产品使用说明书

产品类型: 点阵型LCD液晶显示模组

产品型号: 320240B

客户：

客户编号:

日期:

确认（盖章）

制造商	客户

目　　录

1 . 修订记录

版本	发行日期	新制/修订内容
V3.0	2017-11-03	新制

注：升级版本向下兼容，不做另行通知，如遇兼容问题影响性能请联系本公司解决

2.概述

320240B 是一款点阵型液晶显示模块，可用于显示文字和图形。8位并行数据传输方式，可以直接连接到6800/8080系列MPU，允许选择不同的文本和图形模式组合，包括各种属性功能。

显示分辨率: 320 X 240dots

显示颜色及背光颜色: STN 蓝,黄绿,灰; 背光 黑,白,黄绿

偏光膜:全透/半透

观察角度: 6:00

显示占空比: 1/240 驱动偏压: 1/16

控制芯片: RA8835

支持6800/8080 8位MPU接口

内置160字字体ROM:基本ASCII码，日语，数字

支持256字外接字体ROM

支持最大64个8x16字节外接显示RAM显示模式:字符、图形和混合模式

尺寸 (Unit: mm)

外形尺寸: 160X109X12

可视区域 : 122X92

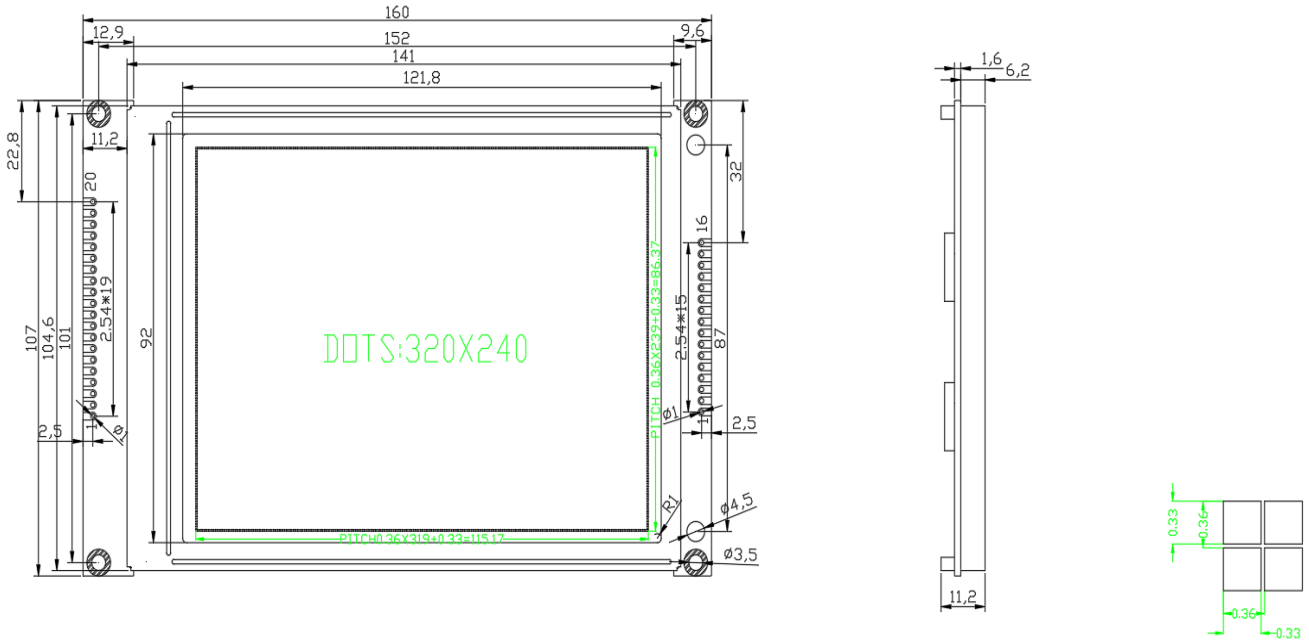
字符尺寸:115.17X86.37　　点尺寸:0.33X0.33

像素间距: 0.36X0.36

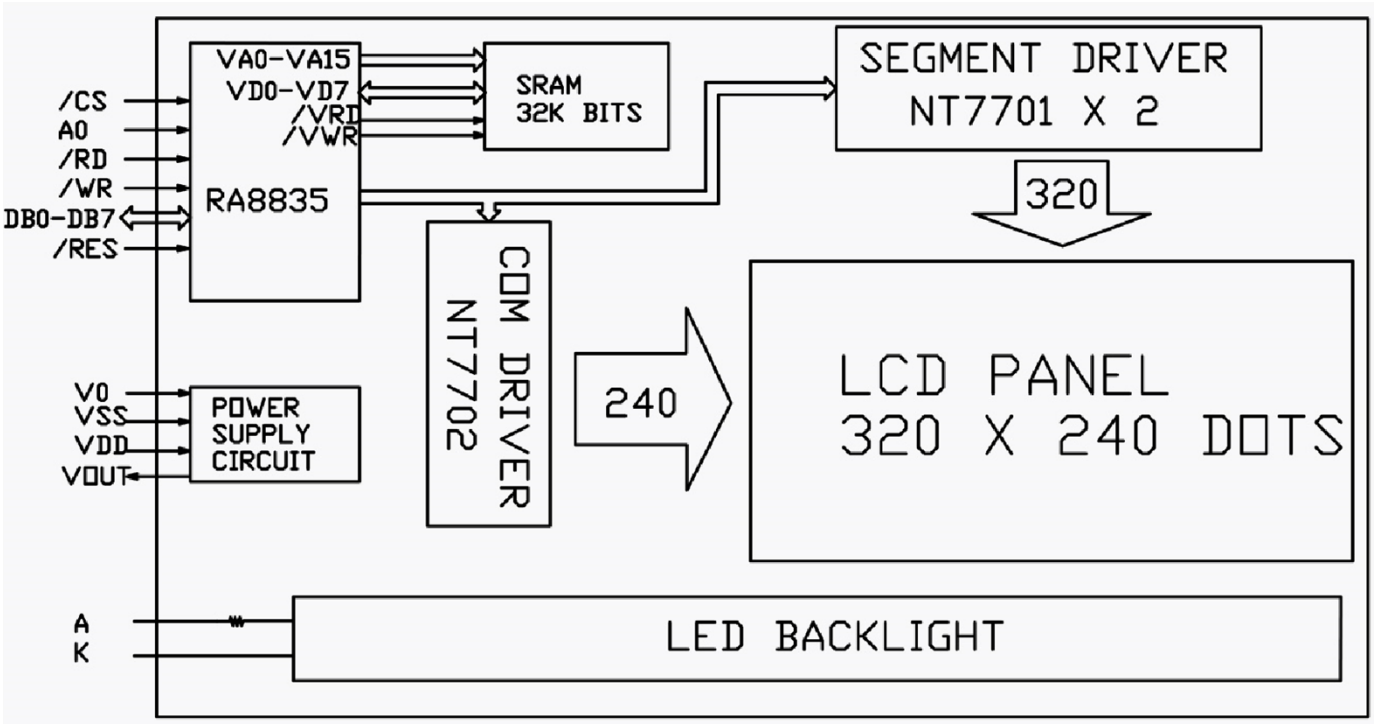
重量：　　g　　对比度：V0外部调节或内部固定对比度

工作电压： +3. 3V或+5V 默认5V

3. 外形尺寸:



4. 硬件方框图:



5.电气特性

5.1极限参数

参数名称	符号	条件	典型值		单位
			最小值	最大值	
工作电压	Vdd		-0.3	+7.0	V
LCD驱动电压	Vlcd		Vee-0.3	Vdd+0.3	V
电源电压	Vee		Vdd-19	Vdd+0.3	V
工作温度(T)	Top	-	-20	70	℃
储存温度(T)	Tstg	-	-30	80	℃

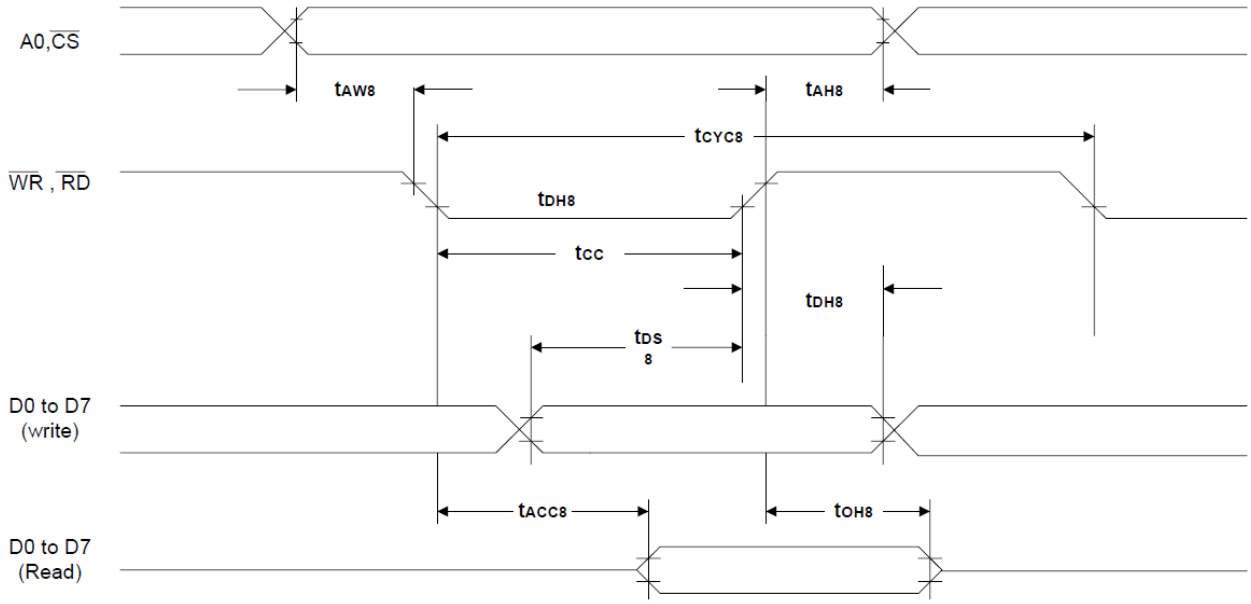
5.2.1 直流参数1(Ta=25°C,Vdd=4.5V~5.5V)

参数名称	符号	条件	标称值			单位
			最小	典型	最大	
电源电压	Vdd-GND	-	4.5	5.0	5.5	V
工作电流（不包括背光）	Idd	Vdd=5V	8	10	16	mA
LCD驱动电压	Vdd-V5		Vee	-	Vdd	V
LED背光工作电流	If	Vf=2.8~3.0V	136	144	160	mA
LED背光功耗	Pd		612	720	880	mW
输入高电平	Vih		0.5Vdd	-	Vdd	V
输入低电平	Vil		VSS	-	0.2Vdd	V
输出高电平	Voh		Vdd-0.4	-	-	V
输出低电平	Vol		VSS	-	Vss+0.4	V

5.2.2 直流参数2(Ta=25°C,Vdd=2.7V~4.5V)

参数名称	符号	条件	标称值			单位
			最小	典型	最大	
电源电压	Vdd-GND	-	2.7	3.3	4.5	V
工作电流（不包括背光）	Idd	Vdd=5V	6	8	14	mA
LCD驱动电压	Vdd-V5		3.0	-	Vdd	V
LED背光工作电流	If	Vf=2.8~3.0V	136	144	160	mA
LED背光功耗	Pd		368	476	720	mW
输入高电平	Vih		0.5Vdd	-	Vdd	V
输入低电平	Vil		Vss	-	0.2Vdd	V
输出高电平	Voh		Vdd-0.4	-	-	V
输出低电平	Vol		Vss	-	Vss+0.3	V

5.3.1 交流参数1(Ta=25°C,Vdd=2.7V~5.5V)8080MPU接口



Ta = –20 to 75°C

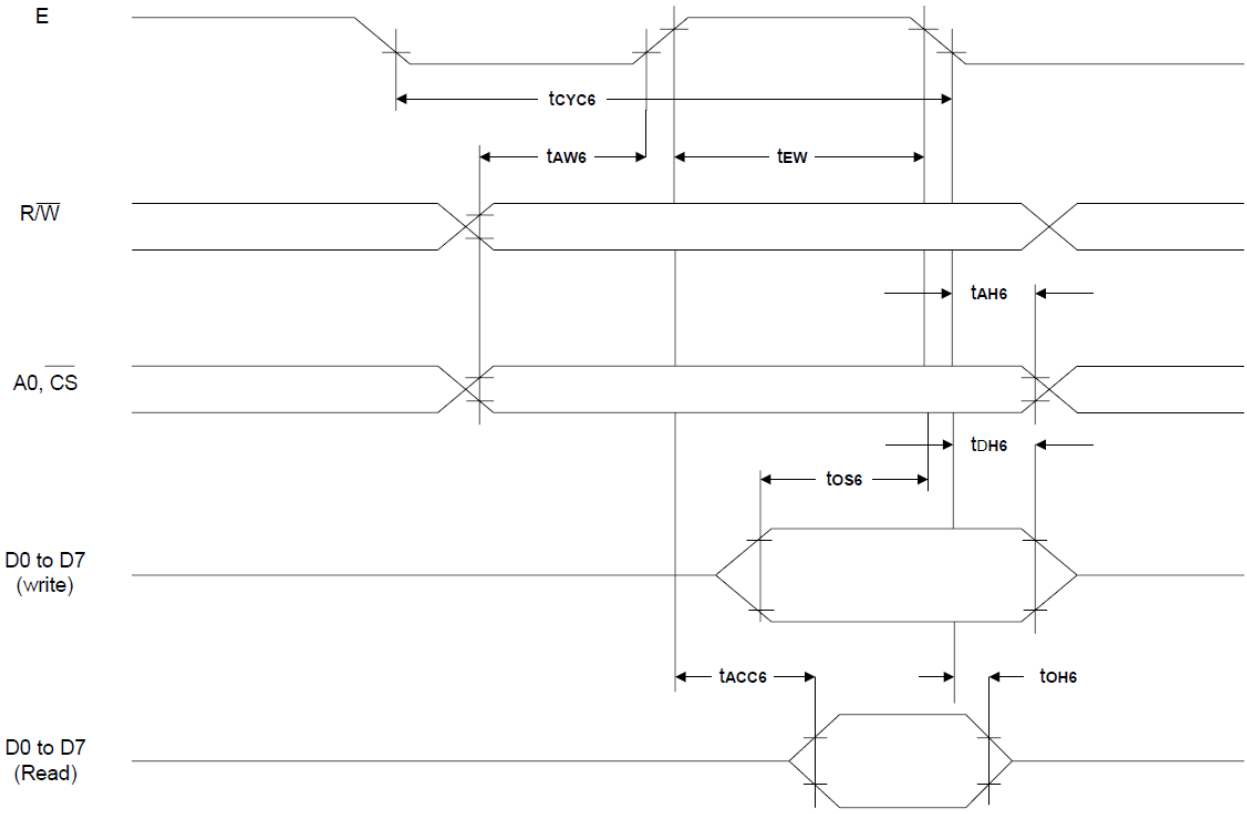
Signal	Symbol	Parameter	V_{DD} = 4.5 to 5.5V		V_{DD} = 2.7 to 4.5V		Unit	Condition
			Min.	Max.	Min.	Max.		
A0, CS	t_{AH8}	Address hold time	10	—	10	—	ns	CL = 100pF
	t_{AW8}	Address setup time	0	—	0	—	ns	
WR , RD	t_{CYC8}	System cycle time	note.	—	note.	—	ns	
	t_{CC}	Strobe pulse width	120	—	150	—	ns	
D0 to D7	t_{DS8}	Data setup time	120	—	120	—	ns	
	t_{DH8}	Data hold time	5	—	5	—	ns	
	t_{ACC8}	RD access time	—	50	—	80	ns	
	t_{OH8}	Output disable time	10	50	10	55	ns	

Note: For memory control and system control commands: $t_{CYC8} = 2t_C + t_{CC} + t_{CEA} + 75 > t_{ACV} + 245$

For all other commands:

$t_{CYC8} = 4t_C + t_{CC} + 30$

5.3.2 交流参数2(Ta=25°C,Vdd=2.7V~5.5V)6800MPU接口



Ta = –20 to 75°C

Signal	Symbol	Parameter	V_{DD} = 4.5 to 5.5V		V_{DD} = 2.7 to 4.5V		Unit	Condition
			Min.	Max.	Min.	Max.		
A0, CS, R/(W)	t_{CYC6}	System cycle time	note.	—	note.	—	ns	CL = 100 pF
	t_{AW6}	Address setup time	0	—	10	—	ns	
	t_{AH6}	Address hold time	0	—	0	—	ns	
D0 to D7	t_{DS6}	Data setup time	100	—	120	—	ns	
	t_{DH6}	Data hold time	0	—	0	—	ns	
	t_{OH6}	Output disable time	10	50	10	75	ns	
	t_{ACC6}	Access time	—	85	—	130	ns	
E	t_{EW}	Enable pulse width	120	—	150	—	ns	

Note: For memory control and system control commands: $t_{CYC6} = 2t_C + t_{EW} + t_{CEA} + 75 > t_{ACV} + 245$

For all other commands:

$t_{CYC6} = 4t_C + t_{EW} + 30$

6.接口说明

20PIN-MPU接口

脚号	符号	功能	备注
1	VSS	供电电源负极	
2	VDD	供电电源正极	
3	V0	LCD偏压供电	可调节对比度
4	/WR	写使能	
5	/RD	读使能	
6	/CE	片选	
7	A0	数据/指令选择(H:指令 L:数据)	
8	RST	系统复位脚	
9	D0	数据位 0	
10	D1	数据位1	
11	D2	数据位2	
12	D3	数据位3	
13	D4	数据位4	
14	D5	数据位5	
15	D6	数据位6	
16	D7	数据位7	
17	BLA	背光正极	
18	VEE	负压输出	
19	BLA	背光正极	
20	BLK	背光负极	

无控制器版本接口

脚号	符号	功能	备注
1	XD0	4-BIT的X驱动数据输入引脚XD[0:4]	
2	XD1		
3	XD2		
4	XD3		
5	YDIS	LCD断电信号	
6	YD	Y驱动器的数据输入	
7	WF	AC输入脚	
8	LP	锁存脉冲，将X驱动器移位寄存器中的信号锁存到输出数据锁存器	
9	XSCL	XD数据的锁存信号	
10	VDD	供电电源正极	
11	VSS	供电电源负极	
12	VEE	负压输出	
13	V0	LCD偏压供电	可调节对比度
14	FG	铁框接地脚	
15	BLA	背光正极	
16	BLK	背光负极	

相关时序请参考RA8835和UCI0086手册

7.指令说明

7.1 指令描述

指令表

指令	A0	R/W	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0	描述
SYSTEM SET	1	0	0	1	0	0	0	0	0	0	初始化系统和显示
SLEEP IN	1	0	0	1	0	1	0	0	1	1	进入待机模式
DISPLAY ON/OFF	1	0	0	1	0	1	1	0	0	D	启用和禁用显示和显示闪烁
SCROLL	1	0	0	1	0	0	0	1	0	0	设置显示首地址和区域
CSRFORM	1	0	0	1	0	1	1	1	0	1	设置光标类型
CGRAM ADR	1	0	0	1	0	1	1	1	0	0	设置CGRAM的起始地址
CSRDIR	1	0	0	1	0	0	1	1	CD1	CD0	设置光标移动方向
HDOT SCR	1	0	0	1	0	1	1	0	1	0	设置水平滚动位置
OVLAY	1	0	1	1	0	1	1	0	1	1	设置显示覆盖格式
CSRW	1	0	1	1	0	0	0	1	1	0	设置光标地址
CSRR	1	0	1	1	0	0	0	1	1	1	读取光标地址
MWRITE	1	0	1	0	0	0	0	0	1	0	写显示数据
MREAD	1	0	1	0	0	0	0	0	1	1	读显示数据

注：

1一般来说，RA8835A系列的内部寄存器会随着每个命令参数的变化而修改输入。但是，微处理器不必设置命令的所有参数，并且可以在输入所有参数之前发送一个新命令。的内部寄存器已输入的参数将被更改，但剩余的参数寄存器不变。2字节参数（其中两个字节被视为1个数据项）处理如下：

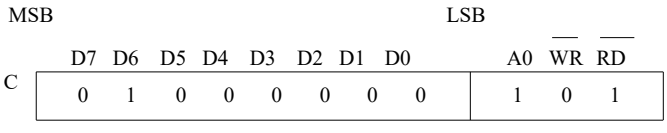
a、 CSRW，CSRR：每个字节单独处理。微处理器可以读或写只是光标地址的低位字节。

b、SYSTEM SET, SCROLL, CGRAM ADR：两个参数字节一起处理。如果输入一半参数后命令被更改，单字节为忽略。

2APL和APH是2字节参数，但被视为两个1字节参数。

7.2 SYSTEM SET

Initializes the device, sets the window sizes, and selects the LCD interface format. Since this command sets the basic operating parameters of the RA8835A series, an incorrect SYSTEM SET command may cause other commands to operate incorrectly.



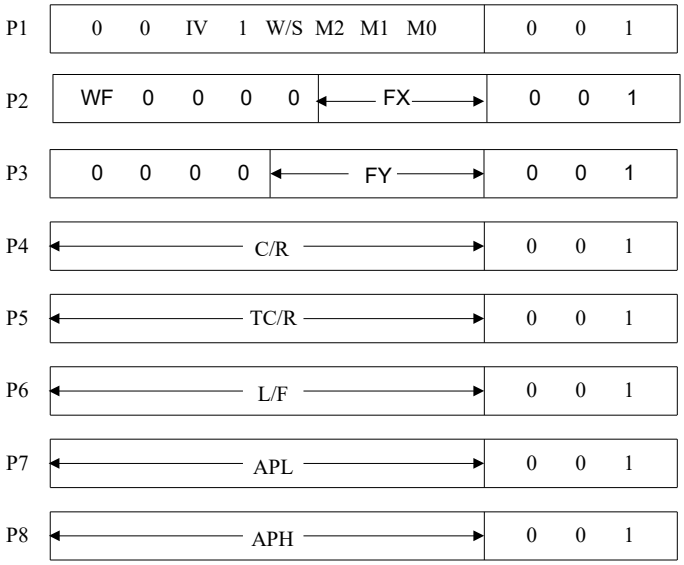


Figure 7-1: SYSTEM SET Instruction

7.2.1 C

This control byte performs the following:

1. Resets the internal timing generator
2. Disables the display
3. Cancels sleep mode

Parameters following P1 are not needed if only canceling sleep mode.

7.2.2 M0

Select the internal or external character generator ROM. The internal character generator ROM contains 160, 5 X 7 pixel characters, These characters are fixed at fabrication by the metallization mask.

The external character generator ROM, on the other hand, can contain up to 256 user-defined characters.

M0 = 0: Internal CG ROM

M0 = 1: External CG ROM

Note that if the CG ROM address space overlaps the display memory address space, that portion of the display memory cannot be written to.

7.2.3 M1

Select the memory configuration for user-definable characters. The CG RAM codes select one of the 64 codes shown in figure 7-29.

M1 = 0: No D6 correction.

The CG RAM1 and CG RAM2 address spaces are not contiguous, the CG RAM1 address space is treated as character generator RAM, and the CG RAM2 address space is treated as character generator ROM.

M1 = 1: D6 correction.
The CG RAM1 and CG RAM2 address spaces are contiguous and are both treated as character generator RAM.

7.2.4 M2

Select the height of the character bitmaps. Characters more than 16 pixels high can be displayed by creating a bitmap for each portion of each character and using the RA8835A series graphics mode to reposition them.

M2 = 0: 8-pixel character height (2716 or equivalent ROM)
M2= 1: 16-pixel character height (2732 or equivalent ROM)

7.2.5 W/S

Select the LCD drive method.

W/S = 0: Single-panel drive
W/S = 1: Dual-panel drive

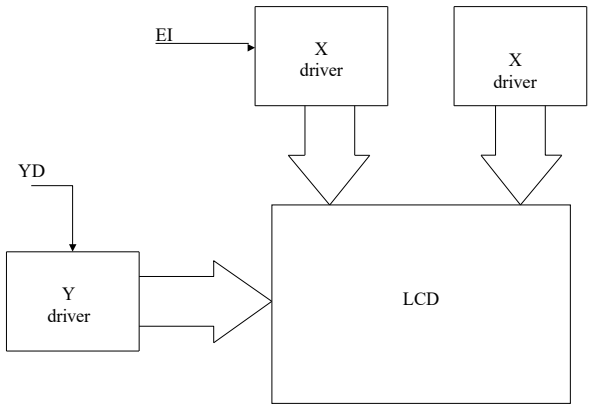


Figure 7-2: Single-panel Display

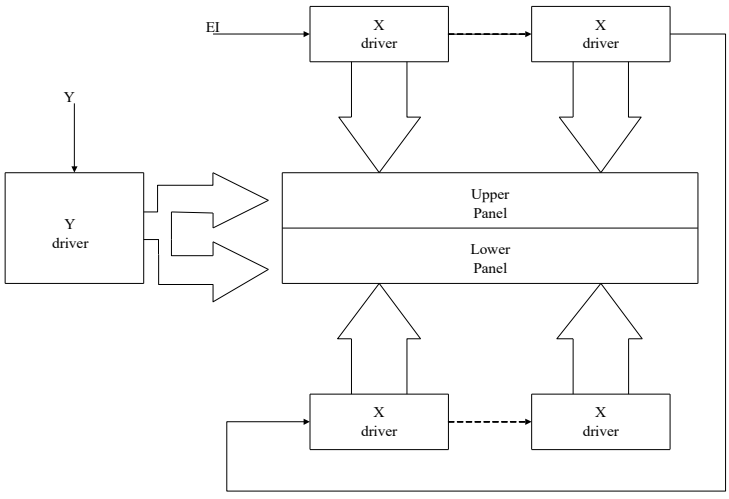


Figure 7-3: Above and Below Two-panel Display

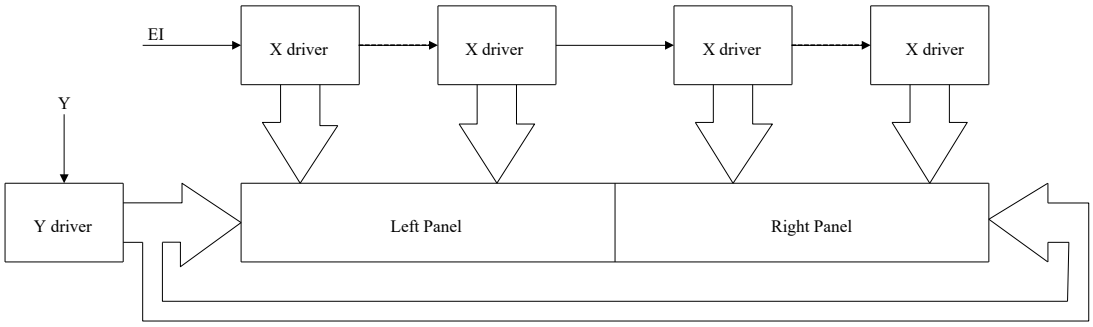


Figure 7-4: Left-and-Right Two-panel Display

Note: There are no RAiO LCD units in the configuration shown in Figure 7-4.

Table-2: LCD Parameters

Parameter	W/S = 0		W/S = 1	
	IV = 1	IV = 0	IV = 1	IV = 0
C/R	C/R	C/R	C/R	C/R
TC/R	TC/R	TC/R (See note 1.)	TC/R	TC/R
L/F	L/F	L/F	L/F	L/F
SL1	00H to L/F	00H to L/F + 1 (See note 2.)	(L/F) / 2	(L/F) / 2
SL2	00H to L/F	00H to L/F + 1 (See note 2.)	(L/F) / 2	(L/F) / 2
SAD1	First screen block	First screen block	First screen block	First screen block
SAD2	Second screen block	Second screen block	Second screen block	Second screen block
SAD3	Third screen block	Third screen block	Third screen block	Third screen block
SAD4	Invalid	Invalid	Fourth screen block	Fourth screen block
Cursor movement range	Continuous movement over whole screen		Above-and-below configuration: continuous movement over whole screen	

Notes:

4. See Table-24 for further details on setting the C/R and TC/R parameters when using
5. The value of SL when IV = 0 is equal to the value of SL when IV = 1, plus one.

7.2.6 IV

Screen origin compensation for inverse display. IV is usually set to 1. The best way of displaying inverted characters is to Exclusive-OR the text layer with the graphics background layer. However, inverted characters at the top or left of the screen are difficult to read as the character origin is at the top-left of its bitmap and there are no background pixels either above or to the left of these characters.

The IV flag causes the RA8835A series to offset the text screen against the graphics back layer by one vertical pixel. Use the horizontal pixel scroll function (HDOT SCR) to shift the text screen 1 to 7 pixels to the right. All characters will then have the necessary surrounding background pixels that ensure easy reading of the inverted characters.

IV = 0: Screen top-line correction

IV = 1: No screen top-line correction

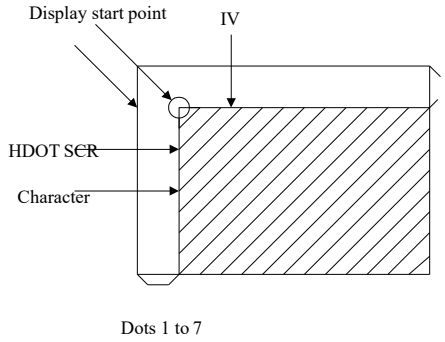


Figure 7-5: IV and HDOT SCR Adjustment

7.2.7 FX

Define the horizontal character size. The character width in pixels is equal to FX + 1, where FX can range from 00 to 07H inclusive. If data bit 3 is set (FX is in the range 08 to 0FH) and an 8-pixel font is used, a space is inserted between characters.

Table-3: Horizontal Character Size Selection

FX					[FX] character width (pixels)
HEX	D3	D2	D1	D	
00	0	0	0	0	1
01	0	0	0	1	2
↓	↓	↓	↓	↓	↓
07	0	1	1	1	8

Since the RA8835A series handles display data in 8-bit units, characters larger than 8 pixels wide must be formed from 8-pixel segments. As Figure 7-6 shows, the remainder of the second eight bits are not displayed. This also applies to the second screen layer.

In graphics mode, the normal character field is also eight pixels. If a wider character field is used, any remainder in the second eight bits is not displayed.

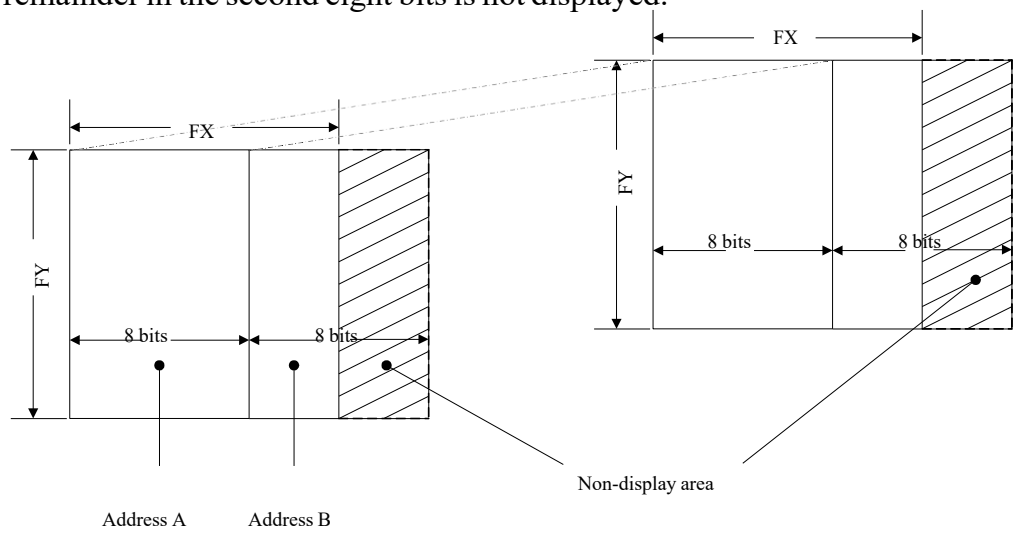


Figure 7-6: FX and FY Display Addresses

7.2.8 WF

Select the AC frame drive waveform period. WF is usually set to 1. WF
= 0: 16-line AC drive
WF = 1: two-frame AC drive
In two-frame AC drive, the WF period is twice the frame period.

In 16-line AC drive, WF inverts every 16 lines.
Although 16-line AC drive gives a more readable display, horizontal lines may appear when using high LCD drive voltages or at high viewing angles.

7.2.9 FY

Set the vertical character size. The height in pixels is equal to FY + 1. FY can range from 00 to 0FH inclusive. Set FY to zero (vertical size equals one) when in graphics mode.

Table-4: Vertical Character Size Selection

FY					[FY] character height (pixels)
HEX	D	D	D	D	
00	0	0	0	0	1
01	0	0	0	1	2
↓	↓	↓	↓	↓	↓
07	0	1	1	1	8
↓	↓	↓	↓	↓	↓
0E	1	1	1	0	15
0F	1	1	1	1	16

7.2.10 C/R

Set the address range covered by one display line, that is, the number of characters less one, multiplied by the number of horizontal bytes per character. C/R can range from 0 to 239.

For example, if the character width is 10 pixels, then the address range is equal to twice the number of characters, less 2. See Section 17-1-1 for the calculation of C/R. [C/R] cannot be set to a value greater than the address range. It can, however, be set smaller than the address range, in which case the excess display area is blank. The number of excess pixels must not exceed 64.

Table-5: Display Line Address Range

C/R									[C/R] bytes per display line
HEX	D7	D6	D5	D4	D3	D2	D1	D0	
00	0	0	0	0	0	0	0	0	1
01	0	0	0	0	0	0	0	1	2
↓	↓	↓	↓	↓	↓	↓	↓	↓	↓
4F	0	1	0	0	1	1	1	1	80
↓	↓	↓	↓	↓	↓	↓	↓	↓	↓
EE	1	1	1	0	1	1	1	0	239
EF	1	1	1	0	1	1	1	1	240

7.2.11 TC/R

Set the length, including horizontal blanking, of one line. The line length is equal to TC/R + 1, where TC/ R can range from 0 to 255. TC/R must be greater than or equal to C/R + 4. Provided this condition is satisfied, [TC/R] can be set according to the equation given in section 17-1-1 in order to hold the frame period constant and minimize jitter for any given main oscillator frequency, f_{osc}.

Table-6: Line Length Selection

TC/R									[TC/R] line length (bytes)
HEX	D7	D6	D5	D4	D3	D2	D1	D0	
00	0	0	0	0	0	0	0	0	1
01	0	0	0	0	0	0	0	1	2
↓	↓	↓	↓	↓	↓	↓	↓	↓	↓
52	0	1	0	1	0	0	1	0	83
↓	↓	↓	↓	↓	↓	↓	↓	↓	↓
FE	1	1	1	1	1	1	1	0	255
FF	1	1	1	1	1	1	1	1	256

7.2.12 L/F

Set the height, in lines, of a frame. The height in lines is equal to L/F + 1, where L/F can range from 0 to 255.

Table-7: Frame Height Selection

L/F									[L/F] lines per frame
HEX	D7	D6	D5	D4	D3	D2	D1	D0	
00	0	0	0	0	0	0	0	0	1
01	0	0	0	0	0	0	0	1	2
↓	↓	↓	↓	↓	↓	↓	↓	↓	↓
7F	0	1	1	1	1	1	1	1	128
↓	↓	↓	↓	↓	↓	↓	↓	↓	↓
FE	1	1	1	1	1	1	1	0	255
FF	1	1	1	1	1	1	1	1	256

If W/S is set to 1, selecting two-screen display, the number of lines must be even and L/F must, therefore, be an odd number.

7.2.13 AP

Define the horizontal address range of the virtual screen. APL is the least significant byte of the address.

APL	AP7	AP6	AP5	AP4	AP3	AP2	AP1	AP0
APH	AP15	AP14	AP13	AP12	AP11	AP10	AP9	AP8

Figure 7-7: AP Parameters

Table-8: Horizontal Address Range

Hex code				[AP] addresses
APH		APL		
0	0	0	0	0
0	0	0	1	1
↓	↓	↓	↓	↓
0	0	5	0	80
↓	↓	↓	↓	↓
F	F	F	E	$2^{16}-2$
F	F	F	F	$2^{16}-1$

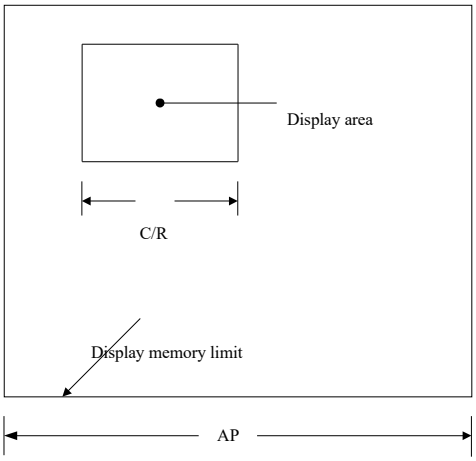


Figure 7-8: AP and C/R Relationship

7.3 SLEEP IN

Place the system in standby mode. This command has no parameter bytes. At least one blank frame after receiving this command, the RA8835A halts all internal operations, including the oscillator, and enters the sleep state.

Blank data is sent to the X-drivers, and the Y-drivers have their bias supplies turned off by the YDIS signal. Using the YDIS signal to disable the Y-drivers guards against any spurious displays. The internal registers of the RA8835A series maintain their values during the sleep state. The display memory control pins maintain their logic levels to ensure that the display memory is not corrupted. The RA8835A series can be removed from the sleep state by sending the SYSTEM SET command with only the P1 parameter. The DISP ON command should be sent next to enable the display.

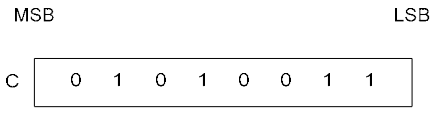


Figure 7-9: SLEEP IN

1. The YDIS signal goes LOW between one and two frames after the SLEEP IN command is received. Since YDIS forces all display driver outputs to go to the deselected output voltage, YDIS can be used as a power-down signal for the LCD unit. This can be done by having YDIS turn off the relatively high power LCD drive supplies at the same time as it blanks the display.
2. Since all internal clocks in the RA8835A series are halted while in the sleep state, a DC voltage will be applied to the LCD panel if the LCD drive supplies remain on. If reliability is a prime consideration, turn off the LCD drive supplies before issuing the SLEEP IN command.
3. Note that, although the bus lines become high impedance in the sleep state, pull-up or pull-down resistors on the bus will force these lines to a known state.

7.4 DISP ON/OFF

Turn the whole display on or off. The single-byte parameter enables and disables the cursor and layered screens, and sets the cursor and screen flash rates. The cursor can be set to flash over one character or over a whole line.

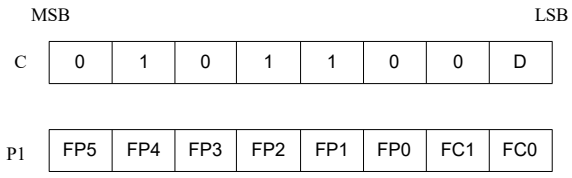


Figure 7-10: DISP ON/OFF Parameters

7.4.1 D

Turn the display ON or OFF. The D bit takes precedence over the FP bits in the parameter.
D = 0: Display OFF
D = 1: Display ON

7.4.2 FC

Enables/disables the cursor and sets the flash rate. The cursor flashes with a 70% duty cycle (ON/OFF).

Table-9: Cursor Flash Rate Selection

FC1	FC0	Cursor display	
0	0	OFF (blank)	
0	1	ON	No flashing
1	0		Flash at f_{FR}/32 Hz (approx. 2 Hz)
1	1		Flash at f_{FR}/64 Hz (approx. 1 Hz)

Note: As the MWRITE command always enables the cursor, the cursor position can be checked even when performing consecutive writes to display memory while the cursor is flashing.

7.4.3 FP

Each pair of bits in FP sets the attributes of one screen block, as follows. The display attributes are as follows:

Table-10: Screen Block Attribute Selection

FP1	FP0	First screen block (SAD1)	
FP3	FP2	Second screen block (SAD2, SAD4). See note.	
FP5	FP4	Third screen block (SAD3)	
0	0	OFF (blank)	
0	1	ON	No flashing
1	0		Flash at f_{FR}/32 Hz (approx. 2 Hz)
1	1		Flash at f_{FR}/4 Hz (approx. 16 Hz)

Note: If SAD4 is enabled by setting W/S to 1, FP3 and FP2 control both SAD2 and SAD4. The attributes of SAD2 and SAD4 cannot be set independently.

7.5 SCROLL

7.5.1 C

Set the scroll start address and the number of lines per scroll block. Parameters P1 to P10 can be omitted if not required. The parameters must be entered sequentially as shown in Figure 7-11.

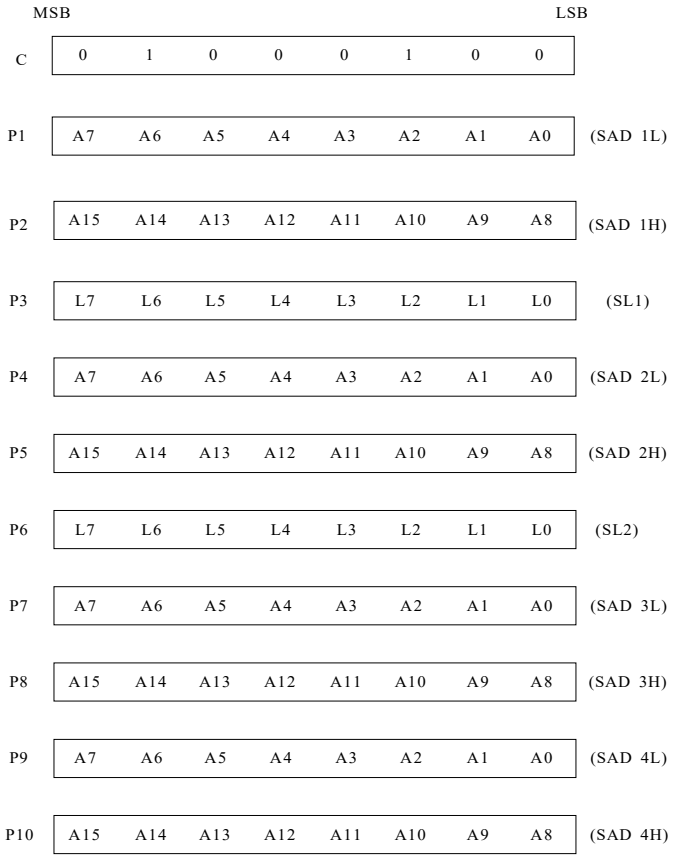


Figure 7-11: SCROLL Instruction Parameters

Note: Set parameters P9 and P10 only if both two-screen drive (W/S = 1) and two-layer configuration are selected. SAD4 is the fourth screen block display start address.

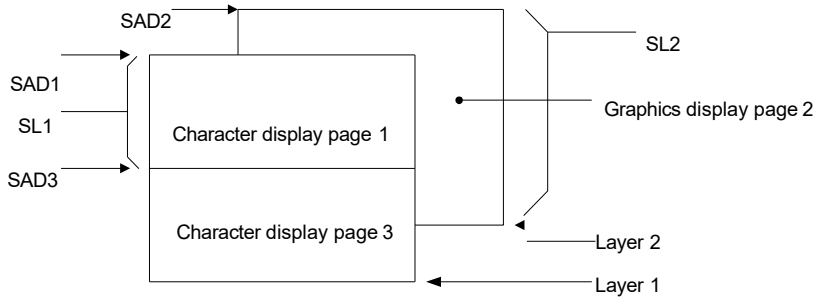
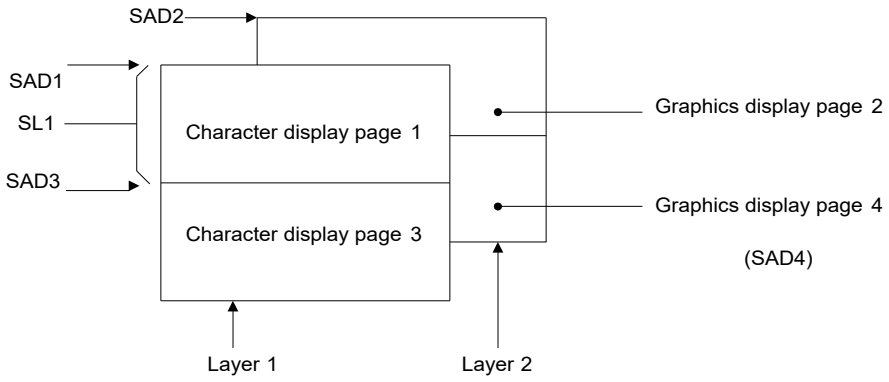
Table-11: Screen Block Start Address Selection

SL1, SL2									[SL] screen lines
HEX	L7	L6	L5	L4	L3	L2	L1	L0	
00	0	0	0	0	0	0	0	0	1
01	0	0	0	0	0	0	0	1	2
↓	↓	↓	↓	↓	↓	↓	↓	↓	↓
7F	0	1	1	1	1	1	1	1	128
↓	↓	↓	↓	↓	↓	↓	↓	↓	↓
FE	1	1	1	1	1	1	1	0	255
FF	1	1	1	1	1	1	1	1	256

7.5.2 SL1, SL2

SL1 and SL2 set the number of lines per scrolling screen. The number of lines is SL1 or SL2 plus one. The relationship between SAD, SL and the display mode is described below.

Table-12: Text Display Mode

<table>
<tr><th>W/S</th><th>Screen</th><th>First Layer</th><th>Second Layer</th></tr>
<tr><td rowspan="5">0</td><td>First screen block</td><td>SAD1</td><td>SAD2</td></tr>
<tr><td>Second screen block</td><td>SL1</td><td>SL2</td></tr>
<tr><td>Third screen block (partitioned screen)</td><td colspan="2">SAD3 (see note 1)
Set both SL1 and SL2 to L/F + 1 if not using a partitioned screen.</td></tr>
<tr><td colspan="3">Screen configuration example:
 
</td></tr>
<tr><td rowspan="4">1</td><td rowspan="2">Upper screen</td><td>SAD1
SL1</td><td>SAD2
SL2</td></tr>
<tr><td>SAD3
(See note 2)</td><td>SAD4
(See note 2)</td></tr>
<tr><td colspan="3">Set both SL1 and SL2 to ((L/F) / 2 + 1)</td></tr>
<tr><td colspan="3">Screen configuration example:
 
</td></tr>
</table>

Notes:

1. SAD3 has the same value as either SAD1 or SAD2, whichever has the least number of lines (set by SL1 and SL2).
2. Since the parameters corresponding to SL3 and SL4 are fixed by L/F, they do not have to be set in this mode.

Table-13: Graphics Display Mode

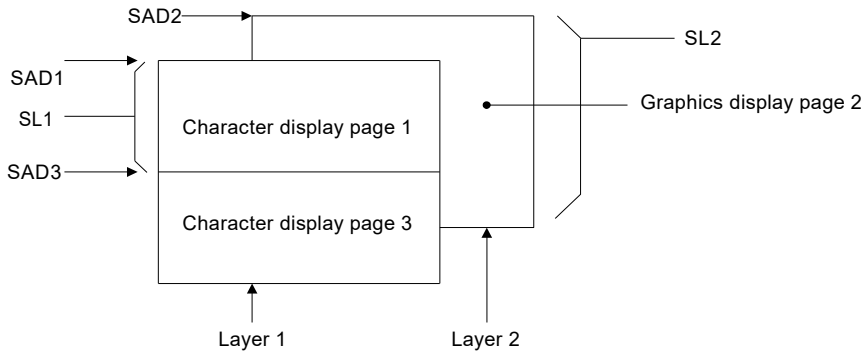
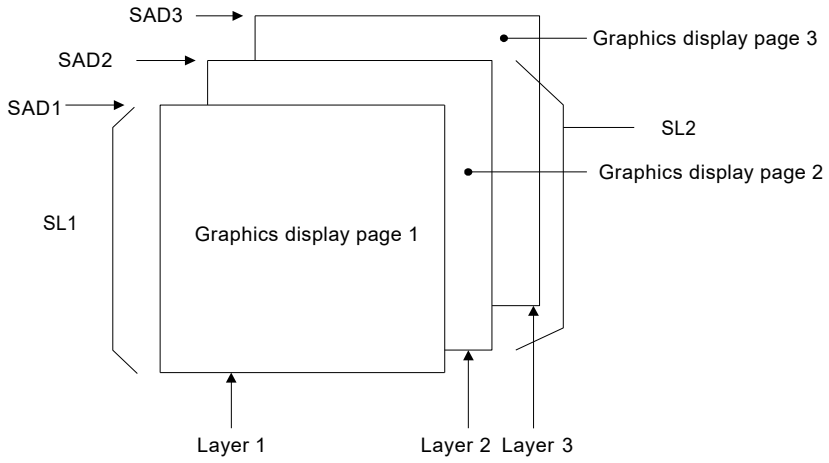
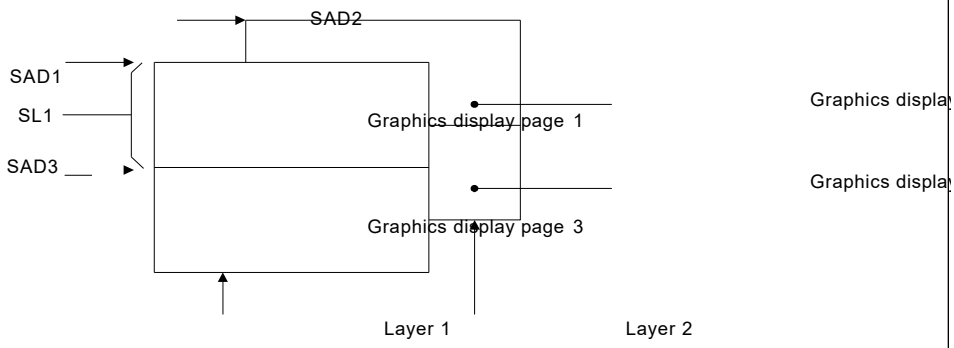
<table>
<tr><th>W/S</th><th>Screen</th><th>First Layer</th><th>Second Layer</th><th>Third Layer</th></tr>
<tr><td rowspan="3">0</td><td>Two-layer composition</td><td>SAD1
SL1</td><td>SAD2
SL2</td><td>—</td></tr>
<tr><td>Upper screen</td><td colspan="2">SAD3 (see note 3)
Set both SL1 and SL2 to L/F + 1
if not using a partitioned screen</td><td>—</td></tr>
<tr><td colspan="4">Screen configuration example:
 
</td></tr>
<tr><td rowspan="2">0</td><td>Three-layer configuration</td><td>SAD1
SL1 = L/F + 1</td><td>SAD2
SL1 = L/F + 1</td><td>SAD3
—</td></tr>
<tr><td colspan="4">Screen configuration example:
 
</td></tr>
</table>

Table-13: Graphics Display Mode (continued)

W/S	Screen	First Layer	Second Layer	Third Layer
1	Upper screen	SAD1 SL1	SAD2 SL2	—
	Lower screen	SAD3 (See note 2)	SAD4 (See note 2)	—
	Screen configuration example (See note 3): 			

Notes:

1. SAD3 has the same value as either SAD1 or SAD2; whichever has the least number of lines (set by SL1 and SL2).
2. Since the parameters corresponding to SL3 and SL4 are fixed by L/F, they do not have to be set.
3. If, and only if, W/S = 1, the differences between SL1 and (L/F + 1) / 2, and between SL2 and (L/F + 1) / 2, are blanked.

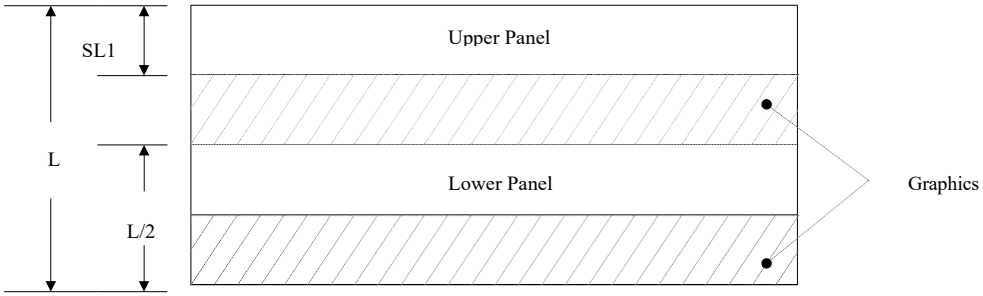


Figure 7-12: Two-panel Display Height

7.6 CSRFORM

Set the cursor size and shape. Although the cursor is normally only used in text displays, it may also be used in graphics displays when displaying special characters.

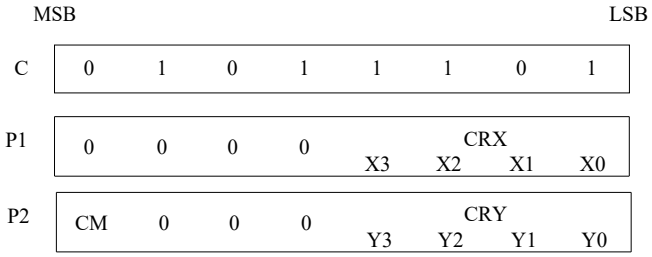


Figure 7-13: CSRFORM Parameter Bytes

7.6.1 CRX

Set the horizontal size of the cursor from the character origin. CRX is equal to the cursor size less one. CRX must be less than or equal to FX.

Table-14: Horizontal Cursor Size Selection

CRX					[CRX] cursor width (pixels)
HEX	X3	X2	X1	X0	
0	0	0	0	0	1
1	0	0	0	1	2
↓	↓	↓	↓	↓	↓
4	0	1	0	0	9
↓	↓	↓	↓	↓	↓
E	1	1	1	0	15
F	1	1	1	1	16

7.6.2 CRY

Set the location of an underscored cursor in lines, from the character origin. When using a block cursor, CRY sets the vertical size of the cursor from the character origin. CRY is equal to the number of lines less one.

Table-15: Cursor Height Selection

CRY					[CRY] cursor height (lines)
HEX	Y3	Y2	Y1	Y0	
0	0	0	0	0	Illegal
1	0	0	0	1	2
↓	↓	↓	↓	↓	↓
8	1	0	0	0	9
↓	↓	↓	↓	↓	↓
E	1	1	1	0	15
F	1	1	1	1	16

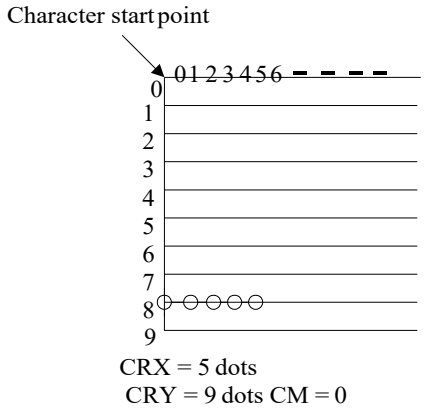


Figure 7-14: Cursor Size and Position

7.6.3 CM

Set the cursor shape. Always set CM to 1 when in graphics mode.

CM = 0: Underscore cursor

CM = 1: Block cursor

7.7 CSRDIR

Set the direction of automatic cursor increment. The cursor can move left or right one character, or up or down by the number of bytes specified by the address pitch, AP. When reading from and writing to display memory, this automatic cursor increment controls the display memory address increment on each read or write.

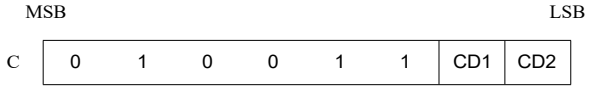


Figure 7-15: CSRDIR Parameters

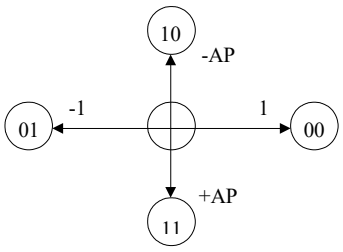


Figure 7-16: Cursor Direction

Table-16: Cursor Shift Direction

C	CD1	CD0	Shift direction
4CH	0	0	Right
4DH	0	1	Left
4EH	1	0	Up
4FH	1	1	Down

Note: Since the cursor moves in address units even if $FX \geq 9$, the cursor address increment must be preset for movement in character units.

7.8 OVLAY

Selects layered screen composition and screen text/ graphics mode.

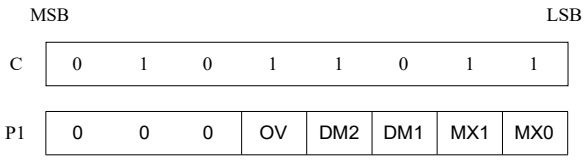


Figure 7-17: OVLAY Parameters

7.8.1 MX0, MX1

MX0 and MX1 set the layered screen composition method, which can be either OR, AND, Exclusive-OR or Priority- OR. Since the screen composition is organized in layers and not by screen blocks, when using a layer divided into two screen blocks, different composition methods cannot be specified for the individual screen blocks. The Priority-OR mode is the same as the OR mode unless flashing of individual screens is used.

Table-17: Composition Method Selection

MX1	MX0	Function	Composition Method	Applications
0	0	L1 ∪L2 ∪L3	OR	Underlining, rules, mixed text and graphics
0	1	(L1 ⊕L2) ∪L3	Exclusive-OR	Inverted characters, flashing regions, underlining
1	0	(L1 ∩L2) ∪L3	AND	Simple animation, three-dimensional appearance
1	1	L1 > L2> L3	Priority-OR	

Notes:

L1: First layer (text or graphics). If text is selected, layer L3 cannot be used.

L2: Second layer (graphics only)

L3: Third layer (graphics only)

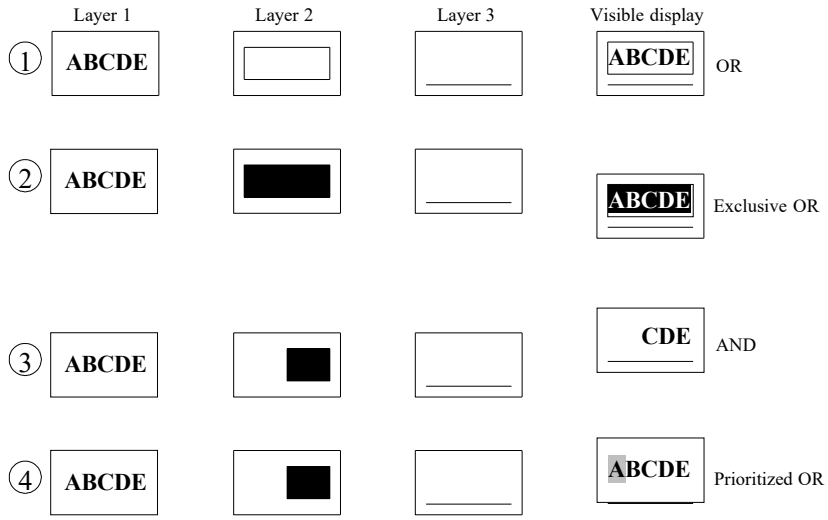


Figure 7-18: Combined Layer Display

Notes: L1: Notflashing

L2: Flashing at 1 Hz

L3: Flashing at 2 Hz

7.8.2 DM1, DM2

DM1 and DM2 specify the display mode of screen blocks 1 and 3, respectively.

DM1/2 = 0: Text mode

DM1/2 = 1: Graphics mode

Note 1: Screen blocks 2 and 4 can only display graphics.

Note 2: DM1 and DM2 must be the same, regardless of the setting of W/S.

7.8.3 OV

Specifies two- or three-layer composition in graphics mode.

OV = 0: Two-layer composition

OV = 1: Three-layer composition

Set OV to 0 for mixed text and graphics mode.

7.9 CGRAM ADR

Specifies the CG RAM start address.

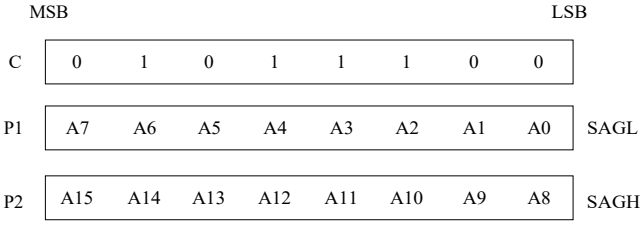


Figure 7-19: CGRAM ADR Parameters

7.10 HDOT SCR

While the SCROLL command only allows scrolling by characters, HDOT SCR allows the screen to be scrolled horizontally by pixels. HDOT SCR cannot be used on individual layers.

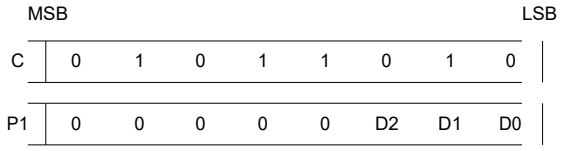


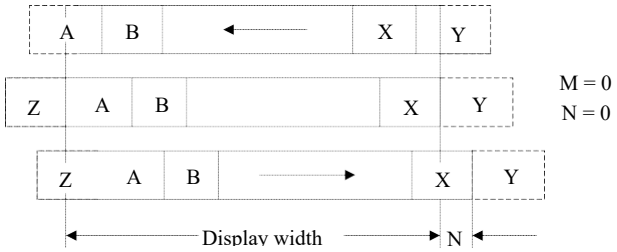
Figure 7-20: HDOT SCR Parameters

7.10.1 D0 to D2

Specifies the number of pixels to scroll. The C/R parameter has to be set to one more than the number of horizontal characters before using HDOT SCR. Smooth scrolling can be simulated if the controlling microprocessor repeatedly issues the HDOT SCR command to the RA8835A series.

Table-18: Scroll Step Selection

P1				Number of pixels to scroll
HEX	D2	D1	D0	
00	0	0	0	0
01	0	0	1	1
02	0	1	0	2
↓	↓	↓	↓	↓
06	1	1	0	6
07	1	1	1	7



M/N is the number of bits(dots) that parameter 1 (P1) is incremented/decremented by.

Figure 7-21 Horizontal Scrolling

7.11 CSRW

The 16-bit cursor address register contains the display memory address of the data at the cursor position as shown in Figure 7-22. Note that the microprocessor cannot directly access the display memory. The MREAD and MWRITE commands use the address in this register.

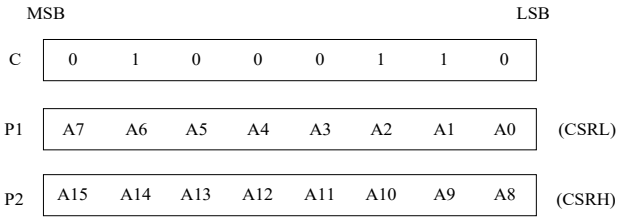


Figure 7-22: CSRW Parameters

The cursor address register can only be modified by the CSRW command, and by the automatic increment after an MREAD or MWRITE command. It is not affected by display scrolling. If a new address is not set, display memory accesses will be from the last set address or the address after previous automatic increments.

7.12 CSRR

Read from the cursor address register. After issuing the command, the data read address is read twice, for the low byte and then the high byte of the register.

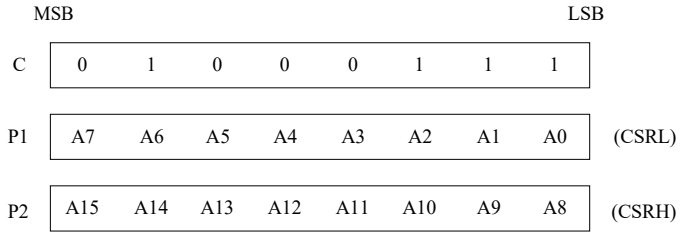


Figure 7-23: CSRR Parameters

7.13 MWRITE

The microprocessor may write a sequence of data bytes to display memory by issuing the MREAD command and then writing the bytes to the RA8835A series. There is no need for further MWRITE commands or for the microprocessor to update the cursor address register after each byte as the cursor address is automatically incremented by the amount set with CSRDIR, in preparation for the next data write.

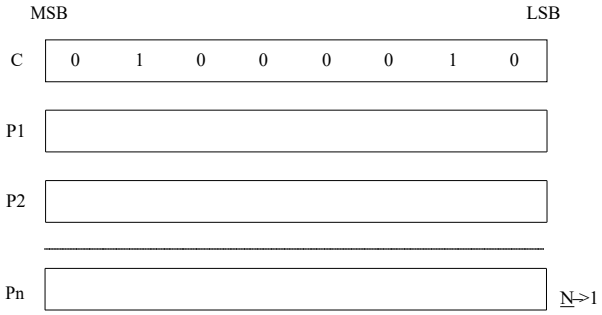


Figure 7-24: MWRITE Parameters

Note: P1, P2, ..., Pn: display data.

7.14 MREAD

Put the RA8835A series into the data output state. Each time the microprocessor reads the buffer, the cursor address is incremented by the amount set by CSRDIR and the next data byte fetched from memory, so a sequence of data bytes may be read without further MREAD commands or by updating the cursor address register. If the cursor is displayed, the read data will be from two positions ahead of the cursor.

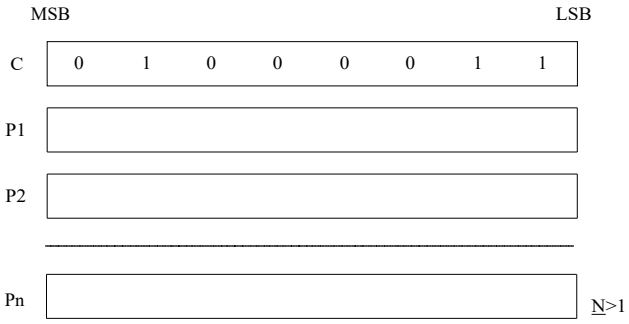


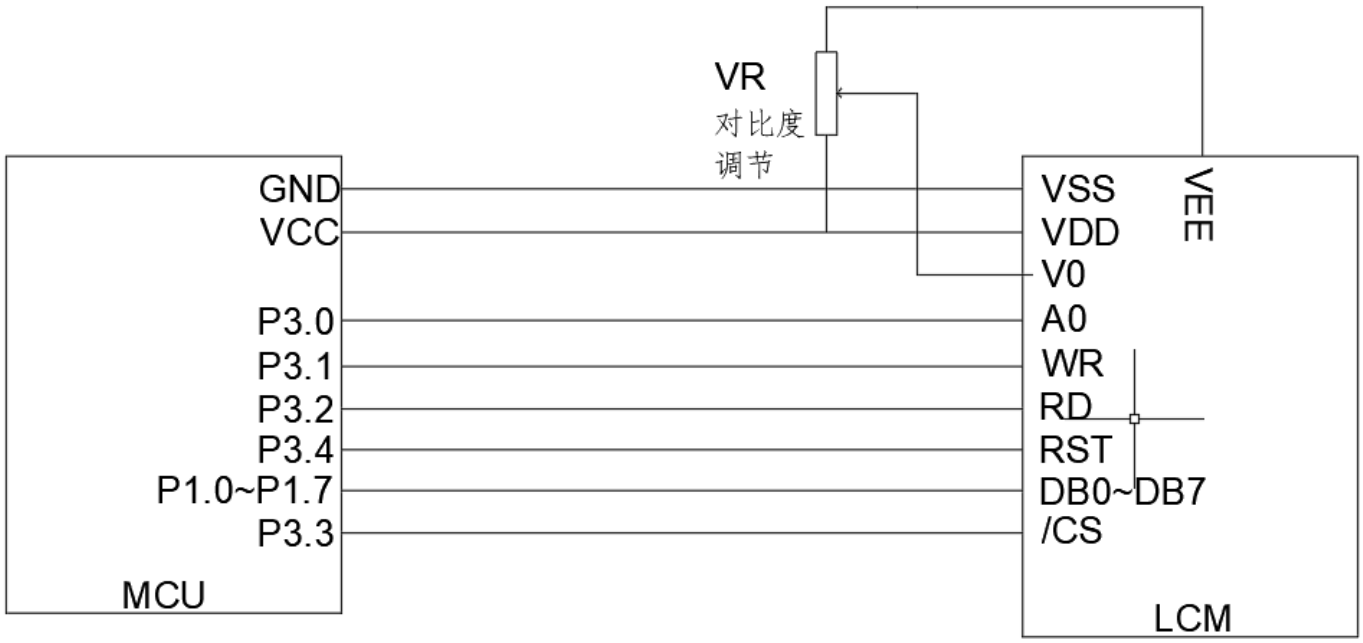
Figure 6-25: MREAD Parameters

8.操作时序

参考检测波形图、

9.应用例程

9.1 并行传输接线图



9.2 并行C51例程

```
#include <STC15.H>
#include <string.h>
#include <INTRINS.H>
#define uchar unsigned char
#define uint  unsigned int
#define db  P1
sbit ao=P3^0;
sbit wr=P3^1;
sbit rd=P3^2;
sbit cs=P3^3;
sbit rst=P3^4;
uchar code sysset [] =  {0x30, 0x87, 0x07, 0x27, 0x42, 0xf0, 0x28, 0x00};
uchar code scroll []={0,0,0xf0,
                      0,0x30,0xf0,
                      0,0x60,0,0x90};
//Defination Border Dots Matrix
uchar code txt1[] = {
"Hunan Xuyang Display Technology Co., Ltd"
```

```
 " Shenzhen yaoxingyang Industry Co., Ltd "
 "http://www.yxylcm.com mobile:18028784142"
 "ABCDE 320*240 DOTS + Character LCM FGHIJ"
 "abcdefghijklmnopqrstuvwxyz0123456789,./;"};
 unsigned char code bmp1[] =                // 数据表
 {
    0x80,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,
    0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x01,
    0x80,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,
    0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x01,
    0x80,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,
    0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x01,
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0x80,0x00,0x00,0x00,0x00,0x00,0x04,0x21,0x08,0x42,0x01,0x02,0x10,0x18,0x21,0x00,0x01,0x18,0x42,0x26,0x48,0x20,0x00,0x00,0x00,0x00,0x00,0x00,0x0F,0xFC,0x00,0x38,
0x00,0x03,0xFF,0x3C,0xFF,0xFF,0x1F,0x80,0x3F,0xF1,0x80,0x00,0x00,0x00,0x00,0x0C,0x23,0x0C,0x42,0x03,0x06,0x18,0x28,0x21,0x00,0x01,0x0C,0xC3,0x06,0x08,
0x00,0x00,0x00,0x00,0x00,0xFF,0x8F,0xF8,0x71,0xFD,0x00,0x00,0x00,0x00,0xFF,0xFE,0x1F,0xF0,0x1F,0xF1,0x80,0x00,0x00,0x00,0x00,0x00,0x23,0x0C,0xC3,0x13,
0x26,0x18,0x28,0x61,0x80,0x01,0x04,0x81,0x06,0x08,0x00,0x00,0x00,0x00,0x01,0xFF,0x8E,0x00,0x71,0xFF,0x80,0x00,0x00,0x03,0xFC,0x00,0x03,0xF0,0x03,0x81,
0x80,0x00,0x00,0x00,0x00,0x00,0x60,0x08,0xC3,0x1A,0x60,0x10,0x48,0x61,0x80,0x01,0x04,0x81,0x06,0x0C,0x00,0x00,0x00,0x00,0x01,0xFF,0x8F,0x00,0x71,0xFF,
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0x00,0x00,0x00,0x00,0x00,0xFF,0x8E,0x00,0x71,0xFF,0x00,0x0F,0x9F,0xCF,0xFC,0x00,0x07,0xF0,0x07,0x81,0x80,0x00,0x00,0x00,0x00,0x00,0x40,0x10,0x83,0x03,
0x00,0x20,0x88,0x41,0x80,0x01,0x04,0x81,0x06,0x01,0xC0,0x00,0x00,0x00,0x00,0x1C,0x00,0x3C,0x71,0xF8,0x00,0x3F,0xFF,0xFF,0x1C,0x78,0x1F,0x80,0x3C,0x71,
0x80,0x00,0x00,0x00,0x00,0x00,0x20,0x20,0x83,0x1E,0xE0,0x41,0x08,0x41,0x80,0x01,0x04,0x81,0x06,0x00,0x60,0x00,0x00,0x00,0x00,0x1C,0x00,0x3C,0x71,0xF8,
0x00,0x3F,0xFF,0xFF,0x1C,0x78,0x1F,0x80,0x3C,0x71,0x80,0x00,0x00,0x00,0x00,0x00,0x30,0x40,0xC3,0x12,0x20,0x81,0xFE,0x61,0x80,0x01,0x04,0x81,0x06,0x00,
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0x80,0x00,0x00,0x00,0x00,0x0C,0x31,0x04,0x42,0x03,0x02,0x08,0x08,0x21,0x00,0x01,0x08,0x43,0x06,0x08,0x10,0x00,0x00,0x00,0x01,0xE3,0xF1,0xE0,0x7F,0xF8,
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0x07,0xF0,0x3E,0x0C,0x00,0x07,0xE0,0x3C,0x0F,0x0B,0xC0,0x00,0x00,0x00,0x01,0xE0,0x0E,0x3C,0x71,0xC7,0x80,0x07,0x1E,0x00,0x00,0x7F,0x03,0x80,0x03,0xF1,
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0x80,0x07,0x1E,0x00,0x00,0x7F,0x03,0x80,0x07,0xF1,0x80,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,
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0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x01,0xE0,0x70,0x00,0x7E,0x00,0x0E,0x38,0x1F,0xC7,0xE0,0x7F,0xFC,0x0E,0x07,0x81,

```
0x80,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x01,0xE0,0x70,0x00,0x7E,0x00,
0x1E,0x38,0x1F,0xC7,0xE0,0x7F,0xFC,0x0F,0x07,0x81,0x80,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,
0x00,0x00,0x00,0x00,0x01,0xE0,0x70,0x00,0x7E,0x00,0x1E,0x38,0x1F,0xC7,0xE0,0x7F,0xFC,0x0F,0x07,0x81,0x80,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,
0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x01,0xE0,0x00,0x3F,0xF0,0x00,0x1F,0xC7,0xFE,0x78,0xE3,0xC1,0xFF,0xFF,0x07,0x81,
0x80,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x01,0xE0,0x00,0x3F,0xF0,0x00,
0x1F,0xC7,0xFE,0x78,0xE3,0x80,0xFF,0xFF,0x07,0x81,0x80,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,
0x00,0x00,0x00,0x00,0x01,0xE0,0x00,0x3F,0xF0,0x00,0x1F,0xC7,0xFE,0x78,0xE3,0x81,0xFF,0xFF,0x07,0x81,0x80,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,
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0x80,0x00,0x00,0x00,0x00,0x00,0x00,0x11,0x30,0x00,0x00,0x00,0x01,0x00,0x00,0x18,0x00,0x00,0x80,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x7F,0xFC,
0x01,0xC0,0x1F,0xC0,0xFF,0x81,0xE0,0x0F,0x07,0x81,0x80,0x00,0x00,0x00,0x00,0x00,0x00,0x11,0x20,0x3F,0xFF,0xE0,0x01,0x80,0x00,0x08,0x00,0x00,0x81,0x00,
0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x7F,0xF8,0x01,0xC0,0x1F,0xC0,0xFF,0x80,0xE0,0x0E,0x07,0x81,0x80,0x00,0x00,0x00,0x00,0x00,0x00,0xFF,0xFE,0x00,
0xCC,0x00,0x00,0x80,0x07,0xFF,0xF0,0x7F,0x7E,0x00,0x00,0x00,0x00,0x00,0x00,0xFF,0xFF,0xF8,0x7F,0xFF,0xE1,0xF8,0xFF,0xFF,0xFF,0xFF,0xE3,0x8F,0xC7,0xF1,
0x80,0x00,0x00,0x00,0x00,0x00,0x00,0x11,0x20,0x00,0xCC,0x01,0xFF,0xFF,0x04,0x00,0x20,0x41,0x00,0x00,0x00,0x00,0x00,0x00,0x01,0xFF,0xFF,0xFC,0x01,0xC7,
0xF0,0x38,0xFE,0x7F,0x1C,0x7F,0xE3,0x8F,0xE7,0xF1,0x80,0x00,0x00,0x00,0x00,0x00,0x00,0x11,0x20,0x00,0xCC,0x40,0x08,0x10,0x0C,0x00,0x40,0x41,0x00,0x00,
0x00,0x00,0x00,0x00,0x01,0xFF,0xFF,0xFC,0x01,0xC7,0xF0,0x38,0xFE,0x7F,0x1C,0x7F,0xE3,0x8F,0xE7,0xF1,0x80,0x00,0x00,0x00,0x00,0x00,0x00,0x20,0x20,0x0F,
0xFF,0xE0,0x08,0x30,0x03,0xFF,0x80,0x5F,0xFF,0x00,0x00,0x00,0x00,0x00,0x01,0xFF,0xFF,0xFC,0x01,0xC7,0xF0,0x78,0xFE,0x7F,0x1C,0x7F,0xE3,0x8F,0xC3,0xF1,
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0xFF,0xC7,0xFF,0xC0,0xFC,0x78,0xE0,0x0E,0x00,0x01,0x80,0x00,0x00,0x00,0x00,0x00,0x01,0x01,0x04,0x08,0x8C,0x40,0x04,0x20,0x00,0x04,0x00,0x42,0x60,0x00,
0x00,0x00,0x00,0x00,0x01,0xE0,0x00,0x3C,0x01,0xC0,0xFF,0xC7,0xFF,0xC0,0xFC,0x78,0xE0,0x0F,0x00,0x01,0x80,0x00,0x00,0x00,0x00,0x00,0x01,0x01,0x04,0x08,
0x8C,0x40,0x04,0x60,0x00,0x18,0x00,0x44,0x44,0x00,0x00,0x00,0x00,0x00,0x01,0xE0,0x00,0x3C,0x01,0xC0,0xFF,0xC7,0xFF,0xC0,0xFE,0x79,0xE0,0x0F,0x00,0x01,
0x80,0x00,0x00,0x00,0x00,0x00,0x00,0x3F,0xF8,0x08,0x8C,0x40,0x02,0x40,0x0F,0xFF,0xF0,0x4F,0xFE,0x00,0x00,0x00,0x00,0x00,0x01,0xE3,0xFE,0x3C,0x70,0x3C,
0xFF,0xFF,0x1E,0x7F,0xFF,0x8F,0xFF,0xFF,0x3F,0x81,0x80,0x00,0x00,0x00,0x00,0x00,0x00,0x21,0x08,0x09,0x0C,0x40,0x02,0xC0,0x00,0x08,0x00,0x40,0x40,0x00,
0x00,0x00,0x00,0x00,0x01,0xE3,0xFE,0x3C,0x70,0x38,0xFF,0xFF,0x1E,0x3F,0xFF,0x8F,0xFF,0xFF,0x3F,0x81,0x80,0x00,0x00,0x00,0x00,0x00,0x00,0x21,0x08,0x09,
0x07,0xC0,0x01,0x80,0x00,0x08,0x00,0x40,0x40,0x00,0x00,0x00,0x00,0x00,0x01,0xE3,0xFE,0x3C,0x70,0x3C,0xFF,0xFF,0x1E,0x7F,0xFF,0x8F,0xFF,0xFF,0x3F,0x81,
0x80,0x00,0x00,0x00,0x00,0x00,0x00,0x21,0x08,0x0A,0x00,0x40,0x01,0x80,0x00,0x08,0x00,0x7F,0xFF,0x00,0x00,0x00,0x00,0x00,0x01,0xE3,0xFE,0x3C,0x70,0x3F,
0x9E,0x00,0xE3,0xF8,0xE3,0x8F,0x03,0xF1,0xE0,0x01,0x80,0x00,0x00,0x00,0x00,0x00,0x00,0x21,0x08,0x0C,0x00,0x40,0x06,0x60,0x00,0x08,0x00,0x80,0x40,0x00,
0x00,0x00,0x00,0x00,0x01,0xE3,0xFE,0x3C,0x70,0x3F,0x9E,0x00,0xE3,0xF8,0xE3,0x8F,0x03,0xF1,0xE0,0x01,0x80,0x00,0x00,0x00,0x00,0x00,0x00,0x21,0x30,0x0F,
0xFF,0xC0,0x08,0x3C,0x00,0x08,0x00,0x80,0x40,0x00,0x00,0x00,0x00,0x00,0x01,0xE3,0xFE,0x3C,0x70,0x3F,0x9E,0x00,0xE3,0xF8,0xE3,0xCF,0x03,0xF1,0xE0,0x01,
0x80,0x00,0x00,0x00,0x00,0x00,0x00,0x01,0x00,0x08,0x00,0x40,0x70,0x0F,0x00,0x78,0x01,0x00,0x40,0x00,0x00,0x00,0x00,0x00,0x01,0xE3,0xFE,0x3C,0x71,0xFF,
0x9E,0x38,0x00,0x00,0x1F,0xF8,0x1C,0x70,0x3C,0x71,0x80,0x00,0x00,0x00,0x00,0x00,0x00,0x01,0x00,0x00,0x00,0x01,0x80,0x00,0x00,0x10,0x00,0x00,0x40,0x00,
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0x80,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x01,0xE0,0x00,0x3C,0x00,0x00,
0xF3,0xC7,0xE3,0xFF,0xFC,0x7F,0xFF,0x80,0x00,0x71,0x80,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,
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0x80,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x01,0xFF,0xFF,0xFC,0x01,0xC0,
0x5E,0x87,0xA1,0x7F,0xF3,0xFF,0x07,0xF1,0xFF,0xF1,0x80,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,
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0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x01,0xFF,0xFF,0xFC,0x01,0xC0,0x1E,0x07,0x00,0x7F,0xE3,0xFF,0x03,0xF1,0xFF,0xF1,
0x80,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0xFF,0xFF,0xF8,0x01,0xC0,
0x0C,0x07,0x00,0x3F,0xE1,0xFE,0x03,0xF0,0xFF,0xE1,0x80,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,
0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x01};//////////////////////////////////DB区完
//////////////////////////////////////////////
/*****************************************************************
*******************************************************************/
void    delay(unsigned int m)           //延时程序
              {
                unsigned int i,j;
                for(i=0;i<m;i++)
                  for(j=0;j<20;j++);
              }


//////////////////////////////////////////
/*****************************************************************
*******************************************************************/
void    delayms(unsigned int n)           //延时10×n毫秒程序
              {
                unsigned int i,j;
```

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

void wr_cmd(uchar cmd)
{
    cs=0;
    ao=1;

    db=cmd;
    rd=1;
    wr=0;
    _nop_();

    wr=1;
    cs=1;
}

void wr_dat(uchar dat)
{
    cs=0;
    ao=0;

    P0=dat;
    rd=1;
    wr=0;
    _nop_();

    wr=1;
    cs=1;
}

void show_on(void)   //////////////显示开
{
 wr_cmd(0x59);
 wr_dat(0x57);

}

void show_off(void)   //////////显示关
{
 wr_cmd(0x58);
 wr_dat(0x57);
```

```
}

void lcd_cls(uchar dat) ////////////////清屏
{
uint i=0x8000;
     wr_cmd(0x4c);
      wr_cmd(0x46);
      wr_dat(0);
      wr_dat(0);
     wr_cmd(0x42);
     while(i--)wr_dat(dat);

}
void gbdw_xy(uint x,uchar y)
{
 uint addr;
     addr=y*40+x;
     wr_cmd(0x46);
     wr_dat((uchar)(addr&0xff));
     wr_dat((uchar)(addr>>8));

}

void initial()
{uchar i;
     wr_cmd(0x40);
     for(i=0;i<8;i++)
     wr_dat(sysset_[i]);
     wr_cmd(0x44);
     for(i=0;i<10;i++)
     wr_dat(scroll_[i]);
     wr_cmd(0x5d);
     wr_dat(8);
     wr_dat(8);
     wr_cmd(0x4c);
     wr_cmd(0x5a);
     wr_dat(0);
     wr_cmd(0x5b);
     wr_dat(0x0c);
     wr_cmd(0x5c);
     wr_dat(0x00);
     wr_dat(0x00);
     show_off();
     lcd_cls(0);
```

```
    show_on();
}

void disp_dat(uchar dat1,uchar dat2)
{
    uint page_cnt,col_cnt;
    wr_cmd(0x5b);
    wr_dat(0x0c);
     wr_cmd(0x46);
     wr_dat(0);
     wr_dat(8);
     gbdw_xy(0,0);
     wr_cmd(0x42);
   for(page_cnt=0;page_cnt<120;page_cnt++)
    {
     //wr_cmd(0xb0);
      for (col_cnt=0;col_cnt<40;col_cnt++)
      {
              wr_dat(dat1);

      }
      for (col_cnt=0;col_cnt<40;col_cnt++)
      {

              wr_dat(dat2);
      }
    }

}



void disp_str(uchar code *txtzz)
{uint i;
wr_cmd(0x5b);
    wr_dat(0x00);
     wr_cmd(0x46);
     wr_dat(0);
     wr_dat(0);
     gbdw_xy(0,0);
     wr_cmd(0x42);
    for(i=0;i<40;i++)
    {
 wr_dat(45);
    }
```

```
        for(i=0;i<95;i++)
        {
  wr_dat(i+33);
        }
        for(i=0;i<25;i++)
        {
  wr_dat(i+33);
        }
        for(i=0;i<40;i++)
        {
  wr_dat(45);
        }
  for(i=0;i<200;i++)
        {
  wr_dat(txtzz[i]);
        }
        for(i=0;i<40;i++)
        {
  wr_dat(45);
        }
        for(i=0;i<95;i++)
        {
  wr_dat(i+33);
        }
        for(i=0;i<25;i++)
        {
  wr_dat(i+33);
        }
        for(i=0;i<40;i++)
        {
  wr_dat(45);
        }
  for(i=0;i<200;i++)
        {
  wr_dat(txtzz[i]);
        }
        for(i=0;i<40;i++)
        {
  wr_dat(45);
        }
        for(i=0;i<95;i++)
        {
  wr_dat(i+33);
        }
        for(i=0;i<25;i++)
```

```
      {
 wr_dat(i+33);
      }
      for(i=0;i<40;i++)
      {
 wr_dat(45);
      }
      for(i=0;i<200;i++)
      {
 wr_dat(txtzz[i]);
      }
}

 void disp_bmp(uchar code *bmparea)
 {uint i;
      wr_cmd(0x5b);
      wr_dat(0x0c);
        wr_cmd(0x46);
        wr_dat(0);
        wr_dat(8);
        gbdw_xy(0,0);
        wr_cmd(0x42);
      for(i=0;i<40;i++)
      {
 wr_dat(0xff);
      }
 for(i=0;i<4760;i++)
      {
 wr_dat(bmparea[i]);
      }
      for(i=0;i<4760;i++)
      {
 wr_dat(bmparea[i+4760]);
      }
      for(i=0;i<40;i++)
      {
 wr_dat(0xff);
      }

 }//////////////////////////////////////////////
 /*********************************************************************
 * 名称 : Main()
 * 功能 : 主函数
 *********************************************************************/
 void    main(void)
```

```
    {
       rst = 0;
     delays(10);
     rst = 1;
     delays(100);
     initial();
     while (1)
     {
       lcd_cls(0);
       disp_dat(0xff,0xff); //All Dots Display
       delayms(500);
       disp_dat(0xaa,0xaa); //Seperate Rows I
       delayms(500);
       disp_dat(0xff,0x00); //Seperate Columns II
       delayms(500);
       disp_dat(0xaa,0x55); //Seperate Dots I
       delayms(500);
       disp_dat(0x55,0xaa); //Separate Dots II
       delayms(500);
      disp_str(txt1);
       delayms(500);
       disp_bmp(bmp1);
       delayms(500);
       }
}
```

10.注意事项

1.液晶显示器（LCD）

液晶显示器是由玻璃，有机密封胶，有机流体，和聚合物基偏光片。搬运时应注意以下事项：，

（1） .保持温度在使用和储存范围内。过高的温度和湿度会导致偏振退化、偏振器剥离或气泡。

（2） .不要用比HB铅笔芯更硬的东西接触暴露的偏光镜。清除显示器表面的灰尘，用棉花轻轻擦拭，鹿皮巾或其他软材料浸泡在清洁油中。

（3） 立即擦掉唾液或水滴。ITO与水接触时间过长，会导致液晶显示器表面变形或变色。

（4） 玻璃很容易因粗暴的操作而碎裂。尤其是在角落和边缘。

（5） .不要用直流电压驱动液晶显示器。

2.液晶显示模块

2.1机械注意事项

LCM的装配和调整具有高精度。避免过度震动，不要做任何改动或修改。应注意以下几点。

（1） .不要以任何方式改变金属框架上的凸耳。

（2） .请勿通过钻额外的孔、更改其轮廓、移动其组件或修改其图案来修改PCB。

（3） .请勿触摸弹性体连接器，尤其是插入背光面板（例如，EL）。

（4） .安装LCM时，请确保PCB板不受任何压力，如弯曲或扭曲。弹性体接触非常精细，任何元素的轻微错位都可能导致像素缺失。

（5） .避免压在金属挡板上，否则弹性体连接器可能会变形和失去接触，从而导致丢失像素。

2.2.静电

LCM包含CMOS LSI，对此类设备应采取相同的预防措施，即

（1） .当操作员与模块接触时，应将其接地。切勿用人体任何部位接触任何导电部件，如LSI焊盘、PCB上的铜导线和接口端子。

（2） .模块应保存在防静电袋或其他防静电容器中储存。

（3） .只能使用正确接地的烙铁。

（4） .如果使用电动螺丝刀，应良好接地，并防止换向器火花。

（5） .工作服和工作台应遵守正常的防静电措施；对于后者，建议使用导电（橡胶）垫。

（6） 。由于干燥空气会感应静电，建议相对湿度为50-60%。

2.3.焊接

（1） .仅焊接至I/O端子。

（2） .只能使用接地正确且无漏电的烙铁。

（3） .焊接温度：280℃±10℃

（4） .焊接时间：3到4秒。

（5） .使用树脂助焊剂填充的低温焊锡。

（6） .如果使用助焊剂，应覆盖LCD表面，以避免焊剂飞溅。助焊剂残留物应在防护后清除。

2.4.操作

（1） 观察角度可以通过改变LCD驱动电压V0来调节。

（2） 驱动电压应保持在规定的范围内，过高的电压会缩短显示器的寿命。（3） 响应时间随着温度的降低而增加。

（4） .在高于其工作范围的温度下，显示器可能会变成黑色或深蓝色；这（但是不要按压显示区域）可能会导致部分显示线段“断裂”。

（5） .操作过程中的机械损害（如按压显示区域）可能会导致线段出现“断裂”。

2.5.储存

如果有液体从损坏的玻璃电池中漏出，将任何接触的人体部分用肥皂和水冲洗干净。切勿吞下液体。毒性极低，但应始终小心。

2.6.有限保修

除非与客户另有约定，从装运日期起一年内，当根据验收标准检查时发现其电气和外观缺陷，将维修或修理其任何LCD和IC，该日期的确认应以货运单据为依据，保修责任仅限于根据上述条款进行的维修和/或更换。不会对任何后续或后果性事件负责。