



SPECIFICATIONS FOR TFT-LCD MODULE

Model Name:DBT043BWSA02CP

Version:	0
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- Approved For Specifications
- Approved For Specifications & Sample

Aptus ELECTRONICS CO., LIMITED:

CUSTOMER:

Aptus Model No.:	DBT043BWSA02CP
Prepared by:	Bob
Checked by	Luck
Approved by:	Jack

Customer Model No.:	_____
Approved by:	_____
Date:	_____
Note:	_____



TABLE OF CONTENTS

List	Description	Page No.
	Cover	1
	Revision Record	2
	Table of Contents	3
1	Scope	4
2	General Information	4
3	External Dimensions	5
4	Interface Description	6
5	Absolute Maximum Ratings	7
6	Electrical Specifications	8
7	Timing Characteristics	9-15
8	Backlight Characteristics	16
9	Optical Characteristics	17-19
10	Reliability Test Conditions and Methods	20
11	Inspection Standard	21-25
12	Handling Precautions	26-27
13	Precaution for Use	28



1. Scope

This specification defines general provisions as well as inspection standards for TFT module supplied by Aptus electronics Co.,LTD.

If the event of unforeseen problem or unspecified items may occur, naturally shall negotiate and agree to solution.

2. General Specifications

2.1 LCD Parameter

Item	Contents	Unit	Note
LCD Type	TFT	-	
Display color	16.7M		
Viewing Direction	ALL	O'Clock	
Grayscale inversion direction	-	O'Clock	
Operating temperature	-20~+70	°C	
Storage temperature	-30~+80	°C	
Module size	4.3	inch	
Active Area(W×H)	95.04x53.86	mm	
Number of Dots	800x480	dots	
Controller	ST7262E43 OR EQU	-	
Power Supply Voltage	3.3	V	
Outline Dimensions	105.48x67.26x4.41	mm	
Backlight	5x3-LEDs (white)	pcs	
Weight	---	g	
Interface	RGB	-	

2.2 CTP Parameter

Item	Contents	Unit	Note
Cover View Area	95.64(H)X54.46(V)		
CTP Resolution	800*480	dots	
Interface Mode	IIC	-	
Touch Mode	5 Human fingers multi-touch	-	
Surface hardness	6H	-	
Transparency	>=85%	-	
Accuracy	Centre +/-1.5,Edge +/-2.5mm	mm	
CTP Controller	ST1633i	-	
Power Supply Voltage	3.3	V	



4.Interface Description

4.1 LCD interface

Pin No.	Symbol	I/O	Function
1	LEDK	P	LED back light(Cathode).
2	LEDA	P	LED back light(Anode).
3	GND	P	Ground.
4	VDD	P	Power supply .
5-12	R0-R7	I	Red data bus.
13-20	G0-G7	I	Green data bus.
21-28	B0-B7	I	Blue data bus.
29	GND	P	Ground.
30	PCLK	I	Data clock.
31	DISP	I	Standby mode select pin.
32	HSYNC	I	Horizontal sync signal.
33	VSYNC	I	Vertical sync signal.
34	DE	I	Data input Enable. Active High to enable the data input Bus under “DE Mode”.
35	NC	-	No connection.
36	GND	P	Ground.
37	XR	I	Touch panel pins,if not use,please NC.
38	YD	I	
39	XL	I	
40	YU	I	

4.2 CTP interface

Pin No.	Symbol	I/O	Function
1	VDD	P	Power supply.
2	GND	P	Ground.
3	SCL	I	Serial interface clock.
4	SDA	I/O	Serial input/output data bus.
5	INT	O	External Interrupt pin.
6	WAKE	I	Reset signal.

5. Absolute Maximum Ratings(Ta=25°C)

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

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

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°C	80°C	-20°C	70°C	1,2
Humidity	-	-	-	-	3

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. $T_a \leq 40^\circ\text{C}$:85%RH MAX.
 $T_a \geq 40^\circ\text{C}$:Absolute humidity must be lower than the humidity of 85%RH at 40°C.



6. Electrical Specifications and Instruction Code

6.1 Electrical characteristics($V_{SS}=0V$, $T_a=25^{\circ}C$)

Parameter	Symbol	Condition	Min	Typ	Max	Unit	Note	
Power supply	VDD	$T_a=25^{\circ}C$	2.7	3.3	3.6	V	-	
Input voltage	'H'	V_{IH}	VDD=3.3V	0.7VDD	-	VDD	V	-
	'L'	V_{IL}		GND	-	0.3VDD	V	-
Output voltage	'H'	V_{OH}	-	VDD-0.4	-	VDD	V	-
	'L'	V_{OL}	-	0	-	GND+0.4	V	-
Current Consumption	I_{CC1}	Normal mode	-	TBD	-	mA	2	

Note:

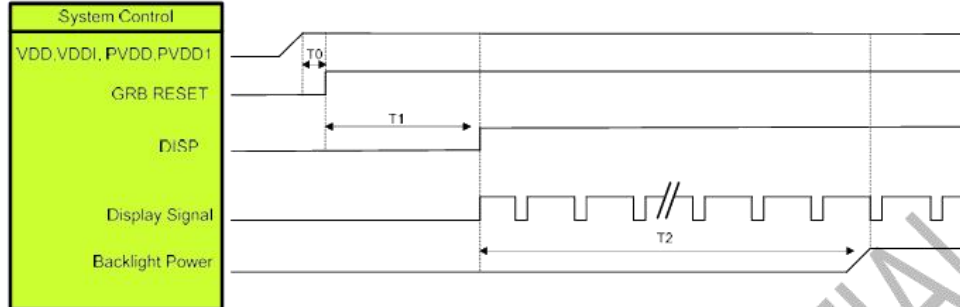
1:When an optimum contrast is obtained in transmissive mode.

2: Tested in 1×1 chessboard pattern.

7. Timing Characteristics

7.1 Power on/off Sequence

Power on:

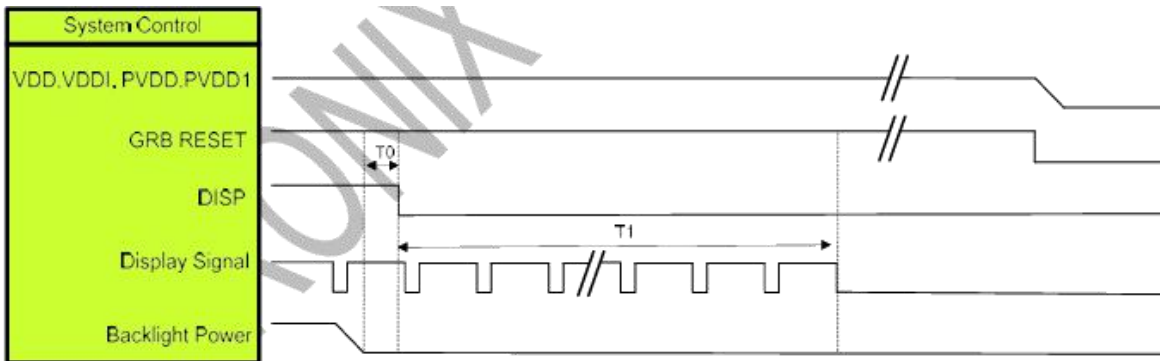


Symbol	Description	Min. Time	Unit
T0	System power stability to GRB RESET signal	0	ms
T1	GRB RESET= "High" to DISP="High"	10	ms
T2	Display Signal output to Backlight Power on	250	ms

Note :

1. When DISP pull "H" or "L", IC will execute the internal power on or power off procedures. Please be careful about the timing of DISP and do not interrupt it during power on or power off procedure, otherwise unexpected errors will occur.
2. RGB interface Display signal: DCLK; VSYNC; HSYNC; DE; DR[7:0]; DG[7:0]; DB[7:0]
3. LVDS interface Display signal: DCLK P/N; RX[3:0] P/N

Power off:



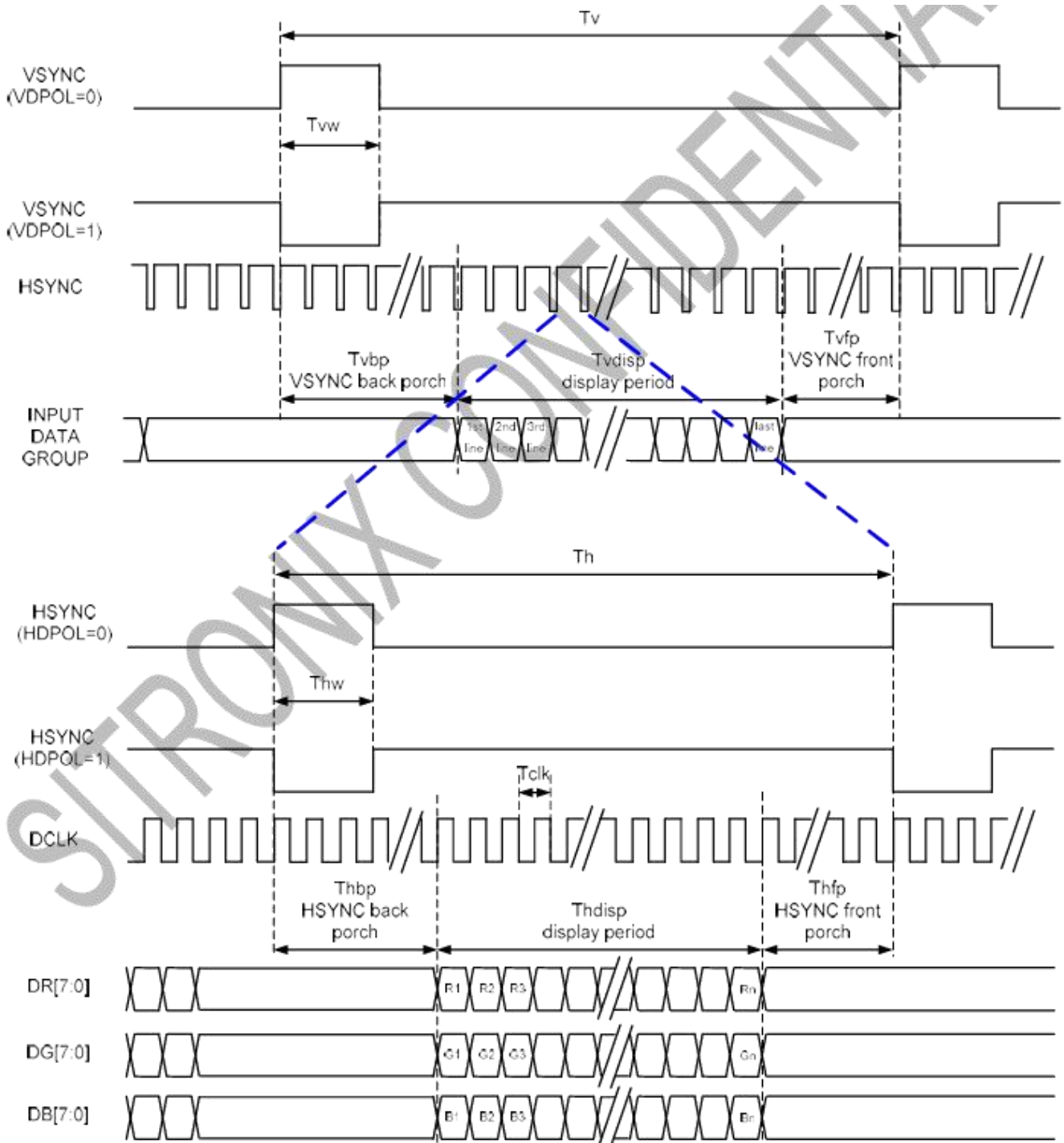
Symbol	Description	Min. Time	Unit
T0	Backlight Power off to DISP="Low"	5	ms
T1	DISP="Low" to IC internal voltage discharge complete	100	ms

Note :

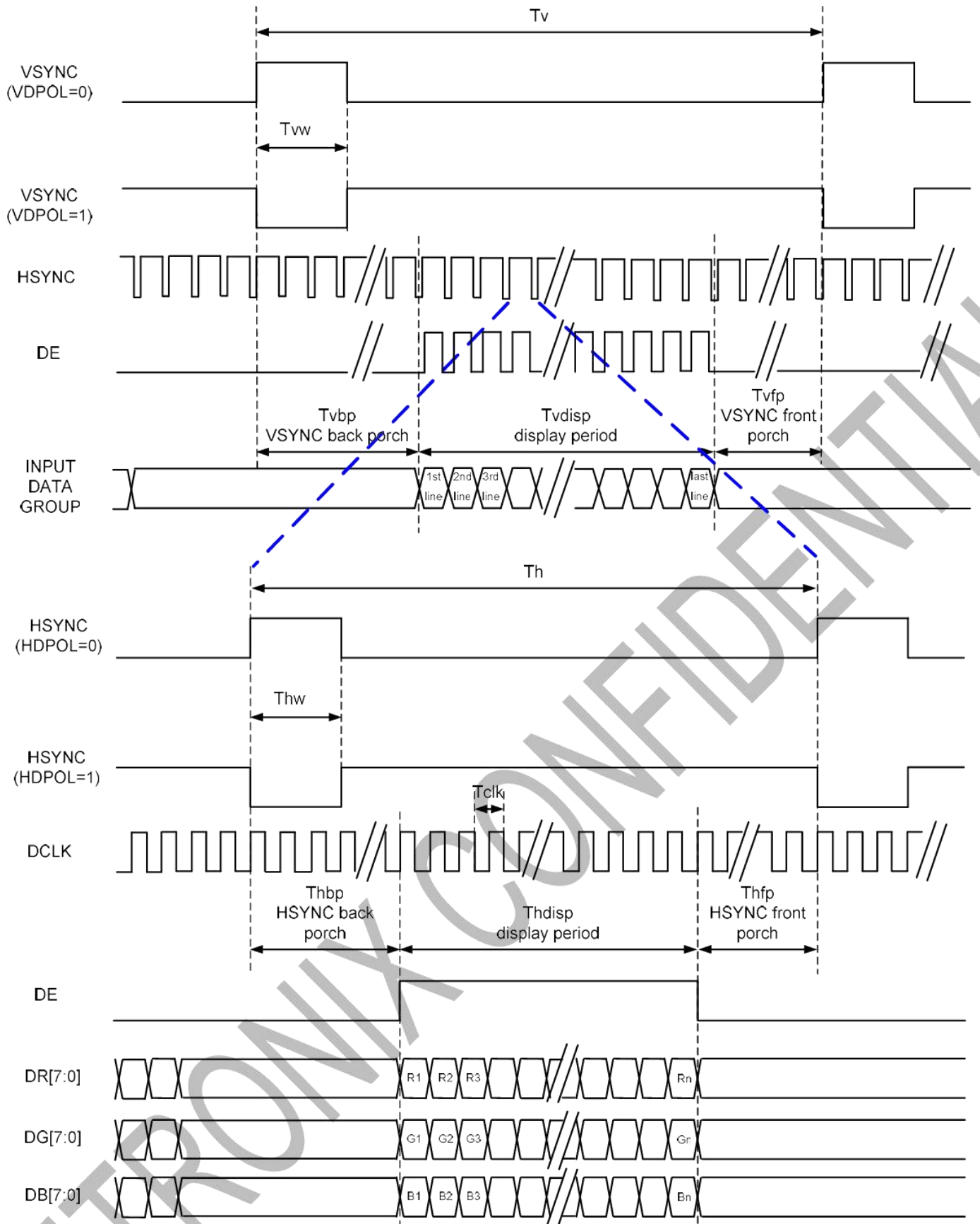
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7.2 AC electrical characteristic

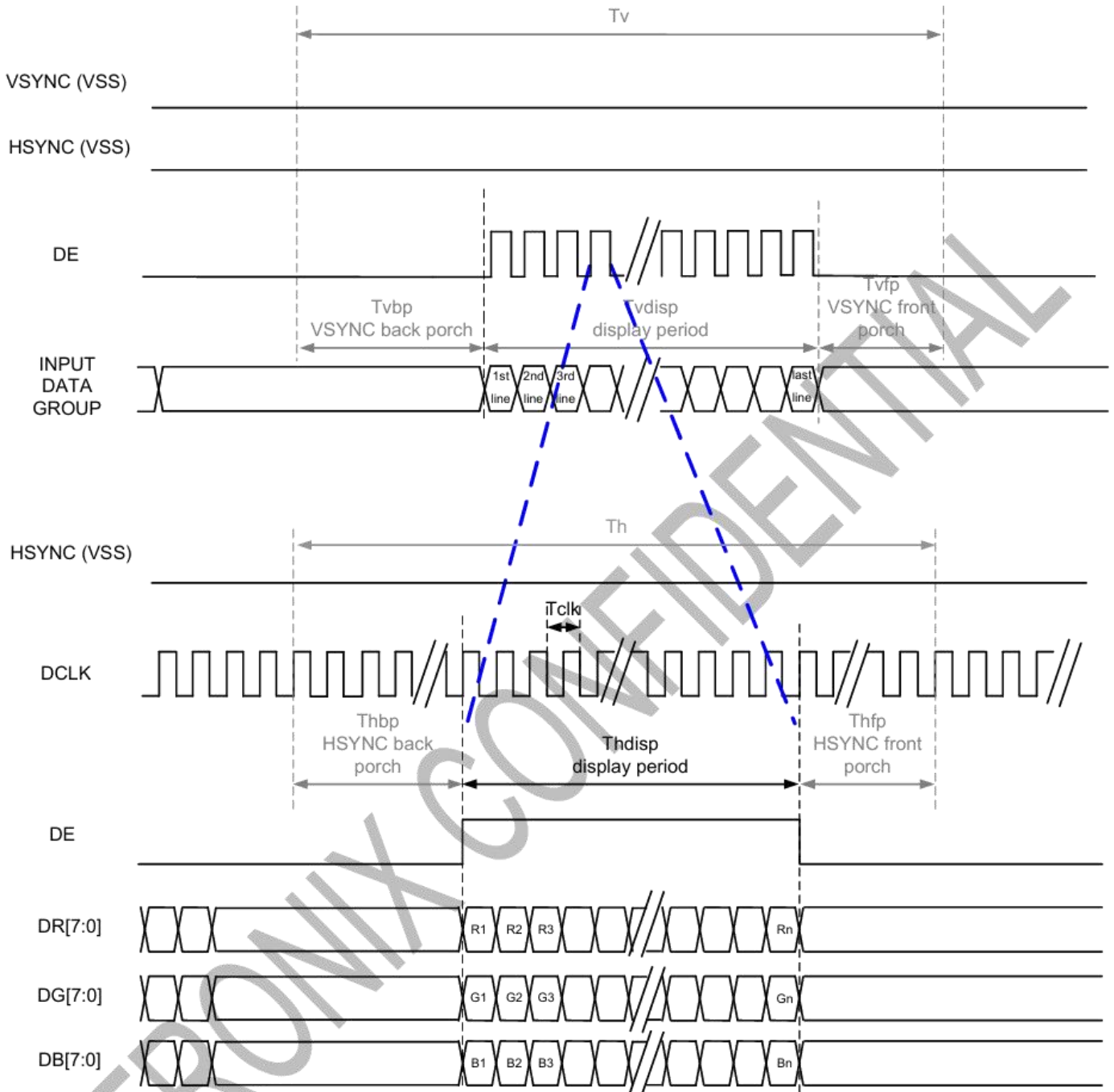
7.2.1 SYNC Mode



7.2.2 SYNC-DE Mode



7.2.3 DE Mode



Item	Symbol	Min.	Typ.	Max.	Unit	Conditions
CLK Pulse Duty	Tclk	40	50	60	%	
VSYNC Setup Time	Tvst	10	-	-	ns	
VSYNC Hold Time	Tvhd	10	-	-	ns	
HSYNC Setup Time	Thst	10	-	-	ns	
HSYNC Hold Time	Thhd	10	-	-	ns	
Data Setup Time	Tdsu	10	-	-	ns	
Data Hold Time	Tdhd	10	-	-	ns	
DE Setup Time	Tdest	10	-	-	ns	
DE Hold Time	Tdehd	10	-	-	ns	

7.2.5 Parallel 24-bit RGB Input Timing Table

Parallel 24-bit RGB Input Timing (PVDD=PVDD1=VDD=VDDI= 3.3V, AGND= 0V, TA=25°C)

Parallel 24-bit RGB Interface Timing Table						
Item	Symbol	Min.	Typ.	Max.	Unit	Remark
DCLK Frequency	Fclk	23	25	27	MHz	
HSYNC	Period Time	Th	808	816	896	DCLK
	Display Period	Thdisp	800			DCLK
	Back Porch	Thbp	4	8	48	DCLK
	Front Porch	Thfp	4	8	48	DCLK
	Pulse Width	Thw	2	4	8	DCLK
VSYNC	Period Time	Tv	492	496	504	HSYNC
	Display Period	Tvdisp	480			HSYNC
	Back Porch	Tvbp	6	8	12	HSYNC
	Front Porch	Tvfp	6	8	12	HSYNC
	Pulse Width	Tvw	2	4	8	HSYNC

Note: 1. The minimum blanking time depends on the GIP timing of the panel specification

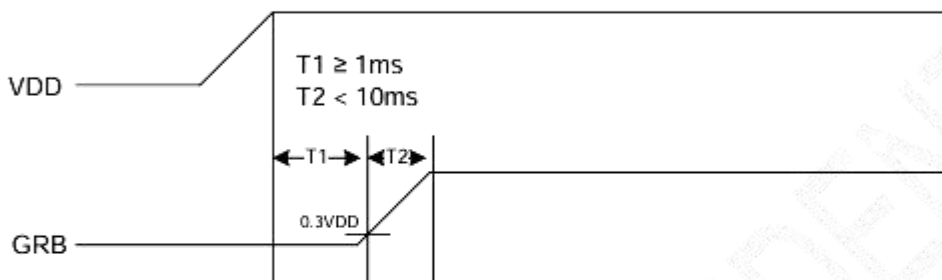
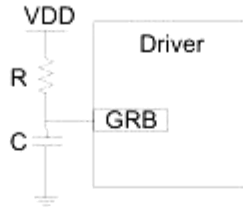
2. To ensure the compatibility of different panels, it is recommended to use the typical setting.

3. It is necessary to keep Tvbp =12 and Thbp =43 in sync mode. DE mode is unnecessary to keep it.

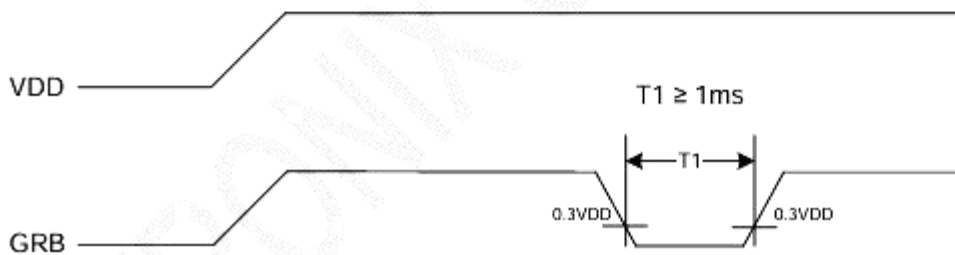
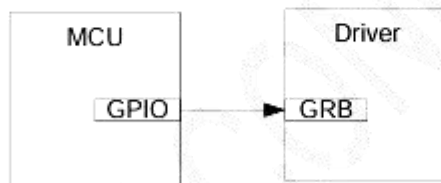
7.3 Reset Timing

Setting GRB pin to "L" (hardware reset) can initialize internal function. Initialized by GRB pin is essential before operating. There are two suggestions for hardware reset connection.

(1) The GRB pin with external RC circuit.

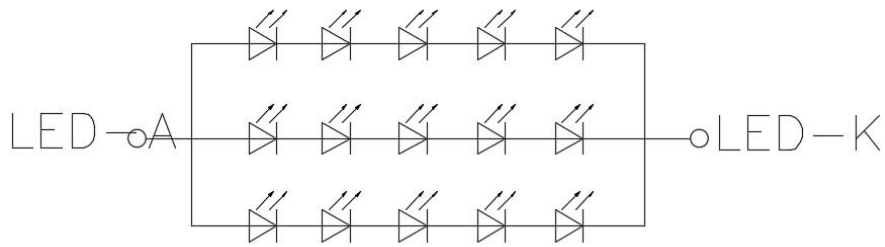


(2) The GRB pin controlled by MCU.



8.0 Backlight Characteristic

LED CIRCUIT DIAGRAM:

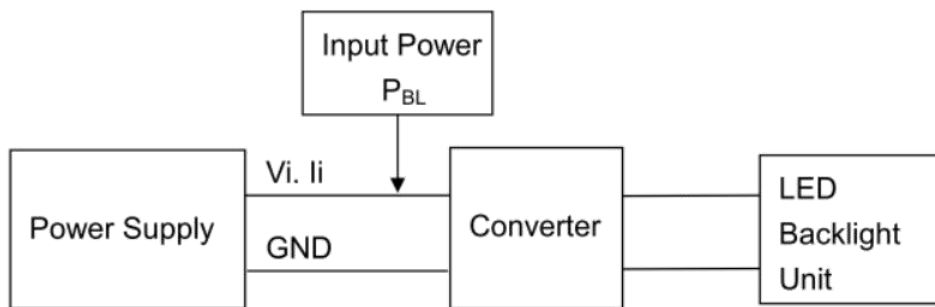


BL driving conditions:
 $I_f = 60 \text{ mA}$, $V_f = 15V \pm 1.5V$

Item	Symbol	Min	Typ	Max	Unit	Test Condition
Supply Voltage	V_f	13.5	15.0	6.5	V	Note 1
Supply Current	I_f	-	60	-	mA	Note 2
Power dissipation	P_{BL}	-	0.9	-	W	
Life Time	-	30000	-	-	Hr	Note 3,4
Backlight Color	White					

Note 1: The LED Supply Voltage is defined by the number of LED at $T_a = 25^\circ\text{C}$ and $I_f = 60\text{mA}$.

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 $T_a = 25^\circ\text{C}$ and $I_f = 60\text{mA}$. The LED lifetime could be decreased if operating I_f is larger than 60mA.

Note 4: LED light bar circuit:

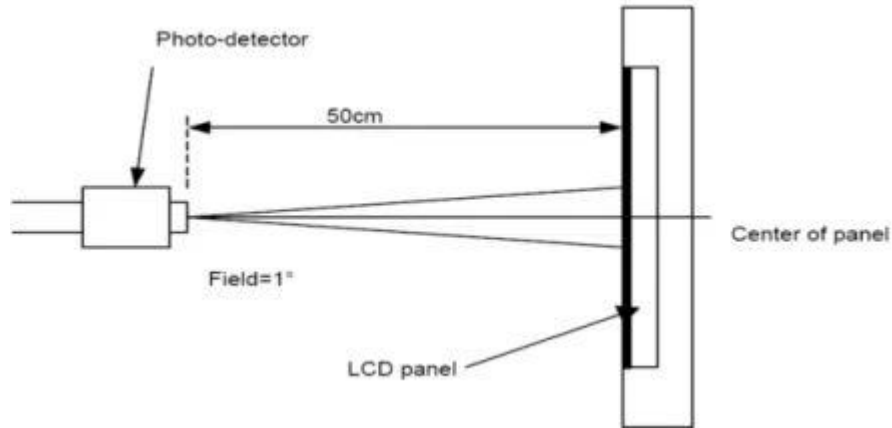
9. Optical Characteristics

Item	Symbol	Condition	Min.	Typ.	Max.	Unit	Note	
Brightness	Bp	If=60mA	650	800	-	Cd/m ²	1	
Uniformity	△Bp		75	80	-	%	1,2	
Viewing Angle	3:00	Cr≥10	-	80	-	Deg	1,2	
	6:00		-	80	-			
	9:00		-	80	-			
	12:00		-	80	-			
Contrast Ratio	Cr	θ=0° Φ=0°	-	1200	-	-	3,4	
Response Time	T _r +T _f		-	30	-	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°C.-Adjust operating voltage to get optimum contrast at the center of the display.

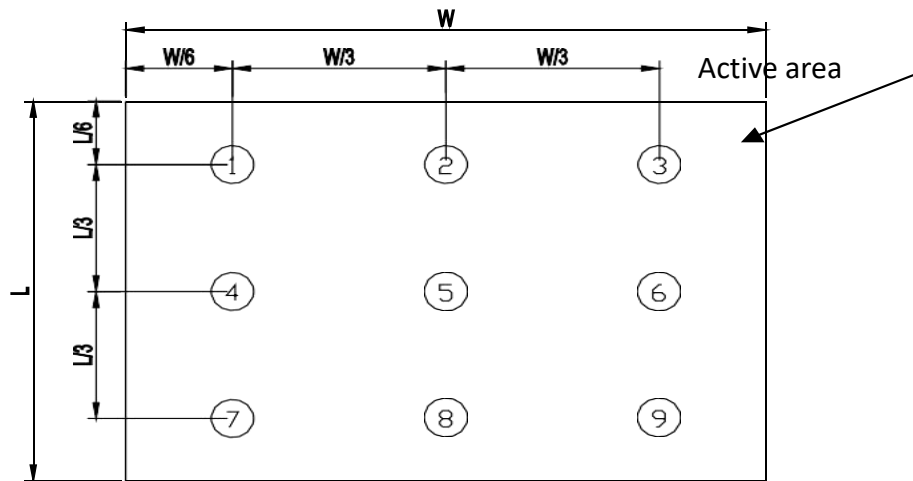
The measured value is more than 5 minutes at the center point of the LCD panel, and the backlight is turned on at the same time.



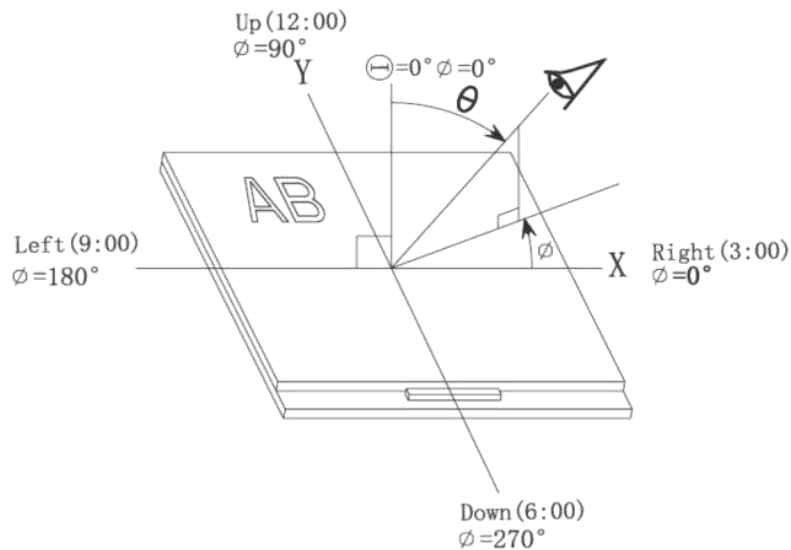
Note 2: The luminance uniformity is calculated by using following formula.

$$\Delta B_p = B_p (\text{Min.}) / B_p (\text{Max.}) \times 100 (\%); B_p (\text{Max.}) = \text{Maximum brightness in 9 measured spots}$$

$$B_p (\text{Min.}) = \text{Minimum brightness in 9 measured spots.}$$



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

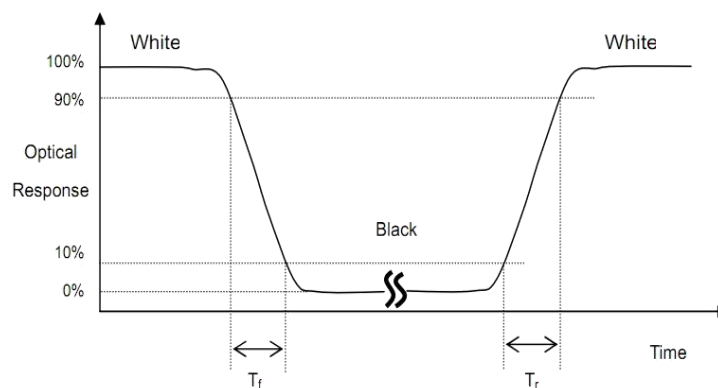


Note 4: Definition of contrast ratio Contrast measurements shall be made at viewing angle of $\theta = 0$ and at the center of the LCD surface. Luminance shall be measured with all pixels in the view field set first

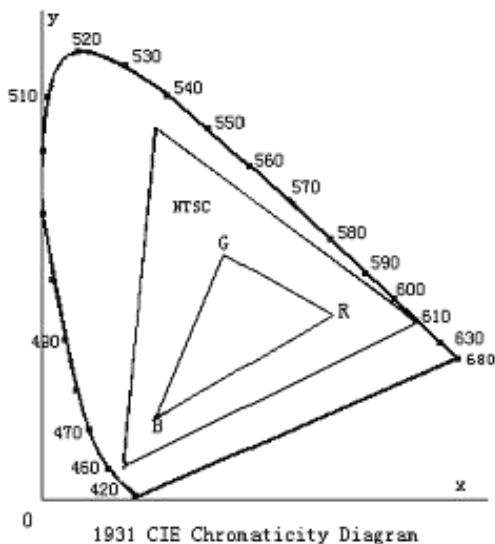
to white, then to the dark (black) state.

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

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.



Color gamut:

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

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. 7, The surface shall be free from damage. 8, The electric characteristic requirements shall be satisfied. 9. Brightness reduction more than 50%.
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 ← (30min) ↔ (5min) ↔ (30min) → 80°C 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: $25\pm 5^{\circ}\text{C}$.

Humidity: $65\pm 5\%$ 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.

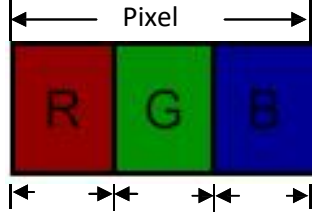
11.3.4 Inspection time:

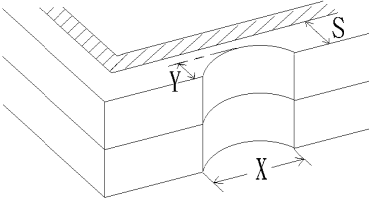
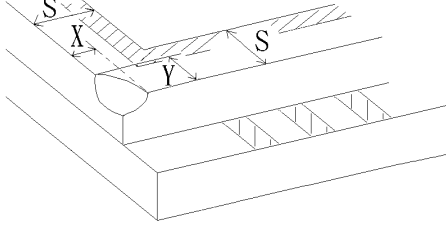
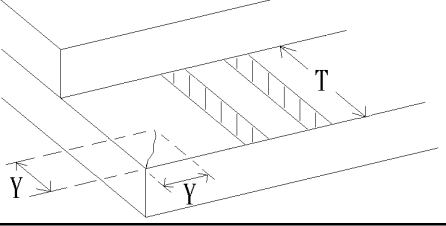
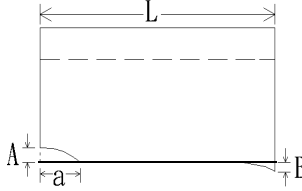
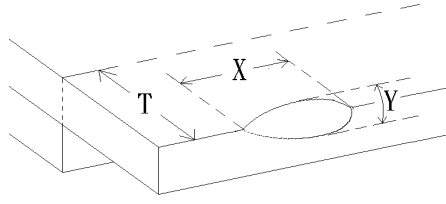
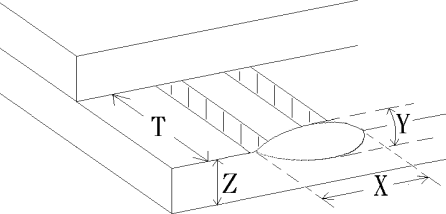
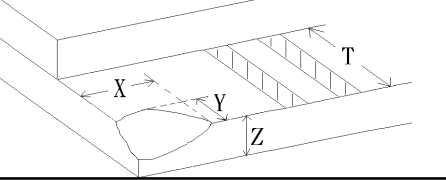
Perceptibility Test Time: 20 seconds max.

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

NO.	CLASS	ITEM	JUDGMENT																				
11.5.1	Minor	Black and white spot. Foreign material. Dust. Blemish. Scratch.	<p>(A) Round type: Unit: mm</p> <table border="1"> <thead> <tr> <th>Diameter (mm.)</th> <th>Acceptable Q'ty</th> </tr> </thead> <tbody> <tr> <td>$\Phi \leq 0.1$</td> <td>Disregard</td> </tr> <tr> <td>$0.1 < \Phi \leq 0.25$</td> <td>2(Distance>10mm)</td> </tr> <tr> <td>$0.25 < \Phi$</td> <td>0</td> </tr> </tbody> </table> <p>Note: $\Phi = (\text{length} + \text{width}) / 2$</p> <p>(B) Linear type: Unit: mm</p> <table border="1"> <thead> <tr> <th>Length</th> <th>Width (mm.)</th> <th>Acceptable Q'ty</th> </tr> </thead> <tbody> <tr> <td>--</td> <td>$W \leq 0.03$</td> <td>Disregard</td> </tr> <tr> <td>$L \leq 3.0$</td> <td>$0.03 < W \leq 0.05$</td> <td>1(Distance>10mm)</td> </tr> <tr> <td>--</td> <td>$0.05 < W$</td> <td>Not allow</td> </tr> </tbody> </table>	Diameter (mm.)	Acceptable Q'ty	$\Phi \leq 0.1$	Disregard	$0.1 < \Phi \leq 0.25$	2(Distance>10mm)	$0.25 < \Phi$	0	Length	Width (mm.)	Acceptable Q'ty	--	$W \leq 0.03$	Disregard	$L \leq 3.0$	$0.03 < W \leq 0.05$	1(Distance>10mm)	--	$0.05 < W$	Not allow
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11.5.2	Minor	Dent on polarizer.	<p style="text-align: right;">Unit: mm.</p> <table border="1"> <thead> <tr> <th>Diameter</th> <th>Acceptable Q'ty</th> </tr> </thead> <tbody> <tr> <td>$\Phi \leq 0.1$</td> <td>Disregard</td> </tr> <tr> <td>$0.1 < \Phi \leq 0.25$</td> <td>2(Distance>10mm)</td> </tr> <tr> <td>$0.25 < \Phi$</td> <td>0</td> </tr> </tbody> </table>	Diameter	Acceptable Q'ty	$\Phi \leq 0.1$	Disregard	$0.1 < \Phi \leq 0.25$	2(Distance>10mm)	$0.25 < \Phi$	0												
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$0.25 < \Phi$	0																						
11.5.3	Minor	Bubble in polarizer.	<p style="text-align: right;">Unit: mm.</p> <table border="1"> <thead> <tr> <th>Diameter</th> <th>Acceptable Q'ty</th> </tr> </thead> <tbody> <tr> <td>$\Phi \leq 0.1$</td> <td>Disregard</td> </tr> <tr> <td>$0.1 < \Phi \leq 0.25$</td> <td>2(Distance>10mm)</td> </tr> <tr> <td>$0.25 < \Phi$</td> <td>0</td> </tr> </tbody> </table>	Diameter	Acceptable Q'ty	$\Phi \leq 0.1$	Disregard	$0.1 < \Phi \leq 0.25$	2(Distance>10mm)	$0.25 < \Phi$	0												
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11.5.4	Minor	Dot defect	<table border="1"> <thead> <tr> <th>Items</th> <th>Acceptable Q'ty</th> </tr> </thead> <tbody> <tr> <td>Bright dot</td> <td>$N \leq 3$</td> </tr> <tr> <td>Dark dot</td> <td>$N \leq 3$</td> </tr> <tr> <td>Total dot</td> <td>$N \leq 6$</td> </tr> </tbody> </table> <p>Pixel define :</p>  <p style="text-align: center;">Dot Dot Dot</p> <p>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</p>	Items	Acceptable Q'ty	Bright dot	$N \leq 3$	Dark dot	$N \leq 3$	Total dot	$N \leq 6$												
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11.5.5	Minor	LCD glass chipping.		Reject	$Y > S$
11.5.6	Minor	LCD glass chipping.		X or Reject	$Y > S$
11.5.7	Major	LCD glass crack.		$Y > (1/2)$ Reject	T
11.5.8	Major	LCD glass scribe defect.		1. $a > L/3$, $A > 1.5\text{mm}$ Reject 2. B : According to dimension	
11.5.9	Minor	LCD glass chipping. (on the terminal area)		$\Phi = (x+y)/2 > 2.5\text{mm}$ Reject	
11.5.10	Minor	LCD glass chipping. (on the terminal surface)		Reject	$Y > (1/3)T$
11.5.11	Minor	LCD glass chipping.		$Y > T$	Reject



12. Handling Precautions

12.1 Mounting method

The LCD panel of **Aptus** TFT module consists of two thin glass plates with polarizers which easily be damaged. And since the module is 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 happens 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 uses C-MOS LSI drivers, so we recommend 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 directly 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 than the limit causes 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 than the operating temperature range and on the other hand at higher temperature LCD's show 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 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 **Aptus** 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.