LCD&LCM

SPECIFICATION

液晶显示屏产品使用说明书

MODULE NO.

T240160C02F

240x160 图形点阵

COG 工艺

Designed	Checked	Approved

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申　　明

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Revision history 修改记录

revision	date	description	remark
A00	2014-9-25	First release	

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1. Feature/显示特性

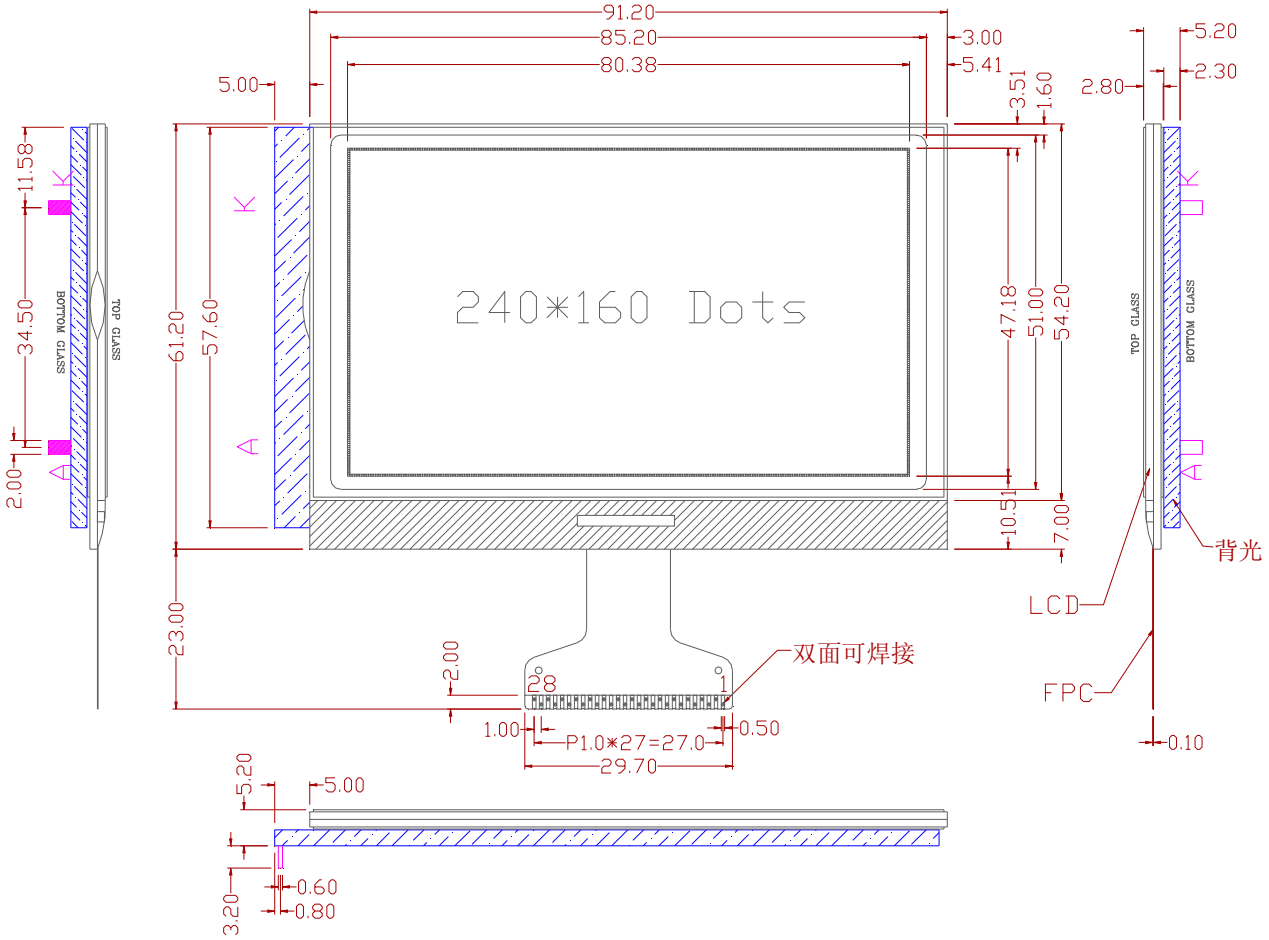
Display resolution/点阵数 : 240(w)*160(h)
Display mode/显示模式 : FSTN ,Positive, Transflective（or Negative,Transmissive）
Driving method/驱动方式 : 1/160 Duty , 1/11 Bias
Viewing direction/视角 : 12:00 o'clock
Backlight/背光 : LED , White(or Other)
Built-in controller/控制器 : UC1698
Operation temp/工作温度 : -20℃~+70℃
Storage temp/储存温度 : -30℃~+80℃

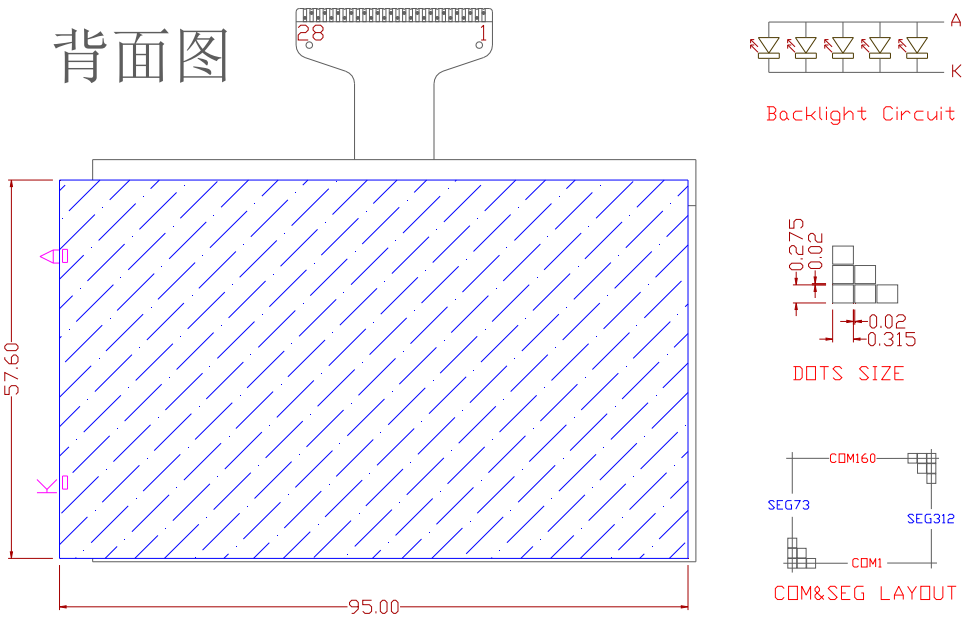
2. Mechanical Specifications/外形尺寸说明

2.1 尺寸描述

Dimensional outline (W*H*T)/外形尺寸 : 91.2mm*61.2mm*5.2mm
Viewing area (W*H)/视域尺寸 : 85.2mm*51.0mm
Active area(W*H)/显示尺寸 : 80.38mm*47.18mm
Dot pitch (W*H)/点距 : 0.335mm*0.295mm
Dot size (W*H)/点大小 : 0.315mm*0.275mm
Weigh/重量 t : Approx

2.2 Outline Dimension 外形尺寸图





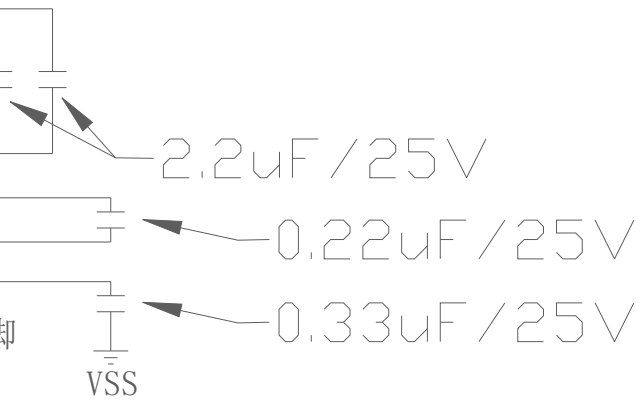
3. Block Diagram & Power supply/电路原理图

PIN	SYMBOL	
1	NC	空脚
2--9	D7--D0	8位数据口
10	RST	复位
11	WR0	
12	WR1	
13	CD	
14	CS	片选
15	BM0	
16	BM1	VSS
17	TST4	悬空
18	ID0	VSS或VDD
19	VSS	地GND
20	VDD	电源，3.3V
21	VB0+	
22	VB1+	
23	VB1-	
24	VB0-	
25	VS-	
26	VS+	
27	VLCD	
28	NC	空脚

8080时序时	WR0=写入，WR1=读
6800时序时	WR0=读/写，WR1=EN使能

高电平	写入的是数据
低电平	写入的是指令

高电平	8位并口6800时序
低电平	8位并口8080时序



4. Pin description/PIN 脚描述

Pin No.	Pin Name	Function
1、28	NC	空脚
2---9	D7---D0	DATA BUS 数据总线
10	RST	Reset signal (Low effective) 复位
11	WR0	8080时序时，WR0=写入，WR1=读； 6800时序时，WR0=读/写，WR1=EN使能；
12	WR1	
13	CD	Register select input, H: data; L: command 选择写入的是指令或数据
14	CS	Chip select input pin. 片选
15	BM0	BM0=1是6800时序，BM0=0是8080时序
16	BM1	BM1=0，8位并口（本产品只能用并口通讯）
17	TXT4	测试脚，悬空即可
18	ID0	接VSS或VDD
19	VSS	GND. 0V 地
20	VDD	Power Supply. 3.3V 电源
21	CB0-	接电容
22	CB1-	
23	CB1+	
24	CB0+	
25	VS-	
26	VS+	
27	VLCD	Connect capacitors Ground 倍压输出
背光	A	LED正极，工作电压3.0V，工作电流50mA~60mA
	K	LED负极，0V

5. Absolute Maximum Ratings/限定参数

Items	Symbol	MIN.	MAX.	Unit	Condition
Supply Voltage/供电电压	V_{DD}	-0.3	+3.3	V	V_{SS} = 0V
	Vlcd	-0.3	+15.0	V	V_{SS} = 0V
Input Voltage/输入电压	V_{IN}	-0.3	V_{DD}+0.3	V	V_{SS} = 0V
LED forward current/背光电流	If	0	30	mA	---
Operating Temp./工作温度	T_{OP}	-20	+70	℃	---
Storage Temp./储存温度	Tst	-30	+80	℃	---

6. Electrical Characteristics/电气特性

6.1 Typical Electrical Characteristics

(V_{SS} = 0V, V_{DD} = 3.3V ± 10%, Top = 25°C)

ABSOLUTE MAXIMUM RATINGS

In accordance with IEC134, note 1 and 2.

Symbol	Parameter	Min.	Max.	Unit
V_{DD}	Logic Supply voltage	-0.3	+4.0	V
V_{DD2}	LCD Generator Supply voltage	-0.3	+4.0	V
V_{DD3}	Analog Circuit Supply voltage	-0.3	+4.0	V
$V_{DD2/3}$-V_{DD}	Voltage difference between V_{DD} and $V_{DD2/3}$	–	1.6	V
V_{LCD}	LCD Generated voltage (-30°C ~ +80°C)	-0.3	+19.8	V
V_{IN}	Digital input signal	-0.4	V_{DD} + 0.5	V
T_{OPR}	Operating temperature range	-30	+85	°C
T_{STR}	Storage temperature	-55	+125	°C

Notes

1. V_{DD} is based on V_{SS} = 0V
2. Stress beyond ranges listed above may cause permanent damages to the device.

SPECIFICATIONS

DC CHARACTERISTICS

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
V_{DD}	Supply for digital circuit		1.65		3.3	V
$V_{DD2/3}$	Supply for bias & pump		2.7		3.3	V
V_{LCD}	Charge pump output	$V_{DD2/3}$ = 2.8V, 25°C		15.2	18	V
V_D	LCD data voltage	$V_{DD2/3}$ = 2.8V, 25°C	1.09		1.95	V
V_{IL}	Input logic LOW				0.2V_{DD}	V
V_{IH}	Input logic HIGH		0.8V_{DD}			V
V_{OL}	Output logic LOW				0.2V_{DD}	V
V_{OH}	Output logic HIGH		0.8V_{DD}			V
I_{IL}	Input leakage current				1.5	μA
I_{SB}	Standby current	V_{DD} = $V_{DD2/3}$ = 3.3V, Temp = 85°C			50	μA
C_{IN}	Input capacitance			5	10	PF
C_{OUT}	Output capacitance			5	10	PF
$R_{ON(SEG)}$	SEG output impedance	V_{LCD} = 15V		750	1100	Ω
$R_{ON(COM)}$	COM output impedance	V_{LCD} = 15V		750	1100	Ω
f_{LINE}	Average line rate	LC[4:3] = 10b, 25°C	-10%	37.0	+10%	Klps

POWER CONSUMPTION

V_{DD} = 2.7 V,
V_{LCD} = 16.5 V,
Mux Rate = 160,
C_B = 2.2 μF,
N-line inversion = 31 lines

Bias Ratio = 12,
Line Rate = 10b,
Bus mode = 6800,
Temperature = 25°C,
Color Mode = 64K color mode,

PM = 64,
Panel Loading (PC[1:0]) = 0b,
C_L = 330 nF,
MTP=00 H,
All HV outputs are open circuit.

Display Pattern	Conditions	Typ. (μA)	Max. (μA)
All-Pixel-OFF	Bus = idle	1764	(TBD)
2-pixel checker	Bus = idle	2468	(TBD)
None	Reset (stand-by current)	<1	5

6.2 Timing Specifications

6.2.1. 8080 Mode System Bus Timing

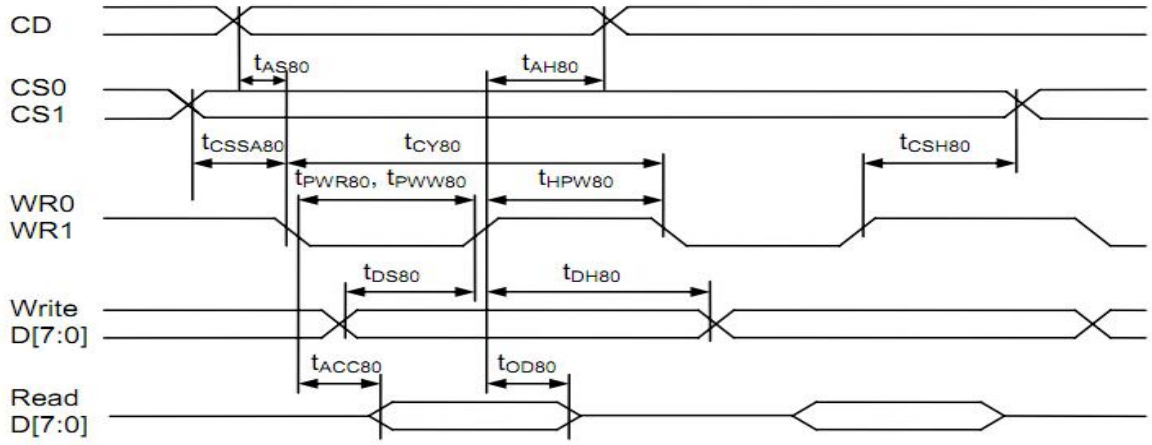


FIGURE 14: Parallel Bus Timing Characteristics (for 8080 MCU)

($2.5V \leq V_{DD} < 3.3V$, Ta= –30 to +85°C)

Symbol	Signal	Description	Condition	Min.	Max.	Units
t_{AS80} t_{AH80}	CD	Address setup time Address hold time		0 0	–	nS
t_{CY80}		System cycle time 16-bit bus (read) (write) 8-bit bus (read) (write)		 170 130 100 80	–	nS
t_{PWR80}	WR1	Pulse width 16-bit (read) 8-bit		85 50	–	nS
t_{PWW80}	WR0	Pulse width 16-bit (write) 8-bit		65 40	–	nS
t_{HPW80}	WR0, WR1	High pulse width 16-bit bus (read) (write) 8-bit bus (read) (write)		 85 65 50 40	–	nS
t_{DS80} t_{DH80}	D0~D15	Data setup time Data hold time		30 0	–	nS
t_{ACC80} t_{OD80}		Read access time Output disable time	C_L = 100pF	– 15	60 30	nS
T_{CSSA80} t_{CSH80}	CS1/CS0	Chip select setup time		5 5		nS

6.2.2 . 6800 Mode System Bus Timing

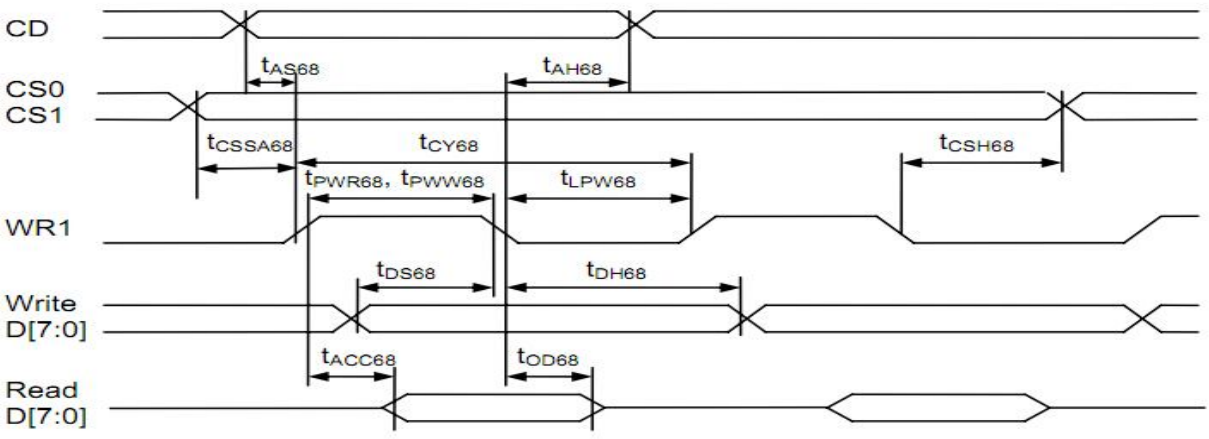


FIGURE 15: Parallel Bus Timing Characteristics (for 6800 MCU)

(2.5V ≤ V_{DD} < 3.3V, Ta= –30 to +85°C)

Symbol	Signal	Description	Condition	Min.	Max.	Units
t_{AS68} t_{AH68}	CD	Address setup time Address hold time		0 0	–	nS
t_{CY68}		System cycle time 16-bit bus (read) (write) 8-bit bus (read) (write)		 170 130 100 80	–	nS
t_{PWR68}	WR1	Pulse width 16-bit (read) 8-bit		85 50	–	nS
t_{PWW68}		Pulse width 16-bit (write) 8-bit		65 40	–	nS
t_{LPW68}		Low pulse width 16-bit bus (read) (write) 8-bit bus (read) (write)		 85 65 50 40	–	nS
t_{DS68} t_{DH68}	D0~D7	Data setup time Data hold time		30 0	–	nS
t_{ACC68} t_{OD68}		Read access time Output disable time	C_L = 100pF	– 15	60 30	nS
t_{CSSA68} t_{CSH68}	CS1/CS0	Chip select setup time		5 5		nS

Reset timing

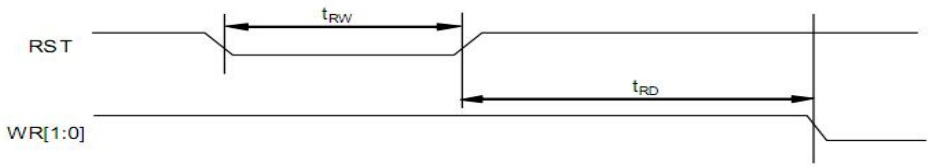


FIGURE 17: Reset Characteristics

(1.65V ≤ V_{DD} < 3.3V, Ta= –30 to +85°C)

Symbol	Signal	Description	Condition	Min.	Max.	Units
t_{RW}	RST	Reset low pulse width		3	–	μS
t_{RD}	RST, WR	Reset to WR pulse delay		10	–	mS

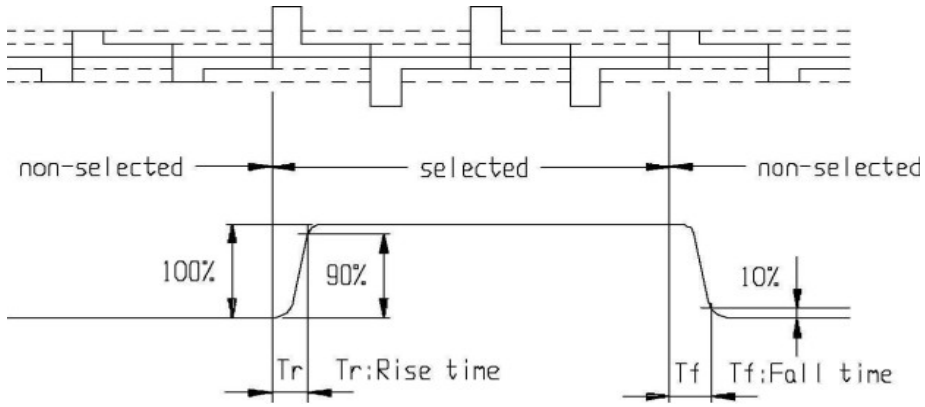
7. Backlight Characteristics/背光特性

Items	Symbol	MIN.	TYP.	MAX.	Unit	Condition
Forward Voltage/电压	Vf	2.8	3.0	3.1	V	If=50mA
Reverse current/电流	Ir	---	50	60	mA	Vr=3V
Peak wave length/波长	λ	---	---	---	nM	If=30mA
Luminance/亮度	Lv	---	---	---	Cd/m^2	If=30mA
Color /颜色	White (白色，或者其他色)					

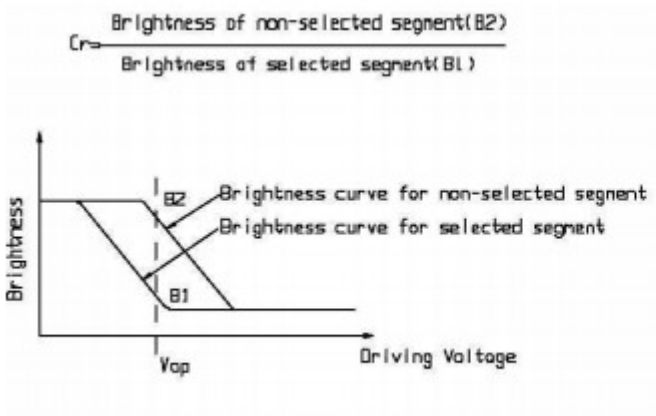
8. Electrical-Optical Characteristics/光学特性

Items	Symbol	Condition	MIN.	TYP.	MAX.	Unit	NOTE
Response time/反应时间	Tr	Ta= 25℃	---	250	---	ms	2
	Tf		---	400	---		
Contrast ratio/对比度	Cr	Ta= 25℃	---	--	---		3
Viewing angle range/视角范围	θ	Cr≥2	-40	---	40	degree	

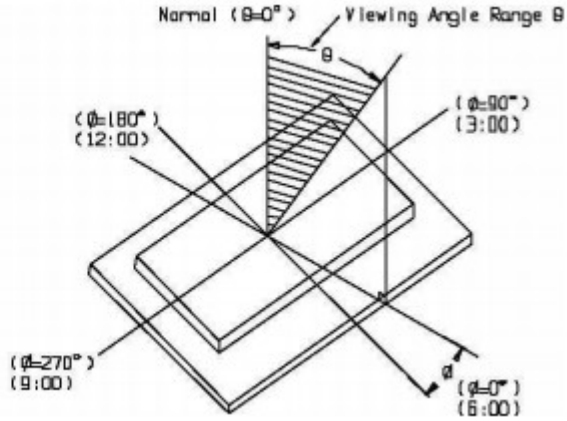
Note 1. Definition of response time



Note2 . Definition of Contrast Ratio‘Cr’



Note 3. Definition of Viewing Angle Range ‘ θ ’



9. Control and display commands/指令描述

COMMAND TABLE

The following is a list of host commands supported by UC1698u

C/D: 0: Control, 1: Data
W/R: 0: Write Cycle, 1: Read Cycle
#: Useful Data bits –: Don’t Care

	Command	C/D	W/R	D7	D6	D5	D4	D3	D2	D1	D0	Action	Default
1	Write Data Byte	1	0	#	#	#	#	#	#	#	#	Write 1 byte	N/A
2	Read Data Byte	1	1	#	#	#	#	#	#	#	#	Read 1 byte	N/A
3	Get Status & PM	0	1	GE	MX	MY	WA	DE	WS	MD	MS	Get {Status, Ver, PMO, Product Code, PID, MID}	N/A
				Ver	PMO[6:0]								
				Product Code (8h)				PID[1:0]		MID[1:0]			
4	Set Column Address LSB	0	0	0	0	0	0	#	#	#	#	Set CA[3:0]	0
	Set Column Address MSB	0	0	0	0	0	1	0	#	#	#	Set CA[6:4]	0
5	Set Temp. Compensation	0	0	0	0	1	0	0	1	#	#	Set TC[1:0]	0
6	Set Power Control	0	0	0	0	1	0	1	0	#	#	Set PC[1:0]	10b
7	Set Adv. Program Control	0	0	0	0	1	1	0	0	0	R	Set APC[R][7:0], R = 0 or 1	N/A
	(double-byte command)	0	0	#	#	#	#	#	#	#	#		
8	Set Scroll Line LSB	0	0	0	1	0	0	#	#	#	#	Set SL[3:0]	0
	Set Scroll Line MSB	0	0	0	1	0	1	#	#	#	#	Set SL[7:4]	0
9	Set Row Address LSB	0	0	0	1	1	0	#	#	#	#	Set RA[3:0]	0
	Set Row Address MSB	0	0	0	1	1	1	#	#	#	#	Set RA[7:4]	0
10	Set V_{BIAS} Potentiometer	0	0	1	0	0	0	0	0	0	1	Set PM[7:0]	40H
	(double-byte command)	0	0	#	#	#	#	#	#	#	#		

	Command	C/D	W/R	D7	D6	D5	D4	D3	D2	D1	D0	Action		Default
11	Set Partial Display Control	0	0	1	0	0	0	0	1	0	#	Set LC[8]		0
12	Set RAM Address Control	0	0	1	0	0	0	1	#	#	#	Set AC[2:0]		001b
13	Set Fixed Lines	0 0	0 0	1 #	0 #	0 #	1 #	0 #	0 #	0 #	0 #	Set {FLT,FLB}		0
14	Set Line Rate	0	0	1	0	1	0	0	0	#	#	Set LC[4:3]		10b
15	Set All-Pixel-ON	0	0	1	0	1	0	0	1	0	#	Set DC[1]		0
16	Set Inverse Display	0	0	1	0	1	0	0	1	1	#	Set DC[0]		0
17	Set Display Enable	0	0	1	0	1	0	1	#	#	#	Set DC[4:2]		110b
18	Set LCD Mapping Control	0	0	1	1	0	0	0	#	#	#	Set LC[2:0]		0
19	Set N-Line Inversion	0	0	1 -	1 -	0 -	0 #	1 #	0 #	0 #	0 #	Set NIV[4:0]		1DH
20	Set Color Pattern	0	0	1	1	0	1	0	0	0	#	Set LC[5]		0 (BGR)
21	Set Color Mode	0	0	1	1	0	1	0	1	#	#	Set LC[7:6]		10b
22	Set COM Scan Function	0	0	1	1	0	1	1	#	#	#	Set CSF[2:0]		000b
23	System Reset	0	0	1	1	1	0	0	0	1	0	System Reset		N/A
24	NOP	0	0	1	1	1	0	0	0	1	1	No operation		N/A
25	Set Test Control (double-byte command)	0 0	0 0	1 #	1 #	1 #	0 #	0 #	1 #	TT #	#	For testing only. Do not use.		N/A
26	Set LCD Bias Ratio	0	0	1	1	1	0	1	0	#	#	Set BR[1:0]		11b: 12
27	Set COM End	0 0	0 0	1 -	1 #	1 #	1 #	0 #	0 #	0 #	1 #	Set CEN[6:0]		159
28	Set Partial Display Start	0 0	0 0	1 -	1 #	1 #	1 #	0 #	0 #	1 #	0 #	Set DST[6:0]		0
29	Set Partial Display End	0 0	0 0	1 -	1 #	1 #	1 #	0 #	0 #	1 #	1 #	Set DEN[6:0]		159
30	Set Window Program Starting Column Address	0 0	0 0	1 -	1 #	1 #	1 #	0 #	1 #	0 #	0 #	Shared with MTP commands	Set WPC0	0
31	Set Window Program Starting Row Address	0 0	0 0	1 #	1 #	1 #	1 #	0 #	1 #	0 #	1 #		Set WPP0	0
32	Set Window Program Ending Column Address	0 0	0 0	1 -	1 #	1 #	1 #	0 #	1 #	1 #	0 #		Set WPC1	127
33	Set Window Program Ending Row Address	0 0	0 0	1 #	1 #	1 #	1 #	0 #	1 #	1 #	1 #		Set WPP1	159
34	Window Program Mode	0	0	1	1	1	1	1	0	0	#	Set AC[3]		0: Inside
35	Set MTP Operation control	0 0	0 0	1 -	0 -	1 -	1 #	1 #	0 #	0 #	0 #	Set MTPC[4:0]		10H
36	Set MTP Write Mask	0 0 0	0 0 0	1 - -	0 # -	1 # -	1 # -	1 # -	0 # -	0 # #	1 # #	Set MTPM[6:0] MTPM1[1:0]		0
37	Set V_{MTP1} Potentiometer	0 0	0 0	1 #	1 #	1 #	1 #	0 #	1 #	0 #	0 #	Shared with Window Program commands	Set MTP1	N/A
38	Set V_{MTP2} Potentiometer	0 0	0 0	1 #	1 #	1 #	1 #	0 #	1 #	0 #	1 #		Set MTP2	N/A
39	Set MTP Write Timer	0 0	0 0	1 #	1 #	1 #	1 #	0 #	1 #	1 #	0 #		Set MTP3	N/A
40	Set MTP Read Timer	0 0	0 0	1 #	1 #	1 #	1 #	0 #	1 #	1 #	1 #		Set MTP4	N/A

NOTE:

- All other bit patterns other than commands listed above may result in undefined behavior.
- The interpretation of commands (36)~(40) depends on the setting of register MTPC[3].
  - Commands (37)~(40) are shared with commands (30)~(33). These two sets of commands share exactly the same code and control registers. When MTPC[3]=0, they are interpreted as Window Program commands and registers. When MTPC[3]=1, they function as MTP Control commands and registers.
- After MTP ERASE or PROGRAM operation, before resuming normal operation, please always
  a) Remove TST4 power source,
  b) Do a full V_{DD} ON-OFF-ON cycle.
- Under 16-bit bus mode and CD=0, D[15:8] is ignored and only D[7:0] is used. As a result, the bus cycles for commands under 16-bit bus and 8-bit bus are the same, and double-byte commands still need two bus cycles under 16-bit bus mode.

  Example:

  8-bit bus mode:

  Set PL[1:0] = 2'b11 : D[7:0] = 0010 1011

  Set PM[7:0] = 8'h8b : 1st D[7:0] = 1000 0001

  2nd D[7:0] = 1000 1011

  16-bit bus mode:

  Set PL[1:0] = 2'b11: D[15:0] = 0000 0000 0010 1011

  Set PM[7:0] = 8'h8b: 1st D[15:0] = 0000 0000 1000 0001

  2nd D[15:0] = 0000 0000 1000 1011

10. DDRAM 映射表

DISPLAY DATA RAM

DATA ORGANIZATION

The input display data (depend on color mode) are stored to a dual port static RAM (RAM, for Display Data RAM) organized as 160x128X16.

After setting CA and RA, the subsequent data write cycles will store the data for the specified pixel to the proper memory location.

Please refer to the map in the following page between the relation of COM, SEG, SRAM, and various memory control registers.

DISPLAY DATA RAM ACCESS

The Display RAM is a special purpose dual port RAM which allows asynchronous access to both its column and row data. Thus, RAM can be independently accessed both for Host Interface and for display operations.

DISPLAY DATA RAM ADDRESSING

A Host Interface (HI) memory access operation starts with specifying Row Address (RA) and Column Address (CA) by issuing `Set Row Address` and `Set Column Address` commands.

If wrap-around (WA, AC[0]) is OFF (0), CA will stop incrementing after reaching the end of row (159), and system programmers need to set the values of RA and CA explicitly.

If WA is ON (1), when CA reaches the end of a row, CA will be reset to 0 and RA will increment or decrement, depending on the setting of row Increment Direction (RID, AC[2]). When RA reaches the boundary of RAM (i.e. RA = 0 or 159), RA will be wrapped around to the other end of RAM and continue.

MX IMPLEMENTATION

Column Mirroring (MX) is implemented by selecting either (CA) or (127–CA) as the RAM column address. Changing MX affects the data written to the RAM.

Since MX has no effect on the data already stored in RAM, changing MX does not have immediate effect on the displayed pattern. To refresh the display, refresh the data stored in RAM after setting MX.

ROW MAPPING

COM electrode scanning orders are not affected by Start Line (SL), Fixed Line (FLT & FTB) or Mirror Y (MY, LC[3]). Visually, register SL having a non-zero value is equivalent to scrolling the LCD display up or down (depends on MY) by *SL* rows.

RAM ADDRESS GENERATION

The mapping of the data stored in the display SRAM and the scanning COM electrodes can be obtained by combining the fixed COM scanning sequence and the following RAM address generation formula.

When FL=0, during the display operation, the RAM line address generation can be mathematically represented as following:

For the 1st line period of each field

$Line = SL$

Otherwise

$Line = \mathrm{Mod}(Line+1, 160)$

Where Mod is the modular operator, and *Line* is the bit slice line address of RAM to be outputted to SEG drivers. Line 0 corresponds to the first bit-slice of data in RAM.

The above *Line* generation formula produces the "loop around" effect as it effectively resets *Line* to 0 when *Line+1* reaches 160. Effects such as scrolling can be emulated by changing SL dynamically.

MY IMPLEMENTATION

Row Mirroring (MY) is implemented by reversing the mapping order between COM electrodes and RAM, i.e. the mathematical address generation formula becomes:

For the 1st line period of each field

$Line = \mathrm{Mod}(SL + MUX\text{-}1, 160)$
where MUX = CEN + 1

Otherwise

$Line = \mathrm{Mod}(Line\text{-}1, 160)$

Visually, the effect of MY is equivalent to flipping the display upside down. The data stored in display RAM are not affected by MY.

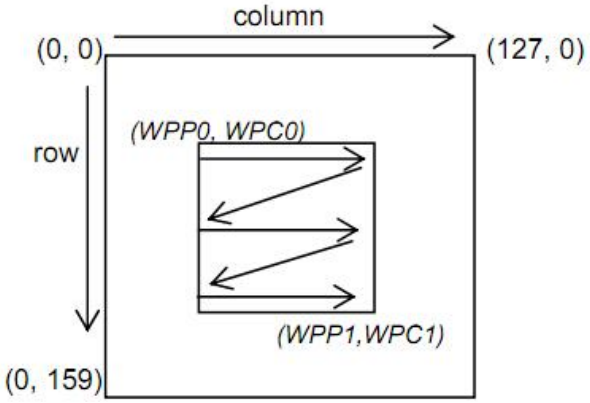
WINDOW PROGRAM

Window program is designed for data write in a specified window range of SRAM address. The procedure should start with window boundary registers setting (*WPP0*, *WPP1*, *WPC0* and *WPC1*) and AC[3] setting for inside/outside window mode. When AC[3] is set to '0' (default value), data can be written to SRAM within the window address range which is specified by (*WPP0, WPC0*) and (*WPP1, WPC1*). When AC[3] is set to '1', data will be written to whole SRAM excluding the specified window area.

The data write direction will be determined by AC[2:0] and MX settings. When AC[0]=1, the data write can be consecutive within the range of the specified window. AC[1] will control the data write in either column or row direction. AC[2] will result the data write starting either from row *WPP0* or WPP1. MX is for the initial column address either from *WPC0* to *WPC1* or from (*MC-WPC0* to *MC-WPC1*).

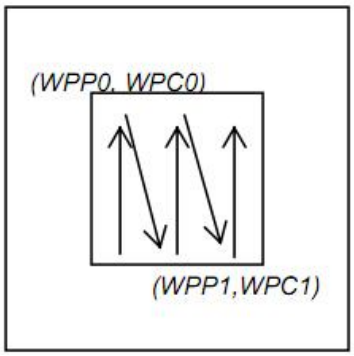
Example1 (AC[2:0] = 001) :

AC[3]=0 MX=0



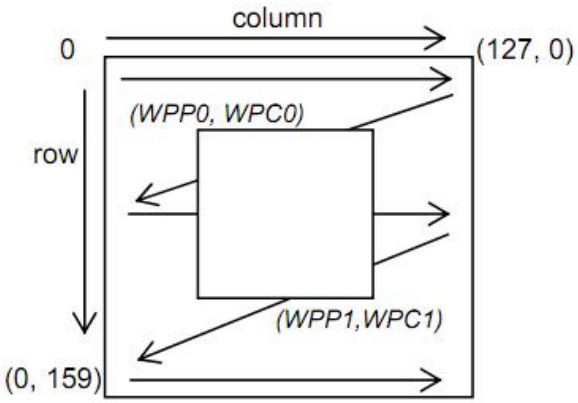
Example 2 (AC[2:0] = 111) :

AC[3] = 0 MX = 0



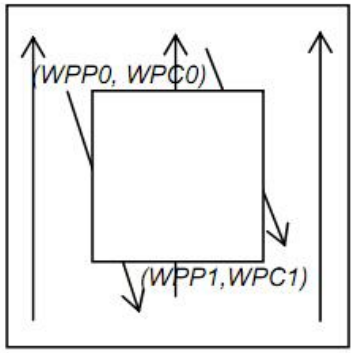
Example1-1 :

AC[3]=1 MX=0



Example 2-1 :

AC[3] = 1 MX = 0



Row Adderss	RAM	MY=0 SL=0	MY=0 SL=16	MY=1 SL=0	MY=1 SL=16
00H		COM1	COM17	COM160	COM16
01H		COM2	COM18	COM159	COM15
02H		COM3	COM19	COM158	COM14
03H		COM4	COM20	COM157	COM13
04H		COM5	COM21	COM156	COM12
05H		COM6	COM22	COM155	COM11
06H		COM7	COM23	COM154	COM10
07H		COM8	COM24	COM153	COM9
08H		COM9	COM25	COM152	COM8
09H		COM10	COM26	COM151	COM7
0AH		COM11	COM27	COM150	COM6
0BH		COM12	COM28	COM149	COM5
0CH		COM13	COM29	COM148	COM4
0DH		COM14	COM30	COM147	COM3
0EH		COM15	COM31	COM146	COM2
0FH		COM16	COM32	COM145	COM1
10H		COM17	COM33	COM144	COM160
11H		COM18	COM34	COM143	COM159
12H		COM19	COM35	COM142	COM158
13H		COM20	COM36	COM141	COM157
14H		COM21	COM37	COM140	COM156
15H		COM22	COM38	COM139	COM155
16H		COM23	COM39	COM138	COM154
17H		COM24	COM40	COM137	COM153
18H		COM25	COM41	COM136	COM152
19H		COM26	COM42	COM135	COM151
1AH		COM27	COM43	COM134	COM150
1BH		COM28	COM44	COM133	COM149
1CH		COM29	COM45	COM132	COM148
88H		COM137	COM153	COM24	COM40
89H		COM138	COM154	COM23	COM39
8AH		COM139	COM155	COM22	COM38
8BH		COM140	COM156	COM21	COM37
8CH		COM141	COM157	COM20	COM36
8DH		COM142	COM158	COM19	COM35
8EH		COM143	COM159	COM18	COM34
8FH		COM144	COM160	COM17	COM33
90H		COM145	COM1	COM16	COM32
91H		COM146	COM2	COM15	COM31
92H		COM147	COM3	COM14	COM30
93H		COM148	COM4	COM13	COM29
94H		COM149	COM5	COM12	COM28
95H		COM150	COM6	COM11	COM27
96H		COM151	COM7	COM10	COM26
97H		COM152	COM8	COM9	COM25
98H		COM153	COM9	COM8	COM24
99H		COM154	COM10	COM7	COM23
9AH		COM155	COM11	COM6	COM22
9BH		COM156	COM12	COM5	COM21
9CH		COM157	COM13	COM4	COM20
9DH		COM158	COM14	COM3	COM19
9EH		COM159	COM15	COM2	COM18
9FH		COM160	COM16	COM1	COM17

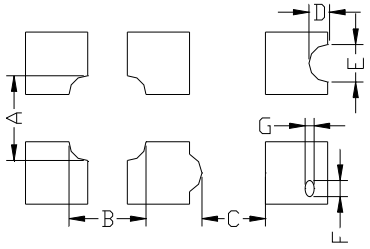
MX	SEG1	SEG2	SEG3	SEG4	SEG5			SEG380	SEG381	SEG382	SEG383	SEG384
0												
1	SEG382	SEG383	SEG384	SEG379	SEG380			SEG5	SEG6	SEG1	SEG2	SEG3

Example for memory mapping: let MX = 0, MY = 0, SL = 0, LC[7:6] = 10b (RRRRR-GGGGGG-BBBBB, 64K-color), according to the data shown in the above table (R: 11111b, G: 111111b, B: 11111b):

⇒ 1st Byte write data: 11111111b

⇒ 2nd Byte write data: 11111111b

12. Inspection Standards/检验标准

Item	Criterion for defects	Defect type
1) Display on inspection/显示效果	(1) Non display (2) Vertical line is deficient (3) Horizontal line is deficient (4) Cross line is deficient	Major
2) Black / White spot/黑点或白点	Size Φ(mm) Acceptable number Φ≤0.3 Ignore (note) 0.3<Φ≤0.45 3 0.45<Φ≤0.6 1 0.6<Φ 0	Minor
3) Black / White line/黑线或白线	Length (mm) Width (mm) Acceptable number L≤10 W≤0.03 Ignore 5.0≤L≤10 0.03<W≤0.04 3 5.0≤L≤10 0.04<W≤0.05 2 1.0≤L≤10 0.05<W≤0.06 2 1.0≤L≤10 0.06<W≤0.08 1 L≤10 0.08<W follows 2) point defect Defects separate with each other at an interval of more than 20mm	Minor
4) Display pattern/显示模式	 $\frac{A+B}{2}\leq 0.28$ | $0<C$ | $\frac{D+E}{2}\leq 0.25$ | $\frac{F+G}{2}\leq 0.25$ Note: 1) Up to 3 damages acceptable 2) Not allowed if there are two or more pinholes every three-fourth inch.	Minor
5) Spot-like contrast irregularity/均匀度	Size Φ(mm) Acceptable Number Φ≤0.7 Ignore (note) 0.7<Φ≤1.0 3 1.0<Φ≤1.5 1 1.5<Φ 0 Note: 1) Conformed to limit samples. 2) Intervals of defects are more than 30mm.	Minor
6) Bubbles in polarizer/玻璃内有气泡	Size Φ(mm) Acceptable Number Φ≤0.4 Ignore (note) 0.4<Φ≤0.65 2 0.65<Φ≤1.2 1 1.2<Φ 0	Minor
7) Scratches and dent on the polarizer/玻璃刮痕/凹痕	Scratches and dent on the polarizer shall be in the accordance with “2) Black/white spot”, and “3) Black/White line”.	Minor
8) Stains on the surface of LCD panel/玻璃上有污点	Stains which cannot be removed even when wiped lightly with a soft cloth or similar cleaning.	Minor
9) Rainbow color/杂色	No rainbow color is allowed in the optimum contrast on state within the active area.	Minor
10)Viewing-area encroachment/玻璃边线出现在视域	Polarizer edge or line is visible in the opening viewing area due to polarizer shortness or sealing line.	Minor
11) Bezel appearance/铁筐外观	Rust and deep damages that are visible in the bezel are rejected.	Minor
12) Defect of land surface 表面缺裂	Evident crevices that are visible are rejected.	Minor
13) Parts mounting/部件安装	(1) Failure to mount parts (2) Parts not in the specifications are mounted (3) For example: Polarity is reversed, HSC or TCP falls off.	Minor
14) Part alignment/部件结合度	(1) LSI, IC lead width is more than 50% beyond pad outline. (2) More than 50% of LSI, IC leads is off the pad outline.	Minor
15) Conductive foreign matter (solder ball,solder hips)/杂质（焊接遗留物）	(1) 0.45<Φ, N≥1 (2) 0.3<Φ≤0.45, N≥1, Φ: Average diameter of solder ball (unit: mm) (3) 0.5<L, N≥1, L: Average length of solder chip (unit: mm)	Minor
16) Bezel flaw/铁筐缺裂	Bezel claw missing or not bent	Minor
17) Indication on name plate (sampling indication label)/标志	(1) Failure to stamp or label error, or not legible.(all acceptable if legible) (2) The separation is more than 1/3 for indication discoloration, in which the characters can be checked.	Minor

12. Handling precautions 注意事项

1. Refrain from strong mechanical shock and forces to the module. It may cause improper operating or damage to the module.
   防止震动和压迫模组，以免造成模组损坏和运行正常。
2. The polarizer used on the display surface is easily scratched and damaged. Extreme care should be taken when handling. When cleaning the display surface, use soft cloth with a solvent recommended : ethyl alcohol , isopropyl or hexane) and wipe gently, do not use the following solvents : water, ketone or aromatics .
   模组表面的偏光极易被刮伤和损坏，所以操作是要非常小心。请用蘸有乙醇等溶剂的湿软布轻轻擦拭，不要使用水，乙酮等溶剂。
3. Wipe off water or oil drop immediately If you leave drop for a long time, stain and discoloration may occur.
   要立即擦拭掉屏幕上的油滴和水滴，否则会出现污点和杂质。
4. Do not touch pads or pins of interface directly with bare hands. When handling the LCD module, put on a soft glover like finger-glover.
   不要直接用手去触碰接口处的金属管脚。当操作模组的时候，请配带软指套。
5. Protect the module from static electricity, it may cause damage to CMOS LSI.
   模组需要有防静电保护，否则会损坏CMOS LSI。
6. To prevent LCD panels from degradation, do not operate or store them exposed directly to sunlight or high temperature/humidity.
   不要直接在太阳,高温或潮湿环境下操作和储存LCD模组，以免影响模组的质量。
7. If the liquid crystal leaks from the panel it should be kept away from the eyes and mouths. In case of contact with skins, wash away thoroughly with soap and water.
   若有液晶漏出，务必避免其入眼入口。若沾到皮肤上了，马上用肥皂和水冲洗干净。
8. Soldering should be only performed on the I/O terminals within the temperature of 280±20℃ and soldering time should be less than 4 seconds.
   要在280±20℃的条件下在I/O终端实现焊接，并且保证焊接时间短于4秒。
9. Supply voltage within the specified voltage limit, the maximum rating, higher voltage cause the shorter LCD life or damaged.
   绝对要在指定的电压范围内驱动模组， 因为如果在高于指定电压的情况下驱动模组，会使模组寿命变短
10. Do not input any signals before power is turned on. Do not connect or disconnect the module on the state of Power-ON.
    供电之前不要输入任何信号，不要在通电时连接和段开 LCD 模组。