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## Product information

**To:**

**Product Name: M150MNN1 R1**

**Document Issue Date: 2012/12/05**

Note: 1. Please contact InfoVision Company. Before designing your product based on this product.  
2. The information contained herein is presented merely to indicate the characteristics and performance of our products.





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## 1.0 General Descriptions

### 1.1 Introduction

The M150MNN1 R1 is a color active matrix thin film transistor (TFT) liquid crystal display (LCD) that uses amorphous silicon TFT as a switching device. It is composed of a TFT LCD panel, a timing controller, voltage reference, common voltage, column driver, and row driver circuit. This TFT LCD has a 15-inch diagonally measured active display area with XGA resolution (1024horizontal by 768 vertical pixel arrays).

### 1.2 Features

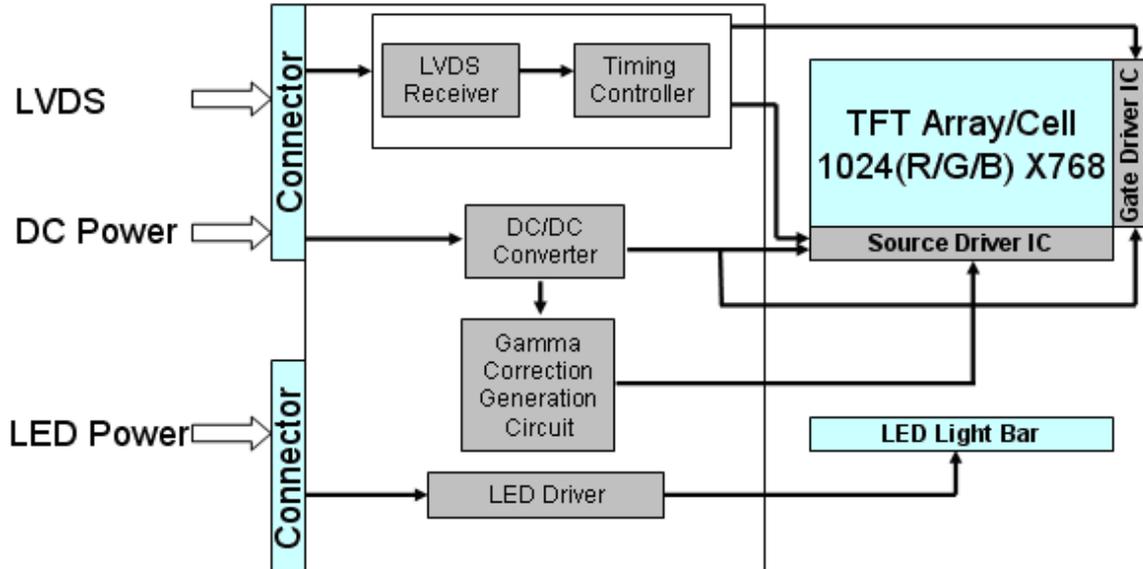
- 15" TFT LCD Panel
- LED Backlight System
- Supported XGA (1024x768 pixels) resolution
- Aspect ratio: 4:3
- Compatible with RoHS standard

### 1.3 Product Summary

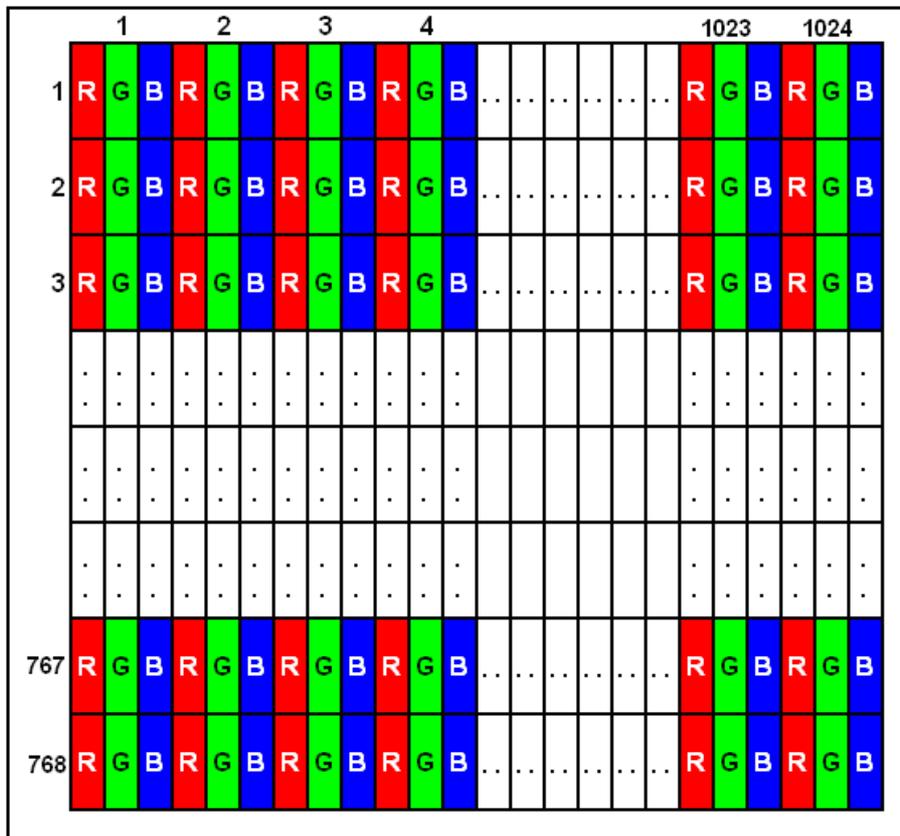
Items	Specifications	Unit
Screen Diagonal	38 (15 inch) Diagonal	cm
Active Area	304.1 (H) x 228.1(V)	mm
Pixel format	1024(H) x768 (V) (1 pixel=R+G+B dot)	pixel
Pixel Pitch	0.297(H) x 0.297(V)	mm
Pixel Arrangement	R.G.B. Vertical Stripe	-
Display Mode	Normally White	-
White Luminance	450 typ;	cd /m <sup>2</sup>
Contrast Ratio	800:1 typ; 450:1min	-
Response Time	30typ	msec
Input Voltage	3.3V(Logic),12V(LED)	V
Weight	995(Typ)	g
Unit outline dimensions	326.5(W) x 253.5(H) x 9.6 (D)	mm
Electrical Interface (Logic)	LVDS	-
Support Color	16.7M colors	-
Surface Treatment	Anti-glare & hard-coating 3H	-

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### 1.4 Functional Block Diagram



### 1.5 Pixel Format Image





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## 2.0 Absolute Maximum Ratings

Item	Symbol	Condition	Pin	Ratings	Unit	Note
Supply Voltage	V <sub>CC</sub>	T <sub>a</sub> =25℃	VCC	-0.3~+4.0	V	(1),(2)
	V <sub>DD</sub>	T <sub>a</sub> =25℃	VDD	-0.3~+15.0	V	(1),(2)
Input voltage	V <sub>I1</sub>	T <sub>a</sub> =25℃	RxINi-/+ CK IN-/+	-0.3~V <sub>CC</sub> +0.3	V	i=0,1,2,3
	V <sub>I2</sub>	T <sub>a</sub> =25℃	RL/UD,SELLVDS	-0.3~ V <sub>CC</sub> +0.3	V	
	V <sub>I4</sub>	T <sub>a</sub> =25℃	XSTABY,VBR	-0.3~ V <sub>DD</sub>	V	
Storage temperature	T <sub>STG</sub>	-	-	-30~+80	℃	(1)
Operating temperature	T <sub>OPA</sub>	-	-	-20~+70	℃	(1),(3),(4)

Note (1): Humidity: 95%RH Max. (T<sub>a</sub>≤40℃) Note static electricity.

Maximum wet bulb temperature at 39℃ or less. (T<sub>a</sub>>40℃) No condensation.

Note (2): The V<sub>CC</sub> power supply capacity must use the one of 2A or more.

The V<sub>DD</sub> power supply capacity must use the one of 3A or more.

Note (3): There is a possibility of causing deterioration in the irregularity and others of the screen and the display fineness though the liquid crystal module doesn't arrive at destruction when using it at 65~70℃ or -10~0℃. There is a possibility of causing the fineness deterioration by the prolonged use in the (high temperature) humidity environment (60% or more).

Note (4): In the operating temperature item, the low temperature side is the ambient temperature regulations. The high temperature side is the panel surface temperature regulations.

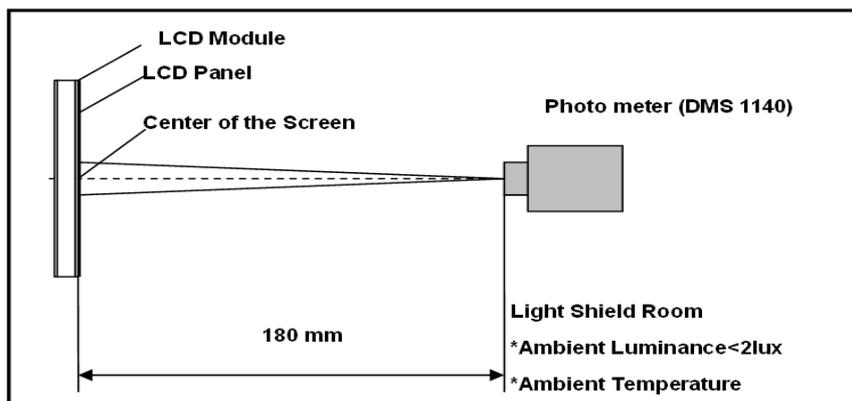
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### 3.0 Optical Characteristics

Item	Condition		Specification			
			Min.	Typ.	Max.	Note
Viewing Angle [degrees] K=Contrast Ratio>10	Horizontal	$\theta_L$	70	80	-	(1),(2),(4)
		$\theta_R$	70	80	-	
	Vertical	$\theta_T$	60	80	-	
		$\theta_B$	70	80	-	
Contrast Ratio	Center		450	800	-	(2),(4)
Response time	$T_R$		-	6	-	(3),(4)
	$T_F$		-	24	-	
	$T_R + T_F$		-	30	-	
Color Chromaticity (CIE 1,931)	Red	x	-0.03	0.580	+0.03	(4)
	Red	y		0.330		
	Green	x		0.325		
	Green	y		0.600		
	Blue	x		0.155		
	Blue	y		0.100		
	White	x	0.250	0.300	0.350	
	White	y	0.260	0.310	0.360	
White Luminance [cd/m <sup>2</sup> ]	Center		400	450	-	(4)
White Uniformity [%]	5Points		-	-	1.33	(5)

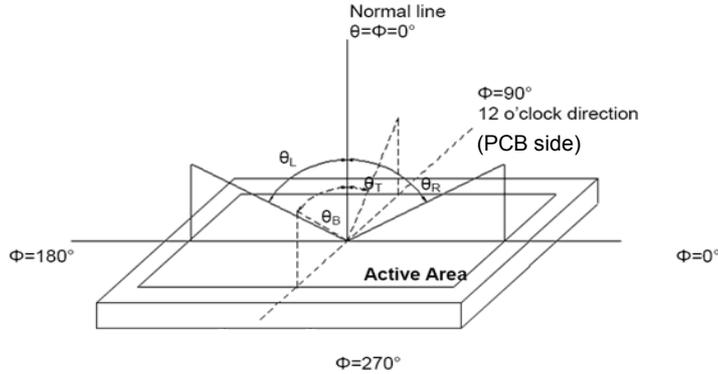
The measurement shall be executed 30 minutes after lighting at rating.

The optical characteristics shall be measured in a dark room or equivalent state with the method shown in below.



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Note (1): Definitions of viewing angle range



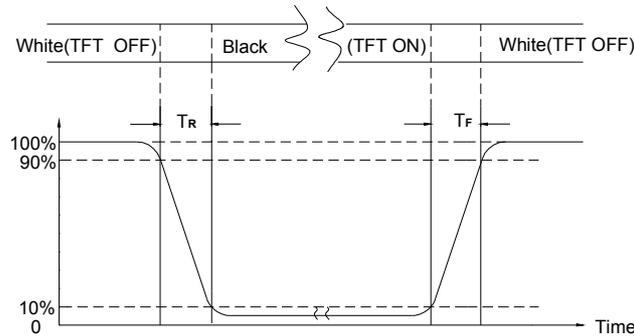
Note (2): Definition of Contrast Ratio (CR)

The contrast ratio is defined as the following

$$CR = \text{Luminance with all pixels white} / \text{Luminance with all pixels black}$$

Note (3): Definition of Response Time ( $T_R$ ,  $T_F$ )

The response time is defined as the following figure and shall be measured by switching the input signal for “black” and “white”

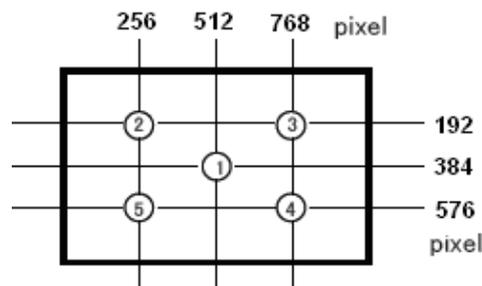


Note (4): This shall be measured at center of the screen.

Note (5): Definition Of white uniformity

White uniformity is defined as the following with five measurements

$$\text{Luminance uniformity} = \frac{(\text{Max Luminance of 5 points})}{(\text{Min Luminance of 5 points})} \times 100\%$$



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#### 4.0 Input Terminals

##### 4.1 TFT LCD panel driving

CN1 (Interface signals and +3.3V power supply)

Using connectors: CN1: MSB240420HD (SIN SHENG TERMINAL & MACHINE INC.) or Similar type.

Corresponding connectors: P240420 (SIN SHENG TERMINAL & MACHINE INC.)

Using LVDS receiver:

Building into control IC (THC63LVDF84B (Thine electronics) or Compatible product)

Corresponding LVDS transmitter: THC63LVDM83D (Thine electronics) or Compatible product.

Pin #	Symbol	Function	Remarks
1	VCC	+3.3V Power supply	-
2	VCC	+3.3V Power supply	-
3	GND	GND	-
4	GND	GND	-
5	RxIN0-	LVDS receiver signal CH0(-)	LVDS
6	RxIN0+	LVDS receiver signal CH0(+)	LVDS
7	GND	GND	-
8	RxIN1-	LVDS receiver signal CH1(-)	LVDS
9	RxIN1+	LVDS receiver signal CH1(+)	LVDS
10	GND	GND	-
11	RxIN2-	LVDS receiver signal CH2(-)	LVDS
12	RxIN2+	LVDS receiver signal CH2(+)	LVDS
13	GND	GND	-
14	CK IN-	LVDS receiver signal CK(-)	LVDS
15	CK IN+	LVDS receiver signal CK(+)	LVDS
16	GND	GND	-
17	RxIN3-	LVDS receiver signal CH3(-)	LVDS
18	RxIN3+	LVDS receiver signal CH3(+)	LVDS
19	RL/UD	Horizontal/Vertical display mode select signal	-
20	SELLVDS	LVDS SET	-

##### 4.1.1 RL/UD drawing

(PCB Side)



(PCB Side)





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4.1.2 SELLVDS is shown as below

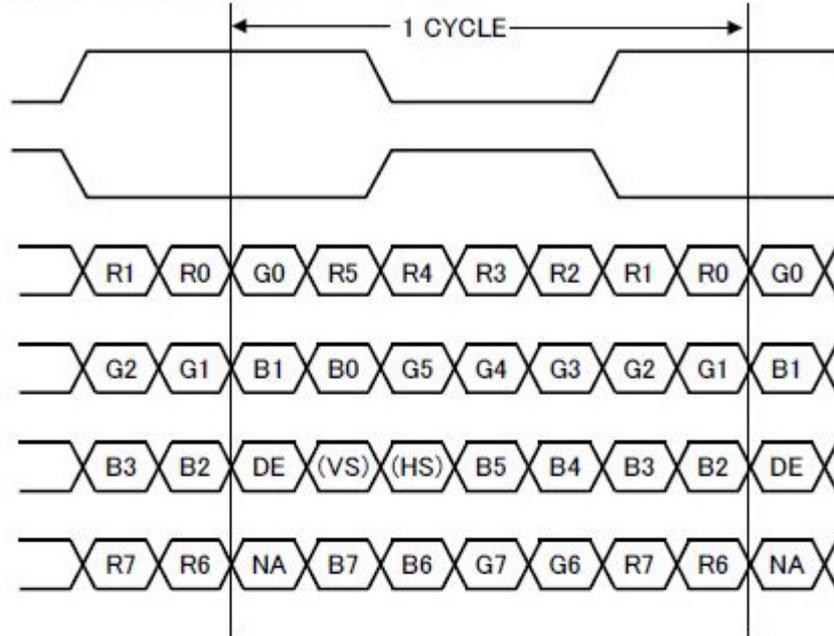
1) Data mapping (8 bit input)

Pin assignment with SELLVDS pin (THC63LVDM83D (Thine electronics) or Compatible product)

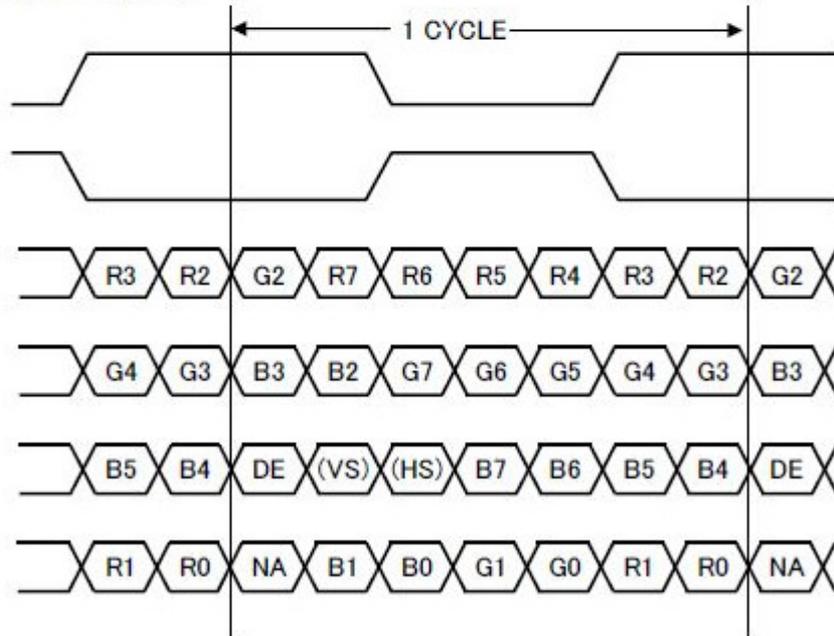
Transmitter		20Pin SELLVDS	
Pin No	Data	=L(GND) or Open	=H(3.3V)
51	TA0	R0(LSB)	R2
52	TA1	R1	R3
54	TA2	R2	R4
55	TA3	R3	R5
56	TA4	R4	R6
3	TA5	R5	R7(MSB)
4	TA6	G0(LSB)	G2
6	TB0	G1	G3
7	TB1	G2	G4
11	TB2	G3	G5
12	TB3	G4	G6
14	TB4	G5	G7(MSB)
15	TB5	B0(LSB)	B2
19	TB6	B1	B3
20	TC0	B2	B4
22	TC1	B3	B5
23	TC2	B4	B6
24	TC3	B5	B7(MSB)
27	TC4	(HS)	(HS)
28	TC5	(VS)	(VS)
30	TC6	DE	DE
50	TD0	R6	R0(LSB)
2	TD1	R7(MSB)	R1
8	TD2	G6	G0(LSB)
10	TD3	G7(MSB)	G1
16	TD4	B6	B0(LSB)
18	TD5	B7(MSB)	B1
25	TD6	(NA)	(NA)

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< SELLVDS = L(GND) or Open >



< SELLVDS = H(3.3V) >



DE: DATA ENABLE  
 HS: Hsync  
 VS: Vsync  
 NA: Non Available



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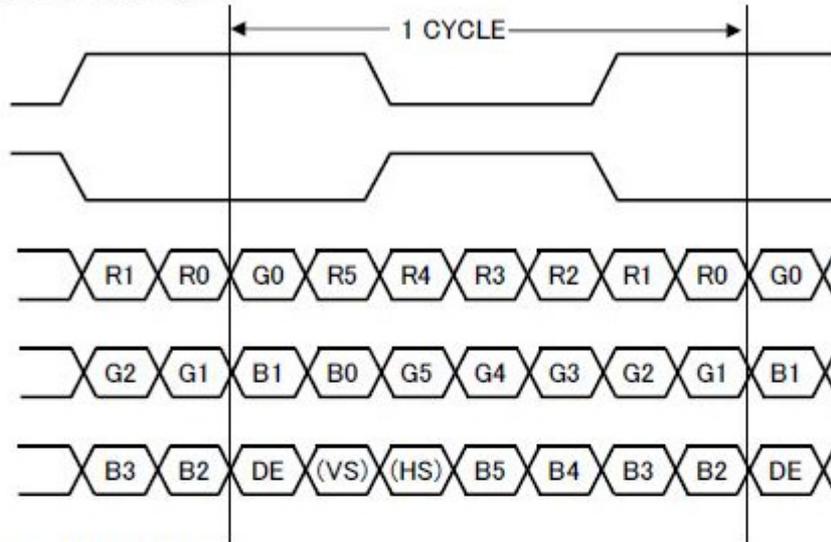
## 2) Data mapping (6 bit input)

Pin assignment with SELLVDS pin (THC63LVDM83D (Thine electronics) or Compatible product)

Transmitter		20Pin SELLVDS	
Pin No	Data	=L(GND) or Open	=H(3.3V)
51	TA0	-	R0(LSB)
52	TA1	-	R1
54	TA2	-	R2
55	TA3	-	R3
56	TA4	-	R4
3	TA5	-	R5(MSB)
4	TA6	-	G0(LSB)
6	TB0	-	G1
7	TB1	-	G2
11	TB2	-	G3
12	TB3	-	G4
14	TB4	-	G5(MSB)
15	TB5	-	B0(LSB)
19	TB6	-	B1
20	TC0	-	B2
22	TC1	-	B3
23	TC2	-	B4
24	TC3	-	B5(MSB)
27	TC4	-	(HS)
28	TC5	-	(VS)
30	TC6	-	DE
50	TD0	-	GND
2	TD1	-	GND
8	TD2	-	GND
10	TD3	-	GND
16	TD4	-	GND
18	TD5	-	GND
25	TD6	-	(NA)

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< SELLVDS = H(3.3V) >



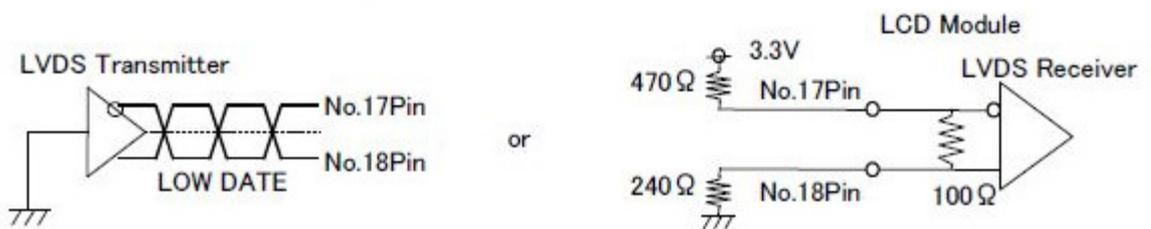
DE: DATA ENABLE

HS: Hsync

VS: Vsync

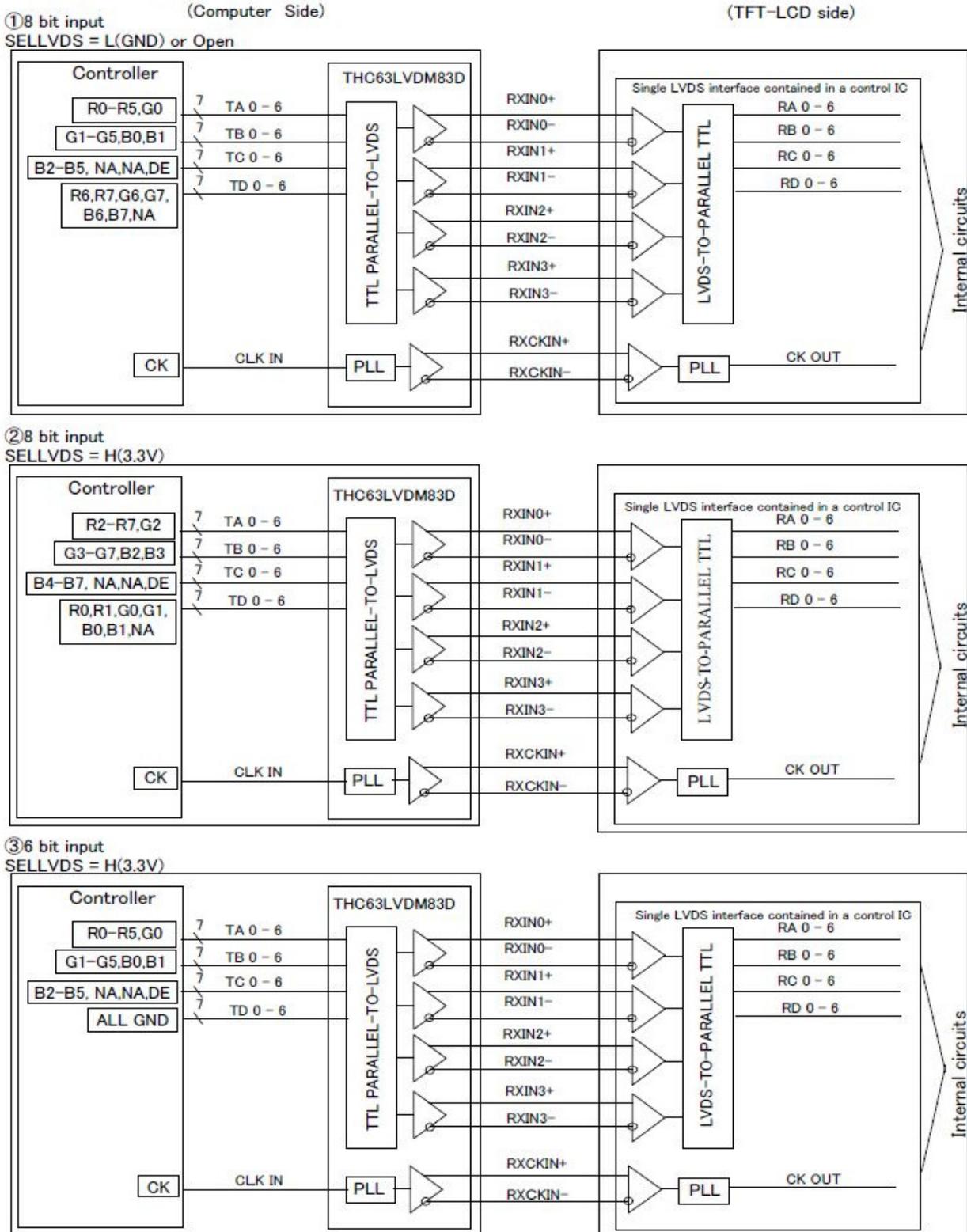
NA: Non Available

Recommended input (17pin, 18pin at 6bit )



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### 4.1.3 Interface block diagram





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#### 4.2 LED backlight connector

CN2 Used connector: SM06B-SHLK-G-TF(HF) (J.S.T. Mfg. Co. Ltd) or similar type

Corresponding connector: SHLP-06V-S-B (J.S.T. Mfg. Co. Ltd)

Pin #	Symbol	Function
1	VDD	+12V Power supply
2	VDD	+12V Power supply
3	GND	GND
4	GND	GND
5	XSTABY	Backlight ON/OFF signal
6	VBR	PWM signal

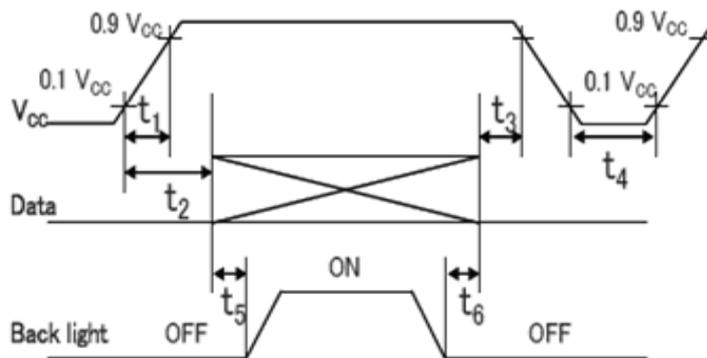
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### 5.0 Electrical Characteristic

#### 5.1 TFT LCD panel driving

Parameter	Symbol	Condition	Min.	Typ.	Max.	Units	Condition
Supply voltage	Vcc	-	3.0	3.3	3.6	[V]	(1)
Current dissipation	Icc	Vcc=3.3V	-	200	300	[mA]	(2)
Input voltage width for LVDS receiver	V <sub>L</sub>	-	0	-	2.4	[V]	-
Permissive input ripple voltage	-	-	-	-	200	mVp-p	Vcc=3.3V
Differential input Threshold voltage	High	V <sub>TH</sub>	-	-	V <sub>cm</sub> +100	mV	V <sub>cm</sub> =1.2V (3)
	Low	V <sub>TL</sub>	-	V <sub>cm</sub> -100	-	mV	
Input voltage	V <sub>IH</sub>	-	2.1	-	-	V	(4)
	V <sub>IL</sub>	-	-	-	0.8	V	
Input leak current	I <sub>OH</sub>	-	-	-	400	uA	V <sub>I2</sub> =+3.3V, (4)
	I <sub>OL</sub>	-	-10	-	+10	uA	V <sub>I2</sub> =0V, (4)
Terminal resistor	R <sub>T</sub>	-	-	100	-	Ω	Differential input

Note (1): On-off condition for supply voltage



$$100\mu s < t_1 \leq 10\text{ms}$$

$$0 < t_2 \leq 20\text{ms}$$

$$0 < t_3 \leq 1\text{s}$$

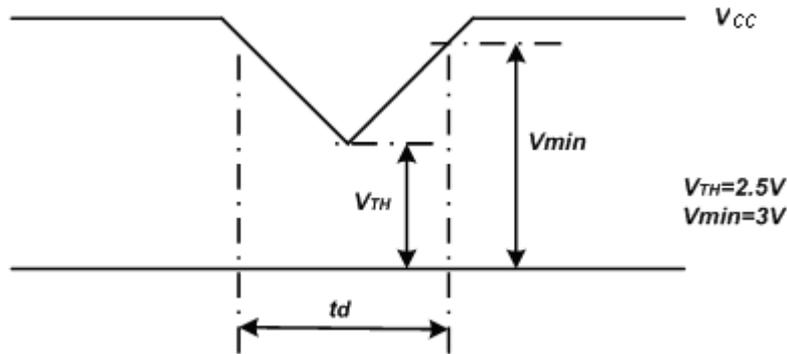
$$1\text{s} < t_4$$

$$300\text{ms} \leq t_5$$

$$200\text{ms} \leq t_6$$

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Vcc-dip Condition



If  $V_{TH} < V_{CC} \leq V_{min}$ , then  $t_d \leq 10ms$ ; When the voltage return to normal our panel must revive automatically.

If  $V_{CC} < V_{th}$ , then Vcc-dip conditions should also follow the On-off conditions for supply voltage.

\* Hsync/Vsync need not be input so that this model may drive only by the ENAB signal. Even if Hsync/ Vsync are input, it doesn't become a malfunction.

\* The relation between the data input and the backlight will recommend the above-mentioned input sequence. When the backlight is turned on before the panel operates, there is a possibility of abnormally displaying. The liquid crystal module is not damaged.

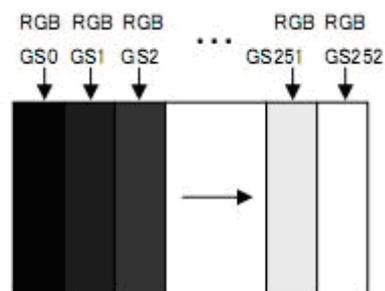
Note (2): Current dissipation

Current dissipation

Typical current situation : 253-gray-bar pattern

(  $V_{CC}=+3.3V$ ,  $f_{ck} = 65MHz$ ,  $T_a=25^{\circ}C$  )

$V_{CM}$  : LVDS common mode voltage



Note (3): Vcm: LVDS Common mode voltage

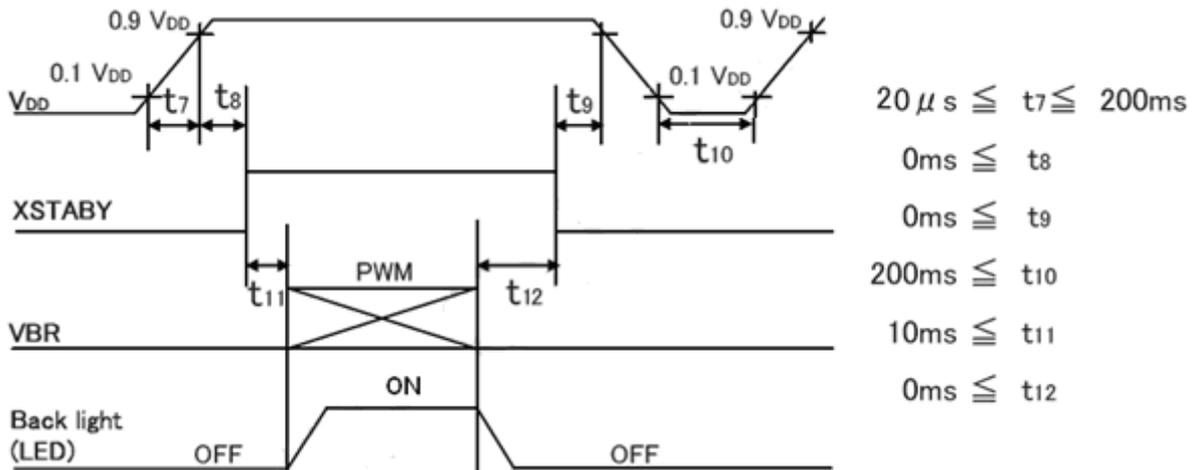
Note (4): RL/UD, SELLVDS

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### 5.2 LED Backlight

Parameter	Symbol	Min	Typ.	Max.	Units	Note	
Supply voltage	V <sub>DD</sub>	10.2	12	13.8	[V]	(1)	
Current dissipation	I <sub>DD1</sub>	-	580	740	mA	(2)	
Permissive input ripple voltage	V <sub>RP_BL</sub>	-	-	200	mVp-p	V <sub>DD</sub> =12V	
XSTABY	High voltage	V <sub>IH_BL1</sub>	2.4	-	V <sub>DD</sub>	V	-
	Low voltage	V <sub>IL_BL1</sub>		-	0.4	V	
PWM frequency	f <sub>PWM</sub>	200	-	1K	Hz	(3)	
PWM duty	D <sub>PWM</sub>	10	-	100	%	(3)	
VBR	High voltage	V <sub>IH_BL2</sub>	2.1	-	V <sub>DD</sub>	V	-
	Low voltage	V <sub>IL_BL2</sub>	-	-	0.4	V	
Life Time	L	(50,000)	-	-	Hours	(4)	

Note (1): On-off conditions for supply voltage



Note (2): Current dissipation

Typ. Value: V<sub>DD</sub> = +12.0V, Duty=100%

Max. Value: V<sub>DD</sub> = +10.2V, Duty=100%

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Note (3): PWM

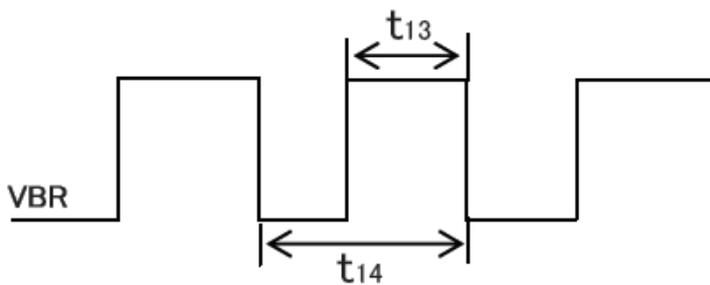
$$f_{PWM} = 1/t_{14}$$

Duty 10%: Min. Luminance (0%: LED OFF)

Duty 100%: Max. Luminance

Luminance changes in proportion to the duty ratio. ( $t_{13} \geq 10\mu s$ )

When the frequency slows, the display fineness might decrease.



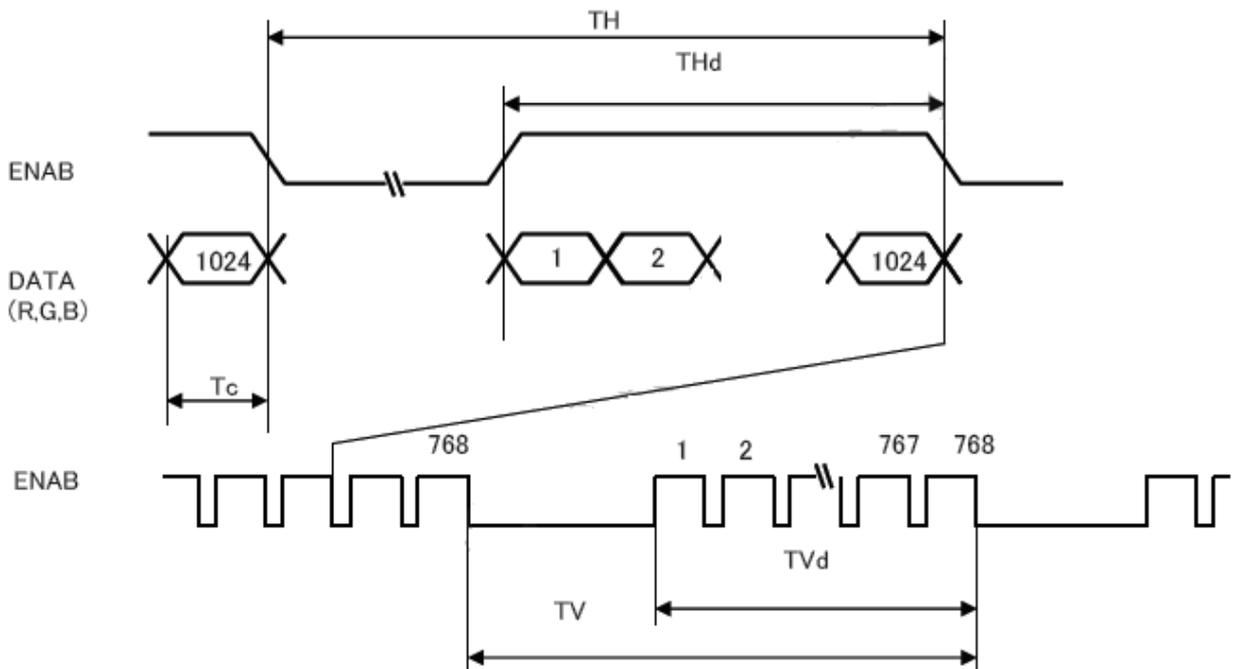
Note (4): Luminance becomes 50% of an initial value. ( $T_a=25^\circ C$ , PWM=100%)

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### 6.0 Timing characteristics of the input signal

Parameter	Symbol	Min	Typ	Max	Unit	Note
DCLK Frequency	1/Tc	50	65	80	MHz	(1)
Horizontal Display Area	THd	1024			DCLK	
H Total Time	TH	1056	1344	1720	DCLK	
		16.0	20.7	23.4	us	
Vertical Display Area	TVd	768			Line	
V Total Time	TV	772	806	990	line	
		13.3	16.7	18	ms	

Note (1): In case of using the long vertical period, the deterioration of display quality, flicker etc. may occur.

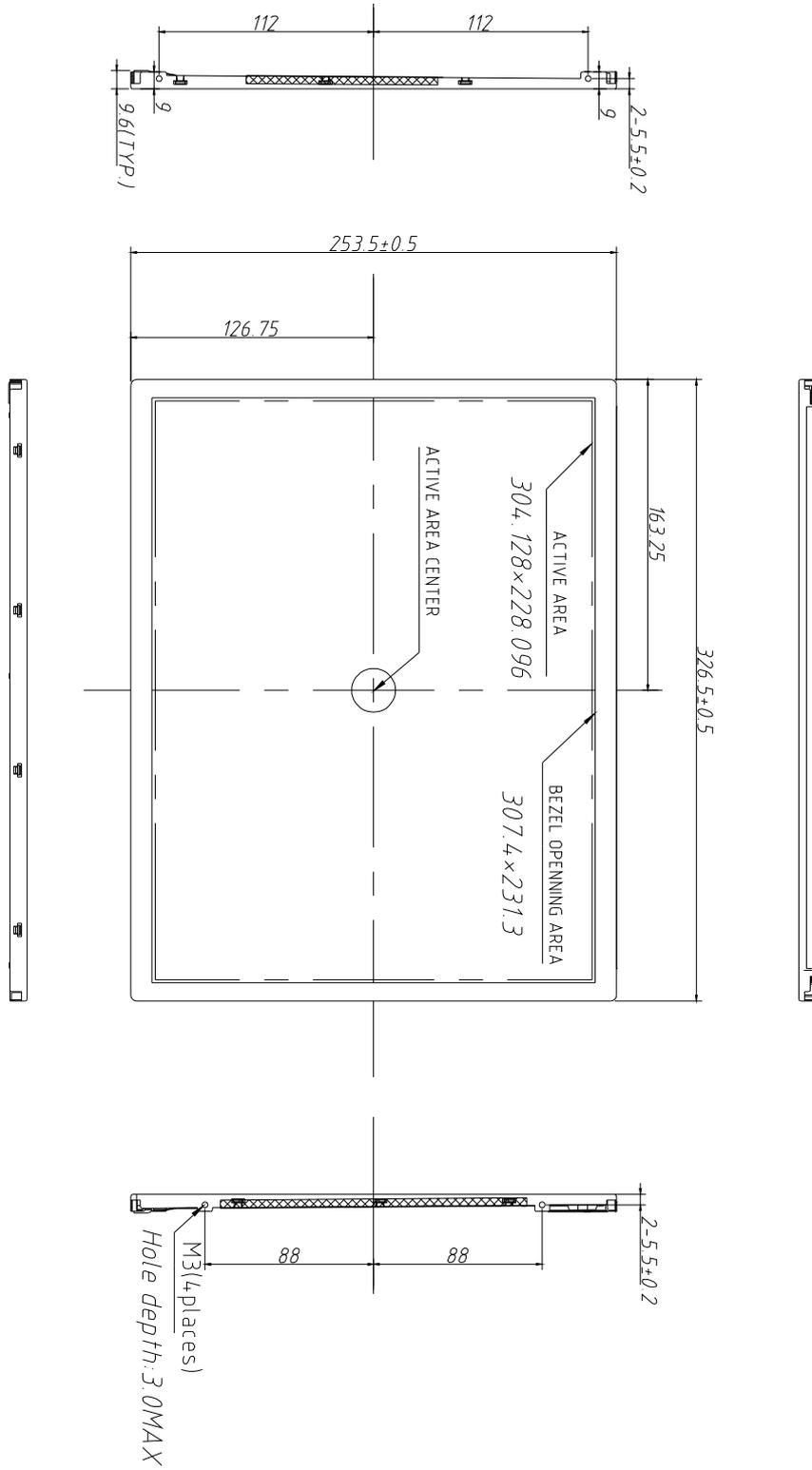




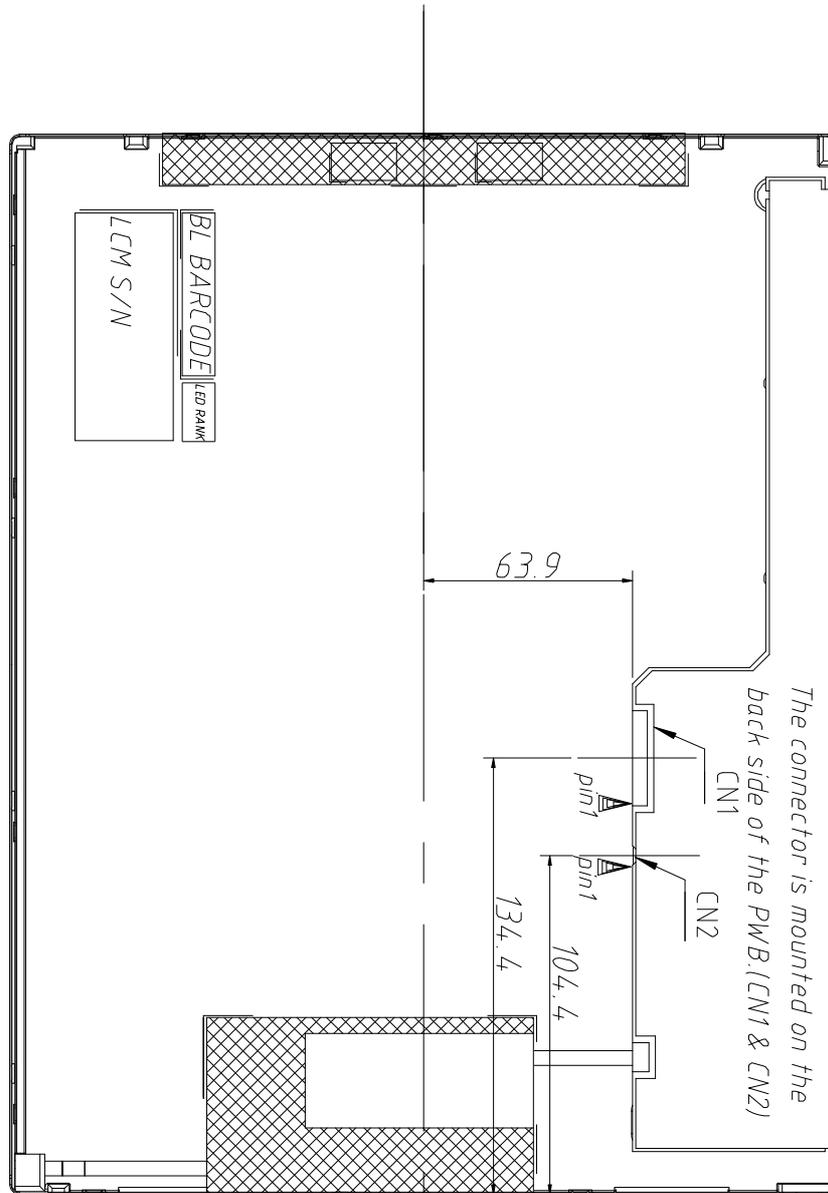
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### 7.0 Mechanical Characteristics

#### 7.1 Outline Drawing



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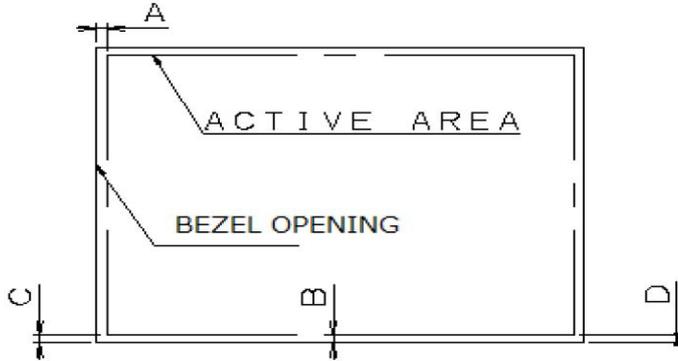


NOTES:

- 1.UNSPECIFIED TOLERANCE TO BE  $\pm 0.5$
- 2.TIGHTEN TORQUE(RECOMMENDATION  $0.294 \pm 0.02 N \cdot m (3.0 \pm 0.2 \text{ kgf} \cdot \text{cm})$ )

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### 7.2 Active area & Bezel opening drawing



7.2.1. Tolerance x-direction A:  $1.6 \pm 0.5 \text{mm}$

7.2.2. Tolerance y-direction B:  $1.6 \pm 0.5 \text{mm}$

7.2.3. Obliquity of Display Area | C-D |  $< 0.5 \text{mm}$

### 7.3 Dimension Specifications

Item	Parameter	Min.	Typ.	Max.	Units
Module Size	Horizontal(H)	326.0	326.5	327.0	mm
	Vertical(V)	253.0	253.5	254.0	mm
	Depth(D)	9.1	9.6	10.1	mm
Weight		915	995	1075	g



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## 8.0 Reliability

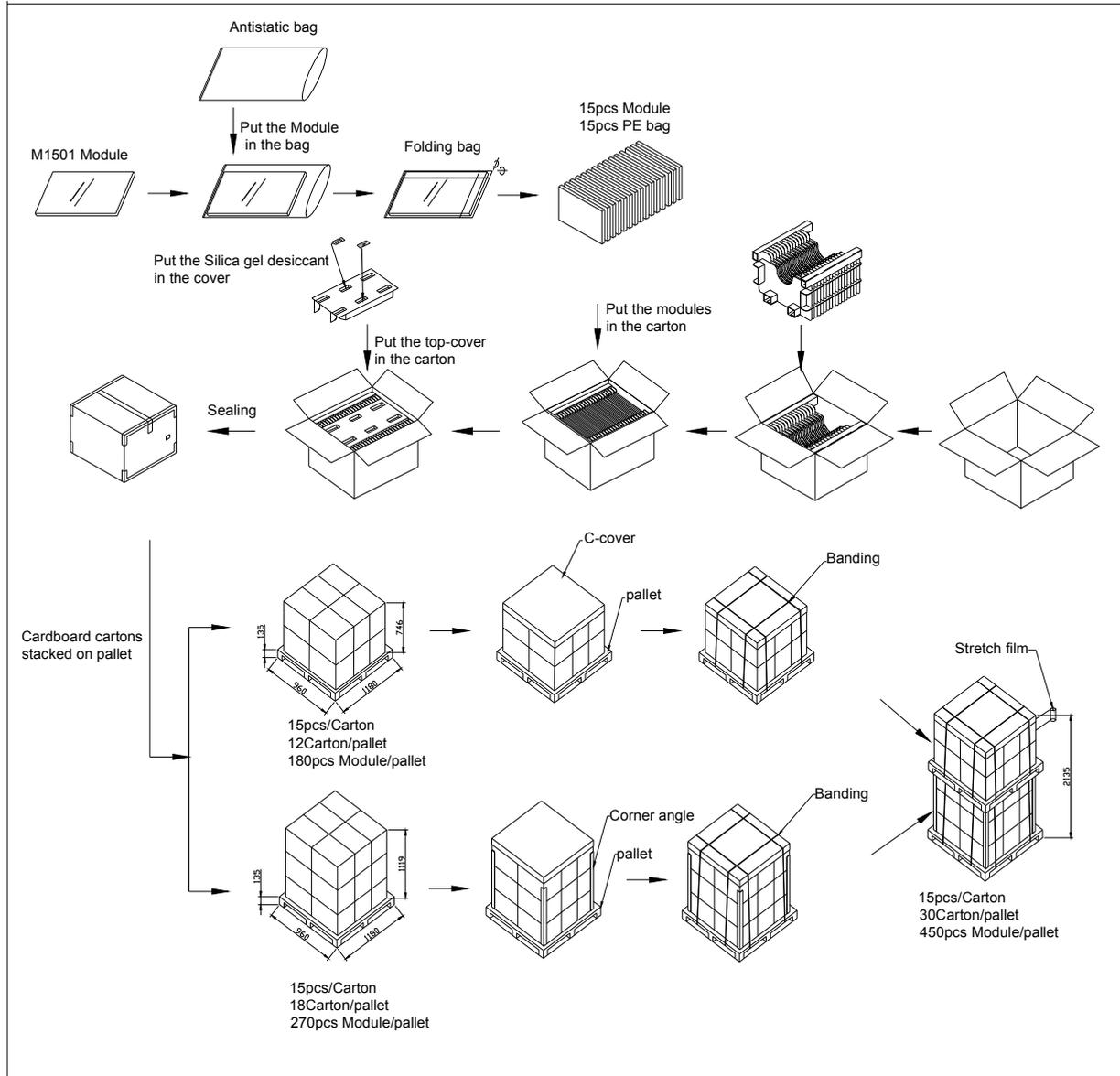
Item	Package	Test Conditions	Conditions
High Temperature Storage Test	Module	Ambient temperature 80℃,500H	Note1
Low Temperature Storage Test	Module	Ambient temperature -30℃, 500hrs	Note1
High Temp./High Humidity Storage Test	Module	Ambient temperature 50℃, Humidity 95%, 500hrs (No condensation)	Note1
High Temperature Operation Test	Module	Ambient temperature 70℃, 500hrs	Note1
Low Temperature Operating Test	Module	Ambient temperature -20℃, 500hrs	Note1
High Temp./High Humidity Operation Test	Module	Ambient temperature 50℃, Humidity 85%, 500hrs (No condensation)	Note1
Image Sticking Test	Module	Ambient temperature 25℃, 24H	Note1
Thermal shock test	Module	-30℃~80℃, 1hr/each cycle, 200cycles	Note1
Altitude Test	Module	40℃, 55kPa, 300H, Altitude Site level to 16K feet	Note1
Pressure Test	Module	3kg/60sec	Note1
ESD Test	Module	Operating Contact ±8kV / Air ±15kV Non-Operating Contact ±10kV / Air ±20kV	Note1
Vibration Test	Module	1.5 G, 10~500Hz, x, y, z each axis/1h	Note1
Shock Test	Module	Half Sine Wave 70G 11ms, ±X,±Y,±Z 1 times each axis	Note1
Vibration Test	With package	1.25G, 5~50Hz, x, y, z each axis/1h (5~50~5Hz 3min)	Note1
Drop Test		65cm, 1corner, 3arris, 6side	Note1

### Note1:

Under the display quality test conditions with normal operation state, these shall be no change which may affect practical display function.(normal operation state:Temperature:15~35℃,Humidity:45~75%,Atmospheric pressure:86~106kpa).

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### 9.0 Package Specification



Components Material	Module	Carton	Antistaticbag	Protect film	Pallet	Weight
Matrrial Size(mm)	326.5*253.5*9.7	433*370*372	350*330*0.06	317*241*0.1	1180*960*135	18.5Kg(Max:20Kg)
Amount (Pcs/Carton)	15	1	15	15	--	15Pcs Module (include packing)



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**10.0 Lot Mark**

**10.1 Lot Mark**

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
---	---	---	---	---	---	---	---	---	----	----	----	----	----	----	----	----	----	----	----

Code 1,2,4,5,6,7,8,9,10,11,16: IVO internal flow control code.

Code 3: Production Location.

Code 12: Production Year.

Code 13: Production Month.

Code 14,15: Production Date.

Code 17,18,19,20: Serial Number.

Note (1) Production Year

Year	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Mark	6	7	8	9	A	B	C	D	E	F

Note (2) Production Month

Month	Jan.	Feb.	Mar.	Apr.	May.	Jun.	Jul.	Aug.	Sep.	Oct	Nov.	Dec.
Mark	1	2	3	4	5	6	7	8	9	A	B	C

**10.2 23 product barcode**

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
---	---	---	---	---	---	---	---	---	----	----	----	----	----	----	----	----	----	----	----	----	----	----

Code 1,2: MD Module Domain.

Code 3,4,5,6,7: IVO Internal Module Name.

Code 8,9,10,13,16: IVO Internal Flow Control Code.

Code 11,12: Cell location "Suzhou" is defined as "SZ".

Code 14,15: Module line "kunshan" is defined as "KS".

Code 17,18,19 : Year, Month, Day Refer to IVO Barcode Note(1),Note(2) in Page23.

Code 20~23 : Serial Number.



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## 11.0 General Precaution

### 11.1 Use Restriction

In case of using the device for life supporting systems, aircraft navigation control systems, military systems and any other application where performance failure could be life-threatening or otherwise catastrophic, take into consideration that appropriate measures such as fail-safe functions and redundant system design should be taken.

### 11.2 Handling Precaution

- (1) Be sure to turn off the power supply when inserting or disconnecting the cable.
- (2) Since the front polarizer is easily damaged, pay attention not to scratch it.
- (3) Wipe off water drop immediately. Long contact with water may cause discoloration or spots.
- (4) When the panel surface is soiled, wipe it with absorbent cotton or other soft cloth.
- (5) Since the panel is made of glass, it may break or crack if dropped or bumped on hard surface. Handle with care.
- (6) Since CMOS LSI is used in this module, take care of static electricity and injure the human earth when handling. Observe all other precautionary requirements in handling components.
- (7) Since there is a circuit board in the module back, stress is not added at the time of a design assembly. Please make it like. If stress is added, there is a possibility that circuit parts may be damaged.
- (8) It causes an irregular display and the defective indication, etc., when always put constant pressure on the back of the module. Please do not make the structure to press the back of the module.
- (9) Do not expose the LCD panel to direct sunlight. Light proof shade etc. should be attached when LCD panel is used under such environment.
- (10) Connect GND to stabilize against EMI and external noise.
- (11) When handling LCD modules and assembling them into cabinets, please avoid that long-terms storage in the environment of oxidization or deoxidization gas and the use of such materials as reagent, solvent, adhesive, resin, etc. which generate these gasses, may cause corrosion and discoloration of the modules. Do not use the LCD module under such environment.
- (12) When the module is installed, please take care not to pull and to hang LED\_FFC.
- (13) Liquid crystal contained in the panel may leak if the LCD is broken. Rinse it as soon as possible if it gets inside your eye or mouth by mistake.
- (14) Be careful when using it for long time with fixed pattern display as it may cause accidental image.
- (15) Adjusting volume has been set optimally before shipment, so do not change any adjusted value. If adjusted value is changed, the specification may not be satisfied.
- (16) If a minute particle enters in the module and adheres to an optical material, it may cause display non-uniformity issue, etc. Therefore, fine-pitch filters have to be installed to cooling and inhalation hole if you intend to install a fan.
- (17) An abnormal display by changing in quality of the polarizing plate might occur regardless of contact or no contact to the polarizing plate, because of epoxy resin (amine system curing agent) that comes out from the material and the packaging material used for the set side, the silicon adhesive (dealcoholization system and ozime system), and the tray blowing agents (azo-compound), etc. Please confirm adaptability with your employed material.
- (18) The polarizer surface on the panel is treated with Anti-Glare for low reflection. In case of attaching protective board over the LCD, be careful about the optical interface fringe etc. which degrades display quality.



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(19) Notice: Never take to pieces the module, because it will cause failure. Please do not peel off the Black tape pasted to the product.

(20) When install LCD modules in the cabinet, please tighten with torque= $0.294\pm 0.02\text{N}\cdot\text{m}$  ( $3.0\pm 0.2\text{kgf}\cdot\text{cm}$ )

### 11.3 Storage Precaution

- (1) Please do not leave LCD module in the environment of high humidity and high temperature for a long time.
- (2) The module shall not be exposed under strong light such as direct sunlight. Otherwise, display characteristics may be changed.
- (3) The module should be stored in a dark place. It is prohibited to apply sunlight or fluorescent light in storage.

### 11.4 Operation Precaution

- (1) Do not connect or disconnect the module in the "Power On" condition.
- (2) Power supply should always be turned on/off by "Power on/off sequence"
- (3) Module has high frequency circuits. Sufficient suppression to the electromagnetic interference should be done by system manufacturers. Grounding and shielding methods may be important to minimize the interference.
- (4) After installation of the TFT Module into an enclosure, do not twist nor bend the TFT Module even momentary. At designing the enclosure, it should be taken into consideration that no bending/twisting forces are applied to the TFT Module from outside. Otherwise the TFT Module may be damaged.

### 11.5 Others

- (1) Ultra-violet ray filter is necessary for outdoor operation.
- (2) Avoid condensation of water which may result in improper operation or disconnection of electrode.
- (3) If the module keeps displaying the same pattern for a long period of time, the image may be "sticked" to the screen.
- (4) This module has its circuitry PCB's on the rear side and should be handled carefully in order not to be stressed.

### 11.6 Disposal

When disposing LCD module, obey the local environmental regulations.