

# SPECIFICATION

**PRODUCT NO. : TCXD215MBLON-68**

**VERSION : Ver 1.0**

**ISSUED DATE : 2022-07-20**

This module uses ROHS material

**FOR CUSTOMER:** \_\_\_\_\_

APPROVAL FOR SPECIFICATION

APPROVAL FOR SAMPLE

DATE	APPROVED BY

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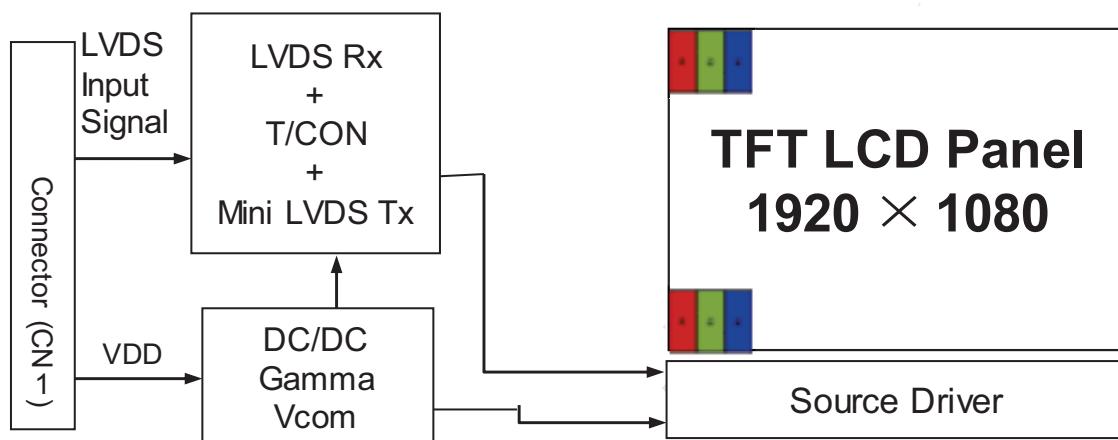


## **1. Record of Revision**

## 1.0 GENERAL DESCRIPTION

### 1.1 Introduction

TCXD215MBLON-68 is a color active matrix TFT LCD module using amorphous silicon TFTs (Thin Film Transistors) as an active switching devices. This module has a 21.5 inch diagonally measured active area with FHD resolutions (1920 horizontal by 1080 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 2 pixel / clock
- High-speed response
- 0.5t Glass
- 6-bit (Hi-FRC) color depth, display 16. 7M colors
- High luminance and contrast ratio, low reflection and wide viewing angle
- DE (Data Enable) only
- RoHS/Halogen Free
- ES 7.0 compliant
- Gamma Correction
- Reverse type

### 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

The followings are general specifications at the model TCXD215MBLON-68.

<Table 1. General Specifications>

Parameter	Specification	Unit	Remarks
Active area	476.064(H) × 267.786(V)	mm	Diagonal: 546.87mm
Number of pixels	1920(H) × 1080(V)	pixels	
Pixel pitch	0.24795(H) x 0.24795(V)	mm	
Pixel arrangement	RGB Vertical stripe	-	
Display colors	16.7M	colors	
Display mode	Normally Black	-	
Dimensional outline	495.6(H)×292.2(V) ×9.15mm	mm	Detail refer to drawing
Weight	TBD	g	
Surface Treatment	Anti-glare, 3H	-	
Power Consumption	P <sub>D</sub> : 6w (max)		@75HZ
Luminance of white	250	(Cd/m <sup>2</sup> )	

## 2.0 ABSOLUTE MAXIMUM RATINGS

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.

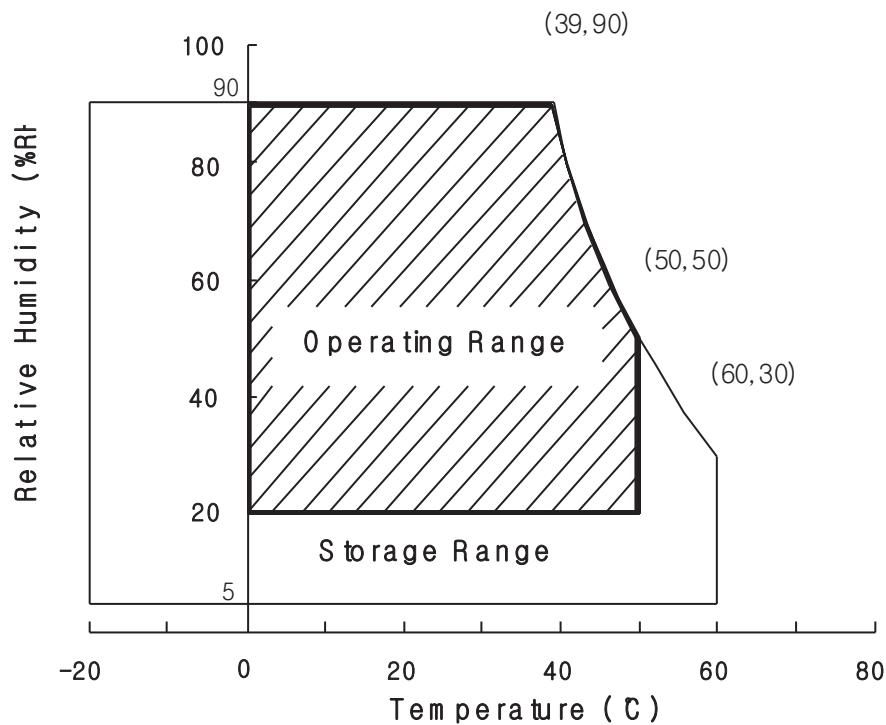
&lt; Table 2. Absolute Maximum Ratings&gt;

[VSS=GND=0V]

Parameter	Symbol	Min.	Max.	Unit	Remarks
Power Supply Voltage	$V_{DD}$	-0.3	5.5	V	$T_a = 25^\circ C$
Logic Supply Voltage	$V_{IN}$	$V_{SS}-0.3$	$V_{DD}+0.3$	V	
Operating Temperature	$T_{OP}$	0	+50	$^\circ C$	1)
Storage Temperature	$T_{ST}$	-20	+60	$^\circ C$	1)

Note : 1) Temperature and relative humidity range are shown in the figure below.

Wet bulb temperature should be 39  $^\circ C$  max. and no condensation of water.



## 3.0 ELECTRICAL SPECIFICATIONS

### 3.1 Electrical Specifications

< Table 3. 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	Note 1
Power Supply Current	I <sub>DD</sub>	-	500	1000	mA	
In-Rush Current	I <sub>RUSH</sub>	-	2.0	3.0	A	Note 2
Permissible Input Ripple Voltage	V <sub>RF</sub>	-	-	300	mV	Note 1,3
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
Power Consumption	P <sub>D</sub>	-	2.5	6	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=75Hz  
 Clock frequency = 92.9 MHz. Test Pattern of power supply current
    - a) Typ : Color Test
    - b) Max : Vertical Subline255
  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.

## 4.0 OPTICAL SPECIFICATION

### 4.1 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  $\theta_{\phi=0} (= \theta_3)$  as the 3 o'clock direction (the "right"),  $\theta_{\phi=90} (= \theta_{12})$  as the 12 o'clock direction ("upward"),  $\theta_{\phi=180} (= \theta_9)$  as the 9 o'clock direction ("left") and  $\theta_{\phi=270} (= \theta_6)$  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°C. Optimum viewing angle direction is 6 o'clock.

### 4.2 Optical Specifications

[VDD = 5.0V, Frame rate = 60Hz, Clock = 74MHz,  $I_{BL} = 160\text{mA}$ ,  $T_a = 25 \pm 2^\circ\text{C}$ ]

< Table 4. Module Optical >

Parameter		Symbol	Condition	Min.	Typ.	Max.	Unit	Remark
Viewing Angle range	Horizontal	$\Theta_3$	CR > 10	85	89	-	Deg.	Note 1
		$\Theta_9$		85	89	-	Deg.	
	Vertical	$\Theta_{12}$		85	89	-	Deg.	
		$\Theta_6$		85	89	-	Deg.	
Luminance Contrast ratio		CR	$\Theta = 0^\circ$ (Center) Normal Viewing Angle	700	1000			Note 2
Reproduction of color	White	$W_x$		0.283	0.313	0.343	-	Note 4
		$W_y$		0.299	0.329	0.359	-	
	Red	$R_x$		0.609	0.639	0.669	-	
		$R_y$		0.327	0.357	0.387	-	
	Green	$G_x$		0.279	0.309	0.339	-	
		$G_y$		0.608	0.638	0.668	-	
	Blue	$B_x$		0.122	0.152	0.182	-	
		$B_y$		0.039	0.069	0.099	-	
Response Time	GTG	$T_g$			14	20	ms	Note 5
Cross Talk		CT		-	-	2.0	%	Note 6

**Note :**

1. Viewing angle is the angle at which the contrast ratio is greater than 10. The viewing area 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  $\theta = 0^\circ$  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. (See FIGURE 1 shown in Appendix) 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 :  
 $\Delta Y = (\text{Minimum Luminance of 9points} / \text{Maximum Luminance of 9points}) * 100$   
 (See FIGURE 2 shown in Appendix).
5. The color chromaticity coordinates specified in Table 5. 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.  
 Each time in below table is defined as appendix Figure 3 and shall be measured by switching the input signal for "any level of gray(bright)" and "any level of gray(dark)".

Measured Response Time		Target															
		0	15	31	47	63	79	95	111	127	143	159	175	191	207	223	239
Start	0																
	15																
	31																
	47																
	63																
	79																
	95																
	111																
	127																
	143																
	159																
	175																
	191																
	207																
	223																
	239																
	255																

7. Cross-Talk of one area of the LCD surface by another shall be measured by comparing the luminance ( $Y_A$ ) of a 25mm diameter area, with all display pixels set to a gray level, to the luminance ( $Y_B$ ) of that same area when any adjacent area is driven dark. (See FIGURE 4 shown in Appendix).

## 5.0 INTERFACE CONNECTION.

### 5.1 Electrical Interface Connection

- CN11      Module Side Connector : UJU IS100-L30R-C23 or Equivalent  
User Side Connector : JAE FI-X30H or Equivalent

Pin No	Symbol	Function	Remark
1	RXO0-	Negative Transmission data of Pixel 0 (ODD)	
2	RXO0+	Positive Transmission data of Pixel 0 (ODD)	
3	RXO1-	Negative Transmission data of Pixel 1 (ODD)	
4	RXO1+	Positive Transmission data of Pixel 1 (ODD)	
5	RXO2-	Negative Transmission data of Pixel 2 (ODD)	
6	RXO2+	Positive Transmission data of Pixel 2 (ODD)	
7	BIST	Bist function	Note1
8	RXOC-	Negative Transmission Clock (ODD)	
9	RXOC+	Positive Transmission Clock (ODD)	
10	RXO3-	Negative Transmission data of Pixel 3 (ODD)	
11	RXO3+	Positive Transmission data of Pixel 3 (ODD)	
12	RXE0-	Negative Transmission data of Pixel 0 (EVEN)	
13	RXE0+	Positive Transmission data of Pixel 0 (EVEN)	
14	GND	Power Ground	
15	RXE1-	Negative Transmission data of Pixel 1 (EVEN)	
16	RXE1+	Positive Transmission data of Pixel 1 (EVEN)	
17	GNG	Power Ground	
18	RXE2-	Negative Transmission data of Pixel 2 (EVEN)	
19	RXE2+	Positive Transmission data of Pixel 2 (EVEN)	
20	RXEC-	Negative Transmission Clock (EVEN)	
21	RXEC+	Positive Transmission Clock (EVEN)	
22	RXE3-	Negative Transmission data of Pixel 3 (EVEN)	
23	RXE3+	Positive Transmission data of Pixel 3 (EVEN)	
24	GND	Power Ground	Note 2
25	CTL	*Reserved for LCD manufacturer's(CTL_DVR)	
26	CE	*Reserved for LCD manufacturer's(CE_DVR)	
27	NC		
28	VDD	Power Supply: +5V	
29	VDD		
30	VDD		

Note 1 : H: White-Black-Red-Green-Blue Pattern Aging, L:Black pattern,when no LVDS signal

Note2: This pin should be connected with GND.

## 5.2 LVDS Interface (Tx; THC63LVDF83A or Equivalent)

### 5.2.1 LVDS Interface

	Input Signal	Transmitter		Interface		MV215FHB-N31 (CN11)	Remark
		Pin No.	Pin No.	System (Tx)	TFT-LCD (Rx)	Pin No.	
L V D S	OR0	51	48 47	OUT0- OUT0+	RXO0- RXO0+	1	
	OR1	52				2	
	OR2	54					
	OR3	55					
	OR4	56					
	OR5	3					
	OG0	4					
	OG1	6	46 45	OUT1- OUT1+	RXO1- RXO1+	3	
	OG2	7				4	
	OG3	11					
	OG4	12					
	OG5	14					
	OB0	15	42 41	OUT2- OUT2+	RXO2- RXO2+	5	
	OB1	19				6	
	OB2	20					
	OB3	22					
	OB4	23					
	OB5	24	38 37	OUT3- OUT3+	RXO3- RXO3+	10	
	Hsync	27				11	
	Vsync	28					
	DE	30		CLK	RXO		
	MCLK	31	40 39	OUT- CLK	CLK- RXO	8 9	
	OR6	50	38 37	OUT+ OUT3-	CLK+ RXO3- RXO3+		
	OR7	2					
	OG6	8					
	OG7	10					
	OB6	16					
	OB7	18					
	RSVD	25					

## 6.0 SIGNAL TIMING SPECIFICATION

6.1 The TCXD215MBLON-68 is operated by the DE only.

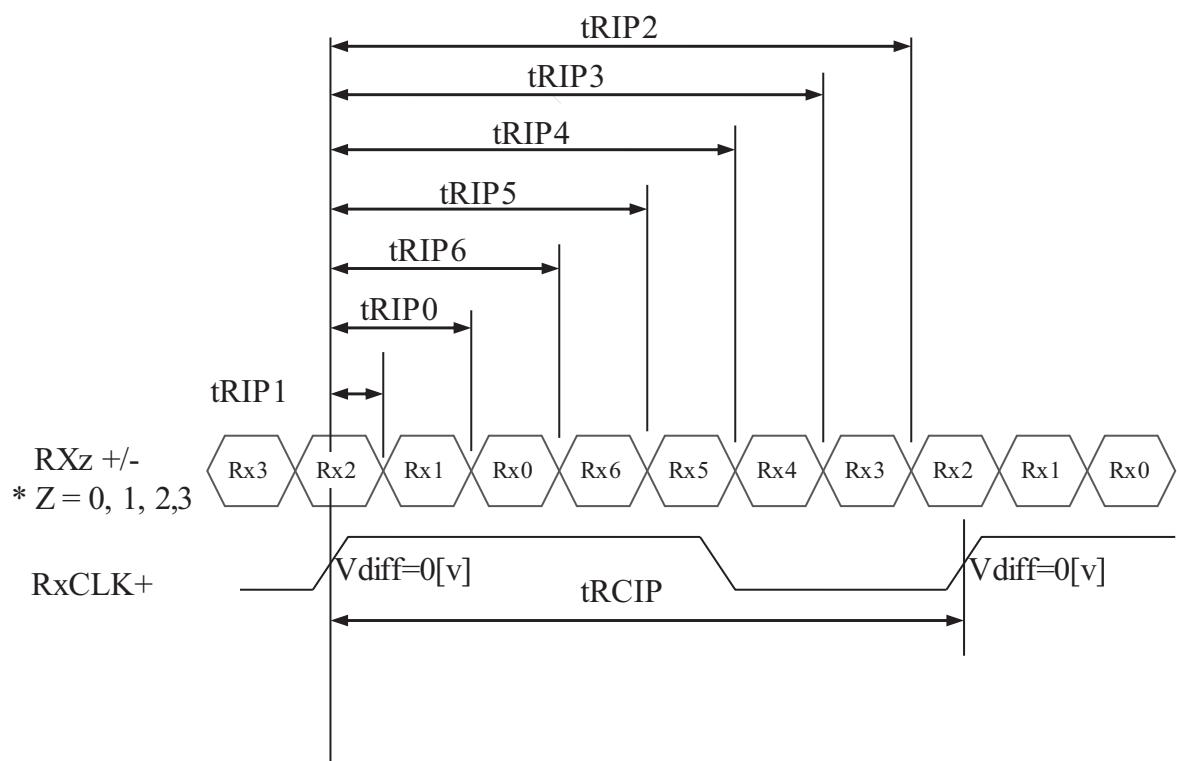
Item	Symbols		Min	Typ	Max	Unit	Note
DCLK	Period	tCLK	10.75	13.47	16.7	ns	
	Frequency	-	60	74	93	MHz	
Hsync	Period	tHP	1050	1100	1120	tCLK	
	Horizontal Valid	tHV	960	960	960	tCLK	
	Horizontal Blank	tHB	90	140	160		
	Frequency	fH	64	67	83	KHz	
Vsync	Period	tVP	1110	1125	1251	tHP	
	Vertical Valid	tVV	1080	1080	1080	tHP	
	Vertical Blank	tVB	30	45	171	tHP	
	Frequency	fV	50	60	75	Hz	
LVDS Receiver clock	Input spread spectrum ratio	SSr	-3	-	+3	%	

## 6.2 LVDS Rx Interface Timing Parameter

The specification of the LVDS Rx interface timing parameter is shown in Table 4.

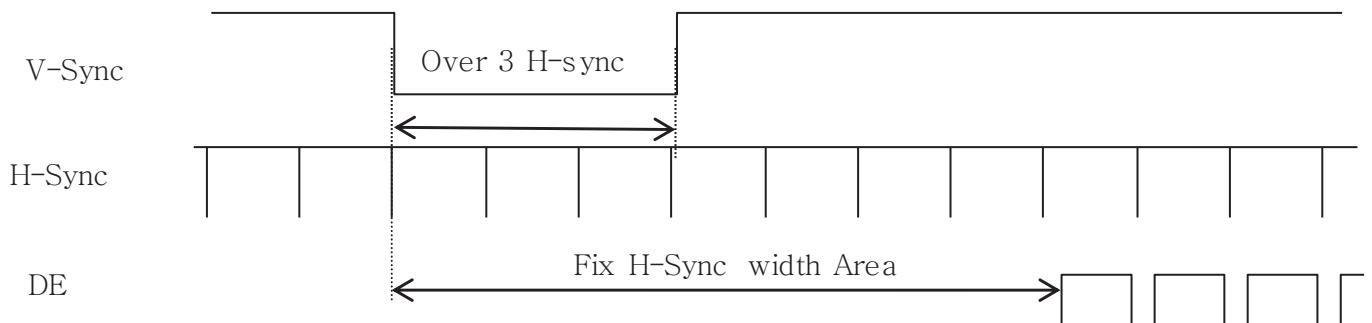
<Table 4. LVDS Rx Interface Timing Specification>

Item	Symbol	Min	Typ	Max	Unit	Remark
CLKIN Period	tRCIP	11.1	13.47	16.7	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	$2 \times tRCIP/7-0.4$	$2 \times tRCIP/7$	$2 \times tRCIP/7+0.4$	nsec	
Input Data 3	tRIP5	$3 \times tRCIP/7-0.4$	$3 \times tRCIP/7$	$3 \times tRCIP/7+0.4$	nsec	
Input Data 4	tRIP4	$4 \times tRCIP/7-0.4$	$4 \times tRCIP/7$	$4 \times tRCIP/7+0.4$	nsec	
Input Data 5	tRIP3	$5 \times tRCIP/7-0.4$	$5 \times tRCIP/7$	$5 \times tRCIP/7+0.4$	nsec	
Input Data 6	tRIP2	$6 \times tRCIP/7-0.4$	$6 \times tRCIP/7$	$6 \times tRCIP/7+0.4$	nsec	



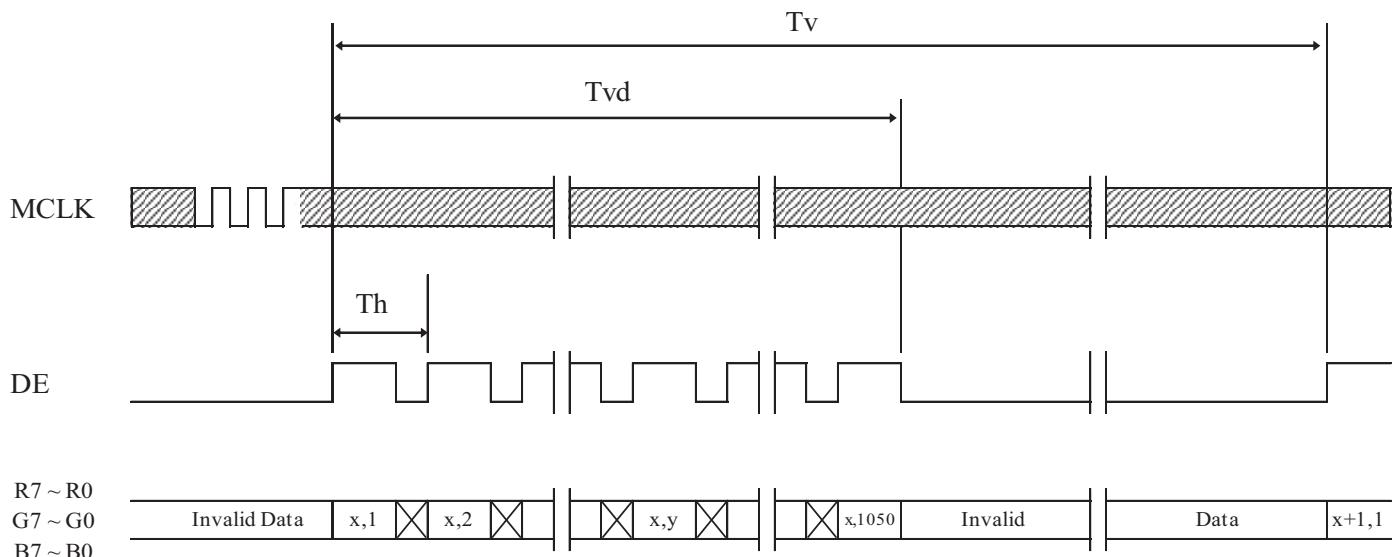
## **7.0 SIGNAL TIMING WAVEFORMS OF INTERFACE SIGNAL**

## 7.1 Sync Timing Waveforms

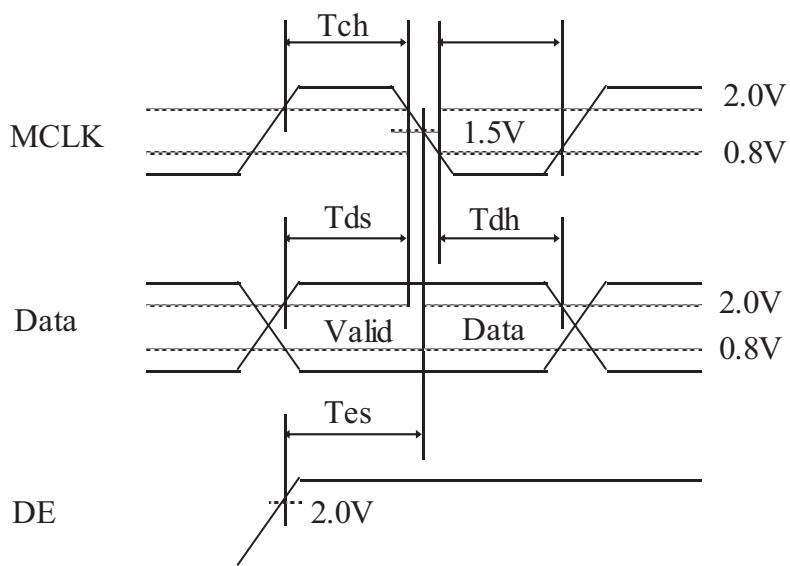
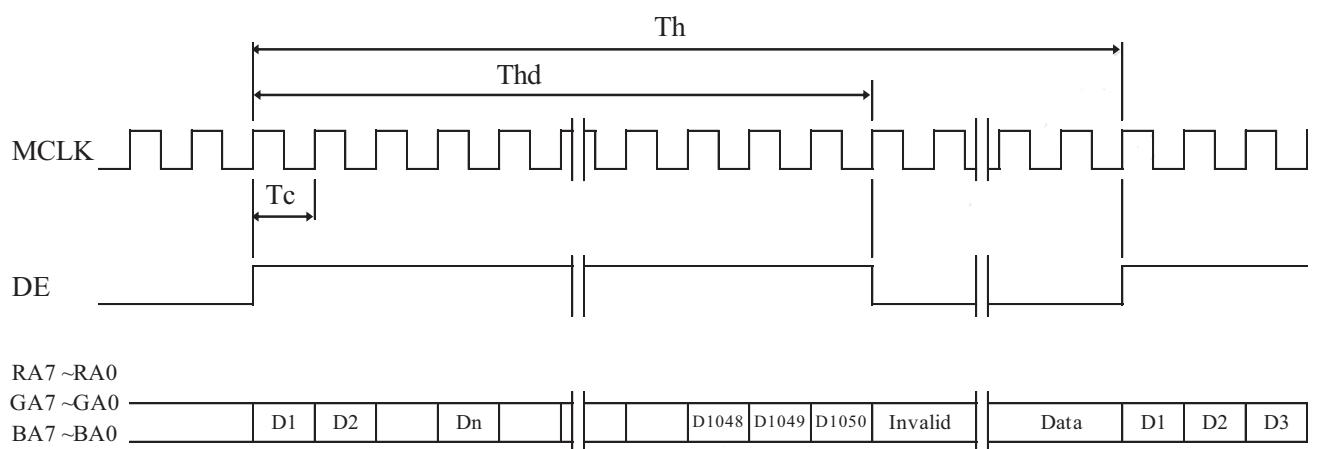


- 1) Need over 3 H-sync during V-Sync Low
  - 2) Fix H-Sync width from V-Sync falling edge to first rising edge

## 7.2 Vertical Timing Waveforms



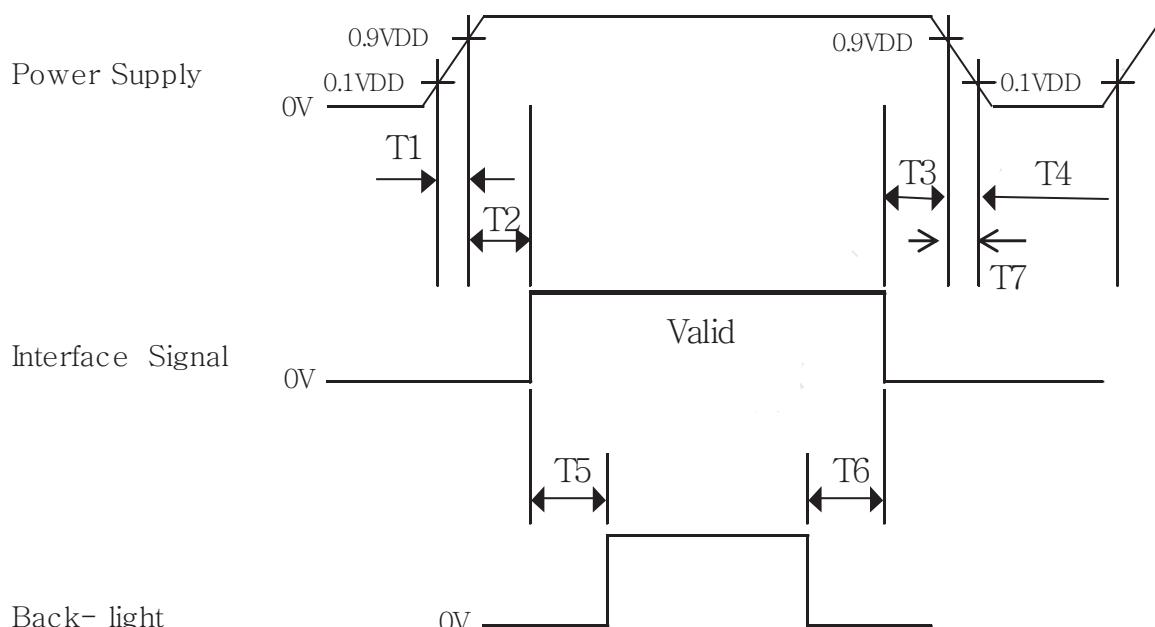
### 7.3 Horizontal Timing Waveforms





## 9.0 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.
5. The above power sequence should be satisfied at these case
  - DC power On/Off; AC power On
  - Mode Change ( Resolution, frequency, timing, sleep mode, color depth change etc.)If not to follow power sequence, there is a risk of abnormal display.

## 10.0 MECHANICAL CHARACTERISTICS

### 10.1 Dimensional Requirements

FIGURE 5 (located in Appendix) shows mechanical outlines for the model TCXD215MBLON-68. Other parameters are shown in Table 8.

<Table 8. Dimensional Parameters>

Parameter	Specification	Unit
Weight	TBD	gram
Active area	476.064 (H) × 267.786 (V)	mm
Pixel pitch	0.24795(H) × 0.24795(V)	mm
Number of pixels	1920 (H) × 1080 (V) (1 pixel = R + G + B dots)	pixels

### 10.2 Mounting

See FIGURE 5 . (shown in Appendix

### 10.3 Anti-Glare and Polarizer Hardness.

The surface of the LCD has an anti-glare coating to minimize reflection and a coating to reduce scratching.

### 10.4 Light Leakage

There shall not be visible light from the back-lighting system around the edges of the screen as seen from a distance 50cm from the screen with an overhead light level of 350lux.

## 11.0 RELIABILITY TEST

The Reliability test items and its conditions are shown in below.

<Table 9 Reliability Test Parameters >

No	Test Items	Conditions	
1	High temperature storage test	Ta = 60 °C, 240 hrs	
2	Low temperature storage test	Ta = -20 °C, 240 hrs	
3	High temperature & high humidity operation test	Ta = 50 °C, 80%RH, 240hrs	
4	High temperature operation test	Ta = 50 °C	
5	Low temperature operation test	Ta = 0°C, 240hrs	
6	Thermal shock	Ta = -20°C , 50°C (0.5 hr), 100 cycle	
7	Vibration test (non-operating)	Frequency Gravity / AMP Period	Random, 10 ~ 300 Hz, 30 min/Axis 1.5 Grms X, Y, Z 30 min
8	Shock test (non-operating)	Gravity	50G
		Pulse width	11msec, sine wave
		Direction	± X, ± Y, ± Z Once for each
9	Electro-static discharge test	Air : 150 pF, 330Ω, 15 KV Contact : 150 pF, 330Ω, 8 KV	

## 12.0 HANDLING & CAUTIONS

### (1) Cautions when taking out the module

- Pick the pouch only, when taking out module from a shipping package.

### (2) Cautions for handling the module

- As the electrostatic discharges may break the LCD module, handle the LCD module with care. Peel a protection sheet off from the LCD panel surface as slowly as possible.
- As the LCD panel and back - light element are made from fragile glass material, impulse and pressure to the LCD module should be avoided.
- As the surface of the polarizer is very soft and easily scratched, use a soft dry cloth without chemicals for cleaning.
- Do not pull the interface connector in or out while the LCD module is operating.
- Put the module display side down on a flat horizontal plane.
- Handle connectors and cables with care.

### (3) Cautions for the operation

- When the module is operating, do not lose CLK, ENAB signals. If any one of these signals is lost, the LCD panel would be damaged.
- Obey the supply voltage sequence. If wrong sequence is applied, the module would be damaged.

### (4) Cautions for the atmosphere

- Dew drop atmosphere should be avoided.
- Do not store and/or operate the LCD module in a high temperature and/or humidity atmosphere. Storage in an electro-conductive polymer packing pouch and under relatively low temperature atmosphere is recommended.

### (5) Cautions for the module characteristics

- Do not apply fixed pattern data signal to the LCD module at product aging.
- Applying fixed pattern for a long time may cause image sticking.

### (6) Other cautions

- Do not disassemble and/or re-assemble LCD module.  
Do not re-adjust variable resistor or switch etc.

When returning the module for repair or etc., Please pack the module not to be broken. We recommend to use the original shipping packages.

## 13.0 APPENDIX

Figure 1. Measurement Set Up

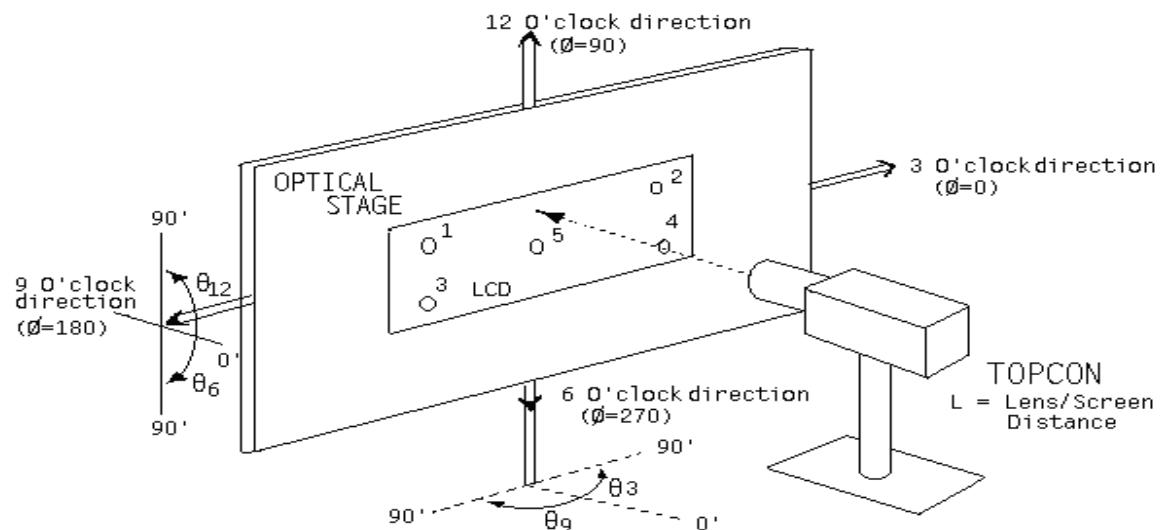
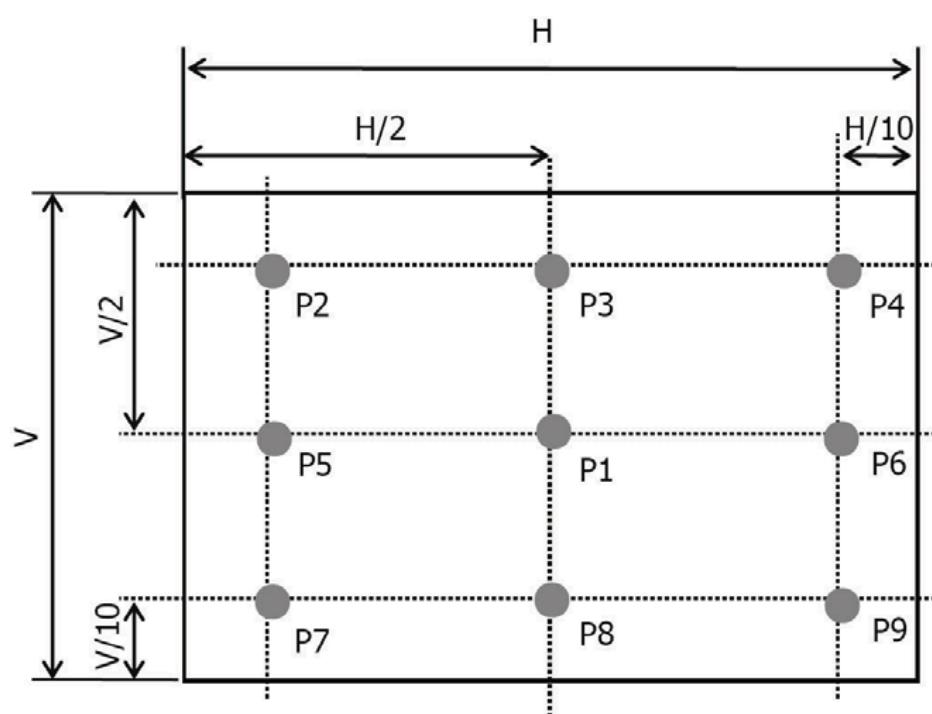


Figure 2. White Luminance and Uniformity Measurement Locations (9 points)

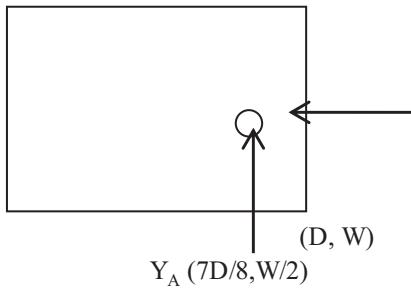


**Figure 3. Response Time Testing**

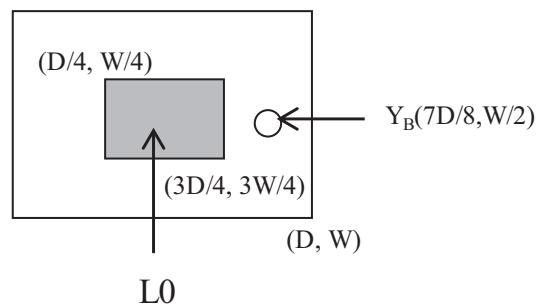
Measured Response Time	Target																
	0	15	31	47	63	79	95	111	127	143	159	175	191	207	223	239	255
Start	0																
	15																
	31																
	47																
	63																
	79																
	95																
	111																
	127																
	143																
	159																
	175																
	191																
	207																
	223																
	239																
	255																

**Figure 4. Cross Modulation Test Description**

VIEW AREA



VIEW AREA

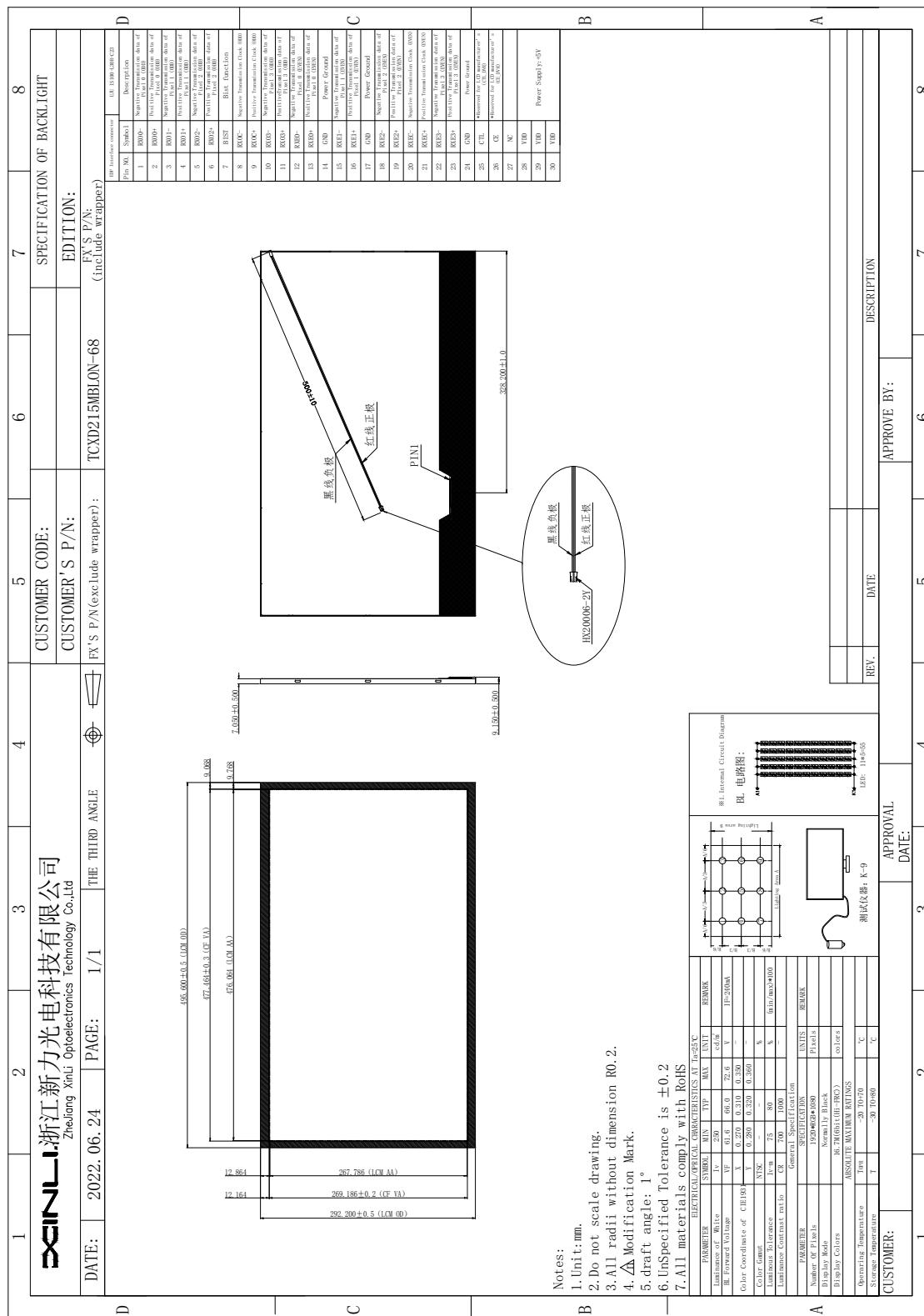


$$\text{Cross-Talk (\%)} = \left| \frac{Y_B - Y_A}{Y_A} \right| \times 100$$

Where:  $Y_A$  = Initial luminance of measured area ( $\text{cd/m}^2$ ) $Y_B$  = Subsequent luminance of measured area ( $\text{cd/m}^2$ )

The location measured will be exactly the same in both patterns

# Mechanical Dimension



Notes:

1. Unit: mm.
2. Do not scale drawing.
3. All radii without dimension R0.2.
4.  $\triangle$  Modification Mark.
5. draft angle:  $1^{\circ}$ .
6. Unspecified Tolerance is  $\pm 0.2$
7. All materials comply with RoHS