

PRELIMINARY

ZETTLER DISPLAYS

SPECIFICATIONS FOR LIQUID CRYSTAL DISPLAY

CUSTOMER APPROVAL			
※ PART NO. : ATM0270B1 (ZETTLER DISPLAYS) PRELIMINARY			
APPROVAL		COMPANY CHOP	
CUSTOMER COMMENTS			

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ATM0270B1(ZETTLER DISPLAYS) TFT MODULE **PRELIMINARY**

1. GENERAL SPECIFICATIONS

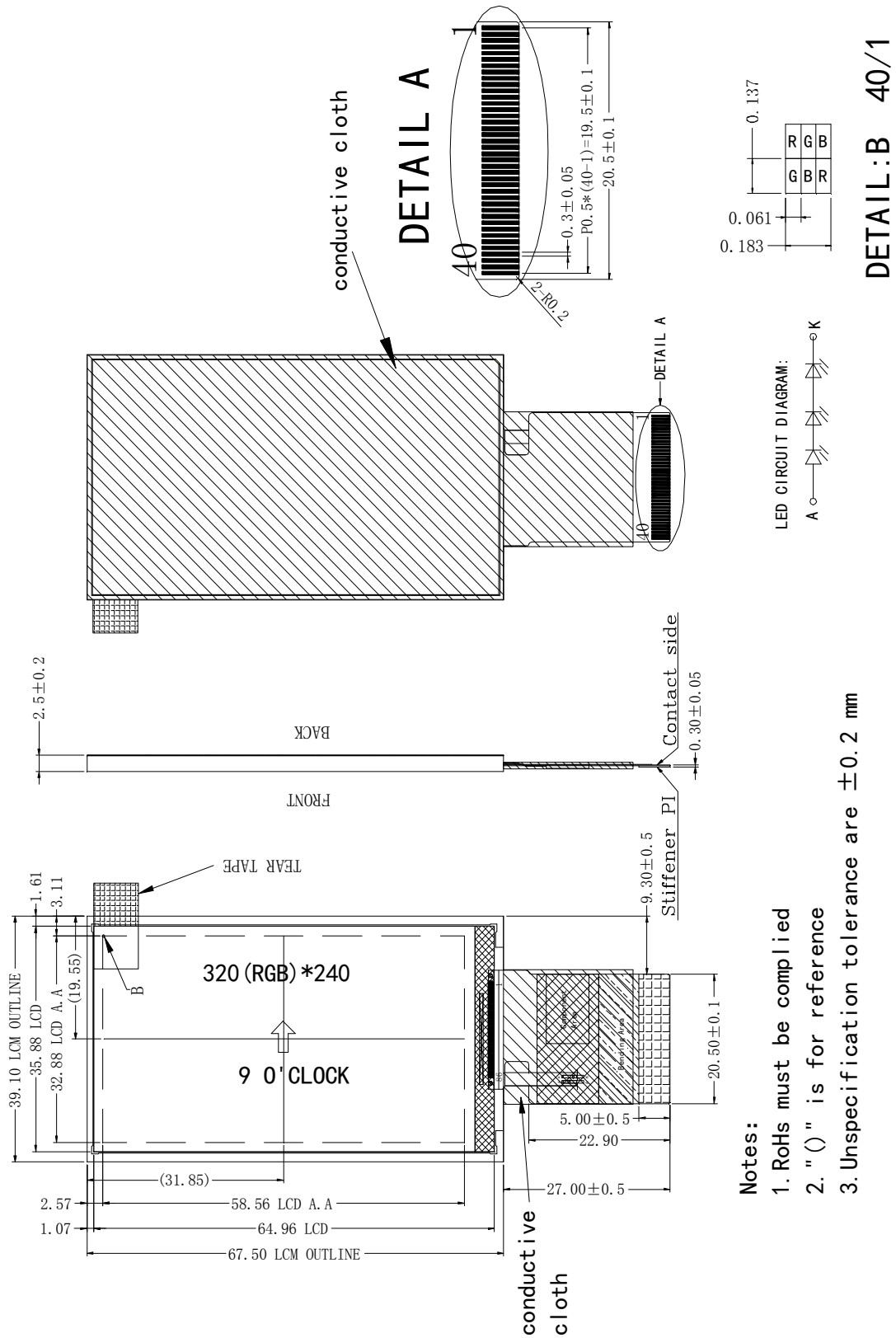
ATM0270B1 is a TFT-LCD module. It is composed of a TFT-LCD panel, driver IC, FPC, a back light unit. The 2.7" display area contains 960 x 240 pixels and can display up to 262K colors. This product accords with RoHS environmental criterion.

Item	Contents	Unit	Note
LCD Type	TFT	-	
Display color	262K		1
Viewing Direction	9	O'Clock	
Operating temperature	-20~+70	°C	
Storage temperature	-30~+80	°C	
Module size	Refer to outline drawing	mm	
Active Area(W×H)	32.88X58.56	mm	2
Number of Dots	320(RGB)*240	dots	
Controller	ILI8961	-	
Power Supply Voltage	3.3	V	
Outline Dimensions	Refer to outline drawing	-	2
Backlight	3-LEDs (white)	pcs	
Weight	--	g	
Interface	8 bit RGB+ 3 SPI	-	

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

Note 2: Without FPC and Solder.

2. OUTLINE DRAWING



3. ABSOLUTE MAXIMUM RATINGS

3.1 Electrical Absolute Maximum Ratings.(Vss=0V ,Ta=25°C)

Item	Symbol	Min.	Max.	Unit	Note
Power Supply Voltage	V _{DD}	-0.3	5.0	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.

3.2 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. Ta<=40°C:90%RH MAX.
Ta>=40°C:Absolute humidity must be lower than the humidity of 90%RH at 40°C.

4. ELECTRICAL SPECIFICATIONS AND INSTRUCTION CODE

4.1 Electrical characteristics(V_{SS}=0V ,T_a=25°C)

Note:

1:

Parameter		Symbol	Condition	Min	Typ	Max	Unit	Note
Power supply		VDD	T _a =25°C	2.7	3.3	3.6	V	
Input voltage	'H'	V _{IH}	V _{DD} =3.3V	0.8V _{DD}	-	V _{DD}	V	
	'L'	V _{IL}	V _{DD} =3.3V	0	-	0.2V _{DD}	V	
Current Consumption		I _{CC1}	Normal mode	-	12	-	mA	1
		I _{CC2}	Sleep mode	-	100	-	uA	1

Note:

1:Tested in 1×1 chessboard pattern.

4.2 LED backlight specification(V_{SS}=0V ,T_a=25°C)

Item	Symbol	Condition	Min	Typ	Max	Unit	Note
Supply voltage for Backlight	V _f	I _f =20mA	-	9	-	V	1
Uniformity for Backlight	Δ Bp		80	-		%	

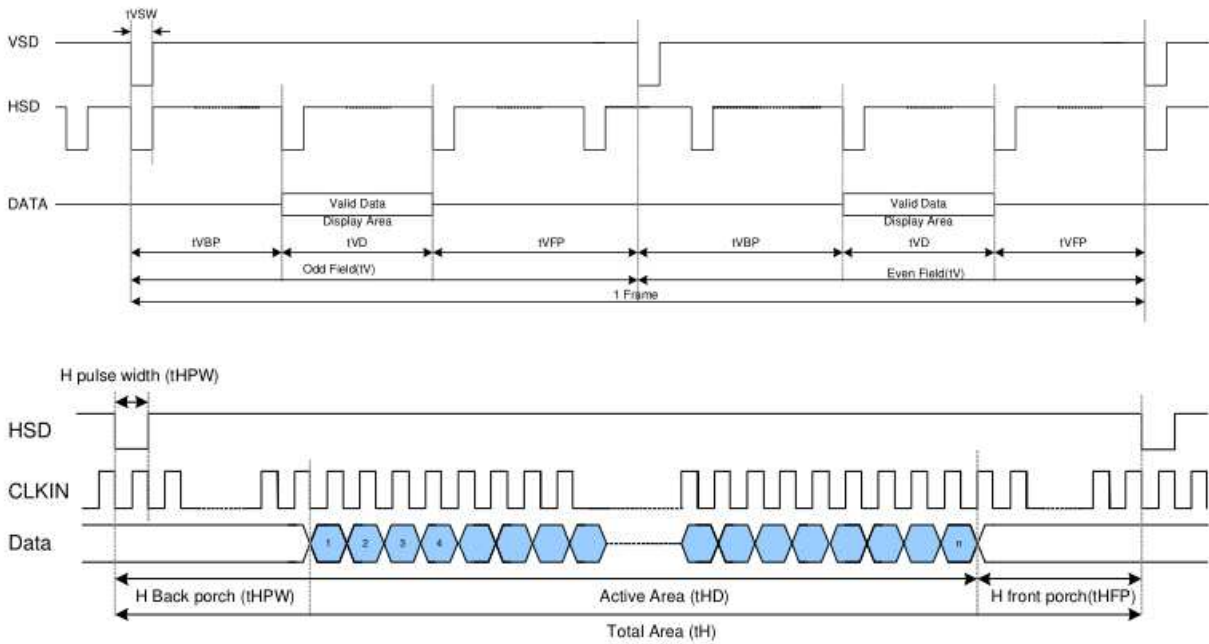
Note:

1: The "LED Life time" is defined as the module brightness decrease to 50% original brightness at T=25 °C and I_{LED}=20mA. The LED Life time could be decreased if operating I_f is larger than 20mA

4.3 Interface signals

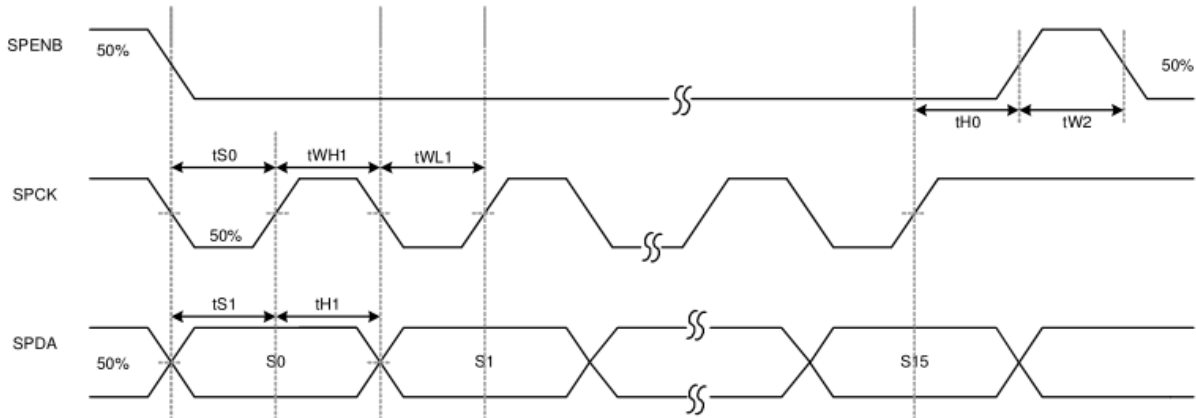
Pin No.	Symbol	Function
1	VCOM	Common electrode driving voltage
2	LEDK	LED power cathode
3	LEDA	LED power anode
4	DRV	VLED boost transistor for VCOM AC
5	VCAC	Power setting capacitor for VCOM AC
6	VCOMDC	VCOM DC voltage output pin
7	FRP	Frame polarity output for VCOM
8	AGND	Ground terminal in the digital circuit
9	VGL	Power setting capacitor connecting pins
10	VGH	Power setting capacitor connecting pins
11	C4M	Charge pump power
12	C4P	Charge pump power
13	VINT3	Charge pump power GND
14	VINT4	Charge pump power GND
15	V3M	Charge pump power
16	V3P	Charge pump power
17	VINT1	Charge pump power GND
18	V2M	Charge pump power
19	V2P	Charge pump power
20	V1N	Charge pump power
21	V1P	Charge pump power
22	DVDD	Charge pump power GND
23	VDDIO	Digital voltage input
24	VDD	System power
25	GND	Ground terminal in the logic circuit
26-33	DB0-DB7	Data input
34	DCLK	Data clock input
35	VSYNC	Vertical sync input
36	HSYNC	Horizontal sync input
37	SCL	Serial command clock input
38	SDA	Serial command data input
39	CS	Serial command enable
40	VCOM	Common electrode driving voltage

4.4 RGB Interface Timing Characteristics



Parameter	Symbol	Interface			Unit	
		Min.	Typ.	Max.		
CLKIN frequency	fCLKIN	13.5	27	27.19	MHz	
HSD period	tH	1024	1716	1728	CLKIN	
HSD display period	tHD		960		CLKIN	
HSD back porch	tHBP	50	70	255	CLKIN	
HSD front porch	tHFP	14	686	513	CLKIN	
HSD pulse width	tHSW	1	1	tHBP-1	CLKIN	
VSD period time	tV	242.5	262.5	450.5	H	
Vertical display area	tVD		240		H	
VSD back porch	Odd field	tVBP	1	21	31	H
	Even field		1.5	21.5	31.5	
VSD front porch	Odd field	tVFP	1.5	1.5	179.5	H
	Even field		1	1	179	
VSD pulse width	tVSW	1CLKIN	1CLKIN	6H		
1 Frame		485	525	901	H	

4.5 Serial Control Timing

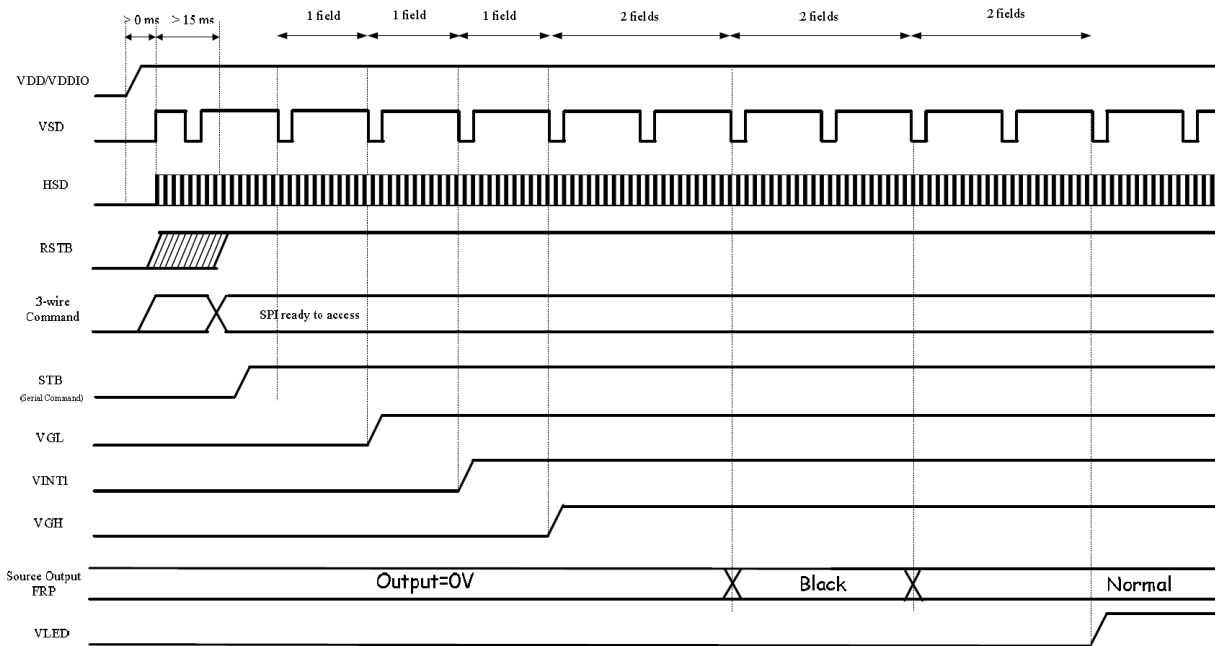


Item	symbol	Min.	Typ.	Max.	Unit
SPENB input setup time	tS0	50			ns
Serial data input setup time	tS1	50			ns
SPENB input hold time	tH0	50			ns
Serial Data Input hold time	tH1	50			ns
SPCK pulse high width	tWH1	50			ns
SPCK pulse low width	tWL1	50			ns
SPENB pulse high width	tW2	400			ns

4.6 Power On/Off Sequence

4.6.1 Power On Sequence

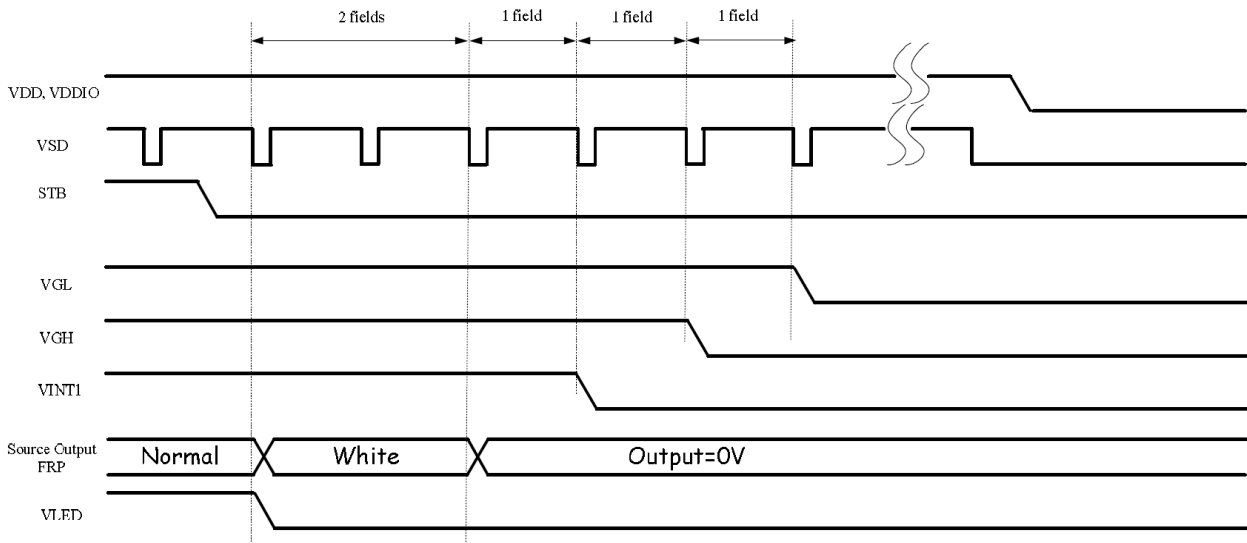
Power On Sequence



Note: 1. The RSTB should keep low until VDDIO was stable, and set to high before SPI command start
 2. After STB set to 1, it takes 9 VSD pulse for power on operation

4.6.2 Power On Sequence

Power Off Sequence



5. OPTICAL CHARACTERISTICS

Item	Symbol	CONDITION	Min.	Typ.	Max.	Unit	Note
Brightness	Bp	$\theta=0^\circ$ $\Phi=0^\circ$	-	300	-	Cd/m ²	1
Uniformity	Δ Bp		80		-	%	1,2
Viewing Angle	3:00	Cr \geq 10	-	55	-	deg	3
	6:00		-	65	-		
	9:00		-	65	-		
	12:00		-	65	-		
Contrast Ratio	Cr	$\theta=0^\circ$ $\Phi=0^\circ$	150	250		-	4
Response Time	T _r		-	10	20	ms	5
	T _f		-	20	30	ms	
Color of CIE Coordinate	W	x	0.278	0.328	0.378	-	1,6
		y	0.296	0.346	0.396	-	
	R	x	0.583	0.633	0.638	-	
		y	0.279	0.329	0.379	-	
	G	x	0.244	0.294	0.344	-	
		y	0.526	0.576	0.626	-	
	B	x	0.083	0.133	0.183	-	
		y	0.072	0.122	0.172	-	
NTSC Ratio	S	--	51.37	-	%		

Note:

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

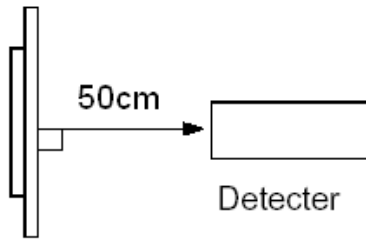
Note 1: The data are measured after LEDs are turned on for 5 minutes. LCM displays full white. The brightness is the average value of 9 measured spots. Measurement equipment PR-705 (Φ5mm)

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.

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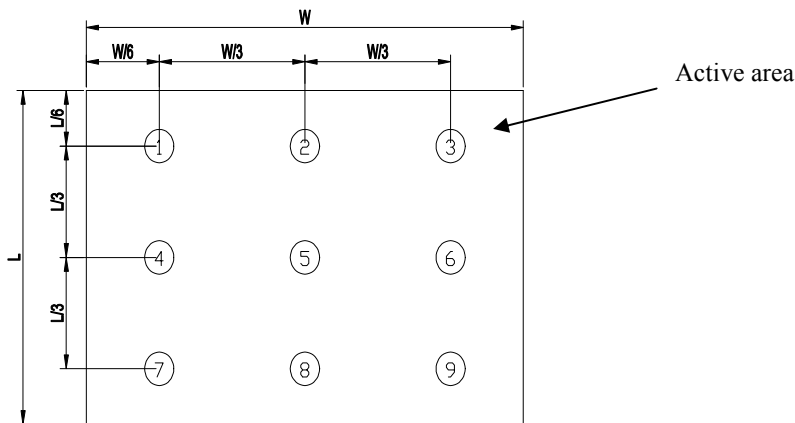


Note 2: The luminance uniformity is calculated by using following formula.

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

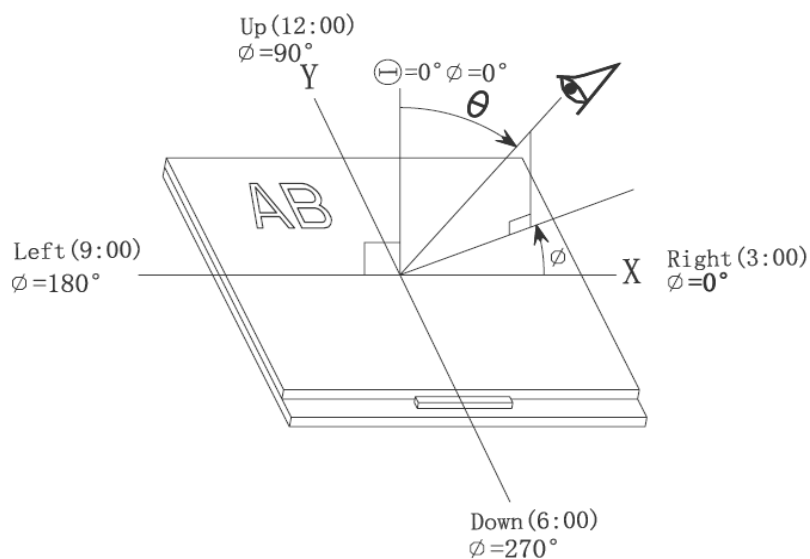
Bp (Max.) = Maximum brightness in 9 measured spots

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



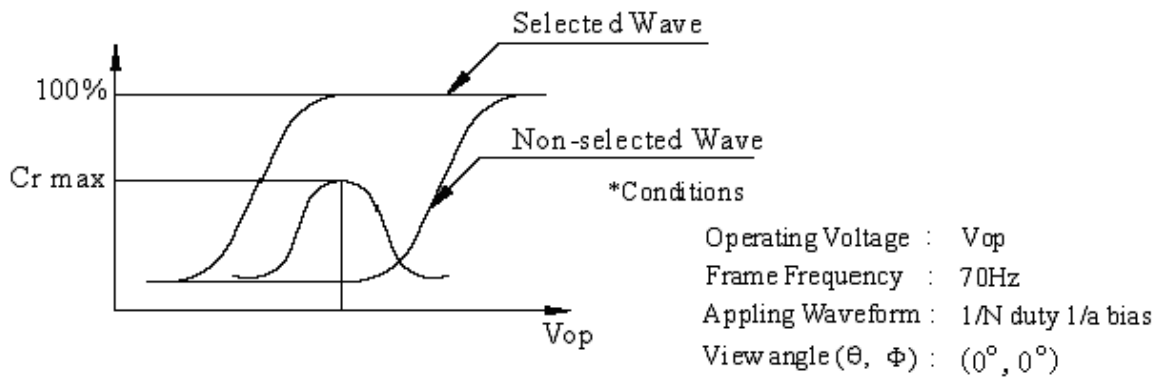
Note 3: The definition of viewing angle:

Refer to the graph below marked by θ and ϕ



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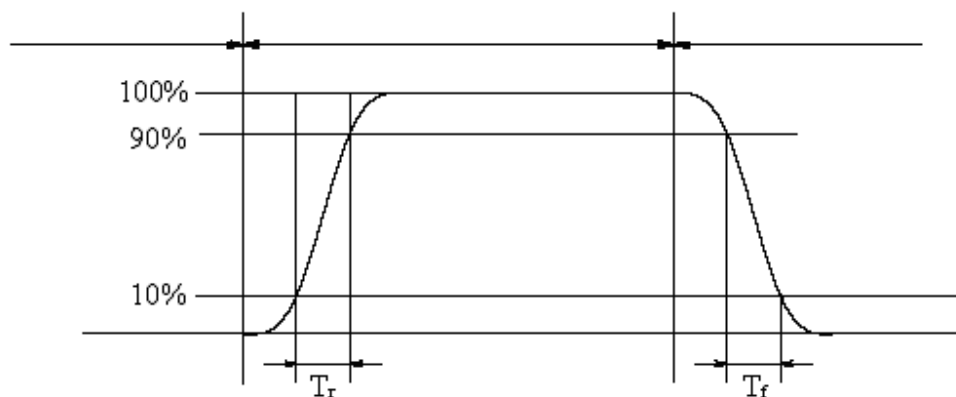
Note 4: Definition of contrast ratio.(Test LCD using DMS501)



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

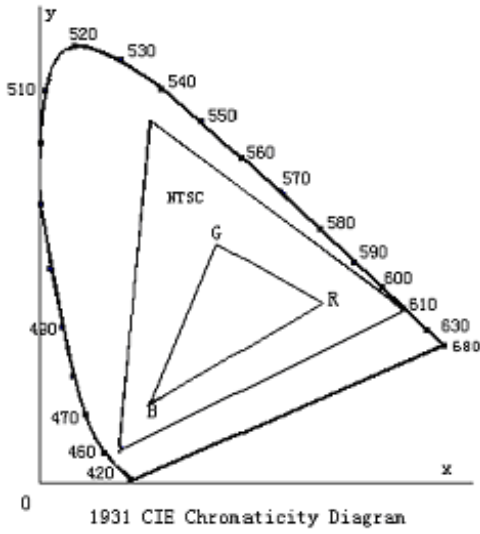
Note 5: Definition of Response time. (Test LCD using DMS501):

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.

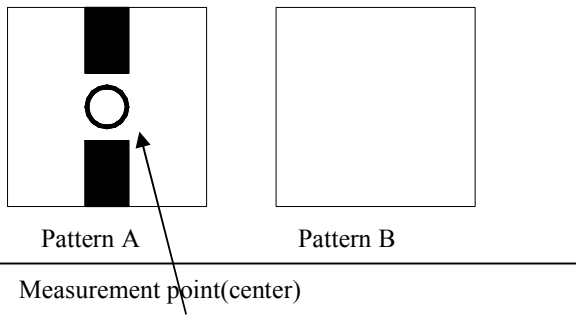


Color gamut:

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

Note 7: Definition of cross talk.

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



Electric volume value=3F+/-3Hex

6. RELIABILITY TEST ITEMS AND CRITERIA

No	Test Item	Test condition	Criterion
1	High Temperature Storage	80°C ,96H	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 ,96H	
3	High Temperature Operation	70°C ,96H	
4	Low Temperature Operation	-20°C, 96H	
5	High Temperature/Humidity Storage	50°C, 90%RH, 96H	
6	Temperature Cycle Test	-20°C,60min~70°C,60min 20cycles	
7	Packing vibration	Frequency range:10HZ~50HZ ,Acceleration of gravity:5G X,Y,Z 30 min for each direction	Note1,2
8	ESD test	Air: ±8KV 150PF/330 Ω 5 times Contact: ±4KV 150PF/330 Ω 5 times	
9	Drop Test (Packaged)	Height: 80CM, 1 Corner, 3edges, 6surfaces	

Note1: No deflection cosmetic and operational function allowable.

Note2: Total current Consumption should be below double of initial value.

7. PRECAUTIONS FOR USE OF LCD MODULES

7.1 Handling Precautions

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

7.1.2 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.

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

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

7.1.5 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

7.1.6 Do not attempt to disassemble the LCD Module.

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

7.1.8 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.

7.2 Storage precautions

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

7.2.2 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: $\leq 80\%$

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

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