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C202A1-BW-YW65

Product Description

- | | |
|---|---|
| <ul style="list-style-type: none">• 20x2 Character LCD• STN Blue Negative• 116.0x37.0mm Module• Serial: I2C, SPI, RS-232(TTL) Interfaces• White LED Backlight | <ul style="list-style-type: none">• Transmissive• Wide Temperature Range• 5.0V• LCD IC: PIC16F690 & ST7066U• RoHS Compliant |
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Revision History

Date	Rev. No	Page	Summary
04/02/2022	1.0	All	First issue

Character LCD Features

Characters: 20x2

Interface(s): I2C, SPI, RS-232(TTL)

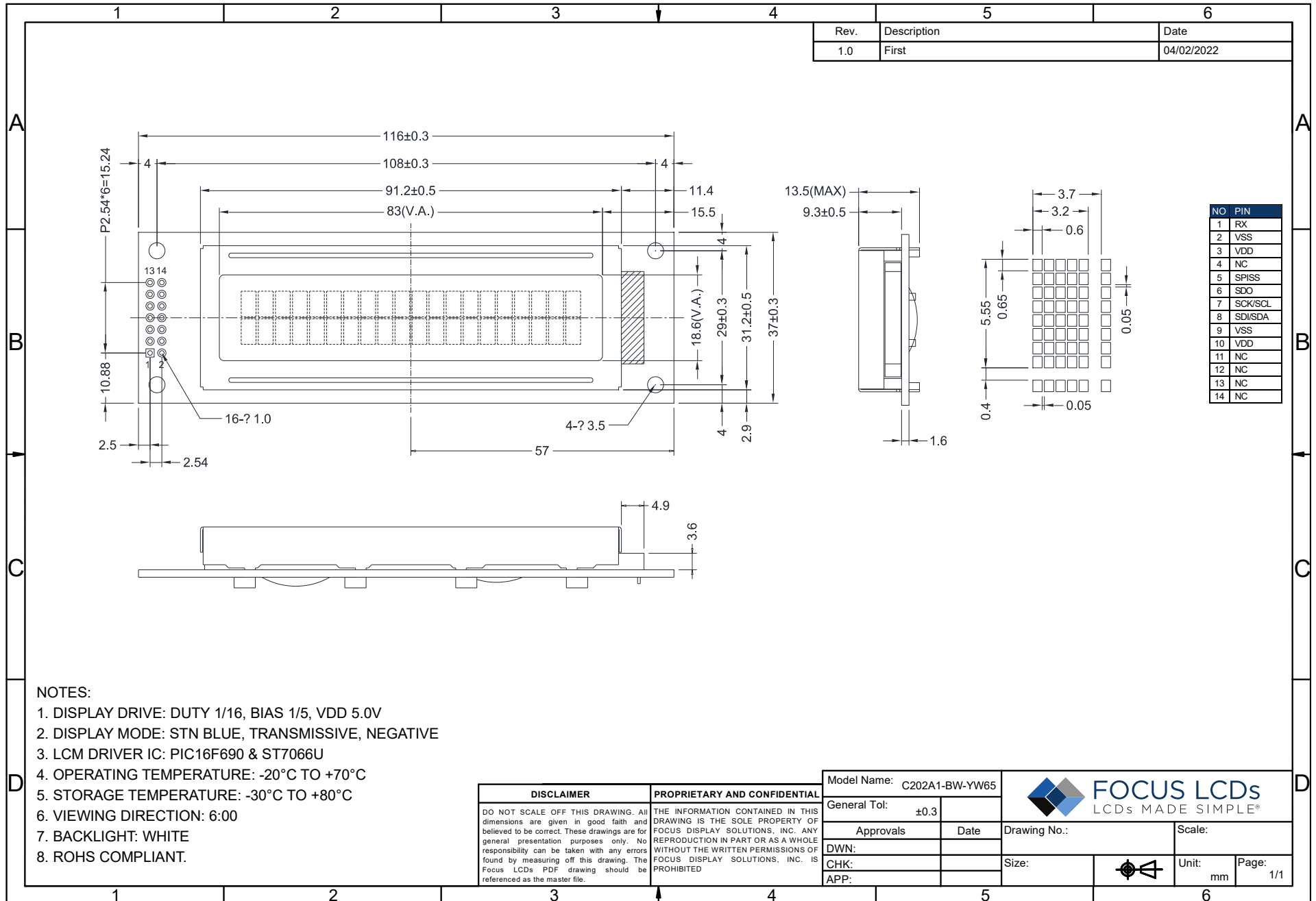
RoHS Compliant

General Information Items	Specification	Unit	Note
	Main Panel		
Viewing Area (VA)	83.0 (H) x 18.6 (V)	mm	--
LCD Type	STN Blue Negative	--	--
Viewing Angle	6:00	O'Clock	--
Polarizer	Transmissive	--	--
Backlight Type	LED	--	--
Backlight Color	White	--	--
LCD IC	PIC16F690 & ST7066U	--	--
Character Height	5.55	mm	--
Operating Temperature	-20 to +70	°C	--
Storage Temperature	-30 to +80	°C	--

Mechanical Information

Item		Min.	Typ.	Max.	Unit	Note
Module Size	Horizontal (H)	--	116.0	--	mm	--
	Vertical (V)	--	37.0	--	mm	--
	Depth (D)	--	13.5	--	mm	--
Weight		--	51	--	g	Approximate

1. Outline Dimensions



2. Input Terminal Pin Assignment

NO.	Symbol	Description	I/O
1	RX	RS-232(TTL) serial input port.	I
2	VSS	Power supply (-).	P
3	VDD	Power supply (+).	P
4	NC	No connection.	--
5	SPISS	SPI Slave Select (NC in I2C mode).	I
6	SDO	Serial data output (SPI). No connection in other modes.	O
7	SCK/SCL	Serial clock.	I
8	SDI/SDA	Serial Data Input (SPI); Serial data (I2C).	I
9	VSS	Power supply (-), ground.	P
10	VDD	Power supply (+).	P
11-14	NC	No connection.	--

I: Input, O: Output, P: Power

3. LCD Optical Characteristics

Item	Symbol	Condition	Min	Typ.	Max	Unit
Contrast Ratio	CR		5	--	--	
Response Time	On	T_{on}	--	200	300	ms
	Off	T_{off}		250	350	ms
Viewing Angle $C_1 \geq 2$, 25°C	Hor.	Θ_L	$\Phi=270^\circ$, 9H	--	--	degree
		Θ_R	$\Phi=90^\circ$, 3H	--	--	
	Ver.	Θ_T	$\Phi=180^\circ$, 12H	--	--	
		Θ_B	$\Phi=0^\circ$, 6H	--	--	

4. Electrical Characteristics

4.1 Absolute Maximum Rating

Characteristics	Symbol	Min	Max	Unit
Input Voltage	V_{IN}/V_{OUT}	-0.3	VDD+0.5	V
Supply Voltage (Logic)	$V_{DD}-V_{SS}$	-0.3	5.5	V
Operating Temperature	T_{OP}	-20	+70	°C
Storage Temperature	T_{ST}	-30	+80	°C

NOTE: If the absolute maximum rating of the above parameters is exceeded, even momentarily, the quality of the product may be degraded. Absolute maximum ratings specify the values which the product may be physically damaged if exceeded. Be sure to use the product within the range of the absolute maximum ratings.

4.2 DC Electrical Characteristics

Characteristics		Symbol	Condition	Min	Typ.	Max	Unit
LCD Driving Voltage		VLCD		--	--	--	V
Supply Voltage		Logic	$V_{DD}-V_{SS}$	4.5	5.0	5.3	V
Supply Current		IDD	VDD=5.0V	--	--	8.0	mA
Input Voltage	H Level	V_{IH}		4.0	--	5.0	V
	L Level	V_{IL}		0.0	--	1.0	V

Condition:

1. VDD = 5.0V
2. 1/16 Duty, 1/5 Bias

5. Communications

5.1 I2C Communication

- To enter the I2C mode, place a jumper on I2C.
- The default I2C address is 80 (50 hex).
- The I2C address can be changed to any 8-bit value by command function, with the exception that the LSB (least significant bit) must always be '0'.
- Once the I2C address has been changed, it will be saved in the system memory, and it will revert back to the default address if either RS232 or SPI protocol is selected.
- The I2C interface is capable of receiving data at up to 50KHz-clock rate.

5.2 SPI Communication

- SPI mode has a normally high idle clock.
- When Slave Select is LOW, data is sampled on the rising edge of the Clock.
- The SPI interface can receive data at up to 100KHz clock rate.
- SPI Mode 3(CPOL = 1, CPHA = 1).

5.3 RS232(TTL) Communication

- To enter the RS-232 mode, both I2C and SPI should be open.
- The RS-232 signal must be 5V TTL compatible.
- Communication format is 8-bit data, 1 stop bit, no parity, no handshaking.
- Default BAUD rate is 9600 and is changeable with a command function.
- Once the BAUD rate has been changed, it will be saved in the system memory, and it will revert to the default address if either I2C or SPI protocol is selected.

5.4 ASCII Text

- To display normal text, just enter its ASCII number.
- A number from 0x00 to 0x07 displays the user defined custom character, 0x20 to 0x7F displays the standard set of characters, 0xA0 to 0xFD display characters and symbols that are factory-masked on the ST7066U controller. 0xFE is reserved.

6. Built-In Functions

There several built-in functions in the serial interface to facilitate the LCD control. These functions eliminate the needs for end user to understand the ST7066 instruction set and timing requirements. It also provides control for features that are not accessible with a serial connection.

Changing the I2C Slave Address

Syntax hexadecimal 0xFE 0x62 [adr]

Parameter	Parameter	Length	Description
	[adr]	1 byte	New I2C address, 0x00 - 0xFE. The LSB is always '0'.

Description This command sets the I2C address, the address must be an even number, (LSB=0). The address change requires 20 microsecond to take effect; therefore, the subsequent input must have an appropriate delay. The default I2C address can be restored if SPI or RS232 is selected as the communication mode.

Default 0x50

Changing BAUD Rate

Syntax hexadecimal 0xFE 0x61 [baud]

Parameter	Parameter	Length	Description
	[baud]	1 byte	New RS232 BAUD Rate, 1 - 8

Description This command sets the RS232 BAUD rate, the single byte parameter select the desired BAUD rate as in the table below. The new BAUD rate requires 20 microsecond to take effect, therefore, the subsequent input must have an appropriate delay. The default BAUD rate can be restored if I2C or SPI is selected as the communication mode. Illegal parameter input will be discarded. (1=300, 2=1200, 3=2400, 4=9600, 5=14400, 6=19.2K, 7=57.6K, 8=115.2K)

Default 9600 BAUD

Turn On Display

Syntax hexadecimal 0xFE 0x41

Parameter	Parameter	Length	Description
	None	None	Turn on LCD screen

Description This command turn on the LCD display screen, the display text is not altered.

Default LCD screen is on

Turn Off Display**Syntax** hexadecimal 0xFE 0x42

Parameter	Parameter	Length	Description
	None	None	Turn off LCD screen

Description This command turn off the LCD display screen, the display text is not altered.**Default** LCD screen is on**Set Cursor Position****Syntax** hexadecimal 0xFE 0x45 [pos]

Parameter	Parameter	Length	Description
	[pos]	1 byte	Put cursor at location specified by [pos], 0x00 to 0x67

Description This command moves the cursor to a specified location where the next character will be displayed. A typical cursor position for a 4-line display is show below; a cursor position outside these ranges will not be viewable.

	Column 1	Column 20
Line 1	0x00	0x13
Line 2	0x40	0x53
Line 3	0x14	0x27
Line 4	0x54	0x67

Default After a reset, the cursor is on position 0x00.**Home Cursor****Syntax** hexadecimal 0xFE 0x46

Parameter	Parameter	Length	Description
	None	None	Position cursor at line 1 column 1

Description This command move the cursor to line 1, column 1 of the LCD screen, the display text is not altered.**Default** None

Turn On Underline Cursor

Syntax hexadecimal 0xFE 0x47

Parameter	Parameter	Length	Description
	None	None	Turn on underline cursor

Description This command turn on the underline cursor, the cursor position is where the next character will appear.

Default The underline cursor is off.

Turn Off Underline Cursor

Syntax hexadecimal 0xFE 0x48

Parameter	Parameter	Length	Description
	None	None	Turn off underline cursor

Description This command turn off the underline cursor.

Default The underline cursor is off.

Move Cursor Left One Space

Syntax hexadecimal 0xFE 0x49

Parameter	Parameter	Length	Description
	None	None	Move cursor left 1 space

Description This command move the cursor position left 1 space, regardless the cursor is displayed or not, and the displayed character is not altered.

Default None

Move Cursor Right One Space

Syntax hexadecimal 0xFE 0x4A

Parameter	Parameter	Length	Description
	None	None	Move cursor right 1 space

Description This command move the cursor position right 1 space, regardless the cursor is displayed or not, and the displayed character is not altered.

Default None

Turn On Blinking Cursor

Syntax hexadecimal 0xFE 0x4B

Parameter	Parameter	Length	Description
	None	None	Turn on the blinking cursor

Description This command turn on the blinking cursor, both the cursor and the character on the cursor will blink.

Default The blinking cursor is off.

Turn Off Blinking Cursor

Syntax hexadecimal 0xFE 0x4C

Parameter	Parameter	Length	Description
	None	None	Turn off the blinking cursor

Description This command turn off the blinking cursor.

Default The blinking cursor is off.

Back Space

Syntax hexadecimal 0xFE 0x4E

Parameter	Parameter	Length	Description
	None	None	Move cursor back one space and delete the character on the cursor.

Description This command is destructive backspace, the cursor is moved back one space and the character on the cursor is deleted.

Default None.

Clear Screen

Syntax hexadecimal 0xFE 0x51

Parameter	Parameter	Length	Description
	None	None	Clear LCD and move cursor to line 1 column 1.

Description This command clears the entire display and place the cursor at line 1 column 1.

Default None.

Set Display Contrast

Syntax hexadecimal 0xFE 0x52 [contrast]

Parameter	Parameter	Length	Description
	[contrast]	1 byte	Set the display contrast, value: 1 to 50

Description This command set the LCD character display contrast, the contrast setting is between 1 to 50, where 50 is the highest contrast.

Default Default contrast value is 40.

Set Backlight Brightness

Syntax hexadecimal 0xFE 0x53 [brightness]

Parameter	Parameter	Length	Description
	[brightness]	1 byte	Set the LCD backlight brightness level, value between 1 to 16

Description This command set the LCD display backlight brightness level, value: 1 to 16.

Default Default contrast value is 1.

Load Custom Characters

Syntax hexadecimal 0xFE 0x54 [addr] [d0...d7]

Parameter	Parameter	Length	Description
	[addr]	1 byte	Custom character address, 0-7
	[d0...d7]	8 bytes	Custom character pattern bit map

Description There are space for eight user defined custom characters, this command load the custom character into one of the eight locations. The custom character pattern is bit mapped into 8 data bytes, the bit map for Spanish character '¿' is shown in table below, to display the custom character, user simply enter the address of the character (0 to 8).

Bit	7	6	5	4	3	2	1	0	Hex
Byte 1	0	0	0	0	0	1	0	0	0x04
Byte 2	0	0	0	0	0	0	0	0	0x00
Byte 3	0	0	0	0	0	1	0	0	0x04
Byte 4	0	0	0	0	1	0	0	0	0x08
Byte 5	0	0	0	1	0	0	0	0	0x10
Byte 6	0	0	0	1	0	0	0	1	0x11
Byte 7	0	0	0	0	1	1	1	0	0x0E
Byte 8	0	0	0	0	0	0	0	0	0x00

Default None.

Shift Display to the Left**Syntax** hexadecimal 0xFE 0x55

Parameter	Parameter	Length	Description
	None	None	Shift the LCD screen to the left one Place.

Description This command shift the display one place to the left, the cursor position also moves with the display, and the display data is not altered.**Default** None**Shift Display to the Right****Syntax** hexadecimal 0xFE 0x56

Parameter	Parameter	Length	Description
	None	None	Shift the LCD screen to the right one Place.

Description This command shift the display one place to the right, the cursor position also moves with the display, and the display data is not altered.**Default** None**Display Firmware Version Number****Syntax** hexadecimal 0xFE 0x70

Parameter	Parameter	Length	Description
	None	None	Display the firmware version number.

Description This command display the micro-controller firmware version number.**Default** None.**Display RS232 Baud Rate****Syntax** hexadecimal 0xFE 0x71

Parameter	Parameter	Length	Description
	None	None	Display Baud Rate

Description This command display the current RS232 BAUD rate.**Default** None.

Display I²C Address

Syntax hexadecimal 0xFE 0x72

Parameter	Parameter	Length	Description
	None	None	Display I2C Address

Description This command display the current I2C slave address.

Default None.

Direct ST7066 Command

Syntax hexadecimal 0xFE 0xFE [cmd]

Parameter	Parameter	Length	Description
	[cmd]	1 byte	Direct interface to the LCD controller, ST7066.

Description This command is for advanced programmer, it allows LCD instruction to send directly to the ST7066 controller.

Default None.

Table of Commands

Prefix	CMD	Parameter	Description
0xFE	0x41	None	Display on
0xFE	0x42	None	Display off
0xFE	0x45	1 Byte	Set cursor
0xFE	0x46	None	Cursor home
0xFE	0x47	None	Underline cursor on
0xFE	0x48	None	Underline cursor off
0xFE	0x49	None	Move cursor left one place
0xFE	0x4A	None	Move cursor right one place
0xFE	0x4B	None	Blinking cursor on
0xFE	0x4C	None	Blinking cursor off
0xFE	0x4E	None	Backspace
0xFE	0x51	None	Clear screen
0xFE	0x52	1 Byte	Set contrast
0xFE	0x53	1 Byte	Set backlight brightness
0xFE	0x54	9 Bytes	Load custom character
0xFE	0x55	None	Shift display left
0xFE	0x56	None	Shift display right
0xFE	0x61	1 Byte	Change baud rate
0xFE	0x62	1 Byte	Change I2C slave address
0xFE	0x70	None	Display firmware version number
0xFE	0x71	None	Display RS232 baud rate
0xFE	0x72	None	Display I2C address
0xFE	0xFE	1 Byte	Direct ST7066 command

7. Built-in Font Table

Lower 4 Bits \ Upper 4 Bits	0000	0001	0010	0011	0100	0101	0110	0111	1000	1001	1010	1011	1100	1101	1110	1111
xxxx0000	CG RAM (1)			0	a	P	`	P				-	夕	ミ	α	p
xxxx0001	(2)		!	1	A	Q	a	q			。	ア	チ	△	ä	q
xxxx0010	(3)		"	2	B	R	b	r			「	イ	ウ	×	ß	θ
xxxx0011	(4)		#	3	C	S	c	s			」	ウ	テ	モ	ε	∞
xxxx0100	(5)		\$	4	D	T	d	t			、	エ	ト	ト	μ	Ω
xxxx0101	(6)		%	5	E	U	e	u			・	オ	ナ	1	ε	ü
xxxx0110	(7)		&	6	F	V	f	v			ヲ	カ	ニ	ヨ	ρ	Σ
xxxx0111	(8)		'	7	G	W	g	w			ア	キ	ヌ	う	g	π
xxxx1000	(1)		(	8	H	X	h	x			イ	ク	ネ	リ	、	又
xxxx1001	(2)		)	9	I	Y	i	y			ウ	ケ	ル	ル	、	y
xxxx1010	(3)		*	:	J	Z	j	z			エ	コ	ハ	レ	j	≠
xxxx1011	(4)		+	;	K	[	k	(			オ	サ	ヒ	ロ	×	π
xxxx1100	(5)		,	<	L	¥	l	l			ヤ	シ	フ	ワ	Φ	円
xxxx1101	(6)		-	=	M	]	m	)			ユ	ズ	ハ	ン	も	÷
xxxx1110	(7)		.	>	N	^	n	÷			ヨ	セ	ホ	°	ñ	
xxxx1111	(8)		/	?	O	_	o	+			ッ	リ	マ	°	ö	■

8. Cautions and Handling

General Precautions:

1. LCD panel is made of glass. Avoid excessive mechanical shock or applying strong pressure onto the surface of display area.
2. The polarizer used on the display surface is easily scratched and damaged. Extreme care should be taken when handling. To clean dust or dirt off the display surface, wipe gently with cotton, or other soft material soaked with isopropyl alcohol, ethyl alcohol or trichlorotrifluoroethane. Do not use water, ketone or aromatics and never scrub hard.
3. Do not tamper in any way with the tabs on the metal frame.
4. Do not make any modification on the PCB without consulting.
5. When mounting the LCM, make sure that the PCB is not under any stress such as bending or twisting. Elastomer contacts are very delicate, and missing pixels could result from slight dislocation of any of the elements.
6. Avoid pressing on the metal bezel, otherwise the elastomer connector could be deformed and lose contact, resulting in missing pixels and cause rainbow on the display.
7. Be careful not to touch or swallow liquid crystal that might leak from a damaged cell. Any liquid crystal adheres to skin or clothes, wash it off immediately with soap and water.

Static Electricity Precautions:

1. CMOS-LSI is used for the module circuit; therefore, operators should be grounded whenever he/she comes into contact with the module.
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.
3. Do not touch the connection terminals of the display with bare hand; it will cause disconnection or defective insulation of terminals.
4. The modules should be kept in anti-static bags or other containers resistant to static for storage.
5. Only properly grounded soldering irons should be used.
6. If an electric screwdriver is used, it should be grounded and shielded to prevent sparks.
7. The normal static prevention measures should be observed for work clothes and working benches.
8. Since dry air is inductive to static, a relative humidity of 50-60% is recommended.

Soldering Precautions:

1. Soldering should be performed only on the I/O terminals.
2. Use soldering irons with proper grounding and no leakage.
3. Soldering temperature: 280°C+10°C.
4. Soldering time: 3 to 4 seconds.
5. Use eutectic solder with resin flux filling.
6. If flux is used, the LCD surface should be protected to avoid spattering flux.
7. Flux residue should be removed.

Operation Precautions:

1. The viewing angle can be adjusted by varying the LCD driving voltage V_o .
2. Since applied DC voltage causes electro-chemical reactions, which deteriorate the display, the applied pulse waveform should be a symmetric waveform such that no DC component remains. Be sure to use the specified operating voltage.
3. Driving voltage should be kept within specified range; excess voltage will shorten display life.
4. Response time increases with decrease in temperature.
5. Display color may be affected at temperatures above its operational range.
6. Keep the temperature within the specified range usage and storage. Excessive temperature and humidity could cause polarization degradation, polarizer peel-off or generate bubbles.
7. For long-term storage under 40°C is required and the relative humidity should be kept below 60%.