TIANMA
Microelectronics Co.,LTD.

SPECIFICATION FOR TFT LCD MODULE

MODEL NO:	TM024HDZ73
CUSTOMER:	
CUSTOMER P/N.	
VERSION	V2.0
CUSTOMER APPROVED	

□ Preliminary Specification

■ Final Specification

PREPARED	CHECKED	VERIFIED BY QA DEPT	VERIFIED BY R&D DEPT
Wu xuan 2012-07-31	Ye qi fei 2012-07-31	Xie yu lian 2012-08-06	

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REVISION RECORD

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1.NOTICE

1.1 announce

1.1.1 These specification sheets are the proprietary product of Tianma and include materials protected under copyright of Tianma. Do not reproduce or cause any third party to reproduce them in any form or by any means, electronic or mechanical, for any purpose,in whole or in part,without theexpress written permission of Tianma . Tianma assumes no responsibility for any problems related to any industrial property right of a third party resulting from the use of the device.

1.1.2 Do not use the device for equipment that requires an extreme level of reliability, such as aerospace applications, nuclear power control equipment and medical or other equipment for life support..Tianma assumes no responsibility for any damage resulting from the use of the device whichdoes not comply with the instructions and the precautions specified in these specification sheets.

1.1.3 Contact and consult. with a Tianma sales representative for any questions about this device.

1.2 For handling and system design

1.2.1 Do not scratch the surface of the polarizer film as it is easily damaged.

1.2.2 If the cleaning of the surface of the LCD panel is necessary, wipe it swiftly with cotton or other soft cloth. Do not use organic solvent as it damages polarizer.

1.2.3 Water droplets on polarizer must be wiped off immediatelyas they may cause color changes, or other defects if remained for a long time.

1.2.4 Since this LCD panel is made of glass, dropping the module or banging it against hard objects may cause cracks or fragmentation.

1.2.5 Certain materials such as epoxy resin (amine's hardener)or silicone adhesive agent(de-alcohol or de-oxym) emits gas to which polarizer reacts(color change).Check carefully that gas from materials used in system housing or packing do not hart polarizer.

1.2.6 Liquid crystal material will freeze below specified storage temperature range and it will not get back to normal quality even after temperature comes back within specified temperature range.Liquid crystal material will become isotropic above specified temperature range and may not get back to normal quality. Keep the LCD module always within specified temperature range.

1.2.7 Do not expose LCD module to the direct sunlight, or to strong ultraviolet light for long time.If the LCD driver IC is exposed to light, normal operation may be impeded. It is necessary to design so that the light is shut off when the LCD module is mounted.

1.2 Do not disassemble the LCD module as it may cause permanent damage. Hold LCD very carefully when placing LCD module into the system housing. Do not apply excessive stress or pressure to LCD module.

1.2.9 As this LCD module contains components sensitive to electrostatic discharge, be sure to follow the instructions in below.

①Operators

Operators must wear anti-static wears to prevent electrostatic charge up to and discharge from human body.

②Equipment and containers

Process equipment such as conveyer, soldering iron, working bench and containers may possibly generate electrostatic charge up and discharge.Equipment must begrounded through 100Mohms resistance. Use ion blower.

③Floor

Floor is an important part to leak static electricity which is generated from human body or equipment. There is a possibility that the static electricity is charged to them without leakage .in case of insulating floor, so the countermeasure(electrostatic earth:1×108Ω) should be made.

④Humidity

Proper umidityof working roommay reduce the isk ofelectrostatic charge up and discharge. Humidity should be kept over 50% all the time.

⑤Transportation/storage

Storage materials must be anti-static to prevent causing electrostatic discharge.

⑥Others

Protective film is attached on the surface of LCD panel to prevent scratches or other damage.When removing this protective film, remove it slowly under proper anti-ESD control such as ion blower.

1.2.10 Do not hold or touch LCD panel to flex interconnection area as it may be damaged.As the binding material between LCD panel and flex connector mentioned in flex area contains an organic material, any type of organic solvents are not allowed to be used. Direct contact by fingers are also prohibited.

1.2.11 When carrying the LCD module, place it on the tray to protect from mechanical damage.

It is recommended to use the conductive trays to protect the CMOS components from electrostatic discharge. When holding the module, hold the Plastic Frame of LCD module so that the panel ,TCP and other electric parts are not damaged. e.g. chart1

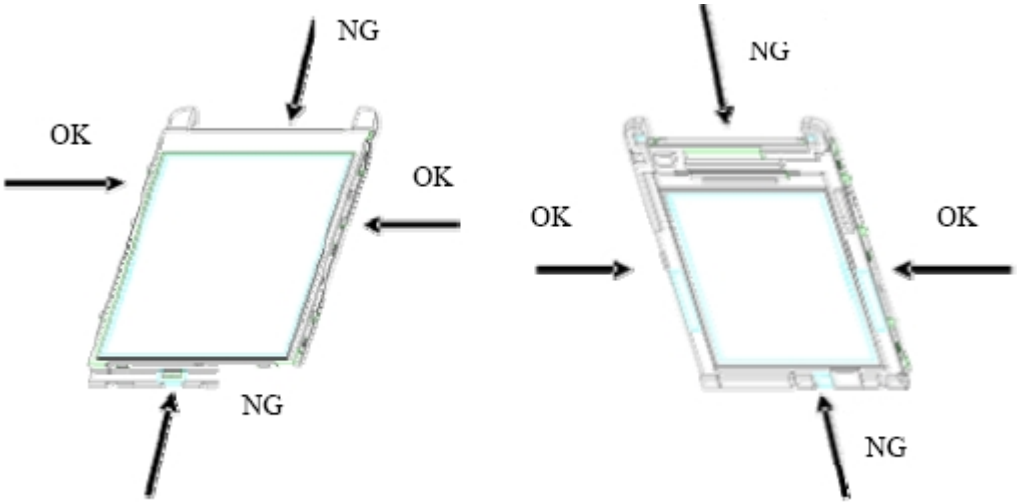


chart1 Note : The LCD module illustration is general module image

1.2.12 Do not touch the FPC 's exposed base film and patterning area, slit part. Otherwise the circuit maybe damaged. Do not touch LSI chips as it may cause a trouble in the inner lead connection.

1.2.13 Place a protective cover on the LCD module to protect the glass panel from mechanical damages.

1.2.14 LCD panel is susceptible to mechanical stress and even the slightest stress will cause a color change in background.So make sure the LCD panel is placed on flat plane without any continuous twisting, bending or pushing stress.

1.2.15 Protective film is placed onto the surface of LCD panel when it is shipped from factory. Make sure to peel it off before assembling the LCD module into the system. Be very careful not to damage LCD module by electrostatic discharge when peeling off this protective film. Ion blower and ground strap are recommended.

1.2.16 Make sure the mechanical design of the system in which the LCD module will be assembled matches specified viewing angle of this LCD module.

1.3 For operating LCD module

1.3.1 Do not operate or store the LCD module under outside of specified environmental conditions.

1.3.2 As opto-electrical characteristics of LCD will be changed, dependent on the temperature, the confirmation of display quality and characteristics has to be done after temperature is set at 25 °C and it becomes stable.

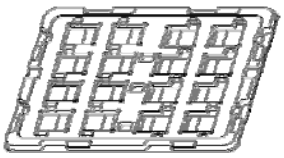
1.4 Precautions for Storage

1.4.1 Do not expose the LCD module to direct sunlight or strong ultraviolet light for long periods. Store in a dark place.

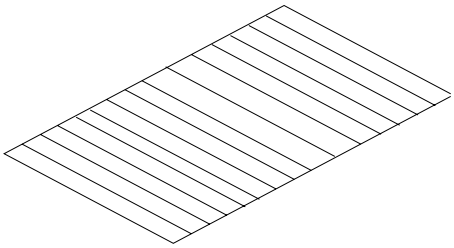
1.4.2 The liquid crystal material will solidify if stored below the rated storage temperature and will becomean isotropic liquid if stored above the rated storage temperature, and may not retain its original properties. Only store the module at normal temperature and humidity(25±5℃ ,60±10% RH) in order to avoid exposing the front polarizer to chronic humidity.

1.4.3 Keeping method

NG



OK



a.Don't keeping under the direct sunlight. **b.Keeping in the tray under the dark place**

1.5 Other Notice

1.5.1 Generally, At power on, in order not to apply DC charge directly to LCD panel, supply logic voltage first and initialize LSI logic function including polarity alternation. At power off, in order not to apply DC charge directly to LCD panel, execute Power OFF sequence and Discharge command.

1.5.2 Don't touch to PWB surface, exposed IC chip, electric parts and other parts, to any electric, metallic materials.

1.5.3 No bromide specific fire-retardant material is used in this module.

1.5.4 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.

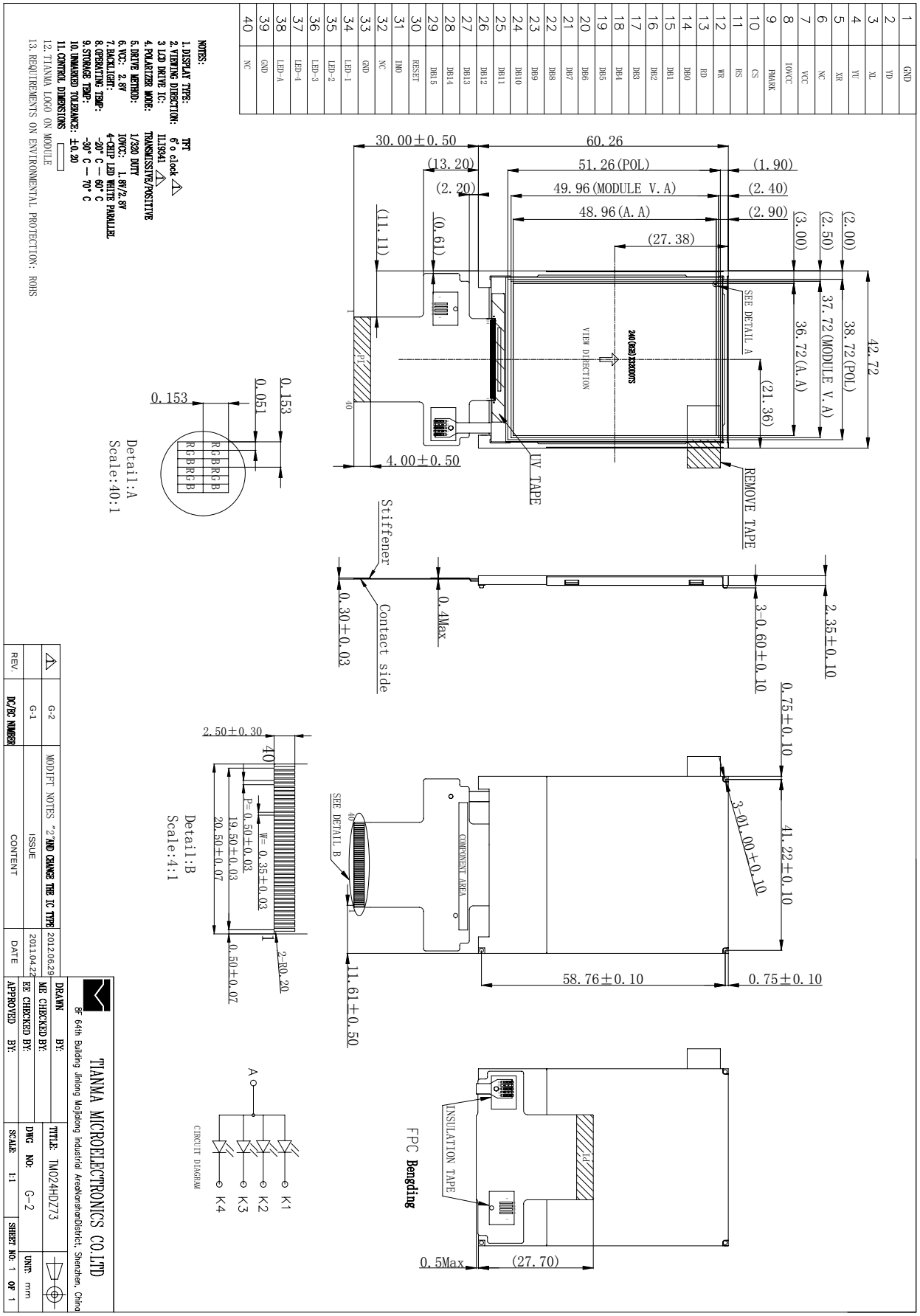
2.General Specifications

TM024HDZ73 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 2.4" display area contains 240 x 320 pixels and can display up to 262K colors.This product accords with RoHS environmental criterion.

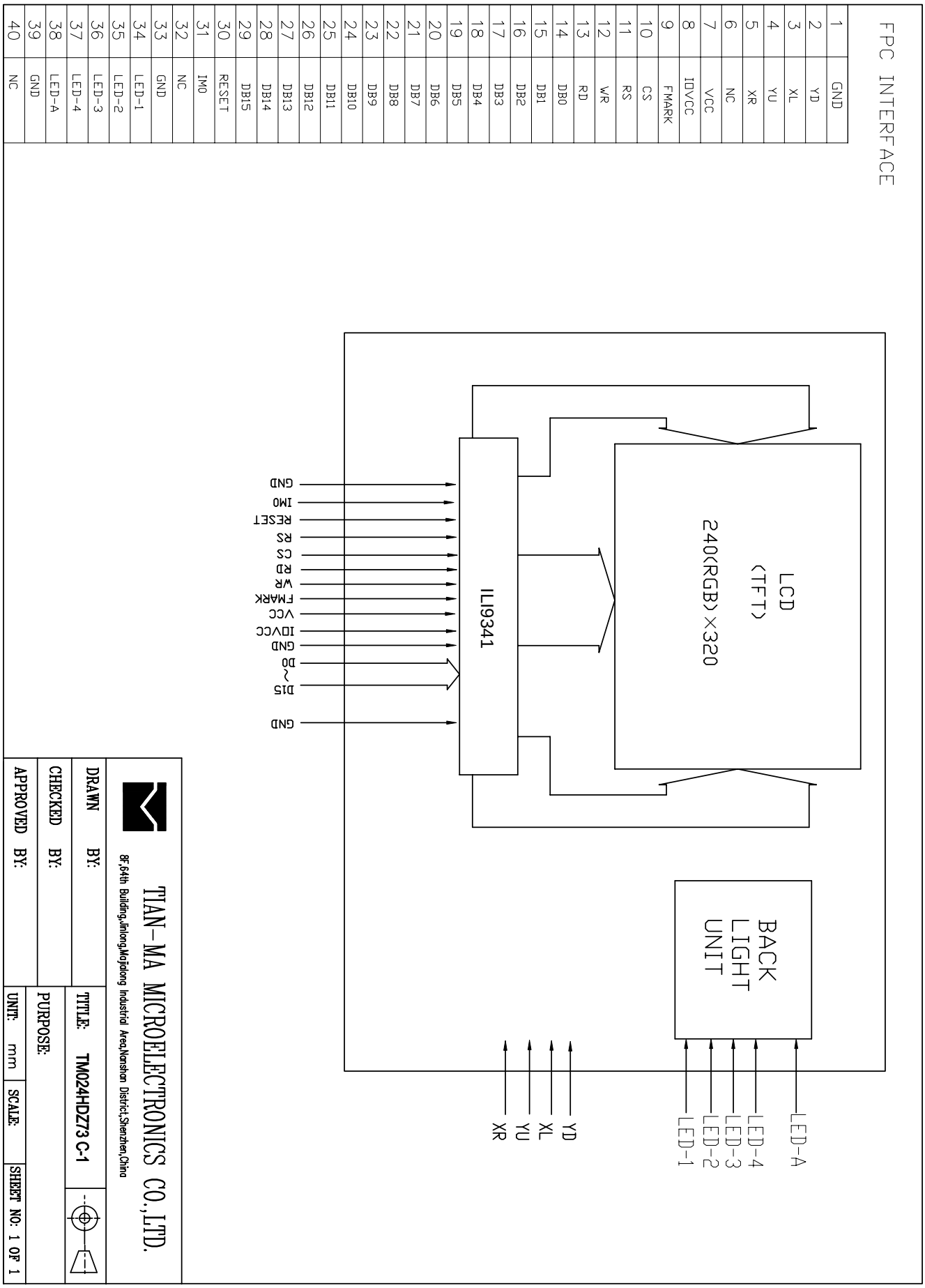
Item	Contents	Unit	Note
LCD Type	a-si TFT	-	
Display Color	65K/262K		1
LCD Duty	1/320	-	
Viewing Direction	6:00	O'Clock	
Active Area(W×H)	36.72×48.96	mm	
Number of Dots	240(RGB)×320		
Dot Pitch(W×H)	0.141X0.141	mm	
Controller	ILI9341	-	
VCC	2.8	V	
IO/VCC	1.8/2.8	V	
Outline Dimensions	Refer to outline drawing on next page		
Backlight	4-LEDs(white parallel)	-	
Weight	11.63	g	
Interface	CPU 8/16 bits	-	
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 2K pcs or above order from customer.

3. Outline Drawing



4. Circuit Block Diagram



5. Absolute Maximum Ratings(Ta=25℃)

Item	Symbol	Min.	Max.	Unit	Note
Power Supply Voltage	VCC	-0.3	4.6	V	1,2,3
Logic Signal Input /Output Voltage	IOVCC	-0.3	4.6	V	
Operating Temperature	Top	-20	+60	℃	
Storage Temperature	Tst	-30	+70	℃	

Notes:

1. **In case of below 0℃，the response time of liquid crystal (LC)becomes slower and the color**
2. **Of panel becomes darker than normal one. Level of retardation depends on temperature, because of LC's characteristics.**
3. **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.**
4. **V_{DD} >V_{SS} must be maintained.**

6. Electrical Specifications and Instruction Code

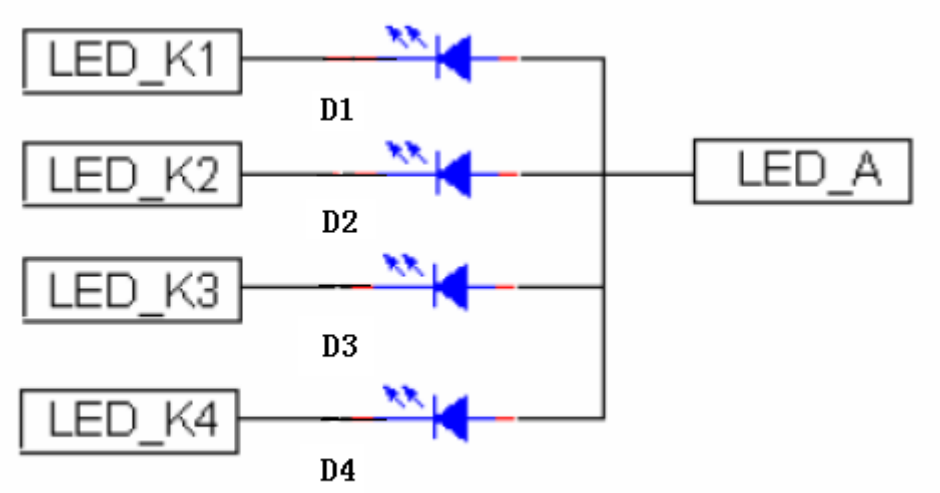
6.1 Electrical characteristics(Vss=0V ,Ta=25℃)

Parameter		Symbol	Min	Typ	Max	Unit	Note
Logic supply voltage		IO/VCC	1.65	2.8	3.3	V	
Analog supply voltage		VCI/VCC	2.5	2.8	3.3	V	
Input voltage	'H'	V_{IH}	0.8 IOVCC	-	IOVCC	V	
	'L'	V_{IL}	VSS	-	0.2 IOVCC	V	
Output Voltage	'H'	V_{OH}	0.8 IOVCC	-	IOVCC	V	
	'L'	V_{OL}	VSS	-	0.2 IO/VCC	V	

6.2 LED backlight specification(VDD=3.0V,Vss=0V ,Ta=25℃)

Item	Symbol	Condition	Min	Typ	Max	Unit	Note
Supply voltage	Vf	1.If=80mA 2.Aperture:1°, 9 Point 3.Average=min/max*100%	2.8	3.2	3.5	V	1,2
Luminance	L_V		5100	5700	-	Cd/m²	
Uniformity	△Bp		80	-	-	%	
Color coordinate*	X		0.260	0.285	0.310	-	
	Y		0.260	0.285	0.310	-	

White LED CIRCUIT DIAGRAM:



NOTE:

1 The LED ‘s driver mode needs to be constant current mode.

2 Permanent damage to the device may occur if maximum values are exceeded or reverse voltage is loaded .Functional operation should be restricted to the conditions described under normal operating conditions.

3 The service life of the LED backlight can reach to 30000 hours under the temperature(25±3℃) and normal current(If ≤80mA), and it will reduce less 50% in 30000 hours.

6.3 Interface Signals

Pin No.	Symbol	I/O	Function	Comment
1	GND	P	Power Ground	
2	YD	O	Floating	
3	XL	O	Floating	
4	YU	O	Floating	
5	XR	O	Floating	
6	LCD_ID	-	Floating.	
7	VCC	P	Power Supply of Analog	
8	IOVCC	P	Power Supply of Logic	
9	FMARK	O	Tearing effect output pin to synchronize MPU to frame writing	
10	CS	I	Chip select signal	
11	RS	I	Register select signal	
12	WR	I	Write enables signal	
13	RD	I	Read enables signal	
14	DB0	I/O	Data Input	
15	DB1	I/O	Data Input	
16	DB2	I/O	Data Input	
17	DB3	I/O	Data Input	
18	DB4	I/O	Data Input	
19	DB5	I/O	Data Input	
20	DB6	I/O	Data Input	
21	DB7	I/O	Data Input	
22	DB8	I/O	Data Input	
23	DB9	I/O	Data input	
24	DB10	I/O	Data input	
25	DB11	I/O	Data input	
26	DB12	I/O	Data input	
27	DB13	I/O	Data input	
28	DB14	I/O	Data input	
29	DB15	I/O	Data input	

Pin No.	Symbol	I/O	Function	Comment
30	RESET	I	Reset signal	
31	IM0	I	Mode select signal	Note2
32	NC	-	Floating	
33	GND	P	Power Ground	
34	LED_K1	P	LED light cathode	
35	LED_K2	P	LED light cathode	
36	LED_K3	P	LED light cathode	
37	LED_K4	P	LED light cathode	
38	LED_A	P	LED light anode	
39	GND	P	Power Ground	
40	NC	-	Floating	

Note1: I/O definition：I-----Input O---Output P----Power/ Ground NC--- Not Connected

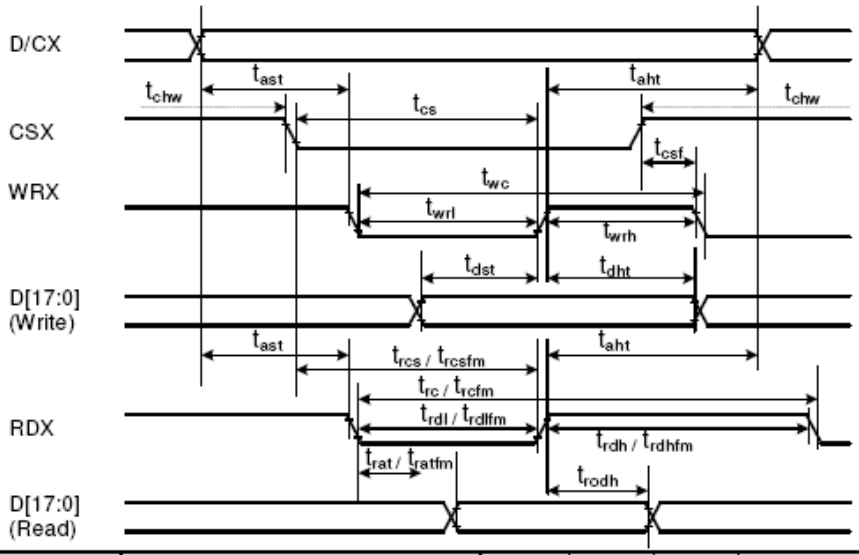
Note2:

IM0	Interface	Data Bus Use	
		Register/Content	GRAM
1	8080 MCU 8_Bit Parallel	DB15~DB8	DB15~DB8
0	8080 MCU 16_Bit Parallel	DB7~DB0	DB15~DB0

6.4 Interface Timing Chart

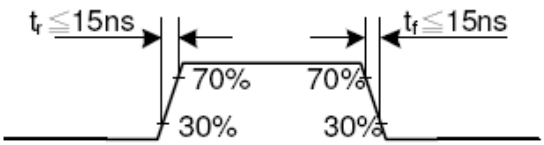
Note: Please refer to ILITEK's ILI9341 data sheet for more details.

ILITEK's ILI9341 INTERFACE PROTOCOL Intel 8080-Ⅰ system CPU interface

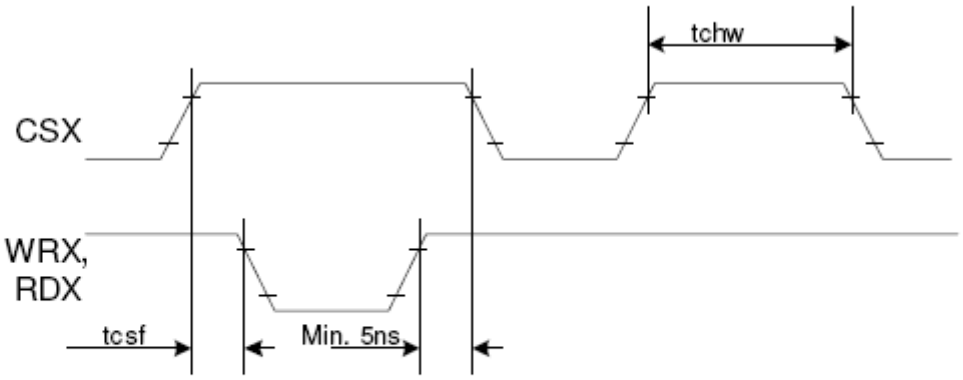


Signal	Symbol	Parameter	min	max	Unit	Description
DCX	tast	Address setup time	0	-	ns	
	taht	Address hold time (Write/Read)	0	-	ns	
CSX	tchw	CSX "H" pulse width	0	-	ns	
	tcs	Chip Select setup time (Write)	15	-	ns	
	trcs	Chip Select setup time (Read ID)	45	-	ns	
	trcsfm	Chip Select setup time (Read FM)	355	-	ns	
	tcsf	Chip Select Wait time (Write/Read)	10	-	ns	
WRX	twc	Write cycle	66	-	ns	
	twrh	Write Control pulse H duration	15	-	ns	
	twrl	Write Control pulse L duration	15	-	ns	
RDX (FM)	trcfm	Read Cycle (FM)	450	-	ns	
	trdhfm	Read Control H duration (FM)	90	-	ns	
	trdlfm	Read Control L duration (FM)	355	-	ns	
RDX (ID)	trc	Read cycle (ID)	160	-	ns	
	trdh	Read Control pulse H duration	90	-	ns	
	trdl	Read Control pulse L duration	45	-	ns	
D[17:0], D[15:0], D[8:0], D[7:0]	tdst	Write data setup time	10	-	ns	For maximum CL=30pF For minimum CL=8pF
	tdht	Write data hold time	10	-	ns	
	trat	Read access time	-	40	ns	
	tratfm	Read access time	-	340	ns	
	trod	Read output disable time	20	80	ns	

Note: Ta = -30 to 70 ℃, VDDI=1.65V to 3.3V, VCI=2.5V to 3.3V, VSS=0V

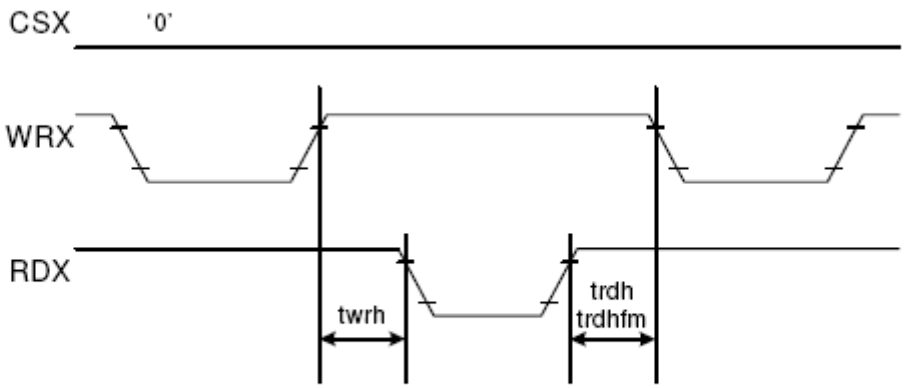


CSX timings :



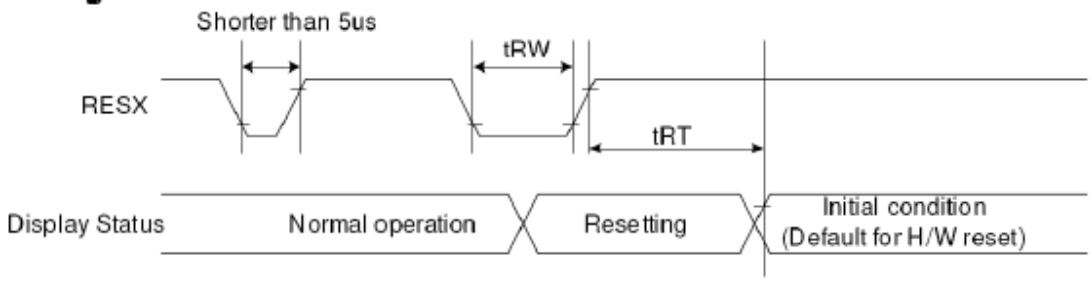
Note: Logic high and low levels are specified as 30% and 70% of VDDI for Input signals.

Write to read or read to write timings:



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

RESET timings



Signal	Symbol	Parameter	Min	Max	Unit
RESX	tRW	Reset pulse duration	10		uS
	tRT	Reset cancel		5 (note 1,5)	mS
				120 (note 1,6,7)	mS

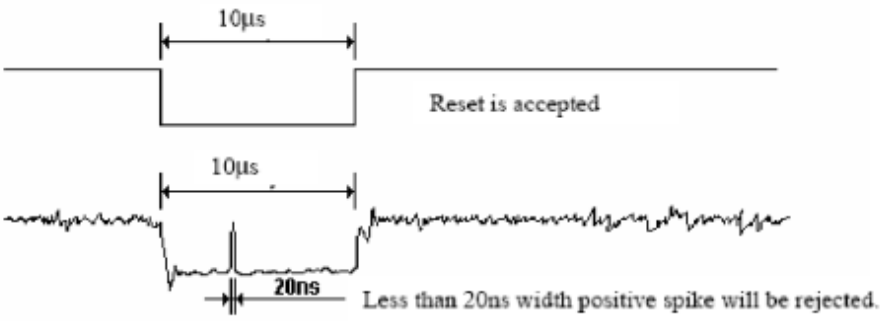
Note 1: The reset cancel includes also required time for loading ID bytes, VCOM setting and other settings from NV memory to registers. This loading is done every time when there is HW reset cancel time (tRT) within 5 ms after a rising edge of RESX.

Note 2: Spike due to an electrostatic discharge on RESX line does not cause irregular system reset according to the table below: -

RESX Pulse	Action
Shorter than 5us	Reset Rejected
Longer than 10us	Reset
Between 5us and 10us	Reset starts

Note 3: During the Resetting period, the display will be blanked (The display is entering blanking sequenc which maximum time is 120 ms, when Reset Starts in Sleep Out –mode. The display remains the blar state in Sleep In -mode.) And then return to Default condition for Hardware Reset.

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



Note 5: When Reset applied during Sleep In Mode.

Note 6: When Reset applied during Sleep Out Mode.

Note 7: It is necessary to wait 5msec after releasing RESX before sending commands. Also Sleep Out command cannot be sent for 120msec.

6.5 INSTRUCTION DESCRIPTION(ILITEK's ILI9341)

Regularive Command Set													
Command Function	D/CX	RDX	WRX	D17-8	D7	D6	D5	D4	D3	D2	D1	D0	Hex
No Operation	0	1	↑	XX	0	0	0	0	0	0	0	0	00h
Software Reset	0	1	↑	XX	0	0	0	0	0	0	0	1	01h
Read Display Identification Information	0	1	↑	XX	0	0	0	0	0	1	0	0	04h
	1	↑	1	XX	X	X	X	X	X	X	X	X	XX
	1	↑	1	XX	ID1 [7:0]								XX
	1	↑	1	XX	ID2 [7:0]								XX
	1	↑	1	XX	ID3 [7:0]								XX
Read Display Status	0	1	↑	XX	0	0	0	0	1	0	0	1	09h
	1	↑	1	XX	X	X	X	X	X	X	X	X	XX
	1	↑	1	XX	D [31:25]							X	00
	1	↑	1	XX	X	D [22:20]			D [19:16]				61
	1	↑	1	XX	X	X	X	X	X	D [10:8]			00
	1	↑	1	XX	D [7:5]			X	X	X	X	X	00
Read Display Power Mode	0	1	↑	XX	0	0	0	0	1	0	1	0	0Ah
	1	↑	1	XX	X	X	X	X	X	X	X	X	XX
	1	↑	1	XX	D [7:2]						0	0	08
Read Display MADCTL	0	1	↑	XX	0	0	0	0	1	0	1	1	0Bh
	1	↑	1	XX	X	X	X	X	X	X	X	X	XX
	1	↑	1	XX	D [7:2]						0	0	00
Read Display Pixel Format	0	1	↑	XX	0	0	0	0	1	1	0	0	0Ch
	1	↑	1	XX	X	X	X	X	X	X	X	X	XX
	1	↑	1	XX	RIM	DPI [2:0]			X	DBI [2:0]			06
Read Display Image Format	0	1	↑	XX	0	0	0	0	1	1	0	1	0Dh
	1	↑	1	XX	X	X	X	X	X	X	X	X	XX
	1	↑	1	XX	X	X	X	X	X	D [2:0]			00
Read Display Signal Mode	0	1	↑	XX	0	0	0	0	1	1	1	0	0Eh
	1	↑	1	XX	X	X	X	X	X	X	X	X	XX
	1	↑	1	XX	D [7:2]						0	0	00
Read Display Self-Diagnostic Result	0	1	↑	XX	0	0	0	0	1	1	1	1	0Fh
	1	↑	1	XX	X	X	X	X	X	X	X	X	XX
	1	↑	1	XX	D [7:6]		X	X	X	X	X	X	00
Enter Sleep Mode	0	1	↑	XX	0	0	0	1	0	0	0	0	10h
Sleep OUT	0	1	↑	XX	0	0	0	1	0	0	0	1	11h
Partial Mode ON	0	1	↑	XX	0	0	0	1	0	0	1	0	12h
Normal Display Mode ON	0	1	↑	XX	0	0	0	1	0	0	1	1	13h
Display Inversion OFF	0	1	↑	XX	0	0	1	0	0	0	0	0	20h
Display Inversion ON	0	1	↑	XX	0	0	1	0	0	0	0	1	21h
Gamma Set	0	1	↑	XX	0	0	1	0	0	1	1	0	26h
	1	1	↑	XX	GC [7:0]								01
Display OFF	0	1	↑	XX	0	0	1	0	1	0	0	0	28h
Display ON	0	1	↑	XX	0	0	1	0	1	0	0	1	29h
Column Address Set	0	1	↑	XX	0	0	1	0	1	0	1	0	2Ah
	1	1	↑	XX	SC [15:8]								XX
	1	1	↑	XX	SC [7:0]								XX
	1	1	↑	XX	EC [15:8]								XX
	1	1	↑	XX	EC [7:0]								XX
Page Address Set	0	1	↑	XX	0	0	1	0	1	0	1	1	2Bh
	1	1	↑	XX	SP [15:8]								XX
	1	1	↑	XX	SP [7:0]								XX
	1	1	↑	XX	EP [15:8]								XX
	1	1	↑	XX	EP [7:0]								XX

Memory Write	0	1	↑	XX	0	0	1	0	1	1	0	0	2Ch
	1	1	↑	D [17:0]									XX
Color SET	0	1	↑	XX	0	0	1	0	1	1	0	1	2Dh
	1	↑	1	XX			R00 [5:0]						XX
	1	↑	1	XX			Rnn [5:0]						XX
	1	↑	1	XX			R31 [5:0]						XX
	1	↑	1	XX			G00 [5:0]						XX
	1	↑	1	XX			Gnn [5:0]						XX
	1	↑	1	XX			G64 [5:0]						XX
	1	↑	1	XX			B00 [5:0]						XX
	1	↑	1	XX			Bnn [5:0]						XX
	1	↑	1	XX			B31 [5:0]						XX
Memory Read	0	1	↑	XX	0	0	1	0	1	1	1	0	2Eh
	1	↑	1	XX	X	X	X	X	X	X	X	X	XX
	1	↑	1	D [17:0]									XX
Partial Area	0	1	↑	XX	0	0	1	1	0	0	0	0	30h
	1	1	↑	XX	SR [15:8]								00
	1	1	↑	XX	SR [7:0]								00
	1	1	↑	XX	ER [15:8]								01
	1	1	↑	XX	ER [7:0]								3F
Vertical Scrolling Definition	0	1	↑	XX	0	0	1	1	0	0	1	1	33h
	1	1	↑	XX	TFA [15:8]								00
	1	1	↑	XX	TFA [7:0]								00
	1	1	↑	XX	VSA [15:8]								01
	1	1	↑	XX	VSA [7:0]								40
	1	1	↑	XX	BFA [15:8]								00
	1	1	↑	XX	BFA [7:0]								00
Tearing Effect Line OFF	0	1	↑	XX	0	0	1	1	0	1	0	0	34h
Tearing Effect Line ON	0	1	↑	XX	0	0	1	1	0	1	0	1	35h
	1	1	↑	XX	X	X	X	X	X	X	X	M	00
Memory Access Control	0	1	↑	XX	0	0	1	1	0	1	1	0	36h
	1	1	↑	XX	MY	MX	MV	ML	BGR	MH	X	X	00
Vertical Scrolling Start Address	0	1	↑	XX	0	0	1	1	0	1	1	1	37h
	1	1	↑	XX	VSP [15:8]								00
	1	1	↑	XX	VSP [7:0]								00
Idle Mode OFF	0	1	↑	XX	0	0	1	1	1	0	0	0	38h
Idle Mode ON	0	1	↑	XX	0	0	1	1	1	0	0	1	39h
Pixel Format Set	0	1	↑	XX	0	0	1	1	1	0	1	0	3Ah
	1	1	↑	XX	X	DPI [2:0]			X	DBI [2:0]			66
Write Memory Continue	0	1	↑	XX	0	0	1	1	1	1	0	0	3Ch
	1	1	↑	D [17:0]									XX
Read Memory Continue	0	1	↑	XX	0	0	1	1	1	1	1	0	3Eh
	1	↑	1	XX	X	X	X	X	X	X	X	X	XX
	1	↑	1	D [17:0]									XX
Set Tear Scanline	0	1	↑	XX	0	1	0	0	0	1	0	0	44h
	1	1	↑	XX	X	X	X	X	X	X	X	STS [8]	00
	1	1	↑	XX	STS [7:0]								00
Get Scanline	0	1	↑	XX	0	1	0	0	0	1	0	1	45h
	1	↑	1	XX	X	X	X	X	X	X	X	X	XX
	1	↑	1	XX	X	X	X	X	X	X	GTS [9:8]		00
	1	↑	1	XX	GTS [7:0]								00
Write Display Brightness	0	1	↑	XX	0	1	0	1	0	0	0	1	51h
	1	1	↑	XX	DBV [7:0]								00

Read Display Brightness	0	1	↑	XX	0	1	0	1	0	0	1	0	52h
	1	↑	1	XX	X	X	X	X	X	X	X	X	XX
	1	↑	1	XX	DBV [7:0]								00
Write CTRL Display	0	1	↑	XX	0	1	0	1	0	0	1	1	53h
	1	1	↑	XX	X	X	BCTRL	X	DD	BL	X	X	00
Read CTRL Display	0	1	↑	XX	0	1	0	1	0	1	0	0	54h
	1	↑	1	XX	X	X	X	X	X	X	X	X	XX
	1	↑	1	XX	X	X	BCTRL	X	DD	BL	X	X	00
Write Content Adaptive Brightness Control	0	1	↑	XX	0	1	0	1	0	1	0	1	55h
	1	1	↑	XX	X	X	X	X	X	X	C [1:0]		00
Read Content Adaptive Brightness Control	0	1	↑	XX	0	1	0	1	0	1	1	0	56h
	1	↑	1	XX	X	X	X	X	X	X	X	X	XX
	1	↑	1	XX	X	X	X	X	X	X	C [1:0]		00
Write CABC Minimum Brightness	0	1	↑	XX	0	1	0	1	1	1	1	0	5Eh
	1	1	↑	XX	CMB [7:0]								00
Read CABC Minimum Brightness	0	1	↑	XX	0	1	0	1	0	1	1	1	5Fh
	1	↑	1	XX	X	X	X	X	X	X	X	X	XX
	1	↑	1	XX	CMB [7:0]								00
Read ID1	0	1	↑	XX	1	1	0	1	1	0	1	0	DAh
	1	↑	1	XX	X	X	X	X	X	X	X	X	XX
	1	↑	1	XX	Module's Manufacture [7:0]								XX
Read ID2	0	1	↑	XX	1	1	0	1	1	0	1	1	DBh
	1	↑	1	XX	X	X	X	X	X	X	X	X	XX
	1	↑	1	XX	LCD Module / Driver Version [7:0]								XX
Read ID3	0	1	↑	XX	1	1	0	1	1	1	0	0	DCh
	1	↑	1	XX	X	X	X	X	X	X	X	X	XX
	1	↑	1	XX	LCD Module / Driver ID [7:0]								XX

Extended Command Set													
Command Function	D/CX	RDX	WRX	D17-8	D7	D6	D5	D4	D3	D2	D1	D0	Hex
RGB Interface Signal Control	0	1	↑	XX	1	0	1	1	0	0	0	0	B0h
	1	1	↑	XX	ByPass_MODE	RCM [1:0]		X	VSPL	HSPL	DPL	EPL	40
Frame Control (In Normal Mode)	0	1	↑	XX	1	0	1	1	0	0	0	1	B1h
	1	1	↑	XX	X	X	X	X	X	X	DIVA [1:0]		00
	1	1	↑	XX	X	X	X	RTNA [4:0]					1B
Frame Control (In Idle Mode)	0	1	↑	XX	1	0	1	1	0	0	1	0	B2h
	1	1	↑	XX	X	X	X	X	X	X	DIVB [1:0]		00
	1	1	↑	XX	X	X	X	RTNB [4:0]					1B
Frame Control (In Partial Mode)	0	1	↑	XX	1	0	1	1	0	0	1	1	B3h
	1	1	↑	XX	X	X	X	X	X	X	DIVC [1:0]		00
	1	1	↑	XX	X	X	X	RTNC [4:0]					1B
Display Inversion Control	0	1	↑	XX	1	0	1	1	0	1	0	0	B4h
	1	1	↑	XX	X	X	X	X	X	NLA	NLB	NLC	02
Blanking Porch Control	0	1	↑	XX	1	0	1	1	0	1	0	1	B5h
	1	1	↑	XX	0	VFP [6:0]							02
	1	1	↑	XX	0	VBP [6:0]							02
	1	1	↑	XX	0	0	0	HFP [4:0]					0A
	1	1	↑	XX	0	0	0	HBP [4:0]					14

Display Function Control	0	1	↑	XX	1	0	1	1	0	1	1	0	B6h
	1	1	↑	XX	X	X	X	X	PTG [1:0]		PT [1:0]		0A
	1	1	↑	XX	REV	GS	SS	SM	ISC [3:0]				82
	1	1	↑	XX	X	X	NL [5:0]						27
	1	1	↑	XX	X	X	PCDIV [5:0]						XX
Entry Mode Set	0	1	↑	XX	1	0	1	1	0	1	1	1	B7h
	1	1	↑	XX	X	X	X	X	DSTB	GON	DTE	GAS	07
Backlight Control 1	0	1	↑	XX	1	0	1	1	1	0	0	0	B8h
	1	1	↑	XX	X	X	X	X	X	X	X	X	XX
	1	1	↑	XX	X	X	X	X	TH_UI [3:0]				04
Backlight Control 2	0	1	↑	XX	1	0	1	1	1	0	0	1	B9h
	1	1	↑	XX	X	X	X	X	X	X	X	X	XX
	1	1	↑	XX	TH_MV [3:0]				TH_ST [3:0]				B8
Backlight Control 3	0	1	↑	XX	1	0	1	1	1	0	1	0	BAh
	1	1	↑	XX	X	X	X	X	X	X	X	X	XX
	1	1	↑	XX	X	X	X	X	DTH_UI [3:0]				04
Backlight Control 4	0	1	↑	XX	1	0	1	1	1	0	1	1	BBh
	1	1	↑	XX	X	X	X	X	X	X	X	X	XX
	1	1	↑	XX	DTH_MV [3:0]				DTH_ST [3:0]				C9
Backlight Control 5	0	1	↑	XX	1	0	1	1	1	1	0	0	BCh
	1	1	↑	XX	X	X	X	X	X	X	X	X	XX
	1	1	↑	XX	DIM2 [3:0]				X	DIM1 [2:0]			44
Backlight Control 7	0	1	↑	XX	1	0	1	1	1	1	1	0	BEh
	1	1	↑	XX	PWM_DIV [7:0]								0F
Backlight Control 8	0	1	↑	XX	1	0	1	1	1	1	1	1	BFh
	1	1	↑	XX	X	X	X	X	X	LEDONR	LEDONPOL	LEDPWMOPL	00
Power Control 1	0	1	↑	XX	1	1	0	0	0	0	0	0	C0h
	1	1	↑	XX	X	X	VRH [5:0]						26
Power Control 2	0	1	↑	XX	1	1	0	0	0	0	0	1	C1h
	1	1	↑	XX	X	X	X	X	X	BT [2:0]			00
VCOM Control 1	0	1	↑	XX	1	1	0	0	0	1	0	1	C5h
	1	1	↑	XX	X	VMH [6:0]							31
	1	1	↑	XX	X	VML [6:0]							3C
VCOM Control 2	0	1	↑	XX	1	1	0	0	0	1	1	1	C7h
	1	1	↑	XX	nVM	VMF [6:0]							C0
NV Memory Write	0	1	↑	XX	1	1	0	1	0	0	0	0	D0h
	1	1	↑	XX	X	X	X	X	X	PGM_ADR [2:0]			00
	1	1	↑	XX	PGM_DATA [7:0]								XX
NV Memory Protection Key	0	1	↑	XX	1	1	0	1	0	0	0	1	D1h
	1	1	↑	XX	KEY [23:16]								55
	1	1	↑	XX	KEY [15:8]								AA
	1	1	↑	XX	KEY [7:0]								66
NV Memory Status Read	0	1	↑	XX	1	1	0	1	0	0	1	0	D2h
	1	↑	1	XX	X	X	X	X	X	X	X	X	XX
	1	↑	1	XX	X	ID2_CNT [2:0]			X	ID1_CNT [2:0]			XX
	1	↑	1	XX	BUSY	VMF_CNT [2:0]			X	ID3_CNT [2:0]			XX

Read ID4	0	↑	1	XX	1	1	0	1	0	0	1	1		D3h
	1	↑	1	XX	X	X	X	X	X	X	X	X		XX
	1	↑	1	XX	0	0	0	0	0	0	0	0		00
	1	↑	1	XX	1	0	0	1	0	0	1	1		93
	1	↑	1	XX	0	1	0	0	0	0	0	1		41
Positive Gamma Correction	0	1	↑	XX	1	1	1	0	0	0	0	0		E0h
	1	1	↑	XX	X	X	X	X	VP0 [3:0]					08
	1	1	↑	XX	X	X	VP1 [5:0]							0E
	1	1	↑	XX	X	X	VP2 [5:0]							12
	1	1	↑	XX	X	X	X	X	VP4 [3:0]					05
	1	1	↑	XX	X	X	X	VP6 [4:0]						03
	1	1	↑	XX	X	X	X	X	VP13 [3:0]					09
	1	1	↑	XX	X	VP20 [6:0]								47
	1	1	↑	XX	VP36 [3:0]				VP27 [3:0]					86
	1	1	↑	XX	X	VP43 [6:0]								2B
	1	1	↑	XX	X	X	X	X	VP50 [3:0]					0B
	1	1	↑	XX	X	X	X	VP57 [4:0]						04
	1	1	↑	XX	X	X	X	X	VP59 [3:0]					00
	1	1	↑	XX	X	X	VP61 [5:0]							00
	1	1	↑	XX	X	X	VP62 [5:0]							00
	1	1	↑	XX	X	X	X	X	VP63 [3:0]					00
Negative Gamma Correction	0	1	↑	XX	1	1	1	0	0	0	0	1		E1h
	1	1	↑	XX	X	X	X	X	VN0 [3:0]					08
	1	1	↑	XX	X	X	VN1 [5:0]							1A
	1	1	↑	XX	X	X	VN2 [5:0]							20
	1	1	↑	XX	X	X	X	X	VN4 [3:0]					07
	1	1	↑	XX	X	X	X	VN6 [4:0]						0E
	1	1	↑	XX	X	X	X	X	VN13 [3:0]					05
	1	1	↑	XX	X	VN20 [6:0]								3A
	1	1	↑	XX	VN36 [3:0]				VN27 [3:0]					8A
	1	1	↑	XX	X	VN43 [6:0]								40
	1	1	↑	XX	X	X	X	X	VN50 [3:0]					04
	1	1	↑	XX	X	X	X	VN57 [4:0]						18
	1	1	↑	XX	X	X	X	X	VN59 [3:0]					0F
	1	1	↑	XX	X	X	VN61 [5:0]							3F
	1	1	↑	XX	X	X	VN62 [5:0]							3F
	1	1	↑	XX	X	X	X	X	VN63 [3:0]					0F
Digital Gamma Control 1	0	1	↑	XX	1	1	1	0	0	0	1	0		E2h
1st Parameter	1	1	↑	XX	RCA0 [3:0]				BCA0 [3:0]					XX
:	1	1	↑	XX	RCAx [3:0]				BCAx [3:0]					XX
16th Parameter	1	1	↑	XX	RCA15 [3:0]				BCA15 [3:0]					XX
Digital Gamma Control 2	0	1	↑	XX	1	1	1	0	0	0	1	1		E3h
1st Parameter	1	1	↑	XX	RFA0 [3:0]				BFA0 [3:0]					XX
:	1	1	↑	XX	RFAx [3:0]				BFAx [3:0]					XX
64th Parameter	1	1	↑	XX	RFA63 [3:0]				BFA63 [3:0]					XX
Interface Control	0	1	↑	XX	1	1	1	1	0	1	1	0		F6h
	1	1	↑	XX	MY_EOR	MX_EOR	MV_EOR	X	BGR_EOR	X	X	WEMODE		01
	1	1	↑	XX	X	X	EPF [1:0]		X	X	MDT [1:0]			00
	1	1	↑	XX	X	X	ENDIAN	X	DM [1:0]		RM	RIM		00

Note 1: Undefined commands are treated as NOP (00h) command.

Note 2: B0 to D9 and DE to FF are for factory use of display supplier. USER can decide if these commands are available or they are treated as NOP (00h) commands before shipping to USER. Default value is NOP (00h).

Note 3: Commands 10h, 12h, 13h, 26h, 28h, 29h, 30h, 36h (Bit B4 only), 38h and 39h are updated during V-SYNC when ILI9341 is in Sleep OUT mode to avoid abnormal visual effects. During Sleep IN mode, these commands are updated immediately. Read status (09h), Read display power mode (0Ah), Read display MADCTL (0Bh), Read display pixel format (0Ch), Read display image mode (0Dh), Read display signal mode (0Eh) and Read display self diagnostic result (0Fh) of these commands are updated immediately both in Sleep IN mode and Sleep OUT mode.

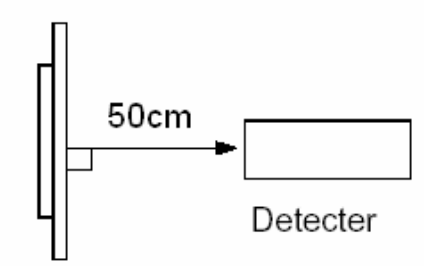
7. Optical Characteristics（VCC=2.8V,Vss=0V ,Ta=25℃）

Item	Symbol		Condition	Min.	Typ.	Max.	Unit	Note
Brightness	Bp		θ=0° Φ=0°	280	310	-	Cd/m²	1
Uniformity	△Bp			-	80%	-		1,2
Viewing Angle	θ1 (Φ=90°)		Cr≥10	50	60	-	Deg	3
	θ1 (Φ=270°)			60	70	-		
	θ2 (Φ=0°)			60	70	-		
	θ2 (Φ=180°)			60	70	-		
Contrast Ratio	Cr		θ=0° Φ=0°	400	500	-	-	4
Response Time	T_r		25℃	-	20	30	ms	5
	T_f							
Color of CIE Coordinate	W	x	θ=0° Φ=0°	0.240	0.290	0.340	-	1,6
		y		0.270	0.320	0.370		
	R	x		0.542	0.592	0.642		
		y		0.294	0.344	0.394		
	G	x		0.285	0.332	0.385		
		y		0.531	0.581	0.631		
	B	x		0.099	0.149	0.199		
		y		0.054	0.104	0.154		
NTSC Ratio	S			-	53%	-	%	

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

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 (Φ8mm)
Measuring condition:

- **Measuring surroundings: Dark room.**
- **Measuring temperature: Ta=25℃.**
- **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 whilebacklight turning on.**

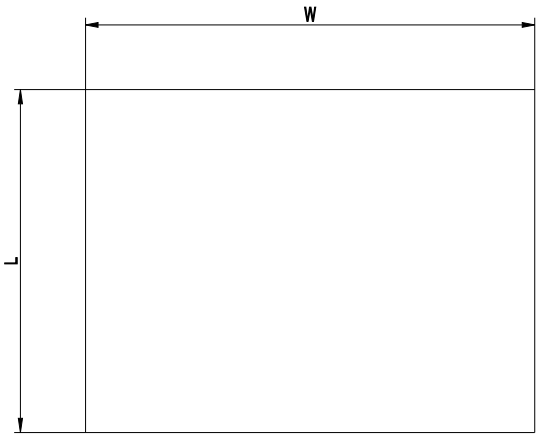


Note 2: The luminance uniformity is calculated by using following formula.

△Bp = Bp (Min.) / Bp (Max.)×100 (%)

Bp (Max.) = Maximum brightness in 9 measured spots

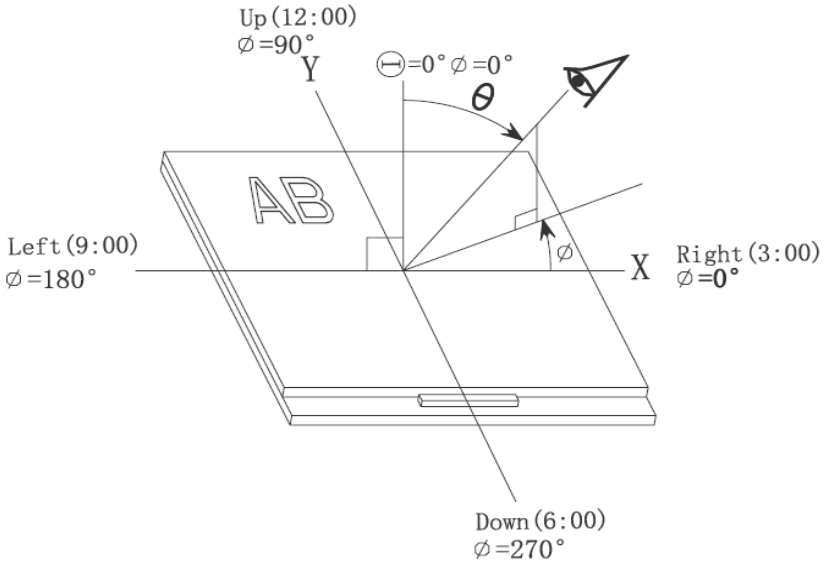
Bp (Min.) = Minimum brightness in 9 measured spots.



Measurement equipment PR-705 (Φ8mm)

Note 3: The definition of viewing angle:

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



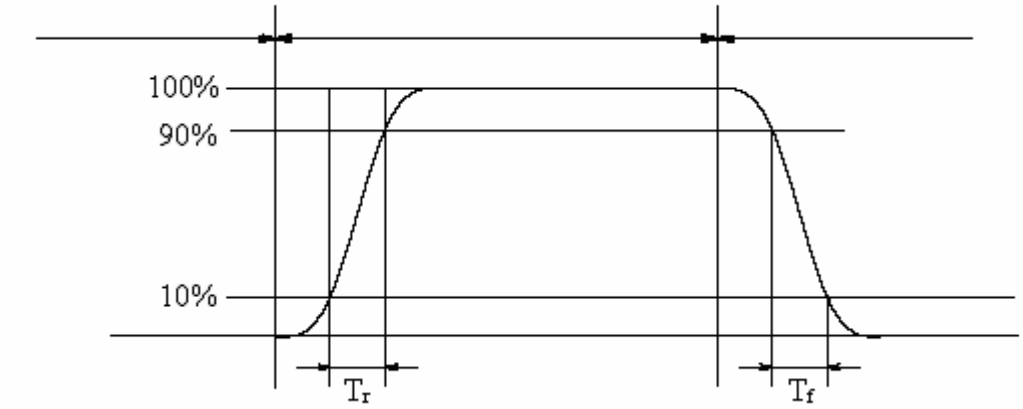
Note 4: The definition of contrast ratio (Test LCM using PR-705):

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

(Contrast Ratio is measured in optimum common electrode voltage)

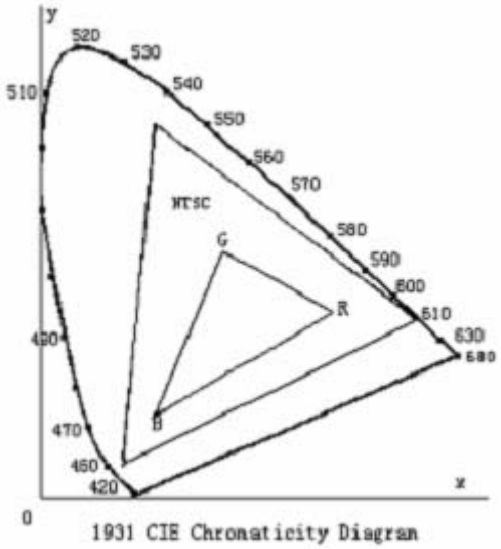
Note 5: Definition of Response time. (Test LCD using DMS501):

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:

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

8.Initial Code Setting（Only reference）

void ILI9341_Tianma2.4_Initial(void)

```
{

        write_cmd(0x01);    //software reset
        delay(5);
//------------power control-----------------------------
        write_cmd(0xc0);    //power control
        write_data16(0x00,0x26);

        write_cmd(0xc1);    //power control
        write_data16(0x00,0x11);

        write_cmd(0xc5);    //vcom control
        write_data16(0x00,0x35);//35
        write_data16(0x00,0x3e);//3E

        write_cmd(0xc7);    //vcom control
        write_data16(0x00,0xbe);
//------------memory access control------------------------
        write_cmd(0x36);      // memory access control
        write_data16(0x00,0x48); //0048        my,mx,mv,ml,BGR,mh,0.0

        write_cmd(0x3a);      // pixel format set
        write_data16(0x00,0x55);//16bit /pixel
//----------------- frame rate-----------------------------
        write_cmd(0xb1);      //    frame rate
        write_data16(0x00,0x00);
        write_data16(0x00,0x1a);    //70

//----------------Gamma---------------------------------
        write_cmd(0xf2);    // 3Gamma Function Disable
        write_data16(0x00,0x08);

        write_cmd(0x26);
        write_data16(0x00,0x01); //    gamma set 4 gamma curve 01/02/04/08

            write_cmd(0xE0);    //positive gamma correction
            write_data16(0x00,0x1f);
            write_data16(0x00,0x1a);
            write_data16(0x00,0x18);
            write_data16(0x00,0x0a);
            write_data16(0x00,0x0f);
            write_data16(0x00,0x06);
            write_data16(0x00,0x45);
            write_data16(0x00,0x87);
            write_data16(0x00,0x32);
            write_data16(0x00,0x0a);
            write_data16(0x00,0x07);
            write_data16(0x00,0x02);
            write_data16(0x00,0x07);
            write_data16(0x00,0x05);
            write_data16(0x00,0x00);
```

```
                write_cmd(0xE1);    //negamma correction
                write_data16(0x00,0x00);
                write_data16(0x00,0x25);
                write_data16(0x00,0x27);
                write_data16(0x00,0x05);
                write_data16(0x00,0x10);
                write_data16(0x00,0x09);
                write_data16(0x00,0x3a);
                write_data16(0x00,0x78);
                write_data16(0x00,0x4d);
                write_data16(0x00,0x05);
                write_data16(0x00,0x18);
                write_data16(0x00,0x0d);
                write_data16(0x00,0x38);
                write_data16(0x00,0x3a);
                write_data16(0x00,0x1f);
//--------------ddram --------------------
          write_cmd(0x2a);       // column set
          write_data16(0x00,0x00);
          write_data16(0x00,0x00);
          write_data16(0x00,0x00);
          write_data16(0x00,0xEF);

          write_cmd(0x2b);      // page address set
          write_data16(0x00,0x00);
          write_data16(0x00,0x00);
          write_data16(0x00,0x01);
          write_data16(0x00,0x3F);

          write_cmd(0x34);      // tearing effect off
          //write_cmd(0x35);      // tearing effect on

           //write_cmd(0xb4);      // display inversion
           //write_data16(0x00,0x00);

           write_cmd(0xb7);    //entry mode set
           write_data16(0x00,0x07);
//-----------------display----------------------
           write_cmd(0xb6);      //    display function control
           write_data16(0x00,0x0a);
           write_data16(0x00,0x82);
           write_data16(0x00,0x27);
           write_data16(0x00,0x00);

           write_cmd(0x11);    //sleep out
           delay(60);
           write_cmd(0x29);      // display on
           delay(100);
           write_cmd(0x2c);      //memory write
}
```

9. Reliability Test Items and Criteria

No	Test Item	Test condition	Criterion
1	**High Temperature Storage**	Ta=+70℃,240hrs	**The test result shall be evaluated after the sample has been left at room temperature and humidity for 2 hours without load. No condensation shall be accepted. The sample shall be free from defects: 1.Air bubble in the LCD; 2.Sealleak; 3.Non-display; 4.missing segments; 5.Glass crack;**
2	**Low Temperature Storage**	Ta=-30℃,240hrs	
3	**High Temperature Operation**	Ts=+60℃,240hrs	
4	**Low Temperature Operation**	Ta=-20℃,240hrs	
5	**High Temperature & Humidity Operation**	60℃±2℃ 90%RH120H Power on	
6	**Temperature Cycle**	--30 ℃←→25 ℃←→70 ℃ 30min 5min 30min after 20cycle, Restore 2H at 25℃ Power off	
7	**Vibration Test**	10Hz~150Hz, 100m/s2, 120min	
8	**Shock Test**	Half-sine wave,300m/s2,1 1ms	
9	**Drop Test(package state)**	800mm, concrete floor,1corner,	
10	**ESD Sensitivity test**	Contact ±4KV，150PF/330， 5 times Air ±8KV,150PF/330， 5 times	

NOTE:

1.The test samples should be applied to only one test item.

2.Sample size for each test item is 5~10pcs.

3.For Damp Proof Test, Pure water(Resistance＞10MΩ) should be used.

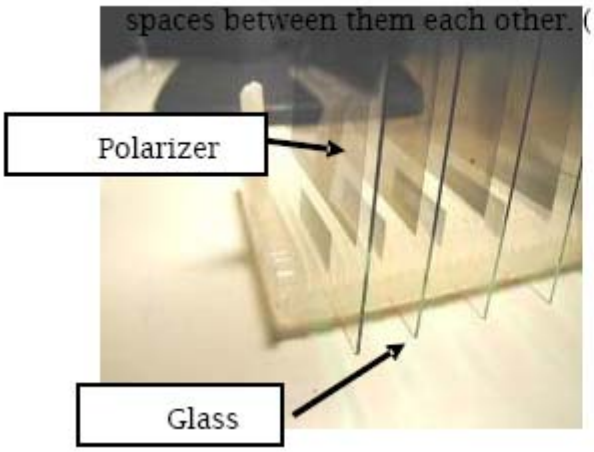
4.In case of malfunction defect caused by ESD damage, if it would be recovered to normal state after resetting, it would be judge as a good part. Using ionizer(an antistatic blower) is recommended at working area in order to reduce electro-static voltage. When removing protection film from LCM panel, peel off the tag slowly(recommended more than one second) while blowing with ionizer toward the peeling face to minimize ESD which may damage electrical circuit.

5. EL evaluation should be excepted from reliability test with humidity and temperature: Some defects such as black spot/blemish can happen by natural chemical reaction with humidity and Fluorescence EL has.

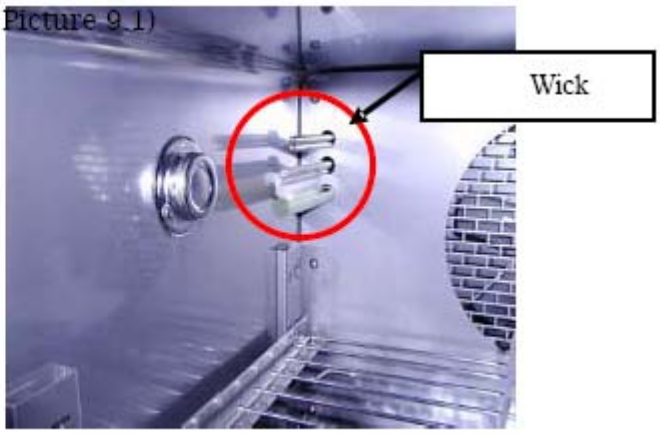
6. Polarizer test criteria

a. when testing avoid samples take out then return, It can cause water coagulation in Polarizer. Increase the distance of samples , And put samples before the wind.

b. When the samples are put into the test, put them upright so that the glasses keep spaces between them each other. (Picture 9.1)



Picture 9.1



Picture 9.2

c. Put samples into testing machine as small as possible so that it is drafty.

d. Do not put samples under wick because water will fall.(Picture 9.2)

e. Do not open testing machine except for taking them out in order to prevent moisture condensation.

7.Please use automatic switch menu(or roll menu) testing mode when test operating mode

8.The inspection terms after reliability test, as below

ITEM	Inspection standard
Contrast	CR>50%
IDD	IDD<200%
Brightness	Brightness>60%
Color Tone	Color Tone+/-0.05

10 Quality level

10.1 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,abnormaldisplay,open or missin 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.

10.2 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 area : center of viewing area
B area : periphery of viewing area
C area : 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):0.5 mm X2(A.A~V.A): 0.5mm
Y1(A.A~V.A):0.5mm Y2(A.A~V.A): 0.5mm

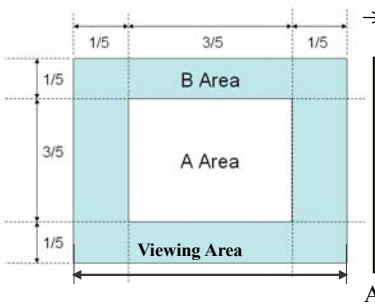


Figure 1

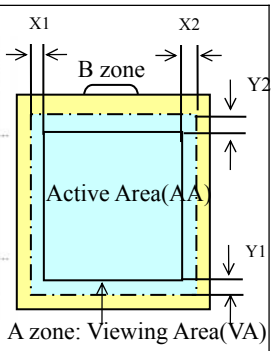


Figure 2

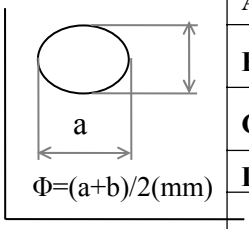
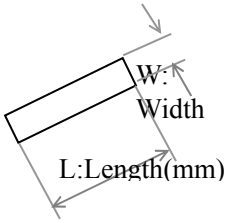
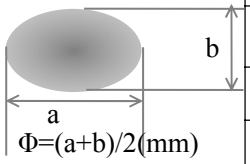
10.3 Inspection items and general notes

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**
	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**

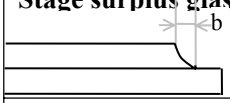
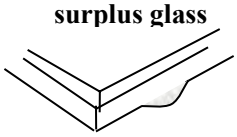
10.4 Outgoing Inspection level

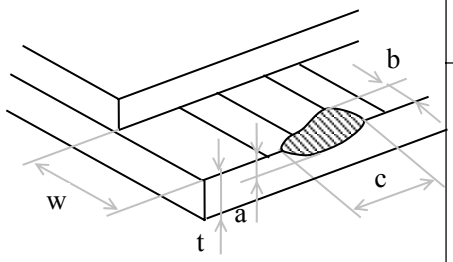
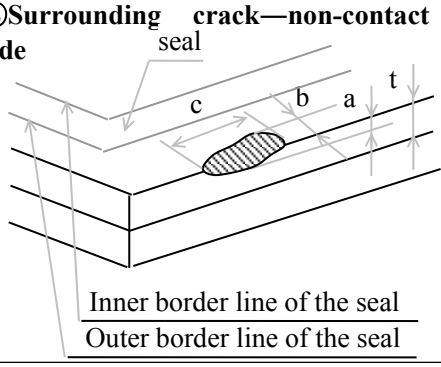
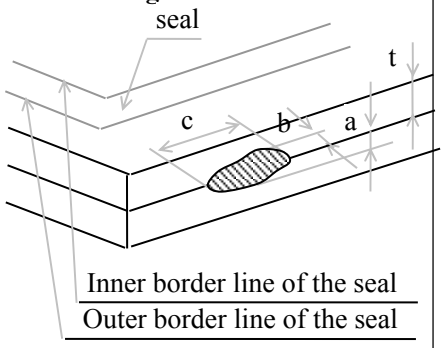
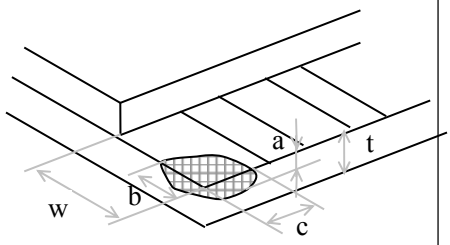
Outgoing Inspection standard	Inspection conditions	Inspection				
		Min.	Max.	Unit	IL	AQL
Major Defects	See 10.3 general notes	See 10.5			II	0.65
Minor Defects	See 10.3 general notes	See 10.5			II	1.5
Note：Sampling standard conforms to GB2828						

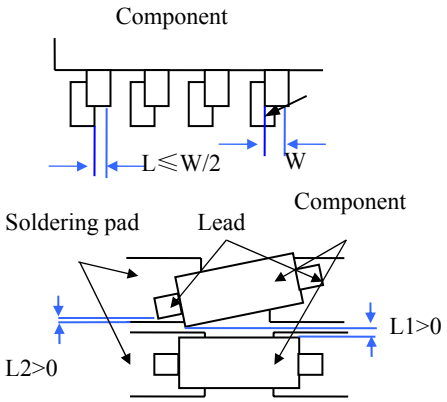
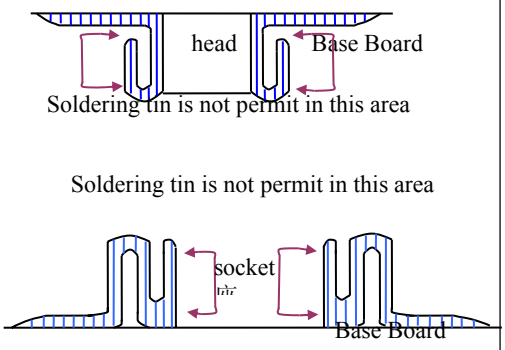
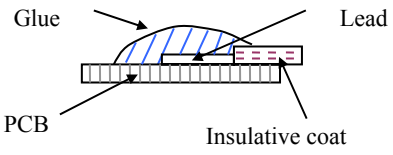
10.5 Inspection Items and Criteria

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≦0.15	2	
			C	0.15<Φ≦0.20	1	
			D	0.20<Φ	0	
			Total defective point(B,C)		3	
2	Black line, White line, 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	

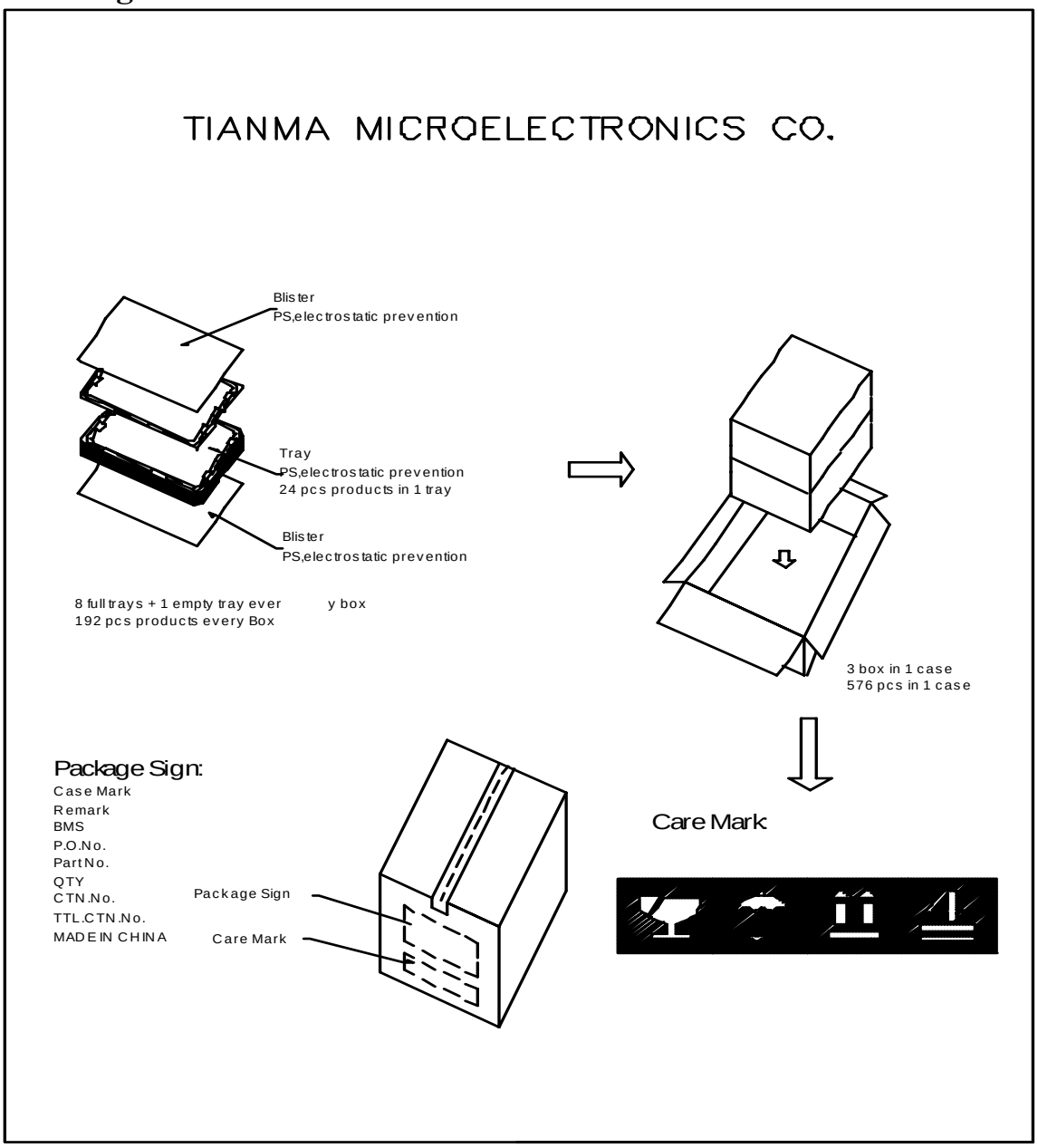
4	Dot defect (if TFT LCD is used)	TFT LCD is smaller than 3 inches	LCD Class	Defect	A area		B area
			B	Bright dot	2		Neglected
				Dark dot	3		
				Total	4		
		TFT LCD between 3~10.4 inches	LCD Class	Defect	A area	B area	C area
			B	Bright dot	2	2	Neglected
				Dark dot	2	3	
				Total	6		

<table>
<tr><td></td><td></td><td colspan="4">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.</td></tr>
<tr><td>5</td><td colspan="2">Bubble inside cell</td><td colspan="2">any size</td><td>None</td><td>none</td></tr>
<tr><td rowspan="4">6</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">7</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>8</td><td colspan="2">Open segment or open common</td><td colspan="4">Not permitted</td></tr>
<tr><td>9</td><td colspan="2">Short circuit</td><td colspan="4">Not permitted</td></tr>
<tr><td>10</td><td colspan="2">False viewing direction</td><td colspan="4">Not permitted</td></tr>
<tr><td>11</td><td colspan="2">Contrast ratio uneven</td><td colspan="4">According to the limit specimen</td></tr>
<tr><td>12</td><td colspan="2">Crosstalk</td><td colspan="4">According to the limit specimen</td></tr>
<tr><td>13</td><td colspan="2">Black /White spot(display)</td><td colspan="4">Refer to item 1</td></tr>
<tr><td>14</td><td colspan="2">Black /White line(display)</td><td colspan="4">Refer to item 2</td></tr>
</table>

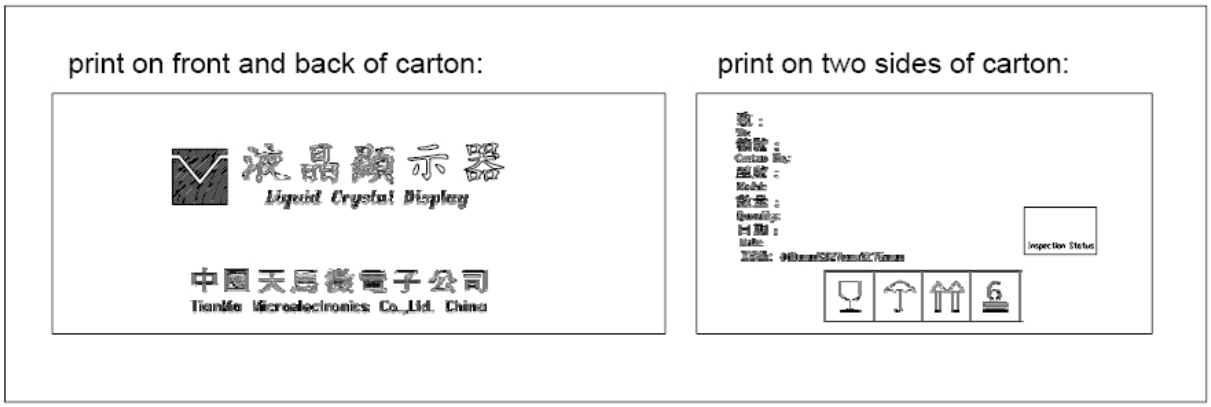
Inspection items			Judgment standard		
			Category(application: B zone)		Acceptable number
15	Glass defect crack	①The front of lead terminals 	A	a≤ t, b≤1/5W, c≤3mm	Max.3 defects allowed
			B	Crack at two sides of lead terminals should not cover patterns and alignment mark	
		②Surrounding crack—non-contact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

11. Package Method



The print on front and side of carton:



Node：the height of carton stack must be less than 1.5m