SVC2004A Series

(20S401DA1)

VFD MODULE USER MANUAL

Please click the following image to buy the sample

Business Card

Wechat Card

Shenzhen Surenoo Technology Co.,Ltd.
www.surenoo.com
E-mail: info@surenoo.com
Skype: Surenoo365

Reference Controller Datasheet

Character VFD Selection Guide

~~~~~~~~~~~~~~~~~~ Index ~~~~~~~~~~~~~~~~~~

1. SCOPE

This specification applies to VFD module (Model No: 20S401DA1)

2. FEATURES

* Vacuum Fluorescent Display: Self Luminous, High Quality and Readable Display

* +5VDC Single Power Supply: Built in DC/DC Converter

* Both Parallel and Serial Interface: Baud-rate: 300 ~ 19,200 bps, Parity Selectable (non, even, odd)

* Two kinds of CG-ROM Font: ASCII + Japanese and ASCII + European

* 4 Brightness Level: 25%, 50%, 75% and 100%

* Character Format: 5*7 Dot Matrix

3. PRECAUTIONS (OPERATING RECOMMENDATIONS)

* Avoid applying excessive shock or vibration beyond the specification for the VFD module.

* Since VFDs are made of glass material, careful handling is required. i.e. Direct impact with hard material to the glass surface(especially exhaust tip) may crack the glass.

* When mounting the VFD module to your system, leave a slight gap between the VFD glass and your front panel. The module should be mounted without stress to avoid flexing of the PCB.

* Avoid plugging or unplugging the interface connection with the power on, otherwise it may cause the severe damage to input circuitry.

* Slow starting power supply may cause non-operation because one-chip MCU won't be reset.

* Exceeding any of maximum ratings may cause the permanent damage.

* Since the VFD modules contain high voltage source, careful handling is required during powered on.

* When the power is turned off, the capacitor does not discharge immediately. The high voltage applied to the VFD must not contact to the ICs. And the short-circuitry of mounted components on PCB within 30 seconds after power-off may cause damage to those.

* The power supply must be capable of providing at least 10 times the rated current, because the surge current can be more than 5 times the specified current consumption when the power is turned on.

* Avoid using the module where excessive noise interference is expected. Noise may affects the interface signal and causes improper operation. And it is important to keep the length of the interface cable less than 50cm.

* Since all VFD modules contain C-MOS ICs, anti-static handling procedures are always required.

4. PRODUCT SPECIFICATIONS

4.1 Type

Type Number (Model)	20S401DA1
Character Format	5 * 7 Dot Matrix
Number of Digits	80 (4 lines * 20 characters)

4.2 Outer Dimensions, Weight

Parameters	Symbols	Specification	Unit
Outer Dimensions	W * H * t	150.0 * 64.0 * 28.6	mm
Glass Size	W * H	118.2 * 48.3	mm
Display Area	W * H	89.52 * 33.07	mm
Character Size	CW * CH	3.07 * 4.87	mm
Character Pitch	CP(x)*CP(y)	4.55 * 9.40	mm
Weight	-	Approx. 140	g

4.3 Environment Conditions

Parameters	Symbols	Min.	Max.	Unit
Operating Temperature	T_{OPR}	- 20	+ 70	^{o}C
Storage Temperature	T_{STG}	- 40	+ 85	^{o}C
Humidity (Operating)	H_{OPR}	0	85	%
Humidity (Non-operating)	H_{STG}	0	90	%
Vibration (10 ~ 55 Hz)	-	-	4	G
Shock	-	-	40	G

4.4 Absolute Maximum Ratings

Parameters	Symbols	Min.	Max.	Unit
Supply Voltage	VCC	-	+ 7.0	VDC
Input Signal Voltage	VIS	0.0	VCC+0.3	VDC

4.5 Recommended Operating Conditions

Parameters	Symbols	Min.	Typ.	Max.	Unit
Supply Voltage	VCC	4.5	5.0	5.5	VDC
H-Level Signal Input Voltage	VIH	2.4	-	VCC+0.3	VDC
L-Level Signal Input Voltage	VIL	-	-	0.8	VDC

4.6 DC Characteristics (when Ta = +25^{o}C, VCC = +5.0VDC)

Parameters	Test Conditions	Min.	Typ.	Max.	Unit
Supply Current (*)	All dots are lit.	-	550	800	mA
H-Level Input Current (**)	VIS = VCC	-	-	20	uA
L-Level Input Current	VIS = 0 VDC	-	-	-1.2	mA
Brightness	All dots are lit.	100 (340)	200 (680)	- -	ft-L (cd/m^2)
Display Color	-	Blue-green (peak wave = 505nm)			-

(*) Note-1: The in-rush current can be approx. 3 times the specified supply current at power on. The peak in-rush current amplitude and duration are dependent on the characteristics of the host power supply.

(**) Note-2: 10Kohm resistors are pulled-up on all signals.

4.7 Timing Chart and AC Characteristics

4.7.1 Parallel Input Timing

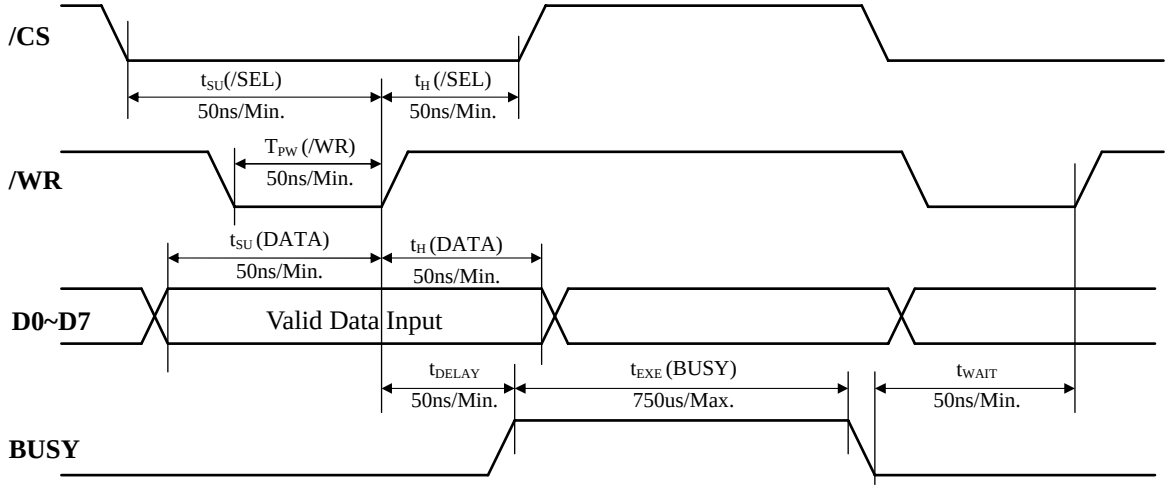


Fig.-1 Parallel Input Timing Diagram

4.7.2 Serial Input Timing

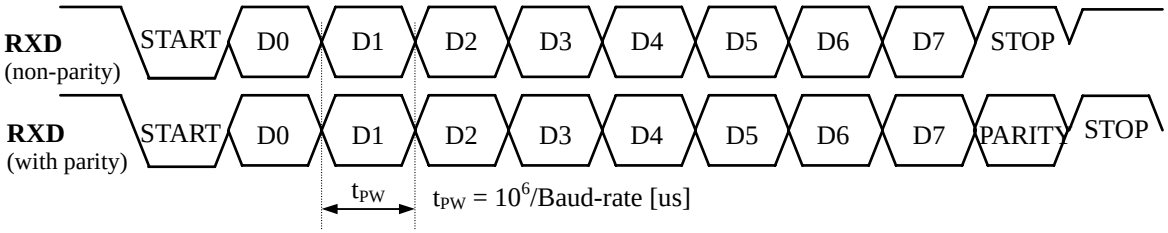


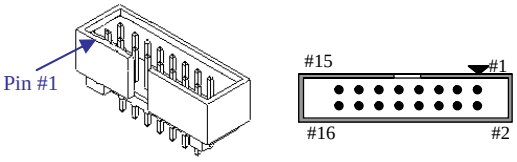
Fig.-2 Serial Input Timing Diagram

In case of serial input mode, it is not necessary to check the BUSY signal because the execution time of data (t_{EXE}) is shorter than the input time of 1 byte serial data. In this mode, BUSY signal always holds low state.

4.8 Signal Interfacing

4.8.1 Parallel Interfacing

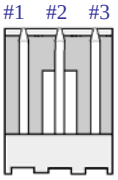
* Connector (Male): BH-S16-FG
  (16-Pin Dual Box Header, Straight)
  .... Mate Socket (Female): MIL-STD-16P



Pin No.	I/O	Signal Name	Pin No.	I/O	Signal Name
1	Input	D7	2	Input	D6
3	Input	D5	4	Input	D4
5	Input	D3	6	Input	D2
7	Input	D1	8	Input	D0
9	Input	WR	10	Input	/CS
11	Input	RXD/T0	12	Output	BUSY
13	-	GND	14	-	GND
15	-	VCC	16	-	VCC

4.8.2 Serial Interfacing

* Connector (Male): 171825-3 (by AMP)
  (3-Pin, Straight, With Locking Tab)
  .... Mate Socket (Female): 171822-3 (by AMP)



Pin No.	I/O	Signal Name
1	-	VCC
2	Input	RXD/T0
3	-	GND

4.9 System Block Diagram

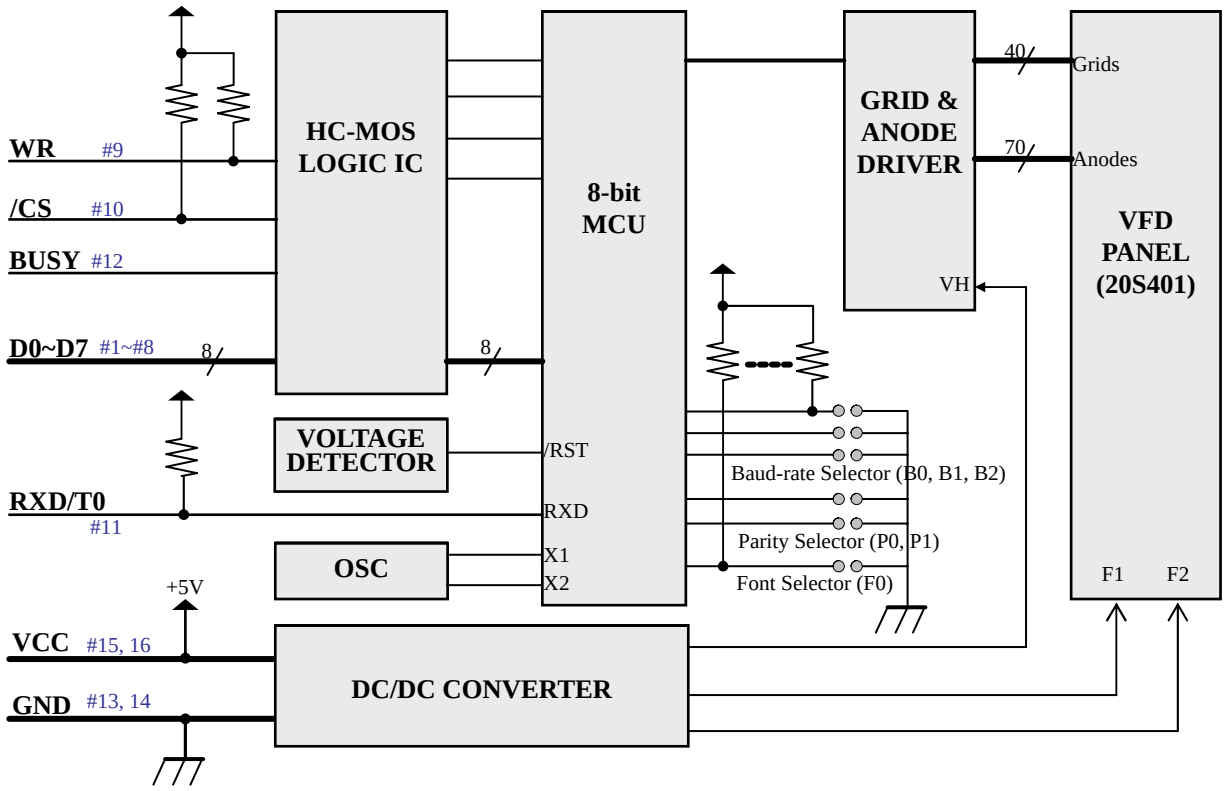


Fig.-3 VFD Module System Block Diagram

4.10 Outer Dimensions

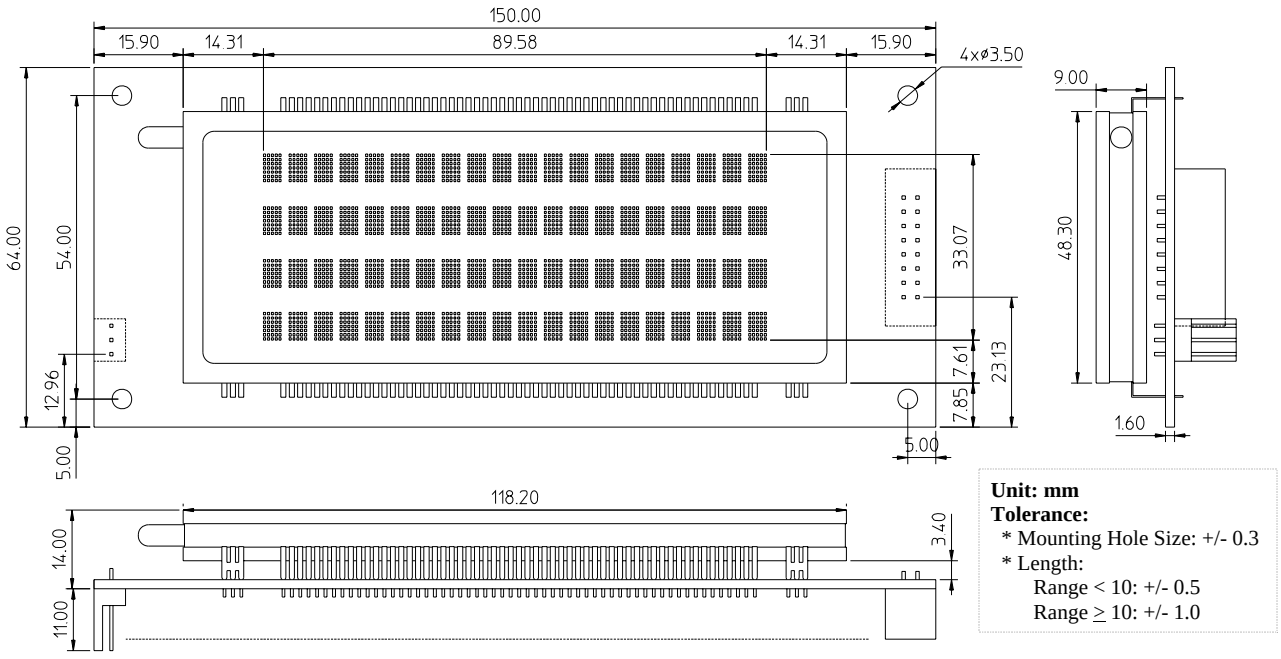


Fig.-4 Outer Dimensions

4.11 Pattern Details

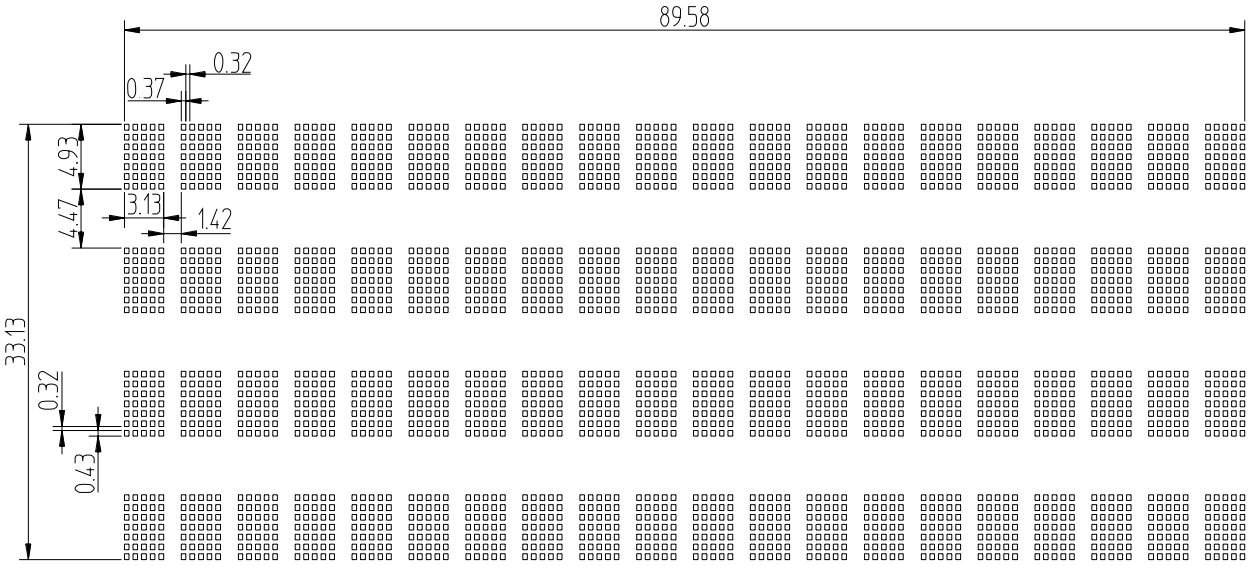


Fig.-5 Pattern Details

5. FUNCTIONS

The module has data and control code write-in, self-test and power on reset function. When the data is being written-in, the BUSY signal is active (High) which indicates that the module is processing the data.

* Data and Control Code Write-in Table

WR	/CS	Function
0 → 1	0	Write-in Data and/or Control Code
*	1	No Operation

5.1 Character Data Write-in

When the character data code (20 Hex ~ FF Hex) is transferred to the module, the character font is displayed on the screen. At this time, the cursor will be shifted to the right one digit automatically.

5.2 Control Code Write-in

The control commands are available as follows and details are will be explained.

(1) BS: Back Space..... 08 Hex
(2) HT: Horizontal Tab..... 09 Hex
(3) LF: Line Feed..... 0A Hex
(4) CH: Cursor Home..... 0C Hex
(5) CR: Carriage Return..... 0D Hex
(6) CLR: Clear Display..... 0E Hex
(7) DC1: Normal Display Mode..... 11 Hex
(8) DC2: Vertical Scroll Mode..... 12 Hex
(9) DC4: Cursor Off Mode..... 14 Hex
(10) DC5: All Dot Cursor Blinking Mode..... 15 Hex
(11) DC6: Cursor Off Mode..... 16 Hex
(12) DC7: Cursor Off Mode..... 17 Hex
(13) CT0: General European Font..... 18 Hex
(14) CT1: Japanese Katakana Font..... 19 Hex
(15) ESC: Escape Sequence..... 1B Hex
[1] UDF: Save a User Definable Character..... (1B Hex + 43 Hex)
[2] DP: Display Position..... (1B Hex + 48 Hex)
[3] DIM: Dimming..... (1B Hex + 4C Hex)
[4] BSC: Blink Speed Control..... (1B Hex + 54 Hex)
[5] RST: Reset (Initialization)..... (1B Hex + 49 Hex)

5.2.1 BS (08 Hex): Back Space
The write-in position is shifted to the left one digit.
When the write-in position is on the most significant digit (left-end digit), the cursor moves to the right-end of the upper line. When the write-in position is on the left-end of the first line, the cursor doesn't move.

5.2.2 HT (09 Hex): Horizontal Tab
The write-in position is shifted to the right one digit.
When the write-in position is on the least significant digit (left-end digit), the cursor moves to the left-end of the lower line. When the write-in position is on the right-end of the forth line, the operation depends on DC1 and DC2.

* DC1 Mode: The write-in position moves to the most significant digit of the first line.
* DC2 Mode: All the characters displayed in second through forth line are shifted to the upper line, clearing forth line. The cursor moves to the left-end digit of the forth line.

5.2.3 LF (0A Hex): Line Feed
All the characters displayed are cleared and the cursor doesn't move.

5.2.4 CH (0C Hex): Cursor Home
The cursor moves to the most significant digit.

5.2.5 CR (0D Hex): Carriage Return
The cursor moves to the most significant digit.

5.2.6 CLR (0E Hex): Clear
All the characters displayed are cleared and the cursor doesn't move.

DC1~DC2 select the display mode. When the power is turned on, DC1 mode is selected default and will be held until another mode is selected.
5.2.7 DC1 (11 Hex): Normal Display Mode
After writing a character, the write-in position is shifted to the right one digit automatically.
When the write-in position is on the least significant digit of the fourth line, the cursor moves to the most significant digit of the first line.

5.2.8 DC2 (12 Hex): Vertical Scroll Mode
When the write-in position is on the least significant digit of the forth line, all the characters displayed in second through forth line moved toward upper line. (The characters on the first line will be disappeared.) The cursor moves to the left-end digit of forth line.

DC4~DC7 are the cursor control command. In case of DC5, the blinking speed can be varied by ESC sequence. (See section 5.2.16-[4] Blinking Speed Control.) When the power is turned on, DC4 mode is default selected and will be held until another mode (DC5~DC7) is selected.
5.2.9 DC4 (14 Hex): Cursor Off Mode
The cursor won't be displayed.

5.2.10 DC5 (15 Hex): All Dot Cursor Blinking Mode
The cursor is displayed as a blinking all dot cursor.

5.2.11 DC6 (16 Hex): Cursor off Mode
The cursor won't be displayed.

5.2.12 DC7 (17 Hex): Cursor off Mode
The cursor won't be displayed.

CT0 and CT1 select the character font table. When the power is turned on, CT0 is default selected and will be held until the other table is selected as below.
5.2.13 CT0 (18 Hex): General European Font Table
The CT0 Font table (Refer to the Appendix-1 on Page-11.) is selected.

5.2.14 CT1 (19 Hex): Japanese Katakana Font Table
The CT1 Font table (Refer to the Appendix-2 on Page-12.) is selected.

5.2.15 ESC (1B Hex): Escape Sequence
This command is used to define font, move cursor, change luminance, blinking speed control and/or initialize the module.

[1] UDF (43 Hex): Save a User Definable Font
The characters can be designed by using this command. These font data are memorized in the RAM of the module.

* Syntax: ESC (1B Hex) + "C" (43 Hex) + CHR (00 ~ FF Hex) + PT1+PT2+PT3+PT4+PT5

Any 5x7 dots pattern consisted of data form PT1 through PT5 (4th~8th byte) can be stored in the character code location specified by CHR (3rd byte). And the maximum kinds of UDFs (User Definable Font) are 16 characters at once.
Storing more than 16 will kill the oldest font. However within 16 characters codes where already defined by UDF, the over-write-latest font replaces the former font.
* 1st byte: ESC (1B Hex).....Specify Escape command.
* 2nd byte: "C" (43 Hex)..... Specify User-Definable-Font Command.
* 3rd byte: CHR (00 Hex ~ FF Hex)..... Specify the character code location from 00hex to FF

Hex by CHR. If CHR overlaps control codes such as BS, HT, LF etc., the control function will be lost. Therefore, overlaps to the ESC codes may not available further UDF function.

* 4th ~ 8th byte (00 Hex ~ FF Hex).....Specify ON/OFF of 35 (5x7 dot) dots' position. Below shows the relation between dots positions a data formation. The notation of "*x*.*y*" means the *y*th bit of *x*th byte. For example, "4.0" means LSB (Least Significant Bit) of 4th byte and "7.7" means MSB (Most Significant Bit) of 7th byte. ("1" = dot turn on, "0" = dot turn off)

5x7 Dot Matrix				
4.0	4.1	4.2	4.3	4.4
4.5	4.6	4.7	5.0	5.1
5.2	5.3	5.4	5.5	5.6
5.7	6.0	6.1	6.2	6.3
6.4	6.5	6.6	6.7	7.0
7.1	7.2	7.3	7.4	7.5
7.6	7.7	8.0	8.1	8.2
*) 8.3 ~ 8.7: Don't Care				

Design Example				
0	0	**1**	**1**	0
0	**1**	0	0	0
1	**1**	**1**	0	0
0	**1**	0	0	0
1	**1**	**1**	0	0
0	**1**	0	0	**1**
0	0	**1**	**1**	0
*	*	*	*	*

UDF Data Coding Example of Left Design
1st Byte: 1B Hex (Escape Sequence)
2nd Byte: 43 Hex (Specify UDF Command)
3rd byte: nn Hex (Location Address)
4th Byte: 01001100b = 4C Hex
5th Byte: 00011100b = 1C Hex
6th Byte: 01110001b = 71 Hex
7th Byte: 00100100b = 24 Hex
8th Byte: 00000011b = 03 Hex

[2] Display Position (48 Hex)
The cursor can be moved to any position of screen by following ESC sequence.

* Syntax: ESC (1B Hex) + "H"(48 Hex) + Cursor Position Data (refer to below table)
Just only the 00 Hex to 4F Hex are available as a cursor position data.

	1st Column	2nd Column	3rd Column	.....	19th Column	20th Column
1st Row (Top Line)	00 Hex	01 Hex	02 Hex	.....	12 Hex	13 Hex
2nd Row	14 Hex	15 Hex	16 Hex	.....	26 Hex	27 Hex
3rd Row	28 Hex	29 Hex	2A Hex	.....	3A Hex	3B Hex
4th Row (Bottom Line)	3C Hex	3D Hex	3E Hex	.....	4E Hex	4F Hex

[3] Dimming (4C Hex)
The screen luminance can be varied into 4 levels by following ESC sequence. When the power is turned on, the brightness level is set to 100%.

* Syntax: ESC (1B Hex) + "L" (4C Hex) + Luminance Data (00 Hex ~ FF Hex)
Luminance Data = 00 Hex to 3F Hex: approx. 25 % (Brightness level)
40 Hex to 7F Hex: approx. 50 %
80 Hex to BF Hex: approx. 75 %
C0 Hex to FF Hex: approx. 100 %

[4] Blinking Speed Control (54 Hex)
Following sequence can vary blinking speed of cursor.

* Syntax: ESC (1B Hex) + "T" (54 Hex) + Blinking Speed Data (00 Hex to FF Hex)
Blinking Speed Data = 00 Hex.....256 (Data Value)
FF Hex..... 255
FE Hex..... 254
.
.
.
.
.
01 Hex..... 1
Period of Blinking = Data Value * approx. 30ms

When the power is turned on, blinking speed data is set to 14 Hex (Data Value = 20). i.e. The period of cursor blinking is set to 600msec (20*30ms = 600ms).

[5] Initialization (49 Hex)
All characters displayed and setting factors are cleared by following ESC sequence.

* Syntax: ESC (1B Hex) + "I" (49 Hex)

By executing the above sequence, module is reset as following status.

1) All characters displayed are cleared.
2) Cursor position is located on the most significant digit.
3) Display mode is set to DC1 Mode (Normal Display Mode)
4) Cursor mode is set to DC4 Mode (Cursor Off Mode)
5) Cursor blinking period is set to 600msec.
6) Baud-rate, parity and character font table are set according to below table.

F0	P1	P0	B2	B1	B0	Function	Setting
*	*	*	1	1	1	Baud-rate Selection	19,200 bps
*	*	*	1	1	0		9,600 bps
*	*	*	1	0	1		4,800 bps
*	*	*	1	0	0		2,400 bps
*	*	*	0	1	1		1,200 bps
*	*	*	0	1	0		600 bps
*	*	*	0	0	1		300 bps
*	*	*	0	0	0		300 bps
*	1	1	*	*	*	Parity Selection	Even Parity
*	1	0	*	*	*		Odd Parity
*	0	*	*	*	*		Non-Parity
1	*	*	*	*	*	Font Selection	CT0 (European)
0	*	*	*	*	*		CT1 (Japanese)
1	1	1	1	1	1	Factory Setting	
*: Don't Care, "1": Open, "0": Short (Jumper Switch Closed by Soldering)							

5.3 Self-Test Mode

Self-test starts when RXD/T0 = "0" is more than 100ms at power on or initialization.
During Self Test, all character fonts are displayed automatically and neither character data (20h to FFh) nor control command (00h to 1Fh) is acceptable. To release this mode, RXD/T0 must be set to "1" and the power must be turned on again.

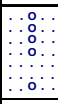
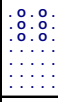
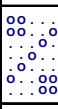
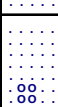
5.4 Power on Reset

When the module is turned on, the display and memory are cleared and the module is initialized. The displaying status is the same as the status of initialization. (Refer to section 5.2.16 [5].)

Appendix-1. CT0 Character Code (General European Font Table)

Upper / Lower Nibble	D7	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1
	D6	0	0	0	0	1	1	1	1	0	0	0	0	1	1	1	1
	D5	0	0	1	1	0	0	1	1	0	0	1	1	0	0	1	1
	D4	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1
D3 D2 D1 D0		0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
0 0 0 0	0																
0 0 0 1	1		DC1														
0 0 1 0	2		DC2														
0 0 1 1	3		DC3														
0 1 0 0	4		DC4														
0 1 0 1	5		DC5														
0 1 1 0	6		DC6														
0 1 1 1	7		DC7														
1 0 0 0	8	BS	CT0														
1 0 0 1	9	HT	CT1														
1 0 1 0	A	LF															
1 0 1 1	B		ESC														
1 1 0 0	C	CH															
1 1 0 1	D	CR															
1 1 1 0	E	CLR															
1 1 1 1	F																

Appendix-2. CT1 Character Code (Japanese Katakana Font Table)

Upper / Lower Nibble	D7	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1
	D6	0	0	0	0	1	1	1	1	0	0	0	0	1	1	1	1
	D5	0	0	1	1	0	0	1	1	0	0	1	1	0	0	1	1
	D4	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1
D3 D2 D1 D0		0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
0 0 0 0	0																
0 0 0 1	1		DC1														
0 0 1 0	2		DC2														
0 0 1 1	3		DC3														
0 1 0 0	4		DC4														
0 1 0 1	5		DC5														
0 1 1 0	6		DC6														
0 1 1 1	7		DC7														
1 0 0 0	8	BS	CT0														
1 0 0 1	9	HT	CT1														
1 0 1 0	A	LF															
1 0 1 1	B		ESC														
1 1 0 0	C	CH															
1 1 0 1	D	CR															
1 1 1 0	E	CLR															
1 1 1 1	F