Product Specification

(Preliminary)

Part Name: Monochrome LCD Display Module

Part No.: BGG12864-39 SERIES

Doc No.: SAS1-1508-A

Customer:		
Approved by:		

From: Blaze Display Technology Co., Ltd.
Approved by:

Blaze Display Technology Co., Ltd.

5/F, HSAE Tech Building, Hi-Tech Park, Nanshan, Shenzhen, China, 518057 Http://www.blazedisplay.com

Notes:

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- 2. The information contained herein is presented merely to indicate the characteristics and performance of our products. No responsibility is assumed by Blaze Display Technology Co., Ltd. for any intellectual property claims or other problems that may result application based on the module described herein.



Revised History

Part Number	Revision	Revision Content	Revised on
BGG12864-39-LB-FPTWD-1.0	1.0	New New	Oct 10th, 2018
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1. Basic Specifications

1.1 Display Specifications

1) Display Type: FSTN/Positive 2) Display Format: 128*64 DOTS

3) Character Color (ON): Black 4) Background Color (ON): White Background Color (OFF): White

5) Drive Method: 1/65 Duty; 1/9Bias

6) Viewing Direction: 6:00

7) Polarizer Type: Transflective

1.2 Mechanical Specifications

1) Outline Dimensions: According to the annexed outline drawing on the next page

2) Viewing Area: $70.70 \text{ W} \times 38.80 \text{ H (mm)}$ 3) Active Area: $66.52 \text{ W} \times 33.24 \text{ H (mm)}$ $0.52W \times 0.52 \text{ H (mm)}$ 4) Dot Pitch: 5) Dot Size: $0.48W \times 0.48 \text{ H (mm)}$

6) Weight: T.B.D.

1.3 Others

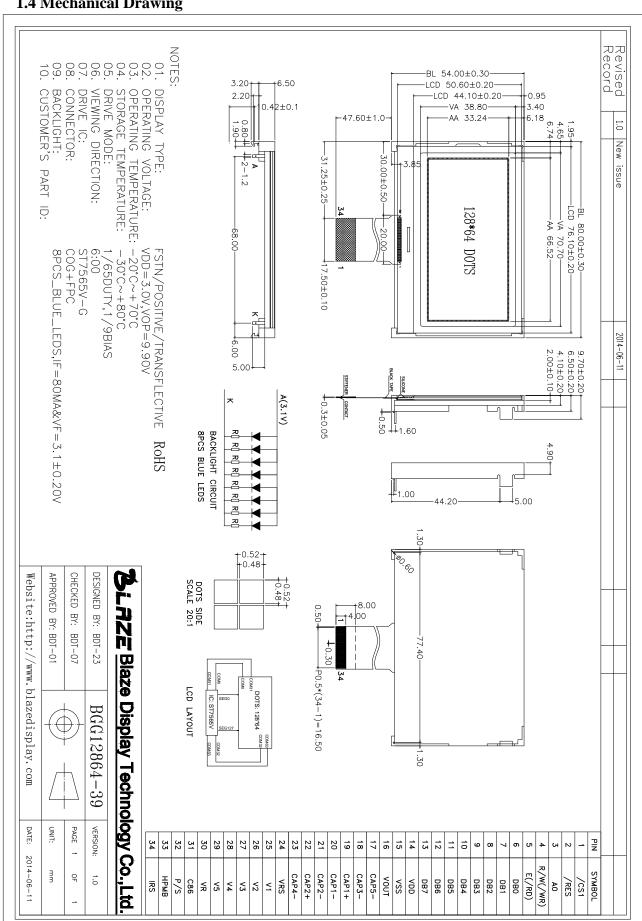
1) Driver IC: ST7565V-G

2) Backlight: 8PCS BLUE LED, If = 80mA, Vf = $3.1 \pm 0.2\text{V}$

3) Operating Temperature: $-20^{\circ}\text{C} - + 70^{\circ}\text{C}$ 4) Storage Temperature: $-30^{\circ}\text{C} - + 80^{\circ}\text{C}$

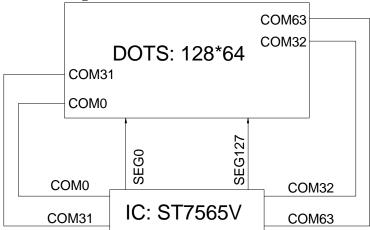
5) RoHS Compliant: Yes

1.4 Mechanical Drawing



2. Electrical Specification

2.1 Block Diagram



2.2 Absolute Maximum Ratings

Item	Symbol	Min.	Max.	Unit
Power Supply for Logic	Vdd	-0.3	+3.6	V
Power supply for LCD Drive	Vout	-13.5	+0.3	V
Input Voltage	Vin	-0.3	Vdd + 0.3	V
Operating Temperature	Topr	-20	+70	°C
Storage Temperature	Tstg	-30	+80	°C

2.3 Electrical Characteristics

Unless otherwise specified, Vss = -3.0V, VDD = 0V, Ta = -30 to 85°C

		Complete		Table 16	Rating		11	Applicable	
<u>'</u>	tem	Symbol	Co	ondition	Min.	Тур.	Max.	Units	Pin
Operating	g Voltage (1)	Vss				_	-1.8	v	Vss*1
Operating	g Voltage (2)	Vss2	(Relative to	VDD)	-3.3	_	-2.4	٧	Vss2
					-12.0	_	-4.0		V5 *2
Operating	g Voltage (3)	Vss2	(Relative to	VDD)	0.4 x V5	_	VDD	v	V1, V2
					V 5	_	0.6 x V5		V3, V4
High-level	Input Voltage	VIHC			0.8 x VDD	_	VDD	٧	*3
Low-level	Input Voltage	VILC			Vss	_	0.2 x VDD	٧	*3
High-level (Output Voltage	Vонс	Iон = −0.5 mA		0.8 x VDD	_	VDD	٧	*4
Low-level (Output Voltage	Volc	IOL = 0.5 mA		Vss	_	0.2 x VDD	٧	*4
Input leal	kage current	lu	VIN = VDD	or Vss	-1.0	_	1.0	μ A	*5
Output lea	akage current	ILO	VIN = VDD	or Vss	-3.0	_	3.0	μ Α	*6
Liquid Crys	stal Driver ON		Ta = 25℃	V5 = -13.0 V	_	2.0	3.5	ΚΩ	SEGn
Res	istance	Ron	(Relative To VDD)	V5 = -8.0 V	_	3.2	5.4	17.77	COMn *7
Static Consu	umption Current	Issq	V5 = -13.	.0V (Relative to	_	0.01	2	μ Α	Vss, Vss2
Output Lea	akage Current	I5Q	VDD)	,	_	0.01	10	μ A	V5
Input Termin	nal Capacitance	CIN	Ta = 25℃ ,	f = 1 MHz	_	5.0	8.0	pF	
	Internal Oscillator	fosc	1/65 duty	T- 05%	17	20	24	kHz	*8
Oscillator	External Input	fcL	1/33 duty	Ta = 25℃	17	20	24	kHz	CL
Frequency	Internal Oscillator	fosc	1/49 duty 1/53 duty	Ta = 25℃	25	30	35	kHz	*8
	External Input	fcL	1/55 duty		25	30	35	kHz	CL

	Item	Symbol Condition			Rating	Units	Applicable	
	item Symbol		Condition	Min.	Тур.	Max.	Units	Pin
	Input voltage	Vss2	(Relative To VDD)	-3.3	_	-2.4	٧	Vss2
ver	Supply Step-up output voltage Circuit	Vоит	(Relative To VDD)	-13.5	_	_	٧	Vоит
al Power	Voltage regulator Circuit Operating Voltage	Vouт	(Relative To VDD)	-13.5	_	-6.0	٧	Vоит
Internal	Voltage Follower Circuit Operating Voltage	V5	(Relative To VDD)	-12.0	_	-4.0	٧	V5 * 9
_	Base Voltage VRS		Ta = 25℃, (Relative To VDD) -0.05%/℃	-2.07	-2.10	-2.13	٧	*10

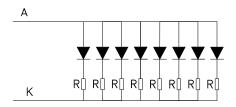
2.4 Pin Definition

No.	Symbol	Function
1	/CS1	Chip select signal
2	RES	This is the MPU interface selection pin
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. A0 = "H": Indicates that D0 to D7 are display data. A0 = "L": Indicates that D0 to D7 are control data.
4	R/W(/WR)	 When connected to an 8080 MPU, this is active LOW. (R/W) This terminal connects to the 8080 MPU /WR signal. The signals on the data bus are latched at the rising edge of the /WR signal. When connected to a 6800 Series MPU: This is the read/write control signal input terminal. When R/W = "H": Read. When R/W = "L": Write.
5	E(/RD)	 When connected to an 8080 MPU, this is active LOW. (E) This pin is connected to the /RD signal of the 8080 MPU, and the ST7565V series data bus is in an output status when this signal is "L". When connected to a 6800 Series MPU, this is active HIGH. This is the 6800 Series MPU enable clock input terminal.
6~13	DB0~DB7	Data bus
14	VDD	Power supply
15	VSS	Ground
16	VOUT	DC/DC voltage converter.
17	CAP5-	DC/DC voltage converter.
18	CAP3-	DC/DC voltage converter.
19	CAP1+	DC/DC voltage converter.
20	CAP1-	DC/DC voltage converter.
21	CAP2-	DC/DC voltage converter.
22	CAP2+	DC/DC voltage converter.
23	CAP4-	DC/DC voltage converter.
24	VRS	This is the internal-output VREG power supply for the LCD power supply voltage regulator.
25~29	V1~V5	This is a multi-level power supply for the liquid crystal drive.
30	VR	Output voltage regulator terminal. Provides the voltage between VDD and V5 through a resistive voltage divider. IRS = "L": the V5 voltage regulator internal resistors are not used. IRS = "H": the V5 voltage regulator internal resistors are used.
31	C86	This is the MPU interface switch terminal. C86 = "H": 6800 Series MPU interface. C86 = "L": 8080 MPU interface.
32	P/S	This is the parallel data input/serial data input switch terminal.

33	НРМВ	This is the power control terminal for the power supply circuit for liquid crystal drive. /HPM = "H": Normal mode /HPM = "L": High power mode
34	IRS	This terminal selects the resistors for the V5 voltage level adjustment. IRS = "H": Use the internal resistors IRS = "L": Do not use the internal resistors. The V5 voltage level isregulated by an external resistive voltage divider attached to the VR terminal

3. LED Backlight

3.1 Power Supply for LED Backlight

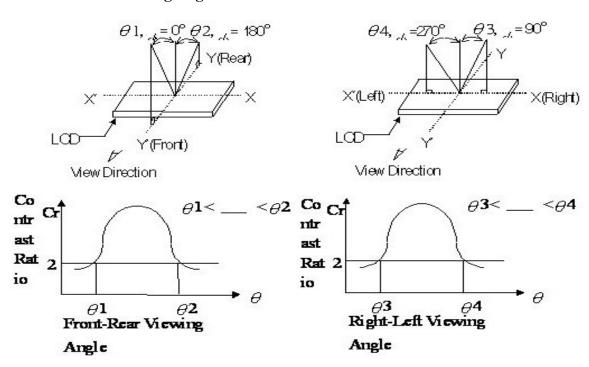


3.2 Electrical Optical Characteristics

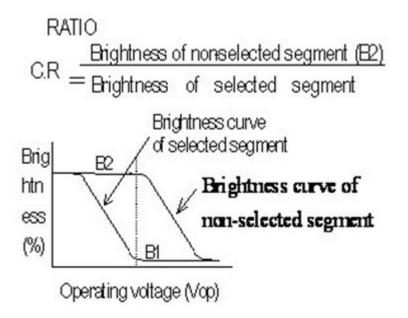
Itom	Cymbol	Conditions	Stan	T I :4		
Item	Symbol	Conditions	Min.	Тур.	Max.	Unit
Forward Voltage	Vf	If = 80mA	3.1	3.1	3.3	V
Reverse Current	Ir	Vr = 3.1V	_	_	100	uA
Spectral Line Half Width	Δλ	IF = 80mA	-	-	_	nm
Peak Wave Length	λр	T = 25°C	_	-	_	nm
Luminance	Lv	IF =80mA	-	TBD	_	Cd/m ²
Uniformity	Δ	Min / Max = 100%	_	_	75%	%

4. Optical Characteristics

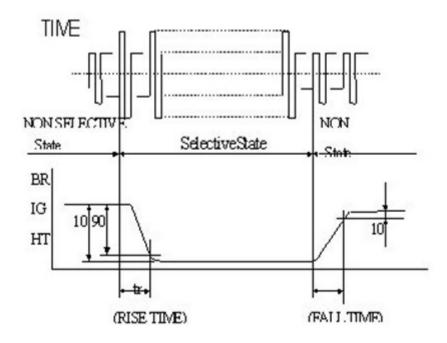
4.1 Definition of Viewing Angle



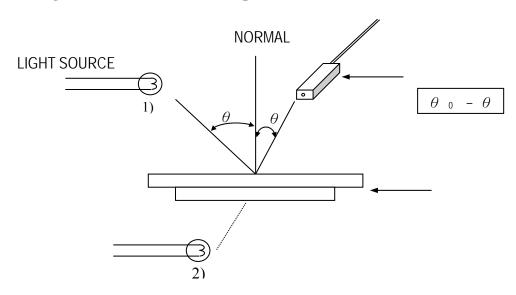
4.2 Definition of Contrast



4.3 Definition of Response



4.4 Measuring Instruments For Electro-optical Characteristics



* Note:

- 1) Light source position for measuring the reflective type of LCD panel;
- 2) Light source position for measuring the transflective / transmissive types of LCD panel.

5. AC Characteristics and Input Timing Characteristics

5.1 AC characteristics (Ta=25°C)

System Bus Read/Write Characteristics 1 (For the 8080 Series MPU)

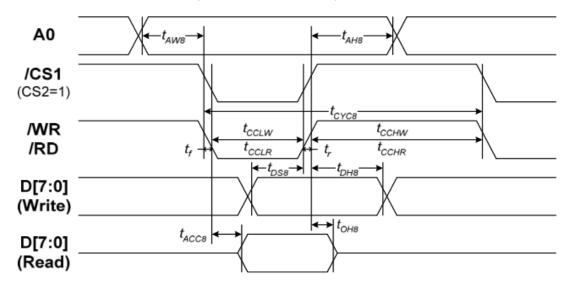


Figure 37

Table 24

(VDD = 3.3V Ta = -30 to 85°C)

Cianal	Symbol	Condition	Rating		Units
Sigilal	Syllibol	Condition	Min.	Max.	Oilles
	tAH8		0	_	
A0	tAW8		0	_	
	tcycs		240	_	
/WR	tccrw		80	_]
	tcchw		80	_	
/DD	tcclr		140	_	Ns
/80	tcchr		80		1
	tDS8		40	_]
D0 to D7	tDH8		0	_]
	tACC8	CL = 100 pF	_	70	
	tOH8	CL = 100 pF	5	50]
	/WR /RD	tah8	Signal Symbol Condition A0 tAH8 tCYC8 tCYC8 /WR tCCLW tCCHW tCCHR tCCHR tCH8 tDN to D7 tDH8 tACC8 CL = 100 pF	Signal Symbol Condition Ration A0 tAH8 0 tCYC8 240 /WR tCCLW 80 tCCHW 80 tCCHR 140 tCCHR 80 tCCHR 40 tD88 40 tDH8 0 tACC8 CL = 100 pF	Signal Symbol Condition Min. Max.

(VDD = 2.7V, Ta = -30 to 85°C)

Item	Cianal Cu	Cumbal	Condition	Rating		Units
item	Signal	Symbol	Condition	Min.	Max.	Units
Address hold time		tAH8		0	_	
Address setup time	A0	tAW8		0	_	
System cycle time		tcyc8		400	_]
Write L pulse width	WR	tccrw		220	_	
Write H pulse width	WH	tcchw		180	_	
Read L pulse width	RD	tCCLR		220	_	ns
Read H pulse width	ND.	tcchr		180	_	
Write Data setup time		tDS8		40	_	
Write Address hold time	D0 to D7	tDH8		0	_	
Read access time	D0 to D7	tACC8	CL = 100 pF	_	140]
Read Output disable time		tOH8	CL = 100 pF	10	100	

System Bus Read/Write Characteristics 2 (For the 6800 Series MPU)

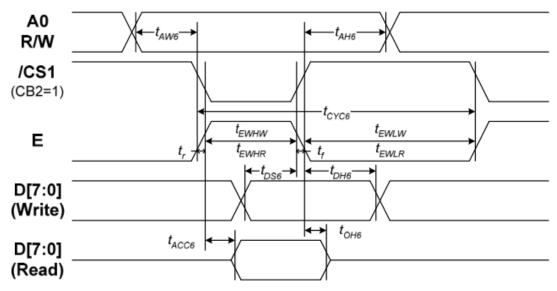


Figure 38

Table 27

(VDD = 3.3V, Ta = -30 to 85℃)

Item	Cianal	Symbol	Condition	Rat	ing	Units
item	Signal	Signal Symbol Condition		Min.	Max.	Units
Address hold time		tAH6		0	_	
Address setup time	A0	tAW6		0	_	
System cycle time		tcyc6		240	_	
Enable L pulse width (WRITE)		tEWLW		80	_	
Enable H pulse width (WRITE)	E	tEWHW		80	_	
Enable L pulse width (READ)		†EWLR		80	_	ns
Enable H pulse width (READ)		†EWHR		140		
WRITE Data setup time		tDS6		40	_	
WRITE Address hold time	D0 to D7	tDH6		0	_	
READ access time	D0 10 D7	tACC6	CL = 100 pF	_	70	
READ Output disable time		tOH6	CL = 100 pF	5	50	

(Vpp = 2.7V Ta = -30 to 85°C)

				1a = -30 to	
Cianal	Cumbal	Condition	Rati	ing	Units
Signai	Signal Symbol Condition		Min.	Max.	Units
	tAH6		0	_	
A0	tAW6		0	_]
	tcyc6		400	_]
	ţEWLW		220	_]
] _	tEWHW		180	_	1
] =	ţEWLR		220	_	ns
]	†EWHR		180	_]
	tDS6		40	_	1
Do to D7	tDH6		0	_	1
00 10 07	tACC6	CL = 100 pF	_	140]
	tOH6	CL = 100 pF	10	100	1
_	A0 E D0 to D7	E	E	Signal Symbol Condition Min.	Table Tabl



The Serial Interface

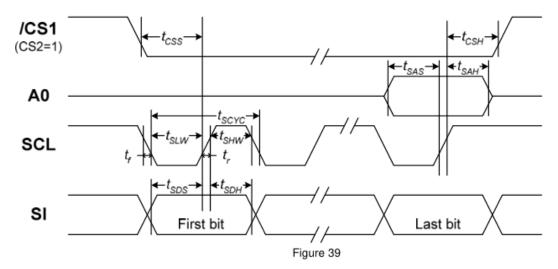


Table 30

(VDD = 3.3V. Ta = -30 to 85°C)

				(VDD = 3.3V,	1a = -50 K	, 00 0,
Item	Signal	Symbol	Condition	Rat	Units	
item	Signal	Symbol	Condition	Min.	Max.	Ullits
Serial Clock Period		tscyc		50	_	
SCL "H" pulse width	SCL	t _{SHW}		25	_	
SCL "L" pulse width		t _{SLW}		25	_	
Address setup time	A0	t _{SAS}		20	_	
Address hold time	A0	t _{SAH}		10	_	ns
Data setup time	SI	t _{SDS}		20	_	
Data hold time	31	t _{SDH}		10	_	
CS-SCL time	CS	tcss		20	_	
CS-SCL time	CS	t _{CSH}		40	_	

Table 31

(VDD = 2.7V, Ta = -30 to 85℃)

Item	Cianal	Cumbal	Condition	Rati	Rating	
item	Signal	Symbol	Condition	Min.	Max.	Units
Serial Clock Period		tscyc		100	_	
SCL "H" pulse width	SCL	t _{SHW}		50	_	
SCL "L" pulse width		t _{SLW}		50	_	
Address setup time	- A0	t _{SAS}		30	_	
Address hold time	AU	tsah		20	_	ns
Data setup time	SI	t _{SDS}		30	_	
Data hold time	31	t _{SDH}		20	_	
CS-SCL time	cs	t _{CSS}		30	_	
CS-SCL time	03	t _{CSH}		60	_	

6. Instruction Table

Command Code					Function								
Command	A0	/RD	/WR	D7	D6	D5	D4	D:	3 D2	2 0)1	D0	Function
(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	D	ispla	ay s	tart	ado	dre	SS	Sets the display RAM display star line address
(3) Page address set	0	1	0	1	0	1	1	Р	age	ad	dre	ess	Sets the display RAM page address
(4) Column address set upper bit Column address set lower bit	0	1	0	0	0	0	0	co Le	ost s lumr ast : lumr	n a	dd nifi	ress cant	Sets the most significant 4 bits of the display RAM column address. Sets the least significant 4 bits of the display RAM column address.
(5) Status read	0	0	1		St	atus	,	() (0	0	0	Reads the status data
(6) Display data write	1	1	0				Writ	te d	ata				Writes to the display RAM
(7) Display data read	1	0	1				Rea	d d	ata				Reads from the display RAM
(8) ADC select	0	1	0	1	0	1	0	C) ()	0	0 1	Sets the display RAM address SEG output correspondence 0: normal, 1: reverse
(9) Display normal/ reverse	0	1	0	1	0	1	0	C) 1	ı	1	0 1	Sets the LCD display normal/ reverse 0: normal, 1: reverse
(10) Display all points ON/OFF	0	1	0	1	0	1	0	C) 1	l	0	0 1	Display all points 0: normal display 1: all points ON
(11) LCD bias set	0	1	0	1	0	1	0	C) ()	1	0 1	Sets the LCD drive voltage bias ratio 0: 1/9 bias, 1: 1/7 bias (ST7565V)
(12) Read/modify/write	0	1	0	1	1	1	0	() ()	0	0	Column address increment At write: +1 At read: 0
(13) End	0	1	0	1	1	1	0	•	1 1	1	1	0	Clear read/modify/write
(14) Reset	0	1	0	1	1	1	0	() ()	1	0	Internal reset
(15) Common output mode select	0	1	0	1	1	0	0	1			*	*	Select COM output scan direction 0: normal direction 1: reverse direction
(16) Power control set	0	1	0	0	0	1	0	1		pe od		ing	Select internal power supply operating mode
(17) V5 voltage regulator internal resistor ratio set	0	1	0	0	0	1	0	C		tesi ratio		or	Select internal resistor ratio(Rb/Ra) mode
(18) Electronic volume mode set Electronic volume register set	0	1	0	1	0	0 Ele	0 ctro	nic) (volu		-	1 alue	Set the V5 output voltage electronic volume register
(19) Sleep Mode Set	0	1	0	1	0	1	0	1			0	0 1 0	0: Display Mode 1: Normal Mode
(20) Booster ratio set	0	1	0	1 0	0	0	1			S		0 o-up lue	select booster ratio 00: 2x,3x,4x 01: 5x 11: 6x
(21) NOP	0	1	0	1	1	1	0	() ()	1	1	Command for non-operation
(22) Test	0	1	0	1	1	1	1			•	*	٠	Command for IC test. Do not use this command



7.1 Contents of Reliability Tests

No.	Test Item	Content of Test	Test Condition		
1	High Temperature Storage	Endurance test applying the high storage temperature for a long time	+80°C 96H		
2	Low Temperature Storage	Low Temperature Endurance test applying the low storage			
3	High Temperature Operation	Endurance test applying the electric stress (voltage & current) and the thermal stress to the element for a long time	+70°C 96H		
4	Low Temperature Operation	Low Temperature Endurance test applying the electric stress			
5	High Temperature/ Humidity Storage	Endurance test applying the high temperature and humidity storage for a long time	40°C 90%RH 96H		
6	Temperature Cycle	Endurance test applying the low and high temperature cycle $-10^{\circ}\text{C} \longleftrightarrow 25^{\circ}\text{C} \longleftrightarrow 60^{\circ}\text{C} \longleftrightarrow 25^{\circ}\text{C}$ 30min 5min 30min 5min $\longleftrightarrow 1 \text{ cycle}$	-20°C/70°C 10 cycles		
7	Vibration Test (Package State)	Endurance test applying the vibration during transportation	10Hz-55Hz, 50m/s,15min		
8	Shock Test (Package State)	ock Test Endurance test applying the shock during			
9	Atmospheric Pressure Test	Endurance test applying the atmospheric pressure during transportation by air	40 kPa 16 H		

7.2 Life Time

Item	Description											
1	Function, performance, appearance, etc. shall be free from remarkable deterioration within 50,000 hours under ordinary operating and storage conditions of room temperature (25±10°C), normal humidity (45±20% RH), and in area not exposed to direct sunlight.											

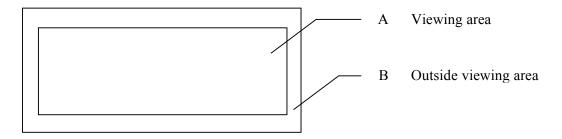
* Note: Test Condition

- 1) Temperature and humidity: If no specification, Temperature set at 25±2°C, Humidity set at 60±5%RH;
- 2) Operating state: Samples subject to the tests shall be in "Operating" condition.



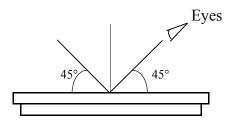
8. Quality Level

8.1 Zone Definition



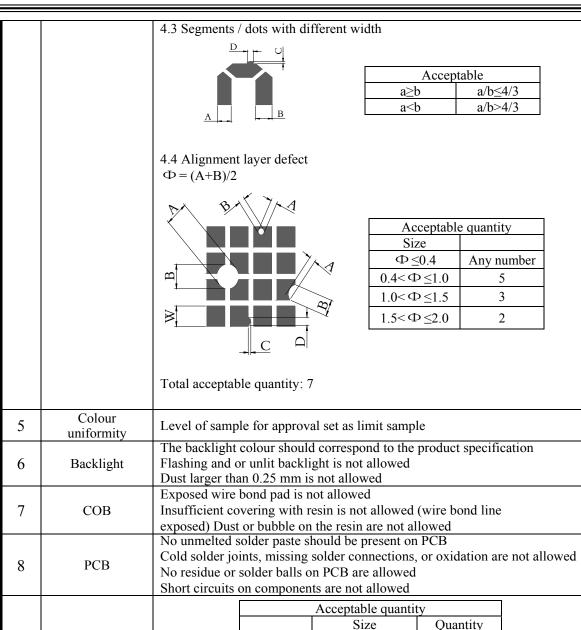
8.2 Visual Inspection

- 1) Inspect under 2x20W or 40W fluorescent lamp (approximately 3000 lux) leaving 25 to 30 cm between the module and the lamp and 30 cm between the module and the eye (measuring
- 2) Appearance is inspected at the best contrast voltage (best contrast is adjusted considering clearness and crosstalk on screen).
- 3) Inspect the module at 45° right and left, top and bottom.
- 4) Use the optimum viewing angle during the contrast inspection.





No.	Item	Criteria							
		Round type: as per following drawing							
		$\Phi = (X+Y)/2$		Λ.	ceptable quantity				
				Zone A	Zone B				
		$\bigcirc \Diamond$		Size Φ < 0.1	Any number	Zone B			
	$\stackrel{ \Leftrightarrow }{X}$			0.1<Ф<0.2	2				
		A		0.2<Ф<0.25	1	Any number			
				.25<Ф	0				
1	Black spot White spot Dust	Line type: as per	followin	g drawing Accept	able quantity				
		$ \langle \vee - \perp \rangle$	Length	Width	Zone A	Zone B			
			_	W≤0.02	Any number	1			
		L L	<u>L≤3.0</u> <u>L≤2.5</u>	0.02 <w≤0.03 0.03<w≤0.05< td=""><td>2</td><td>Any number</td></w≤0.05<></w≤0.03 	2	Any number			
			_	0.05 <w< td=""><td>As round type</td><td></td></w<>	As round type				
		Total acceptable							
2	Polariser scratch	Scratch on protective film is permitted Scratch on polariser: same as No. 1							
		$\Phi = (X+Y)/2$							
					Acceptable quantity				
		Ø v		Size	Zone A	Zone B			
		X		Ф<0.2	Any number				
3	Polariser bubble	Λ		0.2<Ф<0.	5 2	Any number			
				0.5<Ф<1. 1.0<Ф	0 1	Any number			
				0					
		Total acceptable							
		4.1 Pin hole on se W: segment widt		l display					
		$\Phi = (A+B)/2$		Ad	cceptable quantity				
		B ⇒//← , n	, 📙	Width	Quar				
		B	· [W≤0.4	Φ≤0.2 and				
		A		W>0.4	Φ≤0.25 and				
		A A			Ф≤1/3W				
	Comment	→/ W /←			nantity: 1 defect per segment nder 0.10 mm are acceptable				
4	Segment deformation	4.2 Pin hole on dot matrix display							
		₩,	< 0.05	-	Acceptable quantity				
				<u> </u>	Size	<u> </u>			
		(वे)व	a, b<0.1	Any number			
] در			(a+b)/2≤0.1	Any number			
					0.5<Ф<1.0	3			
		Total acceptable quantity: 7							



Ф<0.2

 $\Phi > 0.25$ Φ ≥0.25

L = 3

Any number

2

1

9

Tray particles

On tray

On display

9. Package Specifications

T.B.D.

10. Percautions When Using These LCD Modules

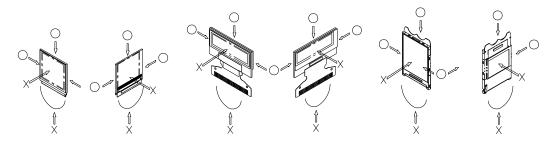
10.1 Handling Precautions

- 1) Since the display panel is being made of glass, do not apply mechanical impacts such us dropping from a high position.
- 2) If the display panel is broken by some accident and the internal organic substance leaks out, be careful not to inhale nor lick the organic substance.
- 3) If pressure is applied to the display surface or its neighborhood of the LCD Module, the cell structure may be damaged and be careful not to apply pressure to these sections.
- 4) The polarizer covering the surface of the LCD Module is soft and easily scratched. Please be careful when handling the LCD Module.
- 5) When the surface of the polarizer of the LCD Module has soil, clean the surface. It takes dvantage of by using following adhesion tape.
 - * Scotch Mending Tape No. 810 or an equivalent.

Never try to breathe upon the soiled surface nor wipe the surface using cloth containing solvent such as ethyl alcohol, since the surface of the polarizer will become cloudy.

Also, pay attention that the following liquid and solvent may spoil the polarizer:

- * Water
- * Ketone
- * Aromatic Solvents
- 6) Hold LCD Module very carefully when palcing LCD Module into the system housing. Do not apply excessive stress or pressure to LCD Module. And, do not over bend the film with electrode pattern layouts. These stresses will influence the display performance. Also, secure sufficient rigidity for the outer cases.



- 7) Do not apply stress to the LSI chips and the surrounding molded sections.
- 8) Do not disassemble nor modify the LCD Module.
- 9) Do not apply input signals while the logic power is off.
- 10) Pay sufficient attention to the working environments when handing LCD Modules to prevent occurrence of element breakage accidents by static electricity.
 - * Be sure to make human body grounding when handling LCD Modules.
 - * Be sure to ground tools to use or assembly such as soldering irons.
 - * To suppress generation of static electricity, avoid carrying out assembly work under dry environments.
 - * Protective film is being applied to the surface of the display panel of the LCD

- Module. Be careful since static electricity may be generated when exfoliating the protective film.
- * Protective film is being applied to the surface of the display panel of the LCD Module. Be careful since static electricity may be generated when exfoliating the protective film
- 11) Protection film is being applied to the surface of the display panel and removes the protection film before assembling it. At this time, if the LCD Module has been stored for a long period of time, residue adhesive material of the protection film may remain surface of the display panel after removed of the film. In such case, remove the residue material by the method introduced in the above Section 5).
- 12) If electric current is applied when the LCD Module is being dewed or when it is placed under high humidity environments, the electrodes may be corroded and be careful to avoid the above.

10.2 Storage Precautions

- 1) When storing LCD Modules, put them in static electricity preventive bags avoiding exposure to direct sun light nor to lights of fluorescent lamps. and, also, avoiding high temperature and high humidity environment or low temperature (less than 0°C) environments. (We recommend you to store these modules in the packaged state when they were shipped from Blaze Display Technology Co., Ltd.) At that time, be careful not to let water drops adhere to the packages or bags nor let dewing occur with them.
- 2) If electric current is applied when water drops are adhering to the surface of the LCD Module, when the LCD Module is being dewed or when it is placed under high humidity environments, the electrodes may be corroded and be careful about the above.

10.3 Designing Precautions

- 1) The absolute maximum ratings are the ratings which can not be exceeded for LCD Module, and if these values are exceeded, panel damage may be happen.
- 2) To prevent occurrence of malfunctioning by noise, pay attention to satisfy the VIL and VIH specifications and, at the same time, to make the signal line cable as short as possible.
- 3) We recommend you to install excess current preventive unit (fuses, etc.) to the power circuit (VDD). (Recommend value: 0.5A)
- 5) Pay sufficient attention to avoid occurrence of mutual noise interference with the neighboring devices.
- 6) As for EMI, take necessary measures on the equipment side basically. When fastening the LCD Module, fasten the external plastic housing section.
- 7) If power supply to the LCD Module is forcibly shut down by such errors as taking out the main battery while the LCD Panel is in operation, we cannot guarantee the quality of this LCD Module.
- 8) The electric potential to be connected to the rear face of the IC chip should be as follows:
 - * Connection (contact) to any other potential than the above may lead to rupture of the IC.

10.4 Precautions When Disposing of the LCD Modules

Request the qualified companies to handle industrial wastes when disposing of the LCD Modules. Or, when burning them, be sure to observe the environmental and hygienic laws and regulations.

10.5 Other Precautions

- 1) When a LCD Module is operated for a long of time with fixed pattern may remain as an after image or slight contrast deviation may occur. Nonetheless, if the operation is interrupted and left unused for a while, normal state can be restored. Also, there will be no problem in the reliability of the module
- 2) To protect LCD Modules from performance drops by static electricity rapture, etc., do not touch the following sections whenever possible while handling the LCD Modules.
 - * Pins and electrodes
 - * Pattern layouts such as the TCP & FPC
- 3) With this LCD Module, the LCD Module driver is being exposed. Generally speaking, semiconductor elements change their characteristics when light is radiated according to the principle of the solar battery. Consequently, if this LCD Module driver is exposed to light, malfunctioning may occur.
 - * Design the product and installation method so that the LCD Module driver may be shielded from light in actual usage.
 - * Design the product and installation method so that the LCD Module driver may be shielded from light during the inspection processes.
- 4) Although this LCD Module stores the operation state data by the commands and the indication data, when excessive external noise, etc. enters into the module, the internal status may be changed to take appropriate measures to suppress noise generation or to protect from influences of noise on the system design.
- 5) We recommend you to construct its software to make periodical refreshment of the operation statuses (re-setting of the commands and re-transference of the display data) to cope with catastrophic noise.