SPECIFICATIONS

CUSTOMER : _____

MODEL NO. : GFC1602AI-BNFE-JP02

VERSION : B

DATE : 2016.12.15

CERTIFICATION : ROHS

CUSTOMER SIGN : _____

QA Approved By	Approved By	Prepared By	Prepared By
	GIFAR 2017.05.29 Donlin	GIFAR 2017.05.29 Hazel	GIFAR 2017.05.29 Rita

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Revision Record

Data(y/m/d)	Ver.	Description	Note	page
2010.10.18	00	New		
2011.07.28	01	修改 connect 下方凸出 pin 長為 4mm		
2016.12.15	B	修改公司抬頭、格式統一		

CONTENTS

1. SCOPE

This specification covers the engineering requirements for the GFC1602AI-BNFE-JP02 liquid crystal module.

2. PRODUCT SPECIFICATIONS

2.1 General

- 16 × 2 dot matrix LCD
- STN(BLUE), Negative mode LCD panel
- Transmissive , Wide temperature type
- 6 o'clock
- Multiplexing driving : 1/16duty, 1/5bias
- Controller IC : SPLC780D1-001A
- Backlight: White(internal control)

2.2 Mechanical Characteristics

Item	Characteristic
Dot configuration	16 × 2
Dot dimensions(mm)	0.45 ×0.65
Dot spacing (mm)	0.5 × 0.7
Module dimensions (Horizontal × Vertical × Thickness, mm)	75.5 × 26 × 11.4 Max
Viewing area (Horizontal × Vertical, mm)	55 × 18
Active area (Horizontal × Vertical, mm)	46.85 × 11.5
Remark	1x15 PIN Connector (下方凸出 PIN 為 4mm)

2.3 Absolute Maximum Ratings (Without LED back-light)

Characteristic	Symbol	Unit	Value
Operating Voltage (logic)	V_{DD}	V	-0.3 to +5.0
Input Voltage	V_{IN}	V	-0.3 to V_{DD}+0.3

Note 1: Referenced to V_{SS}=0V

2.4 Electrical Characteristics (Without LED back-light)

Characteristic	Symbol	Condition	Min.	Typ.	Max.	Unit
Operating Voltage(logic)	V_{DD}-V_{SS}	--	4.7	5.0	5.3	V
Input Voltage	V_{IH}	--	0.8V_{DD}	--	V_{DD}	V
	V_{IL}	--	V_{SS}	--	0.2V_{DD}	
Output Voltage	V_{OH}	I_{OH}=-0.1mA	0.8V_{DD}	--	V_{DD}	V
	V_{HL}	I_{OL}=0.1mA	V_{SS}	--	0.2V_{DD}	

2.5 Optical Characteristics Absolute maximum ratings

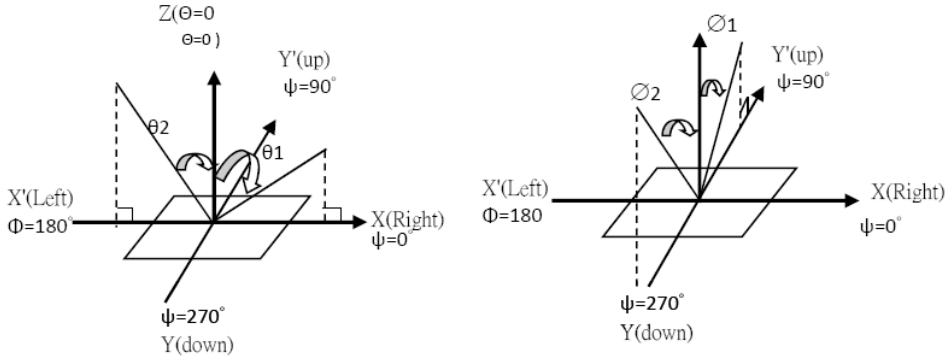
Item	Symbol	Rating	Unit
Operating temperature range	Top	-20~70	°C
Storage temperature range	Tst	-30~80	°C

2.6. Optical Characteristics

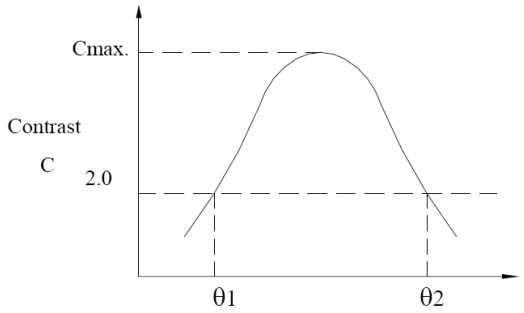
1/16 duty, 1/5 bias, Vop=4.2V, Ta=25℃

Item	Symbol	Conditions	Min.	Typ.	Max	Reference
Driving voltage	Vop		--	-	--	
Viewing angle	θ1、θ2	C≥2.0,∅=0° C	30°	-		Notes 1 & 2
Contrast	C	θ=5°, ∅=0°	2.0	-	-	Note 3
Response time(rise)	ton	θ=5°, ∅=0°	-		250	Note 4
Response time(fall)	toff	θ=5°, ∅=0°	-	-	250	Note 4

Note 1: Definition of angles θ and ∅

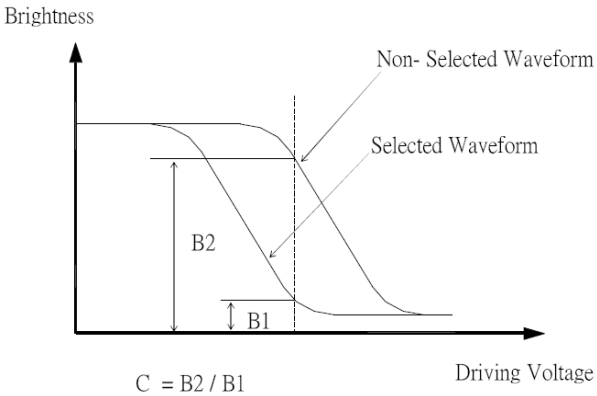


Note 2: Definition of viewing angles θ1 and θ2



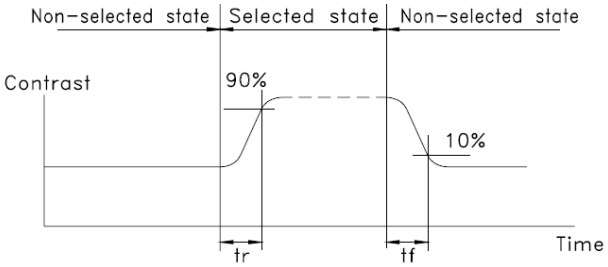
Note : Optimum viewing angle with the naked eye and viewing angle θ at Cmax. Above are not always the same

Note 3: Definition of contrast C



C = B2 / B1

Note 4: Definition of response time



Note: Measured with a transmissive LCD panel which is displayed 1 cm^2

V_{OPR} : Operating voltage f_{FRM} : Frame frequency
t_{ON} : Response time (rise) t_{OFF} : Response time (fall)

2.7 LED Back-light Characteristics

2.7.1 Electrical / optical specifications

Ta = 25°C

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Forward voltage	V_f	If=40mA, White	2.9	3.2	3.6	V
LED *Luminous Intensity	I_V	If=40mA, White	--	200	--	Cd/m2
Chromaticity Coordinate	x	If=40mA, White	0.26	0.31	0.36	
	y		0.25	0.32	0.37	
Reverse Current	IR	VR=5V, White	--	--	0.1	mA
Luminous Uniformity	ΔLv	If=40mA, White	70			%

Note: * Measured at the bare LED back-light unit.

2.7.2 LED Maximum Operating Range

Item	Symbol	WHITE	Unit
Power Dissipation	P_{AD}	144	mW
Forward Current	I_F	40	mA
Reverse Voltage	V_R	5	V

3. RELIABILITY

NO.	ITEM	CONDITION		STANDARD	NOTE
1	High Temp. Storage	80℃	120 hrs	Appearance Without defect	
2	Low Temp. Storage	-30℃	120 hrs	Appearance Without defect	
3	High Temp. & High Humi. Storage	40℃ 90% RH	120 hrs	Appearance Without defect	
4	High Temp. Operating Display	70℃	120 hrs	Appearance Without defect	
5	Low Temp. Operating Display	-20℃	120 hrs	Appearance Without defect	
6	Thermal Shock	-20℃, 30min. → 70℃,30min. (1cycle)		Appearance Without defect	10 cycles

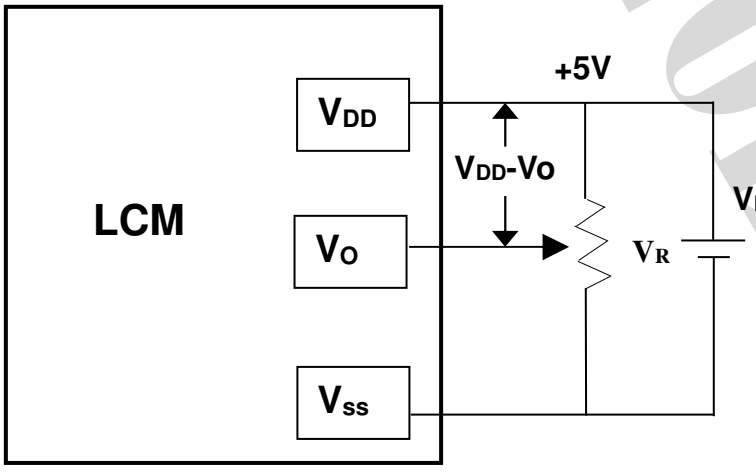
** Dissipation current, contrast and display functions
** Polarizing filter deterioration, other appearance defects
** The function test shall be conducted after 4hours storage at the normal temperature and humidity after remove from the test chamber.

4. OPERATING INSTRUCTIONS

4.1 Input signal Function

NO.	Symbol	Function
1	LEDK	Power supply for LED(GND)
2	VSS	Ground (0V)
3	VDD	Power supply for Logic circuit
4	VO	Power Supply for Driving the LCD
5	RS	Data / Instruction select
6	R/W	Read / Write select
7	E	Enable signal
8-15	DB0-DB7	Data Bus line

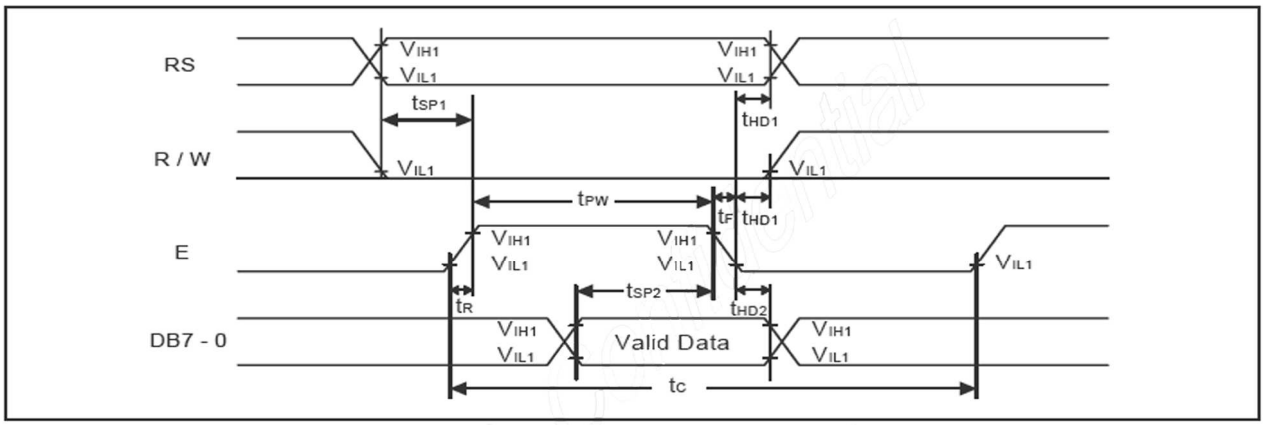
4.2 Voltage Generator Circuit



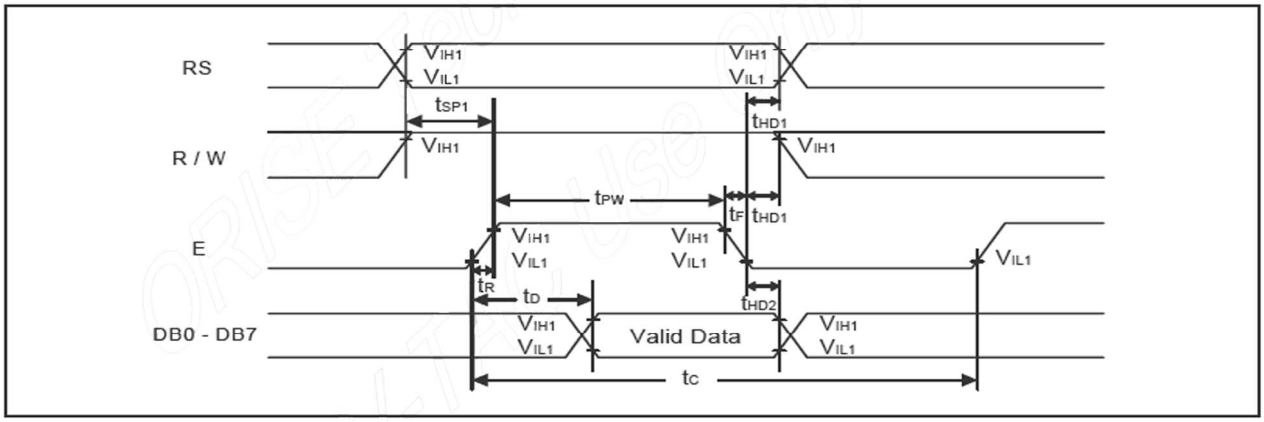
V_{DD}-Vo : LCD Driving Voltage
V_R : 10K~20K

4.3 Timing Diagram

Write mode timing diagram (Writing Data from MPU to SPLC780D1)



Read mode timing diagram (Reading Data from SPLC780D1 to MPU)



Write mode (Writing Data from MPU to SPLC780D1)

Characteristics	Symbol	Limit			Unit	Test Condition
		Min.	Typ.	Max.		
E Cycle Time	t_C	400	-	-	ns	Pin E
E Pulse Width	t_{PW}	150	-	-	ns	Pin E
E Rise/Fall Time	t_R, t_F	-	-	25	ns	Pin E
Address Setup Time	t_{SP1}	30	-	-	ns	Pins: RS, R/W, E
Address Hold Time	t_{HD1}	10	-	-	ns	Pins: RS, R/W, E
Data Setup Time	t_{SP2}	40	-	-	ns	Pins: DB0 - DB7
Data Hold Time	t_{HD2}	10	-	-	ns	Pins: DB0 - DB7

Read mode (Reading Data from SPLC780D1 to MPU)

Characteristics	Symbol	Limit			Unit	Test Condition
		Min.	Typ.	Max.		
E Cycle Time	t_C	400	-	-	ns	Pin E
E Pulse Width	t_W	150	-	-	ns	Pin E
E Rise/Fall Time	t_R, t_F	-	-	25	ns	Pin E
Address Setup Time	t_{SP1}	30	-	-	ns	Pins: RS, R/W, E
Address Hold Time	t_{HD1}	10	-	-	ns	Pins: RS, R/W, E
Data Output Delay Time	t_D	-	-	100	ns	Pins: DB0 - DB7
Data hold time	t_{HD2}	5.0	-	-	ns	Pin DB0 - DB7

4.4.Display Command

Instructions	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 "20H" to DDRAM. and set DDRAM address to "00H" from AC.	1.52ms
Return Home	0	0	0	0	0	0	0	0	1	×	Set DDRAM address to "00H" from AC and return cursor to it's original position if shifted. The contents of DDRAM are not changed.	1.52ms
Entry Mode Set	0	0	0	0	0	0	0	1	I/D	SH	Assign cursor moving direction and make shift of entire display enable.	38μs
Display ON/OFF Control	0	0	0	0	0	0	1	D	C	B	Sets display (D), cursor(C), and blinking of cursor(B) on/off control bit.	38μs
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.	38μs
Function Set	0	0	0	0	1	DL	N	F	×	×	Set interface data length (DL:4 - bit/8-bit), numbers of display line (N: 1-line/2-line), display font type(F:5*8 dots/5*11 dots)	38μs
Set CGRAM Address	0	0	0	1	AC5	AC4	AC3	AC2	AC1	AC0	Set CGRAM address in address counter.	38μs
Set DDRAM Address	0	0	1	AC6	AC5	AC4	AC3	AC2	AC1	AC0	Set DDRAM address in address counter.	38μs
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.	0μs
Write Data to RAM	1	0	D7	D6	D5	D4	D3	D2	D1	D0	Write data into internal RAM (DDRAM/CGRAM).	38μs
Read Data from RAM	1	1	D7	D6	D5	D4	D3	D2	D1	D0	Read data from internal RAM (DDRAM/CGRAM).	38μs

※ "×":don't care

5. Character Pattern

6. NOTES

▪ Safety

- If the LCD panel breaks, be careful not to get the liquid crystal in your mouth. If the liquid crystal touches your skin or clothes, wash it off immediately using soap and plenty of water.

Handling

- Avoid static electricity as this can damage the CMOS LSI.
- The LCD panel is plate glass; do not hit or crush it.
- Do not remove the panel or frame from the module.
- The polarizing plate of the display is very fragile; handle it very carefully

Mounting and Design

- Mount the module by using the specified mounting part and holes.
- To protect the module from external pressure, leave a small gap by placing transparent plates (e.g. acrylic or glass) on the display surface, frame, and polarizing plate
- Design the system so that no input signal is given unless the power-supply voltage is applied.
- Keep the module dry. Avoid condensation, otherwise the transparent electrodes may break.

Storage

- Store the module in a dark place where the temperature is 25 ºC±10 ºC and the humidity below 65% RH.
- Do not store the module near organic solvents or corrosive gases.
- Do not crush, shake, or jolt the module (including accessories).

Cleaning

- Do not wipe the polarizing plate with a dry cloth, as it may scratch the surface.
- Wipe the module gently with soft cloth soaked with a petroleum benzine.
- Do not use ketonic solvents (ketone and acetoe) or aromatic solvents (toluene and xylene), as they may damage the polarizing plate.

7. OPERATION PRECAUTIONS

Any changes that need to be made in this specification or any problems arising from it will be dealt with quickly by discussion between both companies.

8. LCM Dimension