

TIANMA MICROELECTRONICS CO., LTD

DEVICE SPECIFICATION FOR LCD MODULE

Model No. TM202JFF6

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To: _____

☐ CUSTOMER'S APPROVAL

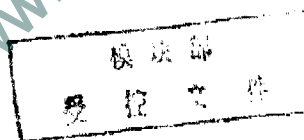
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REVISION RECORD

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

1 Display Specifications

1.1 Display type: STN

1.2 Display color*:

Display color: White

Background color: Blue

1.3 Polarizer mode: Transmissive/Negative

1.4 Viewing Angle: 6:00

1.5 Driving Duty: 1/16

1.6 Backlight: LED

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

2 Mechanical Specifications

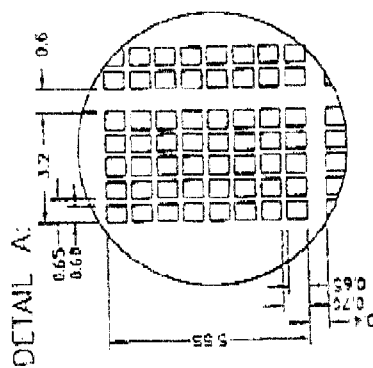
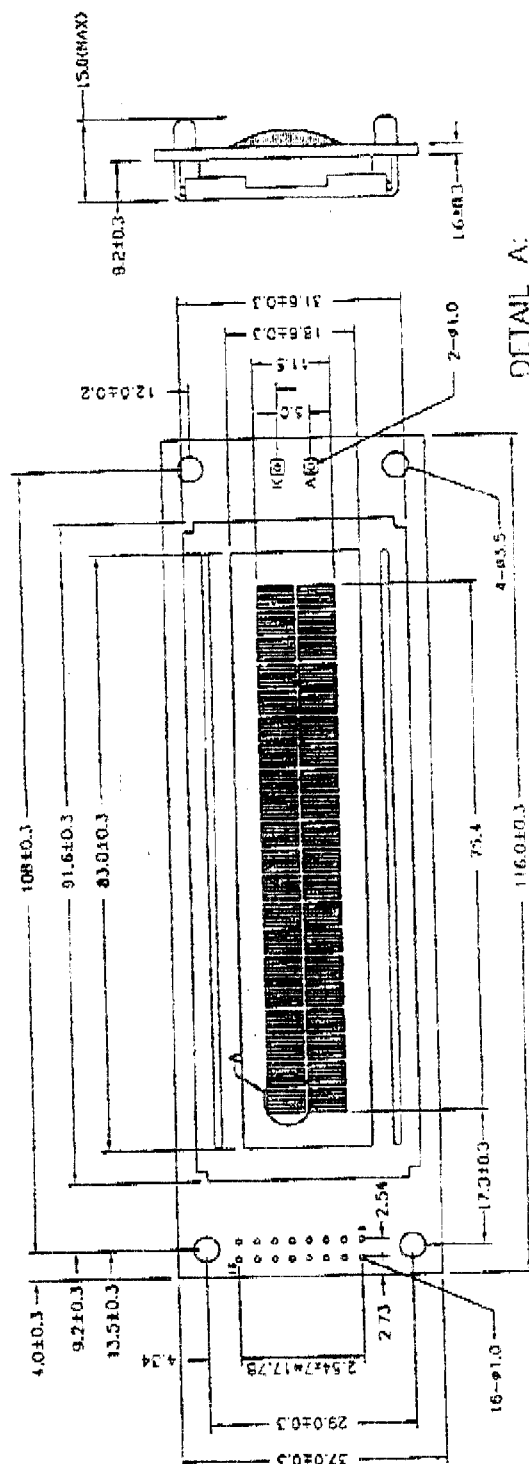
2.1 Outline Dimensions: Refer to outline drawing on page: 2

2.2 Display Format: 20 Characters X 2 Lines

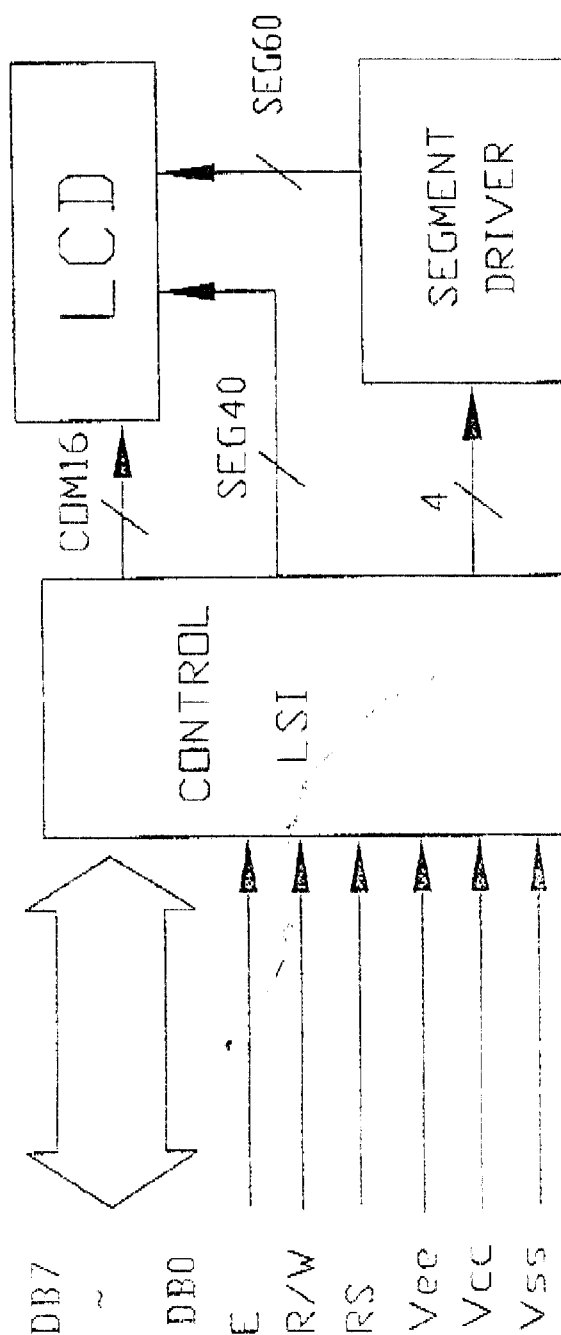
2.3 Dot size: 0.60X0.65 (mm)

2.4 Dot pitch: 0.65X0.70 (mm)

2.5 Weight: 55g



3 Circuit Block Diagram



4 Absolute Maximum Ratings

Item	Symbol	Min.	Max.	Unit	Remark
Power Supply Voltage	$V_{DD}-V_{SS}$	0	7	V	
LCD Driving Voltage	$V_{DD}-V_{EE}$	0	8		
Operating Temperature Range	T_{OP}	0	+50	°C	No Condensation
Storage Temperature Range	T_{ST}	-20	+60		

5 Electrical Specifications and Instruction Code

5.1 Electrical characteristics

Item		Symbol	Min.	Typ.	Max.	Unit	Remark
Supply Voltage (Logic)		$V_{DD}-V_{SS}$	4.5	5.0	5.5	V	
Supply Voltage (LCD Drive)		$V_{DD}-V_{EE}$	-	4.7	-	V	
Input Signal Voltage	'H'Level	V_{IH}	$0.7V_{DD}$	-	$V_{DD}+0.3$	V	
	'L'Level	V_{IL}	0	-	$0.2V_{DD}$	V	
Supply current (Logic)		I_{DD}	-	1.1	-	mA	
Supply current (LCD Drive)		I_{FE}	-	0.1	-	mA	

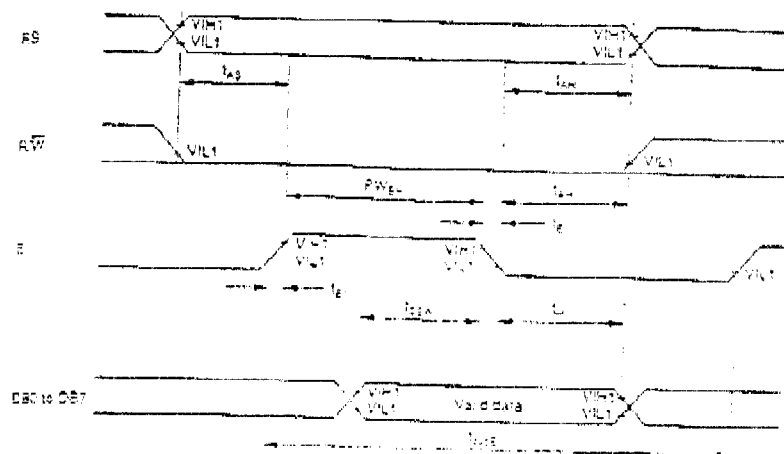
5.2 Interface Signals

Pin No.	Symbol	Level	Description
1	Vss	0V	Ground
2	Vcc	5.0V	Power supply voltage for logic and LCD(+)
3	VEE	0.3V	Power supply voltage for LCD(-)
4	RS	H/L	Selects registers
5	R/W	H/L	Selects read or write
6	E	H/L	Starts data read/write
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	A	4.2V	The positive electrode of LED backlight
16	K	0V	The negative electrode of LED backlight

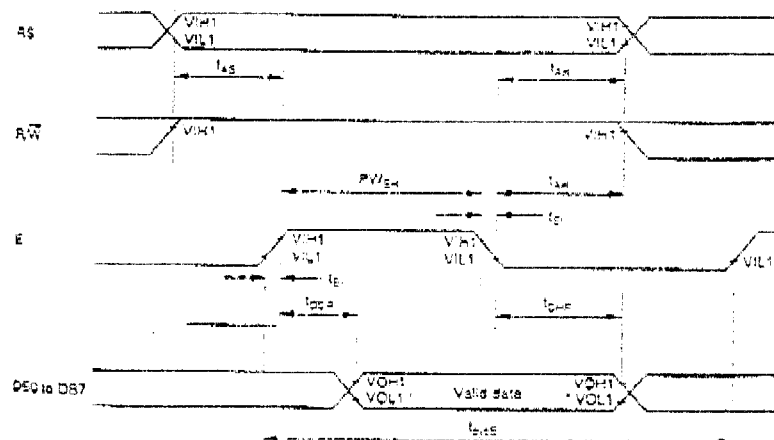
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5.3 Interface Timing Chart:

Write Operation



Read Operation



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5.4 Instruction Code

Instruction	Code										Description	Execution Time (max) (when f_{clk} or f_{osc} is 270 kHz)
	RS	R/W	DS7	DS6	DS5	DS4	DS3	DS2	DS1	DS0		
Clear display	0	0	0	0	0	0	0	0	0	1	Clears entire display and sets DDRAM address 0 in address counter.	
Return home	0	0	0	0	0	0	0	0	1	—	Sets DDRAM address 0 in address counter. Also returns display from being shifted to original position. DDRAM contents remain unchanged.	152 ns
Entry mode set	0	0	0	0	0	0	0	1	10	S	Sets cursor move direction and specifies display shift. These operations are performed during data write and read.	37 μ s
Display on/off control	0	0	0	0	0	0	1	0	0	B	Sets entire display (D) on/off, cursor on/off (C), and blinking of cursor position character (B).	37 μ s
Cursor or display shift	0	0	0	0	0	1	S/C	R/L	—	—	Moves cursor and shifts display without changing DDRAM contents.	37 μ s
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 μ s
Set CGRAM address	0	0	0	1	ACG	ACG	ACG	ACG	ACG	ACG	Sets CGRAM address. CGRAM data is sent and received after this setting.	37 μ s
Set DDRAM address	0	0	1	ADD	ADD	ADD	ADD	ADD	ADD	ADD	Sets DDRAM address. DDRAM data is sent and received after this setting.	37 μ s
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 μ s
Write data to CG or DDRAM	1	0	Write data								Writes data into DDRAM or CGRAM.	37 μ s $t_{acc} = 4 \mu$ s*
Read data from CG or DDRAM	1	1	Read data								Reads data from DDRAM or CGRAM.	37 μ s $t_{acc} = 4 \mu$ s*

I/D = 1: Increment	DDRAM: Display data RAM	Execution time changes when frequency changes
I/D = 0: Decrement	CGRAM: Character generator RAM	Example:
S = 1: Accompanies display shift	ACG: CGRAM address	When f_{clk} or f_{osc} is
S/C = 1: Display shift	ADD: DDRAM address	250 kHz,
S/C = 0: Cursor move	(corresponds to cursor address)	37μ s $\times \frac{270}{250} = 40 \mu$ s
R/L = 1: Shift to the right	AC: Address counter used for both DD and CGRAM addresses	
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 $\times$ 10 dots, F = 0: 5 $\times$ 8 dots		
BF = 1: Internally operating		
BF = 0: Instructions acceptable		

5.5 Standard Character Pattern

Upper 4bit Lower 4bit		LLLL	LLH	LLHL	LLHH	LHLL	LHLH	LHHL	LHHH	HLLL	HLLH	HLHL	HLHH	HHLL	HHLH	HHHL	HHHH
LLLL	CG RAM (1)																
LLH	(2)																
LLHL	(3)																
LLHH	(4)																
LHLL	(5)																
LHLH	(6)																
LHHL	(7)																
LHHH	(8)																
HLLL	(1)																
HLLH	(2)																
HLHL	(3)																
HLHH	(4)																
HHLL	(5)																
HHLH	(6)																
HHHL	(7)																
HHHH	(8)																

2 12 Y 16

6.Optical Characteristics

6.1 Optical Characteristics

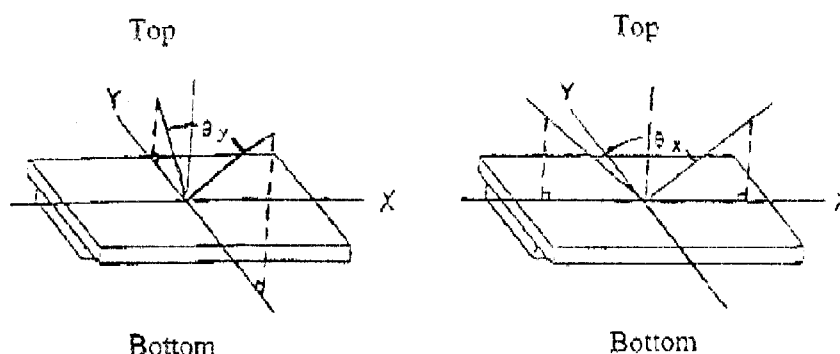
Top=25°C

Item		Symbol	Condition		Min.	Typ.	Max.	Unit	Remark
Viewing Angle		θ_x	Cr>2	$\theta_y=0^\circ$	-30	--	30	Deg	
		θ_y		$\theta_x=0^\circ$	-35	--	20		
Contrast Ratio		Cr	$\theta_x=0^\circ$ $\theta_y=0^\circ$		4.0				
Response Time	Turn on	Ton	$\theta_x=0^\circ$ $\theta_y=0^\circ$				250	ms	
	Turn off	Toff					250		

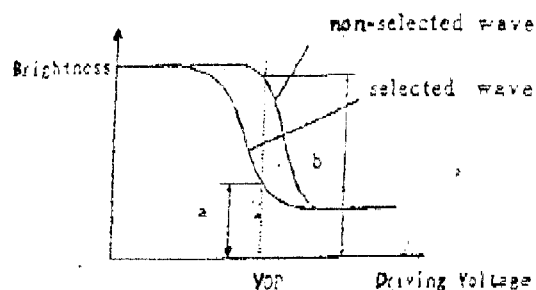
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6.2 Definition of optical characteristics

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



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

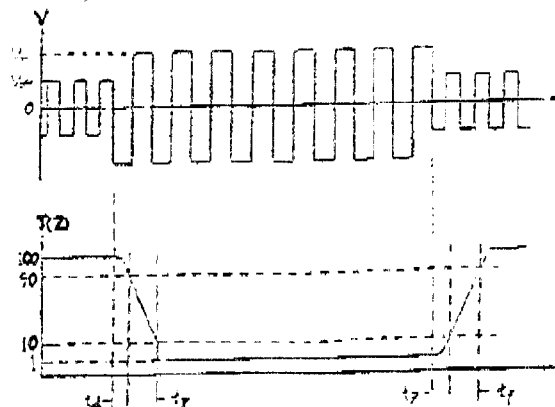


$$\text{Contrast Ratio} = b / a = \frac{\text{non-selected state brightness}}{\text{selected state brightness}}$$

Measuring Conditions:

- 1) Ambient Temperature: 25°C ;
- 2) Frame frequency: 64Hz

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



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

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

Measuring Condition:

- 1) Operating Voltage: 4.7V ;
- 2) Frame frequency: 64Hz

7. Reliability

7.1 Content of Reliability Test

($T_{OP}=25^{\circ}\text{C}$)

No.	Test Item	Content of Test	Test condition
1	High Temperature Storage	Endurance test applying the high storage temperature for a long time	60°C 96H
2	Low Temperature Storage	Endurance test applying the low storage temperature for a long time	-20°C 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°C 96H
4	Low Temperature Operation	Endurance test applying the electric stress under low temperature for a long time	0°C 96H
5	High Temperature /Humidity Storage	Endurance test applying the high temperature and high humidity storage for a long time	40°C 90%RH 96H
6	Temperature Cycle	Endurance test applying the low and high temperature cycle $\begin{array}{c} -20^{\circ}\text{C} \longleftrightarrow 25^{\circ}\text{C} \longleftrightarrow 60^{\circ}\text{C} \longleftrightarrow -20^{\circ}\text{C} \\ 30\text{min} \quad 5\text{min} \quad / \quad 30\text{min} \quad 5\text{min} \\ \hline \text{1 cycle} \end{array}$	-20°C/60°C 10 cycles
7	Vibration Test (package state)	Endurance test applying the vibration during transportation	10Hz~150Hz, 50m/s ² , 40min
8	Shock Test (package state)	Endurance test applying the shock during transportation	Half-sinewave, 100m/s ² , 11ms
9	Atmospheric Pressure Test	Endurance test applying the atmospheric pressure during transportation by air	40kPa 16H

7.2 Failure Judgment Criterion

Criterion Item	Test Item No.									Failure Judgement Criterion
	1	2	3	4	5	6	7	8	9	
Basic Specification	0	0	0	0	0	0	0	0	0	Out of the basic Specification
Electrical specification	0	0	0	0	0					Out of the electrical specification
Mechanical Specification							0	0		Out of the mechanical specification
Optical Characteristic	0	0	0	0	0	0			0	Out of the optical specification
Remark	Basic specification = Optical 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 alcoholSolvents other than those mentioned above may damage the 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 If the logic circuit power is off, do not apply the input signals.
- 8.1.8 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 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 : $0^{\circ}\text{C} \sim 40^{\circ}\text{C}$

relatively humidity: $\leq 80\%$

8.2.3 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.