SWISSDIS

Swissdis AG
Grasweg 7
CH-4911 Schwarzhäusern

Tel.: +41 62 919 44 00
Fax: +41 62 919 44 01
info@swissdis.ch
www.swissdis.ch

lead-free

SPECIFICATIONS

SDC41605KBWJC

Swissdis 108619

LCD Module 4x16 Characters, 5mm

Version January 2007

INDEX

MODIFY RECORD

NO.	VER.	DATE	MODIFY REASON	MODIFY CONTENTS
1	A	2007/01/30	New issued	

1. Precaution in use of LCD Module

(1) Avoid applying excessive shocks to the module or making any alterations or modifications to it.
(2) Don't make extra holes on the printed circuit board, modify its shape or change the components of LCD module.
(3) Don't disassemble the LCM.
(4) Don't operate it above the absolute maximum rating.
(5) Don't drop, bend or twist LCM.
(6) Soldering: only to the I/O terminals.
(7) Storage: please storage in anti-static electricity container and clean environment.
(8) Don't touch the elastomer connecter, especially insert a backlight panel (EL or CCFL)

2. General Specification

2.1 Mechanical Data

Item	Dimension	Unit
Number of Characters	16 characters x 4 Lines	—
Module dimension (L x W x H)	87.0 x 60.0 x 13.6 (Max)- LED B/L	mm
View area	62.0 x 26.0	mm
Active area	56.2 x 20.8	mm
Character size (L x W)	2.95 x 4.75	mm
Character pitch (L x W)	3.55 x 5.35	mm
LCD TYPE	STN Blue	
Viewing Direction	6H	
Backlight	LED White	
Controller IC	KS0066 (or Equivalent)	

3. Electrical Characteristics

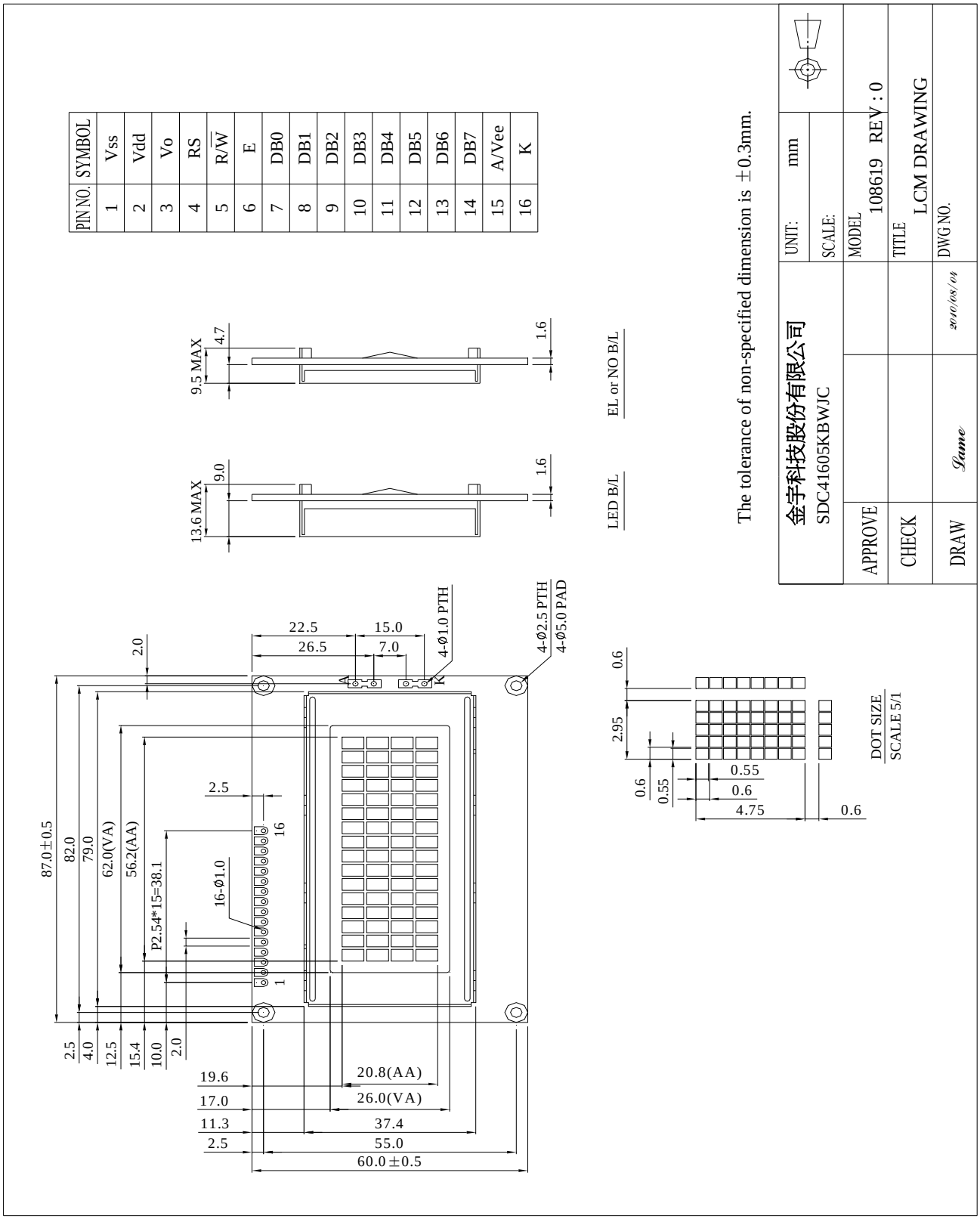
Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Voltage For Logic	Vdd-Vss	—	4.75	5.0	5.25	V
Supply Voltage For LCD *Wide Temp、Type	Vdd-Vo	—				-20℃
				4.5		25℃
						70℃
Input High Vol.	V_{IH}	—	2.2	—	Vdd	V
Input Low Vol.	V_{IL}	—	-0.3	—	0.6	V
Output High Vol.	V_{OH}	—	2.4	—	—	V
Output Low Vol.	V_{OL}	—	—	—	0.4	V
Supply Current(Logic)	Idd	Vdd=5V	—	1.5	—	mA

3.1 Electrical Absolute Maximum Ratings

(Vss=0V, Ta=25℃)

Item		Symbol	Min	Max	Unit
Supply Voltage (Logic)		Vdd- Vss	-0.3	7.0	V
Supply Voltage(LCD driver)		Vdd-Vo	-0.3	10.0	V
Input Voltage		VI	Vss	Vdd	V
Normal Temp. Type	Operation Temp.	TOP	0	50	℃
	Storage Temp.	TSTG	-10	60	℃
Wide Temp. Type	Operation Temp.	TOP	-20	70	℃
	Storage Temp.	TSTG	-30	80	℃

4. Dimensional Outlines



5. Interface Pin Function

Pin No.	Symbol	Level	Description
1	Vss	0V	Supply Voltage for logic Ground
2	Vdd	5.0V	Supply Voltage for logic and LED backlight
3	Vo	(Variable)	Operating voltage for LCD
4	RS	H/L	H:DATA, L: Instruction code
5	R/W	H/L	H: Read(MPU→Module) ; L: Write(MPU→Module)
6	E	H,H→L	Chip enable signal
7	DB0	H/L	Data bit 0
8	DB1	H/L	Data bit 1
9	DB2	H/L	Data bit 2
10	DB3	H/L	Data bit 3
11	DB4	H/L	Data bit 4
12	DB5	H/L	Data bit 5
13	DB6	H/L	Data bit 6
14	DB7	H/L	Data bit 7
15	LED+		Power supply for backlight V+
16	LED-		Power supply for backlight V-

6. Backlight Information

6. 1 Specification

- LED edge white

Parameter	Symbol	Min	Typical	Max	Unit	Test Condition
Supply Current	ILED	—	45	60	mA	V_{LED}=3.0V
Supply Voltage	V		3.0	3.2	V	—
Reverse Voltage	VR	—	—	5	V	—
Luminous Intensity	IV	60	—	—	cd/ m^2	I_{LED}=45mA
Chromaticity	X	—	0.30	—		I_{LED}=45mA
	Y		0.31			
Life Time	—	—	20,000	—	Hr.	V≦3.2V
Color	white					

6.2 Backlight driving methods

LED B/L drive from PIN15 (LED+) , PIN16 (LED-) OR PIN A(LED+) , PIN K(LED-)

7. Controller data

7.1 Function description

The LCD display Module is built in a LSI controller, the controller has two 8-bit registers, an instruction register (IR) and a data register (DR).

The IR stores instruction codes, such as display clear and cursor shift, and address information for display data RAM (DDRAM) and character generator (CGRAM). The IR can only be written from the MPU.
The DR temporarily stores data to be written or read from DDRAM or CGRAM. When address information is written into the IR, then data is stored into the DR from DDRAM or CGRAM. By the register selector (RS) signal, these two registers can be selected.

RS	R/W	Operation
0	0	IR write as an internal operation (display clear, etc.)
0	1	Read busy flag (DB7) and address counter (DB0 to DB7)
1	0	Write data to DDRAM or CGRAM (DR to DDRAM or CGRAM)
1	1	Read data from DDRAM or CGRAM (DDRAM or CGRAM to DR)

Busy Flag (BF)

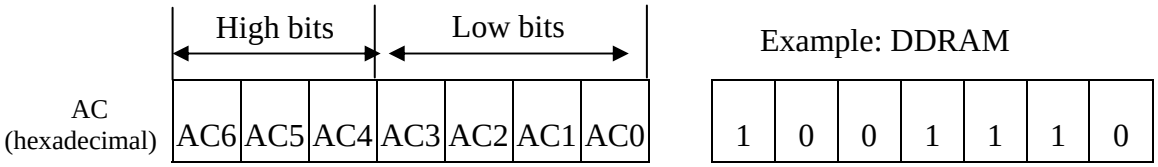
When the busy flag is 1, the controller LSI is in the internal operation mode and the next instruction will not be accepted. When RS=0 and R/W=1, the busy flag is output to DB7. The next instruction must be written after ensuring that the busy flag is 0.

Address Counter (AC)

The address counter (AC) assigns addresses to both DDRAM and CGRAM

Display Data RAM (DDRAM)

This DDRAM is used to store the display data represented in 8-bit character codes. Its extended capacity is 80×8 bits or 80 characters. Below figure is the relationship between DDRAM addresses and positions on the liquid crystal display.



DDRAM Address

Display position DDRAM address

1	2	3	4	5	6										16
00	01	02	03	04	05										0F
40	41	42	43	44	45										4F

Example: 2-Line by 16-Character Display

Character Generator ROM (CGROM)

The CGROM generate 5×8 dot or 5×10 dot character patterns from 8-bit character codes. See Table 2.

7.2 Character Generator RAM (CGRAM)

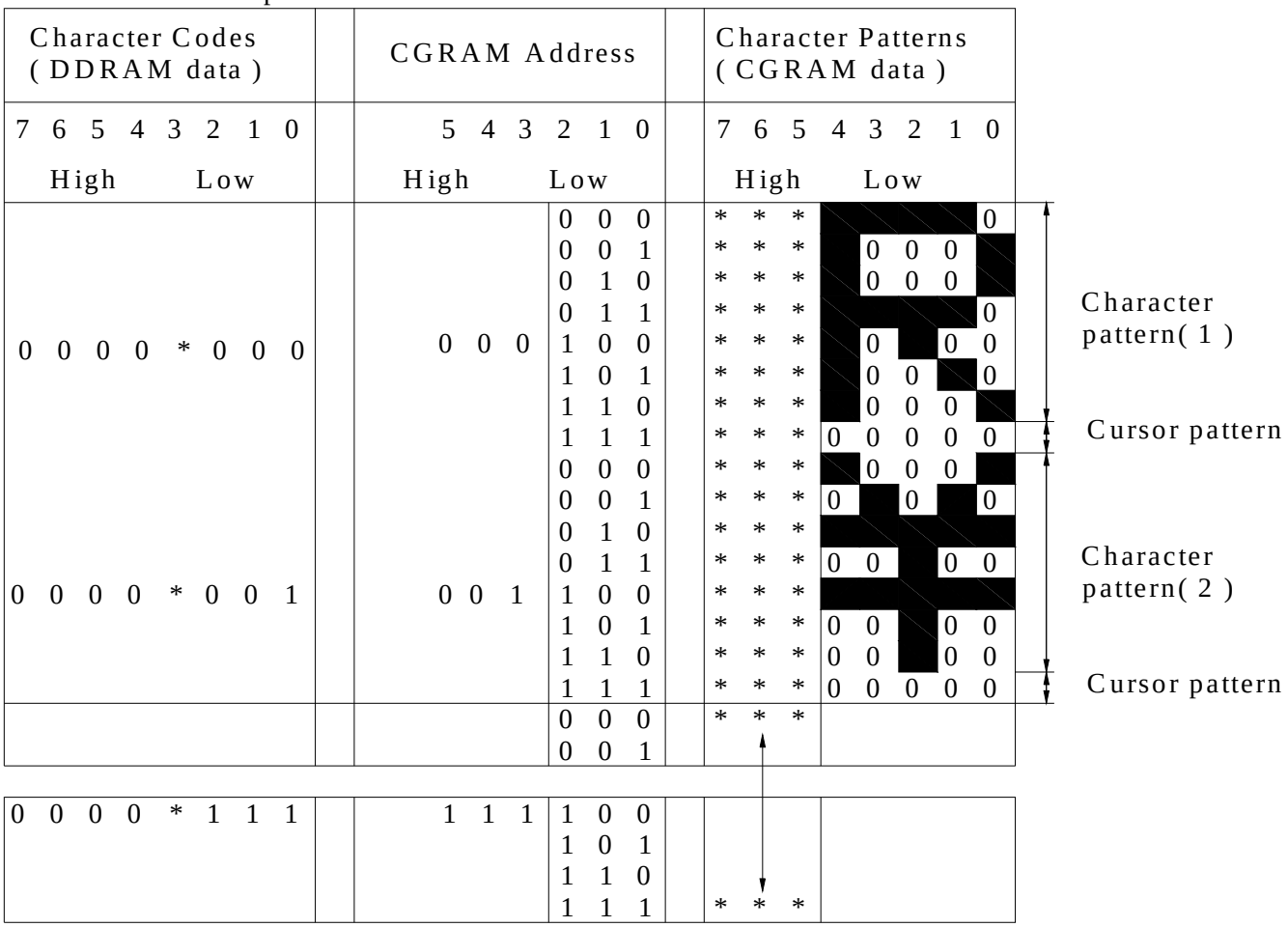
In CGRAM, the user can rewrite character by program. For 5×8 dots, eight character patterns can be written, and for 5×10 dots, four character patterns can be written.

Write into DDRAM the character code at the addresses shown as the left column of table 1. To show the character patterns stored in CGRAM.

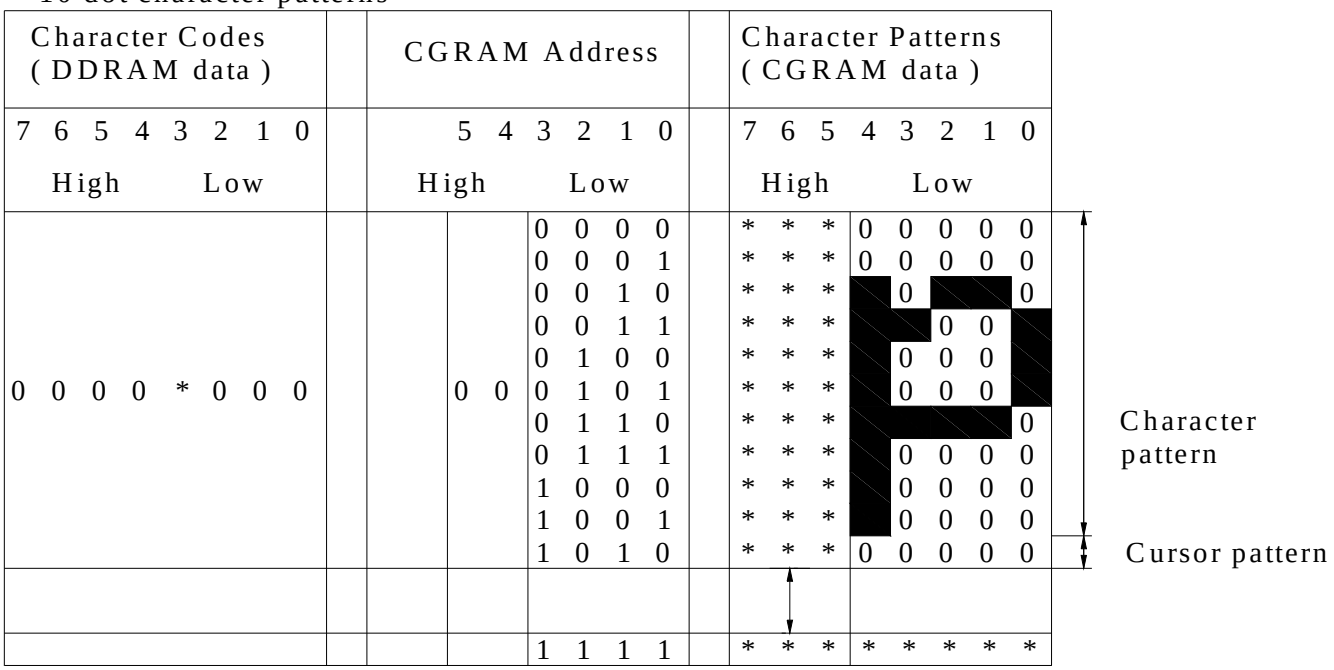
Relationship between CGRAM Addresses, Character Codes (DDRAM) and Character Patterns (CGRAM Data)

Relationship between CGRAM Addresses, Character Codes (DDRAM) and Character Patterns (CGRAM Data)

For 5 * 8 dot character patterns



For 5 * 10 dot character patterns



■ : " High "

7.3 C.G ROM table (table 2)

Code JC: English –Japanese Font

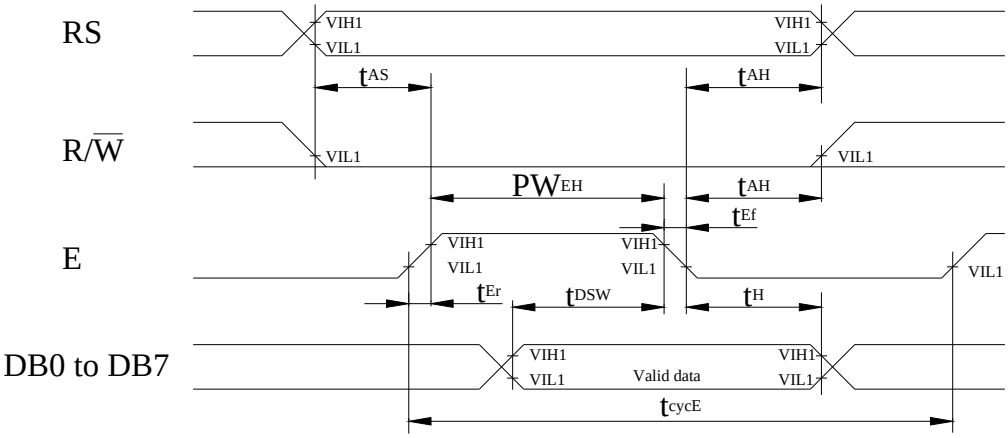
Upper 4 bit / Lower 4 bit	LLLL	LLLH	LLHL	LLHH	LHLL	LHLH	LHHL	LHHH	HLLL	HLLH	HLHL	HLHH	HHLL	HHLH	HHHL	HHHH
LLLL	CG RAM (1)															
LLLH	(2)															
LLHL	(3)															
LLHH	(4)															
LHLL	(5)															
LHLH	(6)															
LHHL	(7)															
LHHH	(8)															
HLLL	(1)															
HLLH	(2)															
HLHL	(3)															
HLHH	(4)															
HHLL	(5)															
HHLH	(6)															
HHHL	(7)															
HHHH	(8)															

7.4 Instruction table

Instruction	Instruction Code										Description	Execution time (fosc=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 “00H” to DDRAM and set DDRAM address to “00H” from AC	1.53ms
Return Home	0	0	0	0	0	0	0	0	1	—	Set DDRAM address to “00H” from AC and return cursor to its original position if shifted. The contents of DDRAM are not changed.	1.53ms
Entry Mode Set	0	0	0	0	0	0	0	1	I/D	SH	Assign cursor moving direction and enable the shift of entire display.	39 μ s
Display ON/OFF Control	0	0	0	0	0	0	1	D	C	B	Set display (D), cursor (C), and blinking of cursor (B) on/off control bit.	39 μ s
Cursor or Display Shift	0	0	0	0	0	1	S/C	R/L	—	—	Set cursor moving and display shift control bit, and the direction, without changing of DDRAM data.	39 μ s
Function Set	0	0	0	0	1	DL	N	F	—	—	Set interface data length (DL:8-bit/4-bit), numbers of display line (N:2-line/1-line)and, display font type (F:5×11 dots/5×8 dots)	39 μ s
Set CGRAM Address	0	0	0	1	AC5	AC4	AC3	AC2	AC1	AC0	Set CGRAM address in address counter.	39 μ s
Set DDRAM Address	0	0	1	AC6	AC5	AC4	AC3	AC2	AC1	AC0	Set DDRAM address in address counter.	39 μ s
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 μ s
Write Data to RAM	1	0	D7	D6	D5	D4	D3	D2	D1	D0	Write data into internal RAM (DDRAM/CGRAM).	43 μ s
Read Data from RAM	1	1	D7	D6	D5	D4	D3	D2	D1	D0	Read data from internal RAM (DDRAM/CGRAM).	43 μ s

7.5 Timing characteristics

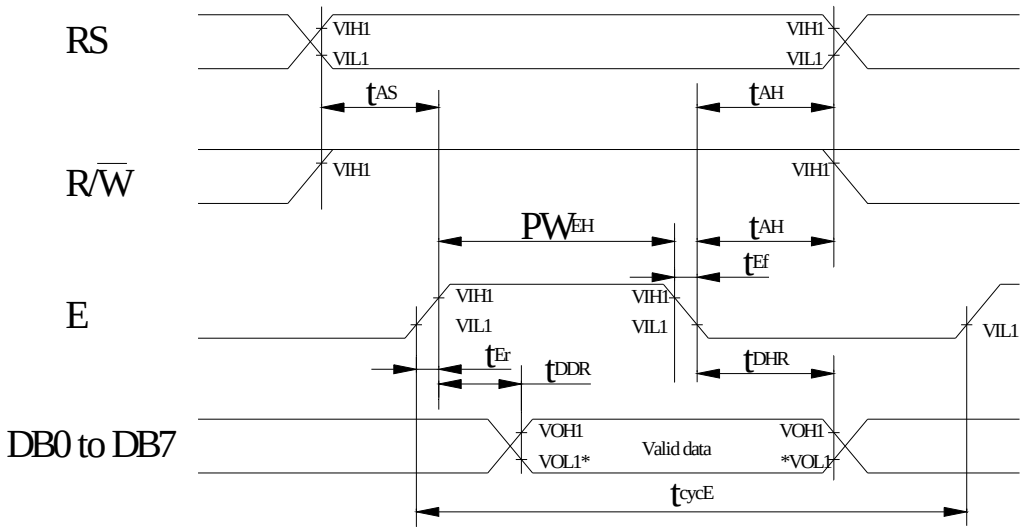
Write Operation



Ta= 25℃,Vdd=5.0±0.5V

Item	Symbol	Min	Typ	Max	Unit
Enable cycle time	t_{cycE}	500	—	—	ns
Enable pulse width (high level)	PW_{EH}	230	—	—	ns
Enable rise/fall time	t_{Er},t_{Ef}	—	—	20	ns
Address set-up time (RS, R/W to E)	t_{AS}	40	—	—	ns
Address hold time	t_{AH}	10	—	—	ns
Data set-up time	t_{DSW}	80	—	—	ns
Data hold time	t_{H}	10	—	—	ns

Read Operation



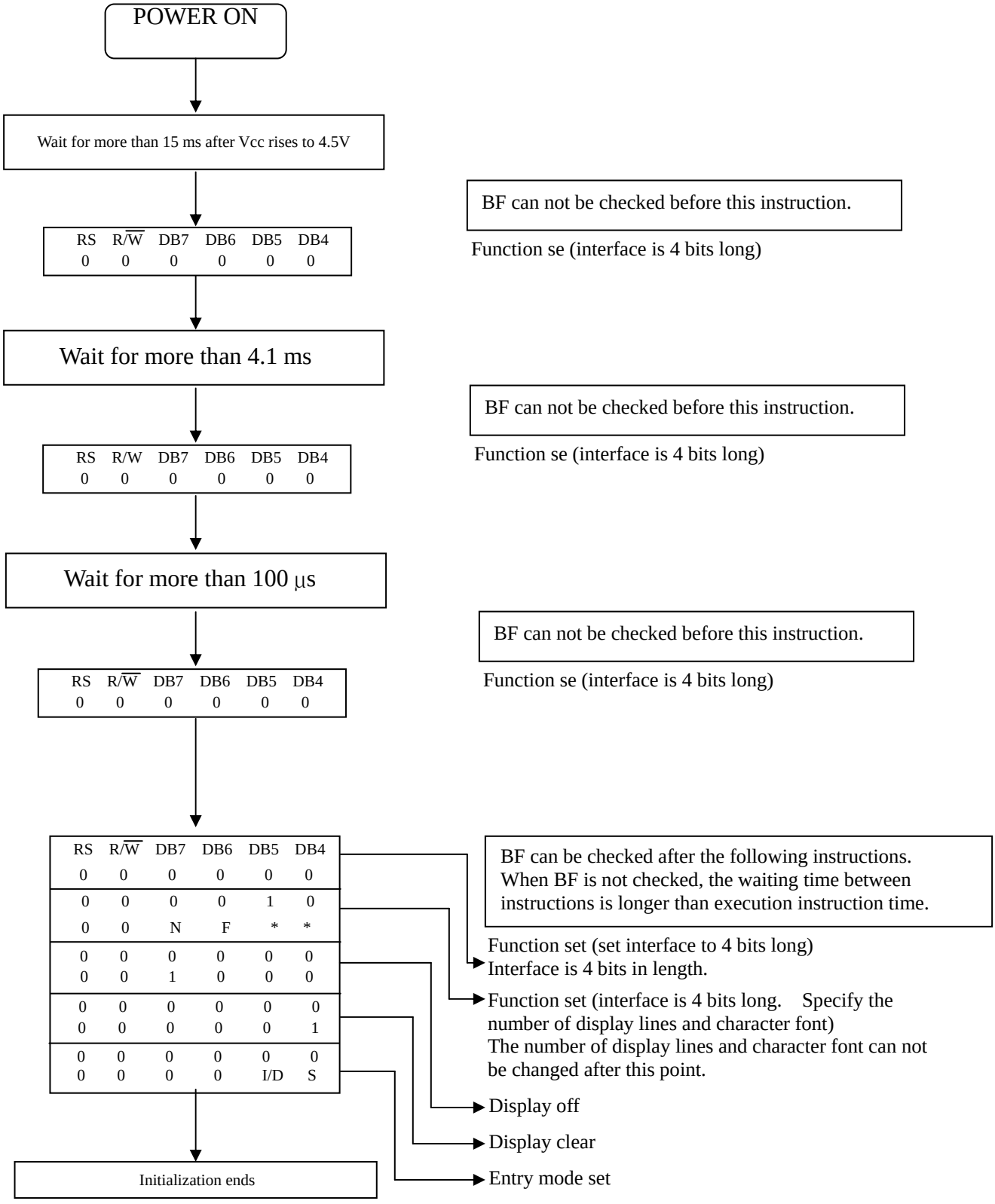
NOTE: *VOL1 is assumed to be 0.8V at 2 MHZ operation.

Ta=25℃,Vdd=5.0±0.5V

Item	Symbol	Min	Typ	Max	Unit
Enable cycle time	t_{cycE}	500	—	—	ns
Enable pulse width (high level)	PW_{EH}	230	—	—	ns
Enable rise/fall time	t_{Er},t_{Ef}	—	—	20	ns
Address set-up time (RS, R/W to E)	t_{AS}	40	—	—	ns
Address hold time	t_{AH}	10	—	—	ns
Data delay time	t_{DDR}	—	—	100	ns
Data hold time	t_{DHR}	5	—	—	ns

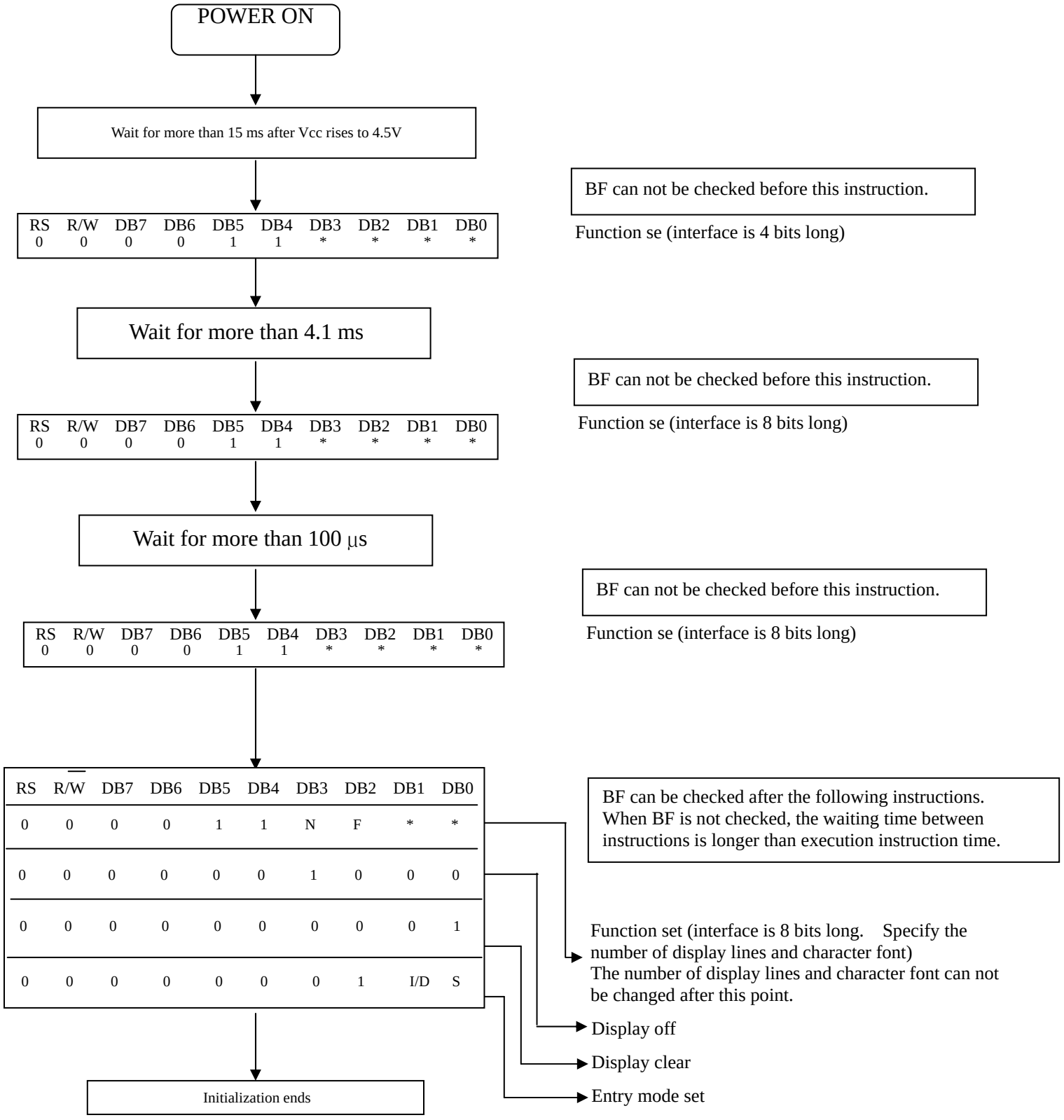
7.6 Initializing soft ware of LCM

4-bit interface



4-Bit interface

8-bit interface



8-Bit interface

8. Optical Characteristics

8.1 OPTICAL CHARACTERISTICS

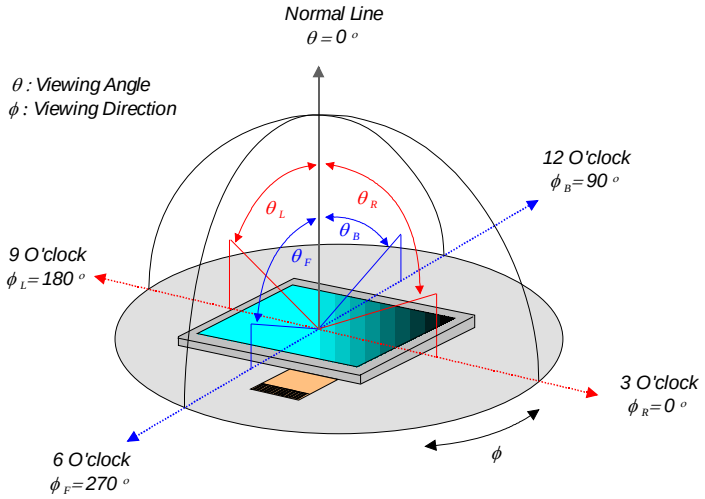
Item	Symbol	Condition	Min.	Typ.	Max.	Unit
View Angle	(V) θ	CR≧2	10		45	deg
	(H) φ	CR≧2	-30		30	deg
Contrast Ratio	CR	—		3		—
Response Time 25℃	T rise	—		150	250	ms
	T fall	—		180	250	ms

Conditions :

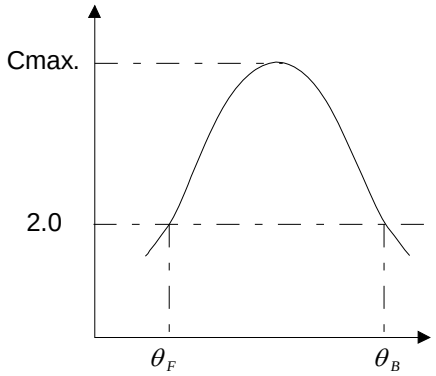
Operating Voltage : Vop　　Viewing Angle(θ ， φ) : 0°， 0°

Frame Frequency : 64 HZ　　Driving Waveform : 1/N duty , 1/a bias

8.2 Definition of Viewing Angle and Optimum Viewing Area



8.3 Definition of Viewing Angle θ_F and θ_B

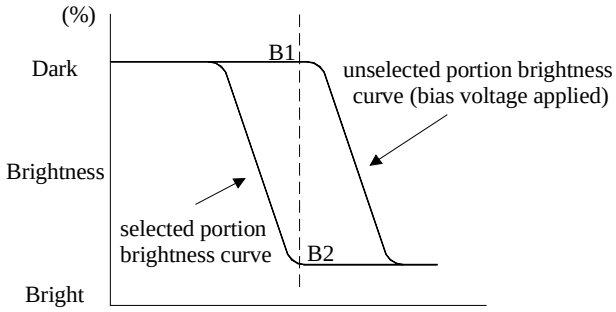


Viewing angles θ (ϕ fixed)

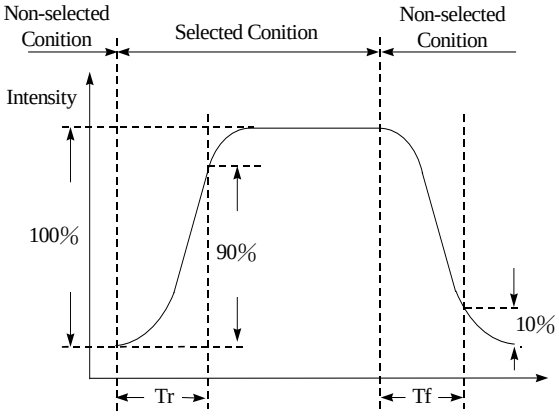
Optimum viewing angle with the naked eye and viewing angle θ at Cmax. Above are not always the same.

8.4 Definition of Contrast CR

CR= Brightness of selected dot (B1)/ Brightness of unselected dot (B2)

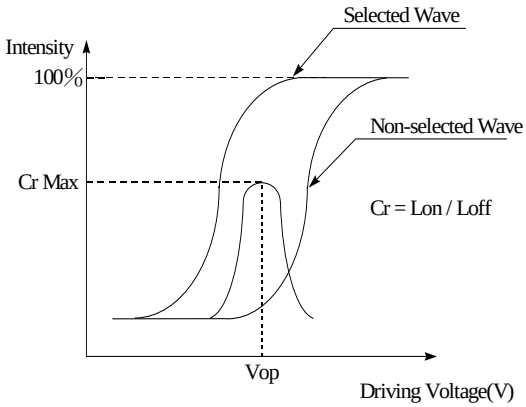


8.5 Definition of Response Time (Tr , Tf)



[Negative type]

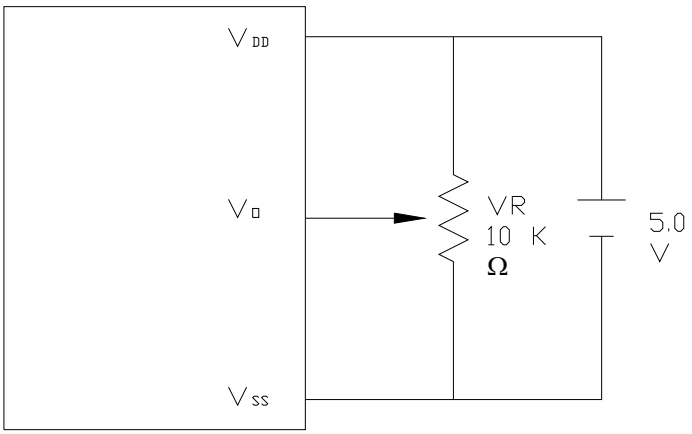
8.6 Definition of Operation Voltage (Vop)



[Negative type]

9. Power Supply for LCD Module and LCD Operating Voltage Adjustment

LCD Module block diagram



10. Reliability

10.1Content of Reliability Test

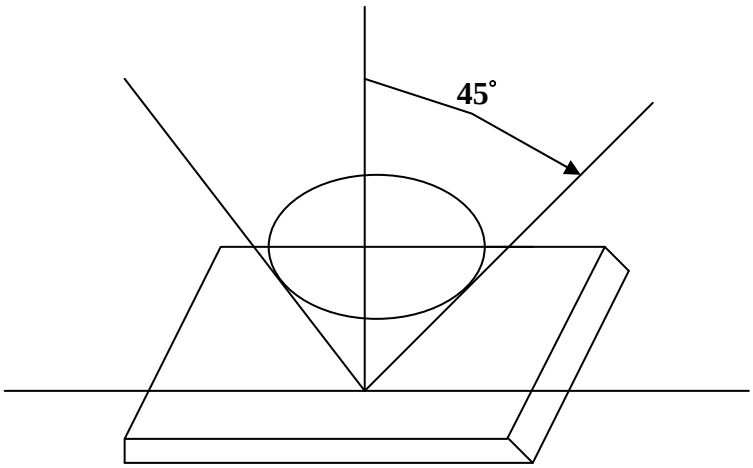
Environmental Test				
No.	Test Item	Content of Test	Test Condition	Applicable Standard
1	High Temperature storage	Endurance test applying the high storage temperature for a long time.	80℃ / 96hrs	——
2	Low Temperature storage	Endurance test applying the high storage temperature for a long time.	-30℃ 96hrs	——
3	High Temperature Operation	Endurance test applying the electric stress (Voltage & Current) and the thermal stress to the element for a long time.	70℃ 96hrs	——
4	Low Temperature Operation	Endurance test applying the electric stress under low temperature for a long time.	-20℃ 96hrs	——
5	High Temperature/ Humidity Storage	Endurance test applying the high temperature and high humidity storage for a long time.	60℃,90%RH 96hrs	——
6	High Temperature/ Humidity Operation	Endurance test applying the electric stress (Voltage & Current) and temperature / humidity stress to the element for a long time.	40℃,90%RH 96hrs	——
7	Temperature Cycle	Endurance test applying the low and high temperature cycle. -30℃ 25℃ 80℃ 30min 5min 30min 1 cycle	-30℃/80℃ 5 cycles	——
Mechanical Test				
8	Vibration test	Endurance test applying the vibration during transportation and using.	Total fixed amplitude : 1.5mm Vibration Frequency :10~55Hz One cycle 60 seconds to 3 directions of X,Y,Z for Each 15 minutes	——
Others				
9	Static electricity test	Endurance test applying the electric stress to the terminal.	VS=800V,RS=1.5kΩ CS=100pF 1 time	——

***Supply voltage for logic system=5V. Supply voltage for LCD system =Operating voltage at 25℃

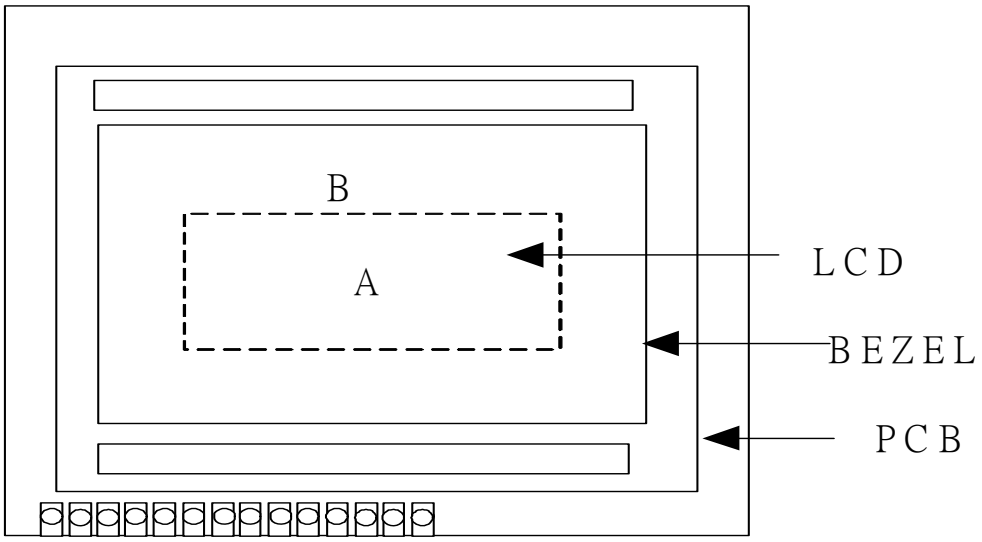
11. Quality Assurance

11.1 Inspection conditions

The LCD shall be inspected under 40W white fluorescent light. The distance between the eyes and the sample shall be more than 30cm. All directions for inspecting the sample should be within 45° against perpendicular line.



Definition of applicable Zones

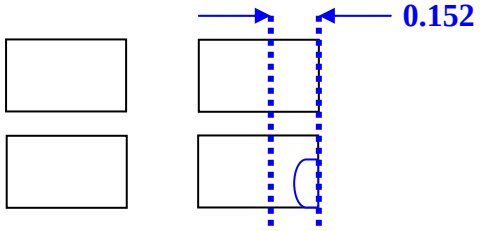
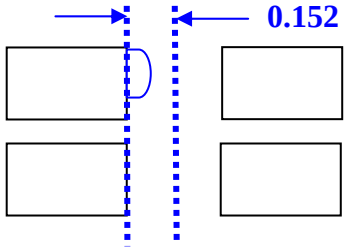
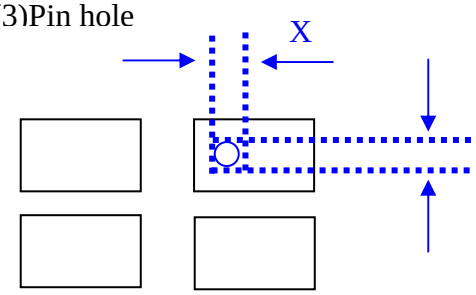
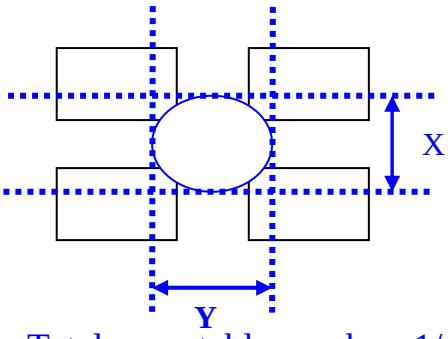


A : Display Area

B : Non-Display Area

11.2 Inspection Parameters

<table>
<tr><th>NO.</th><th>Parameter</th><th>Criteria</th></tr>
<tr><td>1</td><td>Black or White spots</td><td>
<table>
<tr><th rowspan="2">Zone / Dimension</th><th colspan="2">Acceptable Number</th><th rowspan="2">Class Of Defects</th><th rowspan="2">Acceptable Level</th></tr>
<tr><th>A</th><th>B</th></tr>
<tr><td>D＜0.15</td><td>*</td><td>*</td><td rowspan="4">Minor</td><td rowspan="4">2.5</td></tr>
<tr><td>0.15≦D≦0.2</td><td>4</td><td>4</td></tr>
<tr><td>0.2≦D≦0.25</td><td>2</td><td>2</td></tr>
<tr><td>D≦0.3</td><td>0</td><td>1</td></tr>
</table>
D=(Long + Short)/2 *: Disregard
</td></tr>
<tr><td>2</td><td>Scratch, Substances</td><td>
<table>
<tr><th rowspan="2">Zone / X(mm) Y(mm)</th><th colspan="2">Acceptable Number</th><th rowspan="2">Class Of Defects</th><th rowspan="2">Acceptable Level</th></tr>
<tr><th>A</th><th>B</th></tr>
<tr><td>*</td><td>0.04≧W</td><td>*</td><td>*</td><td rowspan="4">Minor</td><td rowspan="4">2.5</td></tr>
<tr><td>3.0≧L</td><td>0.06≧W</td><td>4</td><td>4</td></tr>
<tr><td>2.0≧L</td><td>0.08≧W</td><td>2</td><td>3</td></tr>
<tr><td>—</td><td>0.1＜W</td><td>0</td><td>1</td></tr>
</table>
X: Length Y: Width *: Disregard
Total defects should not exceed 4/module
</td></tr>
<tr><td>3</td><td>Air Bubbles
(between glass & polarizer)</td><td>
<table>
<tr><th rowspan="2">Zone / Dimension</th><th colspan="2">Acceptable Number</th><th rowspan="2">Class Of Defects</th><th rowspan="2">Acceptable Level</th></tr>
<tr><th>A</th><th>B</th></tr>
<tr><td>D≦0.15</td><td>*</td><td>*</td><td rowspan="3">Minor</td><td rowspan="3">2.5</td></tr>
<tr><td>0.15＜D≦0.25</td><td>2</td><td>*</td></tr>
<tr><td>0.25＜D</td><td>0</td><td>1</td></tr>
</table>
*: Disregard
Total defects shall not excess 3/module.
</td></tr>
</table>

4.	Uniformity	(1)Pixel shape (with Dent)  (2)Pixel shape (with Projection)  (3)Pin hole  (X +Y)/2≦0.02mm (Less than 0.1mm is No counted) (4) Deformation  (X + Y)/2≦0.3mm Total acceptable number: 1/pixel ;.5/cell

LCD Numbering system

SD	C	116	05	G	F	W	JC	
①	②	③	④	⑤	⑥	⑦	⑧	⑨

① Brand Name

SD	Swissdis AG

② Display Type

C	Character Type
G	Graphic Type

O	COG
S	Segment Type

C	Character Type
G	Graphic Type

③ Number of Pixels

Character Module	Lines x Characters per line
Graphic Module	Row Dots x Column Dots

④ Character Size

05	~ 5 mm

⑤ LCD Polarize

	Normal Temperature		Wide Temperature	
	6:00	12:00	6:00	12:00
Reflective	A	B	C	D
Transflective	E	F	G	H
Transmissive	I	J	K	L

⑥ LCD Mode

	TN	STN	FSTN	DFSTN
Positive	P	G (Gray)	F	
		Y (Yellow/Green)		
Negative	N	B (Blue)	W	D

⑦ Backlight

None	N	None						
EL	I	White	U	Blue Green				
LED	A	Amber	B	Blue	G	Green	E	Yellow/Green, edge
	R	Red	W	White	Y	Yellow/Green		
CCFL	C	White						

⑧ IC Font Character

Cyrillic / English	CC
Japanese / English	JC
European / English	RC, EC

⑨ Special Code

O6	I2C