惠 州 市 中 显 电 子 科 技 有 限 公 司

产 品 说 明 书

ZXM240128A6

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目 录

一、概述

ZXM240128A6 是一种图形点阵液晶显示器,它由控制器 T6963C、行驱动器/ 列驱动器及 240×128 全点阵液晶显示器组成.可完成图形显示,也可以显示 15×8 个(16×16 点阵)汉字.

主要技术参数和性能:

1.电源:VDD:+5V±10%; 模块内可自带-14V 负压, 用于 LCD 的驱动电压;
2.显示内容:240(列)×128(行)点;
3.全屏幕点阵;
4.带 32K 外部数据存储器(其地址由软件设定);
5.其接口适配 8080 系列和 Z80 系列 MPU 的控制时序;
6.驱动方式:1/128 DUTY,1/12 BIAS;
7.工作温度: -20℃ ∽ +70℃ ,存储温度: -30℃ ∽ +80℃;
8.模块可带 LED 或 EL 背光;背光电流≤250 mA
9.6 O'CLOCK 显示;

二、外形尺寸图

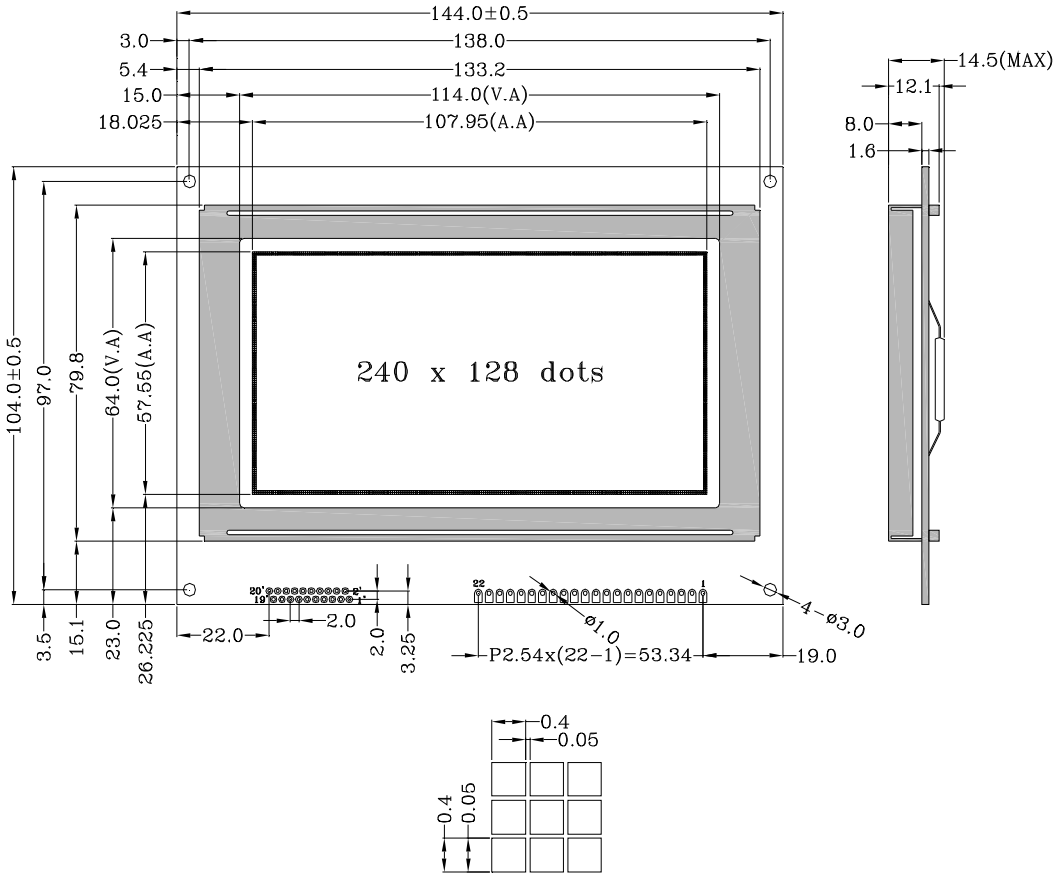


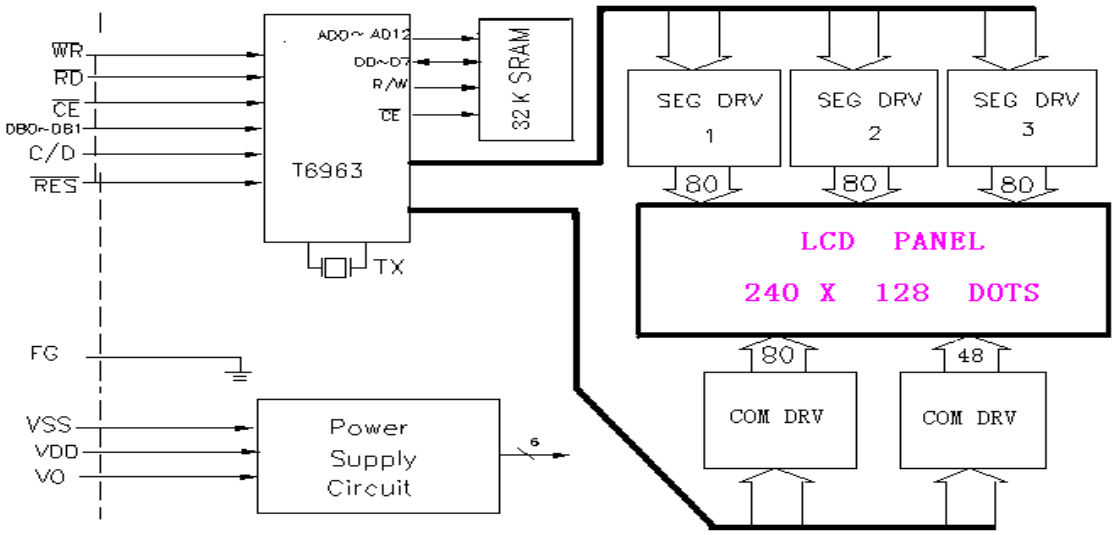
图 1

2. 外形尺寸一览

表 1

项　　目	标 准 尺 寸	单　　位
模 块 体 积	144.0x104.0x14.5	mm
视　　域	114.0x64.0	mm
行列点阵数	240x128	dots
点　距　离	0.45x0.45	mm
点　大　小	0.40x0.40	mm

三、硬件结构图



四、模块的外部接口

引脚号	引脚名称	电 平	引 脚 功 能 描 述
1	FG	0V	压框地
2	VSS	0V	电源地
3	VDD	+5V	电源电压
4	V0	- -	液晶显示驱动电
5	/WR	H/L	低电平有效。写操作信号
6	/RD	H/L	低电平有效。读操作信号
7	/CE	H/L	低电平有效。片选信号
8	C/D	H/L	通道选择信号 C/D=H 为指令通道 C/D=L 为数据通道
9	NC	- -	空脚
10	/RESET	H/L	复位信号,低有效
11	DB0	H/L	八位三态并行数据总线
12	DB1		
13	DB2		
14	DB3		
15	DB4		
16	DB5		
17	DB6		
18	DB7		
19	FS	H/L	字体选择。 FS=H, 6×8 点阵字体 FS=L, 8×8 点阵字体
20	VOUT	- -	模块内部负压输出
21	LEDA	+5V	背光电源,I_{dd}≤160mA
22	LEDK	0V	

引脚号	引脚名称	电 平	引 脚 功 能 描 述	
1	FG	0V	压框地	
2	VDD	H	电源电压	
3	VSS	L	电源地	
4	V0	- -	液晶显示驱动电	
5	/WR	H/L	低电平有效。写操作信号	
6	/RD	H/L	低电平有效。读操作信号	
7	/CE	H/L	低电平有效。片选信号	
8	C/D	H/L	通道选择信号	C/D=H 为指令通道
				C/D=L 为数据通道
9				
10	DB0	H/L	八位三态并行数据总线	
11	DB1			
12	DB2			
13	DB3			
14	DB4			
15	DB5			
16	DB6			
17	DB7			
18	VOUT	- -	模块内部负压输出	
19	LEDA	H	背光电源,I_{dd}≤250mA	
20	LEDK	L		

五、IC 说明及指令表

T6963C is LCD controller designed to be used for control LCD driver LCD driver LSIs and display data Memory, It has an 8 bit parallel data bus And control lines for reading or writing through a MPU I/F. It has 128 words character generator ROM with the capability to control External display RAM of up to 128K bytes. Allocation of text, graphics And external generator RAM can be easily made and the display window can Be freely moved within the allocated memory range.

It supports a very board range of LCD formats by selecting different Combinations on a set of programmable inputs. It can be used in text,graphic Modes and has various attribute functions.

指令表：

表 2

COMMAND	CODE	D1	D2	FUNCTION
Register Set	00100001	X address	Y address	Cursor pointer set
	00100010	Data	00H	Off register
	00100100	Low address	High address	Address pointer set
Control Word set	01000000	Low address	High address	Text home address set
	01000001	Columns	00H	Text area set
	01000010	Low address	High address	Graphic home address set
	01000011	Columns	00H	Graphic area set
Mode set	1000x000	-	-	"OR" mode
	1000x001	-	-	"EXOR" mode
	1000x011	-	-	"AND" mode
	1000x100	-	-	"Text attribute" mode
	10000xxx	-	-	Internal CGROM mode
	10001xxx	-	-	External CGRAM mode
Display Mode	10010000	-	-	Display off
	1001xx10	-	-	Cursor on, blink off
	1001xx11	-	-	Cursor on, blink on
	100101xx	-	-	Text on, graphic off
	100110xx	-	-	Text off, graphic on
	100111xx	-	-	Text on, graphic on
Cursor Pattern Select	10100000	-	-	1 line cursor
	10100001	-	-	2 line cursor
	10100010	-	-	3 line cursor
	10100011	-	-	4 line cursor
	10100100	-	-	5 line cursor
	10100101	-	-	6 line cursor
	10100110	-	-	7 line cursor
	10100111	-	-	8 line cursor
Data auto Read/write	10110000	-	-	Data auto write set
	10110001	-	-	Data auto read set
	10110010	-	-	Auto reset
Data read Write	11000000	Data	-	Data write and ADP increment
	11000001	-	-	Data read and ADP increment
	11000010	Data	-	Data write and ADP decrement
	11000011	-	-	Data read and ADP decrement
	11000100	Data	-	Data write and ADP no variable
	11000101	-	-	Data read and ADP no variable
Screen peek	11100000	-	-	Screen peek
Screen copy	11101000	-	-	Screen copy
Bit Set/Reset	11110XX	-	-	Bit reset
	11111XXX	-	-	Bit set
	1111X000	-	-	Bit 0(LSB)
	1111X001	-	-	Bit 1
	1111X010	-	-	Bit 2
	1111X011	-	-	Bit 3
	1111X100	-	-	Bit 4
	1111X101	-	-	Bit 5
	1111X110	-	-	Bit 6
	1111X111	-	-	Bit 7(MSB)

六、电气参数

1.ABSOLUTE MAXIMUM RATING

Item	Symbol	Condition	Min	Typ	Max	Unit
Supply Voltage(logic)	VDD-VSS	-	-0.3	-	7	V
Supply Voltage(LCD Drive)	VDD-VO	-	VDD+0.3	-	VDD-0.3	V
Input Voltage	VI	-	-0.3	-	VDD+0.3	V
Operating Temperature	Topr	-	-10	-	+55	° C
Storage Temperature	Tstg	-	-20	-	+60	° C

2.OPTICAL DATA Ta=25° C

Item	Symbol	Condition		Standard Value			Unit
				min	typ	max	
Supply voltage(Logic)	VDD-VSS	-		4.75	5	5.25	V
Supply voltage(LCD Drive)	VDD-VO	-		-	-	-	V
Supply current	IDD	-		-	12.0	17.0	mA
	IO	-		-	1.8	2.5	mA
EL Backlight current	IEL	-		-	100	-	mA
Input high voltage	VIH	High level		0.7VDD	-	VDD	V
Input low voltage	VIL	Low level		0	-	0.3VDD	V
Supply voltage for LCD Drive (1/80 duty)	VDD-VO	Ta=0° C		14.2	14.5	14.8	V
		Ta=25° C		13.3	13.6	13.9	V
		Ta=50° C		12.3	12.6	12.9	V
Contrast Ratio	CR			-	4	-	-
Viewing Angle	-	CR≥2	θ	-10	-	20	deg
			θ	60	-	120	deg
Response Time (rise)	Tr	Note 1	Ta=25°	-	130	200	ms
Response Time (delay)	Td	Note 2	Ta=25°	-	150	230	ms

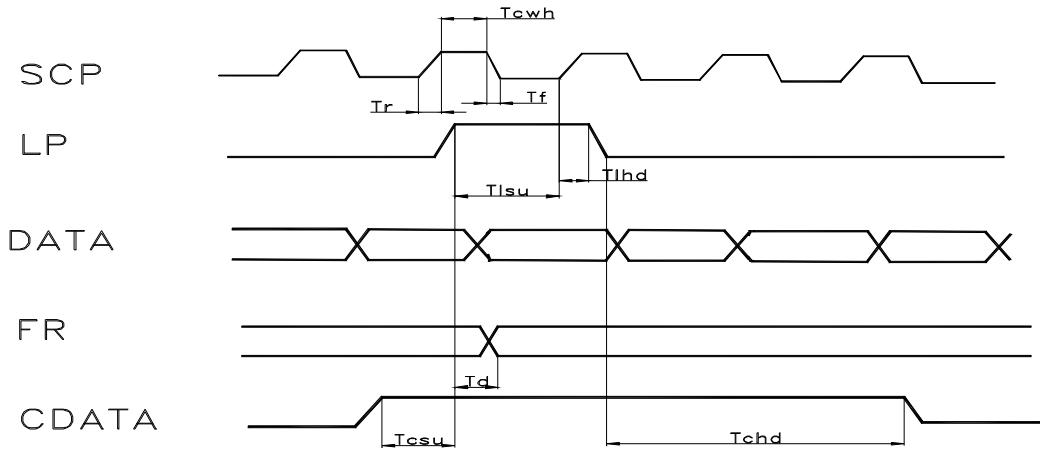
NOTE 1: Required time for blackening ratio of segment goes up from 0% to 90% when Wave from is switched from one selected one (θ =10° , ϕ=90°)

Note 2: Required time for blackening ratio of segment goes down from 100% to 10% When wave from is switched from one selected one (θ =10° , ϕ=90°)

3.TIMING CHARACTERISICS

Item	Symbol	Min	Max	Unit
Operating frequency	fSCP	-	2.75	MHZ
SCP pulse width	Tcwh, Tcwl	150		ns
SCP rise/fall time	Tr	-	30	ns
LP set up time	Tlsu	150	290	ns
LP hold time	Tlhd	5	40	ns
Data set up time	Tdsu	170	-	ns
Data hold time	Tdhd	80	-	ns
FR delay time	Td	0	90	ns
CDATA set up time	Tcsu	450	850	ns
CDATA hold time	Tchd	450	950	ns

Condition: DV=+5.0V±10%, Ta=-10∽+70° C



驱动波形图

4.INTERFACE TIMING

Item	Symbol	Min	Max	Unit
C/D set up time	Tcds	100	-	ns
C/D hold time	Tcdh	10	-	ns
CE,RD,WR pulse width	Tce,Trd,Twr	80	-	ns
DATA set up time	Tds	80	-	ns
DATA hold time	Tdh	40	-	ns
Access time	Tacc	-	150	ns
Output hold time	Toh	10	50	ns

读写时序图

5.EL Backlight Electrical Characteristics

Ta=25° C VDD=5V

Symbol	Parameter	Min	Type	Max	Units
IIN	VDD supply current	10		150	mA
VA-B	Output voltage across lamp	37	40	43	V
		75	80	85	V
FEL	VA-B output drive frequency	600	800	1000	V
VDD	Supply voltage	4.5		12	V
CL	Load capacitance	0		25	nF
TA	Operating temperature	0		50	° C

Note: EL Backlight with white lamp.

七、功能描述

7.1 STATUS READ

Before sending data(read/write),command it is necessary to check the Status.

Status check

Status of T6963c can read from data lines.

/RD L
/WR H
/CE L
C/D H
D0∽D7 Status word

T6963C status word format is following

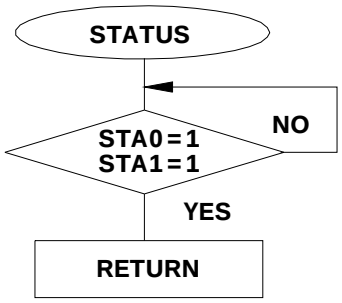
MSB LSB

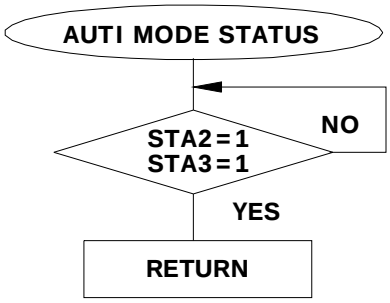
STA7	STA6	STA5	STA4	STA3	STA2	STA1	STA0
D7	D6	D5	D4	D3	D2	D1	D0

STA0	Check capability of command execution	0:Disable 1:Enable
STA1	Check capability of data read/write	0:Disable 1:Enable
STA2	Check capability of auto mode data read	0:Disable 1:Enable
STA3	Check capability of auto mode data write	0:Disable 1:Enable
STA4	Not use	
STA5	Check capability of controller operation	0:Disable 1:Enable
STA6	Error flag. Using screen peek/copy command	0:No error 1:error
STA7	Check the condition blink	0:Disable 1:Enable

Note 1:It is necessary to check STA0 and STA1 at the same time, The error
Is happened by sending data at executing command.
2:The status check will be enough to check STA0/STA1.
3:STA2/STA3 are valid in auto mode STA0/STA1 are invalid.

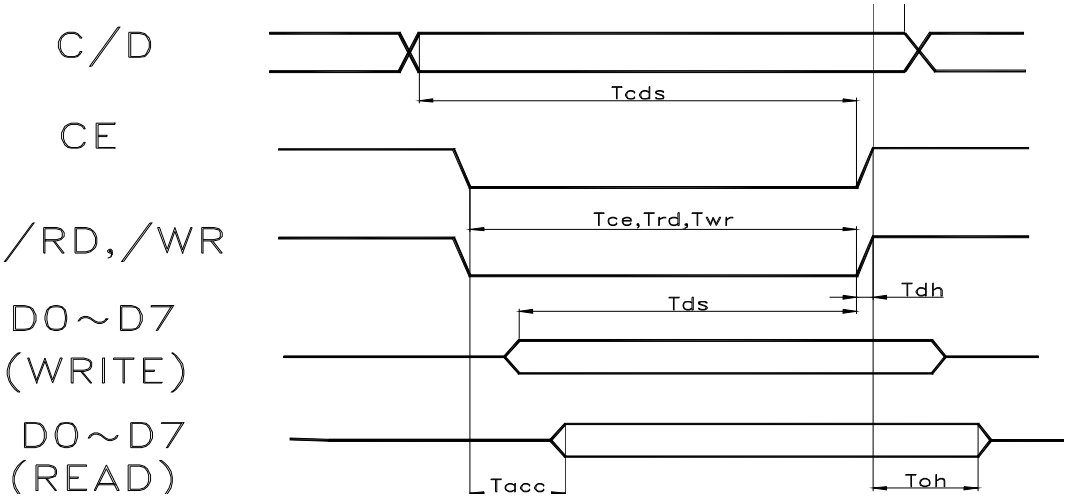
Status checking flow:



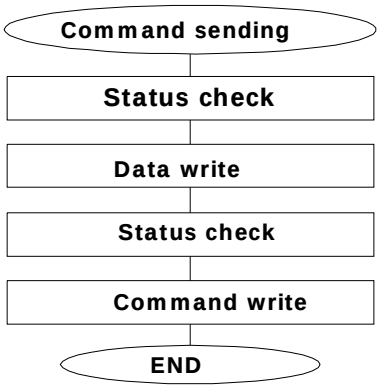


7.2 DATA SET

In T6963C,the data have been set and command executes.

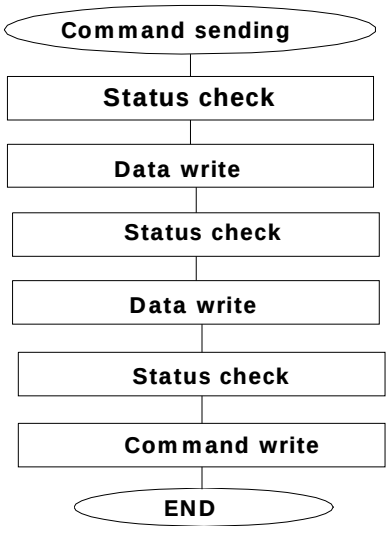


The order of procedure of command sending



Note:In case of over 2 data sending,

valid).



7.31 Description of command

1. Register set

CODE	HEX	FUNCTION	D1	D2
00100001	21H	Cursor pointer set	X address	Y address
00100010	22H	Offset register set	Data	00H
00100100	24H	Address pointer set	Low address	High address

(1) Cursor pointer set

The position of cursor is specified by X address. The cursor position Is moved only by this command. The cursor pointer doesn't have the Function of increment and decrement. The shift of cursor set by this Command. X address, Y address are specified following.

X address 00H - - - - 4FH(Low 7bits are valid)

Y address 00H - - - - 1FH(Low 5bits are valid)

1 Screen drive

X address 00H - - - - 4FH

Y address 00H - - - - 0FH

(2) Offset register set

The offset register is used to determine external character generator RAM area.

T6963C has 16 bits address lines as follow:

MSB LSB

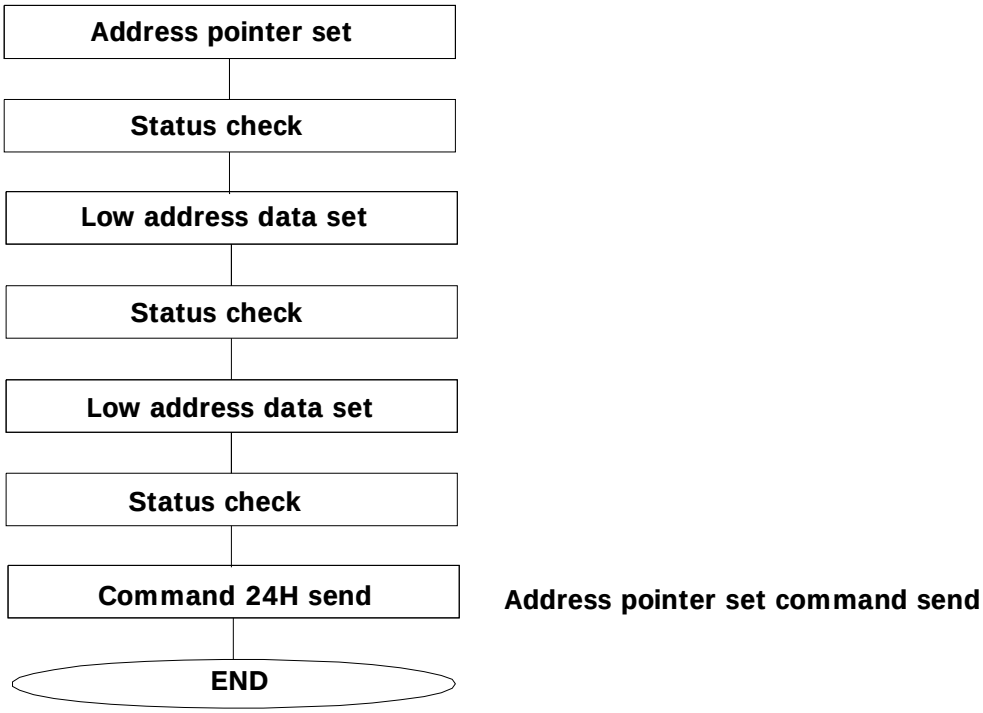
Ad15	Ad14	Ad13	Ad12	Ad11	Ad10	Ad9	Ad8	Ad7	Ad6	Ad5	Ad4	Ad3	Ad2	Ad1	Ad0

The upper 5 bits (ad15 - ad11) are determined by offset register. The Middle 8 bits (ad10 - ad3) are determined by character code. The Lower 3 bit (ad2 - ad10) are determined by vertical counter. The Lower 5 bit of D1(data) are valid. The data format of external character Generator RAM.

(3) Address pointer set

The address pointer set command is used to indication the start address For writing (or reading) to external RAM.

The flow chart address pointer set command



7.32 Control word set

CODE	HEX	FUNCTION	D1	D2
01000000	40H	Text home address set	Low address	High address
01000001	41H	Text area set	Columns	00H
01000010	42H	Graphic home address set	Low address	High address
01000011	43H	Graphic area set	Columns	00H

The home address and column size are defined by this command

(1) Text home address and area set

The starting address of external display RAM for text display is Defined by this command. The text home address shows the left end and Most upper position .

The relationship of external display RAM address and display position

Example:

Text home address: 0000H

Text area: 00A0H

MD2=0, MD3=0: 80 COLUMN

DUAL=0, MDS=1, MD0=1, MD1=0: 28 LINES

Display plane:

0000H	0001H	- - - - -	004EH	004FH	1 Line
00A0H	00A1H	- - - - -	00EEH	00EFH	2 Line
:	:	:	:	:	:
:	:	:	:	:	:
:	:	:	:	:	:
10E0H	10E1H	- - - - -	112EH	112FH	28 Lines

(2) Graphic home address and area set

The starting address of external display RAM for Graphic display is Defined by this command. The graphic home address shows the left end most Upper line.

The relationship of external display RAM address and display position.

Example:

Graphic home address: 0000H

Graphic area: 0020H

MD2=H, MD3=H: 32 COLUMNS

DUAL=H, MDS=L, MD0=H, MD1=H: 2 LINES

Example:

Display plane:

0000H	0001H	- - - - -	001EH	001FH
0020H	0021H	- - - - -	003EH	003FH
:	:	:	:	:
:	:	:	:	:
:	:	:	:	:
01E0H	01E1H		01FEH	01FFH

7.33 MODE SET

The display mode is defined by this command. The display mode don't have changed until to send next this command. Logically "OR","EXOR","AND" of text and graphic display can be displayed. When internal character generator mode is selected, character code 00H - 7FH are selected from built-in character generator ROM. The character code 80H-FFH are automatically selected external character generator RAM.

NOTE: Only text display is attributed, because attributed data is located.

Attribute function

"Reverse display", "Character blink" and "Inhibit" are called "Attribute".The attribute data is written in the graphic area defined by control word set command. The mode set command selects text display only and graphic the mode set command selects text display only and graphic display cannot be displayed. The attribute data of the 1ST character in text area Is written at the IST 1 byte in graphic area, and attribute data of n-th 1byte in graphic area. Attribute function is defined as follow.

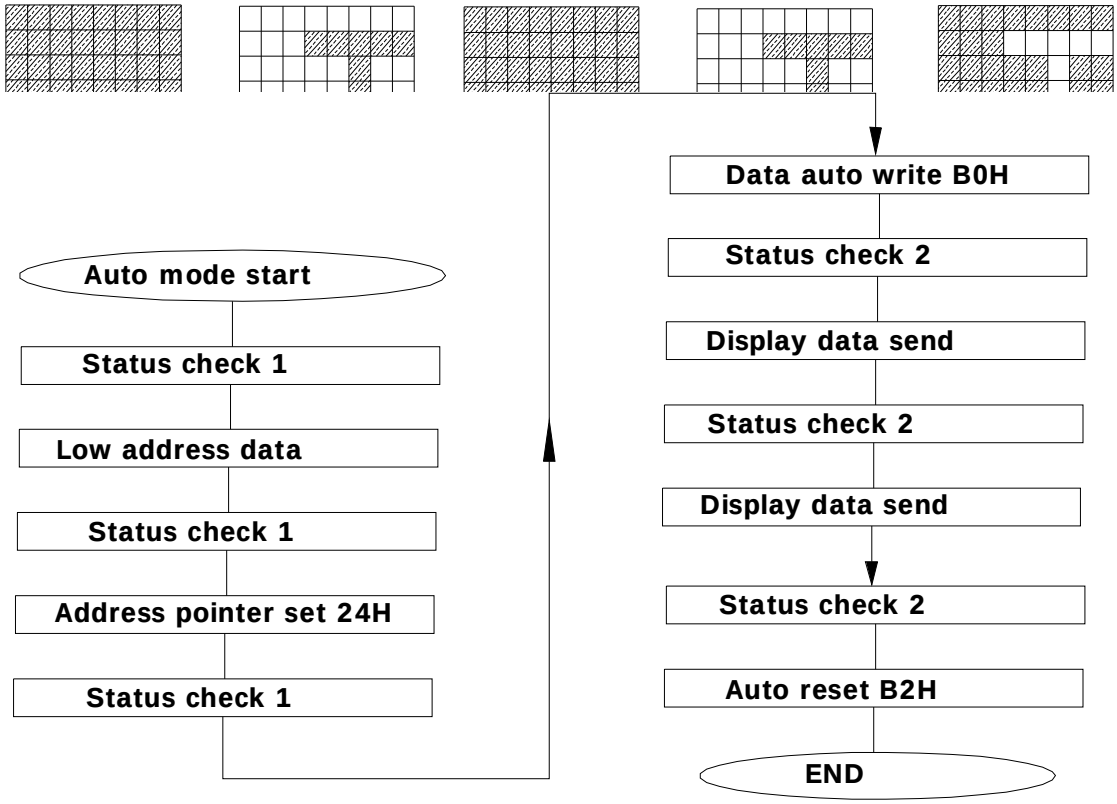
Attribute RAM 1byte

X	X	X	X	D3	D2	D1	D0

X: don't care

D3	D2	D1	D0	FUNCTION
0	0	0	0	Normal display
0	1	0	1	Reverse display
0	0	1	1	Inhibit display

1	0	0	0	Blink of normal display
1	1	0	0	Blink of reverse display
1	0	1	1	Blink of inhibit display



7.34 DATA AUTO READ/WRITE

CODE	HEX	FUNCTION	OPERAND
10110000	B0H	Data auto write set	-
10110001	B1H	Data auto read set	-
10110010	B2H	Auto reset	-

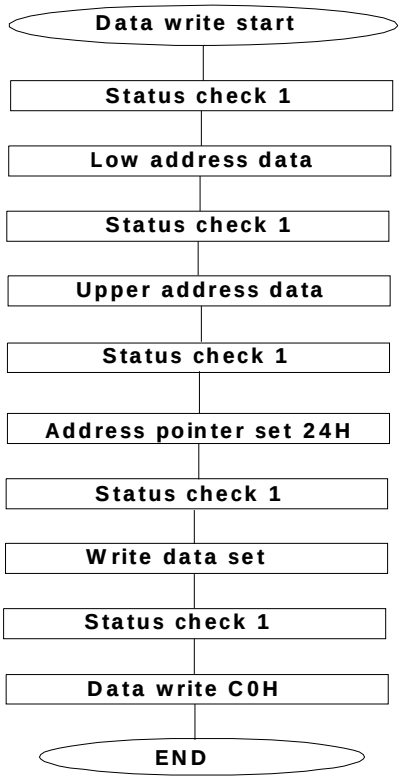
This command is convenient to send full screen data from external display RAM. After setting auto mode , "Data write(or read)" command is not necessary between each data. "Data auto write (or read)" command should follow the "Address pointer set" and address pointer is automatically increment by + 1 after each data. After sending (or receiving) all data
"Auto reset" is necessary to return normal operation because all data is regarded "Display data" and no command can be accepted in the auto mode.
Note: status check for auto mode(STA2,STA3 should be checked between each
Data. Auto reset should be performed after checking (STA3=1 STA2=1)

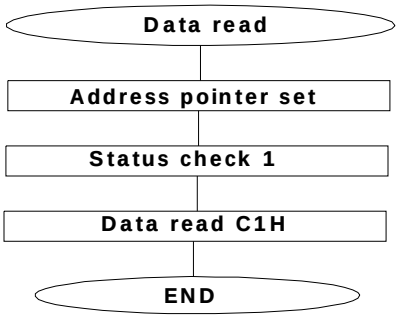
7.35 DATA READ WRITE

CODE	HEX	FUNCTION	OPERAND
11000000	C0H	Data write and ADP increment	Data
11000001	C1H	Data read and ADP increment	Data
11000010	C2H	Data write and ADP decrement	Data
11000011	C3H	Data read and ADP decrement	Data
11000100	C4H	Data write and ADP nonvariable	Data
11000101	C5H	Data read and ADP nonvariable	Data

This command is used for data write from MPU to external display RAM, AND data read external display RAM to MPU. Data write/data read should be executed after setting address by address pointer set command. Address Pointer can be automatically increment by setting this command.
Note: this command is necessary for each 1 byte data.

Please refer following flow chart.





NOTE:

(1) After power on, it is necessary to reset. /RESET is kept "L" between 5 CLOCK up(oscillation clock).
(2) When /HALT has been "L", the oscillation is stopped. It is necessary To turn off power supply for LCD, because LCD goes down by DC bias.
(3) The HALF function contains the RESET function.
(4) After state of RESET/HALT.

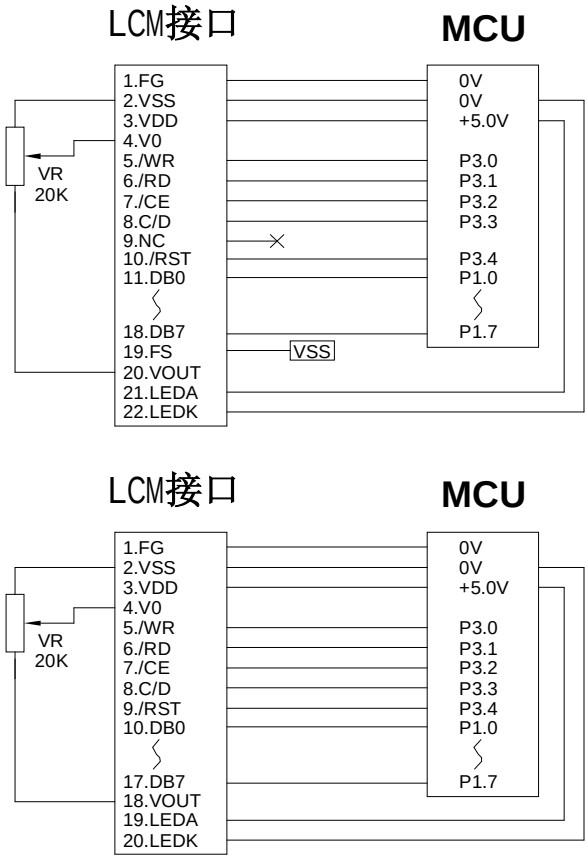
TERMINAL	HALT	RESET
D0-D7	F	F
D0-d7	F	F
R/w	H	H
/ce	H (NOTE 1)	H (NOTE 1)
Ad0-ad15	H (NOTE 2)	H (NOTE 2)
/ce0,/ce1	H (NOTE 1)	H (NOTE 1)
ED,HOD	Final Data	Final Data
HSCP	L	L
LP	L	L
CDATA	H	H
FR	H	H
CH1	L	K0
CH2	L	VEND
DSPON	L	L
XO	H	OSC CLOCK

H: Level H
L: Level L

```
   F: Floating (High impedance)
   KO: Internal state (TEXT data access) normally open
VEND: End signal of V-counter(Line count) if MDS=H, T2=L,
      HEND (end signal of H-count) normally open.
Note 1: In Attribute mode, H or L by state of Graphinc pointer.
Note 2: In Attribute mode, DATA of Graphinc pointer.
```

八、模块接口连接方式：

ZXM240128A6 与单片机 8031 的一种接口如图.所示：



注：51 单片机 P0 口作为数据线时，应加 10K 上拉电阻。

九、液晶显示模块使用注意事项

1. 操作注意事项

1）显示屏由玻璃制成，请勿对其造成机械冲击，例如从高处坠落等。

2）如果显示屏破损并且造成液晶材料泄漏，请确保未进入口中，如果液晶接触皮肤或衣物，请立刻用肥皂及清水冲洗。

3）请勿过度挤压显示区表面或相邻区域，这可能会导致色质的变化。

4）覆盖在 LCD 模块显示区表面的偏光片很柔软且容易划伤，请小心接触。

5）如果显示区表面被污染，请吹拂表面并用柔软的干燥布料轻拭。如果仍不能完全清除，请用布料沾取以下溶剂：

--丙酮

--普通酒精

除此以外的溶剂会对偏光片造成损伤，特别不要使用以下溶剂：

--水
--酮
--芳香剂

6）请勿对 LCD 模块进行拆卸或加工

2. 装配注意事项

1）安装 LCD 模块时请确保未出现扭曲、翘曲和变形。变形会对显示质量造成严重影响。并确保外包装盒足够坚硬。

2）移动 LCD 模块时请勿接触正面。

3）NC 脚请悬空勿连。

4）如果逻辑电路电源断开，请勿输入信号。

5）为了防止静电损伤，请确保适宜的工作环境

-接触 LCD 模块时请确保人体接地。

-装配工具，例如烙铁，必须确保接地

-为了减少静电的产生，请不要在干燥环境下进行装配或其它操作

-LCD 模块的显示区上有一层保护膜，为防止静电的产生，揭膜时请小心操作。

5）玻璃屏的边缘很锋利，处理时请小心。

3. 贮存注意事项

1）贮存 LCD 模块，请避免日光及荧光灯直射，请勿贮存在高温高湿条件下。请尽可能地使 LCD 模块贮存在与出厂状况相同的条件下。

2）请小心操作以尽量减少电极腐蚀。水汽或者在高湿度环境下通电会加速电极的腐蚀。

4. 设计注意事项

1）最大绝对额定值代表了 LCD 模块无法超越的额定值。当 LCD 模块使用超过额定值时，

它们的工作特性就会受到相反的影响。

2）为防止噪声干扰，必须注意确保 V_{IL}，V_{IH} 满足规格要求，包括预防线路短接。

3）LCD 具有显著的温度依赖特性，当 LCD 在规定的工作温度范围外使用时显示识别会变得困难，请确保在温度范围内使用。同时请注意 LCD 清晰显示的驱动电压会随温度变化而改变。

4）我们建议电源线必须有过流保护装置。（例如保险丝 推荐值：0.5A）。

5）请充分注意外围设备相互的噪声干扰。

6）为了解决电磁干扰问题，请从输出端着手。

7）请将 LCD 模块牢固的安装在 LCD 屏上。

8）显示屏由普通的浮法玻璃制成，不保证其强度。因此请考虑以下问题

-请勿对其造成机械冲击例如直接坠落

-请勿直接接触屏面

5. 其它

1）液晶在低温下（低于贮存温度）的凝固会造成取向缺陷或产生气泡（黑色或白色）。在低温下对 LCD 模块进行强烈冲击也会造成气泡的产生。

2）如果 LCD 模块长时间驱动一个相同的图案，此图案会在屏幕上产生鬼影同时可能会造成微小的对比缺陷。静置一段时间后会恢复正常的工作状态。请注意这种现象不会反过来影响可靠性。

3）为了降低由静电等因素对 LCD 模块的损害而造成的性能下降，请小心避免接触 LCD 模块终端电极面。

4）取得最佳对比度的电压决定于产品。因此每块显示器上都要配备电量调整的电压调节器。

5） LCD 模块的处理措施。当处理 LCD 模块时，请让获得政府许可的工业废料处理公司进行处理。当焚烧 LCD 模块时，请遵守环境保护法。