

**PRODUCT SPECIFICATION****TFT-LCD MODULE****Module No: 312266-01**☒ Preliminary Specification☐ Approval Specification

Designed by	Checked by	Approved by

Final Approval by Customer

Approved by	Comment

For more information, contact us:

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※The specification of "TBD" should refer to the measured value of sample . If there is difference between the design specification and measured value, we naturally shall negotiate and agree to solution with customer.

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Revision Record

[illegible]

1. Numbering System

2. TFT General Information

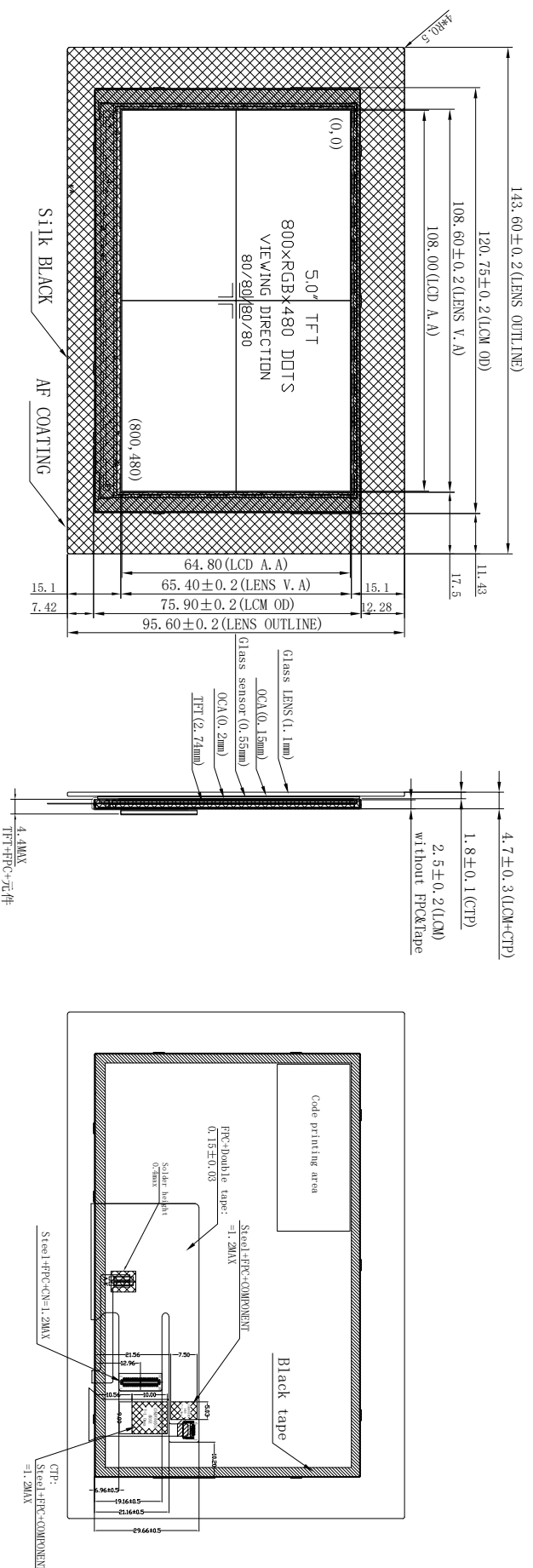
ITEM	STANDARD VALUES	UNITS
LCD type	5.0" TFT	--
Dot arrangement	800H × 480V	dots
Color filter array	RGB vertical stripe	--
Display mode	IPS / Transmissive / Normally Black	--
Viewing Direction	80/80/80/80	--
LCM+CTP Outline Dimension	143.60(W) × 95.60(H) × 4.70(T)	mm
Active area	108.00(W) × 64.80(H)	mm
Dot pitch	0.135(H) × 0.135(V)	mm
Interface	3line SPI + 24bit RGB	--

3. External Dimensions

Front View

Side View

Back View



25	G7	50	GND	3	NC	26	G6	1	NC	25	G5	Pin	Symbl	Pin	Symbl
24	G6	49	CTP-SDA	2	A	27	G5	2	A	27	G5	2	A	27	G5
23	R1	47	CTP-SCL	3	A	28	G4	3	A	28	G4	3	A	28	G4
22	R2	48	CTP	4	K	29	G1	4	K	29	G1	4	K	29	G1
21	R3	45	CTP-INT	5	K	30	G3	5	K	30	G3	5	K	30	G3
20	R4	46	BT	6	GND	31	G0	6	GND	31	G0	6	GND	31	G0
19	R5	44	CTP-RST	7	NC	32	G2	7	NC	32	G2	7	NC	32	G2
18	R6	43	CTP	8	VCC1	33	B7	8	VCC1	33	B7	8	VCC1	33	B7
17	R7	42	/S	9	/RESET	34	NC	9	/RESET	34	NC	9	/RESET	34	NC
16	DE	41	CTP-VCC	11	V5VNC	36	SDA	11	V5VNC	36	SDA	11	V5VNC	36	SDA
15	GND	40	CTP-VCC	12	HSVNC	37	B5	12	HSVNC	37	B5	12	HSVNC	37	B5
14	P1K	39	B4	13	GND	38	SCK	13	GND	38	SCK	13	GND	38	SCK
13	GND	38	SCK	14	P1K	39	B4	14	P1K	39	B4	14	P1K	39	B4
12	DE	41	CTP-VCC	15	GND	40	CTP-VCC	15	GND	40	CTP-VCC	15	GND	40	CTP-VCC
11	R7	42	/S	16	DE	41	CTP	16	DE	41	CTP	16	DE	41	CTP
10	R6	43	CTP	17	R7	42	/S	17	R7	42	/S	17	R7	42	/S
9	R5	44	CTP-RST	18	R6	43	CTP	18	R6	43	CTP-RST	18	R6	43	CTP-RST
8	R4	45	BT	19	R5	44	CTP-RST	19	R5	44	CTP-RST	19	R5	44	CTP-RST
7	R3	46	CTP-INT	20	R4	45	BT	20	R4	45	BT	20	R4	45	BT
6	R2	47	CTP	21	R3	46	CTP-INT	21	R3	46	CTP-INT	21	R3	46	CTP-INT
5	R1	48	CTP-SCL	22	R2	47	CTP	22	R2	47	CTP	22	R2	47	CTP
4	G7	50	GND	23	R1	48	CTP-SCL	23	R1	48	CTP-SCL	23	R1	48	CTP-SCL
3	G6	49	CTP-SDA	24	G7	50	GND	24	G7	50	GND	24	G7	50	GND

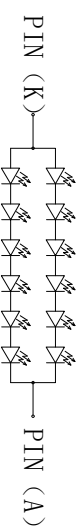
CTP-PIN

PIN	Name
1	CTP_VCC
2	GND
3	CTP_INT
4	CTP_RST
5	CTP_SDA
6	CTP_SCL

CTP NOTE:

1. G+G+FPC+OCA
LENS GLASS: 1.1mm
SENSOR GLASS: 0.55mm
IC: FT5426
2. Operation Voltage: 2.8V-3.3 V
3. Transmittance: $\geq 82\%$
4. The cover hardness: 6H

IF=40mA, VF=1.8. 6V (TYP)



Notes:

1. Display : 5.0", TFT
2. Resolution: 800xRGBx480
3. LCD Viewing Direction: ALL,
4. Display Mode: Normally Black
5. LCM Brightness: 380cd/m²(TYP)
- LCM+CTP Brightness: 330cd/m²(TYP)
6. unmark Tolerance: ±0.2
7. OPERATING TEMP: -20° C ~ +70° C
8. STORAGE TEMP: -30° C ~ +80° C
9. Requirements on Environmental Protection: ROHS

3		
2		
1	NEW	
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REV	DESCRIPTION	DATE NAME
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SCALE: 1/1					UNIT: mm		PAGE: 1/1				Approve		Check		Drawn	
Part No:					312266-01				VER: V0							
Customer No:																

DCU  **TEK**

4. Interface Description

PIN NO.	PIN NAME	DESCRIPTION
1	NC	NC
2	A	Power supply for backlight anode input terminal.
3	A	Power supply for backlight anode input terminal.
4	K	Power supply for backlight cathode input terminals.
5	K	Power supply for backlight cathode input terminals.
6	GND	Ground
7	NC	NC
8	VCI	TFT and CTP power supply input.
9	VCI	TFT and CTP power supply input.
10	/RESET	Reset signal input terminal, active at 'L'.
11	VSYNC	Vertical Sync Input
12	HSYNC	Horizontal Sync Input
13	GND	Ground
14	PCLK	Dot Data Clock
15	GND	Ground
16	DE	Data Enable Input
17	R7	Red data bus.
18	R6	
19	R5	
20	R4	
21	R3	
22	R2	
23	R1	
24	R0	
25	G7	Green data bus.
26	G6	
27	G5	
28	G4	
29	G1	
30	G3	
31	G0	
32	G2	

33	B7	Blue data bus.
34	NC	NC
35	B6	Blue data bus.
36	SDA	SPI Interface Data.
37	B5	Blue data bus.
38	SCL	SPI Interface Data Clock.
39	B4	Blue data bus.
40	NC	NC
41	B3	Blue data bus.
42	/CS	Chip select signal, Active "L"
43	B2	Blue data bus.
44	CTP_RST	CTP reset line.
45	B1	Blue data bus.
46	CTP_INT	CTP interrupt line.
47	B0	Blue data bus.
48	CTP_SCL	CTP I2C clock line.
49	CTP_SDA	CTP I2C data line.
50	GND	Ground

5. Absolute Maximum Ratings

Item	Symbol	Min.	Max.	Unit
Analog Supply Voltage	VCI	-0.3	3.6	V
Input Voltage	V _{in}	-0.3	VCI+0.5	V
Operating Temperature	T _{OP}	-20	70	°C
Storage Temperature	T _{ST}	-30	80	°C
Storage Humidity	HD	20	90	%RH

6. DC Characteristics

Item	Symbol	Min.	Typ.	Max.	Unit	Remark
Analog Supply Voltage	VCI	2.5	2.8	3.3	V	-
Input High Voltage	V _{IH}	0.7VCI	-	VCI	V	Digital input pins
Input Low Voltage	V _{IL}	GND	-	0.3VCI	V	Digital input pins
Output High Voltage	V _{OH}	0.8VCI	-	VCI	V	Digital output pins
Output Low Voltage	V _{OL}	GND	-	0.2VCI	V	Digital output pins
I/O Leak Current	I _{LI}	-1.0	-	1.0	uA	-

7. Timing Characteristics

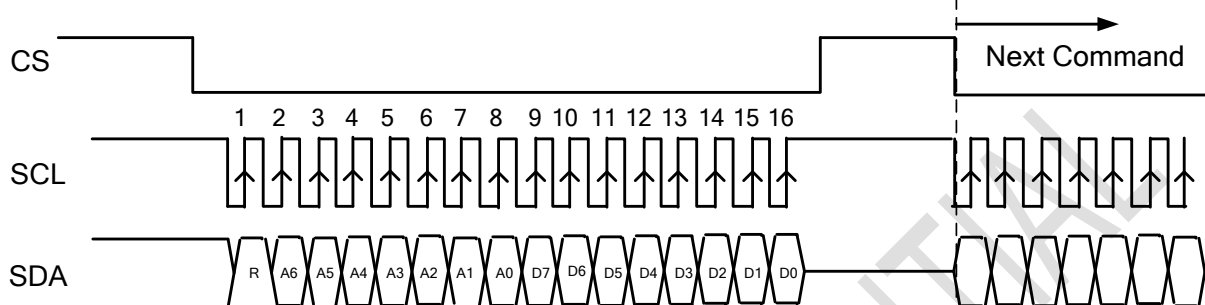
7.1 3-wire Serial Interface

R/W: Read/Write mode control bit.

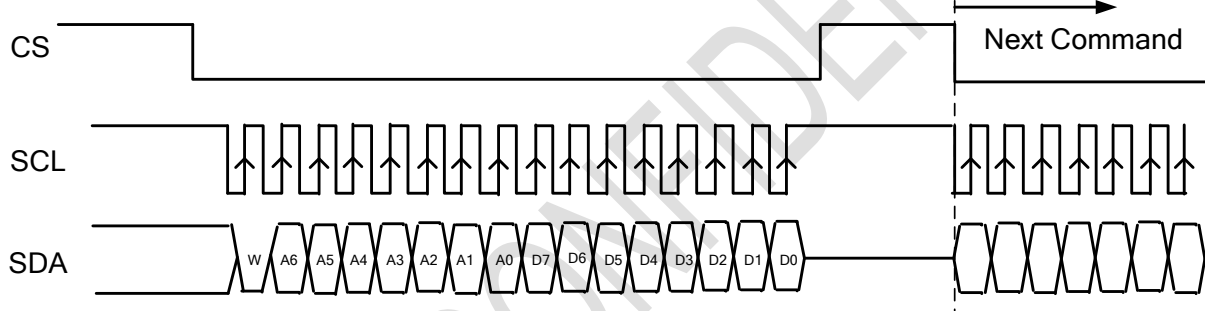
R/W=1: Read mode

R/W=0: Write mode

Read Mode



Write Mode



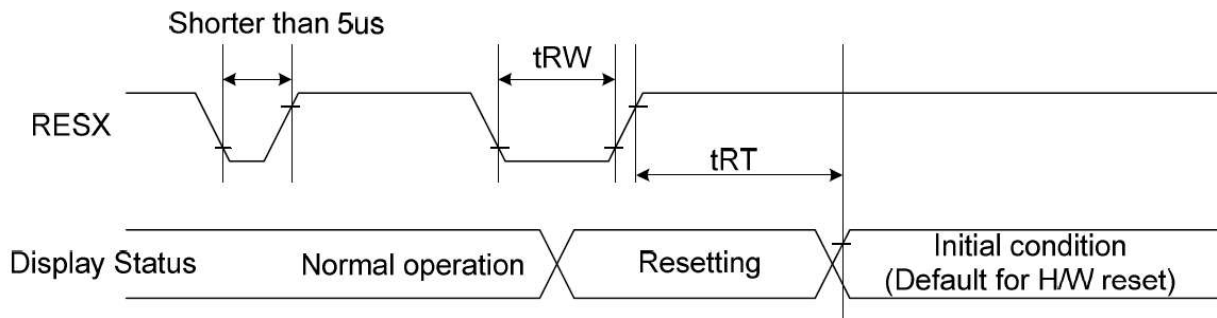
- Each serial command consists of 16 bits of data which is loaded one bit a time at the rising edge of serial clock SCL.
- Command loading operation starts from the falling edge of CS and is completed at the next rising edge of CS.
- The serial control block is operational after power on reset, but commands are established by the VSYNC signal. If command is transferred multiple times for the same register, the last command before the VSYNC signal is valid.
- If less than 16 bits of SCL are input while CS is low, the transferred data is ignored.
- If 16 bits or more of SCL are input while CS is low, the previous 16 bits of transferred data before then rising edge of CS pulse are valid data.
- Serial block operates with the SCL clock.
- Serial data can be accepted in the power save mode.
- After power on reset or GRB reset, it is required 100ms delay to begin SPI communication.

7.2. Parallel 24-bit RGB Input Timing Table

Parallel 24-bit RGB Input Timing (PVDD=VDD=VDDI= 3.3V, AGND= 0V, TA=25°C).

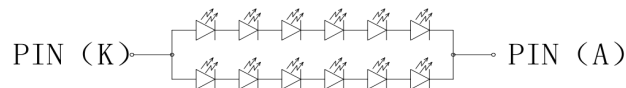
Parallel 24-bit RGB Interface Timing Table						
Item	Symbol	Min.	Typ.	Max.	Unit	Remark
DCLK Frequency	Fclk	23	25	27	MHz	.
HSYNC	Period Time	Th	808	816	848	DCLK
	Display Period	Thdisp	800			DCLK
	Back Porch	Thbp	4	8	24	DCLK
	Front Porch	Thfp	4	8	24	DCLK
	Pulse Width	Thw	2	4	8	DCLK
VSYNC	Period Time	Tv	496	512	528	HSYNC
	Display Period	Tvdisp	480			HSYNC
	Back Porch	Tvbp	8	16	24	HSYNC
	Front Porch	Tvfp	8	16	24	HSYNC
	Pulse Width	Tvw	2	4	8	HSYNC

7.3 Reset Timing Characteristics



Signal	Symbol	Parameter	Min	Max	Unit
RESX	t_{RW}	Reset pulse duration	10		uS
	t_{RT}	Reset cancel		5 (note 1,5)	mS
				120 (note 1,6,7)	mS

8. Backlight Characteristics



$I_F=40\text{mA}$, $V_F=18.6\text{V}$ (TYP)

Item	Symbol	MIN	TYP	MAX	UNIT	Test Condition
Supply Voltage	V_f	-	18.6	-	V	$I_f=40\text{mA}$
Supply Current	I_f	-	40	-	mA	-
Luminous Intensity	-	-	330	-	Cd/m^2	$I_f=40\text{mA}$
Uniformity for LCM	-	80	-	-	%	$I_f=40\text{mA}$
Life Time	-	30000	-	-	Hr	$I_f=40\text{mA}$
Backlight Color	White					

9. Optical Characteristics

<Table 1. Optical Specifications>

[Ta=25±2°C]

Parameter		Symbol	Condition	Min.	Typ.	Max.	Unit	Remark
Viewing Angle Range	Horizontal	Θ_3	CR > 10	70	80	-	Deg.	Note 4.1
		Θ_9		70	80	-	Deg.	
	Vertical	Θ_{12}		70	80	-	Deg.	
		Θ_6		70	80	-	Deg.	
Contrast Ratio		CR	$\Theta = 0^\circ$	1000	1200	-		w/o APF @C Light Note 4.2/4.3
Cell Transmittance		Tr		4.15	4.9	-	%	
Reproduction of color		Rx	$\Theta = 0^\circ$	0.595	0.625	0.655		With @C Light Note 4.4
		Ry		0.283	0.313	0.343		
		Gx		0.282	0.312	0.342		
		Gy		0.534	0.564	0.594		
		Bx		0.111	0.141	0.171		
		By		0.113	0.143	0.173		
		Wx		0.278	0.308	0.338		
		Wy		0.309	0.339	0.369		
Color Gamut			$\Theta = 0^\circ$	50	55	-	%	
Response Time		Tr+Tf	Ta= 25° C $\Theta = 0^\circ$	-	30	40	ms	Note 4.5

Note:

- Viewing angle is the angle at which the contrast ratio is greater than 10. The viewing are determined for the horizontal or 3, 9 o'clock direction and the vertical or 6, 12 o'clock direction with respect to the optical axis which is normal to the LCD surface (see FIG.2).
- Contrast measurements shall be made at viewing angle of $\Theta = 0$ and at the center of the LCD surface. Luminance shall be measured with all pixels in the view field set first to white, then to the dark (black) state. (See FIG. 2) Luminance Contrast Ratio (CR) is defined mathematically. CR = White Luminance (ON) / Black Luminance (OFF)
- Transmittance is the value with DBEF Polarizer.
- The color chromaticity coordinates specified in Table1 shall be calculated from the spectral data measured with all pixels first in red, green, blue and white. Measurements shall be made at the center of the C/F. Measurement condition is C - light source & Halogen Lamp
- The electro-optical response time measurements shall be made as FIG.3 by switching the "data" input signal ON and OFF. The times needed for the luminance to change from 10% to 90% is Tr , and 90% to 10% is Tf.

Figure 1. The definition of V_{th} & V_{sat}

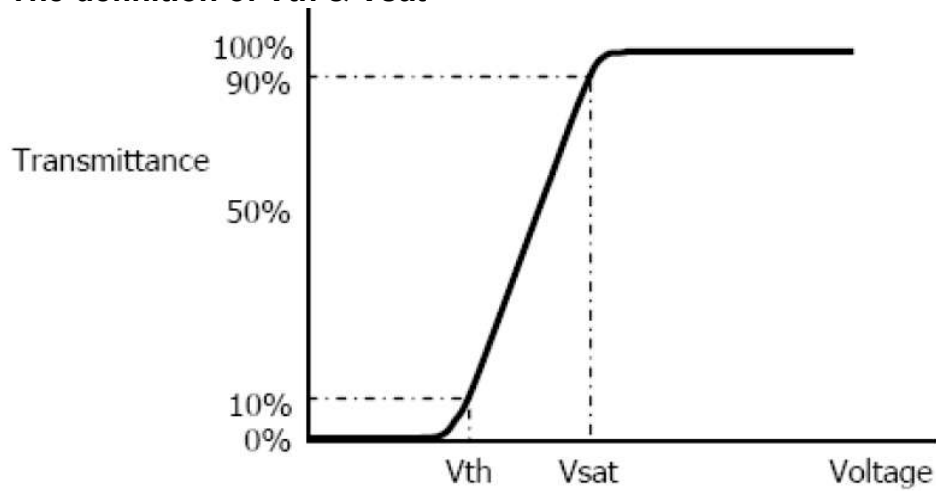


Figure 2. Measurement Set Up

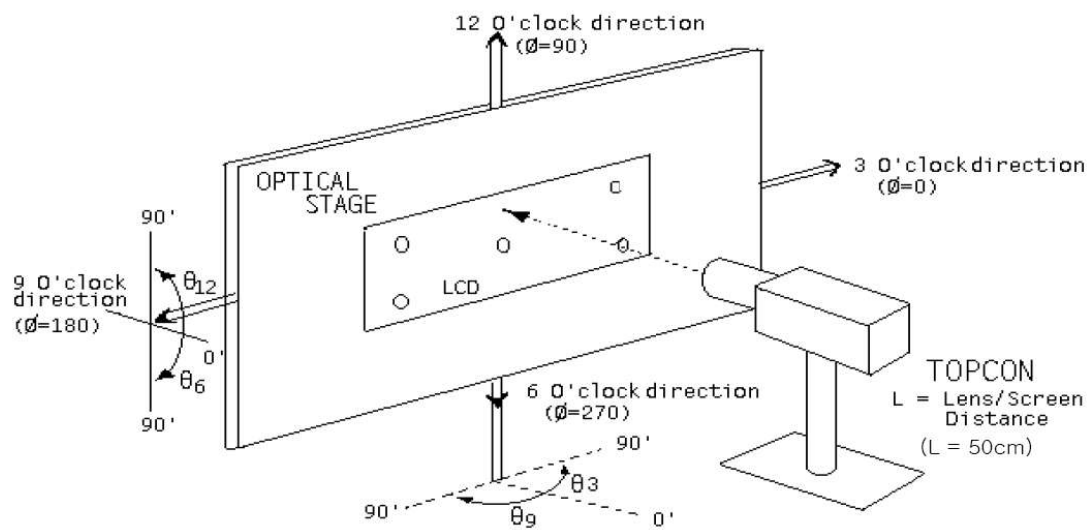
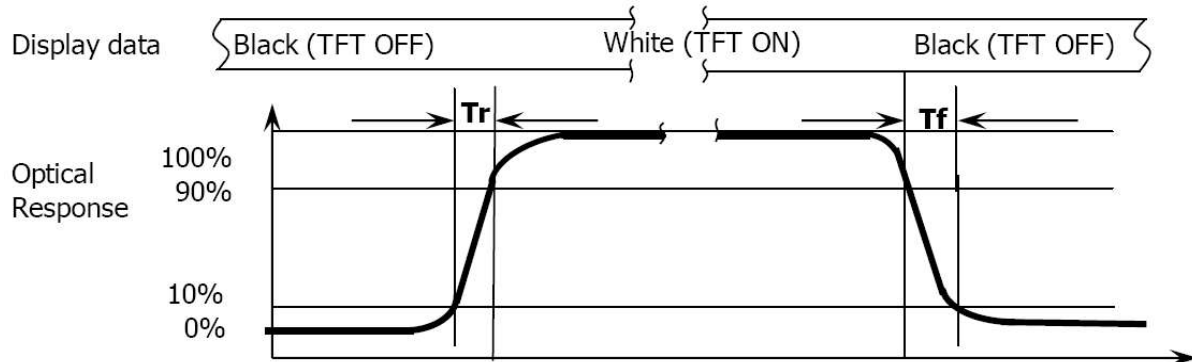


Figure 3. Response Time Testing



10. Reliability Test Conditions And Methods

NO.	TEST ITEMS	TEST CONDITION	INSPECTION AFTER TEST
①	High Temperature Storage	80℃±2℃×96Hours	Inspection after 2~4hours storage at room temperature,the samples should be free from defects: 1,Air bubble in the LCD. 2,Sealleak. 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 charateristic requirements shall be satisfied.
②	Low Temperature Storage	-30℃±2℃×96Hours	
③	High Temperature Operating	70℃±2℃×96Hours	
④	Low Temperature Operating	-20℃±2℃×96Hours	
⑤	Temperature Cycle(Storage)	-10℃ $\longleftrightarrow$ 25℃ $\longleftrightarrow$ 60℃ (30min) (5min) (30min) 1cycle Total 10cycle	
⑥	Damp Proof Test (Storage)	50℃±5℃×90%RH×96Hours	
⑦	Vibration Test	Frequency:10Hz~55Hz~10Hz Amplitude:1.5M X,Y,Z direction for total 3hours (Packing Condition)	
⑧	Drooping Test	Drop to the ground from 1M height one time every side of carton. (Packing Condition)	
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 excepted 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

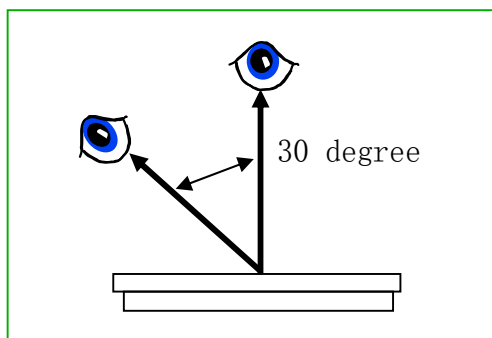
This standard apply to C-STN/TFT module

1. Spot check plan:

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

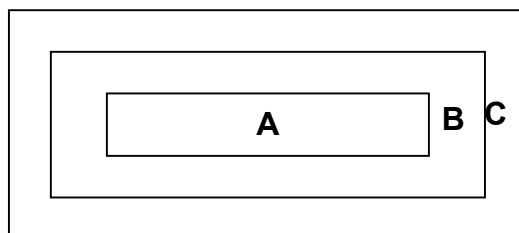
A 级: major non-conformance: AQL 0.65 minor non-conformance: AQL 1.

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

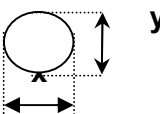
Remark :non-conformance at area C,but is OK that isn't influence raliability of product & assembly by customer.

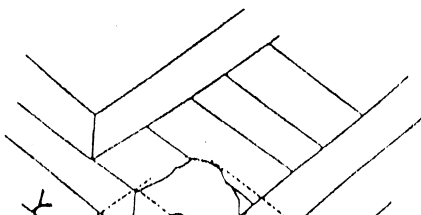
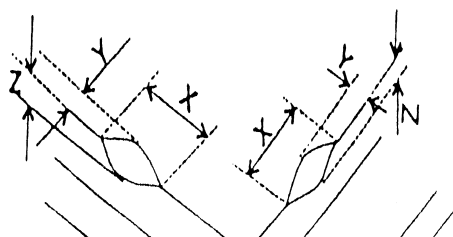
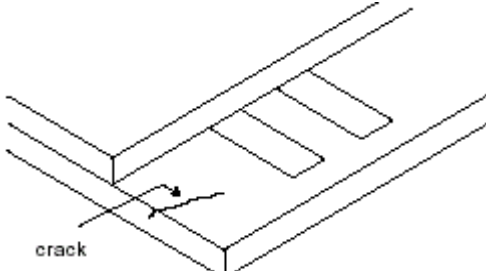
4. Inspection standard

4.1 Major non-conformance

NO.	Item	Inspection standard	Rate
4.1.1	Function non-conformance	1) No display, display abnormaly 2) Miss line, short 3) B/L no function or function abnormaly 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

NO.	Item	Inspection standard	Rate																											
4.2.1	Black or white spot (power on)	dot non-conformance define Φ $\Phi = \frac{(x+y)}{2}$ 	Minor																											
		A grade <table> <tr> <th rowspan="2"> area size (mm) </th> <th colspan="3">Most approve q'ty</th> </tr> <tr> <th>A</th> <th>B</th> <th>C</th> </tr> <tr> <td>$\Phi \leq 0.10$</td> <td colspan="2">ignore</td> <td rowspan="5">ignore</td> </tr> <tr> <td>$0.10 < \Phi \leq 0.15$</td> <td colspan="2">3</td> </tr> <tr> <td>$0.15 < \Phi \leq 0.20$</td> <td colspan="2">2</td> </tr> <tr> <td>$0.20 < \Phi \leq 0.25$</td> <td colspan="2">1</td> </tr> <tr> <td>$0.25 < \Phi$</td> <td colspan="2">0</td> </tr> </table>		area size (mm)	Most approve q'ty			A	B	C	$\Phi \leq 0.10$	ignore		ignore	$0.10 < \Phi \leq 0.15$	3		$0.15 < \Phi \leq 0.20$	2		$0.20 < \Phi \leq 0.25$	1		$0.25 < \Phi$	0					
		area size (mm)			Most approve q'ty																									
				A	B	C																								
		$\Phi \leq 0.10$		ignore		ignore																								
		$0.10 < \Phi \leq 0.15$		3																										
		$0.15 < \Phi \leq 0.20$		2																										
		$0.20 < \Phi \leq 0.25$		1																										
$0.25 < \Phi$	0																													
Most approve 4 damages, dot to dot $\geq 10\text{mm}$																														
4.2.2	Black or white line (power on)	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>$W \leq 0.03$</td> <td colspan="2">ignore</td> <td rowspan="5">ignore</td> </tr> <tr> <td>$L \leq 5.0$</td> <td>$0.03 < W \leq 0.05$</td> <td colspan="2">2</td> </tr> <tr> <td>$L \leq 3.0$</td> <td>$0.05 < W \leq 0.07$</td> <td colspan="2">1</td> </tr> <tr> <td></td> <td>$0.07 < W$</td> <td colspan="2">Treat with dot non-conformance</td> </tr> </table>	Size(mm)		Most approve q'ty			L(length)	W(width)	A	B	C	ignore	$W \leq 0.03$	ignore		ignore	$L \leq 5.0$	$0.03 < W \leq 0.05$	2		$L \leq 3.0$	$0.05 < W \leq 0.07$	1			$0.07 < W$	Treat with dot non-conformance		Minor
		Size(mm)		Most approve q'ty																										
		L(length)	W(width)	A	B	C																								
		ignore	$W \leq 0.03$	ignore		ignore																								
		$L \leq 5.0$	$0.03 < W \leq 0.05$	2																										
		$L \leq 3.0$	$0.05 < W \leq 0.07$	1																										
			$0.07 < W$	Treat with dot non-conformance																										
Most approve 3 damages, line to line $\geq 10\text{mm}$																														
4.2.3	Polarizer position	1) polarizer attach meet drawing,disallow out of LCD.	Minor																											
		2) polarizer must cover display area (special require unless)																												

4.2.4	LCD non-conformance	(i) crash at side (remark: S=ITO length)  <table border="1"><tr><td>X</td><td>Y</td><td>Z</td></tr><tr><td>≤3.0</td><td>≤S</td><td>ignore</td></tr></table> Crash disallow extend to ITO or seal.	X	Y	Z	≤3.0	≤S	ignore	Minor	
		X	Y	Z						
		≤3.0	≤S	ignore						
(ii) commonly surface scathe  <table border="1"><tr><td>X</td><td>Y</td><td>Z</td></tr><tr><td>≤2.0</td><td><frame edge</td><td>ignore</td></tr></table>	X	Y	Z	≤2.0	<frame edge	ignore				
X	Y	Z								
≤2.0	<frame edge	ignore								
(iii) crack Disallow extend crack 										
4.2.5	Contrast voltage arp	VOP/Vlcd voltage of confirmed sample±0.15V	Minor							
4.2.6	color	Color & luminance of module scope reference spec	Minor							
4.2.7	Cross talk	Reference confirmed limit sample	Minor							

12. Handling Precautions

12.1 Mounting method

The LCD panel of LTK LCD module consists of two thin glass plates with polarizers which easily be damaged. And since the module is 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 silicide coated on the pad, ITO patterns could be damaged due to the corrosion as time goes on.

If ITO corrosion happens 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 uses C-MOS LSI drivers, so we recommend that you:

Connect any unused input terminal to Vdd or Vss, do not input any signals before power is turned on, and ground your body, work/assembly areas, 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 directly 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 than the limit causes 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 than the operating temperature range and on the other hand at higher temperature LCD's show 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.
- A 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 storage

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 LTK LCD , 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