深圳市拓普微科技开发有限公司
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LM6063NCW

LCD Module User Manual

Prepared by:	Checked by:	Approved by:
Lin		
Date: 2012-2-10	Date:	Date:

Rev.	Descriptions	Release Date
0.1	Preliminary release	2012-1-10
0.2	Typing Correcting	2012-2-10

Table of Content

1. Basic Specifications

1.1 Display Specifications

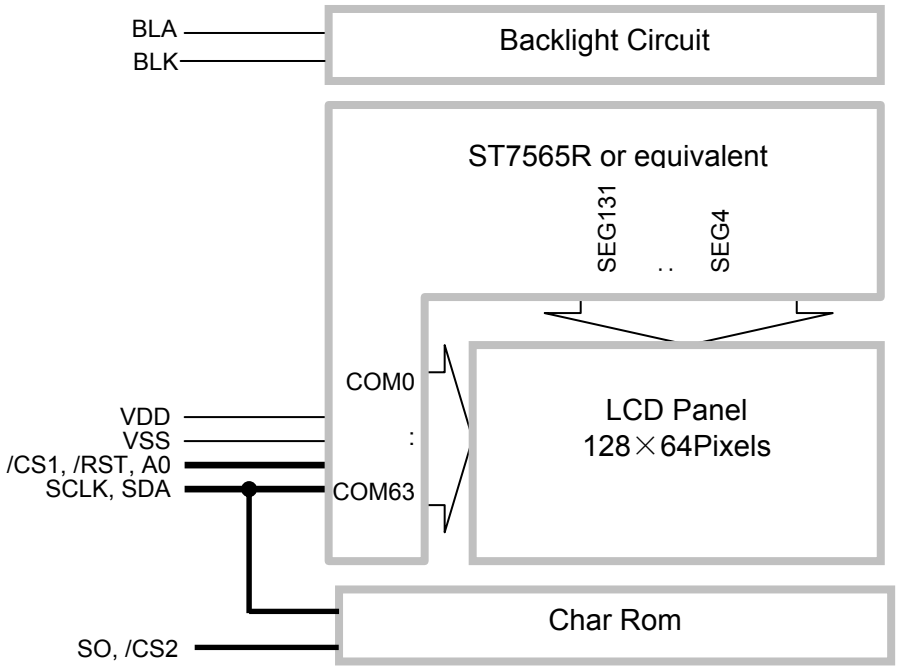
1) LCD Display Mode : FSTN, Positive, Transmissive
2) Display Color : Display Data = “1” : Dark Gray(*1)
: Display Data = “0” : Light Gray (*2)
3) Viewing Angle : 6H
4) Driving Method : 1/65 duty, 1/9 bias
5) Backlight : White LED backlight

Note:
*1. Color tone may slightly change by Temperature and Driving Condition.
*2. The Color is defined as the inactive / background color
*3. Fine Contrast adjustment function is necessary in the application design for optimal display result

1.2 Mechanical Specifications

1) Outline Dimension : 93.0 x70.0 x 10.1MAX (mm)
(See attached Outline Drawing for details)

1.3 Block Diagram



1.4 Terminal Functions

Pin No.	PIN Name	I/O	Descriptions
1	VSS	Power	Negative power supply,0V
2	VDD	Power	Negative power supply,0V
3	/CS1	Input	Chip Select /CS1=L, enable access to the LCD module /CS1=H, disable access to the LCD module
4	/RST	Input	Reset signal /RST = L, Initialization is executed /RST = H, Normal running.
5	VSS	Power	Negative power supply,0V
6	A0	Input	Register Select A0 = H, Transferring the Display Data A0 = L, Transferring the Control Data
7	SCLK	Input	Serial clock input of LCD module and Char ROM
8	VSS	Power	Negative power supply,0V
9	SDA	Input	Serial data input of LCD module and Char ROM
10	/CS2	Input	Chip Select /CS2=L, Char Rom selected
11	SO	Input	Serial data output of Char ROM Data shift-out on the falling edge of the serial clock
12	VSS	Power	Negative power supply,0V
13	BLA	Power	Positive power for LED backlight
14	BLK	Power	Negetive power for LED backlight

2. Absolute Maximum Ratings

Items	Symbol	Min.	Max.	Unit	Condition
Supply Voltage	V_{DD}	-0.3	+3.4	V	V_{SS} = 0V
Input Voltage	V_{IN}	-0.3	V_{DD}+0.3	V	V_{SS} = 0V
Operating Temperature	T_{OP}	-20	+70	°C	No Condensation
Storage Temperature	T_{ST}	-30	+80	°C	No Condensation

Cautions:
Any Stresses exceeding the Absolute Maximum Ratings may cause substantial damage to the device. Functional operation of this device at other conditions beyond those listed in the specification is not implied and prolonged exposure to extreme conditions may affect device reliability.

3. Electrical Characteristics

3.1 DC Characteristics

V_{SS}=0V, V_{DD}=3.3V,T_{OP}=25°C

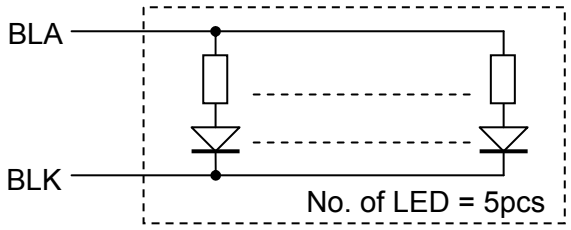
Items	Symbol	MIN.	TYP.	MAX.	Unit	Condition / Application Pin
Operating Voltage	V_{DD}	2.9	3.3	3.4	V	VDD
Input High Voltage	V_{IH}	0.8xV_{DD}	-	V_{DD}	V	RES, /CS1, A0,
Input Low Voltage	V_{IL}	V_{SS}	-	0.2xV_{DD}	V	D0～D7
Operating Current	I_{DD}	-	0.36	1.8	mA	VDD

3.2 LED Backlight Circuit Characteristics

V_{SS}=0V, If_{BLA}=85mA, T_{OP} =25°C

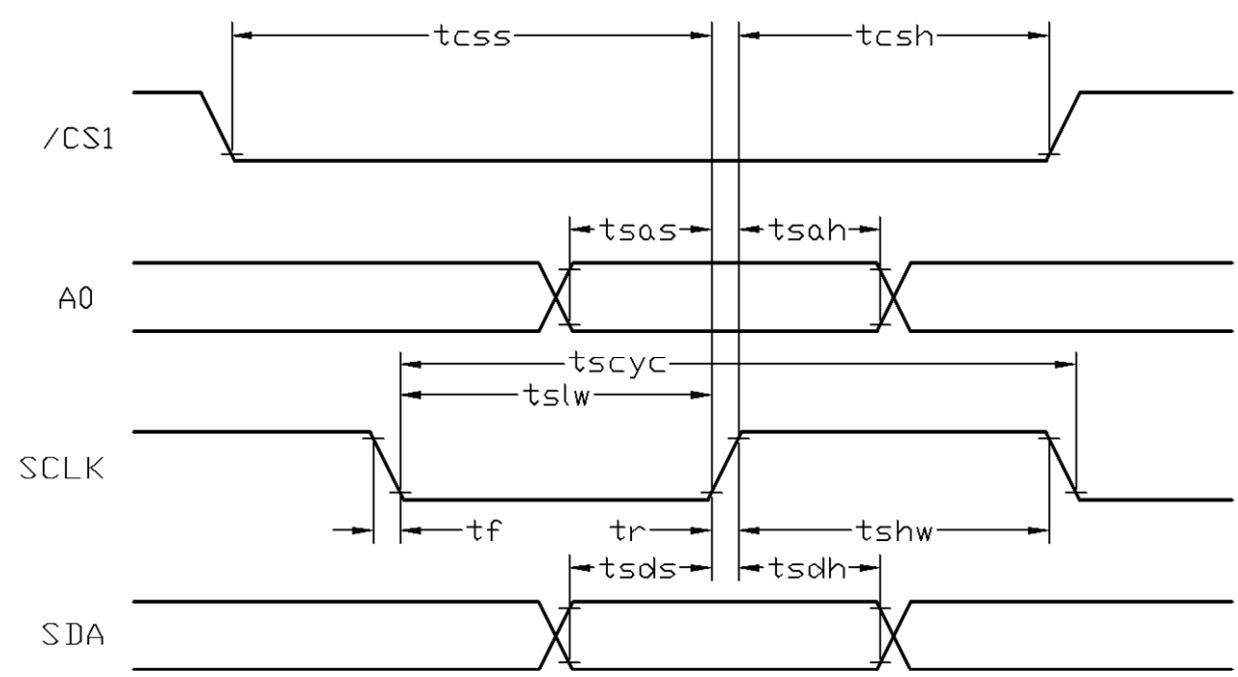
Items	Symbol	MIN.	TYP.	MAX.	Unit	Applicable Pin
Forward Voltage	Vf_{BLA}	-	3.3	-	V	BLA
Forward Current	If_{BLA}	-	85	100	mA	BLA

Cautions:
Exceeding the recommended driving current could cause substantial damage to the backlight and shorten its lifetime.



3.3 AC Characteristics

3.3.1 Serial Mode Interface

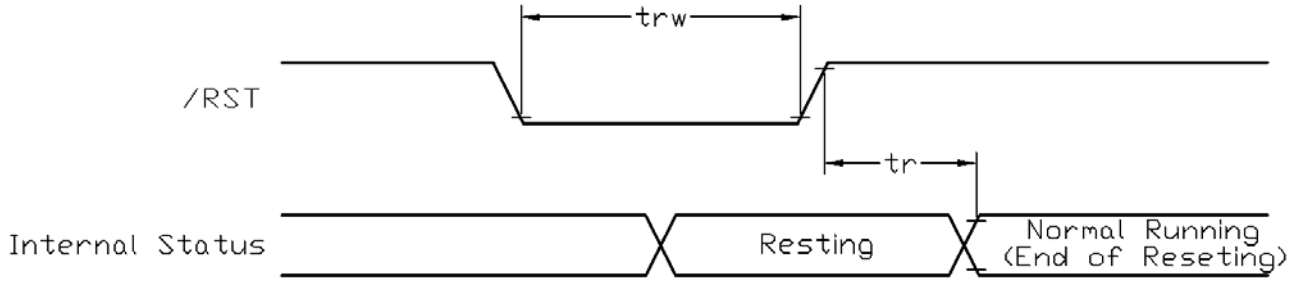


V_{SS}=0V, V_{DD}=3.3V, T_{OP}=25°C

Item	Symbol	MIN.	TYP.	MAX.	Unit
Serial Clock Period	tscyc	125	-	-	ns
Address setup time (A0)	tsas	38	-	-	ns
Address hold time (A0)	tsah	25	-	-	ns
SCLK “H” pulse width	tshw	63	-	-	ns
SCLK “L” pulse width	tslw	63	-	-	ns
Data setup time	tsds	38	-	-	ns
Data hold time	tsdh	25	-	-	ns
/CS1-SCLK time	tcss	38	-	-	ns
/CS1-SCLK time	tcsh	75	-	-	ns

Note:
*1. Input signal rise/fall time should be less than 15ns .
*2. CL=100pF
*3.All timing is using 20% and 80% of VDD as the reference.

3.3.2 Reset Timing



V_{SS}=0V, V_{DD}=3.3V, T_{OP}=25°C

Item	Symbol	MIN.	TYP.	MAX.	Unit
Reset time	tr	-	-	2.5	µs
Reset LOW pulse width	trw	2.5	-	-	µs

Note:
*1.All timing is using 20% and 80% of VDD as the reference.

4. Function specifications

4.1 Adjusting the Display Contrast

- This LCD module equipped with latest digital contrast adjustment function.
- Its display contrast could be adjusted by MCU command. (please see the command tables for details)
- It is recommended to provide a contrast adjustment interface for end-user, where the best display result could meet the individual preference in mass production.

4.2 Basic Setting

To drive the LCD module correctly and provide normally display, please use the following setting

- ADC = 1 (reverse)
- SHL select = 0 (normal)
- LCD Bias Select = 1/9
- Initial Display Line = 0
- Entire Display ON/OFF = OFF (normal)
- Reverse Display ON/OFF = OFF (normal)
- Set Power Control Set:
  voltage follower = ON, voltage converter = ON, voltage regulator = ON
- Display ON/OFF = ON

Note:
*1. These setting/commands should issue the LCD module while start up.
*2. See the Display Commands section for details.

4.3 Resetting the LCD module

The LCD module should be initialized by using /RST terminal.
While turning on the VDD and VSS power supply, maintain /RST terminal at LOW level. After the power supply stabilized, release the reset terminal (/RST=HIGH)

4.4 Display Memory Map

Page address	data	LCD Display (front view)
0	D0 : D7	
1	D0 : D7	
2	D0 : D7	
3	D0 : D7	128x64 pixels
4	D0 : D7	
5	D0 : D7	
6	D0 : D7	
7	D0 : D7	
Column Address		00h → 7Fh

Note:
*1. ADC = 1 (reverse)
*2. SHL Selection = 0 (normal)
*3. Initial Display Line = 0

4.5 Display Commands

No.	Instructions	Code											Function
		a0	/RD	/WR	D7	D6	D5	D4	D3	D2	D1	D0	
1	Display ON/OFF	0	1	0	1	0	1	0	1	1	1	DON	DON=0, display off DON=1, display on
2	Display start line set	0	1	0	0	1	Display start address						Sets the display RAM display start line address
3	Set Page Address	0	1	0	1	0	1	1	Page Address				Set the display RAM page address
4	Set Column Address (Upper-4-bits)	0	1	0	0	0	0	1	Col. Add. Upper				Set the upper-4-bit of column address counter
	Set Column Address (Lower-4-bits)	0	1	0	0	0	0	0	Col. Add. Lower				Set the lower-4-bit of column address counter
5	Read Status	0	0	1	Status				0	0	0	0	Read the status data
6	Write Display Data	1	1	0	Write Data								Write data into the display RAM
7	Read Display Data	1	0	1	Read Data								Read data form the display RAM
8	ADC Select	0	1	0	1	0	1	0	0	0	0	ADC	Sets the display RAM address SEG output correspondence ADC= 0,normal . ADC=1, reverse
9	Normal/Reverse Display	0	1	0	1	0	1	0	0	1	1	REV	REV=0, Normal display REV=1, Reverse display
10	Entire Display ON/OFF	0	1	0	1	0	1	0	0	1	0	EON	EON=0, Normal display EON=1, Entire display ON
11	Set LCD Bias	0	1	0	1	0	1	0	0	0	1	BIAS	Set the LCD driving voltage bias BIAS=0, 1/9 BIAS BIAS=1, 1/7 BIAS
12	Set Read-Modify-Write	0	1	0	1	1	1	0	0	0	0	0	Enter the “Read-Modify-Write” mode column address counter will increase in each “Write Display Data”, and will not increase in each “Read Display Data command”
13	Reset Read-Modify-Write	0	1	0	1	1	1	0	1	1	1	0	Clear the “Read-Modify-Write” mode
14	Reset	0	1	0	1	1	1	0	0	0	1	0	Resets the LCD module
15	SHL Select	0	1	0	1	1	0	0	SHL	*	*	*	Set the COM scanning direction SHL=0, Normal display SHL=1, Flipped in y direction * = don’t care terms
16	Power Control Set	0	1	0	0	0	1	0	1	VC	VR	VF	Set the power circuit operation mode VF: LCD Supply Voltage Follower VR: LCD Supply Voltage Regulator VC: LCD Supply Voltage Converter (1=ON, 0=OFF)
17	Regulator Resistor Select	0	1	0	0	0	1	0	0	Radio setting			Set the built-in resistor ratio (Rb/Ra)

4.6 Display Commands (continue)

No.	Instructions	Code										Function
		A0	/RD	/WR	D7	D6	D5	D4	D3	D2	D1	D0	
18	Electronic volume mode set	0	1	0	1	0	0	0	0	0	0	1	Set reference voltage mode
	Electronic volume register set	0	1	0	*	*	Electronic Control value						Set reference voltage register (Display contrast value)
19	Sleep Mode Set	0	1	0	1	0	1	0	1	1	0	S	Sleep Mode (2 byte command) S=0, sleep mode S=1, normal mode
		0	1	0	0	0	0	0	0	0	0	0	
20	Booster Ratio Set	0	1	0	1	1	1	1	1	0	0	0	Booster Ratio (2 byte command) Ratio=00, 2x, 3x, 4x Ratio=01, 5x Ratio=11, 6x
		0	1	0	0	0	0	0	0	0	Ratio		
21	NOP	0	1	0	1	1	1	0	0	0	1	1	Non-operation command

Note: *1. Do not use any other command not listed, or the system malfunction may result.
*2. For the details of the Display Commands, please refer to ST7565R data sheet.

4.6.1 Power off the LCD Module

It recommends that enter Sleep Mode before power off the LCD module.

4.6.2 Refreshing The LCD Module

It recommends that the operating modes and display contents be refreshed periodically to prevent the effect of unexpected noise.

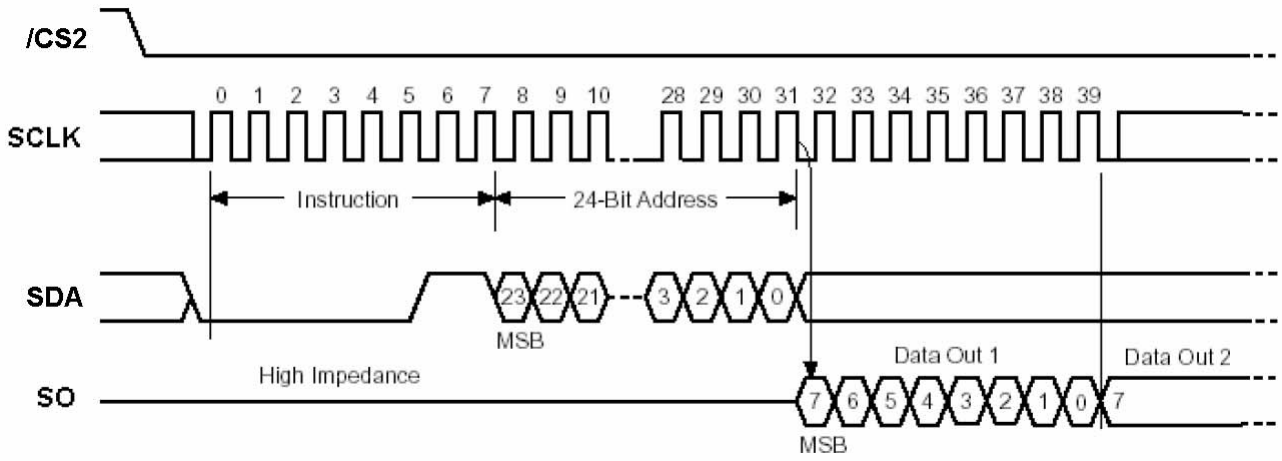
5. Character Rom

5.1 AC Characteristics

First, /CS1=L, 1byte command (03 or 0B, common speed or fast speed) and 3bytes address through SI at every SCLK= L→H bit by bit

Second, the data in the address send out through SO at every SCLK= H→L bit by bit

Third, only /CS1=H, reading data is finished, otherwise the data in the next address will be read out.



5.2 Instruction Set of using Character ROM

Instruction	Description	Instruction Code(One-Byte)		Address Bytes	Dummy Bytes	Data Bytes
READ	Read Data Bytes	0000 0011	03 h	3	—	1 to ∞
FAST_READ	Read Data Bytes at Higher Speed	0000 1011	0B h	3	1	1 to ∞

5.4 Dot Matrix Front Address Table

No	Type	Ver.	Font	Char Set	Characters	Capacity	Base Address
1	ASCII		5X7 ASCII	ASCII	96	768	0
2			7X8 ASCII	ASCII	96	768	768
3			6X12 ASCII	ASCII	128	1,536	1,536
4			8X16 ASCII	ASCII	128	2,048	3,072
5			8X16 Bold ASCII	ASCII	96	1,536	5,120
6			12 dot proportional adjusted Arial	ASCII	96	2,496	6,656
7			12 dot proportional adjusted Times New Roman	ASCII	96	2,496	9,152
8			16 dot proportional adjusted Arial	ASCII	96	3,264	11,648
9			16 dot proportional adjusted Times New Roman	ASCII	96	3,264	14,912
10			24 dot proportional adjusted Arial	ASCII	96	7,104	18,176
11	UNICODE	5.0	8X16 Latin characters	Basic	496	7,936	25,280
12			8X16 Latin characters	Supplement			
13			8X16 Latin characters	Extended A			
14			8X16 Latin characters	Extended B			
15			8X16 Latin characters	Extended Additional			
16			8X16 Greek characters	Basic	96	1,536	33,216
17			8X16 Cyrillic characters	Basic	208	3,328	34,752
18			8X16 Hebrew characters	Basic	112	1,792	38,080
19			8X16 Thai characters	Basic	128	2,048	39,872
20		5.0	12X24 Latin characters	Basic	496	23,808	41,920
21			12X24 Latin characters	Supplement			
22			12X24 Latin characters	Extended A			
23			12X24 Latin characters	Extended B			
24			12X24 Latin characters	Extended Additional			
25			12X24 Greek characters	Basic	96	4,608	65,728
26			12X24 Hebrew characters	Basic	208	9,984	70,336
27		3.0	16 dot proportional adjusted Arabic	Basic+Supplement+Form B	576	19,584	80,320
28		5.0	16 dot proportional adjusted Latin	Basic	496	16,864	99,904
29			16 dot proportional adjusted Latin	Supplement			
30			16 dot proportional adjusted Latin	Extended A			
31			16 dot proportional adjusted Latin	Extended B			
32			16 dot proportional adjusted Latin	Extended Additional			
33			16 dot proportional adjusted Greek	Basic	96	3,264	116,768
34			16 dot proportional adjusted Cyrillic	Basic	208	7,072	120,032
35			12 dot proportional adjusted Latin	Basic	496	12,896	127,104
36			12 dot proportional adjusted Latin	Supplement			
37			12 dot proportional adjusted Latin	Extended A			

Dot Matrix Front Address Table (continue)

38			12 dot proportional adjusted Latin	Extended B			
39			12 dot proportional adjusted Latin	Extended Additional			
40			12 dot proportional adjusted Greek	Basic	96	2,496	140,000
41			12 dot proportional adjusted Cyrillic	Basic	208	5,408	142,496
42	ISO8859	1998 -8X16	ISO 8859-1 (8x16)	ISO8859	128	2,048	147,904
43			ISO 8859-2 (8x16)	ISO8859	128	2,048	149,952
44			ISO 8859-3 (8x16)	ISO8859	128	2,048	152,000
45			ISO 8859-4 (8x16)	ISO8859	128	2,048	154,048
46			ISO 8859-5 (8x16)	ISO8859	128	2,048	156,096
47			ISO 8859-7 (8x16)	ISO8859	128	2,048	158,144
48			ISO 8859-8 (8x16)	ISO8859	128	2,048	160,192
49			ISO 8859-9 (8x16)	ISO8859	128	2,048	162,240
50			ISO 8859-10 (8x16)	ISO8859	128	2,048	164,288
51			ISO 8859-11 (8x16)	ISO8859	128	2,048	166,336
52			ISO 8859-13 (8x16)	ISO8859	128	2,048	168,384
53			ISO 8859-14 (8x16)	ISO8859	128	2,048	170,432
54			ISO 8859-15 (8x16)	ISO8859	128	2,048	172,480
55			ISO 8859-16 (8x16)	ISO8859	128	2,048	174,528
56		1998 -5X7	ISO 8859-1 (5x7)	ISO8859	128	1,024	176,576
57			ISO 8859-2 (5x7)	ISO8859	128	1,024	177,600
58			ISO 8859-3 (5x7)	ISO8859	128	1,024	178,624
59			ISO 8859-4 (5x7)	ISO8859	128	1,024	179,648
60			ISO 8859-5 (5x7)	ISO8859	128	1,024	180,672
61			ISO 8859-7 (5x7)	ISO8859	128	1,024	181,696
62			ISO 8859-8 (5x7)	ISO8859	128	1,024	182,720
63			ISO 8859-9 (5x7)	ISO8859	128	1,024	183,744
64			ISO 8859-10 (5x7)	ISO8859	128	1,024	184,768
65			ISO 8859-11 (5x7)	ISO8859	128	1,024	185,792
66			ISO 8859-13 (5x7)	ISO8859	128	1,024	186,816
67			ISO 8859-14 (5x7)	ISO8859	128	1,024	187,840
68			ISO 8859-15 (5x7)	ISO8859	128	1,024	188,864
69			ISO 8859-16 (5x7)	ISO8859	128	1,024	189,888
70	LCM Character	LCM	LCM-1 (5x10)	SPLC780C-01 Compatible	256	2,560	190,912
71			LCM-2 (5x10)	SPLC780C-02 Compatible	256	2,560	193,472
72			LCM-3 (5x10)	SPLC780C-03 Compatible	256	2,560	196,032
73			LCM-8 (5x10)	SPLC780C-08 Compatible	256	2,560	198,592
74			LCM-11 (5x10)	SPLC780C-11 Compatible	256	2,560	201,152
75			LCM-12 (5x10)	SPLC780C-12 Compatible	256	2,560	203,712
76			LCM 13 (5x10)	SPLC780C-13 Compatible	256	2,560	206,272
77			LCM-0 (5x7)	7032 Compatible	256	2,048	208,832
78			LCM reserved area - 1 (5x10)		256	2,560	210,880
			LCM reserved area - 2 (5x10)		256	2,560	213,440
79	UNICODE	3.0	24 dot proportional adjusted Arabic	Basic+Supplement +Form B	576	42,624	216,000

6. Design and Handling Precaution

1. The LCD panel is made by glass. Any mechanical shock (eg. dropping form high place) will damage the LCD module.
2. Do not add excessive force on the surface of the display, which may cause the Display color change abnormally.
3. The polarizer on the LCD is easily get scratched. If possible, do not remove the LCD protective film until the last step of installation.
4. Never attempt to disassemble or rework the LCD module.
5. Only Clean the LCD with Isopropyl Alcohol or Ethyl Alcohol. Other solvents (eg. water) may damage the LCD.
6. When mounting the LCD module, make sure that it is free form twisting, warping and distortion.
7. Ensure to provide enough space (with cushion) between case and LCD panel to prevent external force adding on it, or it may cause damage to the LCD or degrade the display result.
8. Only hold the LCD module by its side. Never hold LCD module by add force on the heat seal or TAB.
9. Never add force to component of the LCD module. It may cause invisible damage or degrade of the reliability.
10. LCD module could be easily damaged by static electricity. Be careful to maintain an optimum anti-static work environment to protect the LCD module.
11. When peeling off the protective film from LCD, static charge may cause abnormal display pattern. It is normal and will resume to normal in a short while.
12. Take care and prevent get hurt by the LCD panel sharp edge.
13. Never operate the LCD module exceed the absolute maximum ratings.
14. Keep the signal line as short as possible to prevent noisy signal applying to LCD module.
15. Never apply signal to the LCD module without power supply.
16. IC chip (eg. TAB or COG) is sensitive to the light. Strong lighting environment could possibly cause malfunction. Light sealing structure casing is recommend.
17. LCD module reliability may be reduced by temperature shock.
18. When storing the LCD module, avoid exposure to the direct sunlight, high humidity, high temperature or low temperature. They may damage or degrade the LCD module