SPECIFICATION FOR TFT LCD MODULE

MODEL NO:	**TM018FDZ52**
CUSTOMER:	标屏
CUSTOMER P/N.	
VERSION	**V1.0**
CUSTOMER APPROVED	

□ **Preliminary Specification**

■ **Final Specification**

PREPARED	CHECKED	VERIFIED BY QA DEPT	VERIFIED BY R&D DEPT

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REVISION RECORD

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2010-7-30	**V1.0**		**The first release**	---

CONTENTS

Page

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 forany damage resulting from the use of the device which does 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

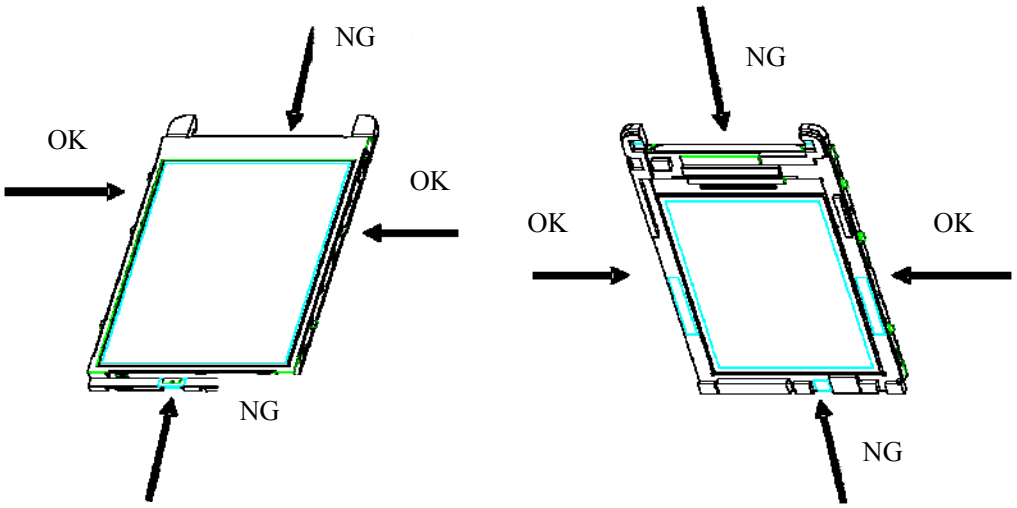


chart1 Note : The LCD module illustration is general module image

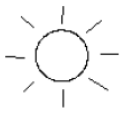
1.2.12 Do not touch the FPC ‘s exposed base film and patterning area, slit part. Otherwise the circuit maybe damaged. Do not touch LSI chips as it may cause a trouble in the inner lead connection.
1.2.13 Place a protective cover on the LCD module to protect the glass panel from mechanical damages.
1.2.14 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

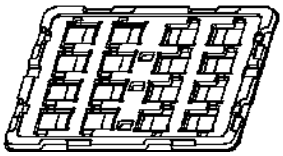
1.3.1 Do not operate or store the LCD module under outside of specified environmental conditions.
1.3.2 As opto-electrical characteristics of LCD will be changed, dependent on the temperature, the confirmation of display quality and characteristics has to be done after temperature is set at 25 °C and it becomes stable.

1.4 Precautions for Storage

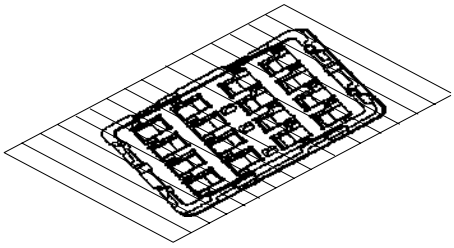
1.4.1 Do not expose the LCD module to direct sunlight or strong ultraviolet light for long periods. Store in a dark place.
1.4.2 The liquid crystal material will solidify if stored below the rated storage temperature and will becomean isotropic liquid if stored above the rated storage temperature, and 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. Then supply voltage for LCD bias. 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.

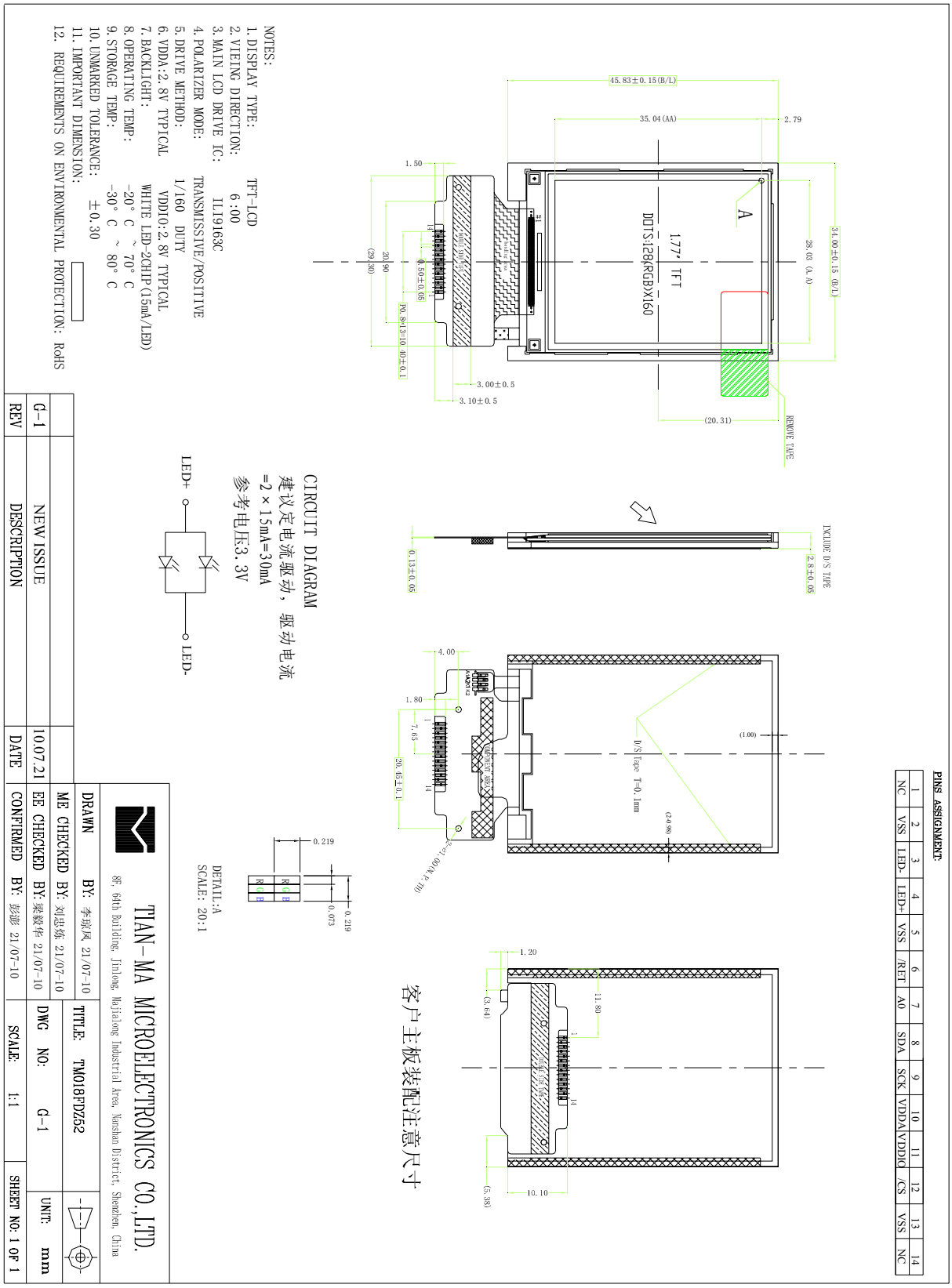
2.General Specifications

TM018FDZ52 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 1.77" 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	65K/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(RGB)×160	mm	
Dot Pitch(W×H)	0.219X0.219	mm	
Controller	ILI9163C	-	
VDDA	2.8	V	
VDDIO	1.8/2.8	V	
Outline Dimensions	Refer to outline drawing on next page		
Backlight	2-LEDs(white)	-	
Weight	TBD	g	
Interface	4-line series 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.

3. 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 TIANM FAE or RD change rind.

4. Absolute Maximum Ratings(Ta=25℃)

Item	Symbol	Min.	Max.	Unit	Note
Power Supply Voltage	VDDA	-0.3	4.6	V	1，2,3
Logic Signal Input /Output Voltage	VDDIO	-0.3	4.6	V	
Operating Temperature	Top	-20	+70	℃	
Storage Temperature	Tst	-30	+80	℃	

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.

5. Electrical Specifications and Instruction Code

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

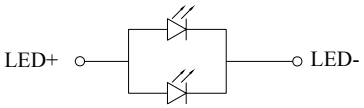
Parameter		Symbol	Condition	Min	Typ	Max	Unit	Note
Input voltage	'H'	V_{IH}		0.7 VDDIO	-	VDDIO	V	
	'L'	V_{IL}		Vss	-	0.3 VDDIO	V	
Output Voltage	'H'	V_{OH}	IOH = -1.0mA	0.8 VDDIO	-	VDDIO	V	
	'L'	V_{OL}	IOL = +1.0mA	Vss	-	0.2 VDDIO	V	
Current Consumption		I_{CC1}	Normal mode	-	-	-	mA	1,3
		I_{CC2}	Standby 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 LED backlight specification(VDD=2.8V,Vss=0V ,Ta=25℃)

Item		Symbol	Condition	Min	Typ	Max	Unit	Note
Supply voltage		Vf	If=30mA	-	3.3	-	V	1
Reverse voltage		V_r	-	-	-	-	V	
Forward current	Normal	I_{pn}	2-chip		30	-	mA	2
	Dimming	I_{pd}						
Reverse Current		I_r	-	-	-	-	μA	
Uniformity		△Bp	I_f=30mA	80%				
Color coordinate*		X		0.270	-	0.315	-	
		Y		0.270	-	0.315	-	

White LED CIRCUIT DIAGRAM:



CIRCUIT DIAGRAM
建议定电流驱动，驱动电流
=2×15mA=30mA
参考电压3.3V

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.

5.3 Interface Signals

Pin No.	Symbol	I/O	Function
1	NC	NC	NC
2	VSS	PG	Connect to Ground
3	LED-	I	Cathode NO.1 for LED backlighting
4	LED+	I	Anode for LED backlighting
5	VSS	PG	Connect to Ground
6	/RET	I	Reset pin
7	A0	I	Display data / Command selection pin in parallel
8	SDA	I	Serial display data input
9	SCK	I	Serial interface clock
10	VDDA	P	Power supply (2.8V)
11	VDDIO	P	Power supply (1.8/2.8V)
12	/CS	I	Chip select input pin(“low” is enable)
13	VSS	PG	Connect to Ground
14	NC	NC	NC

5.4 Interface Timing Chart

Note: Please refer to ILITEK's ILI9163C data sheet for more details.

ILITEK's ILI9163C INTERFACE PROTOCOL

80 system Serial interface

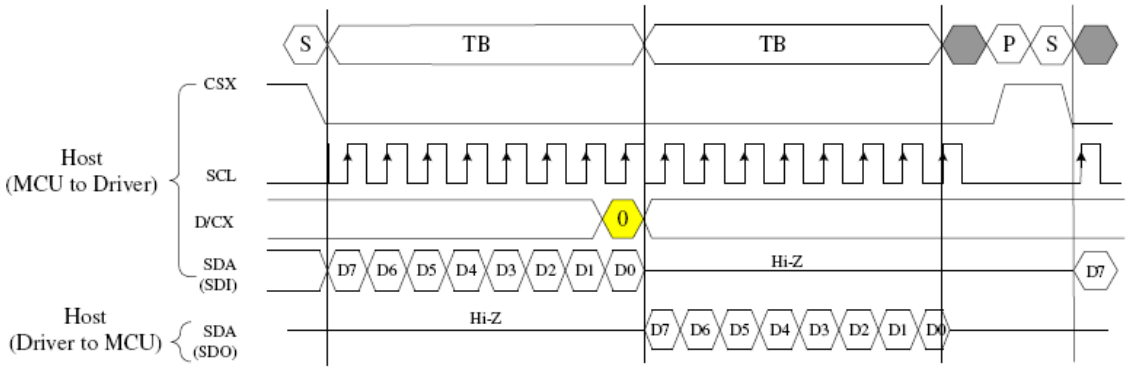


Figure6: 4-pins Serial Protocol (for RDID1/RDID2/RDID3/0AH/0BH/0CH/0DH/0EH/0FH command; 8-bits

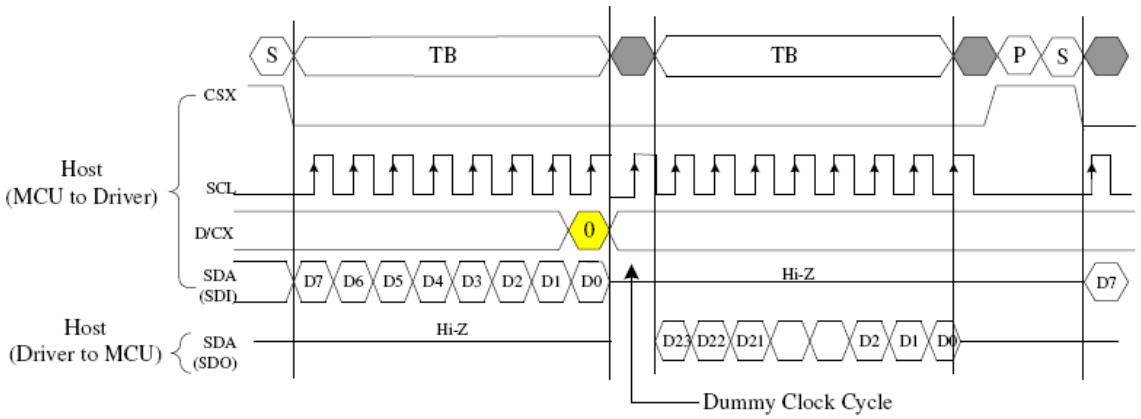


Figure7: 4-pins Serial Protocol (for RDID command: 24-bits read)

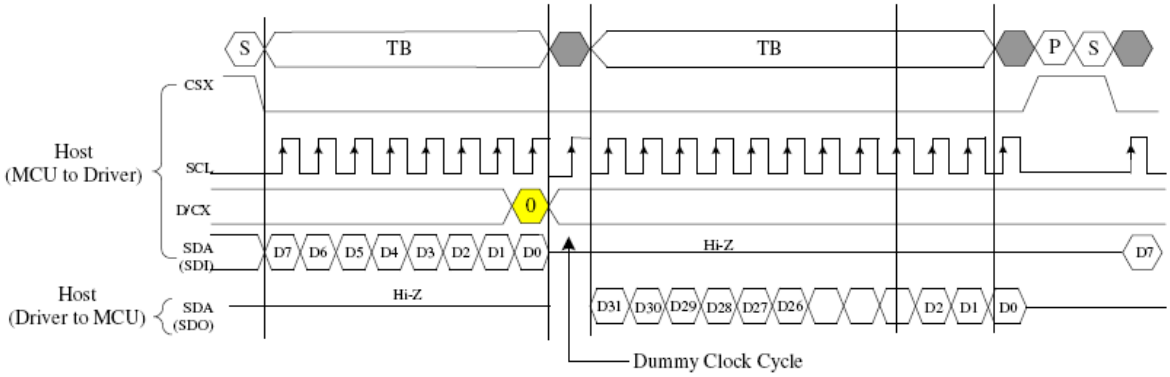


Figure8: 4-pins Serial Protocol (for RDST command: 32-bits read)

INSTRUCTION DESCRIPTION(ILITEK's ILI9163C)

Code	Command	D17-8	D7	D6	D5	D4	D3	D2	D1	D0	Hex	Ref.
00H	NOP (No Operation)	X	0	0	0	0	0	0	0	0	00h	14.2.1
01H	Software Reset	X	0	0	0	0	0	0	0	1	01h	14.2.2
04H	Read Display Identification Information	X	0	0	0	0	0	1	0	0	04h	14.2.3
	1st Parameter	X	X	X	X	X	X	X	X	X	X	
	2nd Parameter	X	ID17	ID16	ID15	ID14	ID13	ID12	ID11	ID10	54h	
	3rd Parameter	X	ID27	ID26	ID25	ID24	ID23	ID22	ID21	ID20	80h	
	4th Parameter	X	ID37	ID36	ID35	ID34	ID33	ID32	ID31	ID30	66h	
09H	Read Display Status	X	0	0	0	0	1	0	0	1	09h	14.2.4
	1st Parameter	X	X	X	X	X	X	X	X	X	X	
	2nd Parameter	X	BSTON	MY	MX	MV	ML	RGB	MH	ST24	00h	
	3rd Parameter	X	ST23	IFPF2	IFPF1	IFPF0	IDMON	PTLON	SLOUT	NORON	61h	
	4th Parameter	X	VSSON	ST14	INVON	ST12	ST11	DISON	TEON	GCS2	00h	
	5th Parameter	X	GCS1	GCS0	TELOM	HSON	VSON	PCKON	DEON	ST0	00h	
0AH	Read Display Power Mode	X	0	0	0	0	1	0	1	0	0Ah	12.4.5
	1st Parameter	X	X	X	X	X	X	X	X	X	X	
	2nd Parameter	X	BSTON	IDMON	PLTON	SLPOUT	NORON	DISON	D1	D0	08h	
0BH	Read Display MADCTL	X	0	0	0	0	1	0	1	1	0Bh	12.4.6
	1st Parameter	X	X	X	X	X	X	X	X	X	X	
	2nd Parameter	X	MY	MX	MV	ML	RGB	MH	D1	D0	00h	
0CH	Read Display Pixel Format	X	0	0	0	0	1	1	0	0	0Ch	12.4.7
	1st Parameter	X	X	X	X	X	X	X	X	X	X	
	2nd Parameter	X	VIPF3	VIPF2	VIPF1	VIPF0	D3	IFPF2	IFPF1	IFPF0	06h	
0DH	Read Display Image Mode	X	0	0	0	0	1	1	0	1	0Dh	12.4.8
	1st Parameter	X	X	X	X	X	X	X	X	X	X	
	2nd Parameter	X	VSSON	D6	INVON	D4	D3	GCS2	GCS1	GCS0	00h	
0EH	Read Display Signal Mode	x	0	0	0	0	1	1	1	0	0Eh	14.2.9
	1st Parameter	x	x	x	x	x	x	x	x	x	x	
	2nd Parameter	x	D7	D6	HSON	VSON	PCKON	DEON	D1	D0	00h	
0FH	Read Display Signal Mode	x	0	0	0	0	1	1	1	1	0Fh	14.2.10
	1st Parameter	x	X	x	x	x	x	x	x	x	x	
	2nd Parameter	x	RELD	FUND	D5	D4	D3	D2	D1	D0	00h	

10H	Sleep In	x	0	0	0	1	0	0	0	0	10h	14.2.11
11H	Sleep Out	x	0	0	0	1	0	0	0	1	11h	14.2.12
12H	Partial Mode On	x	0	0	0	1	0	0	1	0	12h	14.2.13
13H	Normal Display Mode On	x	0	0	0	1	0	0	1	1	13h	14.2.14
20H	Display Inversion Off	x	0	0	1	0	0	0	0	0	20h	14.2.15
21H	Display Inversion On	x	0	0	1	0	0	0	0	1	21h	14.2.16
26H	Gamma Set	x	0	0	1	0	0	1	1	0	26h	14.2.17
	1st Parameter	x	GC7	GC6	GC5	GC4	GC3	GC2	GC1	GC0	01h	
28H	Display Off	x	0	0	1	0	1	0	0	0	28h	14.2.18
29H	Display On	x	0	0	1	0	1	0	0	1	29h	14.2.19
2AH	Column Address Set	x	0	0	1	0	1	0	1	0	2Ah	14.2.20
	1st Parameter	x	XS15	XS14	XS13	XS12	XS11	XS10	XS9	XS8	-	
	2nd Parameter	x	XS7	XS6	XS5	XS4	XS3	XS2	XS1	XS0	-	
	3rd Parameter	x	XE15	XE14	XE13	XE12	XE11	XE10	XE9	XE8	-	
	4th Parameter	x	XE7	XE6	XE5	XE4	XE3	XE2	XE1	XE0	-	
2BH	Page Address Set	x	0	0	1	0	1	0	1	1	2Bh	14.2.21
	1st Parameter	x	YS15	YS14	YS13	YS12	YS11	YS10	YS9	YS8	-	
	2nd Parameter	x	YS7	YS6	YS5	YS4	YS3	YS2	YS1	YS0	-	
	3rd Parameter	x	YE15	YE14	YE13	YE12	YE11	YE10	YE9	YE8	-	
	4th Parameter	x	YE7	YE6	YE5	YE4	YE3	YE2	YE1	YE0	-	
2CH	Memory Write	x	0	0	1	0	1	1	0	0	2Ch	14.2.22
	1st Parameter	D17-8	D7	D6	D5	D4	D3	D2	D1	D0	-	
	:	x	:	:	:	:	:	:	:	:	:	
	Nth Parameter	D17-8	D7	D6	D5	D4	D3	D2	D1	D0	-	
2DH	Color Setting for 4K, 65K and 262K	x	0	0	1	0	1	1	0	1	2Dh	14.2.23
	1st Parameter	x	x	x	R005	R004	R003	R002	R001	R000	-	
	:	x	x	x	Rnn5	Rnn4	Rnn3	Rnn2	Rnn1	Rnn0	-	
	32nd parameter	x	x	x	R315	R314	R313	R312	R311	R310	-	
	33rd Parameter	x	x	x	G005	G004	G003	G002	G001	G000	-	
	:	x	x	x	Gnn5	Gnn4	Gnn3	Gnn2	Gnn1	Gnn0	-	
	96th Parameter	x	x	x	G635	G634	G633	G632	G631	G630	-	
	97th Parameter	x	x	x	B005	B004	B003	B002	B001	B000		
	:	x	x	x	Bnn5	Bnn4	Bnn3	Bnn2	Bnn1	Bnn0	-	
	128th Parameter	x	x	x	B315	B314	B313	B312	B311	B310	-	

2EH	Memory Read	x	0	0	1	0	1	1	1	0	2Eh	14.2.24
	1st Parameter	x	x	x	x	x	x	x	x	x	-	
	2nd Parameter	x	D17	D16	D15	D14	D13	D12	D11	D10	-	
	:	x	:	:	:	:	:	:	:	:	-	
	Nth Parameter	x	Dn7	Dn6	Dn5	Dn4	Dn3	Dn2	Dn1	Dn0	-	
30H	Partial Area	x	0	0	1	1	0	0	0	0	30h	14.2.25
	1st Parameter	x	PSL15	PSL14	PSL13	PSL12	PSL11	PSL10	PSL9	PSL8	-	
	2nd Parameter	x	PSL7	PSL6	PSL5	PSL4	PSL3	PSL2	PSL1	PSL0	-	
	3rd Parameter	x	PEL15	PEL14	PEL13	PEL12	PEL11	PEL10	PEL9	PEL8	-	
	4th Parameter	x	PEL7	PEL6	PEL5	PEL4	PEL3	PEL2	PEL1	PEL0	-	
33H	Vertical Scrolling Definition	x	0	0	1	1	0	0	1	1	33h	14.2.26
	1st Parameter	x	TFA15	TFA14	TFA13	TFA12	TFA11	TFA10	TFA9	TFA8	-	
	2nd Parameter	x	TFA7	TFA6	TFA5	TFA4	TFA3	TFA2	TFA1	TFA0	-	
	3rd Parameter	x	VSA15	VSA14	VSA13	VSA12	VSA11	VSA10	VSA9	VSA8	-	
	4th Parameter	x	VSA7	VSA6	VSA5	VSA4	VSA3	VSA2	VSA1	VSA0	-	
	5th Parameter	x	BFA15	BFA14	BFA13	BFA12	BFA11	BFA10	BFA9	BFA8	-	
	6th Parameter	x	BFA7	BFA6	BFA5	BFA4	BFA3	BFA2	BFA1	BFA0	-	
34H	Tearing Effect Line Off	x	0	0	1	1	0	1	0	0	34h	14.2.27
35H	Tearing Effect Line On	x	0	0	1	1	0	1	0	1	35h	14.2.28
	1st Parameter	x	x	x	x	x	x	x	x	M	00h	
36H	Memory Access Control	x	0	0	1	1	0	1	1	0	36h	14.2.29
	1st Parameter	x	MY	MX	MV	ML	RGB	MH	x	x	00h	
37H	Vertical Scrolling Start Address	x	0	0	1	1	0	1	1	1	37h	14.2.30
	1st Parameter	x	SSA 15	SSA 14	SSA 13	SSA 12	SSA 11	SSA 10	SSA 9	SSA 8	00h	
	2nd Parameter	x	SSA 7	SSA 6	SSA 5	SSA 4	SSA 3	SSA 2	SSA 1	SSA 0	00h	
38H	Idle Mode Off	x	0	0	1	1	1	0	0	0	38h	14.2.31
39H	Idle Mode On	x	0	0	1	1	1	0	0	1	39h	14.2.32
3AH	Interface Pixel Format	x	0	0	1	1	1	0	1	0	3Ah	14.2.33
	1st Parameter	x	VIPF3	VIPF2	VIPF1	VIPF0	D3	IFPF2	IFPF1	IFPF0	66h	

B1H	Frame Rate Control (In normal mode/Full colors)		1	0	1	1	0	0	0	1	B1h	14.2.37
	1st Parameter		x	x	x	DIVA4	DIVA3	DIVA2	DIVA1	DIVA0	x	
	2nd Parameter		x	x	VPA5	VPA4	VPA3	VPA2	VPA1	VPA0	x	
B2H	Frame Rate Control(In Idle mode/8-colors)		1	0	1	1	0	0	1	0	B2h	14.2.38
	1st Parameter		x	x	x	DIVB4	DIVB3	DIVB2	DIVB1	DIVB0	x	
	2nd Parameter		x	x	VPB5	VPB4	VPB3	VPB2	VPB1	VPB0	x	
B3H	Frame Rate Control(In Partial mode/full colors)		1	0	1	1	0	0	1	1	B3h	14.2.39
	1st Parameter		x	x	x	DIVC4	DIVC3	DIVC2	DIVC1	DIVC0	x	
	2nd Parameter		x	x	VPC5	VPC4	VPC3	VPC2	VPC1	VPC0	x	
B4H	Display Inversion Control	x	1	0	1	1	0	1	0	0	B4h	14.2.40
	1st Parameter	x	0	0	0	0	0	NLA	NLB	NLC	02H	
B5H	RGB Interface Blanking Porch setting	x	1	0	1	1	0	1	0	1	B5h	14.2.41
	1st Parameter	x	x	x	HBP5	HBP4	HBP3	HBP2	HBP1	HBP0	08h	
	2nd Parameter	x	VBP7	VBP6	VBP5	VBP4	VBP3	VBP2	VBP1	VBP0	03h	
	3rd Parameter	x	x	x	x	x	x	x	VBP9	VBP8	00h	
B6H	Display Function Set	x	1	0	1	1	0	1	1	0	B6h	14.2.41
	1st Parameter		x	x	NO1	NO0	SDT1	SDT0	EQ1	EQ2	06h	
	2nd Parameter		x	x	x	x	x	PTG0	PT1	PT0	02h	
B7H	Source Driver Direction Control	x	1	0	1	1	0	1	1	1	B7h	14.2.42
	1st Parameter	x	0	0	0	0	0	0	0	CRL	00h	
B8H	Gate Driver Direction Control	x	1	0	1	1	1	0	0	0	B8h	14.2.43
	1st Parameter	x	0	0	0	0	0	0	0	CTB	00h	
C0H	Power_Control1	x	1	1	0	0	0	0	0	0	C0h	14.2.44
	1st Parameter	x	0	0	0	VRH4	VRH3	VRH2	VRH1	VRH0	x	
	2nd Parameter	x	0	0	0	0	0	VC2	VC1	VC0	02h	
C1H	Power_Control2	x	1	1	0	0	0	0	0	1	C1h	14.2.45
	1st Parameter	x	0	0	0	0	0	BT2	BT1	BT0	07h	

C2H	Power_Control3	x	1	1	0	0	0	0	1	0	C2h	14.2.46
	1st Parameter	x	0	0	0	0	0	APA2	APA1	APA0	00h	
C3H	Power_Control4	x	1	1	0	0	0	0	1	1	C3h	14.2.47
	1st Parameter	x	0	0	0	0	0	APB2	APB1	APB0	00h	
C4H	Power_Control 5	x	1	1	0	0	0	1	0	0	C4h	14.2.48
	1st Parameter	x	0	0	0	0	0	APC2	APC1	APC1	01h	
C5H	VCOM_Control 1	x	1	1	0	0	0	1	0	1	C5h	14.2.49
	1st Parameter	x	x	VMH 6	VMH 5	VMH 4	VMH 3	VMH 2	VMH 1	VMH 0	-	
	2nd Parameter	x	0	VML6	VML 5	VML 4	VML 3	VML 2	VML 1	VML 0	-	
C6H	VCOM_Control 2	x	1	1	0	0	0	1	1	0	C6h	14.2.50
	1st Parameter	x	0	0	VMA 5	VMA 4	VMA 3	VMA 2	VMA 1	VMA 0	13h /06 h	
C7H	VCOM Offset Control	x	1	1	0	0	0	1	1	1	C7h	14.2.51
	1st Parameter	0	nVM*	VMF6	VMF5	VMF4	VMF3	VMF2	VMF1	VMF0	40h	
D3H	Write ID4 Value	x	1	1	0	1	0	0	1	1	D3h	14.2.52
	1st Parameter	x	x	x	x	x	x	x	x	x	x	
	2nd Parameter	x	ID417	ID416	ID415	ID414	ID413	ID412	ID411	ID410	91h	
	3rd Parameter	x	ID427	ID426	ID425	ID424	ID423	ID422	ID421	ID420	63h	
	4th Parameter	x	x	x	x	x	ID433	ID432	ID431	ID430	00h	
	5th Parameter	x	x	x	x	x	x	x	x	x	x	
D5H	NV Memory Function Controller(1)	x	1	1	0	1	1	0	1	0	D5h	14.2.53
	1st Parameter	x	ID33	ID32	ID31	ID30	ID23	ID22	ID21	ID20	00h	
	2nd Parameter	x	OTP_ BS	0	0	0	OTP_ VMF3	OTP_ VMF2	OTP_ VMF1	OTP_ VMF0	00h	
D6H	NV Memory Function Controller(2)	x	1	1	0	1	1	0	1	0	D6h	14.2.54
	1st Parameter	x	OTP_ D[7]	OTP_D [6]	OTP_ D[5]	OTP_ D[4]	OTP_ D[3]	OTP_ D[2]	OTP_ D[1]	OTP_D [0]	00h	
	2nd Parameter	x	0	0	0	0	0	0	OTP_ TP[1]	OTP_ TP[0]	00h	
D7H	NV Memory Function Controller(3)	x	1	1	0	1	1	0	1	0	D7h	14.2.55
	1st Parameter	x	0	1	0	1	0	1	0	1	55h	
	2nd Parameter	x	1	0	1	0	1	0	1	0	AAh	

	3rd Parameter	x	0	1	1	0	0	1	1	0	66h	
DAH	**Read ID1**	x	1	1	0	1	1	0	1	0	DAh	14.2.34
	1st Parameter	x	x	x	x	x	x	x	x	x	x	
	2nd Parameter	x	ID17	ID16	ID15	ID14	ID13	ID12	ID11	ID10	54h	
DBH	**Read ID2**	x	1	1	0	1	1	0	1	1	DBh	14.2.35
	1st Parameter	x	x	x	x	x	x	x	x	x	x	
	2nd Parameter	x	1	ID26	ID25	ID24	ID23	ID22	ID21	ID20	80h	
DCH	**Read ID3**	x	1	1	0	1	1	1	0	0	DCh	14.2.36
	1st Parameter	x	x	x	x	x	x	x	x	x	x	
	2nd Parameter	x	ID37	ID36	ID35	ID34	ID33	ID32	ID31	ID30	66h	
E0H	**Positive Gamma Correction Setting**		1	1	1	0	0	0	0	0	E0h	14.2.57
	1st Parameter		x	x	VP0[5:0]						-	
	2nd Parameter		x	x	VP1[5:0]						-	
	3rd Parameter		x	x	VP2[5:0]						-	
	4th Parameter		x	x	VP4[5:0]						-	
	5th Parameter		x	x	VP6[5:0]						-	
	6th Parameter		x	x	x	VP13[4:0]					-	
	7th Parameter		x	VP20[6:0]							-	
	8th Parameter		VP36[3:0]				VP27[3:0]				-	
	9th Parameter		x	VP43[6:0]							-	
	10th Parameter		x	x	VP50[5:0]						-	
	11st Parameter		x	x	VP57[5:0]						-	
	12nd arameter		x	x	VP59[5:0]						-	
	13rd Parameter		x	x	VP61[5:0]						-	
	14th Parameter		x	x	VP62[5:0]						-	
	15th Parameter		x	x	VP63[5:0]						-	
E1H	**Negative Gamma Correction Setting**		1	1	1	0	0	0	0	1	E1h	14.2.58
	1st Parameter		x	x	VN63[5:0]						-	
	2nd Parameter		x	x	VN62[5:0]						-	
	3rd Parameter		x	x	VN61[5:0]						-	
	4th Parameter		x	x	VN59[5:0]						-	
	5th Parameter		x	x	VN57[5:0]						-	
	6th Parameter		x	x	x	VN50[4:0]					-	

	7th Parameter		x	VN43[6:0]						-	
	8th Parameter		VN27[3:0]			VN36[3:0]				-	
	9th Parameter		x	VN20[6:0]						-	
	10th Parameter		x	x	VN13[5:0]					-	
	11st Parameter		x	x	VN6[5:0]					-	
	12nd arameter		x	x	VN4[5:0]					-	
	13rd Parameter		x	x	VN2[5:0]					-	
	14th Parameter		x	x	VN1[5:0]					-	
	15th Parameter		x	x	VN0[5:0]					-	
E6H	**Deep stand by control**		1	1	1	0	0	1	1	0	E6h	
	1st Parameter		x	x	x	x	x	x	x	DSTB	00h	
F2H	**GAM_R_SEL**		1	1	1	1	0	0	1	0	F2h	14.2.59
	1st Parameter		x	x	x	x	x	x	x	GAM_R_SEL	Write	

6. Optical Characteristics（VDD=2.8V,Vss=0V ,Ta=25℃）

Item	Symbol		Condition	Min.	Typ.	Max.	Unit	Note
Brightness	Bp		θ=0° Φ=0°	-	200	-	Cd/m^2	1
Uniformity	△Bp			-	80%	-		1,2
Viewing Angle	θ1 (Φ=90° or270°)		Cr≥10	-50～+30			Deg	3
	θ2 (Φ=0° or 180°)			-50～+50				
Contrast Ratio	Cr		θ=0° Φ=0°		350		-	4
Response Time	TON			-	30	-	Ms	5
	TOFF						Ms	
Color of CIE Coordinate	W	x	θ=0° Φ=0°	-	-	-	-	1,6
		y		-	-	-	-	
	R	x		-	-	-	-	
		y		-	-	-	-	
	G	x		-	-	-	-	
		y		-	-	-	-	
	B	x		-	-	-	-	
		y		-	-	-	-	
NTSC Ratio	S			-	45%			

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

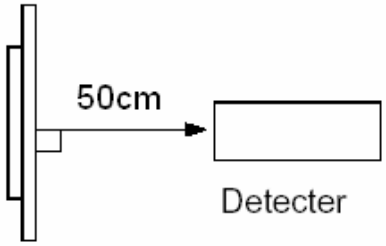
PR-705 (Φ8mm)

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 while

backlight turning on.

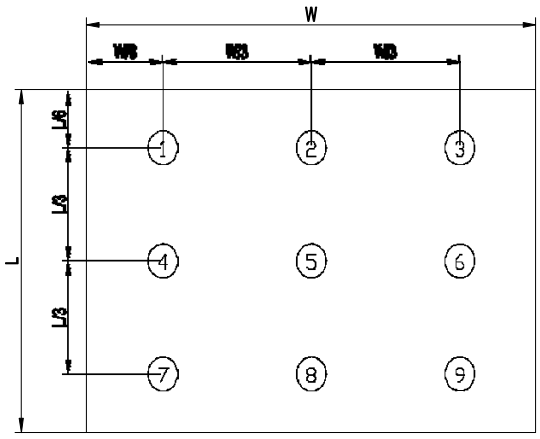


Note 2: The luminance uniformity is calculated by using following formula.

△Bp = Bp (Min.) / Bp (Max.)×100 (%)

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

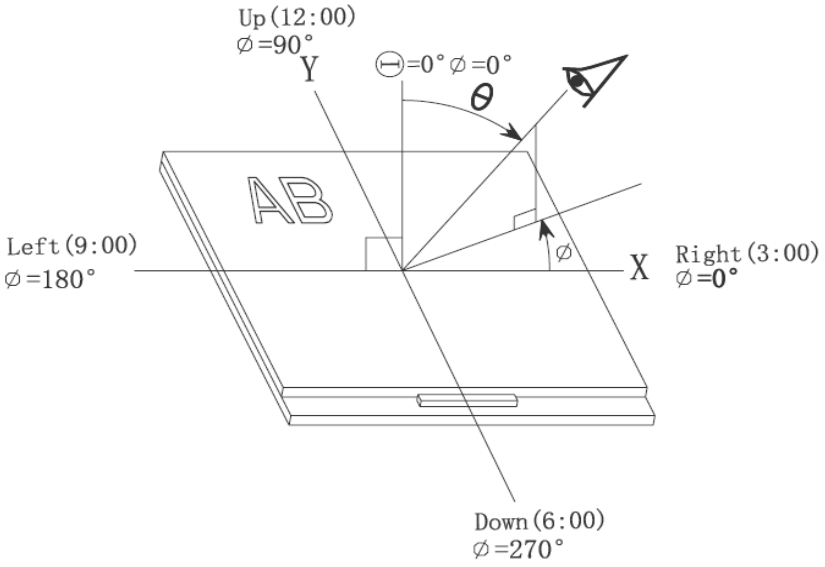
Bp (Min.) = Minimum brightness in 9 measured spots.



Measurement equipment PR-705 (Φ8mm)

Note 3: The definition of viewing angle:

Refer to the graph below marked by θ and Φ



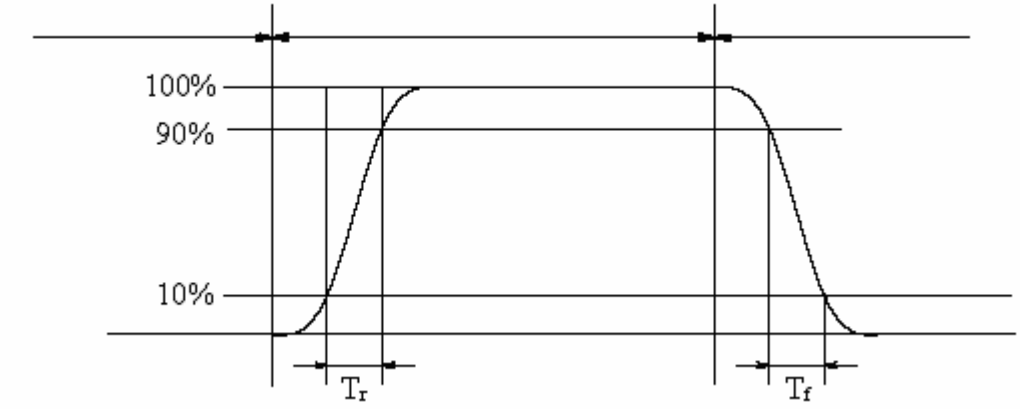
Note 4: The definition of contrast ratio (Test LCM using PR-705):

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

(Contrast Ratio is measured in optimum common electrode voltage)

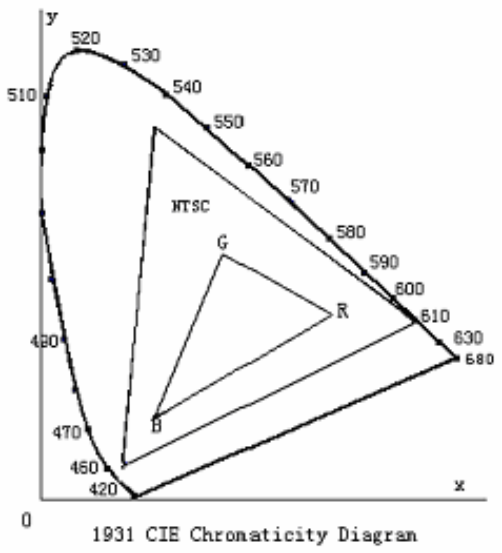
Note 5: Definition of Response time. (Test LCD using DMS501):

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:

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

7. Reliability Test Items and Criteria

No	Test Item	Test condition	Criterion
1	High Temperature Storage	80℃±2℃ 96H Restore 2H at 25℃ Power off	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	-30℃±2℃ 96H Restore 2H at 25℃ Power off	
3	High Temperature Operation	70℃±2℃ 96H Restore 2H at 25℃ Power on	
4	Low Temperature Operation	-20℃±2℃ 96H Restore 4H at 25℃ Power on	
5	High Temperature & Humidity Operation	60℃±2℃ 90%RH 96H Power on	
6	Temperature Cycle	−30℃ → 25℃ → 80℃ 30min 5 min 30min after 10cycle, Restore 2H at 25℃ Power off	
7	Vibration Test	10Hz~150Hz, 100m/s^2, 120min	
8	Shock Test	Half-sine wave,300m/s	
9	Drop Test(package state)	800mm, concrete floor,1corner, 3edges, 6 sides each time	
10	ESD Sensitivity test	Contact ±4KV，150PF/330，20times Air ±8KV,150PF/330，20times	

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

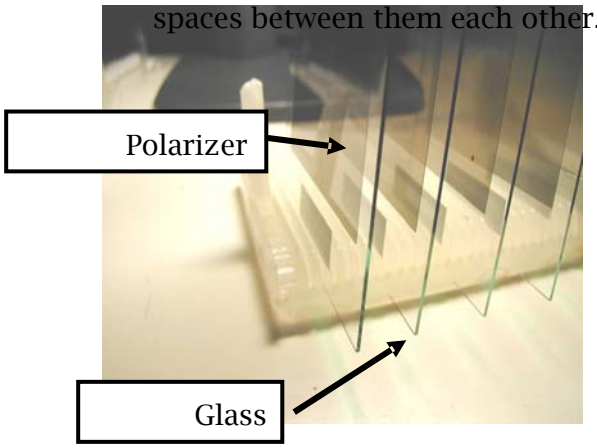
second) while blowing with ionizer toward the peeling face to minimize ESD which may damage electrical circuit.

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.

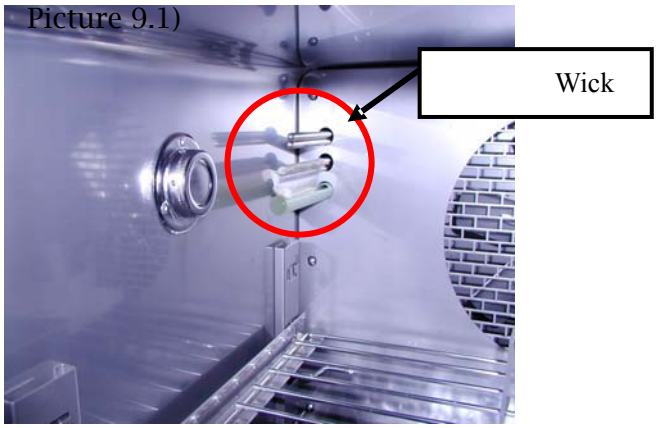
6. Polarizer test criteria

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

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,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.

8.2 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): mm X2(A.A~V.A): mm

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

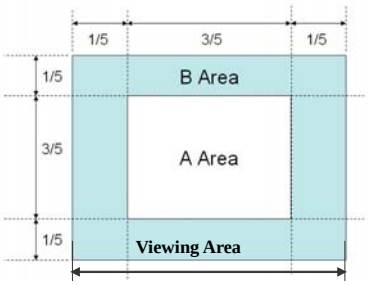


Figure 1

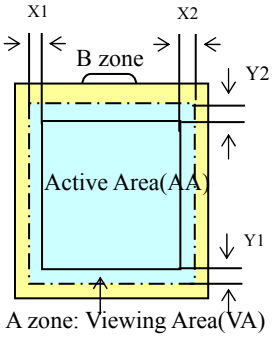


Figure 2

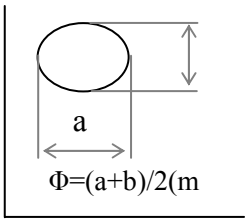
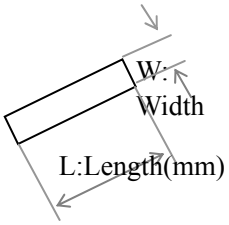
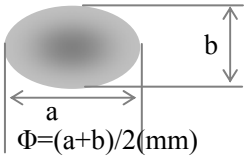
8.3 Inspection items and general notes

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

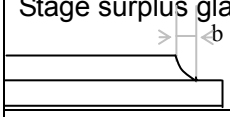
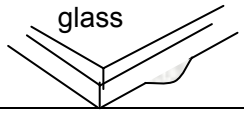
8.4 Outgoing Inspection level

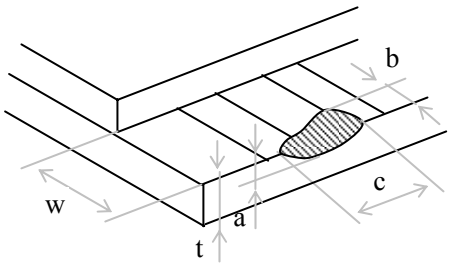
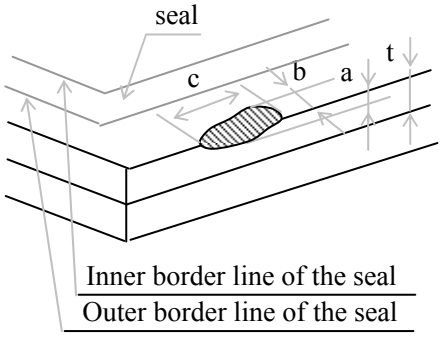
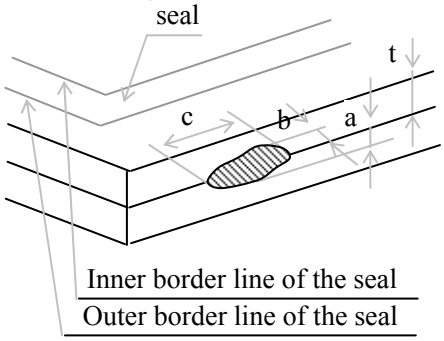
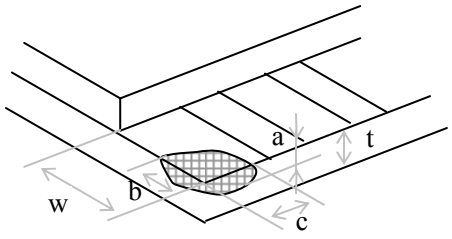
Outgoing Inspection standard	Inspection conditions	Inspection				
		Min.	Max.	Unit	IL	AQL
Major Defects	See 8.3 general notes	See 8.5			II	0.65
Minor Defects	See 8.3 general notes	See 8.5			II	1.5
Note：Sampling standard conforms to GB2828						

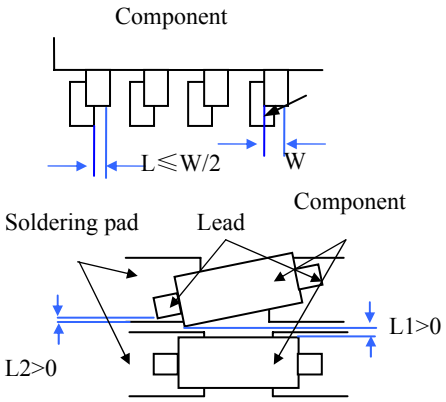
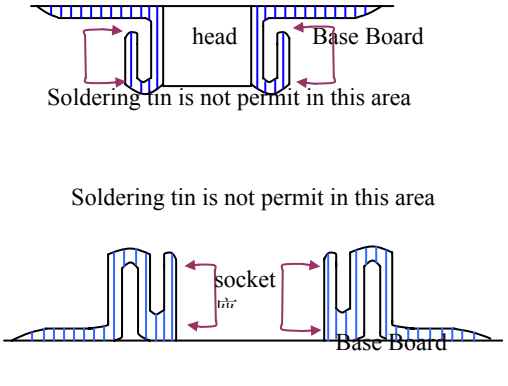
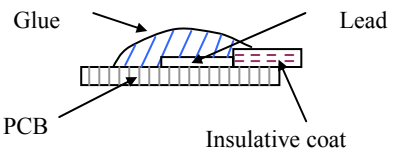
8.5 Inspection Items and Criteria

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	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	LCD Class	Defect	A area	B area	C area
			B	Bright dot	2	2	Neglecte

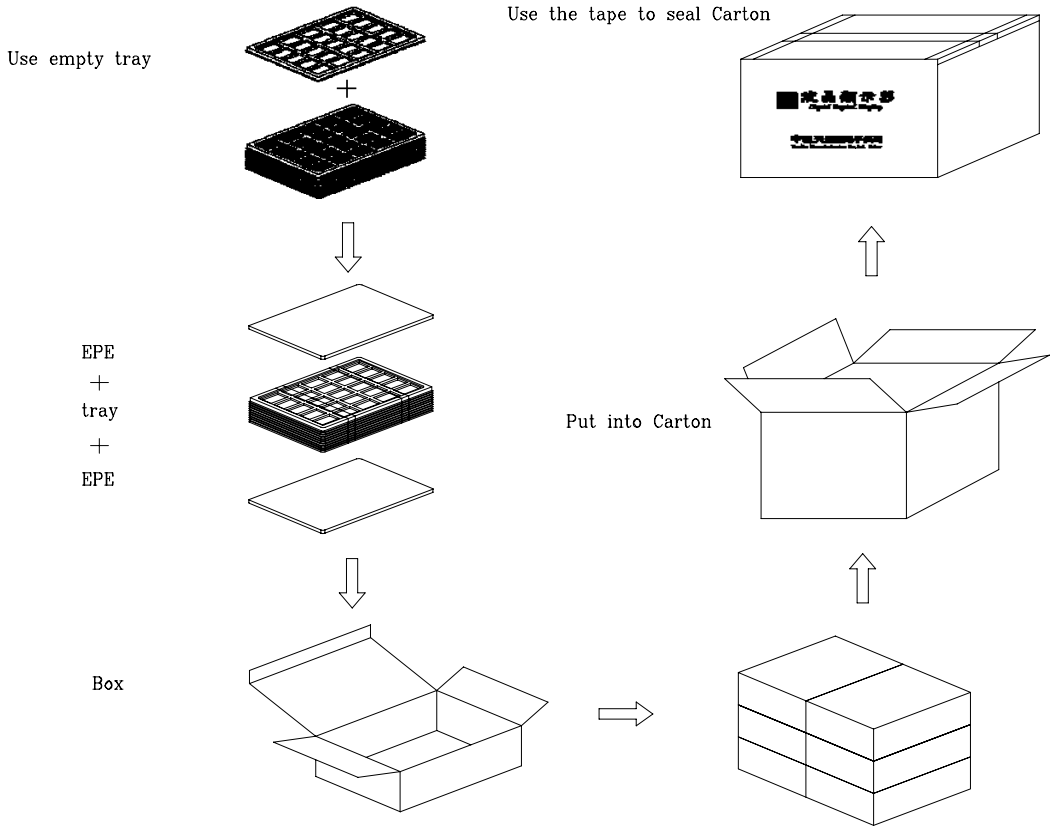
<table>
<tr><td rowspan="2"></td><td rowspan="2"></td><td>3~10.4 inches</td><td></td><td>Dark dot</td><td>2</td><td>3</td><td>d</td></tr>
<tr><td colspan="3">Total</td><td colspan="2">6</td></tr>
<tr><td colspan="8">Notes:
Bright dot: in R、G、B or dark display figure, the pixel appears bright.
Dark dot: 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="3">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="5">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="5">b≦0.3mm</td></tr>
<tr><td>Surrounding surplus glass  </td><td colspan="5">Should not influence outline dimension and assembling.</td></tr>
<tr><td>8</td><td colspan="2">Open segment or open common</td><td colspan="5">Not permitted</td></tr>
<tr><td>9</td><td colspan="2">Short circuit</td><td colspan="5">Not permitted</td></tr>
<tr><td>10</td><td colspan="2">False viewing direction</td><td colspan="5">Not permitted</td></tr>
<tr><td>11</td><td colspan="2">Contrast ratio uneven</td><td colspan="5">According to the limit specimen</td></tr>
<tr><td>12</td><td colspan="2">Crosstalk</td><td colspan="5">According to the limit specimen</td></tr>
<tr><td>13</td><td colspan="2">Black /White spot(display)</td><td colspan="5">Refer to item 1</td></tr>
<tr><td>14</td><td colspan="2">Black /White line(display)</td><td colspan="5">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.	

9. Package Method

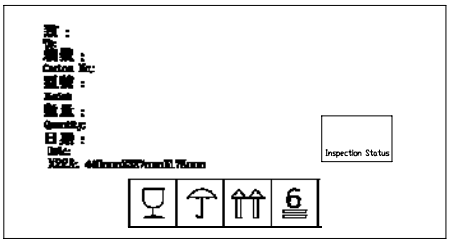
模块出货包装示意图：



其中卡通箱的正面背面及侧面印刷如下：

卡通箱正面和背面的印刷如下：

卡通箱两个侧面的印刷如下：



注：卡通箱堆叠高度需小于 1.5m