PRODUCT SPECIFICATION
FOR LCD MODULE

MODULE NO. : 20848A

Customer Approval:

PREPARED BY		DATE	
CHECKED BY		DATE	
APPROVED BY		DATE	

DOCUMENT REVISION HISTORY

VERSION	DATE	DESCRIPTION	CHANGED BY
V1	**2021-07-21**	First issue	YXS

1. PRECAUTIONS FOR USING LCD MODULES

Handing Precautions

(1) The display panel is made of glass. Do not subject it to a mechanical shock by dropping it or impact.

(2) If the display panel is damaged and the liquid crystal substance leaks out, be sure not to get any in your mouth. If the substance contacts your skin or clothes, wash it off using soap and water.

(3) Do not apply excessive force to the display surface or the adjoining areas since this may cause the color tone to vary.

(4) The polarizer covering the display surface of the LCD module is soft and easily scratched. Handle this polarizer carefully.

(5) If the display surface becomes contaminated, breathe on the surface and gently wipe it with a soft dry cloth. If it is heavily contaminated, moisten cloth with one of the following solvents :

- Isopropyl alcohol
- Ethyl alcohol

(6) Solvents other than those above-mentioned may damage the polarizer. Especially, do not use the following.

- Water
- Ketone
- Aromatic solvents

(7) Exercise care to minimize corrosion of the electrode. Corrosion of the electrodes is accelerated by water droplets, moisture condensation or a current flow in a high-humidity environment.

(8) Install the LCD Module by using the mounting holes. When mounting the LCD module make sure it is free of twisting, warping and distortion. In particular, do not forcibly pull or bend the I/O cable or the backlight cable.

(9) Do not attempt to disassemble or process the LCD module.

(10) NC terminal should be open. Do not connect anything.

(11) If the logic circuit power is off, do not apply the input signals.

(12) To prevent destruction of the elements by static electricity, be careful to maintain an optimum work environment.

- Be sure to ground the body when handling the LCD modules.
- Tools required for assembling, such as soldering irons, must be properly grounded.
- To reduce the amount of static electricity generated, do not conduct assembling and other work under dry conditions.
- The LCD module is coated with a film to protect the display surface. Exercise care when peeling off this protective film since static electricity may be generated.

Storage Precautions

When storing the LCD modules, avoid exposure to direct sunlight or to the light of fluorescent lamps. Keep the modules in bags (avoid high temperature / high humidity and low temperatures below 0°C). Whenever possible, the LCD modules should be stored in the same conditions in which they were shipped from our company.

Others

Liquid crystals solidify under low temperature (below the storage temperature range) leading to defective orientation or the generation of air bubbles (black or white). Air bubbles may also be generated if the module is subject to a low temperature.

If the LCD modules have been operating for a long time showing the same display patterns, the display patterns may remain on the screen as ghost images and a slight contrast irregularity may also appear. A normal operating status can be regained by suspending use for some time. It should be noted that this phenomenon does not adversely affect performance reliability.

To minimize the performance degradation of the LCD modules resulting from destruction caused by static electricity etc., exercise care to avoid holding the following sections when handling the modules.

- Exposed area of the printed circuit board.
- Terminal electrode sections.

2. USING LCD MODULES

Liquid Crystal Display Modules

LCD is composed of glass and polarizer. Pay attention to the following items when handling.

(1) Please keep the temperature within specified range for use and storage. Polarization degradation, bubble generation or polarizer peel-off may occur with high temperature and high humidity.

(2) Do not touch, push or rub the exposed polarizers with anything harder than an HB pencil lead (glass, tweezers, etc.).

(3) N-hexane is recommended for cleaning the adhesives used to attach front/rear polarizers and reflectors made of organic substances which will be damaged by chemicals such as acetone, toluene, ethanol and isopropylalcohol.

(4) When the display surface becomes dusty, wipe gently with absorbent cotton or other soft material like chamois soaked in petroleum benzin. Do not scrub hard to avoid damaging the display surface.

(5) Wipe off saliva or water drops immediately, contact with water over a long period of time may cause deformation or color fading.

(6) Avoid contacting oil and fats.

(7) Condensation on the surface and contact with terminals due to cold will damage, stain or dirty the polarizers. After products are tested at low temperature they must be warmed up in a container before coming is contacting with room temperature air.

(8) Do not put or attach anything on the display area to avoid leaving marks on.

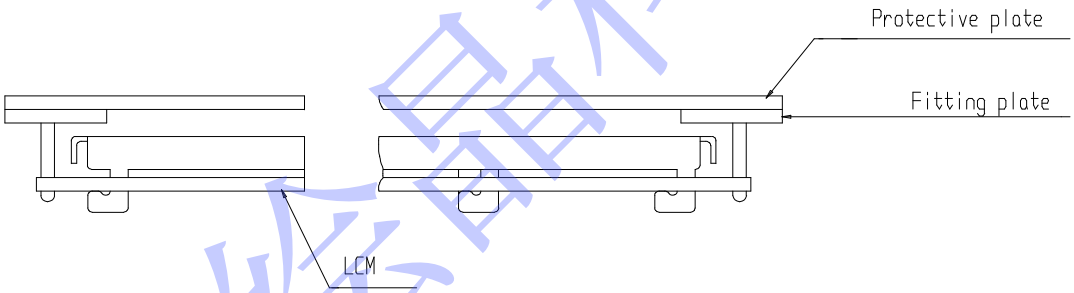
(9) Do not touch the display with bare hands. This will stain the display area and degradate insulation between terminals (some cosmetics are determinated to the polarizers).

(10) As glass is fragile. It tends to become or chipped during handling especially on the edges. Please avoid dropping or jarring.

Installing LCD Modules

The hole in the printed circuit board is used to fix LCM as shown in the picture below. Attend to the following items when installing the LCM.

(1) Cover the surface with a transparent protective plate to protect the polarizer and LC cell.



(2) When assembling the LCM into other equipment, the spacer to the bit between the LCM and the fitting plate should have enough height to avoid causing stress to the module surface, refer to the individual specifications for measurements. The measurement tolerance should be ±0.1mm.

Precaution for Handing LCD Modules

Since LCM has been assembled and adjusted with a high degree of precision, avoid applying excessive shocks to the module or making any alterations or modifications to it.

(1) Do not alter, modify or change the shape of the tab on the metal frame.

(2) Do not make extra holes on the printed circuit board, modify its shape or change the positions of components to be attached.

(3) Do not damage or modify the pattern writing on the printed circuit board.

(4) Absolutely do not modify the zebra rubber strip (conductive rubber) or heat seal connector.

(5) Except for soldering the interface, do not make any alterations or modifications with a soldering iron.

(6) Do not drop, bend or twist LCM.

(7) In order to avoid the cracking of the FPC, you should to pay attention to the area of FPC (R50mm) where the FPC was bent .the edge of coverlay ; the area of surface of Ni-Au plating, the area of soldering land, the area of through hole.

Electro-Static Discharge Control

Since this module uses a CMOS LSI, the same careful attention should be paid to electrostatic discharge as for an ordinary CMOS IC.

(1) Make certain that you are grounded when handing LCM.
(2) Before remove LCM from its packing case or incorporating it into a set, be sure the module and your body have the same electric potential.
(3) When soldering the terminal of LCM, make certain the AC power source for the soldering iron does not leak.
(4) When using an electric screwdriver to attach LCM, the screwdriver should be of ground potentiality to minimize as much as possible any transmission of electromagnetic waves produced sparks coming from the commutator of the motor.
(5) As far as possible make the electric potential of your work clothes and that of the work bench the ground potential.
(6) To reduce the generation of static electricity be careful that the air in the work is not too dried. A relative humidity of 50%-60% is recommended.

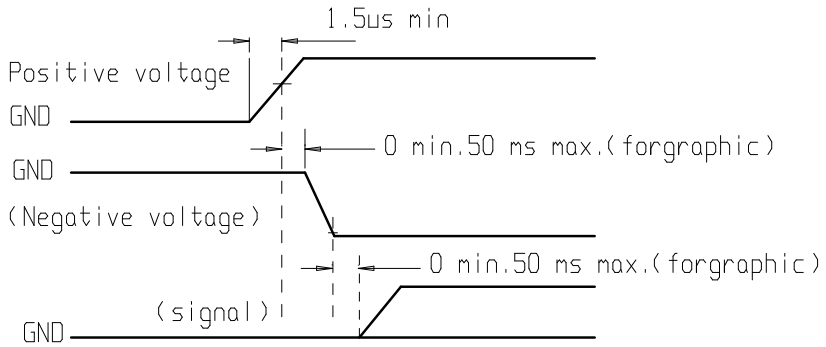
Precaution for soldering to the LCM

(1) Observe the following when soldering lead wire, connector cable and etc. to the LCM.
- Soldering iron temperature : 260°C ± 10°C.
- Soldering time : 3-4 sec.
- Solder : eutectic solder.

If soldering flux is used, be sure to remove any remaining flux after finishing to soldering operation. (This does not apply in the case of a non-halogen type of flux.) It is recommended that you protect the LCD surface with a cover during soldering to prevent any damage dur to flux spatters.
(2) When soldering the electroluminescent panel and PC board, the panel and board should not be detached more than three times. This maximum number is determined by the temperature and time conditions mentioned above, though there may be some variance depending on the temperature of the soldering iron.
(3) When remove the electoluminescent panel from the PC board, be sure the solder has completely melted, the soldered pad on the PC board could be damaged.
(4)Soldering iron is not allowed to touch the surface of FPC's cover film directly.

Precautions for Operation

(1) Viewing angle varies with the change of liquid crystal driving voltage (VO). Adjust VO to show the best contrast.
(2) Driving the LCD in the voltage above the limit shortens its life.
(3) Response time is greatly delayed at temperature below the operating temperature range. However, this does not mean the LCD will be out of the order. It will recover when it returns to the specified temperature range.
(4) If the display area is pushed hard during operation, the display will become abnormal. However, it will return to normal if it is turned off and then back on.
(5) Condensation on terminals can cause an electrochemical reaction disrupting the terminal circuit. Therefore, it must be used under the relative condition of 40°C , 50% RH.
(6) When turning the power on, input each signal after the positive/negative voltage becomes stable.



Storage

When storing LCDs as spares for some years, the following precaution are necessary.
(1) Store them in a sealed polyethylene bag. If properly sealed, there is no need for dessicant.

(2) Store them in a dark place. Do not expose to sunlight or fluorescent light, keep the temperature between 0°C and 35°C.

(3) The polarizer surface should not come in contact with any other objects. (We advise you to store them in the container in which they were shipped.)

(4) Environmental conditions :

- Do not leave them for more than 160hrs. at 70°C.
- Should not be left for more than 48hrs. at -20°C.

Safety

(1) It is recommended to crush damaged or unnecessary LCDs into pieces and wash them off with solvents such as acetone and ethanol, which should later be burned.

(2) If any liquid leakes out of a damaged glass cell and comes in contact with the hands, wash off thoroughly with soap and water.

Limited Warranty

Unless agreed between EAST and customer, EAST will replace or repair any of its LCD modules which are found to be functionally defective when inspected in accordance with EAST LCD acceptance standards (copies available upon request) for a period of one year from date of shipments. Cosmetic/visual defects must be returned to EAST within 90 days of shipment. Confirmation of such date shall be based on freight documents. The warranty liability of EAST limited to repair and/or replacement on the terms set forth above. EAST will not be responsible for any subsequent or consequential events.

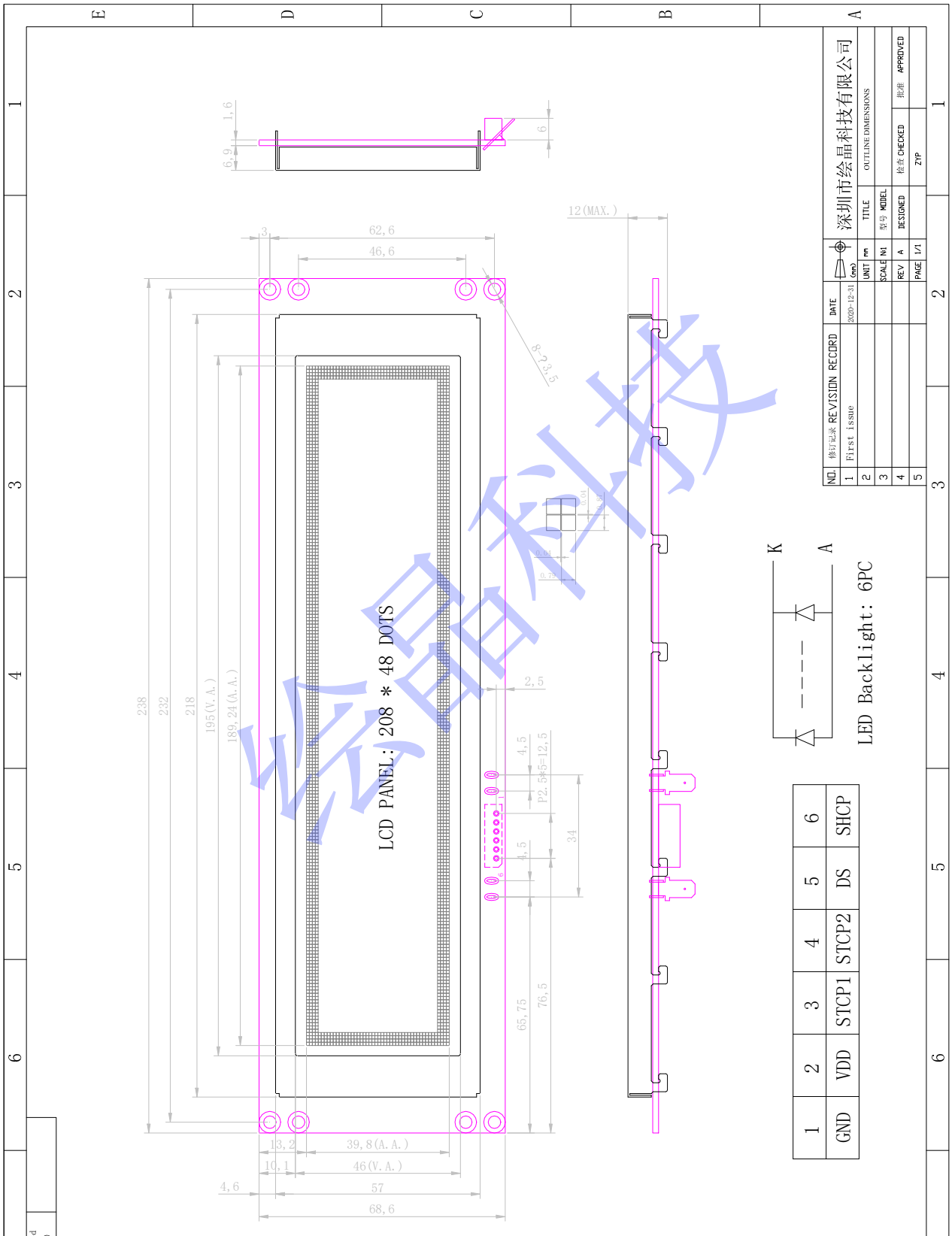
Return LCM under warranty

No warranty can be granted if the precautions stated above have been disregarded. The typical examples of violations are :

- Broken LCD glass.
- PCB eyelet's damaged or modified.
- PCB conductors damaged.
- Circuit modified in any way, including addition of components.
- PCB tampered with by grinding, engraving or painting varnish.
- soldering to or modifying the bezel in any manner.

Module repairs will be invoiced to the customer upon mutual agreement. Modules must be returned with sufficient description of the failures or defects. Any connectors or cable installed by the customer must be removed completely without damaging the PCB's eyelet, conductors and terminals.

3. External Dimensions And Parameter



Item	Reference
LCM SIZE（W×h×z）	238.0×68.6×12
Viewing area（W×h）	195.0×46.0
Dot spacing（W×h）	0.91×0.83
Dot size（W×h）	0.87×0.79

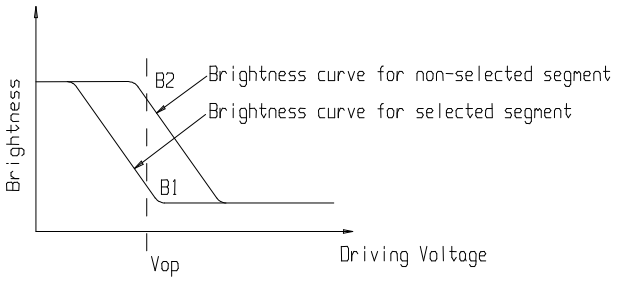
4.Pin Description

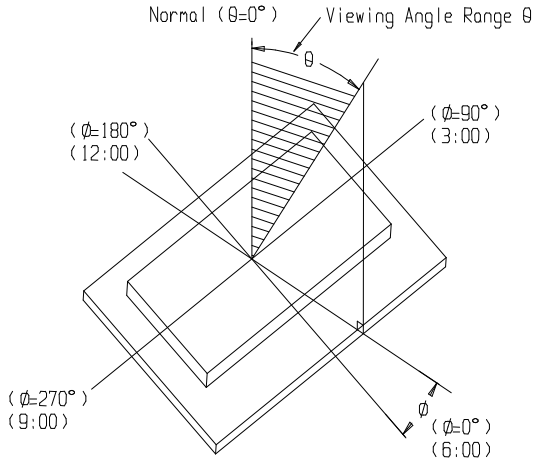
PIN	Symbol	Level	Function
1	VSS	0V	Ground
2	VDD	3.3V	Power Supply For Logic
3	STCP1	--	No connection
4	STCP1	H/L	Store register clock input
5	DS	H/L	Data input
6	SHCP	H/L	Shift register clock input

5. Optical Characteristics(VDD=5.0V, Ta = 25 °C)

Item	Symbol	Condition	Min	Type	Max	Unit	Remarks	Note
Contrast ratio	Cr	---	2	3	---	---	---	1
Viewing Angle	θ	Cr ≥ 2	35	---	---	deg	∅ = 90°	2
			35	---	---	deg	∅ = 270°	2
			50	---	---	deg	∅ = 0°	2
			33	---	---	deg	∅ = 180°	2

$$Cr = \frac{\text{Brightness of non-selected segment(B2)}}{\text{Brightness of selected segment(B1)}}$$





6. DC power supply parameters (VSS = 0 V, VDD = 5.0 V ± 10%, Ta = -20 to 70°C)

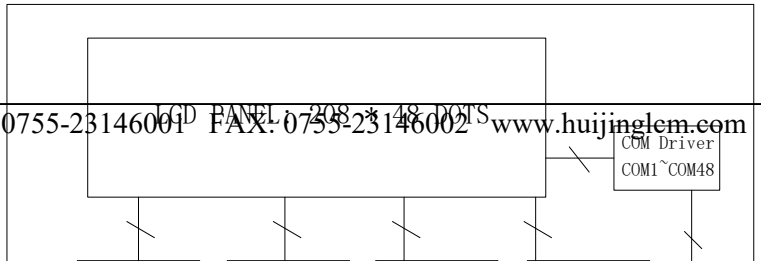
Item	Symbol	Test Condition	Min	Typ.	Max	Unit
Operating Voltage	VDD	-	3.0	3.3	3.6	V
Glass voltage	VLCD	VDD-VO	10.2	10.5	10.8	V
Backlight voltage	VLED	-	2.8	3.0	3.2	V
IO input high level	VIH	-	0.7VDD	-	VDD	V
IO input low level	VIL	-	-	-	1.0	V
LCM outputs high level	VOH	-	0.8VDD	-	VDD	V
LCM output low level	VOL	-	-	-	0.6	V
Module working current	IDD	=VDD	-	-	0.5	mA
Module standby current	IDO	=VDD	-	-	10	uA
Backlight working current	ILED	=VLED	60	90	120	mA

7. ABSOLUTE MAXIMUM RATINGS (Ta = 25°C)

Parameter	Symbol	Min	Max	Unit
Supply voltage for logic	Vdd-Vss	-0.3	7.0	V
LCD Driving Voltage	VLCD=VDD-V0	-0.3	17.0	V
The input voltage	Vin	-0.3	Vdd+0.3	V
Operating temperature	Top	-20	70	°C
Storage temperature	Tst	-30	80	°C

*Note: Based on Vss=0V.

8. BLOCK DIAGRAM



9. Displays The Memory Map

DDRAM

Page1: 0xB8 Arrange from top to bot:D0~D7	1	2	3	…	206	207	208
Page 2: 0xB9 Arrange from top to bot:D0~D7	1	2	3	…	206	207	208
Page 3: 0xBA Arrange from top to bot:D0~D7	1	2	3	…	206	207	208
Page 4: 0xBB Arrange from top to bot:D0~D7	1	2	3	…	206	207	208
Page 5: 0xBC Arrange from top to bot:D0~D7	1	2	3	…	206	207	208
Page 6: 0xBD Arrange from top to bot:D0~D7	1	2	3	…	206	207	208

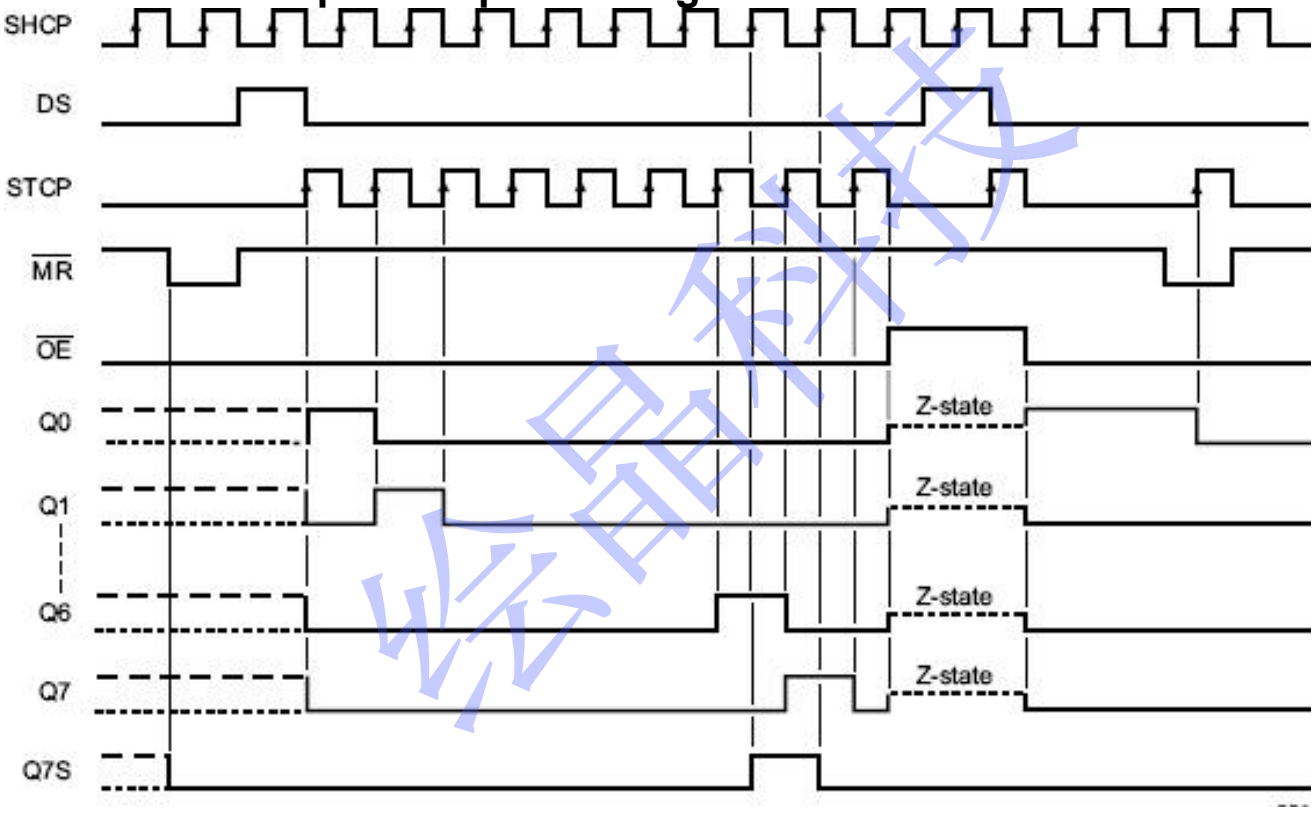
10.Instruction Table

10.1 Series-Convert-Parallel Function Meter (HC595)

The Control End				Input	output		Function
SHCP	STCP	OE	MR	DS	Q7S	Q	
X	X	L	L	X	L	NC	a LOW-level on MR only affects the shift registers
X	↑	L	L	X	L	L	empty shift register loaded into storage register
X	X	H	L	X	L	Z	shift register clear; parallel outputs in high-impedance OFFstate
↑	X	L	H	H	Q6S	NC	logic HIGH-level shifted into shift register stage 0. Contents of all shift register stages shifted through, e.g. previous state of stage 6 (internal Q6S) appears on the serial output (Q7S).
X	↑	L	H	X	NC	QnS	contents of shift register stages (internal QnS) are transferred to the storage register and parallel output stages
↑	↑	L	H	X	Q6S	QnS	contents of shift register shifted through; previous contents of the shift register is transferred to the storage register and the parallel output stages

H = HIGH voltage state;
L = LOW voltage state;
↑ = LOW-to-HIGH transition;
X = don’ t care;
NC = no change;
Z = high-impedance OFF-state.

10.2 Series to parallel port timing



10.3 Command table

NO	COMMAND	C/D	R/W	D7	D6	D5	D4	D3	D2	D1	D0	Instructions	Default
1	Display on or off	0	0	0	0	1	1	1	1	1	D	Display on or off	03EH
2	Show starting line	0	0	1	1	C5	C4	C3	C2	C1	C0	C[5:0]=0~63	00H
3	Page address setting	0	0	1	0	1	1	1	P2	P1	P0	P[2:0]=0~7	-
4	Column address setting	0	0	0	1	C5	C4	C3	C2	C1	C0	C[5:0]=0~63	-
5	Read the state	0	1	B	0	0	R	0	0	0	0	Busy, ON/OFF, RET	-
6	Read display data	1	1									Read a byte	-
7	Write display data	1	0									Write a byte	-

11.Software Design Guide

```
//                                    MCU: STC15W408S
//                                    液晶驱动控制IC:
7108*3+7107*1+HC595*2
/*********************************************
接口定义:                                MCU小板
1---VSS                                  6 VSS
2---VDD                                  7 VDD 3.3V
3---STCP1                          (NC) 8 ---
4---STCP2                               9 P12
5---DS                                   10  P13
6---SHCP                                11  P14
*********************************************/
#include <reg52.h>
#include <intrins.h>

#include <delay.h>                        //延时
#include <HZdot_V.h>                      //ASCII码+部分要显示的汉字的点阵数
据
#include <timer.h>                        //定时器,需要使用到T0做计时,显示时
分秒

#define u8 unsigned char
#define u16 unsigned int
```

```
#define CSL(n)                          (~(1<<n)) //CS片选低有效: 清零某位
(选定某个CS) 与原值执行与操作
#define CSH(n)                          (1<<n)   //CS片选高有效: 置位某位(选
定某个CS) 与原值执行或操作
//                                          DB7 DB6 DB5 DB4 DB3 DB2 DB1 DB0
595A
//                                          R/W  E  RET CS4 CS3 CS2 CS1 RS
595B
//                                           0   x   1   0   0   0   0   x
CS=1 Hight Active
//                                           0   x   1   1   1   1   1   x
CS=0 Low Active
#define CMDEL 0x20 //E=0 , RS=0
#define CMDEH 0x60 //E=1 , RS=0

#define DATEL 0x21 //E=0 , RS=1
#define DATEH 0x61 //E=1 , RS=1

sfr                                     AUXR  = 0x8e;
sfr                                     P5    = 0xc8;

sbit                                    STCP2 = P1^2; //存储寄存器时钟(二
级) 一二级存储时钟电路上联接在一起了
sbit                                    DS    =  P1^3; //串行数据入口
sbit                                    SHCP  = P1^4; //串行移位寄存器时钟
sbit                                    KEY    = P3^2; //外中断0触发
//sbit                                  LED   = P2^5; //已经在定时器中使用
了

void send_byte(u8 dat);                  //串行发送一字节
void wr_cmd(u8 n,u8 dat);               //向某个显示发送控制命令
void wr_dat(u8 n,u8 dat);               //向某个显示发送显示数据
u8 set_pos(u8 pa,u8 ca);                //定位:设置页地址和列地址,并返回显
示区编号
```

```
void test_lcd(u8 d1,u8 d2);       //测试及清屏
void dis_en5(u8 fb,u8 pa,u8 ca,u8 ch);  //指定位置显示一个ASCII字符
5*8点阵
void dis_enstr(u8 fb,u8 pa,u8 ca,u8 *str);
void dis_en8(u8 fb,u8 pa,u8 ca,u8 ch);  //指定位置显示一个ASCII字符
8*16点阵
void dis_str(u8 fb,u8 pa,u8 ca,u8 *s);  //指定位置显示一串ASCII字符
(8*16点阵)
void dis_cn(u8 fb,u8 pa,u8 ca,u16 hz_code);//指定位置显示一个中文字
void dis_cnstr(u8 fb,u8 pa,u8 ca,u8 *str);  //指定位置显示一串中文字
void dis_frame(void);

u8 hh,mm,ss,sss;                  // 时分秒 0.1秒
u16 T0count;                       //  T0时数
u8 loop;
/*****************************************************************
**********************/
void main(void)
{
                                  u8 i,t[11]; //

                                  delay(1);
                                  IE = 0x81; //开中断INT0
                                  T0_init();
                                  loop=20;
                                  while(1)
                                  {
                                   loop++;
                                   for(i=1;i<5;i++)
                                   {
                                     wr_cmd(i,0x40);
                                     wr_cmd(i,0xb8);
                                     wr_cmd(i,0xc0);//显示开始行
                                     wr_cmd(i,0x3f);//显示开
```

```
}
test_lcd(0,0);
test_lcd(0xff,0);delay(5);
test_lcd(0,0xff);delay(5);
test_lcd(0x55,0x55);delay(5);
test_lcd(0xaa,0xaa);delay(5);
test_lcd(0x55,0xaa);delay(5);
test_lcd(0xaa,0x55);delay(5);
test_lcd(0xff,0xff);delay(5);

test_lcd(0,0);
dis_frame();

dis_str(1,1,4,"123456789ABCDEFGHIJK
LMNOP");

dis_str(0,3,4,"0123456789ABCDEFGHIJ
KLMNO");
 delay(5);

dis_str(0,1,4,"123456789ABCDEFGHIJK
LMNOP");

dis_str(1,3,4,"0123456789ABCDEFGHIJ
KLMNO");
 delay(10);
 test_lcd(0,0);
 dis_frame();
 dis_enstr(1,1,2,"ShenzhenHuijing
Technology Co.,LTD");
 dis_cnstr(1,2,24,"深圳绘晶科技有限
公司");
 dis_enstr(1,4,2,"Tel:0755-
23146001Fax:0755-23146002");
```

```
                                    delay(5);
                                    dis_enstr(0,1,2,"ShenzhenHuijing
Technology Co.,LTD");
                                    dis_cnstr(0,2,24,"深圳绘晶科技有限
公司");
                                    dis_enstr(0,4,2,"Tel:0755-
23146001Fax:0755-23146002");
                                    delay(10);
//                                  dis_enstr(1,1,54,"          ");
                                    dis_enstr(1,2,54,"          ");
                                    dis_enstr(1,3,54,"          ");
//                                  dis_enstr(1,4,54,"          ");
                                    t[0]='C';
                                    t[1]='=';
                                    t[2]=0x30 + loop/10;
                                    t[3]=0x30 + loop%10;
                                    t[4]=0x20;
                                    t[5]=0;
                                    dis_str(1,2,62,t);
                                    delay(10);
                                    while(loop>20)// 以下显示时 分 秒
                                    {

                                      test_lcd(0,0);
                                      dis_frame();
                                      dis_str(1,1,100,"HUIJING KEJI");
                                      dis_cnstr(0,1,20,"绘晶科技");
                                      dis_cnstr(1,3,20,"有限公司");
                                      dis_enstr(0,5,2,"Tel:0755-
23146001Fax:0755-23146002");
                                      while(loop)
                                      {
```

```
                                        t[0] = 0x30 + hh/10; //t={ hh :
mm : ss : s 0 }
                                        t[1] = 0x30 + hh%10;
                                        t[2] = ':';
                                        t[3] = 0x30 + mm/10;
                                        t[4] = 0x30 + mm%10;
                                        t[5] = ':';
                                        t[6] = 0x30 + ss/10;
                                        t[7] = 0x30 + ss%10;
                                        t[8] = ':';
                                        t[9] = 0x30 + sss%10;
                                        t[10] = 0;
                                        dis_str(1,3,100,t);
                                        t[0]=0x30 + loop/10;
                                        t[1]=0x30 + loop%10;
                                        t[2]=0;
                                        dis_str(1,3,184,t);
                                    }
                                }
                            }
}
/*************************************************************************
**********************/
void int0_int(void) interrupt 0 using 1
{
                                    u16 i= 1000;
                                    EX0 = 0;
                                    if(!KEY)
                                    {
                                     while(i--);
                                     while(!KEY);
```

```
                                        while(KEY);
                                        while(!KEY);
                                    }
                                    EX0=1;
                                    if(loop>20)     //进入时钟显示时,按一
下就会退出
                                        loop=0;
}

void send_byte(u8 dat)
{
                                    u8 i;
                                    for(i=0;i<8;i++)
                                    {
                                     DS = (dat & 0x80); //从高位到低位
依次发送8bits数据
                                     dat = dat<<1;//准备下一位传送位
                                     SHCP= 0;
                                     _nop_();
                                     SHCP= 1;    //产生上升沿,激发串口传
送
                                    }
                                    SHCP = 0;
}
//                                  向第n个显示区写控制指令 n=1,2,3,4
void wr_cmd(u8 n,u8 dat)
{
                                    send_byte(dat);    //先送数据
口:DB7~DB0
                                    send_byte(CMDEH | CSH(n)); //后送控
制端口 R/W,E,RET,RS,CS高电平有效
                                    STCP2=0;
```

```
                                    _nop_();
                                    STCP2=1;
                                    _nop_();_nop_();_nop_();
                                    STCP2=0;
                                    send_byte(dat);      //先送数据
口:DB7~DB0
                                    send_byte(CMDEL | CSH(n)); //后送控
制端口 R/W,E,RET,RS,CS高电平有效
                                    STCP2=0;
                                    _nop_();
                                    STCP2=1;
}
//                                  向第n个显示区写显示数据 n=1,2,3,4
void wr_dat(u8 n,u8 dat)
{
                                    send_byte(dat);        //先送数据
口:DB7~DB0
                                    send_byte(DATEH | CSH(n)); //后送控
制端口 R/W,E,RET,RS,CS高电平有效
                                    STCP2=0;
                                    _nop_();
                                    STCP2=1;
                                    _nop_();_nop_();_nop_();

                                    send_byte(dat);        //先送数据
口:DB7~DB0
                                    send_byte(DATEL | CSH(n)); //后送控
制端口 R/W,E,RET,RS,CS高电平有效
                                    STCP2=0;
                                    _nop_();
                                    STCP2=1;
}
```

```
//                                  设置页地址和列地址,返回显示区编号
(1~4对应CS1~CS4) 0~63,64~127,128~191,192~255
//                                  pa=0~7,  ca=0~207
u8 set_pos(u8 pa,u8 ca)
{
                                    u8 i;
                                    if(ca>=192)  //由列地址确定显示区号
                                    {
                                     i = 4;
                                     ca -=192;
                                    }
                                    else if(ca>=128)
                                    {
                                     i = 3;
                                     ca -=128;
                                    }
                                    else if(ca>=64)
                                    {
                                     i = 2;
                                     ca -=64;
                                    }
                                    else if(ca<64)
                                    {
                                     i = 1;
                                    }
                                    wr_cmd(i,pa+0xb8);
                                    wr_cmd(i,ca+0x40);
                                    return i;
}

void test_lcd(u8 d1,u8 d2)          //d1=d2=0时相当于清屏
{
                                    u8 i,k;
                                    u16 j;
```

```
                                                for(i=0;i<8;i++)
                                                {
/*
                                                 for(j=0;j<256;j=j+2)
                                                 {
                                                   if((j==0) || (j==64) || (j==128)
|| (j==192))                                    //列地址=所在显示区首地址时设置列地
址并返回显示区编号
                                                     k=set_pos(i,j);
                                                 //  if((j==62) || (j==126) ||
(j==190))                                       //测试用
                                                 //    delay(5);
                                                   wr_dat(k,d1);
                                                   wr_dat(k,d2);
                                                 }
*/
                                                 for(j=0;j<256;j=j+2)
                                                 {
                                                   k=set_pos(i,j);
                                                   wr_dat(k,d1);
                                                   wr_dat(k,d2);
                                                 }

                                                }
}

//                                              显示四个边框
void dis_frame(void)
{
                                                u8 i,k;

                                                for(i=1;i<207;i++)//上下边框
                                                {
                                                 k=set_pos(0,i);
```

```
                                    wr_dat(k,0x01);
                                    k=set_pos(5,i);
                                    wr_dat(k,0x80);
                                   }
                                   for(i=0;i<6;i++)//左右边框
                                   {
                                    k=set_pos(i,0);
                                    wr_dat(k,0xff);
                                    k=set_pos(i,207);
                                    wr_dat(k,0xff);
                                   }

}
//                                 显示5*8点阵的ASCII字符
void dis_en5(u8 fb,u8 pa,u8 ca,u8 ch)
{
                                   u8 j,k,hzd;
                                   u8 code *addr;
                                   addr = HZDots5 + (ch -0x20) * 5;

                                   for(j=0;j<5;j++)
                                   {
                                    k=set_pos(pa,ca+j);
                                    hzd=*addr++;
                                    if(!fb)
                                      hzd=~hzd;
                                    wr_dat(k,hzd);
                                   }
                                   hzd=0;   //最后一列间隔空白列
                                   if(!fb)
                                    hzd=~hzd;
                                   wr_dat(k,hzd);
}
void dis_enstr(u8 fb,u8 pa,u8 ca,u8 *s)
```

```
{
                                    while(*s)
                                    {
                                     dis_en5(fb,pa,ca,*s++);
                                     ca=ca+6;
                                     if(ca>207)
                                     {
                                       ca=0;
                                       pa++;
                                       if(pa>5)
                                         pa=0;
                                     }
                                    }
}

//                                  显示16*8点阵的ASCII字符
void dis_en8(u8 fb,u8 pa,u8 ca,u8 ch)
{
                                    u8 i,j,k,hzd;
                                    u8 code *addr;
                                    addr = HZDots8 + (ch -0x20) * 16;
                                    for(i=0;i<2;i++)
                                    {
                                     for(j=0;j<8;j++)
                                     {
                                       k=set_pos(pa+i,ca+j);
                                       hzd=*addr++;
                                       if(!fb)
                                         hzd=~hzd;
                                       wr_dat(k,hzd);
                                     }
                                    }
}
//                                  显示16*8点阵的ASCII字符串
```

```
void dis_str(u8 fb,u8 pa,u8 ca,u8 *s)
{
                                    while(*s)
                                    {
                                     dis_en8(fb,pa,ca,*s++);
                                     ca=ca+8;
                                     if(ca>207)
                                     {
                                       ca=0;
                                       pa+=2;
                                       if(pa>5)
                                         pa=0;
                                     }
                                    }
}
//                                  显示一个中文汉字
//                                  参数pa,ca是页(0~7)和列(0xb8~0xbf)地
址;
//                                  hz_code是汉字编码双字节;fb=0反白显
示;fb=1正常显示
void dis_cn(u8 fb,u8 pa,u8 ca,u16 hz_code)
{
                                    u16 tmp;
                                    u8 code *hzadd;
                                    u8 c,i,j,k,hzd;
                                    i=0;c=0;
                                    while(i<=255)//读取汉字串内的汉字位
置
                                    {
                                     tmp= *(HZS+i*2)<<8 | *(HZS+i*2+1);
                                    //*HZS="中文字串" 存储在code区间
                                     if(hz_code==tmp)
                                     {
                                       c=1;break;
```

```
                                        }
                                        i++;
                                    }
                                    if(c)  //有对应的汉字字模数据
                                    {
                                     hzadd=HZDots16+i*32; //HZDots[] 为
汉字串HZS内汉字的点阵数据,按汉字排序存放
                                     for(i=0;i<2;i++)    //写两排汉字点
阵数据
                                     {
//                                     k=set_pos(pa+i,ca);
                                       for(j=0;j<16;j++)//每排16列
                                       {
                                         hzd=*hzadd++;//  正常显示
                                         if(!fb)
                                           hzd=~hzd;//  fb=0 反白显示
                                         k=set_pos(pa+i,ca+j);  //显示地
址及显示区
                                         wr_dat(k,hzd);
                                       }
                                     }
                                    }
}
//                                  显示一串中文汉字,这里不进行非汉字排
除!请保持字符串为纯汉字
void dis_cnstr(u8 fb,u8 pa,u8 ca,u8 *str)
{
                                    u16 ss;
                                    if(pa>5 || ca>207)
                                     return;
                                    while(*str)
                                    {
                                     ss=*str<<8 | *(str+1); //取字符串中
两个字节的汉字码,
```

```
                dis_cn(fb,pa,ca,ss);
                str+=2;
                ca+=16;
                if (ca>207)
                { ca=0;pa+=2;}
                if(pa>5)
                  break; //最多写满一屏
              }
}
```