TIANMA Microelectronics (U.S.A.) Inc.

SPECIFICATION FOR LCD MODULE

Model No. TM162JBC6

To:

□ Customer's Approval
Date: _____
By: _____

Presented
By: _____
Tianma Microelectronics (U.S.A.) Inc.

REVISION RECORD

Date	Ref. Page	Revision No.	Revision Items	Check & Approval

1 Display Specifications

1.1 Display type(TN/STN): STN

1.2 Display color*(TN/Yellow Mode/Gray Mode/B/W Mode): YELLOW

1.3 Polarizer mode(Positive/Negative): POSITIVE

1.4 Viewing Angle(6:00/12:00/Other): 6:00

1.5 Driving Duty:(1/8 1/16): 1/16

1.6 Backlight(None/LED/EL): LED

* Color tone is slightly changed by temperature and driving voltage.

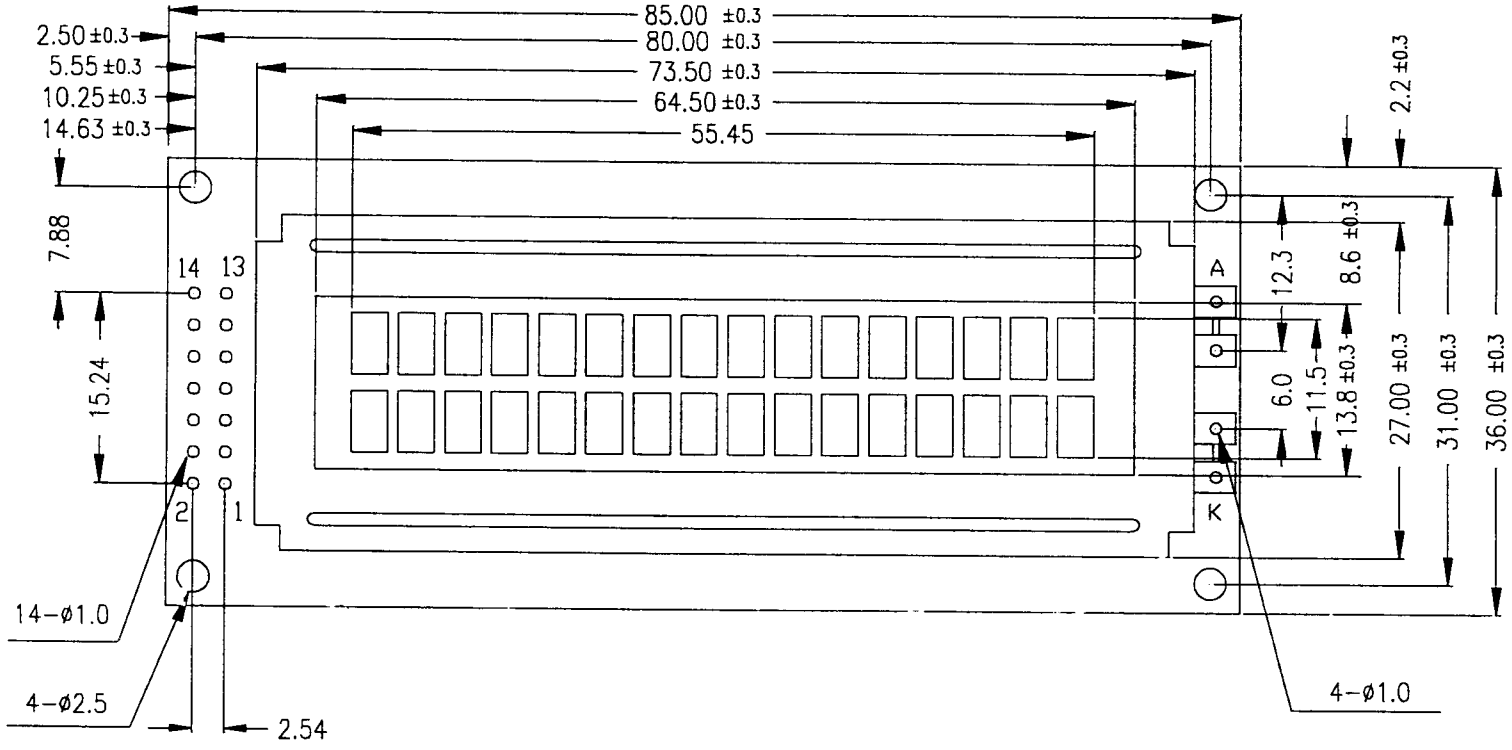
2 Mechanical Specifications

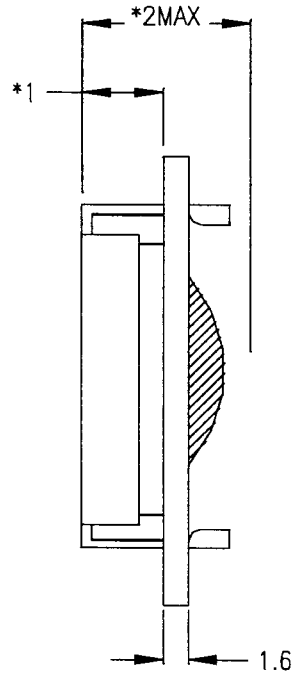
2.1 Outline Dimensions: Refer to outline drawing on page: 2

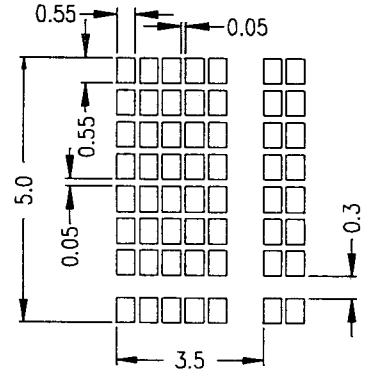
2.2 Dot Matrix: Refer to outline drawing on page: 2

2.3 Dot size: Refer to outline drawing on page: 2

2.4 Dot pitch: Refer to outline drawing on page : 2

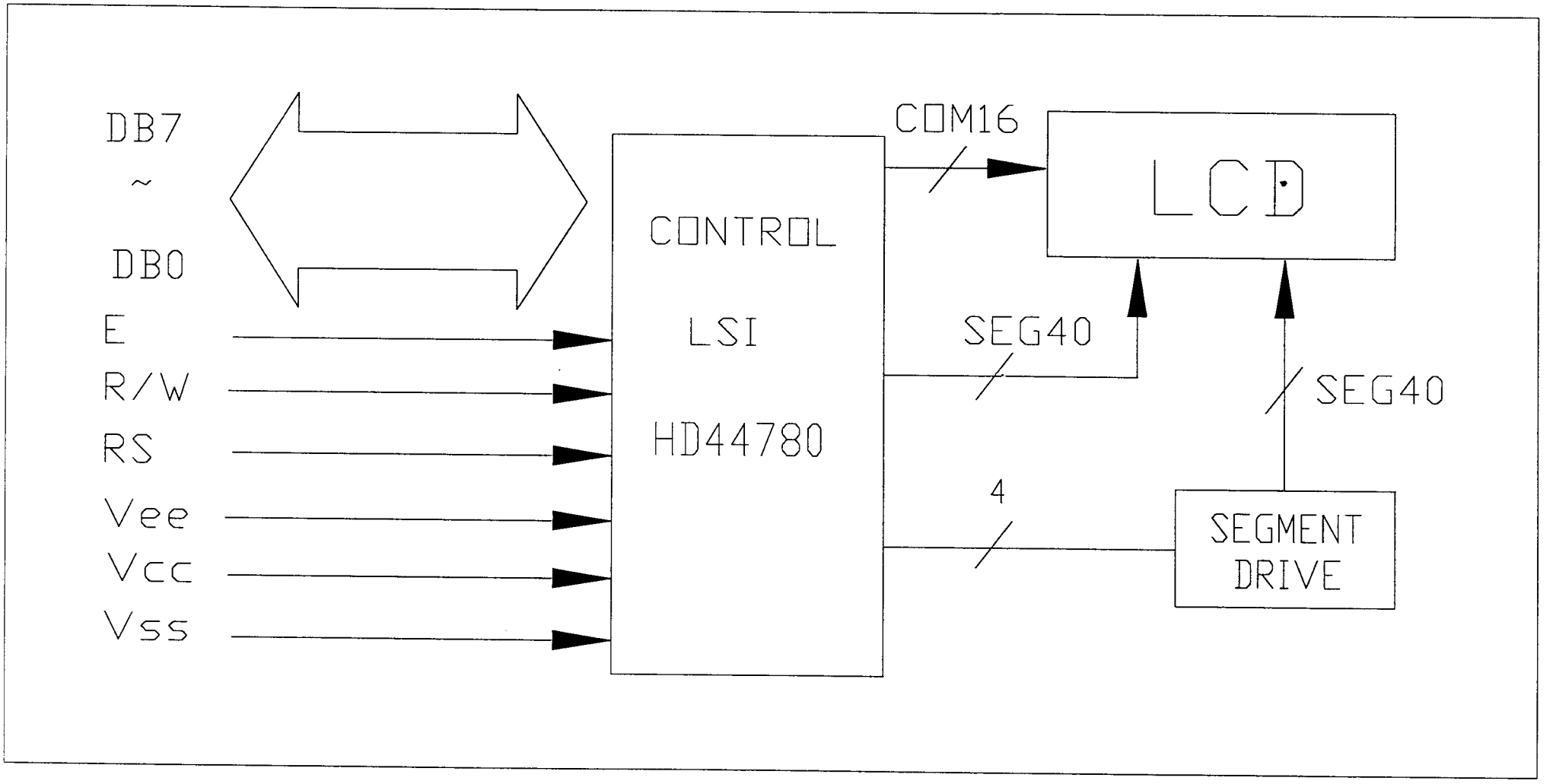






1	2	3	4	5	6	7	8	9	10	11	12	13	14	A	K
VSS	VDD	VO	RS	R/W	E	DB0	DB1	DB2	DB3	DB4	DB5	DB6	DB7	LED+	LED-

TYPE	*1	*2
R&EL	5.2	10.5
LED	7.7	14.0


DB7
~
DB0
E
R/W
RS
Vee
Vcc
Vss
CONTROL
LSI
HD44780
COM16
LCD
SEG40
SEG40
4
SEGMENT
DRIVE

4 Absolute Maximum Ratings

Item	Symbol	Min.	Max.	Unit	Remark
Power Supply Voltage	VDD–VSS	0	6.7	V	
LCD Driving Voltage	VDD–VEE	–	6.0		
Operating Temperature Range	Top	0	50	℃	No Condensation
Storage Tempernture Range	Tst	–20	70		

5 Electrical Specifications and Instruction Code

5.1 Electrical characteristics

Item		Symbol	Min.	Typ.	Max.	Unit	Remark
Supply Voltage (logic)		VDD–VSS	4.5	5.0	5.5	V	
Supply Voltage (LCD Drive)		VSS–VEE	4.5	4.7	5.0	V	
Input Signal Voltag	'H'Level	VIH	0.7VDD	–	VDD	V	
	'L'level	VIL	0	–	0.3VDD	V	
Supply current (logic)		IDD	2.0	–	4.0	mA	
Supply current (LCD Drive)		IEE	2.0		4.0	mA	

5.2 Interface Signals

Pin No.	Symbol	Level	Description
1	Vss	0V	Ground
2	Vcc	5.0V	Power supply voltage for logic and LCD(+)
3	Vo	0.5V	Power supply voltage for LCD(-)
4	RS	H/L	Instruction/Data Selects registers
5	R/W	H/L	Selects read or write
6	E	H/L	Enable Input
7	DB0	H/L	Data bit0
8	DB1	H/L	Data bit1
9	DB2	H/L	Data bit2
10	DB3	H/L	Data bit3
11	DB4	H/L	Data bit4
12	DB5	H/L	Data bit5
13	DB6	H/L	Data bit6
14	DB7	H/L	Data bit7
15	LED +	4.2V	DC Power supply Voltage for LED (+)
16	LED -	0V	DC Power supply Voltage for LED (-)

5.3 Interface Timing Chart:

Timing Characteristics

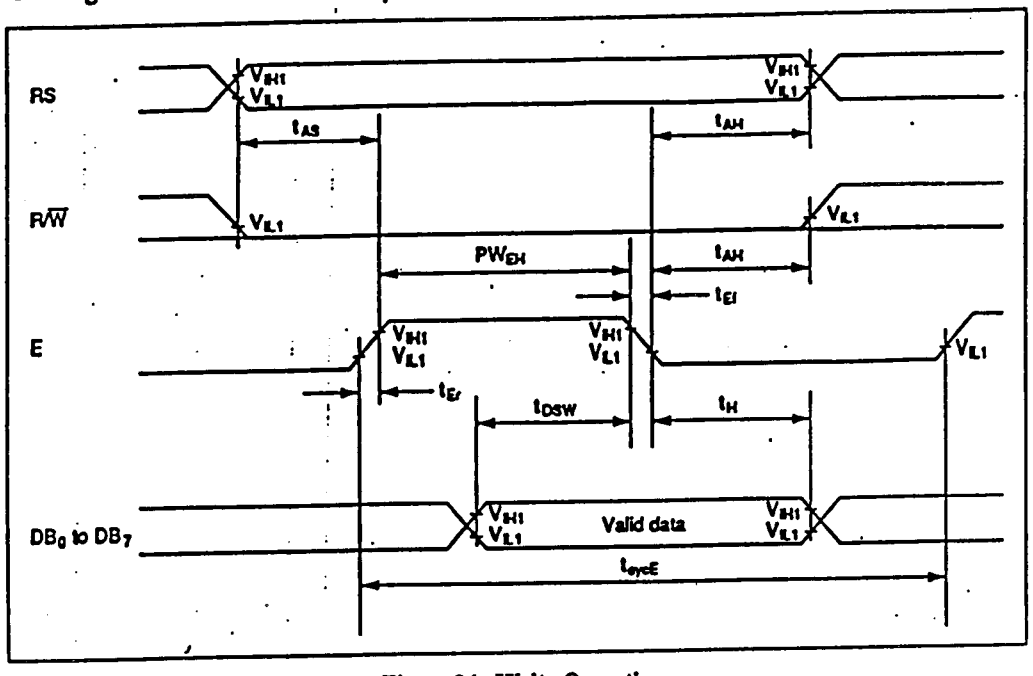
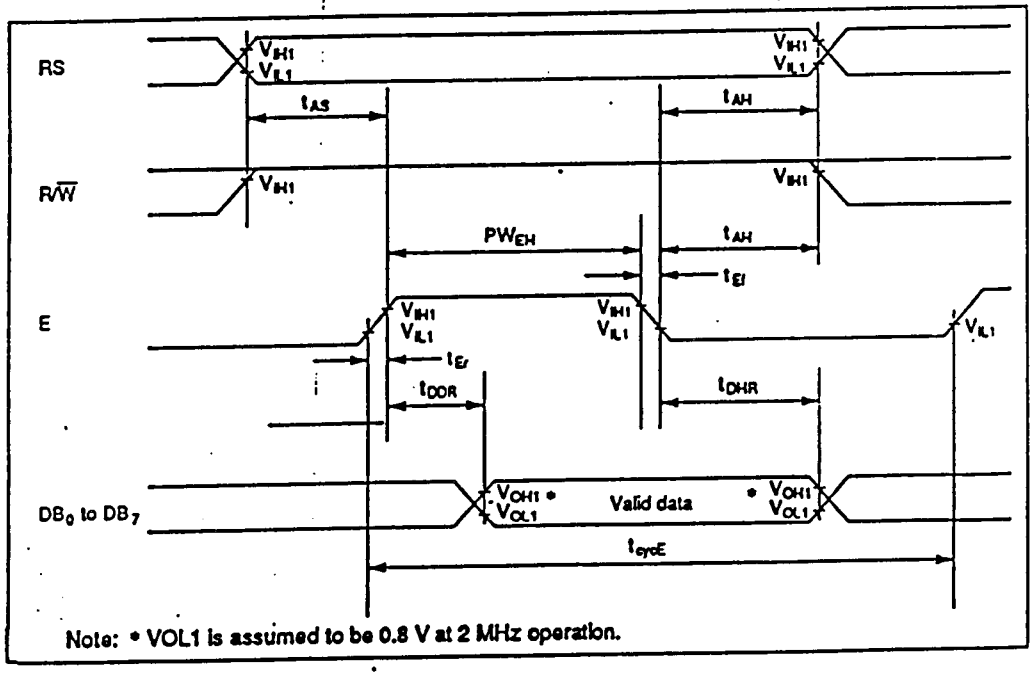


Figure 34 Write Operation



Note: * VOL1 is assumed to be 0.8 V at 2 MHz operation.

Write Operation

Item	Symbol	Min	Typ	Max	Unit
Enable cycle time	t_{cycE}	1000	—	—	ns
Enable pulse width (high level)	PW_{EH}	450	—	—	
Enable rise/fall time	t_{Er}, t_{Ef}	—	—	25	
Address set-up time (RS, R/$\overline{W}$ to E)	t_{AS}	60	—	—	
Address hold time	t_{AH}	20	—	—	
Data set-up time	t_{DSW}	195	—	—	
Data hold time	t_H	10	—	—	

Read Operation

Item	Symbol	Min	Typ	Max	Unit
Enable cycle time	t_{cycE}	1000	—	—	ns
Enable pulse width (high level)	PW_{EH}	450	—	—	
Enable rise/fall time	t_{Er}, t_{Ef}	—	—	25	
Address set-up time (RS, R/W to E)	t_{AS}	60	—	—	
Address hold time	t_{AH}	20	—	—	
Data delay time	t_{DDR}	—	—	360	
Data hold time	t_{DHR}	5	—	—	

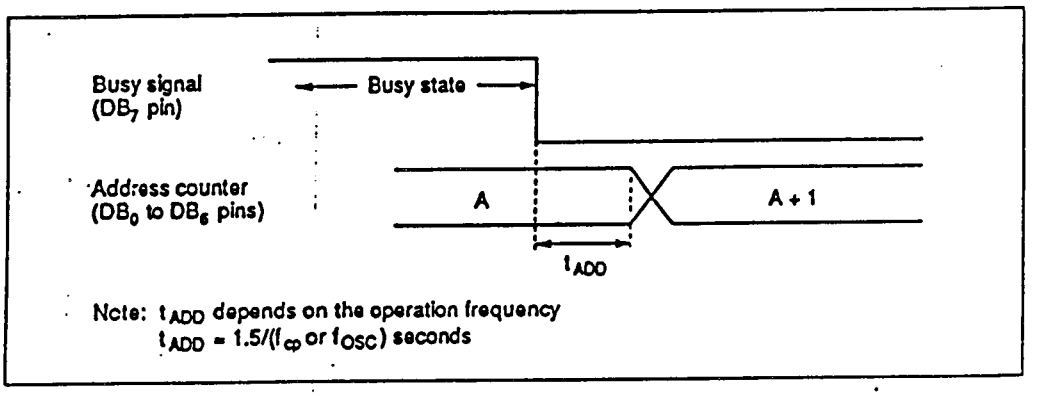
5.4 Instruction Code.

Instruction	Code RS	R/$\overline{W}$	DB_7	DB_6	DB_5	DB_4	DB_3	DB_2	DB_1	DB_0	Description	Execution Time (max) (when f_{cp} or f_{OSC} is 270 kHz)
Clear display	0	0	0	0	0	0	0	0	0	1	Clears entire display and sets DD RAM address 0 in address counter.	15.2 ms
Return home	0	0	0	0	0	0	0	0	1	—	Sets DD RAM address 0 in address counter. Also returns display from being shifted to original position. DD RAM contents remain unchanged.	15.2 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.	37 µs
Display on/off control	0	0	0	0	0	0	1	D	C	B	Sets entire display (D) on/off, cursor on/off (C), and blinking of cursor position character (B).	37 µs
Cursor or display shift	0	0	0	0	0	1	S/C	R/L	—	—	Moves cursor and shifts display without changing DD RAM contents.	37 µs
Function set	0	0	0	0	1	DL	N	F	—	—	Sets interface data length (DL), number of display lines (N), and character font (F).	37 µs
Set CG RAM address	0	0	0	1	A_{CG}	A_{CG}	A_{CG}	A_{CG}	A_{CG}	A_{CG}	Sets CG RAM address. CG RAM data is sent and received after this setting.	37 µs
Set DD RAM address	0	0	1	A_{DD}	A_{DD}	A_{DD}	A_{DD}	A_{DD}	A_{DD}	A_{DD}	Sets DD RAM address. DD RAM data is sent and received after this setting.	37 µs
Read busy flag & address	0	1	BF	AC	AC	AC	AC	AC	AC	AC	Reads busy flag (BF) indicating internal operation is being performed and reads address counter contents.	0 µs

Table 6 Instructions (cont)

Instruction	Code RS	R/W	DB_7	DB_6	DB_5	DB_4	DB_3	DB_2	DB_1	DB_0	Description	Execution Time (max) (when f_{cp} or f_{OSC} is 270 kHz)
Write data to CG or DD RAM	1	0	Write data								Writes data into DD RAM or CG RAM.	37 μs t_{ADD} = 4 μs*
Read data from CG or DD RAM	1	1	Read data								Reads data from DD RAM or CG RAM.	37 μs t_{ADD} = 4 μs*
	I/D = 1: Increment I/D = 0: Decrement S = 1: Accompanies display shift S/C = 1: Display shift S/C = 0: Cursor move R/L = 1: Shift to the right R/L = 0: Shift to the left DL = 1: 8 bits, DL = 0: 4 bits N = 1: 2 lines, N = 0: 1 line F = 1: 5 × 10 dots, F = 0: 5 × 8 dots BF = 1: Internally operating BF = 0: Instructions acceptable										DD RAM: Display data RAM CG RAM: Character generator RAM A_{CG}: CG RAM address A_{DD}: DD RAM address (corresponds to cursor address) AC: Address counter used for both DD and CG RAM addresses	Execution time changes when frequency changes Example: When f_{cp} or f_{OSC} is 250 kHz, $37\ \mu s \times \frac{270}{250} = 40\ \mu s$

Note: — Indicates no effect.
* After execution of the CG RAM/DD RAM data write or read instruction, the RAM address counter is incremented or decremented by 1. The RAM address counter is updated after the busy flag turns off. In figure 13, t_{ADD} is the time elapsed after the busy flag turns off until the address counter is updated.



Note: t_{ADD} depends on the operation frequency
t_{ADD} = 1.5/(f_{cp} or f_{OSC}) seconds

6. Optical Characteristics

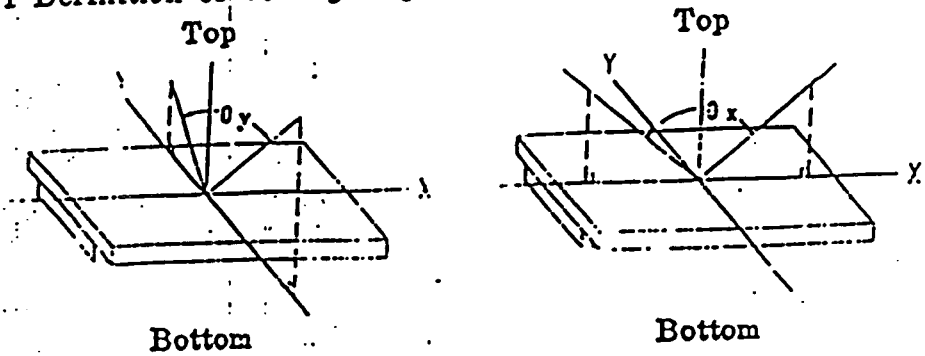
6.1 TN LCD Module Optical Characteristics

Ta=25℃

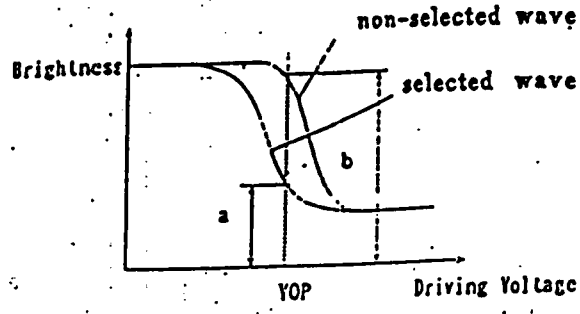
Item		Symbol	Condition		Min.	Typ.	Max.	Unit	Remark
Viewing Angle		θ x	Cr≥ 2	θ y=0	10	—	40	Deg	
		θ y		θ x=0	-30	—	30		
Contrast Ratio		Cr	θ x=0° θ y=20°		8				
Response Time	Turn on	Ton	θ x=0° θ y=0°				150	ms	
	Turn off	Toff					150		

6.2 Definition of optical characteristics

6.2.1 Definition of vewing Angle(see fig. as follow)



6.2.2 Definition of Contrast Ratio(see fig. as follow)

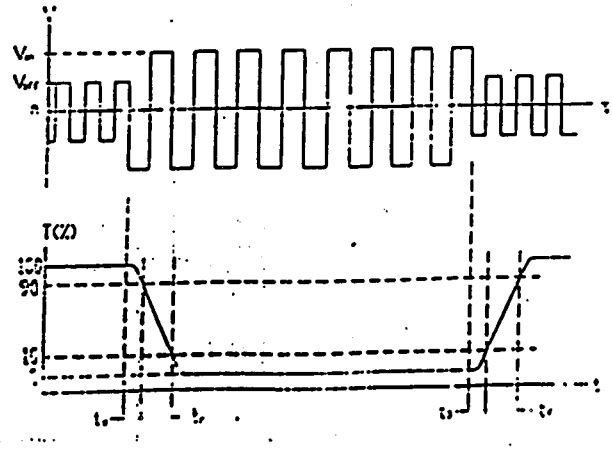


$$\text{Contrast Ratio}=b/a=\frac{\text{non-selected state brightness}}{\text{selected state brightness}}$$

Measuring Conditions:

1) Ambient Temperature: 25℃ ; 2) Frame frequency: 32Hz

6.2.3 Definition of Response time(see fig. as follow)



Turn-on time: $t_{on}=t_A+t_r$

Turn-off time: $t_{off}=t_D+t_f$

Measuring Condition:

1) Operating Voltage: 12 V ; 2) Frame friquency: 32Hz

7. Reliability

7.1 Content of Reliablity Test

No	Test Item	Content of Test	Test condition
1	High Temperature Storage	Endurance test applying the high storage temperature for a long time	60℃ 96H
2	Low Temperature Storage	Endurance test applying the low storage temperature for a long time	-20℃ 96H
3	High Temperature Operation	Endurance test applying the electric stress (voltage & current)and the thermal stress to the element for a long time	50℃ 96H
4	Low Temperature Operature	Endurance test applying the electric stress under low temperature for a long time	0℃ 96H
5	High Temperature /Humidity Storage	Endurance test applying the high temperature and high humidity storage for a long time	40℃ 90%RH 96H
6	Temperature Cycle	Endurance test applying the low and high temperature cycle -20℃←→25℃←→60℃←→25℃ 30min 5min 30min 5min ←——————→ 1 cycle	-20℃/60℃ 10 cycles
7	Vibration Test(package state)	Endurance test applying the vibration during transportation	10Hz~55Hz ~10Hz; 1.5mmP-P, 1.5g; X.Y.-15min
8	Shock Test (package state)	Endurance test applying the shock during transportation	Drop a product from a height of 76cm to a solid unbending and horizontal plane
9	Atmospheric Pressure Test	Eudurance test applying the atmospheric pressure during transportation by air	40kPa 16H

7.2 Failure Judgment Criterion

Criterion Item	Test Item No.									Failure
	1	2	3	4	5	6	7	8	9	
Basic Specification	O	O	O	O	O	O	O	O	O	Out of the basic specfication
Electrical Specification	O	O	O	O	O					Out of the electrical specification
Mechanical Specification						O	O	O		Out of the mechanical specification
Optical Characteristic	O	O	O	O	O	O			O	Out of the optical specification
Remark	Basic specification= Display specification + Mechanical specification									

8 Precautions for use of LCD Modules.

8.1 Handling Precautions

8.1.1 The display panel is made of glass. Do not subject it to a mechanical shock by dropping it from a high place,etc.

8.1.2 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.

8.1.3 Do not apply excessive force to the display surface or the adjoining areas since this may cause the color tone to vary.

8.1.4 The polarizer covering the display surface of the LCD module is soft and easily scratched. Handle this polarizer carefully.

8.1.5 If the display surface is contaminated, breathe on the surface and gently wipe it with a soft dry cloth.if still not completely clear, moisten cloth with one of the following solvents:

— Isopropyl alcohol
— Ethyl alcohol

Solvents other than those mentioned above may damage polarizer.Especially,do not use the following:

—Water
—Ketone
—Aromatic solvents

8.1.6 Do not attempt to disassemble the LCD Module.

8.1.7 NC terminal should be open. Do not connect anything.

8.1.8 If the logic circuit power is off,do not apply the input signals.

8.1.9 To prevent destruction of the elements by static electricity,be careful to maintain an optimum work environment.

a. Be sure to ground the body when handling the LCD Modules.
b. Tools required for assembly, such as soldering irons,must be properly ground.
c. To reduce the amount of static electricity generated do not conduct assembly and other work under dry conditions.
d. The LCD Module is coated with a film to protect the display surface. Be care when peeling off this protective film since static electricity may be generated.

8.2 Storage precautions

8.2.1 When storing the LCD modules, avoid exposure to direct sunlight or to the light of fluorescent lamps.

8.2.2 Keep the LCD modules in bags designed to prevent static electri-city charging.

8.2.3 The LCD modules should be stored under the storage temperature range. If the LCD modules will be stored for a long time, the recommend condition is:

temperature : 0℃ ~ 40℃

relatively humidity: <80%

8.2.4 The LCD modules should be stored in the room without acid, alkali and harmful gas.

8.3 The LCD modules should be no falling and violent shocking during transportation, and also should avoid excessive press, water, damp and sunshine.

ADDITION 1:

Character Code & Pattern Table

Lower 4bit \ Higher 4bit	0000	0010	0011	0100	0101	0110	0111	1010	1011	1100	1101	1110	1111
××××0000	CG RAM (1)												
××××0001	(2)												
××××0010	(3)												
××××0011	(4)												
××××0100	(5)												
××××0101	(6)												
××××0110	(7)												
××××0111	(8)												
××××1000	(1)												
××××1001	(2)												
××××1010	(3)												
××××1011	(4)												
××××1100	(5)												
××××1101	(6)												
××××1110	(7)												
××××1111	(8)												

(Note) CGRAM is a character generator RAM that stores character patterns the user can freely re-write in the program.