Fema Part Number

GM1024768D-121-TTX2NLW-H	
Description	12.1" Full Color TFT LCD
	1024x768 Resolution
	Brightness = 1500 nits (Typical)
	Optional Resistive or Projected Capacitive Touch Panel Available

2. General Description

2.1, Overview

This specification applies to the Color Active Matrix Liquid Crystal Display composed of a TFT-LCD display a LED backlight system. The screen format is intended to support XGA (1024(H) x 768(V)) screen and 16.2M / 262k colors.

LED driving board for backlight unit is not included.

2.2 Features

- Sunlight readable display, 1500nits by LED backlight.
- Wide viewing angle
- Wide operation temperature
- RoHS Compliance

2.3 Application

Industrial Application; especial kiosk and digital signage display.

2.4 Display Specifications

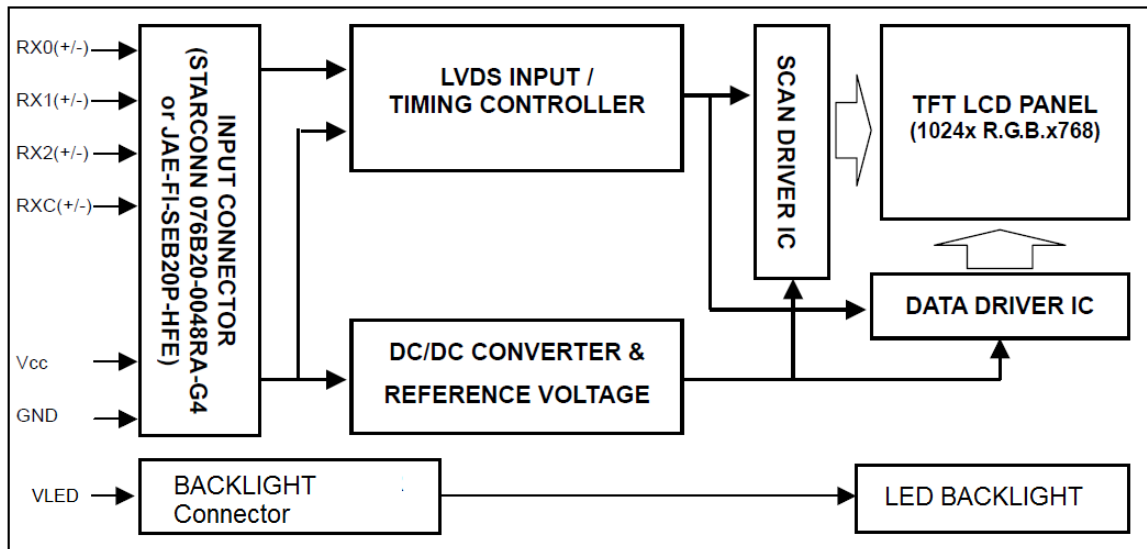| Items	Unit	Specification
Screen Diagonal	inch	12.1
Active Area	mm	245.76 (H) x 184.32 (V)
Pixels H x V	pixels	1024 x3(RGB) x 768
Pixels Pitch	um	240 (per one triad) x 240
Pixel Arrangement		RGB Vertical stripe
Display mode		TN mode, normally white
White luminance (center)	Cd/m^2	1500 (Typ.)
Contrast ratio		700 (Typ.)
Optical Response Time	msec	16 ms (Typ. on/off)
Normal Input Voltage VDD	Volt	3.3
Power Consumption (Vcc Line + LED backlight)	Watt	12.0
Weight	Grams	435 max.
Physical size	mm	260.5(H) x 204.0(V) x 7.2(D) (Max.)
Electrical Interface		One Channel LVDS
Support Colors		16.2M / 262K colors
Surface Treatment		Anti-Glare, 3H
Temperature range Operating Storage (Shipping)	^0C ^0C	-30 ~ 70 -40 ~ 80
RoHS Compliance		RoHS Compliance

2.5 Optical Characteristics

The following optical characteristics are measured under stable condition at 25 ^{0}C

Items	Unit	Conditions		Min.	Typ.	Max.	Note
Viewing angle	Deg.	Horizontal (Right) CR=10 (Left)		140	160		2
		Vertical (Up) CR=10 (Down)		120	140		
Contrast Ratio		Normal Direction			700		3
Response Time	msec	Raising time (T_{rR})			5		4
		Falling time (T_{rF})			11		
		Raising + Falling			16		
Color / Chromaticity Coordinates (CIE)		Red x		-0.03	0.625	+0.03	5
		Red y			0.358		
		Green x			0.324		
		Green y			0.604		
		Blue x			0.144		
		Blue y			0.088		
Color coordinates (CIE) White		White x			0.310		
		White y			0.330		
Center Luminance	Cd/m^2			1200	1500		6
Luminance Uniformity	%			70	75		7
Crosstalk (in 60 Hz)	%					1.5	
Flicker	dB					-20	

3. **Functional Block Diagram**

The following diagram shows the functional block of the 12.1 inches Color TFT-LCD Module:

4. Absolute Maximum Ratings

Absolute maximum ratings of the module are as following:

4.1 TFT LCD Module

Items	Symbol	Min	Max	Unit	Conditions
Power supply voltage	Vcc	-0.3	7.0	Volt	
Logic/ LCD drive voltage	Vin	-0.3	7.0	Volt	Note 1, 2

4.2 Backlight unit

Items	Symbol	Min	Max	Unit	Conditions
LED Current	I LED	--	450	mA	Note 1, 2

4.3 Absolute Ratings of Environment

Items	Symbol	Values			Unit	Conditions
		Min.	Typ.	Max.		
Operation temperature	T_{OP}	-30	-	70	^0C	
Operation Humidity	H_{OP}	5		90	%	Note 3
Storage temperature	T_{ST}	-40		80	^0C	
Storage Humidity	H_{ST}	5		90	%	

Note 1: With in Ta= 25℃

Note 2: Permanent damage to the device may occur if exceed maximum values

Note 3: For quality performance, please refer to IIS (Incoming Inspection Standard).
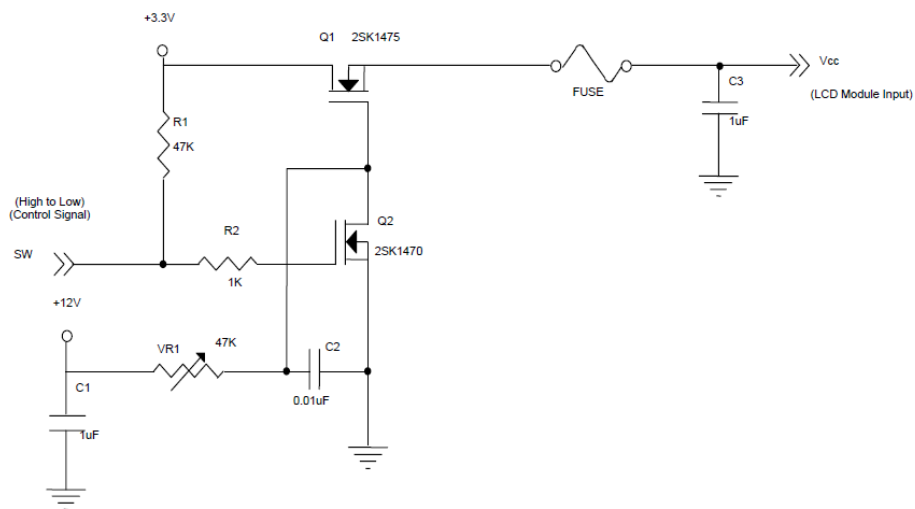
5. Electrical characteristics
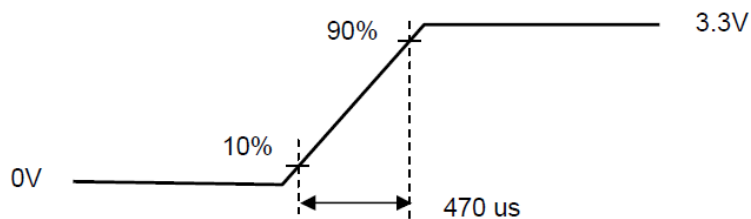
5.1 TFT LCD Module

5.1.1 Power Specification

Input power specifications are as follows

Symbol	Parameter	Min	Typ.	Max	Unit	Conditions
Vcc	Logic/ LCD Drive Voltage	3	3.3	3.6	Volt	+/- 10%, at Vcc= 3.3V
		4.75	5.0	5.24	Volt	at Vcc= 5.0 V
Icc	Input current		540	650	mA	Vcc =3.3V, All black pattern.
Pcc	Vcc power		2.0		W	Vcc =3.3V, All black pattern.
IRush	Inrush current			1.0	A	
Vccrp	Allowable Logic/LCD Drive Ripple Voltage			100	mV p-p	Vcc=3.3V, All black pattern.

Note 1: Measurement condition:

VDD rising time

5.1.2 Signal Electrical Characteristics

Input signal shall be low or Hi-Z state when Vcc is off. Please refer to specification of SN75LVDS82DGG (Texas Instruments) in detail.

Characteristics of each signal are as following:

Symbol	Parameter	Min	Typ	Max	Unit	Condition
VTH	Differential Input High Threshold			+100	mV	VICM = 1.25V
VTL	Differential Input Low Threshold	-100			mV	VICM = 1.25V
│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.

5.2 Backlight Unit

Parameter guideline is under stable conditions at 25℃ (Room Temperature):

Parameter	Min	Typ	Max	Unit	Note
LED voltage (VL)		37.2	21	[V]	2
LED current (IL)		270	360	[mA]	2,
LED Power (PL)		10.0		W	3
LED Life Time(LTLED)	50,000			[Hour]	1

Note 1: The "LED lift time" is defined as the module brightness decrease to 50% original brightness that the ambient temperature is 25℃ and typical LED Current at 270 mA (Long lifetime mode).

Note 2: The LED driving condition is defined for each LED module.

Note 4 : For connectors

Pin No.	Symbol	I/O	Function
1	VLED+	P	Power for LED backlight anode
2	VLED-	P	Power for LED backlight cathode

LED Light Bar Connector is used for the integral backlight system. The recommended model is BHSR-02VS-1 manufactured by JST.

6. Signal Characteristic

6.1 Pixel Format Image

Following figure shows the relationship of the input signals and LCD pixel format.

6.2 TFT-LCD Interface Signal Description

Pin	Name	Description	Remark
1	RX3+	Differential Data Input, CH3 (Positive)	
2	RX3-	Differential Data Input, CH3 (Negative)	
3	NC	NC	
4	SEL68	LVDS 6/8 bit select function control, Low or NC → 6 bit Input Mode High → 8bit Input Mode	Note (3)
5	GND	Ground	
6	RXC+	Differential Clock Input (Positive)	
7	RXC-	Differential Clock Input (Negative)	
8	GND	Ground	
9	RX2+	Differential Data Input , CH2 (Positive)	
10	RX2-	Differential Data Input , CH2 (Negative)	
11	GND	Ground	
12	RX1+	Differential Data Input , CH1 (Positive)	
13	RX1-	Differential Data Input, CH1 (Negative)	
14	GND	Ground	
15	RX0+	Differential Data Input, CH0 (Positive)	
16	RX0-	Differential Data Input, CH0 (Negative)	
17	reLR	Horizontal Reverse Scan Control, Low or NC → Normal Mode. High → Horizontal Reverse Scan	Note (3)
18	reUD	Vertical Reverse Scan Control, Low or NC → Normal Mode, High → Vertical Reverse Scan	Note (3)
19	VCC	Power supply	
20	VCC	Power supply	

Note (1) Connector Part No.: STARCONN 076B20-0048RA-G4 or JAE FI-SEB20P-HFE or equivalent.

Note (2) User's connector Part No.: JAE FI-SE20ME or equivalent.

Note (3) "Low" stands for 0V. "High" stands for 3.3V. "NC" stands for "No Connected"..

6.3 Color Data Input Assignment

The brightness of each primary color (red, green and blue) is based on the 6-bit gray scale data input for the color. The higher the binary input, the brighter the color. The table below provides the assignment of color versus data input.

	Color	Data Signal																	
		Red						Green						Blue					
		R5	R4	R3	R2	R1	R0	G5	G4	G3	G2	G1	G0	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
	Red	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0
	Green	0	0	0	0	0	0	1	1	1	1	1	1	0	0	0	0	0	0
	Blue	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1
	Cyan	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1
	Magenta	1	1	1	1	1	1	0	0	0	0	0	0	1	1	1	1	1	1
	Yellow	1	1	1	1	1	1	1	1	1	1	1	1	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
Gray Scale Of Red	Red(0)/Dark	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red(1)	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
	Red(2)	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	Red(61)	1	1	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0
	Red(62)	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red(63)	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0
Gray Scale Of Green	Green(0)/Dark	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Green(1)	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
	Green(2)	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	Green(61)	0	0	0	0	0	0	1	1	1	1	0	1	0	0	0	0	0	0
	Green(62)	0	0	0	0	0	0	1	1	1	1	1	0	0	0	0	0	0	0
	Green(63)	0	0	0	0	0	0	1	1	1	1	1	1	0	0	0	0	0	0
Gray Scale Of Blue	Blue(0)/Dark	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Blue(1)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	Blue(2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	Blue(61)	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	0	1
	Blue(62)	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	0
	Blue(63)	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1

Note (1) 0: Low Level Voltage, 1: High Level Voltage

The brightness of each primary color (red, green and blue) is based on the 8-bit gray scale data input for the color. The higher the binary input, the brighter the color. The table below provides the assignment of color versus data input.

Color		Data Signal																								
		Red								Green								Blue							
		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
	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
	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
	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
	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
	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	Red(0) / Dark	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red(1)	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red(2)	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	Red(253)	1	1	1	1	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red(254)	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(255)	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	Green(0)/ Dark	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Green(1)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
	Green(2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	Green(253)	0	0	0	0	0	0	0	0	1	1	1	1	1	1	0	1	0	0	0	0	0	0	0	0
	Green(254)	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0
	Green(255)	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	Blue(0) / Dark	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(1)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	Blue(2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	Blue(253)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	0	1
	Blue(254)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	0
	Blue(255)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1

6.4 TFT-LCD Interface Timing

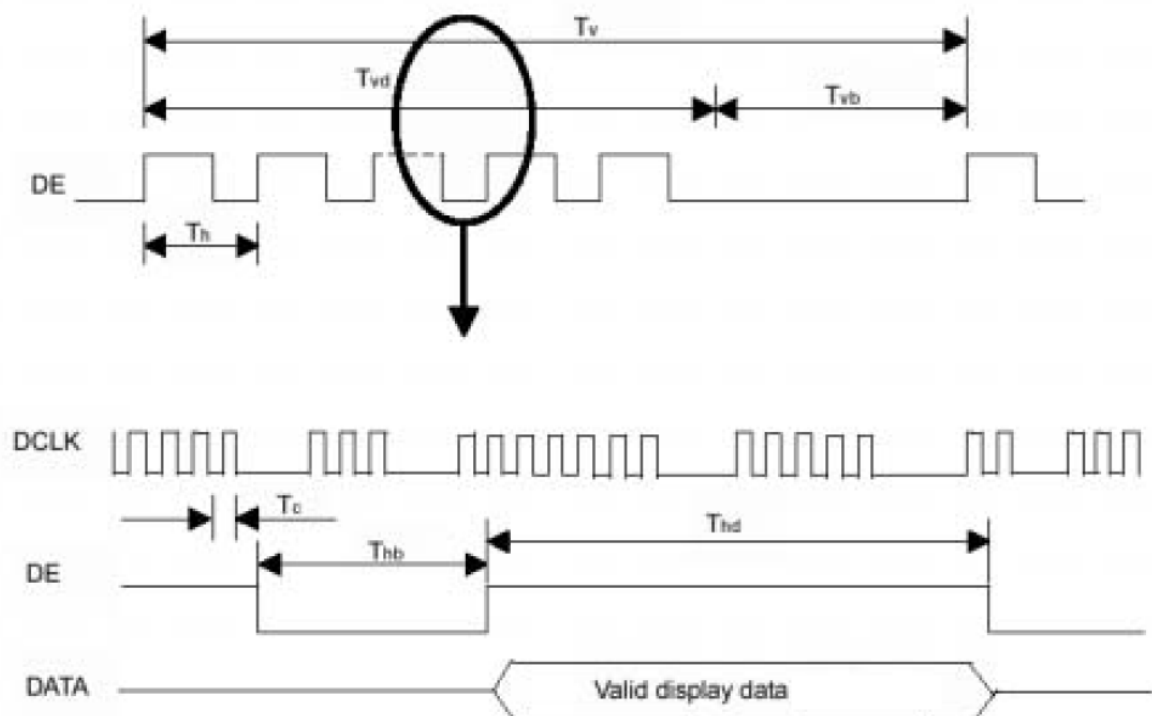### 6.4.1 Timing Characteristics

The input signal timing specifications are shown as the following table and timing diagram.

Signal	Item	Symbol	Min.	Typ.	Max.	Unit	Note
DCLK	Frequency	Fc	57.5	64.9	74.4	MHz	
Vertical Active Display Term	Total	Tv	774	806	848	Th	Tv=Tvd+Tvb
	Display	Tvd	-	768	-	Th	-
	Blank	Tvb	6	38	80	Th	-
Horizontal Active Display Term	Total	Th	1240	1344	1464	Tc	Th=Thd+Thb
	Display	Thd	-	1024	-	Tc	-
	Blank	Thb	216	320	440	Tc	-

Note (1) Since this assembly is operated in DE only mode, Hsync and Vsync input signals
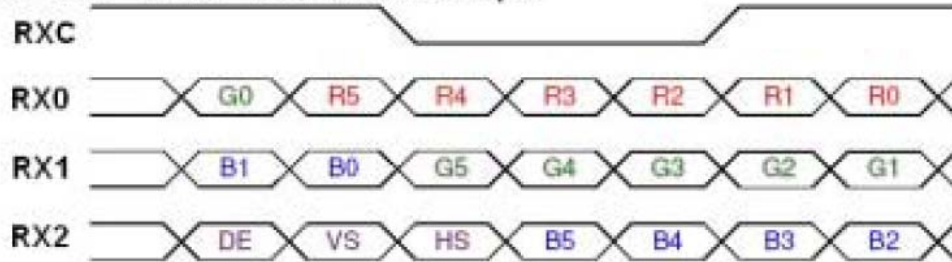should be set to low logic level. Otherwise, this assembly would operate abnormally.

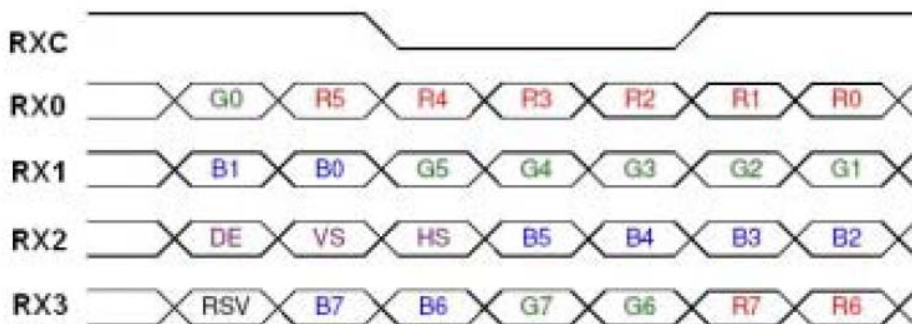   (2) Frame rate is 60Hz

INPUT SIGNAL TIMING DIAGRAM

6.4.2 The Input Data Format

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

RXC							
RX0	G0	R5	R4	R3	R2	R1	R0
RX1	B1	B0	G5	G4	G3	G2	G1
RX2	DE	VS	HS	B5	B4	B3	B2

SEL68 = "High" for 8 bits LVDS Input

RXC							
RX0	G0	R5	R4	R3	R2	R1	R0
RX1	B1	B0	G5	G4	G3	G2	G1
RX2	DE	VS	HS	B5	B4	B3	B2
RX3	RSV	B7	B6	G7	G6	R7	R6

Note (1) R/G/B data 7: MSB, R/G/B data 0: LSB

Note (2) Please follow PSWG

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 (3) Output signals from any system shall be low or Hi-Z state when VCC is off.

6.4.3 Scanning Direction

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

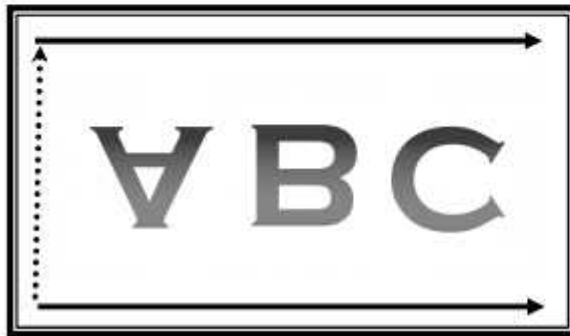

Fig.1 Normal Scan

Fig.2 Reverse Scan

Fig.3 Reverse Scan

Fig.4 Reverse Scan

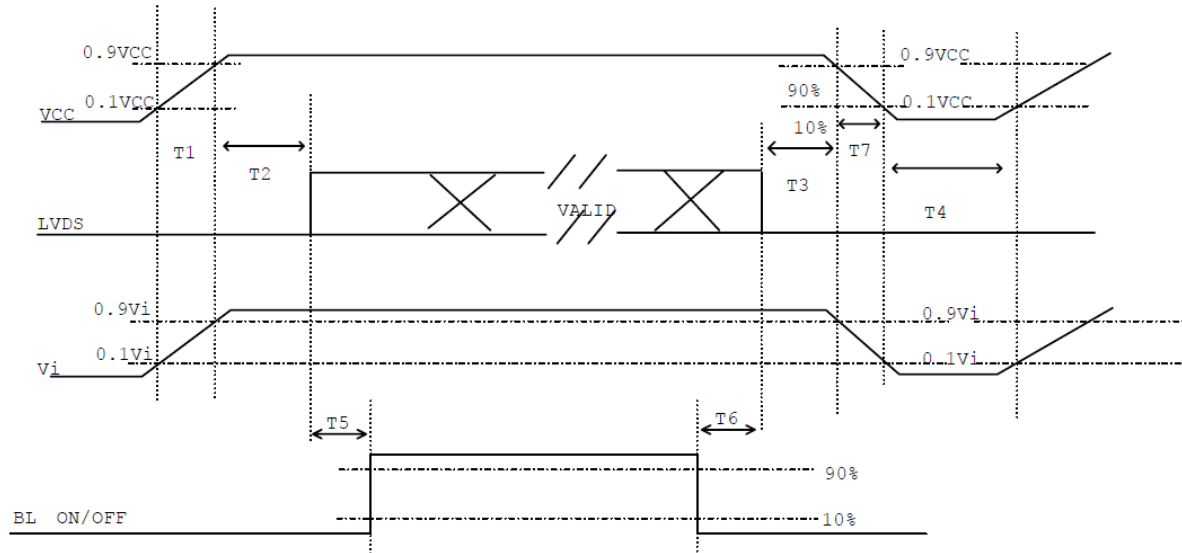Fig. 1 Normal scan (pin 17, reLR = Low or NC, pin 18, reUD = Low or NC)

Fig. 2 Reverse scan (pin 17, reLR = High, pin 18, reUD = Low or NC)

Fig. 3 Reverse scan (pin 17, reLR = Low or NC, pin 18, reUD = High)

Fig. 4 Reverse scan (pin 17, reLR = High, pin 18, reUD = High)

6.5 Power ON/OFF Sequence

To prevent a latch-up or DC operation of LCD module, the power on/off sequence should follow the conditions shown in the following diagram.

Power ON/OFF sequence

Note (1) Please avoid floating state of interface signal at invalid period.

Note (2) When the interface signal is invalid, be sure to pull down the power supply of LCD VCC to 0 V.

Note (3) The Backlight converter power must be turned on after the power supply for the logic and the interface signal is valid. The Backlight converter power must be turned off before the power supply for the logic and the interface signal is invalid.

Parameter	Value			Units
	Min	Typ	Max	
T1	0.5	-	10	ms
T2	0	-	50	ms
T3	0	-	50	ms
T4	500	-	-	ms
T5	200	-	-	ms
T6	200	-	-	ms
T7	5	-	300	ms

8. Reliability Test

Environment test conditions are listed as following table.

Items	Required Condition	Note
Temperature Humidity Bias (THB)	Ta= 50℃, 90%RH, 240hours	
High Temperature Operation (HTO)	Ta= 70℃, 50%RH, 240hours	3
Low Temperature Operation (LTO)	Ta= -30℃, 240hours	
High Temperature Storage (HTS)	Ta= 80℃, 240hours	
Low Temperature Storage (LTS)	Ta= -40℃, 240hours	
Drop Test	Height: 60 cm, package test	
Thermal Shock Test (TST)	-30℃/30min, 80℃/30min, 100 cycles	
On/Off Test	On/10sec, Off/10sec, 30,000 cycles	
ESD (ElectroStatic Discharge)	Contact Discharge: ± 8KV, 150pF(330Ω) 1sec, 9 points, 25 times/ point.	
	Air Discharge: ± 15KV, 150pF(330Ω) 1sec 9 points, 25 times/ point.	

Note 1: The TFT-LCD module will not sustain damage after being subjected to 100 cycles of rapid temperature change. A cycle of rapid temperature change consists of varying the temperature from -20℃ to 60℃, and back again. Power is not applied during the test. After temperature cycling, the unit is placed in normal room ambient for at least 4 hours before power on.

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

Note 3: The test items are tested by open frame type chassis.

10. Mechanical Characteristic

171±1

65.05±1

55.55

56.55±1

PIN1

PIN1

PIN1

I/F CONNECTOR:
FI-SEB20P-HFE(JAE) or EQUIVALENT
(STARCONN 076B20-0048RA-G4)

Z=5.44

Z=6.1(SCREW)

Z=6.0

200 mm