TIANMA

SPECIFICATION
FOR LCD MODULE

MODEL NO:	**TM320222ACIGNA**
CUSTOMER:	**Cisco**
CUSTOMER P/N.	**30-1428-02**
VERSION	**V1.4**
CUSTOMER APPROVED	

□Preliminary specification

■Final specification

PREPARED BY	CHECKED BY	VERIFIED BY QA DEPT.	APPROVED BY

REVISION RECORD

Version	Page	Revision Items	Name	Date
1.0		First release	MengYu	2009.08.18
1.1		Add CUSTOMER P/N	Cindy Cheng	2010.06.21
1.2		Change CUSTOMER P/N and Mechanical drawing	Cindy Cheng	2010.06.23
1.3		New LCD solution	Cindy Cheng	2010.11.19
1.4	11,15,17	modify optical characteristics; add package and double check	Cindy Cheng	2011.05.05

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Page

1 Description

The TM320222ACIGNA, Graphics LCM unit consists of 320(segment) x 222(common) dots dot-matrix LCD panel, LCD driver on a single glass. The unit can efficiently display the desired graphics under microprocessor control.

◆ Requirements on environmental protection: RoHS.

2 Features

Item	Contents
LCD type	FSTN
	positive
LCD Duty	1/222
LCD Bias	1/14.7
Polarizer	reflective
LCD background color	Gray
Segment color	blue-black
Backlighting	--
Backlighting type	--
Backlighting color	--
Backlighting drive	--
View direction	6:00
Operating temperature	-10℃~60℃
Storage temperature	-20℃~70℃
Driver	NT7711 & NT7702
Frame	Plastic Frame
Technology	COG+TAB
Power supply	VDD=3.3V
Data Transfer	8-bit parallel

Notes:
● Color tone can slightly change with temperature and driving voltage.

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3 Absolute maximum ratings

(Without LED backlighting ,Ta=25℃)

Parameter	Symbol	Min	Max	Unit	Remark
Logic circuit supply voltage	V_{DD}	-0.3	+7.0	V	
LCD driving voltage	V_{OP}	-0.3	+38.0	V	
Operating temperature range	Top	-10	+60	℃	No Condensation
Storage temperature range	Tst	-20	+70	℃	

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

4 Mechanical Characteristics

4.1 Mechanical features

Parameter	Standard Value	Unit
Display type	Graphics module	--
Character size(W×H)	--	mm
Number of dots/characters (W×H)	320 x 222	--
View area (W×H)	103.75 x 72.586	mm
Active Area (W×H)	101.75 x 70.586	mm
Dot Size (W×H)	0.308 x 0.308	mm
Dot Pitch (W×H)	0.318 x 0.318	mm
Module size(W×H×D)	117.65* x 88.43* x 7.9*	mm
Module total weight (approx)	102.2	g
Module outline dimensions	Refer to page 5-"Mechanical drawing"	--

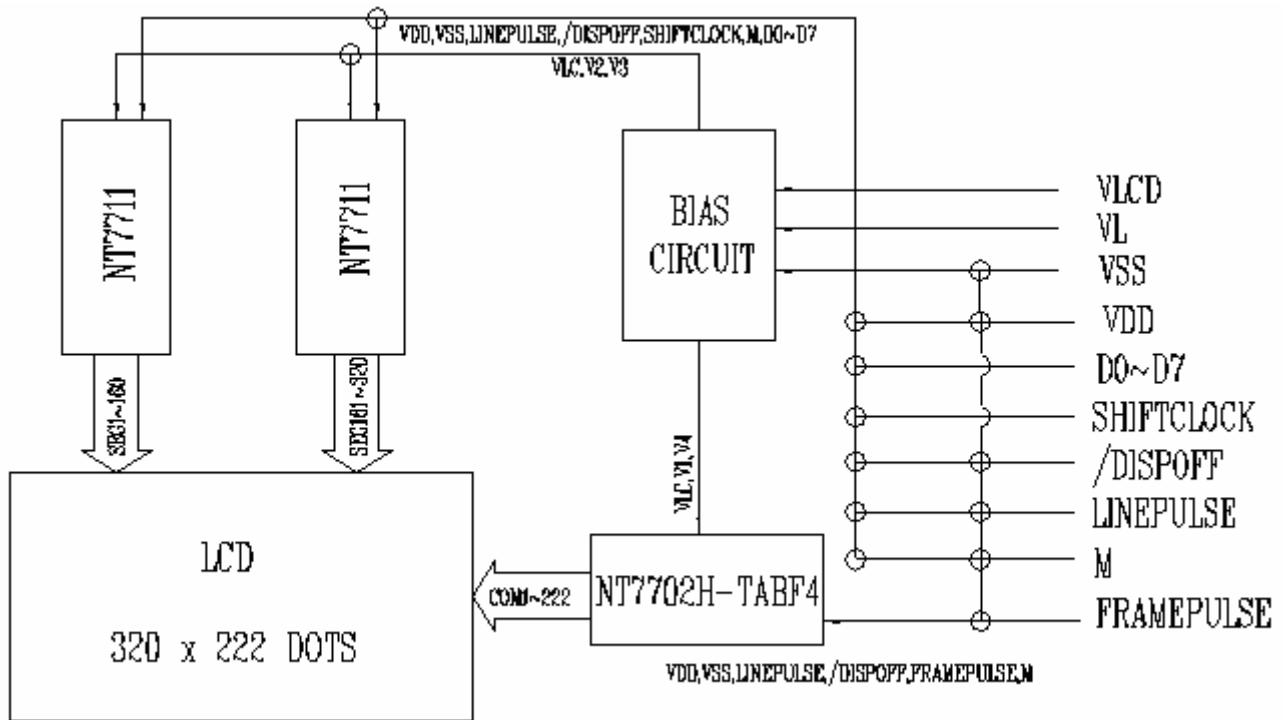"*"Note: The dimension includes the frame, and the depth does not include the pole. The height doesn't include length of FPC.

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4.2 Mechanical drawing.
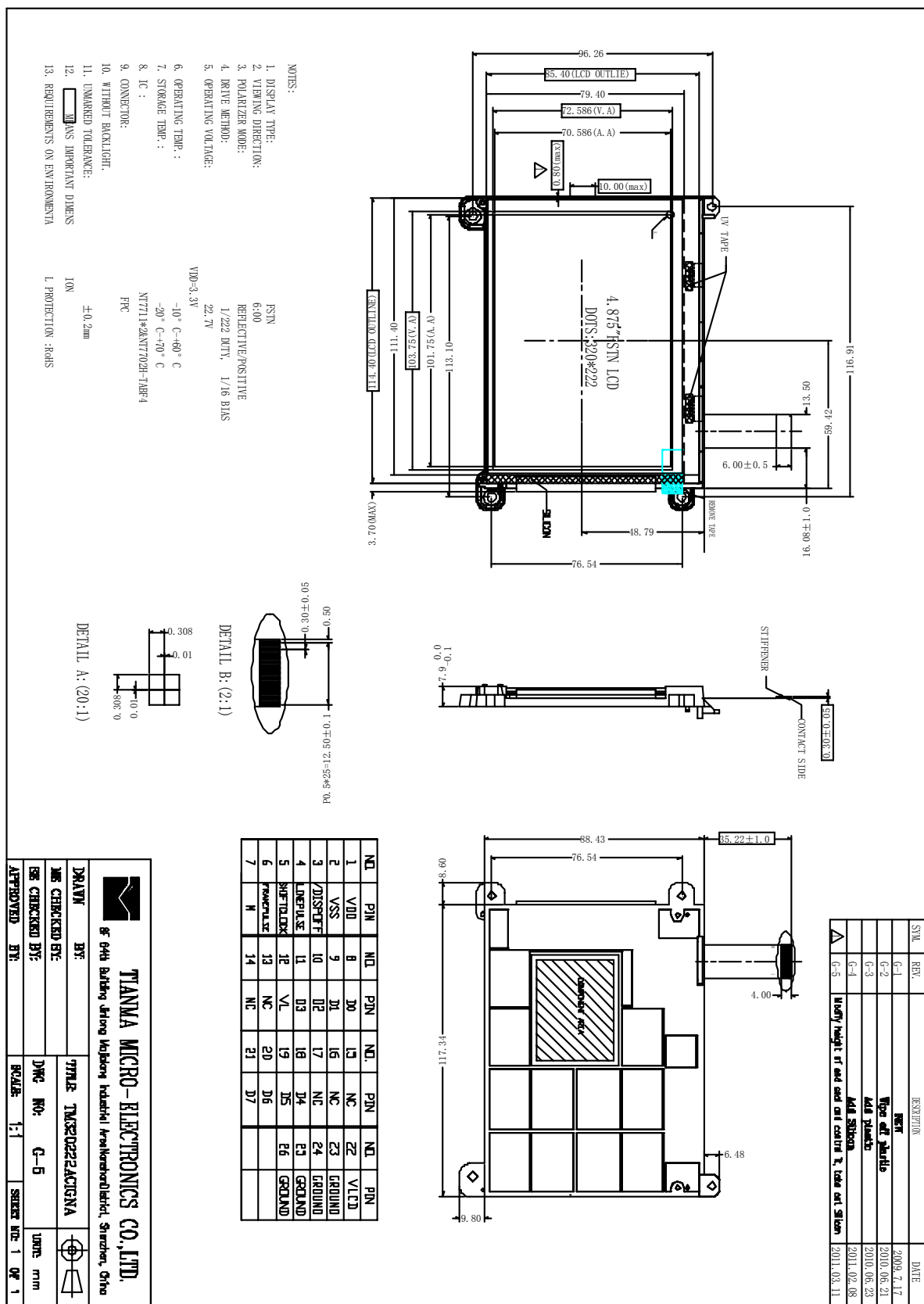
5 Circuit

5.1 Block Diagram

5.2 Recommend interface circuit

NO.	PIN	
1	VDD	3.3V
2	VSS	0V
3	/DISPOFF	DISPOFF
4	LINEPULSE	LP
5	SHIFTCLOCK	XCLK
6	FRAMEPULSE	FLM
7	M	M

NO.	PIN	
8	D0	LD0
9	D1	LD1
10	D2	LD2
11	D3	LD3
12	VL	
13	NC	
14	NC	

RV1
0V   26V

NO.	PIN	
15	NC	
16	NC	
17	NC	
18	D4	LD4
19	D5	LD5
20	D6	LD6
21	D7	LD7

NO.	PIN	
22	VLCD	26V
23	GROUND	0V
24	GROUND	0V
25	GROUND	0V
26	GROUND	0V

6 Interface description .

Pin No.	Symbol	I/O	Description
1	V_{DD}	3.3V	Power supply voltage for logic circuit
2	VSS	0 V	Ground
3	/DISPOFF	I	Display ON/OFF
4	LINEPULSE	I	Line clock
5	SHIFTCLOCK	I	Shift clock (Pixel clock)
6	FRAMEPULSE	I	Frame clock
7	M	I	AC Signal for LCD drive
8	D0	I	Data Bus
9	D1	I	Data Bus
10	D2	I	Data Bus
11	D3	I	Data Bus
12	VL	22.7V	Power supply voltage for LCD+
13	NC	--	No connection.
14	NC	--	No connection.
15	NC	--	No connection.
16	NC	--	No connection.
17	NC	--	No connection.
18	D4	I	Data Bus
19	D5	I	Data Bus
20	D6	I	Data Bus
21	D7	I	Data Bus
22	VLCD	26V	LCD drive power
23	Ground	0 V	Ground
24	Ground	0 V	Ground
25	Ground	0 V	Ground
26	Ground	0 V	Ground

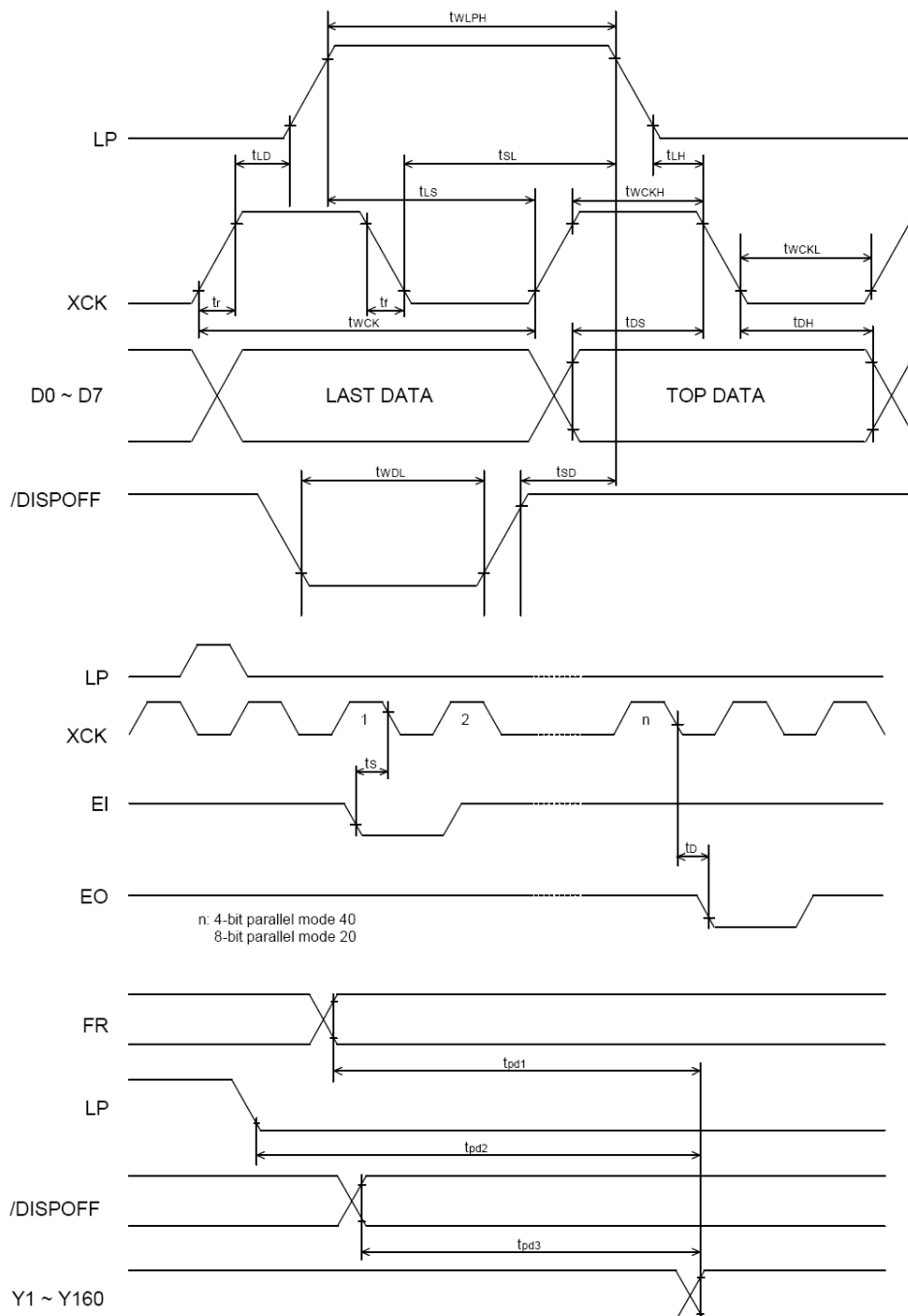# 7 Instruction Code & Timing characteristics

7.1 COMMAND

The module TM320222ACIGNA includes the driver-NT7711&NT7702, and does not include controller. The command please refer to the datasheet of controller you using.

7.2 Interface Timing characteristics

Note: Please refer to IC: NT7711&NT7702   data sheet for more details.
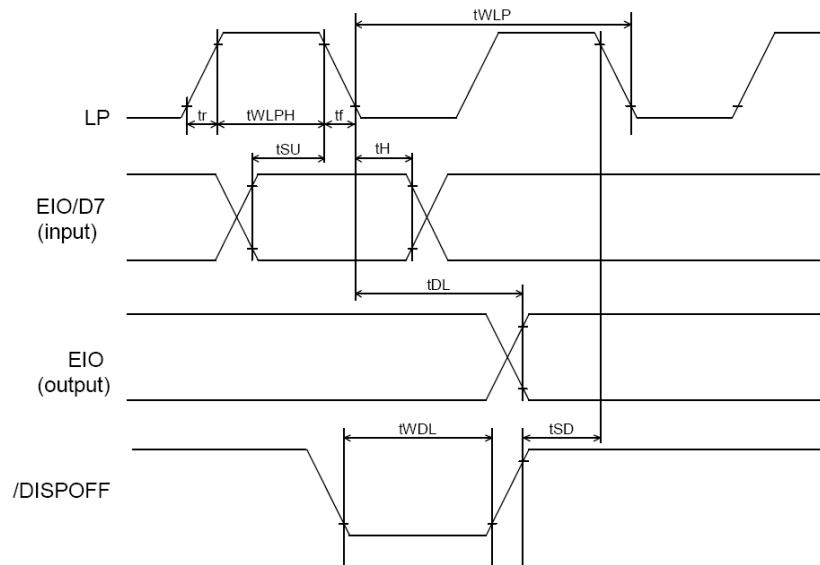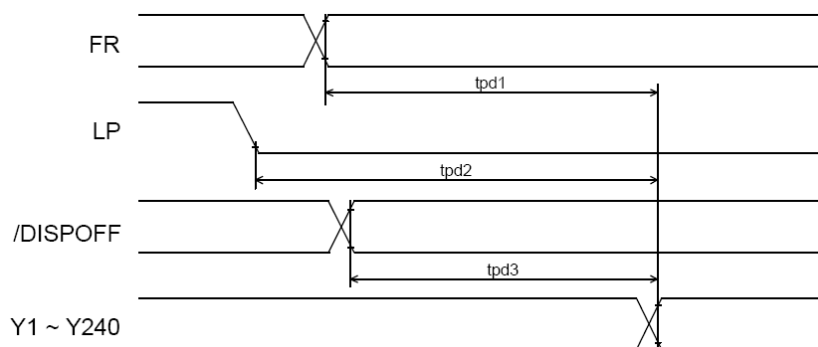
Segment timing

Parameter	Symbol	Min.	Typ.	Max.	Unit	Condition
Shift clock period	t_{WCK}	82	-		ns	tr, tf ≤ 10ns, Note 1
Shift clock "H" pulse width	t_{WCKH}	28	-		ns	
Shift clock "L" pulse width	t_{WCKL}	28	-		ns	
Data setup time	t_{DS}	20	-		ns	
Data hold time	t_{DH}	23	-		ns	
Latch pulse "H" pulse width	t_{WLPH}	30	-		ns	
Shift clock rise to Latch pulse rise time	t_{LD}	0	-		ns	
Shift clock fall to Latch pulse fall time	t_{SL}	65	-		ns	
Latch pulse rise to Shift clock rise time	t_{LS}	30	-		ns	
Latch pulse fall to Shift clock fall time	t_{LH}	35	-		ns	
Input signal rise time	t_r		-	50	ns	Note 2
Input signal fall time	t_f		-	50	ns	Note 2
Enable setup time	t_s	30	-		ns	
/DISPOFF Removal time	t_{SD}	100	-		ns	
/DISPOFF enable pulse width	t_{WDL}	1.2	-		µs	
Output delay time (1)	t_D		-	57	ns	CL=15pF
Output delay time (2)	t_{pd1}, t_{pd2}		-	1.2	µs	CL=15pF
Output delay time (3)	t_{pd3}		-	1.2	µs	CL=15pF

Note

1. Take the cascade connection into consideration.
2. $(t_{WCK} - t_{WCKH} - t_{WCKL})/2$ is the maximum in the case of high speed operation.

Common timing

Parameter	Symbol	Min.	Typ.	Max.	Unit	Condition
Shift clock period	t_{WLP}	250	-	-	ns	t_r, $t_f \leq$ 20ns
Shift clock "H" pulse width	t_{WLPH}	15	-	-	ns	VDD=5.0V±10%
		30	-	-	ns	VDD=2.5~4.5V
Data setup time	t_{SU}	30	-	-	ns	
Data hole time	t_H	50	-	-	ns	
Input signal rise time	t_r		-	50	ns	
Input signal fall time	t_f		-	50	ns	
/DISPOFF Removal time	t_{SD}	100	-	-	ns	
/DISPOFF enable pulse width	t_{WDL}	1.2	-	-	µs	
Output delay time (1)	t_{DL}	-	-	200	ns	CL=15pF
Output delay time (2)	t_{pd1}, t_{pd2}	-	-	1.2	µs	CL=15pF
Output delay time (3)	t_{pd3}	-	-	1.2	µs	CL=15pF

8 Electrical characteristics
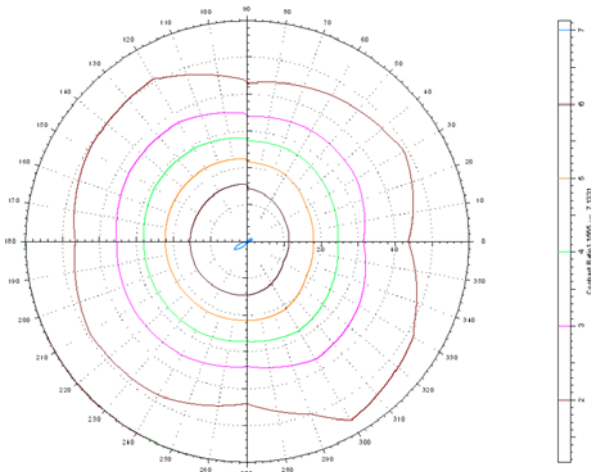
V_{SS}=0V,　Ta=25℃

Parameter		Symbol	Condition	MIN	TYP	MAX	UNIT
Logic circuit supply voltage		V_{DD}	--	3.0	3.3	3.6	V
Input voltage for logic circuit	"H"level	V_{IH}		0.8 V_{DD}	--	--	V
	"L"level	V_{IL}		--	--	0.2 V_{DD}	
Output voltage for logic circuit	"H"level	V_{OH}	V_{DD}=3.3V	V_{DD} -0.4	--	--	V
	"L"level	V_{OL}		--	--	0.4	
Logic power supply current (Without backlighting)		I_{CC}		--	--	8.0	mA
Used driver IC		NT7711 & NT7702					

9 Optical Characteristics

9.1 Optical Characteristics

Ta=25℃

Parameter		Symbol	Ratings			Unit	Measuring Temp.	Reference
			Min	Type	Max.			
Operating voltage		V_o	22.4	22.7	23.0		25℃	
Frame frequency		f	--	64	--	Hz		〔Note9-2〕
Contrast ratio		Cr(θ=20°, Φ=90° or 270°)	5	7	--		25℃	〔Note9-3〕
Response time	Turn on	t_{on}	--	150	400	ms	25℃	〔Note9-4〕
	Turn off	t_{off}	--	320	400	ms	25℃	
Viewing angle (Cr≥2)	Up-down	$\theta 1$ (Φ=90°or 270°)	-35~33	-40~41	--	deg	25℃	〔Note9-5〕
	Left-right	$\theta 2$ (Φ=0° or 180°)	-37~36	-45~40	--	deg	25℃	
ISO contrast plot								〔Note9-6〕

〔Note9-1〕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 9.2.

〔Note9-2〕The frequency shouldn't be too low to avoid flicker. Refer to definition of drive voltage, refer to 9.2.

〔Note9-3〕Refer to 9.2/9.3/9.4/9.5.

〔Note9-4〕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 9.6 definition of response time.

〔Note9-5〕Generally the viewing direction is 6:00 or 12:00, 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 9.4.

〔Note9-6〕Measured on LCD5200.

9.2 Definition of drive voltage

(1) Definition of drive voltage and waveform
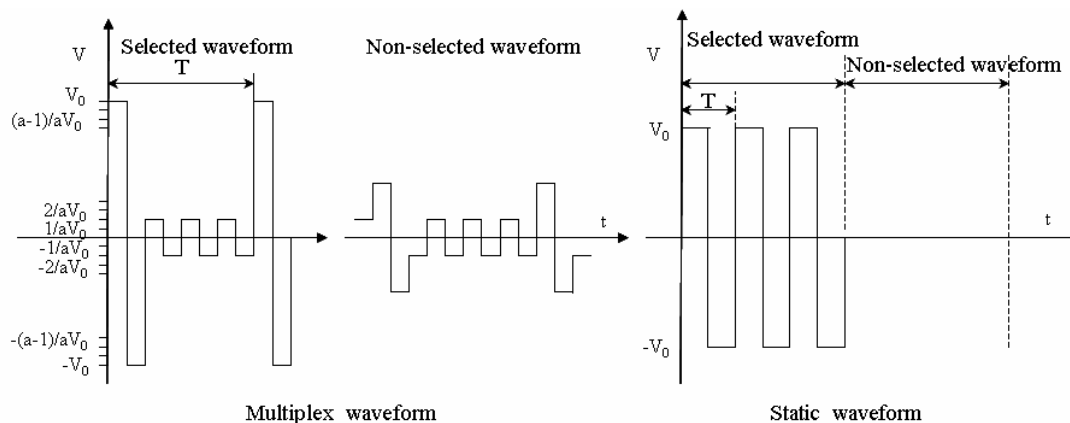
Fig.1 Definition of drive voltage and waveform

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.

9.3 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.

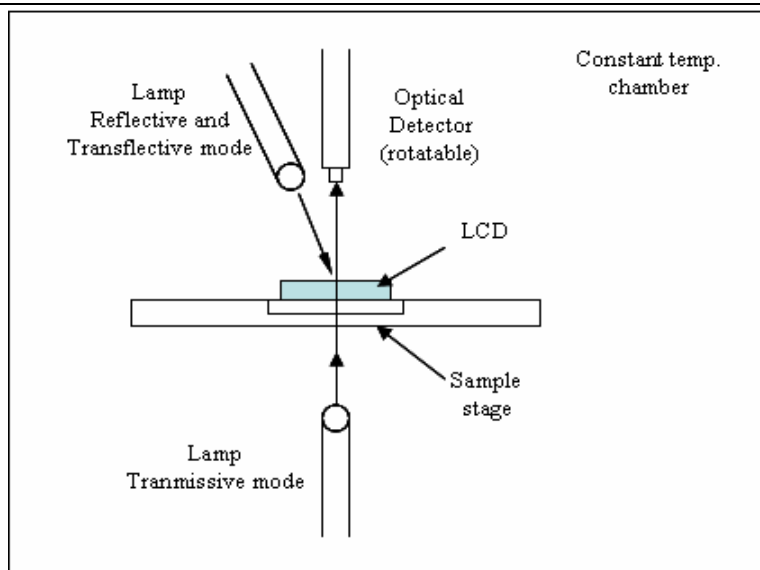Reflective mode and transflective mode: light resource is placed at the front side of LCD.

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.

9.4 Definition of viewing direction
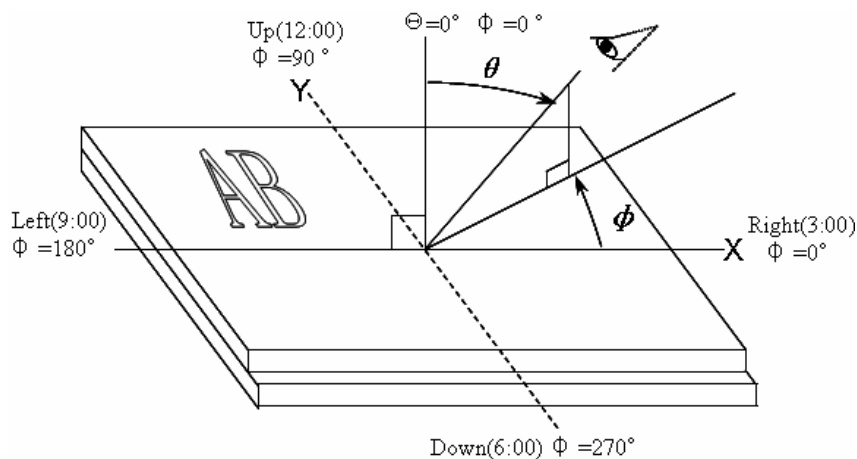
Refer to the graph below marked by $θ$ and $Φ$

Fig.3 Definition of viewing direction

9.5 Definition of contrast ratio

Contrast ratio can be calculated by the formula (9-1) below for positive type. If the LCD is positive type, Cr ($θ$, $Φ$) is equal to luminance ($θ$, $Φ$, selected state) divided by luminance ($θ$, $Φ$, non-selected state). Fig.4 shows the relationship between selected state, non-selected state and bright state, dark state.

$$Cr(\theta,\phi) = \frac{L_2}{L_1} = \frac{Luminance(\theta,\phi)\,(Dark\ state)}{Luminance(\theta,\phi)\,(Bright\ state)} \qquad (9\text{-}1)$$
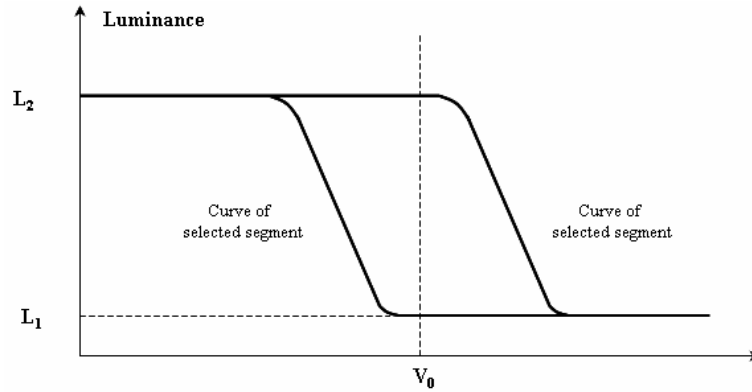
Fig.4 Electro-optical characteristic (EOC) graph (positive type)

9.6 Definition of response time

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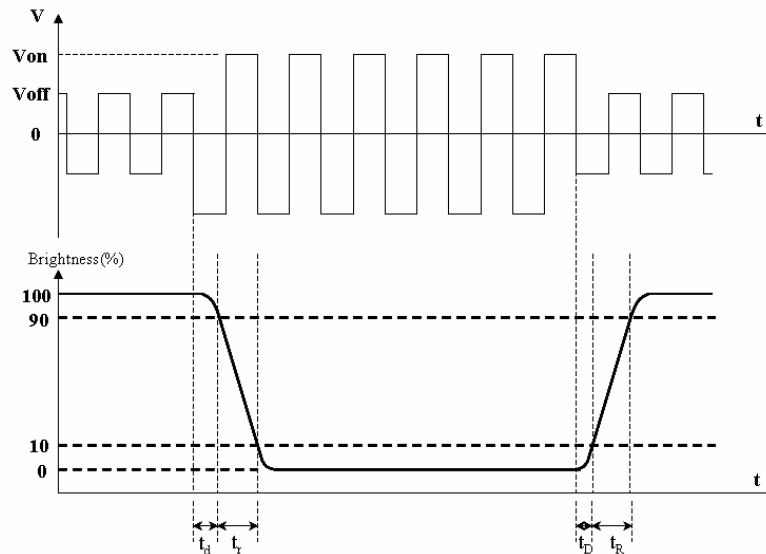Turn off time (fall time): $t_{off}=t_D + t_R$ (from selected state to non-selected state)

Fig.5 Definition of response time (positive type)
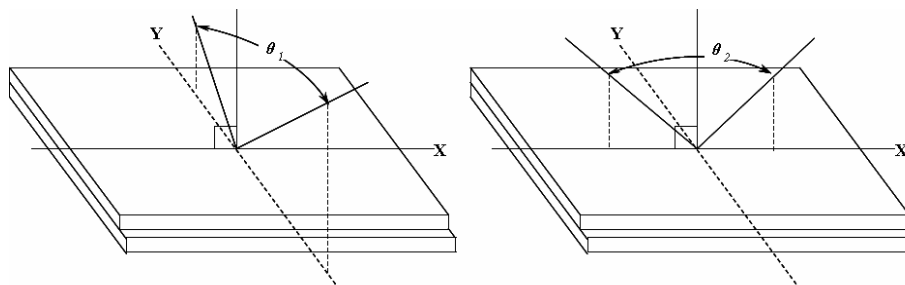
9.7 Definition of viewing angle

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 Reliability

10.1 Content of Reliability Test   Ta=25℃

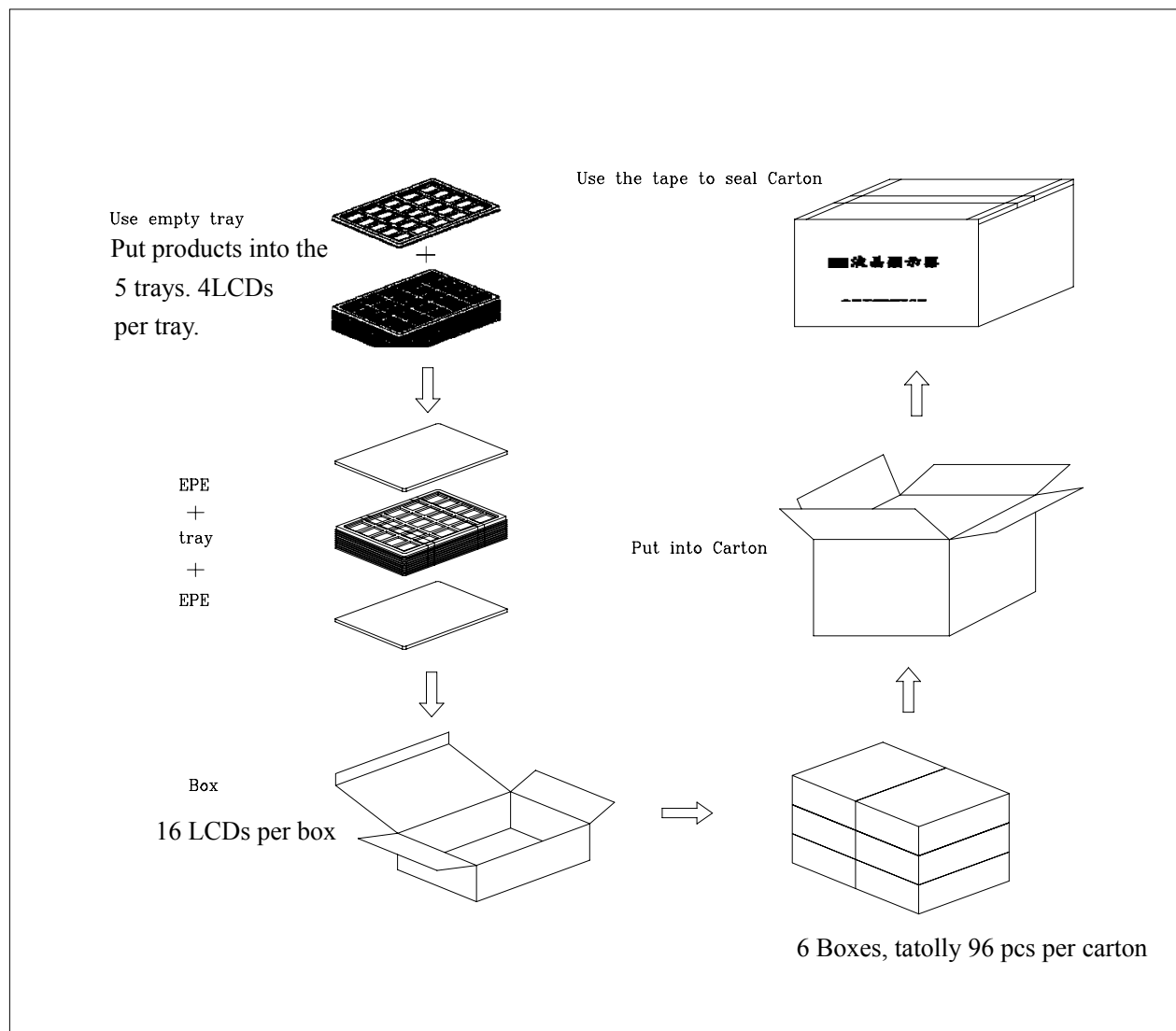| No	Test Item	Test condition	Criterion
1	High Temperature Storage	70℃±2℃ 240H Power off	After testing, cosmetic and electrical defects should not happen.
2	Low Temperature Storage	-20℃±2℃ 240H Power off	
3	High Temperature Operation	60℃±2℃ 240H Power on	
4	Low Temperature Operation	-10℃±2℃ 240H Power on	
5	High Temperature & Humidity Operation	60℃±2℃ 90%RH 240H Power on	
6	Temperature Cycle	-20℃ →25℃ →60℃ 20 min→5 min→20 min Duration: 6 cycles, Power on	
7	Vibration Test	10Hz~150Hz, 100m/s², 120min	
8	Shock Test	Half-sine wave,300m/s2,11ms	
9	Drop Test(package state)	750mm, 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.
10	ESD Test	150 PF/330 Ohm, Air discharge: ±8KV, 6times	No malfunction the test sample after test.

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 storing at room temperature and room humidity after each test item is finished.
3. The criteria refer to 10.2.
4.   Performance may be exceptional during the test, but it can recover by itself after several seconds.

10.2 Inspection of criteria

Remark NO.	Content
1	Functional test is OK. Missing Segment, shorts, unclear segment, non-display, 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 150% 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.

11 Package

Use empty tray

Put products into the
5 trays. 4LCDs
per tray.

Use the tape to seal Carton

EPE
+
tray
+
EPE

Put into Carton

Box

16 LCDs per box

6 Boxes, tatolly 96 pcs per carton
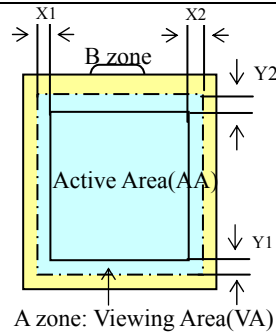
12 Quality level

12.1 Classification of defects

Major defects (MA): A major defect refers to a defect that may substantially degrade usability for product applications, 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.

12.2 Definition of inspection range

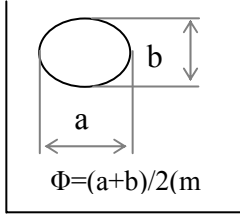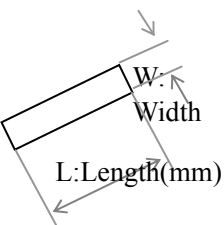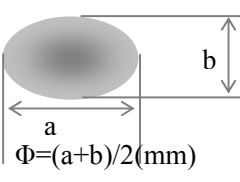|	
For LCD defects, dividing two areas to make a judgment (according figure 1). 　A zone : Inside Viewing area 　B zone : Outside Viewing area 　X1(A.A~V.A): 1mm　　X2(A.A~V.A): 1mm 　Y1(A.A~V.A): 1mm　　Y2(A.A~V.A): 1mm	X1　　　　X2 B zone 　　　　　↓ Y2 Active Area(AA) 　　　　　↓ Y1 A zone: Viewing Area(VA) Figure 1

12.3 Inspection items and general notes
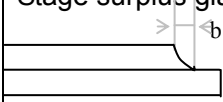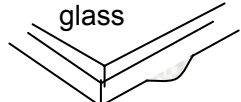
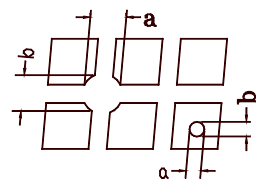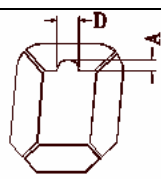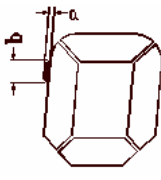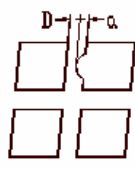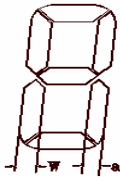|		
General notes	①Should any defects which are not specified in this standard happen, additional standard shall be determined by mutual agreement between customer and TIANMA. ②Viewing area should be the area which TIANMA guarantees. ③Limit sample should be prior to this Inspection standard. ④Viewing judgment should be under static pattern. ⑤Inspection conditions 　Inspection distance: 250 mm (from the sample)　　Temperature　　: 25±5 ºC 　Inspection angle　: 45 degrees in 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

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12.4 Outgoing Inspection level
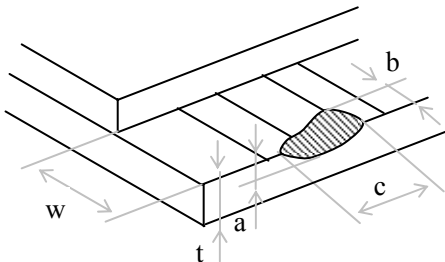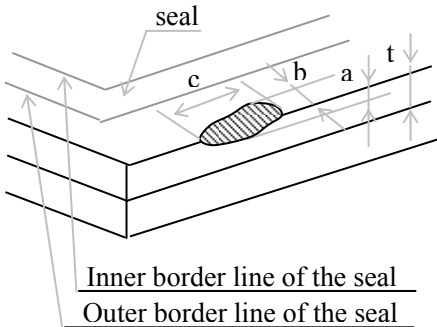
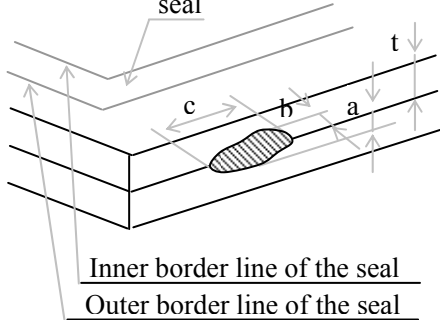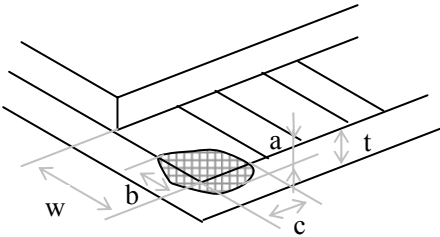| Outgoing Inspection standard	Inspection conditions	Inspection				
		Min.	Max.	Unit	IL	AQL
Major Defects	See 11.3 general notes	See 12.5			II	0.65
Minor Defects	See 11.3 general notes	See 12.5			**II**	1.5
Note：Sampling standard conforms to GB2828						

12.5 Inspection Items and Criteria
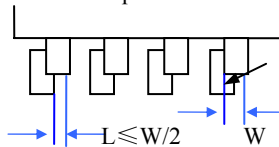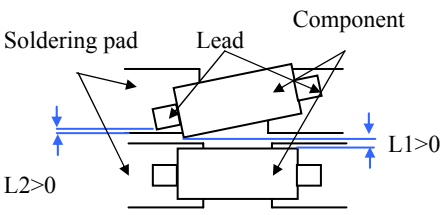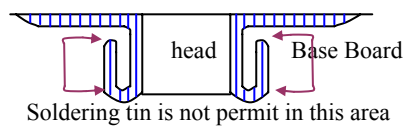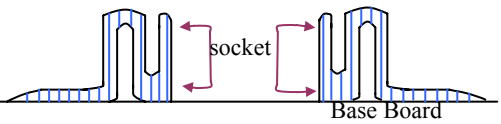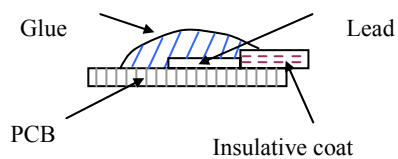
Inspection items			Judgment standard			
			Category		Acceptable number	
					A zone	B zone
1	Black spot,White spot, Bright Spot, Pinhole, Foreign Particle, Particle in or on glass, Scratch on glass	$\Phi=(a+b)/2(m$	A	$\Phi\leqq0.10$	Neglected	Neglected
			B	$0.10<\Phi\leqq0.20$	3	
			C	$0.20<\Phi$	0	
2	Black line, White line, Particle Between Polarizer and glass, Scratch on glass	W: Width L:Length(mm)	A	$W\leqq0.02$	Neglected	Neglected
			B	$0.02<W\leqq0.05$ $L\leqq3.0$	3	
			C	$W>0.05$ or $L>3.0$	0	
3	Contrast variation	$\Phi=(a+b)/2(mm)$	A	$\Phi\leqq0.2$	Neglected	Neglected
			B	$0.2<\Phi\leqq0.3$	2	
			C	$0.3<\Phi\leqq0.4$	1	
			D	$0.4<\Phi$	0	
			Total defective point(B,C)		3	
4	Bubble inside cell		any size		none	none
5	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	$\Phi\leqq0.3$	Neglected	Neglected
			B	$0.3<\Phi\leqq0.7$	2	

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			C	0.7<Φ	0	

6	Surplus glass	Stage surplus glass	b≦0.3mm			
		Surrounding surplus glass	Should not influence outline dimension and assembling.			
7	Open segment or open common		Not permitted			
8	Short circuit		Not permitted			
9	False viewing direction		Not permitted			
10	Contrast ratio uneven		According to the limit specimen			
11	Crosstalk		According to the limit specimen			
12	Black /White spot(display)		Refer to item 1			
13	Black /White line(display)		Refer to item 2			
14	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 each segment		
			A<0.1mm	0.1mm≤A≤0.2mm D<0.25mm		
15	Transformation of segment		not counted	Max.1 defect allowed each segment		Max.3 defects allowed
			x<0.1mm	0.1mm≤x≤0.2mm		
			x=(a+b)/2			
			not counted	Max.1 defect allowed each segment		
			a<0.1mm	0.1mm≤a≤0.2mm D>0		

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			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	①The front of lead terminals b c w a t	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 seal c b a t Inner border line of the seal Outer border line of the seal		b < Inner borderline of the seal	

③ Surrounding crack— contact side

seal

c　　　b　　a

t

Inner border line of the seal

Outer border line of the seal

b < Outer borderline of the seal

④Corner

a

t

w

b

c

A	$a \leqq t$, $b \leqq 3.0$, $c \leqq 3.0$
B	Glass crack should not cover patterns u and alignment mark and patterns.

RoHS

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.	

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.

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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	320222	A	C	I	G	N	A
①	②	③	④	⑤	⑥	⑦	⑧

NO.	Explanation
①	**TIANMA module indicating**
②	**Module type: 320 columns X 222 rows**
③	**TIANMA module series**
④	**LCD type**
	C Positive, FSTN
⑤	**Backlight type**
	I Reflective, Without Backlight
⑥	**Technology**
	G COG
⑦	**The color of backlight**
	N Without Backlight
⑧	**Function choice**
	A Basic function