

Product Specification

PART NUMBER # REV: FLC-156MME8200001#00

DESCRIPTION: TFT 15.6"W, 1920(H)*1080(V), eDP
262K Colors, 400CD

- Preliminary Specification
- Approved Specification

Customer Name:	
Signature:	Date:

PREPARED BY	REVIEWED BY
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Revision History

Version	Date	Page	Description	Note
V1.0	2022/07/20		First Edition	
V1.1	2022/12/15		Correct pinout	

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1. GENERAL DESCRIPTION

1.1 Description

15.6 inch is a Color Active Matrix Liquid Crystal Display Module composed of a TFT LCD panel and LED backlight system. The screen format is intended to support the 1920 x 1080 screen and 262K colors.

1.2 Product Summary

The following items are summary on the table under Ta=25 °C condition:

No.	Item	Specification	Unit
1	Display Size	15.6" W	Inch
2	Pixel Number	1920 (H) x 3(RGB)x 1080 (V)	Pixels
3	Outline Dimension	359.5(W)×223.8(H)×4.25(D) max.	mm
4	Active Area	344.16 (W) x 193.59 (H)	mm
5	Pixel Pitch	0.17925(W) x 0.17925 (H)	mm
6	Display Colors	262K	
7	Number of Bit	6 bit	
8	Pixel Arrangement	RGB vertical stripe	-
9	Display Mode	Normally Black	-
10	Electrical Interface	2 lane eDP	-
11	Surface Treatment	Anti-glare	-
12	Brightness	400 (Typ.)	cd/m ²
13	Contrast Ratio	800 (Typ.)	-
14	Power Supply Voltage	3.3V for LCD	
15	Power Consumption	LCM: 1.0 W (Typ.) Backlight System: 5.3 W (max) Total: 6.3 W	W

2. ABSOLUTE MAXIMUM RATING

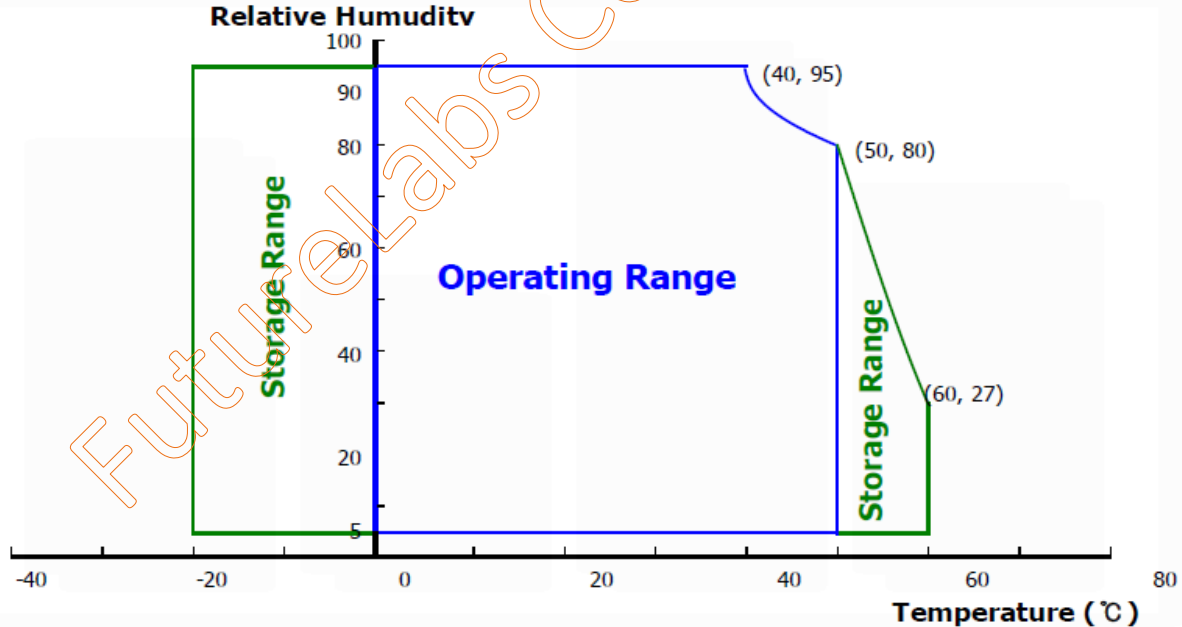
The followings are maximum values which, if exceed, may cause faulty operation or damage to the unit. The operational and non-operational maximum voltage and current values are listed in Table 2.

<Table 2. Absolute Maximum Ratings>

Ta=25+/-2°C

Parameter	Symbol	Min.	Max.	Unit	Note
Power Supply Voltage	V _{DD}	-0.3	4.0	V	(1)
Logic Supply Voltage	V _{IN}	V _{SS} -0.3	V _{SS} +0.3	V	
Operating Temperature	T _{OP}	0	+50	°C	(2)
Storage Temperature	T _{ST}	-20	+60	°C	

- 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. 95 % RH Max. (40 °C ≥ Ta) Maximum wet-bulb temperature at 39 °C or less. (Ta > 40 °C) No condensation



3. ELECTRICAL CHARACTERISTICS

3.1 Electrical Specifications

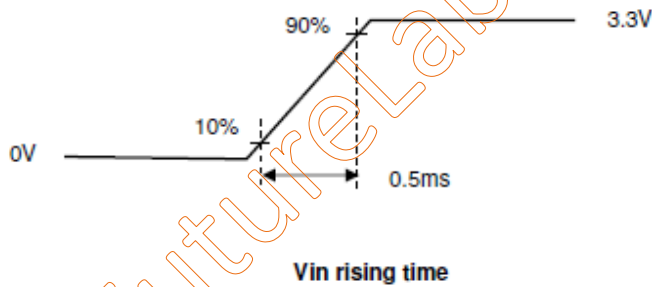
Ta=25 +/-2 °C

Parameter	Symbol	Min	Typ	Max	Unit	Note
Power Supply Voltage	V _{DD}	3.0	3.3	3.6	V	(1)
Permissible Input Ripple Voltage	V _{RF}	-	-	100	mV	At V _{DD} =3.3V
Power Supply Current	I _{DD}	-	273	452	mA	(1)
Power Supply Inrush Current	Inrush	-	-	2.0	A	(2)
Differential Input Voltage	V _{ID}	120	-	1200	mA	
Power Consumption	P _D	-	1.0	1.5	W	(1)
	P _{BL}	-	-	5.3	W	
	P _{total}	-	-	6.8	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.

(2) Measure Condition



3.2 Backlight Unit

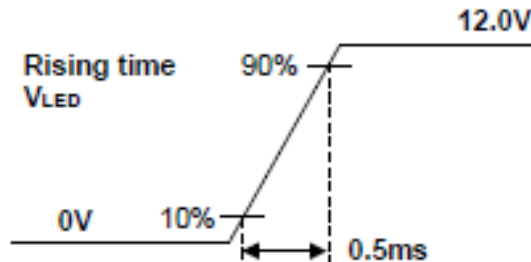
Ta=25+/-2°C

Parameter		Symbol	Min.	Typ.	Max.	Unit	Remark
LED Forward Voltage		V _F	-	-	3.1	V	-
LED Forward Current		I _F	-	34	-	mA	-
LED Power Consumption		P _{LED}		-	4.96	W	(1)
LED Power Inrush Current		I _{rush}			1.5	A	(4)
LED Life-Time		N/A	30,000	-	-	Hour	I _F = 34 mA
Power supply voltage for LED Driver		V _{LED}	8	12	21	V	
EN Control Level	Backlight on		2.2		5.0	V	
	Backlight off		0		0.6	V	
PWM Control Level	PWM High Level		2.2		5.0	V	
	PWM Low Level		0		0.6	V	
PWM Control Frequency		F _{PWM}	200	-	10,000	Hz	
Duty Ratio		-	1	-	100	%	(3)

Note : 1. Power supply voltage 12V for LED Driver

Calculator Value for $I_F \times V_F \times 40 / 0.85(\text{efficiency}) = P_{LED}$

- LED Lighting Bar (40*LED Array). The LED Life-time define as the estimated time to 50% degradation of initial luminous.
- 1% duty cycle is achievable with a dimming frequency less than 1KHz.
- Test condition



4 Timing Characteristic

4.1 Signal Timing Specification

Item		Symbol	Min.	Typ.	Max.	Unit
Clock	Frequency	1/Tc	139.7	141.4	150.4	MHz
Frame Period		Tv	1100	1120	1140	lines
			-	60	-	Hz
			-	16.7	-	Ms
Vertical Display Period		Tvd	-	1080	-	Lines
One line Scanning Period		Th	2080	2100	2100	clocks
Horizontal Display Period		Thd	-	1920	-	clocks

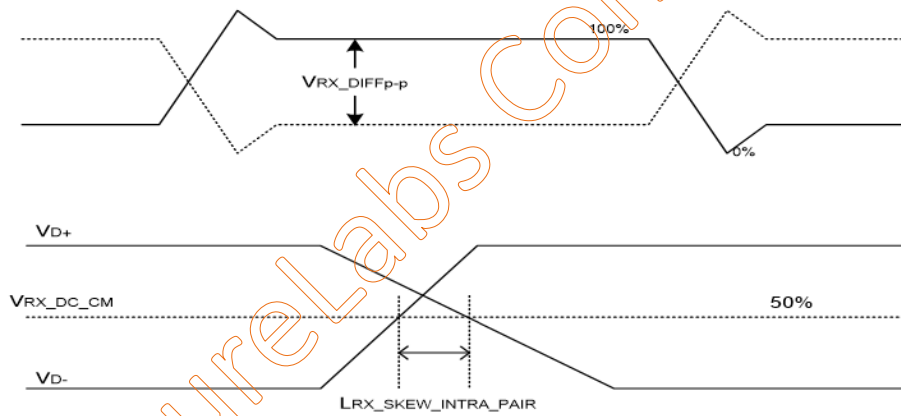
Note: This Module can support frame refresh rate 60Hz .

This Module is operated by DE only.

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4.2 eDP Rx Interface Timing Parameter

Item	Symbol	Min.	Typ.	Max.	Unit	Remark
Spread spectrum clock	ssc		0.5		%	
Differential peak-to-peak input voltage at package pins	VRX-DIFFp-p	120	-	1200	mV	
Rx input DC common mode voltage	VRX_DC_CM	0	-	2.0	V	
Differential termination resistance	RRX-DIFF	80	100	120	Ω	
Single-ended termination resistance	RRX-SE	40	-	60	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	

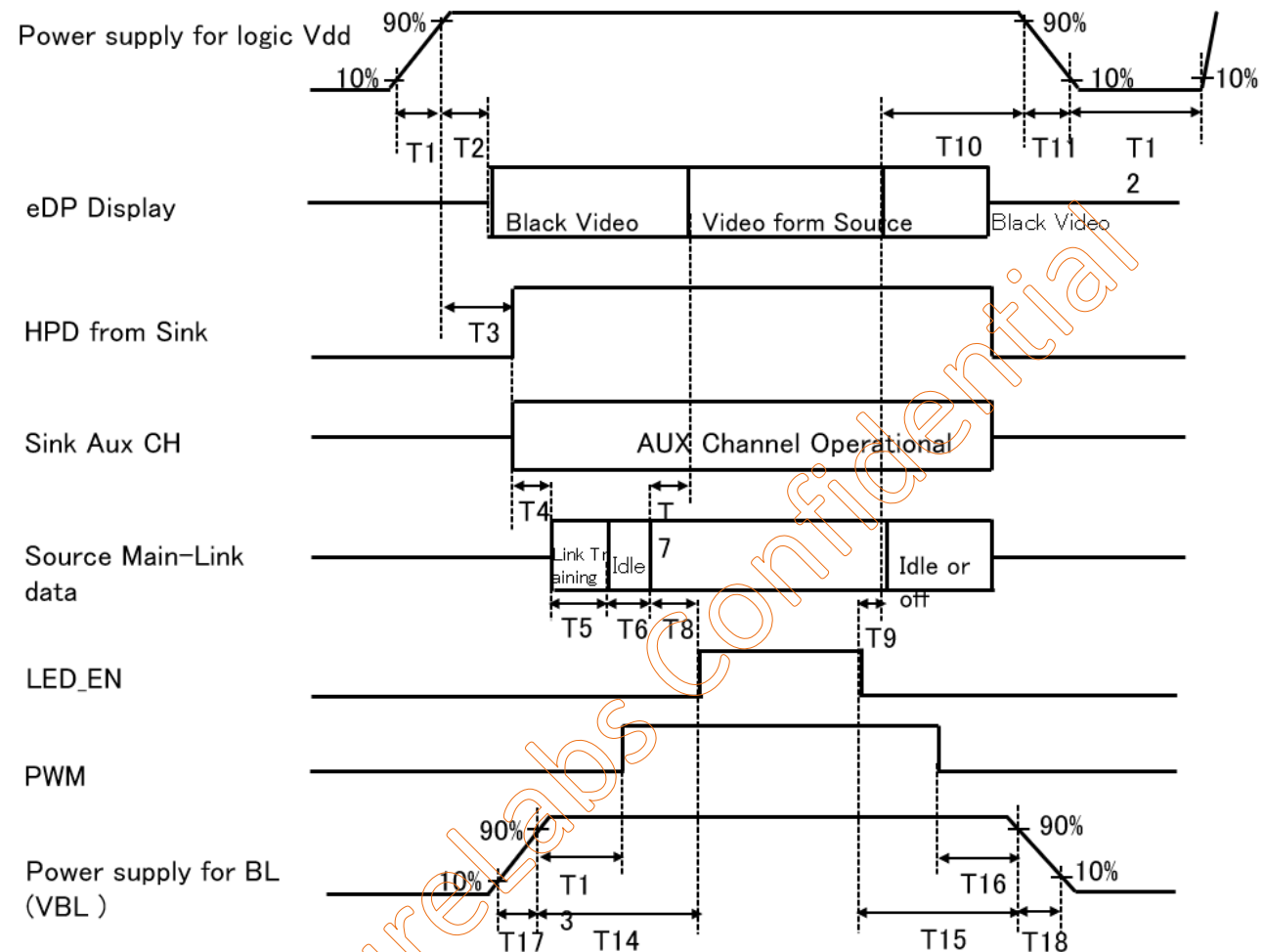


4.3 Input Signals, Basic Display Colors & Gray Scale of Colors

	Colors & Gray scale	Data signal																	
		R0	R1	R2	R3	R4	R5	G0	G1	G2	G3	G4	G5	B0	B1	B2	B3	B4	B5
Basic colors	Black	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	1	1	1	1	1	1
	Green	0	0	0	0	0	0	1	1	1	1	1	1	0	0	0	0	0	0
	Light Blue	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1
	Red	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0
	Purple	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
Gray scale of Red	Black	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	△ Darker	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	△ ▽																		
	▽ Brighter	1	0	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0
	▽	0	1	1	1	1	1	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
Gray scale of Green	Black	0	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
	△ ▽																		
	▽ Brighter	0	0	0	0	0	0	1	0	1	1	1	1	0	0	0	0	0	0
	▽	0	0	0	0	0	0	0	1	1	1	1	1	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
Gray scale of Blue	Black	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	△ Darker	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
	△ ▽																		
	▽ Brighter	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	1	1	1
	▽	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1
	Blue	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1
Gray scale of White & Black	Black	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	△ Darker	1	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0
	△ ▽																		
	▽ Brighter	1	0	1	1	1	1	1	0	1	1	1	1	1	0	1	1	1	1
	▽	0	1	1	1	1	1	0	1	1	1	1	1	0	1	1	1	1	1
	White	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1

4.4 Power Sequence

To prevent a latch-up or DC operation of the LCD module, the power on/off sequence shall be as shown in below



- $0.5\text{ms} \leq T1 \leq 10\text{ms}$
- $0\text{ms} \leq T2 \leq 200\text{ms}$
- $0\text{ms} \leq T3 \leq 200\text{ms}$
- $0\text{ms} \leq T13$
- $0\text{ms} \leq T14$
- $0\text{ms} \leq T17$
- $T3+T4+T5+T6+T8 > 200\text{ms}$
- $0\text{ms} < T7 \leq 50\text{ms}$
- $0\text{ms} < T9$
- $0\text{ms} \leq T10 \leq 500\text{ms}$
- $0.5\text{ms} \leq T11 \leq 10\text{ms}$
- $500\text{ms} \leq T12$
- $0\text{ms} \leq T15$
- $0\text{ms} \leq T16$
- $0\text{ms} \leq T18$
- $T7 < T8$

Notes:

1. When the power supply VDD is 0V, keep the level of input signals on the low or keep high impedance.
2. Do not keep the interface high impedance when power is on. Back Light must be turn on after power for logic and interface signal are valid.

5. INTERFACE PIN DESCRIPTION

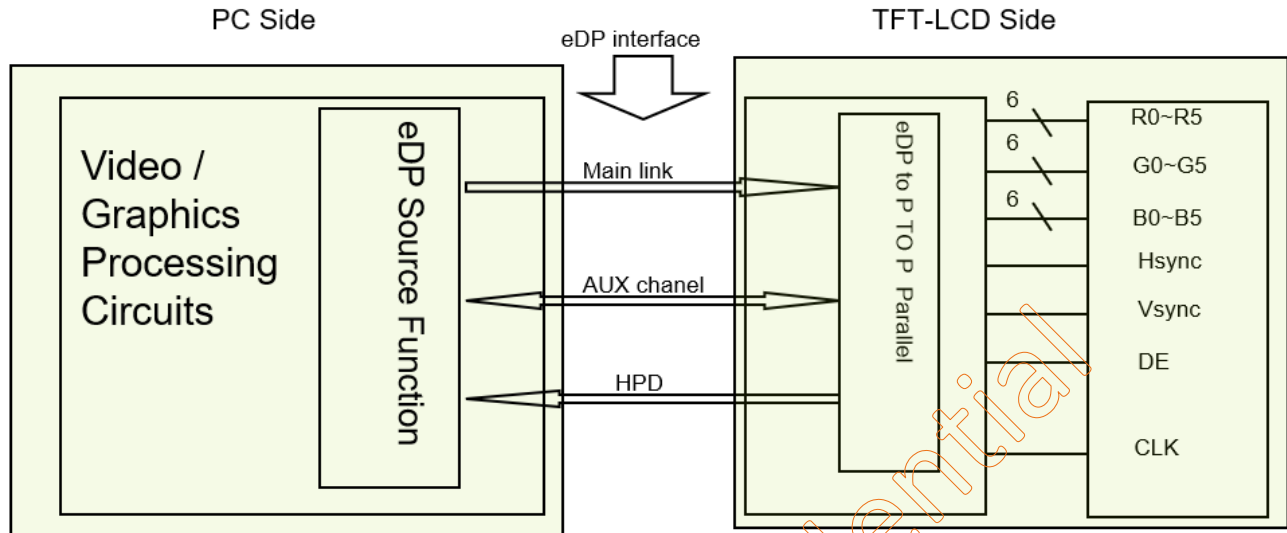
5.1 Electrical Interface Connection

The electronics interface connector is UJU IS050-L30B-C10 or Compatible.

Mating housing is IPEX 20454-030T or Compatible.

Terminal	Symbol	Functions
Pin No.	Symbol	Description
1	NC	No Connection
2	H_GND	Ground
3	LANE1_N	eDP RX channel 1 negative
4	LANE1_P	eDP RX channel 1 positive
5	H_GND	Ground
6	LANE0_N	eDP RX channel 0 negative
7	LANE0_P	eDP RX channel 0 positive
8	H_GND	Ground
9	AUX_CH_P	eDP AUX CH positive
10	AUX_CH_N	eDP AUX CH negative
11	H_GND	Ground
12	LCD_VCC	Power Supply, 3.3V (typ.)
13	LCD_VCC	Power Supply, 3.3V (typ.)
14	NC	No Connection
15	H_GND	Ground
16	H_GND	Ground
17	HPD	Hot plug detect output
18	BL_GND	LED Ground
19	BL_GND	LED Ground
20	BL_GND	LED Ground
21	BL_GND	LED Ground
22	BL_ENABLE	LED enable pin(+3.3V Input)
23	BL_PWM	System PWM Signal Input
24	NC	No Connection
25	NC	No Connection
26	BL_POWER	LED Power Supply 8V-21V
27	BL_POWER	LED Power Supply 8V-21V
28	BL_POWER	LED Power Supply 8V-21V
29	BL_POWER	LED Power Supply 8V-21V
30	NC	No Connection

5.2 eDP Interface



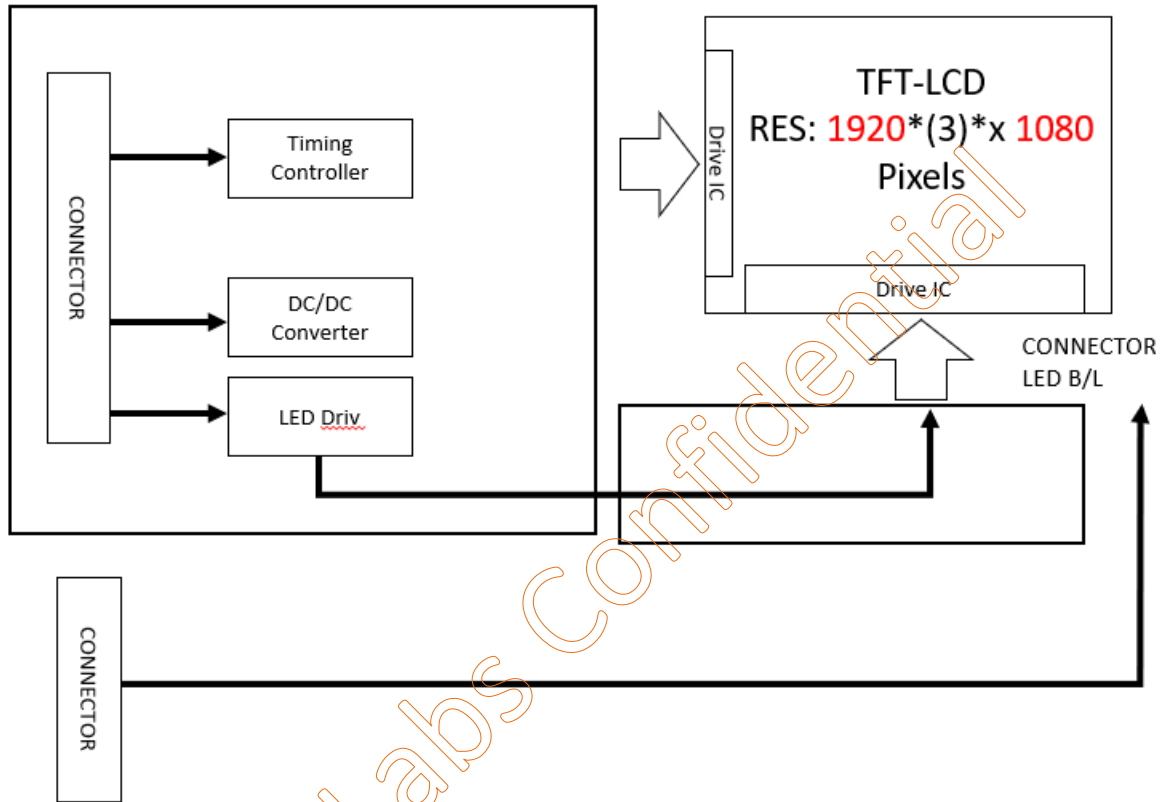
Note. Transmitter : Parade DP501 or equivalent. Transmitter is not contained in Module.

5.3 eDP Input signal

Lane 0	Lane 1
R0-5:0 G0-5:4	R1-5:0 G1-5:4
G0-3:0 B0-5:2	G1-3:0 B1-5:2
B0-1:0 R2-5:0	B1-1:0 R3-5:0
G2-5:0 B2-5:4	G3-5:0 B3-5:4
B2-3:0 R4-5:2	B3-3:0 R5-5:2
R4-1:0 G4-5:0	R5-1:0 G5-5:0
B4-5:0 R6-5:4	B5-5:0 R7-5:4
R6-3:0 G6-5:2	R7-3:0 G7-5:2
G6-1:0 B6-5:0	G7-1:0 B7-5:0

6. BLOCK DIAGRAM

The following diagram shows the functional block of the TFT module:



7. OPTICAL CHARACTERISTIC

The optical characteristics are measured under stable conditions at room temperature $25 \pm 2^\circ\text{C}$.

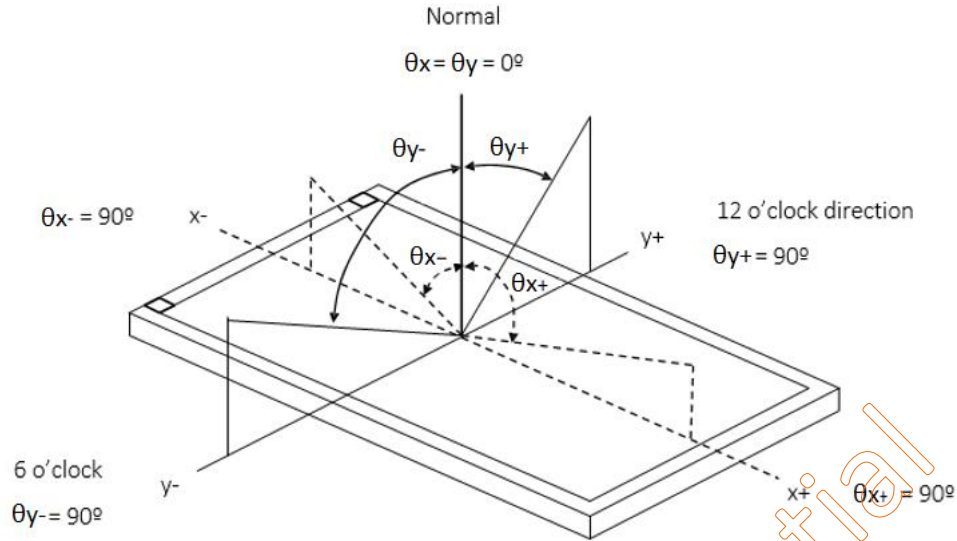
Item		Symbol	Condition	Min.	Typ.	Max.	Unit	Note
Contrast Ratio		CR	$\theta_x=0^\circ$	-	800	-	-	(2)(5)
Response Time		TR+ TF	25°C	-	30	35	ms	(3)
Center Luminance of White		LC		320	400	-	cd/m ²	(4)(5)
Brightness uniformity					80			
Chromaticity	Red	Rx	$\theta_x=0^\circ, \theta_y=0^\circ$ Viewing angle at normal direction	Typ. -0.03	0.59	Typ. +0.03	-	(1)(5)
		Ry			0.35		-	
	Green	Gx			0.33		-	
		Gy			0.555		-	
	Blue	Bx			0.153		-	
		By			0.119		-	
	White	Wx			0.313		-	
		Wy			0.329		-	
Viewing Angle	Horizontal	θ_{x+}	CR > 10	-	85	-	Deg.	(1)(5)
		θ_{x-}		-	85	-		
	Vertical	θ_{y+}		-	85	-		
		θ_{y-}		-	85	-		

The following optical specifications shall be measured in a darkroom or equivalent state (ambient luminance < 2 lux, and at room temperature).

The room temperature is $25^\circ\text{C} \pm 2^\circ\text{C}$.

Note 1: Definition of Viewing Angle

Viewing angle is the angle at which the contrast ratio is greater than 10. The viewing angles are determined for the horizontal or the vertical clock direction with respect to the optical axis which is normal to the LCD surface

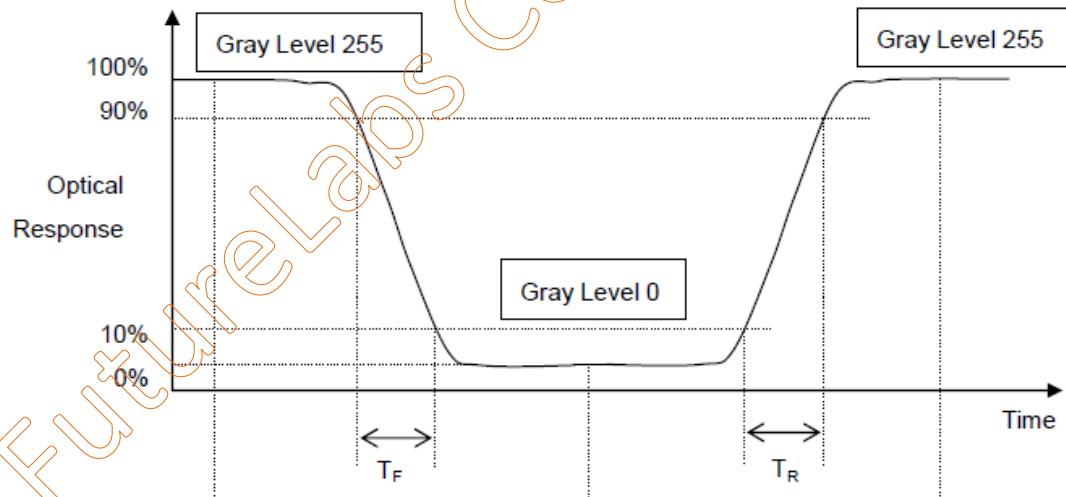


Note 2: Definition of Contrast Ratio (CR)

Measure the viewing angle of $\Theta = 0$ and at the center of the LCD surface. Luminance with all pixels in white state divide by Luminance with all pixels in Black state.

Note 3: Definition of Response Time:

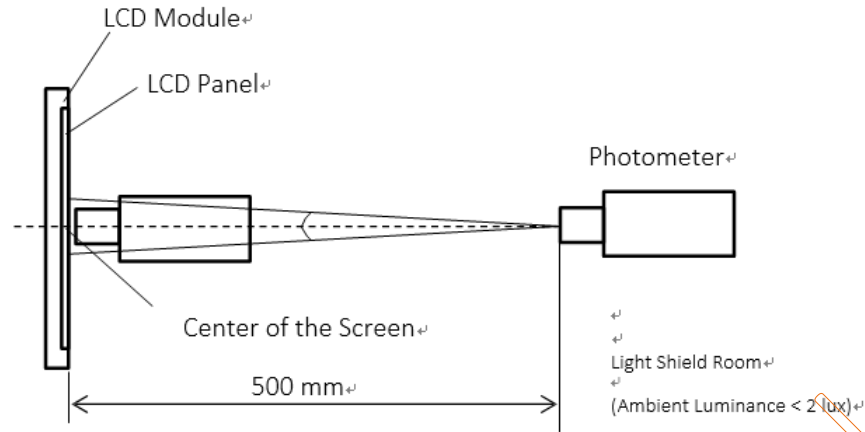
The response time is set initially by defining the “Rising Time (TR)” and the “Falling Time (TF)” respectively. Please refer the figure to the followings:



Note 4: Definition of Brightness (L)

Measure the center area of the panel and the viewing angle of the $\theta_x = \theta_y = 0^\circ$

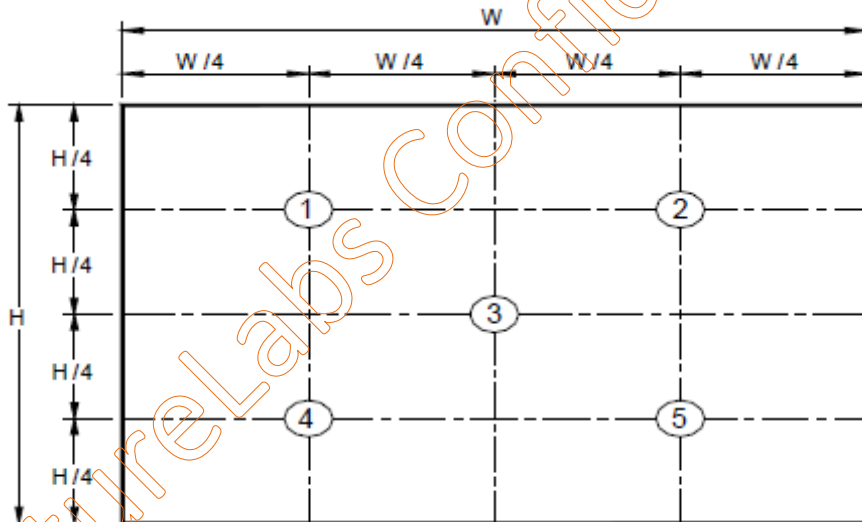
Note 5: The method of optical measurement:



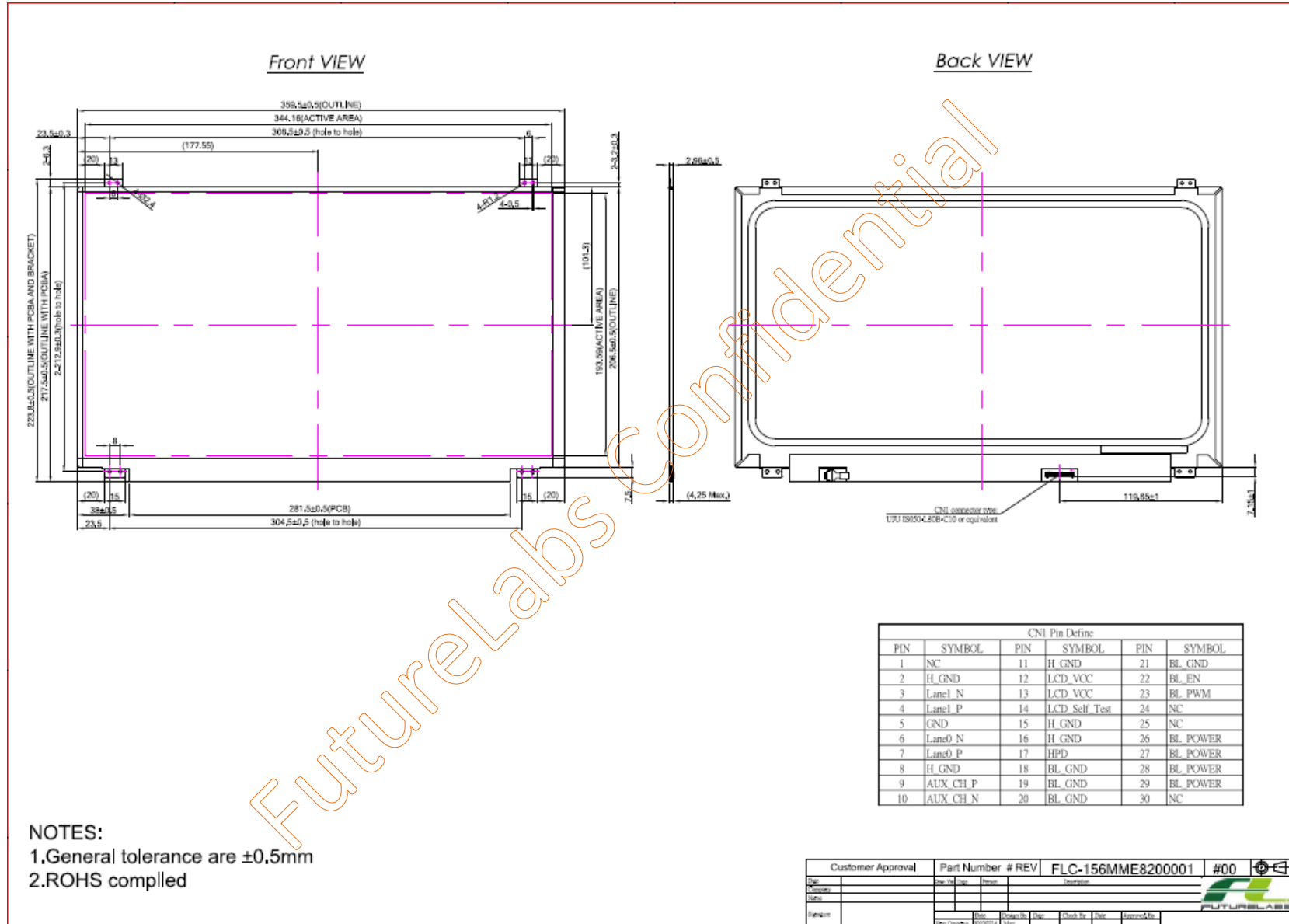
Note 6: Definition of White Variation (δW):

Measure the luminance of gray level 255 at 5 points

$$\delta W = (\text{Maximum } [L(1), L(2), L(3), L(4) \sim L(5)] / \text{Minimum } [L(1), L(2), L(3), L(4) \sim L(5)]) \times 100\%$$



8. DIMENSION AND DRAWING



9. PRECAUTION AND PRODUCT HANDLING

- Do not apply the external force such as bending or twisting to the LCD panel and backlight during assembly.
- Do not insert and plug out the input connector while the LCD panel is operating.
- Do not take apart the panel or frame from LCD module assembly or insert anything into the backlight unit.
- Do not keep the same pattern in a long period of time, it may cause image sticking on LCD panel. Can use shuffle content periodically if fixed pattern is displayed on the screen.
- Do not touch the display area with bare hands, this will stain the display area.
- Pay attention to handle lead wire of backlight, that is not tugged in connect with LED driver.
- Do not change variable resistance settings in LCD panel, it may cause not satisfy of LCD characteristics specification.
- The surface of LCD panel's polarizer is very soft and easily scratched, please use a very soft dry cloth without chemicals for cleaning.
- To avoid the static electricity to damage the CMOS LSI, the operator should be grounded when in contact with the LCD panel, and also to all electrical equipment.
- Need to follow the correct power frequency when LCD panel is connecting and operating, this can avoid damage to CMOS LSI during latch-up.
- Need to store the LCD panel indoor without the exposure of sunlight where the temperature is $25^{\circ}\text{C} \pm 5^{\circ}\text{C}$ and the humidity is below 60% RH.