



Winstar Display Co., LTD 華凌光電股份有限公司



住址: 407 台中市中清路 163 號
No.163 Chung Ching RD.,
Taichune, Taiwan, R.O.C

WEB: <http://www.winstar.com.tw>
E-mail: winstar@winstar.com.tw
Tel:886-4-24262208 Fax : 886-4-24262207

SPECIFICATION

CUSTOMER : _____

MODULE NO.: WH1601A-NGJ-CT

APPROVED BY: (FOR CUSTOMER USE ONLY)	
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SALES BY	APPROVED BY	CHECKED BY	PREPARED BY
ISSUED DATE:			

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1.Module Classification Information

W H 1 6 0 1 A - N G J - CT
① ② ③ ④ ⑤ ⑥ ⑦ ⑧

- ① Brand : WINSTAR DISPLAY CORPORATION
- ② Display Type : H→ Character Type, G→ Graphic Type
- ③ Display Font : Character 16 words, 1Lines.
- ④ Model serials no.
- ⑤ Backlight Type : N→ Without backlight
 B→ EL, Blue green A→ LED, Amber
 D→ EL, Green R→ LED, Red
 W→ EL, White O→ LED, Orange
 F→ CCFL, White G→ LED, Green
 Y→ LED, Yellow Green
- ⑥ LCD Mode : B→ TN Positive, Gray T→ FSTN Negative
 N→ TN Negative,
 G→ STN Positive, Gray
 Y→ STN Positive, Yellow Green
 M→ STN Negative, Blue
 F→ FSTN Positive
- ⑦ LCD Polarizer Type/ Temperature range/ View direction
- | | |
|-----------------------------|-----------------------------|
| A→ Reflective, N.T, 6:00 | H→ Transflective, W.T,6:00 |
| D→ Reflective, N.T, 12:00 | K→ Transflective, W.T,12:00 |
| G→ Reflective, W. T, 6:00 | C→ Transmissive, N.T,6:00 |
| J→ Reflective, W. T, 12:00 | F→ Transmissive, N.T,12:00 |
| B→ Transflective, N.T,6:00 | I→ Transmissive, W. T, 6:00 |
| E→ Transflective, N.T,12:00 | L→ Transmissive, W.T,12:00 |
- ⑧ Special Code CT : English and Cyrillic standard font

2. Precautions in use of LCD Modules

- (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.

3. General Specification

Item	Dimension	Unit
Number of Characters	16 characters x 1 Lines	-
Module dimension	80.0 x 36.0 x 9.7(MAX)	mm
View area	66.0 x 16.0	mm
Active area	59.62 x 6.56	mm
Dot size	0.55 x 0.75	mm
Dot pitch	0.63 x 0.83	mm
Character size	3.07 x 6.56	mm
Character pitch	3.77 x 6.56	mm
LCD type	STN, Positive, Reflective, Gray	
Duty	1/16	
View direction	12 o'clock	

4. Absolute Maximum Ratings

Item	Symbol	Min	Typ	Max	Unit
Operating Temperature	T_{OP}	-20	-	+70	°C
Storage Temperature	T_{ST}	-30	-	+80	°C
Input Voltage	V_I	V_{SS}	-	V_{DD}	V
Supply Voltage For Logic	$V_{DD}-V_{SS}$	-0.3	-	7	V
Supply Voltage For LCD	$V_{DD}-V_0$	-0.3	-	13	V

5. Electrical Characteristics

Item	Symbol	Condition	Min	Typ	Max	Unit
Supply Voltage For Logic	$V_{DD}-V_{SS}$	-	4.5	-	5.5	V
Supply Voltage For LCD	$V_{DD}-V_0$	$T_a=-20^{\circ}\text{C}$	-	-	5.2	V
		$T_a=25^{\circ}\text{C}$	-	4.5	-	V
		$T_a=70^{\circ}\text{C}$	3.8	-	-	V
Input High Volt.	V_{IH}	-	2.2	-	V_{DD}	V
Input Low Volt.	V_{IL}	-	-	-	0.6	V

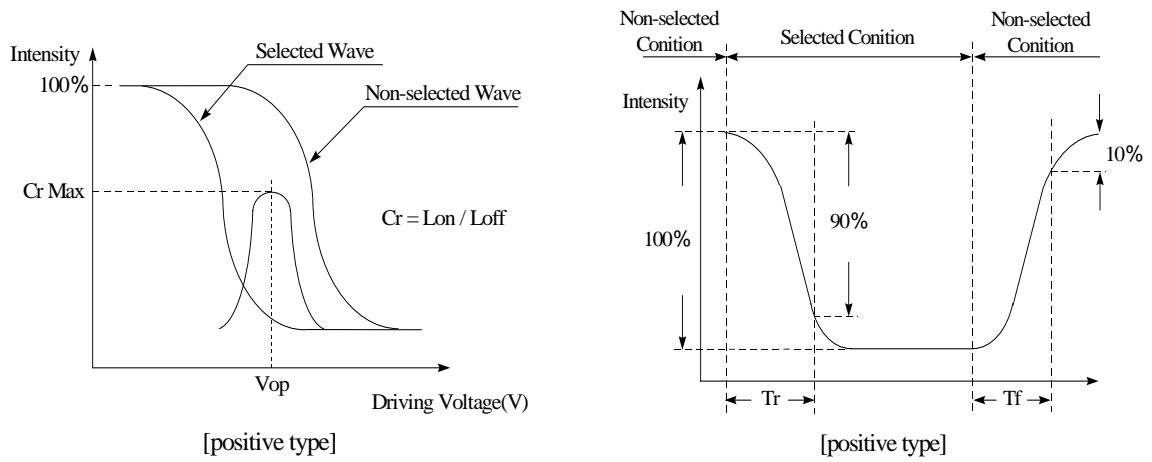
Output High Volt.	V_{OH}	-	2.4	-	-	V
Output Low Volt.	V_{OL}	-	-	-	0.4	V
Supply Current	I_{DD}	$V_{DD}=5V$	-	1.2	-	mA

6. Optical Characteristics

Item	Symbol	Condition	Min	Typ	Max	Unit
View Angle	(V) θ	$CR \geq 2$	10	-	105	deg
	(H) ϕ	$CR \geq 2$	-30	-	30	deg
Contrast Ratio	CR	-	-	3	-	-
Response Time	T rise	-	-	150	200	ms
	T fall	-	-	150	200	ms

Definition of Operation Voltage (Vop)

Definition of Response Time (Tr , Tf)

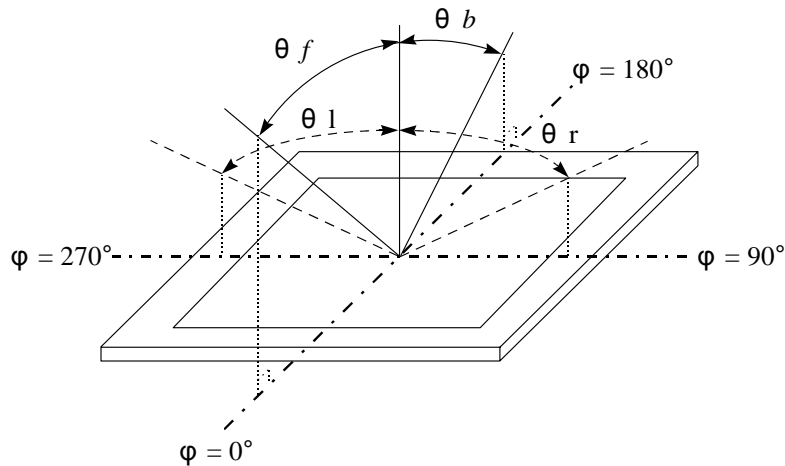


Conditions :

Operating Voltage : V_{op} Viewing Angle(θ , φ) : 0° , 0°

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

Definition of viewing angle($CR \geq 2$)

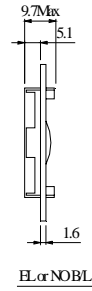
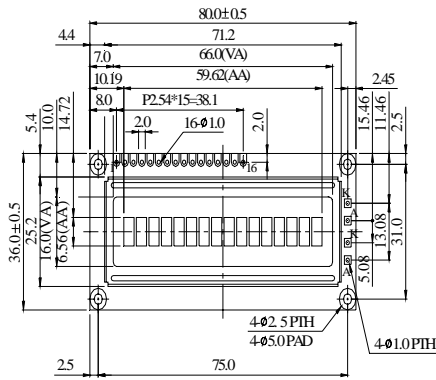


7. Interface Pin Function

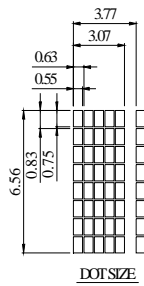
Pin No.	Symbol	Level	Description
1	V_{SS}	0V	Ground
2	V_{DD}	5.0V	Supply Voltage for logic
3	VO	(Variable)	Operating voltage for LCD
4	RS	H/L	H: DATA, L: Instruction code
5	R/W	H/L	H: Read(MPU→ Module) L: Write(MPU→ Module)
6	E	H,H→ L	Chip enable signal

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	A	-	NC
16	K	-	NC

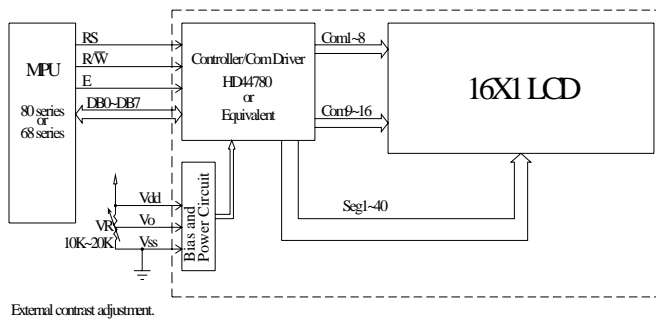
8. Contour Drawing & Block Diagram



PIN NO.	SYMBOL
1	Vss
2	Vdd
3	V ₀
4	RS
5	R/W
6	E
7	DB0
8	DB1
9	DB2
10	DB3
11	DB4
12	DB5
13	DB6
14	DB7
15	A/V _{ee}
16	K



The non-specified tolerance of dimension is ±0.3mm



External contrast adjustment.

Character located	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
DDRAM Address	00	01	02	03	04	05	06	07	40	41	42	43	44	45	46	47

2-line display mode.

9. 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)

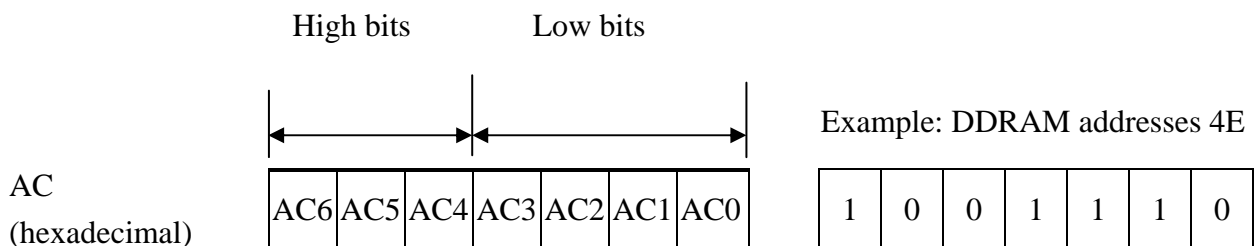
When the busy flag is 1, the controller LSI is in the internal operation mode, and the next instruction will not be accepted. When RS=0 and R/W=1, the busy flag is output to DB7. The next instruction must be written after ensuring that the busy flag is 0.

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 relationships between DDRAM



addresses and positions on the liquid crystal display.

Display position DDRAM address

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
00	01	02	03	04	05	06	07	08	09	0A	0B	0C	0D	0E	0F

1-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.

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

Table 1.

For 5 * 8 dot character patterns

Character Codes (DDRAM data)		CGRAM Address		Character Patterns (CGRAM data)				
7 6 5 4 3 2 1 0		5 4 3 2 1 0		7 6 5 4 3 2 1 0				
High Low		High Low		High Low				
0 0 0 0 * 0 0 0		0 0 0	0 0 0	* * *		Character pattern (1)		
			0 0 1	* * *			0 0 0	Cursor pattern
			0 1 0	* * *			0 0 0	
			0 1 1	* * *			0 0 0	
			1 0 0	* * *			0 0 0	
			1 0 1	* * *			0 0 0	
			1 1 0	* * *			0 0 0	
			1 1 1	* * *			0 0 0	
			0 0 0	* * *			0 0 0	
			0 0 1	* * *			0 0 0	
0 1 0	* * *	0 0 0						
0 1 1	* * *	0 0 0						
1 0 0	* * *	0 0 0						
1 0 1	* * *	0 0 0						
1 1 0	* * *	0 0 0						
1 1 1	* * *	0 0 0						
			0 0 0	* * *				
			0 0 1	* * *				
			1 0 0	* * *				
			1 0 1	* * *				
			1 1 0	* * *				
			1 1 1	* * *				
			0 0 0	* * *				
			0 0 1	* * *				

For 5 * 10 dot character patterns

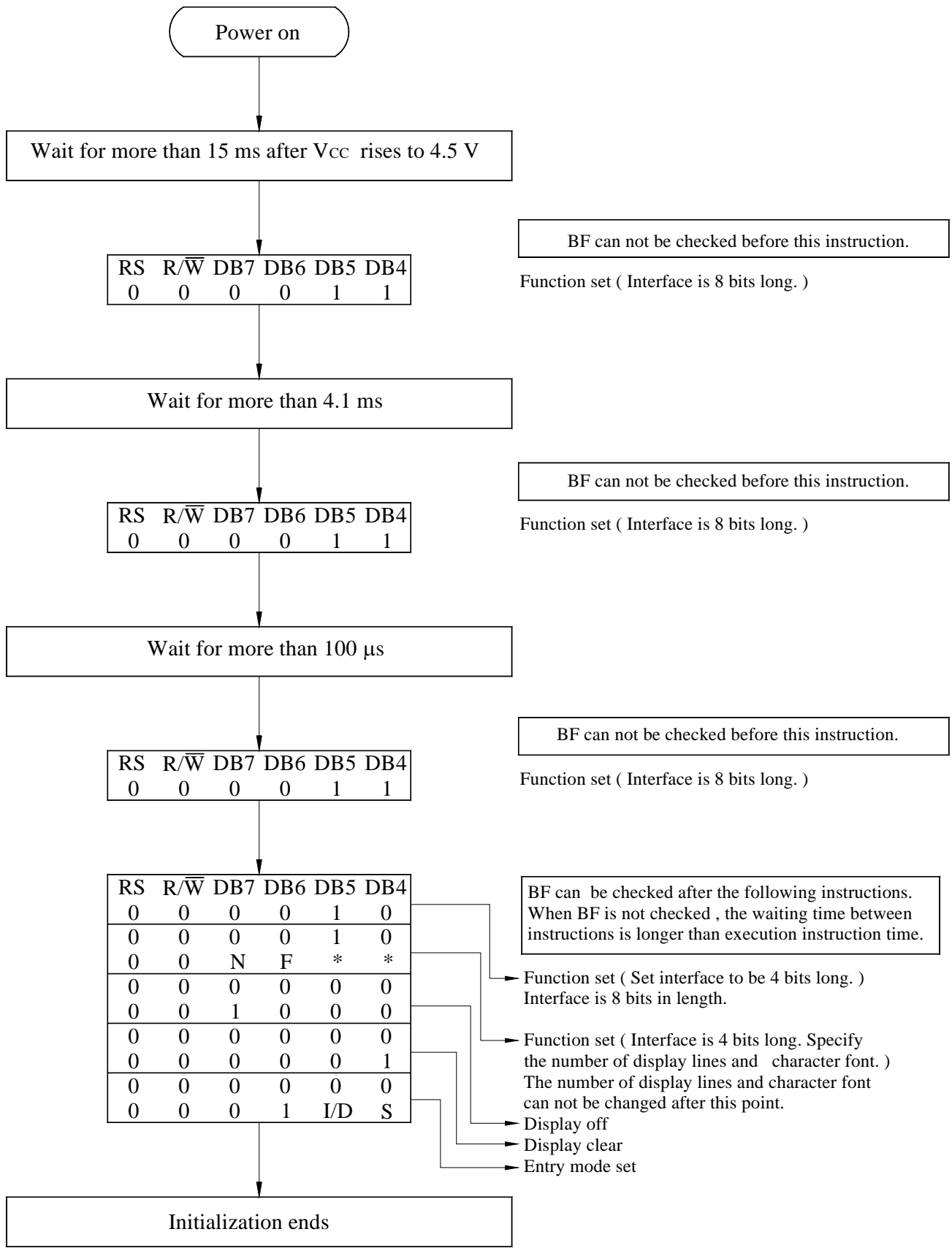
Character Codes (DDRAM data)		CGRAM Address		Character Patterns (CGRAM data)				
7 6 5 4 3 2 1 0		5 4 3 2 1 0		7 6 5 4 3 2 1 0				
High Low		High Low		High Low				
0 0 0 0 * 0 0 0		0 0	0 0 0 0	* * *		Character pattern		
			0 0 0 1	* * *			0 0 0 0	Cursor pattern
			0 0 1 0	* * *			0 0 0	
			0 0 1 1	* * *			0 0 0	
			0 1 0 0	* * *			0 0 0	
			0 1 0 1	* * *			0 0 0	
			0 1 1 0	* * *			0 0 0	
			0 1 1 1	* * *			0 0 0	
			1 0 0 0	* * *			0 0 0	
			1 0 0 1	* * *			0 0 0	
1 0 1 0	* * *	0 0 0						
			1 1 1 1	* * *	* * * * *			

■ : " High "

10.Character Generator ROM Pattern

Table.2

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)			0	1	2	3	4			5	6	7	8	9	0
LLLH	CG RAM (2)		!	1	2	3	4	5			6	7	8	9	0	1
LLHL	CG RAM (3)		"	2	3	4	5	6			7	8	9	0	1	2
LLHH	CG RAM (4)		#	3	4	5	6	7			8	9	0	1	2	3
LHLL	CG RAM (5)		\$	4	5	6	7	8			9	0	1	2	3	4
LHLH	CG RAM (6)		%	5	6	7	8	9			0	1	2	3	4	5
LHHL	CG RAM (7)		&	6	7	8	9	0			1	2	3	4	5	6
LHHH	CG RAM (8)		'	7	8	9	0	1			2	3	4	5	6	7
HLLL	CG RAM (1)		(8	9	0	1	2			3	4	5	6	7	8
HLLH	CG RAM (2))	9	0	1	2	3			4	5	6	7	8	9
HLHL	CG RAM (3)		*	0	1	2	3	4			5	6	7	8	9	0
HLHH	CG RAM (4)		+	1	2	3	4	5			6	7	8	9	0	1
HHLL	CG RAM (5)		,	2	3	4	5	6			7	8	9	0	1	2
HHLH	CG RAM (6)		-	3	4	5	6	7			8	9	0	1	2	3
HHHL	CG RAM (7)		.	4	5	6	7	8			9	0	1	2	3	4
HHHH	CG RAM (8)		/	5	6	7	8	9			0	1	2	3	4	5



BF can not be checked before this instruction.

Function set (Interface is 8 bits long.)

BF can not be checked before this instruction.

Function set (Interface is 8 bits long.)

BF can not be checked before this instruction.

Function set (Interface is 8 bits long.)

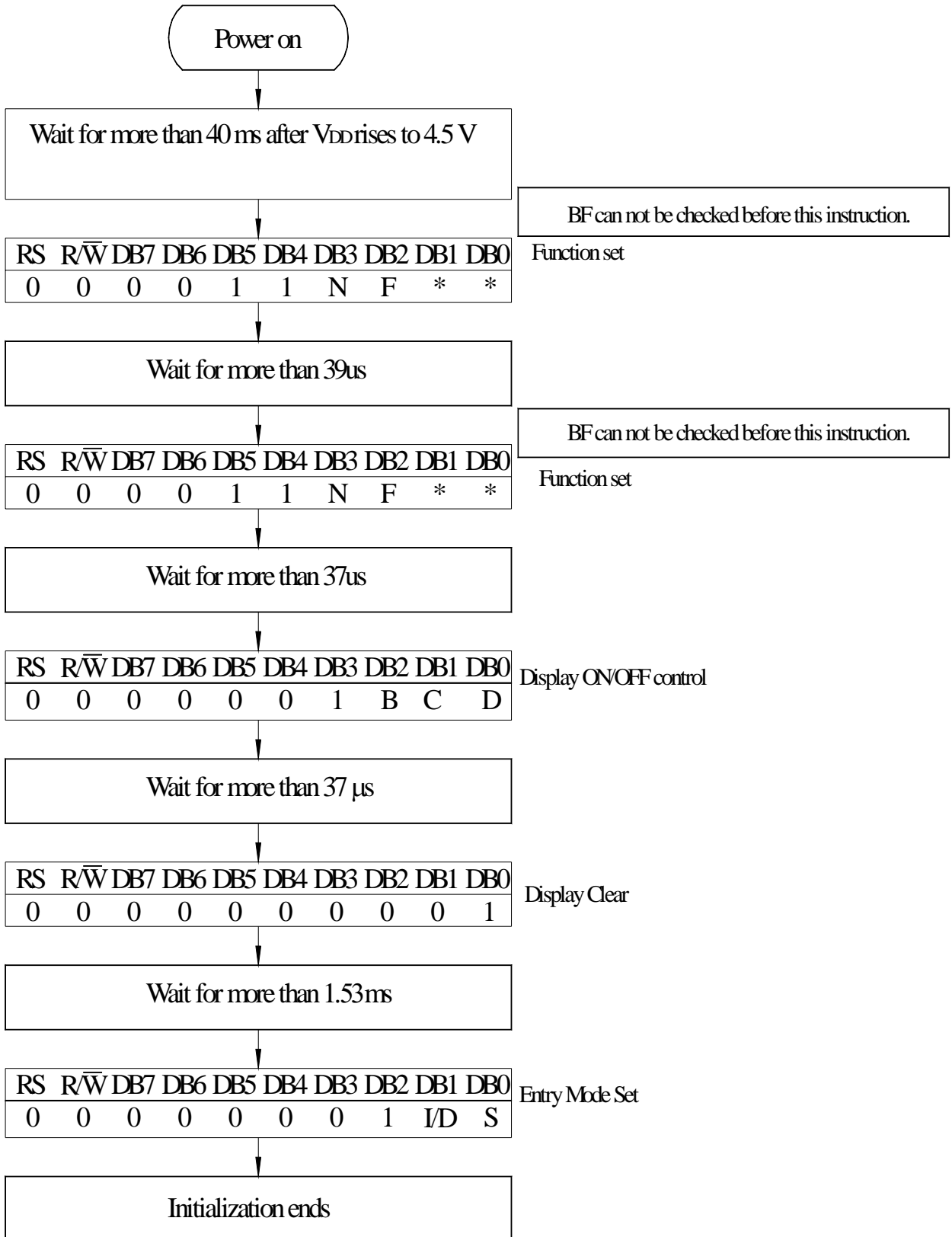
BF can be checked after the following instructions.
When BF is not checked, the waiting time between instructions is longer than execution instruction time.

Function set (Set interface to be 4 bits long.)
Interface is 8 bits in length.

Function set (Interface is 4 bits long. Specify the number of display lines and character font.)
The number of display lines and character font can not be changed after this point.

- Display off
- Display clear
- Entry mode set

4-Bit Ineterface



8-Bit Ineterface

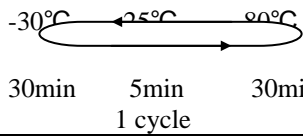
14. Quality Assurance

Screen Cosmetic Criteria

Item	Defect	Judgment Criterion	Partition																				
1	Spots	<p>A)Clear</p> <table border="1"> <thead> <tr> <th>Size: d mm</th> <th>Acceptable Qty in active area</th> </tr> </thead> <tbody> <tr> <td>$d \leq 0.1$</td> <td>Disregard</td> </tr> <tr> <td>$0.1 < d \leq 0.2$</td> <td>6</td> </tr> <tr> <td>$0.2 < d \leq 0.3$</td> <td>2</td> </tr> <tr> <td>$0.3 < d$</td> <td>0</td> </tr> </tbody> </table> <p>Note: Including pin holes and defective dots which must be within one pixel size.</p> <p>B)Unclear</p> <table border="1"> <thead> <tr> <th>Size: d mm</th> <th>Acceptable Qty in active area</th> </tr> </thead> <tbody> <tr> <td>$d \leq 0.2$</td> <td>Disregard</td> </tr> <tr> <td>$0.2 < d \leq 0.5$</td> <td>6</td> </tr> <tr> <td>$0.5 < d \leq 0.7$</td> <td>2</td> </tr> <tr> <td>$0.7 < d$</td> <td>0</td> </tr> </tbody> </table>	Size: d mm	Acceptable Qty in active area	$d \leq 0.1$	Disregard	$0.1 < d \leq 0.2$	6	$0.2 < d \leq 0.3$	2	$0.3 < d$	0	Size: d mm	Acceptable Qty in active area	$d \leq 0.2$	Disregard	$0.2 < d \leq 0.5$	6	$0.5 < d \leq 0.7$	2	$0.7 < d$	0	Minor
Size: d mm	Acceptable Qty in active area																						
$d \leq 0.1$	Disregard																						
$0.1 < d \leq 0.2$	6																						
$0.2 < d \leq 0.3$	2																						
$0.3 < d$	0																						
Size: d mm	Acceptable Qty in active area																						
$d \leq 0.2$	Disregard																						
$0.2 < d \leq 0.5$	6																						
$0.5 < d \leq 0.7$	2																						
$0.7 < d$	0																						
2	Bubbles in Polarize	<table border="1"> <thead> <tr> <th>Size: d mm</th> <th>Acceptable Qty in active area</th> </tr> </thead> <tbody> <tr> <td>$d \leq 0.3$</td> <td>Disregard</td> </tr> <tr> <td>$0.3 < d \leq 1.0$</td> <td>3</td> </tr> <tr> <td>$1.0 < d \leq 1.5$</td> <td>1</td> </tr> <tr> <td>$1.5 < d$</td> <td>0</td> </tr> </tbody> </table>	Size: d mm	Acceptable Qty in active area	$d \leq 0.3$	Disregard	$0.3 < d \leq 1.0$	3	$1.0 < d \leq 1.5$	1	$1.5 < d$	0	Minor										
Size: d mm	Acceptable Qty in active area																						
$d \leq 0.3$	Disregard																						
$0.3 < d \leq 1.0$	3																						
$1.0 < d \leq 1.5$	1																						
$1.5 < d$	0																						
3	Scratch	In accordance with spots cosmetic criteria. When the light reflects on the panel surface, the scratches are not to be remarkable.	Minor																				
4	Allowable Density	Above defects should be separated more than 30mm each other.	Minor																				
5	Coloration	Not to be noticeable coloration in the viewing area of the LCD panels. Back-light type should be judged with back-light on state only.	Minor																				

15. Reliability

Content of Reliability Test

Environmental Test			
Test Item	Content of Test	Test Condition	Applicable Standard
High Temperature storage	Endurance test applying the high storage temperature for a long time.	80°C 200hrs	—
Low Temperature storage	Endurance test applying the high storage temperature for a long time.	-30°C 200hrs	—
High Temperature Operation	Endurance test applying the electric stress (Voltage & Current) and the thermal stress to the element for a long time.	70°C 200hrs	—
Low Temperature Operation	Endurance test applying the electric stress under low temperature for a long time.	-20°C 200hrs	—
High Temperature/ Humidity Storage	Endurance test applying the high temperature and high humidity storage for a long time.	80°C,90%RH 96hrs	—
High Temperature/ Humidity Operation	Endurance test applying the electric stress (Voltage & Current) and temperature / humidity stress to the element for a long time.	70°C,90%RH 96hrs	—
Temperature Cycle	Endurance test applying the low and high temperature cycle.  30min 5min 30min 1 cycle	-30°C/80°C 10 cycles	—
Mechanical Test			
Vibration test	Endurance test applying the vibration during transportation and using.	10~22Hz→ 1.5mmp-p 22~500Hz→ 1.5G Total 0.5hrs	—
Shock test	Constructional and mechanical endurance test applying the shock during transportation.	50G Half sign wave 11 msec 3 times of each direction	—
Atmospheric pressure test	Endurance test applying the atmospheric pressure during transportation by air.	115mbar 40hrs	—
Others			
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°C

