BOE TFT-LCD

MODEL: RV657UBM

Issue Date : 2021/1/25

(*)Preliminary Specifications
( )Final Specifications

BOE	*Drafter By*	
	Approved By	
Customer	*Signature*	

CONTENTS

REVISION HISTORY

Version	Date	Page	Description
2.0	2021/01/25	All	First release

1. GENERAL DESCRIPTION

1.1 OVERVIEW

This specification applies to the 65.7 inch Color TFT-LCD Module RV657UBM. This LCD module has a TFT active matrix type liquid crystal panel 3840x600 pixels, and diagonal size of 65.7 inch. This module supports 3840*2160 mode. Each pixel is divided into Red, Green and Blue sub-pixels or dots which are arranged in vertical stripes. Gray scale or the brightness of the sub-pixel color is determined with a 10-bit gray scale signal for each dot. The RV657UBM has been designed to apply the V-BY-ONE interface method. It is intended to support displays where high brightness, wide viewing angle, high color saturation, and high color depth are very important.

1.2 GENERAL SPECIFICATIONS

Item	Specification	Unit	Note
Screen Size	65.7	Inch	-
Driver Element	a-Si TFT active matrix	-	-
Pixel Number	V by One:3840x R.G.B. x 600	Pixel	
Pixel Number	0.4296(H) x 0.4296(W)	mm	
Pixel Arrangement	RGB vertical stripe	-	
Display Colors	1.07B (Dithered 10bit) 16.7 millions	Color	
Transmissive Mode	Normally Black	-	
Surface Treatment	Hard coating (3H), AG (Haze 1%)	-	
Luminance, White	700 (typical)	cd/m2	
Color Gamut	72% of NTSC(Typ.)	-	
Power Consumption	OC Max:21W BL Max:54W total:75W		(1)

Note(1) The specified power consumption: Total=cell(reference 4.3.1)+BL(reference 4.3.3)

2. MECHANICAL SPECIFICATIONS

Item		Min	Typ.	Max	Unit	Note
Module Size	Horizontal(H)	Typ.-1	1680.2	Typ.+1	mm	(1)
	Vertical (V)	Typ.-1	290.5	Typ.+1	mm	
	Thickness (T)	Typ.-1	34.7	Typ.+1	mm	To inverter cover
Bezel Area	Horizontal	Typ.-0.5	1652.66	Typ.+0.5	mm	
	Vertical	Typ.-0.5	260.3	Typ.+0.5	mm	
Active Area	Horizontal	-	1649.66	-	mm	
	Vertical	-	257.3	-	mm	
Weight		-	TBD	-	Kg	

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

3. ABSOLUTE MAXIMUM RATINGS

3.1 ABSOLUTE RATINGS OF ENVIRONMENT

Item	Symbol	Value		Unit	Note
		Min.	Max.		
Storage Temperature	TST	-20	+60	ºC	(1)
Operating Ambient Temperature	TOP	0	+50	ºC	(1),(2)

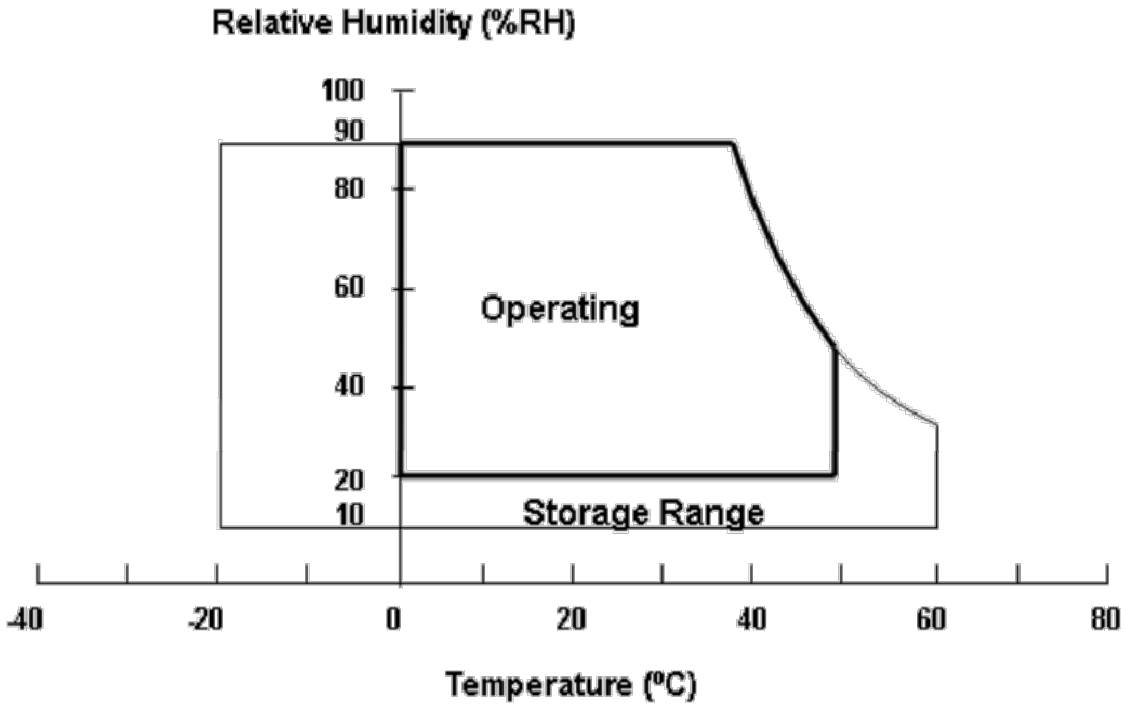
Note (1)

(a) 90 %RH Max. (Ta <= 40 ºC).

(b) Wet-bulb temperature should be 39 ºC Max. (Ta > 40 ºC).

(c) No condensation.

Note (2) The temperature of panel surface should be 0 ºC min. and 60 ºC max.



3.2 ELECTRICAL ABSOLUTE RATINGS

3.2.1 BACKLIGHT UNIT

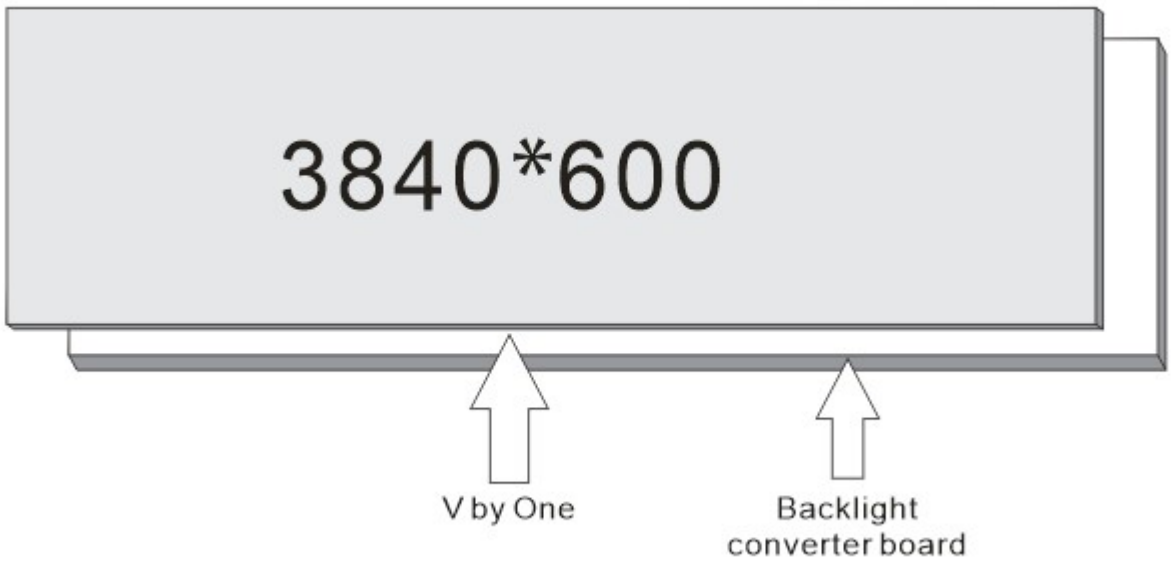
Item	Symbol	Value			Unit	Note
		Min.	Typ.	Max.		
LED Forward Current Per Input Pin	I_F	-	-	450	mA	(1),(2) Duty=100%
LED Pulse Forward Current Per Input Pin	I_P	-	-	900	mA	(1),(2)

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 input pin of LED light bar at Ta=25±2 ºC (Refer to 4.3.3 and 4.3.4 for further information).

4. ELECTRICAL SPECIFICATIONS

4.1 FUNCTION BLOCK DIAGRAM



4.2 INTERFACE CONNECTIONS

No	Symbol	Description	No	Symbol	Description
1	VLCD	Power Supply +12.0V (notes 2)	27	GND	Ground
2	VLCD	Power Supply +12.0V (notes 2)	28	Rx0n	V-by-One HS Data Lane 0
3	VLCD	Power Supply +12.0V (notes 2)	29	Rx0p	V-by-One HS Data Lane 0
4	VLCD	Power Supply +12.0V (notes 2)	30	GND	Ground
5	VLCD	Power Supply +12.0V (notes 2)	31	Rx1n	V-by-One HS Data Lane 1
6	VLCD	Power Supply +12.0V (notes 2)	32	Rx1p	V-by-One HS Data Lane 1
7	VLCD	Power Supply +12.0V (notes 2)	33	GND	Ground
8	VLCD	Power Supply +12.0V (notes 2)	34	Rx2n	V-by-One HS Data Lane 2
9	NC	No Connection	35	Rx2p	V-by-One HS Data Lane 2
10	GND	Ground	36	GND	Ground
11	GND	Ground	37	Rx3n	V-by-One HS Data Lane 3
12	GND	Ground	38	Rx3p	V-by-One HS Data Lane 3
13	GND	Ground	39	GND	Ground
14	GND	Ground	40	Rx4n	V-by-One HS Data Lane 4
15	Data format 0	Fixed =Mode3	41	Rx4p	V-by-One HS Data Lane 4
16	Data format 1	Input Data Format [1:0] : ‘00’=Mode1, ’01’=Mode2,	42	GND	Ground
17	PCID_EN	High Only,	43	Rx5n	V-by-One HS Data Lane 5
18	SDA	SDA (for I2C)	44	Rx5p	V-by-One HS Data Lane 5
19	SCL	SCL (for I2C)	45	GND	Ground
20	WP	Write Protection	46	Rx6n	V-by-One HS Data Lane 6
21	NC	No Connection(notes 4)	47	Rx6p	V-by-One HS Data Lane 6
22	NC	No Connection(notes 4)	48	GND	Ground
23	AGP or NSB	‘H’ or NC : AGP ‘L’ : NSB (No signal Black)	49	Rx7n	V-by-One HS Data Lane 7
24	GND	Ground	50	Rx7p	V-by-One HS Data Lane 7
25	HTPDN	Hot plug detect	51	GND	Ground
26	LOCKN	Lock detect	-	-	-

Notes:

1.All GND (ground) pins should be connected together to the LCD module’s metal frame.

2.#1~#8 NC (No connection) : These pins are used for back up power source, VLCD (power input) .
These pins are should be connected together.

3.All Input levels of V-by-One signals are based on the V-by-One HS Standard Version 1.4.

4.#21, #22 NC (No Connection) : These pins are used only for LGD (Do not connect)

5.About specific pin (#15,#16) , Please see the Appendix IV-1.

6.Specific pin No. #23 is used for “No signal detection” of system signal interface.
It should be GND for NSB (No Signal Black) while the system interface signal is not. If this pin is “H” or “NC”, LCD Module displays AGP (Auto Generation Pattern).

- LCD Connector (CN2) : FI-RXE41S-HF(manufactured by JAE)

-- Mating Connector : FI-RE41HL

4.3 ELECTRICAL CHRARCTERISTICS

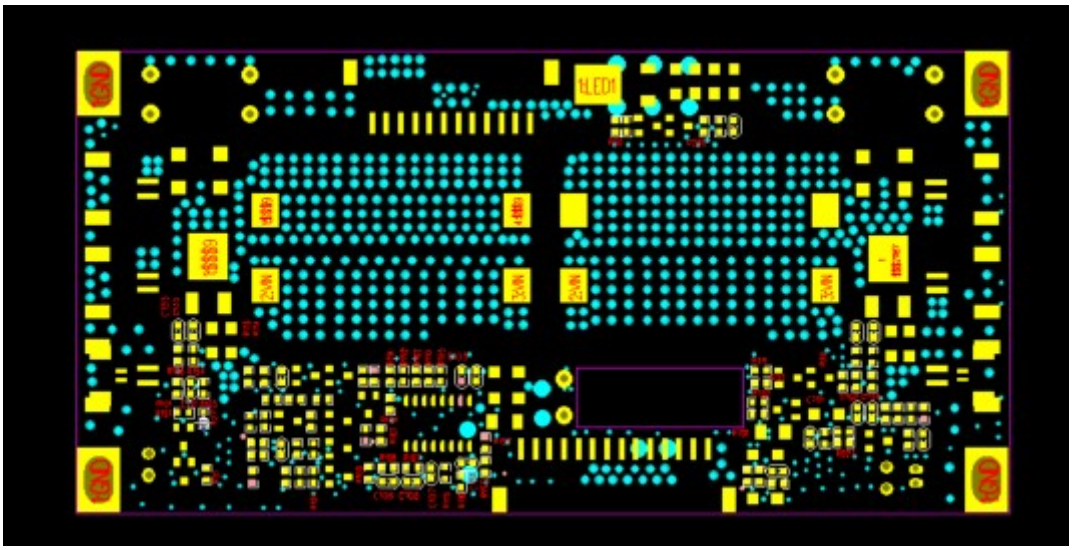
4.3.1 BACKLIGHT UNIT

Parameter	Symbol	Value			Unit	Note
		Min.	Typ.	Max.		
LED Light Bar Input Voltage Per Input Pin	VPIN	-	-	60	V	(1)
LED Light Bar Current Per Input Pin	IPIN	-	-	450	mA	(1),(2) Duty=100%
LED Life Time	LLED	-	50000	-	Hrs	(3)
Power Consumption	PBL	-	-	54	W	(1)

Note (1) LED light bar input voltage and current are measured by utilizing a true RMS multimeter as shown below:

Note (2) PBL(Typ) = IPIN(Typ) × VPIN(Typ) × (2),PBL(Max)=IPIN(TYP) ×VPIN(Max) ×(2) , LED light bar circuit is (10)Series, (8)Parallel.

Note (3) The lifetime of LED is defined as the time when LED packages continue to operate under the conditions at Ta = 25 ±2 ℃ and I= 65 mA (per chip) until the brightness becomes ≦ 50% of its original value.



外形尺寸：130*64*10mm

CON1 Pin	Symbol	Description
1	VCC	Operating Voltage Supply, 12~24V DC regulated
2	VCC	Operating Voltage Supply, 12~24V DC regulated
3	VCC	Operating Voltage Supply, 12~24V DC regulated
4	VCC	Operating Voltage Supply, 12~24V DC regulated
5	VCC	Operating Voltage Supply, 12~24V DC regulated
6	GND	Ground and Current Return
7	GND	Ground and Current Return
8	GND	Ground and Current Return
9	GND	Ground and Current Return
10	GND	Ground and Current Return
11	NC	Not connect
12	BL ON/OFF	BLU On-Off control: High/Open (2~5.5V) : BL On ; Low (0~0.8V/GND) : BL Off
13	ADJ	External PWM (10~100% Duty, open for 0%)
14	NC	Not connect

CON2 Pin	Symbol	Description
1	LED1+	Operating Voltage Supply
2	LED1+	Operating Voltage Supply
3	LED1+	Operating Voltage Supply
4	LED1+	Operating Voltage Supply
5	LED1+	Operating Voltage Supply
6	LED1+	Operating Voltage Supply
7	LED1-	Current Return
8	LED1-	Current Return
9	LED1-	Current Return
10	LED1-	Current Return
11	LED1-	Current Return
12	LED1-	Current Return

Item	Symbol		Value			Unit	Note
			Min.	Typ.	Max.		
Input Voltage	Vin		22.8	24	36	V	
On/Off voltage	V_{BLON}	ON	2.5	-	5.5	V	
		OFF	0	-	0.8	V	
External PWM Control Voltage	V_{PWM}	HIGH	3.3	-	5.5	V	
		LOW	0	-	0.8	V	
External PWM Duty Ratio	D_{PWM}		10	-	100	%	100% for max. Brightness 10% for min.brightness
External PWM Frequency	F_{PWM}		180	200	1000	Hz	

4.4 DISPLAY TIMMING SPECIFICATIONS

Table 4 shows the signal timing required at the input of the Vx1 transmitter. All of the interface signal timings should be satisfied with the following specification for normal operation.

ITEM		Symbol	Min	Typ	Max	Unit	Note
Horizontal	Display Period	t_{HV}	480	480	480	t_{CLK}	3840/8
	Blank	t_{HB}	50	70	120	t_{CLK}	1
	Total	t_{HP}	540	550	600	t_{CLK}	
Vertical	Display Period	t_{VV}	2160	2160	2160	Lines	
	Blank	t_{VB}	40	90	600	Lines	1
	Total	t_{VP}	2200	2250	2760	Lines	

ITEM		Symbol	Min	Typ	Max	Unit	Note
Frequency	DCLK	f_{CLK}	60	74.25	80.00	MHz	1188/16
	Horizontal	f_H	121.8	135	140	KHz	1
	Vertical	f_V	47	60	63	Hz	2

notes: 1. The input of HSYNC & VSYNC signal does not have an effect on normal operation (DE Only Mode).
If you use spread spectrum of EMI, add some additional clock to minimum value for clock margin.
2.The performance of the electro-optical characteristics may be influenced by variance of the vertical refresh rate and the horizontal frequency
3.Spread Spectrum Rate (SSR) is limited to ±0.5% center spread at 30KHz
*Timing should be set based on clock frequency.

4.4.1 V by One Input Signal Timing Diagram

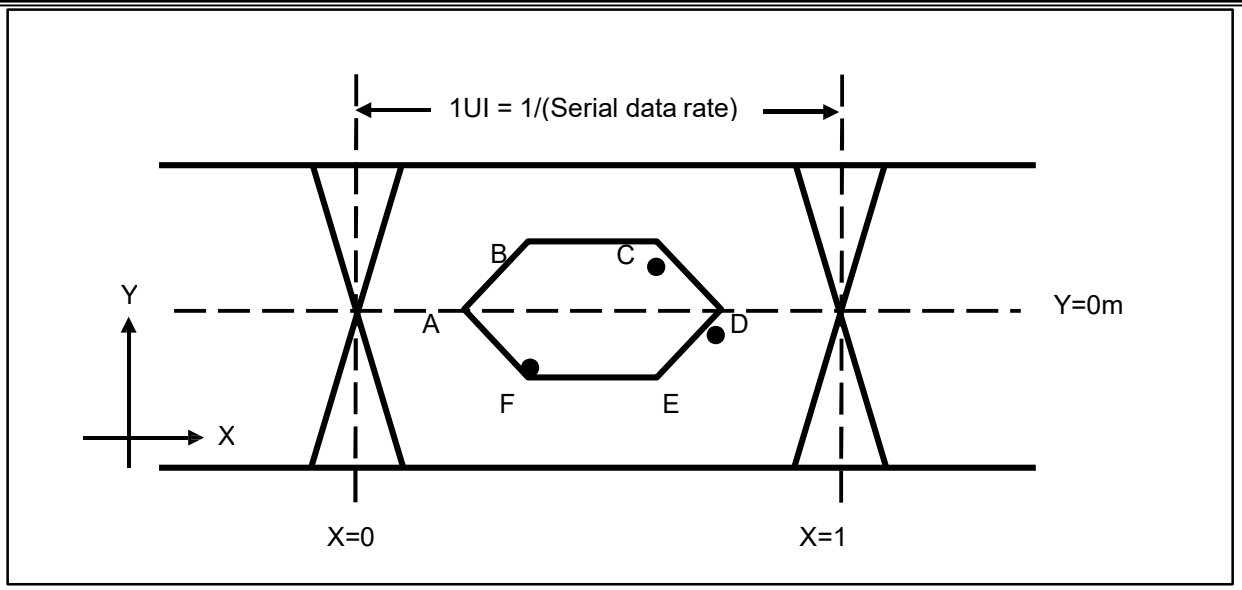


Table 5. Eye Mask Specification

	X[UI]	Note	Y[mV]	Note
A	0.25 (max)	2	0	-
B	0.3 (max)	2	50	3
C	0.7(min)	3	50	3
D	0.75(min)	3	0	-
E	0.7(min)	3	I -50 I	3
F	0.3(max)	2	I -50 I	3

notes 1. All Input levels of V by One signals are based on the V by One HS Standard Ver. 1.4

2.This is allowable maximum value.

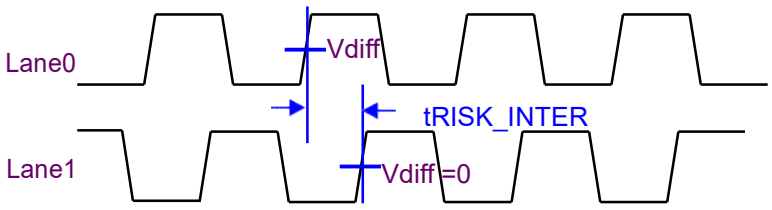
3.This is allowable minimum value.

4.The eye diagram is measured by the oscilloscope and receiver CDR characteristic must be emulated.

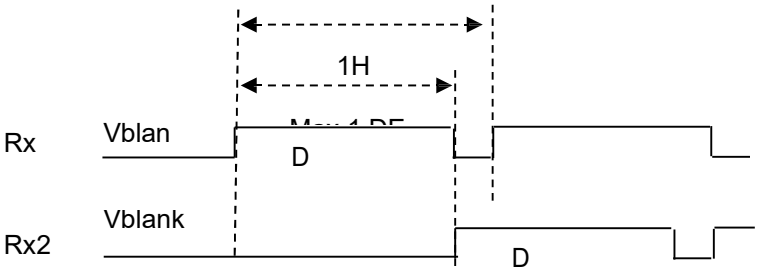
-PLL bandwidth : 15 Mhz

-Damping Factor : 1.0

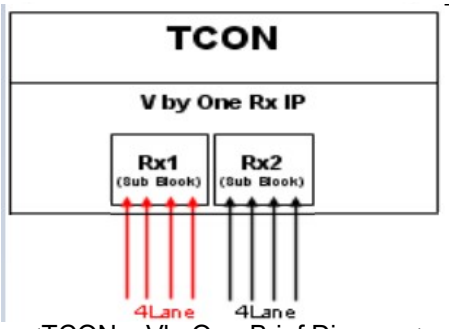
4.4.2 V by One Input Signal Characterisitics



<Inter-pair Skew between two Lanes>



<Inter-pair Skew between two sub Blocks>



<TCON – VbyOne Brief Diagram >

	Symbol	Min	Max	Unit	notes
Allowable inter-pair skew between lanes	tRISK_INTER	-	5	UI	1,3
Allowable iner-pair skew between sub-blocks	tRISK_BLOCK	-	1	DE	1,4

Notes 1.1UI = 1/serial data rate

2.it is the time difference between the true and complementary single-ended signals.

3.it is the time difference of the differential voltage between any two lanes in one sub block.

4.it is the time difference of the differential voltage between any two blocks in one IP.

4.5 POWER ON/OFF SEQUENCE

4.5.1 LCD Driving circuit

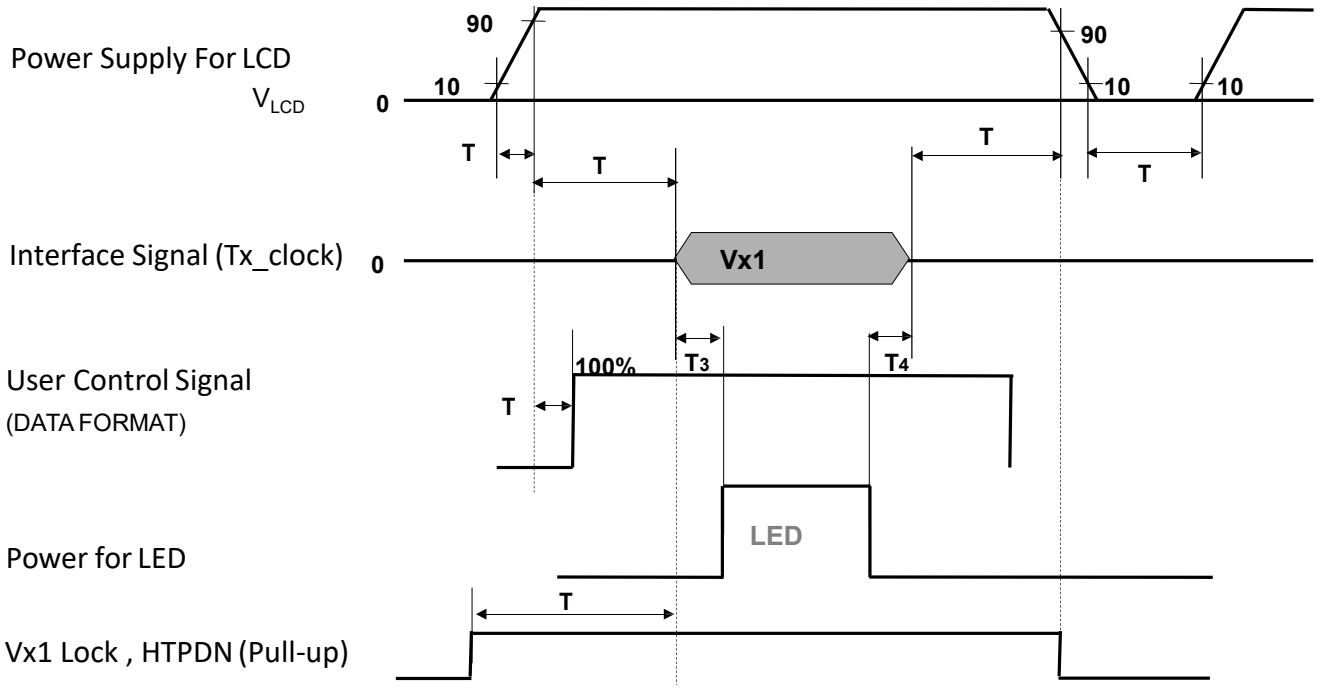


Table 8. POWER SEQUENCE

Parameter	Value			Unit	Note
	Min	Typ	Max		
T1	0.5	-	20	ms	1
T2	0	-	-	ms	2
T3	400	-	-	ms	3
T4	100	-	-	ms	3
T5	1.0	-	-	s	4
T6	0	-	T2	ms	5
T7	0	-	-	ms	6
T8	0	-	-	ms	

Note : 1. Even though T1 is over the specified value, there is no problem if I2T spec of fuse is satisfied.

2.If T2 is satisfied with specification after removing LVDS Cable, there is no problem.

3.The T3 / T4 is recommended value, the case when failed to meet a minimum specification, abnormal display would be shown. There is no reliability problem.

4.T5 should be measured after the Module has been fully discharged between power off and on period.

5.If the on time of signals (Interface signal and user control signals) precedes the on time of Power (VLCD), it will be happened abnormal display. When T6 is NC status, T6 doesn’t need to be measured.

6.It is recommendation specification that T7 has to be 0ms as a minimum value.

*Please avoid floating state of interface signal at invalid period.

*When the power supply for LCD (VLCD) is off, be sure to pull down the valid and invalid data to 0V.

5. OPTICAL CHARACTERISTICS

5.1 TEST CONDITIONS

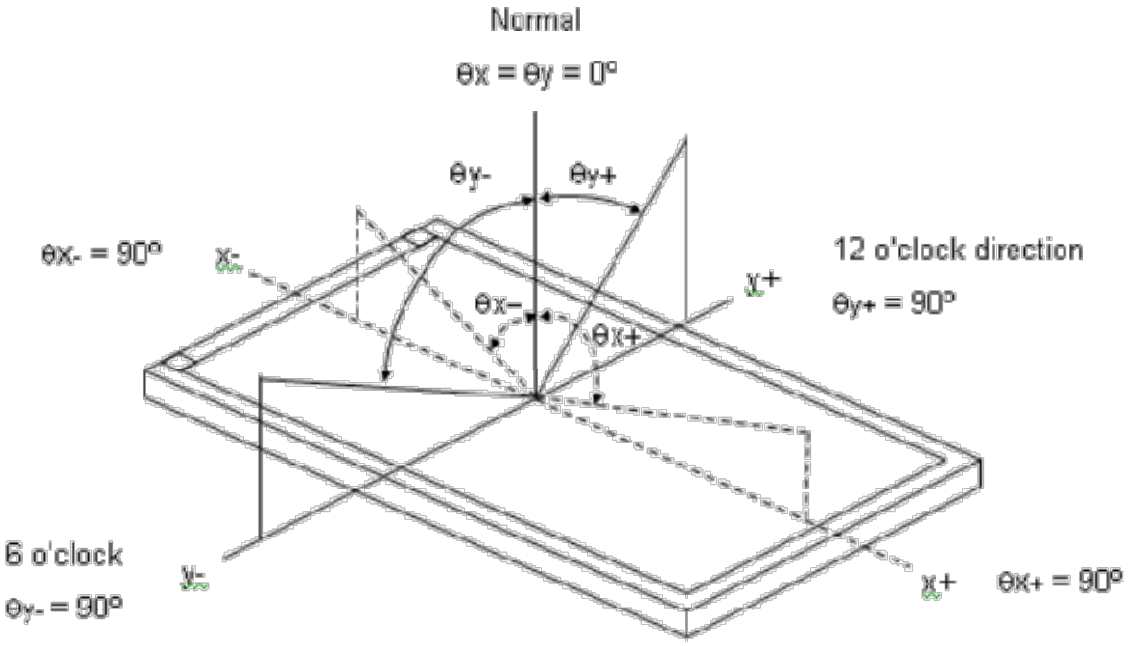
Item	Symbol	Value	Unit
Ambient Temperature	Ta	25±2	ºC
Ambient Humidity	Ha	50±10 %R	%RH
Vertical Frame Rate	Fr	60	Hz
Supply Voltage	Vcc	12±1.2	V
Input Signal	According to typical value in "3. ELECTRICAL CHARACTERISTICS"		
LED Light Bar Input Current Per Input Pin	IPIN	-	mA
PWM Duty Ratio	D	100	%

5.2 OPTICAL SPECIFICATIONS

The relative measurement methods of optical characteristics are shown in 5.2. The following items should be measured under the test conditions described in 5.1 and stable environment shown in Note (5).

Item		Symbol	Condition	Min.	Typ.	Max.	Uint	Note
Color Chromaticity (CIE)	Red	Rcx	Normal θx=0° , θY =0° Viewing Angle	Typ – 0.03	TBD	Typ + 0.03	-	
		Rcy			TBD			
	Green	Gcx			TBD			
		Gcy			TBD			
	Blue	Bcx			TBD			
		Bcy			TBD			
	White	Wcx			TBD			
		Wcy			TBD			
Center Luminance of White (Center of Screen)		LC		600	700	-	cd/m2	(4),(5)
Contrast Ratio		CR		700	1000	-	-	(2),(5)
Response Time		G-to-G	θx=0° , θY =0°	-	9.5	-	ms	(3)
White variation		δW	θx=0° , θY =0°	75	80		-	(5),(6)
Viewing Angle	Horizontal	θx	CR ≧ 10	-	89	-	Deg.	(1),(5)
	Vertical	θy		-	89	-		
Viewing Angle	Horizontal	θx		-	89	-	Deg.	(1),(5)
	Vertical	θy		-	89	-		

Note (1) Definition of Viewing Angle (θx, θy):



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

The contrast ratio can be calculated by the following expression.

Contrast Ratio (CR) = L255 / L0

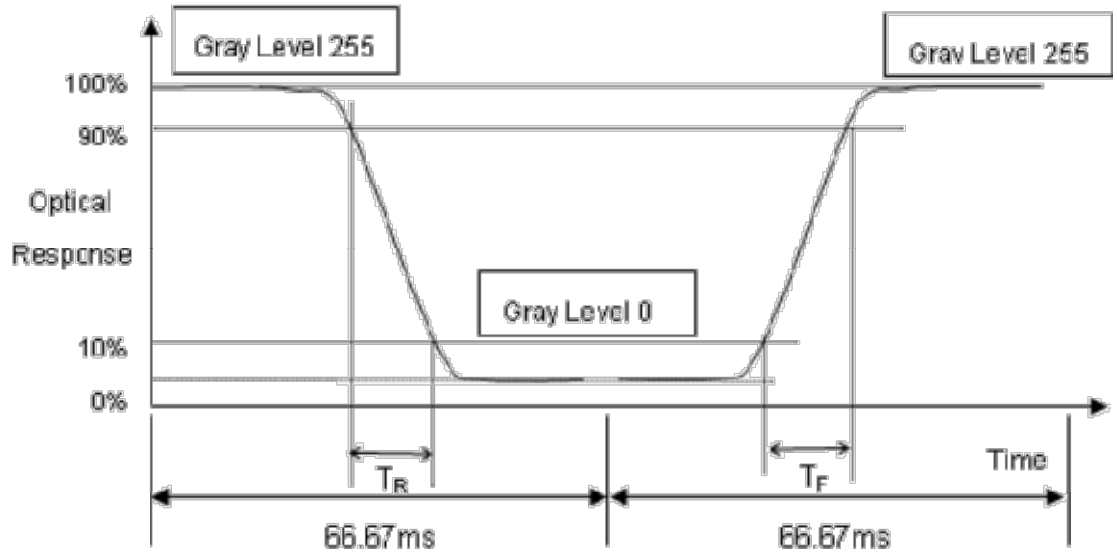
L255: Luminance of gray level 255

L 0: Luminance of gray level 0

CR = CR (5)

CR (X) is corresponding to the Contrast Ratio of the point X at Figure in Note (6).

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



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

Measure the luminance of gray level 255 at center point

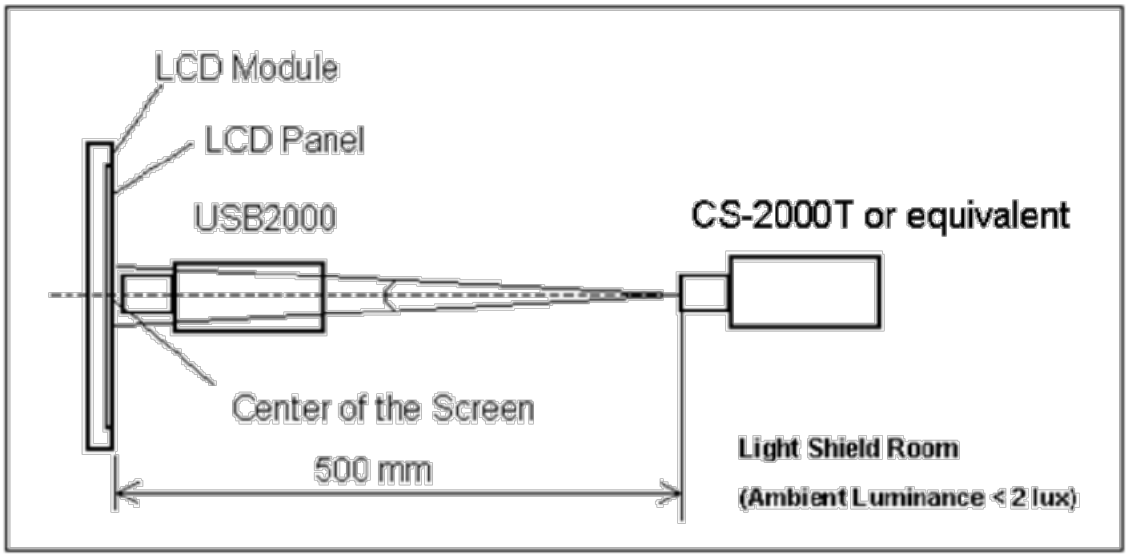
L_C = L (5)

L (x) is corresponding to the luminance of the point X at Figure in Note (6).

Note (5) Measurement Setup:

The LCD module should be stabilized at given temperature for 40 minutes to avoid abrupt temperature change during measuring. In order to stabilize the luminance, the measurement should

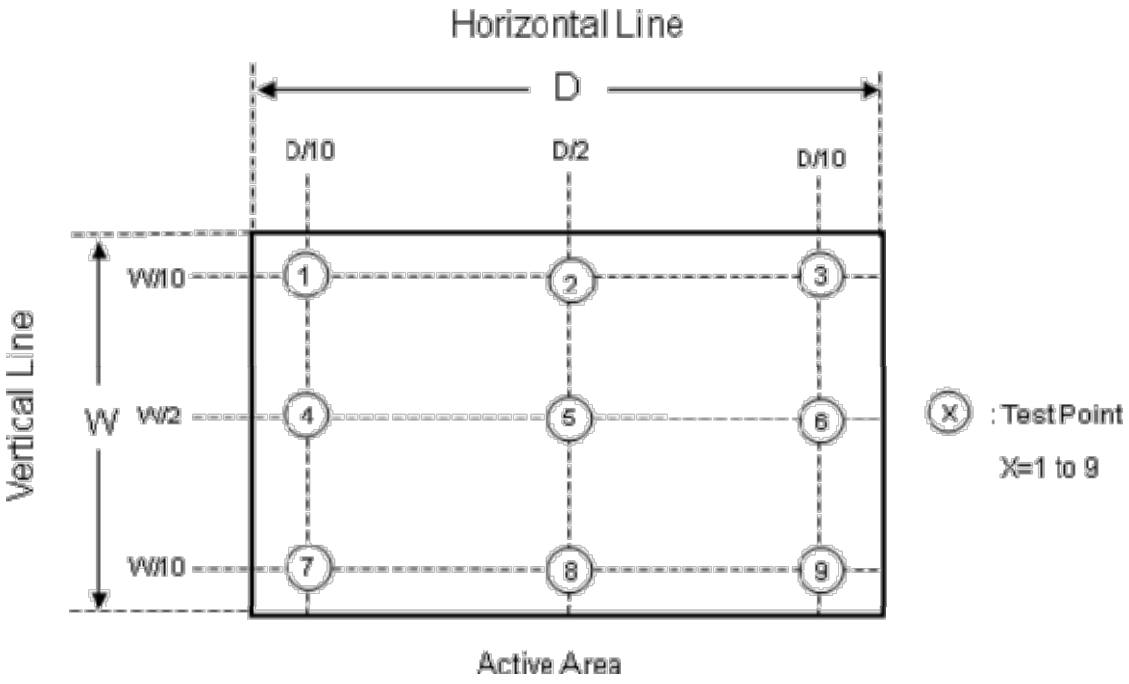
be executed after lighting Backlight for 40 minutes in a windless room.



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

Measure the luminance of gray level 255 at 9 points

δW = (Minimum [L (1) ~ L (9)] / Maximum [L (1) ~ L (9)]) *100%



6. RELIABILITY TEST ITEM

Item	Required Condition	Note
Temperature Humidity Bias (THB)	Ta= 50℃ , 80%RH, 240hours	
High Temperature Operation (HTO)	Ta= 50℃ , 240hours	
Low Temperature Operation (LTO)	Ta= 0℃ , 240hours	
High Temperature Storage (HTS)	Ta= 60℃ , 240hours	
Low Temperature Storage (LTS)	Ta= -20℃ , 240hours	
Vibration Test (Non-operation)	Acceleration: 1.5 G Wave: Sine	

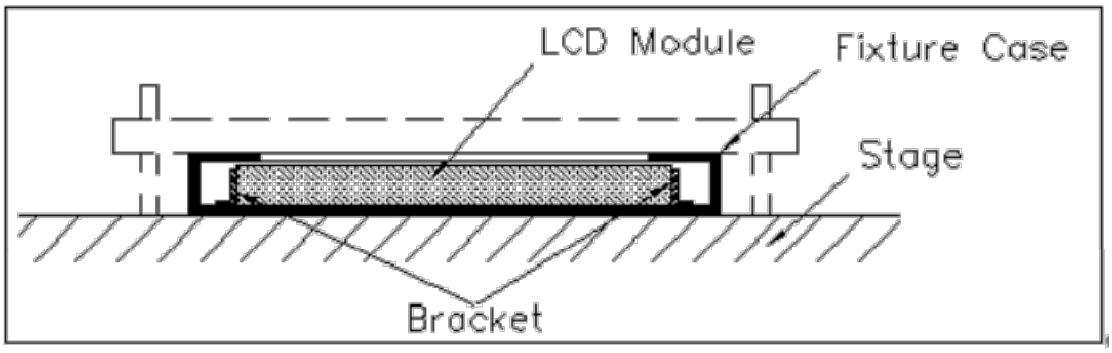
	Frequency: 10 - 300 Hz Sweep: 30 Minutes each Axis (X, Y, Z)	
Shock Test (Non-operation)	Acceleration: 50 G Wave: Half-sine Active Time: 11 ms Direction : ± X, ± Y, ± Z.(one time for each Axis)	
Thermal Shock Test (TST)	-20℃ /30min , 60℃ / 30min , 100 cycles	
On/Off Test	25℃ ,On/10sec , Off /10sec , 30,000 cycles	
ESD (Electro Static Discharge)	Contact Discharge: ± 8KV, 150pF(330Ω) Air Discharge: ± 15KV, 150pF(330Ω)	
Altitude Test	Operation:10,000 ft / 24hours Non-Operation:30,000 ft / 24hours	

Note (1) criteria : Normal display image with no obvious non-uniformity and no line defect.

Note (2) Evaluation should be tested after storage at room temperature for more than two hour

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.

The fixing condition is shown as below:



7. PACKGING

TBD.

8. MODULE LABEL

TBD.

9. PRECAUTIONS

9.1 ASSEMBLY AND HANDLING PRECAUTIONS

(1) Do not apply rough force such as bending or twisting to the module during assembly.

(2) To assemble or install module into user's system can be only in clean working areas. The dust and oil may cause electrical short or worsen the polarizer.

(3) It's not permitted to have pressure or impulse on the module because the LCD panel and Backlight will be damaged.

(4) Always follow the correct power sequence when LCD module is connecting and operating. This can prevent damage to the CMOS LSI chips during latch-up.
(5) Do not pull the I/F connector in or out while the module is operating.
(6) Do not disassemble the module.
(7) Use a soft dry cloth without chemicals for cleaning, because the surface of polarizer is very soft and easily scratched.
(8) It is dangerous that moisture come into or contacted the LCD module, because moisture may damage LCD module when it is operating.
(9) High temperature or humidity may reduce the performance of module. Please store LCD module within the specified storage conditions.
(10)When ambient temperature is lower than 10ºC may reduce the display quality. For example, the response time will become slowly.

9.2 STORAGE PRECAUTIONS

(1) Do not leave the module in high temperature, and high humidity for a long time. It is highly recommended to store the module with temperature from 0℃ to 35℃ and relative humidity of less than 70%
(2) Do not store the TFT – LCD module in direct sunlight
(3) The module should be stored in dark place. It is prohibited to apply sunlight or fluorescent light in storing

9.3 OPERATION PRECAUTIONS

(1) The LCD product should be operated under normal condition.
Normal condition is defined as below :
Temperature : 20±15℃
Humidity: 65±20%
Display pattern : continually changing pattern(Not stationary)
(2) If the product will be used in extreme conditions such as high temperature,high humidity,high altitude ,display pattern or operation time etc…It is strongly recommended to contact CMI for application engineering advice . Otherwise , Its reliability and function may not be guaranteed.

9.4 SAFETY PRECAUTIONS

(1) If the liquid crystal material leaks from the panel, it should be kept away from the eyes or mouth. In case of contact with hands, skin or clothes, it has to be washed away thoroughly with soap.
(2) After the module's end of life, it is not harmful in case of normal operation and storage.

9.5 SAFETY STANDARDS

The LCD module should be certified with safety regulations as follows:
(1) UL60950-1 or updated standard.
(2) IEC60950-1 or updated standard.

9.6 OTHER

When fixed patterns are displayed for a long time ,remnant image is likely to occur.

Appendix. OUTLINE DRAWING