

JLX160160G-162-BN 使用说明书

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1. 概述

晶联讯电子专注于液晶屏及液晶模块的研发、制造。所生产 JLX160160G-162 型液晶模块由于使用方便、显示清晰，广泛应用于各种人机交流面板。

JLX160160G-162 可以显示 160 列*160 行点阵单色图片，或显示 10 个×10 行=100 个 16*16 点阵的汉字，或显示 20 个×10 行=200 个 8*16 点阵的英文、数字、符号，或显示 32 个×20 行的点阵的英文、数字、符号。

2. JLX160160G-162 图像型点阵液晶模块的特性

2.1 结构轻、薄、带背光、焊接式 FPC。

2.2 IC 采用 ST75161, 功能强大，稳定性好

2.3 功耗低:当电压为 3.3V 时，功耗低：不带背光 1.29mW (3.3V* (0.39mA 测试最大值))，带背光不大于 270mW (3.3V*45mA)；

2.4 显示内容：

(1) 160*160 点阵单色图片，或其它小于 160*160 点阵的单色图片；

(2) 可选用 16*16 点阵或其他点阵的图片来自编汉字，按照 16*16 点阵汉字来计算可显示 13 字*13 行；

(3) 按照 8*16 点阵汉字来计算可显示 20 字*10 行；

(4) 按照 5*8 点阵汉字来计算可显示 32 字*20 行；

(5) 可选用 16*16 点阵或其它点阵的图片自编汉字，也可配合晶联讯字库 IC (JLX-GB2312-3207) 来显示汉字；

2.5 指令功能强；

2.6 接口简单方便:并行 (6800 时序或 8080 时序可选)、串行、IIC 接口；

2.7 工作温度宽:-20℃ - +70℃；

2.8 储存温度宽:-30℃ - +80℃；

3. 外形尺寸及接口引脚功能

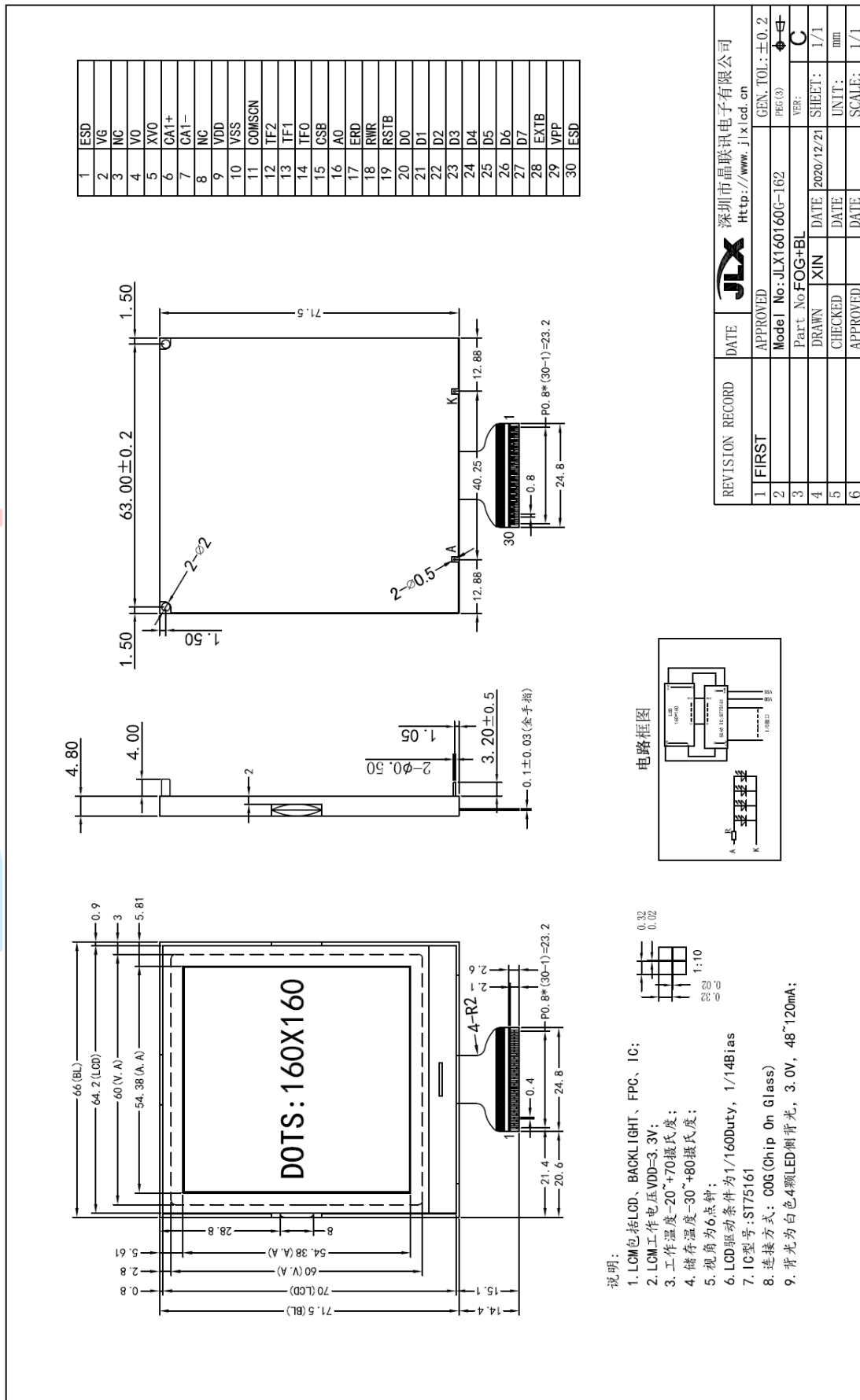


图 1. 外形尺寸

模块的接口引脚功能：

引线号	符号	名称	功能
1	ESD	空	空
2	VG	VG	与 VSS 串一个电容
3	NC	空	空
4	V0	升压电容	V0 和 XV0 之间串一个电容
5	XV0	升压电容	
6	CA1+	升压电容	CA1-和 CA1+之间串一个电容
7	CA1-	升压电容	
8	NC	空	空
9	VDD	供电电源正极	供电电源正极
10	VSS	接地	0V
11	COMSCN	COMSCN	H:接高电平
12	TF2	TF2	L:接低电平
13	TF1	TF1	并口接口 H:接高电平 串口或 IIC 接口时 L:接低电平
14	TF0	TF0	6800 时序或串口 L:接低电平 8080 时序或 IIC H:接高电平
15	CSB(CS)	片选	低电平片选 IIC 接口时:接 VSS
16	A0(RS)	寄存器选择信号	H:数据寄存器 0:指令寄存器 IIC 接口时:接高电平 VDD
17	ERD	使能信号	并行接口时并且选择 6800 时序时: H:读数据 并行接口时并且选择 8080 时序时: L:写数据. 串行接口时:接高电平 IIC 接口时:不用,建议接高电平
18	RWR	读、写	并行接口时并且选择 6800 时序时: 使能信号,高电平有效. 并行接口时并且选择 8080 时序时: 读数据,低电平有效. 串行接口时:接高电平 IIC 接口时:不用,建议接高电平
19	RSTB	复位	低电平复位,复位完成后,回到高电平,液晶模块开始工作
20	D0(SCLK)	I/O	并行接口时:数据总线 1 IIC/串行接口时:串行时钟(SCLK)
21-23	D1-D3(SDA)	I/O	并行接口时:数据总线 DB1-DB3 IIC/串行接口时:串行数据(SDA)
24	D4	I/O	并行接口时:数据总线 DB4 IIC/串行接口时:接高电平
25	D5	I/O	并行接口时:数据总线 DB5 IIC/串行接口时:接高电平
26	D6	I/O	并行接口时:数据总线 DB6 串行接口时:接高电平 IIC 接口时:接低电平
27	D7	I/O	并行接口时:数据总线 DB7 串行接口时:接高电平 IIC 接口时:接低电平
28	EXTB	空	空
29	VPP	空	空
30	ESD	空	空

表 1：模块的接口引脚功能

4. 基本原理

4.1 液晶屏 (LCD)

在 LCD 上排列着 160×160 点阵, 160 个列信号与驱动 IC 相连, 160 个行信号也与驱动 IC 相连, IC 邦定在 LCD 玻璃上 (这种加工工艺叫 COG) .

4.2 工作电路:

图 2 是 JLX160160G-162 图像点阵型模块的电路框图, 它由驱动 ST75161 及几个电阻电容组成。

电路框图

电路框图

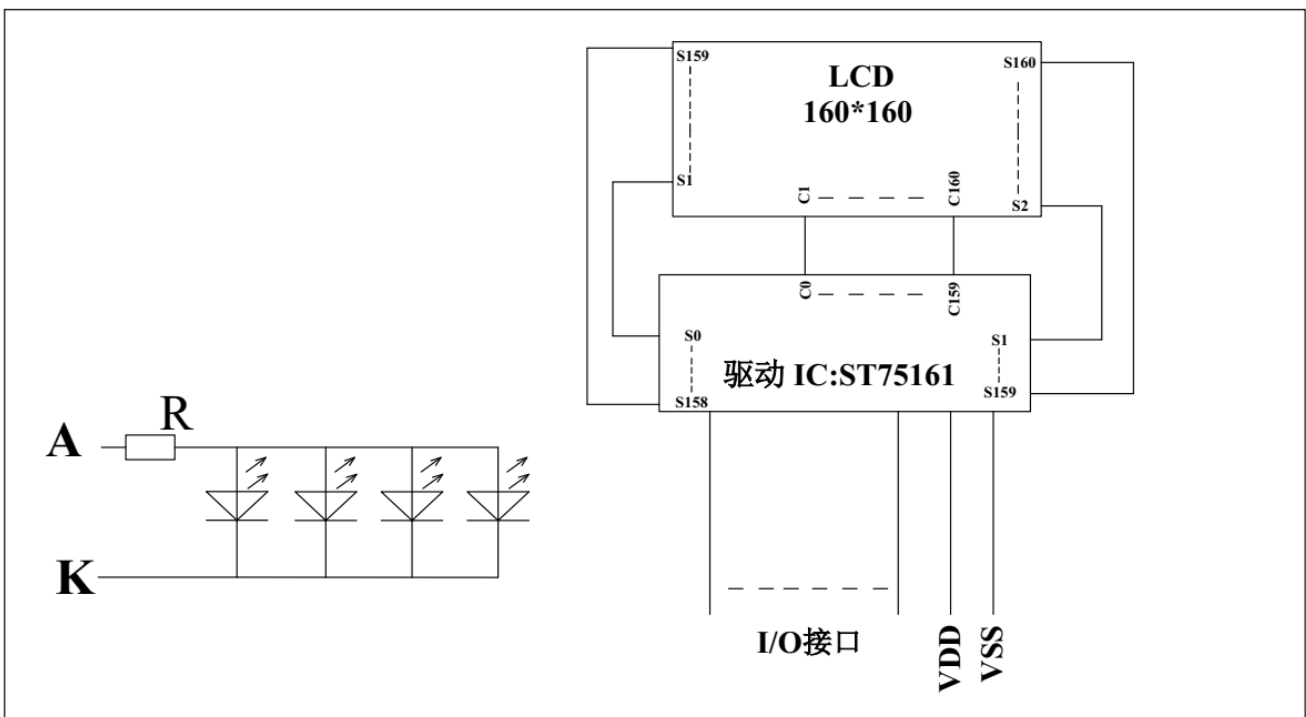


图 2: JLX160160G-162 图像点阵型液晶模块的电路框图

4.2 背光参数

该型号液晶模块带 LED 背光源。它的性能参数如下:

背光板可选择白色。

正常工作电流为: 24~60mA (LED 灯数共 4 颗);

工作电压: 3.0V (或串一个 20 欧电阻接 3.3V, 或串一个 100 欧电阻接 5.0V);

5. 技术参数

5.1 最大极限参数（超过极限参数则会损坏液晶模块）

名称	符号	标准值			单位
		最小	典型	最大	
电路电源	VDD - VSS	-0.3	3.3	3.5	V
LCD 驱动电路	V0-XV0	-0.3	15.5	19	V
工作温度		-40		+70	°C
储存温度		-50		+80	°C

表 2：最大极限参数

5.2 直流（DC）参数

名称	符号	测试条件	标准值			单位
			MIN	TYPE	MAX	
工作电压	VDD		2.6	3.3	3.5	V
背光工作电压	VLED		2.9	3.0	3.1	V
输入高电平	VIH	-	0.8xVDD		VDD	V
输入低电平	VIO	-	VSS		0.2	V
输出高电平	VOH	IOH = 0.2mA	0.8xVDD		VDD	V
输出低电平	VOO	I00 = 1.2mA	VSS		0.2xVDD	V
模块工作电流	IDD	VDD = 3.0V	-		0.3	mA
背光工作电流	ILED	VLED=3.0V	24	60	90	mA

表 3：直流（DC）参数

6. 读写时序特性

6.1 串行接口：

从 CPU 写到 ST75161 (Writing Data from CPU to ST75161)

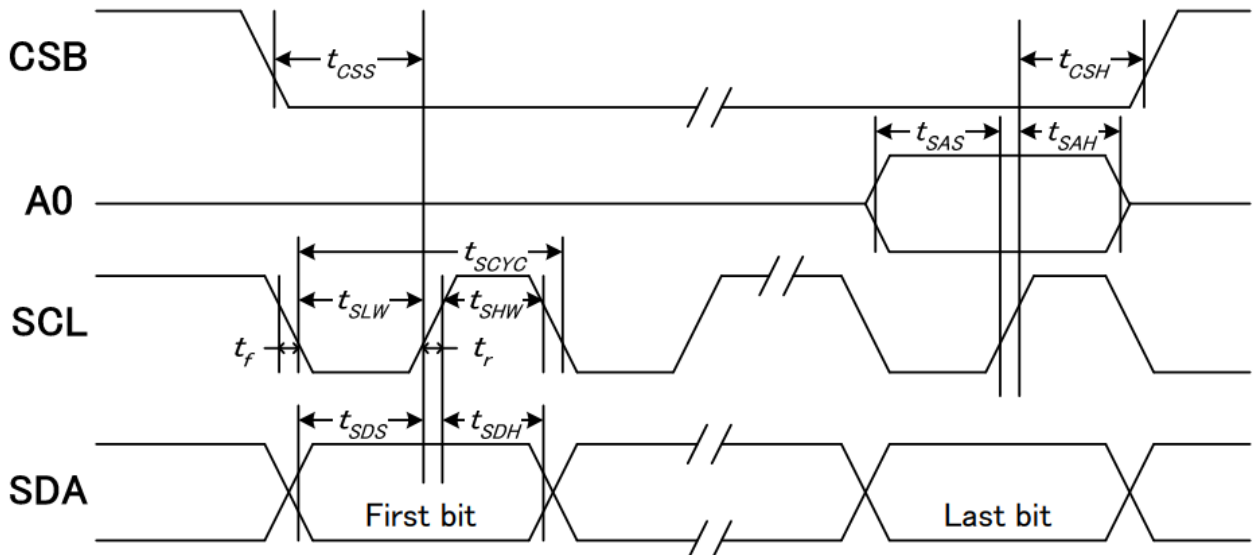


图 3. 从 CPU 写到 ST75161 (Writing Data from CPU to ST75161)

6.2 串行接口：时序要求（AC 参数）：
写数据到 ST75161 的时序要求：

VDD1 = 1.8~3.3V, Ta = -45~85 °C

Item	Signal	Symbol	Condition	Min.	Max.	Unit
Serial clock period	SCLK	tSCYC		80	—	ns
SCLK “H” pulse width		tSHW		30	—	
SCLK “L” pulse width		tSLW		30	—	
Address setup time	A0	tSAS		20	—	
Address hold time		tSAH		20	—	
Data setup time	SDA	tSDS		20	—	
Data hold time		tSDH		20	—	
CSB-SCLK time	CSB	tCSS		20	—	
CSB-SCLK time		tCSH		20	—	
CS “H” pulse width		tCHW		0	—	

Note:

1. The input signal rise and fall time (tr, tf) are specified at 15 ns or less.
2. All timing is specified using 20% and 80% of VDD1 as the standard.

表 4

6.3 并行接口：(8080)

从 CPU 写到 ST75161 (Writing Data from CPU to ST75161)

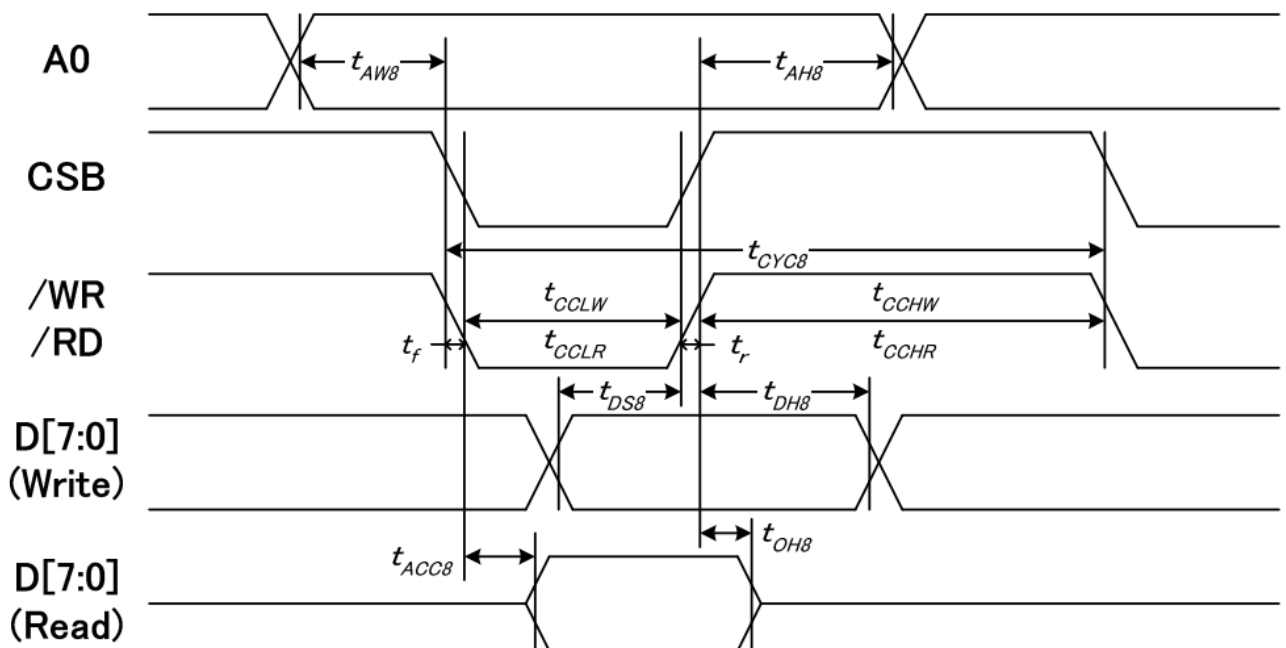


图 4. 从 CPU 写到 ST75161 (Writing Data from CPU to ST75161)

**6.4 并行接口：时序要求（AC 参数）：
写数据到 ST75161 的时序要求：（8080 系列 MPU）**

VDD1 = 1.8~3.3V, Ta = -45~85 °C

Item	Signal	Symbol	Condition	Min.	Max.	Unit
Address setup time	A0	tAW8		20	—	ns
Address hold time		tAH8		0	—	
System cycle time (WRITE)	/WR	tCYC8		160	—	
/WR L pulse width (WRITE)		tCCLW		70	—	
/WR H pulse width (WRITE)		tCCHW		70	—	
System cycle time (READ)	RD	tCYC8		400	—	
/RD L pulse width (READ)		tCCLR		180	—	
/RD H pulse width (READ)		tCCHR		180	—	
WRITE Data setup time	D[7:0]	tDS8		15	—	
WRITE Data hold time		tDH8		15	—	
READ access time		tACC8	CL = 30 pF	—	100	
READ Output disable time		tOH8	CL = 30 pF	10	110	

Note:

1. The input signal rise time and fall time (tr, tf) is specified at 15 ns or less. When the system cycle time is extremely fast, $(tr + tf) \leq (tCYC8 - tCCLW - tCCHW)$ for $(tr + tf) \leq (tCYC8 - tCCLR - tCCHR)$ are specified.
2. All timing is specified using 20% and 80% of VDD1 as the reference.

表 5

**6.5 并行接口：（6800）
从 CPU 写到 ST75161（Writing Data from CPU to ST75161）**

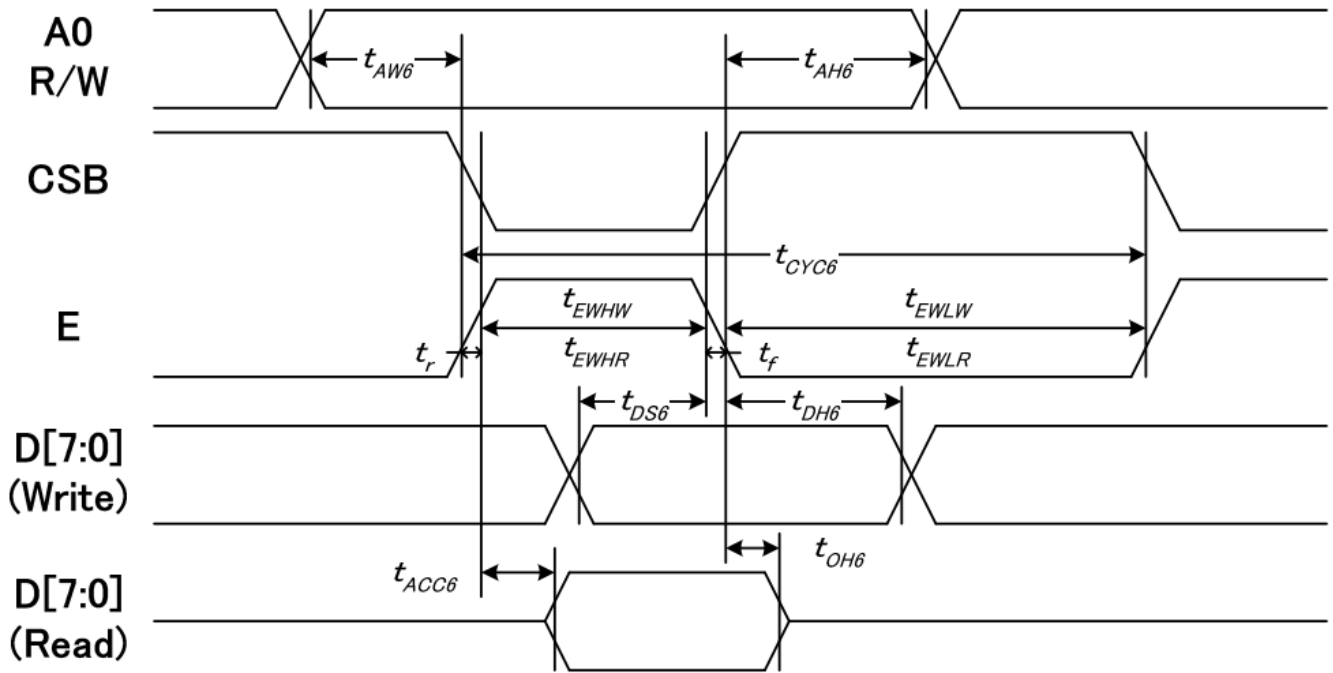


图 5. 从 CPU 写到 ST75161 (Writing Data from CPU to ST75161)

6.6 并行接口：时序要求 (AC 参数):
 写数据到 ST75161 的时序要求: (6800 系列 MPU)

VDD1 = 1.8~3.3V, Ta = -45~85 °C

Item	Signal	Symbol	Condition	Min.	Max.	Unit
Address setup time	A0	tAW6		20	—	ns
Address hold time		tAH6		0	—	
System cycle time (WRITE)	E	tCYC6		160	—	
Enable L pulse width (WRITE)		tEHLW		70	—	
Enable H pulse width (WRITE)		tEHWLW		70	—	
System cycle time (READ)		tCYC6		400	—	
Enable L pulse width (READ)	E	tEHLR		180	—	
Enable H pulse width (READ)		tEHWHR		180	—	
Write data setup time	D[7:0]	tDS6		15	—	
Write data hold time		tDH6		15	—	
Read data access time		tACC6	CL = 30 pF	—	100	
Read data output disable time		tOH6	CL = 30 pF	10	110	

Note:

- The input signal rise time and fall time (tr, tf) is specified at 15 ns or less. When the system cycle time is extremely fast, (tr + tf) ≤ (tCYC6 – tEHLW – tEHWLW) for (tr + tf) ≤ (tCYC6 – tEHLR – tEHWHR) are specified.
- All timing is specified using 20% and 80% of VDD1 as the reference.

表 6

6.7 IIC 接口：

从 CPU 写到 ST75161 (Writing Data from CPU to ST75161)

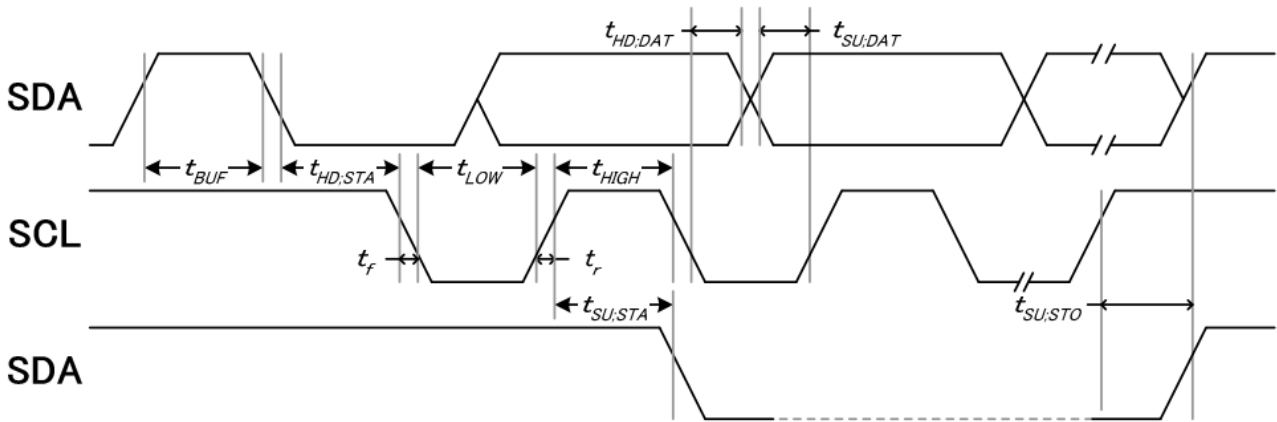


图 6. 从 CPU 写到 ST75161 (Writing Data from CPU to ST75161)

6.8 IIC 接口：时序要求 (AC 参数)：

写数据到 ST75161 的时序要求：

VDD1 = 1.8~3.3V, Ta = -45~85 °C

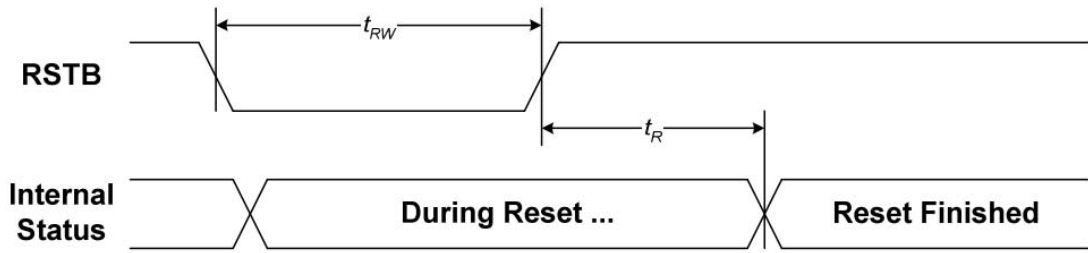
Item	Signal	Symbol	Condition	Rating		Unit
				Min.	Max.	
SCL clock frequency	SCL	fSCL		—	400	KHZ
SCL clock low period		tLOW		1.3	—	
SCL clock high period		tHIGH		0.6	—	
Data set-up time	SDA	tSU;Data		0.1	—	us
Data hold time		tHD;Data		0	0.9	
Setup time for a repeated START condition		tSU;STA		0.6	—	
Start condition hold time		tHD;STA		0.6	—	
Setup time for STOP condition		tSU;STO		0.6	—	
Bus free time between a STOP and START		tBUF		0.1	—	
Signal rise time	SCL	tr		20+0.1Cb	300	ns
Signal fall time		tf		20+0.1Cb	300	
Capacitive load represented by each bus line	SDA	Cb		—	400	pF
Tolerable spike width on bus		tSW		—	50	ns

Note:

- All timing is specified using 20% and 80% of VDD1 as the standard.

表 7

6.9 电源启动后复位的时序要求 (RESET CONDITION AFTER POWER UP):



VDD1 = 1.8~3.3V, Ta = -45~85 °C

Item	Symbol	Condition	Min.	Max.	Unit
Reset time	tR		—	1	ms
Reset "L" pulse width	tRW		1	—	ms

图 7：电源启动后复位的时序



7. 指令功能:

7.1 指令表

下表是“ST75161” IC 支持的指令:

A0: 0: 指令; 1: 数据 W/R: 0: 写; 1: 读 D7~D0: 有用的数据位; -: 不必理会的
表 8.

INSTRUCTION	A0	R/W	COMMAND BYTE								DESCRIPTION
			D7	D6	D5	D4	D3	D2	D1	D0	
1.Extension Command	0	0	0	0	1	1	EXT1	0	0	EXT0	Set extension instruction
Ext[1:0]=0,0 (Extension Command 1)											
2.Display ON/OFF	0	0	1	0	1	0	1	1	1	DSP	Set LCD display DSP=0: Display off DSP=1: Display on
3.Inverse Display	0	0	1	0	1	0	0	1	1	INV	Set inverse display INV=0: Normal display INV=1: Inverse display
4.All Pixel ON/OFF	0	0	0	0	1	0	0	0	1	AP	Set all pixel on mode AP=0: All pixel off mode AP=1: All pixel on mode
5.Display Control	0	0	1	1	0	0	1	0	1	0	Set display control CLD :Set CL dividing ratio DT[7:0] : Set the number of duty LF[4:0] : Set N-line inversion counter FI : Set the inversion type of frame at the end of common scan cycle
	1	0	0	0	0	0	0	CLD	0	0	
	1	0	DT7	DT6	DT5	DT4	DT3	DT2	DT1	DT0	
	1	0	0	0	LF4	FI	LF3	LF2	LF1	LF0	
6.Power Save	0	0	1	0	0	1	0	1	0	SLP	Set power save mode SLP=0: Sleep out mode SLP=1: Sleep in mode
7.Set Page Address	0	0	0	1	1	1	0	1	0	1	Set page address Starting page address: 00h ≤ YS ≤ 27h Ending page address: YS ≤ YE ≤ 27h
	1	0	YS7	YS6	YS5	YS4	YS3	YS2	YS1	YS0	
	1	0	YE7	YE6	YE5	YE4	YE3	YE2	YE1	YE0	
8.Set Column Address	0	0	0	0	0	1	0	1	0	1	Set column address Starting column address: 00h ≤ XS ≤ 9Fh Ending column address: XS ≤ XE ≤ 9Fh
	1	0	XS7	XS6	XS5	XS4	XS3	XS2	XS1	XS0	
	1	0	XE7	XE6	XE5	XE4	XE3	XE2	XE1	XE0	
9.Data Scan Direction	0	0	1	0	1	1	1	1	0	0	Set normal/ inverse display of address and address scan direction
	1	0	0	0	0	0	0	MV	MX	0	
10.Write Data	0	0	0	1	0	1	1	1	0	0	Write data to DDRAM
	1	0	D7	D6	D5	D4	D3	D2	D1	D0	
11.Read Data	0	0	0	1	0	1	1	1	0	1	Read data from DDRAM (Only for parallel interface and I ² C)
	1	1	D7	D6	D5	D4	D3	D2	D1	D0	
12.Partial In	0	0	1	0	1	0	1	0	0	0	Set partial area Starting partial display address: 00h ≤ PTS ≤ 9Fh Ending partial display address: 00h ≤ PTE ≤ 9Fh
	1	0	PTS7	PTS6	PTS5	PTS4	PTS3	PTS2	PTS1	PTS0	
	1	0	PTE7	PTE6	PTE5	PTE4	PTE3	PTE2	PTE1	PTE0	

INSTRUCTION	A0	R/W	COMMAND BYTE								DESCRIPTION
			D7	D6	D5	D4	D3	D2	D1	D0	
13.Partial Out	0	0	1	0	1	0	1	0	0	1	Exit the partial mode
14.Read/Modify/Write In	0	0	1	1	1	0	0	0	0	0	Enable read modify write
15.Read/Modify/Write Out	0	0	1	1	1	0	1	1	1	0	Disable read modify write
16.Scroll Area	0	0	1	0	1	0	1	0	1	0	Set scroll area TL[7:0] : Set top line address BL[7:0] : Set bottom line address NSL[7:0] : Number of specified line SCM[1:0] : Area scroll mode
	1	0	TL7	TL6	TL5	TL4	TL3	TL2	TL1	TL0	
	1	0	BL7	BL6	BL5	BL4	BL3	BL2	BL1	BL0	
	1	0	NSL7	NSL6	NSL5	NSL4	NSL3	NSL2	NSL1	NSL0	
17.Set Start Line	0	0	1	0	1	0	1	0	1	1	Set scroll start address 00h ≤ SL ≤ 9Fh
	1	0	SL7	SL6	SL5	SL4	SL3	SL2	SL1	SL0	
18.OSC ON	0	0	1	1	0	1	0	0	0	1	Turn on the internal oscillator
19.OSC OFF	0	0	1	1	0	1	0	0	1	0	Turn off the internal oscillator
20.Power Control	0	0	0	0	1	0	0	0	0	0	Power circuit operation VB=0: OFF, VB=1: ON VF=0: OFF, VF=1: ON VR=0: OFF, VR=1: ON
	1	0	0	0	0	0	VB	0	VF	VR	
21.Set Vop	0	0	1	0	0	0	0	0	0	1	Set Vop
	1	0	0	0	Vop5	Vop4	Vop3	Vop2	Vop1	Vop0	
	1	0	0	0	0	0	0	Vop8	Vop7	Vop6	
22.Vop Control	0	0	1	1	0	1	0	1	1	VOL	Control Vop VOL=0: Vop increase one step VOL=1: Vop decrease one step
23.Read Register Mode	0	0	0	1	1	1	1	1	0	REG	Set read register mode REG=0: read the register value of Vop[5:0] REG=1: read the register value of Vop[8:6]
24.Nop	0	0	0	0	1	0	0	1	0	1	No operation
25.Read Status (Parallel and I ² C)	0	1	D7	D6	D5	D4	D3	D2	D1	D0	Read status byte (Parallel and I ² C)
26.Read Status (4-Line and 3-Line SPI)	0	0	1	1	1	1	1	1	1	0	Read status byte (4-Line and 3-Line SPI)
	0	1	D7	D6	D5	D4	D3	D2	D1	D0	
27.Data Format Select	0	0	0	0	0	0	1	DO	0	0	DO=0; LSB on bottom (Default) DO=1; LSB on top
28. Display Mode	0	0	1	1	1	1	0	0	0	0	Set display mode DM=0 :Mono(Default) DM=1 :4Gray Scale Mode
	1	0	0	0	0	1	0	0	0	DM	

INSTRUCTION	A0	R/W	COMMAND BYTE								DESCRIPTION
			D7	D6	D5	D4	D3	D2	D1	D0	
29.Set ICON	0	0	0	1	1	1	0	1	1	ICON	Enable/Disable ICON RAM ICON=1 ; Enable ICON RAM ICON=0 ; Disable ICON RAM
Ext[1:0]=0,1 (Extension Command 2)											
30. Set Gray Level	0	0	0	0	1	0	0	0	0	0	Set gray scale level GL[4:0]: Set Light Gray Level GD[4:0]: Set Dark Gray Level
	1	0	0	0	0	0	0	0	0	0	
	1	0	0	0	0	0	0	0	0	0	
	1	0	0	0	0	0	0	0	0	0	
	1	0	0	0	0	GL4	GL3	GL2	GL1	GL0	
	1	0	0	0	0	GL4	GL3	GL2	GL1	GL0	
	1	0	0	0	0	GL4	GL3	GL2	GL1	GL0	
	1	0	0	0	0	0	0	0	0	0	
	1	0	0	0	0	0	0	0	0	0	
	1	0	0	0	0	GD4	GD3	GD2	GD1	GD0	
	1	0	0	0	0	GD4	GD3	GD2	GD1	GD0	
	1	0	0	0	0	GD4	GD3	GD2	GD1	GD0	
	1	0	0	0	0	GD4	GD3	GD2	GD1	GD0	
	1	0	0	0	0	0	0	0	0	0	
	1	0	0	0	0	0	0	0	0	0	
31.Analog Circuit Set	0	0	0	0	1	1	0	0	1	0	Set analog circuit BE[1:0]: Booster efficiency set BS[2:0]: Set bias ratio
	1	0	0	0	0	0	0	0	0	0	
	1	0	0	0	0	0	0	0	BE1	BE0	
	1	0	0	0	0	0	0	BS2	BS1	BS0	
32.Booster Level	0	0	0	1	0	1	0	0	0	1	Set booster level BST=0 : X8 BST=1 : X10
	1	0	1	1	1	1	1	0	1	BST	
33. Driving Select	0	0	0	1	0	0	0	0	0	DS	Power type DS=0: Internal (Default) DS=1 :External
34.Auto Read Control	0	0	1	1	0	1	0	1	1	1	Set auto-read instruction XARD=0: Enable auto read XARD=1: Disable auto read
	1	0	1	0	0	XARD	1	1	1	1	
35.OTP WR/RD Control	0	0	1	1	1	0	0	0	0	0	OTP WR/RD control WR/RD=0: Enable OTP read WR/RD=1: Enable OTP write
	1	0	0	0	WR/RD	0	0	0	0	0	
36.OTP Control Out	0	0	1	1	1	0	0	0	0	1	OTP control out
37.OTP Write	0	0	1	1	1	0	0	0	1	0	OTP write
38.OTP Read	0	0	1	1	1	0	0	0	1	1	OTP read

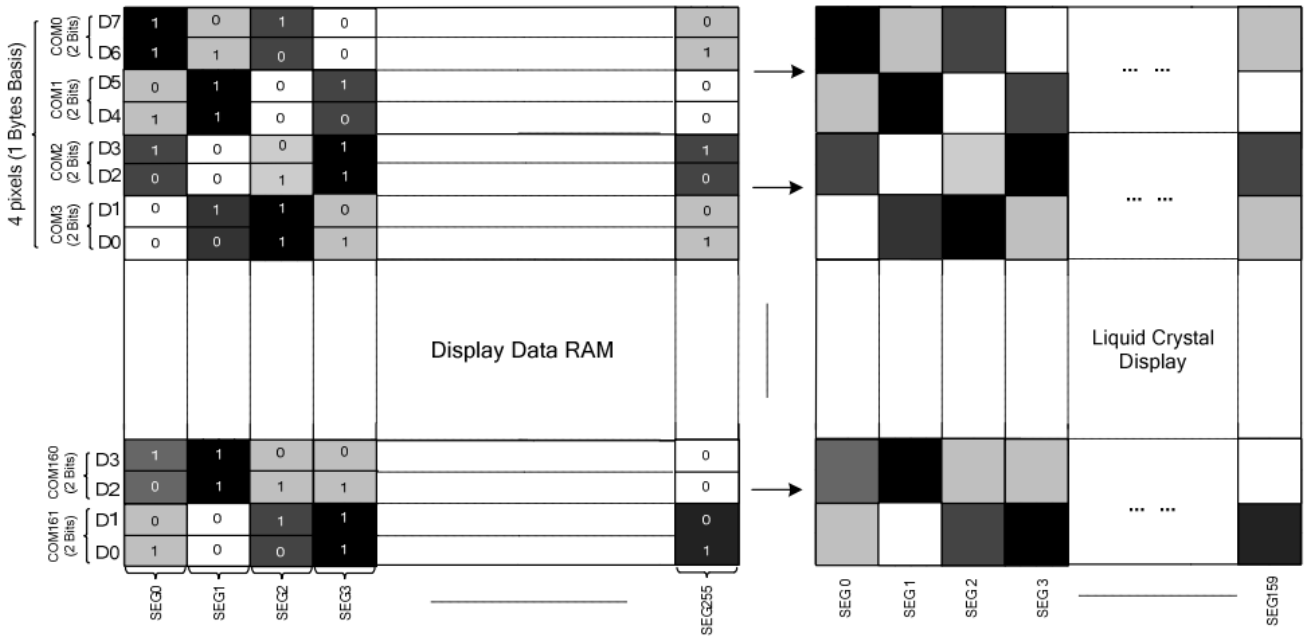
INSTRUCTION	A0	R/W	COMMAND BYTE								DESCRIPTION
			D7	D6	D5	D4	D3	D2	D1	D0	
39.OTP Selection Control	0	0	1	1	1	0	0	1	0	0	OTP selection control Ctrl=1: Disable OTP Selection Ctrl=0: Enable OTP Selection
	1	0	1	Ctrl	0	1	1	0	0	1	
40.OTP Programming Setting	0	0	1	1	1	0	0	1	0	1	OTP programming setting
	1	0	0	0	0	0	1	1	1	1	
41.Frame Rate	0	0	1	1	1	1	0	0	0	0	Frame rate setting in different temperature range
	1	0	0	0	0	FRA4	FRA3	FRA2	FRA1	FRA0	
	1	0	0	0	0	FRB4	FRB3	FRB2	FRB1	FRB0	
	1	0	0	0	0	FRC4	FRC3	FRC2	FRC1	FRC0	
	1	0	0	0	0	FRD4	FRD3	FRD2	FRD1	FRD0	
42.Temperature Range	0	0	1	1	1	1	0	0	1	0	Temperature range setting
	1	0	0	TA6	TA5	TA4	TA3	TA2	TA1	TA0	
	1	0	0	TB6	TB5	TB4	TB3	TB2	TB1	TB0	
	1	0	0	TC6	TC5	TC4	TC3	TC2	TC1	TC0	
43.Temperature Gradient Compensation	0	0	1	1	1	1	0	1	0	0	Set temperature gradient compensation coefficient
	1	0	MT13	MT12	MT11	MT10	MT03	MT02	MT01	MT00	
	1	0	MT33	MT32	MT31	MT30	MT23	MT22	MT21	MT20	
	1	0	MT53	MT52	MT51	MT50	MT43	MT42	MT41	MT40	
	1	0	MT73	MT72	MT71	MT70	MT63	MT62	MT61	MT60	
	1	0	MT93	MT92	MT91	MT90	MT83	MT82	MT81	MT80	
	1	0	MTB3	MTB2	MTB1	MTB0	MTA3	MTA2	MTA1	MTA0	
	1	0	MTD3	MTD2	MTD1	MTD0	MTC3	MTC2	MTC1	MTC0	
	1	0	MTF3	MTF2	MTF1	MTF0	MTE3	MTE2	MTE1	MTE0	
Ext[1:0]=1,1(Extension Command 4)											
44.Enable OTP	0	0	1	1	0	1	0	1	1	0	Enable OTP EOTP =0 ; Disable (Default) EOTP =1 ; Enable
	1	0	0	0	0	EOTP	0	0	0	0	

请详细参考 IC 资料“ST75161-G2A_V1.2a PDF”的第 55~77 页。

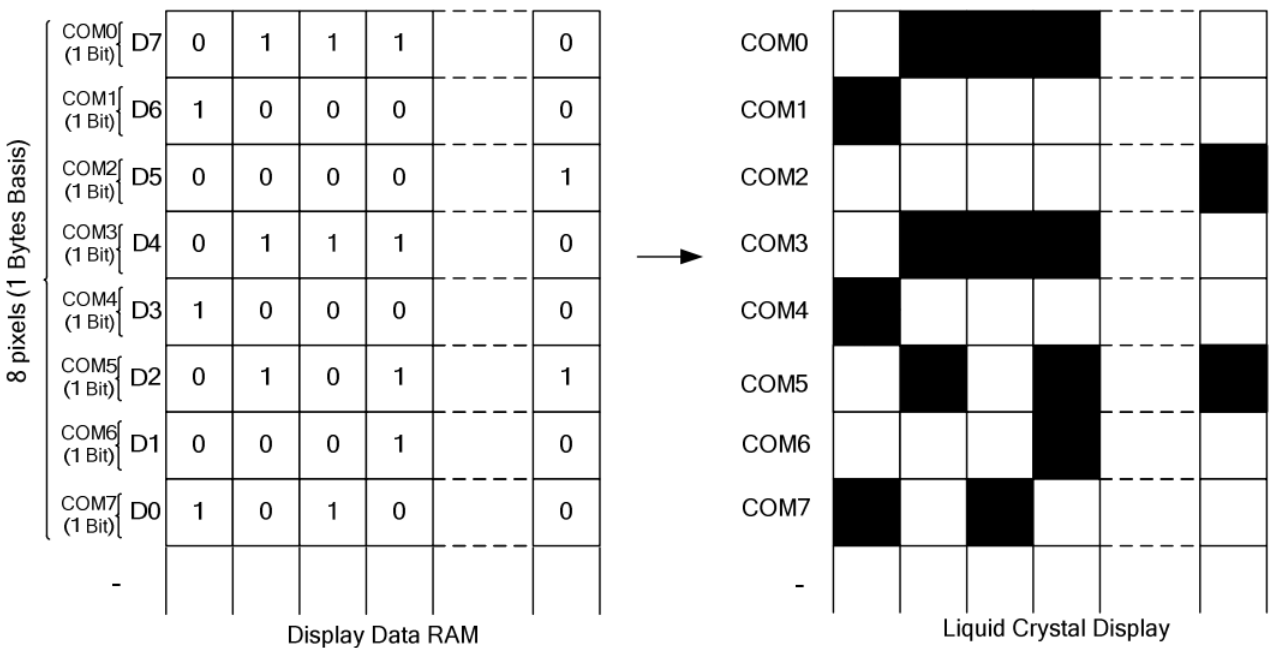
7.3 点阵与 DD RAM(显示数据存储)地址的对应关系

ST75161 包含 160 x161x2 位静态 RAM 存储显示数据。数据显示 RAM (DDRAM)

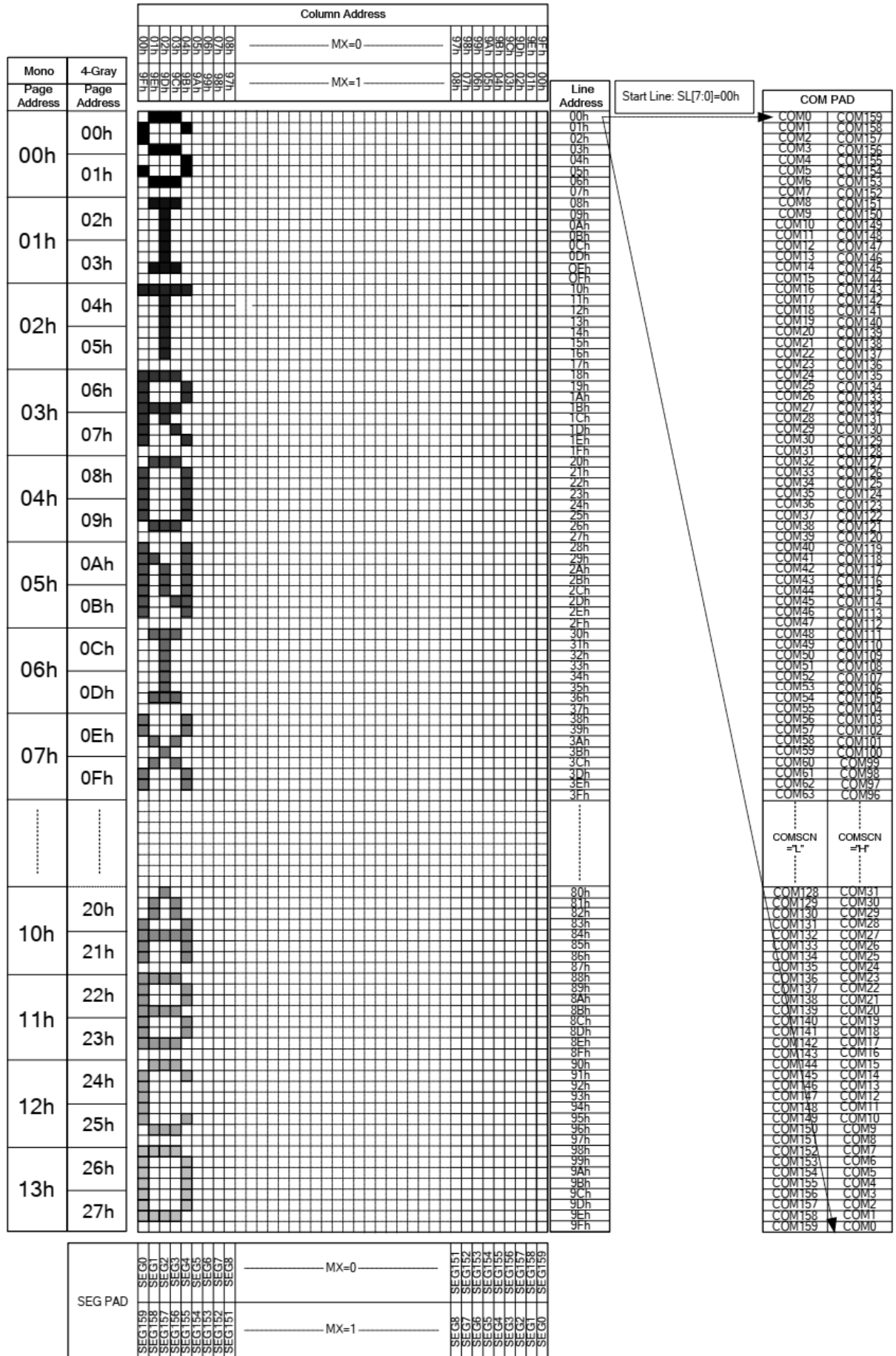
商店液晶显示器的像素数据。内置的 DDRAM 与 160 列可寻址内存数组 161 行。ST75161 提供 2 种显示模式(4-Gray /单色规模模式)和一个 fast-addressing 模式快速更新显示数据。每个页面地址代表不同 sub-COMs 不同的显示模式。例如,在 4-Gray /单色规模模式设置页面地址“00 h”意味着即将到来的 8 位数据寻址 COM0 ~ COM3 / COM0 ~ COM7。列地址到赛格输出数量直接相关。LCD 控制器读取像素 DDRAM 中的数据,然后输出 COM/SEG 垫。而液晶控制器独立运作,显示数据可以写入 DDRAM 同时数据也被显示在 LCD 面板不会引起异常显示。如下图所示:



2 Bits Data N=0~3		DDRAM		LCD
D2N+1	D2N			
1	1	1	1	
0	0	0	0	
1	0	1	0	
0	1	0	1	



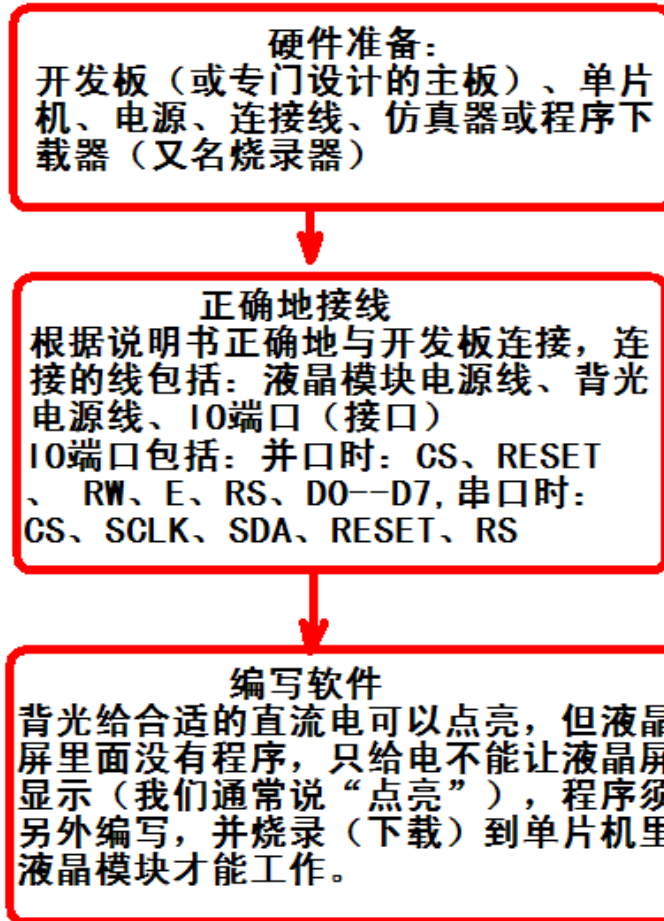
下图摘自 ST75161 IC 资料，可通过“ST75161-G2A_V1.2a pdf”第 38~49 页。



7.4 初始化方法

用户所编的显示程序, 开始必须进行初始化, 否则模块无法正常显示, 过程请参考程序

点亮液晶模块的步骤



7.5 程序举例：

液晶模块与 MPU(以 8051 系列单片机为例)接口图如下：

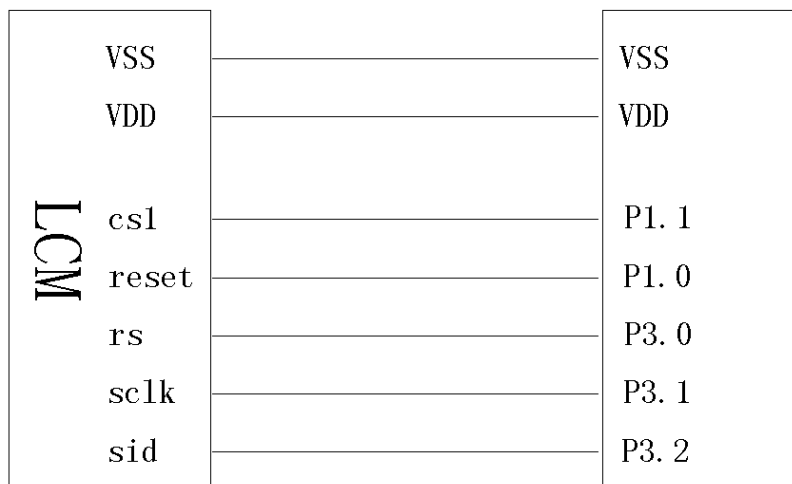


图 8. 串行接口


```
#define uint unsigned int
#define ulong unsigned long
```

```
/*延时：1 毫秒的 i 倍*/
```

```
void delay(int i)
{
    int j,k;
    for(j=0;j<i;j++)
        for(k=0;k<110;k++);
}
```

```
/*延时：1us 的 i 倍*/
```

```
void delay_us(int i)
{
    int j,k;
    for(j=0;j<i;j++)
        for(k=0;k<1;k++);
}
```

```
/*等待一个按键，我的主板是用 P2.0 与 GND 之间接一个按键*/
```

```
void waitkey()
{
    repeat:
        if (key==1) goto repeat;
        else delay(2000);
}
```

```
//=====transfer command to LCM=====
```

```
//写指令到 LCD 模块
```

```
void transfer_command(int data1)
{
    char i;
    cs1=0;
    rs=0;
    for(i=0;i<8;i++)
    {
        sclk=0;
        if(data1&0x80) sid=1;
        else sid=0;
        sclk=1;
        data1=data1<<=1;
    }
}
```

```
    }
    cs1=1;
}

//写数据到LCD 模块
void transfer_data(int data1)
{
    char i;
    cs1=0;
    rs=1;
    for(i=0;i<8;i++)
    {
        sclk=0;
        if(data1&0x80) sid=1;
        else sid=0;
        sclk=1;
        data1=data1<<=1;
    }
    cs1=1;
}

//-----对比度值设置,粗调 0x05,微调 0x23-----//
void initial_lcd()
{
    reset=0;
    delay(100);
    reset=1;
    delay(500);
    transfer_command_lcd(0x30); //EXT=0
    transfer_command_lcd(0x94); //Sleep out
    transfer_command_lcd(0x31); //EXT=1
    transfer_command_lcd(0xD7); //Autoread disable
    transfer_data_lcd(0X9F); //
    transfer_command_lcd(0x32); //Analog SET
    transfer_data_lcd(0x00); //OSC Frequency adjustment
    transfer_data_lcd(0x01); //Frequency on booster capacitors->6KHz
    transfer_data_lcd(0x00); //Bias=1/14
    transfer_command_lcd(0x20); // Gray Level
    transfer_data_lcd(0x01);
    transfer_data_lcd(0x03);
    transfer_data_lcd(0x05);
    transfer_data_lcd(0x07);
    transfer_data_lcd(0x09);
    transfer_data_lcd(0x0b);
    transfer_data_lcd(0x0d);
    transfer_data_lcd(0x10);
```

```
transfer_data_lcd(0x11);
transfer_data_lcd(0x13);
transfer_data_lcd(0x15);
transfer_data_lcd(0x17);
transfer_data_lcd(0x19);
transfer_data_lcd(0x1b);
transfer_data_lcd(0x1d);
transfer_data_lcd(0x1f);

transfer_command_lcd(0x31); //EXT=1
transfer_command_lcd(0xf0); //此指令比较重要,不加之指令升压会慢 0.5s
transfer_data_lcd(0x0f);
transfer_data_lcd(0x0f);
transfer_data_lcd(0x0f);
transfer_data_lcd(0x0f);

transfer_command_lcd(0x30); //EXT=0
transfer_command_lcd(0x75); //Page Address setting
transfer_data_lcd(0x00); // XS=0
transfer_data_lcd(0x28); // XE=159 0x28
transfer_command_lcd(0x15); //Clumn Address setting
transfer_data_lcd(0x00); // XS=0
transfer_data_lcd(0xff); // XE=256
transfer_command_lcd(0xBC); //Data scan direction
transfer_data_lcd(0x00); //MX.MY=Normal
transfer_data_lcd(0xA6);
transfer_command_lcd(0xCA); //Display Control
transfer_data_lcd(0x00); //
transfer_data_lcd(0x9F); //Duty=160
transfer_data_lcd(0x20); //Nline=off
transfer_command_lcd(0xF0); //Display Mode
transfer_data_lcd(0x10); //10=Monochrome Mode, 11=4Gray
transfer_command_lcd(0x81); //EV control
transfer_data_lcd(0x23); //微调对比度的值, 可设置范围 0x00~0x3f
transfer_data_lcd(0x05); //粗调对比度, 可设置范围 0x00~0x07
transfer_command_lcd(0x20); //Power control
transfer_data_lcd(0x0B); //D0=regulator ; D1=follower ; D3=booste, on:1 off:0
delay(20);
transfer_command_lcd(0xAF); //Display on
}
```

```
/*写 LCD 行列地址: X 为起始的列地址, Y 为起始的行地址, x_total, y_total 分别为列地址及行地址的起点到终点的差值
*/
```

```
void lcd_address(int x, int y, x_total, y_total)
```

```
{
    x=x;
    y=y-1;

    transfer_command_lcd(0x15); //Set Column Address
    transfer_data_lcd(x);
    transfer_data_lcd(x+x_total-1);

    transfer_command_lcd(0x75); //Set Page Address
    transfer_data_lcd(y);
    transfer_data_lcd(y+y_total-1);
    transfer_command_lcd(0x30);
    transfer_command_lcd(0x5c);
}
```

/*清屏*/

```
void clear_screen()
```

```
{
    int i, j;
    lcd_address(0, 1, 160, 20);
    for(i=0;i<20;i++)
    {
        for(j=0;j<160;j++)
        {
            transfer_data_lcd(0x00);
        }
    }
}
```

```
void test(uchar data1,uchar data2)
```

```
{
    int i, j;
    lcd_address(0, 1, 160, 20);
    for(i=0;i<20;i++)
    {
        for(j=0;j<160;j++)
        {
            transfer_data_lcd(data1);
            transfer_data_lcd(data2);
        }
    }
}
```

//显示 8x16 的点阵的字符串，括号里的参数分别为（页，列，字符串指针）

```
void display_string_8x16(uint page,uint column,uchar reverse,uchar *text)
```

```
{
    uint i=0, j, k, n;
    if(column>248)
    {
        column=1;
        page+=2;
    }
    while(text[i]>0x00)
    {
        if((text[i]>=0x20)&&(text[i]<=0x7e))
        {
            j=text[i]-0x20;
            for(n=0;n<2;n++)
            {
                lcd_address(column, page+n, 256, 8);
                for(k=0;k<8;k++)
                {
                    if(reverse==1)
                    {
                        transfer_data_lcd(~ascii_table_8x16[j][k+8*n]); //写数据到 LCD, 每写完 1 字节的数据后列地址自动
                        加 1
                    }
                    else
                    {
                        transfer_data_lcd(ascii_table_8x16[j][k+8*n]); //写数据到 LCD, 每写完 1 字节
                        的数据后列地址自动加 1
                    }
                }
            }
            i++;
            column+=8;
        }
        else
            i++;
    }
}
```

//显示 5x8 的点阵的字符串，括号里的参数分别为（页，列，字符串指针）

```
void display_string_5x8(uint page,uint column,uchar reverse,uchar *text)
```

```
{
    uint i=0, j, k, disp_data;
    while(text[i]>0x00)
    {
        if((text[i]>=0x20)&&(text[i]<=0x7e))
```



```

    {
        j=text[i]-0x20;
        lcd_address(column, page, 256, 8);
        for(k=0;k<5;k++)
        {
            if(reverse==1)
            {
                disp_data=~ascii_table_5x8[j][k];
            }
            else
            {
                disp_data=ascii_table_5x8[j][k];
            }

            transfer_data_lcd(disp_data); //写数据到LCD, 每写完 1 字节的数据后列地址自动加 1
        }
        if(reverse==1) transfer_data_lcd(0xff); //写入一列空白列, 使得 5x8 的字符与字符之间有一
        列间隔, 更美观
        else transfer_data_lcd(0x00); //写入一列空白列, 使得 5x8 的字符与字符之间有一列间
        隔, 更美观

        i++;
        column+=6;
        if(column>251)
        {
            column=1;
            page++;
        }
        else
        i++;
    }
}

```

```

//写入一组 16x16 点阵的汉字字符串（字符串表格中需含有此字）
//括号里的参数：（页，列，汉字字符串）
void display_string_16x16(uchar column, uchar page, uchar *text)
{
    uchar i, j, k;
    uint address;
    j=0;
    while(text[j]!='\0')
    {
        i=0;
        address=1;
        while(Chinese_text_16x16[i]> 0x7e)

```

```
{
    if(Chinese_text_16x16[i] == text[j])
    {
        if(Chinese_text_16x16[i+1] == text[j+1])
        {
            address=i*16;
            break;
        }
    }
    i +=2;
}
if(column>255)
{
    column=0;
    page+=2;
}
if(address !=1)
{
    lcd_address(column, page, 16, 2);
    for(k=0;k<2;k++)
    {
        for(i=0;i<16;i++)
        {
            transfer_data_lcd(Chinese_code_16x16[address]);
            address++;
        }
        j +=2;
    }
    else
    {
        lcd_address(column, page, 16, 2);
        for(k=0;k<2;k++)
        {
            for(i=0;i<16;i++)
            {
                transfer_data_lcd(0x00);
            }
        }
        j++;
    }
    column+=16;
}
}
```

```
/*显示 32*32 点阵的汉字或等同于 32*32 点阵的图像*/
```

```
void disp_32x32(int x,int y,uchar *dp)
{
    int i,j;
    lcd_address(x,y,32,4);
    for(i=0;i<4;i++)
    {
        for(j=0;j<32;j++)
        {
            transfer_data_lcd(*dp);
            dp++;
        }
    }
}
```

```
/*显示 256*160 点阵的图像*/
```

```
void disp_160x160(int x,int y,char *dp)
{
    int i,j;
    lcd_address(x,y,160,20);
    for(i=0;i<20;i++)
    {
        for(j=0;j<160;j++)
        {
            transfer_data_lcd(*dp);
            dp++;
        }
    }
}
```

```
//-----
void main()
{
    P1M1=0x00;
    P1M0=0x00; //P1 配置为准双向
    P2M1=0x00;
    P2M0=0x00; //P2 配置为准双向
    P3M1=0x00;
    P3M0=0x00; //P3 配置为准双向
    initial_lcd(); //对液晶模块进行初始化设置
    while(1)
    {
        clear_screen(); //清屏
        transfer_command_lcd(0x0c); //低位在前
    }
}
```

```
disp_160x160(0, 1, bmp2); //显示一幅 160*160 点阵的黑白图。
waitkey();
clear_screen(); //清屏
disp_160x160(0, 1, bmp1); //显示一幅 160*160 点阵的黑白图。
waitkey();
transfer_command_lcd(0x08); //低位在前
clear_screen(); //清屏
disp_160x160(0, 1, bmp3); //显示一幅 160*160 点阵的黑白图。
waitkey();
clear_screen(); //清屏
disp_160x160(0, 1, bmp4); //显示一幅 160*160 点阵的黑白图。
waitkey();
clear_screen();
transfer_command_lcd(0x08); //高位在前
display_string_16x16(16, 4, "深圳市晶联讯电子");
disp_32x32(0, 8, jing2);
disp_32x32((32*1+0), 8, lian2);
disp_32x32((32*2+0), 8, xun2);
disp_32x32((32*3+0), 8, dian2);
disp_32x32((32*4+0), 8, zi2);
waitkey();
clear_screen(); //清屏函数
transfer_command_lcd(0x0c); //低位在前
display_string_8x16(1, 1, 1, "0123456789abcdeefgjie");
display_string_8x16(3, 1, 0, "! # $ % & ' ( ) * +, - # $ % & * +, -");
display_string_5x8(5, 1, 1, "0123456789abcdecdef~6789`");
display_string_5x8(6, 1, 0, "JLX electronic slectroc ");
display_string_5x8(7, 1, 0, "established at ablished");
display_string_5x8(8, 1, 0, "www.jlxlcd.cnwww.jlxlcd.cn");
display_string_8x16(9, 1, 1, "0123456789abcdeefgjie");
display_string_8x16(11, 1, 0, "0123456789ABCEFGHILD");
display_string_8x16(13, 1, 1, "RSTUVWXYZ[]*+,. 1234");
display_string_8x16(15, 1, 0, "UVWXYZ[]*+,. 123HILD");
display_string_8x16(17, 1, 1, "BCEFGHILD1-# $ % & *3HIL");
display_string_5x8(19, 1, 0, "JLX electronic slectroc ");
display_string_5x8(20, 1, 0, "established at ablished");
waitkey();
}
}

uchar code Chinese_text_16x16[]=
{
    "深圳市晶联讯电子有限公司"
};
```

```
uchar code Chinese_code_16x16[]=
{
/*-- 文字： 深 --*/
/*-- 新宋体 12； 此字体下对应的点阵为： 宽 x 高=16x16 --*/
0x08, 0x86, 0x60, 0x07, 0x00, 0x64, 0x44, 0x58, 0x40, 0x43, 0x50, 0x48, 0x4C, 0x60, 0x40, 0x00,
0x20, 0x3F, 0xC0, 0x04, 0x04, 0x88, 0x88, 0x90, 0xA0, 0xFF, 0xA0, 0x90, 0x98, 0x8C, 0x08, 0x00,

/*-- 文字： 圳 --*/
/*-- 新宋体 12； 此字体下对应的点阵为： 宽 x 高=16x16 --*/
0x08, 0x08, 0x08, 0x7F, 0x08, 0x08, 0x7F, 0x00, 0x00, 0x3F, 0x00, 0x00, 0x00, 0x7F, 0x00, 0x00,
0x10, 0x10, 0x20, 0xE2, 0x24, 0x18, 0xE0, 0x00, 0x00, 0xF8, 0x00, 0x00, 0x00, 0xFE, 0x00, 0x00,

/*-- 文字： 市 --*/
/*-- 新宋体 12； 此字体下对应的点阵为： 宽 x 高=16x16 --*/
0x20, 0x20, 0x20, 0x27, 0x24, 0x24, 0xA4, 0x7F, 0x24, 0x24, 0x24, 0x24, 0x27, 0x20, 0x20, 0x00,
0x00, 0x00, 0x00, 0xFC, 0x00, 0x00, 0x00, 0xFF, 0x00, 0x00, 0x08, 0x04, 0xF8, 0x00, 0x00, 0x00,

/*-- 文字： 晶 --*/
/*-- 新宋体 12； 此字体下对应的点阵为： 宽 x 高=16x16 --*/
0x00, 0x00, 0x00, 0x00, 0x7E, 0x54, 0x54, 0x54, 0x54, 0x54, 0x7E, 0x00, 0x00, 0x00, 0x00,
0x00, 0xFE, 0xA4, 0xA4, 0xA4, 0xA4, 0xFE, 0x00, 0x00, 0xFE, 0xA4, 0xA4, 0xA4, 0xA4, 0xFE, 0x00,

/*-- 文字： 联 --*/
/*-- 新宋体 12； 此字体下对应的点阵为： 宽 x 高=16x16 --*/
0x40, 0x7F, 0x49, 0x49, 0x49, 0x7F, 0x48, 0x88, 0x48, 0x38, 0x0F, 0x18, 0xE8, 0x48, 0x08, 0x00,
0x10, 0xF8, 0x10, 0x10, 0x20, 0xFF, 0xA0, 0x81, 0x82, 0x8C, 0xF0, 0x88, 0x84, 0x83, 0x82, 0x00,

/*-- 文字： 讯 --*/
/*-- 新宋体 12； 此字体下对应的点阵为： 宽 x 高=16x16 --*/
0x04, 0x84, 0x74, 0x27, 0x00, 0x42, 0x42, 0x7F, 0x42, 0x42, 0x42, 0x40, 0x7F, 0x00, 0x00, 0x00,
0x00, 0x00, 0x00, 0xFE, 0x04, 0x08, 0x00, 0xFE, 0x00, 0x00, 0x00, 0x00, 0x00, 0xFC, 0x02, 0x1C, 0x00,

/*-- 文字： 电 --*/
/*-- 新宋体 12； 此字体下对应的点阵为： 宽 x 高=16x16 --*/
0x00, 0x00, 0x1F, 0x12, 0x12, 0x12, 0x12, 0xFF, 0x12, 0x12, 0x12, 0x12, 0x1F, 0x00, 0x00, 0x00,
0x00, 0x00, 0xF0, 0x20, 0x20, 0x20, 0x20, 0xFC, 0x22, 0x22, 0x22, 0x22, 0xF2, 0x02, 0x0E, 0x00,

/*-- 文字： 子 --*/
/*-- 新宋体 12； 此字体下对应的点阵为： 宽 x 高=16x16 --*/
0x00, 0x00, 0x40, 0x40, 0x40, 0x40, 0x40, 0x47, 0x48, 0x50, 0x60, 0x40, 0x00, 0x01, 0x00, 0x00,
0x80, 0x80, 0x80, 0x80, 0x80, 0x82, 0x81, 0xFE, 0x80, 0x80, 0x80, 0x80, 0x80, 0x80, 0x80, 0x00,

/*-- 文字： 有 --*/
/*-- 新宋体 12； 此字体下对应的点阵为： 宽 x 高=16x16 --*/
0x00, 0x20, 0x21, 0x22, 0x27, 0x2C, 0x34, 0xE4, 0x24, 0x24, 0x24, 0x27, 0x20, 0x20, 0x20, 0x00,
0x40, 0x80, 0x00, 0x00, 0xFF, 0x90, 0x90, 0x90, 0x94, 0x92, 0x93, 0xFE, 0x00, 0x00, 0x00, 0x00,
```

```

/*-- 文字： 限 --*/
/*-- 新宋体 12： 此字体下对应的点阵为： 宽 x 高=16x16 --*/
0x7F, 0x40, 0x4C, 0x72, 0x41, 0x00, 0x7F, 0x52, 0x53, 0x52, 0x52, 0x7E, 0x00, 0x00, 0x00,
0xFF, 0x00, 0x40, 0x20, 0xC0, 0x00, 0xFF, 0x02, 0x04, 0xC0, 0x30, 0x48, 0x84, 0x06, 0x04, 0x00,

```

```

/*-- 文字： 公 --*/
/*-- 新宋体 12： 此字体下对应的点阵为： 宽 x 高=16x16 --*/
0x00, 0x00, 0x01, 0x02, 0x0C, 0x70, 0x21, 0x00, 0x00, 0x70, 0x08, 0x06, 0x03, 0x01, 0x01, 0x00,
0x00, 0x80, 0x04, 0x0E, 0x14, 0x24, 0xC4, 0x8C, 0x08, 0x08, 0x28, 0x1E, 0x0C, 0x80, 0x00, 0x00,

```

```

/*-- 文字： 司 --*/
/*-- 新宋体 12： 此字体下对应的点阵为： 宽 x 高=16x16 --*/
0x00, 0x08, 0x49, 0x49, 0x49, 0x49, 0x49, 0x49, 0x49, 0x49, 0x48, 0x40, 0x40, 0x7F, 0x00, 0x00,
0x00, 0x00, 0xF8, 0x20, 0x20, 0x20, 0x20, 0x20, 0x20, 0xF0, 0x00, 0x04, 0x02, 0xFC, 0x00, 0x00,
};

```

```

uchar code jing2[]={
/*-- 文字： 晶 --*/
/*-- 宋体： 此字体下对应的点阵为： 宽 x 高=32x32 --*/

0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x1F, 0x1F, 0x08, 0x08, 0x08, 0x08, 0x08,
0x08, 0x08, 0x08, 0x08, 0x08, 0x08, 0x1F, 0x1F, 0x08, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00,
0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0xFE, 0xFE, 0x88, 0x88, 0x88, 0x88, 0x88,
0x88, 0x88, 0x88, 0x88, 0x88, 0x88, 0xFE, 0xFC, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00,
0x00, 0x00, 0x00, 0x00, 0xFF, 0x7F, 0x42, 0x42, 0x42, 0x42, 0x42, 0x42, 0x7F, 0xFF, 0x40, 0x00,
0x00, 0x00, 0xFF, 0x7F, 0x42, 0x42, 0x42, 0x42, 0x42, 0x42, 0x42, 0x42, 0xFF, 0x40, 0x00, 0x00,
0x00, 0x00, 0x00, 0x00, 0xFE, 0xFC, 0x08, 0x08, 0x08, 0x08, 0x08, 0x08, 0x08, 0x08, 0xFC, 0xFC, 0x00, 0x00,
0x00, 0x00, 0xFE, 0xFC, 0x08, 0x08, 0x08, 0x08, 0x08, 0x08, 0x08, 0x08, 0xFC, 0x00, 0x00, 0x00,
};

```

```

uchar code lian2[]={
/*-- 文字： 联 --*/
/*-- 宋体： 此字体下对应的点阵为： 宽 x 高=31x32 --*/

0x00, 0x00, 0x04, 0x04, 0x07, 0x07, 0x04, 0x04, 0x04, 0x04, 0x07, 0x07, 0x04, 0x0C, 0x04, 0x00,
0x20, 0x1C, 0x0F, 0x07, 0x00, 0x00, 0x00, 0x01, 0x0E, 0x3C, 0x10, 0x00, 0x00, 0x00, 0x00, 0x00,
0x00, 0x00, 0x00, 0x00, 0xFF, 0xFF, 0x10, 0x10, 0x10, 0x10, 0xFF, 0xFF, 0x00, 0x00, 0x20, 0x20,
0x20, 0x20, 0xA0, 0x20, 0x3F, 0x3F, 0x60, 0xA0, 0x20, 0x20, 0x60, 0x60, 0x21, 0x00, 0x00, 0x00,
0x00, 0x00, 0x00, 0x00, 0xFF, 0xFF, 0x40, 0x40, 0x41, 0x41, 0xFF, 0xFF, 0x42, 0x42, 0x42, 0x40,
0x40, 0x40, 0x40, 0x43, 0xFF, 0xF0, 0x78, 0x47, 0x41, 0x40, 0x40, 0x80, 0x80, 0x80, 0x00, 0x00,
0x00, 0x00, 0x40, 0xE0, 0xC0, 0xC0, 0x80, 0x80, 0x00, 0x00, 0xFE, 0xFC, 0x00, 0x02, 0x04, 0x0C,
0x18, 0x30, 0xE0, 0xC0, 0x00, 0x00, 0x00, 0x00, 0xC0, 0x70, 0x38, 0x1C, 0x0C, 0x08, 0x00, 0x00,

```

```
};
```

```
uchar code xun2[]={  
/*-- 文字： 讯 --*/  
/*-- 宋体； 此字体下对应的点阵为： 宽 x 高=32x32 --*/  
  
0x00, 0x00, 0x00, 0x00, 0x00, 0x10, 0x18, 0x0E, 0x07, 0x00, 0x00, 0x00, 0x04, 0x04, 0x04, 0x04,  
0x05, 0x05, 0x04, 0x04, 0x04, 0x04, 0x04, 0x04, 0x0F, 0x0F, 0x04, 0x00, 0x00, 0x00, 0x00, 0x00,  
0x00, 0x00, 0x04, 0x04, 0x04, 0x04, 0x04, 0x07, 0x0F, 0x04, 0x00, 0x01, 0x01, 0x01, 0x01, 0x01,  
0xFF, 0xFF, 0x81, 0x01, 0x01, 0x03, 0x01, 0x00, 0xFF, 0xFF, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00,  
0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0xFF, 0xFF, 0x00, 0x00, 0x01, 0x02, 0x00, 0x00, 0x00,  
0xFF, 0xFF, 0x00, 0x00, 0x00, 0x00, 0x00, 0x80, 0xF8, 0xFF, 0x03, 0x00, 0x00, 0x03, 0x00, 0x00,  
0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0xF0, 0xF8, 0x60, 0xC0, 0x80, 0x00, 0x00, 0x00, 0x00,  
0xFC, 0xFC, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x80, 0xE0, 0x78, 0x18, 0xFC, 0x00, 0x00,  
  
};
```

```
uchar code dian2[]={  
/*-- 文字： 电 --*/  
/*-- 宋体； 此字体下对应的点阵为： 宽 x 高=32x32 --*/  
  
0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x3F, 0x1F,  
0x10, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00,  
0x00, 0x00, 0x00, 0x00, 0xFF, 0xFF, 0x41, 0x41, 0x41, 0x41, 0x41, 0x41, 0x41, 0xFF, 0xFF,  
0x41, 0x41, 0x41, 0x41, 0x41, 0x41, 0x41, 0xFF, 0xFF, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00,  
0x00, 0x00, 0x00, 0x00, 0xFF, 0xFF, 0x04, 0x04, 0x04, 0x04, 0x04, 0x04, 0x04, 0xFF, 0xFF,  
0x04, 0x04, 0x04, 0x04, 0x04, 0x04, 0x04, 0xFE, 0xFE, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00,  
0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00,  
0x04, 0x04, 0x04, 0x04, 0x04, 0x04, 0x04, 0x04, 0x04, 0x04, 0x04, 0x04, 0x04, 0x04, 0x04, 0x04,  
  
};
```

```
uchar code zi2[]={  
/*-- 文字： 子 --*/  
/*-- 宋体； 此字体下对应的点阵为： 宽 x 高=32x32 --*/  
  
0x00, 0x00, 0x00, 0x00, 0x00, 0x08, 0x08, 0x08, 0x08, 0x08, 0x08, 0x08, 0x08, 0x08, 0x08, 0x08,  
0x08, 0x08, 0x08, 0x08, 0x08, 0x09, 0x0B, 0x0E, 0x0E, 0x1C, 0x0C, 0x04, 0x00, 0x00, 0x00, 0x00,  
0x00, 0x00, 0x01, 0x01, 0x01, 0x01, 0x01, 0x01, 0x01, 0x01, 0x01, 0x01, 0x01, 0x01, 0x01, 0x3F,  
0x3F, 0x31, 0x41, 0x41, 0x81, 0x01, 0x01, 0x01, 0x01, 0x01, 0x03, 0x07, 0x03, 0x01, 0x00, 0x00,  
0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0xFF,  
0xFF, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00,  
0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x10, 0x08, 0x08, 0x0C, 0x0E, 0xFE,  
0xFC, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00,  
  
};
```


0x00, 0x00, 0x00, 0x7F, 0x20, 0x10, 0x00, 0xFF, 0x00, 0x00, 0x00, 0x0F, 0x30, 0x40, 0xF8, 0x00,
 0x00, 0x00, 0x1F, 0x08, 0x08, 0x08, 0x08, 0x7F, 0x88, 0x88, 0x88, 0x88, 0x9F, 0x80, 0xF0, 0x00,
 0x00, 0x00, 0x00, 0x00, 0x00, 0x40, 0x80, 0x7F, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00,
 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00,
 0x00, 0x10, 0x10, 0xF8, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00,
 0x00, 0x00, 0x08, 0x08, 0xF8, 0x08, 0x08, 0x00, 0x08, 0xF8, 0x08, 0x00, 0x00, 0x00, 0x00, 0x00,
 0x08, 0x18, 0x68, 0x80, 0x80, 0x68, 0x18, 0x08, 0x00, 0x10, 0x10, 0xF8, 0x00, 0x00, 0x00, 0x00,
 0x00, 0xE0, 0x10, 0x88, 0x88, 0x18, 0x00, 0x00, 0x00, 0xE0, 0x10, 0x08, 0x08, 0x10, 0xE0, 0x00,
 0x00, 0x10, 0x10, 0xF8, 0x00, 0x00, 0x00, 0x00, 0x00, 0xE0, 0x10, 0x88, 0x88, 0x18, 0x00, 0x00,
 0x00, 0xE0, 0x10, 0x08, 0x08, 0x10, 0xE0, 0x00, 0xC0, 0x30, 0x08, 0x08, 0x08, 0x38, 0x00, 0x00,
 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x10, 0x10, 0xF8, 0x00, 0x00, 0x00, 0x00,
 0x00, 0xE0, 0x10, 0x88, 0x88, 0x18, 0x00, 0x00, 0x00, 0x70, 0x08, 0x08, 0x88, 0x70, 0x00,
 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00,
 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00,
 0x00, 0x20, 0x20, 0x3F, 0x20, 0x20, 0x00, 0x00, 0x00, 0x30, 0x30, 0x00, 0x00, 0x00, 0x00, 0x00,
 0xC0, 0x80, 0x80, 0x80, 0x7F, 0x00, 0x00, 0x20, 0x3F, 0x20, 0x20, 0x20, 0x20, 0x30, 0x00,
 0x20, 0x30, 0x2C, 0x03, 0x03, 0x2C, 0x30, 0x20, 0x00, 0x20, 0x20, 0x3F, 0x20, 0x20, 0x00, 0x00,
 0x00, 0x0F, 0x11, 0x20, 0x20, 0x11, 0x0E, 0x00, 0x00, 0x0F, 0x10, 0x20, 0x20, 0x10, 0x0F, 0x00,
 0x00, 0x20, 0x20, 0x3F, 0x20, 0x20, 0x00, 0x00, 0x00, 0x0F, 0x11, 0x20, 0x20, 0x11, 0x0E, 0x00,
 0x00, 0x0F, 0x10, 0x20, 0x20, 0x10, 0x0F, 0x00, 0x07, 0x18, 0x20, 0x20, 0x22, 0x1E, 0x02, 0x00,
 0x00, 0x01, 0x01, 0x01, 0x01, 0x01, 0x01, 0x01, 0x00, 0x20, 0x20, 0x3F, 0x20, 0x20, 0x00, 0x00,
 0x00, 0x0F, 0x11, 0x20, 0x20, 0x11, 0x0E, 0x00, 0x00, 0x30, 0x28, 0x24, 0x22, 0x21, 0x30, 0x00,
 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00,
 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00,
 0x00, 0x70, 0x08, 0x08, 0x88, 0x70, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00,
 0x00, 0x00, 0xC0, 0x40, 0x40, 0x40, 0x7F, 0x48, 0x48, 0x48, 0x48, 0xC8, 0x08, 0x08, 0x00, 0x00,
 0x00, 0xFE, 0x02, 0x22, 0xDA, 0x06, 0x08, 0xC8, 0xB8, 0x8F, 0xE8, 0x88, 0x88, 0x88, 0x08, 0x00,
 0x90, 0x52, 0x34, 0x10, 0xFF, 0x10, 0x34, 0x52, 0x80, 0x70, 0x8F, 0x08, 0x08, 0xF8, 0x08, 0x00,
 0x00, 0x00, 0x00, 0xC0, 0xC0, 0x00, 0x00, 0x00, 0x00, 0x10, 0x10, 0xF8, 0x00, 0x00, 0x00, 0x00,
 0x00, 0xE0, 0x10, 0x88, 0x88, 0x18, 0x00, 0x00, 0x00, 0xE0, 0x10, 0x08, 0x08, 0x10, 0xE0, 0x00,
 0x40, 0x40, 0x80, 0xF0, 0x80, 0x40, 0x40, 0x00, 0x00, 0x10, 0x10, 0xF8, 0x00, 0x00, 0x00, 0x00,
 0x00, 0xE0, 0x10, 0x88, 0x88, 0x18, 0x00, 0x00, 0x00, 0xE0, 0x10, 0x08, 0x08, 0x10, 0xE0, 0x00,
 0x00, 0x00, 0xC0, 0x40, 0x40, 0x40, 0x7F, 0x48, 0x48, 0x48, 0x48, 0xC8, 0x08, 0x08, 0x00, 0x00,
 0x00, 0xFE, 0x02, 0x22, 0xDA, 0x06, 0x08, 0xC8, 0xB8, 0x8F, 0xE8, 0x88, 0x88, 0x88, 0x08, 0x00,
 0x00, 0x30, 0x28, 0x24, 0x22, 0x21, 0x30, 0x00, 0x00, 0x30, 0x30, 0x00, 0x00, 0x00, 0x00, 0x00,
 0x80, 0x40, 0x37, 0x04, 0x04, 0x14, 0x64, 0x04, 0x14, 0x64, 0x04, 0x07, 0x10, 0xE0, 0x00, 0x00,
 0x00, 0xFF, 0x08, 0x10, 0x08, 0x07, 0x08, 0x08, 0x08, 0x08, 0xFF, 0x08, 0x08, 0x08, 0x08, 0x00,
 0x82, 0x9A, 0x56, 0x63, 0x22, 0x52, 0x8E, 0x00, 0x80, 0x40, 0x33, 0x0C, 0x33, 0x40, 0x80, 0x00,
 0x00, 0x00, 0x00, 0x30, 0x30, 0x00, 0x00, 0x00, 0x00, 0x20, 0x20, 0x3F, 0x20, 0x20, 0x00, 0x00,
 0x00, 0x0F, 0x11, 0x20, 0x20, 0x11, 0x0E, 0x00, 0x00, 0x0F, 0x10, 0x20, 0x20, 0x10, 0x0F, 0x00,
 0x02, 0x02, 0x01, 0x0F, 0x01, 0x02, 0x02, 0x00, 0x00, 0x20, 0x20, 0x3F, 0x20, 0x20, 0x00, 0x00,
 0x00, 0x0F, 0x11, 0x20, 0x20, 0x11, 0x0E, 0x00, 0x00, 0x0F, 0x10, 0x20, 0x20, 0x10, 0x0F, 0x00,
 0x80, 0x40, 0x37, 0x04, 0x04, 0x14, 0x64, 0x04, 0x14, 0x64, 0x04, 0x07, 0x10, 0xE0, 0x00, 0x00,
 0x00, 0xFF, 0x08, 0x10, 0x08, 0x07, 0x08, 0x08, 0x08, 0x08, 0xFF, 0x08, 0x08, 0x08, 0x08, 0x00,
 0x00, 0x30, 0x08, 0x88, 0x88, 0x48, 0x30, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00,
 0x00, 0x02, 0x02, 0xF2, 0x12, 0x12, 0x12, 0xF2, 0x02, 0x02, 0x02, 0xFE, 0x02, 0x02, 0x02, 0x00,

0x08, 0x08, 0x89, 0xEE, 0x98, 0x00, 0x00, 0xFE, 0x02, 0x02, 0xF2, 0x02, 0x02, 0xFE, 0x00, 0x00,
 0x00, 0xFE, 0x02, 0x02, 0x02, 0x12, 0x22, 0x42, 0x82, 0x42, 0x22, 0x1A, 0x02, 0x02, 0x00, 0x00,
 0x00, 0x00, 0x00, 0xC0, 0xC0, 0x00, 0x00, 0x00, 0x00, 0xE0, 0x10, 0x88, 0x88, 0x18, 0x00, 0x00,
 0x00, 0xE0, 0x10, 0x08, 0x08, 0x10, 0xE0, 0x00, 0x40, 0x40, 0x80, 0xF0, 0x80, 0x40, 0x40, 0x00,
 0x00, 0xE0, 0x10, 0x88, 0x88, 0x18, 0x00, 0x00, 0x00, 0xE0, 0x10, 0x08, 0x08, 0x10, 0xE0, 0x00,
 0x80, 0x80, 0x80, 0x80, 0x80, 0x80, 0x80, 0x00, 0x80, 0x80, 0x80, 0x80, 0x80, 0x80, 0x80, 0x00,
 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00,
 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00,
 0x00, 0x18, 0x20, 0x20, 0x20, 0x11, 0x0E, 0x00, 0x00, 0x30, 0x30, 0x00, 0x00, 0x00, 0x00, 0x00,
 0x00, 0x00, 0x00, 0x0F, 0x04, 0x04, 0x04, 0x0F, 0x00, 0x40, 0x80, 0x7F, 0x00, 0x00, 0x00, 0x00,
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0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00,
0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00,
};
uchar code bmp4[]={
/*-- 调入了一幅图像：E:\WORK\点阵图片\160160点阵\猫和老鼠 1. bmp --*/
/*-- 宽度 x 高度=160x160 --*/
0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x0F, 0x0A, 0x0A,
0x0A, 0x0A, 0x0A, 0x0A, 0x0A, 0x0F, 0x00, 0x00, 0x00, 0x00, 0x04, 0x07, 0x04, 0x04, 0x07, 0x04,
0x00, 0x09, 0x05, 0x01, 0x05, 0x09, 0x00, 0x00, 0x00, 0x00, 0x08, 0x06, 0x00, 0x04, 0x04, 0x07,
0x04, 0x04, 0x04, 0x07, 0x00, 0x00, 0x00, 0x00, 0x00, 0x01, 0x01, 0x01, 0x01, 0x01, 0x0F, 0x01,
0x01, 0x01, 0x01, 0x01, 0x00, 0x00, 0x00, 0x00, 0x08, 0x08, 0x08, 0x08, 0x08, 0x08, 0x08, 0x09,
0x0A, 0x0C, 0x08, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00,
0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00,
0x01, 0x01, 0x01, 0x03, 0x03, 0x03, 0x03, 0x03, 0x03, 0x07, 0x03, 0x03, 0x07, 0x07, 0x07, 0x0F,
0x0F, 0x1F, 0x1F, 0x1E, 0x1C, 0x18, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00,
0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00,
0x7E, 0x3F, 0x0F, 0x03, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x3F, 0x24, 0xA4, 0xA4, 0xA4,
0xBF, 0x80, 0xBF, 0xA4, 0xA4, 0xA4, 0x24, 0x3F, 0x00, 0x00, 0x01, 0xFF, 0x91, 0x92, 0xFF, 0x02,
0x10, 0x10, 0x13, 0xFC, 0x13, 0x10, 0x10, 0x00, 0x00, 0x40, 0x40, 0x7F, 0x01, 0x22, 0x20, 0xFF,
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0xFF, 0xFF, 0xFF, 0xFF, 0xFF, 0xFF, 0xFF, 0xFF, 0xFF, 0xFF, 0xFF, 0xFF, 0xFF, 0xFF, 0xFF, 0xFF,
0xFF, 0xFF, 0xFE, 0xF8, 0x70, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00,
0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00,
0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00,
0x00, 0xC0, 0x60, 0x20, 0x10, 0x18, 0x08, 0x0C, 0x06, 0x06, 0x02, 0x02, 0x03, 0x03, 0x03, 0x03,
0x02, 0x02, 0x06, 0x8C, 0xF8, 0xF0, 0xE0, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00,

```

```

};
uchar code ascii_table_8x16[95][16]={

```

//粗体 8x16 点阵的 ASCII 码的点阵数据，从“JLX-GB2312”型号的字库 IC 中读出来的国标的。

0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00,	//- (即“空格”) ASCII 码:
0X20	
0x00, 0x00, 0x38, 0xFC, 0xFC, 0x38, 0x00, 0x00, 0x00, 0x00, 0x0D, 0x0D, 0x00, 0x00, 0x00,	//!- ASCII
码: 0X21	
0x00, 0x0E, 0x1E, 0x00, 0x00, 0x1E, 0x0E, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00,	//"-
0x20, 0xF8, 0xF8, 0x20, 0xF8, 0xF8, 0x20, 0x00, 0x02, 0x0F, 0x0F, 0x02, 0x0F, 0x0F, 0x02, 0x00,	//#-
0x38, 0x7C, 0x44, 0x47, 0x47, 0xCC, 0x98, 0x00, 0x06, 0x0C, 0x08, 0x38, 0x38, 0x0F, 0x07, 0x00,	//-\$-
0x30, 0x30, 0x00, 0x80, 0xC0, 0x60, 0x30, 0x00, 0x0C, 0x06, 0x03, 0x01, 0x00, 0x0C, 0x0C, 0x00,	//%-
0x80, 0xD8, 0x7C, 0xE4, 0xBC, 0xD8, 0x40, 0x00, 0x07, 0x0F, 0x08, 0x08, 0x07, 0x0F, 0x08, 0x00,	//&-
0x00, 0x10, 0x1E, 0x0E, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00,	//'-
0x00, 0x00, 0xF0, 0xF8, 0x0C, 0x04, 0x00, 0x00, 0x00, 0x00, 0x03, 0x07, 0x0C, 0x08, 0x00, 0x00,	//(-
0x00, 0x00, 0x04, 0x0C, 0xF8, 0xF0, 0x00, 0x00, 0x00, 0x08, 0x0C, 0x07, 0x03, 0x00, 0x00,	//)-
0x80, 0xA0, 0xE0, 0xC0, 0xC0, 0xE0, 0xA0, 0x80, 0x00, 0x02, 0x03, 0x01, 0x01, 0x03, 0x02, 0x00,	//*- ASCII
码: 0X2A	
0x00, 0x80, 0x80, 0xE0, 0xE0, 0x80, 0x80, 0x00, 0x00, 0x00, 0x00, 0x03, 0x03, 0x00, 0x00, 0x00,	//+-
0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x10, 0x1E, 0x0E, 0x00, 0x00, 0x00,	//-, -
0x80, 0x80, 0x80, 0x80, 0x80, 0x80, 0x80, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00,	//---
0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x0C, 0x0C, 0x00, 0x00, 0x00,	//-. -
0x00, 0x00, 0x00, 0x80, 0xC0, 0x60, 0x30, 0x00, 0x0C, 0x06, 0x03, 0x01, 0x00, 0x00, 0x00, 0x00,	//-/
0xF8, 0xF8, 0x0C, 0xC4, 0x0C, 0xF8, 0xF0, 0x00, 0x03, 0x07, 0x0C, 0x08, 0x0C, 0x07, 0x03, 0x00,	//-0- ASCII
码: 0X30	
0x00, 0x10, 0x18, 0xFC, 0xFC, 0x00, 0x00, 0x00, 0x00, 0x00, 0x08, 0x08, 0x0F, 0x0F, 0x08, 0x08, 0x00,	//-1-
0x08, 0x0C, 0x84, 0xC4, 0x64, 0x3C, 0x18, 0x00, 0x0E, 0x0F, 0x09, 0x08, 0x08, 0x0C, 0x0C, 0x00,	//-2-
0x08, 0x0C, 0x44, 0x44, 0x44, 0xFC, 0xB8, 0x00, 0x04, 0x0C, 0x08, 0x08, 0x08, 0x0F, 0x07, 0x00,	//-3-
0xC0, 0xE0, 0xB0, 0x98, 0xFC, 0xFC, 0x80, 0x00, 0x00, 0x00, 0x00, 0x08, 0x0F, 0x0F, 0x08, 0x00,	//-4- ASCII
码: 0X34	
0x7C, 0x7C, 0x44, 0x44, 0x44, 0xC4, 0x84, 0x00, 0x04, 0x0C, 0x08, 0x08, 0x08, 0x0F, 0x07, 0x00,	//-5-
0xF0, 0xF8, 0x4C, 0x44, 0x44, 0xC0, 0x80, 0x00, 0x07, 0x0F, 0x08, 0x08, 0x08, 0x0F, 0x07, 0x00,	//-6-
0x0C, 0x0C, 0x04, 0x84, 0xC4, 0x7C, 0x3C, 0x00, 0x00, 0x00, 0x0F, 0x0F, 0x00, 0x00, 0x00, 0x00,	//-7-
0xB8, 0xFC, 0x44, 0x44, 0x44, 0xFC, 0xB8, 0x00, 0x07, 0x0F, 0x08, 0x08, 0x08, 0x0F, 0x07, 0x00,	//-8-
0x38, 0x7C, 0x44, 0x44, 0x44, 0xFC, 0xF8, 0x00, 0x00, 0x08, 0x08, 0x08, 0x0C, 0x07, 0x03, 0x00,	//-9-
0x00, 0x00, 0x00, 0x30, 0x30, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x06, 0x06, 0x00, 0x00, 0x00,	//-:-
0x00, 0x00, 0x00, 0x30, 0x30, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x08, 0x0E, 0x06, 0x00, 0x00, 0x00,	//-;-
0x00, 0x80, 0xC0, 0x60, 0x30, 0x18, 0x08, 0x00, 0x00, 0x00, 0x01, 0x03, 0x06, 0x0C, 0x08, 0x00,	//-<-
0x00, 0x20, 0x20, 0x20, 0x20, 0x20, 0x20, 0x00, 0x01, 0x01, 0x01, 0x01, 0x01, 0x01, 0x01, 0x00,	//=-
0x00, 0x08, 0x18, 0x30, 0x60, 0xC0, 0x80, 0x00, 0x00, 0x08, 0x0C, 0x06, 0x03, 0x01, 0x00, 0x00,	//->- ASCII
码: 0X3E	
0x18, 0x1C, 0x04, 0xC4, 0xE4, 0x3C, 0x18, 0x00, 0x00, 0x00, 0x00, 0x0D, 0x0D, 0x00, 0x00, 0x00,	//-?-
0xF0, 0xF0, 0x08, 0xC8, 0xC8, 0xF8, 0xF0, 0x00, 0x07, 0x0F, 0x08, 0x0B, 0x0B, 0x0B, 0x01, 0x00,	//-@-
0xE0, 0xF0, 0x98, 0x8C, 0x98, 0xF0, 0xE0, 0x00, 0x0F, 0x0F, 0x00, 0x00, 0x00, 0x0F, 0x0F, 0x00,	//-A- ASCII
码: 0X41	

0x04, 0xFC, 0xFC, 0x44, 0x44, 0xFC, 0xB8, 0x00, 0x08, 0x0F, 0x0F, 0x08, 0x08, 0x0F, 0x07, 0x00, //B-	
0xF0, 0xF8, 0x0C, 0x04, 0x04, 0x0C, 0x18, 0x00, 0x03, 0x07, 0x0C, 0x08, 0x08, 0x0C, 0x06, 0x00, //C-	
0x04, 0xFC, 0xFC, 0x04, 0x0C, 0xF8, 0xF0, 0x00, 0x08, 0x0F, 0x0F, 0x08, 0x0C, 0x07, 0x03, 0x00, //D-	
0x04, 0xFC, 0xFC, 0x44, 0xE4, 0x0C, 0x1C, 0x00, 0x08, 0x0F, 0x0F, 0x08, 0x08, 0x0C, 0x0E, 0x00, //E-	
0x04, 0xFC, 0xFC, 0x44, 0xE4, 0x0C, 0x1C, 0x00, 0x08, 0x0F, 0x0F, 0x08, 0x00, 0x00, 0x00, 0x00, //F-	
0xF0, 0xF8, 0x0C, 0x84, 0x84, 0x8C, 0x98, 0x00, 0x03, 0x07, 0x0C, 0x08, 0x08, 0x07, 0x0F, 0x00, //G-	
0xFC, 0xFC, 0x40, 0x40, 0x40, 0xFC, 0xFC, 0x00, 0x0F, 0x0F, 0x00, 0x00, 0x00, 0x0F, 0x0F, 0x00, //H-	ASCII
码：0X48	
0x00, 0x00, 0x04, 0xFC, 0xFC, 0x04, 0x00, 0x00, 0x00, 0x00, 0x08, 0x0F, 0x0F, 0x08, 0x00, 0x00, //I-	
0x00, 0x00, 0x00, 0x04, 0xFC, 0xFC, 0x04, 0x00, 0x07, 0x0F, 0x08, 0x08, 0x0F, 0x07, 0x00, 0x00, //J-	
0x04, 0xFC, 0xFC, 0xC0, 0xE0, 0x3C, 0x1C, 0x00, 0x08, 0x0F, 0x0F, 0x00, 0x01, 0x0F, 0x0E, 0x00, //K-	
0x04, 0xFC, 0xFC, 0x04, 0x00, 0x00, 0x00, 0x00, 0x08, 0x0F, 0x0F, 0x08, 0x08, 0x0C, 0x0E, 0x00, //L-	
0xFC, 0xFC, 0x38, 0x70, 0x38, 0xFC, 0xFC, 0x00, 0x0F, 0x0F, 0x00, 0x00, 0x00, 0x0F, 0x0F, 0x00, //M-	
0xFC, 0xFC, 0x38, 0x70, 0xE0, 0xFC, 0xFC, 0x00, 0x0F, 0x0F, 0x00, 0x00, 0x00, 0x0F, 0x0F, 0x00, //N-	
0xF8, 0xFC, 0x04, 0x04, 0x04, 0xFC, 0xF8, 0x00, 0x07, 0x0F, 0x08, 0x08, 0x08, 0x0F, 0x07, 0x00, //O-	
0x04, 0xFC, 0xFC, 0x44, 0x44, 0x7C, 0x38, 0x00, 0x08, 0x0F, 0x0F, 0x08, 0x00, 0x00, 0x00, 0x00, //P-	
0xF8, 0xFC, 0x04, 0x04, 0x04, 0xFC, 0xF8, 0x00, 0x07, 0x0F, 0x08, 0x0E, 0x3C, 0x3F, 0x27, 0x00, //Q-	
0x04, 0xFC, 0xFC, 0x44, 0xC4, 0xFC, 0x38, 0x00, 0x08, 0x0F, 0x0F, 0x00, 0x00, 0x0F, 0x0F, 0x00, //R-	
0x18, 0x3C, 0x64, 0x44, 0xC4, 0x9C, 0x18, 0x00, 0x06, 0x0E, 0x08, 0x08, 0x08, 0x0F, 0x07, 0x00, //S-	
0x00, 0x1C, 0x0C, 0xFC, 0xFC, 0x0C, 0x1C, 0x00, 0x00, 0x00, 0x08, 0x0F, 0x0F, 0x08, 0x00, 0x00, //T-	
0xFC, 0xFC, 0x00, 0x00, 0x00, 0xFC, 0xFC, 0x00, 0x07, 0x0F, 0x08, 0x08, 0x08, 0x0F, 0x07, 0x00, //U-	
0xFC, 0xFC, 0x00, 0x00, 0x00, 0xFC, 0xFC, 0x00, 0x01, 0x03, 0x06, 0x0C, 0x06, 0x03, 0x01, 0x00, //V-	
0xFC, 0xFC, 0x00, 0x00, 0x00, 0xFC, 0xFC, 0x00, 0x07, 0x0F, 0x0E, 0x03, 0x0E, 0x0F, 0x07, 0x00, //W-	
0x0C, 0x3C, 0xF0, 0xE0, 0xF0, 0x3C, 0x0C, 0x00, 0x0C, 0x0F, 0x03, 0x01, 0x03, 0x0F, 0x0C, 0x00, //X-	
0x00, 0x0C, 0x7C, 0xC0, 0xC0, 0x7C, 0x3C, 0x00, 0x00, 0x00, 0x08, 0x0F, 0x0F, 0x08, 0x00, 0x00, //Y-	
0x1C, 0x0C, 0x84, 0xC4, 0x64, 0x3C, 0x1C, 0x00, 0x0E, 0x0F, 0x09, 0x08, 0x08, 0x0C, 0x0E, 0x00, //Z-	
0x00, 0x00, 0xFC, 0xFC, 0x04, 0x04, 0x00, 0x00, 0x00, 0x0F, 0x0F, 0x08, 0x08, 0x00, 0x00, //[-	
0x38, 0x70, 0xE0, 0xC0, 0x80, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x01, 0x03, 0x07, 0x0E, 0x00, //\-	
0x00, 0x00, 0x04, 0x04, 0xFC, 0xFC, 0x00, 0x00, 0x00, 0x00, 0x08, 0x08, 0x0F, 0x0F, 0x00, 0x00, //]-	
0x08, 0x0C, 0x06, 0x03, 0x06, 0x0C, 0x08, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, //^-	
0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x20, 0x20, 0x20, 0x20, 0x20, 0x20, 0x20, 0x20, //_-	
0x00, 0x00, 0x03, 0x07, 0x04, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, //^-	
0x00, 0xA0, 0xA0, 0xA0, 0xE0, 0xC0, 0x00, 0x00, 0x07, 0x0F, 0x08, 0x08, 0x07, 0x0F, 0x08, 0x00, //a-	ASCII
码：0X61	
0x04, 0xFC, 0xFC, 0x20, 0x60, 0xC0, 0x80, 0x00, 0x00, 0x0F, 0x0F, 0x08, 0x08, 0x0F, 0x07, 0x00, //b-	
0xC0, 0xE0, 0x20, 0x20, 0x20, 0x60, 0x40, 0x00, 0x07, 0x0F, 0x08, 0x08, 0x08, 0x0C, 0x04, 0x00, //c-	
0x80, 0xC0, 0x60, 0x24, 0xFC, 0xFC, 0x00, 0x00, 0x07, 0x0F, 0x08, 0x08, 0x07, 0x0F, 0x08, 0x00, //d-	
0xC0, 0xE0, 0xA0, 0xA0, 0xA0, 0xE0, 0xC0, 0x00, 0x07, 0x0F, 0x08, 0x08, 0x08, 0x0C, 0x04, 0x00, //e-	
0x40, 0xF8, 0xFC, 0x44, 0x0C, 0x18, 0x00, 0x00, 0x08, 0x0F, 0x0F, 0x08, 0x00, 0x00, 0x00, 0x00, //f-	
0xC0, 0xE0, 0x20, 0x20, 0xC0, 0xE0, 0x20, 0x00, 0x27, 0x6F, 0x48, 0x48, 0x7F, 0x3F, 0x00, 0x00, //g-	
0x04, 0xFC, 0xFC, 0x40, 0x20, 0xE0, 0xC0, 0x00, 0x08, 0x0F, 0x0F, 0x00, 0x00, 0x0F, 0x0F, 0x00, //h-	
0x00, 0x00, 0x20, 0xEC, 0xEC, 0x00, 0x00, 0x00, 0x00, 0x00, 0x08, 0x0F, 0x0F, 0x08, 0x00, 0x00, //i-	

```

0x00, 0x00, 0x00, 0x00, 0x20, 0xEC, 0xEC, 0x00, 0x00, 0x30, 0x70, 0x40, 0x40, 0x7F, 0x3F, 0x00, //j-
0x04, 0xFC, 0xFC, 0x80, 0xC0, 0x60, 0x20, 0x00, 0x08, 0x0F, 0x0F, 0x01, 0x03, 0x0E, 0x0C, 0x00, //k-
0x00, 0x00, 0x04, 0xFC, 0xFC, 0x00, 0x00, 0x00, 0x00, 0x00, 0x08, 0x0F, 0x0F, 0x08, 0x00, 0x00, //l-
0xE0, 0xE0, 0x60, 0xC0, 0x60, 0xE0, 0xC0, 0x00, 0x0F, 0x0F, 0x00, 0x07, 0x00, 0x0F, 0x0F, 0x00, //m-
0x20, 0xE0, 0xC0, 0x20, 0x20, 0xE0, 0xC0, 0x00, 0x00, 0x0F, 0x0F, 0x00, 0x00, 0x0F, 0x0F, 0x00, //n-
0xC0, 0xE0, 0x20, 0x20, 0x20, 0xE0, 0xC0, 0x00, 0x07, 0x0F, 0x08, 0x08, 0x08, 0x0F, 0x07, 0x00, //o-

0x20, 0xE0, 0xC0, 0x20, 0x20, 0xE0, 0xC0, 0x00, 0x40, 0x7F, 0x7F, 0x48, 0x08, 0x0F, 0x07, 0x00, //p-
0xC0, 0xE0, 0x20, 0x20, 0xC0, 0xE0, 0x20, 0x00, 0x07, 0x0F, 0x08, 0x48, 0x7F, 0x7F, 0x40, 0x00, //q-
0x20, 0xE0, 0xC0, 0x60, 0x20, 0xE0, 0xC0, 0x00, 0x08, 0x0F, 0x0F, 0x08, 0x00, 0x00, 0x00, 0x00, //r-
0x40, 0xE0, 0xA0, 0x20, 0x20, 0x60, 0x40, 0x00, 0x04, 0x0C, 0x09, 0x09, 0x0B, 0x0E, 0x04, 0x00, //s-
0x20, 0x20, 0xF8, 0xFC, 0x20, 0x20, 0x00, 0x00, 0x00, 0x00, 0x07, 0x0F, 0x08, 0x0C, 0x04, 0x00, //t-
0xE0, 0xE0, 0x00, 0x00, 0xE0, 0xE0, 0x00, 0x00, 0x07, 0x0F, 0x08, 0x08, 0x07, 0x0F, 0x08, 0x00, //u-
0x00, 0xE0, 0xE0, 0x00, 0x00, 0xE0, 0xE0, 0x00, 0x00, 0x03, 0x07, 0x0C, 0x0C, 0x07, 0x03, 0x00, //v-
0xE0, 0xE0, 0x00, 0x80, 0x00, 0xE0, 0xE0, 0x00, 0x07, 0x0F, 0x0C, 0x07, 0x0C, 0x0F, 0x07, 0x00, //w-
0x20, 0x60, 0xC0, 0x80, 0xC0, 0x60, 0x20, 0x00, 0x08, 0x0C, 0x07, 0x03, 0x07, 0x0C, 0x08, 0x00, //x-
0xE0, 0xE0, 0x00, 0x00, 0x00, 0xE0, 0xE0, 0x00, 0x47, 0x4F, 0x48, 0x48, 0x68, 0x3F, 0x1F, 0x00, //y-

0x60, 0x60, 0x20, 0xA0, 0xE0, 0x60, 0x20, 0x00, 0x0C, 0x0E, 0x0B, 0x09, 0x08, 0x0C, 0x0C, 0x00, //z- //
0x00, 0x40, 0x40, 0xF8, 0xBC, 0x04, 0x04, 0x00, 0x00, 0x00, 0x00, 0x07, 0x0F, 0x08, 0x08, 0x00, //-{-
0x00, 0x00, 0x00, 0xBC, 0xBC, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x0F, 0x0F, 0x00, 0x00, 0x00, //-|-
0x00, 0x04, 0x04, 0xBC, 0xF8, 0x40, 0x40, 0x00, 0x00, 0x08, 0x08, 0x0F, 0x07, 0x00, 0x00, 0x00, //-}-
0x08, 0x0C, 0x04, 0x0C, 0x08, 0x0C, 0x04, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, //~~ ASCII 码:
0X7E

};

uchar code ascii_table_5x8[95][5]={
/*全体 ASCII 列表:5x8 点阵*/
0x00, 0x00, 0x00, 0x00, 0x00, //- - //space
0x00, 0x00, 0x4f, 0x00, 0x00, //-!-
0x00, 0x07, 0x00, 0x07, 0x00, //-"-
0x14, 0x7f, 0x14, 0x7f, 0x14, //-#-
0x24, 0x2a, 0x7f, 0x2a, 0x12, //-$$-
0x23, 0x13, 0x08, 0x64, 0x62, //-%-
0x36, 0x49, 0x55, 0x22, 0x50, //-&-
0x00, 0x05, 0x07, 0x00, 0x00, //-'-
0x00, 0x1c, 0x22, 0x41, 0x00, //-(-
0x00, 0x41, 0x22, 0x1c, 0x00, //-)-
0x14, 0x08, 0x3e, 0x08, 0x14, //-*-
0x08, 0x08, 0x3e, 0x08, 0x08, //-+-
0x00, 0x50, 0x30, 0x00, 0x00, //-,-
0x08, 0x08, 0x08, 0x08, 0x08, //----
0x00, 0x60, 0x60, 0x00, 0x00, //-.-
0x20, 0x10, 0x08, 0x04, 0x02, //-/-
0x3e, 0x51, 0x49, 0x45, 0x3e, //-0-

```

0x00, 0x42, 0x7f, 0x40, 0x00, //-1-
0x42, 0x61, 0x51, 0x49, 0x46, //-2-
0x21, 0x41, 0x45, 0x4b, 0x31, //-3-
0x18, 0x14, 0x12, 0x7f, 0x10, //-4-
0x27, 0x45, 0x45, 0x45, 0x39, //-5-
0x3c, 0x4a, 0x49, 0x49, 0x30, //-6-
0x01, 0x71, 0x09, 0x05, 0x03, //-7-
0x36, 0x49, 0x49, 0x49, 0x36, //-8-
0x06, 0x49, 0x49, 0x29, 0x1e, //-9-
0x00, 0x36, 0x36, 0x00, 0x00, //-:-
0x00, 0x56, 0x36, 0x00, 0x00, //-;-
0x08, 0x14, 0x22, 0x41, 0x00, //-<-
0x14, 0x14, 0x14, 0x14, 0x14, //-==
0x00, 0x41, 0x22, 0x14, 0x08, //->-
0x02, 0x01, 0x51, 0x09, 0x06, //-?-
0x32, 0x49, 0x79, 0x41, 0x3e, //-@-
0x7e, 0x11, 0x11, 0x11, 0x7e, //-A-
0x7f, 0x49, 0x49, 0x49, 0x36, //-B-
0x3e, 0x41, 0x41, 0x41, 0x22, //-C-
0x7f, 0x41, 0x41, 0x22, 0x1c, //-D-
0x7f, 0x49, 0x49, 0x49, 0x41, //-E-
0x7f, 0x09, 0x09, 0x09, 0x01, //-F-
0x3e, 0x41, 0x49, 0x49, 0x7a, //-G-
0x7f, 0x08, 0x08, 0x08, 0x7f, //-H-
0x00, 0x41, 0x7f, 0x41, 0x00, //-I-
0x20, 0x40, 0x41, 0x3f, 0x01, //-J-
0x7f, 0x08, 0x14, 0x22, 0x41, //-K-
0x7f, 0x40, 0x40, 0x40, 0x40, //-L-
0x7f, 0x02, 0x0c, 0x02, 0x7f, //-M-
0x7f, 0x04, 0x08, 0x10, 0x7f, //-N-
0x3e, 0x41, 0x41, 0x41, 0x3e, //-O-
0x7f, 0x09, 0x09, 0x09, 0x06, //-P-
0x3e, 0x41, 0x51, 0x21, 0x5e, //-Q-
0x7f, 0x09, 0x19, 0x29, 0x46, //-R-
0x46, 0x49, 0x49, 0x49, 0x31, //-S-
0x01, 0x01, 0x7f, 0x01, 0x01, //-T-
0x3f, 0x40, 0x40, 0x40, 0x3f, //-U-
0x1f, 0x20, 0x40, 0x20, 0x1f, //-V-
0x3f, 0x40, 0x38, 0x40, 0x3f, //-W-
0x63, 0x14, 0x08, 0x14, 0x63, //-X-
0x07, 0x08, 0x70, 0x08, 0x07, //-Y-
0x61, 0x51, 0x49, 0x45, 0x43, //-Z-
0x00, 0x7f, 0x41, 0x41, 0x00, //-[-
0x02, 0x04, 0x08, 0x10, 0x20, //-\-
0x00, 0x41, 0x41, 0x7f, 0x00, //-]-
0x04, 0x02, 0x01, 0x02, 0x04, //-^-



```

0x40, 0x40, 0x40, 0x40, 0x40, //_ _-
0x01, 0x02, 0x04, 0x00, 0x00, //^-`-
0x20, 0x54, 0x54, 0x54, 0x78, //-a-
0x7f, 0x48, 0x48, 0x48, 0x30, //-b-
0x38, 0x44, 0x44, 0x44, 0x44, //-c-
0x30, 0x48, 0x48, 0x48, 0x7f, //-d-
0x38, 0x54, 0x54, 0x54, 0x58, //-e-
0x00, 0x08, 0x7e, 0x09, 0x02, //-f-
0x48, 0x54, 0x54, 0x54, 0x3c, //-g-
0x7f, 0x08, 0x08, 0x08, 0x70, //-h-
0x00, 0x00, 0x7a, 0x00, 0x00, //-i-
0x20, 0x40, 0x40, 0x3d, 0x00, //-j-
0x7f, 0x20, 0x28, 0x44, 0x00, //-k-
0x00, 0x41, 0x7f, 0x40, 0x00, //-l-
0x7c, 0x04, 0x38, 0x04, 0x7c, //-m-
0x7c, 0x08, 0x04, 0x04, 0x78, //-n-
0x38, 0x44, 0x44, 0x44, 0x38, //-o-
0x7c, 0x14, 0x14, 0x14, 0x08, //-p-
0x08, 0x14, 0x14, 0x14, 0x7c, //-q-
0x7c, 0x08, 0x04, 0x04, 0x08, //-r-
0x48, 0x54, 0x54, 0x54, 0x24, //-s-
0x04, 0x04, 0x3f, 0x44, 0x24, //-t-
0x3c, 0x40, 0x40, 0x40, 0x3c, //-u-
0x1c, 0x20, 0x40, 0x20, 0x1c, //-v-
0x3c, 0x40, 0x30, 0x40, 0x3c, //-w-
0x44, 0x28, 0x10, 0x28, 0x44, //-x-
0x04, 0x48, 0x30, 0x08, 0x04, //-y-
0x44, 0x64, 0x54, 0x4c, 0x44, //-z-
0x08, 0x36, 0x41, 0x41, 0x00, //-{-
0x00, 0x00, 0x77, 0x00, 0x00, //-|-
0x00, 0x41, 0x41, 0x36, 0x08, //-}-
0x04, 0x02, 0x02, 0x02, 0x01, //-~-
};
    
```



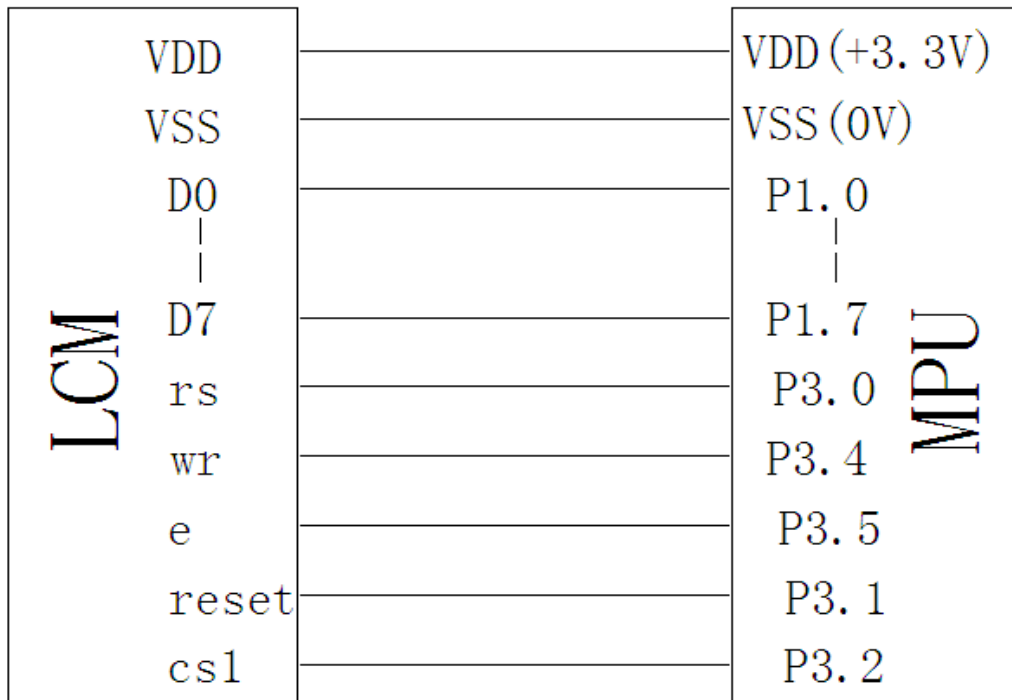
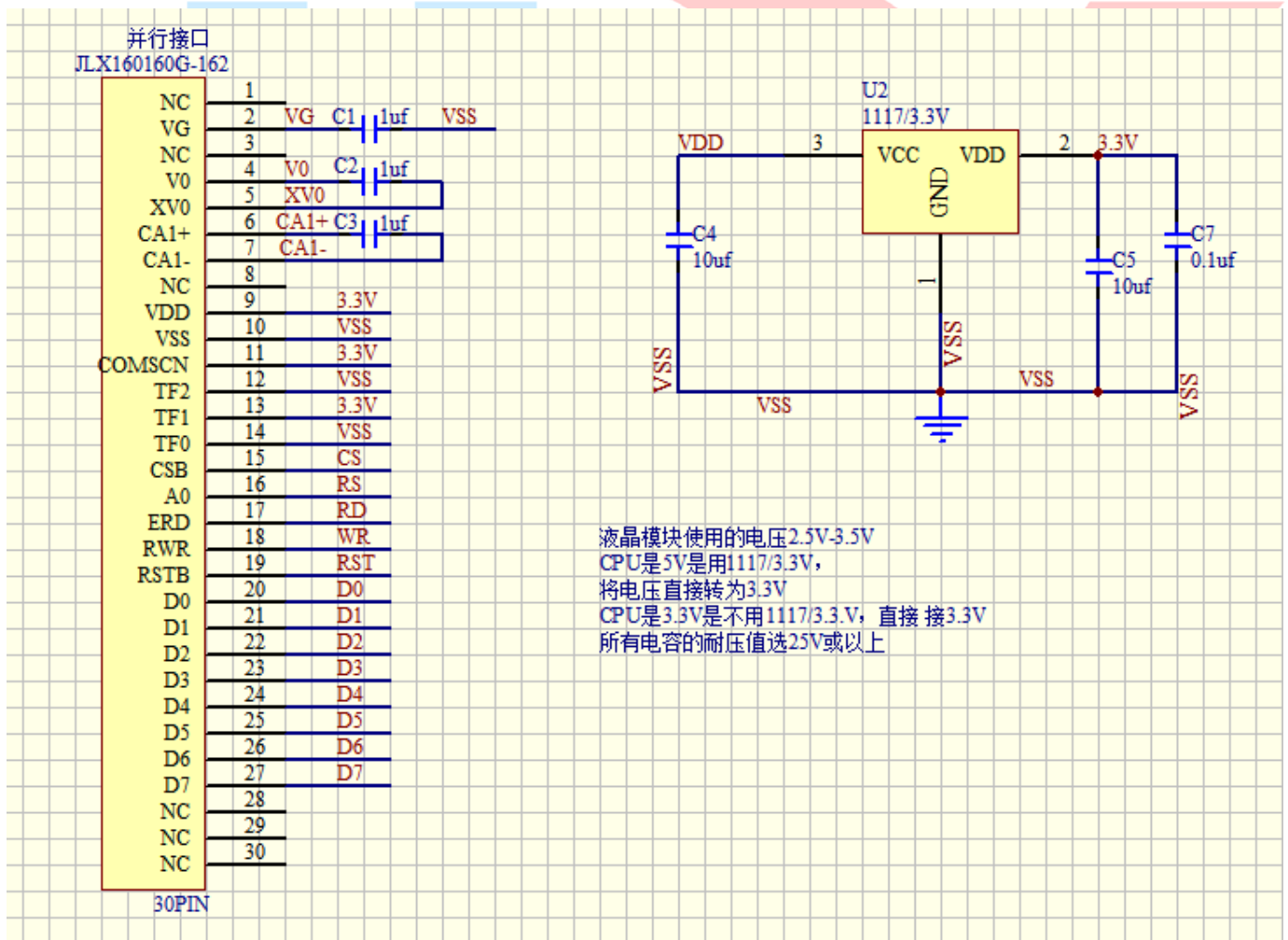


图 9. 并行接口



并行原理图

并行程序与串行只是接口定义、写数据和命令不一样，其它都一样

并行程序：

```
#include <STC15F2K60S2.H>
#include <intrins.h>
#include <chinese_code.h>

sbit cs1=P3^2;    /*接口定义*/
sbit reset=P3^1; /*接口定义*/
sbit rs=P3^0;    /*接口定义*/
sbit e=P3^5;     /*接口定义*/
sbit wr=P3^4;    /*接口定义。另外 P1.0~1.7 对应 DB0~DB7*/
sbit key=P2^0;   /*按键接口，P2.0 口与 GND 之间接一个按键*/
```

//写指令到 LCD 模块

```
void transfer_command(int data1)
{
    cs1=0;
    rs=0;
    wr=0;
    e=0;
    P1=data1;
    e=1;
    e=0;
    P1=0x00;
    cs1=1;
}
```

//写数据到 LCD 模块

```
void transfer_data(int data1)
{
    cs1=0;
    rs=1;
    wr=0;
    e=0;
    P1=data1;
    e=1;
    e=0;
    P1=0x00;
    cs1=1;
}
```

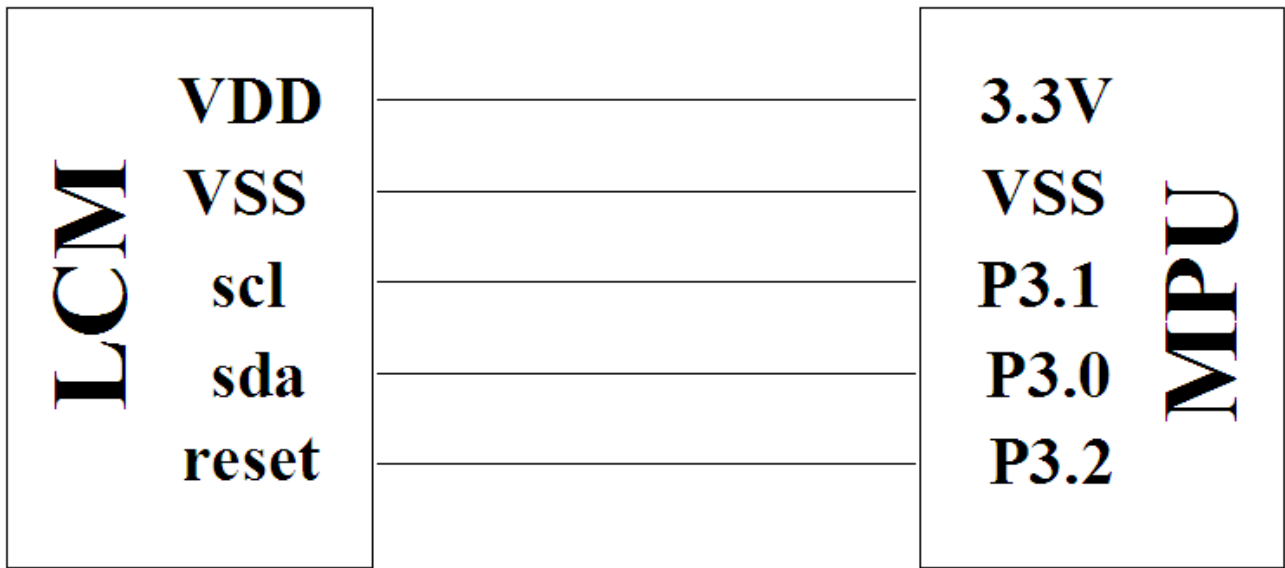
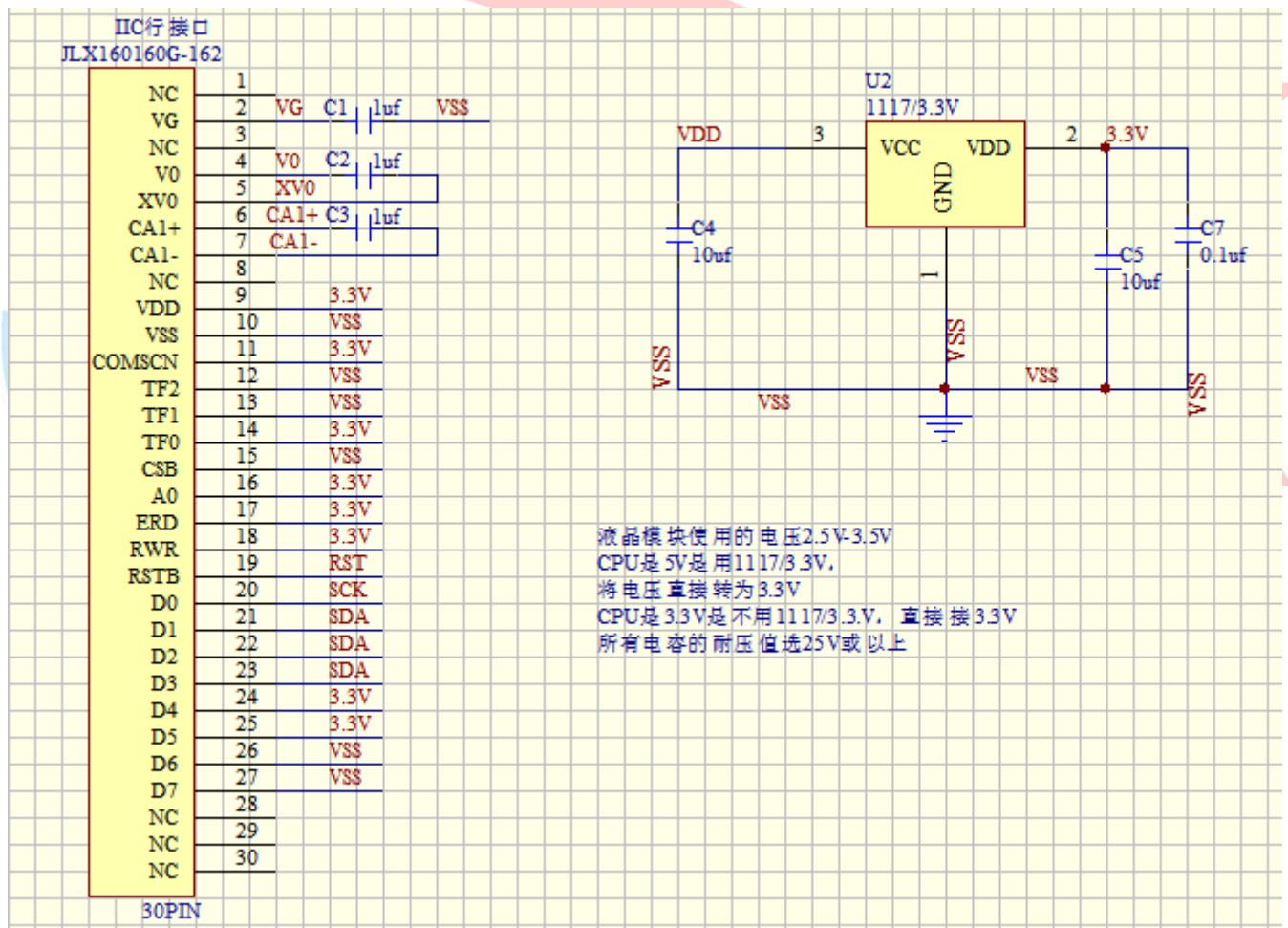



图 10. IIC 接口



IIC 原理图

IIC 程序与串、并行接口定义、写数据和命令不一样，取模代码是一样的

IIC 程序：

```
// 液晶演示程序 JLX160160G-162， IIC 接口！  
// 驱动 IC 是:ST75161
```

```
#include <STC15F2K60S2.H>  
#include <intrins.h>  
#include <chinese_code.h>
```

```
sbit reset=P3^2;  
sbit scl=P3^1;  
sbit sda=P3^0;  
sbit key=P2^0;
```

```
void delay_us(int i);  
void delay(int i);
```

```
//延时 1  
void delay(int i)  
{  
    int j,k;  
    for(j=0;j<i;j++)  
        for(k=0;k<110;k++);  
}
```

```
//延时 2  
void delay_us(int i)  
{  
    int j,k;  
    for(j=0;j<i;j++)  
        for(k=0;k<10;k++);  
}
```

```
void waitkey()  
{  
repeat:  
    if(key==1)goto repeat;  
    else delay(400);  
}
```

```
void transfer(int data1)  
{  
    int i;  
    for(i=0;i<8;i++)  
    {  
        scl=0;  
        if(data1&0x80) sda=1;  
        else sda=0;  
        scl=1;  
        scl=0;  
        data1=data1<<1;  
    }  
    sda=0;  
    scl=1;  
    scl=0;
```

```
void start_flag()
{
    scl=1;      /*START FLAG*/
    sda=1;      /*START FLAG*/
    sda=0;      /*START FLAG*/
}

void stop_flag()
{
    scl=1;      /*STOP FLAG*/
    sda=0;      /*STOP FLAG*/
    sda=1;      /*STOP FLAG*/
}

//写命令到液晶显示模块
void transfer_command(uchar com)
{
    start_flag();
    transfer(0x78);
    transfer(0x80);
    transfer(com);
    stop_flag();
}

//写数据到液晶显示模块
void transfer_data(uchar dat)
{
    start_flag();
    transfer(0x78);
    transfer(0xc0);
    transfer(dat);
    stop_flag();
}
```

