



**SPECIFICATION
FOR
LCD Module
KD024FM-1 V3**

MODULE:	KD024FM-1 V3
CUSTOMER:	

REV	DESCRIPTION	DATE
1.0	FIRST ISSUE	2012.05.20

STARTEK	INITIAL	DATE
PREPARED BY		
CHECKED BY		
APPROVED BY		

CUSTOMER	INITIAL	DATE
APPROVED BY		



Revision History

[illegible]

Part. No	KD024FM-1 V3	REV	V1.0	Page 2 of 32
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General Description

* Description

This is a color active matrix TFT (Thin Film Transistor) LCD (liquid crystal display) that uses amorphous silicon TFT as a switching device. This model is composed of a Transmissive type TFT-LCD Panel, driver circuit, back-light unit. The resolution of a 2.4'TFT-LCD contains 240x320 pixels, and can display up to 262K colors.

* Features

- Low Input Voltage: 3.3V(TYP)
- Display Colors of TFT LCD: 65K/262Kcolors
- Interface: 8/9/16/18Bit MCU;3/4SPI+16/18Bit RGB

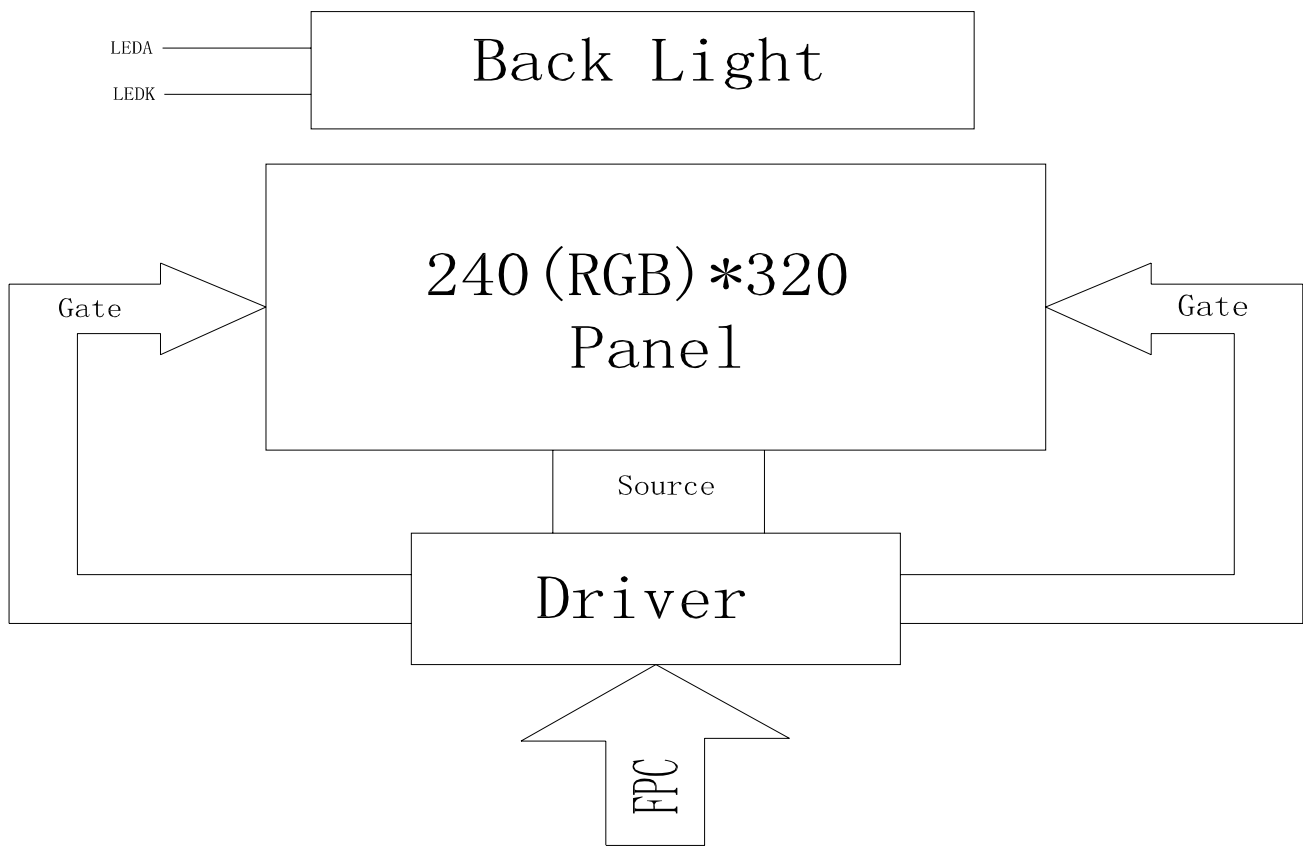
General Information Items	Specification	Unit	Note
	Main Panel		
Display area(AA)	36.72(H)*48.96(V) (2.4inch)	mm	-
Driver element	TFT active matrix	-	-
Display colors	65/262K	colors	-
Number of pixels	240(RGB)*320	dots	-
Pixel arrangement	RGB vertical stripe	-	-
Pixel pitch	0.153(H)*0.153(V)	mm	-
Viewing angle	ALL	o'clock	-
Controller IC	ILI9341V	-	-
Display mode	Transmissive/ Normally Black	-	-
Operating temperature	-20~+70	°C	-
Storage temperature	-30~+80	°C	-

* Mechanical Information

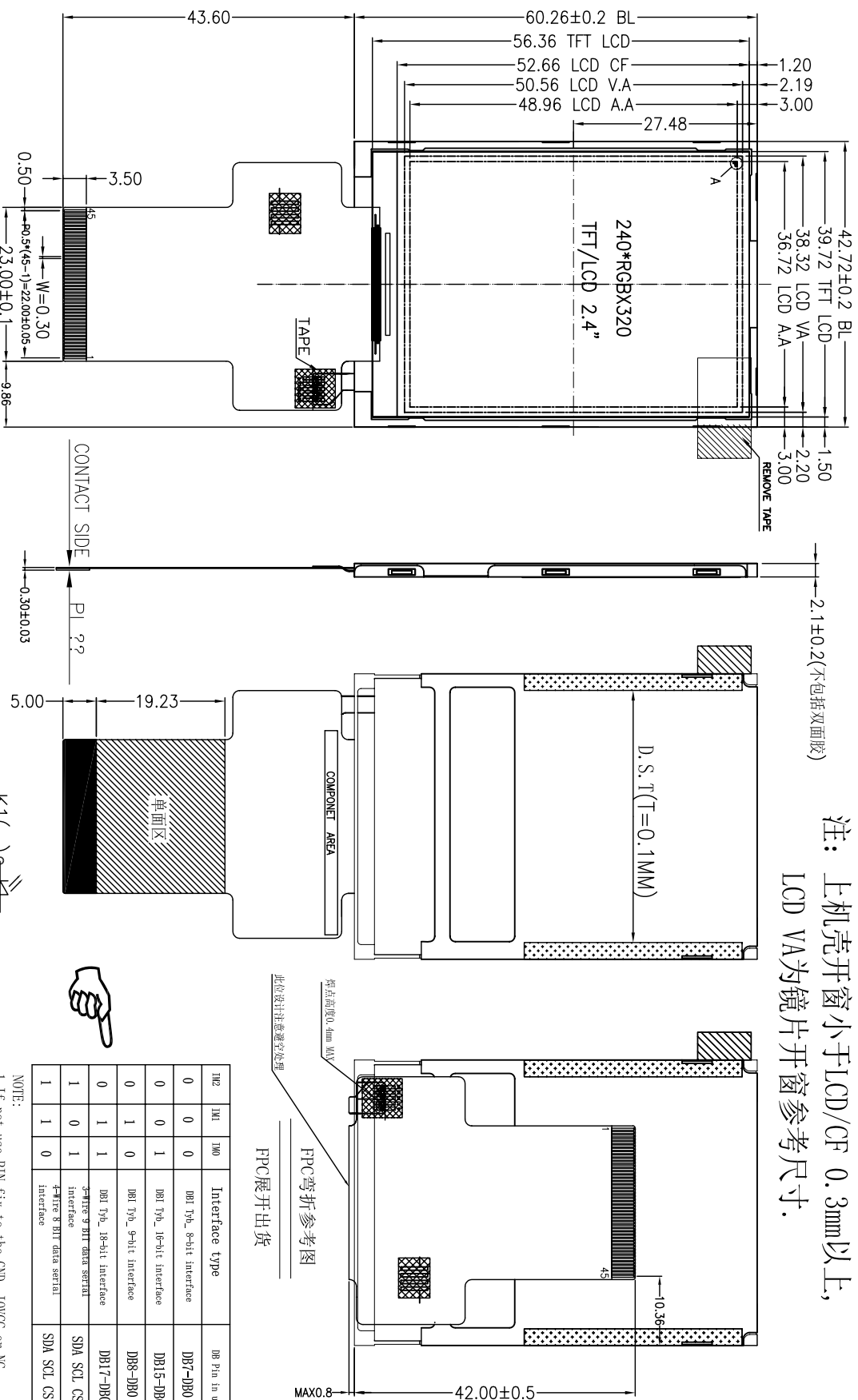
Item		Min.	Typ.	Max.	Unit	Note
Module size	Horizontal(H)		42.72		mm	-
	Vertical(V)		60.26		mm	-
	Depth(D)		2.1		mm	-
Weight			TBD		g	-



1. Block Diagram



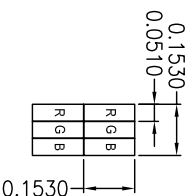
LCD VA为镜片开窗参考尺寸.



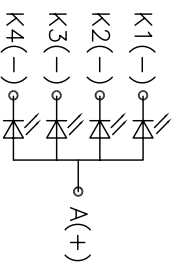
No.	Pin Name
1	GND
2	VCC
3	VCC
4	IM2
5	IM1
6	IM0
7	RESET
8	CS
9	DC(SPI-SCL)
10	WR(SPI-SS)
11	RD
12	VS/VCC
13	HEVNC
14	ENABLE
15	DOTCLK
16	SDA
17	SDB
18	DB01
19	DB02
20	DB03
21	DB04
22	DB05
23	DB06
24	DB07
25	DB08
26	DB09
27	DB10
28	DB11
29	DB12
30	DB13
31	DB14
32	DB15
33	DB16
34	DB17
35	SIO
36	LEDA
37	LEDB1
38	LEDB2
39	LEDB3
40	LEDB4
41	WRNC
42	VUVC
43	XLUNC
44	GND
45	YDNC

NOTES:

1. DISPLAY TYPE: 2.4", TFT-LCD, 262K COLORS
2. DISPLAY MODE: T/M NORMALLY BLACK
3. VIEWING DIRECTION: SUPER WIDE VIEWING ANGL
4. DRIVER IC: IL9341 (COG)
5. VCI: 3.3V
6. OPERATING TEMP: -20°C TO 70°C
STORAGE TEMP: -30°C TO 80°C
7. BACK LIGHT: LED WHITE, 4 LED, 80mA, 3.2±0.3V
8. ROHS COMPLIANT.



BLU CIRCUIT DIAGRAM



ReV	Revision content description	Date
V0	FIRST	2014/07/07

TOLERANCE(公差)	DRAWING NAME	KD024FM-1 V3-LC
	PARTS NO.	99024006A

深圳市柯达科电子科技有限公司

SHENZHEN STARTEK ELECTRONICS CO.,LTD

TOLERANCE(公差)	
00034006A	INDOZ11 M I V3 EC

QTY.	PARTS NO.	99024006A
1	99024006A	

TOLERANCE	Dose (mg)	Time (min)
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UNLESS OTHERWISE SPECIFIED	$X \pm 0.3$	Drawn	Check

OTHERWISE	Y Y Y Y Y Y	Checked	

Specified	Checked
AXXU.2	

1		Амброзия	1
2		Дюба	1

Scale	1:1	1:1	1:1

3. Input terminal Pin Assignment

NO.	SYMBOL	DISCRIPTION	I/O
1	GND	Ground.	P
2	VCI	Supply voltage(3.3V).	P
3	VCI	Supply voltage(3.3V).	P
4	IM2	MPU Parallel interface bus and serial interface select If use RGB Interface must select serial interface. Fix this pin at VCI and GND.	I
5	IM1		I
6	IM0		I
7	RESET	This signal will reset the device and must be applied to properly initialize the chip.	I
8	CS	Chip select input pin ("Low" enable). fix this pin at VCI or GND when not in use.	I
9	DC(SCL)	This pin is used to select "Data or Command" in the parallel interface. When D/CX = '1', data is selected. When D/CX = '0', command is selected. This pin is used serial interface clock in 3-wire 9-bit / 4-wire 8-bit serial data interface. fix this pin at VCI or GND when not in use.	I
10	WR(SPI-RS)	The data is applied on the rising edge of the SCL signal. If not used, fix this pin at VCI or GND when not in use.	I
11	RD	Serves as a read signal and MCU read data at the rising edge. fix this pin at VCI or GND when not in use.	I
12	VSYN	Frame synchronizing signal for RGB interface operation. fix this pin at VCI or GND when not in use.	I
13	HSYN	Line synchronizing signal for RGB interface operation. fix this pin at VCI or GND when not in use.	I
14	ENABLE	Data enable signal for RGB interface operation. fix this pin at VCI or GND when not in use.	I
15	DOTCLK	Dot clock signal for RGB interface operation.	I



		Fix this pin at VCI or GND when not in use.	
16	SDA	Serial input signal. The data is latched on the rising edge of the SCL signal. fix this pin at VCI or GND when not in use.	I
17-34	DB0-DB17	18-bit parallel bi-directional data bus for MCU system and RGB interface mode . Fix to GND level when not in use	I/O
35	SDO	SPI interface output pin. -The data is output on the falling edge of the SCL signal. -If not used, let this pin open.	O
36	LEDA	Anode pin of backlight	P
37	LEDK1	Cathode pin OF backlight	P
38	LEDK2	Cathode pin OF backlight	P
39	LEDK3	Cathode pin OF backlight	P
40	LEDK4	Cathode pin OF backlight	P
41	XR	Touch panel Right Glass Terminal	A/D
42	YD	Touch panel Bottom Film Terminal	A/D
43	XL	Touch panel LIFT Glass Terminal	A/D
44	YU	Touch panel Top Film Terminal	A/D
45	GND	Ground.	P

4. LCD Optical Characteristics

4.1 Optical specification

Optical characteristics are determined after the unit has been 'ON' and stable for approximately 30 minutes in a dark environment at 25 °C. The values specified are at an approximate distance 50 cm from the TFT-LCD surface at a viewing angle of Φ and θ equal to 0 °.

Measurement condition: Refer to next pages (LED back light with 20 mA/1 ea)

*1): with LPL Polarizer

*2): Only Color Filter glass

Parameter	Symbol	Values			Unit	Notes
		Min	Typ	Max		
*1) Threshold Voltage	Vsat	3.7	3.8	3.9	V	Fig.2
	Vth	1.9	2.0	2.1	V	
*1) Transmittance	T(%)	3.86	4.40	-	%	Fig.1
*1) Contrast Ratio	C/R	400	500	-		
*1) Response Time	Tr+Tf	-	35	50	msec	Fig.3
*2) CIE Color Coordinate	Rx	0.640	0.660	0.680		
	Ry	0.297	0.317	0.337		
	Gx	0.240	0.260	0.280		
	Gy	0.555	0.575	0.595		
	Bx	0.121	0.141	0.161		
	By	0.055	0.075	0.095		
	Wx	0.275	0.295	0.315		
	Wy	0.297	0.317	0.337		
*1) Viewing Angle	θ_l	-	80	-	Degree	C/R>10 Fig.4
	θ_r	-	80	-		
	θ_u	-	80	-		
	θ_d	-	80	-		

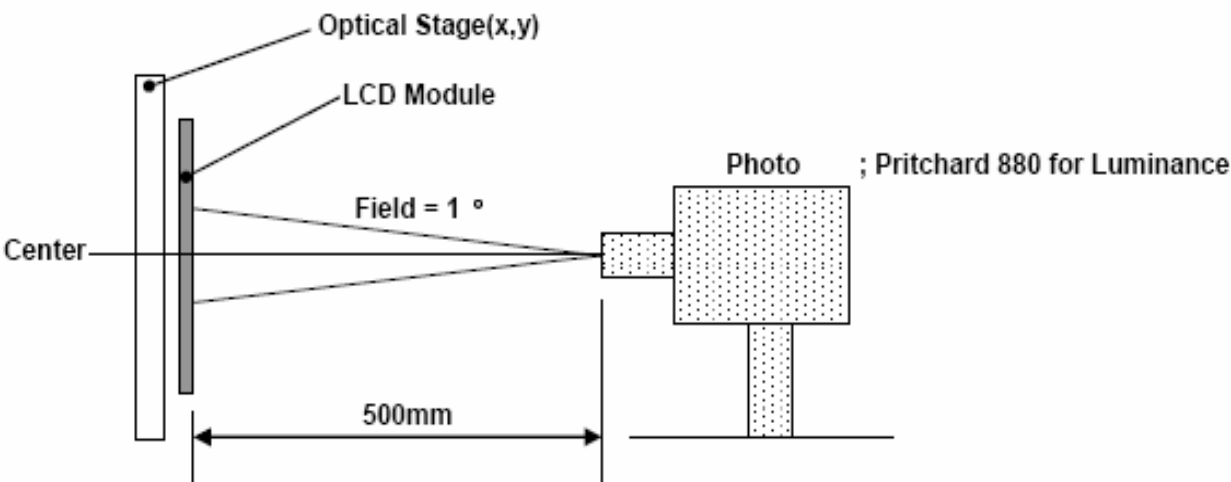
- Notes :
1. Contrast Ratio(CR) is defined mathematically as :

$$\text{Contrast Ratio} = \frac{\text{Surface Luminance with all white pixels}}{\text{Surface Luminance with all black pixels}}$$
 2. Surface luminance is the center point across the TFT-LCD surface 240 mm from the surface with all pixels displaying white. For more information see FIG 1.
 3. Response time is the time required for the display to transition from black to white(Rise Time, Tr) and from white to black(Falling Time, Tf). For additional information see FIG 3.
 4. Viewing angle is the angle at which the contrast ratio is greater than 10. The angles are determined for the horizontal or x axis and the vertical or y axis with respect to the z axis which is normal to the TFT-LCD surface. For more information see FIG 4.
 5. Optimum contrast is obtained by adjusting the TFT-LCD Threshold voltage(Vth & Vsat)

FIG. 1 Optical Characteristic Measurement Equipment and Method

Pritchard 880 System

[Test Equipment Set Up]



- Measuring Condition ;
 - Measuring surroundings : Dark Room
 - Measuring temperature : $T_a=25^{\circ}\text{C}$
 - Adjust operating voltage to get optimum contrast at the center of the display.
 - Measured value at the center point of LCD panel after more than 30 minutes while backlight turning on.



FIG. 2 The definition of V_{th} and V_{sat}

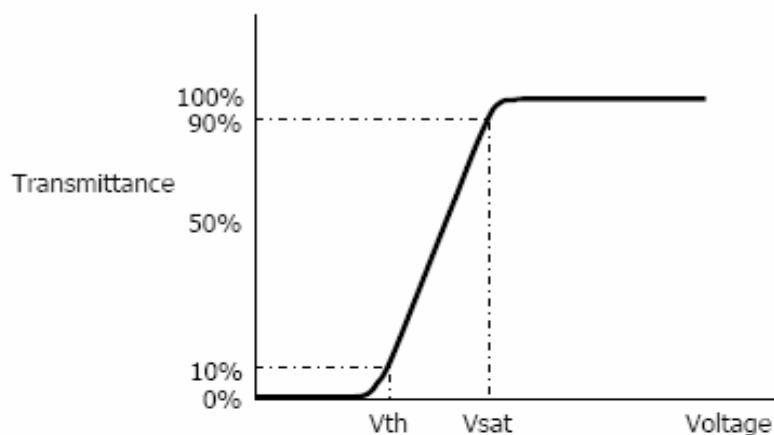
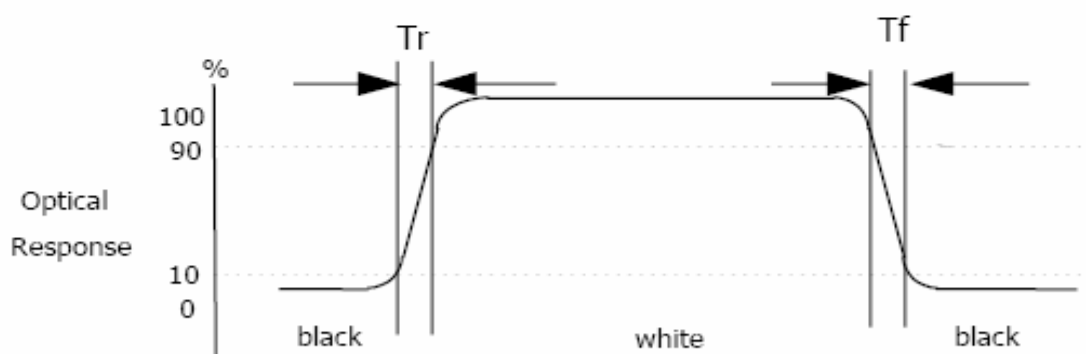


FIG. 3 The definition of Response Time

The response time is defined as the following figure and shall be measured by switching the input signal for "black" and "white".



* Voltage conditions for Response time
 V_{gate} : 20V DC
 V_{data} : 0V~5V DC
 V_{com} : 0V (Ground)

FIG. 4 The definition of viewing angle

<dimension of viewing angle range>

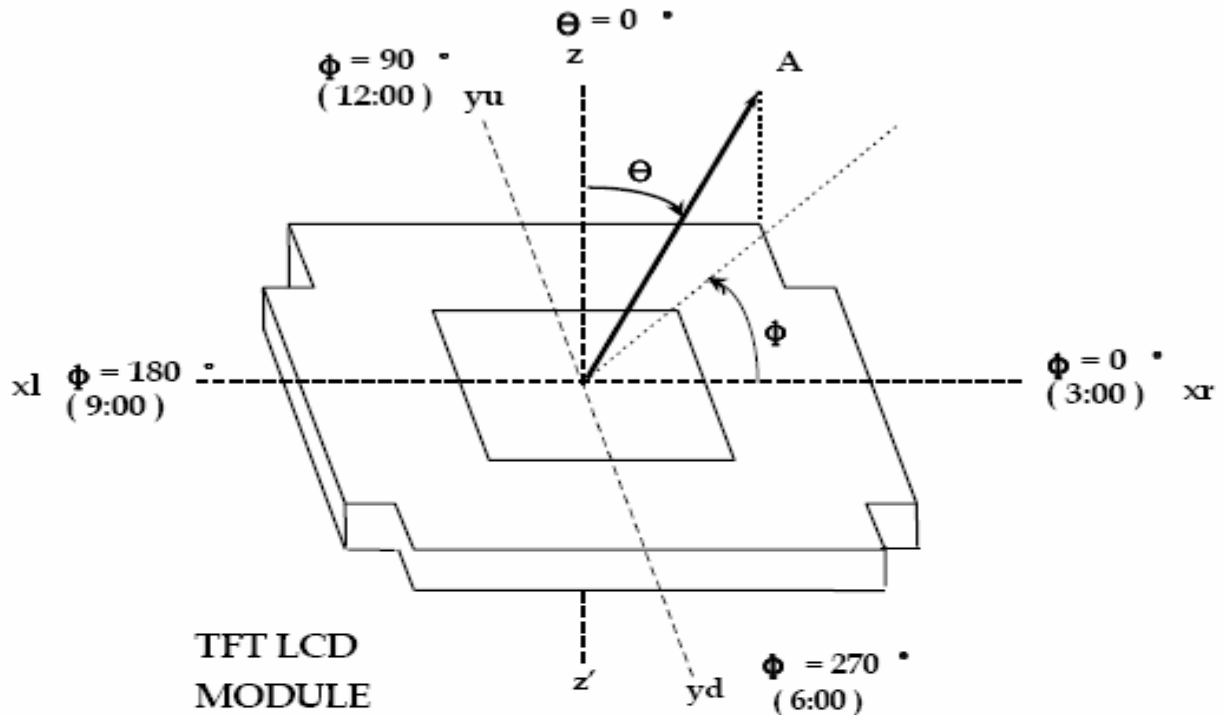
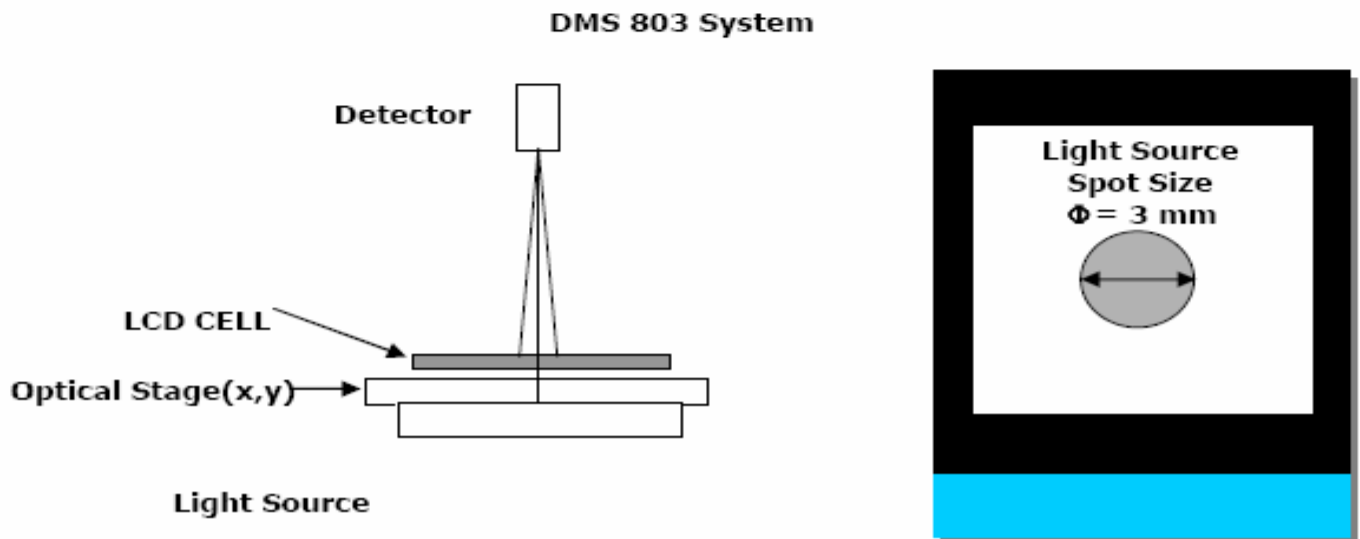


FIG. 5 Response Time Measurement Equipment and Method





5. Electrical Characteristics

5.1 Absolute Maximum Rating (Ta=25 VSS=0V)

Characteristics	Symbol	Min.	Max.	Unit
Digital Supply Voltage	VDD	-0.3	4.6	V
Digital interface supply Voltage	VDDIO	-0.3	4.6	V
Operating temperature	T _{OP}	-20	+70	°C
Storage temperature	T _{ST}	-30	+80	°C

5.2 DC Electrical Characteristics

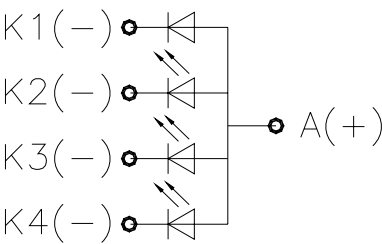
Characteristics	Symbol	Min.	Typ.	Max.	Unit	Note
Digital Supply Voltage	VDD	2.4	3.3	4.2	V	
Digital interface supply Voltage	VDDIO	1.65	3.3	4.2	V	
Normal mode Current consumption	IDD	--	10	--	mA	
Level input voltage	V _{IH}	0.7V _{DDIO}		VDDIO	V	
	V _{IL}	GND		0.3V _{DDIO}	V	
Level output voltage	V _{OH}	0.8VDDIO		VDDIO	V	
	V _{OL}	GND		0.2VDDIO	V	



5.3 LED Backlight Characteristics

The back-light system is edge-lighting type with 4chips White LED

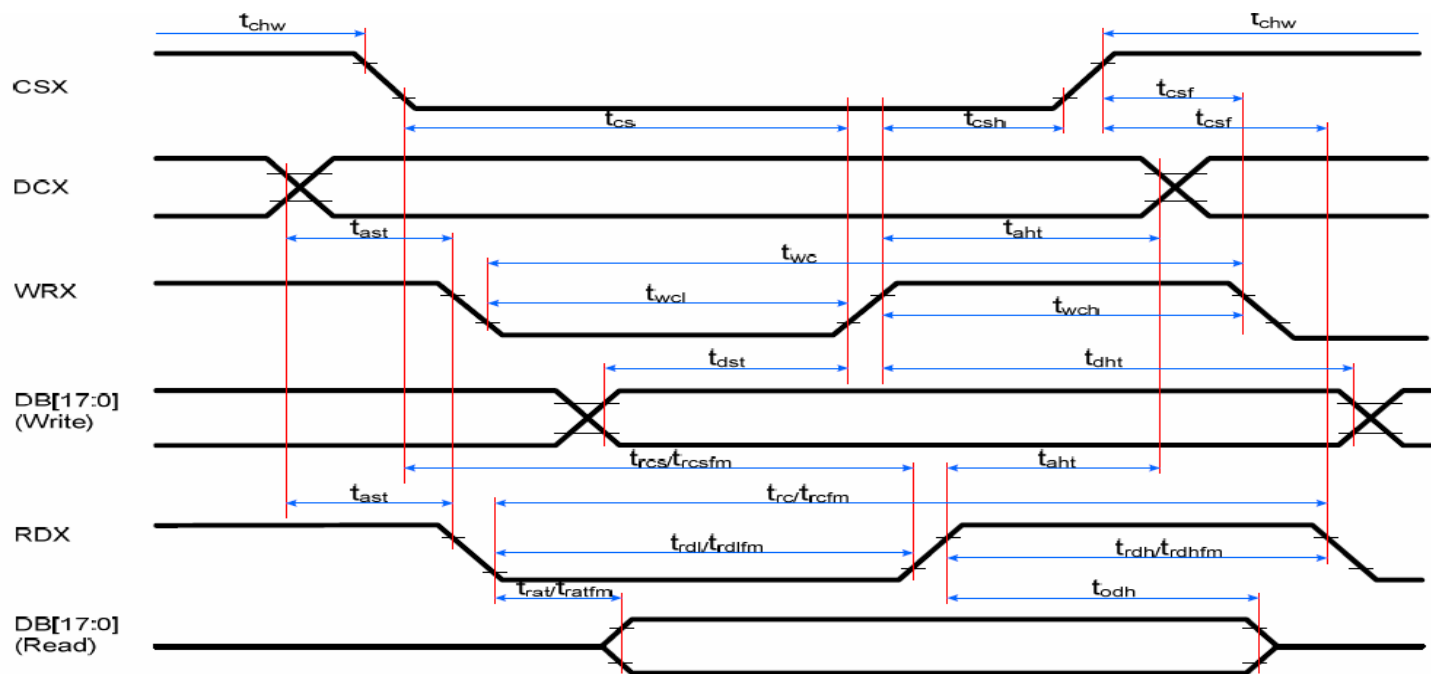
Item	Symbol	Min.	Typ.	Max.	Unit	Note
Forward Current	I _F	60	80	--	mA	
Forward Voltage	V _F	--	3.2	--	V	
LCM Luminance	L _V	450	--	--	cd/m2	IF=80MA
Uniformity	AVg	80	--	--	%	



BLU CIRCUIT DIAGRAM

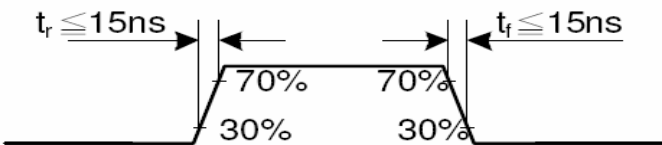
6. AC Characteristic

6.1. Display Parallel 18/16/9/8-bit Interface Timing Characteristics (8080- I system)

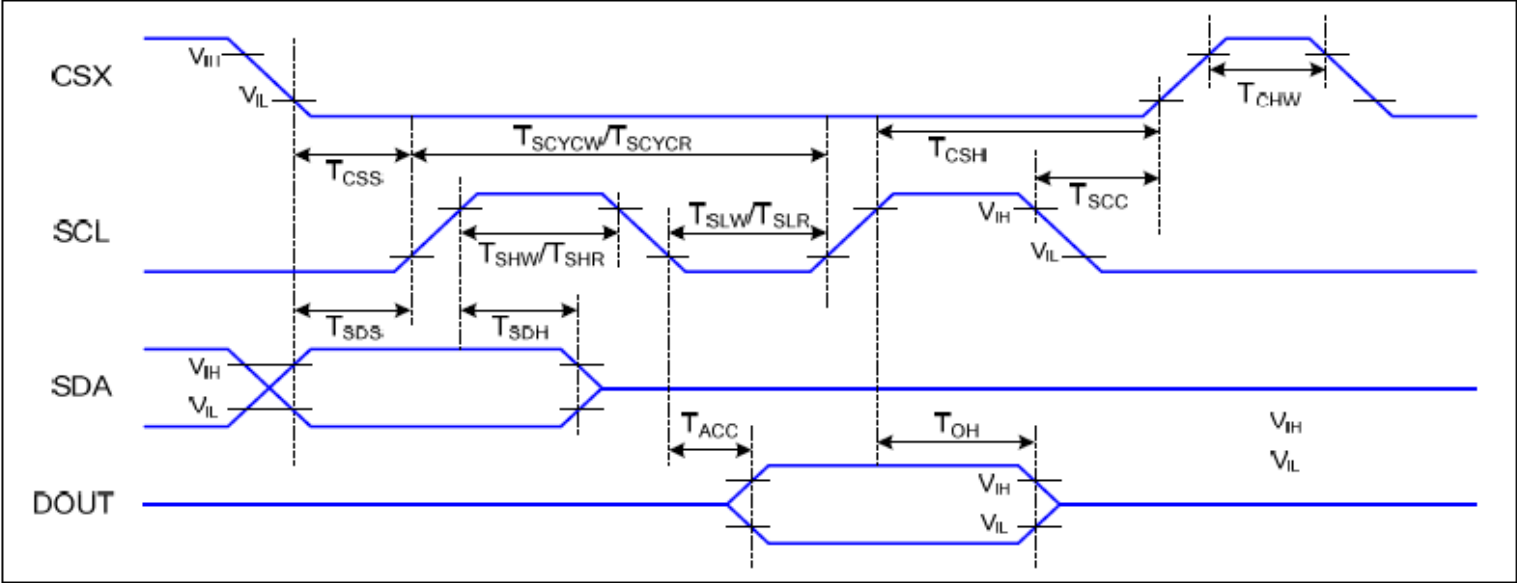


Signal	Symbol	Parameter	min	max	Unit	Description
DCX	t _{ast}	Address setup time	0	-	ns	
	t _{ah}	Address hold time (Write/Read)	10	-	ns	
CSX	t _{chw}	CSX "H" pulse width	0	-	ns	
	t _{cs}	Chip Select setup time (Write)	15	-	ns	
	t _{rcs}	Chip Select setup time (Read ID)	45	-	ns	
	t _{rcsfm}	Chip Select setup time (Read FM)	355	-	ns	
	t _{csf}	Chip Select Wait time (Write/Read)	10	-	ns	
WRX	t _{wc}	Write cycle	66	-	ns	
	t _{wrh}	Write Control pulse H duration	15	-	ns	
	t _{wrl}	Write Control pulse L duration	15	-	ns	
RDX (FM)	t _{rcfm}	Read Cycle (FM)	450	-	ns	
	t _{trdhfm}	Read Control H duration (FM)	90	-	ns	
	t _{trdlfm}	Read Control L duration (FM)	355	-	ns	
RDX (ID)	t _{trc}	Read cycle (ID)	160	-	ns	
	t _{trdh}	Read Control pulse H duration	90	-	ns	
	t _{trdl}	Read Control pulse L duration	45	-	ns	
D[17:0], D[15:0], D[8:0], D[7:0]	t _{dst}	Write data setup time	10	-	ns	For maximum CL=30pF For minimum CL=8pF
	t _{dht}	Write data hold time	10	-	ns	
	t _{rat}	Read access time	-	40	ns	
	t _{ratfm}	Read access time	-	340	ns	
	t _{trod}	Read output disable time	20	80	ns	

Note: Ta = -30 to 70 ℃, IOVCC=1.65V to 2.8V, VCI=2.6V to 3.3V, GND=0V



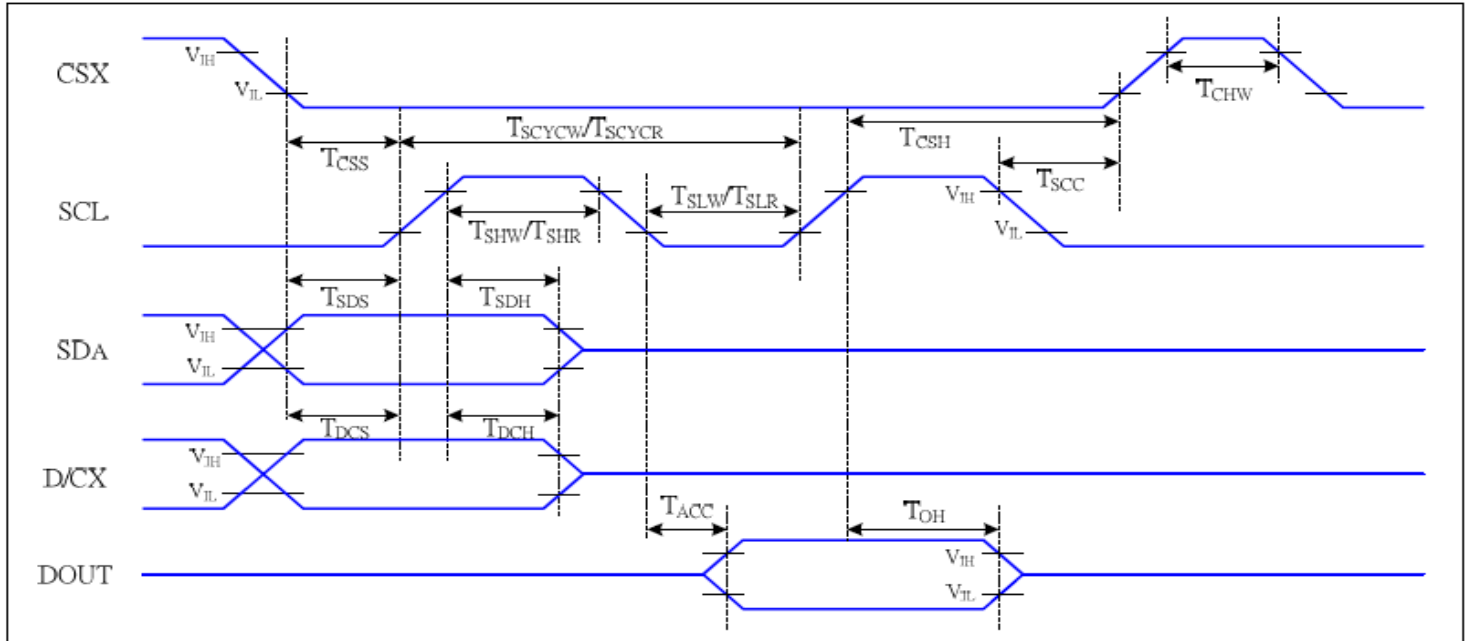
6.2 Display Serial Interface Timing Characteristics (3-line SPI system)



VDDI=1.65 to 3.3V, VDD=2.4 to 3.3V, AGND=DGND=0V, Ta=-30 to 70 ℃

Signal	Symbol	Parameter	Min	Max	Unit	Description
CSX	T_{CSS}	Chip select setup time (write)	15		ns	
	T_{CSH}	Chip select hold time (write)	15		ns	
	T_{CSS}	Chip select setup time (read)	60		ns	
	T_{SCC}	Chip select hold time (read)	65		ns	
	T_{CHW}	Chip select "H" pulse width	40		ns	
SCL	T_{SCYCW}	Serial clock cycle (Write)	66		ns	
	T_{SHW}	SCL "H" pulse width (Write)	15		ns	
	T_{SLW}	SCL "L" pulse width (Write)	15		ns	
	T_{SCYCR}	Serial clock cycle (Read)	150		ns	
	T_{SHR}	SCL "H" pulse width (Read)	60		ns	
	T_{SLR}	SCL "L" pulse width (Read)	60		ns	
SDA (DIN)	T_{SDS}	Data setup time	10		ns	
	T_{SDH}	Data hold time	10		ns	
DOUT	T_{ACC}	Access time	10	50	ns	For maximum CL=30pF
	T_{OH}	Output disable time	15	50	ns	For minimum CL=8pF

6.3 Display Serial Interface Timing Characteristics (4-line SPI system)

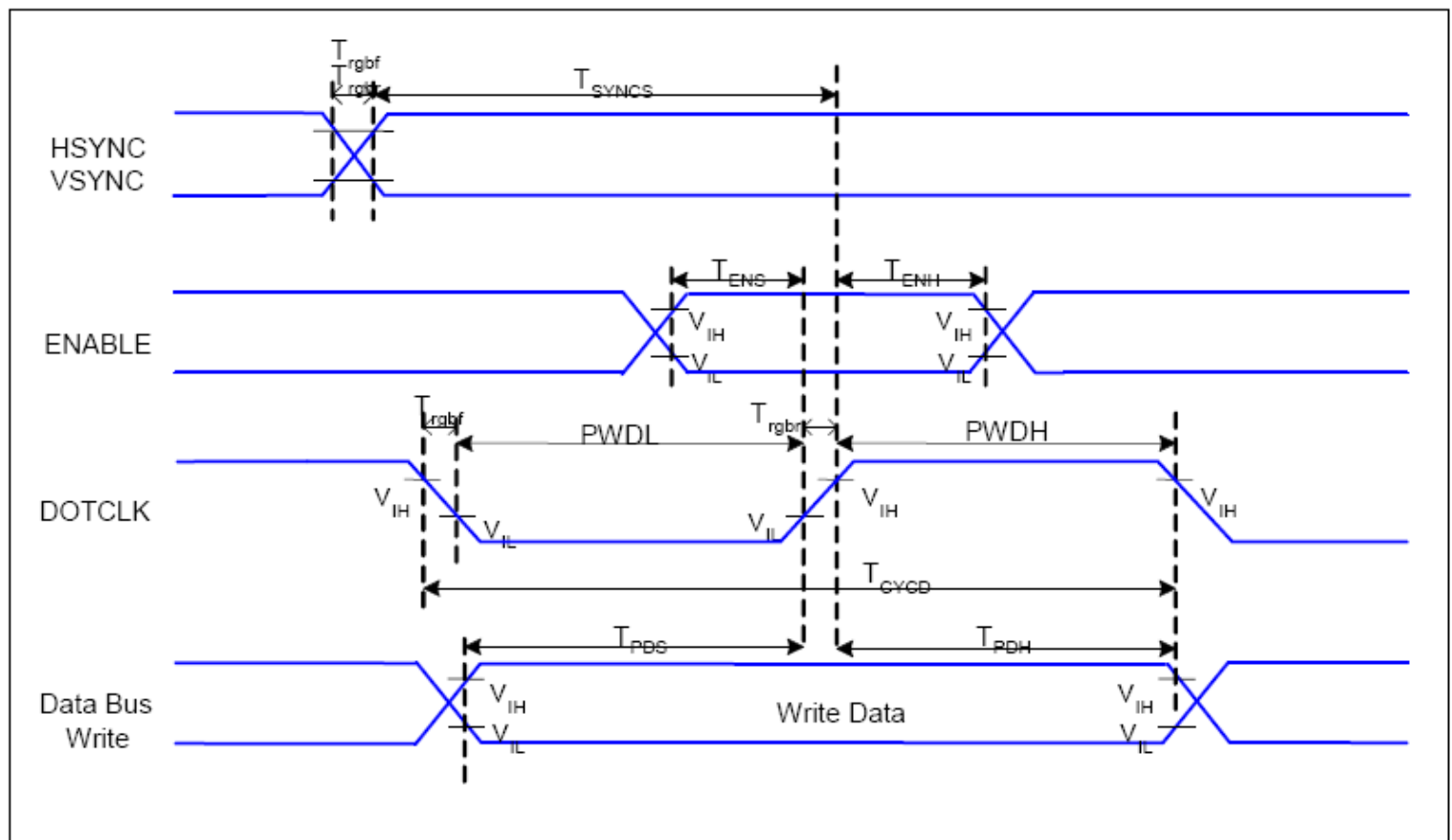


VDDI=1.65 to 3.3V, VDD=2.4 to 3.3V, AGND=DGND=0V, Ta=-30 to 70 °C

Signal	Symbol	Parameter	MIN	MAX	Unit	Description
CSX	T _{CSS}	Chip select setup time (write)	15		ns	
	T _{CSH}	Chip select hold time (write)	15		ns	
	T _{CSS}	Chip select setup time (read)	60		ns	
	T _{SCC}	Chip select hold time (read)	65		ns	
	T _{CHW}	Chip select "H" pulse width	40		ns	
SCL	T _{SCYCW}	Serial clock cycle (Write)	66		ns	-write command & data ram
	T _{SHW}	SCL "H" pulse width (Write)	15		ns	
	T _{SLW}	SCL "L" pulse width (Write)	15		ns	
	T _{SCYCR}	Serial clock cycle (Read)	150		ns	-read command & data ram
	T _{SHR}	SCL "H" pulse width (Read)	60		ns	
	T _{SLR}	SCL "L" pulse width (Read)	60		ns	
D/CX	T _{DCS}	D/CX setup time	10		ns	
	T _{DCH}	D/CX hold time	10		ns	
SDA (DIN)	T _{SDS}	Data setup time	10		ns	
	T _{SDH}	Data hold time	10		ns	
DOUT	T _{ACC}	Access time	10	50	ns	For maximum CL=30pF
	T _{OH}	Output disable time	15	50	ns	For minimum CL=8pF



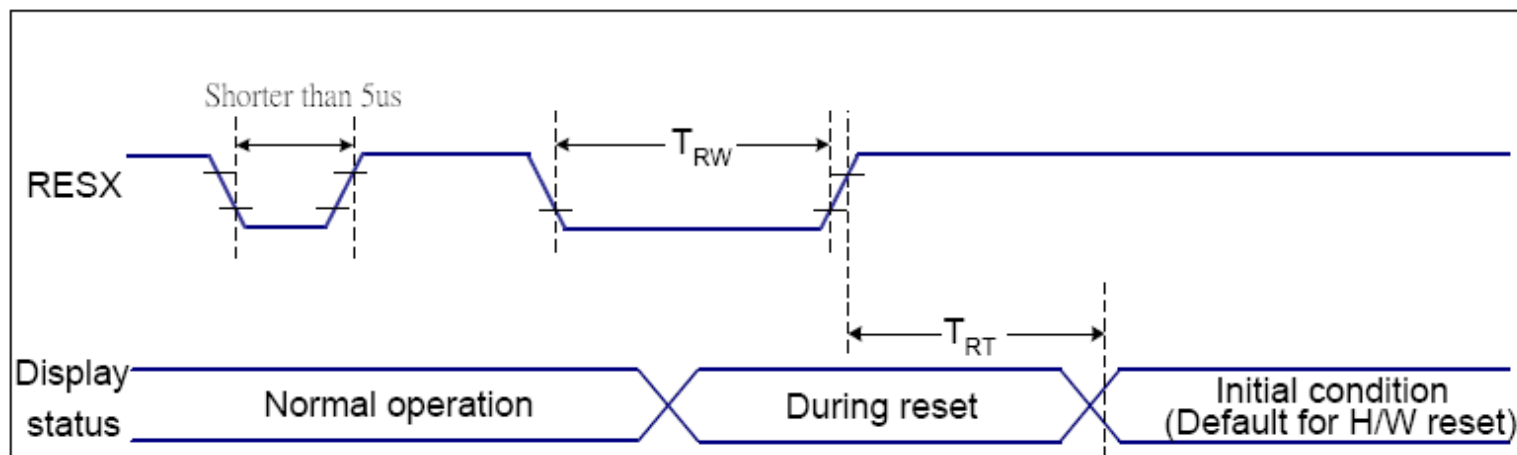
6.4 Parallel RGB Interface Timing Characteristics



$V_{DDI}=1.65$ to $3.3V$, $V_{DD}=2.4$ to $3.3V$, $AGND=DGND=0V$, $T_a=-30 \sim 70^{\circ}C$

Signal	Symbol	Parameter	MIN	MAX	Unit	Description
HSYNC, VSYNC	T_{SYNCS}	VSYNC, HSYNC Setup Time	30	-	ns	
ENABLE	T_{ENS}	Enable Setup Time	25	-	ns	
	T_{ENH}	Enable Hold Time	25	-	ns	
DOTCLK	PWDH	DOTCLK High-level Pulse Width	60	-	ns	
	PWDL	DOTCLK Low-level Pulse Width	60	-	ns	
	T_{CYCD}	DOTCLK Cycle Time	120	-	ns	
	T_{rghr}, T_{rghf}	DOTCLK Rise/Fall time	-	20	ns	
DB	T_{PDS}	PD Data Setup Time	50	-	ns	
	T_{PDH}	PD Data Hold Time	50	-	ns	

6.5 Reset Timing Characteristics



$V_{DDI}=1.65$ to $3.3V$, $V_{DD}=2.4$ to $3.3V$, $AGND=DGND=0V$, $T_a=-30 \sim 70^\circ C$

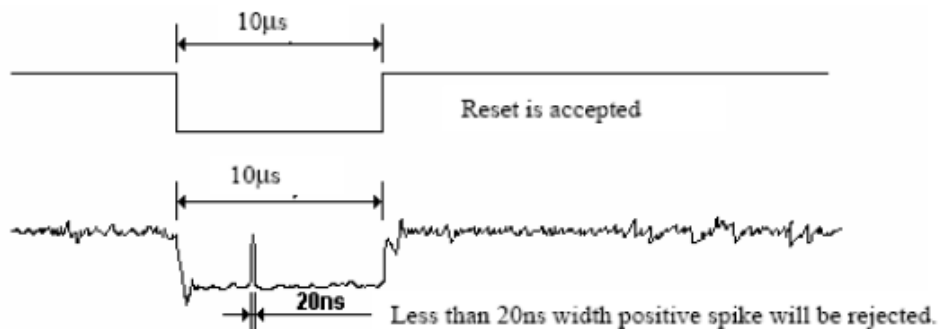
Related Pins	Symbol	Parameter	MIN	MAX	Unit
RESX	TRW	Reset pulse duration	10	-	us
	TRT	Reset cancel	-	5 (Note 1, 5)	ms
				120 (Note 1, 6, 7)	ms

Notes:

1. The reset cancel includes also required time for loading ID bytes, VCOM setting and other settings from NVM (or similar device) to registers. This loading is done every time when there is HW reset cancel time (t_{RT}) within 5 ms after a rising edge of RESX.
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 9us	Reset
Between 5us and 9us	Reset starts

3. During the Resetting period, the display will be blanked (The display is entering blanking sequence, which maximum time is 120 ms, when Reset Starts in Sleep Out –mode. The display remains the blank state in Sleep In –mode.) and then return to Default condition for Hardware Reset.
4. Spike Rejection also applies during a valid reset pulse as shown below:



5. When Reset applied during Sleep In Mode.

6. When Reset applied during Sleep Out Mode.

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

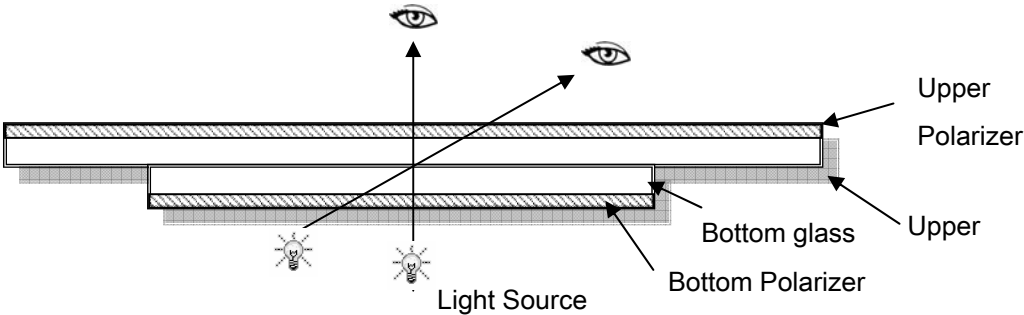
7. LCD Module Out-Going Quality Level

7.1 VISUAL & FUNCTION INSPECTION STANDARD

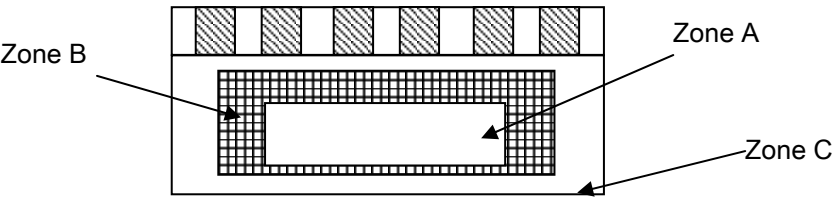
7.1.1 Inspection conditions

Inspection performed under the following conditions is recommended.

- Temperature : 25±5℃
- Humidity : 65%±10%RH
- Viewing Angle : Normal viewing Angle.
- Illumination: Single fluorescent lamp (300 to 700Lux)
- Viewing distance:30–50cm



7.1.2 Definition



- Zone A : Effective Viewing Area(Character or Digit can be seen)
- Zone B : Viewing Area except Zone A
- Zone C : Outside (Zone A+Zone B) which can not be seen after assembly by customer .)

Note:

As a general rule ,visual defects in Zone C can be ignored when it doesn't effect product function or appearance after assembly by customer.

7.1.3 Sampling Plan

According to GB/T 2828-2003 ; , normal inspection, Class II

AQL:

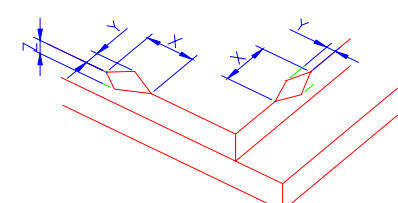
Major defect	Minor defect
0.65	1.5

LCD: Liquid Crystal Display , TP: Touch Panel , LCM: Liquid Crystal Module

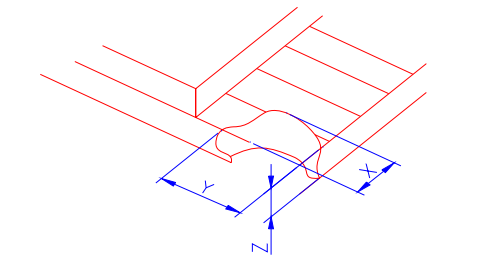
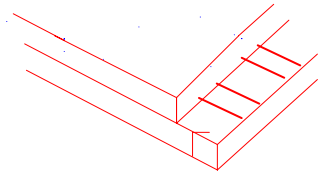
No	Items to be inspected	Criteria	Classification of defects
1	Functional defects	1) No display, Open or miss line 2) Display abnormally, Short 3) Backlight no lighting, abnormal lighting. 4) TP no function	Major
2	Missing	Missing component	
3	Outline dimension	Overall outline dimension beyond the drawing is not allowed	
4	Color tone	Color unevenness, refer to limited sample	Minor
5	Soldering appearance	Good soldering , Peeling off is not allowed.	
6	LCD/Polarizer/TP	Black/White spot/line, scratch, crack, etc.	

7

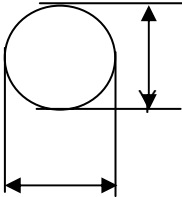
7.1.4 Criteria (Visual)

Number	Items	Criteria(mm)						
1.0 LCD Crack/Broken	(1) The edge of LCD broken	 <table> <tr> <th>X</th><th>Y</th><th>Z</th></tr> <tr> <td>≤3.0mm</td><td><Inner border line of the seal</td><td>≤T</td></tr> </table>	X	Y	Z	≤3.0mm	<Inner border line of the seal	≤T
X	Y	Z						
≤3.0mm	<Inner border line of the seal	≤T						
NOTE: X: Length Y: Width								



Z: Height L: Length of ITO, T: Height of LCD	(2)LCD corner broken	 <table><tr><td>X</td><td>Y</td><td>Z</td></tr><tr><td>≤3.0mm</td><td>≤L</td><td>≤T</td></tr></table>	X	Y	Z	≤3.0mm	≤L	≤T
	X	Y	Z					
≤3.0mm	≤L	≤T						
(3) LCD crack	 Crack Not allowed							



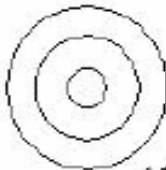
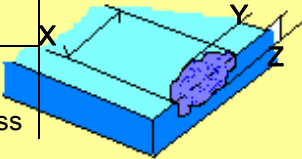
Number	Items	Criteria (mm)																									
2.0	Spot defect  X Φ=(X+Y)/2	① light dot (LCD/TP/Polarizer black/white spot , light dot, pinhole, dent, stain)																									
		<table><tr><th rowspan="2">Zone Size (mm)</th><th colspan="3">Acceptable Qty</th></tr><tr><th>A</th><th>B</th><th>C</th></tr><tr><td>Φ≤0.10</td><td colspan="2">Ignore</td><td rowspan="4">Ignore</td></tr><tr><td>0.10<Φ≤0.15</td><td colspan="2">3(distance≥10mm)</td></tr><tr><td>0.15<Φ≤0.2</td><td colspan="2">1</td></tr><tr><td>0.2<Φ</td><td colspan="2">0</td></tr></table>	Zone Size (mm)	Acceptable Qty			A	B	C	Φ≤0.10	Ignore		Ignore	0.10<Φ≤0.15	3(distance≥10mm)		0.15<Φ≤0.2	1		0.2<Φ	0						
		Zone Size (mm)		Acceptable Qty																							
			A	B	C																						
		Φ≤0.10	Ignore		Ignore																						
		0.10<Φ≤0.15	3(distance≥10mm)																								
		0.15<Φ≤0.2	1																								
		0.2<Φ	0																								
		②Dim spot (LCD/TP/Polarizer dim dot, light leakage、 dark spot)																									
		<table><tr><th rowspan="2">Zone Size (mm)</th><th colspan="3">Acceptable Qty</th></tr><tr><th>A</th><th>B</th><th>C</th></tr><tr><td>Φ≤0.1</td><td colspan="2">Ignore</td><td rowspan="4">Ignore</td></tr><tr><td>0.1<Φ≤0.2</td><td colspan="2">2(distance≥10mm)</td></tr><tr><td>0.2<Φ≤0.3</td><td colspan="2">1</td></tr><tr><td>Φ>0.3</td><td colspan="2">0</td></tr></table>	Zone Size (mm)	Acceptable Qty			A	B	C	Φ≤0.1	Ignore		Ignore	0.1<Φ≤0.2	2(distance≥10mm)		0.2<Φ≤0.3	1		Φ>0.3	0						
Zone Size (mm)	Acceptable Qty																										
	A	B	C																								
Φ≤0.1	Ignore		Ignore																								
0.1<Φ≤0.2	2(distance≥10mm)																										
0.2<Φ≤0.3	1																										
Φ>0.3	0																										
③ Polarizer accidented spot																											
<table><tr><th rowspan="2">Zone Size (mm)</th><th colspan="3">Acceptable Qty</th></tr><tr><th>A</th><th>B</th><th>C</th></tr><tr><td>Φ≤0.2</td><td colspan="2">Ignore</td><td rowspan="3">Ignore</td></tr><tr><td>0.2<Φ≤0.5</td><td colspan="2">2(distance≥10mm)</td></tr><tr><td>Φ>0.5</td><td colspan="2">0</td></tr></table>	Zone Size (mm)	Acceptable Qty			A	B	C	Φ≤0.2	Ignore		Ignore	0.2<Φ≤0.5	2(distance≥10mm)		Φ>0.5	0											
Zone Size (mm)		Acceptable Qty																									
	A	B	C																								
Φ≤0.2	Ignore		Ignore																								
0.2<Φ≤0.5	2(distance≥10mm)																										
Φ>0.5	0																										
Line defect (LCD/TP /Polarizer black/white line, scratch, stain)	<table><tr><th rowspan="2">Width(mm)</th><th rowspan="2">Length(mm)</th><th colspan="3">Acceptable Qty</th></tr><tr><th>A</th><th>B</th><th>C</th></tr><tr><td>Φ≤0.03</td><td>Ignore</td><td colspan="2">Ignore</td><td rowspan="3">Ignore</td></tr><tr><td>0.03<W≤0.05</td><td>L≤3.0</td><td colspan="2">N≤2</td></tr><tr><td>0.05<W≤0.08</td><td>L≤2.0</td><td colspan="2">N≤2</td></tr><tr><td>0.08<W</td><td colspan="4">Define as spot defect</td></tr></table>	Width(mm)	Length(mm)	Acceptable Qty			A	B	C	Φ≤0.03	Ignore	Ignore		Ignore	0.03<W≤0.05	L≤3.0	N≤2		0.05<W≤0.08	L≤2.0	N≤2		0.08<W	Define as spot defect			
Width(mm)	Length(mm)			Acceptable Qty																							
		A	B	C																							
Φ≤0.03	Ignore	Ignore		Ignore																							
0.03<W≤0.05	L≤3.0	N≤2																									
0.05<W≤0.08	L≤2.0	N≤2																									
0.08<W	Define as spot defect																										

	Items	Criteria (mm)
	Spot defect	X $\Phi=(X+Y)/2$ Zone Size (mm) $\Phi\leq 0.10$ $0.10<\Phi\leq 0.15$ $0.15<\Phi\leq 0.2$ $0.2<\Phi$ Acceptable Qty A B C Ignore 3(distance $\geq 10\text{mm}$) 1 0 Ignore Zone Size (mm) $\Phi\leq 0.1$ $0.1<\Phi\leq 0.2$ $0.2<\Phi\leq 0.3$ $\Phi > 0.3$ Acceptable Qty A B C Ignore 2(distance $\geq 10\text{mm}$) 1 0 Ignore Zone Size (mm) $\Phi\leq 0.2$ $0.2<\Phi\leq 0.5$ $\Phi>0.5$ Acceptable Qty A B C Ignore 2(distance $\geq 10\text{mm}$) 0 Ignore ① light dot (LCD/TP/Polarizer black/white spot , light dot, pinhole, dent, stain) ②Dim spot (LCD/TP/Polarizer dim dot, light leakage、dark spot) ③ Polarizer accidented spot



	Line defect (LCD/TP /Polarizer black/white line, scratch, stain)	<table><tr><th rowspan="2">Width(mm)</th><th rowspan="2">Length(mm)</th><th colspan="3">Acceptable Qty</th></tr><tr><th>A</th><th>B</th><th>C</th></tr><tr><td>$\Phi \leq 0.03$</td><td>Ignore</td><td colspan="2">Ignore</td><td rowspan="3">Ignore</td></tr><tr><td>$0.03 < W \leq 0.05$</td><td>$L \leq 3.0$</td><td colspan="2">$N \leq 2$</td></tr><tr><td>$0.05 < W \leq 0.08$</td><td>$L \leq 2.0$</td><td colspan="2">$N \leq 2$</td></tr><tr><td>$0.08 < W$</td><td colspan="4">Define as spot defect</td></tr></table>					Width(mm)	Length(mm)	Acceptable Qty			A	B	C	$\Phi \leq 0.03$	Ignore	Ignore		Ignore	$0.03 < W \leq 0.05$	$L \leq 3.0$	$N \leq 2$		$0.05 < W \leq 0.08$	$L \leq 2.0$	$N \leq 2$		$0.08 < W$	Define as spot defect			
Width(mm)	Length(mm)	Acceptable Qty																														
		A	B	C																												
$\Phi \leq 0.03$	Ignore	Ignore		Ignore																												
$0.03 < W \leq 0.05$	$L \leq 3.0$	$N \leq 2$																														
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$0.08 < W$	Define as spot defect																															
	Polarizer Bubble	<table><tr><th rowspan="2">Zone Size (mm)</th><th colspan="3">Acceptable Qty</th></tr><tr><th>A</th><th>B</th><th>C</th></tr><tr><td>$\Phi \leq 0.2$</td><td colspan="2">Ignore</td><td rowspan="4">Ignore</td></tr><tr><td>$0.2 < \Phi \leq 0.4$</td><td colspan="2">2(distance $\geq 10\text{mm}$)</td></tr><tr><td>$0.4 < \Phi \leq 0.6$</td><td colspan="2">1</td></tr><tr><td>$0.6 < \Phi$</td><td colspan="2">0</td></tr></table>					Zone Size (mm)	Acceptable Qty			A	B	C	$\Phi \leq 0.2$	Ignore		Ignore	$0.2 < \Phi \leq 0.4$	2(distance $\geq 10\text{mm}$)		$0.4 < \Phi \leq 0.6$	1		$0.6 < \Phi$	0							
Zone Size (mm)	Acceptable Qty																															
	A	B	C																													
$\Phi \leq 0.2$	Ignore		Ignore																													
$0.2 < \Phi \leq 0.4$	2(distance $\geq 10\text{mm}$)																															
$0.4 < \Phi \leq 0.6$	1																															
$0.6 < \Phi$	0																															
	SMT	According to IPC-A-610C class II standard . Function defect and missing part are major defect ,the others are minor defect.																														

		TP bubble/ accidented spot	<table><tr><th rowspan="2">Size Φ(mm)</th><th colspan="3">Acceptable Qty</th></tr><tr><th>A</th><th>B</th><th>C</th></tr><tr><td>Φ≤0.1</td><td colspan="3">Ignore</td></tr><tr><td>0.1<Φ≤0.2</td><td colspan="3">2</td></tr><tr><td>0.2<Φ≤0.3</td><td colspan="3">1</td></tr><tr><td>0.3<Φ</td><td colspan="3">0</td></tr></table>	Size Φ(mm)	Acceptable Qty			A	B	C	Φ≤0.1	Ignore			0.1<Φ≤0.2	2			0.2<Φ≤0.3	1			0.3<Φ	0		
Size Φ(mm)	Acceptable Qty																									
	A	B	C																							
Φ≤0.1	Ignore																									
0.1<Φ≤0.2	2																									
0.2<Φ≤0.3	1																									
0.3<Φ	0																									
		Assembly deflection	beyond the edge of backlight ≤0.15mm																							

5.0	TP Related	Newton Ring Newton Ring	Newton area>1/3 TP NG Newton area≤1/3 TP OK	Ring area Ring area	 1 规律性  2 非规律性  似牛顿环					
		TP corner broken X : length Y : width Z : height	<table><tr><td>X</td><td>Y</td></tr><tr><td>X≤3.0mm</td><td>Y≤3.0mm</td></tr></table> * Circuitry broken is not allowed.	X	Y	X≤3.0mm	Y≤3.0mm	<table><tr><td>Z</td></tr><tr><td>Z<LCD thickness</td></tr></table>	Z	Z<LCD thickness
X	Y									
X≤3.0mm	Y≤3.0mm									
Z										
Z<LCD thickness										
		TP edge broken X : length Y : width Z : height	<table><tr><td>X</td><td>Y</td></tr><tr><td>X≤6.0mm</td><td>Y≤2.0mm</td></tr></table> * Circuitry broken is not allowed.	X	Y	X≤6.0mm	Y≤2.0mm	<table><tr><td>Z</td></tr><tr><td>Z<LCD thickness</td></tr></table>	Z	Z<LCD thickness
X	Y									
X≤6.0mm	Y≤2.0mm									
Z										
Z<LCD thickness										



Criteria (functional items)

Number	Items	Criteria (mm)
1	No display	Not allowed
2	Missing segment	Not allowed
3	Short	Not allowed
4	Backlight no lighting	Not allowed
5	TP no function	Not allowed

8. Reliability Test Result

8.1 Condition

Item	Condition	Sample Size	Test Result	Note
Low Temperature Operating Life test	-20℃, 96HR	3ea	pass	-
Thermal Humidity Operating Life test	70℃, 90%RH, 96HR	3ea	pass	-
Temperature Cycle ON/OFF test	-20℃ ↔ 70℃, ON/OFF, 20CYC	3ea	pass	(1)
High Temperature Storage test	80℃, 96HR	3ea	pass	-
Low Temperature Storage test	- 30℃, 96HR	3ea	pass	-
Thermal Shock Resistance	The sample should be allowed to stand the following 5 cycles of operation: TSTL for 30 minutes -> normal temperature for 5 minutes -> TSTH for 30 minutes -> normal temperature for 5 minutes, as one cycle, then taking it out and drying it at normal temperature, and allowing it stand for 24 hours	3ea	pass	
Box Drop Test	1 Corner 3 Edges 6 faces, 66cm(MEDIUM BOX)	1box	pass	-

Note (1) ON Time over 10 seconds, OFF Time under 10 seconds

9. Cautions and Handling Precautions

9.1 Handling and Operating the Module

(1) When the module is assembled, it should be attached to the system firmly.

Do not warp or twist the module during assembly work.

(2) Protect the module from physical shock or any force. In addition to damage, this may cause improper operation or damage to the module and back-light unit.

(3) Note that polarizer is very fragile and could be easily damaged. Do not press or scratch the surface.

(4) Do not allow drops of water or chemicals to remain on the display surface.

If you have the droplets for a long time, staining and discoloration may occur.

(5) If the surface of the polarizer is dirty, clean it using some absorbent cotton or soft cloth.

(6) The desirable cleaners are water, IPA (Isopropyl Alcohol) or Hexane.

Do not use ketene type materials (ex. Acetone), Ethyl alcohol, Toluene, Ethyl acid or Methyl chloride. It might permanent damage to the polarizer due to chemical reaction.

(7) If the liquid crystal material leaks from the panel, it should be kept away from the eyes or mouth. In case of contact with hands, legs, or clothes, it must be washed away thoroughly with soap.

(8) Protect the module from static; it may cause damage to the CMOS ICs.

(9) Use finger-stalls with soft gloves in order to keep display clean during the incoming inspection and assembly process.

(10) Do not disassemble the module.

(11) Protection film for polarizer on the module shall be slowly peeled off just before use so that the electrostatic charge can be minimized.

(12) Pins of I/F connector shall not be touched directly with bare hands.

(13) Do not connect, disconnect the module in the "Power ON" condition.

(14) Power supply should always be turned on/off by the item 6.1 Power On Sequence & 6.2 Power Off Sequence

9.2 Storage and Transportation.

(1) Do not leave the panel in high temperature, and high humidity for a long time.

It is highly recommended to store the module with temperature from 0 to 35 °C and relative humidity of less than 70%

(2) Do not store the TFT-LCD module in direct sunlight.

(3) The module shall be stored in a dark place. When storing the modules for a long time, be sure to adopt effective measures for protecting the modules from strong ultraviolet radiation, sunlight, or fluorescent light.

(4) It is recommended that the modules should be stored under a condition where no condensation is allowed. Formation of dewdrops may cause an abnormal operation or a failure of the module.

In particular, the greatest possible care should be taken to prevent any module from being operated where condensation has occurred inside.

(5) This panel has its circuitry FPC on the bottom side and should be handled carefully in order not to be stressed.

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10.Packing

