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	2015-04-08	NEW ISSUE	

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

ITEM	STANDARD VALUES	UNITS
LCD type	2.8”TFT	--
Dot arrangement	240(RGB)×320	dots
Color filter array	RGB vertical stripe	--
Display mode	Transmission / Normally Black	--
Viewing Direction	Full view	--
Driver IC	HX8347-I	--
Module size	50(W)×69.2(H)×2.2(T)	mm
Active area	43.2(W)×57.6(H)	mm
Dot pitch	0.18(W)×0.18(H)	mm
Interface	RGB mode	--
Operating temperature	-20 ~ +70	°C
Storage temperature	-30 ~ +80	°C
Back Light	4 White LED	--
Weight	TBD	g

3. External Dimensions

4. Interface Description

<table>
<tr><th>PIN NO.</th><th>PIN NAME</th><th>DESCRIPTION</th></tr>
<tr><td>1</td><td>IM0</td><td>elect the MPU system interface mode
<table>
<tr><th>IM3</th><th>IM0</th><th>MPU- Interface mode</th><th>DB Pin in use</th></tr>
<tr><td>0</td><td>0</td><td>80 MCU 16bit interface II</td><td>DB[17: 10],DB[8: 1]</td></tr>
<tr><td>0</td><td>1</td><td>80 MCU 8bit interface II</td><td>DB[17:10]</td></tr>
<tr><td>1</td><td>0</td><td>80 MCU 18bit interface II</td><td>DB[17:0]</td></tr>
<tr><td>1</td><td>1</td><td>80 MCU 9bit interface II</td><td>DB[17:9]</td></tr>
</table></td></tr>
<tr><td>2</td><td>IM3</td><td></td></tr>
<tr><td>3</td><td>K4</td><td rowspan="4">The cathode of LED power</td></tr>
<tr><td>4</td><td>K3</td></tr>
<tr><td>5</td><td>K2</td></tr>
<tr><td>6</td><td>K1</td></tr>
<tr><td>7</td><td>A</td><td>The Anode of LED power</td></tr>
<tr><td>8</td><td>NRESET</td><td>Reset pin setting either pin low initializes the LSI
Must be reset after power supplied</td></tr>
<tr><td>9~12</td><td>GND</td><td>Power supply for ground</td></tr>
<tr><td>13~30</td><td>DB17~DB0</td><td>18-bit bi-directional data bus
The unused pins let to open</td></tr>
<tr><td>31</td><td>NC</td><td>No connection</td></tr>
<tr><td>32</td><td>GND</td><td>Power supply for ground</td></tr>
<tr><td>33</td><td>NRD</td><td>Read enable pin I80 parallel bus system interface</td></tr>
<tr><td>34</td><td>NWR</td><td>Write enable pin I80 parallel bus system interface</td></tr>
<tr><td>35</td><td>NDC(RS)</td><td>Command/parameter or display data selection pin</td></tr>
<tr><td>36</td><td>NCS</td><td>Chip select signal
Low: chip can be accessed
High: chip cannot be accessed</td></tr>
<tr><td>37</td><td>VCC</td><td>Analog power supply</td></tr>
<tr><td>38~39</td><td>GND</td><td>Power supply for ground</td></tr>
<tr><td>40</td><td>VCI</td><td>Logic power supply</td></tr>
</table>

5. Absolute Maximum Ratings

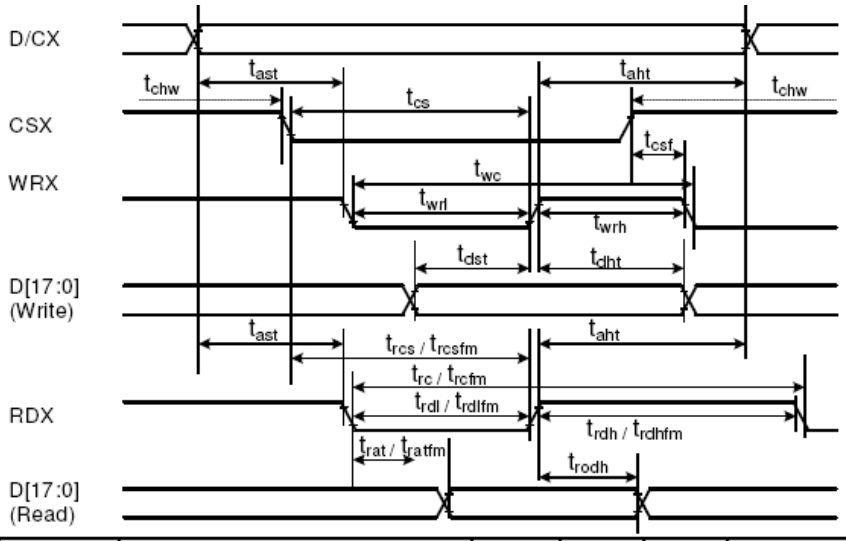
Item	Symbol	Min.	Max.	Unit
Logic Supply Voltage	VDDIO	-0.3	4.6	V
Analog Supply Voltage	VDD	-0.3	4.6	V
Input Voltage	Vin	-0.3	VDDIO +0.5	V
Operating Temperature	TOP	-20	70	°C
Storage Temperature	TST	-30	80	°C
Storage Humidity	HD	20	90	%RH

6. DC Characteristics

Item	Symbol	Min.	Typ.	Max.	Unit	Remark
Logic Supply Voltage	VDDIO	1.65	1.8	3.3	V	-
Analog Supply Voltage	VDD	2.4	2.75	3.3	V	-
Input High Voltage	V_{IH}	0.7 VDDIO	-	VDDIO	V	Digital input pins
Input Low Voltage	V_{IL}	GND	-	0.3 VDDIO	V	Digital input pins
Output High Voltage	V_{OH}	0.8 VDDIO	-	VDDIO	V	Digital output pins
Output Low Voltage	V_{OL}	GND	-	0.2 VDDIO	V	Digital output pins
I/O Leak Current	I_{LI}	-1	-	-	uA	-

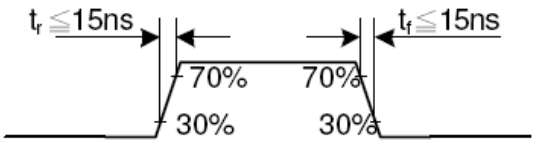
7. Timing Characteristics

7.1 i80-System Interface Timing Characteristics

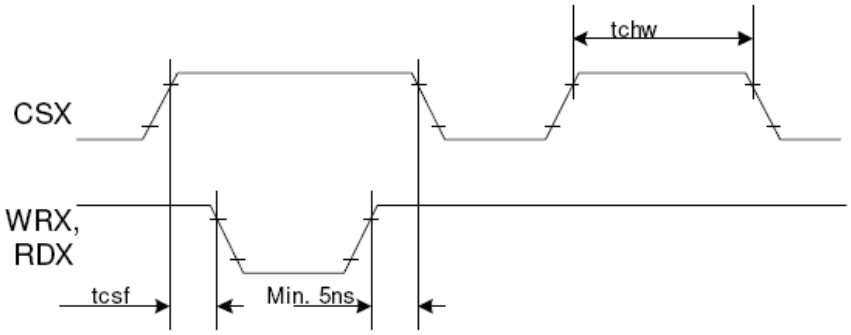


Signal	Symbol	Parameter	min	max	Unit	Description
DCX	tast	Address setup time	0	-	ns	
	taht	Address hold time (Write/Read)	0	-	ns	
CSX	tchw	CSX "H" pulse width	0	-	ns	
	tcs	Chip Select setup time (Write)	15	-	ns	
	trcs	Chip Select setup time (Read ID)	45	-	ns	
	trcsfm	Chip Select setup time (Read FM)	355	-	ns	
	tcsf	Chip Select Wait time (Write/Read)	10	-	ns	
WRX	twc	Write cycle	66	-	ns	
	twrh	Write Control pulse H duration	15	-	ns	
	twrl	Write Control pulse L duration	15	-	ns	
RDX (FM)	trcfm	Read Cycle (FM)	450	-	ns	
	trdhfm	Read Control H duration (FM)	90	-	ns	
	trdlfm	Read Control L duration (FM)	355	-	ns	
RDX (ID)	trc	Read cycle (ID)	160	-	ns	
	trdh	Read Control pulse H duration	90	-	ns	
	trdl	Read Control pulse L duration	45	-	ns	
D[17:0], D[15:0], D[8:0], D[7:0]	tdst	Write data setup time	10	-	ns	For maximum CL=30pF For minimum CL=8pF
	tdht	Write data hold time	10	-	ns	
	trat	Read access time	-	40	ns	
	tratfm	Read access time	-	340	ns	
	trod	Read output disable time	20	80	ns	

Note: Ta = -30 to 70 ℃, VDDI=1.65V to 3.3V, VCI=2.5V to 3.3V, VSS=0V

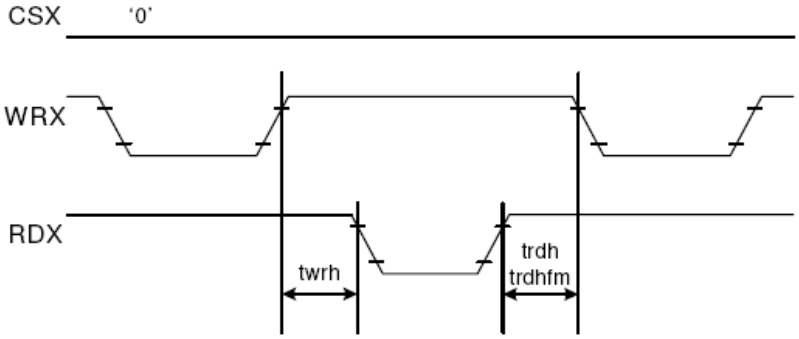


CSX timings :



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

Write to read or read to write timings:

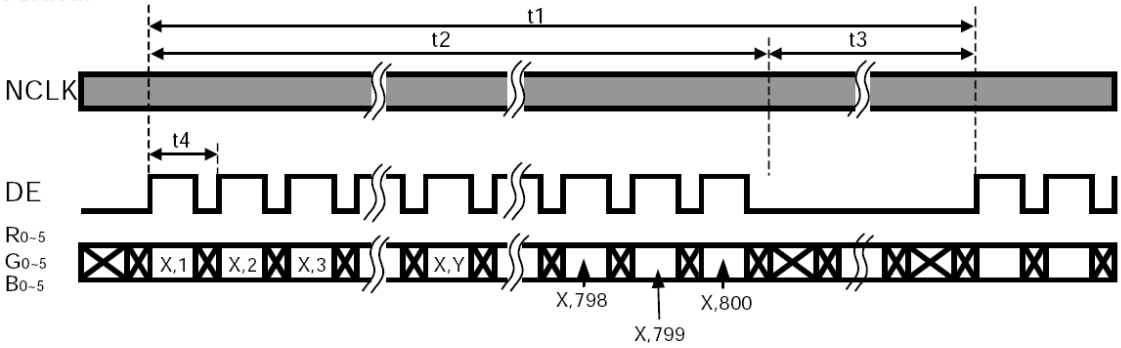


Note: Logic high and low levels are specified as 30% and 70% of VDDI for Input signals.

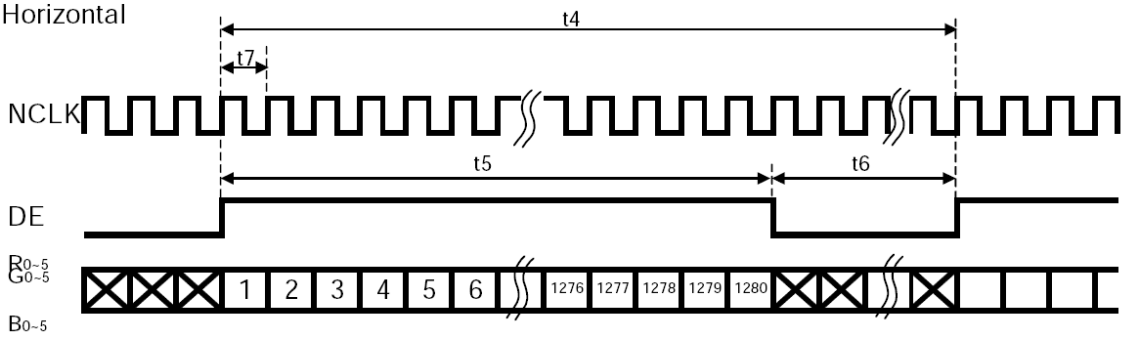
7.2 Reset Timing Characteristics

AC Electrical Characteristics

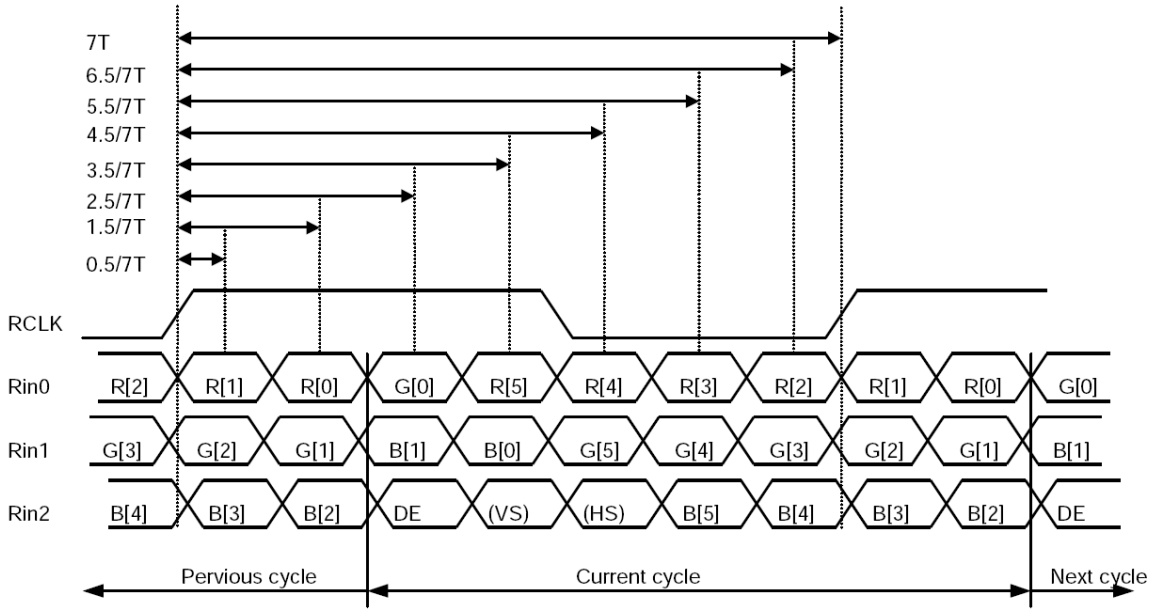
(1)Vertical



(2)Horizontal



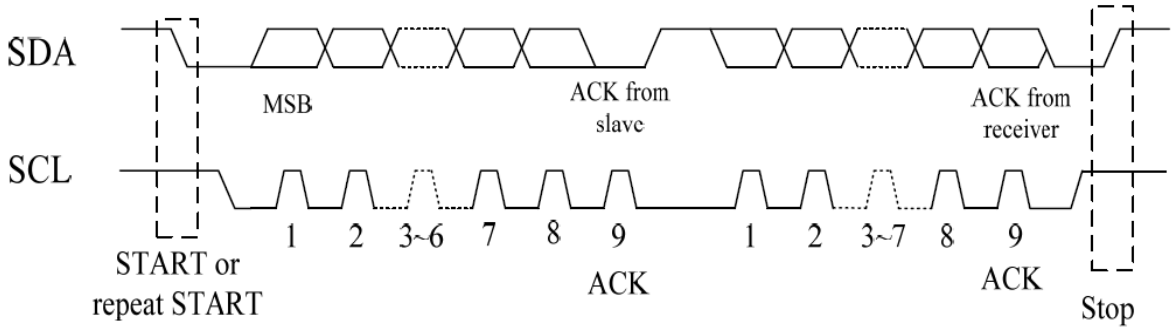
Data Input Format

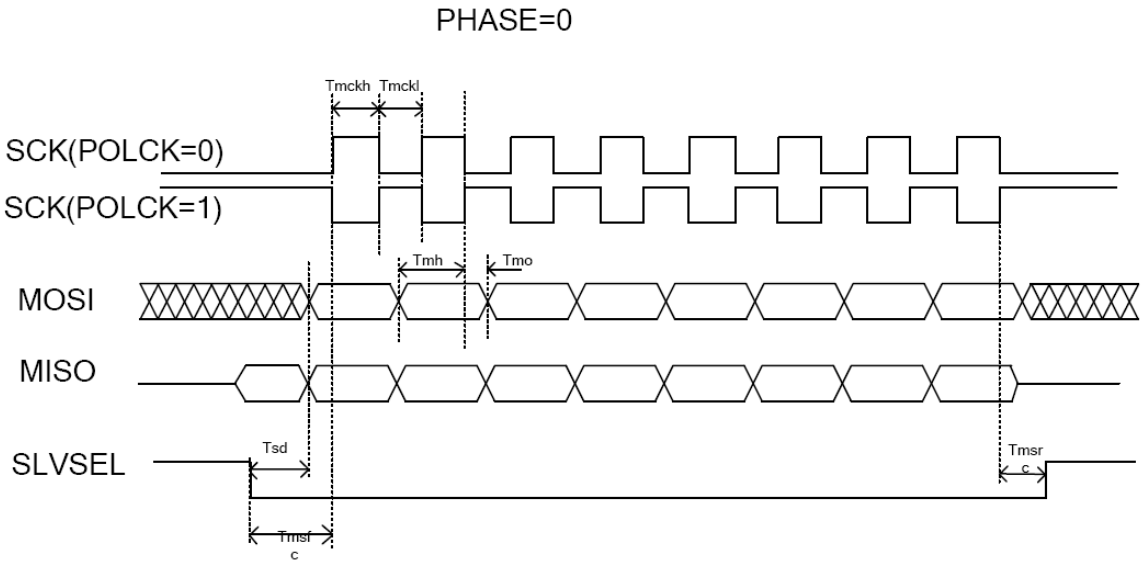


LVDS Receiver Input Timing Definition
for 6bits LVDS input

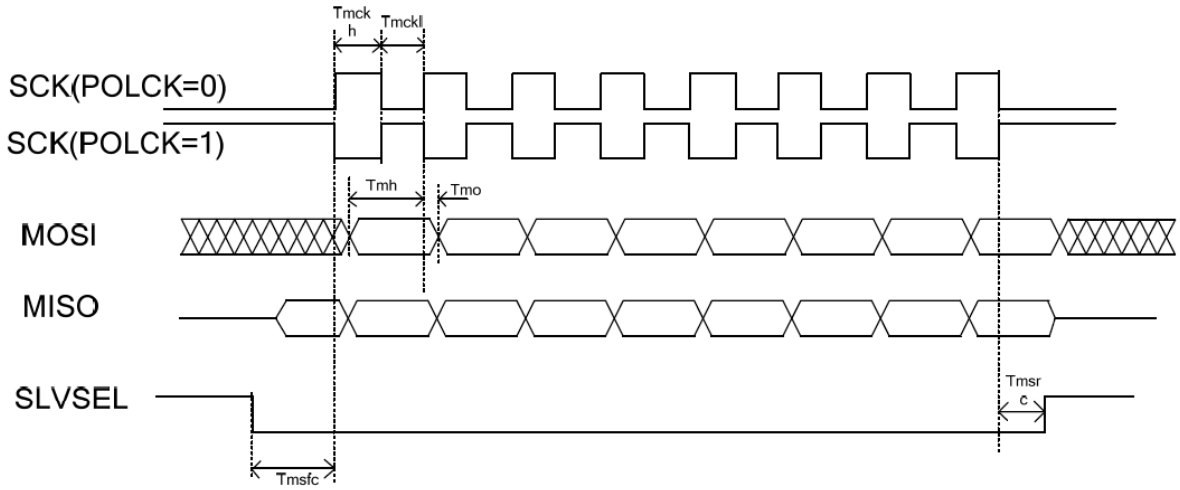
Item	Symbol	Min.	Typ.	Max.	Unit
Frame Rate	--	55	60	65	Hz
Frame Period	t1	803	823	1023	line
Vertical Display Time	t2	800	800	800	line
Vertical Blanking Time	t3	3	23	223	line
1 Line Scanning Time	t4	1334	1440	1961	clock
Horizontal Display Time	t5	1280	1280	1280	clock
Horizontal Blanking Time	t6	54	160	681	clock
Clock Rate	t7	64.3	71.1	82	MHz

7.3 CTP Timing characteristics

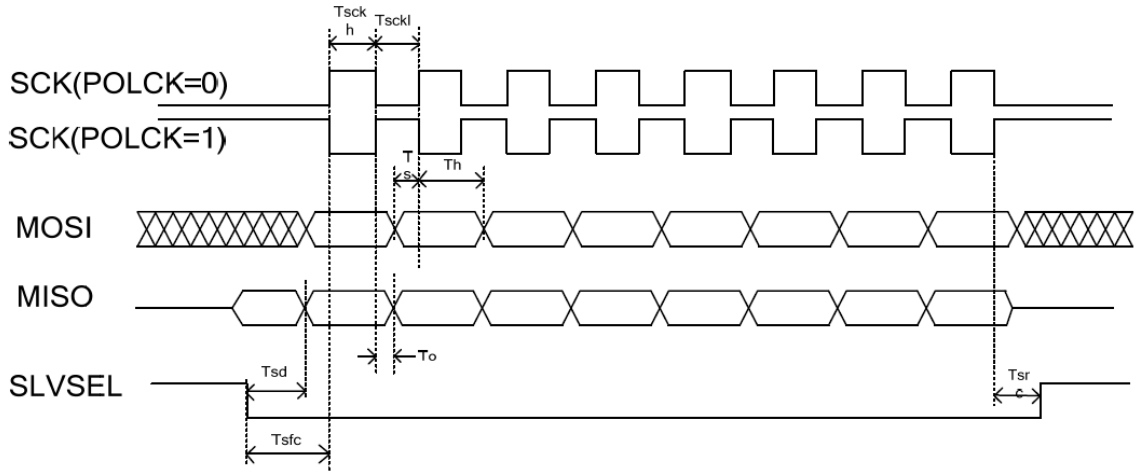




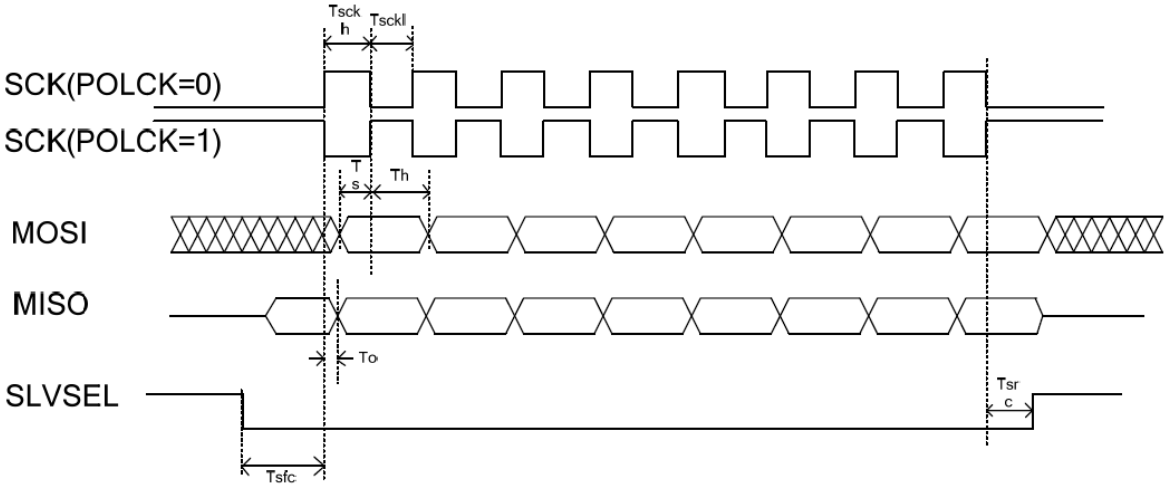
PHASE=1



PHASE=0



PHASE=1



Parameter	Description	Min	Max	Units
Master Mode timing (see figure 2-11,2-12)				
Tmckh	sck high time	4×Tsysclk	--	ns
Tmckl	sck low time	4×Tsysclk	--	ns
Tmo	sck shift edge to mosi data change	0	--	ns
Tmh	mosi data valid to sck shift edge	3×Tsysclk	--	ns
Tsd	slvsel falling edge to mosi data valid	4×Tsysclk	--	ns
Tmsfc	slvsel falling edge to first sck edge	(Tmckh+Tmckl)/	--	ns
		2		
Tmsrc	last sck edge to slvsel rising edge	(Tmckh+Tmckl)/ 2	--	ns
Slave mode timing(See figure 2-13,2-14)				
Tsckh	sck high Time	4×Tsysclk	--	ns
Tsckl	sck low Time	4×Tsysclk	--	ns
Tsd	slvsel falling edge to Miso valid data time	0	4xTsysclk	ns
Ts	Mosi Data valid to sck sample edge	0	--	ns
Th	sck sample edge to Mosi data change	4×Tsysclk	--	ns
To	sck shift edge to Miso data change	0	4xTsysclk	ns
Tsfc	slvsel falling edge to first sck edge	4×Tsysclk	--	ns
Tsrc	last sck edge to slvsel rising edge	4×Tsysclk	--	ns
*Tsysclk is equal to one period of the device system clock				

8. Backlight Characteristic

8.1 Absolute Maximum Ratings

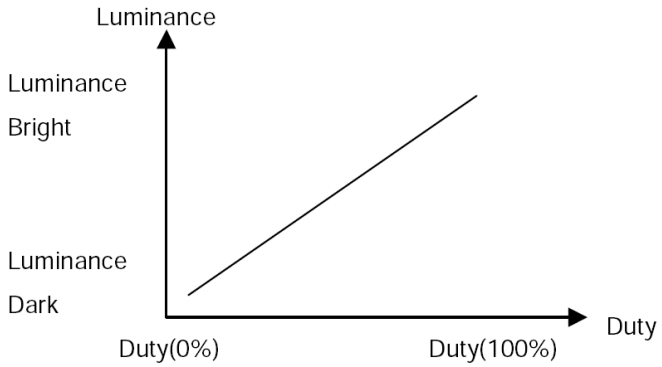
Item	Symbol	Min.	Max.	Unit	Note
LED Power Supply voltage	V_{LED}	-0.3	6	Volt	
LED_EN	V_{EN}	--	6	Volt	

8.2 DC Electrical Characteristics

Parameter	Symbol	Min	Typ	Max	Units	Remark
LED Power Supply Voltage	V_{LED}	3.0	--	5.0	Volt	
LED_EN High Threshold	V_{LED_ENH}	1.4	--	V_LED	Volt	
LED_EN Low Threshold	V_{LED_ENL}	--	--	0.5	Volt	

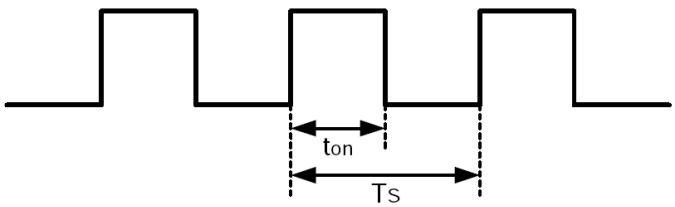
[Note]

(1) LED_EN can adjust brightness to control Pin. Pulse duty the bigger the brighter.



(2) LED_EN Signal=0~3.3V，Operation Conditions：

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
LED_EN Logic-High Level	V_{ADJH}		1.8	3.3	3.6	V
LED_EN Logic-Low Level	V_{ADJL}		0	0	0.4	V
Dimming Frequency	F_{ADJ}		18	20	22	kHz
Dimming Duty Cycle	D		20	--	100	%



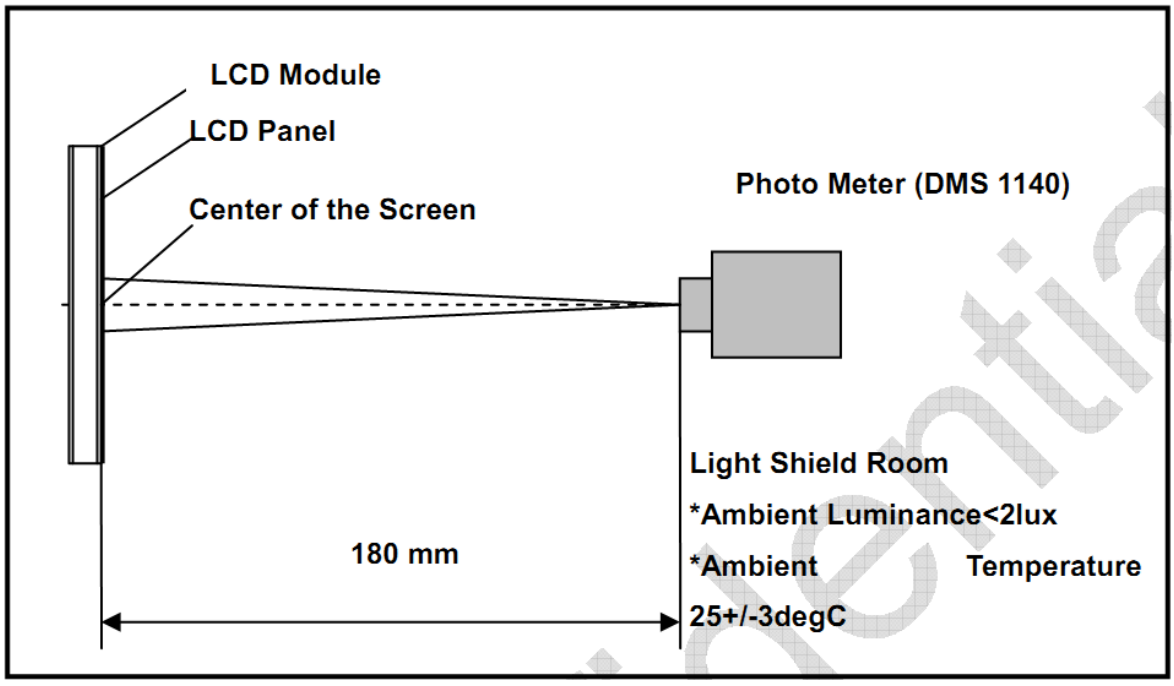
$D = t_{on} / T_S \times 100\%$

$F_{ADJ} = 1 / T_S$

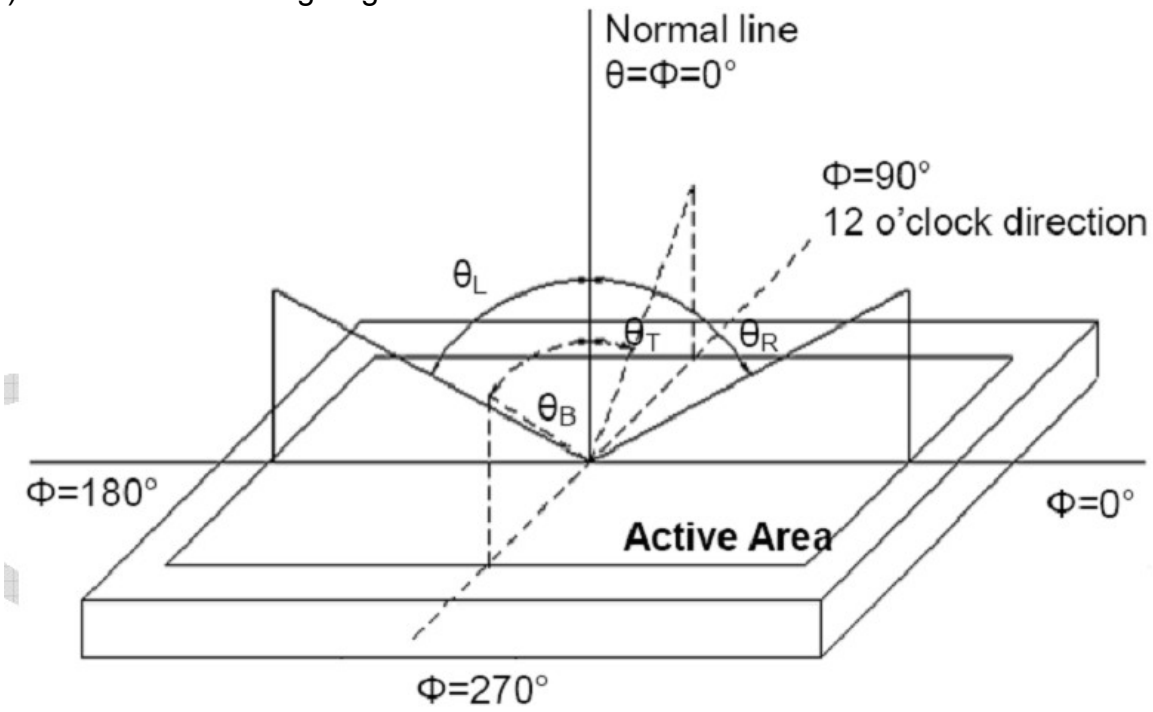
9. Optical Characteristics

Item	Conditions		Min.	Typ.	Max.	Unit	Note
Viewing Angle (CR>10)	Horizontal	θ_L	70	80	-	degree	(1),(2),(6)
		θ_R	70	80	-		
	Vertical	θ_T	70	80	-		
		θ_B	70	80	-		
Contrast Ratio	Center		640	800	-	-	(1),(3),(6)
LCM Luminance	Center point		300	350	-	Cd/m^2	
Response Time	Rising + Falling		-	16	-	ms	(1),(4),(6)
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	CIE1931		-	60.52	-	%	(1),(6)
Transmittance	-		-	4.4	-	%	(1),(5),(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



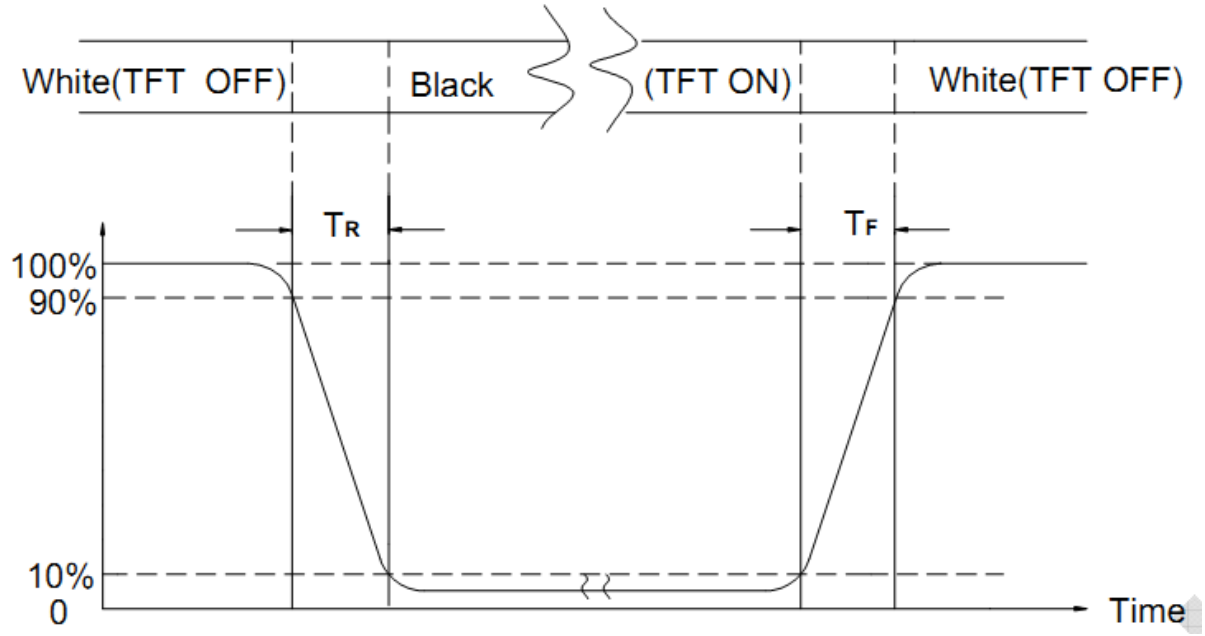
Note (3) Definition of Contrast Ratio (CR)

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
①	High Temperature Storage	80°C±2°C×200Hours	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.
②	Low Temperature Storage	-30°C±2°C×200Hours	
③	High Temperature Operating	70°C±2°C×120Hours	
④	Low Temperature Operating	-20°C±2°C×120Hours	
⑤	Temperature Cycle(Storage)	-20°C ⇔ 25°C ⇔ 70°C (30min) (5min) (30min) 1cycle Total 10cycle	
⑥	Damp Proof Test (Storage)	50°C±5°C×90%RH×120Hours	
⑦	Vibration Test	Frequency:10Hz~55Hz~10Hz Amplitude:1.5M X,Y,Z direction for total 3hours (packing condition test will be tested by a carton)	
⑧	Drooping Test	Drop to the ground from 1M height one time every side of carton. (packing condition test will be tested by a carton)	
⑨	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

This standard apply to C-STN/TFT module

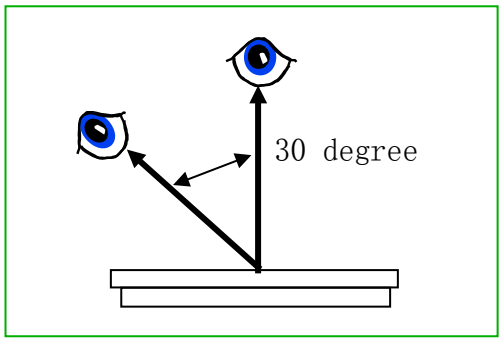
1. Spot check plan：

According to spot check level Ⅱ,MIL-STD-105D Level Ⅱ ,the rank of accept or reject is below:

3A 级、2A 级：major non-conformance：AQL 0.25 minor non-conformance：AQL 0.4

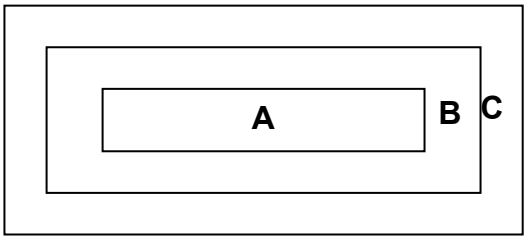
A 级：major non-conformance： AQL 0.65 minor non-conformance ： AQL 1.

2. Inspection condition：



Under daylight lamp 20～40W， product distance inspector ‘eye 30cm,incline degree 30°。

3. LCD area define：



Area A：display area

Area B：VA area

Area C：out of VA area, not in sight after assembly

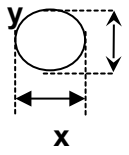
Remark: non-conformance at area C, but is OK that isn’t influence reliability of product & assembly by customer.

4. Inspection standard

4.1 Major non-conformance

NO.	Item	Inspection standard	Rate
4.1.1	Function non-conformance	1) No display, display abnormally 2) Miss line, short 3) B/L no function or function abnormally 4) TP no function	major
4.1.2	miss	No matter miss what component	
4.1.3	Out of size	Module dimension out of spec	

4.2 Appearance non-conformance

<table>
<tr><th>NO.</th><th>Item</th><th>Inspection standard</th><th>Rate</th></tr>
<tr><td>4.2.1</td><td>Black or white spot（power on）</td><td>dot non-conformance define Φ
Φ= $\frac{(x+y)}{2}$
 

A grade
<table>
<tr><th>Area
Size (mm)
Most approve q’ty</th><th>A</th><th>B</th><th>C</th></tr>
<tr><td>Φ≤0.10</td><td colspan="2">ignore</td><td>ignore</td></tr>
<tr><td>0.10＜Φ≤0.15</td><td colspan="2">4</td><td></td></tr>
<tr><td>0.15＜Φ≤0.20</td><td colspan="2">2</td><td></td></tr>
<tr><td>0.20＜Φ≤0.25</td><td colspan="2">1</td><td></td></tr>
<tr><td>0.25＜Φ</td><td colspan="2">0</td><td></td></tr>
</table>
Most approve 4 damages, dot to dot ≥10mm</td><td>Minor</td></tr>
<tr><td>4.2.2</td><td>Black or white line（power on）</td><td>A grade
<table>
<tr><th colspan="2">Size(mm)</th><th colspan="3">Most approve q’ty</th></tr>
<tr><th>L(length)</th><th>W(width)</th><th>A</th><th>B</th><th>C</th></tr>
<tr><td>ignore</td><td>W≤0.03</td><td colspan="2">ignore</td><td>ignore</td></tr>
<tr><td>L≤5.0</td><td>0.03＜W≤0.05</td><td colspan="2">3</td><td></td></tr>
<tr><td>L≤3.0</td><td>0.05＜W≤0.07</td><td colspan="2">1</td><td></td></tr>
<tr><td></td><td>0.07＜W</td><td colspan="2">Treat with dot non-conformance</td><td></td></tr>
</table></td><td>Minor</td></tr>
</table>

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 (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 IOVCC or GND, 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