

5.7" VGA**High brightness color TFT-LCD module****Model: VM06B2 V5****Version : 01****Date: Jun. 6th, 2022****Note: This specification is subject to change
without notice****Customer : _____****Date : _____****Approved****Prepared****Date:****Date:**

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RECORD OF REVISION

Version and Date	Page	Old description	New description	Remark
0.1 2022/06/06	All	First Edition for customer		

1. Handling Precautions

- 1) Since front polarizer is easily damaged, pay attention not to scratch it.
- 2) Be sure to turn off power supply when inserting or disconnecting from input connector.
- 3) Wipe off water drop immediately. Long contact with water may cause discoloration or spots.
- 4) When the panel surface is soiled, wipe it with absorbent cotton or other soft cloth.
- 5) Since the panel is made of glass, it may break or crack if dropped or bumped on hard surface.
- 6) Since CMOS LSI is used in this module, take care of static electricity and insure human earth when handling.
- 7) Do not open or modify the Module Assembly.
- 8) Do not press the reflector sheet at the back of the module to any directions.
- 9) At the insertion or removal of the Signal Interface Connector, be sure not to rotate nor tilt the Interface Connector of the TFT Module.
- 10) 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.

2. General Description

2.1 Overview

This VM06B2 V5 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 VGA (640(H) x 480(V)) screen and 262K (6 bits) color support.

2.2 Features

- High brightness display, 1000nits by LED backlight.
- Long operation lifetime BLU design
- DE (Data Enable) mode and DE+SYNC mode selection
- TTL Interface
- Reversible scan direction
- Extra wide view angle
- Extra wide operation temperature
- RoHS Compliance

2.3 Application

Industrial applications.

2.4 Display specifications

Items	Unit	Specification
Screen Diagonal	inch	5.7"
Active Area	mm	115.2 (H) X 86.4 (V)
Pixels H x V	pixels	640 x3(RGB) x 480
Pixels Pitch	um	180 (per one triad) x 180
Pixel Arrangement		RGB Vertical stripe
Display mode		Normally black
White luminance (center)	Cd/m ²	1000 (Typ)
Contrast ratio		600:1 (Typ.)
Optical Response Time	msec	25 ms (Typ. On/off)
Normal Input Voltage VDD	Volt	3.3
Power Consumption (Vcc Line + LED backlight)	Watt	TBD (VDD line=TBD; LED lines= 3.6 W)
Weight	Grams	TBD
Physical size	mm	144.0 (W)× 104.6 (H)× 12.3 (D)
Electrical Interface		TTL
Support colors		262K colors (6 bits)
Surface Treatment		Hard coating
Temperature range		
Operating	°C	-30 ~ 85 (TFT surface)
Storage	°C	-40 ~ 85
RoHS Compliance		RoHS Compliance

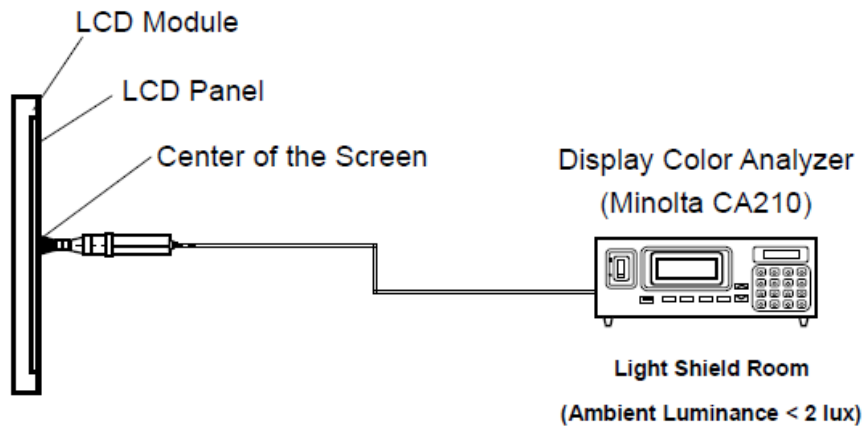
2.5 Optical characteristics

The following optical characteristics are measured under stable condition at 25 °C

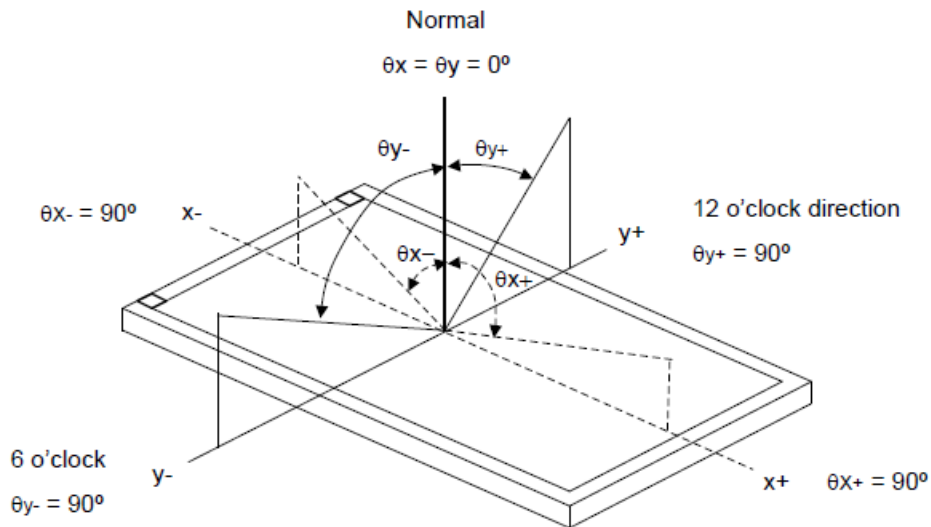
Items	Unit	Conditions	Min.	Typ.	Max.	Note
Viewing angle	Deg.	Horizontal (Right)	80	88		2
		CR=10 (Left)	80	88		
		Vertical (Up)	80	88		
		CR=10 (Down)	80	88		
Contrast Ratio		Normal Direction		600	800	3
Response Time	msec	Raising + Falling		25	35	4
Color coordinates (CIE) White		Red x	-0.05	0.652	+0.05	
		Red y		0.336		
		Green x		0.321		
		Green y		0.603		
		Blue x		0.152		
		Blue y		0.050		
		White x		0.313		
		White y		0.329		5
Center Luminance	Cd/m ²		800	1000		6
Luminance Uniformity	%		70	75		7
Crosstalk (in 60 Hz)	%				1.5	
Flicker	dB				-20	

Note 1: Measurement method

The LCD module should be stabilized at given temperature for 0.5 hour to avoid abrupt temperature change during measuring. In order to stabilize the luminance, the measurement should be executed after lighting Backlight for 1 hour in a windless room.



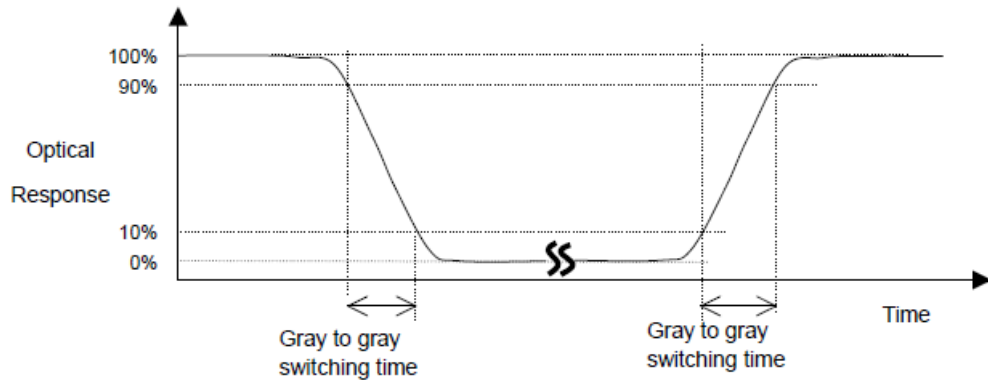
Note 2: Definition of viewing angle



Note 3: Contrast ratio is measured by Minolta CA210

Note 4: Definition of Response time

The output signals of photo detector are measured when the input signals are changed from “Full Black” to “Full White” (rising time), and from “Full White” to “Full Black” (falling time), respectively. The response time is interval between the 10% and 90% of amplitudes. Please refer to the figure as below.



Note 5: Color chromaticity and coordinates (CIE) is measured by Minolta CA210

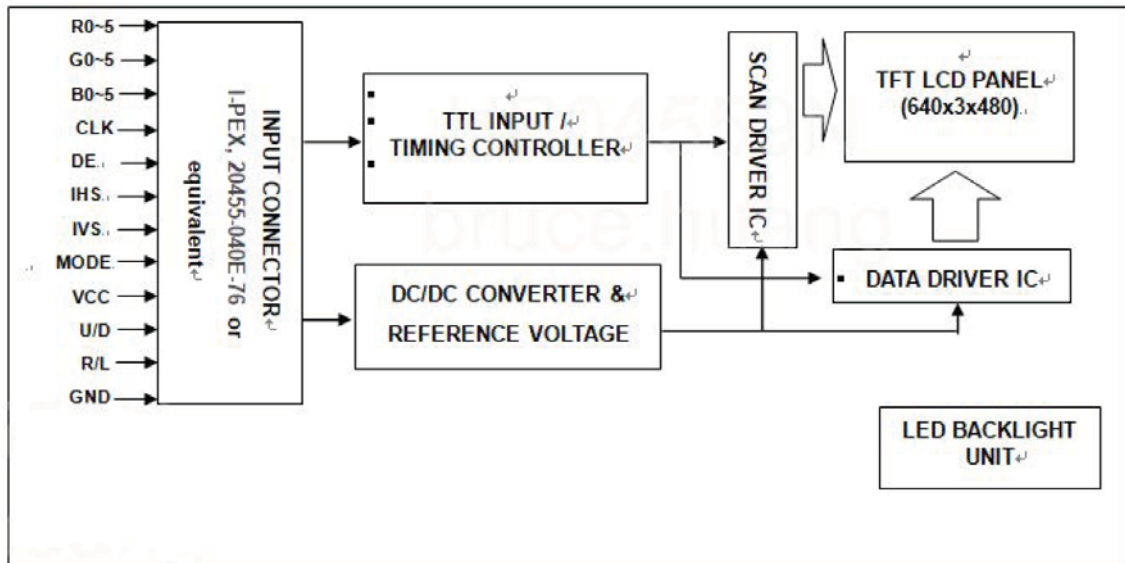
Note 6: Center luminance is measured by Minolta CA210

Note 7: Luminance uniformity of these 5 points is defined as below and measured by Minolta CA210



$$\text{Uniformity} = (\text{Min. Luminance of 5 points}) / (\text{Max. Luminance of 5 points})$$

3. Diagram



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	V _{DD}	-0.3	4	Volt	Note 1, 2

4.2 Backlight unit

Items	Symbol	Min	Max	Unit	Conditions
LED bar input current			240	mA	

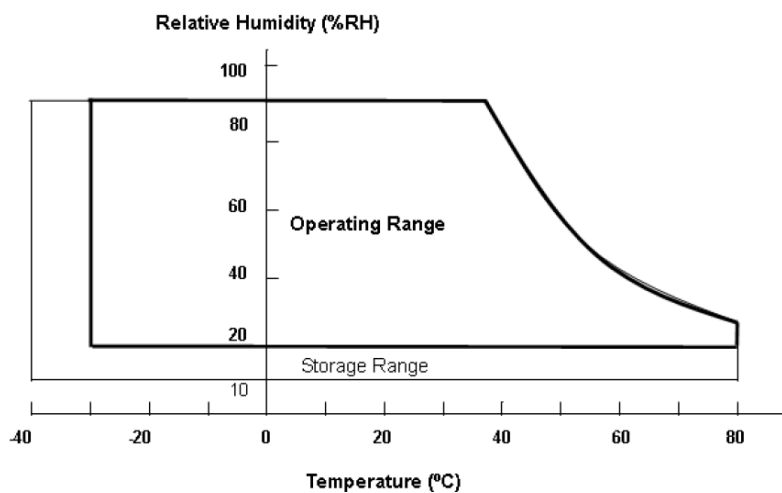
4.3 Environment

Items	Symbol	Values			Unit	Conditions
		Min.	Typ.	Max.		
Operation temperature	T _{OS}	-30	-	85	°C	Note 3
Operation Humidity	H _{OP}	10		85	%	
Storage temperature	T _{ST}	-40		85	°C	
Storage Humidity	H _{ST}	5		90	%	

Note 1: With in Ta= 25°C

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

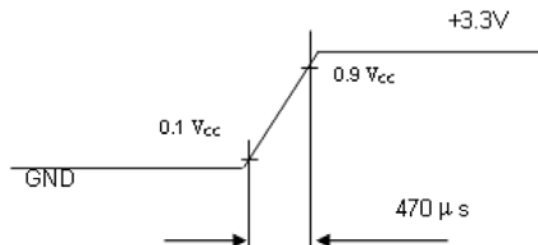
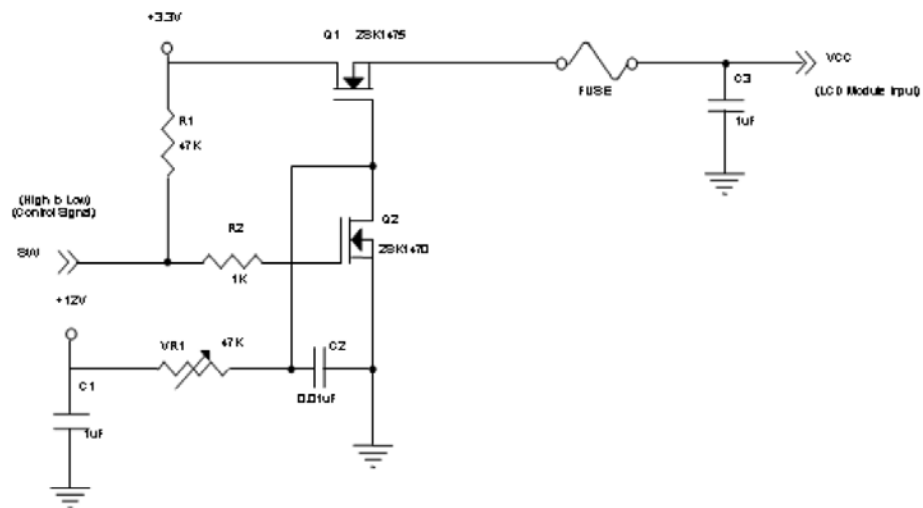
5.1 LCD electronics specification

5.1.1 Power specification

Parameter	Symbol	Value			Unit	Note	
		Min.	Typ.	Max.			
Power Supply Voltage	V_{CC}	3.0	3.3	3.6	V	-	
Ripple Voltage	V_{RP}	-	-	100	mVp-p		
Inrush Current	I_{INRUSH}	-	-	2.0	A	(2)	
Power Supply Current	White	I_{CC}	-	TBD	TBD	mA	(3)a
	Black		-	TBD	TBD	mA	(3)b
Power Consumption	P_L	-	TBD	-	W		
Logic High Input Voltage	V_{IH}	$0.7V_{CC}$		V_{CC}	V		
Logic Low Input Voltage	V_{IL}	GND		$0.3V_{CC}$	V		

Note (1) The module should be always operated within above ranges.

Note (2) Measurement Conditions:



5.2 Backlight unit

Parameter	Min	Typ	Max	Unit	Note
LED voltage (VL)		24		[V]	2
LED current (IL)		150		[mA]	2
LED power (PL)		3.6		[W]	
LED lite time (MTBF)		80,000		[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°C and typical LED Current at 150 mA

Note 2: The variance of LED Light Bar power consumption is ±10%. Calculator value for reference ($IL \times VL = PLED$)

5.3 Interface connector

5.3.1 TFT connector(CN1)

Pin No.	Symbol	Function	Note
1	GND	Ground	
2	CLK	Dot Clock. Latch data at the rising edge.	
3	IHS	Horizontal synchronous signal	
4	IVS	Vertical synchronous signal	
5	GND	Ground	
6	R5	Red data (MSB)	
7	R4	Red data	
8	R3	Red data	
9	R2	Red data	
10	R1	Red data	
11	R0	Red data (LSB)	
12	GND	Ground	
13	G5	Green data (MSB)	
14	G4	Green data	
15	G3	Green data	
16	G2	Green data	
17	G1	Green data	
18	G0	Green data (LSB)	
19	GND	Ground	
20	B5	Blue data (MSB)	Note (3)
21	B4	Blue data	
22	B3	Blue data	
23	B2	Blue data	
24	B1	Blue data	
25	B0	Blue data (LSB)	
26	GND	Ground	
27	DE	Data Enable Signal	
28	NC	No Connection	Note (3)
29	NC	No Connection	Note (3)
30	R/L	Horizontal Reverse Scan Control, Low or NC → Normal Mode. High → Horizontal Reverse Scan	Note (3)
31	U/D	Vertical Reverse Scan Control, High or NC → Normal Mode Low → Vertical Reverse Scan	Note (3)
32	NC	No Connection	Note (3) Note (4)
33	NC	No Connection	Note (3) Note (4)
34	NC	No Connection	Note (3) Note (4)
35	MODE	DE / HV mode select. High → HV mode. Low or NC → DE mode.	Note (3)
36	NC	No Connection	Note (3) Note (4)
37	NC	No Connection	Note (3)
38	VCC	Power supply: +3.3V	
39	VCC	Power supply: +3.3V	
40	VCC	Power supply: +3.3V	

Note (1) Connector Part No.: 20455-040E-76(I-PEX) or equivalent.

Note (2) User's connector Part No.: 20453-040T-03(I-PEX) or equivalent.

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

Note (4) Pin32, Pin33, Pin34, Pin36 input signals should be set to no connection or ground, this module would operate normally.

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

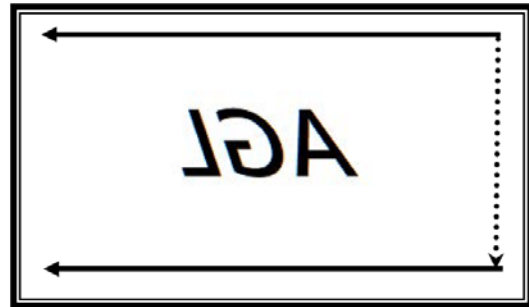


Fig.3 Reverse Scan



Fig.4 Reverse Scan



PCBA on the top side

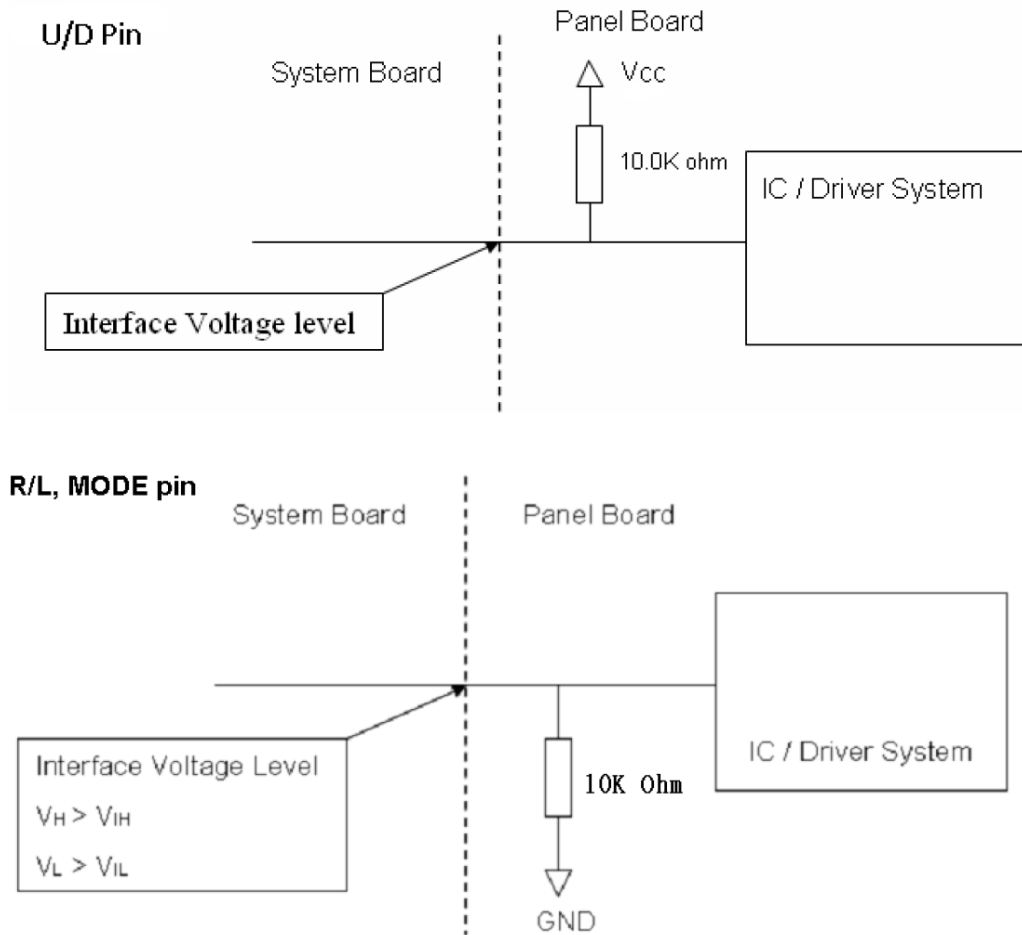
PCBA on the top side

Fig. 1 Normal scan (pin 30,R/L=Low or NC, pin 31,U/D = High or NC)

Fig. 2 Reverse scan (pin 30,R/L=High, pin 31,U/D = High or NC)

Fig. 3 Reverse scan (pin 30,R/L=Low or NC, pin 31,U/D = Low)

Fig. 4 Reverse scan (pin 30,R/L=High, pin 31,U/D = Low)



5.3.2 Backlight connector(CN2)

Recommended connector : BHSR-02VS-1 manufactured by JST

Pin no	Symbol	I/O	Description	Remark
1	VLED+	P	Backlight LED anode	Red
2	VLED-	P	Backlight LED cathode	Black

6. Signal characteristics

6.1 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
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	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	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	
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	Green(61)	0	0	0	0	0	0	1	1	1	1	0	1	0	0	0	0	0	
	Green(62)	0	0	0	0	0	0	1	1	1	1	1	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		
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
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	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

7. Interface timing

7.1 Input signal timing specifications

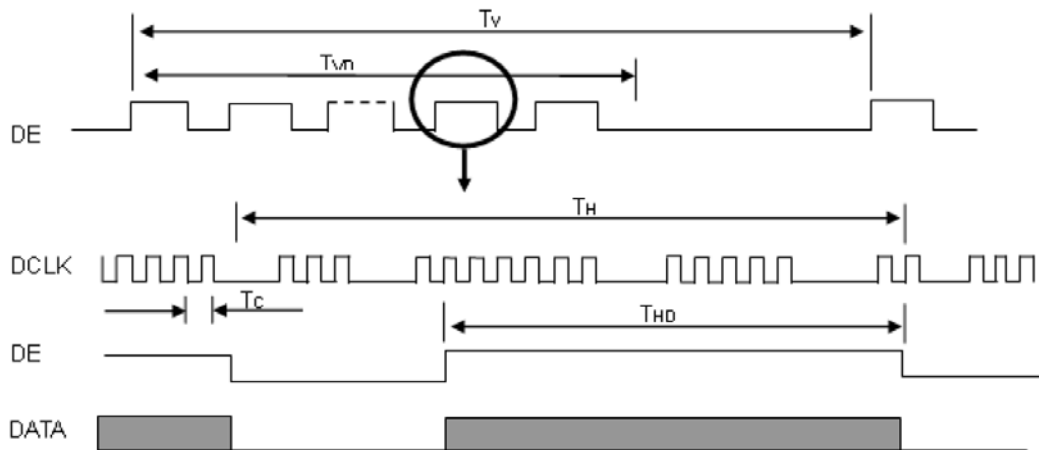
The input signal timing specifications are shown as the following table and timing diagram.

Signal	Item	Symbol	Min.	Typ.	Max.	Unit	Note
DCLK	Frequency	F_r	20.5	20.7	29.8	MHz	-
	Period	T_c	33.56	48.31	48.78	ns	-
	Input cycle to cycle jitter	T_{rdl}	---	---	200	ns	(a)
	Spread spectrum modulation range	$F_{clk_{in_mod}}$	$0.98 \cdot F_c$	-	$1.02 \cdot F_c$	MHz	(b)
	Spread spectrum modulation frequency	F_{SSM}	-	-	200	KHz	
Vertical Display Term	Frame Rate	F_r	---	60	---	Hz	$T_v = T_{vd} + T_{vb}$
	Total	T_v	488	490	611	T_h	-
	Active Display	T_{vd}	480	480	480	T_h	-
	Blank	T_{vb}	8	10	131	T_h	-
Horizontal Display Term	Total	T_h	700	704	814	T_c	$T_h = T_{hd} + T_{hb}$
	Active Display	T_{hd}	640	640	640	T_c	-
	Blank	T_{hb}	60	64	174	T_c	-

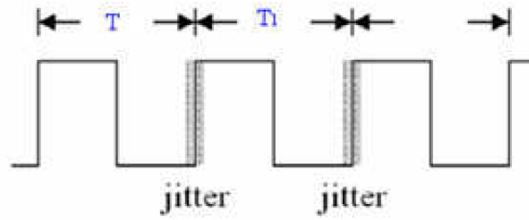
Note (1) Because this module is operated by DE only mode, Hsync and Vsync input signals should be set to low logic level or ground. Otherwise, this module would operate abnormally.

Note (2) The $T_v(T_{vd}+T_{vb})$ must be integer, otherwise, the module would operate abnormally.

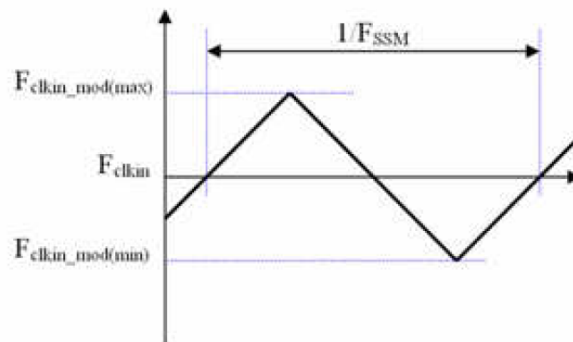
INPUT SIGNAL TIMING DIAGRAM



Note (a) The input clock cycle-to-cycle jitter is defined as below figures. $T_{rcj} = |T1 - T1|$



Note (b) The SSCG (Spread spectrum clock generator) is defined as below figures.



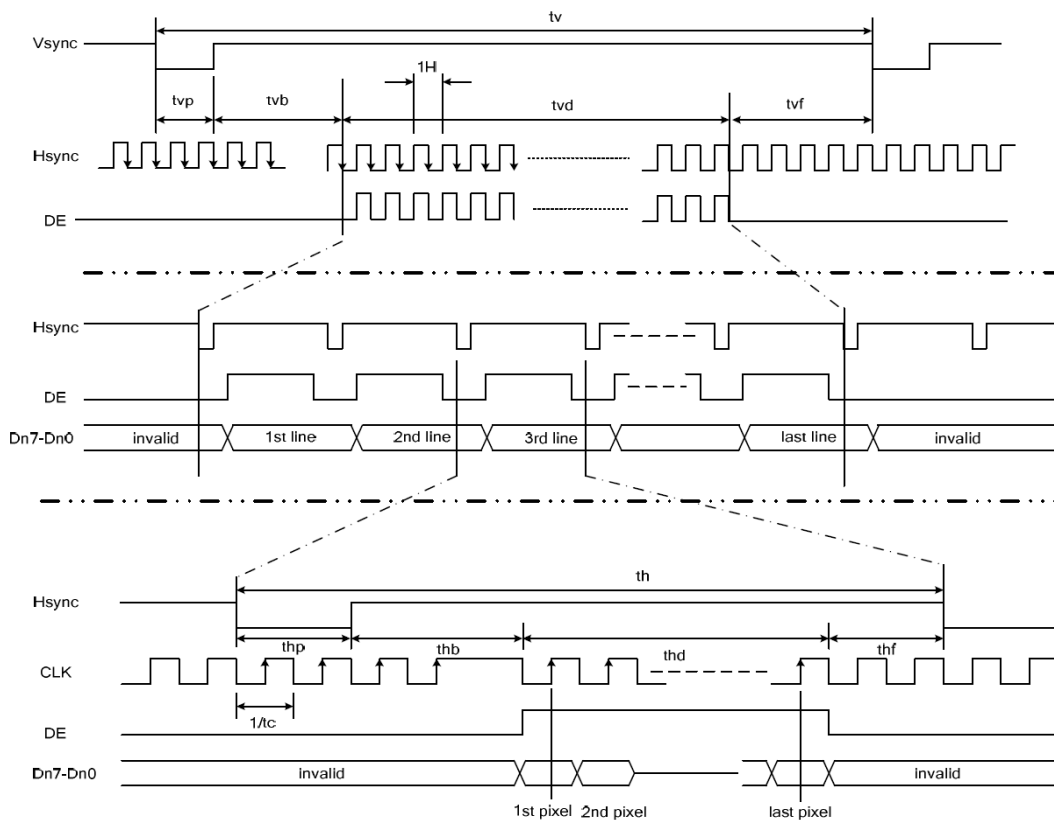
7.2 DE +SYNC mode input signal timing specifications

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

Signal	Item	Symbol	Min.	Typ.	Max.	Unit	Note
DCLK	Frequency	Tc	20.5	20.7	29.8	MHz	
Vertical Active Display Term	Total	Tv	488	490	611	Th	
	Display	Tvd	-	480	-	Th	
	Front Porch	Tvf	3	5	126	Th	
	Back Porch	Tvb	5	5	5	Th	
	VS Pluse	Tvp	1	2	4	Th	
Horizontal Active Display Term	Total	Th	700	704	814	Tc	
	Display	Thd	-	640	-	Tc	
	Front Porch	Thf	28	32	142	Tc	
	Back Porch	Thb	32	32	32	Tc	
	HS Pluse	Thp	1	2	31	Tc	

Note (1) The $Tv(Tvd+Tvb+Tvf+Tvp)$ must be integer, otherwise, the module would operate abnormally

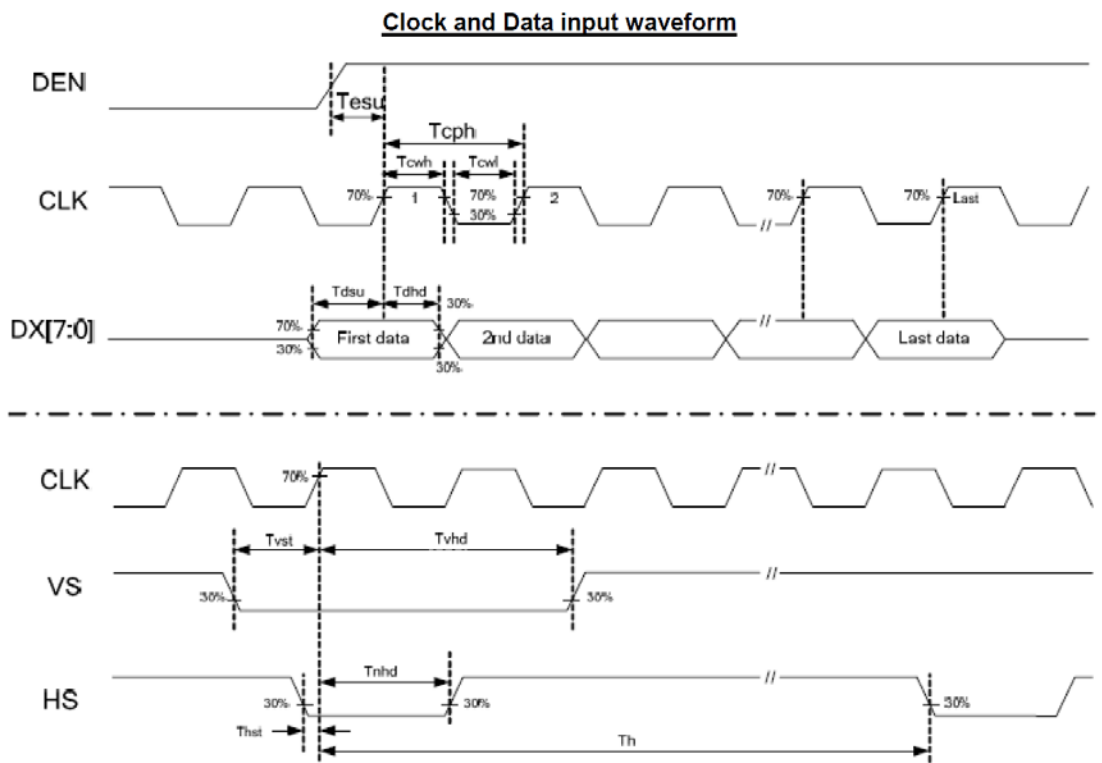
INPUT SIGNAL TIMING DIAGRAM



7.3AC electrical characteristics

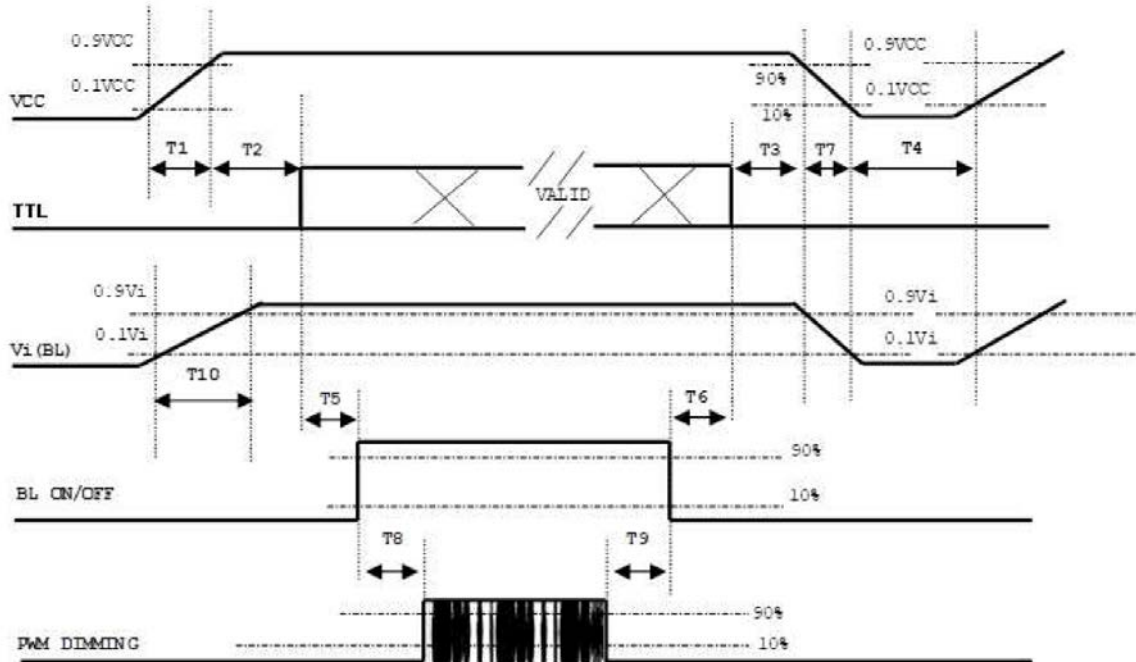
Parameter	Symbol	Value			Unit	Condition
		Min.	Typ.	Max.		
Data setup time	Tdsu	10	-	-	ns	Note (1)
Data hold time	Tdhd	10	-	-	ns	Note (1)
DE setup time	Tesu	10	-	-	ns	
HS setup time	Thst	10	-	-	ns	
HS hold time	Thhd	10	-	-	ns	
VS setup time	Tvst	10	-	-	ns	
VS hold time	Tvhd	10	-	-	ns	

Note (1) CLK latching data at the rising edge.



7.4 Power ON/OFF sequence

To prevent a latch-up or DC operation of LCD assembly, the power on/off sequence should be as the diagram below.



Parameter	Value			Units
	Min	Typ	Max	
T1	0.5	-	10	ms
T2	0	-	50	ms
T3	0	-	50	ms
T4	500	-	-	ms
T5	450	-	-	ms
T6	200	-	-	ms
T7	10	-	100	ms
T8	10	-	-	ms
T9	10	-	-	ms
T10	20	-	50	ms

Note(1) The supply voltage of the external system for the module input should be the same as the definition of Vcc.

Note(2) When the backlight turns on before the LCD operation of the LCD turns off, the display may momentarily become abnormal screen.

Note(3) In case of VCC = off level, please keep the level of input signals on the low or keep a high impedance.

Note(4) T4 should be measured after the module has been fully discharged between power off and on period.

Note(5) Interface signal shall not be kept at high impedance when the power is on.

Note(6) INX won't take any responsibility for the products which are damaged by the customers not following the Power Sequence.

Note(7) There might be slight electronic noise when LCD is turned off (even backlight unit is also off). To avoid this symptom, we suggest "Vcc falling timing" to follow "T7 spec

8. Reliability Test

Environment test conditions are listed as following table.

Items	Required Condition	Note
Temperature Humidity Bias (THB)	Ta=40°C, 80%RH, 240hours	
High Temperature Operation (HTO)	Ts= 80°C, 240hours	3
Low Temperature Operation (LTO)	Ta= -30°C, 240hours	
High Temperature Storage (HTS)	Ta= 80°C, 240hours	
Low Temperature Storage (LTS)	Ta= -40°C, 240hours	
Thermal Shock Test (TST)	-20°C/30min, 60°C/30min, 100 cycles	
On/Off Test	On/10sec, Off/10sec, 30,000 cycles	
ESD (ElectroStatic Discharge)	Contact Discharge: ± 8KV, 150pF(330Ω) 1sec/cycle	
	Air Discharge: ± 15KV, 150pF(330Ω) 1sec/cycle	

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 -10°C to 50°C, 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.

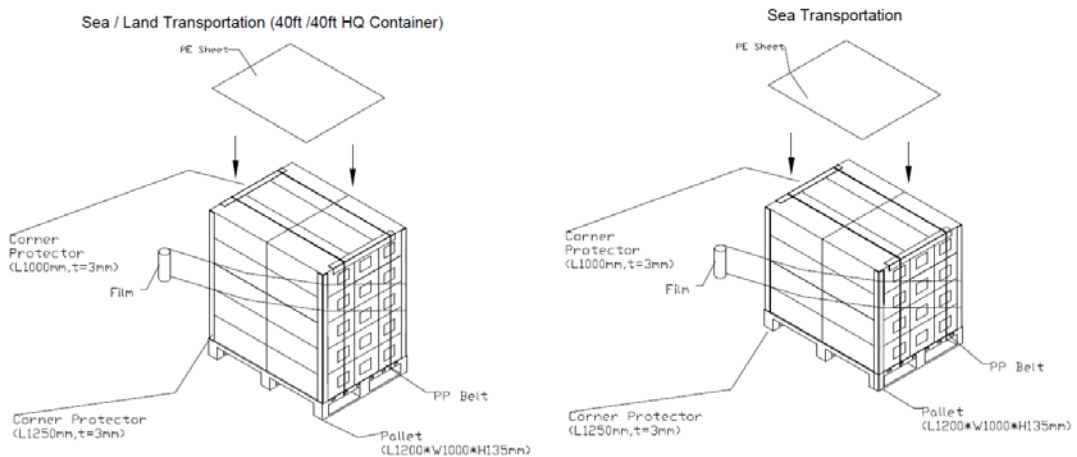
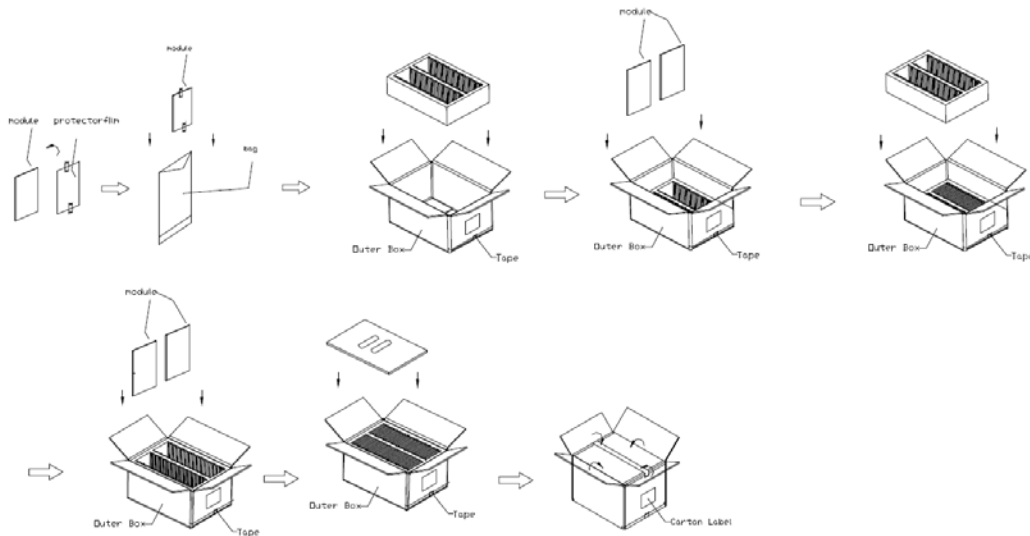
Note 2: According to EN61000-4-2 , ESD class B: Some performance degradation allowed. No data lost. Self-recoverable. No hardware failures.

Note 3: TFT surface.

9. Shipping package (TBD)

- (1) 60pcs LCD modules / 1 Box
- (2) Box dimensions: 500 (L) X 400 (W) X 330 (H) mm
- (3) Weight: approximately 11.65Kg (60 modules per box)

PACKING METHOD



10. Mechanical Characteristics

