AZ DISPLAYS

SPECIFICATIONS FOR LIQUID CRYSTAL DISPLAY

CUSTOMER APPROVAL			
※ **PART NO. :** AQM12832BC-FLW-YBW VER 1.0			
APPROVAL		**COMPANY CHOP**	
CUSTOMER COMMENTS			

DISPLAYTRONIC ENGINEERING APPROVAL		
DESIGN BY	**CHECKED BY**	**APPROVED BY**

REVISION RECORD

REVISION	REVISION DATE	PAGE	CONTENTS
VER1.0	**17/11-2009**		FIRST ISSUE

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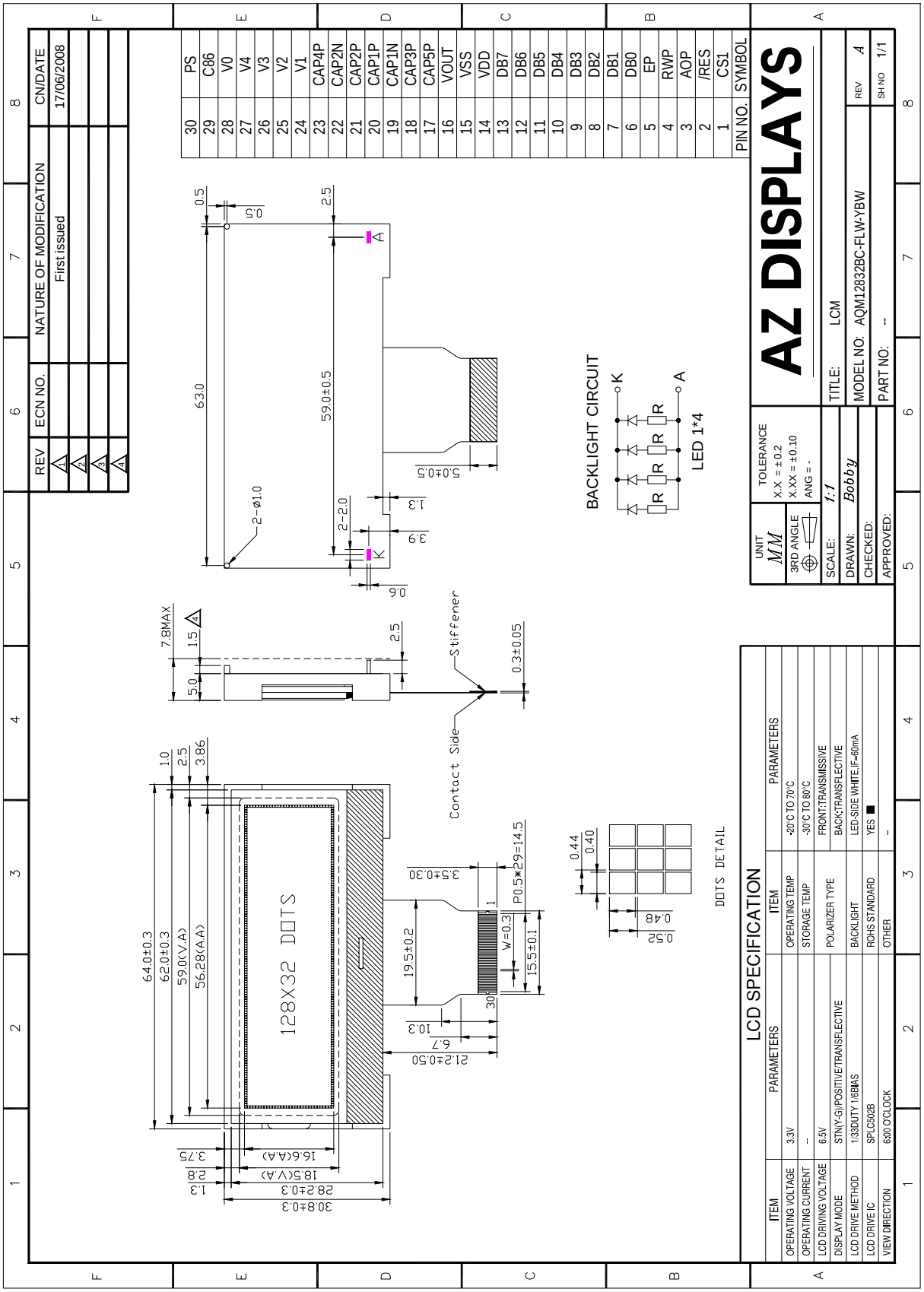
1.0 MECHANICAL DIAGRAM



2.0 MECHANICAL SPECS

1. Display Format	128*32 DOTS
2. Power Supply	3.3V
3. Overall Module Size	64.0mm(L) x 30.8mm(W) x MAX7.8mm(T)
4. Viewing Aera(W*H)	59.0mm(L)x18.5mm(W)
5. Dot Size (W*H)	0.40mm(W) x 0.48mm(H)
6. Dot Pitch (W*H)	0.44mm(W) x 0.52mm(H)
7. Viewing Direction	6 O'Clock
8. Driving Method	1/33Duty,1/6Bias
9. Controller IC	SPLC502B
10. LC Fluid Options	STN(Y-G) /Positive
11. Polarizer Options	Transflective
12. Backlight Options	LED-SIDE(White)
13. Operating temperature	-20ºC ~ 70ºC
14. Storage temperature	-30ºC ~ 80ºC
15. ROHS	ROHS compliant

3.0 ABSOLUTE MAXIMUM RATINGS

Item	Symbol	Min	Typ	Max	Unit
Operating temperature	Top	-20	-	70	ºC
Storage temperature	Tst	-30	-	80	ºC
Input voltage	Vin	Vss-0.3	-	Vdd+0.3	V
Supply voltage for logic	Vdd- Vss	-0.3	-	3.6	V
Supply voltage for LCD drive	Vdd- V0	-0.3	-	12.0	V

4.0 ELECTRICAL CHARACTERISTICS

4.1 Electrical Characteristics Of LCM

Item	Symbol	Condition	Min	Typ	Max	Unit
Power Supply Voltage	VDD	Ta=25ºC	1.8	3.3	3.6	V
Power Supply Current	Idd1	Vdd=3.3V	-	--	-	mA
Input voltage (high)	Vih	H level	0.8Vdd	-	Vdd	V
Input voltage (low)	Vil	L level	Vss	-	0.2Vdd	V
Recommended LC Driving Voltage	Vdd -Vo	25ºC	6.35	6.5	6.65	V

4.2 The Characteristics Of Backlight

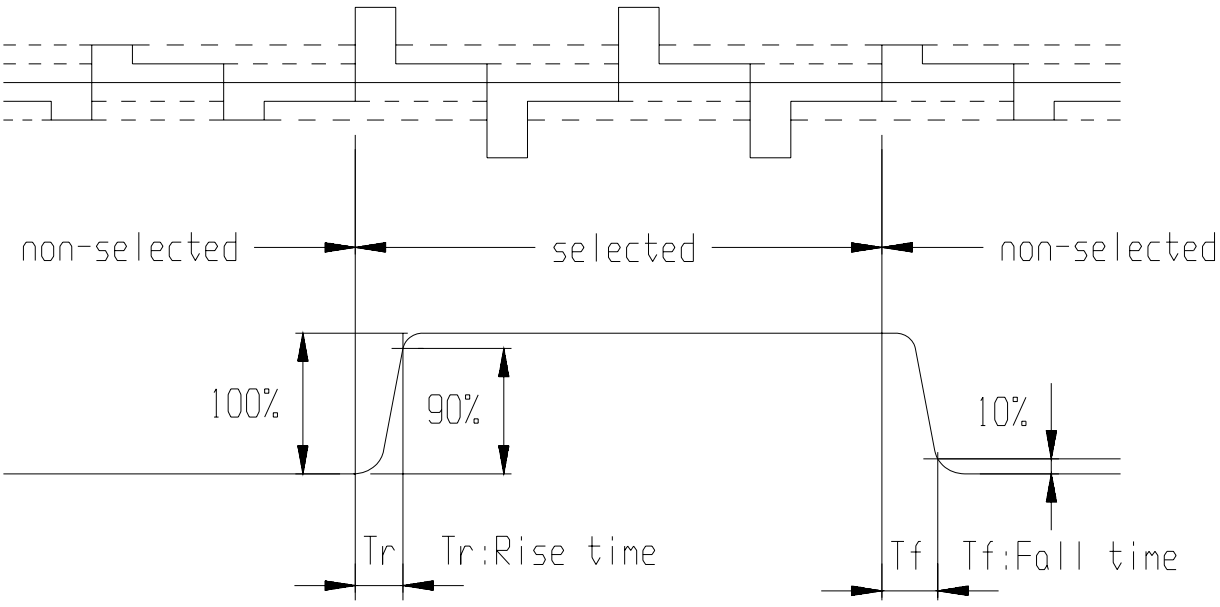
Item	Symbol	Condition	Min	Typ	Max	Unit
Operate Current	IF	Vbl=3.3V	--	60	72	mA
Luminance	Lv	IF= 60 mA	300	--	--	cd/m²
Coordinate range		IF= 60 mA	x=0.25~0.29, y=X-0.0135~X+0.0175			

Note:Luminance means the backlight brightness without glass

5.0 OPTICAL CHARACTERISTICS

Item	Symbol	Condition	Min	Typ	Max	Unit	Remarks	Note
Reponse time	Tr	Ta = 25°C	---	250	750	ms	---	1
	Tf		---	280	900	ms	---	1
Contrast		Ta = 25°C	6	---	---	---	---	2
Viewing angle range	θ	Cr ≥ 2	---	15	---	deg	∅ = 90°	3
			---	35	---	deg	∅ = 270°	3
			---	25	---	deg	∅ = 0°	3
			---	25	---	deg	∅ = 180°	3

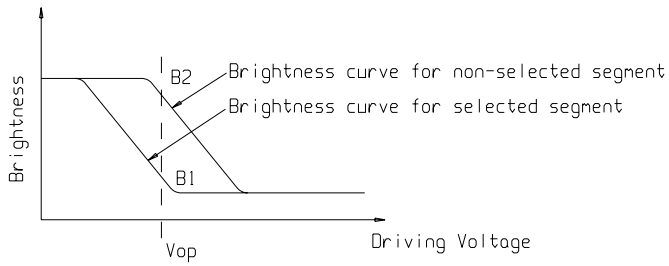
Note1: Definition of response time.

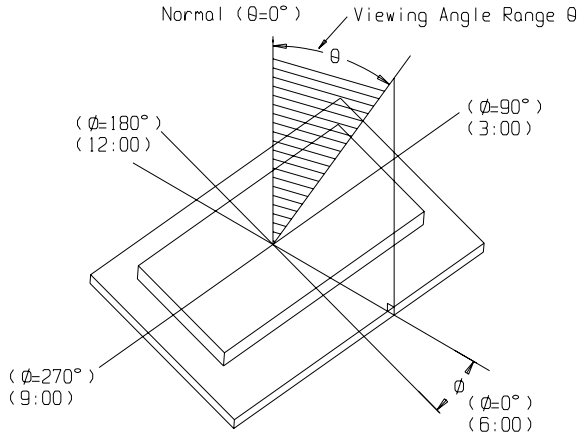


Note2: Definition of contrast ratio ‘Cr’ .

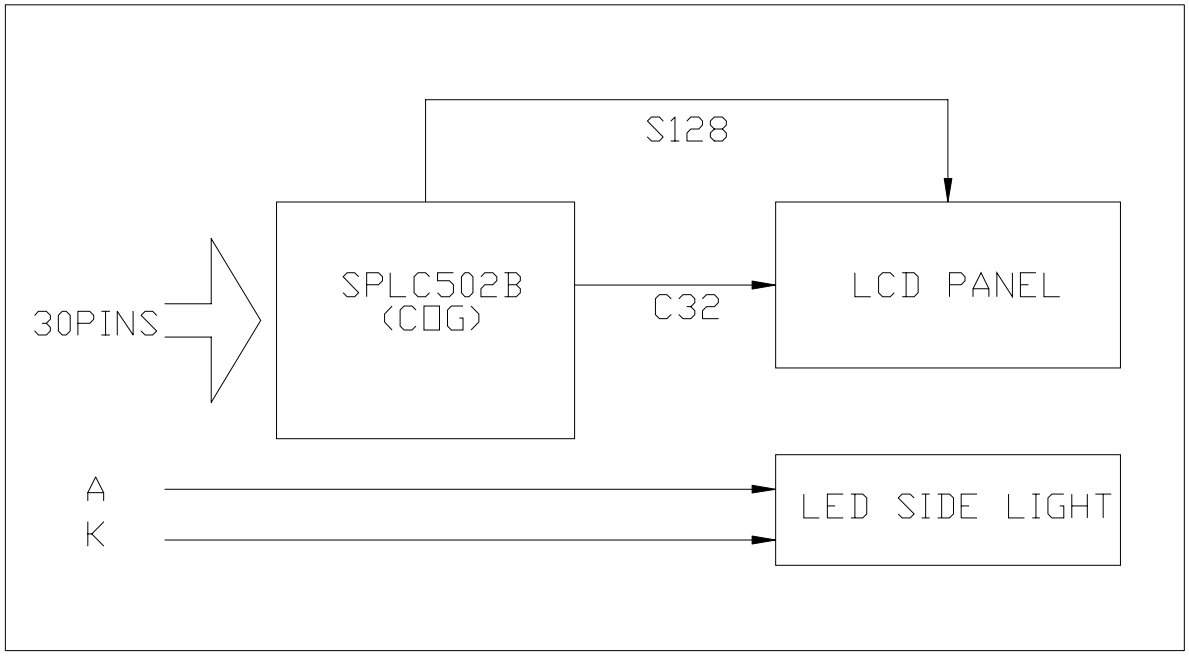
Note3: Definition of viewing angle range ‘θ’.

$$Cr = \frac{\text{Brightness of non-selected segment(B2)}}{\text{Brightness of selected segment(B1)}}$$





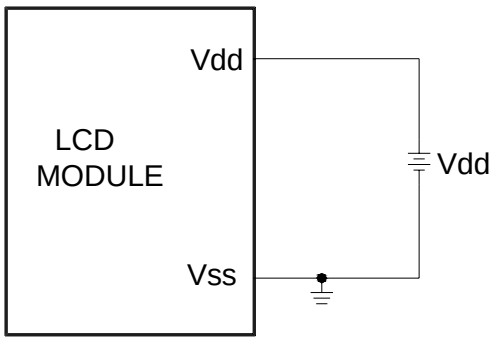
6.0 BLOCK DIAGRAM



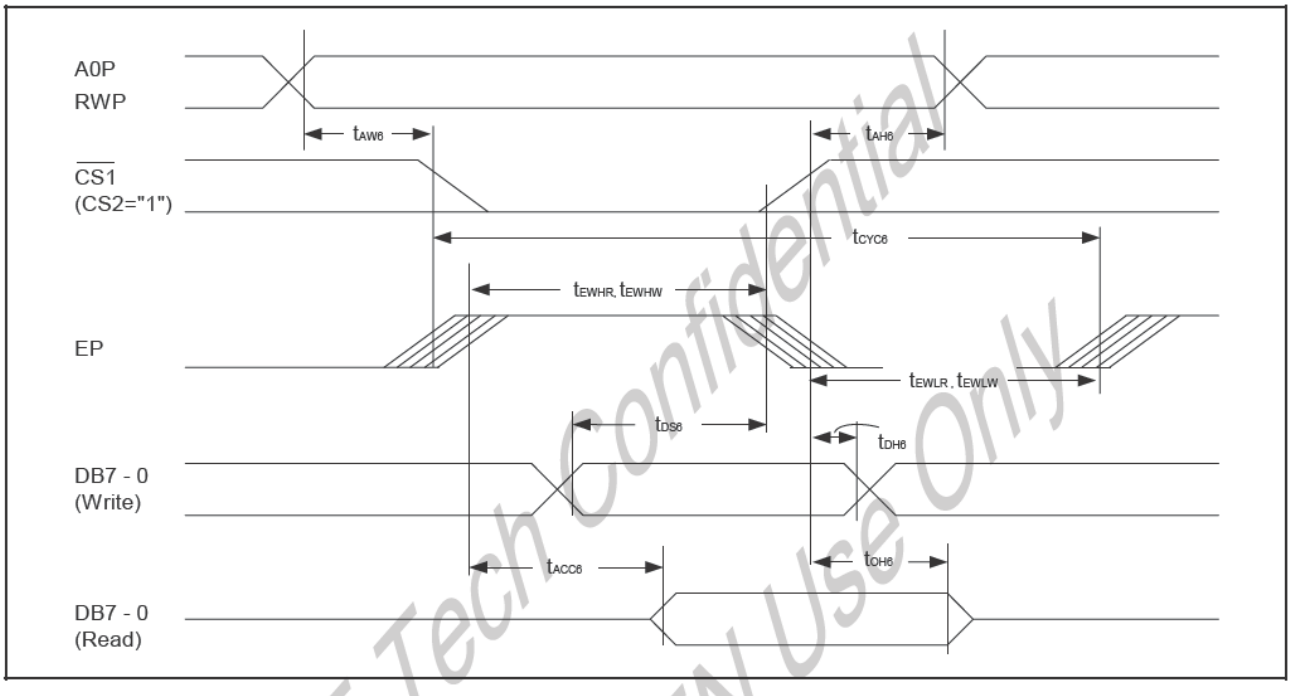
7.0 PIN ASSIGNMENT

Pin No.	Symbol	Function
1	CS1	Chip select signal
2	/RES	Reset signal
3	AOP	Data/command select
4	RWP	Read/write control signal
5	EP	Clock input terminal
6	DB0	Data bit 0
7	DB1	Data bit 1
8	DB2	Data bit 2
9	DB3	Data bit 3
10	DB4	Data bit 4
11	DB5	Data bit 5
12	DB6	Data bit 6
13	DB7	Data bit 7
14	VDD	Power Supply
15	VSS	GND
16	VOUT	DC/DC voltage converter
17	CAP5P	DC/DC voltage converter
18	CAP3P	DC/DC voltage converter
19	CAP1N	DC/DC voltage converter
20	CAP1P	DC/DC voltage converter
21	CAP2P	DC/DC voltage converter
22	CAP2N	DC/DC voltage converter
23	CAP4P	DC/DC voltage converter
24	V1	A multi-level power supply for the LCD
25	V2	A multi-level power supply for the LCD
26	V3	A multi-level power supply for the LCD
27	V4	A multi-level power supply for the LCD
28	V0	A multi-level power supply for the LCD
29	C68	MPU interface switch terminal
30	PS	Parallel/serial data input switch terminal
A	LED+	LED anode terminal
K	LED-	LED cathode terminal

8.0 POWER SUPPLY



9.0 TIMING CHARACTERISTICS



(VDD = **3.3V to 3.6V**, T_A = 25℃)

Item		Signal	Symbol	Condition	Rating		Units
					Min.	Max.	
Address hold time		A0P	t_{AH6}		0	-	ns
Address setup time			t_{AW6}		0	-	ns
System cycle time		A0P	t_{CYC6}		**240**	-	ns
Data setup time		DB7 - 0	t_{DS6}	C_L = 100pF	30	-	ns
Data hold time			t_{DH6}		10	-	ns
Access time			t_{ACC6}		-	70	ns
Output disable time			t_{OH6}		10	50	ns
Enable H pulse time	Read	EP	t_{EWHR}		80	-	ns
	Write		t_{EWHW}		80	-	ns
Enable L pulse time	Read	EP	t_{EWLR}		80	-	ns
	Write		t_{EWLW}		80	-	ns

(VDD = 2.7V to 3.3V, T_A = 25℃)

Item		Signal	Symbol	Condition	Rating		Units
					Min.	Max.	
Address hold time		A0P	t_{AH6}		0	-	ns
Address setup time			t_{AW6}		0	-	ns
System cycle time		A0P	t_{CYC6}		400	-	ns
Data setup time		DB7 - 0	t_{DS6}	C_L = 100pF	40	-	ns
Data hold time			t_{DH6}		15	-	ns
Access time			t_{ACC6}		-	140	ns
Output disable time			t_{OH6}		10	100	ns
Enable H pulse time	Read	EP	t_{EWHR}		100	-	ns
	Write		t_{EWHW}		100	-	ns
Enable L pulse time	Read	EP	t_{EWLR}		100	-	ns
	Write		t_{EWLW}		100	-	ns

Note1: The input signal rise time and fall time (tr, tf) is specified at 15 ns or less. When the system cycle time is extremely fast, $(t_r + t_f) \leqq (t_{CYC6} - t_{EWLW} - t_{EWHW})$ for $(t_r + t_f) \leqq (t_{CYC6} - t_{EWLR} - t_{EWHR})$ are specified.

Note2: All timing is specified using 20% and 80% of VDD as the reference.

Note3: t_{EWLW} and t_{EWLR} are specified as the overlap between $\overline{CS1}$ being 'L' (CS2 = 'H') and EP.

10.0 RELIABILITY TEST

NO	Test Item		Description	Test Condition	remark
1	Environmental Test	High temperature storage	Applying the high storage temperature Under normal humidity for a long time Check normal performance	80 ºC 96hrs	
2		Low temperature storage	Applying the low storage temperature Under normal humidity for a long time Check normal performance	-30ºC 96hrs	
3		High temperature Operation	Apply the electric stress(Volatge and current) Under high temperature for a long time	70 ºC 96hrs	Note1
4		Low temperature Operation	Apply the electric stress Under low temperature for a long time	-20ºC 96hrs	Note1 Note2
5		High temperature/High Humidity Storage	Apply high temperature and high humidity storage for a long time	90% RH 40ºC 96hrs	Note2
6		Temperature Cycle	Apply the low and high temperature cycle -30ºC＜＞25ºC＜＞80ºC ＜＞25ºC 30min 10min 30min 10min ◄——— 1 cycle ———► Check normal performance	-30ºC/80ºC 10 cycle	
7	Mechanical Test	Vibration test(Package state)	Applying vibration to product check normal performance	Freq:10-55Hz Max Acceleration 5G 1cycle time:1min time X.Y.Z direction for 15 mines	
8		Shock test(package state)	Applying shock to product check normal performance	Drop them through 70cm height to strike horizontal plane	
9	Other				

Remark

Note1:Normal operations condition (25ºC±5ºC).

Note2:Pay attention to keep dewdrops from the module during this test.

11.0 DISPLAY CONTROL INSTRUCTION

Command	Command Code											Function
	A0P	$\overline{RD}$	$\overline{WR}$	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0	
1). Display ON/OFF	0	1	0	1	0	1	0	1	1	1	0 1	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	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	1	0	0	0	0	0	Least significant column address				Set 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 1	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 1	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 1	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 1	Sets the LCD driver voltage bias ratio SPLC502B…….0:1/9, 1:1/7
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 1	*	*	*	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). V0 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 V0 output voltage electronic volume register
Electronic volume register set	0	1	0	*	*	Electronic volume value						

Command	Command Code											Function
	A0P	$\overline{RD}$	$\overline{WR}$	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0	
19). Static indicator ON/OFF	0	1	0	1	0	1	0	1	1	0	0	0: OFF, 1: ON
											1	
Static indicator Register set				*	*	*	*	*	*	Mode		Set the flashing mode
20). Page Blink	0	1	0	1	1	0	1	0	1	0	1	
Page selection	0	1	0	P7	P6	P5	P4	P3	P2	P1	P0	P7 - 0: 1 - blinking page 0 - no blinking, normal display
21). Driving Mode Set	0	1	0	1	1	0	1	0	0	1	0	Set the driving mode register
Mode selection	0	1	0	0	0	0	0	0	0	0	D0	Driving capability (D0): (1)>(0)
22). Power saver												Display OFF and display all points ON compound command
23). NOP	0	1	0	1	1	1	0	0	0	1	1	Command for non-operation
24). Test	0	1	0	1	1	1	1	*	*	*	*	Command for IC test. Do not use this command
				1	1	0	1	0	1	0	0	
25). Oscillator Frequency selection	0	1	0	1	1	1	0	0	1	0	0	20KHz/33KHz (Default)
											1	16.4KHz/ 27.06KHz

12.0 PRECAUTION FOR USING LCM

1. When design the product with this LCD Module, make sure the viewing angle matches to its purpose of usage.
2. As LCD panel is made of glass substrate, Dropping the LCD module or banging it against hard objects may cause cracking or fragmentation. Especially at corners and edges.
3. Although the polarizer of this LCD Module has the anti-glare coating, always be careful not to scratch its surface. Use of a plastic cover is recommended to protect the surface of polarizer.
4. If the LCD module is stored at below specified temperature, the LC material may freeze and be deteriorated. If it is stored at above specified temperature, the molecular orientation of the LC material may change to Liquid state and it may not revert to its original state. Excessive temperature and humidity could cause polarizer peel off or bubble. Therefore, the LCD module should always be stored within specified temperature range.
5. Saliva or water droplets must be wiped off immediately as those may leave stains or cause color changes if remained for a long time. Water vapor will cause corrosion of ITO electrodes.
6. If the surface of LCD panel needs to be cleaned, wipe it swiftly with cotton or other soft cloth. If it is not still clean enough, blow a breath on the surface and wipe again.
7. The module should be driven according to the specified ratings to avoid malfunction and permanent damage. Applying DC voltage cause a rapid deterioration of LC material. Make sure to apply alternating waveform by continuous application of the M signal. Especially the power ON/OFF sequence should be kept to avoid latchup of driver LSIs and DC charge up to LCD panel.
8. Mechanical Considerations
   a) LCM are assembled and adjusted with a high degree of precision. Avoid excessive shocks and do not make any alterations or modifications. The following should be noted.
   b) Do not tamper in any way with the tabs on the metal frame.
   c) Do not modify the PCB by drilling extra holes, changing its outline, moving its components or modifying its pattern.
   d) Do not touch the elastomer connector; especially insert a backlight panel (for example, EL).
   e) When mounting a LCM makes sure that the PCB is not under any stress such as bending or twisting. Elastomer contacts are very delicate and missing pixels could result from slight dislocation of any of the elements.
   f) Avoid pressing on the metal bezel, otherwise the elastomer connector could be deformed and lose contact, resulting in missing pixels.
   9. Static Electricity
   a) Operator

Ware the electrostatics shielded clothes because human body may be statically charged if not ware shielded clothes.

Never touch any of the conductive parts such as the LSI pads; the copper leads on the PCB and the interface terminals

with any parts of the human body.

b) Equipment

There is a possibility that the static electricity is charged to the equipment, which has a function of peeling or friction

action (ex: conveyer, soldering iron, working table). Earth the equipment through proper resistance (electrostatic

earth: 1x108 ohm).

Only properly grounded soldering irons should be used.

If an electric screwdriver is used, it should be well grounded and shielded from commutator sparks.

The normal static prevention measures should be observed for work clothes and working benches; for the latter

conductive (rubber) mat is recommended.

c) Floor

Floor is the important part to drain static electricity, which is generated by operators or equipment.

There is a possibility that charged static electricity is not properly drained in case of insulating floor. Set the electrostatic earth (electrostatic earth: 1x108 ohm).

d) Humidity

Proper humidity helps in reducing the chance of generating electrostatic charges. Humidity should be kept over

50%RH.

e) Transportation/storage

The storage materials also need to be anti-static treated because there is a possibility that the human body or storage

materials such as containers may be statically charged by friction or peeling.

The modules should be kept in antistatic bags or other containers resistant to static for storage.

f) Soldering

Solder only to the I/O terminals.Use only soldering irons with proper grounding and no leakage.

Soldering temperature : 280° C ± 10° C

Soldering time: 3 to 4 sec.

Use eutectic solder with resin flux fill.

If flux is used, the LCD surface should be covered to avoid flux spatters. Flux residue should be removed afterwards.

g) Others

The laminator (protective film) is attached on the surface of LCD panel to prevent it from scratches or stains. It should

be peeled off slowly using static eliminator.

Static eliminator should also be installed to the workbench to prevent LCD module from static charge.

10. Operation

a) Driving voltage should be kept within specified range; excess voltage shortens display life.

b) Response time increases with decrease in temperature.

c) Display may turn black or dark blue at temperatures above its operational range; this is (however not pressing on the viewing area) may cause the segments to appear “fractured”.

d) Mechanical disturbance during operation (such as pressing on the viewing area) may cause the segments to appear “fractured”.

11. If any fluid leaks out of a damaged glass cell, wash off any human part that comes into contact with soap and water. The toxicity is extremely low but caution should be exercised at all the time.
12. Disassembling the LCD module can cause permanent damage and it should be strictly avoided.
13. LCD retains the display pattern when it is applied for long time (Image retention). To prevent image retention, do not apply the fixed pattern for a long time. Image retention is not a deterioration of LCD. It will be removed after display pattern is changed.
14. Do not use any materials, which emit gas from epoxy resin (hardener for amine) and silicone adhesive agent (dealcohol or deoxym) to prevent discoloration of polarizer due to gas.
15. Avoid the exposure of the module to the direct sunlight or strong ultraviolet light for a long time.
16. The brightness of LCD module may be affected by the routing of CCFL cables due to leakage to the chassis through coupling effect. The inverter circuit needs to be designed taking the level of leakage current into consideration. Thorough evaluation is needed for LCD module and inverter built into its host equipment to ensure specified brightness.