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Disea Electronics Co., LTD

DISEA
Customized Display

PRODUCT SPECIFICATIONS

For Customer: _____   □ : APPROVAL FOR SPECIFICATION

Customer Model No. _____   □ : APPROVAL FOR SAMPLE

Module No.:   _ZW-T024HQI-13CP_   _Date : 2019-12-24_

Table of Contents

For Customer's Acceptance:

Approved By	Comment

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

2. Revision Record

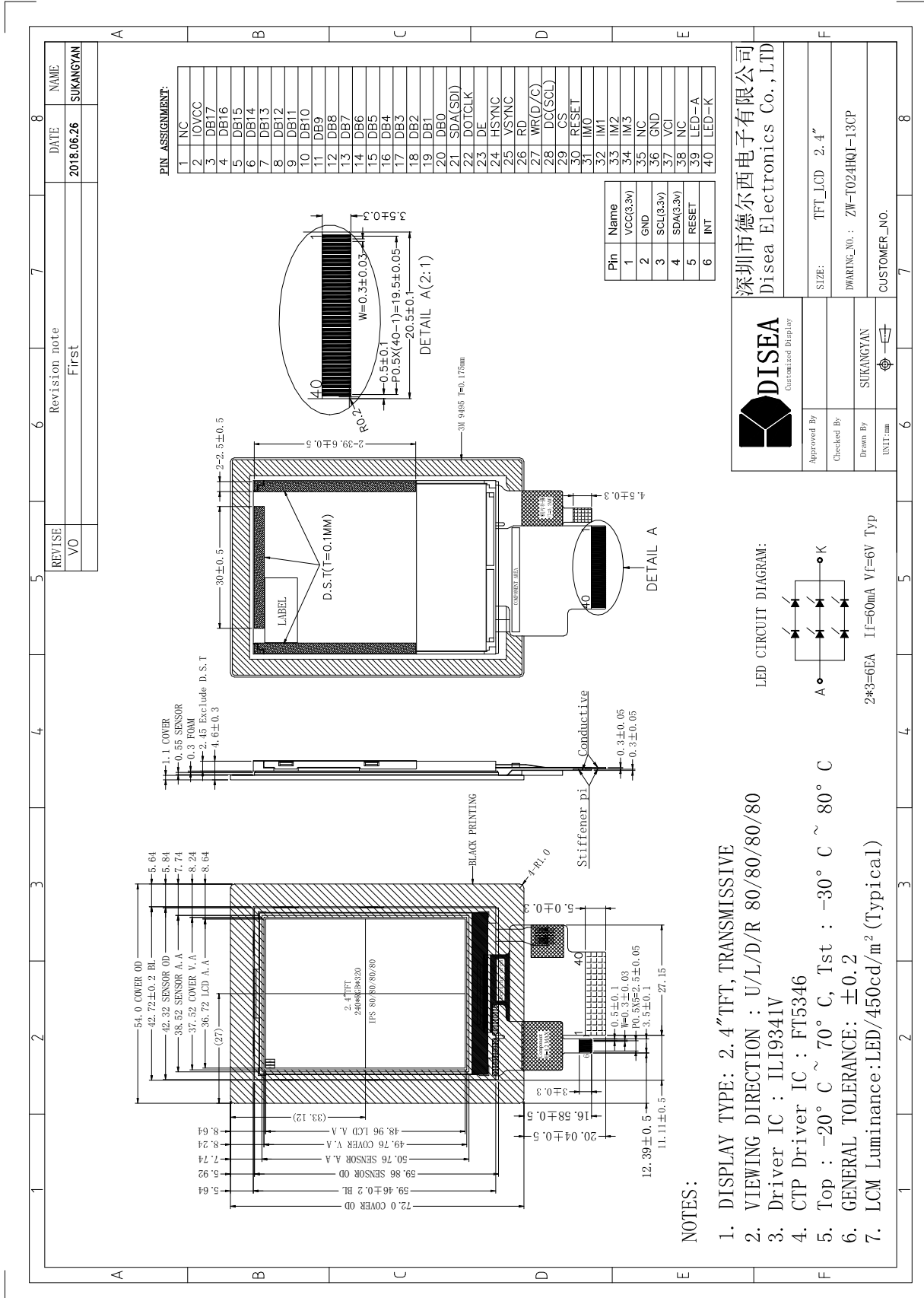| Date	Rev.No.	Page	Revision Items	Prepared
2019.12.24	**V0**		**The first release**	**SSX**

3. General Specifications

ZW-T024HQI-13CP is a TFT-LCD module. It is composed of a TFT-LCD panel, driver IC, FPC,a back light and CTP unit . The 2.4″ 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	color	1
Viewing Direction	ALL	O'Clock	
Operating temperature	-20~+70	℃	
Storage temperature	-30~+80	℃	
Module size	54.00X72.00X4.60	mm	2
Active Area(W×H)	36.72X48.96	mm	
Number of Dots	240×320	dots	
Controller	ILI9341V	-	
CTP Controller	FT5346	-	
Power Supply Voltage	2.8	V	
Backlight	2S3P-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.With CTP.

4.Outline.Drawing

PIN ASSIGNMENT:

1	NC
2	IOVCC
3	DB17
4	DB16
5	DB15
6	DB14
7	DB13
8	DB12
9	DB11
10	DB10
11	DB9
12	DB8
13	DB7
14	DB6
15	DB5
16	DB4
17	DB3
18	DB2
19	DB1
20	DB0
21	SDA(SDI)
22	DOTCLK
23	DE
24	HSYNC
25	VSYNC
26	RD
27	WR(D/C)
28	DC(SCL)
29	CS
30	RESET
31	IM0
32	IM1
33	IM2
34	IM3
35	NC
36	GND
37	VCI
38	NC
39	LED-A
40	LED-K

Pin	Name
1	VCC(3.3v)
2	GND
3	SCL(3.3v)
4	SDA(3.3v)
5	RESET
6	INT

DETAIL A(2:1)

W=0.3±0.03
3.5±0.3
0.5±0.1
P0.5X(40-1)=19.5±0.05
20.5±0.1
R0.2
40
3M 9495 T=0.175mm

DETAIL A
4.5±0.3

D.S.T(T=0.1MM)
LABEL
2-39.6±0.5
2-2.5±0.5
30±0.5

1.1 COVER
0.55 SENSOR
0.3 FOAM
2.45 Exclude D.S.T
4.6±0.3
Conductive
Stiffener pi
BLACK PRINTING
0.3±0.05
0.3±0.05
4-R1.0

5.64
5.84
7.74
8.24
8.64
54.0 COVER OD
42.72±0.2 BL
42.32 SENSOR OD
38.52 SENSOR A.A
37.52 COVER V.A
36.72 LCD A.A
(27)
2.4"TFT
240RGBx320
IPS 80/80/80/80
0.5±0.1
W=0.3±0.03
P0.5X5=2.5±0.05
3.5±0.1
40
5.0±0.3
27.15
3±0.3
16.58±0.5

20.04±0.5
12.39±0.5
11.11±0.5
(33.12)
48.96 LCD A.A
49.76 COVER V.A
50.76 SENSOR A.A
59.86 SENSOR OD
59.46±0.2 BL
72.0 COVER OD
8.64
8.24
7.74
5.92
5.64

LED CIRCUIT DIAGRAM:
K
A
2*3=6EA If=60mA Vf=6V Typ

NOTES:
1. DISPLAY TYPE: 2.4"TFT, TRANSMISSIVE
2. VIEWING DIRECTION : U/L/D/R 80/80/80/80
3. Driver IC : ILI9341V
4. CTP Driver IC : FT5346
5. Top : -20°C ~ 70°C, Tst : -30°C ~ 80°C
6. GENERAL TOLERANCE: ±0.2
7. LCM Luminance:LED/450cd/m² (Typical)

REVISE	Revision note	
VO	First	
DATE	2018.06.26	
NAME	SUKANGYAN	

深圳市德尔西电子有限公司
Disea Electronics Co.,LTD

Approved By	
Checked By	
Drawn By	SUKANGYAN
UNIT:mm	

SIZE: TFT_LCD 2.4"
DWARING_NO.: ZW-T024HQI-13CP
CUSTOMER_NO.:

5. Absolute Maximum Ratings(Ta=25℃)

5.1 Electrical Absolute Maximum Ratings.(Vss=0V ,Ta=25℃)

Item	Symbol	Min.	Max.	Unit	Note
Power Supply Voltage	VCI	-0.3	4.6	V	1,2
	IOVCC	-0.3	4.6		
	CTP_VCC	2.7	3.6		

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. $V_{CI} > V_{SS}$ 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℃	80℃	-20℃	70℃	1,2
Humidity	-	-	-	-	3

Notes:

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. Ta<=40℃:85%RH MAX.

   Ta>=40℃:Absolute humidity must be lower than the humidity of 85%RH at 40℃.

6. Electrical Specifications

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

Parameter		Symbol	Condition	Min	Typ	Max	Unit
Power supply		VCI	Ta=25℃	2.5	2.8	3.3	V
		IOVCC	Ta=25℃	1.65	2.8	3.3	
		CTP_VCC	Ta=25℃	3.0	3.3	3.6	
Input voltage	'H'	V_{IH}	Ta=25℃	0.7*IOVCC	-	IOVCC	
	'L'	V_{IL}	Ta=25℃	0	-	0.3*IOVCC	

6.2 LED backlight specification(VSS=0V ,Ta=25℃)

Item	Symbol	Condition	Min	Typ	Max	Unit	Note
Supply voltage	V_f	If=60mA	5.4	6.0	6.6	V	
Uniformity	△Bp	If=60mA	75	80	-	%	
Life Time	time	If=60mA	20K	-		hours	1
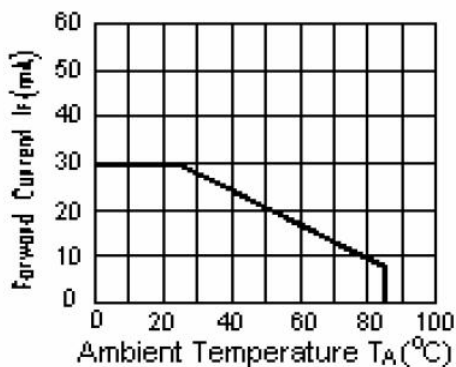
Note 1:   Brightness to be decreased to 50% of the initial value at ambient temperature TA=25℃

6.3 Interface signals

Pin No.	Symbol	I/O	Function
1	NC	-	No connect
2	IOVCC	P	Power for interface logic circuits
3-20	DB17-DB0	I	Data input
21	SDA(SDI)	I	Serial Input /output data bus
22	DOTCLK	I	Data clock
23	DE	I	Data enable pin
24	HSYNC	I	Line sync signal
25	VSYNC	I	Frame sync signal
26	RD	I	Read data control signal
27	WR(D/C)	I	8080-I/8080-II system: serves as a write signal an MCU write data at the rising edge. 4-line system:serves as Data or Command select. In serial interface "2-data-lane data" transfers mode, serves as a second data pin
28	DC(SCL)	I	DC：This pin is used to select "Data or Command" in the parallel interface SCL：Serial data clock in serial bus system
29	CS	I	Chip select pin
30	RESET	I	Reset the display,active "L"
31-34	IM0-IM3	I	MCU parallel interface bus and serial interface select
35	NC	-	No connect
36	GND	P	Ground
37	VCI	P	Power for analog circuits
38	NC	-	No connect
39	LED-A	P	LED back light(Anode)
40	LED-K	P	LED back light(Cathode)

CTP interface

Pin No.	Symbol	I/O	Function
1	VCC	P	CTP Power supply
2	GND	P	Ground
3	SCL(3.3V)	I	I2C clock
4	SDA(3.3V)	I	I2C data
5	RESET	I	CTP reset pin,active "L"
6	INT	I	External Interrupt to the IC of CTP

The selection of interface is done by setting external pins IM [3:0] as shown in the following table.

IM3	IM2	IM1	IM0	MCU-Interface Mode	Pins in use	
					Register/Content	GRAM
0	0	0	0	8080 MCU 8-bit bus interface Ⅰ	D[7:0]	D[7:0],WRX,RDX,CSX,D/CX
0	0	0	1	8080 MCU 16-bit bus interface Ⅰ	D[7:0]	D[15:0] ,WRX,RDX,CSX,D/CX
0	0	1	0	8080 MCU 9-bit bus interface Ⅰ	D[7:0]	D[8:0] ,WRX,RDX,CSX,D/CX
0	0	1	1	8080 MCU 18-bit bus interface Ⅰ	D[7:0]	D[17:0] ,WRX,RDX,CSX,D/CX
0	1	0	1	3-wire 9-bit data serial interface Ⅰ	SCL,SDA,CSX	
0	1	1	0	4-wire 8-bit data serial interface Ⅰ	SCL,SDA,D/CX,CSX	
1	0	0	0	8080 MCU 16-bit bus interface Ⅱ	D[8:1]	D[17:10],D[8:1],WRX,RDX,CSX,D/CX
1	0	0	1	8080 MCU 8-bit bus interface Ⅱ	D[17:10]	D[17:10],WRX,RDX,CSX,D/CX
1	0	1	0	8080 MCU 18-bit bus interface Ⅱ	D[8:1]	D[17:0],WRX,RDX,CSX,D/CX
1	0	1	1	8080 MCU 9-bit bus interface Ⅱ	D[17:10]	D[17:9],WRX,RDX,CSX,D/CX
1	1	0	1	3-wire 9-bit data serial interface Ⅱ	SCL,SDI,SDO, CSX	
1	1	1	0	4-wire 8-bit data serial interface Ⅱ	SCL,SDI,D/CX,SDO, CSX	

6.4 AC Characteristics

### 6.4.1 Display Parallel 18/16/9/8-bit Interface Timing Characteristics (8080- Ⅰ system)
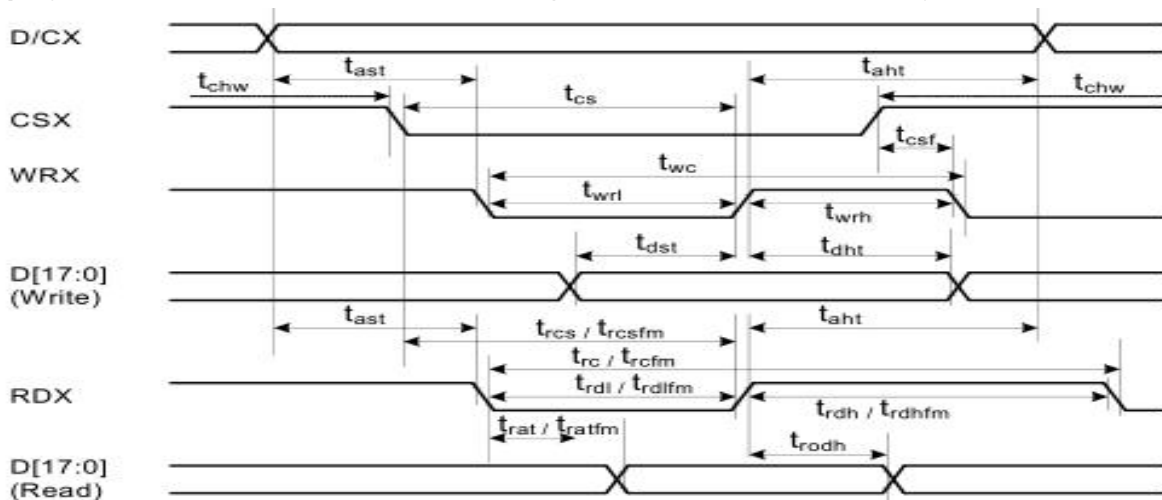
Signal	Symbol	Parameter	min	max	Unit	Description
DCX	tast	Address setup time	0	-	ns	
	taht	Address hold time (Write/Read)	0	-	ns	
CSX	tchw	CSX "H" pulse width	0	-	ns	
	tcs	Chip Select setup time (Write)	15	-	ns	
	trcs	Chip Select setup time (Read ID)	45	-	ns	
	trcsfm	Chip Select setup time (Read FM)	355	-	ns	
	tcsf	Chip Select Wait time (Write/Read)	10	-	ns	
WRX	twc	Write cycle	66	-	ns	
	twrh	Write Control pulse H duration	15	-	ns	
	twrl	Write Control pulse L duration	15	-	ns	
RDX (FM)	trcfm	Read Cycle (FM)	450	-	ns	
	trdhfm	Read Control H duration (FM)	90	-	ns	
	trdlfm	Read Control L duration (FM)	355	-	ns	
RDX (ID)	trc	Read cycle (ID)	160	-	ns	
	trdh	Read Control pulse H duration	90	-	ns	
	trdl	Read Control pulse L duration	45	-	ns	
D[17:0], D[15:0], D[8:0], D[7:0]	tdst	Write data setup time	10	-	ns	For maximum CL=30pF For minimum CL=8pF
	tdht	Write data hold time	10	-	ns	
	trat	Read access time	-	40	ns	
	tratfm	Read access time	-	340	ns	
	trod	Read output disable time	20	80	ns	

6.4.2 Display Serial Interface Timing Characteristics (3-line SPI system)
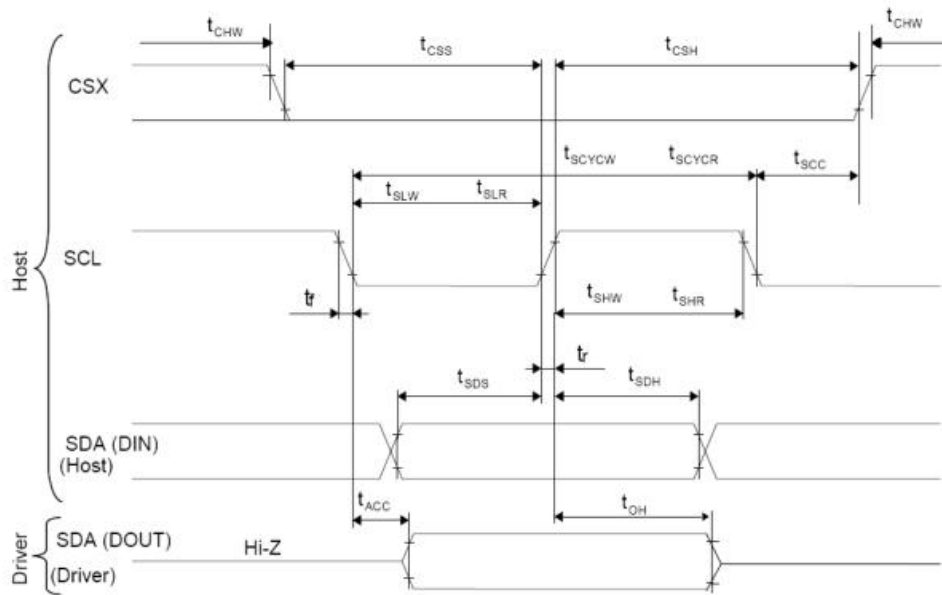
Signal	Symbol	Parameter	min	max	Unit	Description
SCL	tscycw	Serial Clock Cycle (Write)	100	-	ns	
	tshw	SCL "H" Pulse Width (Write)	40	-	ns	
	tslw	SCL "L" Pulse Width (Write)	40	-	ns	
	tscycr	Serial Clock Cycle (Read)	150	-	ns	
	tshr	SCL "H" Pulse Width (Read)	60	-	ns	
	tslr	SCL "L" Pulse Width (Read)	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	

6.4.3 Display Serial Interface Timing Characteristics (4-line SPI system)
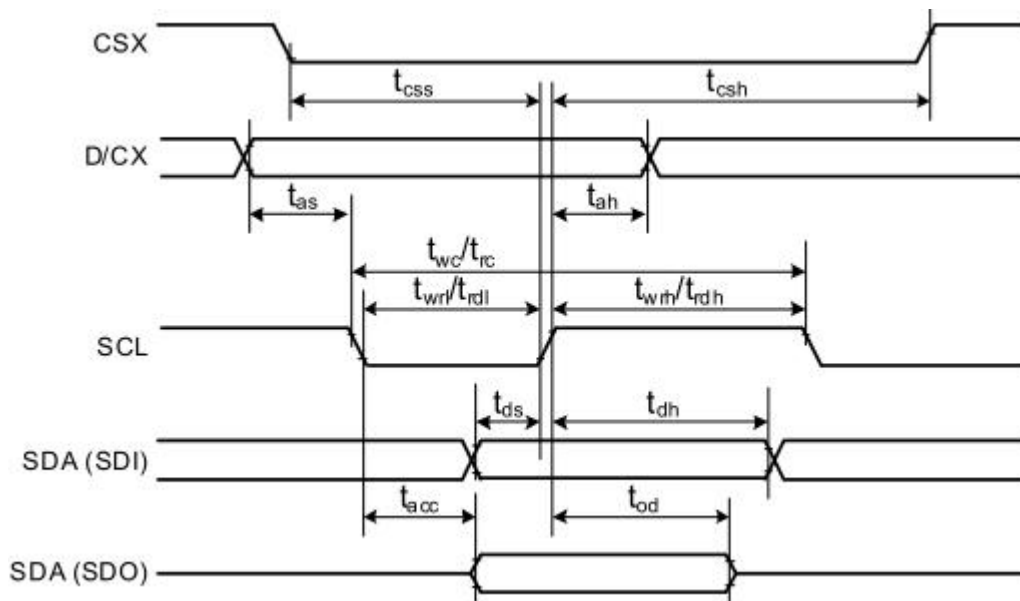
Signal	Symbol	Parameter	min	max	Unit	Description
CSX	tcss	Chip select time (Write)	40	-	ns	
	tcsh	Chip select hold time (Read)	40	-	ns	
SCL	twc	Serial clock cycle (Write)	100	-	ns	
	twrh	SCL "H" pulse width (Write)	40	-	ns	
	twrl	SCL "L" pulse width (Write)	40	-	ns	
	trc	Serial clock cycle (Read)	150	-	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

6.4.4 Parallel 18/16/6-bit RGB Interface Timing Characteristics
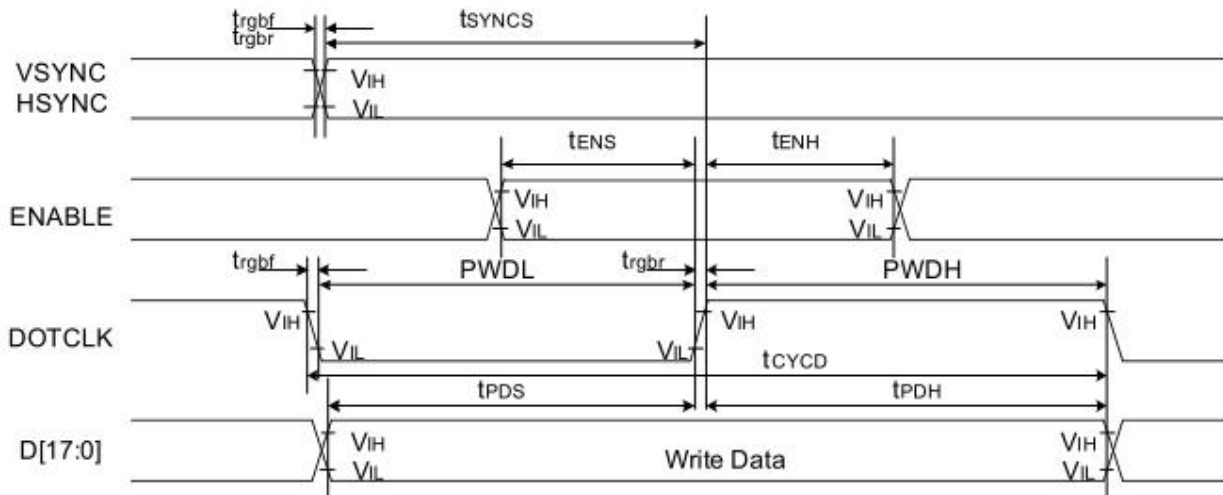
Signal	Symbol	Parameter	min	max	Unit	Description
VSYNC / HSYNC	t_{SYNCS}	VSYNC/HSYNC setup time	15	-	ns	18/16-bit bus RGB interface mode
	t_{SYNCH}	VSYNC/HSYNC hold time	15	-	ns	
DE	t_{ENS}	DE setup time	15	-	ns	
	t_{ENH}	DE hold time	15	-	ns	
D[17:0]	t_{POS}	Data setup time	15	-	ns	
	t_{PDH}	Data hold 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	

The timing chart of 18-/16-bit RGB interface mode is shown as below
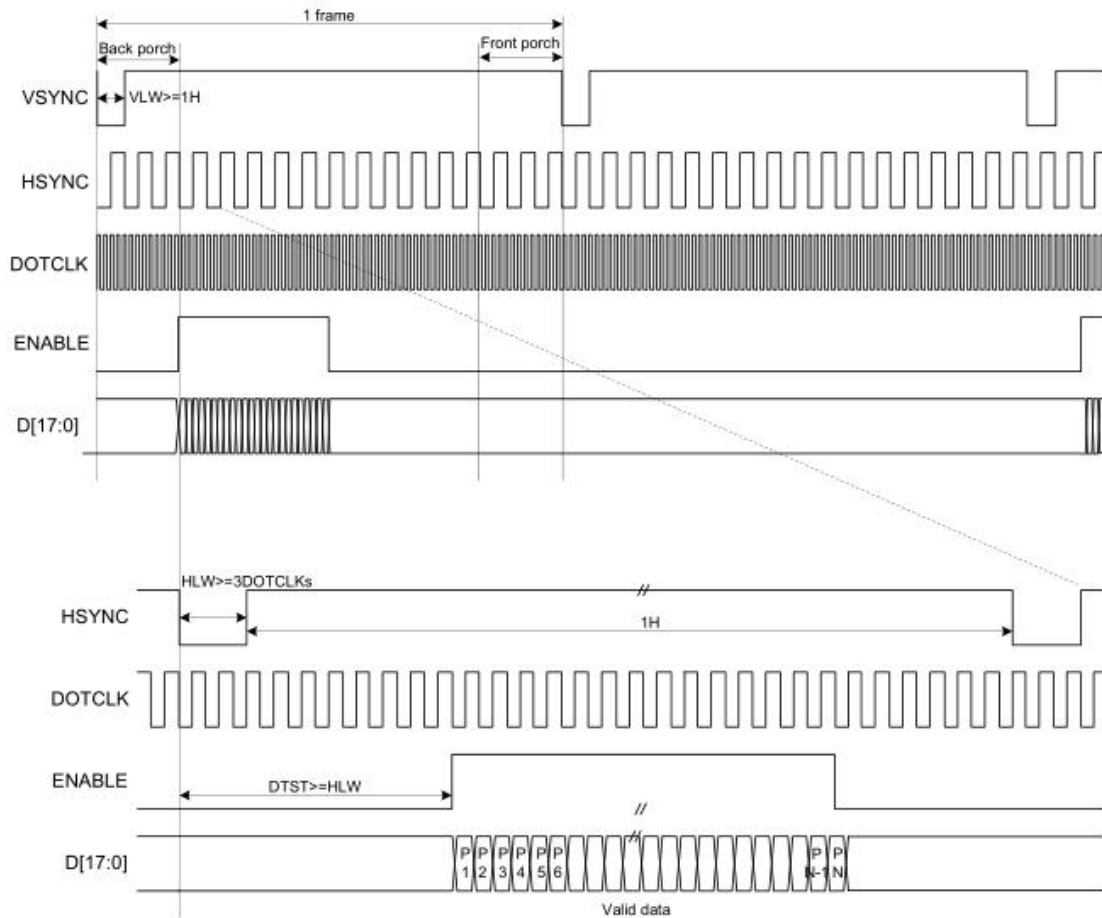
VLW : VSYNC Low Width
HLW : HSYNC Low Width
DTST : Data Transfer Startup Time
P : Pixel : N=240X320=76800
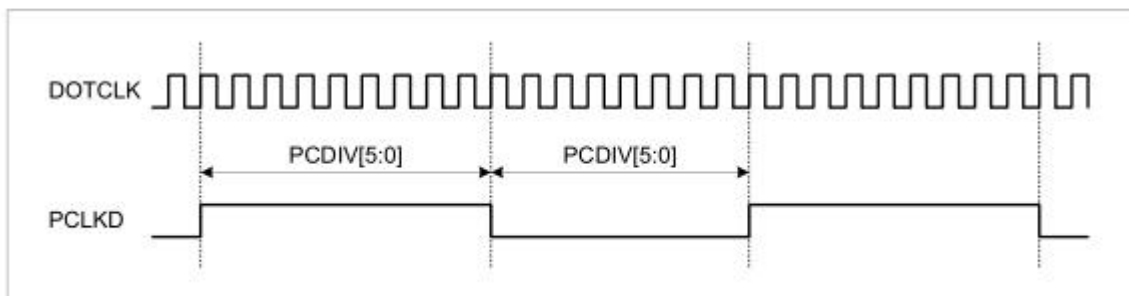
Note 1: The DE signal is not needed when RGB interface SYNC mode is selected.

Note 2: VSPL='0', HSPL='0', DPL='0' and EPL='0' of "Interface Mode Control (B0h)" command.

7. Optical Characteristics

Item	Symbol		Condition	Min.	Typ.	Max.	Unit	Note
Brightness	Bp		θ=0° Φ=0°	-	450	-	Cd/m^2	1
Uniformity	$\triangle$Bp			75	80	-	%	1,2
Viewing Angle	3:00		Cr≥10	-	80	-	Deg	3
	6:00			-	80			
	9:00			-	80	-		
	12:00			-	80	-		
Contrast Ratio	Cr		θ=0° Φ=0°	640	800	-	-	4
Response Time	$T_r + T_f$			-	35	45	ms	5
Color of CIE Coordinate	W	x	θ=0° Φ=0°	Typ -0.05	0.308	Typ +0.05	-	1,6
		y			0.330		-	
	R	x			0.649		-	
		y			0.318		-	
	G	x			0.352		-	
		y			0.601		-	
	B	x			0.140		-	
		y			0.063		-	
NTSC Ratio	S			-	70	-	%	

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

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

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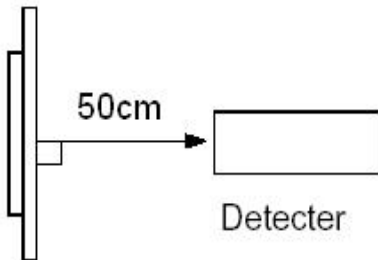
(Φ5mm)

Measuring condition:

- *Measuring surroundings: Dark room.*
- *Measuring temperature: Ta=25℃.*
- *Adjust operating voltage to get optimum contrast at the center of the display.*
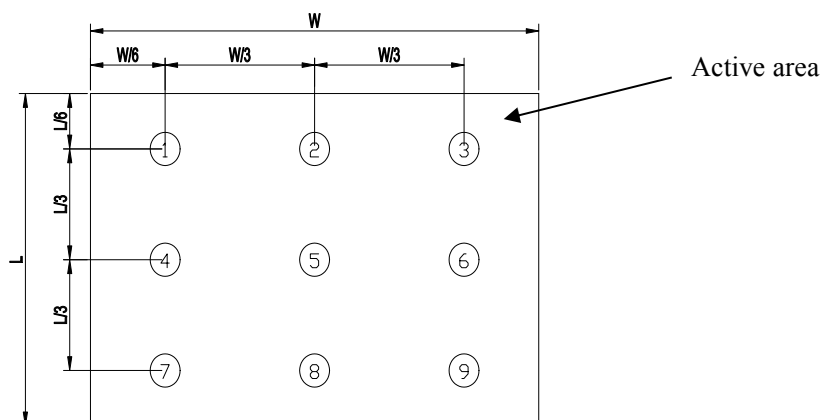
Measured value at the center point of LCD panel after more than 5 minutes while backlight turning on.

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

$\angle Bp = Bp$ *(Min.) / Bp (Max.)×100 (%)*

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

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

Note 3: The definition of viewing angle:
*Refer to the graph below marked by θ and Φ*
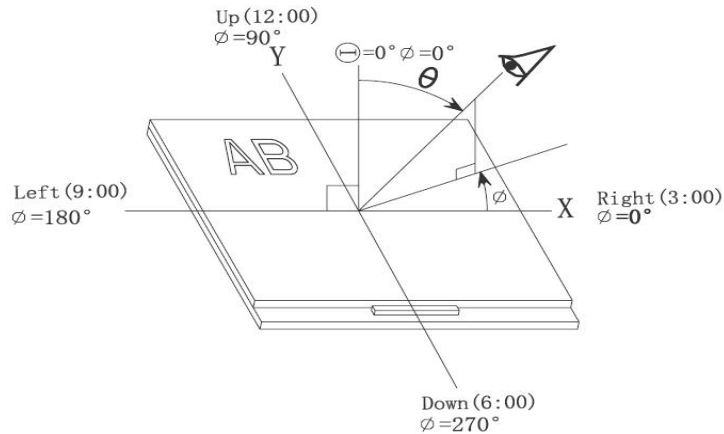
Note 4: Definition of contrast ratio.(Test LCD using DMS501)

*Conditions

Operating Voltage : Vop
Frame Frequency : 70Hz
Appling Waveform : 1/N duty 1/a bias
View angle (Θ, Φ) : (0°, 0°)
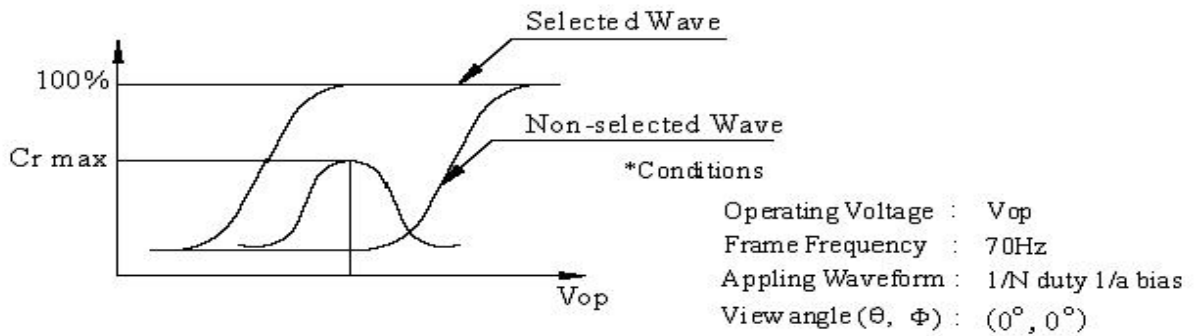
$$Contrast\ ratio(Cr) = \frac{Brightness\ of\ selected\ dots}{Brightness\ of\ non-selected\ dots}$$

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.
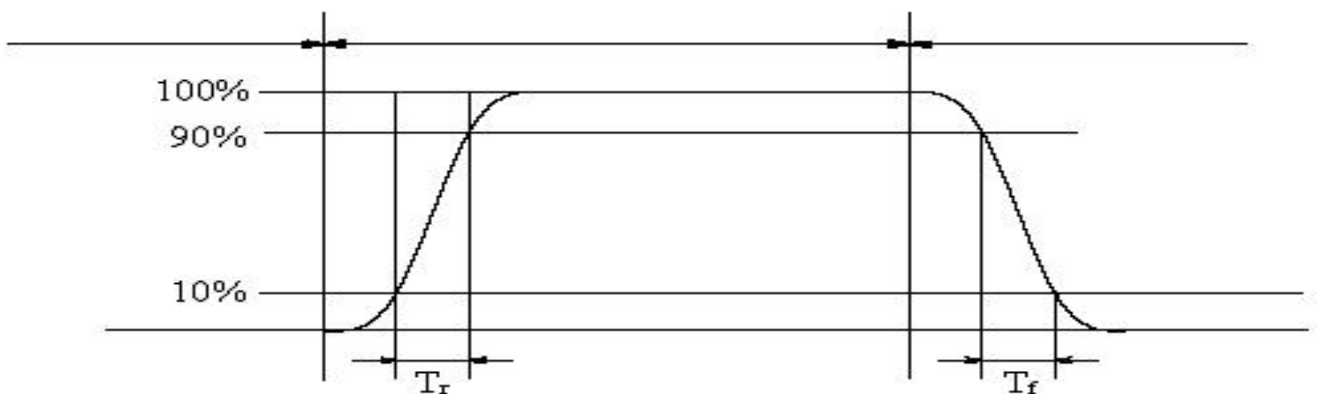
The definition of response time

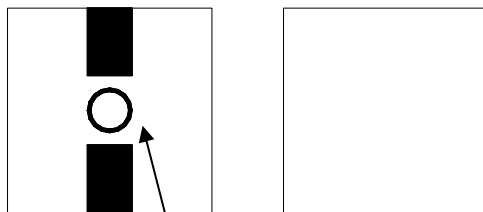*Note 6: Definition of Color of CIE Coordinate and NTSC Ratio.*

1931 CIE Chromaticity Diagram
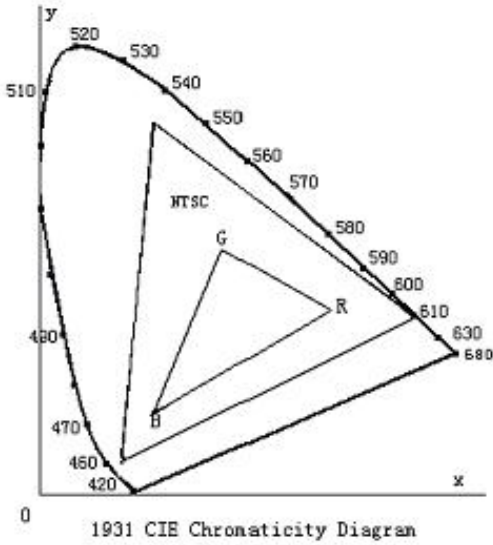
Color gamut:

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

Note 7: Definition of cross talk.

Cross talk ratio(%)=|pattern A Brightness-pattern B Brightness|/pattern A Brightness*100

Pattern A   Pattern B

Measurement point(center)

Electric volume value=3F+/-3Hex

8. Reliability Test Items and Criteria

Test Item	Test condition	Remark
High Temperature Storage	Ta = 80℃ 96hrs	Note1,Note3，4
Low Temperature Storage	Ta = -30℃ 96hrs	Note1,Note3，4
High Temperature Operation	Ts = 70℃ 96hrs	Note2,Note3，4
Low Temperature Operation	Ta = -20℃ 96hrs	Note1,Note3，4
Operation at High Temperature/Humidity	+60℃, 90%RH 96hrs	Note3，4
Thermal Shock	-30℃/30 min ~ +80℃/30 min for a total 10 cycles, Start with cold temperature and end with high temperature.	Note3，4
Vibration Test	Frequency range:10~55Hz Stroke:1.5mm Sweep:10Hz~55Hz~10Hz 2 hours for each direction of X. Y. Z. (6 hours for total)	
Mechanical Shock	100G 6ms,±X, ±Y, ±Z 3 times for each direction	
Package Vibration Test	Random Vibration : 0.015G*G/Hz from 5-200HZ, -6dB/Octave from 200-500HZ 2 hours for each direction of X. Y. Z. (6 hours for total)	
Package Drop Test	Height:60cm 1 corner, 3 edges, 6 surfaces	
Electro Static Discharge	±2KV, Human Body Mode, 100pF/1500Ω	

Note 1: Ta is the ambient temperature of samples.

Note 2: Ts is the temperature of panel's surface.

Note 3: In the standard condition, there shall be no practical problem that may affect the display function. After the reliability test, the product only guarantees operation, but don't guarantee all of the cosmetic specification.

Note 4: Before cosmetic and function test, the product must have enough recovery time,at least 2 hours at room temperature

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℃ ～ 40℃

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

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