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	2025-02-18	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

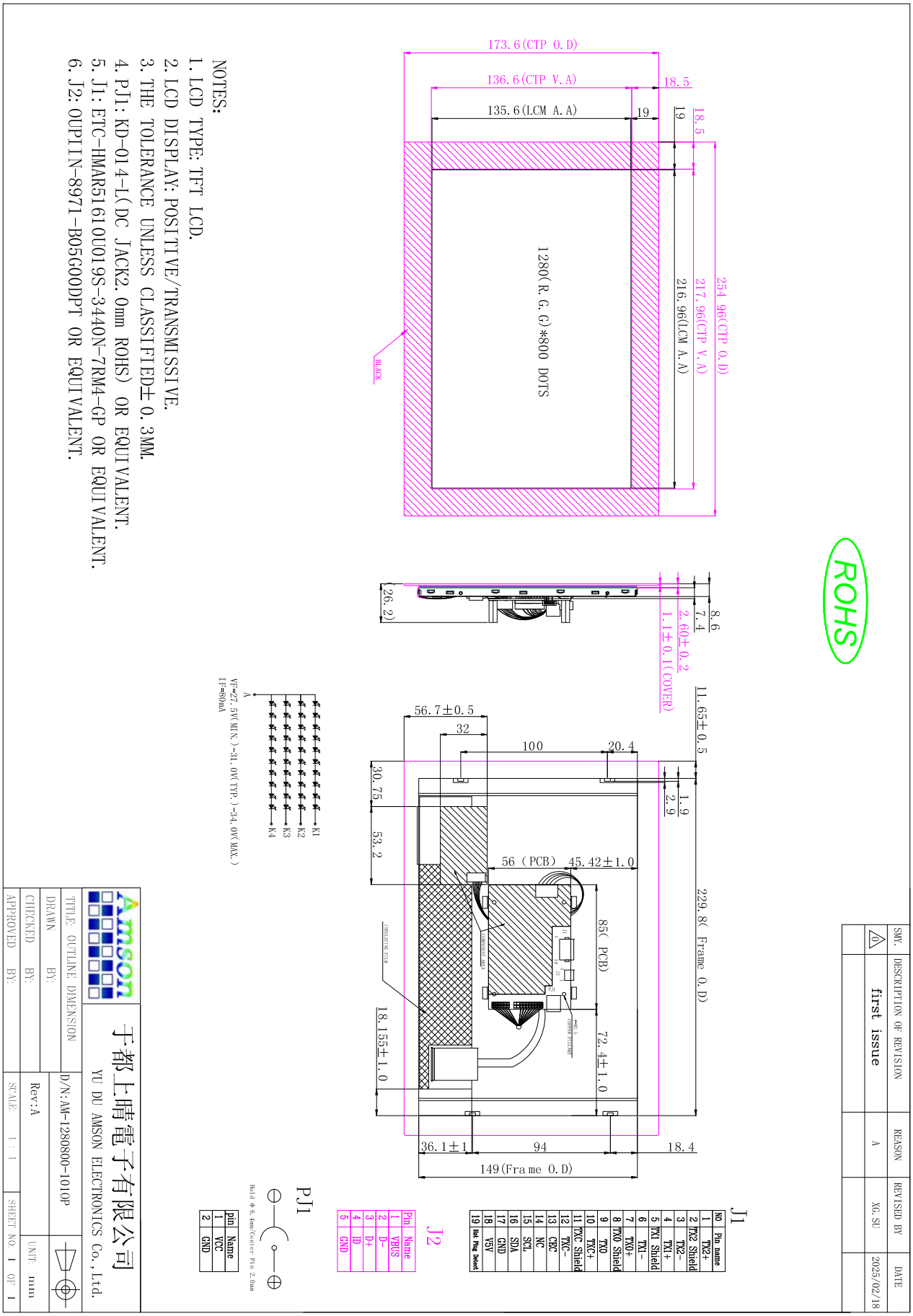
LCM

ITEM	STANDARD VALUES	UNITS
Panel Size	10.1 inch	--
Resolution	1280 (RGB) x 800	dots
Active Area	216.96(W) x 135.6(H) mm	-
Interface	HDMI	--
Module Size	254.96(W) x 173.6(H) x26.2(D) mm	mm
Display Mode	Normally Black, Transmissive	--
Display Color	16.7M	--
Viewing Direction	ALL	--
Operating temperature	-20 ~ +70	°C
Storage temperature	-30 ~ +80	°C

CTP

ITEM	STANDARD VALUES	UNITS
Touch Panel Size	10.1 inch	--
Touch Type	Projective Capacitive Touch Panel	--
Input Method	Finger / 5 Points touch	--
Output Interface	USB	--
Hardness	≥6H	--

3. External Dimensions



4. Interface Description

4.1 LCM PIN: J1 HDMI 1.3 A type Interface

PIN	PIN NAME	DESCRIPTION
1	TX2+	TMDS Data 2+
2	TX2 Shield	TMDS Data 2 Shield
3	TX2–	TMDS Data 2-
4	TX1+	TMDS Data 1+
5	TX1 Shield	TMDS Data 1 Shield
6	TX1–	TMDS Data 1-
7	TX0+	TMDS Data 0+
8	TX0 Shield	TMDS Data 0 Shield
9	TX0–	TMDS Data 0-
10	TXC+	TMDS Clock+
11	TXC Shield	TMDS Clock Shield
12	TXC–	TMDS Clock-
13	CEC	CEC
14	NC	No connection
15	SCL	Serial Clock for DDC
16	SDA	Serial Data for DDC
17	GND	Power Ground
18	V5V	+5V Power for HDMI
19	Hot Plug Detect	Hot Plug Detect

4.2 CTP PIN: J2 Micro USB Capacitive Touch Panel Interface

Pin	Pin Name	Description
1	V_{Bus}	V_{Bus} 4.75V-5.25V
2	D-	Data-
3	D+	Data+
4	ID	No connection

5. Absolute Maximum Ratings

Item	Symbol	Condition	Min.	Max.	Unit
Power Supply Voltage	VCC	-	-0.3	+23.0	V
	V_{Bus}	-	-0.3	+6.0	V
Logic Voltage	BL__PWM	-	-0.3	+5.5	V
Operating Temperature	T_{OP} (Ts)	Note 1	-20	+70	℃
Storage Temperature	T_{ST} (Ta)	Note 2	-30	+80	℃
Storage Humidity	H_D	Ta < 60 ℃	-	90	%RH

Voltage (AGND=GND=0V, Ta = 25°C)

Note 1 : Ts is the temperature of panel's surface

Note 2 : Ta is the ambient temperature of samples

6. DC Characteristics

Item	Symbol	Min.	Typ.	Max.	Unit	Remark
Power Supply Voltage	VCC	11.5	12.0	12.5	V	-
	V_{Bus}	4.75	5.0	5.25	V	-
Power Supply Current	ICC	-	500	550	mA	-
	I_{Bus}	-	50	100	mA	-
Logic Voltage	BL__PWM	0	-	5.0	V	-
PWM Frequency	F_{PWM}	100	-	20000	HZ	-

Note: Maximum current from RGB full-display

7. HDMI Characteristics

7.1 Signal DC & AC Characteristics

DC ELECTRICAL CHARACTERISTICS

over operating free-air temperature range (unless otherwise noted)

PARAMETER		TEST CONDITIONS	MIN	TYP	MAX	UNIT
V_{ID}	Analog input differential voltage (1)		75		1200	mV
V_{IC}	Analog input common-mode voltage (1)		AV_{DD} – 300		AV_{DD} – 37	mV
$V_{I(OC)}$	Open-circuit analog input voltage		AV_{DD} – 10		AV_{DD} + 10	mV
$I_{DD(2PIX)}$	Normal 2-pix/clock power supply current (2)	ODCK = 82.5 MHz, 2-pix/clock			370	mA
I_{PD}	Power-down current (3)	$\overline{PD}$ = low			10	mA
I_{PDO}	Output drive power-down current (3)	$\overline{PDO}$ = low		35		mA

(1) Specified as dc characteristic with no overshoot or undershoot
(2) Alternating 2-pixel black/2-pixel white pattern. ST = high, $\overline{STAG}$ = high, QE[23:0] and QO[23:0] C_L = 10 pF.
(3) Analog inputs are open circuit (transmitter is disconnected from TFP401/401A).

AC ELECTRICAL CHARACTERISTICS

over recommended operating free-air temperature range (unless otherwise noted)

PARAMETER		TEST CONDITIONS	MIN	TYP	MAX	UNIT
$V_{ID(2)}$	Differential input sensitivity(1)		150		1560	mV_{p-p}
t_{ps}	Analog input intra-pair (+ to –) differential skew (2)				0.4	t_{bit}(3)
t_{ccs}	Analog input inter-pair or channel-to-channel skew (2)				1	t_{pix}(4)
t_{ijit}	Worst-case differential input clock jitter tolerance(2)(5)		50			ps
t_{f1}	Fall time of data and control signals(6)(7)	ST = low, C_L = 5 pF			2.4	ns
		ST = high, C_L = 10 pF			1.9	
t_{r1}	Rise time of data and control signals(6)(7)	ST = low, C_L = 5 pF			2.4	ns
		ST = high, C_L = 10 pF			1.9	
t_{f2}	Rise time of ODCK clock(6)	ST = low, C_L = 5 pF			2.4	ns
		ST = high, C_L = 10 pF			1.9	
t_{f2}	Fall time of ODCK clock(6)	ST = low, C_L = 5 pF			2.4	ns
		ST = high, C_L = 10 pF			1.9	
t_{su1}	Setup time, data and control signal to falling edge of ODCK	1 pixel/clock, PIXS = low, OCK_INV = low	1.8			ns
		2 pixel/clock, PIXS = high, $\overline{STAG}$ = high, OCK_INV = low	3.8			
		2 pixel and STAG, PIXS = high, $\overline{STAG}$ = low, OCK_INV = low	0.7			
t_{h1}	Hold time, data and control signal to falling edge of ODCK	1 pixel/clock, PIXS = low, OCK_INV = low	0.6			ns
		2 pixel and STAG, PIXS = high, $\overline{STAG}$ = low, OCK_INV = low	2.5			
		2 pixel/clock, PIXS = high, $\overline{STAG}$ = high, OCK_INV = low	2.9			

(1) Specified as ac parameter to include sensitivity to overshoot, undershoot and reflection.
(2) By characterization
(3) t_{bit} is 1/10 the pixel time, t_{pix}
(4) t_{pix} is the pixel time defined as the period of the RxC input clock. The period of ODCK is equal to t_{pix} in 1-pixel/clock mode or $2t_{pix}$ when in 2-pixel/clock mode.
(5) Measured differentially at 50% crossing using ODCK output clock as trigger
(6) Rise and fall times measured as time between 20% and 80% of signal amplitude.
(7) Data and control signals are QE[23:0], QO[23:0], DE, HSYNC, VSYNC. and CTL[3:1].

AC ELECTRICAL CHARACTERISTICS (continued)

over recommended operating free-air temperature range (unless otherwise noted)

PARAMETER		TEST CONDITIONS	MIN	TYP	MAX	UNIT
t_{su2}	Setup time, data and control signal to rising edge of ODCK	1 pixel/clock, PIXS = low, OCK_INV = high	2.1			ns
		2 pixel/clock, PIXS = high, $\overline{STAG}$ = high, OCK_INV = high	4			
		2 pixel and STAG, PIXS = high, $\overline{STAG}$ = low, OCK_INV = high	1.5			
t_{h2}	Hold time, data and control signal to rising edge of ODCK	1 pixel/clock, PIXS = low, OCK_INV = high	0.5			ns
		2 pixel and STAG, PIXS = high, $\overline{STAG}$ = low, OCK_INV = high	2.4			
		2 pixel/clock, PIXS = high, $\overline{STAG}$ = high, OCK_INV = high	2.1			
f_{ODCK}	ODCK frequency	PIX = low (1-PIX/CLK)	25		165	MHz
		PIX = high (2-PIX/CLK)	12.5		82.5	
	ODCK duty-cycle		40%	50%	60%	
$t_{pd(PDL)}$	Propagation delay time from $\overline{PD}$ low to Hi-Z outputs				9	ns
$t_{pd(PDOL)}$	Propagation delay time from $\overline{PDO}$ low to Hi-Z outputs				9	ns
$t_{t(HSC)}$	Transition time between DE transition to SCDT low(8)			1e6		t_{pix}
$t_{t(FSC)}$	Transition time between DE transition to SCDT high(8)			1600		t_{pix}
$t_{d(st)}$	Delay time, ODCK latching edge to QE[23:0] data output	$\overline{STAG}$ = low, PIXS = high		0.25		t_{pix}

(8) Link active or inactive is determined by amount of time detected between DE transitions. SCDT indicates link activity.

7.2 Parameter Measurement Information

PARAMETER MEASUREMENT INFORMATION

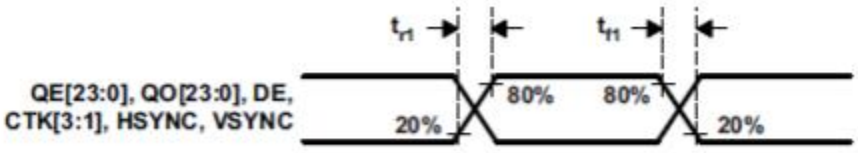


Figure 1. Rise and Fall Times of Data and Control Signals

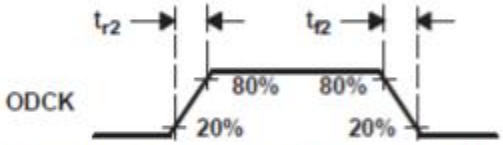


Figure 2. Rise and Fall Times of ODCK

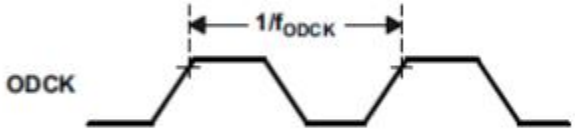


Figure 3. ODCK Frequency

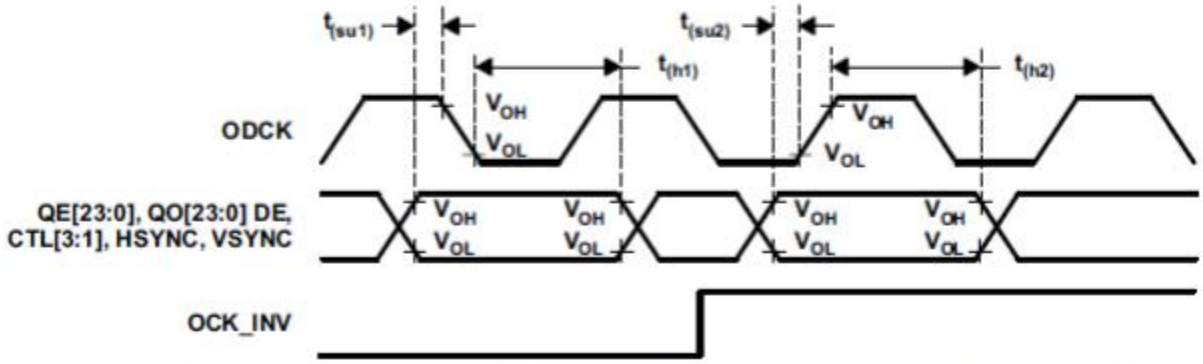


Figure 4. Data Setup and Hold Times to Rising and Falling Edges of ODCK

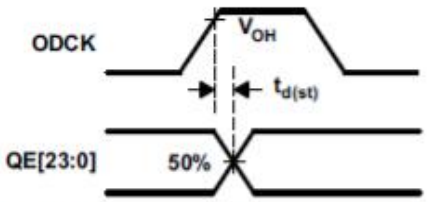


Figure 5. ODCK High to QE[23:0] Staggered Data Output

Figure 6. Analog Input Intra-Pair Differential Skew

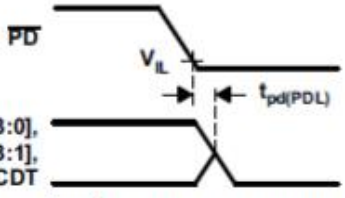


Figure 7. Delay From $\overline{PD}$ Low to Hi-Z Outputs

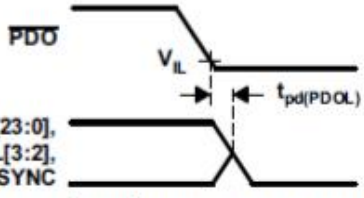


Figure 8. Delay From $\overline{PDO}$ Low to Hi-Z Outputs

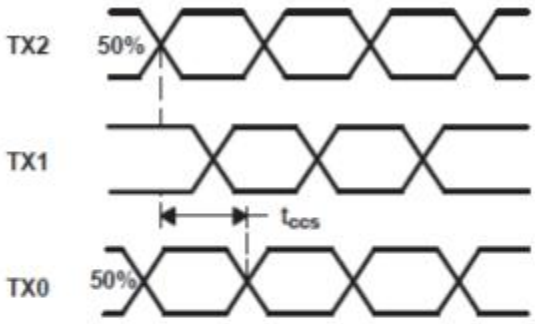


Figure 11. Analog Input Channel-to-Channel Skew

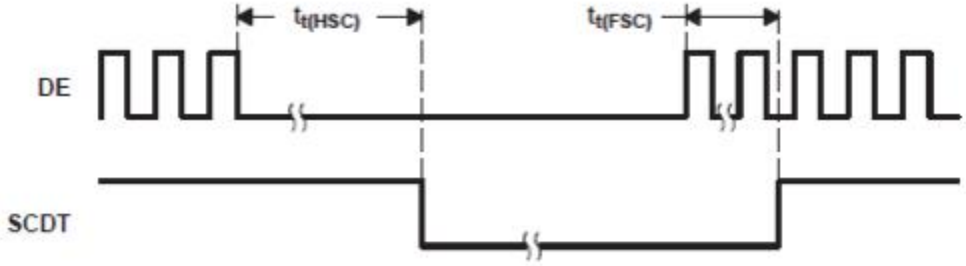


Figure 12. Time Between DE Transitions to SCDT Low and SCDT High

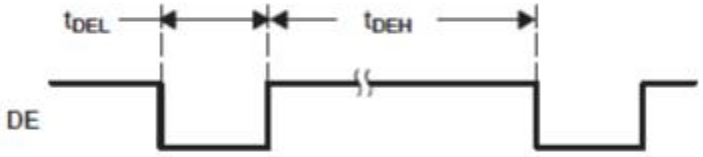


Figure 13. Minimum DE Low and Maximum DE High

DETAILED DESCRIPTION
PARAMETER MEASUREMENT INFORMATION (continued)

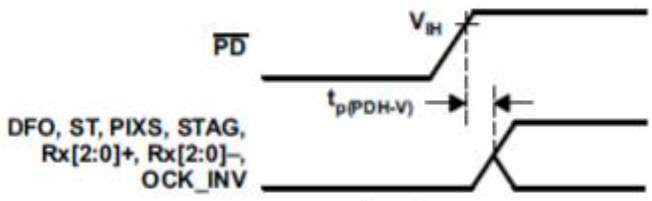


Figure 9. Delay From $\overline{PD}$ Low to High Before Inputs Are Active

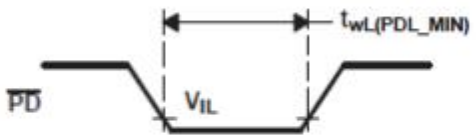
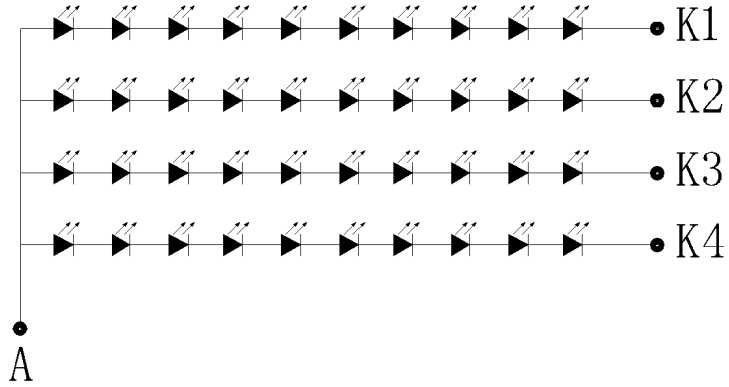


Figure 10. Minimum Time $\overline{PD}$ Low

8. Backlight Characteristic



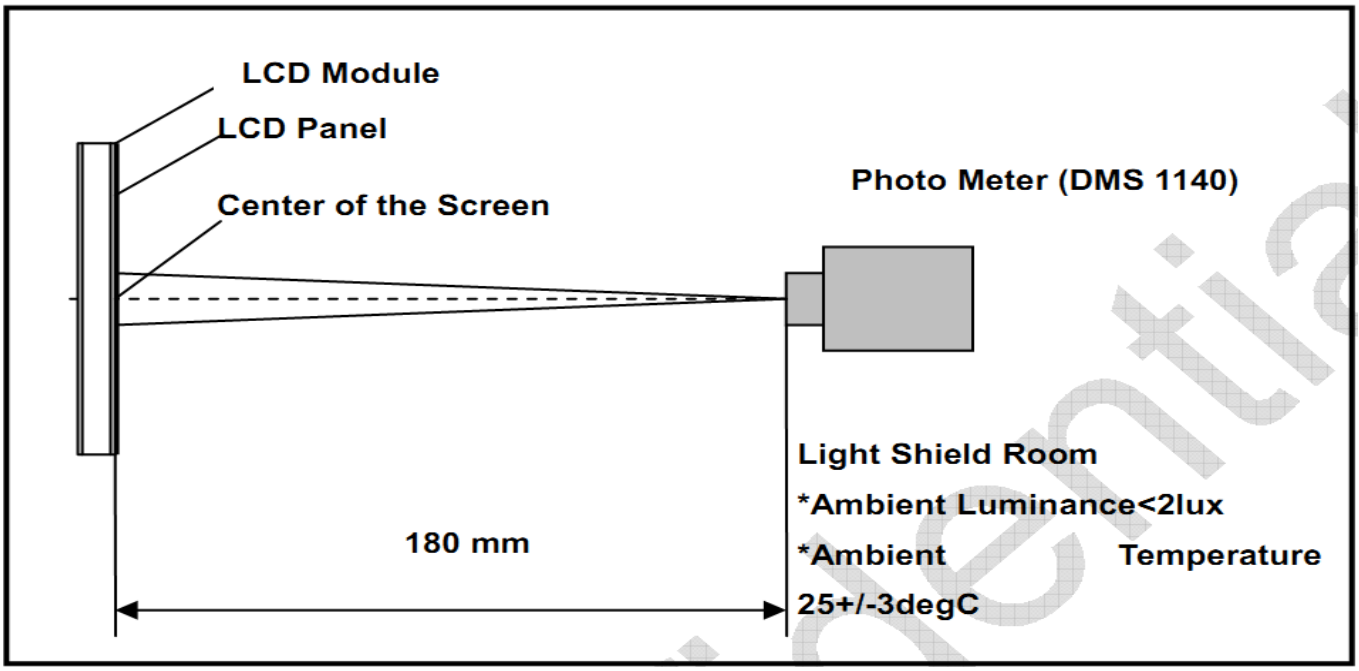
Item	Symbol	Conditions	Min.	Typ.	Max.	Unit
Voltage for LED Backlight	VF	If=80mA	27.5	31.0	34.0	V
Current for LED Backlight	IF		-	80	-	mA
Color	White					

Note: LED life time is defined as the time when Brightness becomes 50 % of the original value at Ta=25°C.

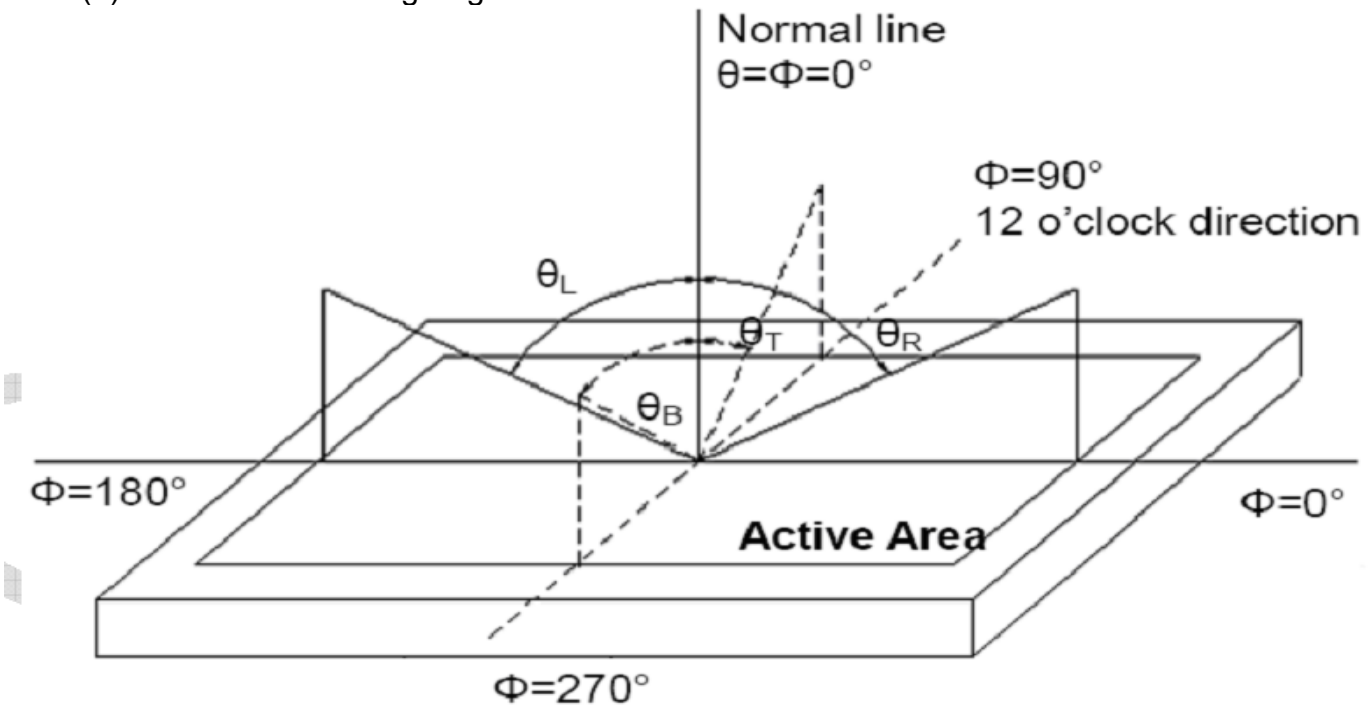
9. Optical Characteristics

Item	Conditions		Min.	Typ.	Max.	Unit	Note
Viewing Angle (CR>10)	Horizontal	θL	75	85	-	degree	(1),(2),(6)
		θR	75	85	-		
	Vertical	θT	75	85	-		
		θB	75	85	-		
Contrast Ratio	Center		600	800	-	-	(1),(3),(6)
Response Time	TR+TF		-	25	50	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			0.31		-	
	White y			0.35		-	
Luminance	L		350	450	-	cd/m^2	

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



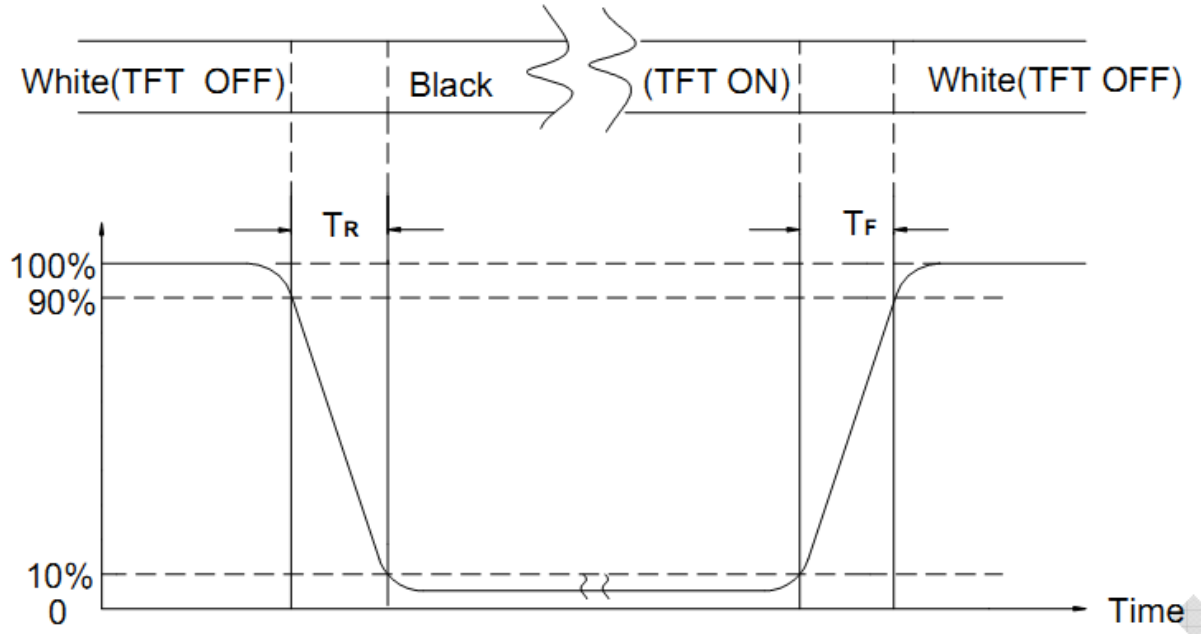
Note (3) Definition of Contrast Ratio (CR)

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

ITEM	Test Conditions	Remark
High Temperature Storage	80°C	Note1, Note2
Low Temperature Storage	30°C	Note1, Note2
High Temperature Operation	70°C	Note1, Note2
Low Temperature Operation	-20°C	Note1, Note2
Operation at High Temperature and Humidity	+60°C, 90%RH	Note1, Note2
Thermal Shock	-20°C /30min ~ +60°C /30min for a total 10cycles. Start with cold temperature and end with high temperature.	
Package Drop Test	Height 60cm 1corner, 3edges, 6surfaces	
Elector Static Discharge	±2KV, Human Body Mode, 150pF/330Ω	

Note1: In the standard condition, there shall be no practical problem that may affect the display function. After the reliability test, the product only guarantees operation, but don't guarantee all of the cosmetic specification.

Note2: Before cosmetic and function test, the product must have enough recovery time, at least 2 hours at room temperature.

11. Inspection Standard

11.1 Inspection Conditions

Inspection performed under the following conditions is recommended.

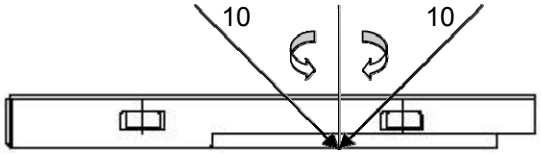
Temperature: 25±5°C

Humidity: 65%±10%RH

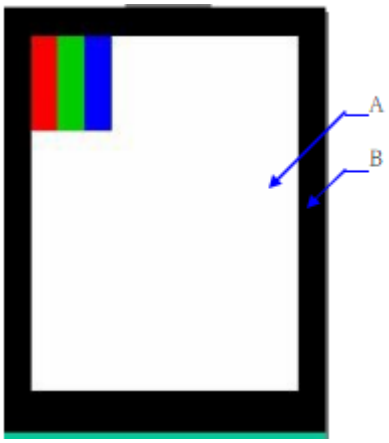
Viewing Angle: Normal viewing Angle.

Illumination: Single fluorescent lamp (300 to 700Lux)

Viewing distance: 30-50cm



11.2 Definition



A: Viewing area

B: Outside viewing area

11.3 Sampling Plan

The defects classify of AQL as following:

AQL:

Major defect	Minor defect
0.65	**2.5**

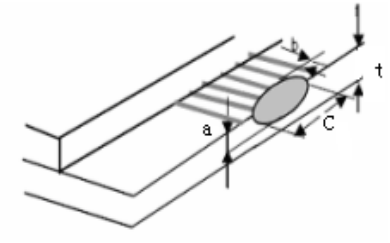
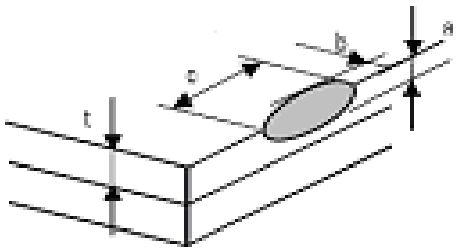
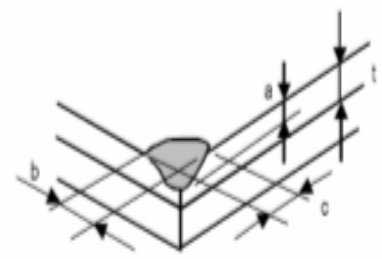
a. When the standard can not be described, AQL will be applied.

b. The sample of the lowest acceptable quality level must be negotiated by both supplier and customer when any dispute happened.

c. New item must be added on time when it is necessary.

11.4 Criteria (Visual)

<table>
<tr><th>No.</th><th>Item</th><th>Criterion</th><th>AQL</th></tr>
<tr><td>01</td><td>Electrical testing</td><td>1.1 Missing vertical, horizontal segment, segment contrast defect.
1.2 Missing character, dot or icon.
1.3 Display malfunction.
1.4 No function or no display.
1.5 Current consumption exceeds product specifications.
1.6 Flicker</td><td>0.65</td></tr>
<tr><td>02</td><td>Line defect (LCD, BL, TP, POL surface)</td><td>
<table>
<tr><th rowspan="2">module size</th><th rowspan="2">Length(L)</th><th rowspan="2">Width (W)</th><th colspan="2">Acceptance (Q’ty)</th></tr>
<tr><th>A area</th><th>B area</th></tr>
<tr><td rowspan="5">3.5” to less 9”</td><td>---</td><td>W ≤ 0.03</td><td>Ignore</td><td rowspan="5">Ignore</td></tr>
<tr><td>L ≤10.0</td><td>0.03 < W ≤ 0.05</td><td>4</td></tr>
<tr><td>L ≤5.0</td><td>0.05 < W ≤ 0.10</td><td>2</td></tr>
<tr><td>---</td><td>0.10 < W</td><td>As round type</td></tr>
<tr><td colspan="2">Total</td><td>5</td></tr>
<tr><td rowspan="4">9” to 15”</td><td>---</td><td>W ≤ 0.05</td><td>Ignore</td><td rowspan="4">Ignore</td></tr>
<tr><td>L ≤10.0</td><td>0.05< W ≤ 0.10</td><td>5</td></tr>
<tr><td>---</td><td>0.10 < W</td><td>As round type</td></tr>
<tr><td colspan="2">Total</td><td>5</td></tr>
</table>
X: Length Y: Width
</td><td>2.5</td></tr>
<tr><td>03</td><td>Poor spots (Bright, Color spots, Dark Spots, white Spots, dirty spots, bubble spots)</td><td>
<table>
<tr><th rowspan="2">Dimension (diameter Φ)</th><th colspan="2">Acceptance (Q’ty)</th></tr>
<tr><th>A area</th><th>B area</th></tr>
<tr><td>Φ ≤ 0.25</td><td>Ignore</td><td rowspan="4">Ignore</td></tr>
<tr><td>0.25 < Φ ≤ 0.50</td><td>5</td></tr>
<tr><td>0.50 < Φ</td><td>0</td></tr>
<tr><td>Total</td><td>5</td></tr>
</table>
Φ：Diameter
</td><td>2.5</td></tr>
</table>

No.	Item	Criterion	AQL
04	Chipped glass	(1) The PAD face ITO is partially broken  a≤t b≤1.0mm c≤3.0mm (2) Frame edge broken  a≤t b≤1.0mm c≤3.0mm (3)The corner is broken  a≤t; b+ c≤3.0mm	2.5

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 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