

SPECIFICATION OF LCD MODULE

MODULE NO.: HL173T04-01

Customer Approval:

☐ Accept

☐ Reject

	SIGNATURE	DATE
PREPARED BY		
CHECKED BY		
APPROVED BY		

DOCUMENT REVISION HISTORY

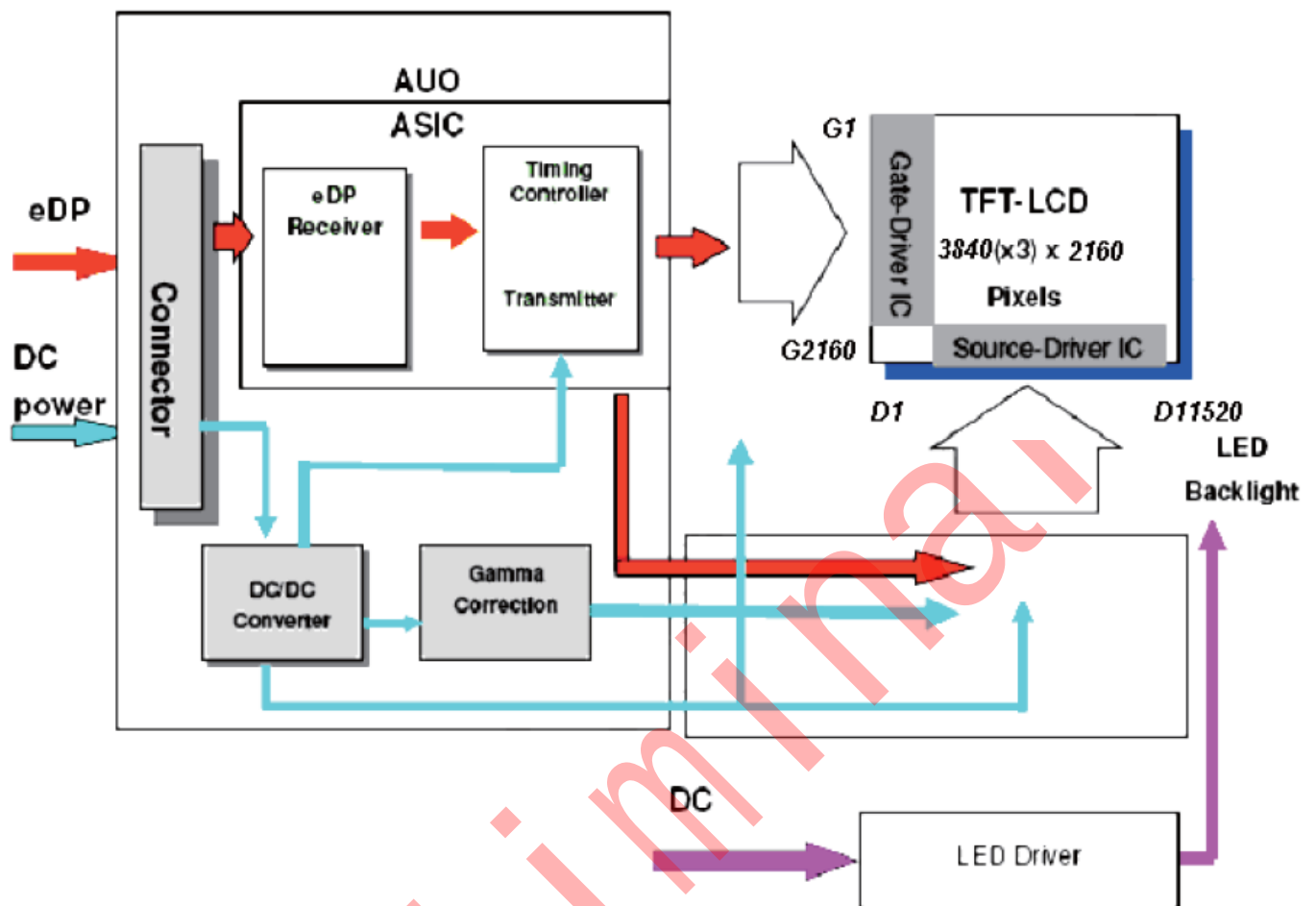
Sample Version	Doc. Version	DATE	DESCRIPTION	CHECKED BY
A1	A1	2021-4-25	First Release.	

1. MECHANICAL SPECIFICATIONS:

ITEM	SPECIFICATION	UNIT
OUTLINE DIMENSIONS	412.85(W) X266.39(H) X14.4(D)	mm
DISPLAY SIZE	17.3	inch
PIXEL PITCH	99.45X99.45	um
NUMBER OF DOTS	3840* (RGB) *2160	-
DISPLAY COLORS	16.7M(8bit)	-
PIXEL ARRANGEMENT	Pixels RGB stripes arrangement	-
DISPLAY MODE	Transmissive mode, normally black	-
SURFACE TREATMENT	Advanced Anti-glare treatment of the front polarizer (3H)	-

***See attached drawing for details.**

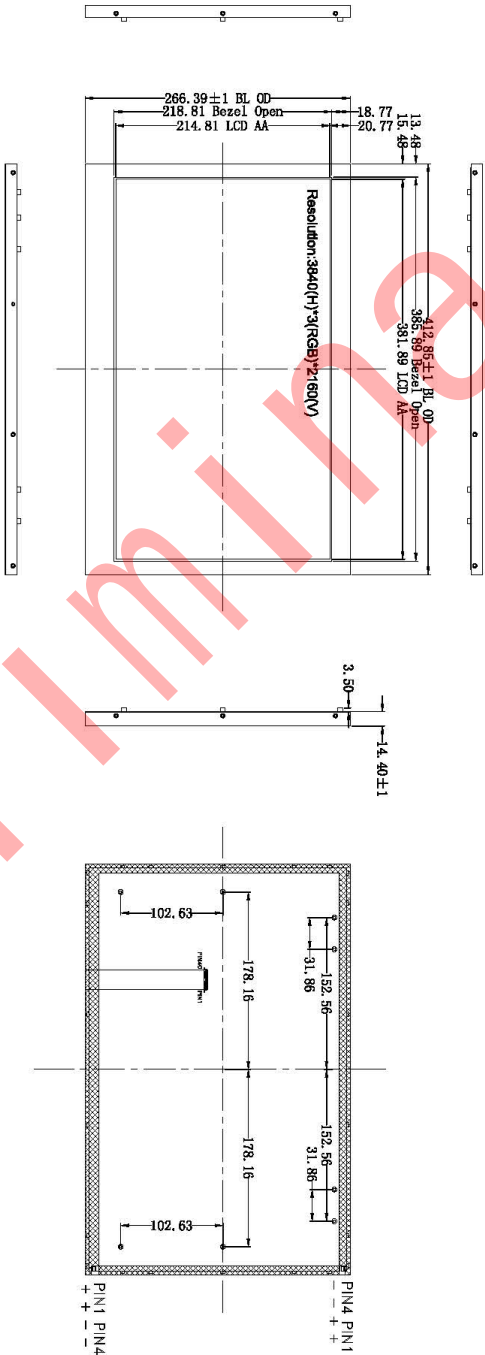
2.BLOCK DIAGRAM:



3.DIMENSIONAL

Display Type	17.3" TFT-LCD transmissive, normal black
Display Resolution	3840(RGB)*2160(V)
Interface	eDP
Logic Voltage	3.3V
Operation Temperature	0°C TO 50°C
Storage Temperature	-20°C TO 60°C
Remark	Connector on BL: JST SHR-04V-S

12.0	Modify outline	20220316	HL 海罗光电有限公司 HL173T04	
11.0	Modify outline	20210729		
10.0	Modify BL pin order	20200110		
9.0	Modify BL pin map	20191217		
8.0	Modify BL pin map	20191216		
7.0	Modify BL pin map	20191216	CHECKED	
MARK REV.		DATE	APPROVED	
CONTENTS MODIFIED				



4. INTERFACE:

4.1 PIN MAP

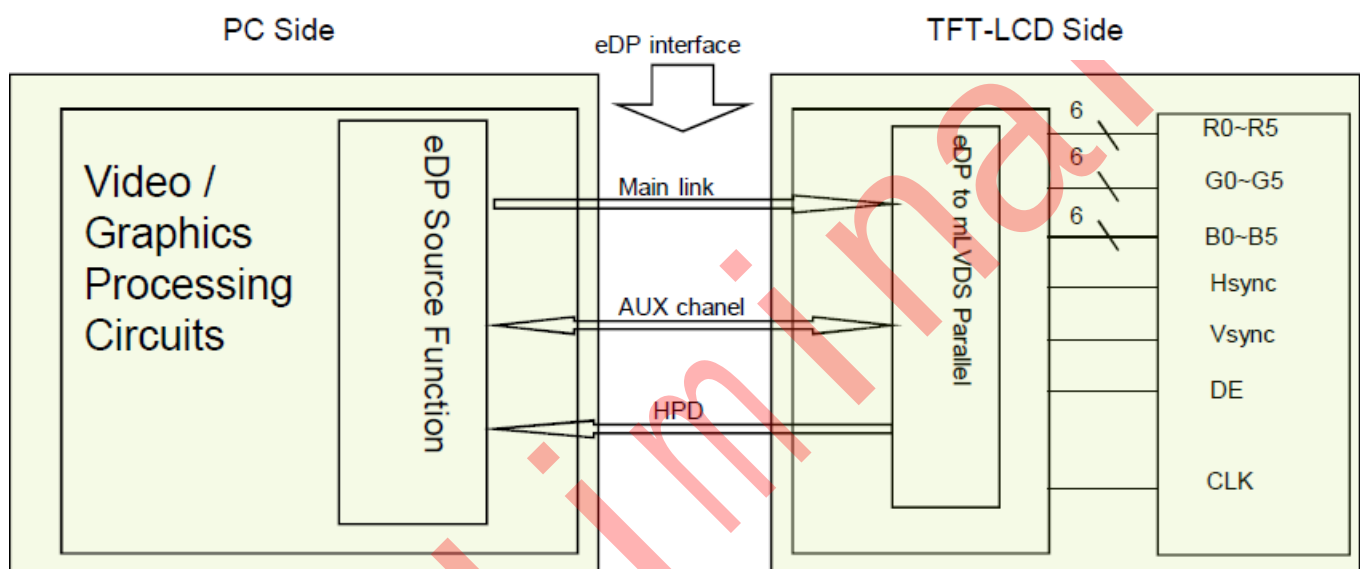
LCD Connector : IPEX 20453-240T-03 or Equivalent

Housing : IPEX 20455-040E-76

NO.	PIN NAME	Description
1	NC	No connection
2	H_GND	Ground
3	Lane3_N	eDP RX Channel 3 Negative
4	Lane3_P	eDP RX Channel 3 Positive
5	H_GND	Ground
6	Lane2_N	eDP RX Channel 2 Negative
7	Lane2_P	eDP RX Channel 2 Positive
8	H_GND	Ground
9	Lane1_N	eDP RX Channel 1 Negative
10	Lane1_P	eDP RX Channel 1 Positive
11	H_GND	Ground
12	Lane0_N	eDP RX Channel 0 Negative
13	Lane0_P	eDP RX Channel 0 Positive
14	H_GND	Ground
15	AUX_CH_P	eDP AUX CH Positive
16	AUX_CH_N	eDP AUX CH Negative
17	H_GND	Ground
18	LCD_VCC	Power Supply, 3.3V (Typ.)
19	LCD_VCC	Power Supply, 3.3V (Typ.)
20	LCD_VCC	Power Supply, 3.3V (Typ.)
21	LCD_VCC	Power Supply, 3.3V (Typ.)
22	LCD Self Test	No connection
23	LCD_GND	Ground
24	LCD_GND	Ground
25	LCD_GND	Ground
26	LCD_GND	Ground
27	HPD	Hot Plug Detect Output
28	NC	No connection
29	NC	No connection
30	NC	No connection
31	NC	No connection
32	NC	No connection

33	NC	No connection
34	NC	No connection
35	NC	No connection
36	NC	No connection
37	NC	No connection
38	NC	No connection
39	NC	No connection
40	NC	No connection

4.2 EDP INTERFACE

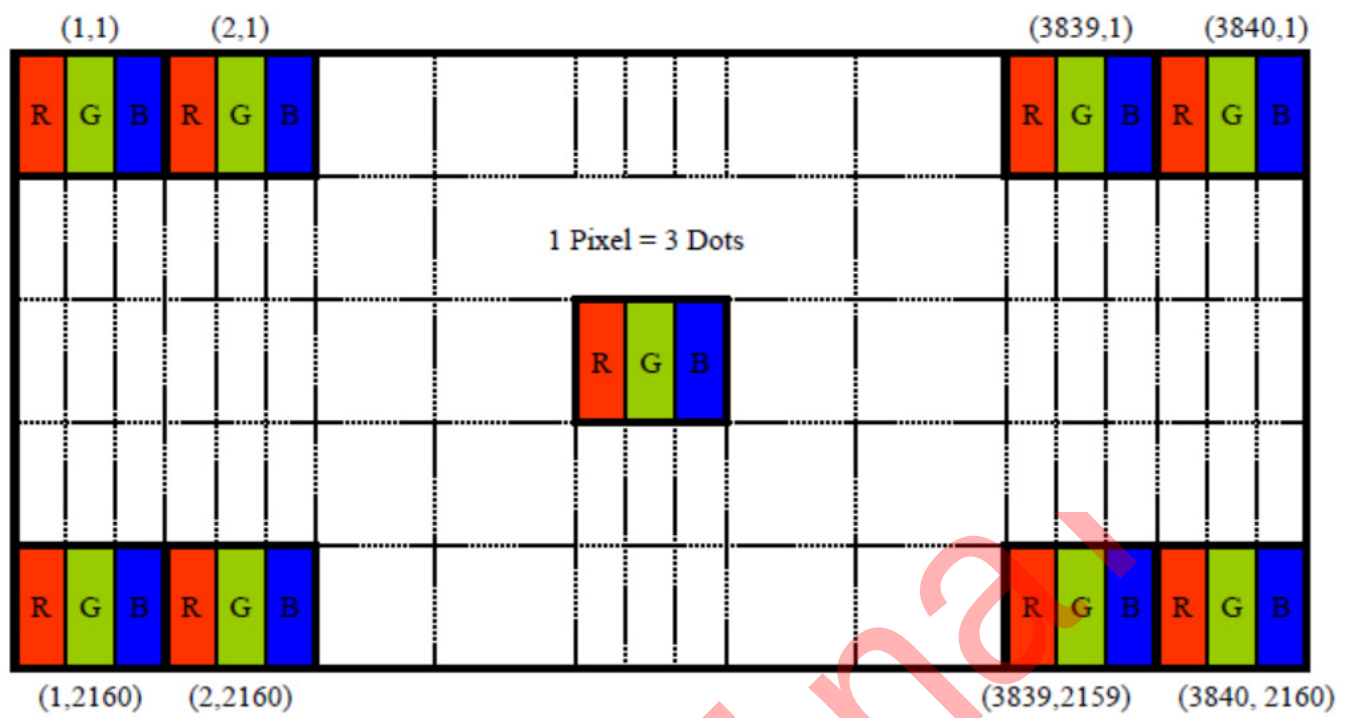


Note. Transmitter : NT71871C or equivalent.
Transmitter is not contained in Module

eDP input signal

Lane 0	Lane 1	Lane 2	Lane 3
R0-7:0	R1-7:0	R2-7:0	R3-7:0
G0-7:0	G1-7:0	G2-7:0	G3-7:0
B0-7:0	B1-7:0	B2-7:0	B3-7:0
R4-7:0	R5-7:0	R6-7:0	R7-7:0
G4-7:0	G5-7:0	G6-7:0	G7-7:0
B4-7:0	B5-7:0	B6-7:0	B7-7:0
R8-7:0	R9-7:0	R10-7:0	R11-7:0
G8-7:0	G9-7:0	G10-7:0	G11-7:0
B8-7:0	B9-7:0	B10-7:0	B11-7:0

Data input format



5. MAXIMUM ABSOLTE LIMIT:

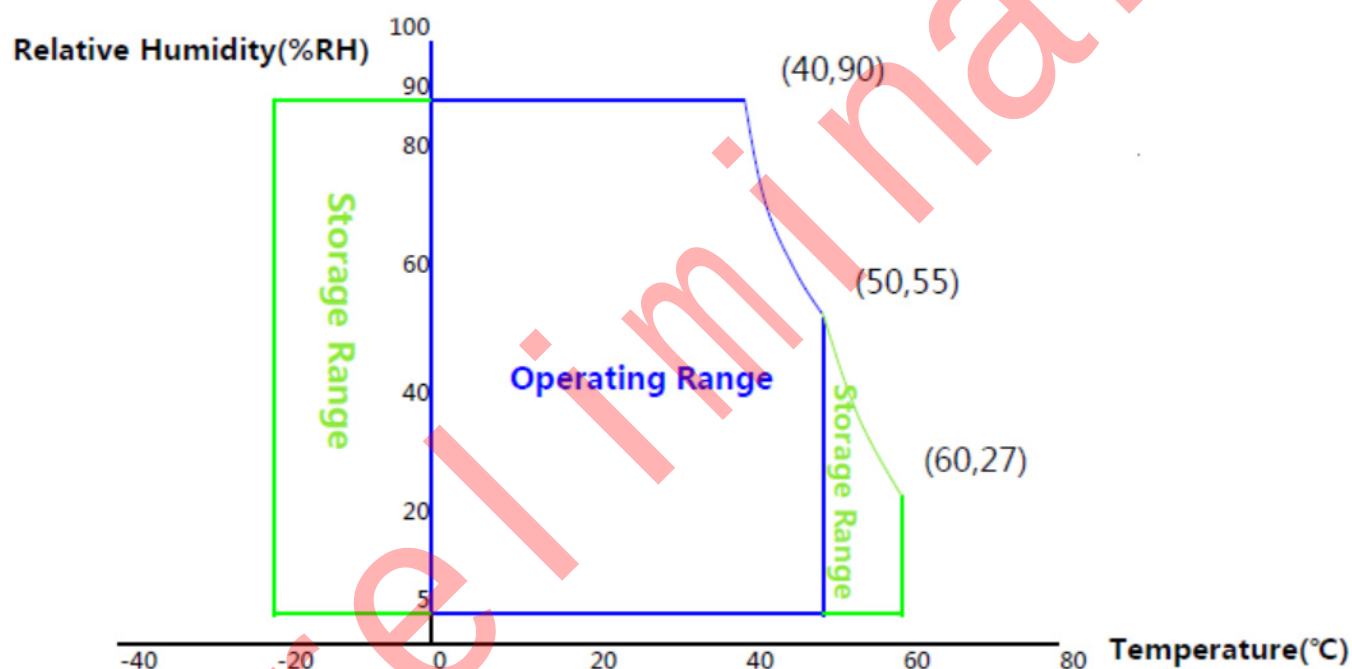
Item	Symbol	Value	Unit
Power supply voltage	LCD_VCC	GND-0.3 ~ 4	V
eDP input voltage	Vedp	0 - 2	V
Operating temperature	Topr	0 to 50	°C
Storage temperature	Tstg	-20 to 60	°C(3)

Notes :

1. Permanent damage to the device may occur if maximum values are exceeded functional operation should be restricted to the condition described under normal operating conditions.

2. Temperature and relative humidity range are shown in the figure below.

90 % RH Max. ($40^{\circ}\text{C} \geq T_a$) Maximum wet - bulb temperature at 39°C or less. ($T_a > 40^{\circ}\text{C}$) No condensation.



6.ELECTRICAL CHARACTERISTICS

6.1 DC Characteristics (Ta=25°C)

Item	Symbol	Min	Type	Max	Unit
Voltage of power supply	LCD_VCC	3.0	3.3	3.6	V
Permissive Power Input Ripple	Vrf	-10%VCC	90	+10%VCC	V
Rush Current	I _{RUSH}	-	-	2	A
LCD Power Supply Input Current	Mosaic	-	-	485	mA
	RGB	-	-	606	mA
LCD power consumption	Mosaic	-	-	1.9	W
	RGB	-	-	2.0	W

Notes :

1. The supply voltage is measured and specified at the interface connector of LCM.

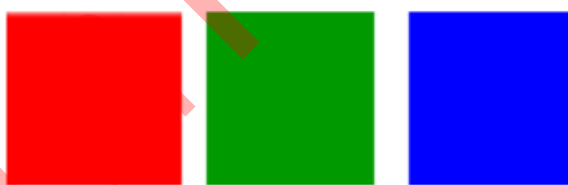
The current draw and power consumption specified is for 3.3V at 25 °C.

a) Mosaic pattern 8*8

b) R/G/B patterns



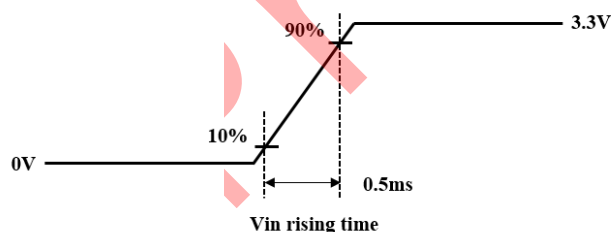
(a)



(b)

2. Calculated value for reference ($V_{LED} \times I_{LED}$)

3. Measure condition



6.2 Backlight Electrical-optical Characteristics

Item	Symbol	MIN	TYP	MAX	UNIT	Test Condition	Note
Supply Voltage	Vf		68.2	70.4	V		-
Supply Current	If	-	700	-	mA	-	2string total
Reverse Voltage	Vr	-	-	5	V	10uA	
Power dissipation	Pd	-	47.74	-	W	-	
Uniformity for LCM	-	80	-	-	%		-
Life Time	-	30000	-	-	Hr		-
Backlight Color	White						

NOTE:

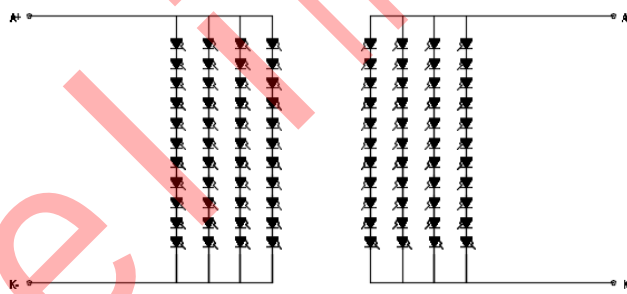
1. Average Luminous Intensity of P1-P9
2. Uniformity = Min/Max * 100%
3. LED life time defined as follows: The final brightness is at 70% of original brightness

Measured Method: (X*Y: Light Area)(Left Draft as follow)

Internal Circuit Diagram(Right Draft as follow)

(Effective spatial Distribution)

Hole Diameter ø 3mm ; 1 to 9 per Position Measured Luminous:



4. BL connector: JST SHR-04V-S

7 TIMING

7.1 Timing characteristics

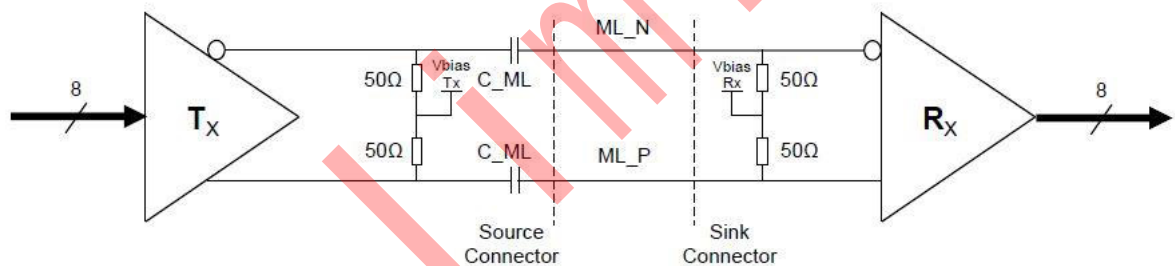
The HL173T04-01 is operated by the DE only

Item		Symbols	Min	Typ	Max	Unit
Clock	Frequency	1/Tc	355.52	533.25	586.6	MHz
	High Time	Tch	-	4/7	-	Tc
	Low Time	Tcl	-	3/7	-	Tc
Frame Period		Tv	3900	4000	4050	lines
			-	60	-	Hz
			25	16.7	15.15	ms
Vertical Display Period		Tvd	-	2160	-	lines
One line Scanning Period		Th	2180	2222	2240	clocks
Horizontal Display Period		Thd	-	3840	-	clocks

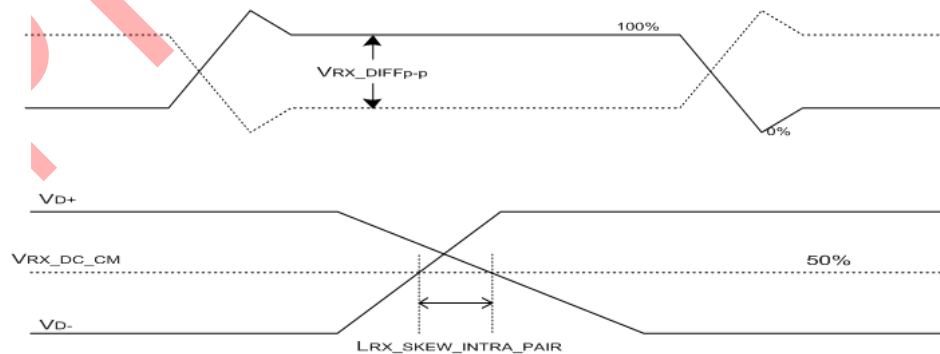
Note : The above is as optimized setting.

7.2 eDP Rx Interface Timing Parameter

Item	Symbol	Min	Typ	Max	Unit	Remark
Spread spectrum clock (Link clock down-spreading)	SSC	-	0.5		%	
Differential peak-to-peak input voltage at package pins	VRX-DIFFp-p	120	-	-	mV	
Rx input DC common mode voltage	VRX_DC_CM	0	-	2.0	V	
Differential termination resistance	RRX-DIFF	72.3	85	97.8	Ω	
Single-ended termination resistance	RRX-SE	36.15	42.5	48.9	Ω	
Rx short circuit current limit	IRX_SHORT	-	-	50	mA	
Intra-pair skew at Rx package pins (HBR) RX intra-pair skew tolerance at HBR	LRX_SKEW_ INTRA_PAIR	-	-	60	ps	
AC Coupling Capacitor	CSOURCE_ML	75		200	nF	Source side



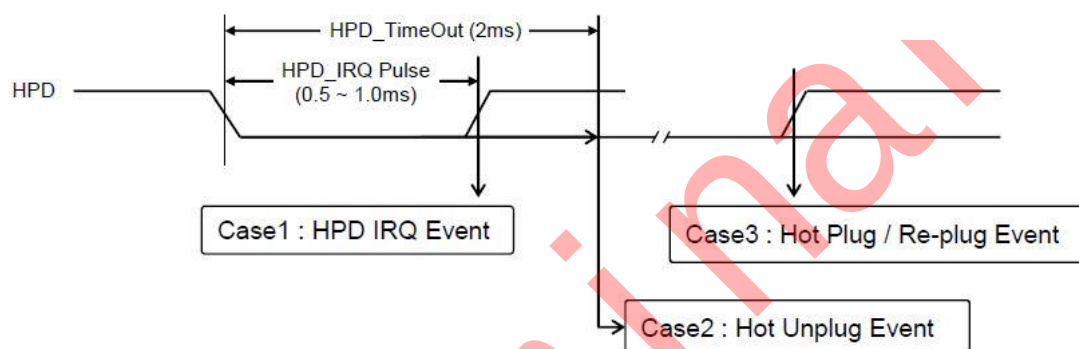
Main link differential pair



VRX-DIFFp-p & LRX_SKEW_INTRA_PAIR

Item	Symbol	Min	Typ	Max	Unit	Remark
HPD voltage	V _{HPD}	2.25	-	3.6	V	
Hot Plug Detection Threshold	-	2.0	-	-	V	Source side Detecting
Hot Unplug Detection Threshold	-	-	-	0.8V	V	
HPD_IRQ Pulse Width	HPD_IRQ	0.5	-	1	ms	
HPD_TimeOut	-	2.0	-	-	ms	

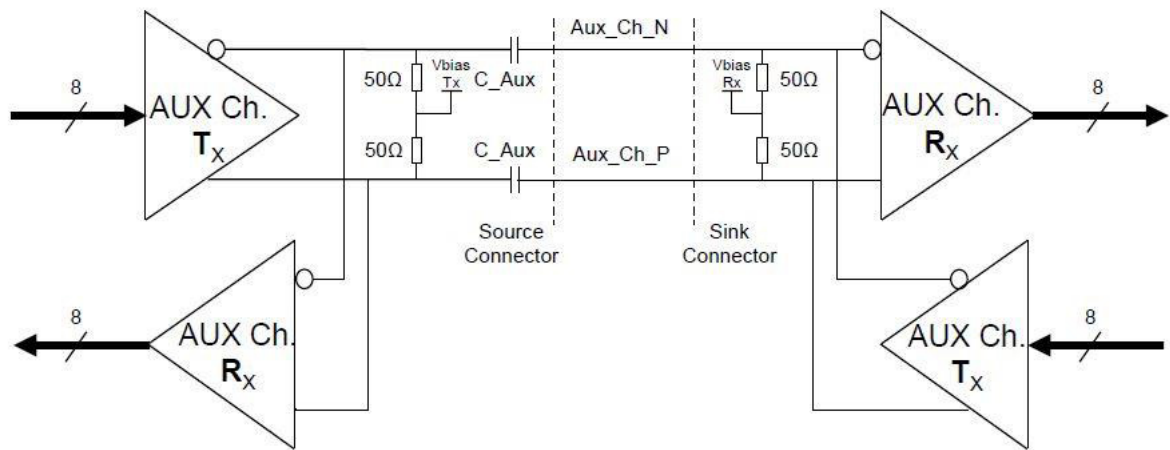
HPD Characteristics



HPD Events

Item	Symbol	Min	Typ	Max	Unit	Remark
AUX unit interval	UI _{AUX}	0.4	0.5	0.6	Us	
AUX peak-to-peak input differential voltage	VAUX-RX-DIFFp-p	0.29	-	1.38	V	
AUX CH termination DC resistance	RAUX-TERMIN	80	100	120	Ohm	
AUX DC common mode voltage	VAUX-DC-CM	0	-	2	V	
AUX turn around common mode voltage	VAUX-TURN-CM	-	-	0.3	V	
AUX short circuit current limit	IAUX-SHORT	-	-	90	mA	
AUX AC Coupling Capacitor	CSOURCE-AUX	75	-	200	nf	Source side

AUX Characteristics



AUX differential pair

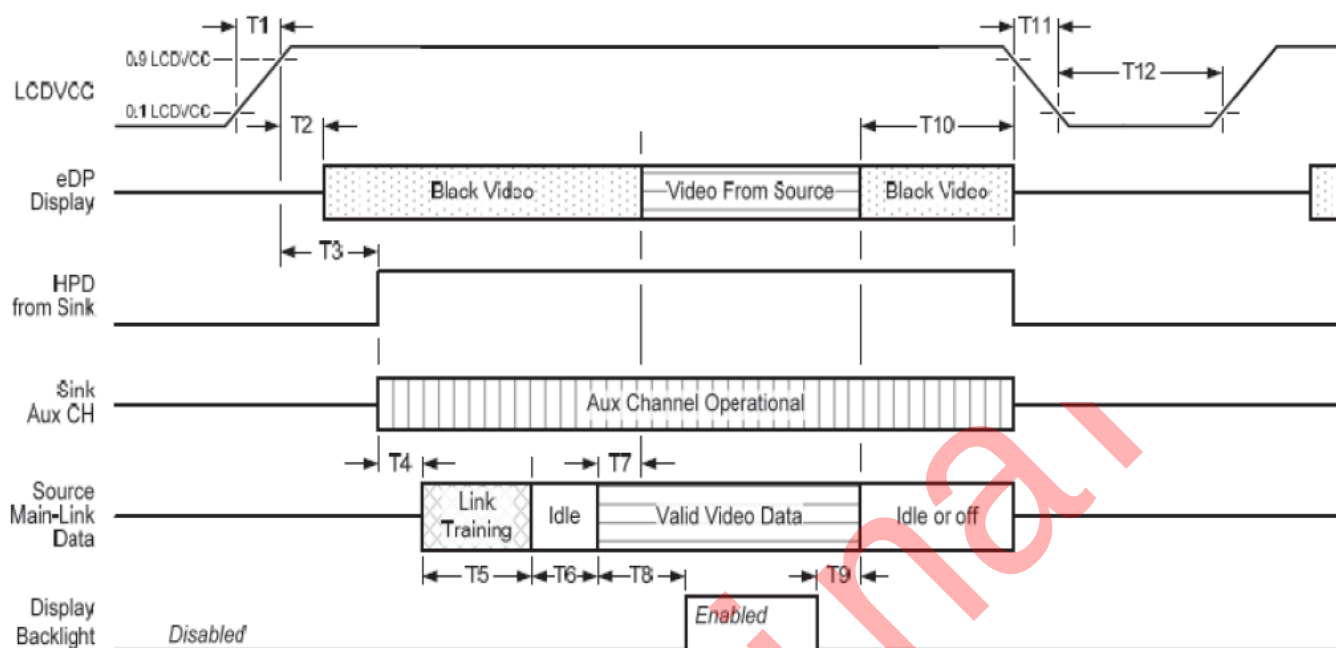
preliminary

7.3 INPUT SIGNALS, BASIC DISPLAY COLORS & GRAY SCALE OF COLORS

Color & Gray Scale		Input Data Signal																								
		Red Data								Green Data								Blue Data								
		R7	R6	R5	R4	R3	R2	R1	R0	G7	G6	G5	G4	G3	G2	G1	G0	B7	B6	B5	B4		B2	B1	B0	
Basic Colors	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	
	Blue	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	
	Green	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	
	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	
	Red	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	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	
Gray Scale of Red	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	
	△	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	Darker	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	△	↑								↑								↑								
	▽	↓								↓								↓								
	Brighter	1	1	1	1	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	▽	1	1	1	1	1	1	1	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	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gray Scale of Green	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	
	△	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	
	Darker	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	
	△	↑								↑								↑								
	▽	↓								↓								↓								
	Brighter	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	0	1	0	0	0	0	0	0	0	0
	▽	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0
	Green	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0
Gray Scale of Blue	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	
	△	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	
	Darker	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	
	△	↑								↑								↑								
	▽	↓								↓								↓								
	Brighter	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	0	1
	▽	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0
	Blue	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1
Gray Scale of White	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	
	△	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	
	Darker	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	
	△	↑								↑								↑								
	▽	↓								↓								↓								
	Brighter	1	1	1	1	1	1	0	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	0	1	
	▽	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	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	

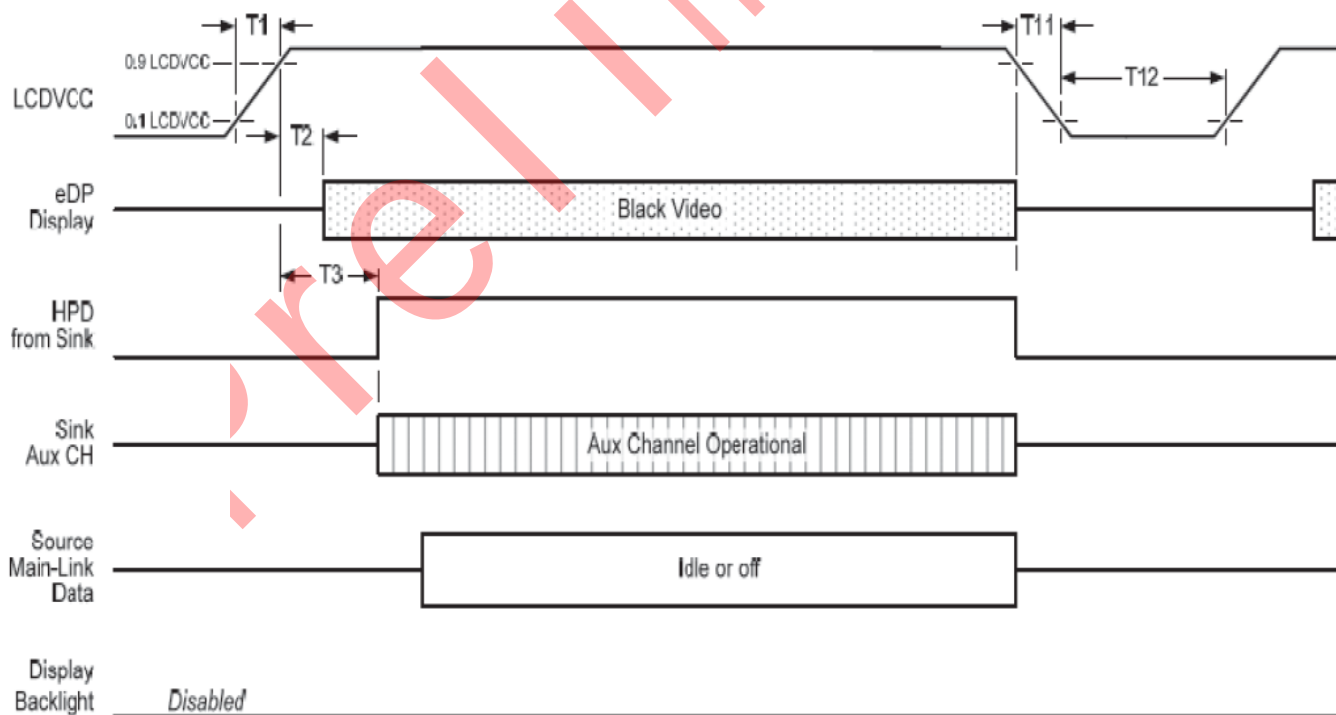
7.4 Power Sequence

Display Port panel power sequence:



Display port interface power up/down sequence, normal system operation

Display Port AUX_CH transaction only:



Display port interface power up/down sequence, AUX_CH transaction only

Timing parameter	Description	Reqd. by	Limits			Notes
			Min.	Typ.	Max.	
T1	power rail rise time, 10% to 90%	source	0.5ms		10ms	
T2	delay from LCDVDD to black video generation	sink	0ms		200ms	prevents display noise until valid video data is received from the source
T3	delay from LCDVDD to HPD high	sink	0ms		200ms	sink AUX_CH must be operational upon HPD high.
T4	delay from HPD high to link training initialization	source				allows for source to read link capability and initialize.
T5	link training duration	source				dependant on source link to read training protocol.
T6	link idle	source				Min accounts for required BS-Idle pattern. Max allows for source frame synchronization.
T7	delay from valid video data from source to video on display	sink	0ms		50ms	max allows sink validate video data and timing.
T8	delay from valid video data from source to backlight enable	source				source must assure display video is stable.
T9	delay from backlight disable to end of valid video data	source				source must assure backlight is no longer illuminated.
T10	delay from end of valid video data from source to power off	source	0ms		500ms	
T11	power rail fall time, 90% to 10%	source			10ms	
T12	power off time	source	500ms			

Note1: The sink must include the ability to generate black video autonomously. The sink must automatically enable black video under the follow conditions:

- upon LCDVDD power on(with in T2 max)-when the "Novideostream_Flag"(VB-ID Bit 3) is received from the source(at the end of T9)
- when no main link data, or invalid video data, is received from the source. Black video must be displayed within 64ms (typ) from the start of either condition. Video data can be deemed invalid based on MSA and timing information, for example.

Note2: The sink may implement the ability to disable the black video function, as described in Note 1, above, for system development and debugging purpose.

Note3: The sink must support AUX_CH polling by the source immediately following LCDVDD power on without causing damage to the sink device (the source can re-try if the sink is not ready). The sink must be able to respond to an AUX_CH transaction with the time specified within T3 max.

8. OPTICAL CHARACTERISTICS:

Driving the backlight

No.	ITEM		Symbol	Conditions	Specification			Unit	Note
					Min	Typ	Max		
1	Response Time		Tg	25℃	-	25	-	ms	(1)(2)
2	Contrast Rate		Cr	θ=0, Normal viewing angle	800	1000	-	-	(1)(3)
3	Viewing Angle	Hor.	θL + θR	CR>10	170	178	-	Deg	-
		Ver.	θ+ + θ-		170	178	-		
4	Chromaticiry	White	x	Brightness is ON	Typ – 0.03	TBD	Typ+0.03		
			y			TBD			
		Red	x			TBD			
			y			TBD			
		Green	x			TBD			
			y			TBD			
		Blue	x			TBD			
			y						
5	luminance		L		1000	1500	-	cd/m2	
6	Color Gamut				-	100	-	%	DCI P3
7	White Variation		δ W		80			%	

Measure Conditions:

1. Measure surrounding : dark room;
2. Ambient temperature: 25±2°C;
3. 30min.warm-up time.

Note

1. Viewing angle is the angle at which the contrast ratio is greater than 10. The viewing are determined for the horizontal or 3, 9 o' clock direction and the vertical or 6, 12 o' clock direction with respect to the optical axis which is normal to the LCD surface.
2. Contrast measurements shall be made at viewing angle of = 0° and at the center of the LCD surface. Luminance shall be measured with all pixels in the view field set first to white, then to the dark (black) state. Luminance Contrast Ratio (CR) is defined mathematically.

$$CR = \frac{\text{Luminance when displaying a white raster}}{\text{Luminance when displaying a black raster}}$$

3. Center Luminance of white is defined as the LCD surface. Luminance shall be measured with all pixels in the view field set first to white. This measurement shall be taken at the locations shown in FIGURE 2 for a total of the measurements per display.

4. The White luminance uniformity on LCD surface is then expressed as :

$$\Delta Y = (\text{Minimum Luminance of 9points} / \text{Maximum Luminance of 9points}) * 100$$

5. The color chromaticity coordinates specified shall be calculated from the spectral data measured with all pixels first in red, green, blue and white. Measurements shall be made at the center of the panel.

6. Response time T_g is the average time required for display transition by switching the input signal as below table and is based on Frame rate $f_V = 60\text{Hz}$ to optimize.

7. Cross-Talk of one area of the LCD surface by another shall be measured by comparing the luminance (YA) of a 25mm diameter area, with all display pixels set to a gray level, to the luminance (YB) of that same area when any adjacent area is driven dark.

9. GENERAL PRECAUTIONS

9.1 Handling

- (a) When the module is assembled, it should be attached to the system firmly using all mounting holes. Be careful not to twist and bend the module.
- (b) Because the inverter uses high voltages, it should be disconnected from power source before it is assembled or disassembled.
- (c) Refrain from strong mechanical shock and / or any force to the module. In addition to damage, it may cause improper operation or damage to the module and CCFT back light.
- (d) Note that polarizer films are very fragile and could be damaged easily. Do not press or scratch the surface harder than a HB pencil lead.
- (e) Wipe off water droplets or oil immediately. If you leave the droplets for a long time, staining or discoloration may occur.
- (f) If the surface of the polarizer is dirty, clean it using absorbent cotton or soft cloth.
- (g) Desirable cleaners are water, IPA (Isopropyl Alcohol) or Hexane. Do not use Ketone type materials (ex. Acetone), Ethyl alcohol, Toluene, Ethyl acid or Methyl chloride. It might cause permanent damage to the polarizer due to chemical reaction.
- (h) If the liquid crystal material leaks from the panel, it should be kept away from the eyes or mouth. In case of contact with hands, legs or clothes, it must be washed away with soap thoroughly.
- (i) Protect the Module from static, or the CMOS Gate Array IC would be damaged.
- (j) Use finger-stalls with soft gloves in order to keep display clean during the incoming inspection and assembly process.
- (k) Do not disassemble the Module.
- (l) Do not pull or fold the lamp wire.
- (m) Do not adjust the variable resistor located on the Module.
- (n) Protection film for polarizer on the Module should be slowly peeled off just before use so that the electrostatic charge can be minimized.
- (o) Pins of I/F connector should not be touched directly with bare hands.

9.2 Storage

- (a) Do not leave the Module in high temperature, and high humidity for a long time. It is highly recommended to store the Module with temperature from 0 to 35°C and relative humidity of less than 70%.
- (b) Do not store the TFT-LCD Module in direct sunlight.

- (c) The Module should be stored in a dark place. It is prohibited to apply sunlight or fluorescent light in storing.

9.3 Operation

- (a) Do not connect or disconnect the Module in the "Power On" condition.
- (b) Power supply should always be turned on/off by the item "Power on/off sequence"
- (c) Module has high frequency circuits. Sufficient suppression to the electromagnetic interference should be done by system manufacturers. Grounding and shielding methods may be important to minimize the interference.
- (d) The cable between the back light connector and its inverter power supply should be connected directly with a minimized length. A longer cable between the back light and the inverter may cause lower luminance of lamp(CCFT) and may require higher startup voltage(Vs).

9.4 Operation Condition Guide

- (a) The LCD product should be operated under normal conditions.

Normal condition is defined as below;

- Temperature : $20 \pm 15^{\circ}\text{C}$
- Humidity : $65 \pm 20\%$
- Display pattern : continually changing pattern (Not stationary)

- (b) If the product will be used in extreme conditions such as high temperature, humidity, display patterns or operation time etc., It is strongly recommended to contact SEC for Application engineering advice. Otherwise, its reliability and function may not be guaranteed. Extreme conditions are commonly found at Airports, Transit Stations, Banks, Stock market, and Controlling systems.

9.5 Others

- (a) Ultra-violet ray filter is necessary for outdoor operation.
- (b) Avoid condensation of water. It may result in improper operation or disconnection of electrode.
- (c) Do not exceed the absolute maximum rating value. (supply voltage variation, input voltage variation, variation in part contents and environmental temperature, and so on) Otherwise the Module may be damaged.
- (d) If the Module keeps displaying the same pattern for a long period of time, the image may be "sticked" to the screen. To avoid image sticking, it is recommended to use a screen saver.
- (e) This Module has its circuitry PCB's on the rear side and should be handled carefully in order not to be stressed.

(f) Please contact SEC in advance when you display the same pattern for a long time.

Preliminary

Hello Lighting co., ltd reserves the right to change this specification.
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