



# Disea Electronics Co., LTD

E-mail:sales@diseaelec.com    URL:www.diseaelec.com

ADD: 4F,#3 Building, TianFuAn Industrial park,  
LeZhuJiao, ZhouShi Road,XiXiang Town, BaoAn  
District, ShenZhen City, GuangDong Province , China

## PRODUCT SPECIFICATIONS

For Customer: \_\_\_\_\_

: APPROVAL FOR SPECIFICATION

Customer Model No. \_\_\_\_\_

: APPROVAL FOR SAMPLE

Module No.: ZW-T028BQIA-24

Date : 2023-05-05

### Table of Contents

No.	Item	Page
1	Cover Sheet(Table of Contents)	P1
2	Revision Record	P2
3	General Specifications	P3
4	Outline Drawing	P4
5	Absolute Maximum Ratings	P5
6	Electrical Specifications	P6-P10
7	Optical Characteristics	P11-P14
8	Reliability Test Items and Criteria	P15
9	Precautions for Use of LCD Modules	P16-P17

### For Customer's Acceptance:

Approved By	Comment

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



## 3. General Specifications

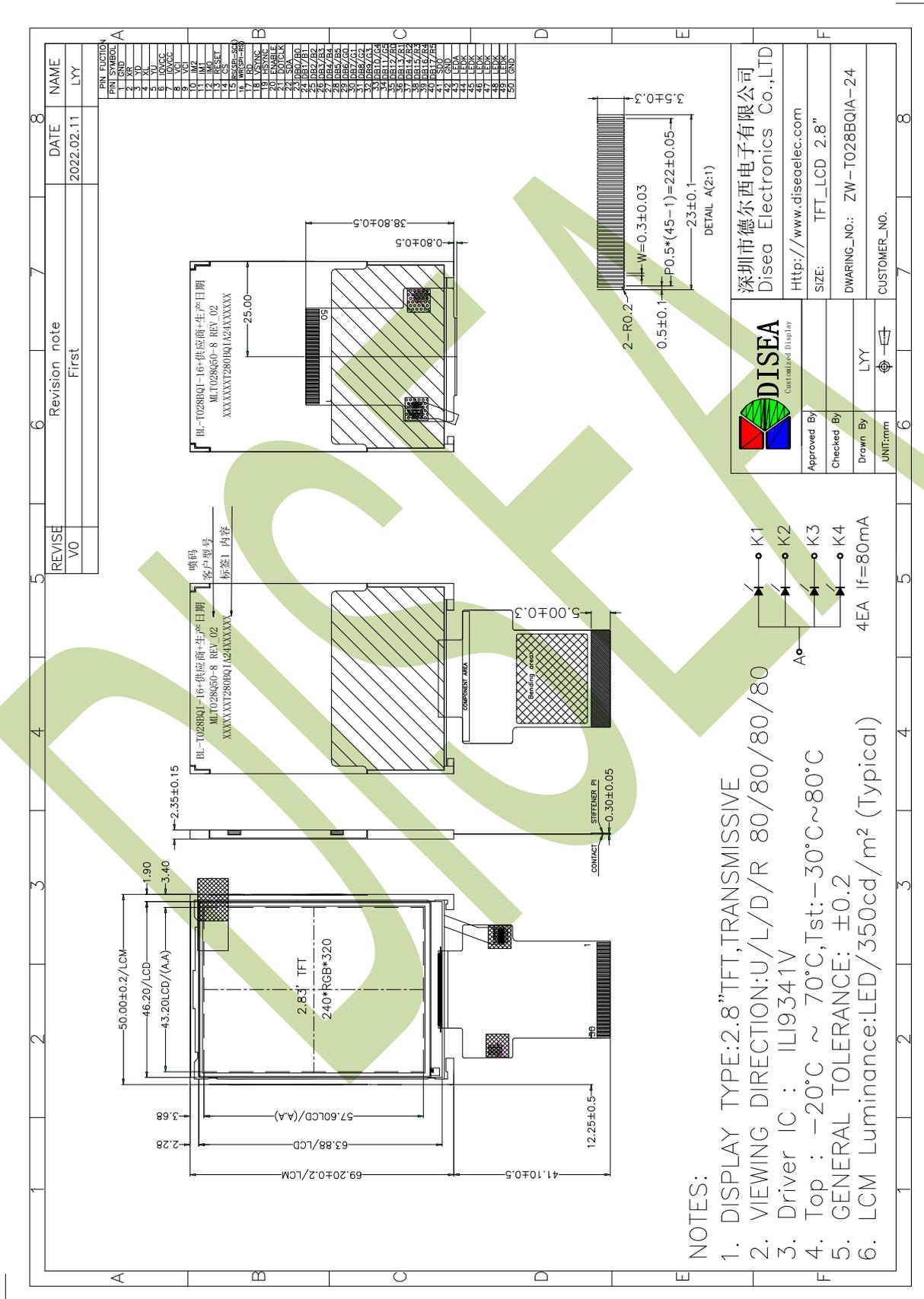
ZW-T028BQIA-24 is a TFT-LCD module. It is composed of a TFT-LCD panel, driver IC, FPC, a back light unit. The 2.83" display area contains 240X(RGB)x320 pixels and can display up to 262K colors. This product accords with ROHS environmental criterion.

Item	Contents	Unit	Note
LCD Type	TFT	-	
Display color	262K		1
Viewing Direction	ALL	O'Clock	
Gray scale inversion direction	FREE	O'Clock	
Operating temperature	-20~+70	°C	
Storage temperature	-30~+80	°C	
Module size	50.00X69.20X2.35	mm	2
Active Area(W×H)	43.20X57.60	mm	
Number of Dots	240×320	dots	
Controller	ILI9341V	-	
Power Supply Voltage	2.8	V	
Backlight	4-LEDs (white)	pcs	
Weight	---	g	
Interface	RGB/MCU/SPI	-	

Note 1: Color tune is slightly changed by temperature and driving voltage.

Note 2: Without FPC and Solder.

## 4.Outline.Drawing



## 5. Absolute Maximum Ratings( $T_a=25^\circ\text{C}$ )

### 5.1 Electrical Absolute Maximum Ratings.( $V_{SS}=0\text{V}$ , $T_a=25^\circ\text{C}$ )

Item	Symbol	Min.	Max.	Unit	Note
Power Supply Voltage	VCI	-0.3	4.6	V	1.2
	IOVCC	-0.3	4.6		

Notes:1. If the module is above these absolute maximum ratings. It may become permanently damaged. Using the module within the following electrical characteristic conditions are also exceeded, the module will malfunction and cause poor reliability.

- 2.  $V_{DVDD} > V_{SS}$  must be maintained.
- 3. Please be sure users are grounded when handing LCD Module.

### 5.2 Environmental Absolute Maximum Ratings.

Item	Storage		Operating		Note
	MIN.	MAX.	MIN.	MAX.	
Ambient Temperature	$-30^\circ\text{C}$	$80^\circ\text{C}$	$-20^\circ\text{C}$	$70^\circ\text{C}$	1,2
Humidity	-	-	-	-	3

- 1. The response time will become lower when operated at low temperature.
- 2. Background color changes slightly depending on ambient temperature.  
The phenomenon is reversible.
- 3.  $T_a \leq 40^\circ\text{C}$ : 85%RH MAX.  
 $T_a > 40^\circ\text{C}$ : Absolute humidity must be lower than the humidity of 85%RH at  $40^\circ\text{C}$ .

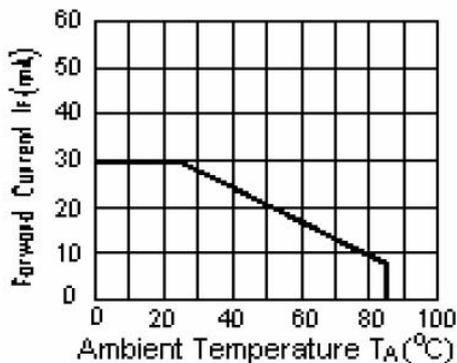
## 6. Electrical Specifications

### 6.1 Electrical characteristics ( $V_{SS}=0V, T_a=25^\circ C$ )

Parameter	Symbol	Condition	Min	Typ	Max	Unit	Note
Power supply	VCI	$T_a=25^\circ C$	2.6	2.8	3.3	V	
	IOVCC	$T_a=25^\circ C$	1.65	1.8	3.3	V	
Input voltage	'H'	$V_{IH}$	IOVCC=1.8V	$0.7 \cdot IOVCC$	-	IOVCC	V
	'L'	$V_{IL}$	IOVCC=1.8V	0	-	$0.3 \cdot IOVCC$	V

### 6.2 LED backlight specification ( $V_{SS}=0V, T_a=25^\circ C$ )

Item	Symbol	Condition	Min	Typ	Max	Unit	Note
Supply voltage	$V_f$	$I_f=80mA$	2.7	3.0	3.3	V	
Uniformity	$\Delta B_p$	$I_f=80mA$	75	80	-	%	
Life Time	time	$I_f=80mA$	30K	-	-	hours	1



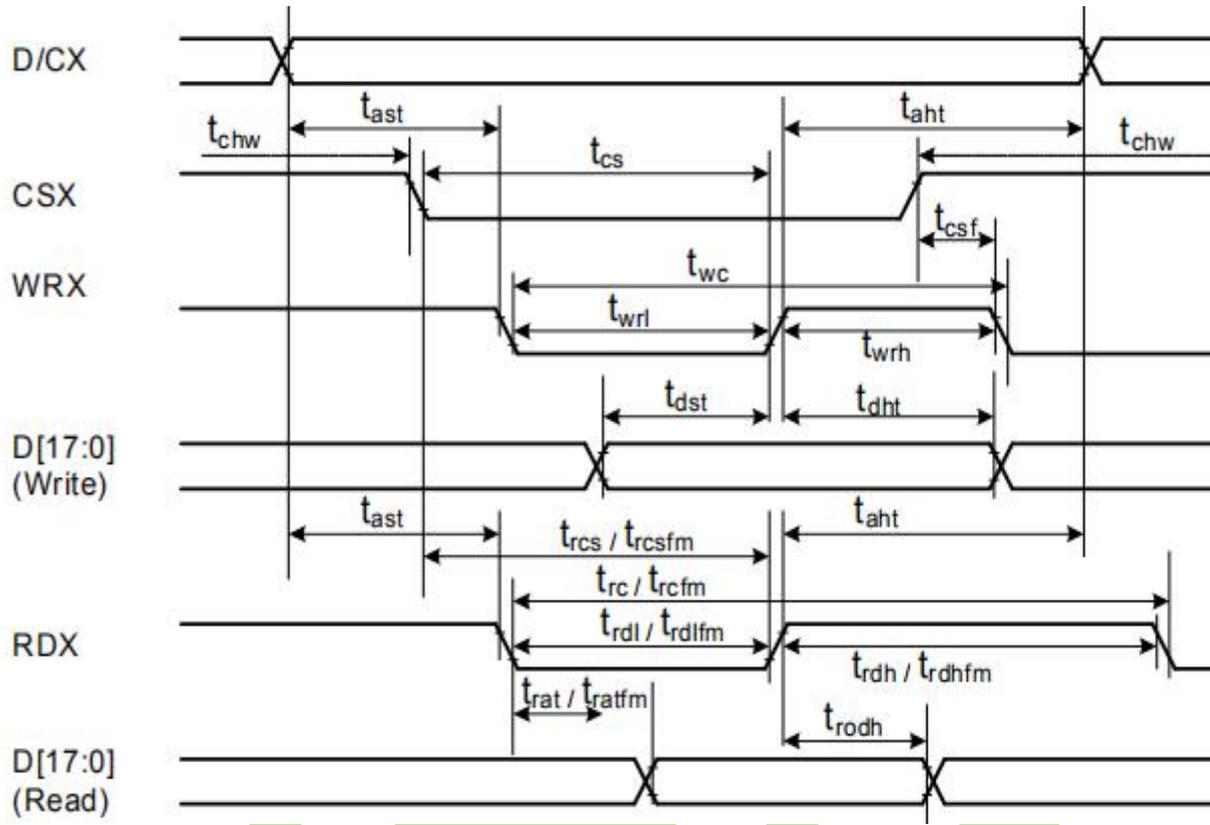
Note 1: Brightness to be decreased to 50% of the initial value at ambient temperature  $T_A=25^\circ C$

## 6.3 Interface signals

Pin No	Symbol	I/O	Function				
1	GND	P	Ground				
2	XR	I	RTP Pin, Please NC				
3	YD	I					
4	XL	I					
5	YU	I					
6-7	IOVCC	P	Power Supply for IO				
8-9	VCI	P	Power Supply for logic				
10	IM2	I	IM2	IM1	IM0	Interface Mode	DB Pin in use
			0	0	0	80 MCU 16-bit bus	D[17:10], D[8:1]
11	IM1	I	0	0	1	80 MCU 8-bit bus	D[17:10]
			0	1	0	80 MCU 18-bit bus	D[17:0]
12	IM0	I	0	1	1	80 MCU 9-bit bus	D[17:9]
			1	0	1	3-wire 9-bit data serial	SDI: In ,SDO: Out
			1	1	0	4-wire 8-bit data serial	SDI: In ,SDO: Out
13	RESET	I	Reset signal, Signal is active low				
14	CS	I	Chip select input pin				
15	RS(SPI-SC L)	I	Display data/command selection pin in parallel interface. This pin is used to be serial interface clock.				
16	WR(SPI-RS )	I	Write enable in MCU parallel interface Display data/command selection pin in serial interface.				
17	RD	I	Read enable in MCU parallel interface.				
18	VSYNC	I	Vertical (Frame) synchronizing input signal for RGB interface operation				
19	HSYNC	I	Horizontal (Line) synchronizing input signal for RGB interface operation				
20	ENABLE	I	Data enable signal for RGB interface operation				
21	DOTCLK	I	Dot clock signal for RGB interface operation.				
22	SDA	I	SPI interface data input /output pin.				
23-40	DB0-DB17	I	Data input				
41	SDO	O	SPI interface data output pin.				
42	GND	P	Ground				
43	LEDA	P	LED anode				
44-49	LEDK	P	LED cathode				
50	GND	P	Ground				

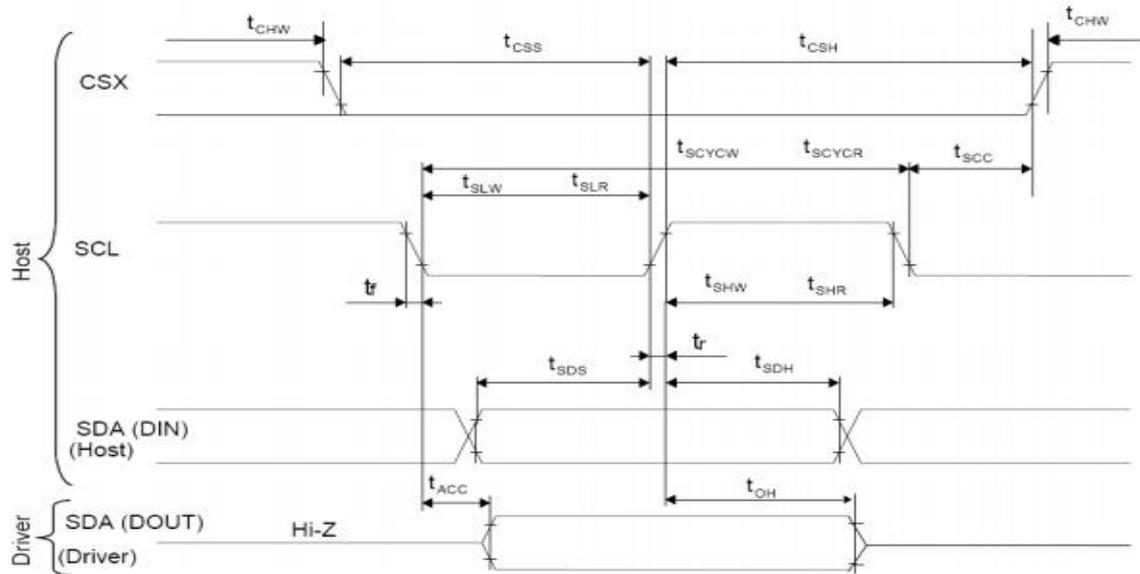
## 6.4 AC Characteristics

**8080 Series MCU Parallel Interface Characteristics: 18/16/9/8-bit Bus**



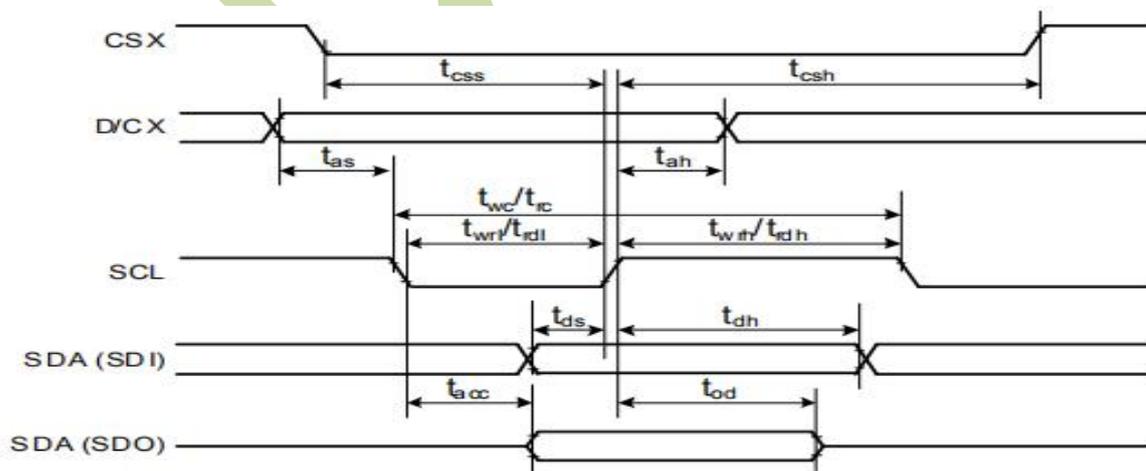
Signal	Symbol	Parameter	min	max	Unit	Description
DCX	$t_{ast}$	Address setup time	0	-	ns	
	$t_{ah}$	Address hold time (Write/Read)	0	-	ns	
CSX	$t_{chw}$	CSX "H" pulse width	0	-	ns	
	$t_{cs}$	Chip Select setup time (Write)	15	-	ns	
	$t_{rcs}$	Chip Select setup time (Read ID)	45	-	ns	
	$t_{rcsfm}$	Chip 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	
	$t_{rdhfm}$	Read Control H duration (FM)	90	-	ns	
	$t_{rdlfm}$	Read Control L duration (FM)	355	-	ns	
RDX (ID)	$t_{rc}$	Read cycle (ID)	160	-	ns	
	$t_{rdh}$	Read Control pulse H duration	90	-	ns	
	$t_{rdl}$	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	
	$t_{rod}$	Read output disable time	20	80	ns	

## Serial Interface Characteristics (3-line serial):



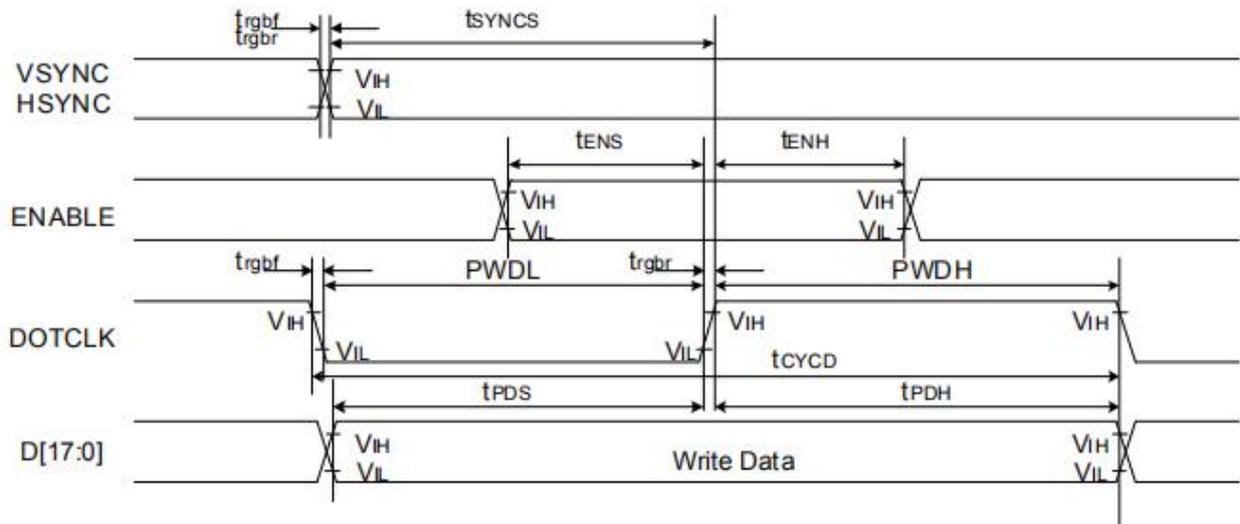
Signal	Symbol	Parameter	min	max	Unit	Description
SCL	tscycw	Serial Clock Cycle (Write)	100	-	ns	
	tshw	SCL "H" Pulse Width (Write)	40	-	ns	
	tslw	SCL "L" Pulse Width (Write)	40	-	ns	
	tscyrc	Serial Clock Cycle (Read)	150	-	ns	
	tshr	SCL "H" Pulse Width (Read)	60	-	ns	
SDA / SDI (Input)	tsds	Data setup 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	tsc	SCL-CSX	20	-	ns	
	tchw	CSX "H" Pulse Width	40	-	ns	
	tcss	CSX-SCL Time	60	-	ns	
	tcsh		65	-	ns	

## Serial Interface Characteristics (4-line serial):



Signal	Symbol	Parameter	min	max	Unit	Description
CSX	tcss	Chip select time (Write)	40	-	ns	
	tcsh	Chip select hold time (Read)	40	-	ns	
SCL	twc	Serial clock cycle (Write)	100	-	ns	
	twrh	SCL "H" pulse width (Write)	40	-	ns	
	twrl	SCL "L" pulse width (Write)	40	-	ns	
	trc	Serial clock cycle (Read)	150	-	ns	
	trdh	SCL "H" pulse width (Read)	60	-	ns	
	trdl	SCL "L" pulse width (Read)	60	-	ns	
D/CX	tas	D/CX setup time	10	-		
	tah	D/CX hold time (Write / Read)	10	-		
SDA / SDI (Input)	tds	Data setup time (Write)	30	-	ns	
	tdh	Data hold time (Write)	30	-	ns	
SDA / SDO (Output)	tacc	Access time (Read)	10	-	ns	For maximum CL=30pF
	tod	Output disable time (Read)	10	50	ns	For minimum CL=8pF

### RGB Interface Timing 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	50	-	ns	
	$t_{rgbr}, t_{rgbf}$	DOTCLK, HSYNC, VSYNC rise/fall time	-	15	ns	

## 7. Optical Characteristics

Item	Symbol	Condition	Min.	Typ.	Max.	Unit	Note
Brightness	Bp	$\theta=0^\circ$ $\Phi=0^\circ$	-	500	-	Cd/m <sup>2</sup>	1
Uniformity	$\Delta$ Bp		75	80	-	%	1,2
Viewing Angle	3:00	Cr $\geq$ 10	-	80	-	Deg	3
	6:00		-	80	-		
	9:00		-	80	-		
	12:00		-	80	-		
Contrast Ratio	Cr	$\theta=0^\circ$ $\Phi=0^\circ$	500	800	-	-	4
Response Time	T <sub>r</sub> +T <sub>f</sub>		-	30	35	ms	5
Color of CIE Coordinate	W	x	-0.05	TBD	+0.05	-	1,6
		y		TBD		-	
	R	x		TBD		-	
		y		TBD		-	
	G	x		TBD		-	
		y		TBD		-	
	B	x		TBD		-	
		y		TBD		-	
NTSC Ratio	S	65	70	-	%		

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

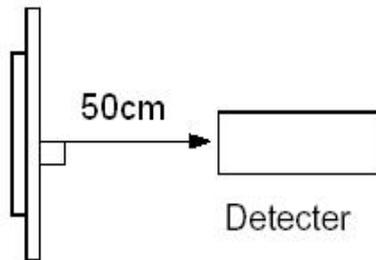
Note 1: The data are measured after LEDs are turned on for 5 minutes. LCM displays full white.

The brightness is the average value of 9 measured spots. Measurement equipment BM-7 (Φ5mm)

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 5 minutes while backlight turning on.

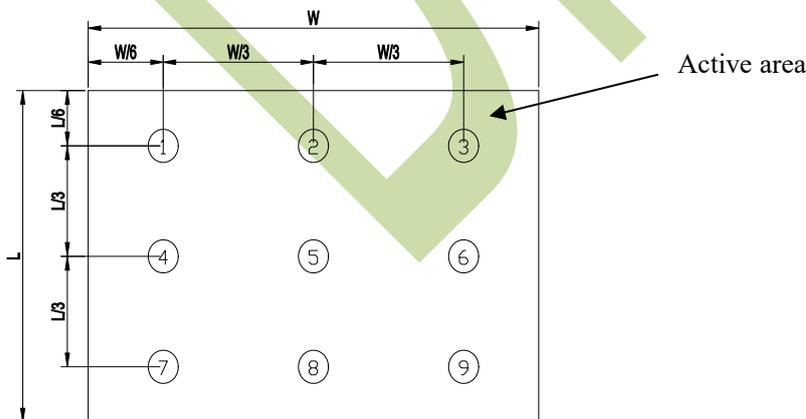


Note 2: The luminance uniformity is calculated by using following formula.

$$\Delta B_p = B_p (\text{Min.}) / B_p (\text{Max.}) \times 100 (\%)$$

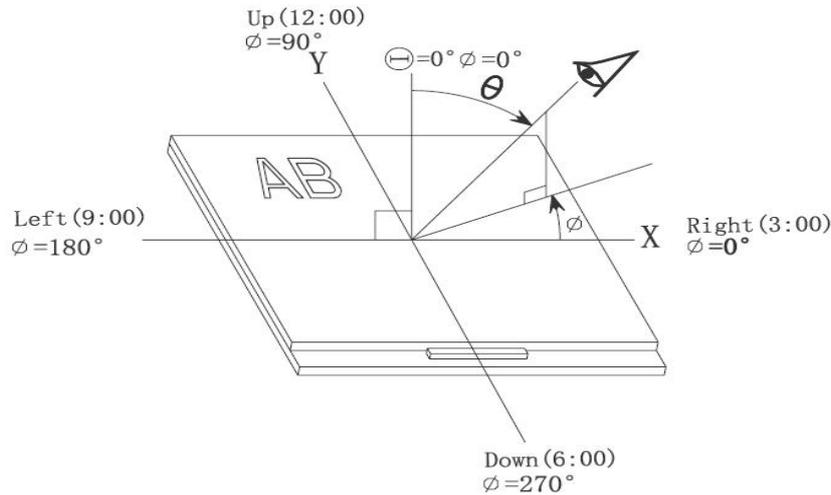
$B_p (\text{Max.})$  = Maximum brightness in 9 measured spots

$B_p (\text{Min.})$  = Minimum brightness in 9 measured spots.

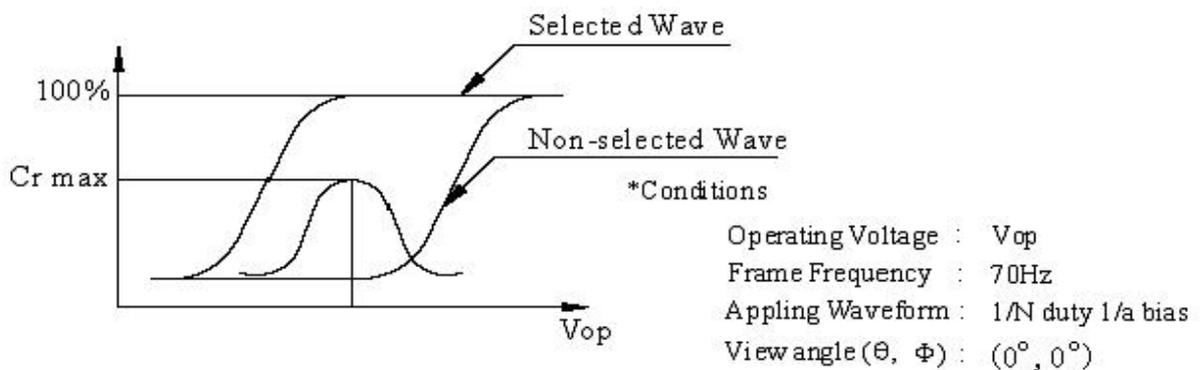


Note 3: The definition of viewing angle:

Refer to the graph below marked by  $\theta$  and  $\Phi$



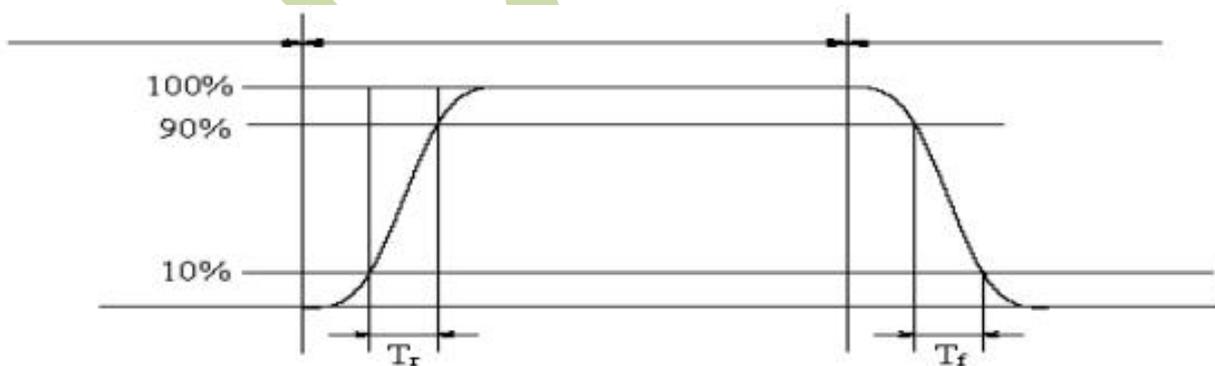
Note 4: Definition of contrast ratio.( Test LCD using DMS501)



$$\text{Contrast ratio}(Cr) = \frac{\text{Brightness of selected dots}}{\text{Brightness of non-selected dots}}$$

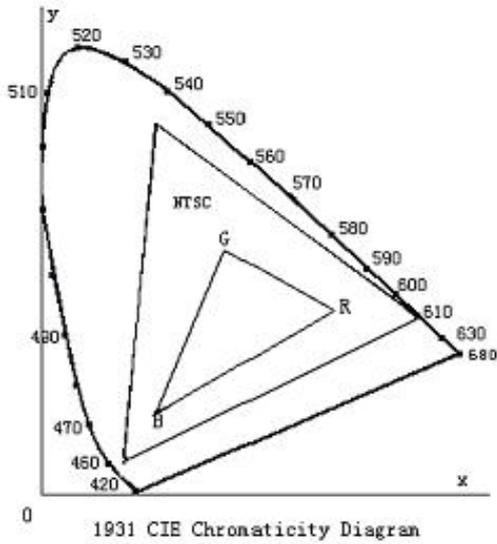
Note 5: Definition of Response time. (Test LCD using DMS501):

The output signals of photo detector are measured when the input signals are changed from "black" to "white" (falling time) and from "white" to "black" (rising time), respectively. The response time is defined as the time interval between the 10% and 90% of amplitudes. Refer to figure as below.



The definition of response time

Note 6: Definition of Color of CIE Coordinate and NTSC Ratio.

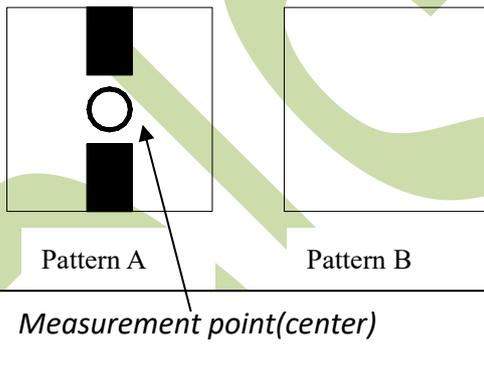


Color gamut:

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

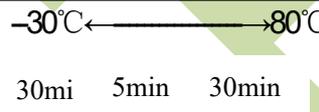
Note 7: Definition of cross talk.

Cross talk ratio(%) =  $\frac{|\text{pattern A Brightness} - \text{pattern B Brightness}|}{\text{pattern A Brightness}} \times 100$



Electric volume value =  $3F \pm 3Hex$

## 8. Reliability Test Items and Criteria

No	Test Item	Test condition	Criterion
1	High Storage Temperature	80°C±2°C 96H Restore 2H at 25°C Power off	1. After testing, cosmetic and electrical defects should not happen. 2. Total current consumption should not be more than twice of initial value.
2	Low Storage Temperature	-30°C±2°C 96H Restore 2H at 25°C Power off	
3	High Operation Temperature	70°C±2°C 96H Restore 2H at 25°C Power on	
4	Low Operation Temperature	-20°C±2°C 96H Restore 4H at 25°C Power on	
5	High Temperature/Humidity Operation	60°C±2°C 90%RH 96H Power on	
6	Temperature Cycle	 after 5 cycle, Restore 2H at 25°C Power off	

Note: Operation: Supply 2.8V for logic system.

The inspection terms after reliability test, as below

ITEM	Inspection
Contrast	CR>50%
IDD	IDD<200%
Brightness	Brightness>60%
Color Tone	Color Tone+/-0,05

## **9. Precautions for Use of LCD Modules**

### **9.1 Handling Precautions**

9.1.1 *The display panel is made of glass. Do not subject it to a mechanical shock by dropping it from a high place, etc.*

9.1.2 *If the display panel is damaged and the liquid crystal substance inside it leaks out, be sure not to get any in your mouth, if the substance comes into contact with your skin or clothes, promptly wash it off using soap and water.*

9.1.3 *Do not apply excessive force to the display surface or the adjoining areas since this may cause the color tone to vary.*

9.1.4 *The polarizer covering the display surface of the LCD module is soft and easily scratched. Handle this polarizer carefully.*

9.1.5 *If the display surface is contaminated, breathe on the surface and gently wipe it with a soft dry cloth. If still not completely clear, moisten cloth with one of the following solvents:*

— Isopropyl alcohol      — Ethyl alcohol

*Solvents other than those mentioned above may damage the polarizer. Especially, do not use the following:*

— Water                      — Ketone                      — Aromatic solvents

9.1.6 *Do not attempt to disassemble the LCD Module.*

9.1.7 *If the logic circuit power is off, do not apply the input signals.*

9.1.8 *To prevent destruction of the elements by static electricity, be careful to maintain an optimum work environment.*

a. *Be sure to ground the body when handling the LCD Modules.*

b. *Tools required for assembly, such as soldering irons, must be properly ground.*

c. *To reduce the amount of static electricity generated, do not conduct assembly and other work under dry conditions.*

d. *The LCD Module is coated with a film to protect the display surface. Be care when peeling off this protective film since static electricity may be generated.*

## **9.2 Storage precautions**

9.2.1 *When storing the LCD modules, avoid exposure to direct sunlight or to the light of fluorescent lamps.*

9.2.2 *The LCD modules should be stored under the storage temperature range. If the LCD modules will be stored for a long time, the recommend condition is:*

*Temperature :        0 °C ~ 40 °C*

*Relatively humidity: ≤80%*

9.2.3 *The LCD modules should be stored in the room without acid, alkali and harmful gas.*

**9.3 *The LCD modules should be no falling and violent shocking during transportation, and also should avoid excessive press, water, damp and sunshine.***

END