

**TFT-LCD Module SPECIFICATIONS**

For Customer: _____

 : APPROVAL FOR SPECIFICATION

Customer Model No. _____

 : APPROVAL FOR SAMPLEModule No.: SDT035QHI-19Date : 2019-07-01**Table of Contents**

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For Customer's Acceptance:

Approved By	Comment

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

2. Revision Record

Date	Rev.No.	Page	Revision Items	Prepared
2019.07.01	V0		The first release	YGM



Sunshine Display

Sunshine Display Technology Limited

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Sunshine Display

**3. General Specifications**

SDT035QHI-19 is a TFT-LCD module. It is composed of a TFT-LCD panel, driver IC, FPC, a back light unit. The 3.5" display area contains 320X(RGB)x480 pixels and can display up to 262K colors. This product accords with ROHS environmental criterion.

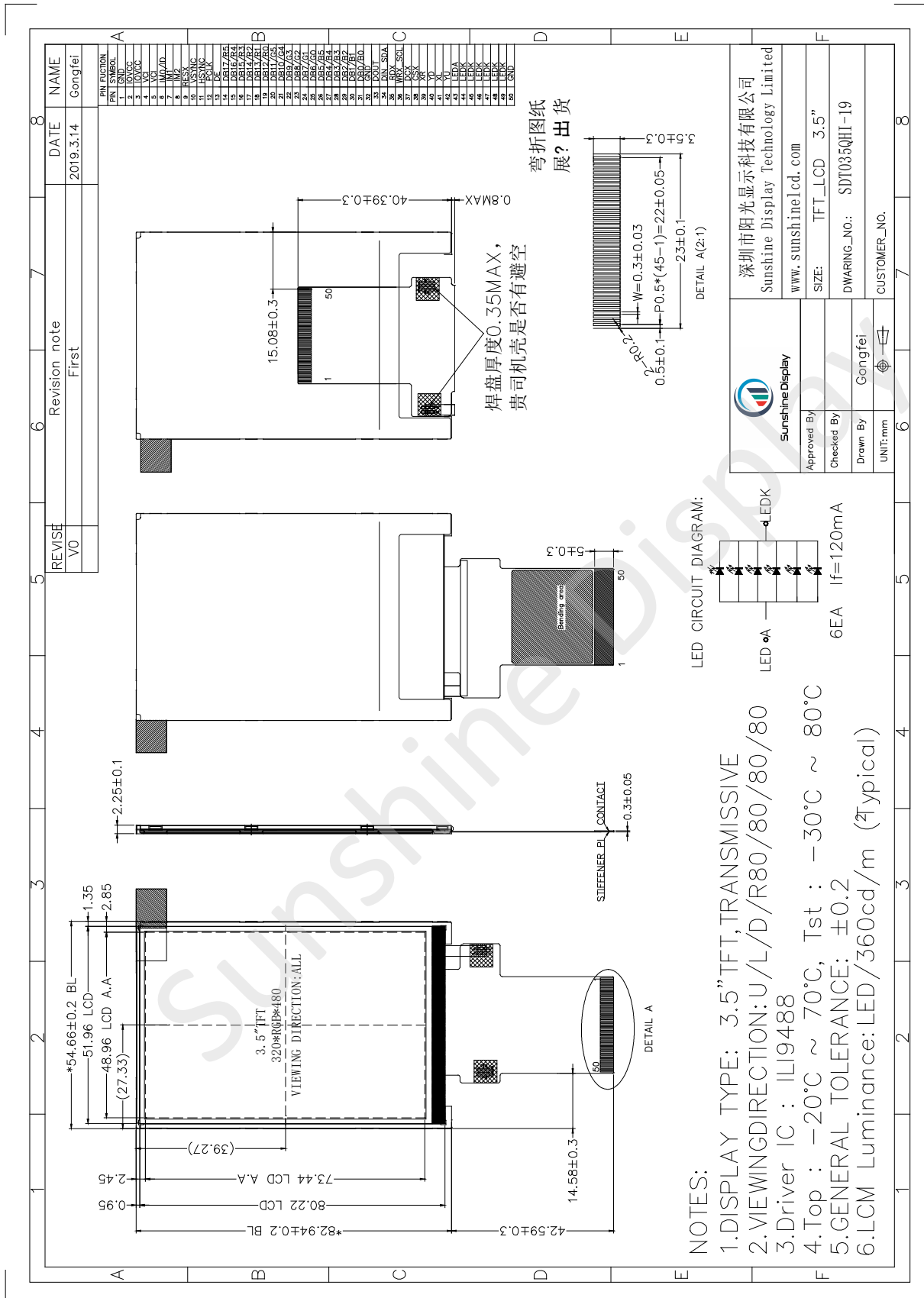
Item	Contents	Unit	Note
LCD Type	TFT	-	
Display color	262K		1
Viewing Direction	ALL	O'Clock	
Gray scale inversion direction	FREE	O'Clock	
Operating temperature	-20~+70	°C	
Storage temperature	-30~+80	°C	
Module size	54.66X82.94X2.25	mm	2
Active Area(W×H)	48.96X73.44	mm	
Number of Dots	320×480	dots	
Controller	ILI9488	-	
Power Supply Voltage	2.8	V	
Backlight	6-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(Ta=25 °C)****5.1 Electrical Absolute Maximum Ratings.(Vss=0V , Ta=25 °C)**

Item	Symbol	Min.	Max.	Unit	Note
Power Supply Voltage	VCI	-0.3	3.3	V	1.2
	IOVCC	-0.3	3.3		

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. $V_{D V D D} > V_{S S}$ 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 °C	80 °C	-20 °C	70 °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. $T_a \leq 40$ °C:85%RH MAX.

$T_a \geq 40$ °C:Absolute humidity must be lower than the humidity of 85%RH at 40 °C.

6. Electrical Specifications**6.1 Electrical characteristics(Vss=0V , Ta=25 °C)**

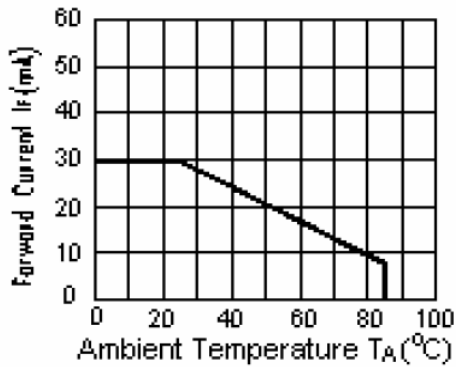
Parameter	Symbol	Condition	Min	Typ	Max	Unit	Note
Power supply	VCI	Ta=25 °C	-	2.8	3.3	V	
	IOVCC	Ta=25 °C	-	1.8	3.3	V	



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(VSS=0V ,Ta=25°C)

Item	Symbol	Condition	Min	Typ	Max	Unit	Note
Supply voltage	V_f	If=120mA	2.7	3.0	3.3	V	
Uniformity	ΔBp	If=120mA	75	80	-	%	
Life Time	time	If=120mA	20K	-		hours	1



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



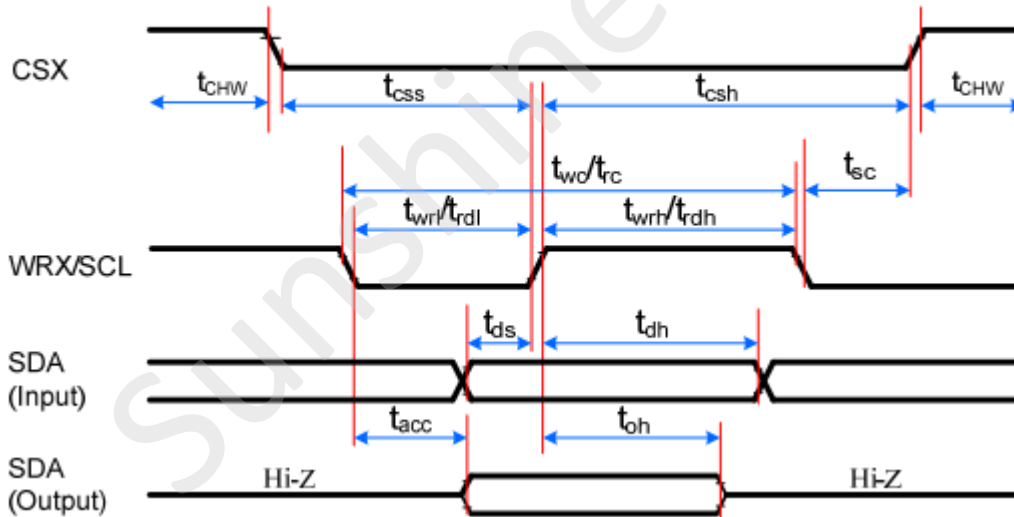
6.3 Interface signals

Pin No	Symbol	I/O	Function				
1	GND	P	Ground				
2-3	IOVCC	P	Power Supply for IO				
4-5	VCI	P	Power Supply for logic				
6	IM0	I	MIPI-DBI Type B				
			IM2	IM1	IM0	Interface	Data Pin in Use
7	IM1	I	0	0	0	24-bit bus (DB_EN=1)	DB [23:0]
			0	0	0	18-bit bus (DB_EN=0)	DB [17:0]
			0	0	1	9-bit bus	DB [8:0]
			0	1	0	16-bit bus	DB [15:0]
8	IM2	I	0	1	1	8-bit bus	DB [7:0]
			MIPI-DBI Type C				
			1	0	1	Option1 (3-line SPI)	SDA,SDO
			1	1	1	Option3 (4-line SPI)	SDA,SDO
9	RESX	I	Reset signal,Signal is active low				
10	VSYNC	I	Vertical (Frame) synchronizing input signal for RGB interface operation				
11	HSYNC	I	Horizontal (Line) synchronizing input signal for RGB interface operation				
12	PCLK	I	Dot clock signal for RGB interface operation.				
13	DE	I	Data enable signal for RGB interface operation				
14-31	DB17-DB0	I	Data input				
32	GND	P	Ground				
33	DOUT	O	SPI interface data output pin.				
34	SDA	I	SPI interface data input /output pin.				
35	RDX	I	Read enable in MCU parallel interface.				
36	WRX-SCL		Write enable in MCU parallel interface This pin is used to be serial interface clock.				
37	DCX	I	Display data/command selection pin in parallel interface.				
38	CSX	I	Chip select input pin				
39	XR	I	RTP Pin,Please NC				
40	YD	I					
41	XL	I					
42	YU	I					
43	LEDA	P	LED anode				
44-49	LEDK	P	LED cathode				
50	GND	P	Ground				



Signal	Symbol	Parameter	min	max	Unit	Description
DCX	tast	Address setup time	0	-	ns	-
	that	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)	0	-	ns	-
WRX	twc	Write cycle	40	-	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	When read from Frame Memory
	trdhfm	Read Control H duration (FM)	90	-	ns	
	trdlfm	Read Control L duration (FM)	355	-	ns	
RDX (ID)	trc	Read cycle (ID)	160	-	ns	When read ID data
	trdh	Read Control pulse H duration	90	-	ns	
	trdl	Read Control pulse L duration	45	-	ns	
DB [23:0], DB [17:0], DB [15:0], DB [8:0], DB [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	

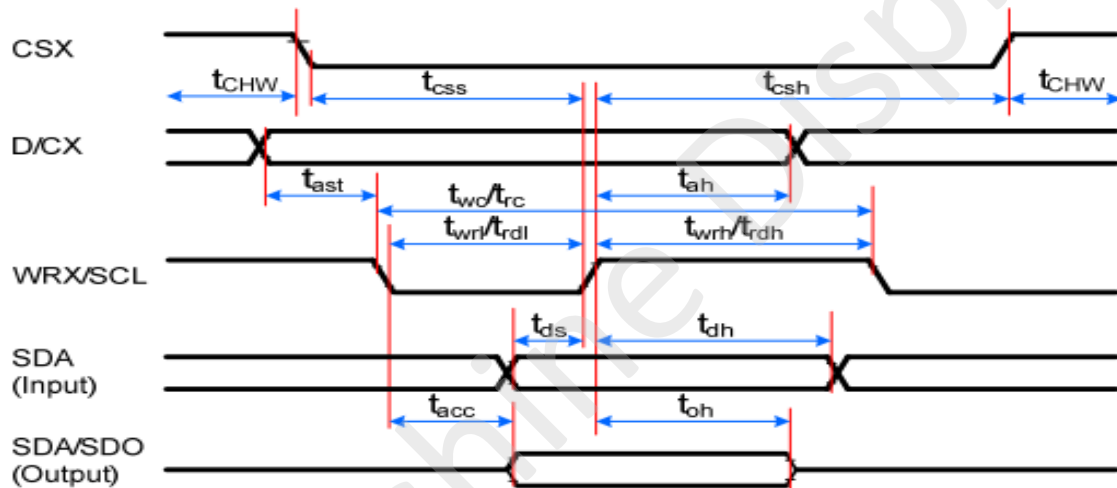
DBI Type C Option 1 (3-Line SPI System) Timing Characteristics





Signal	Symbol	Parameter	min	max	Unit	Description
CSX	tsc	SCL-CSX	15	-	ns	
	tchw	CSX H Pulse Width	40	-	ns	
	tcss	Chip select time (Write)	60	-	ns	
	tcsH	Chip select hold time (Read)	65	-	ns	
SCL	twc	Serial Clock Cycle (Write)	66	-	ns	
	twrh	SCL H Pulse Width (Write)	15	-	ns	
	twrl	SCL L Pulse Width (Write)	15	-	ns	
	trc	Serial Clock Cycle (Read)	150	-	ns	
	trdh	SCL H Pulse Width (Read)	60	-	ns	
	trdl	SCL L Pulse Width (Read)	60	-	ns	
SDA (Input)	tds	Data setup time (Write)	10	-	ns	
	tdh	Data hold time (Write)	10	-	ns	
SDA/SDO (Output)	tacc	Access time (Read)	10	50	ns	For maximum CL=30pF
	toh	Output disable time (Read)	15	50	ns	For minimum CL=8pF

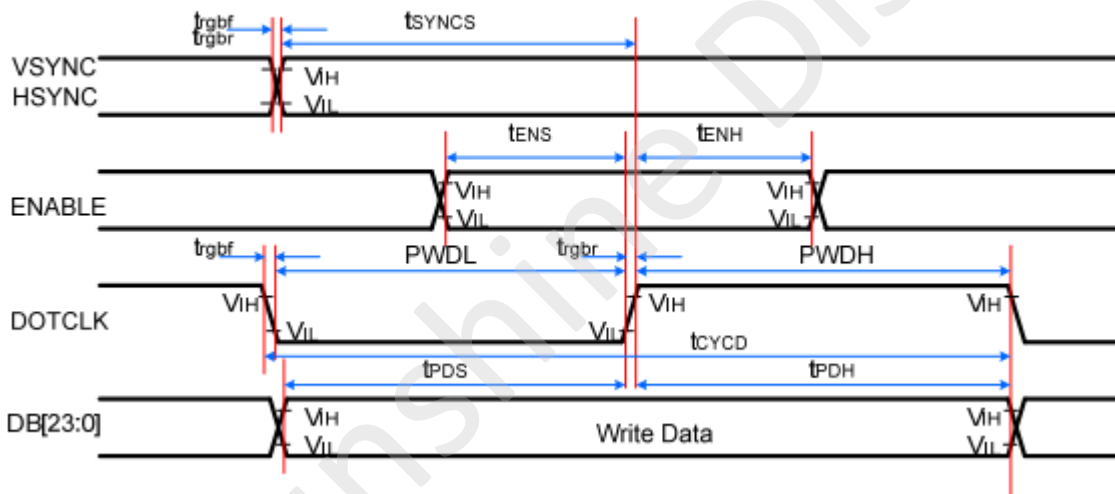
DBI Type C Option 3 (4-Line SPI System) Timing Characteristics





Signal	Symbol	Parameter	min	max	Unit	Description
CSX	tcss	Chip select time (Write)	15	-	ns	
	tcsH	Chip select hold time (Read)	15	-	ns	
	tCHW	CS H pulse width	40	-	ns	
SCL	twc	Serial clock cycle (Write)	50	-	ns	
	twrh	SCL H pulse width (Write)	10	-	ns	
	twrl	SCL L pulse width (Write)	10	-	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	-	ns	
	tah	D/CX hold time (Write/Read)	10	-	ns	
SDA (Input)	tds	Data setup time (Write)	10	-	ns	
	tdh	Data hold time (Write)	10	-	ns	
SDA/SDO (Output)	taoc	Access time (Read)	10	50	ns	For maximum CL=30pF
	tod	Output disable time (Read)	15	50	ns	For minimum CL=8pF

DPI (Display Parallel 16-/18-/24-bit interface) Timing Characteristics



Signal	Symbol	Parameter	min	max	Unit	Description
VSYNC/HSYNC	t_{SYNCS}	VSYNC/HSYNC setup time	15	-	ns	16-/18-/24-bit bus RGB interface mode
	t_{SYNCH}	VSYNC/HSYNC hold time	15	-	ns	
ENABLE	t_{ENS}	ENABLE setup time	15	-	ns	
	t_{ENH}	ENABLE hold time	15	-	ns	
DB [23:0]	t_{PDS}	Data setup time	15	-	ns	
	t_{PDH}	Data hold time	15	-	ns	
DOTCLK	PWDH	DOTCLK high-level period	20	-	ns	
	PWDL	DOTCLK low-level period	20	-	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	$\theta=0^\circ$	-	360	-	Cd/m ²	1	
Uniformity	ΔBp	$\Phi=0^\circ$	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	$\theta=0^\circ$	-	700	-	-	4	
Response Time	T _r +T _f	$\Phi=0^\circ$	-	30	-	ms	5	
Color of CIE Coordinate	W	x	$\theta=0^\circ$ $\Phi=0^\circ$	-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	-	TBD	-	%			

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

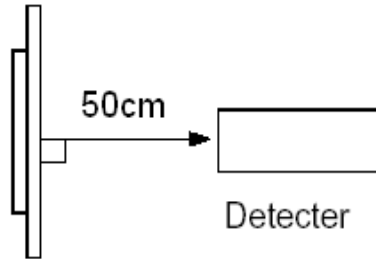
Note 1: The data are measured after LEDs are turned on for 5 minutes. LCM displays full white. The brightness is the average value of 9 measured spots. Measurement equipment BM-7 (Φ5mm)

Measuring condition:

- Measuring surroundings: Dark room.
- Measuring temperature: Ta=25 °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.

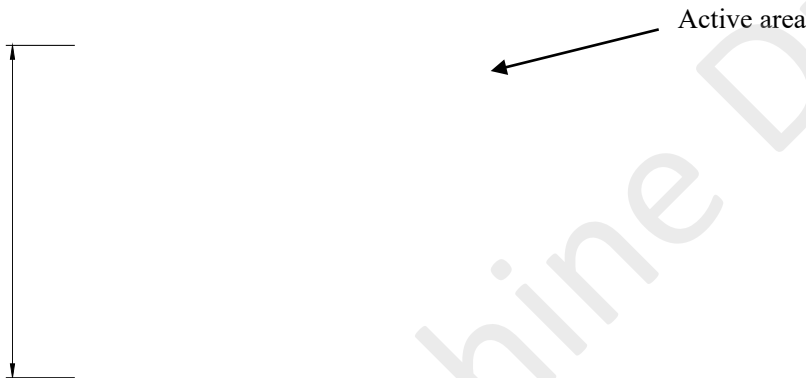


Note 2: The luminance uniformity is calculated by using following formula.

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

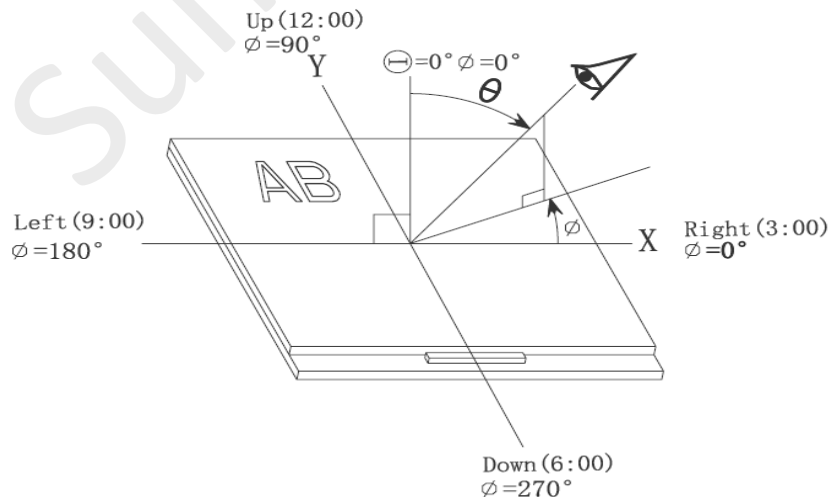
$Bp (\text{Max.})$ = Maximum brightness in 9 measured spots

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



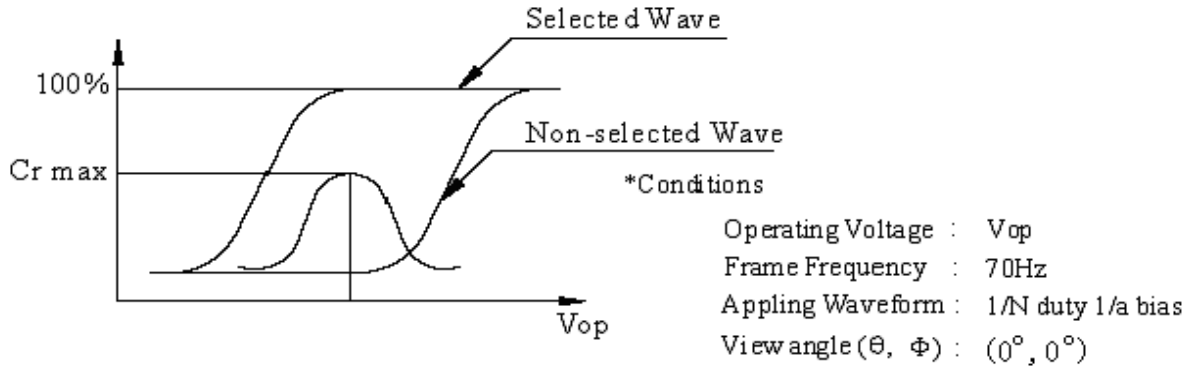
Note 3: The definition of viewing angle:

Refer to the graph below marked by ϑ and ϕ





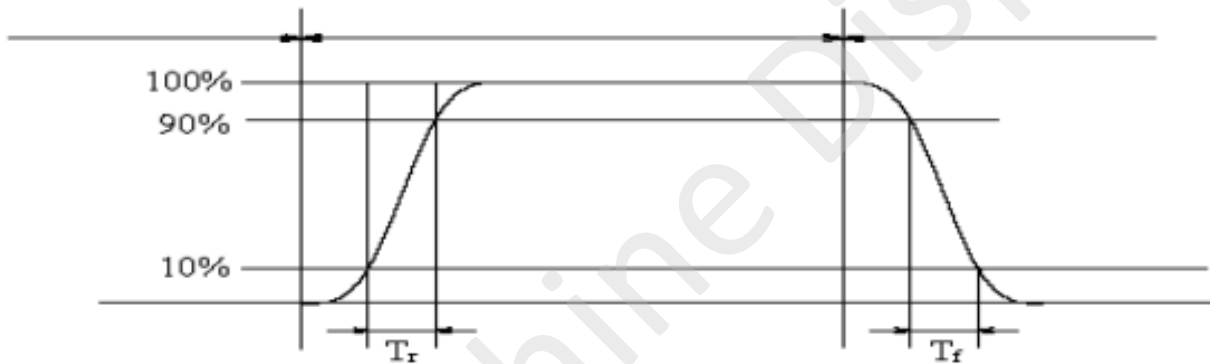
Note 4: Definition of contrast ratio.(Test LCD using DMS501)



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

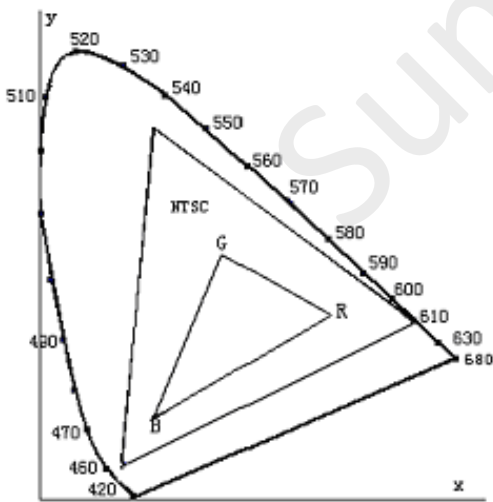
Note 5: Definition of Response time. (Test LCD using DMS501):

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.



1931 CIE Chromaticity Diagram

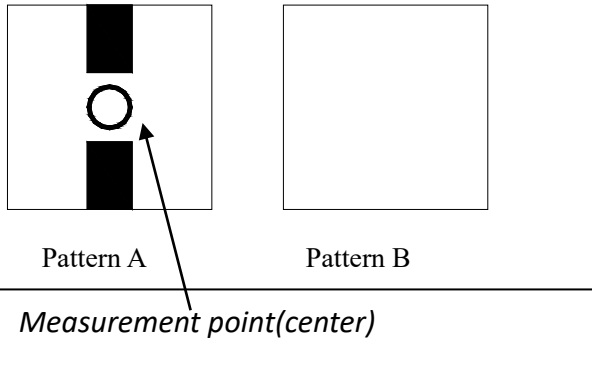
Color gamut:

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



Note 7: Definition of cross talk.

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



Electric volume value=3F+/-3Hex

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**8. Reliability Test Items and Criteria**

No	Test Item	Test condition	Criterion
1	High Temperature Storage	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 Temperature Storage	-30°C±2°C 96H Restore 2H at 25°C Power off	
3	High Temperature Operation	70°C±2°C 96H Restore 2H at 25°C Power on	
4	Low Temperature Operation	-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	-30°C → 80°C 30mi 5min 30min 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 : $0^{\circ}\text{C} \sim 40^{\circ}\text{C}$

Relatively humidity: $\leq 80\%$

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