

# TFT-DISPLAY DATASHEET

LG Display  
Model: LD860DBN-UJA2

## BRIEF SPEC.:

Main Feature	High Brightness Wide Viewing Angle Bar Display
Active Screen Area	2148.48 x 335.7
Diagonal   Format	86"
Resolution	3840 (RGB) X 600
Colors	10 Bit 1.07B colors
Backlight	LED
Brightness	700 cd/m <sup>2</sup>
LED Life Time	50k (h)
Interface	Vby1
Viewing Angle	89/89 L/R 89/89
Touchscreen	no
Power Supply	12 V
Module Outline	2158.3 x 348.5 x 38.3(mm)
Operation Temperature	- 0 ... +50 °C
Storage Temperature	-20... +60 °C
Surface Treatment	Hardcoating 3H Antiglare Haze 10%

Product Specification

# SPECIFICATION FOR APPROVAL

( ● ) Preliminary Specification

(   ) Final Specification

Title	86.0" Stretch TFT LCD
-------	-----------------------

BUYER	General
SET MODEL	

SUPPLIER	LG Display Co., Ltd.
*MODEL	LD860DBN
SUFFIX	UJA2 (RoHS Verified)

APPROVED BY	SIGNATURE DATE
/	_____
/	_____
/	_____

APPROVED BY	SIGNATURE DATE
S.J Lee / Team Leader	_____
<b>REVIEWED BY</b>	
D.S.KIM / Project Leader	_____
<b>PREPARED BY</b>	
Y.J.Hong / Engineer	_____

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

**TV Product Development Dept.  
LG Display Co., Ltd.**

## Product Specification

# CONTENTS

Number	ITEM	Page
	COVER	0
	CONTENTS	1
	RECORD OF REVISIONS	2
1	GENERAL DESCRIPTION	3
2	ABSOLUTE MAXIMUM RATINGS	4
3	ELECTRICAL SPECIFICATIONS	5
3-1	ELECTRICAL CHARACTERISTICS	5
3-2	INTERFACE CONNECTIONS	7
3-3	SIGNAL TIMING SPECIFICATIONS	9
3-4	V by One SIGNAL SPECIFICATIONS	10
3-5	COLOR DATA REFERENCE	12
3-6	POWER SEQUENCE	13
4	OPTICAL SPECIFICATIONS	15
5	MECHANICAL CHARACTERISTICS	19
6	RELIABILITY	22
7	INTERNATIONAL STANDARDS	23
7-1	Safety	23
7-2	ENVIRONMENT	23
8	PACKING	24
8-1	INFORMATION OF LCM LABEL	24
8-2	PACKING FORM	24
9	PRECAUTIONS	25
9-1	MOUNTING PRECAUTIONS	25
9-2	OPERATING PRECAUTIONS	25
9-3	ELECTROSTATIC DISCHARGE CONTROL	26
9-4	PRECAUTIONS FOR STRONG LIGHT EXPOSURE	26
9-5	STORAGE	26
9-6	HANDLING PRECAUTIONS FOR PROTECTION FILM	26
9-7	Appropriate Condition for Commercial Display	27



## Product Specification

### 1. General Description

The LD860DBN 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 85.6 inch diagonally measured active display area with 600 vertical by 3840 horizontal pixel array.

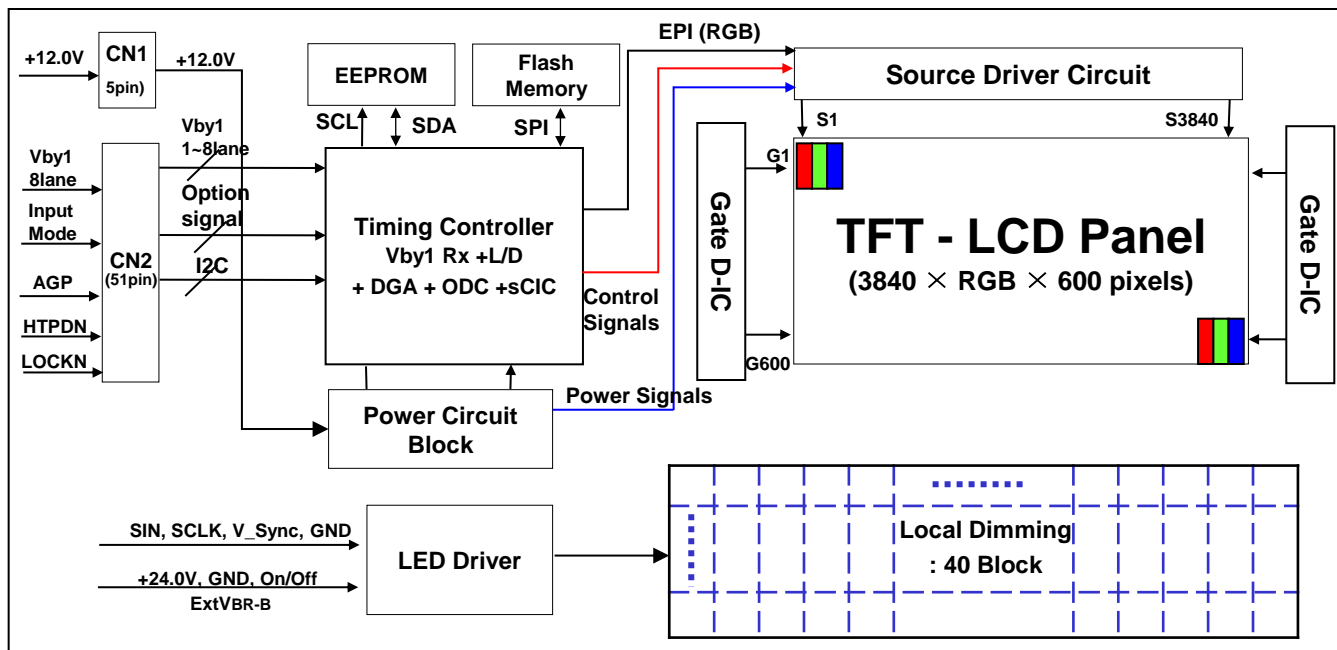
Each pixel is divided into RGB dots which are arranged in vertical stripes.

Gray scale or the luminance of the sub-pixel color is determined with a 10-bit gray scale signal for each dot.

Therefore, it can present a palette of more than 1.07Billion colors.

It has been designed to apply the 10-bit 8 Lane V by One interface.

It is intended to support LCD 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	85.6 inches(2174.5mm) diagonal
Outline Dimension	2158.3(H) X 348.5(V) X 38.3(B/D) (Typ.)
Pixel Pitch	0.5595 mm x 0.5595 mm
Pixel Format	3840 horiz. by 600 vert. Pixels, RGB stripe arrangement
Color Depth	10bit(D), 1.07 Billion colors
Luminance, White	700cd/m2 (Center 1point ,Typ.)
Viewing Angle (CR>10)	Viewing angle free ( R/L 178 (Min.), U/D 178 (Min.))
Power Consumption	Total 192.9W(TBD)(Typ.) [Logic= 13.3W, LED Backlight= 196.7W(TBD) (ExtVbr-B=100%)]
Weight	15.04Kg (Typ.)
Display Mode	Transmissive mode, Normally black
Surface Treatment	Hard coating(3H), Anti-glare treatment of the front polarizer (Haze 10%)
Possible display type	Landscape and Portrait Enabled

## Product Specification

### 2. Absolute Maximum Ratings

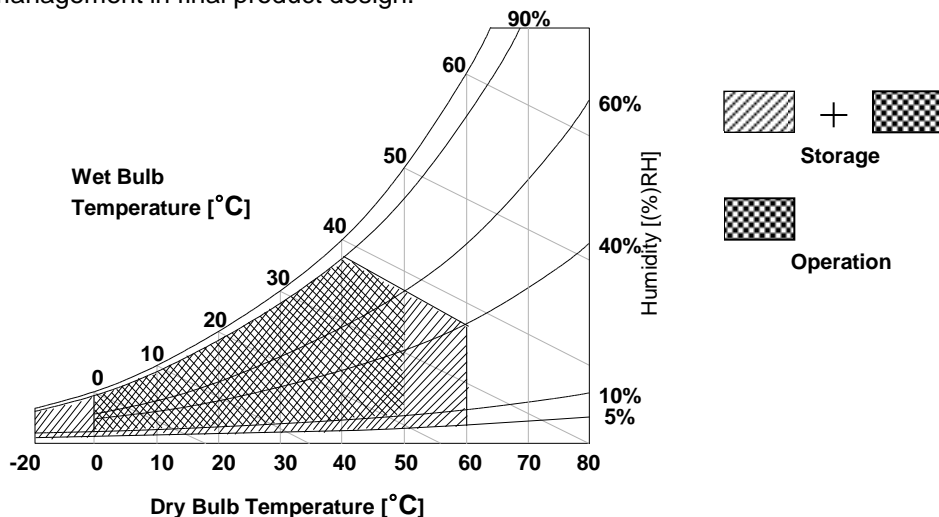
The following items are maximum values which, if exceeded, may cause faulty operation or permanent damage to the LCD module.

**Table 1. ABSOLUTE MAXIMUM RATINGS**

Parameter		Symbol	Value		Unit	Note	
			Min	Max			
Power Input Voltage	LCD Circuit	VLCD	-0.3	+14.0	VDC	1	
	Driver	VBL	-0.3	+ 27.0	VDC		
Driver Control Voltage	ON/OFF	VOFF / VON	-0.3	+3.9	VDC		
	Brightness	EXTVBR-B	-0.3	+3.9	VDC		
	Status	Status	-0.3	+3.9	VDC		
T-Con Option Selection Voltage		VLOGIC	-0.3	+4.0	VDC		
Operating Temperature		TOP	0	+50	°C		2,3
Storage Temperature		TST	-20	+60	°C		
Panel Front Temperature		TSUR	-	+68	°C	4	
Operating Ambient Humidity		HOP	10	90	%RH	2,3	
Storage Humidity		HST	5	90	%RH		

#### Note

- Ambient temperature condition ( $T_a = 25 \pm 2 \text{ }^\circ\text{C}$ )
- Temperature and relative humidity range are shown in the figure below.  
Wet bulb temperature should be Max  $39^\circ\text{C}$ , and no condensation of water.
- Gravity mura can be guaranteed below  $40^\circ\text{C}$  condition.
- The maximum operating temperatures is based on the test condition that the surface temperature of display area is less than or equal to  $68^\circ\text{C}$  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  $68^\circ\text{C}$ . The range of operating temperature may be degraded in case of improper thermal management in final product design.



## Product Specification

### 3. Electrical Specifications

#### 3-1. Electrical Characteristics

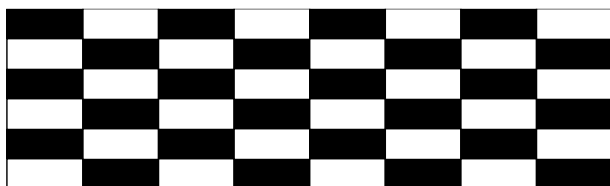
It requires two power inputs. One is employed to power for the LCD circuit. The other is used for the LED backlight.

**Table 2. ELECTRICAL CHARACTERISTICS**

Parameter	Symbol	Value			Unit	Note	
		Min	Typ	Max			
<b>Circuit :</b>							
Power Input Voltage	V <sub>LCD</sub>	10.8	12	13.2	V <sub>DC</sub>		
Power Input Current	I <sub>LCD</sub>	-	1105	1437	mA	1	
		-	1740	2262	mA	2	
T-CON Option Selection Voltage	Input High Voltage	V <sub>IH</sub>	2.7	-	3.6	V <sub>DC</sub>	
	Input Low Voltage	V <sub>IL</sub>	0	-	0.7	V <sub>DC</sub>	
Power Consumption	P <sub>LCD</sub>	-	13.3	17.2	Watt	1	
Rush current	I <sub>RUSH</sub>	-	-	8	A	3	

- Notes
1. The specified current and power consumption are under the  $V_{LCD}=12.0V$ ,  $T_a=25 \pm 2^\circ C$ ,  $f_v=60Hz$  condition, and mosaic pattern(8 x 6) is displayed and  $f_v$  is the frame frequency.  
Specially only to this model, the specified current is the characteristic data of display period.
  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  $\pm 5\%$  of typical voltage

White : 1023 Gray  
Black : 0 Gray



**Mosaic Pattern(8 x 6)**

White : 1023 Gray



**Max Current Pattern**

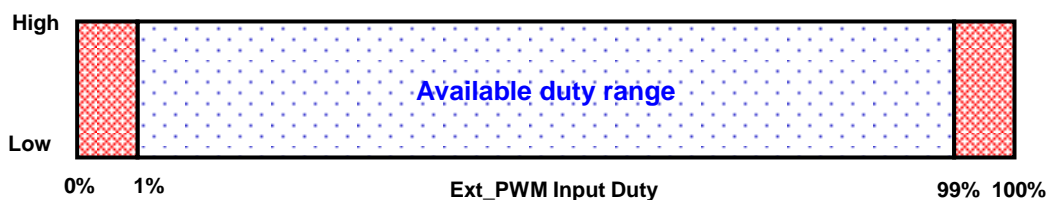
## Product Specification

**Table 3. ELECTRICAL CHARACTERISTICS (Continue)**

Parameter		Symbol	Values			Unit	Note
			Min	Typ	Max		
LED Driver :							
Power Supply Input Voltage		VBL	21.6	24.0	26.4	Vdc	1
Power Supply Input Current		IBL	-	8.2 (TBD)	8.7 (TBD)	A	1
Power Supply Input Current (In-Rush)		In-rush	-	-	11.6 (TBD)	A	<b>VBL = 21.6V</b> ExtVBR-B=100% 4
Power Consumption (Total)		PBL	-	196.7 (TBD)	208.7 (TBD)	W	1
Input Voltage for Control System Signals	On/Off	On	V on	2.5	-	3.6	Vdc
		Off	V off	-0.3	0.0	0.7	Vdc
	Brightness Adjust	ExtVBR-B	1	-	100	%	On Duty 5
	PWM Frequency for NTSC & PAL	PAL		100		Hz	
		NTSC		120		Hz	
	Pulse Duty Level (PWM)	High Level		2.5	-	3.6	Vdc
Low Level			0.0	-	0.7	Vdc	
LED :							
Life Time			50,000			Hrs	6

### Note

- Electrical characteristics are determined after the unit has been 'ON' and stable for approximately 60 minutes at  $25 \pm 2^\circ\text{C}$ . The specified current and power consumption are under the typical supply input voltage 24V and  $V_{BR}$  (ExtVBR-B : 100%), it is total power consumption.
- LGD recommend that the PWM freq. is synchronized with One time harmonic of  $V_{sync}$  signal of system. Though PWM frequency is over 120Hz (max 252Hz), function of LED Driver is not affected.
- The duration of rush current is about 200ms. This duration is applied to LED on time
- Even though inrush current is over the specified value, there is no problem if  $I^2T$  spec of fuse is satisfied.
- Ext\_PWM Signal have to input available duty range.  
Between 99% and 100% ExtVBR-B duty have to be avoided. ( $99\% < \text{ExtVBR-B} < 100\%$ )  
But ExtVBR-B 0% and 100% is possible.
- The life time 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  $25 \pm 2^\circ\text{C}$ , based on duty 100%.





## Product Specification

### 3-2. Interface Connections

This LCD module employs three kinds of interface connection, 51-pin connector is used for the module electronics and 4-pin, 4-pin connectors are used for the integral backlight system.

#### 3-2-1. LCD Module

- LCD Connector(CN1): FI-RE51S-HF (manufactured by JAE)

**Table 4. MODULE CONNECTOR(CN1) PIN CONFIGURATION**

No	Symbol	Description	No	Symbol	Description
1	VLCD	Power Supply +12.0V	27	GND	Ground
2	VLCD	Power Supply +12.0V	28	Rx0n	V-by-One HS Data Lane 0
3	VLCD	Power Supply +12.0V	29	Rx0p	V-by-One HS Data Lane 0
4	VLCD	Power Supply +12.0V	30	GND	Ground
5	VLCD	Power Supply +12.0V	31	Rx1n	V-by-One HS Data Lane 1
6	VLCD	Power Supply +12.0V	32	Rx1p	V-by-One HS Data Lane 1
7	VLCD	Power Supply +12.0V	33	GND	Ground
8	VLCD	Power Supply +12.0V	34	Rx2n	V-by-One HS Data Lane 2
9	NC	No Connection	35	Rx2p	V-by-One HS Data Lane 2
10	GND	Ground	36	GND	Ground
11	GND	Ground	37	Rx3n	V-by-One HS Data Lane 3
12	GND	Ground	38	Rx3p	V-by-One HS Data Lane 3
13	GND	Ground	39	GND	Ground
14	NC	No Connection	40	Rx4n	V-by-One HS Data Lane 4
15	NC	No Connection	41	Rx4p	V-by-One HS Data Lane 4
16	NC	No Connection	42	GND	Ground
17	INPUT_MODE	Input Data Format, 'L'=Non-Division , 'H'=2-Division	43	Rx5n	V-by-One HS Data Lane 5
18	NC	No Connection	44	Rx5p	V-by-One HS Data Lane 5
19	NC	No Connection	45	GND	Ground
20	NC	No Connection	46	Rx6n	V-by-One HS Data Lane 6
21	Bit_SEL	'H'=10bit , "L" =8bit	47	Rx6p	V-by-One HS Data Lane 6
22	NC	Internally fixed L-Dim 'H=Enable'	48	GND	Ground
23	AGP or NSB	'H' :AGP 'L' : NSB	49	Rx7n	V-by-One HS Data Lane 7
24	GND	Ground	50	Rx7p	V-by-One HS Data Lane 7
25	HTPDN	Hot plug detect	51	GND	Ground
26	LOCKN	Lock detect	-	-	-

- Note
1. All GND (ground) pins should be connected together to the LCD module's metal frame.
  2. All Input levels of V-by-One signals are based on the V-by-One-HS Standard Version 1.4
  3. #9 & #14~#16 & #18~#20 NC(No Connection) : These pins are used only for LGD (Do not connect)
  4. Specific pin (#22) is used for Local Dimming function of the LCD module.  
If not used, these pins are no connection. (Please see the Appendix IV-2 for more information.)
  5. Specific pin No. #23 is used for "No signal detection" of system signal interface.  
It should be GND for NSB (No Signal Black) while the system interface signal is not.  
If this pin is "H", LCD Module displays AGP (Auto Generation Pattern).

## Product Specification

### 3-2-2. Backlight Module

[ Input CNT ]

- LED Driver Connector : 20022WR-H14B2(Yeonho) / : 20022WR-H14B2(Yeonho)

**Table 6 . LED DRIVER CONNECTOR PIN CONFIGURATION**

Pin No	Symbol	Description (CN1)	Description (CN2)	Note
1	VBL	Power Supply +24.0V	Power Supply +24.0V	
2	VBL	Power Supply +24.0V	Power Supply +24.0V	
3	VBL	Power Supply +24.0V	Power Supply +24.0V	
4	VBL	Power Supply +24.0V	Power Supply +24.0V	
5	VBL	Power Supply +24.0V	Power Supply +24.0V	
6	GND	Backlight Ground	Backlight Ground	1
7	GND	Backlight Ground	Backlight Ground	
8	GND	Backlight Ground	Backlight Ground	
9	GND	Backlight Ground	Backlight Ground	
10	GND	Backlight Ground	Backlight Ground	
11	Status	Back Light Status	Back Light Status	2
12	VON/OFF	Backlight ON/OFF control	Backlight ON/OFF control	
13	EXTVBR-B	External PWM	External PWM	3
14	GND	Backlight Ground	Backlight Ground	1

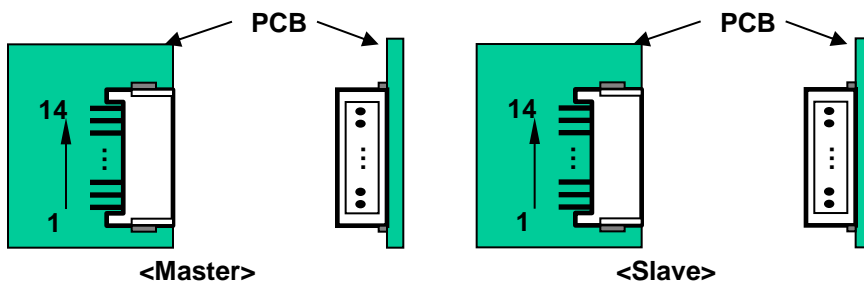
Notes :1. GND should be connected to the LCD module's metal frame.

2. Normal : Low (under 0.7V) / Abnormal : Open

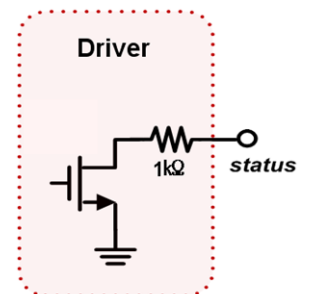
3. High : on duty / Low : off duty, Pin#13can be opened. ( if Pin #13 is open , EXTVBR-B is 100% )

4. Each impedance of pin #12 and 13 is over 50 [KΩ] .

#### ◆ Rear view of LCM



#### ◆ Status



## Product Specification

### 3-3. Signal Timing Specifications

Table 6 shows the signal timing required at the input of the Vx1 transmitter. All of the interface signal timings should be satisfied with the following specification for normal operation.

**Table 7. TIMING TABLE (DE Only Mode)**

ITEM		Symbol	Min	Typ	Max	Unit	Note
Horizontal	Display Period	$t_{HV}$	480	480	480	$t_{CLK}$	3840/8
	Blank	$t_{HB}$	60	70	120	$t_{CLK}$	1
	Total	$t_{HP}$	540	550	600	$t_{CLK}$	
Vertical	Display Period	$t_{VV}$	2160	2160	2160	Lines	
	Blank	$t_{VB}$	40	90	600	Lines	1
	Total	$t_{VP}$	2200	2250	2760	Lines	

ITEM		Symbol	Min	Typ	Max	Unit	Note
Frequency	DCLK	$f_{CLK}$	67	74.25	78.00	MHz	594/8
	Horizontal	$f_H$	121.8	135	140	KHz	2
	Vertical	$f_V$	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

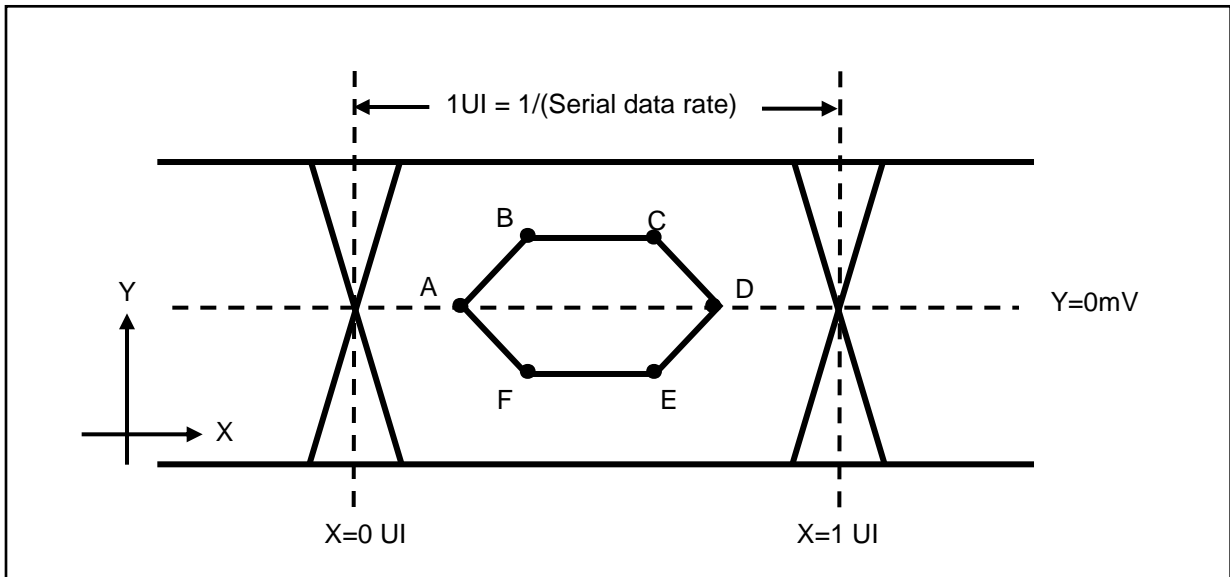
3. Spread Spectrum Rate (SSR) is limited to  $\pm 0.5\%$  center spread at 30KHz

※ Timing should be set based on clock frequency.

## Product Specification

### 3-4. V by One input signal Characteristics

#### 3-4-1. V by One Input Signal Timing Diagram



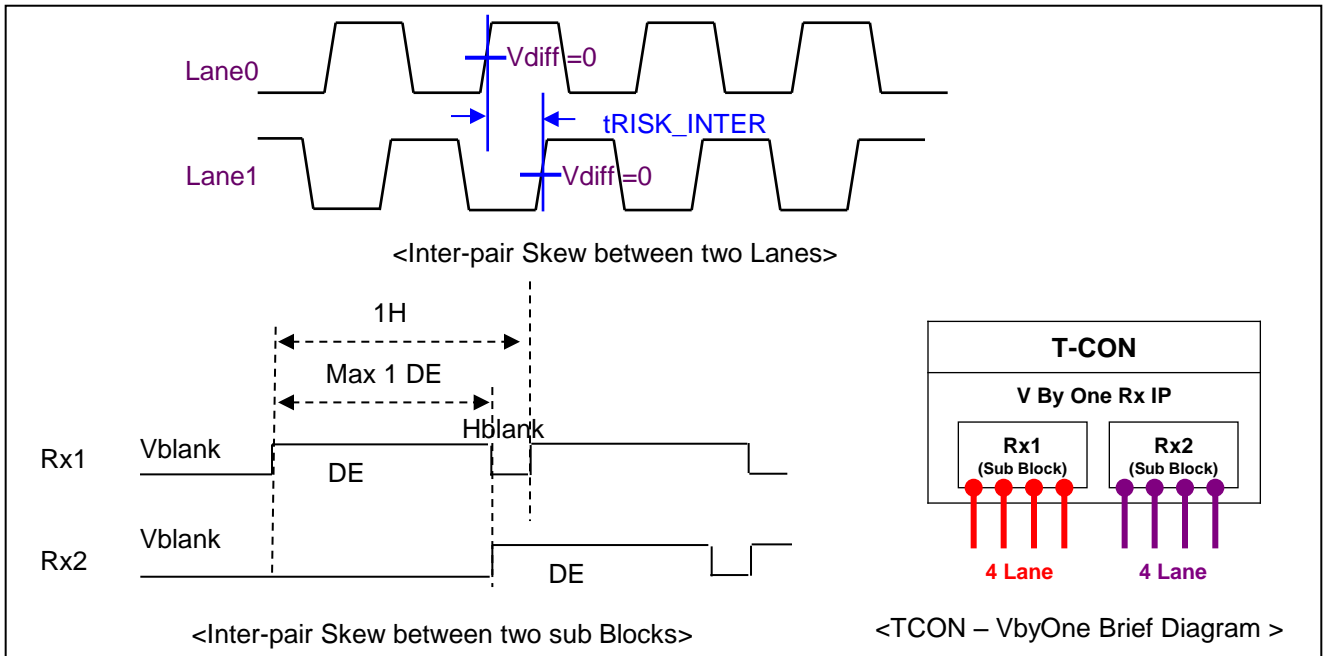
**Table 8. Eye Mask Specification**

	X[UI]	Note	Y[mV]	Note
A	0.25 (max)	2	0	-
B	0.3 (max)	2	50	3
C	0.7(min)	3	50	3
D	0.75(min)	3	0	-
E	0.7(min)	3	-50	3
F	0.3(max)	2	-50	3

- notes
1. All Input levels of V by One signals are based on the V by One HS Standard Ver. 1.4
  2. This is allowable maximum value.
  3. This is allowable minimum value.
  4. The eye diagram is measured by the oscilloscope and receiver CDR characteristic must be emulated.
    - PLL bandwidth : 15 Mhz
    - Damping Factor : 1

## Product Specification

### 3-4-2. V by One Input Signal Characteristics



Description	Symbol	Min	Max	Unit	notes
Allowable inter-pair skew between lanes	tRISK_INTER	-	5	UI	1,3
Allowable iner-pair skew between sub-blocks	tRISK_BLOCK	-	1	DE	1,4

Notes 1.1UI = 1/serial data rate

2. it is the time difference between the true and complementary single-ended signals.
3. it is the time difference of the differential voltage between any two lanes in one sub block.
4. it is the time difference of the differential voltage between any two blocks in one IP.

## Product Specification

### 3-5. Color Data Reference

The brightness of each primary color (red, green, blue) is based on the 10bit or 8bit gray scale data input for the color.

The higher binary input, the brighter the color. Table 8 provides a reference for color versus data input.

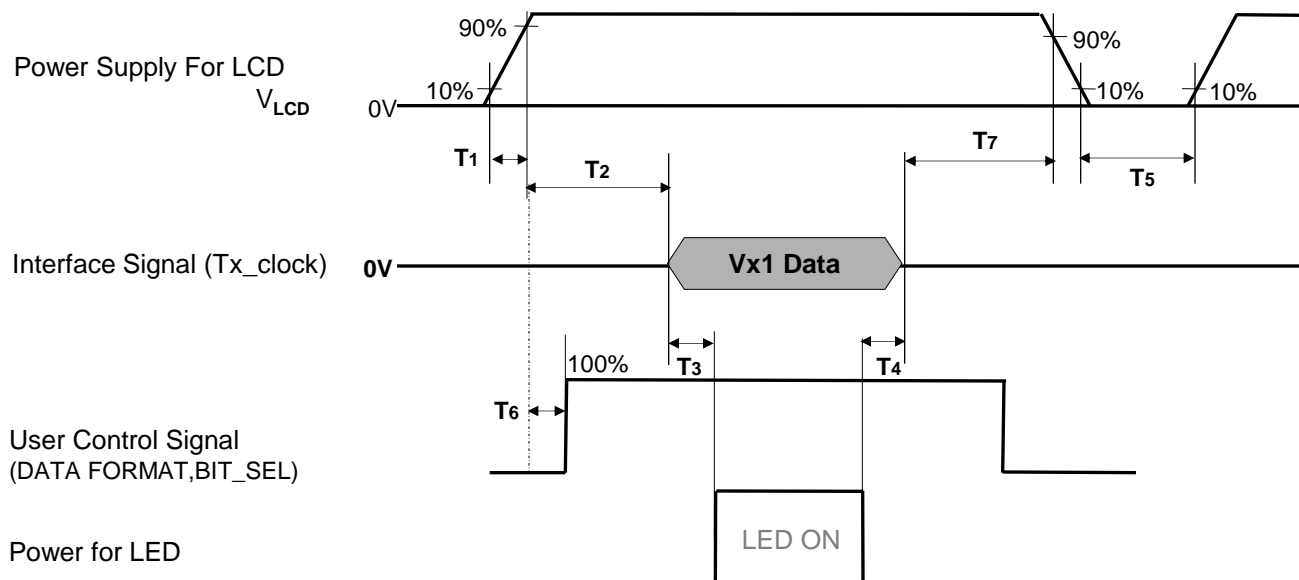
**Table 9. COLOR DATA REFERENCE**

Packer input & Unpacker output		30bpp RGB (10bit)	24bpp RGB (8bit)
Byte0	D[0]	R[2]	R[0]
	D[1]	R[3]	R[1]
	D[2]	R[4]	R[2]
	D[3]	R[5]	R[3]
	D[4]	R[6]	R[4]
	D[5]	R[7]	R[5]
	D[6]	R[8]	R[6]
	D[7]	R[9]	R[7]
Byte1	D[8]	G[2]	G[0]
	D[9]	G[3]	G[1]
	D[10]	G[4]	G[2]
	D[11]	G[5]	G[3]
	D[12]	G[6]	G[4]
	D[13]	G[7]	G[5]
	D[14]	G[8]	G[6]
	D[15]	G[9]	G[7]
Byte2	D[16]	B[2]	B[0]
	D[17]	B[3]	B[1]
	D[18]	B[4]	B[2]
	D[19]	B[5]	B[3]
	D[20]	B[6]	B[4]
	D[21]	B[7]	B[5]
	D[22]	B[8]	B[6]
	D[23]	B[9]	B[7]
Byte3	D[24]	Don't care	
	D[25]	Don't care	
	D[26]	B[0]	
	D[27]	B[1]	
	D[28]	G[0]	
	D[29]	G[1]	
	D[30]	R[0]	
	D[31]	R[1]	

## Product Specification

### 3-6. Power Sequence

#### 3-6-1. LCD Driving circuit



**Table 10. POWER SEQUENCE**

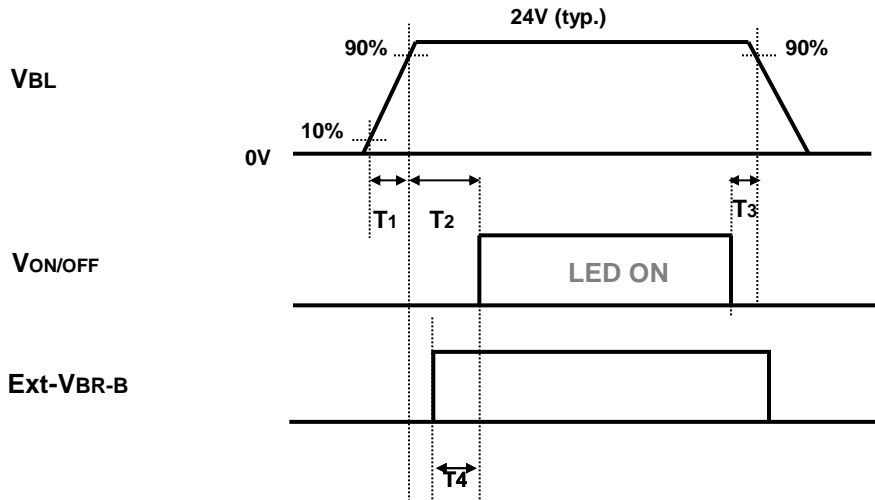
Parameter	Value			Unit	Notes
	Min	Typ	Max		
T1	0.5	-	20	ms	1
T2	0	-	-	ms	2
T3	400	-	-	ms	3
T4	100	-	-	ms	3
T5	1.0	-	-	s	4
T6	0	-	T2	ms	5
T7	0	-	-	ms	6

- 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 V by One 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.

## Product Specification

### 3-6-2. Sequence for LED Driver

#### Power Supply For LED Driver



### 3-6-3. Dip condition for LED Driver

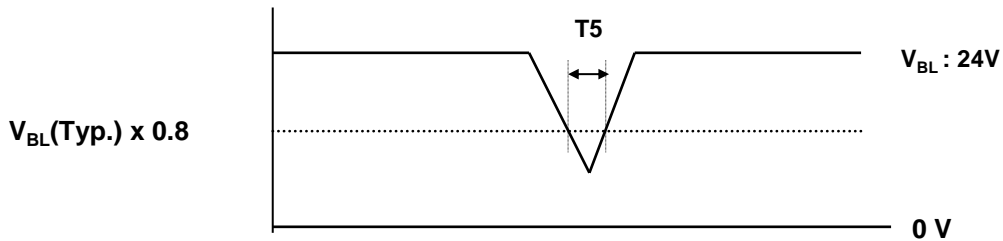


Table 11. Power Sequence for LED Driver

Parameter	Values			Units	Note
	Min	Typ	Max		
T1	20	-	-	ms	1
T2	500	-	-	ms	
T3	10		-	ms	
T4	0	-	-	ms	
T5	-	-	10	ms	$V_{BL}(\text{Typ}) \times 0.8$

#### Note

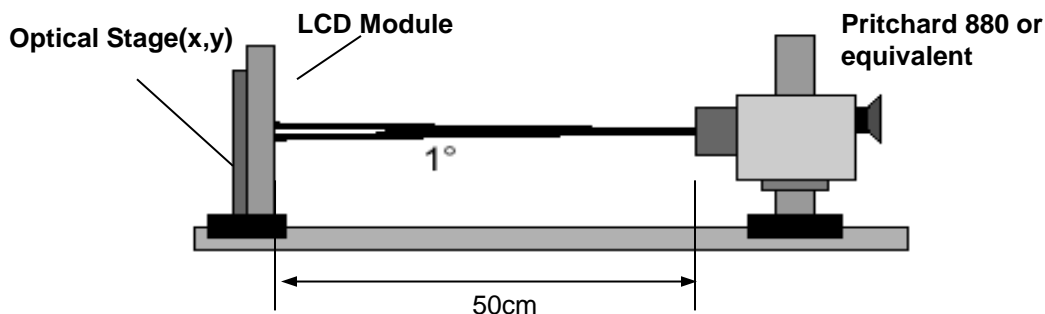
- T1 describes rising time of 0V to 24V and this parameter does not applied at restarting time. Even though T1 is over the specified value, there is no problem if I<sup>2</sup>T spec of fuse is satisfied.



## Product Specification

### 4. Optical Specification

Optical characteristics are determined after the unit has been 'ON' and stable in a dark environment at  $25\pm 2^{\circ}\text{C}$ . The values are specified at distance 50cm from the LCD surface at a viewing angle of  $\Phi$  and  $\theta$  equal to  $0^{\circ}$ . FIG. 1 shows additional information concerning the measurement equipment and method.



**FIG. 1 Optical Characteristic Measurement Equipment and Method**

$T_a = 25\pm 2^{\circ}\text{C}$ ,  $V_{\text{LCD}} = 12\text{V}$ ,  $f_v = 60\text{Hz}$ ,  $D_{\text{clk}} = 74.25\text{MHz}$   
EXTVbr-B=100%

**Table 12. OPTICAL CHARACTERISTICS**

Parameter		Symbol		Value			Unit	notes	
				Min	Typ	Max			
Contrast Ratio		CR		825	1100(TBD)	-		1	
Surface Luminance, white		$L_{\text{WH}}$	2D	560	700	-	cd/m <sup>2</sup>	2	
Luminance Variation		$\delta_{\text{WHITE}}$	17P	65	-	-	%	3	
Response Time	Gray to Gray	G to G			8	12	ms	4	
Color Coordinates [CIE1931]	RED	Rx		Typ -0.03	0.645	Typ +0.03			
		Ry			0.334				
	GREEN	Gx			0.306				
		Gy			0.608				
	BLUE	Bx			0.154				
		By			0.059				
	WHITE	Wx			0.279				
		Wy			0.292				
Color Temperature					10,000		K		
Color Gamut					72		%		
Viewing Angle	2D (CR>10)	right( $\phi=0^{\circ}$ )		$\theta_r$ (x axis)	89	-	-	degree	5
		left ( $\phi=180^{\circ}$ )		$\theta_l$ (x axis)	89	-	-		
		up ( $\phi=90^{\circ}$ )		$\theta_u$ (y axis)	89	-	-		
		down ( $\phi=270^{\circ}$ )		$\theta_d$ (y axis)	89	-	-		
Gray Scale					-	2.2	-		6

## Product Specification

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.

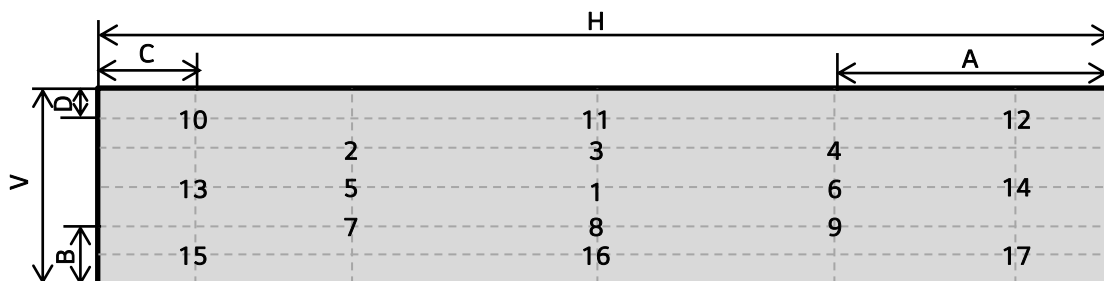
2. Surface luminance is determined after the unit has been 'ON' and 1 Hour after lighting the backlight in a dark environment at  $25 \pm 2^\circ\text{C}$ . Surface luminance is the luminance value at center 1-point across the LCD surface 50cm from the surface with all pixels displaying white. For more information see the FIG. 2.
3. The variation in surface luminance,  $\delta$  WHITE is defined as :  
 $\delta \text{ WHITE}(9\text{P}) = \text{Minimum}(L_{\text{on}1}, L_{\text{on}2} \sim L_{\text{on}8}, L_{\text{on}9}) / \text{Maximum}(L_{\text{on}1}, L_{\text{on}2} \sim L_{\text{on}8}, L_{\text{on}9}) * 100$   
 Where  $L_{\text{on}1}$  to  $L_{\text{on}9}$  are the luminance with all pixels displaying white at 9 locations.  
 For more information, see the FIG. 2.
4. Response time is the time required for the display to transit from G(N) to G(M) (Rise Time, TrR) and from G(M) to G(N) (Decay Time, TrD). For additional information see the FIG. 3. (N<M)  
 ※ G to G Spec stands for average value of all measured points.  
 Photo Detector : RD-80S / Field :  $2^\circ$   
 ※ . Gray to Gray / Response time uniformity is Reference data. Appendix VI
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 13..

**Table 13. GRAY SCALE SPECIFICATION**

Gray Level	Luminance [%] (Typ)
L0	0.09
L63	0.27
L127	1.04
L191	2.49
L255	4.68
L319	7.66
L383	11.5
L447	16.1
L511	21.6
L575	28.1
L639	35.4
L703	43.7
L767	53.0
L831	63.2
L895	74.5
L959	86.7
L1023	100

## Product Specification

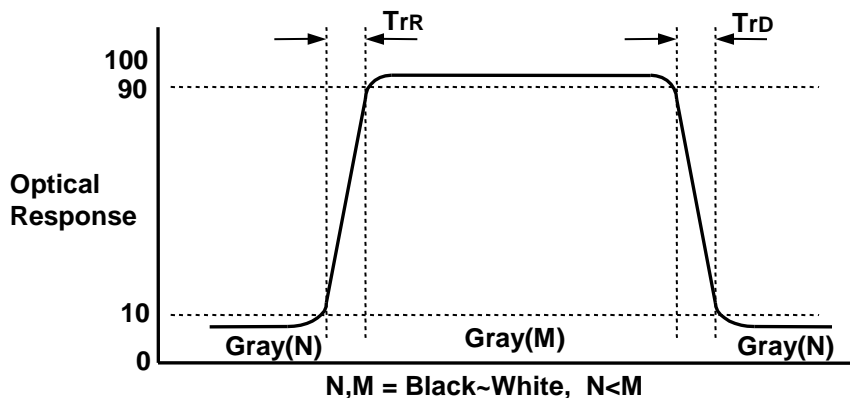
Measuring point for surface luminance & measuring point for luminance variation.



A :  $H / 4\text{mm}$   
 B :  $V / 4\text{mm}$   
 C :  $H / 12\text{mm}$   
 D :  $V / 9\text{mm}$   
 @ H,V : Active Area

**FIG. 2 17 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 "Gray(M)".



**FIG. 3 Response Time**

## Product Specification

Dimension of viewing angle range

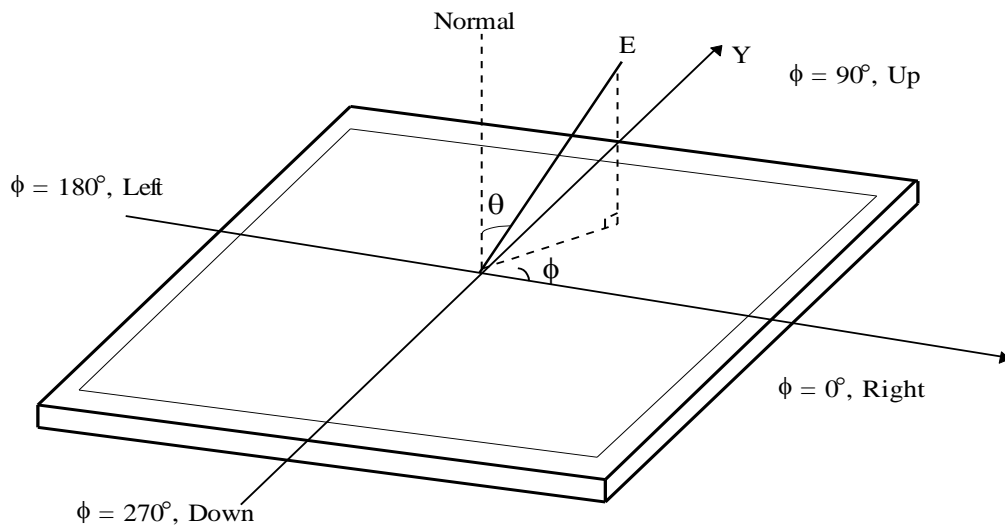


FIG. 4 Viewing Angle

## Product Specification

### 5. Mechanical Characteristics

Table 14 provides general mechanical characteristics.

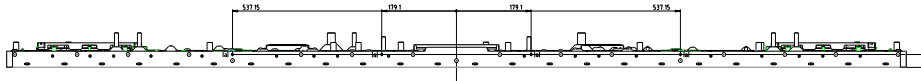
**Table 14. MECHANICAL CHARACTERISTICS**

Item	Value	
Outline Dimension	Horizontal	2158.3 mm
	Vertical	348.5 mm
	Depth	38.3 mm
Bezel Area	Horizontal	2149.5mm
	Vertical	336.7mm
Active Display Area	Horizontal	2148.48mm
	Vertical	335.7mm
Weight	15.04Kg (Typ.)	
Case Top	Material	EGI 0.6T
	Case Top Color	Black

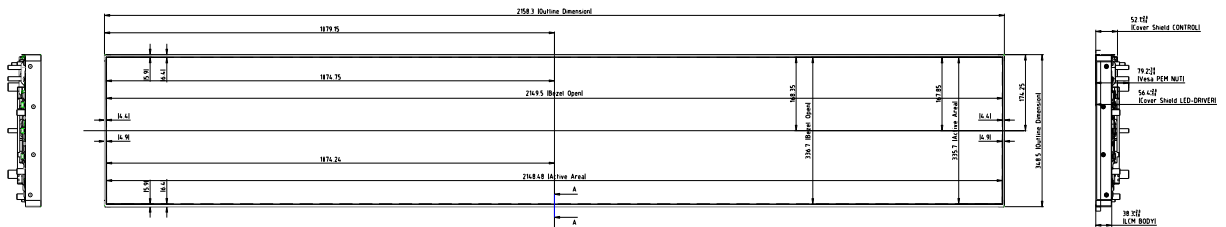
Note : Please refer to a mechanic drawing in terms of tolerance at the next page.

Product Specification

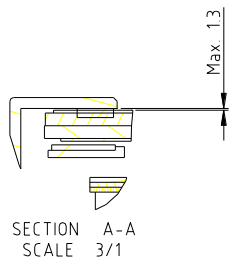
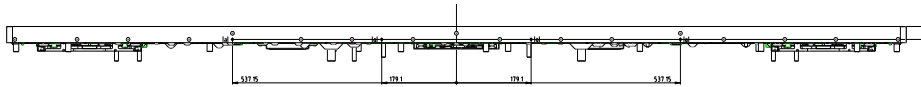
[ FRONT VIEW ]



SET : TOP

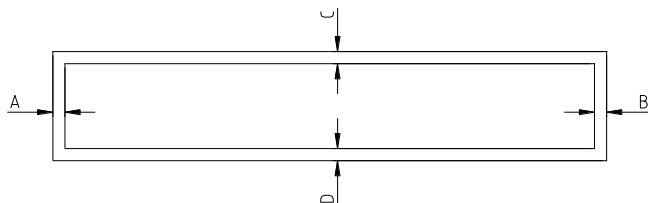


SET : DOWN



Notes

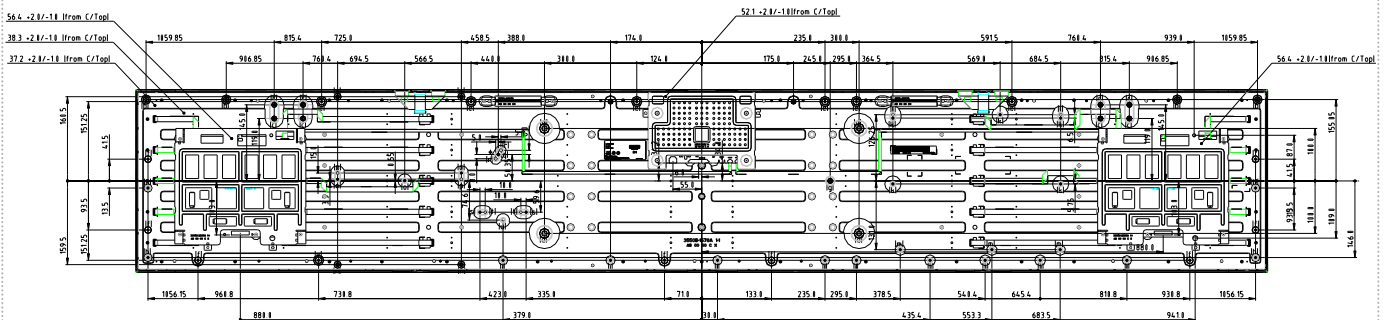
1. Unspecified tolerances is  $\pm 10\text{mm}$
2. Max Torque : Refer to table.
3. Max Depth : Refer to table.
3. The Same feature means the same dimension.
5. Designer's approval is required before mass-production.
6. This drawing is only preliminary data and can be changed.
7. Tilt and Partial disposition tolerance of display area is as following.
  - (1) X-direction :  $IA-BI \leq 2.0$
  - (2) Y-direction :  $IC-DI \leq 2.0$



## Product Specification

## [ REAR VIEW ]

## SET : TOP



## SET : DOWN

Item	UDM Height (mm)	TAP	Max. Depth (mm)	Max. Torque (kgf.cm)	Notes
(a)	-	M4.0	12.0	8.0	Middle Cabinet (Ready)
(b)	4.0	M4.0	4.0	8.0	User Handle
(c)	4.21	M4.0	9.0	8.0	Shaft
(d)	4.09	M8.0	20.0	14.0	Vesa Pemnut
(e)	20.0	M3.0	9.0	5.0	Back Cabinet
(f)	19.5	M3.0	9.0	5.0	Back Cabinet
(g)	4.09	M4.0	9.0	8.0	Back Cabinet
(h)	2.9	M3.0	4.0	5.0	Back Cabinet
(i)	4.0	M3.0	4.0	5.0	Back Cabinet
(j)	5.4	M3.0	5.0	5.0	Back Cabinet
(k)	10.5	M3.0	10.0	5.0	Main Board
(l)	10.5	n 4.0	H=15	-	Main Board (Embo)
(m)	5.0	M3.0	6.0	5.0	Main Board
(n)	9.1	M3.0	9.0	5.0	Power Board
(o)	8.0	M3.0	9.0	5.0	Power Board
(p)	8.0	n 3.7	H=19	-	Power Board (Embo)
(q)	4.9	M4.0	5.0	8.0	Ground
(r)	4.9	n 4.0	H=2.0	-	Ground (Embo)
(s)	7.5	M3.0	8.0	5.0	Bracket
(t)	7.5	n 3.0	H=2.0	-	Bracket (Embo)
(u)	7.5	-	-	-	Bracket

## Product Specification

### 6. Reliability

**Table 15. 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

Note : 1. Before and after Reliability test, LCM should be operated with normal function.



## Product Specification

### 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

## Product Specification

### 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)  
E : MONTH

D : YEAR  
F ~ M : SERIAL NO.

notes

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 : 4pcs

b) Pallet Size : 2,360mm(W) X 760 mm(D) X 665 mm(H)

## Product Specification

### 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, Concentrated 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 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.
- (10) Touching the LED Driver might cause an electric shock and damage to LED Driver. Please always use antistatic tools when handling the LED Driver

#### 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 minimize 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 cause 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.

## 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.
- (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

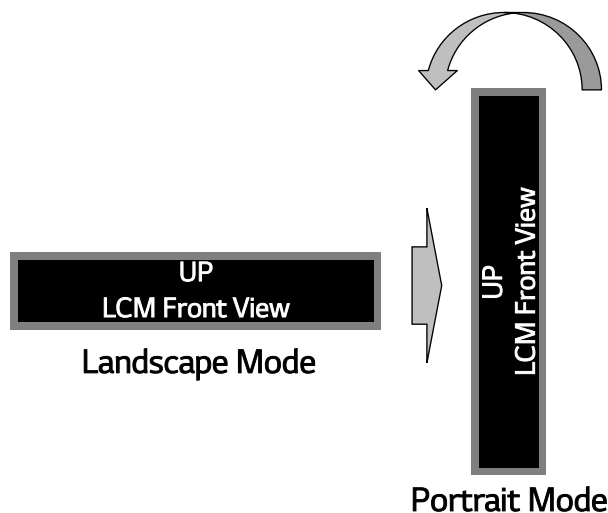
- (1) The protection film is attached to the bezel with a small masking tape.  
When the protection film is peeled off, static electricity is generated between the film and polarizer.  
This should be peeled off slowly and carefully by people who are electrically grounded and with well ion-blown equipment 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.

## Product Specification

### 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.

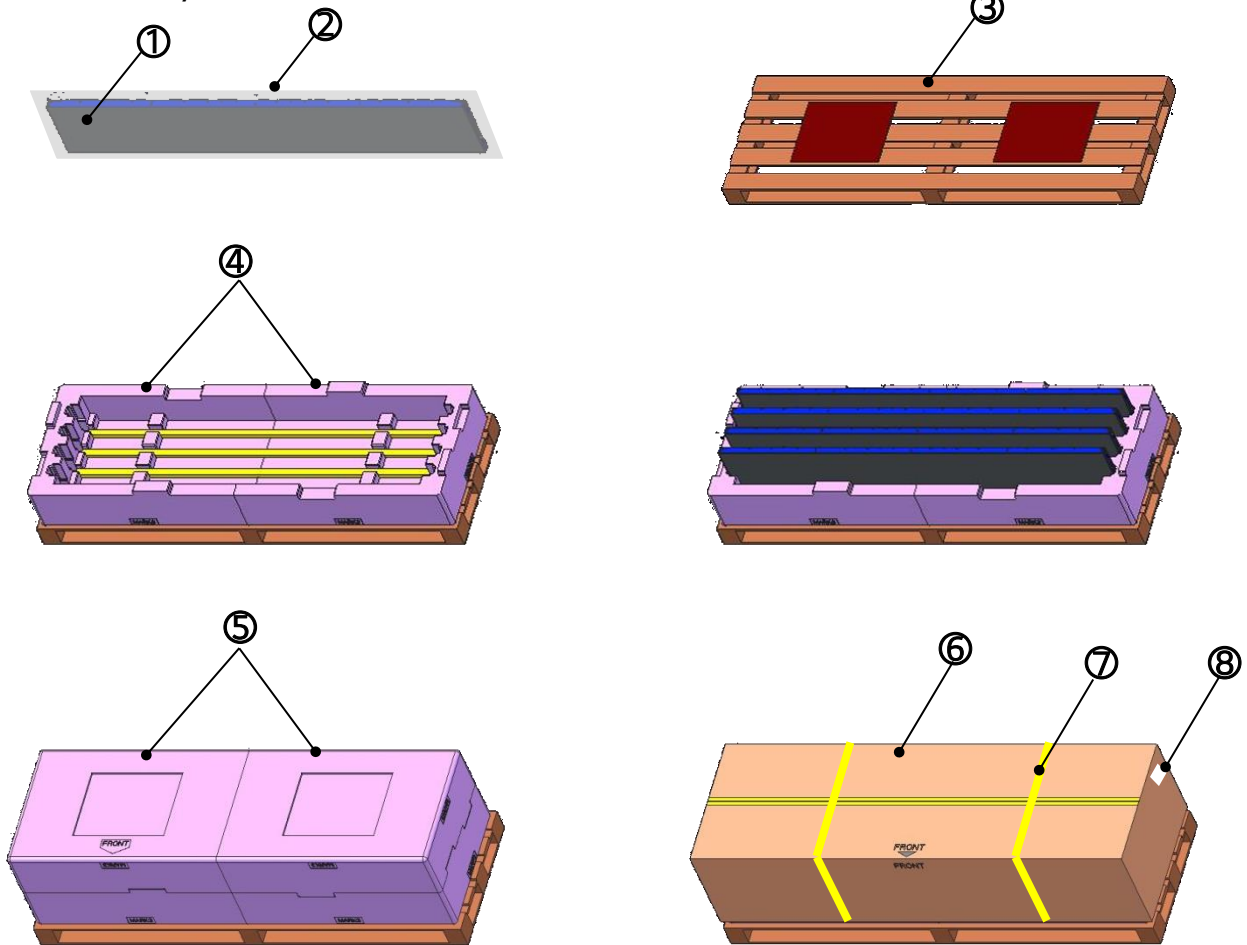
1. Normal operating condition
  - Temperature: 0 ~ 40°C
  - Operating Ambient Humidity : 10 ~ 90 %
  - Display pattern: dynamic pattern (Real display)
  - Note) Long-term static display can cause image sticking.
2. Operating usages under abnormal condition
  - a. Ambient condition
    - Well-ventilated place is recommended to set up PD system.
  - b. Power and screen save
    - Periodical power-off or screen save is needed after long-term display.
3. Operating usages to protect against image sticking due to long-term static display
  - a. Suitable operating time on 'Static Image' : Under 18 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 is used according to operating usages.
5. Module should be turned counter clockwise based on front view when used in portrait mode.



## Product Specification

## # APPENDIX- I

## ■ Pallet Ass'y



NO.	DESCRIPTION	MATERIAL
①	LCD Module	86INCH
②	AL BAG	AL
③	PALLET	PLYWOOD 2360×760×125mm
④	PACKING,BOTTOM	EPS
⑤	PACKING, TOP	EPS
⑥	Angle packing	Paper
⑦	BAND	PP
⑧	LABEL	YUPO 80G 100X70

**Product Specification**

**# APPENDIX- II-1**

**■ LCM Label**



**■ Production site**

- LG Display (PJ, Heesung) Co., LTD

Note

1. The origin of LCM Label will be changed according to the production site.

**Product Specification**

**# APPENDIX- II - 2**

■ Pallet Label

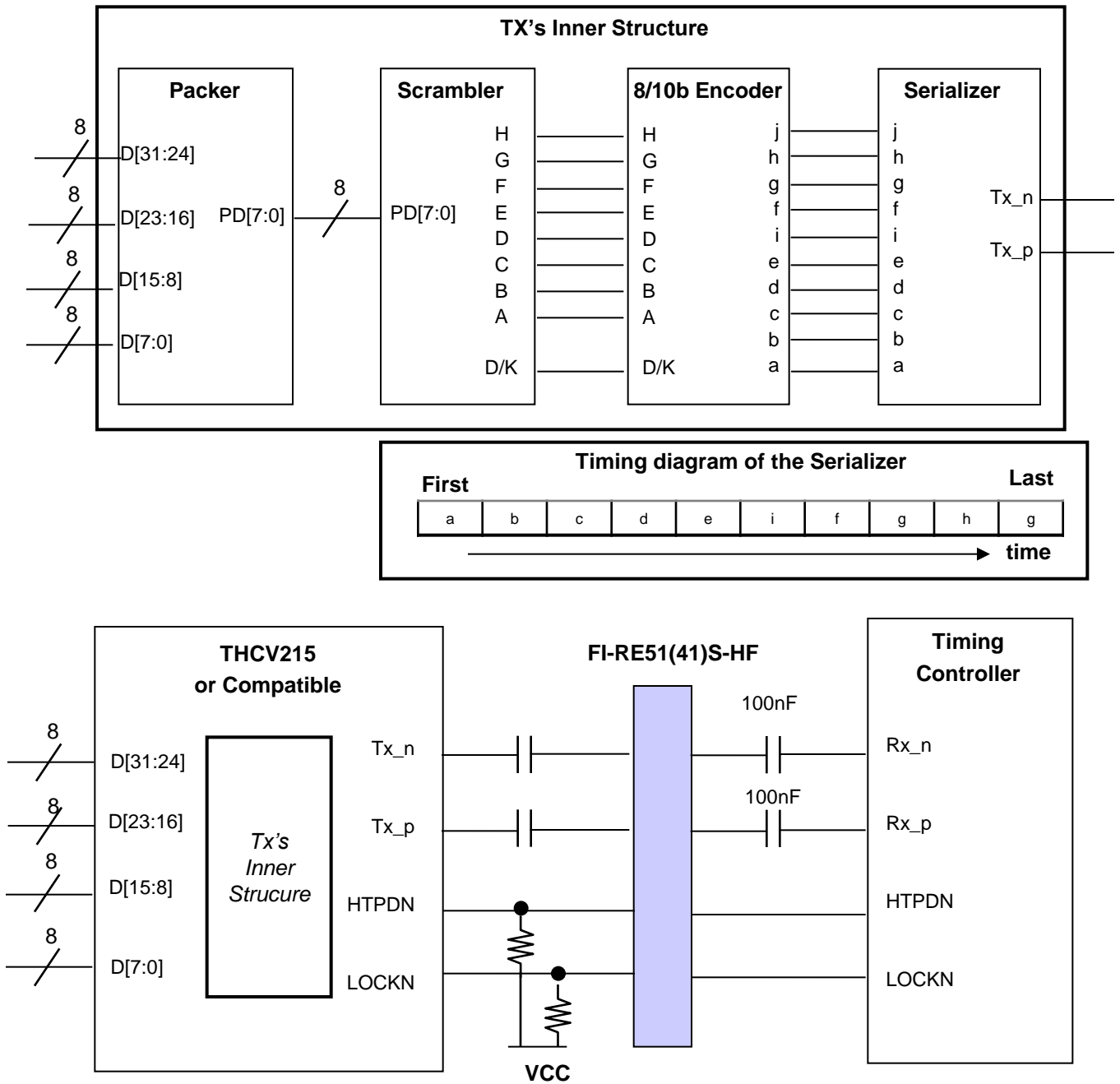




## Product Specification

### # APPENDIX- III

#### ■ Required signal assignment for Flat Link (Thine : THCV215) Transmitter



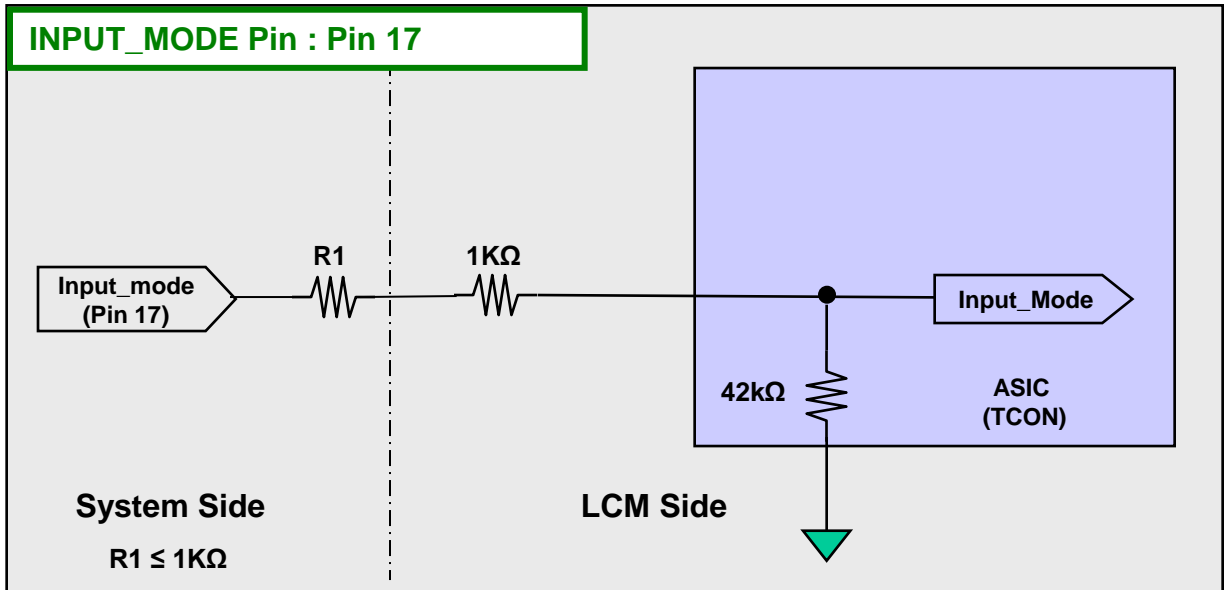
- notes: 1. The LCD module uses a 100 nF capacitor on positive and negative lines of each receiver input.  
 2. Refer to Vx1 Transmitter Data Sheet for detail descriptions. (THCV215 or Compatible)  
 3. About Module connector pin configuration, Please refer to the Page 7

## Product Specification

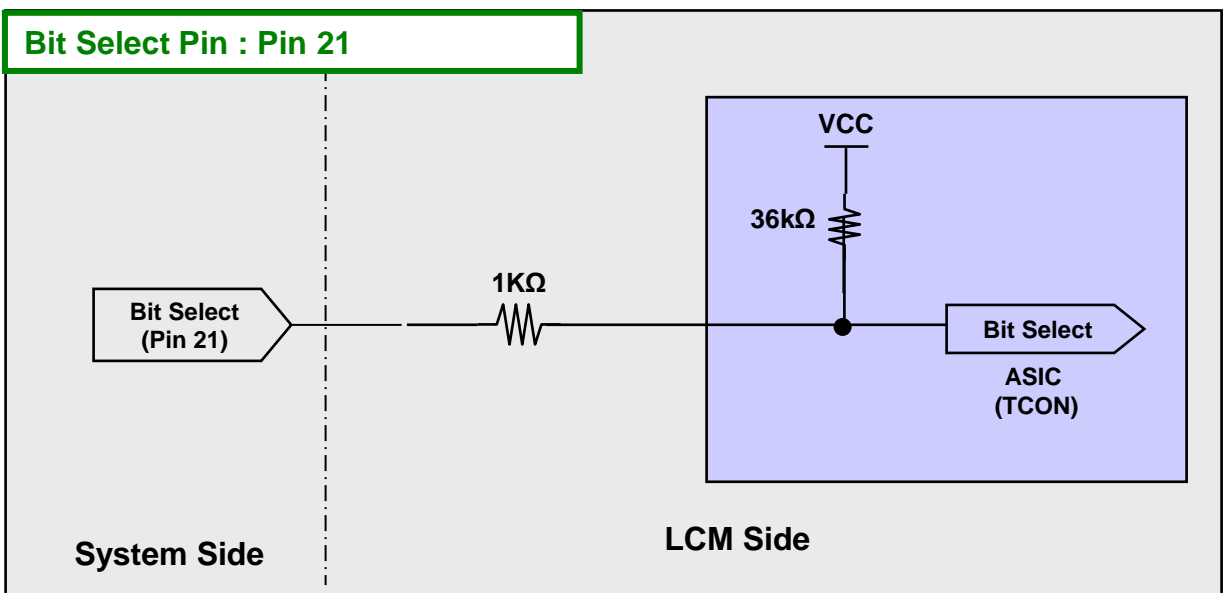
## # APPENDIX- IV-1

## ■ Option Pin Circuit Block Diagram

## 1) Circuit Block Diagram of Input\_Mode Selection pin



## 2) Circuit Block Diagram of Bit Selection pin

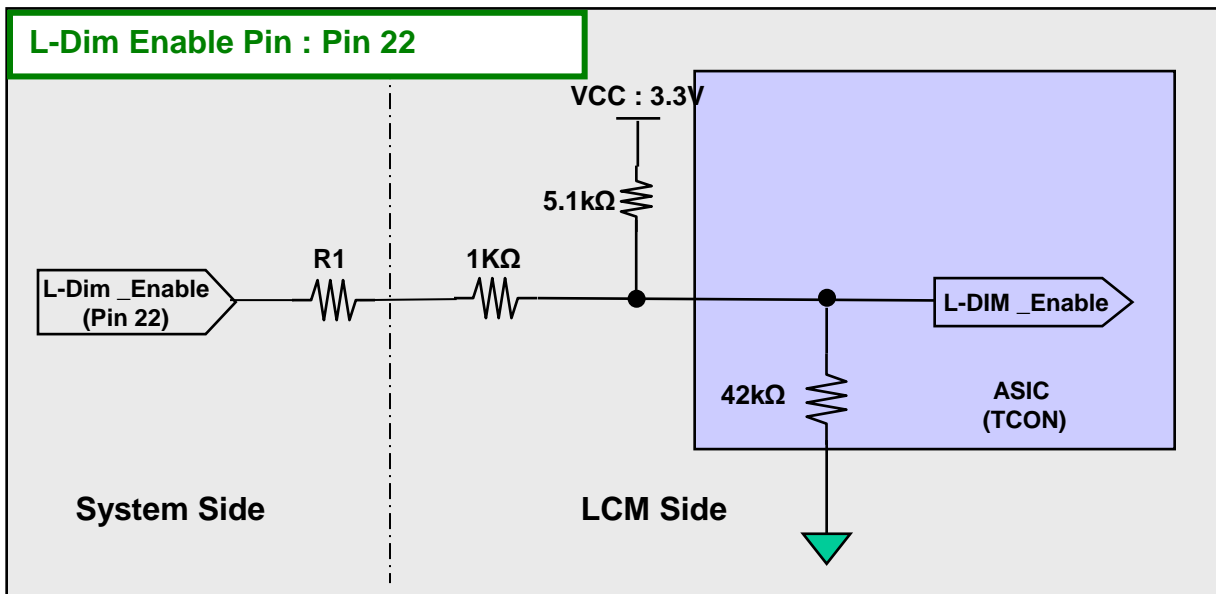


## Product Specification

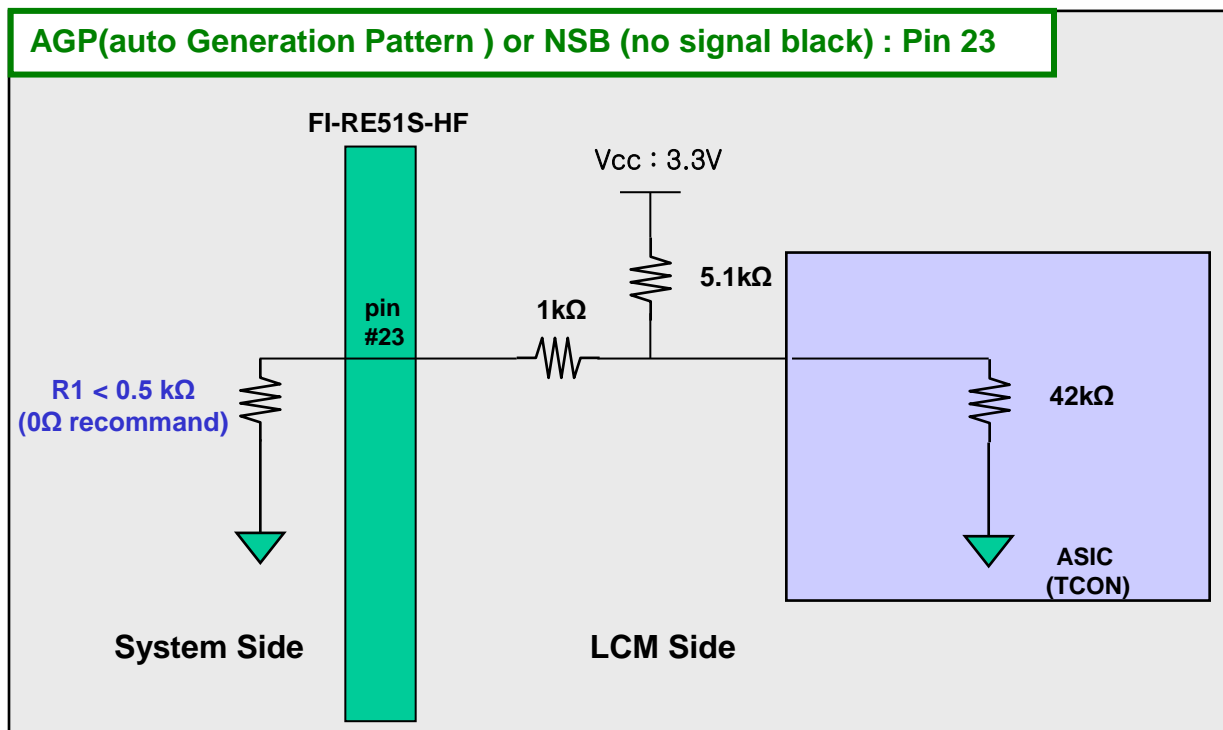
## # APPENDIX- IV-2

## ■ Option Pin Circuit Block Diagram

## 3) Circuit Block Diagram of Local Dimming Enable pin



## 4) Circuit Block Diagram of AGP Selection pin

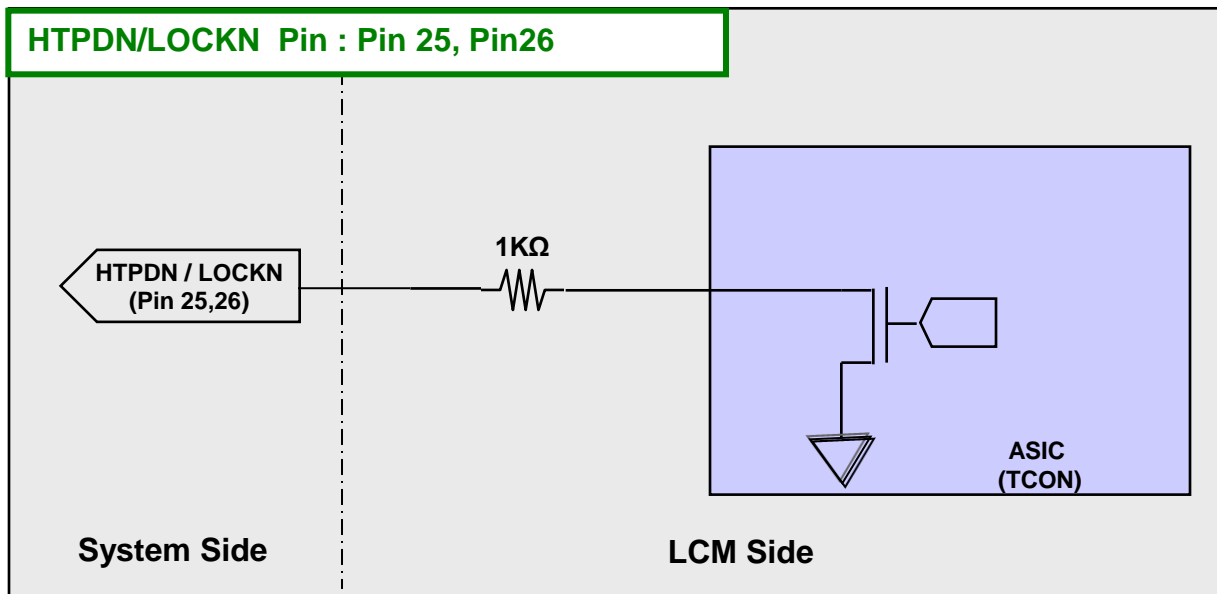


## Product Specification

## # APPENDIX- IV-3

## ■ Option Pin Circuit Block Diagram

## 5) Circuit Block Diagram of HTPDN/ LOCKN Selection pin

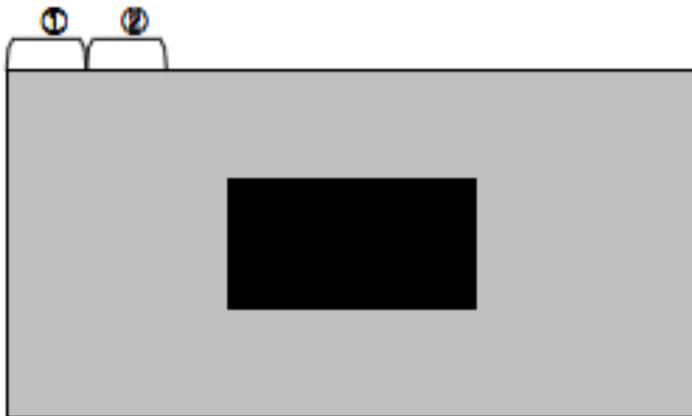


## Product Specification

## # APPENDIX- V-1

■ input mode of pixel data

### Mode : Non-Division



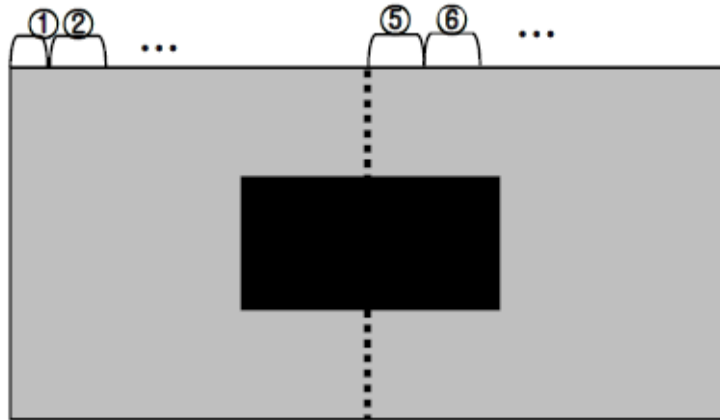
Lane	1 <sup>st</sup> Data	2 <sup>nd</sup> Data	Data#
Lane0	1	9	3833
Lane1	2	10	3834
Lane2	3	11	3835
Lane3	4	12	3836
Lane4	5	13	3837
Lane5	6	14	3838
Lane6	7	15	3839
Lane7	8	16	3840

## Product Specification

## # APPENDIX- V-2

## ■ input mode of pixel data

## Mode : 2-Division

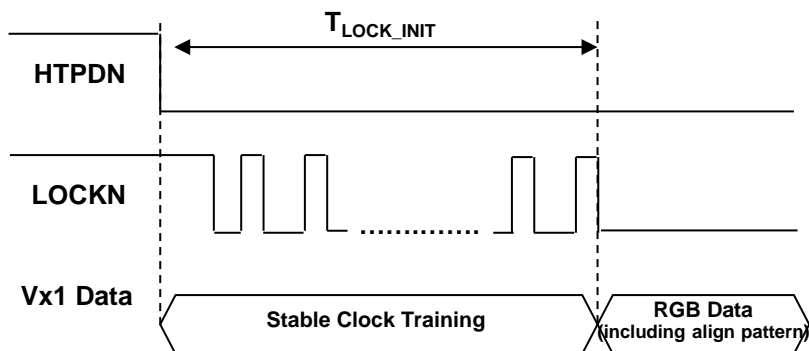


Lane	1 <sup>st</sup> Data	2 <sup>nd</sup> Data	Data#
Lane0	1	5	1917
Lane1	2	6	1918
Lane2	3	7	1919
Lane3	4	8	1920
Lane4	1921	1925	3837
Lane5	1922	1926	3838
Lane6	1923	1927	3839
Lane7	1924	1928	3840

## Product Specification

## # APPENDIX- VI

## ■ Vx1 Initialization Characteristics



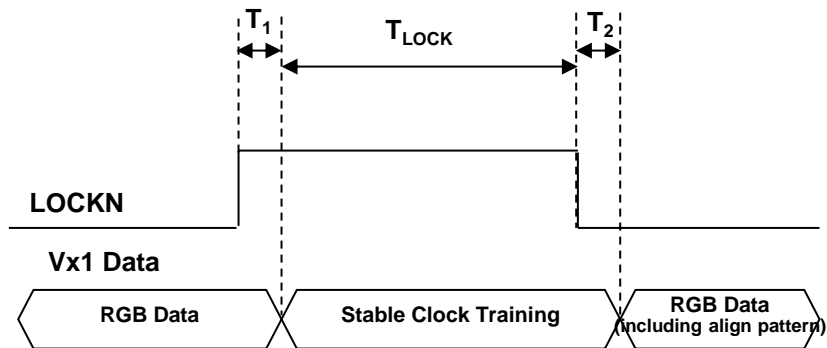
## 2). UHD60Hz T-Con

Characteristics	Symbol	Min	Typ	Max	Unit
Initial CDR lock time (From Stable CDR training to CDR lock)	$T_{\text{LOCK\_INIT}}$	0		<b>310</b>	ms

## Product Specification

## # APPENDIX- VII

## ■ Vx1 Lock Timing In Normal Operation



Characteristics	Symbol	Min	Typ	Max	Unit
CDR lock time from stable clock training pattern to LOCKN "Low" in normal operation	$T_{LOCK}$			2	ms
Latency from LOCKN "High" to clock training pattern	$T_1$			100	us
Latency from clock "Low" to normal RGB Data	$T_2$			100	us

※ Vx1 Rx should get clock training pattern in  $T_1$

※ Vx1 Rx should get RGB Data (including align pattern) in  $T_2$