

SLG384160A Series GRAPHIC LCD MODULE USER MANUAL

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Reference Controller Datasheet

Graphic LCD Selection Guide

ST7586S

SUR-GB2312-3205

Library

1. 概述

深圳襄诺科技专注于液晶屏及液晶模块的研发、制造。所生产 SLG384160A 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。

SLG384160A LCD 可以显示 384 列*160 行点阵单色或 4 灰度级的图片，或显示 12 个/行*5 行 32*32 点阵或显示 16 个/行*6 行 24*24 点阵的汉字，或显示 24 个/行*10 行 16*16 点阵的汉字，或显示 8*16 点阵的英文、数字、字符 48 个*10 行，或显示 5*8 点阵的英文、数字、字符 64 个*20 行。又含有 SUR-GB2312-3205 字库 IC，可以从字库 IC 中读出内置的字库的点阵数据写入到 LCD 驱动 IC 中，以达到显示汉字的目的。

SLG384160A 图像型点阵液晶模块的特性

- 1 结构牢。
- 2 IC 采用矽创公司 ST7586S, 功能强大，稳定性好
- 3 功耗低。
- 4 接口简单方便:可采用 4 线 SPI 串行接口，或选择并行接口。
- 5 工作温度宽:-20℃ - 70℃；
- 6 显示内容：

- 可 384*160 点阵单色或 4 灰度级图片；
- 可显示 12 个×5 行 32*32 点阵的汉字；
- 可显示 16 个×6 行 24*24 点阵的汉字；
- 可显示 24 个×10 行 16*16 点阵的汉字；
- 可显示 32 个×13 行 12*12 点阵的汉字；
- 可显示 48 个*10 行 8*16 点阵的英文、数字、字符；
- 可显示 64 个*20 行 5*8 点阵的英文、数字、字符；
- 可显示其他的 ASCII 码等；

7 字库 IC (IC 型号：SUR-GB2312-3205，此 IC 为可选的配件) 自带字库内容：

分类	字库内容	编码体系（字符集）	字符数
汉字字符	11X12 点 GB2312 标准点阵字库	GB2312	6763+846
	15X16 点 GB2312 标准点阵字库	GB2312	6763+846
	24X24 点 GB2312 标准点阵字库	GB2312	6763+846
	32X32 点 GB2312 标准点阵字库	GB2312	6763+846
	6X12 点国标扩展字符	GB2312	126
	8X16 点国标扩展字符	GB2312	126
	12X24 点国标扩展字符	GB2312	126
	16X32 点国标扩展字符	GB2312	126
ASCII 字符	5X7 点 ASCII 字符	ASCII	96
	7X8 点 ASCII 字符	ASCII	96
	6X12 点 ASCII 字符	ASCII	96
	8X16 点 ASCII 字符	ASCII	96
	8X16 点粗体 ASCII 字符	ASCII	96
	12 点阵不等宽 ASCII 方头 (Arial) 字符	ASCII	96
	12 点阵不等宽 ASCII 白正 (Times New Roman) 字符	ASCII	96
	16 点阵不等宽 ASCII 方头 (Arial) 字符	ASCII	96
	16 点阵不等宽 ASCII 白正 (Times New Roman) 字符	ASCII	96
	24 点阵不等宽 ASCII 方头 (Arial) 字符	ASCII	96
	24 点阵不等宽 ASCII 白正 (Times New Roman) 字符	ASCII	96
	32 点阵不等宽 ASCII 方头 (Arial) 字符	ASCII	96
	32 点阵不等宽 ASCII 白正 (Times New Roman) 字符	ASCII	96
输入法码表	全拼输入法码表	GB2312	

字型样张

11X12 点 GB2312 汉字

啊阿埃挨哎唉哀皑癌藹矮艾碍爱隘鞍
氨安俺按暗岸胺案肮昂盎凹敖熬翱袄
傲奥懊澳芭捌扒叭吧芭八疤巴拔跋靶
把耙坝霸罢爸白柏百摆佰败拜裨斑班
搬扳般颁板版扮拌伴瓣半办絆邦帮梆
榜膀绑棒磅蚌镑傍苞袍包褓剥薄苞
保堡饱宝抱报暴豹鲍爆杯碑悲卑北辈
背贝狈倍惫惫惫惫被奔笨笨笨崩绷甬

15X16 点 GB2312 汉字

啊阿埃挨哎唉哀皑癌藹矮艾碍爱隘鞍
氨安俺按暗岸胺案肮昂盎凹敖熬翱袄
傲奥懊澳芭捌扒叭吧芭八疤巴拔跋靶
把耙坝霸罢爸白柏百摆佰败拜裨斑班
搬扳般颁板版扮拌伴瓣半办絆邦帮梆
榜膀绑棒磅蚌镑傍苞袍包褓剥薄苞
保堡饱宝抱报暴豹鲍爆杯碑悲卑北辈
背贝狈倍惫惫惫惫被奔笨笨笨崩绷甬

24X24 点 GB2312 汉字

啊阿埃挨哎唉哀皑
癌藹矮艾碍爱隘鞍
氨安俺按暗岸胺案
肮昂盎凹敖熬翱袄

32X32 点 GB2312 汉字

啊阿埃挨哎唉
哀皑癌藹矮艾
碍爱隘鞍氨安

5x7 点 ASCII 字符

!"#\$%&'()*+,-./0123456789:
=>?@ABCDEFGHIJKLMN O PQRSTU V
YZ[\]^_`abcdefghijklmnopqrstuvwxyz

7x8 点 ASCII 字符

!"#\$%&'()*+,-./01234
6789:;<=>?@ABCDEFGHIJ
LMNOPQRSTUVWXYZ[\]^_`
bcdefghijklmnopqrstuv
6789:;<=>?@ABCDEFGHIJ

6x12 点 ASCII 字符

!"#\$%&'()*+,-./0123456789:
=>?@ABCDEFGHIJKLMN O PQRSTU V
YZ[\]^_`abcdefghijklmnopqrstuvwxyz
{|}~āāāāēēēēīīīīōōōōū

8x16 点 ASCII 字符

!"#\$%&'()*+,-./0123456789:
=>?@ABCDEFGHIJKLMN O PQRSTU V
YZ[\]^_`abcdefghijklmnopqrstuvwxyz

12 点阵不等宽 ASCII 方头

!"#\$%&'()*+,-./01234
6789:;<=>?@ABCDEFGHIJ
LMNOPQRSTUVWXYZ[\]^_`
bcdefghijklmnopqrstuv
6789:;<=>?@ABCDEFGHIJ

16 点阵不等宽 ASCII 方头

!"#\$%&'()*+,-./0123456789:
=>?@ABCDEFGHIJKLMN O PQRSTU V
YZ[\]^_`abcdefghijklmnopqrstuvwxyz
{|}~āāāāēēēēīīīīōōōōū

Interface

Pin No.	Symbol			Level	Description
	80 MPU	68 MPU	Serial		
1	ROM_IN			-	Font Chip: Input Singal
2	ROM_OUT			-	Font Chip: Output Singal
3	ROM_SCK			-	Font Chip: Serial Clock Singal
4	ROM_CS			-	Font Chip: Chip Selection
5	BLA			3.3V	Backlight Anode
6	VSS			0V	Power Ground
7	VDD			3.3V	Logic Power Supply
8	A0		SLC	H/L	Parallel: A0 (H: Data Code L: Instruction Code); Serial: SLC (Serial Clock Input)
9	RST			L	Reset Signal, Low-Active
10	CS			L	Chip selection signal. Active "L".
11-18	DB7-DB2		NC	H/L	Data Bus Line / No Connection
17	DB1		A0	H/L	Parallel: Data Bus Line / Serial: A0 (H: Data Code L: Instruction Code)
18	DB0		SDA	H/L	Parallel: Data Bus Line / Serial: SDA (Serial Data Input)
19	RD	E	NC	H	Read Signal / Enable Signal / No Connection
20	WR	R/W	NC	H/L	Write Signal / Write & Read Signal / No Connection

3.1 电路框图

电路框图

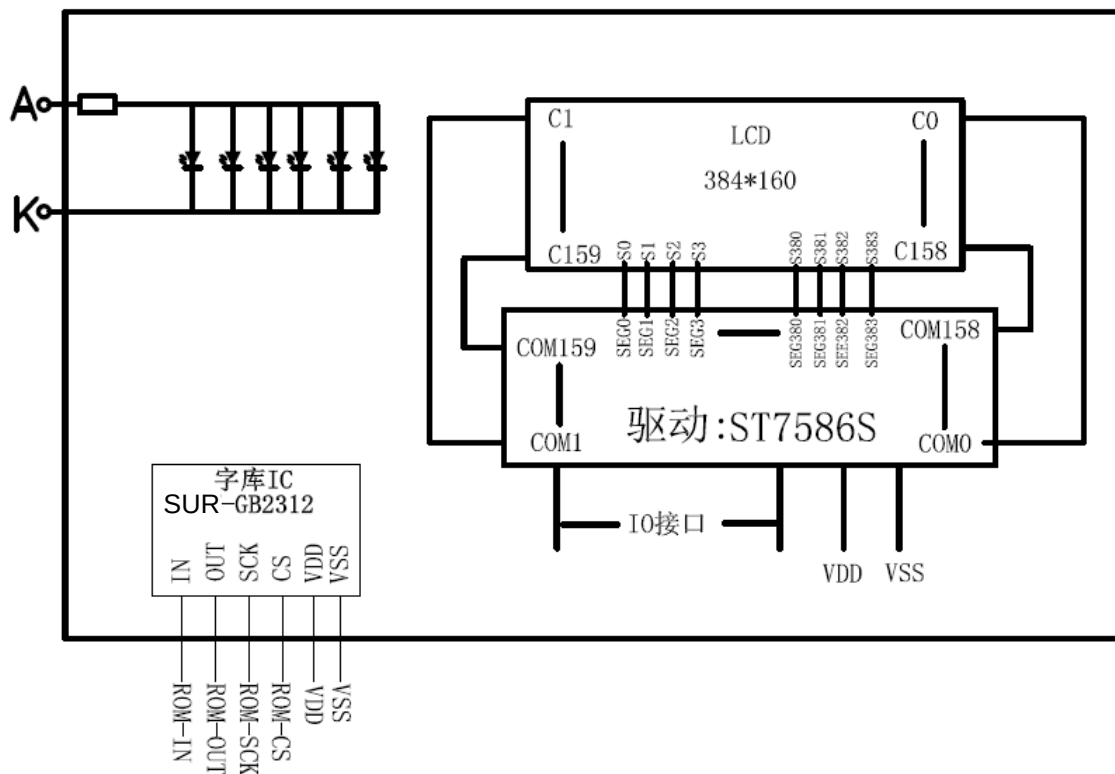


图2:SLG384160A图像点阵型液晶模块的电路框图

3.2 背光参数

该型号液晶模块带 LED 背光源。它的性能参数如下：

工作温度： $-20. \sim +70^{\circ} \text{C}$ ；

背光颜色：白色。

正常工作电流为： $(8 \sim 20) * 6 = 48 \sim 120 \text{mA}$ （LED 灯数共 6 颗）；

工作电压：5V 或 3.3V，由你选择的 VDD 电源电压（5V 或 3.3V）决定；

正常工作条件下，LED 可连续点亮 5 万小时；

4. 指令表及硬件接口、编程案例

液晶模块中有两个 IC，一个 IC 在 LCD 玻璃上，叫 ST7586S, 是液晶屏的驱动 IC, 另一个 IC 在 PCB 上，叫 JLX-GB2312-3205, 是标准的汉字库存储芯片，是不可改写的存储器 (ROM)。

不带字库 IC 时，单片机 (MCU) 也可以通过控制驱动 IC (ST7586S) 使液晶屏显示。

带字库 IC 时，单片机 (MCU) 可以从字库 IC 中读取汉字的点阵数据，再将点阵数据写入驱动 IC (ST7586S) 使液晶屏显示。

4.1 LCD 驱动 IC (ST7586S) 的指令表:

INSTRUCTION TABLE

INSTRUCTION	A0	R/W	COMMAND BYTE								DESCRIPTION
			D7	D6	D5	D4	D3	D2	D1	D0	
NOP	0	0	0	0	0	0	0	0	0	0	No operation
RESET	0	0	0	0	0	0	0	0	0	1	Software reset
Power Save	0	0	0	0	0	1	0	0	0	SLP	Set power save mode SLP=0: Sleep in mode SLP=1: Sleep out mode
Partial Mode	0	0	0	0	0	1	0	0	1	PTL	Set partial mode PTL=0: Partial mode on PTL=1: Partial mode off
Inverse Display	0	0	0	0	1	0	0	0	0	INV	Set inverse display mode INV=0: Normal display INV=1: Inverse display
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
Display ON/OFF	0	0	0	0	1	0	1	0	0	DSP	Set LCD display DSP=0: Display off DSP=1: Display on
Set Column Address	0	0	0	0	1	0	1	0	1	0	Set column address Starting column address: $00h \leq XS \leq 7Fh$ Ending column address: $XS \leq XE \leq 7Fh$
	1	0	XS15	XS14	XS13	XS12	XS11	XS10	XS9	XS8	
	1	0	XS7	XS6	XS5	XS4	XS3	XS2	XS1	XS0	
	1	0	XE15	XE14	XE13	XE12	XE11	XE10	XE9	XE8	
Set Row Address	0	0	0	0	1	0	1	0	1	1	Set row address Starting row address: $00h \leq YS \leq 9Fh$ Ending row address: $YS \leq YE \leq 9Fh$
	1	0	YS15	YS14	YS13	YS12	YS11	YS10	YS9	YS8	
	1	0	YS7	YS6	YS5	YS4	YS3	YS2	YS1	YS0	
	1	0	YE15	YE14	YE13	YE12	YE11	YE10	YE9	YE8	
Write Display Data	0	0	0	0	1	0	1	1	0	0	Write display data to DDRAM
	1	0	D7	D6	D5	D4	D3	D2	D1	D0	
Read Display Data	0	0	0	0	1	0	1	1	1	0	Read display data from DDRAM
	1	1	D7	D6	D5	D4	D3	D2	D1	D0	
Partial Display Area	0	0	0	0	1	1	0	0	0	0	Set partial area Partial display address start: $00h \leq PTS \leq 9Fh$ Partial display address end: $00h \leq PTE \leq 9Fh$ Display Area: $64 \leq Duty \leq 160$
	1	0	PTS15	PTS14	PTS13	PTS12	PTS11	PTS10	PTS9	PTS8	
	1	0	PTS7	PTS6	PTS5	PTS4	PTS3	PTS2	PTS1	PTS0	
	1	0	PTE15	PTE14	PTE13	PTE12	PTE11	PTE10	PTE9	PTE8	
Scroll Area	0	0	0	0	1	1	0	0	1	1	Set scroll area Top Area: TA=00h~A0h Scrolling Area: SA=00h~A0h Bottom Area: BA=00h~A0h TA+SA+BA=160
	1	0	TA7	TA6	TA5	TA4	TA3	TA2	TA1	TA0	
	1	0	SA7	SA6	SA5	SA4	SA3	SA2	SA1	SA0	
	1	0	BA7	BA6	BA5	BA4	BA3	BA2	BA1	BA0	
Display Control	0	0	0	0	1	1	0	1	1	0	Set scan direction of COM and SEG MY=0: COM0→COM159 MY=1: COM159→COM0 MX=0: SEG0→SEG383 MX=1: SEG383→SEG0
	1	0	MY	MX	0	0	0	0	0	0	
Start Line	0	0	0	0	1	1	0	1	1	1	Set display start line S=00h~9Fh
	1	0	S7	S6	S5	S4	S3	S2	S1	S0	

INSTRUCTION	A0	R/W	COMMAND BYTE								DESCRIPTION
			D7	D6	D5	D4	D3	D2	D1	D0	
Display Mode	0	0	0	0	1	1	1	0	0	M	Set display mode M=0: Gray mode M=1: Monochrome mode
Enable DDRAM Interface	0	0	0	0	1	1	1	0	1	0	Enable DDRAM interface
	1	0	0	0	0	0	0	0	1	0	
Display Duty	0	0	1	0	1	1	0	0	0	0	Set display duty DT=03h~9Fh
	1	0	DT7	DT6	DT5	DT4	DT3	DT2	DT1	DT0	
First Output COM	0	0	1	0	1	1	0	0	0	1	Set first output COM FC=00h~9Fh
	1	0	FC7	FC6	FC5	FC4	FC3	FC2	FC1	FC0	
FOSC Divider	0	0	1	0	1	1	0	0	1	1	Set FOSC dividing ratio
	1	0	0	0	0	0	0	0	FOD1	FOD0	
Partial Display	0	0	1	0	1	1	0	1	0	0	Set partial display mode
	1	0	1	0	1	0	0	0	0	0	
N-Line Inversion	0	0	1	0	1	1	0	1	0	1	Set N-Line inversion
	1	0	M	0	0	NL4	NL3	NL2	NL1	NL0	
Read Modify Write	0	0	1	0	1	1	1	0	0	RMW	Read modify write control RMW=0: Enable read modify write RMW=1: Disable read modify write
Set Vop	0	0	1	1	0	0	0	0	0	0	Set Vop
	1	0	Vop7	Vop6	Vop5	Vop4	Vop3	Vop2	Vop1	Vop0	
	1	0	-	-	-	-	-	-	-	Vop8	
Vop Increase	0	0	1	1	0	0	0	0	0	1	Vop increase one step
Vop Decrease	0	0	1	1	0	0	0	0	1	0	Vop decrease one step
BIAS System	0	0	1	1	0	0	0	0	1	1	Set BIAS system
	1	0	-	-	-	-	-	BS2	BS1	BS0	
Booster Level	0	0	1	1	0	0	0	1	0	0	Set booster level
	1	0	-	-	-	-	-	BST2	BST1	BST0	
Vop Offset	0	0	1	1	0	0	0	1	1	1	Set Vop offset
	1	0	0	VOF6	VOF5	VOF4	VOF3	VOF2	VOF1	VOF0	
Analog Control	0	0	1	1	0	1	0	0	0	0	Enable analog circuit
	1	0	0	0	0	1	1	1	0	1	
Auto Read Control	0	0	1	1	0	1	0	1	1	1	Auto read control XARD=0: Enable auto read XARD=1: Disable auto read
	1	0	1	0	0	XARD	1	1	1	1	
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	
OTP Control Out	0	0	1	1	1	0	0	0	0	1	OTP control out
OTP Write	0	0	1	1	1	0	0	0	1	0	OTP programming procedure
OTP Read	0	0	1	1	1	0	0	0	1	1	OTP up-load procedure
OTP Selection Control	0	0	1	1	1	0	0	1	0	0	OTP selection control Ctrl=0: Disable OTP Ctrl=1: Enable OTP
	1	0	0	Ctrl	0	1	1	0	0	1	
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	

INSTRUCTION	A0	R/W	COMMAND BYTE								DESCRIPTION
			D7	D6	D5	D4	D3	D2	D1	D0	
Frame Rate	0	0	1	1	1	1	0	0	0	1	Frame rate setting in different temperature range
	1	0	-	-	-	FRA4	FRA3	FRA2	FRA1	FRA0	
	1	0	-	-	-	FRB4	FRB3	FRB2	FRB1	FRB0	
	1	0	-	-	-	FRC4	FRC3	FRC2	FRC1	FRC0	
	1	0	-	-	-	FRD4	FRD3	FRD2	FRD1	FRD0	
Temperature Range	0	0	1	1	1	1	0	0	1	0	Temperature range setting
	1	0	-	TA6	TA5	TA4	TA3	TA2	TA1	TA0	
	1	0	-	TB6	TB5	TB4	TB3	TB2	TB1	TB0	
	1	0	-	TC6	TC5	TC4	TC3	TC2	TC1	TC0	
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	

请详细参考 ST7586S 的 IC 资料。

4.2 字库 IC (SUR-GB2312-3205) 的操作指令及点阵数据的调用方法:

4.2.1 字库 IC 的操作指令只有两条，两条只选一条进行使用，操作指令表如下:

Instruction Set

Instruction	Description	Instruction Code(One-Byte)		Address Bytes	Dummy Bytes	Data Bytes
READ	Read Data Bytes	0000 0011	03 h	3	—	1 to ∞
FAST_READ	at Higher Speed	0000 1011	0B h	3	1	1 to ∞

Read Data

Bytes

所有对本芯片 SPI 接口的操作只有 2 个，那就是 Read Data Bytes (READ “一般读取”)和 Read Data Bytes at Higher Speed (FAST_READ “快速读取点阵数据”)。

以下分别介绍一般读取和快速读取:

4.2.1.1 Read Data Bytes (一般读取)

Read Data Bytes 需要用指令码来执行每一次操作。READ 指令的时序如下(图):

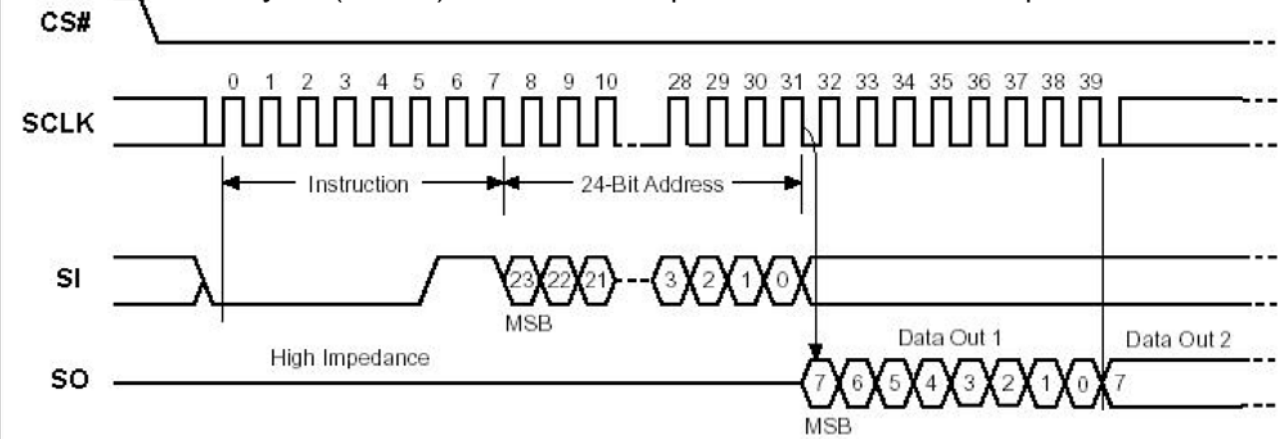
首先把片选信号 (CS#) 变为低，紧跟着的是 1 个字节的命令字 (03 h) 和 3 个字节的地址和通过串行数据输入引脚 (SI) 移位输入，每一位在串行时钟 (SCLK) 上升沿被锁存。

然后该地址的字节数据通过串行数据输出引脚 (SO) 移位输出，每一位在串行时钟 (SCLK) 下降沿被移出。

读取字节数据后，则把片选信号 (CS#) 变为高，结束本次操作。

如果片选信号 (CS#) 继续保持为底，则下一个地址的字节数据继续通过串行数据输出引脚 (SO) 移位输出。

图: Read Data Bytes (READ) Instruction Sequence and Data-out sequence



4.2.1.2 Read Data Bytes at Higher Speed (快速读取点阵数据)

Read Data Bytes at Higher Speed 需要用指令码来执行操作。**READ_FAST** 指令的时序如下(图):

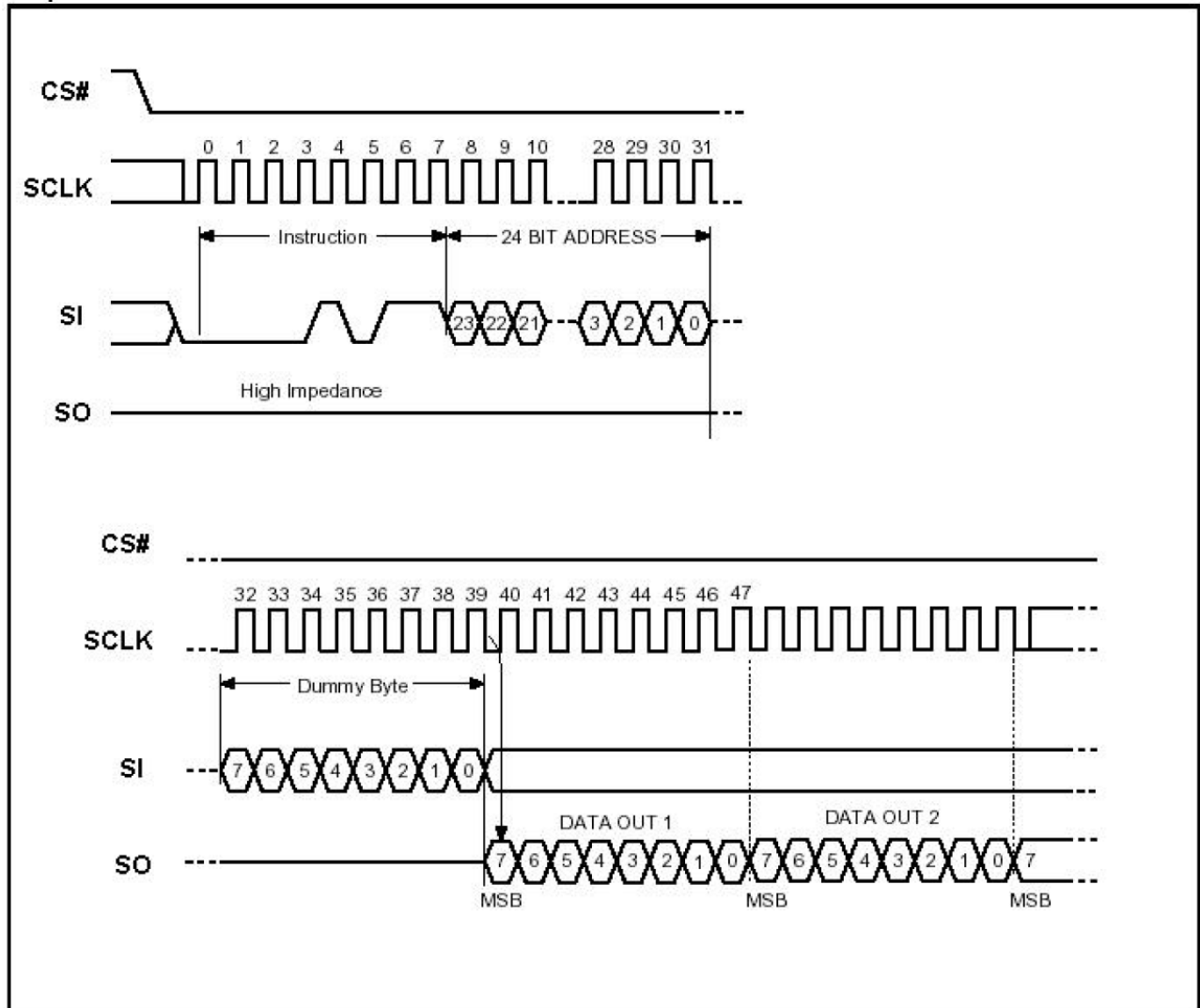
首先把片选信号 (**CS#**) 变为低, 紧跟着的是 1 个字节的命令字 (**0B h**) 和 3 个字节的地址以及一个字节 **Dummy Byte** 通过串行数据输入引脚 (**SI**) 移位输入, 每一位在串行时钟 (**SCLK**) 上升沿被锁存。

然后该地址的字节数据通过串行数据输出引脚 (**SO**) 移位输出, 每一位在串行时钟 (**SCLK**) 下降沿被移出。

如果片选信号 (**CS#**) 继续保持为底, 则下一个地址的字节数据继续通过串行数据输出引脚 (**SO**) 移位输出。例: 读取一个 **15x16** 点阵汉字需要 **32Byte**, 则连续 **32** 个字节读取后结束一个汉字的点阵数据读取操作。

如果不需要继续读取数据, 则把片选信号 (**CS#**) 变为高, 结束本次操作。

图：Read Data Bytes at Higher Speed (READ_FAST) Instruction Sequence and Data-out sequence



4.2.2 字库调用方法:

4.2.2.1 汉字点阵排列格式

每个汉字在芯片中是以汉字点阵字模的形式存储的，每个点用一个二进制位表示，存 1 的点，当显示时可以在屏幕上显示亮点，存 0 的点，则在屏幕上不显示。点阵排列格式为横置横排：即一个字节的低位表示左面的点，高位表示右面的点（如果用户按 word mode 读取点阵数据，请注意高低字节的顺序），排满一行的点后再排下一行。这样把点阵信息用来直接在显示器上按上述规则显示，则将出现对应的汉字。

4.2.2.2 11X12 点、15X16点、24X24点、32X32点汉字及5X7 点、7X8 点、6X12点、12X24 点字符、12 点阵不等宽字符、16点阵不等宽字符的排列格式：详见字库IC资料（SUR-GB2312-3205）的第19-26页。

4.2.2.3 汉字点阵字库地址表如下:

	字库内容	编码体系	码位范围	字符数	起始地址	参考算法
1	11X12 点 GB2312 标准点阵字库	GB2312	A1A1-F7FE	6763+846	0000	6.3.1.1
2	15X16 点 GB2312 标准点阵字库	GB2312	A1A1-F7FE	6763+846	2C9D0	6.3.1.2
3	24X24 点 GB2312 标准点阵字库	GB2312	A1A1-F7FE	6763+846	68190	6.3.1.3
4	32X32 点 GB2312 标准点阵字库	GB2312	A1A1-F7FE	6763+846	EDF00	6.3.1.4
5	6X12 点国标扩展字符	GB2312	A1A1-ABC0	126	1DBE0C	6.3.1.5
6	6X12 点 ASCII 字符	ASCII	20~7F 96		1DBE00	6.3.2.3
7	12 点阵不等宽 ASCII 方头 (Arial) 字符	ASCII	20~7F 96		1DC400	6.3.2.7
8	12 点阵不等宽 ASCII 白正字符	ASCII	20~7F	96	1DCDC0	6.3.2.8
9	8X16 点国标扩展字符	GB2312	A1A1-ABC0	126	1DD790	6.3.1.6
10	8X16 点 ASCII 字符	ASCII	20~7F 96		1DD780	6.3.2.4
11	5X7 点 ASCII 字符	ASCII	20~7F 96		1DDF80	6.3.2.1
12	7X8 点 ASCII 字符	ASCII	20~7F 96		1DE280	6.3.2.2
13	16 点阵不等宽 ASCII 方头 (Arial) 字符	ASCII	20~7F 96		1DE580	6.3.2.9
14	16 点阵不等宽 ASCII 白正字符	ASCII	20~7F	96	1DF240	6.3.2.10
15	12X24 点国标扩展字符	GB2312	A1A1-ABC0	126	1DFF30	6.3.1.8
16	12X24 点 ASCII 字符	ASCII	20~7F 96		1DFF00	6.3.2.5
17	24 点阵不等宽 ASCII 方头 (Arial) 字符	ASCII	20~7F 96		1E22D0	6.3.2.11
18	24 点阵不等宽 ASCII 白正字符	ASCII	20~7F	96	1E3E90	6.3.2.12
19	16X32 点国标扩展字符	GB2312	A1A1-ABC0	126	1E5A90	6.3.1.9
20	16X32 点 ASCII 字符	ASCII	20~7F 96		1E5A50	6.3.2.6
21	32 点阵不等宽 ASCII 方头 (Arial) 字符	ASCII	20~7F 96		1E99D0	6.3.2.13
22	32 点阵不等宽 ASCII 白正字符	ASCII	20~7F	96	1ECA90	6.3.2.14
23	保留区				1EFB50	
29	输入法码表	GB2312			1F36F0	
32	保留区				1F7CC8	

4.2.2.4 字符在芯片中的地址计算方法:

用户只要知道字符的内码, 就可以计算出该字符点阵在芯片中的地址, 然后就可从该地址连续读出点阵信息用于显示。

举例说明:15X16 点 GB2312 标准点阵字库:

参数说明:

GBCode表示汉字内码。

MSB 表示汉字内码GBCode的高8bits。

LSB 表示汉字内码GBCode 的低8bits。

Address 表示汉字或ASCII字符点阵在芯片中的字节地址。

BaseAdd: 说明点阵数据在字库芯片中的起始地址。

计算方法:

BaseAdd=0x2C9D0;

if(MSB >=0xA1 && MSB <= 0xA9 && LSB >=0xA1)

Address = (MSB - 0xA1) * 94 + (LSB - 0xA1)*32+ BaseAdd;

else if(MSB >=0xB0 && MSB <= 0xF7 && LSB >=0xA1)

Address = ((MSB - 0xB0) * 94 + (LSB - 0xA1)+ 846)*32+ BaseAdd;

4.3 接口方式及程序:

4.3.1 液晶模块与 MPU(以 8051 系列单片机为例) 接口图如下:

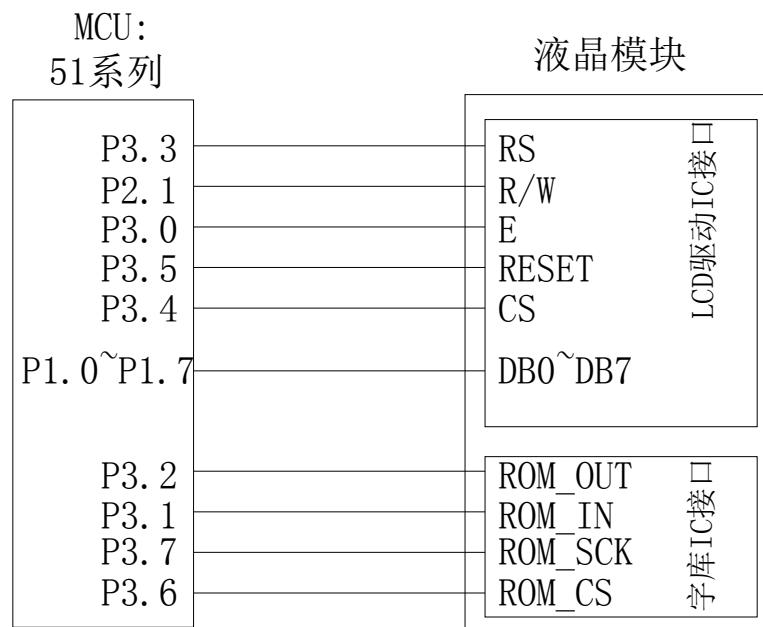


图 3: 并行接口图

5. INSPECTION CRITERIA

5.1 Acceptable Quality Level

Each lot should satisfy the quality level defined as follows

Partition	AQL	Definition
A. Major	0.4%	Functional defective as product
B. Minor	1.5%	Satisfy all functions as product but not satisfy cosmetic standard

5.2 Definition of Lot

One lot means the delivery quantity to customer at one time.

5.3 Condition of Cosmetic Inspection

◆ INSPECTION AND TEST

- FUNCTION TEST
- APPEARANCE INSPECTION
- PACKING SPECIFICATION

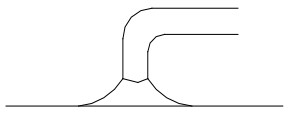
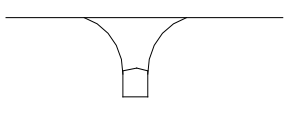
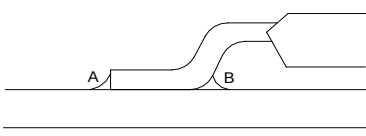
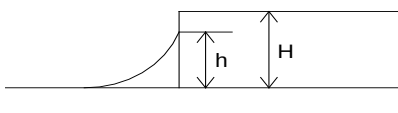
◆ INSPECTION CONDITION

- Put under the lamp (20W) at a distance 100mm from
- Tilt upright 45 degree by the front (back) to inspect Panel appearance.

◆ AQL INSPECTION LEVEL

- SAMPLING METHOD: MIL-STD-105D
- SAMPLING PLAN: SINGLE
- MAJOR DEFECT: 0.4% (MAJOR)
- MINOR DEFECT: 1.5% (MINOR)
- GENERAL LEVEL: II/NORMAL

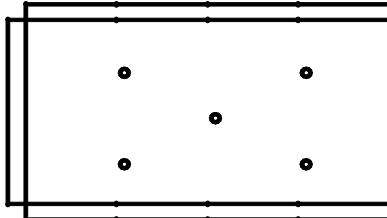
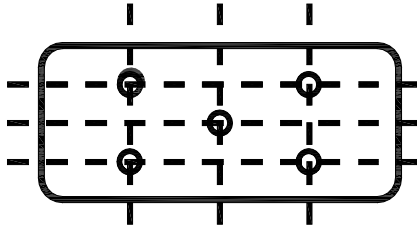
5.4 Module Cosmetic Criteria

No.	Item	Judgment Criterion	Partition
1	Difference in Spec.	None allowed	Major
2	Pattern Peeling	No substrate pattern peeling and floating	Major
3	Soldering Defects	No soldering missing	Major
		No soldering bridge	Major
		No cold soldering	Minor
4	Resist Flaw on Substrate	Invisible copper foil(ϕ 0.5mm or more)on substrate pattern	Minor
5	Accretion of Metallic Foreign Matter	No soldering dust	Minor
		No accretion of metallic foreign matters(Not exceed ϕ 0.2mm)	
6	Stain	No stain to spoil cosmetic badly	Minor
7	Plate Discoloring	No plate fading, rusting and discoloring	Minor
8	Solder Amount 1.Lead Parts	a. Soldering side of PCB Solder to form a 'Filet' all around t Solder should not hide the lead forr  b.Components side (In case of 'Through Hole PCB') Solder to reach the Components side of PCB 	Minor
	2.Flat Packages	Either 'toe' (A) or 'heal' (B) of the lead to be covered by Filet'  Lead form to be assume over solder.	Minor
	3.Chips	$(3/2) H \geq h \geq (1/2)H$ 	Minor

9	Backlight Defects	1.Light fails or flickers.(Major) 2. Color and luminance do not correspond to specifications. (Major) 3.Exceeds standards for display' s blemishes, foreign matter, dark lines or scratches.(Minor)	See list ←
10	PCB Defects	Oxidation or contamination on connectors.* 2. Wrong parts, missing parts, or parts not in specification.* 3.Jumpers set incorrectly.(Minor) 4.Solder(if any)on bezel, LED pad, zebra pad, or screw hole pad is not smooth.(Minor) *Minor if display functions correctly. Major if the display fails.	See list ←
11	Soldering Defects	1. Unmelted solder paste. 2. Cold solder joints, missing solder connections, or oxidation.* 3. Solder bridges causing short circuits.* 4. Residue or solder balls. 5. Solder flux is black or brown. *Minor if display functions correctly. Major if the display fails.	Minor

5.5 Screen Cosmetic Criteria (Non-Operating)

No.	Defect	Judgment Criterion	Partition
1	Spots	In accordance with Screen Cosmetic Criteria (Operating) No.1.	Minor
2	Lines	In accordance with Screen Cosmetic Criteria (Operation) No.2.	Minor
3	Bubbles in Polarizer		Minor
		Size: d mm	
		Acceptable Qty in active area	
		d≤0.3	
		Disregard	
		0.3<d≤1.0	3
		1.0<d≤1.5	1
		1.5<d	0
4	Scratch	In accordance with spots and lines operating cosmetic criteria, When the light reflects on the panel surface, the scratches are not to be remarkable.	Minor
5	Allowable density	Above defects should be separated more than 30mm each other.	Minor
6	Coloration	Not to be noticeable coloration in the viewing area of the Graphic panels. Back-lit type should be judged with back-lit on state only.	Minor
7	Contamination	Not to be noticeable.	Minor

No.	Defect	Judgment Criterion	Partition
3	Rubbing line	Not to be noticeable.	Minor
4	Allowable density	Above defects should be separated more than 10mm each other.	Minor
5	Rainbow	Not to be noticeable.	Minor
6	Dot size	To be 95%~105% of the dot size (Typ.) in drawing. Partial defects of each dot (ex.pin-hole) should be treated as spot. (see Screen Cosmetic Criteria (Operating) No.1)	Minor
7	Brightness (only back-lit Module)	Brightness Uniformity must be $B_{MAX}/B_{MIN} \leq 2$ - B_{MAX} : Max.value by measure in 5 points - B_{MIN} : Min.value by measure in 5 points Divide active area into 4 vertically and horizontally. Measure 5 points shown in the following figure. 	Minor
8	Contrast Uniformity	Contrast Uniformity must be $B_{MAX}/B_{MIN} \leq 2$ Measure 5 points shown in the following figure. Dashed lines divide active area into 4 vertically and horizontally. Measuring points are located at the inter-sections of dashed line.  Note: B_{MAX} – Max.value by measure in 5 points. B_{MIN} – Min.value by measure in 5 points. O – Measuring points in $\phi 10mm$.	Minor
Note: (1) Size: $d = (\text{long length} + \text{short length})/2$ (2) The limit samples for each item have priority. (3) Complexed defects are defined item by item, but if the number of defects is defined in above table, the total number should not exceed 10.			

6.3 Operating Precautions

- ◆ DO NOT plug or unplug Surenoo module when the system is powered up.
- ◆ Minimize the cable length between Surenoo module and host MPU.
- ◆ For models with backlights, do not disable the backlight by interrupting the HV line. Unload inverters produce voltage extremes that may arc within a cable or at the display.
- ◆ Operate Surenoo module within the limits of the modules temperature specifications.

6.4 Mechanical/Environmental Precautions

- ◆ Improper soldering is the major cause of module difficulty. Use of flux cleaner is not recommended as they may seep under the electrometric connection and cause display failure.
- ◆ Mount Surenoo module so that it is free from torque and mechanical stress.
- ◆ Surface of the Graphic panel should not be touched or scratched. The display front surface is an easily scratched, plastic polarizer. Avoid contact and clean only when necessary with soft, absorbent cotton dampened with petroleum benzene.
- ◆ Always employ anti-static procedure while handling Surenoo module.
- ◆ Prevent moisture build-up upon the module and observe the environmental constraints for storage tem
- ◆ Do not store in direct sunlight
- ◆ If leakage of the liquid crystal material should occur, avoid contact with this material, particularly ingestion. If the body or clothing becomes contaminated by the liquid crystal material, wash thoroughly with water and soap.

6.5 Storage Precautions

When storing the Graphic modules, avoid exposure to direct sunlight or to the light of fluorescent lamps.

Keep Surenoo modules in bags (avoid high temperature / high humidity and low temperatures below 0 °C).

Whenever possible, Surenoo Graphic modules should be stored in the same conditions in which they were shipped from our company.

6.6 Others

Liquid crystals solidify under low temperature (below the storage temperature range) leading to defective orientation or the generation of air bubbles (black or white). Air bubbles may also be generated if the module is subject to a low temperature. If Surenoo Graphic modules have been operating for a long time showing the same display patterns, the display patterns may remain on the screen as ghost images and a slight contrast irregularity may also appear. A normal operating status can be regained by suspending use for some time. It should be noted that this phenomenon does not adversely affect performance reliability.

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

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

(4) In case of 'concentration', even the spots or the lines of 'disregarded' size should not be allowed. Following three situations should be treated as 'concentration'.

- 7 or over defects in circle of ϕ 5mm.
- 10 or over defects in circle of ϕ 10mm
- 20 or over defects in circle of ϕ 20mm

6. PRECAUTIONS FOR USING

6.1 Handling Precautions

- ◆ This device is susceptible to Electro-Static Discharge (ESD) damage. Observe Anti-Static precautions.
- ◆ Surenoo display panel is made of glass. Do not subject it to a mechanical shock by dropping it or impact.
- ◆ If Surenoo display panel is damaged and the liquid crystal substance leaks out, be sure not to get any in your mouth. If the substance contacts your skin or clothes, wash it off using soap and water.
- ◆ Do not apply excessive force to the Surenoo display surface or the adjoining areas since this may cause the color tone to vary.
- ◆ The polarizer covering the Surenoo display surface of the Graphic module is soft and easily scratched. Handle this polarizer carefully.
- ◆ If Surenoo display surface becomes contaminated, breathe on the surface and gently wipe it with a soft dry cloth. If it is heavily contaminated, moisten cloth with one of the following Isopropyl or alcohol.
- ◆ Solvents other than those above-mentioned may damage the polarizer. Especially, do not use the Water.
- ◆ Exercise care to minimize corrosion of the electrode. Corrosion of the electrodes is accelerated by water droplets, moisture condensation or a current flow in a high-humidity environment.
- ◆ Install the Surenoo Graphic Module by using the mounting holes. When mounting the Graphic module make sure it is free of twisting, warping and distortion. In particular, do not forcibly pull or bend the cable or the backlight cable.
- ◆ Do not attempt to disassemble or process Surenoo Graphic module.
- ◆ NC terminal should be open. Do not connect anything.
- ◆ If the logic circuit power is off, do not apply the input signals.
- ◆ To prevent destruction of the elements by static electricity, be careful to maintain an optimum work environment.
 - Be sure to ground the body when handling Surenoo Graphic modules.
 - Tools required for assembling, such as soldering irons, must be properly grounded.
- To reduce the amount of static electricity generated, do not conduct assembling and other work under dry conditions.
- The Graphic module is coated with a film to protect the display surface. Exercise care when peeling off this protective film since static electricity may be generated.

6.2 Power Supply Precautions

- ◆ Identify and, at all times, observe absolute maximum ratings for both logic and LC drivers. Note that there is some variance between models.
- ◆ Prevent the application of reverse polarity to VDD and VSS, however briefly.
- ◆ Use a clean power source free from transients. Power-up conditions are occasionally jolting and may exceed the maximum ratings of Surenoo modules.
- ◆ The VDD power of Surenoo module should also supply the power to all devices that may access the display. Don't allow the data bus to be driven when the logic supply to the module is turned off.

7. USING Graphic MODULES

7.1 Liquid Crystal Display Modules

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

- ◆ Please keep the temperature within specified range for use and storage. Polarization degradation, bubble generation or polarizer peel-off may occur with high temperature and high humidity.
- ◆ Do not touch, push or rub the exposed polarizers with anything harder than an HB pencil lead (glass, tweezers, etc.).
- ◆ N-hexane is recommended for cleaning the adhesives used to attach front/rear polarizers and reflectors made of organic substances which will be damaged by chemicals such as acetone, toluene, ethanol and isopropyl alcohol.
- ◆ When Surenno display surface becomes dusty, wipe gently with absorbent cotton or other soft material like chamois soaked in petroleum benzin. Do not scrub hard to avoid damaging the display surface.
- ◆ Wipe off saliva or water drops immediately, contact with water over a long period of time may cause deformation or color fading.
- ◆ Avoid contacting oil and fats.
- ◆ Condensation on the surface and contact with terminals due to cold will damage, stain or dirty the polarizers. After products are tested at low temperature they must be warmed up in a container before coming in contact with room temperature air.
- ◆ Do not put or attach anything on Surenno display area to avoid leaving marks on.
- ◆ Do not touch the display with bare hands. This will stain the display area and degrade insulation between terminals (some cosmetics are determined to the polarizers).
- ◆ As glass is fragile. It tends to become or chipped during handling especially on the edges. Please avoid dropping.

7.2 Installing Graphic Modules

- ◆ Cover the surface with a transparent protective plate to protect the polarizer and LC cell.
- ◆ When assembling the LCM into other equipment, the spacer to the bit between the LCM and the fitting plate should have enough height to avoid causing stress to the module surface, refer to the individual specifications for measurements. The measurement tolerance should be $\pm 0.1\text{mm}$.

7.3 Precaution for Handling Graphic Modules

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

- ◆ Do not alter, modify or change the shape of the tab on the metal frame.
- ◆ Do not make extra holes on the printed circuit board, modify its shape or change the positions of components to be attached.
- ◆ Do not damage or modify the pattern writing on the printed circuit board.
- ◆ Absolutely do not modify the zebra rubber strip (conductive rubber) or heat seal connector.
- ◆ Except for soldering the interface, do not make any alterations or modifications with a soldering iron.
- ◆ Do not drop, bend or twist Surenno LCM.

7.4 Electro-Static Discharge Control

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

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

7.5 Precaution for Soldering to Surenoo LCM

- ◆ Observe the following when soldering lead wire, connector cable and etc. to the LCM.
 - Soldering iron temperature : $280^{\circ}\text{C} \pm 10^{\circ}\text{C}$
 - Soldering time: 3-4 sec.
 - Solder: eutectic solder.

If soldering flux is used, be sure to remove any remaining flux after finishing to soldering operation. (This does not apply in the case of a non-halogen type of flux.) It is recommended that you protect the Panel surface with a cover during soldering to prevent any damage due to flux spatters.

- ◆ When soldering the electroluminescent panel and PC board, the panel and board should not be detached more than three times. This maximum number is determined by the temperature and time conditions mentioned above, though there may be some variance depending on the temperature of the soldering iron.
- ◆ When remove the electroluminescent panel from the PC board, be sure the solder has completely melted, the soldered pad on the PCs board could be damaged.

7.6 Precaution for Operation

- ◆ Driving the Surenoo Graphic in the voltage above the limit shortens its life.
- ◆ Response time is greatly delayed at temperature below the operating temperature range. However, this does not mean the Panel will be out of the order. It will recover when it returns to the specified temperature range.
- ◆ If Surenoo display area is pushed hard during operation, the display will become abnormal. However, it will return to normal if it is turned off and then back on.
- ◆ Condensation on terminals can cause an electrochemical reaction disrupting the terminal circuit. Therefore, it must be used under the relative condition of 40°C , 50% RH.
- ◆ When turning the power on, input each signal after the positive/negative voltage becomes stable.

7.7 Limited Warranty

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

7.8 Return Policy

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

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

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

8. IMAGE STICKING

8.1 What is Image Sticking?

If you remain a fixed image on Graphic Display for a long period of time, you may experience a phenomenon called Image Sticking. Image Sticking - sometimes also called "image retention" or "ghosting" - is a phenomenon where a faint outline of a previously displayed image remains visible on the screen when the image is changed. It can occur at variable levels of intensity depending on the specific image makeup, as well as the amount of time the core image elements are allowed to remain unchanged on the screen. In POS applications, for example, a button menu which remains fixed, or in which the "frame" elements (core image) remain fixed and the buttons may change, may be susceptible to image sticking. It is important to note that if the screen is used exclusively for this application, the user may never notice this phenomenon since the screen never displays other content. It is only when an image other than the "retained" image is shown on the screen that this issue becomes evident. Image sticking is different that the "burn-in" effect commonly associated with phosphor based devices.

8.2 What causes Image Sticking?

Image sticking is an intrinsic behavior of Graphic displays due to the susceptibility to polarization of the interior materials (liquid crystals) when used under static, charged conditions (continuously displaying the same image). The individual liquid crystals in an Graphic panel have unique electrical properties. Displaying a fixed pattern - such as the POS menu described above - over prolonged periods can cause a parasitic charge build-up (polarization) within the liquid crystals which affects the crystals' optical properties and ultimately prevents the liquid crystal from returning to its normal, relaxed state when the pattern is finally changed. This effect takes place at a cellular level within the Panel, and the effect can cause charged crystal alignment at the bottom or top of a crystal cell in the "z" axis, or even crystal migration to the edges of a cell, again based on their polarity. These conditions can cause image sticking over an entire area, or at boundaries of distinct color change respectively. In either case, when the liquid crystals in the pixels and sub-pixels utilized to display the static image are polarized such that they can not return fully to their "relaxed" state upon deactivation, the result is a faint, visible, retained image on the panel upon presentation of a new, different image. The actual rate of image retention depends on variation factors such as the specific image, how long it is displayed unchanged, the temperature within the panel and even the specific panel brand due to manufacturing differences amongst panel manufacturers.

8.3 How to Avoid Image Sticking?

- Try not to operate the Graphic with a “fixed” image on the screen for more than 2 hours.
- If you are operating the monitor in an elevated temperature environment and with a displayed image which is contrary to the recommendations in “For Software Developers” below, image stick can occur in as little as 30 minutes. Adjust your screen saver settings accordingly.
- Power down the unit during prolonged periods of inactivity such as the hours a store is closed or a shift during which the piece of equipment isn't used.
- Use a screensaver with a black or medium gray background that is automatically set to come on if the device is inactive for more than 5-10 minutes.
- Avoid placing the monitor in poorly ventilated areas or in areas that will create excess heat around the monitor for software developers.
- In defining the icons, buttons, or windows in the screen, try to utilize block patterns instead of distinct lines as borders for dividing the display into distinct areas.
- If it is necessary to display a static image, try to use colors that are symmetric to the middle grey level at the boundary of two different colors, and slightly shift the borders line once in a while.
- Try to utilize medium gray hues for those areas that will have prolonged display times or remain static as other menu elements change.

8.4 How to Fix the Image Sticking?

Unlike the usually irreversible “burn-in” effects commonly associated with direct view phosphor display devices such as CRTs, an image retained on an Graphic display can be reversed – often to a point of total invisibility. However, the severity of the underlying causes (as described above) of the image retained on a specific display, as well as the variation factors (see “For Software Developers” above) under which the retained image was created, will dictate the final level of retention reversal. One way to erase a retained image on a panel is to run the screen (monitor “on”) in an “all black” pattern for 4-6 hours. It is also helpful to do this in an elevated temperature environment of approximately 35° to 50°C. Again, utilizing a dynamic screen saver with an all black background during prolonged idle display periods is a good way to avoid image retention issues.

8.5 Is Image Sticking Covered by Surenoo RMA Warranty?

Image sticking is a phenomenon inherent to Graphic Display technology itself, and as such, the occurrence of this “ghosting” effect is considered normal operation by the manufacturers of the Graphic display modules which are integrated into today's monitor solutions. Surenoo does not warrant any display against the occurrence of image sticking. We strongly advise that you follow the operating recommendations listed above to avoid the occurrence of this phenomenon.

That's the end of the datasheet.