



深圳市拓普微科技开发有限公司

SHENZHEN TOPWAY TECHNOLOGY CO., LTD.

# LMT185EBKFDA

## LCD Module User Manual

Prepared by:  <b>Chenzhonghua</b>  Date: 2024-03-16	Checked by:    Date:	Approved by:    Date:
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Rev.	Descriptions	Edit	Release Date
0.1	Preliminary	Chenzhonghua	2024-03-16

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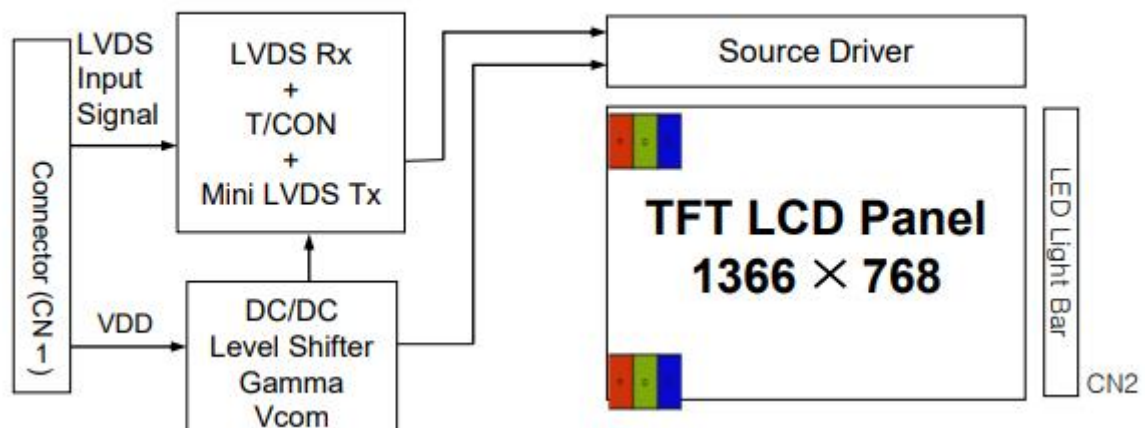
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## 1. General Description

### 1.1 Introduction

LMT185EBKFDA is a color active matrix TFT LCD module using amorphous silicon TFT's (Thin Film Transistors) as an active switching devices. This module has a 18.5 inch diagonally measured active area with WXGA resolutions (1366 horizontal by 768 vertical

pixel array). Each pixel is divided into RED, GREEN, BLUE dots which are arranged in vertical stripe and this module can display 16.7M colors. The TFT-LCD panel used for this module is adapted for a low reflection and higher color type.



### 1.2 Features

- LVDS Interface with 1 pixel / clock
- High-speed response
- Low power consumption
- 6-bit (Hi-FRC) color depth, display 16.7M colors
- Incorporated edge type back-light (One Light Bar)
- High luminance and contrast ratio, low reflection and normal viewing angle
- DE (Data Enable) only
- RoHS
- ES 6.0 compliant
- Gamma correction

### 1.3 Application

- Desktop Type of PC & Workstation Use
- Slim-Size Display for Stand-alone Monitor
- Display Terminals for Control System
- Monitors for Process Controller

**1.4 General Specification**

<b>Parameter</b>	<b>Specification</b>	<b>Unit</b>	<b>Remarks</b>
Active area	409.8(H) × 230.4(V)	mm	
Number of pixels	1366(H) × 768(V)	pixels	
Pixel pitch	0.1(H) × 0.3(V)	mm	
Pixel arrangement	RGB Vertical stripe		
Display colors	16.7M	colors	
Display mode	Normally Black		
Dimensional outline	430.4(H) × 254.6(V) × 10.9(D) typ.	mm	Detail refer to drawing
Weight	1300(typ.)	g	
Bezel width (L/R/U/D)	8.5/8.5/10.3/10.3	mm	
Surface Treatment	Haze 25%, 3H		
Back-light	rightedge side, 1-LED Light bar		

## 2. Terminal Function

### 2.1 Electrical Interface Connection

- CN1                      Module Side Connector : UJU IS100-30O-C23 or Equivalent  
                                  User Side Connector : JAE FI-X30H or Equivalent

Pin No	Symbol	Function	Remark
1	NC	No connection	
2	NC	No connection	
3	NC	No connection	
4	GND	GND Ground	
5	RX0-	Negative LVDS differential data input. Channel 0	
6	RX0+	Positive LVDS differential data input. Channel 0	
7	GND	Ground	Optical: Bist function
8	RX1-	Negative LVDS differential data input. Channel 1	
9	RX1+	Positive LVDS differential data input. Channel 1	
10	GND	Ground	
11	RX2-	Negative LVDS differential data input. Channel 2	
12	RX2+	Positive LVDS differential data input. Channel 2	
13	GND	Ground	
14	RXCLK-	Negative LVDS differential clock input.	
15	RXCLK+	Positive LVDS differential clock input.	
16	GND	Ground	
17	RX3-	Negative LVDS differential data input. Channel 3	
18	RX3+	Positive LVDS differential data input. Channel 3	
19	GND	Ground	
20	NC	Not connection, this pin should be open.	
21	NC	Not connection, this pin should be open.	
22	NC	Not connection, this pin should be open.	
23	GND	Ground	
24	GND	Ground	
25	GND	Ground	
26	VCC	5V Power supply	
27	VCC		
28	VCC		
29	VCC		
30	VCC		

**2.2 LED Light Bar**

-LED connector: 3708K-Q06N-00R manufactured by Entry

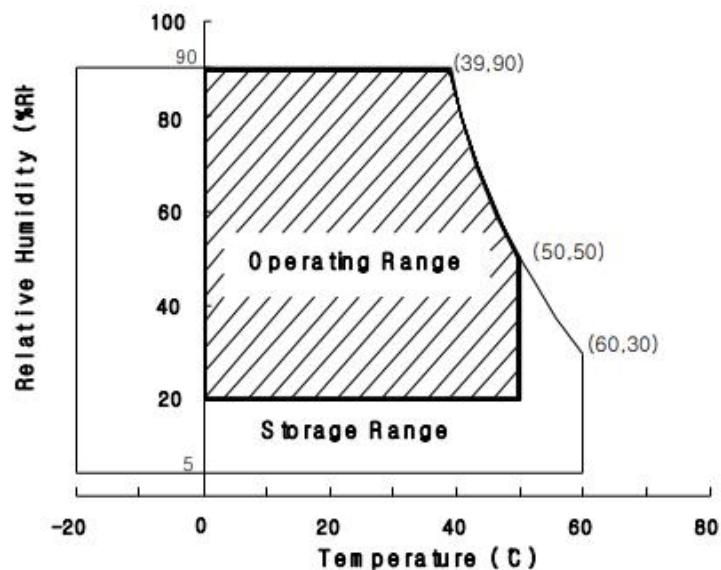
Pin No	Symbol	Description
1	IRLED1	LED current sense for string1
2	IRLED2	LED current sense for string2
3	VLED	LED power supply
4	VLED	LED power supply
5	IRLED3	LED current sense for string3
6	IRLED4	LED current sense for string4

**3. Absolute Maximum Ratings**

**3.1 Driving TFT LCD Panel**

Parameter	Symbol	Min.	Max.	Unit	Remarks
Power Supply Voltage	$V_{DD}$	-0.3	5.5	V	Ta = 25 °C
Logic Supply Voltage	$V_{IN}$	VSS-0.3	$V_{DD}+0.3$	V	
LED Channel Current	$I_{BL}$	-	85	mA	
Operating Temperature	$T_{OP}$	0	+50	°C	1)
Storage Temperature	$T_{ST}$	-20	+60	°C	1)

Note : 1) Temperature and relative humidity range are shown in the figure below.  
Wet bulb temperature should be 39 OC max. and no condensation of water.



## 4. Electrical Characteristics

### 4.1 Electrical Specifications

[Ta = 25± 2 °C]

Parameter		Min.	Typ.	Max.	Unit	Remarks
Power Supply Voltage	V <sub>DD</sub>	4.5	5.0	5.5	V	Note1
Power Supply Current	I <sub>DD</sub>	-	500	720	mA	
In-Rush Current	I <sub>RUSH</sub>	-	2	3	A	Note 2
Permissible Input Ripple Voltage	V <sub>RF</sub>	-	-	300	mV	Note1,3
High Level Differential Input Threshold Voltage	V <sub>IH</sub>	-	-	+100	mV	
Low Level Differential Input Threshold Voltage	V <sub>IL</sub>	-100	-	-	mV	
Differential input voltage	V <sub>ID</sub>	200	-	600	mV	
Differential input common mode voltage	V <sub>cm</sub>	1.0	1.2	1.5		V <sub>IH</sub> =100mV, V <sub>IL</sub> =-100mV
LED Channel Voltage	V <sub>L</sub>	17.4	18	19.8	V	
LED Channel Current	I <sub>L</sub>	-	100	-	mA	
LED Lifetime		30,000	-	-	Hrs	
Power Consumption	P <sub>D</sub>	-	2.5	3.6	W	@60Hz
	P <sub>BL</sub>	-	7.2	7.92	W	I <sub>L</sub> =100mA, Note 4
	P <sub>total</sub>	-	8.62	10.33	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 VDD=5.0V, Frame rate=60Hz and

Clock frequency = 75.4MHz. Test Pattern of power supply current

a) Typ : Color Bar pattern

b) Max: Gray Level 255

2. Duration of rush current is about 2 ms and rising time of VDD is 520 μs ± 20 %

3. Ripple Voltage should be covered by Input voltage Spec.

4. Calculated value for reference (V<sub>L</sub> × I<sub>L</sub>) × 4(channel) excluding driver loss. (LED Light bar: 6S4P)

## 4.2 Backlight Unit

Parameter		Min.	Typ.	Max.	Unit	Remarks
LED Light Bar Input Voltage Per Input Pin	VPIN	17.4	18	19.8	V	Duty 100%
LED Light Bar Input Current Per Input pin	IPIN	-	100	-	mA	
LED Power Consumption	P <sub>BL</sub>	-	7.2	7.92	W	Note 3
LED Life-Time	-	30,000	-		Hrs	Note 4

LED bar consists of 24LED packages,4 strings(parallel)\*6packages(serial)

Note1: There are one light bar ,and the specified current is input LED chip 100% duty current

Note2: The sense current of each input pin is 100mA

Note3:  $P_{BL}=4 \text{ Input pins} \times V_{PIN} \times I_{PIN}$

Note4: The lifetime is determined as the time at which luminance of LED become 50% of the initial brightness or not normal lighting at  $I_{PIN}=85\text{mA}$  on condition of continuous operating at  $25 \pm 2 \text{ }^\circ\text{C}$



**5. LVDS Interface**

	Input Signal	Transmitter		Interface		LMT185EBKFDA (CN11)	Remark
		Pin No.	Pin No.	System (Tx)	TFT-LCD (Rx)	Pin No.	
LVDS	OR0	51	48 47	OUT0- OUT0+	RX00- RX00+	5 6	
	OR1	52					
	OR2	54					
	OR3	55					
	OR4	56					
	OR5	3					
	OG0	4	46 45	OUT1- OUT1+	RX01- RX01+	8 9	
	OG1	6					
	OG2	7					
	OG3	11					
	OG4	12					
	OG5	14					
	OB0	15	42 41	OUT2- OUT2+	RX02- RX02+	11 12	
	OB1	19					
	OB2	20					
	OB3	22					
	OB4	23					
	OB5	24					
	Hsync	27	40 39	CLK OUT- CLK OUT+	RX0 CLK- RX0 CLK+	14 15	
	Vsync	28					
	DE	30	38 37	OUT3- OUT3+	RX03- RX03+	17 18	
	MCLK	31					
	OR6	50					
	OR7	2					
	OG6	8					
	OG7	10					
	OB6	16					
	OB7	18					
RSVD	25						

## 6. Timing Chart

### 6.1 AC Characteristics(LVDS)

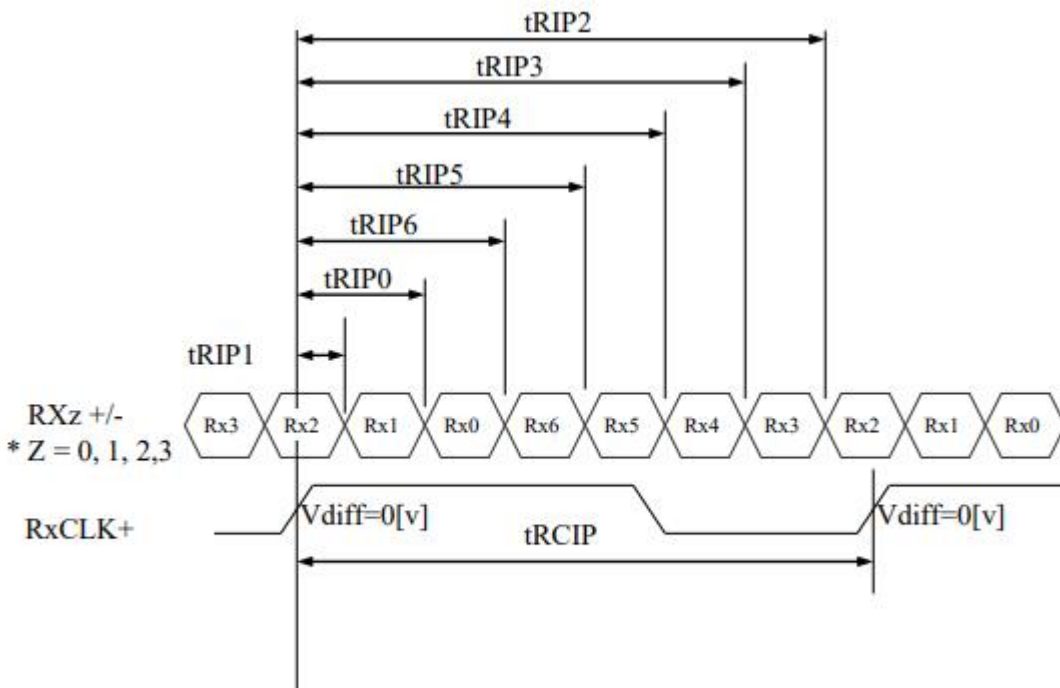
Item	Symbols		Min	Typ	Max	Unit
DCLK	Period	tCLK	10.6	13.26	15.91	ns
	Frequency	-	62.9	75.4	94.3	MHz
Horizontal Display Term	Period	tHP	1446	1560	1936	tCLK
	Horizontal Valid	tHV	1366	1366	1366	tCLK
	Horizontal Blank	tHB	80	194	570	tCLK
	Frequency	fH	40.3	48.36	60.45	KHz
Vertical Display Term	Period	tVP	778	806	888	tHP
	Vertical Valid	tVV	768	768	768	tHP
	Vertical Blank	tVB	10	38	120	tHP
	Frequency	fV	50	60	75	Hz
LVDS Receiver clock	Input spread spectrum ratio	SSr	-3	-	+3	%

Note: The DCLK range at last line of V-blanking should be set in 0~987

**6.2 LVDS Rx Interface Timing Parameter**

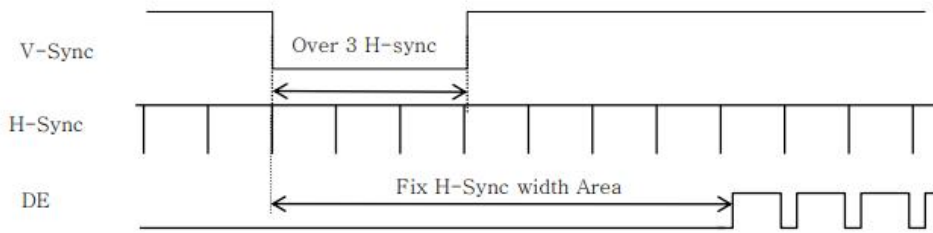
The specification of the LVDS Rx interface timing parameter is shown.

Item	Symbol	Min	Typ	Max	Unit	Remark
CLKIN Period	tRCIP	10.60	13.26	15.91	nsec	
Input Data 0	tRIP1	-0.4	0.0	+0.4	nsec	
Input Data 1	tRIP0	tRCIP/7-0.4	tRCIP/7	tRCIP/7+0.4	nsec	
Input Data 2	tRIP6	2 ×tRCIP/7-0.4	2 ×tRCIP/7	2 ×tRCIP/7+0.4	nsec	
Input Data 3	tRIP5	3 ×tRCIP/7-0.4	3 ×tRCIP/7	3 ×tRCIP/7+0.4	nsec	
Input Data 4	tRIP4	4 ×tRCIP/7-0.4	4 ×tRCIP/7	4 ×tRCIP/7+0.4	nsec	
Input Data 5	tRIP3	5 ×tRCIP/7-0.4	5 ×tRCIP/7	5 ×tRCIP/7+0.4	nsec	
Input Data 6	tRIP2	6 ×tRCIP/7-0.4	6 ×tRCIP/7	6 ×tRCIP/7+0.4	nsec	



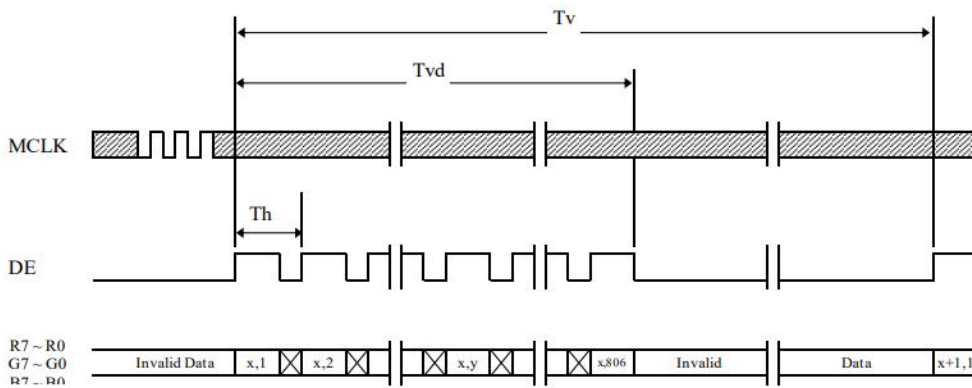
\*  $V_{diff} = (RXz+) - (RXz-), \dots, (RXCLK+) - (RXCLK-)$

### 6.3 Sync Timing Waveforms

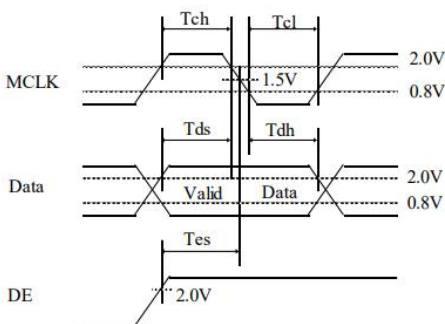
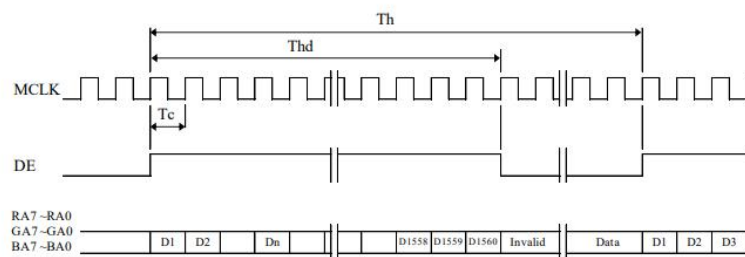


- 1) Need over 3 H-sync during V-Sync Low
- 2) Fix H-Sync width from V-Sync falling edge to first rising edge

### 6.4 Vertical Timing Waveforms



### 6.5 Horizontal Timing Waveforms

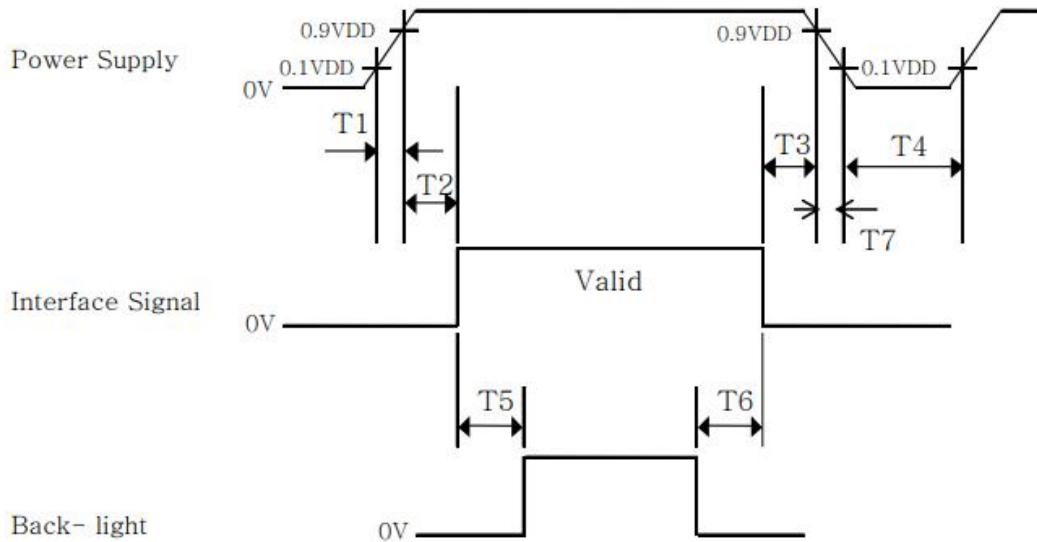


**7. Input signals, Basic display colors & Grayscale of colors**

Color & Gray Scale		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	B3	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	0	1	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
	▽	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	1	1	1	1	1	1	1	1	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	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
	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
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	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
	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
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

## 8. 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



- $0.5\text{ ms} \leq T1 \leq 10\text{ms}$
- $0 \leq T2 \leq 50\text{ ms}$
- $0 \leq T3 \leq 50\text{ ms}$
- $1\text{sec} \leq T4$
- $200\text{ ms} \leq T5$
- $200\text{ ms} \leq T6$

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 signal high impedance when power is on.
3. Back Light must be turn on after power for logic and interface signal are valid.
4. T7 decreases smoothly, there is none re-bouncing voltage.

## 9. Optical Characteristics

### 9.1 Overview

The test of Optical specifications shall be measured in a dark room (ambient luminance  $\leq 1$  lux and temperature =  $25 \pm 2^\circ\text{C}$ ) with the equipment of Luminance meter system (Goniometer system and TOPCONE PR730) and test unit shall be located at an approximate distance 50cm from the LCD surface at a viewing angle of  $\theta$  and  $\Phi$  equal to 0. We refer to  $\theta_{\theta=0}$  ( $=\theta_s$ ) as the 3 o'clock direction (the "right"),  $\theta_{\theta=90}$  ( $=\theta_{12}$ ) as the 12 o'clock direction ("upward"),  $\theta_{\theta=180}$  ( $=\theta_9$ ) as the 9 o'clock direction ("left") and  $\theta_{\theta=270}$  ( $=\theta_6$ ) as the 6 o'clock direction ("bottom"). While scanning  $\theta$  and/or  $\Phi$ , the center of the measuring spot on the Display surface shall stay fixed. The measurement shall be executed after 30 minutes warm-up period. VDD shall be 5.0V +/-10% at  $25^\circ\text{C}$ . Optimum viewing angle direction is 6 'clock



**9.2 Optical Characteristics**

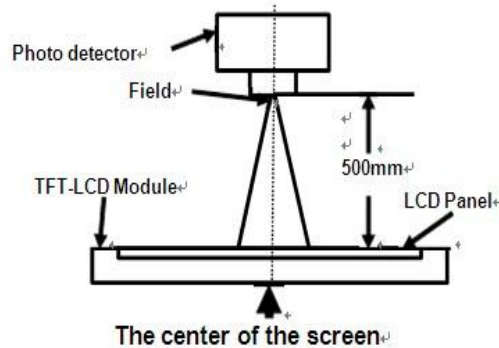
Item	Symbol	Condi	Min	Typ	Max	Unit	Remark	
View Angles	$\theta T$	$CR \geq 10$	85	89	-	Degree	Note 2	
	$\theta B$		85	89	-			
	$\theta L$		85	89	-			
	$\theta R$		85	89	-			
Contrast Ratio	CR	$\theta=0^\circ$	700	1000	-	-	Note1 Note3	
Response Time	TON+TOFF	25°C	-	15	25	ms	Note1 Note4	
Chromaticity	White	Backlight is on	x	0.283	0.313	0.343	-	Note5 Note1
			y	0.299	0.329	0.359		
	Red		x	0.638	0.658	0.688		
			y	0.308	0.338	0.368		
	Green		x	0.267	0.297	0.327		
			y	0.627	0.657	0.687		
	Blue		x	0.122	0.152	0.182		
			y	0.040	0.070	0.100		
Uniformity	U	-	75	80	-	%	Note1 Note6	
Luminance	L	-	200	250	-	cd/m <sup>2</sup>	Note1 Note7	

Test Conditions:

1. The ambient temperature is  $25 \pm 2^\circ\text{C}$ . humidity is  $65 \pm 7\%$
2. The test systems refer to Note 1 and Note 2.

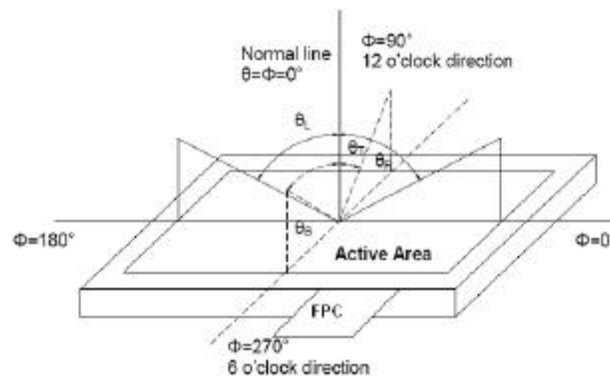
Note 1: Definition of optical measurement system.

The optical characteristics should be measured in dark room. After 5 Minutes operation, the optical properties are measured at the center point of the LCD screen. All input terminals LCD panel must be ground when measuring the center area of the panel.



Note 2: Definition of viewing angle range and measurement system.

viewing angle is measured at the center point of the LCD.



Note 3: Definition of contrast ratio

$$\text{Contrast ratio (CR)} = \frac{\text{Luminance measured when LCD is on the "White" state}}{\text{Luminance measured when LCD is on the "Black" state}}$$

“White state”: The state is that the LCD should driven by Vwhite.

“Black state”: The state is that the LCD should driven by Vblack.

Vwhite: To be determined                      Vblack: To be determined.

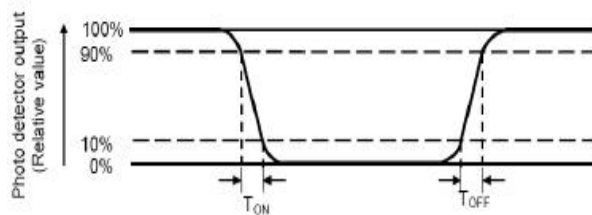
**Note 4: Definition of Response time**

The response time is defined as the LCD optical switching time interval between “White” state and “Black” state.

Rise time (TON) is the time between photo detector output intensity changed from 90% to 10%. And fall time

(TOFF) is the time between photo detector output intensity changed from 10% to 90%.

White (TFT off)	Black (TFT on)		White (TFT off)
-----------------	----------------	--	-----------------



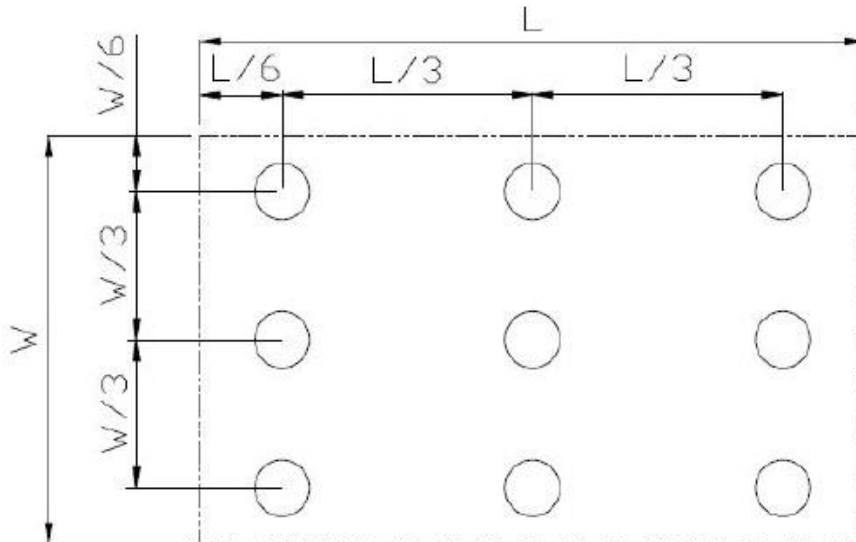
**Note 5: Definition of color chromaticity (CIE1931)**  
Color coordinates measured at center point of LCD.

**Note 6: Definition of Luminance Uniformity**

Active area is divided into 9 measuring areas (Refer Fig. 2). Every measuring point is placed at the center of each measuring area.

L-----Active area length                      W----- Active area width

$$\text{Luminance Uniformity (U)} = \text{Lmin} / \text{Lmax}$$



Lmax: The measured Maximum luminance of all measurement position.

Lmin: The measured Minimum luminance of all measurement position.

**Note 7: Definition of Luminance:**

Measure the luminance of white state at center point.



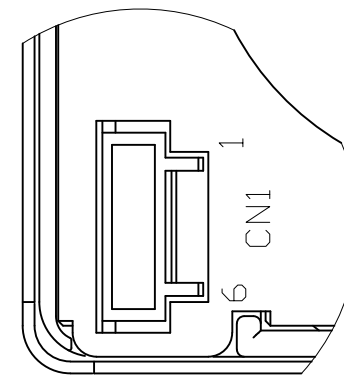
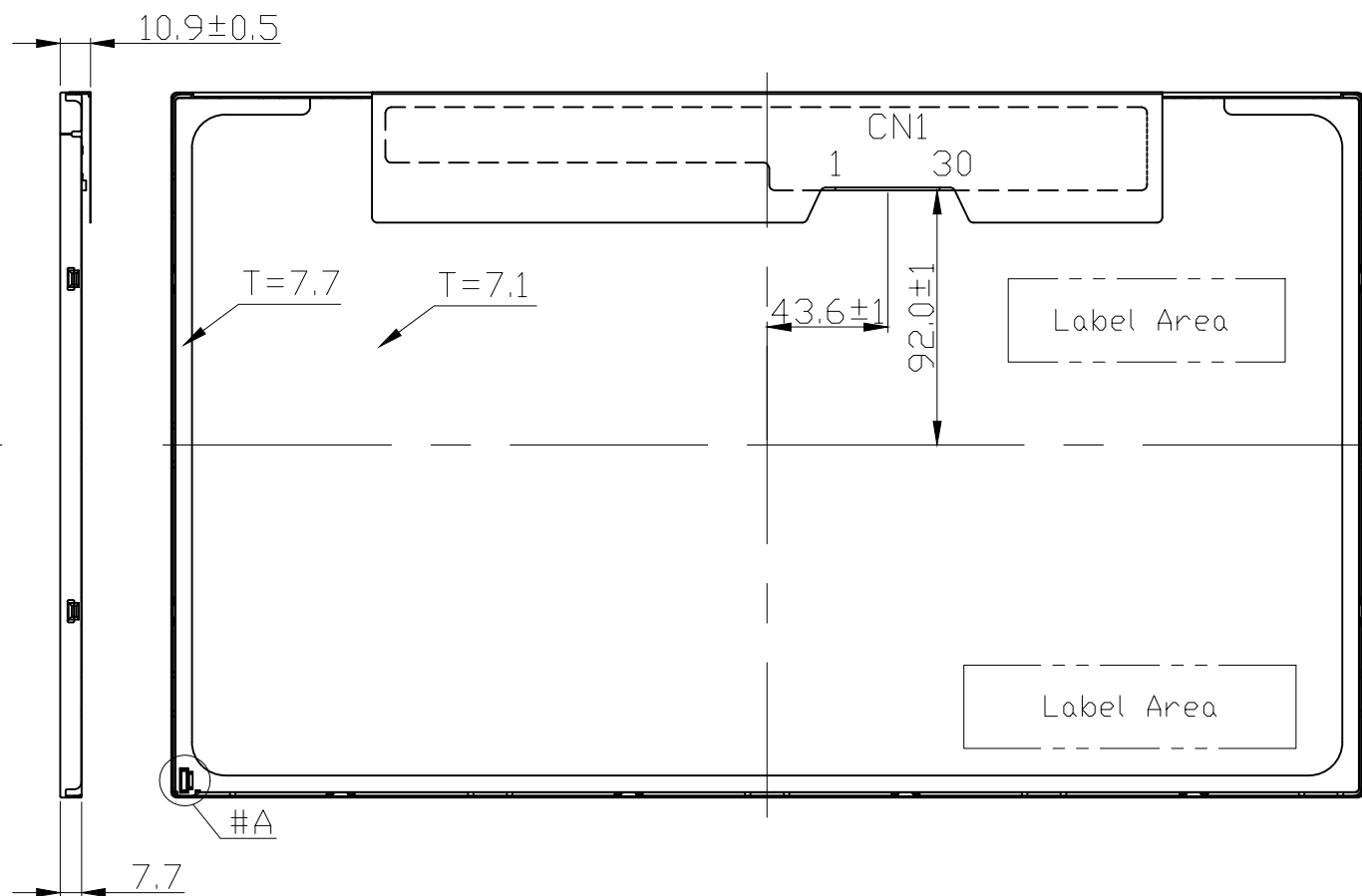
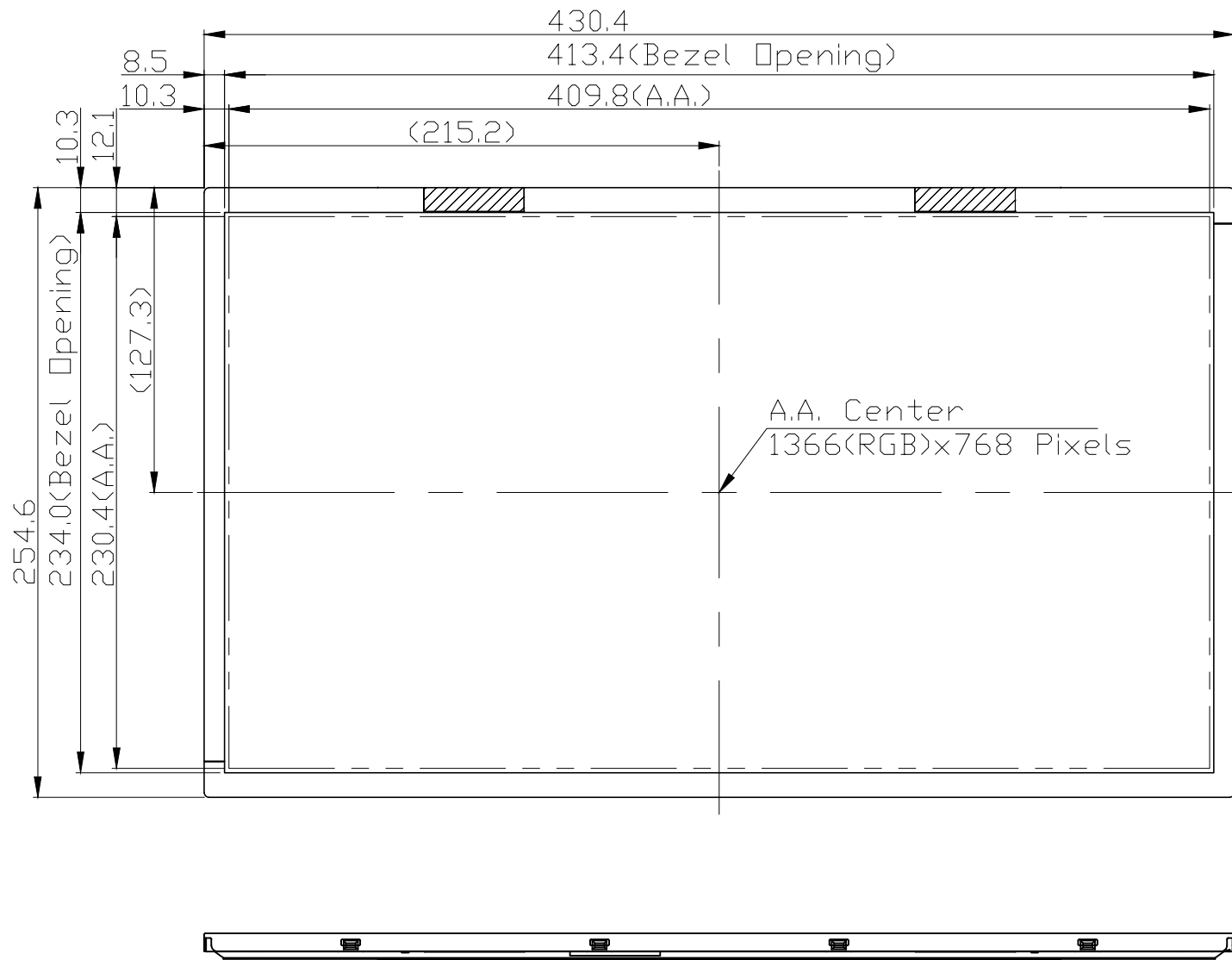
## 10. Mechanical characteristics

Parameter	Specification	Unit
Dimensional outline	430.4 × 254.6× 10.9	mm
Weight	1300(typ.)	gram
Active area	409.8(H) × 230.4(V)	mm
Pixel pitch	0.1(H) × 0.3(V)	mm
Number of pixels	1366(H)× 768(V) (1 pixel = R + G + B dots)	pixels
Back-light	Right edge side 1-LED Light bar Type	

## 11. Warranty

This product has been manufactured to our company's specifications as a part for use in your company's general electronic products. It is guaranteed to perform according to delivery specifications. For any other use apart from general electronic equipment, we cannot take responsibility if the product is used in medical devices, nuclear power control equipment, aerospace equipment, fire and security systems, or any other applications in which there is a direct risk to human life and where extremely high levels of reliability are required. If the product is to be used in any of the above applications, we will need to enter into a separate product liability agreement.

- We cannot accept responsibility for any defect, which may arise from additional manufacturing of the product (including disassembly and reassembly), after product delivery.
- We cannot accept responsibility for any defect, which may arise after the application of strong external force to the product.
- We cannot accept responsibility for any defect, which may arise due to the application of static electricity after the product has passed our company's acceptance inspection procedures.
- When the product is in CCFL models, CCFL service life and brightness will vary according to the performance of the inverter used, leaks, etc. We cannot accept responsibility for product performance, reliability, or defect, which may arise.
- We cannot accept responsibility for intellectual property of a third party, which may arise through the application of our product to our assembly with exception to those issues relating directly to the structure or method of manufacturing of our product.



CN1 Terminal		
No	Pin	Name
1	NC	
2	NC	
3	NC	
4	GND	
5	RX0-	
6	RX0+	
7	GND	
8	RX1-	
9	RX1+	
10	GND	
11	RX2-	
12	RX2+	
13	GND	
14	RXCLK-	
15	RXCLK+	
16	GND	
17	RX3-	
18	RX3+	
19	GND	
20	NC	
21	NC	
22	NC	
23	GND	
24	GND	
25	GND	
26	VCC	
:	:	
30	VCC	

CN2 Terminal		
No	Pin	Name
1	IRLED1	
2	IRLED2	
3	VLED	
4	VLED	
5	IRLED3	
6	IRLED4	

- Note:
- \*1. LCD Display Type: TFT.Transmissive(Full view)
  - \*2. Pixel Arrangement: RGB-STRIPE
  - \*3. Color Depth : 16.7M/262K
  - \*4. Interface : LVDS\_18bit/24bit
  - \*5. Supply Voltage : 5.0V
  - \*6. Backlight Supply : 100mA(Constant Current 18.0V TYP.)
  - \*7. Backlight : White LED
  - \*8. Connector type :  
 CN1 : FI-XB30SSL-HF15(JAE) or IS100-L300-C23(UJU) or equivalent  
 CN2 : 3707K-Q06N-08X(ENTERY) or equivalent
  - \*9. Operating Temperature : 0°C~50°C
  - \*10. Storage Temperature : -20°C~60°C
  - \*11. Unmarked Tolerance : ≤150,±0.3; >150,±0.5

B			
A			
Rev/Note		Date	
Dwg Title	LMT185EBKFDA Outline Dwg		
Dwg No.	MK-008389-1-1	Date	2024-03-16
Scale	1/1	Tol.	Unit mm Paper Size A3
Approved	Checked	Drawn Tao qingwen	

