Specification for Approval

Customer:_____

Model Name:_____

Supplier Approval			Customer approval
R&D Designed	R&D Approved	QC Approved	
Peter	*Peng Jun*		

Revision Record

REV NO.	REV DATE	CONTENTS	Note
A	2019-06-11	NEW ISSUE	
B	2019-09-10	CHANGE TFT IC	

Table of Contents

1. Scope

This specification defines general provisions as well as inspection standards for TFT module supplied by AMSON electronics.

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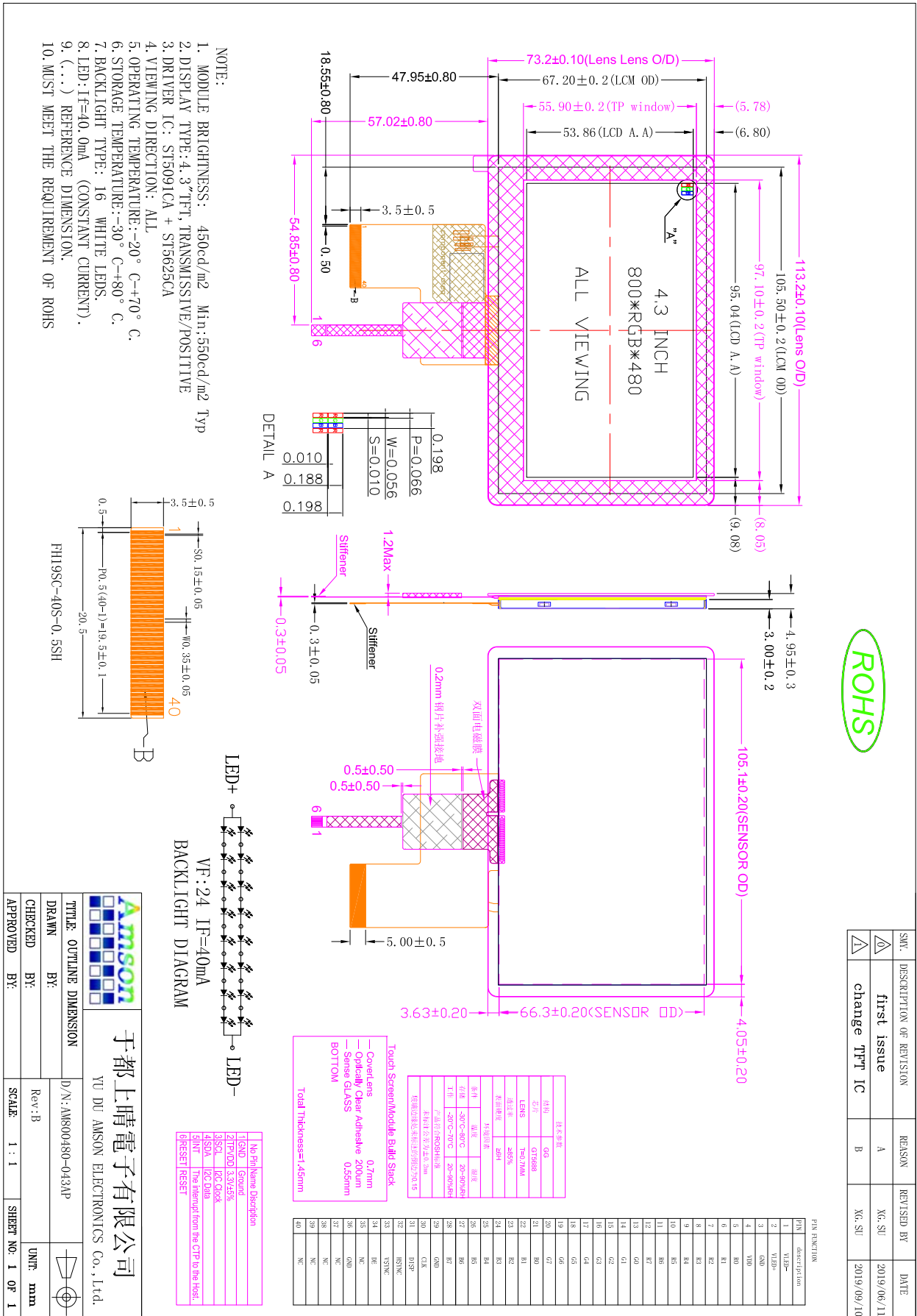
2. General Information

LCM

ITEM	STANDARD VALUES	UNITS
LCD type	4.3"TFT	--
Dot arrangement	800 (RGB)×480	dots
Color filter array	RGB vertical stripe	--
Display mode	Normally BLACK IPS	-
Viewing Direction	ALL Viewi	
Driver IC	ST5091CA + ST5625CA	--
Module size	113.20(W)×73.2(H)×4.95(T)	mm
Active area	95.04(W)×53.86(H)	mm
Dot pitch	0.135(W)×0.135(H)	mm
Interface	24-bit Parallel RGB Interface	--
Operating temperature	-20 ~ +70	°C
Storage temperature	-30 ~ +80	°C
Back Light	16 White LED	--

CTP

ITEM	STANDARD VALUES	UNITS
CTP type	Cover Lens + sensor + FPC	--
CTP Driver IC	GT5688_	--
Surface hardness	6H	--
Transmittance	≥85％	--
CTP size	113.20(W)×73.2(H)×1.95(T)	mm
CTP Active area	95.04(W)×53.85(H)	mm
CTP Interface	I2C	
response time	10	ms

3. External Dimensions

NOTE：

1. MODULE BRIGHTNESS: 450cd/m2 Min;550cd/m2 Typ
2. DISPLAY TYPE:4.3"TFT, TRANSMISSIVE/POSITIVE
3. DRIVER IC: ST5091CA + ST5625CA
4. VIEWING DIRECTION: ALL.
5. OPERATING TEMPERATURE:-20°C~+70°C.
6. STORAGE TEMPERATURE:-30°C~+80°C.
7. BACKLIGHT TYPE: 16 WHITE LEDS.
8. LED:If=40.0mA (CONSTANT CURRENT).
9. (...) REFERENCE DIMENSION.
10. MUST MEET THE REQUIREMENT OF ROHS

18.55±0.80

47.95±0.80

57.02±0.80

73.2±0.10(Lens Lens O/D)

67.20±0.2(LCM OD)

55.90±0.2(TP window)

(5.78)

53.86(LCD A.A)

(6.80)

3.5±0.5

0.50

54.85±0.80

113.2±0.10(Lens O/D)

105.50±0.2(LCM OD)

97.10±0.2(TP window)

95.04(LCD A.A)

4.3 INCH
800*RGB*480
ALL VIEWING

"A"

(9.08)

(8.05)

DETAIL A

0.010
0.188
0.198

P=0.198
P=0.066
W=0.056
S=0.010

Stiffener
1.2Max
Stiffener
0.3±0.05
0.3±0.05

4.95±0.3
3.00±0.2

ROHS

FH19SC-40S-0.5SH

3.5±0.5
S0.15±0.05
P0.5(40-1)=19.5±0.1
W0.35±0.05
20.5

0.2mm铜片补强接地
双面电磁膜

0.5±0.50
0.5±0.50

105.1±0.20(SENSOR OD)

5.00±0.5

3.63±0.20
66.3±0.20(SENSOR OD)
4.05±0.20

LED+
VF:24 IF=40mA
BACKLIGHT DIAGRAM
LED-

Touch Screen/Module Build Stack
— CoverLens   0.7mm
— Optically Clear Adhesive 200um
— Sense GLASS   0.55mm
BOTTOM
Total Thickness=1.45mm

No	Pin Name	Discription
1	GND	Ground
2	TP/VDD	3.3V±5%
3	SCL	I2C Clock
4	SDA	I2C Data
5	INT	The Interrupt from the CTP to the Host.
6	RESET	RESET

SMK.	DESCRIPTION OF REVISION	REASON	REVISED BY	DATE
	first issue	A	XG.SU	2019/06/11
	change TFT IC	B	XG.SU	2019/09/10

PIN FUNCTION

PIN	description
1	VLED-
2	VLED+
3	GND
4	VDD
5	R0
6	R1
7	R2
8	R3
9	R4
10	R5
11	R6
12	R7
13	G0
14	G1
15	G2
16	G3
17	G4
18	G5
19	G6
20	G7
21	GG
22	B0
23	B1
24	B2
25	B3
26	B4
27	B5
28	B6
29	B7
30	GND
31	CLK
32	DISP
33	HSYNC
34	VSYNC
35	GND
36	NC
37	NC
38	NC
39	NC
40	NC

4. Interface Description

TFT

Pin	Symbol	Description.
1	LEDK	LED backlight (Cathode).
2	LEDA	LED backlight (Anode).
3	GND	Ground.
4	VDD	Power supply.
5~12	R0~R7	Red Data.
13~20	G0~G7	Green Data.
21~28	B0~B7	Blue Data.
29	GND	Ground.
30	DCLK	Clock.
31	DISP	Display on/off.
32	HSYNC	Horizontal sync input in RGB mode.
33	VSYNC	Vertical sync input in RGB mode.
34	DE	Data input Enable.
35	NC	No connection.
36	GND	Ground.
37	NC	No connection.
38	NC	No connection.
39	NC	No connection.
40	NC	No connection.

CTP

Pin	Symbol	Description.
1	GND	Power ground
2	TPVDD	Power supply 3.3V.
3	SCL	CTP I2C_clock.
4	SDA	CTP I2C_data.
5	INT	CTP interruption signal.
6	RESET	CTP reset pin. Active low to enter reset state.

5. Absolute Maximum Ratings

Item	Symbol	Min.	Max.	Unit
Logic Supply Voltage	VDD	-0.5	3.6	V
Input Voltage	Vin	-0.3	3.6	V
Operating Temperature	T_{OP}	-20	70	°C
Storage Temperature	T_{ST}	-30	80	°C
Storage Humidity	HD	20	90	%RH

6. DC Characteristics

Item	Symbol	Min.	Typ.	Max.	Unit	Remark
Logic Supply Voltage	VDD	3.0	3.3	3.6	V	-
Input High Voltage	V_{IH}	0.7VDD	-	VDD	V	-
Input Low Voltage	V_{IL}	GND	-	0.3 VDD	V	-
Output High Voltage	V_{OH}	VDD-0.4	-	VDD	V	-
Output Low Voltage	V_{OL}	GND	-	GND+0.4	V	-
I/O Leak Current	I_{LI}	-1	-	1	uA	-
Supply Current	IDD	-	7.0	10	mA	-

7. Timing Characteristics
7.1 Power ON/OFF Sequence

Power on sequence (VDD→VEE→VGH)
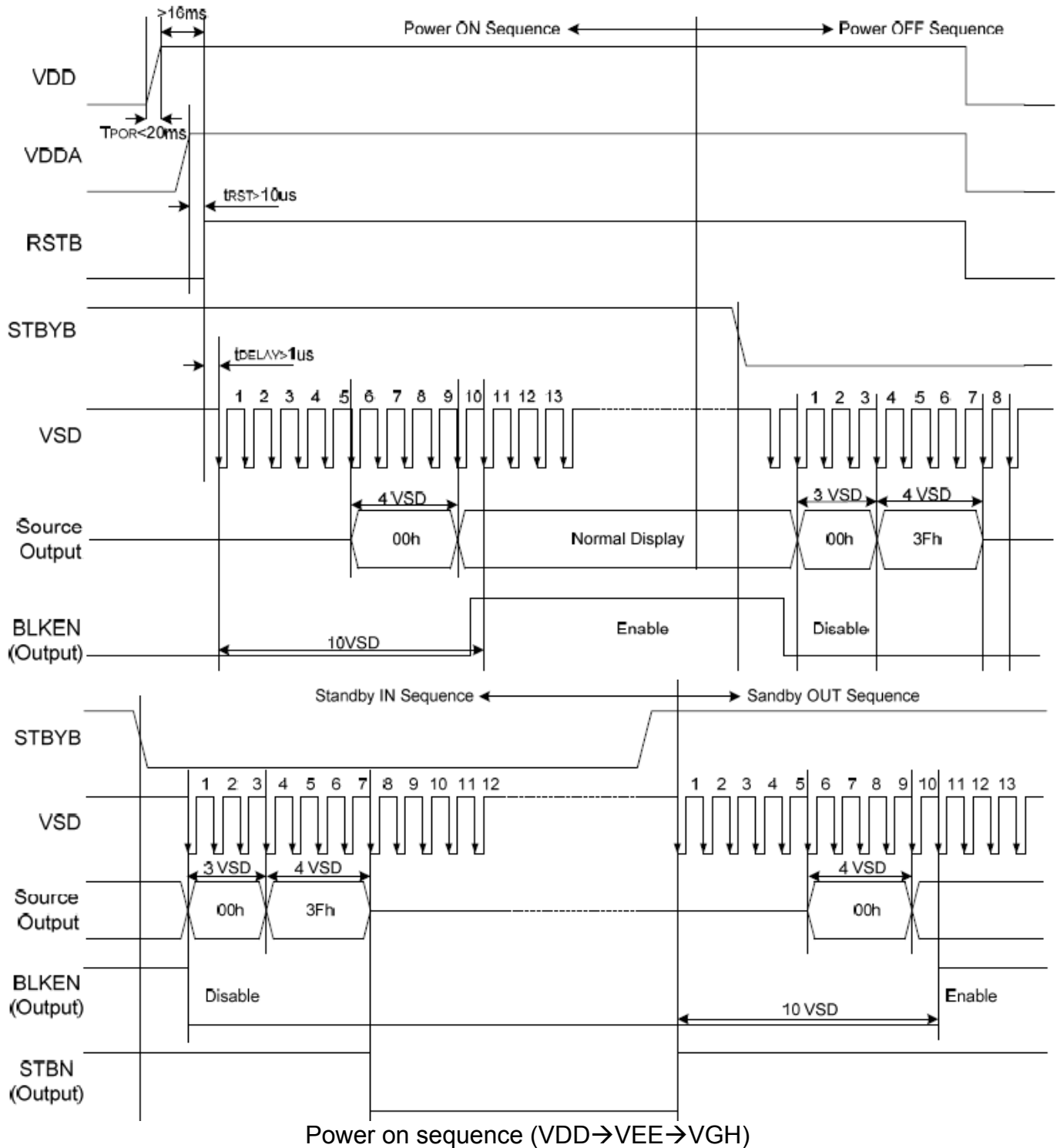
7.2 AC Timing characteristics

DE Mode (MODE='1')
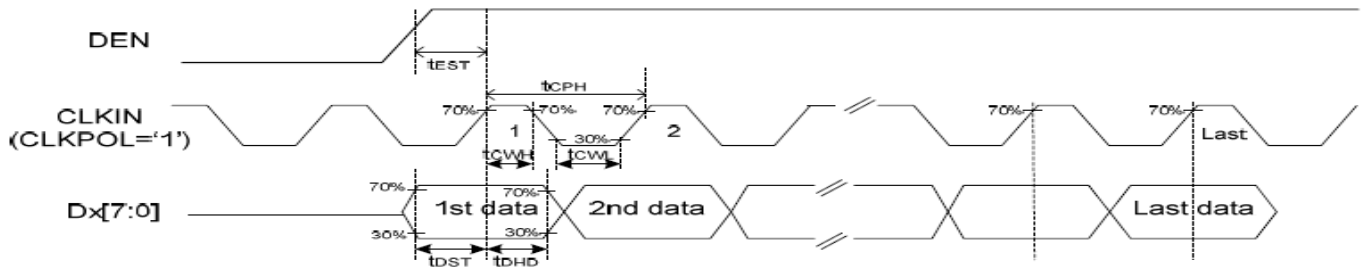
SYNC Mode (MODE='0')
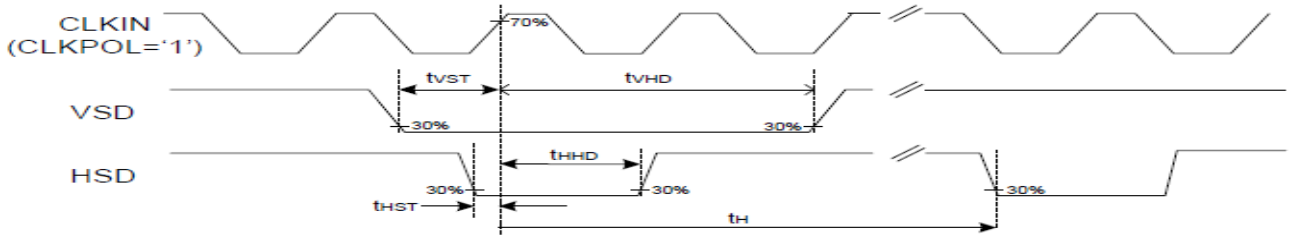
Source Output timing Diagram (Cascade)
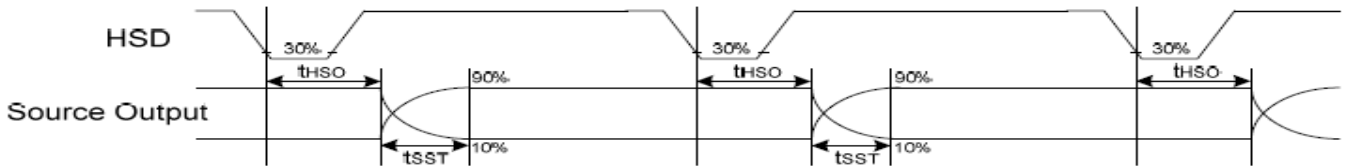
Vertical Timing Diagram of SYNC Mode (Dual Gate)
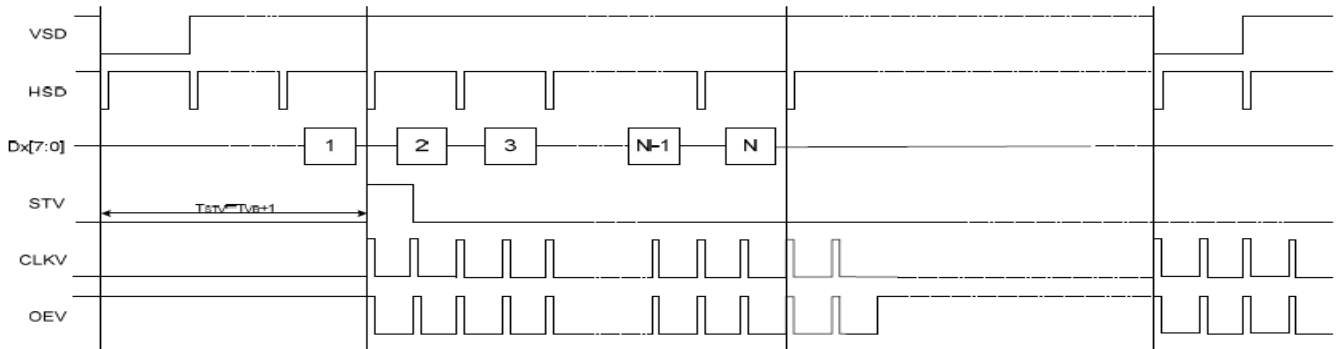
Vertical Timing Diagram of DE Mode (Dual Gate)
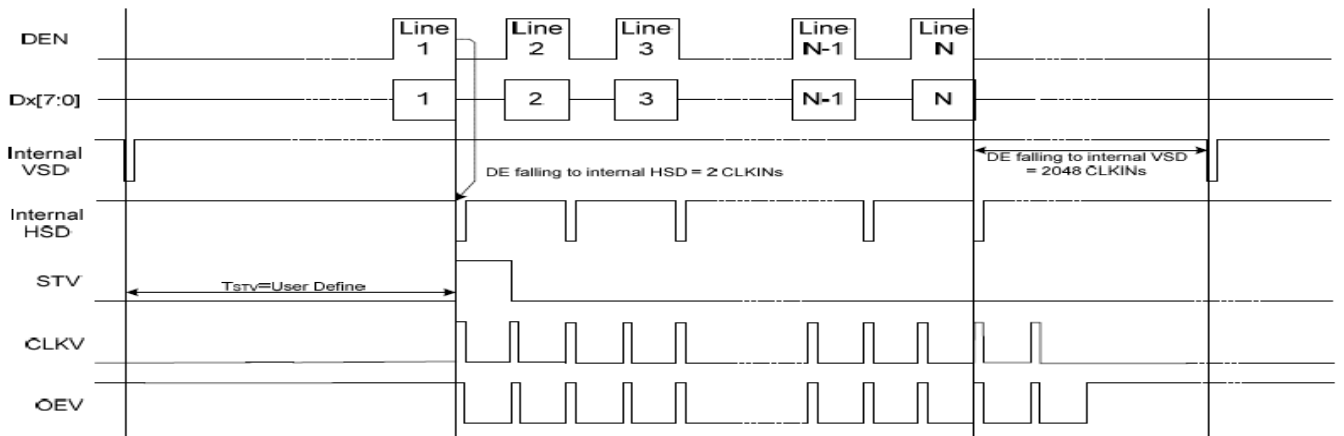
7.3 Display Timing characteristics(Resolution: 800x480)
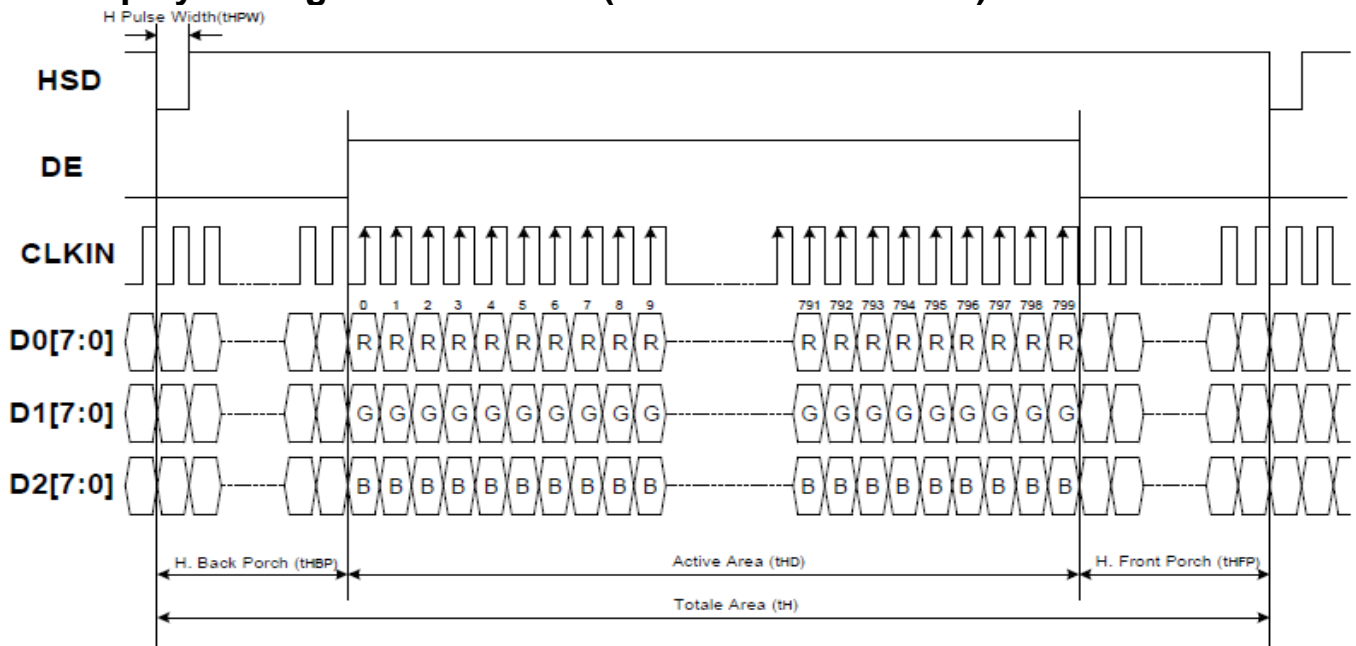
Horizontal Input Timing

Parameter		Symbol	Value			Unit
			Min.	Typ.	Max.	
Horizontal display area		t_{HD}	--	800	--	CLKIN
CLKIN frequency		f_{CLK}	--	33.3	50	MHz
1 Horizontal line period		t_H	862	1056	1200	CLKIN
HSD pulse width	Min.	t_{HPW}	--	1	--	CLKIN
	Typ.		--	--	--	CLKIN
	Max.		--	40	--	CLKIN
HSD back porch	SYNC	t_{HBP}	46	46	46	CLKIN
HSD front porch	SYNC	t_{HFP}	16	210	354	CLKIN
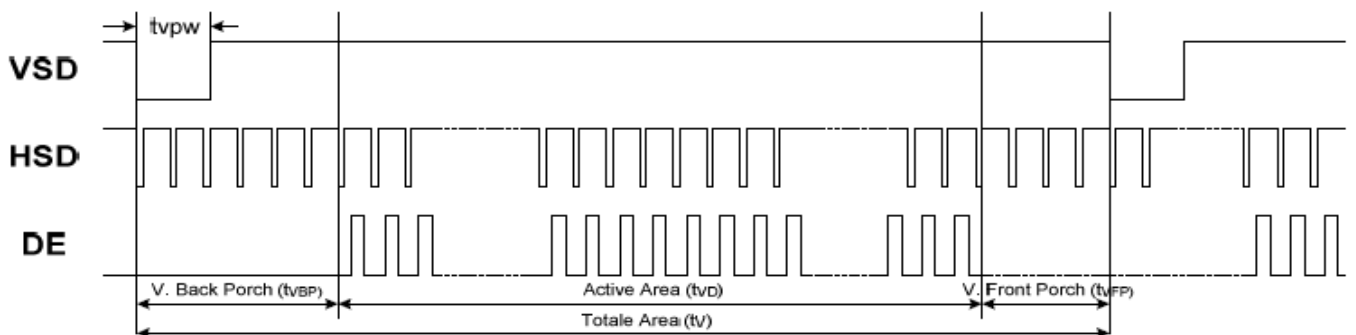
Vertical Input Timing

Parameter	Symbol	Value			Unit
		Min.	Typ.	Max.	
Vertical display area	t_{VD}	--	480	--	HSD
VSD period time	t_V	510	525	650	HSD
VSD pulse width	t_{VPW}	1	--	20	HSD
VSD back porch	t_{VBP}	23	23	23	HSD
VSD front porch	t_{VFP}	7	22	147	HSD

7.4 CTP Timing Characteristics
I2C Interfacing
Clock stretching

Special attention should be paid to clock stretching when interfacing with a Synaptics Touch Controller over I2C. The host processor must support clock stretching. The first byte of a transaction contains the slave address and read/write bit. At the end of the first byte, the sensor holds SCL low (clock stretches) and checks that the slave address matches its own. If the slave address does not match, the S3103 will not stretch the clock on subsequent byte transmissions until it detects the next start condition. If the slave address does match, the sensor acknowledges and may stretch the clock after some or all of the subsequent bytes within the same transaction (Figure 8).
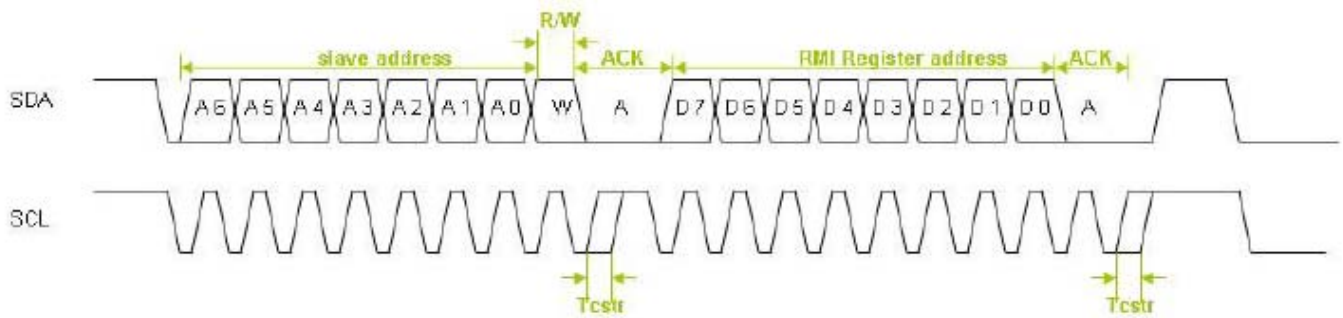
Clock stretching within an I2C transaction

7.4.1 AC electrical characteristics
I2C
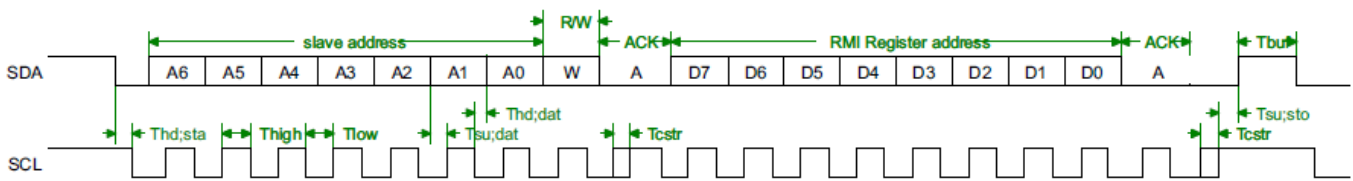
I2C timing

I2C parameters

Parameter	Symbol	Standard-Mode		Fast-Mode		Unit
		Min.	Max.	Min.	Max.	
SCL clock frequency	f_{SCL}	—	100	—	400	kHz
Stretch time	t_{CSTR}	—	25	—	25	µs
Hold time (repeated) START condition. After this period, the first clock pulse is generated.	$t_{HD;STA}$	4.0	—	0.6	—	µs
LOW period of the SCL clock	t_{LOW}	4.7	—	1.3	—	µs
HIGH period of the SCL clock	t_{HIGH}	4.0	—	0.6	—	µs
Set-up time for a repeated START condition	$t_{SU;STA}$	4.7	—	0.6	—	µs
Data hold time	$t_{HD;DAT}$	0	3.45	0	0.9	µs
Data out hold time	$t_{HD;DATO}$	—	0	—	0	µs
Data set-up time	$t_{SU;DAT}$	250	—	100	—	ns
Rise time of both SDA and SCL signals	t_r	—	1000	$20 + 0.1\,C_b^{(1)}$	300	ns
Fall time of both SDA and SCL signals	t_f	—	300	$20 + 0.1\,C_b^{(1)}$	300	ns
Set-up time for STOP condition	$t_{SU:STO}$	4.0	—	0.6	—	µs
Bus free time between a STOP and START condition	t_{BUF}	4.7	—	1.3	—	µs
Capacitive load for each bus line	C_b	—	400	—	400	pF

7.4.2 CTP Block Diagram
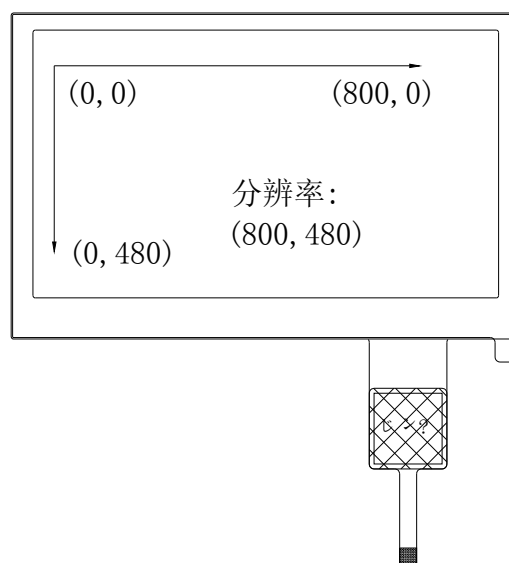
8. Backlight Characteristics
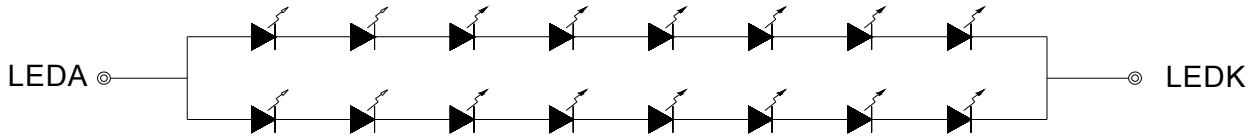
Item	Symbol	MIN	TYP	MAX	UNIT	Test Condition
Supply Voltage	Vf	23	24	25.0	V	If=40mA
Supply Current	If	-	40	-	mA	
Luminous Intensity for LCM	-	450	550	-	cd/m^2	If=40mA
Uniformity for LCM	-	80	-	-	％	If=40mA
Life Time	-	-	50000	-	Hr	If=40mA
Backlight Color	White					

9. Optical Characteristics

Item	Conditions		Min.	Typ.	Max.	Unit	Note
Viewing Angle (CR>10)	Horizontal	θL	-	80	-	degree	(1),(2),(6)
		θR	-	80	-		
	Vertical	θT	-	80	-		
		θB	-	80	-		
Contrast Ratio	Center		400	500	-	-	(1),(3),(6)
Response Time	Rising		-	10	20	ms	(1),(4),(6)
	Falling		-	15	30		
CF Color Chromaticity (CIE1931)	Red x		Typ. -0.05	TBD	Typ. +0.05	-	(1), (6)
	Red y			TBD		-	
	Green x			TBD		-	
	Green y			TBD		-	
	Blue x			TBD		-	
	Blue y			TBD		-	
	White x			TBD		-	
	White y			TBD		-	
NTSC			-	61.	-	%	(1),(6)

Note (1) Measurement Setup: The LCD module should be stabilized at given temp. 25°C for 15 minutes to avoid abrupt temperature change during measuring. In order to stabilize the luminance, the measurement should be executed after lighting backlight for 15 minutes in a windless room.
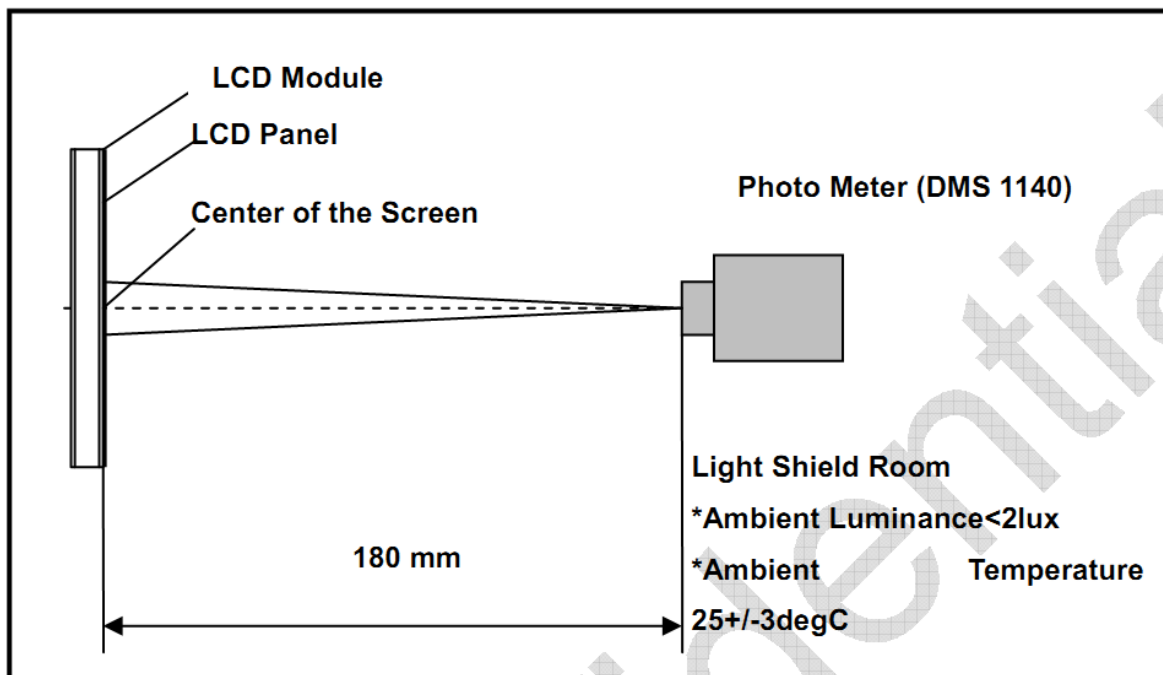
Note (2) Definition of Viewing Angle
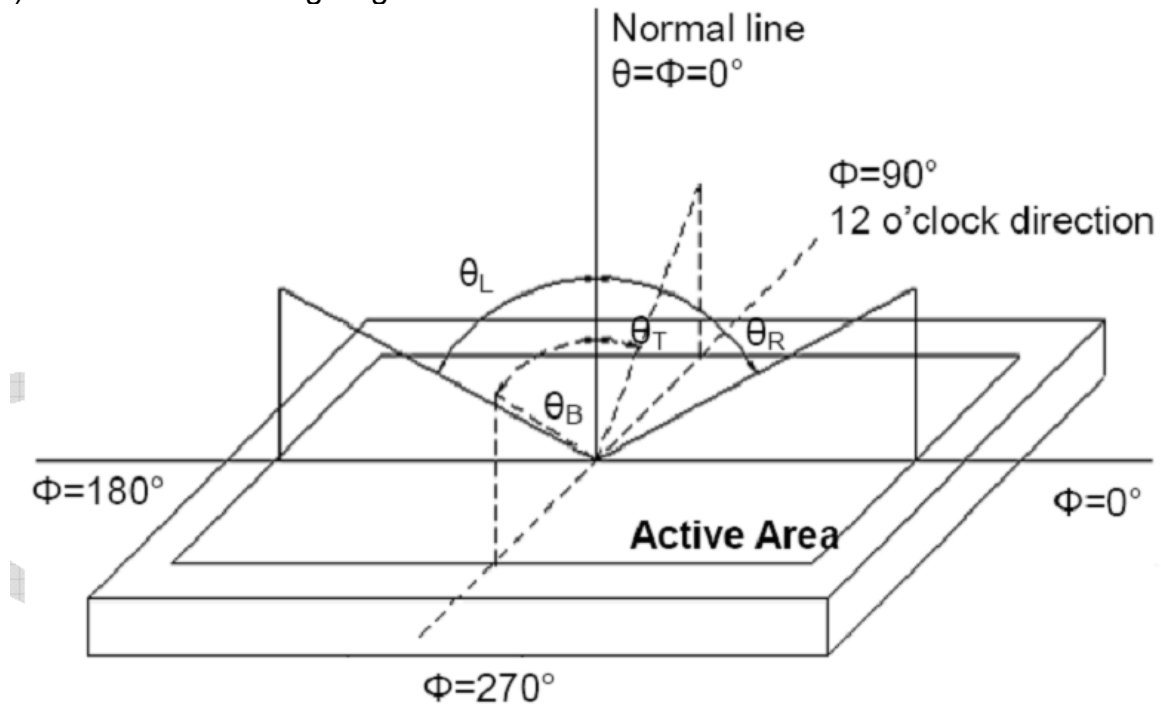
Note (3) Definition Of Contrast Ratio (CR)

The contrast ratio can be calculated by the following expression

Contrast Ratio (CR) = L63 / L0

L63: Luminance of gray level 63, L0: Luminance of gray level 0

Note (4) Definition of response time
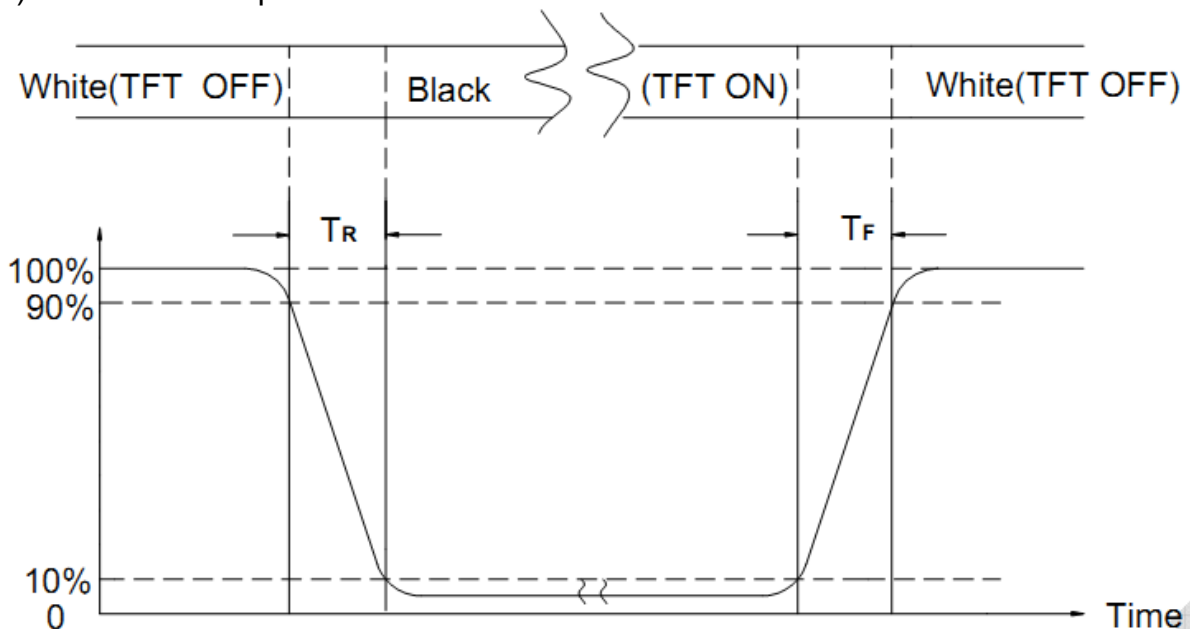
Note (5) Definition of Transmittance (Module is without signal input)

Transmittance = Center Luminance of LCD / Center Luminance of Back Light x 100%

Note (6) Definition of color chromaticity (CIE1931)

Color coordinates measured at the center point of LCD

10. Reliability Test Conditions and Methods

NO.	TEST ITEMS	TEST CONDITION	INSPECTION AFTER TEST
	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.
	Low Temperature Storage	-30°C±2°C×96Hours	
	High Temperature Operating	70°C±2°C×96Hours	
	Low Temperature Operating	-20°C±2°C×96Hours	
	Temperature Cycle(Storage)	-20°C ⟷ 25°C ⟷ 70°C (30min) (5min) (30min) 1cycle Total 10cycle	
	Damp Proof Test (Storage)	50°C±5°C×90%RH×96Hours	
	Vibration Test	Frequency:10Hz~55Hz~10Hz Amplitude:1.5MM X,Y,Z direction for total 3hours (packing condition test will be tested by a carton)	
	Drooping Test	Drop to the ground from 1M height one time every side of carton. (packing condition test will be tested by a carton)	
	ESD Test	Voltage:±8KV,R:330Ω,C:150PF,Air Mode,10times	

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. QUALITY :

THE QUALITY OF GOODS SUPPLIED TO PURCHASER SHALL COME UP TO THE FOLLOWING STANDARD.

11.1.1. INSPECTIONTOOLS AND INSTRUMENTS

Vernier calipers, film scales, multimeter, magnifying eyepiece, ND5%, luminance meter and so on.

11.1.2. THE METHOD OF PRESERVING GOODS

AFTER DELIVERY OF GOODS FROM AMSON TO PURCHASER. PURCHASER SHALL CONTROL THE LCM   AT -10 TO 40 ,AND IT MIGHT BE DESIRABLE TO KEEP AT THE NORMAL ROOM TEMPERATURE AND HUMIDITY UNTIL INCOMING INSPECTION OR THROWING INTO PROCESS LINE.

11.1.3. INCOMING INSPECTION

(A) THE METHOD OF INSPECTION

IF PURCHASER MAKE AN INCOMING INSPECTION , A SAMPLING PLAN SHALL BE APPLIED ON THE CONDITION THAT QUALITY OF ONE DELIVERY SHALL BE REGARDED AS ONE LOT.

(B) THE STANDARD OF QUALITY

ISO-2859-1 (SAME AS MIL-STD-105E) ,LEVEL:II

CLASS	AQL(%)
CRITICAL	0.4 %
MAJOR	0.65 %
MINOR	1.5 %

EVERY ITEM SHALL BE INSPECTED ACCORDING TO THE CLASS.

(C) MEASURE

IF AS THE RESULT OF ABOVE RECEIVING INSPECTION , A LOT OUT IS DISCOVERED. PURCHASER SHALL BE INFORM SELLER OF IT WITHIN SEVEN DAYS. BUT FIRST SHIPMENT WITHIN FOURTEEN DAYS.

11.1.4. WARRANTY POLICY

AMSON WILL PROVIDE ONE-YEAR WARRANTY FOR THE PRODUCTS ONLY IF UNDER SPECIFICATION OPERATING CONDITIONS. AMSON WILL REPLACE NEW PRODUCTS FOR THESE DEFECT PRODUCTS WHICH UNDER WARRANTY PERIOD AND BELONG TO THE RESPONSIBILITY OF AMSON.

11.2. CHECKING CONDITION

11.2.1. CHECKING DIRECTION SHALL BE IN THE 45 DEGREE AREA TO FACE THE SAMPLE.

11.2.2. CHECKER SHALL SEE OVER 300±25 mm. WITH BARE EYES FAR FROM SAMPLE

11.2.3. Ambient Illumination:

0 ~30 Lux for functional inspection

500 ~ 1200 Lux for external appearance inspection.

11.2.4. TEST AREA：
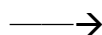
11.2.5. Inspection should be carried out with rope electrostatic ring and static finger cover (both hands except small fingers must be worn)
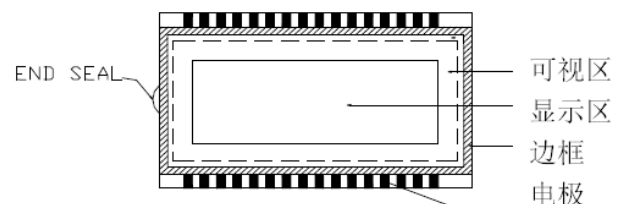
11.2.6. The inspector may make a visual inspection or a comparative examination with a film ruler and a magnifying eyepiece. Individual defects shall be determined according to the limited samples.

11.2.7. Functional testing uses electrical testing fixtures or test fixtures required by customers.

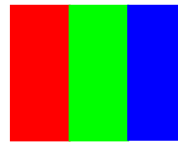**11.2.8.** the ion fan should be used when testing.

11.2.9. the principle of judgment

11.3.1   If the defect outside the visual area does
 not affect the assembly and display,
   it will be judged as a good product.

11.3.2   Poor definition
Pixel:
A combination of three sub-pixels
 (Red + Green + Blue).

Dot:
Any of the sub-pixels
 (Red or Green or Blue).
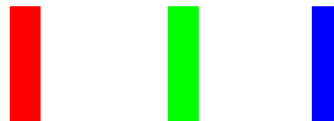
Bright and dark dots:
    A point pixel (sub-pixel: R, G, B pixels) is lit or turned off during the display function test.
Highlights:
    Usually considered to be shown on a black screen.
Dark spots:
     They are generally considered to be shown on R, G, B solid colors or white images.
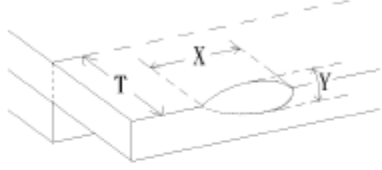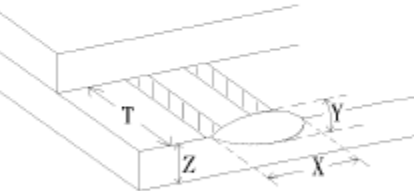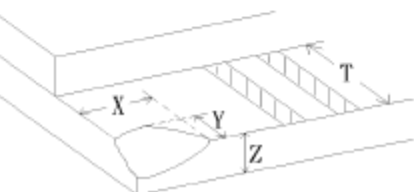**Neighborhood**:
     Two or three adjacent point pixels (dot: sub-pixel) connected together (R, G or G, B or B, R or RGB).
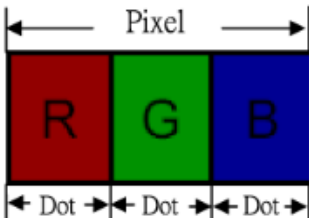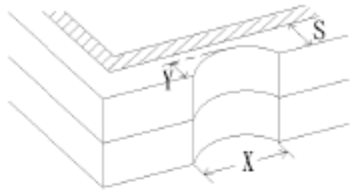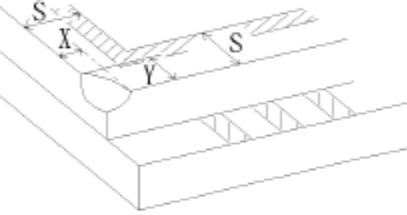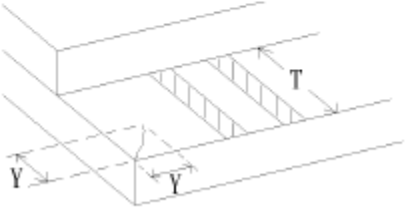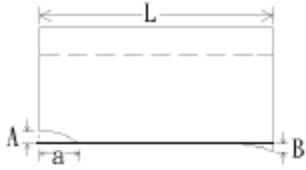
11.3. INSPECTION PLAN :

CLASS	ITEM	JUDGEMENT	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...............REJECTED QUANTITY SHORT OR OVER......REJECTED	Critical
	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 VISABLE 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)	Critical
	11.MISSING LINE	MISSING DOT、LINE、CHARACTER ....REJECTED	Critical
	12.SHORT CIRCUIT、WRONG PATTERN DISPLAY	NO DISPLAY、WRONG PATTERN DISPLAY、CURRENT CONSUMPTION OUT OF SPECIFICATION...... REJECTED	Critical
	13. DOT DEFECT (FOR COLOR AND TFT)	ACCORDING TO STANDARD OF VISUAL INSPECTION	Minor

11.4. STANDARD OF VISUAL INSPECTION

NO.	CLASS	ITEM	JUDGEMENT
11.4.1	MINOR	BLACK AND WHITE SPOT FOREIGN MATERIEL DUST IN THE CELL BLEMISH SCRATCH	(A) ROUND TYPE: unit : mm.
11.4.2	MINOR	BUBBLE IN POLARIZER DENT ON POLARIZER	unit : mm.
11.4.3	MINOR	Dot Defect	

(A) ROUND TYPE: unit : mm.

DIAMETER (mm.)	ACCEPTABLE Q'TY
$\Phi \leq 0.1$	DISREGARD
$0.1 < \Phi \leq 0.25$	3 (Distance>5mm)
$0.25 < \Phi$	0

NOTE: Φ=(LENGTH+WIDTH)/2

(B) LINEAR TYPE: unit : mm.

LENGTH	WIDTH	ACCEPTABLE Q'TY
------	$W \leq 0.03$	DISREGARD
$L \leq 5.0$	$0.03 < W \leq 0.07$	3 (Distance>5mm)
------	$0.07 < W$	FOLLOW ROUND TYPE

unit : mm.

DIAMETER	ACCEPTABLE Q'TY
$\Phi \leq 0.2$	DISREGARD
$0.2 < \Phi \leq 0.5$	2 (Distance>5mm)
$0.5 < \Phi$	0

Items	ACC. Q'TY
Bright dot	$N \leq 4$
Dark dot	$N \leq 4$

Pixel Define :

Note 1: 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: Dark dot: Dots appear dark and unchanged in size in which LCD panel is displaying under pure red, green ,blue pattern.

NO.	CLASS	ITEM	JUDGEMENT	
11.4.4	MINOR	LCD GLASS CHIPPING	$Y > S$	Reject
11.4.5	MINOR	LCD GLASS CHIPPING	X or $Y > S$	Reject
11.4.6	MAJOR	LCD GLASS GLASS CRACK	$Y > (1/2)\,T$	Reject
11.4.7	MAJOR	LCD GLASS SCRIBE DEFECT	1. $a > L/3$, $A > 1.5$mm. Reject 2. B : ACCORDING TO DIMENSION	
11.4.8	MINOR	LCD GLASS CHIPPING (ON THE TERMINAL AREA)	$\Phi = (x+y)/2 > 2.5$ mm	Reject
11.4.9	MINOR	LCD GLASS CHIPPING (ON THE TERMINAL SURFACE)	$Y > (1/3)\,T$	Reject
11.4.10	MINOR	LCD GLASS CHIPPING	$Y > T$	Reject

12. Handling Precautions

12.1 Mounting method

The LCD panel of AMSON 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 (CI) , 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 (CI), 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 electrochemical 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 this is not specified in this specification.
- When an inspection specifications change or operating condition change in customer is reported to AMSON 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.

14. Packing Method
TBD