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	2017-04-26	NEW ISSUE	

Table of Contents

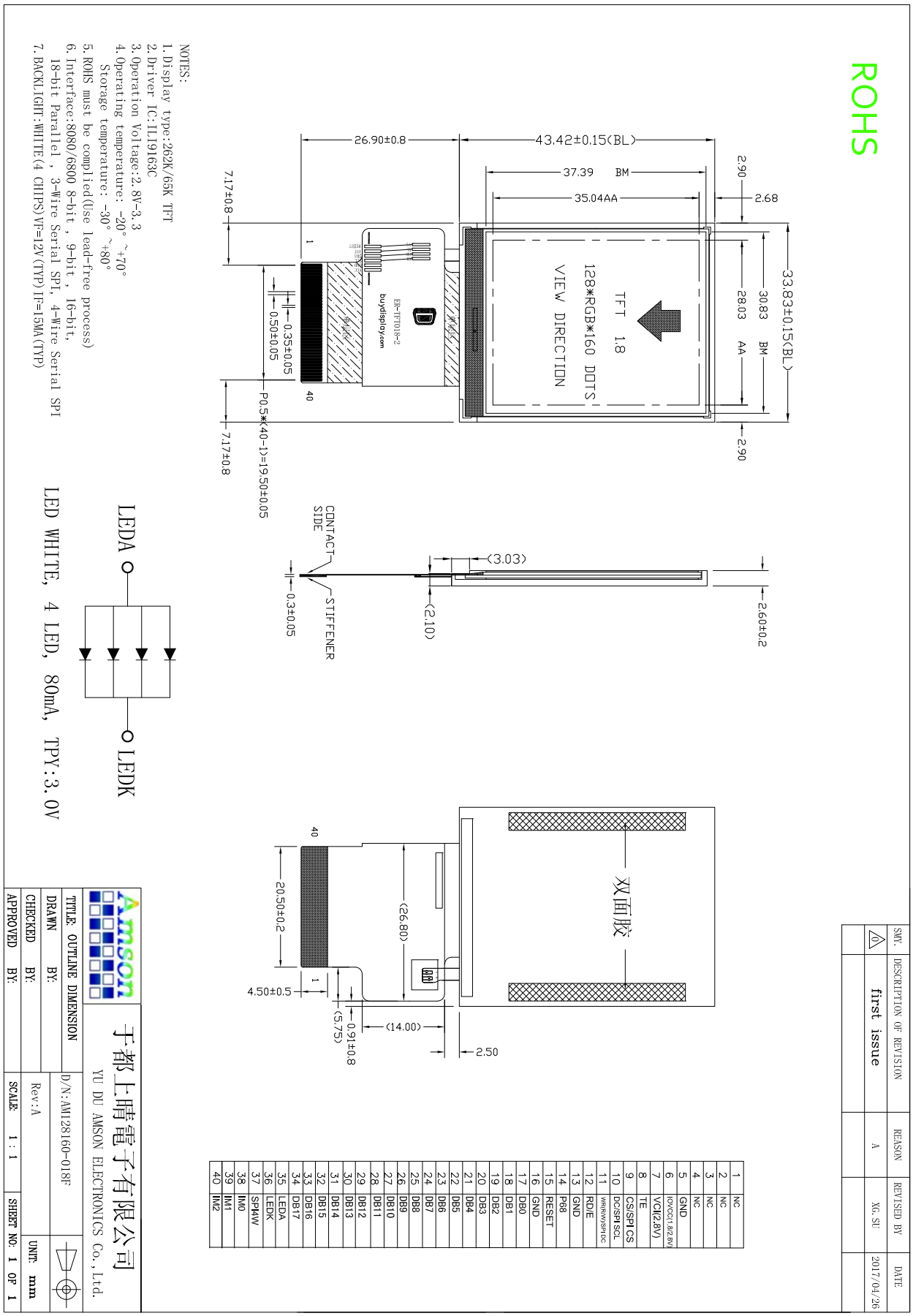
1. Scope

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	1.77”TFT	--
Dot arrangement	128(RGB)×160	dots
Color filter array	RGB vertical stripe	--
Display mode	TN / Transmissive / Normally White	--
Gray scale inversion Direction	12 o’clock	--
Viewing Direction	6 o’clock	--
Driver IC	ILI9163V	--
Module size	33.83(W)×43.42(H)×2.6(T)	mm
Active area	28.03(W)×35.04(H)	mm
Dot pitch	0.219(W)×0.219(H)	mm
Interface	MCU / SPI	--
Operating temperature	-20 ~ +70	°C
Storage temperature	-30 ~ +80	°C
Back Light	4 White LED In Parallel	--

3. External Dimensions



4. Interface Description

PIN.NO	SYMBOL	I/O/P	FUNCTION
1	NC	-	No connection
2	NC	-	No connection
3	NC	-	No connection
4	NC	-	No connection
5	GND	P	Power Ground
6	IOVCC(1.8/2.8V)	P	Power supply for interface logic circuits (1.65 ~ 3.3 V)
7	VCI(2.8V)	P	Power supply for analog circuit. Could connect to external power supply (VCI=2.5~4.0V).
8	TE	O	Tearing effect output pin to synchronies MCU to frame writing, activated by S/W command. When this pin is not activated, this pin is low. If not used, please open this pin.
9	CS / SPI CS	I	Chip select input pin (“Low” enable). This pin can be permanently fixed “Low” in MCU interface mode only.
10	D/CX / SPI SCL	I	Display data / Command selection pin in parallel and SCL in 3pin SPI interface. D/CX=’1’: Display data. D/CX=’0’: Command data. If not used, please connect this pin to GND.
11	WR(R/W) / SPI D/CX	I	Write enable in parallel interface. WRX: for 8080 MCU R/WX: for 6800 MCU D/CX: for 4wire SPI If not used, please connect this pin to IOVCC or GND.
12	RD / E	I	Read enable in 8080parallel interface and Read/ Write operation enable pin in 6800parallel interface. In 8080parallel interface, if not used, please connect this pin to IOVCC. In 6800parallel interface, if not used, please connect this pin to IOVCC or GND.
13	GND	P	Power Ground
14	P68	I	8080/6800 MCU Interface mode selection. P68=’1’: select 6800MCU parallel interface P68=’0’: select 8080MCU parallel interface If not used, please fix this pin at GND level.
15	RESET	I	Chip reset pin (“Low Active”). This signal low will reset the device and must be applied to properly initialize the

<table>
<tr><td></td><td></td><td></td><td>chip.</td></tr>
<tr><td>16</td><td>GND</td><td>P</td><td>Power Ground</td></tr>
<tr><td>17-34</td><td>DB0-DB17</td><td>I/O</td><td>When RCM1=’0’ (MCU I/F), DB[17:0] are used to MCU parallel interface data bus, and DB0 is also the serial input/ output signal in SPI interface mode. In serial interface, DB[17:1] are not used and should be connected to ground.
When RCM1=’1’ (RGB I/F), DB[17:0] are used to RGB interface data bus.</td></tr>
<tr><td>35</td><td>LEDA</td><td>P</td><td>Power for backlight (anode)</td></tr>
<tr><td>36</td><td>LEDK</td><td>P</td><td>Power for backlight (cathode)</td></tr>
<tr><td>37</td><td>SPI4W</td><td>I</td><td>SPI interface selection pin
SPI4W=’0’: 3wire SPI. (default)
SPI4W=’1’: 4wire SPI.
This pin is internal pull low.</td></tr>
<tr><td>38</td><td>IM0</td><td rowspan="2">I</td><td rowspan="2">MCU parallel interface type selection
<table>
<tr><th>IM1</th><th>IM0</th><th>Parallel interface</th></tr>
<tr><td>0</td><td>0</td><td>MCU 8bit Parallel</td></tr>
<tr><td>0</td><td>1</td><td>MCU 16bit Parallel</td></tr>
<tr><td>1</td><td>0</td><td>MCU 9bit Parallel</td></tr>
<tr><td>1</td><td>1</td><td>MCU 18bit Parallel</td></tr>
</table></td></tr>
<tr><td>39</td><td>IM1</td></tr>
<tr><td>40</td><td>IM2</td><td>I</td><td>MCU Parallel interface bus and Serial interface select
- IM2=’1’;Parallel Interface
- IM2=’0’;Serial Interface</td></tr>
</table>

5. Absolute Maximum Ratings

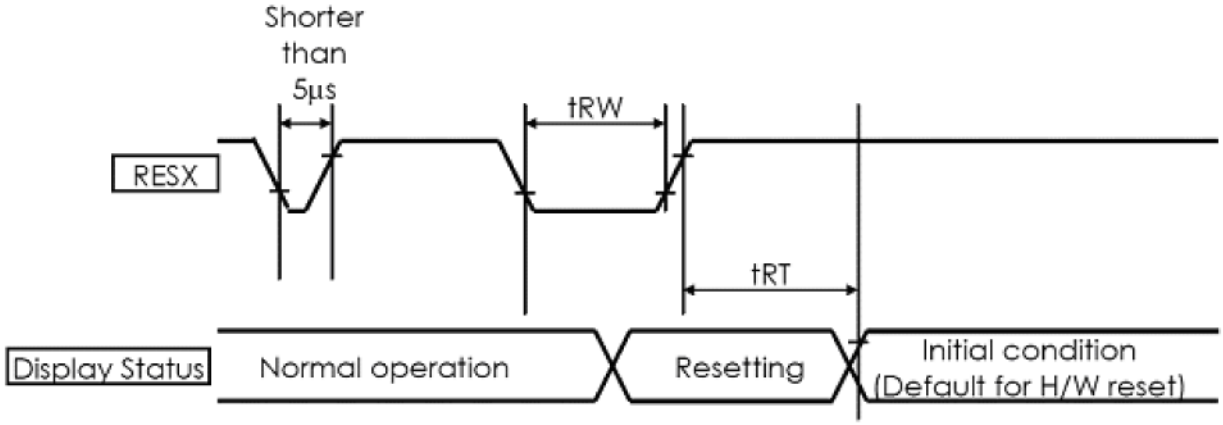
Item	Symbol	Min.	Max.	Unit
Analog Supply Voltage	VCI	-0.3	4.0	V
Logic Supply Voltage	IOVCC	-0.3	3.3	
Operating Temperature	TOP	-20	70	°C
Storage Temperature	TST	-30	80	°C
Storage Humidity	HD	20	90	%RH

6. DC Characteristics

Item	Symbol	Min.	Typ.	Max.	Unit	Remark
Analog Supply Voltage	VCI	2.5	--	3.3	V	--
Logic Supply Voltage	IOVCC	1.65	--	3.3	V	--
Input High Voltage	V_{IH}	0.7IOVCC	--	IOVCC	V	Digital input pins
Input Low Voltage	V_{IL}	GND	--	0.3 IOVCC	V	Digital input pins
Output High Voltage	V_{OH}	0.8 IOVCC	--	IOVCC	V	Digital output pins
Output Low Voltage	V_{OL}	GND	--	0.2 IOVCC	V	Digital output pins
I/O Leak Current	I_{LI}	-0.1	--	0.1	uA	--

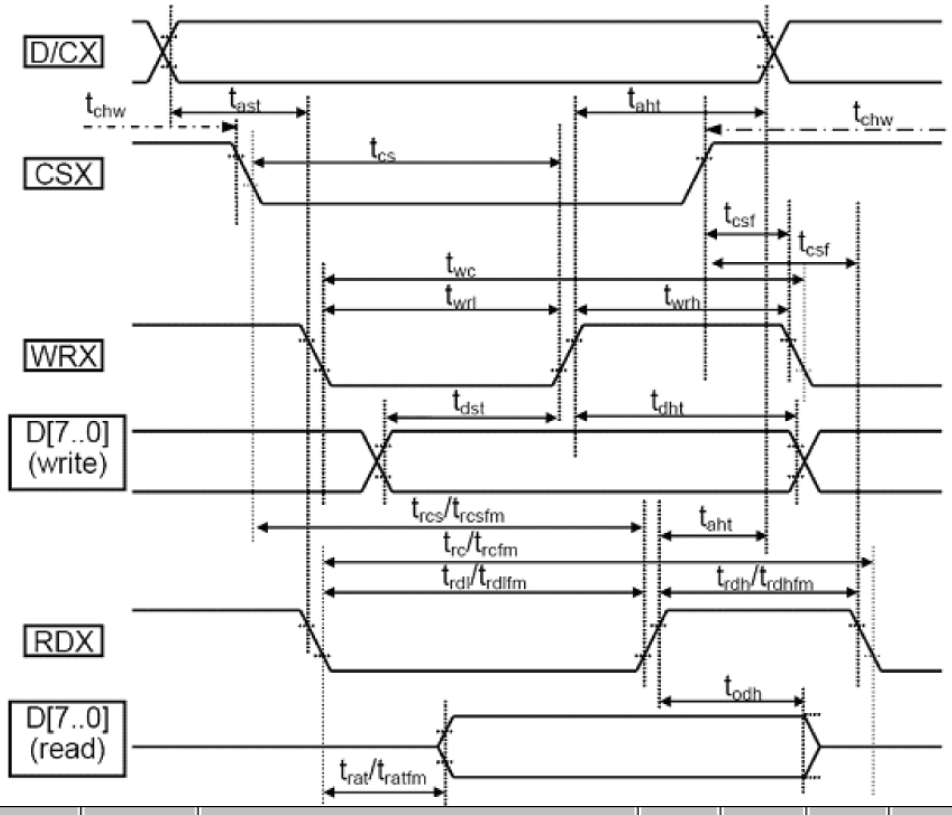
7. Timing Characteristics

7.1 Reset Timing Characteristics



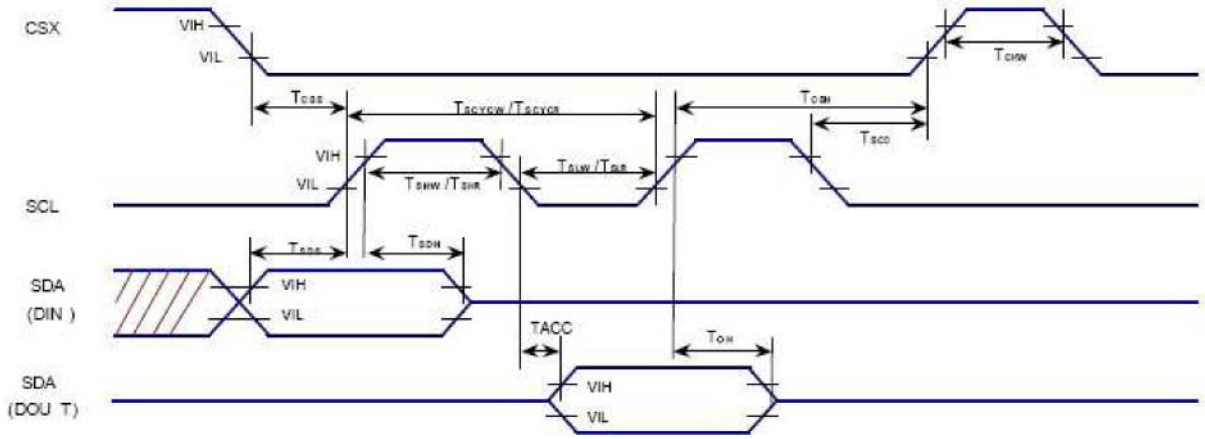
Symbol	Parameter	Related Pins	MIN	TYP	MAX	Note	Unit
tRESW	*1) Reset low pulse width	RESX	10	-	-	-	µs
tREST	*2) Reset complete width	-	-	-	5	When reset applied during Sleep in mode	ms
		-	-	-	120	When reset applied during Sleep out mode	ms

7.2 Parallel MCU 18/16/9/8-bit Bus



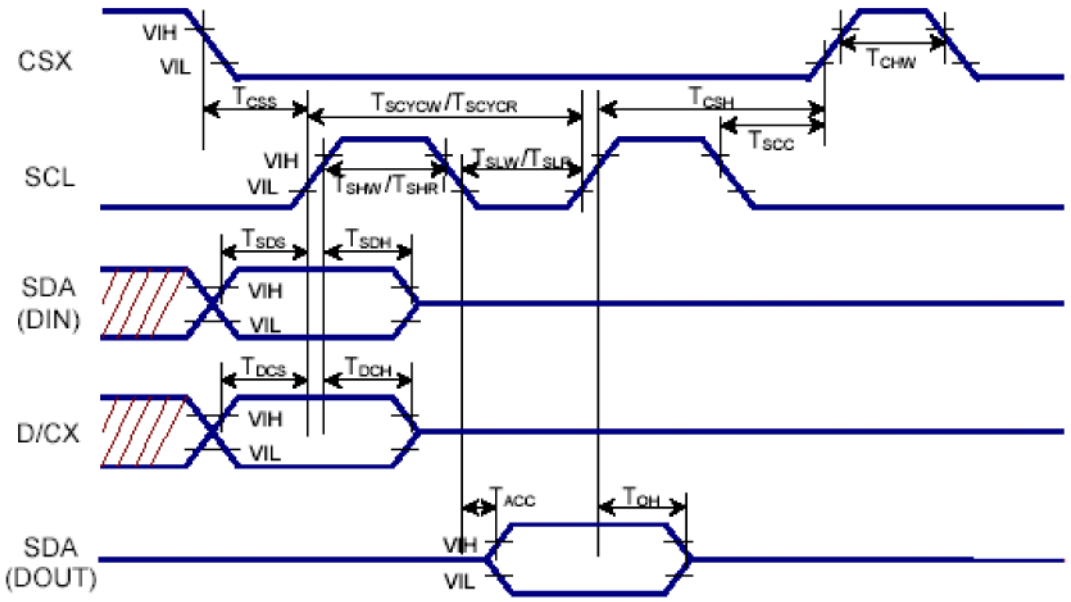
Signal	Symbol	Parameter	min	max	unit	description
D/CX	tast	Address setup time	0		ns	
	taht	Address hold time(Write/Read)	10		ns	
CSX	tchw	"S""H" Pulse Widtch	0		ns	
	tcs	Chip Select setup time (Write)	10		ns	
	trcs	Chip Select setup time (Read ID)	45		ns	
	trcsfm	Chip Select setup time (Read FM)	355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

7.3 3-pin Serial Interface



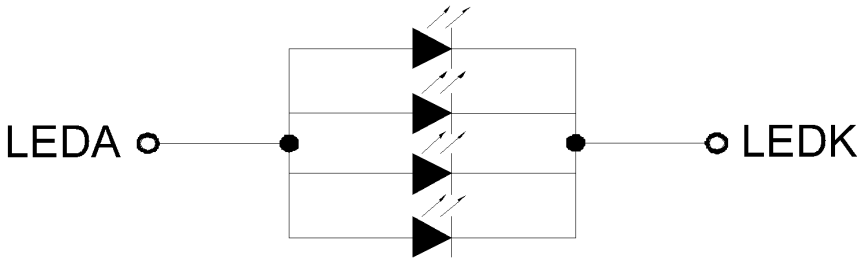
Signal	Symbol	Parameter	MIN	MAX	Unit	Description
CSX	TCSS	Chip select setup time	10		ns	
	TCSH	Chip select hold time	30		ns	
	TCHW	Chip select “H” pulse width	30		ns	
SCL	TSCYCW	Serial clock cycle(Write)	66		ns	
	TSHW	S“L””H" pulse width(Write)	15		ns	
	TSLW	S“L””L" pulse width(Write)	15		ns	
	TSCYCR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

7.4 4-pin Serial Interface



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

8. Backlight Characteristics



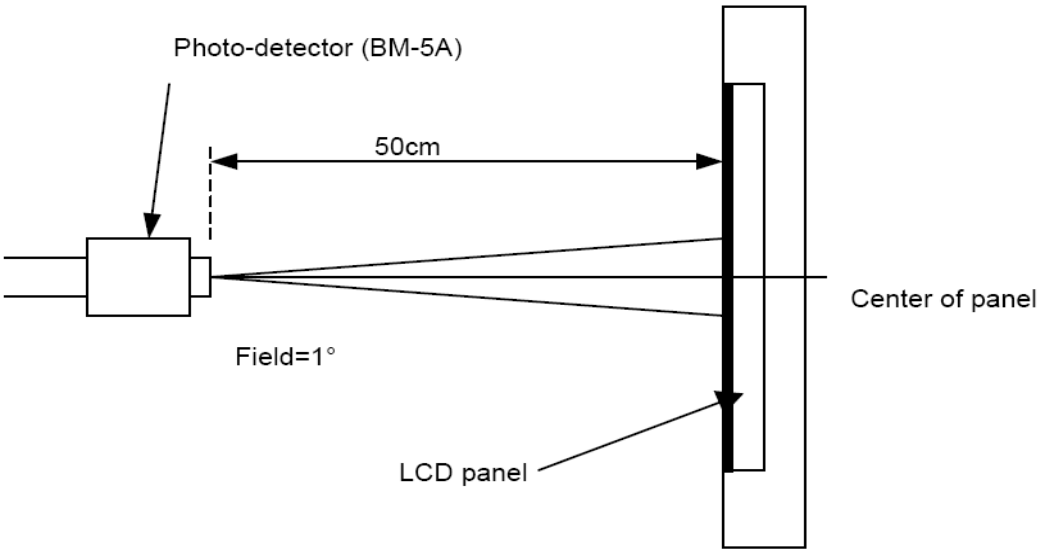
BL CIRCUIT DIAGRAM:

Item	Symbol	MIN	TYP	MAX	UNIT	Test Condition
Supply Voltage	Vf	2.7	3.0	3.3	V	If=80mA
Supply Current	If	--	80	--	mA	--
Luminous Intensity for LCM	--	--	250	--	Cd/m^2	If=80mA
Uniformity for LCM	--	80%	--	--	%	If=80mA
Life Time	--	20000	--	--	Hr	If=80mA
Backlight Color	White					

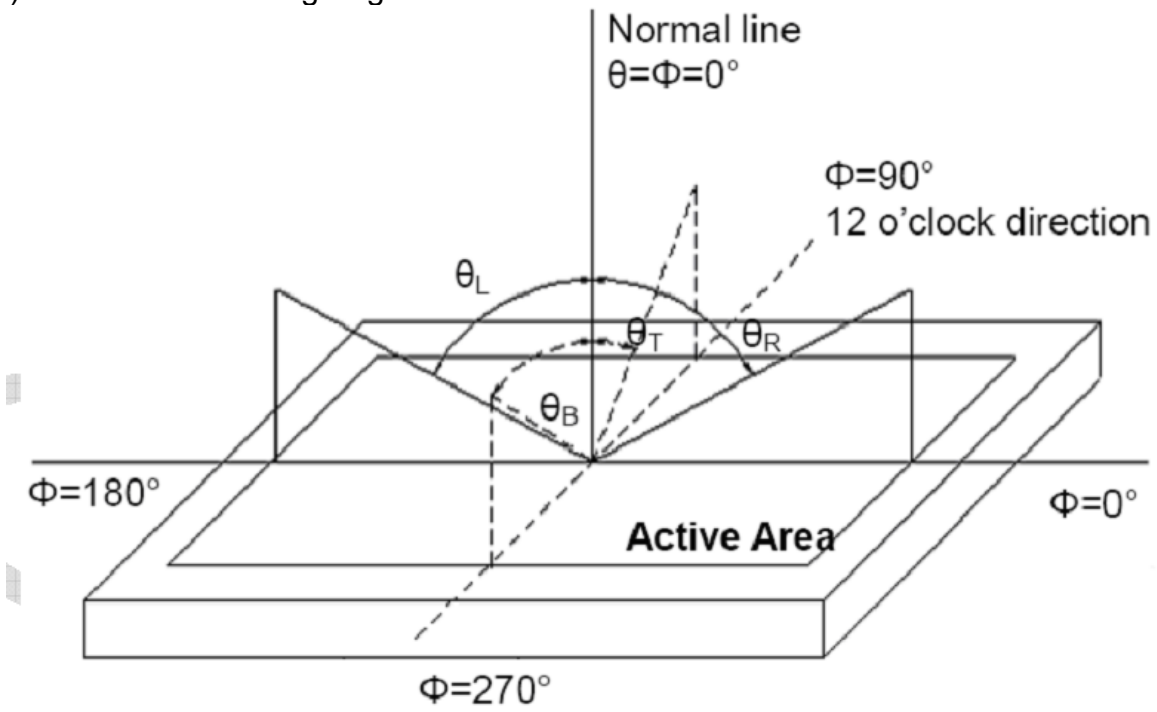
9. Optical Characteristics

Item	Conditions		Min.	Typ.	Max.	Unit	Note
Viewing Angle (CR>10)	Horizontal	θ_L	40	45	-	degree	(1),(2),(6)
		θ_R	40	45	-		
	Vertical	θ_T	40	45	-		
		θ_B	15	20	-		
Contrast Ratio	Center		200	300	-	-	(1),(3),(6)
Response Time	Rising + Falling		-	30	60	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		-	

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



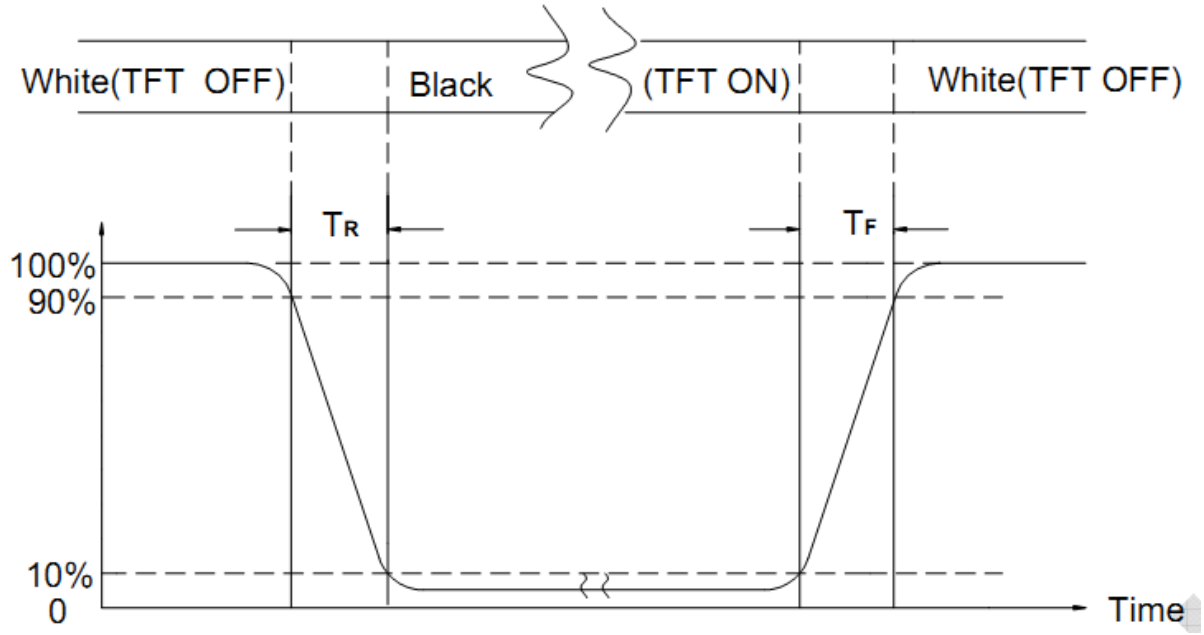
Note (3) Definition Of Contrast Ratio (CR)

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

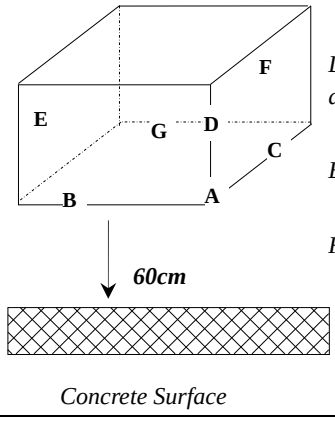
10. Reliability Test Conditions and Methods

No change on display and in operation under the following test condition.

Condition: Unless otherwise specified, tests will be conducted under the following condition.

Temperature: 20±5°C Humidity: 65±5%RH

Tests will be not conducted under functioning state.

No.	Parameter	Condition	Notes
1	High Temperature Operating	70°C±2°C, 240hrs (Operation state)	--
2	Low Temperature Operating	-20°C±2°C, 240hrs (Operation state)	--
3	High Temperature Storage	80°C±2°C, 240hrs	--
4	Low Temperature Storage	-30°C±2°C, 240hrs	--
5	High Temperature and High Humidity Operation Test	60°C±2°C, 90%, 240hrs	--
6	Vibration Test	Total fixed amplitude: 1.5mm Vibration Frequency: 10~55Hz One cycle 60 seconds to 3 direction of X, Y, Z each 15 minutes.	--
7.	Drop Test	To be measured after dropping from 60cm high on the concrete surface in packing state.  *Dropping method corner dropping* *A corner: once* *Edge dropping* *B, C, D edge: once* *Face dropping* *E, F, G face: once*	--

Notes: 1. No dew condensation to be observed.

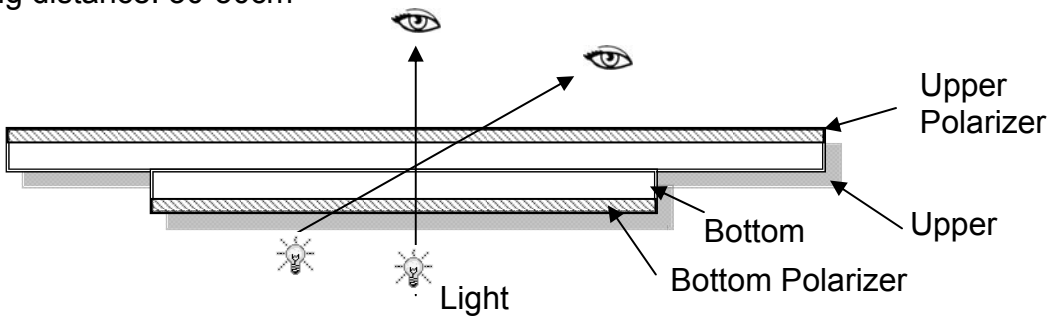
2. The function test shall be conducted after 4 hours storage at the normal temperature and humidity after removed from the test chamber.

3. Vibration test will be conducted to the product itself without putting I in a container.

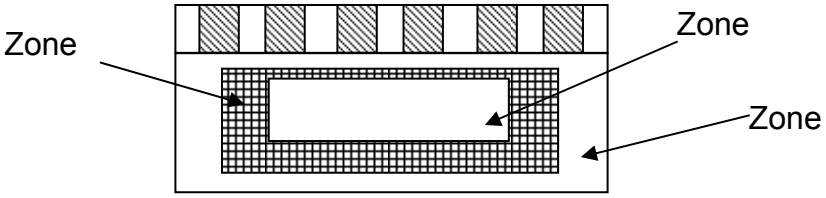
11. Inspection Standard

11.1.1 Inspection conditions

Inspection performed under the following conditions is recommended.
Temperature: 25±5℃
Humidity: 65%±10%RH
Viewing Angle: Normal viewing Angle.
Illumination: Single fluorescent lamp (300 to 700Lux)
Viewing distance: 30-50cm



11.1.2 Definition



Zone A: Effective Viewing Area (Character or Digit can be seen)
Zone B: Viewing Area except Zone A
Zone C: Outside (Zone A + Zone B) which cannot be seen after assembly by customer.)
Note:
As a general rule, visual defects in Zone C can be ignored when it doesn't effect product function or appearance after assembly by customer.

11.1.3 Sampling Plan

According to GB/T 2828-2003; normal inspection, Class Ⅱ
AQL:

Major defect	Minor defect
0.65	1.5

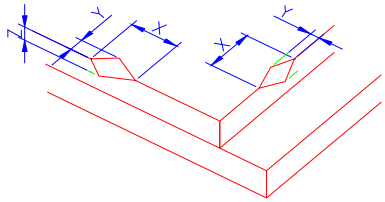
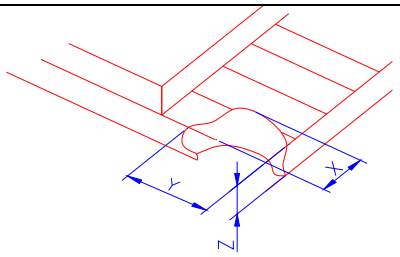
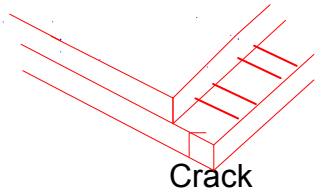
LCD: Liquid Crystal Display, TP: Touch Panel, LCM: Liquid Crystal Module

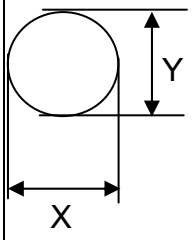
No	Items to be inspected	Criteria	Classification of defects
1	Functional defects	1) No display, Open or miss line 2) Display abnormally, Short 3) Backlight no lighting, abnormal lighting. 4) TP no function	Major
2	Missing	Missing component	

3	Outline dimension	Overall outline dimension beyond the drawing is not allowed	
4	Color tone	Color unevenness, refer to limited sample	Minor
5	Soldering appearance	Good soldering, Peeling off is not allowed.	
6	LCD/Polarizer/TP	Black/White spot/line, scratch, crack, etc.	

11.1.4 Criteria (Visual)

<table>
<tr><th>Number</th><th>Items</th><th>Criteria(mm)</th></tr>
<tr><td rowspan="3">1.0
LCD Crack / Broken

NOTE:
X: Length
Y: Width
Z: Height
L: Length of ITO,
T: Height of LCD</td><td>(1) The edge of LCD broken</td><td> 
<table><tr><th>X</th><th>Y</th><th>Z</th></tr><tr><td>≤3.0mm</td><td><Inner border line of the seal</td><td>≤T</td></tr></table></td></tr>
<tr><td>(2)LCD corner broken</td><td> 
<table><tr><th>X</th><th>Y</th><th>Z</th></tr><tr><td>≤3.0mm</td><td>≤L</td><td>≤T</td></tr></table></td></tr>
<tr><td>(3) LCD crack</td><td> 
Crack
Not allowed</td></tr>
</table>

<table>
<tr><th>Number</th><th>Items</th><th>Criteria (mm)</th></tr>
<tr><td rowspan="2">2.0</td><td>Spot defect
 

Φ=(X+Y)/2</td><td>① light dot（LCD/TP/Polarizer black/white spot , light dot, pinhole, dent, stain）
<table>
<tr><th rowspan="2">Zone
Size (mm)</th><th colspan="3">Acceptable Qty</th></tr>
<tr><th>A</th><th>B</th><th>C</th></tr>
<tr><td>Φ≤0.10</td><td colspan="2">Ignore</td><td rowspan="4">Ignore</td></tr>
<tr><td>0.10<Φ≤0.15</td><td colspan="2">3(distance≧10mm)</td></tr>
<tr><td>0.15<Φ≤0.2</td><td colspan="2">1</td></tr>
<tr><td>0.2<Φ</td><td colspan="2">0</td></tr>
</table>
②Dim spot（LCD/TP/Polarizer dim dot, light leakage、dark spot）
<table>
<tr><th rowspan="2">Zone
Size (mm)</th><th colspan="3">Acceptable Qty</th></tr>
<tr><th>A</th><th>B</th><th>C</th></tr>
<tr><td>Φ≤0.1</td><td colspan="2">Ignore</td><td rowspan="4">Ignore</td></tr>
<tr><td>0.1<Φ≤0.2</td><td colspan="2">2(distance≧10mm)</td></tr>
<tr><td>0.2<Φ≤0.3</td><td colspan="2">1</td></tr>
<tr><td>Φ＞0.3</td><td colspan="2">0</td></tr>
</table>
③ Polarizer accidented spot
<table>
<tr><th rowspan="2">Zone
Size (mm)</th><th colspan="3">Acceptable Qty</th></tr>
<tr><th>A</th><th>B</th><th>C</th></tr>
<tr><td>Φ≤0.2</td><td colspan="2">Ignore</td><td rowspan="3">Ignore</td></tr>
<tr><td>0.2<Φ≤0.5</td><td colspan="2">2(distance≧10mm)</td></tr>
<tr><td>Φ>0.5</td><td colspan="2">0</td></tr>
</table></td></tr>
<tr><td>Line defect (LCD/TP /Polarizer black/white line, scratch, stain)</td><td>
<table>
<tr><th rowspan="2">Width(mm)</th><th rowspan="2">Length(mm)</th><th colspan="3">Acceptable Qty</th></tr>
<tr><th>A</th><th>B</th><th>C</th></tr>
<tr><td>Φ≤0.03</td><td>Ignore</td><td colspan="2">Ignore</td><td rowspan="3">Ignore</td></tr>
<tr><td>0.03<W≤0.05</td><td>L≤3.0</td><td colspan="2">N≤2</td></tr>
<tr><td>0.05<W≤0.08</td><td>L≤2.0</td><td colspan="2">N≤2</td></tr>
<tr><td>0.08<W</td><td colspan="4">Define as spot defect</td></tr>
</table></td></tr>
</table>

<table>
<tr><td>3.0</td><td>Polarizer Bubble</td><td>
<table>
<tr><td rowspan="2">Zone
Size (mm)</td><td colspan="3">Acceptable Qty</td></tr>
<tr><td>A</td><td>B</td><td>C</td></tr>
<tr><td>Φ≤0.2</td><td colspan="2">Ignore</td><td rowspan="4">Ignore</td></tr>
<tr><td>0.2<Φ≤0.4</td><td colspan="2">2(distance≧10mm)</td></tr>
<tr><td>0.4<Φ≤0.6</td><td colspan="2">1</td></tr>
<tr><td>0.6<Φ</td><td colspan="2">0</td></tr>
</table>
</td></tr>
<tr><td>4.0</td><td>SMT</td><td>According to IPC-A-610C class Ⅱ standard. Function defect and missing part are major defect, the others are minor defect.</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 (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 VDD 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