SPECIFICATION
FOR
APPROVAL

( ) **Preliminary Specification**

(●) **Final Specification**

Title	21.5" WUXGA TFT LCD
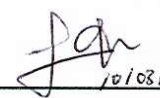
BUYER	Amtran
MODEL	

SUPPLIER	LG Display Co., Ltd.
*MODEL	LC215EUE
SUFFIX	TCA1

*When you obtain standard approval,
  please use the above model name without suffix

APPROVED BY	SIGNATURE DATE
/	
/	
/	

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

APPROVED BY	SIGNATURE DATE
H.S.SONG / Team Leader	2010.03.04
REVIEWED BY	
O.H.LEE / Project Leader	10/08/04
PREPARED BY	
H.S.CHOI / Engineer	10/03/04

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

Product Specification

CONTENTS

RECORD OF REVISIONS

Revision No.	Revision Date	Page	Description
0.1	Dec. 08, 2009	-	Preliminary Specification(First Draft)
0.2	Jan. 26, 2010	6	Change the I_{LCD} max spec.
		7	LED string max current update. LED Driver design guide update. Notes 3,6 LED Bar electrical characteristics update.
		8	Notes 4 add, table3 27pin description update.
		22,23	Change the mechanical drawings.
1.0	Feb. 09, 2010	-	Final CAS

Product Specification

1. General Description

The LC215EUE is a Color Active Matrix Liquid Crystal Display with an integral LED (White LED) backlight system without LED driver. The matrix employs a-Si Thin Film Transistor as the active element.
It is a transmissive display type which is operating in the normally white mode. It has a 21.53 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.
thus presenting a palette of more than 16.7M(6bit + A-FRC) colors.
It has been designed to apply the 8-bit 2-port LVDS interface.
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.
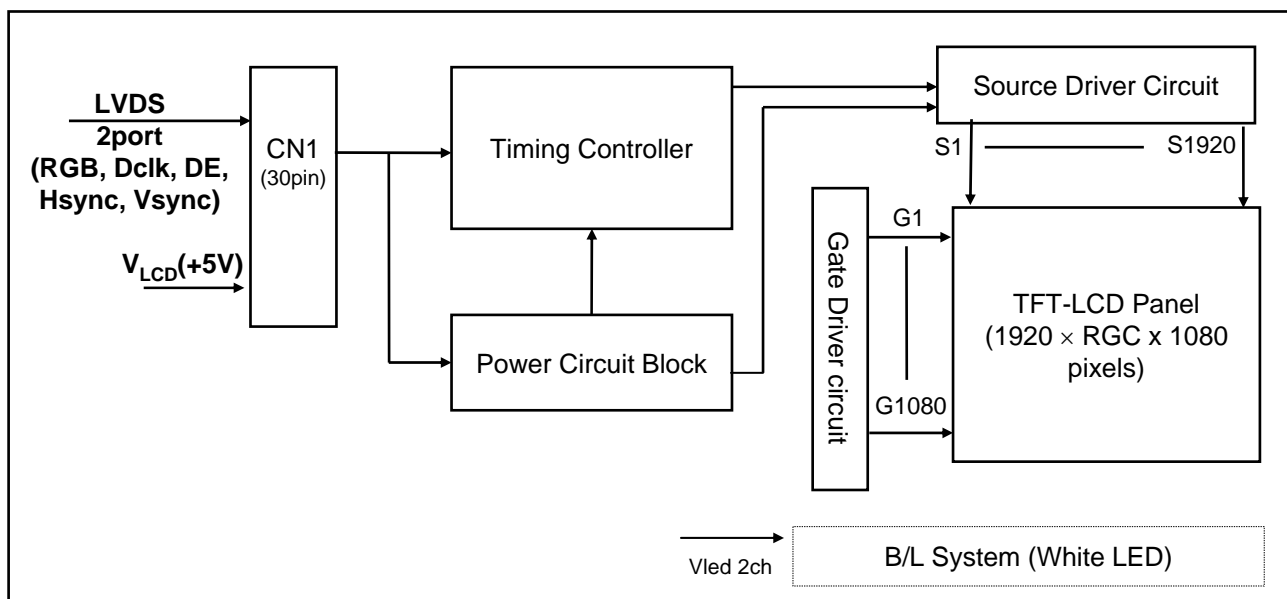
Block diagram

General Features

|	
Active Screen Size	21.53 inches(546.86mm) diagonal
Outline Dimension	495.6(H) × 292.2(V) X 11.5(D) mm (Typ.)
Pixel Pitch	0.248 mm x 0.248 mm
Pixel Format	1920 horiz. by 1080 vert. Pixels, RGB stripe arrangement
Color Depth	16.7M colors (6bit + A FRC)
Luminance, White	250 cd/m^2 (Center 1point ,Typ.)
Viewing Angle (CR>10)	Viewing angle free (R/L 170 (Typ.), U/D 160 (Typ.))
Power Consumption	Total 16.2W (Logic= 3.5W, LED Backlight =12.7W@ without Driver)
Weight	1550g(Typ.), 1630g(Max.)
Display Mode	Transmissive mode, Normally white
Surface Treatment	Hard coating(3H), Anti-glare treatment of the front polarizer

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2. Absolute Maximum Ratings

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

Table 1. ABSOLUTE MAXIMUM RATINGS

Parameter	Symbol	Value		Unit	Note
		Min	Max		
Power Input Voltage	V_{LCD}	4.5	5.5	VDC	1
Operating Temperature	T_{OP}	0	+50	°C	
Storage Temperature	T_{ST}	-20	+60	°C	
Panel Front Temperature	T_{SUR}	-	+68	°C	2,3,4,5
Operating Ambient Humidity	H_{OP}	10	90	%RH	
Storage Humidity	H_{ST}	10	90	%RH	

Note   1. Ambient temperature condition (Ta = 25 ± 2 °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. Storage condition is guaranteed under packing condition.
  5. 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℃. The range of operating temperature may degraded in case of
    improper thermal management in final product design.
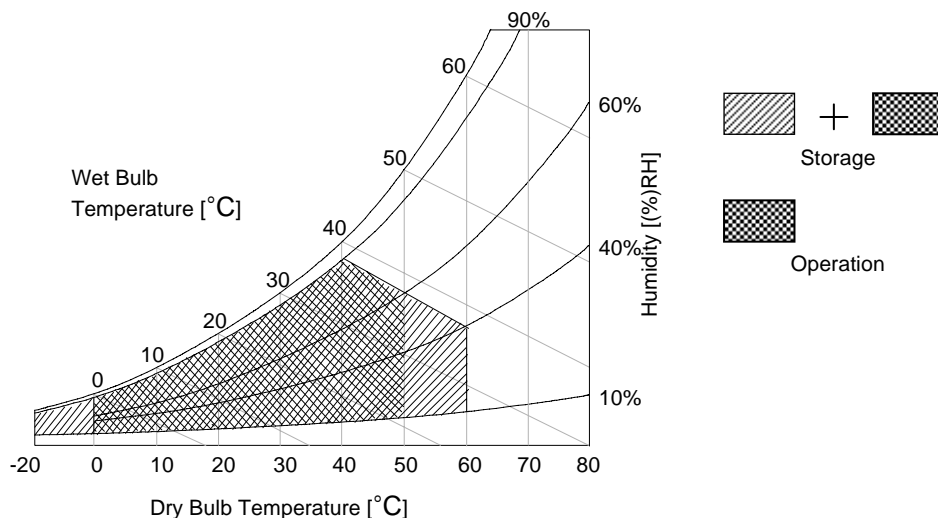
Product Specification

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 and LED Driver circuit.

Table 2. ELECTRICAL CHARACTERISTICS

Parameter	Symbol	Value			Unit	Note
		Min	Typ	Max		
Circuit :						
Power Input Voltage	V_{LCD}	4.5	5.0	5.5	V_{DC}	
Power Input Current	I_{LCD}	-	700	910	mA	1
		-	900	1170	mA	2
Power Consumption	P_{LCD}		3.5	4.6	Watt	1
Rush current	I_{RUSH}	-	-	3.0	A	3

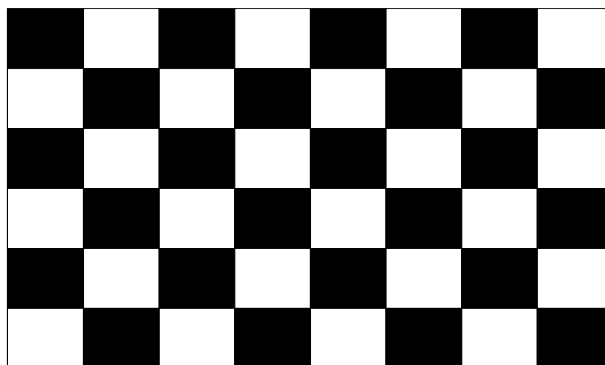Note 1. The specified current and power consumption are under the V_{LCD}=5.0V, Ta=25 $\pm$ 2°C, f_V=60Hz condition whereas mosaic pattern(8 x 6) is displayed and f_V is the frame frequency.
2. The current is specified at the maximum current pattern.
3. The duration of rush current is about 2ms and rising time of power input is 0.5ms (min.).

White : 255 Gray
Black :   0 Gray

Mosaic Pattern(8 x 6)

Product Specification

Table 2_2. LED Bar ELECTRICAL CHARACTERISTICS

Parameter	Symbol	Condition	Values			Unit	Notes
			Min.	Typ.	Max.		
LED :							1,7
LED String Current	Is		-	110	120	mA	2,7
LED String Voltage	Vs		-	57.6	61.2	V	3,7
Power Consumption	PBar		-	12.7	13.5	Watt	4,6,7
LED Life Time	LED_LT		30,000	-	-	Hrs	5,7
LED Junction Temperature	Tj		-	-	70	℃	7

LED driver design guide

: The design of the LED driver must have specifications for the LED in LCD Assembly**.**
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 and output current should be
Constant current control.
Please control feedback current of each string individually to compensate the current variation
among the strings of LEDs.
When you design or order the LED driver, please make sure unwanted lighting caused by
the mismatch of the LED and the LED driver (no lighting, flicker, etc) never occurs.
When you confirm it, the LCD module should be operated in the same condition as installed in
your instrument.

1. Specified values are for a single LED bar.
2. The specified current is input LED chip 100% duty current.
3. The specified voltage is input LED string voltage at typical 110 mA 100% duty current.
4. The specified power consumption is input LED bar power consumption at typical 110 mA 100% duty current.
5. The life is determined as the time at which luminance of the LED is 50% compared to that of initial
   value at the typical LED current on condition of continuous operating at $25 \pm 2°C$.
6. The LED bar power consumption shown above does not include loss of external driver.
   The used LED string current is the LED typical current.
   Typ Power Consumption is calculated with PBar = Vs(typ.) x Is(Typ.) x the number of LED string
   Max Power Consumption is calculated with PBar = Vs(Max.) x Is(Typ) x the number of LED string
7. LED operating DC Forward Current and Junction Temperature must not exceed LED Max Ratings at $25 \pm 2°C$.

3-2. Interface Connections

This LCD employs Two interface connections, a 30 pin connector is used for the module electronics and a 4Pin Connector is used for the integral backlight system.

3-2-1. LCD Module

LCD Connector(CN1): GT103-30S-HF15-E2500, (Manufactured by LSC)
Mating Connector : FI-X30C2L (Manufactured by JAE) or Equivalent

Table 4. MODULE CONNECTOR(CN1) PIN CONFIGURATION

No	Symbol	Description	No	Symbol	Description
1	FR0M	Minus signal of odd channel 0 (LVDS)	16	SR1P	Plus signal of even channel 1 (LVDS)
2	FR0P	Plus signal of odd channel 0 (LVDS)	17	GND	Ground
3	FR1M	Minus signal of odd channel 1 (LVDS)	18	SR2M	Minus signal of even channel 2 (LVDS)
4	FR1P	Plus signal of odd channel 1 (LVDS)	19	SR2P	Plus signal of even channel 2 (LVDS)
5	FR2M	Minus signal of odd channel 2 (LVDS)	20	SCLKINM	Minus signal of even clock channel (LVDS)
6	FR2P	Plus signal of odd channel 2 (LVDS)	21	SCLKINP	Plus signal of even clock channel (LVDS)
7	GND	Ground	22	SR3M	Minus signal of even channel 3 (LVDS)
8	FCLKINM	Minus signal of odd clock channel (LVDS)	23	SR3P	Plus signal of even channel 3 (LVDS)
9	FCLKINP	Plus signal of odd clock channel (LVDS)	24	GND	Ground
10	FR3M	Minus signal of odd channel 3 (LVDS)	25	NC	No Connection
11	FR3P	Plus signal of odd channel 3 (LVDS)	26	NC	No Connection
12	SR0M	Minus signal of even channel 0 (LVDS)	27	PWM_OUT	Reference signal for LED Driver control
13	SR0P	Plus signal of even channel 0 (LVDS)	28	VLCD	Power Supply +5.0V
14	GND	Ground	29	VLCD	Power Supply +5.0V
15	SR1M	Minus signal of even channel 1 (LVDS)	30	VLCD	Power Supply +5.0V

Note: 1. All GND(ground) pins should be connected together and to Vss which should also be connected to the LCD's metal frame.
2. All VLCD (power input) pins should be connected together.
3. Input Level of LVDS signal is based on the IEA 664 Standard.
4. PWM_OUT is a reference signal for inverter control.
   This PWM signal is synchronized with vertical frequency.
   Its frequency is 3 times of vertical frequency, and its duty ratio is 50%.
   If the system don't use this pin, do not connect

Rear view of LCM

#1   #30

GT103-30S-HF15-E2500(LSC)

#1   #30

Connector diagram

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3-2-2. Backlight Module

The LED interface connector is a model FN100-Z04B-C20 manufactured by UJU.
The mating connector a FFC/FPC marked LED interface connector specification.
The pin configuration for the connector is shown in the table below.

Pin	Symbol	Description	Notes
1	NC	No Connection	
2	FB1	Channel1 Current Feedback	
3	FB2	Channel2 Current Feedback	
4	VLED	LED Power Supply	
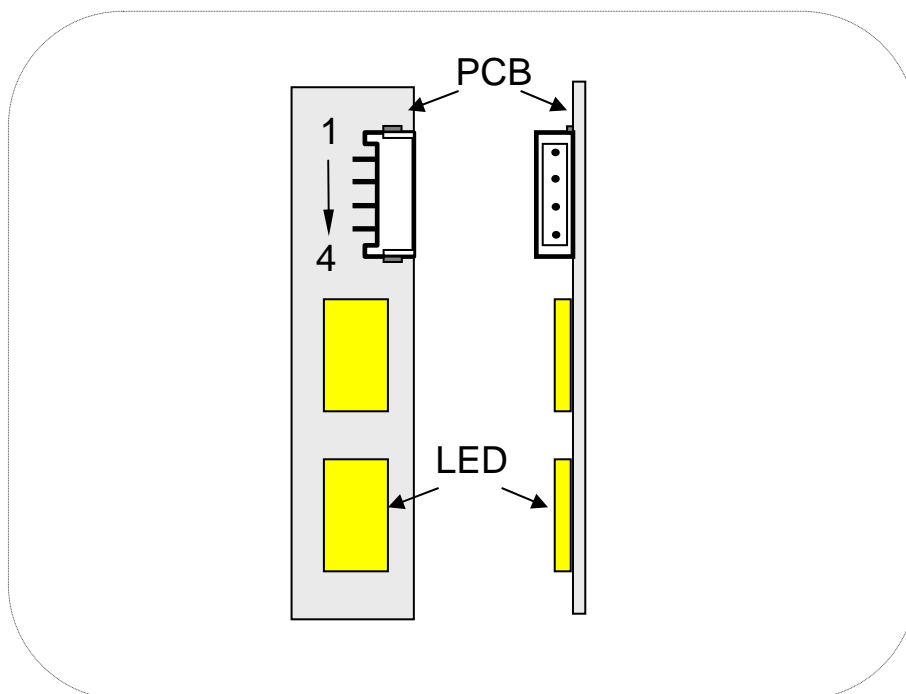
Backlight connector diagram

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3-3. Signal Timing Specifications

Table 5 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 5-1. TIMING TABLE for NTSC (DE Only Mode)

ITEM		Symbol	Min	Typ	Max	Unit	Note
Horizontal	Display Period	t_{HV}	-	960	-	tclk	
	Blank	t_{HB}	100	140	240	tclk	
	Total	t_{HP}	1060	1100	1200	tclk	2200/2
Vertical	Display Period	t_{VV}	-	1080	-	t_{HP}	
	Blank	t_{VB}	11	45	69	t_{HP}	
	Total	t_{VP}	1091	1125	1149	t_{HP}	
Frequency	DCLK	f_{CLK}	70	74.25	77	MHz	148.5/2
	Horizontal	f_{H}	65	67.5	70	KHz	
	Vertical	f_{V}	57	60	63	Hz	

Table 5-2. TIMING TABLE for PAL (DE Only Mode)

ITEM		Symbol	Min	Typ	Max	Unit	Note
Horizontal	Display Period	t_{HV}	-	960	-	tclk	
	Blank	t_{HB}	100	140	240	tclk	
	Total	t_{HP}	1060	1100	1200	tclk	2200/2
Vertical	Display Period	t_{VV}	-	1080	-	t_{HP}	
	Blank	t_{VB}	228	270	300	t_{HP}	
	Total	t_{VP}	1308	1350	1380	t_{HP}	
Frequency	DCLK	f_{CLK}	70	74.25	77	MHz	148.5/2
	Horizontal	f_{H}	65	67.5	70	KHz	
	Vertical	f_{V}	47	50	53	Hz	

Note   The Input of HSYNC & VSYNC signal does not have an effect on normal operation(DE Only Mode).
The performance of the electro-optical characteristics may be influenced by variance of the vertical refresh rate.
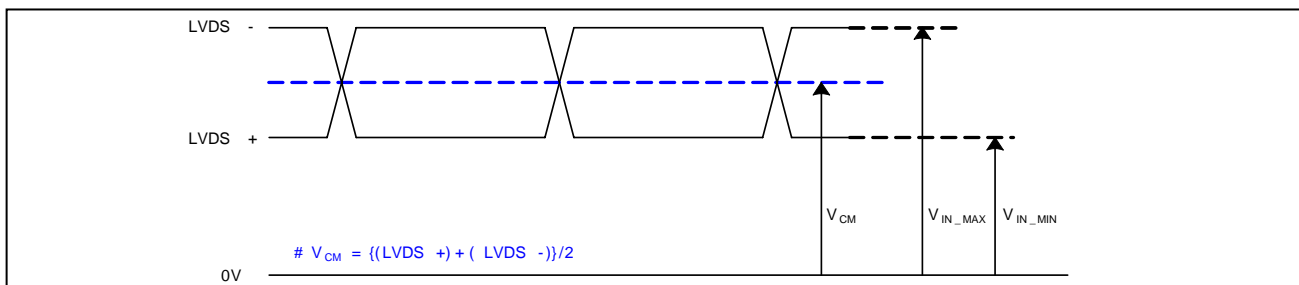
3-4. LVDS Signal Specification

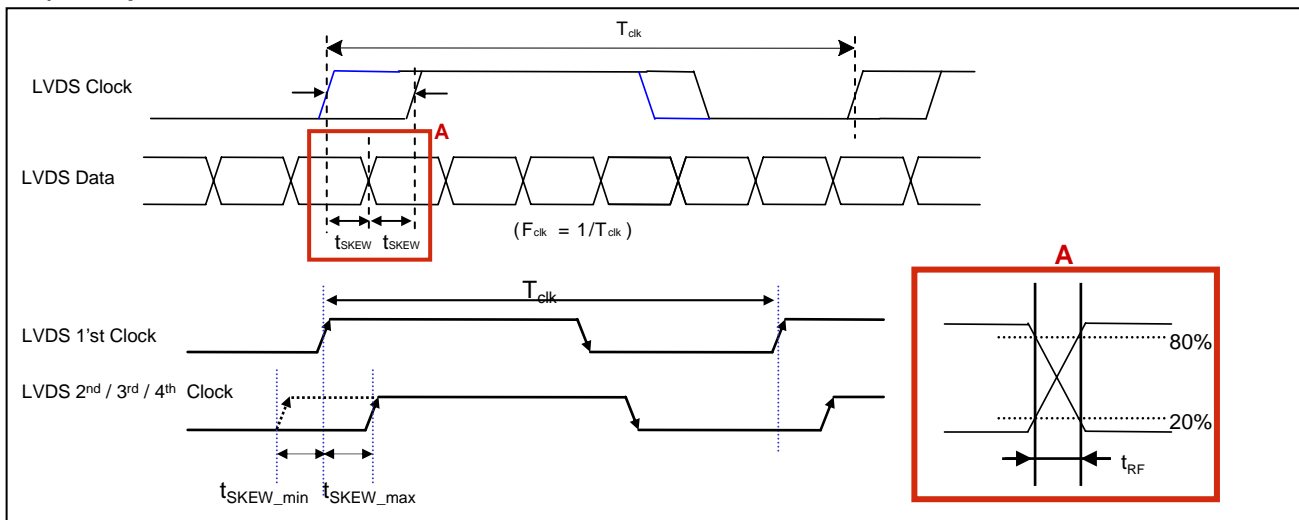### 3-4-1. LVDS Input Signal Timing Diagram
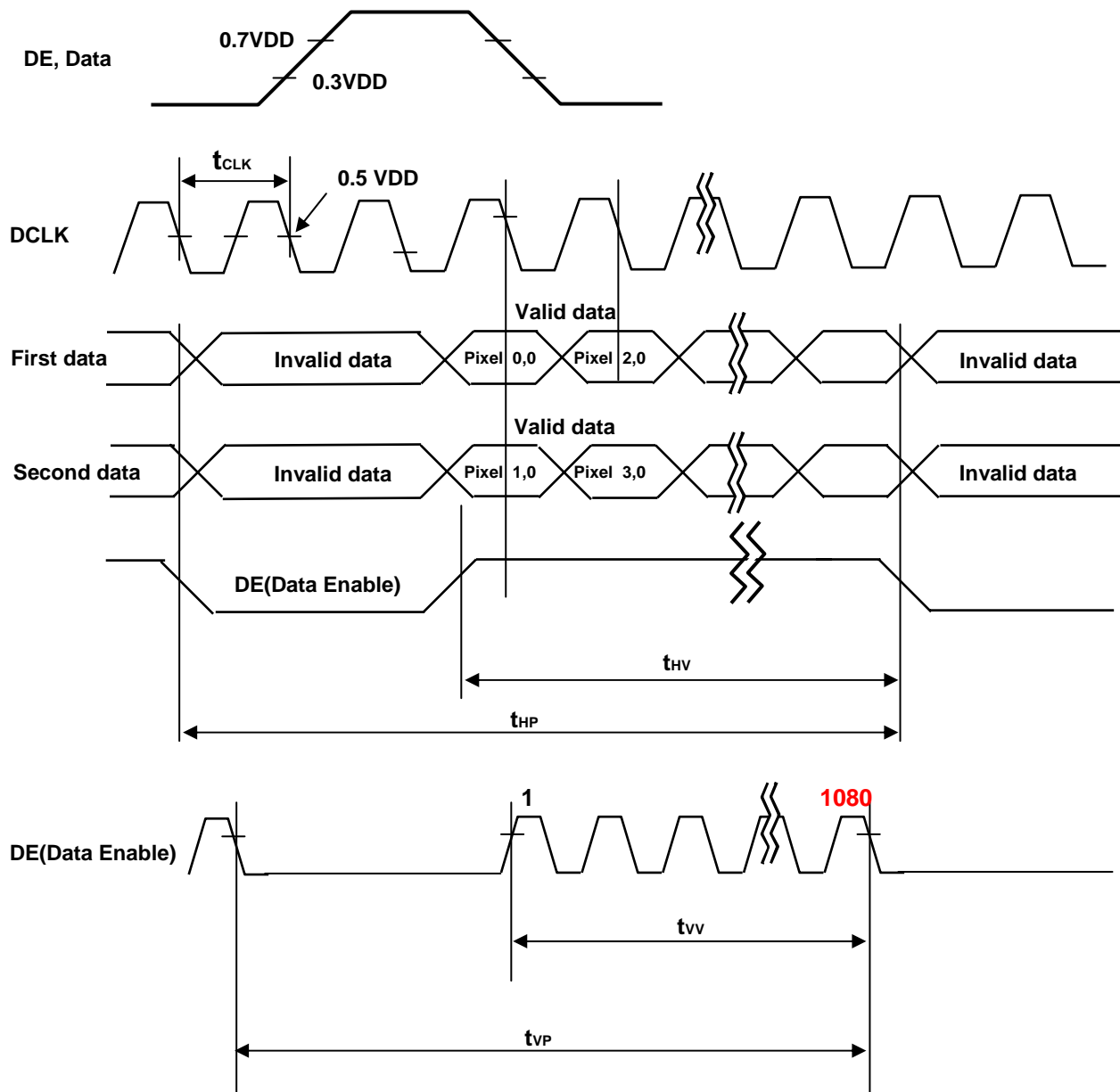
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3-4-2. LVDS Input Signal Characteristics

1) DC Specification

$V_{CM} = \{(LVDS\ +) + (\ LVDS\ -)\}/2$

Description	Symbol	Min	Max	Unit	Note
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	$\triangle VCM$		250	mV	-

2) AC Specification

$(F_{clk} = 1/T_{clk})$

Description		Symbol	Min	Max	Unit	Note
LVDS Differential Voltage	High Threshold	V_{TH}	100	300	mV	3
	Low Threshold	V_{TL}	-300	-100	mV	
LVDS Clock to Data Skew Margin		t_{SKEW}		$|(0.2*T_{clk})/7|$	ps	-
LVDS Clock/DATA Rising/Falling time		t_{RF}	260	$(0.3*T_{clk})/7$	ps	2
Effective time of LVDS		t_{eff}	± 360		ps	-
LVDS Clock to Clock Skew Margin (Even to Odd)		t_{SKEW_EO}		$1/7* T_{clk}$	T_{clk}	-

Note 1. All Input levels of LVDS signals are based on the EIA 644 Standard.
    2. If t_{RF} isn't enough, t_{eff} should be meet the range.
    3. LVDS Differential Voltage is defined within t_{eff}

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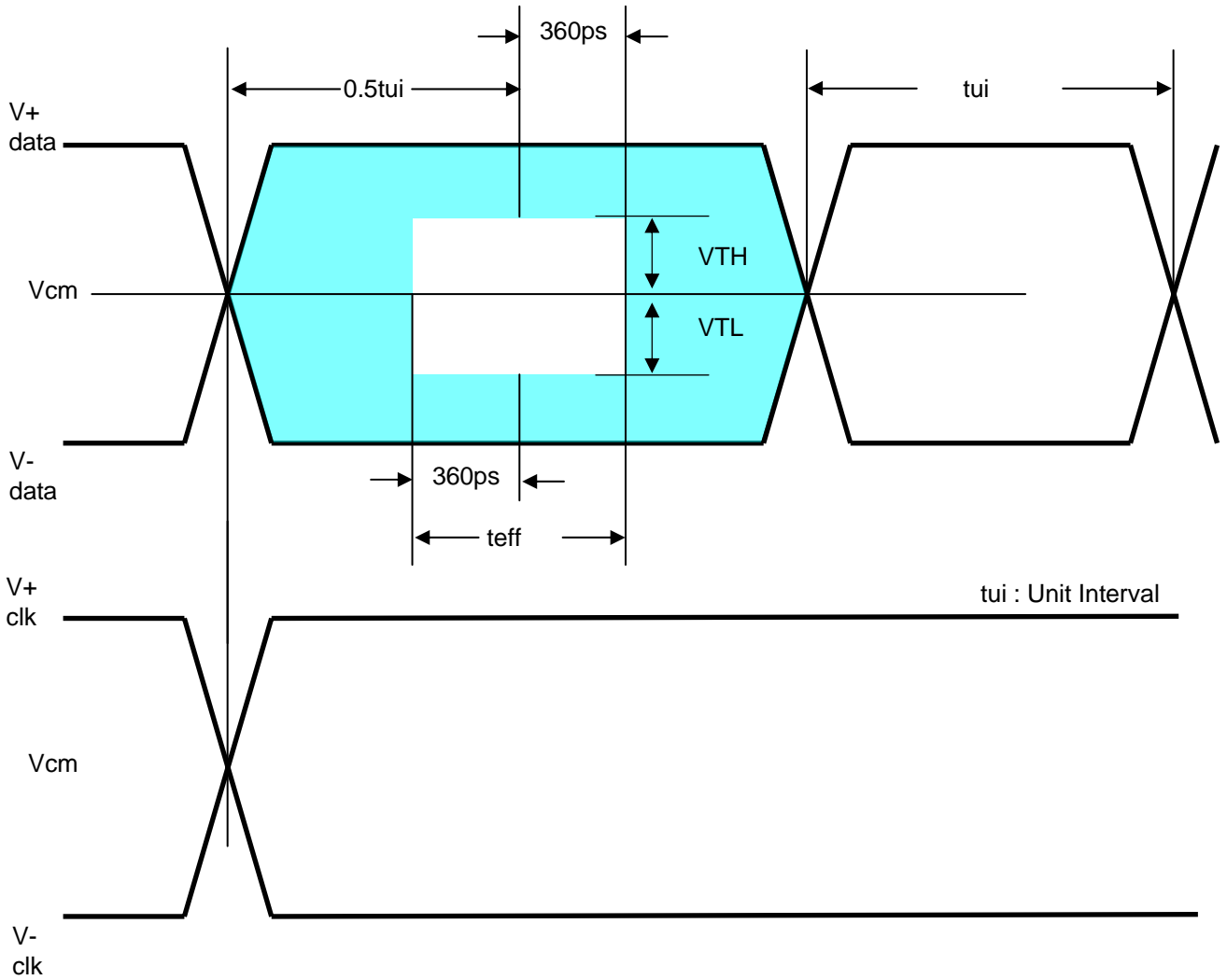
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3-5. Color Data Reference

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 6 provides a reference for color versus data input.

Table 6. 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) Dark	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	RED (001)	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	...			...								...								...					
	RED (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) Dark	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	GREEN (001)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
	...			...								...								...					
	GREEN (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) Dark	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	BLUE (001)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	...			...								...								...					
	BLUE (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
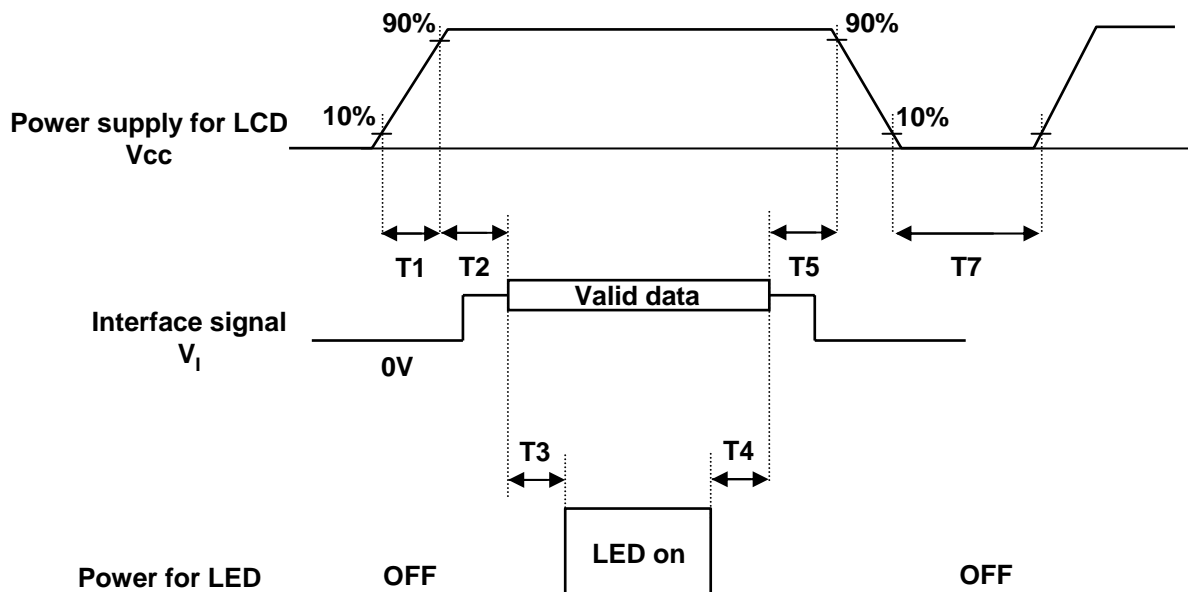
Table 7. POWER SEQUENCE

Parameter	Values			Units
	Min	Typ	Max	
T1	0.5	-	10	ms
T2	0.01	-	50	ms
T3	500	-	-	ms
T4	200	-	-	ms
T5	0.01	-	50	ms
T7	500		-	ms

Notes : 1. Please avoid floating state of interface signal at invalid period.

2. When the interface signal is invalid, be sure to pull down the power supply for LCD V_{LCD} to 0V.

3. Lamp power must be turn on after power supply for LCD and interface signal are valid.

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3-7. VLCD Power Dip Condition

The V_{LCD} dip condition is caused by the PWM IC initialization.
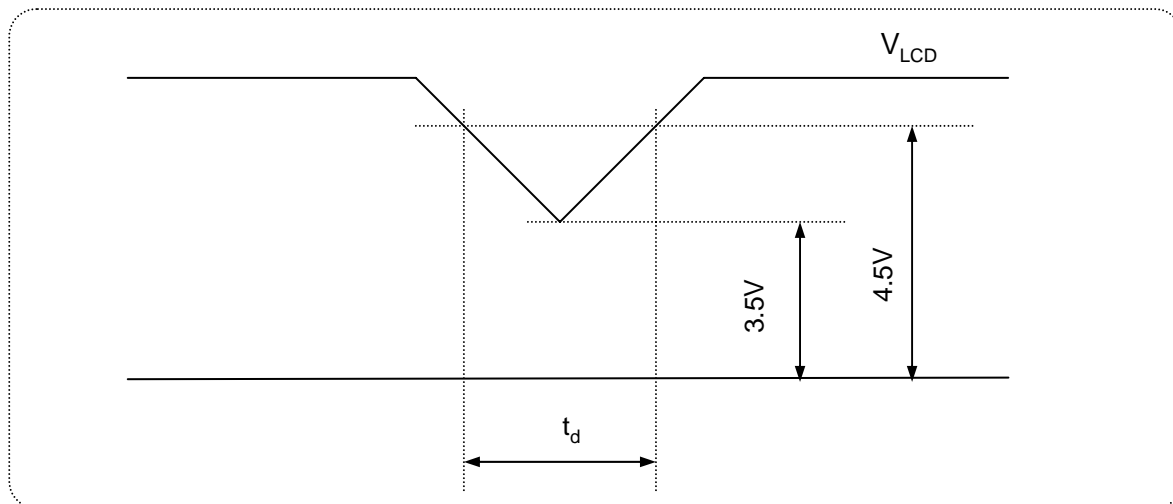
1) Dip condition

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

2) $V_{LCD} < 3.5V$

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

4. Optical Specification

Optical characteristics are determined after the unit has been 'ON' for approximately 60 minutes
in a dark environment at 25±2°C. The values specified are at an approximate distance 50cm from the LCD
surface at a viewing angle of Φ and θ equal to 0 ° and aperture 1 degree.
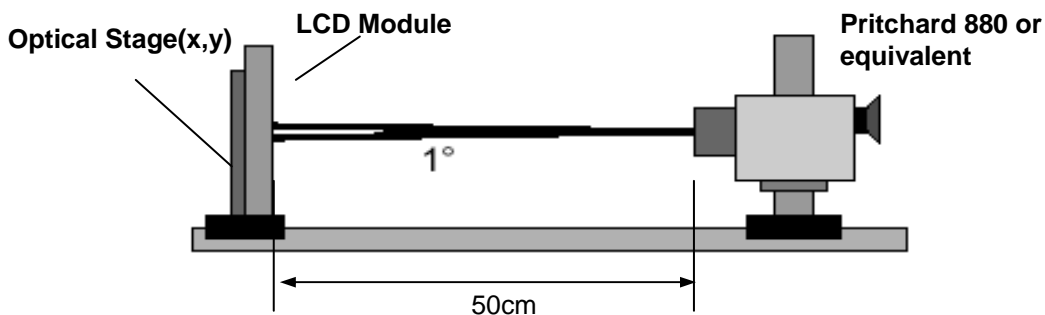 FIG. 1 presents additional information concerning the measurement equipment and method.

Optical Stage(x,y)   **LCD Module**   **Pritchard 880 or equivalent**

1°

50cm

FIG. 1 Optical Characteristic Measurement Equipment and Method

Table 8. OPTICAL CHARACTERISTICS   Ta= 25±2°C, V_{LCD}=5.0V, fv=60Hz, Dclk=148.5MHz, ILED = 110mA (Typ)

Parameter			Symbol		Value			Unit	Note
					Min	Typ	Max		
Contrast Ratio			CR		700	1000	-		1
Surface Luminance, white			L_{WH}		200	250	-	cd/m^2	2
Luminance Variation			δ_{WHITE}	9P	75	-	-	%	3
Response Time	Rising		Tr		-	1.3	2.6	ms	4
	Falling		Tf		-	3.7	7.4		
Color Coordinates [CIE1931]	RED		Rx			0.631			
			Ry			0.349			
	GREEN		Gx			0.341			
			Gy		Typ -0.03	0.622	Typ +0.03		
	BLUE		Bx			0.152			
			By			0.058			
	WHITE		Wx			0,313			
			Wy			0.329			
Viewing Angle (CR>10)									
		x axis, right(φ=0°)	θr		70	85	-	degree	5
		x axis, left (φ=180°)	θl		70	85	-		
		y axis, up (φ=90°)	θu		60	75	-		
		y axis, down (φ=270°)	θd		70	85	-		
Gray Scale					-	2.2	-		6

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Note : 1. Contrast Ratio(CR) is defined mathematically as : (By PR880)

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

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°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. 1.

3. The variation in surface luminance , δ WHITE is defined as : (By PR880)

$$\delta_{WHITE} = \frac{\text{Minimum}(L_{on1}, L_{on2}, \ldots L_{on9})}{\text{Maximum}(L_{on1}, L_{on2}, \ldots L_{on9})} \times 100(\%)$$

For more information, see the FIG. 2.
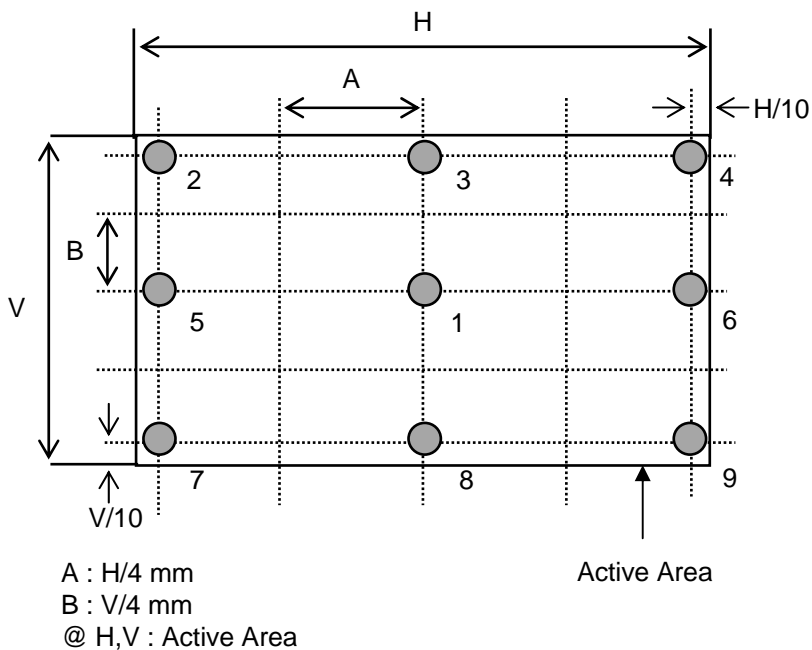
4. The response time is defined as the following figure and shall be measured by switching the input signal for "black" and "white".
Response time is the time required for the display to transition from white to black (Rise Time, TrR) and from black to white (Decay Time, TrD). (By RD80S)

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 9.

Table 9. GRAY SCALE SPECIFICATION

Gray Level	Luminance [%] (Typ)
L0	0.11
L31	1.08
L63	4.72
L95	11.49
L127	21.66
L159	35.45
L191	53.0
L223	74.48
L255	100

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

FIG. 2 5 Points for Luminance Measure

A : H/4 mm
B : V/4 mm
@ H,V : Active Area

Active Area

Response time is defined as the following figure and shall be measured by switching the input signal for "Gray(N)" and "Gray(M)".
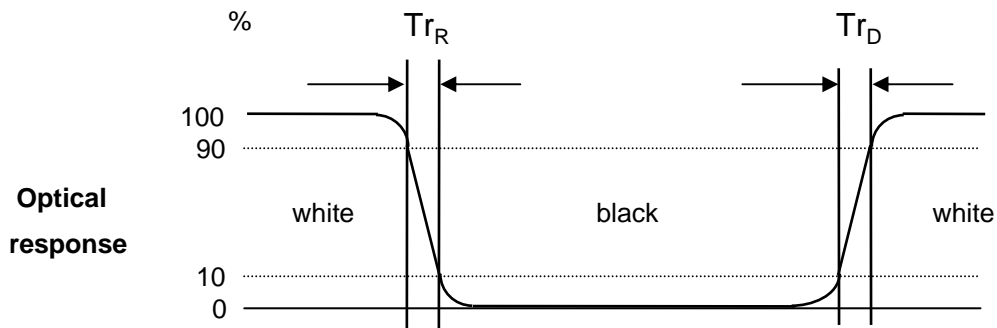
FIG. 3 Response Time

Product Specification
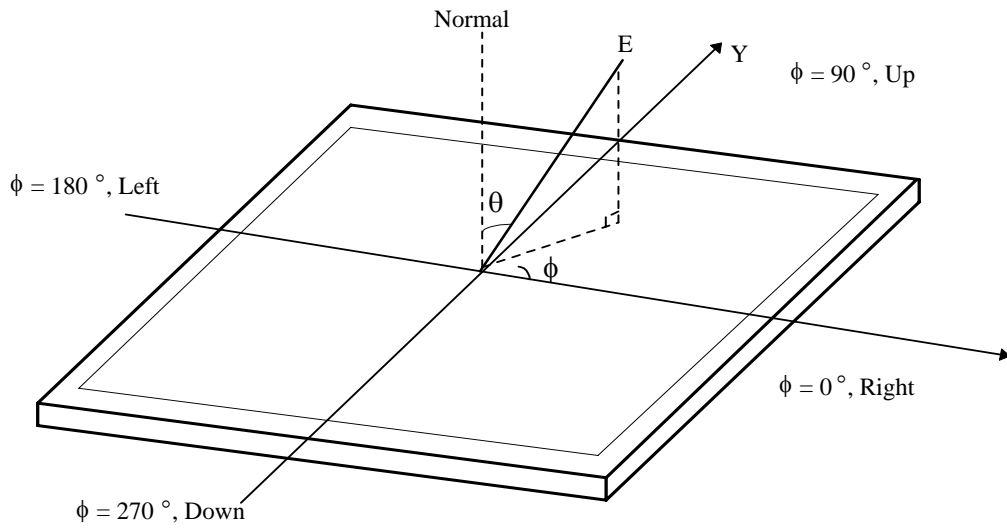
Dimension of viewing angle range

FIG. 4 Viewing Angle

5. Mechanical Characteristics
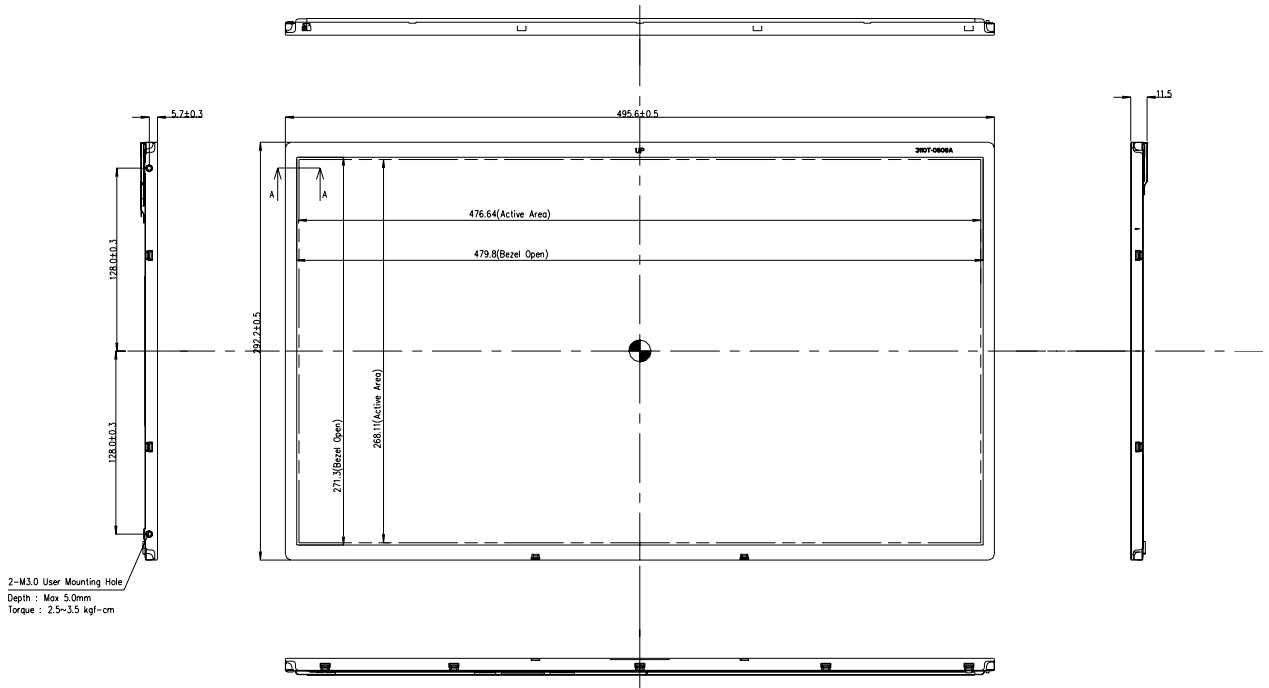
Table 10 provides general mechanical characteristics.

Table 10. MECHANICAL CHARACTERISTICS

Item	Value	
Outline Dimension	Horizontal	495.6 mm
	Vertical	292.2 mm
	Depth	11.5 mm
Bezel Area	Horizontal	479.8 mm
	Vertical	271.3 mm
Active Display Area	Horizontal	476.64 mm
	Vertical	268.11 mm
Weight	1550g(typ.), 1630g(Max.)	

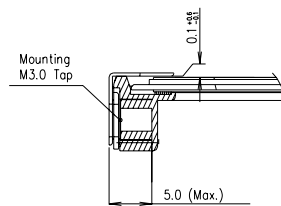Note : Please refer to a mechanic drawing in terms of tolerance at the next page.
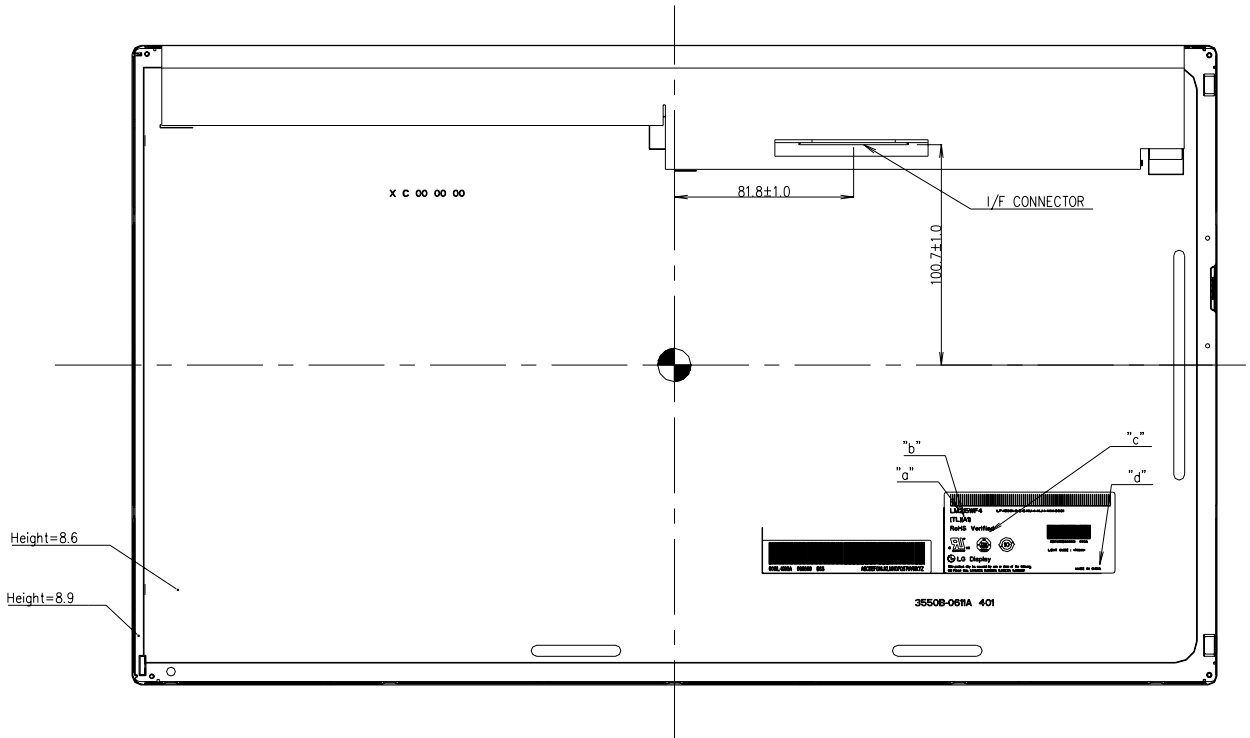
Product Specification

[FRONT VIEW]

5.7±0.3

495.6+0.5

11.5

UP

3110T-0606A

A

A

476.64(Active Area)

479.8(Bezel Open)

128.0±0.3

392.2±0.5

271.3(Bezel Open)

268.11(Active Area)

128.0±0.3

2-M3.0 User Mounting Hole
Depth : Max 5.0mm
Torque : 2.5~3.5 kgf-cm

Mounting
M3.0 Tap

0.1 +0.6 -0.1

5.0 (Max.)

SECTION A-A
SCALE 2/1

Product Specification

[REAR VIEW]

81.8±1.0

I/F CONNECTOR

100.7±1.0

X C 00 00 00

"b"

"c"

"a"

"d"

Height=8.6

Height=8.9

3550B-0611A 401

NOTES
1. Unspecified tolerances to be ±0.5mm
2. Backlight has 1 LED Array Ass'y
3. I/F Connector Specification : GT103-30S-HF15-E2500(LSC) or Equivalent
4. Tilt and partial disposition tolerance of display area as following
   (1) Y-Direction : IA-BI$\leq$1.0
   (2) X-Direction : IC-DI$\leq$1.0

A

Bezel open

C

D

Active area

B
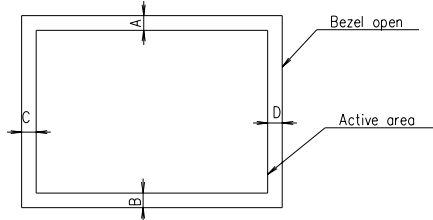
6. Reliability

Table 11. ENVIRONMENT TEST CONDITION

No.	Test Item	Condition
1	High temperature storage test	Ta= 60°C 240h
2	Low temperature storage test	Ta= -20°C 240h
3	High temperature operation test	Ta= 50°C 50%RH 240h
4	Low temperature operation test	Ta= 0°C 240h
5	Vibration test (non-operating)	Wave form : random Vibration level : 1.0Grms Bandwidth : 10-300Hz Duration : X,Y,Z, 30 min 　　　　　Each direction per 10 min
6	Shock test (non-operating)	Shock level : 100Grms Waveform : half sine wave, 2ms Direction : $\pm$X, $\pm$Y, $\pm$Z 　　　　　One time each direction
7	Humidity condition Operation	Ta= 40 °C ,90%RH
8	Altitude　　　　storage / shipment	0 - 40,000 ft

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

Product Specification

7. International Standards

7-1. Safety

a) UL 60065, Seventh Edition, 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 60065:2002 + A11:2008, European Committee for Electrotechnical Standardization (CENELEC).
   Audio, Video and Similar Electronic Apparatus - Safety Requirements.
d) IEC 60065:2005 + A1:2005, The International Electrotechnical Commission (IEC).
   Audio, Video and Similar Electronic Apparatus - Safety Requirements.
   (Including report of IEC60825-1:2001 clause 8 and clause 9)

   Notes
     1. Laser (LED Backlight) Information

Class 1M LED Product IEC60825-1 : 2001 Embedded LED Power (Class1M) Power : 4.44 mW (Max.) Wavelength : 258 ~ 622 (nm) Width : 1.5 x 0.6 (mm)

     2. Caution
       : LED inside.
        Class 1M laser (LEDs) radiation when open.
        Do not open while operating.

7-2. EMC

a) ANSI C63.4 "American National Standard for Methods of Measurement of Radio-Noise
   Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz."
   American National Standards Institute (ANSI), 2003.
b) CISPR 22 "Information technology equipment – Radio disturbance characteristics – Limit and
   methods of measurement." International Special Committee on Radio Interference
   (CISPR), 2005.
c) CISPR 13 "Sound and television broadcast receivers and associated equipment – Radio disturbance
   characteristics – Limits and method of measurement." International Special Committee on Radio
   Interference (CISPR), 2006.

7-3. Environment

a) RoHS, Directive 2002/95/EC of the European Parliament and of the council of 27 January 2003

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)   D : YEAR
E : MONTH   F ~ M : SERIAL NO.

Note
1. YEAR

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

2. MONTH

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

b) Location of Lot Mark

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

8-2. Packing Form

a) Package quantity in one box : 10 pcs

b) Box size :364mm X314mm X593mm.

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 holes arranged in four corners or left sides.
(2) You should consider the mounting structure so that uneven force (ex. Twisted stress) is not applied to the module. And the case on which a module is mounted should have sufficient strength so that external force is not transmitted directly to the module.
(3) Please attach 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 benzene. Normal-hexane is recommended for cleaning the adhesives used to attach front / rear polarizers. Do not use acetone, toluene and alcohol because they cause chemical damage to the polarizer.
(8) Wipe off saliva or water drops as soon as possible. Their long time contact with polarizer causes deformations and color fading.
(9) Do not open the case because inside circuits do not have sufficient strength.

9-2. OPERATING PRECAUTIONS

(1) The spike noise causes the mis-operation of circuits. It should be lower than following voltage :
V=±200mV(Over and under shoot voltage)
(2) Response time depends on the temperature.(In higher temperature, it becomes longer.)
(3) Brightness depends on the temperature. (In higher temperature, it becomes lower.)
And in lower temperature, response time(required time that brightness is stable after turned on) becomes longer.
(4) Be careful for condensation at sudden temperature change. Condensation makes damage to polarizer or electrical contacted parts. And after fading condensation, smear or spot will occur.
(5) When fixed patterns are displayed for a long time, remnant image is likely to occur.
(6) Module has high frequency circuits. Sufficient suppression to the electromagnetic interference shall be done by system manufacturers. Grounding and shielding methods may be important to minimized the interference.
(7) Please do not give any mechanical and/or acoustical impact to LCM. Otherwise, LCM can't be operated its full characteristics perfectly.
(8) A screw which is fastened up the steels should be a machine screw.
(if not, it causes metallic foreign material and deal LCM a fatal blow)
(9) Please do not set LCD on its edge.

9-3. Electrostatic Discharge Control

Since a module is composed of electronic circuits, it is not strong to electrostatic discharge. Make certain that treatment persons are connected to ground through wrist band etc. And don't touch interface pin directly.

9-4. Precautions for Strong Light Exposure

Strong light exposure causes degradation of polarizer and color filter.

9-5. Storage

When storing modules as spares for a long time, the following precautions are necessary.

(1) Store them in a dark place. Do not expose the module to sunlight or fluorescent light. Keep the temperature between 5°C and 35°C at normal humidity.
(2) The polarizer surface should not come in contact with any other object.
   It is recommended that they be stored in the container in which they were shipped.

9-6. Handling Precautions for Protection Film

(1) The protection film is attached to the bezel with a small masking tape.
   When the protection film is peeled off, static electricity is generated between the film and polarizer.
   This should be peeled off slowly and carefully by people who are electrically grounded and with well ion-blown equipment or in such a condition, etc.
(2) When the module with protection film attached is stored for a long time, sometimes there remains a very small amount of glue still on the bezel after the protection film is peeled off.
(3) You can remove the glue easily. When the glue remains on the bezel 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
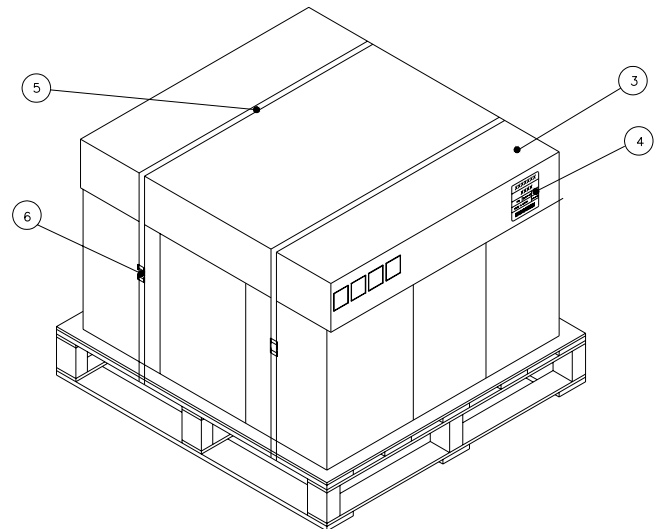
APPENDIX-I

■ LC215EUE-TCA1 Packing Ass'y
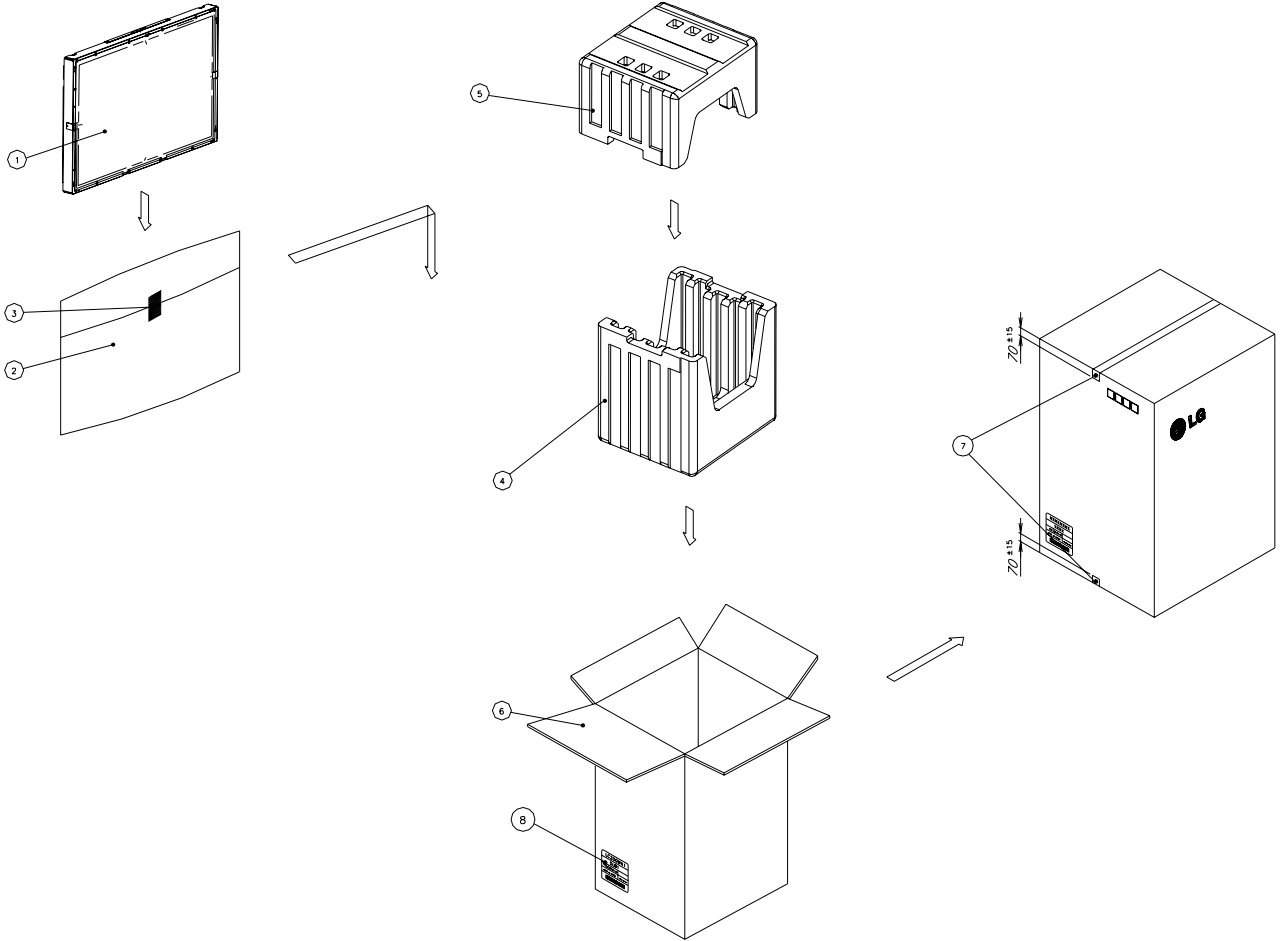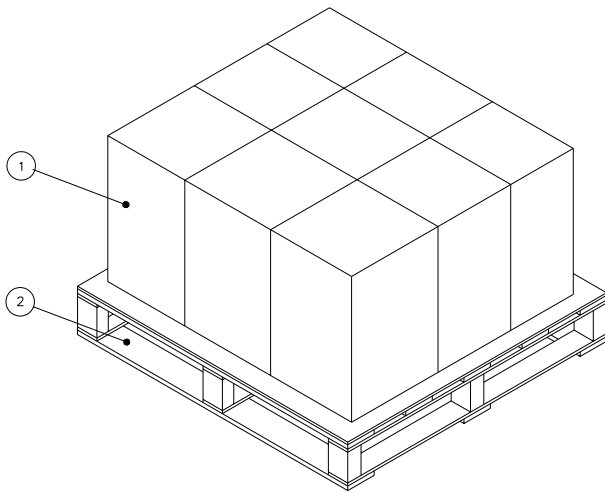

NO.	DESCRIPTION	MATERIAL
1	LCM	
2	BAG	AL
3	TAPE	OPP
4	PACKING, BOTTOM	EPS
5	PACKING, TOP	EPS
6	BOX	PAPER, SW
7	TAPE	OPP
8	LABEL	ART

Product Specification

APPENDIX- I

■ LC215EUE-TCA1 Pallet Ass'y

NO.	DESCRIPTION	MATERIAL
1	PACKING ASS'Y	-
2	PALLET	PLYWOOD_1140X990X117.5
3	BAND	PP
4	BAND, CLIP	CLIP
5	ANGLE COVER	PAPER, SW
6	LABEL	ART

APPENDIX- II

■ LC215EUE-TCA1 LCM Label

Model →

**LC215EUE
(TC)(A1)**

RoHS Verified

UL, TUV Mark →

→ Serial No.

`*************  ***`

LGD Logo → **LG Display**

US PATENT No. →
This product may be covered by one or more of the following
US Patent Nos. 5,041,823 ; 5,061,920 ; 5,280,371 ; 5,835,139

MADE IN KOREA ← Origin
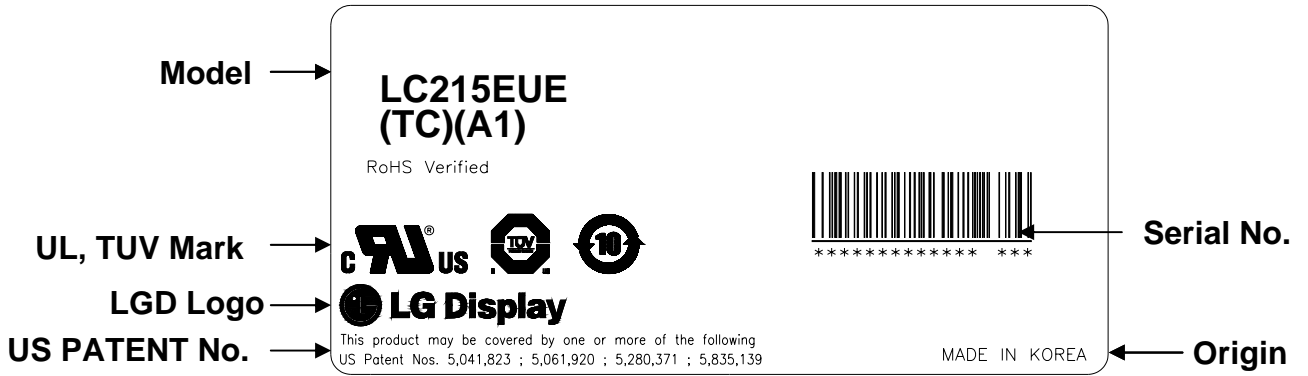
Product Specification

APPENDIX- III

■ Box Label

LC215EUE
TCA1

| **10 PCS** | **001/01-01** | |
| **MADE IN KOREA** | | **RoHS Verified** |

XXXXXXXXXXXXX XXX

100.0 / 70.0

■ Pallet Label

LC215EUE
TCA1

| **90 PCS** | **001/01-01** | |
| **MADE IN KOREA** | | **RoHS Verified** |

XXXXXXXXXXXXX XXX

100.0 / 70.0
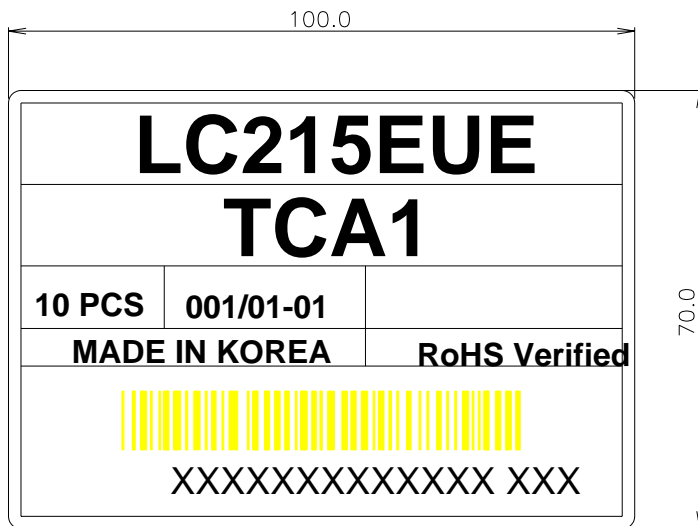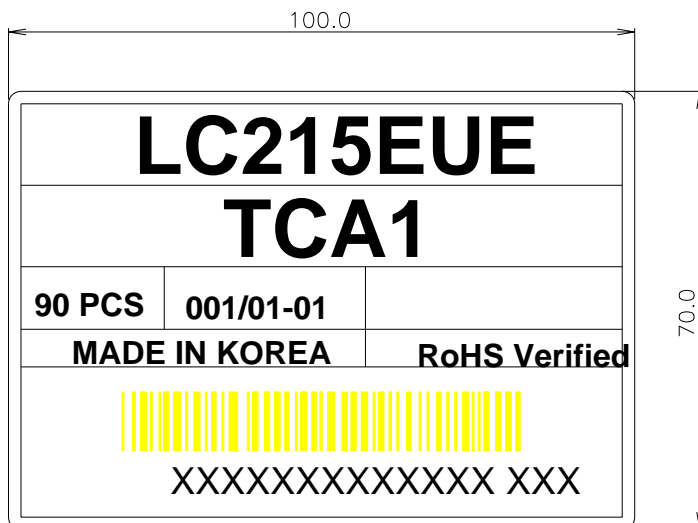
APPENDIX- IV

■ Required signal assignment for Flat Link (TI : SN75LVDS83) Transmitter

Pin #	Pin Name	Require Signal	Pin #	Pin Name	Require Signal
1	Vcc	Power Supply for TTL Input	29	GND	Ground pin for TTL
2	D5	TTL Input (R7)	30	D26	TTL Input (DE)
3	D6	TTL Input (R5)	31	T_X CLKIN	TTL Level clock Input
4	D7	TTL Input (G0)	32	PWR DWN	Power Down Input
5	GND	Ground pin for TTL	33	PLL GND	Ground pin for PLL
6	D8	TTL Input (G1)	34	PLL Vcc	Power Supply for PLL
7	D9	TTL Input (G2)	35	PLL GND	Ground pin for PLL
8	D10	TTL Input (G6)	36	LVDS GND	Ground pin for LVDS
9	Vcc	Power Supply for TTL Input	37	TxOUT3＋	Positive LVDS differential data output 3
10	D11	TTL Input (G7)	38	TxOUT3－	Negative LVDS differential data output 3
11	D12	TTL Input (G3)	39	T_X CLKOUT＋	Positive LVDS differential clock output
12	D13	TTL Input (G4)	40	T_X CLKOUT－	Negative LVDS differential clock output
13	GND	Ground pin for TTL	41	T_X OUT2＋	Positive LVDS differential data output 2
14	D14	TTL Input (G5)	42	T_X OUT2－	Negative LVDS differential data output 2
15	D15	TTL Input (B0)	43	LVDS GND	Ground pin for LVDS
16	D16	TTL Input (B6)	44	LVDS Vcc	Power Supply for LVDS
17	Vcc	Power Supply for TTL Input	45	T_X OUT1＋	Positive LVDS differential data output 1
18	D17	TTL Input (B7)	46	T_X OUT1－	Negative LVDS differential data output 1
19	D18	TTL Input (B1)	47	T_X OUT0＋	Positive LVDS differential data output 0
20	D19	TTL Input (B2)	48	T_X OUT0－	Negative LVDS differential data output 0
21	GND	Ground pin for TTL Input	49	LVDS GND	Ground pin for LVDS
22	D20	TTL Input (B3)	50	D27	TTL Input (R6)
23	D21	TTL Input (B4)	51	D0	TTL Input (R0)
24	D22	TTL Input (B5)	52	D1	TTL Input (R1)
25	D23	TTL Input (RSVD)	53	GND	Ground pin for TTL
26	Vcc	Power Supply for TTL Input	54	D2	TTL Input (R2)
27	D24	TTL Input (HSYNC)	55	D3	TTL Input (R3)
28	D25	TTL Input (VSYNC)	56	D4	TTL Input (R4)

Notes : Refer to LVDS Transmitter Data Sheet for detail descriptions.

APPENDIX- V

■ LVDS Data-Mapping Information (8 Bit)