



深圳市一众显示科技有限公司

SHEN ZHEN TEAM SOURCE DISPLAYTECH. CO, TD.

TFT-LCD Module Specification

Module NO.: TST057VGCH-H01

Version: V1.0

APPROVAL FOR SPECIFICATION

APPROVAL FOR SAMPLE

For Customer' s Acceptance:	
Approved by	Comment

Team Source Display:		
Presented by	Reviewed by	Organized by

Version No.	Date	Content	Remark
V1.0	2022-07-07	First Released	

1. GENERAL DESCRIPTION

1.1 OVERVIEW

TST057VGCH-H01 is a 5.7" TFT Liquid Crystal Display IAV module with LED backlight and 40 pins 1ch-TTL interface. This module supports 640 x 480 VGA mode and can display 262k colors.

The PSWG is to establish a set of displays with standard mechanical dimensions and select electrical interface requirements for an industry standard 5.7" VGA LCD panel and the LED driving device for Backlight is built in PCBA.

1.2 FEATURE

- VGA (640 x 480 pixels) resolution
- DE (Data Enable) mode and DE+SYNC mode selection
- TTL Interface
- PSWG (Panel Standardization Working Group)
- Wide operating temperature.
- Reversible scan direction
- RoHS compliance

1.3 APPLICATION

- TFT LCD Monitor
- Factory Application
- Amusement

1.4 GENERAL SPECIFICATIONS

Item	Specification	Unit	Note
Active Area	115.2 (H) x 86.4 (V) (5.7" diagonal)	mm	(1)
Driver Element	a-Si TFT active matrix	-	-
Pixel Number	640 x R.G.B x 480	pixel	-
Pixel Pitch	0.18(H) x 0.18(W)	mm	-
Pixel Arrangement	RGB vertical Stripe	-	-
Display Colors	262K	color	-
Display Mode	Normally Black	-	-
Surface Treatment	Hard Coating (3H), Anti-Glare	-	-
Module Power Consumption	TBD(PanelTBD+BL 2.3W)	W	Typ.

1.5 MECHANICAL SPECIFICATIONS

Item		Min.	Typ.	Max.	Unit	Note
Module Size	Horizontal(H)	143.5	144	144.5	mm	(1)
	Vertical(V)	104.1	104.6	105.1	mm	
	Depth(D)	11.8	12.3	12.8	mm	
Bezel Area	Horizontal	117.6	118.2	118.4	mm	-
	Vertical	88.8	89.4	89.6	mm	
Active Area	Horizontal	-	115.2	-	mm	
	Vertical	-	86.4	-	mm	
Weight		-	(TBD)		g	

Note (1)Please refer to the attached drawings for more information of front and back outline dimensions.

2. ABSOLUTE MAXIMUM RATINGS

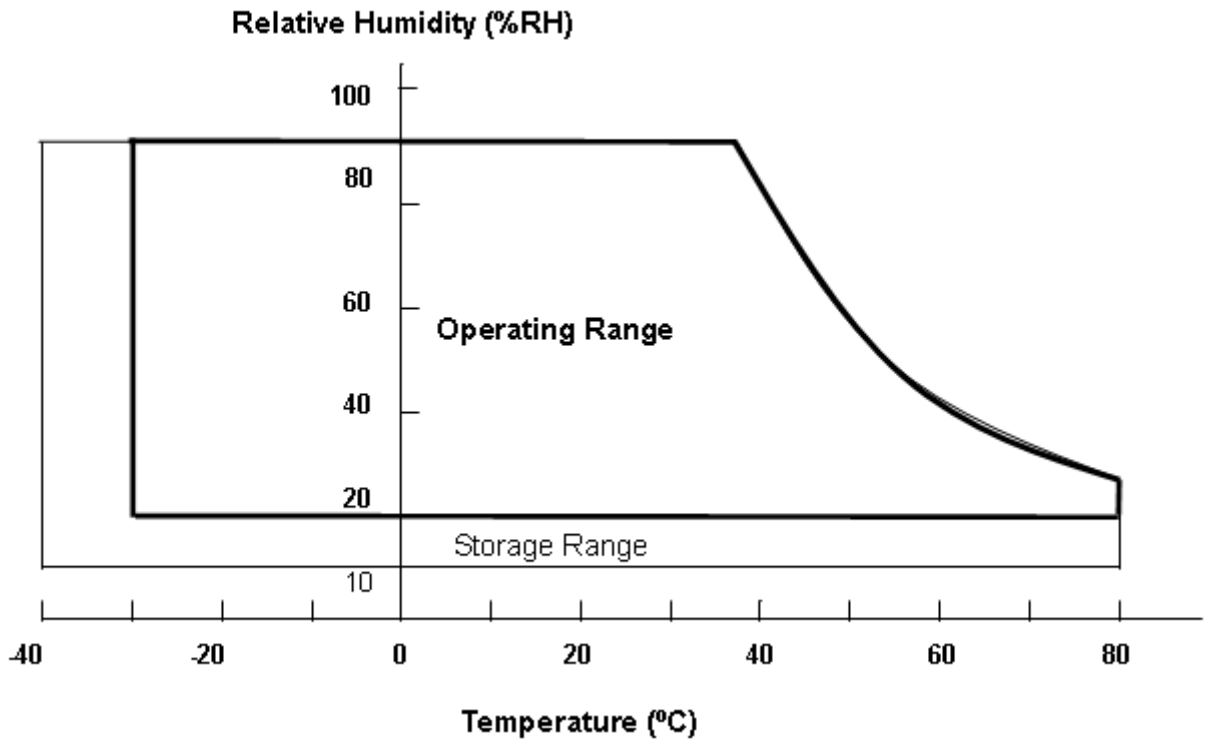
2.1 ABSOLUTE RATINGS OF ENVIRONMENT

Item	Symbol	Value		Unit	Note
		Min.	Max.		
Operating Ambient Temperature	T _{OP}	-30	+85	°C	(1)(2)
Storage Temperature	T _{ST}	-40	+85	°C	

Note (1)

- (a) 90 %RH Max.
- (b) Wet-bulb temperature should be 39 °C Max.
- (c) No condensation.

Note (2) Panel surface temperature should be 0°C min. and 65°C max under Vcc=5.0V, fr =60Hz, typical LED string current, 25°C ambient temperature, and no humidity control . Any condition of ambient operating temperature ,the surface of active area should be keeping not higher than 85°C.



2.2 ELECTRICAL ABSOLUTE RATINGS

2.2.1 TFT LCD MODULE

Item	Symbol	Value		Unit	Note
		Min.	Max.		
Power Supply Voltage	VCC	-0.3	4	V	(1)
Logic Input Voltage	V _{IN}	-0.3	4	V	

2.2.2 BACKLIGHT UNIT

Item	Symbol	Value		Unit	Note
		Min.	Max.		
Converter Voltage	V _i	-0.3	18	V	(1) , (2)
Enable Voltage	EN	---	5.5	V	
Backlight Adjust	Dimming	---	5.5	V	

Note (1) Permanent damage to the device may occur if maximum values are exceeded. Function operation should be restricted to the conditions described under Normal Operating Conditions.

Note (2) Specified values are for LED (Refer to 3.2 for further information).

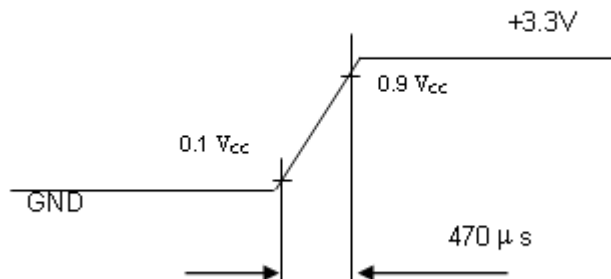
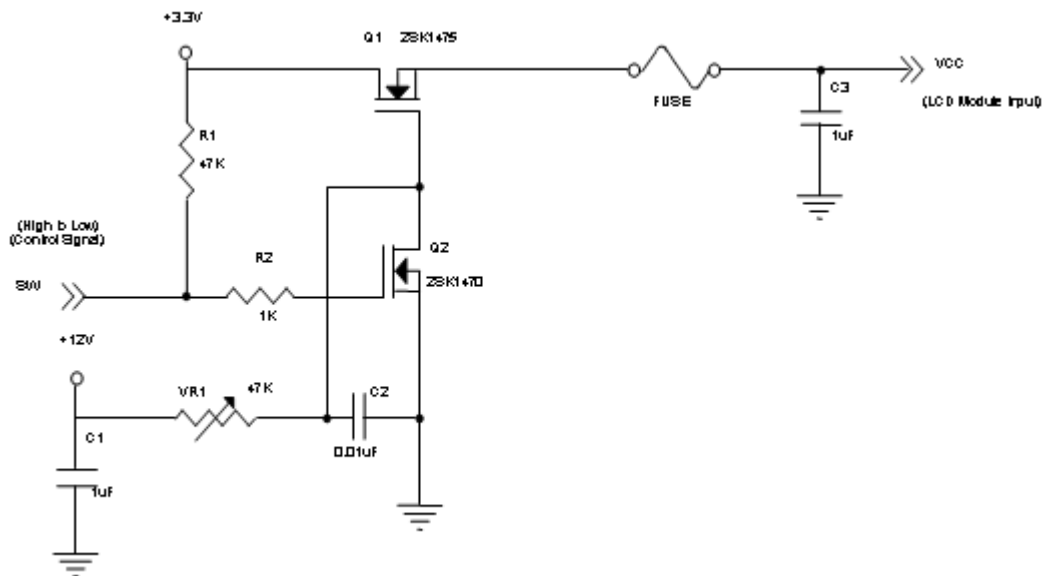
3. ELECTRICAL CHARACTERISTICS

3.1 TFT LCD MODULE

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	-	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:



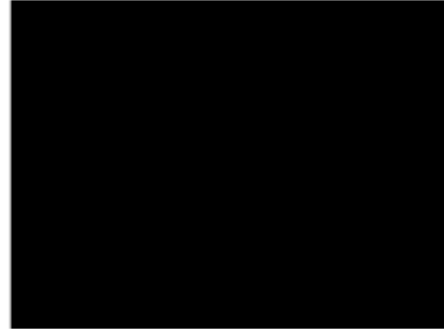
Note (3) The specified power supply current is under the conditions at $V_{DD} = 3.3V$, $T_a = 25 \pm 2^\circ C$, DC Current and $f_v = 60$ Hz, whereas a power dissipation check pattern below is displayed.

a. White Pattern



Active Area

b. Black Pattern

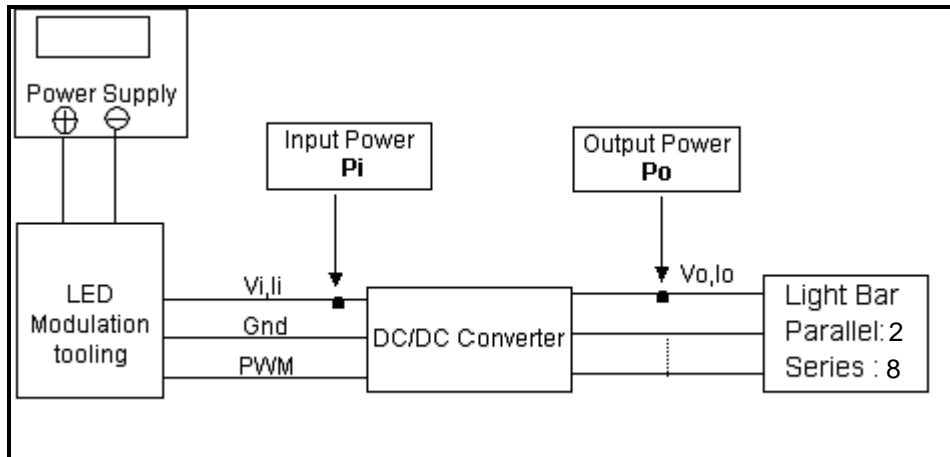


Active Area

3.2 BACKLIGHT UNIT

Parameter	Symbol	Value			Unit	Note	
		Min.	Typ.	Max.			
Converter Input Voltage	V_i	10.8	12.0	13.2	V_{DC}	(Duty 100%)	
Converter Input Ripple Voltage	V_{iRP}	-	-	500	mV		
Converter Input Current	I_i	0.16	0.19	0.22	A_{DC}	@ $V_i = 12V$ (Duty 100%)	
Converter Inrush Current	I_{rush}	-	-	3.0	A	@ V_i rising time=10ms ($V_i=12V$)	
Input Power Consumption	P_i	-	2.3		W	(1)	
EN Control Level	Backlight on	ENLED	2.0	3.3	5.0	V	
	Backlight off	(BLON)	0	-	0.3	V	
PWM Control Level	PWM High Level	Dimming	2.0	-	5.0	V	
	PWM Low Level	(E_PWM)	0	-	0.15	V	
PWN Noise Range	V_{Noise}	-	-	0.1	V		
PWM Control Frequency	f_{PWM}	190	200	20k	Hz	(2)	
PWM Dimming Control Duty Ratio	-	-	5	-	100	%	(2), @ 190Hz < f_{PWM} < 1kHz
			20	-	100	%	(2), @ 1kHz ≤ f_{PWM} < 20kHz
LED Life Time	L_{LED}	50,000		-	Hrs	(3)	

Note (1) LED current is measured by utilizing a high frequency current meter as shown below:



Note (2) The lifetime of LED is estimated data and defined as the time when it continues to operate under the conditions at $T_a = 25 \pm 2 \text{ }^\circ\text{C}$ and Duty 100% until the brightness becomes $\leq 50\%$ of its original value. Operating LED at high temperature condition will reduce life time and lead to color shift.

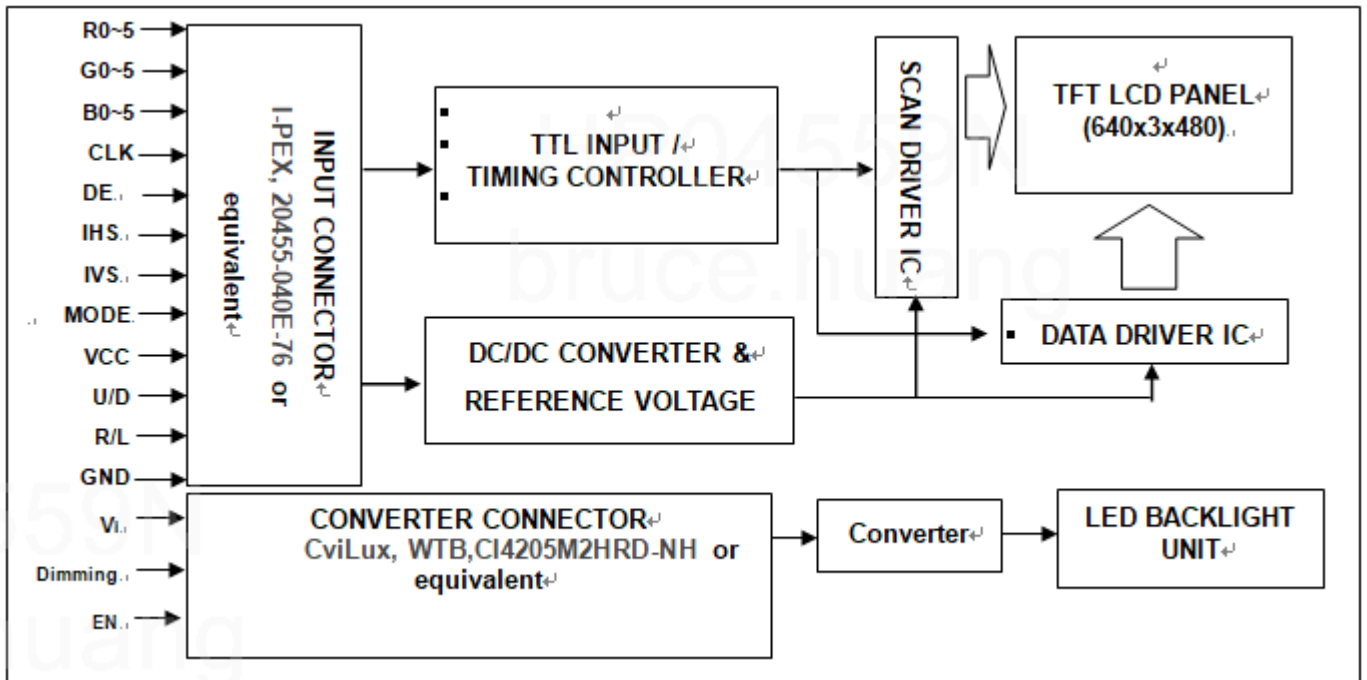
Note (3) At 190 ~1kHz PWM control frequency, duty ratio range is restricted from 5% to 100%.

1K ~20kHz PWM control frequency, duty ratio range is restricted from 20% to 100%.

If PWM control frequency is applied in the range from 1KHz to 20KHZ, The “non-linear” phenomenon on the Backlight Unit may be found. So It’ s a **suggestion** that PWM control frequency should be **less than 1KHz**.

4. BLOCK DIAGRAM

4.1 TFT LCD MODULE



5. INPUT TERMINAL PIN ASSIGNMENT

5.1 TFT LCD MODULE

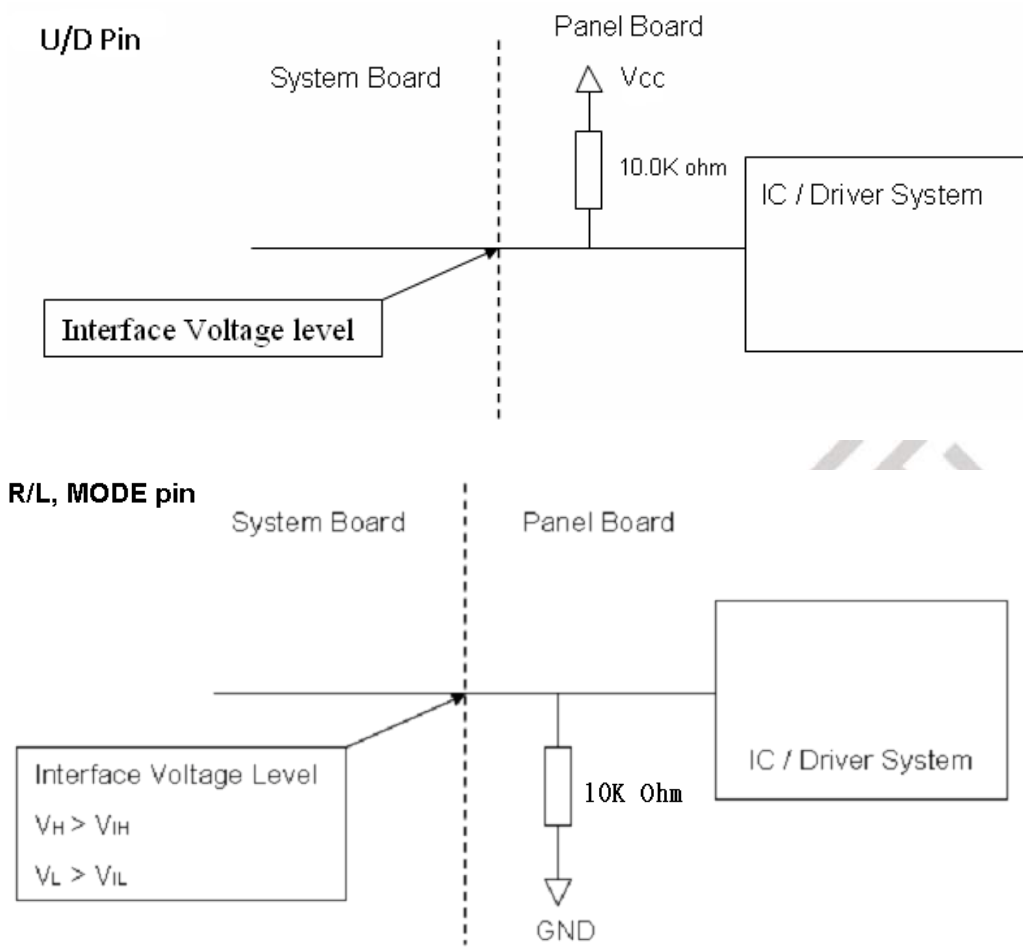
Pin No.	Symbol	Function	Note
1	GND	Ground	
2	CLK	Dot Clock. Latch data at the rising edge.	
3	IHS	Horizontal synchronous signal	
4	IVS	Vertical synchronous signal	
5	GND	Ground	
6	R5	Red data (MSB)	
7	R4	Red data	
8	R3	Red data	
9	R2	Red data	
10	R1	Red data	
11	R0	Red data (LSB)	
12	GND	Ground	
13	G5	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.

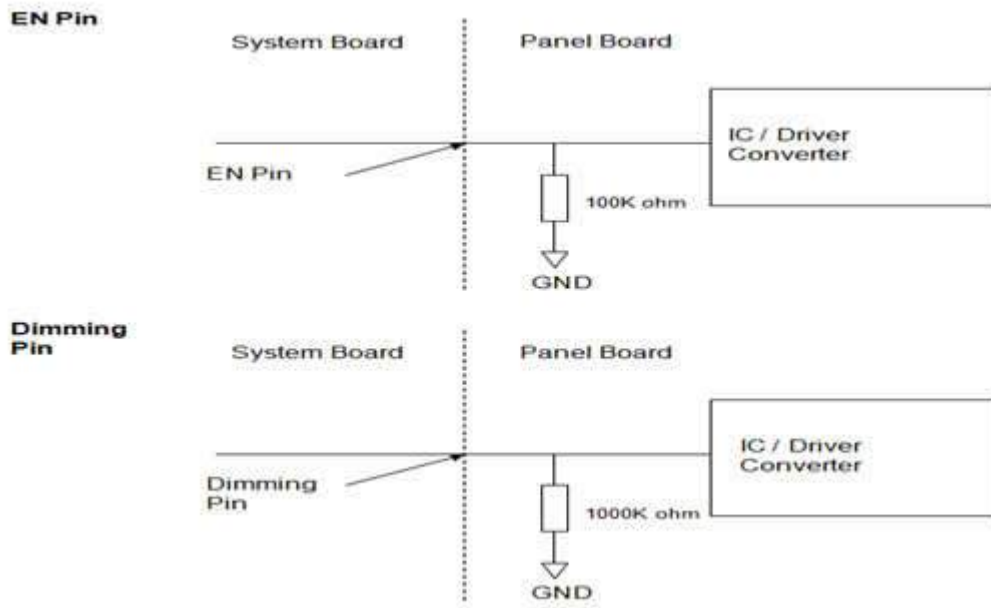


5.2 BACKLIGHT UNIT(Converter connector pin)

Pin	Symbol	Description	Remark
1	NC	Not Connect	
2	Dimming	Backlight Adjust	PWM Dimming (Hi: 3.3V _{DC} , Lo: 0V _{DC})
3	EN	Enable pin	3.3V
4	V _{GND}	Converter ground	Ground
5	V _i	Converter input voltage	12V

Note (1)Connector Part No.: CI4205M2HRD-NH (Cvilux) or equivalent.

Note (2)User's connector Part No.: 9827H-04-N0HF(SWB) or equivalent.



5.3 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
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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	0
	Green(2)	0	0	0	0	0	0	0	0	0	1	0	0	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	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
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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

6. INTERFACE TIMING

6.1 INPUT SIGNAL TIMING SPECIFICATIONS

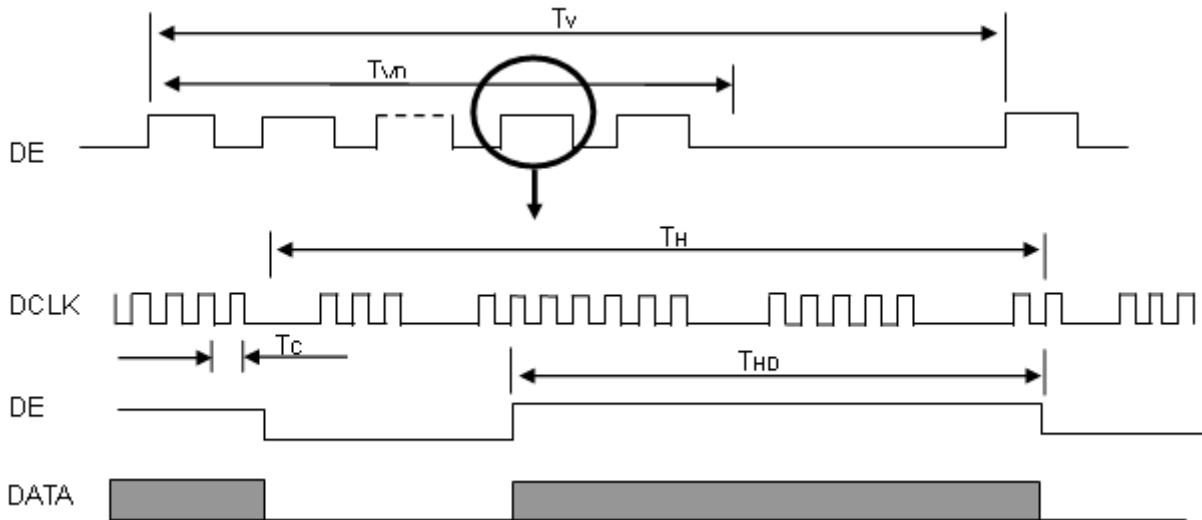
The input signal timing specifications are shown as the following table and timing diagram.

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_{clkin_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	-

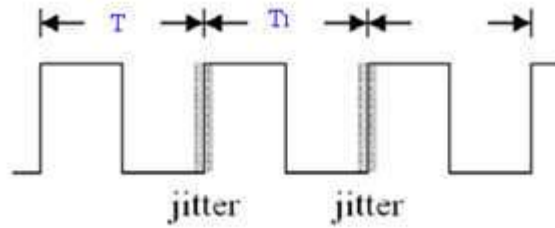
Note (1) Because this module is operated by DE only mode, Hsync and Vsync input signals should be set to low logic level or ground. Otherwise, this module would operate abnormally.

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

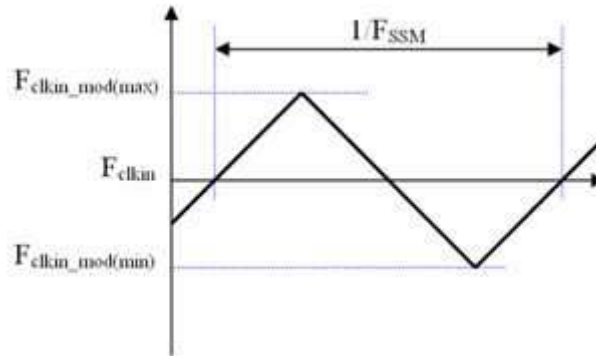
INPUT SIGNAL TIMING DIAGRAM



Note (a) The input clock cycle-to-cycle jitter is defined as below figures. $T_{rc1} = |T1 - T1|$



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



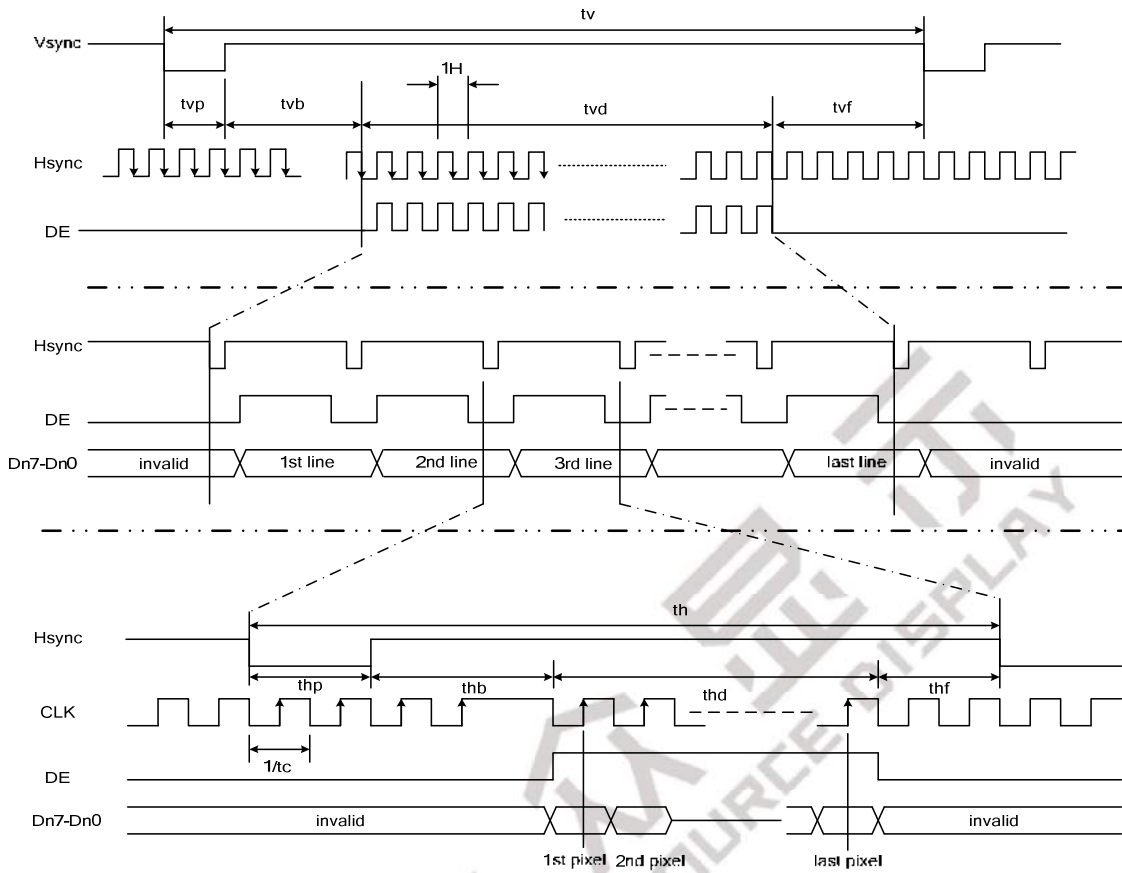
6.2 DE +SYNC MODE INPUT SIGNAL TIMING SPECIFICATIONS

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

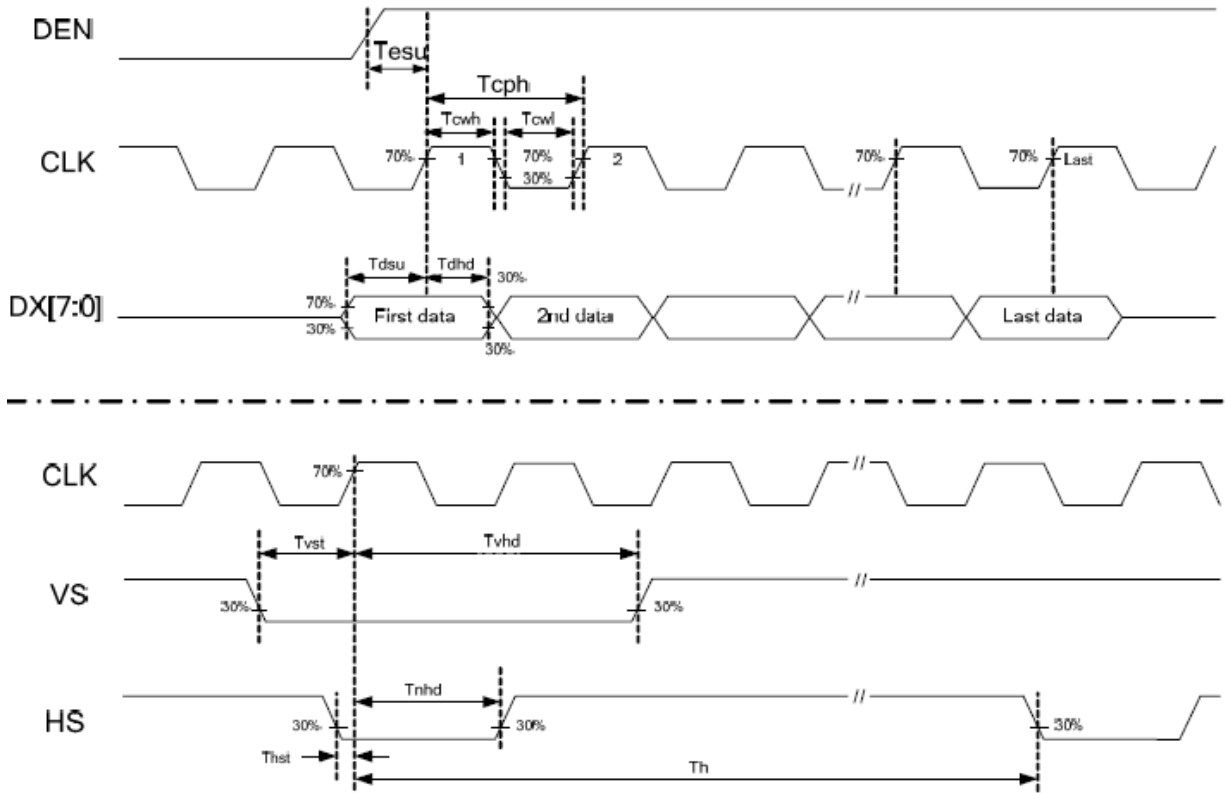


6.3 AC ELECTRICAL CHARACTERISTICS

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	

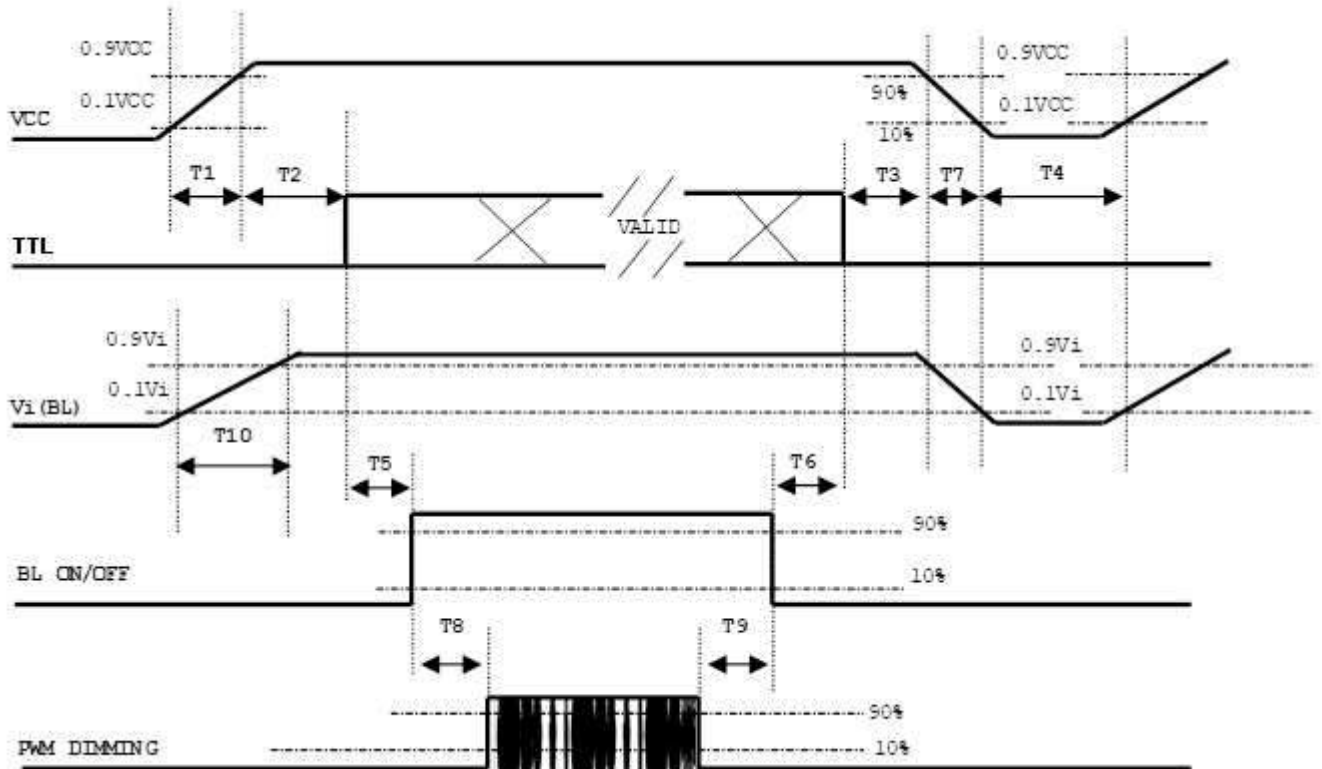
Note (1) CLK latching data at the rising edge.

Clock and Data input waveform



6.4 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) TSD 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

7. OPTICAL CHARACTERISTICS

7.1 TEST CONDITIONS

Item	Symbol	Value	Unit
Ambient Temperature	Ta	25±2	oC
Ambient Humidity	Ha	50±10	%RH
Supply Voltage	According to typical value and tolerance in "ELECTRICAL CHARACTERISTICS"		
Input Signal			
PWM Duty Ratio	D	100	%

7.2 OPTICAL SPECIFICATIONS

The relative measurement methods of optical characteristics are shown here and all items are measured at the center point of screen unless otherwise noted. The following items should be measured under the test conditions described above and stable conditions shown in Note (5).

Item	Symbol	Condition	Min.	Typ.	Max.	Unit	Note
Color Chromaticity	Red	Rx	(0.602)	(0.652)	(0.702)	-	(1), (5)
		Ry	(0.286)	(0.336)	(0.386)		
	Green	Gx	(0.271)	(0.321)	(0.371)		
		Gy	(0.553)	(0.603)	(0.653)		
	Blue	Bx	(0.102)	(0.152)	(0.202)		
		By	(0.000)	(0.050)	(0.100)		
	White	Wx	(0.263)	(0.313)	(0.363)		
		Wy	(0.279)	(0.329)	(0.379)		
Center Luminance of White	LC		(360)	(450)		(4), (5)	
Contrast Ratio	CR		(600)	(800)		(2), (5)	
Response Time	TR	$\theta X=0^\circ, \theta Y=0^\circ$	-	(13)	(18)	-	(3)
	TF		-	(12)	(17)	-	
White Variation	δW	$\theta X=0^\circ, \theta Y=0^\circ$	(72)	(80)	-	%	(5), (6)
Viewing Angle	Horizontal	$\theta X+$	80	88	-	Deg.	(1), (5)
		$\theta X-$	80	88	-		
	Vertical	$\theta Y+$	80	88	-		
		$\theta Y-$	80	88	-		

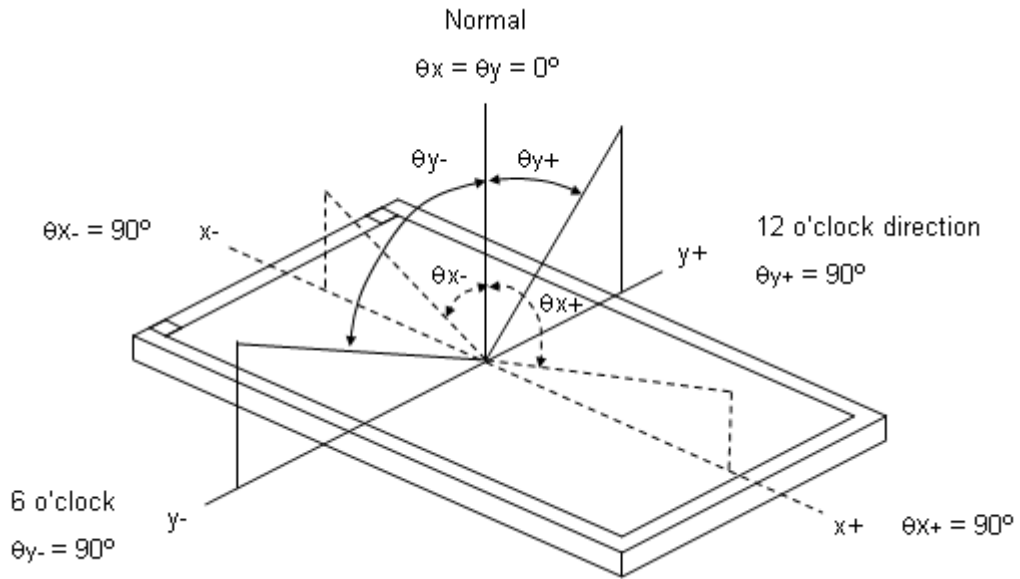
Definition :

Grayscale Maximum : Grayscale 255 (10 bits: grayscale 1023 ; 8 bits : grayscale 255 ; 6 bits: grayscale 63)

White : Luminance of Grayscale Maximum (All R,G,B)

Black : Luminance of grayscale 0 (All R,G,B)

Note (1) Definition of Viewing Angle (θ_x, θ_y):

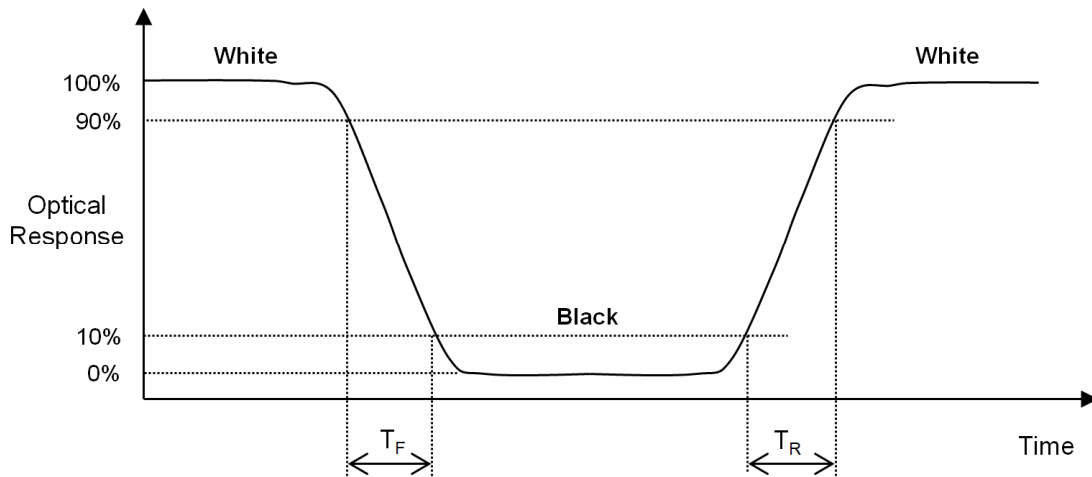


Note (2) Definition of Contrast Ratio (CR):

The contrast ratio can be calculated by the following expression at center point.

$$\text{Contrast Ratio (CR)} = \text{White} / \text{Black}$$

Note (3) Definition of Response Time (T_R, T_F):

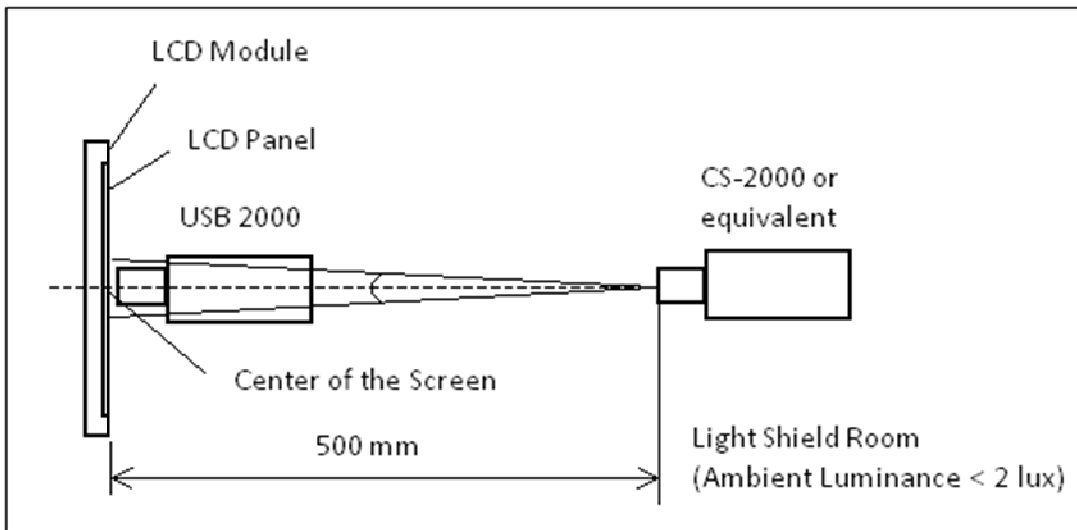


Note (4) Definition of Luminance of White (L_c):

Measure the luminance of White at center point.

Note (5) Measurement Setup:

The LCD module should be stabilized at given temperature to avoid abrupt temperature change during measuring. In order to stabilize the luminance, the measurement should be executed after lighting Backlight for 40 minutes in a windless room. The measurement placement of module should be in accordance with module drawing.

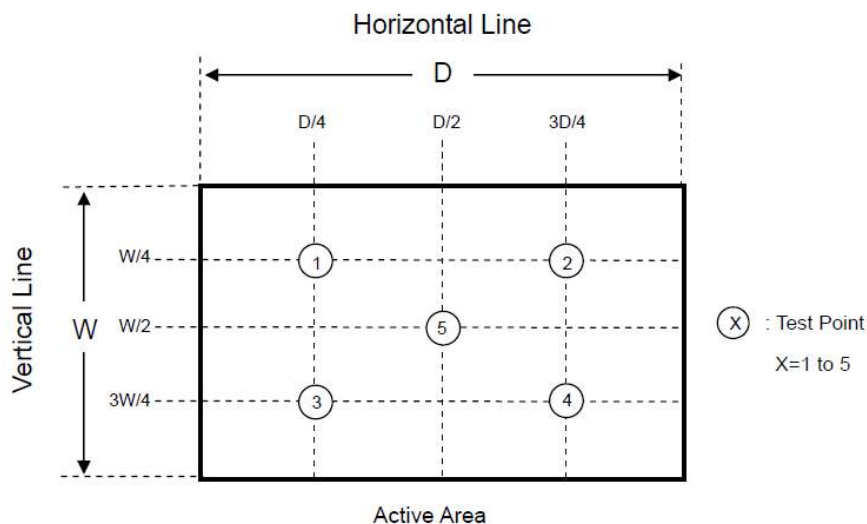


Note (6) Definition of White Variation (δW):

Measure the luminance of White at 5 points.

Luminance of White : $L(X)$, where X is from 1 to 5.

$$\delta W = \frac{\text{Minimum [} L(1) \text{ to } L(5) \text{]}}{\text{Maximum [} L(1) \text{ to } L(5) \text{]}} \times 100\%$$



8. RELIABILITY TEST CRITERIA

Test Item	Test Condition	Note
High Temperature Storage Test	85°C, 240 hours	(1),(2) (4),(5)
Low Temperature Storage Test	-40°C, 240 hours	
Thermal Shock Storage Test	-30°C, 0.5 hour ↔ 70°C, 0.5 hour; 100cycles, 1 hour/cycle)	
High Temperature Operation Test	85°C, 240 hours	
Low Temperature Operation Test	-30°C, 240 hours	
High Temperature & High Humidity Operation Test	60°C, RH 90%, 240 hours	
ESD Test (Operation)	150pF, 330Ω, 1 sec/cycle Condition 1 : panel contact, ±8 KV Condition 2 : panel non-contact ±15 KV	(1), (4)
Shock (Non-Operating)	50G, 11ms, half sine wave, 1 time for ± X, ± Y, ± Z direction	(2), (3)
Vibration (Non-Operating)	1.5G, 10 ~ 300 Hz sine wave, 10 min/cycle, 3 cycles each X, Y, Z direction	

Note (1) There should be no condensation on the surface of panel during test ,

Note (2) Temperature of panel display surface area should be 85°C Max.

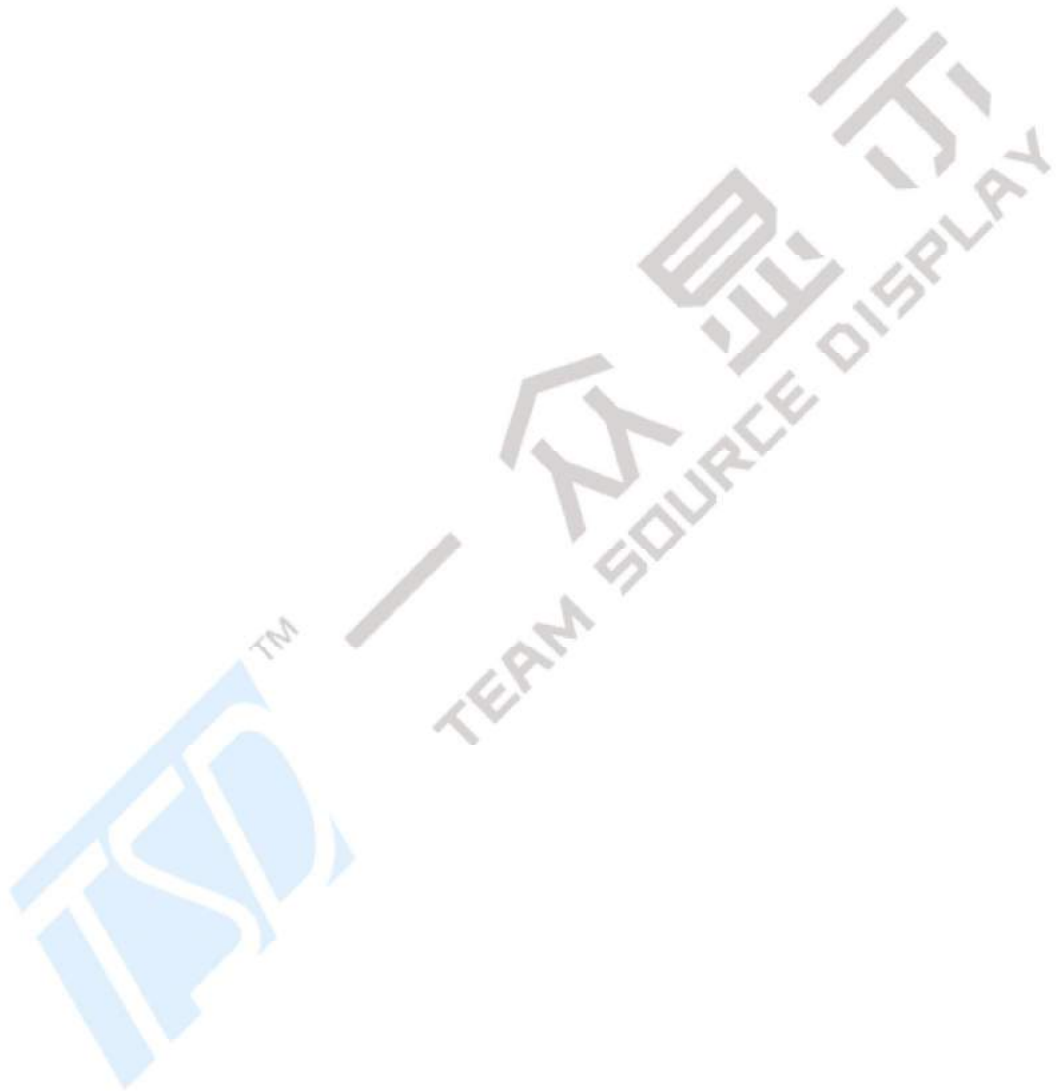
Note (3) At testing Vibration and Shock, the fixture in holding the module has to be hard and rigid enough so that the module would not be twisted or bent by the fixture.

Note (4) In the standard conditions, there is no function failure issue occurred. All the cosmetic specification is judged before reliability test.

Note (5) Before cosmetic and function test, the product must have enough recovery time, at least 24 hours at room temperature.

9. PACKAGING

TBD



10. PRECAUTIONS

10.1 ASSEMBLY AND HANDLING PRECAUTIONS

- (1) The module should be assembled into the system firmly by using every mounting hole. Be careful not to twist or bend the module.
- (2) While assembling or installing modules, it can only be in the clean area. The dust and oil may cause electrical short or damage the polarizer.
- (3) Use fingerstalls or soft gloves in order to keep display clean during the incoming inspection and assembly process.
- (4) Do not press or scratch the surface harder than a HB pencil lead on the panel because the polarizer is very soft and easily scratched.
- (5) If the surface of the polarizer is dirty, please clean it by some absorbent cotton or soft cloth. Do not use Ketone type materials (ex. Acetone), Ethyl alcohol, Toluene, Ethyl acid or Methyl chloride. It might permanently damage the polarizer due to chemical reaction.
- (6) Wipe off water droplets or oil immediately. Staining and discoloration may occur if they left on panel for a long time.
- (7) If the liquid crystal material leaks from the panel, it should be kept away from the eyes or mouth. In case of contacting with hands, legs or clothes, it must be washed away thoroughly with soap.
- (8) Protect the module from static electricity, it may cause damage to the C-MOS Gate Array IC.
- (9) Do not disassemble the module.
- (10) Do not pull or fold the lamp wire.
- (11) Pins of I/F connector should not be touched directly with bare hands.

10.2 STORAGE PRECAUTIONS

- (1)When storing for a long time, the following precautions are necessary.
 - (a) Store them in a dark place. Do not expose the module to sunlight or fluorescent light. Keep the temperature between 5°C and 30°C at humidity 50+-10%RH.
 - (b) The polarizer surface should not come in contact with any other object.
 - (c) It is recommended that they be stored in the container in which they were shipped.
 - (d) Storage condition is guaranteed under packing conditions.
 - (e)The phase transition of Liquid Crystal in the condition of the low or high storage temperature will be recovered when the LCD module returns to the normal condition
- (2)High temperature or humidity may reduce the performance of module. Please store LCD module within the specified storage conditions.
- (3)It is dangerous that moisture come into or contacted the LCD module, because the moisture may damage LCD module when it is operating.
- (4)It may reduce the display quality if the ambient temperature is lower than 10 °C. For example, the response time will become slowly, and the starting voltage of lamp will be higher than the room temperature.

10.3 OTHER PRECAUTIONS

(1) Normal operating condition

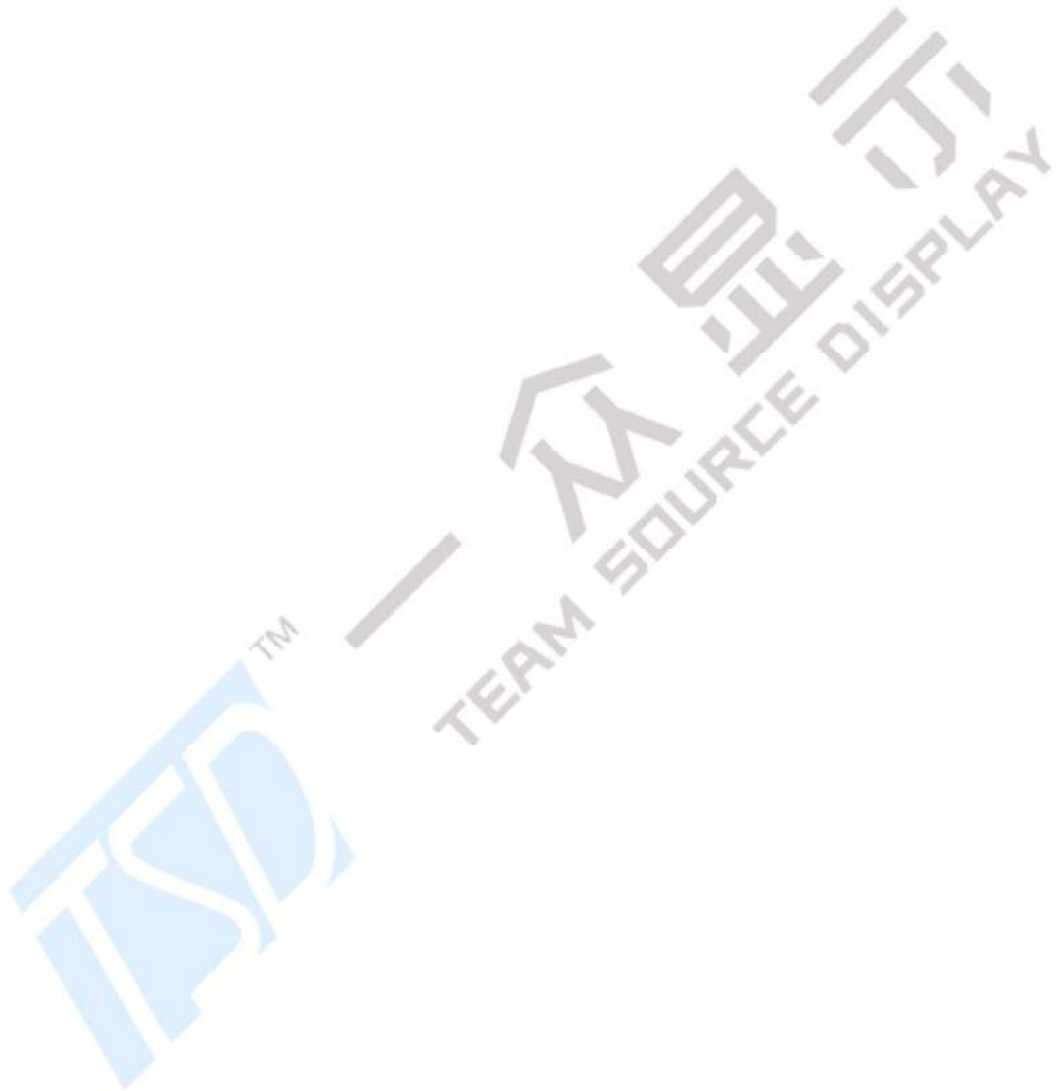
(a) Display pattern: dynamic pattern (Real display)

(Note) Long-term static display can cause image sticking.

(2) Operating usages to protect against image sticking due to long-term static display

(a) Static information display recommended to use with moving image.

(3) Abnormal condition just means conditions except normal condition.



11. MECHANICAL CHARACTERISTICS

