InfoVision Optoelectronics (Kunshan) Co.,LTD.

Document Title	M156MWR1 Product information			Page No.	1/30
Document No.		Issue date	2010/05/07	Revision	02

Product information

To:

Product Name: M156MWR1 **R0**

H．W：4.1

Document Issue Date: 2010/05/07

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Revision	Date	Page	Old Description	New Description	Remark
00	2009/01/08	--	--	final spec. was first issued	
01	2010-04-14	8	Rx: 0.653 Ry: 0.333 Gx: 0.256 Gy: 0.614 Bx: 0.141 By: 0.163	Rx: 0.620 Ry: 0.337 Gx: 0.291 Gy: 0.584 Bx: 0.146 By: 0.075	
02	2010-5-7	28	Label HW1.1	Label HW4.1	

Contents

1.0 GENERAL DESCRIPTIONS

1.1 Introduction

The M156MWR1 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 controler, voltage reference, common voltage, DC-DC converter, column driver, and row driver circuit. This TFT LCD has a 15.6-inch diagonally measured active display area with WXGA resolution (1366 vertical by 768 horizontal pixel array).

1.2 Features

- 15.6"WXGA TFT LCD Panel
- 2 CCFLs Backlight System
- Supported WXGA(V:1366 lines, H:768 pixels) Resolution
- Supported to 75Hz Refresh Rate
- Compatible with RoHS Standard

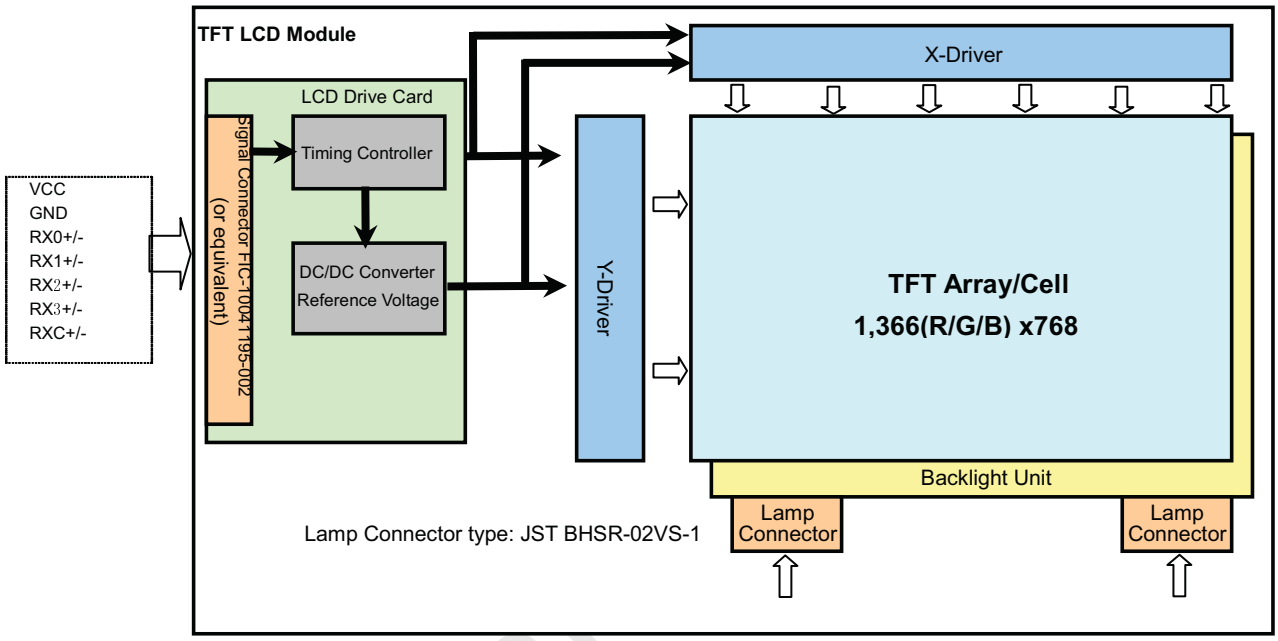
1.3 Product Summary

Items	Specifications	**Unit**
Screen Diagonal	15.6 inch	inch
Active Area	344.232(H) x 193.536(V)	mm
Pixels H x V	1,366 (x3) x 768	
Pixel Pitch	0.252*0.252	mm
Pixel Arrangement	R.G.B. Vertical Stripe	
Display Mode	Normally White	
White Luminance	250 typical	cd/ m2 (CCFL current 7.0mA)
Contrast Ratio	500 : 1 typical	
Response Time	8 typical	msec
Input Voltage	+5.0 typical	v
Logic Power Consumption	1.75 typical (Black pattern, 60Hz)	watt
Backlight Power Consumption	10.8 typical (CCFL current 7.0mA)	watt
Weight	1,300 maximum	g
Outline Dimension	363.8 (W) x 215.9 (H) x 14.3 (T) typical	mm
Electrical Interface (Logic)	6bit+Hi_FRC single LVDS	
Support Color	16.7M	
Lamp Life Time	50,000(Ta=25+/-3degC and ICCFL=7.0mA, brightness becomes lower than 50% of initial value)	hours
Luminance Uniformity	80% typical (@9 points)	

1.4 Functional Block Diagram

Figure 1 shows the functional block diagram of the LCD module.

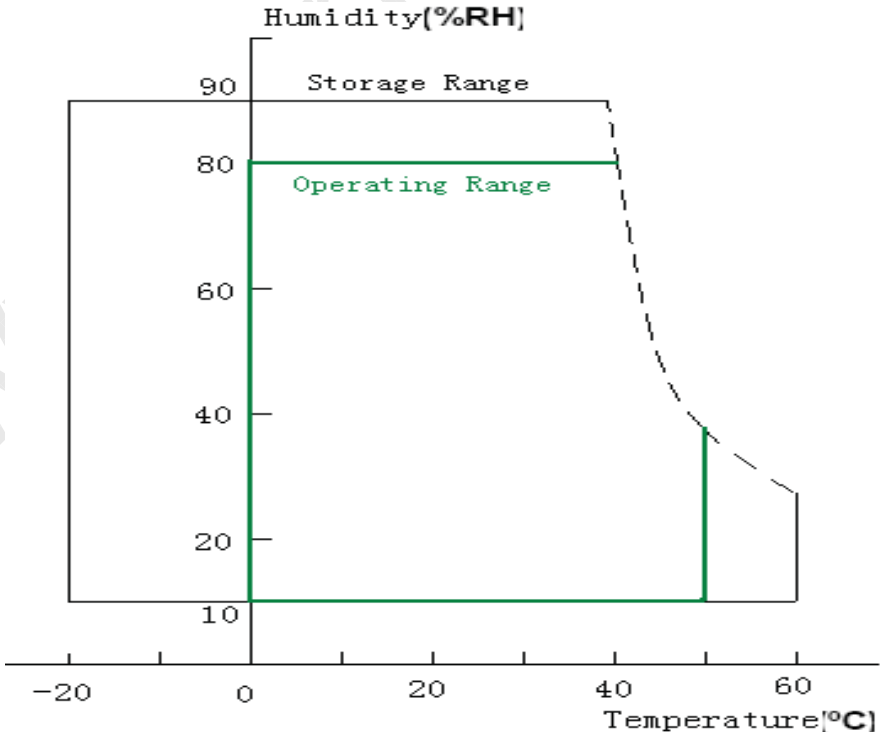
Figure 1 Block Diagram



2.0 Absolute Maximum Ratings

Item	Symbol	Min	Max	Unit	Conditions
Supply Voltage	VDD	-0.3	+6.0	V	
Operating Temperature	TOP	0	+50	deg. C	(Note)
Operating Humidity	HOP	10	80	%RH	(Note)
Storage Temperature	TST	-20	+60	deg. C	(Note)
Storage Humidity	HST	10	90	%RH	(Note)
Vibration			1.5 10-200-10	G Hz	30min for X, Y, Z axis
Shock			50 11	G ms	Half sign wave
CCFL Current	ICCFL	-	7.5	mArms	

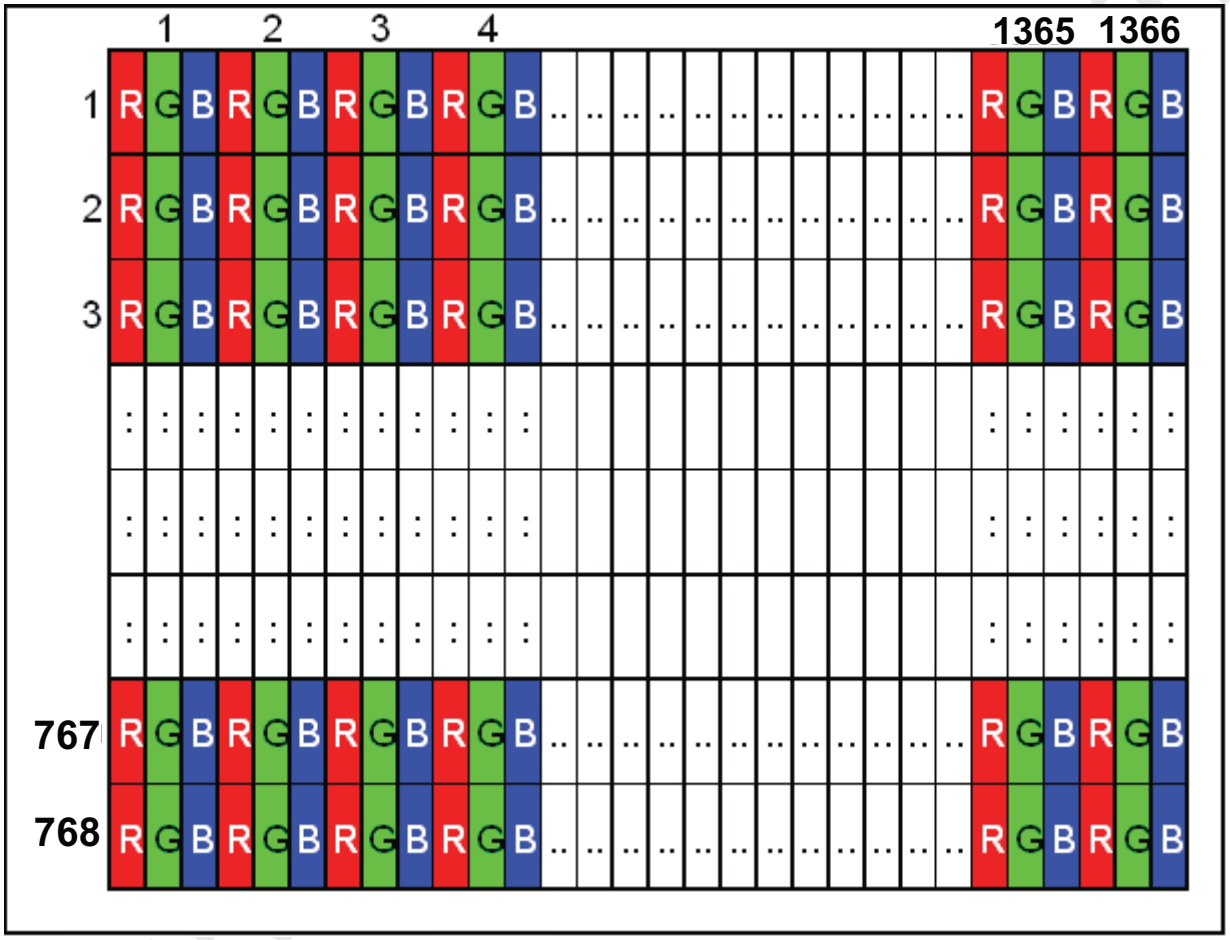
Note: Storage /Operating temperature. Maximum Wet-Bulb should be 39 degree C.
No condensation.



3.0 Pixel Format Image

Figure 2 shows the relationship of the input signals and LCD pixel format image.

Figure 2 Pixel Format



4.0 Optical Characteristics

The optical characteristics are measured under stable conditions as following notes

Table 1 Optical characteristics

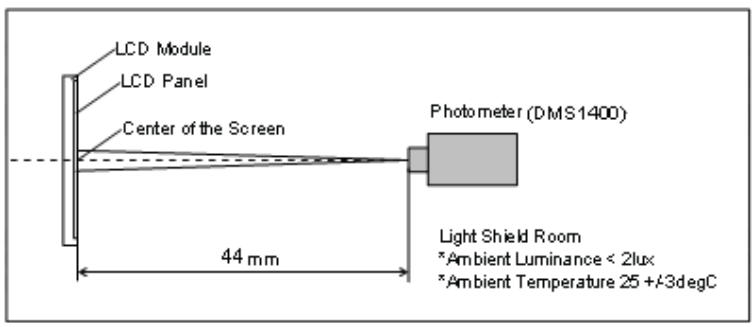
Item	Conditions	Specification			
		Min	Typ.	Max	Note
Viewing Angle [degrees]	Horizontal	80	90	--	A, B
K=Contrast Ratio>10	Vertical	45	65	--	
Contrast Ratio		350	500	--	A, C
Response Time [ms]	Rising + Falling	--	8	15	A, D
Color Chromaticity (CIE1931)	Red x	Typ. -0.03	(0.620)	Typ. +0.03	A,
	Red y		(0.337)		A,
	Green x		(0.291)		A,
	Green y		(0.584)		A,
	Blue x		(0.146)		A,
	Blue y		(0.075)		A,
	White x	0.283	0.313	0.343	A,
	White y	0.299	0.329	0.359	A,
White Luminance [cd/m^2]	ICCFL=7.0mA	200	250	--	Center A, E
Luminance Uniformity	ICCFL=7.0mA, 13points	75%	80%	--	A, F

Note:

A. Measurement Setup:

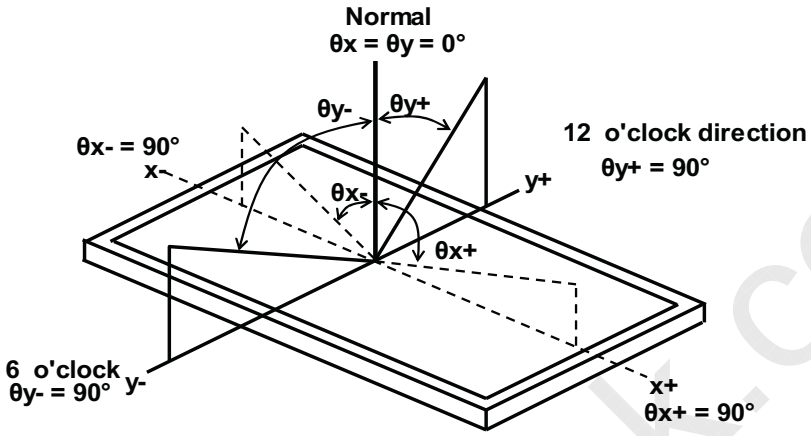
The LCD module should be stabilized at given temperature for 30 minutes to avoid abrupt temperature change during measuring. In order to stabilize the luminance, the measurement should be executed after lighting backlight for 30 minutes in a windless room.

Figure 3 Measurement Setup



B. Definition of Viewing Angle

Figure 4 Definition of Viewing Angle



C. Definition of Contrast Ratio (CR)

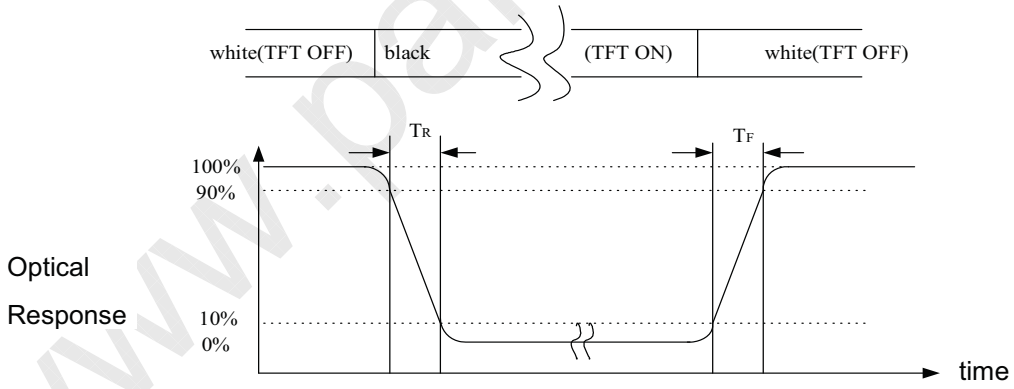
The contrast ratio can be calculated by the following expression

Contrast Ratio (CR) = L255 / L0

L255: Luminance of gray level 255, L0: Luminance of gray level 0

D. Definition of Response Time (T_R, T_F)

Figure 5 Definition of Response Time



E. Definition of Luminance White

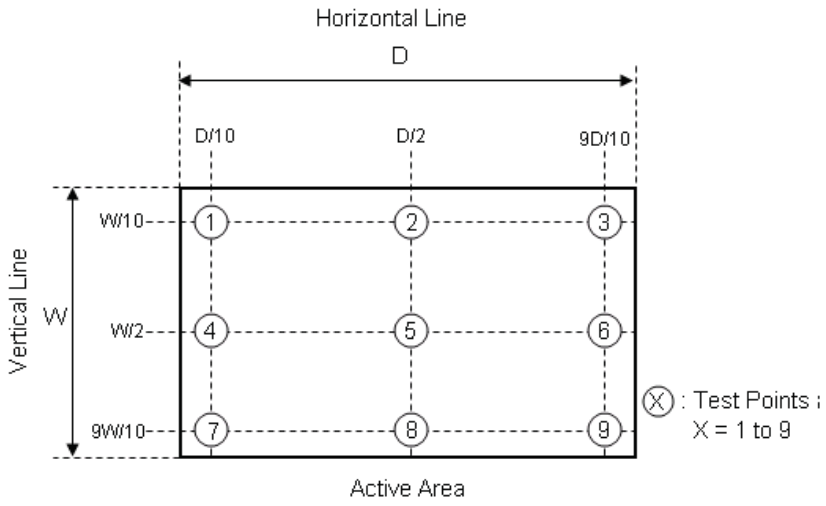
Measure the luminance of gray level 255 at center point.

F. Definition of Luminance Uniformity(Variation)

Measure the luminance of gray level 255 at 9 points.

$$\mathrm{UNF}(9\mathrm{pts}) = \frac{\min(L1, L2, \cdots L9)}{\max(L1, L2, \cdots L9)}$$

Figure 6 Measurement Locations of 9 Points



5.0 Backlight Characteristics

5.1 CCFL Connector

Table 2 Connector Name / Designation

Manufacturer	JST
Type / Part Number	BHSR-02VS-1 or equivalent
Mating Type / Part Number	SM02B-BHSS-1

Table 3 Signal assignment

Pin #	Signal Name
1	Lamp High Voltage
2	Lamp Low Voltage

5.2 Parameter Guideline for CCFL Inverter

Table 4 Parameter guideline for CCFL Inverter

SYMBOL	PARAMETER	MIN	Design Point	MAX	UNITS	CONDITION
(L255)	White Luminance (Center)	210	250	--	[cd/m^2]	Ta=25[deg C]
ICCFL	CCFL Current	3.0	7.0	7.5	[mArms]	Ta=25[deg C] **(Note A)**
FCCFL	CCFL Frequency	50	55	60	[kHz]	Ta=25[deg C] **(Note B)**
VCCFLi	Inverter Ignition Voltage		--	1200	[Vrms]	Ta=0[deg C] **(Note C)**
			--	1100	[Vrms]	Ta=25[deg C] **(Note C)**
VCCFL	CCFL Voltage	585	650	715	[Vrms]	@ ICCFL=7mA Ta=25[deg C]

Note:

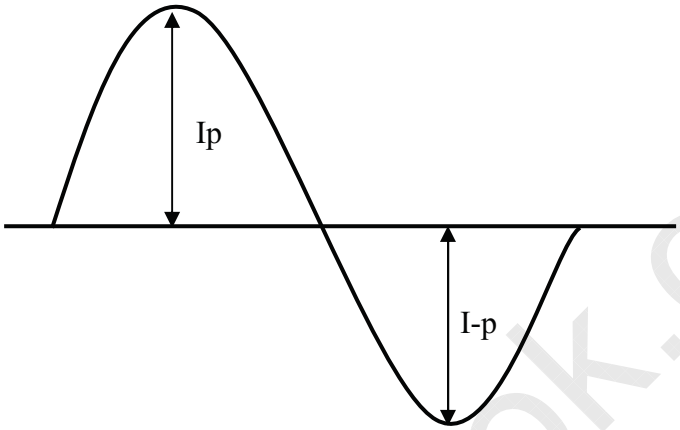
A. If it exceeds MIN/MAX values, then "CCFL Life", "ON/OFF Cycle", and "SAFETY" will not be guaranteed.

B. CCFL Frequency should be carefully determined to avoid interference between inverter and TFT LCD.

C. The voltage over specified value (VCCFLi) should be applied to the lamp more than 1 second after startup. Otherwise, the lamp may not be turned on. The used lamp current is the lamp typical current. The inverter should be able to give out a power that has a generating capacity of over 1200 voltage.Lamp units need to over 1200 voltage for ignition.

D. The distortion tae of the waveform should be within √2±10%

The inverter output waveform should be better similar to the ideal sine wave.



Asymmetry rate = $|I_p - I_{-p}| / I_{rms} \times 100\%$

Distortion rate = I_p (or I_{-p}) / I_{rms}

Figure 7 Recommendation of Lighting Waveform

6.0 Electrical Characteristics

6.1 Interface Connector

Table 5 Connector Name / Designation

Manufacturer	FCI (or equivalent)
Type / Part Number	FCI-10041195-002 (or equivalent)
Mating Receptacle/Part Number	JAE FI-X30H

Table 6 Signal pin assignment

Pin #	Signal Name	Description	Remarks
1	NC	Not connected	
2	NC	Not connected	
3	NC	Not connected	
4	GND	Ground	
5	RX0-	LVDS differential data input	
6	RX0+	LVDS differential data input	
7	GND	Ground	
8	RX1-	LVDS differential data input	
9	RX1+	LVDS differential data input	
10	GND	Ground	
11	RX2-	LVDS differential data input	
12	RX2+	LVDS differential data input	
13	GND	Ground	
14	RXClk -	LVDS differential clock input	
15	RXClk +	LVDS differential clock input	
16	GND	Ground	
17	RX3-	LVDS differential data input	
18	RX3+	LVDS differential data input	
19	GND	Ground	
20	NC	Not connected	
21	NC	Not connected	
22	TP	Test point	
23	GND	Ground	
24	GND	Ground	

25	GND	Ground	
26	VDD	power supply+5.0V	
27	VDD	power supply+5.0V	
28	VDD	power supply+5.0V	
29	VDD	power supply+5.0V	
30	VDD	power supply+5.0V	

All input signals shall be low or Hi-Z state when Vcc is off.

6.2 LVDS Receiver

6.2.1 Signal Electrical Characteristics for LVDS Receiver

The built-in LVDS receiver is compatible with ANSI/TIA/TIA-644 standard.

Table 7 LVDS Receiver Electrical Characteristics

Parameter	Symbol	Min	Typ	Max	Unit	Conditions
Differential Input High Threshold	Vth	--	--	+100	mV	Vcm=+1.2V
Differential Input Low Threshold	Vtl	-100	--	--	mV	Vcm=+1.2V
Magnitude Differential Input Voltage	|Vid|	100	--	600	mV	
Common Mode Voltage	Vcm	1.0	1.2	1.4	V	Vth - Vtl = 200mV
Common Mode Voltage Offset	ΔVcm	-50	--	+50	mV	Vth - Vtl = 200mV

Note:

A. Input signals shall be low or Hi-Z state when VDD is off.

B. All electrical characteristics for LVDS signal are defined and shall be measured at the interface connector of LCD.

Table 8 Timing Requirements

Parameter	Symbol	Min	Typ	Max	Unit	Conditions	Note
Clock Frequency	Fc	50	76	85	MHz		
Input Data Skew Margin	Trskm	-850	--	+850	ps	Fc=76MHz, |Vth-Vtl| = 400mV Vcm = 1.2V, ΔVcm = 0	Figure 11

Note: All values are at VDD=5.0V, Ta=25 degree C.

Figure 8 Voltage Definitions

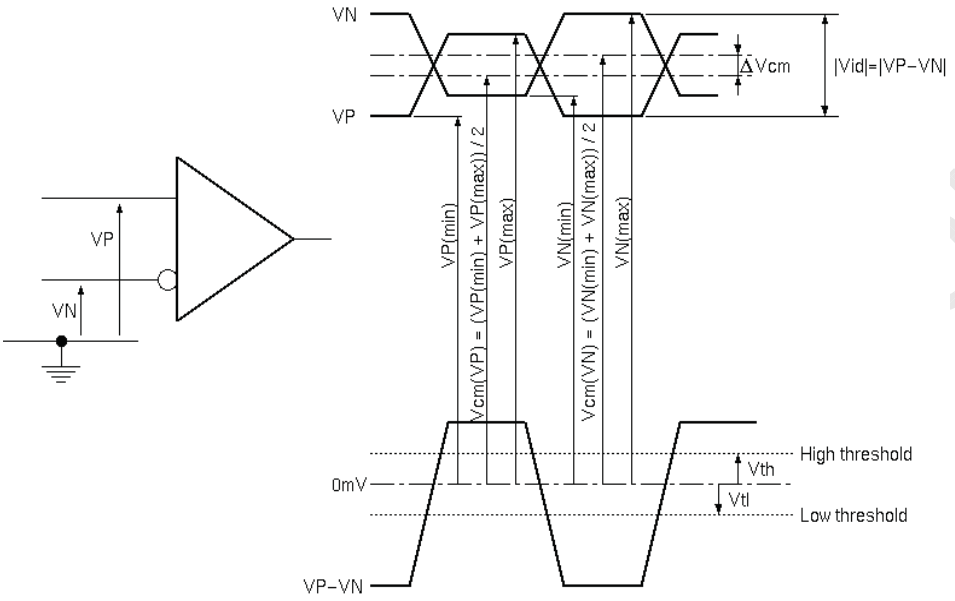


Figure 9 Measurement System

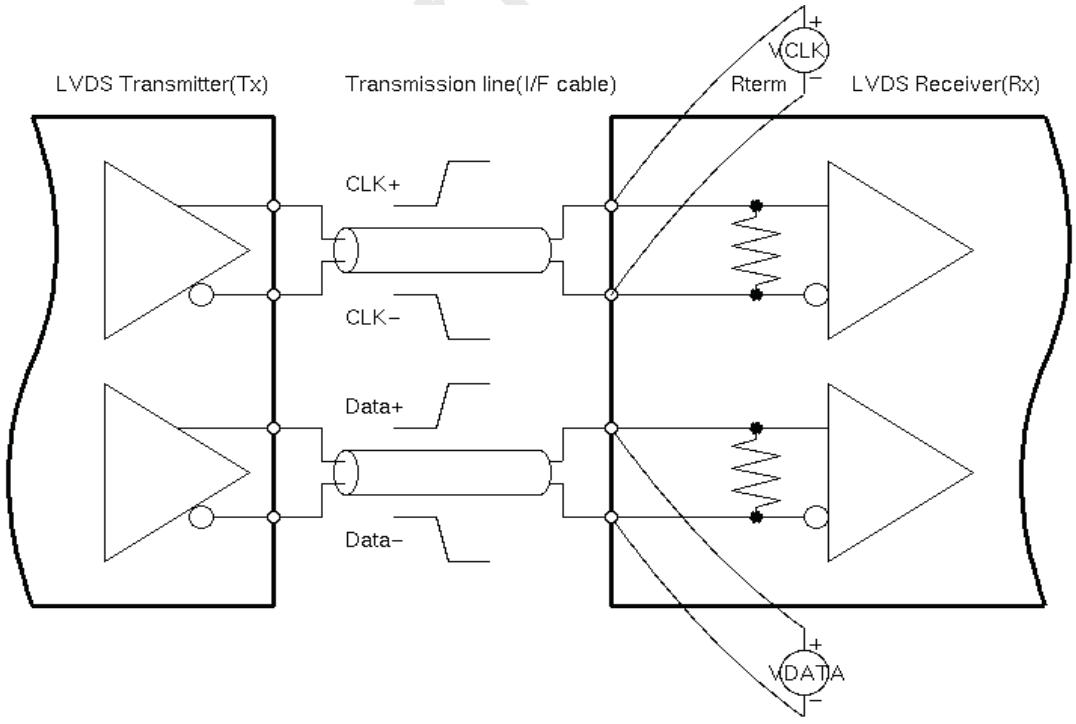


Figure 10 Data mapping

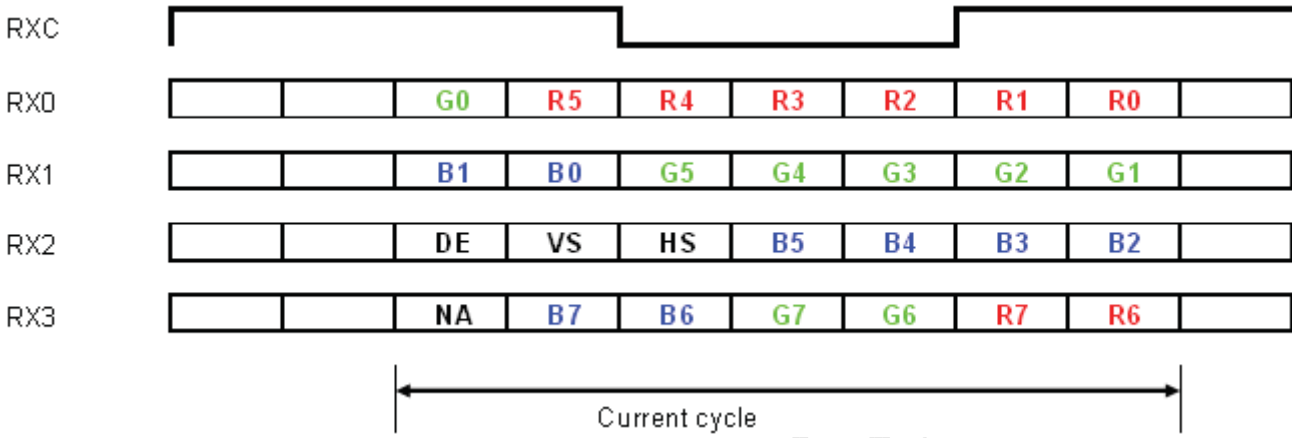
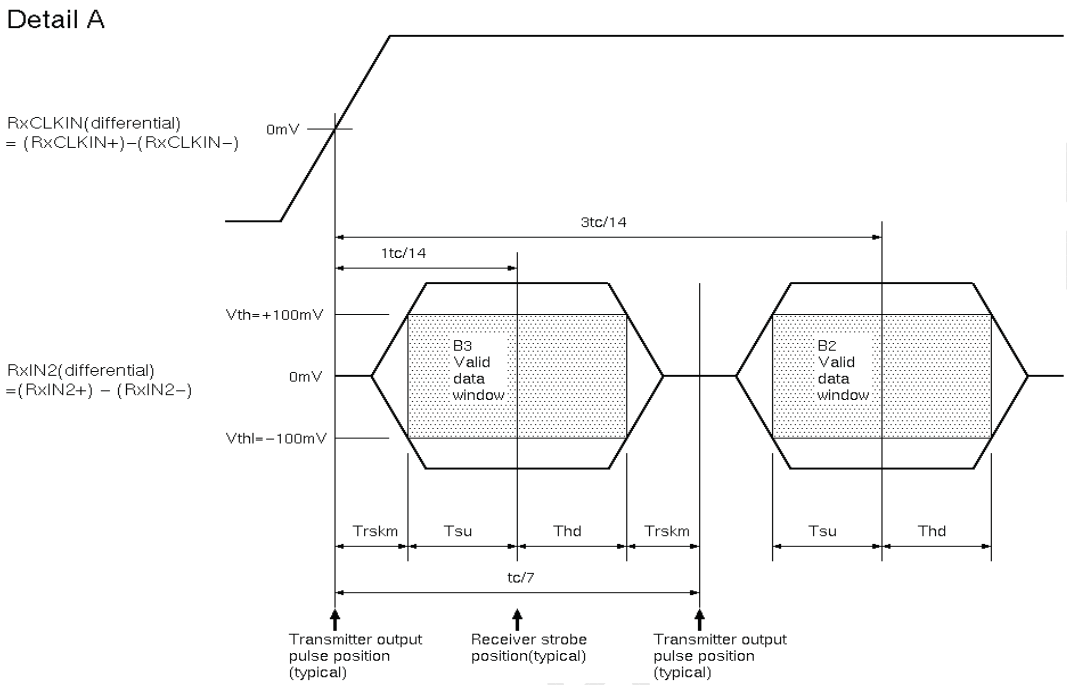


Figure 11 Timing Definition



Note: Tsu and Thd is internal data sampling window of receiver. Trskm is the system skew margin; i.e., the sum of cable skew, source clock jitter, and other inter-symbol interference, shall be less than Trskm.

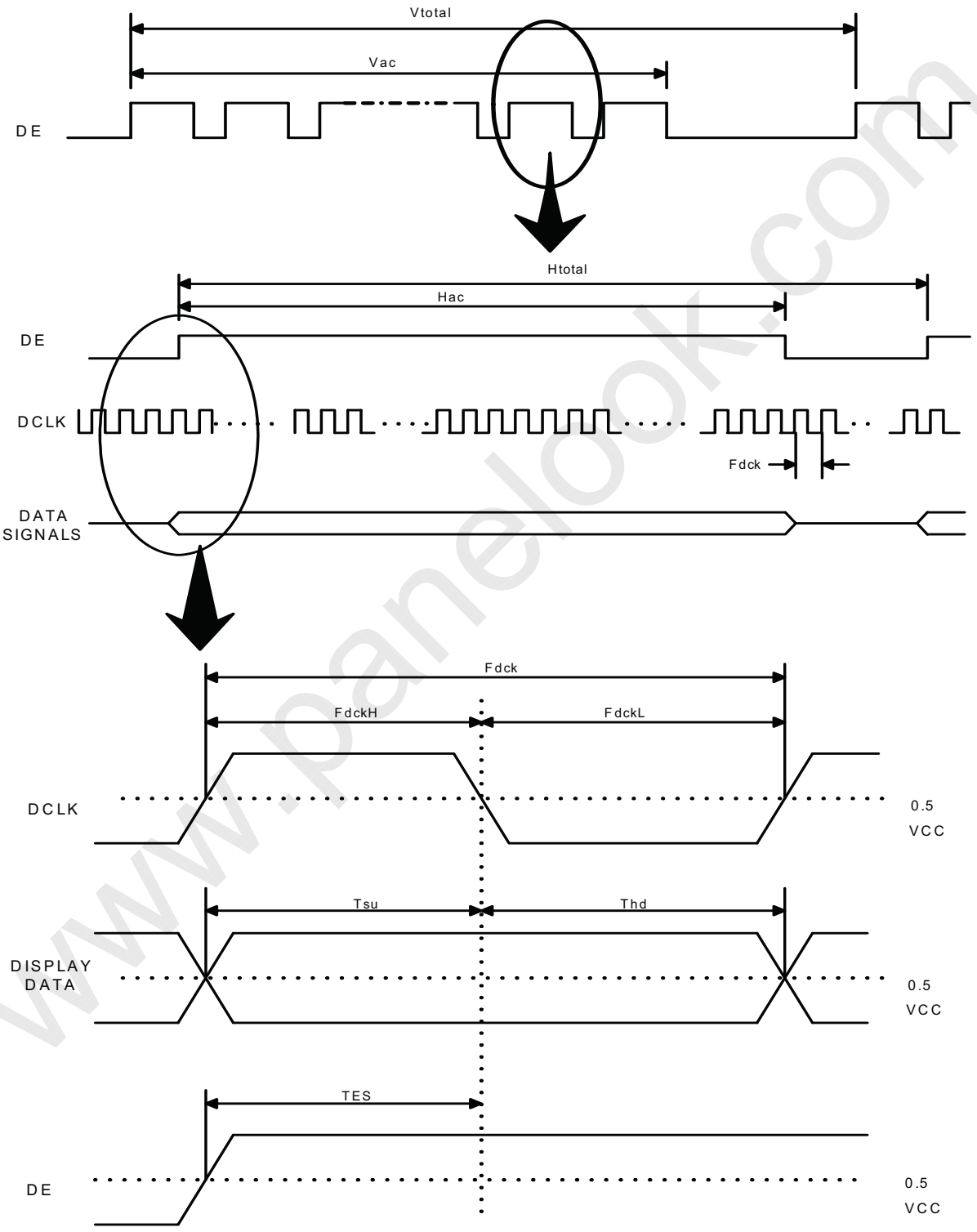
6.3 Timing Characteristics

Table 9 Interface timings

Parameter	Symbol	Unit	min	typ	Max
LVDS Clock Frequency	Fdck	MHz	50	76	90
H Total Time	Htotal	clocks	1446	1560	1936
H Active Time	Hac	clocks	1366	1366	1366
V Total Time	Vtotal	lines	778	806	888
V Active Time	Vac	lines	768	768	768
Frame Rate	Vsync	Hz	55	60.0	75.0

Note: This product is DE only mode. The input of Hsync & Vsync signal does not have an effect on normal operation.

Figure 12 Timing Characteristics



Note: TES is data enable signal setup time.

7.0 Power Consumption

Input power specifications are as follows.

Table 10 Power consumption

SYMBOL	PARAMETER	Min	Typ	Max	UNITS	CONDITION
VDD	Logic/LCD Drive Voltage	4.5	5.0	5.5	[V]	
IDD	VDD Current	--	0.35	0.41	[A]	All black pattern, 60Hz
		--	0.4	0.45	[A]	Vertical Stripe pattern, 60Hz
PDD	VDD Power	--	1.75	--	[W]	All black pattern, 60Hz
Irush	Rush Current	--	--	2	[A]	
VDDrp	Allowable Logic/LCD Drive Ripple Voltage	--	--	250	[mVp-p]	

Note: PDD=VDD*IDD

8.0 Power ON/OFF sequence

VDD power, interface signals, and lamp on/off sequence are shown in figure 13.

Signals shall be Hi-Z state or low level when VDD is off.

Figure 13 Power sequence

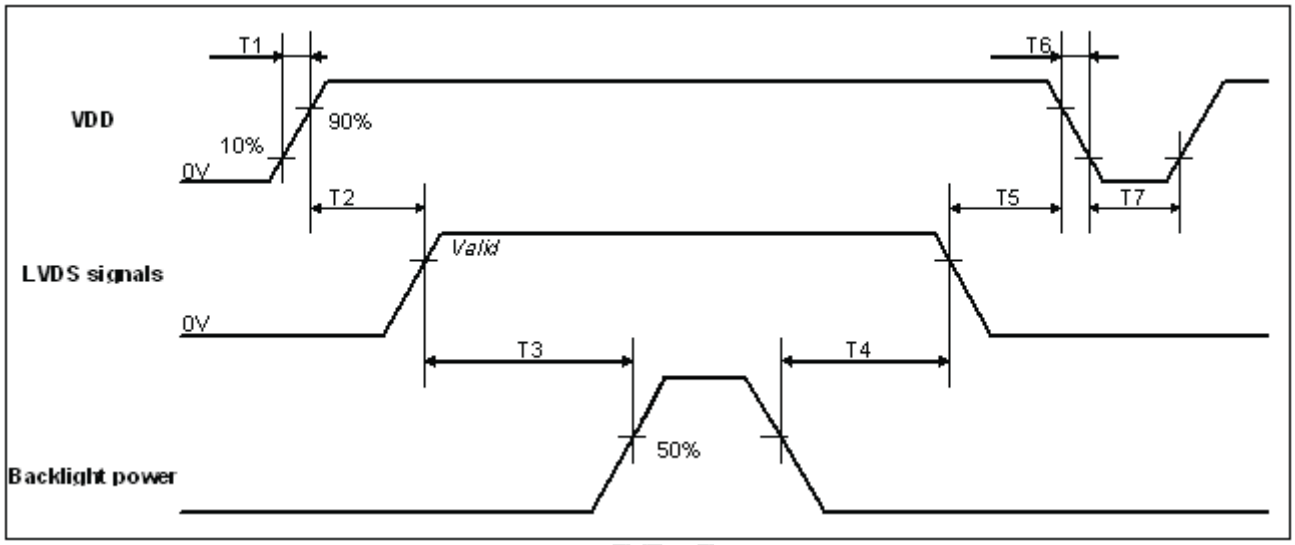


Table 11 Power Sequencing Requirements

Parameter	Symbol	Unit	min	typ	max	Note
VDD Rise Time	T1	ms	0.5		10	
VDD Good to Signal Valid	T2	ms	0		50	
Signal Valid to Backlight On	T3	ms	450		--	
Backlight Off to Signal Disable	T4	ms	90		--	
Signal Disable to Power Down	T5	ms	0		50	
VDD Fall Time	T6	ms	0		10	A
Power Off	T7	ms	500	--	--	

Note A: The system designed should decrease the Vdd under 2.5V within 10ms during T6 period.

9.0 Mechanical Characteristics

9.1 Dimension Specifications

Table 12 Module Dimension Specifications

Width [mm]		363.8 ± 0.5
Height [mm]		215.9± 0.5
Thickness [mm]		14.8 max
Bezel Opening [mm]	X	347.5 ± 0.3
	Y	196.8 ± 0.3
Mounting Hole [mm]	UR	45 ± 0.3
	LR	90 ± 0.3
	UL	69 ± 0.3
	LL	138 ± 0.3
Connector Position from Screen Center [mm]	X	66.9 ± 1
	Y	69.5 ± 1
CCFL Harness Length [mm]		120 ± 5
Weight [g]		1300 Max.
BM : | a-b | & | c-d |		≦1.0mm

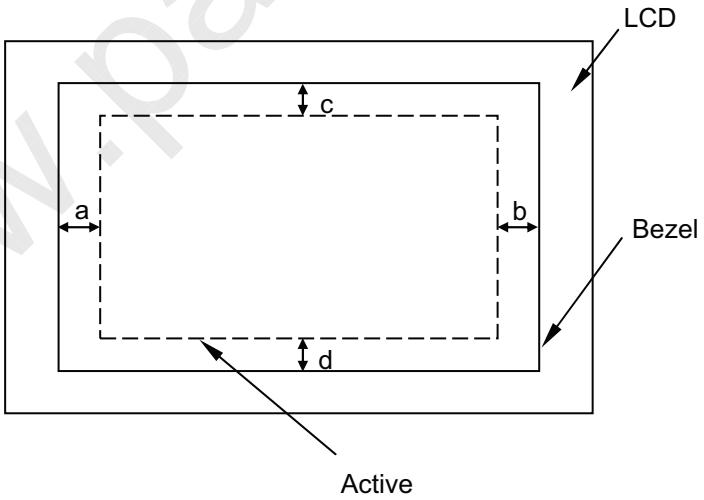


Figure 14 Reference outline drawing (Front side)

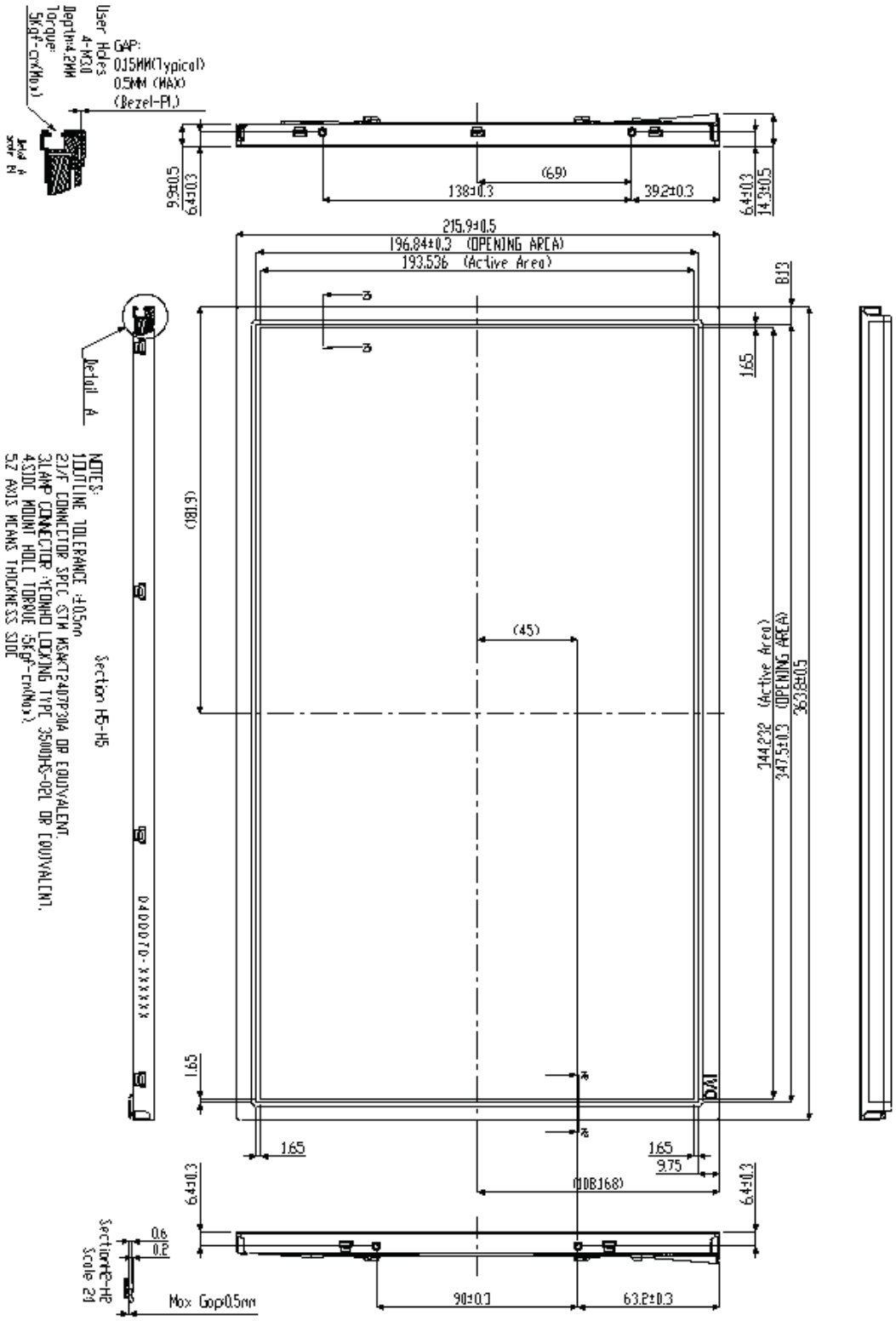
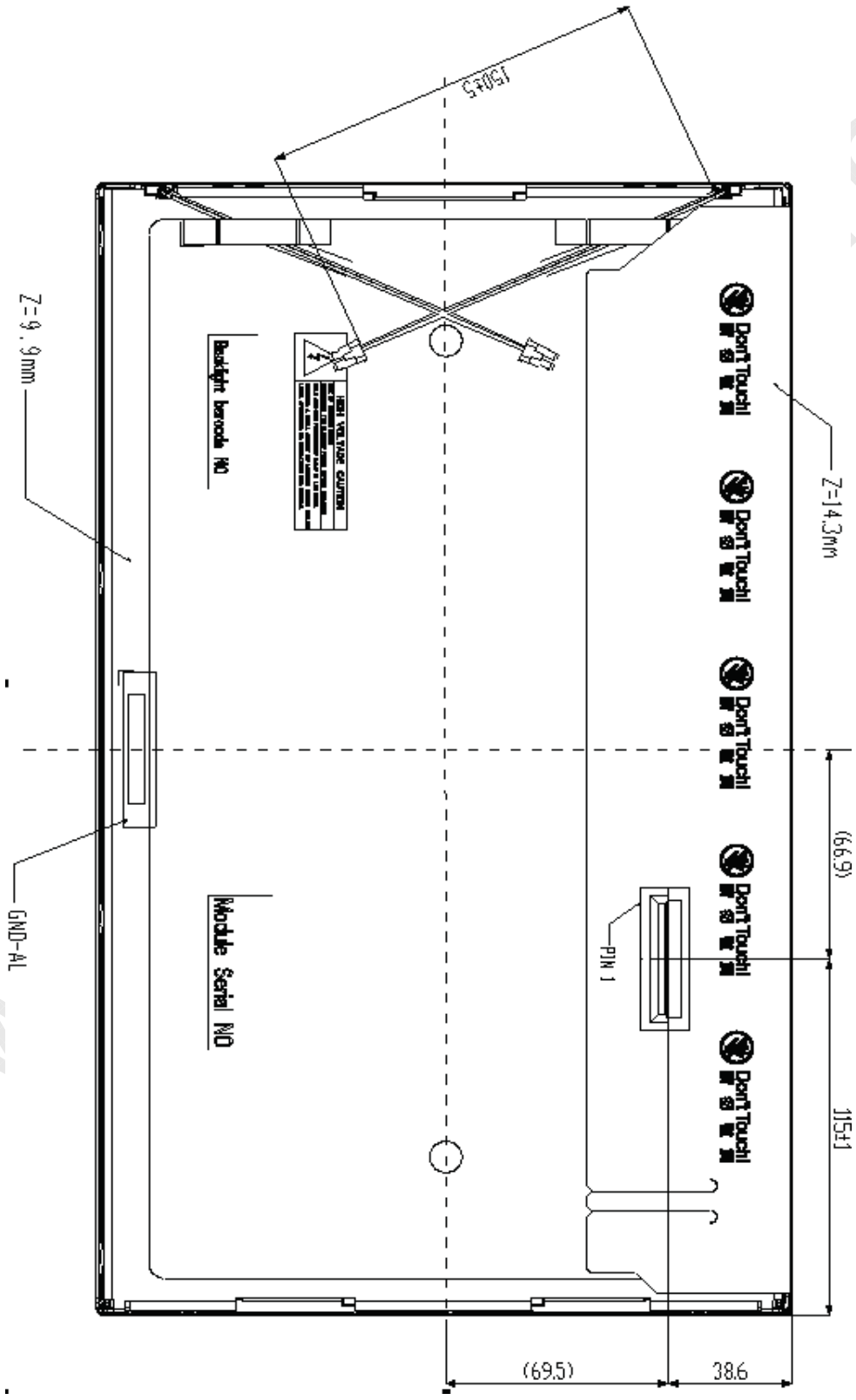
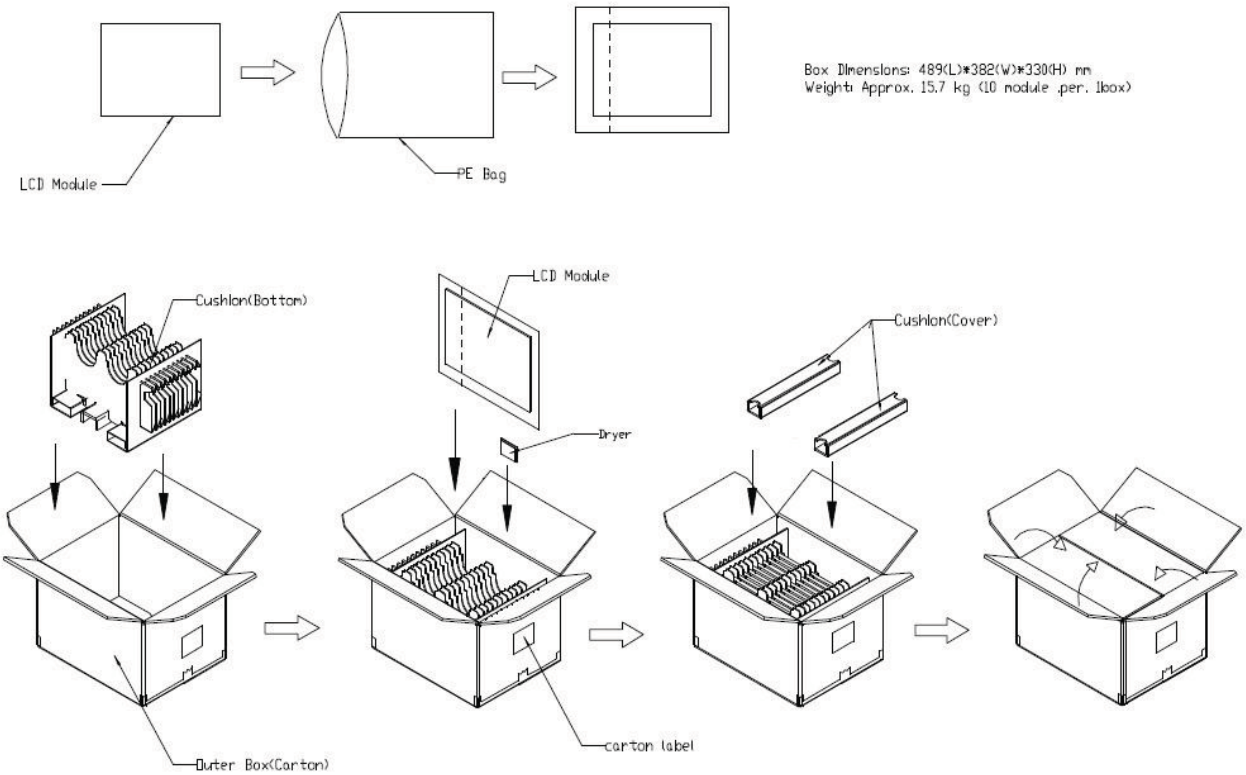


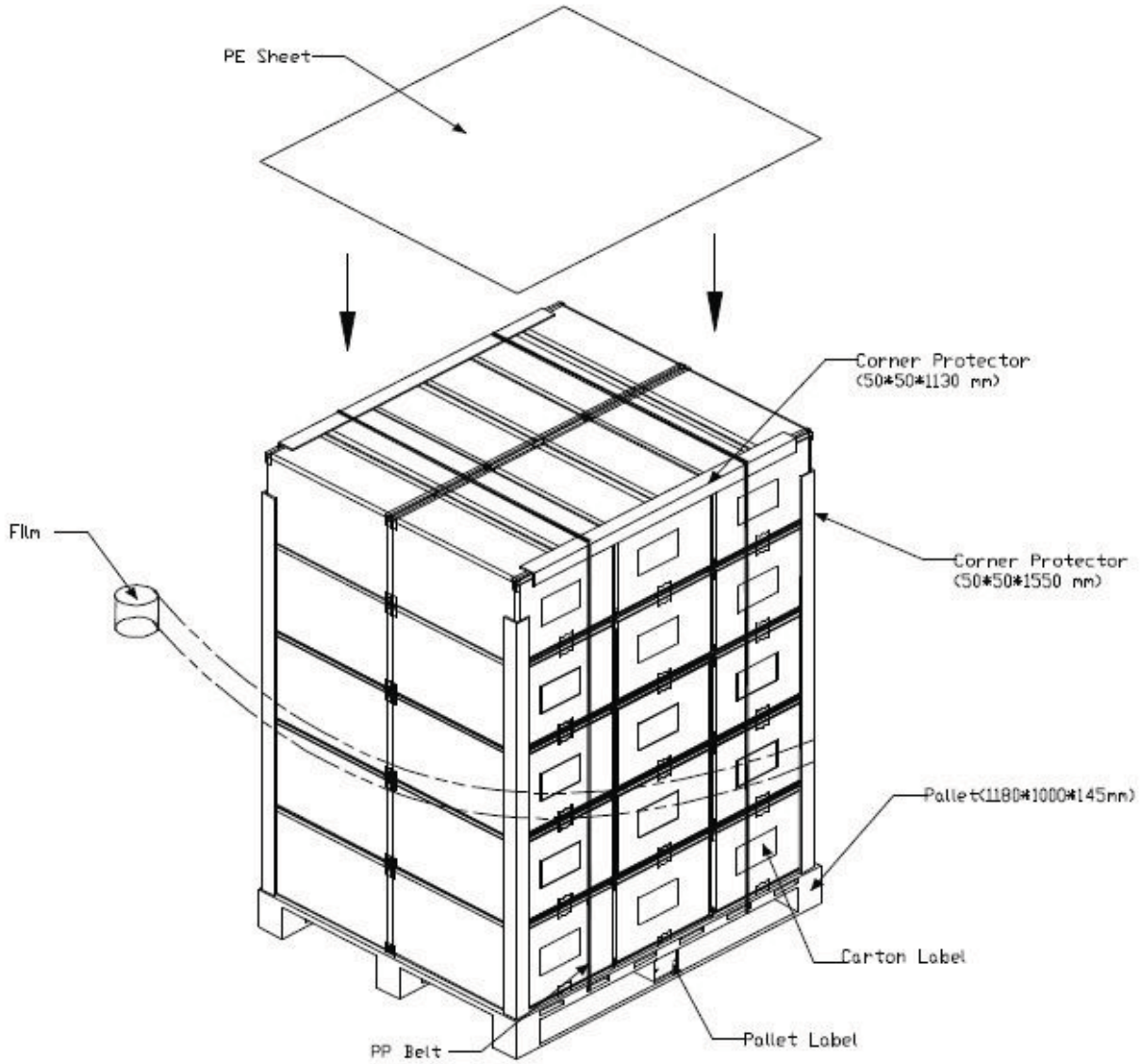
Figure 15 Reference outline drawing (Back side)



10.0 PACKAGE SPECIFICATION



Sea and land transportation



11.0 LOT MARK

11.1 Lot Mark

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

code 1,2,3,6,7,8,9,10,11: MTDis internal flow control code.
code 5: production location.
code 12: production year.
code 13: production month.
code 16,17,18,19,20: 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	F	G

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

11.2 The Customer 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 Mindtech Display.
code 3,4,5,6,7: MTDis internal module name.
code 8,9,10,13,16: MTDis internal flow control code.
code 11,12: Cell location Suzhou defined as “SZ”.
code 14 ,15: Module line kunshan defined as” KS”.
code 17,18,19 : Year, Month, Day Refer to MTDis barcode Note(1),Note(2).
code 20~23 : Serial Number.

12.0 GENERAL PRECAUTION

12.1 Use Restriction

This product is not authorized for use in life supporting systems, aircraft navigation control systems, military systems and any other application where performance failure could be life-threatening or otherwise catastrophic.

12.2 Handling Precaution

(1) Please mount LCD module by using mounting holes arranged in four corners tightly.

(2) Do not disassemble or modify the module. It may damage sensitive parts inside LCD module, and may cause scratches or dust on the display. MTD does not warrant the module, if customers disassemble or modify the module.

(3) If LCD panel is broken and liquid crystal spills out, do not ingest or inhale liquid Crystal, and do not contact liquid crystal with skin. If liquid crystal contacts mouth or eyes, rinse out with water immediately. If liquid crystal contacts skin or cloths, wash it off immediately with alcohol and Rinse thoroughly with water.

(4) Disconnect power supply before handling LCD module

(5) Refrain from strong mechanical shock and /or any force to the module.

(6) Do not exceed the absolute maximum rating values, such as the supply voltage variation, input voltage variation, variation in parts' parameters, environmental temperature; etc otherwise LCD module may be damaged. It's recommended employing protection circuit for power supply.

(7) Do not touch, push or rub the polarizer with anything harder than HB pencil lead. Use fingerstalls of soft gloves in order to keep clean display quality, when Persons handle the LCD module for incoming inspection or assembly.

(8) When the surface is dusty, please wipe gently with absorbent cotton or other soft Material. When cleaning the adhesives, please use absorbent cotton wetted with a little Petroleum benzene or other adequate solvent.

(9) Wipe off saliva or water drops as soon as possible. If saliva or water drops Contact with polarizer for a long time, they may causes deformation or color Fading.

(10) Protection film must remove very slowly from the surface of LCD module to Prevent from electrostatic occurrence.

(11) Because LCD module uses CMOS-IC on circuit board and TFT-LCD panel, it is Very weak to electrostatic discharge, Please be careful with electrostatic Discharge .Persons who handle the module should be grounded through adequate methods.

(12) Do not adjust the variable resistor located on the module.

12.3 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.

12.4 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 9.0 "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.

12.5 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.

12.6 Disposal

When disposing LCD module, obey the local environmental regulations.