ORIENT DISPLAY

Your Total LCD Solution Provider

http://www.orientdisplay.com

SPECIFICATION
FOR
TFT MODULE

MODULE NO: AFS240320TG-2.4-P150001
REVISION NO: 00

Customer's Approval:

	SIGNATURE	DATE
PREPARED BY (RD ENGINEER)	XJZ	2011-12-8
CHECKED BY	YHW	2011-12-8
APPROVED BY	HSH	2011-12-8

Orient Display (N.A.) Ltd.
145 Royal Crest Court Unit 42, Markham, ON, Canada L3R 9Z4
Tel: 905-477-1166 Fax: 905-477-1782

Orient Display (USA) Corp.
1315 NW Mall St. Suite 5, Issaquah, WA, USA 98027
Tel: 425-392-6880 Fax: 425-557-6560

DOCUMENT REVISION HISTORY

Version	DATE	DESCRIPTION	CHANGED BY
00	Oct-17-2011	First Issue	Ylh

CONTENTS

1. Features & Mechanical Specifications

Item	Contents	Unit
	LCD	
LCD Type	TFT / Transmissive / Normal White	--
Viewing direction	12 O'clock	--
Backlight	4 Chip White LED in Parallel	--
Interface	3-wine SPI+RGB interface	--
Driver IC	ILI9341	--
Outline Dimension	42.72(W) ×60.26(H) × 2.4(T)	mm
Glass area (W×H×T)	39.72 ×55.76 × 1.0	mm
Active area (W×H)	36.72 × 48.96	mm
Number of Dots	240(RGB) × 320	--
Dot pitch (W×H)	0.051 × 0.153	mm
Pixel pitch (W×H)	0.153 × 0.153	mm
Operating Temperature	-20 ～ +70	℃
Storage temperature	-30 ～ +80	℃

2. Dimensional Outline

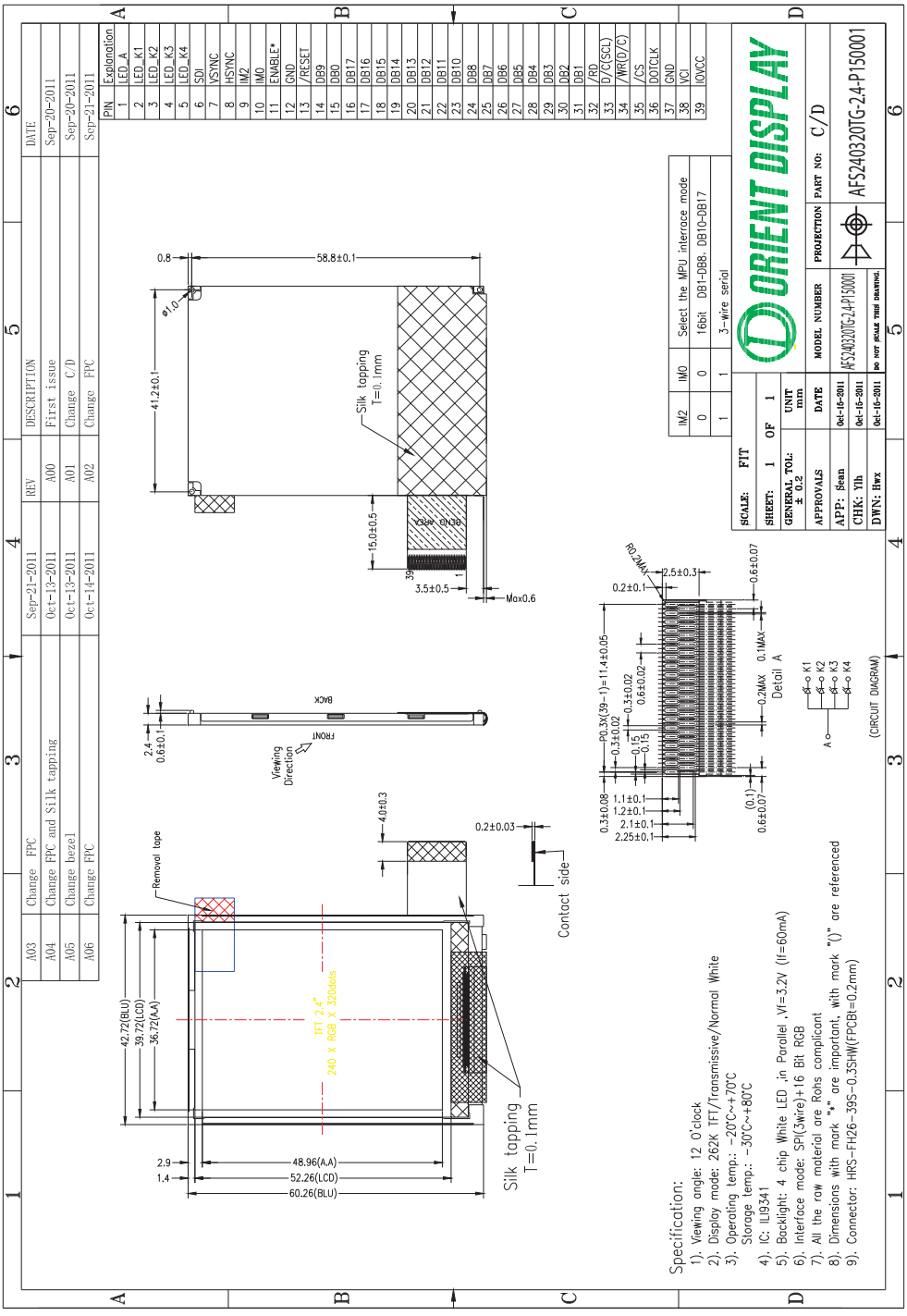


Figure 1. Dimensional outline

2. Block Diagram

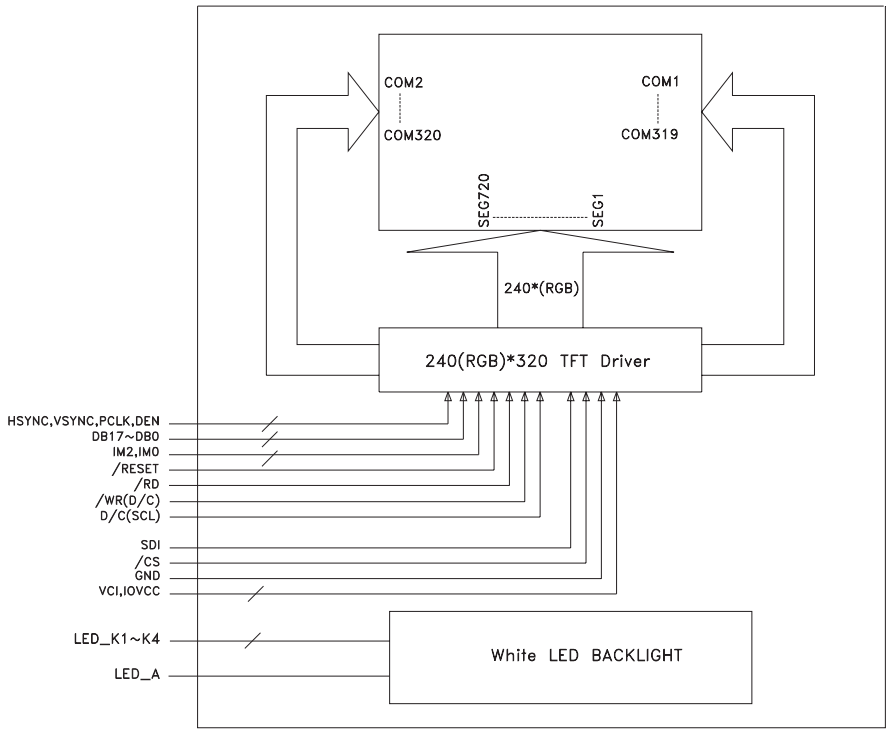


Figure 2. Block diagram

4. Pin Description

PIN No.	SYMBOL	Function
1	LED_A	Backlight LED Anode
2	LED_K1	Backlight LED1 Cathode
3	LED_K2	Backlight LED2 Cathode
4	LED_K3	Backlight LED3 Cathode
5	LED_K4	Backlight LED4 Cathode
6	SDI	The data is applied on the rising edge of the SCL signal. If not used, fix this pin GND.
7	VSYNC	Frame synchronizing signal for RGB interface operation Fix to GND level when not in use.
8	HSYNC	Line synchronizing signal for RGB interface operation. Fix to GND level when not in use.
9	IM2	Select the system interface mode. Please See "**Interface Note**"
10	IM0	Select the system interface mode. Please See "**Interface Note**"
11	ENABLE	Data enable signal for RGB interface operation. Fix to GND level when not in use.
12	GND	Ground
13	/RESET	Reset pin. (Active Low)
14	DB9	Data Bus
15	DB0	Data Bus
16~23	DB17~DB10	Data Bus
24~31	DB8~DB1	Data Bus
32	/RD	- 8080 system (/RD) Serves as a read signal and MCU read data at the rising edge. Fix to IOVCC level when not in use.
33	D/C(SCL)	This pin is used to select "Data or Command" in the parallel interface or 4-wire 8-bit serial data interface. When D/C = '1', data is selected. When D/C = '0', command is selected. This pin is used serial interface clock in 3-wire 9-bit / 4-wire 8-bit serial data interface. If not used, this pin should be connected to IOVCC or GND.
34	/WR(D/C)	- 8080 system (/WR): Serves as a write signal and writes data at the rising edge. - 4-line system (D/C): Serves as command or parameter select. Fix to IOVCC level when not in use.
35	/CS	Chip selection pin (Low enable)
36	DOTCLK	Dot clock signal for RGB interface operation Fix to GND level when not in use.
37	GND	Ground
38	VCI	High voltage power supply for analog circuit blocks (2.8 V)
39	IOVCC	Low voltage power supply for interface logic circuits (1.8 / 2.8 V)

Interface Note:

IM2	IM0	Interface Mode
0	0	8080-16bit interface: DB17～DB10, DB8～DB1
0	1	8080-8bit interface: DB17~DB10
1	1	9-bit 3 wires Serial Peripheral interface
1	0	8-bit 4 wires Serial Peripheral interface

R1	R2	Interface Mode
Open	Short	9-bit 3 wires Serial Peripheral interface (default)
Short	Open	8-bit 4 wires Serial Peripheral interface

R1, R2 are SMT Components on the FPC.

5. Absolute Maximum Ratings

Item	Symbol	Rating	Unit
Supply Voltage range	VCI	-0.3 to +4.6	V
Supply Voltage range	IOVCC	-0.3 to +4.6	V
Operating Temperature range	TOP	-20 to +70	℃
Storage Temperature range	TST	-30 to +80	℃

6. Electrical Characteristics

DC Characteristics

Item	Symbol	Min.	Type.	Max.	Unit
Logic Supply Voltage	VCI	2.5	2.8	3.3	V
I/O Supply Voltage	IOVCC	1.65	2.8	3.3	V

7. Backlight Characteristics

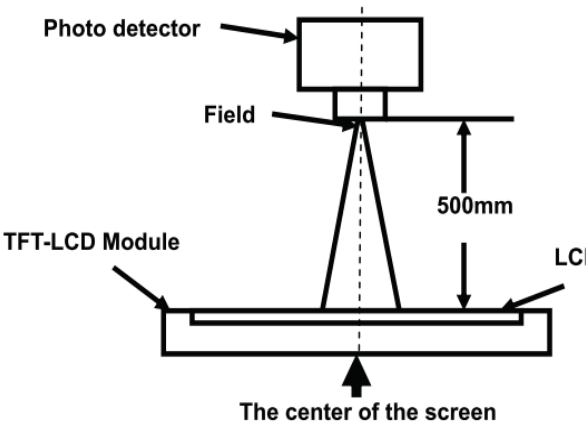
White LED × 4 Parallel **(Ta = 25°C)**

Item	Symbol	Condition	Min	Typ	Max	Unit
Forward Voltage	VF	IF = 60mA	-	3.2	-	V
Uniformity	△Bp	-	80	-	-	%
Luminance for LCD	Lv	IF = 60mA		3500	-	cd/m^2

8. Electro-Optical Characteristics

Note 1: Definition of optical measurement system.

The optical characteristics should be measured in dark room. After 5 minutes operation, the optical properties are measured at the center point of the LCD screen. All input terminals LCD panel must be ground when measuring the center area of the panel.



Item	Photo detector	Field
Contrast Ratio	SR-3A	1°
Luminance		
Chromaticity		
Lum Uniformity		
Response Time	BM-7A	2°

Note 2: Definition of viewing angle range and measurement system.

viewing angle is measured at the center point of the LCD by CONOSCOPE(ergo-80)。

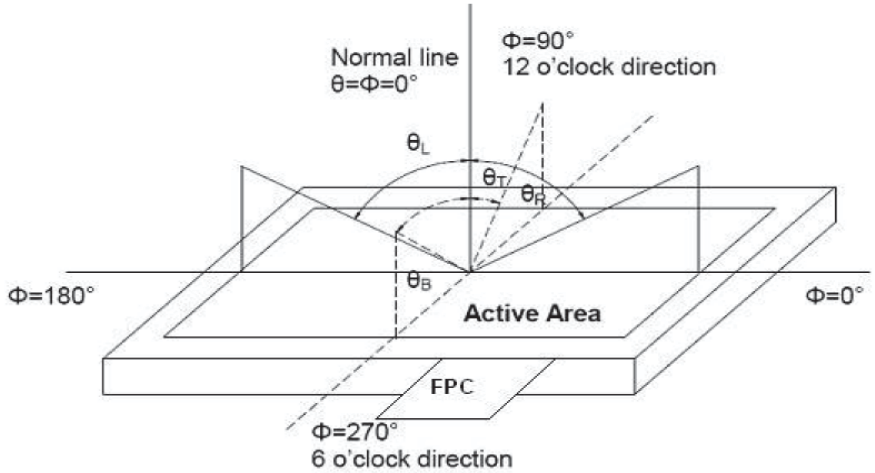


Fig. 1 Definition of viewing angle

Note 3: Definition of contrast ratio

$$\text{Contrast ratio (CR)} = \frac{\text{Luminance measured when LCD is on the "White" state}}{\text{Luminance measured when LCD is on the "Black" state}}$$

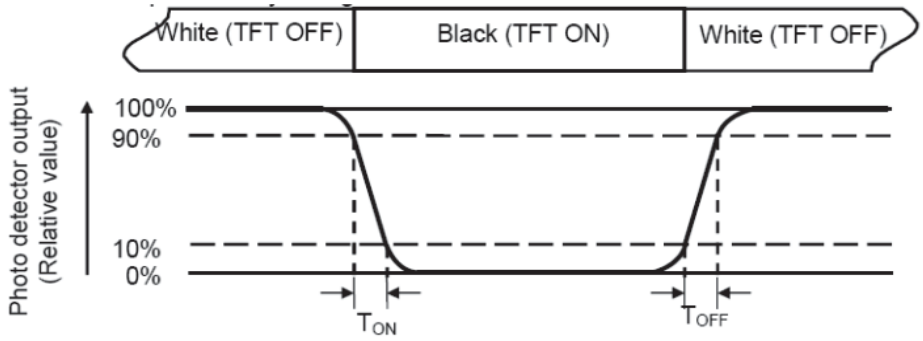
“White state “:The state is that the LCD should driven by Vwhite.

“Black state”: The state is that the LCD should driven by Vblack.

V_{White}: To be determined V_{Black}: To be determined.

Note 4: Definition of response time

The response time is defined as the LCD optical switching time interval between “White” state and “Black” state. Rise time (T_{ON}) is the time between photo detector output intensity changed from 90% to 10%. And fall time (T_{OFF}) is the time between photo detector output intensity changed from 10% to 90%.



9. Instruction Description

Regulative 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

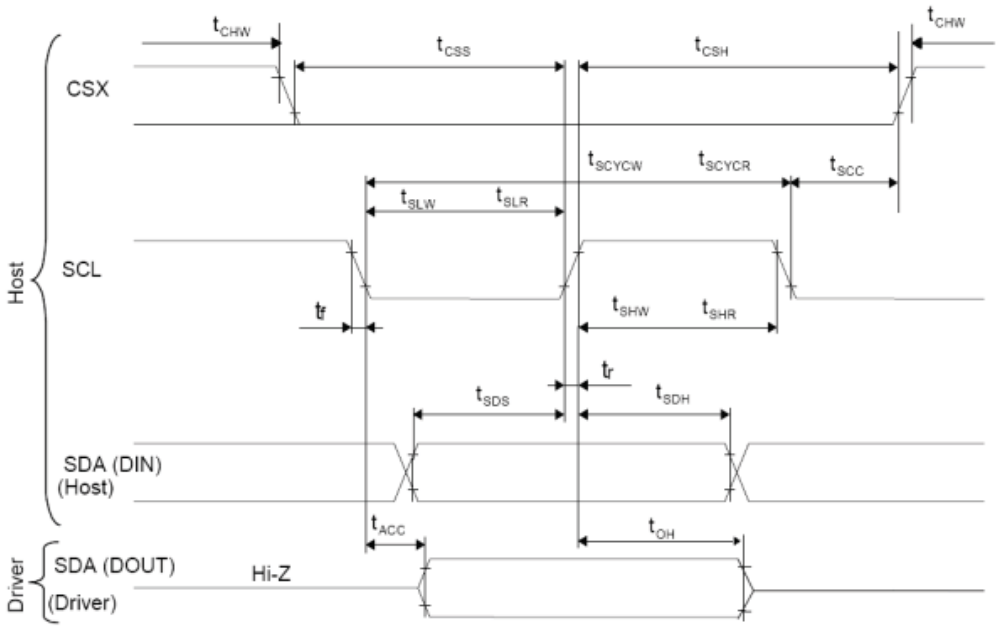
Extended Command Set													
Command Function	D/CX	RDX	WRX	D17-8	D7	D6	D5	D4	D3	D2	D1	D0	Hex
RGB Interface Signal Control	0	1	↑	XX	1	0	1	1	0	0	0	0	B0h
	1	1	↑	XX	ByPass_MODE	RCM [1:0]		X	VSPL	HSPL	DPL	EPL	40
Frame Control (In Normal Mode)	0	1	↑	XX	1	0	1	1	0	0	0	1	B1h
	1	1	↑	XX	X	X	X	X	X	X	DIVA [1:0]		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	0	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

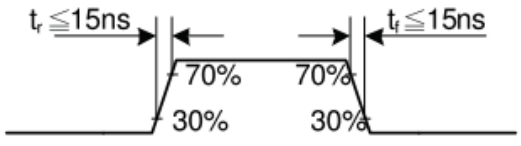
10. AC Characteristics

10.1 Serial data Transfer Interface Characteristics

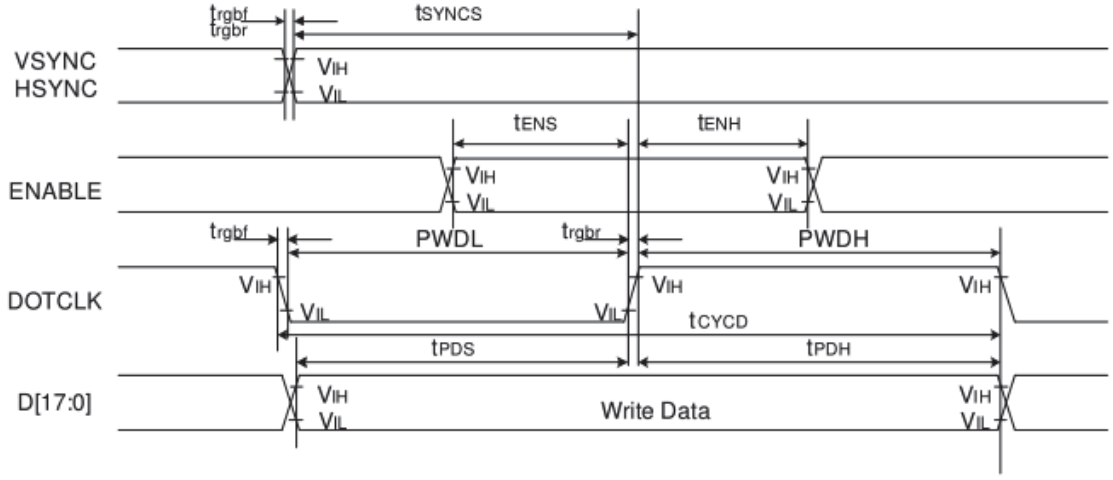


Signal	Symbol	Parameter	min	max	Unit	Description
SCL	tscycw	Serial Clock Cycle (Write)	100	-	ns	
	tshw	SCL "H" Pulse Width (Write)	40	-	ns	
	tslw	SCL "L" Pulse Width (Write)	40	-	ns	
	tscycr	Serial Clock Cycle (Read)	150	-	ns	
	tshr	SCL "H" Pulse Width (Read)	60	-	ns	
	tslr	SCL "L" Pulse Width (Read)	60	-	ns	
SDA / SDI (Input)	tsds	Data setup time (Write)	30	-	ns	
	tsdh	Data hold time (Write)	30	-	ns	
SDA / SDO (Output)	tacc	Access time (Read)	10	-	ns	
	toh	Output disable time (Read)	10	50	ns	
CSX	tscc	SCL-CSX	20	-	ns	
	tchw	CSX "H" Pulse Width	40	-	ns	
	tcss	CSX-SCL Time	60	-	ns	
	tcsh		65	-	ns	

Note: Ta = 25 ℃, VDDI=1.65V to 3.3V, VCI=2.5V to 3.3V, AGND=VSS=0V

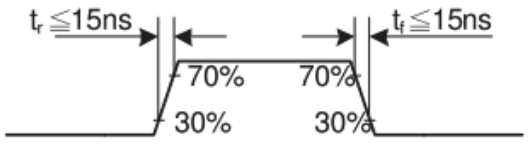


10.2 RGB Interface Characteristics



Signal	Symbol	Parameter	min	max	Unit	Description
VSYNC / HSYNC	t_{SYNCS}	VSYNC/HSYNC setup time	15	-	ns	18/16-bit bus RGB interface mode
	t_{SYNCH}	VSYNC/HSYNC hold time	15	-	ns	
DE	t_{ENS}	DE setup time	15	-	ns	
	t_{ENH}	DE hold time	15	-	ns	
D[17:0]	t_{POS}	Data setup time	15	-	ns	
	t_{PDH}	Data hold time	15	-	ns	
DOTCLK	PWDH	DOTCLK high-level period	15	-	ns	
	PWDL	DOTCLK low-level period	15	-	ns	
	t_{CYCD}	DOTCLK cycle time	100	-	ns	
	t_{rgbr} , t_{rgbf}	DOTCLK,HSYNC,VSYNC rise/fall time	-	15	ns	
VSYNC / HSYNC	t_{SYNCS}	VSYNC/HSYNC setup time	15	-	ns	6-bit bus RGB interface mode
	t_{SYNCH}	VSYNC/HSYNC hold time	15	-	ns	
DE	t_{ENS}	DE setup time	15	-	ns	
	t_{ENH}	DE hold time	15	-	ns	
D[17:0]	t_{POS}	Data setup time	15	-	ns	
	t_{PDH}	Data hold time	15	-	ns	
DOTCLK	PWDH	DOTCLK high-level pulse period	15	-	ns	
	PWDL	DOTCLK low-level pulse period	15	-	ns	
	t_{CYCD}	DOTCLK cycle time	100	-	ns	
	t_{rgbr} , t_{rgbf}	DOTCLK,HSYNC,VSYNC rise/fall time	-	15	ns	

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



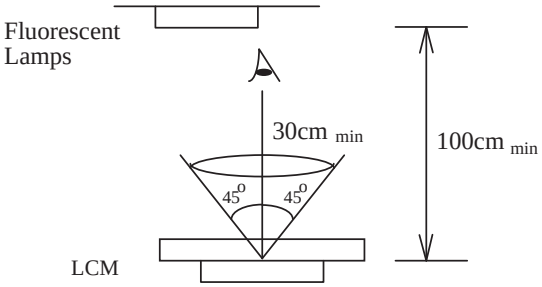
11.Quality Specifications

All The raw material are Rohs complicant.

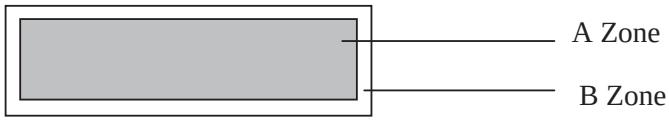
11.1 Standard of the product appearance test

Manner of appearance test: The inspection should be performed in using 20W x 2 fluorescent lamps. Distance between LCM and fluorescent lamps should be 100 cm or more. Distance between LCM and inspector eyes should be 30 cm or more.

Viewing direction for inspection is 45° from vertical against LCM.



Definition of zone:



A Zone: viewing area
B Zone: outside viewing area

11.2 Specification of quality assurance

AQL inspection standard

Sampling method: MIL-STD-105E, Level II, single sampling

Defect classification (Note: * is not including)

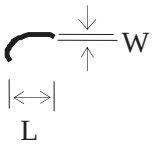
Classify	Item		Note	AQL
Major	Display state	Short or open circuit	1	0.65
		LC leakage		
		Flickering		
		No display		
		Wrong viewing direction		
		Contrast defect (dim, ghost)	2	
		Back-light	1,8	
	Non-display	Flat cable or pin reverse	10	
		Wrong or missing component	11	
Minor	Display state	Background color deviation	2	1.0
		Black spot and dust	3	
		Line defect, Scratch	4	
		Rainbow	5	
		Chip	6	
		Pin hole	7	
	Polarizer	Protruded	12	
		Bubble and foreign material	3	
	Soldering	Poor connection	9	
	Wire	Poor connection	10	
	TAB	Position, Bonding strength	13	

Note on defect classification

<table>
<tr><th>No.</th><th>Item</th><th>Criterion</th></tr>
<tr><td rowspan="6">1</td><td>Short or open circuit</td><td rowspan="6">Not allow</td></tr>
<tr><td>LC leakage</td></tr>
<tr><td>Flickering</td></tr>
<tr><td>No display</td></tr>
<tr><td>Wrong viewing direction</td></tr>
<tr><td>Wrong Back-light</td></tr>
<tr><td rowspan="2">2</td><td>Contrast defect</td><td rowspan="2">Refer to approval sample</td></tr>
<tr><td>Background color deviation</td></tr>
<tr><td>3</td><td>Point defect,
Black spot, dust
(including Polarizer)

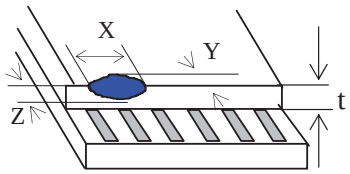
$\phi = (X+Y)/2$</td><td> 

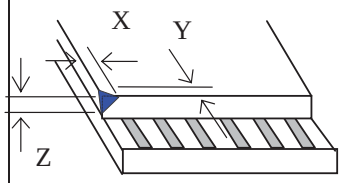
<table>
<tr><th>Point
Size</th><th>Acceptable Qty.</th></tr>
<tr><td>$\phi \leq 0.10$</td><td>Disregard</td></tr>
<tr><td>$0.10 < \phi \leq 0.20$</td><td>3</td></tr>
<tr><td>$0.20 < \phi \leq 0.25$</td><td>2</td></tr>
<tr><td>$0.25 < \phi \leq 0.30$</td><td>1</td></tr>
<tr><td>$\phi > 0.30$</td><td>0</td></tr>
</table>
Unit：mm</td></tr>
<tr><td>4</td><td>Line defect,

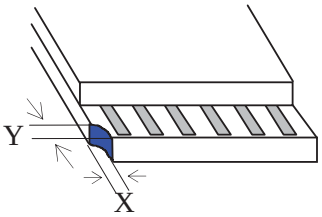
Scratch</td><td> 

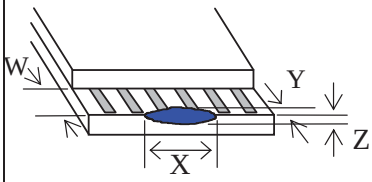
<table>
<tr><th colspan="2">Line</th><th>Acceptable Qty.</th></tr>
<tr><td>L</td><td>W</td><td></td></tr>
<tr><td>---</td><td>0.015≥W</td><td>Disregard</td></tr>
<tr><td>3.0≥L</td><td>0.03≥W</td><td rowspan="2">2</td></tr>
<tr><td>2.0≥L</td><td>0.05≥W</td></tr>
<tr><td>1.0≥L</td><td>0.1＞W</td><td>1</td></tr>
<tr><td>---</td><td>0.05<W</td><td>Applied as point defect</td></tr>
</table>
Unit: mm</td></tr>
<tr><td>5</td><td>Rainbow</td><td>Not more than two color changes across the viewing area.</td></tr>
</table>

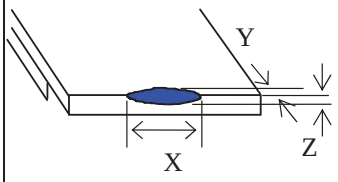
<table>
<tr><th>No</th><th>Item</th><th>Criterion</th></tr>
<tr><td>6</td><td>Chip

Remark:
X: Length direction
Y: Short direction
Z: Thickness direction
t: Glass thickness
W: Terminal Width</td><td>


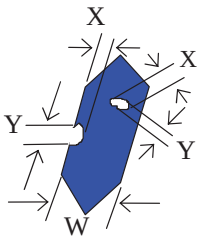
Acceptable criterion
<table>
<tr><th>X</th><th>Y</th><th>Z</th></tr>
<tr><td>≤2</td><td>0.5mm</td><td>≤t/2</td></tr>
</table>


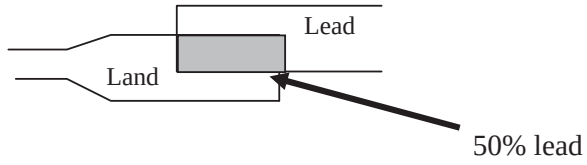
Acceptable criterion
<table>
<tr><th>X</th><th>Y</th><th>Z</th></tr>
<tr><td>≤2</td><td>0.5mm</td><td>≤t</td></tr>
</table>


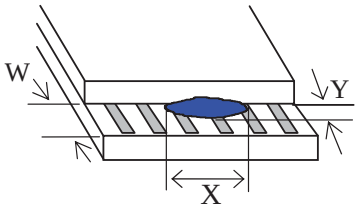
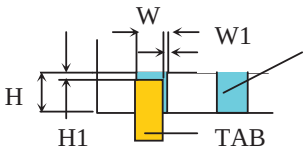
Acceptable criterion
<table>
<tr><th>X</th><th>Y</th><th>Z</th></tr>
<tr><td>≤3</td><td>≤2</td><td rowspan="2">≤t</td></tr>
<tr><td colspan="2">shall not reach to ITO</td></tr>
</table>


Acceptable criterion
<table>
<tr><th>X</th><th>Y</th><th>Z</th></tr>
<tr><td>Disregard</td><td>≤0.2</td><td>≤t</td></tr>
</table>


Acceptable criterion
<table>
<tr><th>X</th><th>Y</th><th>Z</th></tr>
<tr><td>≤5</td><td>≤2</td><td>≤t/3</td></tr>
</table>
</td></tr>
</table>

<table>
<tr><th>No.</th><th>Item</th><th>Criterion</th></tr>
<tr><td>7</td><td>Segment
pattern
W = Segment width
ϕ = (X+Y)/2</td><td>(1) Pin hole
ϕ < 0.10mm is acceptable.
 

<table>
<tr><th>Point Size</th><th>Acceptable Qty</th></tr>
<tr><td>ϕ≤1/4W</td><td>Disregard</td></tr>
<tr><td>1/4W< ϕ≤1/2W</td><td>1</td></tr>
<tr><td>ϕ>1/2W</td><td>0</td></tr>
</table>
Unit: mm</td></tr>
<tr><td>8</td><td>Back-light</td><td>(1) The color of backlight should correspond its specification.
(2) Not allow flickering</td></tr>
<tr><td>9</td><td>Soldering</td><td>(1) Not allow heavy dirty and solder ball on PCB.
(The size of dirty refer to point and dust defect)
(2) Over 50% of lead should be soldered on Land.
 
</td></tr>
<tr><td>10</td><td>Wire</td><td>(1) Copper wire should not be rusted
(2) Not allow crack on copper wire connection.
(3) Not allow reversing the position of the flat cable.
(4) Not allow exposed copper wire inside the flat cable.</td></tr>
<tr><td>11*</td><td>PCB</td><td>(1) Not allow screw rust or damage.
(2) Not allow missing or wrong putting of component.</td></tr>
</table>

No	Item	Criterion
12	Protruded W: Terminal Width	 Acceptable criteria: Y ≤ 0.4
13	TAB	1. Position  W1≤1/3W H1≤1/3H 2 FPC bonding strength test  P (=F/FPC bonding width) ≥650gf/cm ,(speed rate: 1mm/min) 5pcs per SOA (shipment)
14	Total no. of acceptable Defect	A. Zone Maximum 2 minor non-conformities per one unit. Defect distance: each point to be separated over 10mm B. Zone It is acceptable when it is no trouble for quality and assembly in customer's end product.

11.3 Reliability of LCM

Reliability test condition:

Item	Condition	Time (hrs)	Assessment
High temp. Storage	60°C	48	No abnormalities in functions and appearance
High temp. Operating	50°C	48	
Low temp. Storage	-10°C	48	
Low temp. Operating	0°C	48	
Humidity	60°C/ 90%RH	48	
Temp. Cycle	-10°C ← 25°C →60°C (60 min ← 5 min → 60min)	10cycles	

Recovery time should be 24 hours minimum. Moreover, functions, performance and appearance shall be free from remarkable deterioration within 50,000 hours under ordinary operating and storage conditions room temperature (20±8°C), normal humidity (below 65% RH), and in the area not exposed to direct sun light.

11.4 Precaution for using LCD/LCM

LCD/LCM is assembled and adjusted with a high degree of precision. Do not attempt to make any alteration or modification. The followings should be noted.

General Precautions:

1. LCD panel is made of glass. Avoid excessive mechanical shock or applying strong pressure onto the surface of display area.
2. The polarizer used on the display surface is easily scratched and damaged. Extreme care should be taken when handling. To clean dust or dirt off the display surface, wipe gently with cotton, or other soft material soaked with isoproply alcohol, ethyl alcohol or trichlorotriflorothane, do not use water, ketone or aromatics and never scrub hard.
3. Do not tamper in any way with the tabs on the metal frame.
4. Do not made any modification on the PCB without consulting Regal Honour.
5. When mounting a LCM, make sure that the PCB is not under any stress such as bending or twisting. Elastomer contacts are very delicate and missing pixels could result from slight dislocation of any of the elements.
6. Avoid pressing on the metal bezel, otherwise the elastomer connector could be deformed and lose contact, resulting in missing pixels and also cause rainbow on the display.
7. Be careful not to touch or swallow liquid crystal that might leak from a damaged cell. Any liquid crystal adheres to skin or clothes, wash it off immediately with soap and water.

Static Electricity Precautions:

1. CMOS-LSI is used for the module circuit; therefore operators should be grounded whenever he/she comes into contact with the module.
2. Do not touch any of the conductive parts such as the LSI pads; the copper leads on the PCB and the interface terminals with any parts of the human body.
3. Do not touch the connection terminals of the display with bare hand; it will cause disconnection or defective insulation of terminals.
4. The modules should be kept in anti-static bags or other containers resistant to static for storage.
5. Only properly grounded soldering irons should be used.
6. If an electric screwdriver is used, it should be grounded and shielded to prevent sparks.
7. The normal static prevention measures should be observed for work clothes and working benches.
8. Since dry air is inductive to static, a relative humidity of 50-60% is recommended.

Soldering Precautions:

1. Soldering should be performed only on the I/O terminals.
2. Use soldering irons with proper grounding and no leakage.
3. Soldering temperature: 280°C$\pm$10°C
4. Soldering time: 3 to 4 second.
5. Use eutectic solder with resin flux filling.
6. If flux is used, the LCD surface should be protected to avoid spattering flux.
7. Flux residue should be removed.

Operation Precautions:

1. The viewing angle can be adjusted by varying the LCD driving voltage Vo.
2. Since applied DC voltage causes electro-chemical reactions, which deteriorate the display, the applied pulse waveform should be a symmetric waveform such that no DC component remains. Be sure to use the specified operating voltage.
3. Driving voltage should be kept within specified range; excess voltage will shorten display life.
4. Response time increases with decrease in temperature.
5. Display color may be affected at temperatures above its operational range.
6. Keep the temperature within the specified range usage and storage. Excessive temperature and humidity could cause polarization degradation, polarizer peel-off or generate bubbles.
7. For long-term storage over 40°C is required, the relative humidity should be kept below 60%, and avoid direct sunlight.

Limited Warranty

Regal Honour LCDs and modules are not consumer products, but may be incorporated by Regal Honour's customers into consumer products or components thereof, Regal Honour does not warrant that its LCDs and components are fit for any such particular purpose.

1. The liability of Regal Honour is limited to repair or replacement on the terms set forth below. Regal Honour will not be responsible for any subsequent or consequential events or injury or damage to any personnel or user including third party personnel and/or user. Unless otherwise agreed in writing between Regal Honour and the customer, Regal Honour will only replace or repair any of its LCD which is found defective electrically or visually when inspected in accordance with Regal Honour general LCD inspection standard. (Copies available on request)
2. No warranty can be granted if any of the precautions state in handling liquid crystal display above has been disregarded. Broken glass, scratches on polarizer mechanical damages as well as defects that are caused accelerated environment tests are excluded from warranty.
3. In returning the LCD/LCM, they must be properly packaged; there should be detailed description of the failures or defect.