

## Product Specification

PART NUMBER # REV: FLC-215MML1000SA1#00

DESCRIPTION: TFT 21.5"W FHD 8bit LVDS 1000CD Full View

- ( ) Preliminary Specification
- (V) Approved Specification

<b>Customer Name:</b>	
<b>Signature:</b>	<b>Date:</b>

<b>PREPARED BY</b>	<b>REVIEWED BY</b>	<b>SIGNATURE DATE</b>
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## Revision History

Version	Date	Page	Description	Note
V1.0	2020/12/04		First Edition	
V1.1	2020/12/08		Revised O.D.	
V1.2	2020/12/29		Revise Drawing	

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# 1. GENERAL DESCRIPTION

## 1.1 Description

21.5"W 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 1920x1080 screen and 16.7 M 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	21.5"W	Inch
2	Pixel Number	1920 (H) x 3(RGB)x 1080 (V)	Pixels
3	Outline Dimension	495.6(W) × 292.2(H) × 24.05(D)	mm
4	Active Area	476.64 (H) x 268.11 (V)	mm
5	Pixel Pitch	248.25x248.25	um
6	Display Colors	16.7M colors	
7	Pixel Arrangement	RGB vertical stripe	--
8	Display Mode	Full View / Normally Black	--
9	Electrical Interface	LVDS	--
10	Surface Treatment	Antiglare, 3H	--
11	Brightness	1000 (Typ.)	cd/m2
12	Contrast Ratio	5000 (Typ.)	--

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## 2. ABSOLUTE MAXIMUM RATING

### 2.1 Electrical Absolute Rating

Item	Symbol	Values			Unit	Note
		Min	Typ	Max		
Logic/LCD Drive Voltage	VDD	0	-	5.5	V	
LED Forward Voltage	Vf	3.0	-	3.3	V	

Note (1) Permanent damage to the device may occur if max values are exceeded.

Function operation should be restricted to the conditions described under normal operating conditions.

(2) Specified values are for input pin of LED light bar at  $T_a = -25 \pm 2^\circ\text{C}$

### 2.2 Environment Absolute Rating

Item	Symbol	Values			Unit	Note
		Min	Typ	Max.		
Operating Temperature	Top	-20		+80	$^\circ\text{C}$	Note(1)(2)
Storage Temperature	Tstg	-20		+80	$^\circ\text{C}$	

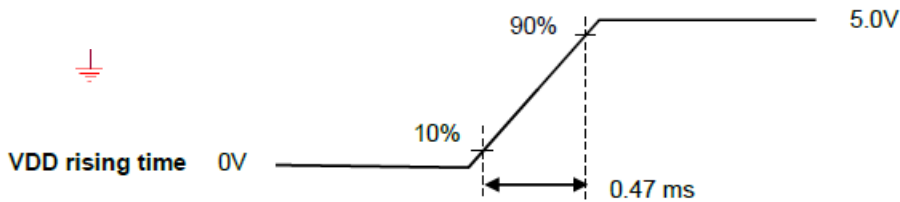
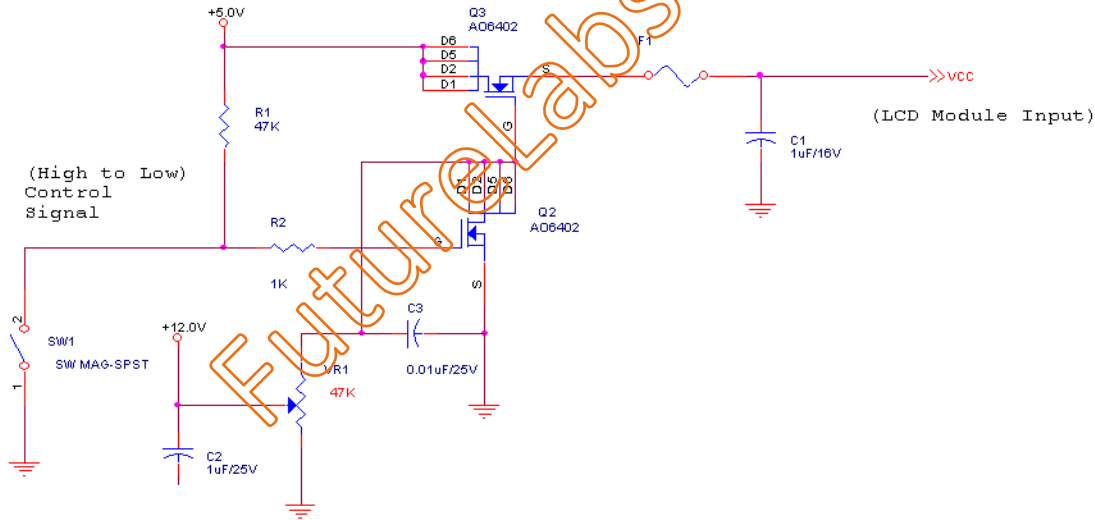
Note (1): The absolute maximum rating values of this product are not allowed to be exceeded at any times. The module should not be used over the absolute maximum rating value. It will cause permanently unrecoverable function fail in such a condition

### 3. ELECTRICAL CHARACTERISTICS

#### 3.1 LCD Electrical Specification

Item	Symbol	Min.	Type	Max.	Unit.	Note
LCD logic Driver voltage	VDD	4.5	5.0	5.5	V	+/- 10%
Allowable logic/LCD drive Ripple Voltage		-	-	500	mV	VDD=5V,all white pattern @75Hz
Inrush current	IRush	-	-	3	A	
LCD Input current	IDD	-	0.7	0.8	A	VDD=5V,all white pattern @60Hz
LCD Input current	IDD	-	0.81	0.89	A	VDD=5V,all white pattern @75Hz
VDD power consumption	PDD	-	3.5	4.4	W	VDD=5V,all white pattern @60Hz
VDD power consumption	PDD	-	4.05	4.9	W	VDD=5V,all white pattern @75Hz

Note 1: Measurement conditions: the duration of rising time of power input is 470us.



### 3.2 Signal Electrical Characteristics

Item	Symbol	Min.	Typ.	Max.	Unit	Note
Differential Input High Threshold	VTH	-	-	+100	mV	VCM=1.2V
Differential Input Low Threshold	VTL	-100	-	-	mV	VCM=1.2V
Input Differential Voltage	VID	100	-	600	mV	
Differential Input Common Mode Voltage	VCM	+1.0	+1.2	+1.5	V	VPH-TVL=200MV(max)

### 3.3 Backlight Unit

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

Item	Symbol	Min.	Typ.	Max.	Unit	Note
Power voltage	LED	10.8	12	13.2	V	PWM 180Hz
Forward current	IF	-	3.42	-	A	
Power Consumption	PLED	-	41.04	-	W	
Operating LED life time	Hr	50000	-	-	Hour	

Note: (1) Permanent damage may occur to the LCD module if beyond this specification. Functional operation should be restricted to the conditions described under normal operating conditions.

(2) LED light bar structure: 2 light bar x 4 strings x20pcs/string = 160pcs LED

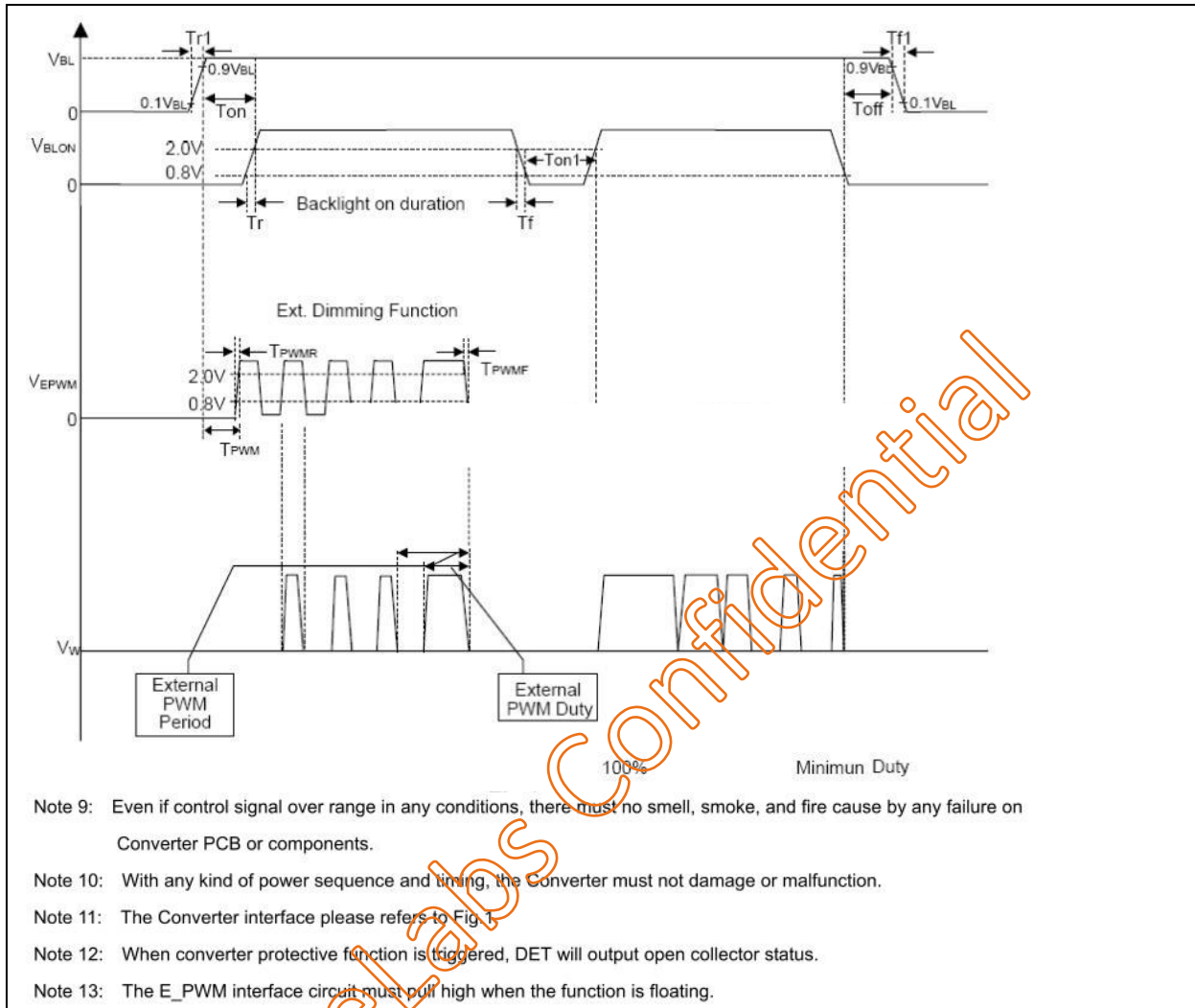
(3) The "LED life time" is defined as the module brightness decrease to 50% original brightness at Ta=25°C

## 4. Interface Characteristics & Timing

### 4.1 Interface Characteristics

Item		Symbol	Min.	Type	Max.	Unit.	Remark
On/Off control voltage	On	VBLON	2.0	-	5	V	Frame Rate=60Hz
	Off		0	-	0.8	V	
Error Signal		ERR					Normal: GND Abnormal: Open Collector
PWM Control Voltage	H	E_PWM	2.0	-	3.3	V	VSEL=H , ON duration
	L		0	-	0.8	V	VSEL=L, Off duration
Control signal rising time		Tr	-		100	ms	
Control signal falling time		Tf	-		100	ms	
VBL rising time		Tr1	-	20	-	ms	
VBL falling time		Tf1	-	20	-	ms	
PWM signal rising time		TPWMR	-	-	50	us	
PWM signal falling time		TPWMF	-	-	50	us	
Input impedance		RIN	300	-	-	Kohm	
BLON delay time		Ton	300	-	500	mS	
BLON off time		Toff	300	-	500	mS	
Dimming Control Frequency		FEPWM	90	180	240	Hz	
Dimming control duty		EPWM	0	-	100	%	



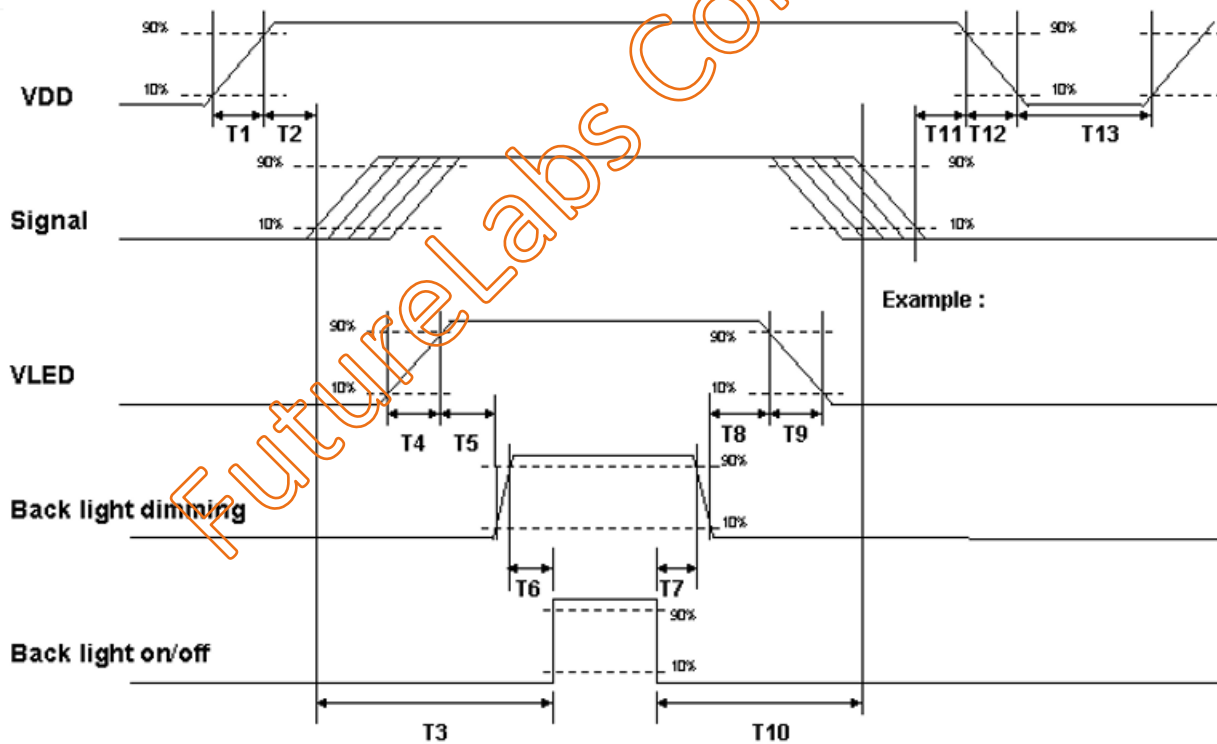


## 4.2 Timing

Signal	Item	Symbol	Min	Typ	Max	Unit
Clock	Frequency	1/ TClock	40	72	83	MHz
Frame Rate	Frequency	F	50	60	75	Hz
Vertical section	Period	TV	1092	1130	1653	T-line
	Active	TVD	1080	1080	1080	
	Blanking	TVB	12	50	573	
Horizontal Section	Period	TH	1004	1050	1100	T-clock
	Active	THD	960	960	960	
	Blanking	THB	44	90	140	

DE mode only; typical value refer to VESA standard.

## 4.3 Power On/Off Sequence



Parameter	Value			Units
	Min.	Typ.	Max.	
T1	0.5	--	10	[ms]
T2	30	40	50	[ms]
T3	200	--	--	[ms]
T4	0.5	--	10	[ms]
T5	10	--	--	[ms]
T6	10	--	--	[ms]
T7	0	--	--	[ms]
T8	10	--	--	[ms]
T9	--	--	10	[ms]
T10	110	--	--	[ms]
T11	0	16	50	[ms]
T12	--	--	10	[ms]
T13	1000	--	--	[ms]

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## 5. INTERFACE PIN DESCRIPTION

### 5.1 LCM Connector PIN Assignment

The electronics interface connector is JAE FI-XB30SRL-HF11 or Equivalent and mating housing part number is JAE FI-X30HL or compatible

Pin No.	Symbol	Function
1	RXinO0-	- LVDS differential data input (Odd data)
2	RXinO0+	+ LVDS differential data input (Odd data)
3	RXinO1-	- LVDS differential data input (Odd data)
4	RXinO1+	+ LVDS differential data input (Odd data)
5	RXinO2-	+LVDS differential data input (Odd data)
6	RXinO2+	-LVDS differential data input (Odd data)
7	GND	Power Ground
8	RXOCLKIN-	-LVDS differential clock input (Odd clock)
9	RXOCLKIN+	+LVDS differential clock input (Odd clock)
10	RXinO3-	+LVDS differential data input (Odd data)
11	RXinO3+	-LVDS differential data input (Odd data)
12	RXinE0-	- LVDS differential data input (Even data)
13	RXinE0+	+ LVDS differential data input (Even data)
14	GND	Power Ground
15	RXinE1-	- LVDS differential data input (Even data)
16	RXinE1+	+ LVDS differential data input (Even data)
17	GND	Power Ground
18	RXinE2-	- LVDS differential data input (Even data)
19	RXinE2+	+ LVDS differential data input (Even data)
20	RXECLKIN-	-LVDS differential clock input (Even clock)

21	RXECLKIN+	+LVDS differential clock input (Even clock)
22	RXinE3-	- LVDS differential data input (Even data)
23	RXinE3+	+ LVDS differential data input (Even data)
24	GND	Power Ground
25	NC	No Connection
26	NC	No Connection
27	NC	No Connection
28	VDD	Power +5V
29	VDD	Power +5V
30	VDD	Power +5V

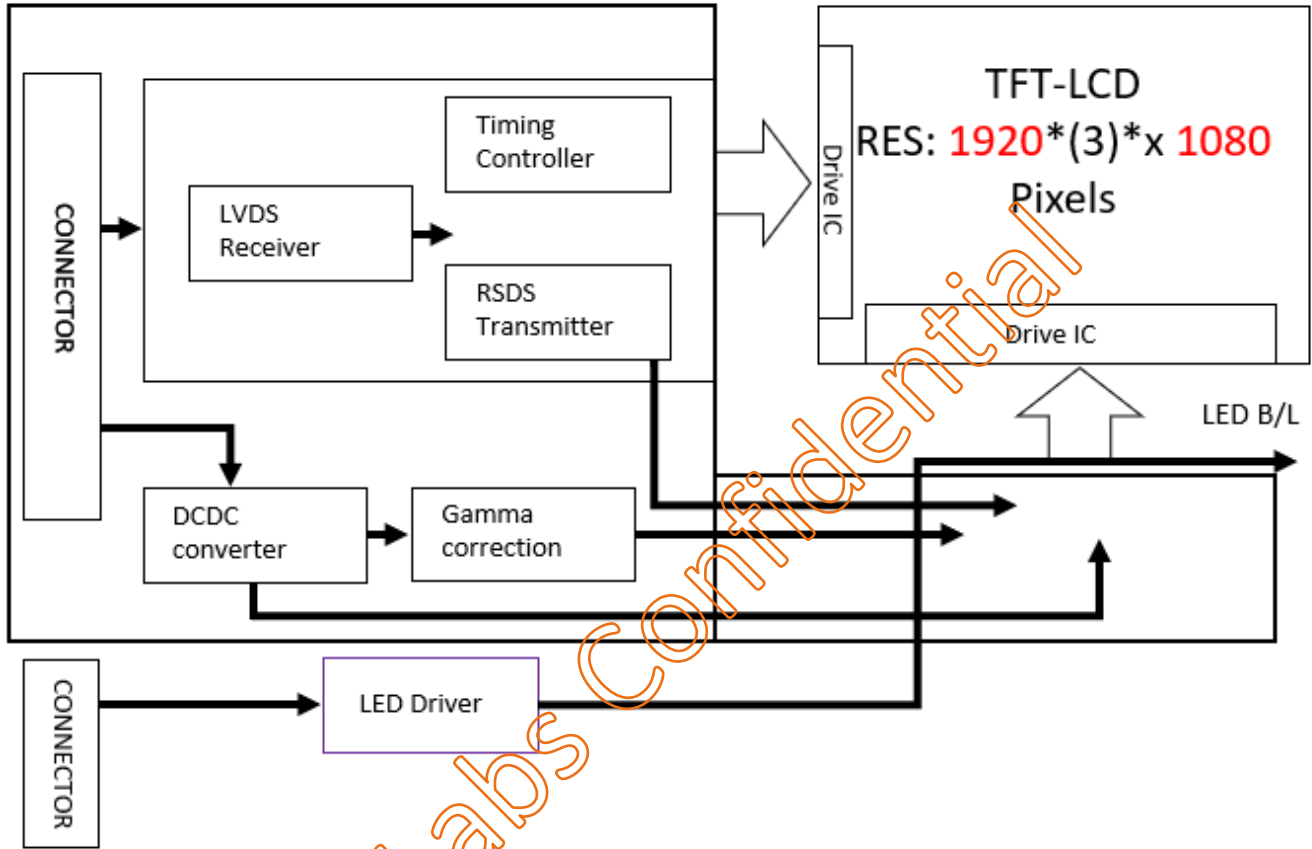
## 5.2 Backlight PIN Assignment

Connector model is CVILUX CI0110M1HRO-NH or equivalent

PIN #	SIGNAL NAME	DESCRIPTION
1	VCC	Supply Voltage 12V
2	VCC	Supply Voltage 12V
3	VCC	Supply Voltage 12V
4	VCC	Supply Voltage 12V
5	GND	Ground
6	GND	Ground
7	GND	Ground
8	GND	Ground
9	BLON	BL On/Off
10	E_PWM	PWM Control

## 7. BLOCK DIAGRAM

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



## 8. OPTICAL CHARACTERISTIC

The optical characteristics are measured under stable conditions at room temperature.

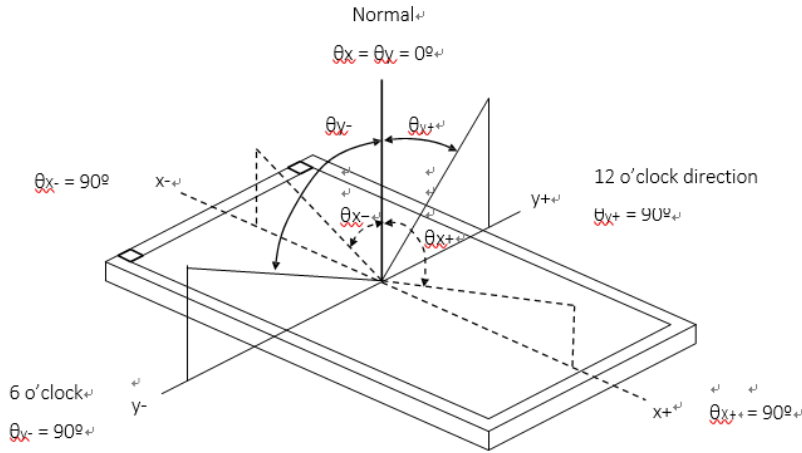
Item		Symbol	Condition	Min.	Typ.	Max.	Unit	Note	
Contrast Ratio		CR	$\theta_x=0^\circ, \theta_y=0^\circ$ Viewing angle at normal direction	3000	5000		-	(2)(5)	
Response Time		TR		-	20	25	ms	(3)	
		TF		-	5	10	ms		
Center Luminance of White		LC			800	1000		cd/m <sup>2</sup>	(4)(5)
Brightness uniformity					70	75	-	%	(5)(6)
Chromaticity	Red	Rx				0.654		-	(1) (5)
		Ry				0.336		-	
	Green	Gx				0.321		-	
		Gy				0.623		-	
	Blue	Bx			Typ.	0.152	Typ.	-	
		By		-0.05	0.065	+0.05	-		
	White	Wx			0.313		-		
		Wy			0.329		-		
Viewing Angle	Horizontal	$\theta_{y+}$	CR=10	75	89	-	Deg.	(1)(5)	
		$\theta_{x-}$		75	89	-			
	Vertical	$\theta_{y+}$		75	89	-			
		$\theta_{y-}$		75	89	-			
Crosstalk(in 60HZ)						1.5	%		
Flicker						-20	dB		

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°C±2°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

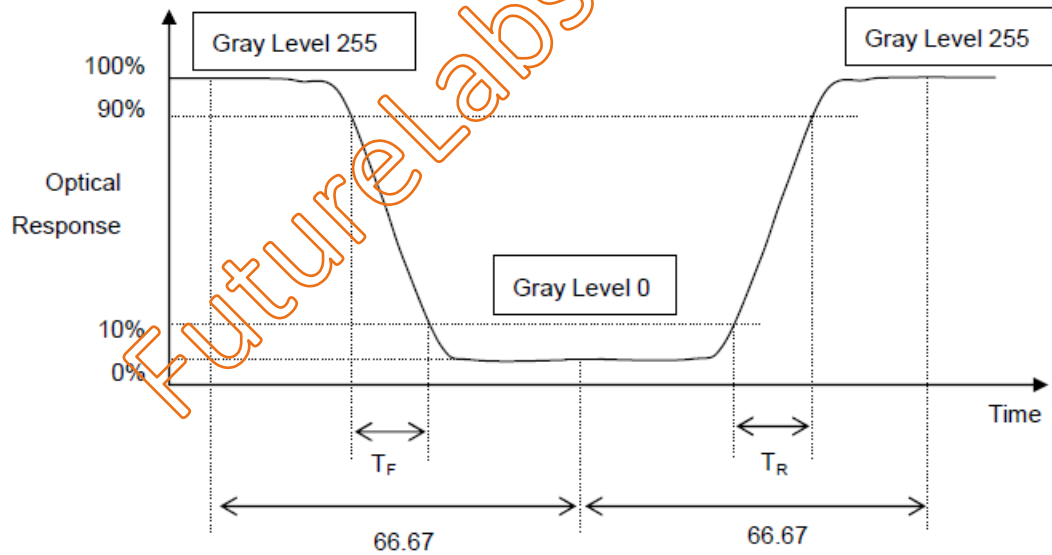


Note 2: Definition of Contrast Ratio (CR)

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 ( $T_R$ )" and the "Falling Time ( $T_F$ )" respectively. Please refer the figure to the followings:

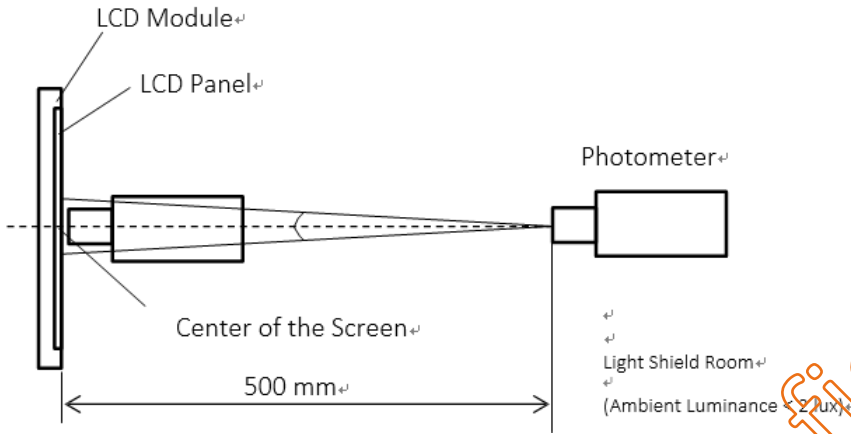


Note 4: Definition of Brightness (L)

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:

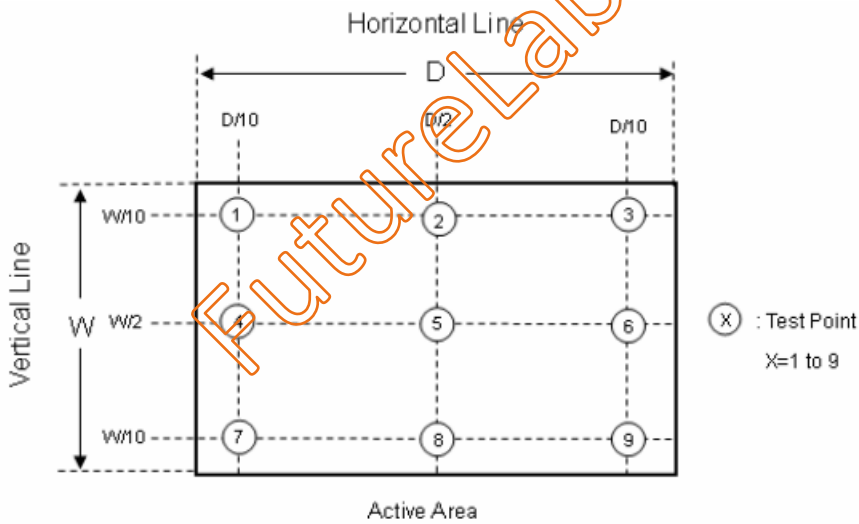




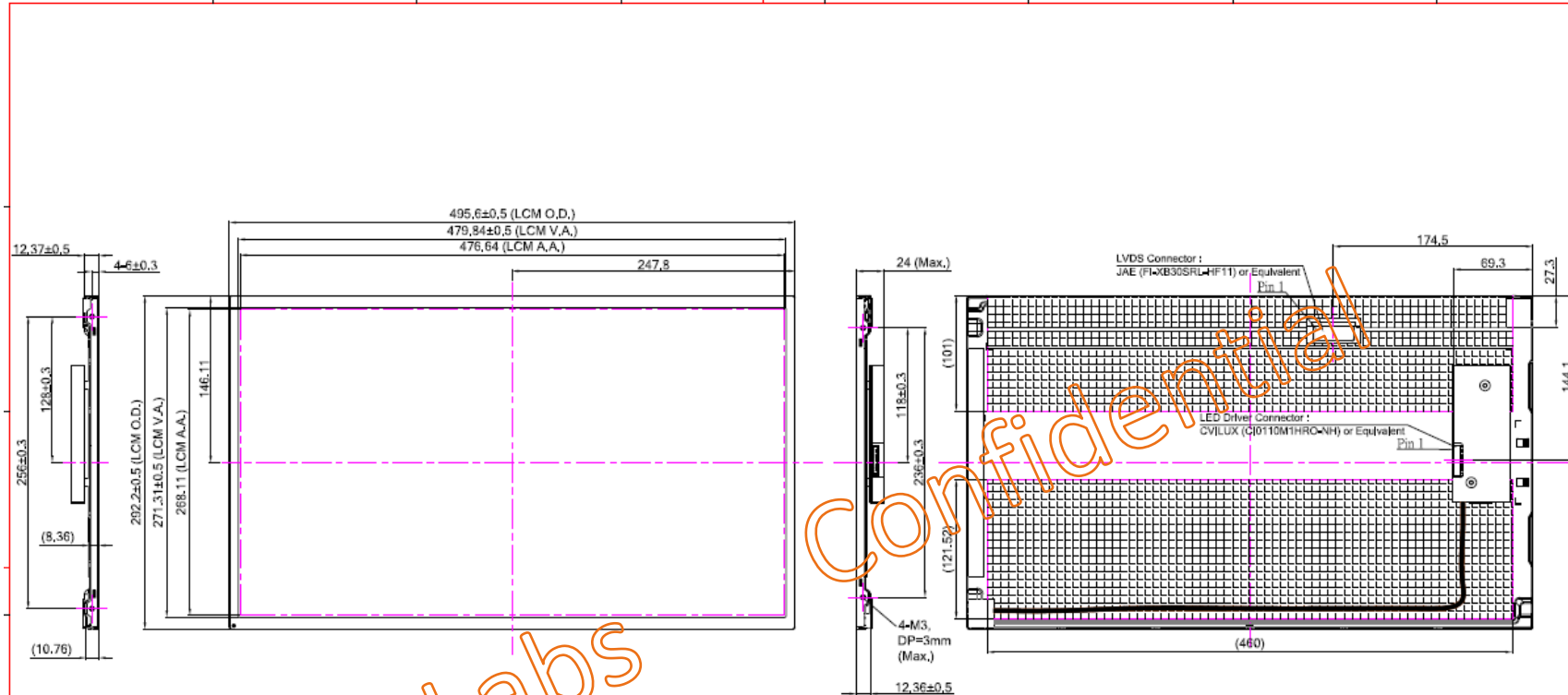
Note 6: Definition of White Variation ( $\delta W$ ):

Measure the luminance of gray level 255 at 5 points

$$\delta W = \text{Maximum} [L(1), L(2), L(3), L(4) \sim L(9)] / \text{Minimum} [L(1), L(2), L(3), L(4) \sim L(9)]$$



# 9. DIMENSION AND DRAWING




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**NOTES:**  
1. General tolerance are ±0.5mm

LED Driver PIN Define		LVDS PIN Define					
NO.	Description	NO.	Pin Define	NO.	Pin Define	NO.	Pin Define
1	VCC 12V	1	RxOIN0-	11	RxOIN3+	21	RxECLKIN+
2	VCC 12V	2	RxOIN0+	12	RxEIN0-	22	RxEIN3-
3	VCC 12V	3	RxOIN1-	13	RxEIN0+	23	RxEIN3+
4	VCC 12V	4	RxOIN1+	14	GND	24	GND
5	GND	5	RxOIN2-	15	RxEIN1-	25	NC
6	GND	6	RxOIN2+	16	RxEIN1+	26	NC
7	GND	7	GND	17	GND	27	NC
8	GND	8	RxOCLKIN-	18	RxEIN2-	28	VDD
9	BL ON/OFF	9	RxOCLKIN+	19	RxEIN2+	29	VDD
10	External PWM Control	10	RxOIN3-	20	RxECLKIN-	30	VDD

Customer Approval	Part Number #Rev.	FLC-215MML1000SA1 #00	
Date	Max Date	Person	Description
Company	01/2020	01/27/20	Supplier update Drawing SPEC
Name	02/2020	02/24/20	Asst. mdr
Signature	Date	Design By	Date
	For Drawing	02/20/20	11/20
		Check By	Date
		Approved By	

## 10. 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.