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SPECIFICATION

VXT177SSI-02

☐ Preliminary Specification

☐ Final Specification

Approved By:
Date:

RECORD OF REVISION

Rev No.	Rev Date	Page	Contents	Editor
V00	2025/3/26		New issue.	Solon

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1. Scope

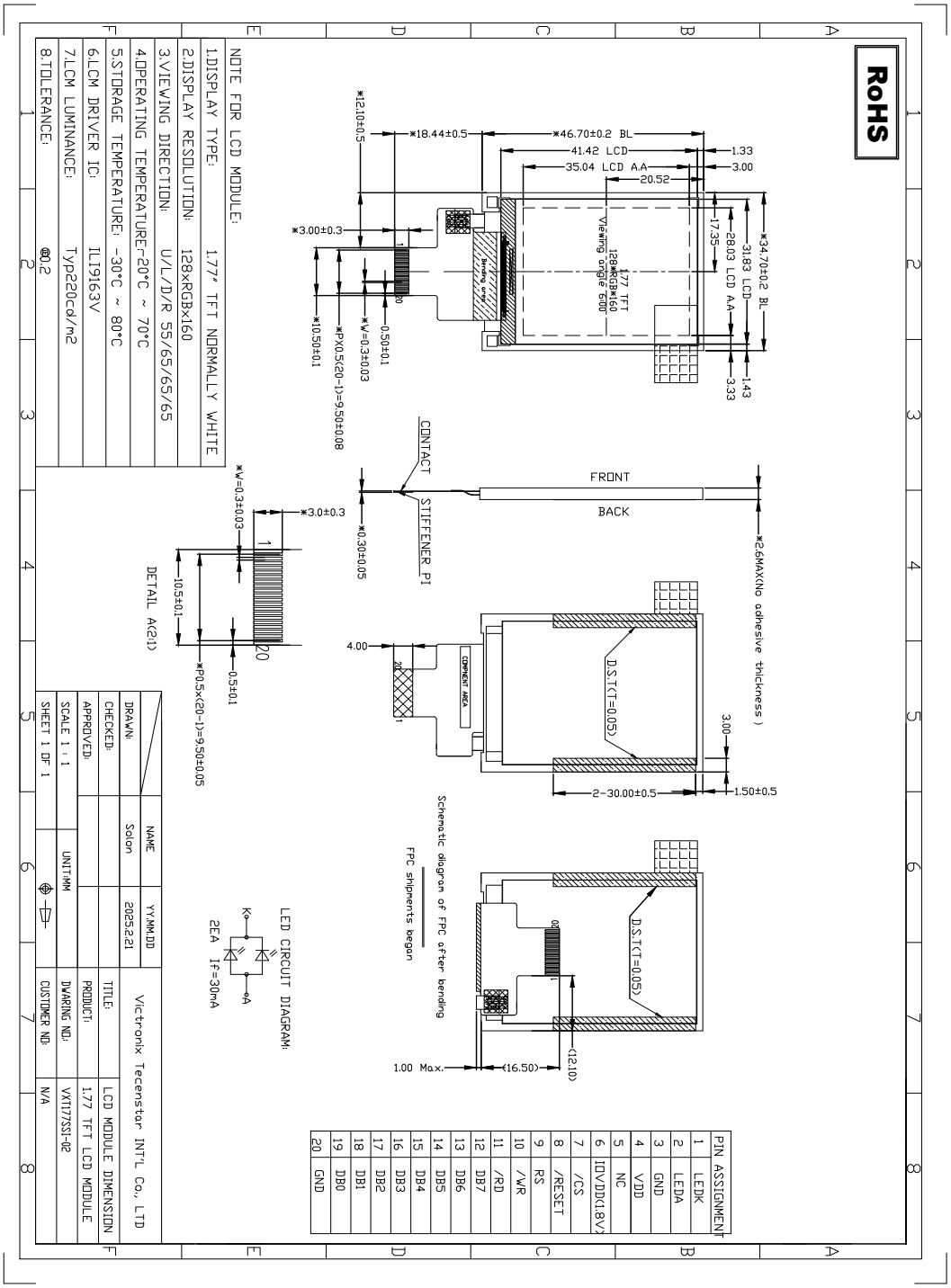
VXT177SSI-02 is a TFT-LCD module. It is composed of a TFT-LCD panel, driver IC, FPC, a back light unit. The 1.77inch display area contains 128 x (RGB) x 160 pixels and can display up to 262K colors. This product accords with ROHS environmental criterion.

2. General Specifications

2.1 LCD Parameter

Item	Contents	Unit	Note
LCD Type	TFT	-	
Display color	262K		
Viewing Direction	12	O'Clock	
Operating temperature	-20~+70	℃	
Storage temperature	-30~+80	℃	
Active Area(W×H)	28.03x35.04	mm	
Number of Dots	128x160	dots	
Controller	ILI9163V	-	
Power Supply Voltage	2.8	V	
Outline Dimensions	34.70x46.70x2.60	mm	
Backlight	2x1-LEDs (white)	pcs	
Interface	8BIT MCU	-	

3.OutlineDrawing



4.Interface Description

4.1 LCD interface

Pin No	Symbol	I/O	Function
1	LEDK	P	LED cathode
2	LEDA	P	LED anode
3	GND	P	Ground
4	VDD	P	Power Supply
5	NC	-	No Connection
6	IOVDD	P	Power Supply
7	CS	I	Chip select input pin (“Low” enable) This pin can be permanently fixed “Low” in MCU interface mode only
8	RESET	I	Chip reset pin (“Low Active”) This signal low will reset the device and must be applied to properly initialize the chip
9	RS	I	Read enable in 8080-parallel interface and Read/ Write operation enable pin in 6800-parallel interface
10	WR	I	Write enable in MCU parallel interface Display data/command selection pin in serial interface
11	RD	I	Read enable in MCU parallel interface
12-19	DB7-DB0	I	Data input
20	GND	P	Ground

5. Absolute Maximum Ratings(Ta=25℃)

5.1 Electrical Absolute Maximum Ratings.(Vss=0V ,Ta=25℃)

Item	Symbol	Min.	Max.	Unit	Note
Power Supply Voltage	VDD	-0.3	4.0	V	1，2
	IOVDD	-0.3	3.3		

Notes:

1. If the module is above these absolute maximum ratings. It may become permanently damaged. Using the module within the following electrical characteristic conditions are also exceeded, the module will malfunction and cause poor reliability.
2. V_{DD} >V_{SS} must be maintained.

5.2 Environmental Absolute Maximum Ratings.

Item	Storage		Operating		Note
	MIN.	MAX.	MIN.	MAX.	
Ambient Temperature	-30℃	80℃	-20℃	70℃	1,2

1. The response time will become lower when operated at low temperature.
2. Background color changes slightly depending on ambient temperature.
   The phenomenon is reversible.
3. Ta<=40℃:85%RH MAX.
   Ta>=40℃:Absolute humidity must be lower than the humidity of 85%RH at 40℃.

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6. Electrical Specifications and Instruction Code

6.1 Electrical characteristics(Vss=0V ,Ta=25℃)

Parameter		Symbol	Condition	Min	Typ	Max	Unit	Note
Power supply		VDD	Ta=25℃	2.5	2.8	4.0	V	-
		IOVDD		1.65	1.8	3.3	V	-
Input voltage	'H'	V_{IH}	IOVDD=1.8V	0.7IOVDD	-	IOVDD	V	-
	'L'	V_{IL}		GND	-	0.3IOVDD	V	-
Output voltage	'H'	V_{OH}	-	0.8IOVDD	-	IOVDD	V	-
	'L'	V_{OL}	-	GND	-	0.2IOVDD	V	-

Note:

1:When an optimum contrast is obtained in transmissive mode.

2: Tested in 1╳1 chessboard pattern.

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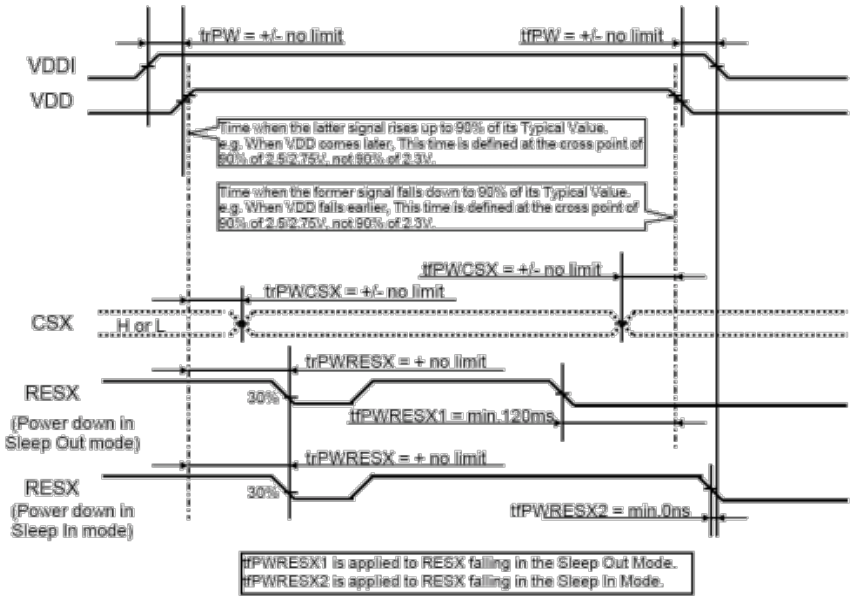
7. Timing Characteristics

7.1 Power on/off Sequence

Case 1 – RESX line is held High or Unstable by Host at Power ON

If RESX line is held high or unstable by the host during Power On, then a Hardware Reset must be applied after both VCI and VDDI have been applied – otherwise correct functionality is not guaranteed. There is no timing restriction upon this hardware reset.



Note: Unless otherwise specified, timings herein show cross point at 50% of signal/power level.

Case 2 – RESX line is held Low by Host at Power ON

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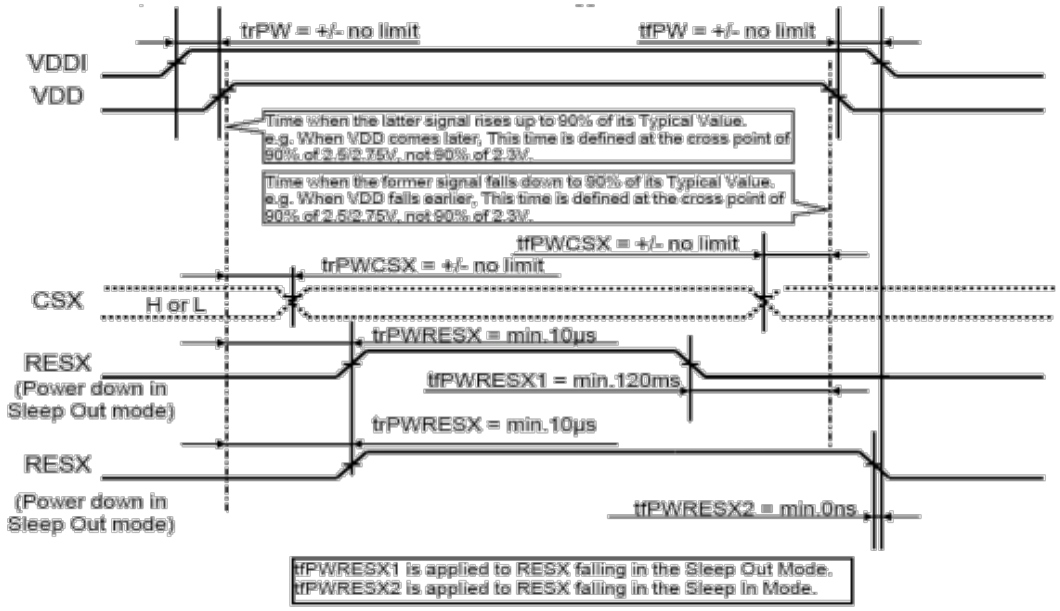
If RESX line is held Low (and stable) by the host during Power On, then the RESX must be held low for minimum 10μsec after both VCI and VDDI have been applied.



Note: Unless otherwise specified, timings herein show cross point at 50% of signal/power level.

7.2 AC electrical characteristic

7.2.1 Display Parallel 18/16/9/8-bit Interface Timing Characteristics(8080-Ⅱ system)

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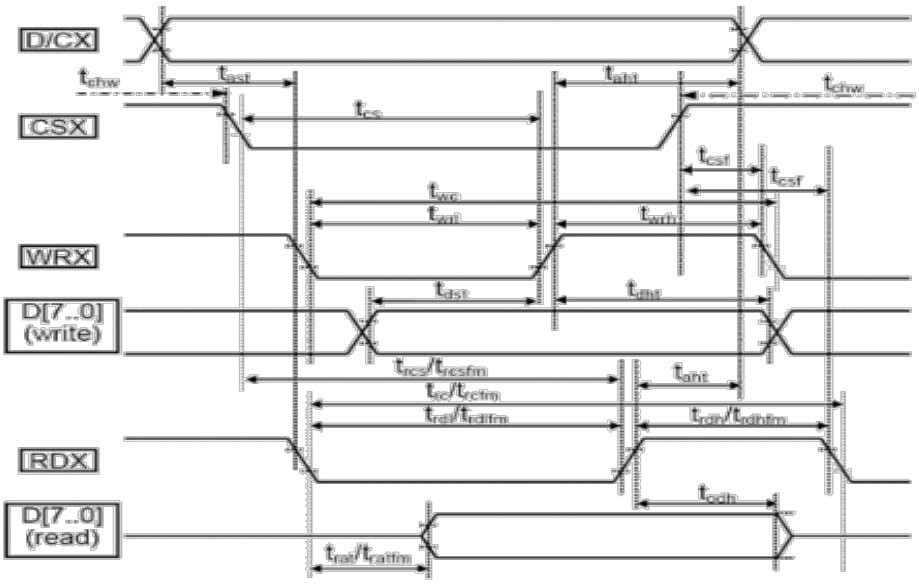

Note: Logic high and low levels are specified as 30% and 70% of VDDI for Input signals.

Table 17.3.1 AC characteristics of parallel CPU I/F in asynchronous mode

Signal	Symbol	Parameter	min	max	unit	description
D/CX	tast	Address setup time	0		ns	
	taht	Address hold time(Write/Read)	10		ns	
CSX	tchw	"S""H" Pulse Widtch	0		ns	
	tcs	Chip Select setup time (Write)	10		ns	
	trcs	Chip Select setup time (Read ID)	45		ns	
	trcsfm	Chip Select setup time (Read FM)	355		ns	
	tcsf	Chip Select Wait time(Write/read)	10		ns	
WRX	twc	Write cycle	66		ns	
	twrh	Controlpulse H duration	15		ns	
	twrl	Control pulse L duration	15		ns	
RDX	trc	Read cycle (ID)	160		ns	When read ID data
	trdh	Control pulse H duration(ID)	90		ns	
	trdl	Control pulse L duration(ID)	45		ns	
RDX	trcfm	Read cycle (FM)	450		ns	When read from frame memory
	trdhfm	Control pulse H duration (FM)	90		ns	
	trdlfm	Control pulse L duration (FM)	355		ns	
D[17..0]	tdst	Data setup time	10		ns	For maximum CL= 30pF For minimum CL= 8pF
	tdht	Data hold time	10		ns	
	trat	Read access time (ID)		40	ns	
	tratfm	Read access time (FM)		340	ns	
	todh	Output disable time	20	80	ns	

Note 1: VDDI 1.65 to 3.3V, VCI=2.6 to 3.3V, AGND=GND=0V, Ta=-30 to 70 °C (to +85°C no damage)

Note 2: This input signal rise time and fall time (tr, tf) is specified at 15 ns or less. Logic high and low levels are specified as 30% and 70% of VDDI for input signals

7.2.2 3-pin Serial Interface

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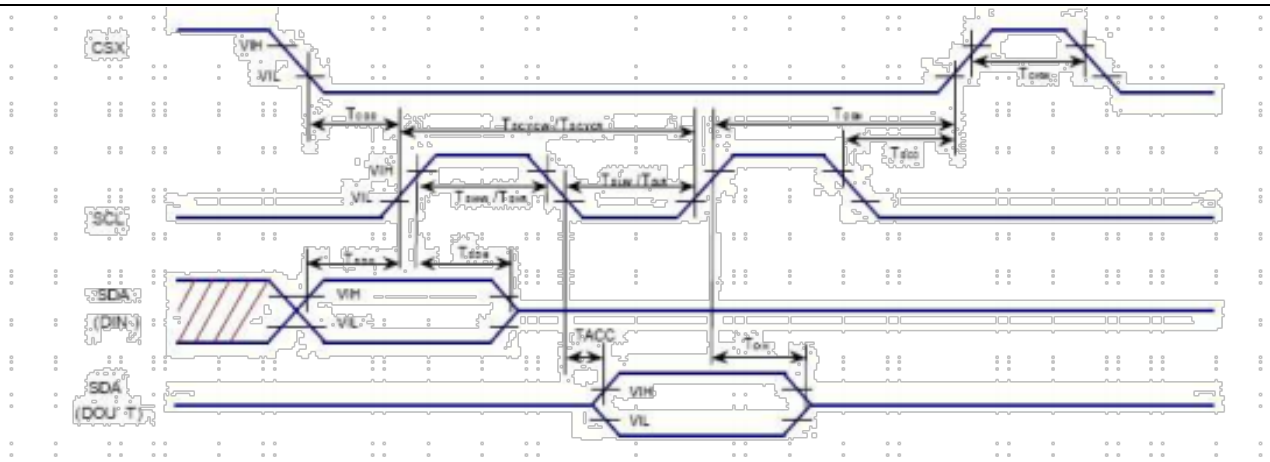

Table 17.3.2.1: 3-pin Serial Interface Characteristics

Signal	Symbol	Parameter	MIN	MAX	Unit	Description
CSX	TCSS	Chip select setup time	10		ns	
	TCSH	Chip select hold time	30		ns	
	TCHW	Chip select "H" pulse width	30		ns	
SCL	TSCYCW	Serial clock cycle(Write)	66		ns	
	TSHW	S"L""H" pulse width(Write)	15		ns	
	TSLW	S"L""L" pulse width(Write)	15		ns	
	TSCYCR	Serial clock cycle(Read)	150		ns	
	TSHR	S"L""H" pulse width(Read)	60		ns	
	TSLR	S"L""L" pulse width(Read)	60		ns	
SDA(DIN) (DOUT)	TSDS	Data setup time	5		ns	
	TSDH	Data hold time	5		ns	
	TACC	Access time	5	50	ns	For maximum CL = 30pF
	TOH	Output disable time	10		ns	For minimum CL = 8pF

Note 1: VDDI=1.65 to 3.3V, VCI=2.6 to 3.3V, AGND=GND=0V. Ta=-30 to 70℃ (to +85℃ no damage)

Note 2 : The input signal rise time and fall time(tr, tf) is specified at 15 ns or less.

Logic high and low levels are specified as 10% and 90% of VDDI for Input signals.

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7.2.3 4-pin Serial Interface

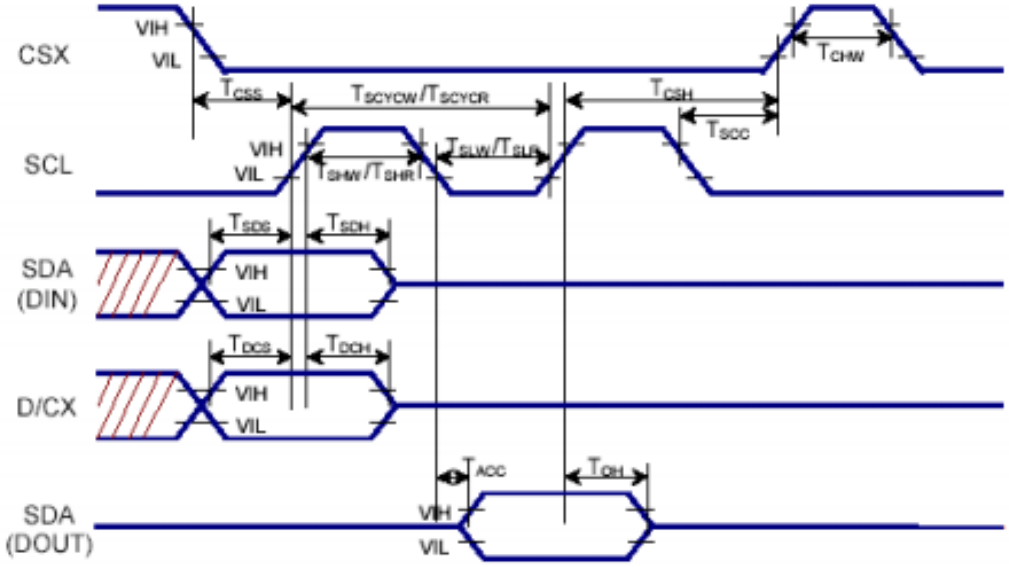

Table 17.3.2.2: 4 pin Serial Interface Characteristics

Signal	Symbol	Parameter	MIN	MAX	Unit	Description
CSX	TCSS	Chip select setup time	10		ns	
	TCSH	Chip select hold time	30		ns	
	TCHW	Chip select "H" pulse width	30		ns	
SCL	TSCYCW	Serial clock cycle(Write)	66		ns	
	TSHW	S"L""H" pulse width(Write)	15		ns	
	TSLW	S"L""L" pulse width(Write)	15		ns	
	TSCYCR	Serial clock cycle(Read)	150		ns	
	TSHR	S"L""H" pulse width(Read)	60		ns	
	TSLR	S"L""L" pulse width(Read)	60		ns	
D/CX	TDCS	D/CX setup time	5		ns	
	TDCH	D/CX hold time	5		ns	
SDA(DIN) (DOUT)	TSDS	Data setup time	5		ns	
	TSDH	Data hold time	5		ns	
	TACC	Access time	5	50	ns	For maximum CL = 30pF
	TOH	Output disable time	10		ns	For minimum CL = 8pF

Note 1: VDDI=1.65 to 3.3V, VCI=2.6 to 3.3V, AGND=GND=0V. Ta=-30 to 70℃ (to +85℃ no damage)

Note 2 : The input signal rise time and fall time(tr, tf) is specified at 15 ns or less.

Logic high and low levels are specified as 10% and 90% of VDDI for Input signals.

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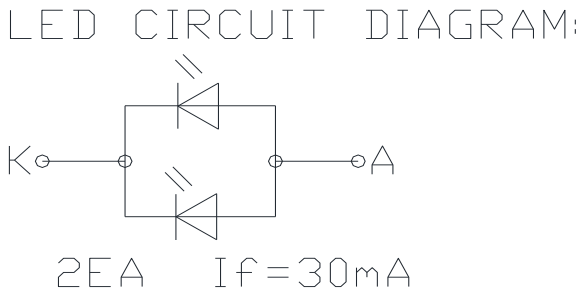
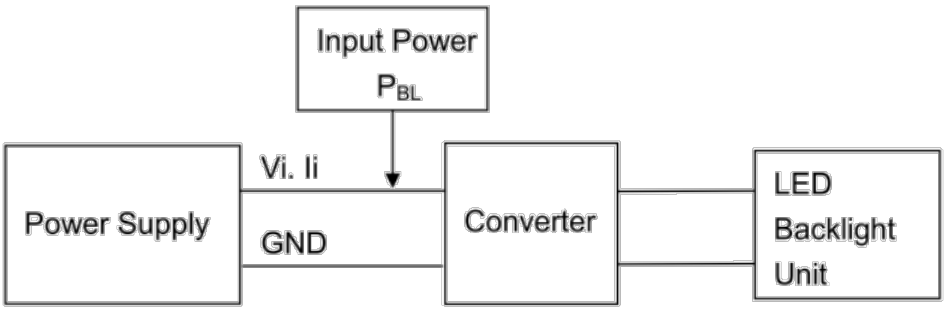
8.0 Backlight Characteristic



Item	Symbol	Min	Typ	Max	Unit	Test Condition
Supply Voltage	Vf	3.0	3.0	3.3	V	Note 1
Supply Current	If	-	30	-	mA	Note 2
Power dissipation	P_{BL}	-	0.09	-	W	
Life Time	-	30K	-	-	Hr	Note 3,4
Backlight Color	White					

Note 1: The LED Supply Voltage is defined by the number of LED at Ta=25℃ and If =30mA.

Note 2: LED current is measured by utilizing a high frequency current meter as shown below:



Note 3: The “LED life time” is defined as the module brightness decrease to 50% original brightness at Ta=25℃ and If =30mA. The LED lifetime could be decreased if operating If is larger than 30mA.
Note 4: LED light bar circuit:

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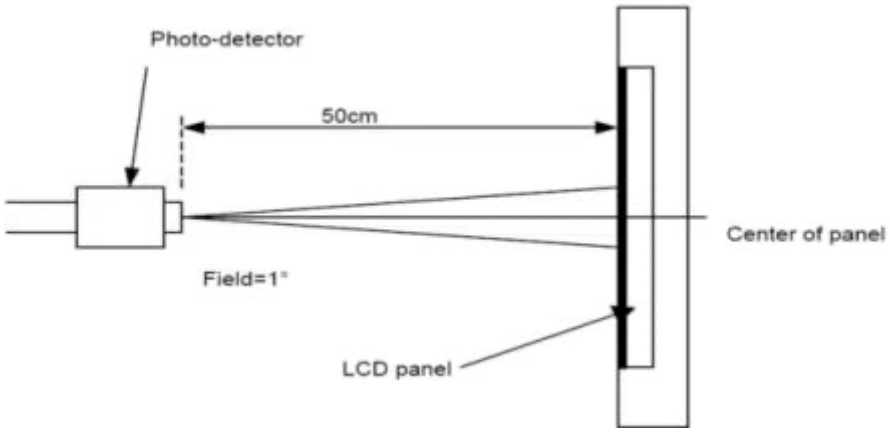
9. Optical Characteristics

Item	Symbol		Condition	Min.	Typ.	Max.	Unit	Note
Brightness	Bp		If=30mA	-	220	-	Cd/m^2	1
Uniformity	⊿Bp			-	80	-	%	1,2
Viewing Angle	3:00		Cr≥10	-	65	-	Deg	1,2
	6:00			-	65	-		
	9:00			-	65	-		
	12:00			-	55	-		
Contrast Ratio	Cr		θ=0° Φ=0°	200	300	-	-	3,4
Response Time	T_r+T_f			-	30	60	ms	4,5
Color of CIE Coordinate	W	x	θ=0° Φ=0°	-	TBD	-	-	1,6
		y		-	TBD	-	-	
	R	x		-	TBD	-	-	
		y		-	TBD	-	-	
	G	x		-	TBD	-	-	
		y		-	TBD	-	-	
	B	x		-	TBD	-	-	
		y		-	TBD	-	-	
NTSC Ratio	S			-	50	-	%	

*The parameter is slightly changed by temperature, driving voltage and materiel

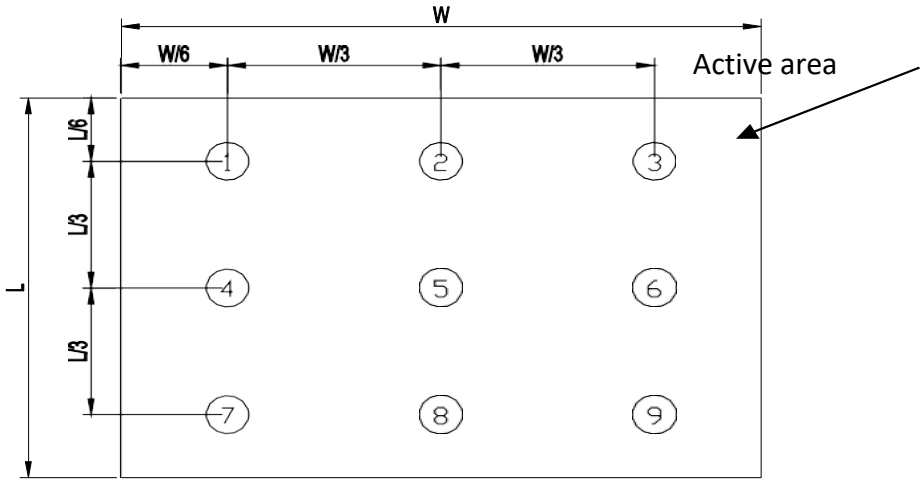
Note 1: The data are measured after LEDs are turned on for 5 minutes. LCM displays full white. The brightness is the average value of 9 measured spots. Measurement equipment CA310 Measuring condition:-Measuring surroundings: Dark room.-Measuring temperature: Ta=25℃.-Adjust operating voltage to get optimum contrast at the center of the display.

The measured value is more than 5 minutes at the center point of the LCD panel, and the backlight is turned on at the same time.

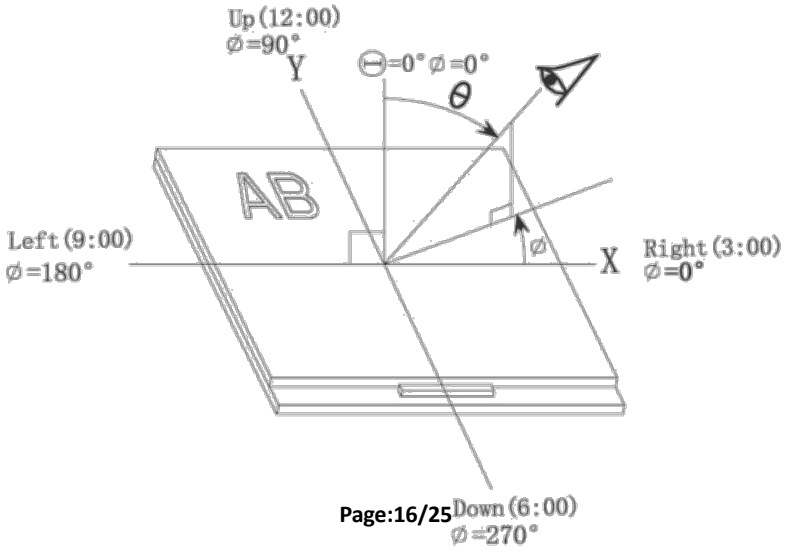


Note 2: The luminance uniformity is calculated by using following formula.

⊿Bp = Bp (Min.) / Bp (Max.)×100 (%);Bp (Max.) = Maximum brightness in 9 measured spots Bp (Min.) = Minimum brightness in 9 measured spots.



Note 3: The definition of viewing angle:Refer to the graph below marked by θ and Φ



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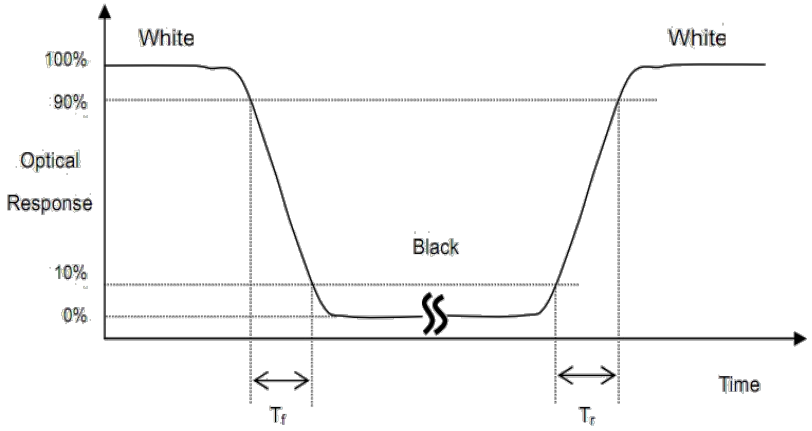
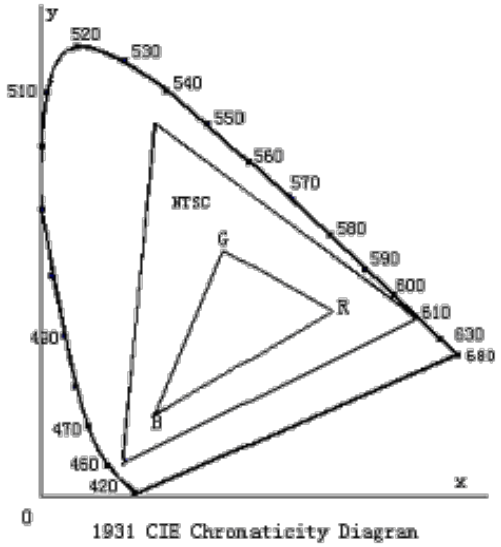
Note 4: Definition of contrast ratio Contrast measurements shall be made at viewing angle of Θ= 0 and at the center of the LCD surface.Luminance shall be measured with all pixels in the view field set first to white, then to the dark (black) state.

$$\mathbf{CR} = \frac{\text{Luminance when displaying a white raster}}{\text{Luminance when displaying a black raster}}$$

Note 5: Definition of Response time The output signals of photo detector are measured when the input signals are changed from “white” to “black”(Tf) and from “black” to “white”(Tr), respectively. The response time is defined as the time interval between the 10% and 90% of amplitudes. Refer to figure as below.



Note 6: Definition of Color of CIE Coordinate and NTSC Ratio.



1931 CIE Chromaticity Diagram

Color gamut:

$$\mathbf{S} = \frac{\textbf{area of RGB triangle}}{\textbf{area of NTSC triangle}} \times 100\%$$

10. Reliability Test Conditions and Methods

No.	Test Items	Test Condition	Inspection After Test
①	High Temperature Storage	80°C±2°C×96Hours	Inspection after 2~4hours storage at room temperature, the samples should be free from defects: 1, Air bubble in the LCD. 2, Seal leak. 3, Non-display. 4, Missing segments. 5, Glass crack. 6, Current IDD is twice higher than initial value.
②	Low Temperature Storage	-30°C±2°C×96Hours	
③	High Temperature Operating	70°C±2°C×96Hours	
④	Low Temperature Operating	-20°C±2°C×96Hours	
⑤	Temperature Cycle(Storage)	-30°C ⇔ 80°C (30min) (5min) (30min) 1cycle Total 10cycle.	
⑥	Damp Proof Test (Storage)	60°C±5°C×90%RH×96Hours	

REMARK:

1, The Test samples should be applied to only one test item.

2, Sample side for each test item is 5~10pcs.

3,For Damp Proof Test, Pure water(Resistance＞10MΩ)should be used.

4,In case of malfunction defect caused by ESD damage, if it would be recovered to normal state after resetting, it would be judge as a good part.

5, EL evaluation should be accepted from reliability test with humidity and temperature: Some defects such as black spot/blemish can happen by natural chemical reaction with humidity and Fluorescence EL has.

6, Failure Judgment Criterion: Basic Specification Electrical Characteristic, Mechanical Characteristic, Optical Characteristic.

11. Inspection Standard

11.1 Scope

Specifications contain
11.1.1 Display Quality Evaluation
11.1.2 Mechanics Specification

11.2 Sampling Plan

Unless there is other agreement, the sampling plan for incoming inspection shall follow MIL-STD-105E.
11.2.1 Lot size: Quantity per shipment as one lot (different model as different lot).
11.2.2 Sampling type: Normal inspection, single sampling.
11.2.3 Sampling level: Level II.
11.2.4 AQL: Acceptable Quality Level
Major defect: AQL=0.65
Minor defect: AQL=1.5

11.3 Panel Inspection Condition

11.3.1 Environment:
Room Temperature: 25±5°C.
Humidity: 65±5% RH.
Illumination: 300 ~ 700 Lux.

11.3.2 Inspection Distance:
35±5 cm

11.3.3 Inspection Angle:
The vision of inspector should be perpendicular to the surface of the Module.
11.3.4 Inspection time：
Perceptibility Test Time: 20 seconds max.

11.4 Inspection Plan

Class	Item	Judgment	Class
Packing & Indicate	1. Outside and inside package.	"MODEL NO.", "LOT NO." and "QUANTITY" should indicate on the package.	Minor
	2. Model mixed and quantity.	Other model mixed Quantity short or over	Major
	3. Product indication.	"MODEL NO." should indicate on the product.	Major
Assembly	4. Dimension, LCD glass scratch and scribe defect.	According to specification or drawing.	Major
Appearance	5. Viewing area.	Polarizer edge or LCD's sealing line is visible in the viewing area…….Rejected.	Minor
	6. Blemish, black spot, white spot in the LCD and LCD glass cracks.	According to standard of visual inspection.(inside viewing area)	Minor
	7. Blemish, black spot, white spot and scratch on the polarizer.	According to standard of visual inspection.(inside viewing area)	Minor
	8. Bubble in polarizer.	According to standard of visual inspection.(inside viewing area)	Minor
	9. LCD's rainbow color.	Strong deviation color (or newton ring) of LCD……..Rejected. Or according to limited sample.(if needed, and inside viewing area)	Minor
Electrical	10. Electrical and optical characteristics.(contrast Vop chromaticity….etc)	According to specification or drawing.(inside viewing area)	Major
	11. Missing line.	Missing dot line character	Major
	12.Short circuit. Wrong pattern display.	No display, wrong pattern display, current consumption. Out of specification	Major

	13. Dot defect.(for color and TFT)	According to standard of visual Inspection.	Minor

11.5 Standard Of Visual Inspection

<table>
<tr><th>NO.</th><th>CLASS</th><th>ITEM</th><th>JUDGMENT</th></tr>
<tr><td>11.5.1</td><td>Minor</td><td>Black and white spot.
Foreign materiel.
Dust.
Blemish.
Scratch.</td><td>(A) Round type: Unit: mm
<table>
<tr><th>Diameter (mm.)</th><th>Acceptable Q'ty</th></tr>
<tr><td>Φ≦0.1</td><td>Disregard</td></tr>
<tr><td>0.1 < Φ≦0.2</td><td>2(Distance>10mm)</td></tr>
<tr><td>0.20 < Φ</td><td>0</td></tr>
</table>
Note: Φ = (length+width)/2
(B) Linear type: Unit: mm
<table>
<tr><th>Length</th><th>Width (mm.)</th><th>Acceptable Q'ty</th></tr>
<tr><td>--</td><td>W≦0.03</td><td>Disregard</td></tr>
<tr><td>L≦3.0</td><td>0.03< W≦0.05</td><td>1(Distance>10mm)</td></tr>
<tr><td>--</td><td>0.05 < W</td><td>Not allow</td></tr>
</table></td></tr>
<tr><td>11.5.2</td><td>Minor</td><td>Dent on polarizer.</td><td>Unit: mm.
<table>
<tr><th>Diameter</th><th>Acceptable Q'ty</th></tr>
<tr><td>Φ≦0.1</td><td>Disregard</td></tr>
<tr><td>0.1 < Φ≦0.2</td><td>2(Distance>10mm)</td></tr>
<tr><td>0.2 < Φ</td><td>0</td></tr>
</table></td></tr>
<tr><td>11.5.3</td><td>Minor</td><td>Bubble in polarizer.</td><td>Unit: mm.
<table>
<tr><th>Diameter</th><th>Acceptable Q'ty</th></tr>
<tr><td>Φ≦0.1</td><td>Disregard</td></tr>
<tr><td>0.1< Φ≦0.25</td><td>2(Distance>10mm)</td></tr>
<tr><td>0.2 < Φ</td><td>0</td></tr>
</table></td></tr>
</table>

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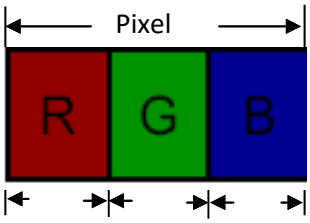
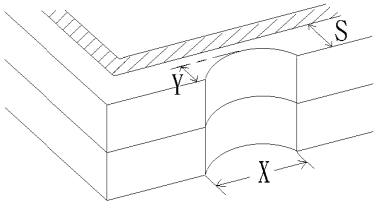
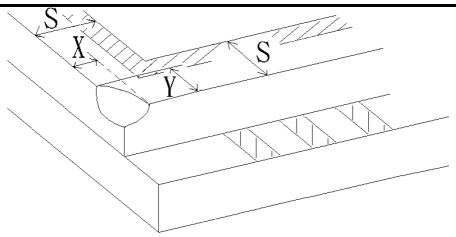
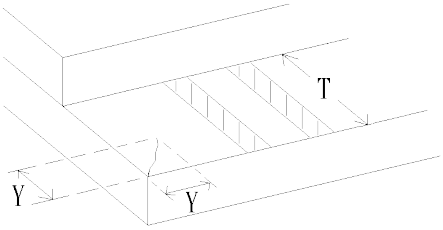
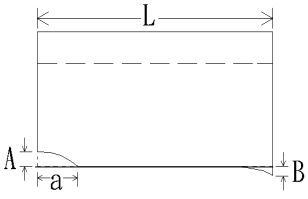
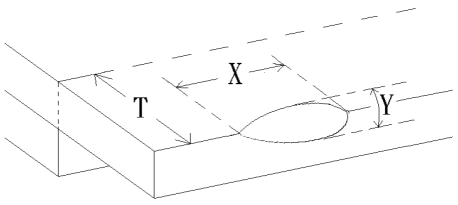
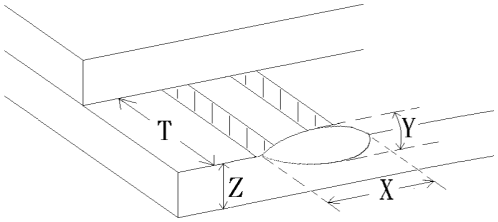
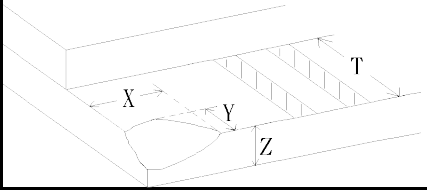
11.5.4	Minor	Dot defect	<table><tr><th>Items</th><th>Acceptable Q'ty</th></tr><tr><td>Bright dot</td><td>N ≦3</td></tr><tr><td>Dark dot</td><td>N ≦3</td></tr><tr><td>Total dot</td><td>N ≦6</td></tr></table> Pixel define :  Dot Dot Dot Note1: The definition of dot: The size of a defective dot over 1/2 of whole dot is regarded as one defective dot. Note 2: Bright dot: Dots appear bright and unchanged in size in which LCD panel is displaying under black pattern. Note 3: The bright dot defect must be visible through 2% ND filter Note 4: Dark dot: Dots appear dark and unchanged in size in which LCD panel is displaying under pure red, green, blue
11.5.5	Minor	LCD glass chipping.	 Y>S Reject
11.5.6	Minor	LCD glass chipping.	 X or Y>S Reject
11.5.7	Major	LCD glass crack.	 Y>(1/2) T Reject
11.5.8	Major	LCD glass scribe defect.	 1. a>L/3, A>1.5mm Reject 2. B : According to dimension

11.5.9	Minor	LCD glass chipping. (on the terminal area)		Φ = (x+y)/2>2.5mm Reject
11.5.10	Minor	LCD glass chipping. (on the terminal surface)		Y>(1/3)T Reject
11.5.11	Minor	LCD glass chipping.		Y>T Reject

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12. Handling Precautions

12.1 Mounting method

The TFT module consists of two thin glass plates with polarizes which easily be damaged. And since the module in so constructed as to be fixed by utilizing fitting holes in the printed circuit board.

Extreme care should be needed when handling the LCD modules.

12.2 Caution of LCD handling and cleaning

When cleaning the display surface, Use soft cloth with solvent

[Recommended below] and wipe lightly.

- Isopropyl alcohol.
- Ethyl alcohol.

Do not wipe the display surface with dry or hard materials that will damage the polarizer surface.
Do not use the following solvent:

- Water.
- Aromatics.

Do not wipe ITO pad area with the dry or hard materials that will damage the ITO patterns
Do not use the following solvent on the pad or prevent it from being contaminated:

- Soldering flux.
- Chlorine (Cl) , Sulfur (S).

If goods were sent without being silicon coated on the pad, ITO patterns could be damaged due to the corrosion as time goes on.

If ITO corrosion happen by miss-handling or using some materials such as Chlorine (Cl), Sulfur (S) from customer, Responsibility is on customer.

12.3 Caution against static charge

The LCD module use C-MOS LSI drivers, so we recommended that you:

Connect any unused input terminal to POWER or GROUND, do not input any signals before power is turned on, and ground your body, work/assembly areas, and assembly equipment to protect against static electricity.

12.4 packing

- Module employs LCD elements and must be treated as such.
- Avoid intense shock and falls from a height.

- To prevent modules from degradation, do not operate or store them exposed direct to sunshine or

high temperature/humidity.

12.5 Caution for operation

- It is an indispensable condition to drive LCD's within the specified voltage limit since the higher voltage then the limit cause the shorter LCD life.
- An electro chemical reaction due to direct current causes LCD's undesirable deterioration, so that the use of direct current drive should be avoided.
- Response time will be extremely delayed at lower temperature then the operating temperature range and on the other hand at higher temperature LCD's how dark color in them. However those phenomena do not mean malfunction or out of order with LCD's, which will come back in the specified operation temperature.
- If the display area is pushed hard during operation, some font will be abnormally displayed but it resumes normal condition after turning off once.
- Slight dew depositing on terminals is a cause for electro-chemical reaction resulting in terminal open circuit.

Usage under the maximum operating temperature, 50%Rh or less is required.

12.6 storing

In the case of storing for a long period of time for instance, for years for the purpose or replacement use, the following ways are recommended.

- Storage in a polyethylene bag with the opening sealed so as not to enter fresh air outside in it. And with no desiccant.
- Placing in a dark place where neither exposure to direct sunlight nor light's keeping the storage temperature range.
- Storing with no touch on polarizer surface by the anything else.

[It is recommended to store them as they have been contained in the inner container at the time of delivery from us.

12.7 Safety

- It is recommendable to crash damaged or unnecessary LCD's into pieces and wash off liquid crystal by either of solvents such as acetone and ethanol, which should be burned up later.
- When any liquid leaked out of a damaged glass cell comes in contact with your hands, please wash it off well with soap and water.

13. Precaution for Use

13.1

A limit sample should be provided by the both parties on an occasion when the both parties agreed its necessity. Judgment by a limit sample shall take effect after the limit sample has been established and confirmed by the both parties.

13.2

On the following occasions, the handing of problem should be decided through discussion and agreement between responsible of the both parties.

- When a question is arisen in this specification
- When a new problem is arisen which is not specified in this specifications
- When an inspection specifications change or operating condition change in customer is reported to TFT , and some problem is arisen in this specification due to the change
- When a new problem is arisen at the customer's operating set for sample evaluation in the customer site.

- END