

SPECIFICATION FOR TFT LCD MODULE

MODEL NO:	TM128160F4NFWGWC14
CUSTOMER:	天马标屏
CUSTOMER P/N.	
VERSION	V3.0
CUSTOMER APPROVED	

Preliminary Specification

Final Specification

PREPARED	CHECKED	VERIFIED BY QC DEPT	VERIFIED BY R&D DEPT
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REVISION RECORD

Date	Rev.No.	Page	Revision Items	Prepared
2009.3.10	V2.0	P5	Change Outline Drawing	GUOJIE
2009.6.1	V3.0	P11	Change BL current IF	
		P5	Change Outline Drawing , Add NOTE	GUOJIE

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1. General Specifications

TM128160F4NFWGWC14 is a color active matrix LCD module incorporating amorphous silicon TFT (Thin Film Transistor). It is composed of a color TFT-LCD panel, driver IC, FPC and a back light unit. The module display area contains 128 x 160 pixels and can display up to 262K colors. This product accords with RoHS environmental criterion.

Item	Contents	Unit	Note
LCD Type	TFT	-	
Display Color	262K		1
LCD Duty	1/160	-	
Viewing Direction	6:00	O'Clock	
Active Area(W×H)	28.03×35.04	mm	
Number of Dots	128×160		
Dot Pitch(W×H)	0.219X0.073	mm	
Controller	ILI9163B	-	
V _{DD}	2.8	V	
V _{DDIO}	2.8	V	
Outline Dimensions	Refer to outline drawing on next page		
Backlight	2LEDs(white)	-	
Weight	TBD	g	
Interface	8 bits parallel bus	-	
Polarizer Mode	Transmissive/Positive	-	

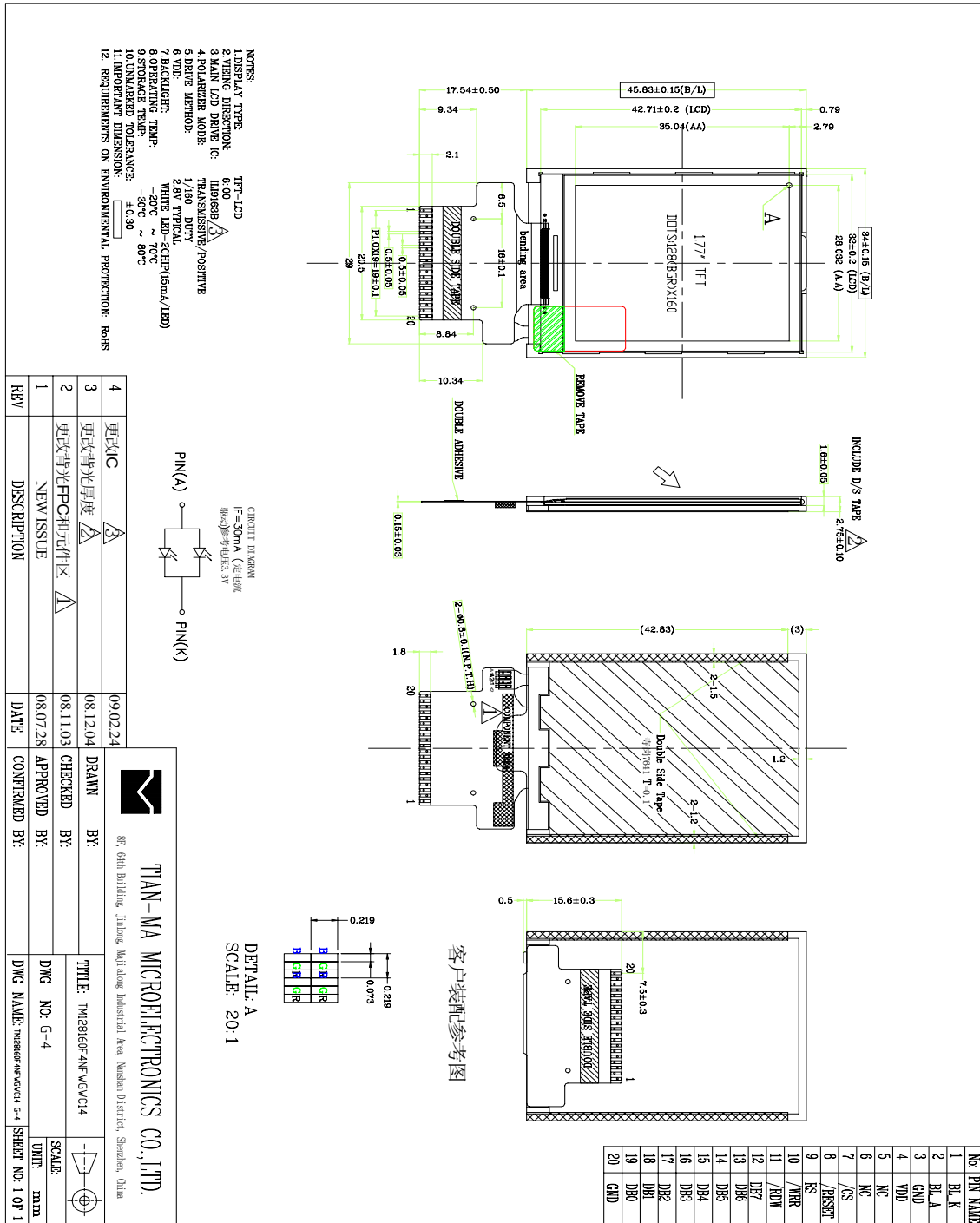
Note 1: Color tune is slightly changed by temperature and driving voltage.

Note 2: Requirements on Environmental Protection:RoHS

Note 3: Customer should do assembly according to our FPC bending sketch in the outline drawing.

Note 4: Please approve our spec before placing mass production order. Otherwise we will regard customer has approved the spec when we receive the first 2Kpcs or above order from customer.

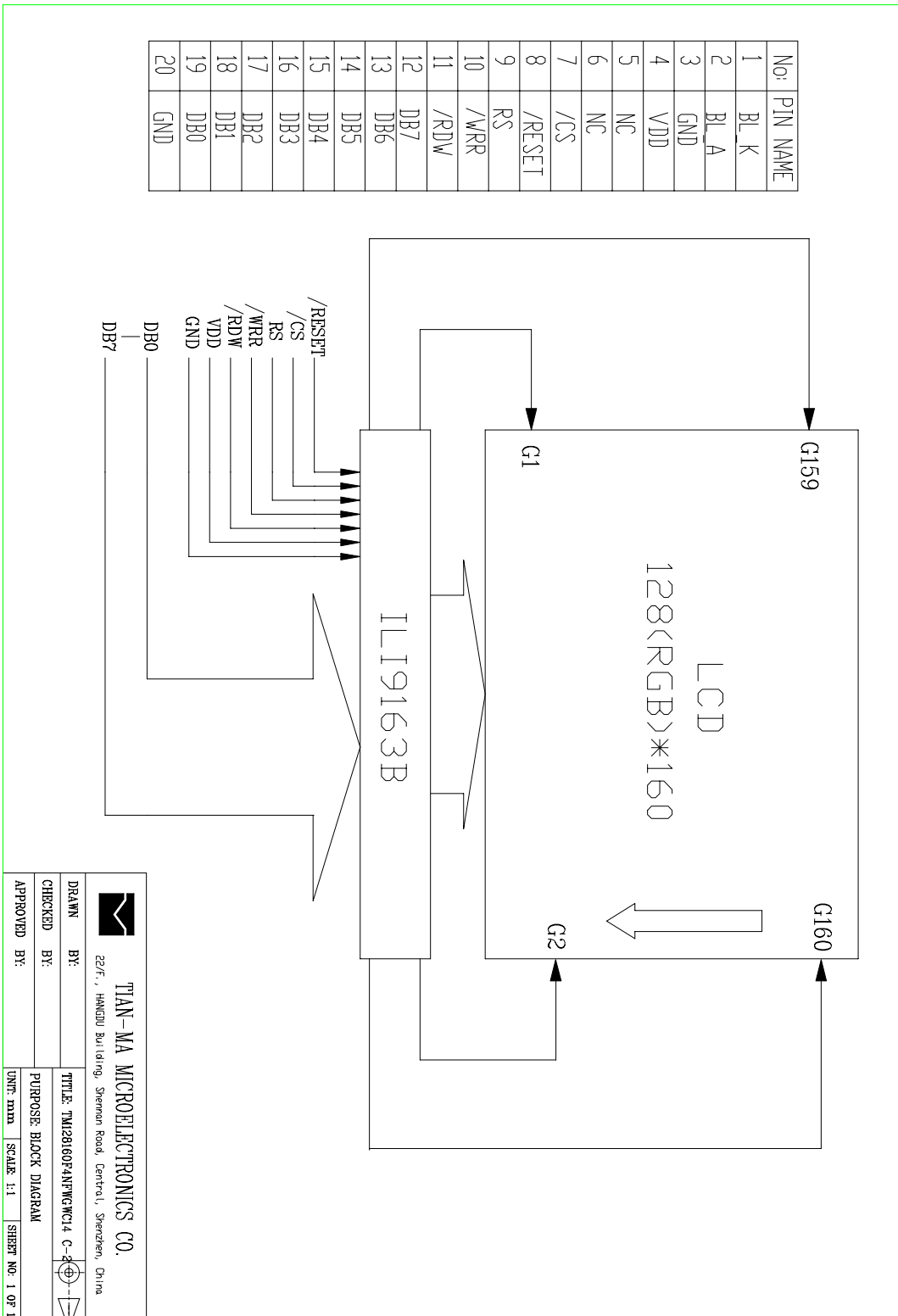
2. Outline Drawing



NOTE 1: FPC,BL,TP etc. may have not only one provider, appearance, silk-screen may exist difference.

NOTE 2: Customer's rind(handset rind etc.) and TIANMA's standard module may exist interference , Customer should advise on TIANMA FAE or RD change rind.

3. Circuit Block Diagram



4. Absolute Maximum Ratings(Ta=25°C)

Item	Symbol	Min.	Max.	Unit	Note
Power Supply Voltage	V _{DD}	-0.3	4.6	V	1, 2
Logic Signal Input /Output Voltage	V _{I/OVCC}	-0.3	4.6	V	
Operating Temperature	T _{op}	-20	+70	°C	
Storage Temperature	T _{st}	-30	+80	°C	

Notes:

1. If the module is above these absolute maximum ratings. It may become permanently damaged.
Using the module within the following electrical characteristic conditions are also exceeded, the module will malfunction and cause poor reliability.
2. V_{DD} > V_{SS} must be maintained.

5. Electrical Specifications and Instruction Code

5.1 Electrical characteristics($V_{SS}=0V$, $T_a=25^{\circ}C$)

Parameter		Symbol	Condition	Min	Typ	Max	Unit	Note
Input voltage	'H'	V_{IH}	$V_{DD}=2.8V$	$0.7V_{DD}$	-	V_{DD}	V	
	'L'	V_{IL}	$V_{DD}=2.8V$	V_{SS}	-	$0.3V_{DD}$	V	
Output Voltage	'H'	V_{OH}	-	$0.8V_{DD}$	-	V_{DD}	V	
	'L'	V_{OL}	-	V_{SS}	-	$0.2V_{DD}$	V	
Current Consumption		I_{CC1}	Normal mode	-	-	-	mA	1,3
		I_{CC2}	Standby mode	-	-	-	mA	2

Note:

1: Display full white. Backlight on state.

2: IC on standby mode.

3: the default voltage is 3.2V, for N lights in series, the power is that the current multiply N.

5.2 Instruction Code

Hex Code	Command	Description	Number of Parameters	Display Architecture Implementation Requirement		
				Type 1	Type 2	Type 3
00h	nop	No Operation	0	Yes	Yes	Yes
01h	soft_reset	Software Reset	0	Yes	Yes	Yes
06h	get_red_channel	Get the red component of the pixel at (0, 0).	1	No	Yes	Yes
07h	get_green_channel	Get the green component of the pixel at (0, 0).	1	No	Yes	Yes
08h	get_blue_channel	Get the blue component of the pixel at (0, 0).	1	No	Yes	Yes
0Ch	get_pixel_format	Get the current pixel format.	1	Yes	Yes	Yes
0Ah	get_power_mode	Get the current power mode.	1	Yes	Yes	Yes
0Bh	get_address_mode	Get the frame memory to the display panel read order.	1	Yes	Yes	Yes
0Dh	get_display_mode	Get the current display mode from the peripheral.	1	Yes	Yes	Yes
0Eh	get_signal_mode	Get display module signaling mode.	1	Yes	Yes	Yes
0Fh	get_diagnostic_result	Get Peripheral Self-Diagnostic Result	1	Yes	Yes	Yes
10h	enter_sleep_mode	Power for the display panel is off.	0	Yes	Yes	Yes
11h	exit_sleep_mode	Power for the display panel is on.	0	Yes	Yes	Yes
12h	enter_partial_mode	Part of the display area is used for image display.	0	Yes	Yes	No
13h	enter_normal_mode	The whole display area is used for image display.	0	Yes	Yes	No
20h	exit_invert_mode	Displayed image colors are not inverted.	0	Yes	Yes	Yes
21h	enter_invert_mode	Displayed image colors are inverted.	0	Yes	Yes	Yes
26h	set_gamma_curve	Selects the gamma curve used by the display device.	1	Yes	Yes	Yes
28h	set_display_off	Blanks the display device.	0	Yes	Yes	Yes
29h	set_display_on	Show the image on the display device.	0	Yes	Yes	Yes
2Ah	set_column_address	Set the column extent.	4	Yes	Yes	No
2Bh	set_page_address	Set the page extent.	4	Yes	Yes	No
2Ch	write_memory_start	Transfer image data from the Host Processor to the peripheral starting at the location provided by set_column_address and set_page_address.	variable	Yes	Yes	No
2Dh	write_LUT	Fills the peripheral look-up table with the provided data.	variable	optional	No	No
2Eh	read_memory_start	Transfer image data from the peripheral to the Host Processor interface starting at the location provided by set_column_address and set_page_address.	variable	Yes	Yes	No
30h	set_partial_area	Defines the partial display area on the display device.	4	Yes	Yes	No
33h	set_scroll_area	Defines the vertical scrolling and fixed area on display device.	6	Yes	No	No
34h	set_tear_off	Synchronization information is not sent from the display module to the host processor.	0	Yes	No	No
35h	set_tear_on	Synchronization information is sent from the display module to the host processor at the start of VFP.	1	Yes	No	No

36h	set_address_mode	Set the read order from frame memory to the display panel.	1	Yes	Yes	Yes
37h	set_scroll_start	Defines the vertical scrolling starting point.	2	Yes	No	No
38h	exit_idle_mode	Full color depth is used on the display panel.	0	Yes	No	No
39h	enter_idle_mode	Reduced color depth is used on the display panel.	0	Yes	No	No
3Ah	set_pixel_format	Defines how many bits per pixel are used in the interface.	1	Yes	Yes	Yes
3Ch	write_memory_continue	Transfer image information from the Host Processor interface to the peripheral from the last written location.	variable	Yes	Yes	No
3Eh	read_memory_continue	Read image data from the peripheral continuing after the last read_memory_continue or read_memory_start.	variable	Yes	Yes	No
44h	set_tear_scanline	Synchronization information is sent from the display module to the host processor when the display device refresh reaches the provided scanline.	2	Yes	No	No
45h	get_scanline	Get the current scanline.	2	Yes	Yes	No
DAh	Read ID1					
DBh	Read ID2					
DCh	Read ID3					

Notes:

1. There will be no abnormal visible effects on the display when S/W or H/W Reset are applied.
2. After Powered-On Reset finishes within 10 μ s after both VDD & VDDI are applied.
3. Mode 1 means Tearing Effect Output Line consists of V-Blanking Information only.

5.3 LED backlight specification(V_{ss}=0V ,T_a=25℃)

Item		Symbol	Condition	Min	Typ	Max	Unit	Note
Forward Voltage		V _f	I _f =30MA	-	3.3	-	V	
Supply current		-	-	-	-	-	mA	
Reverse voltage		V _r	-	-	-	-	V	
Forward current	Normal	I _{pn}	2chips Parallel		30	-	mA	
	Dimming	I _{pd}			2			
Reverse Current		I _r	-	-	-	-	μA	
Uniformity		ΔBp		-	80%			
Color coordinate*		X	I _f =30mA	0.270	-	0.315	-	
		Y		0.270	-	0.315	-	

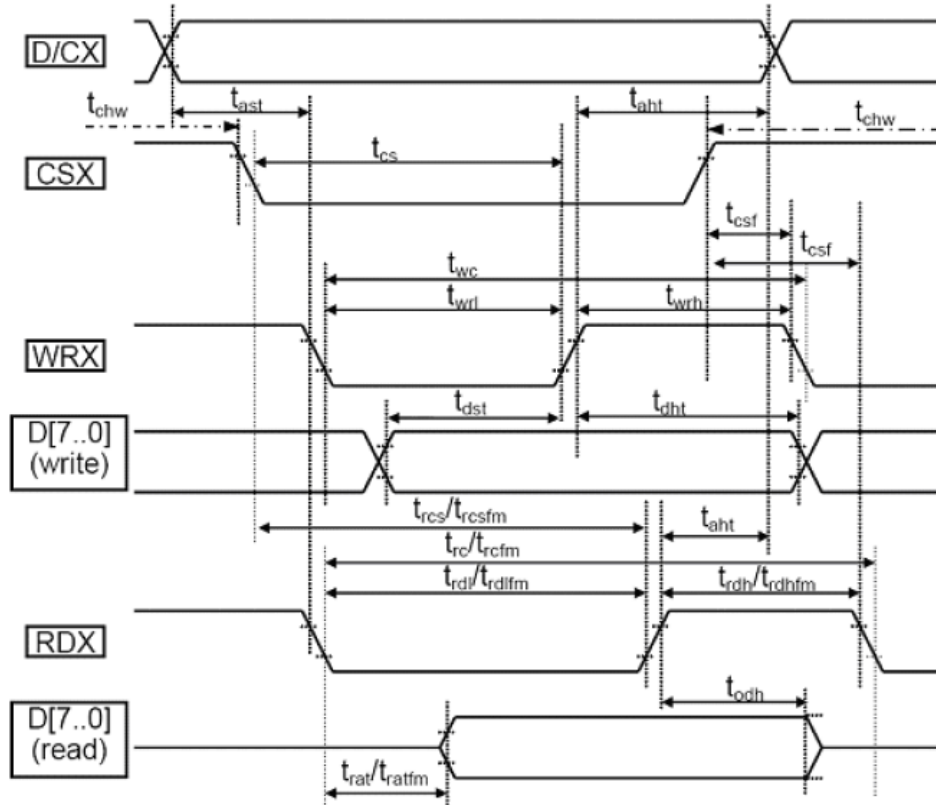
5.4 Interface Signals

Pin No.	Symbol	I/O	Function
1	BL_K	I	Power for LED backlight -
2	BL_A	I	Power for LED backlight +
3	GND	I	Power ground
4	VDD	I	Power Supply for LCM
5	NC		
6	NC		
7	/CS	I	Chip select input pin("low" is enable)
8	/RESET	I	Reset input pin. , Signal is active low
9	RS	I	Display data/command selection pin in MCU interface
10	/WRR	I	Read/Write control pin
11	/RDW	I	Read/Write control pin
12	DB7	I/O	Display data input
13	DB6	I/O	Display data input
14	DB5	I/O	Display data input
15	DB4	I/O	Display data input
16	DB3	I/O	Display data input
17	DB2	I/O	Display data input
18	DB1	I/O	Display data input
19	DB0	I/O	Display data input
20	GND	I	Power Ground

5.5 Interface Timing Chart

Display module parallel 18/16/9/8-bit bus

I



Note: Logic high and low levels are specified as 30% and 70% of VDDI for Input signals.

Table 17.4.1 AC characteristics of parallel CPU I/F in asynchronous mode

Signal	Symbol	Parameter	min	max	unit	description
D/CX	t _{ast}	Address setup time	0		ns	
	t _{ahw}	Address hold time(Write/Read)	10		ns	
CSX	t _{chw}	CSX"H" Pulse Width	0		ns	
	t _{cs}	Chip Select setup time (Write)	10		ns	
	t _{rcs}	Chip Select setup time (Read ID)	45		ns	
	t _{rcsfm}	Chip Select setup time (Read FM)	355		ns	
	t _{csf}	Chip Select Wait time(Write/read)	10		ns	

WRX	twc	Write cycle	66		ns	
	twrh	Control pulse H duration	15		ns	
	twrl	Control pulse L duration	15		ns	
RDX	trc	Read cycle (ID)	160		ns	When read ID data
	trdh	Control pulse H duration(ID)	90		ns	
	trdl	Control pulse L duration(ID)	45		ns	
RDX	trcfm	Read cycle (FM)	450		ns	When read from frame memory
	trdhfm	Control pulse H duration (FM)	90		ns	
	trdlfm	Control pulse L duration (FM)	355		ns	
D[17..0]	tdst	Data setup time	10		ns	For maximum CL = 30pF
	tdht	Data hold time	10		ns	
	trat	Read access time (ID)		40	ns	For minimum CL = 8pF
	tratfm	Read access time (FM)		340	ns	
	todh	Output disable time	20	80	ns	

Note 1: VDDI 1.65 to 3.3V, VDD=2.6 to 3.3V, AGND=GND=0V, Ta=-30 to 70 °C (to +85°C no damage)

Note 2: This input signal rise time and fall time (tr, tf) is specified at 15 ns or less. Logic high and low levels are specified as 30% and 70% of VDDI for input signals

6. Optical Characteristics

Item	Symbol	Condition	Min.	Typ.	Max.	Unit	Note
Brightness	Bp	$\theta=0^\circ$ $\Phi=0^\circ$	-	190	-	Cd/ m ²	1
Uniformity	Δ Bp		-	80%	-		1,2
Viewing Angle	θ_1 ($\Phi=90^\circ$ or 270°)	Cr \geq 10	-40~+53			Deg	3
	θ_2 ($\Phi=0^\circ$ or 180°)		-70~+70				
Contrast Ratio	Cr	$\theta=0^\circ$ $\Phi=0^\circ$		250		-	4
Response Time	t _{on}		-	15	30	ms	5
	t _{off}		-	35	50	ms	
Color of CIE Coordinate	W	x	0.237	0.287	0.337	-	1,6
		y	0.250	0.300	0.350	-	
	R	x	0.563	0.613	0.663	-	
		y	0.290	0.340	0.390	-	
	G	x	0.267	0.317	0.367	-	
		y	0.532	0.582	0.632	-	
	B	x	0.132	0.152	0.202	-	
		y	0.032	0.082	0.132	-	
NTSC Ratio	S	-	59%				

Note: The parameter is slightly changed by temperature, driving voltage and material.

Note 1: The data are measured after LEDs are turned on for 5 minutes. LCM displays full white.

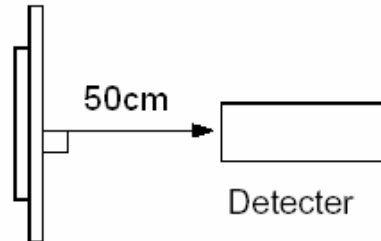
The brightness is the average value of 9 measured spots. Measurement equipment PR-705 (Φ 8mm)

Measuring condition:

- Measuring surroundings: Dark room.
- Measuring temperature: Ta=25°C.
- Adjust operating voltage to get optimum contrast at the center of the display.

Measured value at the center point of LCD panel after more than 5 minutes while

backlight turning on.

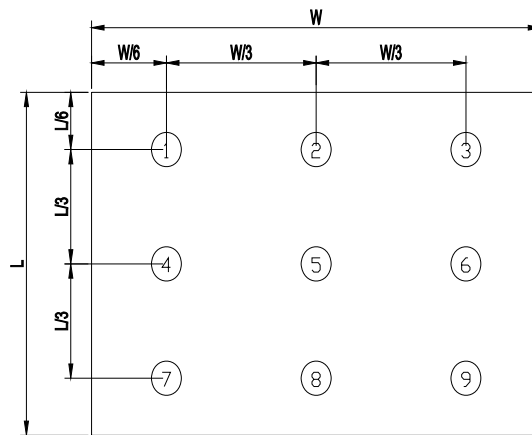


Note 2: The luminance uniformity is calculated by using following formula.

$$\Delta B_p = B_p (\text{Min.}) / B_p (\text{Max.}) \times 100 (\%)$$

$B_p (\text{Max.})$ = Maximum brightness in 9 measured spots

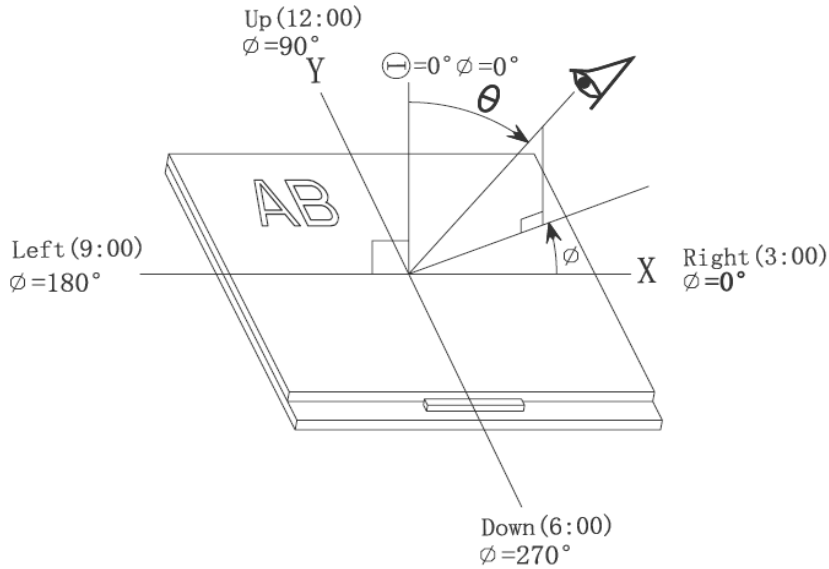
$B_p (\text{Min.})$ = Minimum brightness in 9 measured spots.



Measurement equipment PR-705 ($\Phi 8\text{mm}$)

Note 3: The definition of viewing angle:

Refer to the graph below marked by θ and ϕ



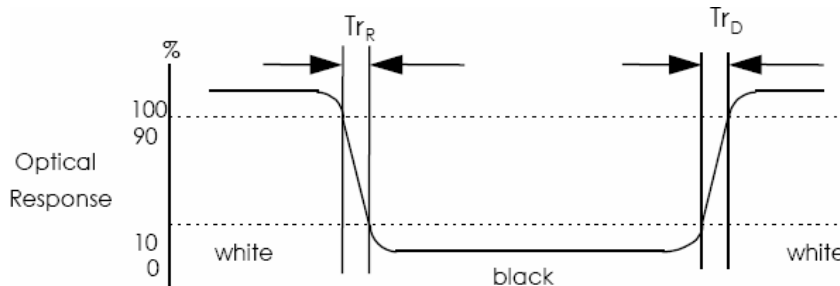
Note 4: The definition of contrast ratio (Test LCM using PR-705):

$$\text{Contrast Ratio(CR)} = \frac{\text{Luminance When LCD is at "White" state}}{\text{Luminance When LCD is at "Black" state}}$$

(Contrast Ratio is measured in optimum common electrode voltage)

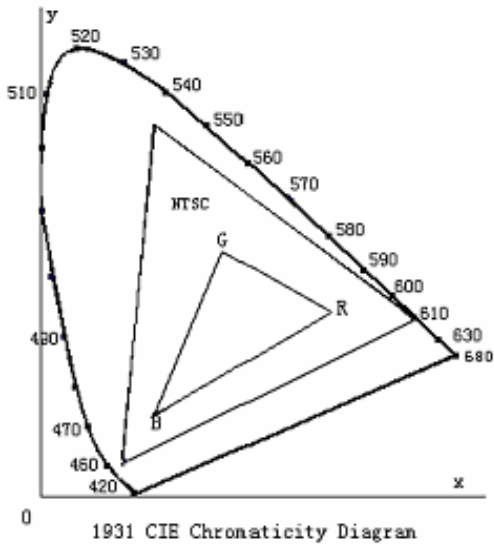
Note 5: Definition of Response time. (Test LCD using DMS501):

The output signals of photo detector are measured when the input signals are changed from "black" to "white"(falling time) and from "white" to "black"(rising time), respectively. The response time is defined as the time interval between the 10% and 90% of amplitudes. Refer to figure as below.



The definition of response time

Note 6: Definition of Color of CIE Coordinate and NTSC Ratio.



Color gamut:

$$S = \frac{\text{area of RGB triangle}}{\text{area of NTSC triangle}} \times 100\%$$

7. Reliability Test Items and Criteria

No	Test Item	Test condition	Criterion
1	High Temperature Storage	80°C±2°C 96H Restore 2H at 25°C Power off	After testing, cosmetic and electrical defects should not happen.
2	Low Temperature Storage	-30°C±2°C 96H Restore 2H at 25°C Power off	
3	High Temperature Operation	70°C±2°C 96H Restore 2H at 25°C Power on	
4	Low Temperature Operation	-20°C±2°C 96H Restore 4H at 25°C Power on	
5	High Temperature & Humidity Operation	60°C±2°C 90%RH 96H Power on	
6	Temperature Cycle	-30°C→25°C→80°C 30min 5min 30min after 10cycle, Restore 2H at 25°C 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.

Note:Additional test Item proposed by customer shall be determined by mutual agreement between customer and Tianma

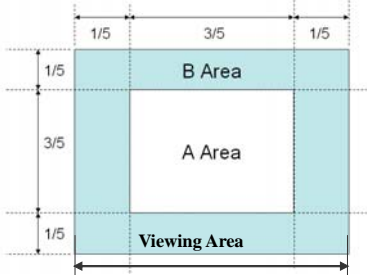
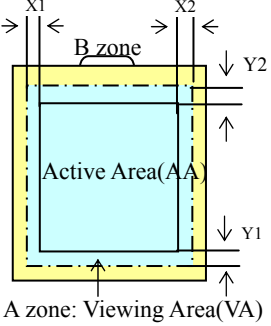
8 Quality level

8.1 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.

8.2 Definition of inspection range

<p>For dot defect of TFT LCD which is not smaller than 3 inches, dividing three areas to make a judgment (according to figure 1).</p> <p>A area : center of viewing area B area : periphery of viewing area C area : Outside viewing area</p> <p>For other defects, dividing two areas to make a judgment (according to figure 2).</p> <p>A zone : Inside Viewing area B zone : Outside Viewing area</p> <p>X1(A.A~V.A): mm X2(A.A~V.A): mm Y1(A.A~V.A): mm Y2(A.A~V.A): mm</p>	 <p>Figure 1</p>  <p>Figure 2</p>
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8.3 Inspection items and general notes

General notes	<p>① Should any defects which are not specified in this standard happen, additional standard shall be determined by mutual agreement between customer and TIANMA.</p> <p>② Viewing area should be the area which TIANMA guarantees.</p> <p>③ Limit sample should be prior to this Inspection standard.</p> <p>④ Viewing judgment should be under static pattern.</p> <p>⑤ Inspection conditions Inspection distance: 250 mm (from the sample) Temperature : 25±5 °C Inspection angle : 45 degrees in 6 o'clock direction (all defects in viewing area should be inspected from this direction)</p>	
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

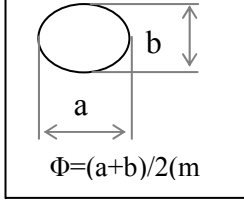
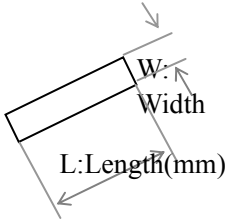
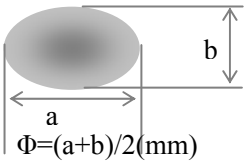
	Functional defect	No display, Abnormal display, Open or missing segment, Short circuit, False viewing direction
	Glass defect	Glass crack, Shaved corner of glass, Surplus glass
	PCB defect	Components assembly defect

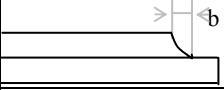
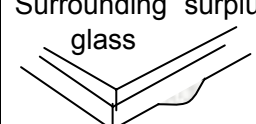
8.4 Outgoing Inspection level

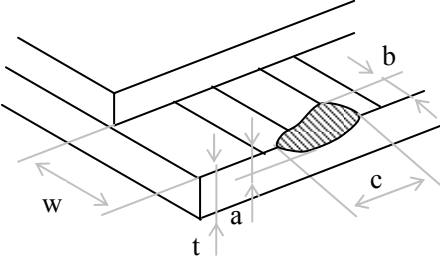
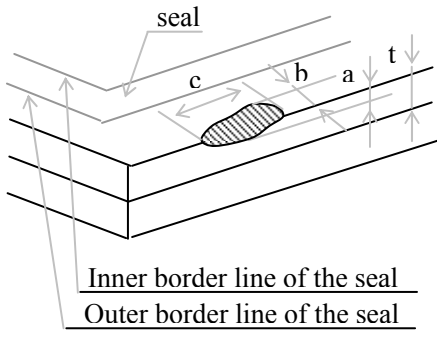
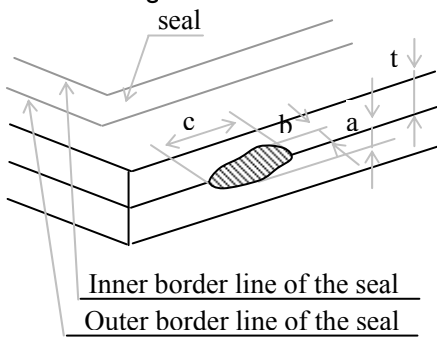
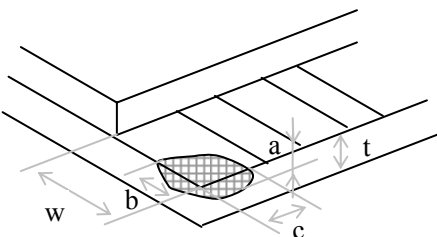
Outgoing Inspection standard	Inspection conditions	Inspection				
		Min.	Max.	Unit	IL	AQL
Major Defects	See 8.3 general notes	See 8.5			II	0.65
Minor Defects	See 8.3 general notes	See 8.5			II	1.5

Note: Sampling standard conforms to GB2828

8.5 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	$\Phi \leq 0.10$	Neglected		
			B	$0.10 < \Phi \leq 0.15$	2		
			C	$0.15 < \Phi \leq 0.20$	1		
			D	$0.20 < \Phi$	0		
			Total defective point(B,C)		2		Neglected
2	Black line, White line, and Particle Between Polarizer and glass, Scratch on glass		A	$W \leq 0.01$	Neglected		
			B	$0.01 < W \leq 0.03$ $L \leq 3.0$	2		
			C	$0.03 < W \leq 0.05$ $L \leq 3.0$	1		
			D	$0.05 < W$	0		
			Total defective point(B,C)		2		Neglected
3	Contrast variation		A	$\Phi \leq 0.2$	Neglected		
			B	$0.2 < \Phi \leq 0.3$	2		
			C	$0.3 < \Phi \leq 0.4$	1		
			D	$0.4 < \Phi$	0		
			Total defective point(B,C)		2		Neglected

4	Dot defect (if TFT LCD is used)	TFT LCD is smaller than 3 inches	LCD Class	Defect	A area		B area
			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 area	B area	C area
			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	$\Phi \leq 0.3$	Neglected	Neglected	
			B	$0.3 < \Phi \leq 0.7$	2		
			C	$0.7 < \Phi$	0		
7	Surplus glass	Stage surplus glass 	$b \leq 0.3\text{mm}$				
		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					

Inspection items		Judgment standard		Acceptable number		
		Category(application: B zone)				
15	Glass defect crack	①The front of lead terminals 	A	$a \leq t, b \leq 1/5W, c \leq 3\text{mm}$	Max.3 defects allowed	
			B	Crack at two sides of lead terminals should not cover patterns and alignment mark		
		②Surrounding crack—non-contact side 				$b < \text{Inner border line of the seal}$
		③ Surrounding crack— contact side 				$b < \text{Outer border line of the seal}$
		④Corner 	A	$a \leq t, b \leq 3.0, c \leq 3.0$		
			B	Glass crack should not cover patterns u and alignment mark and patterns.		

Inspection items		Judgment standard	
		Category(application: B zone)	
16	PCB defect	<p>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)</p>	
		<p>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</p>	
		<p>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</p>	
	<p>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.</p>		

9. Precautions for Use of LCD Modules

9.1 Handling Precautions

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

9.1.2 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, promptly wash it off using soap and water.

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

9.1.4 The polarizer covering the display surface of the LCD module is soft and easily scratched. Handle this polarizer carefully.

9.1.5 If the display surface is contaminated, breathe on the surface and gently wipe it with a soft dry cloth. 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

9.1.6 Do not attempt to disassemble the LCD Module.

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

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

- a. Be sure to ground the body when handling the LCD Modules.
- 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 care when peeling off this protective film since static electricity may be generated.

9.2 Storage precautions

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

9.2.2 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 : 0°C ~ 40°C

Relatively humidity: ≤80%

9.2.3 The LCD modules should be stored in the room without acid, alkali and harmful gas.

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