



# FOCUS LCDs

LCDs MADE SIMPLE®

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TFT | OLED | CHARACTER | GRAPHIC | UWVD | SEGMENT | CUSTOM

## Character Display Module

Part Number

**C204AS-FTW-LW63**

### Overview:

- 20x4 Character LCD
- FSTN Gray
- 98x60 mm Module
- I2C, SPI or RS232/TTL Interface(s)
- White LED Backlight
- Transflective
- Wide Temp Range
- 3.3V
- LCD IC: ST7066U and PIC16F690
- RoHS Compliant

## Character LCD Features

Characters: 20x4

Interface(s): I2C, SPI or RS232/TTL Interface(s)

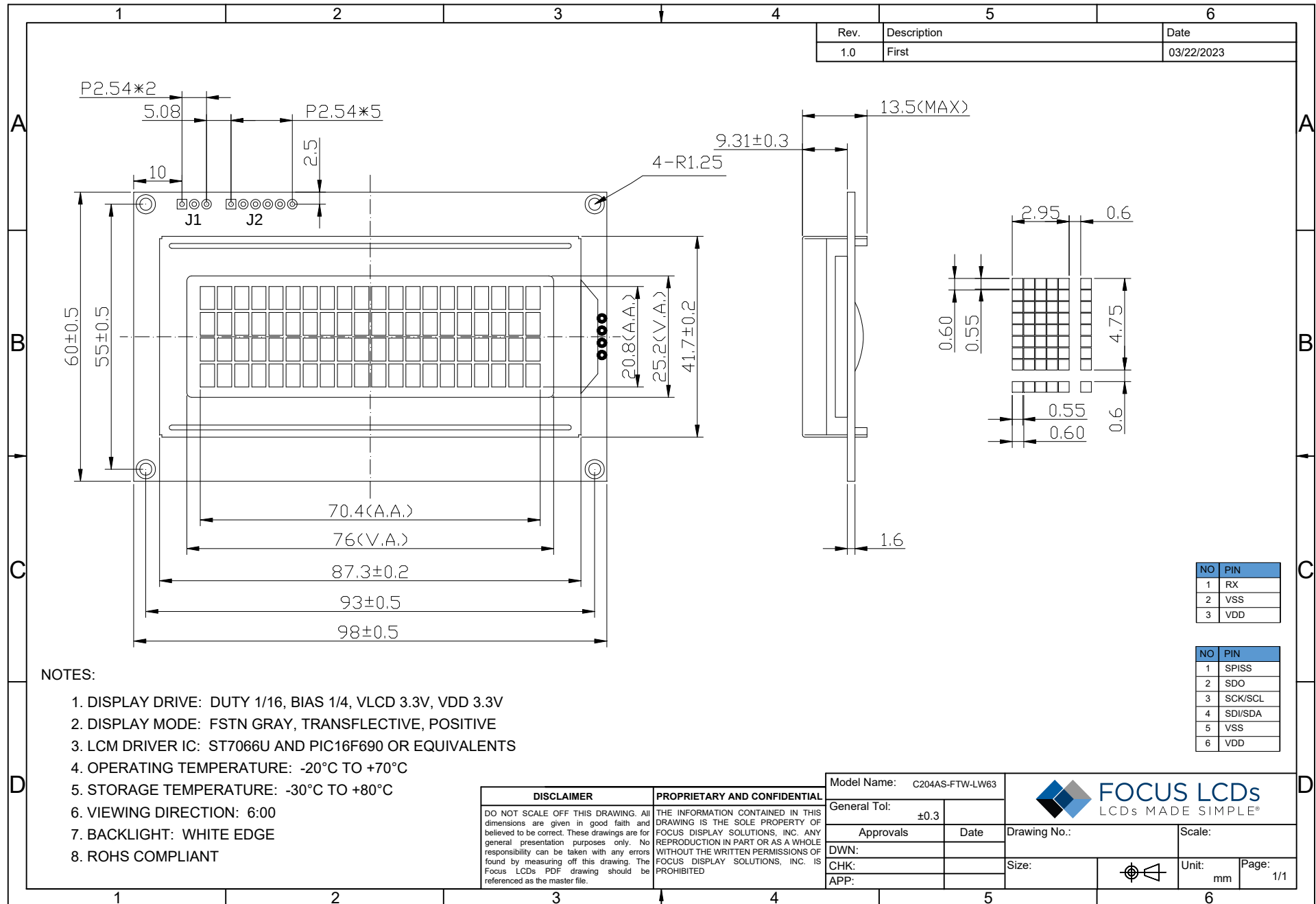
RoHS Compliant

| General Information Items | Specification         | Unit    | Note |
|---------------------------|-----------------------|---------|------|
|                           | Main Panel            |         |      |
| Viewing Area (VA)         | 76.0 (H) x 25.2 (V)   | mm      | --   |
| LCD Type                  | FSTN Gray             | --      | --   |
| Viewing Angle             | 6:00                  | O'Clock | --   |
| Polarizer                 | Transflective         | --      | --   |
| Backlight Type            | LED                   | --      | --   |
| Backlight Color           | White                 | --      | --   |
| LCD IC                    | ST7066U and PIC16F690 | --      | --   |
| Character Height          | 4.75                  | 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) | --   | 98.0 | --   | mm   | --          |
|             | Vertical (V)   | --   | 60.0 | --   | mm   | --          |
|             | Depth (D)      | --   | 13.5 | --   | mm   | --          |
| Weight      |                | --   | 70   | --   | g    | Approximate |

# 1. Outline Dimensions



## 2. Absolute maximum ratings

| Item                        | Symbol  | Standard |   |     | Unit |
|-----------------------------|---------|----------|---|-----|------|
| Power voltage               | VDD-VSS | 0        | - | 7.0 | V    |
| Input voltage               | VIN     | VSS      | - | VDD |      |
| Operating temperature range | VOP     | -20      | - | +70 | °C   |
| Storage temperature range   | VST     | -30      | - | +80 |      |

## 3. Interface pin description

| Pin no. | Symbol  | External connection | Function                                    |
|---------|---------|---------------------|---------------------------------------------|
| 1       | RX      | O                   | RS232 Serial input port                     |
| 2       | VSS     | Power supply        | Signal ground for LCM (GND)                 |
| 3       | VDD     |                     | Power supply for logic (+3.3V) for LCM      |
| 1       | SPISS   | I                   | SPITM slave select input                    |
| 2       | SDO     | O                   | SPITM data output                           |
| 3       | SCK/SCL | I                   | SCK: SPITM clock SCL: I2CTM clock           |
| 4       | SDI/SDA | I                   | SDI: SPITM data input SDA: I2CTM data input |
| 5       | VSS     | Power supply        | Signal ground for LCM (GND)                 |
| 6       | VDD     |                     | Power supply for logic (+3.3V) for LCM      |

## 4. Optical characteristics

STN type display module (Ta=25°C, VDD=3.3V)

| Item                         | Symbol     | Condition | Min. | Typ. | Max. | Unit |
|------------------------------|------------|-----------|------|------|------|------|
| Viewing angle<br>(6 O'clock) | Horizontal | θx+       | 10   | -    | 60   | deg  |
|                              |            | θx-       | 10   | -    | 60   |      |
|                              | Vertical   | Φy+       | -45  | -    | 45   |      |
|                              |            | Φy-       | -45  | -    | 45   |      |
| Contrast ratio               |            | CR        | -    | 3    | -    | -    |
| Response time                | Rise       | tr        | -    | 100  | 150  | ms   |
|                              | Fall       | tf        | -    | 150  | 200  |      |

## 5. Electrical characteristics

DC characteristics

| Parameter                | Symbol | Conditions                  | Min. | Typ. | Max. | Unit |
|--------------------------|--------|-----------------------------|------|------|------|------|
| Input voltage            | VDD    |                             | 3.1  | 3.3  | 3.5  |      |
| Supply current           | IDD    | Ta=25°C, VDD=3.3V           | 1.0  | 2.0  | 2.5  | mA   |
| Input leakage current    | ILKG   |                             | -    | -    | 2.0  | uA   |
| "H" level input voltage  | VIH    |                             | 2.2  | -    | VDD  | V    |
| "L" level input voltage  | VIL    | Twice initial value or less | 0    | -    | 0.6  |      |
| "H" level output voltage | VOH    | LOH=-0.25mA                 | 2.4  | -    | -    |      |
| "L" level output voltage | VOL    | LOH=1.6mA                   | -    | -    | 0.4  |      |

Backlight information

| Parameter                | Symbol | Conditions | Min. | Typ. | Max. | Unit |
|--------------------------|--------|------------|------|------|------|------|
| Supply current           | ILED   | Ta=25°C    | 15   | 30   | 50   | mA   |
| Supply voltage           | Vf     | ILED=30mA  | 2.7  | 3.0  | 3.2  | V    |
| Reverse voltage          | VR     | Ta=25°C    | -    | 5.0  | -    |      |
| Leakage current          | Ir     | Vr=3.3V    | -    | -    | 10   | uA   |
| Chromaticity coordinates | X      |            | 0.25 | -    | 0.30 | -    |

## 6. Communications

### I2C Communication

To enter the I<sup>2</sup>C mode, a jumper is placed on R1 of the interface board and 2 pull-up resistors (nominal value of 1K to 10K Ohm), must be placed on SDA and SCK communication lines, R7 and R8.

The default I<sup>2</sup>C address is 50 (32 hex). The I<sup>2</sup>C 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 I<sup>2</sup>C 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 can receive data at up to 400KHz-clock rate.

### SPI Communication

To enter the SPI mode, a jumper is placed on R2 of the interface board.

The SPI mode has a normally high-level idle clock; data sampled on the rising edge of the clock and Slave Select is enabled.

### RS232 Communication

To enter the RS232 mode, both jumpers, R1 and R2 are removed.

The RS232 signal must be 3.3V, TTL compatible. The communication format is 8-bit data, one stop bit, no parity and no hand shaking. The default BAUD rate is 9600, and it is changeable with a command function, once the BAUD rate is changed, it will be saved in the system memory, and it can be reverted back to default BAUD rate if either I<sup>2</sup>C or SPI protocol is selected.

#### Changing the I2C Slave Address

Syntax      hexadecimal 0xFE    0x62    [adr]

| Parameter | Parameter | Length | Description                                                         |
|-----------|-----------|--------|---------------------------------------------------------------------|
|           | [adr]     | 1 byte | New I <sup>2</sup> C address, 0x00 – 0xFE<br>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 microseconds 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 selects the desired BAUD rate as in the table below. The new BAUD rate requires 20 microseconds 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.

Default      9600 BAUD

| Parameter | BAUD   |
|-----------|--------|
| 1         | 300    |
| 2         | 1200   |
| 3         | 2400   |
| 4         | 9600   |
| 5         | 14400  |
| 6         | 19.2K  |
| 7         | 57.6K  |
| 8         | 115.2K |

## 7. Built-In Functions

### Introduction

There are several built-in functions in the serial interface to facilitate the LCD control, These functions eliminate the needs for end user to understand the ST7066U instruction set and timing requirements. It also provides control for features that are not accessible with a serial connection.

### Turn On Display

Syntax      hexadecimal 0xFE    0x41

| Parameter | Parameter | Length | Description        |
|-----------|-----------|--------|--------------------|
|           | None      | None   | Turn on LCD screen |

Description    This command turns 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 turns 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.

|        | Column1 | Column20 |
|--------|---------|----------|
| Line1  | 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 moves 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 turns 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 turns 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 moves 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 moves 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 turns 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 turns 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   | <table><tr><th>Parameter</th><th>Length</th><th>Description</th></tr><tr><td>[contrast]</td><td>1 byte</td><td>Set the display contrast, value between 1 to 50</td></tr></table> | Parameter                                       | Length     | Description | [contrast] | 1 byte | Set the display contrast, value between 1 to 50 |  |  |
| Parameter   | Length                                                                                                                                                                           | Description                                     |            |             |            |        |                                                 |  |  |
| [contrast]  | 1 byte                                                                                                                                                                           | Set the display contrast, value between 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    | <table><tr><th>Parameter</th><th>Length</th><th>Description</th></tr><tr><td>[brightness]</td><td>1 byte</td><td>Set the LCD backlight brightness level, value between 1 to 8</td></tr></table> |                                                              |              | Parameter | Length | Description | [brightness] | 1 byte | Set the LCD backlight brightness level, value between 1 to 8 |
| Parameter    | Length                                                                                                                                                                                          | Description                                                  |              |           |        |             |              |        |                                                              |
| [brightness] | 1 byte                                                                                                                                                                                          | Set the LCD backlight brightness level, value between 1 to 8 |              |           |        |             |              |        |                                                              |
| Description  | This command set the LCD display backlight brightness level, the value is between 1 to 8.                                                                                                       |                                                              |              |           |        |             |              |        |                                                              |
| Default      | Default contrast value is 5.                                                                                                                                                                    |                                                              |              |           |        |             |              |        |                                                              |

## Load Custom Characters

| Syntax      | hexadecimal 0xFE    0x54    [addr]    [d0 ...d7]                                                                                                                                                                                                                                                                                                         |                                  |        |             |        |        |                                 |          |         |                                  |
|-------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------|--------|-------------|--------|--------|---------------------------------|----------|---------|----------------------------------|
| Parameter   | <table><tr><th>Parameter</th><th>Length</th><th>Description</th></tr><tr><td>[addr]</td><td>1 byte</td><td>Custom character address, 0 – 7</td></tr><tr><td>[D0..D7]</td><td>8 bytes</td><td>Custom character pattern bit map</td></tr></table>                                                                                                          | Parameter                        | Length | Description | [addr] | 1 byte | Custom character address, 0 – 7 | [D0..D7] | 8 bytes | Custom character pattern bit map |
| 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). |                                  |        |             |        |        |                                 |          |         |                                  |
| Default     | None.                                                                                                                                                                                                                                                                                                                                                    |                                  |        |             |        |        |                                 |          |         |                                  |

| 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 |

### 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 shifts 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 shifts 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 displays 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 displays the current RS232 BAUD rate.

Default        None.

### Display I<sup>2</sup>C Address

Syntax      hexadecimal 0xFE    0x72

| Parameter | Parameter | Length | Description                      |
|-----------|-----------|--------|----------------------------------|
|           | None      | None   | Display I <sup>2</sup> C Address |

Description    This command displays the current I<sup>2</sup>C slave address.

Default        None.

## Direct ST7066U Command

|             |                                                                                                                |                         |                                                               |
|-------------|----------------------------------------------------------------------------------------------------------------|-------------------------|---------------------------------------------------------------|
| Syntax      | hexadecimal 0xFE                                                                                               | 0xFE                    | [cmd]                                                         |
| Parameter   | <u>Parameter</u><br>[cmd]                                                                                      | <u>Length</u><br>1 byte | <u>Description</u><br>Direct interface to the LCD controller. |
| Description | This command is for advanced programmer, it allows LCD instruction to send directly to the ST7066U controller. |                         |                                                               |
| Default     | None.                                                                                                          |                         |                                                               |

## 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. And numbers from 0xA0 to 0xFD display characters and symbols that are factory-masked on the ST7066U controller and 0xFE is reserved for function command.

## Command Summary

| Prefix | CMD  | Param  | 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 Byte | Load custom character               |
| 0xFE   | 0x55 | None   | Move display one place to the left  |
| 0xFE   | 0x56 | None   | Move display one place to the right |
| 0xFE   | 0x61 | 1 Byte | Change RS232 BAUD rate 232          |
| 0xFE   | 0x62 | 1 Byte | Change I2C 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 | Send control byte to                |

## 8. Standard character pattern

| 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    |      |      |      | -    | 9    | 3    | α    | p    |
| xxxx0001                    | (2)        |      | !    | 1    | A    | Q    | a    | q    |      |      | 。    | ア    | チ    | △    | ä    | q    |
| xxxx0010                    | (3)        |      | "    | 2    | B    | R    | b    | r    |      |      | 「    | イ    | ツ    | ×    | ß    | θ    |
| xxxx0011                    | (4)        |      | #    | 3    | C    | S    | c    | s    |      |      | 」    | ウ    | テ    | モ    | ≡    | ∞    |
| xxxx0100                    | (5)        |      | \$   | 4    | D    | T    | d    | t    |      |      | 、    | エ    | ト    | ハ    | μ    | Ω    |
| xxxx0101                    | (6)        |      | %    | 5    | E    | U    | e    | u    |      |      | ・    | オ    | ナ    | 1    | ℃    | ü    |
| xxxx0110                    | (7)        |      | &    | 6    | F    | V    | f    | v    |      |      | ヲ    | カ    | ニ    | ヨ    | ρ    | Σ    |
| xxxx0111                    | (8)        |      | '    | 7    | G    | W    | g    | w    |      |      | ア    | キ    | ヌ    | ラ    | g    | π    |
| xxxx1000                    | (1)        |      | <    | 8    | H    | X    | h    | x    |      |      | イ    | ク    | ネ    | リ    | フ    | Σ    |
| xxxx1001                    | (2)        |      | >    | 9    | I    | Y    | i    | y    |      |      | ウ    | ケ    | ル    | ル    | ´    | y    |
| xxxx1010                    | (3)        |      | *    | :    | J    | Z    | j    | z    |      |      | エ    | コ    | ハ    | レ    | j    | チ    |
| 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    | モ    | ÷    |
| xxxx1110                    | (7)        |      | .    | >    | N    | ^    | n    | ÷    |      |      | ヨ    | セ    | ホ    | °    | ñ    |      |
| xxxx1111                    | (8)        |      | /    | ?    | O    | _    | o    | €    |      |      | ッ    | リ    | マ    | °    | ö    | ■    |

## 9. 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:  $280^{\circ}\text{C} + 10^{\circ}\text{C}$
4. Soldering time: 3 to 4 second.
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%.