

AZ DISPLAYS

SPECIFICATIONS FOR LIQUID CRYSTAL DISPLAY

CUSTOMER APPROVAL			
※ PART NO. : AQM1064A-FN-FBS(AZ DISPLAYS) VER1.0			
APPROVAL		COMPANY CHOP	
CUSTOMER COMMENTS			

AZ DISPLAYS ENGINEERING APPROVAL		
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REVISION RECORD

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1.0 MECHANICAL SPECS

1. Display Format	100*64 DOTS
2. Power Supply	3.0V
3. Overall Module Size	48.0mm(W) x40.0mm(H) x 2.1mm(D)
4. Viewing Area(W*H)	44.0mm(W) x27.0mm(H)
5. Dot Size	0.33mm(W) x 0.33mm(H)
6. Dot Pitch	0.36mm(W) x 0.36mm(H)
7. Viewing Direction	6:00 O'Clock
8. Driving Method	1/65Duty,1/9Bias
9. Controller IC	NT7534H-BDT or compatible
10. Display Mode	FSTN /Positive/ Transflective
11. Backlight Options	NC
12. Operating temperature	-10°C ~ 50°C
13. Storage temperature	-15°C ~ 60°C
14. RoHS	RoHS compliant

2.0 ABSOLUTE MAXIMUM RATINGS

Item	Symbol	Min	Typ	Max	Unit
Operating temperature	Top	-10	-	50	°C
Storage temperature	Tst	-15	-	60	°C
Input voltage	Vin	Vss-0.3	--	Vdd+0.3	V
Supply voltage for logic	Vdd- Vss	-0.3	-	4.0	V
DC Supply Voltage	(Vout)	6.0		14.2	V
Supply voltage for LCD drive	Vo	4.0		14.2	V

3.0 ELECTRICAL CHARACTERISTICS

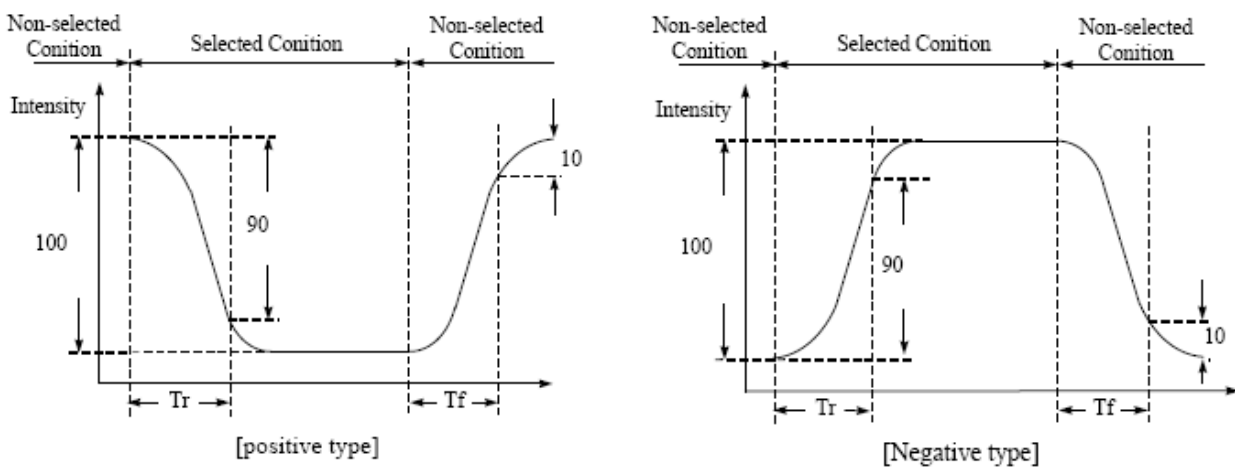
3.1 Electrical Characteristics Of LCM

Item	Symbol	Condition	Min	Typ	Max	Unit
Power Supply Voltage	Vdd	25°C	2.7	3.0	3.3	V
Power Supply Current	Idd	Vdd=3.0V	--	--	--	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	Vo	-10°C	--	--	--	V
		25°C	--	9.0	--	
		50°C	--	--	---	

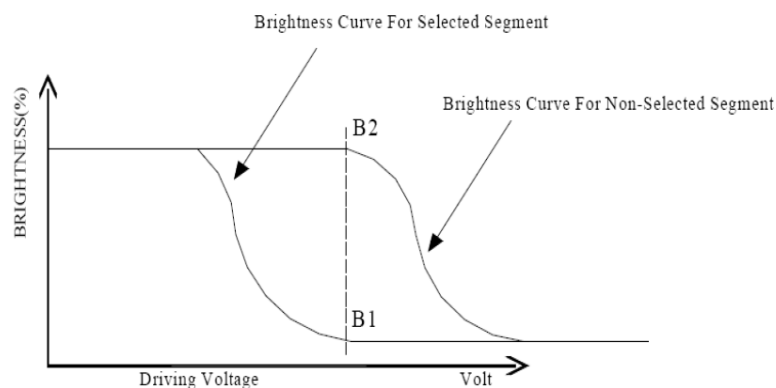
4.0 OPTICAL CHARACTERISTICS (Ta=25°C, Vdd= 3.0V±0.3V)

Item	Symbol	Condition	Min	Typ	Max	Unit
Viewing angle (horizontal)	θ	$Cr \geq 2.0$	-35	-	35	deg
Viewing angle (vertical)	ϕ	$Cr \geq 2.0$	-25	-	40	deg
Contrast Ratio	Cr	$\phi=0^\circ, \theta=0^\circ$	-	6	-	
Response time (rise)	Tr	$\phi=0^\circ, \theta=0^\circ$	-	180	300	ms
Response time (fall)	Tf	$\phi=0^\circ, \theta=0^\circ$	-	150	250	ms

(1). Definition of Optical Response Time

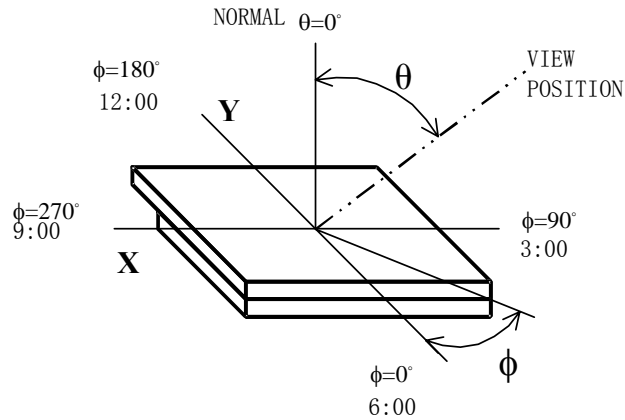


(2). Definition of Contrast Ratio

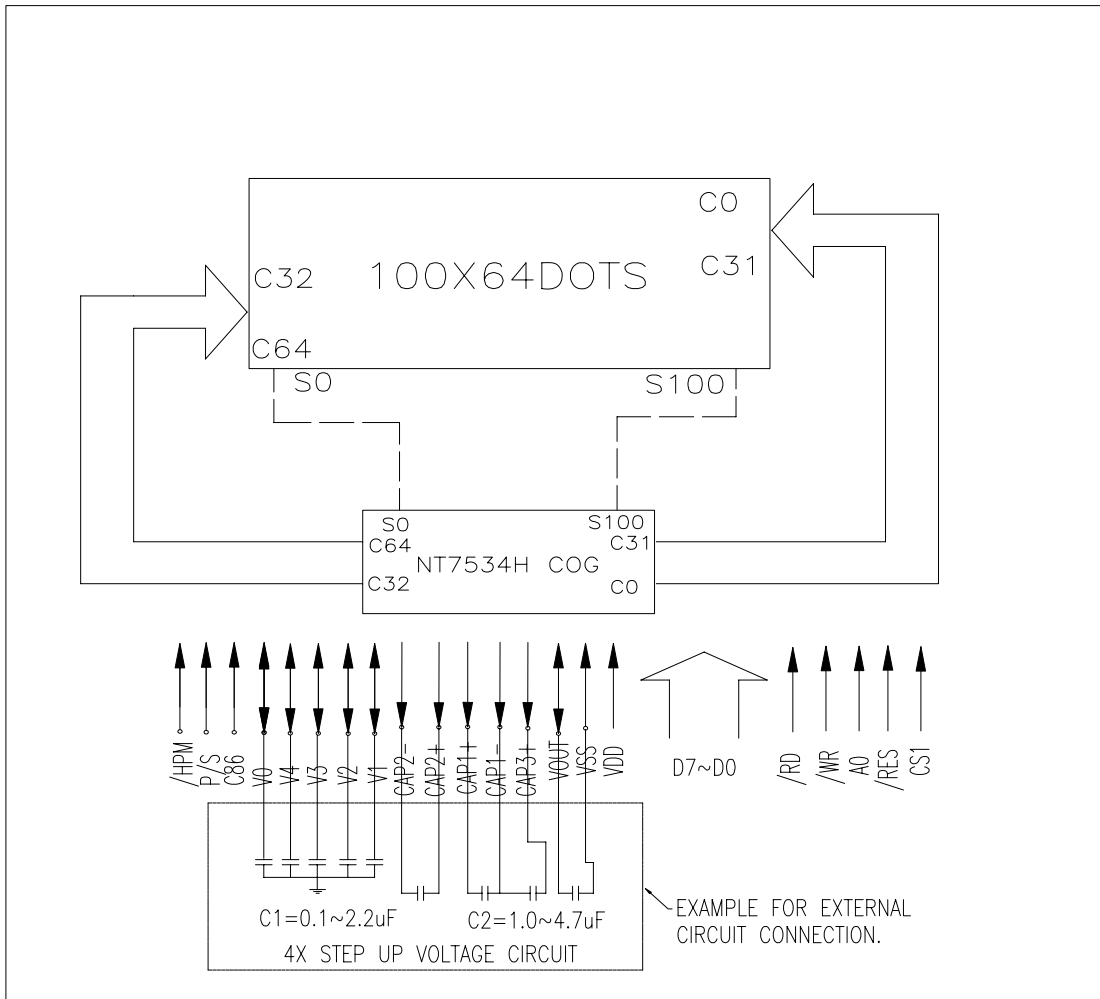


$$Cr = \frac{\text{Brightness of Non-selected Segment}(B2)}{\text{Brightness of selected Segment}(B1)}$$

(3). Definition of Viewing Angle θ and Φ



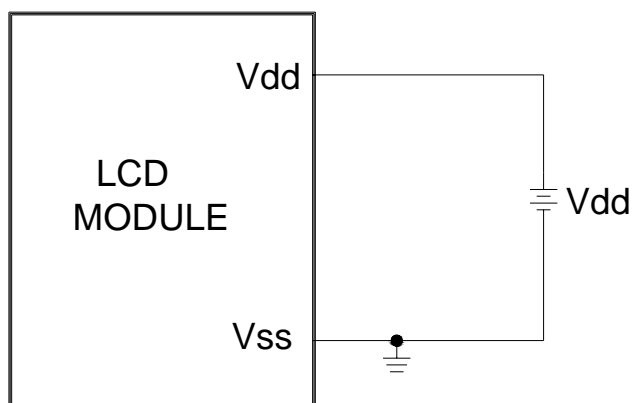
5.0 BLOCK DIAGRAM



6.0 PIN ASSIGNMENT

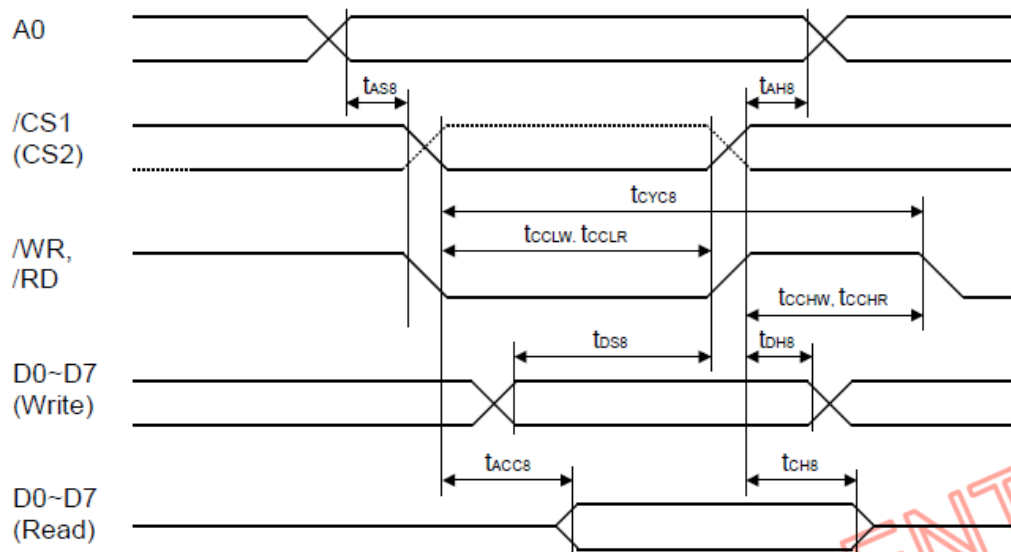
Pin No	I/O	Name	Description
1	I	CS1	Chip select signal. Active when low
2	I	/RES	Chip reset signal. Active when low
3	I	A0	It decide whether the data bits are data or a command. "L" is for command and "H" is for data.
4	I	/WR	Write signal. Active when low
5	I	/RD	Read signal. Active when low
6~13	I/O	DB0~DB7	8-bit directional data bus
14	I	VDD	Power supply
15	I	VSS	Power supply
16	I/O	VOUT	DC/DC voltage converter output
17	O	CAP3+	Pins for DC/DC voltage converter
18	O	CAP1-	
19	O	CAP1+	
20	O	CAP2+	
21	O	CAP2-	
22	NC	NC	NC
23~27	I/O	V1~V0	LCD driver supplies voltages
28	I	C86	MPU interface switch
29	I	P/S	data input switch
30	I	/HPM	power control terminal

7.0 POWER SUPPLY



8.0 TIMING CHARACTERISTICS

System Buses Read/Write Characteristics (for 8080 Series MPU)



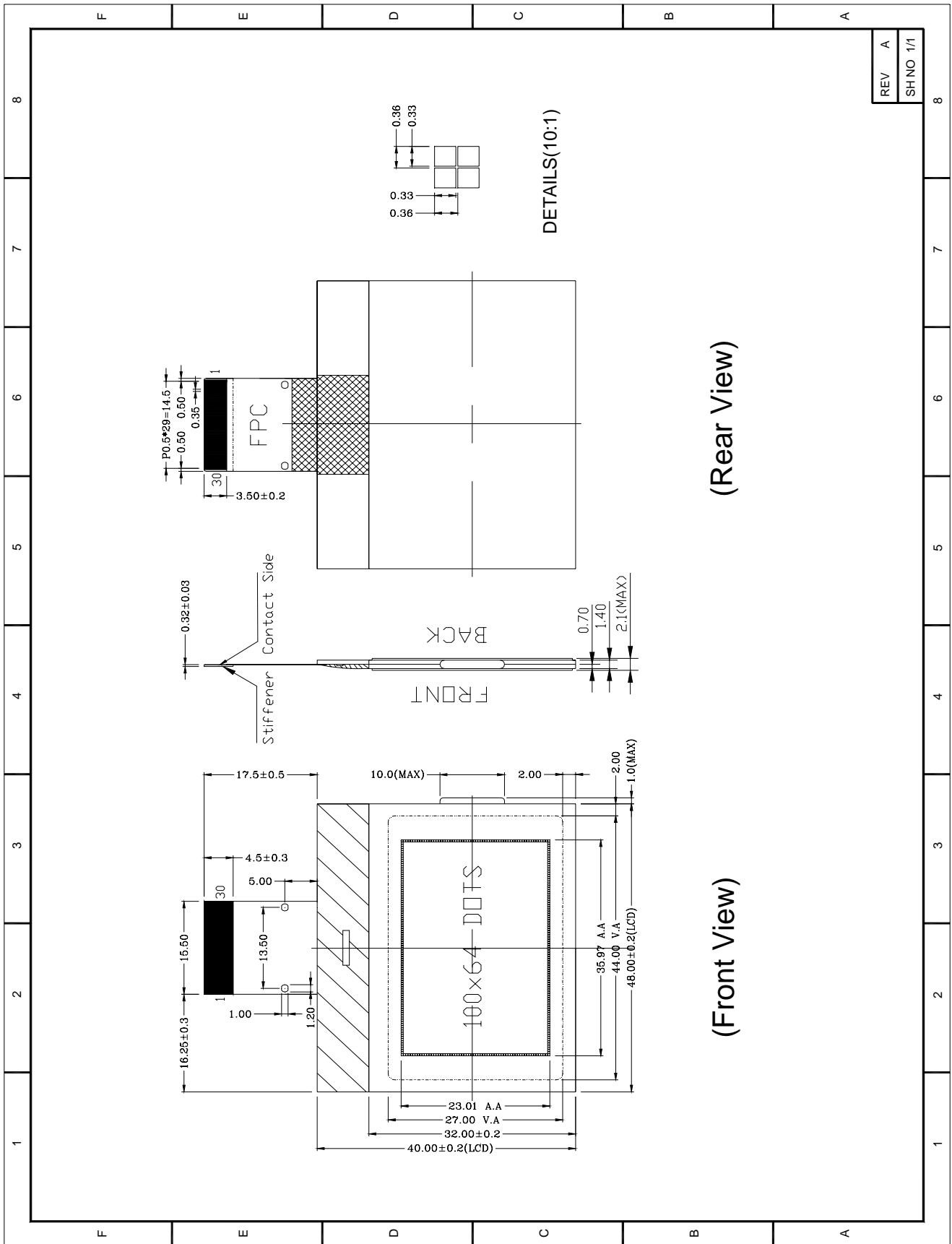
(VDD = 2.7 ~ 3.6V, Ta = -40 ~ +85°C)

Symbol	Parameter	Min.	Typ.	Max.	Unit	Condition
T _{AH8}	Address hold time	0	-	-	ns	A0
T _{AS8}	Address setup time	0	-	-	ns	
t _{CYC8}	System cycle time	240	-	-	ns	
t _{CCLW}	Control low pulse width (write)	90	-	-	ns	/WR
t _{CCLR}	Control low pulse width (read)	120	-	-	ns	/RD
t _{CCHW}	Control high pulse width (write)	100	-	-	ns	/WR
t _{CCHR}	Control high pulse width (read)	60	-	-	ns	/RD
T _{DS8}	Data setup time	40	-	-	ns	D0~D7
T _{DH8}	Data hold time	0	-	-	ns	
t _{ACC8}	/RD access time	-	-	140	ns	D0~D7, CL = 100pF
T _{CH8}	Output disable time	5	-	50	ns	

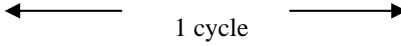
NOTE:

- The input signal rise time and fall time (t_r, t_f) is specified at 15ns or less.
 $(t_r + t_f) < (t_{CYC8} - t_{CCLW} - t_{CCHW})$ for write, $(t_r + t_f) < (t_{CYC8} - t_{CCLR} - t_{CCHR})$ for read.
- All timing is specified using 20% and 80% of VDD as the reference.
- t_{CCLW} and t_{CCLR} are specified as the overlap interval when /CS1 is low (CS2 is high) and /WR or /RD is low.

9.0 MECHANICAL DRAWING



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	60 °C 96hrs	
2		Low temperature storage	Applying the low storage temperature Under normal humidity for a long time Check normal performance	-15°C 96hrs	
3		High temperature Operation	Apply the electric stress(Volatge and current) Under high temperature for a long time	50 °C 96hrs	Note1
4		Low temperature Operation	Apply the electric stress Under low temperature for a long time	-10°C 96hrs	Note1 Note2
5		High temperature/High Humidity Storage	Apply high temperature and high humidity storage for a long time	90% RH 40°C 96hrs	Note2
6		Temperature Cycle	Apply the low and high temperature cycle -20°C <> 25°C <> 60°C <> 25°C 30min 10min 30min 10min  Check normal performance	-20°C/60°C 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 (25°C±5°C).

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

11.0 DISPLAY INSTRUCTION TABLE

Command	A0	/RD	/WR	Code								Hex	Function	
				D7	D6	D5	D4	D3	D2	D1	D0			
(1) Display OFF	0	1	0	1	0	1	0	1	1	1	0	1	A0h AFh	Turn on LCD panel when high, and turn off when low
(2) Display Start Line Set	0	1	0	0	1	Display Start Address					40h to 7Fh	Specifies RAM display line for COM0		
(3) Page Address Set	0	1	0	1	0	1	1	Page Address				B0h to B8h	Set the display data RAM page in Page Address register	
(4) Column Address Set	0	1	0	0	0	0	1	Higher Column Address				00h to 18h	Set 4 higher bits and 4 lower bits of column address of display data RAM in register	
	0	1	0	0	0	0	0	Lower Column Address						
(5) Read Status	0	0	1	Status				0	0	0	0	XX	Reads the status information	
(6) Write Display Data	1	1	0	Write Data								XX	Write data in display data RAM	
(7) Read Display Data	1	0	1	Read Data								XX	Read data from display data RAM	
(8) ADC Select	0	1	0	1	0	1	0	0	0	0	0	1	A0h A1h	Set the display data RAM address SEG output correspondence
(9) Normal/Reverse Display	0	1	0	1	0	1	0	0	1	1	0	1	A6h A7h	Normal indication when low, but full indication when high
(10) Entire Display ON/OFF	0	1	0	1	0	1	0	0	1	0	0	1	A4h A5h	Select normal display (0) or entire display on
(11) LCD Bias Set	0	1	0	1	0	1	0	0	0	1	0	1	A2h A3h	Sets LCD driving voltage bias ratio
(12) Read-Modify-Write	0	1	0	1	1	1	0	0	0	0	0	0	E0h	Increments column address counter during each write
(13) End	0	1	0	1	1	1	0	1	1	1	1	0	EEh	Releases the Read-Modify-Write
(14) Reset	0	1	0	1	1	1	0	0	0	0	1	0	E2h	Resets internal functions
(15) Common Output Mode Select	0	1	0	1	1	0	0	0	1	*	*	*	C0h to CFh	Select COM output scan direction *: invalid data
(16) Power Control Set	0	1	0	0	0	1	0	1	Operation Status			28h to 2Fh	Select the power circuit operation mode	
(17) V0 Voltage Regulator Internal Resistor ratio Set	0	1	0	0	0	1	0	0	Resistor Ratio			20h to 27h	Select internal resistor ratio Rb/Ra mode	
(18) Electronic Volume mode Set Electronic Volume Register Set	0	1	0	1	0	0	0	0	0	0	1	81h		
	0	1	0	*	*	Electronic Control Value					XX	Sets the V0 output voltage electronic volume register		
(19) Set Static Indicator ON/OFF Set Static Indicator Register	0	1	0	1	0	1	0	1	1	0	0	1	ACH ADh	Sets static indicator ON/OFF 0: OFF, 1: ON
	0	1	0	*	*	*	*	*	*	Mode		XX	Sets the flash mode	
(20) Power Save	0	1	0	-	-	-	-	-	-	-	-	-	-	Compound command of Display OFF and Entire Display ON
(21) NOP	0	1	0	1	1	1	0	0	0	1	1	1	E3h	Command for non-operation

Command	A0	/RD	/WR	Code								Hex	Function	
				D7	D6	D5	D4	D3	D2	D1	D0			
(22) Oscillation Frequency Select	0	1	0	1	1	1	0	0	1	0	0	1	E4h E5h	Select the oscillation frequency
(23) Partial Display mode Set	0	1	0	1	0	0	0	0	0	1	0	1	82h 83h	Enter/Release the partial display mode
(24) Partial Display Duty Set	0	1	0	0	0	1	1	0	Duty Ratio			30h 37h	Sets the LCD duty ratio for partial display mode	
(25) Partial Display Bias Set	0	1	0	0	0	1	1	1	Bias Ratio			38h 3Fh	Sets the LCD bias ratio for partial display mode	
(26) Partial Start Line Set	0	1	0	1	1	0	1	0	0	1	1	D3h	Enter Partial Start Line Set	
Partial Start Line Set	0	1	0	1	1	Partial Start Line					XX	Sets the LCD Number of partial display start line		
(27) N-Line Inversion Set	0	1	0	1	0	0	0	0	1	0	1	85h	Enter N-Line inversion	
Number of Line Set	0	1	0	*	*	*	Number of Line					XX	Sets the number of line used for N-Line inversion	
(28) N-Line Inversion Release	0	1	0	1	0	0	0	0	1	0	0	84h	Exit N-Line Inversion	
(29) DC/DC Clock Set	0	1	0	1	1	1	0	0	1	1	0	E6h	Set DC/DC Clock Frequency	
DC/DC Clock Division Set	0	1	0	1	1	0	0	Clock Division			XX	Set the Division of DC/DC Clock Frequency		
(30) Test Command	0	1	0	1	1	1	1	*	*	*	*	F1h to FFh	IC test command. Do not use!	
(31) Test Mode Reset	0	1	0	1	1	1	1	0	0	0	0	F0h	Command of test mode reset	

Note: Do not use any other command, or system malfunction may result.

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 latch-up 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

Wear the electrostatics shielded clothes because human body may be statically charged if not wear 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: 1×10^8 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: 1×10^8 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.