TO:

Trillifit International Corporation

MTDis Product Specification

Model Name: M190MWW1

Issue date: 2007/ 04 /25

Product Development and Customer Engineering Division	Customer
Vincentliu *2007/04/25*	

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2. The information contained herein is presented merely to indicate the characteristics and performance of our products. No responsibility is assumed by MTDis for any intellectual property claims or other problems that may result from application based on the module described herein.

Revision	Date	Page	Old Description	New Description	Remark
01	2007/04/25			M190MWW1 finial spec. was first issued.	

Contents

1.0 GENERAL DESCRIPTIONS

1.1 Introduction

The **M190MWW1** 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, driver DC-DC converter, column driver, and row driver circuit. This TFT LCD has a 19-inch diagonally measured active display area with WXGA+ resolution (1440 vertical by 900 horizontal pixel array).

1.2 Features

- 19”WXGA+ TFT LCD Panel
- 4 CCFLs Backlight System
- Supported WXGA+ (V:1440 lines, H:900 pixels) resolution
- Supported to 75Hz Refresh Rate
- Compatible with RoHS Standard

1.3 Product Summary

Items	Specifications	Unit
Screen Diagonal	19.05 inch	Inch
Active Area	410.4(H) x 256.5(V)	mm
Pixels H x V	1,440 (x3) x 900	
Pixel Pitch	0.285 (per one triad) x 0.285	mm
Pixel Arrangement	R.G.B. Vertical Stripe	
Display Mode	Normally White	
White Luminance	300 typical	cd/ m^2 (CCFL current 7.0mA)
Contrast Ratio	800 : 1 typical	
Response Time	5 typical	msec
Input Voltage	+5.0 typical	V
Logic Power Consumption	2.6 typical (Black pattern, 60Hz)	Watt
Backlight Power Consumption	21.0 typical (CCFL current 7.0mA)	Watt
Weight	2,500 maximum	g
Outline Dimension	427.2 (W) x 277.4 (H) x 15.5 (T) typical	mm
Electrical Interface (Logic)	8bit dual LVDS	
Support Color	16.2M	
Lamp Life Time	50,000(Ta=25+/-3degC and ICCFL=7.0mA, brightness becomes lower than 50% of initial value)	Hours
Luminance Uniformity	1.3 typical (@9 points)	
Optimum Viewing Direction	6 o’colok	

1.4 Functional Block Diagram

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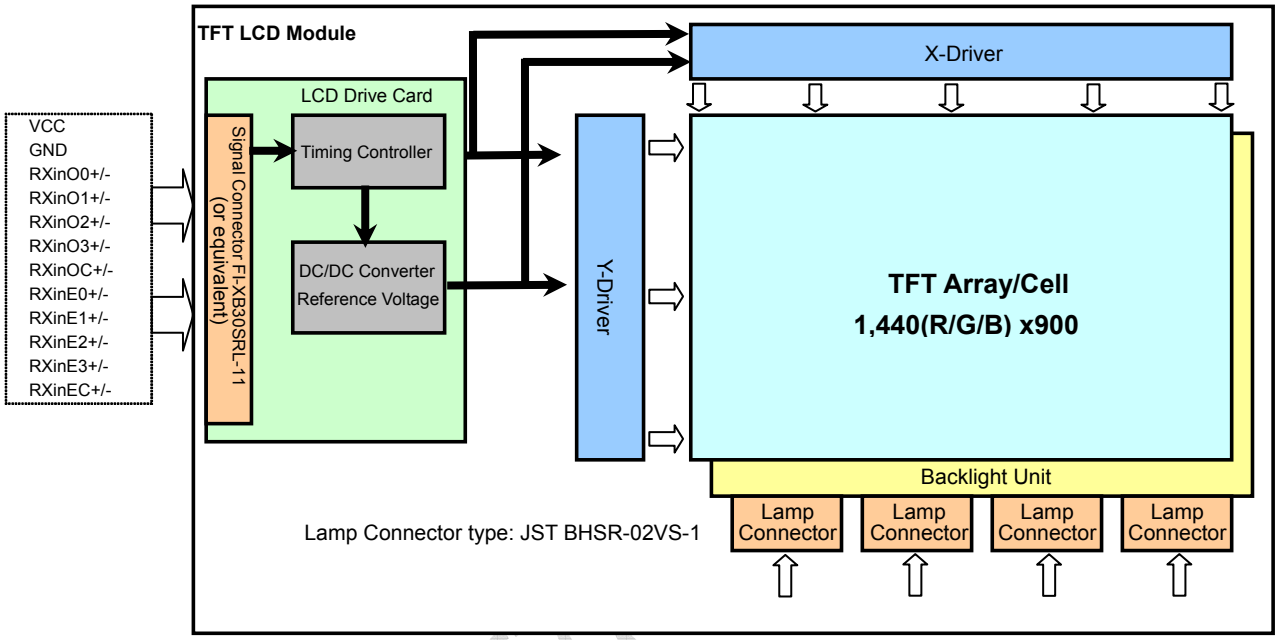
Figure 1 shows the functional block diagram of the LCD module.

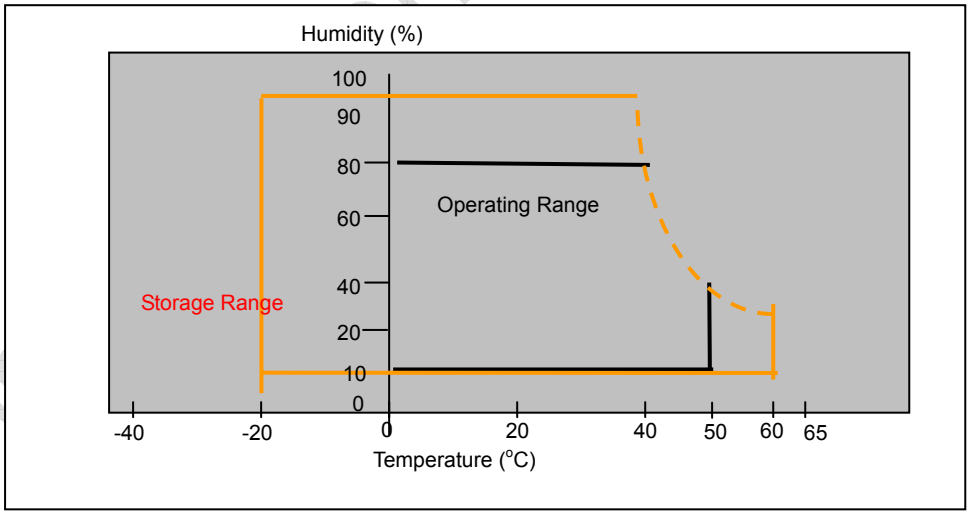
Figure 1 Block Diagram



2.0 Absolute Maximum Ratings

Item	Symbol	Min	Max	Unit	Conditions
Supply Voltage	VDD	-0.3	+6.0	V	
Input Signal		-0.3	+2.7	V	LVDS signals
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	

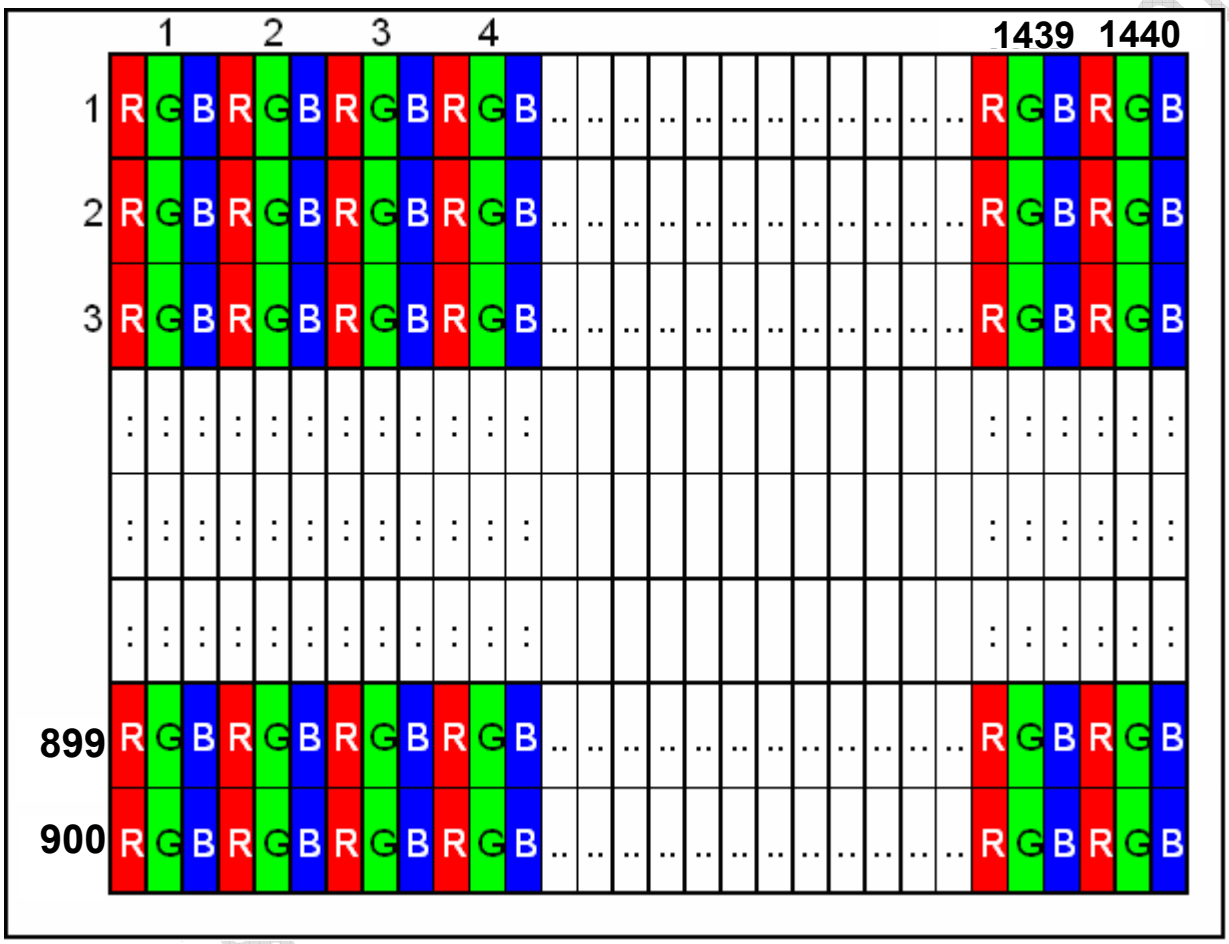
Note (1)Storage /Operating temperature. Maximum Wet-Bulb should be 39 degree C. No condensation.



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

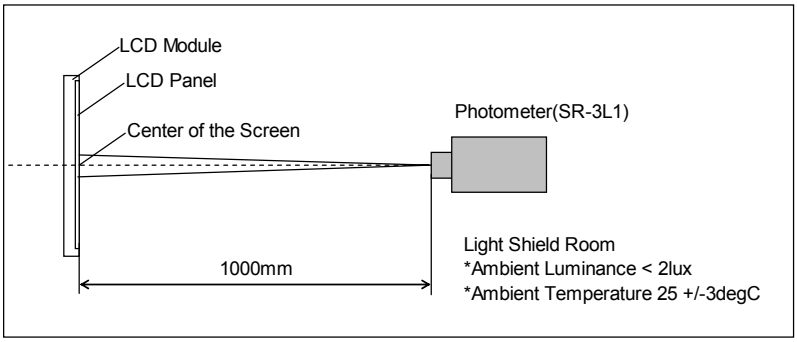
Item	Conditions	Specification			
		Min	Typ.	Max	Note
Viewing Angle [degrees]	Horizontal	140	160		A, B
K=Contrast Ratio>10	Vertical	140	160		
Contrast ratio		600	800		A, C
Response Time [ms]	Rising + Falling		5	10	A, D
Color Chromaticity	Red x	0.61	0.64	0.67	A,
(CIE1931)	Red y	0.31	0.34	0.37	A,
	Green x	0.26	0.29	0.32	A,
	Green y	0.55	0.58	0.61	A,
	Blue x	0.11	0.14	0.07	A,
	Blue y	0.03	0.06	0.09	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	250	300		Center A, E
Luminance Uniformity	ICCFL=7.0mA, 9points	--	1.3	1.4	A, F

Note:

A. Measurement Setup:

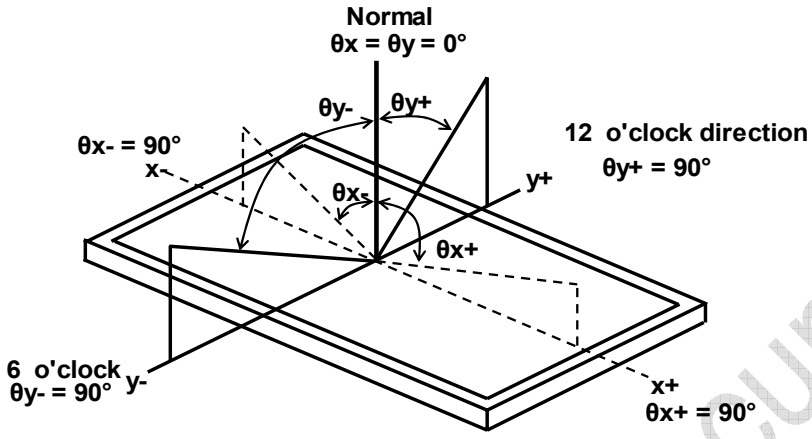
The LCD module should be stabilized at given temperature for 20 minutes to avoid abrupt temperature change during measuring. In order to stabilize the luminance, the measurement should be executed after lighting backlight for 20 minutes in a windless room.

Figure 3 Measurement Setup



B. Definition of Viewing Angle

Figure 4 Definition of Viewing Angle



C. Definition of Contrast Ratio (CR)

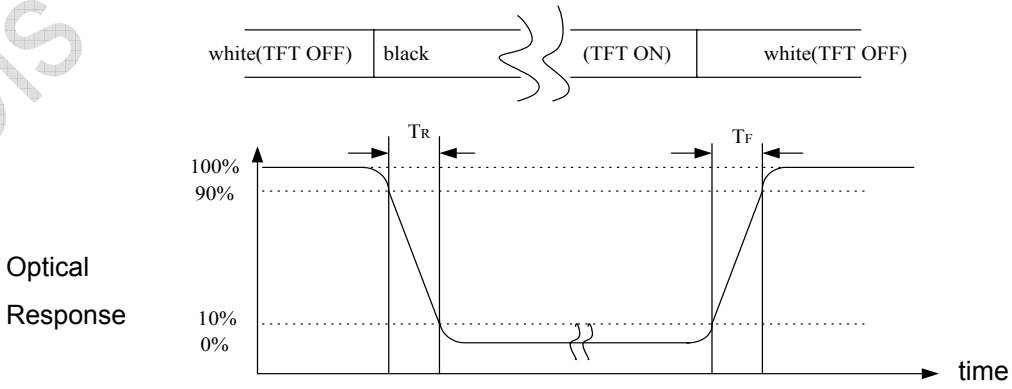
The contrast ratio can be calculated by the following expression

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

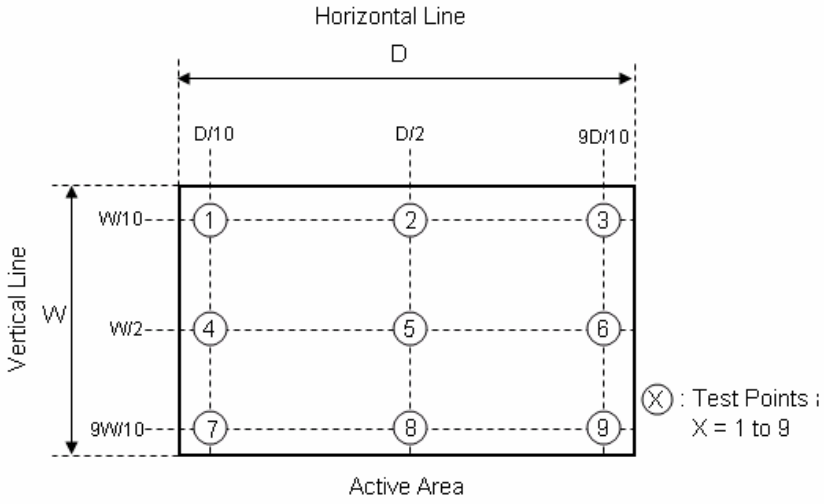
Measure the luminance of gray level 255 at center point

F. Definition of Luminance Uniformity(Variation)

Measure the luminance of gray level 255 at 9 points.

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

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)	250	300		[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	40	55	80	[kHz]	Ta=25[deg C] **(Note B)**
VCCFLi	Inverter Ignition Voltage			2050	[Vrms]	Ta=0[deg C] **(Note C)**
				1570		Ta=25[deg C] **(Note C)**
VCCFL	CCFL Voltage	650	723	796	[Vrms]	@ ICCFL=7mA Ta=25[deg C]

Note:

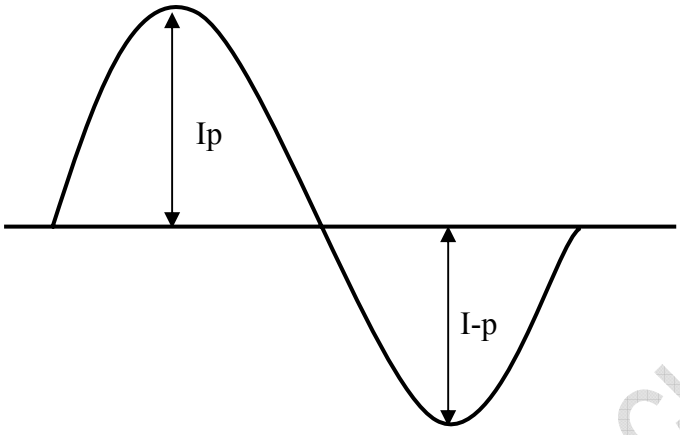
A. If it exceeds MIN/MAX values, then "CCFL Life", "ON/OFF Cycle", and "SAFETY" will not be guaranteed.

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.

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 = $|I_p - I_{-p}| / I_{rms}$ x 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	JAE (or equivalent)
Type / Part Number	JAE FI-XB30SRL-HF11 (or equivalent)
Mating Receptacle/Part Number	JAE FI-X30H(L), JAE FI-X30C*(L), JAE FI-X30M*

Table 6 Signal pin assignment

Pin #	Signal Name	Description	Remarks
1	RXinO0-	LVDS differential data input	
2	RXinO0+	LVDS differential data input	
3	RXinO1-	LVDS differential data input	
4	RXinO1+	LVDS differential data input	
5	RXinO2-	LVDS differential data input	
6	RXinO2+	LVDS differential data input	
7	GND	Ground	
8	RXOC-	LVDS differential data input	
9	RXOC+	LVDS differential data input	
10	RXinO3-	LVDS differential data input	
11	RXinO3+	LVDS differential data input	
12	RXinE0-	LVDS differential data input	
13	RXinE0+	LVDS differential data input	
14	GND	Ground	
15	RXinE1-	LVDS differential data input	
16	RXinE1+	LVDS differential data input	
17	GND	Ground	
18	RXinE2-	LVDS differential data input	
19	RXinE2+	LVDS differential data input	
20	RXEC-	LVDS differential data input	
21	RXEC+	LVDS differential data input	
22	RXinE3-	LVDS differential data input	
23	RXinE3+	LVDS differential data input	
24	GND	Ground	
25	GND	Ground	
26	NC	Reserved for LCD manufacturer.	
27	GND	Ground	

28	VCC	Power Supply	
29	VCC	Power Supply	
30	VCC	Power Supply	

All input signals shall be low or Hi-Z state when VDD 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	40.8	44.5	55.6	MHz		
Input Data Skew Margin	Trskm	-850		+850	ps	Fc=44.5MHz, |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

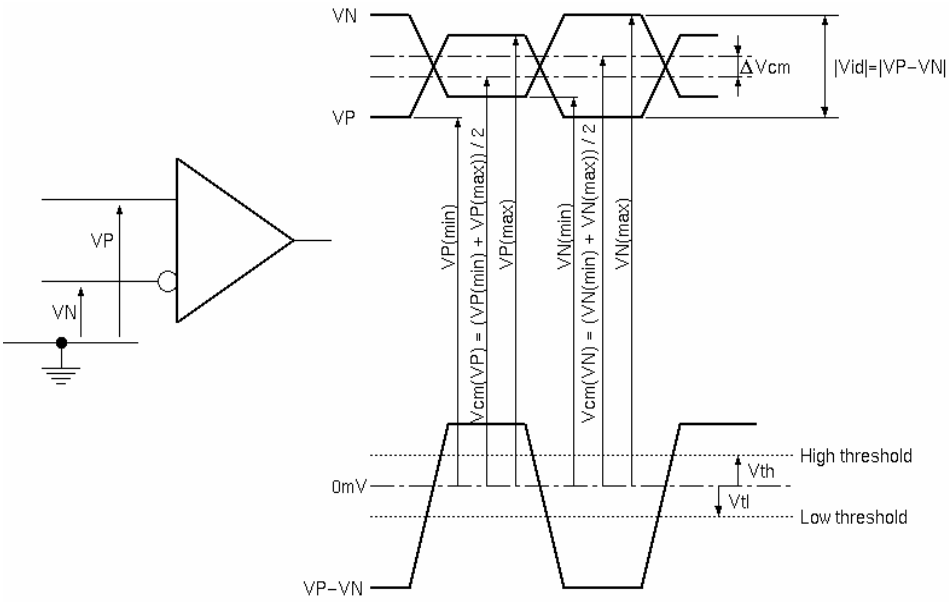


Figure 9 Measurement System

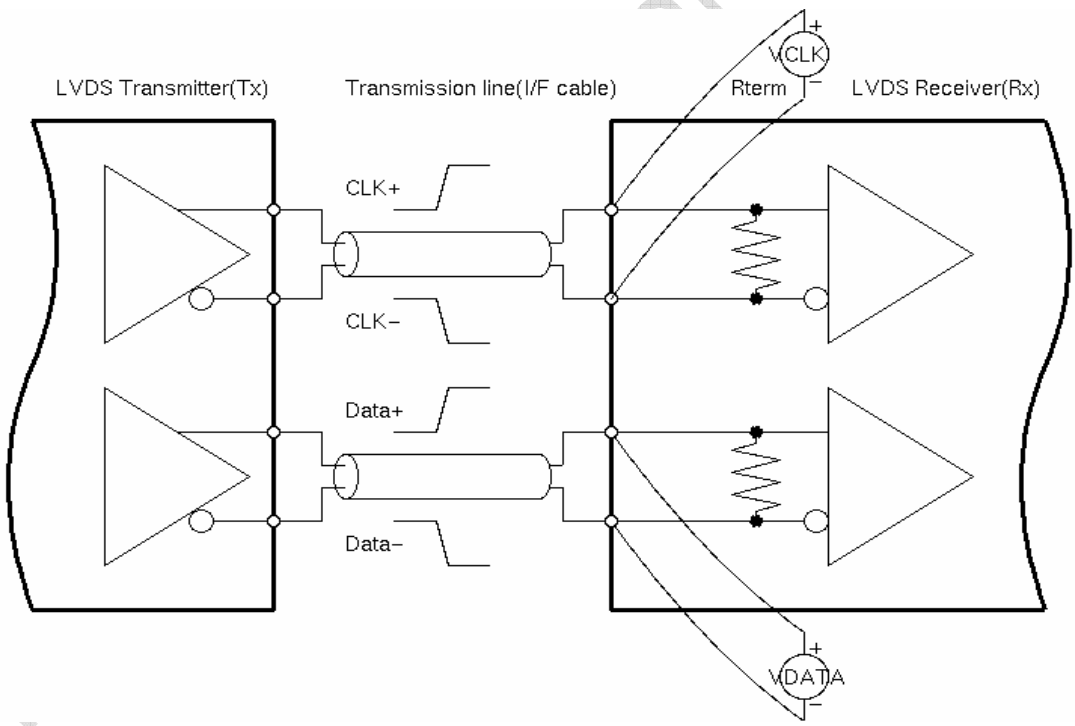


Figure 10 Data mapping

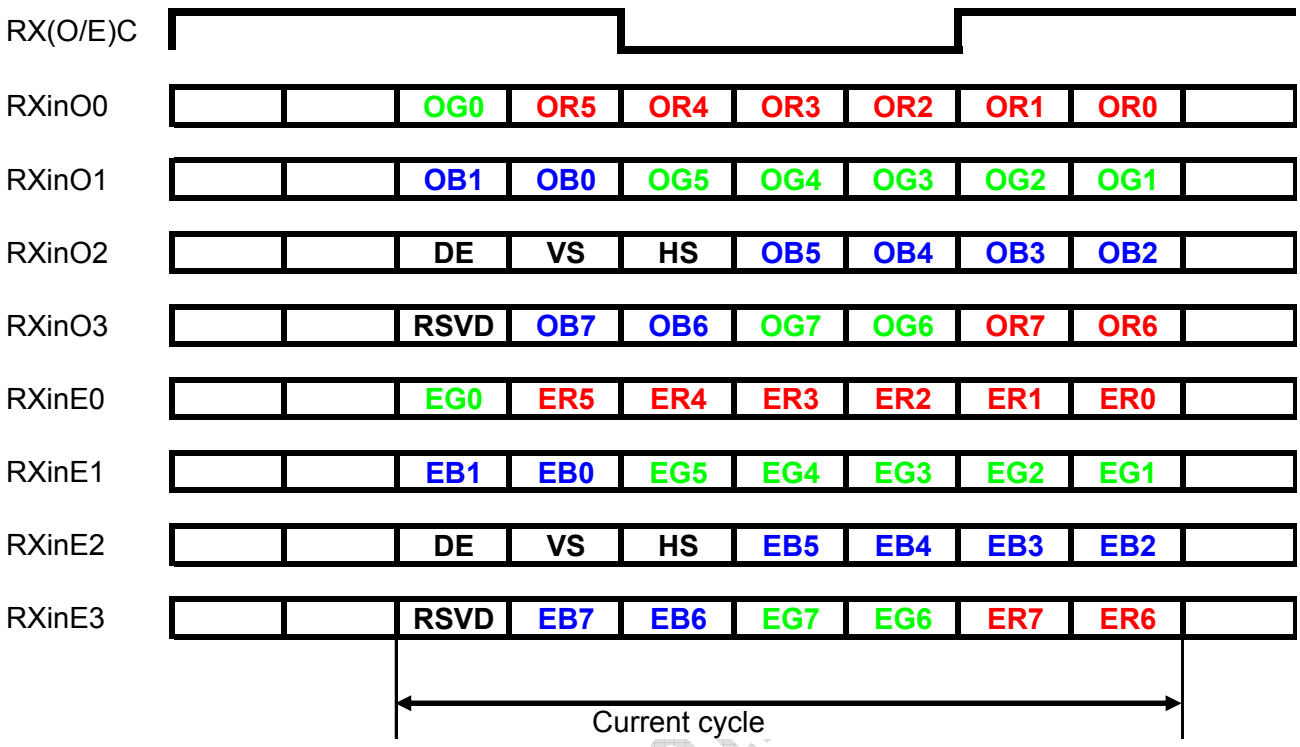
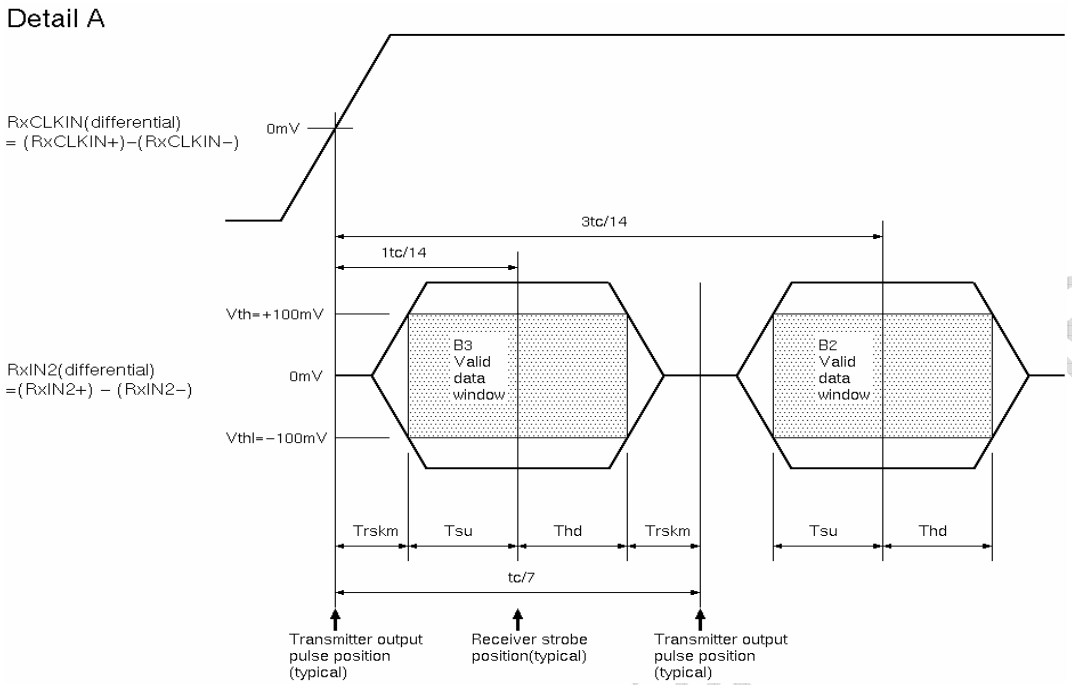


Figure 11 Timing Definition

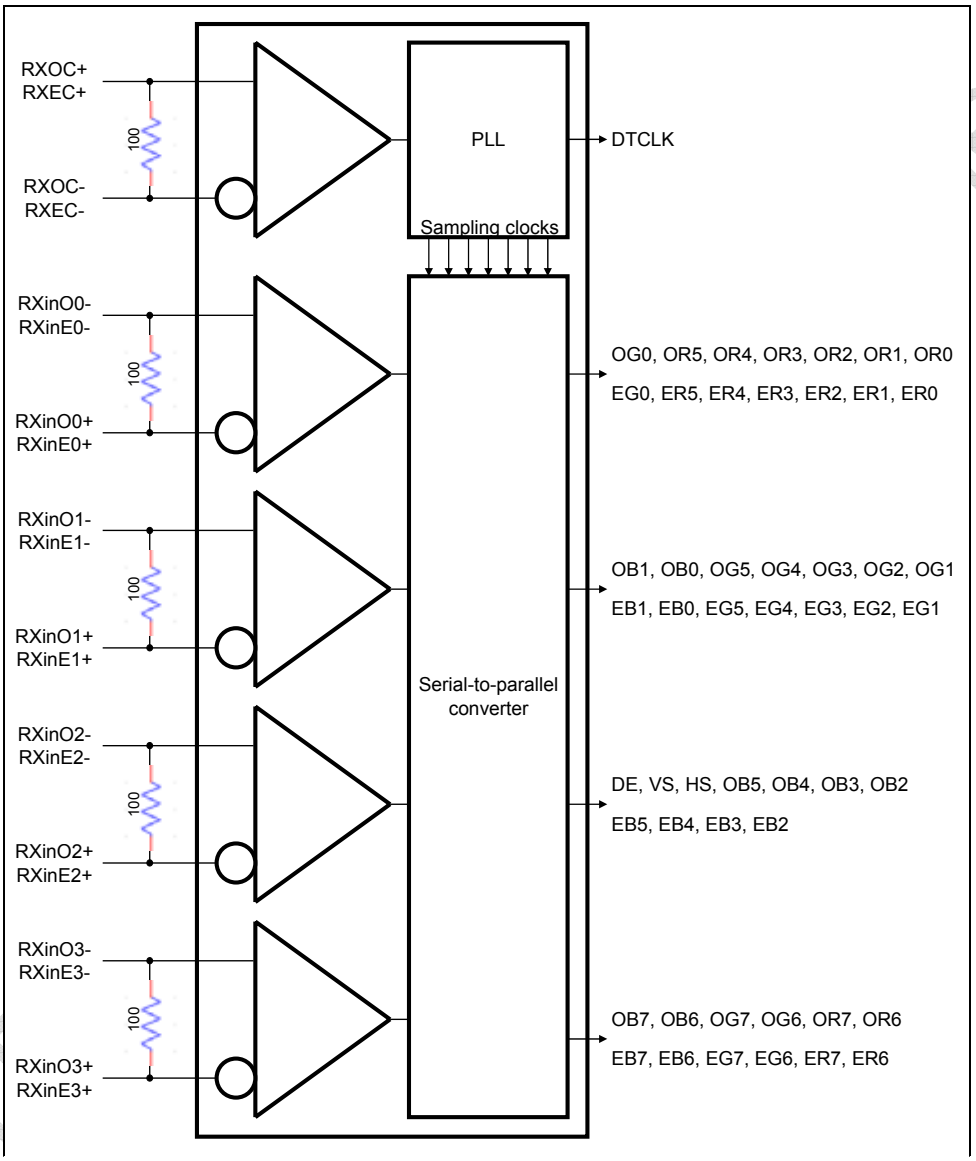


Note: Tsu and Thd is internal data sampling window of receiver. Trskm is the system skew margin; i.e., the sum of cable skew, source clock jitter, and other inter-symbol interference, shall be less than Trskm.

6.2.2 LVDS Receiver Internal Circuit

Figure 12 LVDS Receiver Internal Circuit shows the internal block diagram of the LVDS receiver. This LCD module equips termination resistors for LVDS link.

Figure 12 LVDS Receiver Internal Circuit



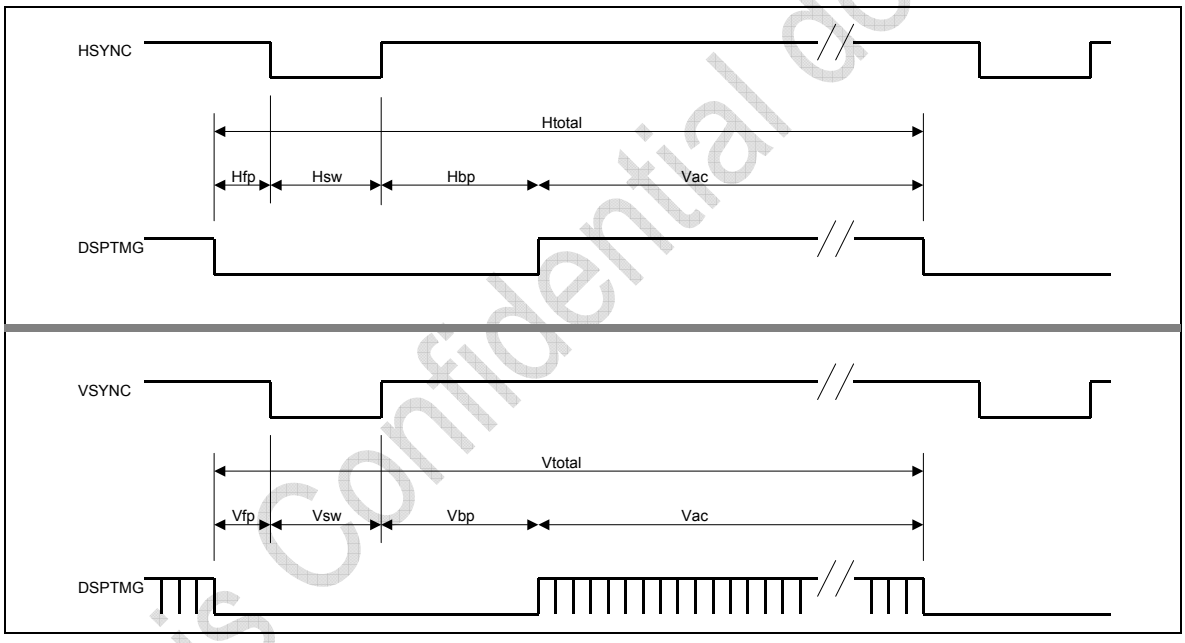
7.0 Interface Timings

7.1 Timing Characteristics

Table 9 Interface timings

Parameter	Symbol	Unit	min	typ	Max
LVDS Clock Frequency(dual)	Fdck	MHz	40.8	44.5	55.6
H Total Time	Htotal	clocks	760	800	1398
H Active Time	Hac	clocks	720	720	720
V Total Time	Vtotal	lines	905	926	1599
V Active Time	Vac	lines	900	900	900
Frame Rate	Vsync	Hz	55.0	60.0	75.0

Figure 13 Timing Characteristics



8.0 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		0.50		[A]	All black pattern, 60Hz
				0.95	[A]	Max pattern, 75Hz
PDD	VDD Power		2.5		[W]	All black pattern, 60Hz
				4.3	[W]	Max pattern, 75Hz
Irush	Rush Current			4.5	[A]	
VDDrp	Allowable Logic/LCD Drive Ripple Voltage			100	[mVp-p]	

9.0 Power ON/OFF sequence

VDD power, interface signals, and lamp on/off sequence are shown in Figure **14**.Signals shall be Hi-Z state or low level when VDD is off.

Figure 14 Power sequence

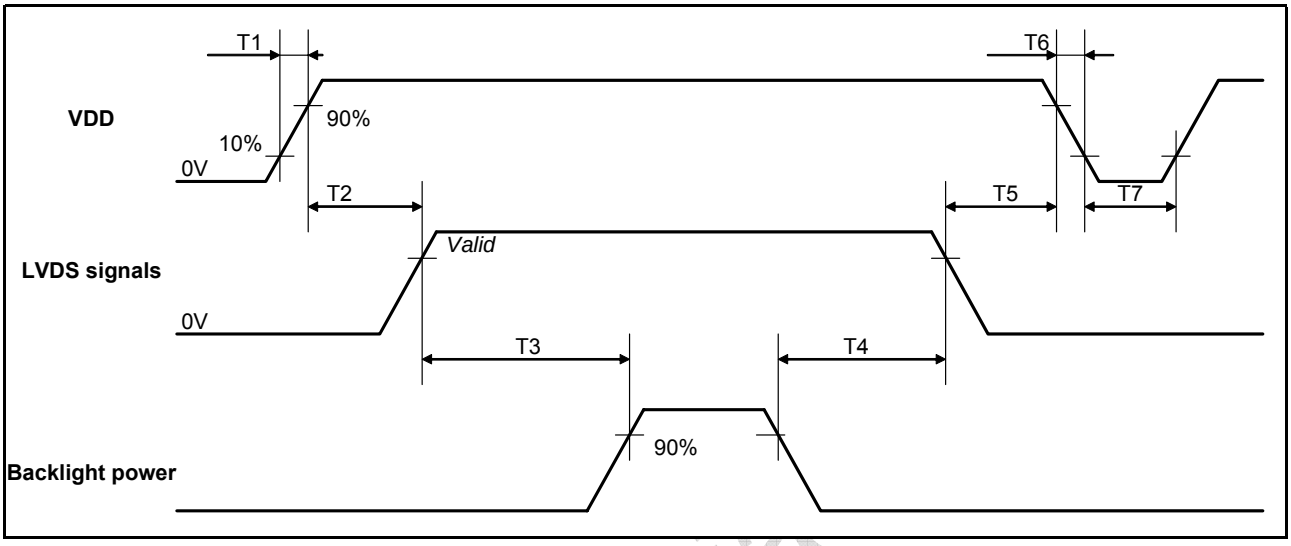


Table 11 Power Sequencing Requirements

Parameter	Symbol	Unit	min	typ	max
VDD Rise Time	T1	ms	0.5	-	10
VDD Good to Signal Valid	T2	ms	0	-	10
Signal Valid to Backlight On	T3	ms	200	-	-
Backlight Off to Signal Disable	T4	ms	100	-	-
Signal Disable to Power Down	T5	ms	0	-	50
VDD Fall Time	T6	ms	-	-	10
Power Off	T7	ms	1000	-	-

10.0 Mechanical Characteristics

Figure 15 Reference outline drawing (Front side)

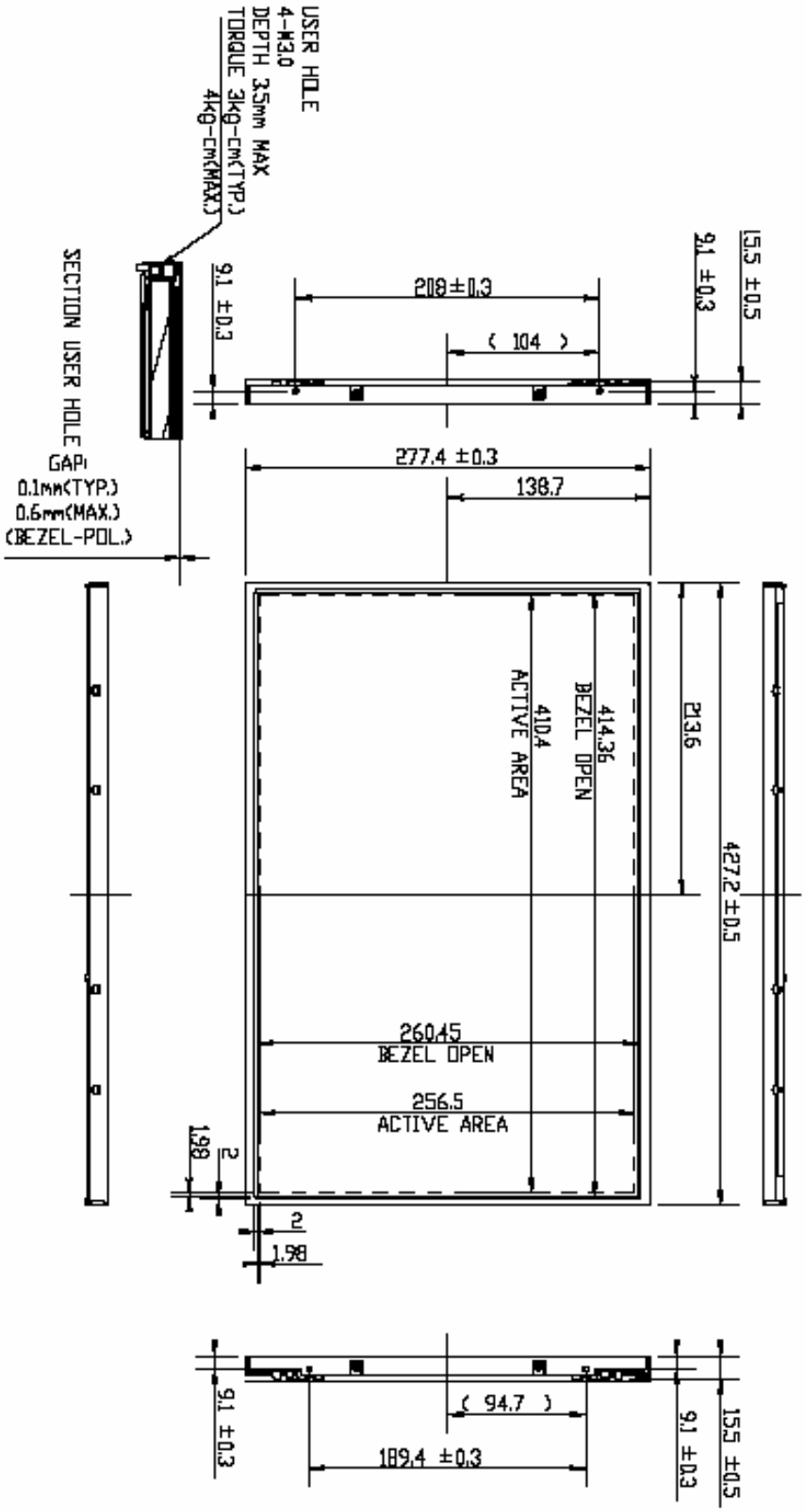
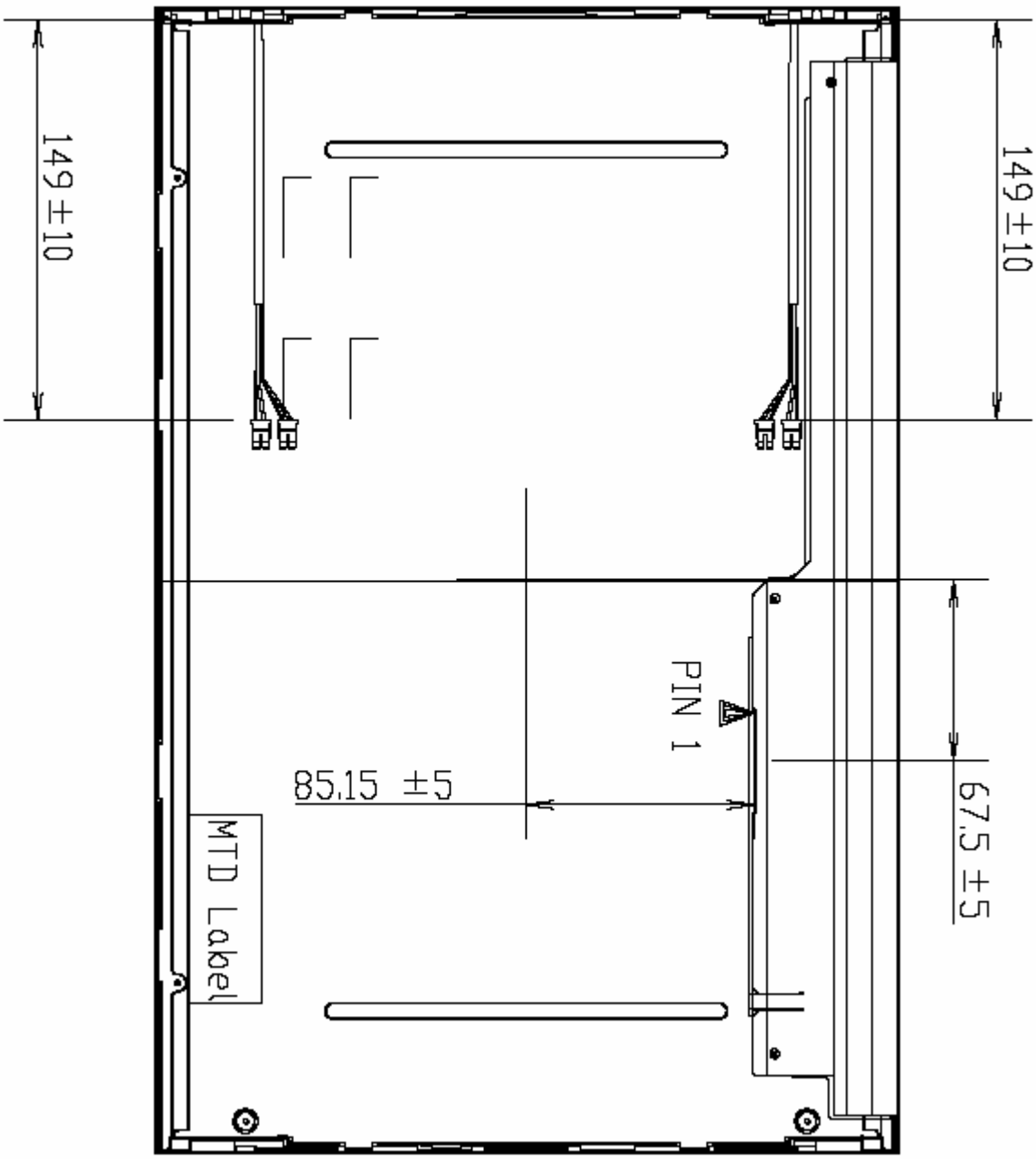


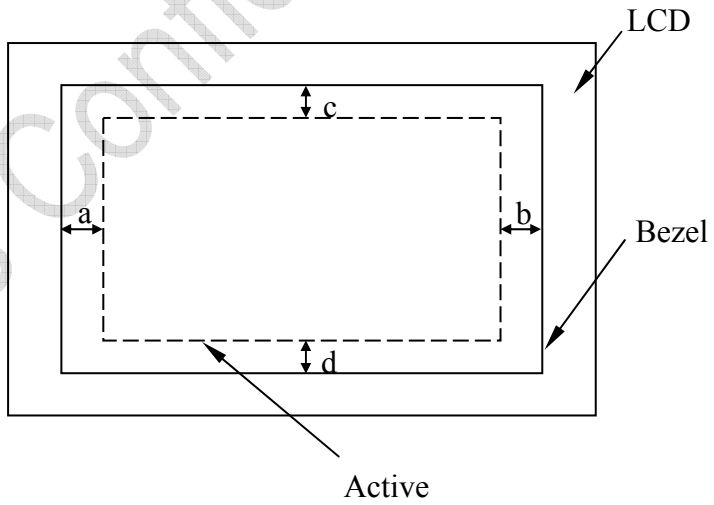
Figure 16 Reference outline drawing (Back side)



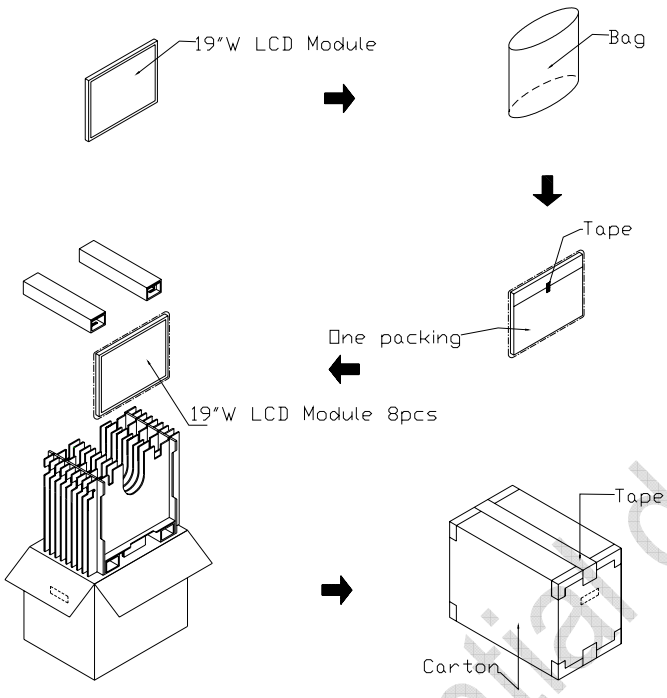
10.1 Dimension Specifications

Table 12 Module Dimension Specifications

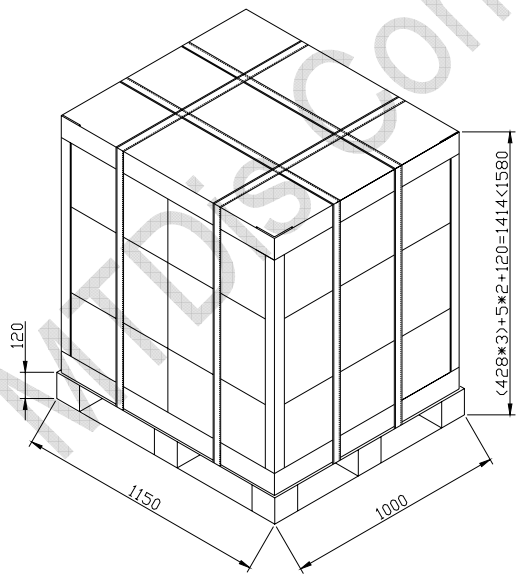
Width [mm]		427.2 ± 0.5
Height [mm]		277.4 ± 0.5
Thickness [mm]		Typical 15,5, Max 16.0
Bezel Opening [mm]	X	414.36 ± 0.3
	Y	260.45 ± 0.3
Mounting Hole [mm]	UR	94.7 ± 0.3
	LR	189.4 ± 0.3
	UL	104.0 ± 0.3
	LL	208.0 ± 0.3
Connector position from screen center [mm]	X	146.1 ± 1
	Y	53.55 ± 1
CCFL harness length [mm]		149 ± 10
Weight [g]		2,500 Max.
BM：｜a-b｜ & ｜c-d｜		< 1.0mm



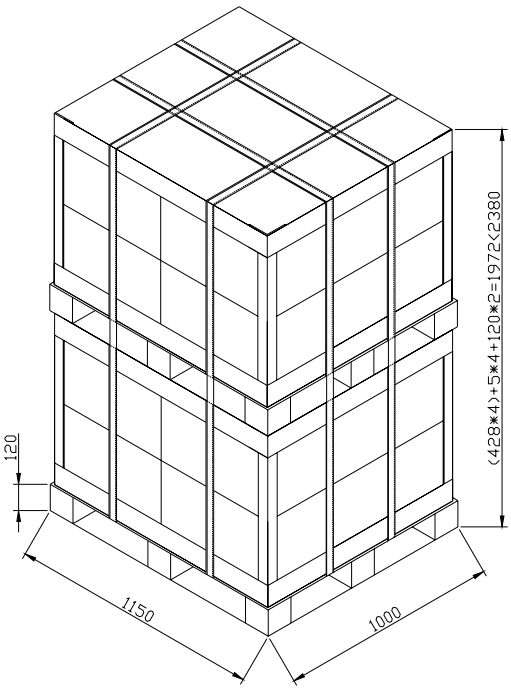
11.0 PACKAGE SPECIFICATION



Air freight (144PCS)



Ocean shipping (192PCS)



12.0 LOT MARK

12.1 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

13.0 GENERAL PRECAUTION

13.1 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.

13.2 Disassembling or Modification

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.

13.3 Breakage of LCD Panel

13.3.1 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.

13.3.2 If liquid crystal contacts mouth or eyes, rinse out with water immediately.

13.3.3 If liquid crystal contacts skin or cloths, wash it off immediately with alcohol and Rinse thoroughly with water.

13.3.4 Handle carefully with chips of glass that may cause injury, when the glass is Broken

13.4 Electric Shock

13.4.1 Disconnect power supply before handling LCD module.

13.4.2 Do not pull or fold the CCFL cable.

13.4.3 Do not touch the parts inside LCD modules and the fluorescent lamp's connector Or cables in order to prevent electric shock

13.5 Absolute Maximum Ratings and Power Protection Circuit

13.5.1 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.

13.5.2 Please do not leave LCD module in the environment of high humidity and high temperature for a long time.

13.5.3 It's recommended employing protection circuit for power supply.

13.6 Operation

13.6.1 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.

13.6.2 When the surface is dusty, please wipe gently with absorbent cotton or other soft Material

13.6.3 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

13.6.4 When cleaning the adhesives, please use absorbent cotton wetted with a little Petroleum benzene or other adequate solvent

13.7 Mechanism

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

13.8 Static Electricity

13.8.1 Protection film must remove very slowly from the surface of LCD module to

Prevent from electrostatic occurrence.

13.8.2 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

13.8.3 Persons who handle the module should be grounded through adequate methods.

13.9 Strong Light Exposure

The module shall not be exposed under strong light such as direct sunlight. Otherwise, Display characteristics may be changed.

13.10 Disposal

When disposing LCD module, obey the local environmental regulations.

14.0 Inspection Standards for LCD Modules

14.1 Description

These inspection standards shall be applied to LCD Module supplied by Mindtech Display Co.,Ltd.

14.2 The environmental condition of inspection

The environmental condition and visual inspection shall be conducted as below

(1) Ambient temperature:15~25°C

(2) Humidity:25~75%RH

(3) External appearance inspection shall be conducted by using a single 20W fluorescent lamp or equivalent illumination.

(4) Panel visual inspection on the operation condition for cosmetic shall be conducted at the distance 35cm or more between the LCD module and eyes of inspector.And,the viewing angle shall be 90 degree to the front surface of display panel

Ambient Illumination:400~600 Lux for external appearance inspection

Ambient Illumination:100~200 Lux for light on inspection

14.3 Method of sampling inspection

Unless defined in the other document, the sampling method shall be in accordance with MIL-STD-105E.

(1)Lot size: quantity of per delivery for inspection per model

(2)Sampling type: Normal inspection, single sampling

(3)Sampling table: MIL-STD-105E

14.4 Classification of defects

Defects are classified two types, major defect according to the defect. And, the definition of defects is classified as below.

(1)Major defect

Any defect may result in functional failure, or reduce the usability of product for its purpose. For example, electrical failure, deformation and etc..

(2)Minor defect

A defect that is not to reduce the usability of product for its intended purpose and un-uniformity, dot defect and etc..

The criteria on major and/or minor judgement will be according with the classification of defects.

14.5 Acceptable quality level (AQL)

AQL means that the quality level of product is acceptable for shipment, and the AQL shall satisfy with customer's quality request.

The AQL (%) for major or minor defect are expressed as below respectively.

(1)Major defect::0.4%

(2)Minor defect::0.65%

14.6 Inspection Criteria

14.6.1 Definition of dot defect

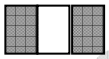
a) The definition of dot :The size of a defective dot over 1/2 of whole dot is regarded as one defective dot

b) Bright dot::Dots appear bright and unchanged in size in which LCD panel is displaying under black pattern.

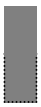
c) Dark dot: Dots appear dark and unchanged in size in which LCD panel is displaying under pure red, green, blue picture.

d) 2 dot adjacent=1pair=2dots

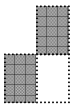
2 dot adjacent



2 dot adjacent



2 dot adjacent(vertical)



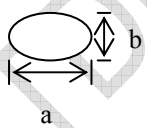
2 dot adjacent(slant)

14.6.2 Display Inspection criteria

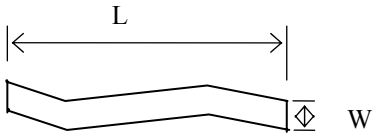
Item		Acceptable count
Bright dot	Random	N≦3
	2 dots adjacent (pair)	N≦0
	3 dots adjacent or more	N≦0
Dark dot	Random	N≦4
	2 dots adjacent (pair)	N≦1
	3 dots adjacent or more	N≦0
Distance	Minimum Distance Between Bright dots	L≧15mm
	Minimum Distance Between Dark dots	L≧10mm
Total bright and dark dot		N≦5
Display failure (V-line/H-line/Cross line etc.)		Not allowable
Mura	Judge by limit sample or not visible through ND filter	6%

14.6.3 Appearance inspection criteria

Item	Standards
Foreign Black / White Spots	0.15<D≦0.5mm, N≦3
Foreign Lint	0.1<W≦0.2mm, 0.3<L≦5mm , N≦3
Polarizer Scratches	0.05<W≦0.1mm, 0.3<L≦5.0 mm,N≦3
Dent/Air Bubble	0.15<D≦0.5mm N≦3



D=(a+b)/2



W: width, L：length

14.6.4 External appearance inspection criteria

Item	Contents	
Screw	Parts mounting, incomplete assembly, deformation, oxidized, crooked or rusty is not permitted.	
CCFT cable	Cable not continuous、Break-off 、Connector Burn-off /Break-off	
Metal frame (Bezel)	Scratch	*Noticeable scratch and exfoliation coating are not permitted. *The oxidized metal is not permitted.
	Incomplete assembly is not permitted.	
Backlight	Scratch	The scratch which may causes a problem in practical use is not permitted.
	Break-off	Breaking off is not permitted.
	Crack	The crack is not permitted.
Stain on Polarizer	The stain which can't be wiped off is not permitted.	
Tape/Label	Incorrect position, missed label is not permitted.	
Connector	Oxidized/rusty connector is not permitted.	
Outline size	Spec. out is not permitted.	

14.6.5 . Classification of defects

Inspection Item	Criteria and Description	Defect type
Vertical line	Signal input, vertical line off or abnormal V-line appears	Major
Horizontal line	Signal input,horizontal line off or abnormal H-line appears	Major
Cross line	Patern signal input,a correct display is not obtained	Major
No display	Signal input,display is dead	Major
Abnormal display	Pattern signal input,a correct display is not obtained	Major
Bezel finger	Bezel finger is missed or not bent	Major
Outline size	Length, Wide, High,CCFT cable length	Major
Dots defect	Exceed specified standards	Minor
Light leakage	Visible light leakage appears around the edges of screen	Minor
Foreign material	Exceed specified standards	Minor
External Appearance	A appearance defect that do not affect function or performance	Minor
Polarizer bubble	Exceed specified standards	Minor