HIGHNESS™

HM084SV101A ver9
8.4" Color TFT-LCD

FUNCTIONAL DRAFT SPECIFICATION

(This document is meant for customers' approval)

Release Date
27th Apr 2020

HIGHNESS MICROELECTRONICS PVT. LTD

1. General Description

This specification applies to the 8.4-inch color TFT LCD module HM084SV101A ver9.

HM084SV101A ver9 designed with wide viewing angle; wide operating temperature and long-life LEDs backlight is well suited to be the display units for Industrial Applications.

LED driving board for backlight unit is included in this panel and the structure of the LED units is replaceable.

HM084SV101A ver9 is built in timing controller and LVDS interface.

The screen format is intended to support the SVGA (800(H) x 600(V)) screen and 16.2M (RGB 8-bits) or 262k colors (RGB 6-bits).

HM084SV101A ver9 is a RoHS product.

1.1 Display Characteristics

The following items are characteristics summary on the table under 25°C condition:

Items	Unit	Specifications
Screen Diagonal	[inch]	8.4 (213.4mm)
Active Area	[mm]	170.4(H) x 127.8(V)
Pixels H x V		800x3(RGB) x 600
Pixel Pitch	[mm]	0.213x 0.213
Pixel Arrangement		R.G.B. Vertical Stripe
Display Mode		TN, Normally White
Nominal Input Voltage VDD	[Volt]	3.3 (typ)
Typical Power Consumption	[Watt]	2.94 (typ)
Weight	[Grams]	250 (typ)
Physical Size	[mm]	203.0(W) x 142.5(H) x 8.0(D) (typ.)
Electrical Interface		1 channel LVDS
Surface Treatment		Anti-glare, Hardness 3H
Support Color		262K(6-bit) / 16.2M(8-bit)

Temperature Range
    Operating
    Storage (Non-Operating)
	[°C]
	[°C]
		-30 to +85 (panel surface temperature)
		-30 to +85

RoHS Compliance		RoHS Compliance

1.2 Optical Characteristics

The optical characteristics are measured under stable conditions at 25○C (Room Temperature):

| Item	Unit	Conditions	Min.	Typ.	Max.	Note
White Luminance	[cd/m2]	I_F= 50mA (center point)	350	450	-	1
Uniformity	%	9 Points	70	75	-	1, 2, 3
Contrast Ratio			400	600	-	4
Response Time	[msec]	Rising	-	20	30	5
	[msec]	Falling	-	10	20	
	[msec]	Raising + Falling	-	30	50	
Viewing Angle	[degree] [degree]	Horizontal (Right) CR ≧ 10 (Left)	70 70	80 80	- -	6
	[degree] [degree]	Vertical (Upper) CR ≧ 10 (Lower)	65 50	80 60	- -	
Color / Chromaticity Coordinates (CIE 1931)		Red x	0.509	0.609	0.709	1
		Red y	0.233	0.333	0.433	
		Green x	0.265	0.365	0.465	
		Green y	0.47	0.57	0.67	
		Blue x	0.051	0.151	0.251	
		Blue y	0.006	0.106	0.206	
		White x	0.21	0.31	0.41	
		White y	0.23	0.33	0.43	
Color Gamut	%			45	-	1

Note 1: Measurement method

Equipment: Pattern Generator, Power Supply, Digital Voltmeter, Luminance meter
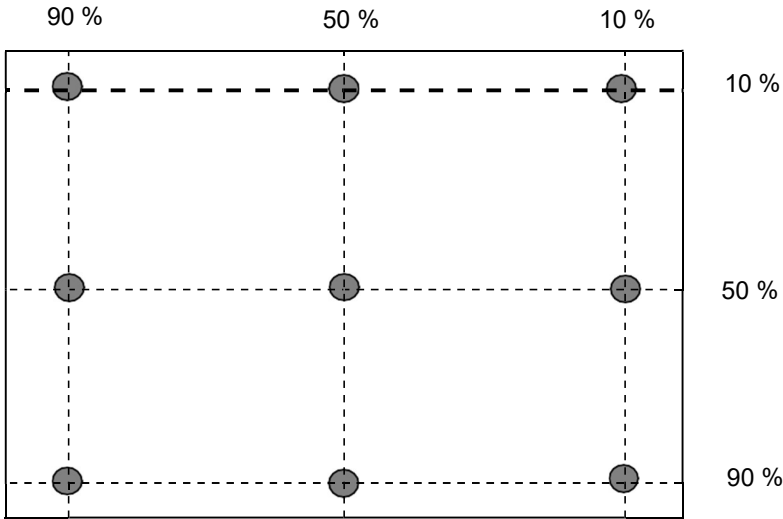
Aperture   1○with 50cm viewing distance

Test Point   Center

Environment   < 1 lux
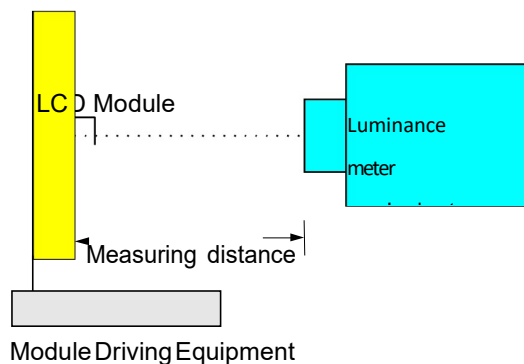
Note 2: Definition of 9 points position (Display active area : 170.4(H) x 127.8(V))

90 %	50 %	10 %

10 %

50 %

90 %

Note 3: The luminance uniformity of 9 points is defined by dividing the minimum luminance value by the maximum test point luminance

$$\delta_{W9} = \frac{\text{Minimum Brightness of nine points}}{\text{Maximum Brightness of nine points}}$$

Note 4： Definition of contrast ratio (CR):

$$\text{Contrast ratio (CR)} = \frac{\text{Brightness on the "White" state}}{\text{Brightness on the "Black" state}}$$

Note 5: Definition of response time:

The output signals of photo detector are measured when the input signals are changed from "White" to "Black" (falling time) and from "Black" to "White" (rising time), respectively. The response time interval is between 10% and 90% of amplitudes. Please refer to the figure as below.
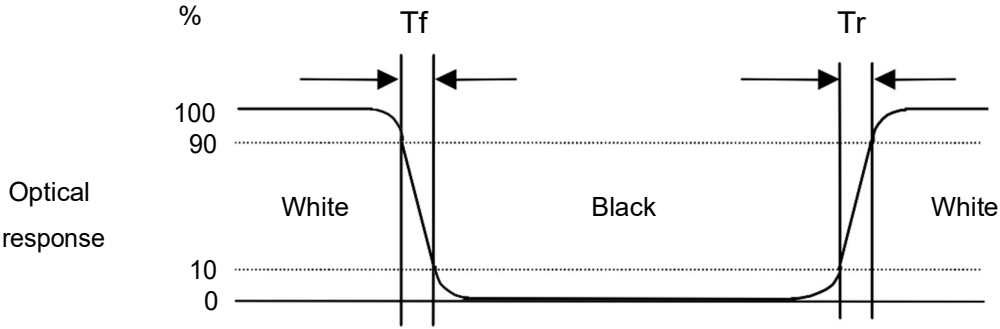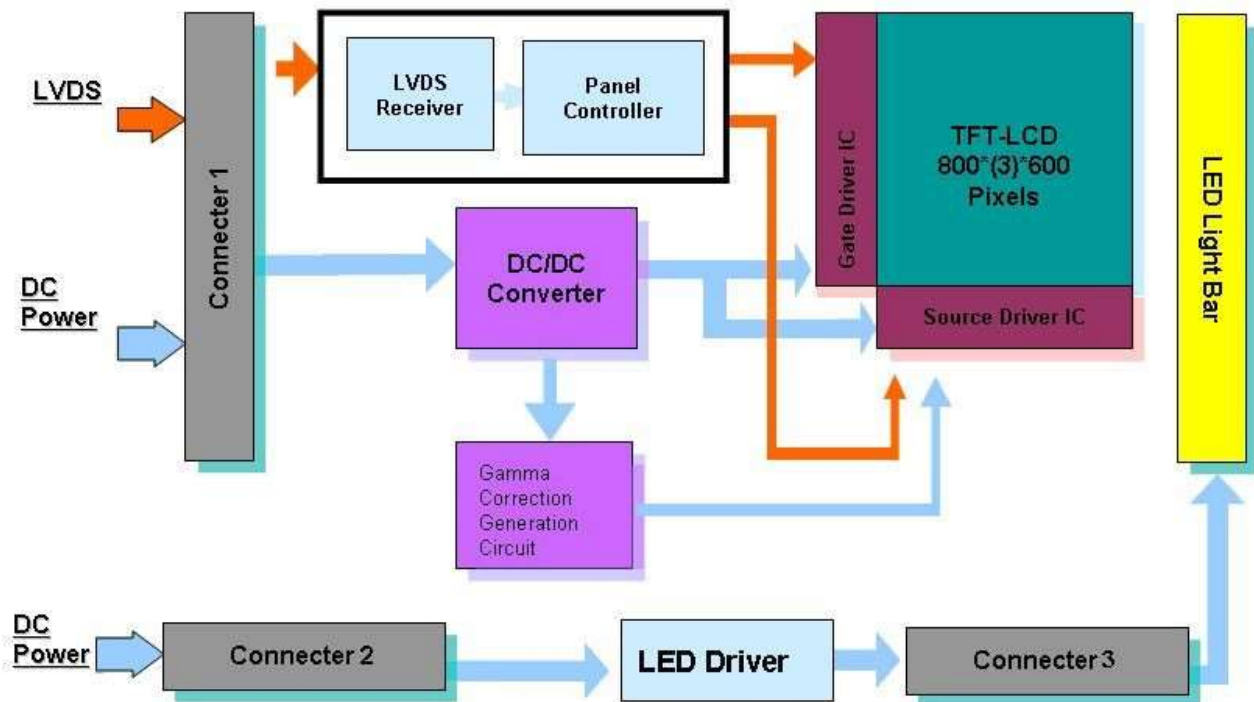
Note 6: Definition of viewing angle

 Viewing angle is the measurement of contrast ratio ≧10, at the screen center, over a 180° horizontal and 180° vertical range (off-normal viewing angles). The 180° viewing angle range is broken down as below: 90° (θ) horizontal left and right, and 90° (Φ) vertical high (up) and low (down). The measurement direction is typically perpendicular to the display surface with the screen rotated to its center to develop the desired measurement viewing angle.
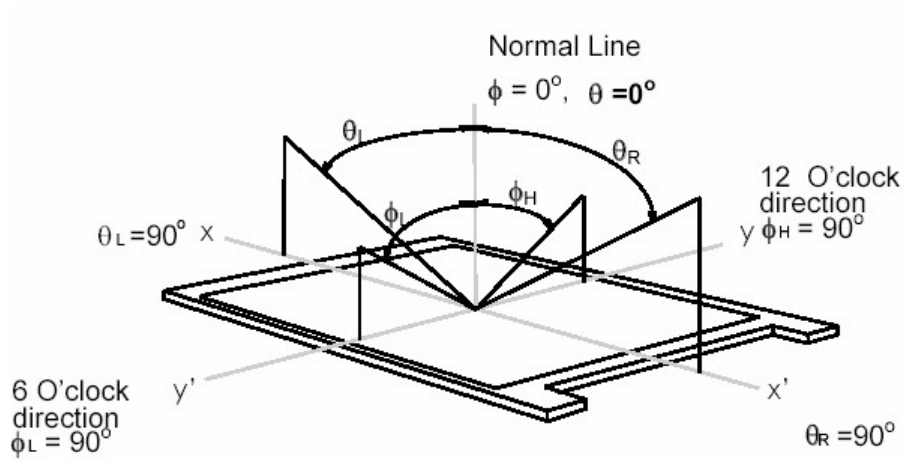
2. Functional Block Diagram

The following diagram shows the functional block of the 8.4-inch color TFT/LCD module:

LVDS

DC
Power

Connecter 1

LVDS
Receiver

Panel
Controller

DC/DC
Converter

Gamma
Correction
Generation
Circuit

Gate Driver IC

TFT-LCD
800*(3)*600
Pixels

Source Driver IC

LED Light Bar

DC
Power

Connecter 2

LED Driver

Connecter 3

3. Absolute Maximum Ratings

3.1 Absolute Ratings of TFT LCD Module

Item	Symbol	Min	Max	Unit	Conditions
Logic/LCD Drive Voltage	VDD	-0.3	+3.6	[Volt]	

3.2 Absolute Ratings of Environment

Item	Symbol	Min	Max	Unit
Operating Temperature	TOP	-30	+85	[$^{\circ}$C]
Operation Humidity	HOP	5	90	[%RH]
Storage Temperature	TST	-30	+85	[$^{\circ}$C]
Storage Humidity	HST	5	90	[%RH]

Note: Maximum Wet-Bulb should be 390C and no condensation.

4. Electrical Characteristics

4.1 TFT LCD Module

4.1.1 Power Specification

Symbol	Parameter	Min	Typ	Max	Units	Remark
VDD	Logic/LCD Drive Voltage	3.0	3.3	3.6	[Volt]	±10%
I$_{VDD}$	VDD Current	-	270	330	[mA]	64 Gray Bar Pattern (VDD=3.3V, at 60Hz)
P$_{VDD}$	VDD Power	-	0.9	1.2	[Watt]	64 Gray Bar Pattern (VDD=3.3V, at 60Hz)

Note 1: Measurement condition:

VDD rising time
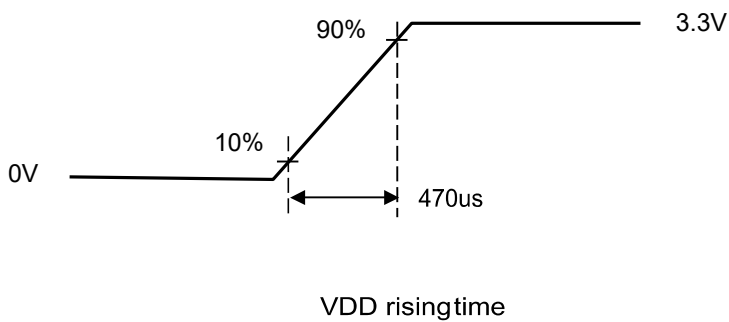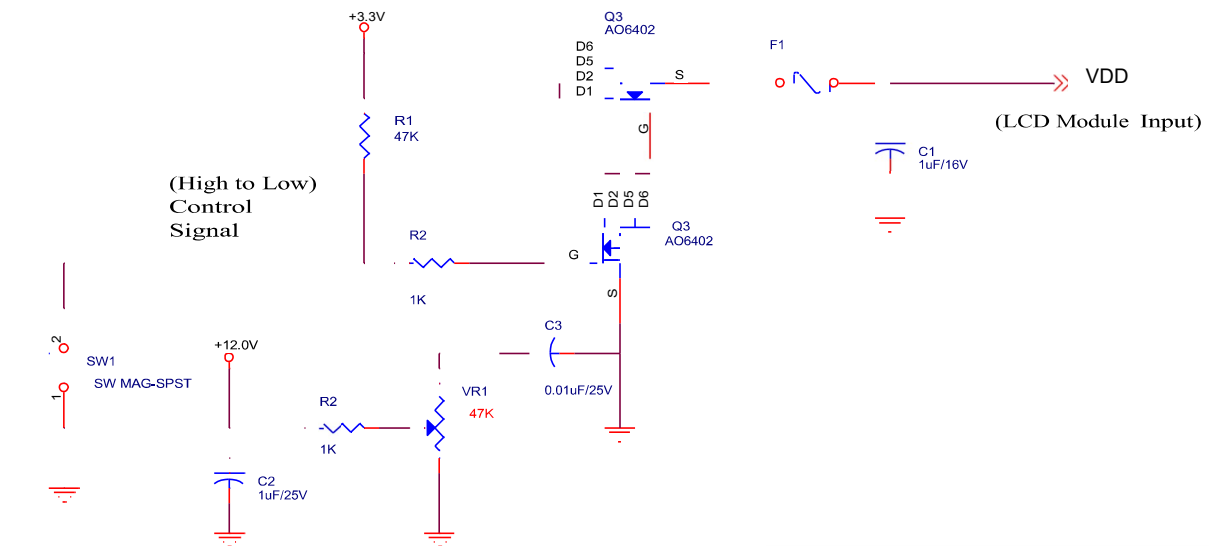
64 Gray pattern

4.1.2 Signal Electrical Characteristics

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

Symbol	Item	Min.	Typ.	Max.	Unit	Remark
VTH	Differential Input High Threshold	-	-	100	[mV]	VICM=1.2V
VTL	Differential Input Low Threshold	-100	-	-	[mV]	VICM=1.2V
| VID |	Input Differential Voltage	100	400	600	[mV]	
VICM	Differential Input Common Mode Voltage	1.1		1.6	[V]	VTH/VTL=±100mV

Note: LVDS Signal Waveform.
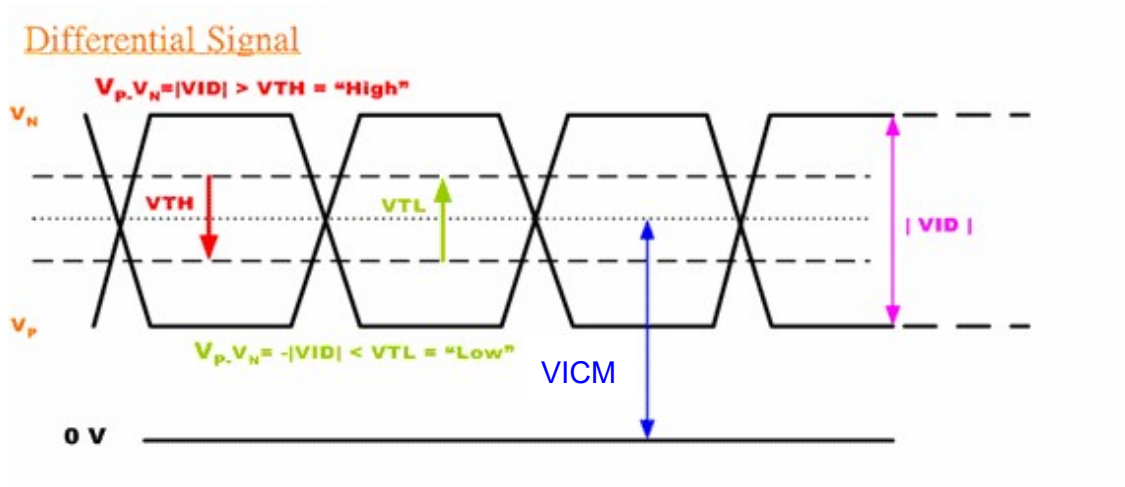
4.2 Backlight Unit

4.2.1 Parameter guideline for LED backlight

Following characteristics are measured under a stable condition using an inverter at 250C (Room Temperature):

Symbol	Parameter	Min.	Typ.	Max.	Unit	Remark
VCC	Input Voltage	10.8	12	12.6	[Volt]	
I_{VCC}	Input Current	-	0.17	-	[A]	100% PWM Duty
P_{VCC}	Power Consumption	-	2.04	2.14	[Watt]	100% PWM Duty
F_{PWM}	Dimming Frequency	200	-	20K	[Hz]	
	Swing Voltage	3	3.3	5.5	V	
	Dimming Duty Cycle	5	-	100	%	
I_F	LED Forward Current	-	50	52.5	mA	Ta = 25°C
V_F	LED Forward Voltage	-	21		Volt	I_F = 50mA, Ta = -30°C
			19.2	21.9	Volt	I_F = 50mA, Ta = 25°C
			18.3			I_F = 50mA, Ta = 85°C
P_{LED}	LED Power Consumption	-	1.92	-	Watt	I_F = 50mA, Ta = 25°C (total power)
Operation Lifetime		50,000			Hrs	I_F = 50mA, Ta = 25°C

Note 1: Ta means ambient temperature of TFT-LCD module.

Note 2: VCC, Ivcc, P_{VCC} , are defined for LED B/L.(100% duty of PWM dimming)

Note 3: I_F, V_F are defined for each channel of LED Light Bar. There are two LED channels (AN1-CA1-CA2) in back

light unit.

Note 4: If HM084SV101A VER9 V9 module is driven by high current or at high ambient temperature & humidity condition. The

operating life will be reduced.

Note 5: Operating life means brightness goes down to 50% initial brightness. Minimum operating life time is estimated

data.

5. Signal Characteristic

5.1 Pixel Format Image

Following figure shows the relationship between input signal and LCD pixel format.

|	1	2		799	800
1st Line	R G B R G B	· · · · · · · · · · ·	R G B R G B		
600th Line	R G B R G B	·	R G B R G B		

5.2 Signal Description

LVDS is a differential signal technology for LCD interface and high speed data transfer device. The connector pin definition is as below.

Pin No.	Symbol	Description
1	VDD	Power Supply, 3.3V (typical)
2	VDD	Power Supply, 3.3V (typical)
3	UD	Vertical Reverse Scan Control, When UD=Low or NC → Normal Mode. When UD=High → Vertical Reverse Scan. Note 1,2
4	LR	Horizontal Reverse Scan Control, When LR=Low or NC → Normal Mode. When LR=High → Horizontal Reverse Scan. Note 1,2
5	RxIN1-	LVDS differential data input Pair 0
6	RxIN1+	
7	GND	Ground
8	RxIN2-	LVDS differential data input Pair 1
9	RxIN2+	
10	GND	Ground
11	RxIN3-	LVDS differential data input Pair 2
12	RxIN3+	
13	GND	Ground
14	RxCLKIN-	LVDS differential Clock input Pair
15	RxCLKIN+	
16	GND	Ground
17	SEL 68	LVDS 6/8 bit select function control, Low or NC → 6 Bit Input Mode. High → 8 Bit Input Mode. Note
18	NC	NC
19	RxIN4-	LVDS differential data input Pair 3. Must be set to NC in
20	RxIN4+	6 bit input mode.

Note 1 : "Low" stands for 0V. "High" stands for 3.3V. "NC" stands for "No Connected."

Note2 : For reverse scan mode, please connect to 3.3V directly. A pull-up resistor on the input side will cause abnormal reverse scan.
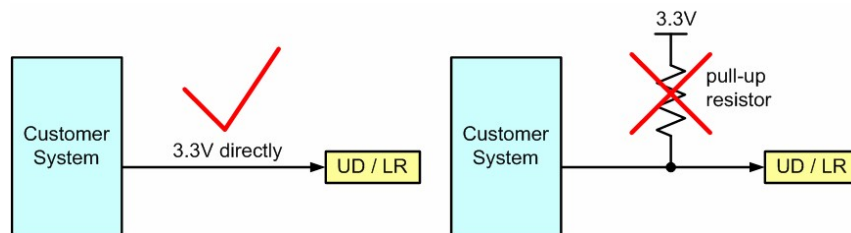
5.3 Scanning Direction

The following figures show the image seen from the front view. The arrow indicates the direction of scan.
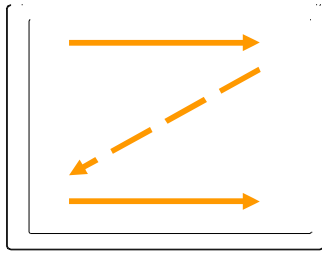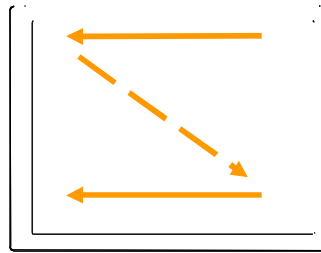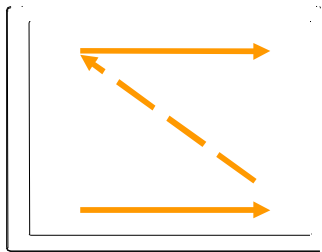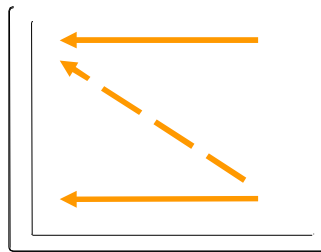

Fig. 1

Fig. 2

Fig. 3

Fig. 4

Fig. 1 Normal scan (Pin3, UD = Low or NC ; Pin4, RL = Low or NC)

Fig. 2 Reverse scan (Pin3, UD = Low or NC ; Pin4, RL = High)
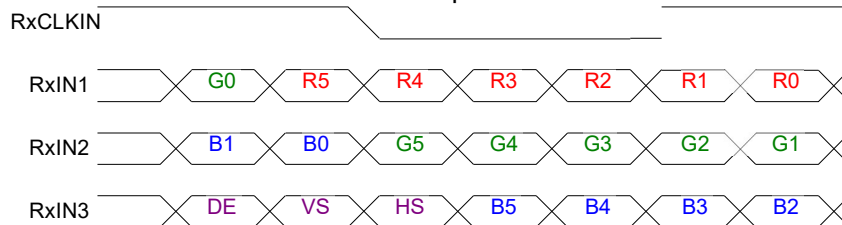
Fig. 3 Reverse scan (Pin3, UD = High ; Pin4, RL = Low or NC)

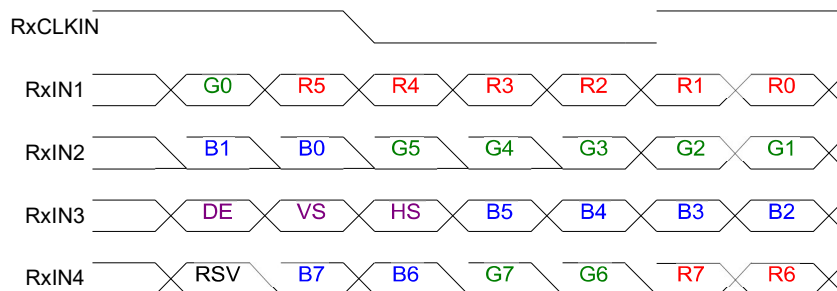Fig. 4 Reverse scan (Pin3, UD = High ; Pin4, RL = High)

5.4 The Input Data Format

5.4.1 SEL68

SEL68 = "Low" or "NC" for 6 bits LVDS Input

RxCLKIN						
RxIN1	G0	R5	R4	R3	R2	R1	R0
RxIN2	B1	B0	G5	G4	G3	G2	G1
RxIN3	DE	VS	HS	B5	B4	B3	B2

SEL68 = "High" for 8 bits LVDS Input

RxCLKIN						
RxIN1	G0	R5	R4	R3	R2	R1	R0
RxIN2	B1	B0	G5	G4	G3	G2	G1
RxIN3	DE	VS	HS	B5	B4	B3	B2
RxIN4	RSV	B7	B6	G7	G6	R7	R6

Note1: Please follow PSWG.
Note2: R/G/B data 7:MSB, R/G/B data 0:LSB

Signal Name	Description	Remark
R7	Red Data 7 (MSB)	Red-pixel Data
R6	Red Data 6	Each red pixel's brightness data consists of these
R5	Red Data 5	8 bits pixel data.
R4	Red Data 4	
R3	Red Data 3	
R2	Red Data 2	
R1	Red Data 1	
R0	Red Data 0 (LSB)	
G7	Green Data 7 (MSB)	Green-pixel Data
G6	GreenData 6	Each green pixel's brightness data consists of these
G5	GreenData 5	8 bits pixel data.
G4	GreenData 4	
G3	GreenData 3	
G2	GreenData 2	
G1	GreenData 1	
G0	GreenData 0 (LSB)	
B7	Blue Data 7 (MSB)	Blue-pixel Data
B6	Blue Data 6	Each blue pixel's brightness data consists of these
B5	Blue Data 5	8 bits pixel data.
B4	Blue Data 4	
B3	Blue Data 3	
B2	Blue Data 2	
B1	Blue Data 1	
B0	Blue Data 0 (LSB)	
RxCLKIN+ RxCLKIN-	LVDS Clock Input	
DE	Display Enable	
VS	Vertical Sync	
HS	Horizontal Sync	

Note: Output signals from any system shall be low or Hi-Z state when VDD is off.

5.5 Interface Timing

5.5.1 Timing Characteristics

DE mode only

Parameter		Symbol	Min.	Typ.	Max.	Unit	Condition
Clock frequency		$1/T_{Clock}$	33.6	39.8	48.3	MHz	
Vertical Section	Period	T_V	608	628	650	T_H	
	Active	T_{VD}	600	600	600		
	Blanking	T_{VB}	8	28	50		
Horizontal Section	Period	T_H	920	1056	1240	T_{Clock}	
	Active	T_{HD}	800	800	800		
	Blanking	T_{HB}	120	256	440		

Note: Frame rate is 60 Hz.
Note: DE mode.

5.5.2 Input Timing Diagram
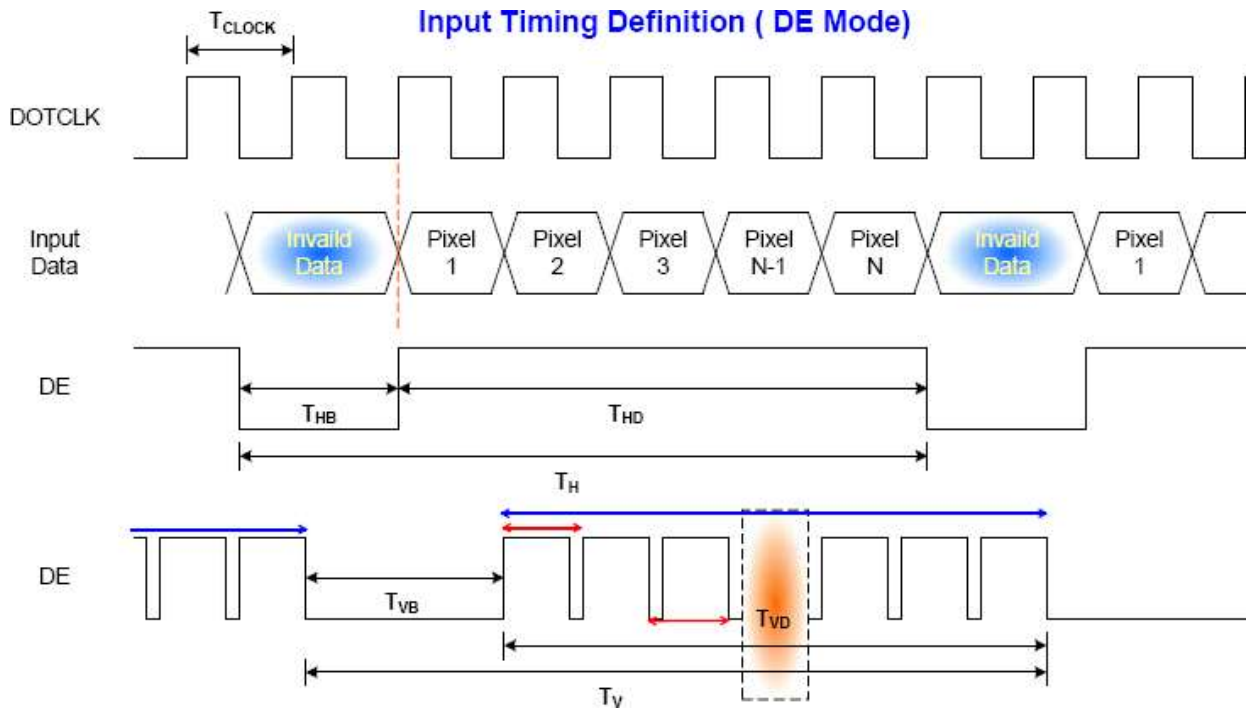
5.6 Power ON/OFF Sequence

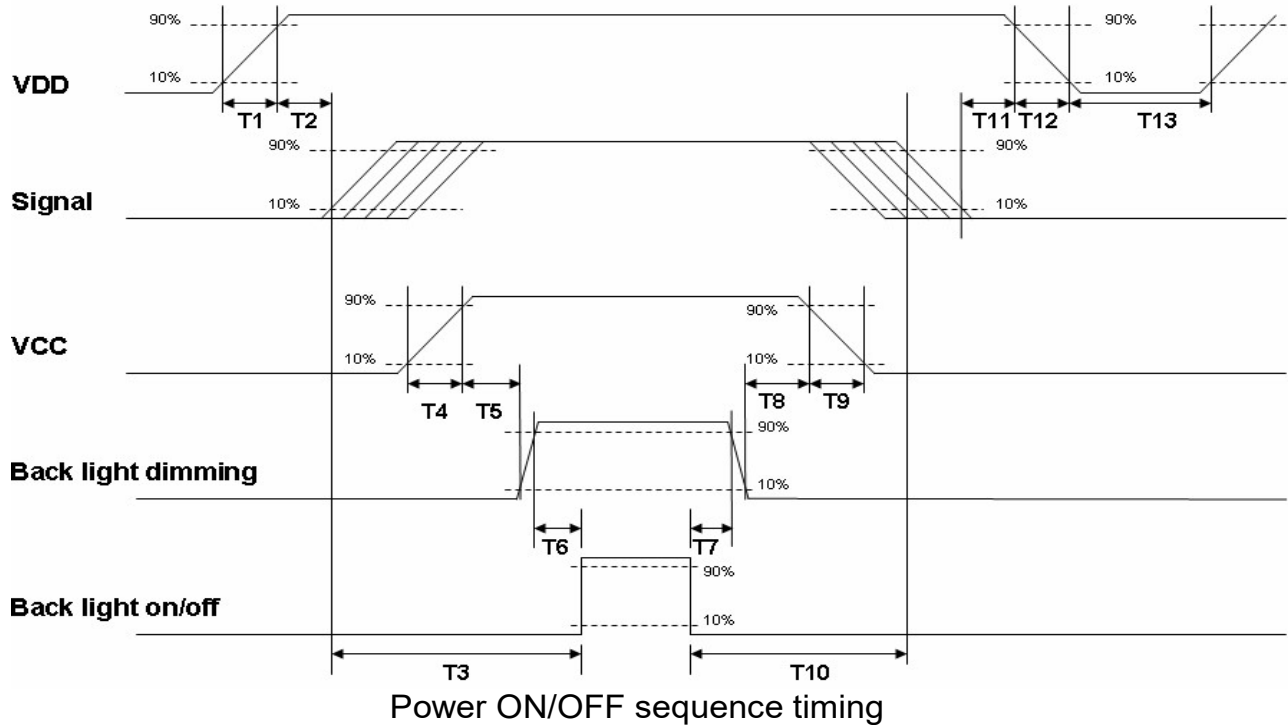VDD power and BackLight on/off sequence is as below. Interface signals are also shown in the chart. Signals from any system shall be Hi-Z state or low level when VDD is off.

Power ON/OFF sequence timing

Parameter	Value			Units
	Min.	Typ.	Max.	
T1	0.5	--	10	[ms]
T2	30	40	50	[ms]
T3	200	--	--	[ms]
T4	0.5	--	10	[ms]
T5	10	--	--	[ms]
T6	10	--	--	[ms]
T7	0	--	--	[ms]
T8	10	--	--	[ms]
T9	--	--	10	[ms]
T10	110	--	--	[ms]
T11	0	16	50	[ms]
T12	--	--	10	[ms]
T13	1000	--	--	[ms]

The above on/off sequence should be applied to avoid abnormal function in the display. Please make sure to turn off the power when you plug the cable into the input connector or pull the cable out of the connector.

6. Connector & Pin Assignment

Physical interface is described as for the connector on module. These connectors are capable of accommodating the following signals and will be following components.

6.1 TFT LCD Signal (CN1): LVDS Connector

Connector Name / Designation	Signal Connector
Manufacturer	STM, Hirose or compatible
Connector Model Number	STM -MSB24013P20HA, Hirose- DF19LA-20P-1H or compatible
Mating Model Number	STM-P24013P20, Hirose-DF19-20S-1C or compatible

Pin No.	Signal Name	Pin No.	Signal Name
1	VDD	2	VDD
3	UD	4	LR
5	RxIN1-	6	RxIN1+
7	GND	8	RxIN2-
9	RxIN2+	10	GND
11	RxIN3-	12	RxIN3+
13	GND	14	RxCKIN-
15	RxCKIN+	16	GND
17	SEL 68	18	NC
19	RxIN4-	20	RxIN4+

6.2 LED Backlight Unit (CN2): LED Driver Connector

Connector Name / Designation	LED Connector
Manufacturer	ENTERY
Connector Model Number	ENTERY 3808K-F04N-02R or compatible
Mating Model Number	ENTERY H208K-P04N-02B or compatible.

Pin #	Symbol	Pin Description
1	VCC	12V input
2	GND	GND
3	Display_ON/OFF	+5.0V or +3.3 V:ON, 0V:OFF
4	Dimming	PWM

6.3 LED Light Bar Input Connector (CN3):

Manufacturer	ENTERY
Connector Model Number	ENTERY 3800K-F03N-03 or compatible
Mating Connecter Model Number	ENTERY H203K-D03N-04B or compatible

Pin #	Symbol	Pin Description
1	AN1	LED anode
2	CA1	LED cathode
3	CA2	LED cathode

Pin #	Symbol	Cable color
1	AN1	Red
2	CA1	Black
3	CA2	Black

7. Reliability Test Criteria

Items	Required Condition	Note
Temperature Humidity Bias	40°C/90%,300 hours	
High Temperature Operation	85°C,300 hours	
Low Temperature Operation	-30°C,300 hours	
Hot Storage	85°C,300 hours	
Cold Storage	-30°C,300 hours	
Thermal Shock Test	-20°C/30 min ,600C/30 min ,100cycles	
Shock Test (Non-Operating)	50G,20ms,Half-sine wave,(±X, ±Y, ±Z)	
Vibration Test (Non-Operating)	1.5G, (10~200Hz, P-P) 30 mins/axis (X, Y, Z)	
On/off test	On/10 sec, Off/10 sec, 30,000 cycles	
ESD	Contact Discharge: ± 8KV, 150pF(330Ω) 1sec, 8 points, 25 times/ point Air Discharge: ± 15KV, 150pF(330Ω) 1sec, 8 points, 25 times/ point	Note 1

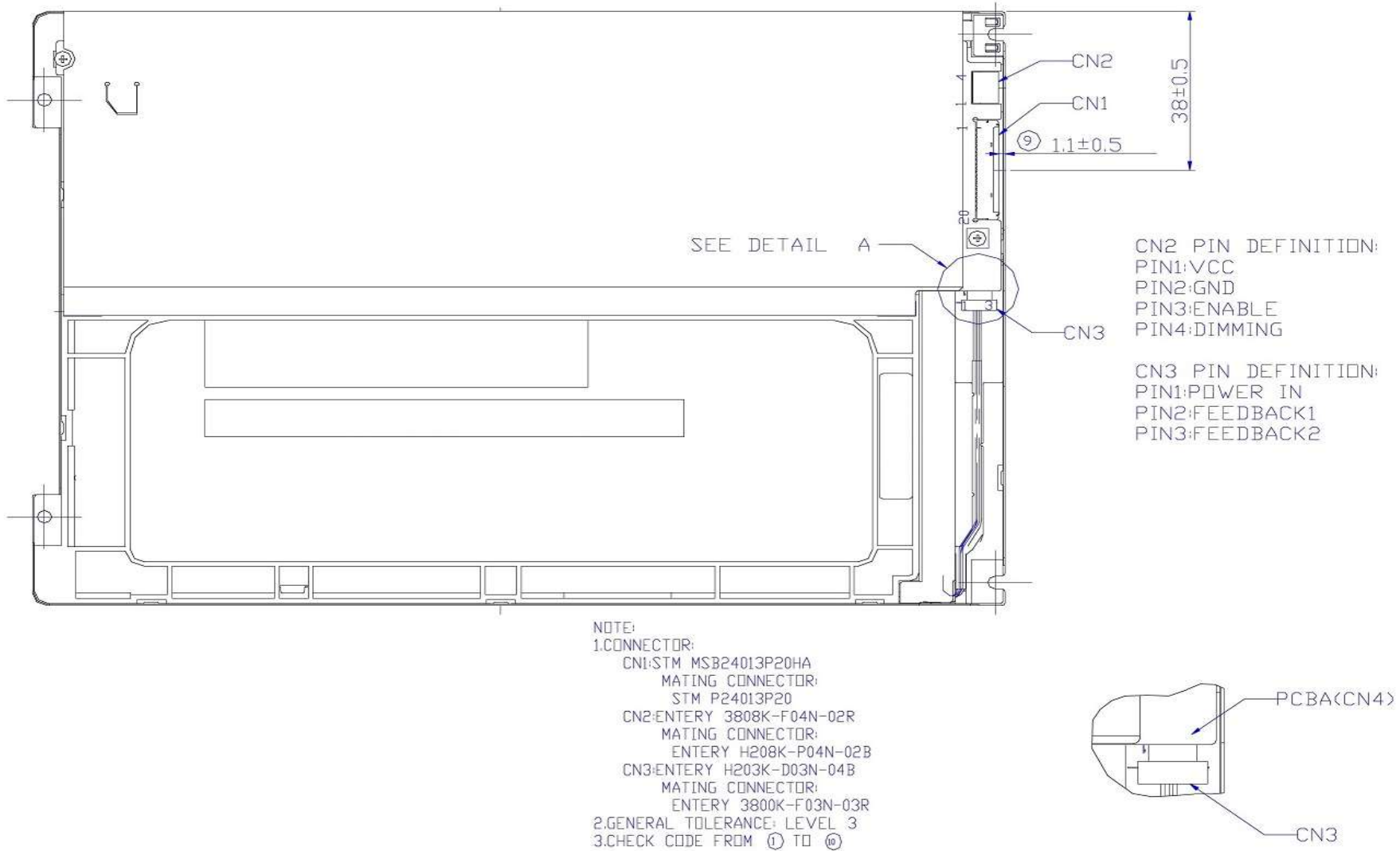Note1: According to EN61000-4-2, ESD class B: Some performance degradation allowed. No data lost
. Self-recoverable. No hardware failures.

8. Mechanical Characteristics
8.1 LCM Front View

8.2 LCM Rear View

CN2

CN1

⑨ 1.1±0.5

38±0.5

SEE DETAIL A

CN3

CN2 PIN DEFINITION:
PIN1:VCC
PIN2:GND
PIN3:ENABLE
PIN4:DIMMING

CN3 PIN DEFINITION:
PIN1:POWER IN
PIN2:FEEDBACK1
PIN3:FEEDBACK2

NOTE:
1.CONNECTOR:
   CN1:STM MSB24013P20HA
     MATING CONNECTOR:
      STM P24013P20
   CN2:ENTERY 3808K-F04N-02R
     MATING CONNECTOR:
      ENTERY H208K-P04N-02B
   CN3:ENTERY H203K-D03N-04B
     MATING CONNECTOR:
      ENTERY 3800K-F03N-03R
2.GENERAL TOLERANCE: LEVEL 3
3.CHECK CODE FROM ① TO ⑩

Reminding to check screw's torque value before fastening panel.

PCBA(CN4)

CN3

DETAIL A
SCALE 2.000

9. Display Label.