(ISO9001:2008)

字符型液晶显示模组

型　　号：HC1624-LYH

版　　本：A

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版本.	日期	内容	备注
A	2010.07.20	第一版	

产品编码规则

HG 320240 C – B - LW H- NV- L4- TPSD- U- T

(1) (2) (3) (4) (5) (6) (7) (8) (9) (10) (11)

(1):产品序列号
- HC→字符
- HG→SMT/COB 图形单色
- HGT→TAB 图形单色
- HGO→COG 图形单色
- HGR→ COLOR STN
- HGF→TFT
- HGS→OLED
- HCS→字符型 OLED

(2):规格
- 字符→字符数/每行*行数
- 图形→点/每行*点/每列

(3):产品序列号

(4):显示模式

LCD 模块：
- 省略→STN 黄绿模式
- G→STN 灰模式
- B→STN 蓝模式
- F→FSTN 半透半反
- T→FSTN 透射

OLED 模块：
- Y→黄字
- G→绿字
- B→蓝字
- W→白字

(5):背光类型
- 省略→无背光
- LY→LED 黄绿底光
- SY→LED 黄绿侧光
- LW→LED 白光
- SW→LED 超亮白光
- LB→LED 蓝光
- LR→LED 红光
- LA→LED 琥珀光
- LG→LED 绿光
- EB→EL 蓝光
- EG→EL 绿光
- EW→EL 白光
- CW→CCFL 白光

(6):温度范围
- 省略→常温
- H→宽温
- EH→特宽温

(7):电源
- 省略→5V 单电源
- NV→5V 双电源
- SV→5V 带温度补偿
- LV→3.0/3.3V 单电源
- LNV→3.0/3.3V 双电源
- LSV→3.0/3.3V 带温度补偿
- OV→单电源，V0 不接

(8):背光输入电压说明，请参照液晶详细资料

(9):特殊编号
- 省略→无触摸屏/并行/全屏
- TP→带触摸屏
- S→串行通信
- D→分屏

(10):视角
- 省略→6:00
- U→12:00
- L→9:00
- R→3:00

(11):内部编号

目录

1. 简介

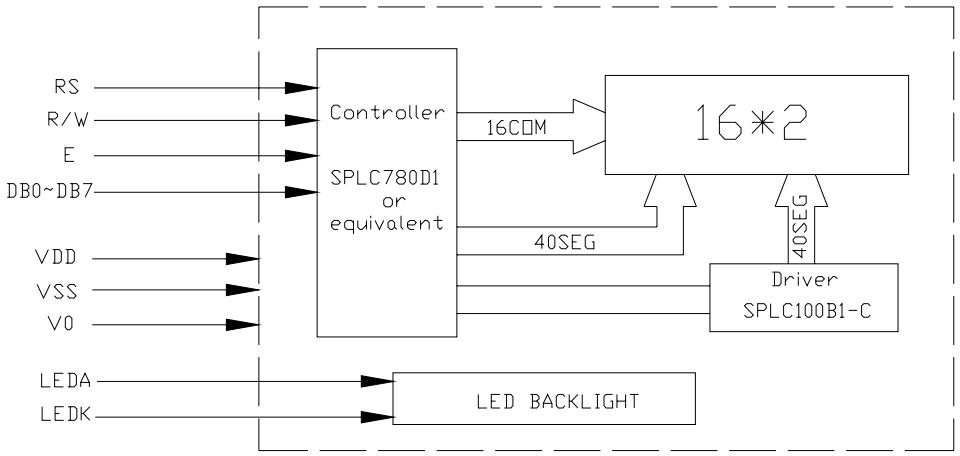
1.1 模块规格

项目	规格
显示类型	STN/黄绿色/正性/半透
颜色	显示像素: 蓝黑色
	显示背景: 黄绿色
数据输入格式	68 并行数据
占空比	1/16 占空比
视角	6 点
驱动 IC	SPLC780D1-001A 或兼容 IC
外壳	0.6T
背光	LED 黄绿光
工作温度	-20 °C ~70 °C
存储温度	-30 °C ~ 80 °C
其他	

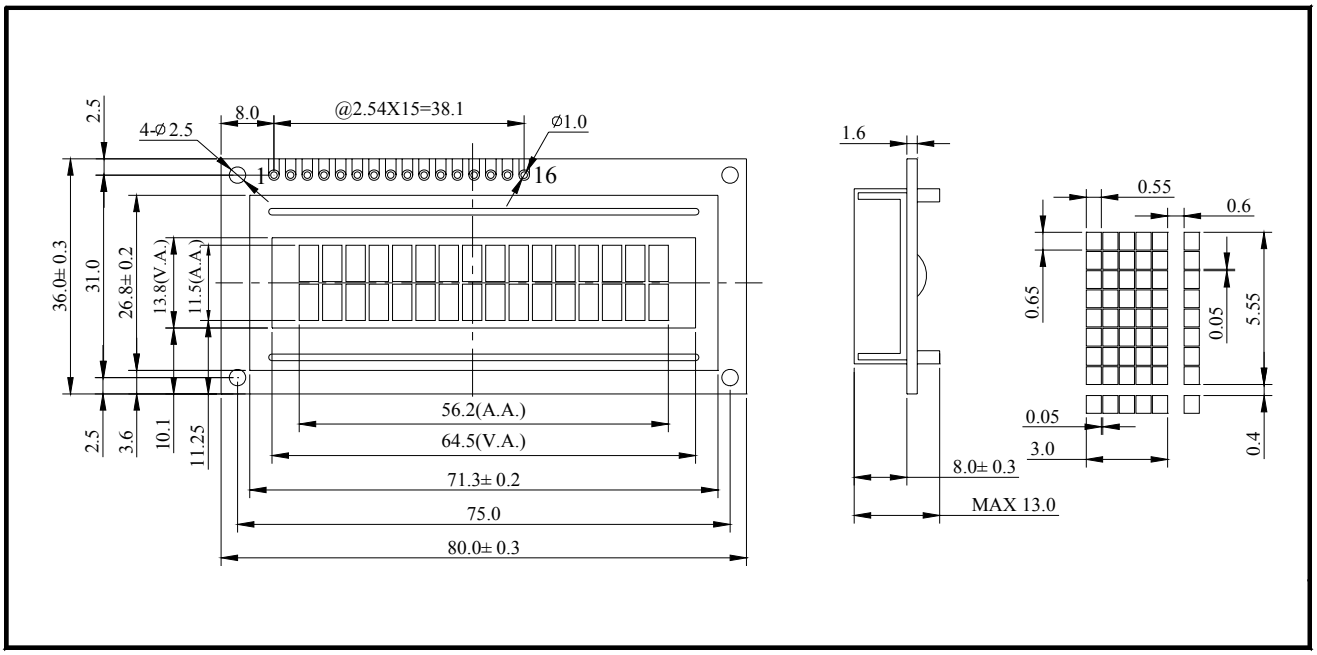
1.2 尺寸规格

项目	规格	单位	备注
外形尺寸	80.0(W)×36.0(H)×13.0MAX.(T)	mm	
可视区	64.5(W)×13.8(H)	mm	
有效区	56.2(W)×11.5(H)	mm	
点阵	16Characters×2Lines	---	
字符大小	3.00(W)×5.55(H)	mm	
点大小	0.55(W)×0.65(H)	mm	

1.3 原理结构图



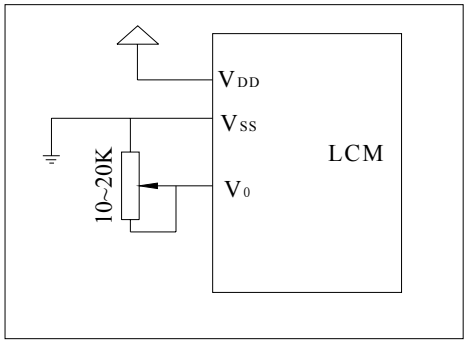
1.4 模块外形图



1.5 接口定义

编号	符号	电平	功能
1	V_{SS}	0V	接地
2	V_{DD}	+5.0V	逻辑电压
3	V_0	-	LCD 驱动电压
4	RS	H/L	H: 数据 L: 指令
5	R/W	H/L	H: 读 L: 写
6	E	H-L	使能信号
7~14	DB0~DB7	H/L	数据线
15	LEDA	+5.0V	LED 背光源输入电压
16	LEDK	0V	

1.5 对比度调整电路



2. 极限参数

（Ta=25 °C, VSS=0V）

参量	符号	范围	单位
电源电压	VDD-VSS	-0 .3~ 7.0	V
LCD 驱动电压	VDD～V5	0 ~ 10.0	V
输入电压	VIN	VSS ~ VDD	V
工作温度	Topr	-20 ~70	°C
存储温度	Tstg	-30 ~ 80	°C

3. 电气特性

3.1 电特性

（Ta=25 °C ,VSS=0V）

项目	符号	条件	最小值	典型值	最大值	单位	备注
逻辑工作电压	VDD –VSS	--	4.5	5.0	5.3	V	
输入低电平	VIL	--	-0.3	--	0.6	V	
输入高电平	VIH	--	2.2	--	VDD	V	
输出低电平	VOL	--	0	--	0.4	V	
输出高电平	VOH	--	2.4	--	VDD	V	
逻辑工作电流	IDD	VDD –VSS =5.0V	--	1.1	--	mA	
LCD 驱动电压	*VLCD Φ=0 θ=0	Ta=25 °C	--	5.0	--	V	

3.2 LED 背光规格

项目	符号	最小值	典型值	最大值	单位	条件
工作电压 **	Vf	4.0	4.1	4.2	V	If=100 mA
颜色	黄绿色					

**客户使用模块时只需从接口加入+5.0V 电压即可，无需再加限流电路，因为内部已经设计有限流电路。

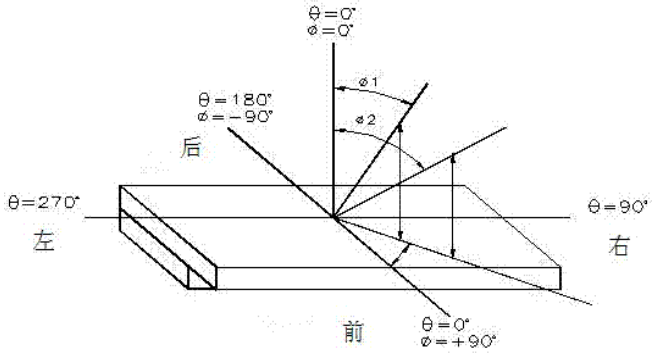
3.3 光电特性

（Ta=25 °C ，VDD=5.0V）

项目	符号	条件	最小值	典型值	最大值	单位	备注
视角	ϕ2-ϕ1	K≥3	--	50	--	DEG	1、2
对比度	K	ϕ =0°,θ=0°	3	5	--	--	3
帧频率				70		Hz	
响应时间	Tr(rise)	ϕ =0°,θ=0°	--	250	350	ms	
	Tf(fall)	ϕ =0°,θ=0°	--	250	350	ms	4

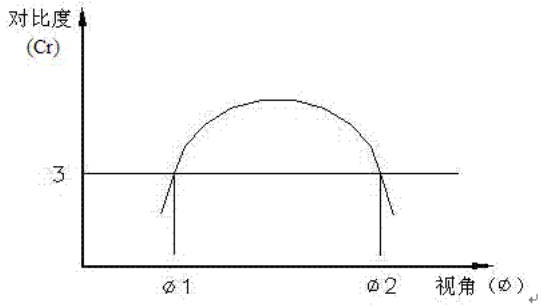
备注：

1: 视角 θ, ϕ 的定义：

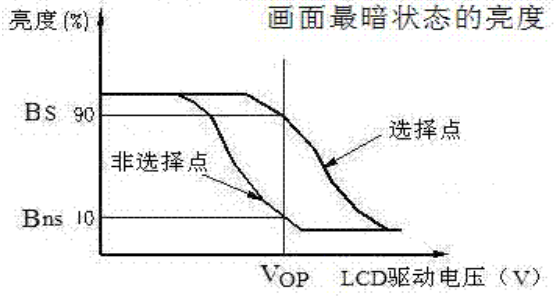


2: 视角范围的定义 Δϕ=|ϕ 2-ϕ 1|

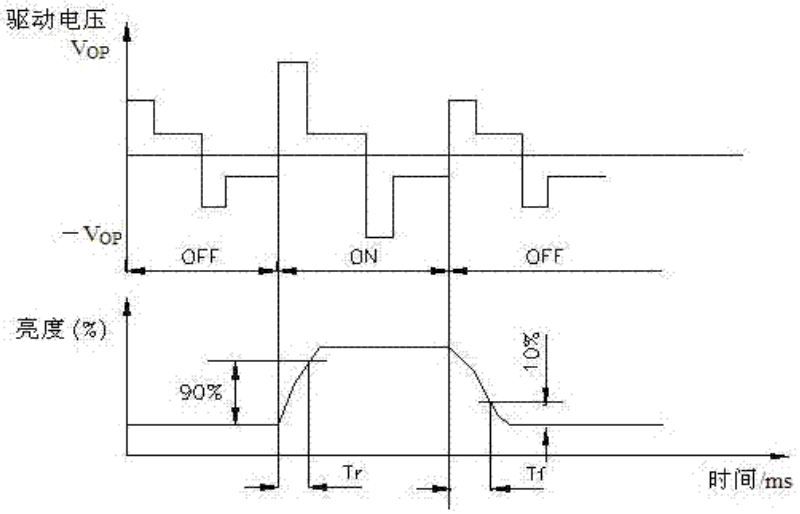
3: 对比度的定义



$$Cr = \frac{\text{画面最亮状态的亮度 [Bs]}}{\text{画面最暗状态的亮度 [Bns]}}$$



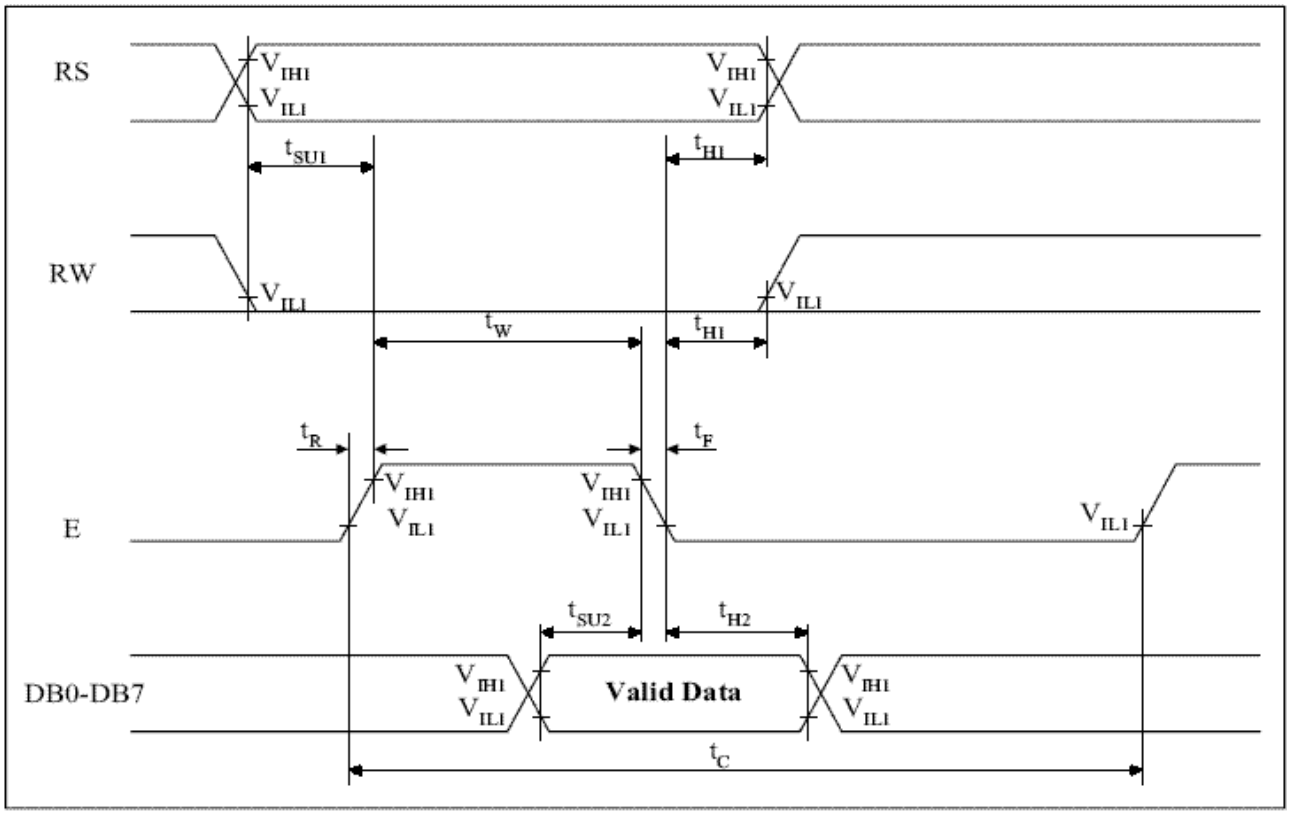
4: 响应时间的定义



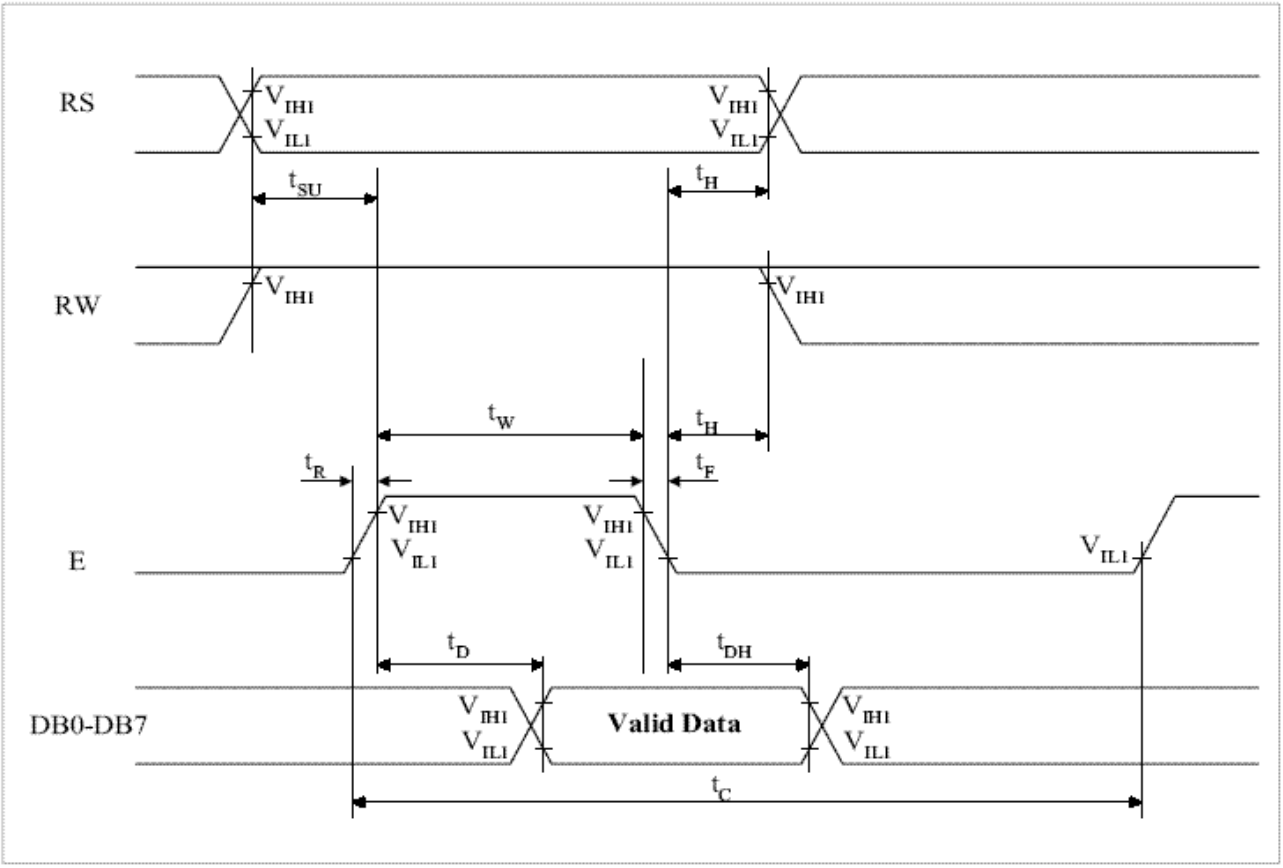
4.时序说明

(V_{DD} = 4.5V~5.5V, Ta = -30~+85℃)

Mode	Characteristic	Symbol	Min.	Typ.	Max.	Unit
Write mode (refer to Fig.6)	E cycle time	t_C	500	-	-	ns
	E rise/fall time	t_R, t_F	-	-	20	
	E pulse width (high, low)	t_W	230	-	-	
	R/W and RS setup time	t_{SU1}	40	-	-	
	R/W and RS hold time	t_{H1}	10	-	-	
	Data setup time	t_{SU2}	60	-	-	
	Data hold time	t_{H2}	10	-	-	
Read mode (refer to Fig.7)	E cycle time	t_C	500	-	-	ns
	E rise/fall time	t_R, t_F	-	-	20	
	E pulse width (high, low)	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 hold time	t_{DH}	5	-	-	



Write mode timing diagram



Read mode timing diagram

5. 控制器指令及功能介绍

System Interface

This chip has all two kinds of interface type with MPU: 4-bit and 8-bit bus.
4-bit bus and 8-bit bus is selected by DL bit in the instruction register.

During read or write operation, two 8-bit registers are used. One is data register (DR), the other is instruction register (IR).

The data register (DR) is used as temporary data storage place for being written into or read from DDRAM/CGRAM, target RAM is selected by RAM address setting instruction. Each internal operation, reading from or writing into RAM, is done automatically. So to speak, after MPU reads DR data, the data in the next DDRAM/CGRAM address is transferred into DR automatically. Also after MPU writes data to DR, the data in DR is transferred into DDRAM/CGRAM automatically.

The Instruction register (IR) is used only to store instruction code transferred from MPU. MPU cannot use it to read instruction data.

To select register, use RS input pin in 4-bit/8-bit bus mode.

Table 1. Various kinds of operations according to RS and R/W bits.

RS	R/W	Operation
L	L	Instruction Write operation (MPU writes Instruction code into IR)
L	H	Read Busy Flag (DB7) and address counter (DB0~DB6)
H	L	Data Write operation (MPU writes data into DR)
H	H	Data Read operation (MPU reads data from DR)

MSB						LSB
AC6	AC5	AC4	AC3	AC2	AC1	AC0

Fig.1. DDRAM Address

1) 1 line display

In case of 1 line display, the address range of DDRAM is 00H ~ 4FH. Extension driver will be used. Fig.2 shows the example that 40 segment extension driver is added.

2) 2 line display

In case of 2 line display, the address range of DDRAM is 00H ~ 27H, 40H ~ 67H. Extension driver will be used. Fig.3 shows the example that 40 segment extension driver is added.

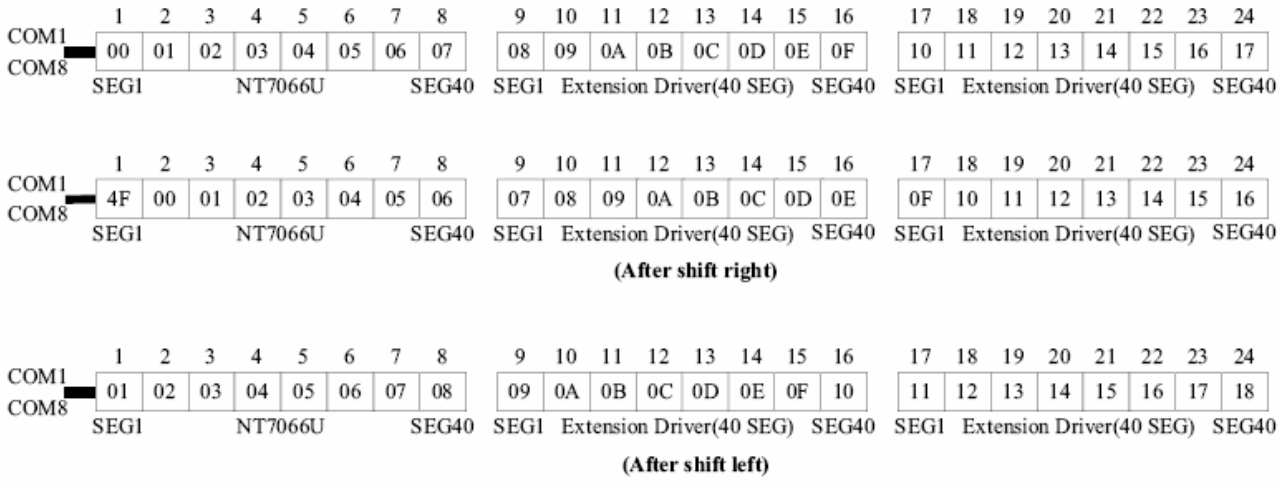


Fig.2. 1-line X 24ch, display with 40 SEG & extension driver.

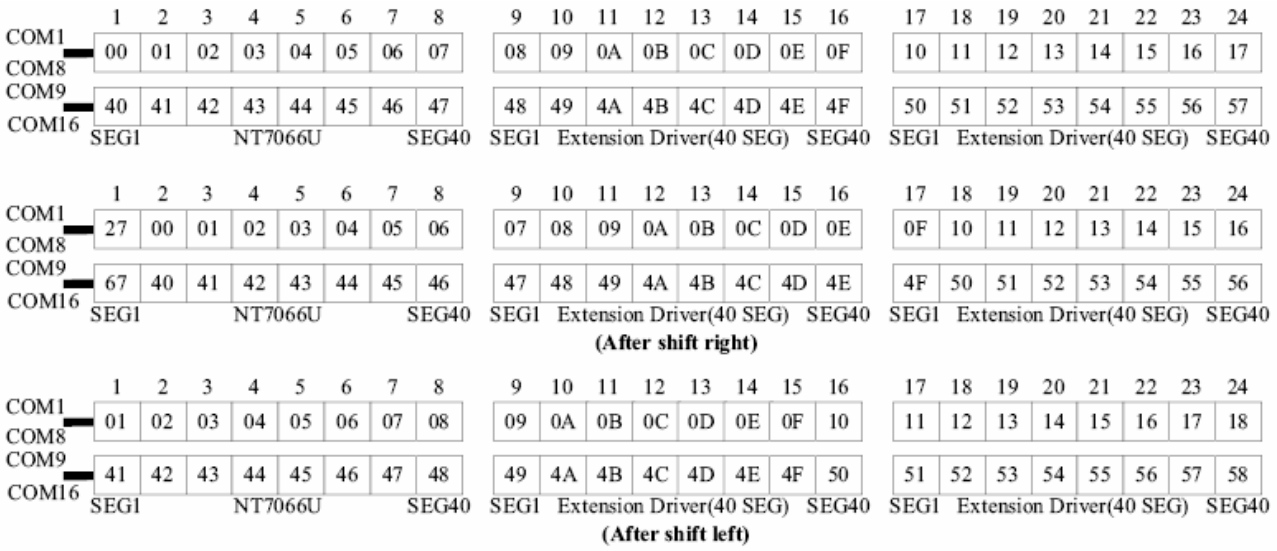


Fig.3. 2-line X 24ch, display with 40 SEG & extension driver.

CGROM (Character Generator ROM)
CGROM has 5 x 8 dot, 208 character, 5 x 11 dot, 32 characters pattern. (Refer to Table 2)

CGRAM (Character Generator RAM)
CGRAM has up to 5 x 8 dot, 8 characters. By writing font data to CGRAM, user defined character can be used. (Refer to Table 3)

Timing Generation Circuit
Timing generation circuit generates clock signals for the internal operations.

Cursor/Blink Control Circuit
It controls cursor/blink ON/OFF at cursor position.

Table 2. Standard Character pattern (SPLC780D1-001A)

Table 3. Relationship between Character Code(DDRAM) and Character pattern(CGRAM)

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	Pattern 1
				.					.		0	0	1		.		1	0	0	0	1	
				.					.		0	1	0		.		1	0	0	0	1	
				.					.		0	1	1		.		1	1	1	1	1	
				.					.		1	0	0		.		1	0	0	0	1	
				.					.		1	0	1		.		1	0	0	0	1	
				.					.		1	1	0		.		1	0	0	0	1	
				.					.		1	1	1		.		0	0	0	0	0	
				.					.			.						.				.
				.					.			.						.				.
				.					.			.						.				.
0	0	0	0	X	1	1	1	1	1	1	0	0	0	X	X	X	1	0	0	0	1	Pattern 8
				.					.		0	0	1		.		1	0	0	0	1	
				.					.		0	1	0		.		1	0	0	0	1	
				.					.		0	1	1		.		1	1	1	1	1	
				.					.		1	0	0		.		1	0	0	0	1	
				.					.		1	0	1		.		1	0	0	0	1	
				.					.		1	1	0		.		1	0	0	0	1	
				.					.		1	1	1		.		0	0	0	0	0	

"X": don't care

INTRODUCTION DESCRIPTION

OUTLINE

To overcome the speed difference between internal clock of NT7066U and MPU clock, NT7066U performs internal operation by storing control information to IR or DR. The internal operation is determined according to the signal from MPU, composed of read/write and date bus. (Refer to Table 5). Instruction can be divided largely four kinds,

(1) NT7066U function set instructions (set display methods, set data length, etc.)
(2) Address set instructions to internal RAM
(3) Data transfer instructions with internal RAM
(4) Others instructions.

The address of internal RAM is automatically increased or decreased by 1.

*Note: During internal operation, Busy Flag (DB7) is read High. Busy Flag check must precede the next instruction.

Contents

1) Clear Display

RS	RW	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0
0	0	0	0	0	0	0	0	0	1

Clear all the display data by writing "20H" (space code) to all DDRAM address, and set DDRAM address to "00H" into AC (address counter). Return cursor to the original status. Namely, bring the cursor to the left edge on first line of the display. Make entry mode increment (I/D = "1").

2) Return Home

RS	RW	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0
0	0	0	0	0	0	0	0	1	-

Return Home is cursor return home instruction. Set DDRAM address to "00H" into the address counter. Return cursor to its original site and return display to its original status, if shifted. Contents of DDRAM do not change.

3) Entry Mode Set

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

Set the moving direction of cursor and display.

I/D: Increment / decrement of DDRAM address (cursor or blink)
When I/D = "High", cursor/blink moves to right and DDRAM address is increased by 1.
When I/D = "Low", cursor/blink moves to left and DDRAM address is decreased by 1.
* CGRAM operates the same as DDRAM, when read from or write to CGRAM.

SH: Shift of entire display
When DDRAM read (CGRAM read / write) operation or SH = "Low", shift of entire display is not performed. If SH = "High" and DDRAM write operation, shift of entire display is performed according to I/D value (I/D ="1" : shift left, I/D = "0" : shift right).

4) Display ON/OFF Control

RS	RW	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0
0	0	0	0	0	0	1	D	C	B

Control display / cursor / blink ON / OFF 1 bit register.

D: Display ON / OFF control bit
When D = "High", entire display is turned on.
When D = "Low", display is turned off, but display data is remained in DDRAM.

C: Cursor ON / OFF control bit
When C = "High", cursor is turned on.
When C = "Low", Cursor is disappeared in current display, but I/D register remains its data.

B: Cursor Blink ON / OFF control bit

When B = "High", cursor blink is on, that performs alternate between all the high data and display character at the cursor position.

When B = "Low", blink is off.

5) Cursor or Display Shift

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

Without Writing or reading of display data, shift right/left cursor position or display. This instruction is used to correct or search display data. (refer to Table 4) During 2-line mode display, cursor moves to the 2nd line after 40th digit of 1st line. Note that display shift is performed simultaneously in all the line. When displayed data is shifted repeatedly, each line shifted individually. When display shift is performed, the contents of address counter are not changed.

Table 4. Shift patterns according to S/C and R/L bits

S/C	R/L	Operation
0	0	Shift the cursor to the left, AC is decreased by 1.
0	1	Shift the cursor to the right, AC is increased by 1.
1	0	Shift all the display to the left, cursor moves according to the display.
1	1	Shift all the display to the right, cursor moves according to the display.

6) Function Set

RS	RW	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0
0	0	0	0	1	DL	N	F	-	-

DL: Interface data length control bit

When DL = "High", it means 8-bit bus mode with MPU.

When DL = "Low", it means 4-bit bus mode with MPU. So to speak, DL is a signal to select 8-bit or 4-bit mode.

When 4-bit bus mode, it needs to transfer 4-bit data by two times.

N: Display line number control bit

When N = "Low", it means 1-line display mode.

When N = "High", 2-line display mode is set.

F: Display font type control bit

When F = "Low", it means 5 x 8 dots format display mode

When F = "High", 5 x11 dots format display mode.

7) Set CGRAM Address

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

Set CGRAM address to AC. This instruction makes CGRAM data available from MPU.

8) Set DDRAM Address

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

Set DDRAM address to AC.
This instruction makes DDRAM data available from MPU. When 1-line display mode (N = 0), DDRAM address is from "00H" to "4FH". In 2-line display mode (N = 1), DDRAM address is the 1st line is from "00H" to "27H", and DDRAM address in the 2nd line is from "40H" to "67H".

9) Read Busy Flag & Address

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

This instruction shows whether NT7066U is in internal operation or not. If the resultant BF is High, it means the internal operation is in progress and you have to wait until BF to be Low, and then the next instruction can be performed. In this instruction you can read also the value of address counter.

10) Write data to RAM

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

Write binary 8-bit data to DDRAM/CGRAM.
The selection of RAM from DDRAM, CGRAM, is set by the previous address set instruction: DDRAM address set, CGRAM address set. RAM set instruction can also determine the AC direction to RAM. After write operation, the address is automatically increased/decreased by 1, according to the entry mode.

11) Read data from RAM

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

Read binary 8-bit data from DDRAM/CGRAM.
The selection of RAM is set by the previous address set instruction. If address set instruction of RAM is not performed before this instruction, the data that read first is invalid, because the direction of AC is not determined. If you read RAM data several times without RAM address set instruction before read operation, you can get correct RAM data from the second, but the first data would be incorrect, because there is no time margin to transfer RAM data.
In case of DDRAM read operation, cursor shift instruction plays the same role as DDRAM address set instruction : it also transfer RAM data to output data register. After read operation address counter is automatically increased/decreased by 1 according to the entry mode. After CGRAM read operation, display shift may not be executed correctly.
* In case of RAM write operation, after this AC is increased/decreased by 1 like read operation. In this time, AC indicates the next address position, but you can read only the previous data by read instruction.

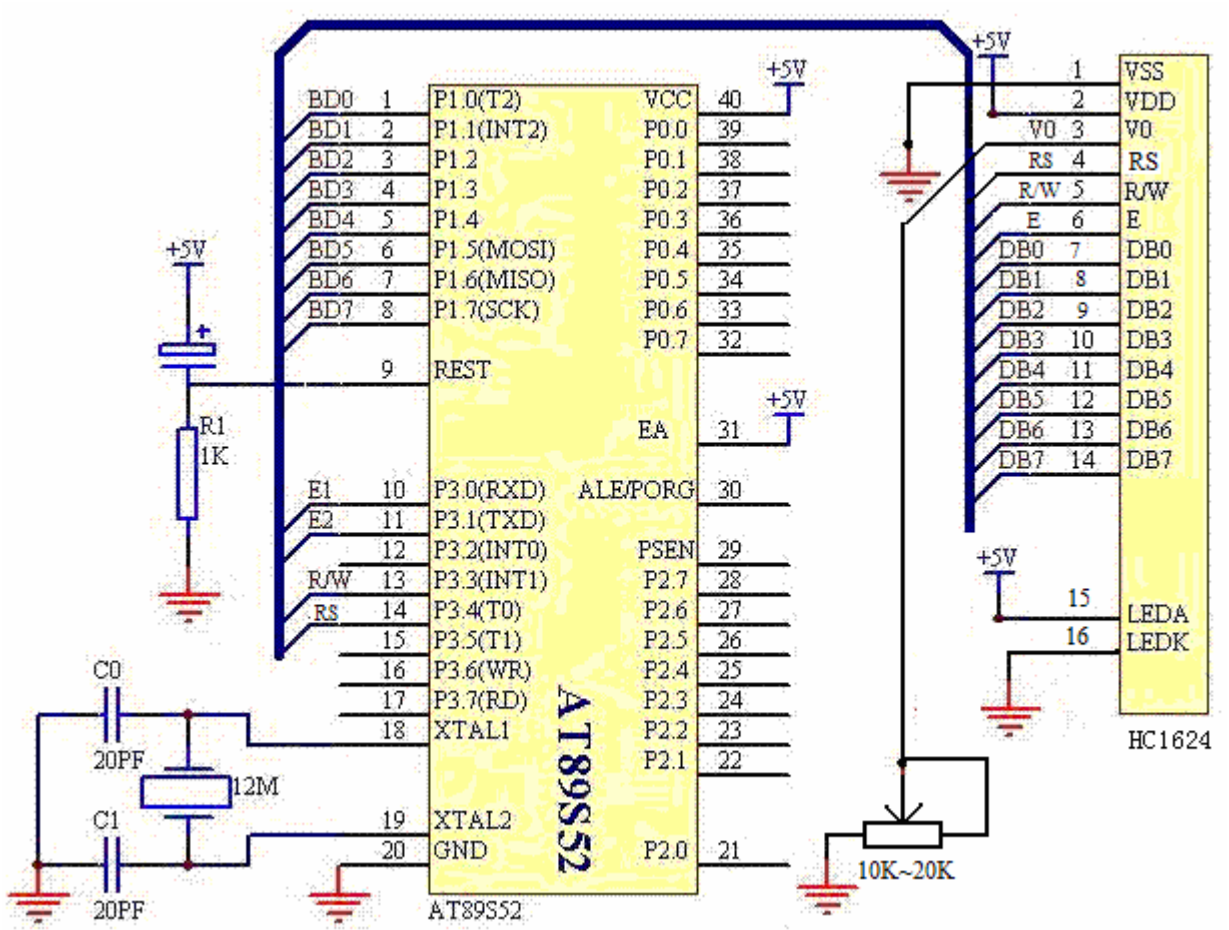
Table 5. Instruction Table

Instruction	Instruction Code										Description	Execution time (f_{OSC}=270K Hz)
	RS	R/W	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0		
Clear Display	0	0	0	0	0	0	0	0	0	1	Write "20H" to DDRAM and set DDRAM address to "00H" from AC.	1.52ms
Return Home	0	0	0	0	0	0	0	0	1	X	Set DDRAM address to "00H" from AC and return cursor to its original position if shifted. The contents of DDRAM are not changed.	1.52ms
Entry Mode Set	0	0	0	0	0	0	0	1	I/D	SH	Assign cursor moving direction and make shift of entire display enable.	37 μ s
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.	37 μ s
Cursor or Display Shift	0	0	0	0	0	1	S/C	R/L	X	X	Set cursor moving and display shift control bit, and the direction, without changing DDRAM data.	37 μ s
Function Set	0	0	0	0	1	DL	N	F	X	X	Set interface data length(DL:4-bit/8-bit), numbers of display line(N: 1-line/2-line), display font type(F: 5X8 dots/ 5X11 dots)	37 μ s
Set CGRAM Address	0	0	0	1	AC5	AC4	AC3	AC2	AC1	AC0	Set CGRAM address in address counter.	37 μ s
Set DDRAM Address	0	0	1	AC6	AC5	AC4	AC3	AC2	AC1	AC0	Set DDRAM address in address counter.	37 μ s
Read Busy Flag and Address	0	1	BF	AC6	AC5	AC4	AC3	AC2	AC1	AC0	Whether during internal operation or can not be known by reading BF. The contents of address counter can also be read.	0 μ s
Write Data to RAM	1	0	D7	D6	D5	D4	D3	D2	D1	D0	Write data into internal RAM (DDRAM/CGRAM).	43 μ s
Read Data from RAM	1	1	D7	D6	D5	D4	D3	D2	D1	D0	Read data from internal RAM (DDRAM/CGRAM).	43 μ s

"X": don't care

6.应用参考示例

（1）应用电路：



（2）示例程序

```
#include<reg51.h>
#include <string.h>

#define uchar unsigned char
#define uint unsigned int
#define data  P1
sbit rs   = P3^0 ;
sbit rw    = P3^1 ;
sbit e    = P3^3;
uchar code name1[]={"010340608"} ;
uchar code name2[]={"work in jia xian"} ;
uchar code CGR[]={
0x08,0x0f,0x12,0x0f,0x0a,0x1f,0x02,0x02,
0x0f,0x09,0x0f,0x09,0x0f,0x09,0x0b,0x11,
0x0f,0x09,0x09,0x09,0x0f,0x09,0x09,0x0f,
0x15,0x15,0x15,0x15,0x15,0x15,0x15,0x15,
0x1f,0x00,0x1f,0x00,0x1f,0x00,0x1f,0x00,0xf
f};
uchar code ch[]={
'2','0','1','0',0x08,'9',0x09,'8',0x0a,0x00
}  ;

void delay(uint z)
{
uint x,y;
for(x=z;x>0;x--)
for(y=124;y>0;y--);
}

void wait(void)
{
 data=0xff;
```

```
 rs=0;
 rw=1;
 e=1;
 while(data&0x80) ;
 e=0;
}

void wr_data(uchar b)
{
 wait();
 rs=1;
 rw=0;
 data=b;
 e=1;
 e=0;
}

uchar rd_data(void)
{
 int temp;
 wait();
 data=0xff;
 rs=1;
 rw=1;
 e=1 ;
 temp=data;
 e=0;
 return temp;
}

void wr_com(uchar com)
{
wait();
rs=0;
rw=0;
data=com;
e=1;
e=0;
}

uchar rd_com(void)
{
 int temp;
 wait();
 data=0xff;
 rs=0;
 rw=1;
 e=1 ;
 temp=data;
 e=0;
 return temp;
}

void  dot(uchar x,uchar y)
{
y&=0x1;
x&=0xf;
if(y) x|=0x40;
x|=0x80;
wr_com(x);
}

void disp(uchar x,uchar y,uchar code  * s)
{
 y&=0x1;
 x&=0xf;
while(*s>0&&x<16)
 {
  dot(x,y);
  wr_data(*s);
  s++;
  x++;
  delay(1000);
 }
}

 void  fill(uchar z)         //全屏
 {
 char x,y ;
 for(y=0;y<2;y++)
    for(x=0;x<16;x++)
    {
    dot(x,y);
    wr_data(z);
    }
 }

 void en_c_l(uchar x,uchar y,uchar code  * s)
//输入方式光标左移 ,x 设置时注意从右边开始写
 {uchar n=strlen(s);
```

```
  wr_com(0x04);
  y&=0x1;
  x&=0xf;
  dot(x,y);
  while(n>0 &&x<16)
   {
   wr_data(*(s+n-1));
   n--;
   x--;
   delay(50);
   }
  }

void en_c_r(uchar x,uchar y,uchar code  * s)
//输入方式光标右移 ,x 设置时注意从左边开始写
 {
  wr_com(0x06);
  y&=0x1;
  x&=0xf;
  dot(x,y);
  while(*s>0&&x<16)
   {
   wr_data(*s);
   s++;
   x++;
   delay(50);
   }
  }

void en_disp_l(uchar x,uchar y,uchar code  *
s)   //输入方式画面左滚动， xy 的地址是光标所
在位置，字符始终在光标左边。
 {uchar i=40;        //最多输入 40 个字符
  wr_com(0x07);
  y&=0x1;
  x&=0xf;
  dot(x,y);
  while(*s>0&&i--)
 {
   if(x==40) dot(0,y);//让光标跟随画面的变化
   wr_data(*s);
   s++;
   x++;
   delay(300);
   }
  }
 void en_disp_r(uchar x,uchar y,uchar code  *
s)    //输入方式画面右滚动，字符在光标右边
 {
  uchar n=strlen(s);
  uchar i=40;
  wr_com(0x05);
  y&=0x1;
  x&=0xf;
  dot(x,y);
  while(n>0&&i--)
 {
   if(x==0xff) {if(y) wr_com(0xe7);
              else wr_com(0xa7);
              }
   wr_data(*(s+n-1));
   n--;
   x--;
   delay(300);
   }
  }

void c_l(uchar n)       //光标左滚动
{
 while(n--)
  {
   wr_com(0x10);
   delay(300);
   }
 }

void c_r(uchar n)        //光标右滚动
{
 while(n--)
  {
   wr_com(0x14);
   delay(300);
   }
 }

void disp_l(uchar n)     //画面左滚动
{
 while(n--)
  {
   wr_com(0x18);
```

```
    delay(300);
    }
 }
void disp_r(uchar n)        //画面右滚动
{
 while(n--)
  {
   wr_com(0x1c);
   delay(300);
   }
 }

//建立自定义字符库
void CGR_SET(uchar code *s)
{
 uchar i=0;
 while(*s!=0xff&i<=64)
  {
   wr_com(0x40+i);
   wr_data(*s);
   s++;
   i++;
  }
}

void free_c(uchar comp)  //游标演示程序
{
 uchar com;
 com=rd_com();
 while(com!=comp)
   {
    if(com>comp)
      {
       wr_com(0x04);
       wr_data(0x20);
       delay(300);
      }
    else if(com<comp)
           {
            wr_com(0x06);
            wr_data(0xff);
            delay(300);
           }
     com=rd_com();
   }
 }

 //修改数据演示程序
void mod(uchar old,uchar new)
{
 uchar i=0,j;
 wr_com(0x06);
 while(i<80)
   {
    if(i>=40) wr_com(0x80+24+i);
    else      wr_com(0x80+i);
    j=rd_data();
    if(j==old)
       {
       delay(1000);
        c_l(1);
        wr_data(new);
       }
     i++;
     delay(100);
   }
}

void init(void)
{

 wr_com(0x3c);
 delay(1);
  wr_com(0x0c);
 delay(1);
 wr_com(0x01);
 delay(2);
  wr_com(0x06);
 }

/*void init(void)
{ delay(15);
  wr_comn(0x38);
  delay(5);
  wr_comn(0x38);
  delay(5);
  wr_comn(0x38);
  wr_com(0x38);
  wr_com(0x08);
  wr_com(0x01);
```

```
  wr_com(0x06);
  wr_com(0x0c);
}*/

main()
{
uchar i ;
init();
while(1)
  {
    for(i=0x30;i<0x32;i++)
    {
    fill(i);
      delay(500);
      }
CGR_SET(CGR);
fill(0xff)  ;      //全屏
delay(1000);
wr_com(0x01);     //清屏
delay(1000);
fill(0x0b)  ;     //隔列
delay(1000);
fill(0x0c);      //隔行
delay(1000);
  }
}
```

7. 质量标准

7.1 合格质量标准

检验项目	检测标准	AQL
电气特性	GB2828-81 检测水平 II 常规检测 单个样品检测	0.65
非电气特性	GB2828-81 检测水平 II 常规检测 单个样品检测	1.5
尺寸测量	GB2828-81 检测水平 II 常规检测 单个样品检测	1.5

7.2 检验环境条件

- 室温: 25±3 °C
- 湿度: 65±20%RH

7.3 检验标准

7.3.1 加电检测

检测项目	检测标准
无显示	任何像素有不显示的情况，视为不合格品
显示错误	不允许不当操作 在所选择模式，出现异常显示或显示位置不正确
显示不正常	任何一列显示不正常，视为不合格品
过流	总电流要求与模块所需电流相匹配，不允许超过模块正常工作的最大电流值.
视角	视角不要接近规格书所标最小值，如果有接近最小值的产品做不合格品处理.
对比度	对比度不要接近规格书所标最小值，如果有接近最小值的产品做不合格品处理.
LCD驱动电压	见产品规格书

7.3.2 不加电检测

检测项目	检测标准
模块尺寸	见模块外形图，尺寸不允许超出公差范围
液晶屏面板划伤	如果有效区的划伤长和宽尺寸大于下面所示组合，我们做不合格处理。 数目：一个或更多 宽度：0.15 长度：5.0 三个或更多 宽度：0.10 长度：3.0 三个或更多 宽度：0.05 长度：2.0 当损坏超出这些尺寸，按不合格品处理.

8.可靠性

测试项目	测试内容	测试条件
高温存储	高温存储环境适应能力测试	60℃，200hrs
低温存储	低温存储环境适应能力测试	-10℃，200hrs
高温运行	高温环境运行测试	50℃，200hrs
低温运行	低温环境运行测试	0℃，200hrs
高温/湿存储	高温/湿存储适应能力测试	60℃,90%RH，96hrs
高温/湿运行	高温/湿运行测试	40℃,90%RH，96hrs
温度循环测试	温度变化循环测试： -10℃→25℃→60℃ 30min←5min←30min 1 cycle	-10℃/60℃，10 cycle
机械振动	机械振动测试	10~22Hz→1.5mmp-p 22~500Hz→1.5G Total 0.5hrs

备注1：在模块上不允许有任何水珠.

备注2：模块应该在正常条件下储存4小时后进行检测。

9. 出厂测试报告

（VDD=+5.0V ,Ta=25℃）

项目	条件	检测结果	备注
高温存储	80℃,120 hrs	无异常	---
低温存储	- 30℃,120 hrs	无异常	---
高温运行	70℃,240 hrs	无异常	---
低温运行	- 20℃,240 hrs	无异常	---
高温湿存储	50℃,90% RH,120 hrs	无异常	---
高温湿运行	40℃,90% RH,120 hrs	无异常	---
热震动	-20℃, 30min→+25℃, 5min →+60℃, 30min	无异常	10 cycles

10. 注意事项

10.1 使用过程中注意事项

在液晶显示模块出厂前，我们已经做了精确的装配和调试, 因此客户在使用操作时请注意以下几点:

（1） 模块上装有 LCD 屏，必须避免剧烈震动、冲击、挤压和从高处掉落。

（2） 液晶显示模块避免扭动,拆卸金属钮角.

（3） 液晶显示模块避免在印有线路的工作平台上操作.

（4） 避免接触,调整,修改导电橡胶.

（5） 防止施加直流电.

（6） 液晶显示屏中的液晶材料是有害物质,当不慎溅落到手,身体,衣服等处时,应尽快用肥皂冲洗干净。

10.2 安装注意

液晶模块由两片带有偏光片的薄玻璃组装而成，它被固定在带有安装孔的 PCB 板上之后，很容易损坏。必须谨慎处理 LCD，模块才可以被安装。

10.3 LCD 处理及清洗注意事项

在清理显示屏表面时，使用带溶剂（建议如下）的软布，轻轻擦拭。

（1）异丙醇

（2）乙醇

（3）不要用干燥或者比较硬的材料擦拭显示屏表面，否则很容易损坏表面偏光片。

以下溶剂请不要使用：

（1）水

（2）酮

（3）芳烃

10.4 严防静电

LCD 驱动电路是低压、微功耗的 COMS 电路，因此我们建议将任何没有使用的输入终端连接到 VDD 或 VSS 上，在打开电源之前，请不要输入任何信号，并且保证人体、工作台及组装设备良好接地，严防静电.。我们推荐以下措施：

（1）在装配使用液晶显示模块前,请不要将其从包装袋中取出. 液晶显示模块所使用的包装袋是经过防静电处理的特殊包装袋. 在储存液晶显示模块时也要带有包装袋储存,或者放在能充分接地的容器中储存.

（2）在操作液晶显示模块时,要始终保持操作人充分接地. 使人体和液晶模块保持同一电位。

（3）在操作过程中所需的设备要充分接地.尤其是驱动器,必须良好接地,没有漏电,以避免干扰.

（4）液晶模块表面都有一层保护膜, 目的在于避免造成 LCD 的偏光片划伤,沾染污渍等. 请慢慢揭去液晶显示模块保护膜.如果快速揭去保护膜都将产生静电.

（5）注意厂房的湿度：厂房湿度范围: 50~60%RH

10.5 电流保护装置

液晶显示模块上没有装电流保护装置,因此,在使用时应预备好电流保护装置.驱动电压直流成分越小越好，最好不超过 50mV，长时间施加过大的直流成分会使电极产生电化学反应而老化。

10.6 操作注意事项

（1） 液晶模块如果输入电压过高会缩短它的寿命，所以对液晶模块的输入电压进行限制是很重要的。

（2） 液晶模块在低温运行时响应时间相对于正常工作温度将明显变慢，另一方面，在高温环境运行 LCD 屏将变黑。但是，这些现象并不意味着模块故障或 LCD 失控，当温度调整到正常工作范围时，模块工作恢复正常。

（3） 如果在运行过程中有些显示区域无法驱动，导致某些字符显示异常，但是重启一次将会恢复正常。

（4） 终端如果有轻微裸露都将引起电化学反应导致终端开路。

（5） 如果工作温度在最高工作温度，那么要求湿度小于等于 50%RH.

10.7 焊接注意事项:

在焊接液晶显示模块时须注意以下几点:

※ 液晶显示模块上只有输入/输出连线处可以焊接.

※ 焊接所需的烙铁必须绝缘.

（1）焊接时所需条件:

电铁的温度: 280℃±10℃

焊接时间: < 3-4S

焊接材料: 低熔点,可充分熔化的焊锡

避免使用融化后易流动的焊锡,因为在焊接时易渗透到液晶显示模块里面,在清理时易对液晶模块造成污染.此外,为了避免焊接时焊锡对液晶显示模块的污染,应在焊接完成后再揭去液晶显示模块的保护膜.

（2）重复焊接时注意事项:

由于连接线是穿过模块的焊盘与模块焊接的,所以在拆除时需等到焊锡完全熔化时再移动连接线.若焊锡未能完全熔化就用力移动连接线,就极易造成焊盘损坏或脱落.在拆除连接线时最好使用”吸枪”.此外还应注意,重复焊接不得超过 3 次.

10.8 包装与存储

当液晶显示模块需要长时间储存时,应遵循以下原则:

如果储存方法不当,将影响偏光片的质量,使显示效果不佳；容易造成焊盘的氧化，容易焊接。

（1）储存时尽可能使用出厂时的原包装.

（2）储存散装的液晶显示模块时,应先装入防静电袋,封口严密.

（3）为防止模块性能退化，不要暴露在高湿温环境或有阳光直射的位置对它直接操作或存储。

（4）储存应保持低湿度,最佳储存温度范围为: 0℃~35℃

（5）存储时不允许任何东西接触到偏光片表面。

11.使用须知

（1）在合作双方认为有必要提供定制样品的情况下应该提供样品。合同在样品设计好并且双方确认后生效。

（2）在遇到以下情况，必须经双方代表讨论并且同意后处理问题：

-当产品规格书出现问题时。

-当一个新的问题出现，而在此产品规格书中没有说明时。

-如果客户的检测标准或运行条件改变要告知**清达**，这些改变将使产品规格书出现问题。

-当一个新的问题在客户操作过程中出现，经分析样品也存在该问题时。