

MD21605G12W3-BNMLW-VE	2 x 16	5mm Character Height	LCD Module
Specification			
Version: 1		Date: 14/08/2020	
Revision			
1	12/08/2020	First Issue	

Display Features			
Character Count	2 x 16		
Appearance	White on Blue		
Logic Voltage	3.3V / 5V		
Interface	Parallel		
Font Set	English / Japanese		
Display Mode	Transmissive		
Character Height	5.15mm		
LC Type	Blue STN		
Module Size	80.00 x 36.00 x 11.00 mm		
Operating Temperature	-20°C ~ +70°C		
Construction	COB		
LED Backlight	White		
		Box Quantity	Weight / Display
		---	---

Display Accessories	
Part Number	Description
MCCBL1A16SLIP -16DILS-150	16 Way, Single in-line to Dual In-line connector Cable.
MCCBL1A16SLIP -16SILS-150	16 Way, Single in-line to Single In-line connector Cable.

Optional Variants		
Fonts	Appearances	Voltage



Overview

The MD21605G12W3-BNMLW-VE is a character type liquid crystal display module that is a dot matrix type liquid crystal display module specially used to display letters, numbers, symbols, etc. Piece. Minute 4 Bit sum 8 Bit data transmission method. provide 5 X 7 Dot matrix + cursor display mode. Provide display data buffer

DDRAM , Character generator CGROM And character generator CGRAM ,can use CGRAM To store the most defined 8 A 5 X 8 The font data of the graphic characters of the dot matrix. Provides a wealth of command settings: clear display; cursor back to origin; display on/off; cursor on/off; display characters flashing; cursor shift; display shift element, etc. Provide internal power-on automatic reset circuit,

When external power is applied, the module is automatically initialized and the module is set to the default display working state.

Display characters: 16 characters X 2 lines

Character dot matrix: 5X7 character matrix + cursor

Display color and backlight color: STN blue; backlight white. (Other colours available).

Polarizing film: fully transparent/semi-transparent

Observation angle: 6:00

Display duty cycle: 1/16 Drive bias: 1/5

Character generator ROM (CGROM): 10880 bits (192 character 5*8 dots) or

(64 character 5*11 dots)

Character generator RAM (CGRAM): 64X8 bits (8 characters 5*8 dots) or

(4 characters 5*11dots)

Display Data RAM (DDRAM) :80X8 bits (80 characters max)

Size (Unit: mm)

Dimensions: 80X36X11

Viewable area: 64.5X13.8

Character font: 5X8 dots + Cursor point

Character size: 55.7X11

size: 0.54X0.6

Character spacing: 3.52X5.85

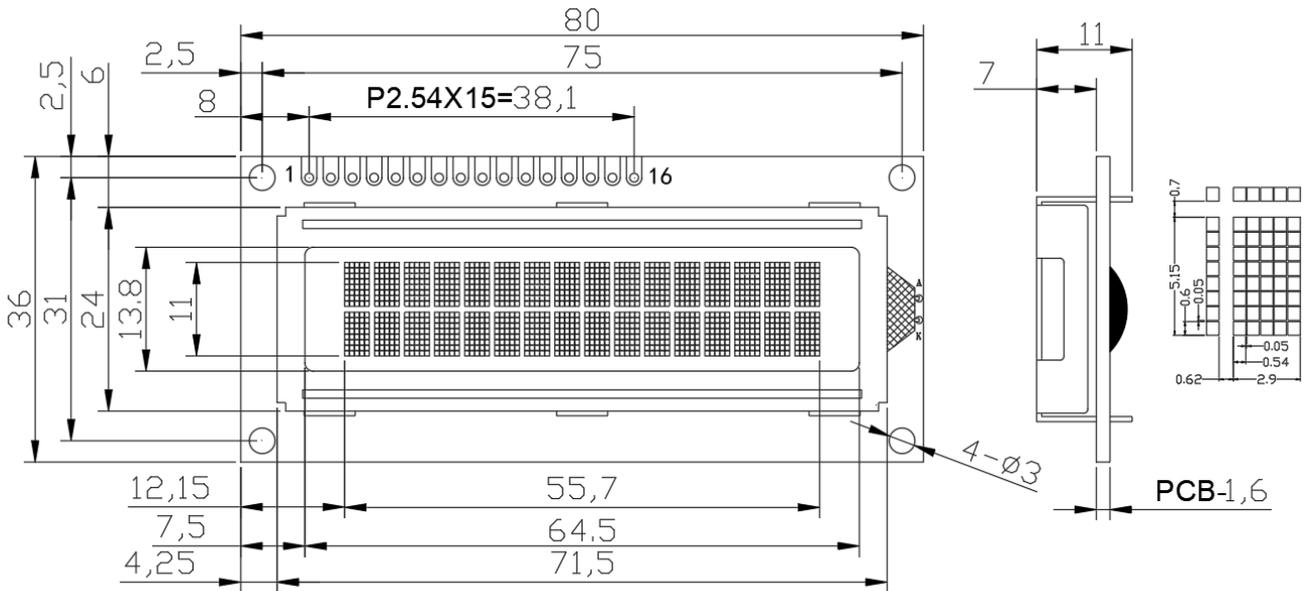
Contrast: V0 Externally adjusted or internally fixed contrast

weight : g

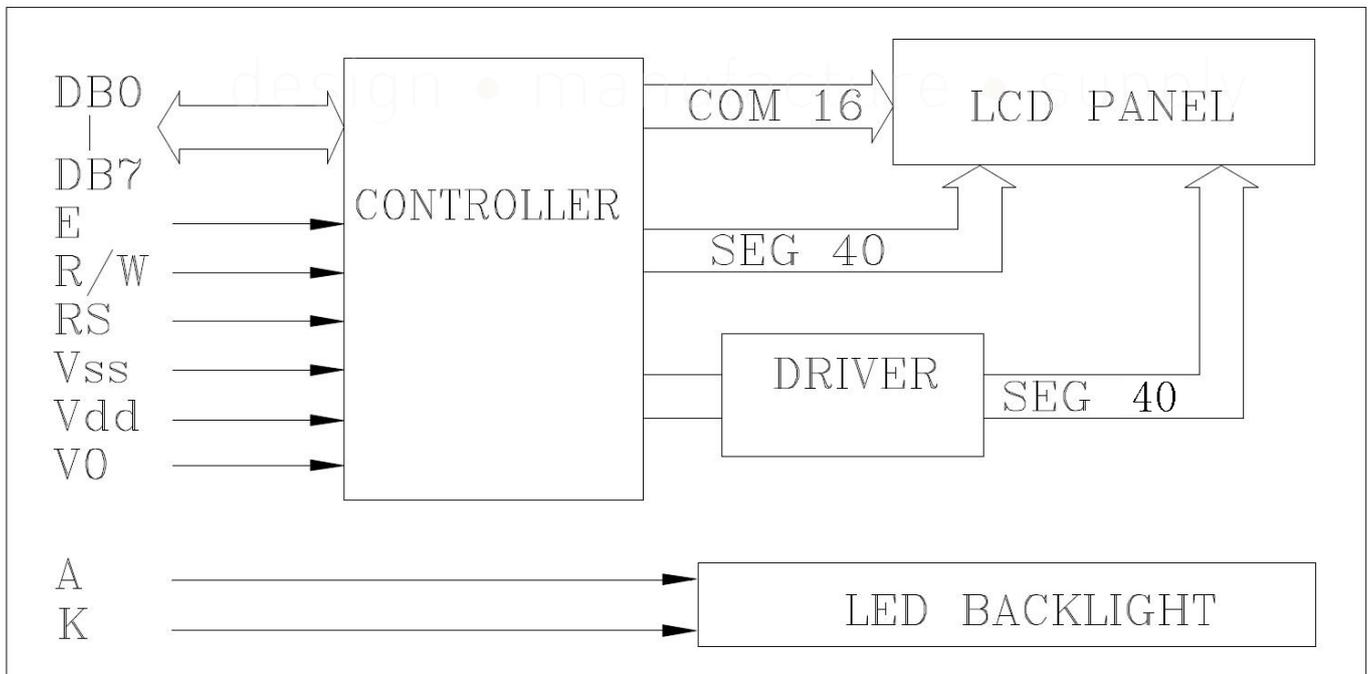
Operating Voltage : +3.3V or + 5V default 5V



Dimensions:



Hardware block diagram:



Electrical characteristics

1. Limit parameters

parameter name	symbol	condition	Typical value		unit
			Minimum	Max	
voltage	Vdd		-0.3	7.0	V
LCD Drive voltage	V5		Vdd-10.0	Vdd+0.3	V
Input voltage	Vi		-0.3	Vdd+0.3	V
Operating temperature(T)	Top	-	-20	70	°C
Storage temperature(T)	Tstg	-	-30	80	°C

2.1 DC parameters 1(Ta=25 °C, Vdd=4.5V~5.5V)

parameter name	symbol	condition	Nominal value			unit
			Minimum	typical	maximum	
voltage	Vdd-GND	-	4.5	5.0	5.5	V
Operating current (not including backlight)	Idd	Vdd=5V	0.9	1.5	1.7	mA
LCD Drive current	I _{ee}		-	0.6	-	mA
LCD Drive voltage	Vdd-V5		4.2	4.5	4.8	V
led Backlight working current	I _f	V _f =3.0~3.2V	17	18	20	mA
led Backlight power consumption	P _d		90	100	110	mW
Input high level	V _{ih}		2.5	-	Vdd	V
Input low level	V _{il}		-0.3	-	0.6	V
Output high level	V _{oh}	I _{oh} =-0.205mA	2.4	-	-	V
Output low level	V _{ol}	I _{ol} =1.2mA	-	-	0.4	V

2.2 DC parameters 2(Ta=25 °C, Vdd=2.7V~4.5V)

parameter name	symbol	condition	Nominal value			unit
			Minimum	typical	maximum	
voltage	Vdd-GND	-	2.7	3.3	4.5	V
Operating current (not including backlight)	Idd	Vdd=3.3V	0.45	0.9	1.0	mA
LCD Drive current	I _{ee}		-	0.6	-	mA
LCD Drive voltage	Vdd-V5		4.2	4.5	4.8	V
led Backlight working current	I _f	V _f =3.0~3.2V	17	18	20	mA
led Backlight power consumption	P _d		55	60	66	mW
Input high level	V _{ih}		0.7Vdd	-	Vdd	V
Input low level	V _{il}		-0.3	-	0.55	V
Output high level	V _{oh}	I _{oh} =-0.1mA	0.75Vdd	-	-	V
Output low level	V _{ol}	I _{ol} =0.1mA	-	-	0.2Vdd	V



3.1 Communication parameters 1 (Ta=25 °C, Vdd=4.5V~5.5V)

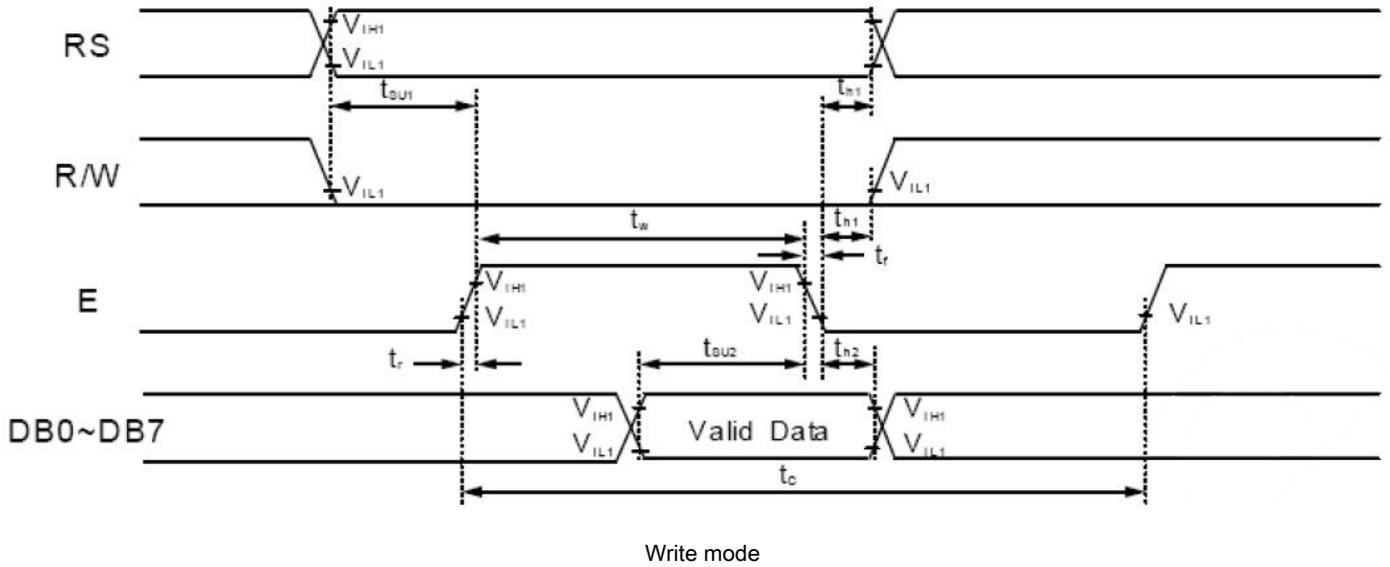
Parameter name	Symbol	Test Conditions	Min	Typ.	Max	Unit
E Cycle	t _c	Write Mode	500	-	-	ns
E Rise/Fall Time	t _{R, t_F}		-	-	20	
E Pulse width (1,0)	t _w		230	-	-	
R/W and RS setup time	t _{su1}		40	-	-	
R/W and RS hold time	t _{H1}		10	-	-	
Data establishment time	t _{su2}		80	-	-	
Data retention time	t _{H2}		10	-	-	
E Cycle	t _c	Read Mode	500	-	-	ns
E Rise/Fall Time	t _{R, t_F}		-	-	20	
E Pulse width (1,0)	t _w		230	-	-	
R/W and RS setup time	t _{su}		40	-	-	
R/W and RS hold time	t _H		10	-	-	
Data Output Delay Time	t _D		-	-	120	
Data retention time	t _{DH}		5	-	-	

3.2 Communication parameters 2 (Ta=25 °C, Vdd=2.7V~4.5V)

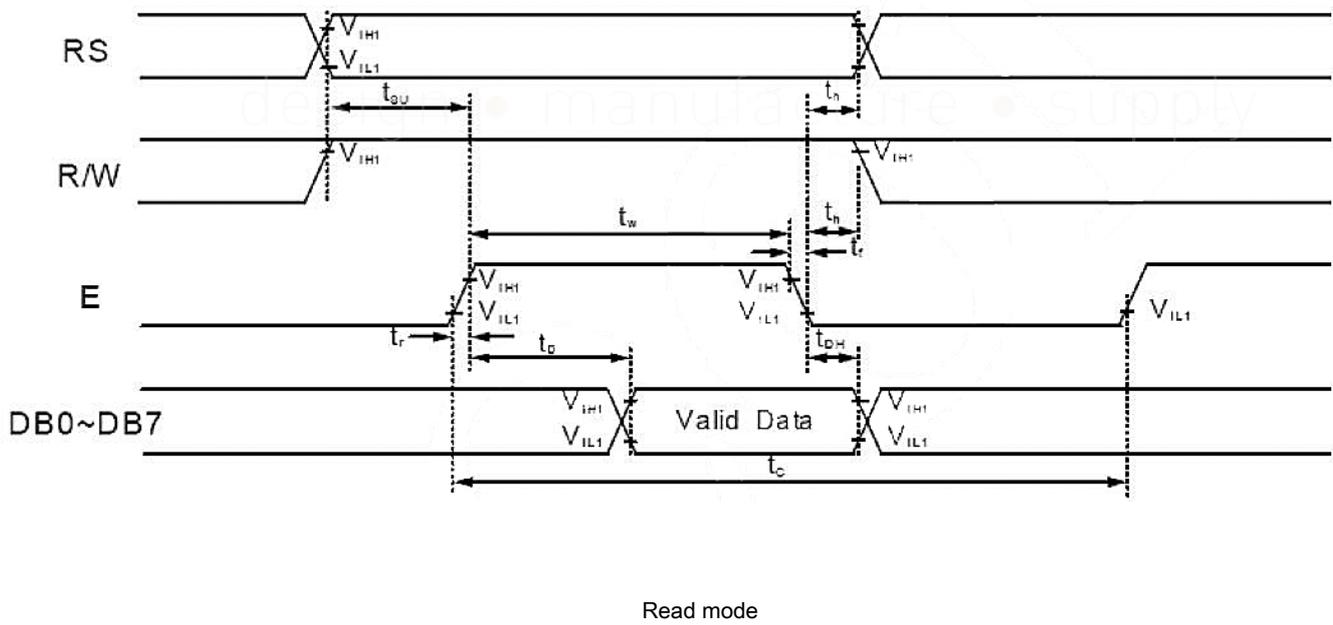
Parameter name	Symbol	Test Conditions	Min	Typ.	Max	Unit
E Cycle	t _c	Write Mode	1000	-	-	ns
E Rise/Fall Time	t _{R, t_F}		-	-	25	
E Pulse width (1,0)	t _w		450	-	-	
R/W and RS setup time	t _{su1}		60	-	-	
R/W and RS hold time	t _{H1}		20	-	-	
Data establishment time	t _{su2}		195	-	-	
Data retention time	t _{H2}		10	-	-	
E Cycle	t _c	Read Mode	1000	-	-	ns
E Rise/Fall Time	t _{R, t_F}		-	-	25	
E Pulse width (1,0)	t _w		450	-	-	
R/W and RS setup time	t _{su}		60	-	-	
R/W and RS hold time	t _H		20	-	-	
Data Output Delay Time	t _D		-	-	360	
Data retention time	t _{DH}		5	-	-	



AC test waveform



MIDAS



Interface Description

Foot number	symbol	Features		Remarks
1	Vss	power supply	0V	
2	Vdd		+ 5V	
3	Vo		LCD Bias adjustment	Contrast adjustment
4	RS	Data/command selection (H: data L: instruction)		
5	R/W	Read/write selection (H: read L: write)		
6	E	Enable signal		
7	DB0	Data bit 0		
8	DB1	Data bit 1		
9	DB2	Data bit 2		
10	DB3	Data bit 3		
11	DB4	Data bit 4		
12	DB5	Data bit 5		
13	DB6	Data bit 6		
14	DB7	Data bit 7		
15	A	led Backlight positive		
16	K	led Backlight negative		

Instructions

The module has 4 Bit/ 8 Bit MCU Parallel communication mode, 4 Bit/ 8 Bit bus through the instruction register DL Bit to select.

In read and write operations, use 2 A 8 Bit register, one is data register DR , The other is the instruction register IR . data register DR As write and read DDRAM/CGRAM Temporary storage place of data, target RAM by RAM Address setting command Make selection, any read and write RAM Internal operations are done automatically, when MCU read out DR Internal data, DDRAM/CGRAM Data is automatically transferred to DR , Too, when MCU Write data to DR , DR The data in is automatically transferred out DDRAM/CGRAM . Means Make register IR Used to store from MCU Instruction code, MCU Can't read command data, can pass RS Pin switch selection register Device.

By setting RS/RW Various operations of bits:

RS	RW	operating
L	L	Write instruction operation (MCU Write instruction code to IR)
L	H	Read busy sign (DB7) And address counter (DB0~DB6)
H	L	Write data operation (MCU Write data to DR)
H	H	Read data operation (MCU From DR Read data)

1. Busy sign (BF)

BF If it is high, it means the internal operation is in progress, so the next instruction will not be executed within this time. when RS= " 0 "

And R/W= " 1 "(When reading instructions), BF The value can be from DB7 Read out from the mouth, you must confirm when executing the next instruction BF Not " 1 ".

2. Address counter (AC)

From the instruction register DDRAM/CGRAM When the address is stored in the address counter, the data in the address counter is being written In or out DDRAM/CGRAM After increment or decrement, when RS= " 0 "And R/W= " 1 ", the data in the address counter can be DB0~DB6 read out.

3. Display Data RAM (DDRAM)



Modular DDRAM The address range is 00H~27H with 40H~67H .

4. Character generation ROM (CGROM)

Character generation ROM have 5X8 lattice, 192 Characters, and 5x11 lattice, 64 Character mode

5. Character generation RAM (CGRAM)

Character generation RAM have 5*8 lattice, 8 Character spaces, each character space consists of 8 A 5 Bit byte space composed by writing Custom character data to CGRAM ,this 8 Character space users can write DDRAM data 00H~07H To call custom.

DDRAM/CGRAM Address map:

Character Code (DDRAM data)								CGRAM address						CGRAM Data								Pattern number
D7	D6	D5	D4	D3	D2	D1	D0	A5	A4	A3	A2	A1	A0	P7	P6	P5	P4	P3	P2	P1	P0	
0	0	0	0	x	0	0	0	0	0	0	0	0	0	x	x	x	0	1	1	1	0	pattern1
											0	0	1				0	0				
											0	1	0				0	0				
											0	1	1				0	0				
											1	0	0				0	0				
											1	0	1				0	0				
											1	1	0				0	0				
											1	1	1				0	0				
0	0	0	0	x	0	0	1	0	0	1	0	0	0	x	x	x	0	1	1	1	0	pattern2
											0	0	1				0	1				
											0	1	0				0	0				
											0	1	1				0	0				
											1	0	0				0	0				
											1	0	1				0	0				
											1	1	0				0	1				
											1	1	1				0	0				
*				*				*														
0	0	0	0	x	1	1	1	1	1	1	0	0	0	x	x	x	1	1	1	1	1	pattern8
											0	0	1				0	0				
											0	1	0				0	0				
											0	1	1				0	0				
											1	0	0				0	0				
											1	0	1				0	0				
											1	1	0				0	1				
											1	1	1				0	0				

6. Instruction description

Instruction list

instruction	RS	R/W	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0	execution time	description
Clear display	0	0	0	0	0	0	0	0	0	1	1.53ms	will 20H Write DDRAM To count addresses Device address is set to 00H
return	0	0	0	0	0	0	0	0	1	-	1.53ms	Set the address counter address to 00H , and Return the cursor to the initial position, DDRAM Content remains unchanged
Input mode Style setting	0	0	0	0	0	0	0	1	I/D	SH	39us	Set the cursor movement direction and allow the entire Show move
display switch	0	0	0	0	0	0	1	D	C	B	39us	Set display, cursor, cursor blinking control Position



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Shift	0	0	0	0	0	1	S/C	R/L	-	-	39us	Set the cursor movement, display the moving direction Control bit, DDRAM Data remains unchanged
Features Set up	0	0	0	0	1	DL	N	F	-	-	39us	Set the interface data width (DL: 8 Bit/ 4 Bit), display the number of rows (N:2 Row/ 1 Line), display Font (F:5x11 lattice/ 5x8 lattice)
Set up CGRAM address	0	0	0	1	AC5	AC4	AC3	AC2	AC1	AC0	39us	Set in the address counter CGRAM address
Set up DDRA M address	0	0	1	AC6	AC5	AC4	AC3	AC2	AC1	AC0	39us	Set in the address counter DDRAM Ground site
Busy reading Logo & address	0	1	BF	AC6	AC5	AC4	AC3	AC2	AC1	AC0	0us	Read busy flag BF , In the address counter Are read out at the same time
Write data	1	0	D7	D6	D5	D4	D3	D2	D1	D0	43us	Write data to internal RAM (DDRAM/CGRAM)
Read data	1	1	D7	D6	D5	D4	D3	D2	D1	D0	43us	From the inside RAM (DDRAM/CGRAM) Read data

Note: "-" is not considered

6.1 Clear display

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

By writing 20H (Space code) to all DDRAM Address and set the address counter as 00H, You can clear the display data,

Place the cursor at the initial state position and set the input mode to incremental (I/D Is high).

6.2 return

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

"-" is not considered

The return instruction is to return the cursor to the starting position, DDRAM Address is set to 00H Write the address counter and change the display to the initial state, DDRAM The data in remains unchanged.

6.3 Input mode

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

Set the direction of movement of the cursor and display

I/D : DDRAM Increase or decrease of address (cursor or flashing)

when I/D for 1 When the cursor blinks and moves to the right, DDRAM The address is incremented; when I/D for 0 When the cursor blinks and moves to the left, DDRAM Address decrement, when read or write CGRAM When, the way of movement is the same as DDRAM Consistent.

SH : Display shift

when SH for 0 When, right DDRAM or CGRAM During read and write operations, the entire display will not shift. when SH for 1 When, right DDRAM Write operation is, the entire display shift will be based on I/D Displacement in the set direction.

6.4 Display switch control

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

Display/cursor and blinking control

D : Display switch control position

when D for 1 When, the display is on; when D for 0 When the display turns off, but DDRAM The data displayed in remains unchanged.



C : Cursor switch control bit

when C for 1 When, the cursor is on; when C for 0 When the cursor disappears, but I/D The register holds its data.

B : Cursor blinking switch control bit

when B for 1 When the cursor blinks on, when B for 0 When, the cursor blinks off.

6.5 Cursor blinking/shifting

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

Do not read or write the display data, move the cursor position or display to the left or right. This instruction is used to correct and find the display data. 2 Row In the display mode, in the 1 Line 40 Characters, the cursor moves to the 2 Row. Note that in all rows, the display shift is performed simultaneously When the display data is shifted repeatedly, each bit is shifted independently, when the display is shifted, the content of the address counter remains unchanged

Shift format table

S/C	R/L	operating
0	0	The cursor moves to the left, the address counter is decremented 1
0	1	The cursor moves to the right and the address counter is incremented 1
1	0	So the display moves to the left, and the cursor moves with the display
1	1	All displays move to the right, the cursor moves with the display

6.6 Function setting

RS	R/W	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0
0	0	0	0	1	DL	N	F	-	-

DL : Interface data width control bit

when DL for 1 When 8 Bit bus connected to MCU

when DL for 0 When 4 Bit bus connected to MCU , As 4 In bit bus mode, 8 Bit data needs to be transmitted 4 Bit data 2

Completed.

N : Display line number control bit

when N for 0 时 , 为 1 Line display mode; when N for 1 时 , 为 2 Line display mode.

F : Display font settings

when F for 0 , The font is 5x8 Dot matrix mode; when F for 1 , The font is 5x11 Dot matrix mode.

6.7 Set up CGRAM address

RS	R/W	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0
0	0	0	1	AC5	AC4	AC3	AC2	AC1	AC0

will CGRAM The address is placed in the address counter so that it comes from MCU of CGRAM The data is valid.

6.8 Set up DDRAM address

RS	R/W	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0
0	0	1	AC6	AC5	AC4	AC3	AC2	AC1	AC0

will DDRAM The address is placed in the address counter so that it comes from MCU of DDRAM The data is valid when 1 In line display mode,

DDRAM address 00H~4FH ;when 2 In line display mode, the first 1 OK DDRAM Address from 00H~27H , The first 2 Row DDRAM address

From 40H~67H .



6.9 Read busy flag and address

RS	R/W	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0
0	1	BF	AC6	AC5	AC4	AC3	AC2	AC1	AC0

This instruction shows whether the module is in internal work, if BF for 1, Internal work is in progress, need to wait until BF Be placed 0 At this time, the next instruction can be executed. In this instruction, the value in the address counter can also be read.

6.10 Write data to RAM

RS	R/W	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0
1	0	D7	D6	D5	D4	D3	D2	D1	D0

Write 8 Bit data to DDRAM/CGRAM . DDRAM with CGRAM The choice between is determined by the address setting command (DDRAM Address setting instructions and CGRAM Address setting instruction), the address will be based on RAM Set the place of instruction The address counter is incremented or decremented.

6.11 From RAM Mid-reading data

RS	R/W	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0
1	1	D7	D6	D5	D4	D3	D2	D1	D0

From DDRAM/CGRAM Read in 8 Bit data, DDRAM with CGRAM The choice between is determined by the address setting instruction, If there is no write address setting instruction before reading data, the read data is invalid; if there is no write before reading operation RAM Ground Address setting instruction, and read data multiple times, it is valid from the second data, the first data is wrong, because there is no time Order fit RAM Data output in DDRAM In the read operation, the cursor transfer instruction played DDRAM Same address setting instructions Role, the same will RAM The data is sent to the output register. After the read operation, the address counter is incremented or decremented according to the input mode instruction, in CGRAM After the read operation, the display shift may not be performed correctly.

6.12 initialization

When the power is turned on, the module will be initialized. During this process, the following instructions will be executed. The busy flag will remain before the initialization

Is high.

1. Clear display instructions: all DDRAM be recorded 20H

2. Set function instruction: DL=1 , 8 Bit bus mode

N=0 , 1 Line display mode

F=0 , 5x8 Font

3. Display switch instructions: D=0 , Show off

C=0 , Cursor off

B=0 , Flashing off

4. Set the return instruction: I/D=1 , Increasing

SH=0 , The display does not shift



7. Display position and RAM Address correspondence table

Display position	1-1	1-2	1-3	1-4	1-5	1-6	1-7	1-8	1-9	1-10
DDRAM address	00	01	02	03	04	05	06	07	08	09
Display position	1-11	1-12	1-13	1-14	1-15	1-16	1-17	1-18	1-19	1-20
DDRAM address	0A	0B	0C	0D	0E	0F	10	11	12	13
Display position	1-21	1-22	1-23	1-24	1-25	1-26	1-27	1-28	1-29	1-30
DDRAM address	14	15	16	17	18	19	1A	1B	1C	1D
Display position	1-31	1-32	1-33	1-34	1-35	1-36	1-37	1-38	1-39	1-40
DDRAM address	1E	1F	20	21	22	23	24	25	26	27
Display position	2-1	2-2	2-3	2-4	2-5	2-6	2-7	2-8	2-9	2-10
DDRAM address	40	41	42	43	44	45	46	47	48	49
Display position	2-11	2-12	2-13	2-14	2-15	2-16	2-17	2-18	2-19	2-20
DDRAM address	4A	4B	4C	4D	4E	4F	50	51	52	53
Display position	2-21	2-22	2-23	2-24	2-25	2-26	2-27	2-28	2-29	2-30
DDRAM address	54	55	56	57	58	59	5A	5B	5C	5D
Display position	2-31	2-32	2-33	2-34	2-35	2-36	2-37	2-38	2-39	2-40
DDRAM address	5E	5F	60	61	62	63	64	65	66	67

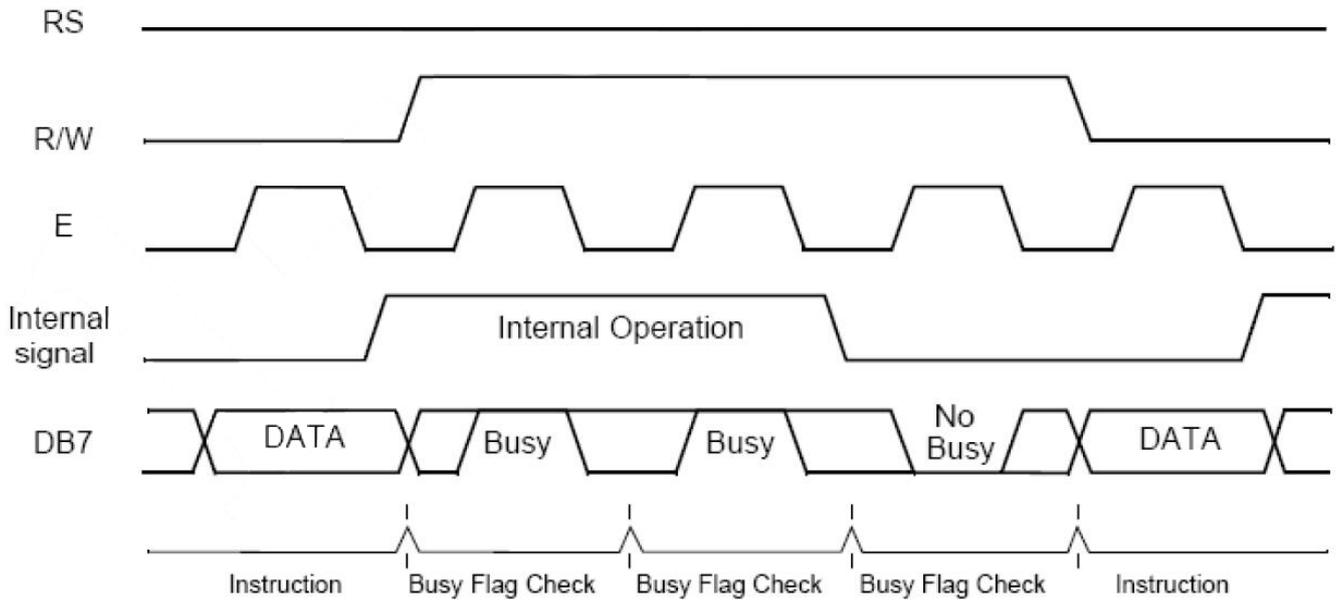
1-1 Represents the first character of the first line



Operation sequence

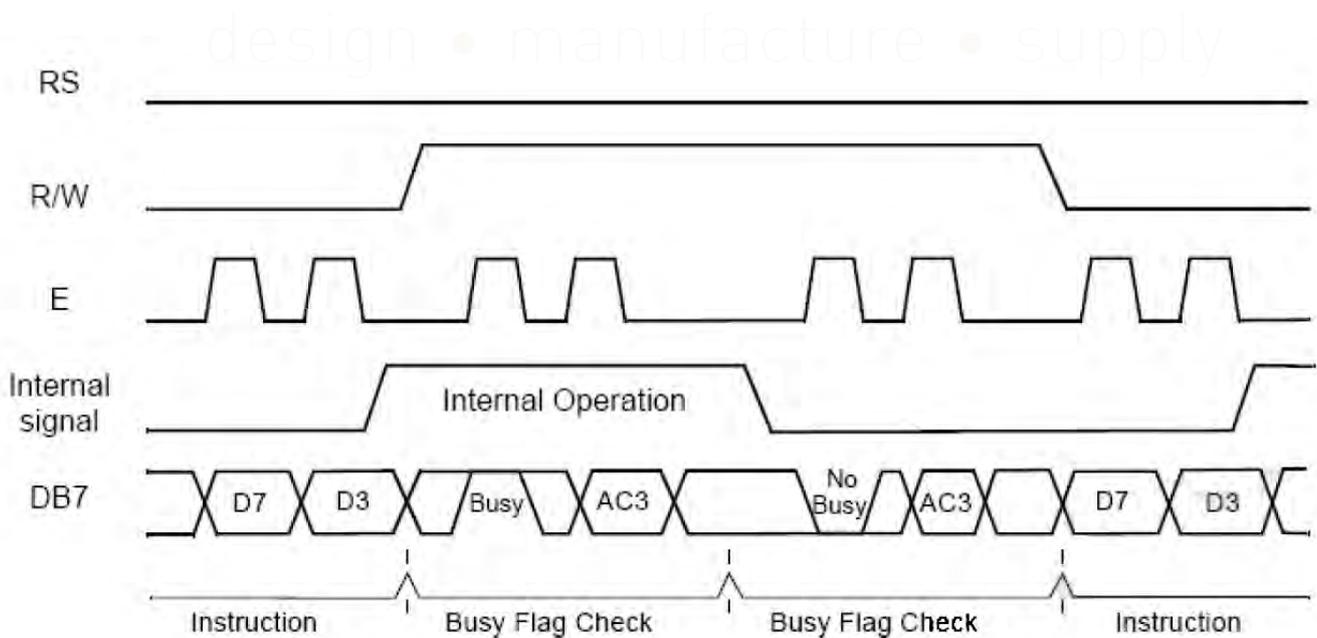
1. 8 Bit MCU interface

When the interface data width is set to 8 Bit, the data from 8 Bit port (DB0-DB7) Simultaneous read and write, the sequence is shown in the figure below:



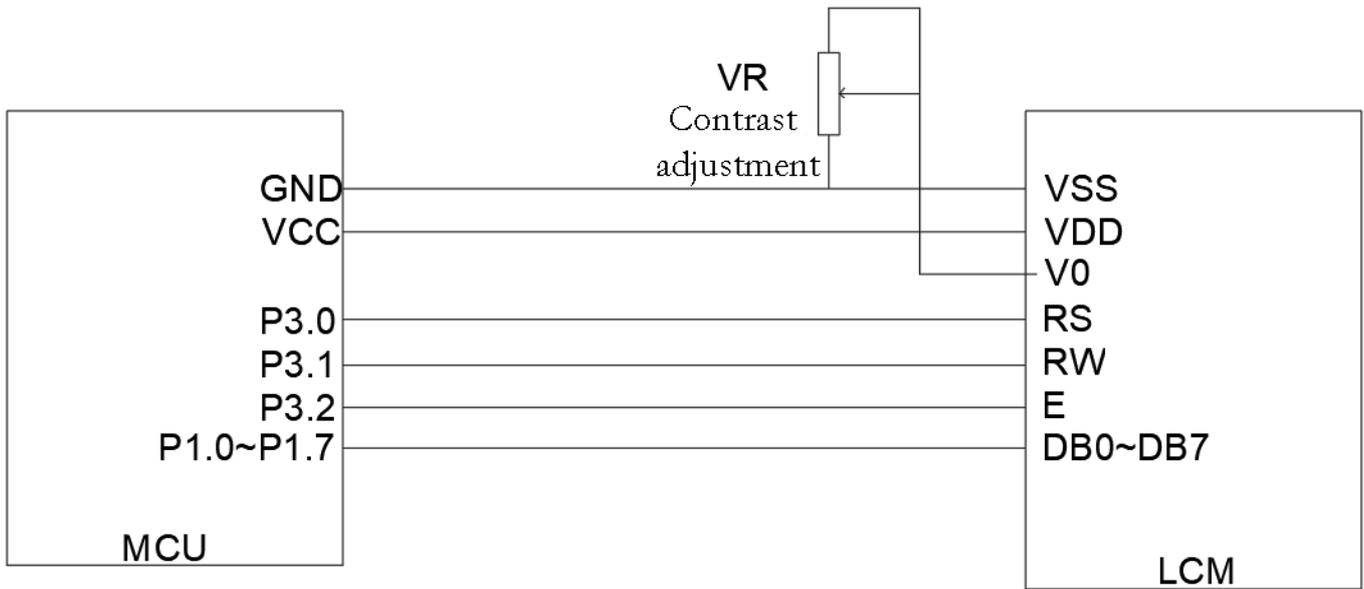
2. 4 Bit MCU interface

When the interface data width is set to 4 Bit, the data is only from 8 Bit port high 4 Bit (DB4-DB7) Read and write, first transmit high 4 Bit retransmission low 4 Bit, the timing is shown in the figure below:



Application routine

1. 8 Bit wiring diagram



8 - Position wiring method

2. 8 Bit C51 Routine

```
# include <STC15.H>
```

```
# include <string.h>
```

```
# include <INTRINS.H>
```

```
# define uchar unsigned char
```

```
# define uint unsigned int
```

```
# define DB07 P1
```

```
sbit RS=P3^0;
```

```
sbit RW=P3^1;
```

```
sbit E=P3^2;
```

```
//////////////////////////////////DB Area
```

```
uchar code border_inf[16] = {
```

```
0xaa,0x55,0xaa,0x55,0xaa,0x55,0xaa,0x55,
```

```
0x55,0xaa,0x55,0xaa,0x55,0xaa,0x55,0xaa,
```

```
};
```

```
uchar code string[]={
```

```
0xa0,0xa1,0xa2,0xb0,0xb1,0xb2,0xc0,0xc1,0xc2,0xd0,0xd1,0xd2,0xe0,0xe1,0xe2,0xf0,
```

```
0xf1,0xf2,0xa3,0xa4,0xa5,0xb3,0xa5,0xa6
```

```
0xb6,0xc3,0xc4,0xc5,0xc6,0xd3,0xd4,0xd5,0xd6,0xe3,0xe4,0xe5,0xf3,0xf4,0xf5
```

```
};
```



```

void delay(unsigned int m)                // Delay program
{
    unsigned int i,j;
    for(i=0;i<m;i++)
        for(j=0;j<20;j++);
}

void delaysms(unsigned int n)            // Delay 10 X n Millisecond program
{
    unsigned int i,j;
    for(i=0;i<n;i++)
        {
            for(j=0;j<800;j++);
        }
}

```

```

void LcdWriteCom(uchar com)
{
    E=0;
    RW=0;
    RS=0;
    DB07=com;
    E=1;
    delay(10);
    E=0;
}

```

```

void LcdWriteData(uchar dat)
{
    E=0;
    RW=0;
    RS=1;
    DB07=dat;
    E=1;
    delay(10);
    E=0;
}

```

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```
void LcdInit()
{
    LcdWriteCom(0x38);
    LcdWriteCom(0x0c);
    LcdWriteCom(0x06);
    LcdWriteCom(0x01);
    delays(5);
}
```

```
void Show_string1(uchar a[])
{
    uchar i;
    LcdWriteCom(0x80);
    for(i=0;a[i]!='\0';i++)
    {
        LcdWriteData(a[i]);
    }
}
```

```
void Show_string2(uchar *a)
{
    uchar i;
    LcdWriteCom(0x80+0X40);
    for(i=0;i<16;i++)
    {
        LcdWriteData(a[i]);
    }
}
```

```
/****** *****
```

```
* Name: Main()
* Function: main function
* Input: None
* Output: None
```

```
*****
```

```
/
void main(void)
```



```

{
    uchar i,j;
    LcdInit();
    LcdWriteCom(0x40);
    for(i=0;i<16;i++)
    {
        LcdWriteData(border_inf[i]);
    }
    while(1)
    {
        for(j=0;j<2;j++)
        {
            LcdWriteCom(0x80);
            for(i=0;i<16;i++)
            {
                LcdWriteData(j);
            }
            LcdWriteCom(0xC0);
            for(i=0;i<16;i++)
            {
                LcdWriteData(j);
            }
            delayms(500);
        }
        Show_string1(" 12345abcefg!@ #${}%");
        Show_string2(string);
        delayms(600);
    }
}

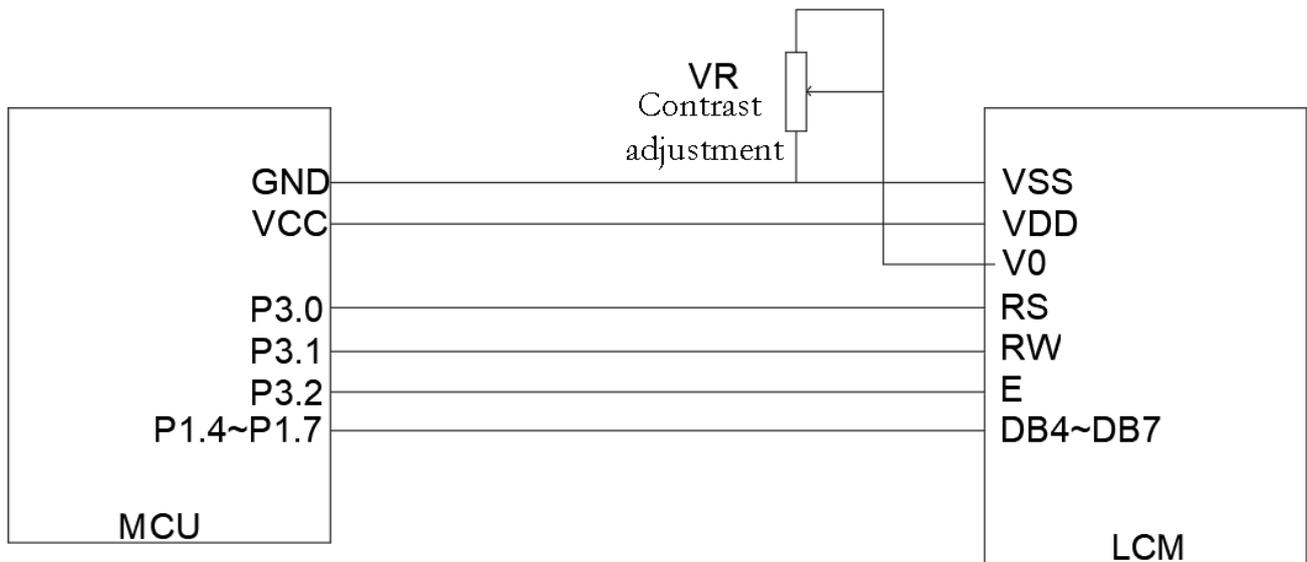
```

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3. 4 Bit wiring diagram



4 - Position wiring method

4. 4 Bit C51 Routine

```
# include <STC15.H>
```

```
# include <string.h>
```

```
# include <INTRINS.H>
```

```
# define uchar unsigned char
```

```
# define uint unsigned int
```

```
# define DB07 P1
```

```
sbit RS=P3^0;
```

```
sbit RW=P3^1;
```

```
sbit E=P3^2;
```

```
uchar code border_inf[16] = {
```

```
    0xaa,0x55,0xaa,0x55,0xaa,0x55,0xaa,0x55,
```

```
    0x55,0xaa,0x55,0xaa,0x55,0xaa,0x55,0xaa,
```

```
};
```

```
uchar code string[]={
```

```
    0xa0,0xa1,0xa2,0xb0,0xb1,0xb2,0xc0,0xc1,0xc2,0xd0,0xd1,0xd2,0xe0,0xe1,0xe2,0xf0,
```

```
    0xf1,0xf2,0xa3,0xa4,0xa5,0xb3,0xa5,0xa6
```

```
    0xb6,0xc3,0xc4,0xc5,0xc6,0xd3,0xd4,0xd5,0xd6,0xe3,0xe4,0xe5,0xf3,0xf4,0xf5
```

```
};
```

```
void delay(unsigned int m)
```

```
// Delay program
```



```
{
    unsigned int i,j;
    for(i=0;i<m;i++)
        for(j=0;j<20;j++);
}
```

```
void delaysms(unsigned int n)                // Delay 10 X n Millisecond program
```

```
{
    unsigned int i,j;
    for(i=0;i<n;i++)
        {
            for(j=0;j<800;j++);
        }
}
```

```
void LcdWriteCom(uchar com)
```

```
{
    uchar com1,com2;
    com1=com&0xf0;
    com2=(com<<4)&0xf0;
    E=0;
    RW=0;
    RS=0;
    DB07=com1;
    E=1;
    delay(10);
    E=0;
    RW=0;
    RS=0;
    DB07=com2;
    E=1;
    delay(10);
    E=0;
}
```

```
void LcdWriteData(uchar dat)
```

```
{
    uchar dat1,dat2;
    dat1=dat&0xf0;
```



```
    dat2=(dat<<4)&0xf0;
    E=0;
    RW=0;
    RS=1;
    DB07=dat1;
    E=1;
    delay(10);
    E=0;
    RW=0;
    RS=1;
    DB07=dat2;
    E=1;
    delay(10);
    E=0;
}
```

```
void LcdInit()
{
    LcdWriteCom(0x28);
    LcdWriteCom(0x0c);
    LcdWriteCom(0x06);
    LcdWriteCom(0x01);
    delays(5);
}
```

```
void Show_string1(uchar a[])
{
    uchar i;
    LcdWriteCom(0x80);
    for(i=0;a[i]!='\0';i++)
    {
        LcdWriteData(a[i]);
    }
}
```

```
void Show_string2(uchar *a)
{
    uchar i;
    LcdWriteCom(0x80+0X40);
    for(i=0;i<16;i++)
```



```

    {
        LcdWriteData(a[i]);
    }
}

```

```

/*****

```

```

* Name: Main()

```

```

* Function: main function

```

```

* Input: None

```

```

* Output: None

```

```

*****

```

```

/

```

```

void main(void)

```

```

{

```

```

    uchar i,j;

```

```

    LcdInit();

```

```

    LcdWriteCom(0x40);

```

```

    for(i=0;i<16;i++)

```

```

    {

```

```

        LcdWriteData(border_inf[i]);

```

```

    }

```

```

    while(1)

```

```

    {

```

```

        for(j=0;j<2;j++)

```

```

        {

```

```

            LcdWriteCom(0x80);

```

```

            for(i=0;i<16;i++)

```

```

            {

```

```

                LcdWriteData(j);

```

```

            }

```

```

    LcdWriteCom(0xC0);

```

```

    for(i=0;i<16;i++)

```

```

    {

```

```

        LcdWriteData(j);

```

```

    }

```

```

    delayms(500);

```

```

    }

```

```

    Show_string1(" 12345abcefg!@ #${}%");

```

```

    Show_string2(string);

```



delays(600);

}

}

5. Font

b7-b4 b3-b0	0000	0001	0010	0011	0100	0101	0110	0111	1000	1001	1010	1011	1100	1101	1110	1111
0000	CG RAM (1)			0	@	P	^	F				-	9	3	o	p
0001	(2)	!	1	A	Q	a	a				.	7	7	4	ã	q
0010	(3)	"	2	B	R	b	r				7	7	9	x	p	o
0011	(4)	#	3	C	S	c	s				7	7	7	e	e	*
0100	(5)	\$	4	D	T	d	t				7	7	7	f	u	o
0101	(6)	%	5	E	U	e	u				.	*	*	1	o	o
0110	(7)	&	6	F	V	f	v				7	7	7	7	p	z
0111	(8)	*	7	G	W	g	w				7	7	7	7	g	a
1000	(1)	(8	H	X	h	x				4	7	*	7	7	z
1001	(2))	9	I	Y	i	y				o	7	7	7	7	y
1010	(3)	*	:	J	Z	j	z				z	7	7	7	7	7
1011	(4)	+	;	K	L	k	l				*	7	7	7	7	7
1100	(5)	,	<	L	*	l	l				*	7	7	7	7	7
1101	(6)	-	=	M	1	m	1				z	7	7	7	7	7
1110	(7)	.	>	N	^	n	^				z	7	7	7	7	7
1111	(8)	/	?	O	_	o	_				w	7	7	7	7	7



Precautions

1. LCD Monitor(LCD

The liquid crystal display is made of glass, organic sealant, organic fluid, and polymer-based polarizer. Pay attention to the following items when handling:

- (1 .) Keep the temperature within the range of use and storage. Excessive temperature and humidity can cause polarization degradation, polarizer peeling or air bubbles.
- (2 .) Don't use more than HB The harder pencil lead touches the exposed polarizer. Remove the dust on the surface of the display, use cotton Wipe, deerskin towel or other soft material soaked in cleaning oil.
- (3) Wipe off saliva or water droplets immediately. ITO Prolonged contact with water can cause deformation or discoloration of the LCD surface.
- (4) The glass is easily broken due to rough handling. Especially in the corners and edges.
- (5) Do not use DC voltage to drive the LCD.

2. LCD module

2.1 Mechanical considerations

LCM The assembly and adjustment of the machine have high precision. Avoid excessive vibration and do not make any changes or modifications. The following points should be noted.

- (1) Do not change the lugs on the metal frame in any way.
- (2) .Do not modify by drilling extra holes, changing its outline, moving its components or modifying its pattern PCB .
- (3) . Do not touch the elastomer connector, especially when inserting the backlight panel (for example, EL).
- (4) .Install LCM When, make sure PCB The board is not subject to any pressure, such as bending or twisting. The elastomer contact is very fine, any element A slight misalignment of pixels may cause pixel deletion.
- (5) . Avoid pressing on the metal baffle, otherwise the elastomer connector may deform and lose contact, resulting in loss of pixels.

2.2. Static electricity

LCM contain CMOS LSI , The same precautions should be taken for such equipment, namely

- (1) When the operator touches the module, it should be grounded. Do not touch any conductive parts with any part of the human body, such as LSI weld plate, PCB Copper wires and interface terminals on the
- (2) The module should be stored in an anti-static bag or other anti-static container.
- (3) . Only use a soldering iron that is properly grounded.
- (4) If you use an electric screwdriver, it should be well grounded and prevent sparks from the commutator.
- (5) . Work clothes and workbenches should follow normal anti-static measures; for the latter, conductive (rubber) pads are recommended.
- (6) . Since dry air will induce static electricity, the recommended relative humidity is 50-60% .

2.3. welding

- (1) .Only welded to I/O Terminal.
- (2) . Only use a soldering iron that is properly grounded and has no leakage current.
- (3) .Welding temperature: $280\text{ }^{\circ}\text{C}\pm 10\text{ }^{\circ}\text{C}$
- (4) .Welding time: 3 To 4 second.
- (5) . Low temperature solder filled with resin flux.
- (6) . If flux is used, it should be covered LCD Surface to avoid flux spatter. Flux residues should be removed after protection.

2.4. operating

- (1) The viewing angle can be changed by LCD Drive voltage V_0 To adjust.
- (2) The driving voltage should be kept within the specified range, too high voltage will shorten the life of the display. (3) Response time increases with The temperature decreases and increases.
- (4) . At a temperature higher than its operating range, the display may turn black or dark blue; this (but do not press the display area Domain) may cause some of the displayed line segments to "break".
- (5) . Mechanical damage during operation (such as pressing the display area) may cause the line segment to "break".

2.5. store

If liquid leaks from the damaged glass battery, wash any parts of the human body that come into contact with soap and water. Do not swallow liquid body. Very low toxicity, but you should always be careful.



2.6. Limited warranty

Unless otherwise agreed with the customer, within one year from the date of shipment, when electrical and appearance defects are found during inspection according to the acceptance criteria, the Repair or repair any of its LCD with IC , The confirmation of this date should be based on the shipping documents, and the warranty liability is limited to Repairs and/or replacements performed. Will not be responsible for any subsequent or consequential events.

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