SPECIFICATION FOR LCD MODULE

Model No. GVLCM1602G-12514A

Approved	Checked	Department

Revision	Document No.	
	Document Rev.	1.0

Data	Sheet No.	Summary
		New

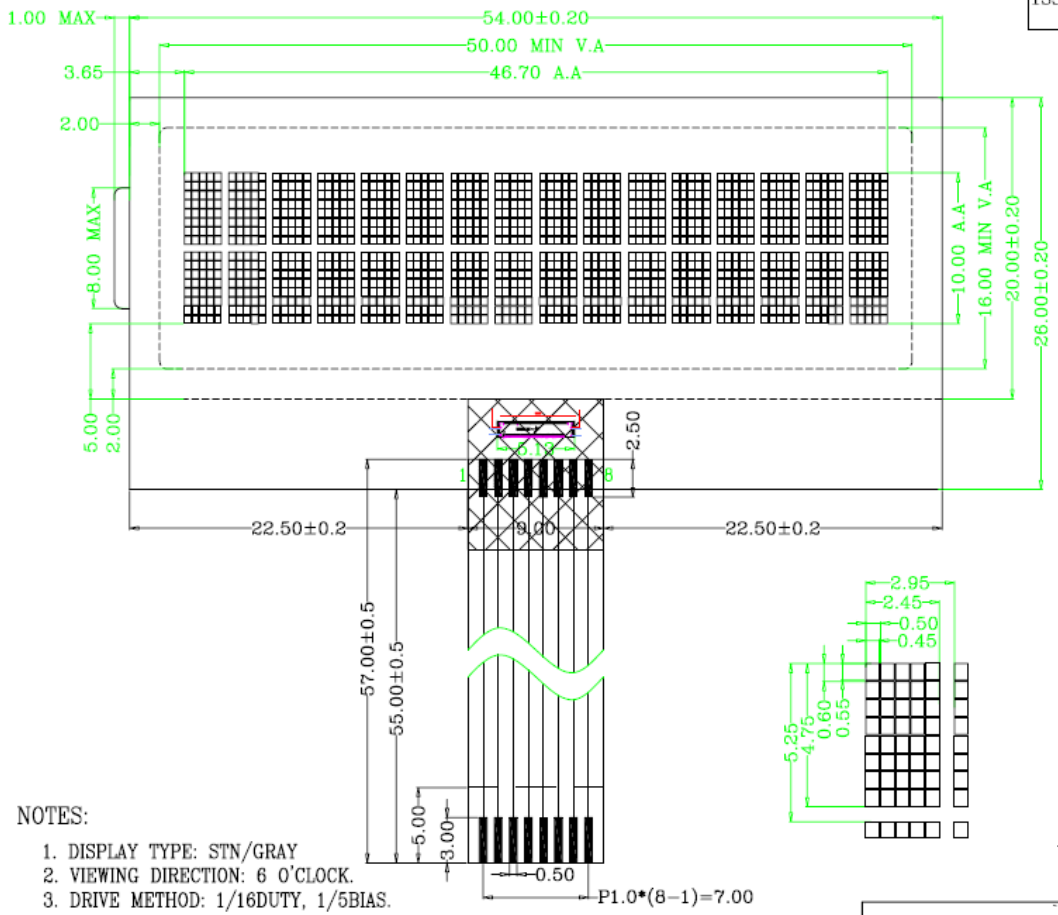
1.General Specifications:

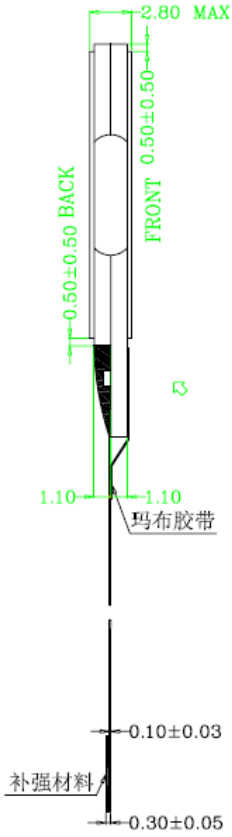
- Display type: STN/GRAY
- Polarizer mode: Transflective/Positive
- Viewing Angle: 6:00 clock Direction
- Driving Method: 1/16 Duty 1/5 Bias
- Lcd operation voltage: 5.0V, VDD=3.3V
- Controller: ST7032
- Data Transfer: I2c
- Operating Temperature: 0℃ ~ 50℃
- Storage Temperature: -10℃ ~ 60℃
- Outline Dimensions: Refer to outline drawing on next page
- Number Of Dot: (LxW) 16x2(5x8)
- Weight: TBD

2. Outline Drawing

APPROVED BY :

ISSUE	AMENDMENT	DATE	Drawn By





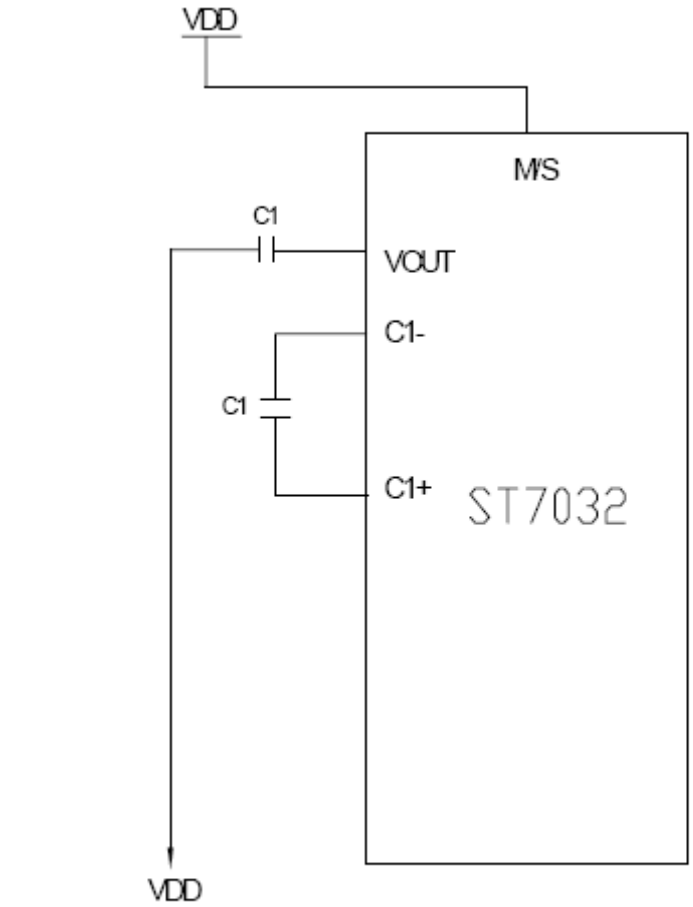
PIN	SIGNAL
1	RES
2	SCL
3	SDA
4	VSS
5	VDD
6	CAP1+
7	CAP1-
8	VOUT

NOTES:

1. DISPLAY TYPE: STN/GRAY
2. VIEWING DIRECTION: 6 O'CLOCK.
3. DRIVE METHOD: 1/16DUTY, 1/5BIAS.
4. OPERATING VOLTAGE: 5.0V.
5. POLARIZER MODE:TRANSFLECTIVE/POSITIVE.
6. OPERATING TEMP: 0°C ~ +50°C.
7. STORAGE TEMP: -10°C ~ +60°C.
8. CONNECTOR: COG+FPC(ST7032)
9. ALL WITHOUT TOLERANCES.X±0.3.

MODEL NO	DRAWN BY: ZWJ	SCALE: 1:1	UNIT: MM
GVLCM1602G -12514A	CHECKED BY: WQS	PAGE: 1/1	DATE: 2007.03.08

3. POWER SUPPLY



Note:
C1=1.0—4.7uF

4. Pin Connection

Pin No.	Symbol	Description
1	RES	When /RES is set to “L,” the settings are initialized. The reset operation is performed by the /RES signal level.
2	SCL	Serial clock input.
3	SDA	Serial data input.
4	VSS	POWER SUPPLY.GROUND
5	VDD	Power supply
6	CAP1+	DC/DC voltage converter. Connect a capacitor between this terminal and the CAP1- terminal.
7	CAP1-	DC/DC oltage converter. Connect a capacitor between this terminal and the CAP1+ terminal.
8	VOUT	DC/DC voltage converter. Connect a capacitor between this terminal and VDD.

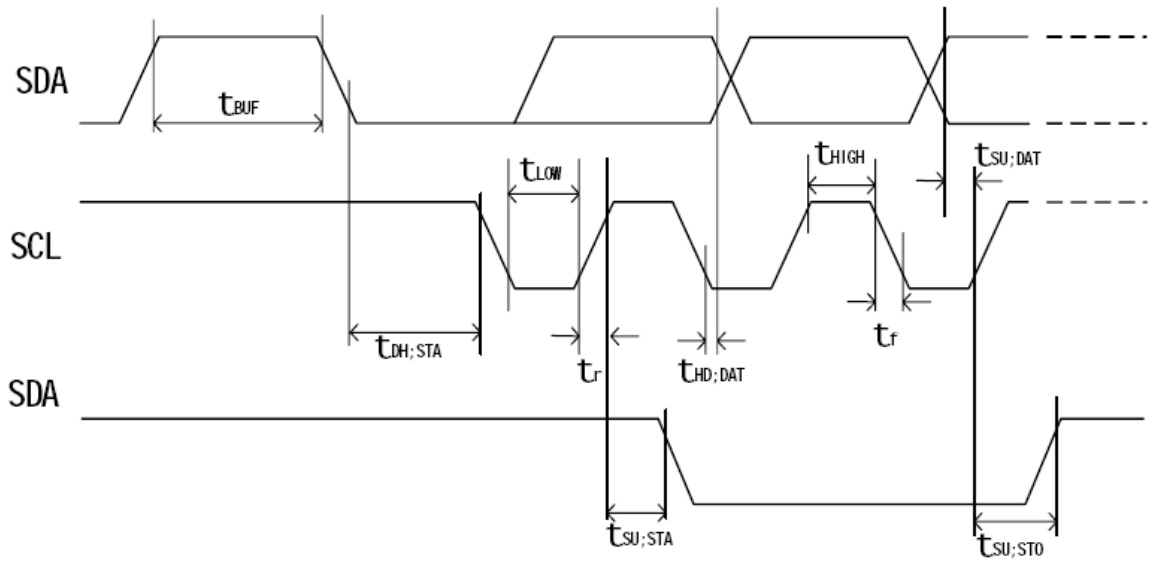
5. DC Characteristics

ITEM		SYMBOL	MIN	TYP	MAX	UINT
Voltage for logic		VDD-VSS	2.0	3.3	3.5	V
Supply current		IOD	—	250	400	uA
Voltage for LCD		VDD-V0	3.7	4.8	5.0	V
Input voltage	**H**	VIH	0.8VDD	—	VDD	V
	L	VIL	VSS	—	0.2VDD	V
Output voltage	**H**	VOH	0.8VDD	—	VDD	V
	L	VOL	VSS	—	0.2VDD	V

6. Absolute Maximum Ratings

Item	Symbol	Min value	Max value	uint
Power supply voltage	VDD-VSS	0	4.7	V
	VDD-V0	0	12	V
Input voltage	VI	VSS	VDD+0.3	V

7. Interface Timing chart



(Ta = 25°C)

Item	Signal	Symbol	Condition	VDD=2.7 to 4.5V Rating		VDD=4.5 to 5.5V Rating		Units
				Min.	Max.	Min.	Max.	
SCL clock frequency	SCL	f_{SCLK}	—	DC	400	DC	400	KHz
SCL clock low period		t_{LOW}		1.3	—	1.3	—	us
SCL clock high period		t_{HIGH}		0.6	–	0.6	–	
Data set-up time	SI	$t_{SU;DAT}$	—	**180**	–	100	–	ns
Data hold time		$t_{HD:DAT}$		0	0.9	0	0.9	us
SCL,SDA rise time	SCL, SDA	t_r	—	20+0.1C_b	300	20+0.1C_b	300	ns
SCL,SDA fall time		t_f		20+0.1C_b	300	20+0.1C_b	300	
Capacitive load represent by each bus line		C_b	—	–	400	–	400	pf
Setup time for a repeated START condition	SI	$t_{SU;STA}$	—	0.6	–	0.6	–	us
Start condition hold time		$t_{HD;STA}$	—	0.6	–	0.6	–	us
Setup time for STOP condition		$t_{SU;STO}$	—	0.6	–	0.6	–	us
Bus free time between a Stop and START condition	SCL	t_{BUF}	—	1.3	–	1.3	–	us

8. Instruction Code Table

➢ **instruction table at "Normal mode"**

(When "EXT" option pin connect to VDD, the instruction set follow below table)

Instruction	Instruction Code										Description	Instruction Execution Time		
	RS	R/W	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0		OSC= 380KHz	OSC= 540kHz	OSC= 700KHz
Clear Display	0	0	0	0	0	0	0	0	0	1	Write "20H" to DDRAM. and set DDRAM address to "00H" from AC	**1.08 ms**	**0.76 ms**	**0.59 ms**
Return Home	0	0	0	0	0	0	0	0	1	x	Set DDRAM address to "00H" from AC and return cursor to its original position if shifted. The contents of DDRAM are not changed.	**1.08 ms**	**0.76 ms**	**0.59 ms**
Entry Mode Set	0	0	0	0	0	0	0	1	I/D	S	Sets cursor move direction and specifies display shift. These operations are performed during data write and read.	**26.3 us**	**18.5 us**	**14.3 us**
Display ON/OFF	0	0	0	0	0	0	1	D	C	B	D=1:entire display on C=1:cursor on B=1:cursor position on	**26.3 us**	**18.5 us**	**14.3 us**
Cursor or Display Shift	0	0	0	0	0	1	S/C	R/L	x	x	S/C and R/L: Set cursor moving and display shift control bit, and the direction, without changing DDRAM data.	**26.3 us**	**18.5 us**	**14.3 us**
Function Set	0	0	0	0	1	DL	N	x	x	x	DL: interface data is 8/4 bits N: number of line is 2/1	**26.3 us**	**18.5 us**	**14.3 us**
Set CGRAM	0	0	0	1	AC5	AC4	AC3	AC2	AC1	AC0	Set CGRAM address in address counter	**26.3 us**	**18.5 us**	**14.3 us**
Set DDRAM address	0	0	1	AC6	AC5	AC4	AC3	AC2	AC1	AC0	Set DDRAM address in address counter	**26.3 us**	**18.5 us**	**14.3 us**
Read Busy flag and address	0	1	BF	AC6	AC5	AC4	AC3	AC2	AC1	AC0	Whether during internal operation or not can be known by reading BF. The contents of address counter can also be read.	**0**	**0**	**0**
Write data to RAM	1	0	D7	D6	D5	D4	D3	D2	D1	D0	Write data into internal RAM (DDRAM/CGRAM)	**26.3 us**	**18.5 us**	**14.3 us**
Read data from RAM	1	1	D7	D6	D5	D4	D3	D2	D1	D0	Read data from internal RAM (DDRAM/CGRAM)	**26.3 us**	**18.5 us**	**14.3 us**

➢ **instruction table at "Extension mode"**

(when "EXT" option pin connect to Vss, the instruction set follow below table)

Instruction	Instruction Code										Description	Instruction Execution Time		
	RS	R/W	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0		OSC= 380KHz	OSC= 540kHz	OSC= 700KHz
Clear Display	0	0	0	0	0	0	0	0	0	1	Write "20H" to DDRAM. and set DDRAM address to "00H" from AC	1.08 ms	0.76 ms	0.59 ms
Return Home	0	0	0	0	0	0	0	0	1	x	Set DDRAM address to "00H" from AC and return cursor to its original position if shifted. The contents of DDRAM are not changed.	1.08 ms	0.76 ms	0.59 ms
Entry Mode Set	0	0	0	0	0	0	0	1	I/D	S	Sets cursor move direction and specifies display shift. These operations are performed during data write and read.	26.3 us	18.5 us	14.3 us
Display ON/OFF	0	0	0	0	0	0	1	D	C	B	D=1:entire display on C=1:cursor on B=1:cursor position on	26.3 us	18.5 us	14.3 us
Function Set	0	0	0	0	1	DL	N	DH	*0	IS	DL: interface data is 8/4 bits N: number of line is 2/1 DH: double height font IS: instruction table select	26.3 us	18.5 us	14.3 us
Set DDRAM address	0	0	1	AC6	AC5	AC4	AC3	AC2	AC1	AC0	Set DDRAM address in address counter	26.3 us	18.5 us	14.3 us
Read Busy flag and address	0	1	BF	AC6	AC5	AC4	AC3	AC2	AC1	AC0	Whether during internal operation or not can be known by reading BF. The contents of address counter can also be read.	0	0	0
Write data to RAM	1	0	D7	D6	D5	D4	D3	D2	D1	D0	Write data into internal RAM (DDRAM/CGRAM/ICONRAM)	26.3 us	18.5 us	14.3 us
Read data from RAM	1	1	D7	D6	D5	D4	D3	D2	D1	D0	Read data from internal RAM (DDRAM/CGRAM/ICONRAM)	26.3 us	18.5 us	14.3 us

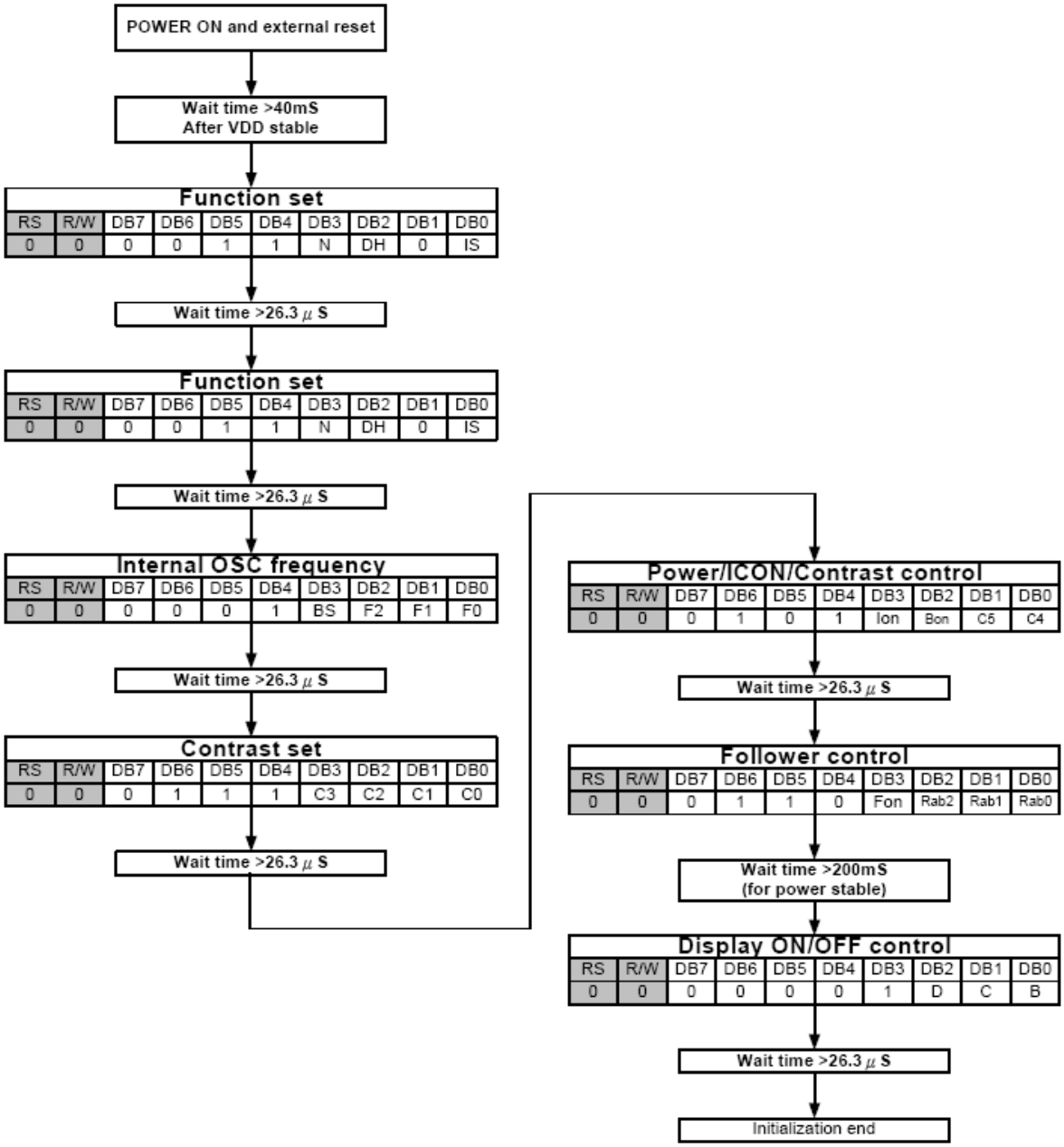
Note * : this bit is for test command , and must always set to "0"

Instruction table 0(IS=0)														
Cursor or Display Shift	0	0	0	0	0	1	S/C	R/L	x	x	S/C and R/L: Set cursor moving and display shift control bit, and the direction, without changing DDRAM data.	26.3 us	18.5 us	14.3 us
Set CGRAM	0	0	0	1	AC5	AC4	AC3	AC2	AC1	AC0	Set CGRAM address in address counter	26.3 us	18.5 us	14.3 us

Instruction table 1(IS=1)														
Internal OSC frequency	0	0	0	0	0	1	BS	F2	F1	F0	BS=1:1/4 bias BS=0:1/5 bias F2~0: adjust internal OSC frequency for FR frequency.	26.3 us	18.5 us	14.3 us
Set ICON address	0	0	0	1	0	0	AC3	AC2	AC1	AC0	Set ICON address in address counter.	26.3 us	18.5 us	14.3 us
Power/ICON control/Contrast set	0	0	0	1	0	1	Ion	Bon	C5	C4	Ion: ICON display on/off Bon: set booster circuit on/off C5,C4: Contrast set for internal follower mode.	26.3 us	18.5 us	14.3 us
Follower control	0	0	0	1	1	0	Fon	Rab 2	Rab 1	Rab 0	Fon: set follower circuit on/off Rab2~0: select follower amplified ratio.	26.3 us	18.5 us	14.3 us
Contrast set	0	0	0	1	1	1	C3	C2	C1	C0	Contrast set for internal follower mode.	26.3 us	18.5 us	14.3 us

9. Initializing By Instruction

Serial interface & IIC interface (fosc = 380KHz)



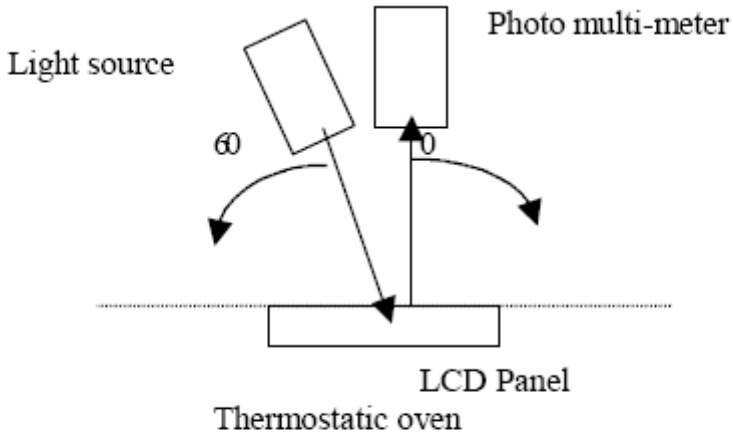
10. Optical Characteristics (Reflective Mode)

Item	Sysmbol	Temp	Min	Typ	Max	Uint	condition	
Vop	Vdd-Vss	25		3.3	3.5	V		
Response Time	Tr	25		200		ms		
	Tf	25		80		ms		
Contrast Ratio	k	25		6.1			Reflective mode	
Viewing Angle		25		38		deg.	=0	CR≧2.0
				34		deg.	=90	
				38		deg.	=180	
				38		deg.	=270	

- Panel only characteristics
- 1/16 duty,1/5 bias

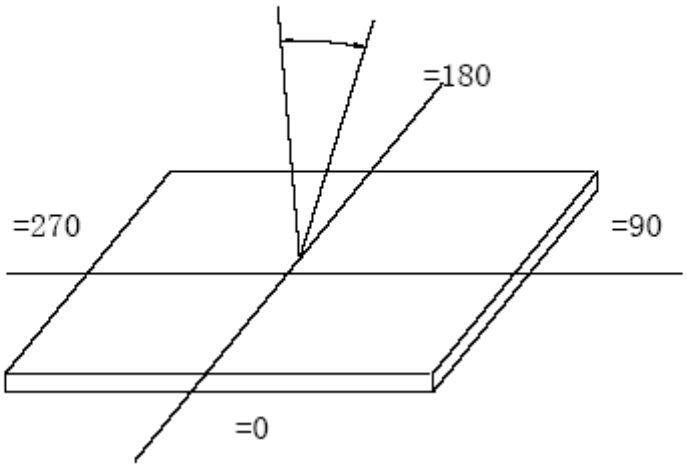
11. Definition of Optical Characteristics

• Optical Measuring Equipment

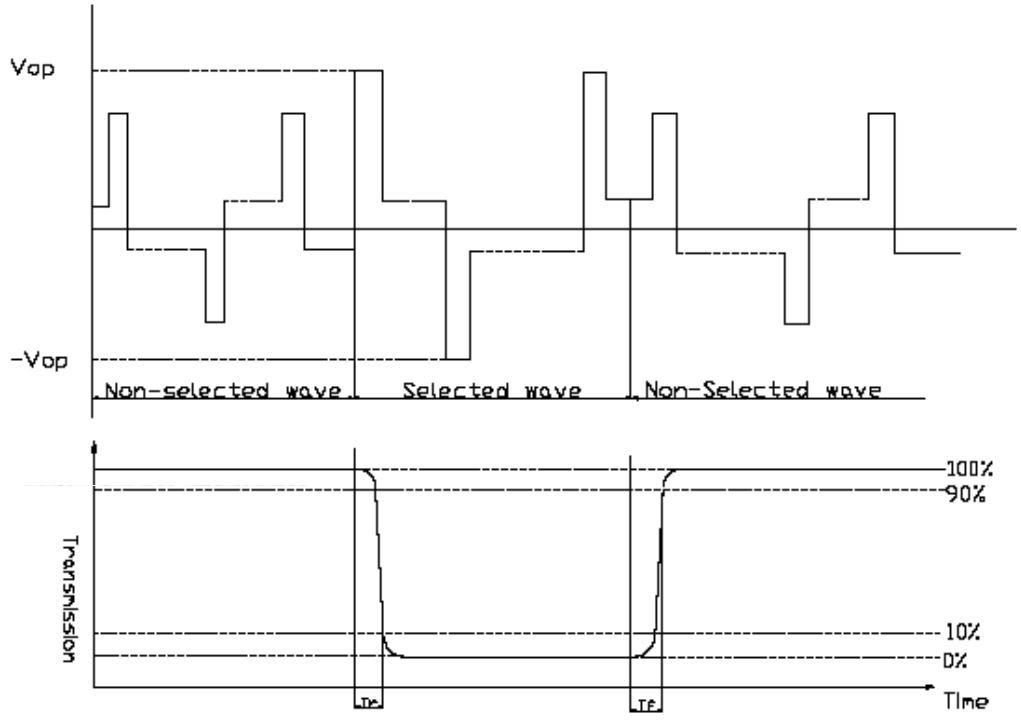


Specification Measuring Condition
Luxmeter: LCD-5100(OTSUKA ELECTRONICS)
Brightness Measuring Spot Diameter =4.0mm.

• Definition of Viewing Angle



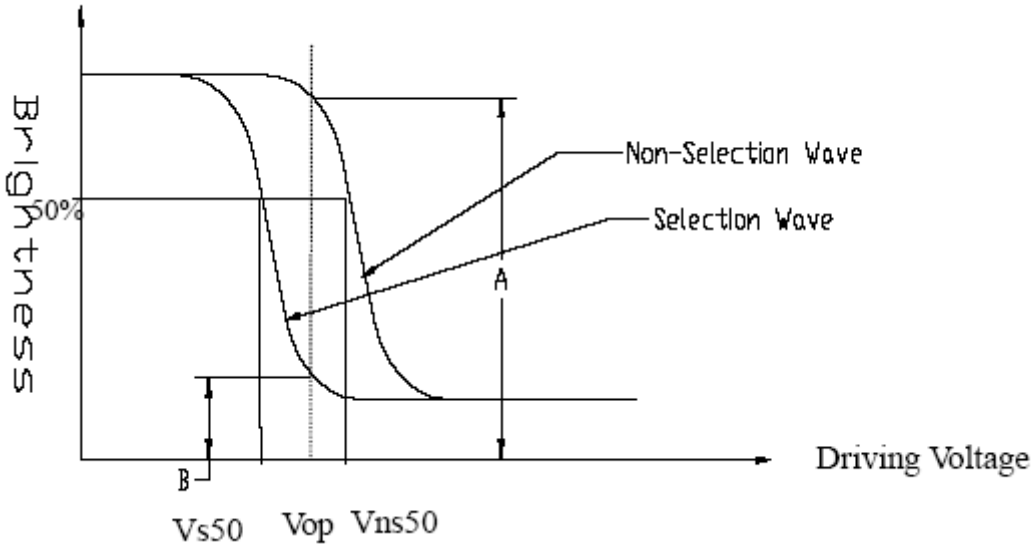
• Definition of Response Time



[Measuring Condition]

$= \Phi = 0$

• Definition of Contrast Ratio



$$\text{Contrast Ratio} = \frac{\text{Brightness of Non-Selected condition (A)}}{\text{Brightness of Selected condition (B)}}$$

[Measuring Condition]

$$\text{Vop} = \frac{Vs50 + Vns50}{2}$$

$$= \Phi = 0$$

• Content of Reliability Test

NO.	Test Item	Content of Test	Condition
1	High Temperature Storage	Endurance test applying the high temperature for a long time	70 120H
2	Low Temperature Storage	Endurance test applying the low temperature for a long time	-20 120H
3	High Temperature/Humidity Storage	Endurance test applying the high temperature and high humidity for a long time	70 &80% RH 100H
4	Heat Shock	Endurance test applying The low and high temperature cycles -10 ≤ ≥ 60 ←——————→ (1H) (1H) 1 Cycle	-10 / 60 5 cycle

• Failure Judgement Criterion

After the above-mentioned test

There should not exist conspicuous failure of display quality and appearance.

No degradation of the display readability.

There should not have any abnormality of function.

12. Handling Precautions

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

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

C) Do not apply excessive force on the surface of display or the adjoining area of LCD module since this may cause the color tone to vary.

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

E) If the display surface of LCD module 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 water, ketone and aromatic solvents.

F) When mounting the LCD module, make sure that it is free of twisting, warping and distortion. Distortion has great influence upon display quality. Also keep the shiftiness enough regarding the outer case.

G) When install the LCD module, do not forcibly pull or bend the I/O cable.

H) Touching the IC of LCD module may cause abnormal display that cannot recover.
Should not touch the IC of LCD module.

I) Do not disassemble or process the LCD module.

J) NC terminal should be open. Do not connect anything.

K) If the logic circuit power is OFF, do not apply the input signals.

L) To prevent destruction of the elements by static electricity be careful to maintain an optimum work environment.
Be sure to ground the body when handling the LCD module.
Tools required for assembly, such as soldering irons, must be properly grounded.
To reduce the amount of static electricity generated, do not conduct assembly and other work under dry conditions.
The LCD module is coated with a film to protect the display surface. Take care when peeling off this protective film since static electricity may be charged.

Please handle carefully, because the glass has a sharp edge.

13.Visual Inspection

The module should operate:
all points should be activated (On/OFF) independently.
Each physical point location should correspond to each software point location.
No color defect inside visible area.
No progressing glass crack.

• Air bubbles

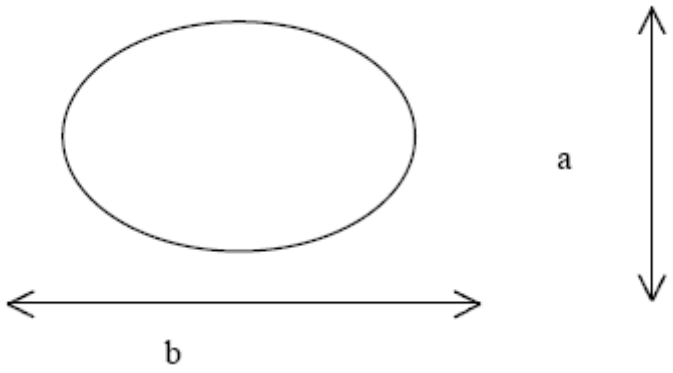
Air bubbles between glass and polarizer.

Size Diam. (mm)	Acceptable Number In Viewing Area
Diam ≦0.2	2 *1
0.3 < diam.	0

*1:The distance between two air bubbles is over 30mm.

• Black/White Spots

Blemish and foreign substances: =(a+b)/2, with b≦ 2a



Size (mm)	Acceptable Number In Viewing Area
≦ 0.15	Ignore
0.15< ≦ 0.3	2 *1
0.3<	0

*1:The distance between two spots is over 30mm.

• Black/White Lines

Blemish, foreign substances and scratch:

Length L (mm)	Width W (mm)	Acceptable Number In Viewing Area
L≦ 5	W≦ 0.05	Ignore
L>5	W≦ 0.05	0
L≦ 3	0.05<W≦ 0.1	3
L>3	W> 0.1	0