TIANMA
Microelectronics Co.,LTD

SPECIFICATION

FOR LCD MODULE

MODEL NO:	**TM240128ACCWVBWD**
CUSTOMER:	**TM standard module**
CUSTOMER P/N.	**---**
VERSION	**0.1**
CUSTOMER APPROVED	

■ Preliminary specification

□ Final specification

PREPARED BY	CHECKED BY	VERIFIED BY QA DEPT.	APPROVED BY

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RoHS

REVISION RECORD

Version	Page	Revision Items	Name	Date
0.0		First release	Lihong Zhou	2008.01.31
0.1		Change format	Yunkang Chen	2008.2.16

TABLE OF CONTENTS

1 Description

The TM240128ACCWVBWD, a Graphic LCM unit consists of 240(segment)×128(common) dots dot-matrix LCD panel, LCD driver ,controller and bias circuits on a single PCB. Incorporating mask ROM-based character generator and display data RAM in the LSI, the unit can efficiently display the desired dot-matrix under microprocessor controller.

- Wide viewing angle
- Wide operation temp.
- Requirements on environmental protection： RoHS.
- Built-in character generator
- Include DC/DC circuit and temperature compensation circuit

2 Features

Item	Contents
LCD type	FSTN
	positive
LCD Duty	128
LCD Bias	1/12
Polarizer	transflective
LCD background color	gray
Segment color	black
Backlighting	LED
Backlighting type	side
Backlighting color	white
Backlighting drive	4.2V
View direction	6:00
Operating temperature	-20□~70□
Storage temperature	-30□~80□
Controller	SAP1024
Frame	SPCC(Black)
Technology	COB
Power supply	VDD=5.0V
Data Transfer	8 Bit Parallel

Notes：

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

3 Absolute maximum ratings

Parameter	Symbol	Min	Max	Unit	Remark
Logic circuit supply voltage	VDD	-0.3	+7.0	V	--
DC/DC circuit supply negative voltage	VEE	-28	+7.0	V	--
LCD driving voltage	VLCD	0	+30	V	Note [3-2]
Operating temperature range	Top	-20	+70	□	Note [3-3]
Storage temperature range	Tst	-30	+80	□	

Note：

Note [3-1]： No parameter is allowed to exceed these maximum ratings.

Note [3-2]：LCD operating voltage VLCD=VDD–VEE–VCE (Transistor：VCE).

Note [3-3]：95% RH MAX (40 ℃≥ Ta);
Maximum wet-bulb temperature is 39℃ or less. (Ta >40 ℃) No dew condensation.

Note [3-4]：Only operation is guarantied at operating temperature. Contrast, response time and another display quality are evaluated at +25℃.

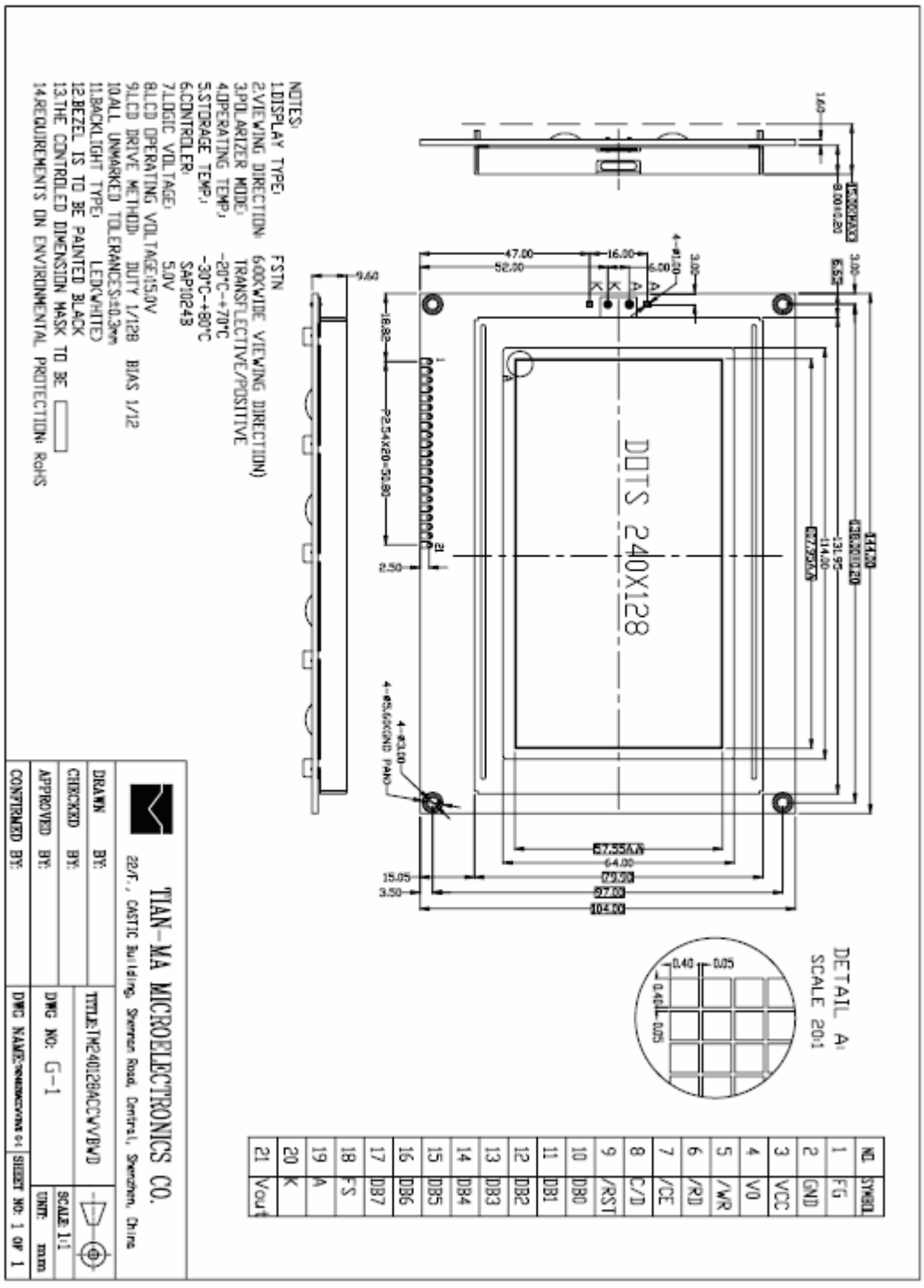
Note [3-5]：VDD ≧VSS ≧ VEE. must be maintained.

4 Mechanical Characteristics

4.1 Mechanical features

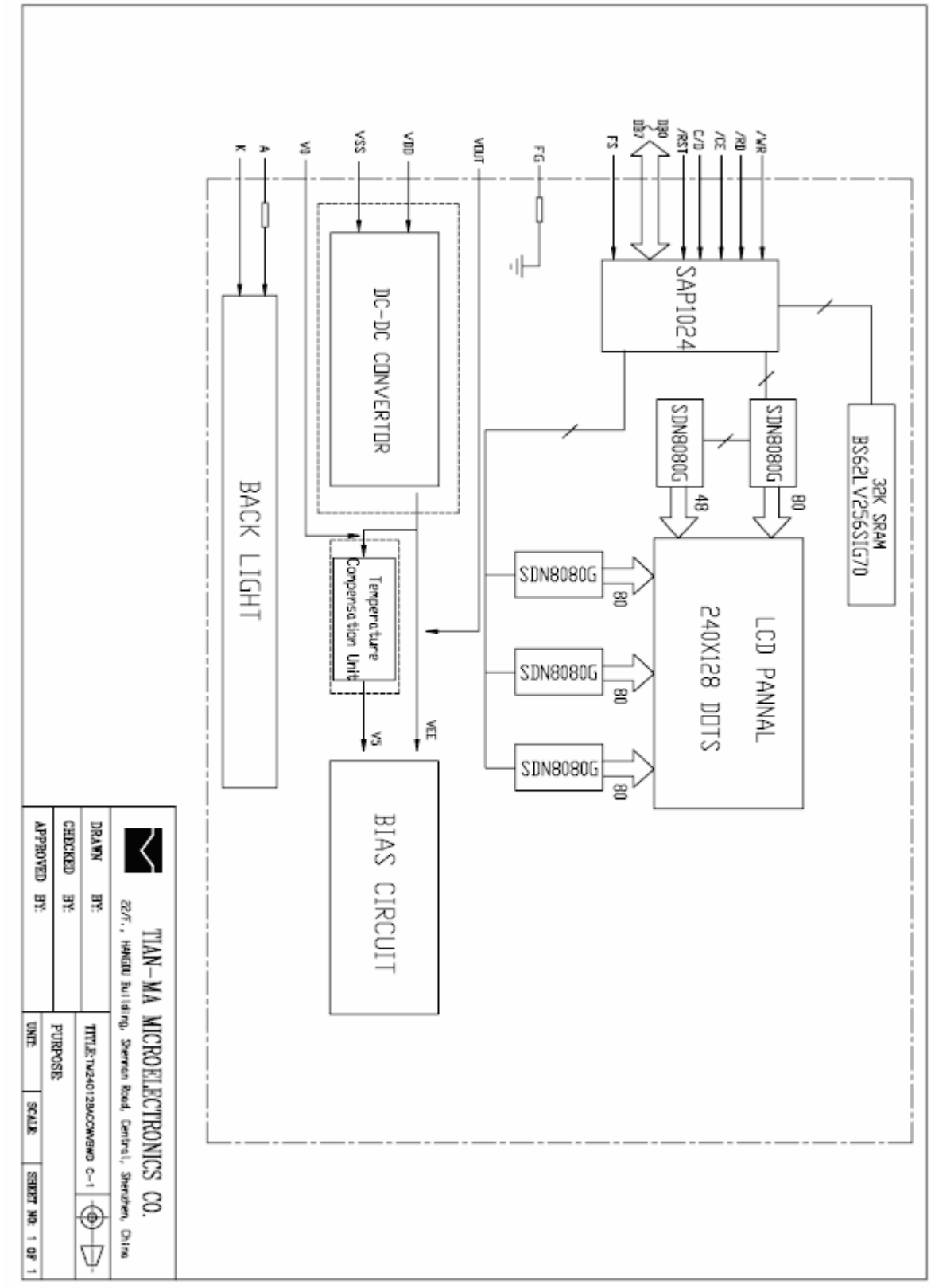
Parameter	Standard Value	Unit
Display type	Graphics module	--
Character size(W×H)	7×8/8×8	dot
Number of dots/characters (W×H)	240 × 128	--
View area (W×H)	114.00×64.00	mm
Active Area (W×H)	107.95 × 57.55	mm
Dot Size (W×H)	0.40 × 0.40	mm
Dot Pitch (W×H)	0.45×0.45	mm
Module size(W×H×D)	144.00 × 104.00 × 9.60 (MAX)	mm
Module total weight (approx)	230	g
Module outline dimensions	Refer to page 5-“Mechanical drawing”	--

4.2 Mechanical drawing.

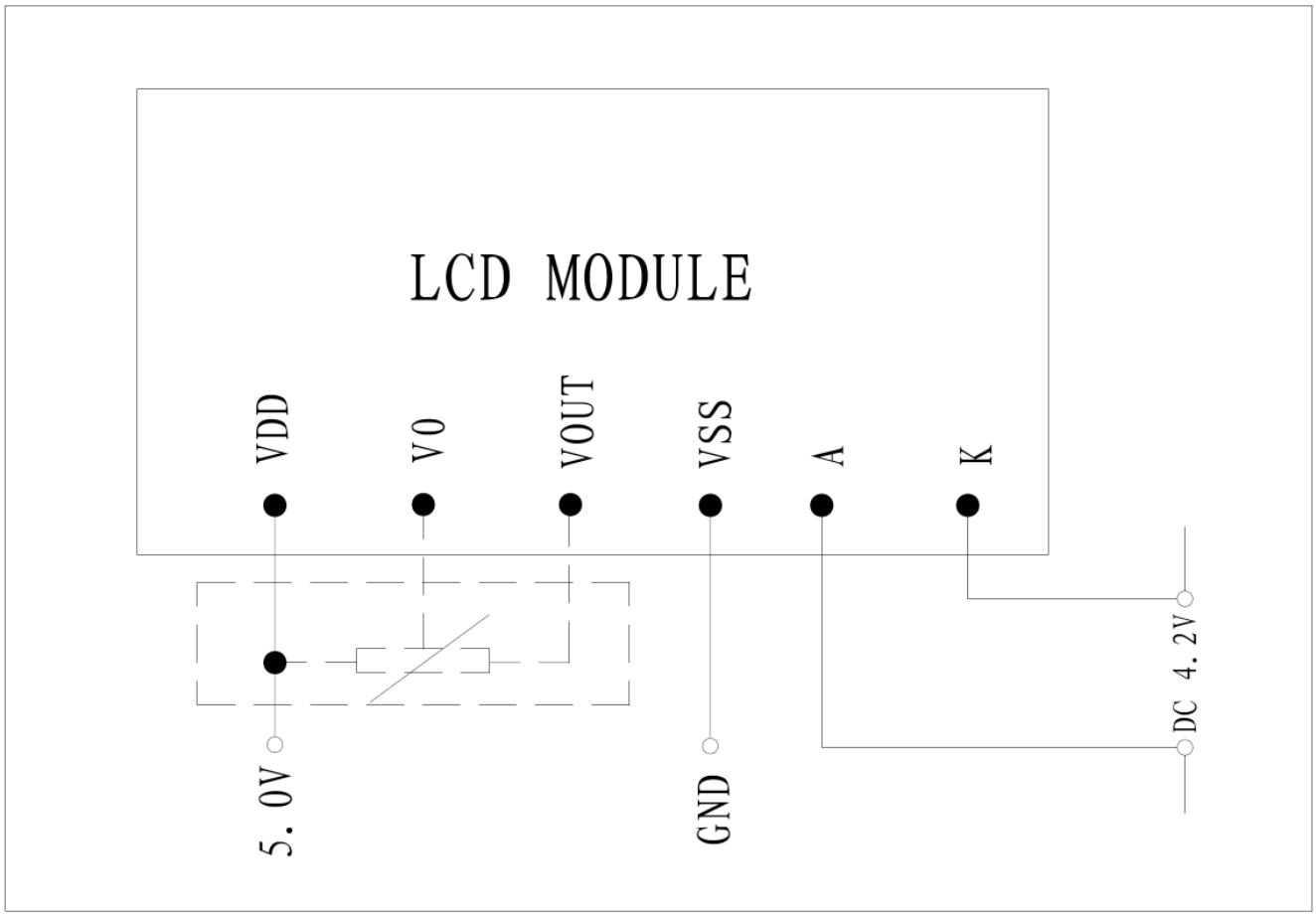


5 Circuit

5.1 Block Diagram



5.2 Recommend interface circuit



Note：

Note [5-1]： The VOUT (VOUT = VEE) comes form by DC-DC circuit on the PCB.

Note [5-2]： If you want to input VOUT directly from external power and don't need the DC-DC circuit, please remove the resistance R23 on the PCB , refer to the circuit above with adjustable resistance.

6 Interface description

Pin No.	Symbol	I/O	Description
1	FG	--	Frame ground
2	VSS	P	Power supply (0V, GND)
3	Vcc	P	Power supply for logic (Vcc =VDD)
4	V0	P	Test pin
5	/WR	I	Write signal L: active
6	/RD	I	Read signal L: active
7	/CE	I	Chip enable signal L: active
8	C/D	I	Write mode H: Command, L: Data write Read mode H: status, L: Data read
9	/RST	I	Reset signal L: reset
10	D0	I/O	Data bit0
11	D1	I/O	Data bit1
12	D2	I/O	Data bit2
13	D3	I/O	Data bit3
14	D4	I/O	Data bit4
15	D5	I/O	Data bit5
16	D6	I/O	Data bit6
17	D7	I/O	Data bit7
18	FS	I	Font switch H: 7×8dots, L: 8×8dots
19	A	P	LED anode terminal
20	K	P	LED cathode terminal
21	Vout	P	The output voltage of DC/DC converter

7 Instruction Code & Timing characteristics

7.1 COMMAND

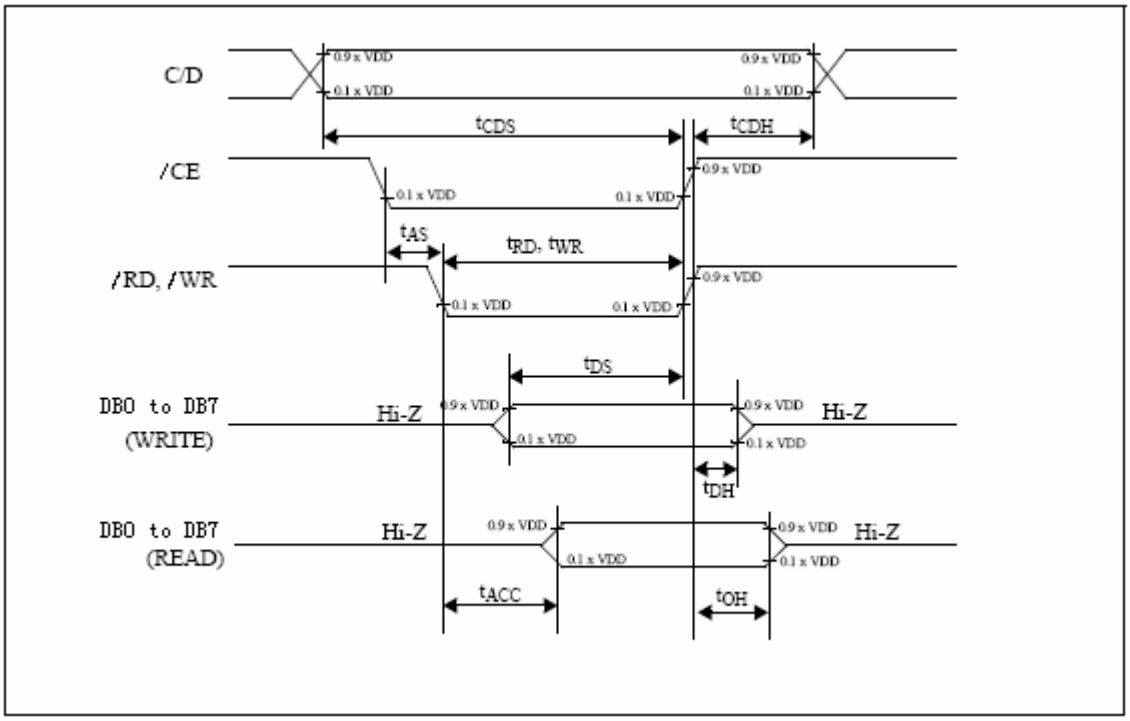
The module TM240128ACCWVBWD include the controller-SAP1024B. When indirect mode is selected for the system interface, use commands to set up the display. The table below lists the types of commands, including the code of each command. more details refer to SAP1024B data sheet please.

COMMAND	CODE	OPERAND 1	OPERAND 2	FUNCTION
Register Setting	0010 0001	X address	Y address	Set cursor pointer
	0010 0010	Data	00H	Set offset register
	0010 0100	Low address	High address	Set address pointer
Set Control Word	0100 0000	Low address	High address	Set text home address
	0100 0001	Columns	00H	Set text area
	0100 0010	Low address	High address	Set graphic home address
	0100 0011	Columns	00H	Set graphic area
Mode Set	1000 x000			OR mode
	1000 x001			EXOR mode
	1000 x011			AND mode
	1000 x100			Text Attribute mode
	1000 0xxx			Internal CG ROM mode
	1000 1xxx			External CG RAM mode
Display mode	1001 0000			Display OFF.
	1001 xx10			Cursor ON, blink OFF.
	1001 xx11			Cursor ON, blink ON.
	1001 01xx			Text ON, graphic OFF.
	1001 10xx			Text OFF, graphic ON.
	1001 11xx			Text ON, graphic ON.
Cursor Pattern Select	1010 0000			Selec one-line cursor.
	1010 0001			Select two-line cursor.
	1010 0010			Select three-line cursor.
	1010 0011			Select four-line cursor.
	1010 0100			Select five-line cursor.
	1010 0101			Select six-line cursor.
	1010 0110			Selec seven-line cursor.
	1010 0111			Select eight-line cursor.
Data Auto Read/Write	1011 0000			Select Data Auto Write
	1011 0001			Select Data Auto Read
	1011 0010			Reset Auto Read/Write

COMMAND	CODE	OPERAND 1	OPERAND 2	FUNCTION
Data READ / WRITE	1100 0000	Data		Data Write and increment Address Pointer
	1100 0001			Data Read and increment Address Pointer
	1100 0010	Data		Data Write and decrement Address Pointer.
	1100 0011			Data Read and decrement Address Pointer
	1100 0100	Data		Data Write and Keep Address Pointer
	1100 0101			Data Read and Keep Address Pointer
Screen Peek	1110 0000			Screen peek
Screen Copy	1110 1000			Screen copy
Bit Set/Reset	1111 0xxxx			Bit Reset
	1111 1xxxx			Bit Set
	1111 x000			Bit 0
	1111 x001			Bit 1
	1111 x010			Bit 2
	1111 x011			Bit 3
	1111 x100			Bit 4
	1111 x101			Bit 5
	1111 x110			Bit 6
	1111 x111			Bit 7

7.2 Interface Timing characteristics

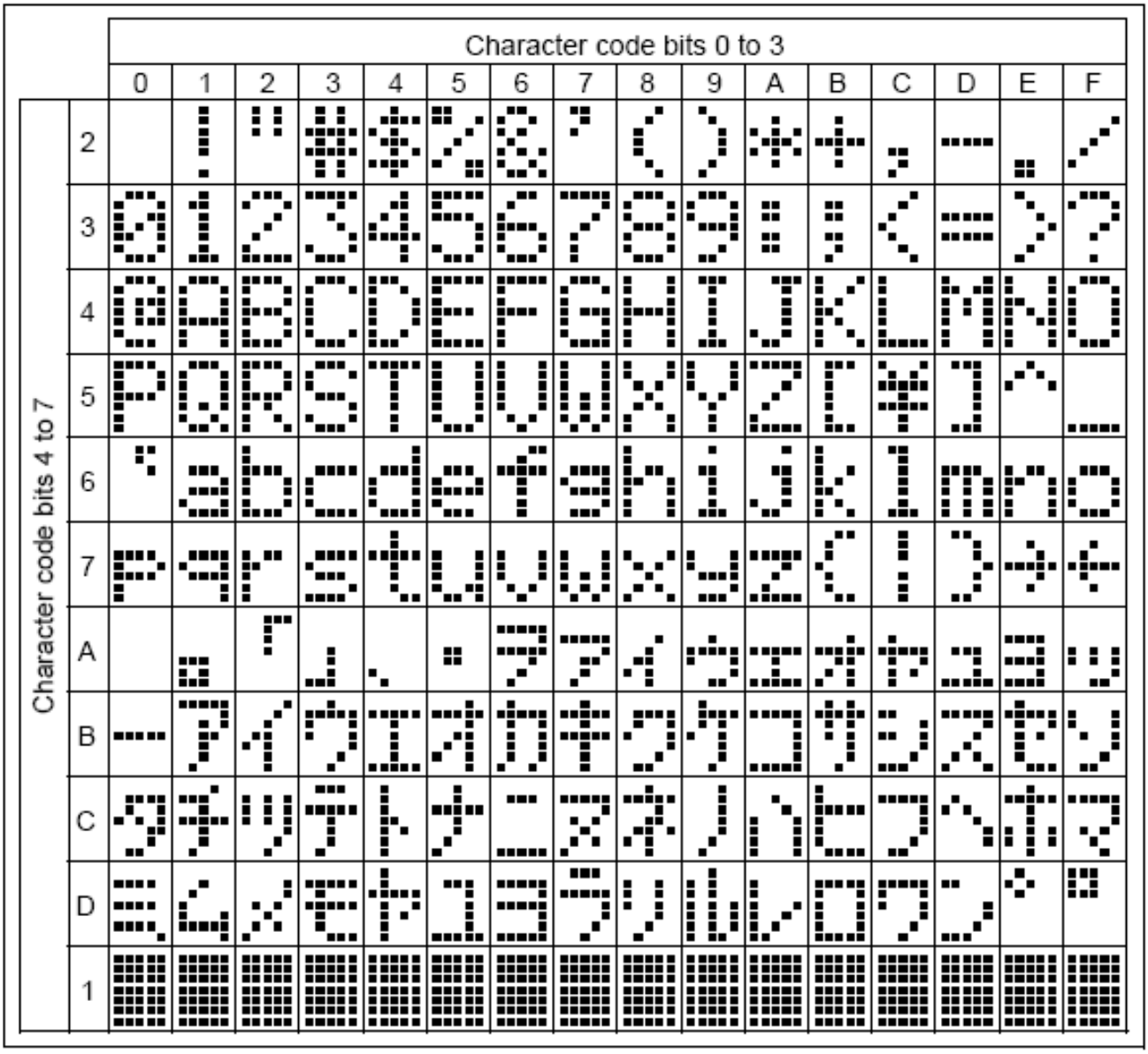
CPU interface timing



V_{DD} = 5 V ±10%; V_{SS} = 0 V; T_{amb} = -20 °C to +70°C.

symbol	parameter	MIN.	MAX.	test conditons	Unit
t_{CDS}	C/D set-up time	100			ns
t_{CDH}	C/D hold time	10			ns
t_{RD}, t_{WR}	/RD ,/WR pulse width	80			ns
t_{AS}	Address set-up time	0			ns
t_{AH}	Address hold time	0			ns
t_{DS}	Data set-up time	80			ns
t_{DH}	Data hold time	40		Note	ns
t_{ACC}	Access time		150	Note	ns
t_{OH}	Output hold time	10	50	Note	ns

7.3 character generator code map



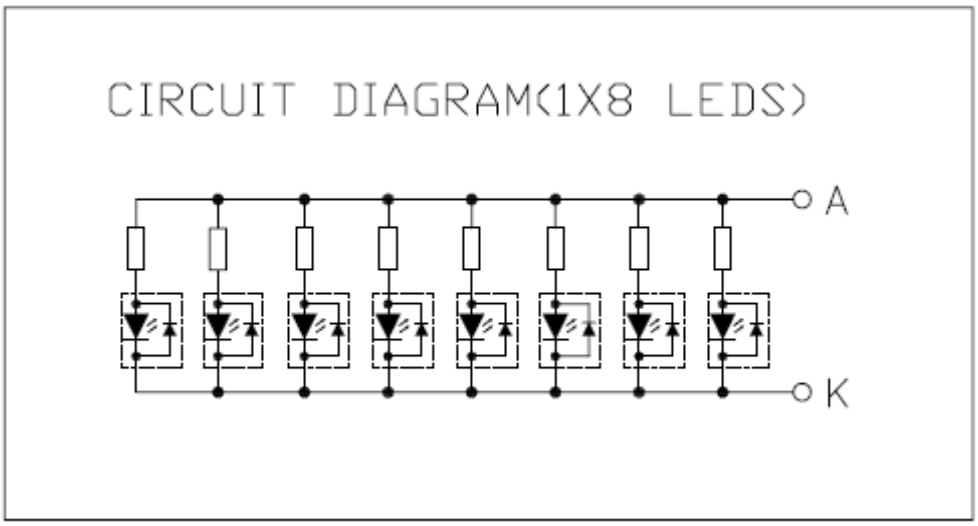
8 Electrical characteristics

V_{SS}=0V, Ta=25℃

Parameter		Symbol	Condition	MIN	TYP	MAX	UNIT
Logic circuit supply voltage		V_{DD}	--	4.5	5.0	5.5	V
Power supply LCD(-)		V_{EE}	--	14.7	15.0	15.3	
Input voltage for logic circuit	"H"level	V_{IH}	V_{DD}=5.0V	0.8VDD	--	VDD	
	"L"level	V_{IL}		0	--	0.2 VDD	
Output voltage for logic circuit	"H"level	V_{OH}		VDD-0.3	--	VDD	
	"L"level	V_{OL}		0	--	0.3	
Logic power supply current (Without backlighting)		I_{CC}		--	--	45.0	mA
Used driver IC		SND8080G of Avant					

9 LED backlight characteristics

Ta=25℃



Item	Symbol	Condition	MIN.	TYP.	MAX.	Unit	Remark
Forward voltage	Vf	If =120mA	4.0	4.2	4.4	V	--
Forward current	If	Vf = 4.2V	--	--	200	mA	--
Reverse voltage	V_r	--	--	--	1.0	V	--
Reverse Current	I_r	V_r=0.8	--	15	20	mA	--
Luminous intensity*	Bp	If =120mA	300	400	--	cd/m^2	
Luminous Uniformity*	△Bp		75	--	--	%	
Color coordinate*	X		0.296	--	0.330	--	
	Y		0.276	--	0.339	--	
Wavelength	λ P	--	--	--	--	nm	Note [9-1,2]
Lifetime	t	25℃,60%RH, If=30mA/led	--	500	--	hour	Note [9-3]

Note:

Note [9-1]： The wavelength is measured with the bare LED backlight unit.

Note [9-2]： If the backlight is used above its' driving voltage or current for a long time, its lifetime will reduce or it will cause poor reliability.

Note [9-3]： The backlight lifetime lasts until the luminance reduces to 50% of its initial value.

10 Optical Characteristics

10.1 Optical Characteristics

Parameter		Symbol	Ratings			Unit	Measuring Temp.	Reference
			Min	Type	Max.			
Operating voltage		V_o	--	--	--	V	-20℃	Note[10-1]
			--	15.09	--		22℃	
			--	--	--		70℃	
Frame frequency		f	--	64	--	Hz		Note[10-2]
Contrast ratio		Cr(θ=20°, Φ=90° or 270°)	2.5	--	--	-	22□	Note[10-3]
Response time	Turn on	t_{on}	--	160	--	ms	22□	Note[10-4]
			--	TBD	--		0□	
	Turn off	t_{off}	--	220	--	ms	22□	
			--	TBD	--		0□	
Viewing angle (Cr≥2)	Up-down	θ1 (Φ=90° or 270°)	--	20	--	deg	25□	Note[10-5]
			--	25	--			
	Left-right	θ2 (Φ=0° or 180°)	--	25	--	deg	25□	
			--	25	--			
Luminance		YL (θ=0°,Φ=0°)	--	40	---	Cd/ m2	22□	Note[10-8] (If =120mA)
Luminance Uniformity		LU (θ=0°,Φ=0°)	70	---	---	%	22□	Note[10-8,9]

Note[10-1]: The maximum and minimum ratings don't mean the LCD works well in the whole range of Vop. Vop must be adjusted to optimize the viewing angle and contrast. Refer to definition of drive voltage, refer to 10.2.

Note[10-2]: The frequency shouldn't be too low to avoid flicker. Refer to definition of drive voltage, refer to 10.2.

Note[10-3]: Refer to 10.2/10.3/10.4/10.5.

Note[10-4]: 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.

Note[10-5]: 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

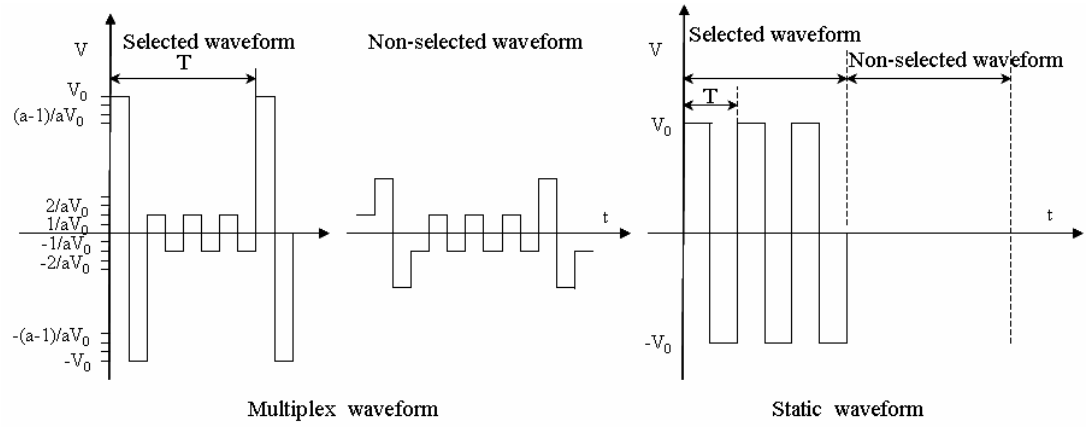


Fig.1 Definition of drive voltage and waveform

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.

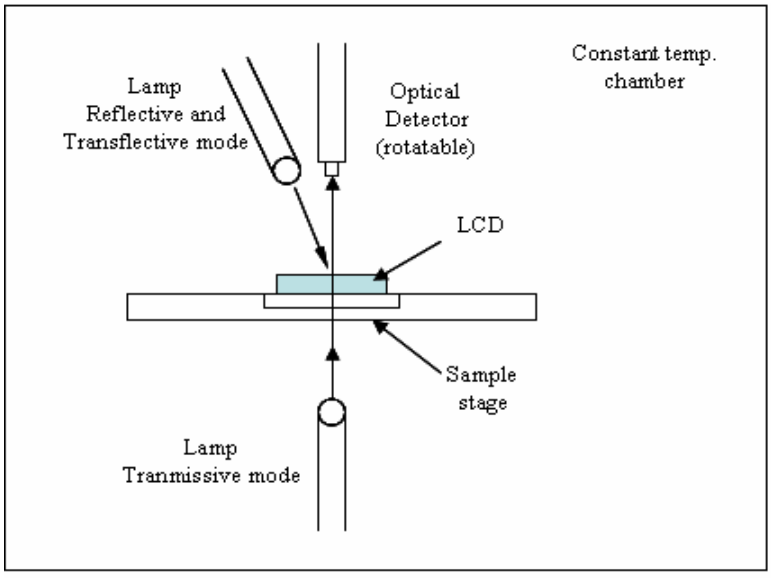


Fig.2 Optical characteristics measurement equipment

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*

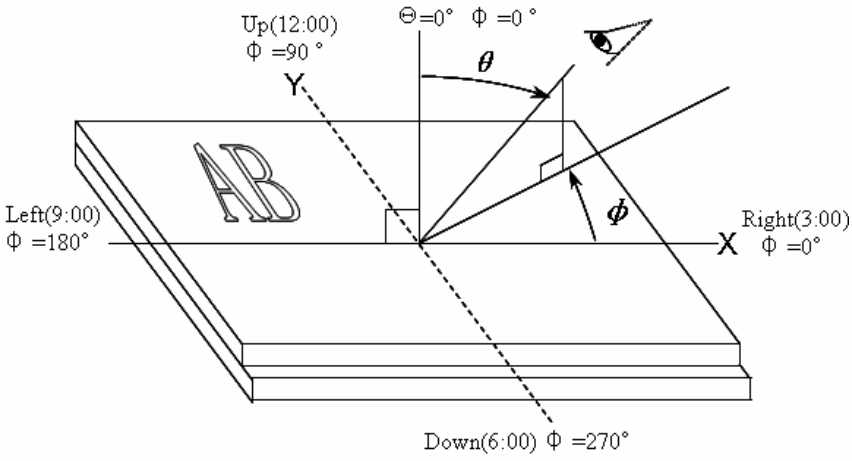


Fig.3 Definition of viewing direction

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.

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

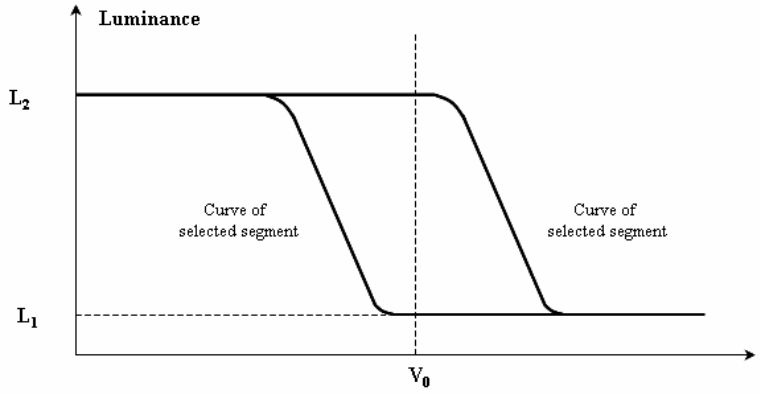


Fig.4 Electro-optical characteristic (EOC) graph (positive type)

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)

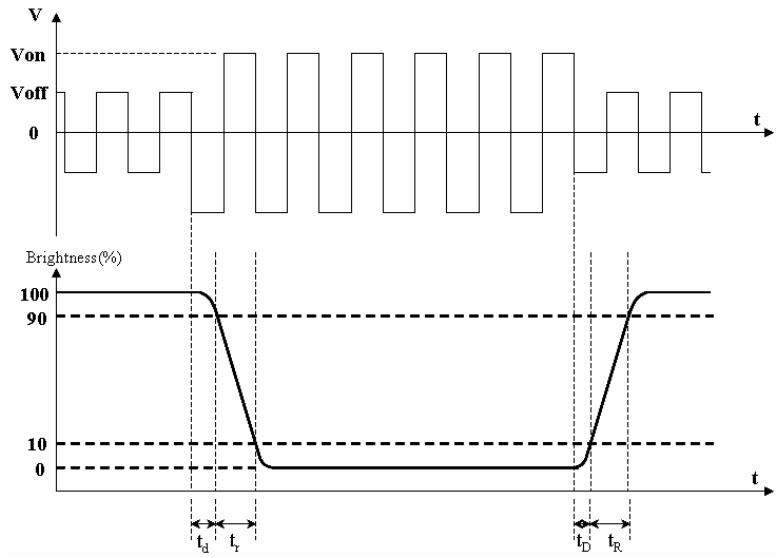


Fig.5 Definition of response time (positive type)

10.7 Definition of viewing angle

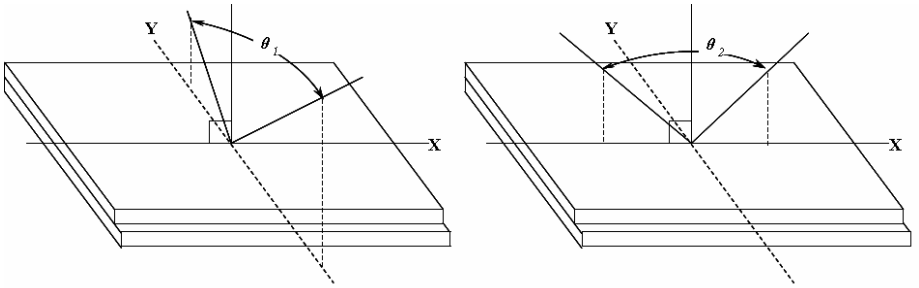


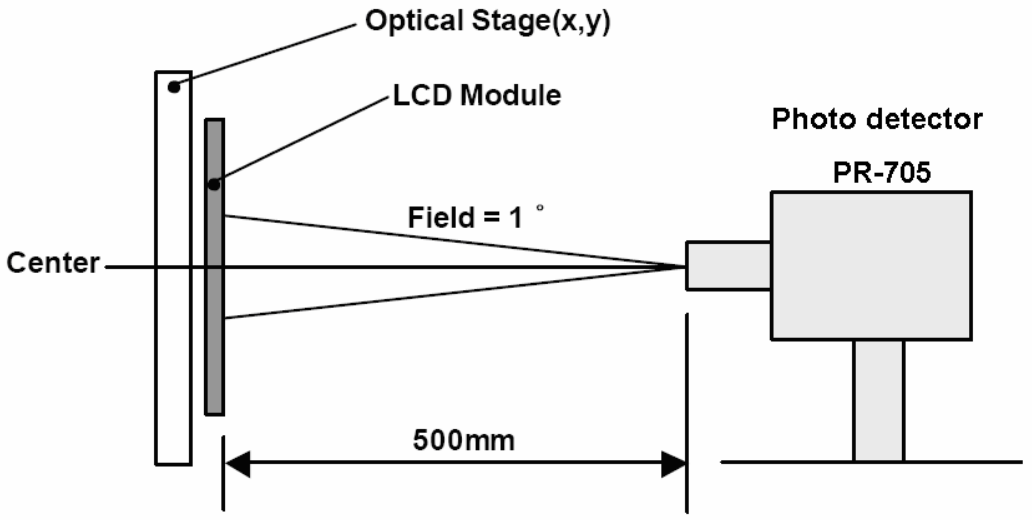
Fig 6 Definition of viewing angle

θ_1 ——range of viewing angle from up to down
θ_2 ——range of viewing angle from left to right.

10.8 Measuring equipments: DMS-501, PR-705

Measuring condition：

- After stabilizing and leaving the panel alone at a given temperature for 30 min, the measurement should be executed
- Measuring surroundings: a stable, windless and dark room
- Measuring temperature: Ta=25°C
- 30 min after lighting the back-light

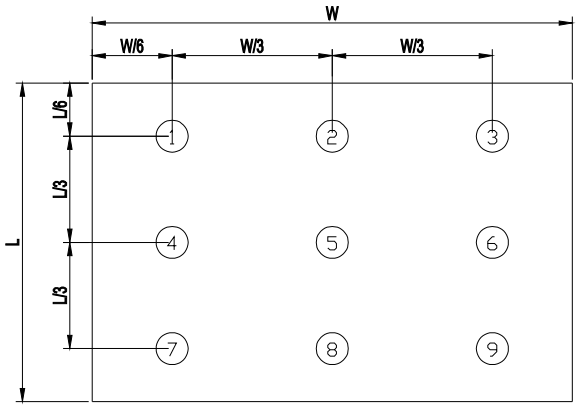


10.9 The definition of luminance uniformity

The luminance uniformity is calculated by using following formula.

$$\text{Luminance uniformity (Lu)} = \frac{\text{Minimum luminance from } \square \text{ to } \square}{\text{Maximum luminance from } \square \text{ to } \square}$$

The luminance is measured at near the 9 points shown below.



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	60℃±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/s2,11ms	
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 Package

TBD

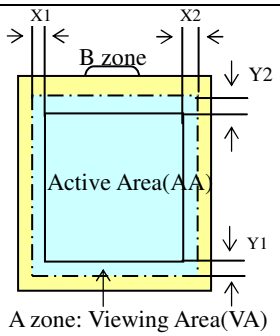
13 Quality level

13.1 Classification of defects

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

Minor defects (MI): A minor defect refers to a defect which is not considered to be able to 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, such as black spot, white spot, bright spot, pinhole, black line, white line, contrast variation, glass defect, polarizer defect, etc.

13.2 Definition of inspection range

For LCD defects, dividing two areas to make a judgment (according figure 1). A zone : Inside Viewing area B zone : Outside Viewing area X1(A.A~V.A): 3.025mm X2(A.A~V.A): 3.025mm Y1(A.A~V.A): 3.225mm Y2(A.A~V.A): 3.225mm	 Figure 1

13.3 Inspection items and general notes

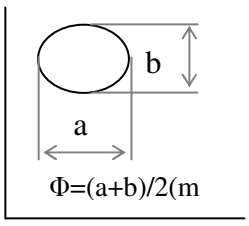
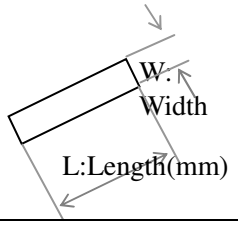
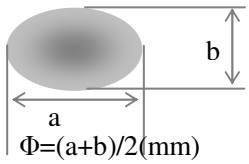
General notes	□Should any defects which are not specified in this standard happen, additional standard shall be determined by mutual agreement between customer and TIANMA. □Viewing area should be the area which TIANMA guarantees. □Limit sample should be prior to this Inspection standard. □Viewing judgment should be under static pattern. □Inspection conditions Inspection distance: 250 mm (from the sample) Temperature : 25±5 ºC Inspection angle : 45 degrees in 6 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

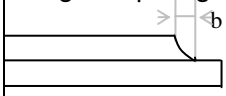
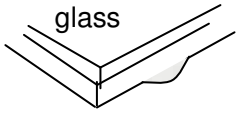
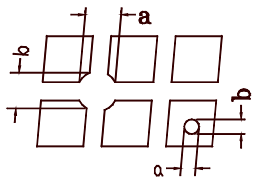
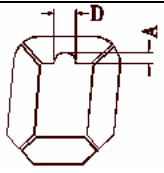
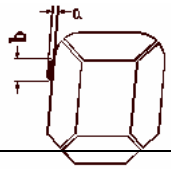
	Polarizer defect	Scratch, Dirt, Particle, Bubble on polarizer or between polarizer and glass
	Functional defect	no display, display abnormally, open or missing segment, short circuit, False viewing direction
	Glass defect	Glass crack, Shaved corner of glass, Surplus glass
	Segment defect	Pin holes or cracks in segment, Transformation of segment
	PCB defect	Components assembly defect

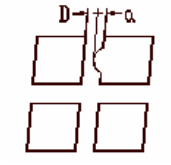
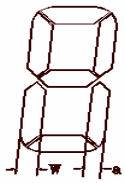
13.4 Outgoing Inspection level

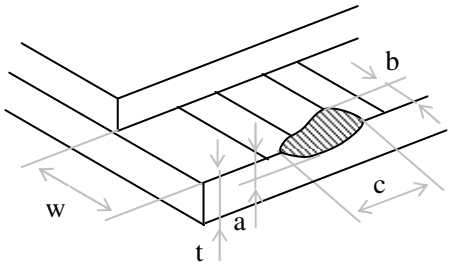
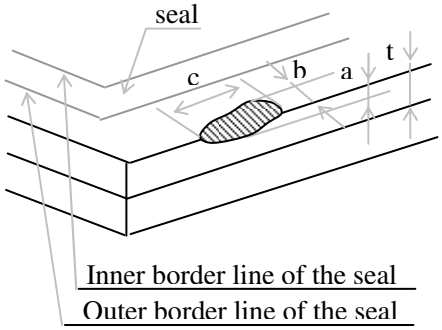
Outgoing Inspection standard	Inspection conditions	Inspection				
		Min.	Max.	Unit	IL	AQL
Major Defects	See 13.3 general notes	See 13.5			II	0.65
Minor Defects	See 13.3 general notes	See 13.5			**II**	1.5
Note：Sampling standard conforms to GB2828						

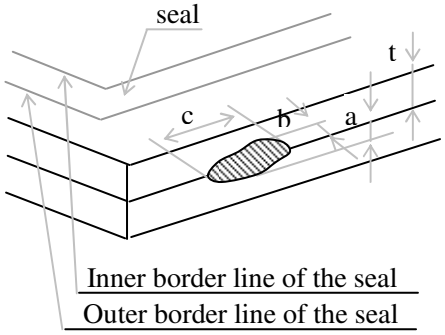
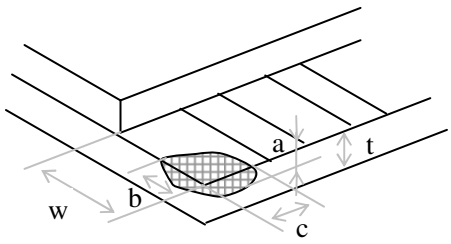
13.5 Inspection Items and Criteria

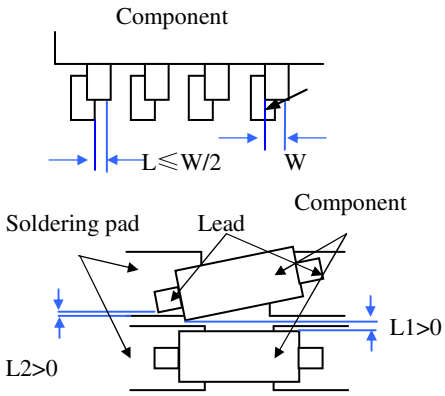
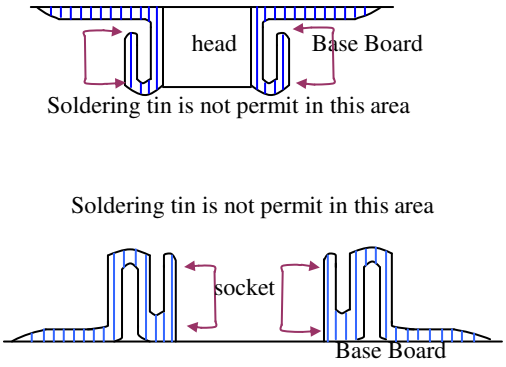
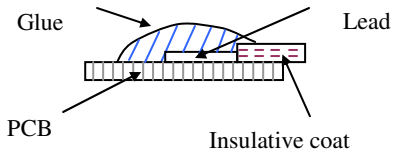
Inspection items			Judgment standard			
			Category		Acceptable number	
					A zone	B zone
1	Black spot,White spot, Bright Spot, Pinhole, Foreign Particle, Particle in or on glass, Scratch on glass		A	Φ≦0.10	Neglected	Neglected
			B	0.10<Φ≦0.20	3	
			C	0.20<Φ	0	
2	Black line, White line, Particle Between Polarizer and glass, Scratch on glass		A	W≦0.02	Neglected	Neglected
			B	0.02<W≦0.05 L≦3.0	3	
			C	W＞0.05 or L＞3.0	0	
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	Bubble inside cell		any size		none	none

<table>
<tr><td rowspan="4">5</td><td rowspan="4">Polarizer defect (if Polarizer is used)</td><td>Scratch ,damage on polarizer, Particle on polarizer or between polarizer and glass.</td><td colspan="4">Refer to item 1 and item 2.</td></tr>
<tr><td rowspan="3">Bubble, dent and convex</td><td>A</td><td>Φ≦0.3</td><td>Neglected</td><td rowspan="3">Neglected</td></tr>
<tr><td>B</td><td>0.3<Φ≦0.7</td><td>2</td></tr>
<tr><td>C</td><td>0.7<Φ</td><td>0</td></tr>
<tr><td rowspan="2">6</td><td rowspan="2">Surplus glass</td><td>Stage surplus glass
  </td><td colspan="4">b≦0.3mm</td></tr>
<tr><td>Surrounding surplus glass
  </td><td colspan="4">Should not influence outline dimension and assembling.</td></tr>
<tr><td>7</td><td colspan="2">Open segment or open common</td><td colspan="4">Not permitted</td></tr>
<tr><td>8</td><td colspan="2">Short circuit</td><td colspan="4">Not permitted</td></tr>
<tr><td>9</td><td colspan="2">False viewing direction</td><td colspan="4">Not permitted</td></tr>
<tr><td>10</td><td colspan="2">Contrast ratio uneven</td><td colspan="4">According to the limit specimen</td></tr>
<tr><td>11</td><td colspan="2">Crosstalk</td><td colspan="4">According to the limit specimen</td></tr>
<tr><td>12</td><td colspan="2">Black /White spot(display)</td><td colspan="4">Refer to item 1</td></tr>
<tr><td>13</td><td colspan="2">Black /White line(display)</td><td colspan="4">Refer to item 2</td></tr>
<tr><td rowspan="4">14</td><td rowspan="4">Pin holes and cracks in segment</td><td rowspan="2">  </td><td>not counted</td><td colspan="2">Max.3 dots allowed</td><td rowspan="4">Max.3 dots allowed</td></tr>
<tr><td>x<0.1mm</td><td colspan="2">0.1mm≤x≤0.2mm</td></tr>
<tr><td colspan="3">x=(a+b)/2</td></tr>
<tr><td>  </td><td>not counted</td><td colspan="2">Max.2 dots allowed each segment</td></tr>
<tr><td></td><td>A<0.1mm</td><td colspan="2">0.1mm≤A≤0.2mm
D<0.25mm</td></tr>
<tr><td rowspan="2">15</td><td rowspan="2">Transformation of segment</td><td rowspan="2">  </td><td>not counted</td><td colspan="2">Max.1 defect allowed each segment</td><td rowspan="2">Max.3 defects allowed</td></tr>
<tr><td>x<0.1mm</td><td colspan="2">0.1mm≤x≤0.2mm</td></tr>
</table>

			x=(a+b)/2		
			not counted	Max.1 defect 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)		Acceptable number
17	Glass defect crack	□The front of lead terminals 	A	a≤ t, b≤1/5W, c≤3mm	Max.3 defects allowed
			B	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		

<table>
<tr><td></td><td></td><td>③ Surrounding crack— contact side
 
</td><td colspan="2">b < Outer borderline of the seal</td><td></td></tr>
<tr><td></td><td></td><td>④Corner
 
</td><td>A</td><td>a □ t, b □ 3.0, c □ 3.0</td><td></td></tr>
<tr><td></td><td></td><td></td><td>B</td><td>Glass crack should not cover patterns u and alignment mark and patterns.</td><td></td></tr>
</table>

Inspection items			Judgment standard Category(application: B zone)
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.	

14 Precautions for Use of LCD Modules

14.1 Handling Precautions

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

14.1.2 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.

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

14.1.4 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.

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

14.1.6 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

14.1.7 Do not attempt to disassemble the LCD Module.

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

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

14.1.10 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.

14.2 Storage precautions

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

14.2.2 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%

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

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

14.3 Transportation precautions

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

14.4 Soldering

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

14.4.2 No higher than 280□ and time less than 3-4 second during soldering.

14.4.3 Rewiring: no more than 3 times.

14.4.4 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.

15. LCD Module Part Numbering System

TM	240128	A	C	C	W	V	B	W	D
□	□	□	□	□	□	□	□	□	□

NO.	Explanation	
□	**TIANMA module indicating**	
□	**Module type: 240columns X128rows, 6 DIGITS**	
□	**TIANMA module series**	
□	**LCD type**	
	C	Positive, FSTN
□	**Backlight type**	
	C	Transflective, LED
□	**Temperature range**	
	W	Wide temperature
□	**Viewing Angle**	
	V	Wide viewing direction
□	**Technology**	
	B	COB(including SMT)
□	**The color of backlight**	
	W	White
□	**Function choice**	
	D	Including DC-DC and Temp. Compensate circuit