



CLOVER DISPLAY LTD.

LCD MODULE SPECIFICATION

Model: CG9161A - _ _ - _ - _ - _

Revision	00
Engineering	Timmy Kwan
Date	28 SEP 2010
Our Reference	X9048

ADDRESS : 1st FLOOR, EFFICIENCY HOUSE, 35 TAI YAU STREET, SAN PO KONG,
KOWLOON, HONG KONG.

TEL : (852) 2341 3238 (SALES OFFICE) (852) 2342 8228 (GENERAL OFFICE)

FAX : (852) 2357 4237 (SALES OFFICE)

E-MAIL : cdl@cloverdisplay.com

URL : <http://www.cloverdisplay.com>

MODE OF DISPLAY**Display mode**

- STN : Yellow green
 Grey
 Blue (negative)
 FSTN positive
 FSTN negative

Display condition

- Reflective type
 Transflective type
 Transmissive type
 Others

Viewing direction

- 6 O' clock
 12 O' clock
 3 O' clock
 9 O' clock

LCD MODULE NUMBER NOTATION:**CG9161A- N N - F F - W 6**

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)

*(1)---Model number of standard LCD Modules

*(2)---Backlight type

- N – No backlight
E – EL backlight
L – Side-lited LED backlight
M– Array LED backlight
C – CCFL

*(3)---Backlight color

- N – No backlight
A – Amber
B – Blue
O– Orange
W–White
Y – Yellow green

*(4)---Display mode

- T – TN
V – TN (Negative)
S – STN Yellow green
G – STN Grey
B – STN Blue (Negative)
F – FSTN
N – FSTN (Negative)

*(5)---Rear polarizer type

- R – Reflective
F – Transflective
T – Transmissive

*(6)---Temperature range

- N – Normal
W– Extended

*(7)---Viewing direction

- 6 – 6 O'clock
2 – 12 O'clock
3 – 3 O'clock
9 – 9 O'clock

*(8)---Special code for other requirements
(Can be omitted if not used)

GENERAL DESCRIPTION

Display mode : 16 characters X 1 line COG LCD module
 Interface : 4-bit or 8-bit parallel
 Driving method : 1/16 duty, 1/5 bias
 Controller IC : SPLC782A1 or Equivalent
 For the detailed information, please refer to the IC specifications.

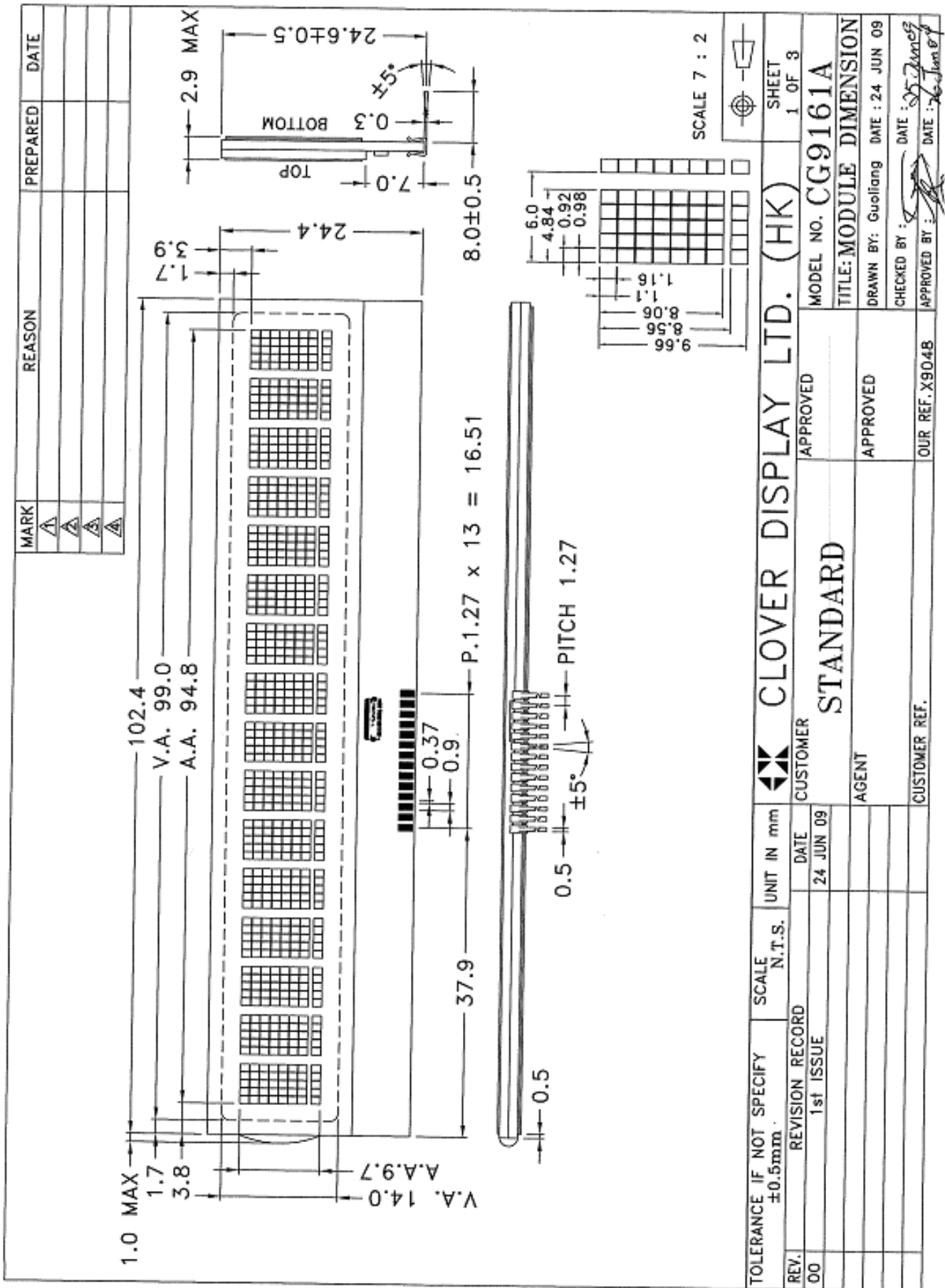
MECHANICAL DIMENSIONS

Item	Dimension	Unit	Item	Dimension	Unit
Outline Dimension	102.4(L)x24.4(W)x2.9Max(H)	mm	Character Pitch	8.56(L)x6.0(W)	mm
Viewing Area	99.0(L)x14.0(W)	mm	Dot Size	1.1(L)x0.92(W)	mm
Character Size	4.84 (L)X9.66 (W)	mm			

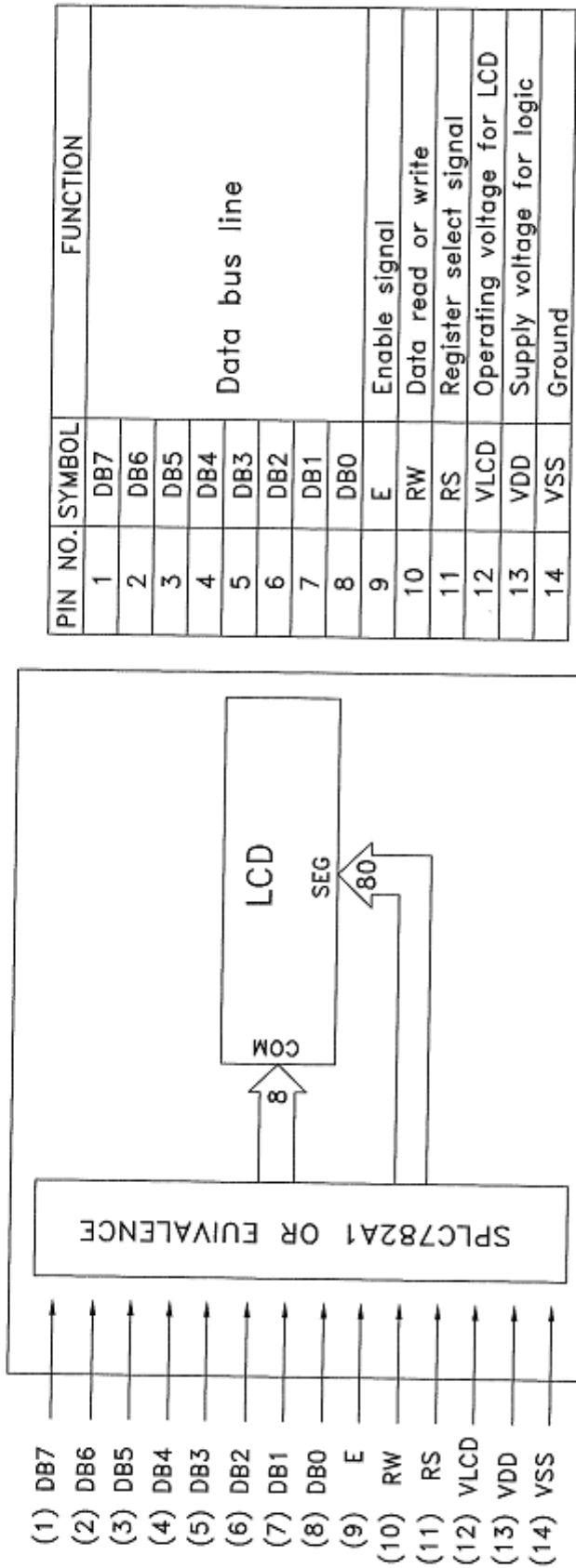
CONNECTOR PIN ASSIGNMENT

Pin No.	Symbol	Function	Pin No.	Symbol	Function
1	DB7	Data Bus	9	E	Enable signal
2	DB6		10	RW	Data read or write
3	DB5		11	RS	Register select signal
4	DB4		12	VLCD	Operating voltage for LCD
5	DB3		13	VDD	Supply voltage for logic
6	DB2		14	VSS	Ground
7	DB1				
8	DB0				

COUNTER DRAWING OF MODULE DIMENSION



COUNTER DRAWING OF PIN OUT & BLOCK DIAGRAM



PIN NO.	SYMBOL	FUNCTION
1	DB7	Data bus line
2	DB6	
3	DB5	
4	DB4	
5	DB3	
6	DB2	
7	DB1	
8	DB0	
9	E	Enable signal
10	RW	Data read or write
11	RS	Register select signal
12	VLCD	Operating voltage for LCD
13	VDD	Supply voltage for logic
14	VSS	Ground

TOLERANCE IF NOT SPECIFY ±0.5mm		SCALE N.T.S.	UNIT IN mm	CLOVER DISPLAY LTD. (HK)		SHEET 2 OF 3
REV.	REVISION RECORD	DATE	CUSTOMER	APPROVED	MODEL NO. CG9161A	
00	1st ISSUE	24 JUN 09	AGENT	APPROVED	TITLE: PIN OUT & BLOCK DIAGRAM	
			CUSTOMER REF.	OUR REF. X9048	DRAWN BY: Guoliang	DATE: 24 JUN 09
					CHECKED BY: [Signature]	DATE: [Signature]
					APPROVED BY: [Signature]	DATE: [Signature]

ELECTRICAL CHARACTERISTICS

Conditions: VSS=0V, Ta=25°C

Item	Symbol	MIN.	TYP.	MAX.	Unit
Supply Voltage for Logic	VDD	4.75	5.0	5.25	V
Supply Current for Logic	IDD		0.18	0.27	mA
Operating Voltage for LCD (*)	VLCD	4.3	4.5	4.7	V
'High' Level Input Voltage	VIH	0.7VDD	—	VDD	V
'Low' Level Input Voltage	VIL	-0.3	—	0.6	V

Note (*): There is tolerance in optimum LCD driving voltage during production and it will be within the specified range.

ABSOLUTE MAXIMUM RATINGS

Please make sure not to exceed the following maximum rating values under the worst application conditions

Item	Symbol	Rating (for normal temperature)	Rating (for wide temperature)	Unit
Supply Voltage for Logic	VDD	-0.3 to 7.0	-0.3 to 7.0	V
Input Voltage for Logic	VIN	-0.3 to VDD +0.3	-0.3 to VDD +0.3	V
Operating Temperature	Topr	0 to 50	-20 to 70	°C
Storage Temperature	Tstg	-10 to 60	-30 to 80	°C

INSTRUCTIONS TABLE

Clear Display	0	0	0	0	0	0	0	0	0	1	Write "20H" to DDRAM and set DDRAM address to "00H" from AC	4.1ms	
Return Home	0	0	0	0	0	0	0	0	0	1	Set DDRAM address to "00H" from AC and return cursor to its original position if shifted. The contents of DDRAM are not changed.	4.1ms	
Entry Mode Set	0	0	0	0	0	0	0	0	1	I/D	S	Assign cursor moving direction and enable the shift of entire display	100μs
Display ON/OFF Control	0	0	0	0	0	0	1	D	C	B	Set display (D), cursor(C), and blinking of cursor(B) on/off control bit.	100μs	
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.	100μs	
Function Set	0	0	0	0	1	DL	N	F	-	-	Set interface data length (DL: 8-bit/4-bit), numbers of display line (N: 2-line/1-line) and, display font type (F:5x10 dots/5x8 dots)	100μs	
Set CGRAM Address	0	0	0	1	AC5	AC4	AC3	AC2	AC1	AC0	Set CGRAM address in address counter.	100μs	
Set DDRAM Address	0	0	1	AC6	AC5	AC4	AC3	AC2	AC1	AC0	Set DDRAM address in address counter	100μs	
Read Busy Flag and Address Counter	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).	100μs	
Read Data from RAM	1	1	D7	D6	D5	D4	D3	D2	D1	D0	Read data from internal RAM (DDRAM/CGRAM).	100μs	

6. FUNCTIONAL DESCRIPTIONS

6.1. Oscillator

The built-in RC oscillator generates suitable clock for SPLC782A1 operation.

6.2. Control and Display Instructions

Control and display instructions is shown as follows:

6.2.1. Clear display

	RS	R/W	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0
Code	0	0	0	0	0	0	0	0	0	1

Figure 6-1: Clear Display Instruction Code

It clears the whole display and sets display data RAM's address 0 in address counter.

6.2.2. Return home

	RS	R/W	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0
Code	0	0	0	0	0	0	0	0	1	X

Figure 6-2: Return Home Instruction Code

X: Do not care (0 or 1)

It sets display data RAM's address 0 in address counter and display returns to its original position. The cursor or blink goes to the left edge of the display (to the 1st line if 2 lines are displayed). The content of the Display Data RAM does not change.

6.2.3. Entry mode set

During writing and reading data, it sets cursor move direction and shifts the display.

	RS	R/W	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0
Code	0	0	0	0	0	0	0	1	I/D	S

Figure 6-3: Entry Mode Instruction Code

I / D = 1: Increment, I / D = 0: Decrement.

S = 1: The display shift, S = 0: The display does not shift.

S = 1	I / D = 1	It shifts the display to the left
S = 1	I / D = 0	It shifts the display to the right

Figure 6-4: Shift Direction Patterns According to S and I/D Bits

6.2.4. Display ON/OFF control

	RS	R/W	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0
Code	0	0	0	0	0	0	1	D	C	B

Figure 6-5: Display ON/OFF Control Instruction Code

D = 1: Display on, D = 0: Display off

C = 1: Cursor on, C = 0: Cursor off

B = 1: Blinks on, B = 0: Blinks off

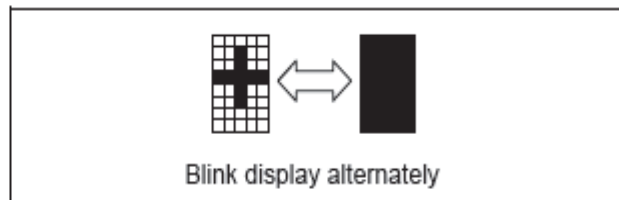
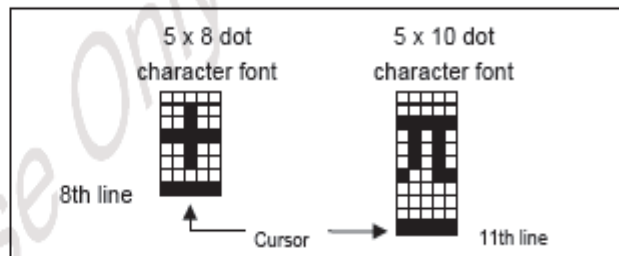


Figure 6-6: Cursor and Blinking

6.2.5. Cursor or display shift

Without changing DD RAM's data, it can move cursor and shift display.

	RS	R/W	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0
Code	0	0	0	0	0	1	S/C	R/L	X	X

Figure 6-7: Cursor or Display Shift Instruction Code

S/C	R/L	Description	Address Counter
0	0	Shift cursor to the left	AC = AC - 1
0	1	Shift cursor to the right	AC = AC + 1
1	0	Shift display to the left. Cursor follows the display shift	AC = AC
1	1	Shift display to the right. Cursor follows the display shift	AC = AC

6.2.6. Function set

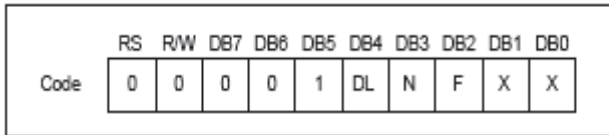


Figure 6-9: Function Set Instruction Code

X: Do not care (0 or 1)

DL: It sets interface data length.

DL = 1: Datas are transferred with 8-bit lengths (DB0 - DB7).

DL = 0: Datas are transferred with 4-bit lengths (DB4 - DB7).

(It requires two times to transfer data)

N: It sets the number of the display line.

N = 0: One-line display.

N = 1: Two-line display.

F: It sets the character font.

F = 0: 5 x 8 dots character font.

F = 1: 5 x 10 dots character font.

N	F	No. of Display Lines	Character Font	Duty Factor
0	0	1	5 x 8 dots	1 / 8
0	1	1	5 x 10 dots	1 / 11
1	X	2	5 x 8 dots	1 / 16

Figure 6-10: Function Set Description

It cannot display two lines with 5 x 10 dot character font.

6.2.7. Set character generator RAM address

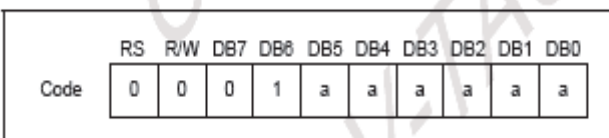


Figure 6-11: Set CGRAM address Instruction Code

It sets character generator RAM address (aaaaaa)₂ to the address counter. Character generator RAM data can read or write after this setting.

6.2.8. Set display data RAM address

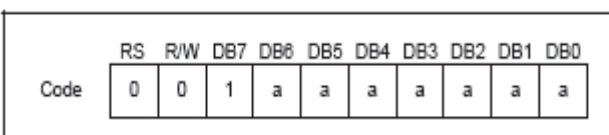


Figure 6-12: Set DDRAM address Instruction Code

It sets display data RAM address (aaaaaa)₂ to the address counter.

Display data RAM can read or write after this setting.

In one-line display (N = 0),

$$(aaaaaaa)_2 (00)_{16} - (4F)_{16}$$

In two-line display (N = 1),

$$(aaaaaaa)_2 (00)_{16} - (27)_{16} \text{ for the first line,}$$

$$(aaaaaaa)_2 (40)_{16} - (67)_{16} \text{ for the second line.}$$

6.2.9. Read busy flag and address

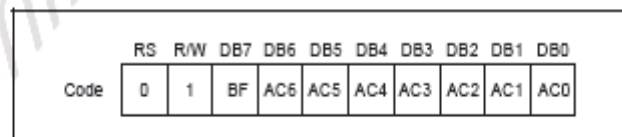


Figure 6-13: Read busy flag and address Instruction Code

When (BF = 1) indicates that the system is busy now; it will not accept any instruction until no busy (BF = 0). At the same time, the address counter contents (aaaaaaa)₂ is read out.

6.2.10. Write data to character generator RAM or display data RAM

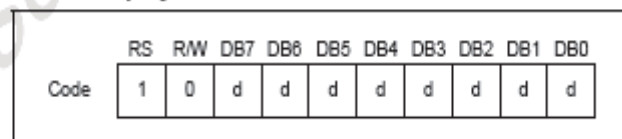


Figure 6-14: Write Data to CGRAM/DDRAM Instruction Code

It writes data (ddddddd)₂ to character generator RAM or display data RAM.

6.2.11. Read data from character generator RAM or display data RAM

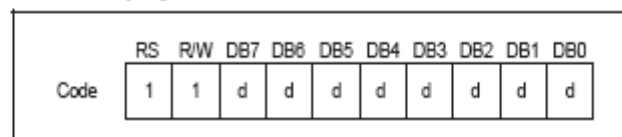


Figure 6-15: Read Data from CGRAM/DDRAM Instruction Code

It reads data (ddddddd)₂ from character generator RAM or display data RAM.

To get the correct data readout is shown belows:

- 1). Set the address of the character generator RAM or display data RAM or shift the cursor instruction.
- 2). Send the "Read" instruction.

6.4. 8-Bit Operation and 16-Digit 1-Line Display (Using Internal Reset)

NO.	Instruction	Display	Operation
1	Power on. (SPLC782A1 starts initializing)		Power on reset. No display.
2	Function set RS RW DB7 DB6 DB5 DB4 DB3 DB2 DB1 DB0 0 0 0 0 1 1 0 0 X X		Set to 8-bit operation and select 1-line display line and character font.
3	Display on / off control 0 0 0 0 0 0 1 1 1 0	_	Display on. Cursor appear.
4	Entry mode set 0 0 0 0 0 0 0 1 1 0	_	Increase address by one. It will shift the cursor to the right when writing to the DD RAM/CG RAM. Now the display has no shift.
5	Write data to CG RAM / DD RAM 1 0 0 1 0 1 0 1 1 1	W_	Write " W ". The cursor is incremented by one and shifted to the right.
6	Write data to CG RAM / DD RAM 1 0 0 1 0 0 0 1 0 1	WE_	Write " E ". The cursor is incremented by one and shifted to the right.
7	:	:	
8	Write data to CG RAM / DD RAM 1 0 0 1 0 0 0 1 0 1	WELCOME_	Write " E ". The cursor is incremented by one and shifted to the right.
9	Entry mode set 0 0 0 0 0 0 0 1 1 1	WELCOME_	Set mode for display shift when writing
10	Write data to CG RAM / DD RAM 1 0 0 0 1 0 0 0 0 0	ELCOME _	Write " "(space). The cursor is incremented by one and shifted to the right.
11	Write data to CG RAM / DD RAM 1 0 0 1 0 0 0 0 1 1	LCOME C_	Write " C ". The cursor is incremented by one and shifted to the right.
12	:	:	
13	Write data to CG RAM / DD RAM 1 0 0 1 0 1 1 0 0 1	COMPANY _	Write " Y ". The cursor is incremented by one and shifted to the right.
14	Cursor or display shift 0 0 0 0 0 1 0 0 X X	COMPANY _	Only shift the cursor's position to the left (Y).
15	Cursor or display shift 0 0 0 0 0 1 0 0 X X	COMPANY	Only shift the cursor's position to the left (M).
16	Write data to CG RAM / DD RAM 1 0 0 1 0 0 1 1 1 0	COMPANY	Write " N ". The display moves to the left.
17	Cursor or display shift 0 0 0 0 0 1 1 1 X X	COMPANY	Shift the display and the cursor's position to the right.
18	Cursor or display shift 0 0 0 0 0 1 0 1 X X	COMPANY_	Shift the display and the cursor's position to the right.
19	Write data to CG RAM / DD RAM 1 0 0 1 0 0 0 0 0 0	COMPANY _	Write " "(space). The cursor is incremented by one and shifted to the right.
20	:	:	
21	Return home 0 0 0 0 0 0 0 0 1 0	WELCOME _	Both the display and the cursor return to the original position (address 0).

6.5. 4-Bit Operation and 16-Digit 1-Line Display (Using Internal Reset)

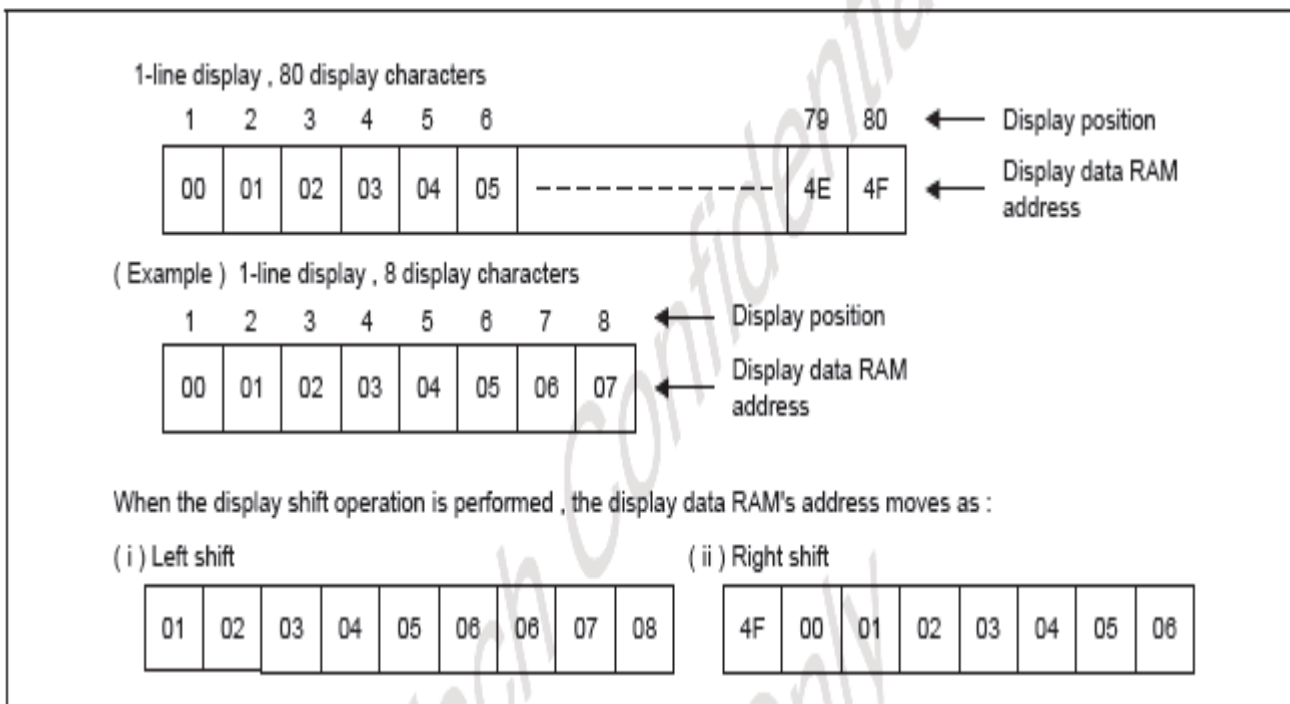
NO.	Instruction	Display	Operation												
1	Power on. (SPLC782A1 starts initializing)	<input type="text"/>	Power on reset. No display.												
2	Function set RS RW DB7 DB6 DB5 DB4 <table border="1"><tr><td>0</td><td>0</td><td>0</td><td>0</td><td>1</td><td>0</td></tr></table>	0	0	0	0	1	0	<input type="text"/>	Set to 4-bit operation.						
0	0	0	0	1	0										
3	Function set <table border="1"><tr><td>0</td><td>0</td><td>0</td><td>0</td><td>1</td><td>0</td></tr><tr><td>0</td><td>0</td><td>0</td><td>0</td><td>X</td><td>X</td></tr></table>	0	0	0	0	1	0	0	0	0	0	X	X	<input type="text"/>	Set to 4-bit operation and select 1-line display line and character font.
0	0	0	0	1	0										
0	0	0	0	X	X										
4	Display on / off control <table border="1"><tr><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td></tr><tr><td>0</td><td>0</td><td>1</td><td>1</td><td>1</td><td>0</td></tr></table>	0	0	0	0	0	0	0	0	1	1	1	0	<input type="text" value="-"/>	Display on. Cursor appears.
0	0	0	0	0	0										
0	0	1	1	1	0										
5	Entry mode set <table border="1"><tr><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td></tr><tr><td>0</td><td>0</td><td>0</td><td>1</td><td>1</td><td>0</td></tr></table>	0	0	0	0	0	0	0	0	0	1	1	0	<input type="text" value="-"/>	Increase address by one. It will shift the cursor to the right when writing to the DD RAM/CG RAM. Now the display has no shift.
0	0	0	0	0	0										
0	0	0	1	1	0										
6	Write data to CG RAM / DD RAM <table border="1"><tr><td>1</td><td>0</td><td>0</td><td>1</td><td>0</td><td>1</td></tr><tr><td>1</td><td>0</td><td>0</td><td>1</td><td>1</td><td>1</td></tr></table>	1	0	0	1	0	1	1	0	0	1	1	1	<input type="text" value="W_"/>	Write "W". The cursor is incremented by one and shifted to the right.
1	0	0	1	0	1										
1	0	0	1	1	1										

DISPLAY DATA RAM

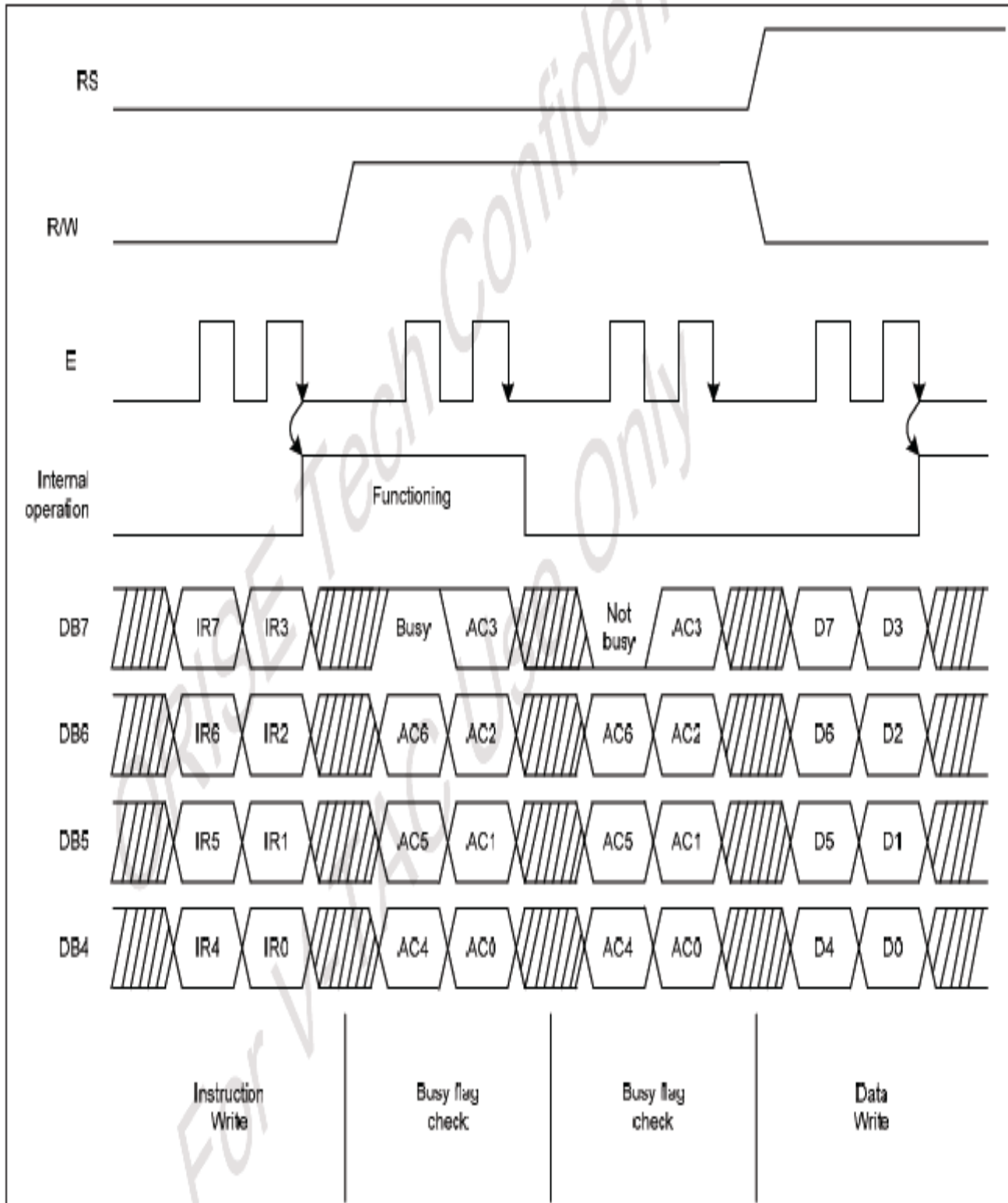
6.8. Display Data RAM (DD RAM)

The DD RAM stores display data and its RAM size is 80 bytes. The area in DD RAM that is not used for display can be used as a general data RAM. Its address is set in the address counter.

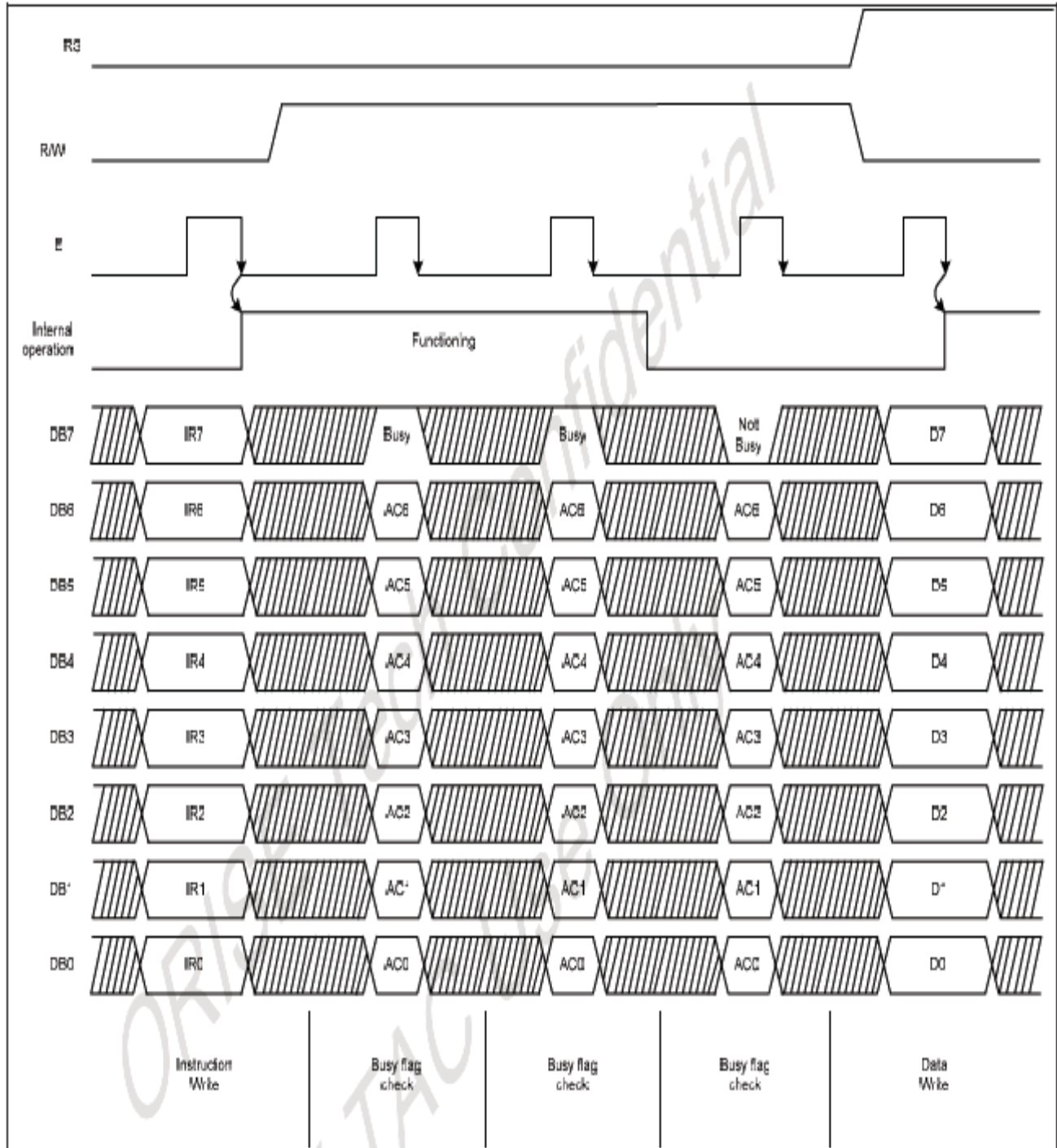
There are the relations between the display data RAM's address and the LCD's position shown belows.



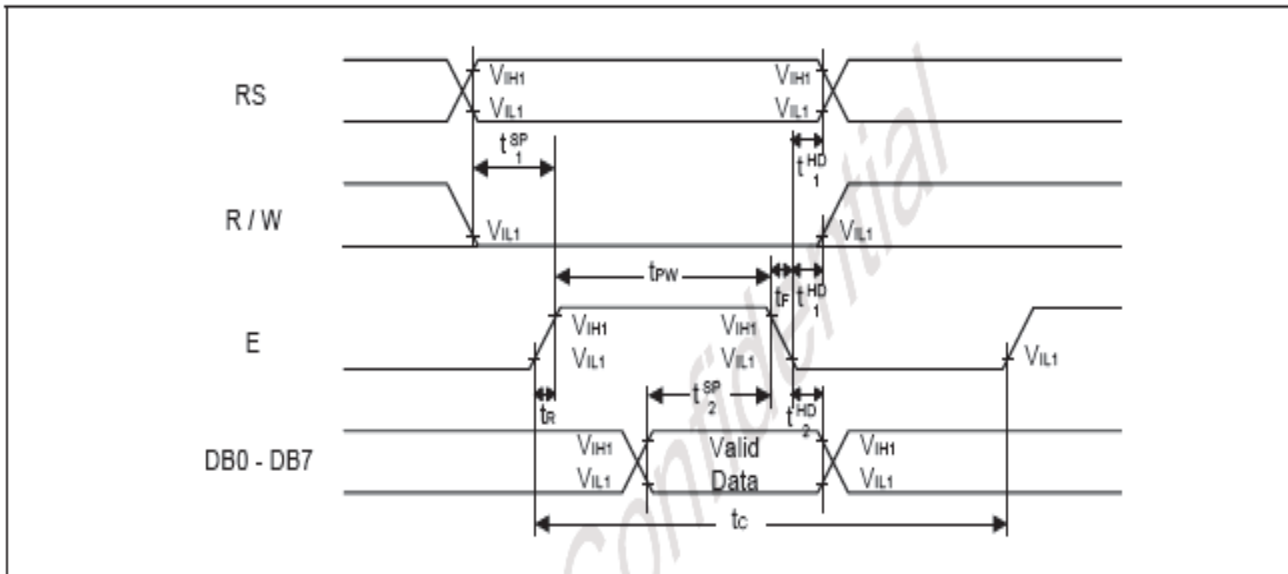
4-BIT TIMING DIAGRAM



8-BIT TIMING DIAGRAM

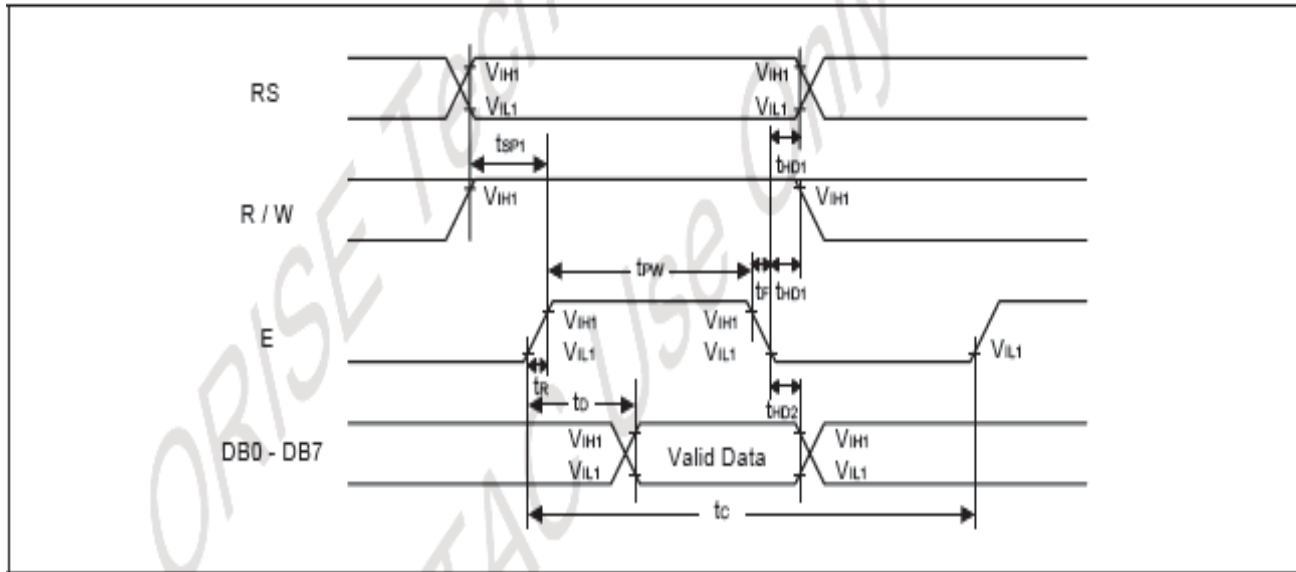


WRITE MODE TIMING DIAGRAM



Characteristics	Symbol	Limit			Unit	Test Condition
		Min.	Typ.	Max.		
E Cycle Time	t_c	850	-	-	ns	Pin E
E Pulse Width	t_{PW}	300	-	-	ns	Pin E
E Rise/Fall Time	t_r, t_f	-	-	25	ns	Pin E
Address Setup Time	t_{SP1}	60	-	-	ns	Pins: RS, R/W, E
Address Hold Time	t_{HD1}	20	-	-	ns	Pins: RS, R/W, E
Data Setup Time	t_{SP2}	105	-	-	ns	Pins: DB0 - DB7
Data Hold Time	t_{HD2}	10	-	-	ns	Pins: DB0 - DB7

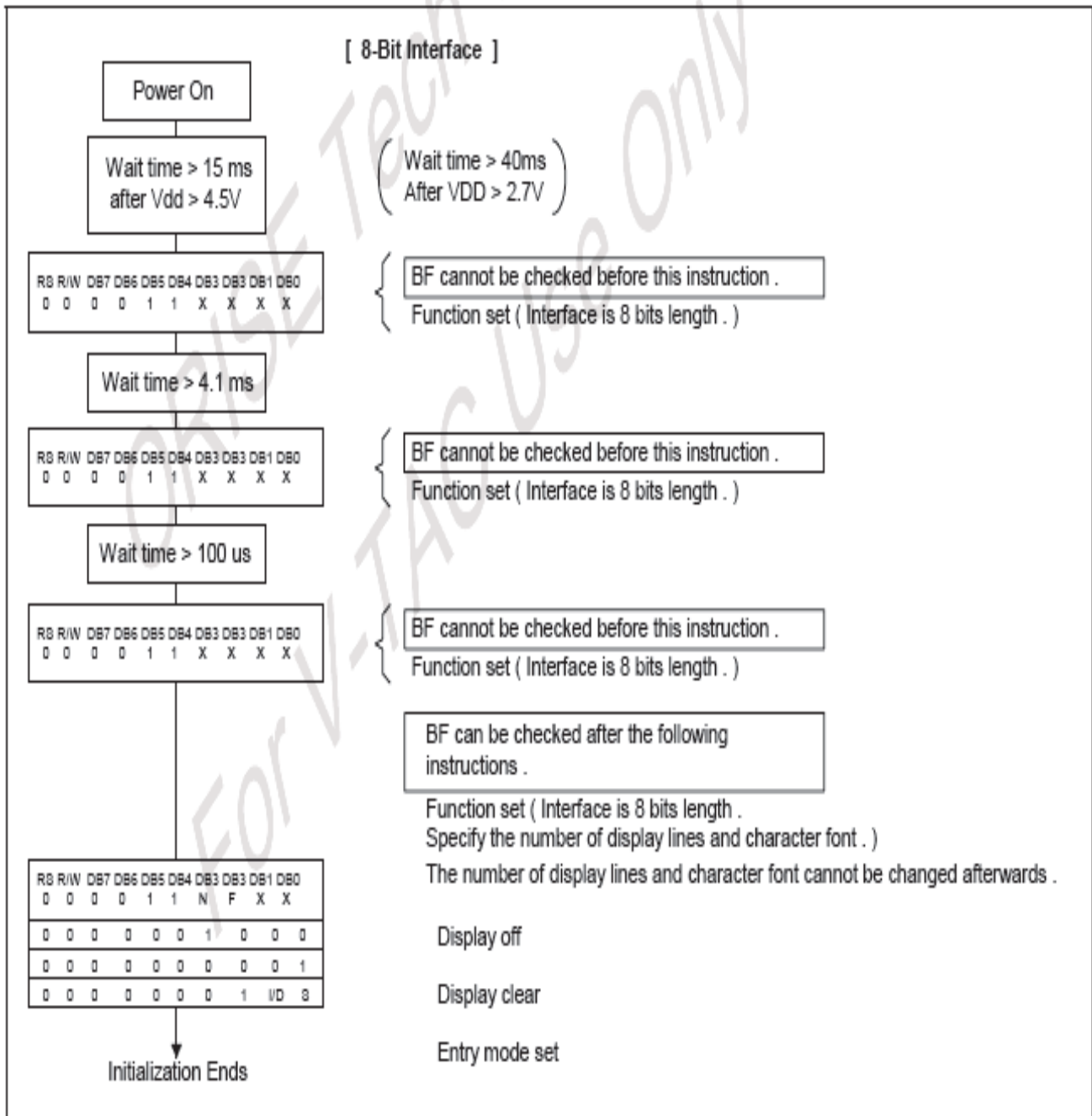
READ MODE TIMING DIAGRAM



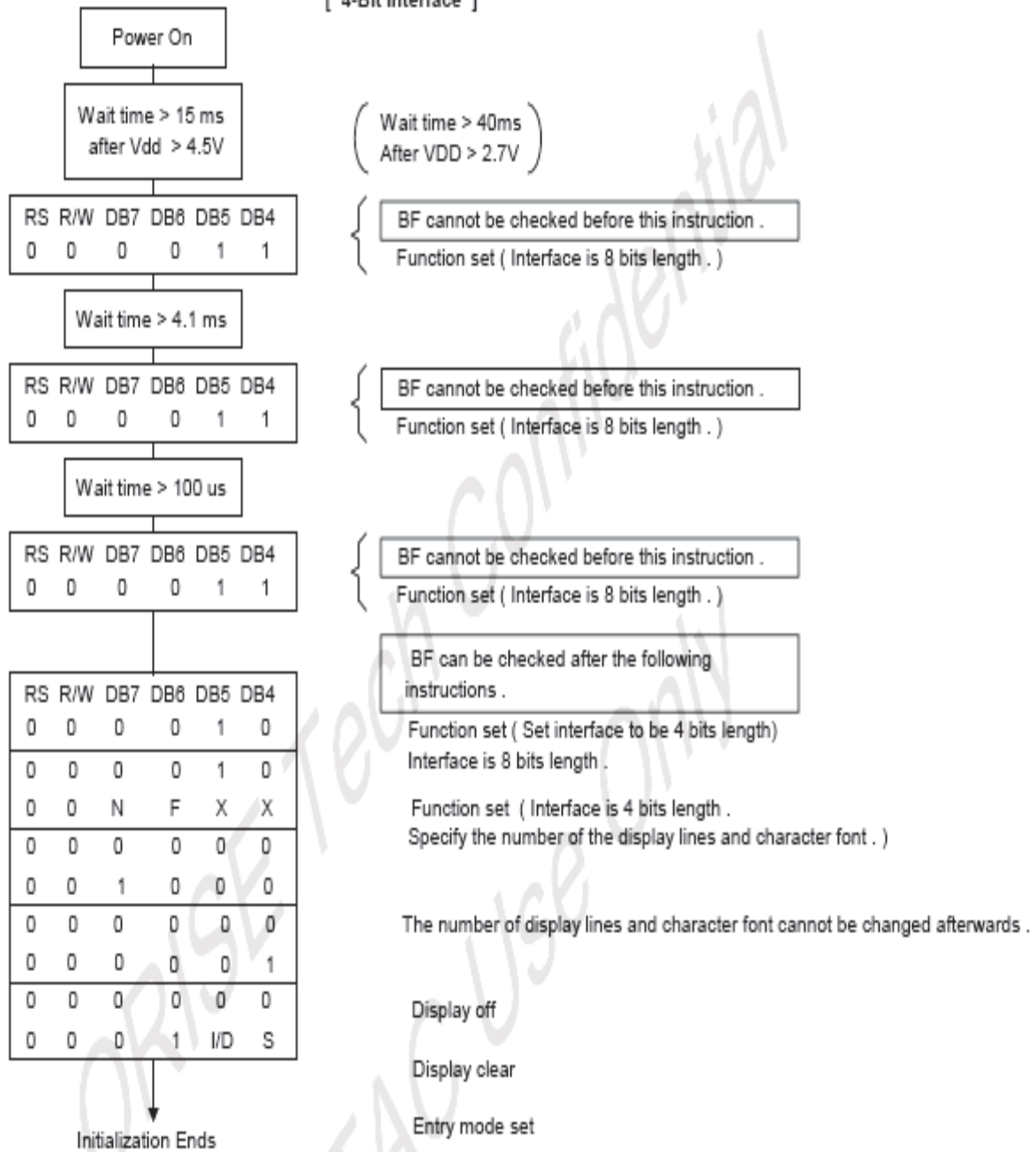
Characteristics	Symbol	Limit			Unit	Test Condition
		Min.	Typ.	Max.		
E Cycle Time	t_c	1250	-	-	ns	Pin E
E Pulse Width	t_{PW}	600	-	-	ns	Pin E
E Rise/Fall Time	t_r, t_f	-	-	25	ns	Pin E
Address Setup Time	t_{SP1}	60	-	-	ns	Pins: RS, R/W, E
Address Hold Time	t_{HD1}	20	-	-	ns	Pins: RS, R/W, E
Data Output Delay Time	t_D	-	-	360	ns	Pins: DB0 - DB7
Data hold time	t_{HD2}	5.0	-	-	ns	Pin DB0 - DB7

THE RESET CIRCUIT ALIZING WITHOUT THE BUILT-IN POWER SUPPLY CIRCUITS

At power on, it starts the internal auto-reset circuit and executes the initial instructions. There are the initial procedures shown as follows:



[4-Bit Interface]



CHARACTER CODES AND CHARACTER PATTERN

SPLC782A1 - 016

Upper 4 bit Lower 4 bit	LLLL	LLLH	LLHL	LLHH	LHLL	LHLH	LHHL	LHHH	HLLL	HLLH	HLHL	HLLH	HHLH	HHLH	HHLH	HHLH
LLLL																
LLLH																
LLHL																
LLHH																
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SPLC782A1 - 022

Upper 4 bit Lower 4 bit	LLLL	LLLH	LLHL	LLHH	LHLL	LHLH	LHHL	LHHH	HLLL	HLLH	HLHL	HLHH	HHLL	HHLH	HHHL	HHHH
LLLL	☐	月	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
LLLH	☐	日	!	1	A	Q	S	4	Q	☐	☐	☐	☐	☐	☐	☐
LLHL	☐	☐	"	2	B	R	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
LLHH	☐	1	#	3	C	S	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
LHLL	☐	☐	幸	4	D	T	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
LHLH	☐	☐	%	5	E	U	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
LHHL	☐	☐	&	6	F	V	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
LHHH	☐	☐	'	7	G	W	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
HLLL	☐	☐	C	8	H	×	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
HLLH	☐	☐	☐	9	I	Y	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
HLHL	☐	☐	☐	*	J	Z	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
HLHH	☐	☐	☐	+	K	[☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
HHLL	☐	☐	☐	,	<	羊	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
HHLH	☐	☐	☐	-	=	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
HHHL	☐	☐	☐	.	>	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
HHHH	☐	☐	☐	/	?	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

ELECTRO-OPTICAL CHARACTERISTICS

MEASURING CONDITION: POWER SUPPLY = $V_{OP} / 64 \text{ Hz}$
 TEMPERATURE = $22 \pm 5 \text{ }^\circ\text{C}$
 RELATIVE HUMIDITY = $60 \pm 15 \%$

ITEM	SYMBOL	UNIT	TYP. FSTN
RESPONSE TIME	T_{on}	ms	150
	T_{off}	ms	190
CONTRAST RATIO	Cr	-	15
VIEWING ANGLE ($Cr \geq 2$)	$V_{3:00}$	$^\circ$	45
	$V_{6:00}$	$^\circ$	70
	$V_{9:00}$	$^\circ$	45
	$V_{12:00}$	$^\circ$	60

THE ELECTRO-OPTICAL CHARACTERISTICS ARE MEASURED VALUE BUT NOT GUARANTEED ONES.

ITEM	TEST CONDITION FOR NORMAL TEMPERATURE	TEST CONDITION FOR WIDE TEMPERATURE	TIME
High temperature operating	50°C	70°C	240 hours
Low temperature operating	0°C	-20°C	240 hours
High temperature storage	60°C	80°C	240 hours
Low temperature storage	-10°C	-30°C	240 hours
Temperature-humidity storage	40°C 90% R.H.	60°C 90% R.H.	96 hours
Temperature cycling	-10°C to 60°C 30 Min Dwell	-30°C to 80°C 30 Min Dwell	5 cycle
Vibration Test at LCM Level	Freq 10-55 Hz Sweep rate: 10-55-10 at 1 min Sweep mode Linear Displacement: 2 mm p-p 1 Hour each for X, Y, Z	Freq 10-55 Hz Sweep rate: 10-55-10 at 1 min Sweep mode Linear Displacement: 2 mm p-p 1 Hour each for X, Y, Z	—

QUALITY STANDARD OF LCD MODULE

1.0	Sampling Method		
	Sampling Plan : MIL STD 105 E Class of AQL : Level II/Single Sampling Critical : 0.25% Major 0.65% Minor 1.5%		
2.0	Defect Group	Failure Category	Failure Reasons
	Critical Defect 0.25%(AQL)	Malfunction	Open Short Burnt or dead component Missing part/improper part P.C.B. Broken
	Major Defect 0.65%(AQL)	Poor Insulation	Potential short High current Component damage or scratched or Lying too close improper coating
		Poor Conduction	Damage joint Wrong polarity Wrong spec. part Uneven/intermittent contact Loose part Copper peeling Rust or corrosion or dirt's
	Minor Defect 1.5%(AQL)	Cosmetic Defect	Minor scratch Flux residue Thin solder Poor plating Poor marking Crack solder Poor bending Poor packing Wrong size

SAMPLING METHOD

SAMPLING PLAN: MIL-STD 105E

CLASS OF AQL: LEVEL II/ SINGLE SAMPLING
 MAJOR-0.65% MINOR – 1.5%

QUALITY STANDARD

DEFECT	CRITERIA	TYPE	FIGURE
SHORT CIRCUIT	-	MAJOR	-
MISSING SEGMENT	-	MAJOR	-
UNEVEN / POOR CONTRAST	-	MAJOR	-
CROSS TALK	-	MAJOR	-
PIN HOLE	$MAX(a,b) \leq 1 / 4 W$	MINOR	1
EXCESS SEGMENT	$MAX(c,d) \leq 1 / 4 T$	MINOR	1
BUBBLES	$d^* \geq 0.2$ QTY=0	MINOR	2
BLACKS SPOTS	$d \leq 0.3$ N.A.** $0.3 < d \leq 0.4$ QTY \leq 1 $0.4 < d$ QTY=0	MINOR	2
LINE SCRATCHES	$x \geq 0.7$ $y \geq 0.05$ QTY=0	MINOR	3
BLACK LINE	$x \geq 0.7$ $y \geq 0.05$ QTY=0	MINOR	3

*d = MAX (d₁,d₂)

** N. A . = NOT APPLICABLE

DEFECT TABLE : B

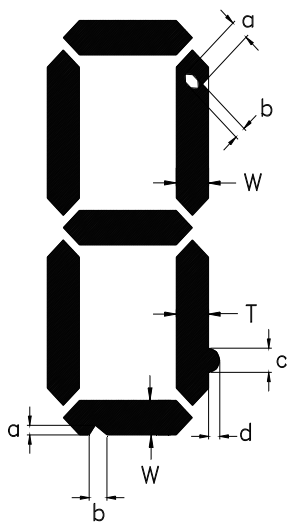
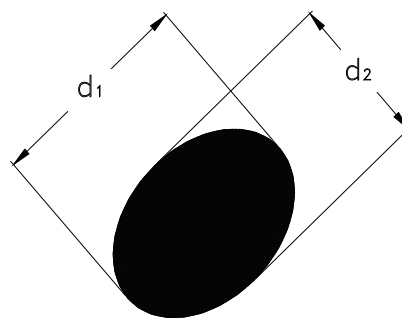
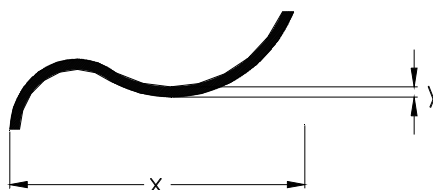


fig . 1



POLARIZER BUBBLES / SPOTS

fig . 2



LINE SCRATCHES / BLACK LINE

fig . 3

QUALITY STANDARD (CONT .)

DEFECT		CRITERIA	TYPE	FIGURE
CHIPS	CONTACT EDGE	$e \leq 1/2T$ $f \leq 1/3W$ $g \leq 3.5$	MINOR	4
	BOTTOM GLASS	$p \leq 1.0$ $q \leq 3.5$ $r \leq 1/2T$		4
	CORNER	$a \leq 1.5$ $b \leq W$		4
	TOP GLASS	$a \leq 3.0$ $b \leq 1/3T$ $c \leq 1/2W$		5
GLASS PROTRUSION		$a \leq 1/4 W$	MINOR	6
RAINBOW		-	MINOR	-

UNLESS STATE OTHERWISE , ALL UNIT ARE IN MILLIMETER .

DEFECT TABLE : B

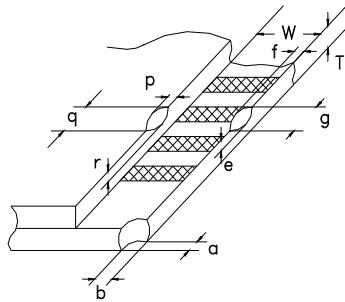


fig . 4

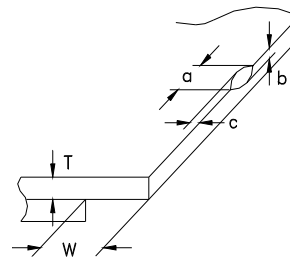


fig . 5

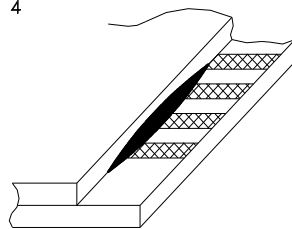
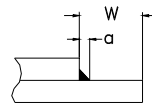


fig . 6



HANDLING PRECAUTIONS

(1) CAUTION OF LCD HANDLING & CLEANING

Use soft cloth with solvent (recommended below) to clean the display surface and wipe lightly.

- Isopropyl alcohol, ethyl alcohol, trichlorotrifluoroethane

Do not wipe the display surface with dry or hard materials that will damage the polarizer surface. Do not use the following solvent;

-water, ketone, aromatics

(2) CAUTION AGAINST STATIC CHARGE

The LCD modules use CMOS LSI drivers, so customers are recommended that any unused input terminal would be connected to V_{DD} or V_{SS} , do not input any signals before power is turned on, and ground your body, work/assembly areas, assembly equipment to protect against static electricity.

Remove the protective film slowly and, if possible, under ESD control device like ion blower and humidity of working room should be kept over 50%RH to reduce risk of static charge.

(3) PACKAGING

Avoid intense shock and falls from a height and do not operate or store them exposed direct to sunshine or high temperature/humidity.

(4) CAUTION FOR OPERATION

It is an indispensable condition to drive LCD's within the specified voltage limit since the higher voltage than the limit causes the shorter LCD life. The use of direct current drive should be avoided because an electrochemical reaction due to direct current causes LCD's undesirable deterioration.

Response time will be extremely delayed at low temperature, and LCD's show dark color at high temperature. However those phenomena do not mean malfunction or out of order with LCD's.

Some font will be abnormally displayed when the display area is pushed hard during operation. But it resumes normal condition after turning off once.

(5) SOLDERING (for Pin type)

It is recommended to complete dip soldering at 270 °C or hand soldering at 280 °C within 3 seconds. The soldering position is at least 3mm apart from the pin head. Wave or reflow soldering are not recommended. Metal pins should not be soldered for more than 3 times and each soldering should be done after cool down of metal pins.

(6) SAFETY

For crash damaged or unnecessary LCD's, it is recommended to wash off liquid crystal by either of solvents such as acetone and ethanol and should be burned up later.

When any liquid leaked out of a damaged glass cell comes in contact with your hands, wash it off with soap and water.

WARRANTY

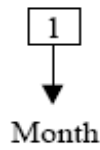
CLOVER will replace or repair any of her LCD module in accordance with her LCD specification for a period of one year from date of shipment. The warranty liability of Clover is limited to repair and/or replacement. Clover will not be responsible for any subsequent or consequential event.

APPENDIX

LOT INDICATION OF LCD MODULE

CODING SYSTEM:

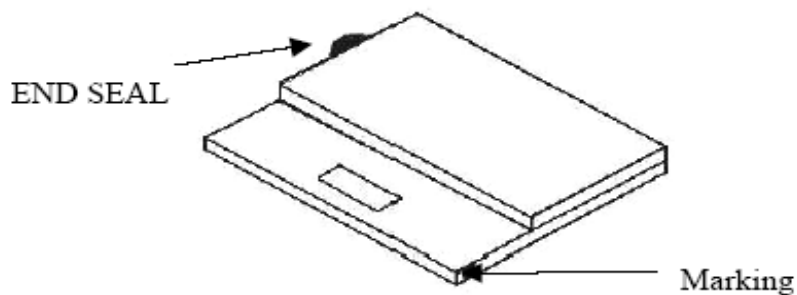
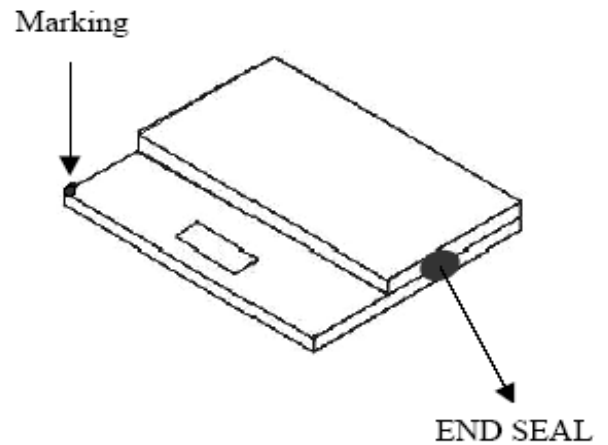
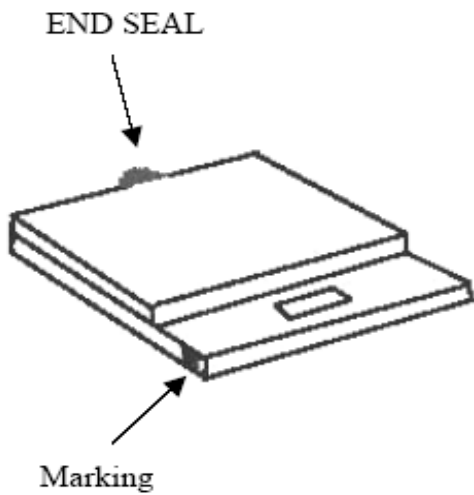
1 DIGIT COLOR CODE:



COLOR CODE:

MONTH	COLOR	
1	BROWN	棕
2	RED	紅
3	ORANGE	橙
4	YELLOW	黃
5	GREEN	綠
6	BLUE	藍
7	PURPLE	紫
8	GREY	灰
9	WHITE	白
10	BLACK	黑
11	GOLD	金
12	SILVER	銀

3 TYPES OF LOCATION AS SHOWN BELOW:



SPECIFICATION REVISION RECORD