FORMIKE® GROUP
LCD·SOLUTION·TOUCHSCREEN

PRODUCT SPECIFICATION

MONO LCD MODULE

MODEL : WC1602A1SGW6B-D Version: 1.0

【 ◆ 】 Preliminary Specification

【 】 Finally Specification

CUSTOMER'S APPROVAL	
SIGNATURE:	DATE:

●It signifies that you fully understand and accept all the contents of this specification if you sign and send back the first page of this specifications.

Designed by	R&D Checked by	Quality Department by	Approved by
SIMON			

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Revision record

VER NO.	VER DATE	CONTENTS	Note
1.0	**2017-01-17**	**NEW ISSUE**	SIMON

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*ANNEX : Inspection Standard

1. General Description

1.1. FEATURES

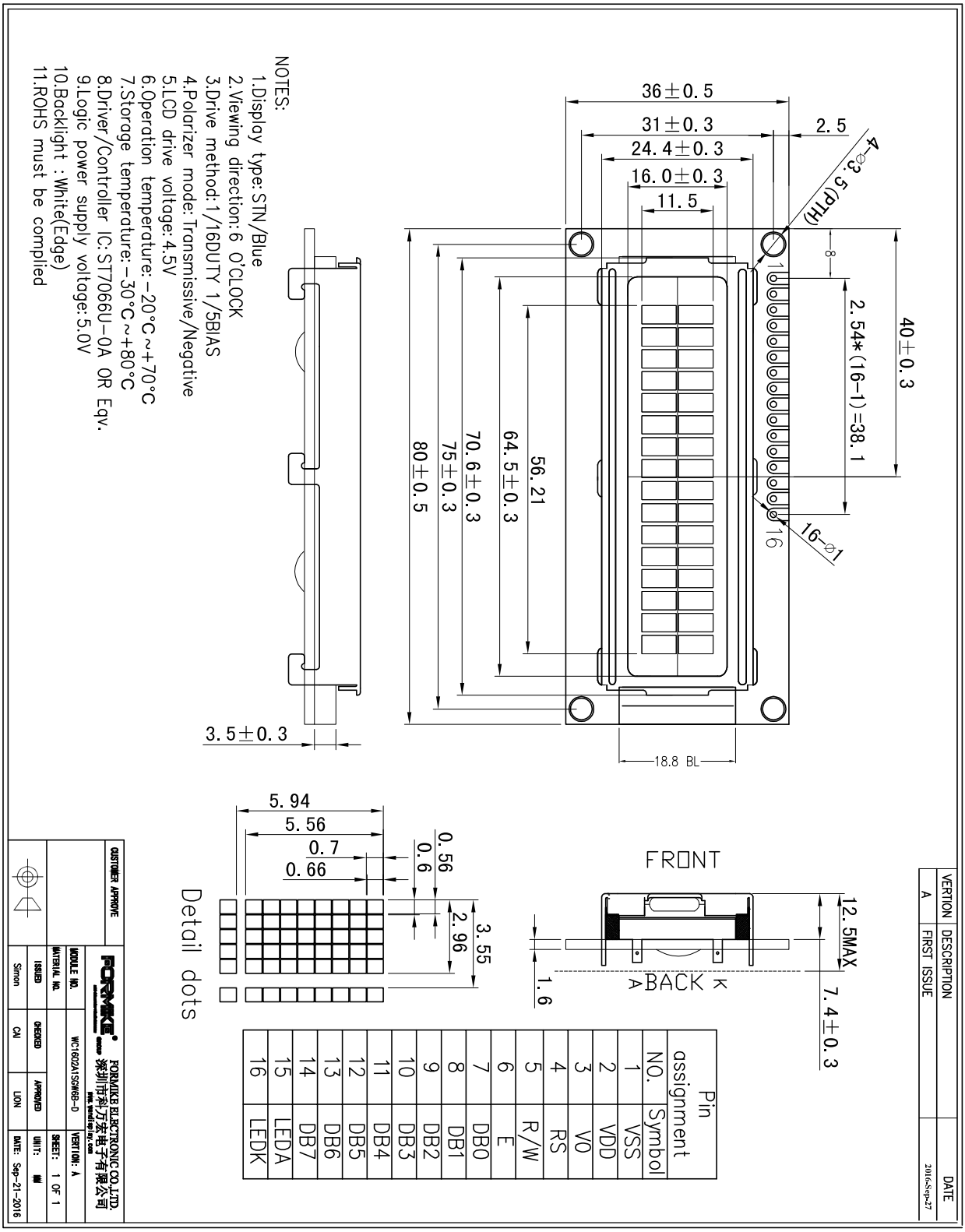
The features of LCD are as follows

* Display mode : STN(BLUE) , Negative ,Transmissive
* Color : Display dot : white
  Background: Blue
* Display format : 16character*2 line
* IC : ST7066U-0A English / Japan Font
* Interface Input Data : 4-bit or 8-bit MPU interface enabled
* Driving Method : 1/16 Duty, 1/5 Bias
* Viewing Direction : 6 O'clock
* Backlight : WHITE

1.2. MECHANICAL SPECIFICATIONS

Item	Specifications	Unit
Module Size	80.0(W) x36(H) x 12.5MAX(T)	mm
Viewing Area	64.5MIN(W) x16MIN(H)	mm
Effective Display Area	56.21(W) X 11.5(H)	mm
Number of Dots	16*2 LINE CHARACTER	-
Dot Size	0.56 (W) X 0.66(H)	mm
Dot Pitch	0.6(W) X 0.7(H)	mm

2. External Dimensions



3. Interface Description

Pin NO.	Symbol	I / O	Functions
1	VSS	P	Ground.
2	VDD	P	Power Supply.
3	V0	P	LCD supply voltage
4	RS	I	Select registers. 0: Instruction register (for write) Busy flag: address counter (for read) 1: Data register (for write and read)
5	R/W	I	Select read or write. 0: Write 1: Read
6	E	I	Starts data read/write.
7-10	DB0-DB3	I/O	Four high order bi-directional tristate data bus pins. Used for data transfer and receive between the MPU and the ST7066U. DB7 can be used as a busy flag.
11-14	DB4-DB7	I/O	Four low order bi-directional tristate data bus pins. Used for data transfer and receive between the MPU and the ST7066U. These pins are not used during 4-bit operation.
15	LEDA	P	Backlight supply (+5.0V)
16	LEDK	P	Backlight cathode

I: input, O:output, P:Power.

4. Absolute Maximum Ratings (Vss=0V)

Item	Symbol	Standard Value			Unit
		Min.	Typ.	Max.	
Supply Voltage For Logic	V_{DD}	-0.3		+6.0	V
Supply Voltage For LCD Drive	VLCD	VDD-10.0		VDD+0.3	V
Input Voltage	V_{IN}	-0.4		V_{DD}+0.5	V
Operating Temp.	T_{OP}	-20	-	+70	℃
Storage Temp.	T_{ST}	-30	-	+80	℃

5. Electrical Characteristics(Vss=0V)

Item		Symbol	Test Condition	Min.	Typ.	Max.	Unit
Supply Voltage For Logic		V_{DD} - V_{SS}	-	4.8	5	5.2	V
Supply Voltage For LCD		V_0	-	4.2	4.5	4.8	V
Input Voltage	"H" Level	V_{IH}	V_{DD}=5V 5%	0.85V_{DD}	-	-	V
	"L" Level	V_{IL}		-	-	0.15V_{DD}	V
Output Voltage	"H" Level	V_{OH}	I_{OH}= -0.5mA	0.8V_{DD}	-	-	V
	"L" Level	V_{OL}	I_{OL}=0.5mA	-	-	0.2V_{DD}	V
Current Consumption		I_{DD}	V_{DD} =5V 5% VLCD=4.5V	-	1	2	mA
Frame Frequency		f_{FLM}	V_{DD}=5V 5%	-	70	-	Hz

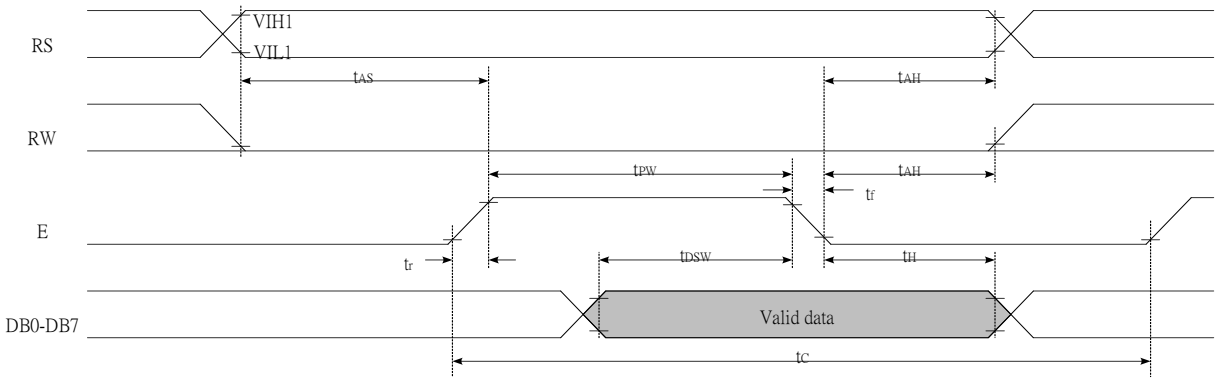
NOTE: 1) Duty Ratio=1/16 Bias Ratio=1/5

2) Measuring in Dots ON-state

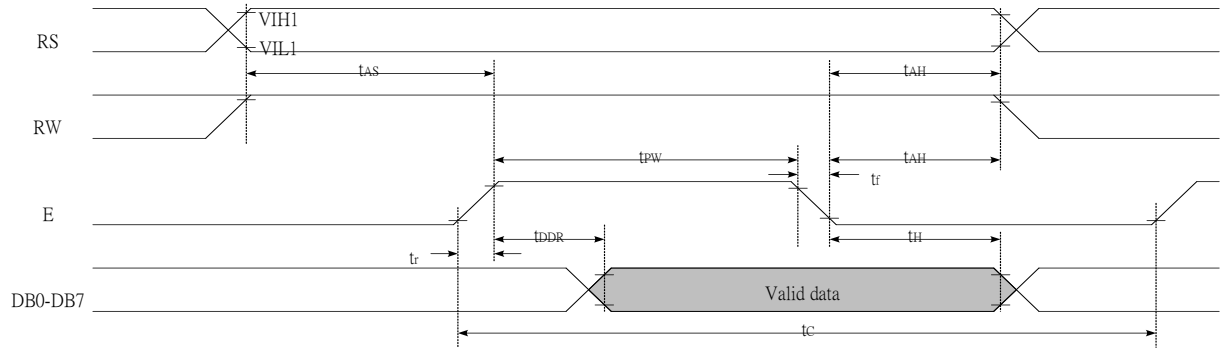
6. Timing Characteristics.

6.1. Timing Characteristics.

- **Writing data from MPU to ST7066U**



- **Reading data from ST7066U to MPU**



Write Mode (Writing data from MPU to ST7066U)

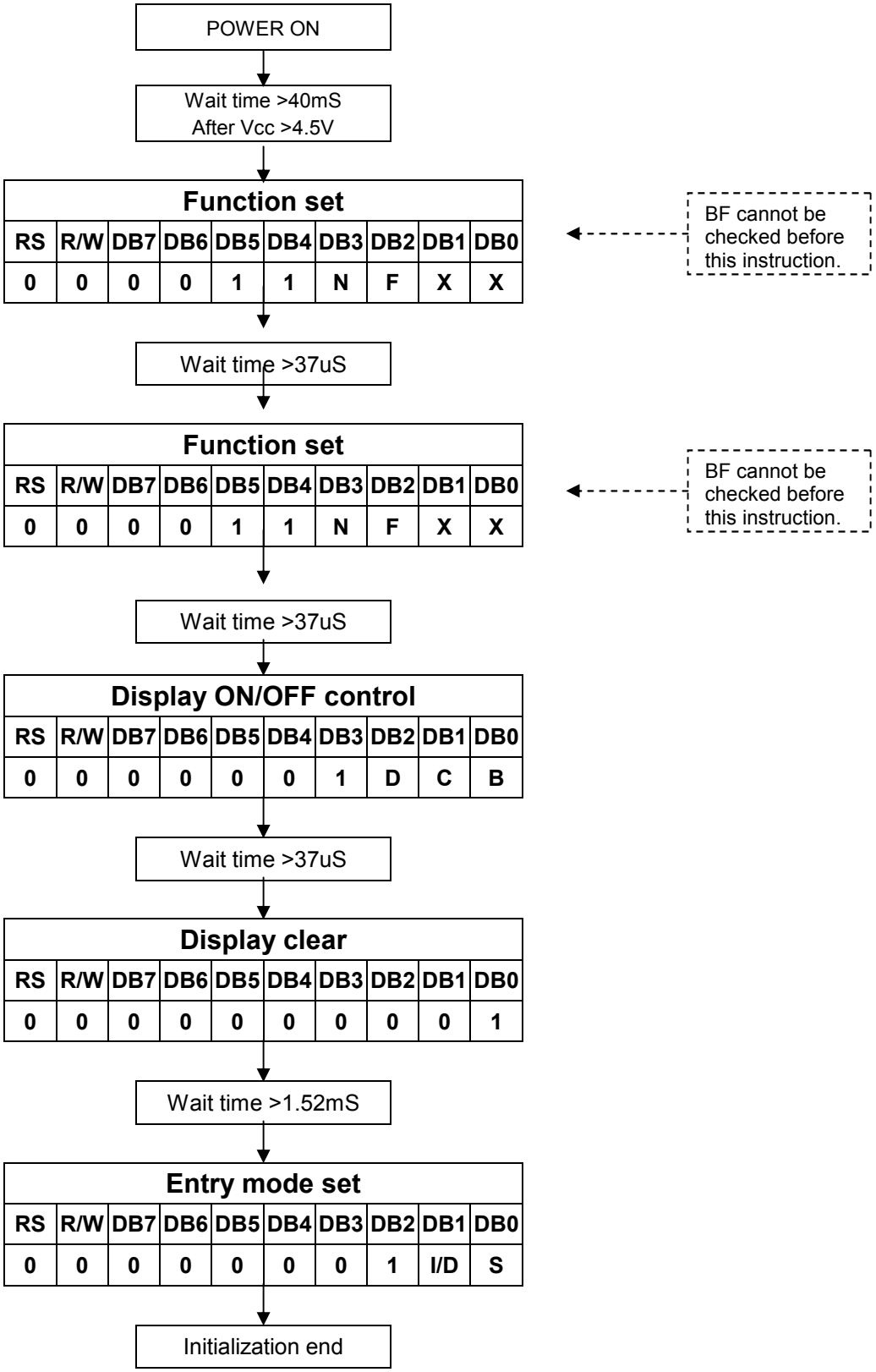
T_C	Enable Cycle Time	Pin E	1200	-	-	ns
T_{PW}	Enable Pulse Width	Pin E	140	-	-	ns
T_R,T_F	Enable Rise/Fall Time	Pin E	-	-	25	ns
T_{AS}	Address Setup Time	Pins: RS,RW,E	0	-	-	ns
T_{AH}	Address Hold Time	Pins: RS,RW,E	10	-	-	ns
T_{DSW}	Data Setup Time	Pins: DB0 - DB7	40	-	-	ns
T_H	Data Hold Time	Pins: DB0 - DB7	10	-	-	ns
Read Mode (Reading Data from ST7066U to MPU)						
T_C	Enable Cycle Time	Pin E	1200	-	-	ns
T_{PW}	Enable Pulse Width	Pin E	140	-	-	ns
T_R,T_F	Enable Rise/Fall Time	Pin E	-	-	25	ns
T_{AS}	Address Setup Time	Pins: RS,RW,E	0	-	-	ns
T_{AH}	Address Hold Time	Pins: RS,RW,E	10	-	-	ns
T_{DDR}	Data Setup Time	Pins: DB0 - DB7	-	-	100	ns
T_H	Data Hold Time	Pins: DB0 - DB7	10	-	-	ns

6.2. COMMAND LIST AND INITIAL CODE

Instruction Table:

Instruction	Instruction Code										Description	Description Time (270KHz)
	RS	R/W	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0		
Clear Display	0	0	0	0	0	0	0	0	0	1	Write "20H" to DDRAM. and set DDRAM address to "00H" from AC	1.52 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.	1.52 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.	37 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	37 us
Cursor or Display Shift	0	0	0	0	0	1	S/C	R/L	x	x	Set cursor moving and display shift control bit, and the direction, without changing DDRAM data.	37 us
Function Set	0	0	0	0	1	DL	N	F	x	x	DL:interface data is 8/4 bits N:number of line is 2/1 F:font size is 5x11/5x8	37 us
Set CGRAM address	0	0	0	1	AC5	AC4	AC3	AC2	AC1	AC0	Set CGRAM address in address counter	37 us
Set DDRAM address	0	0	1	AC6	AC5	AC4	AC3	AC2	AC1	AC0	Set DDRAM address in address counter	37 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 us
Write data to RAM	1	0	D7	D6	D5	D4	D3	D2	D1	D0	Write data into internal RAM (DDRAM/CGRAM)	37 us
Read data from RAM	1	1	D7	D6	D5	D4	D3	D2	D1	D0	Read data from internal RAM (DDRAM/CGRAM)	37 us

6.3. COMMAND LIST AND INITIAL CODE (CONTINUE)

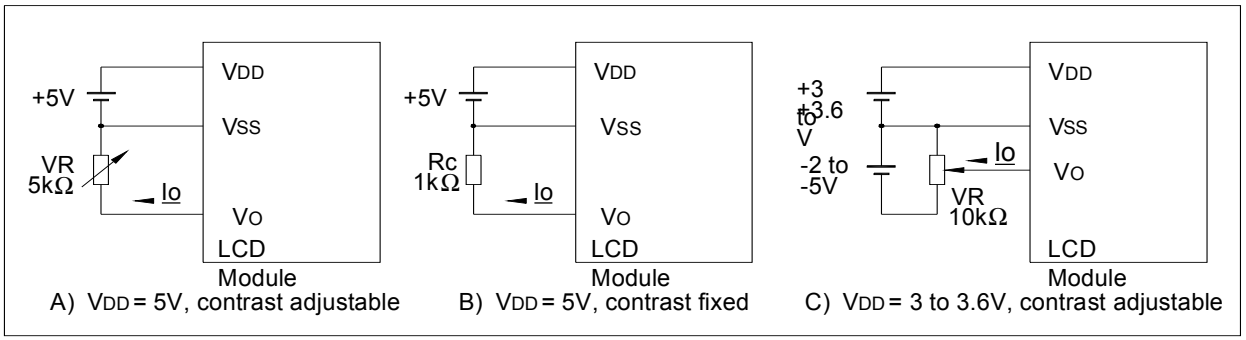


7. Backlight Characteristics.

Item	Conditions	Symbol	MIN	TYP	MAX	Unit
Luminance Intensity	If=15*2mA	LV	400	500	-	cd/m2
Forward Voltage		Vf	2.8	3.0	3.2	V
Uniformity		U		>=70%		
Reverse Current	Vr=5V	Ir	-	-	25	μA

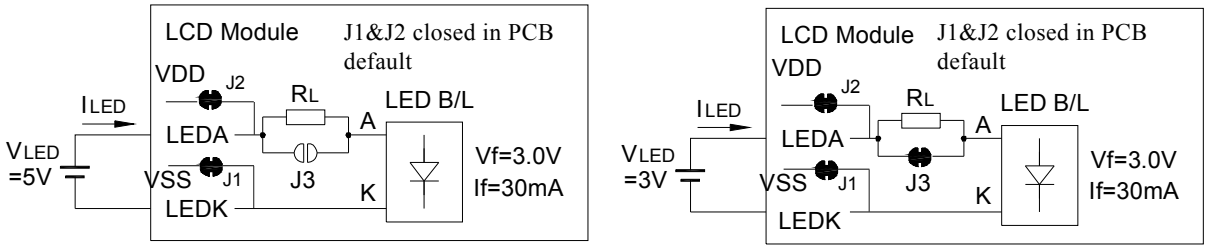
* The brightness is measured without LCD panel

8. POWER SUPPLY AND BLOCK DIAGRAM



A) VDD = 5V, contrast adjustable B) VDD = 5V, contrast fixed C) VDD = 3 to 3.6V, contrast adjustable

* VO is for LCD contrast adjusting, VDD-VO is around 4.5V



A) VLED = 5V: J3 open, supply 5V to LEDA/LEDK B) VLED is other voltage: J3 close, supply 3V to LEDA/LEDK

* RL are the current limiting resistors for LED backlight

1) J3 open, supply 5.0V to VDD (Pin 2) and VSS (Pin 1) **<Default>**

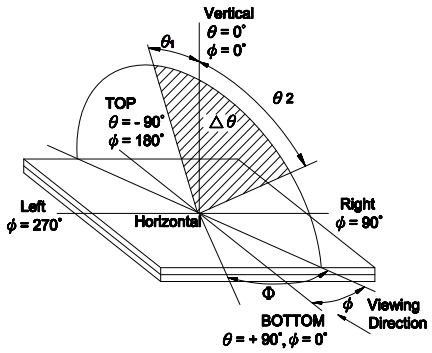
2) J3 close, supply 3.0V to VDD (Pin 2) and VSS (Pin 1),Power Supply for Logic and LCD should 3.0V refer to Point 3.4 C

3) Open J1&J2 while supply voltage diretly to LEDA (PIN15) and LEDK(PIN16)

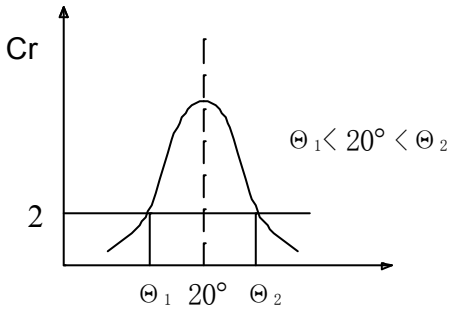
9. Optical Characteristics

Item	Symbol	Temp.	Min.	Typ.	Max.	Unit	Conditions	Note
Viewing Angle	Θ2 –Θ1	25℃	30	70	-	Deg.	Cr=2.0	1,2
	Φ		60	98	-			
Contrast Ratio	Cr	25℃	2	7	-	-	Θ= 20° Φ= 0°	3
Response Time(rise)	Tr	25℃	-	75	250	ms	Θ= 20° Φ= 0°	4
Response Time(fall)	Tf	25℃	-	108	250	ms	Θ= 20° Φ= 0°	4

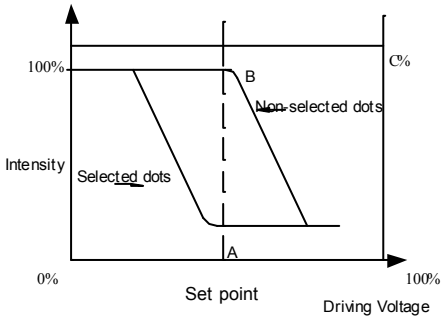
Note1 . Definition of angle Θ & Φ



Note2. Definition of viewing angle Θ1 & Θ1

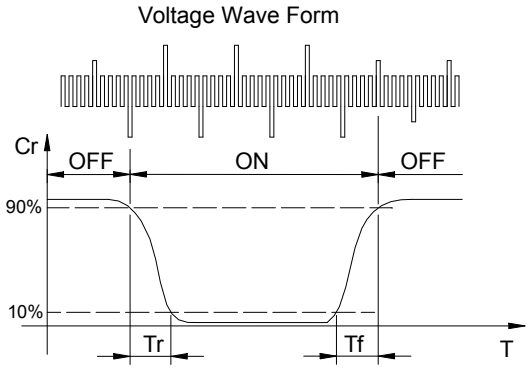


Note3 . Definition of contrast Cr



Cr = B/A

Note4. Definition of optical response



10. RELIABILITY

NO.	Item	Condition	Criterion
1	High Temperature Operating	70℃, 120Hrs	No defect in cosmetic and operational function allowable. Total current Consumption should be below double of initial value.
2	Low Temperature Operating	-20℃ , 120Hrs	
3	High Humidity	40℃ , 90%RH, 120Hrs	
4	High Temperature Storage	80℃ , 120Hrs	
5	Low Temperature Storage	-30℃, 120Hrs	
6	Vibration	Random wave 10 ~ 100Hz Acceleration: 2g 2 Hrs per direction(X,Y,Z)	
7	Thermal Shock	-0℃ to 25℃ to 50℃ (60Min) (5Min) (60Min) 10Cycles	
8	ESD Testing	Contract Discharge Voltage:+1 ~ 4kV and –1 ~ –4kV	There will be discharged ten times at every discharging voltage cycle. The voltage gap is 1kV.
		Air Discharge Voltage: +1 ~ 8kV and –1 ~ -8kV	

Note: 1) Above conditions are suitable for FORMIKE standard products.
2) For restrict products, the test conditions listed as above must be revised.

11. PRECAUTION RELATING & PRODUCT HANDLING

Display is assembled and adjusted with a high degree of precision. Do not attempt to make any alteration or modification.

11.1 SAFETY

11.1.1 If the LCD panel breaks, be careful not to get the liquid crystal to touch your skin.

11.1.2 If the liquid crystal touches your skin or clothes, please wash it off immediately by using soap and water.

11.2 HANDLING

11.2.1 Avoid any strong mechanical shock which can break the glass.

11.2.2 Avoid static electricity which can damage the CMOS LSI - When working with the module, be sure to ground your body and any electrical equipment you may be using. The followings should be noted:

11.2.2.1 CMOS-LSI is used for the module circuit; therefore operators should be grounded whenever he/she comes into contact with the module.

11.2.2.2 Do not touch any of the conductive parts such as the LSI pads; the copper leads on the PCB and the interface terminals with any parts of the human body.

11.2.2.3 Do not touch the connection terminals of the display with bare hand; it will cause disconnection or defective insulation of terminals.

11.2.2.4 The modules should be kept in anti-static bags or other containers resistant to static for storage.

11.2.2.5 Only properly grounded soldering irons should be used.

11.2.2.6 If an electric screwdriver is used, it should be grounded and shielded to prevent sparks.

11.2.2.7 The normal static prevention measures should be observed for work clothes and working benches.

11.2.3.8 Since dry air is inductive to static, a relative humidity of 50-60% is recommended

11.2.3 Do not remove the panel or frame from the module.

11.2.4 The polarizing plate of the display is very fragile. Please handle it very carefully, do not touch, push or rub the exposed polarizing with anything harder than an HB pencil lead (glass, tweezers, etc.)

11.2.5 Do not wipe the polarizing plate with a dry cloth, as it may easily scratch the surface of plate.

11.2.6 Do not touch the display area with bare hands, this will stain the display area.

11.2.7 Do not use ketonics solvent & aromatic solvent. Use with a soft cloth soaked with a cleaning naphtha solvent.

11.2.8 To control temperature and time of soldering is 300± 10℃and 3-4 sec.

To avoid liquid (include organic solvent) stained on LCD Module.

11.3 STORAGE

11.3.1 Store the panel or module in a dark place where the temperature is 25℃±5℃and the humidity is below 60% RH.

11.3.2 Avoid exposure to direct sunlight or to the light of fluorescent lamps.

11.3.3 Do not place the module near organic solvents or corrosive gases.

Do not crush, shake, or jolt the module.

11.4 LIMITED WARRANTY

11.4.1 FORMIKE modules are not consumer products, but may be incorporated by FORMIKE's customers into consumer products or components thereof, FORMIKE does not warrant that its modules and components are fit for any such particular purpose.

11.4.2 The liability of FORMIKE is limited to repair or replacement on the terms set forth below. FORMIKE will not be responsible for any subsequent or consequential events or injury or damage to any personnel or user including third party personnel and/or user. Unless otherwise agreed in writing between FORMIKE and the customer, FORMIKE will only replace or repair any of its Modules which is found defective electrically or visually when inspected in accordance with FORMIKE INSPECTION CRITERIA

11.4.3 No warranty can be granted if any of the precautions state in handling liquid crystal display has been disregarded. Broken glass, scratches on polarizer mechanical damages as well as defects that are caused accelerated environment tests are excluded from warranty.

11.4.4 In returning the modules, they must be properly packaged; there should be detailed description of the failures or defect.

12. OTHERS

12.1 If there is any not specified quality standard in this specification as well as RMA , please refer to < INSPECTION CRITERIA>. Contact FORMIKE to get the complete <INSPECTION CRITERIA> by the contact window or feedback@wandisplay.com.

12.2 Special agreement of <INSPECTION CRITERIA> is recognized only in writhing between FORMIKE and the customer also indicated it before ordering.