LITEMAX

DPF5501-LNN

Sunlight Readable 55" LED B/L LCD

User Manual

Approved by	Checked by	Prepared by

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Record of Revision

Version and Date	Page	Old Description	New Description	Remark
Nov./28/2024	all		Initial release	

Contents

1 General Description

The DPF5501-LNN is a 55 inch industrial grade sunlight readable LCD, with high brightness 4000 nits, it produce sharp images, crisp text and lifelike colors. The Durapixel LED backlight technology ensures high reliability and low power consumption, suitable for outdoor application, kiosk, factory automation, military, transportation and gaming application.

1.1 Features

- High Brightness 4000 nits
- Sunlight Readable
- Resolution :1920 x 1080
- Wild Viewing Angle of 178°(H),178°(V)
- LCD Blackening Defect Free (H-Tni 110 ˚C)
- Low Power Consumption
- BL MTBF: 100,000 hours

1.2 General Specifications

| Model Name	DPF5500-LNN
Description	55" TFT LCD, 4000 nits LED Backlight, 1920x1080
Screen Size	55"
Display Area (mm)	1209.6(H) x 680.4(V)
Brightness (Typ.)	4000 cd/m^2
Resolution	1920x1080
Aspect Ratio	16 : 9
Contrast Ratio	1600 : 1
Pixel Pitch (mm)	0.630(H) x 0.630(V)
Pixel Per Inch (PPI)	40
Viewing Angle	178°(H),178°(V)
Color Saturation (NTSC)	80%
Display Colors	16.7M
Response Time (Typical)	9ms
Panel Interface	LVDS
Panel Input Power	DC12V
BL Input Power	DC24V
Power Consumption	233W
Dimensions (mm)	1236.5 x 707.5 x 56.1 mm
Bezel Size(U/B/L/R)	13.55/13.551/13.45/13.45 mm
Weight (Net)	18.3kg
Operating Temperature	0 ˚C ~ 50 ˚C
Storage Temperature	-20 ˚C ~ 60 ˚C

DPF= Panel + LED Driving Board

1.3 Absolute Maximum Ratings

Permanent damage may occur if exceeding the following maximum rating.

Parameter		Symbol	Value		Unit	Note
			Min	Max		
Power Input Voltage	LCD Circuit	V$_{LCD}$	-0.3	+14.0	V$_{DC}$	1
T-Con Option Selection Voltage		V$_{LOGIC}$	-0.3	+4.0	V$_{DC}$	
Operating Temperature		T$_{OP}$	0	+50	°C	2,3
Storage Temperature(**without packing**)		T$_{ST}$	-20	+60	°C	
Panel Front Temperature		T$_{SUR}$	-	+68	°C	4
Operating Ambient Humidity		H$_{OP}$	10	90	%RH	2,3
Storage Humidity		H$_{ST}$	**5**	90	%RH	

Note:

1. Ambient Temperature and condition (Ta=25±2^{0}°C)
2. Temperature and relative humidity range are shown in the figure below. We bulb temperature should be Max 39^{0}°C, and no condensation of water.
3. Gravity mura can be guaranteed below 40°C condition.
4. The maximum operating temperature 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 be degraded in case of improper thermal management in final product design.
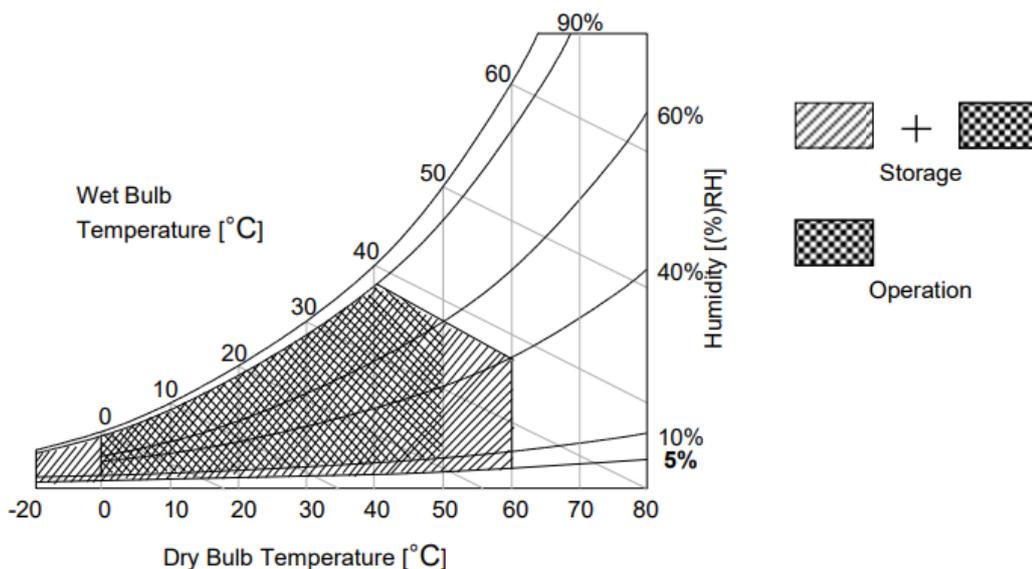
2   Electrical Absolute Ratings

2.1   Electrical Characteristics

Parameter		Symbol	Value			Unit	Note
			Min	Typ	Max		
Circuit :							
Power Input Voltage		V_{LCD}	10.8	12.0	13.2	V_{DC}	
Power Input Current		I_{LCD}	-	460	595	mA	1
			-	700	910	mA	2
T-CON Option Selection Voltage	Input High Voltage	V_{IH}	2.7	-	3.6	V_{DC}	
	Input Low Voltage	V_{IL}	0	-	0.7	V_{DC}	
Power Consumption		P_{LCD}	-	5.52	7.17	Watt	1
Rush current		I_{RUSH}	-	-	5.0	A	3

Note
1. The specified current and power consumption are under the V_{LCD}=12.0V, Ta=25 ±2°C, f_V=60Hz condition, and mosaic pattern(8 x 6) is displayed and f_V is the frame frequency.
2. The current is specified at the maximum current pattern.
3. The duration of rush current is about 2ms and rising time of power input is 0.5ms (min.).
4. Ripple voltage level is recommended under ±5% of typical voltage
5. Maximum of Power Input Voltage is included with ripple.

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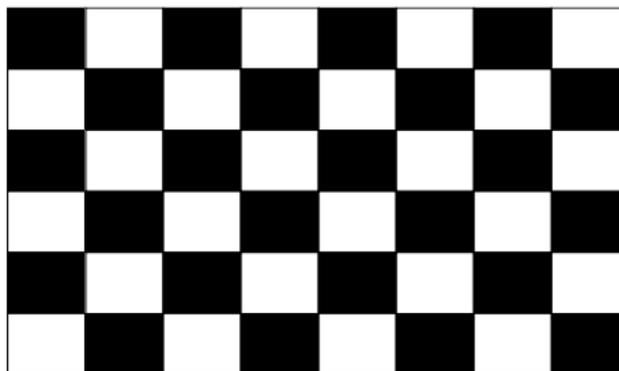
Mosaic Pattern(8 x 6)

2.2   Interface Connection

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.

4.   #1~#6 & #8~#10 NC (No Connection): These pins are used only for LiteMax (Do not connect)

5.   Specific pin No. #44 is used for "No signal detection" of system signal interface. It should be GND for NSB (No Signal Black) during the system interface signal is not. If this pin is "H", LCD Module displays AGP (Auto Generation Pattern)

2.3   Signal Timing Specifications

The below table 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.

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

Notes:

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

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

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

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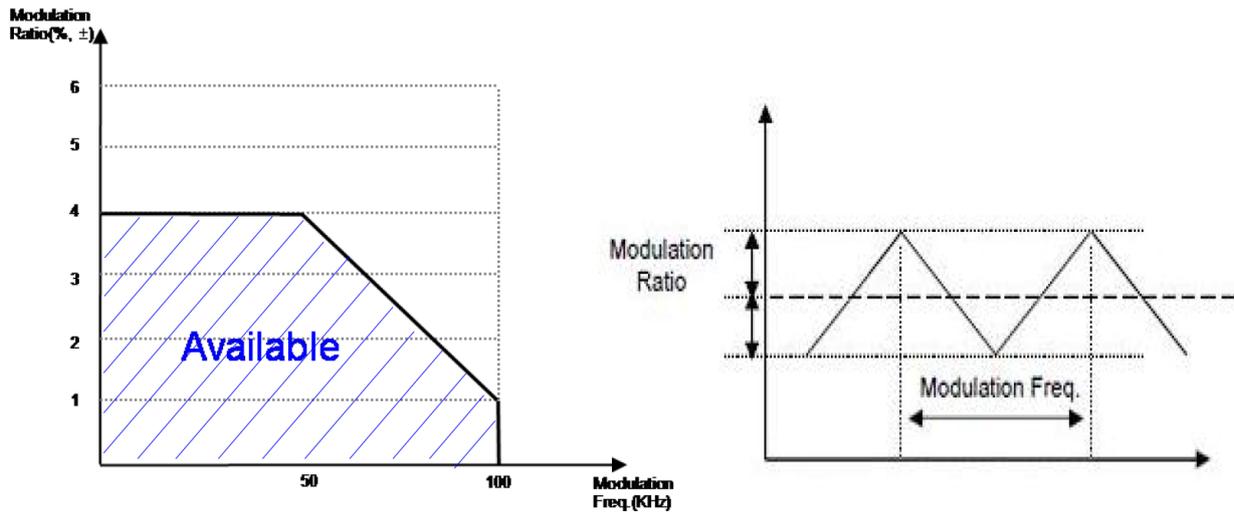
※ Please pay attention to the followings when you set Spread Spectrum Rate(SSR) and Modulation Frequency(FMOD)

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

2. Please check FOS after you set Spread Spectrum Rate(SSR) and Modulation Frequency(FMOD) to avoid abnormal display. Especially, harmonic noise can appear when you use Spread Spectrum under FMOD 30 KHz.
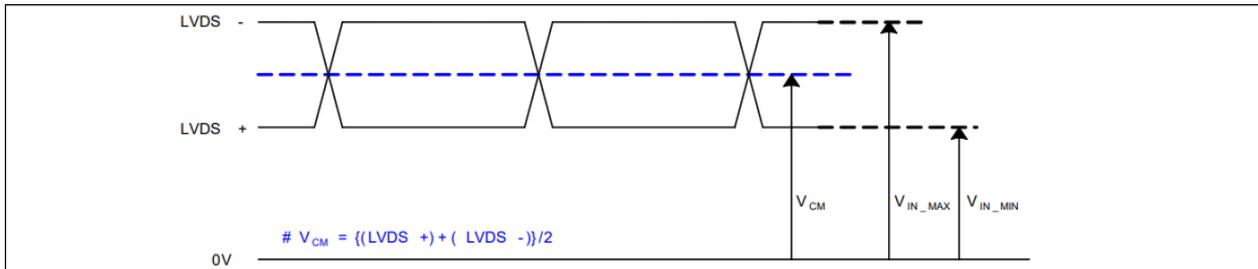
2.4 LVDS Signal Specifications
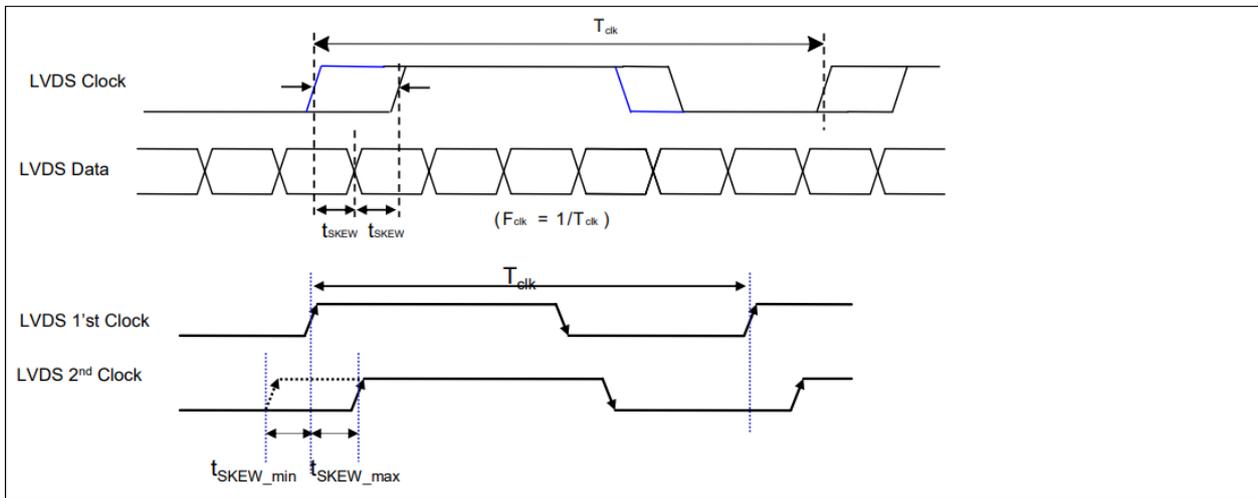
LVDS Input Signal Timing Diagram
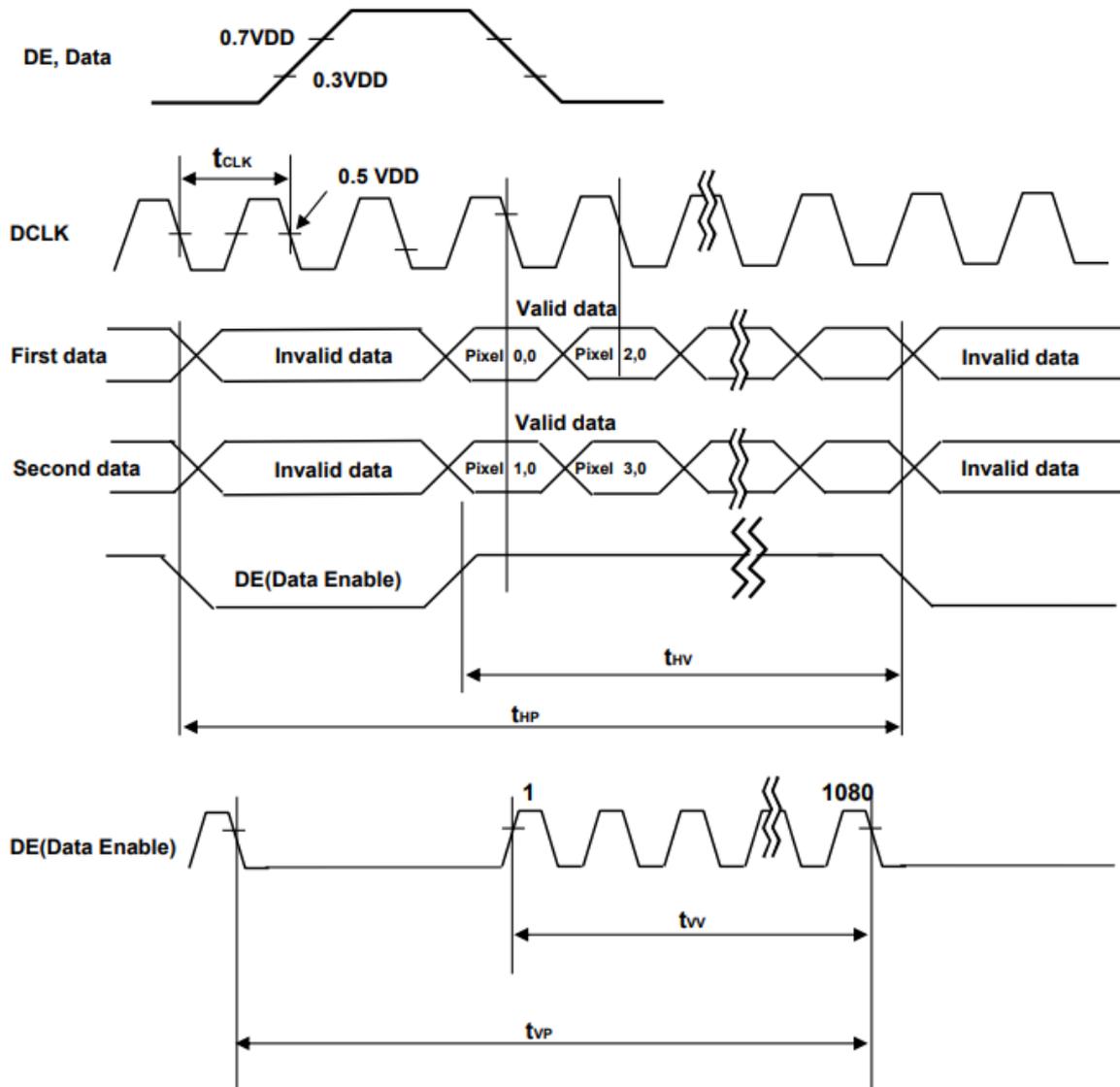
2.5 LVDS Input Signal Characteristics

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	ΔVCM	-	250	mV	-

AC Specification

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

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

Notes

1. All Input levels of LVDS signals are based on the EIA 644 Standard.
2. LVDS Differential Voltage is defined within t_{eff}
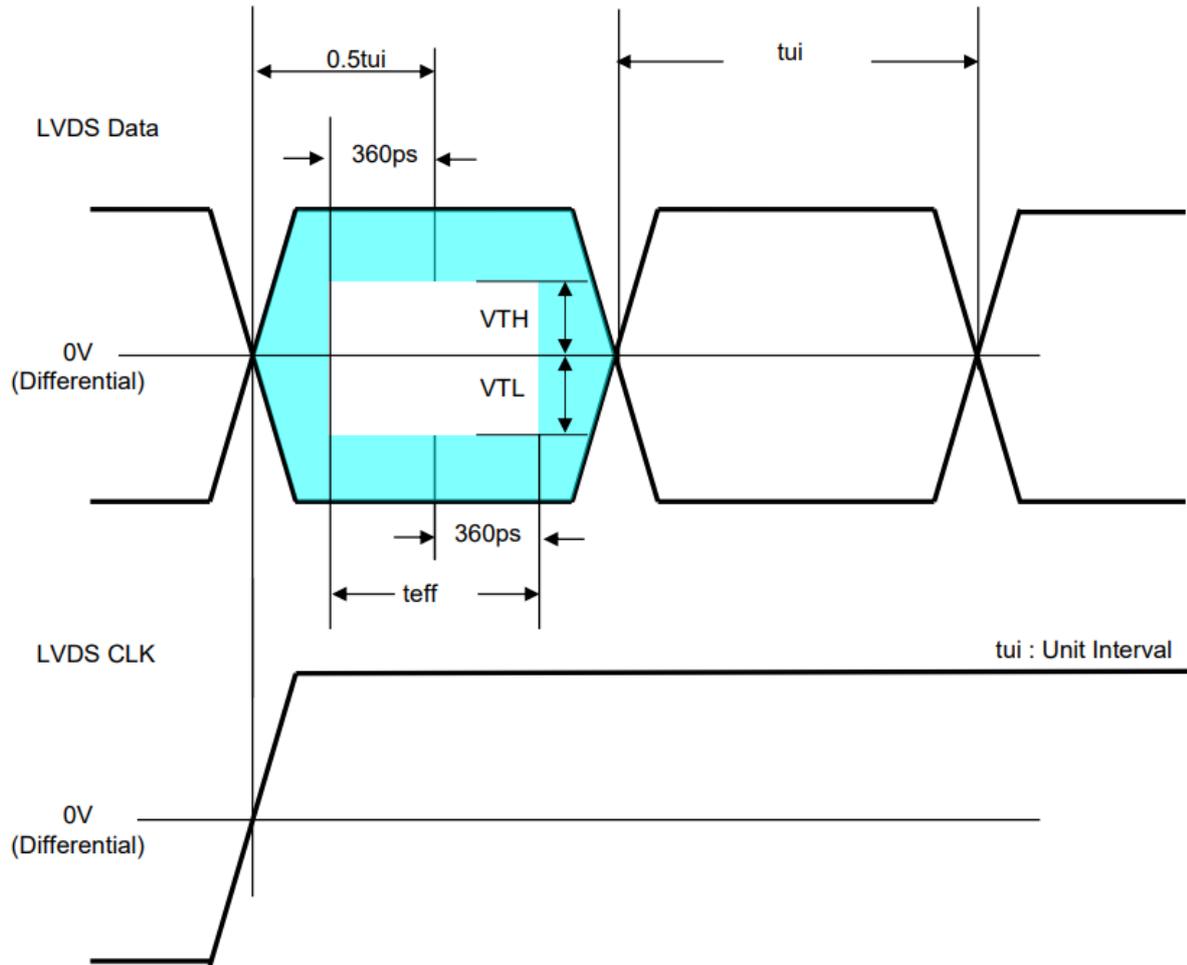
※ This accumulated waveform is tested with differential probe

2.6 Intra interface Signal Specification

EPI Signal Specification

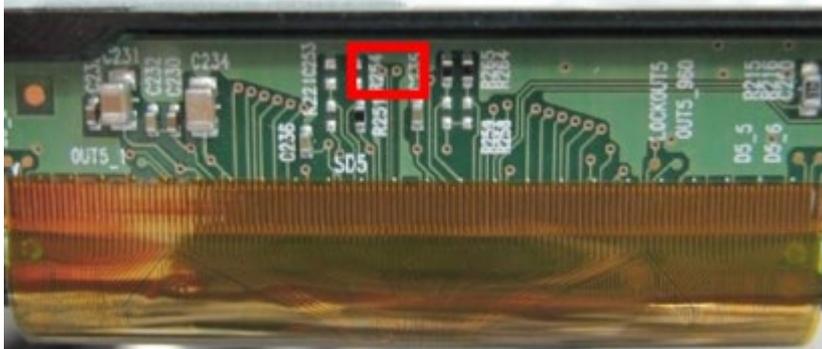| Parameter	Symbol	Condition	MIN	TYP	MAX	Unit	notes
Logic & EPI Power Voltage	VCC	-	1.62	1.8	1.98	VDC	
EPI input common voltage	VCM	LVDS Type	0.8	VCC/2	1.3	V	
EPI input differential voltage	Vdiff	-	150	-	500	mV	
EPI Input eye diagram	Veye	-	90	-	-	mV	
Effective Veye width time	B1&B2	0.25	-	-	UI	
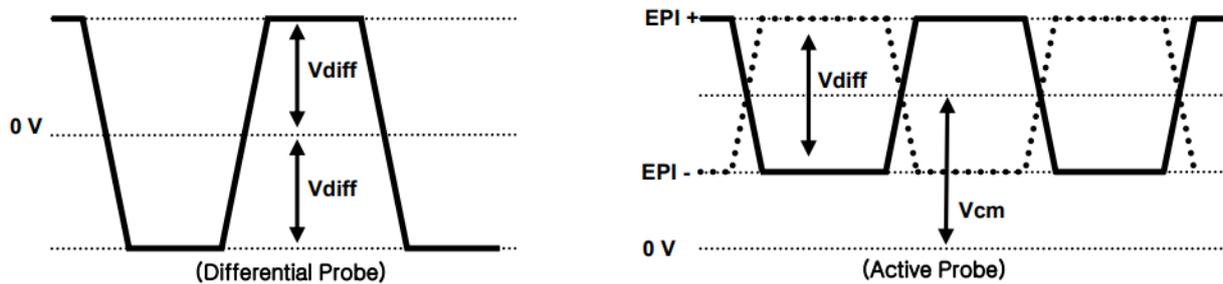
EPI Differential signal characteristics
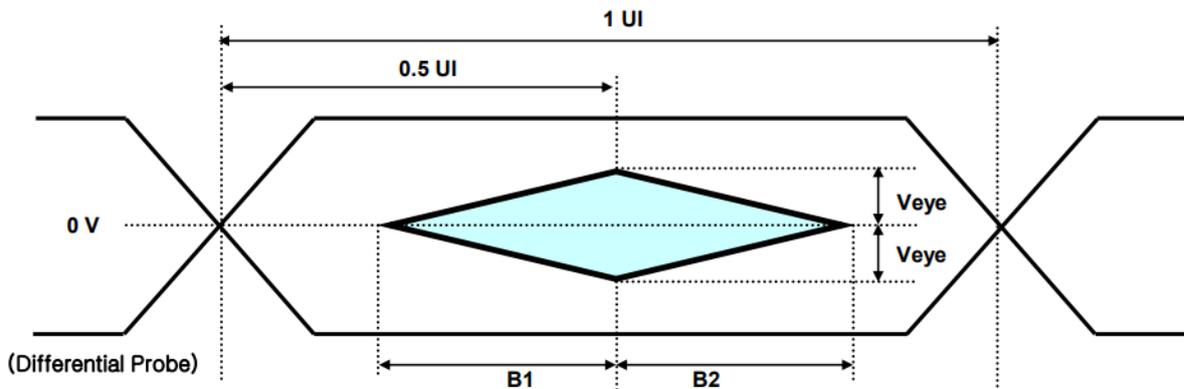
Eye Pattern of EPI Input

Source PCB (Measure Point)

2.7 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.

Color		Input Color Data																								
		RED MSB							LSB	GREEN MSB							LSB	BLUE MSB							LSB
		R7	R6	R5	R4	R3	R2	R1	R0	G7	G6	G5	G4	G3	G2	G1	G0	B7	B6	B5	B4	B3	B2	B1	B0
Basic Color	Black	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red (255)	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Green (255)	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0
	Blue (255)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1
	Cyan	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	Magenta	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1
	Yellow	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0
	White	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
RED	RED (000)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	RED (001)	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	...			...								...								...					
	RED (254)	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	RED (255)	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
GREEN	GREEN (000)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	GREEN (001)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
	...			...								...								...					
	GREEN (254)	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0
	GREEN (255)	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0
BLUE	BLUE (000)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	BLUE (001)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	...			...								...								...					
	BLUE (254)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	0
	BLUE (255)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1

2.8 Power On/Off Sequence
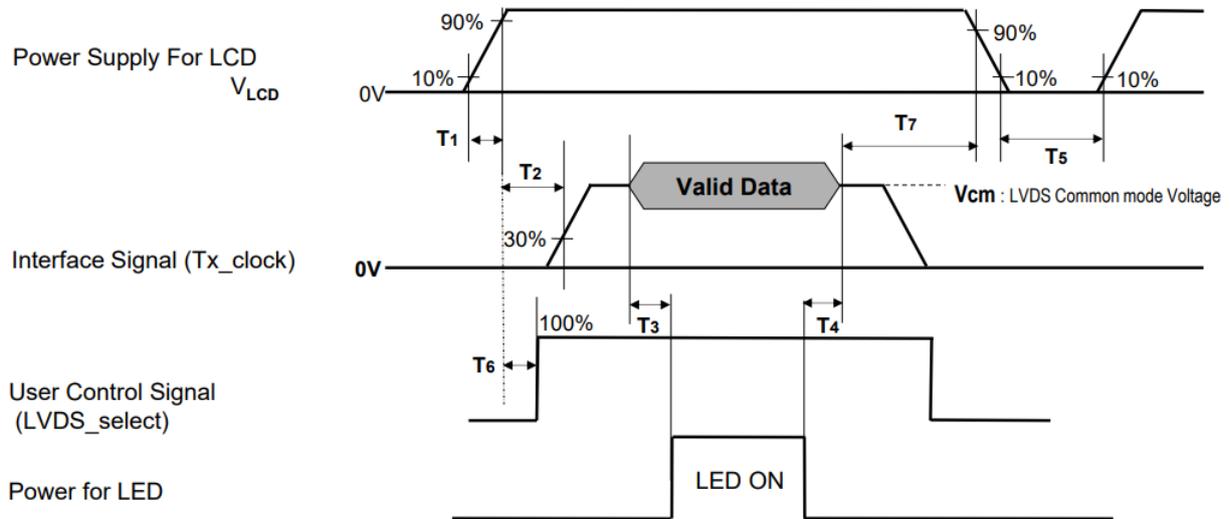
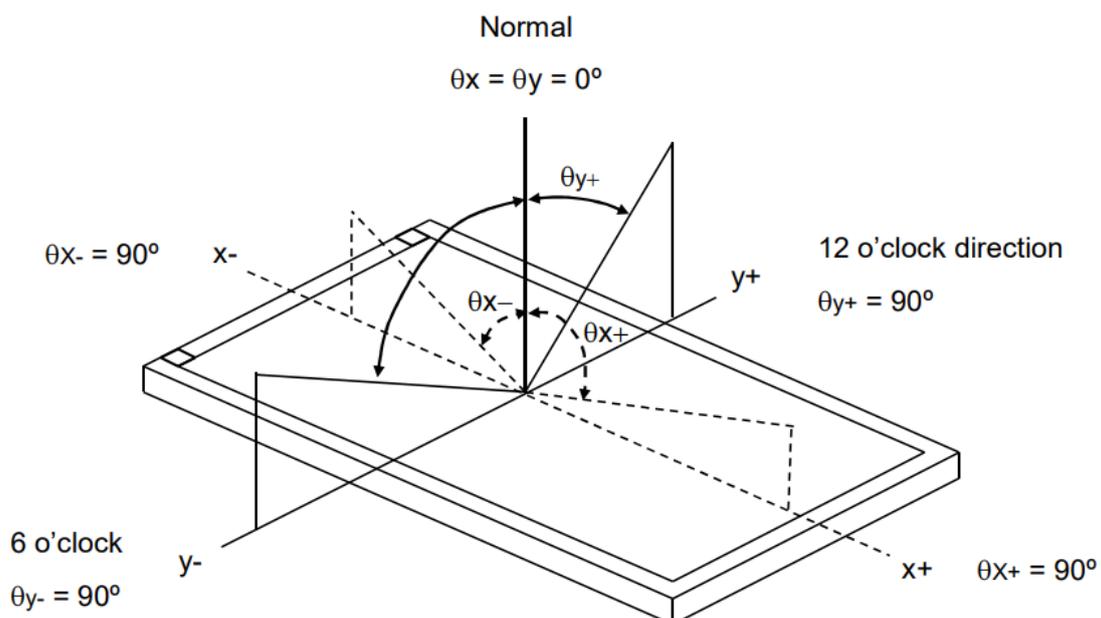| Parameter	Value			Unit	Notes
	Min	**Typ**	**Max**		
T1	0.5	-	20	ms	1
T2	0	-	-	ms	2
T3	400	-	-	ms	3
T4	**100**	-	-	ms	3
T5	1.0	-	-	s	4
T6	0	-	T2	ms	5
T7	0	-	-	ms	6

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.

2. T5 should be measured after the Module has been fully discharged between power off and on period.

3. If the on time of signals (Interface signal and user control signals) precedes the on time of Power (VLCD), 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
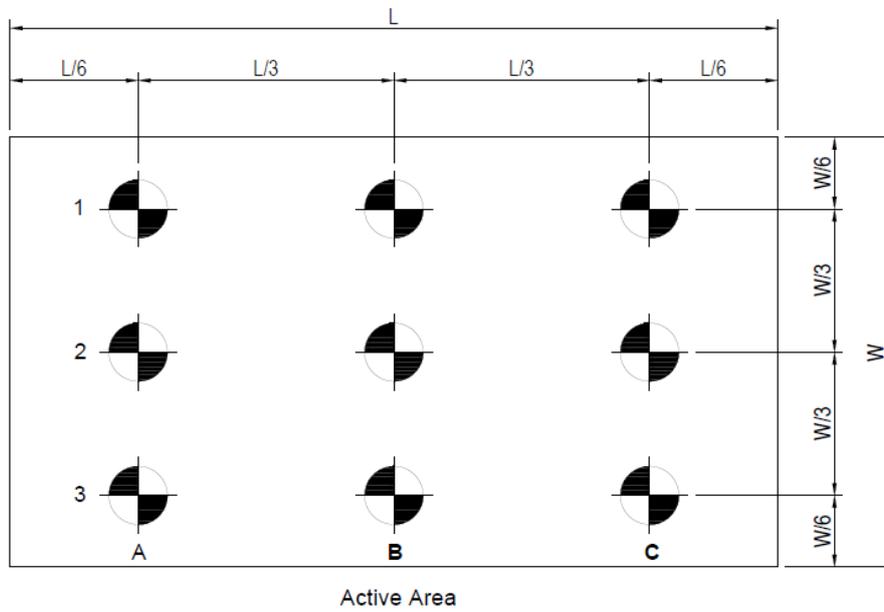
3 Optical Specification

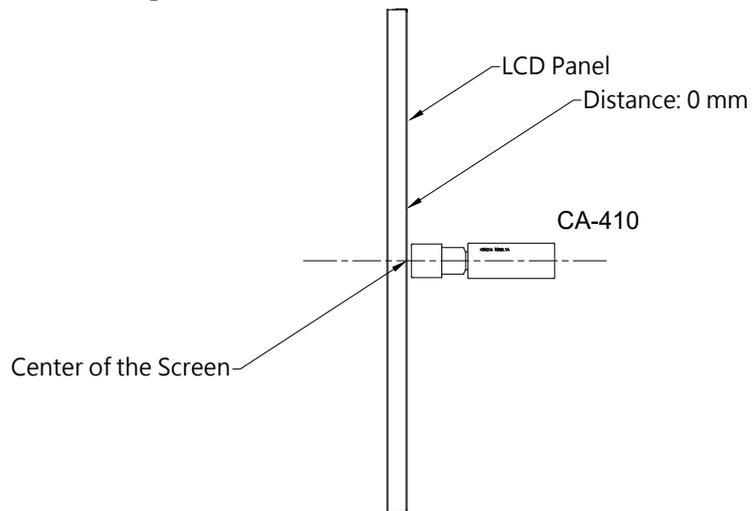| Item		Symbol	Condition	Min.	Typ.	Max.	Unit	Note
Color chromaticity	Red	Rx	θx=0 θy=0 Klein K-10	0.625	0.655	0.685	-	Test Mode: (2) (3) (4)
		Ry		0.303	0.333	0.363	-	
	Green	Gx		0.287	0.317	0.347	-	
		Gy		0.567	0.597	0.627	-	
	Blue	Bx		0.113	0.143	0.173	-	
		By		0.046	0.076	0.106	-	
	White	Wx		0.265	0.295	0.325	-	
		Wy		0.301	0.331	0.361	-	
Center Luminance of White		Lc	θx=0 θy=0	3600	4000	5200	cd/m^2	
Uniformity		Lu	CA-410		89		%	
Contrast Ratio		CR	θx=0 θy=0 Klein K-10	1440:1	1600:1		-	Test Mode: (4)
Color Saturation		NTSC			80		%	
Viewing Angle	Horizontal	θx+	CR ≥ 10		89		Deg	Test Mode: (1)
		θx-			89			
	Vertical	θy+			89			
		θy-			89			

Test Mode：
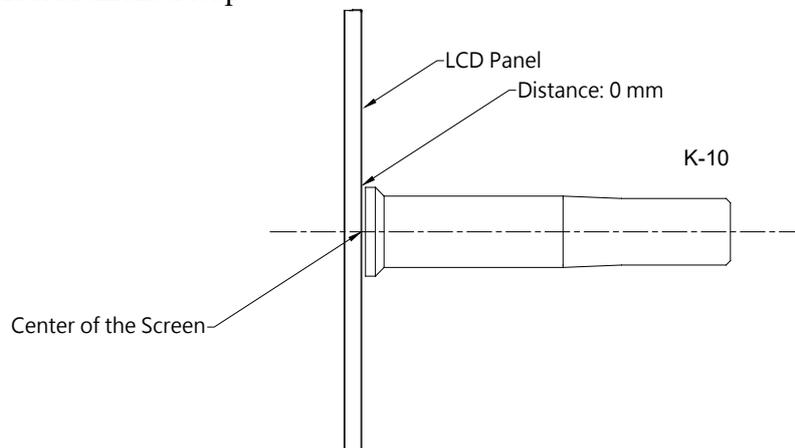
(1) Definition of Viewing Angle (θx , θy):

(2) Definition of Test Point:

Active Area

(3) CA-410 Measurement Setup:

(4) Klein K-10 Measurement Setup:

4 LED Driving Board Specifications

This specification is applied to LED converter unit for LED backlight.

4.1 Operating Characteristics

Item	Symbol	Conditions	MIN.	TYP.	MAX.	Unit	Remark
Input Voltage	Vin		22	24	26	V	
Input Current (Low Brightness)	IinL	PWM=0%	0.0	-----	-----	mA	
Input Current (High Brightness)	IinH	PWM=100%	5.66	5.52	5.34	A	(1)
LED Current (Low Brightness)	IoutL	PWM=0%	0.0	-----	-----	Arms	
LED Current (High Brightness)	IoutH	PWM=100%	0.95	1	1.1	A	J3
			1.92	2	2.1	A	J7, J8
Working Frequency	Freq	PWM=100%	350	400	450	KHZ	
Brightness Control	PWM	Duty cycle	0	--	100	%	Max ratio:100:1
		Freq.	--	2	--	KHz	(2)
ON/OFF Control	Von	Normal Operation	2	-----	5	V	
	Voff	Normal Operation	0	-----	0.8	V	
Output Voltage	Vout	PWM=100%	39.2	40.2	41.3	V	J3
			39.4	40.5	41.8	V	J7, J8
Efficiency	η	PWM=100%	87.7	90.5	94.4	%	(3)

Remark:
(1) this data is based on the testing result of practical input voltage, Iin is measured by related Vin.(min, typ, max)
(2) Frequency can be adjusted in accordance with demand(120Hz minimum, or lights will be flickering)

(3) $\eta_{max} = V_{out(max)} \times I_{outH(max)} / V_{in(max)} \times I_{inH(min)}$
$\eta_{min} = V_{out(min)} \times I_{outH(min)} / V_{in(min)} \times I_{inH(max)}$

4.2 Connector Socket

Input Connector: CN1(JST B10B-PH-K-S or Compatible)

PIN No	Symbol	Description
1	Vin	DC+
2	Vin	DC+
3	Vin	DC+
4	Vin	DC+
5	Vin	DC+
6	GND	Ground
7	GND	Ground
8	GND	Ground
9	GND	Ground
10	GND	Ground

Input Connector :CN2(JST B3B-PH-K-S or Compatible)

PIN No	Symbol	Description
1	Control	ON/OFF Control
2	Brightness	Brightness Control
3	GND	Ground

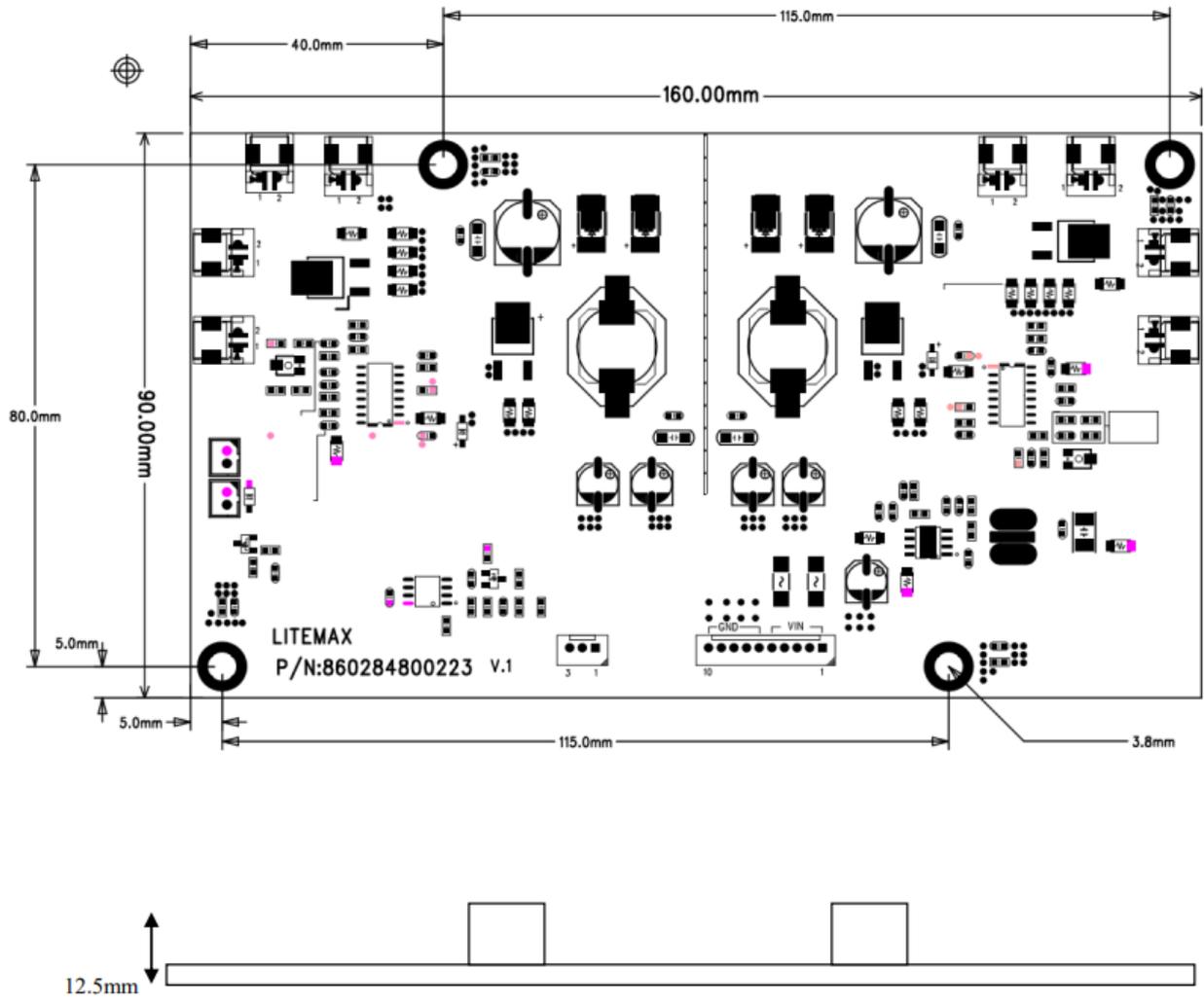**Output Connector: J1,J2,J3,J4.J5.J6,J7,J8 (JST B2B-EH-TS or Compatible)**

PIN NO	Symbol	Description
1	Output	LED High Voltage (+)
2	Output	LED Low Voltage (-)

Output Connector: H133,H134 (JST S2B-PH-K-S or Compatible)

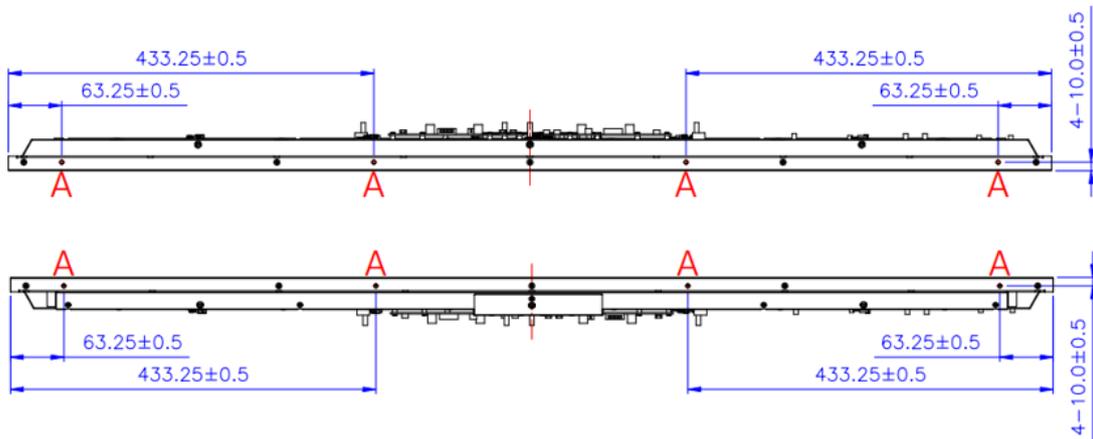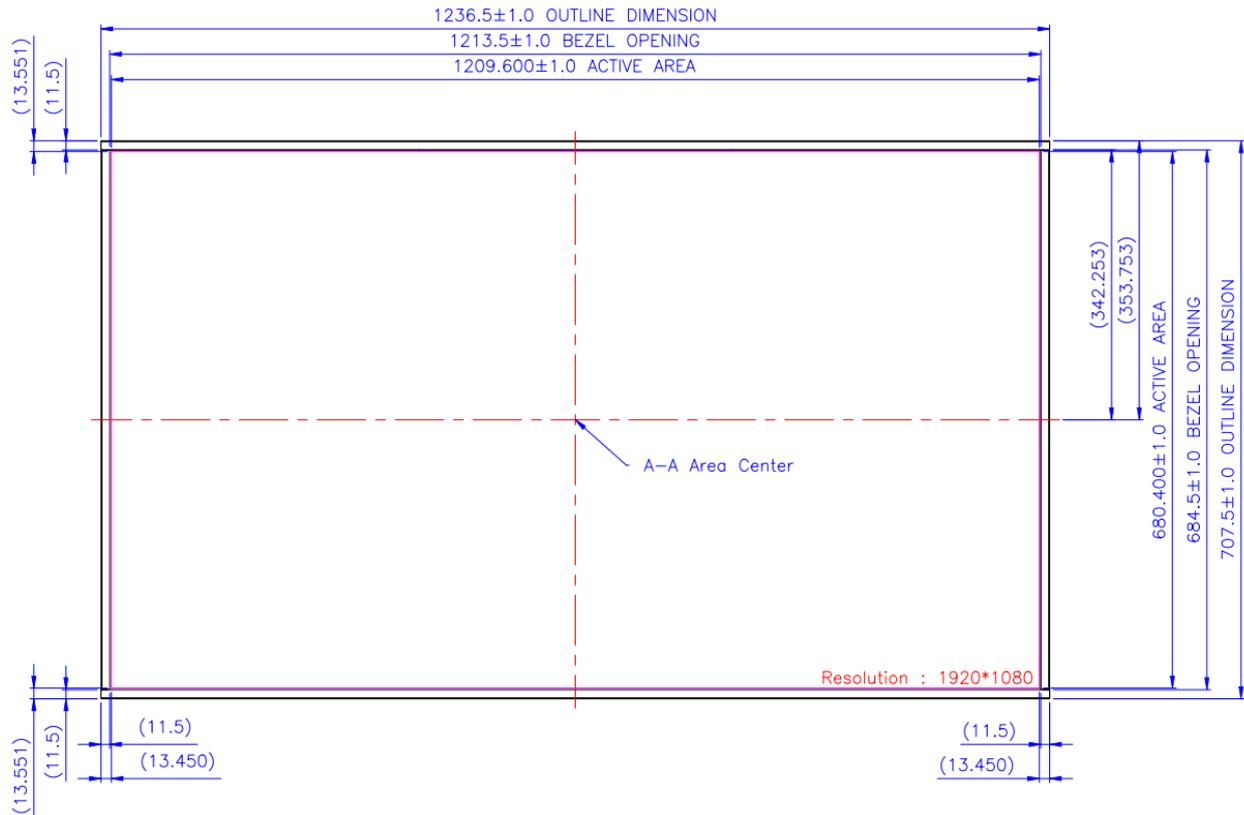| PIN NO	Symbol	Description
1	Output	Fan (+)
2	Output	Fan (-)

4.3 Mechanical Characteristics

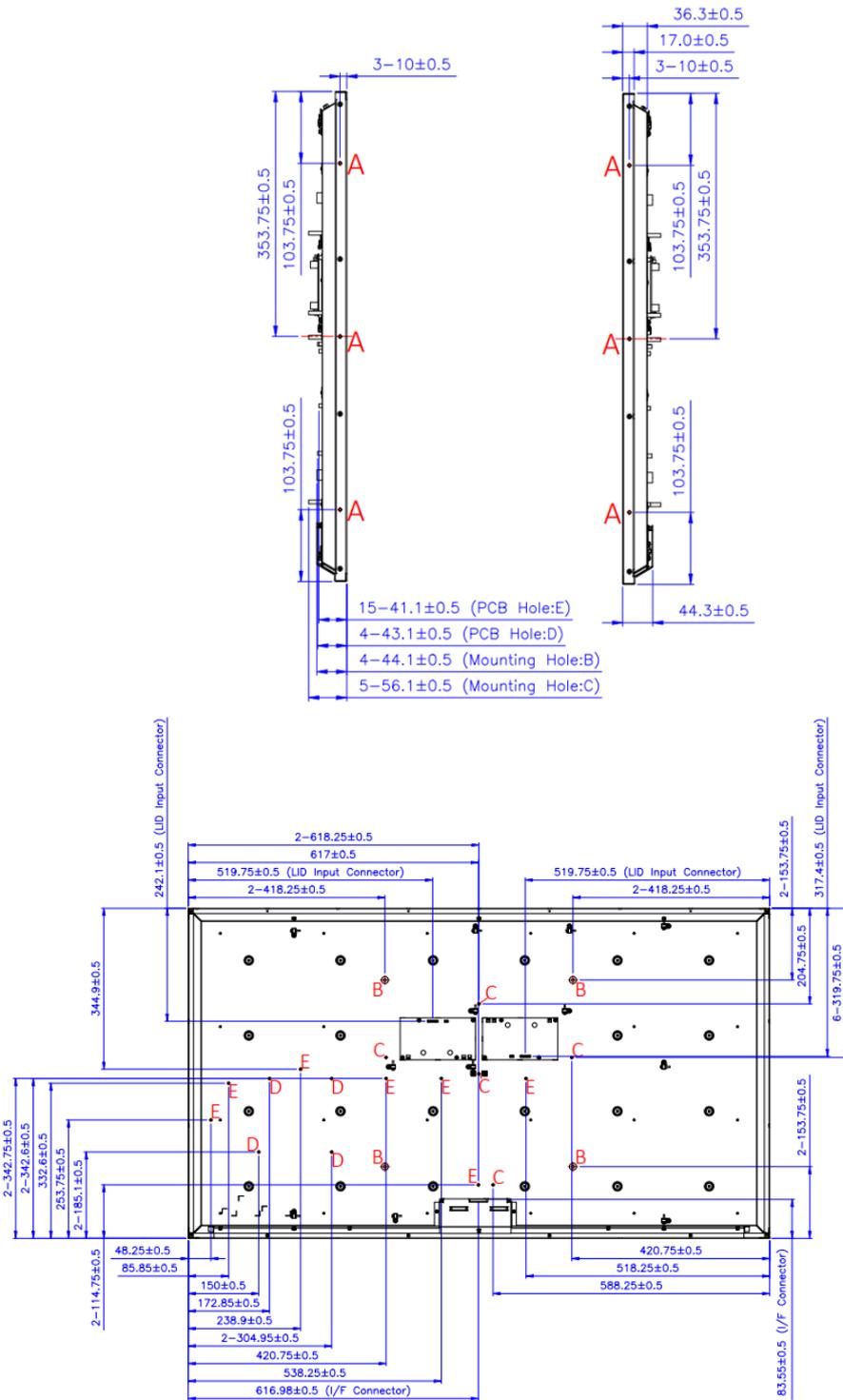Dimension: 160 x 90 x 12.5mm

5   Mechanical Drawing

Unit:mm

A	M4 MOUNTING HOLE (14X), DP=6.0mm MAX, TORQUE=8.0kgf-cm MAX

B	M6 MOUNTING HOLE (4X), DP=6.0mm MAX, TORQUE=25.0kgf-cm MAX
C	M3 MOUNTING HOLE (5X), DP=10.0mm MAX, TORQUE=5.0kgf-cm MAX
D	M3 PCB HOLE (4X), DP=4.5mm MAX, TORQUE=5.0kgf-cm MAX
E	M3 PCB HOLE (7X), DP=3.5mm MAX, TORQUE=5.0kgf-cm MAX

Note:
1.Resolution:1920x1080
2."( )" marks the reference dimension.
3.M3 max torque:5kgf-cm

6 Precautions

6.1 Handling and Mounting Precautions

(1) The module should be assembled into the system firmly by using every mounting hole. Do not apply rough force such as bending or twisting to the LCD during assembly.

(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 LCD module.

(3) While assembling or installing LCD modules, it can only be in the clean area. The dust and oil may cause electrical short or damage the polarizer.

(4) Use fingerstalls or soft gloves in order to keep display clean during the incoming inspection and assembly process.

(5) Do not press or scratch the surface harder than a HB pencil lead on the panel because the polarizer is very soft and easily be scratched.

(6) Please attach the surface transparent protection film to the surface in order to protect the polarizer. Transparent protection film should have sufficient strength in order to the resist external force.

(7) When the transparent 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.

(8) If the surface of the polarizer is dirty, please clean it by some absorbent cotton or soft cloth. Do not use Ketone type materials (ex. Acetone), Ethyl alcohol, Toluene, Ethyl acid or Methyl chloride. It might permanently damage the polarizer due to chemical reaction.

(9) Wipe off water droplets or oil immediately. Staining and discoloration may occur if they left on panel for a long time.

(10) If the liquid crystal material leaks from the panel, it should be kept away from the eyes or mouth. In case of contacting with hands, legs or clothes, it must be washed away thoroughly with soap.

(11) Protect the LCD module from static electricity, it may cause damage to the C-MOS Gate Array IC.

(12) Do not disassemble the module.

(13) Do not pull or fold the lamp wire.

(14) Pins of I/F connector should not be touched directly with bare hands.

6.2 Storage Precautions

(1) High temperature or humidity may reduce the performance of LCD module. Please store LCD module within the specified storage conditions.

(2) If possible store them in a dark place. Do not expose the module to sunlight or fluorescent light. Keep the temperature between 5℃ and 35℃ at normal humidity.

(3) It is dangerous that moisture come into or contacted the LCD module, because the moisture may damage LCD module when it is operating.

(4) 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.

6.3 Operation Precautions

(1) Do not pull the I/F connector in or out while the LCD module is operating.

(2) Always follow the correct power on/off sequence when LCD module is connecting and operating. This can prevent the CMOS LSI chips from damage during latch-up.

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

(4) Brightness depends on the temperature. (In lower temperature, it becomes lower.)

(5) 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.

(6) Module has high frequency circuits. Sufficient suppression to the electromagnetic interference shall be done by system manufacturers. Grounding and shielding methods are very important to minimize the interference.

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

(8) 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) Do not display the fixed pattern for a long time because it may cause image sticking.

(10) In order to prevent image sticking, periodical power-off or screen save is needed after fixed pattern long time display.

(11) Black image or moving image is strongly recommended as a screen save.

(12) Static information display recommended to use with moving image. Cycling display between 10 minutes' information (static) display and 10 seconds' moving image.

(13) Background and character (image) color change is recommended. Use different colors for background and character, respectively. And change colors themselves periodically.

(14) LCD system is required to place in well-ventilated environment. Adapting active cooling system is highly recommended.

(15) Product reliability and functions are only guaranteed when the product is used under right operation usages.

(16) If product will be used in extreme conditions, such as high temperature/ humidity, shock and vibration it is strongly recommended to contact LiteMax for filed application engineering advice. Otherwise, its reliability and function may not be guaranteed. Extreme conditions are commonly found at airports, transit stations, taxi-top, in vehicle and controlling systems.

7 Disclaimer

All information in this document are subject to change, please constant LiteMax for any new design.