Specification For Approval

□ Preliminary specification

■ Final specification

Title	23.2 ZZ ADS TFT-LCD (MDL)

Buyer	
Model	

Supplier	Cheng Du BOE Optoelectronics Technology CO.LTD
Model	EV232ZZM-N10

TITLE/SIGNATURE	DATE
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Please return one copy confirmation with signature and your comments	

ITEM	SIGNATURE/DATE
Approved	________________
Reviewed	________________
Reviewed	________________
Prepared	________________
BOE CHENG DU Optoelectronics Technology CO., LTD	

CONTENT LIST

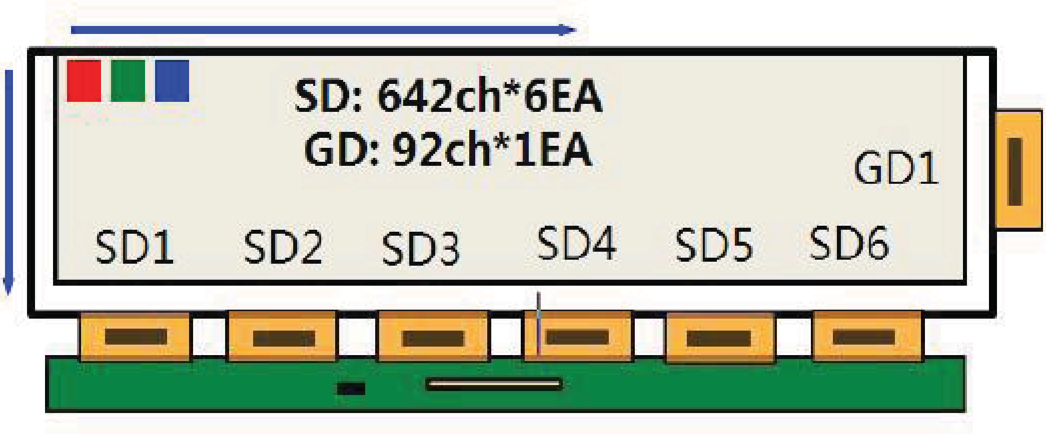
Record of Revisions

Revision	Date	Page	Description	Released by
Rev.0	2017.03.28		Initial Released	wanghengruo

1.0 GENERAL DESCRIPTION

1.1 Introduction

EV232ZZM-N10 is a color active matrix TFT-LCD model using amorphous silicon TFT's(Thin Film Transistors) as an active switching devices. This model is composed of a TFT-LCD Panel, a driving circuit and a back light system. It is a transmissive type display operating in the normal black. This TFT-LCD has a 23.2 inch diagonally measured active area with 1280*92 resolutions (1280 horizontal by 92 vertical pixel array). Each pixel is divided into Red, Green, Blue dots which are arranged in vertical stripe and this panel can display 16.7M colors.



1.2 Features

- 0.5t Glass (Single)
- Module Design
- High contrast ratio, wide viewing angle
- RoHS Compliant

1.3 Application

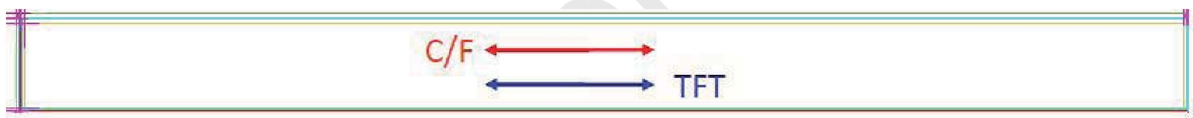
- Automotive

1.4 General Specifications (H: horizontal length, V: vertical length)

Parameter	Specification	Unit	Remark
Active Area	588.48(H) × 42.297(V)	mm	
Number of Pixels	1280(H) RGB × 92(V)	pixels	
Pixel Pitch	459.75(H) × 459.75(V)	um	
Pixel Arrangement	RGB Vertical stripe		
Display Colors	16.7 M	colors	
Color Gamut	72%		
Display Mode	NB / ADS		
Dimensional Outline	598.38±0.4(H)×56.897+0.45/-0.25(V) ×10.5±0.3(D)	mm	Module (without Rivet)
Viewing Direction(Human Eye)	80/80/70/60 @ CR ≥ 10:1 50/50/30/30 @ CR ≥ 100:1		

Note:

1.The TFT and CF LC Align Direction



2.0 ELECTRICAL SPECIFICATION

2.1 Absolute Maximum Ratings

The followings are maximum values which, if exceed, may cause faulty operation or damage to the unit. Make sure all the design characteristics are adequate before the panel is initialed. All the measurements should be operated with driver IC and FPC mounted.

Parameter	Symbol	Min	Max	Unit	Remark
Operating Temperature	T_{OP}	0	+50	℃	
Storage Temperature	T_{ST}	-20	+60	℃	
Operating Ambient Humidity *1)	Hop	10	*2)	%RH	*2)
Storage Humidity	Hst	10	*2)	%RH	*2)

Note: **[VSS = GND = 0V]**

1. Temp≤60℃ 90% RH MAX
2. Non-condensation

2.2 DC characteristics

Source IC---HX8159-K12-A

Parameter	Symbol	Spec. Min.	Spec. Typ.	Spec. Max.	Unit
Power supply voltage	VDDA	-0.5	-	+19.8	V
	VDDD	-0.5	-	+4.0	V
Input voltage	$V_{\gamma1}$ ~ $V_{\gamma9}$	0.5VDDA	-	VDDA+0.5	V
	$V_{\gamma10}$ ~ $V_{\gamma18}$	-0.5	-	0.5VDDA	V
	the others	-0.5	-	VDDD+0.5	V
Output voltage	OUT1 ~ OUT726	-0.5	-	VDDA+0.5	V
	EIO1 & EIO2	-0.5	-	VDDD+0.5	V
Storage temperature	T_{STG}	-55	-	+125	℃

Gate IC---HX8658-H

Parameter	Symbol	Spec. Min.	Spec. Typ.	Spec. Max.	Unit
Power supply voltage 1	VDD	-0.3	-	+5.0	V
Power supply voltage 2	VGH	-0.3	-	+42.0	V
Power supply voltage 3	VGL	-25.0	-	+0.3	V
Power supply voltage 4	VGH-VGL	-0.3	-	+42.0	V
Input voltage	V_{IN}	-0.3	-	VDD+0.3	V
Storage temperature	T_{STG}	-55	-	+125	℃

Parameter	Symbol	Min	Typ	Max	Unit	Remark
Backlight Voltage	LED_Vcc	17.5	19	20.5	V	-

Backlight Current	I_{LED}		280	330	mA	-
Inrush Current	$I_{LED\ inrush}$			1	A	
Backlight Power Consumption	P		5.32	6.2	W	Note 1
LED Life-Time					Hrs	IF = 20mA Note 2

2.3 Backlight Driving Conditions

Notes:

1. Calculator Value for reference $I_{LED} \times V_{LED} \times$ LED Quantity = P_{LED}
2. The LED Life-time define as the estimated time to 50% degradation of initial luminous.

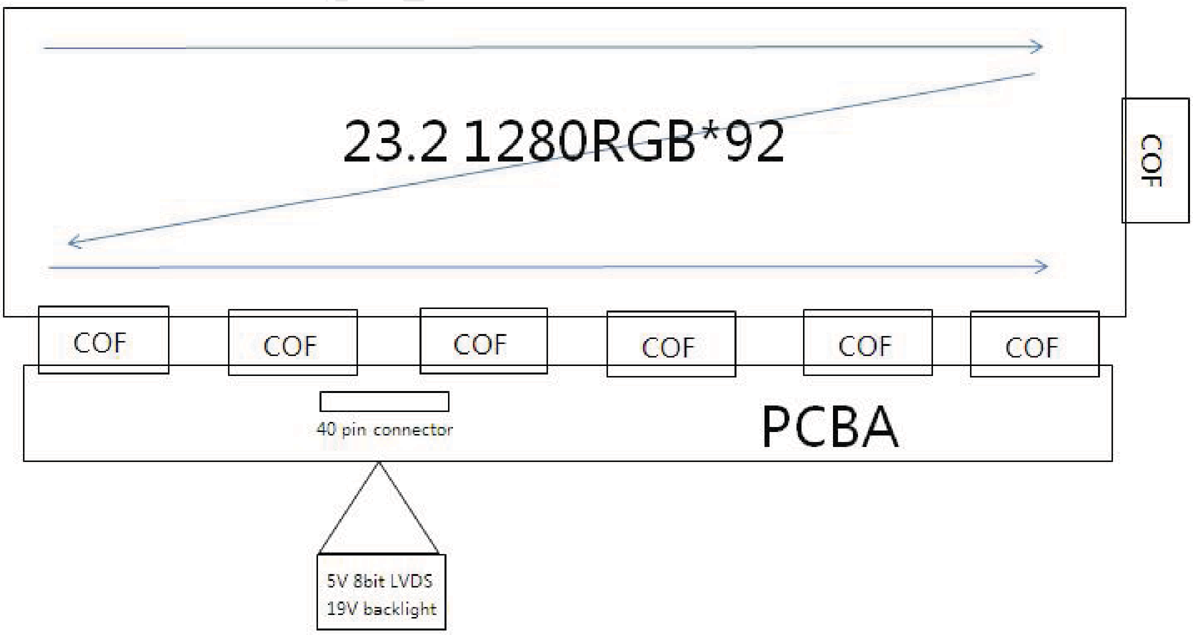
2.4 Power Consumption

Parameter	Symbol	Min	Typ	Max	Unit	Remark
LCD Voltage	Vcc	4.75	5	5.25	V	-
Vcc ripple				300	mV	-
LCD Current	I_{LCD}		380	550	mA	-
Inrush Current	$I_{LCD\ inrush}$			2.5	A	
LCD Power Consumption	P		1.9	2.75	W	Note

Note:

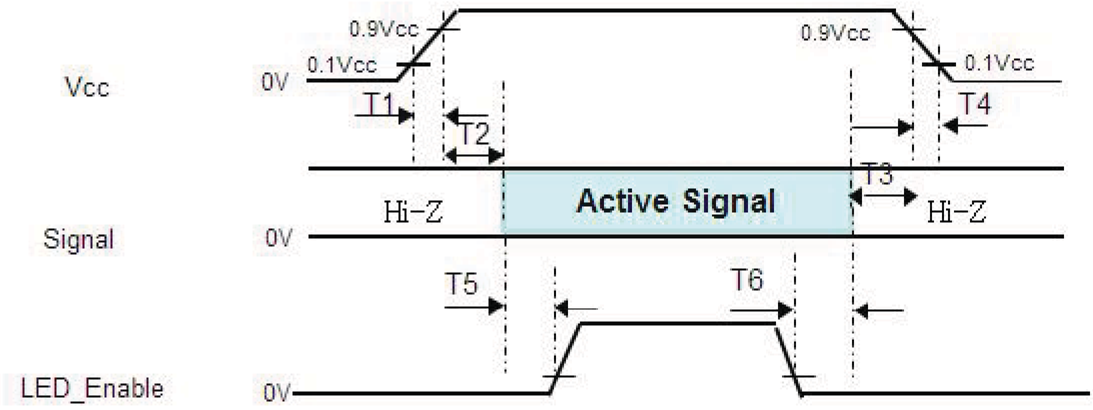
Frame rate=60HZ, Color bar pattern, 25℃

2.5 Block Diagram

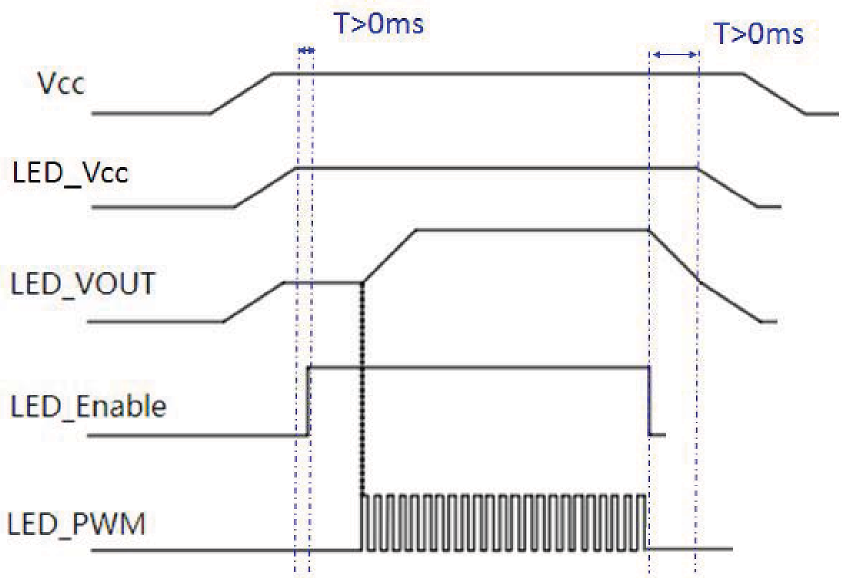


2.6 Power ON/OFF Sequence

The power supply ON/OFF setting sequences is illustrated in figure below.



- 0.5ms ≤ T1 ≤ 10 ms
- 0 ms ≤ T2
- 0 ms ≤ T3
- 0 ms ≤ T4 ≤ 10ms
- 100 ms ≤ T5
- 100 ms ≤ T6

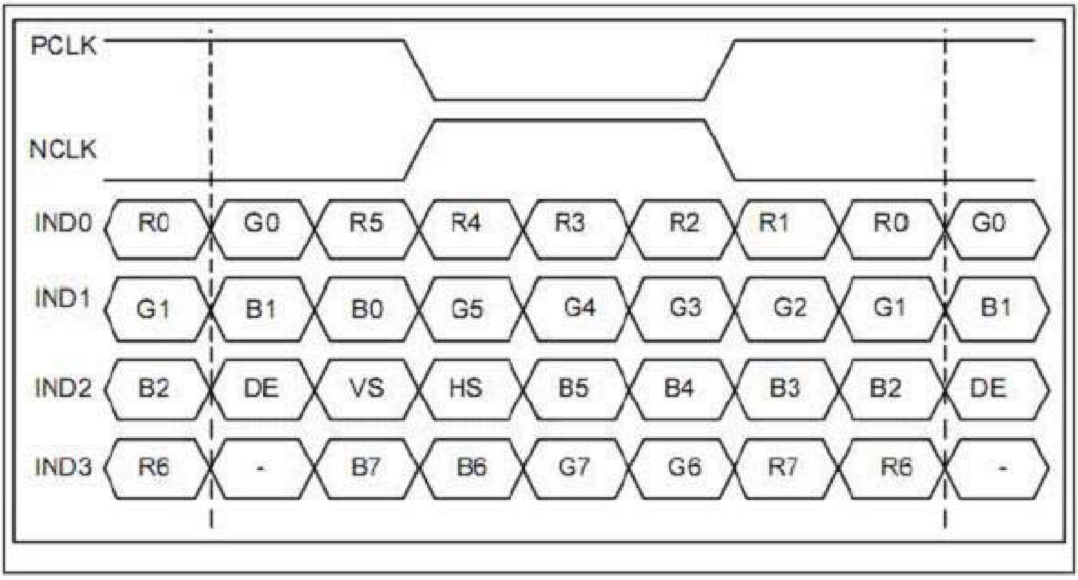


Note:

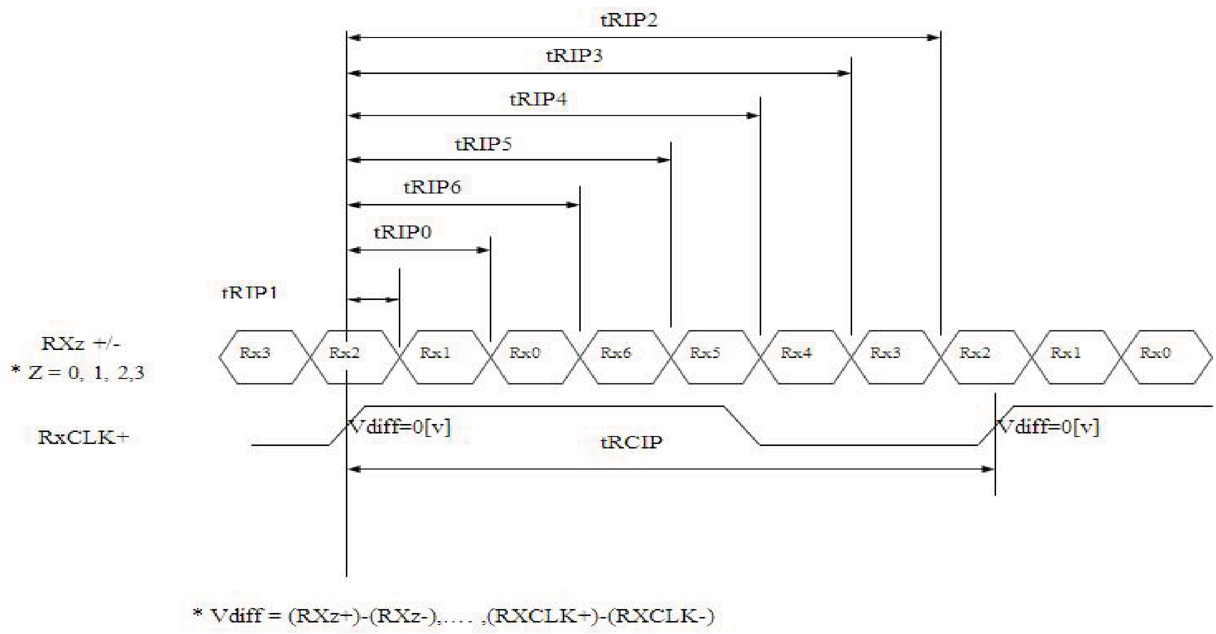
There is no tight timing between EN and PWM signal.

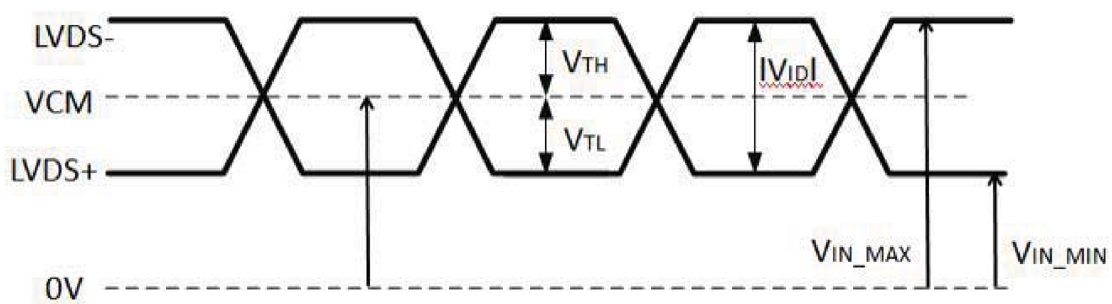
3.0 SIGNAL TIMING SPECIFICATION

3.1 LVDS Timing



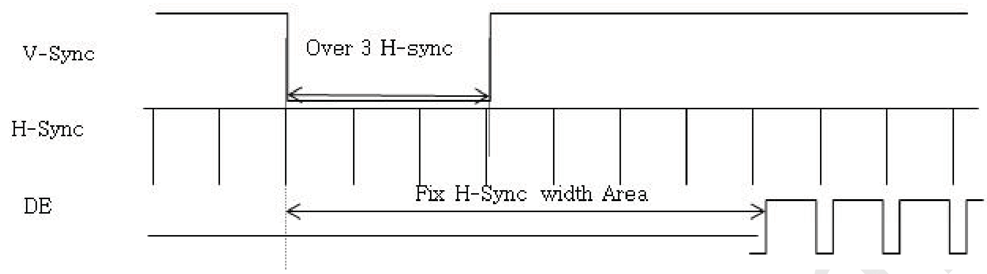
Item	Symbol	Min	Typ	Max	Unit	Remark
CLKIN Period	tRCIP	10.82	13.47	16.54	nsec	
Input Data 0	tRIP1	-0.4	0.0	+0.4	nsec	
Input Data 1	tRIP0	tRCIP/7-0.4	tRCIP/7	tRCIP/7+0.4	nsec	
Input Data 2	tRIP6	2 ×tRCIP/7-0.4	2 ×tRCIP/7	2 ×tRCIP/7+0.4	nsec	
Input Data 3	tRIP5	3 ×tRCIP/7-0.4	3 ×tRCIP/7	3 ×tRCIP/7+0.4	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	



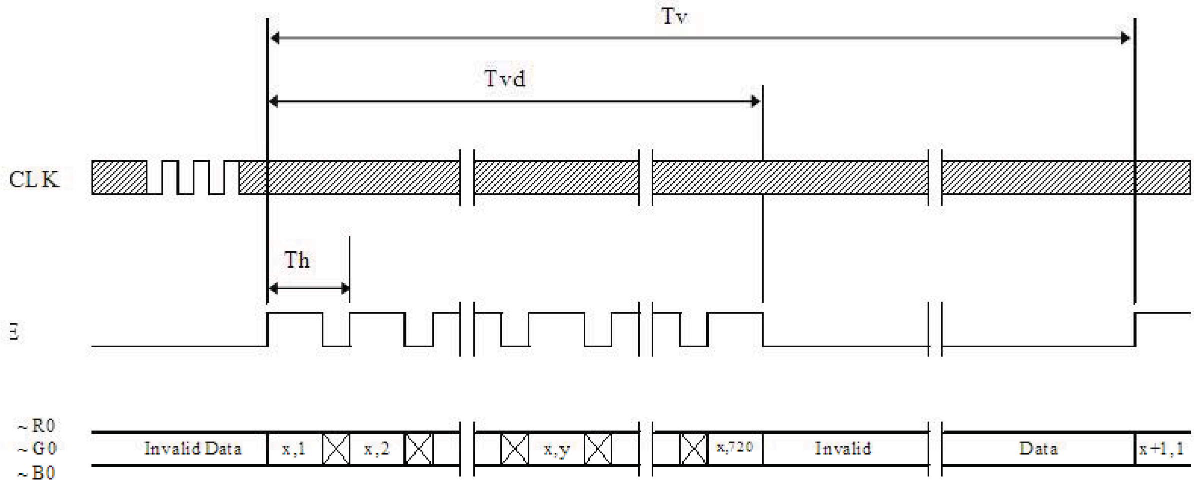


High Level Differential Input Threshold Voltage	V_{IH}	+100	-	+300	mV	
Low Level Differential Input Threshold Voltage	V_{IL}	-300	-	-100	mV	
Differential input voltage	$\|V_{ID}\|$	200	-	600	mV	
Differential input common mode v oltage	Vcm	1.0	1.2	1.4	V	
Input Voltage Range	Vin	0.7	-	1.7	V	

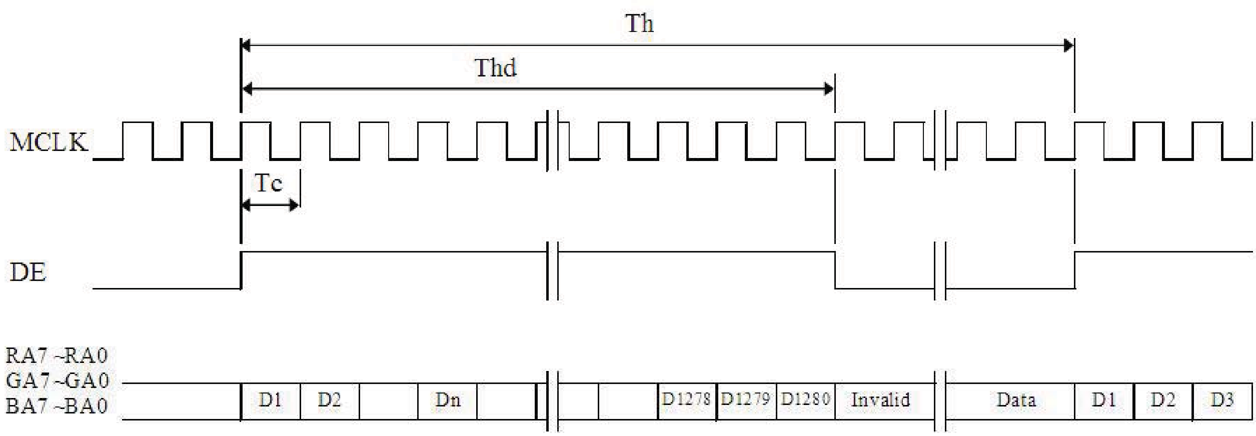
Sync Timing Waveforms



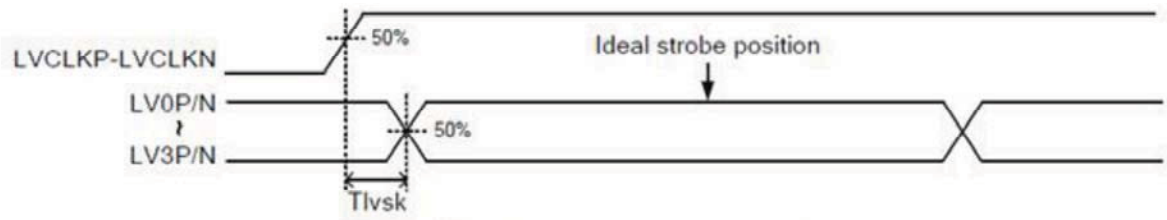
Vertical Timing Waveforms



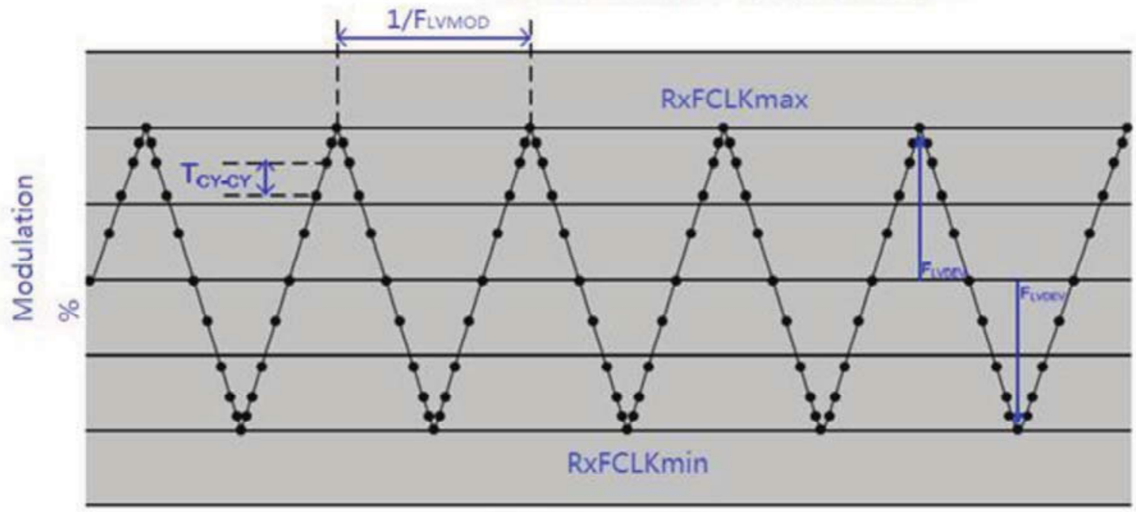
Sync Timing Waveforms



Parameter	Symbol	Min.	Typ.	Max.	Unit
Clock frequency	RxFCLK	60.44	74.25	92.4	MHz
Horizontal Display Area	thd		1280		DCLK
HS Period	th	1380	1650	1750	DCLK
HS Blanking	Thb+thfp	100	370	470	DCLK
Vertical Display Area	tvd		720		TH
VS Period	tv	730	750	880	TH
VS Blanking	Tvbp+tvfp	10	30	160	TH

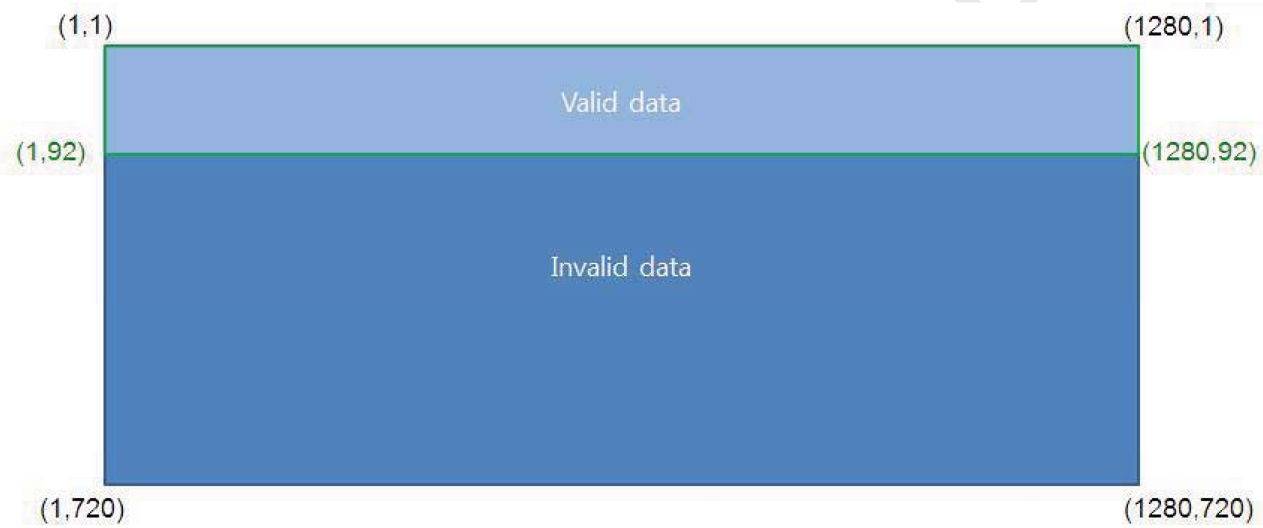


LVDS channel to channel skew



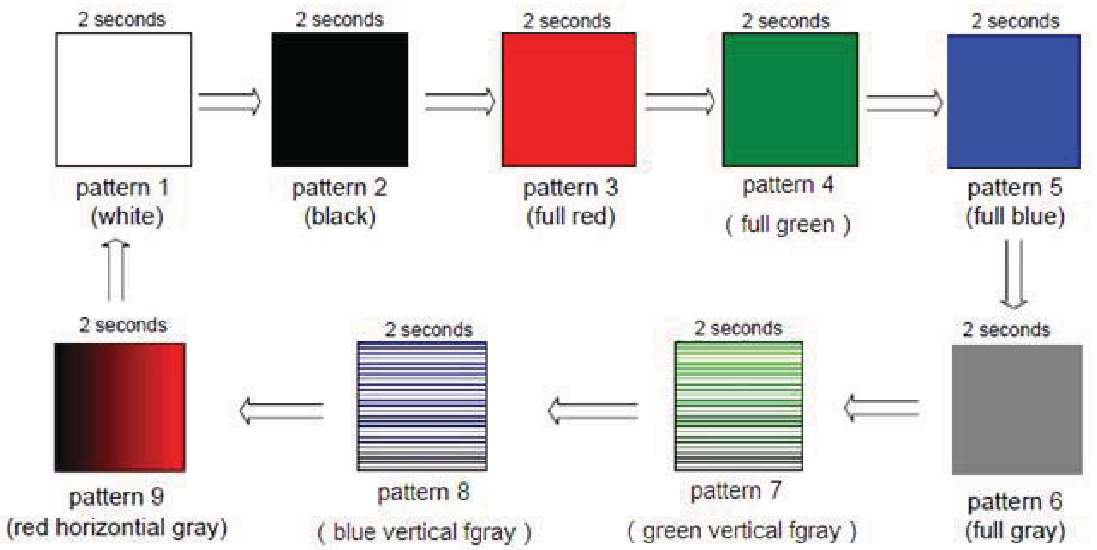
LVDS input SSC

Symbol	Parameter	Spec			Unit
		Min	Typ	Max	
T_{LVSK}	LVDS channel to channel skew	-400	-	+400	ps
F_{LVMOD}	Modulating frequency of input clock during SSC	10	-	144	KHz
F_{LVDEV}	Maximum deviation of input clock frequency during SSC	-3	-	+3	%
T_{CY-CY}	Cycle to cycle jitter	-	-	200	ps



The customer system needs to input 1280*720@60Hz signal, with valid data in line1~line92 and invalid data in other lines.

Default BIST (built-in self test) patterns



Aging_enable: when input LVDS signal, ignore this pin.
when no LVDS signal, H → BIST pattern , L → Black pattern

EDID_WP: H → only read.
L → can write.

Parameter	Symbol	Min.	Typ.	Max.	Unit
Aging_Enable and all EDID Signal Levels	V_{IH}	2.5	-	3.3	V
	V_{IL}	0	-	0.6	V

Parameter	Symbol	Min.	Typ.	Max.	Unit	Note
EN&PWM	V_{IH}	1.6	-	5	V	
	V_{IL}	0	-	0.5	V	
Dimming frequency Duty	$f_{PWM\text{-}duty}$	1.6		100	%	1KHz<f_{PWM}≤2KHz

4.0 INTERFACE CONNECTION

4.1 PIN Assignment

Pin	Signal	Description	Pin	Signal	Description
1	V_{cc}	Logic power, +5.0V power supply	21	CLK-	- LVDS differential clock input
2	V_{cc}	Logic power, +5.0V power supply	22	CLK+	+ LVDS differential clock input
3	V_{cc}	Logic power, +5.0V power supply	23	V_{ss3}	Signal 3 ground
4	GND_L	Logic ground	24	RIN3-	- LVDS differential data input channel 3
5	GND_L	Logic ground	25	RIN3+	+ LVDS differential data input channel 3
6	GND_L	Logic ground	26	V_{ss4}	Signal 4 ground
7	Aging_Enable	For aging test, default BIST patterns H: 3.3V L: 0V	27	GND_L	Logic ground
8	NC	For LCD internal use only, no external connection	28	WP_EDID	EDID Write Protection H: 3.3V L: 0V
9	NC	For LCD internal use only, no external connection	29	SCL_EDID	EDID I^2C Clock Signal H: 3.3V L: 0V
10	GND_L	Logic ground	30	SDA_EDID	EDID I^2C Data Signal H: 3.3V L: 0V
11	V_{ss0}	Signal 0 ground	31	GND_L	Logic ground
12	RIN0-	- LVDS differential data input channel 0	32	NC	Not connected
13	RIN0+	+ LVDS differential data input channel 0	33	LED_GND	Ground (LED)
14	V_{ss1}	Signal 1 ground	34	LED_GND	Ground (LED)
15	RIN1-	- LVDS differential data input channel 1	35	LED_GND	Ground (LED)
16	RIN1+	+ LVDS differential data input channel 1	36	LED_Enable	Backlight control pin
17	V_{ss2}	Signal 2 ground	37	LED_PWM	PWM control signal for LED brightness control
18	RIN2-	- LVDS differential data input channel 2	38	LED_V_{cc}	LED converter power supply
19	RIN2+	+ LVDS differential data input channel 2	39	LED_V_{cc}	LED converter power supply
20	V_{ssk}	Signal K ground	40	LED_V_{cc}	LED converter power supply

Note:

1. Interface Connector: 40 pin LVDS connector MSAK24025P40 (STM)
2. 5V input power supply

4.2 EDID

	00	01	02	03	04	05	06	07	08	09	0A	0B	0C	0D	0E	0F
00h	00	FF	FF	FF	FF	FF	FF	00	09	E5	36	06	00	00	00	00
10h	2C	1A	01	04	95	3B	04	78	02	E2	70	A6	56	53	9B	24
20h	11	50	54	00	00	00	01	01	01	01	01	01	01	01	01	01
30h	01	01	01	01	01	01	01	1D	00	72	51	D0	1E	20	6E	28
40h	55	00	32	11	00	00	00	1E	00	00	00	00	00	00	00	00
50h	00	00	00	00	00	00	00	00	00	1E	00	00	00	FE	00	42
60h	4F	45	20	43	44	0A	20	20	20	20	20	20	00	00	00	FE
70h	00	45	56	32	33	32	5A	5A	4D	2D	4E	31	30	0A	00	69

5.0 OPTICAL SPECIFICATIONS

5.1 Overview

The test of Optical specifications shall be measured in a dark room(ambient luminance≤ 1 lux and temperature = 25±2℃) with the equipment of Luminance meter system (Topcon SR-UL1R and Westar TRD-100A) and test unit shall be located at an approximate distance 50cm from the LCD surface at a viewing angle of θ and Φ equal to 0°.The center of the measuring spot on the Display surface shall stay fixed.

The backlight should be operating for 30 minutes prior to measurement.

5.2 Optical Specifications

Parameter		Symbol	Condition	Min.	Typ.	Max.	Unit	Remark
Viewing Angle	Horizontal	Θ3	CR>10	80			°	Note 1
		Θ9		80			°	
	Vertical	Θ12		70			°	
		Θ6		60			°	
Contrast Ratio		CR	Θ= 0°	600	900			Note 2
LCM Tr.		%		4.9	5.4			
Luminance		Im	Θ= 0°	450	500		cd/m2	Note 3
Uniformity(Long-range)		%	Θ= 0°	85				Note 4
Uniformity(Short-range)				95				
NTSC		%	Θ= 0°	68	72			
Reproduction Of color	Red	Ru′	Θ= 0°		0.4500	0.06 (u′, v′)		Module Δ u′v′=[(Max variation u′–Typ u′)2+(Max variation v′–Typ v′)2]1/2
		Rv′			0.5281			
	Green	Gu′			0.1348	0.03 (u′, v′)		
		Gv′			0.5673			
	Blue	Bu′			0.1799	0.07 (u′, v′)		
		Bv′			0.1300			
White		$W_{u'}$	Θ= 0°		0.1978	ΔE≤25		ΔE ≤25 (ΔE = 1000*[(Δu′)^2+(Δv′)^2]$^{1/2}$)
		$W_{v'}$			0.4683			
Response Time		Tr+Tf	Θ= 0°		15	20	ms	Note 5
Gamma		γ	Θ= 0° center		2.2			

Note:

1. Viewing angle is the angle at which the contrast ratio is greater than 10. The viewing 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 (See FIG.1).

2. Contrast measurements shall be made at viewing angle of Θ= 0° 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 FIG. 1) Luminance Contrast Ratio (CR) is defined mathematically.

$$CR = \frac{\text{Luminance when displaying a white raster}}{\text{Luminance when displaying a black raster}}$$

3. Surface luminance is the center point across the LCD surface 50cm from the surface with all pixels displaying white. This measurement shall be taken at the locations shown in FIG. 2.

4. Uniformity measurement shall be taken at the locations shown in FIG. 1&2, for a total of the measurements per display, measure surface luminance of these nine points across the LCD surface 50cm from the surface with all pixels displaying white.

$$\text{Uniformity} = \frac{\text{Min Luminance}}{\text{Max Luminance}} \times 100\%$$

Long-range Luminance Uniformity: 5 Point measurement;

Short-range Luminance Uniformity： Any 2 Point in 1 inch.

5. The color chromaticity coordinates specified in Table1 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 Module.

6. The electro-optical response time measurements shall be made as FIG.3 by switching the "data" input signal ON and OFF.

The times needed for the luminance to change from 10% to 90% is Tr and 90% to 10% is Tf.

Figure 1. Measurement Set Up

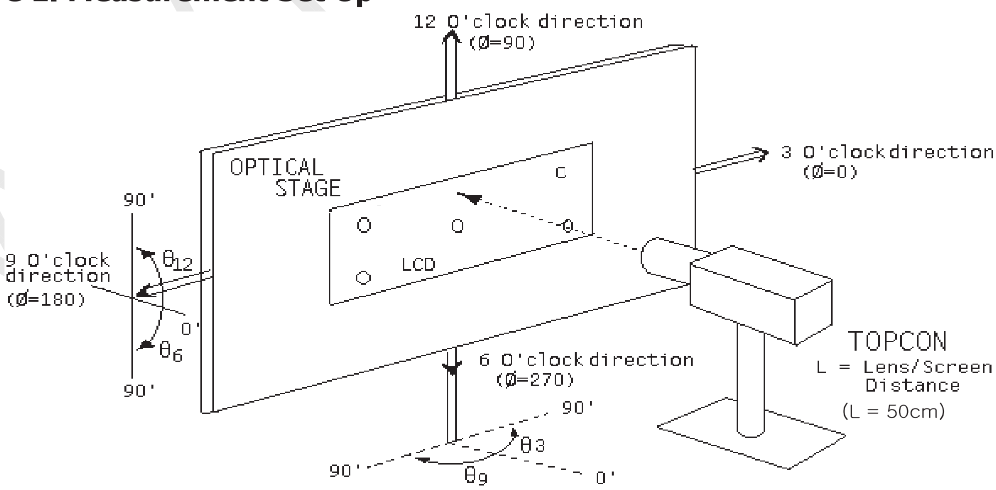


Figure 2. Uniformity Measurement Locations

Long-range Luminance Uniformity 5 Point measurement:

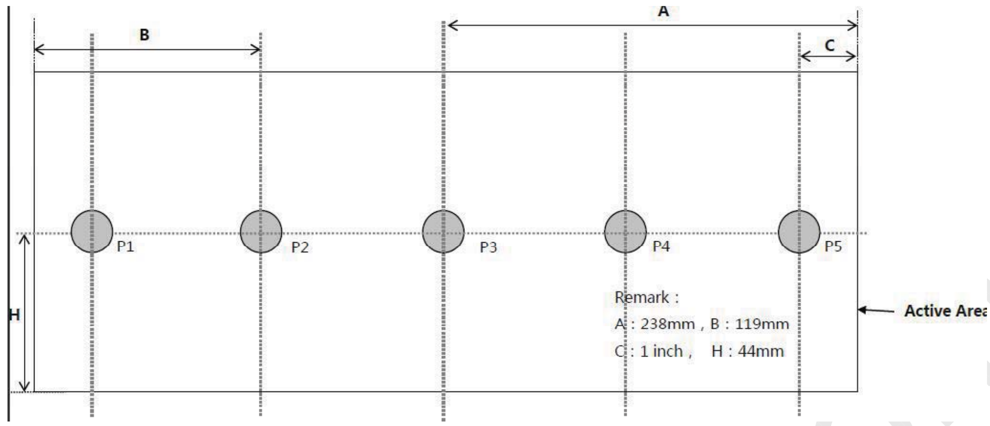
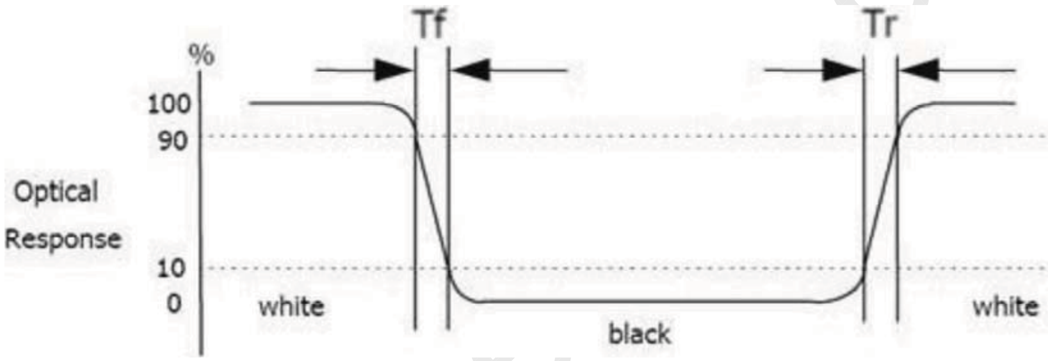


Figure 3. Response Time Testing



6.0 MECHANICAL CHARACTERISTICS

6.1 Dimension Requirements

Parameter	Specification	Unit	Remark
Panel Size	594.93(H) × 49.3(V)	mm	Cell
CF Size	593.13(H) × 47.3(V)	mm	
Active Area	588.48(H) × 42.297(V)	mm	
Dimensional outline	598.38±0.4(H)×56.897+0.45/-0.25(V)×10.5 ±0.3(D)	mm	Module (without Rivet)

Figure5. LCM Outline Dimension (unit:mm)

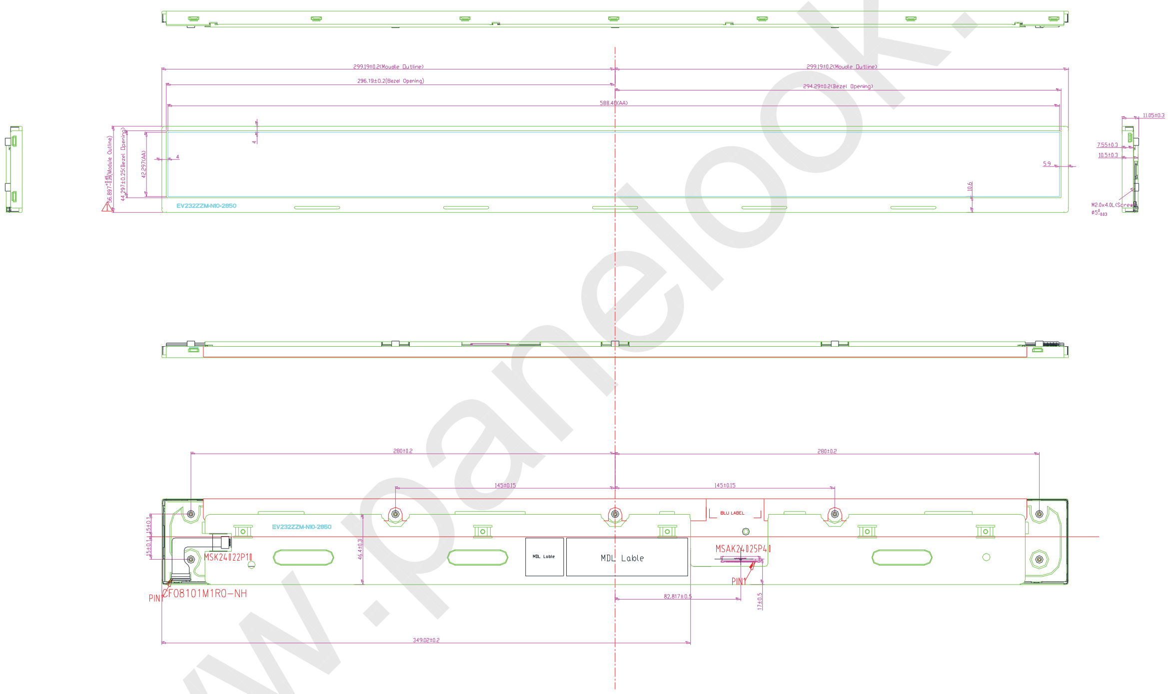
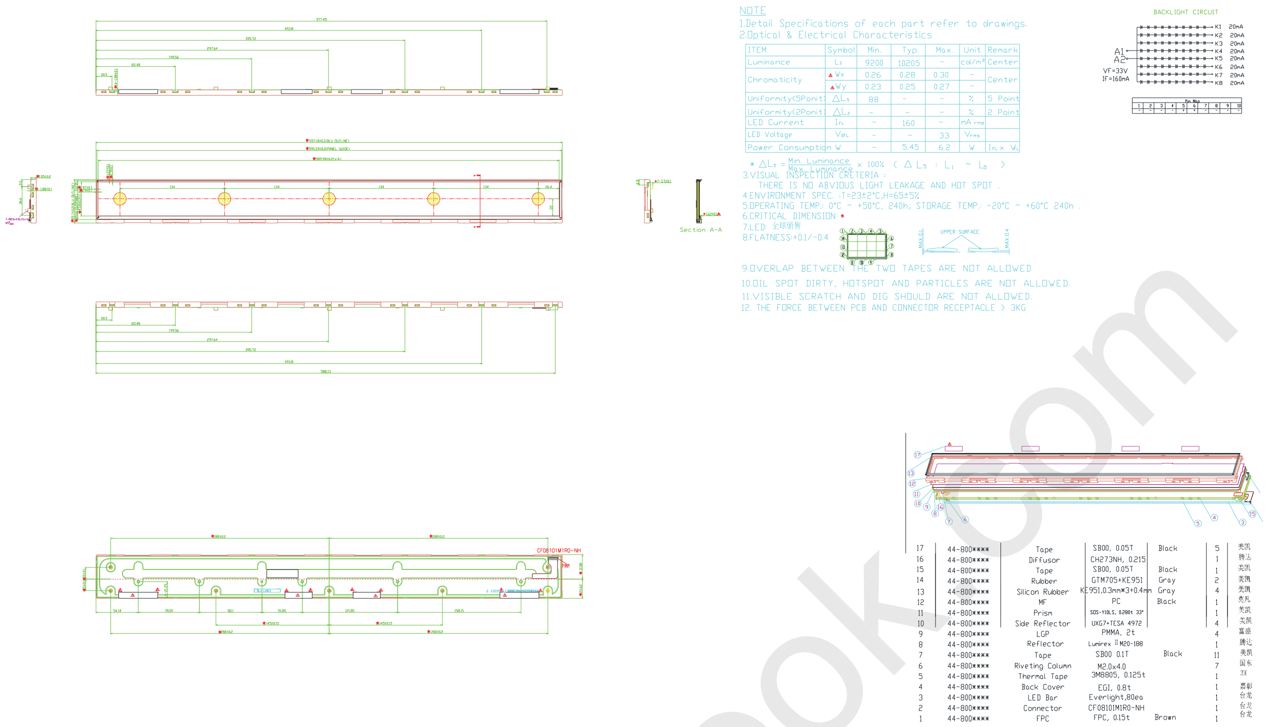


Figure6. BLU Outline Dimension (unit:mm)



ITEM	Symbol	Min.	Typ.	Max.	Unit	Remark
Luminance	L_3	9200	10205	-	cd/m²	Center
Chromaticity	Wx	0.26	0.28	0.30	-	Center
	Wy	0.23	0.25	0.27	-	
Uniformity(5Ponit)	ΔL_5	88	-	-	%	5 Point
Uniformity(2Ponit)	ΔL_2	-	-	-	%	2 Point
LED Current	I_{FL}	-	160	-	mA rms	
LED Voltage	V_{SFL}	-	-	33	Vrms	
Power Consumption	W	-	5.45	6.2	W	$I_{FL} \times V_{FL}$

$* \ \Delta L_5 = \frac{\text{Min. Luminance}}{\text{Max. Luminance}} \times 100\%$ (ΔL_5 : L_1 ~ L_5)

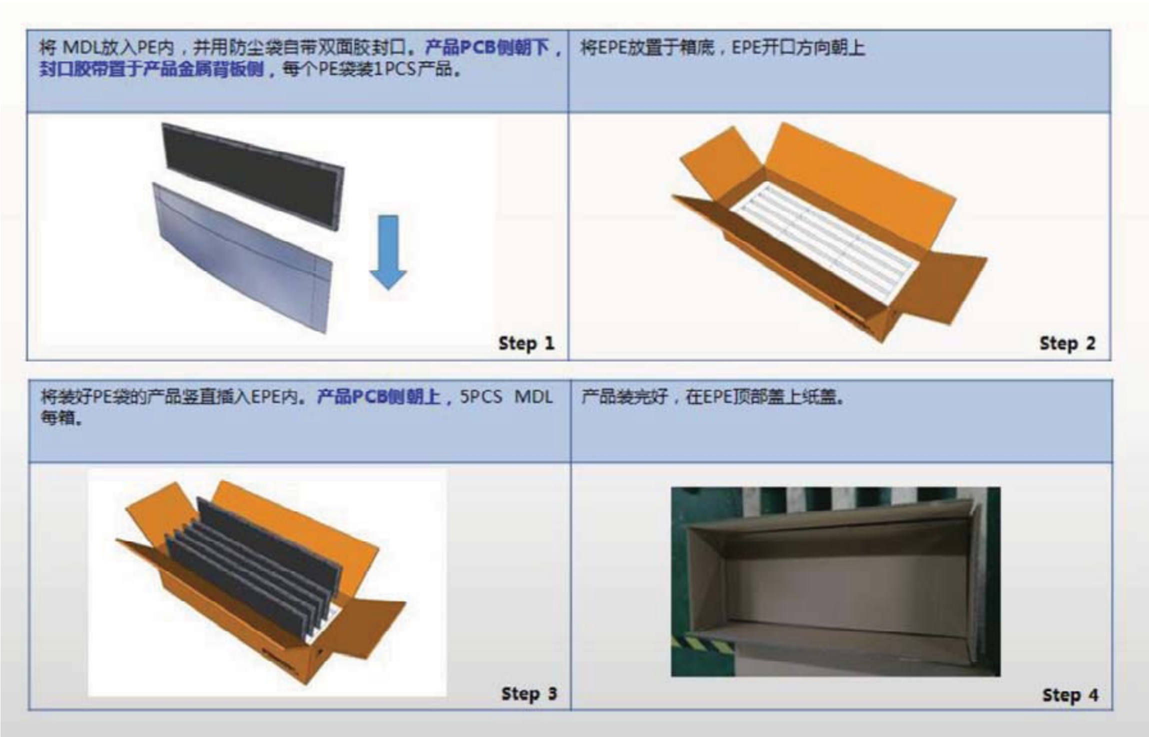
17	44-800****	Tape	SB00, 0.05T	Black	5	美凯
16	44-800****	Diffusor	CH273NH, 0.215		1	腾达
15	44-800****	Tape	SB00, 0.05T	Black	1	美凯
14	44-800****	Rubber	GTM705+KE951	Gray	2	美凯
13	44-800****	Silicon Rubber	KE951,0.3mm*3+0.4mm	Gray	4	美凯
12	44-800****	MF	PC	Black	1	莫凡
11	44-800****	Prism	SOS-Y10LS, 0.280t 33°		1	美凯
10	44-800****	Side Reflector	UXG7+TESA 4972		4	美凯
9	44-800****	LGP	PMMA, 2t		4	富盛
8	44-800****	Reflector	Lumirex II M20-188		1	腾达
7	44-800****	Tape	SB00 0.1T	Black	11	美凯
6	44-800****	Riveting Column	M2.0x4.0		7	国东
5	44-800****	Thermal Tape	3M8805, 0.125t		1	3M
4	44-800****	Back Cover	EGI, 0.8t		1	嘉彰
3	44-800****	LED Bar	Everlight,80ea		1	台龙
2	44-800****	Connector	CF08101M1R0-NH		1	台龙
1	44-800****	FPC	FPC, 0.15t	Brown	1	台龙

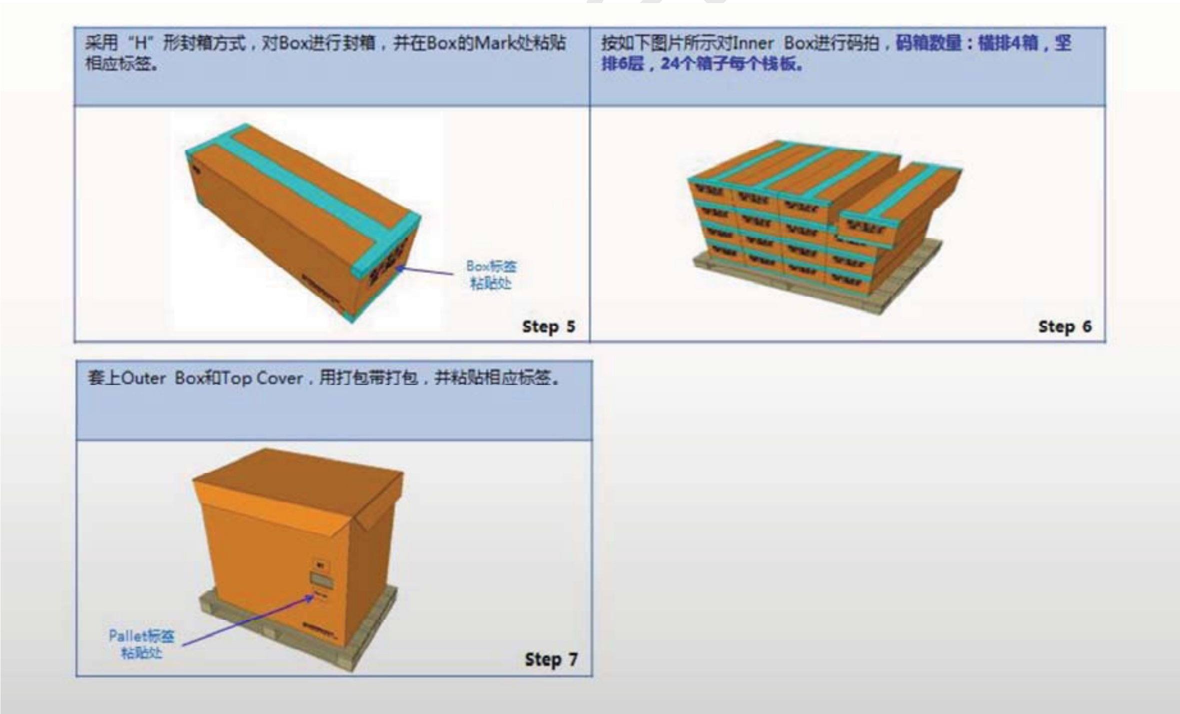
7.0 RELIABILITY TEST

NO	Test Item	Test Condition	Duration
1	High temperature, high humidity operation test(THO)	50℃,80%RH	240hr
2	Low temperature operation test(LTO)	0 ℃	240hr
3	High temperature operation test(HTO)	50 ℃	240hr
4	High temperature storage test(HTS)	60℃	240hr
5	Low temperature storage test(LTS)	-20℃	240hr
6	Thermal shock test (TST)	-20 ℃ →60 ℃ (100cycles,10s for temp change)	0.5hr
7	ESD	150pF 330Ω ±15KV(Air) / ±8KV(Contact)	100strikes
8	Vibration	1.5G,10/500/10,Sine,X/Y/Z Direction	30min
9	Shock	50G,11msec,half-sine, X/Y/Z Direction	Total 6 (one time each orientation)
10	Drop	1corner,3edge,6face,60cm	

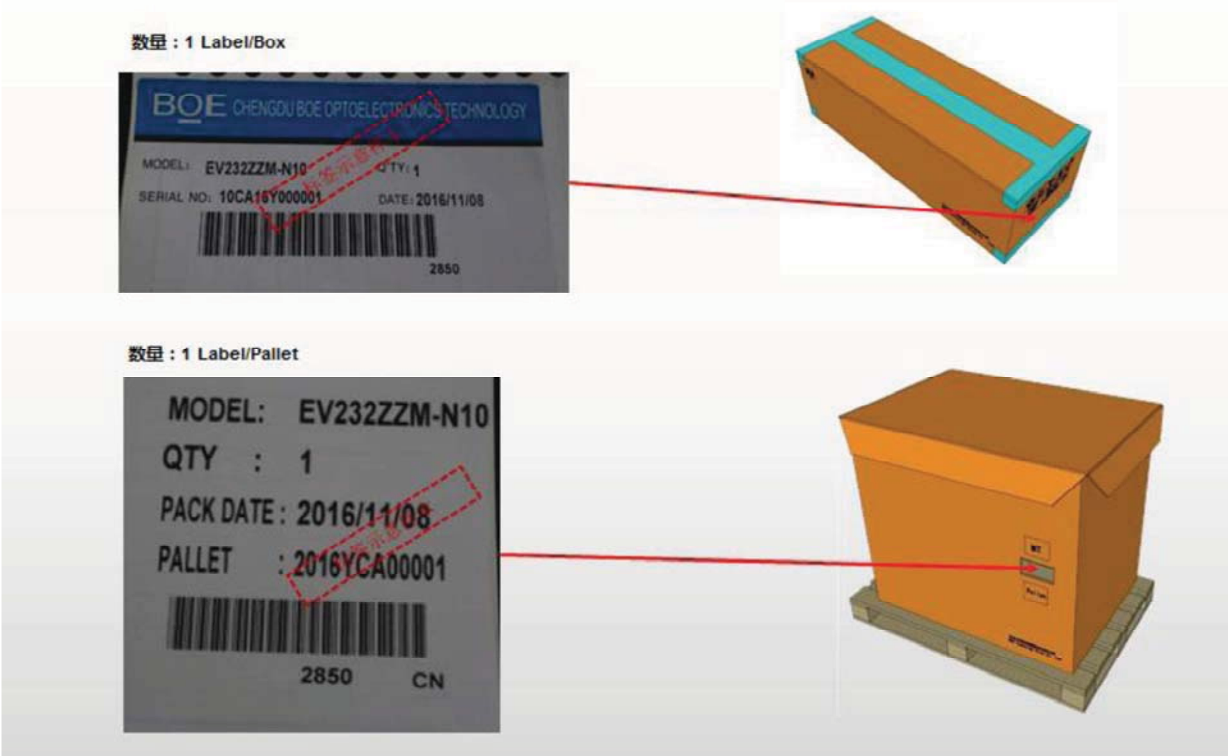
8.0 PACKING METHOD

8.1 Packing Process





8.2 Label Information



9.0 PRODUCT ID RULE

EV232ZZM – N 10

1 2 3 4 5 6 7 8

1 <Application area>

Code	Description
E	Healthcare & Industrial
H	TV
A	Automotive

2 <Mode>

Code	Description
V	ADS-a Si
S	ADS-LTPS
L	SEL/E-Paper

3 <Size>

Code	Description
232	23.2"
040	4.0"
060	6.0"

4 <Resolution>

Code	Description
ZZ	1280*92
WQ	WQVGA
LC	LQCIF

5 <Production type>

Code	Description
M	Module
A	Array
S	Q-Panel SLM

6 <Product state>

Code	Description
N	Normal
E	In Cell Touch
A	Add On Touch

7 <Product THK>

Code	Description
1	1.0mm
5	0.5mm
6	0.6mm

8 <Product Rev>

Code	Description
0	First Mode
1	Second Mode
2	Third Mode

10.0 HANDDLING & CAUTIONS

10.1 Mounting Method

● The panel of the LCM consists of two thin glasses with polarizer which easily get damaged. So extreme care should be taken when handling the LCM.

● Excessive stress or pressure on the glass of the LCM should be avoided. Care must be taken to insure that no torsional or compressive forces are applied to the LCM unit when it is mounted.

● If the customer's set presses the main parts of the LCM, the LCM may show the abnormal display. But this phenomenon does not mean the malfunction of the LCM and should be pressed by the way of mutual agreement.

● To determine the optimum mounting angle, refer to the viewing angle range in the specification for each model.

● Mount a LCM with the specified mounting parts.

10.2 Caution of LCM Handling and Cleaning

● Since the LCM is made of glass, do not apply strong mechanical impact or static load onto it. Handling with care since shock, vibration, and careless handling may seriously affect the product. If it falls from a high place or receives a strong shock, the glass maybe broken.

● The polarizer on the surface of panel are made from organic substances. Be very careful for chemicals not to touch the polarizer or it leads the polarizer to be deteriorated.

● If the use of a chemical is unavoidable, use soft cloth with solvent recommended below to clean the LCM's surface with wipe lightly.

-IPA (Isopropyl Alcohol), Ethyl Alcohol, Tri-chloro, tri-florothane.

● Do not wipe the LCM's surface with dry or hard materials that will damage the polarizer and others. Do not use the following solvent—Water, acetone, Aromatics.

● It is recommended that the LCM be handled with soft gloves during assembly, etc.
The polarizer on the LCM's surface are vulnerable to scratch and thus to be damaged by shape particles.

● Do not drop water or any chemicals onto the LCM's surface.

● A protective film is supplied on the LCM and should be left in place until the LCM is required for operation.

● The ITO pad area needs special careful caution because it could be easily corroded. Do not contact the ITO pad area with HCFC, Soldering flux, Chlorine, Sulfur, saliva or fingerprint. To prevent from the ITO corrosion, customers are recommended that the ITO area would be covered by UV or silicon.

● Please clean the LCD without ultrasonic to avoid line open.

10.3 Caution Against Static Charge

● The LCM use C-MOS LSI drivers, so customers are recommended that any unused input terminal would be connected to Vdd or Vss, do not input any signals before power is turn on, and ground you body, work/assembly area, assembly equipments to protect against static electricity.

● Remove the protective film slowly, keeping the removing direction approximate 30-degree not vertical from panel surface, if possible, under ESD control device like ion blower, and the humidity of working room should be kept over 50%RH to reduce the risk of static charge.

● Avoid the use work clothing made of synthetic fibers. We recommend cotton clothing or other conductivity-treated fibers.

● In handling the LCM, wear non-charged material gloves. And the conducting wrist to the earth and the conducting shoes to the earth are necessary.

10.4 Caution For Operation

● It is indispensable to drive the LCM within the specified voltage limit since the higher voltage than the limit causes LCM's life shorter. An electro-chemical reaction due to DC causes undesirable deterioration of the LCM so that the use of DC drive should avoid.

● Do not connect or disconnect the LCM to or from the system when power is on.

● Never use the LCM under abnormal conditions of high temperature and high humidity.

● When expose to drastic fluctuation of temperature(hot to cold or cold to hot), the LCM may be affected; specifically, drastic temperature fluctuation from cold to hot, produces dew on the LCM's surface which may affect the operation of the polarizer on the LCM.

● Response time will be extremely delay at lower temperature than the operating temperature range and on the other hand LCM may turn black at temperature above its operational range. However those phenomenon do not mean malfunction or out of order with the LCM. The LCM will revert to normal operation once the temperature returns to the recommended temperature range for normal operation.

● Do not display the fixed pattern for a long time because it may develop image sticking due to the LCM structure. If the screen is displayed with fixed pattern, use a screen saver.

● Do not disassemble and/or re-assemble LCM module

10.5 Packaging

● Modules use LCM element, and must be treated as such.

-Avoid intense shock and falls from a height.

-To prevent modules from degradation, do not operate or store them exposed directly to sunshine or high temperature/humidity for long periods.

10.6 Storage

- A slight dew depositing on terminals is a cause for electro-chemical reaction resulting in terminal open circuit. Relative humidity of the environment should therefore be kept below 60%RH.
- Original protective film should be used on LCM's surface (polarizer). Adhesive type protective film should be avoided, because it may change color and/or properties of the polarizer.
- Do not store the LCM near organic solvents or corrosive gasses.
- Keep the LCM safe from vibration, shock and pressure.
- Black or white air-bubbles may be produced if the LCM is stored for long time in the lower temperature or mechanical shocks are applied onto the LCM.
- In the case of storing for a long period of time for the purpose or replacement use, the following ways are recommended.

-Store in a polyethylene bag with sealed so as not to enter fresh air outside in it.
-Store in a dark place where neither exposure to direct sunlight nor light is.
-Keep temperature in the specified storage temperature range.
-Store with no touch on polarizer surface by the anything else. If possible, store the LCM in the packaging situation when it was delivered.

10.7 Safety

- For the crash damaged or unnecessary LCM, it is recommended to wash off liquid crystal by either of solvents such as acetone and ethanol an should be burned up later.
- In the case of LCM is broken, watch out whether liquid crystal leaks out or not. If your hands touch the liquid crystal, wash your hands cleanly with water and soap as soon as possible.
- If you should swallow the liquid crystal, first, wash your mouth thoroughly with water, then drink a lot of water and induce vomiting, and then, consult a physician.
- If the liquid crystal get in your eyes, flush your eyes with running water for at least fifteen minutes.
- If the liquid crystal touches your skin or clothes, remove it and wash the affected part of your skin or clothes with soap and running water.

11.0 Applicable Scope

- This product specification only applies to the products manufactured and sold by our company.
- Any specification, quality etc. about other parts mentioned in this product spec are no concern of our company.