Issue date	**: 2003.07.04**
Revision NO.	**: 1.1**

Model : ZX12864P-3 FEGW

(SPECIFICATION FOR LCD MODULE)

Design :

Check :

Approval :

Customer:

Customer Approval:

• REVISION RECORD

REV. NO	DATE	PAGE	ITEMS
1.0		ALL	
1.1	03.07.04	4	Vop and bias is changed.

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CONTENTS

1、Scope

This specification defines general provision as well as inspection standards for LCD module supplied by HUARI Corporation.

If the event of unforeseen problem or unspecified items may occur, naturally shall negotiate and agree to solution.

2、Warranty

Module products manufactured to this specification will be capable of meeting all the characteristics for a minimum period of 12 months, which calculates from the date of shipping from HUARI Corporation. And all the products should be stored or used as specified conditions described in these sheets.

If module products are not stored or used as specified conditions, herein, it will be void the 12 months warranty.

3、Features

1) Display Type: STN-Y/G

2) Polarizer Mode: Transflective and Positive Type

3) Viewing Angle: 12:00

4)Viewing Area:59mm×28mm

5) Driving Method:9.8V, 1/64Duty, 1/7 Bias

6) Controller/Driver: SSD1815B

7) Dot Matrix: 128×64 Dots

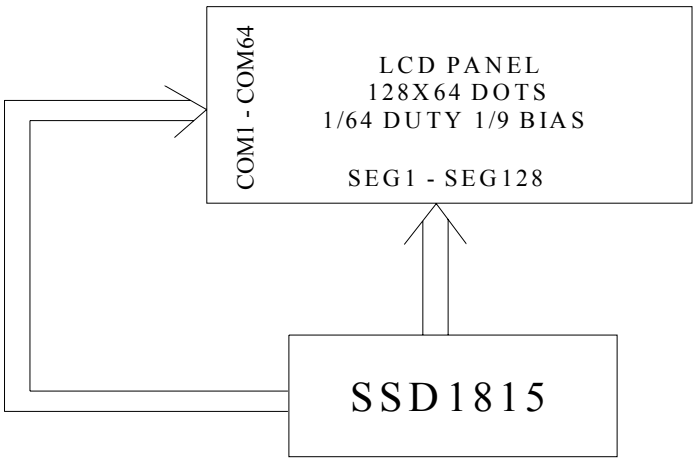
8) Outline Dimensions: Refer to outline drawing

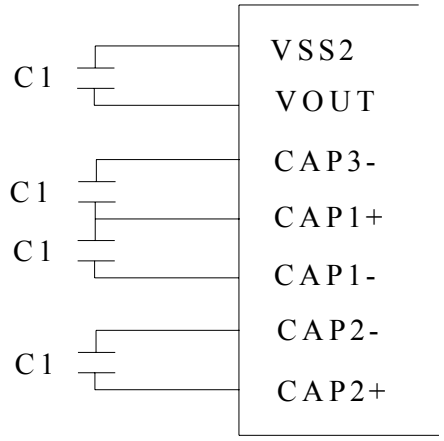
9)Dot Size:0.41mm×0.37mm

10)Dot Pitch:0.43mm×0.39mm

11)Back Light Type:EL,Yellow-Green

12)Back Light Driving Method:AC 100V, 400Hz





4XStep-up voltage circuit

4、Maximum ratings

Item	Symbol	Standard Value		Unit	Remark
		Min.	Max.		
Power Supply Voltage For Logic	V_{DD},V_{DD2}	-0.3	+4	V	
Power Supply Voltage For LCD	V0	0	-12。0	V	
Input Voltage	V_{IN}	Vss- 0.3	V_{DD}+0.3	V	
Operating Temperature	T_{op}	-20	+60	℃	No Condensation
Storage Temperature	T_{st}	-30	+70	℃	No Condensation

5、Electrical characteristics

DC CHARACTERISTICS

Table 10 DC Characteristics (Unless otherwise specified, Voltage Referenced to V_{SS}, V_{DD} = 2.4 to 3.5V, T_A = -30 to 85°C.)

Symbol	Parameter	Test Condition	Min	Typ	Max	Unit
V_{DD}	Logic Circuit Supply Voltage Range	Recommend Operating Voltage Possible Operating Voltage	2.4 1.8	2.7 -	3.5 3.5	V V
I_{AC}	Access Mode Supply Current Drain (V_{DD} Pins)	V_{DD} = 2.7V, Voltage Generator On, 4X DC-DC Converter Enabled, Write accessing, T_{cyc} =3.3MHz, Typ. Osc. Freq., Display On, no panel attached.	-	300	600	µA
I_{DP1}	Display Mode Supply Current Drain (V_{DD} Pins)	V_{DD} = 2.7V, V_{EE} = -8.1V, Voltage Generator Disabled, R/$\overline{W}$($\overline{WR}$) Halt, Typ. Osc. Freq., Display On, V_{L6} - V_{DD} = -9V, no panel attached.	-	60	100	µA
I_{DP2}	Display Mode Supply Current Drain (V_{DD} Pins)	V_{DD} = 2.7V, V_{EE} = -8.1V, Voltage Generator On, 4x DC-DC Converter Enabled, R/$\overline{W}$($\overline{WR}$) Halt, Typ. Osc. Freq., Display On, V_{L6} - V_{DD} = -9V, no panel attached.	-	150	200	µA
I_{SB}	Standby Mode Supply Current Drain (V_{DD} Pins)	V_{DD} = 2.7V, LCD Driving Waveform Off, Typ. Osc. Freq., R/$\overline{W}$($\overline{WR}$) halt.	-	3.5	10	µA
I_{SLEEP}	Sleep Mode Supply Current Drain (V_{DD} Pins)	V_{DD} = 2.7V, LCD Driving Waveform Off, Oscillator Off, R/$\overline{W}$($\overline{WR}$) halt.	-	0.2	5	µA
V_{EE}	LCD Driving Voltage Generator Output (V_{EE} Pin)	Display On, Voltage Generator Enabled, DC-DC Converter Enabled, Typ. Osc. Freq., Regulator Enabled, Divider Enabled.	-12.0	-	-1.8	V
V_{LCD}	LCD Driving Voltage Input (V_{EE} Pin)	Voltage Generator Disabled.	-12.0	-	-1.8	V

Table 10 DC Characteristics (Unless otherwise specified, Voltage Referenced to V_{SS}, V_{DD} = 2.4 to 3.5V, T_A = -30 to 85°C.)

Symbol	Parameter	Test Condition	Min	Typ	Max	Unit
V_{OH1}	Logic High Output Voltage	I_{out}=-100µA	0.9*V_{DD}	-	V_{DD}	V
V_{OL1}	Logic Low Output Voltage	I_{out}=100µA	0	-	0.1*V_{DD}	V
V_{L6}	LCD Driving Voltage Source (V_{L6} Pin)	Regulator Enabled (V_{L6} voltage depends on Int/Ext Contrast Control)	V_{EE}-0.5	-	V_{DD}	V
V_{L6}	LCD Driving Voltage Source (V_{L6} Pin)	Regulator Disable	-	Floating	-	V
V_{IH1}	Logic High Input voltage		0.8*V_{DD}	-	V_{DD}	V
V_{IL1}	Logic Low Input voltage		0	-	0.2*V_{DD}	V
V_{L2} V_{L3} V_{L4} V_{L5} V_{L6}	LCD Display Voltage Output (V_{L2}, V_{L3}, V_{L4}, V_{L5}, V_{L6} Pins)	Voltage reference to V_{DD}, Bias Divider Enabled, 1:a bias ratio	- - - - -	1/a*V_{L6} 2/a*V_{L6} (a-2)/a*V_{L6} (a-1)/a*V_{L6} V_{L6}	- - - - -	V V V V V
V_{L2} V_{L3} V_{L4} V_{L5} V_{L6}	LCD Display Voltage Input (V_{L2}, V_{L3},V_{L4}, V_{L5}, V_{L6} Pins)	Voltage reference to V_{DD}, External Voltage Generator, Bias Divider Disabled	V_{L3} V_{L4} V_{L5} V_{L6} -12V	- - - - -	V_{DD} V_{L2} V_{L3} V_{L4} V_{L5}	V V V V V
I_{OH}	Logic High Output Current Source	V_{out} = V_{DD}-0.4V	50	-	-	µA
I_{OL}	Logic Low Output Current Drain	V_{out} = 0.4V	-	-	-50	µA
I_{OZ}	Logic Output Tri-state Current Drain Source		-1	-	1	µA
I_{IL}/I_{IH}	Logic Input Current		-1	-	1	µA
C_{IN}	Logic Pins Input Capacitance		-	5	7.5	pF
ΔV_{L6}	Variation of V_{L6} Output (V_{DD} is fixed)	Regulator Enabled, Internal Contrast Control Enabled, Set Contrast Control Register = 0	-3	0	3	%
	Temperature Coefficient Compensation					
TC0	Flat Temperature Coefficient (POR)	Voltage Regulator Enabled	0	-0.01	-0.12	%/°C
TC2	Temperature Coefficient 2*	Voltage Regulator Enabled	-0.12	-0.15	-0.17	%/°C
TC4	Temperature Coefficient 4*	Voltage Regulator Enabled	-0.17	-0.20	-0.25	%/°C
TC7	Temperature Coefficient 7*	Voltage Regulator Enabled	-0.25	-0.30	-	%/°C

* The formula for the temperature coefficient is:

$$TC(\%) = \frac{V_{ref} \text{ at } 50°C - V_{ref} \text{ at } 0°C}{50°C - 0°C} \times \frac{1}{V_{ref} \text{ at } 25°C} \times 100\%$$

AC CHARACTERISTICS

Table 11 AC Characteristics (Unless otherwise specified, Voltage Referenced to V_{SS}, V_{DD} = 2.4 to 3.5V, T_A = 25°C.)

Symbol	Parameter	Test Condition	Min	Typ	Max	Unit
F_{OSC}	Oscillation Frequency of Display Timing Generator for: • SSD1815B	Internal Oscillator Enabled (default), V_{DD} = 2.7V Remark: Oscillation Frequency vs Temperature change (-20°C to 70°C): -0.5%/°C *	17	19	23	kHz
F_{FRM}	Frame Frequency for: • SSD1815B	132 x 64 Graphic Display Mode, Display ON, Internal Oscillator Enabled 132 x 64 Graphic Display Mode, Display ON, Internal Oscillator Disabled, External clock with freq., F_{ext}, feeding to CL pin.		$\frac{F_{OSC}}{4 \times 65}$ $\frac{F_{ext}}{4 \times 65}$		Hz Hz

* The formula for Oscillation Frequency vs Temperature Change:

$$\%change\ (F_{osc}) = \frac{F_{osc}\ at\ 70°C - F_{osc}\ at\ -20°C}{70°C - (-20°C)} \times \frac{1}{F_{osc}\ at\ 25°C} \times 100\%$$

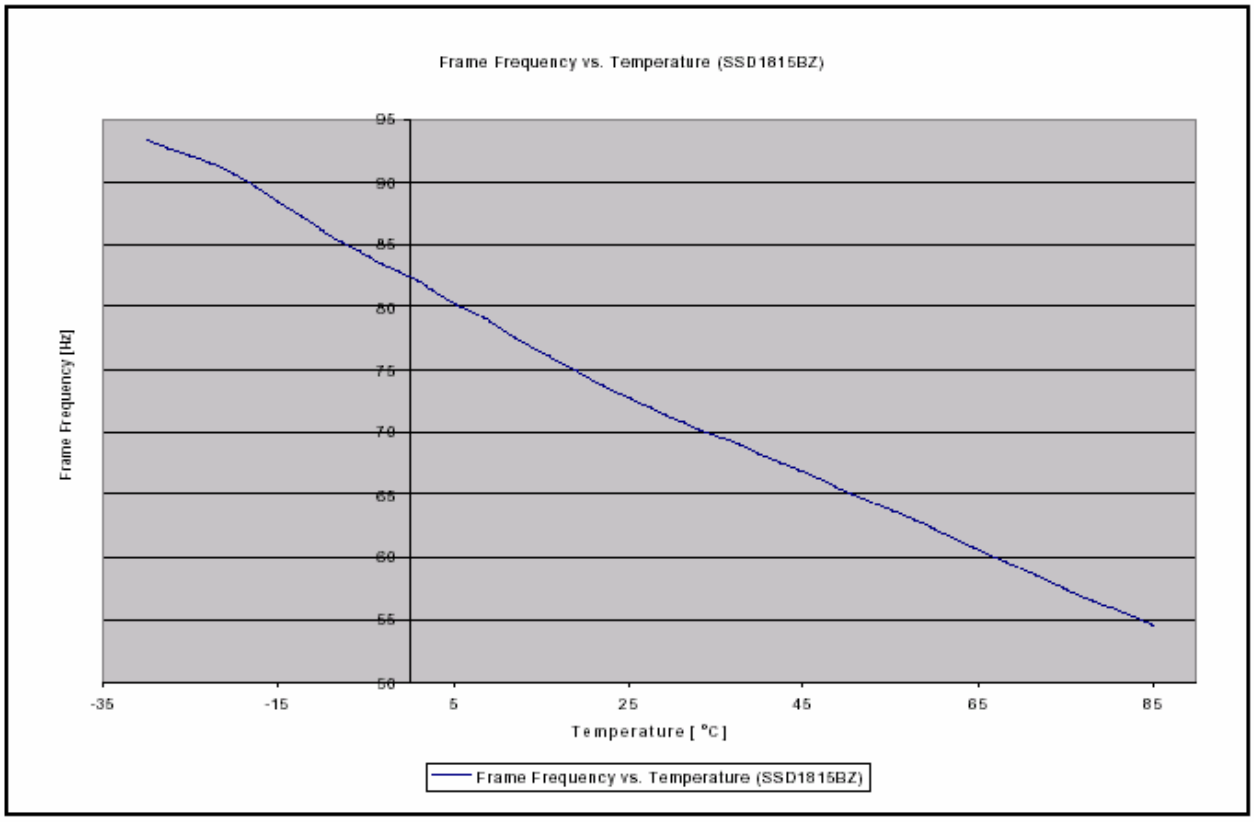


Table 12 6800-Series MPU Parallel Interface Timing Characteristics (V_{DD} - V_{SS} = 2.4 to 3.5V, T_A = -30 to 85°C)

Symbol	Parameter	Min	Typ	Max	Unit
t_{cycle}	Clock Cycle Time	300	-	-	ns
t_{AS}	Address Setup Time	0	-	-	ns
t_{AH}	Address Hold Time	0	-	-	ns
t_{DSW}	Write Data Setup Time	40	-	-	ns
t_{DHW}	Write Data Hold Time	15	-	-	ns
t_{DHR}	Read Data Hold Time	20	-	-	ns
t_{OH}	Output Disable Time	-	-	70	ns
t_{ACC}	Access Time	-	-	140	ns
PW_{CSL}	Chip Select Low Pulse Width (read) Chip Select Low Pulse Width (write)	120 60	- -	- -	ns ns
PW_{CSH}	Chip Select High Pulse Width (read) Chip Select High Pulse Width (write)	60 60	- -	- -	ns ns
t_R	Rise Time	-	-	15	ns
t_F	Fall Time	-	-	15	ns

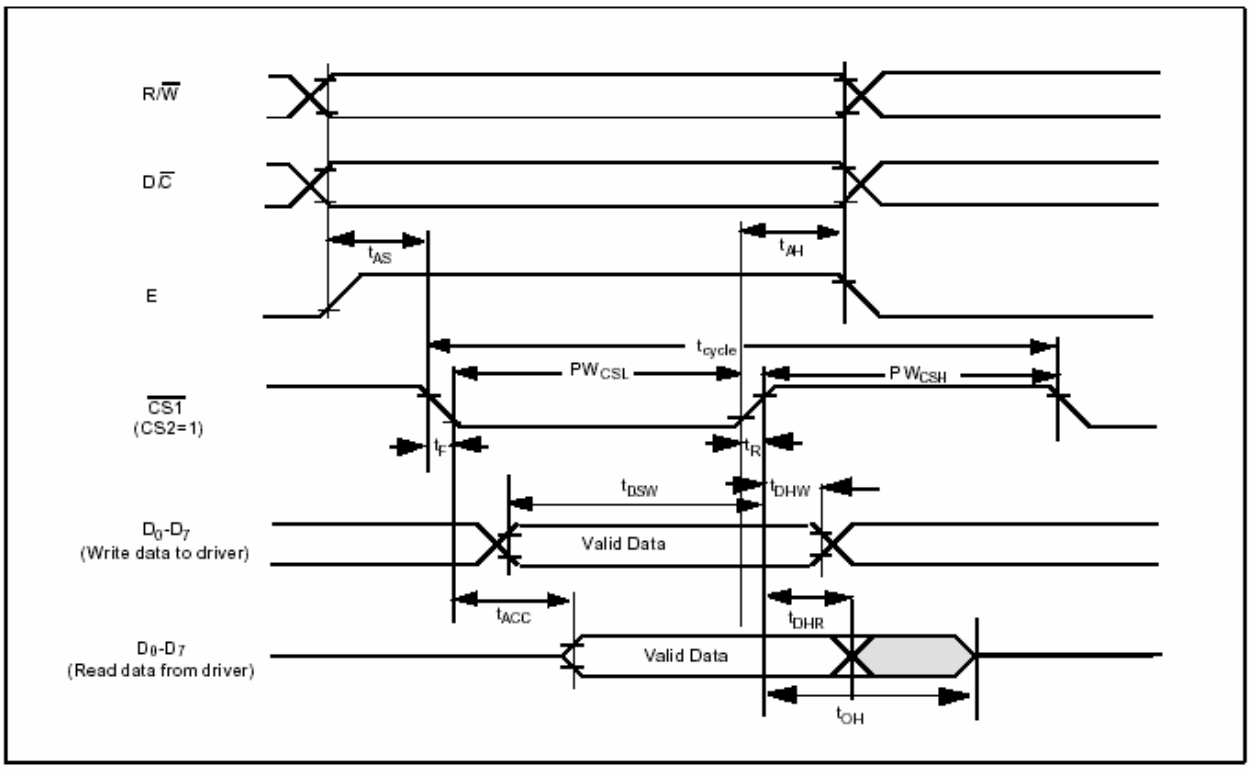


Figure 11 6800-series MPU Parallel Interface Characteristics

Table 13 8080-Series MPU Parallel Interface Timing Characteristics (V_{DD} - V_{SS} = 2.4 to 3.5V, T_A = -30 to 85°C)

Symbol	Parameter	Min	Typ	Max	Unit
t_{cycle}	Clock Cycle Time	300	-	-	ns
t_{AS}	Address Setup Time	0	-	-	ns
t_{AH}	Address Hold Time	0	-	-	ns
t_{DSW}	Write Data Setup Time	40	-	-	ns
t_{DHW}	Write Data Hold Time	15	-	-	ns
t_{DHR}	Read Data Hold Time	20	-	-	ns
t_{OH}	Output Disable Time	-	-	70	ns
t_{ACC}	Access Time	-	-	140	ns
PW_{CSL}	Chip Select Low Pulse Width (read) Chip Select Low Pulse Width (write)	120 60	- -	- -	ns ns
PW_{CSH}	Chip Select High Pulse Width (read) Chip Select High Pulse Width (write)	60 60	- -	- -	ns ns
t_R	Rise Time	-	-	15	ns
t_F	Fall Time	-	-	15	ns

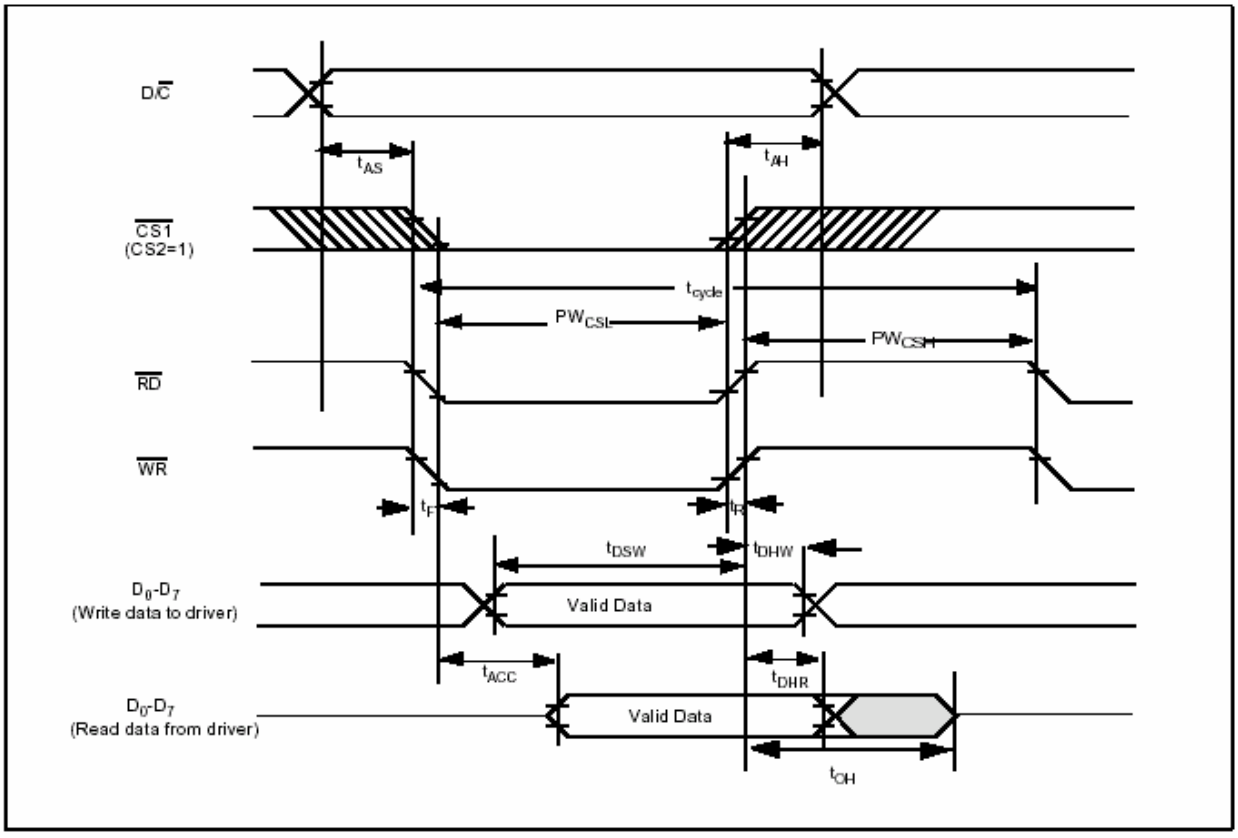


Figure 12 8080-series MPU Parallel Interface Characteristics

Table 14 Serial Interface Timing Characteristics (V_{DD} - V_{SS} = 2.4 to 3.5V, T_A = -30 to 85°C)

Symbol	Parameter	Min	Typ	Max	Unit
t_{cycle}	Clock Cycle Time	250	-	-	ns
t_{AS}	Address Setup Time	150	-	-	ns
t_{AH}	Address Hold Time	150	-	-	ns
t_{CSS}	Chip Select Setup Time (for D_7 input)	120	-	-	ns
t_{CSH}	Chip Select Hold Time (for D_0 input)	60	-	-	ns
t_{DSW}	Write Data Setup Time	100	-	-	ns
t_{DHW}	Write Data Hold Time	100	-	-	ns
t_{CLKL}	Clock Low Time	100	-	-	ns
t_{CLKH}	Clock High Time	100	-	-	ns
t_R	Rise Time	-	-	15	ns
t_F	Fall Time	-	-	15	ns

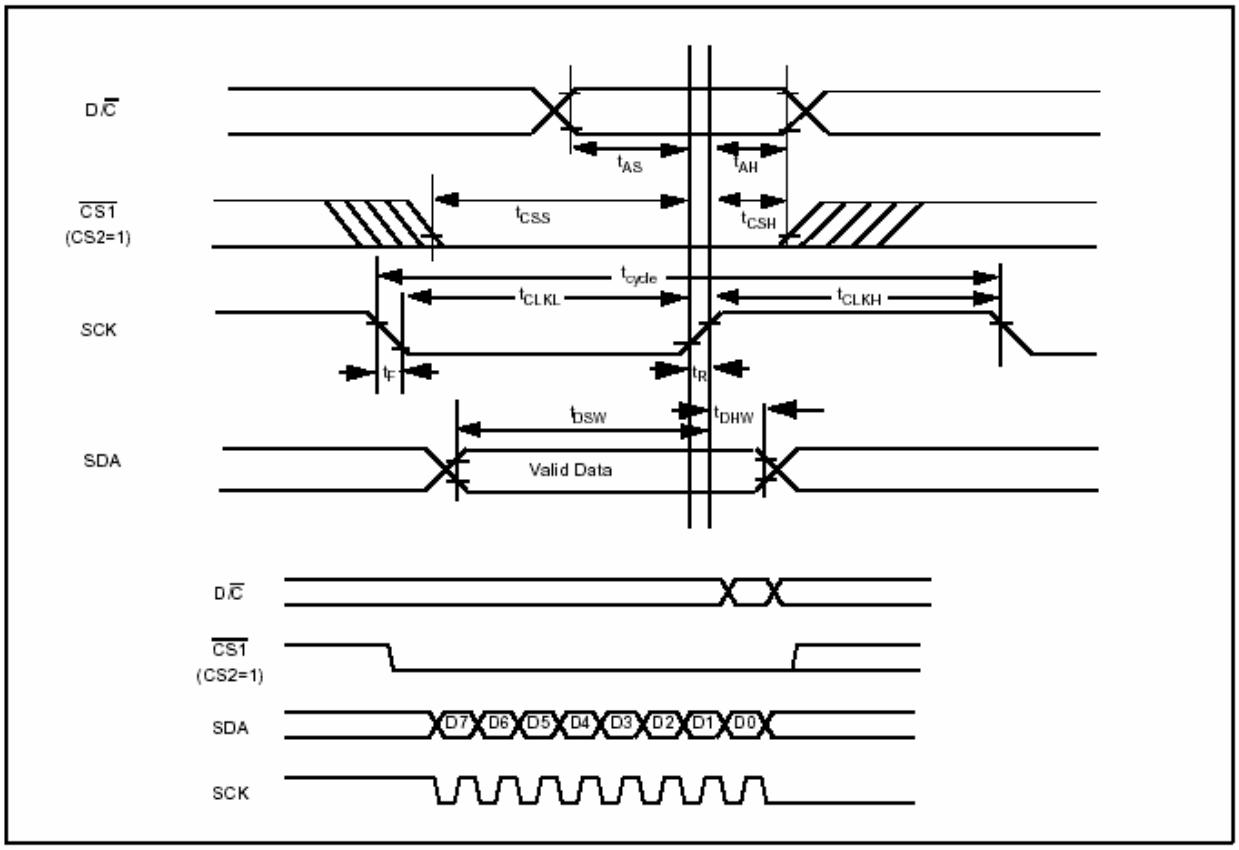


Figure 13 Serial Interface Characteristics

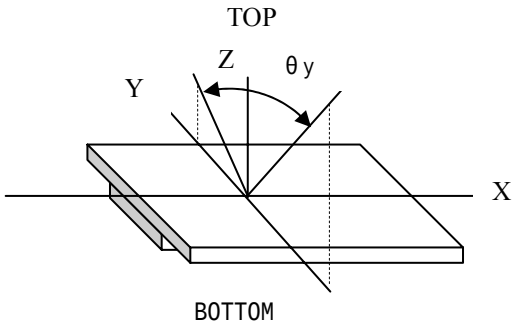
6、Electro –optical Characteristics

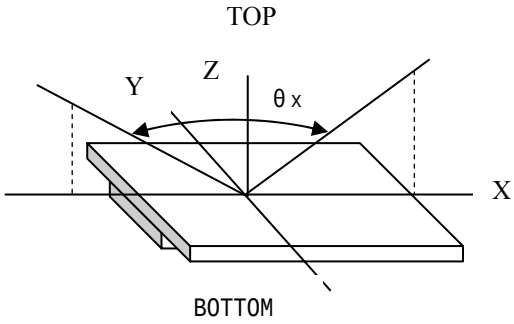
6.1、Electro-optical Characteristics

Item		Symbol	Condition		Standard Value			Unit
					Min.	Typ.	Max.	
Viewing Angle		θx	Cr=5	θy =0°	-30	-	30	Deg
		θy		θx =10°	-30	-	30	
Contrast Ratio		Cr	θx =0° θy =0°		5	-	-	
Response Time	Turn on	Ton	θx =25° θy =25°		-	-	250	ms
	Turn off	Toff			-	-	250	

6.2、Definition of Electro-optical Characteristics

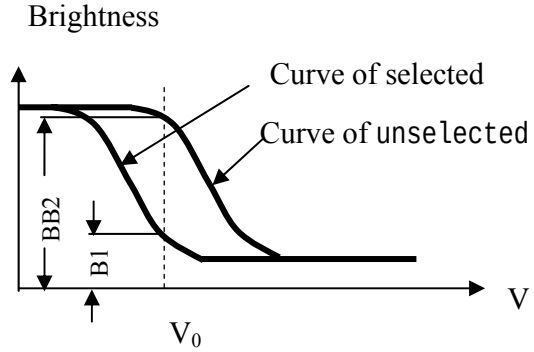
6.2.1、Definition of Viewing Angle





6.2.2、Definition of Contrast Ratio

$$\text{Contrast Ratio} = B2/B1 = \frac{\text{Unselected state brightness}}{\text{Selected state brightness}}$$



Measuring Conditions

1) Ambient Temperature: 25℃
2) Frame frequency : 60Hz
3) θx= θy=0°

7、I/O terminal

NO.	Symbol	Description
1	VDD	Shared with the MPU power supply terminal VCC
2	/RES	When RES is set to LOW , the settings are initialized. The reset operation performed by the RES signal level
3	A0	This is connect to the least significant bit of the normal MPU address bus , and it determines whether the data bits are data or a command.
4	R/W	When connected to an 6800 Series MPU ,this is the read/wwrite control signal input terminal . when r/w =HIGH :Read.. when r/w =LOW:write
5	E	When connected to an 6800 Series MPU , this is active HIGH This is the 6800 Series MPU enable clock input terminal.
6	D0	Data bit
7	D1	Data bit
8	D2	Data bit
9	D3	Data bit
10	D4	Data bit
11	D5	Data bit
12	D6	Data bit
13	D7	Data bit
14	VDD	Shared with the MPU power supply terminal VCC
15	VSS	This is a 0V terminal connected to system GND.
16	VOUT	DC/DC voltage converter. Connect a capacitor between this terminal and vss2.
17	CAP3-	DC/DC voltage converter . connect a capacitor between this terminal and the CAP1+ terminal
18	CAP1+	DC/DC voltage converter . connect a capacitor between this terminal and the CAP1- terminal
19	CAP1-	DC/DC voltage converter . connect a capacitor between this terminal and the CAP1+ terminal
20	CAP2-	DC/DC voltage converter . connect a capacitor between this terminal a the CAP2+ terminal
21	CAP2+	DC/DC voltage converter . connect a capacitor between this terminal and the CAP2- terminal
22	V1	LCD driver supply voltages
23	V2	LCD driver supply voltages
24	V3	LCD driver supply voltages
25	V4	LCD driver supply voltages
26	V5	LCD driver supply voltages

NO.	Symbol	Description
27	VR	Output voltage regulator terminal. Provides the voltage between VDD and V5 through a resistive voltage divider.
28	VDD	Shared with the MPU power supply terminal VCC
29	IRS	This terminal selects the resistors for the V5 voltage level adjustment.
30	VDD	Shared with the MPU power supply terminal VCC

8. **INSPECTION CRITERIA**

Refer to Appendix:《INSPECTION CRITERIA》

9、Reliability

9.1、Content of Reliability Test

	No	Test Item	Content of Test	Test Condition
Environment Test	1	High Temperature Storage	Endurance test of high temperature for a long time.	70±2℃ 96H
	2	Low Temperature Storage	Endurance test of low temperature for a long time.	-30±2℃ 96H
	3	High Temperature Operation	Endurance test of electrical stress (Voltage & Current) and the thermal stress to the element.	60±2℃ 96H
	4	High Temperature /Humidity Storage	Endurance Test of high temperature and high humidity for a long time.	40±2℃ 90±2%RH 96H
	5	Thermal shock	Endurance test of low and high temperature cycles.(air to air) -30±2℃ ← → 60±2℃ (60min) (60min) 1 cycle	-20±2℃/60±2℃ 10 cycle

Note: 1) When making the low temperature test, not to dewy.

2) Driving condition for operation test.

Power Supply Voltage for Logic System (VDD) =3.2V

9.2、Failure Judgment Criterion

After the above mentioned test.

(For Environmental Test, after 2 hours in room temperature.)

1) There should not be conspicuous failure of display quality and appearance.
2) Contrast ratio should be 50% of the initial contrast ratio.
3) There should not have any abnormality of functions.

10、Precaution for use of LCD module

10.1、Handling Precautions

1) The display panel is made of glass. Do not subject it to a mechanical shock by dropping it from a high place, etc.
2) If the display panel is damaged and the liquid crystal substance inside it leaks out ,be sure not to get any in your mouth, if the substance comes into contact with your skin or clothes, promptly wash it off using soap and water.
3) Do not apply excessive force to the display surface or the adjoining areas since this may cause the color tone to vary.
4) The polarizer covering the display surface of the LCD module is soft and easily scratched. Handle this polarizer carefully.

5) If the display surface is contaminated, breathe on the surface and gently wipe it with a soft dry cloth. If still not completely clear, moisten cloth with one of the following solvents:
--Isopropyl alcohol
--Ethyl alcohol
Solvents other than those mentioned above may damage the polarizer.
Especially, do not use the following:
--Water
--Ketone
--Aromatic solvents
6) Do not attempt to disassemble or process the LCD module.

10.2、Assembling Precautions

1) When mounting the LCD module make sure that it is free of twisting, warping, and distortion. Distortion has great influence upon display quality. Also keep the stiffness enough regarding the outer case.
2) Please handle the LCD module by its side.
3) NC terminal should be open. Do not connect anything.
4) If the logic circuit power is OFF, do not apply the input signals.
5) To prevent destruction of the elements by static electricity, be careful to maintain an optimum work environment.
·Be sure to ground the body when handling the LCD module.
·Tools required for assembly, such as soldering irons, must be properly grounded.
·To reduce the amount of static electricity generated, do not conduct assembly and other work under dry conditions.
·The LCD module is coated with a film to protect the display surface. Exercise care when peeling off this protective film since static electricity may be generated.
6) Be careful when treating the glass panel because it has very sharpened edge.

10.3、Storage Precautions

1) When storing the LCD module, avoid exposure to direct sunlight of to the light of fluorescent lamps and high temperature/high humidity. Whenever possible, the LCD module should be stored in the same conditions in which they were shipped from our company.
2) Exercise care to minimize corrosion of the electrode. Corrosion of the electrodes is accelerated by water droplets or a current flow in a high-humidity environment.

10.4、Design Precautions

1) The absolute maximum ratings represent the rated value beyond which LCD module can not exceed. When the LCD modules are used in excess of this rated value, their operation characteristics may be adversely affected.
2) To prevent the occurrence of erroneous operation caused by noise, attention must be paid to satisfy V_{IL}, V_{IH} specification values including taking the precaution of using signal cables that are short.
3) The LCD exhibits temperature dependency characteristics. Since recognition of the display becomes difficult when the LCD is used outside its designated operating temperature range, be

sure to use the LCD within this range. Also keep in mind that the LCD driving voltage levels necessary for clear displays will vary according to temperature.

4) We recommended that power supply lines (VDD) have over-current protection line. (Fuse etc. Recommend Value:0.5A)
5) Sufficiently notice the mutual noise interference occurred by peripheral devices.
6) To cope with EMI, take measures basically on outputting side.
7) When installing an LCD module, fasten it at the LCD panel.
8) The display panel is made of general float glass which is not guaranteed for strength. So please consider about following.
   ·Do not subject panel to a mechanical shock by dropping directly.
   ·Do not let case to touch to panel directly.

10.5、Others

1) Liquid crystal solidifies under low temperature (below the storage temperature range) leading to defective orientation or the generation of air bubbles (black or white). Air bubbles may also be generated if the LCD module is subjected to a strong shock at a low temperature.
2) If the LCD modules have been operating for a long time showing the same display patterns, the display patterns may remain on the screen as ghost images and a slight contrast irregularity may also appear. A normal operating status can be regained by suspending use for some time. It should be noted that this phenomenon does not adversely affect performance reliability.
3) To minimize the performance degradation of the LCD module's resulting from destruction caused by static electricity, etc., exercise care to avoid touching the following section when handling this module: LCD's Terminal electrode sections.
4) Optimum voltage to obtain best contrast value depending on products. Therefore voltage adjustment with electric volume is required in each display.
5) Precaution for disposal of LCD module. When disposal of LCD module, ask specialization company of industrial waste which is permitted by the government. When burn up LCD module, obey the law of environmental hygienics.

11、Outline dimensions
