■Preliminary Specification
□Approval Specification

TFT-LCD Module

MODEL NO.: BI416ME

REV.

Customer:

Model NO.:

Part NO.:

APPROVED BY SIGNATURE

*Please return 1 copy for your confirmation with your signature and comments.

Approved By	Checked By	Prepared By

-CONTENTS -

Revision History

Version	Issued Date	Page	Old Description	New Description
01	8/10/2015	\	Initial release	\

1. GENERAL DESCRIPTION

1.1 OVERVIEW

V420DK1-KS1 is a 42" TFT Liquid Crystal Display product with driver ICs and 2ch-LVDS interface. This product supports 3840 x 2160 Full HDTV format and can display 16.7M colors (8-bit). The backlight unit is built in. **1.2 CHARACTERISTICS**

Item	Specification	Unit	Note
Screen Size	41.6 inch Diagonal	in	
Active Area	919.296 (H) x 517.104 (V)	mm	-
Pixel Number	3840 x R.G.B. x 2160	pixel	-
Sub-Pixel Pitch	0.1596(H) × 0.4788(V)	mm	-
Pixel Arrangement	RGB vertical stripe	-	-
Glass thickness (Array / CF)	0.5 / 0.5	mm	-
Transmissive Mode	Normally Black	-	-
Polarizer Surface Treatment	Anti-Glare coating (Haze 1%)	-	-

1.3 MECHANICAL SPECIFICATIONS

Item		Min.	Typ.	Max.	Unit	Remark
Module Size	Horizontal (H)	934.4	934.9	935.4	mm	
	Vertical (V)	539.05	539.55	540.05	mm	
	Depth (D)	10.22	10.72	11.22	mm	
		13.97	14.47	14.97	mm	
Bezel Area	Horizontal (H)	922.6	923.1	923.6	mm	
	Vertical (V)	521.15	521.65	522.15	mm	
Active Area	Horizontal (H)	-	919.296	-	mm	
	Vertical (V)	-	517.104	-	mm	
Weight			-		kg	

[Note 1] Please refer to the attached drawings for more information of front and back outline dimensions and the dimension of bosses are not included.

2. ABSOLUTE MAXIMUM RATINGS

2.1 ABSOLUTE RATINGS OF ENVIRONMENT

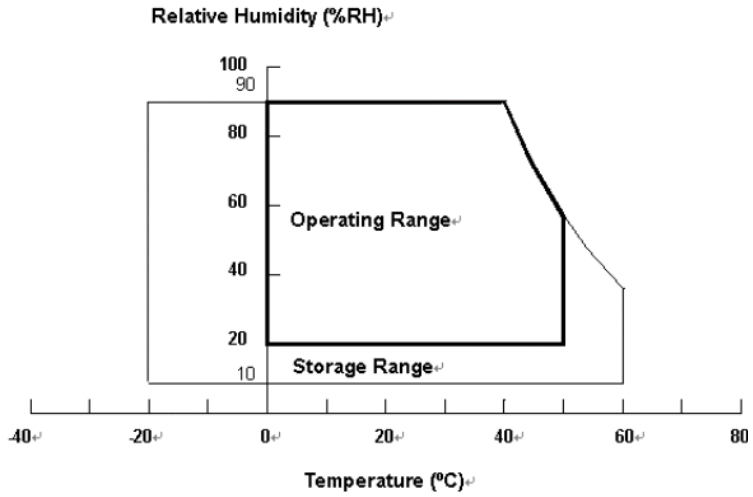
Item	Symbol	Value		Unit	Remark
		Min.	Max.		
Storage Temperature	T_{ST}	-20	+60	℃	[Note 1]
Operating Ambient Temperature	T_{OP}	0	50	℃	[Note 1,2]

Note (1) Temperature and relative humidity range is shown in the figure below.

(a) 90 %RH Max. (Ta < 40 ºC).

(b) Wet-bulb temperature should be 39 ºC Max. (Ta < 40 ºC).

Note (2) Thermal management should be considered in final product design to prevent the surface temperature of display area from being over 65 ºC. The range of operating temperature may degrade in case of improper thermal management in final product design.



3. ELECTRICAL CHARACTERISTICS

3.1 LCD ELETRONICS SPECIFICATION

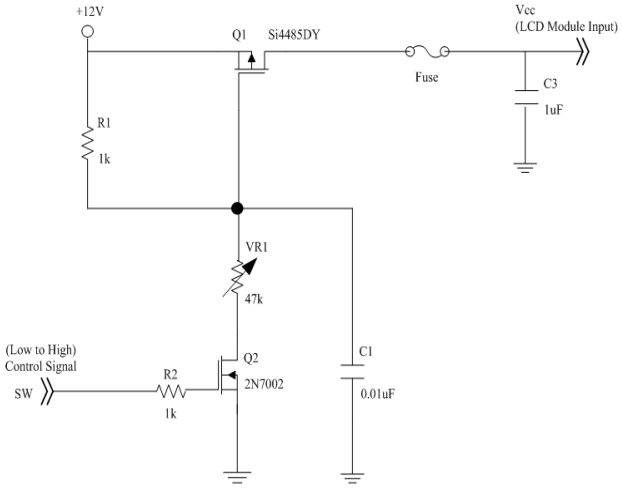
(Ta = 25 ± 2 °C)

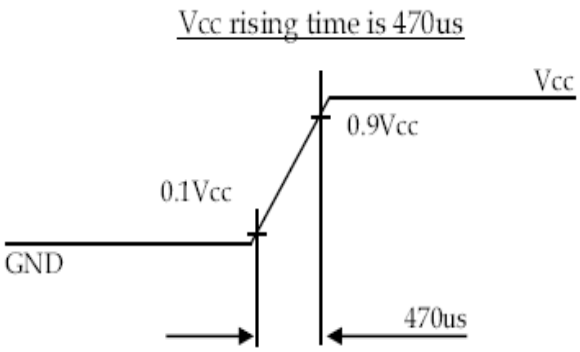
Parameter		Symbol	Value			Unit	Note
			Min.	Typ.	Max.		
Power Supply Voltage		V_{CC}	10.8	12	13.2	V	(1)
Rush Current		I_{RUSH}	—	—	3.5	A	(2)
Power consumption	White Pattern	P_T	—	4.2	5.2	W	(3)
	Black Pattern	P_T	—	4	4.9		
	Horizontal Stripe	P_T	—	7.4	9.1		
Power Supply Current	White Pattern	P_T	—	0.35	0.43	A	
	Black Pattern	P_T	—	0.33	0.41		
	Horizontal Stripe	P_T	—	0.62	0.76		
LVDS interface	Differential Input High Threshold Voltage	V_{LVTH}	+100	—	+300	mV	(4)
	Differential Input Low Threshold Voltage	V_{LVTL}	-300	—	-100	mV	
	Common Input Voltage	V_{CM}	1.0	1.2	1.4	V	
	Differential input voltage	$\|V_{ID}\|$	200	—	600	mV	
	Terminating Resistor	R_T	—	100	—	ohm	
CMOS interface	Input High Threshold Voltage	V_{IH}	2.7	—	3.3	V	
	Input Low Threshold Voltage	V_{IL}	0	—	0.7	V	

Note (1) The module should be always operated within the above ranges.

The ripple voltage should be controlled under 10% of Vcc (Typ.).

Note (2) Measurement condition:





Note (3) The specified power supply current is under the conditions at Vcc = 12 V, Ta = 25 ± 2 ºC, fv = 60 Hz, whereas a power dissipation check pattern below is displayed.

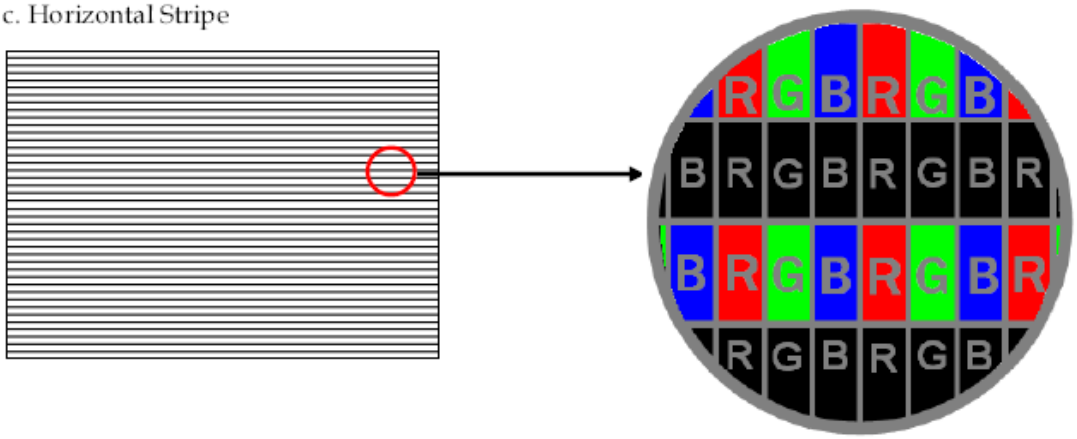
a. White Pattern

Active Area

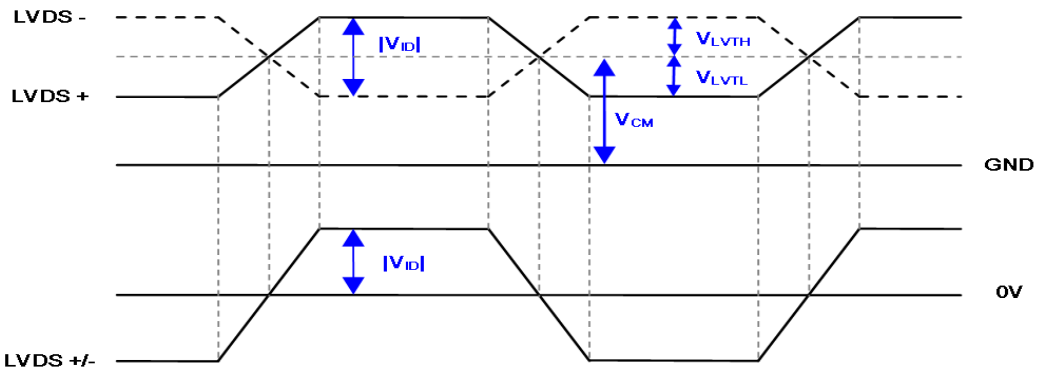
b. Black Pattern

Active Area

c. Horizontal Stripe

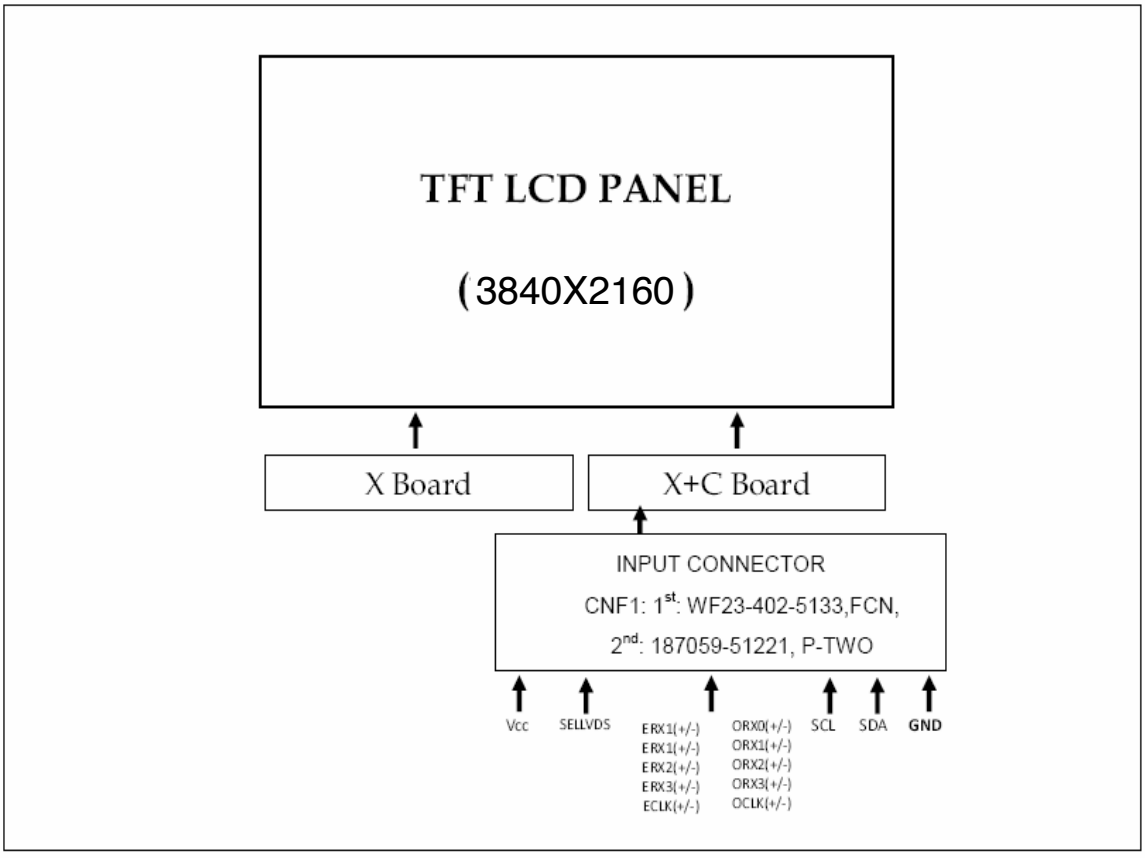


Note (4) The LVDS input characteristics is shown as below :



3.2 INPUT TERMINAL PIN ASSIGNMENT

3.2.1 TFT LCD OPEN CELL



3.3 COLOR DATA INPUT ASSIGNMENT

The brightness of each primary color (red, green and blue) is based on the 8-bit gray scale data input for the color. The higher the binary input, the brighter the color. The table below provides the assignment of color versus data input.

Color		Data Signal																							
		Red								Green								Blue							
		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
	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
	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
	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
	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
	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	Red(0) / Dark	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(1)	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red(2)	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	Red(253)	1	1	1	1	1	1	0	1	0	0	0	:0	0	0	0	0	0	0	0	0	0	0	0	:0
	Red(254)	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(255)	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	Green(0) / Dark	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(1)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
	Green(2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	Green(253)	0	0	0	0	0	0	0	0	1	1	1	1	1	1	0	1	0	0	0	0	0	0	0	0
	Green(254)	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(255)	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	Blue(0) / Dark	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(1)	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(2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	Blue(253)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	0	1
	Blue(254)	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(255)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1

Note (1) 0: Low Level Voltage, 1: High Level Voltage

3.4 LED LIGHTBAR SPECIFICATION FOR BACKLIGHT

Parameter	Symbol	Value			Unit	Note
		Min.	Typ.	Max		
Input Voltage	V_{pin}	43.5	48	49.5	VDC	Duty 100% [Note 1]
Input Current	I_{pin}		440*2		mADC	Duty 100% Per Lightbar [Note 1]
LED Life Time	LT	(30,000)			Hrs	
Power Consumption	PBL		21.12*2		W	
Dimming Duty Ratio		20		100	%	

[Note 1] Permanent damage to the device may occur if maximum values are exceeded. Function operation should be restricted to the conditions described under Normal Operating Conditions.

[Note 2] The life time of LED is defined as the time when it continues to operate under the condition at Ta = 25±2 C and Ipin = 440 mA(typ) *2 until the brightness becomes ≦ 50% of its original value.

4. INTERFACE CONNECTION

4.1 TFT LCD PIN ASSIGNMENT

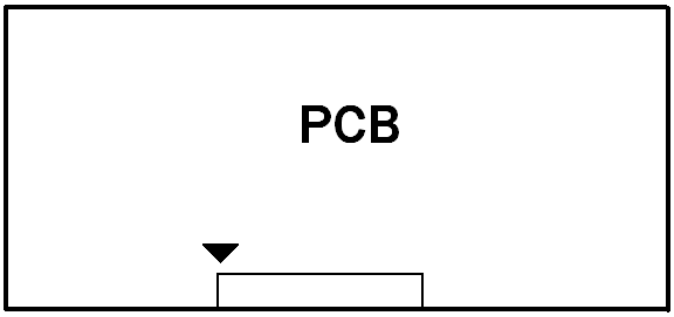
CNF1 Connector Pin Assignment (FCN WF23-402-5133 OR P-TWO 187059-51221)

Matting connector : FI-RE51HL (JAE)

Pin	Name	Description	Note
1	GND	Ground	(2)
2	SCL	I2C clock (For Vcom tunning)	
3	SDA	I2C data (For Vcom tunning)	
4	NC	No connection	(2)
5	NC	No connection	
6	NC	No connection	
7	SELLVDS	LVDS data format Selection	(3)(4)
8	NC	No Connection	(2)
9	NC	No Connection	
10	NC	No connection	
11	GND	Ground	
12	ERX0-	Even pixel Negative LVDS differential data input. Channel 0	(5)
13	ERX0+	Even pixel Positive LVDS differential data input. Channel 0	
14	ERX1-	Even pixel Negative LVDS differential data input. Channel 1	
15	ERX1+	Even pixel Positive LVDS differential data input. Channel 1	
16	ERX2-	Even pixel Negative LVDS differential data input. Channel 2	
17	ERX2+	Even pixel Positive LVDS differential data input. Channel 2	
18	GND	Ground	
19	ECLK-	Even pixel Negative LVDS differential clock input	(5)
20	ECLK+	Even pixel Positive LVDS differential clock input	
21	GND	Ground	
22	ERX3-	Even pixel Negative LVDS differential data input. Channel 3	(5)
23	ERX3+	Even pixel Positive LVDS differential data input. Channel 3	
24	N.C.	No Connection	(2)
25	N.C.	No Connection	
26	GND	Ground	
27	GND	Ground	

28	ORX0-	Odd pixel Negative LVDS differential data input. Channel 0	(5)
29	ORX0+	Odd pixel Positive LVDS differential data input. Channel 0	
30	ORX1-	Odd pixel Negative LVDS differential data input. Channel 1	
31	ORX1+	Odd pixel Positive LVDS differential data input. Channel 1	
32	ORX2-	Odd pixel Negative LVDS differential data input. Channel 2	
33	ORX2+	Odd pixel Positive LVDS differential data input. Channel 2	
34	GND	Ground	
35	OCLK-	Odd pixel Negative LVDS differential clock input.	(5)
36	OCLK+	Odd pixel Positive LVDS differential clock input.	
37	GND	Ground	
38	ORX3-	Odd pixel Negative LVDS differential data input. Channel 3	(5)
39	ORX3+	Odd pixel Positive LVDS differential data input. Channel 3	
40	N.C.	No Connection	(2)
41	N.C.	No Connection	(2)
42	GND	Ground	
43	GND	Ground	
44	GND	Ground	
45	GND	Ground	
46	GND	Ground	
47	N.C.	No Connection	(2)
48	VCC	Power input (+12V)	
49	VCC	Power input (+12V)	
50	VCC	Power input (+12V)	
51	VCC	Power input (+12V)	

Note (1)LVDS connector pin order defined as below



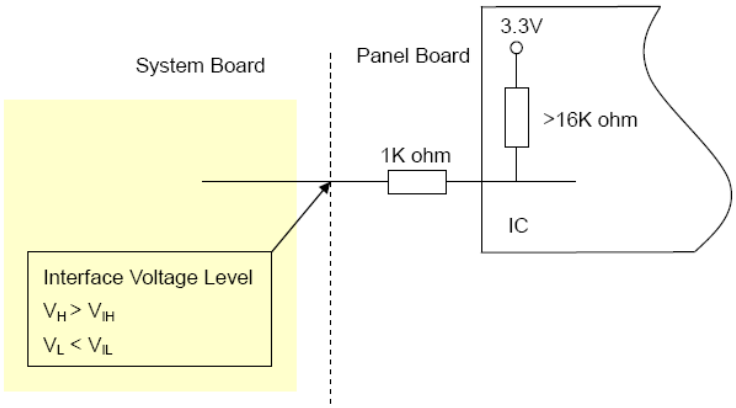
Note (2) Reserved for internal use. Please leave it open.

Note (3) LVDS format selection. Connect to Open or +3.3V: VESA Format, connect to GND: JEIDA Format.

SELLVDS	Mode
H(default)	VESA
L	JEIDA

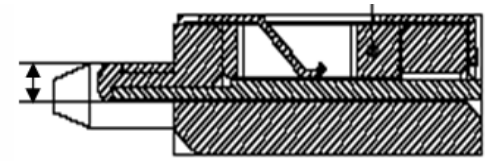
L : Connect to GND, H: Connect to +3.3V

Note (4) Interface optional pin has internal scheme as following diagram. Customer should keep the interface voltage level requirement which including Panel board loading as below.

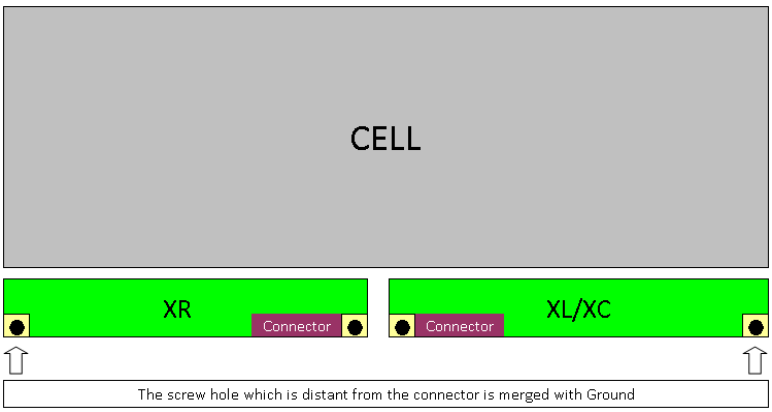


Note (5) Two pixel data send into the module for every clock cycle. The first pixel of the frame is odd pixel and the second pixel is even pixel.

Note (6) LVDS connector mating dimension range request is 0.93mm~1.0mm as below.

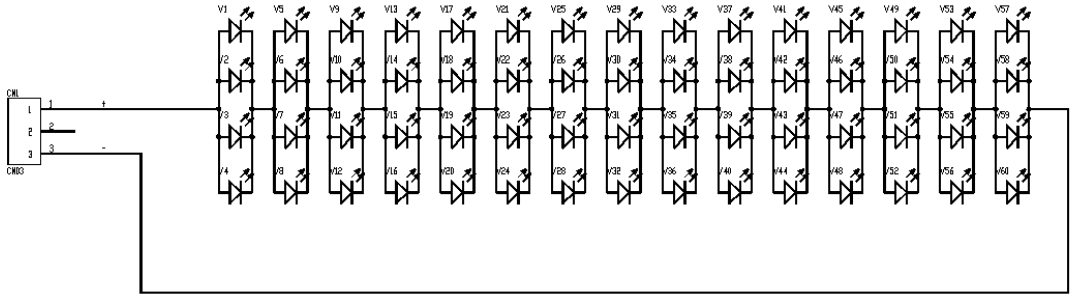


Note (7) The screw hole which is distant from the connector is merged with Ground.



4.2 BACKLIGHT INTERFACE CONNECTION

The backlight unit contains two lightbars. The next figure is electrical circuit of single lightbar. LED lightbar connector type : A1009AWV-03. It connect to output connector PH1.0-3 on supply converter PCB.



5. INTERFACE TIMING

5.1 INPUT SIGNAL TIMING SPECIFICATIONS

The input signal timing specifications are shown as the following table and timing diagram.

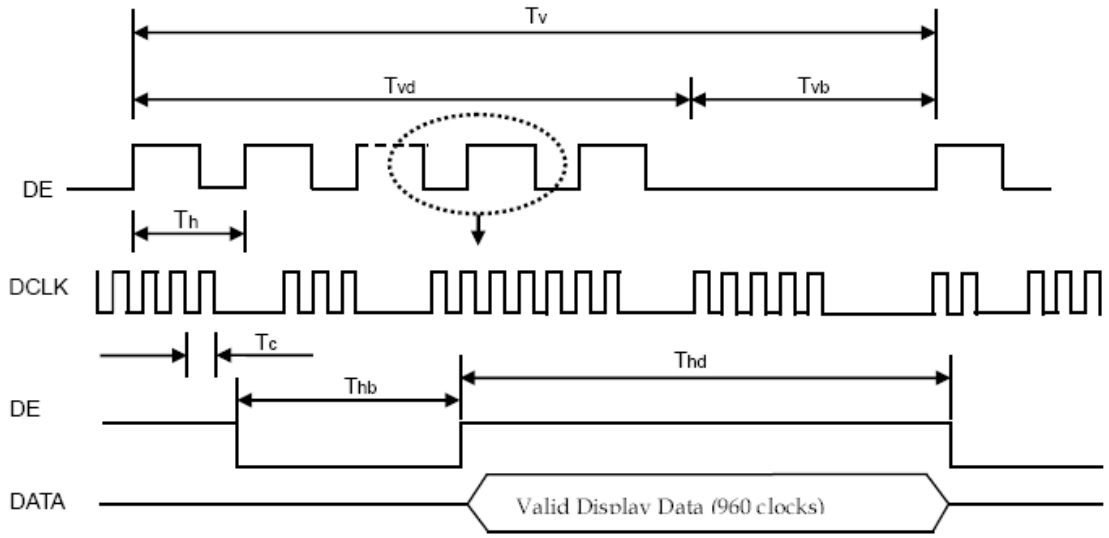
Signal	Item	Symbol	Min.	Typ.	Max.	Unit	Note
LVDS Receiver Clock	Frequency	F_{clkin} (=1/TC)	60	74.25	80	MHz	
	Input cycle to cycle jitter	T_{rcl}	-	—	200	ps	(3)
	Spread spectrum modulation range	F_{clkin_mod}	F_{clkin}-2%	—	F_{clkin}+2%	MHz	(4)
	Spread spectrum modulation frequency	F_{SSM}	—	—	200	KHz	
LVDS Receiver Data	Receiver Skew Margin	T_{RSKM}	-400	—	400	ps	(5)
Vertical Active Display Term	Frame Rate	F_{r5}	47	50	53	Hz	(6)
		F_{r6}	57	60	63	Hz	
	Total	Tv	1090	1125	1480	Th	Tv=Tvd+Tvb
	Display	Tvd	1080	1080	1080	Th	—
	Blank	Tvb	10	45	400	Th	—
Horizontal Active Display Term	Total	Th	1030	1100	1325	Tc	Th=Thd+Thb
	Display	Thd	960	960	960	Tc	—
	Blank	Thb	70	140	365	Tc	—

Note (1) Please make sure the range of pixel clock has follow the below equation:

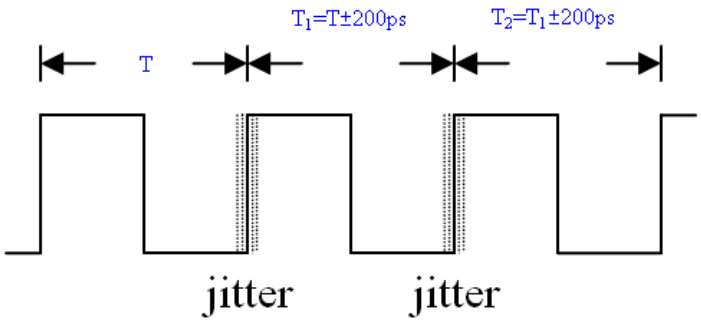
Fclkin(max) ≧ Fr6 ╳ Tv ╳ Th

Fr5 ╳ Tv ╳ Th ≧ Fclkin (min)

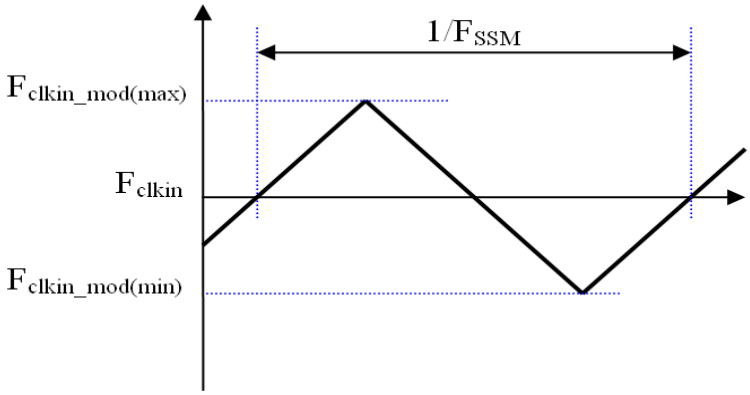
Note (2) This module is operated in DE only mode and please follow the input signal timing diagram below :



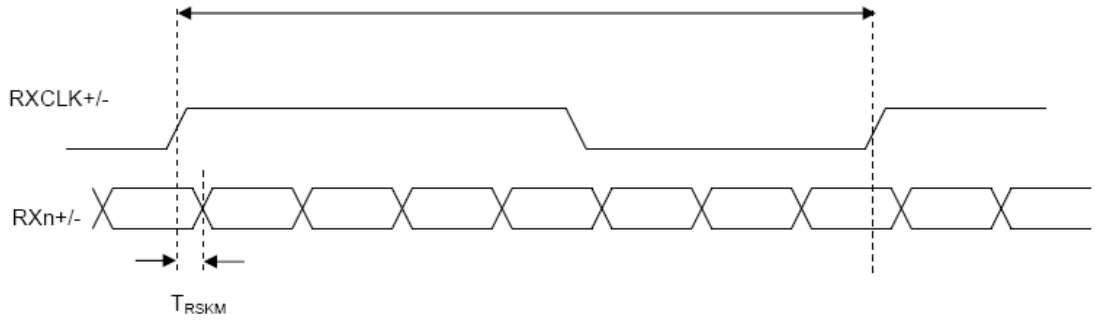
Note (3) The input clock cycle-to-cycle jitter is defined as below figures. Trcl = I T1 – TI



Note (4) The SSCG (Spread spectrum clock generator) is defined as below figures.

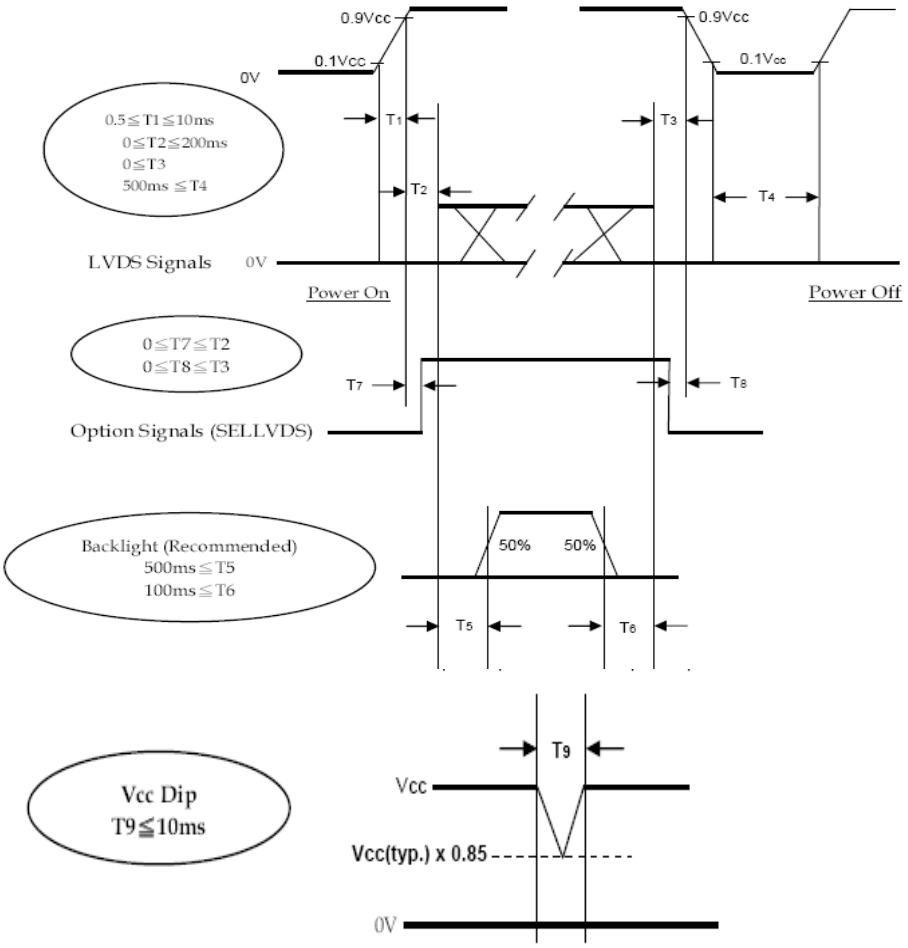


Note (5) The LVDS timing diagram and the receiver skew margin is defined and shown in following figure.



5.2 POWER ON/OFF SEQUENCE

To prevent a latch-up or DC operation of LCD module, the power on/off sequence should be as the diagram below.



Note (1) The supply voltage of the external system for the module input should follow the definition of Vcc.

Note (2) Apply the lamp voltage within the LCD operation range. When the backlight turns on before the LCD operation or

the LCD turns off before the backlight turns off, the display may momentarily become abnormal screen.

Note (3) In case of VCC is in off level, please keep the level of input signals on the low or high impedance.

If T2<0,that maybe cause electrical overstress failure.

Note (4) T4 should be measured after the module has been fully discharged between power off and on period.

Note (5) Interface signal shall not be kept at high impedance when the power is on.

Note (6) Vcc must decay smoothly when power-off.

6. OPTICAL CHARACTERISTICS

6.1 TEST CONDITIONS

Item	Symbol	Value	Unit
Ambient Temperature	Ta	25 ±2	ºC
Ambient Humidity	Ha	50 ±10	%RH
Vertical Frame Rate	Fr	60	Hz
Supply Voltage	V_{CC}	12.0 ±1.2	V
Input Signal	According to typical value in "3. ELECTRICAL CHARACTERISTICS"		

6.2 OPTICAL SPECIFICATIONS

The relative measurement methods of optical characteristics are shown in 6.2. The following items should be measured under the test conditions described in 6.1 and stable environment shown in 6. 1.

Parameter		Symbol	Condition	Min.	Typ.	Max.	Unit	Remark
Luminance	Central Luminance	Lwc	Center	250	280		nit	
	Uniformity	∆ Lw	Min/Max	75			%	
Viewing angle range	Horizontal	θx-+θx+	CR≥10		178		Deg.	(1),(2)
	Vertical	θy-+θy+			178	-	Deg.	
Contrast ratio		CR	(Center) Normal Viewing Angel -	2800	4000	-	-	(1),(3)
Response time	Gray to Gray	T_{GtG_AVE}			9.5	18	ms	(1),(4)
Chromaticity of white		x		TYP.-0.03	0.311	TYP.+0.03	-	(0)
		y			0.351		-	
Chromaticity of red		x			0.660		-	
		y			0.327		-	
Chromaticity of green		x			0.278		-	
		y			0.585		-	
Chromaticity of blue		x			0.136		-	
		y			0.105		-	
Center Transmittance		T%		-	5.9	-	%	(1),(5)

Note (0) Light source is the standard light source ”C” which is defined by CIE and driving voltage are based on suitable gamma voltages. The calculating method is as following :

1. Measure Module’s and BLU’s spectrum at center point. W, R,G, B are with signal input.

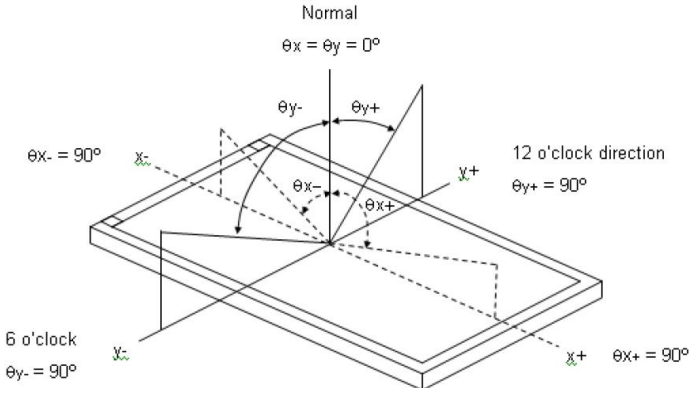
2. Calculate cell’s spectrum.

3. Calculate cell’s chromaticity by using the spectrum of standard light source “C”.

Note (1) Light source is the BLU which supplied by DSBJ and driving voltage are based on suitable gamma voltages.

Note (2) Definition of Viewing Angle (x, y):

Viewing angles are measured by Autronic Conoscope Cono-80 (or Eldim EZ-Contrast 160R)



Note (3) Definition of Contrast Ratio (CR):

The contrast ratio can be calculated by the following expression.

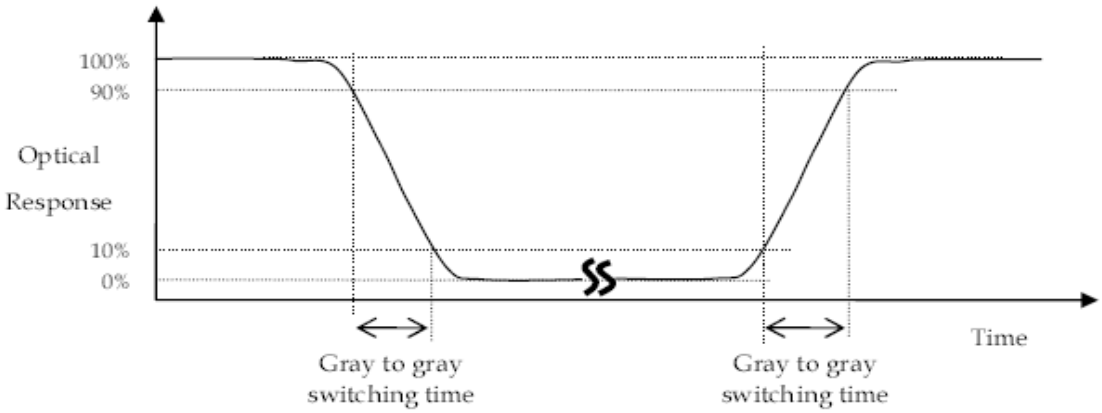
$$T(X) = \frac{\text{L1023 (X) of LCD module}}{\text{Luminance (X) of BLU}} \times 100\%$$

L255: Luminance of gray level 255

L 0: Luminance of gray level 0

CR = CR (5), where CR (X) is corresponding to the Contrast Ratio of the point X at the figure in Note (6).

Note (4) Definition of Gray-to-Gray Switching Time (VA Model):



The driving signal means the signal of gray level 0, 31, 63, 95, 127, 159, 191, 223 and 255.

Gray to gray average time means the average switching time of gray level 0, 31, 63, 95, 127, 159, 191, 223 and 255 to each other.

Note (5) Definition of Transmittance (T%): (VA Model)

Measure the luminance of gray level 1023 of LCD module and the luminance of BLU at 5 points.

$$\text{Transmittance (T\%)} = \frac{\text{average [L (1), L (2), L (3), L (4), L (5)] of LCD module}}{\text{average [L (1), L (2), L (3), L (4), L (5)] of BLU}} \times 100\%$$

9. PRECAUTIONS

9.1 ASSEMBLY AND HANDLING PRECAUTIONS

(a) Do not apply rough force such as bending or twisting to the module during assembly.

(b) It is recommended to assemble or to install a module into the user's system in clean working areas. The dust and oil may cause electrical short or worsen the polarizer.

(c) Since the LCM consists of TFT and electronic circuits with CMOS-ICs, which are very weak to electrostatic discharge, person who is handling an LCM should be grounded though adequate methods such as an anti-static wrist band. Connector pins should not be touched directly with bare hands.

Reference: Process control standard is shown as follow,

	item	Management standard value and performance standard
1	Anti-static mat(shelf)	1to50 [Mega ohm]
2	Anti-static mat(floor, desk)	1to100 [Mega ohm]
3	Ionizer	Attenuate from ±1000V to ±100V within two seconds.
4	Anti-static wrist band	0.8 to 10 [Mega ohm]
5	Anti-static wrist band entry and ground resistance	Below 1000 [ohm]
6	Temperature	22 to 26 [℃]
7	Humidity	60 to 70 [%]

(d) Do not apply pressure or impulse to the module to prevent the damage of LCD panel and backlight.
(e) Always follow the correct power-on sequence when the LCD module is turned on. This can prevent the damage and latch-up of the CMOS LSI chips.
(f) Be sure to turn off the power supply when inserting or disconnecting the cable.
(g) Do not disassemble the module.
(h) Front polarizer can easily be damaged, so please pay attention on it.
(i) Using a absorbent cotton or other soft cloth without chemicals for cleaning, because the surface of polarizer is very soft and easily scratched.
(j) Since long contact with drops of water may cause discoloration or spots, please wipe off them as soon as possible.
(k) The Panel will be broken or chipped when it is dropped or bumped against a hard substance.
(l) Applying too much force and stress to PWBs and drivers may cause a malfunction electrically and mechanically.
(m) Please be careful since image retention may occur when a fixed pattern is displayed for a long time.
(n) Moisture can easily penetrate into LCD module and may cause the damage during operation.
(o) High temperature or humidity may deteriorate the performance of LCD module. Please store LCD modules in the specified storage conditions.
(p) This LCM is corresponded to ROHS.
(q) When any question or issue occurs, it shall be solved by mutual discussion.

9.2 SAFETY PRECAUTIONS

(a) If the liquid crystal material leaks from the panel, it should be kept away from the eyes or mouth. In case of contact with hands, skin or clothes, it has to be washed away thoroughly with soap.
(b) After the module's end of life, it is not harmful in case of normal operation and storage.

10. RELIABILITY

(a) Environment test condition

Test item	Condition
High temperature storage test	Ta= 60 C, 240h
Low temperature storage test	Ta= -20 C, 240h
High temperature and high humidity storage test	Ta= 50 C, 80%RH, 240h (No condensation)
High temperature operation test	Ta= 50 C, 240h
Low temperature operation test	Ta= 0 C,240h

(b) Shock & Vibration (TBD)

Test item	Condition
Shock (Non-Operation)	Shock level：50 Grms Waveform：half sine wave, 11ms Direction：±X,±Y,±Z One time each direction
Vibration (Non-Operation)	Wave form：Random Vibration level：1.0 Grms Bandwidth：10-300 Hz Duration：X,Y,Z, 30 min Each direction per 10 min

(c) ESD test

Test item	Condition
Connector	200 pF，0 Ω，±250 V By using contact-mode to discharge each pin one time and then check the module frame.
Module	50pF，330Ω，±8KV(contact-mode),±15KV(air-mode) 1. Under test conditions, by using air-mode to discharge each test point 25 times continuously and then check the module frame. 2. Under test conditions, by using contact-mode to discharge each test point of panel frame 25 times continuously and then check the module frame.

[Result evaluation criteria]

Under the display quality test condition with normal operation state, there shall be no change, which may affect practical display function.

11. MECHANICAL DRAWING