Product Specification

E156HVN-701

☐ Preliminary Specifications

■ Final Specifications

Module	15.6" (15.55") FHD 16:9 High Brightness Color TFT-LCD
Model Name	E156HVN-701
Document Version	Rev.01

Customer

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Approved by   Date

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Notice: This Specification is subject to change without notice.

Approved By	Prepared By

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Product Specification

E156HVN-701

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Product Specification

E156HVN-701

1. General Description

E156HVN-701 is a Color Active Matrix Liquid Crystal Display composed of a TFT LCD pane. The screen format is intended to support the 16:9 FHD, 1920(H) x 1080(V) screen and 262k colors (RGB 6-bits data driver) and this module doesn't contain an driver board for backlight. All input signals are eDP(Embedded DisplayPort) interface compatible.

E156HVN-701 is designed for a display unit of notebook style personal computer and industrial machine.

1.1 General Specification

The following items are characteristics summary on the table at 25 ℃ condition:

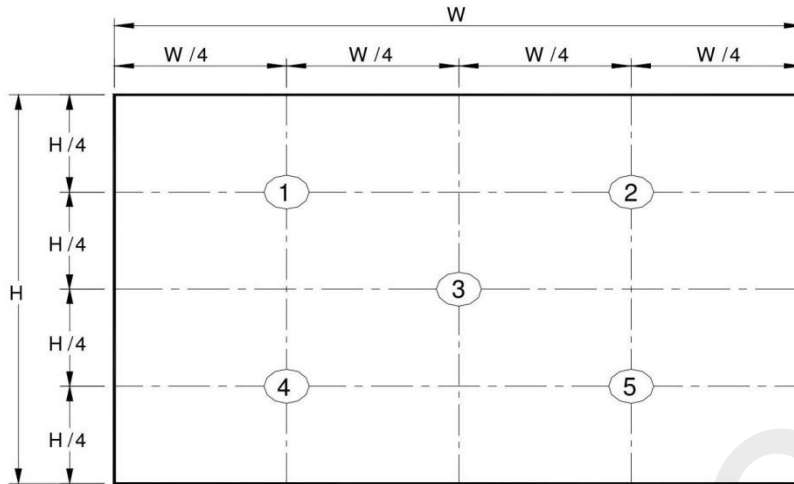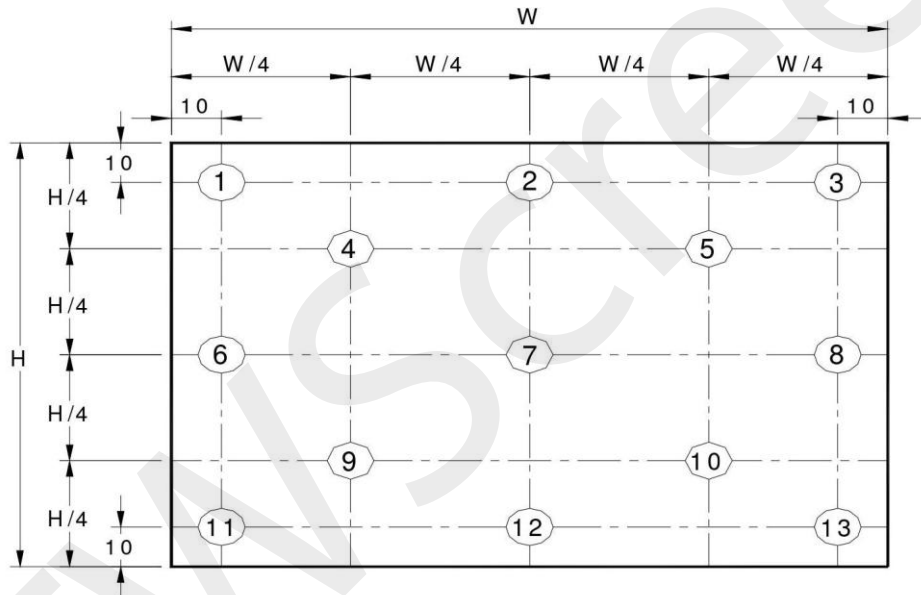| Items	Unit	Specifications			
Screen Diagonal	[mm]	394.9			
Active Area	[mm]	344.16 x 193.59			
Pixels H x V		1920 x 3(RGB) x 1080			
Pixel Pitch	[mm]	0.17925 x 0.17925			
Pixel Format		R.G.B. Vertical Stripe			
Display Mode		Normally Black			
White Luminance (ILED=225mA) **(Note: ILED is LED current)**	[cd/m^2]	700 typ. (Center point) 595 min. (Center point)			
Luminance Uniformity		1.25 max. (5 points)			
Contrast Ratio		700:1 typ			
Response Time	[ms]	25 Typ, 35 max			
Nominal Input Voltage VDD	[Volt]	+3.3 typ.			
Power Consumption	[Watt]	7.03W			
Weight	[Grams]	(350) max.(Without LED Driving Board)			
Physical Size **Include bracket**	[mm]		Min.	Typ.	Max.
		Length	359.00	359.50	360.00
		Width	223.30	223.80	224.30
Thickness		Thickness	3.2 max(Without LED Driving Board)		
Electrical Interface		2 Lane eDP			
Glass Thickness	[mm]	0.4			
Surface Treatment		Anti Glare			
Support Color		262K colors (RGB 6-bit)			
Temperature Range Operating Storage (Non-Operating)	[℃] [℃]	0 to +50 -20 to +60			
RoHS Compliance		RoHS Compliance			

1.2 Optical Characteristics

The optical characteristics are measured under stable conditions at 25℃ (Room Temperature) :

Item	Symbol	Conditions	Min.	Typ.	Max.	Unit	Note
White Luminance ILED=208mA		Center point	595	700	-	cd/m^2	1, 4,.
Viewing Angle	θ_R θ_L	Horizontal (Right) CR = 10 (Left)	80 80	85 85	- -	degree	4, 8
	ψ_H ψ_L	Vertical (Upper) CR = 10 (Lower)	80 80	85 85	- -		
Luminance Uniformity	δ_{5P}	5 Points	-	-	1.25		1, 3, 4
Luminance Uniformity	δ_{13P}	13 Points	-	-	1.60		2, 3, 4
Contrast Ratio	CR		-	700	-		4, 5
Cross talk	%				4		4, 6
Response Time	T_{RT}	Rising + Falling	-	25	35		
Color / Chromaticity Coodinates	Red — Rx	CIE 1931	0.53	0.56	0.59		4
	Red — Ry		0.31	0.34	0.37		
	Green — Gx		0.32	0.35	0.38		
	Green — Gy		0.54	0.57	0.60		
	Blue — Bx		0.13	0.16	0.19		
	Blue — By		0.09	0.12	0.15		
	White — Wx		0.283	0.313	0.343		
	White — Wy		0.299	0.329	0.359		
NTSC	%		-	45	-		

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Note 1: 5 points position (Ref: Active area)

Note 2: 13 points position (Ref: Active area)

Note 3: The luminance uniformity of 5 or13 points is defined by dividing the maximum luminance values by the minimum test point luminance

$$\delta_{W5} = \frac{\text{Maximum Brightness of five points}}{\text{Minimum Brightness of five points}}$$

$$\delta_{W13} = \frac{\text{Maximum Brightness of thirteen points}}{\text{Minimum Brightness of thirteen points}}$$

Note 4: Measurement method

The LCD module should be stabilized at given temperature for 30 minutes to avoid abrupt temperature change during measuring. In order to stabilize the luminance, the measurement should be executed after lighting Backlight for 30 minutes in a stable, windless and dark room, and it should be measured in the

center of screen.

Center of the screen
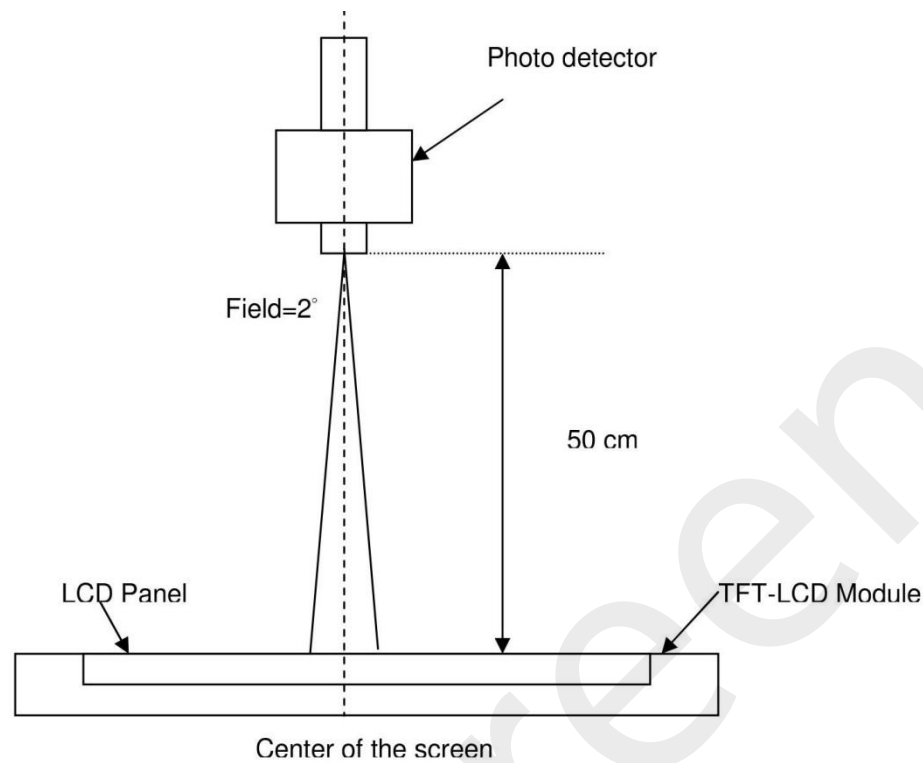
Note 5 : Definition of contrast ratio:

Contrast ratio is calculated with the following formula.

$$\text{Contrast ratio (CR)} = \frac{\text{Brightness on the "White" state}}{\text{Brightness on the "Black" state}}$$

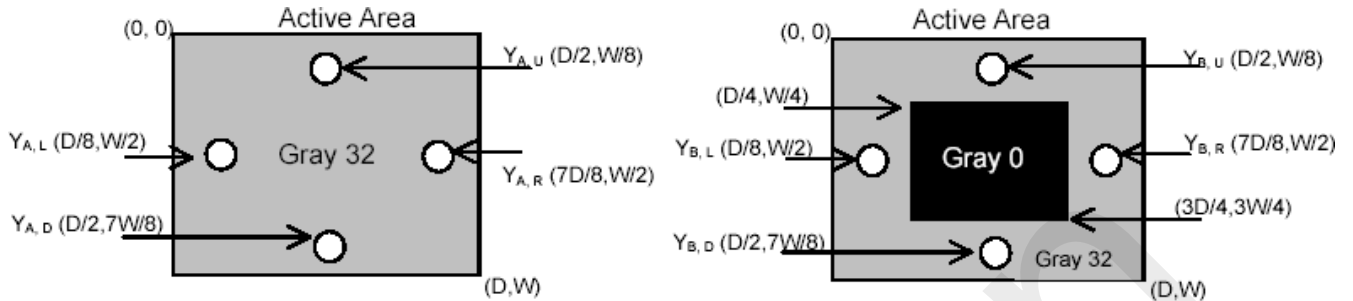**Note 6** : Definition of Cross Talk (CT)

CT = | YB – YA | / YA × 100 (%)

Where

YA = Luminance of measured location without gray level 0 pattern (cd/m2)

YB = Luminance of measured location with gray level 0 pattern (cd/m2)

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Active Area (0, 0)

Gray 32

$Y_{A,U}$ (D/2,W/8)
$Y_{A,L}$ (D/8,W/2)
$Y_{A,R}$ (7D/8,W/2)
$Y_{A,D}$ (D/2,7W/8)

(D,W)

Active Area (0, 0)

(D/4,W/4)

Gray 0

Gray 32

$Y_{B,U}$ (D/2,W/8)
$Y_{B,L}$ (D/8,W/2)
$Y_{B,R}$ (7D/8,W/2)
(3D/4,3W/4)
$Y_{B,D}$ (D/2,7W/8)

(D,W)

Note 7: Definition of response time:

The output signals of BM-7 or equivalent are measured when the input signals are changed from "Black" to "White" (falling time) and from "White" to "Black" (rising time), respectively. The response time interval between the 10% and 90% of amplitudes. Refer to figure as below.

"White"   "Black"   "White"

100%
90%

Signal(Relative value)

10%
0%

Tr   Tf
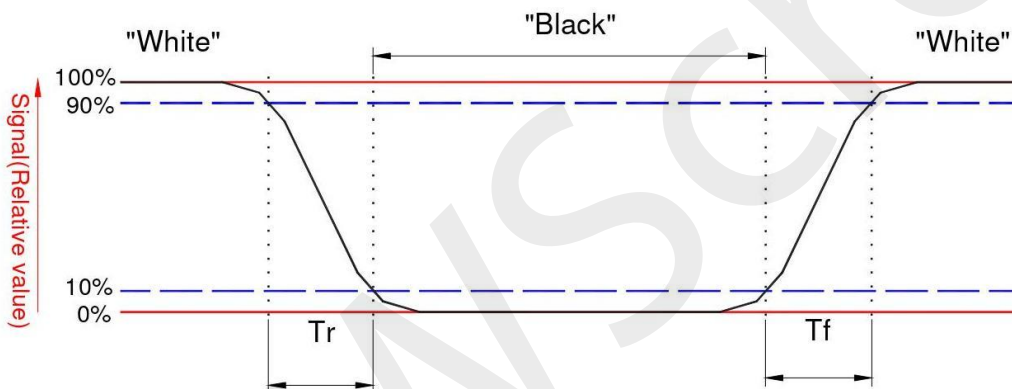
Note 8. Definition of viewing angle

Viewing angle is the measurement of contrast ratio $\geqq 10$, at the screen center, over a 180° horizontal and 180° vertical range (off-normal viewing angles). The 180° viewing angle range is broken down as follows; 90° (θ) horizontal left and right and 90° (Φ) vertical, high (up) and low (down). The measurement direction is typically perpendicular to the display surface with the screen rotated about its center to develop the desired measurement viewing angle.
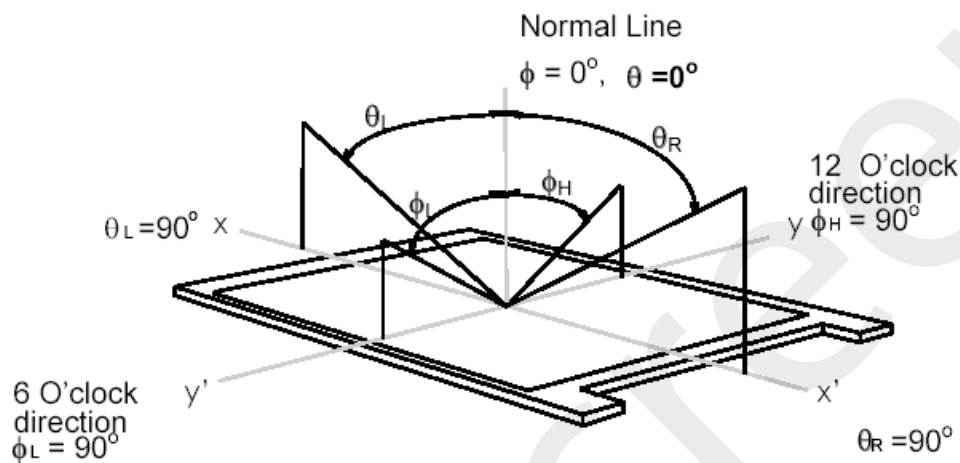
2. (Functional Block Diagram)

The following diagram shows the functional block of the 15.6 inches wide Color TFT/LCD 30 Pin (One CH/connector Module)

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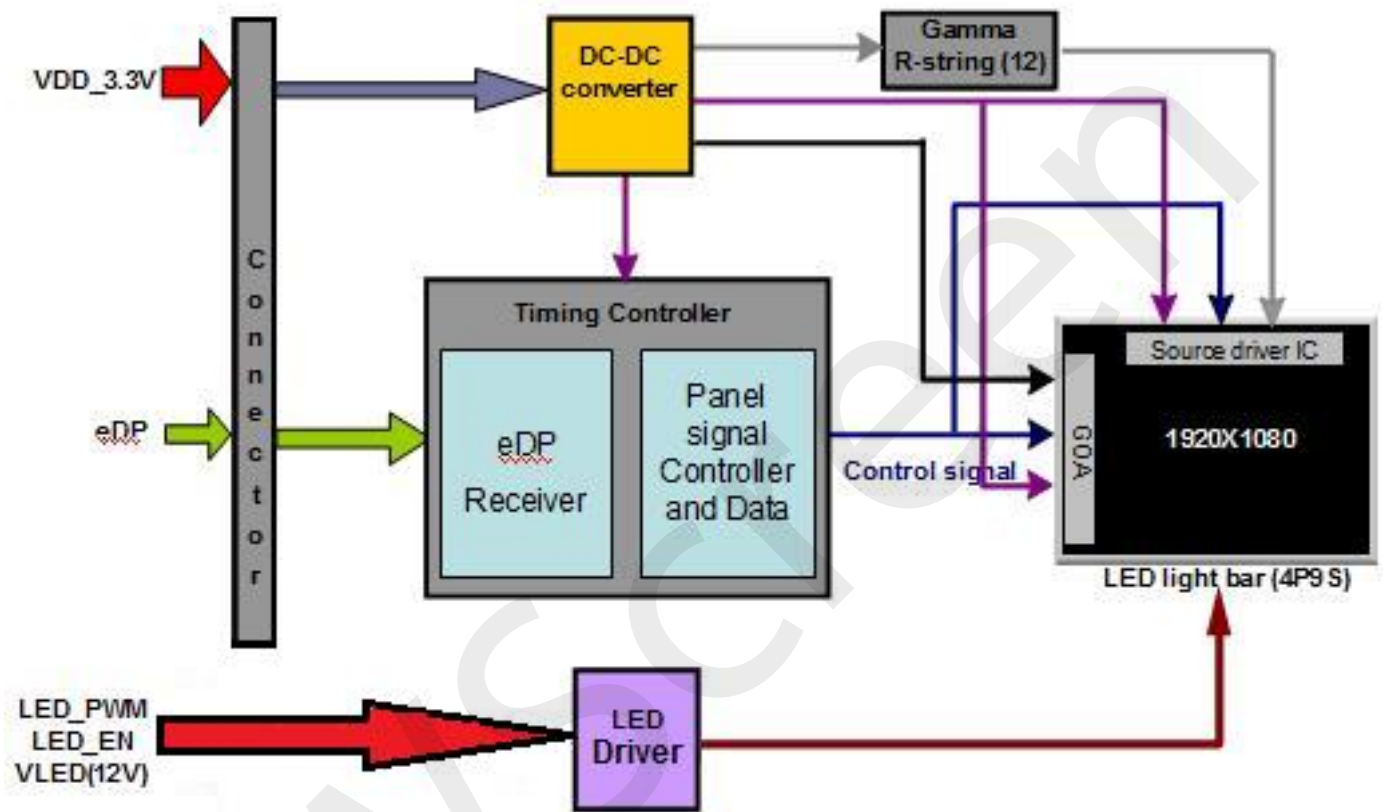
3. Absolute Maximum Ratings

An absolute maximum rating of the module is as following:

3.1 Absolute Ratings of TFT LCD Module

Item	Symbol	Min	Max	Unit	Conditions
Logic/LCD Drive	Vin	-0.3	+4.0	[Volt]	Note 1,2

3.2 Absolute Ratings of Environment

Item	Symbol	Min	Max	Unit	Conditions
Operating	TOP	0	+50	[°C]	Note 4
Operation Humidity	HOP	5	95	[%RH]	Note 4
Storage Temperature	TST	-20	+60	[°C]	Note 4
Storage Humidity	HST	5	95	[%RH]	Note 4

Note 1: At Ta (25℃)

Note 2: Permanent damage to the device may occur if exceed maximum values

Note 3: LED specification refer to section 4.2

Note 4: For quality performance, please refer to AUO IIS (Incoming Inspection Standard).
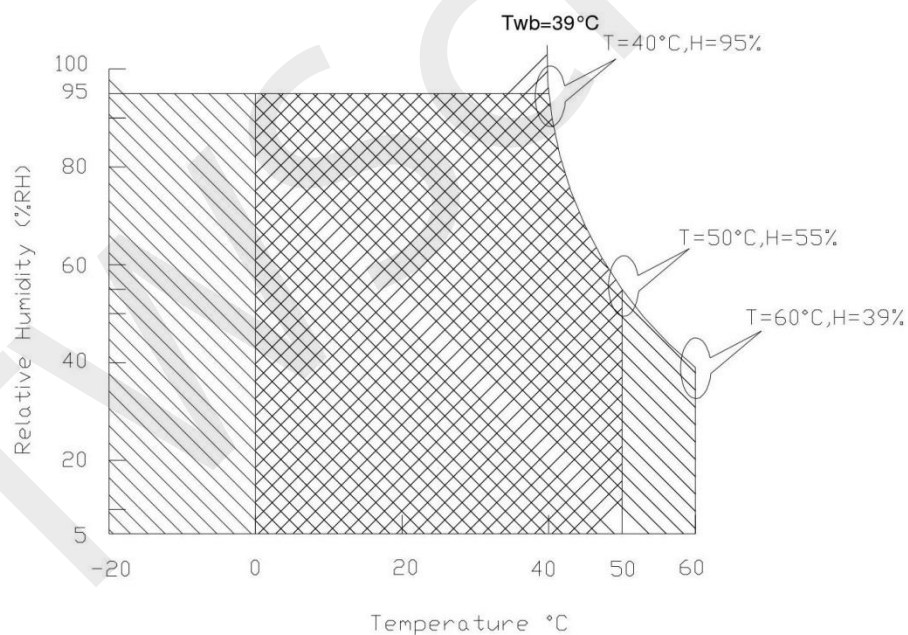
Operating Range

Storage Range

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4. Electrical Characteristics

4.1 TFT LCD Module
4.1.1 Power Specification

Input power specifications are as follows;

The power specification are measured under 25℃ and frame frequency under 60Hz

Symble	Parameter	Min	Typ	Max	Units	Note
VDD	Logic/LCD Drive Voltage	3.0	3.3	3.6	[Volt]	
PDD	VDD Power	-	-	1.2	[Watt]	Note 1
IDD	IDD Current(RMS)	-	-	400	[mA]	Note 1
IRush	Inrush Current	-	-	2000	[mA]	Note 2
VDDrp	Allowable Logic/LCD Drive Ripple Voltage	-	-	100	[mV] p-p	

Note 1 : Maximum Measurement Condition : Mosaic pattern (PDD (max) = VDD(min) x IDD(max))

Note 2 : Measure Condition

Vin rising time

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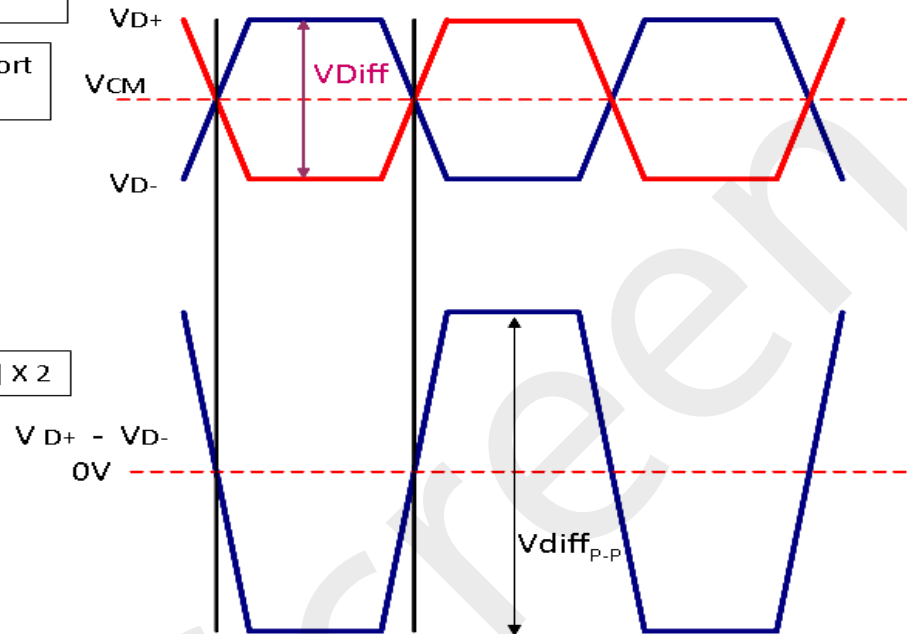
4.1.2 Signal Electrical Characteristics

Signal electrical characteristics are as follows;

Display Port main link signal:

Differential pair VD+ , VD-
Which is one Display port
Main link

VCM of Display port
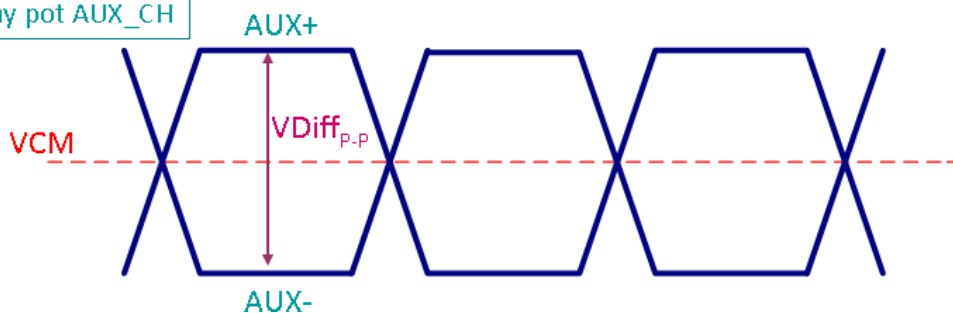Main link

VCM

$$Vdiff_{P-P} = [(VD+) - (VD-)] \times 2$$

V D+ - VD-
0V

Display port main link		Min	Typ	Max	unit
VCM	RX input DC Common Mode Voltage		0		V
VDiff$_{P-P}$	Peak-to-peak Voltage at a receiving Device	100		1320	mV

Follow as VESA display port standard V1.1a

Display Port AUX_CH signal:

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Differential AUX+ , AUX-
Which is Display pot AUX_CH

AUX+

VCM

VDiff$_{P-P}$

AUX-

Display port AUX_CH		Min	Typ	Max	unit
VCM	AUX DC Common Mode Voltage		0		V
VDiff$_{P-P}$	AUX Peak-to-peak Voltage at a receiving Device	0.4	0.6	0.8	V

Fallow as VESA display port standard V1.1a

Display Port VHPD signal:

Display port VHPD		Min	Typ	Max	unit
VHPD	HPD Voltage	2.25	-	3.6	V

Fallow as VESA display port standard V1.1a

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4.2 Backlight Unit

Parameter guideline for LED driving is under stable conditions at 25℃ (Room Temperature):

Symbol	Parameter	Min.	Typ.	Max.	Unit	Remark
I_L	Current of LED Backlight	-	208	-	[mA]	
V_L	Voltage of LED Backlight		28		[Volt]	
P_{LED}	LED Light Bar Power Consumption	-	5.83	-	[Watt]	
LT_{LED}	LED Life Time	30,000	-	-	Hrs	I_L=208mA, Ta= 25℃

Note 1: Ta means ambient temperature of TFT-LCD module.

Note 2: If E156HVN-701 module is driven by high current or at high ambient temperature & humidity condition. The operating life will be reduced.

Note 3: Operating life means brightness goes down to 50% initial brightness. Minimum operating life time is estimated data.

Note 4: LED lifetime is definition: brightness is decreased to 50% of the initial value. LED lifetime is restricted under normal condition, ambient temperature = 25℃ and LED operating I_L =208mA.

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5. Signal Interface Characteristic

5.1 Pixel Format Image

Following figure shows the relationship of the input signals and LCD pixel format.
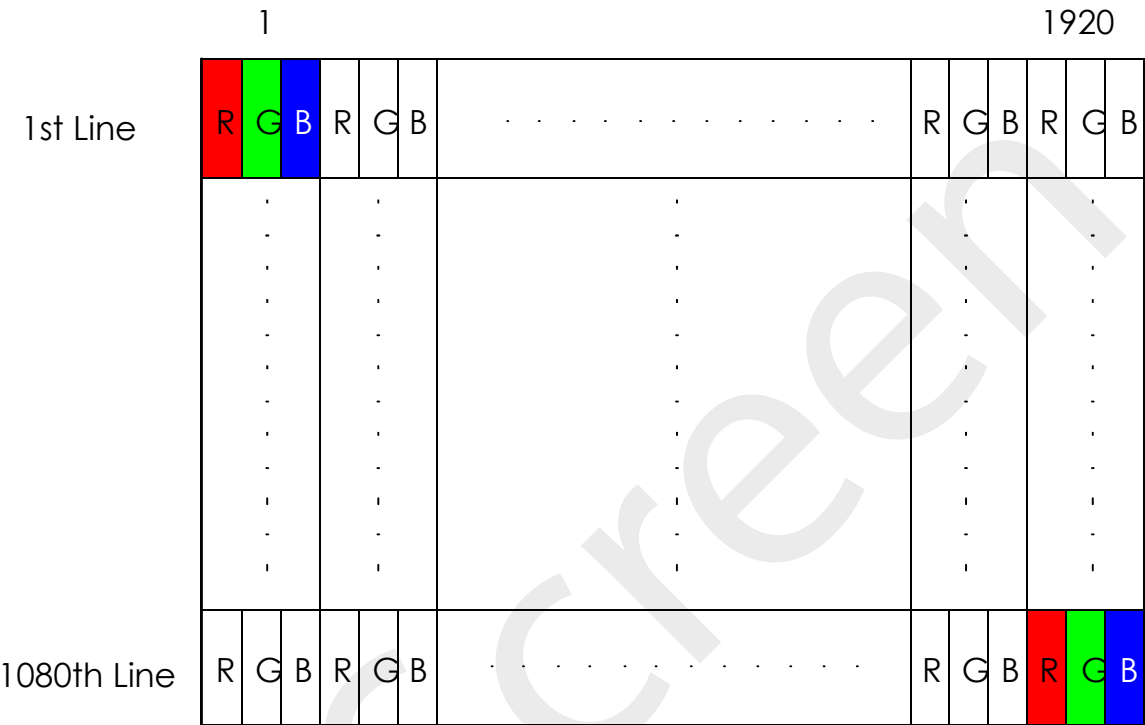
5.2 Integration Interface Requirement

5.2.1 Connector Description

Physical interface is described as for the connector on module.
These connectors are capable of accommodating the following signals and will be following components.

Connector Name / Designation	For Signal Connector
Manufacturer	SMT or compatible
Type / Part Number	SMT MSAK24025P30 or compatible
Mating Housing/Part Number	IPEX 20455-030T-01 or compatible

5.2.2 Pin Assignment

eDP lane is a differential signal technology for LCD interface and high speed data transfer device.

PIN#	Symbol	Function
1	NC	No Connect (Reserved)
2	H_GND	High Speed Ground
3	Lane1_N	Comp Signal Lane 1
4	Lane1_P	True Signal Link Lane 1
5	H_GND	High Speed Ground
6	Lane0_N	Comp Signal Link Lane 0
7	Lane0_P	True Signal Link Lane 0
8	H_GND	High Speed Ground
9	AUX_CH_P	True Signal Auxiliary Ch.
10	AUX_CH_N	Comp Signal Auxiliary Ch.
11	H_GND	High Speed Ground
12	LCD_VCC	LCD logic and driver power
13	LCD_VCC	LCD logic and driver power
14	LCD_Self_Test or NC	LCD Panel Self Test Enable (Optional)
15	LCD GND	LCD logic and driver ground
16	LCD GND	LCD logic and driver ground
17	HPD	HPD signal pin
18	NC	No Connect (Reserved)
19	NC	No Connect (Reserved)
20	NC	No Connect (Reserved)
21	NC	No Connect (Reserved)
22	NC	No Connect (Reserved)
23	NC	No Connect (Reserved)
24	NC	No Connect (Reserved)
25	NC	No connect (Reserved)

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26	NC	No connect (Reserved)
27	NC	No connect (Reserved)
28	NC	No connect (Reserved)
29	NC	No connect (Reserved)
30	NC	No Connect (Reserved)

Note1：start from right side

Note2：Input signals shall be low or High-impedance state when VDD is off.
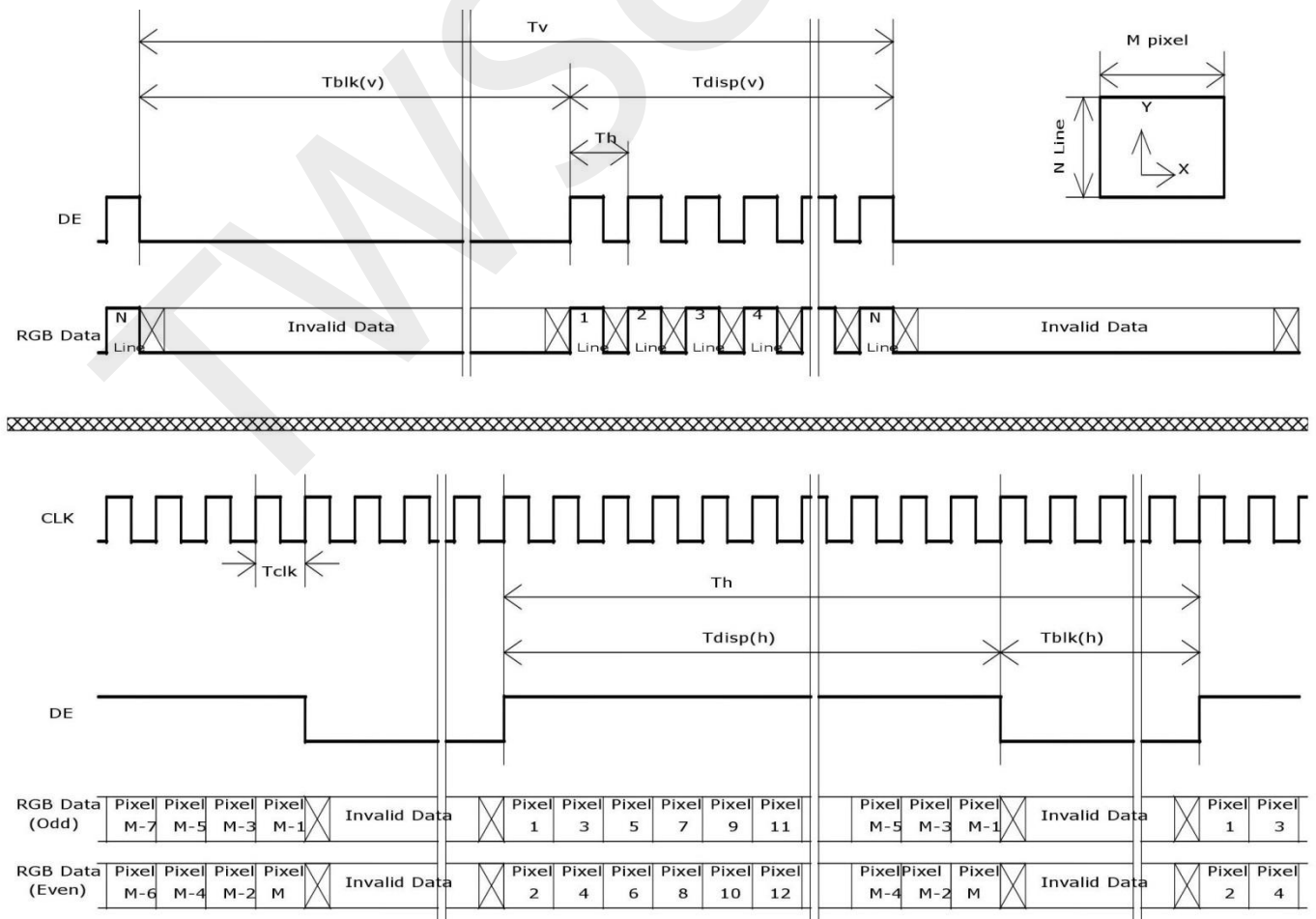
5.3 Interface Timing

Basically, interface timings should match the 1920x1080 /60Hz manufacturing guide line timing.

Parameter		Symbol	Min.	Typ.	Max.	Unit
Frame Rate		-	-	60	-	Hz
Clock frequency		$1/T_{Clock}$	-	141	-	MHz
Vertical Section	Period	T_V	1084	1116	3080	T_{Line}
	Active	T_{VD}		1080		
	Blanking	T_{VB}	4	36	2000	
Horizontal Section	Period	T_H	2000	2104	2320	T_{Clock}
	Active	T_{HD}		1920		
	Blanking	T_{HB}	80	184	400	

Note : 1. DE mode only

2. The maximum clock frequency = (1920+B)*(1080+A)*60 < 149.1MHz

5.3.1 Timing diagram

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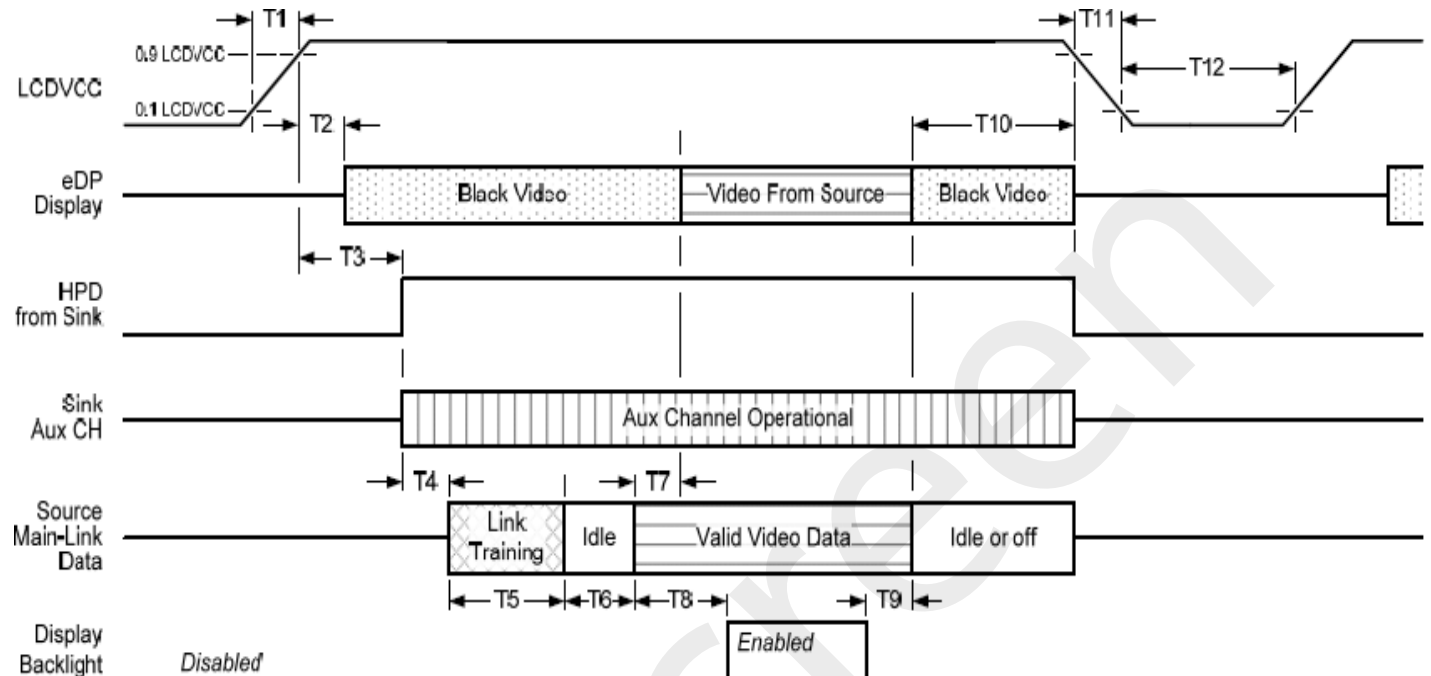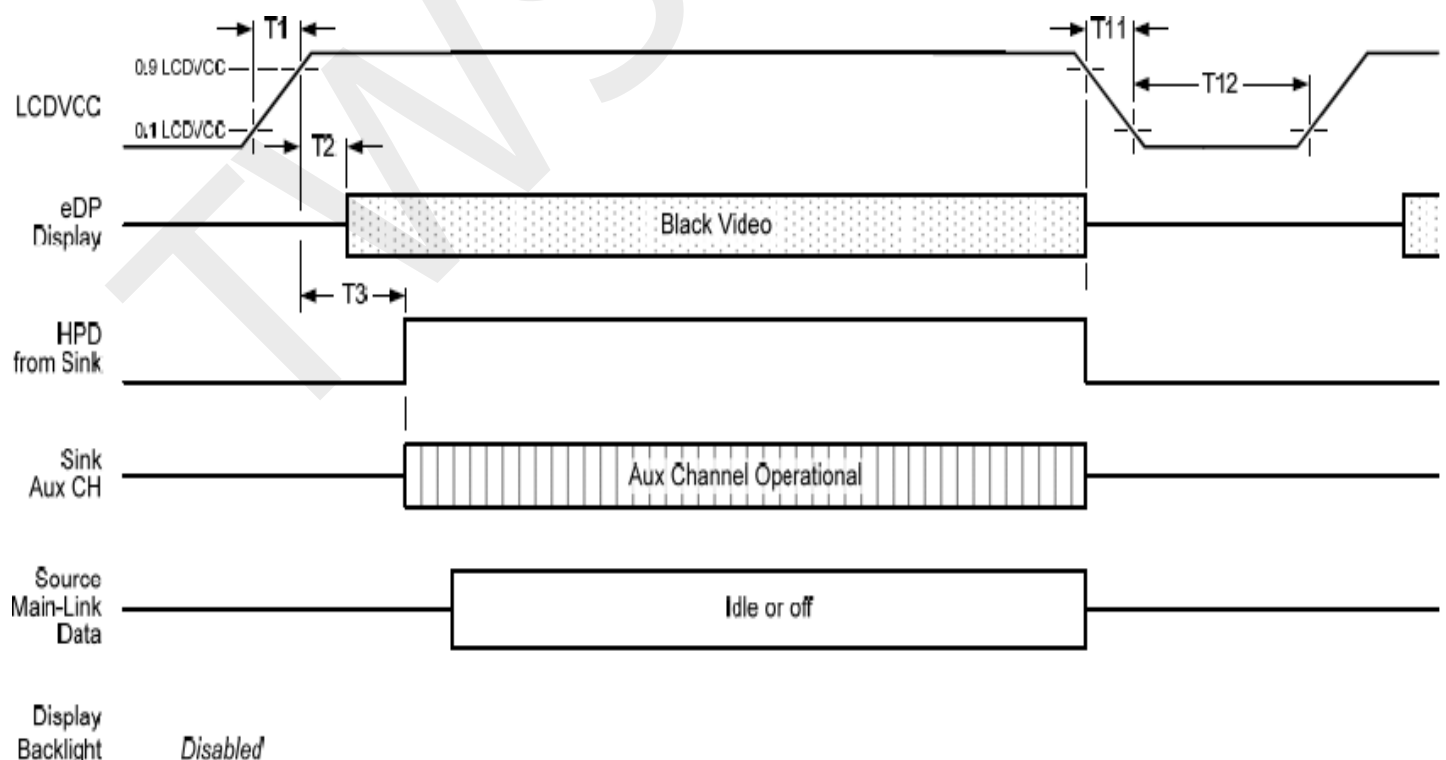
5.4 Power ON/OFF Sequence

Power on/off sequence is as follows. Interface signals and LED on/off sequence are also shown in the chart. Signals from any system shall be Hi-Z state or low level when VDD is off

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

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Display Port panel power sequence timing parameter:

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, 905 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 following conditions:
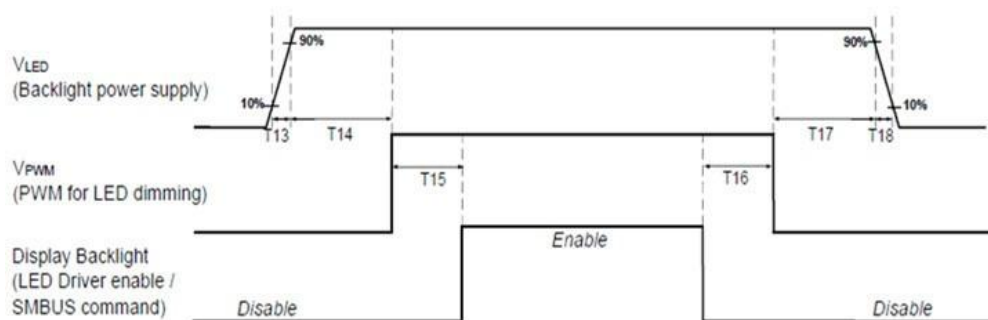
-upon LCDVDD power on (with in T2 max)-when the "Novideostream_Flag" (VB-ID Bit 3) is received from the source (at the end of T9).

-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.

Note 2: The sink may implement the ability to disable the black video function, as described in Note 1, above, for system development and debugging purpose.
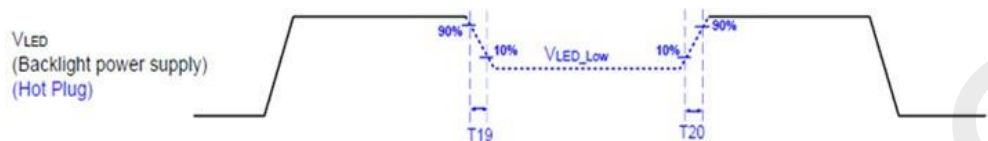
Note 3: The sink must support AUX_CH polling by the source immediately following LCDVDD power on without causing damage to the sink device (the source can re-try if the sink is not ready). The sink must be able to respond to an AUX_CH transaction with the time specified within T3 max.

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Display Port panel B/L power sequence timing parameter:

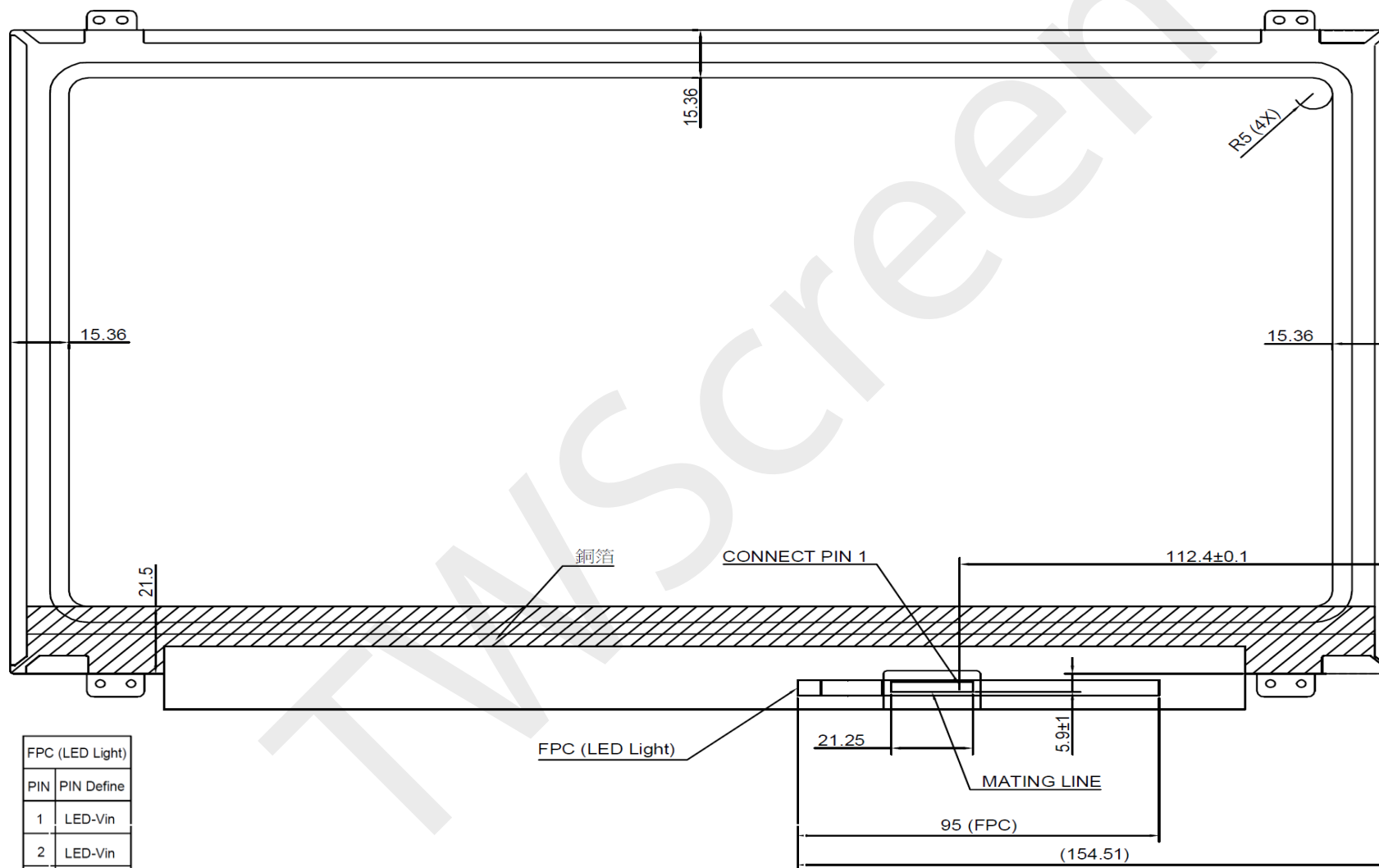|	Min (ms)	Max (ms)
T13	0.5	10
T14	10	-
T15	10	-
T16	10	-
T17	10	-
T18	0.5	10
T19	1*	-
T20	1*	-

Note : When the adapter is hot plugged, the backlight power supply sequence is shown as below.

Seamless change: T19/T20 = $5 \times T_{PWM}$*

*T_{PWM}= 1/PWM Frequency

6. Mechanical Characteristics

6.1 LCM Outline Dimension
6.1.1 Standard Front View

SYSTEM BEZEL OPENING NO MORE THAN 1.00mm
LARGE THAN ACTIVE AREA ON ALL 4 SIDE

6.1.2 Standard Rear View

FPC (LED Light)	
PIN	PIN Define
1	LED-Vin
2	LED-Vin
3	LED-GND
4	LED-GND

Labels in drawing: R5 (4X), 15.36, 15.36, 15.36, 21.5, 銅箔, CONNECT PIN 1, 112.4±0.1, FPC (LED Light), 21.25, MATING LINE, 5.9±1, 95 (FPC), (154.51)

Product Specification

DB-LB1C-02

☐ Preliminary Specifications

■ Final Specifications

Product	LED Driver Board
Model Name	DB-LB1C-02
Document Version	Rev.01

Customer

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| Approved by | Date |

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Notice: This Specification is subject to change without notice.

Approved By	Prepared By
(signature)	*(signature)*

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Product Specification

DB-LB1C-02

1. General Description

This <u>Product Specification</u> is made to be the standard of Elite manufactured LED Driving Board such a standard will be followed in <u>Taiwan Screen</u> production, shipment, and quality inspection.
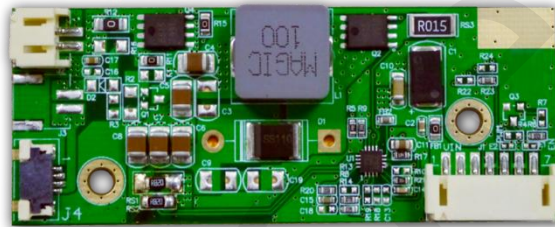
2. Feature

- ■ 30W LED Driver
- ■ Constant-Current Control
- ■ Support PWM Dimming

3. Protection

Item	Max.	Remark
Over current protection (OCP)	Depending on LED B/L	
Over voltage protection (OVP)	56V(Note1)	

Note : When the LED string is opened, over voltage protection will limit the output to approximately 56V

4. Optional Backlight Driving Condition

Item	Symbol	Min.	TYP.	Max.	Unit	Remark
LED Voltage	V_{LED}		28		V	
LED Current	I_{LED}		208		mA	

5. Absolute maximum ratings

Parameter	Symbol	Min.	TYP	Max.	Unit	Remark
Input Voltage	Vin	10.8	12	15	V	
Output Voltage	Vout			50	V	
Output Current	Iout			1000	mA	

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Product Specification
DB-LB1C-02

6. Interface Characteristics

Parameter	Symbol	Min.	TYP.	Max.	Unit	Remark
Backlight ON Voltage	INVON	1.25	5	Vin	V	
Backlight OFF Voltage	INVON			0.4	V	
PWM Control	PWM	3.3	5		V	
PWM Control Frequency	PWM	85	100		Hz	
PWM Control Duty	PWM	0		100	%	

7. Environmental

Item	Symbol	Conditions	MIN	MAX	Unit	Remark
Operating Temperature	Top	Ha=90%RH	0	60	℃	
Storage Temperature	Tstg	Ha=95%RH	-20	85	℃	

8. Connector Socket

8.1 Connector Type

Connector (J1)

Connector Name / Designation	For Signal Connector
Manufacturer	JST or compatible
Type / Part Number	S7B-PH-SM4-TB or compatible
Mating Housing / Part Number	PHR-7 or compatible

Connector (J4)

Connector Name / Designation	For Signal Connector
Manufacturer	ALEX or compatible
Type / Part Number	7907-04-5 or compatible
Mating Housing / Part Number	Pitch 1.0mm

J1 S7B-PH-SM4-TB   J4 7907-04-5

(Pin 1)   (Pin 1)

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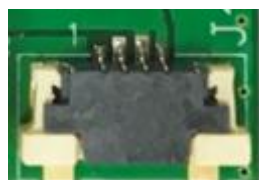
8.2 Pin Definition

Connector (J1)

PIN No.	Symbol	Description
1	Vin	Power Input (+12V)
2	Vin	Power Input (+12V)
3	Vin	Power Input (+12V)
4	GND	Ground
5	PWM	PWM Brightness Control
6	GND	Ground
7	EN	Backlight on/off Control (5V / 0V)

Connector (J4)

PIN No.	Symbol	Description
1	V_LED+	LED Power +
2	V_LED+	LED Power -
3	V_LED	LED Power -
4	V_LED	LED Power -

9. Mechanical Characteristics

Dimension: 75(L) *30(W) *8.5(H) mm
Weight:MAX. 20g

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