection or Ground	27	NC	No connection
2	NC	No Connection (Note 4)	28	R2AN	SECOND LVDS Receiver Signal (A-)
3	NC	No Connection (Note 4)	29	R2AP	SECOND LVDS Receiver Signal (A+)
4	NC	No Connection (Note 4)	30	R2BN	SECOND LVDS Receiver Signal (B-)
5	NC	No Connection (Note 4)	31	R2BP	SECOND LVDS Receiver Signal (B+)
6	NC	No Connection (Note 4)	32	R2CN	SECOND LVDS Receiver Signal (C-)
7	LVDS Select	'H' =JEIDA , 'L' or NC = VESA	33	R2CP	SECOND LVDS Receiver Signal (C+)
8	NC	No Connection (Note 4)	34	GND	Ground
9	NC	No Connection (Note 4)	35	R2CLKN	SECOND LVDS Receiver Clock Signal(-)
10	NC	No Connection (Note 4)	36	R2CLKP	SECOND LVDS Receiver Clock Signal(+)
11	GND	Ground	37	GND	Ground
12	R1AN	FIRST LVDS Receiver Signal (A-)	38	R2DN	SECOND LVDS Receiver Signal (D-)
13	R1AP	FIRST LVDS Receiver Signal (A+)	39	R2DP	SECOND LVDS Receiver Signal (D+)
14	R1BN	FIRST LVDS Receiver Signal (B-)	40	NC	No connection
15	R1BP	FIRST LVDS Receiver Signal (B+)	41	NC	No connection
16	R1CN	FIRST LVDS Receiver Signal (C-)	42	NC or GND	No Connection or Ground
17	R1CP	FIRST LVDS Receiver Signal (C+)	43	NC or GND	No Connection or Ground
18	GND	Ground	44	GND	Ground (Note 5)
19	R1CLKN	FIRST LVDS Receiver Clock Signal(-)	45	GND	Ground
20	R1CLKP	FIRST LVDS Receiver Clock Signal(+)	46	GND	Ground
21	GND	Ground	47	NC	No connection
22	R1DN	FIRST LVDS Receiver Signal (D-)	48	VLCD	Power Supply +12.0V
23	R1DP	FIRST LVDS Receiver Signal (D+)	49	VLCD	Power Supply +12.0V
24	NC	No connection	50	VLCD	Power Supply +12.0V
25	NC	No connection	51	VLCD	Power Supply +12.0V
26	NC or GND	No Connection or Ground	-	-	-

Note 1. All GND(ground) pins should be connected together to the LCD module's metal frame.
     2. All V_{LCD} (power input) pins should be connected together.
     3. All Input levels of LVDS signals are based on the EIA 644 Standard.
     4. #1~#6 & #8~#10 NC (No Connection): These pins are used only for LGD (Do not connect)
     5. Specific pin No. #44 is used for "No signal detection" of system signal interface.
        It should be GND for NSB(No Signal Black) during the system interface signal is not.
        If this pin is "H", LCD Module displays AGP(Auto Generation Pattern).

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3-2-2. Backlight Module

1) BLU Connector (Plug)

   : SMH200-H07M (BOX Type)

2) Mating Connector (LPB, Socket)

   : SMAW200A-H07AA

Table 5. BACKLIGHT CONNECTOR PIN CONFIGURATION

LED Driver CNT		
Pin No	Symbol	Description
1	L Cathode	LED Output Current L
2	N.C	
3	Anode L	LED Input Current for L
4	N.C	
5	R Cathode	LED Output Current R
6	N.C	
7	Anode R	LED Input Current for R

◆ Rear view of LCM
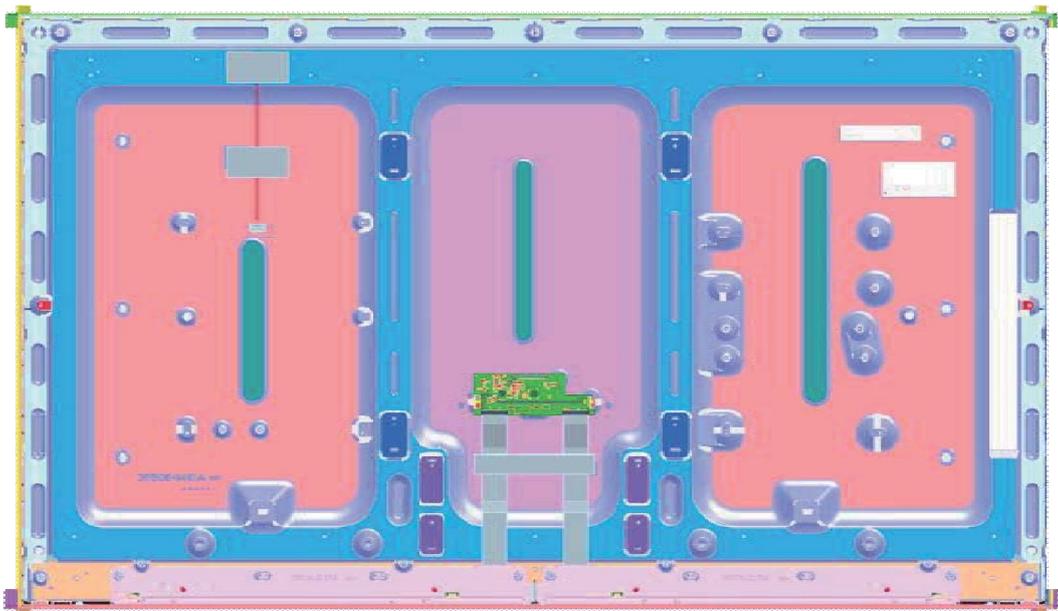
Product Specification

3-3. Signal Timing Specifications

Table 6 shows the signal timing required at the input of the LVDS transmitter. All of the interface signal timings should be satisfied with the following specification for normal operation.

Table 6. TIMING TABLE for NTSC & PAL (DE Only Mode)

ITEM		Symbol	Min	Typ	Max	Unit	Note
Horizontal	Display Period	tHV	960	960	960	tCLK	1920 / 2
	Blank	tHB	100	140	240	tCLK	1
	Total	tHP	1060	1100	1200	tCLK	
Vertical	Display Period	tVV	1080	1080	1080	Lines	
	Blank	tVB	20	45	300	Lines	1
	Total	tVP	1100	1125	1380	Lines	

ITEM		Symbol	Min	Typ	Max	Unit	Note
Frequency	DCLK	fCLK	60.00	74.25	78.00	MHz	
	Horizontal	fH	57.3	67.5	70	KHz	2
	Vertical	fV	47	60	63	Hz	2

notes: 1. The input of HSYNC & VSYNC signal does not have an effect on normal operation (DE Only Mode). If you use spread spectrum of EMI, add some additional clock to minimum value for clock margin.

2. The performance of the electro-optical characteristics may be influenced by variance of the vertical refresh rate and the horizontal frequency

3. Spread Spectrum Rate (SSR) for 50KHz ~ 100kHz Modulation Frequency(FMOD) is calculated by (7 – 0.06*Fmod), where Modulation Frequency (FMOD) unit is KHz. LVDS Receiver Spread spectrum Clock is defined as below figure

※ Timing should be set based on clock frequency.
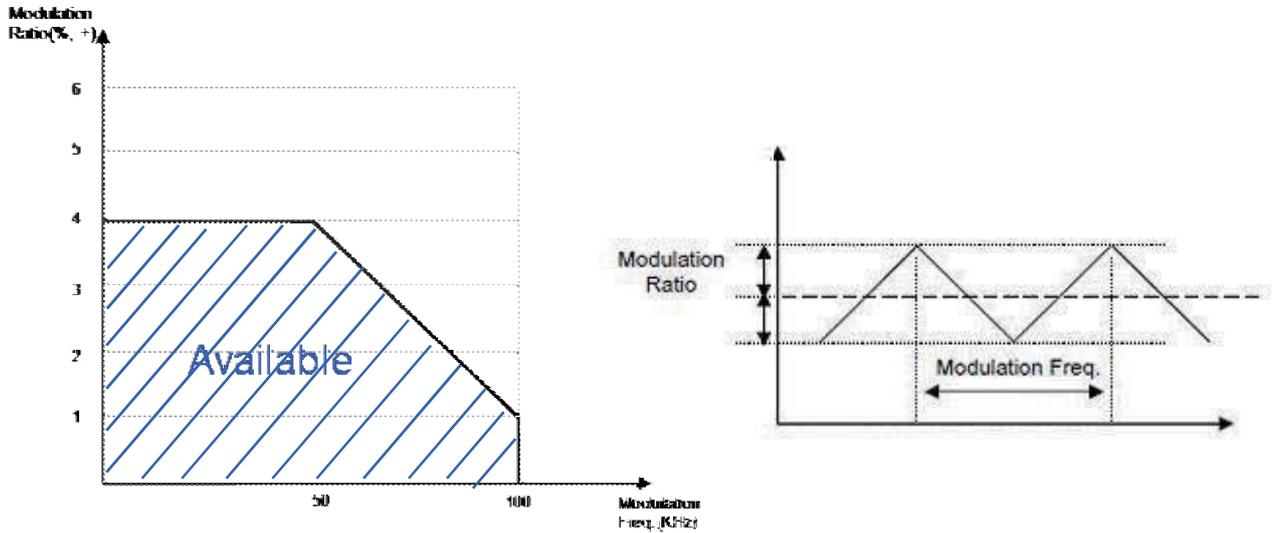
※ Please pay attention to the followings when you set Spread Spectrum Rate(SSR) and Modulation Frequency(FMOD)

1. Please set proper Spread Spectrum Rate(SSR) and Modulation Frequency (FMOD) of TV system LVDS output.

2. Please check FOS after you set Spread Spectrum Rate(SSR) and Modulation Frequency(FMOD) to avoid abnormal display. Especially, harmonic noise can appear when you use Spread Spectrum under FMOD 30 KHz.

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3-4. LVDS Signal Specification

3-4-1. LVDS Input Signal Timing Diagram

DE, Data

0.7VDD

0.3VDD

t_{CLK}

0.5 VDD

DCLK

Valid data

First data   Invalid data   Pixel 0,0   Pixel 2,0   Invalid data

Valid data

Second data   Invalid data   Pixel 1,0   Pixel 3,0   Invalid data

DE(Data Enable)

t_{HV}

t_{HP}

DE(Data Enable)   1   1080

t_{VV}

t_{VP}
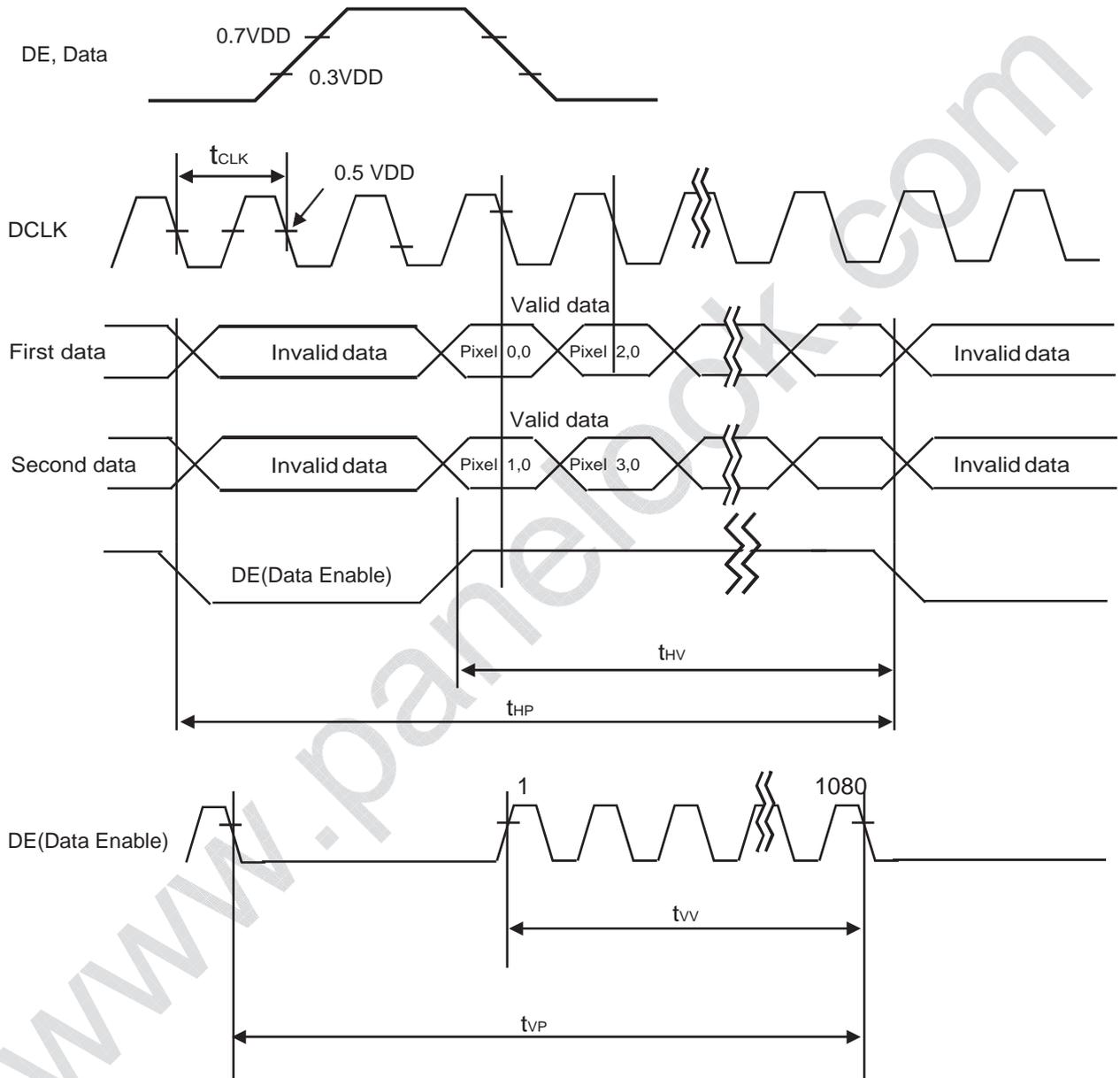
Product Specification

3-4-2. LVDS Input Signal Characteristics

1) DC Specification

V_{CM} = {(LVDS +) + (LVDS -)} /2
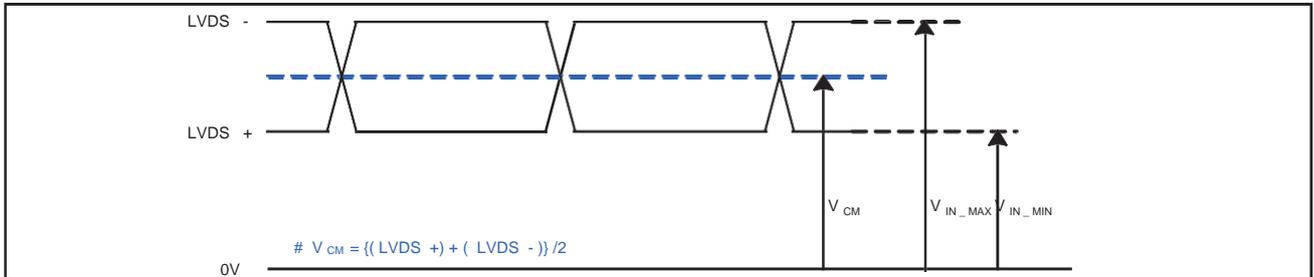
Description	Symbol	Min	Max	Unit	notes
LVDS Common mode Voltage	V_{CM}	1.0	1.5	V	-
LVDS Input Voltage Range	V_{IN}	0.7	1.8	V	-
Change in common mode Voltage	AVCM	-	250	mV	-

2) AC Specification

$(F_{clk} = 1 /T_{clk})$
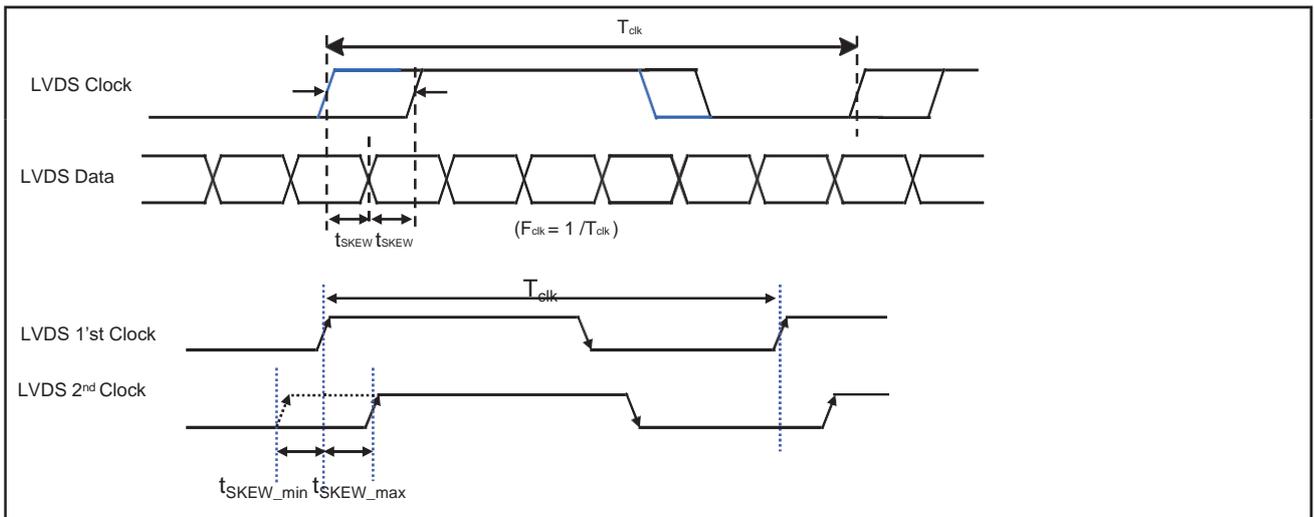
Description	Symbol	Min	Max	Unit	notes
LVDS Differential Voltage	V_{TH}	100	600	mV	Tested with Differential Probe
	V_{TL}	-600	-100	mV	2
LVDS Clock to Data Skew	t_{SKEW}	-	$|(0.2*T_{clk})/7|$	ps	-
Effective time of LVDS	t_{eff}	$|\pm360|$	-	ps	-
LVDS Clock to Clock Skew (Even to Odd)	t_{SKEW_EO}	-	$|1/7* T_{clk}|$	ps	-

notes 1. All Input levels of LVDS signals are based on the EIA 644 Standard.
2. LVDS Differential Voltage is defined within t_{eff}

Product Specification

LVDS Data

0.5tui

360ps

0V
(Differential)

VTH

VTL

360ps

teff

LVDS CLK

tui

tui : Unit Interval

0V
(Differential)

* This accumulated waveform is tested with differential probe

3-5. Color Data Reference

The brightness of each primary color(red,green,blue) is based on the 8bit gray scale data input for the color. The higher binary input, the brighter the color. Table 7 provides a reference for color versus data input.

Table 7. COLOR DATA REFERENCE

Color		Input Color Data																								
		RED								GREEN								BLUE								
		MSB							LSB	MSB							LSB	MSB							LSB	
		R7	R6	R5	R4	R3	R2	R1	R0	G7	G6	G5	G4	G3	G2	G1	G0	B7	B6	B5	B4	B3	B2	B1	B0
Basic Color	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)	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 (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)	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)	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 (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)	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)	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 (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)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1

3-6. Power Sequence

3-6-1. LCD Driving circuit

Power Supply For LCD
V_{LCD}

90%

10%

0V

T_1

T_2

30%

Interface Signal (Tx_clock)

0V

Valid Data

90%

10%

10%

T_7

T_5

Vcm : LVDS Common mode Voltage

100%

T_3

T_4

T_6

User Control Signal
(LVDS_select)

Power for LED

LED ON
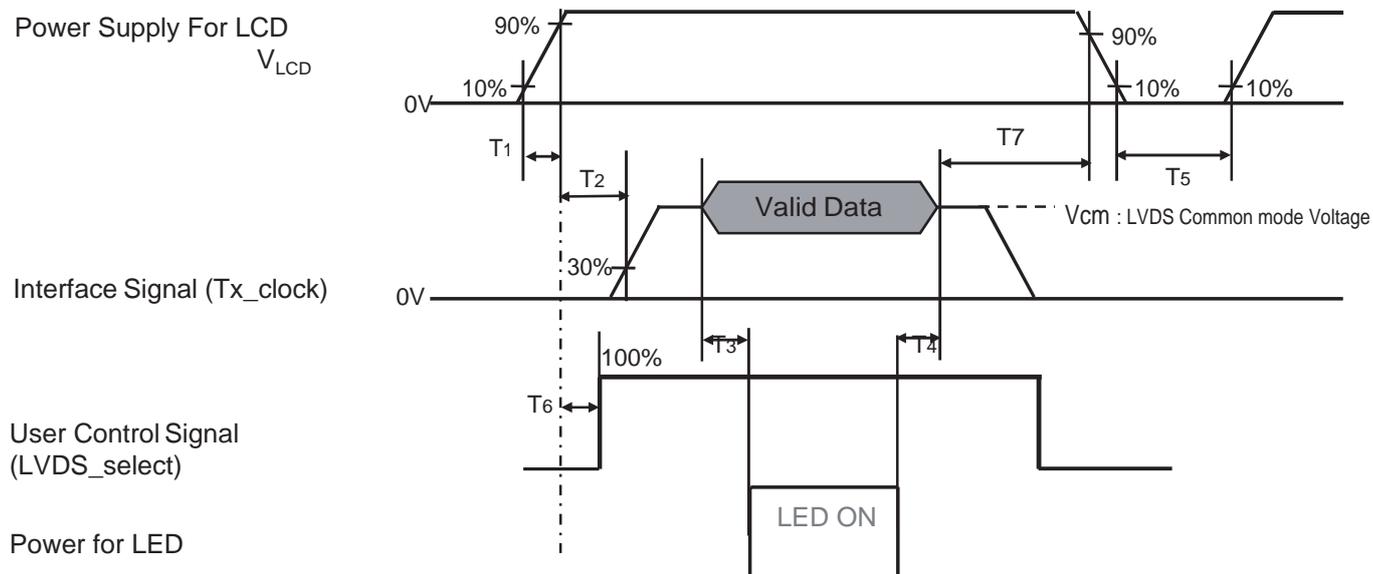
Table 8. POWER SEQUENCE

Parameter	Value			Unit	Notes
	Min	Typ	Max		
T_1	0.5	-	20	ms	1
T_2	0	-	-	ms	2
T_3	400	-	-	ms	3
T_4	100	-	-	ms	3
T_5	1.0	-	-	s	4
T_6	0	-	T_2	ms	5
T_7	0	-	-	ms	6

Note :
1. Even though T1 is over the specified value, there is no problem if I2T spec of fuse is satisfied.
2. If T2 is satisfied with specification after removing LVDS Cable, there is no problem.
3. The T3 / T4 is recommended value, the case when failed to meet a minimum specification, abnormal display would be shown. There is no reliability problem.
4. T5 should be measured after the Module has been fully discharged between power off and on period.
5. If the on time of signals (Interface signal and user control signals) precedes the on time of Power (V_{LCD}), it will be happened abnormal display. When T6 is NC status, T6 doesn't need to be measured.
6. It is recommendation specification that T7 has to be 0ms as a minimum value.
※ Please avoid floating state of interface signal at invalid period.
※ When the power supply for LCD (VLCD) is off, be sure to pull down the valid and invalid data to 0V.

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4. Optical Specification

Optical characteristics are determined after the unit has been 'ON' and stable in a dark environment at $25\pm2°C$. The values are specified at 50cm from the LCD surface at a viewing angle of 8 and 0 equal to 0 $°$. FIG. 1 shows additional information concerning the measurement equipment and method.
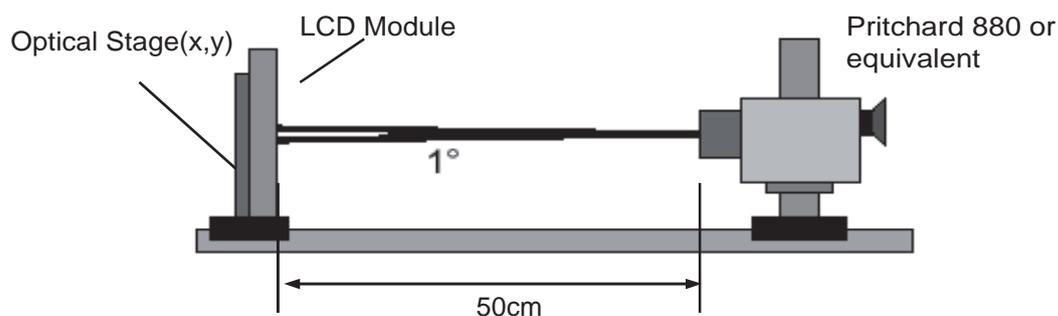

FIG. 1 Optical Characteristic Measurement Equipment and Method

Table 10. OPTICAL CHARACTERISTICS

$Ta= 25\pm2°C$, V_{LCD}=12.0V, f_V=60Hz, Dclk=74.25MHz
Duty =100%

Parameter		Symbol		Value			Unit	Note
				Min	Typ	Max		
Contrast Ratio		CR		800	1100	-		1
Surface Luminance white		L_{WH}	2D	360	450	-	cd/m^2	2
Luminance Variation		6 WHITE	9P	65	-	-	%	3
Response Time	Gray to Gray (BW)	G to G BW			12	16	ms	4
Color Coordinates [CIE1931]	RED	Rx		Typ -0.035	0.644	Typ +0.035		5
		Ry			0.335			
	GREEN	Gx			0.312			
		Gy			0.594			
	BLUE	Bx			0.153			
		By			0.053			
	WHITE	Wx			0.281			
		Wy			0.288			
Color Temperature					10,000		K	
Color Gamut					68		%	
Viewing Angle (CR>10)								
	right($\$=0°$)	0r (x axis)		89	-	-	degree	5
	left ($\$=180°$)	0l (x axis)		89	-	-		
	up ($\$=90°$)	0u (y axis)		89		-		
	down ($\$=270°$)	0d (y axis)		89	-	-		
Gray Scale				-	2.2	-		6

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

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

It is measured at center 1-point.

2. Surface luminance are determined after the unit has been 'ON' and 1 Hour after lighting the backlight in a dark environment at $25\pm2°$C. Surface luminance is the luminance value at center 1-point across the LCD surface 50cm from the surface with all pixels displaying white. For more information see the FIG. 2.

3. The variation in surface luminance , 6 WHITE is defined as :

6 WHITE(5P) = Maximum(L_{on1}, L_{on2}, L_{on3}, L_{on4}, L_{on5}) / Minimum(L_{on1}, L_{on2}, L_{on3}, L_{on4}, L_{on5})

Where L_{on1} to L_{on5} are the luminance with all pixels displaying white at 5 locations .
For more information, see the FIG. 2.

4. Response time is the time required for the display to transit from any gray to white (Rise Time, Tr_R) and from any gray to black (Decay time, Tr_D). For additional information see the FIG. 3.

   ※ G to G_{BW} Spec stands for average value of all measured points.
   Photo Detector : RD-80S / Field : 2 $°$

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 module surface. For more information, see the FIG. 4.

6. Gray scale specification

   Gamma Value is approximately 2.2. For more information, see the Table 11.

Product Specification

Table 11. Gray scale specification

Gray Level	Luminance [%] (Typ)
L0	0.08
L15	0.27
L31	1.04
L47	2.49
L63	4.68
L79	7.66
L95	11.5
L111	16.1
L127	21.6
L143	28.1
L159	35.4
L175	43.7
L191	53.0
L207	63.2
L223	74.5
L239	86.7
L255	100

Measuring point for surface luminance & measuring point for luminance variation.

A : H l 9 mm
B : V l 9 mm
@ H,V : Active Area
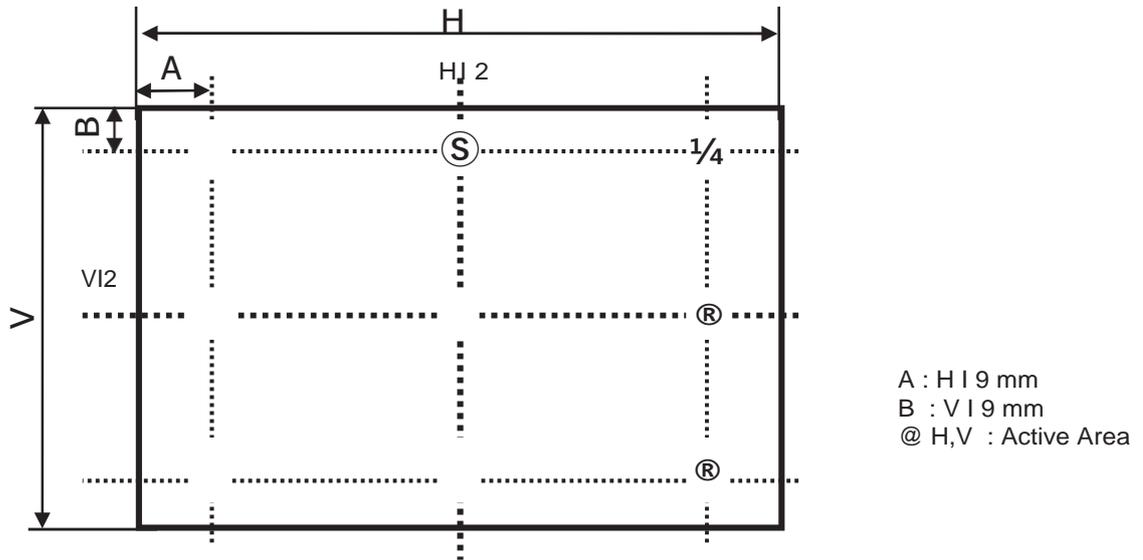
FIG. 2 9 Points for Luminance Measure

Response time is defined as the following figure and shall be measured by switching the input signal for "Gray(N)" and "Black or White".
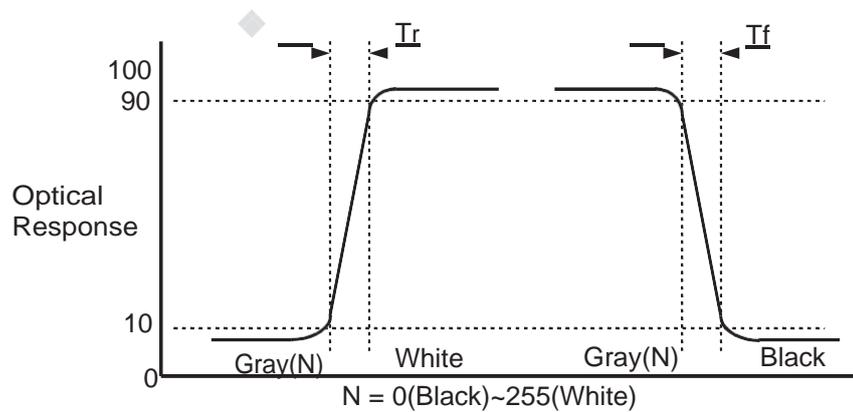

FIG. 3 Response Time

Dimension of viewing angle range
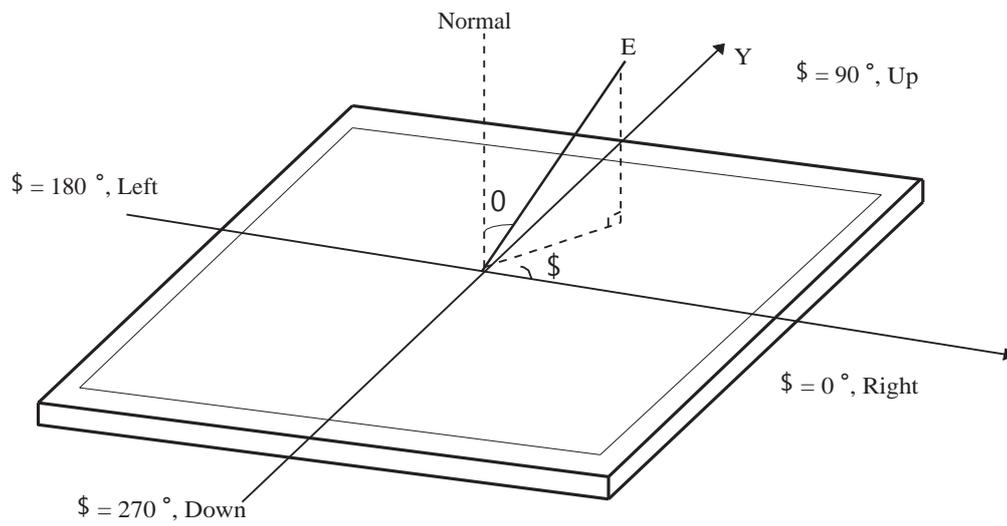
FIG. 4 Viewing Angle

Product Specification

5. Mechanical Characteristics

Table 12 provides general mechanical characteristics.

Table 12. MECHANICAL CHARACTERISTICS

| Item		Value	
Outline Dimension	Horizontal	1096.2mm	
	Vertical	632.5 mm	
	Depth	14.0 mm (D_Body)	
Active Display Area	Horizontal	1073.78 mm	
	Vertical	604.0 mm	
Case Top	Material	EGI PCM	
	Color	Black	
	Manufactory	FMS	
Weight	10 8 Kg (Typ) 11 kg (Max)		

Note : Please refer to a mechanical drawing in terms of tolerance at the next page.
    Outline dimension values are included side sealing thickness.

Product Specification

[FRONT VIEW]

1096.2(Outline Dimension)

548.1

21.5

17.0

1078.4 (BEZEL OPEN)

539.2

1073.78 (ACTIVE AREA)

536.89

304.3

302.00

313.2

608.6 (BEZEL OPEN)

604.00 (ACTIVE AREA)

632.5(Outline Dimension)

A

A

9.2

24.6

28.6

MAX 1.3

(0.3)

2.6 0.5
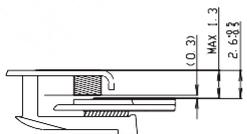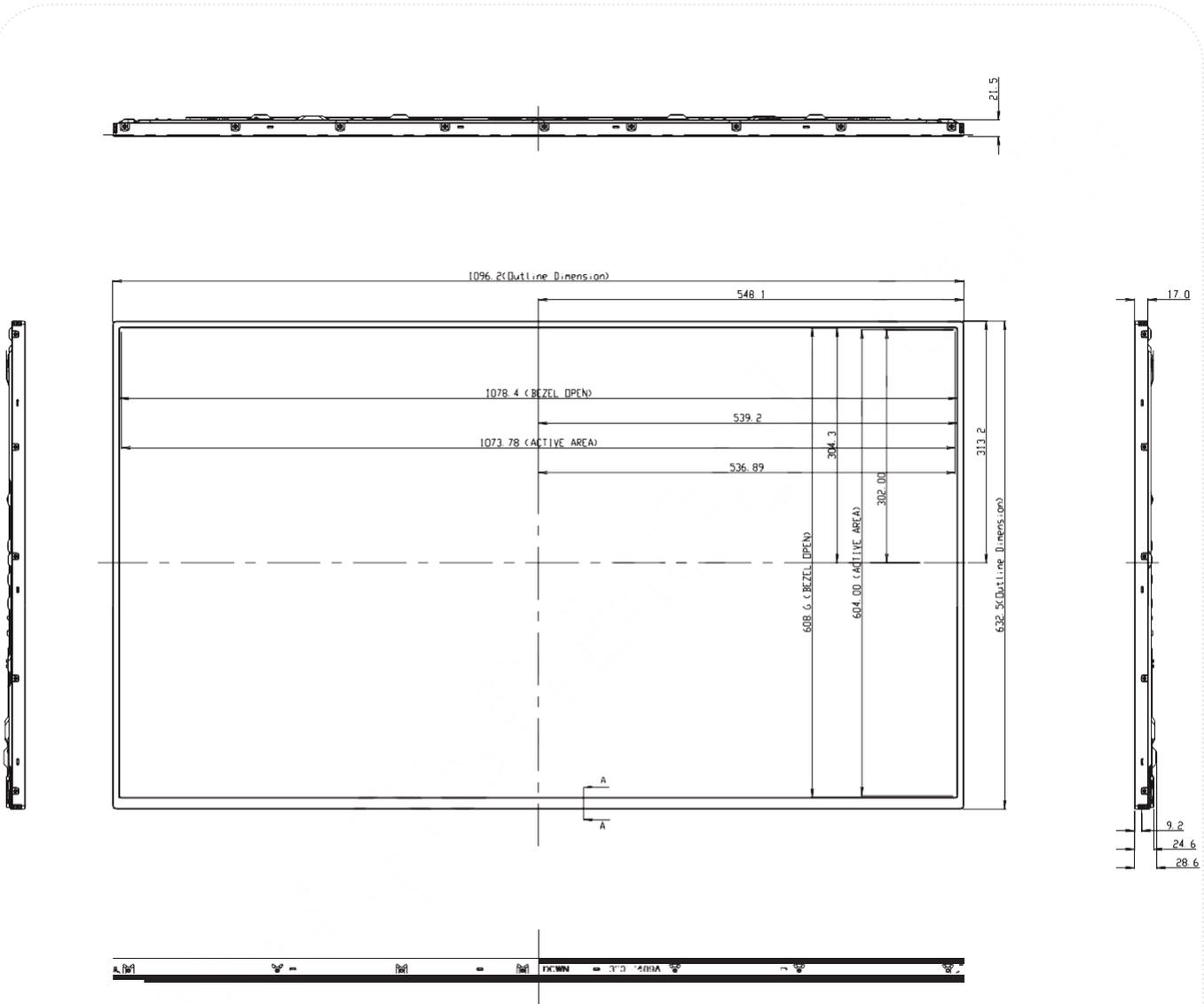
NOTES:
1. UNSPECIFIED TOLERANCE IS ± 1.0mm
2. MAX TORQUE : REFER TO TABLE
3. MAX DEPTH (SCREW) : REFER TO TABLE
4. THE SAME FEATURE MEANS THE SAME DIEMSION
5. TILT AND PARTIAL DISPOSITION TOLERANCE OF DISPLAY AREA IS AS FOLLOWING
   (1) X-DIRECTION : |A-B|<=2.0
   (2) Y-DIRECTION : |C-D|<=2.0
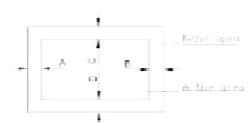
Date	Version

[REAR VIEW]
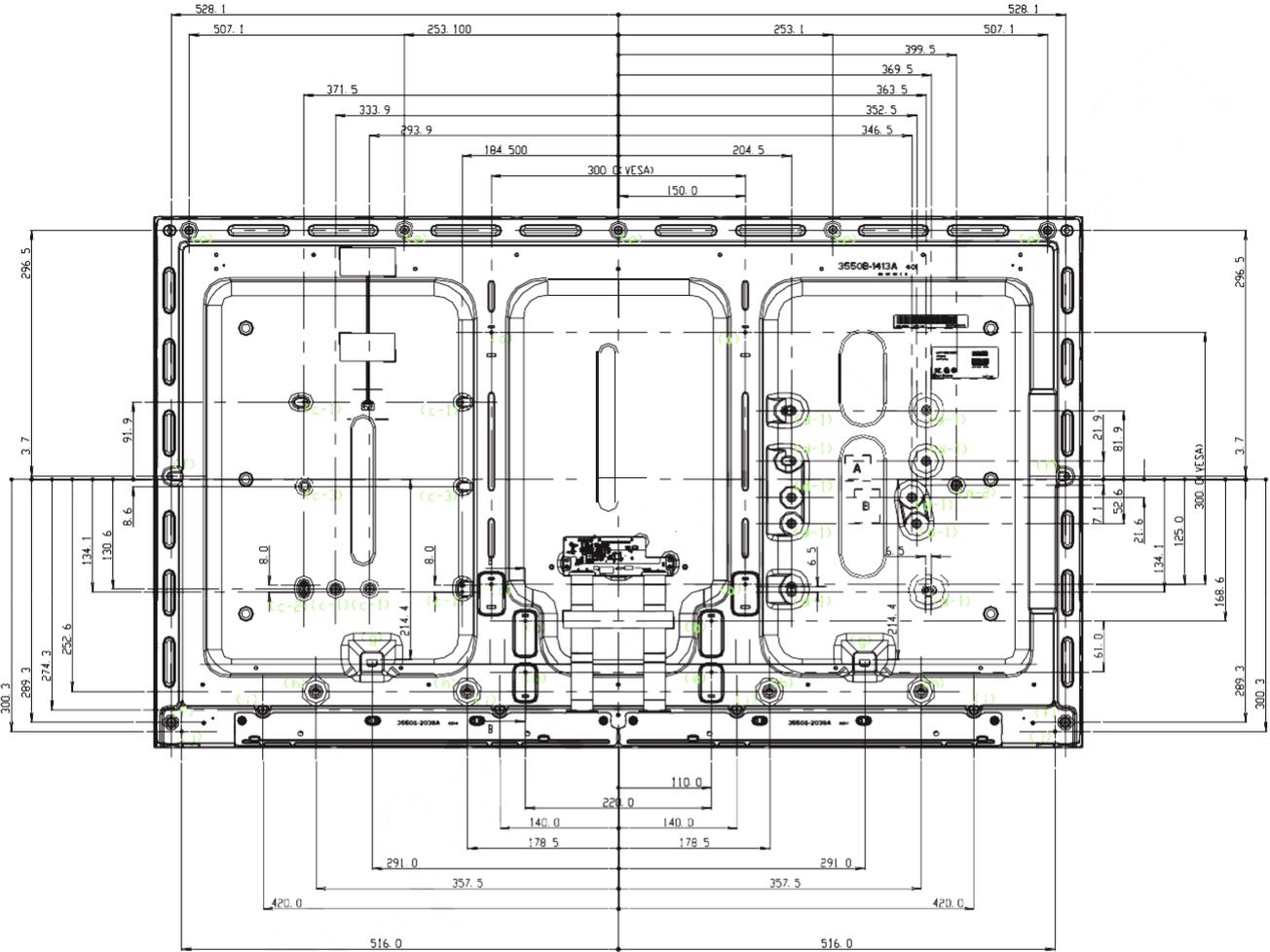
Item	Tap	Height (mm)	Max Screw Depth(mm)	Max. Torque (kgf. cm)	Note
(a-1)	M3	7.5	7.0	Max 5.0	VESA
(a-2)	M3	9.0	8.5	Max 5.0	
(b)	M3	9.0	8.0	Max 5.0	SIAN
(c-1)	M3	4.0	3.0	Max 5.0	PSU
(c-2)	M4	4.0	3.0	Max 5.0	
(c-3)	-	4.0	-	-	
(d-1)	M3	8.8	8.0	Max 5.0	MAIN
(d-2)	M3	3.6	3.0	Max 5.0	
(e)	M3	7.5	7.0	Max 5.0	BACK COVER
(f)	M3	8.5	8.0	Max 5.0	
(g)	-	12.6	12.0	-	SPEAKER
(h)	Ø8.0	14.6	6.0	-	
(i)	M3	8.5	4.0	Max 5.0	B_BLACKET
(j)	M3	5.5	2.0	Max 5.0	

Date	Version

6. Reliability

Table 13. ENVIRONMENT TEST CONDITION

No.	Test Item	Condition
1	High temperature storage test	Ta= 60°C 90% 240h
2	Low temperature storage test	Ta= -20°C 240h
3	High temperature operation test	Ta= 50°C 50%RH 500h
4	Low temperature operation test	Ta= 0°C 500h
5	Humidity condition Operation	Ta= 40 °C, 90%RH
6	Altitude operating storage / shipment	0 – 16,400 ft 0 - 40,000 ft
7	Panel Push Test (Module Condition)	Max 6kgf

Note : 1. Before and after Reliability test, LCM should be operated with normal function.
2. These conditions are for LGD's internal test. Please refer to Absolute Maximum Ratings (Table1) for guaranteed condition.

7. International Standards

7-1. Safety

a) UL 60065, Underwriters Laboratories Inc.
   Audio, Video and Similar Electronic Apparatus - Safety Requirements.

b) CAN/CSA C22.2 No.60065:03, Canadian Standards Association.
   Audio, Video and Similar Electronic Apparatus - Safety Requirements.

c) EN 60065, European Committee for Electrotechnical Standardization (CENELEC).
   Audio, Video and Similar Electronic Apparatus - Safety Requirements.

d) IEC 60065, The International Electrotechnical Commission (IEC).
   Audio, Video and Similar Electronic Apparatus - Safety Requirements.

7-2. Environment

a) RoHS, Directive 2011/65/EU of the European Parliament and of the council of 8 June 2011

8. Packing

8-1. Information of LCM Label

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	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Mark	A	B	C	D	E	F	G	H	J	K

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 Pallet : 22 pcs

b) Pallet Size : 1300 mm(W) X 1140 mm(D) X 825 mm(H)

9. Precautions

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

9-1. Mounting Precautions

(1) You must mount a module using specified mounting holes (Details refer to the drawings).

(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 the surface 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 desirable 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 detrimental to the polarizer.)

(7) When the surface becomes dusty, please wipe gently with absorbent cotton or other soft materials like chamois soaks 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

(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) Response time depends on the temperature.(In lower temperature, it becomes longer.)

(2) 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

(3) 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.

(4) When fixed patterns are displayed for a long time, remnant image is likely to occur.

(5) 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.

(6) Please do not give any mechanical and/or acoustical impact to LCM. Otherwise, LCM can't be operated its full characteristics perfectly.

(7) A screw which is fastened up the steels should be a machine screw.
(if not, it can causes conductive particles and deal LCM a fatal blow)

(8) Please do not set LCD on its edge.

(9) The conductive material and signal cables are kept away from LED driver inductor to prevent abnormal display, sound noise and temperature rising.

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.
(3) Storage condition is guaranteed under packing conditions.
(4) The phase transition of Liquid Crystal in the condition of the low or high storage temperature will be recovered when the LCD module returns to the normal condition.

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 surface or its vestige is recognized, please wipe them off with absorbent cotton waste or other soft material like chamois soaked with normal-hexane.

9-7. Appropriate Condition for Commercial Display

- Generally large-sized LCD modules are designed for consumer applications (TV).
  Accordingly, a long-term display like in Commercial Display application, can cause uneven display including image sticking. To optimize module's lifetime and function, several operating usages are required.

1. Normal operating condition
   - Temperature: 0 ~ 40℃
   - Operating Ambient Humidity : 10 ~ 90 %
   - Display pattern: dynamic pattern (Real display)
   Note) Long-term static display can cause image sticking.

2. Operating usages under abnormal condition
   a. Ambient condition
   - Well-ventilated place is recommended to set up Commercial Display system.
   b. Power and screen save
   - Periodical power-off or screen save is needed after long-term display.

Product Specification

3. Operating usages to protect against image sticking due to long-term static display
  a. Suitable operating time: under 24 hours a day.
     (* The moving picture can be allowed for 24 hours a day)
  b. Static information display recommended to use with moving image.
   - Cycling display between 5 minutes' information(static) display and 10 seconds' moving image.
  c. Background and character (image) color change
   - Use different colors for background and character, respectively.
   - Change colors themselves periodically.
  d. Avoid combination of background and character with large different luminance.
  1) Abnormal condition just means conditions except normal condition.
  2) Black image or moving image is strongly recommended as a screen save.

4. Lifetime in this spec. is guaranteed only when Commercial Display is used according to operating usages.
5. Module should be turned counter-clockwise based on front view when used in portrait mode.

APPENDIX-I

■ Pallet Ass'y

1
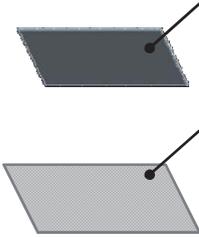
2
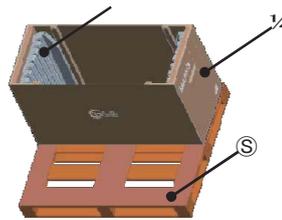
3
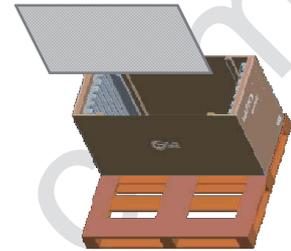
4
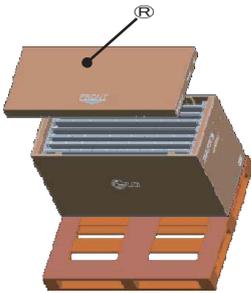
5

6
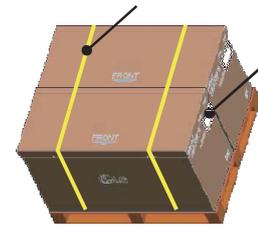
NO.	DESCRIPTION	MATERIAL
	LCD Module	49INCH
	AL BAG	AL
Ⓢ	PALLET	PLYWOOD 1300×1140×125mm
¼	PACKING,BOTTOM	PAPER
	PACKING,SIDE RIB	EPS
Ⓡ	PACKING, TOP	PAPER
	BAND	PP
Ⓡ	LABEL	YUPO 80G 100X70

APPENDIX- II-1

■ LCM Label

Model ⟶ LD490EUE
(FH)(A1)

RoHS Verified

XXXXXXXXXXXX XXXX — Serial No.
LIGHT GUIDE : >PMMA<

UL, TUV Mark ⟶ [UL mark] [TÜV] [mark]

LGD Logo ⟶ ⓛ **LG Display**

MADE IN CHINA ⟵ Origin
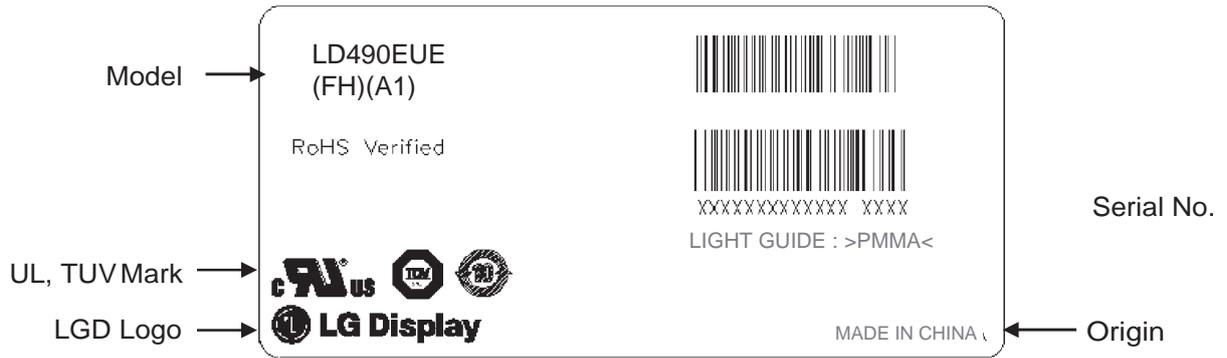
■ Pıoduction site

   — LG Oisplay (Guangzhou) Co., LTO

notes I. The oıigin of LCM Label will be changed accoıding to the pıoduction site.

APPENDIX- II-2

■ Pallet Label

LD490EUE		FHA1
EAJ63308901		
22 PCS	LOT/MM-DD	
MADE IN CHINA		RoHS Verified HF
‖‖‖‖‖‖‖‖‖‖‖‖‖‖‖‖‖‖‖‖		
＊＊＊＊＊＊＊＊＊＊＊＊＊ ＊＊＊		

APPENDIX- III-1

■ Required signal assignment for Flat Link (Thine : THC63LVD103) Transmitter(Pin7= "L" or "NC")

Host System 24 Bit	THC63LVD103 or Compatible
RED0	33
RED1	34
RED2	35
RED3	36
RED4	37
RED5	38
RED6	59
RED7	61
	4
	5
GREEN0	40
GREEN1	41
GREEN2	42
GREEN3	44
GREEN4	45
GREEN5	46
GREEN6	62
GREEN7	63
	6
	8
BLUE0	48
BLUE1	49
BLUE2	50
BLUE3	52
BLUE4	53
BLUE5	54
BLUE6	64
BLUE7	1
	9
	11
Hsync	55
Vsync	57
Data Enable	58
CLOCK	12

FI-RE51S-HF

					Timing Controller
TA-	31	12			RO0N
TA+	30	13	100K		RO0P
TB-	29	14			RO1N
TB+	28	15	100K		RO1P
TC-	25	16			RO2N
TC+	24	17	100K		RO2P
TCLK-	23	19			ROCLKN
TCLK+	22	20	100K		ROCLKP
TD-	21	22			RO3N
TD+	20	23	100K		RO3P
		7			VESA/ JEIDA

GND

LCM Module

Note: 1. The LCD module uses a 100 Ohm[K] resistor between positive and negative lines of each receiver input.
2. Refer to LVDS Transmitter Data Sheet for detail descriptions. (THC63LVD103 or Compatible)
3. '7' means MSB and '0' means LSB at R,G,B pixel data.

Product Specification

APPENDIX- III-2

■ Required signal assignment for Flat Link (Thine : THC63LVD103) Transmitter(Pin7= "H")
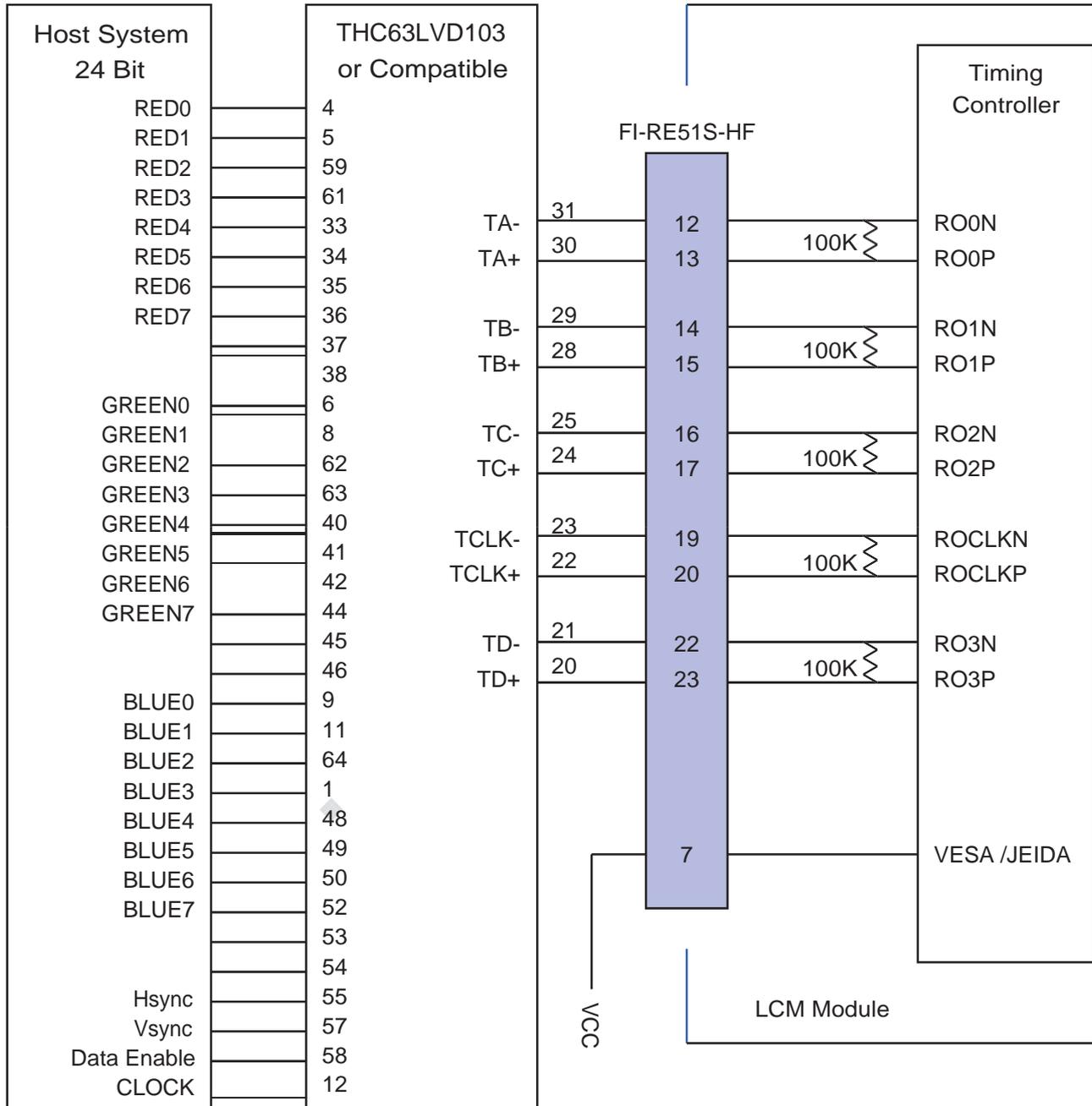
Note :1. The LCD module uses a 100 Ohm[K] resistor between positive and negative lines of each receiver input.

2. Refer to LVDS Transmitter Data Sheet for detail descriptions. (THC63LVD103 or Compatible)

3. '7' means MSB and '0' means LSB at R,G,B pixel data.

APPENDIX- IV

■ LVDS Data-Mapping Information (8 Bit)

1) LVDS Select : "H" Data-Mapping (JEIDA format)

RCLKP								
RCLKM								
RAP	R13'	R12'	G12	R17	R16	R15	R14	R13	R12	G12"
RBP	G14'	G13'	B13	B12	G17	G16	G15	G14	G13	B13"
RCP	B15'	B14'	DE	V_{SYNC}	H_{SYNC}	B17	B16	B15	B14	DE"
RDP	R11'	R10'	X	B11	B10	G11	G10	R11	R10	X"
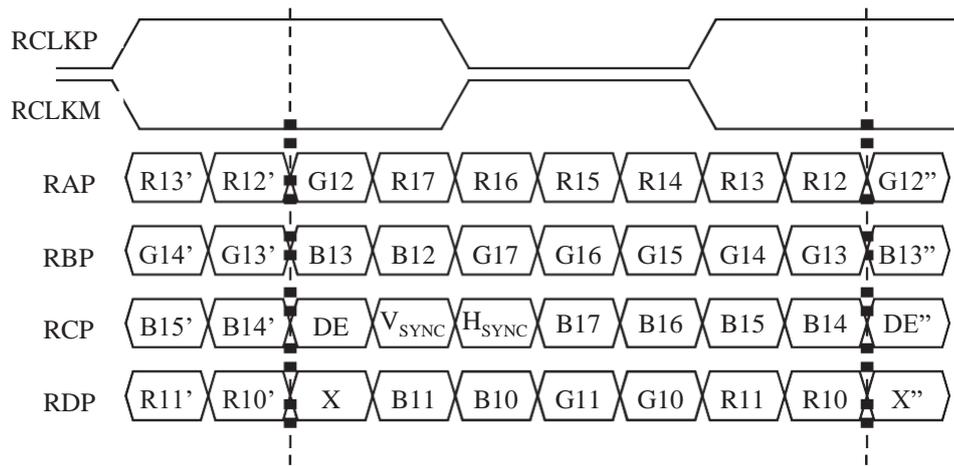
2) LVDS Select : "L" Data-Mapping (VESA format)

RCLKP								
RCLKM								
RAP	R11'	R10'	G10	R15	R14	R13	R12	R11	R10	G10"
RBP	G12'	G11'	B11	B10	G15	G14	G13	G12	G11	B15"
RCP	B13'	B12'	DE	V_{SYNC}	H_{SYNC}	B15	B14	B13	B12	DE"
RDP	R17'	R16'	X	B17	B16	G17	G16	R17	R16	X"
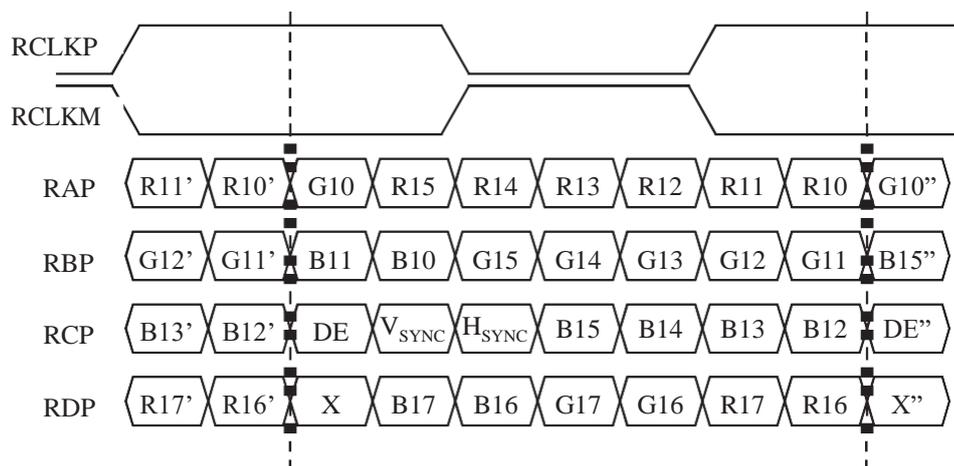
APPENDIX- V

■ Option Pin Circuit Block Diagram

1) Circuit Block Diagram of LVDS Format Selection pin

LVDS Select Pin : Pin 7

LVDS Select
(Pin 7)

1Kfi

LVDS Select

50kfi

ASIC
(TCON)

System Side

LCM Side