

PRODUCT SPECIFICATIONSProduct Name: LCD ModuleModel PartNumber: HG1286404G-bTCOL-VKRevision: R1 Date: 2016-3-24

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Custoer Confirmed Message: _____

Approved By: _____ Date: _____

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Revision History



The following table tracks the history of the changes made to this document.

Date	Rev.	Content	Design
2015-3-29	R0	Orign Released	LGH
2016-3-24	R1	Product label and increase the double-sided adhesive on the back	贺园

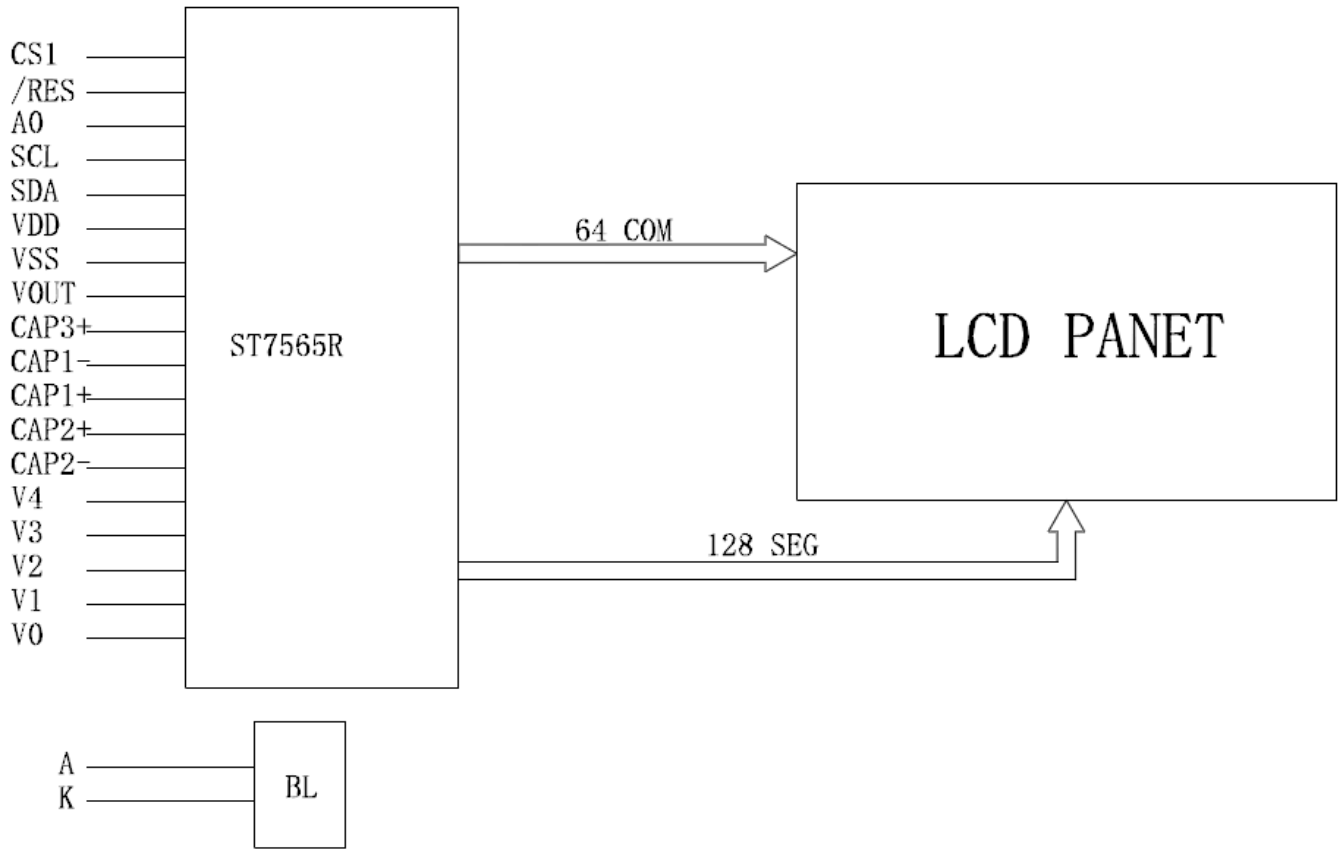
1. TECHNOLOGY SPECIFICATIONS

S/N	Item	SPEC
1	Display Format	128 * 64 Dots
2	Display Mode	STN, Bule, Negative
3	Polarizer Mode	Transmissive
4	Driving Method	1/65Duty, 1/9 Bias
5	Viewing Direction	12 O'clock
6	Backlight	LED, White
7	Controller	ST7565R or Equivalent.
8	Interface	SPI
9	Weight	---

1.2 MECHANICAL SPECIFICATION

Item	Description	Unit
Module Dimension	79.2(W) × 49.8(H) × 6.0(T)	mm
Viewing Area	73.2 (W) × 39.2(H)	mm
Active Area	66.52(W) × 33.24(H)	mm
Dot Size	0.48(W) × 0.48(H)	mm
Dot Pitch	0.52(W) × 0.52(H)	mm
Character Matrix	---	dots
Character Size	---	mm

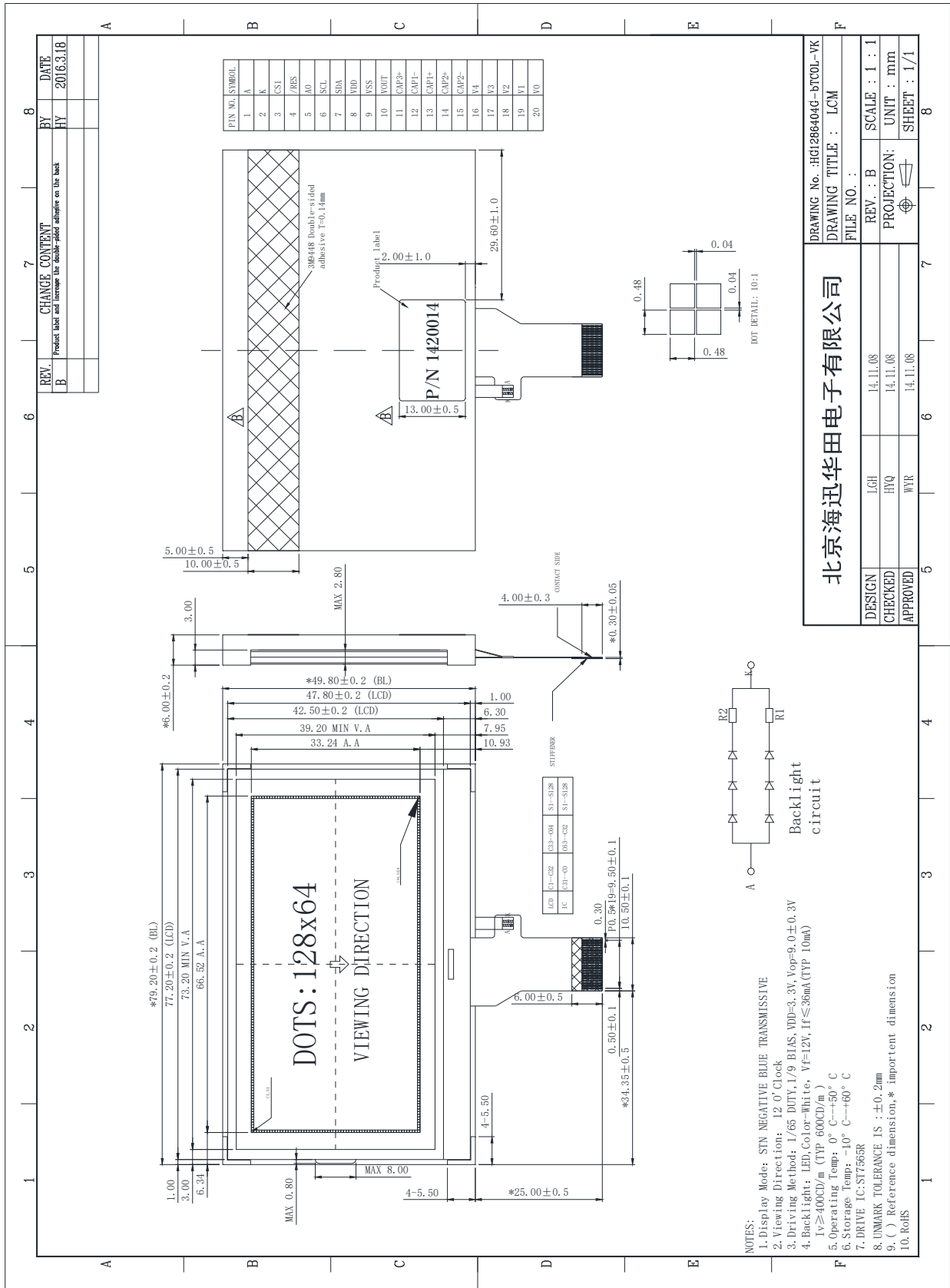
1.3 System Block Diagram



1.4 Terminal Functions

PIN No.	Symbol	Level	Function
1	A	--	Anode for backlight
2	K	--	Cathode for backlight
3	CS1	H/L	Chip select signal
4	/RES	H/L	When "/RES" is setted to L, the register settings are initialized(cleared)
5	AO	H/L	It determines whether the data bits are data or command
6	SCL	H/L	The serial clock input
7	SDA	H/L	The serial data input
8	VDD	--	Power supply
9	VSS	--	Ground
10	VOUT	--	DC/DC voltage converter
11	CAP3+	--	DC/DC voltage converter
12	CAP1-	--	DC/DC voltage converter
13	CAP1+	--	DC/DC voltage converter
14	CAP2+	--	DC/DC voltage converter
15	CAP2-	--	DC/DC voltage converter
16	V0	--	This is multi-level power supply for liquid crystal drive
17	V1	--	This is multi-level power supply for liquid crystal drive
18	V2	--	This is multi-level power supply for liquid crystal drive
19	V3	--	This is multi-level power supply for liquid crystal drive
20	V4	--	This is multi-level power supply for liquid crystal drive

1.5 DIMENSIONAL OUTLINE



2. Absolute Maximum Ratings

Item	Symbol	Min.	Max.	Unit
Supply Voltage (Logic)	VDD-VSS	2.4	3.3	V
Supply Voltage (LCD)	VLCD	8.7	9.3	V
Input Voltage	VI	VSS-0.3	VDD+0.3	V
Operating Temperature	Topr	0	50	°C
Storage Temperature	Tstg	-10	60	°C

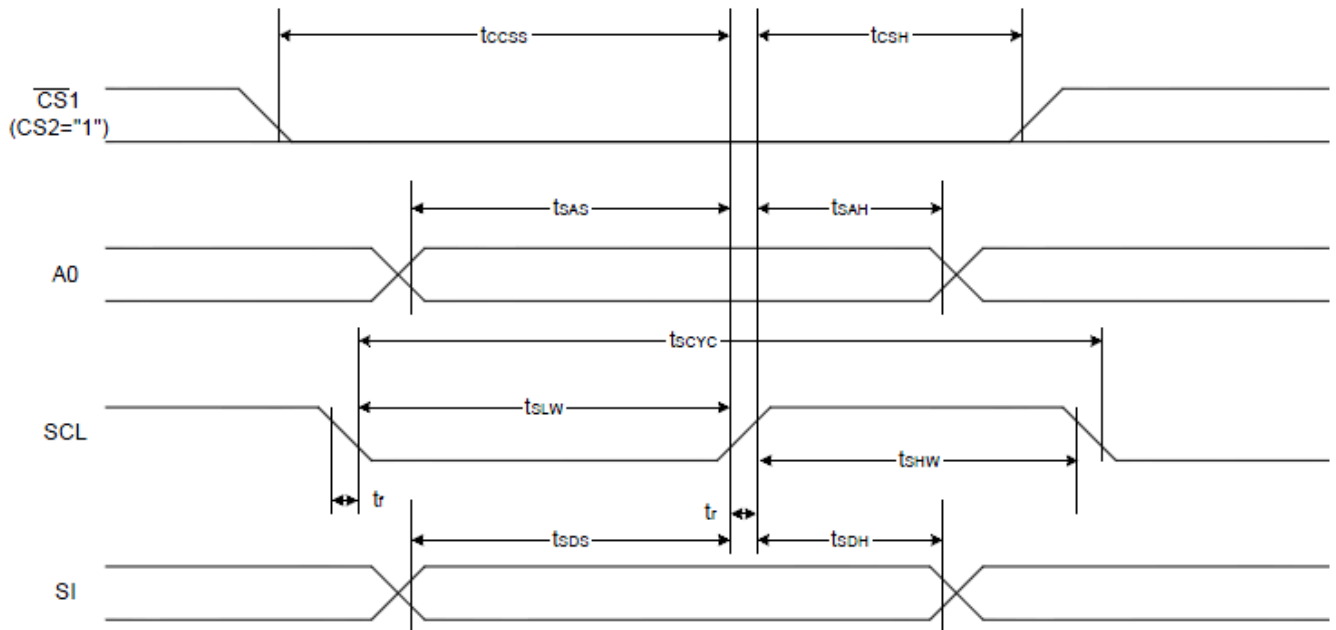
3. Electrical Characteristics

3.1 DC Characteristics (Ta=25 °C)

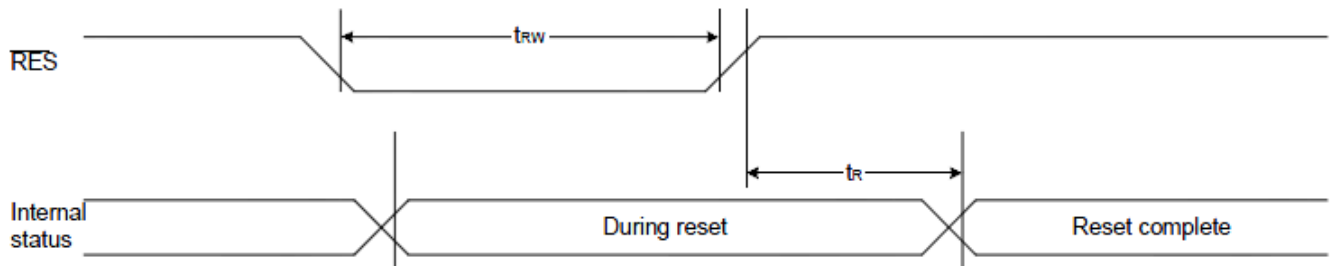
Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Supply Voltage (Logic)	VDD		3.0	3.3	3.6	V
Supply Voltage (LCD Drive)	VLCD-VSS	Ta = 25°C	8.7	9.0	9.3	V
Input High Voltage	VIH		0.8VDD	---	VDD	V
Input Low Voltage	VIL		0	---	0.2VDD	V
LCM Current (include LED Current)	ILCM		---	0.23	--	mA
LED Current	ILED		--	20	--	mA

3.2 Timing Diagram

The 4-line SPI Interface



Reset Timing

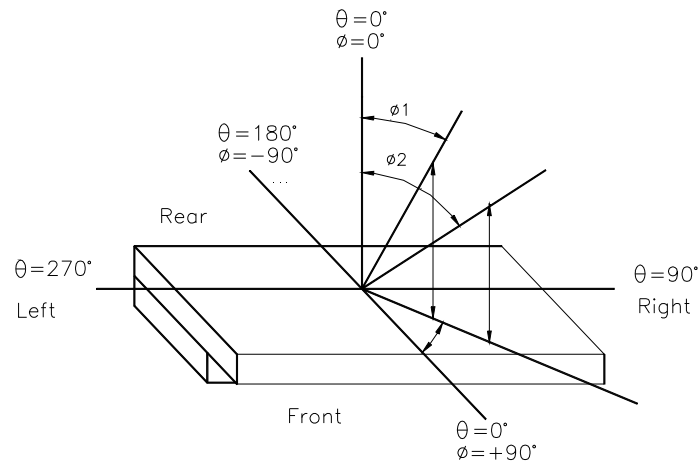


3.3 Optical Characteristics (Ta=25 °C)

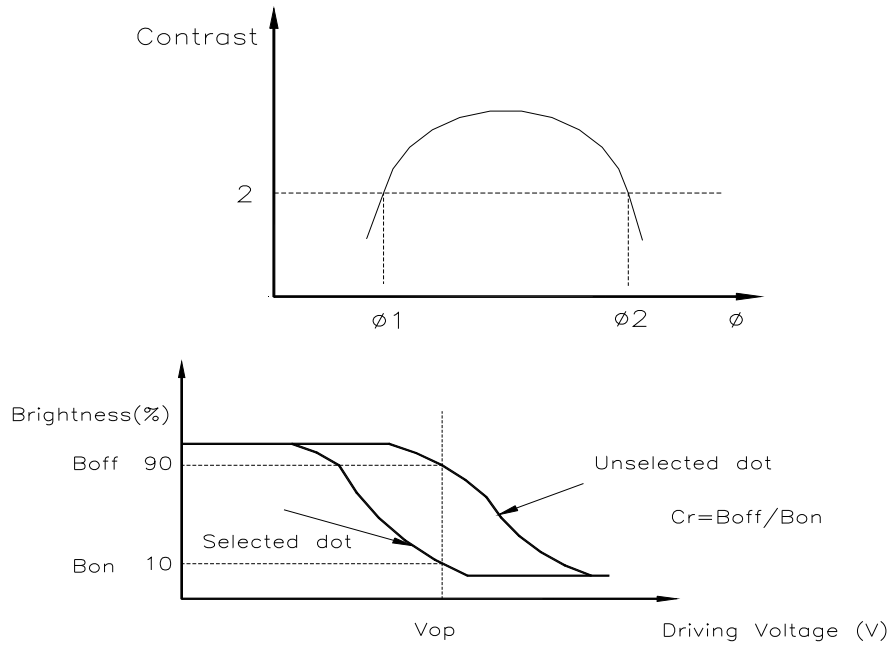
ITEM	SYMBOL	CONDITION	MIN	TYPE	MAX	UNIT
VIEW ANGLE	$\Delta\phi$	$\theta=0^\circ, Cr \geq 2$ $-90^\circ < \phi_1, \phi_2 < 90^\circ$	-	40	-	Deg
CONTRAST	Cr	$\phi=0^\circ, \theta=0^\circ$	2	5	-	—
RESPONSE TIME	tr(rise)	$\phi=0^\circ, \theta=0^\circ$	-	-	200	ms
	tf(fall)	$\phi=0^\circ, \theta=0^\circ$	-	-	200	ms

NOTE1: Definition of Viewing Angle θ, ϕ

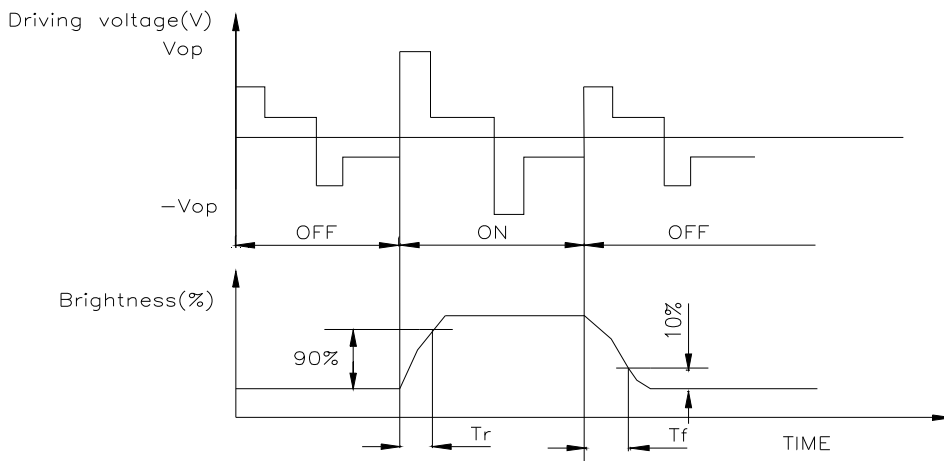
NOTE2: Definition of viewing Angle Range: $\Delta\phi = |\phi_2 - \phi_1|$



NOTE3: Definition of Contrast



NOTE4: Definition of Response Time



4. LED Backlight Characteristics (Ta = 25°C)

Item	Symbol	Min.	Typ.	Max.	Condition	Unit
Forward Current	If	10	20	36	Vf =12V	mA
Reverse Current	Ir			15/LED	Vr = 5V	uA
Peak Wave Length	λ_p				Vf =12V	nm
Spectral Line Half Width	$\Delta\lambda$				Vf =12V	nm
Colour Coordinate	X	0.25		0.32	Vf =12V	
	Y	0.25		0.32	Vf =12V	
Luminance	Lv	400	600	--	Vf =12V	cd/m ²

5、DISPLAY CONTROL INSTRUCTION

Command	Command Code										Function	
	A0	/RD	/WR	D7	D6	D5	D4	D3	D2	D1		D0
(1) Display ON/OFF	0	1	0	1	0	1	0	1	1	1	0	LCD display ON/OFF 0: OFF, 1: ON
(2) Display start line set	0	1	0	0	1	Display start address					Sets the display RAM display start line address	
(3) Page address set	0	1	0	1	0	1	Page address					Sets the display RAM page address
(4) Column address set upper bit	0	1	0	0	0	0	1	Most significant column address				Sets the most significant 4 bits of the display RAM column address.
Column address set lower bit				0	0	0	0	Least significant column address				Sets the least significant 4 bits of the display RAM column address.
(5) Status read	0	0	1	Status				0	0	0	0	Reads the status data
(6) Display data write	1	1	0	Write data							Writes to the display RAM	
(7) Display data read	1	0	1	Read data							Reads from the display RAM	
(8) ADC select	0	1	0	1	0	1	0	0	0	0	0	Sets the display RAM address SEG output correspondence 0: normal, 1: reverse
(9) Display normal/reverse	0	1	0	1	0	1	0	0	1	1	0	Sets the LCD display normal/ reverse 0: normal, 1: reverse
(10) Display all points ON/OFF	0	1	0	1	0	1	0	0	1	0	0	Display all points 0: normal display 1: all points ON
(11) LCD bias set	0	1	0	1	0	1	0	0	0	1	0	Sets the LCD drive voltage bias ratio 0: 1/9 bias, 1: 1/7 bias (ST7565R)
(12) Read-modify-write	0	1	0	1	1	1	0	0	0	0	0	Column address increment At write: +1 At read: 0
(13) End	0	1	0	1	1	1	0	1	1	1	0	Clear read/modify/write
(14) Reset	0	1	0	1	1	1	0	0	0	1	0	Internal reset
(15) Common output mode select	0	1	0	1	1	0	0	0	*	*	*	Select COM output scan direction 0: normal direction 1: reverse direction
(16) Power control set	0	1	0	0	0	1	0	1	Operating mode			Select internal power supply operating mode
(17) V ₀ voltage regulator internal resistor ratio set	0	1	0	0	0	1	0	0	Resistor ratio			Select internal resistor ratio(Rb/Ra) mode
(18) Electronic volume mode set	0	1	0	1	0	0	0	0	0	0	1	Set the V ₀ output voltage electronic volume register
Electronic volume register set				0	0	Electronic volume value						
(19) Sleep mode set	0	1	0	1	0	1	0	1	1	0	0	0: Sleep mode, 1: Normal mode
(20) Booster ratio set	0	1	0	1	1	1	1	1	0	0	0	select booster ratio 00: 2x,3x,4x 01: 5x 11: 6x
(21) NOP	0	1	0	1	1	1	0	0	0	1	1	Command for non-operation
(22) Test	0	1	0	1	1	1	1	*	*	*	*	Command for IC test. Do not use this command

For more details, please refer to ST7565 SPEC.

6、Precautions For use of LCD Module

6.1 Handling Precautions

LCD modules are assembled and adjusted with a high degree of precision, do not applying excessive shocks to it or making any alterations or modifications to it, the following precautions should be taken when handing.

- The display panel is made of glass. Do not subject it to a mechanical shock by dropping it from a high place, etc.
- 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.
- Do not apply excessive force on the surface of display or the adjoining areas of LCD module since this may cause the color tone to vary.
- If the display surface of LCD module becomes contaminated, blow on the surface and gently wipe it with a soft dry cloth. If it is heavily contaminated, 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
- The polarizer covering the display surface of the LCD module is soft and easily scratched. Handle this polarizer carefully.
 - To minimize the performance degradation of the LCD modules resulting from destruction caused by static electricity, etc., exercise care to avoid touching the following sections when handling the module:
 - Terminal electrode sections.
 - Part of pattern wiring on TAB, etc.

6.2 Electro-Static Discharge Control

- The IC mounted on the LCD is very susceptible to static electricity. To protect them from static electricity which your body and clothing collect, connect your body to the ground via a resistor of some $1M\Omega$ so that electricity should discharge connect the resistor close to your body in the grounding line and protect yourself from electric shock hazard.
- Module should be store in antistatic bag or other containers resistant to static after remove from its original package.
- The LCD modules use CMOS LSI drivers, so customers are recommend that any unused input terminal would be connected to VDD or VSS, do not input any signals before power is turned on, and ground your body, work/assembly areas, assembly equipment to protect against static electricity.

- In order to reduce the generation of static electricity, a relative humidity of 50-60% is recommended.
- The LCD module is coated with a film to protect the display surface. Take care when peeling off this protective film since static electricity may be charged.
- Tools required for assembly, such as soldering irons, must be properly grounded.

6.3 Design Precautions

- 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 operating characteristics may be adversely affected.
- To prevent the occurrence of erroneous operation caused by noise, attention must be paid to satisfy VIL, VIH specification values, including taking the precaution of using signal cables that are short.
- The liquid crystal display 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.
- Sufficiently notice the mutual noise interference occurred by peripheral devices.
- To cope with EMI, take measures basically on outputting side.
- If DC is impressed on the liquid crystal display panel, display definition is rapidly deteriorated by the electrochemical reaction that occurs inside the liquid crystal display panel. To eliminate the opportunity of DC impressing, be sure to maintain the AC characteristics of the input signals sent to the LCD Module.

6.4 Soldering Precautions

Soldering should apply to I/O terminals only.

- Soldering temperature is $280^{\circ}\text{C}+(-)10^{\circ}\text{C}$.
- Soldering time 3-4 seconds.
- Eutectic solder (rosin flux filled) should be used.
- Only properly grounded soldering iron should be used.
- If soldering flux is used, be sure to remove any remaining flux after finishing the soldering operation and LCD surface should be covered during soldering to prevent any damage to flux spatters.
- When remove the lead wires from the I/O terminals, use proper de-soldering methods, e.g. suction type de-soldering irons. Do not repeat wiring by soldering more than three times at the pads and plated through holes may be damaged.

6.5 Operational Precautions

- Do not remove the panel or frame from the liquid crystal display module.
- Power supplies should always be turned on before the independent input signal sources turned on, and input signals should be turned off before power supplies turned off.

The IC would break down if the driving voltage exceeds the limit. Make sure of electrical specifications, particularly the supply voltage.

- It is an indispensable condition to drive LCD's within the specified voltage limit since the higher voltage than the limit causes the shorter LCD life. The use of direct current drive should be avoided because an electrochemical reaction due to direct current causes LCD's undesirable deterioration.
- Some font will be abnormally displayed when the display area is pushed hard during operation. But It resumes normal condition after turning off once.
- The response of the display is slow when the ambient temperature is below the lower limit, and the display surface appears dark everywhere when the ambient temperature is above the upper limit, in any case, it does not mean failure. It operates properly in the normal operating temperature range.
- The contrast of the liquid crystal display varies with the viewing angle, ambient temperature, and driving voltage. Adjust the driving voltage for the best contrast by installing external variable switch.
- 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.
- Condensation on terminals can cause an electrochemical reaction disrupting the terminal circuit. To reduce the amount of static electricity generated, do not conduct assembly and other work under dry conditions. Therefore it must be used under the relative condition of 50% RH.

6.6 Storage Precautions

- Take care to minimize corrosion of the electrodes. Water droplets or a current flow in a high humidity environment accelerates corrosion of the electrodes.
- When storing the LCD module, avoid exposure to direct sunlight or to the light of fluorescent lamps. Keep the LCD module in sealed polyethylene bags designed to prevent static electricity charging under low temperature / normal humidity conditions (avoid high temperature / high humidity and low temperature below 0). The temperature range of 0°C~ -30°C and at low humidity is recommended.

Whenever possible, the LCD module should be stored in the same conditions in which they were shipped from our company.

7.QUALITY SPECIFICATION

7.1 ACCEPTABLE QUALITY LEVEL

Inspection items	Sampling procedures	AQL
Visual-operating (Electro-optical)	GB2828-81 Inspection level II Normal inspection Single sample inspection	0.65
Visual-not operating	GB2828-81 Inspection level II Normal inspection Single sample inspection	1.5
Dimension measurement	GB2828-81 Inspection level II Normal inspection Single sample inspection	1.5

7.2 INSPECTION CONDITIONS

7.2.1 THE ENVIRONMENTAL

-Room temperature: 25±3 oC -Humidity: 65±20%RH

7.2.2 MTTF (Mean-Time-To-Fail)

The LCD is designed to meet the MTTF by 50,000 hours under normal room conditions
(25°C,65%RH,without sun-shine)

7.3 INSPECTION STANDARDS

7.3.1 VISUAL WHILE OPERATING

Items to be inspected	Inspection standard
No display	If any pattern is not active at all, they can be rejected.
Irregular operating	No irregular operating are allowed Appeared different display, which they should be chosen in the pattern, or appeared in different position where they should be chosen.
Irregular display	Any segment doesn't active, they can be rejected.
Over current	The total current required to activate the module should not be exceed the MAX current in specification.
View angles	Valves that don't meet the minimum value noted in the specification. they can be rejected.
Contrast	Valves that don't meet the minimum value noted in the specification, they can be reject.
.LCD operate voltage	Meet the specification.

7.3.2 Visual while not operating

Module dimension	Meet the module outline drawing, not exceed the tolerance.
LCD panel scratch	Following scratches inside the effective viewing area considered as the defects when their width & length are larger than the following combinations. Number: one or more Width: 0.1 length: 3.0 three or more Width: 0.05 length: 2.0 three or more Width: 0.03 length: 3.0 When the defects exceed this, it can be rejected.