DISPLAYTRONIC

XIAMEN ZETTLER ELECTRONICS CO., LTD.

SPECIFICATIONS FOR LIQUID CRYSTAL DISPLAY

ACM0802F-FL-YBH-C CHARACTER MODULE VER1.0

CUSTOMER APPROVAL			
※ **PART NO. :** ACM0802F-FL-YBH-C			
APPROVAL		**COMPANY CHOP**	
CUSTOMER COMMENTS			

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

REVISION RECORD

REVISION	REVISION DATE	PAGE	CONTENTS
VER1.0	17/03-2008		FIRST ISSUE

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1.0 MECHANICAL SPECS

1. Overall Module Size (W*H*T)	39.42*48.5*8.0(MAX)mm
2. Viewing Area (W*H)	35.0X14.5mm
3. Dot Size	0.600*0.645
4. Dot Pitch	0.657*0.700
5. Driving Method	1/16Duty, 1/4Bias,VLCD=4.5V
6. Controller IC	ST7032I-0D OR EQU
7. LCD Type	STN(Y/G) ,Positive ,Transflective
8. Viewing Direction	6 O'Clock
9. Interface	I^2C
10. Backlight	LED-Side Y-G
11. Operating Temperature	Wide (-20ºC ~ 70ºC)
12. Rohs	Conforms

2.0 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		Vdd	V
Supply voltage for logic	Vdd- Vss	2.7	-	3.6	V
Supply voltage for LCD drive	Vdd- Vo	3.0		6.5	V

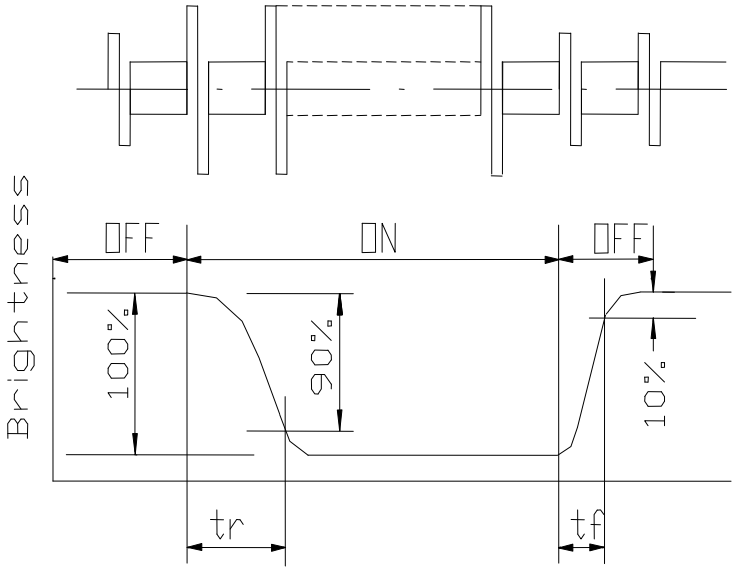
3.0 ELECTRICAL CHARACTERISTICS

Item	Symbol	Condition	Min	Typ	Max	Unit
Power Supply Voltage	VDD	Ta=25ºC	-	3.3		V
Power Supply Current	Idd	Vdd=3.3V	-		1.0	mA
Input voltage (high)	Vih	H level	2.2	-	Vdd	V
Input voltage (low)	Vil	L level	0	-	0.6	V
Recommended LC Driving Voltage	Vdd -Vo	-20ºC	-	-	5.5	V
		25ºC	4.3	4.5	4.7	
		70ºC	3.6	-	-	
LED Power Supply Voltage	V_F	Ta=25ºC	3.0	3.15	3.3	V
LED Power Supply Current	I_F	V_F=3.15V	-	40	-	mA

4.0 OPTICAL CHARACTERISTICS (Ta=25ºC, Vdd= 3.3V±0.25V, STN LC fluid)

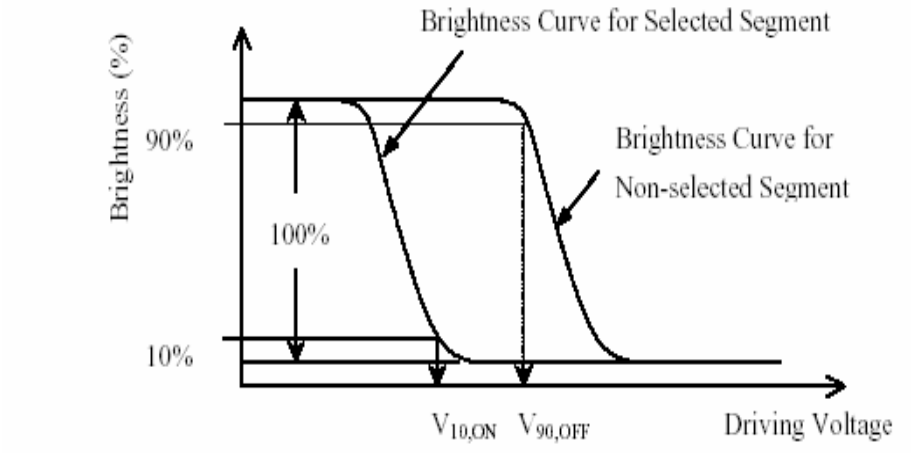
Item	Symbol	Condition	Min	Typ	Max	Unit
Viewing angle (horizontal)	θ	Cr ≥ 2.0	-35	-	35	deg
Viewing angle (vertical)	ϕ	Cr ≥ 2.0	-25	-	45	deg
Contrast Ratio	Cr	ϕ=0°, θ=0°	3.0		-	
Response time (rise)	Tr	ϕ=0°, θ=0°	-	150	250	ms
Response time (fall)	Tf	ϕ=0°, θ=0°	-	160	280	ms

(1). Definition of Optical Response Time

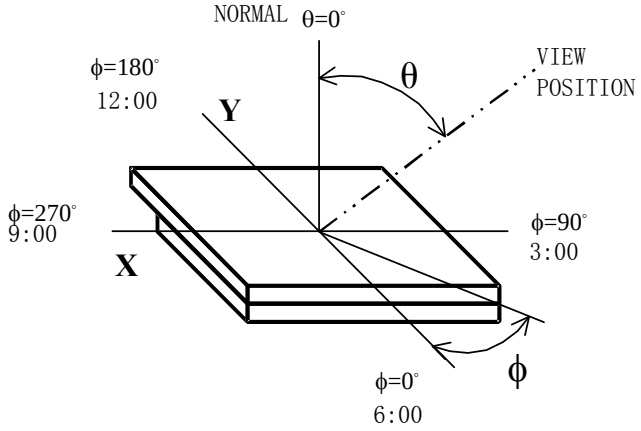


(2). Definition of Driving Voltage (Vlcd)

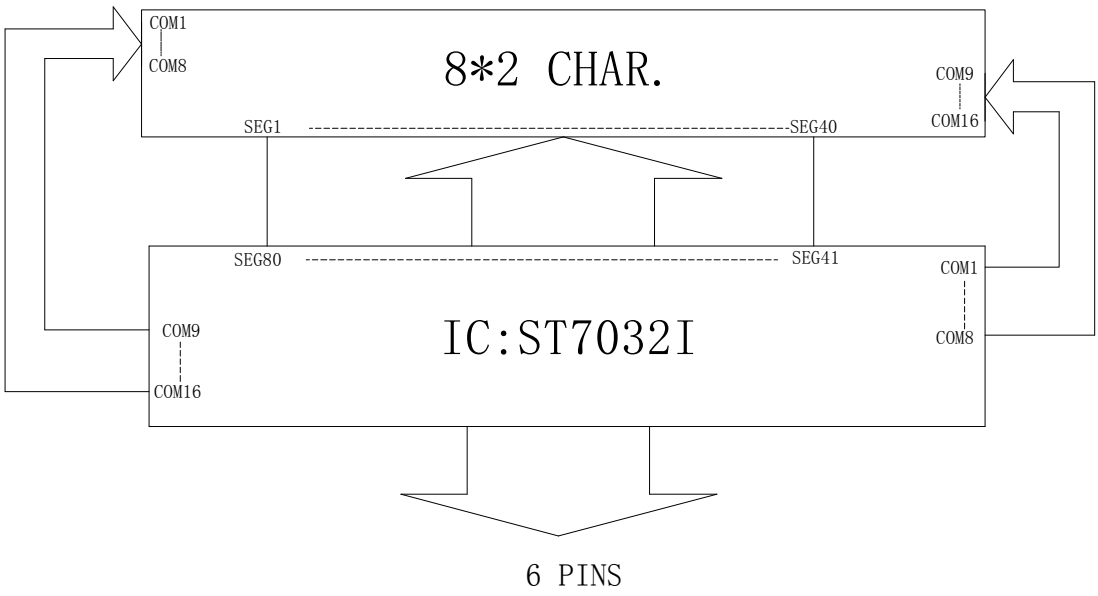
Vlcd=(V10,ON +V90,OFF)/2



(3). Definition of Viewing Angle θ and Φ



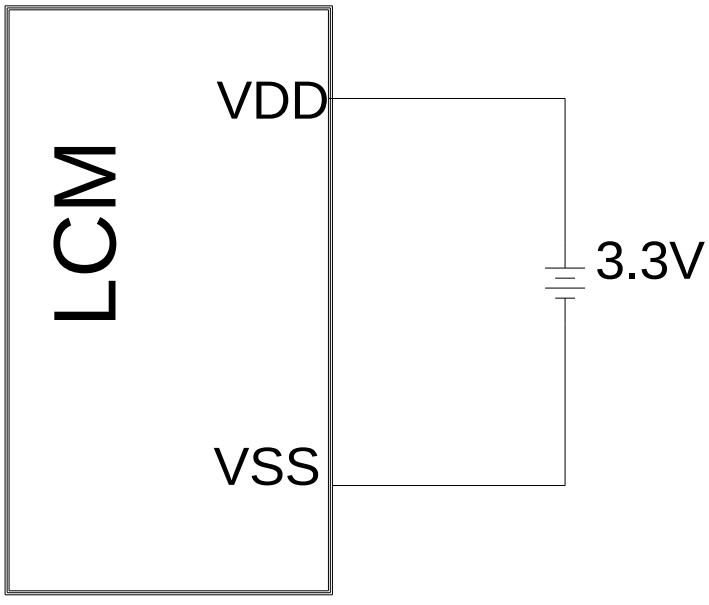
5.0 BLOCK DIAGRAM



6.0 PIN ASSIGNMENT

Pin No.	Symbol	Function
1	SCL	CLOCK INPUT
2	RST	EXTERNAL RESET PIN
3	SDA	DATA INPUT
4	VDD	Power supply
5	VSS	Ground
6	VLCD	Power supply for LCD drive

7.0 POWER SUPPLY

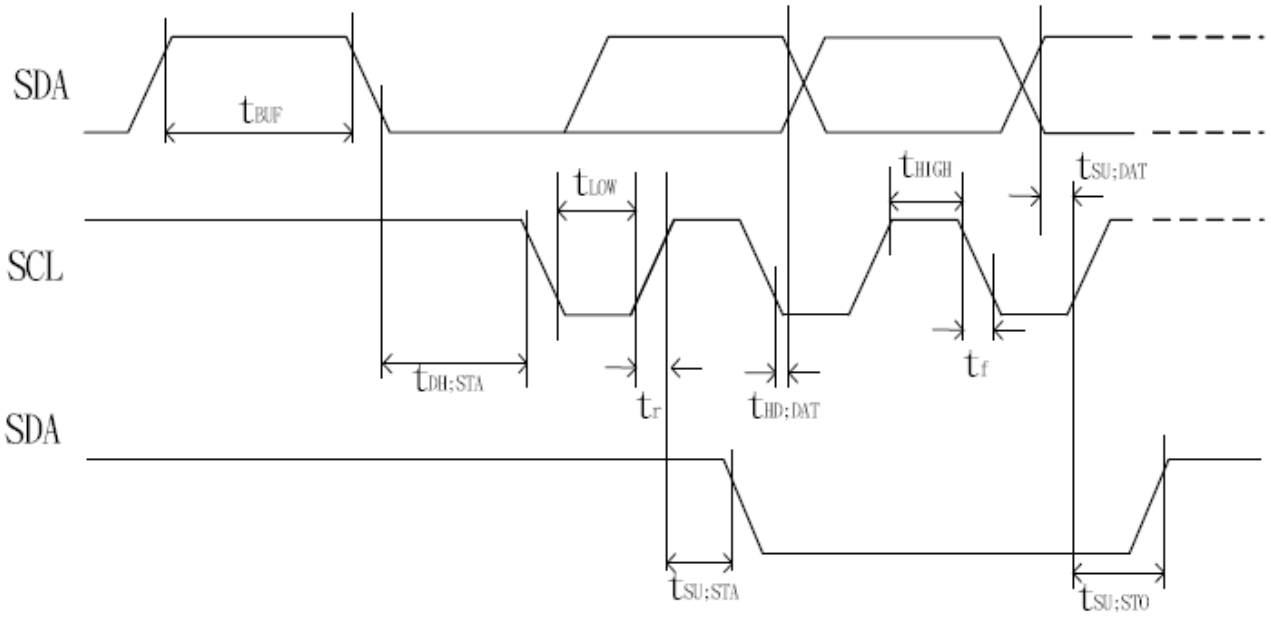


8.0 TIMING CHARACTERISTICS

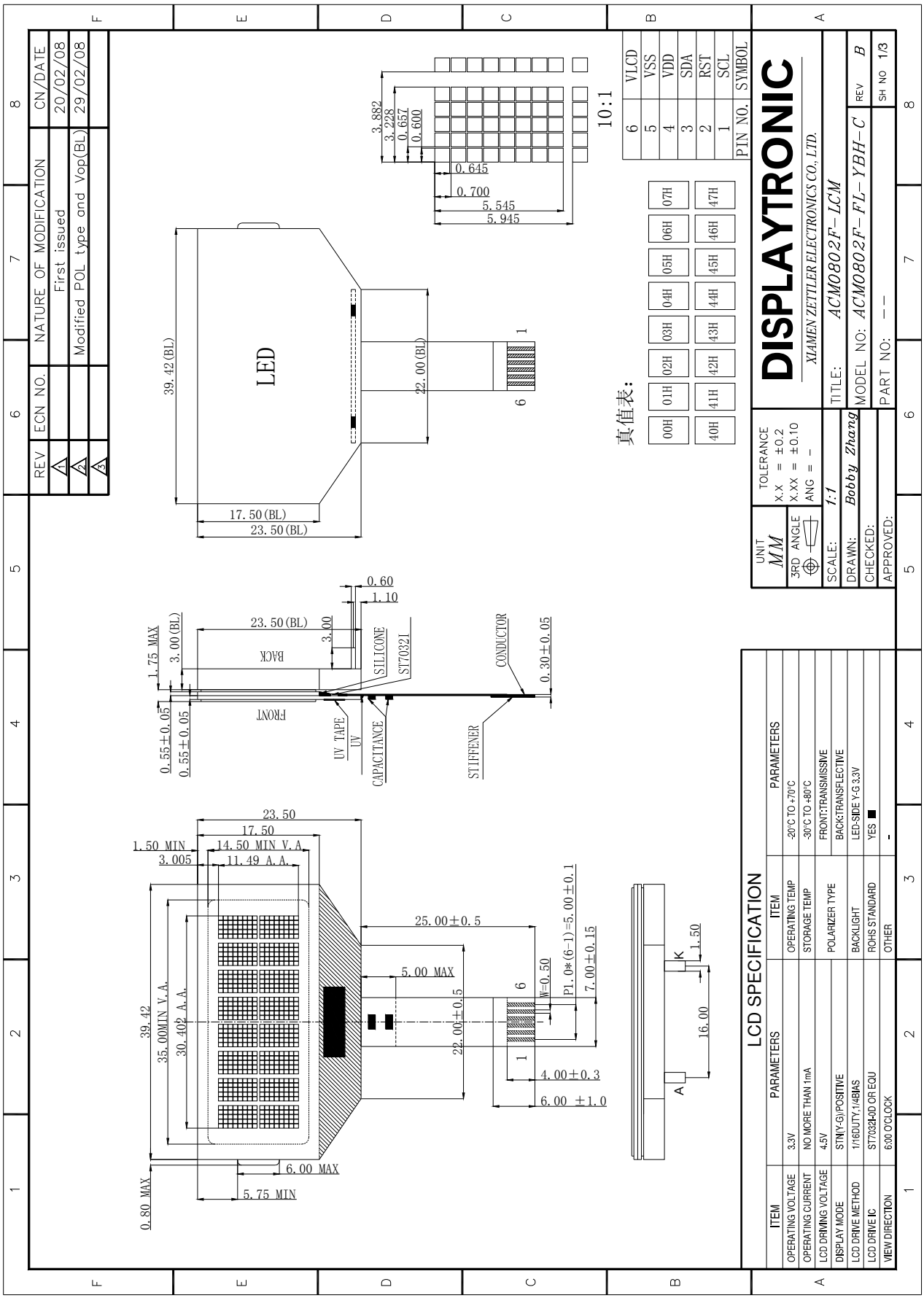
(Ta =-30°C to 85°C)

Item	Signal	Symbol	Condition	VDD=2.7 to 4.5V Rating		VDD=4.5 to 5.5V Rating		Units
				Min.	Max.	Min.	Max.	
SCL clock frequency	SCL	f_{SCLK}	—	DC	400	DC	400	KHz
SCL clock low period		t_{LOW}		1.3	—	1.3	—	us
SCL clock high period		t_{HIGH}		0.6	–	0.6	–	
Data set-up time	SI	$t_{SU;DAT}$	—	**180**	–	100	–	ns
Data hold time		$t_{HD;DAT}$		0	0.9	0	0.9	us
SCL,SDA rise time	SCL, SDA	t_r	—	20+0.1C_b	300	20+0.1C_b	300	ns
SCL,SDA fall time		t_f		20+0.1C_b	300	20+0.1C_b	300	
Capacitive load represent by each bus line		C_b	—	–	400	–	400	pf
Setup time for a repeated START condition	SI	$t_{SU;STA}$	—	0.6	–	0.6	–	us
Start condition hold time		$t_{HD;STA}$	—	0.6	–	0.6	–	us
Setup time for STOP condition		$t_{SU;STO}$	—	0.6	–	0.6	–	us
Bus free time between a Stop and START condition	SCL	t_{BUF}	—	1.3	–	1.3	–	us

I2C interface



9.0 MECHANICAL DIAGRAM



10.0 RELIABILITY TEST

Storage Condition	Content	Evaluations and Assessment*			
		Current Consumption	Oozing	Contrast	Other Appearances
Operation at high temperature and humidity	40ºC,90% RH,96hrs	Twice initial value or less	none	More than 80% of initial value	No abnormality
High temperature storage	60ºC, 96hrs	Twice initial value or less	none	More than 80% of initial value	No abnormality
Low temperature storage	-20ºC, 96hrs	Twice initial value or less		More than 80% of initial value	No abnormality

*Evaluations and assessment to be made two hours after returning to room temperature (25ºC±5ºC).
*The LCDs subjected to the test must not have dew condensation.

11.0 DISPLAY INSTRUCTION TABLE

Instruction	Instruction Code										Description	Instruction Execution Time		
	RS	R/W	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0		OSC= 380KHz	OSC= 540kHz	OSC= 700KHz
Clear Display	0	0	0	0	0	0	0	0	0	1	Write "20H" to DDRAM. and set DDRAM address to "00H" from AC	1.08 ms	0.76 ms	0.59 ms
Return Home	0	0	0	0	0	0	0	0	1	x	Set DDRAM address to "00H" from AC and return cursor to its original position if shifted. The contents of DDRAM are not changed.	1.08 ms	0.76 ms	0.59 ms
Entry Mode Set	0	0	0	0	0	0	0	1	I/D	S	Sets cursor move direction and specifies display shift. These operations are performed during data write and read.	26.3 us	18.5 us	14.3 us
Display ON/OFF	0	0	0	0	0	0	1	D	C	B	D=1:entire display on C=1:cursor on B=1:cursor position on	26.3 us	18.5 us	14.3 us
Cursor or Display Shift	0	0	0	0	0	1	S/C	R/L	x	x	S/C and R/L: Set cursor moving and display shift control bit, and the direction, without changing DDRAM data.	26.3 us	18.5 us	14.3 us
Function Set	0	0	0	0	1	DL	N	x	x	x	DL: interface data is 8/4 bits N: number of line is 2/1	26.3 us	18.5 us	14.3 us
Set CGRAM	0	0	0	1	AC5	AC4	AC3	AC2	AC1	AC0	Set CGRAM address in address counter	26.3 us	18.5 us	14.3 us
Set DDRAM address	0	0	1	AC6	AC5	AC4	AC3	AC2	AC1	AC0	Set DDRAM address in address counter	26.3 us	18.5 us	14.3 us
Read Busy flag and address	0	1	BF	AC6	AC5	AC4	AC3	AC2	AC1	AC0	Whether during internal operation or not can be known by reading BF. The contents of address counter can also be read.	0	0	0
Write data to RAM	1	0	D7	D6	D5	D4	D3	D2	D1	D0	Write data into internal RAM (DDRAM/CGRAM)	26.3 us	18.5 us	14.3 us
Read data from RAM	1	1	D7	D6	D5	D4	D3	D2	D1	D0	Read data from internal RAM (DDRAM/CGRAM)	26.3 us	18.5 us	14.3 us

Note:
Be sure the ST7032 is not in the busy state (BF = 0) before sending an instruction from the MPU to the ST7032. If an instruction is sent without checking the busy flag, the time between the first instruction and next instruction will take much longer than the instruction time itself. Refer to Instruction Table for the list of each instruction execution time.

12.0 CHARACTER PATTERNS(ST7032I-OD)

13.0 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.