

APPROVAL SHEET

Customer : _____
Part Name : **LCD MODULE**
Model NO. : **EDM12864-86**
Drawing NO. : _____
Approved by : _____
Date : **2005. 08. 05**

Approved by	Checked by	Prepared by	Sheet code



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1. Scope

This manual defines general provisions as well as inspection standards for standard LCD module supplied by Dalian Dongfu Color Display Co., Ltd.

If the event of unforeseen problem or unspecified items may occur, please contact the nearest supplier or our company.

2. Warranty

If module is not stored or used as specified in this manual, it will be void the 12-month warranty.

3. Features

3-1. Features

Display mode:	{	Transflective and positive type STN LCD
Display color:	{	Display dot: dark blue Background: yellow green
Display format:		128(w) × 64 (h) full dots
Input data:		8-bit parallel data interface from a MPU
Multiplexing ratio:		1/32 Duty
Viewing direction:		6 O'clock

3-2 . Mechanical features

Item	Specification	Unit
Outline dimensions	93.0(W) × 70.0(H) × 13.0 Max.(T)	mm
Number of dots	128(W) × 64(H) Dots	—
Viewing area	70.8(W) × 39.0(H)	mm
Image area	66.52(W) × 33.24(H)	mm
Dot pitch	0.52(W) × 0.52(H)	mm
Dot size	0.48(W) × 0.48(H)	mm
Weight	Approx.	g

3-3. Absolute maximum ratings

Item		Symbol	Min.	Max.	Unit	Note
Supply Voltage	Logic	Vdd	0	5.5	V	
	LCD drive	Vdd – Vee	0	7.0	V	
Input Voltage		Vi	0	Vdd	V	
Operating Temperature		Top	-20	70		
Storage Temperature		Tstg	-30	80		
Humidity		—	—	90	%RH	

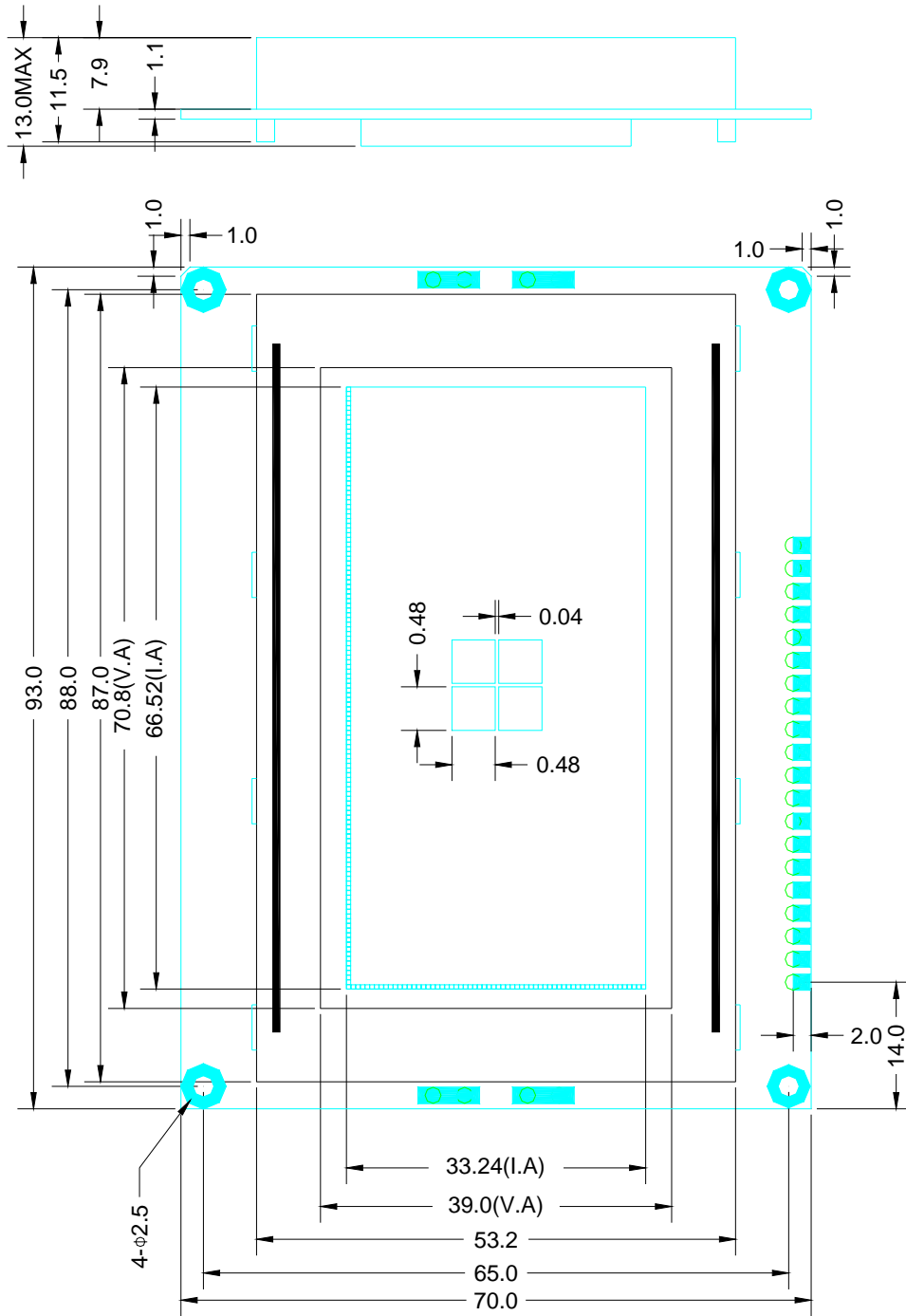
3-4. Electrical Characteristics

3-4-1 Electrical Characteristics

Item		Symbol	Conditions	Min.	Typ.	Max.	Unit
Supply Voltage	Logic	Vdd		2.7	5.0	5.5	V
	LCD drive	Vdd-Vee		3.0	—	7.0	
Input Voltage	"H" Level	Vih	Vdd=5V ± 5%	0.8Vdd	—	Vdd	
	"L" Level	Vil		0	—	0.2Vdd	
Frame Frequency		Ffilm	Vdd=5V	70	75	80	Hz
Current Consumption	Logic	Idd	Vdd=5V Vdd-Vee= 12.0V	—	—	—	mA
	LCD drive	Iee	Ffilm=75Hz	—	—	—	
LCD Driving Voltage (Recommended Voltage)		Vdd-Vee	Ta= 0 =0 °, =0 °	—	—	—	V
			Ta= 25 =0 °, =0 °	—	—	—	
			Ta= 50 =0 °, =0 °	—	—	—	

Note: <1> Duty =1/32 <2> All dots on static state

4. Dimensional outline



5. I/O terminal

5-1. I/O terminal table

Pin No.	Pin name	Level	Functions
1	VSS	--	Ground (0V)
2	VDD	--	Power supply for logic circuit:+5V
3	V0	--	LCD control voltage(NC)
4	RS	H/L	Register select 0: select instruction write , busy flag read. Address counter read 1: select data write , read (Chip select) for serial mode 1: chip enable 0: chip disable
5	RW	H/L	Read write control 0: write 1: read (serial data input)
6	E	H H→L	Enable trigger (serial clock)
7~14	DB0~DB7	--	Data bus
15	PSB	H/L	Interface selection: 0: serial mode 1: 8/4-bits parallel bus mode
16	/RST	--	Reset singal,
17	LEDA	--	Power Supply for LED(DC 4.2V)
18	LEDK	--	Power Supply for LED
19	NC		
20	NC		

5-2 . Function Description

System interface

ST7920 supports 3 kinds of bus interface to MPU. 8 bits parallel , 4 bits parallel and clock synchronized serial interface . Parallel interface is selected by PSB="1" and serial interface by PSB="0" . 8 bit/4 bit interface is selected by function set instruction DL bit.

Two 8 bit registers (data register DR , instruction register IR) are used in ST7920's write and read operation . Data Register(DR) can access DDRAM/CGRAM/GDRAM and IRAM's data through the address pointer implemented by Address Counter(AC). Instruction Register (IR) stores the instruction by MPU to ST7920.

4 modes of read/write operation specified by RS and RW:

RS	RW	Description
L	L	MPU write instruction to instruction register (IR)
L	H	MPU read busy flag(BF) and address counter (AC)
H	L	MPU write data to data register (DR)
H	H	MPU read data from data register (DR)

Busy Flag (BF)

Internal operation is in progress when BF="1" , ST7920 is in busy state . No new instruction will be accepted until BF="0". MPU must check BF to determine whether the internal operation is finished and new instruction can be sent.

Address counter (AC)

Address counter (AC) is used for address pointer of DDRAM/CGRAM/IRAM/GDRAM. (AC) can be set by instruction and after data read or write to the memories (AC) will increase or decrease by 1 according to the setting in "entry mode set" . When RS="0" and RW="1" and E="1" the value of (AC) will output to DB6~DB0.

16X16 character generation ROM(CGROM) and 8X16 half height ROM (HCGROM)

ST7920 provides character generation ROM supporting 8192 16X16 character fonts and 126 8X16 alphanumeric characters . It is easy to support multi languages application such as Chinese and English. Two consecutive bytes are used to specify one 16X16 character or two 8X16 half-height characters . Character codes are written into DDRAM and the corresponding fonts are mapped from CGROM or HCGROM or the display drivers.

Character generation RAM(CGRAM)

ST7920 provides RAM to support user-defined fonts . Four sets of 16X16 bit map area are available. These user-defined fonts are displayed the same ways as CGROM fonts through writing character cod data to DDRAM.

ICON RAM (IRAM)

ST7920 provides 240 ICON display . It consists of 15 sets of IRAM address . Each IRAM address has 16 bits data. IRAM address should be set first before writing to the IRAM . Two bytes for each address . First higher byte (D15~D8) and then lower byte (D7~D0).

Display data RAM (DDRAM)

There are 64X2 bytes for display data RAM area. Can store display data for 16 characters (16X16) by 4 lines or 32 characters (8X16) by 4 lines . However , only 2 lines can be display at a time . Character codes stored in DDRAM point to the fonts specified by CGROM , HCGROM and CGRAM . ST7920 display half height HCGROM fonts , user-defined CGRAM fonts and full 16X16 CGROM fonts . Data codes 0000H~0006H are for CGRAM

User-defined fonts . Data codes 02H~7FH are for half height alpha numeric fonts . Data codes (A140~D75F) are for BIG5 code and (A1A0~F7FF) are for GB code.

1. display HCGROM fonts : Write 2 bytes data to DDRAM to display two 8X16 fonts .

Each byte represents 1 character font . The data of each byte is 02H~7FH.

2. display CGRAM fonts : Write 2 bytes data to DDRAM to display one 16X16 font .
Only 0000H , 0002H , 0004H , 0006H are allowed.

3. display CGROM fonts : Write 2 bytes data to DDRAM to display one 16X16 font.
A140H~D75FH are for (BIG5) code , A1A0H~F7FFH are for (GB) code .

Higher byte (D15~D8) are written first and then lower byte (D7~D0) .

Graphic RAM (GDRAM)

Graphic display RAM supports 64X256 bits bit-mapped memory space . GDRAM address is set by writing 2 consecutive bytes for vertical address and horizontal address . Two-bytes data write to GDRAM for one address .

Address counter will automatically increase by one for the next two-byte data. The procedure is as followings.

1. Set vertical address (Y) for GDRAM
2. Set horizontal address (X) for GDRAM
3. Write D15~D8 to GDRAM (first byte)
4. Write D7~D0 to GDRAM (second byte)

5-3. Instructions

Instruction set 1: (RE=0: basic instruction)

Ins	code										Description	Exec time (540KHZ)	
	RS	RW	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0			
CLEAR	0	0	0	0	0	0	0	0	0	0	1	Fill DDRAM with "20H",and set DDRAM address counter (AC) to "00H"	1.6 ms
HOME	0	0	0	0	0	0	0	0	0	1	X	Set DDRAM address counter (AC) to "00H" , and put cursor to origin ; the content of DDRAM are not changed	72us
ENTRY MODE	0	0	0	0	0	0	0	0	1	I/D	S	Set cursor position and display shift when doing write or read operation	72us
DISPLAY ON/OFF	0	0	0	0	0	0	0	1	D	C	B	D=1: display ON C=1: cursor ON B=1: blink ON	72us
CURSOR DISPLAY CONTROL	0	0	0	0	0	0	1	S/C	R/L	X	X	Cursor position and display shift control ; the content of DDRAM are not changed	72us
FUNCTION SET	0	0	0	0	1	DL	X	0 RE	X	X	X	DL=1 8-BIT interface DL=0 4-BIT interface RE=1: extended instruction RE=0: basic instruction	72us
SET CGRAM ADDR	0	0	0	1	AC5	AC4	AC3	AC2	AC1	AC0	AC0	Set CGRAM address to address counter (AC) Make sure that in extended instruction SR=0 (scroll or RAM address select)	72us
SET DDRAM ADDR	0	0	1	0 AC6	AC5	AC4	AC3	AC2	AC1	AC0	AC0	Set DDRAM address to address counter(AC) AC6 is fixed to 0	72us
READ BUSY FLAG(BF) & ADDR	0	1	BF	AC6	AC5	AC4	AC3	AC2	AC1	AC0	AC0	Read busy flag (BF) for completion of internal operation , also Read out the value of address counter (AC)	0us
WRITE RAM	1	0	D7	D6	D5	D4	D3	D2	D1	D0	D0	Write data to internal RAM	72us
READ RAM	1	1	D7	D6	D5	D4	D3	D2	D1	D0	D0	Read data from internal RAM (DDRAM/CGRAM/IRAM/GDRAM)	72us

Instruction set 2: (RE=1: extended instruction)

Ins	code										Description	Exec time (540KHZ)
	RS	RW	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0		
STAND BY	0	0	0	0	0	0	0	0	0	1	Enter stand by mode , any other instruction can terminate (Com1...32 halted , only Com33 ICON can display)	72us
SCROLL or RAM ADDR SELECT	0	0	0	0	0	0	0	0	0	1	SR SR=1: enable vertical scroll position SR=0: enable IRAM address (extended instruction) SR=0: enable CGRAM address (basic instruction)	72us
REVERSE	0	0	0	0	0	0	0	0	1	R1	R0 Select 1 out of 4 line (in DDRAM) and decide whether to reverse the display by toggling this instruction R1,R0 initial value is 00	72us
EXTENDED FUNCTION SET	0	0	0	0	1	DL	X	1	RE	G	0 DL=1 8-BIT interface DL=0 4-BIT interface RE=1: extended instruction set RE=0: basic instruction set G=1: graphic display ON G=0: graphic display OFF	72us
SET IRAM or SCROLL ADDR	0	0	0	1	AC5	AC4	AC3	AC2	AC1	AC0	SR=1: AC5-AC0 the address of vertical scroll SR=0: AC3-AC0 the address of ICON RAM	72us
SET GRAPHIC RAM ADDR	0	0	1	0	0	0	AC3 AC3	AC2 AC2	AC1 AC1	AC0 AC0	Set GDRAM address to address counter (AC) First set vertical address and the horizontal address by consecutive writing Vertical address range AC5...AC0 Horizontal address range AC3...AC0	72us

Note:

1. Make sure that ST7920 is not in busy state by reading the busy flag before sending instruction or data . If use delay loop instead please make sure the delay time is enough . Please refer to the instruction execution time.
2. "RE" is the selection bit of basic and extended instruction set. Each time when altering the value or RE it will remain . There is no need to set RE every time when using the same group of instruction set

Description of basic instruction set

● **CLEAR**

RS	RW	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0
0	0	0	0	0	0	0	0	0	1

Fill DDRAM with "20H" (space code) . And set DDRAM address counter (AC) to "00H" . Set entry mode I/D bit to be "1" . Cursor moves right and AC adds 1 after write or read operation

● **HOME**

RS	RW	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0
0	0	0	0	0	0	0	0	1	X

Set DDRAM address counter (AC) to "00H" . Cursor moves to origin . Then content of DDRAM is not changed.

● **ENTRY MODE SET**

RS	RW	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0
0	0	0	0	0	0	0	1	I/D	S

Set the cursor movement and display shift direction when doing write or read operation

I/D: address counter increase/decrease

When I/D ="1" , cursor moves right , DRAM address counter (AC) add by 1.

When I/D="0" , cursor moves left , DRAM address counter (AC) subtract by 1.

S: Display shift

S	I/D	DESCRIPTION
H	H	Entire display shift left by 1
H	L	Entire display shift right by 1

● **DISPLAY STATUS**

RS	RW	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0
0	0	0	0	0	0	1	D	C	B

Controls display , cursor and blink ON/OFF .

D: Display ON/OFF control bit

When D="1" , display ON

When D="0" , Display OFF , the content of DDRAM is not changed

C: Cursor ON/OFF control bit

When C="1" , cursor ON .

When C="0" , cursor OFF .

B: Blink ON/OFF control bit

When B="1" , cursor position blink ON . Then display data in cursor position will blink.

When B="0" , cursor position blink OFF

● **CURSOR AND DISPLAY SHIFT CONTROL**

RS	RW	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0
0	0	0	0	0	1	S/C	R/L	X	X

Instruction to move the cursor or shift the entire display . The content of DDRAM is not changed.

S/C	R/L	DESCRIPTION	AC Value
L	L	Cursor moves left by 1	AC=AC-1
L	H	Cursor moves right by 1	AC=AC+1
H	L	Display shift left by 1 , cursor also follows to shift	AC=AC
H	H	Display shift right by 1 , cursor also follows to shift	AC=AC

● **FUNCTION SET**

RS	RW	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0
0	0	0	0	1	DL	X	RE	X	X

DL: 4/8 BIT interface control bit

When DL="1" , 8 BIT MPU bus interface

When DL="0" , 4 BIT MPU bus interface

RE: extended instruction set control bit

When RE="1" , extended instruction set

When RE="0" , basic instruction set

In same instruction cannot alter DL and RE at once . Make sure that change DL first then RE .

● **SET CGRAM ADDRESS**

RS	RW	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0
0	0	0	1	AC5	AC4	AC3	AC2	AC1	AC0

Set CGRAM address to address counter (AC)

AC range is 00H...3FH

Make sure that in extended instruction SR=0 (scroll address or RAM address select)

● **SET DDRAM ADDRESS**

RS	RW	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0
0	0	1	AC6	AC5	AC4	AC3	AC2	AC1	AC0

Set DDRAM address to address counter (AC)

First line AC range is 80H...8FH

Second line AC range is 90H...9FH

Third line AC range is A0H...AFH

Fourth line AC range is B0H...BFH

Please note that only 2 lines can be display at a time.

● **READ BUSY FLAG (BF) AND ADDRESS**

RS	RW	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0
0	1	BF	AC6	AC5	AC4	AC3	AC2	AC1	AC0

Read busy flag (BF) can check whether internal operation is finished . At the same time the value of address counter (AC) is also read . When BF="1" new instruction will not be accepted . Must wait for BF="0" for new instruction.

● **WRITE DATA TO RAM**

RS	RW	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0
0	1	D7	D6	D5	D4	D3	D2	D1	D0

Write data to internal RAM and alter the (AC) by 1

Each RAM address (CGRAM , DDRAM , IRAM.....) must write 2 consecutive bytes for 16 bit data . After the second byte the address counter will add of subtract by 1 according to the entry mode set control bit .

● **READ RAMDATA**

RS	RW	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0
1	1	D7	D6	D5	D4	D3	D2	D1	D0

Read data from internal RAM and alter the (AC) by 1

After address set to read (CGRAM , DDRAM , IRAM) a DUMMY READ is required
There is no need to DUMMY READ for the following bytes unless a new address set instruction is issued.

Description of extended instruction set

● **STAND BY**

RS	RW	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0
0	0	0	0	0	0	0	0	0	1

Instruction to enter stand by mode . Any other instruction follows this instruction can terminate stand by .

The content of DDRAM remain the same.

● **VERTICAL SCROLL OR RAM ADDRESS SELECT**

RS	RW	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0
0	0	0	0	0	0	0	0	0	SR

When SR="1" , the vertical scroll address set is enabled.

When SR="0" , the IRAM address set (extended instruction) and CGRAM address set (basic instruction) is enabled .

● **REVERSE**

RS	RW	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0
0	0	0	0	0	0	0	1	R1	R0

Select 1 out of 4 lines to reverse the display and to toggle the reverse condition by repeating this instruction .

R1,R0 initial vale is 00 . When set the first time the display is reversed and set the second time the display become normal .

R1	R0	Description
L	L	First line normal or reverse
L	H	Second line normal or reverse
H	L	Third line normal or reverse
H	H	Fourth line normal or reverse

● **EXTENED FUNCTION SET**

RS	RW	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0
0	0	0	0	1	DL	X	RE	G	X

DL: 4/8 BIT interface control bit

When DL="1" , 8 BIT MPU interface

When DL="0" , 4 BIT MPU interface

RE: extended instruction set control bit

When RE="1" , extended instruction set

When RE="0" , basic instruction set

G: Graphic display control bit

When G="1" , graphic display ON

When G="0" , graphic display OFF

In same instruction cannot alter DL , RE and G at once . Make sure that change DL or G first and then RE.

● **SET IRAM OR SCROLL ADDRESS**

RS	RW	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0
0	0	0	0	AC5	AC4	AC3	AC2	AC1	AC0

SR="1" , AC5~AC0 is vertical scroll displacement address

SR="0" , AC3~AC0 is ICON RAM address

● **SET GRAPHIC RAM ADDRESS**

RS	RW	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0
0	0	1	AC6	AC5	AC4	AC3	AC2	AC1	AC0

Set GDRAM address to address counter (AC)

First set vertical address and then horizontal address (write 2 consecutive bytes to complete vertical and horizontal address set)

Vertical address range is AC5...AC0

Horizontal address range is AC3...AC0

The address counter (AC) of graphic RAM (GRAM) only increment after write for horizontal address . After horizontal address=0FH it will automatically back to 00H .

However , the vertical address will not increase as the result of the same action.

DDRAM data (character code) , CGRAM data/address map

DDRAM资料 (字元代码)					CGRAM 位址						CGRAM 资料 (高字节)								CGRAM 资料 (低字节)													
B15-B4	B3	B2	B1	B0	B5	B4	B3	B2	B1	B0	D15	D14	D13	D12	D11	D10	D9	D8	D7	D6	D5	D4	D3	D2	D1	D0						
0	X	00	X	00	00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0					
						0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	
						0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0
						0	0	1	1	0	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0
						0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0
						0	1	0	1	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0
						0	1	1	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	1	1	0	0	0	0	0	0	0
						0	1	1	1	0	0	0	0	0	0	0	1	1	0	0	0	0	0	1	1	0	0	0	0	0	0	0
						1	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0
						1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0
						1	0	1	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	1	1	0	1	1	0	0	0	0
						1	0	1	1	0	0	0	0	0	0	0	1	1	0	0	0	0	0	1	1	0	0	1	1	0	0	0
						1	1	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	1	1	0	0	0	1	1	0	0
						1	1	0	1	0	0	0	0	0	0	0	1	1	0	0	0	0	0	1	1	0	0	0	0	1	1	0
						1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	1	0
						1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0
0	X	01	X	01	01	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0					
						0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
						0	0	1	0	0	0	0	0	0	0	1	1	0	0	0	0	0	1	1	1	1	1	1	1	1	0	
						0	0	1	1	0	0	0	0	0	0	1	1	0	0	0	0	0	0	1	1	1	1	1	1	1	0	
						0	1	0	0	0	0	1	1	1	1	1	1	1	0	0	0	0	0	1	1	1	1	1	1	0	0	
						0	1	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0	1	0	0	
						0	1	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	1	1	1	1	1	0	0	
						0	1	1	1	0	0	0	0	0	0	0	1	1	0	0	0	0	0	1	1	0	0	0	0	0	0	
						1	0	0	0	0	0	0	0	0	0	1	1	1	1	1	0	0	0	1	1	1	1	1	1	1	0	
						1	0	0	1	0	0	1	1	0	0	1	0	0	1	0	0	0	0	1	0	0	1	0	0	1	0	
						1	0	1	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	1	0	0	1	0	0	1	0	
						1	0	1	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	1	1	1	1	1	1	0	
						1	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	1	0	0	1	0	
						1	1	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	1	0	0	1	0	
						1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	0	
						1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	

Note:

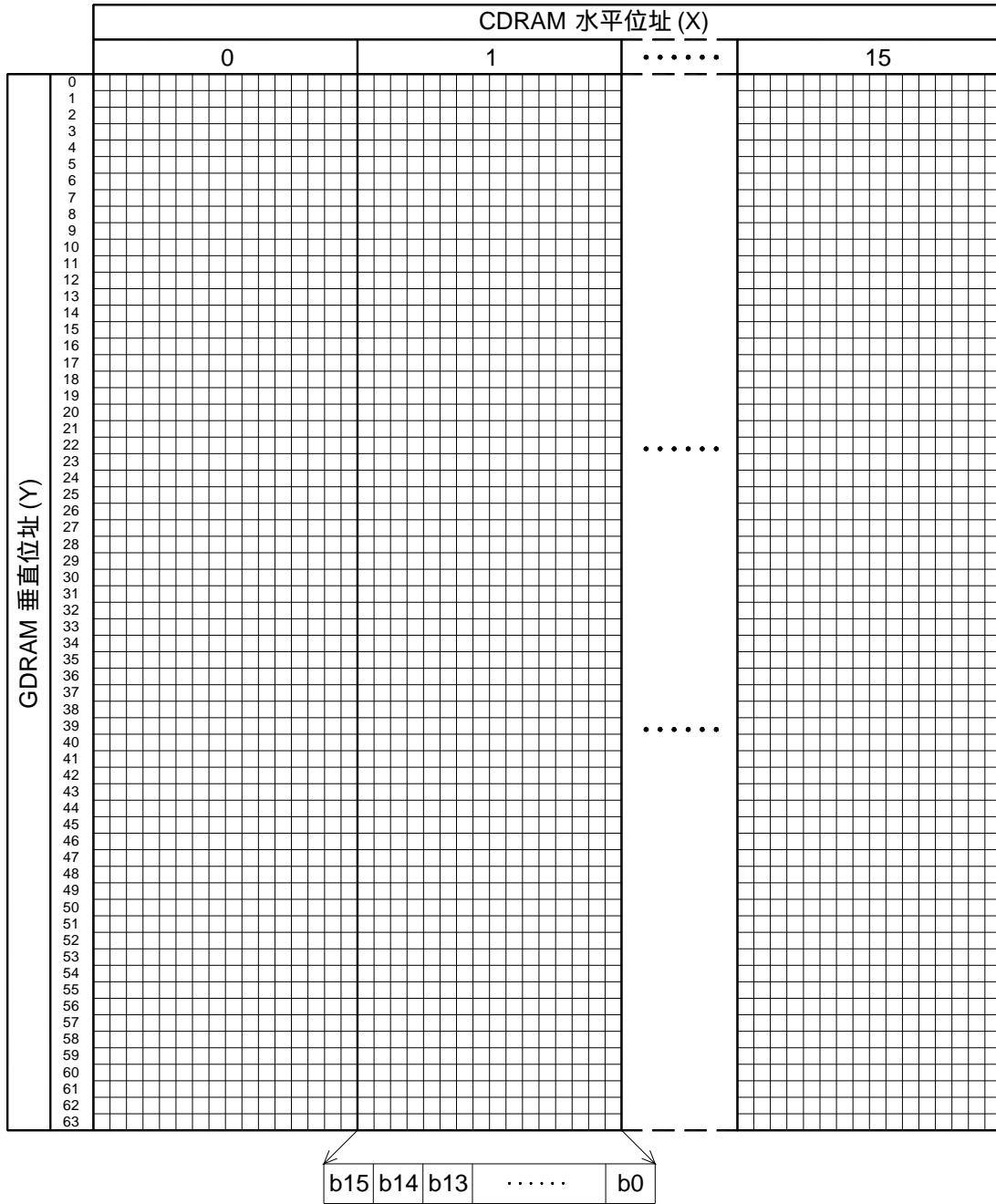
1. DDRAM data (character code) bit1 and bit2 are the same as CGRAM address bit4 and bit5.
2. CGRAM address bit0 to bit3 specify total 16 rows . Row 16 is for cursor display . The

data in row 16 will be logical OR to the cursor.

3. CGRAM data for each address is 16 bits .

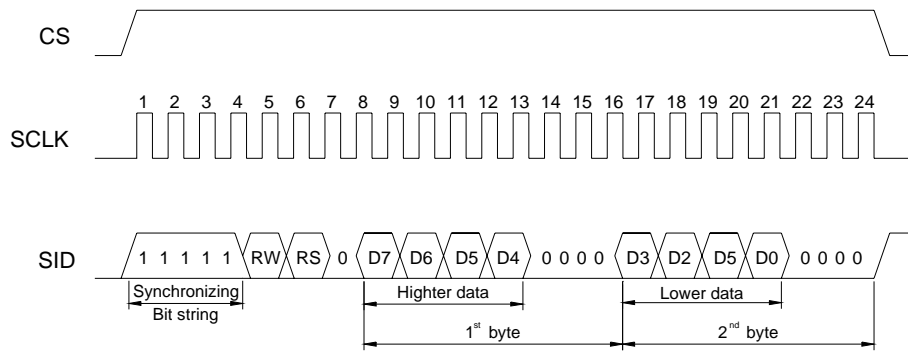
4. DDRAM data to select CGRAM bit4 to bit 15 must be "0" . Bit0 and bit3 value are "don't care" .

GDRAM display coordinates and corresponding address



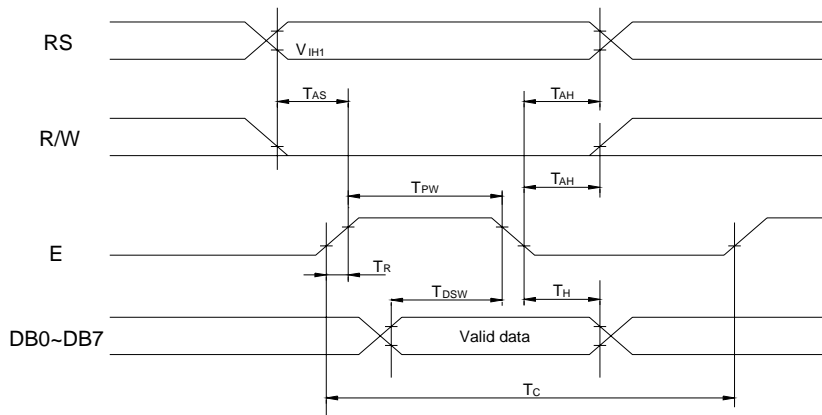
5-4. Timing Diagram

1) Serial interface:

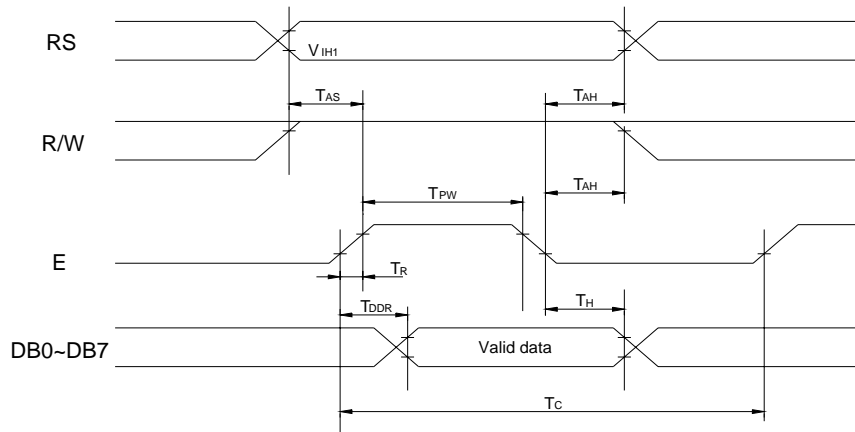


2). 8 bit interface timing diagram

1. MPU write data to ST7920



2. MPU read data from ST7920

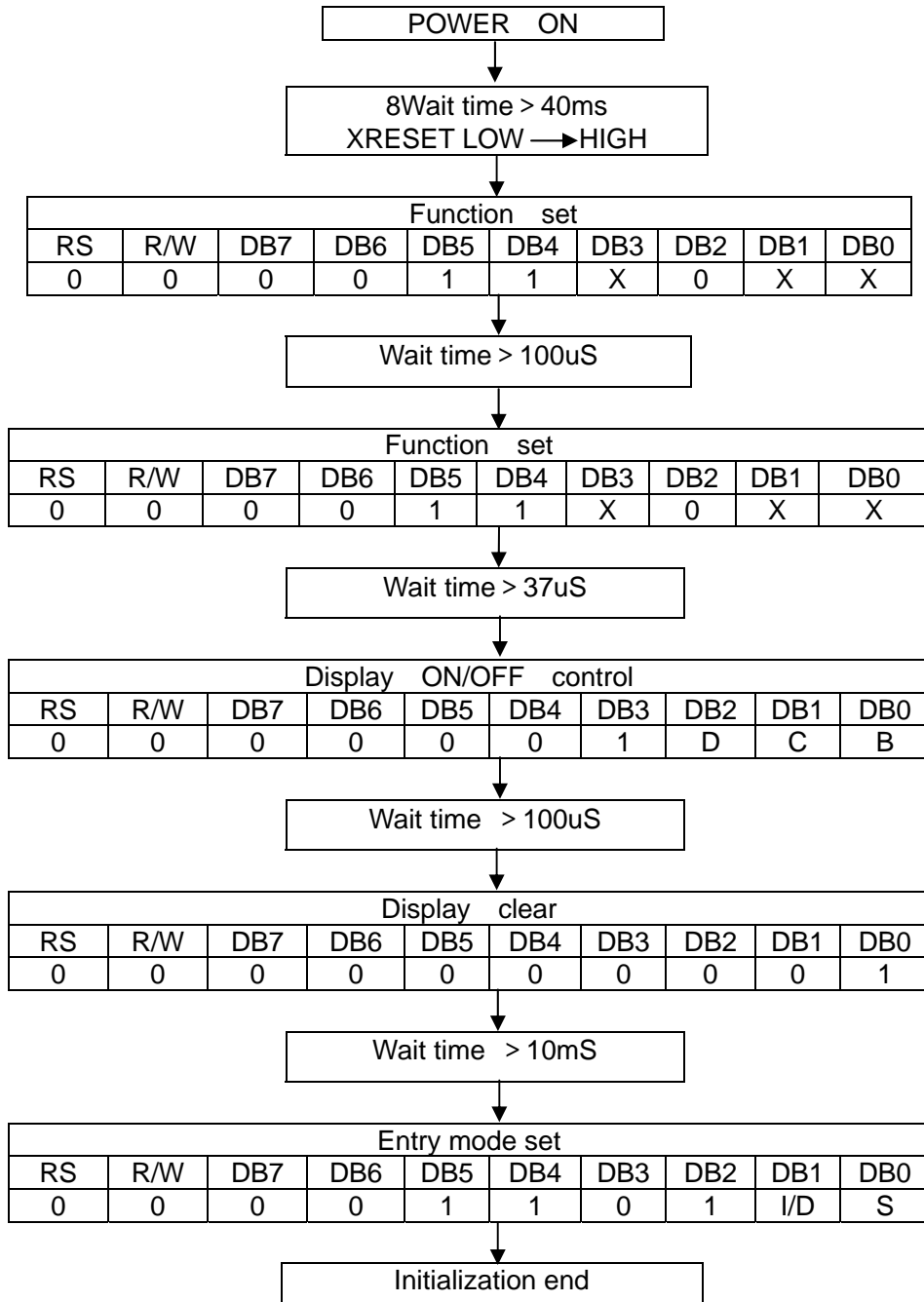


3). AC Characteristics Parallel Mode Interface

名称	符号	最小值	典型值	最大值	单位
Enable Cycle Time	T_C	1000	-	-	ns
Enable Pulse Width	T_{PW}	140	-	-	ns
Enable Rise Time	T_R	-	-	25	ns
Enable Fall Time	T_F	-	-	25	ns
Address Setup Time	T_{AS}	10	-	-	ns
Address Hold Time	T_{AH}	10	-	-	ns
Data Setup Time	T_{DSW}	40	-	-	ns
Data Hold Time	T_H	-	-	20	ns
Data Delay Time	T_{DDR}	-	-	100	ns
Data Hold Time	T_H	20	-	-	ns

5-5. Initialization

8 bit interface:



6. Handling precautions

6-1 Mounting method

A panel of LCD module made by Dalian Dongfu Color Display Co., Ltd. consists of two thin glass plates with polarizers that easily get damaged.

And since the module is so constructed as to be fixed by utilizing fitting holes in the printed circuit board (PCB), extreme care should be used when handling the LCD modules.

6-2 Cautions of LCD handling and cleaning

When cleaning the display surface, use soft cloth with solvent (recommended below) and wipe lightly.

- Isopropyl alcohol
- Ethyl alcohol
- Trichlorotrifluoroethane

Do not wipe the display surface with dry or hard materials that will damage the polarizer surface.

Do not use the following solvent:

- Water
- Ketene
- Aromatics

6-3 Caution against static charge

The LCD module uses C-MOS LSI drivers. So we recommend you:

Connect any unused input terminal to V_{dd} or V_{ss} . Do not input any signals before power is turned on, and ground your body, work/assembly areas, assembly equipment to protect against static electricity.

6-4 Packaging

- Module employs LCD elements, and must be treated as such.
Avoid intense shock and falls from a height.
- To prevent modules from degradation, do not operate or store them exposed direct to sunshine or high temperature/humidity.

6-5 Caution for operation

- It is an indispensable condition to drive LCD module within the limits of the specified voltage since the higher voltage over the limits may cause the shorter life of LCD module.
An electrochemical reaction due to DC (direct current) causes LCD undesirable deterioration so that the uses of DC (direct current) drive should be avoided.
- Response time will be extremely delayed at lower temperature than the operating temperature range and on the other hand at higher temperature LCD module may show dark color in them. However those phenomena do not mean malfunction or out of order of LCD module, which will come back in the specified operating temperature.

6-6 Storage

In the case of storing for a long period of time, the following ways are recommended:

- Storage in polyethylene bag with the opening sealed so as not to enter fresh air outside in it. And with not desiccant.
- Placing in a dark place where neither exposure to direct sunlight nor light is. Keeping the storage temperature range.
- Storing with no touch on polarizer surface by any thing else.

6-7 Safety

- It is recommendable to crash damaged or unnecessary LCD into pieces and to wash off liquid crystal by either of solvents such as acetone and ethanol, which should be burned up later.
- When any liquid leaked out of a damaged glass cell comes in contact with your hands, please wash it off well at once with soap and water.

7. Precaution for use

7-1 Both parties should provide a limit sample on an occasion when both parties agree its necessity.

The judgement by a limit sample shall take effect after the limit sample has been established and confirmed by both parties

7-2 On the following occasions, the handling of problem should be decided through discussion and agreement between responsible of the both parties.

- When a question is arisen in this manual.
- When a new problem is arisen which is not specified in this manual.
- Some problem is arisen due to the change of inspection and operating conditions in users.
- When a new problem is arisen at the customer's operating set for sample evaluation in the customer site.