CRYSTAL CLEAR TECHNOLOGY

Product Specification

T700T06X00

(REVISION 3)

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1.0 Table of content

2.0 Record of revision

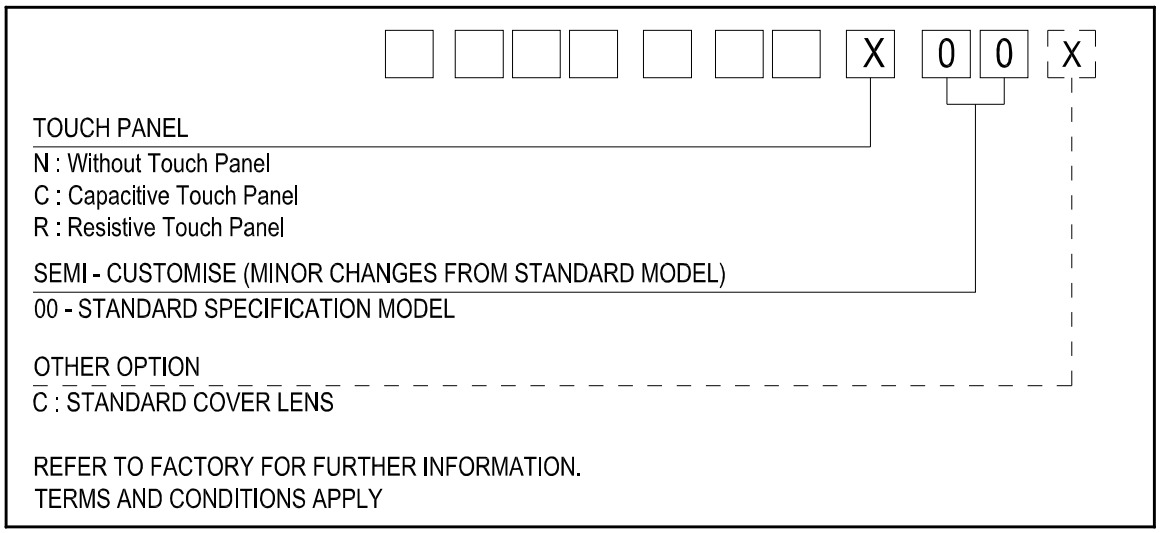
Rev	Date	Item	Page	Comment	Originator	Checked By
1.0	14/11/15			Initial Release	SCChong	Azhar
2.0	10/05/16			Change model no T700X06N00 to T700T06N00, change inspection criteria, and change reliability test condition and change precaution and limited warranty.	Adam	Azhar
3.0	02/09/16			Add RTP version	Azhar	Azhar

3.0 General Specification

T700T06N00 is a TFT-LCD module. It is composed a TFT-LCD panel, LCD display controller, driver IC, and a backlight unit. The 7.0" screen produces 800 X RGB X 480 resolution image. By applying R.G.B. input signal, full colour image are displayed. This product accords with RoHS environmental criterion.

Item	Contents	Unit
LCD type	TFT	---
Viewing Direction (Optimum View)	12	o'clock
Module size (W×H×T)	165x100x3.5	mm
Outline Dimensions	Refer to outline drawing	mm
Active area (W×H)	154.08x85.92	mm
Number of dots	800 X RGB X 480	dots
Operation temperature	-20 ~ +70	℃
Storage temperature	-30 ~ +80	℃
Controller IC	SSD1963	---
Interface mode	8/9/16/18/24 - bit MCU Interface	---
MCU Interface Configuration	8080 Interface	
Back light type/Color	18 white LED	---

AVAILABLE OPTION



4.0 Absolute Maximum Ratings

NO	ITEM	SIMBOL	MIN	MAX	UNIT
1.	Operating Voltage Range	V_{DD}	-0.5	4.6	V
2.	Operating Temperature	T_{op}	-20ºC to +70ºC		°C
3.	Storage Temperature	T_{st}	-30ºC to +80ºC		°C

5.0 Electrical Characteristics

NO	ITEM	SYMBOL	CONDITION	MIN	TYP	MAX	UNIT
1.	Operating Voltage	V_{DD}	-	-	3.3	3.6	V
2.	Current Supply	I_{DD}	-	-	TBD	-	mA
3.	Input Voltage (high)	Vih	H level	0.8 V_{DD}		V_{DD} +0.5	V
4.	Input Voltage (low)	Vil	L level			0.2 V_{DD}	V
5.	Output high voltage	VOH	-	0.8 V_{DD}			V
6.	Output low voltage	VOL	-			0.2 V_{DD}	V

5.1 Backlight Specification

NO	ITEM	SYMBOL	CONDITION	MIN	TYP	MAX	UNIT
1.	Supply Voltage	-	-	-	9.9	-	V
2.	Supply current	If	-	-	160	-	mA
3.	Luminous intensity	Iv	White	200	300	-	Cd/m^2

*Note:
1. Brightness measured at backlight surface.
2. On LCD surface, brightness is only about 10% to 15% of backlight brightness.
3. Lifetime of backlight is 40K hrs.
4. Lifetime of backlight is defined as decay time for backlight brightness to become 50% of its original brightness.
5. Printing color on diffuser will be based on limit sample provided by supplier.
6. The current of LED is 20mA. A LED drive in constant current mode is recommended.
7. LED power consumption is around 0.132W

6.0 Reliability Test Condition

Item		Test Condition
Operating	High Temperature	70degC, 240 hrs
	Low Temperature	-20degC,240 hrs
Storage	High Temperature	80degC, 240hrs and recovery for 2hrs
	Low Temperature	-30degC, 240hrs and recovery for 2hrs
	High Temperature and High Humidity	50degC, 90%RH, 240hrs and recovery for 2 hrs
Thermal	Cycle	RT → 20degC → Rt → 70degC → RT 0min 30min 5min 30min 5min 50 cycles (Power off)
	Shock	RT → 20degV → 70degC 0min 30min 30min 50 cycles (Power off)

Note: RT means Room temperature

7.0 Interface

CN2 – Zif connector, Pitch 0.5mm, Bottom Contact, 45 pins'

Display Controller	SSD1963	
Pin No	**Symbol**	**Description**
1	VLED-	Backlight (-)
2	VLED+	Backlight (+)
3	NC	No Connection
4 – 5	VSS	Ground
6	NC	No Connection
7 – 8	VDD	Power Supply
9	NC	No Connection
10	RST	Hardware Reset
11	CS	Chip Select
12	RS	Data/Command Select
13	RD	Read Strobe Signal
14	WR	Write Strobe signal
15	TE	Tearing Effect
16 - 39	D0 – D23	Data Bus Pins not used should be floating
40 - 45	NC	No Connection

8.0 MCU Interface Timing

8.1 Parallel 8080-Series Interface Timing
(For detail information, please refer to IC specification)

The 8080 mode MCU interface consist of CS#, RS#, RD#, WR#, D[23:0] and TE signals. This interface use WR# to define a write cycle and RD# for read cycle. If the WR# goes low when the CS# signal is low, the data or command will be latched into the system at the rising edge of WR#. Similarly, the read cycle will start when RD# goes low and end at the rising edge of RD#.

8.2 Pixel Data Format

This module support 8-bit, 9-bit, 16-bit, 18-bit and 24-bit data bus. Depending on the width of the data bus, the display data are packed into the data bus in different ways.

Interface	Cycle	D[23]	D[22]	D[21]	D[20]	D[19]	D[18]	D[17]	D[16]	D[15]	D[14]	D[13]	D[12]	D[11]	D[10]	D[9]	D[8]	D[7]	D[6]	D[5]	D[4]	D[3]	D[2]	D[1]	D[0]
24 bits	1st	R7	R6	R5	R4	R3	R2	R1	R0	G7	G6	G5	G4	G3	G2	G1	G0	B7	B6	B5	B4	B3	B2	B1	B0
18 bits	1st							R5	R4	R3	R2	R1	R0	G5	G4	G3	G2	G1	G0	B5	B4	B3	B2	B1	B0
16 bits (565 format)	1st									R5	R4	R3	R2	R1	G5	G4	G3	G2	G1	G0	B5	B4	B3	B2	B1
16 bits	1st									R7	R6	R5	R4	R3	R2	R1	R0	G7	G6	G5	G4	G3	G2	G1	G0
	2nd									B7	B6	B5	B4	B3	B2	B1	B0	R7	R6	R5	R4	R3	R2	R1	R0
	3rd									G7	G6	G5	G4	G3	G2	G1	G0	B7	B6	B5	B4	B3	B2	B1	B0
12 bits	1st													R7	R6	R5	R4	R3	R2	R1	R0	G7	G6	G5	G4
	2nd													G3	G2	G1	G0	B7	B6	B5	B4	B3	B2	B1	B0
9 bits	1st																R5	R4	R3	R2	R1	R0	G5	G4	G3
	2nd																G2	G1	G0	B5	B4	B3	B2	B1	B0
8 bits	1st																	R7	R6	R5	R4	R3	R2	R1	R0
	2nd																	G7	G6	G5	G4	G3	G2	G1	G0
	3rd																	B7	B6	B5	B4	B3	B2	B1	B0

Table 8:1 Pixel Data Format

8.3 8080 Series Interface Timing

Symbol	Parameter		Min	Typ	Max	Unit
f_{MCLK}	System Clock Frequency*		1	-	110	MHz
t_{MCLK}	System Clock Period*		$1/f_{MCLK}$	-	-	ns
t_{PWCSL}	Control Pulse High Width	Write Read	13 30	$1.5* t_{MCLK}$ $3.5* t_{MCLK}$	-	ns
t_{PWCSH}	Control Pulse Low Width	Write (next write cycle) Write (next read cycle) Read	13 80 80	$1.5* t_{MCLK}$ $9* t_{MCLK}$ $9* t_{MCLK}$	-	ns
t_{AS}	Address Setup Time		1	-	-	ns
t_{AH}	Address Hold Time		2	-	-	ns
t_{DSW}	Write Data Setup Time		4	-	-	ns
t_{DHW}	Write Data Hold Time		1	-	-	ns
t_{PWLW}	Write Low Time		12	-	-	ns
t_{DHR}	Read Data Hold Time		1	-	-	ns
t_{ACC}	Access Time		32	-	-	ns
t_{PWLR}	Read Low Time		36	-	-	ns
t_R	Rise Time		-	-	0.5	ns
t_F	Fall Time		-	-	0.5	ns
t_{CS}	Chip select setup time		2	-	-	ns
t_{CSH}	Chip select hold time to read signal		3	-	-	ns

* System Clock denotes external input clock (PLL-bypass) or internal generated clock (PLL-enabled)

Table 8-2: Parallel 8080-series Interface Timing Characteristics

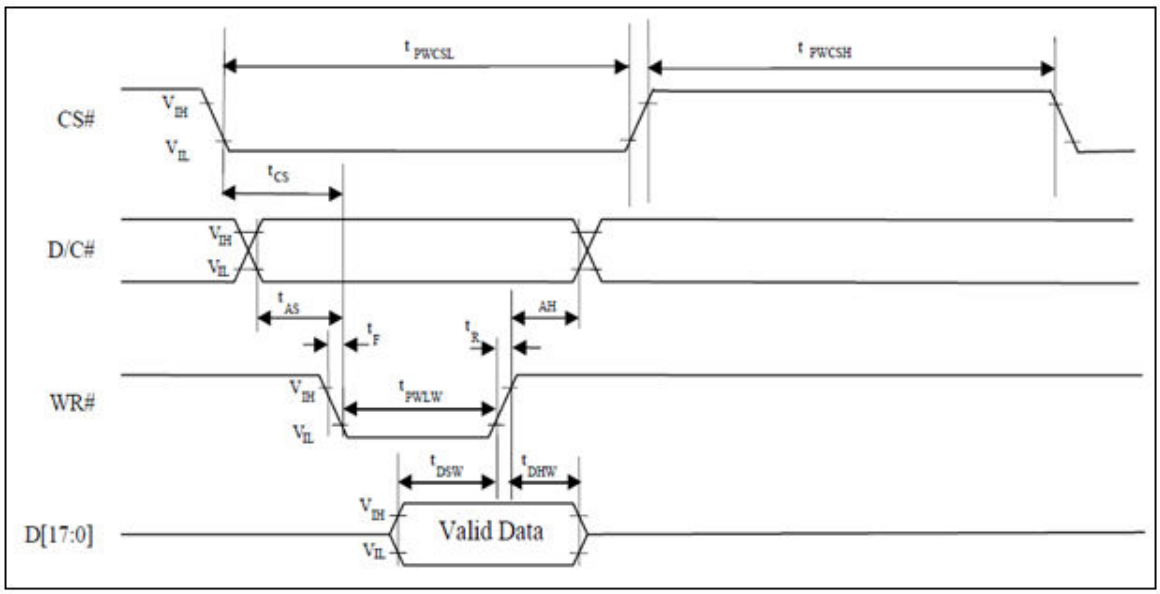


Figure 8-1: Parallel 8080-series Interface Timing Diagram (Write Cycle)

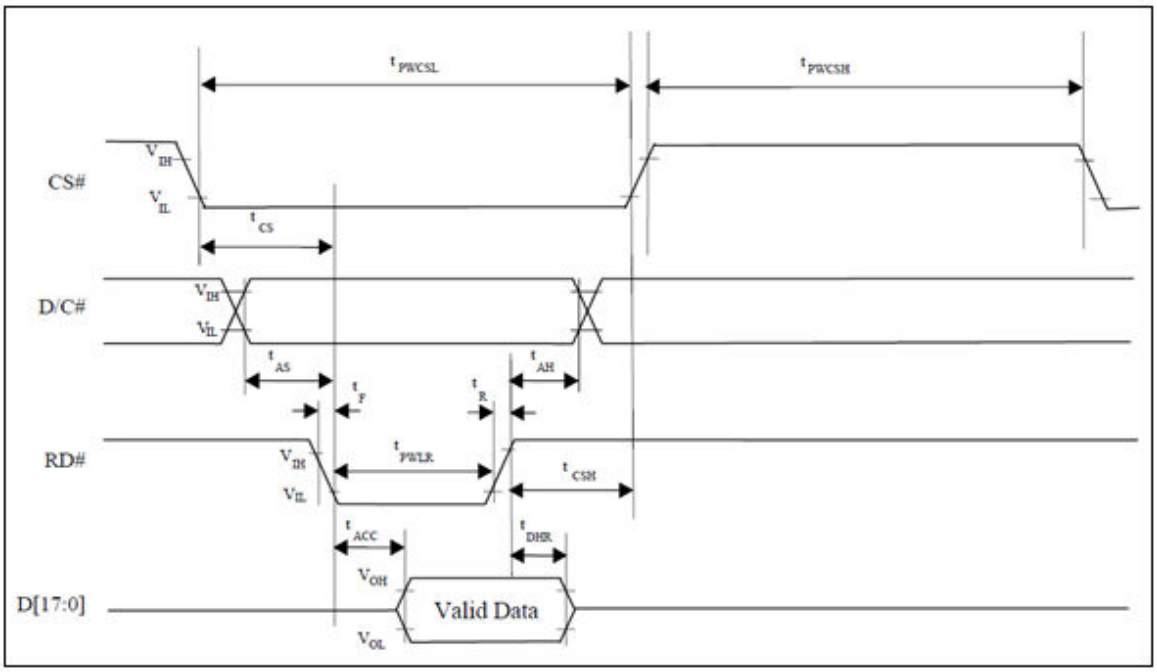


Figure 8-2: Parallel 8080-series Interface Timing Diagram (Read Cycle)

8.4 Parallel LCD Interface Timing

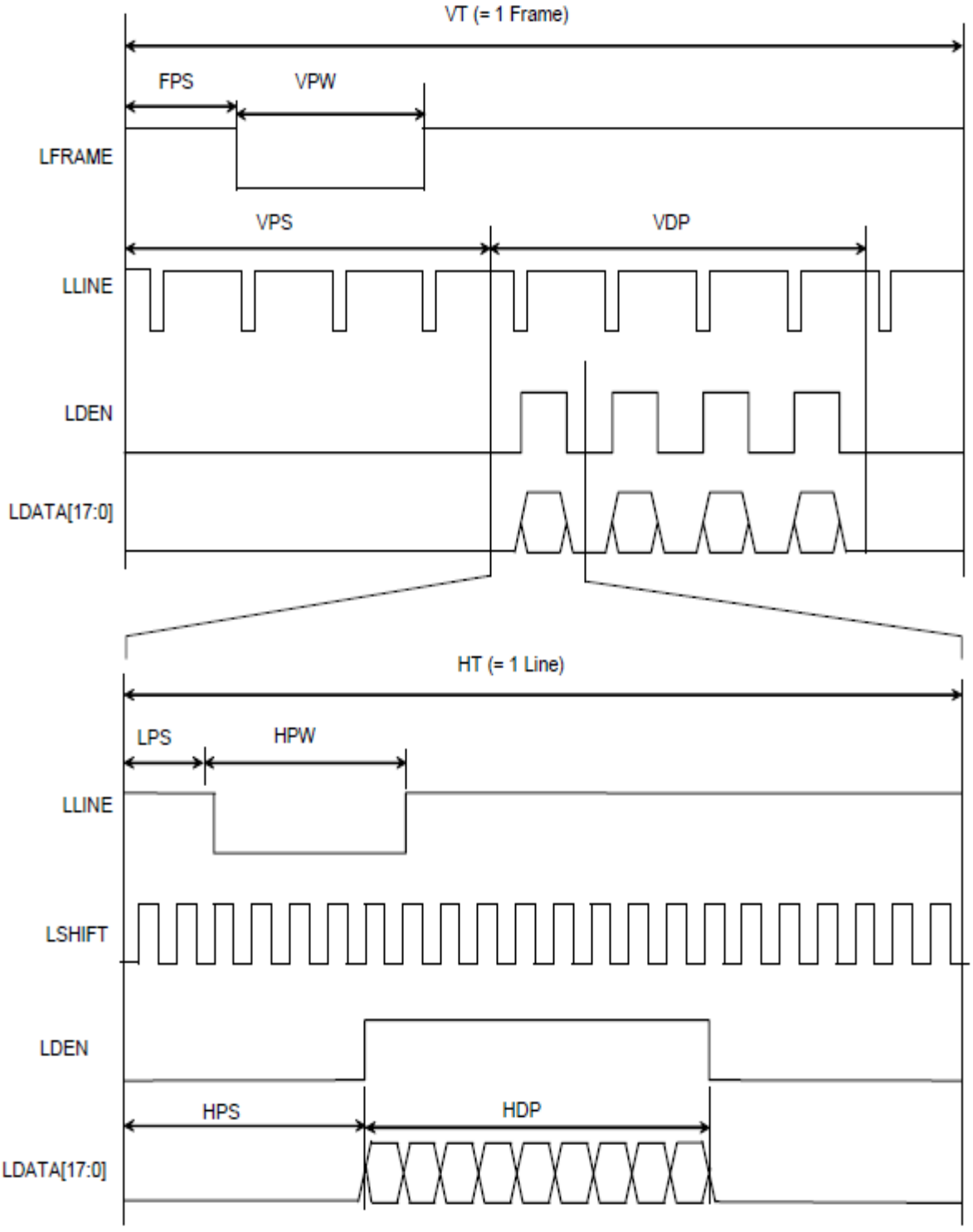


Figure 8-3: General TFT Panel Timing

LCD Parameter setting	Corresponding Command	Register	Maximum Setting	
			Parallel mode	Serial mode
VDP	0xB0	VDP[10:0]	2048 Vertical panel size = (VDP + 1) pixels	
HDP		HDP[10:0]	2048 Horizontal panel size = (HDP + 1) pixels	
LPS	0xB4	LPS[10:0]	2047	8188 (2047 x 4)
HPW		HPW[6:0]	128 (HPW + 1) pixels	512 (128 x4)
HPS		HPS[10:0]	2047	8188 (2047 x 4)
HT		HT[10:0]	2048 Horizontal Total = (HT + 1) lines	
FPS	0xB6	FPS[10:0]	2047	
VPW		VPW[6:0]	128 Vertical Sync Pulse Width = (VPW+1) lines	
VPS		VPS[10:0]	2047	
VT		VT[10:0]	2048 Vertical Total = (VT + 1) lines	

Table 8-2: Quick reference for LCD Parameter Setting

9.0 Instruction Set

Hex Code	Command	Description
0x00	nop	No operation
0x01	soft_reset	Software Reset
0x0A	get_power_mode	Get the current power mode
0x0B	get_address_mode	Get the frame buffer to the display panel read order
0x0C	Reserved	Reserved
0x0D	get_display_mode	The SSD1961 returns the Display Image Mode.
0x0E	get_tear_effect_status	Get the Tear Effect status
0x0F	Reserved	Reserved
0x10	enter_sleep_mode	Turn off the panel. This command will pull low the GPIO0. If GPIO0 is configured as normal GPIO or LCD miscellaneous signal with command set_gpio_conf, this command will be ignored.
0x11	exit_sleep_mode	Turn on the panel. This command will pull high the GPIO0. If GPIO0 is configured as normal GPIO or LCD miscellaneous signal with command set_gpio_conf, this command will be ignored.
0x12	enter_partial_mode	Part of the display area is used for image display.
0x13	enter_normal_mode	The whole display area is used for image display.
0x20	exit_invert_mode	Displayed image colors are not inverted.
0x21	enter_invert_mode	Displayed image colors are inverted.
0x26	set_gamma_curve	Selects the gamma curve used by the display panel.
0x28	set_display_off	Blanks the display panel
0x29	set_display_on	Show the image on the display panel
0x2A	set_column_address	Set the column address
0x2B	set_page_address	Set the page address
0x2C	write_memory_start	Transfer image information from the host processor interface to the SSD1961 starting at the location provided by set_column_address and set_page_address
0x2E	read_memory_start	Transfer image data from the SSD1961 to the host processor interface starting at the location provided by set_column_address and set_page_address
0x30	set_partial_area	Defines the partial display area on the display panel
0x33	set_scroll_area	Defines the vertical scrolling and fixed area on display area
0x34	set_tear_off	Synchronization information is not sent from the SSD1961 to the host processor
0x35	set_tear_on	Synchronization information is sent from the SSD1961 to the host processor at the start of VFP
0x36	set_address_mode	Set the read order from frame buffer to the display panel
0x37	set_scroll_start	Defines the vertical scrolling starting point
0x38	exit_idle_mode	Full color depth is used for the display panel
0x39	enter_idle_mode	Reduce color depth is used on the display panel.
0x3A	Reserved	Reserved
0x3C	write_memory_continue	Transfer image information from the host processor interface to the SSD1961 from the last written location
0x3E	read_memory_continue	Read image data from the SSD1961 continuing after the last read_memory_continue or read_memory_start

Hex Code	Command	Description
0x44	set_tear_scanline	Synchronization information is sent from the SSD1961to the host processor when the display panel refresh reaches the provided scanline
0x45	get_scanline	Get the current scan line
0xA1	read_ddb	Read the DDB from the provided location
0xA8	Reserved	Reserved
0xB0	set_lcd_mode_	Set the LCD panel mode and resolution
0xB1	get_lcd_mode	Get the current LCD panel mode, pad strength and resolution
0xB4	set_hori_period	Set front porch
0xB5	get_hori_period	Get current front porch settings
0xB6	set_vert_period	Set the vertical blanking interval between last scan line and next LFRAME pulse
0xB7	get_vert_period	Set the vertical blanking interval between last scan line and next LFRAME pulse
0xB8	set_gpio_conf	Set the GPIO configuration. If the GPIO is not used for LCD, set the direction. Otherwise, they are toggled with LCD signals.
0xB9	get_gpio_conf	Get the current GPIO configuration
0xBA	set_gpio_value	Set GPIO value for GPIO configured as output
0xBB	get_gpio_status	Read current GPIO status. If the individual GPIO was configured as input, the value is the status of the corresponding pin. Otherwise, it is the programmed value.
0xBC	set_post_proc	Set the image post processor
0xBD	get_post_proc	Set the image post processor
0xBE	set_pwm_conf	Set the image post processor
0xBF	get_pwm_conf	Set the image post processor
0xC0	set_lcd_gen0	Set the rise, fall, period and toggling properties of LCD signal generator 0
0xC1	get_lcd_gen0	Get the current settings of LCD signal generator 0
0xC2	set_lcd_gen1	Set the rise, fall, period and toggling properties of LCD signal generator 1
0xC3	get_lcd_gen1	Get the current settings of LCD signal generator 1
0xC4	set_lcd_gen2	Set the rise, fall, period and toggling properties of LCD signal generator 2
0xC5	get_lcd_gen2	Get the current settings of LCD signal generator 2
0xC6	set_lcd_gen3	Set the rise, fall, period and toggling properties of LCD signal generator 3
0xC7	get_lcd_gen3	Get the current settings of LCD signal generator 3
0xC8	set_gpio0_rop	Set the GPIO0 with respect to the LCD signal generators using ROP operation. No effect if the GPIO0 is configured as general GPIO.
0xC9	get_gpio0_rop	Get the GPIO0 properties with respect to the LCD signal generators.
0xCA	set_gpio1_rop	Set the GPIO1 with respect to the LCD signal generators using ROP operation. No effect if the GPIO1 is configured as general GPIO.
0xCB	get_gpio1_rop	Get the GPIO1 properties with respect to the LCD signal generators.
0xCC	set_gpio2_rop	Set the GPIO2 with respect to the LCD signal generators using ROP operation. No effect if the GPIO2 is configured as general GPIO.

Hex Code	Command	Description
0xCD	get_gpio2_rop	Get the GPIO2 properties with respect to the LCD signal generators.
0xCE	set_gpio3_rop	Set the GPIO3 with respect to the LCD signal generators using ROP operation. No effect if the GPIO3 is configured as general GPIO.
0xCF	get_gpio3_rop	Get the GPIO3 properties with respect to the LCD signal generators.
0xD0	set_dbc_conf	Set the dynamic back light configuration
0xD1	get_dbc_conf	Get the current dynamic back light configuration
0xD4	set_dbc_th	Set the threshold for each level of power saving
0xD5	get_dbc_th	Get the threshold for each level of power saving
0xE0	set_pll	Start the PLL. Before the start, the system was operated with the crystal oscillator or clock input
0xE2	set_pll_mn	Set the PLL
0xE3	get_pll_mn	Get the PLL settings
0xE4	get_pll_status	Get the current PLL status
0xE5	set_deep_sleep	Set deep sleep mode
0xE6	set_lshift_freq	Set the LSHIFT (pixel clock) frequency
0xE7	get_lshift_freq	Get current LSHIFT (pixel clock) frequency setting
0xE8	Reserved	Reserved
0xE9	Reserved	Reserved
0xF0	set_pixel_data_interface	Set the pixel data format of the parallel host processor interface
0xF1	get_pixel_data_interface	Get the current pixel data format settings
0xFF	Reserved	Reserved

10.0 Optical Characteristics

ITEM		SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNIT	NOTE
Panel Transmittance		T	---	4.8	5.1	--	%	
Response Time		Tr +Tf	Point-5	--	25	35	ms	1
Viewing Angle	Horizontal	ϕ	Point-5 CR≥10	120	140	--	°	2
	Vertical	θ		100	120	--	°	2
Color Filter Chromacicity	White	x	$\theta=\phi=0°$	0.273	0.313	0.353		3
		y		0.289	0.329	0.369		3
	Red	x	$\theta=\phi=0°$	(0.562)	(0.602)	(0.642)		3
		y		(0.297)	(0.337)	(0.377)		3
	Greer	x	$\theta=\phi=0°$	(0.309)	(0.349)	(0.389)		3
		y		(0.547)	(0.587)	(0.627)		3
	Blue	x	$\theta=\phi=0°$	(0.123)	(0.163)	(0.203)		3
		y		(0.074)	(0.114)	(0.154)		3

Note 1: Definition of Response Time.(White-Black)
The response tme is defined as the time interval between the 10% and 90% amplitudes.

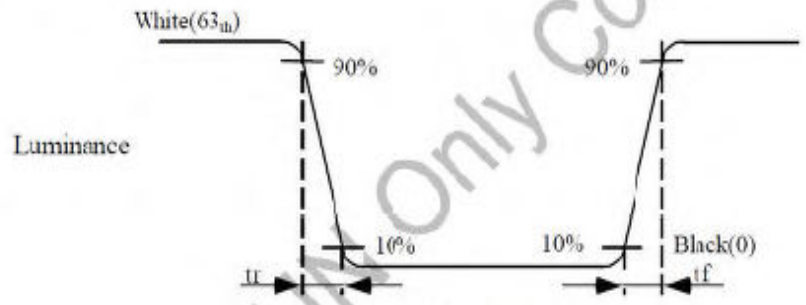


Fig.6-1 Measuring point

Note 2: Definition of Viewing Angle(θ,ψ)

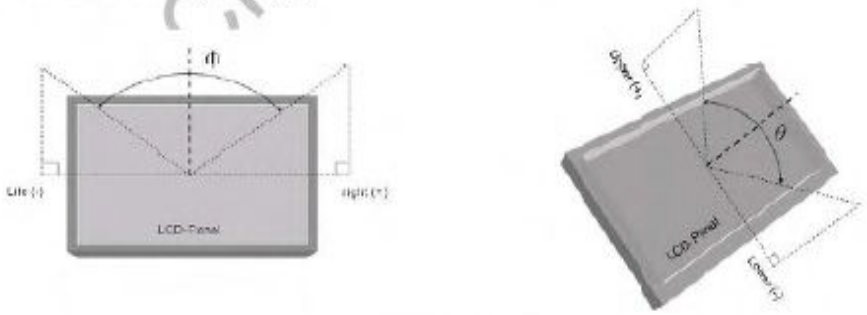


Fig.6-2 Definition of Viewing Angle

Note 3: Under C light

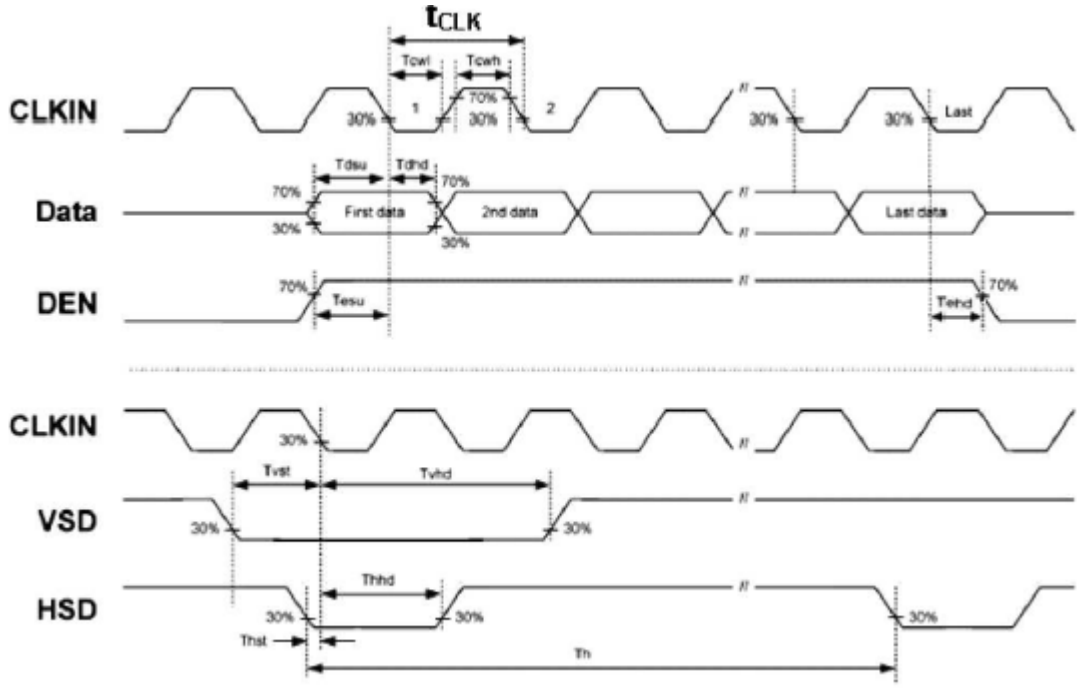
11.0 AC Characteristics

LCD supports DE mode and Sync mode timing. The mode was decided by DE signal internally. When DE is pulled low, will uses HS+VS for timing control and this timing mode is sync mode. When DE is pulled high for active data and pulled low for blanking data, LCD uses DE for timing control and this timing mode is DE mode. The detail timing chart showed below

11.1 Parallel RGB Input Timing requirement

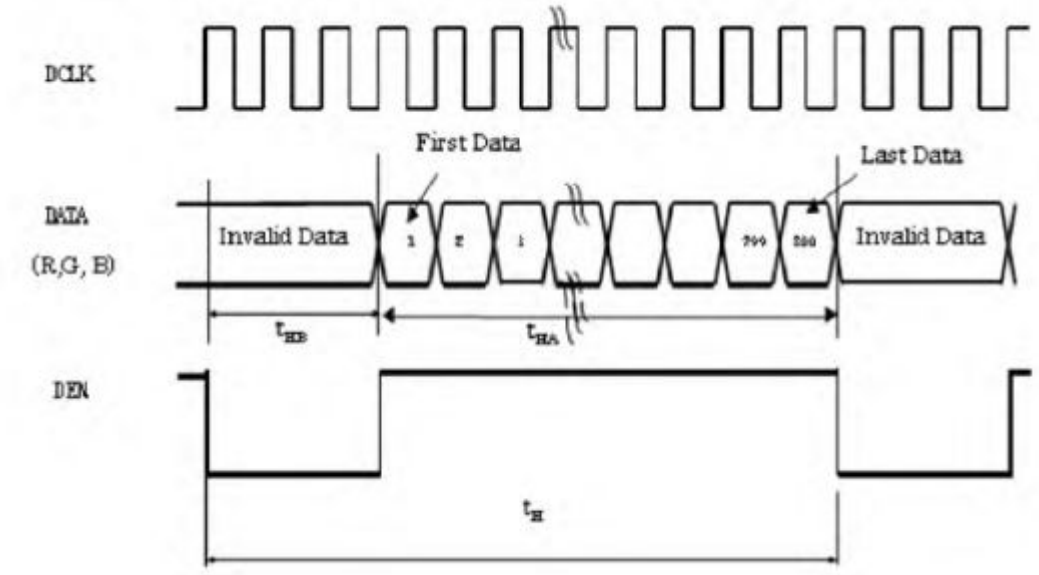
ITEM		SYMBOL	MIN.	TYP.	MAX.	UNIT	Note
DCLK	Dot Clock	$1/t_{CLK}$	29	33	38	MHz	
	DCLK pulse duty	Tcwh	40	50	60	%	
DE	Setup Time	Tesu	8	-	-	ns	
	Hold time	Tehd	8	-	-	ns	
	Horizontal Period	t_H	1026	1056	1086	t_{CLK}	
	Horizontal Valid	t_{HA}		800		t_{CLK}	
	Horizontal Blank	t_{HB}	226	256	286	t_{CLK}	
	Vertical Period	t_V	515	525	535	t_H	
	Vertical Valid	t_{VA}		480		t_H	
	Vertical Blank	t_{VB}	35	45	55	t_H	
SYNC	HSYNC Setup Time	Thst	8	-	-	ns	
	HSYNC Hold Time	Thhd	8	-	-	ns	
	VSYNC Setup Time	Tvst	8	-	-	ns	
	VSYNC Hold Time	Tvhd	8	-	-	ns	
	Horizontal Period	th	1026	1056	1086	t_{CLK}	
	Horizontal Pulse Width	thpw	-	30	-	t_{CLK}	thb + thpw=46DCLK is fixed
	Horizontal Back Porch	thb	-	16	-	t_{CLK}	
	Horizontal Front Porch	thfp	180	210	240	t_{CLK}	
	Horizontal Valid	thd		800		t_{CLK}	
	Vertical Period	tv	515	525	535	th	
	Vertical Pulse Width	tvpw	-	13	-	th	tvpw + tvb = 23th is fixed
	Vertical Back Porch	tvb	-	10	-	th	
	Vertical Front Porch	tvfp	12	22	32	th	
	Vertical Valid	tvd		480		th	
DATA	Setup Time	Tdsu	8	-	-	ns	
	Hold Time	Tdhd	8	-	-	ns	

11.2 Clock and data input diagram

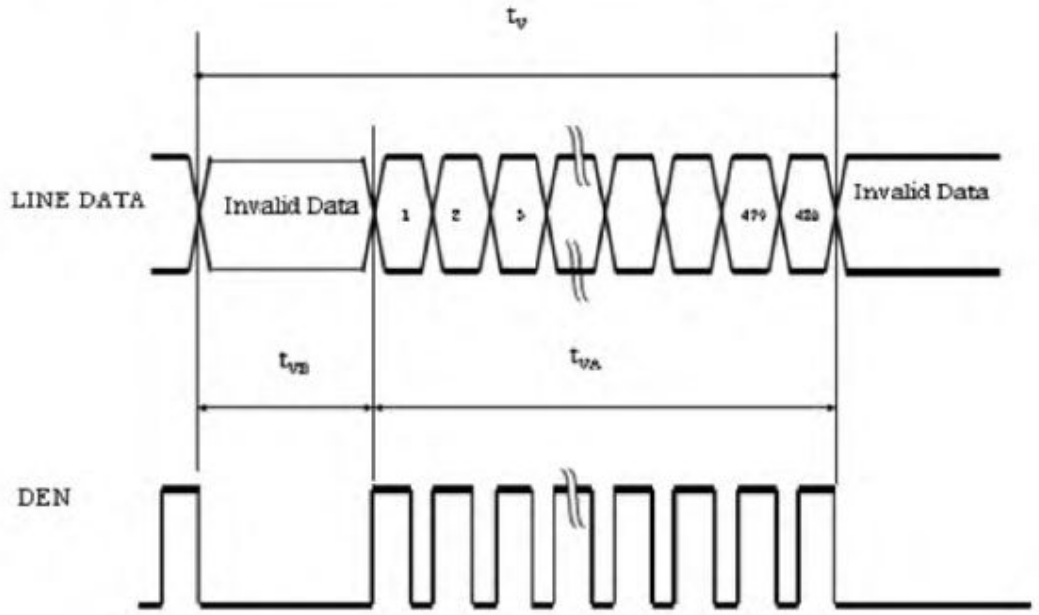


11.2.1 **DE Mode**

Horizontal timing :

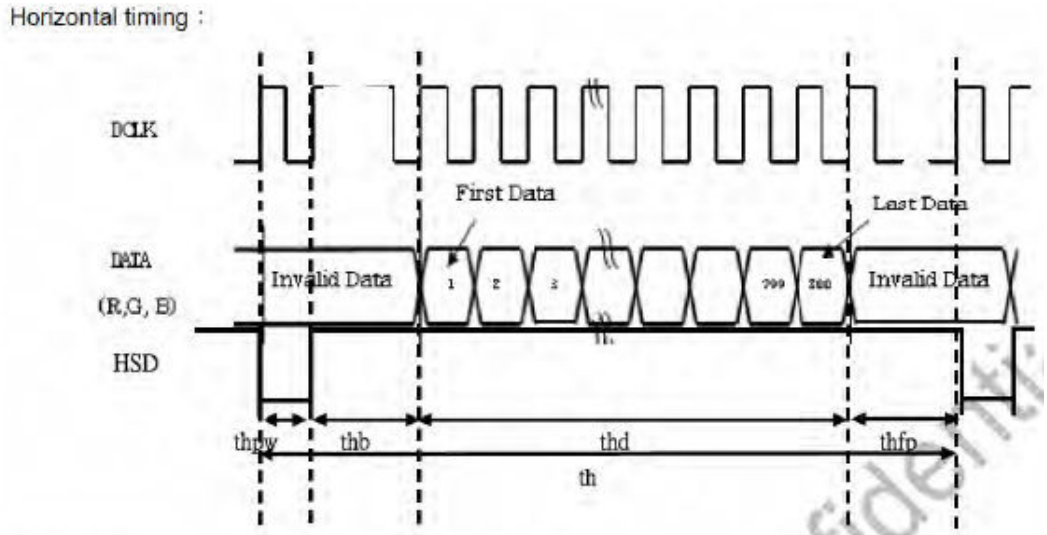


Vertical timing :

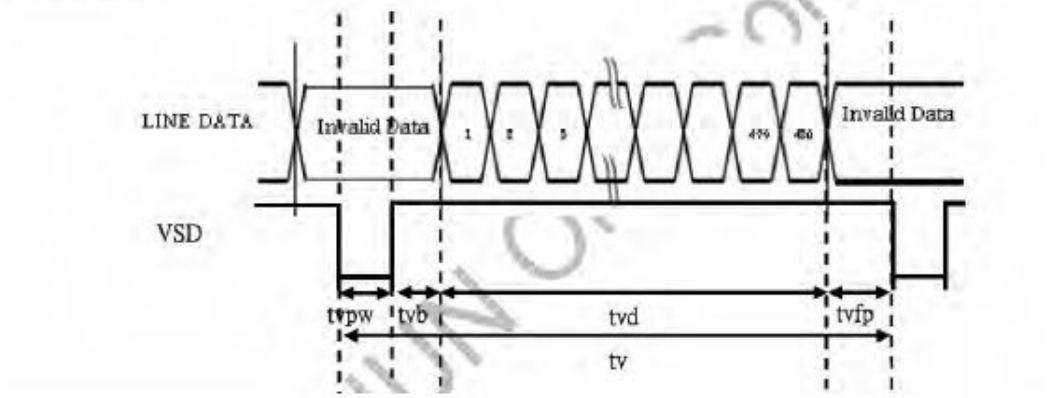


11.2.2 **SYNC Mode**

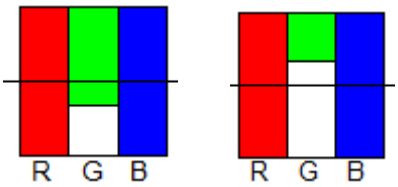
Horizontal timing :

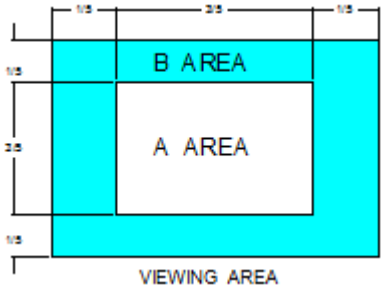
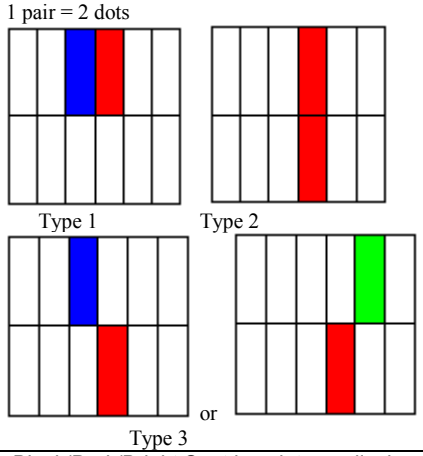
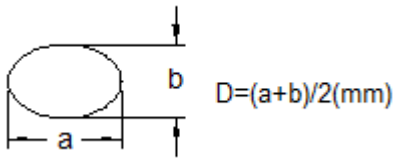
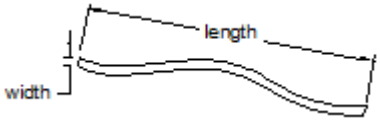


Vertical timing :



12.0 Inspection Criteria

<table>
<tr><th>No</th><th>Defect</th><th>Definition of defect</th><th>Inspection Criteria</th></tr>
<tr><td rowspan="3">1</td><td>a) Definition of dot</td><td>The size of defective dot over ½ of whole is regards as one defective dot.
Smaller than ½ Larger than ½
 

'No dot defect' (ignore) '1 dot defect' (counted)</td><td>A – Viewing area
B – Viewing area
C – Outside Viewing area
 
</td></tr>
<tr><td>b) Bright Dot
c) Dark Dot</td><td>Dot appear bright and unchanged in size when LCD panel is displaying black pattern
Dot appear dark and unchanged in size when LCD panel is displaying pure color (RED, GREEN or BLUE) pattern</td><td><table><tr><th>Defect</th><th>A</th><th>B</th><th>C</th></tr><tr><td>Bright Dot</td><td>1</td><td>1</td><td rowspan="3">NC</td></tr><tr><td>Dark Dot</td><td>2</td><td>2</td></tr><tr><td>Total</td><td colspan="2">4</td></tr></table>NC – Not Count</td></tr>
<tr><td>d) 2 dot adjacent</td><td>1 pair = 2 dots
 
</td><td><table><tr><th>Defect</th><th>Acc. Count</th></tr><tr><td>2 Bright dot Adjacent</td><td>0</td></tr><tr><td>2 Dark dot Adjacent</td><td>1</td></tr></table></td></tr>
<tr><td>2</td><td>Black spot
White Spot
Bright spot
Pin Hole
Foreign Particle</td><td>-Black/Dark/Bright Spot is points on display which appear dark/bright and usually result from contamination
- These defect do not vary in size intensity (contrast) when contras is varied.
 
</td><td><table><tr><th>Defect Category</th><th>A</th><th>B</th></tr><tr><td>D ≤ 0.10</td><td>NC</td><td rowspan="4">NC</td></tr><tr><td>0.10 ≤ D ≤ 0.20</td><td>2</td></tr><tr><td>0.20 ≤ D ≤ 0.30</td><td>1</td></tr><tr><td>D ≥ 0.30</td><td>0</td></tr></table></td></tr>
<tr><td>3</td><td>Black Line
White line
Particle between POL and Glass
Scratch on Glass</td><td> 
</td><td><table><tr><th>Defect Category</th><th>A</th><th>B</th></tr><tr><td>W ≤ 0.03</td><td>NC</td><td rowspan="3">NC</td></tr><tr><td>0.03 ≤ W ≤ 0.08, L ≤2.0</td><td>2</td></tr><tr><td>W ≥ 0.08</td><td>0</td></tr></table></td></tr>
<tr><td>4</td><td>POL Bubble
POL Dented</td><td></td><td><table><tr><th>Defect Category</th><th>A</th><th>B</th></tr><tr><td>D ≤ 0.20</td><td>NC</td><td rowspan="4">NC</td></tr><tr><td>0.20 ≤ D ≤ 0.30</td><td>3</td></tr><tr><td>0.30 ≤ D ≤ 0.50</td><td>2</td></tr><tr><td>D ≥ 0.5</td><td>0</td></tr></table></td></tr>
<tr><td>5</td><td>Mura
(50% Grey)</td><td></td><td>Judged by Limit sample</td></tr>
</table>

13.0 Precaution for Using TFT Modules

1. Handing Precautions
   a. The display panel is made of glass and polarizer. As glass is fragile. It tends to chip during handling especially on the edges. Please avoid dropping or jarring. Do not subject it to a mechanical shock of impact or by dropping it.
   b. If the display panel is damaged and the liquid crystal substance leaks out, be sure not to get any in your mouth. If the substance is in contact with your skin or clothes, wash it off using soap and water.
   c. Do not apply excessive force to the display surface or the adjoining areas since this may cause the color tone to vary. Do not touch the display with bare hands. This will stain the display area and degrade the insulation between terminals. Scratch and dents may occur on polarizer too.
   d. The polarizer covering the display surface of the LCD module is soft and easily scratched. Handle this polarizer carefully. Do not touch, push or rub the exposed polarizers with anything harder than a HB pencil lead (glass, tweezers, etc.). Do not put or attach anything on the display area to avoid leaving marks on it. Condensation on the surface and contact with terminals due to cold will damage, stain or dirty the polarizer. After products are tested at low temperature they must be warmed up in a container before coming in to contact with room temperature air.
   e. If the display surface becomes contaminated, breathe on the surface and gently wipe it with a soft dry cloth. If it is heavily contaminated, moisten cloth with one of the following solvents
      - Isopropyl alcohol
      - Ethyl alcohol
      - Do not scrub hard to avoid damaging the display surface.
   f. Solvents other than those above-mentioned may damage the polarizer. Especially, do not use the following.
      - Water
      - Ketone
      - Aromatic solvents
      - Wipe off saliva or water drops immediately, contact with water over a long period of time may cause deformation or colour fading. Avoid contact with oil and fats.
   g. Exercise care to minimize corrosion of the electrode. Corrosion of the electrodes is accelerated by water droplets, moisture condensation or a current flow in a high-humidity environment.
   h. Install the LCD Module by using the mounting holes. When mounting the LCD module make sure it is free of twisting, warping and distortion. In particular, do not forcibly pull or bend the I/O cable or the backlight cable.
   i. Do not attempt to disassemble or process the LCD module.
   j. NC terminal should be open. Do not connect anything.
   k. If the logic circuit power is off, do not apply the input signals.
   l. Electro-Static Discharge Control. Since this module uses a CMOS LSI, the same careful attention should be paid to electrostatic discharge as for an ordinary CMOS IC. To prevent destruction of the elements by static electricity, be careful to maintain an optimum work environment.
      - Before removing LCM from its packing case or incorporating it into a set, be sure the module and your body have the same electric potential. Be sure to ground the body when handling the LCD modules.
      - Tools required for assembly, such as soldering irons, must be properly grounded. Make certain the AC power source for the soldering iron does not leak. When using an electric screwdriver to attach LCM, the screw driver should be of ground potentiality to minimize as much as possible

any transmission of electromagnetic waves produced sparks coming from the commutator of the motor.
- To reduce the amount of static electricity generated, do not conduct assembly and other work under dry conditions. To reduce the generation of static electricity be careful that the air in the work environment is not too dry. A relative humidity of 50%-60% is recommended. As far as possible make the electric potential of your work clothes and that of the work bench the ground potential.
- The LCD module is coated with a film to protect the display surface. Exercise care when peeling off this protective film since static electricity may be generated.

m. Since LCM has been assembled and adjusted with a high degree of precision, avoid applying excessive shocks to the module or making any alterations or modifications to it.
- Do not alter, modify or change the shape of the tab on the metal frame.
- Do not make extra holes on the printed circuit board, modify its shape or change the positions of components to be attached.
- Do not damage or modify the pattern writing on the printed circuit board.
- Absolutely do not modify the zebra rubber strip (conductive rubber) or heat seal connector.
- Except for soldering the interface, do not make any alterations or modifications with a soldering iron.
- Do not drop, bend or twist the LCM.

2. Storage Precautions

When storing the LCD modules, the following precaution are necessary.

a. Store them in a sealed polyethylene bag. If properly sealed, there is no need for the desiccant.
b. Store them in a dark place. Do not expose to sunlight or fluorescent light, keep the temperature between 0□C and 35□C, and keep the relative humidity between 40%RH and 60%RH.
c. The polarizer surface should not come in contact with any other objects.

3. Others

a. Liquid crystals solidify under low temperature (below the storage temperature range) leading to defective orientation or the generation of air bubbles (black or white). Air bubbles may also be generated if the module is subject to a low temperature.
b. If the LCD modules have been operating for a long time showing the same display patterns, the display patterns may remain on the screen as ghost images and a slight contrast irregularity may also appear. A normal operating status can be regained by suspending use for some time. It should be noted that this phenomenon does not adversely affect performance reliability.
c. To minimize the performance degradation of the LCD modules resulting from destruction caused by static electricity etc. Exercise care to avoid holding the following sections when handling the modules.

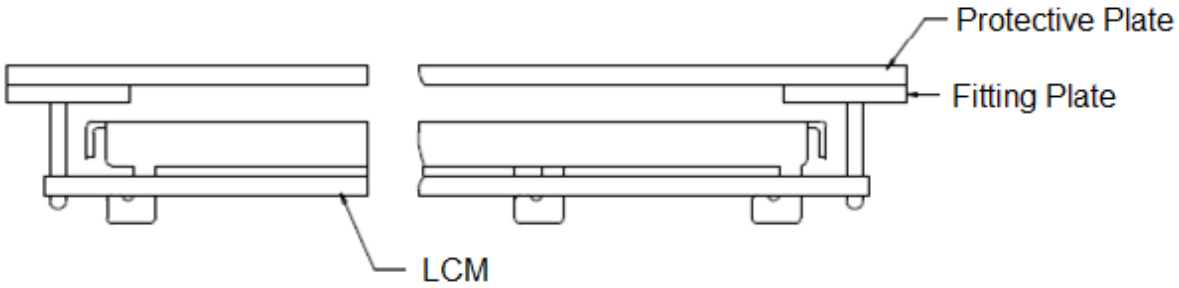
Exposed area of the printed circuit board.
Terminal electrode sections.

4. Using LCD Modules

a. Installing LCD Modules

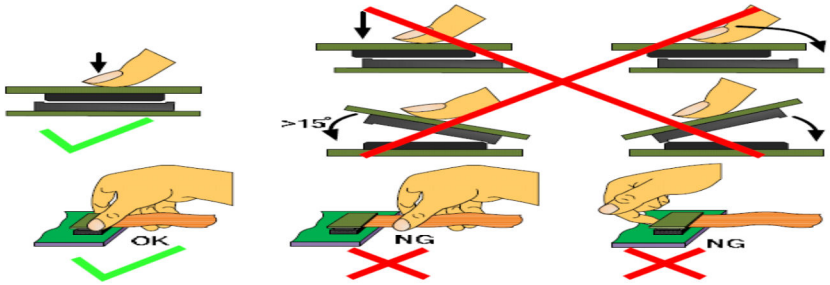
The hole in the printed circuit board is used to fix LCM as shown in the picture below.
Attend to the following items when installing the LCM.

b. Cover the surface with a transparent protective plate to protect the polarizer and LC cell.



c. When assembling the LCM into other equipment, the spacer to the bit between the LCM and the fitting plate should have enough height to avoid causing stress to the module surface, refer to the individual specifications for measurements. The measurement tolerance should be 0.1mm.

d. Precaution for assemble the module with BTB connector:
Please note the position of the male and female connector position, don't assemble or assemble like the method which the following picture shows



5. Precaution for soldering the LCM

	Manual soldering	Machine drag soldering	Machine press soldering
No RoHS Product	290°C ~350°C. Time: 3-5S.	330°C ~350°C. Speed: 4-8 mm/s.	300°C ~330°C. Time: 3-6S. Press: 0.8~1.2Mpa
RoHS Product	340°C ~370°C. Time: 3-5S.	350°C ~370°C. Time: 4-8 mm/s.	330°C ~360°C. Time: 3-6S. Press: 0.8~1.2Mpa

a. If soldering flux is used, be sure to remove any remaining flux after finishing the soldering operation (This does not apply in the case of a non-halogen type of flux). It is recommended that you protect the LCD surface with a cover during soldering to prevent any damage due to flux spatters.

b. When soldering the electroluminescent panel and PC board, the panel and board should not be detached more than three times. This maximum number is determined by the temperature and time conditions mentioned above, though there may be some variance depending on the temperature of the soldering iron.

c. When removing the electroluminescent panel from the PC board, be sure the solder has completely melted, the soldered pad on the PC board could be damaged.

6. Precautions for Operation

a. Viewing angle varies with the change of liquid crystal driving voltage (VLCD). Adjust VLCD to show the best contrast.

b. It is recommended to drive LCD's within the specified voltage limit since over limit will cause shorter LCD life. An electrochemical reaction due to direct current causes LCD-deterioration. Avoid the use of direct current drive.

c. Response time will be extremely delayed at lower temperature compared to room operating temperature range and on the other hand, at higher temperature LCD shows dark color in them. However those phenomena do not mean malfunction. The LCD will return to normal performance when ambient temperature revert to room condition.
d. If the display area is pushed hard during operation, the display will become abnormal. However, it will return to normal if it is turned off and on.
e. A slight dew depositing on terminals is a cause for electro-chemical reaction resulting in terminal open circuit.
f. Input logic voltage before apply analogue high voltage such as LCD driving voltage when power on. Remove analogue high voltage before logic voltage when power off the module. Input each signal after the positive/negative voltage becomes stable.
g. Please keep the temperature within the specified range for use and storage. Polarization degradation, bubble generation or polarizer peel-off may occur with high temperature and high humidity.

7. Safety
   a. It is recommended to crush damaged or unnecessary LCDs into pieces and wash them off with solvents such as acetone and ethanol, which should later be burned.
   b. If any liquid leaks out of a damaged glass cell and comes in contact with the hands, wash off thoroughly with soap and water.

8. Limited Warranty

   Unless otherwise agreed between Crystal Clear Technology and customer, Crystal Clear Technology will replace or repair any of its LCD and LCM which is found to be defective electrically and visually when inspected in accordance with Crystal Clear Technology acceptance standards, for a period of one year from date of shipment. Confirmation of such date shall be based on freight documents. The warranty liability of Crystal Clear Technology is limited to repair and/or replacement on the terms set forth above. Crystal Clear Technology will not responsible for any subsequent or consequential events.

9. Return LCM under Warranty

   No warranty can be granted if the precautions stated above have been disregarded. The typical examples of violations are:
   - Broken LCD glass
   - PCB eyelet's damaged or modified
   - PCB conductors damaged
   - Circuit modified in any way, including addition of components.
   - PCB tampered with by grinding, engraving or painting varnish.
   - Soldering to, or modifying the bezel in any manner.

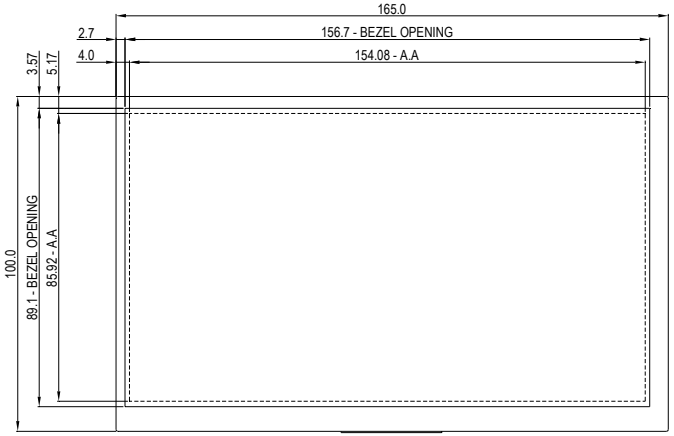
   Module repairs will be invoiced to customer upon mutual agreement. Modules must be returned with sufficient description of failure or defects. Any connectors or cable installed by customer must be removed completely without damaging the PCB eyelet's, conductors and terminals.

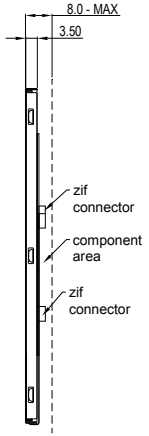
   .

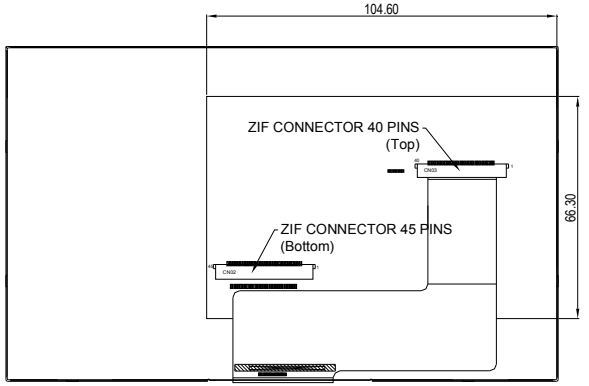
14.0 Mechanical Specification

CN 2 PIN TABLE

1	VLED-
2	VLED+
3	NC
4	VSS
5	VSS
6	NC
7	VDD
8	VDD
9	NC
10	RST
11	CS
12	RS
13	RD
14	WR
15	TE
16	D0
17	D1
18	D2
19	D3
20	D4
21	D5
22	D6
23	D7
24	D8
25	D9
26	D10
27	D11
28	D12
29	D13
30	D14
31	D15
32	D16
33	D17
34	D18
35	D19
36	D20
37	D21
38	D22
39	D23
40	NC
41	NC
42	NC
43	NC
44	NC
45	NC

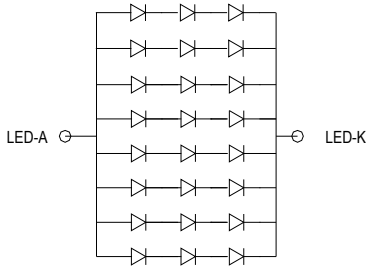






NOTE:
1. GENERAL TOLERANCE TO BE±0.3mm
2. DISPLAY MODE: a_si TFT/ TRANSMISSIVE/ NORMAL WHITE
3. OPERATING TEMPERATURE: -20°C TO +70°C
4. STORAGE TEMPERATURE: -30°C TO +80°C
5. GRAPHIC CONTROLLER: SSD1963 OR EQUIVALENT
5. RoSH COMPLIANCE

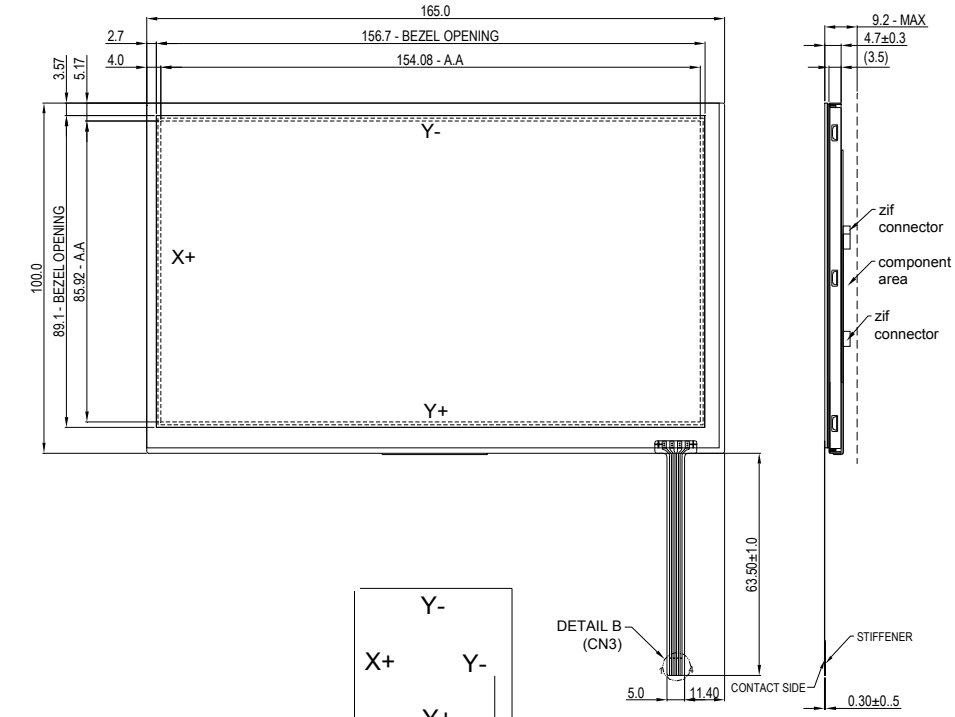
LED CIRCUIT DIAGRAM

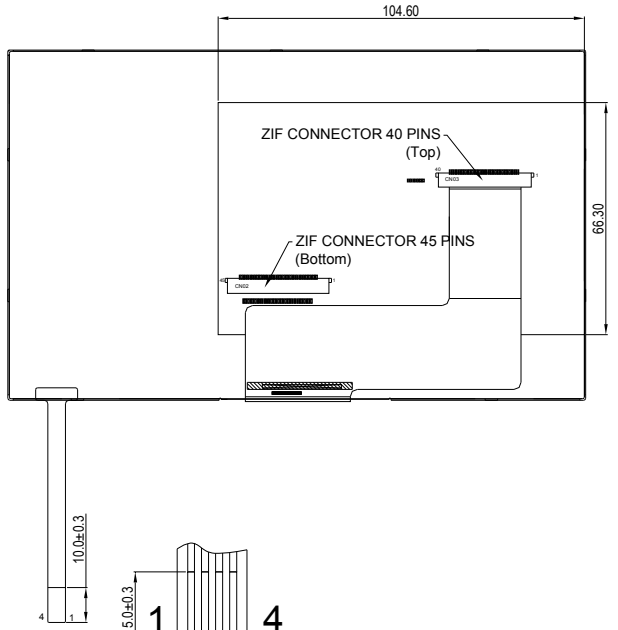


CRYSTAL CLEAR TECHNOLOGY SDN BHD 16, JLN TP5, TMN PERINDUSTRIAN SIME UEP, 47600 SUBANG JAYA, SELANGOR DARUL EHSAN.				PART NAME MECHANICAL SPECIFICATION	
APPROVED	CHECKED	DRAWN HAFIZAH 10-11-2015	UNIT : MM NTS	DRAWING NUMBER T700T06N00	SHEET 1/1
					REV. 1

CN 2 PIN TABLE

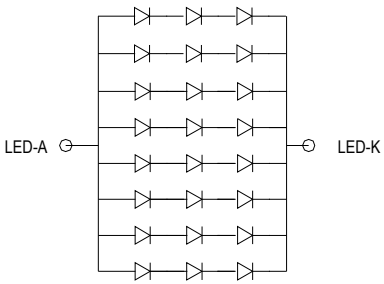
1	VLED-
2	VLED+
3	NC
4	VSS
5	VSS
6	NC
7	VDD
8	VDD
9	NC
10	RST
11	CS
12	RS
13	RD
14	WR
15	TE
16	D0
17	D1
18	D2
19	D3
20	D4
21	D5
22	D6
23	D7
24	D8
25	D9
26	D10
27	D11
28	D12
29	D13
30	D14
31	D15
32	D16
33	D17
34	D18
35	D19
36	D20
37	D21
38	D22
39	D23
40	NC
41	NC
42	NC
43	NC
44	NC
45	NC





DETAIL B
SCALE 4:1

LED CIRCUIT DIAGRAM



CN 3 PIN TABLE

PIN	1	2	3	4
OUT	X+	Y+	X-	Y-

NOTE:
1. GENERAL TOLERANCE TO BE±0.3mm
2. DISPLAY MODE: a_si TFT/ TRANSMISSIVE/ NORMAL WHITE
3. OPERATING TEMPERATURE: -20°C TO +70°C
4. STORAGE TEMPERATURE: -30°C TO +80°C
5. GRAPHIC CONTROLLER: SSD1963 OR EQUIVALENT
5. RoSH COMPLIANCE

CRYSTAL CLEAR TECHNOLOGY SDN BHD
16, JLN TP5, TMN PERINDUSTRIAN SIME UEP,
47600 SUBANG JAYA, SELANGOR DARUL EHSAN.

PART NAME: MECHANICAL SPECIFICATION

APPROVED	CHECKED	DRAWN	UNIT : MM	DRAWING NUMBER	SHEET	REV.
		HAFIZAH 10-11-2015	NTS	T700T06R00	1/1	1