

# SPECIFICATIONS

**CUSTOMER** : \_\_\_\_\_

**SAMPLE CODE** : GFC0802B-BNFE-JP

**DRAWING NO.** : \_\_\_\_\_

**DATE** : 2010.01.06

**CERTIFICATION** : ROHS

Customer Sign	Sales Sign	Approved By	Prepared By

## Revision Record

Data(y/m/d)	Ver.	Description	Note	page
2010.01.06	00	New		
2010.08.12	01	change the supplier of LED backight		



## 11. Relationship Between Character Code (DDRAM) and Character Pattern (CGRAM)

## 12. Character Pattern

## 13. LCM Dimension

### 1. Precautions in use of LCM

#### 1.1 Use Modules

1. When modules switch on or off, after accessing positive supply power with  $5 \pm 0.5$  voltage, then input signal levels, if signal levels input before supply power becomes stable or switches off, IC circuits off, modules will be damaged, as a result, modules will be damaged.
2. Dot matrix modules are high path-number LCDs, they are largely related to the contrast, view angle, driving voltage when displaying, so you should adjust it to get best contrast and view angle, if it is too high, not only displays are effected, but also let life shorted.
3. When using under regulated working temperature below, the display responsiveness is too slow, when using under regulated temperature above, whole display surface turns dark, this is not damaged, when the temperature returns normal, all displays become normal

#### 1.2 Module storage

1. Storing temperature:  $-30 \sim +80$
2. Place in dark sites to avoid strong lights
3. Don't place other thing on their surfaces
4. Packaged in polyer materials (with anti-static electricity layers) and sealed

#### 1.3 Soldering

1. Iron head temperature: 280±10
2. Soldering time: <3-4S
3. Soldering material: eutectic nature, low melting point
4. Don't use acid solder
5. Soldering don't repeat above 3 times

## 2. Mechanical Specifications

Item	Value	Unit
Number of Characters	8X2	Character
Character Format	5 8 Dots	-
Character Pitch	3.55(W) 5.94(H)	mm
Character Size	2.96(W) X5.56(H)	mm
Dot size	0.56(W) 0.66(H)	mm
Dot pitch	0.60(W) 0.70(H)	mm
Module dimension	58 (W) 32(H) 13.5MAX(T)	mm
Active Area	27.81(W) 11.5(H)	mm
Viewing Area	38(W) X 16(H)	mm
Lcd type	STN BLUE Negative Transmissive	
Controller	SPLC708D1-001A	
Duty	1/16	-
Bias	1/5	-
Viewing direction	6 O'clock	-
Backlight	White	-
Module	No Connector	

### 3. Backlight Characteristic

#### 3.1 Electrical / optical specifications

Ta = 25°C

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Forward voltage	$V_f$	If=40mA, White	3.0	3.2	3.4	V
LED *Luminous Intensity	$I_v$	If=40mA, White	--	150	--	Cd/m2
Chromaticity Coordinate	x	If=40mA, White	0.26	0.28	0.30	
	y		0.26	0.28	0.30	
Reverse Current	$I_R$	VR=5V, White	--	--	0.1	mA

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

#### 3.2 LED Maximum Operating Range

Item	Symbol	WHITE	Unit
Power Dissipation	$P_{AD}$	136	mW
Forward Current	$I_F$	40	mA
Reverse Voltage	$V_R$	5	V

#### 4. Absolute Maximum Ratings

Item	Symbol	Conditions	Min.	Max.	Unit
Power supply Voltage	V <sub>DD</sub>	-	-0.3	7.0	V
Input voltage Range	V <sub>IN</sub>	-	-0.3	V <sub>DD</sub> +0.3	V
Operating temperature	TOPR	-	-20	70	
Storage temperature	TSTG	-	-30	80	
Static electricity	Be sure that you are grounded when handing LCM				

**Notes:** 1. Exceeding the absolute maximum ratings may cause permanent damage to the device. Functional operation under these conditions is not implied.

#### 5. DC Electrical Characteristics (Without LED back-light)

Characteristic	Symbol	Condition	Min.	Typ.	Max.	Unit
Operating Voltage	V <sub>DD</sub>	--	4.5	5.0	5.5	V
Supply Current	I <sub>DD</sub>	Internal oscillation or external clock (V <sub>DD</sub> =5.0V, f <sub>OSC</sub> =270kHz)	--	1.5	2	mA
Input Voltage(1) (except OSC1)	V <sub>IH1</sub>	--	0.7 V <sub>DD</sub>	--	V <sub>DD</sub>	V
	V <sub>IL1</sub>	--	-0.3	--	0.6	
Input Voltage(2) (OSC1)	V <sub>IH2</sub>	--	V <sub>DD</sub> -1	--	V <sub>DD</sub>	V
	V <sub>IL2</sub>	--	--	--	1.0	
Output Voltage(1) (DB0 to DB7)	V <sub>OH1</sub>	I <sub>OH</sub> =-0.1mA	3.9	--	V <sub>DD</sub>	V
	V <sub>OL1</sub>	I <sub>OL</sub> =0.1mA	--	--	0.4	
Output Voltage(2) (DB0 to DB7)	V <sub>OH2</sub>	I <sub>O</sub> =-40μA	0.9V <sub>DD</sub>	--	V <sub>DD</sub>	V
	V <sub>OL2</sub>	I <sub>O</sub> =40μA	--	--	0.1V <sub>DD</sub>	
Voltage Drop	V <sub>dCOM</sub>	I <sub>O</sub> =0.1mA	--	--	1	V
	V <sub>dSEG</sub>		--	--	1	
Input Leakage Current	I <sub>IKG</sub>	V <sub>IN</sub> =0V to V <sub>DD</sub>	-1	--	1	μA
Input Low Current	I <sub>IL</sub>	V <sub>IN</sub> =0V, V <sub>DD</sub> =5V (Pull Up)	-50	-125	-250	
Internal Clock (external Rf)	f <sub>OSC1</sub>	Rf=91kΩ ± 2% (V <sub>DD</sub> =5V)	190	270	350	kHz
External Clock	f <sub>OSC</sub>	--	125	270	410	kHz
	duty		45	50	55	%
	t <sub>R</sub> , t <sub>F</sub>		--	--	0.2	μS
LCD Driving Voltage	V <sub>LCD</sub>	V <sub>DD</sub> -V <sub>5</sub> (1/5, 1/4 Bias)	3.0	--	10.0	V

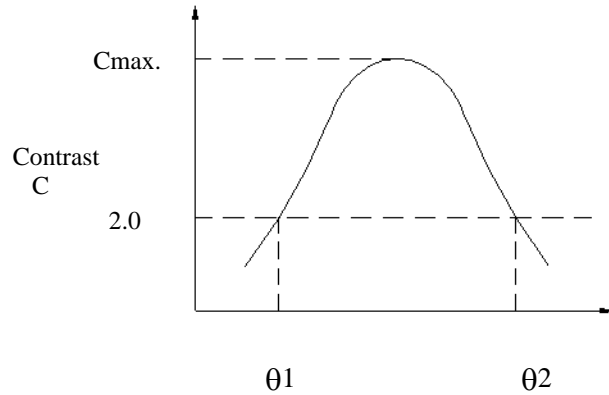
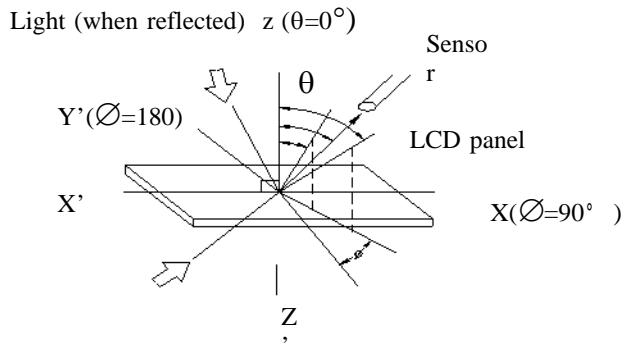
## 6. Optical Characteristics

1/16 duty, 1/5 bias,  $V_{op}=4.3V$ ,  $T_a=25$

Item	Symbol	Conditions	Min.	Typ.	Max	Reference
Driving voltage	$V_{op}=V_{DD-VO}$		--	4.3	--	
Viewing angle	$\theta$	$C \geq 2.0, \varnothing = 0^\circ C$	$30^\circ$	-		Notes 1 & 2
Contrast	C	$\theta = 5^\circ, \varnothing = 0^\circ$	3.0	-	-	Note 3
Response time(rise)	$t_{on}$	$\theta = 5^\circ, \varnothing = 0^\circ$	-		185ms	Note 4
Response time(fall)	$t_{off}$	$\theta = 5^\circ, \varnothing = 0^\circ$	-	-	167ms	Note 4

Note 1: Definition of angles  $\theta$  and  $\varnothing$

Note 2: Definition of viewing angles  $\theta_1$  and  $\varnothing_2$



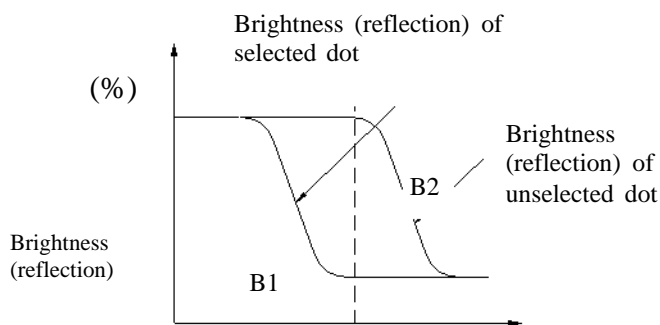
viewing angle  $\theta$  ( fixed)

Note : Optimum viewing angle with the naked eye and viewing angle  $\theta$  at  $C_{max}$ . Above are not always the same

Note 3: Definition of contrast C

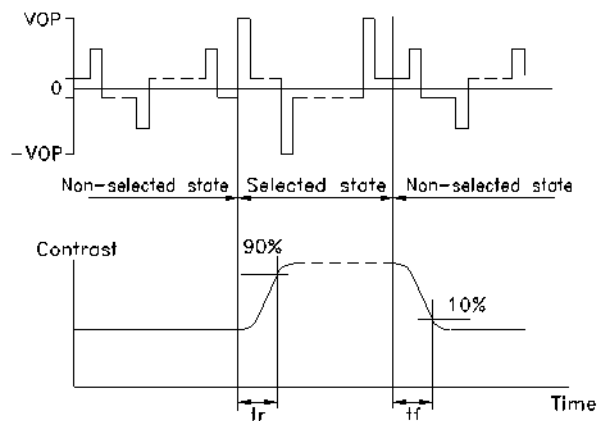
Note 4: Definition of response time

$$C = \frac{\text{Brightness (reflection) of unselected dot (B2)}}{\text{Brightness (reflection) of selected dot (B1)}}$$



0

operating voltage (v)



Note: Measured with a transmissive LCD panel which is displayed 1 cm<sup>2</sup>

$V_{OPR}$  : Operating voltage

$f_{FRM}$  : Frame frequency

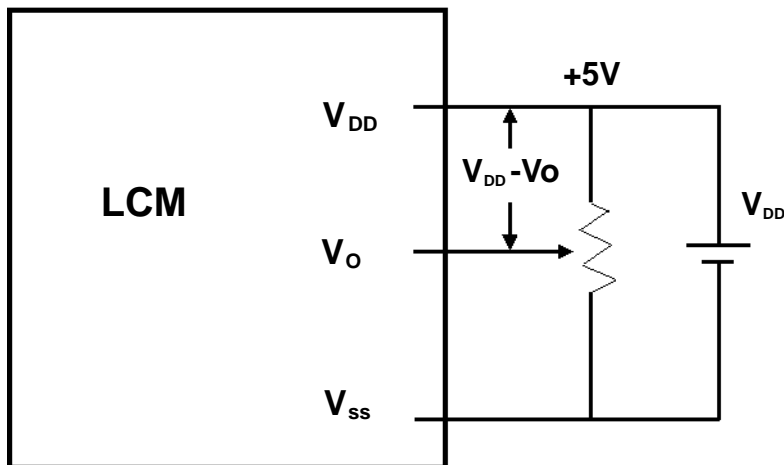
$t_{ON}$  : Response time (rise)

$t_{OFF}$  : Response time (fall)

## 7.Interface Pin Description

NO.	Symbol	Function
1	VSS	Ground (0V)
2	VDD	Power supply for Logic circuit
3	VO	Power Supply for Driving the LCD
4	RS	Data / Instruction select
5	R/W	Read / Write select
6	E	Enable signal
7-14	DB0-DB7	Data Bus line

### Voltage Generator Circuit



$V_{DD} - V_O$  : LCD Driving Voltage

$V_R$  : 10K~20K



## 8. RELIABILITY

Test item	Test condition	Evaluation and assessment
Operation at high temperature and humidity	40°C±2°C 90%RH for 500hours	No abnormalities in functions* and appearance**
Operation at high temperature	60°C±2°C for 500 hours	No abnormalities in functions* and appearance**
Heat shock	-20±2°C ~ +60°C Left for 1 hour at each temperature, transition time 5 min, repeated 10times	No abnormalities in functions* and appearance**
Low temperature	-20±2°C for 500hours	No abnormalities in functions* and appearance**
Vibration	Sweep for 1 min at 10 Hz, 55Hz, 10Hz, amplitude 1.5mm 2 hrs each in the X,Y and Z directions	No abnormalities in functions* and appearance**
Drop shock	Dropped onto a board from a height of 10cm	No abnormalities in functions* and appearance**

\* Dissipation current, contrast and display functions

\*\* Polarizing filter deterioration, other appearance defects

### 8.1 Liquid crystal panel service life

100,000 hours minimum at 25°C±10°C

### 8.2 Definition of panel service life

- Contrast becomes 30% of initial value
- Current consumption becomes three times higher than initial value
- Remarkable alignment deterioration occurs in LCD cell layer
- Unusual operation occurs in display functions

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 Setup Time	$t_{SP2}$	40	-	-	ns	Pins: DB0 - DB7
Data Hold Time	$t_{HD2}$	10	-	-	ns	Pins: DB0 - DB7

## 9. Timing Characteristics

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	$t_{HD}$	5.0	-	-	ns	Pin DB0 - DB7

## 10.Display Command

Instructions	Instruction Code										Description	Execution Time (fosc=270KHZ)
	RSR/WDB7	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	0	0	0	0	0	0	0	0	1	×	Set DDRAM address to "00H"	1.52ms

Home											from AC and return cursor to it's original position if shifted. The contents of DDRAM are not changed.	
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

"x":don't care

## 11. Relationship between Character Code(DDRAM) and

## Character Pattern(CGRAM)

Figure 1

Character Code (DDRAM data)								CGRAM Address						CGRAM Data								Pattern number
D7	D6	D5	D4	D3	D2	D1	D0	A5	A4	A3	A2	A1	A0	P7	P6	P5	P4	P3	P2	P1	P0	
0	0	0	0	x	0	0	0	0	0	0	0	0	0	x	x	x	0				0	pattern 1
											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	x	1	1	1	1	1	1	0	0	0	x	x	x		0	0	0		pattern 8
											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	

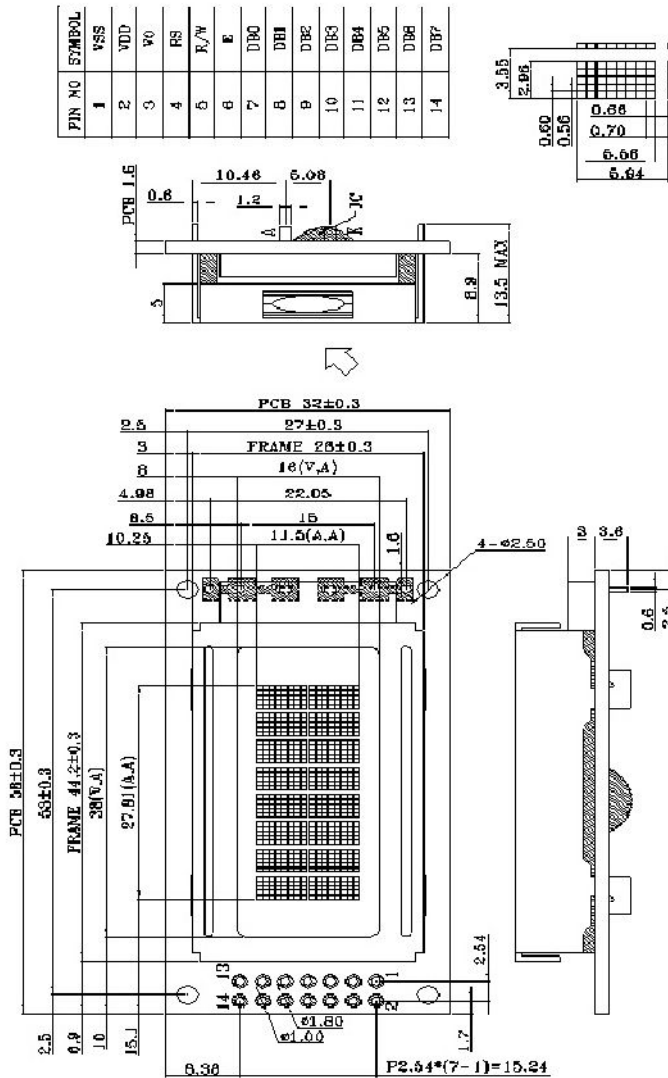
\*"x": dont care

## 12. Character Pattern

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

### 13. LCM Dimension

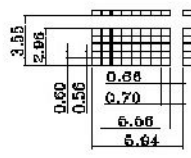
**ROHS**



**NOTES:**

1. DRIVE METHOD: 1/16DUTY, 1/4VARIABLE, VDD=0V, VCP=5V.
2. THERMAL ANGLE: 8° C/CLOCK.
3. OPERATING TEMP: 0°C TO 80°C.
4. OPERATING VOLTAGE: 2.5V.
5. STORAGE TEMP: -30 TO 80 °C.
6. CONNECTION: 288BA.
7. IC SIZE: 1000-1000A.
8. BACKLASH: 0.12mm, 0.12mm, 0.12mm, 0.12mm, 0.12mm.
9. NOT DIMENSION TOLERANCES IS 20%.

DOTS SIZE



091126	B	091126	2009.11.24	REV 02
091204	C	091204	2009.11.24	REV 02
			Product:	GFC0802B-BNPE-JP
			BROWN:	Hazel
			CHECKED:	Kevin
			DATE	2009.11.24
			UNIT	mm
			SCALE	1/1
			SHEET	1/1
			BROWN:	Hazel
			CHECKED:	Kevin
			DATE	2009.11.24
			UNIT	mm
			SCALE	1/1
			SHEET	1/1