广东华美光电科技有限公司

产品规格书

产品型号: HMT602433
文件版本:00

Designed by	R&D Checked by	Holitech Department by	Approved by

Approval by Customer

Approved By _____

广东华美光电科技有限公司

DOCUMENT REVISION HISTORY

Sample Version	DOC. Version	DATE	DESCRIPTION		CHANGED BY
A2	00	2018-06-27	FULL SPEC	First issue	GJH

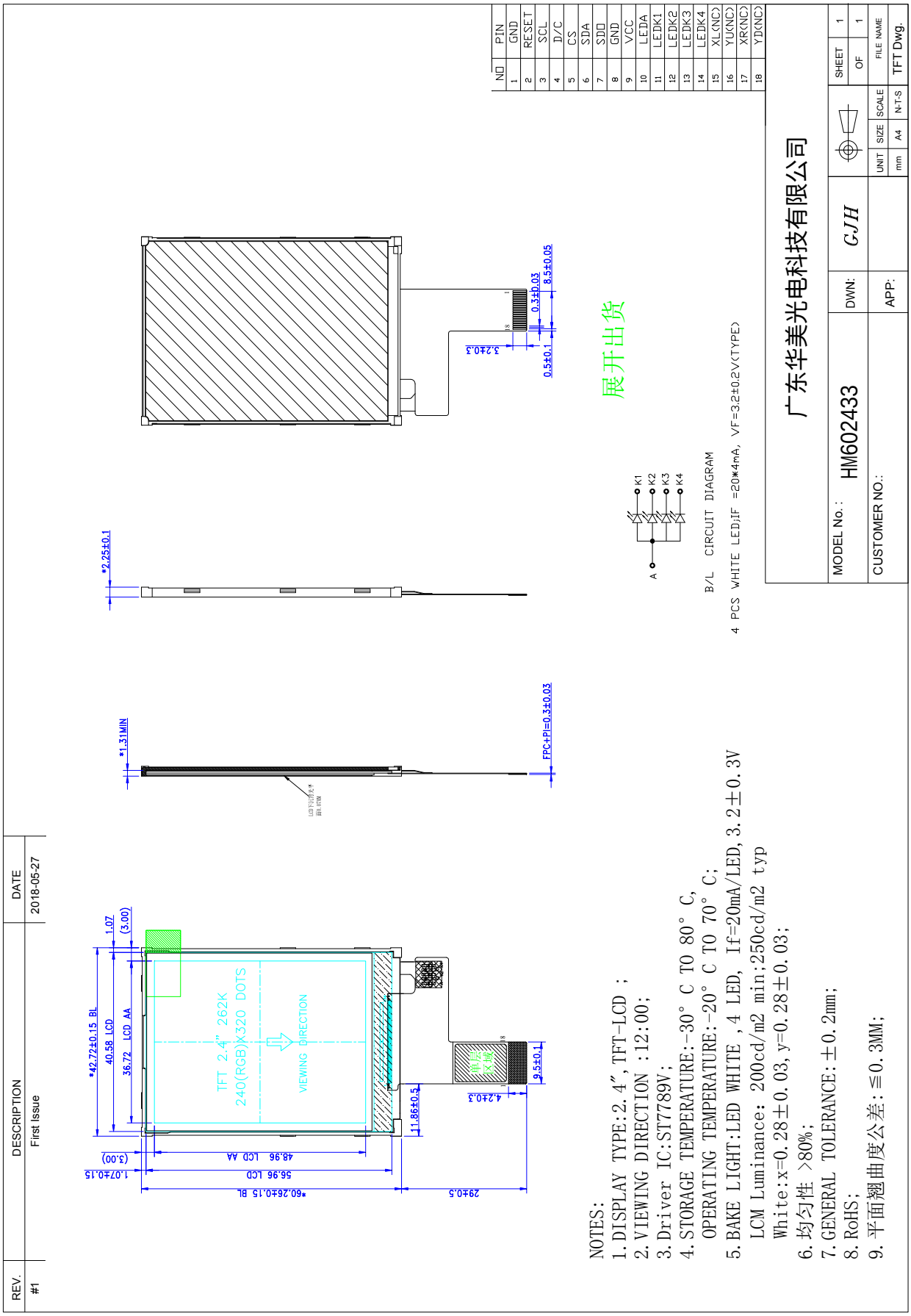
广东华美光电科技有限公司

Table Of Contents

1. General Information

NO	Item	Contents	Unit
(1)	Module outsize（mm）	42.72(H)x60.26(V)x2.25(T)	mm
(2)	Lcd active aera（mm）	36.72(H)x48.96(V)	mm
(3)	Display resolution（dot）	240(H)x3(RGB)x320(V)	dot
(4)	Screen size（inch）	2.4	inch
(5)	Dot pitch(mm)	0.153(H)x0.153(V)	mm
(6)	Color configuration	RGB Vertical stripe	-
(7)	Support color	262K(6 bit)	-
(8)	Display mode	Normal White	-
(9)	Viewing direction	12 O’clock	-
(10)	Lcd type	A-Si TFT	-
(11)	Weight	--	g

2. External Dimensions



NOTES:

1. DISPLAY TYPE:2.4", TFT-LCD ;
2. VIEWING DIRECTION :12:00;
3. Driver IC:ST7789V;
4. STORAGE TEMPERATURE:-30° C TO 80° C,
   OPERATING TEMPERATURE:-20° C TO 70° C;
5. BAKE LIGHT:LED WHITE ,4 LED, If=20mA/LED, 3.2±0.3V
   LCM Luminance: 200cd/m2 min;250cd/m2 typ
   White:x=0.28±0.03, y=0.28±0.03;
6. 均匀性 >80%;
7. GENERAL TOLERANCE:±0.2mm;
8. RoHS;
9. 平面翘曲度公差:≦0.3MM;

3. Interface Description

Pin No.	Symbol	Description
1	GND	Ground
2	RESET	Reset pin
3	SCL	This pin is used to be serial interface clock.
4	D/C	Display data/command selection pin in 4-line serial interface
5	CS	Chip selection pin
6	SDA	The data is latched on the rising edge of the SCL signal
7	SDO	The data is output on the falling edge of the SCL signal
8	GND	Ground
9	VCC	Power supply
10	LED A	Led anode
11-14	LED K1-K4	Led cathode
15	XL(NC)	TP touch(No Connection)
16	YU(NC)	TP touch(No Connection)
17	XR(NC)	TP touch(No Connection)
18	YR(NC)	TP touch(No Connection)

4. Absolute Maximum Ratings

Parameter	SYMBOL	Min	Max	Unit	Remarks
LC operating Voltage	V_{OP}	---	5.0	V	Ta=25±5℃
Operating Temperature (Humidity)	T_{OP}	-20	+70	℃	---
	RH	---	90	%	At 60℃
Storage Temperature (Humidity)	T_{ST}	-30	+80	℃	---
	RH	---	90	%	At 60℃

5. Electrical Characteristics

Parameter	SYMBOL	Value	UNIT	Remarks
Logic power supply voltage	VCC	2.8	V	Ta= +25℃
I/O power supply	IOVCC	1.8~3.3	V	
TFT Gate ON Voltage	VGH	15	V	13~17
TFT Gate OFF Voltage	VGL	-10	V	-8~12
TFT Common Electrode Voltage	VCOMH	0	V	
	VCOML	-2	V	

6.Timing Characteristics.

6.1 Reset Timing Characteristics.

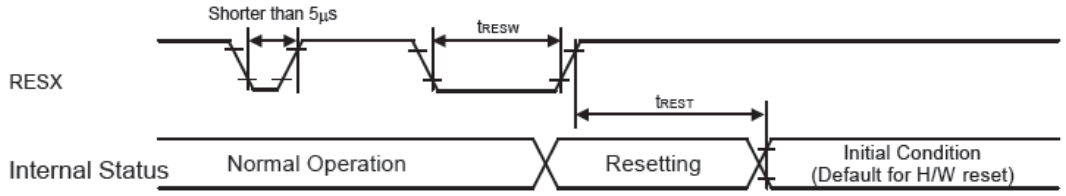


Table 7.3.7.1 Reset input timing

VSS=0V, VDDIO=1.8V to 3.6V, VCI=2.5V to 5.5V,Ta = -30 to 70°C

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

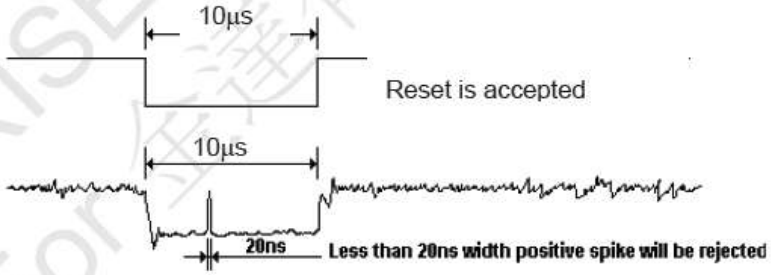
Note 1. Spike due to an electrostatic discharge on RESX line does not cause irregular system reset according to the table below.

RESX Pulse	Action
Shorter than 5µs	Reset Rejected
Longer than 10µs	Reset
Between 5µs and 10µs	Reset starts (It depends on voltage and temperature condition.)

Note 2. During the resetting period, the display will be blanked (The display is entering blanking sequence, which maximum time is 120 ms, when Reset Starts in Sleep Out –mode. The display remains the blank state in Sleep In –mode) and then return to Default condition for H/W reset.

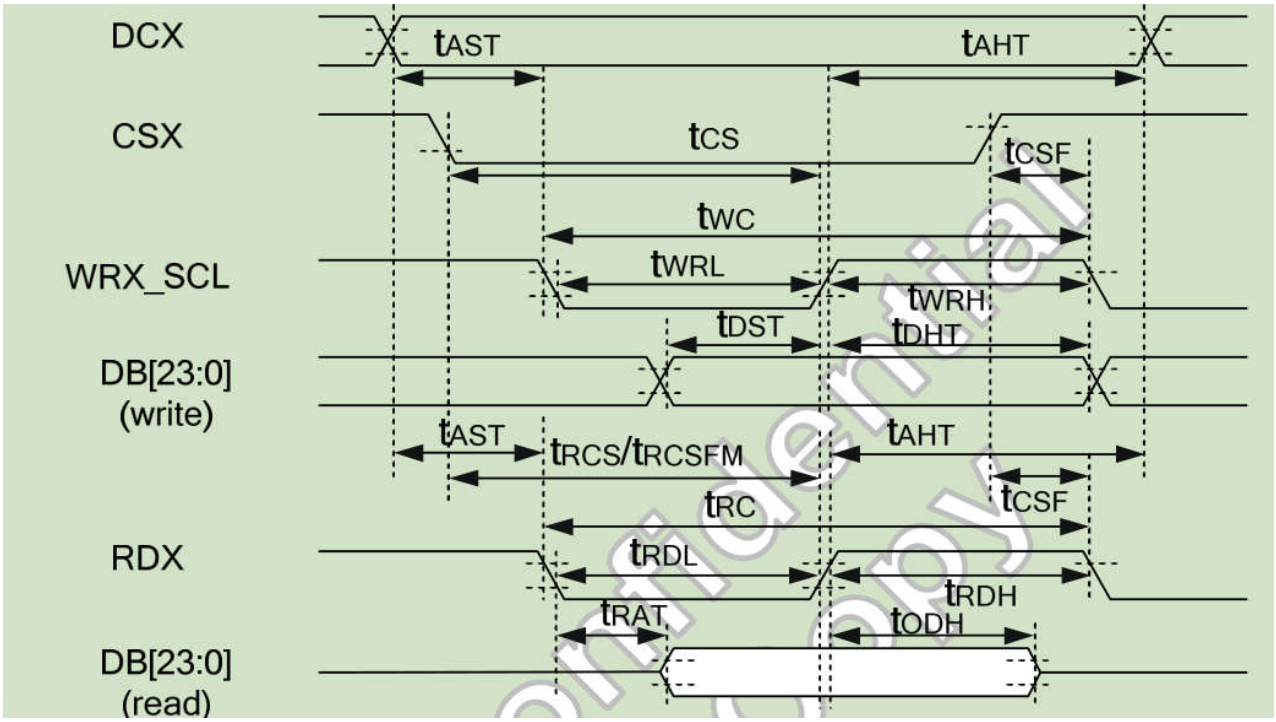
Note 3. During Reset Complete Time, ID1/ID2/ID3/ID4 and VCOM value in OTP will be latched to internal register during this period. This loading is done every time when there is H/W reset complete time (tREST) within 5ms after a rising edge of RESX.

Note 4. Spike Rejection also applies during a valid reset pulse as shown below:



Note 5. It is necessary to wait 5msec after releasing RESX before sending commands. Also Sleep Out command cannot be sent for 120msec.

6.2. MCU Interface Characteristics .



(VSSA=0V, IOVCC=1.8V, VCI=2.8V, T_A=25℃)

Signal	Symbol	Parameter	Min.	Max.	Unit	Description
DCX	t_{AST}	Address setup time	0	-	ns	-
	I	Address hold time (Write/Read)	10	-		
CSX	t_{CS}	Chip select setup time (Write)	10	-	ns	-
	t_{RCS}	Chip select setup time (Read register)	45	-		
	t_{RCSFM}	Chip select setup time (GRAM)	355	-		
	t_{CSF}	Chip select wait time (Write/Read)	10	-		
WRX_SCL	t_{WC}	Write cycle (write register)	50	-	ns	-
	t_{WC}	Write cycle (write GRAM@SLPOUT)	47	-		
	t_{WC}	Write cycle (write GRAM@SLPIN)	100	-		
	t_{WRH}	Control pulse “H” duration	15	-		
	t_{WRL}	Control pulse “L” duration	15	-		
RDX	t_{RC}	Read cycle (read register)	160	-	ns	-
	t_{RC}	Read cycle (GRAM)	450	-		
	t_{RDH}	Control pulse “H” duration	90	-		
	t_{RDL}	Control pulse “L” duration(read register)	35	-		
	t_{RDL}	Control pulse “L” duration(GRAM)	345	-		
DB[23:0]	t_{DST}	Data setup time	10	-	ns	For maximum C_L=30pF For minimum C_L=8pF
	t_{DHT}	Data hold time	10	-		
	t_{RAT}	Read access time(read register)	-	40		
	t_{RAT}	Read access time(GRAM)	-	340		
	t_{ODH}	Output disable time	20	80		

Note: The input signal rise time and fall time (tr, tf) is specified at 15 ns or less.
Logic high and low levels are specified as 30% and 70% of IOVCC for Input signals.

7. Backlight Characteristics.

Item	Symbol	MIN	TYP	MAX	UNIT	Test Condition	Note
Supply Voltage	Vf	3.0	3.2	3.4	V	If=80 ma	-
Supply Current	If	-	80	-	mA		-
Luminous Intensity for LCM	-	-	200	-	Cd/m^2		Note1
Uniformity for LCM	-	80		-	%		Note2
Number of LED	-		4	-	Piece		-
Backlight Color	White						

8.Optical Characteristics

Item of electro-optical characteristics	Symbol		Condition	Min	Typ	Max	Unit	Remark
Contrast ratio	CR		Ø=Ψ=o² Ta=25℃ I_f=120mA	400	500	--		Note3
Response time	Tr+Tf			--	16.1	--	Msec	Note4/8
Viewing anle range	Ø (CR≥10)		Up(12H) Down(6H) Left(9H) Right(3H)	--	35	--	Deg	Note5/8/9
				--	10	--	Deg	
				--	35	--	Deg	
				--	35	--	Deg	
Module Chromaticity CIE(x,y)	White	x	Ø=Ψ=o² Ta=25℃	0.298		0.338		Note6
		y		0.317		0.357		
	Red	x		--	--	--		
		y		--	--	--		
	Green	x		--	--	--		
		y		--	--	--		
	Blue	x		--	--	--		
		y		--	--	--		
NTSC Ratio	S		--	--	70	--	%	Note7

Note1. Surface luminance is the LCD surface from the surface with all pixels displaying white For more imformation see FIG 1.
Lv=Average Suface Luminance with all white pixels (P1,P2,P3,P4,P5)

Note2. The umiformity in surface luminance (& White) is determined by measuring luminance at each test position 1 through 5,and then dividing the maximum luminance of 5 points luminance by minimum luminance of 5 points luminance.For more information see FIG 1.

Note3. Contrast Ratio(CR) is defined mathematically by the folowing fomula Formula. For more information see FIG 1:

Note4. Response time is the time required for the display to transition from White to black(Rise Time Tr) and from black to white(Decay Time Tf) For additional information see FIG 2..

Note 5. Viewing angle is the angle at which the contrast ratio is greater than 2. For TFT module the contrast ratio is greater than 10. The angles are determined for the horizontal or x axis and the vertical or y axis with respect to the z axis which is normal to the LCD surface For more information see FIG 3.

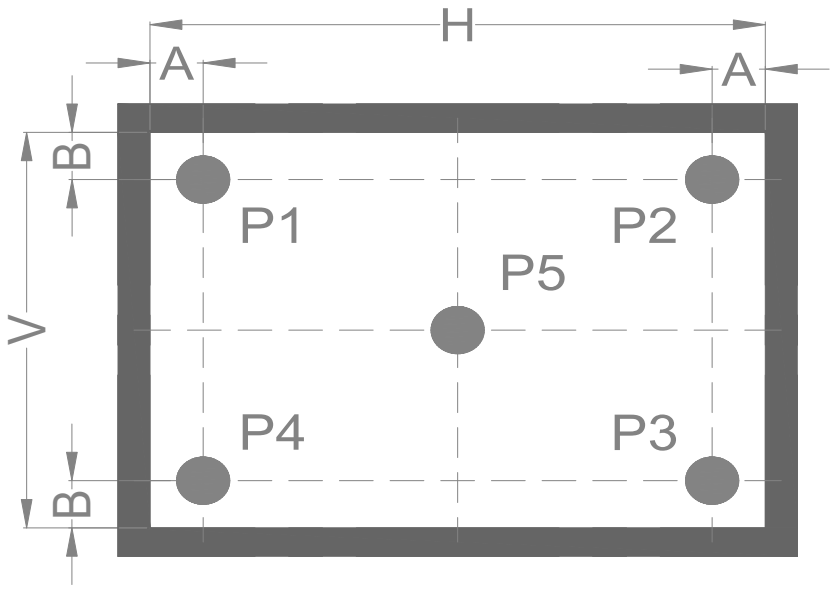
Note 6. CIE(x,y) chromaticity, The x,y value is determined by screen active area position 5 For more information see FIG 1.

Note7. NTSC ratio; For more information see FIG 3.

Note8. For Viewing angle and response time testing, the testing data is base on Autronic-Melchers' s ConoScope. Series Instruments. For comtrast ratio, Surface Luminance, Luminance uniformity and CIE, the testing data is base on BM-7 photo detector.

Note9. For TFT transmissive module. Gray scale reverse occurs in direction of panel viewing angle

FIG. 1. Measuring method for Contrast ratio, surface luminance, Luminance uniformity,CIE (x, y) chromaticity.



A : 5mm
B : 5mm
H, V : Active Area
Lihgt spot size Ø =5mm, 500mm
distance from the LCD suface to
detector lens measurement
instrument is luminance meter BM-7

FIG. 2. The definition of Response Time

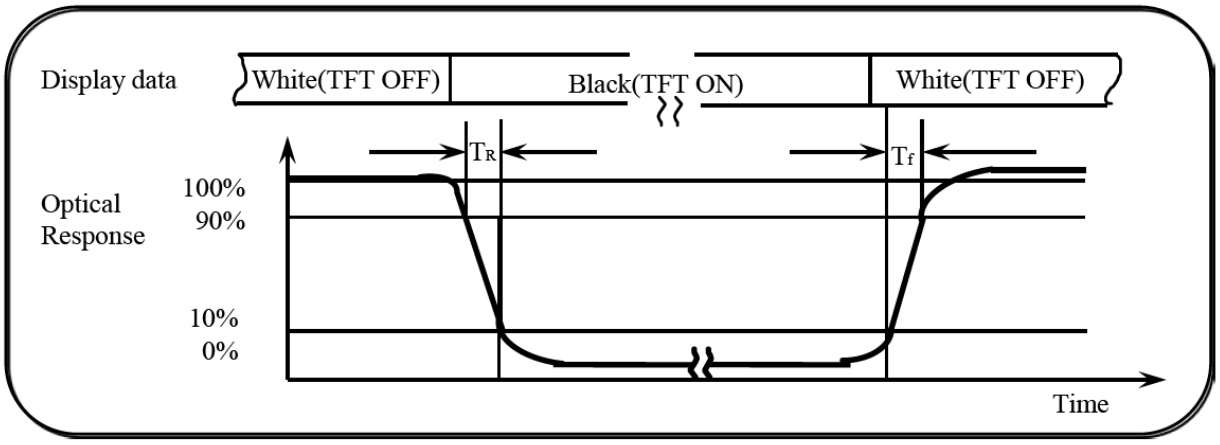
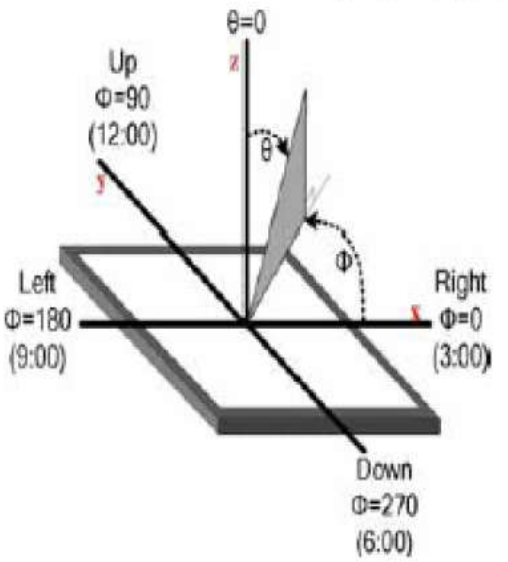
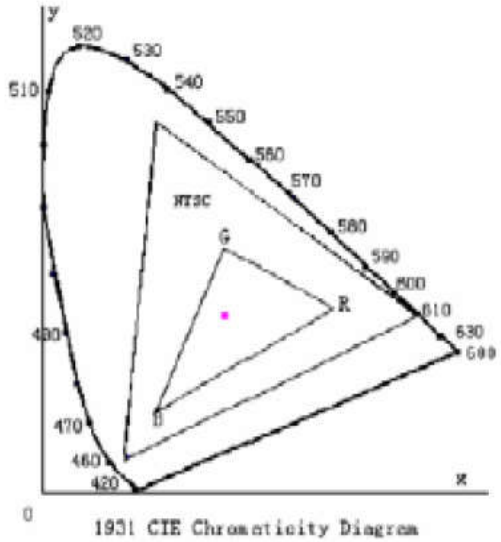


FIG. 3. The definition of viewing angle





1931 CIE Chromaticity Diagram

Fig.4. 1931 CIE chromaticity diagram

9. 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 bublle 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 Characteristics 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)**	-30° C(low temperature)→80° C(high temperature) 0.5 Hours 10 cycle	
⑥	**Damp Proof Test**	50℃±5℃×90%RH×96Hours	
⑦	**Vibration Test**	**Frequency:10Hz~55Hz~10Hz** **Amplitude:1.5mm** **X,Y,Z direction for total 3hours (Packing Condition)**	
⑧	**Dropping Test**	**Drop to the ground from 1M height one time every side of carton.(Packing Condition)**	
⑨	**ESD Test**	Condition:R=330Ω,C=150PF, Air Mode:±8KV,10times Contack Mode:±4KV,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.

10.Inspection Standard

This standard apply to C-STN/TFT module

10.1. Spot check plan：

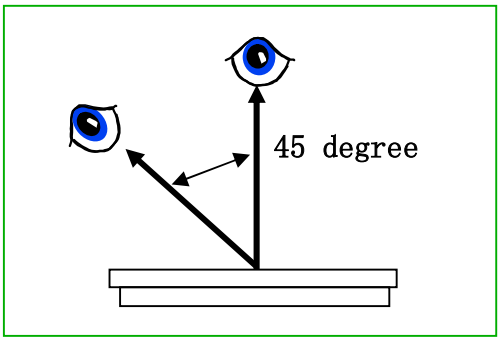
According to spot check level Ⅱ,MIL-STD-105D Level Ⅱ,the rank of accept or reject is below:

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

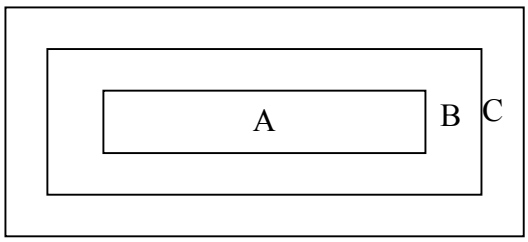
A level：major non-conformance： AQL 0.65 minor non-conformance：AQL 1.

10.2. Inspection condition：

Under daylight lamp 20～40W，product distance inspector'eye 30cm,incline degree 45°。



10.3. LCD area define：



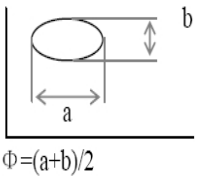
Area A：display area

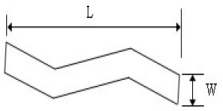
Area B：VA area

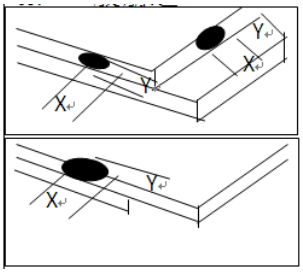
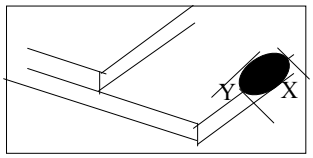
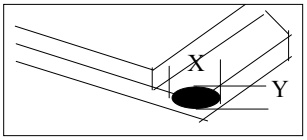
Area C：out of VA area,not in sight after assemby

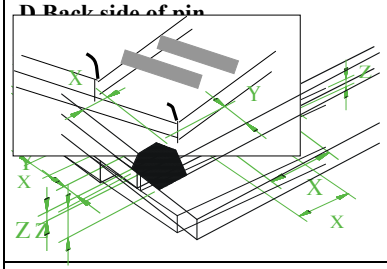
Remark：non-conformance at area C,but is OK that isn't influence raliability of product & assembly by customer.

10.4. Inspection standard

<table>
<tr>
<td>Dark spot、white spot、color spot (power on state)</td>
<td>
6 inch and smaller
<table>
<tr><th>aera / size</th><th colspan="2">Most approve q'ty</th><th></th></tr>
<tr><td></td><td>AA</td><td>VA</td><td>B</td></tr>
<tr><td>Φ≤0.1</td><td colspan="2">ignore</td><td rowspan="4">ignore</td></tr>
<tr><td>0.1<Φ≤0.15</td><td>2</td><td>2</td></tr>
<tr><td>0.15<Φ≤0.2</td><td>1</td><td>1</td></tr>
<tr><td>Φ≥0.20</td><td>0</td><td>0</td></tr>
</table>
large than 6 inch
<table>
<tr><th>aera / size</th><th colspan="2">Most approve q'ty</th><th></th></tr>
<tr><td></td><td>AA</td><td>VA</td><td>B</td></tr>
<tr><td>Φ≤0.1</td><td colspan="2">Ignore</td><td rowspan="5">ignore</td></tr>
<tr><td>0.1<Φ≤0.15</td><td>2</td><td>3</td></tr>
<tr><td>0.15<Φ≤0.2</td><td>1</td><td>2</td></tr>
<tr><td>0.20<Φ≤0.25</td><td>1</td><td>1</td></tr>
<tr><td>0.25<Φ</td><td>0</td><td>0</td></tr>
</table>
</td>
<td>slight</td>
<td>Eye-measurement
Visual mirror
Feilinka
 

Φ=(a+b)/2</td>
</tr>
<tr>
<td>Liner matter</td>
<td>
<table>
<tr><th colspan="2">Size</th><th colspan="3">Most approve q'ty</th></tr>
<tr><td>L</td><td>W</td><td>AA</td><td>VA</td><td>B</td></tr>
<tr><td>ignore</td><td>W<0.01</td><td>ignore</td><td>ignore</td><td rowspan="3">ignore</td></tr>
<tr><td>L≤2</td><td>0.01≤W≤0.035</td><td>2</td><td>2</td></tr>
<tr><td>L≤2</td><td>0.035≤W≤0.05</td><td>1</td><td>1</td></tr>
<tr><td></td><td>W>0.05</td><td>0</td><td>0</td><td>0</td></tr>
</table>
Notice：While W≥0.05mm，judge as spot。
</td>
<td>slight</td>
<td>Eye-measurement
Visual mirror
Feilinka
 
</td>
</tr>
</table>

<table>
<tr><th>scope of examination</th><th>Judge standar</th><th>Degree of defect</th><th>Judging method</th></tr>
<tr>
<td rowspan="3">Chip and crack</td>
<td>A. Normal crack
 
<table>
<tr><td>X</td><td>Y</td><td>Z</td></tr>
<tr><td>ignore</td><td>≤2.0</td><td>≤1/2t</td></tr>
<tr><td>≤1/8X</td><td></td><td>≤t</td></tr>
</table>
</td>
<td>slight</td>
<td>Eye-measurement
Visual mirror
Feilinka</td>
</tr>
<tr>
<td>B. ITO PAD
 
<table>
<tr><td>X</td><td>Y</td><td>Z</td></tr>
<tr><td>ignore</td><td>≤0.3</td><td>≤1/2t</td></tr>
<tr><td>≤1/8X(or X≤2)</td><td>≤1/5t</td><td>≤t</td></tr>
</table>
notice：Y≤1/5L
</td>
<td>slight</td>
<td>Eye-measurement
Visual mirror
Feilinka</td>
</tr>
<tr>
<td>C. Corner chip
 
<table>
<tr><td>X</td><td>Y</td><td>Z</td></tr>
<tr><td>≤2</td><td>≤1.5</td><td>≤t</td></tr>
</table>
</td>
<td>slight</td>
<td>Eye-measurement
Visual mirror
Feilinka</td>
</tr>
</table>

	D.Back side of pin  X | Y | t | Most approve q'ty ≤3.0 | ≤1.0 | Z≤1/2t | ignore	slight	Eye-measurement Visual mirror Feilinka
	E. Frame gaps X | Y | Most approve q'ty ≤3.0 | Outside of frame | ignore	slight	Eye-measuremen Visual mirror Feilinka
	F.Frame marginal gaps X | Y | Most approve q'ty ≤3.0 | Outside of epoxy frame | ignore	slight	Eye-measurement Visual mirror Feilinka
	G. Cracks **Without cracks anywhere。**	serious	Eye-measurement

11. Handling Precautions

11.1 Mounting method

The LCD panel of quality Co.,ltd 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.

11.2 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) , Salfur (S)**

If goods were sent without being sili8con 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), Salfur (S) from customer, Responsibility is on customer.

11.3 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 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.

11.4 packing

- **Module employ 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**

11.5 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.**
- **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.

11.6 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.

2. Storage in a polyethylene bag with the opening sealed so as not to enter fresh air outside in it . And with no desiccant.

3. Placing in a dark place where neither exposure to direct sunlight nor light's keeping the storage temperature range.

4. 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

11.7 Safety

5. 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.

6. 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

12. Precaution For Fse

12.1

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.

12.2

On the following occasions, the handing of problem should be decided through discussion and agreement between responsible of the both parties.

7. When a question is arisen in this specification

8. When a new problem is arisen which is not specified in this specifications

9. When an inspection specifications change or operating condition change in customer is reported to quality Co.,ltd , and some problem is arisen in this specification due to the change

10. When a new problem is arisen at the customer's operating set for sample evaluation in the customer site.