

Product Specification

() Preliminary Specification
(V) Final Specification

Module	23.8" Color TFT-LCD
Model Name	HL238WLB-B-1000
Base Panel	MV238FHM-N10

Customer	Date
_____	_____
Approved by	
_____	_____

Note: This Specification is subject to change without notice.

Approved by	Date
Klaus Kim	2019.07.03
Prepared by	
TED PARK	2019.07.03

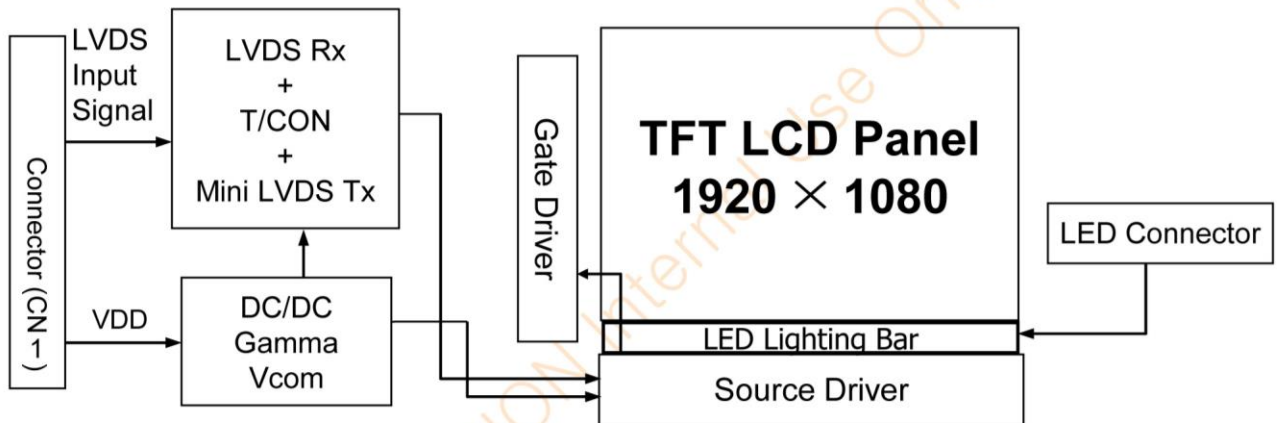
Contents

No.	Item
1.0	General Description
2.0	Absolute Maximum Ratings
3.0	Electrical Specifications
4.0	Optical Specifications
5.0	Interface Connection
6.0	Signal Timing Specifications
7.0	Signal Timing Waveforms of Interface Sigal
8.0	Input Signals, Display Colors & Gray Scale of Colors
9.0	Power Sequence
10.0	Mechanical Characteristics
11.0	Reliability Test
12.0	Handling & Cautions
13.0	Product Seial Number
14.0	Packing
15.0	Appendix

1.0 GENERAL DESCRIPTION

1.1 Introduction

MV238FHM-N10 is a color active matrix TFT LCD module using amorphous silicon TFT's (Thin Film Transistors) as an active switching devices. This module has a 23.8 inch diagonally measured active area with FHD resolutions (1920 horizontal by 1080 vertical pixel array). Each pixel is divided into RED, GREEN, BLUE dots which are arranged in vertical stripe and this module can display 16.7M colors. The TFT-LCD panel used for this module is adapted for a low reflection and higher color type.



1.2 Features

- Reverse Type
- LVDS Interface with 2 pixel / clock
- High-speed response
- 6-bit (Hi-FRC) color depth, display 16.7M colors
- Incorporated edge type back-light (LED)
- Compatible with NTSC72%
- High luminance and contrast ratio, low reflection and wide viewing angle
- DE (Data Enable) only
- RoHS/Halogen Free
- TCO 7.0, ES 7.0 compliant
- Gamma Correction

1.3 Application

- Desktop Type of PC & Workstation Use
- Slim-Size Display for Stand-alone Monitor
- Display Terminals for Control System
- Monitors for Process Controller

1.4 General Specification

The followings are general specifications at the model MV238FHM-N10.

<Table 1. General Specifications>

Parameter	Specification	Unit	Remarks
Active area	527.04 (H) × 296.46(V)	mm	
Number of pixels	1920(H) × 1080(V)	pixels	
Pixel pitch	0.2745(H) × 0.2745(V)	mm	
Pixel arrangement	RGB Vertical stripe		
Display colors	16.7M	colors	
Display mode	Normally Black		
Dimensional outline	543.0 (H) × 317.4(V) × 11.1(D) typ.	mm	
Weight	2390 (Typ.)	g	
Surface Treatment	Haze 25%, 3H		
Back-light	Lower edge side, 1-LED Lighting Bar type		Note 1
Power Consumption	P _D : 3.1W		
	P _{BL} : 34.56W		Note 2
	P _{total} : 37.66		

Notes : 1. LED Lighting Bar (3*input pins)

2. P_{LED}=Input pins* VPIN×IPIN

2.0 ABSOLUTE MAXIMUM RATINGS

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

< Table 2. Absolute Maximum Ratings >

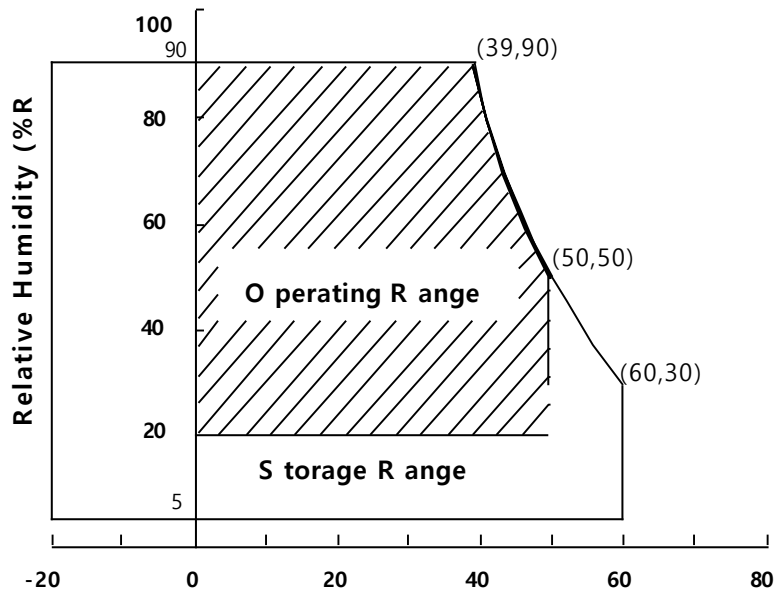
[VSS=GND=0V]

Parameter	Symbol	Min.	Max.	Unit	Remarks
Power Supply Voltage	V _{DD}	-0.3	6.0	V	Ta = 25 °C
Logic Supply Voltage	V _{IN}	VSS-0.3	V _{DD} +0.3	V	
LED Light Bar Current Per Input Pin	I _{PIN}	-	95	mA	Typ: 80mA
LED Light Bar Voltage Per Input Pin	V _{PIN}	-	54.4	V	
Operating Temperature	T _{OP}	0	+50	°C	Note 1)
Storage Temperature	T _{ST}	-20	+60	°C	Note 1)
LCM Surface Temperature (Operation)	T _{surface}	0	+65	°C	Note 2)

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

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

2) LCM Surface Temperature should be Min. 0°C and Max. 65°C under the VLCD=5.0V , fV=60Hz, 25°C ambient Temp. No humidity control and LED string current is typical Value.



3.0 ELECTRICAL SPECIFICATIONS

3.1 Electrical Specifications

< Table 3. Electrical specifications >

[Ta = 25 ± 2 °C]

Parameter		Min.	Typ.	Max.	Unit	Remarks
Power Supply Voltage	V _{DD}	4.5	5.0	5.5	V	Note 1
Power Supply Current	I _{DD}	-	620	1500	mA	
In-Rush Current	I _{RUSH}	-	2.0	3.0	A	Note 2
Permissible Input Ripple Voltage	V _{RF}	-	-	400	mV	V _{DD} = 5.0V
High Level Differential Input Threshold Voltage	V _{IH}	-	-	+100	mV	
Low Level Differential Input Threshold Voltage	V _{IL}	-100	-	-	mV	
Differential input voltage	V _{ID}	100	-	600	mV	
Differential input common mode voltage	V _{cm}	1.0	1.2	1.5		V _{IH} =100mV, V _{IL} =-100mV
Power Consumption	P _d	-	3.1		W	
	P _{BL}	-	34.56		W	Note 3
	P _{total}	-	37.66		W	

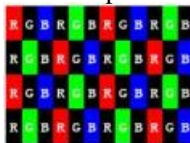
Notes: 1. The supply voltage is measured and specified at the interface connector of LCM.

The current draw and power consumption specified is for VDD=5.0V, Frame rate=75Hz

Clock frequency = 92.9 MHz. Test Pattern of power supply current

a) Typ : Color Test

b) Max : Skip Subpixel255



2. Duration of rush current is about 2 ms and rising time of VDD is 520 μs ± 20 %

3. Calculated value for reference (Input pins*VPIN ×IPIN) excluding inverter loss.

3.2 Backlight Unit

< Table 4. LED Backlight Unit >

Parameter	Symbol	Values			Unit	Notes
		Min.	Typ.	Max.		
LED String Current	Is		90		mA	1, 2, 5
LED String Voltage	Vs		48		V	1, 5
Power Consumption	PBar		34.56		Watt	1, 2, 4
LED Life Time	LED_LT		50,000		Hrs	3

Notes) The LED Bar consists of 64 LED packages, 8 strings (parallel) x 8 packages (serial) x 1 LED Bar

LED driver design guide

: The design of the LED driver must have specifications for the LED in LCD Assembly.

The performance of the LED in LCM, for example life time or brightness, is extremely influenced by the characteristics of the LED driver.

So all the parameters of an LED driver should be carefully designed and output current should be Constant current control.

Please control feedback current of each string individually to compensate the current variation among the strings of LEDs.

When you design or order the LED driver, please make sure unwanted lighting caused by the mismatch of the LED and the LED driver (no lighting, flicker, etc) never occurs.

When you confirm it, the LCD module should be operated in the same condition as installed in your instrument.

1. The specified values are for a single LED bar.
2. The specified current is defined as the input current for a single LED string with 100% duty cycle.
3. The specified voltage is input LED string and Bar voltage at typical Current 100% duty current.
4. The LED life time is defined as the time when brightness of LED packages become 50% or less than the initial value under the conditions at $T_a = 25 \pm 2^\circ\text{C}$ and LED string current is typical value.
5. The power consumption shown above does not include loss of external driver.
The typical power consumption is calculated as $P_{\text{Bar}} = V_s(\text{Typ.}) \times I_s(\text{Typ.}) \times \text{No. of strings}$.
The maximum power consumption is calculated as $P_{\text{Bar}} = V_s(\text{Max.}) \times I_s(\text{Typ.}) \times \text{No. of strings}$.
6. LED operating conditions are must not exceed Max. ratings.

Product Specification

- LED Driver specification(DW1235HB)

Output Characteristics

ITEM	CONDITION	MIN	TYP	MAX	UNIT
INPUT VOLTAGE	-	10.8	12	13.2	V
INPUT CURRENT	V _{in} =12.0V, PWM=100%	-	-	2	A

Control Signal

CONTROL SIGNAL	SPEC	STATUS	UNIT	REMARKS
DIM CONTROL	Duty = 100%	Brightness Max	V	PWM Dimming
	Duty = 0.75%	Brightness Min		
ON/OFF CONTROL	2.4 ~ 5.25	ON	V	
	0 ~ 0.8	OFF		
PWM	100 ~ 20K	1k	Hz	

Connector Pin Description

CN1 INPUT CONNECTOR : 20022WR-06(YEONHO)

PIN NO.	SYMBOL	REMARKS
1	BRT_ADJ	Brightness Control
2	ON/OFF	On/Off Control (5V:ON, 0V:OFF)
3,4	GND	Ground
5,6	V _{in}	DC Input Power

Product Specification

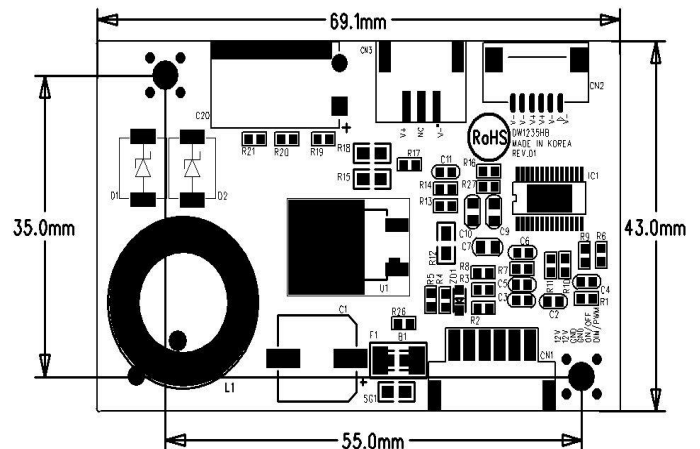
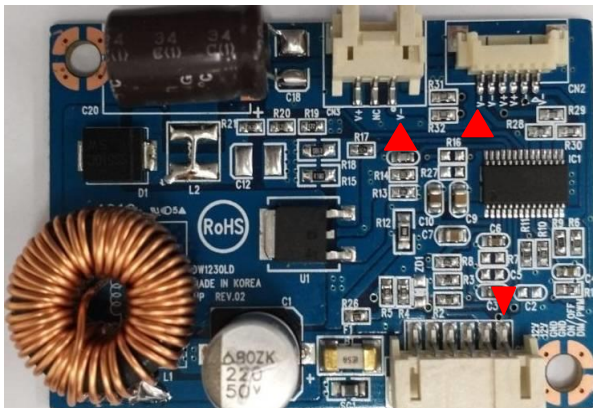
CN3 OUTPUT CONNECTOR : 20037WR-03(YEONHO)

PIN NO.	SYMBOL	REMARKS
1	Io	ILED (current out)
2	NC	Not Connection
3	Vin	VLED (voltage in)

CN2 OUTPUT CONNECTOR : 12505WR-06(YEONHO)

PIN NO.	SYMBOL	REMARKS
1	Io	ILED (current out)
2		
3	Vin	VLED (voltage in)
4		
5	Io	ILED (current out)
6		

- MECHANICAL STRUCTURE (PCB) / Mechanical Drawings



4.0 OPTICAL SPECIFICATION

4.1 Overview

The test of Optical specifications shall be measured in a dark room (ambient luminance ≤ 1 lux and temperature = $25 \pm 2^\circ\text{C}$) with the equipment of Luminance meter system (Goniometer system and TOPCONE BM-5) and test unit shall be located at an approximate distance 50cm from the LCD surface at a viewing angle of θ and Φ equal to 0° . We refer to $\theta_{\theta=0} (= \theta_3)$ as the 3 o'clock direction (the "right"), $\theta_{\theta=90} (= \theta_{12})$ as the 12 o'clock direction ("upward"), $\theta_{\theta=180} (= \theta_9)$ as the 9 o'clock direction ("left") and $\theta_{\theta=270} (= \theta_6)$ as the 6 o'clock direction ("bottom"). While scanning θ and/or Φ , the center of the measuring spot on the Display surface shall stay fixed. The measurement shall be executed after 30 minutes warm-up period. VDD shall be 5.0V +/-10% at 25°C . Optimum viewing angle direction is 6 'clock.

4.2 Optical Specifications

[VDD = 5.0V, Frame rate = 60Hz, Clock = 74.25MHz, Ta = $25 \pm 2^\circ\text{C}$]

Parameter		Symbol	Condition	Min.	Typ.	Max.	Unit	Remark
Viewing Angle range	Horizontal	Θ_3	CR > 10	85	89	-	Deg.	Note 1
		Θ_9		85	89	-	Deg.	
	Vertical	Θ_{12}		85	89	-	Deg.	
		Θ_6		85	89	-	Deg.	
Luminance Contrast ratio		CR	$\Theta = 0^\circ$ (Center) Normal Viewing Angle	3000	4000			Note 2
Luminance of White		Y_w		900	1000		cd/m ²	Note 3
White luminance uniformity		ΔY		75	80		%	Note 4
Reproduction of color	White	W_x		-0.030	+0.030	0.313	-	Note 5
		W_y	0.329			-		
	Red	R_x	0.636			-		
		R_y	0.341			-		
	Green	G_x	0.295			-		
		G_y	0.621			-		
	Blue	B_x	0.152			-		
		B_y	0.053			-		
Response Time	GTG	T_g		14	20	ms	Note 6	
Cross Talk		CT		-	-	2.0	%	Note 7

Note :

1. Viewing angle is the angle at which the contrast ratio is greater than 10. The viewing are determined for the horizontal or 3, 9 o'clock direction and the vertical or 6, 12 o'clock direction with respect to the optical axis which is normal to the LCD surface.
2. Contrast measurements shall be made at viewing angle of $\theta = 0^\circ$ and at the center of the LCD surface. Luminance shall be measured with all pixels in the view field set first to white, then to the dark (black) state. (See FIGURE 1 shown in Appendix) Luminance Contrast Ratio (CR) is defined mathematically.

$$CR = \frac{\text{Luminance when displaying a white raster}}{\text{Luminance when displaying a black raster}}$$

3. Center Luminance of white is defined as the LCD surface. Luminance shall be measured with all pixels in the view field set first to white. This measurement shall be taken at the locations shown in FIGURE 2 for a total of the measurements per display.
4. The White luminance uniformity on LCD surface is then expressed as :
 $\Delta Y = (\text{Minimum Luminance of 9points} / \text{Maximum Luminance of 9points}) * 100$
(See FIGURE 2 shown in Appendix).
5. The color chromaticity coordinates specified in Table 4. shall be calculated from the spectral data measured with all pixels first in red, green, blue and white. Measurements shall be made at the center of the panel.
6. Response time T_g is the average time required for display transition by switching the input signal as below table and is based on Frame rate $f_V = 60\text{Hz}$ to optimize.
Each time in below table is defined as Figure 3 and shall be measured by switching the input signal for "any level of gray(bright)" and "any level of gray(dark)".
(See FIGURE 3 shown in Appendix).
7. Cross-Talk of one area of the LCD surface by another shall be measured by comparing the luminance (Y_A) of a 25mm diameter area, with all display pixels set to a gray level, to the luminance (Y_B) of that same area when any adjacent area is driven dark. (See FIGURE 4 shown in Appendix).

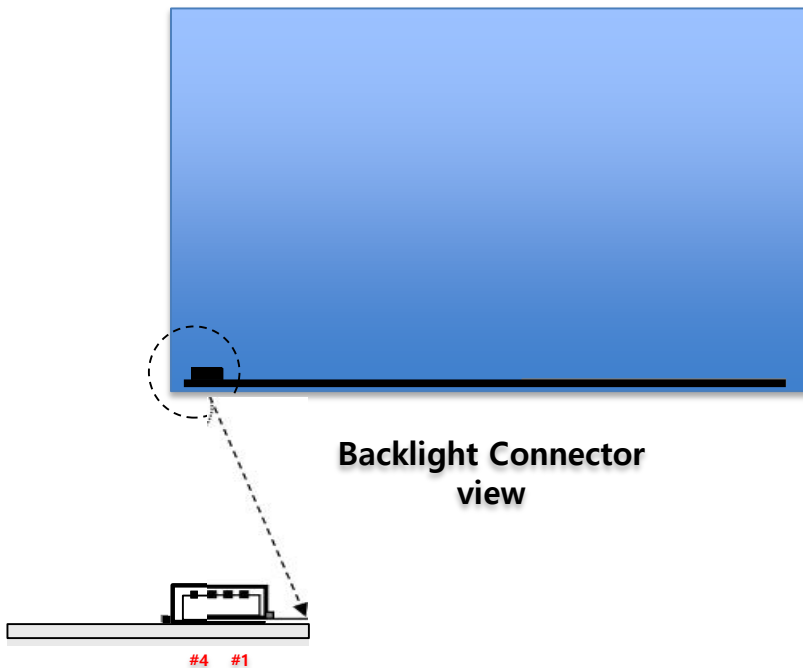
5.0 INTERFACE CONNECTION.

5.1 Electrical Interface Connection

5.1.1 LED Light Bar

The LED interface connector is a model 10035WR-H04B manufactured by YEONHO or equivalent. The mating connector is a 10035HR-H04B and Equivalent. The pin configuration for the connector is shown in the table below.

Pin	Symbol	Description	Notes
1	VLED	LED Power Supply	
2	VLED	LED Power Supply	
3	FB	Current Feedback	
4	FB	Current Feedback	



5.0 INTERFACE CONNECTION.

5.1 Electrical Interface Connection

- CN11 Module Side Connector : UJU IS100-L30R-C23or Equivalent
 User Side Connector : JAE FI-X30H or Equivalent

Pin No	Symbol	Function	Remark
1	RXO0-	Negative Transmission data of Pixel 0 (ODD)	
2	RXO0+	Positive Transmission data of Pixel 0 (ODD)	
3	RXO1-	Negative Transmission data of Pixel 1 (ODD)	
4	RXO1+	Positive Transmission data of Pixel 1 (ODD)	
5	RXO2-	Negative Transmission data of Pixel 2 (ODD)	
6	RXO2+	Positive Transmission data of Pixel 2 (ODD)	
7	BIST	3.3V BIST ON ; Ground/NC BIST OFF	
8	RXOC-	Negative Transmission Clock (ODD)	
9	RXOC+	Positive Transmission Clock (ODD)	
10	RXO3-	Negative Transmission data of Pixel 3 (ODD)	
11	RXO3+	Positive Transmission data of Pixel 3 (ODD)	
12	RXE0-	Negative Transmission data of Pixel 0 (EVEN)	
13	RXE0+	Positive Transmission data of Pixel 0 (EVEN)	
14	GND	Power Ground	
15	RXE1-	Negative Transmission data of Pixel 1 (EVEN)	
16	RXE1+	Positive Transmission data of Pixel 1 (EVEN)	
17	GNG	Power Ground	
18	RXE2-	Negative Transmission data of Pixel 2 (EVEN)	
19	RXE2+	Positive Transmission data of Pixel 2 (EVEN)	
20	RXEC-	Negative Transmission Clock (EVEN)	
21	RXEC+	Positive Transmission Clock (EVEN)	
22	RXE3-	Negative Transmission data of Pixel 3 (EVEN)	
23	RXE3+	Positive Transmission data of Pixel 3 (EVEN)	
24	GND	Power Ground	Note 1
25	SDA	SDA	
26	SCL	SCL	
27	NC	No. Connection	
28	VDD	Power Supply: +5V	
29	VDD		
30	VDD		

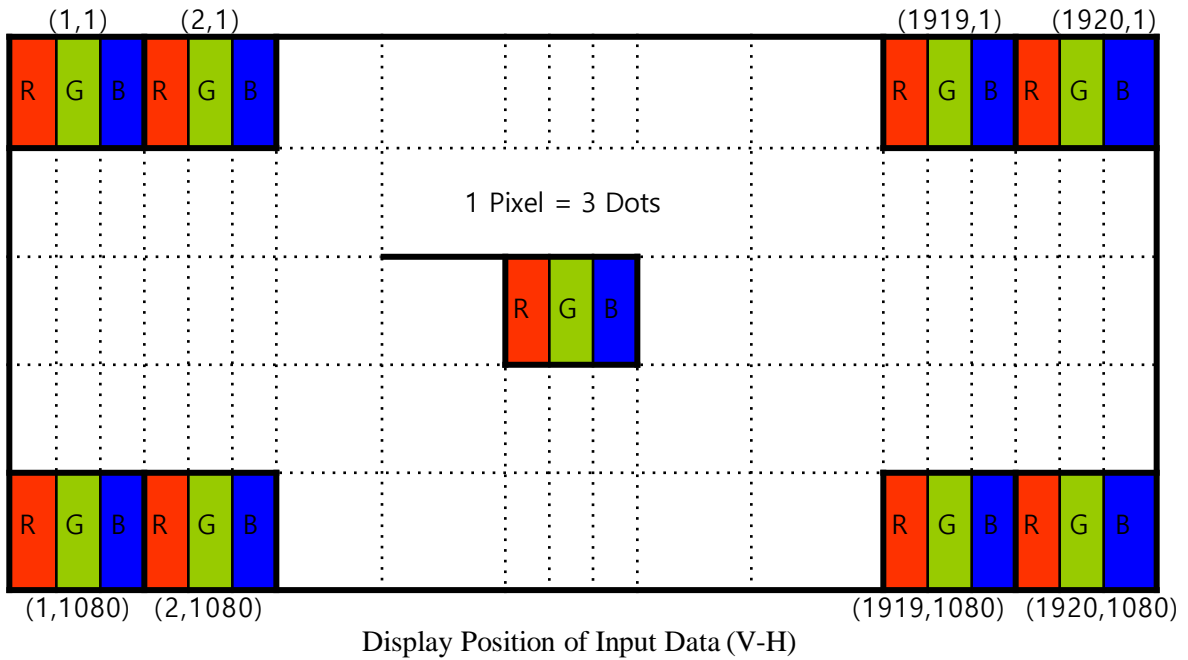
Note 1 : This pin should be connected with GND.

5.2 LVDS Interface (Tx; THC63LVDF83A or Equivalent)

5.2.1 LVDS Interface

	Input Signal	Transmitter		Interface		HR236WU1-100 (CN11)	Remark
		Pin No.	Pin No.	System (Tx)	TFT-LCD (Rx)	Pin No.	
L V D S	OR0	51	48 47	OUT0- OUT0+	RXO0- RXO0+	1 2	
	OR1	52					
	OR2	54					
	OR3	55					
	OR4	56					
	OR5	3					
	OG0	4	46 45	OUT1- OUT1+	RXO1- RXO1+	3 4	
	OG1	6					
	OG2	7					
	OG3	11					
	OG4	12					
	OG5	14					
	OB0	15	42 41	OUT2- OUT2+	RXO2- RXO2+	5 6	
	OB1	19					
	OB2	20					
	OB3	22					
	OB4	23					
	OB5	24					
	Hsync	27	40 39	CLK OUT- CLK OUT+	RXO CLK- RXO CLK+	8 9	
	Vsync	28					
	DE	30					
	MCLK	31					
	OR6	50	38 37	OUT3- OUT3+	RXO3- RXO3+	10 11	
	OR7	2					
	OG6	8					
	OG7	10					
	OB6	16					
	OB7	18					
RSVD	25						

5.3 Data Input Format



6.0 SIGNAL TIMING SPECIFICATION

6.1 The MV238FHM-N10 is operated by the DE only.

Item		Symbols	Min	Typ	Max	Unit
Clock	Frequency	1/Tc	57	74.25	97	MHz
	High Time	Tch	-	4/7Tc	-	
	Low Time	Tcl	-	4/7Tc	-	
Frame Period		Tv	1108	1126	1252	lines
			50	60	75	Hz
			20	16.7	13.3	ms
Vertical Display Period		Tvd	-	1080	-	lines
One line Scanning Period		Th	1050	1100	1150	clocks
Horizontal Display Period		Thd	960	960	960	clocks
Horizontal Frequency		Fh	56	68	90	KHz
LVDS Receiver Clock	Input data skew margin	T _{RSKM}	-300	-	+300	ps
	Input spread spectrum ratio	SSR	-3	-	+3	%
	Input modulation frequency	F _M	-	-	300	KHz

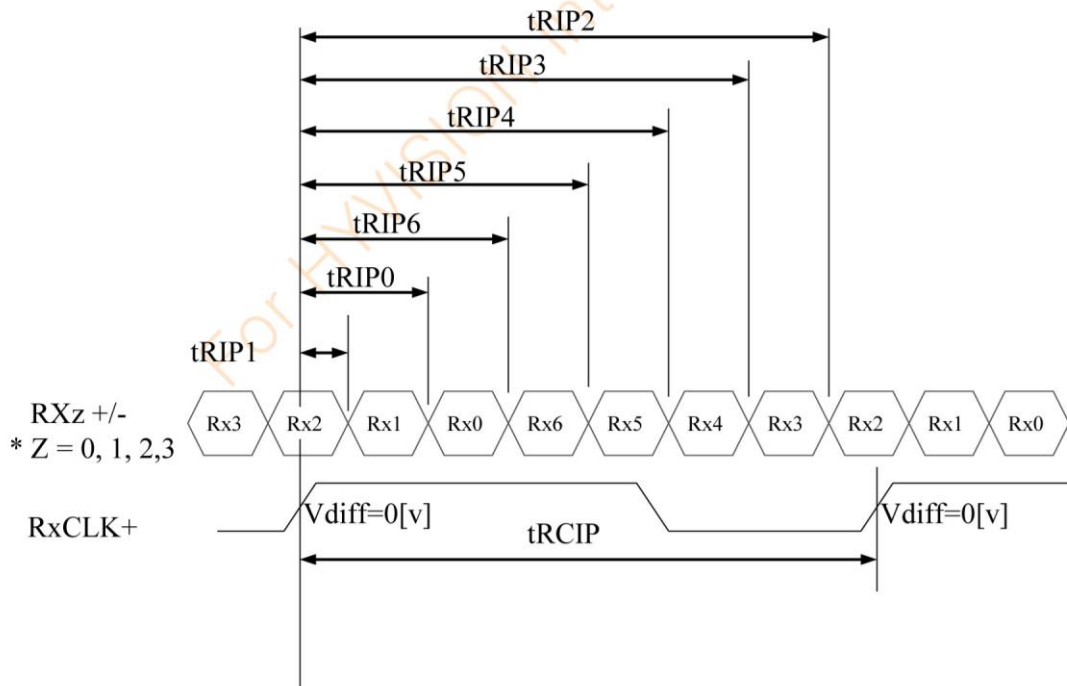
Note: The DCLK range at last line of V-blanking should be set in 0~987

6.2 LVDS Rx Interface Timing Parameter

The specification of the LVDS Rx interface timing parameter is shown in Table 4.

<Table 4. LVDS Rx Interface Timing Specification>

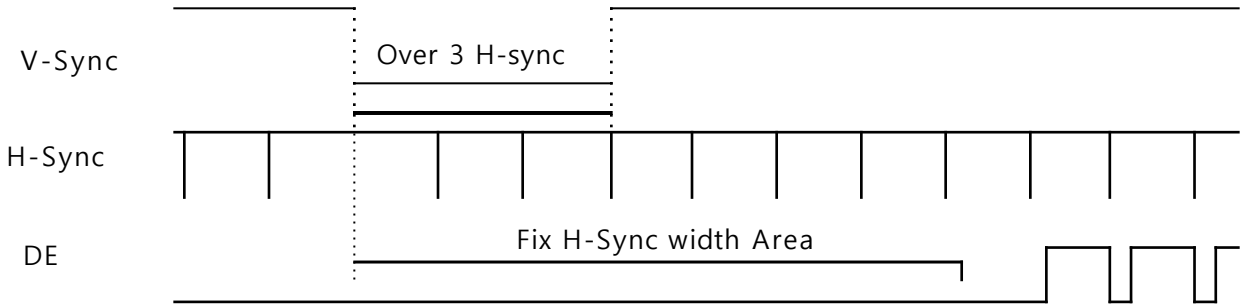
Item	Symbol	Min	Typ	Max	Unit	Remark
CLKIN Period	tRCIP	10.20	13.47	17.08	nsec	
Input Data 0	tRIP1	-0.4	0.0	+0.4	nsec	
Input Data 1	tRIP0	tRCIP/7-0.4	tRCIP/7	tRCIP/7+0.4	nsec	
Input Data 2	tRIP6	2 × tRCIP/7-0.4	2 × tRCIP/7	2 × tRCIP/7+0.4	nsec	
Input Data 3	tRIP5	3 × tRCIP/7-0.4	3 × tRCIP/7	3 × tRCIP/7+0.4	nsec	
Input Data 4	tRIP4	4 × tRCIP/7-0.4	4 × tRCIP/7	4 × tRCIP/7+0.4	nsec	
Input Data 5	tRIP3	5 × tRCIP/7-0.4	5 × tRCIP/7	5 × tRCIP/7+0.4	nsec	
Input Data 6	tRIP2	6 × tRCIP/7-0.4	6 × tRCIP/7	6 × tRCIP/7+0.4	nsec	



* $V_{diff} = (RXz+) - (RXz-), \dots, (RXCLK+) - (RXCLK-)$

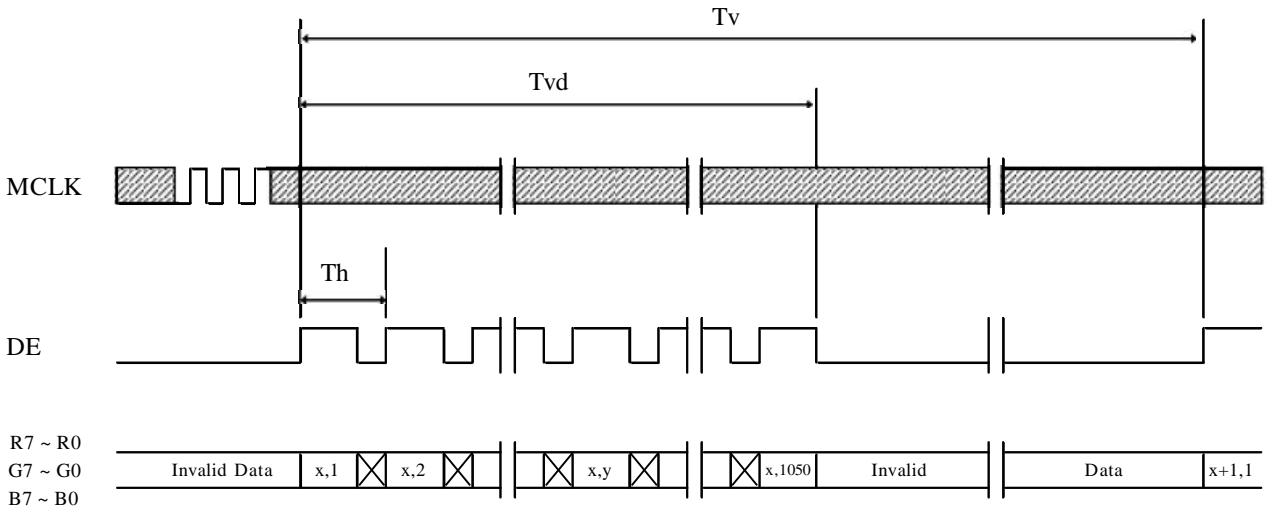
7.0 SIGNAL TIMING WAVEFORMS OF INTERFACE SIGNAL

7.1 Sync Timing Waveforms

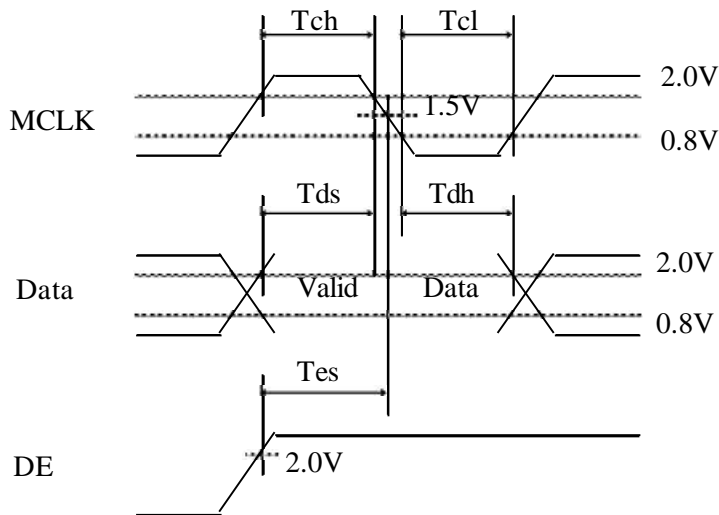
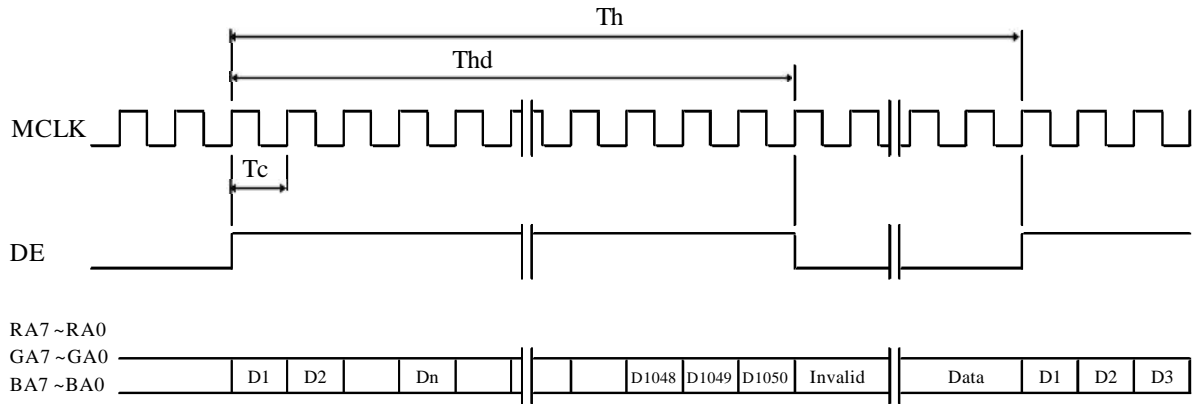


- 1) Need over 3 H-Sync during V-Sync Low
- 2) Fix H-Sync width from V-Sync falling edge to first rising edge

7.2 Vertical Timing Waveforms



7.3 Horizontal Timing Waveforms



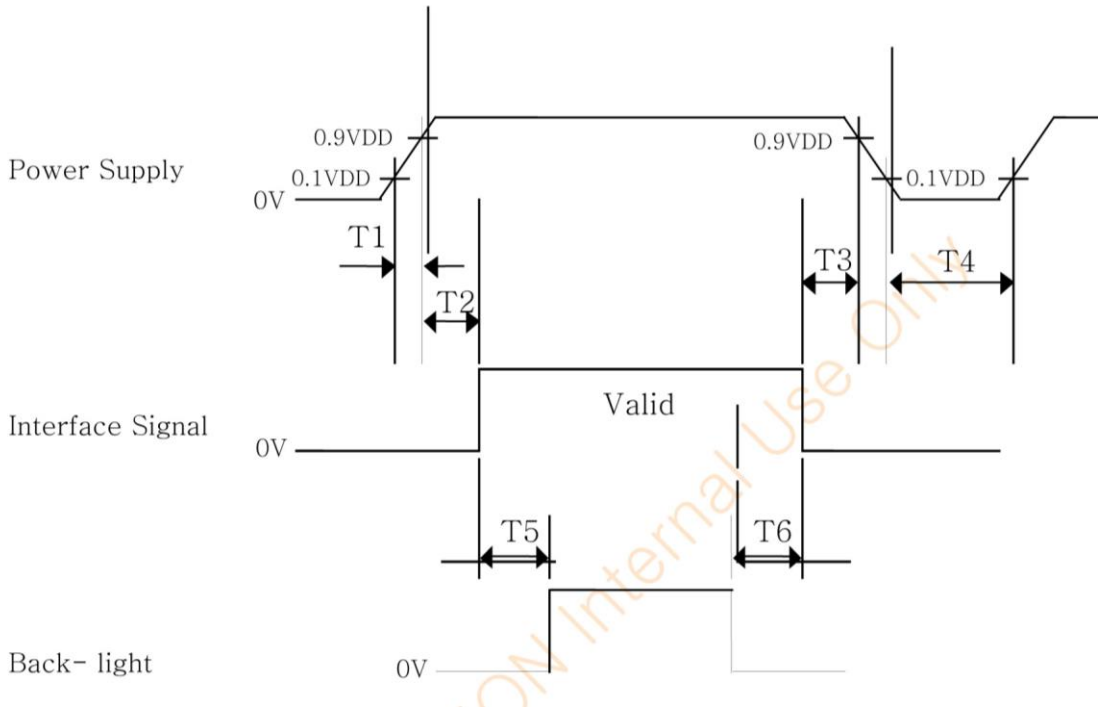
Product Specification

8.0 INPUT SIGNALS, BASIC DISPLAY COLORS & GRAY SCALE OF COLORS

Color & Gray Scale		RED DATA								GREEN DATA								BLUE DATA							
		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
	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
	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
	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
	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
	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	Black	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	△	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Darker	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	△	↑								↑								↑							
	▽	↓								↓								↓							
	Brighter	1	1	1	1	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	▽	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	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	Black	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	△	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
	Darker	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
	△	↑								↑								↑							
	▽	↓								↓								↓							
	Brighter	0	0	0	0	0	0	0	0	1	1	1	1	1	1	0	1	0	0	0	0	0	0	0	0
	▽	0	0	0	0	0	0	0	0	1	1	1	1	1	1	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
Gray Scale of BLUE	Black	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	△	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	Darker	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
	△	↑								↑								↑							
	▽	↓								↓								↓							
	Brighter	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	0	1
	▽	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0
	Blue	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1
Gray Scale of WHITE	Black	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	△	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1
	Darker	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0
	△	↑								↑								↑							
	▽	↓								↓								↓							
	Brighter	1	1	1	1	1	1	0	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	0	1
	▽	1	1	1	1	1	1	1	0	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1	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

9.0 POWER SEQUENCE

To prevent a latch-up or DC operation of the LCD module, the power on/off sequence shall be as shown in below



- $0.5 \text{ ms} \leq T1 \leq 10 \text{ ms}$
- $0 \leq T2 \leq 50 \text{ ms}$
- $0 \leq T3 \leq 50 \text{ ms}$
- $1 \text{ sec} \leq T4$
- $200 \text{ ms} \leq T5$
- $200 \text{ ms} \leq T6$

Notes:

1. When the power supply VDD is 0V, keep the level of input signals on the low or keep high impedance.
2. Do not keep the interface signal high impedance when power is on.
3. Back Light must be turn on after power for logic and interface signal are valid.

10.0 MECHANICAL CHARACTERISTICS

10.1 Dimensional Requirements

FIGURE 6 (located in Appendix) shows mechanical outlines for the model MV238FHM-N10. Other parameters are shown in Table 5.

<Table 5. Dimensional Parameters>

Parameter	Specification	Unit
Dimensional outline	543.0(H) × 317.4(V) × 11.1(D) typ.	mm
Weight	2390(typ.)	gram
Active area	527.04 (H) × 296.46 (V)	mm
Pixel pitch	0.2745 (H) × 0.2745 (V)	mm
Number of pixels	1920 (H) × 1080 (V) (1 pixel = R + G + B dots)	pixels
Back-light	Lower edge side, 1-LED Lighting Bar type	

10.2 Mounting

Left & Right each side have two user holes(See MDL Mechanical Drawing).

10.3 Anti-Glare and Polarizer Hardness.

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

10.4 Light Leakage

There shall not be visible light from the back-lighting system around the edges of the screen as seen from a distance 50cm from the screen with an overhead light level of 350lux.

11.0 RELIABILITY TEST

The Reliability test items and its conditions are shown in below.

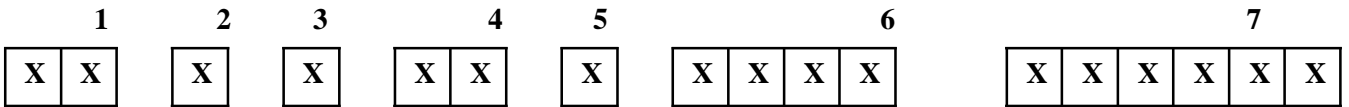
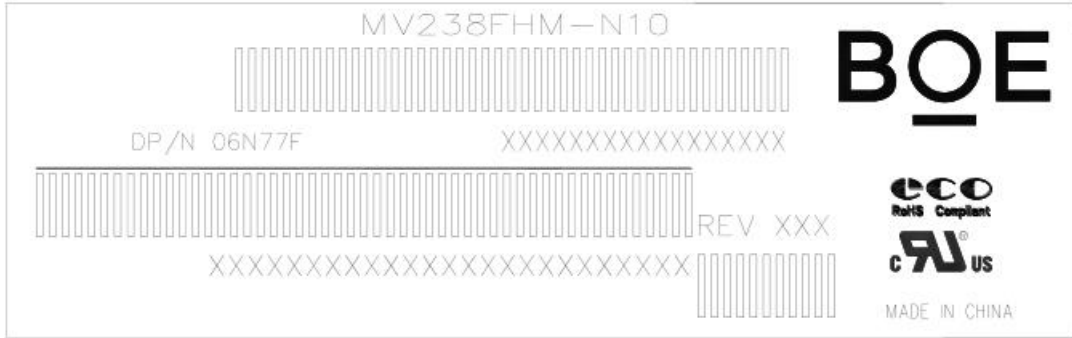
<Table 6. Reliability Test Parameters >

No	Test Items	Conditions	
1	High temperature storage test	Ta = 60 °C, 240 hrs	
2	Low temperature storage test	Ta = -20 °C, 240 hrs	
3	High temperature & high humidity operation test	Ta = 50 °C, 80%RH, 240hrs	
4	High temperature operation test	Ta = 50 °C, 240hrs	
5	Low temperature operation test	Ta = 0°C, 240hr	
6	Thermal shock	Ta = -20 °C ↔ 60 °C (0.5 hr), 100 cycle	
7	Vibrationtest (non-operating)	Frequency	Random, 10 ~ 300 Hz, 30 min/Axis
		Gravity / AMP	1.5 Grms
		Period	X, Y, Z 30 min
8	Shock test (non-operating)	Gravity	50G
		Pulse width	11msec, sine wave
		Direction	±X, ±Y, ±Z Once for each
9	Electro-static discharge test (non-operating)	Air : 150 pF, 330Ω, 15 KV	Contact : 150 pF, 330Ω, 8 KV

12.0 HANDLING & CAUTIONS

- (1) Cautions when taking out the module
 - Pick the pouch only, when taking out module from a shipping package.
- (2) Cautions for handling the module
 - As the electrostatic discharges may break the LCD module, handle the LCD module with care. Peel a protection sheet off from the LCD panel surface as slowly as possible.
 - As the LCD panel and back - light element are made from fragile glass material, impulse and pressure to the LCD module should be avoided.
 - As the surface of the polarizer is very soft and easily scratched, use a soft dry cloth without chemicals for cleaning.
 - Do not pull the interface connector in or out while the LCD module is operating.
 - Put the module display side down on a flat horizontal plane.
 - Handle connectors and cables with care.
- (3) Cautions for the operation
 - When the module is operating, do not lose CLK, ENAB signals. If any one of these signals is lost, the LCD panel would be damaged.
 - Obey the supply voltage sequence. If wrong sequence is applied, the module would be damaged.
- (4) Cautions for the atmosphere
 - Dew drop atmosphere should be avoided.
 - Do not store and/or operate the LCD module in a high temperature and/or humidity atmosphere. Storage in an electro-conductive polymer packing pouch and under relatively low temperature atmosphere is recommended.
- (5) Cautions for the module characteristics
 - Do not apply fixed pattern data signal to the LCD module at product aging.
 - Applying fixed pattern for a long time may cause image sticking.
- (6) Cautions for the interlace mode
 - LCM can't support "Interlace scan method".
- (7) Other cautions
 - Do not disassemble and/or re-assemble LCD module.
 - Do not re-adjust variable resistor or switch etc.
 - When returning the module for repair or etc., Please pack the module not to be broken. We recommend to use the original shipping packages.

13.0 PRODUCT SERIAL NUMBER



1. Control Number

2. Rank / Grade

3. Line Classification

4. Year (2001 : 01, 2002 : 02, ...)

5. Month (1,2,3, ... , 9, X, Y, Z)


6. Internal Use


7. Serial Number


Rear Label(HI LCD)

The label on the panel is shown as below:



Note 1: For Pb Free products, will add  for identification.

Note 2: For RoHS compatible products, will add  for identification.

Note 3: For China RoHS compatible products, will add  for identification.

Note 4: The Green Mark will be presented only when the green documents have been ready by Internal Green Team.

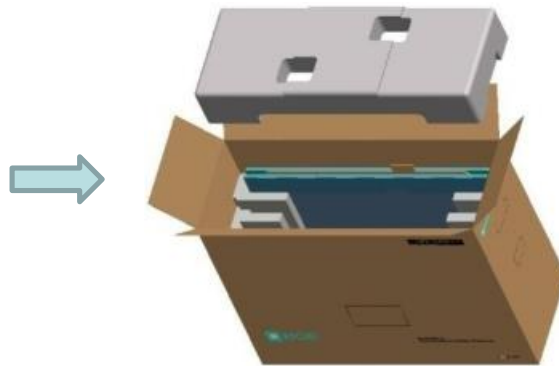
14.0 Packing

14.1 Packing Order

Put pad into the box



Place the modules bundled by packing bag in the box, 8pcs module per box, place a cover on the top of the box



12ea box per pallet

After sealing the box, put the box on the pallet

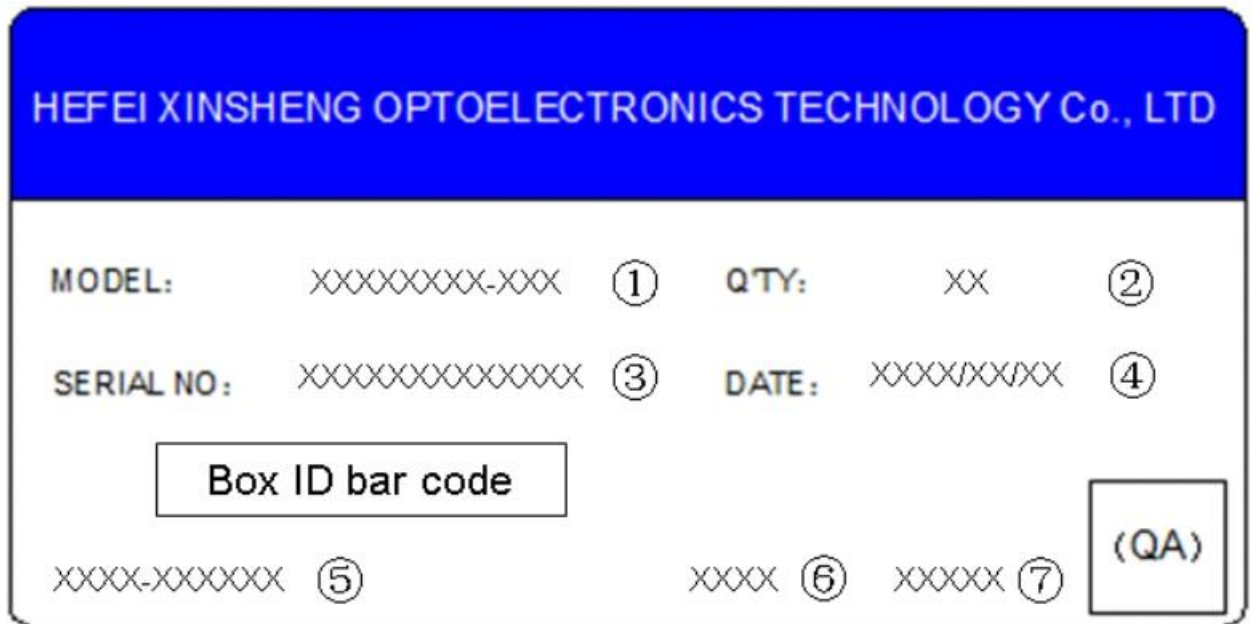


14.2 Packing Note

- Box Dimension : 235mm(W) × 615mm(L) × 448mm(H)
- Package Quantity in one Box : 8 pcs

14.3 Box label

- Label Size : 110mm (L) × 55 mm (W)
- Contents
Model : MV238FHM-N10
Q'ty : Module 8 Q'ty in one box
Serial No. : Box Serial No. See next page for detail description.
Date : Packing Date



蓝色字体为后打印标识,说明如下:

- | | |
|------------------------|-------------------|
| 1. FG-CODE | 2. Box 产品数量 |
| 3. Box ID, 编码规则(CIM提供) | 4. Box Packing 日期 |
| 5. 产品物料号(客户端)(FAE提供) | 6. FG-CODE 后四位 |
| 7. 供应商代码 | |

15.0 APPENDIX

Figure 1. Measurement Set Up

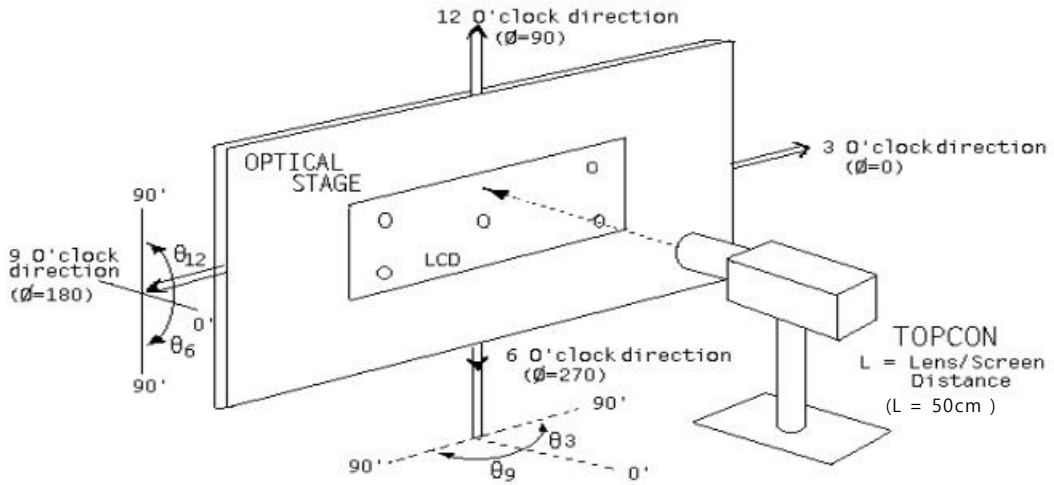


Figure 2. White Luminance and Uniformity Measurement Locations (9 points)

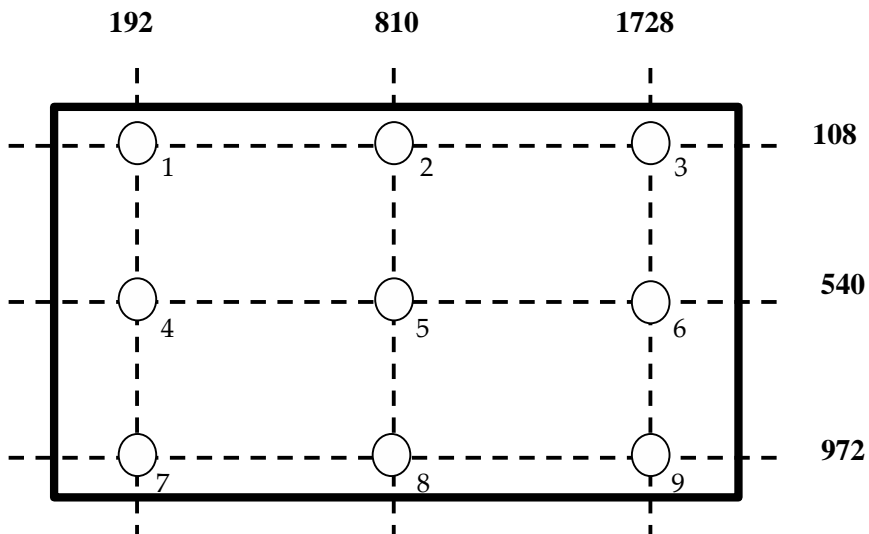
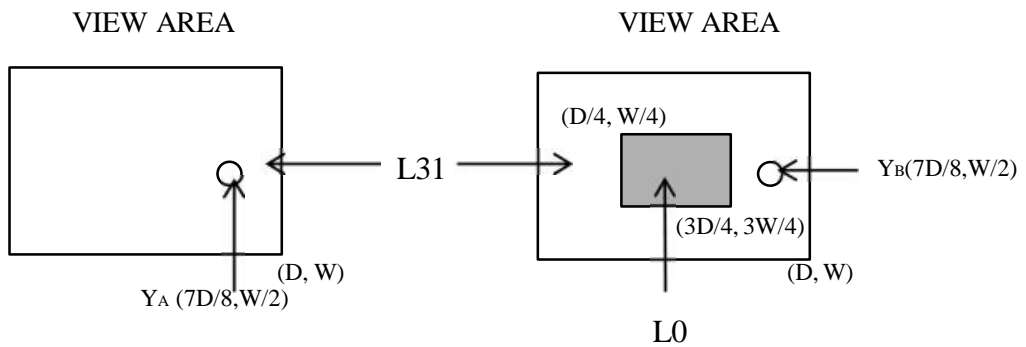


Figure 3. Response Time Testing



Figure 4. Cross Modulation Test Description



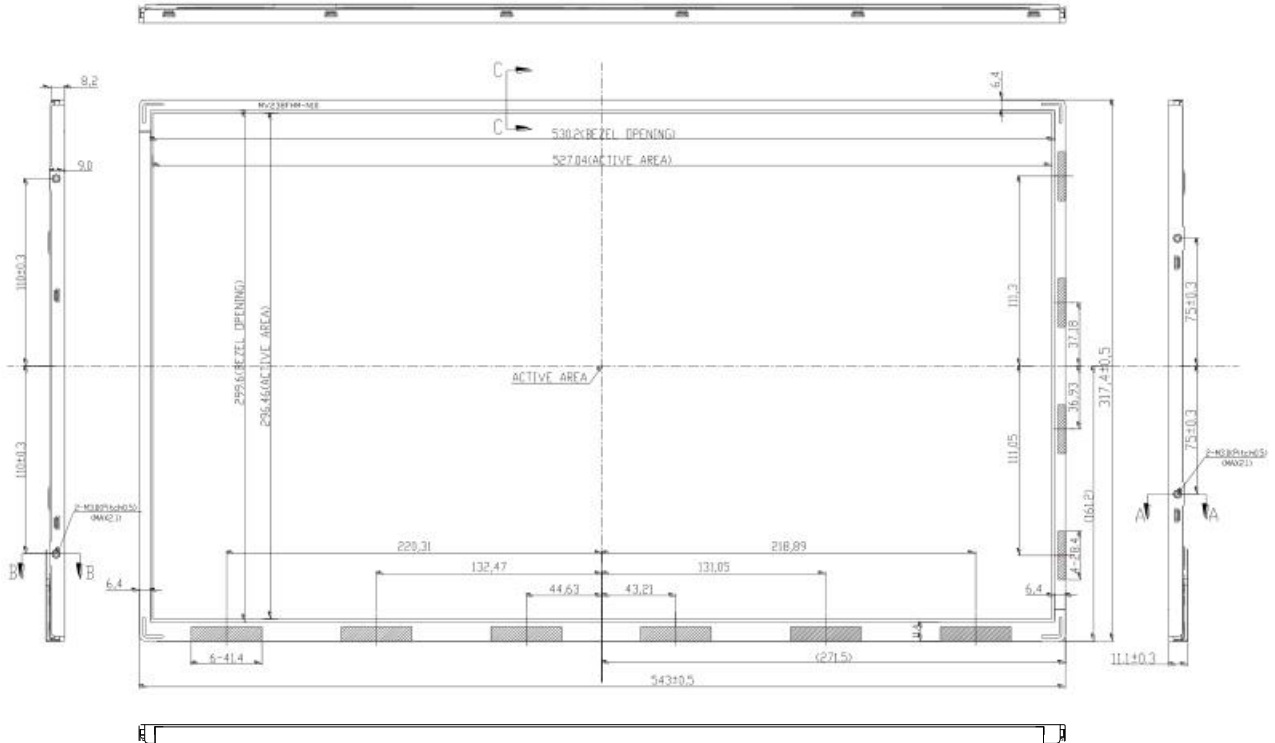
$$\text{Cross-Talk (\%)} = \left| \frac{Y_B - Y_A}{Y_A} \right| \times 100$$

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

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

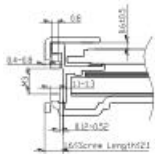
The location measured will be exactly the same in both patterns

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

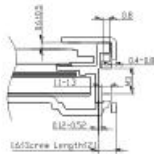


NOTE:

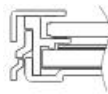
1. I/F CONNECTOR SPECIFICATION
IS100-L300-C23(UJU)
2. LED CONNECTOR SPECIFICATION
10035WR-H04B
3. Torque of userhole: 3.0~4.0kgf·cm.
4. Tilt and partial desposition tolerance display area as following:
(1) Y-direction: |A-B| ≤ 1.4
(2) X-direction: |C-D| ≤ 1.4



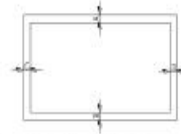
SECTION A-A
SCALE 5/1



SECTION B-B
SCALE 5/1



SECTION C-C
SCALE 5/1



5. Unspecified tolerances to be ±0.5mm.
6. The COF area is weak & sensitive, so don't press the COF area.

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

