

# SPECIFICATION FOR APPROVAL

( ● ) Preliminary Specification

(   ) Final Specification

Title	32.0" WUXGA TFT LCD
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BUYER	General
MODEL	

SUPPLIER	LG Display Co., Ltd.
*MODEL	LD320DPY-SKA1
SUFFIX	

APPROVED BY	SIGNATURE DATE
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/	

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

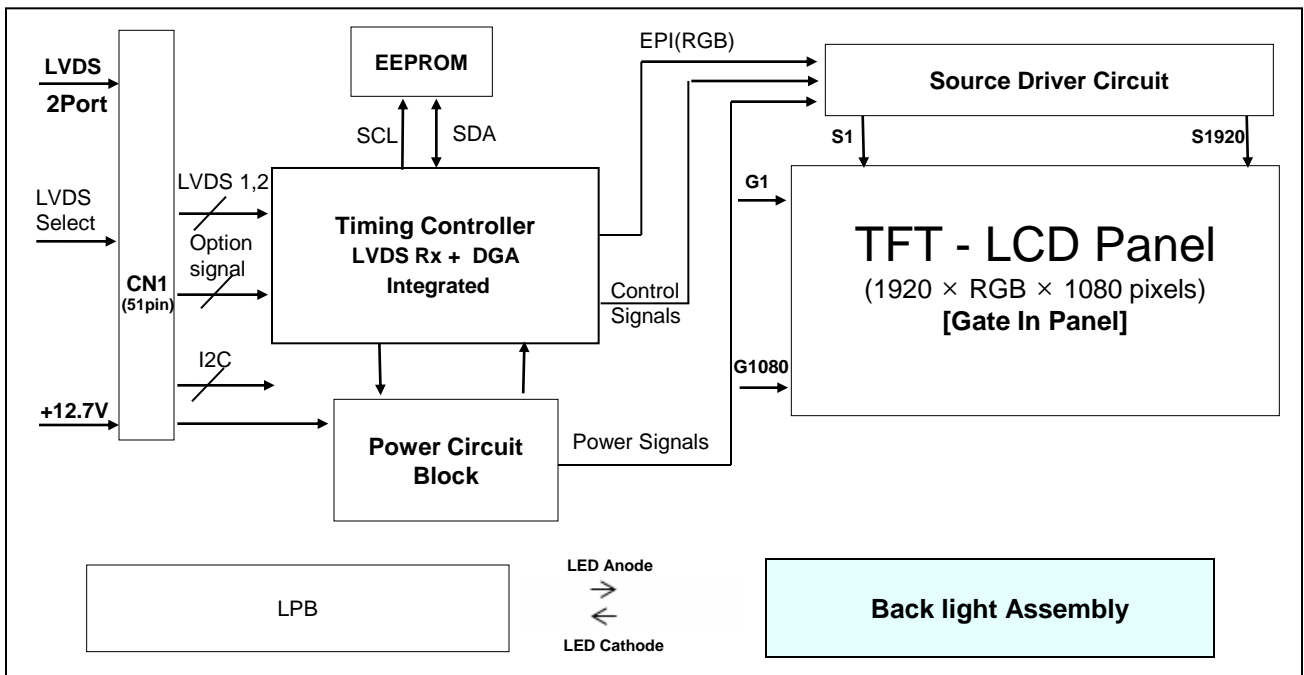
APPROVED BY	SIGNATURE DATE
H.S. Song / Team Leader	
REVIEWED BY	
J.K. Kim / Project Leader	
PREPARED BY	
D.U. Lee / Engineer	

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

## 1. General Description

The LD320DPY is a Color Active Matrix Liquid Crystal Display with an integral the Source PCB and Gate implanted on Panel (GIP). The matrix employs a-Si Thin Film Transistor as the active element. It is a transmissive type display operating in the normally black mode. It has a 31.55 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 arranged 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 16.7Million colors.

It is intended to support LCD TV, PCTV where high brightness, super wide viewing angle, high color gamut, high color depth and fast response time are important.



## General Features

Active Screen Size	31.55 inches(801.31 mm) diagonal
Outline Dimension	731.1(H)*425.7(V)*20.9(B)mm(Typ.)
Pixel Pitch	0.36375 [mm] × 0.36375 [mm]
Pixel Format	1920 horiz. by 1080 vert. Pixels, RGB stripe arrangement
Color Depth	8bit, 16.7 Million colors
Luminance, White	2000 cd/m <sup>2</sup> (Center 1point ,Typ.)
Viewing Angle (CR>10)	Viewing angle free ( R/L 178 (Min.), U/D 178 (Min.))
Power Consumption	<b>Total 45.2W (Typ.)</b> [
Weight	5.5 Kg (Typ.), 6.5 Kg(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

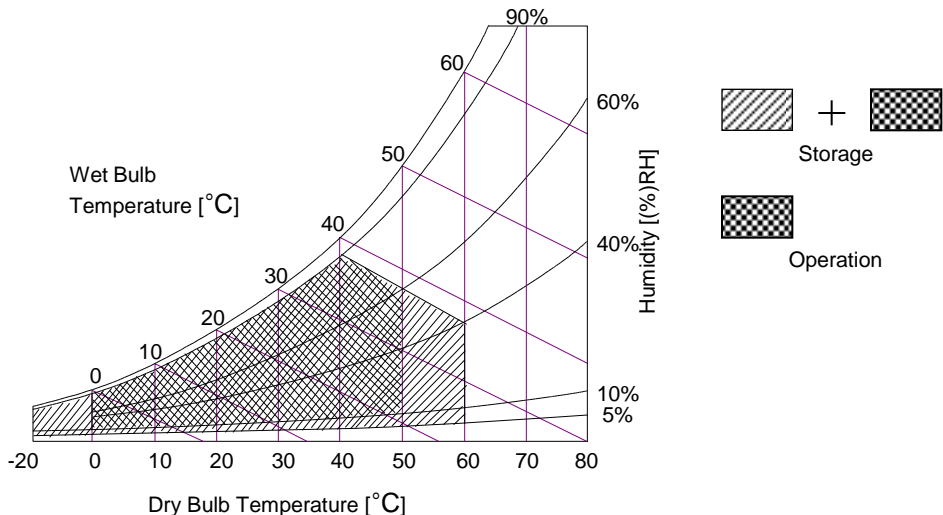
## 2. Absolute Maximum Ratings

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 (Only Panel and Circuit Part of LCD Module)**

Parameter		Symbol	Value		Unit	Note
			Min	Max		
Power Input Voltage	LCD Circuit	V <sub>LCD</sub>	-0.3	+14.0	V <sub>DC</sub>	1
T-Con Option Selection Voltage		V <sub>LOGIC</sub>	-0.3	+4.0	V <sub>DC</sub>	
Operating Temperature		T <sub>OP</sub>	0	+50	°C	2,3
Storage Temperature		T <sub>ST</sub>	-20	+60	°C	
Panel Front Temperature		T <sub>SUR</sub>	-	+68	°C	4
Operating Ambient Humidity		H <sub>OP</sub>	10	90	%RH	2,3
Storage Humidity		H <sub>ST</sub>	10	90	%RH	

1. Ambient temperature condition ( $T_a = 25 \pm 2 \text{ }^\circ\text{C}$ )
2. Temperature and relative humidity range are shown in the figure below.  
Wet bulb temperature should be Max 39°C, and no condensation of water.
3. Gravity mura can be guaranteed below 40°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°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°C. The range of operating temperature may be degraded in case of improper thermal management in final product design.



### 3. Electrical Specifications

#### 3-1. Electrical Characteristics

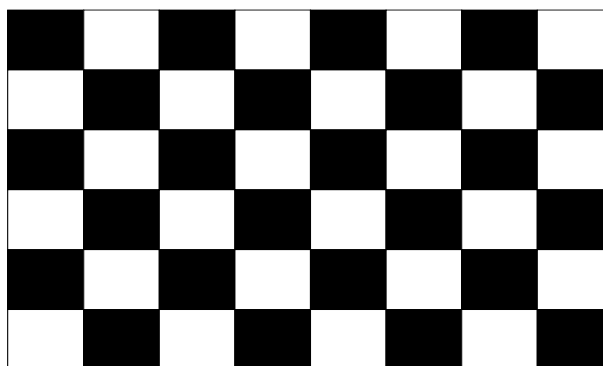
It requires two power inputs. One is employed to power for the LCD circuit. The other is used for the LED backlight and LED Driver circuit.

**Table 2. ELECTRICAL CHARACTERISTICS**

Parameter		Symbol	Value			Unit	Note
			Min	Typ	Max		
<b>Circuit :</b>							
Power Input Voltage		V <sub>LCD</sub>	10.8	12.0	13.2	V <sub>DC</sub>	
Power Input Current		I <sub>LCD</sub>	-	500	650	mA	1
			-	700	910	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>	-	6.0	8.26	Watt	1
Rush current		I <sub>RUSH</sub>	-	-	5.0	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.
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 : 255 Gray  
Black : 0 Gray

**Mosaic Pattern(8 x 6)**

## Product Specification

Table 3. ELECTRICAL CHARACTERISTICS (Continue)

### 3-2-2. Backlight Module

parameter		Symbol	VALUES			Unit	Notes	
			MIN	TYP	MAX			
Power supply input voltage		VBL	22.6	24	26.4	VDC	1	
Power supply input current		IBL_A	-	1.88	-	A	VBR=3.3V	
Power consumption		PBL		45.2		W	VBR=3.3V	
Input signal for inverter control	On/off	on	V on	2.5	-	5	V	
		off	V off	0	-	0.5	V	
	Brightness adjust	EXTVBR-B	35			100	%	Automatic sensitization control

### 3. Reliability Test

	Test Item	Q'ty	Condition
1	High temperature storage test	3	60°C,300hrs
2	Low temperature storage test	3	-20°C,300hrs
3	High temperature operation test	3	50°C,300hrs
4	Low temperature operation test	3	-5°C,300hrs
5	Drop test (With carton)	3	Height: 50cm 1 corner, 3 edges, 6 surfaces (ASTMD4169-I)

### 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

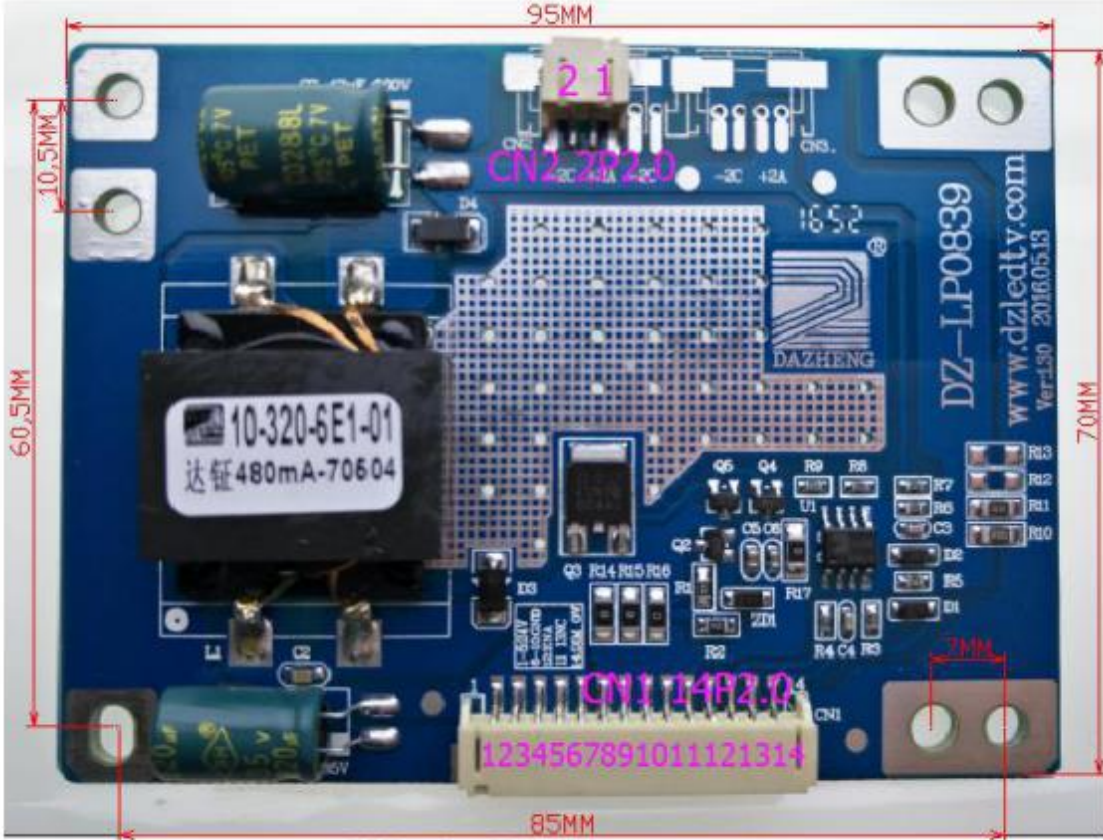
- LCD Connector(CN1): FI-RE51S-HF(manufactured by JAE) or GT05P-51S-H38(manufactured by LSM) or IS050-C51B-C39(manufactured by UJU)
- Mating Connector : FI-R51HL(JAE) or compatible

**Table 4-1. MODULE CONNECTOR(CN1) PIN CONFIGURATION**

No	Symbol	Description	No	Symbol	Description
1	NC	No Connection (Note 4)	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 VLCD (power input) pins should be connected together.
  3. All Input levels of LVDS signals are based on the **EIA 644** Standard.  
If this pin is "H", LCD Module displays AGP(Auto Generation Pattern).
  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).

3-2-2. Backlight Module



CN1 14P2.0: 电源输入口

1~5 脚为电源输入 +24V

6~10 脚为电源输入 -24V (GND)

11 脚 NC 空、13 脚为空

CN2 2P2.0: 灯条输出接口

1 脚为 LED 输出正极

2 脚为 LED 负极

3. Reliability Test

Test Item	Q'ty	Condition
1 High temperature storage test	3	60°C,300hrs
2 Low temperature storage test	3	-20°C,300hrs
3 High temperature operation test	3	50°C,300hrs
4 Low temperature operation test	3	-5°C,300hrs
5 Drop test (With carton)	3	Height: 50cm 1 corner, 3 edges, 6 surfaces (ASTMD4169-I)

### 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	notes
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	notes
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

Note: 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.

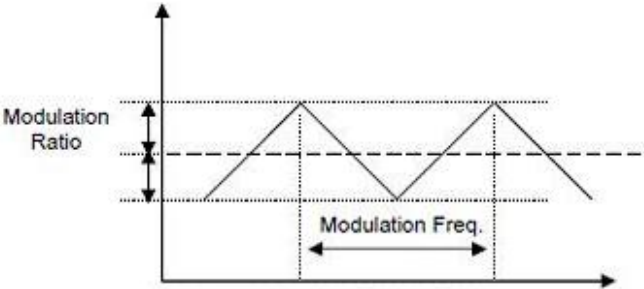
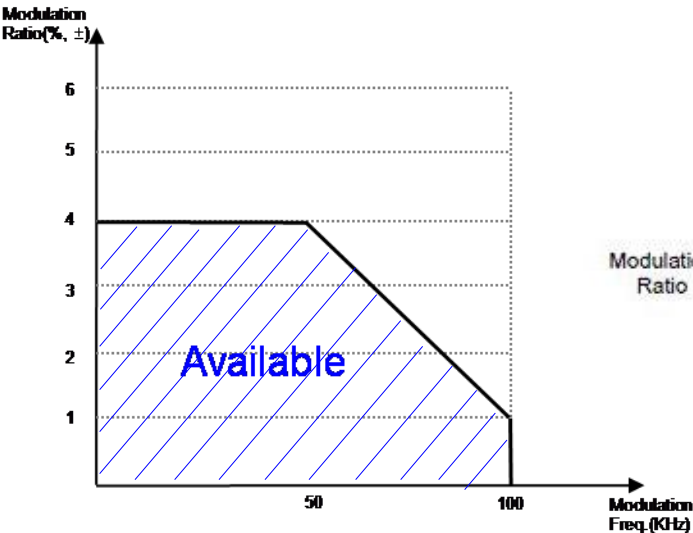
2. The performance of the electro-optical characteristics may be influenced by variance of the vertical refresh rate and the horizontal frequency

3. Spread Spectrum Rate (SSR) for 50KHz ~ 100kHz Modulation Frequency(FMOD) is calculated by  $(7 - 0.06 * F_{mod})$ , 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.



Product Specification

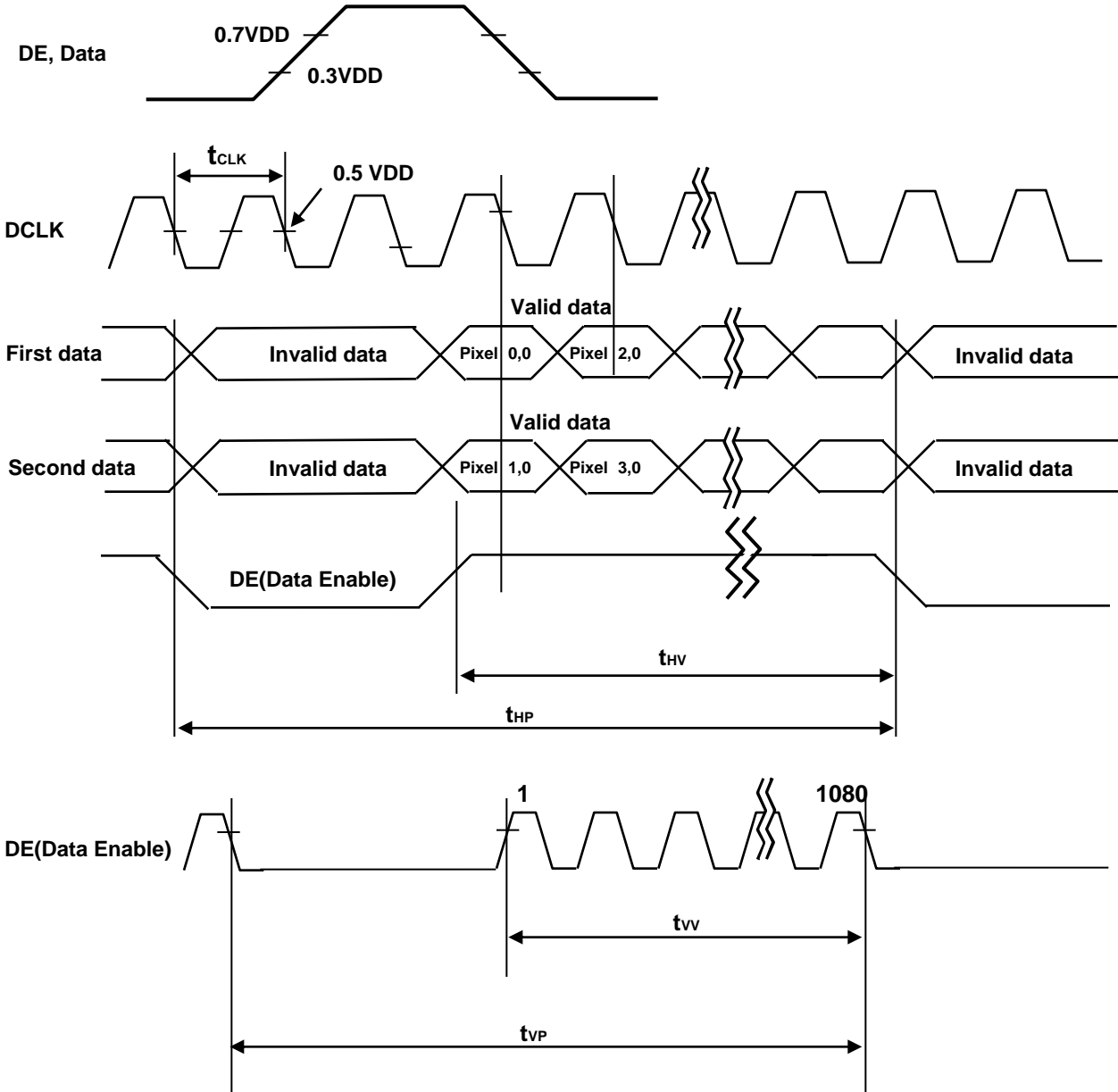


※ Please pay attention to the followings when you set Spread Spectrum Rate(SSR) and Modulation Frequency(FMOD)

- 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.

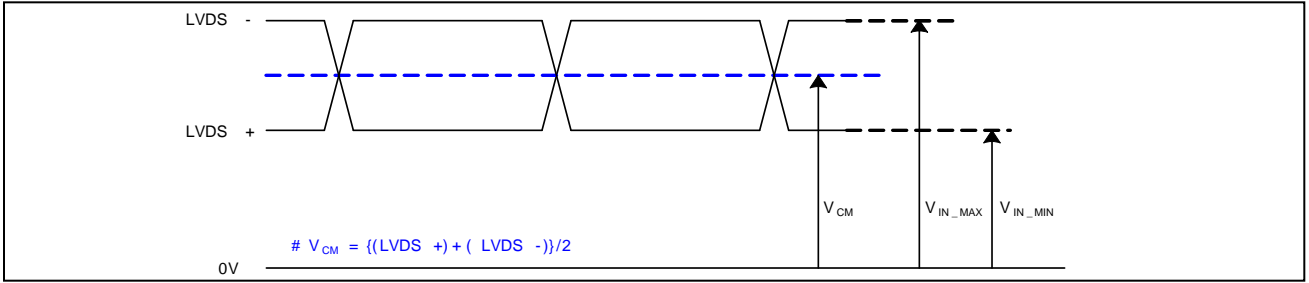
### 3-4. LVDS Signal Specification

#### 3-4-1. LVDS Input Signal Timing Diagram



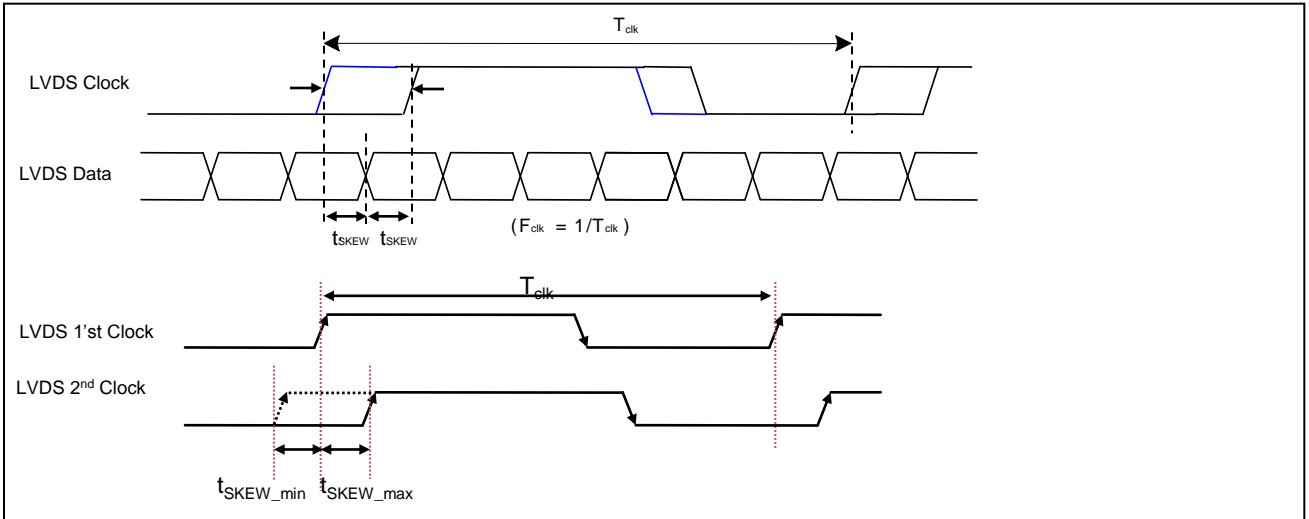
### 3-4-2. LVDS Input Signal Characteristics

#### 1) DC Specification



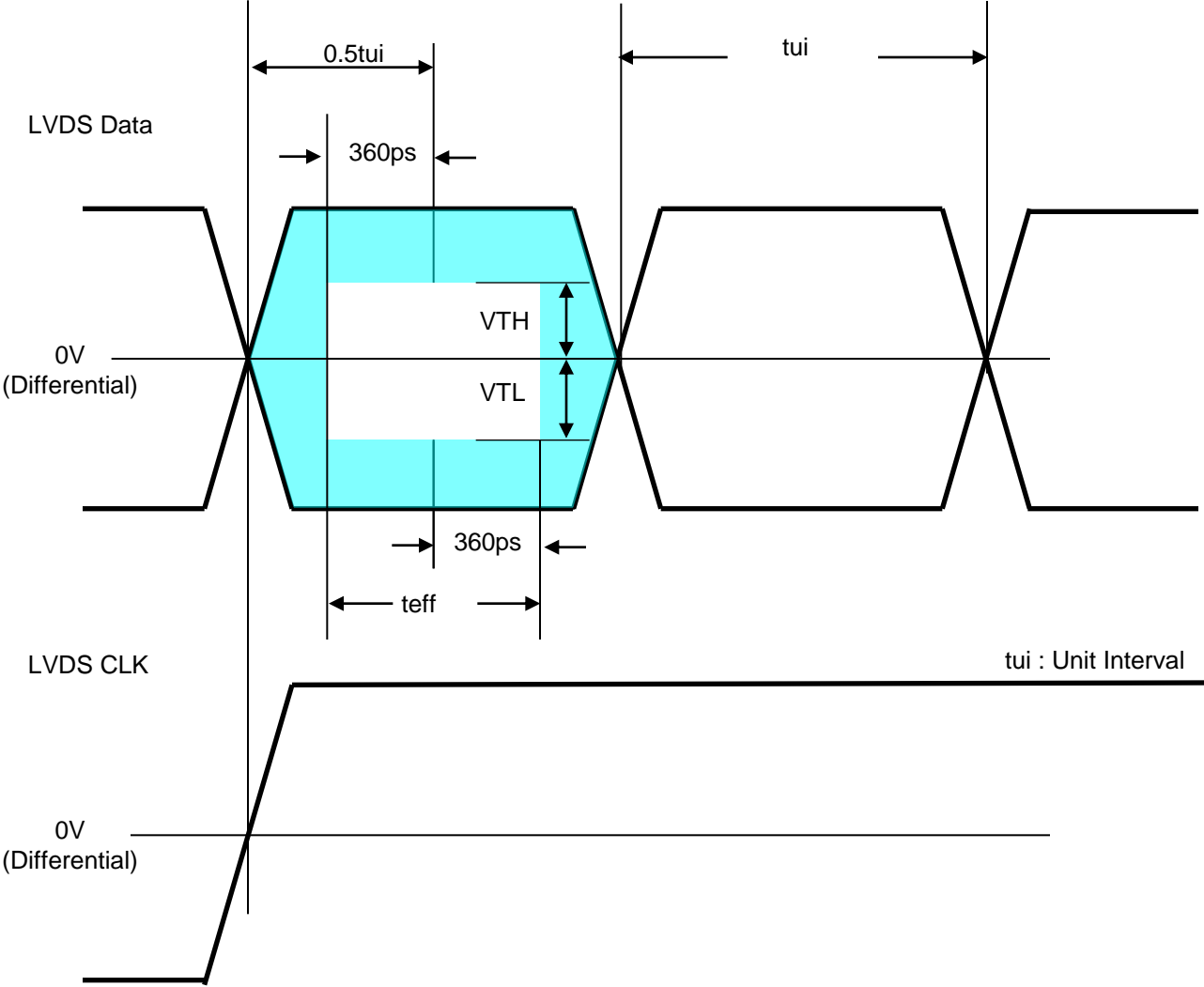
Description	Symbol	Min	Max	Unit	notes
LVDS Common mode Voltage	$V_{CM}$	1.0	1.5	V	-
LVDS Input Voltage Range	$V_{IN}$	0.7	1.8	V	-
Change in common mode Voltage	$\Delta V_{CM}$	-	250	mV	-

#### 2) AC Specification



Description	Symbol	Min	Max	Unit	notes
LVDS Differential Voltage	$V_{TH}$	100	600	mV	Tested with Differential Probe 2
	$V_{TL}$	-600	-100	mV	
LVDS Clock to Data Skew	$t_{SKEW}$	-	$ (0.2 * T_{clk})/7 $	ps	-
Effective time of LVDS	$t_{eff}$	$ \pm 360 $	-	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  $t_{eff}$



\* 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
<b>Basic Color</b>	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
<b>RED</b>	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
<b>GREEN</b>	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
<b>BLUE</b>	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

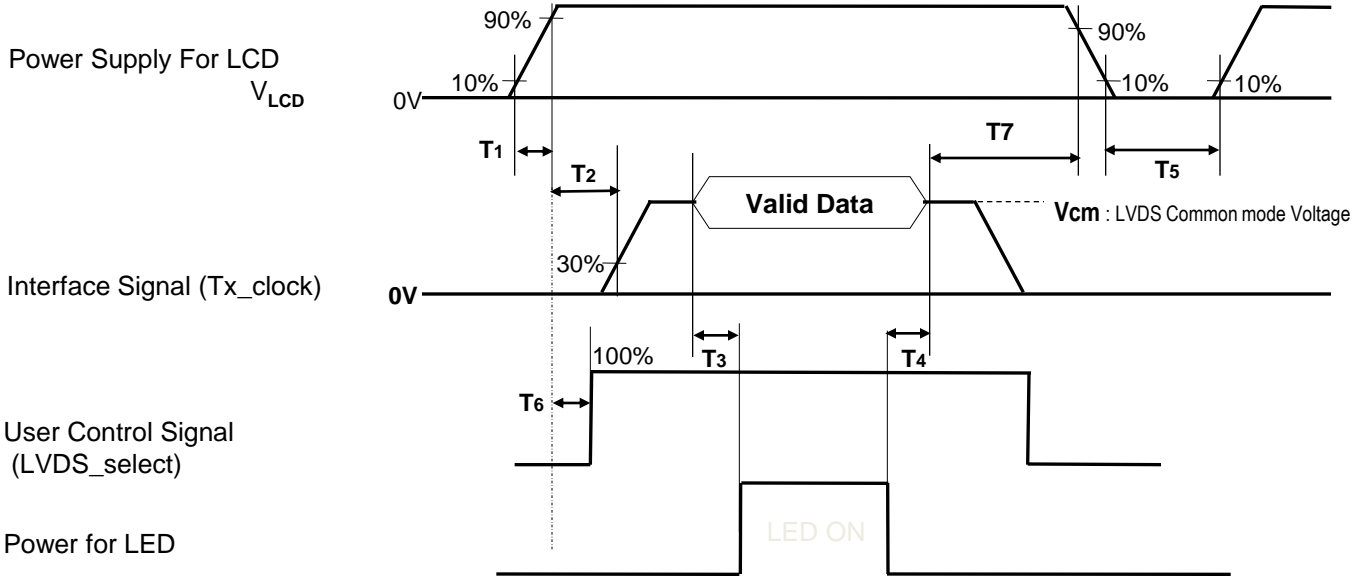


Table 8. POWER SEQUENCE

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 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.

#### 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 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.

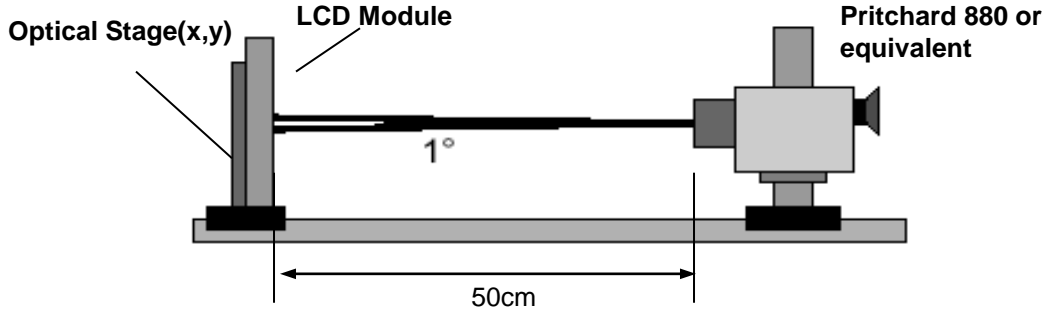


FIG. 1 Optical Characteristic Measurement Equipment and Method

$T_a = 25 \pm 2^\circ\text{C}$ ,  $V_{LCD} = 12.0\text{V}$ ,  $f_v = 60\text{Hz}$ ,  $D_{clk} = 74.25\text{MHz}$ ,  
Duty = 100%

Table 10. OPTICAL CHARACTERISTICS

Parameter	Symbol	Value			Unit	notes	
		Min	Typ	Max			
Contrast Ratio	CR			-		1	
Surface Luminance, white	$L_{WH}$		2000	-	cd/m <sup>2</sup>	2	
Luminance Variation	$\delta_{WHITE}$   9P	65	-	-		3	
Response Time	Gray to Gray (BW)	G to G BW			ms	4	
Color Coordinates [CIE1931]	RED	Rx	Typ -0.03	Typ +0.03		5	
		Ry					
	GREEN	Gx					
		Gy					
	BLUE	Bx					
		By					
WHITE	Wx	Typ -0.03	Typ +0.03		5		
	Wy						
Color Temperature			10,000		K		
Color Gamut			68		%		
Viewing Angle (CR>10)							
	x axis, right( $\phi=0^\circ$ )	$\theta_r$	89	-	-	degree	6
	x axis, left ( $\phi=180^\circ$ )	$\theta_l$	89	-	-		
	y axis, up ( $\phi=90^\circ$ )	$\theta_u$	89	-	-		
	y axis, down ( $\phi=270^\circ$ )	$\theta_d$	89	-	-		
Gray Scale			-	-	-	7	

Note : 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  $25 \pm 2^\circ\text{C}$ . 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. 3.
3. The variation in surface luminance ,  $\delta$  WHITE is defined as :  
 $\delta$  WHITE(9P) = Minimum (Lon1,Lon2~ Lon8, Lon9) / Maximum (Lon1,Lon2~ Lon8, Lon9)\*100  
 Where Lon1 to Lon9 are the luminance with all pixels displaying white at 9 locations .  
 For more information, see the FIG. 3.
4. Response time is the time required for the display to transit from any gray to white (Rise Time,  $\text{Tr}_R$ ) and from any gray to black (Decay time,  $\text{Tr}_D$ ). For additional information see the FIG. 4.  
 ※ G to  $G_{\text{BW}}$  Spec stands for average value of all measured points.  
 Photo Detector : RD-80S / Field :  $2^\circ$
5. White, Red, Green, Blue Color Coordinates are measured at gray level 255(100IRE)
6. 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. 5.
7. Gray scale specification  
 Gamma Value is approximately 2.2. For more information, see the Table 11.



Table 11. Gray scale specification

Gray Level	Luminance [%] (Typ)
L0	0.07(TBD)
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.

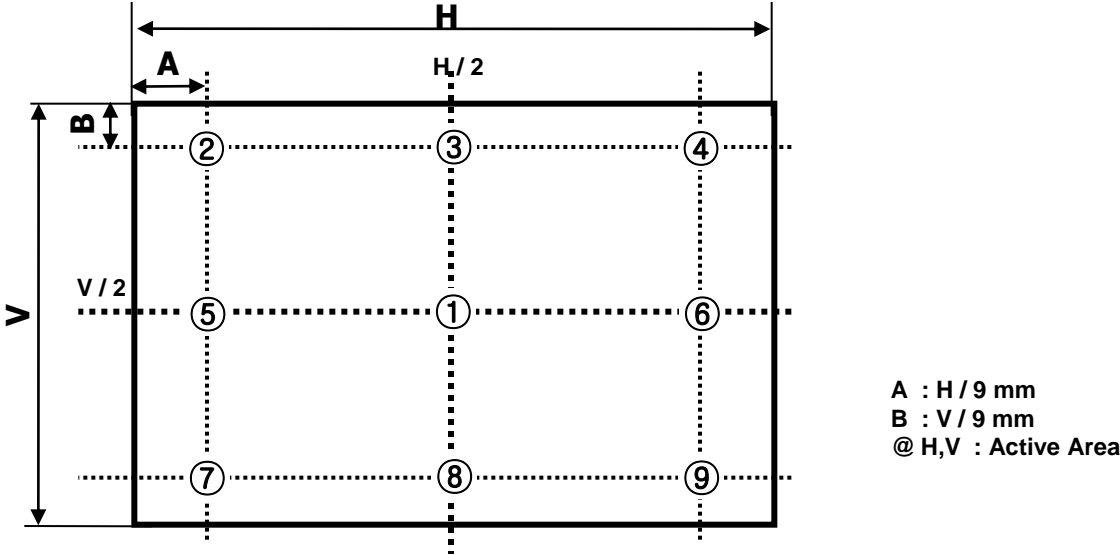


FIG. 3 9 Points for Luminance Measure

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

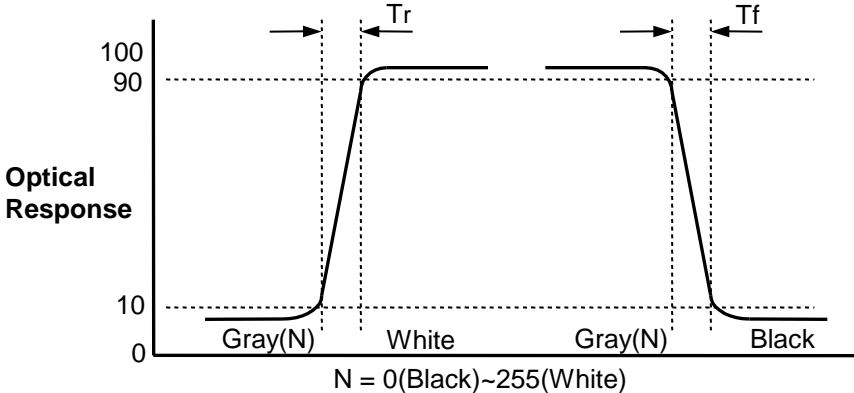
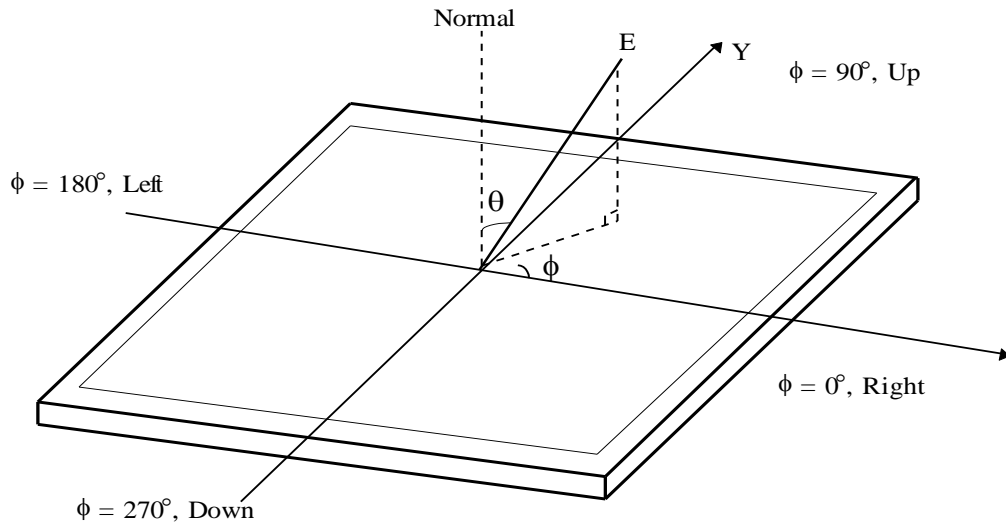


FIG. 4 Response Time

Dimension of viewing angle range



**FIG. 5 Viewing Angle**

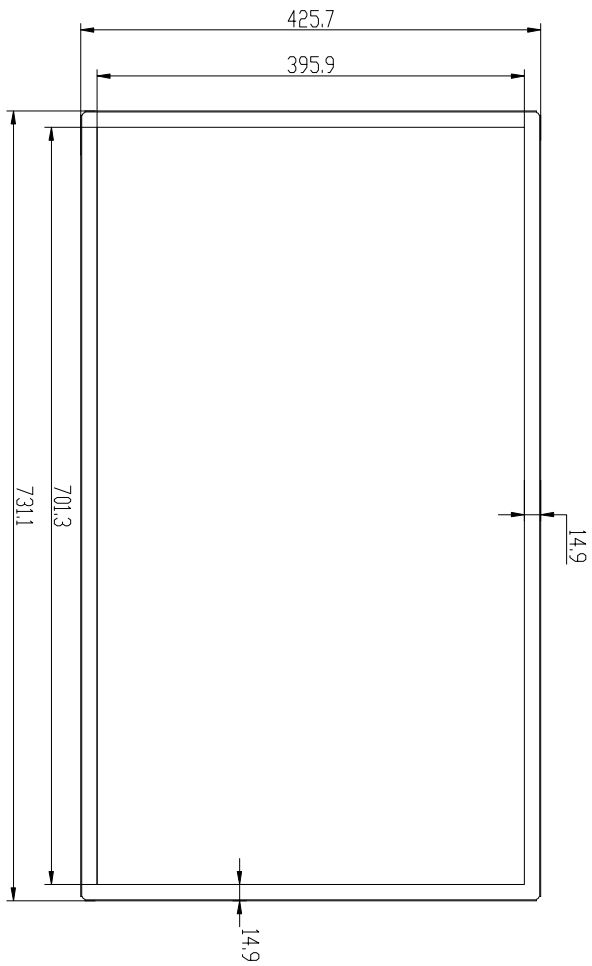
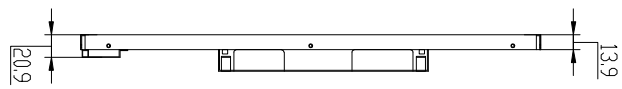
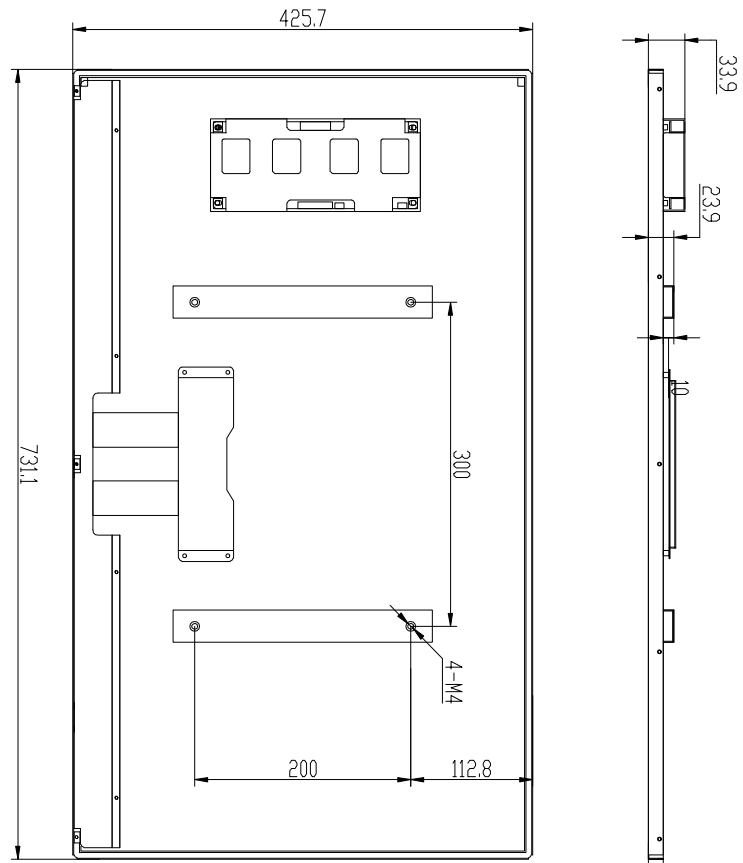
## 5. Mechanical Characteristics

Table 12 provides general mechanical characteristics.

**Table 12. MECHANICAL CHARACTERISTICS**

Item	Value	
Outline Dimension	Horizontal	731.1mm
	Vertical	425.7mm
	Depth	20.9mm
Active Display Area	Horizontal	698.4mm
	Vertical	392.9mm
Case Top	Material	PCM
	Color	Black
	Manufactory	Hansung
Weight		

notes : Please refer to a mechanical drawing in terms of tolerance at the next page.



## 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	Vibration test (non-operating)	TBD
8	Shock test (non-operating)	TBD

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

## 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