TITLE

ZK438FBM-18A Product Specification

Jiangsu Gaomingan Photoelectric Co., Ltd.

REVISION HISTORY

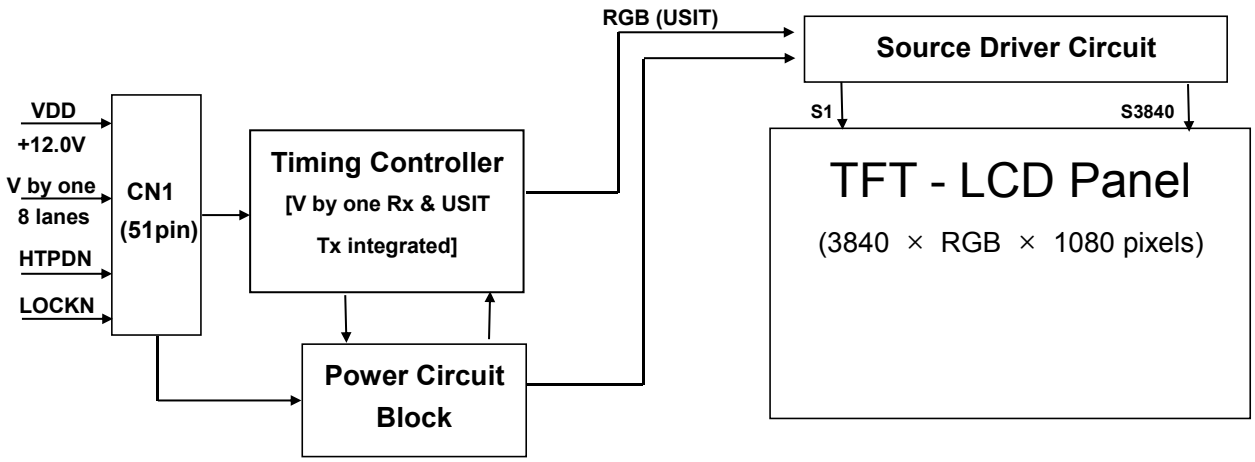
REV.	ECN No.	DESCRIPTION CHANGES	DATE	PREPARED
P0	-	Initial Release	2018.03.21	
P1	-	Update White luminance uniformity and test condition, Module Outline Dimesions	2018.03.29	
P2	-	Update White luminance uniformity to 70% and test condition to 9 points, Backlight Connector, Module Outline Dimesions	2018.04.02	
P3	-	Update Module Outline Dimesions	2018.05.09	
P4	-	Update Data	2018.09.11	

Contents

1.0 GENERAL DESCRIPTION

1.1 Introduction

ZK438FBM-18A 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 43.8 inch diagonally measured active area with resolutions (3840 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 1.07G colors. The TFT-LCD panel used for this module is adapted for a low reflection and higher color type.



1.2 Features

- V by one interface with 8 lanes
- High-speed response
- Low color shift image quality
- 8-bit + FRC color depth, display 1.07G colors
- High luminance and contrast ratio, low reflection and wide viewing angle
- Gate driver use GOA mode
- ADS technology is applied for high display quality
- RoHS compliant

1.3 Application

- Home Alone Multimedia TFT-LCD TV
- Display Terminals for Control System
- Ultra High Definition TV(3840*1080)
- AV application Products

1.4 General Specification

< Table 1. General Specifications >

Parameter	Specification	Unit	Remarks
Active area	1071.36(H) × 301.32(V)	mm	Detail refer to Drawing
Module Size	1086.4 (L) × 324 (W) × 20 (H)	mm	
Number of pixels	3840(H) × 1080(V)	pixel	
Pixel pitch	279(H) × 279(V)	um	
Pixel Arrangement	RGB Vertical Stripe	--	
Display colors	1.07G (8bits+FRC)	colors	
Display Mode	Normally black	--	
Weight	6000(typ.)	g	
Power Consumption	50(typ.)	Watt	
Luminance of white	250	cd/m²	
Surface Treatment	AG25/Clear(CF /TFT POL)	--	

2.0 ABSOLUTE MAXIMUM RATINGS

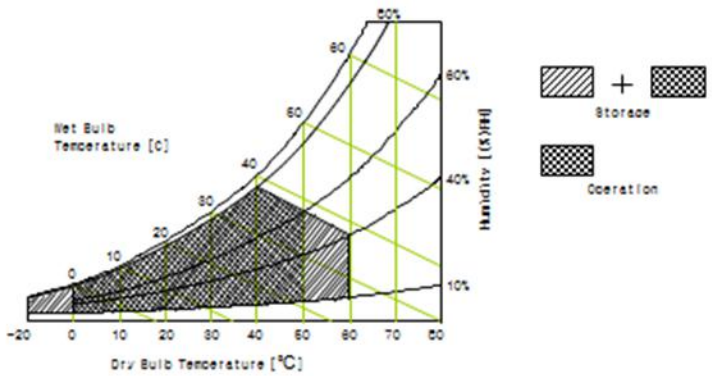
The followings are maximum values which, if exceed, may cause faulty operation or damage to the unit. The operational and non-operational maximum voltage and current values are listed in Table 2.

< Table 2. Open Cell Electrical Specifications >

Parameter	Symbol	Min.	Max.	Unit	Remark
Power Supply Voltage	VDD	VSS-0.3	13.2	V	Ta = 25 ℃
Oprating Temperature	Top	0	+50	℃	Note 1
Storage Temperature	Tsug	-20	+60	℃	
	Tst	-20	+60	℃	
Operating Ambient Humidity	Hop	10	80	%RH	
Storage Humidity	Hst	10	80	%RH	

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

Wet bulb temperature should be 39℃ max. and no condensation of water.



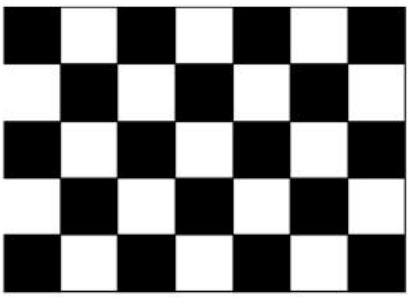
3.0 ELECTRICAL SPECIFICATIONS

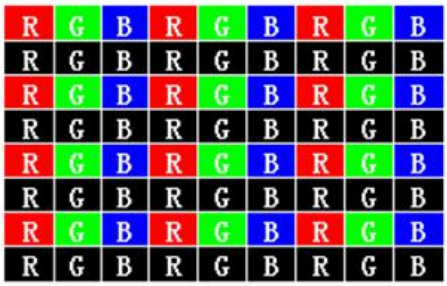
< Table 3. Open Cell Electrical Specifications >

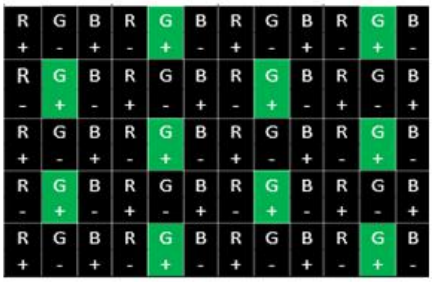
Parameter		Symbol	Values			Unit	Remark
			Min	Typ	Max		
Power Supply Input Voltage		VDD	10.8	12	13.2	Vdc	
Power Supply Ripple Voltage		VRP	-	-	600	mV	
Power Supply Current		IDD	-	650	1450	mA	Note 1
Power Consumption		PDD	-	7.8	17.4	Watt	
Rush current		IRUSH	-	-	4	A	Note 2
V by One Interface	Differential Input High Threshold Voltage	VLVTH	-	-	+50	mV	-
	Differential Input Low Threshold Voltage	VLVTL	-50	-	-	mV	-
	Common Input Voltage	VLVC	-	-	-	V	-
	Terminating Resistor	Tt	90	100	110	ohm	-
CMOS Interface	Input High Threshold Voltage	VIH	2.7	-	3.3	V	
	Input Low Threshold Voltage	VIL	0	-	0.6	V	

Note 1 : The supply voltage is measured and specified at the interface connector of LCM.
The current draw and power consumption specified is for VDD=12.0V,
Frame rate fv=60Hz and Clock frequency = 37.125MHz.
Test Pattern of power supply current
a) Typ : Mosaic 7X5 (L0/L255)
b) Max : Horizontal 1 Line (L0/L255)
c) Flicker Test Pattern

Note 2 : The duration of rush current is about 2ms and rising time of Power Input is 0.5ms(min)







4.0 INTERFACE CONNECTION

4.1 Open Cell Input Signal & Power

-V by one Connector : F05035-51P-H(Changtong) or Equivalent.

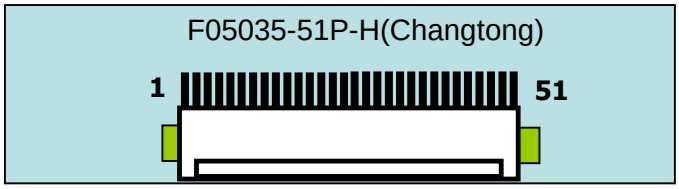
< Table 4. Open Cell Input Connector Pin Configuration >

Pin No	Symbol	Description	Pin No	Symbol	Description
1	VDD	Power Supply +12.0V	27	GND	Ground
2	VDD	Power Supply +12.0V	28	Rx0n	V-by-One HS Data Lane 0
3	VDD	Power Supply +12.0V	29	Rx0p	V-by-One HS Data Lane 0
4	VDD	Power Supply +12.0V	30	GND	Ground
5	VDD	Power Supply +12.0V	31	Rx1n	V-by-One HS Data Lane 1
6	VDD	Power Supply +12.0V	32	Rx1p	V-by-One HS Data Lane 1
7	VDD	Power Supply +12.0V	33	GND	Ground
8	VDD	Power Supply +12.0V	34	Rx2n	V-by-One HS Data Lane 2
9	NC	No Connection	35	Rx2p	V-by-One HS Data Lane 2
10	GND	Ground	36	GND	Ground
11	GND	Ground	37	Rx3n	V-by-One HS Data Lane 3
12	GND	Ground	38	Rx3p	V-by-One HS Data Lane 3
13	GND	Ground	39	GND	Ground
14	GND	Ground	40	Rx4n	V-by-One HS Data Lane 4
15	NC	No Connection	41	Rx4p	V-by-One HS Data Lane 4
16	NC	No Connection	42	GND	Ground
17	NC	No Connection	43	Rx5n	V-by-One HS Data Lane 5
18	SDA	SDA(For Vcom Tuning)	44	Rx5p	V-by-One HS Data Lane 5
19	SCL	SCL(For Vcom Tuning)	45	GND	Ground
20	NC	No Connection	46	Rx6n	V-by-One HS Data Lane 6
21	NC	No Connection	47	Rx6p	V-by-One HS Data Lane 6
22	SEL_SECTION	High:1 Section	48	GND	Ground
23	NC	No Connection	49	Rx7n	V-by-One HS Data Lane 7
24	GND	Ground	50	Rx7p	V-by-One HS Data Lane 7
25	GND	Ground	51	GND	Ground
26	LOCKN	Lock detect			

Notes : NC (Not Connected) : This pins are only used for BOE internal operations.

SEL_SECTION：High:1 Section, Low&NC:2 Section. It should be high.

Rear view of LCM



4.2 V by one Misc. Setting.-1 Section

a) System side have to put pull high resistor on LOCKN/HTPDN pins.

b) V by one data mapping as follows.

< Table 5. V by one setting &data mapping Table >

1 Section								
Hactive= 3840								
	port 0		port 1		port 2		port 3	
	Lane 0	Lane 1	Lane 2	Lane 3	Lane 4	Lane 5	Lane 6	Lane 7
V Blanking	FSBS	FSBS	FSBS	FSBS	FSBS	FSBS	FSBS	FSBS
	FSBP	FSBP	FSBP	FSBP	FSBP	FSBP	FSBP	FSBP
	...	...	...	...	...	...	...	...
	FSBP	FSBP	FSBP	FSBP	FSBP	FSBP	FSBP	FSBP
	FSBE_SR	FSBE_SR	FSBE_SR	FSBE_SR	FSBE_SR	FSBE_SR	FSBE_SR	FSBE_SR
Line 1	Pixel 1	Pixel 2	Pixel 3	Pixel 4	Pixel 5	Pixel 6	Pixel 7	Pixel 8
	Pixel 9	Pixel 10	Pixel 11	Pixel 12	Pixel 13	Pixel 14	Pixel 15	Pixel 16
	...	...	...	...	...	...	...	...
	...	...	...	...	...	...	...	...
	Pixel 3833	Pixel 3834	Pixel 3835	Pixel 3836	Pixel 3837	Pixel 3838	Pixel 3839	Pixel 3840
H Blanking	FSBS	FSBS	FSBS	FSBS	FSBS	FSBS	FSBS	FSBS
	FSBP	FSBP	FSBP	FSBP	FSBP	FSBP	FSBP	FSBP
	...	...	...	...	...	...	...	...
	FSBP	FSBP	FSBP	FSBP	FSBP	FSBP	FSBP	FSBP
	FSBE	FSBE	FSBE	FSBE	FSBE	FSBE	FSBE	FSBE
Line 2	Pixel 1	Pixel 2	Pixel 3	Pixel 4	Pixel 5	Pixel 6	Pixel 7	Pixel 8
	Pixel 9	Pixel 10	Pixel 11	Pixel 12	Pixel 13	Pixel 14	Pixel 15	Pixel 16
	...	...	...	...	...	...	...	...
	...	...	...	...	...	...	...	...
	Pixel 3833	Pixel 3834	Pixel 3835	Pixel 3836	Pixel 3837	Pixel 3838	Pixel 3839	Pixel 3840

5.0 SIGNAL TIMING WAVEFORMS OF INTERFACE SIGNAL

5.1 Input data specification CN1

- Table 6 Vx1 Byte length and Color mapping

Byte	Packer input	Color date mapping
		30 bpp RGB
0	Bit-0	R2
	Bit-1	R3
	Bit-2	R4
	Bit-3	R5
	Bit-4	R6
	Bit-5	R7
	Bit-6	R8
	Bit-7	R9
1	Bit-8	G2
	Bit-9	G3
	Bit-10	G4
	Bit-11	G5
	Bit-12	G6
	Bit-13	G7
	Bit-14	G8
	Bit-15	G9
2	Bit-16	B2
	Bit-17	B3
	Bit-18	B4
	Bit-19	B5
	Bit-20	B6
	Bit-21	B7
	Bit-22	B8
	Bit-23	B9
3	Bit-24	-
	Bit-25	-
	Bit-26	B0
	Bit-27	B1
	Bit-28	G0
	Bit-29	G1
	Bit-30	R0
	Bit-31	R1

6.0 SIGNAL TIMING SPECIFICATION

6.1 Timing Parameters

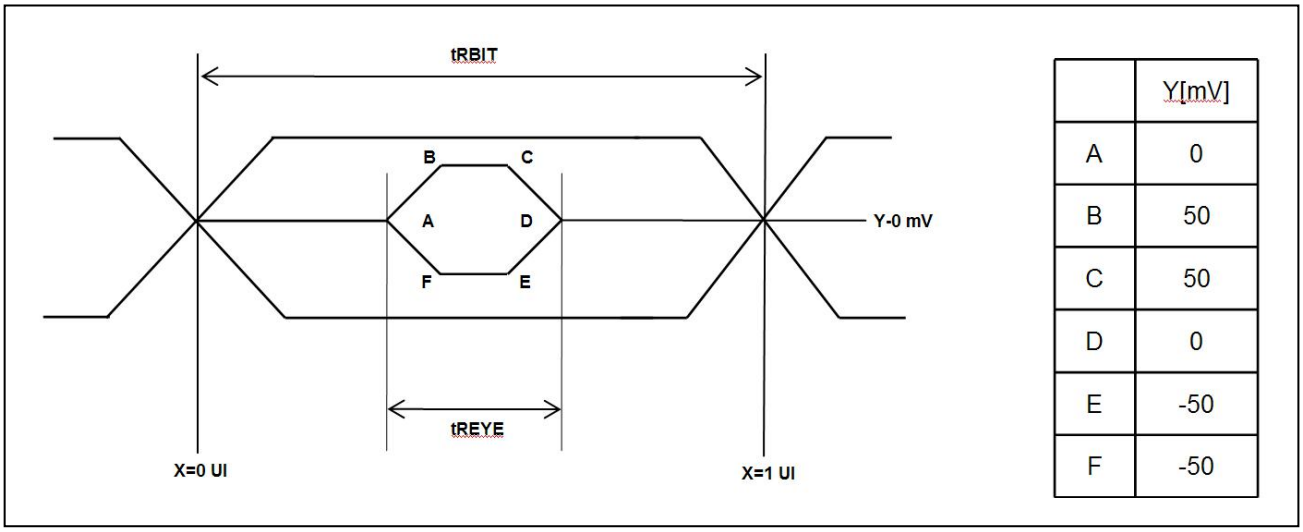
< Table 7. Timing Table >

Item		**Symbols**	**Min**	**Typ**	**Max**	**Unit**
Frequency		1/Tc	33	37.125	48	MHZ
Vertical	Frame Rate	F	56	60	75	Hz
	Total	TV	1115	1125	1380	TH
	Display	TVD		1080		TH
	Blank	TVB	35	45	300	TH
Horizontal	Total	TH	540	550	600	TCLK
	Display	THD		480		TCLK
	Blank	THB	60	70	120	TCLK

6.2 Signal Timing Waveform

< Table 8. Signal Timing Table >

Parameter	Symbol	Condition	Min	Typ	Max	Unit
Unit Interval(VBO Operation Bit Rate)	tRBIT	3-byte	380	tTCIP/30	1667	PS
		4-byte	285	tTCIP/40	1250	PS
		5-byte	266	tTCIP/50	1000	PS
Eye Width at Package Pin	tREYE	-	-	0.5	-	UI
Eye Width Position A at Package Pin	tA	-	-	0.25	-	UI
Eye Width Position B at Package Pin	tB	-	-	0.3	-	UI
Eye Width Position Cat Package Pin	tC	--	-	0.7	-	UI
Eye Width Position D at Package Pin	tD	-	-	0.75	-	UI
Eye Width Position E at Package Pin	tE	-	-	0.7	-	UI
Eye Width Position F at Package Pin	tF	-	-	0.3	-	UI
Intra – pair Skew	TTOSK_intra	-	-	-	0.3	UI
Inter – pair Skew	TTOSK_inter	-	-	-	40	UI
SSCG		30KHz modulation	-0.5		0.5	%



	Y[mV]
A	0
B	50
C	50
D	0
E	-50
F	-50

6.3 Input Signals, Basic Display Colors and Gray Scale of Colors

< Table 9. Input Signal and Display Color Table >

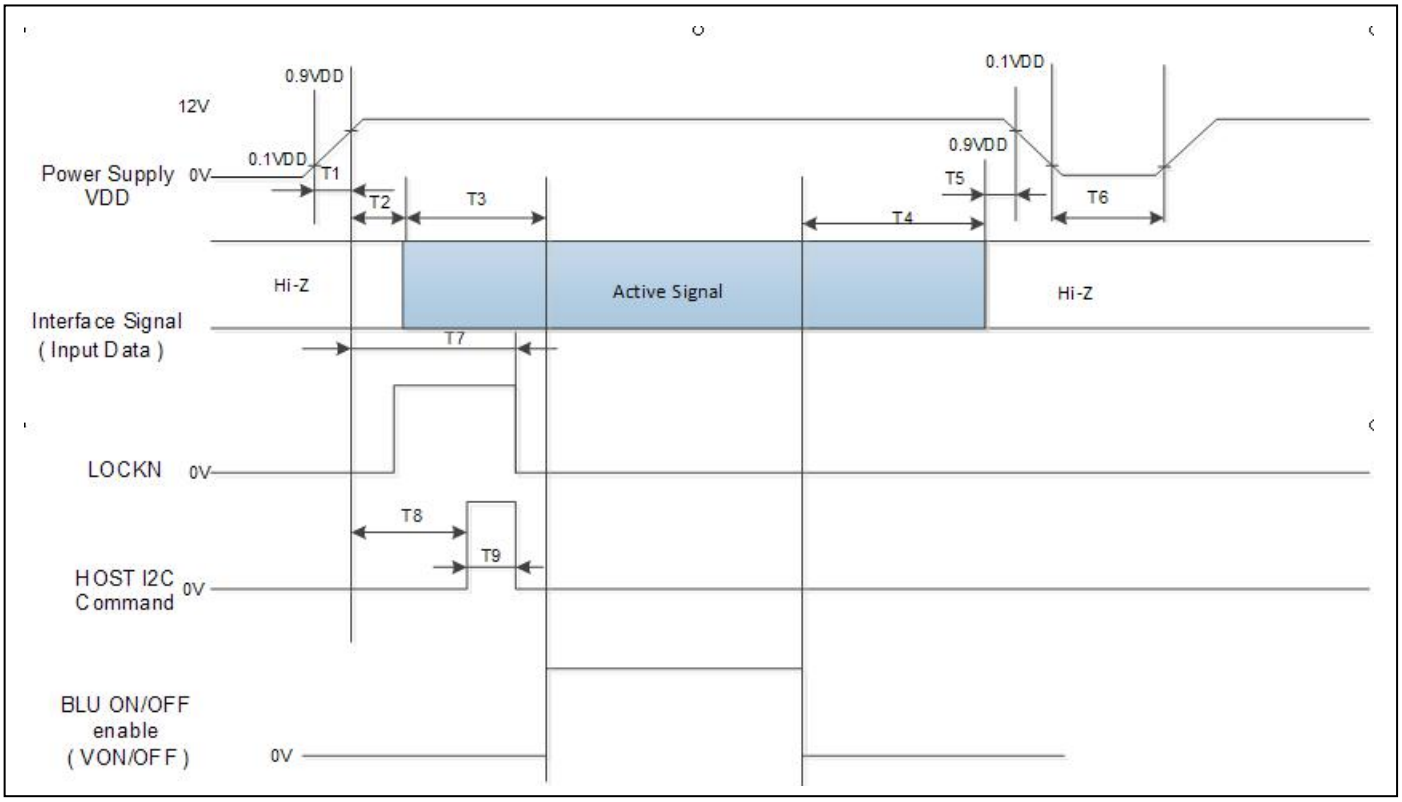
Color		Input Color Data																													
		MSB				RED				LSB		MSB				GREEN				LSB		MSB				BLUE				LSB	
		R9	R8	R7	R6	R5	R4	R3	R2	R1	R0	G9	G8	G7	G6	G5	G4	G3	G2	G1	G0	B9	B8	B7	B6	B5	B4	B3	B2	B1	B0
Basic Color	Black	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red(1023)	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Green(1023)	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0
	Blue(1023)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1
	Cyan	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	Magenta	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	1	1	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	1	1	1	1	0	0	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	1	1	1	1	1	1
R	RED(000)	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
	RED(001)	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	0	0	0	0

	RED(1022)	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	RED(1023)	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
G	Green (000)	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
	Green (000)	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

	Green (1022)	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0
	Green (1023)	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0
B	Blue(000)	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
	Blue(000)	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

	Blue(1022)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	0
	Blue(1023)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1

6.4 Power Sequence



< Table 10. Sequence Table >

Parameter	Values			Units
	Min	Typ	Max	
T1	0.5	Typ	10	ms
T2	0	-	-	ms
T3	200	-	-	ms
T4	100	-	-	ms
T5	0	-	50	ms
T6	1	-	-	s
T7	200	-	-	ms
T8	0	-	1200	ms
T9	Depends on I2C command			ms

Notes: 1. Even though T1 is over the specified value, there is no problem if I2T spec of fuse is satisfied.
2. Back Light must be turn on after power for logic and interface signal are valid.

7.0 Backlight Unit

7.1 Led Light Bar characteristics (Ta = 25 ± 2 ºC)

< Table 11. LightBar characteristics Table >

Parameter	Symbol	Value			Unit	Note
		Min.	Typ.	Max.		
Per Light Bar Voltage	VW	--	66	70.4	VRMS	Duty 100%
Per Light Bar Current	IL	--	320	360	mARMS	
BLU Power	P	--	42.2	50.7	W	
BLU lifetime	hr	30000	--	--	hrs	(2)

Note: (1) The LED Bar consists of 88 LED packages, 4 strings (parallel) x 22packages (serial), total two LightBars.

(2) The lifetime is defined as the time which luminance of the LED decays to 50% compared to the initial value, Operating condition: Continuous operating at Ta = 25±2℃, IL =320mA

(3) The design of the LED driver must have specifications for the LED in LCD Assembly. The performance of the LED in LCM, for example life time or brightness, is extremely influenced by the characteristics of the LED driver. So all the parameters of an LED driver should be carefully designed and output current should be Constant current control. Please control feedback current of each string individually to compensate the current variation among the strings of LEDs. When you design or order the LED driver, please make sure unwanted lighting caused by the mismatch of the LED and the LED driver (no lighting, flicker, etc) never occurs. When you confirm it, the LCD module should be operated in the same condition as installed in your instrument.

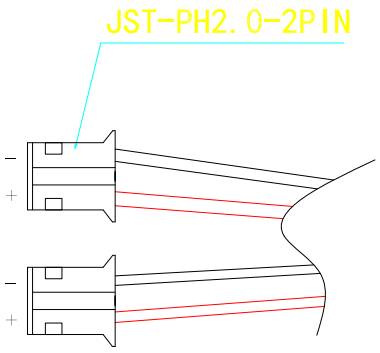
(4) LED operating conditions are must not exceed Max. ratings.

7.2 BACKLIGHT UNIT CONNECTOR DEFINITION

The LED interface connector is a model JST-PH2.0-2PIN Manufactured or equivalent.

< Table 12. LightBar connector definition Table >

PIN	Symbol	Description	Notes
1	FB	Current Feedback	
2	VLED	LED Power Suppy	



BLU LightBar Connector

8.0 OPTICAL CHARACTERISTICS

8.1 Test Conditions

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 (Goniometer system and PR730) and test unit shall be located at an approximate distance 180cm from the LCD surface at a viewing angle of θ and Φ equal to 0° . We refer to $\theta_{Ø=0}$ (=θ_3) as the 3 o'clock direction (the "right"), $\theta_{Ø=90}$ (= θ_{12}) as the 12 o'clock direction ("upward"), $\theta_{Ø=180}$ (= θ_9) as the 9 o'clock direction ("left") and $\theta_{Ø=270}$(= θ_6) as the 6 o'clock direction ("bottom"). While scanning θ and/or Ø, 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 12.0V at 25℃. Optimum viewing angle direction is 6 'clock.

< Table13. Module Optical >

Item		Symbol	Condition	Min.	Typ.	Max.	Unit	Note
Contrast Ratio		CR		700:1	1000:1	-	-	(2)
Response Time		Tg		-	14	25	ms	(6)
Center Luminance of White		Lc		200	250	-	cd/m²	(3)
White luminance uniformity		ΔY		75	-	-	%	(4)
Gamma Scale				2.0	2.2	2.4		
Color Chroma-ticity	Red	Rx	θx=0°, θy=0° (Center) Normal Viewing Angle	Typ -0.03	0.679	Typ +0.03		(5)
		Ry			0.315			
	Green	Gx			0.282			
		Gy			0.663			
	Blue	Bx			0.153			
		BY			0.061			
	White	Wx			0.311			
		Wy			0.347			
	Color gamut	CG		72	88	-	%	NTSC
Viewing Angle	Horizontal	Θ3	CR > 10	-	89	-	Deg.	(1)
		Θ9			89			
	Vertical	Θ12		-	89	-		
		Θ6			89			

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.
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 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 :
ΔY = (Minimum Luminance of 9 points / Maximum Luminance of 9 points) * 100
(See FIGURE 2 shown in Appendix).

5. The color chromaticity coordinates specified in Table 13. 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 Tg is the average time required for display transition by switching the input signal as below table and is based on Frame rate f_V=60Hz 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)”

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).

9.0 MECHANICAL CHARACTERISTICS

9.1 Mounting

See FIGURE 5 . （shown in Appendix）

9.2 Anti-Glare and Polarizer Hardness.

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

9.3 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.

10. REILABILITY TEST

Item	Test Item	Q'ty	Condition
1	High temperature storage test	3	60℃,240hrs
2	Low temperature storage test	3	-20℃,240hrs
3	High temperature operation test	3	50℃,240hrs
4	Low temperature operation test	3	0℃,240hrs

11. 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.

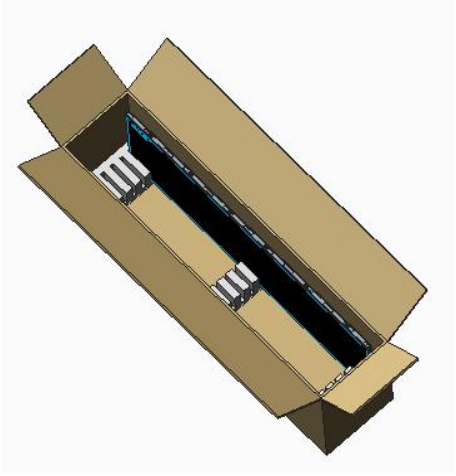
(5) Cautions for the module characteristics
*Do not apply fixed pattern data signal to the LCD module at product aging.
* Applying fixed pattern for a long time may cause image sticking.

(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 bebroken. We recommend to use the original shipping packages.

12. PRODUCT SERIAL NUMBER

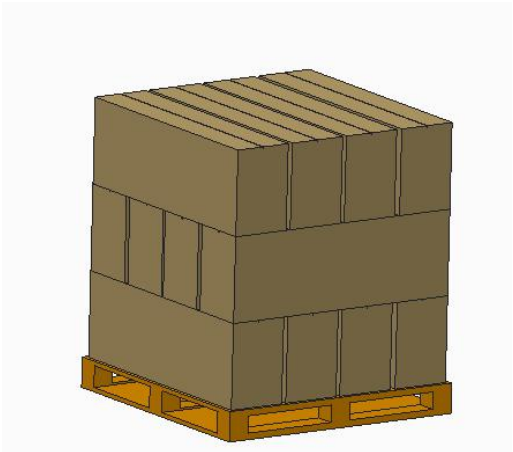
13. PACKING

13.1 Packing Order

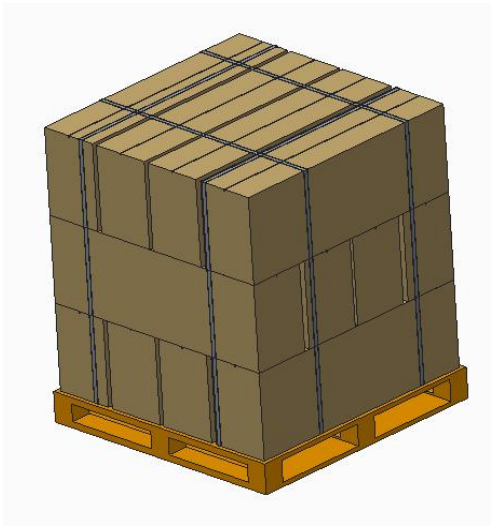


Put 3 EPE bottom into the inner box.

Put each moduleinto a PE bag.
Insert 6 Pcs MDL into each box.
Put 3 EPE cover in and seal the box.



Put the boxes on the pallet (12ea boxes per ballet)



Place paper corners and wrap film around the boxes. Pack with 4 packing belts.

13.2 Packing Note

Box Dimension : 1210.4mm(L) × 323.6mm(W) × 458mm(H)

Package Quantity in one Box : 6pcs

13.3 Boxlabel

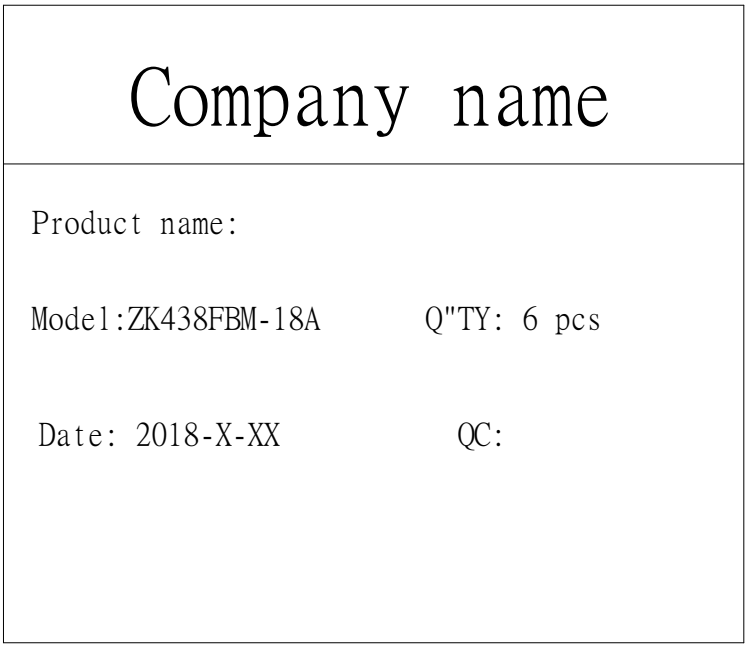
Label Size : 70×60mm. or Other.

Contents:

Model : ZK438FBM-18A

Q`ty: Module 6 Q`ty in one box

Date : Packing Date



14. Appendix

Figure 1. Measurement Set Up

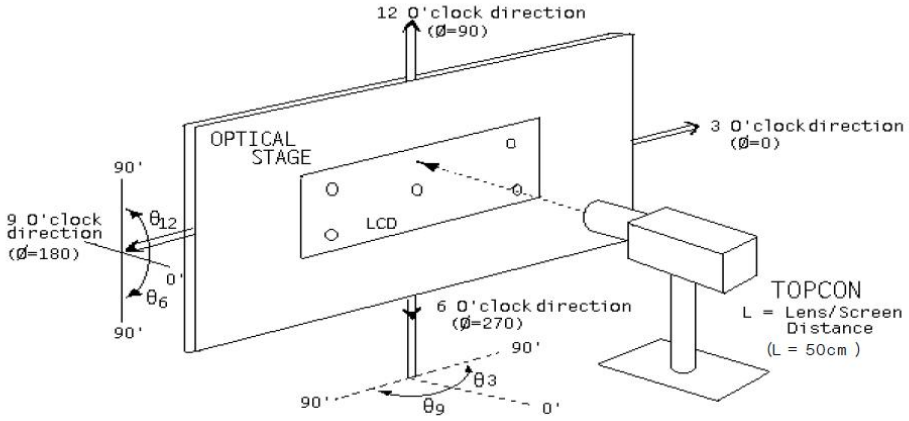


Figure 2. White Luminance and Uniformity Measurement Locations (9 points)

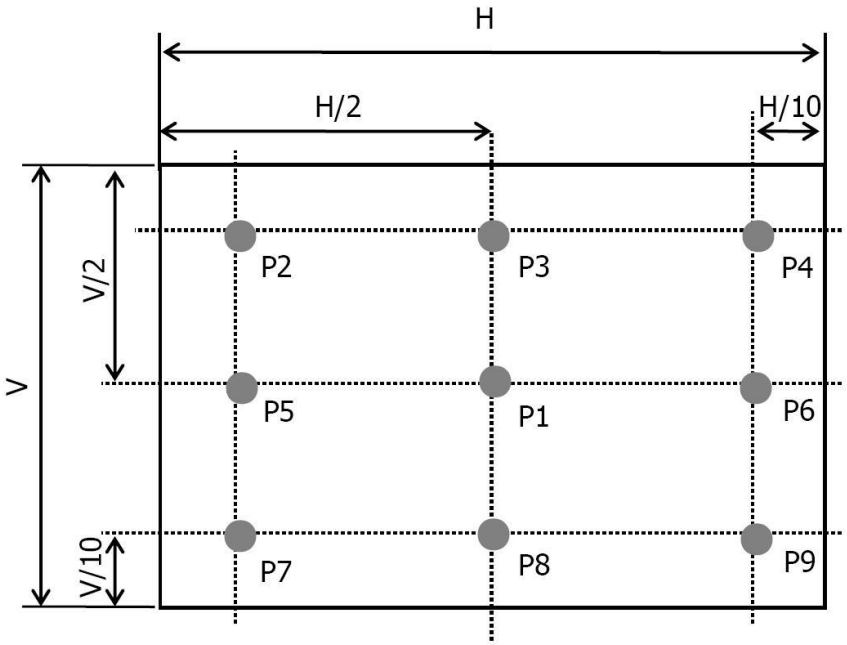


Figure 3. Response Time Testing

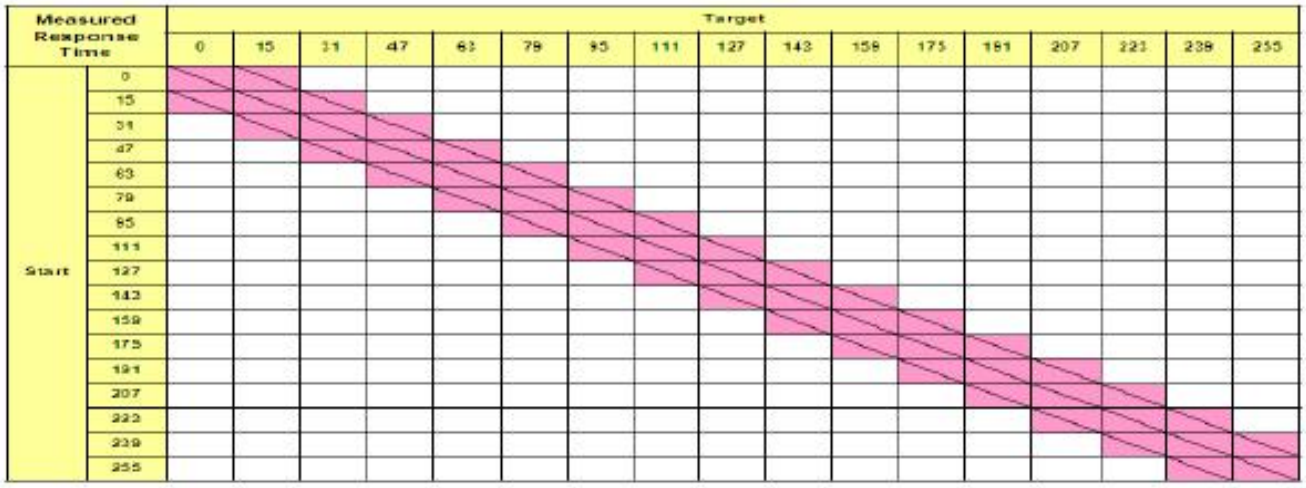
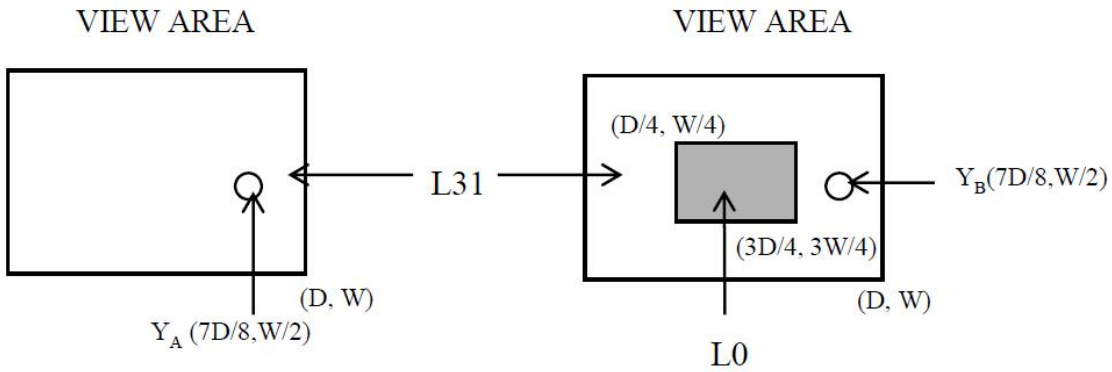


Figure 4. Cross Modulation Test Description



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

Where: Y_A= Initial luminance of measured area (cd/m2)

Y_B= Subsequent luminance of measured area (cd/m2)

The location measured will be exactly the same in both patterns

Figure 5. TFT-LCD Module Outline Dimensions (Front view)

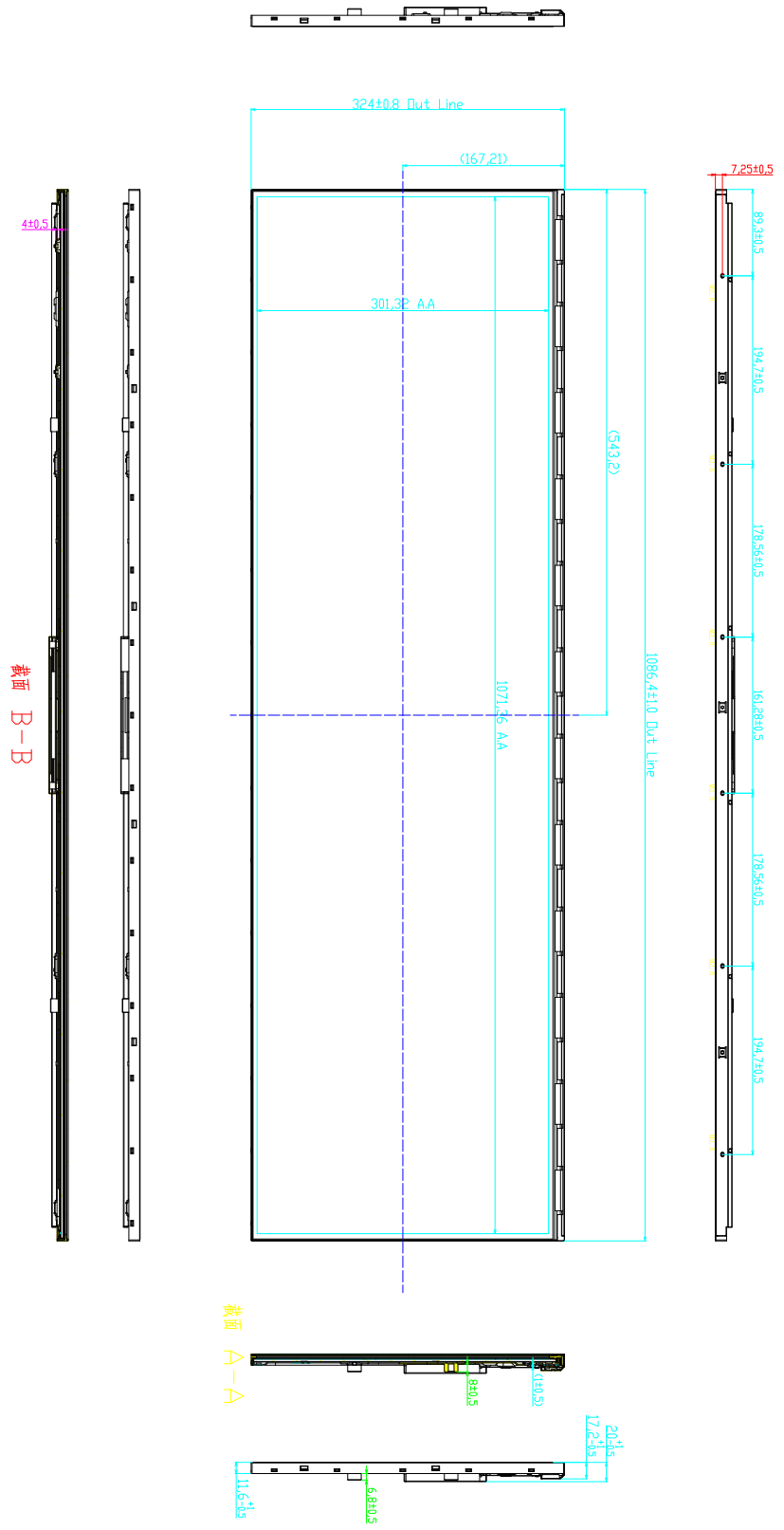


Figure 6. TFT-LCD Module Outline Dimensions (Rear view)