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	2016/01/06	NEW ISSUE	
B	2016/09/14	MODIFY 27 PIN	

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1. Scope

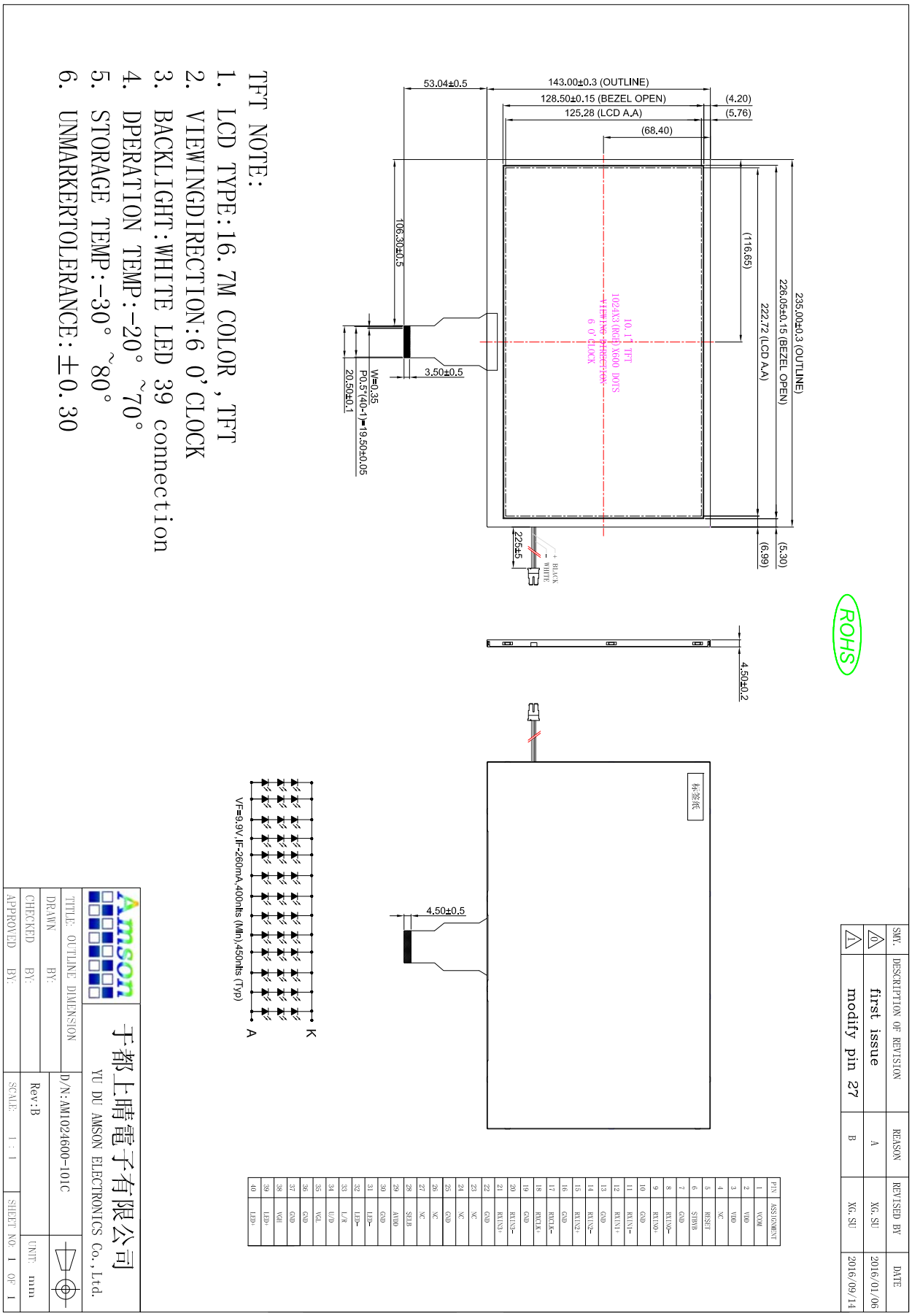
This specification defines general provisions as well as inspection standards for TFT module supplied by AMSON electronics.

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

2. General Information

ITEM	STANDARD VALUES	UNITS
LCD type	10.1”TFT	--
Dot arrangement	1024×3 (RGB)×600	dots
Color filter array	RGB vertical stripe	--
Display mode	Normally White	--
Viewing Direction	6 O’clock	--
Module size	235(W)×143(H)×4.5(T)	mm
Active area	222.72(W)×125.28(H)	mm
Dot pitch	0.2175(W)×0.2088(H)	mm
Interface	LVDS	--
Operating temperature	-20 ~ +70	°C
Storage temperature	-30 ~ +80	°C
Module Weight	230g	g

3. External Dimensions



4. Interface Description

No.	Symbol	I/O	Function	Remark
1	VCOM	P	Common voltage	
2	VDD	P	Digital power	
3	VDD	P	Digital power	
4	NC	-	Not connect	
5	RESET	I	Global reset pin. Active low to enter reset state. Suggest to connecting with an RC reset circuit for stability. Normally pull high. (R=100K_，C=1μF)	
6	STBYB	I	Standby mode, normally pull high STBYB=”1”, normal operation STBYB=”0”,timing control, source driver will turn off, all output	
7	GND	P	Ground	
8	RXIN0-	I	Negative LVDS differential data inputs	
9	RXIN0+	I	Positive LVDS differential data inputs	
10	GND	P	Ground	
11	RXIN1-	I	Negative LVDS differential data inputs	
12	RXIN1+	I	Positive LVDS differential data inputs	
13	GND	P	Ground	
14	RXIN2-	I	Negative LVDS differential data inputs	
15	RXIN2+	I	Positive LVDS differential data inputs	
16	GND	P	Ground	
17	RXCLK-	I	Negative LVDS differential clock inputs	
18	RXCLK+	I	Positive LVDS differential clock inputs	
19	GND	P	Ground	
20	RXIN3-	I	Negative LVDS differential data inputs	
21	RXIN3+	I	Positive LVDS differential data inputs	
22	GND	P	Ground	
23	NC	-	Not connect	
24	NC	-	Not connect	
25	GND	P	Ground	
26	NC	-	Not connect	
27	NC	-	Not connect	
28	SELB	I	6bit/8bit mode select H : 6bit / L : 8bit	
29	AVDD	P	Power for Analog Circuit	
30	GND	P	Ground	
31	NC	-	Not connect	
32	NC	-	Not connect	
33	L/R	I	Horizontal inversion	

34	U/D	I	Vertical inversion	
35	VGL	P	Negative power for TFT	
36	GND	P	Ground	
37	GND	P	Ground	
38	VGH	P	Positive power for TFT	
39	NC	-	Not connect	
40	NC	-	Not connect	

I：input , O：output , P：Power

【Note】：When L/R="0" , set right to left scan direction
When L/R="1" , set left to right scan direction
When U/D="0" , set top to bottom scan direction
When U/D="1" , set bottom to top scan direction

5. Absolute Maximum Ratings

Item	Symbol	Min.	Max.	Unit	Conditions
Digital Supply Voltage	VDD	-0.3	5	V	
TFT Gate on voltage	VGH	-0.3	40	V	
TFT Gate off voltage	VGL	-20	0.3	V	
Analog power supply voltage	AVDD	-0.5	15	V	

6. DC Characteristics

Operating Conditions

Item	Symbol	Min.	Typ.	Max.	Unit	Remark
Digital Supply Voltage	VDD	3.0	3.3	3.6	V	-
TFT Gate on voltage	VGH	20	21	22	V	-
TFT Gate off voltage	VGL	-6.5	-5.5	-4.5	V	-
TFT Common electrode voltage	VCOM	3.7	3.9	4.1	V	-
Analog power supply voltage	AVDD	10.65	10.85	11.05	V	-

Current Consumption

Item	Symbol	Condition	Values			Unit	Remark
			Min.	Typ.	Max.		
Gate on Current	IVGH	VGH =21 V	-	0.5	-	mA	
Gate off Current	IVGL	VGL= -5.5V	-	4.8	-	mA	
Digital Current	IVDD	VDD = 3.3V	-	17.9	-	mA	
Analog Current	IAVDD	AVDD = 10.85V	-	29.1	-	mA	

7. Timing Characteristics

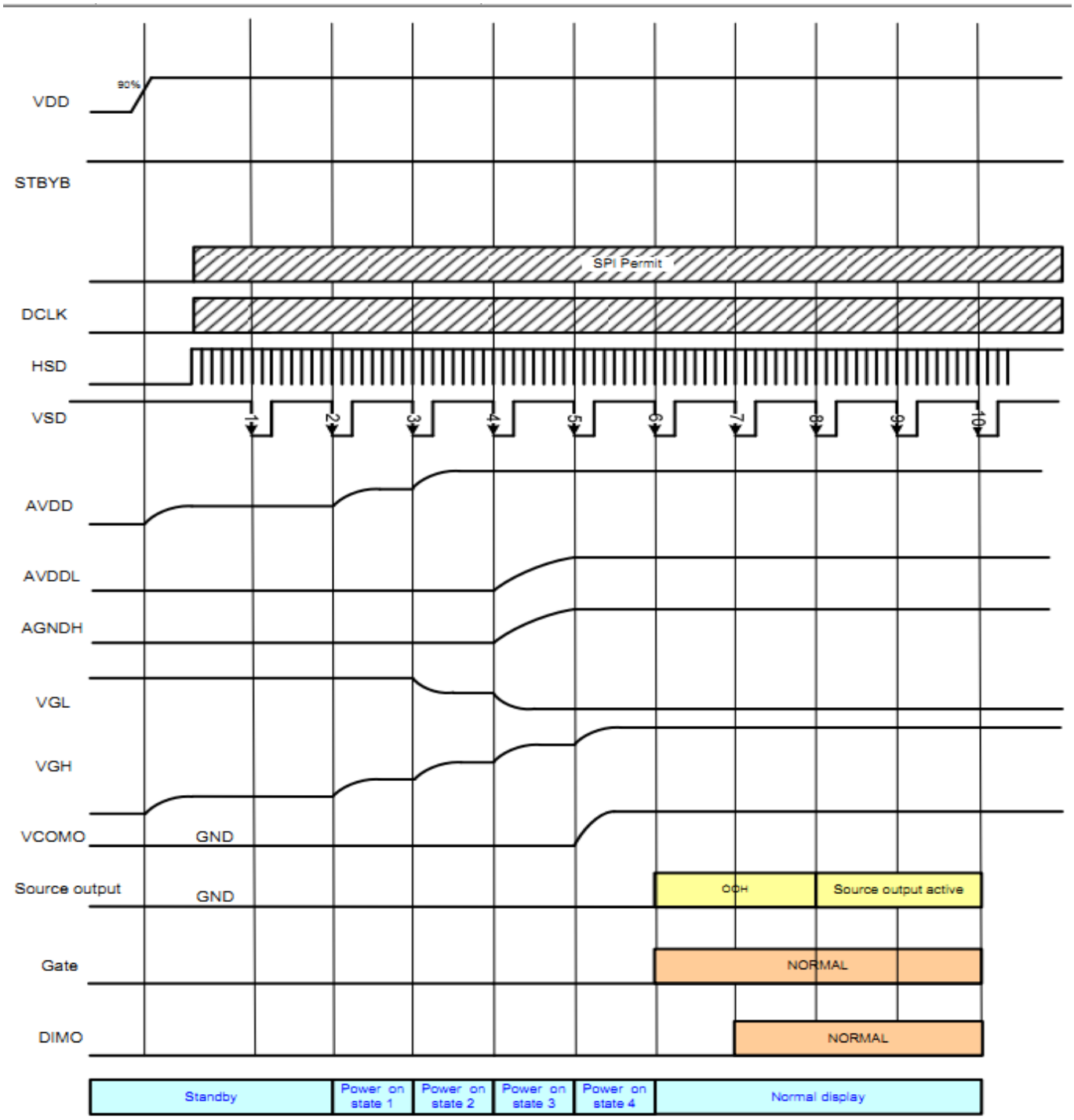
7.1 Power ON/OFF Sequence

To prevent the device damage from latch up, the power on/off sequence shown below must be followed.

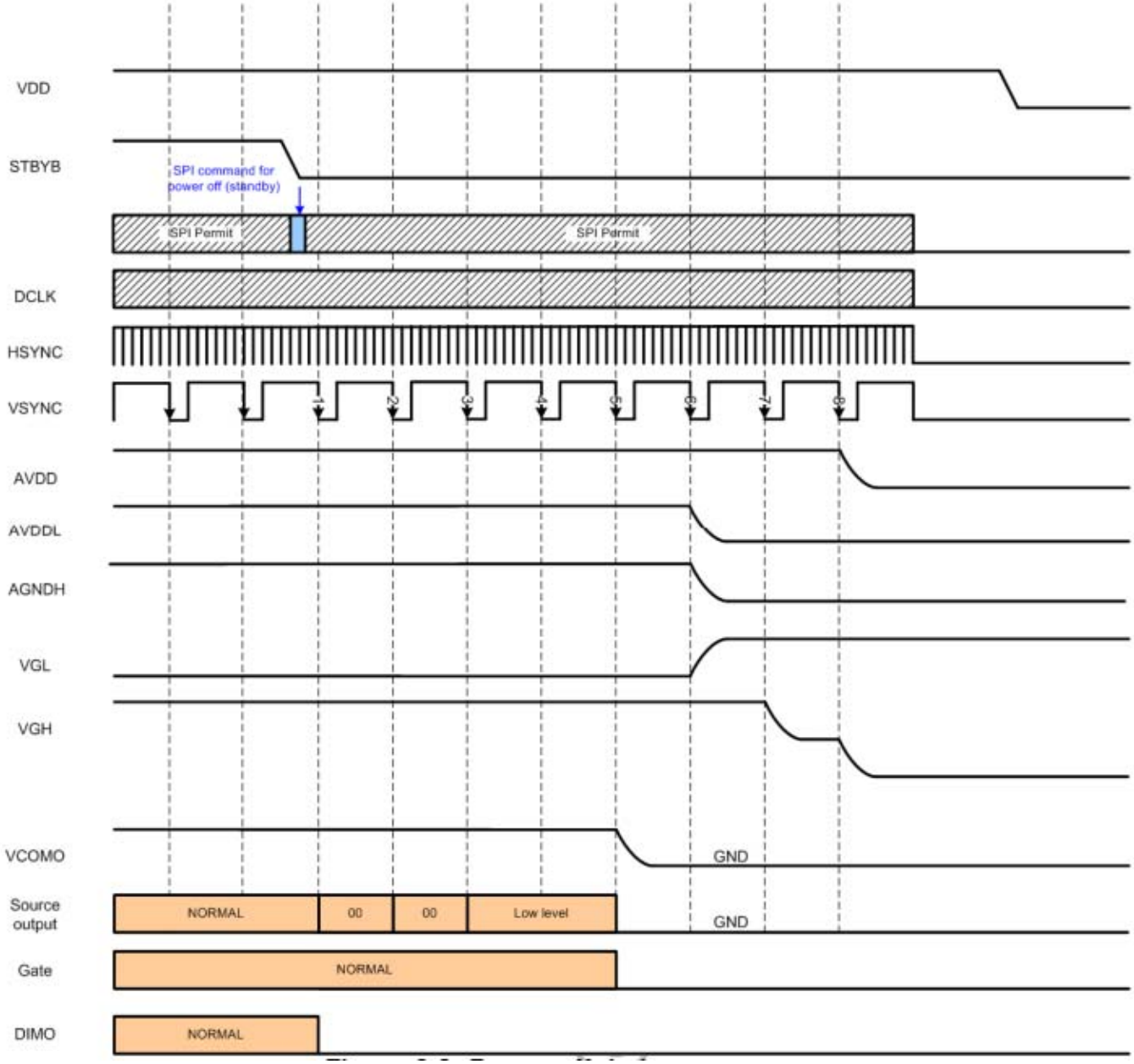
Power on: VDD, GND _ AVDD, AGND _ V1 to V14

Power off: V1 to V14 _ AVDD, AGND_ VDD, GND

Power on/off control



Power on timing sequence



Power off timing sequence

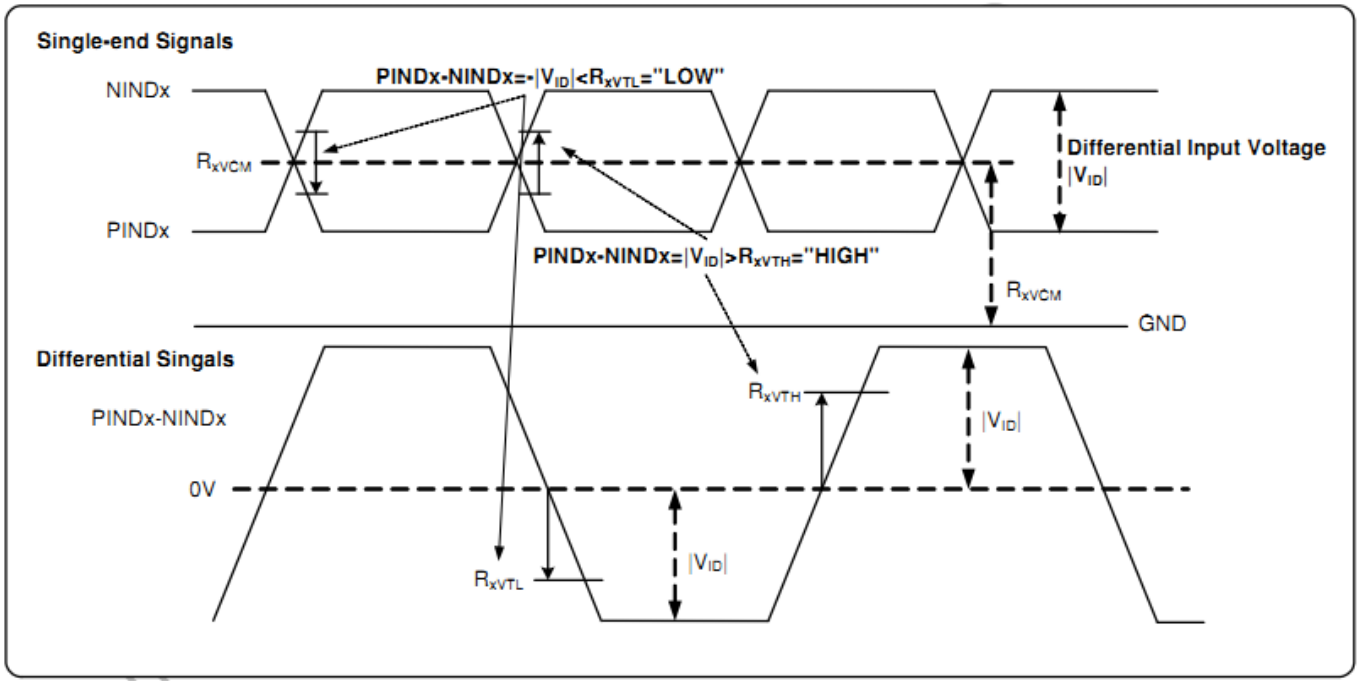
7.2 LVDS Signal Timing Characteristics

7.2.1 DC Electrical Characteristics

LVDS mode DC electrical characteristics

Parameter	Symbol	Spec.			Unit	Condition
		Min.	Typ.	Max.		
Differential input high Threshold voltage	R_{XVTH}	-	-	+0.1	V	R_{XVCM}=1.2V
Differential input low threshold voltage	R_{XVTL}	-0.1	-	-	V	
Input voltage range (singled-end)	R_{XVIN}	0	-	VDD-1.2+ $\|V_{ID}\|/2$	V	-
Differential input common Mode voltage	R_{XVCM}	$\|V_{ID}\|/2$	-	VDD-1.2	V	-
Differential input voltage	$\| V_{ID} \|$	0.2	-	0.6	V	-
Differential input leakage Current	RV_{Xliz}	-10	-	+10	μA	-
LVDS Digital Operating Current	Iddlvds	-	15	30	mA	Fclk=65MHz, VDD=3.3V
LVDS Digital Stand-by Current	Istlvds	-	10	50	μA	Clock & all Functions are stopped

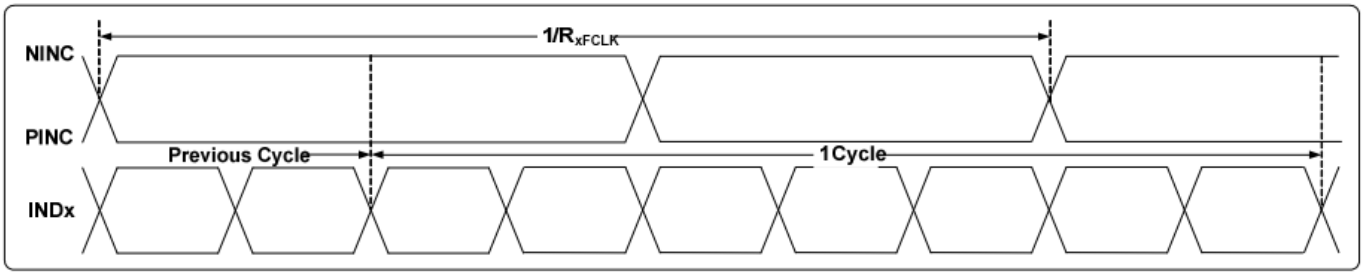
Single-end signals

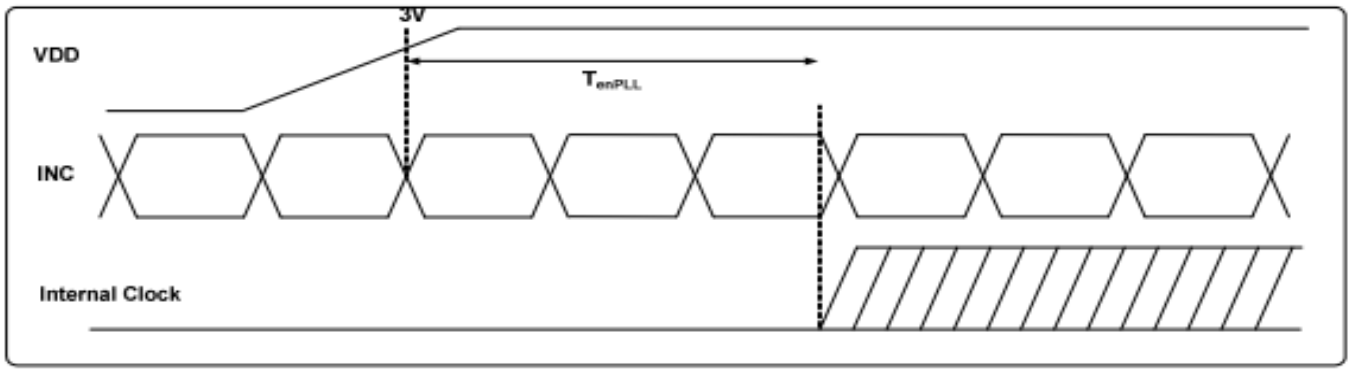


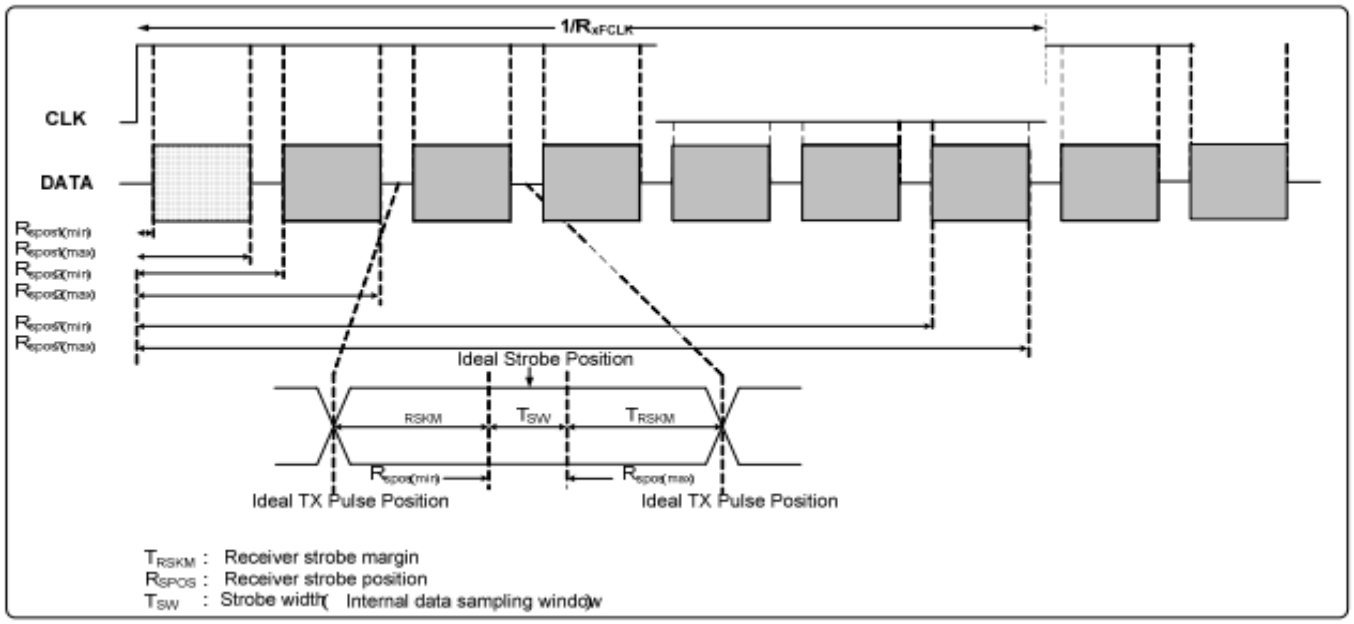
7.2.2 AC Electrical Characteristics

LVDS mode AC electrical characteristics

Parameter	Symbol	Spec.			Unit	Condition
		Min.	Typ.	Max.		
Clock frequency	R_{XFCLK}	20	-	71	MHz	-
Input data skew margin	T_{RSKM}	500	-	-	pS	$\|V_{ID}\|$=400mV R_{XVCM}=1.2V R_{XFCLK}=71MHz
Clock high time	T_{LVCH}	-	4/(7* R_{XFCLK})	-	ns	-
Clock low time	T_{LVCL}	-	3/(7* R_{XFCLK})	-	ns	-
PLL wake-up time	T_{enPLL}	-	-	150	μs	-

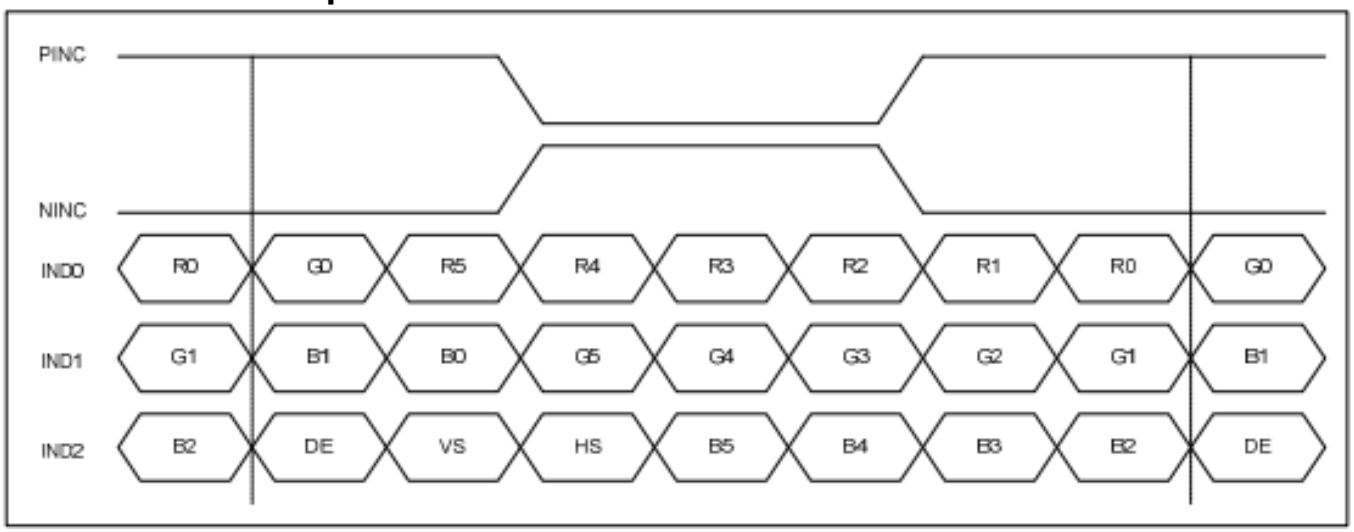




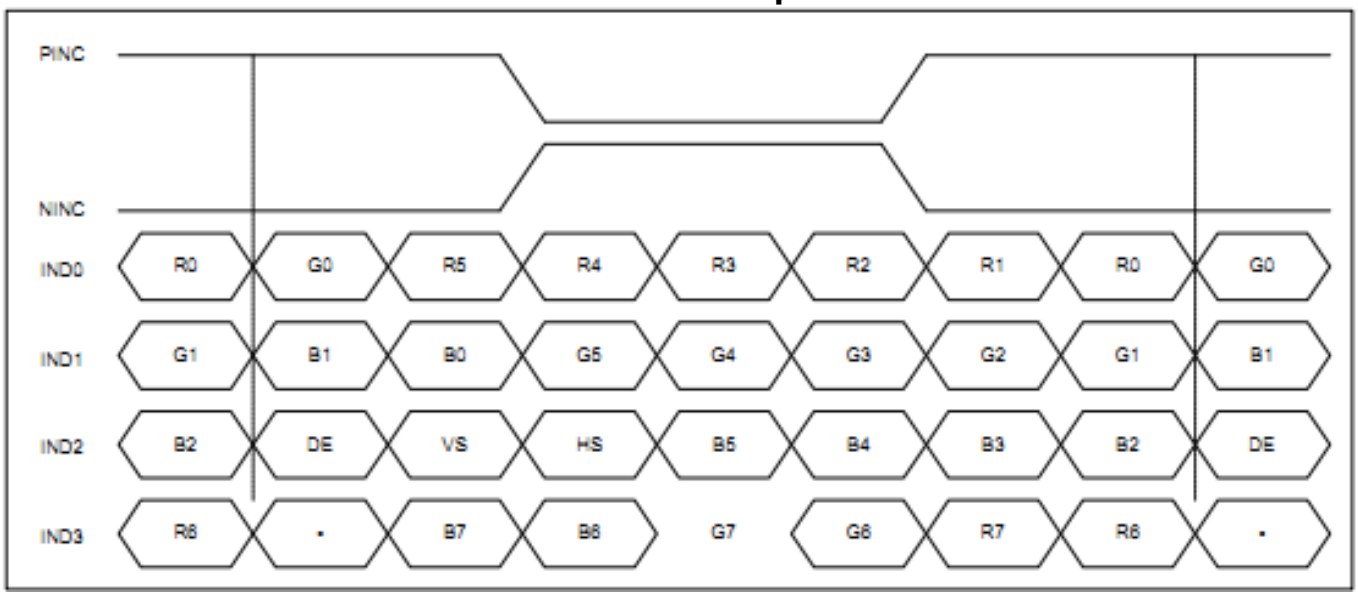


LVDS mode data input format

7.2.3 LVDS Data Input Format



6-bit LVDS input



8-bit LVDS input

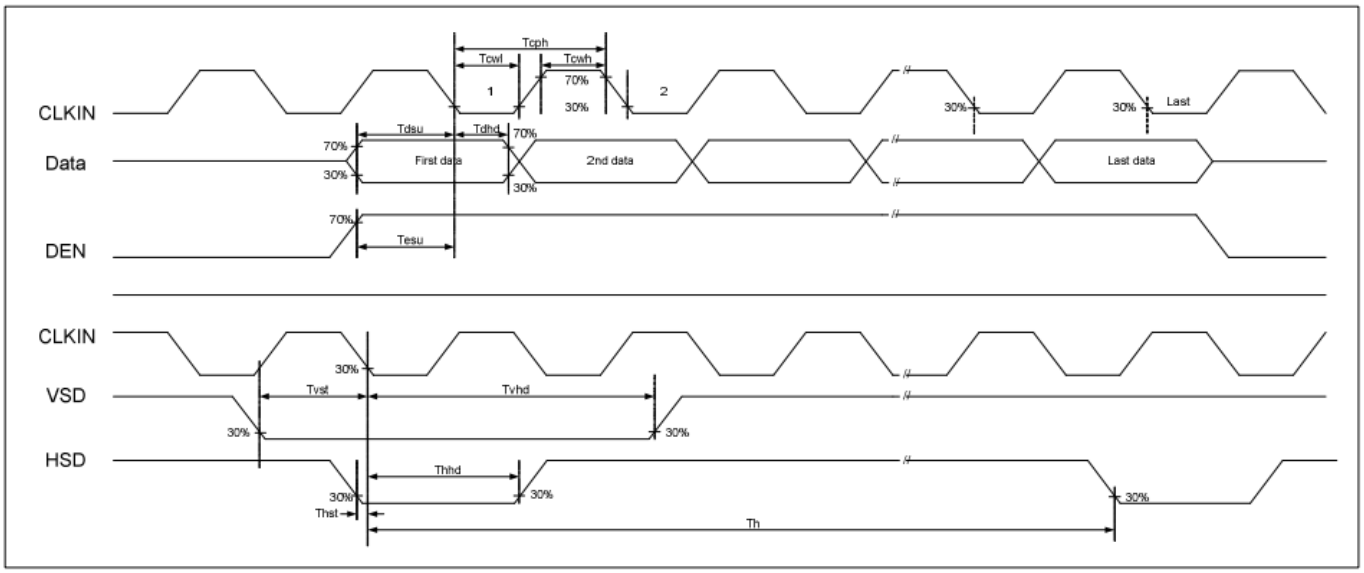
7.3 Parallel RGB Input Timing Table

DE mode (1024x600)

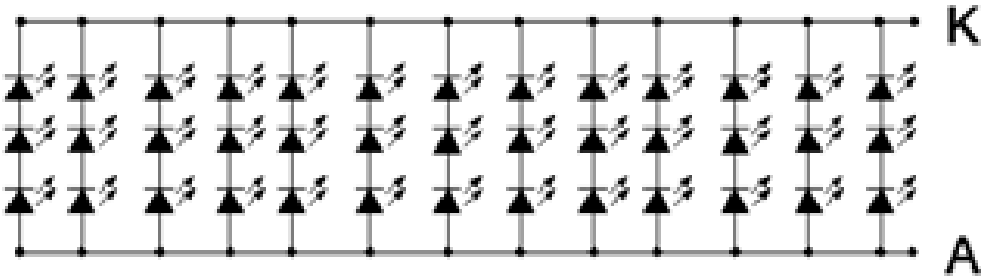
Parameter	Symbol	Spec.			Unit
		Min.	Typ.	Max.	
DCLK Frequency	fclk	40.8	51.2	67.2	MHz
Horizontal Display Area	thd		1024		DCLK
HSD Period	th	1114	1344	1400	DCLK
HSD Blanking	thb+ thfp	90	320	376	DCLK
Vertical Display Area	tvd		600		T_H
VSD Period	tv	610	635	800	T_H
VSD Blanking	tvbp+ tvfp	10	35	200	T_H

7.4 Timing Diagram

Input Clock and Data Timing Diagram



8. Backlight Characteristic

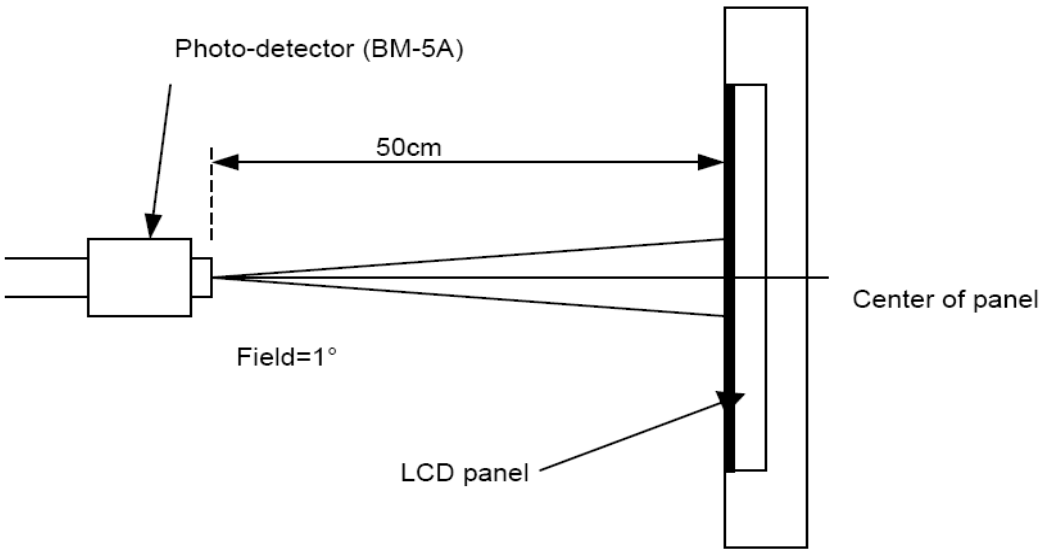


Item	Symbol	MIN	TYP	MAX	UNIT	Test Condition
Supply Voltage	Vf	9	9.9	10.5	V	If=260mA
Supply Current	If	-	260	-	mA	If=260mA
Luminous Intensity for LCM	-	400	450	-	cd/m^2	If=260mA
Uniformity for LCM	-	70	-	-	%	If=260mA
Life Time	-	-	50000	-	Hr	If=260mA

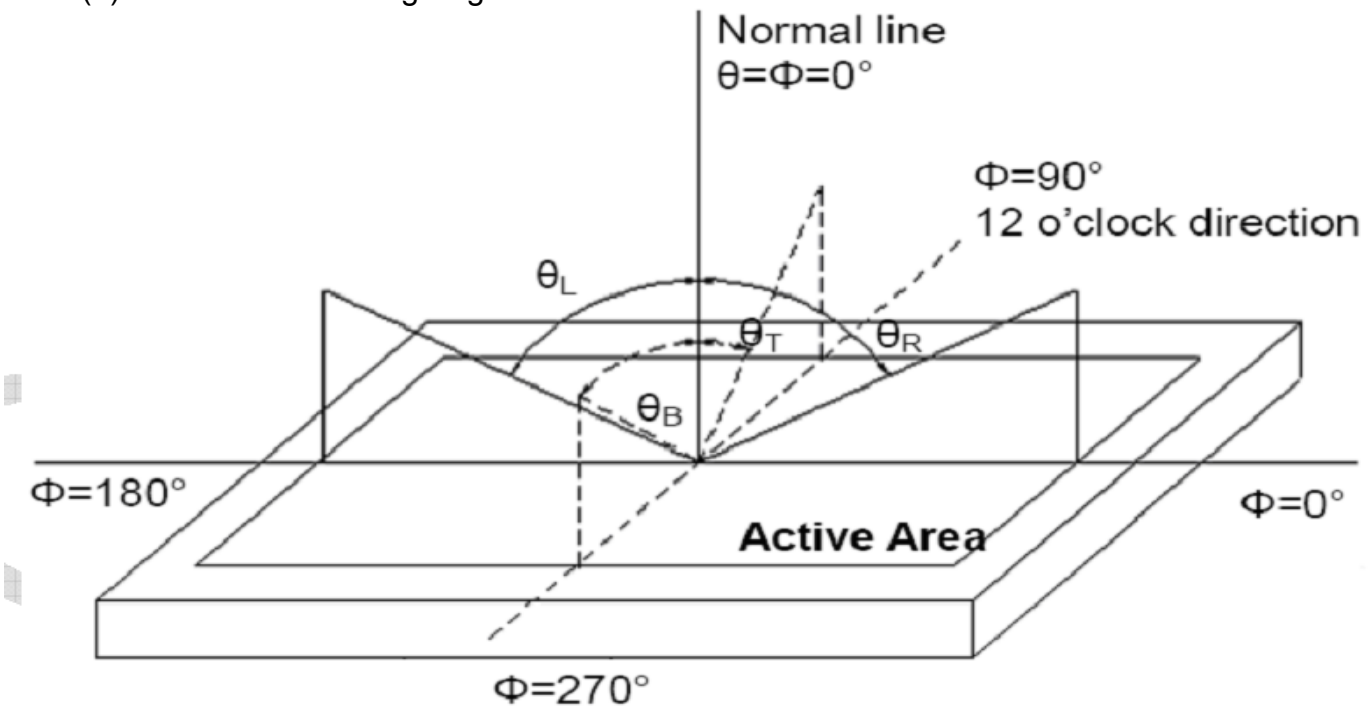
9. Optical Characteristics

Item	Conditions		Min.	Typ.	Max.	Unit	Note
Viewing Angle (CR>10)	Horizontal	θ_L	-	70	-	degree	(1),(2),(6)
		θ_R	-	70	-		
	Vertical	θ_T	-	60	-		
		θ_B	-	70	-		
Contrast Ratio	Center		-	600	-	-	(1),(3),(6)
Response Time	Rising + Falling		-	8	-	ms	(1),(4),(6)
CF Color Chromaticity (CIE1931)	Red x		Typ. -0.05	0.609	Typ. +0.05	-	(1), (6)
	Red y			0.339		-	
	Green x			0.321		-	
	Green y			0.599		-	
	Blue x			0.139		-	
	Blue y			0.123		-	
	White x			0.290		-	
	White y			0.325		-	

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

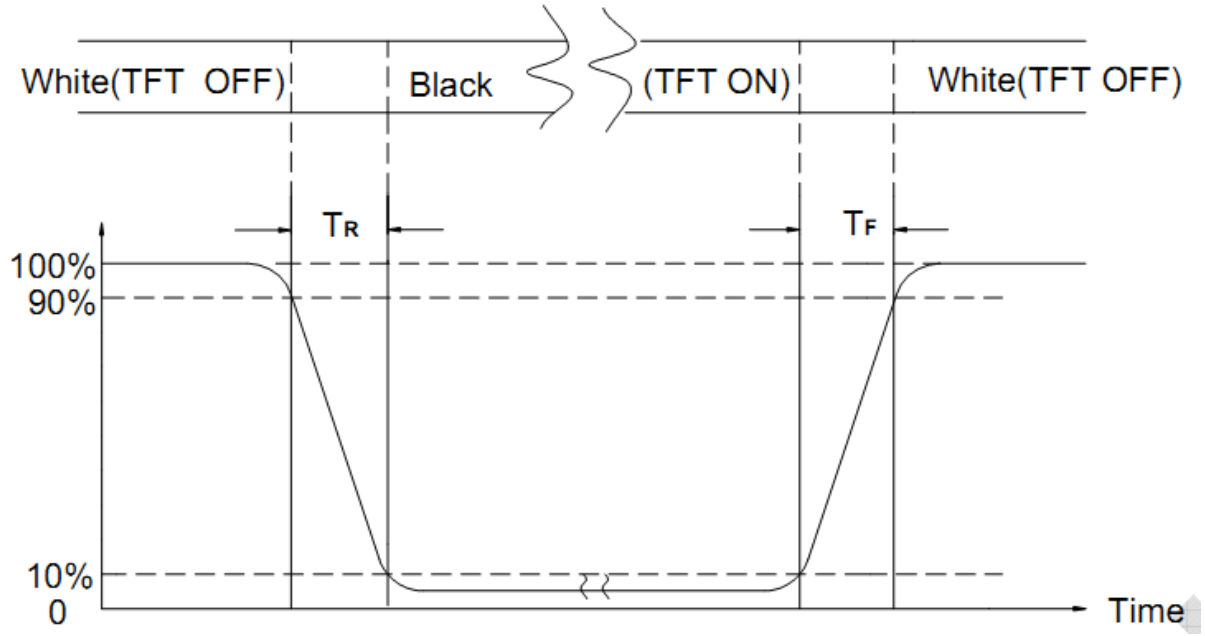


Note (3) Definition of Contrast Ratio (CR)

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%

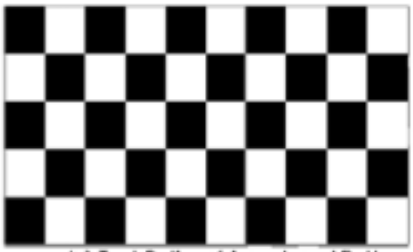
Note (6) Definition of color chromaticity (CIE1931)

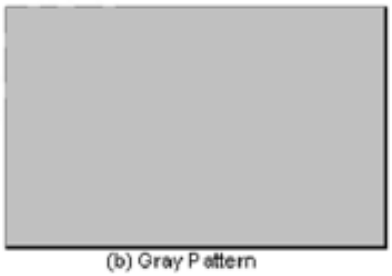
Color coordinates measured at the center point of LCD

10. Reliability Test Conditions and Methods

Test Item	Test Condition	Remark
High Temperature Storage	Ta=80℃; 240hrs	IEC60068-2-1：2007 GB2423.2-2008
Low Temperature Storage	Ta=-30℃; 240hrs	IEC60068-2-1：2007 GB2423.1-2008
High Temperature Operation	Ta=70℃，240Hrs	IEC60068-2-1：2007 GB2423.2-2008
Low Temperature Operation	Ta=-20℃; 240hrs	IEC60068-2-1：2007 GB2423.1-2008
High Temperature High Humidity Operation	Ta=60℃，90%RH，240Hrs(no condensation)	IEC60068-2-78：2001 GB/T2423.3-2006
Thermal Shock	-30℃(0.5h) ~ 80℃(0.5h) / 100cycles	Start with cold temperature，End with high temperature，IEC60068-2-14:1984,GB2423.22-2002
Image Sticking	25℃；4hrs	Note1

Note1:Condition of image sticking test :25℃±2℃
Operation with test pattern sustained for 4hrs,then change to gray pattern immediately.after5 mins,themura must be disappeared completely


(a) Test Pattern (chess board Pattern)


(b) Gray Pattern

11. Inspection Standard

11.1. QUALITY :

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

11.1.1. 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.

11.1.2. 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 SINGLE PLAN.

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

11.1.3. 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

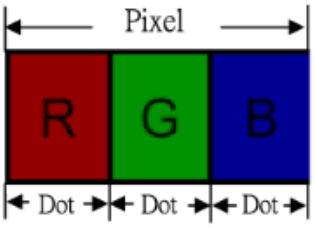
11.2.1.CHECKING DIRECTION SHALL BE IN THE 45 DEGREE AREA TO FACE THE SAMPLE.

11.2.2.CHECKER SHALL SEE OVER 300±25 mm. WITH BARE EYES FAR FROM SAMPLE AND USING 2 PCS. OF 20W FLUORESCENT LAMP.

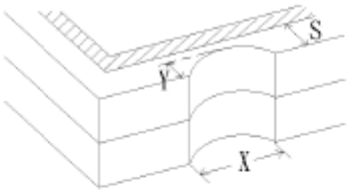
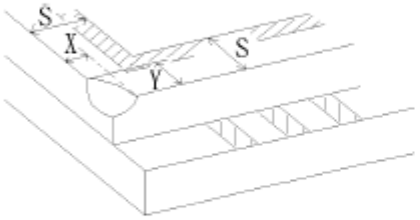
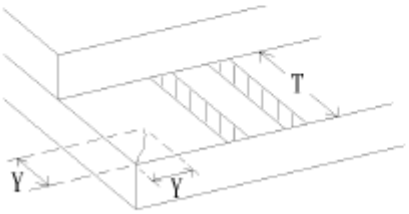
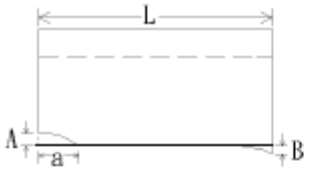
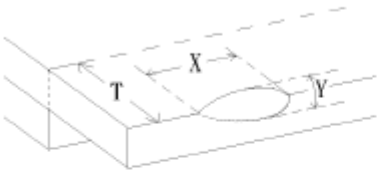
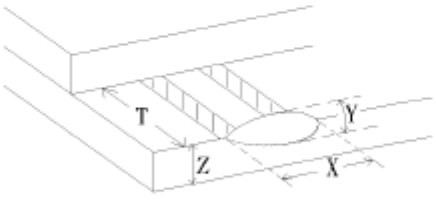
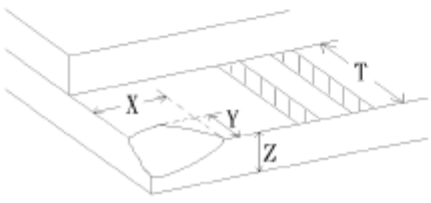
11.3. INSPECTION PLAN :

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

<table>
<tr><th>NO.</th><th>CLASS</th><th>ITEM</th><th>JUDGEMENT</th></tr>
<tr><td>11.4.1</td><td>MINOR</td><td>BLACK AND WHITE SPOT
FOREIGN MATERIEL
DUST IN THE CELL
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 ≦ 0.25</td><td>3 (Distance>5mm)</td></tr>
<tr><td>0.25 < Φ</td><td>0</td></tr>
</table>
NOTE: Φ=(LENGTH+WIDTH)/2
(B) LINEAR TYPE: unit : mm.
<table>
<tr><th>LENGTH</th><th>WIDTH</th><th>ACCEPTABLE Q'TY</th></tr>
<tr><td>------</td><td>W ≦0.03</td><td>DISREGARD</td></tr>
<tr><td>L ≦ 5.0</td><td>0.03 < W ≦0.07</td><td>3 (Distance>5mm)</td></tr>
<tr><td>------</td><td>0.07 < W</td><td>FOLLOW ROUND TYPE</td></tr>
</table></td></tr>
<tr><td>11.4.2</td><td>MINOR</td><td>BUBBLE IN POLARIZER
DENT ON POLARIZER</td><td>unit : mm.
<table>
<tr><th>DIAMETER</th><th>ACCEPTABLE Q'TY</th></tr>
<tr><td>Φ ≦ 0.2</td><td>DISREGARD</td></tr>
<tr><td>0.2 < Φ ≦ 0.5</td><td>2 (Distance>5mm)</td></tr>
<tr><td>0.5 < Φ</td><td>0</td></tr>
</table></td></tr>
<tr><td>11.4.3</td><td>MINOR</td><td>Dot Defect</td><td>
<table>
<tr><th>Items</th><th>ACC. Q'TY</th></tr>
<tr><td>Bright dot</td><td>N≦ 4</td></tr>
<tr><td>Dark dot</td><td>N≦ 4</td></tr>
</table>
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.</td></tr>
</table>

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>1.5mm. Reject 2. B : ACCORDING TO DIMENSION
11.4.8	MINOR	LCD GLASS CHIPPING (ON THE TERMINAL AREA)	 Φ= (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 (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 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 which is not specified in this specifications
- 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