TIANMA
Microelectronics Co.,LTD

SPECIFICATION

FOR LCD MODULE

MODEL NO:	**TM202JBCWVBYA**
CUSTOMER:	
CUSTOMER P/N.	
VERSION	**V1.0**
CUSTOMER APPROVED	

□ Preliminary specification

■ Final specification

PREPARED BY	CHECKED BY	VERIFIED BY QA DEPT.	APPROVED BY

TIANMA MICRO-ELECTRONICS CO., LTD
Address: 22/F Hangdu Building, Catic Zone, Shen Nan Road Central, ShenZhen, China
Tel: +86-755-8379-0744 Fax: +86-755-8379-0431 Web: www.tianma.cn www.tianma.com

RoHS

REVISION RECORD

Version	Page	Revision Items	Name	Date
1.0		First release for new IC	Chenrong	2008.1.15

TABLE OF CONTENTS

Page

1 Description

The TM202JBCWVBYA, Character LCM unit consists of 20-character×2-line dot-matrix(5×8 dot) LCD panel, LCD driver, controller LSI on a single PCB. Incorporating mask ROM-based character generator and display data RAM in the controller LSI, the unit can efficiently display the desired character under microprocessor control.

- Wide viewing direction.
- Wide Operating temperature.
- Requirements on environmental protection: RoHS.

2 Features

Item	Contents
LCD type	STN
	Positive
LCD Duty	1/16
LCD Bias	1/5
Polarizer	Transflective
LCD background color	Yellow-Green
Segment color	Blue-Black
Backlighting	LED
Backlighting type	Area
Backlighting color	Yellow-Green
Backlighting drive	240mA
View direction	6:00(Wide view direction)
Operating temperature	-20℃~+70℃
Storage temperature	-30℃~＋80℃
Controller	ST7066U
Frame	SPCC(Black)
Technology	COB
Power supply	VDD=5.0V
Data Transfer	8- Bit Parallel

Notes:

- Color tone can slightly change with temperature and driving voltage.
- Color tone will be changed by backlight.

3 Absolute maximum ratings

(Without LED backlighting ,Ta=25℃)

Parameter	Symbol	Min	Max	Unit	Remark
Logic circuit supply voltage	VCC	-0.3	+7.0	V	
LCD driving voltage	VLCD	VCC-10.0	VCC+0.3	V	
Operating temperature range	Top	-20	+70	℃	No Condensation
Storage temperature range	Tst	-30	+80	℃	

Note :

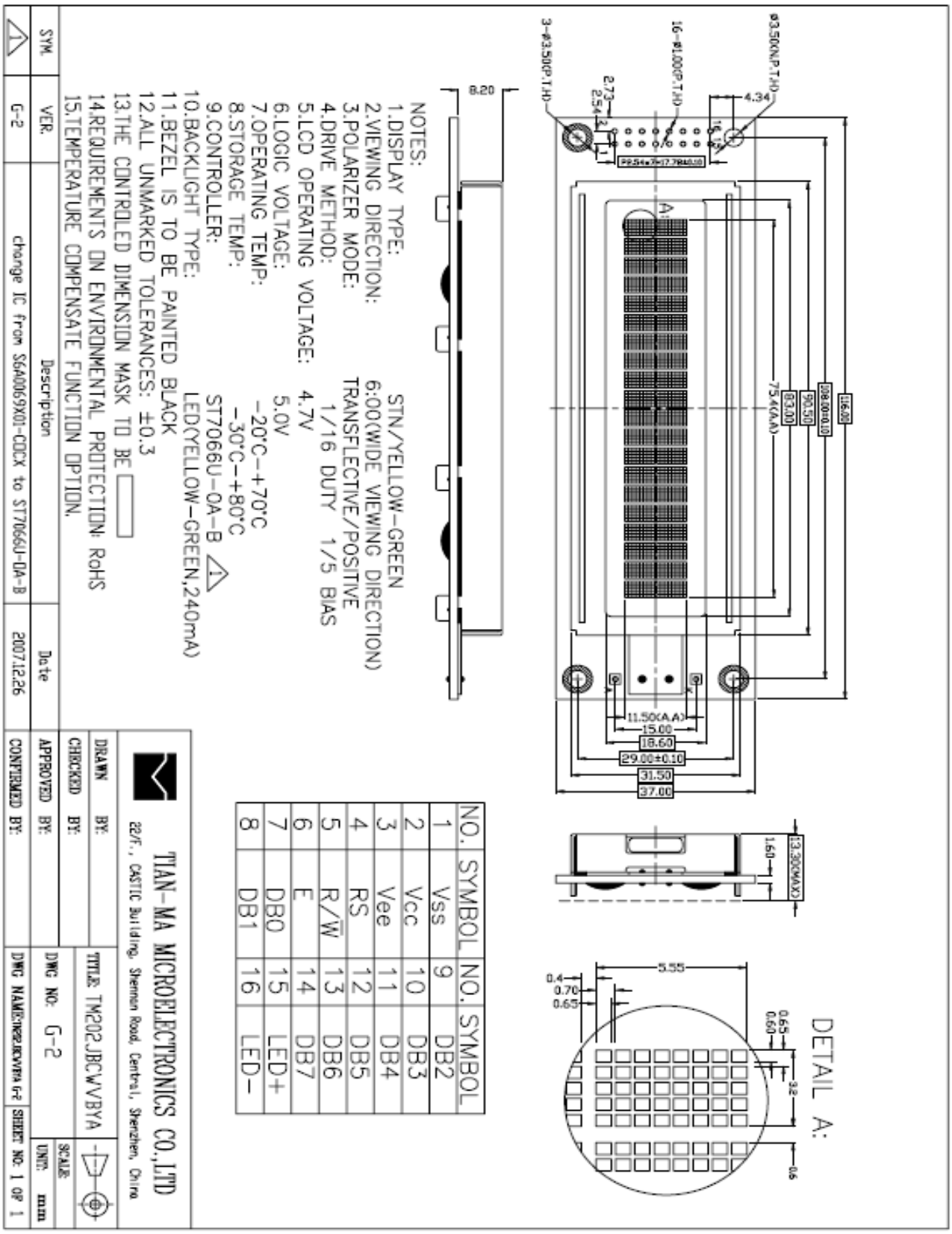
- LCD operating voltage $V_{LCD}=V_{CC}-V_{ee}$
- If the module is above these absolute maximum ratings. It may become permanently damaged.
- $V_{CC}>V_{SS}$ must be maintained.

4 Mechanical Characteristics

4.1 Mechanical features

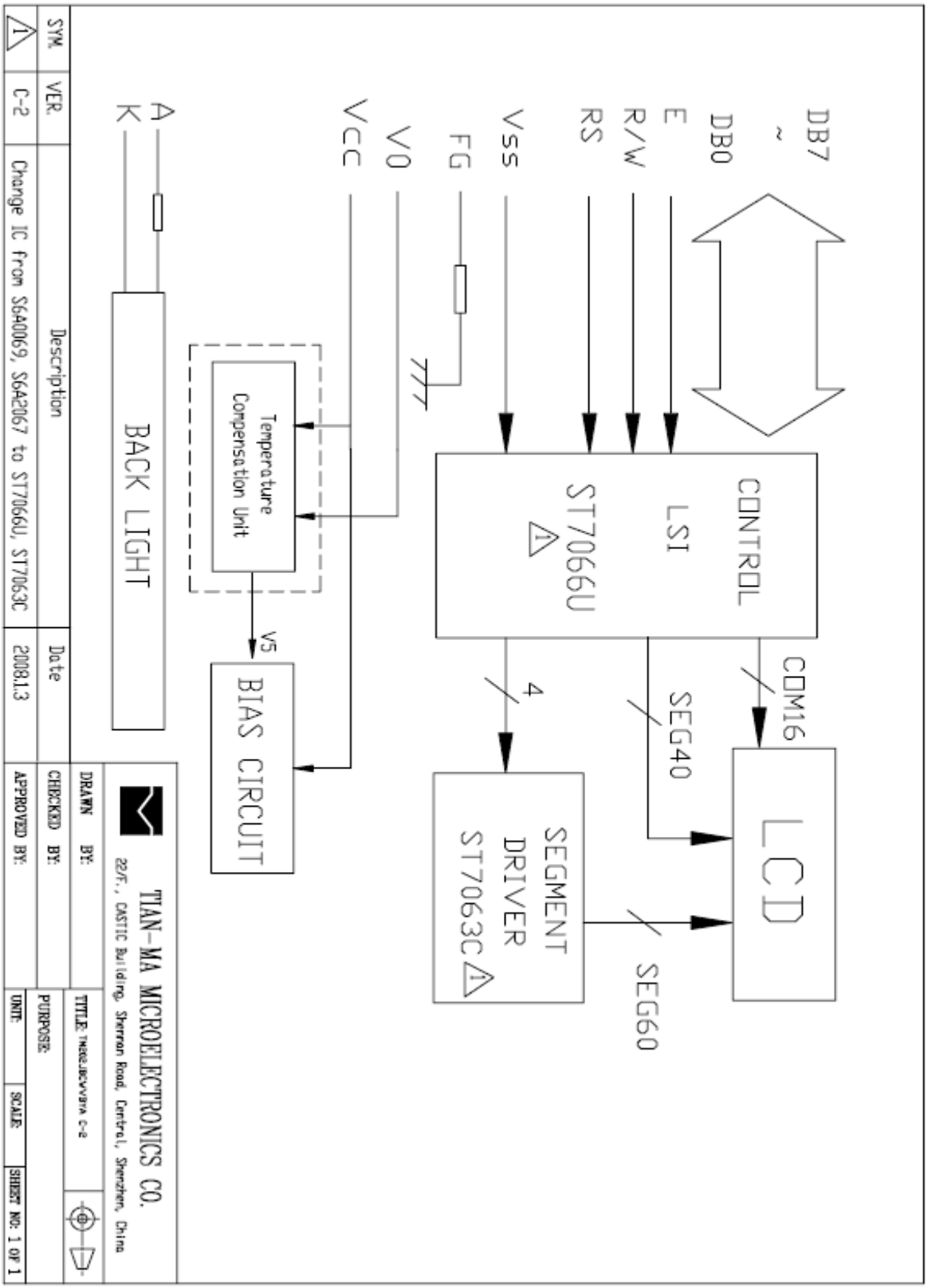
Parameter	Standard Value	Unit
Display type	Character Module	--
Character size(W×H)	3.20 × 5.55	mm
Number of dots/characters (W×H)	20 × 2 (5×8)	--
View area (W×H)	83.00 × 18.60	mm
Active Area (W×H)	75.40 × 11.50	mm
Dot Size (W×H)	0.60 × 0.65	mm
Dot Pitch (W×H)	0.65 × 0.70	mm
Module size(W×H×D)	116.00 × 37.00 × 13.30(MAX)	mm
Module total weight (approx)	55	g
Module outline dimensions	Refer to page 5-“Outline drawing”	--

4.2 Mechanical drawing.



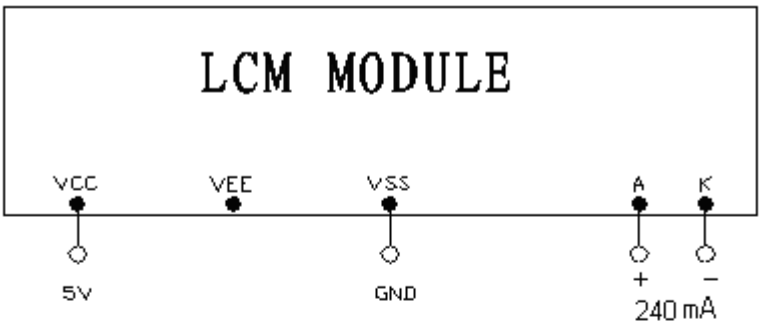
5 Circuit

5.1 Block Diagram

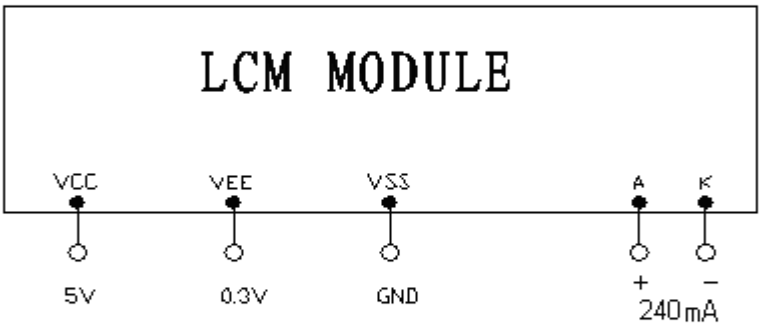


5.2 Recommend power supply circuit

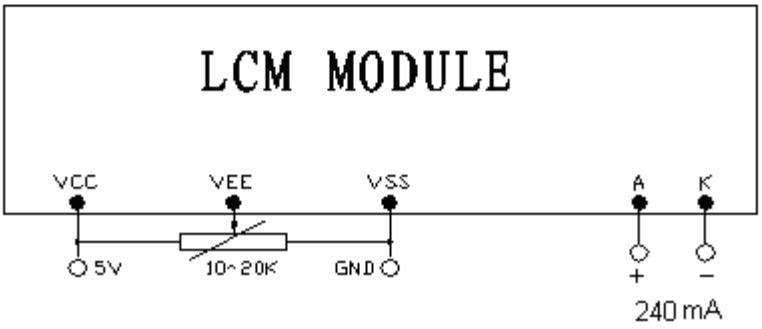
The first driving method



The second driving method



The third driving method



Note:

- You can control the contrast of module outside by add a VR（the third driving method, please remove R11 on PCB）
- You can use fixed current or 4.2VDC to drive the backlight

6 Interface description .

Pin No.	Symbol	I/O	Description
1	VSS	0V	Ground
2	VCC	5.0V	Power supply voltage for logic and LCD(+)
3	VEE	0.3V	Power supply voltage for LCD(-)
4	RS	I/O	Selects registers (H: Data L: Instruction)
5	R/W	I/O	Selects read or write
6	E	I/O	Data read/write enable signal
7	DB0	I/O	Data bit0
8	DB1	I/O	Data bit1
9	DB2	I/O	Data bit2
10	DB3	I/O	Data bit3
11	DB4	I/O	Data bit4
12	DB5	I/O	Data bit5
13	DB6	I/O	Data bit6
14	DB7	I/O	Data bit7
15	A	240mA	Power supply voltage for LED(+)
16	K		Power supply voltage for LED(-)

7 Instruction Code & Timing characteristics

7.1 COMMAND

The module TM202CBCWVBYA include the controller-ST7066U. The table below lists the types of commands, including the code of each command. more details refer to ST7066U data sheet please.

Command	Command Code										Command Description	Execution time (fsoc= 270kHz)
	RS	R/W	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0		
Clear Display	0	0	0	0	0	0	0	0	0	1	Write "20H" to DDRAM. and set DDRAM address to "00H" from AC.	1.52ms
Return Home	0	0	0	0	0	0	0	0	1	X	Set DDRAM address to "00H" from AC and return cursor to its original position if shifted. The contents of DDRAM are not changed.	1.52ms
Entry Mode Set	0	0	0	0	0	0	0	1	I/D	S	Sets cursor move direction and specifies display shift.These operations are performed during data write and read.	37us
Display ON/OFF Control	0	0	0	0	0	0	1	D	C	B	D=1:entire display on C=1:cursor on B=1:cursor position on	37us
Cursor or Display Shift	0	0	0	0	0	1	S/C	R/L	X	X	Set cursor moving and display shift control bit, and the direction, without changing DDRAM data.	37us
Function Set	0	0	0	0	1	DL	N	F	X	X	Set interface data length (DL : 4-bit/8-bit), numbers of display line (N : 1-line/2-line), display font type(F : 5 X 8 dots/ 5 X 11 dots)	37us
Set CGRAM Address	0	0	0	1	AC 5	AC 4	AC 3	AC 2	AC 1	AC 0	Set CGRAM address in address counter.	37us
Set DDRAM Address	0	0	1	AC 6	AC 5	AC 4	AC 3	AC 2	AC 1	AC 0	Set DDRAM address in address counter.	37us
Read Busy Flag and Address	0	1	BF	AC 6	AC 5	AC 4	AC 3	AC 2	AC 1	AC 0	Whether during internal operation or not can be known by reading BF. The contents of address counter can also be read.	0us
Write Data to RAM	1	0	D7	D6	D5	D4	D3	D2	D1	D0	Write data into internal RAM (DDRAM/CGRAM).	37 us
Read Data from RAM	1	1	D7	D6	D5	D4	D3	D2	D1	D0	Read data from internal RAM (DDRAM/CGRAM).	37 us

Be sure the ST7066U is not in the busy state(BF=0) before sending an instruction from the MPU to the

ST7066U.If an instruction is sent without checking the busy flag, the time between the first instruction and next instruction will take much longer than the instruction time itself. Refer to instruction Table for the list of each instruction execution time.

7.2 Interface Timing characteristics

Note: Please refer to IC: ST7066U data sheet for more details.

(VCC = 5V, TA =25℃)

Mode	Characteristics	Symbol	Min	Typ	Max	Unit
Write Mode (refer to Figure-1)	Enable Cycle Time	T_C	1200	-	-	ns
	Enable Rise / Fall Time	T_R, T_F	-	-	25	
	Enable Pulse Width	T_{PW}	140	-	-	
	Address Setup Time	T_{AS}	0	-	-	
	Address Hold Time	T_{AH}	10	-	-	
	Data Setup Time	T_{DSW}	40	-	-	
	Data Hold Time	T_H	10	-	-	

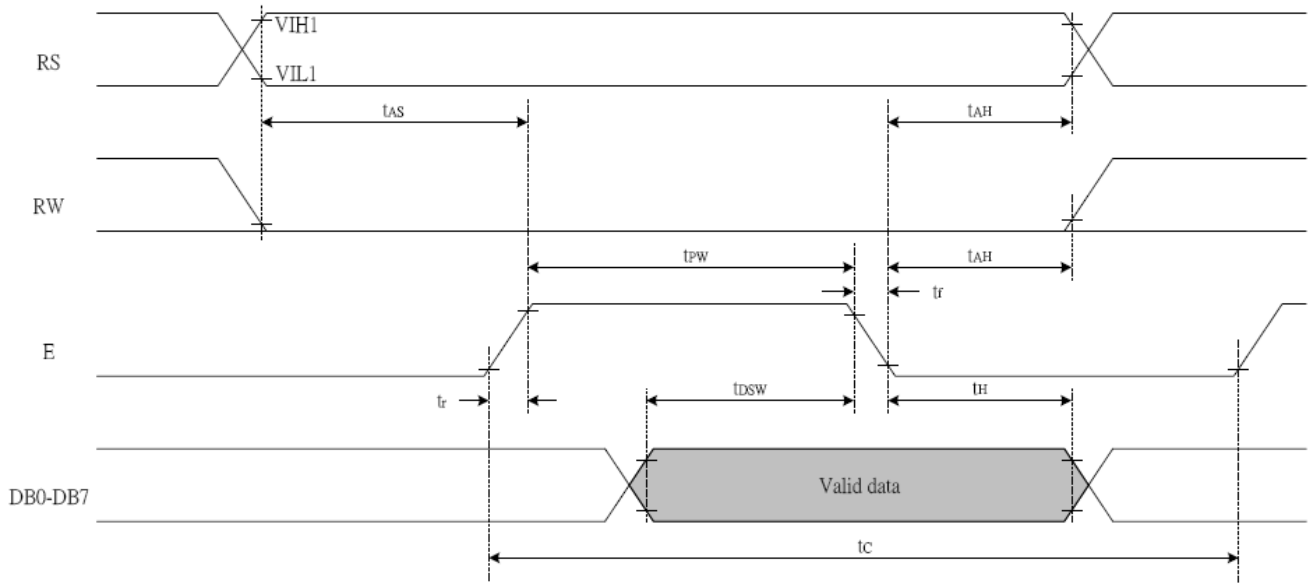


Figure 1. Write Mode Timing Diagram

(VCC = 5V, Ta = 25℃)

Mode	Characteristics	Symbol	Min	Typ	Max	Unit
Read Mode (refer to Figure-2)	Enable Cycle Time	T_C	1200	-	-	ns
	Enable Rise / Fall Time	T_R, T_F	-	-	25	
	Enable Pulse Width	T_{PW}	140	-	-	
	Address Setup Time	T_{AS}	0	-	-	
	Address Hold Time	T_{AH}	10	-	-	
	Data Setup Time	T_{DDR}	-	-	100	
	Data Hold Time	T_H	10	-	-	

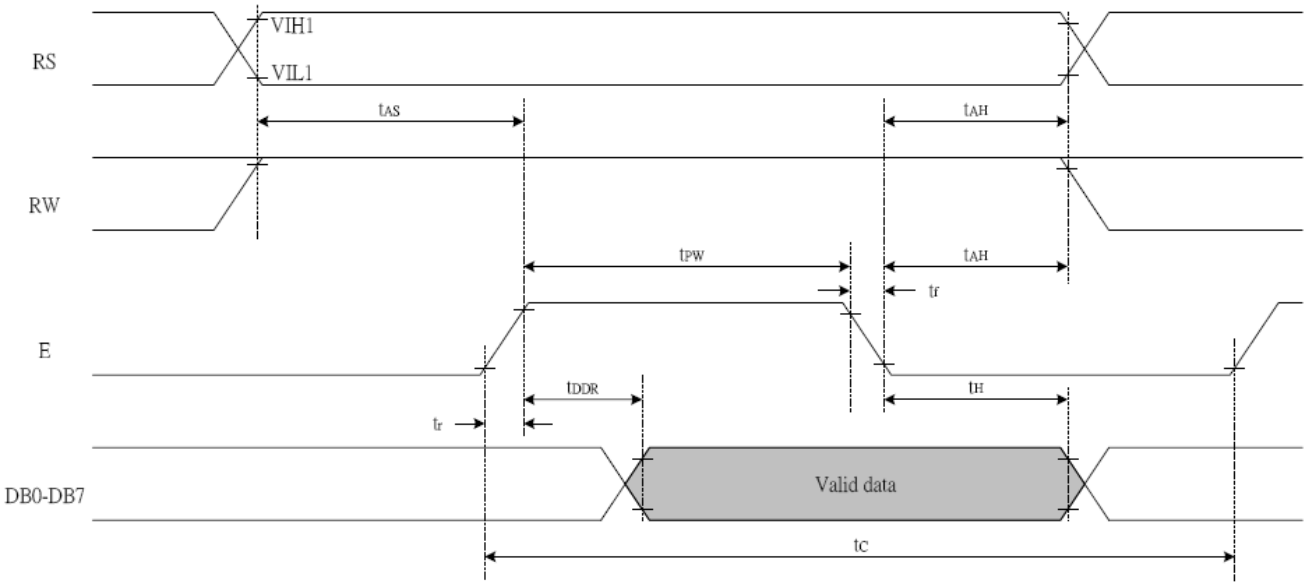
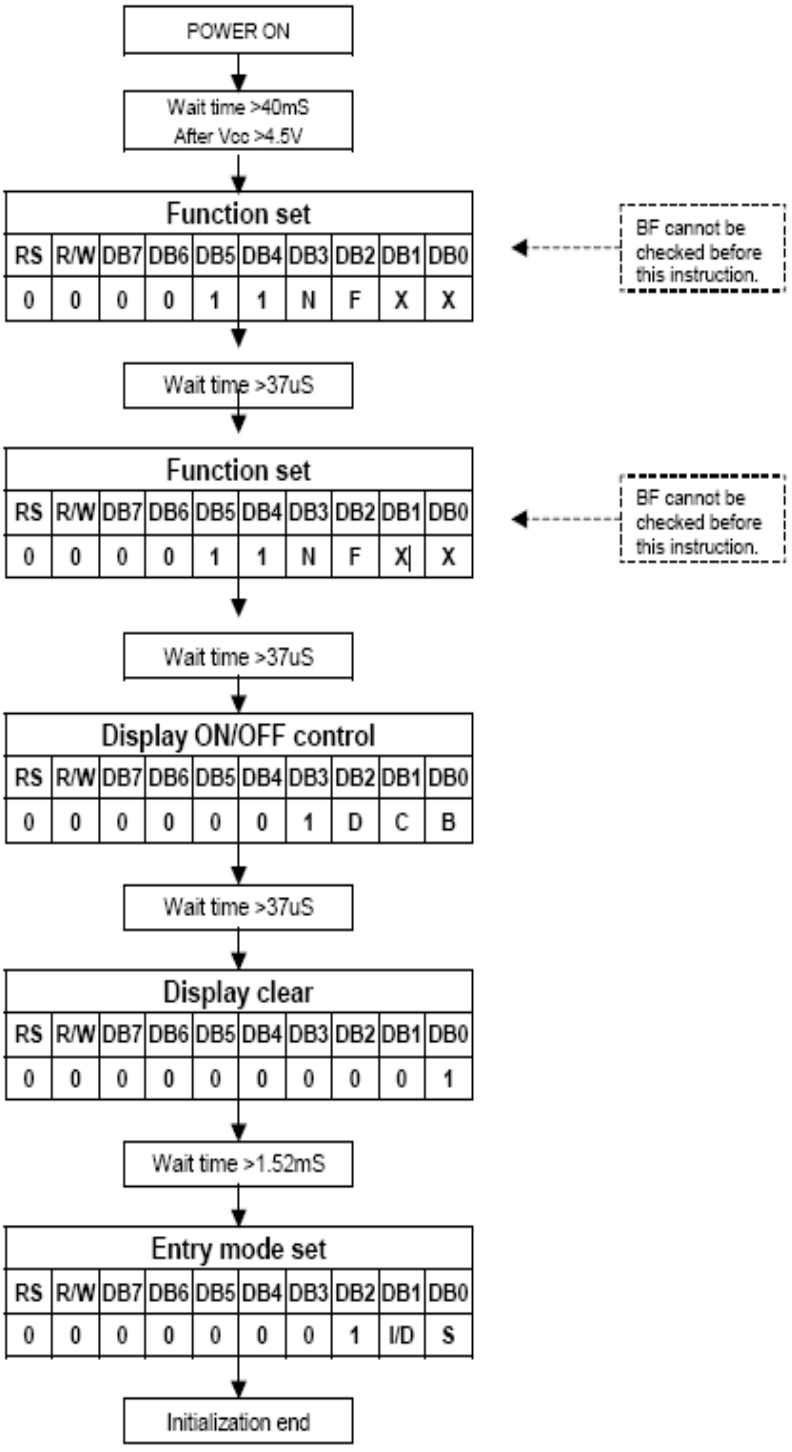


Figure2. Read Mode Timing Diagram

7.3 character generator code map(Please refer to ST7066U datasheet for other character code map)

7.4 Initialization flow map

(For 8-Bit Interface F_{OSC}=270KHz)



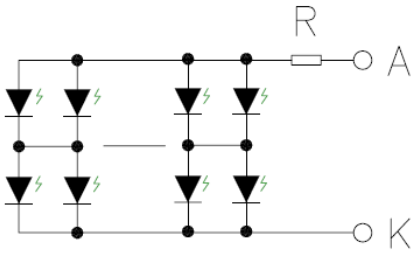
8 Electrical characteristics

V_{CC}=5.0V，V_{SS}=0V, Ta=25℃

Parameter		Symbol	Condition	MIN	TYP	MAX	UNIT
Logic circuit supply voltage		V_{CC}	--	4.8	5.0	5.2	V
Power supply LCD		V_{LCD}	--	4.4	4.7	5.0	
Input voltage for logic circuit	"H"level	V_{IH}	V_{CC}=5.0V	0.7V_{CC}	--	V_{CC}	
	"L"level	V_{IL}		-0.3	--	0.6	
Output voltage for logic circuit	"H"level	V_{OH}		3.9	--	V_{CC}	
	"L"level	V_{OL}		--	--	0.4	
Logic power supply current (Without backlighting)		I_{CC}	F_{OSC} =270KHz VCC=5.0V	--	--	3.0	mA
Used driver IC		ST7066U OF SITRONIX					

9 LED backlight characteristics

Ta=25℃



Circuit diagram (LED 2x24=48 dies)

Item	Symbol	Condition	MIN.	TYP.	MAX.	Unit
Forward voltage	V_f	I_f=240mA	4.0	4.2	4.4	V
Luminous intensity*	Bp	I_f=240mA	200	260	--	cd/m^2
Luminous Uniformity*	△Bp		70	--	--	%
Peak Wave length	λp		569	572	575	nm

Note:

- Measured at the bare LED backlight unit.
- If the backlight is above these maximum ratings for long time, the service life of the LED backlight will reduce or it will cause poor reliability.

10 Optical Characteristics

10.1 Optical Characteristics

Ta=25℃

Parameter		Symbol	Ratings			Unit	Measuring Temp.	Reference
			Min	Type	Max.			
Operating voltage		V_o	4.5	4.7	4.9	V	25℃	〔Note10-1〕
Frame frequency		f		70	--	Hz	--	〔Note10-2〕
Contrast ratio		Cr(θ=20°, Φ=90° or 270°)	--	10	--	--	25℃	〔Note10-3〕
Response time	Turn on	t_{on}	--	--	250	ms	25℃	〔Note10-4〕
			--	--			0℃	
	Turn off	t_{off}	--	--	200	ms	25℃	
			--	--	--		0℃	
Viewing angle (Cr≥2)	Up-down	θ1 (Φ=90° or 270°)	--	-45~60	--	deg	25℃	〔Note10-5〕
	Left-right	θ2 (Φ=0° or 180°)	--	-35~35	--	deg	25℃	

〔Note10-1〕The maximum and minimum ratings don't mean the LCD works well in the whole range of Vo. Vo must be adjusted to optimize the viewing angle and contrast. Refer to definition of drive voltage, refer to 10.2.

〔Note10-2〕 The frequency shouldn't be too low to avoid flicker. Refer to definition of drive voltage, refer to 10.2.

〔Note10-3〕 Refer to 10.2/10.3/10.4/10.5.

〔Note10-4〕The selected state is dark and non-selected state is white(or bright) with positive type, reversely the selected state is white (or bright) and non-selected state is dark with negative type. Refer to 10.6 definition of response time.

〔Note10-5〕Generally the viewing direction is 6:00 or12:00, sometimes 3:00 or 9:00. The range of left to right and up to down based on Cr=2 show the viewing angle. Viewing angle range isn't the range of defects inspection. Refer to 10.4.

10.2 Definition of drive voltage

(1) Definition of drive voltage and waveform

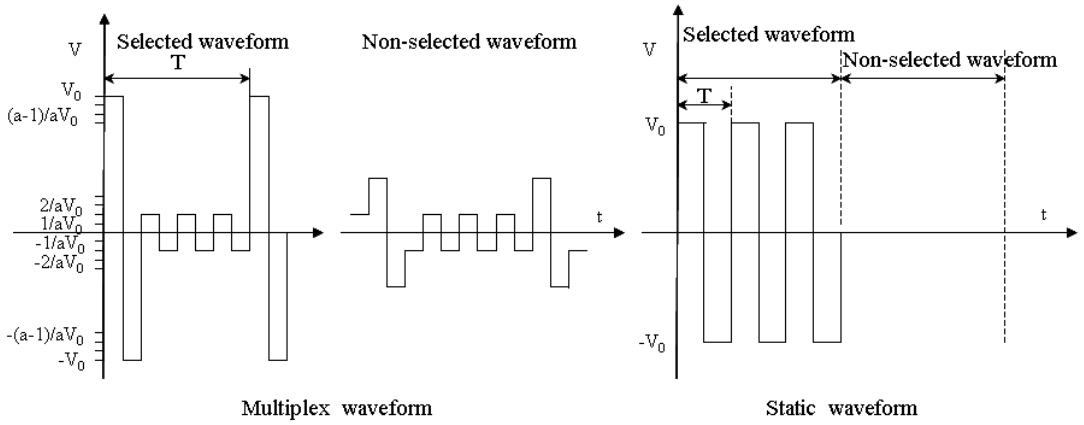


Fig.1 Definition of drive voltage and waveform

Operating voltage：V_o Frame frequency: f=1/T

Duty: 1/N Bias: 1/a

(2) Operating voltage: V_o

TIANMA can evaluate whether the LCD can be redesigned to obtain customer preferable performance if customer's LCD drive voltage isn't adjustable.

10.3 Optical characteristics measurement equipment and method

The setup and test method are showed in fig.2. Test methods are different according to different illumination mode.

Transmissive mode: light resource is placed at the back of LCD.

Reflective mode and transflective mode: light resource is placed at the front side of LCD.

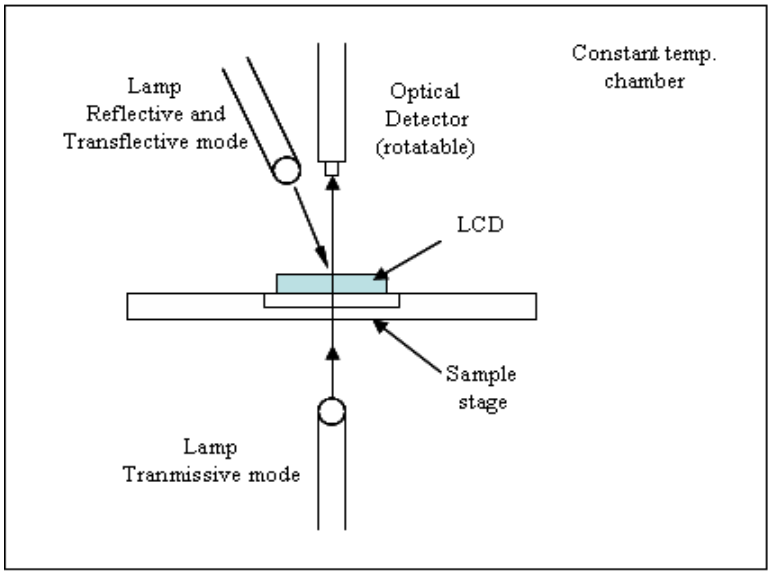


Fig.2 Optical characteristics measurement equipment

The chamber temperature, light resource and driving signal should be stable before testing. If test the characteristics under high or low temperature, the test system should be stable for more than 10 minutes before testing.

10.4 Definition of viewing direction

Refer to the graph below marked by *θ* and *Φ*

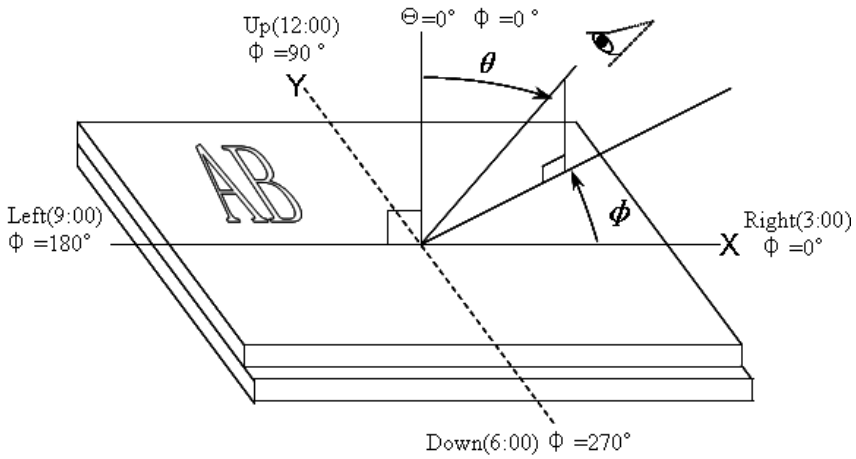


Fig.3 Definition of viewing direction

10.5 Definition of contrast ratio

Contrast ratio can be calculated by the formula (10-1) below for positive type. If the LCD is negative type, Cr (*θ, Φ*) is equal to luminance (*θ, Φ,* non-selected state*)* divided by luminance (*θ, Φ,* selected state). Note3-4 shows the relationship between selected state, non-selected state and bright state, dark state.

$$Cr(\theta,\phi)=\frac{L_2}{L_1}=\frac{\text{Luminance}(\theta,\phi)\ (\text{Bright state})}{\text{Luminance}(\theta,\phi)\ (\text{Dark state})} \qquad (10\text{-}1)$$

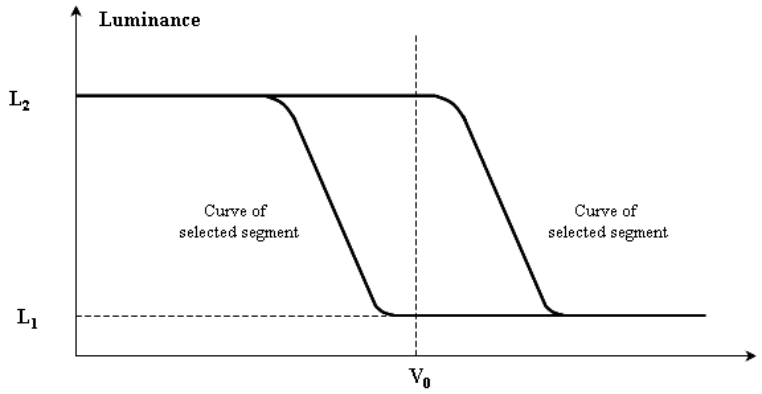


Fig.4 Electro-optical characteristic (EOC) graph (positive type)

10.6 Definition of response time

Turn on time (rise time): $t_{on}= t_d + t_r$ (from non-selected state to selected state)

Turn off time (fall time): $t_{off}=t_D + t_R$ (from selected state to non-selected state)

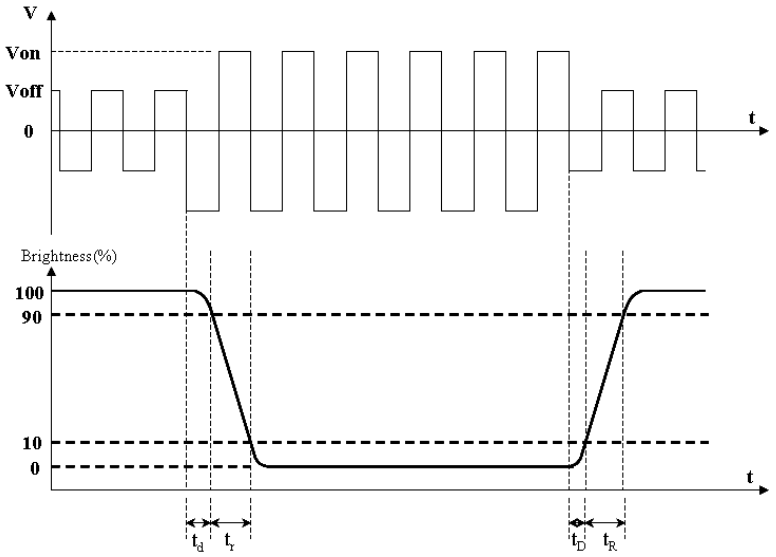


Fig.5 Definition of response time (positive type)

10.7 Definition of viewing angle

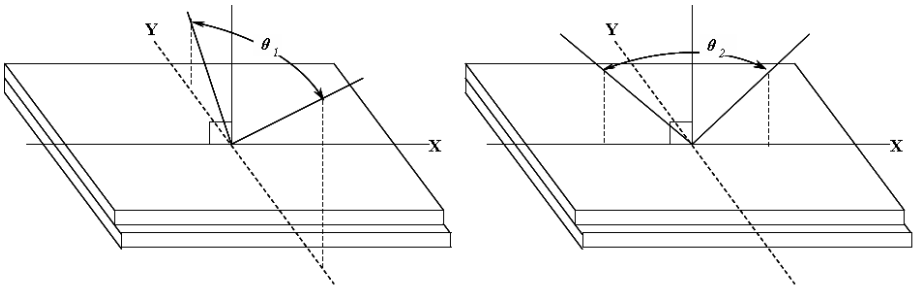


Fig 6 Definition of viewing angle

θ_1 ——range of viewing angle from up to down

θ_2 ——range of viewing angle from left to right.

11 Reliability

11.1 Content of Reliability Test

Ta=25℃

No	Test Item	Test condition	Criterion
1	High Temperature Storage	80℃±2℃ 120H Restore 2H at 25℃ Power off	After testing, cosmetic and electrical defects should not happen.
2	Low Temperature Storage	-30℃±2℃ 120H Restore 2H at 25℃ Power off	
3	High Temperature Operation	70℃±2℃ 120H Restore 2H at 25℃ Power on	
4	Low Temperature Operation	-20℃±2℃ 120H Restore 4H at 25℃ Power on	
5	High Temperature & Humidity Operation	40℃±2℃ 90%RH 120H Power on	
6	Temperature Cycle	−30℃←→25℃←→80℃ 30min 5min 30min after 10cycle, Restore 2H at 25℃ Power off	
7	Vibration Test	10Hz~150Hz, 100m/s^2, 120min	
8	Shock Test	Half-sine wave,300m/s^2,11ms	
9	Drop Test(package state)	800mm, concrete floor,1corner, 3edges, 6 sides each time	1.After testing, cosmetic and electrical defects should not happen. 2.the product should remain at initial place 3.Product uncovered or package broken is not permitted.

Notes:

1. Each test item applies for a test sample only once, The test sample can not be used again in any other test item.
2. The test sample is inspected after 2 hours or more storing at room temperature and room humidity after each test item is finished.
3. The criteria refer to 11.2.

11.2 Inspection of criteria

Remark NO.	Content
1	Functional test is OK. Missing Segment, shorts, unclear segment, nondisplay, display abnormally, liquid crystal leak are unallowable.
2	After testing, cosmetic defects should not happen, no low temperature bubbles, seal loose and fall, frame rainbow, ACF bubble growing are unallowable in the appearance test.
3	Total current consumption should not be over 10% of initial value.
4	After tests being executed, Contrast must be larger than 70% of its initial value prior to the tests.
5	No glass crack, chipped glass, end seal loose frame crack and so on.
6	No structure loose and fall.

12 Quality level

12.1 Classification of defects

Major defects (MA): A major defect refers to a defect that may substantially degrade usability for product applications. All functional defects：no display、display abnormally、open or missing segment、short circuit，missing component，outline dimension beyond the drawing，and progressive defects and those affecting reliability.

Miner defects (MI): A minor defect refers to a defect which is not considered to be able substantially degrade the product application or a defect that deviates from existing standards almost unrelated to the effective use of the product or its operation. Black spot, White spot, Bright spot, Pinhole, Black line, White line, Contrast variation, Bubble(Bubble in the cell is not included),Glass defect, and Polarizer defect beyond the standard as follows.

12.2 Definition of inspection range

For dot defect of TFT LCD which is not smaller than 3 inches, dividing three areas to make a judgment (according to figure 1).

A zone : center of viewing area

B zone : periphery of viewing area

C zone : Outside viewing area

For other defects, dividing two areas to make a judgment (according figure 2).

A zone : Inside Viewing area

B zone : Outside Viewing area

X1(A.A~V.A): 2mm X2(A.A~V.A): 2mm

Y1(A.A~V.A): 2mm Y2(A.A~V.A): 2mm

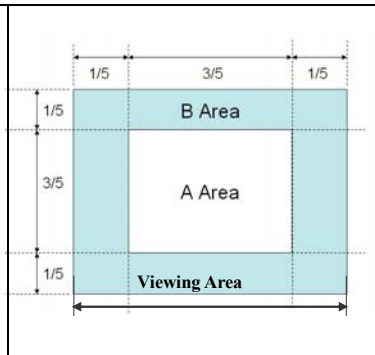


Figure 1

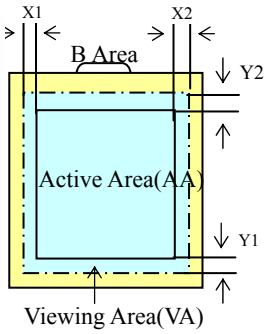


Figure 2

12.3 Inspection items and general notes

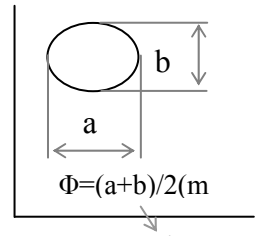
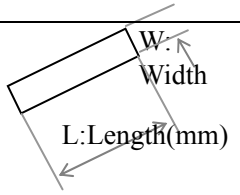
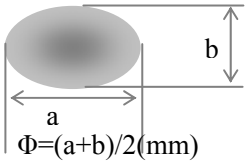
General notes	①Should any defects which are not specified in this standard happen, additional standard shall be determined by mutual agreement between customer and TIANMA. ②Viewing area should be the area which TIANMA guarantees. ③Limited sample should be prior to this Inspection standard. ④Viewing judgment should be under static pattern. ⑤Inspection conditions Inspection distance: 250 mm (from the sample) Temperature : 25±5 ºC Inspection angle : 45 degrees in 12 o′clock direction (all defects in viewing area should be inspected from this direction)	
Inspection items	Pinhole, Bright spot, Black spot, White spot, Black line, White Line, Foreign particle, Bubble	The color of a small area is different from the remainder. The phenomenon doesn't change with voltage
	Contrast variation	The color of a small area is different from the remainder. The phenomenon changes with voltage
	Polarizer defect	Scratch, Dirt, Particle, Bubble on polarizer or between polarizer and glass
	Dot defect (TFT LCD)	the pixel appears bright or dark abnormally when display.

	Functional defect	no display, display abnormally, open or missing segment, short circuit, False viewing direction
	Glass defect	Glass crack, Shaved corner of glass, Surplus glass
	Segment defect	Pin holes or cracks in segment, Transformation of segment
	PCB defect	Components assembly defect

12.4 Outgoing Inspection level

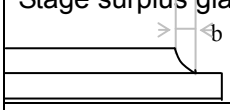
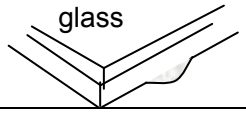
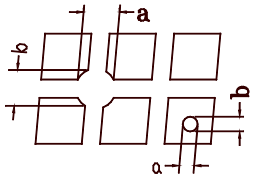
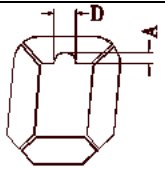
Outgoing Inspection standard	Inspection conditions	Inspection				
		Min.	Max.	Unit	IL	AQL
Major Defects	See 13.3 general notes	See 13.5			II	0.65
Minor Defects	See 13.3 general notes	See 13.5			**II**	1.5
Note：Sampling standard conforms to GB2828						

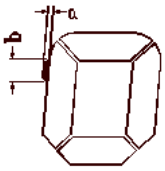
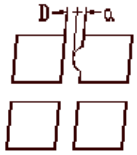
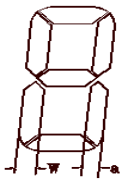
12.5 Inspection Items and Criteria

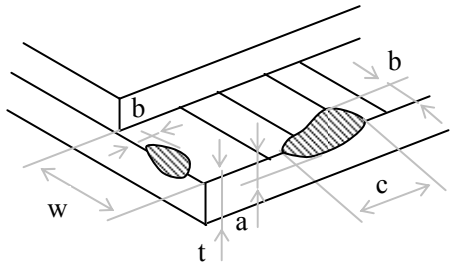
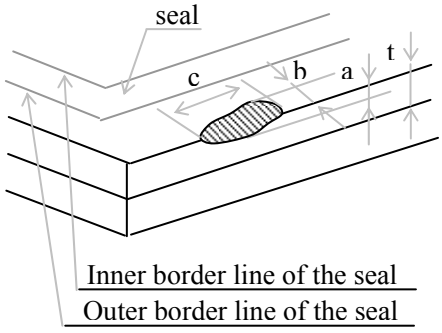
Inspection items			Judgment standard			
			Category		Acceptable number	
					A zone	B zone
1	Black spot, White spot, Bright Spot, Pinhole, Foreign Particle, Bubble and Particle in or on glass, Scratch on glass		A	Φ≦0.10	Neglected	Neglected
			B	0.10<Φ≦0.15	2	
			C	0.15<Φ≦0.20	1	
			D	0.20<Φ	0	
			Total defective point(B,C)		3	
2	Black line, White line, Bubble and Particle Between Polarizer and glass, Scratch on glass		A	W≦0.01	Neglected	Neglected
			B	0.01<W≦0.03 L≦3.0	2	
			C	0.03<W≦0.05 L≦3.0	1	
			D	0.05<W	0	
			Total defective point(B,C)		3	
3	Contrast variation		A	Φ≦0.2	Neglected	Neglected
			B	0.2<Φ≦0.3	2	
			C	0.3<Φ≦0.4	1	
			D	0.4<Φ	0	
			Total defective point(B,C)		3	

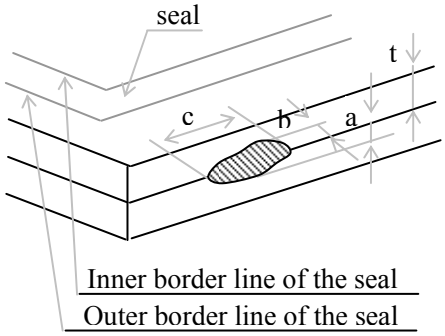
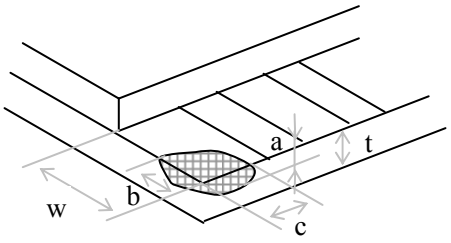
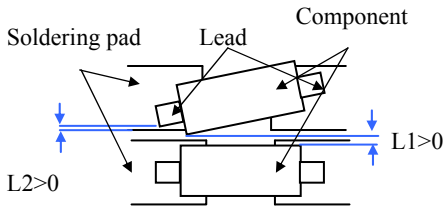
4	Dot defect (if TFT LCD is used)	TFT LCD is smaller than 3 inches	LCD Class	Defect	A zone	B zone
			A	Bright dot	1	Neglected
				Dark dot	2	
				Total	2	
			B	Bright dot	2	
				Dark dot	3	
				Total	4	

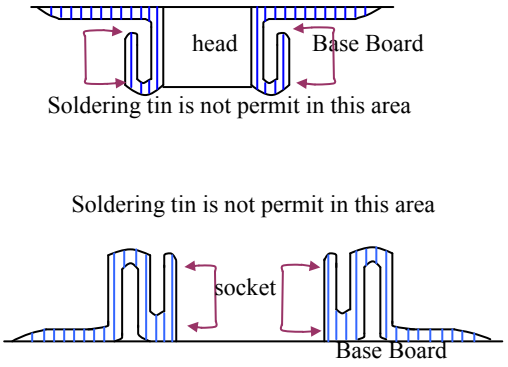
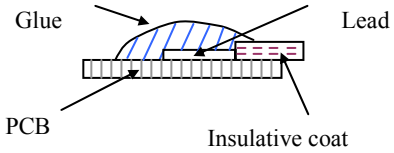
		TFT LCD between 3~10.4 inches	LCD Class	Defect	A zone	B zone	C zone
			A	Bright dot	1	1	Neglected
				Dark dot	1	2	
				Total	4		
			B	Bright dot	2	2	
				Dark dot	2	3	

				Total	6	
		Notes: Bright dot: in R、G、B or dark display figure, the pixel appears bright. Dark dot: in R、G、B or white display figure, the pixel appears dark. Defect area must be less than an half size of the dot.				
5	Bubble inside cell		any size		none	none
6	Polarizer defect (if Polarizer is used)	Scratch ,damage on polarizer, Particle on polarizer or between polarizer and glass.	Refer to item 1 and item 2.			
		Bubble, dent and convex	A	Φ≦0.3	Neglected	Neglected
			B	0.3<Φ≦0.7	2	
			C	0.7<Φ	0	
			Total defective point(B,C)		2	
7	Surplus glass	Stage surplus glass 	b≦0.3mm			
		Surrounding surplus glass 	Should not influence outline dimension and assembling.			
8	Open segment or open common		Not permitted			
9	Short circuit		Not permitted			
10	False viewing direction		Not permitted			
11	Contrast ratio uneven		According to the limit specimen			
12	Crosstalk		According to the limit specimen			
13	Black /White spot(display)		Refer to item 1			
14	Black /White line(display)		Refer to item 2			
15	Pin holes and cracks in segment		not counted	Max.3 dots allowed		Max.3 dots allowed
			x<0.1mm	0.1mm≤x≤0.2mm		
			x=(a+b)/2			
			not counted	Max.2 dots allowed		
			A<0.1mm	0.1mm≤A≤0.2mm D<0.25mm		

16	Transformation of segment		not counted	Max.1 defects allowed each segment	Max.3 defects allowed
			x<0.1mm	0.1mm≤x≤0.2mm	
			x=(a+b)/2		
			not counted	Max.1 defects allowed each segment	
			a<0.1mm	0.1mm≤a≤0.2mm D>0	
			0.8W≤a≤1.2W a=measured value of width W=nominal value of width		Max.2 defects allowed

Inspection items			Judgment standard	
			Category(application: B zone)	
17	Glass defect crack	①The front of lead terminals 	A	If a ≦ t and b ≦1.0, c is not limited
			B	a ≦ t, 1≦b≦2mm, c≦3mm
			C	If glass crack cover alignment mark and patterns, b≦0.5mm.
			D	Crack at two sides of lead terminals should not cover patterns and alignment mark
		②Surrounding crack—non-contact side 	b < Inner borderline of the seal	

		③ Surrounding crack— contact side  	b < Outer borderline of the seal
		④Corner  	A: a ≦ t, b ≦ 3.0, c ≦ 3.0 *Glass crack should not cover patterns u and alignment mark and patterns.
18	PCB defect	Component soldering: No cold soldering、short、open circuit、burr、tin ball The flat encapsulation component position deviation must be less than 1/3 width of the pin (Pic.1)； the sheet component deviation: Pin deviates from the pad and contact with the near components is not permitted（Pic.2）	
		lead defect: The lead lack must be less than 1/3 of its width; The lead burr must be less than 1/3 of the seam; Impurities connect with the near leads is not permitted	

		Connector soldering: Soldering tin is at contact position of the plug and socket is not permitted No foundation is scald Serious cave distortion on plug and socket contact pin is not permitted	
		Glue on root of the speaker receiver and motor lead: The insulative coat of the lead must join into the PCB; the protected glue must envelop to the insulative coat.	

13 Precautions for Use of LCD Modules

13.1 Handling Precautions

13.1.1 The display panel is made of glass. Do not subject it to a mechanical shock by dropping it from a high place, etc.

13.1.2 Liquid in LCD is hazardous substance, if the display panel is damaged and the liquid crystal substance inside it leaks out, be sure not to get any in your mouth, if the substance comes into contact with your skin or clothes, thoroughly and promptly wash it off using soap and water.

13.1.3 Do not apply excessive force to the display surface or the adjoining areas since this may cause the color tone to vary.

13.1.4 Don't touch, push or rub the exposed polarizer covering the display surface of the LCD module with anything harder than an HB pencil lead, the polarizer is soft and easily scratched, handle it carefully.

13.1.5 Don't put or attach anything on the display area to avoid leaving any marks on.

13.1.6 If the display surface is contaminated or becomes dusty, breathe on the surface and gently wipe it with a soft dry cloth. do not scrub hard to avoid damage the surface. If still not completely clear, moisten cloth with one of the following solvents:

— Isopropyl alcohol
— Ethyl alcohol

Solvents other than those mentioned above may damage the polarizer. Especially, do not use the following:

— Water
— Ketone
— Aromatic solvents

13.1.7 Do not attempt to disassemble the LCD Module.

13.1.8 If the logic circuit power is off, do not apply the input signals.

13.1.9 Avoid using the same display pattern long time (continous ON segment).Software must be prepared so that the pattern will be changed

13.1.10 To prevent destruction of the elements by static electricity, be careful to maintain an optimum work environment.

a. Be sure to ground the body and electric appliances when handling the LCD Modules. It is preferable to use conductive mat on table and wear cotton clothes or conductive processed fibre. Synthetic fibre is not recommended.

b. Tools required for assembly, such as soldering irons, must be properly ground.

c. To reduce the amount of static electricity generated, do not conduct assembly and other work under dry conditions.

d. The LCD Module is coated with a film to protect the display surface. Be careful and slow when peeling off this protective film since static electricity may be generated. It is recommended to use ionic fan or machine when operating. It is recommended to remove the protection foil slowly (> 3 sec.).

e. It is preferable to wear gloves etc, to avoid damaging the LCD. Please do not touch electrodes with bare hands or avoid any other contamination.

13.2 Storage precautions

13.2.1 When storing the LCD modules, avoid exposure to direct sunlight or to the light of fluorescent lamps.

13.2.2 The LCD modules should be stored under the storage temperature range. If the LCD modules will be stored for a long time, the recommend condition is:

Temperature : 5℃ ～ 40℃

Relatively humidity: ≤80%

13.2.3 The LCD modules should be stored in a clean environment or room, free from acid, alkali and harmful gas.

13.2.4 Store the module in anti-static electricity container and without any physical load.

13.3 Transportation precautions

The LCD modules should be no falling and violent shocking during transportation, and also should avoid excessive press, water, damp and sunshine.

13.4 Soldering

13.4.1 Use the high quality solders, only solder the I/O terminals.

13.4.2 No higher than 280℃ and time less than 3-4 second during soldering.

13.4.3 Rewiring: no more than 3 times.

13.4.4 when you remove connector or cable soldered to I/O terminals, please confirm that solder is fully melted. If you remove by force, electrodes at I/O terminals may be damaged (or stripped off). It is recommended to use solder suction machine.

14. LCD Module Part Numbering System

TM	202	J	B	C	W	V	B	Y	A
①	②	③	④	⑤	⑥	⑦	⑧	⑨	⑩

NO.	Explanation	
①	**TIANMA module indicating**	
②	**Module type:** 3 DIGITS, 20-Character × 2-Line,	
③	**TIANMA module series (**A,B,C,D…J**)**	
④	**LCD type**	
	B	Positive, Yellow-Green mode, STN
⑤	**Backlight type**	
	C	Transflective, LED
⑥	**Temperature range**	
	W	Wide temperature
⑦	**Viewing Angle**	
	V	Wide viewing direction
⑧	**Technology**	
	B	COB (including SMT)
⑨	**The color of backlight**	
	Y	Yellow-green
⑩	**Function choice**	
	A	Basic function