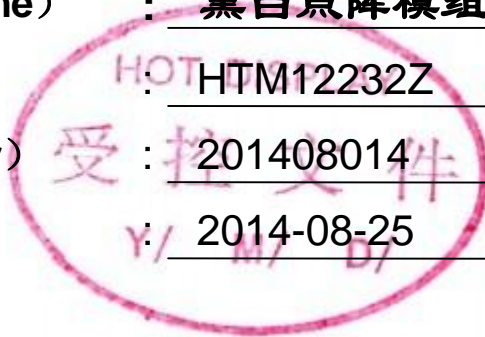




HTM12232Z

产品名称 (Product name) : 黑白点阵模组
 型号 (Model) : HTM12232Z
 编号 (Part number) : 201408014
 日期 (Date) : 2014-08-25



深圳市鑫洪泰电子科技有限公司

Shenzhen Hot Display Technology Co.,Ltd

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编码: QR-R-011 A/0

序号:

Rev.	Descriptions	Date
01	Prelimiay Release	2014-08-25

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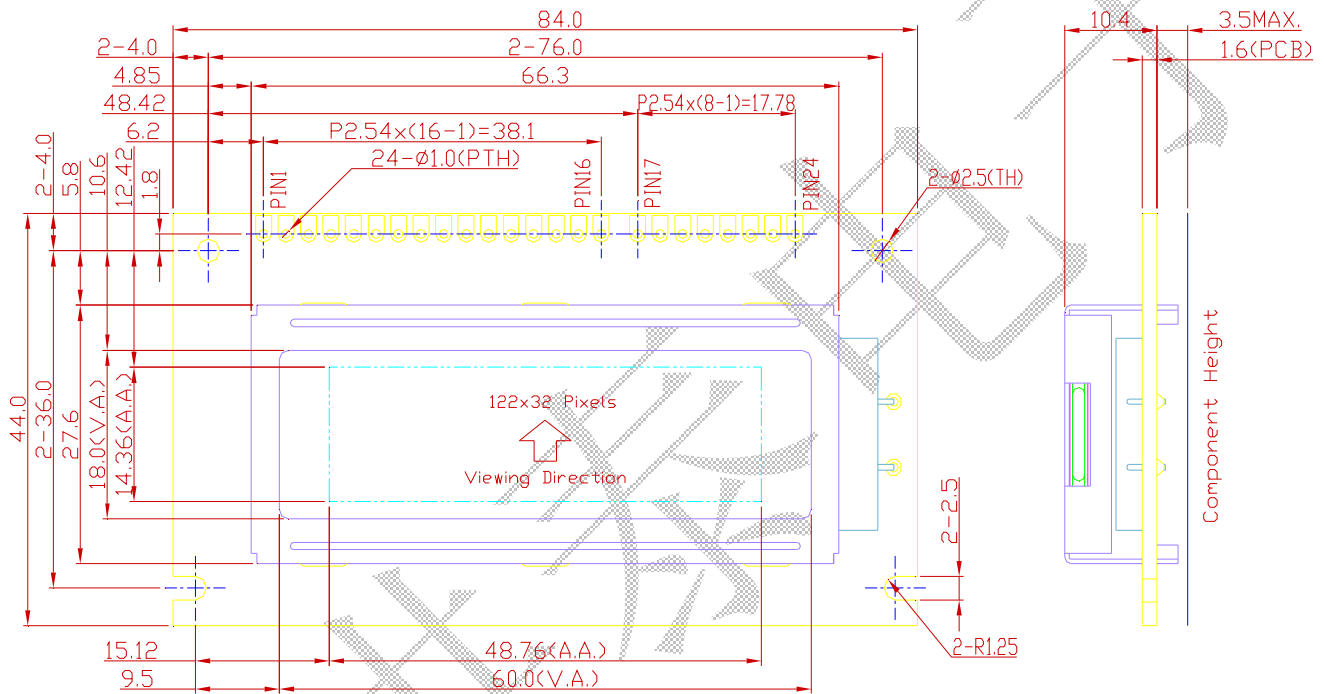
1. Basic Specifications

1.1 Display Specifications

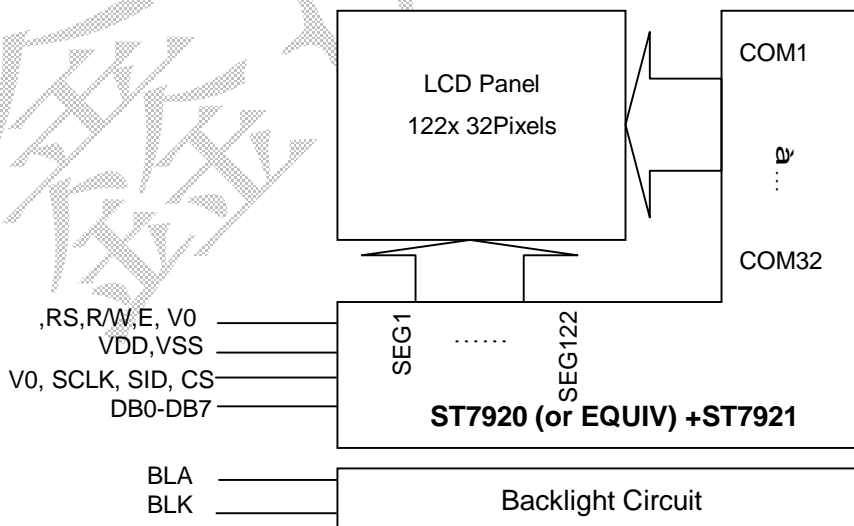
- 1>LCD Display Mode : STN-Bule or Y/G, Negative/Positive, , Transmissive/Transflective
- 2>Viewing Angle : 6H
- 3>Driving Method : 1/32 Duty, 1/5 Bias
- 4 >Backlight : White/Y/G

1.2 Mechanical Specifications

- 1>Outline Dimension : 84.0X44.0 X 13.9mm (See attached Outline Drawing for Deta)

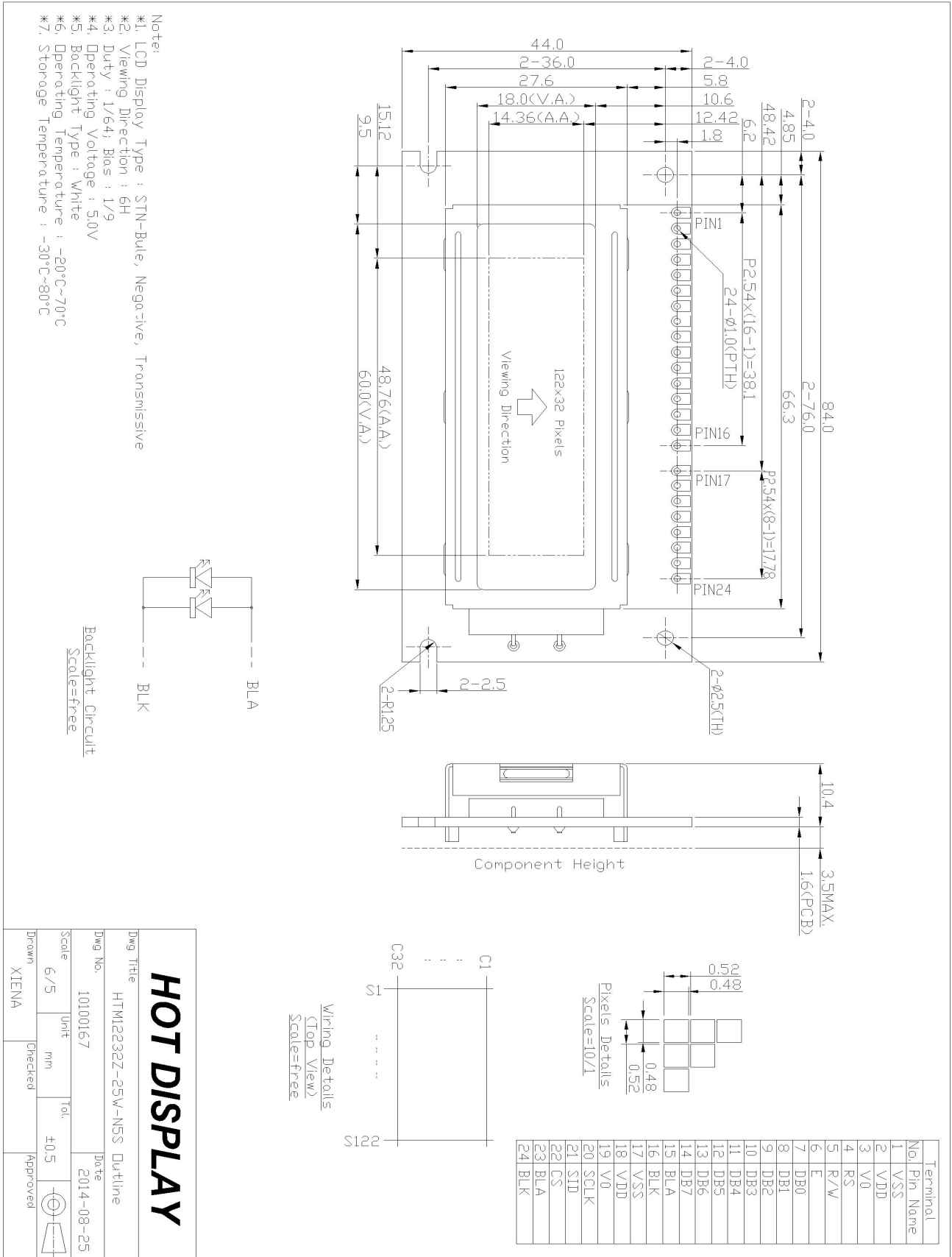


1.3 Circuit Diagram



1.4 Terminal Function

Pin No.	Pin Name	Function
1	VSS	Power Supply Negative(0V)
2	VDD	Power Supply Positive(5.0V)
3	V0	LCM Adjust Contrast
4	RS	H:Data; L: Instruction
5	R/W	Read/Write control. 0: Write; 1: Read.
6	E	Enable signal. H: Read ; L: Write.
7~14	DB0~DB7	Data Buss
15	BLA	Backlight Positive(5.0V)
16	BLK	Backlight Negative(VSS)
下面脚位为串口使用（并口时悬空）		
17	VSS	Power Supply Negative(0V)
18	VDD	Power Supply Positive(5.0V)
19	V0	LCM Adjust Contrast
20	SCLK	Serial clock.
21	SID	Serial data input.
22	CS	Chip selection input
23	BLA	Backlight Positive(5.0V)
24	BLK	Backlight Negative(VSS)

1.5 Product Outline


2. Absolute Maximum Ratings

Items	Symbol	MIN.	MAX.	Unit	Condition
Supply Voltage	V _{DD}	-0.3	+6.0	V	V _{SS} = 0V
Input Voltage	V _{IN}	-0.3	V _{DD} +0.3	V	V _{SS} = 0V
LCD Driver Voltage	V _{LCD}	-0.3	7.0	V	-
Operating Temperature	T _{OP}	-20	+70	°C	No Condensation
Storage Temperature	T _{st}	-30	+80	°C	No Condensation

3. Electrical Characteristics

3.11 DC Characteristics (TA= 25 °C, VDD=2.7V~ 4.5V)

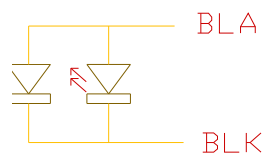
Symbol	Characteristics	Test Condition	Min.	Typ.	Max.	Unit
V _{DD}	Operating Voltage	-	2.7	-	5.5	V
V _{LCD}	LCD Voltage	V ₀ -V _{SS}	3.0	-	7	V
I _{CC}	Power Supply Current	f _{OSC} = 530KHz, V _{DD} =3.0V Rf=18KΩ	-	0.20	0.45	mA
V _{IHI}	Input High Voltage (Except OSC1)	-	0.7V _{DD}	-	V _{DD}	V
V _{ILI}	Input Low Voltage (Except OSC1)	-	-0.3	-	0.6	V
V _{IH2}	Input High Voltage (OSC1)	-	V _{DD} -1	-	V _{DD}	V
V _{IL2}	Input Low Voltage (OSC1)	-	-	-	1.0	V
V _{OH1}	Output High Voltage (DB0 - DB7)	I _{OH} = -0.1mA	0.8V _{DD}	-	V _{DD}	V
V _{OL1}	Output Low Voltage (DB0 - DB7)	I _{OL} = 0.1mA	-	-	0.1	V
V _{OH2}	Output High Voltage (Except DB0 - DB7)	I _{OH} = -0.04mA	0.8V _{DD}	-	V _{DD}	V
V _{OL2}	Output Low Voltage (Except DB0 - DB7)	I _{OL} = 0.04mA	-	-	0.1V _{DD}	V
I _{LEAK}	Input Leakage Current	V _{IN} = 0V to V _{DD}	-1	-	1	μA
I _{PUP}	Pull Up MOS Current	V _{DD} = 3V	22	27	32	μA

3.12 DC Characteristics (TA= 25 °C, VDD=4.5V)

Symbol	Characteristics	Test Condition	Min.	Typ.	Max.	Unit
V _{DD}	Operating Voltage	-	4.5	-	5.5	V
V _{LCD}	LCD Voltage	V ₀ -V _{SS}	3.0	-	7	V
I _{CC}	Power Supply Current	f _{OSC} = 540KHz, V _{DD} =5V Rf=33KΩ	-	0.45	0.75	mA
V _{IHI}	Input High Voltage (Except OSC1)	-	0.7V _{DD}	-	V _{DD}	V
V _{ILI}	Input Low Voltage (Except OSC1)	-	-0.3	-	0.6	V
V _{IH2}	Input High Voltage (OSC1)	-	V _{DD} -1	-	V _{DD}	V
V _{IL2}	Input Low Voltage (OSC1)	-	-	-	1.0	V
V _{OH1}	Output High Voltage (DB0 - DB7)	I _{OH} = -0.1mA	0.8V _{DD}	-	V _{DD}	V
V _{OL1}	Output Low Voltage (DB0 - DB7)	I _{OL} = 0.1mA	-	-	0.4	V
V _{OH2}	Output High Voltage (Except DB0 - DB7)	I _{OH} = -0.04mA	0.8V _{DD}	-	V _{DD}	V
V _{OL2}	Output Low Voltage (Except DB0 - DB7)	I _{OL} = 0.04mA	-	-	0.1V _{DD}	V
I _{LEAK}	Input Leakage Current	V _{IN} = 0V to V _{DD}	-1	-	1	μA
I _{PUP}	Pull Up MOS Current	V _{DD} = 5V	75	80	85	μA

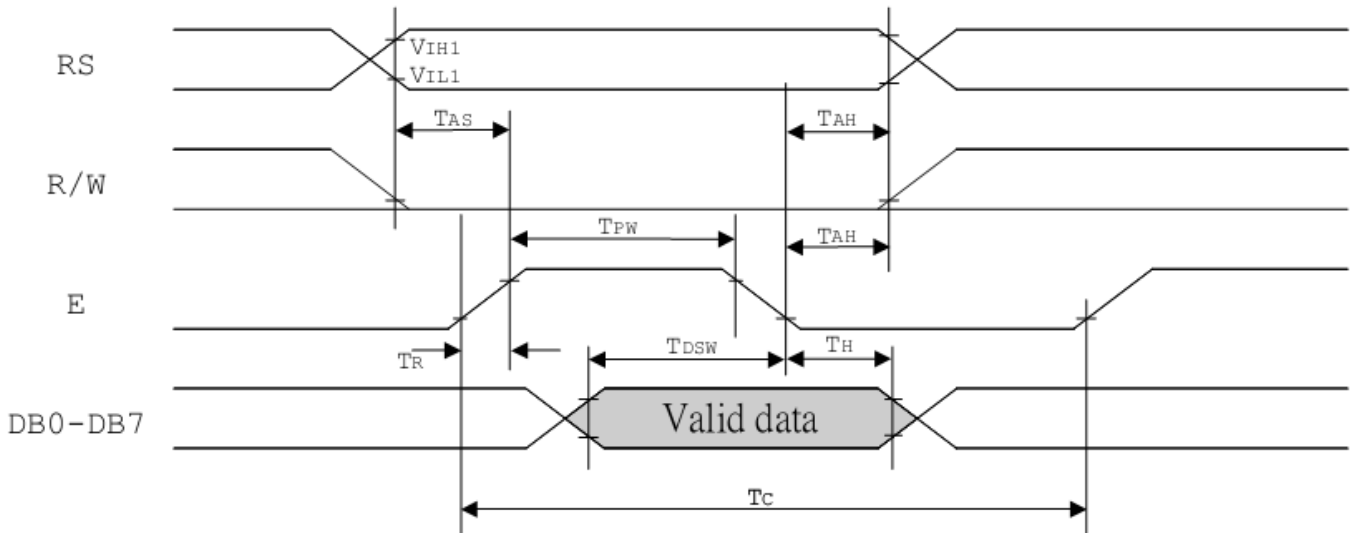
3.2 LED Backlight Circuit

Items	Symbol	MIN.	TYP.	MAX.	Unit	Condition
Forward Voltage	Vf BLA	-	3.1	-	V	Without Resistance
Forward Current	If BLA	-	30	40	mA	-

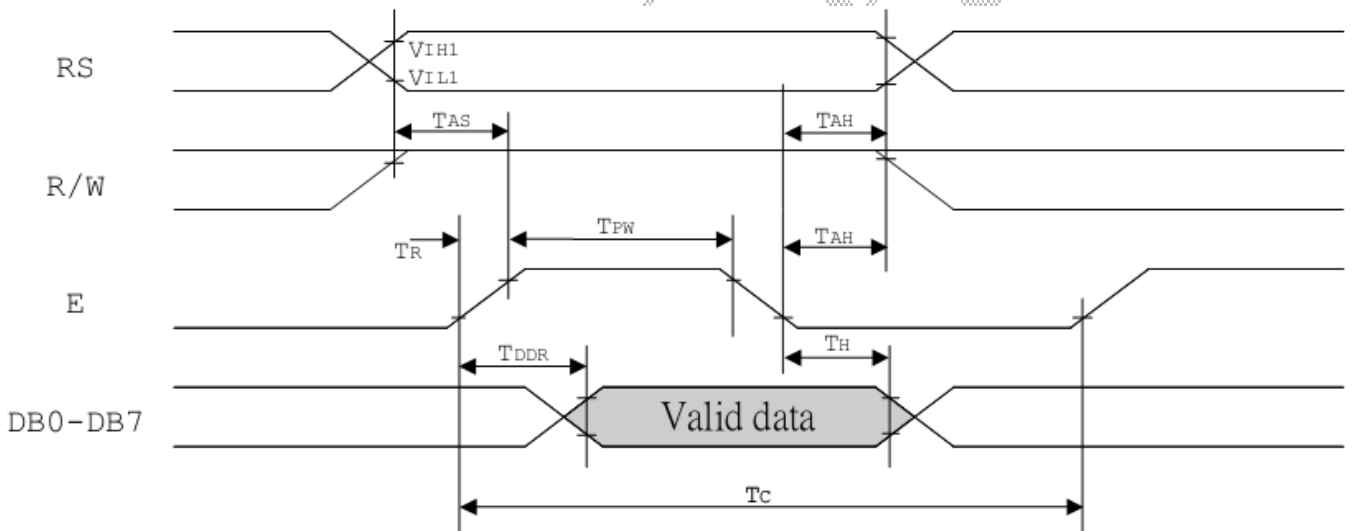


3.3 AC Characteristics

3.31 Parallel Mode Interface



MPU write timing



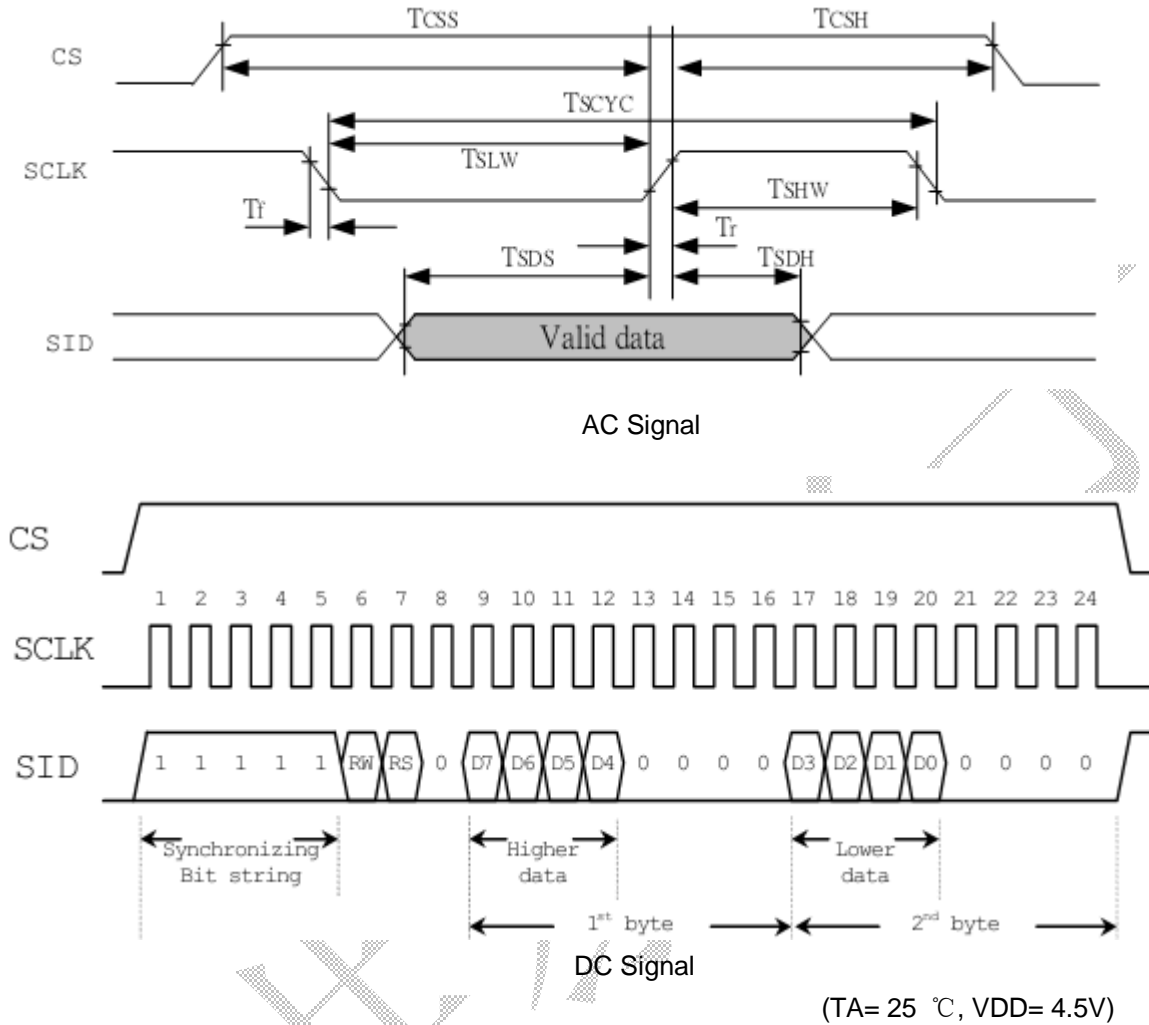
MPU read timing

Symbol	Characteristics	Test Condition	Min.	Typ.	Max.	Unit
<i>Internal Clock Operation</i>						
f _{OSC}	OSC Frequency	R = 33KΩ	480	540	600	KHz
<i>External Clock Operation</i>						
f _{EX}	External Frequency	-	480	540	600	KHz
	Duty Cycle	-	45	50	55	%
T _R ,T _F	Rise/Fall Time	-	-	-	0.2	μs
<i>Write Mode (Writing data from MPU to ST7920)</i>						
T _C	Enable Cycle Time	Pin E	1200	-	-	ns
T _{PW}	Enable Pulse Width	Pin E	140	-	-	ns
T _R ,T _F	Enable Rise/Fall Time	Pin E	-	-	25	ns
T _{AS}	Address Setup Time	Pins: RS,RW,E	10	-	-	ns
T _{AH}	Address Hold Time	Pins: RS,RW,E	20	-	-	ns
T _{DSW}	Data Setup Time	Pins: DB0 - DB7	40	-	-	ns
T _H	Data Hold Time	Pins: DB0 - DB7	20	-	-	ns
<i>Read Mode (Reading Data from ST7920 to MPU)</i>						
T _C	Enable Cycle Time	Pin E	1200	-	-	ns
T _{PW}	Enable Pulse Width	Pin E	140	-	-	ns
T _R ,T _F	Enable Rise/Fall Time	Pin E	-	-	25	ns
T _{AS}	Address Setup Time	Pins: RS,RW,E	10	-	-	ns
T _{AH}	Address Hold Time	Pins: RS,RW,E	20	-	-	ns
T _{DDR}	Data Delay Time	Pins: DB0 - DB7	-	-	100	ns
T _H	Data Hold Time	Pins: DB0 - DB7	20	-	-	ns
<i>Interface Mode with LCD Driver(ST7921)</i>						
T _{CWH}	Clock Pulse with High	Pins: CL1, CL2	800	-	-	ns
T _{CWL}	Clock Pulse with Low	Pins: CL1, CL2	800	-	-	ns
T _{CST}	Clock Setup Time	Pins: CL1, CL2	500	-	-	ns
T _{SU}	Data Setup Time	Pin: D	300	-	-	ns
T _{DH}	Data Hold Time	Pin: D	300	-	-	ns
T _{DM}	M Delay Time	Pin: M	-1000	-	1000	ns

(TA= 25 °C, VDD= 2.7V)

Symbol	Characteristics	Test Condition	Min.	Typ.	Max.	Unit
<i>Internal Clock Operation</i>						
f _{OSC}	OSC Frequency	R = 18KΩ	470	530	590	KHz
<i>External Clock Operation</i>						
f _{EX}	External Frequency	-	470	530	590	KHz
	Duty Cycle	-	45	50	55	%
T _R ,T _F	Rise/Fall Time	-	-	-	0.2	μs
<i>Write Mode (Writing data from MPU to ST7920)</i>						
T _C	Enable Cycle Time	Pin E	1800	-	-	ns
T _{PW}	Enable Pulse Width	Pin E	160	-	-	ns
T _R ,T _F	Enable Rise/Fall Time	Pin E	-	-	25	ns
T _{AS}	Address Setup Time	Pins: RS,RW,E	10	-	-	ns
T _{AH}	Address Hold Time	Pins: RS,RW,E	20	-	-	ns
T _{DSW}	Data Setup Time	Pins: DB0 - DB7	40	-	-	ns
T _H	Data Hold Time	Pins: DB0 - DB7	20	-	-	ns
<i>Read Mode (Reading Data from ST7920 to MPU)</i>						
T _C	Enable Cycle Time	Pin E	1800	-	-	ns
T _{PW}	Enable Pulse Width	Pin E	320	-	-	ns
T _R ,T _F	Enable Rise/Fall Time	Pin E	-	-	25	ns
T _{AS}	Address Setup Time	Pins: RS,RW,E	10	-	-	ns
T _{AH}	Address Hold Time	Pins: RS,RW,E	20	-	-	ns
T _{DDR}	Data Delay Time	Pins: DB0 - DB7	-	-	260	ns
T _H	Data Hold Time	Pins: DB0 - DB7	20	-	-	ns
<i>Interface Mode with LCD Driver(ST7921)</i>						
T _{CWH}	Clock Pulse with High	Pins: CL1, CL2	800	-	-	ns
T _{CWL}	Clock Pulse with Low	Pins: CL1, CL2	800	-	-	ns
T _{CST}	Clock Setup Time	Pins: CL1, CL2	500	-	-	ns
T _{SU}	Data Setup Time	Pin: D	300	-	-	ns
T _{DH}	Data Hold Time	Pin: D	300	-	-	ns
T _{DM}	M Delay Time	Pin: M	-1000	-	1000	ns

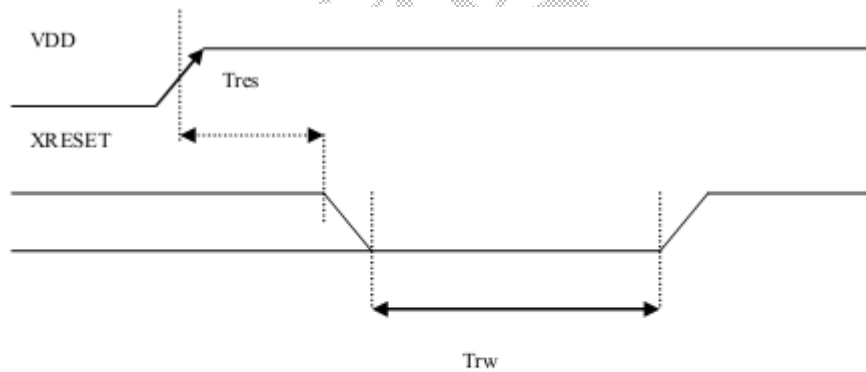
3.32 Serial Mode Interface



Symbol	Characteristics	Test Condition	Min.	Typ.	Max.	Unit
<i>Internal Clock Operation</i>						
f_{OSC}	OSC Frequency	R = 33K Ω	470	530	590	KHz
<i>External Clock Operation</i>						
f_{EX}	External Frequency	-	470	530	590	KHz
	Duty Cycle	-	45	50	55	%
T_R, T_F	Rise/Fall Time	-	-	-	0.2	μ s
TSCYC	Serial clock cycle	Pin E	400	-	-	ns
TSHW	SCLK high pulse width	Pin E	200	-	-	ns
TSLW	SCLK low pulse width	Pin E	200	-	-	ns
TSDS	SID data setup time	Pins RW	40	-	-	ns
TSDH	SID data hold time	Pins RW	40	-	-	ns
TCSS	CS setup time	Pins RS	60	-	-	ns
TCSH	CS hold time	Pins RS	60	-	-	ns

Symbol	Characteristics	Test Condition	Min.	Typ.	Max.	Unit
<i>Internal Clock Operation</i>						
f_{OSC}	OSC Frequency	R = 18K Ω	470	530	590	KHz
<i>External Clock Operation</i>						
f_{EX}	External Frequency	-	470	530	590	KHz
	Duty Cycle	-	45	50	55	%
T_R, T_F	Rise/Fall Time	-	-	-	0.2	μ s
TSCYC	Serial clock cycle	Pin E	600	-	-	ns
TSHW	SCLK high pulse width	Pin E	300	-	-	ns
TSLW	SCLK low pulse width	Pin E	300	-	-	ns
TSDS	SID data setup time	Pins RW	40	-	-	ns
TSDH	SID data hold time	Pins RW	40	-	-	ns
TCSS	CS setup time	Pins RS	60	-	-	ns
TCSH	CS hold time	Pins RS	60	-	-	ns

3.4 Rest Timing



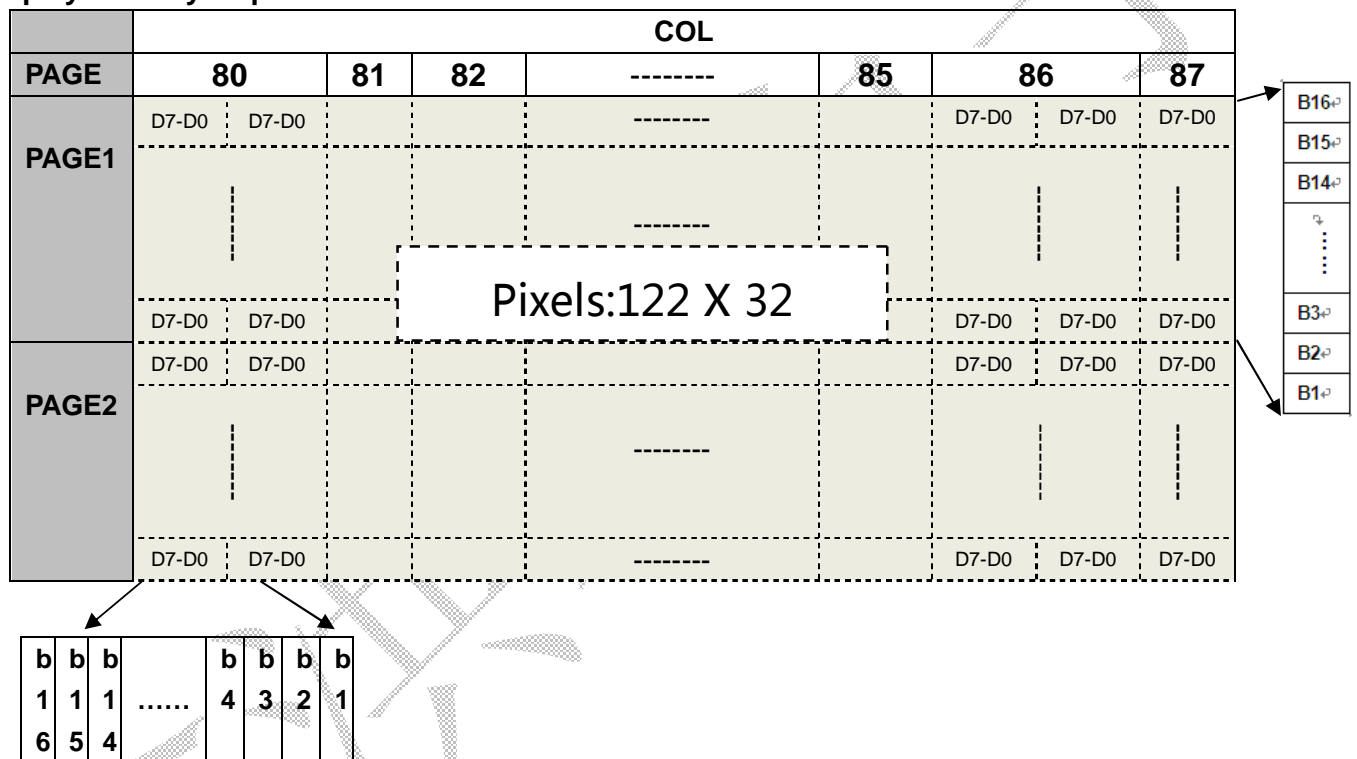
XRESET pulse width	T_{rw}	10 μ s
RESET start time	T_{res}	50ns

4. Function specifications

4.1 The Parallel Interface

Shared	6800 Mode		Serial Mode			Function(6800)
	A0	R/W	E	RS(CS)	E(SCKL)	
H	H	H	-	-	-	Reads the display data
H	L	HàL	-	-	-	Writes the display data
L	H	H	-	-	-	Staus read
L	L	HàL	-	-	-	Write Command data

4.2 Display Memory Map



Note:

1nd Page: from 0x80~ 0x87 (ROW0~ ROW15)

2nd Page: from 0x90~ 0x97 (ROW16~ ROW31)

4.3 Display Commands

Instruction Set 1: (RE=0: Basic Instruction)

Inst.	Code										Description	Exec time (540KHZ)
	RS	RW	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0		
Display Clear	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
Return 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	72 us
Entry Mode Set	0	0	0	0	0	0	0	1	I/D	S	Set cursor position and display shift when doing write or read operation	72 us
Display Control	0	0	0	0	0	0	1	D	C	B	D=1: Display ON C=1: Cursor ON B=1: Character Blink ON	72 us
Cursor Display Control	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	72 us
Function Set	0	0	0	0	1	DL	X	0	X	X	DL=1 8-bit interface DL=0 4-bit interface RE=1: extended instruction RE=0: basic instruction	72 us
Set CGRAM Address.	0	0	0	1	AC5	AC4	AC3	AC2	AC1	AC0	Set CGRAM address to address counter (AC) Make sure that in extended instruction SR=0 (scroll or RAM address select)	72 us
Set DDRAM Address.	0	0	1	0	AC5	AC4	AC3	AC2	AC1	AC0	Set DDRAM address to address counter (AC) AC6 is fixed to 0	72 us
Read Busy Flag (BF) & AC.	0	1	BF	AC6	AC5	AC4	AC3	AC2	AC1	AC0	Read busy flag (BF) for completion of internal operation, also Read out the value of address counter (AC)	0 us
Write RAM	1	0	D7	D6	D5	D4	D3	D2	D1	D0	Write data to internal RAM (DDRAM/CGRAM/GDRAM)	72 us
Read RAM	1	1	D7	D6	D5	D4	D3	D2	D1	D0	Read data from internal RAM (DDRAM/CGRAM/GDRAM)	72 us

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

Inst.	Code										Description	Exec time (540KHZ)	
	RS	RW	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0			
Standby	0	0	0	0	0	0	0	0	0	1	Enter standby mode, any other instruction can terminate. COM1...32 are halted.	72 us	
Scroll or RAM Address. Select	0	0	0	0	0	0	0	0	1	SR	SR=1: enable vertical scroll position SR=0: enable CGRAM address (basic instruction)	72 us	
Reverse (by line)	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 0,0	72 us	
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	72 us
Set Scroll Address	0	0	0	1	AC5	AC4	AC3	AC2	AC1	AC0	SR=1: AC5~AC0 the address of vertical scroll	72 us	
Set Graphic Display RAM Address	0	0	1	0	0	0	AC3	AC2	AC1	AC0	Set GDRAM address to address counter (AC) Set the vertical address first and followed the horizontal address by consecutive writings Vertical address range: AC5...AC0 Horizontal address range: AC3...AC0	72 us	

Note:

1. Make sure that ST7920 is not in busy state by reading the busy flag before sending instruction or data. If using 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. After setting the RE bit, the value will be kept. So that the software doesn't have to set RE every time when using the same instruction set.

Initial Setting (Register flag) (RE=0: basic instruction)

Inst.	Code										Description
	RS	RW	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0	
Entry Mode Set	0	0	0	0	0	0	0	1	I/D	S	Cursor move to right , DDRAM address counter (AC) plus 1
									1	0	
Display Control	0	0	0	0	0	0	1	D	C	B	Display, cursor and blink are ALL OFF
								0	0	0	
CURSOR DISPLAY SHIFT	0	0	0	0	0	1	S/C	R/L	X	X	No cursor or display shift operation
							X	X			
FUNCTION SET	0	0	0	0	1	DL	X	0	RE	X	8-bit MPU interface , basic instruction set
						1		0			

Initial Setting (Register flag) (RE=1: extended instruction set)

Inst.	Code										Description
	RS	RW	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0	
SCROLL OR RAM ADDR. SELECT	0	0	0	0	0	0	0	0	1	SR	Allow vertical scroll or set CGRAM address
										0	
REVERSE	0	0	0	0	0	0	0	1	R1	R0	Begin with normal and toggle to reverse
									0	0	
EXTENDED FUNCTION SET	0	0	0	0	1	DL	X	1	RE	G	Graphic display OFF
									0		

4.4 Basic Operating Sequence Initialization Sequence

	Code Function										Note	
	A0	D7	D6	D5	D4	D3	D2	D1	D0	hex		
Turn on Power Supply VDD & VSS While maintaining /RES at LOW	-	-	-	-	-	-	-	-	-	-	-	
Wait until power supply is stabilized	-	-	-	-	-	-	-	-	-	-	-	
Release the /RES Reset Signal (/RES = High)	-	-	-	-	-	-	-	-	-	-	-	
Extended Function Set	0	0	0	1	D L	X	R E	G	0	30H	DL = "1", 8-bit MPU interface	
Extended Function Set	0	0	0	1	D L	X	R E	G	0	30H	RE = "0", basic instruction set	
Display Control	0	0	0	0	0	1	D	C	B	0CH	D = "1", display ON; C = "0", cursor OFF; B = "0", cursor position blink OFF	
Display Clear	0	0	1	0	0	0	0	0	1	01H	Fill DDRAM with "20H"	
Entry Mode Set	0	0	1	0	0	0	1	I D	S	06H	I/D = "1", cursor moves right, address counter (AC) is increased by 1.	
WRITE DATA	1	X	X	X	X	X	X	X	X	XXH	Display Data	

Reference code

```

bit lcd_busy()
{
    bit result;
    rs = 0;
    rw = 1;
    ep = 1;
    _nop_();
    _nop_();
    _nop_();
    _nop_();
    result
    =(bit)((P1&0x80)>>7);
    ep = 0;
    return result;
}

void Comwrite
(Uchar com)
{
    P1 = 0xFF;
    while(lcd_busy());
    rs = 0;
    rw = 0;
    _nop_();
    P1 = com;
    _nop_();
    _nop_();
    _nop_();
    _nop_();
    ep = 1;
    _nop_();
    _nop_();
    _nop_();
    _nop_();
    ep = 0;
}

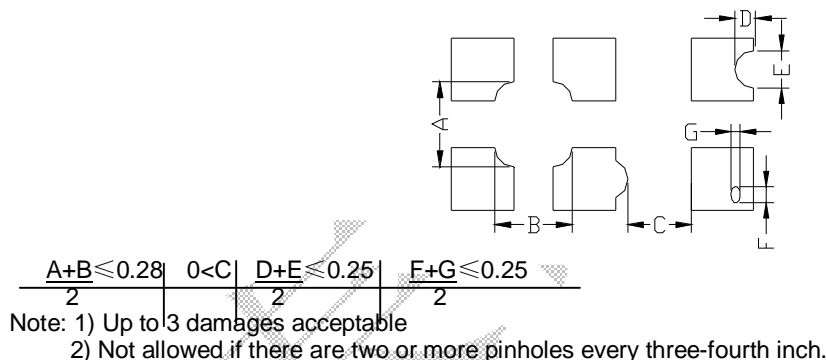
void Datwrite(Uchar dat)
{
    P1 = 0xFF;
    while(lcd_busy());
    rs = 1;
    rw = 0;
    P1 = dat;
    _nop_();
    _nop_();
    _nop_();
    _nop_();
    _nop_();
    ep = 1;
    _nop_();
    _nop_();
    _nop_();
    _nop_();
    ep = 0;
}

void Setadd
(Uchar col,pag)
{
    Comwrite(0x36);
    Comwrite(pag+0x80);
    Comwrite(col+0x80);
    Comwrite(0x30);
}

void asc_tran
(Uchar *asc)
{
    while(*asc != 0)
    {
        Datwrite(*asc);
        asc++;
    }
}

void hanzi_disp0()
{
    Comwrite(0x06);
    Comwrite(0x80);
    asc_tran("---HTM16032
    Series--");
    Comwrite(0x90);
    asc_tran("***内含简体中
    文字库***");
}
    
```

5. Inspection Standards

Item	Criterion for defects	Defect type
1) Display on inspection	(1) Non display (2) Vertical line is deficient (3) Horizontal line is deficient (4) Cross line is deficient	Major
2) Black / White spot	Size Φ (mm) $\Phi \leq 0.3$ Acceptable number $0.3 < \Phi \leq 0.45$ Ignore (note) $0.45 < \Phi \leq 0.6$ 3 $0.6 < \Phi$ 1 0	Minor
3) Black / White line	Length (mm) Width (mm) Acceptable number $L \leq 10$ $W \leq 0.03$ Ignore $5.0 \leq L \leq 10$ $0.03 < W \leq 0.04$ 3 $5.0 \leq L \leq 10$ $0.04 < W \leq 0.05$ 2 $1.0 \leq L \leq 10$ $0.05 < W \leq 0.06$ 2 $1.0 \leq L \leq 10$ $0.06 < W \leq 0.08$ 1 $L \leq 10$ $0.08 < W$ follows 2) point defect Defects separate with each other at an interval of more than 20mm	Minor
4) Display pattern	 <p>Note: 1) Up to 3 damages acceptable 2) Not allowed if there are two or more pinholes every three-fourth inch.</p>	Minor
5) Spot-like contrast irregularity	Size Φ (mm) Acceptable Number $\Phi \leq 0.7$ Ignore (note) $0.7 < \Phi \leq 1.0$ 3 $1.0 < \Phi \leq 1.5$ 1 $1.5 < \Phi$ 0 Note: 1) Conformed to limit samples. 2) Intervals of defects are more than 30mm.	Minor
6) Bubbles in polarizer	Size Φ (mm) Acceptable Number $\Phi \leq 0.4$ Ignore (note) $0.4 < \Phi \leq 0.65$ 2 $0.65 < \Phi \leq 1.2$ 1 $1.2 < \Phi$ 0	Minor
7) Scratches and dent on the polarizer	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	Stains which cannot be removed even when wiped lightly with a soft cloth or similar cleaning.	Minor
9) Rainbow color	No rainbow color is allowed in the optimum contrast on state within the active area.	Minor
10) Viewing area encroachment	Polarizer edge or line is visible in the opening viewing area due to polarizer shortness or sealing line.	Minor
11) Bezel appearance	Rust and deep damages that are visible in the bezel are rejected.	Minor
12) Defect of land surface contact	Evident crevices that are visible are rejected.	Minor
13) Parts mounting	(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	(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)	(1) $0.45 < \Phi$, $N \geq 1$ (2) $0.3 < \Phi \leq 0.45$, $N \geq 1$, Φ : Average diameter of solder ball (unit: mm) (3) $0.5 < L$, $N \geq 1$, L: Average length of solder chip (unit: mm)	Minor
16) Bezel flaw	Bezel claw missing or not bent	Minor
17) Indication on name plate (sampling indication label)	(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

6. Handling Precautions

6.1 Mounting method

A panel of LCD module made by our company 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. Packaging Specifications

		Packaging Specifications			<table border="1"> <tr> <td>Approved</td> <td>Checked</td> <td>Designed</td> </tr> <tr> <td></td> <td></td> <td></td> </tr> </table>		Approved	Checked	Designed			
Approved	Checked	Designed										
		HTM12232Z										
6.1 Packaging Material												
No	Item	Dimensions (mm)	IPCS Weight (KG)	Quantity	Total Weight							
1	LCM	84.0*44.0*10.4	0.040	200	8.0							
2	PE Bag	100*60	0.001	200	0.2							
3	Foam Rubber Cushion	310*170	0.0175	8	0.14							
4	Partition Al	310*170*100	0.30	4	1.2							
5	Product Box	330*180*120 (neutral packing)	0.45	4	1.8							
6	Carton	480*390*330 (neutral packing)	1.0	1	1.0							
7	Tape			AR								
8	Label Specifications			1								
9	Label Rohs			1								
10	Label ESD			1								
6.2. Total LCD Weight in carton: 12.3 KG±10%												
6.3. Packaging Specifications and Quantity:												
(1) Quantity Of Spacer: Al*4												
(2) Total LCM quantity in carton: quantity per box 50* no of boxes 4 = 200												