SPECIFICATION
FOR
APPROVAL

(●) **Preliminary Specification**
( ) **Final Specification**

Title	8.9” WUXGA (1920 x RGB x 1200) TFT LCD

BUYER	**Amazon**
MODEL	Jem

SUPPLIER	LG Display Co., Ltd.
MODEL	LD089WU1
Suffix	SM01

SIGNATURE	**DATE**
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/	

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

SIGNATURE	**DATE**
REVIEWED BY	
PREPARED BY	

Products Engineering Dept.
LG Display Co., Ltd

Contents

RECORD OF REVISIONS

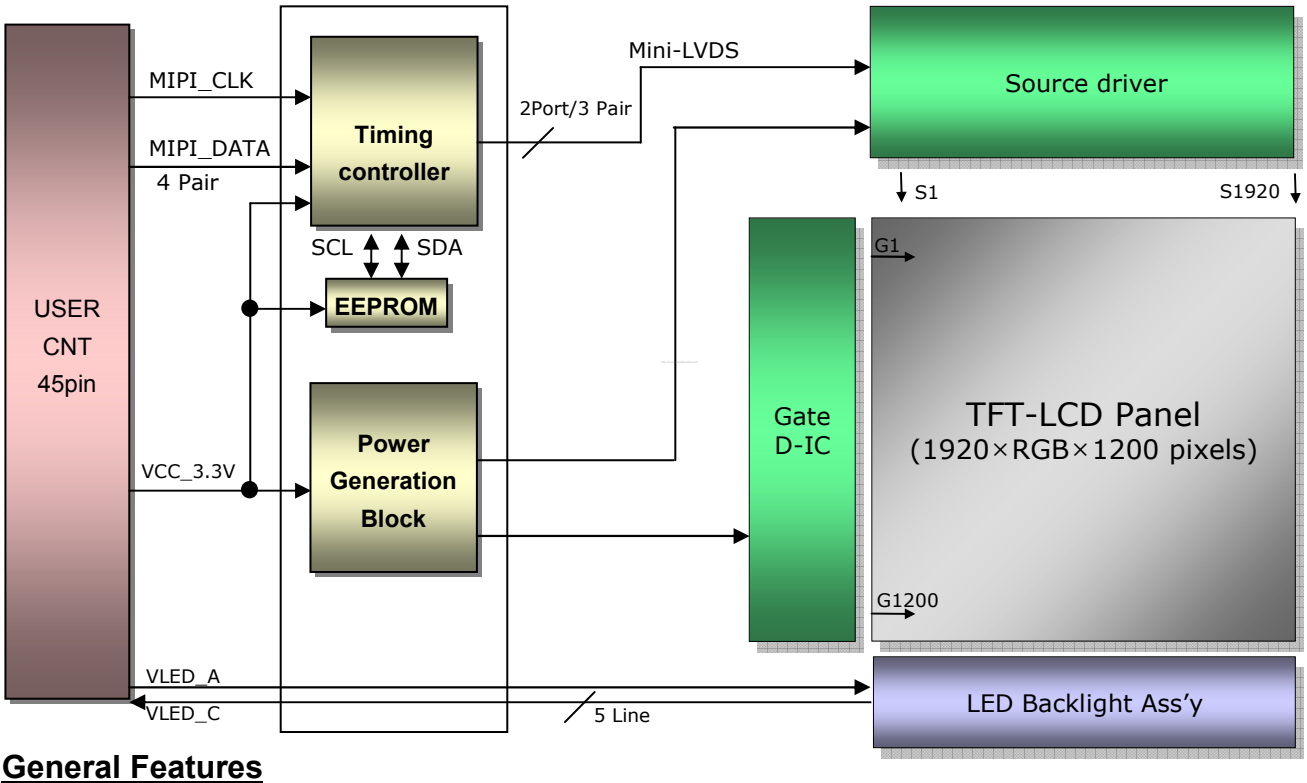
Revision No	Revision Date	Page	Description
0.0	Feb. 21. 2012	-	Preliminary specification
0.1	Mar. 5. 2012	1	Model part no. changed from SL01 to SM01
0.2	Mar. 6. 2012	17	Wx,Wy tolerance changed from 0.04 to 0.03

1. General Description

The LD089WU1 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 type display operating in the normally Black mode. This TFT-LCD has 8.9 inches diagonally measured active display area with WUXGA resolution(1920 horizontal by 1200 vertical pixel array). Each pixel is divided into Red, Green and Blue sub-pixels or dots which are arranged in vertical stripes. Gray scale or the brightness of the sub-pixel color is determined with a 6-bit gray scale signal for each dot, thus, presenting a palette of more than 262,144 colors.

The LD089WU1 has been designed to apply the interface method that enables low power, high speed, low EMI.

The LD089WU1 is intended to support applications where thin thickness, low power are critical factors and graphic displays are important. In combination with the vertical arrangement of the sub-pixels, the LD089WU1 characteristics provide an excellent flat display.



General Features

Active Screen Size	8.9 inches diagonal
Outline Dimension	203.4mm X 135.85mm x 2.65mm
Dot Pitch	0.03325mm × 0.09975mm
Pixel Format	1920 horiz. By 1200 vert. Pixels RGB strip arrangement
Color Depth	6-bit, 262,144colors
Luminance, White	400 cd/m^2 (Min.)
Weight	TBDg(Typ.), TBDg(Max.)
Display Operating Mode	Transmitting type, normally Black
Surface Treatment	HC treatment of the front polarizer

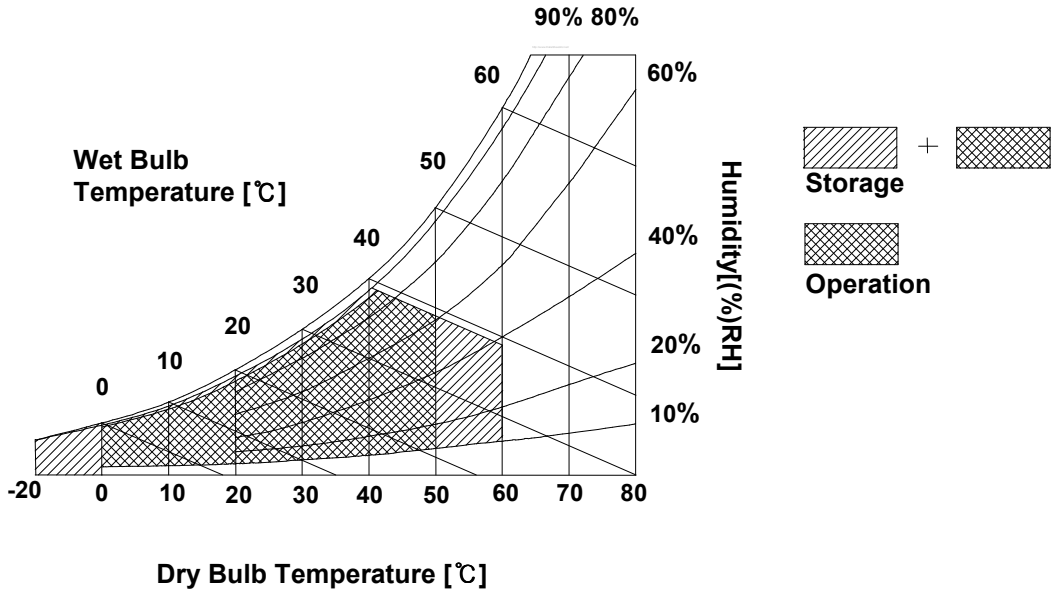
2. Absolute Maximum Ratings

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

Table 1. ABSOLUTE MAXIMUM RATINGS

Parameter	Symbol	Values		Units	Notes
		Min	Max		
Power Input Voltage	VCC	-0.3	5.0	Vdc	at 25 ± 5°C
Operating Temperature	TOP	0	50	°C	1
Storage Temperature	HST	-20	60	°C	1
Operating Ambient Humidity	HOP	10	90	%RH	TBD
Storage Humidity	HST	10	90	%RH	TBD

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



3. Electrical Specifications

3-1. Electrical Characteristics

The LD089WU1 requires two power inputs. One is employed to power the LCD electronics and to drive the TFT array and liquid crystal. The second input which powers the LED, is typically generated by an LED Driver. The LCD don't include LED Driver.

Table 2. ELECTRICAL CHARACTERISTICS

Parameter	Symbol	Values			Unit	Notes
		Min	Typ	Max		
LCD :						
Power Supply Input Voltage	VCC	3.0	3.3	3.6	V_{DC}	
Input High-Level Voltage	V_{IH}	0.7VCC	-	VCC	V_{DC}	
Input Low-Level Voltage	V_{IL}	0	-	0.3VCC	V_{DC}	
Power Supply Input Current	I_{CC}	-	227.3	261.4	mA	[Note 1]
Power Consumption	Pc	-	0.750	0.863	Watt	[Note 1]

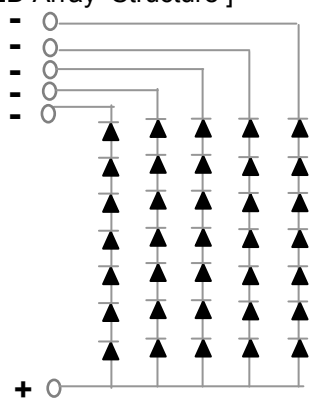
[Note 1] The specified current and power consumption are under the Vcc = 3.3V , 25℃, fv = 60Hz condition whereas "Mosaic Pattern" is displayed and fv is the frame frequency.

Table 3. Backlight Unit $(T_a = 25^\circ C)$

PARAMETER	SYMBOL	MIN.	TYP.	MAX.	UNIT	REMARK
LED forward Current	I_f	-	17.9	-	mA	(per chain)
LED forward Voltage	V_f	-	20.7	23.1	V	(per chain, @typ. current)
Power Consumption	P_{BL}	-	1.85	2.07	W	The sum of 5 chain at Ta=25℃, Typ. Current

Note)
1. The permissible forward current of LED vary with environmental temperature.

[LED Array Structure]



3-2. Interface (Input Terminal)

This LCD employs one interface connections, a 45 pin connector is used for the module electronics interface.
(Connector Type :45pin Connector (PF030-B45B-N09, UJU社)

Table 4. Module Connection Pin Configuration

Pin No.	Symbol	Description	Remark
1	VDD	Power Supply for LCM (Typ.3.3V)	
2	VDD	Power Supply for LCM (Typ.3.3V)	
3	VDD	Power Supply for LCM (Typ.3.3V)	
4	V_EDID	EDID Supply Voltage (Typ. 3.3V)	
5	GND	Ground	
6	BIST	BIST (active high)	
7	EDID SCL	EDID CLK	
8	EDID SDA	EDID DATA	
9	GND	Ground	
10	NC	No connection	
11	NC	No connection	
12	GND	Ground	
13	NC	SCL2 (For PGAMMA, PVCOM ADJ.)	
14	NC	SDA2 (For PGAMMA, PVCOM ADJ.)	
15	GND	Ground	
16	NC	No connection	
17	NC	No connection	
18	GND	Ground	
19	MIPI_2N	MIPI data negative signal	
20	MIPI_2P	MIPI data positive signal	
21	GND	Ground	
22	MIPI_1N	MIPI data negative signal	
23	MIPI_1P	MIPI data positive signal	
24	GND	Ground	
25	MIPI_CLKN	MIPI CLK negative signal	
26	MIPI_CLKP	MIPI CLK positive signal	
27	GND	Ground	
28	MIPI_0N	MIPI data negative signal	
29	MIPI_0P	MIPI data positive signal	
30	GND	Ground	

Table 4. Module Connection Pin Configuration

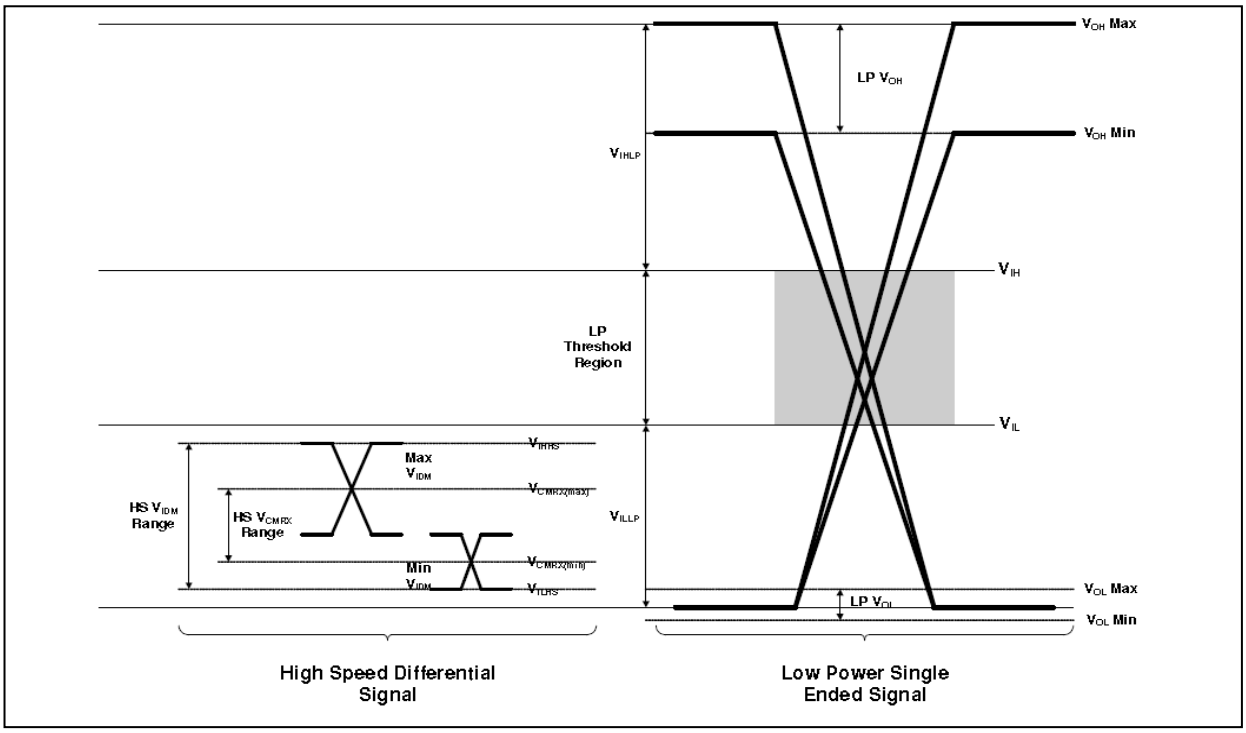
Pin No.	Symbol	Description	Remark
31	MIPI_3N	MIPI data negative signal	
32	MIPI_3P	MIPI data positive signal	
33	GND	Ground	
34	FB1	LED String 1 Cathode	
35	FB2	LED String 2 Cathode	
36	FB3	LED String 3 Cathode	
37	FB4	LED String 4 Cathode	
38	FB5	LED String 5 Cathode	
39	PWM_IN	PWM input	
40	PWM_Out	PWM output	
41	CABC_EN	CABC (active high)	
42	NC	No connection	
43	VLED	LED Power supply (Anode)	
44	VLED	LED Power supply (Anode)	
45	VLED	LED Power supply (Anode)	

3-3. MIPI Signal Timing Specifications

This is the signal timing required at the input of the User connector. All of the interface signal timing should be satisfied with the following specifications and specifications of MIPI Tx/Rx for its proper operation.

3-3.1. MIPI Receiver Differential Input (DC Characteristics)

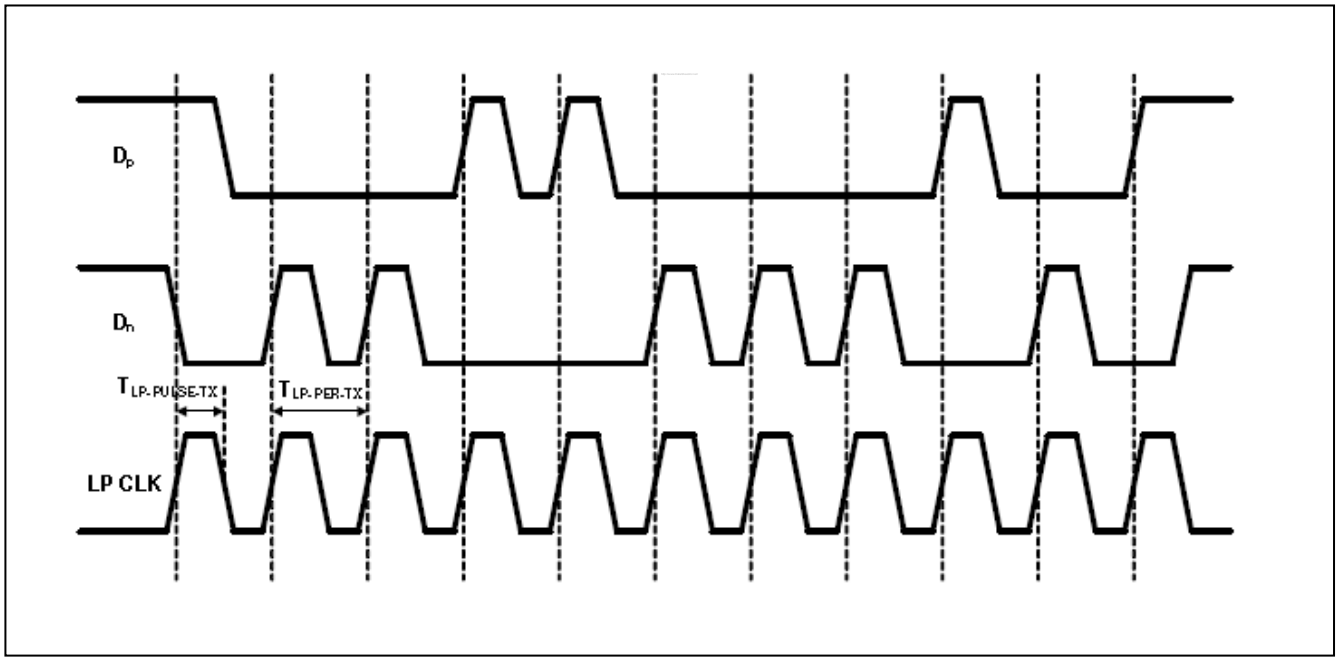
Description	Symbol	Min	Typ	Max	Unit	Notes
Input data bit rate	BR_{MIPI}	200	-	1000	Mbps	-
Common-mode voltage(HS Rx mode)	V_{CMRX}	70	-	330	mV	-
Differential input high threshold(HS Rx mode)	V_{IDTH}	-	-	70	mV	-
Differential input low threshold(HS Rx mode)	V_{IDTL}	-70	-	-	mV	-
Differential input voltage range(HS Rx mode)	$\lvert V_{IDM} \rvert$	70	-	500	mV	-
Single-end input high voltage(HS Rx mode)	V_{IHHS}	-	-	460	mV	-
Single-end input low voltage(HS Rx mode)	V_{ILHS}	-40	-	-	mV	-
Differential input impedance	Z_{ID}	80	100	125	Ω	-
Logic 1 input voltage (LP Rx mode)	V_{IHLP}	880	-	-	mV	-
Logic 0 input voltage (LP Rx mode)	V_{ILLP}	-	-	550	mV	-
Output high level(LP Tx mode)	V_{OH}	1.08	1.2	1.32	V	-
Output low level(LP Tx mode)	V_{OL}	-50	-	50	mV	-



< Definition of MIPI Signal Level >

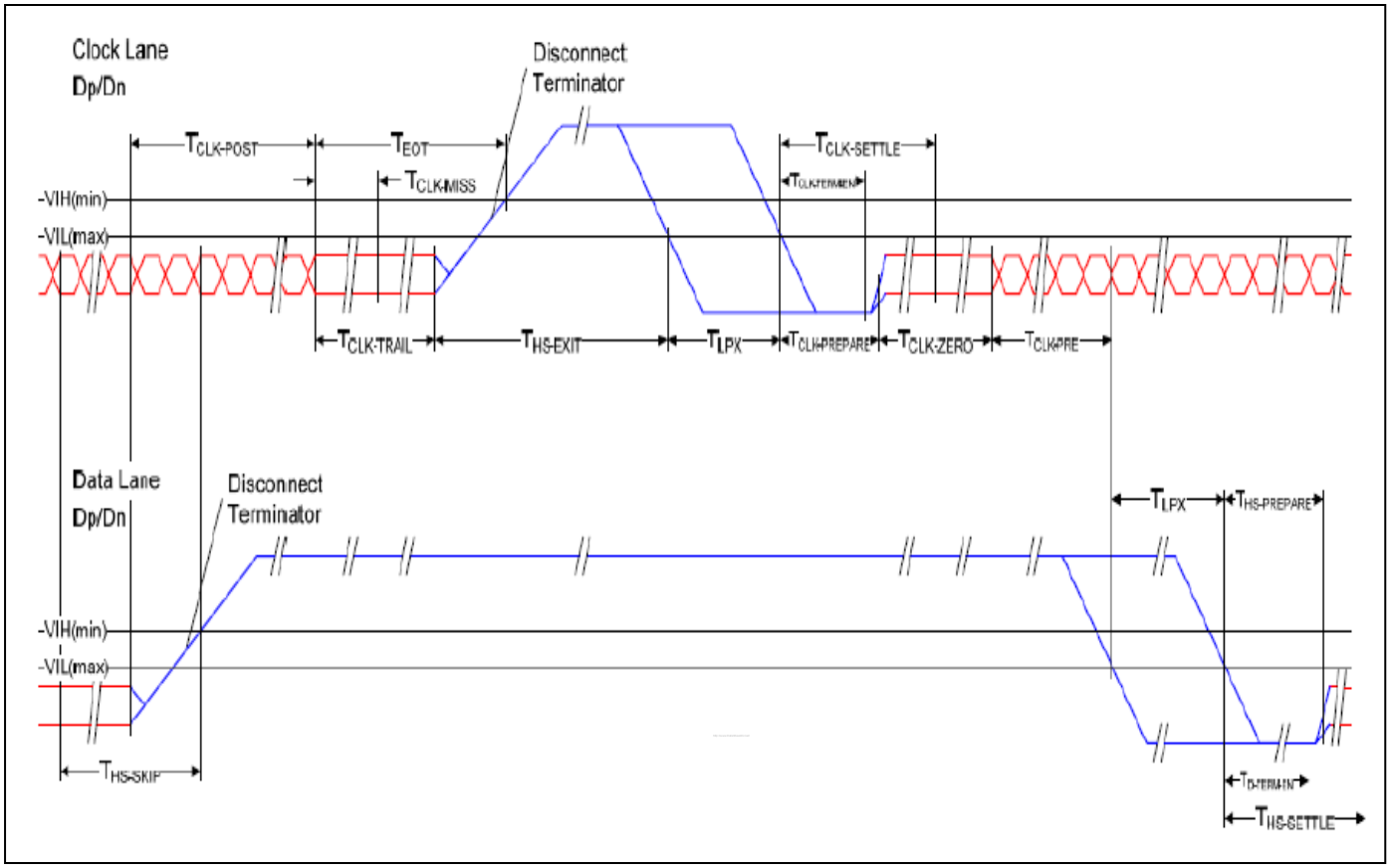
3-3.2. MIPI Receiver Differential Input (AC Characteristics)

Description	Symbol	Min	Typ	Max	Unit	Condition
Minimum pulse width response (LP Rx mode)	T_{MIN-RX}	50	-	-	ns	
Pulse width of the LP exclusive-OR clock	$T_{LP-PULSE-TX}$	50	55	58	ns	1st clock pulse after STOP state or last clock pulse before STOP state/all other pulse
15%~85% rise time and fall time (LP Tx mode)	T_{RLP}/T_{FLP}	-	-	25	ns	
15%~85% rise time and fall time of EOT (LP Tx mode)	T_{REOT}	-	-	35	ns	
Period of the LP exclusive-OR clock	$T_{LP-PER-TX}$	90	-	-	ns	
Data to clock setup time	T_{SETUP}	0.15	-	-	UI	
Data to clock hold time	T_{HOLD}	0.15	-	-	UI	

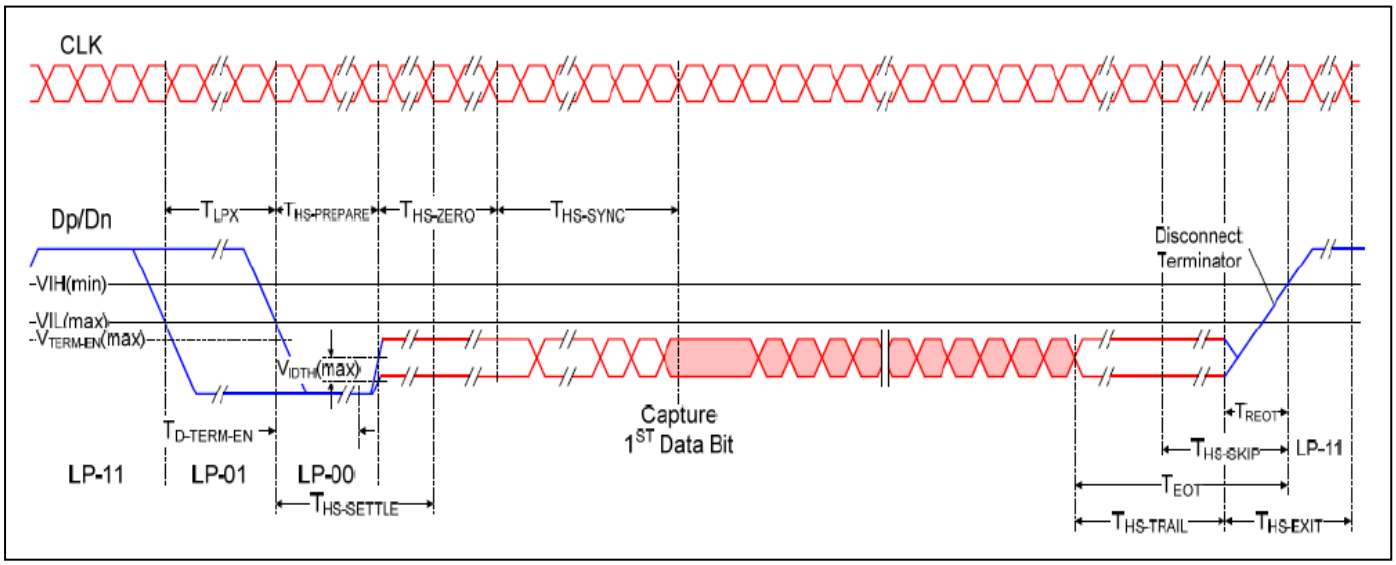


< Definition of Exclusive-OR Clock in LP Mode >

3-3.3. MIPI Alliance specification for D-PHY (Version 1.00.00 14-May-2009)



< Switching the Clock Lane between Clock Transmission and Low-Power Mode >



< High-Speed Data Transmission in Bursts >

3-3.3. MIPI Alliance specification for D-PHY (Version 1.00.00 14-May-2009)

< Global Operation Timing Parameters >

Parameter	Description	Min	Typ	Max	Unit	Notes
$T_{CLK-MISS}$	Timeout for receiver to detect absence of Clock transitions and disable the Clock Lane HS-RX.			60	ns	1, 6
$T_{CLK-POST}$	Time that the transmitter continues to send HS clock after the last associated Data Lane has transitioned to LP Mode. Interval is defined as the period from the end of $T_{HS-TRAIL}$ to the beginning of $T_{CLK-TRAIL}$.	60 ns + 52*UI			ns	5
$T_{CLK-PRE}$	Time that the HS clock shall be driven by the transmitter prior to any associated Data Lane beginning the transition from LP to HS mode.	8			UI	5
$T_{CLK-PREPARE}$	Time that the transmitter drives the Clock Lane LP-00 Line state immediately before the HS-0 Line state starting the HS transmission.	38		95	ns	5
$T_{CLK-SETTLE}$	Time interval during which the HS receiver shall ignore any Clock Lane HS transitions, starting from the beginning of $T_{CLK-PREPARE}$.	95		300	ns	6
$T_{CLK-TERM-EN}$	Time for the Clock Lane receiver to enable the HS line termination, starting from the time point when Dn crosses $V_{IL,MAX}$.	Time for Dn to reach $V_{TERM-EN}$		38	ns	6
$T_{CLK-TRAIL}$	Time that the transmitter drives the HS-0 state after the last payload clock bit of a HS transmission burst.	60			ns	5
$T_{CLK-PREPARE} + T_{CLK-ZERO}$	$T_{CLK-PREPARE}$ + time that the transmitter drives the HS-0 state prior to starting the Clock.	300			ns	5
$T_{D-TERM-EN}$	Time for the Data Lane receiver to enable the HS line termination, starting from the time point when Dn crosses $V_{IL,MAX}$.	Time for Dn to reach $V_{TERM-EN}$		35 ns + 4*UI		6
T_{EOT}	Transmitted time interval from the start of $T_{HS-TRAIL}$ or $T_{CLK-TRAIL}$, to the start of the LP-11 state following a HS burst.			105 ns + n*12*UI		3, 5
$T_{HS-EXIT}$	Time that the transmitter drives LP-11 following a HS burst.	100			ns	5
$T_{HS-PREPARE}$	Time that the transmitter drives the Data Lane LP-00 Line state immediately before the HS-0 Line state starting the HS transmission	40 ns + 4*UI		85 ns + 6*UI	ns	5
$T_{HS-PREPARE} + T_{HS-ZERO}$	$T_{HS-PREPARE}$ + time that the transmitter drives the HS-0 state prior to transmitting the Sync sequence.	145 ns + 10*UI			ns	5
$T_{HS-SETTLE}$	Time interval during which the HS receiver shall ignore any Data Lane HS transitions, starting from the beginning of $T_{HS-PREPARE}$.	85 ns + 6*UI		145 ns + 10*UI	ns	6
$T_{HS-SKIP}$	Time interval during which the HS-RX should ignore any transitions on the Data Lane, following a HS burst. The end point of the interval is defined as the beginning of the LP-11 state following the HS burst.	40		55 ns + 4*UI	ns	6
$T_{HS-TRAIL}$	Time that the transmitter drives the flipped differential state after last payload data bit of a HS transmission burst	max(n*8*UI, 60 ns + n*4*UI)			ns	2, 3, 5
T_{INIT}	See section 5.11.	100			µs	5
T_{LPX}	Transmitted length of any Low-Power state period	50			ns	4, 5
Ratio T_{LPX}	Ratio of $T_{LPX(MASTER)}/T_{LPX(SLAVE)}$ between Master and Slave side	2/3		3/2		
T_{TA-GET}	Time that the new transmitter drives the Bridge state (LP-00) after accepting control during a Link Turnaround.	5*T_{LPX}			ns	5
T_{TA-GO}	Time that the transmitter drives the Bridge state (LP-00) before releasing control during a Link Turnaround.	4*T_{LPX}			ns	5
$T_{TA-SURE}$	Time that the new transmitter waits after the LP-10 state before transmitting the Bridge state (LP-00) during a Link Turnaround.	T_{LPX}		2*T_{LPX}	ns	5
T_{WAKEUP}	Time that a transmitter drives a Mark-1 state prior to a Stop state in order to initiate an exit from ULPS.	1			ms	5

3-3.3. MIPI Alliance specification for D-PHY (Version 1.00.00 14-May-2009)

Notes

1. The minimum value depends on the bit rate. Implementations should ensure proper operation for all the supported bit rates.
2. If a > b then max(a, b) = a otherwise max(a, b) = b
3. Where n = 1 for Forward-direction HS mode and n = 4 for Reverse-direction HS mode
4. T_{LPX} is an internal state machine timing reference. Externally measured values may differ slightly from the specified values due to asymmetrical rise and fall times.
5. Transmitter-specific parameter
6. Receiver-specific parameter

3-4. Signal Timing Specification

This is the signal timing required at the input of the User connector. All of the interface signal timing should be satisfied with the following specifications and specifications of LVDS Tx/Rx for its proper operation.

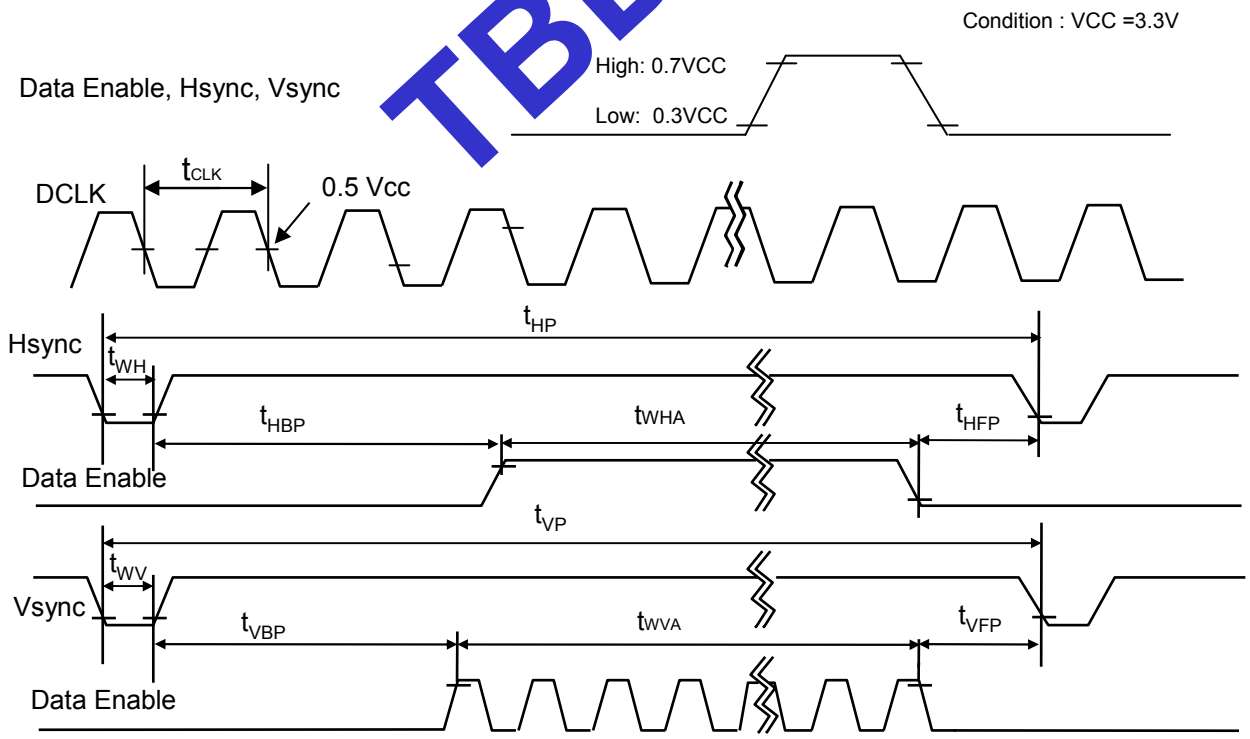
Table 6. Timing Table

ITEM		SYMBOL	Min	Typ	Max	Unit	Note
DCLK	Period	tCLK	(12.82)	**12.98**	(13.16)	ns	Pixel Frequency
	Frequency	fCLK	(75)	**77**	(78)	MHz	Typical 154MHz (2Pixel/clk)
Hsync	Period	tHP	(1024)	**1040**	(1060)	tCLK	
	Width-Active	tWH	(16)	**16**	(16)		
Vsync	Period	tVP	(1225)	**1235**	(1250)	tHP	
	Frequency	fV	(58.72)	**59.95**	(61.46)	Hz	
	Width-Active	tWV	(6)	**6**	(6)	tHP	
Data Enable	Horizontal Valid	tHV	(960)	**960**	(960)	tCLK	
	Horizontal Back Porch	tHBP	(32)	**40**	(60)		
	Horizontal Front Porch	tHFP	(16)	**24**	(44)		
	Horizontal Blank	-	(64)	**80**	(100)		tWH+ tHBP+ tHFP
	Vertical Valid	tVV	(1200)	**1200**	(1200)	tHP	
	Vertical Back Porch	tVBP	(18)	**26**	(42)		
	Vertical Front Porch	tVFP	(2)	**3**	(19)		
	Vertical Blank	-	(26)		(50)		tWV+ tVBP+ tVFP

Note : $t_{HFP}+t_{WH}+t_{HBP} < (1/2)t_{WHA}$

TBD

Condition : VCC =3.3V



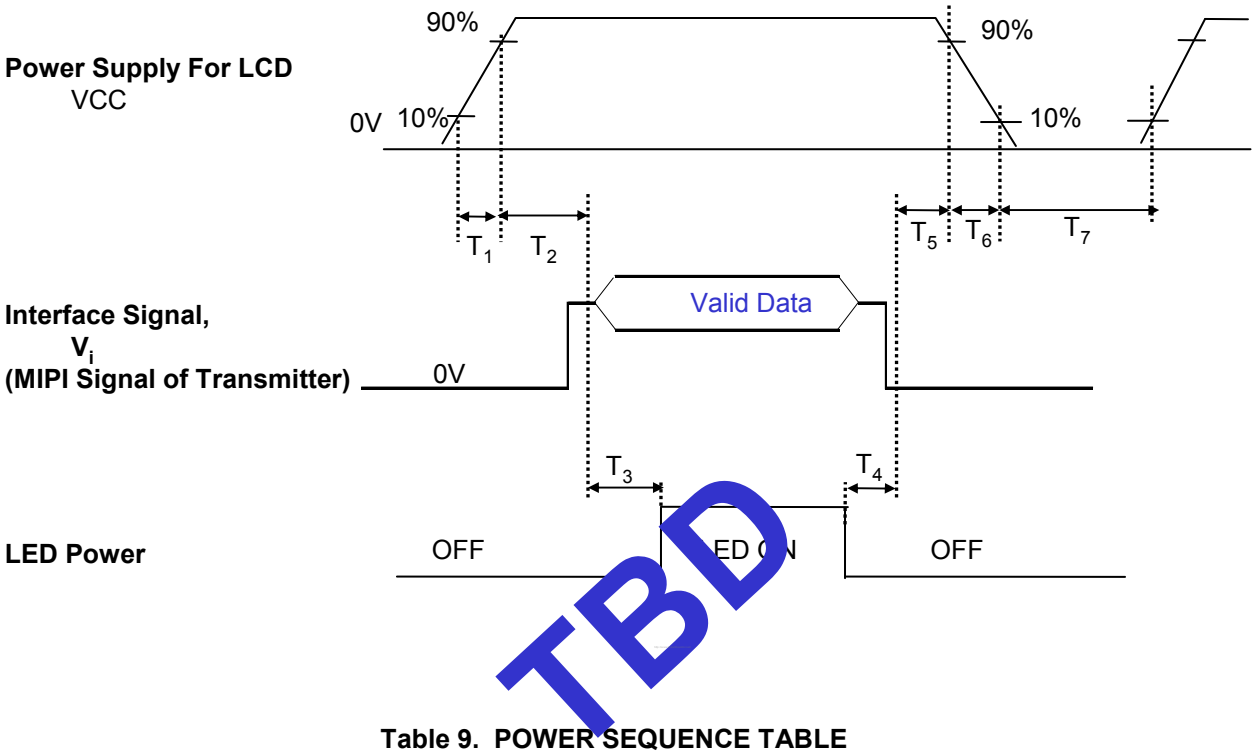
3-5. Color Input Data Reference

The brightness of each primary color (red,green and blue) is based on the 6-bit gray scale data input for the color ; the higher the binary input, the brighter the color. The table below provides a reference for color versus data input.

Table 6. COLOR DATA REFERENCE

Color		Input Color Data																	
		RED						GREEN						BLUE					
		MSB					LSB	MSB					LSB	MSB					LSB
		R5	R4	R3	R2	R1	R0	G5	G4	G3	G2	G1	G0	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
	Red	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0
	Green	0	0	0	0	0	0	1	1	1	1	1	1	0	0	0	0	0	0
	Blue	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1
	Cyan	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1
	Magenta	1	1	1	1	1	1	0	0	0	0	0	0	1	1	1	1	1	1
	Yellow	1	1	1	1	1	1	1	1	1	1	1	1	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
RED	RED (00)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	RED (01)	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
	…			…						…						…			
	RED (62)	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0
	RED (63)	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0
GREEN	GREEN (00)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	GREEN (01)	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
	...			…						…						…			
	GREEN (62)	0	0	0	0	0	0	1	1	1	1	1	0	0	0	0	0	0	0
	GREEN (63)	0	0	0	0	0	0	1	1	1	1	1	1	0	0	0	0	0	0
BLUE	BLUE (00)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	BLUE (01)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	…			…						…						…			
	BLUE (62)	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	0
	BLUE (63)	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1

3-6. Power Sequence



TBD

Table 9. POWER SEQUENCE TABLE

Parameter	Value			Units
	Min.	Typ.	Max.	
T_1	0.5	-	10	(ms)
T_2	70	-	100	(ms)
T_3	300	-	-	(ms)
T_4	200	-	-	(ms)
T_5	0	-	50	(ms)
T_6	3	-	10	(ms)
T_7	400	-	-	(ms)

Note)
1. Valid Data is Data to meet “MIPI Signal Timing Specifications”
2. Please avoid floating state of interface signal at invalid period.
3. When the interface signal is invalid, be sure to pull down the power supply for LCD VCC to 0V.
4. LED power must be turn on after power supply for LCD and interface signal are valid.

4. Optical Specifications

Optical characteristics are determined after the unit has been 'ON' and stable for approximately 5 minutes in a dark environment at 25°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°.
FIG. 1 presents additional information concerning the measurement equipment and method.

FIG. 1 Optical Characteristic Measurement Equipment and Method

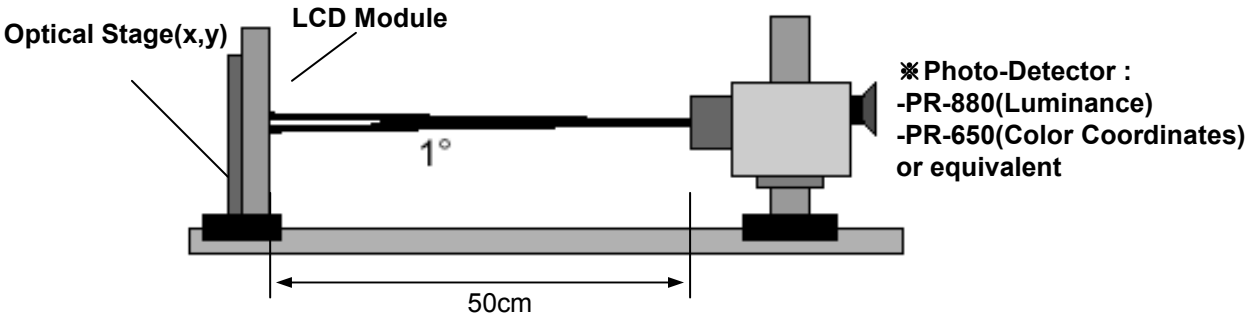


Table 10. OPTICAL CHARACTERISTICS

Ta=25°C, VCC=3.3V, fv=60Hz, f_{CLK}= 77MHz, I_{LED} = 20.7mA

Parameter		Symbol	Values			Units	Notes
			Min	Typ	Max		
Contrast Ratio		CR	600	800	-		1
Surface Luminance, white		L_{WH}	400	450	-	cd/m^2	2
Luminance Variation		δ_{WHITE}	70	80	-	%	3
Response Time				35	50	ms	4
Color Coordinates	Red	RX	-	TBD	-		
		RY	-	TBD	-		
	Green	GX	-	TBD	-		
		GY	-	TBD	-		
	Blue	BX	-	TBD	-		
		BY	-	TBD	-		
	White	WX	0.280	0.310	0.340		
		WY	0.310	0.340	0.370		
Viewing Angle							5
	x axis, right(Φ=0°)	Θr	75	85	-	degree	3 o'clock
	x axis, left (Φ=180°)	Θl	75	85	-	degree	9 o'clock
	y axis, up (Φ=90°)	Θu	75	85	-	degree	12 o'clock
	y axis, down (Φ=270°)	Θd	75	85	-	degree	6 o'clock

[Note 4-1] Contrast Ratio(CR) is defined mathematically as

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

[Note 4-2] Surface luminance is measured at the center point(L_1) of the LCD with all pixels displaying white at the distance of 50cm by PR-880. Color Coordinates are measured at the center point(L_1) of the LCD with all pixels displaying red, green, blue and white at the distance of 50cm by PR-650. For more information, refer to the FIG 1 and FIG 2.

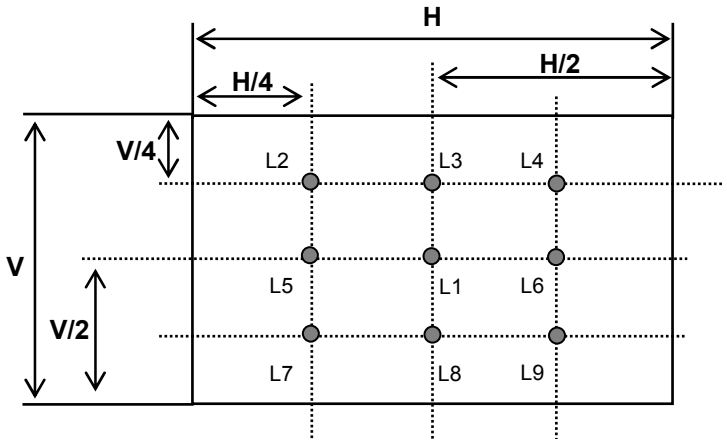
[Note 4-3] Luminance % uniformity is measured for 9 point For more information see FIG 2.
δ WHITE = Minimum (L1,L2, ….. L9) ÷ Maximum (L1,L2, ….. L9)

[Note 4-4] Response time is the time required for the display to transition from white to black (Rise Time, Tr_R) and from black to white(Decay Time, Tr_D). For additional information see FIG 3.

[Note 4-5] Viewing angle is the angle at which the contrast ratio is greater than 10. The angles are determined for the horizontal or x axis and the vertical or y axis with respect to the z axis which is normal to the LCD surface. For more information see FIG 4.

FIG. 2 Luminance

<measuring point for surface luminance & measuring point for luminance variation>



***H,V : ACTIVE AREA**

FIG. 3 Response Time

The response time is defined as the following figure and shall be measured by switching the input signal for “black” and “white”.

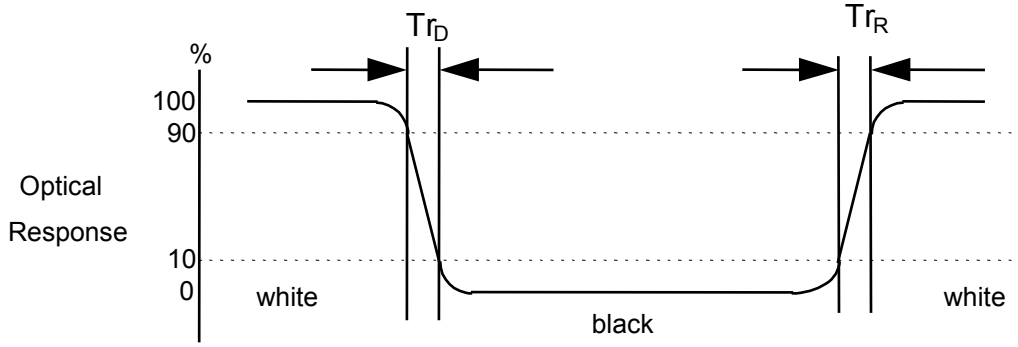
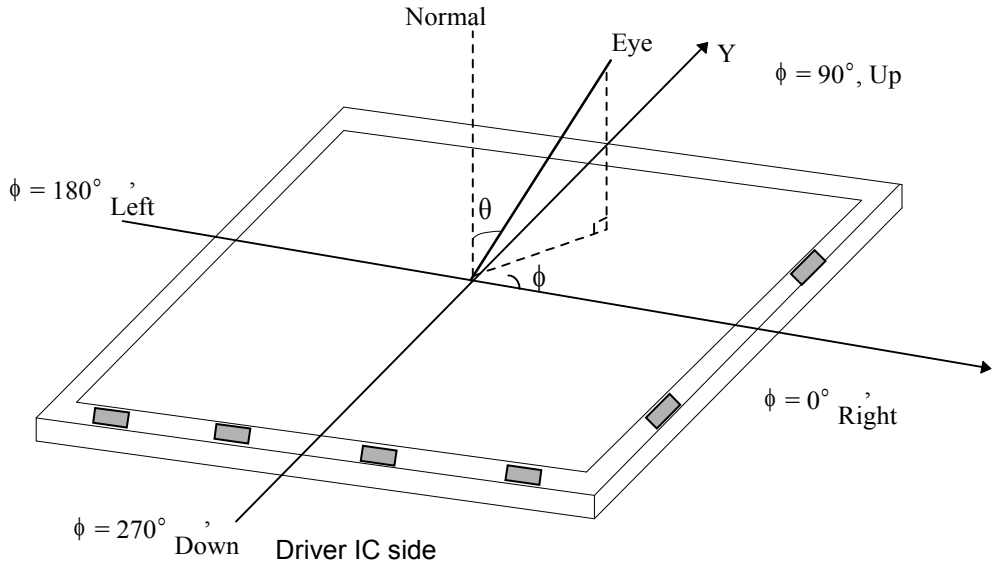


FIG. 4 Viewing angle

<Dimension of viewing angle range>



5. Mechanical Characteristics

The contents provide general mechanical characteristics for the model LD089WU1. In addition the figures in the next page are detailed mechanical drawing of the LCD.

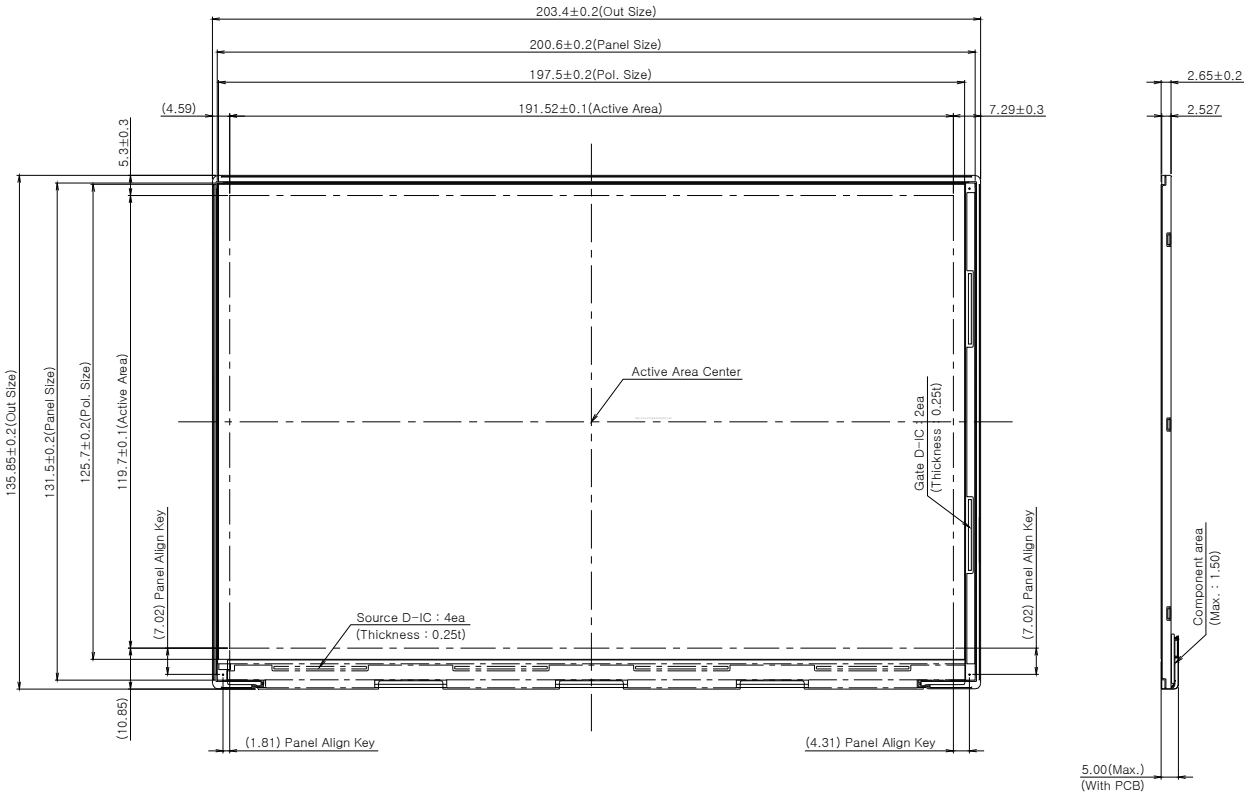
Outline Dimension	Horizontal	203.40 mm (Typ)
	Vertical	135.85 mm (Typ)
	Depth	2.65 mm (Max.)
Bezel Area	Horizontal	203.40 mm (Typ)
	Vertical	135.85 mm (Typ)
Active Display Area	Horizontal	191.52 mm (Typ.)
	Vertical	119.70 mm (Typ.)
Weight	TBDg(Typ.) / TBDg (Max.)	
Surface Treatment	HC treatment of the front polarizer	

Product Specification

<FRONT VIEW>

Unit:[mm], General tolerance: ± 0.2mm

" FOR REFERENCE ONLY "

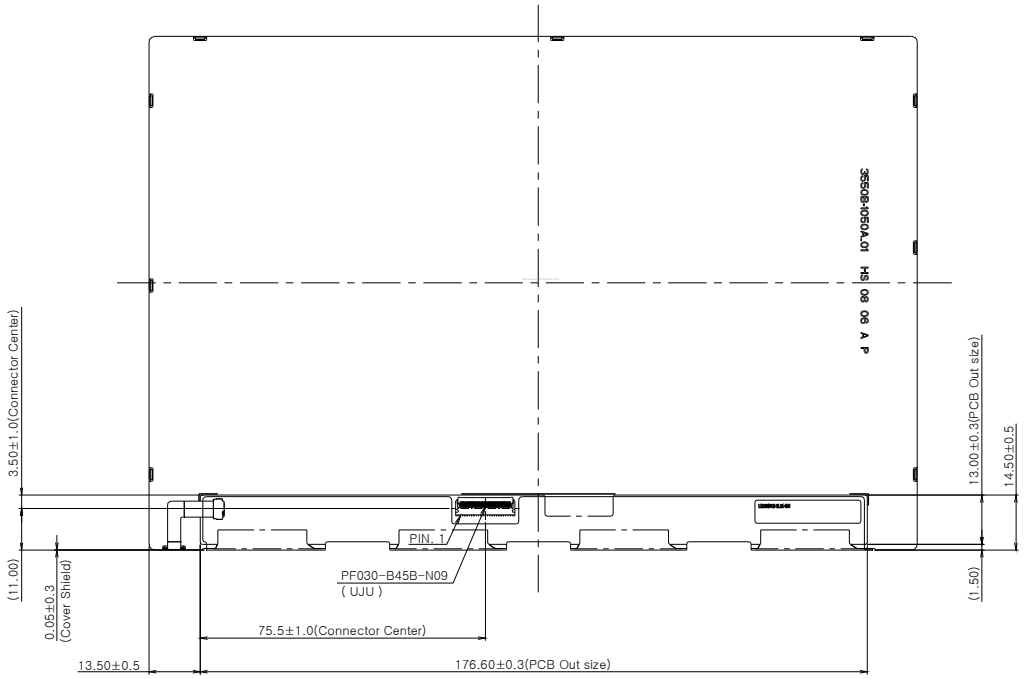


Product Specification

<REAR VIEW>

Unit:[mm], General tolerance: ± 0.2mm

" FOR REFERENCE ONLY "



6. Reliability

6.1. Reliability

No.	Test Items	Test Condition	Remark
1	High Temperature Storage Test	Ta=60℃ 240h	[Note 6-1,2,3]
2	Low Temperature Storage Test	Ta=-20℃ 240h	[Note 6-1,2,3]
3	High Temperature Operation Test	Ta=50℃ 240h	[Note 6-1,2,3]
4	Low Temperature Operation Test	Ta =0℃ 240h	[Note 6-1,2,3]
5	High Temperature and High Humidity Operation Test	Ta=50℃ 80%RH 240h	[Note 6-1,2,3]
6	Electro Static Discharge Test	Operation, 150pF, 330Ω - Top Case, Panel I, Panel II ±15kV Non-operation 200pF, 0Ω - User CNT: ±0.2kV	
7	Shock Test (non-operating)	Half sine wave, 180G, 2.0ms, 3X on each of six faces	
8	Vibration sign sweep (non-operating)	Sine Wave 10 ~ 500 ~ 10Hz 1.5G , 0.37oct/min 3 axis , 1hour/axis	
9	Mechanical vibration Random Vibration (non-operating)	1 GRMS, 3 axis, 15 min/axi	
10	Thermal shock	Ta = -20℃(0.5h) ~ 60℃(0.5h) / 100 cycles (non-operation)	
11	Altitude storage	40000 ft, room temp. 24h	

[Note 6-1] T_a = Ambient Temperature
[Note 6-2] In the Reliability Test, Confirm performance after leaving in room temp.
[Note 6-3] In the standard condition, there shall be no practical problems that may affect the display function 24 hours later after reliability test. After the reliability test, we can guarantee the product only when the corrosion is causing its malfunction. The corrosion causing no functional defect can not be guaranteed.
※ Ta= Ambient Temperature

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

7. International Standards

7-1. Safety

a) UL 60950-1, Second Edition, Underwriters Laboratories Inc.
Information Technology Equipment - Safety - Part 1 : General Requirements.

b) CAN/CSA C22.2 No.60950-1-07, Second Edition, Canadian Standards Association.
Information Technology Equipment - Safety - Part 1 : General Requirements.

c) EN 60950-1:2006 + A11:2009, European Committee for Electrotechnical Standardization(CENELEC).
Information Technology Equipment - Safety - Part 1 : General Requirements.

7-2. EMC

a) ANSI C63.4 – 2003 “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) C.I.S.P.R. Pub. 22. Limits and methods of measurement of radio interference characteristics of information technology equipment." International Special Committee on Radio Interference (C.I.S.P.R.), 2005.

c) EN 55022 "Limits and methods of measurement of radio interference characteristics of information technology equipment." European Committee for Electrotechnical Standardization (CENELEC), 2006.

8. Packing

8-1. Designation of Lot Mark

a) Lot Mark

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

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

Note
1. YEAR

Year	2001 2011	2002 2012	2003 2013	2004 2014	2005 2015	2006 2016	2007 2017	2008 2018	2009 2019	2010 2011
Mark	1	2	3	4	5	6	7	8	9	0

2. MONTH

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

b) Location of Lot Mark

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

8-2. Packing Form

a) Package quantity in one box : 22 pcs

b) Box Size(mm) : 355 mm × 468 mm × 226 mm

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 four sides.
(2) You should consider the mounting structure so that uneven force (ex. Twisted stress) is not applied to the module. And the case on which a module is mounted should have sufficient strength so that external force is not transmitted directly to the module.
(3) Please attach 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 lower temperature, it becomes longer.)
(3) Brightness depends on the temperature. (In lower temperature, it becomes lower.)
And in lower temperature, response time(required time that brightness is stable after turned on) becomes longer.
(4) Be careful for condensation at sudden temperature change. Condensation makes damage to polarizer or electrical contacted parts. And after fading condensation, smear or spot will occur.
(5) When fixed patterns are displayed for a long time, remnant image is likely to occur.
(6) Module has high frequency circuits. Sufficient suppression to the electromagnetic interference shall be done by system manufacturers. Grounding and shielding methods may be important to minimized the interference.
(7) This module is not designed to attach TSP(touch screen panels). If TSP is applied, LPL can't guarantee the 'Ripple' related problems.

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) 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) The protection film is attached to the polarizer with a small amount of glue. If some stress is applied to rub the protection film against the polarizer during the time you peel off the film, the glue is apt to remain on the polarizer.
Please carefully peel off the protection film without rubbing it against the polarizer.
(3) 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 polarizer after the protection film is peeled off.
(4) You can remove the glue easily. When the glue remains on the polarizer surface or its vestige is recognized, please wipe them off with absorbent cotton waste or other soft material like chamois soaked with normal-hexane.