



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-T035SGV-01

Date : 2020-02-27

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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
2020.02.27	V0		The first release	YGM

3. General Specifications

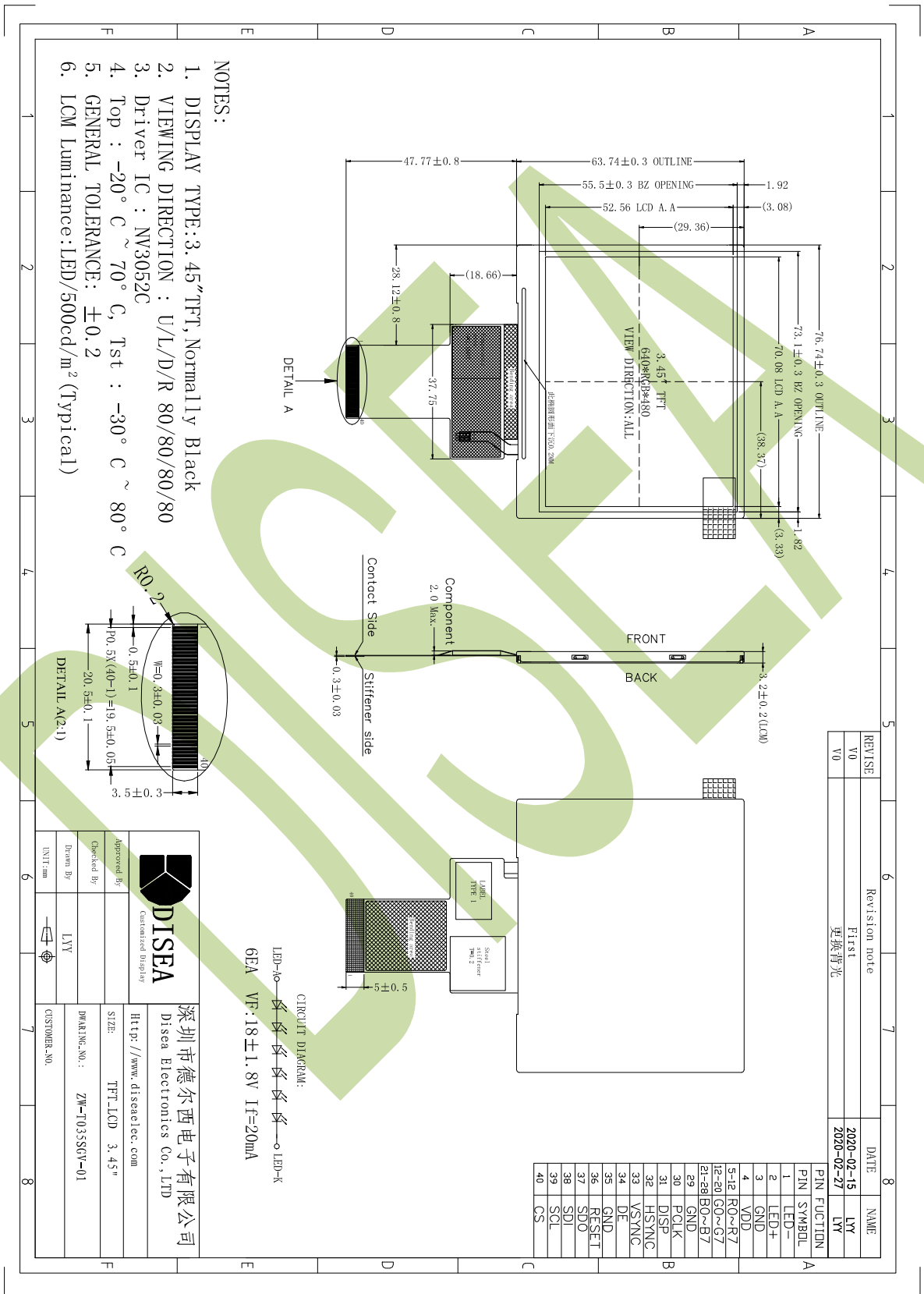
ZW-T035SGV-01 is a TFT-LCD module. It is composed of a TFT-LCD panel, driver IC, FPC, a back light unit . The 3.45'' display area contains 640X(RGB)x480 pixels and can display up to 16.7M colors. This product accords with ROHS environmental criterion.

Item	Contents	Unit	Note
LCD Type	TFT	-	
Display color	16.7M		1
Viewing Direction	ALL	O'Clock	
Operating temperature	-20~+70	°C	
Storage temperature	-30~+80	°C	
Module size	76.74X63.74X3.2	mm	2
Active Area(W×H)	70.08X52.56	mm	
Number of Dots	640×480	dots	
Controller	NV3052C	-	
Power Supply Voltage	2.8	V	
Backlight	6S-LEDs (white)	pcs	
Weight	---	g	
Interface	3SPI+RGB24bit	-	

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($T_a=25\text{ }^\circ\text{C}$)

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

Item	Symbol	Min.	Max.	Unit	Note
Power Supply Voltage	VDD	-0.3	4.5	V	1, 2

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. $V_{DD} > V_{SS}$ 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

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. $T_a \leq 40\text{ }^\circ\text{C}$:85%RH MAX.

$T_a > 40\text{ }^\circ\text{C}$:Absolute humidity must be lower than the humidity of 85%RH at 40 $^\circ\text{C}$.

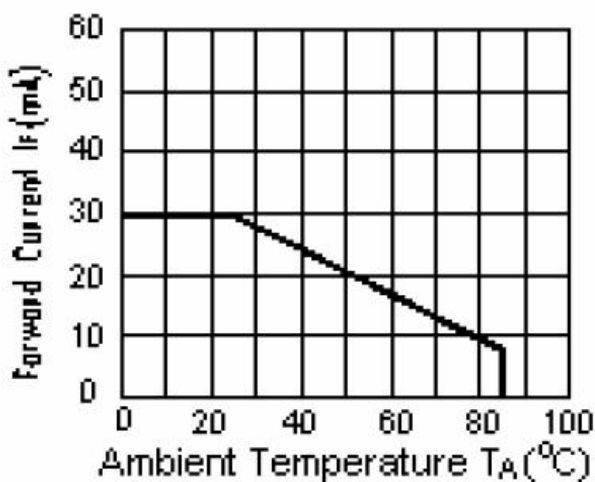
6. Electrical Specifications

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

Parameter	Symbol	Condition	Min	Typ	Max	Unit	Note
Power supply	VDD	$T_a=25^\circ C$	2.5	2.8	3.6	V	
Input voltage	'H'	V_{IH}	$0.7 \cdot VDD$	-	VDD	V	
	'L'	V_{IL}	0	-	$0.3 \cdot VDD$	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	$I_f=20mA$	16.2	18.0	19.8	V	
Uniformity	ΔBp	$I_f=20mA$	75	80	-	%	
Life Time	time	$I_f=20mA$	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	LED-	P	LED back light(Cathode)
2	LED+	P	LED back light(Anode)
3	GND	P	Ground.
4	VDD	P	Power for analog circuit
5-12	R0-R7	I	Graphic display Red data.
13-20	G0-G7	I	Graphic display Green data.
21-28	B0-B7	I	Graphic display Blue data.
29	GND	P	Ground.
30	PCLK	I	Pixel clock signal in RGB mode.
31	DISP	I	Display on/off
32	HSYNC	I	Horizontal sync input in RGB mode.
33	VSYNC	I	Vertical sync input in RGB mode.
34	DE	I	Data enable signal in RGB mode.
35	GND	P	Ground.
36	RESET	I	Reset input pin,Active"L"
37	SDO	O	Serial output signal in SPI I/F
38	SDI	I	Serial input signal in SPI I/F
39	SCL	I	A synchronous clock signal in SPI I/F.
40	CS	I	Chip select input pin ("Low" enable) in SPI I/F.

6.4 AC Characteristics

6.4.1 Serial interface characteristics (SPI)

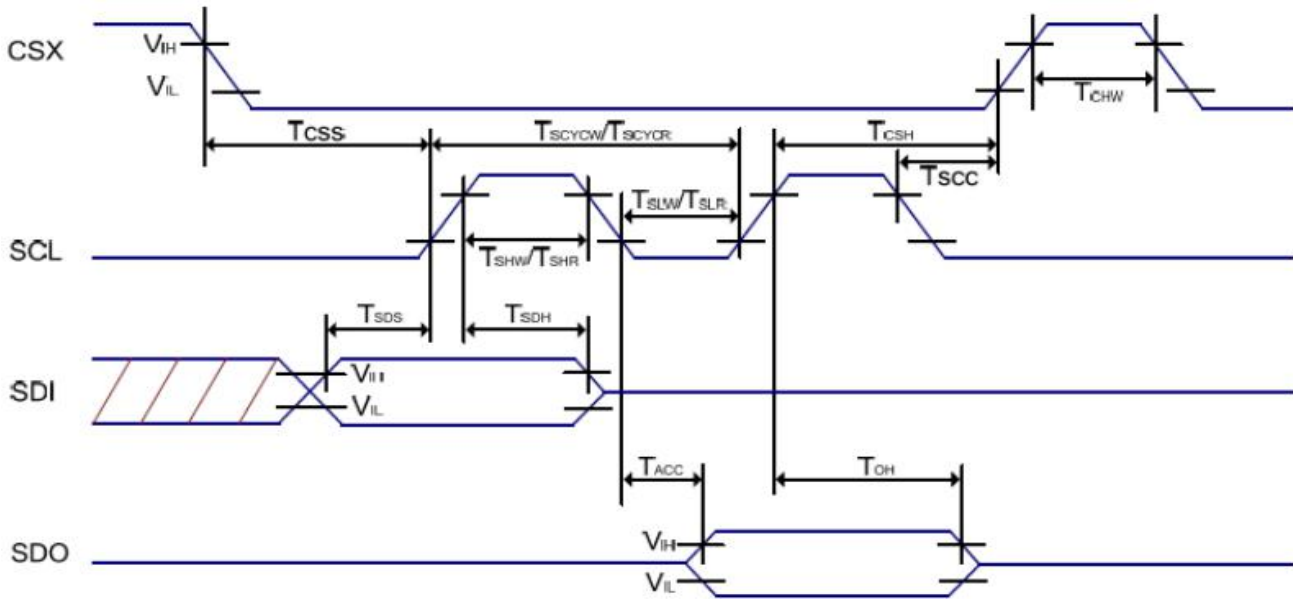
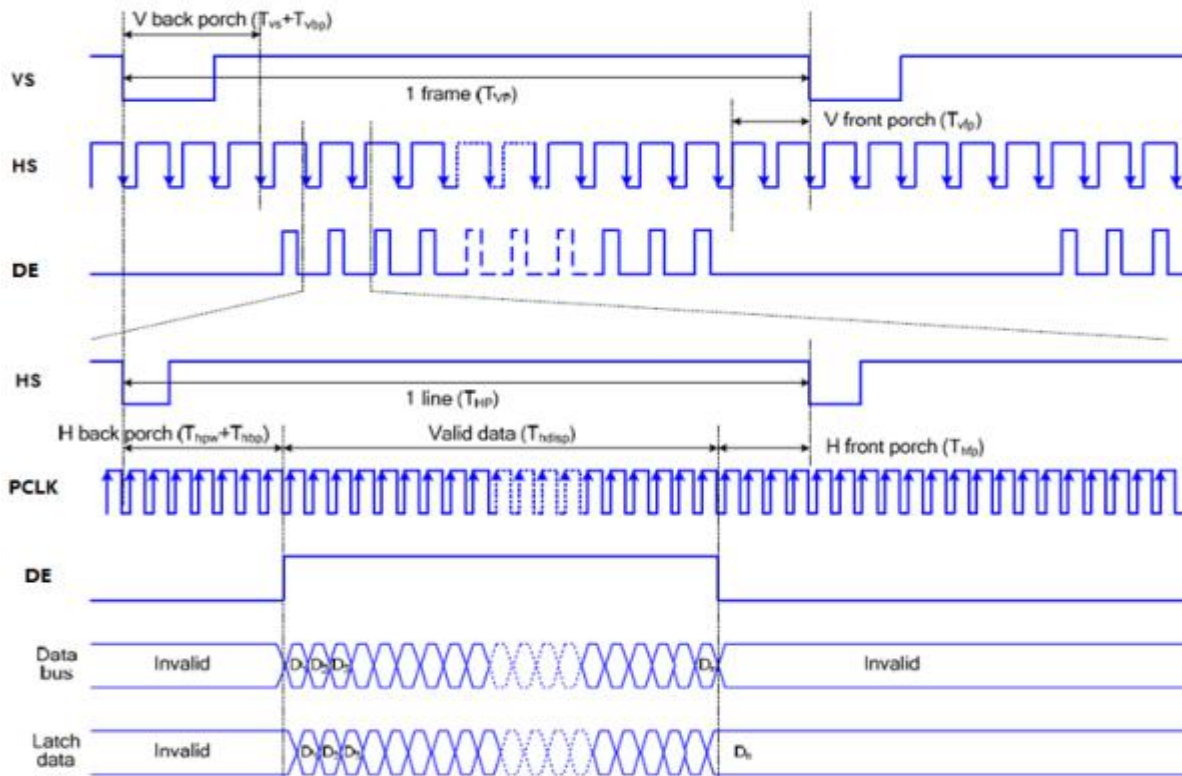


Table: SPI Interface Characteristics

Signal	Symbol	Parameter	MI N	MA X	Unit	Description
CSX	T_{CSS}	Chip select setup time	15	-	ns	-
	T_{CCH}	Chip select hold time	15	-	ns	
	T_{SCC}	Chip select setup time	20	-	ns	
	T_{CHW}	Chip "H" pulse width	40	-	ns	
SCL	T_{SCYW}	Serial clock cycle (Write)	66	-	ns	-
	T_{SHW}	SCL "H" pulse width (Write)	10	-	ns	
	T_{SLW}	SCL "L" pulse width (Write)	10	-	ns	
	T_{SCYCR}	Serial clock cycle (Read)	150	-	ns	-
	T_{SHR}	SCL "H" pulse width (Read)	60	-	ns	
	T_{SLR}	SCL "L" pulse width (Read)	60	-	ns	
SDI	T_{SDS}	Data setup time	10	-	ns	For maximum $C_L=30pF$ For minimum $C_L=8pF$
	T_{SDH}	Data hold time	10	-	ns	
	T_{ACC}	Access time	10	50	ns	
	T_{OH}	Output disable time	15	50	ns	

6.4.2 RGB Interface Timing

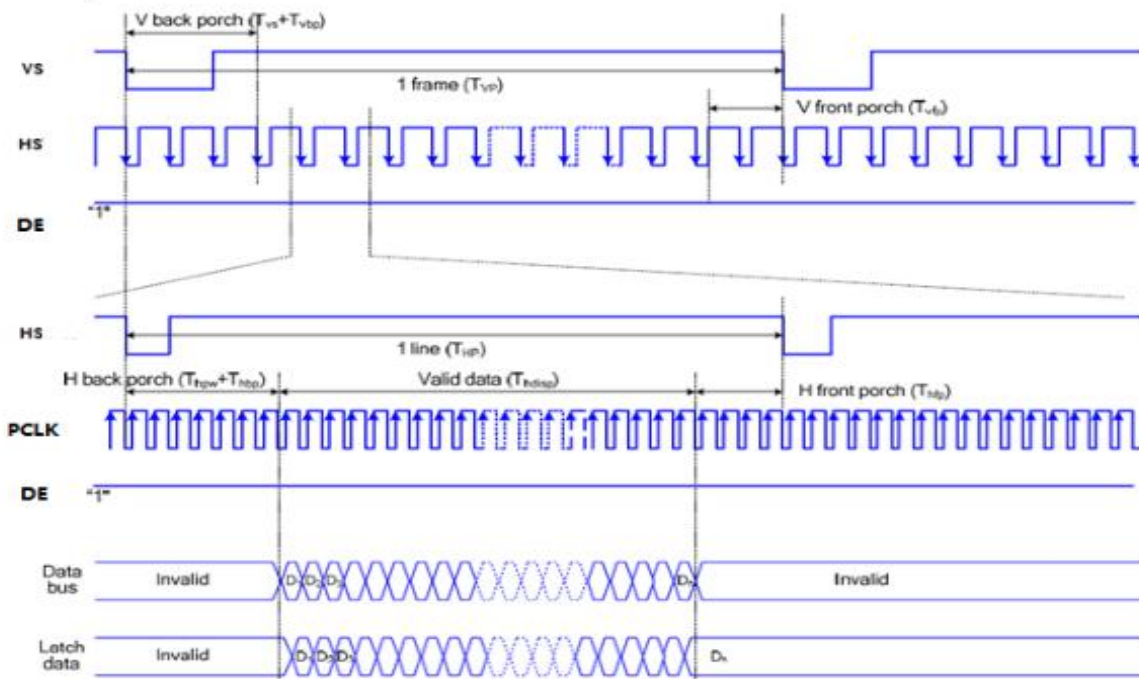
The timing chart of RGB interface DE mode is shown as follows.



Timing Chart of Signals in RGB Interface DE Mode

Note: The setting of front porch and back porch in host must match that in IC as this mode.

The timing chart of RGB interface SYNC mode is shown as follows.



Timing chart of RGB interface SYNC mode

7. Optical Characteristics

Item	Symbol	Condition	Min.	Typ.	Max.	Unit	Note
Brightness	Bp	$\theta=0^\circ$ $\Phi=0^\circ$	-	500	-	Cd/m ²	1
Uniformity	Δ 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	$\theta=0^\circ$ $\Phi=0^\circ$	600	800	-	-	4
Response Time	T _r +T _f		-	25	50	ms	
Color of CIE Coordinate	W	x	Typ. -0.05	TBD	Typ. +0.05	-	1,6
		y		TBD		-	
	R	x		TBD		-	
		y		TBD		-	
	G	x		TBD		-	
		y		TBD		-	
	B	x		TBD		-	
		y		TBD		-	
NTSC Ratio	S		-	50	-	%	

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

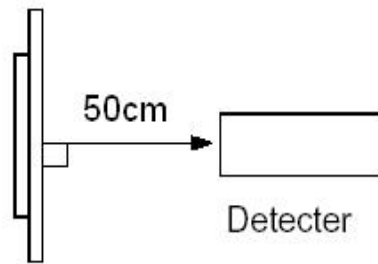
Note 1: The data are measured after LEDs are turned on for 5 minutes. LCM displays full white.

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

Measuring condition:

- Measuring surroundings: Dark room.
- Measuring temperature: $T_a=25\text{ }^\circ\text{C}$.
- 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.

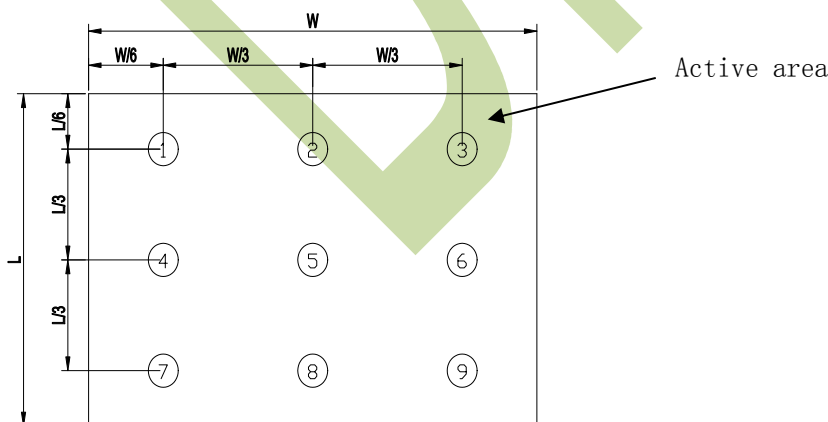


Note 2: The luminance uniformity is calculated by using following formula.

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

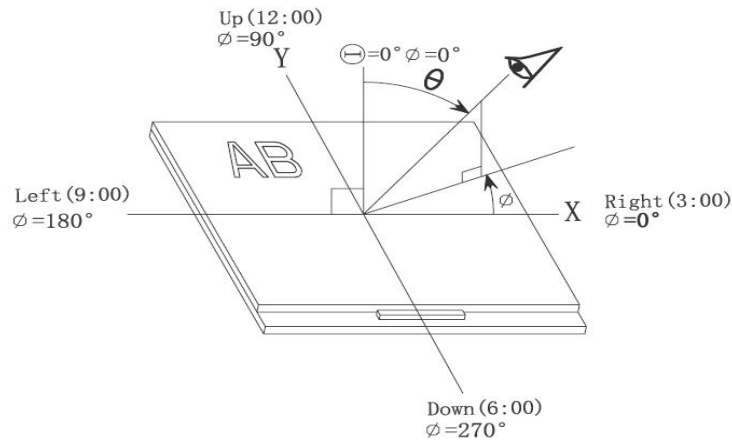
$B_p (\text{Max.})$ = Maximum brightness in 9 measured spots

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

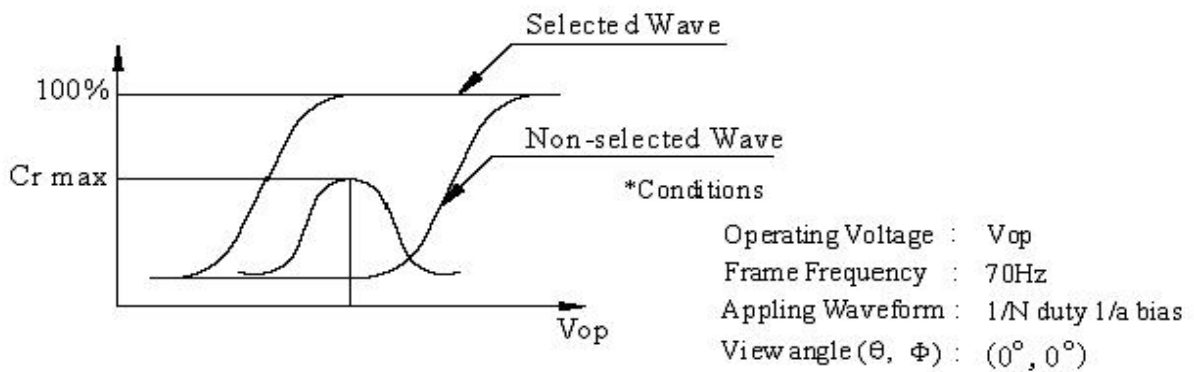


Note 3: The definition of viewing angle:

Refer to the graph below marked by θ and Φ



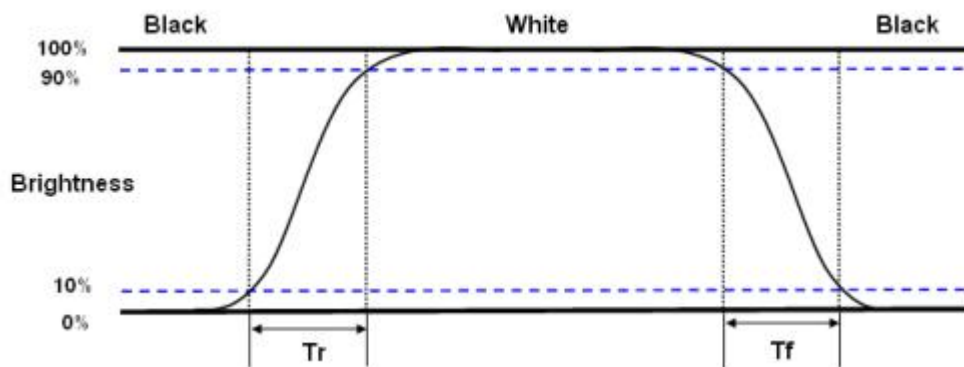
Note 4: Definition of contrast ratio.(Test LCD using DMS501)



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

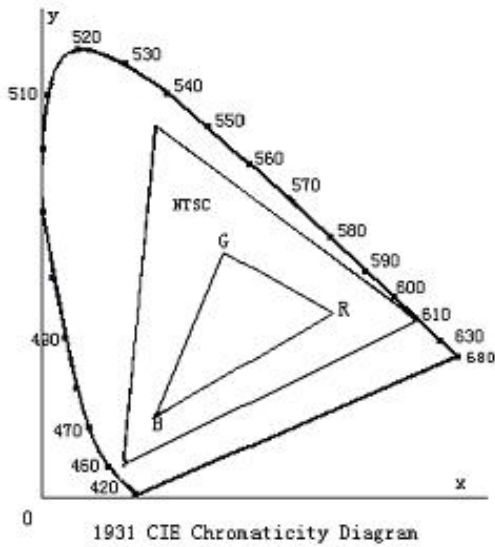
Note 5: Definition of Response time. (Test LCD using DMS501):

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



The definition of response time

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

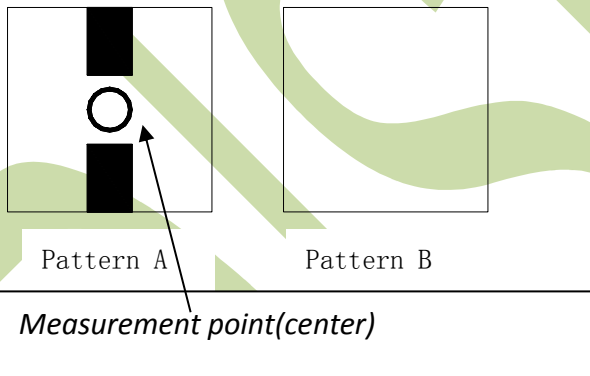


Color gamut:

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

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 +/- 3Hex

8. Reliability Test Items and Criteria

Test Item	Test condition	Remark
High Temperature Storage	Ta = 80°C 96hrs	Note1,Note3, 4
Low Temperature Storage	Ta = -30°C 96hrs	Note1,Note3, 4
High Temperature Operation	Ts = 70°C 96hrs	Note2,Note3, 4
Low Temperature Operation	Ta = -20°C 96hrs	Note1,Note3, 4
Operation at High Temperature/Humidity	+60°C, 90%RH 96hrs	Note3, 4
Thermal Shock	-30°C/30 min ~ +80°C/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 °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