

TIAN-MA  
MICROELECTRONICS CO., LTD

DEVICE SPECIFICATION FOR LCD MODULE

Model No. TM240128ABC

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To: \_\_\_\_\_

CUSTOMER'S APPROVAL

DATE \_\_\_\_\_

By: \_\_\_\_\_

Presented

By: \_\_\_\_\_

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## 1 Display Specifications

1.1 Display type: STN

1.2 Display color\*:

Display color: Blue-Black

Background color: Yellow-Green

1.3 Polarizer mode: Transflective/Positive

1.4 Viewing Angle: 6:00

1.5 Driving Duty: 1/128

1.6 Backlight Type: LED

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

## 2 Mechanical Specifications

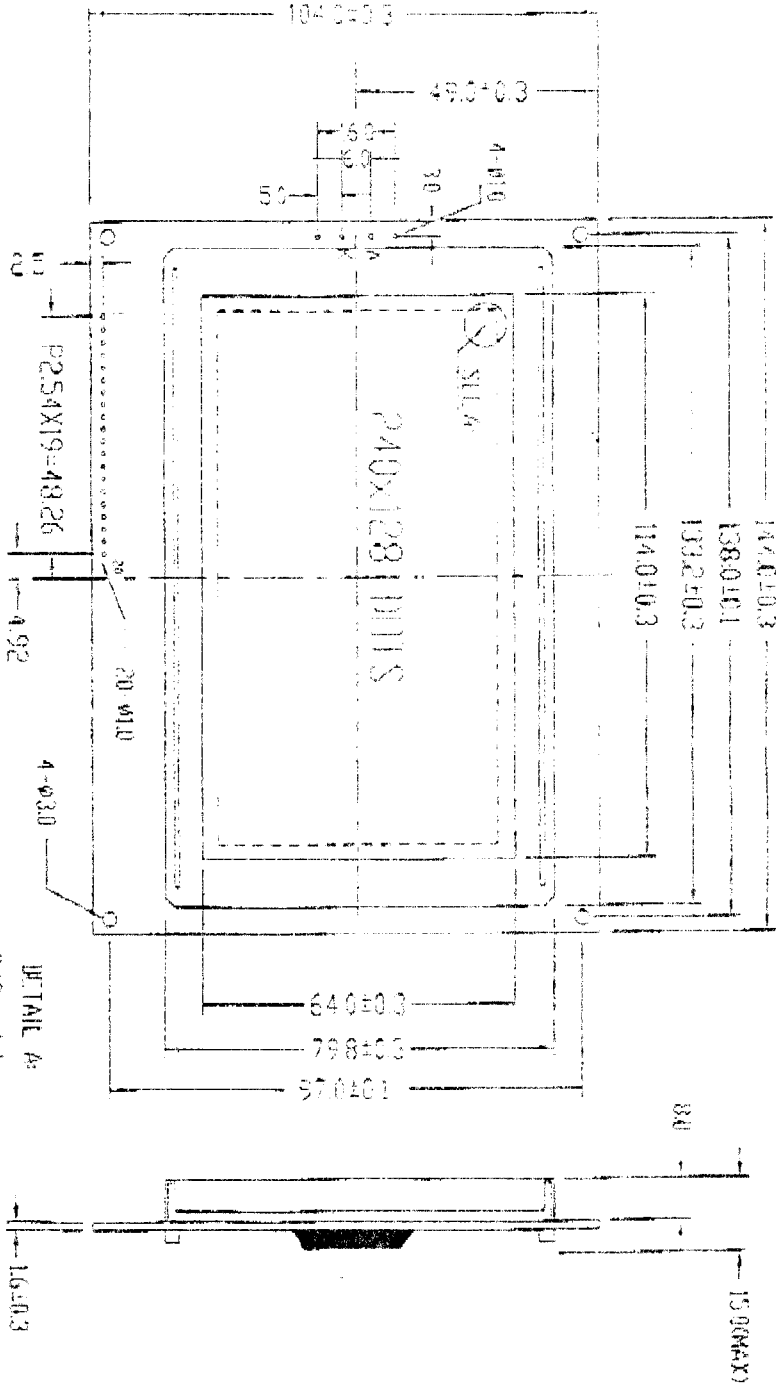
2.1 Outline Dimensions: Refer to outline drawing on page: 2

2.2 Dot Matrix: 240 × 128

2.3 Dot size: 0.40 × 0.40(mm)

2.4 Dot pitch: 0.45 × 0.45(mm)

2.5 Weight: 200g

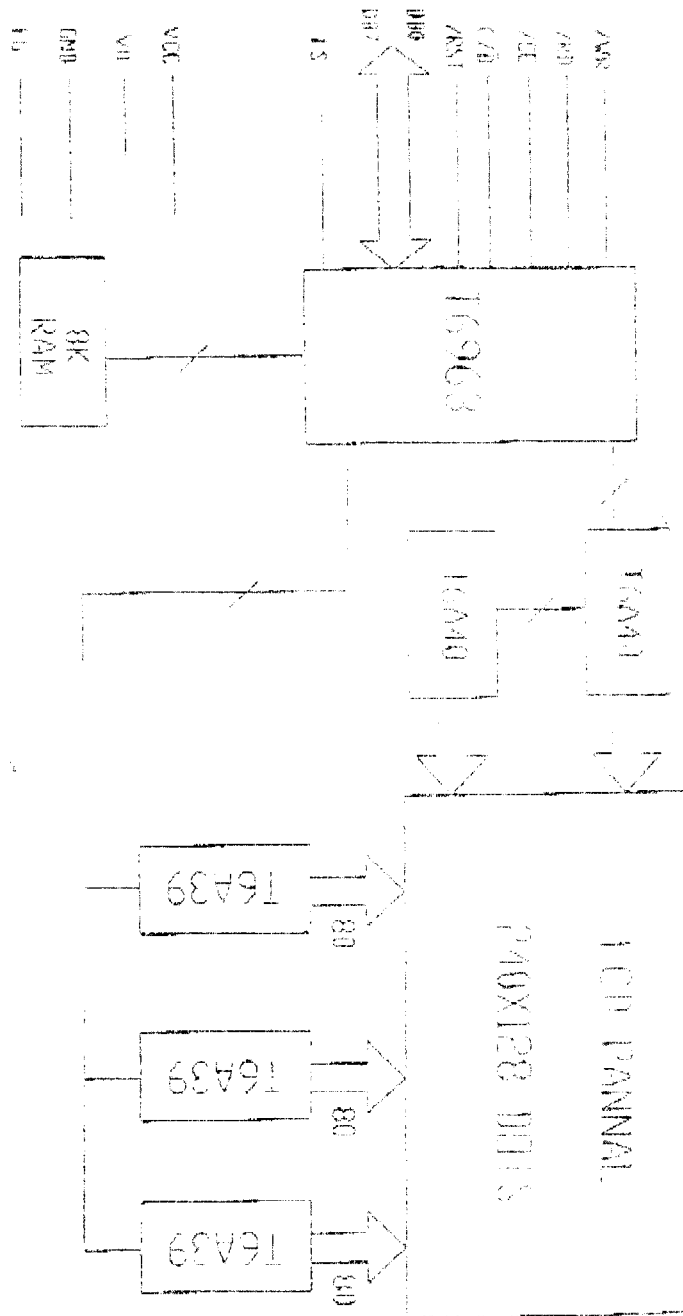


1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
IG	CMD/VCC	V0	/MS/RS	/PC	C/D	/RS	DB0	DB1	DB2	DB3	DB4	DB5	DB6	DB7	TS	A	K		

NOTES:

1. DISPLAY TYPE: SUPERVISED MODE
2. VIEWING DIRECTION: 0-90
3. DRIVE METHOD: 1/20 DUTY
4. BILINERIZER: NONE. TRANSLUCTIVE/POSITIVE
5. OPERATING TEMP: 0C-+50C
6. STORAGE TEMP: -20C-+60C
7. BACKLIGHT TYPE: LED
8. DIMARKET FOR RANGE: 10.2mm
9. CONNECTOR: MINI STRA AND /FURA

### 3 Circuit Block Diagram



#### 4 Absolute Maximum Ratings

Item	Symbol	Min.	Max.	Unit	Remark
Power Supply Voltage	$V_{DD}-V_{SS}$	0	6.5	V	
LCD Driving Voltage	$V_{DD}-V_o$	0	18.0		
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

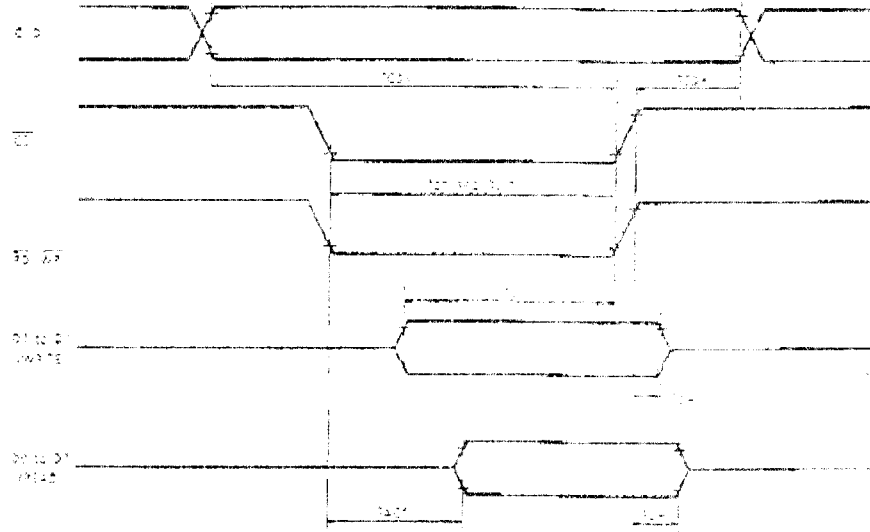
Item	Symbol	Min.	Typ.	Max.	Unit	Remark	
Supply Voltage (Logic)	$V_{DD}-V_{SS}$	4.75	5.0	5.25	V		
Supply Voltage (LCD Drive)	$V_{DD}-V_o$	-	15.0	-	V		
Input Signal Voltage	'H'Level	$V_{IH}$	$0.7V_{DD}$	-	$V_{DD}$	V	
	'L'Level	$V_{IL}$	0	-	$0.3V_{DD}$	V	
Supply current (Logic)	$I_{DD}$	-	10.5	-	mA		
Supply current (LCD Drive)	$I_{EE}$		2.7		mA		
Backlight (LED)	$I_{LED}$	-		280.0	mA		

### 5.2 Interface Signals:

Pin No.	Symbol	Description(Function)	Remark
1	FG	Module Frame Ground	
2	V <sub>SS</sub>	Ground	
3	V <sub>DD</sub>	Power Supply For Logic And LCD(+)	
4	V <sub>0</sub>	Operating Voltage For LCD(-)	
5	$\overline{\text{WR}}$	Write Data Into T6963C	
6	$\overline{\text{RD}}$	Read Data From T6963C	
7	$\overline{\text{CE}}$	Chip Enable Signal	
8	C/ $\overline{\text{D}}$	Command / Data Selection	
9	$\overline{\text{Reset}}$	Reset Signal	
10	DB0	Data0	
11	DB1	Data1	
12	DB2	Data2	
13	DB3	Data3	
14	DB4	Data4	
15	DB5	Data5	
16	DB6	Data6	
17	DB7	Data7	
18	FS	Font Selection	
19	A	The Positive Electrode of LED Backlight	
20	K	The Negative Electrode of LED Backlight	

### 5.3 Interface Timing Chart:

Bus Timing



TEST CONDITIONS (Unless otherwise noted,  $V_{DD} = 5.0V \pm 10\%$ ,  $V_{SS} = 0V$ ,  $T_a = -20$  to  $70^\circ C$ )

ITEM	SYMBOL	TEST CONDITIONS	MIN.	MAX.	UNIT
C/D Set-up Time	$t_{CDS}$	—	100	—	ns
C/D Hold Time	$t_{CDH}$	—	10	—	ns
CE, RD, WR Pulse Width	$t_{CE, RD, WR}$	—	80	—	ns
Data Set-up Time	$t_{DS}$	—	60	—	ns
Data Hold Time	$t_{DH}$	—	40	—	ns
Access Time	$t_{ACC}$	—	—	150	ns
Output Hold Time	$t_{OH}$	—	10	80	ns



## 5.4 Instruction Code

### COMMAND DEFINITIONS

COMMAND	CODE	D1	D2	FUNCTION
REGISTERS SETTING	0010000	X address	Y address	Set Cursor Pointer
	00100010	Data	00H	Set Offset Register
	00100100	Low address	High address	Set Address Pointer
SET CONTROL WORD	01000000	Low address	High address	Set Text Home Address
	01000001	Columns	00H	Set Text Area
	01000010	Low address	High address	Set Graphic Home Address
	01000011	Columns	00H	Set Graphic Area
MODE SET	1000X000	—	—	OR mode
	1000X001	—	—	ENCR mode
	1000X011	—	—	AND mode
	1000X100	—	—	Text Attribute mode
	1000X1XX	—	—	Internal CG ROM mode
	10001X00	—	—	External CG RAM mode
DISPLAY MODE	10010000	—	—	Display off
	1001XX10	—	—	Cursor on, blink off
	1001XX11	—	—	Cursor on, blink on
	100101XX	—	—	Text on, graphic off
	100110XX	—	—	Text off, graphic on
CURSOR PATTERN SELECT	10100000	—	—	0-line cursor
	10100001	—	—	2-line cursor
	10100010	—	—	3-line cursor
	10100011	—	—	4-line cursor
	10100100	—	—	5-line cursor
	10100101	—	—	6-line cursor
	10100110	—	—	7-line cursor
DATA AUTO READ/ WRITE	10110000	—	—	Set Data Auto Write
	10110001	—	—	Set Data Auto Read
	10110010	—	—	Auto Reset
DATA READ/WRITE	11000000	Data	—	Data Write and Increment ADP
	11000001	—	—	Data Read and Increment ADP
	11000010	Data	—	Data Write and Decrement ADP
	11000011	—	—	Data Read and Decrement ADP
	11000100	Data	—	Data Write and Nonvariable ADP
SCREEN PEEK	11000101	—	—	Data Read and Nonvariable ADP
	11100000	—	—	Screen Peek
SCREEN COPY	11101000	—	—	Screen Copy

X: invalid

# 5.5 Character Code Map

ROM CODE 0101

	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
0	0000	0001	0010	0011	0100	0101	0110	0111	1000	1001	1010	1011	1100	1101	1110	1111
1	0000	0001	0010	0011	0100	0101	0110	0111	1000	1001	1010	1011	1100	1101	1110	1111
2	0000	0001	0010	0011	0100	0101	0110	0111	1000	1001	1010	1011	1100	1101	1110	1111
3	0000	0001	0010	0011	0100	0101	0110	0111	1000	1001	1010	1011	1100	1101	1110	1111
4	0000	0001	0010	0011	0100	0101	0110	0111	1000	1001	1010	1011	1100	1101	1110	1111
5	0000	0001	0010	0011	0100	0101	0110	0111	1000	1001	1010	1011	1100	1101	1110	1111
6	0000	0001	0010	0011	0100	0101	0110	0111	1000	1001	1010	1011	1100	1101	1110	1111
7	0000	0001	0010	0011	0100	0101	0110	0111	1000	1001	1010	1011	1100	1101	1110	1111

6. Optical Characteristics

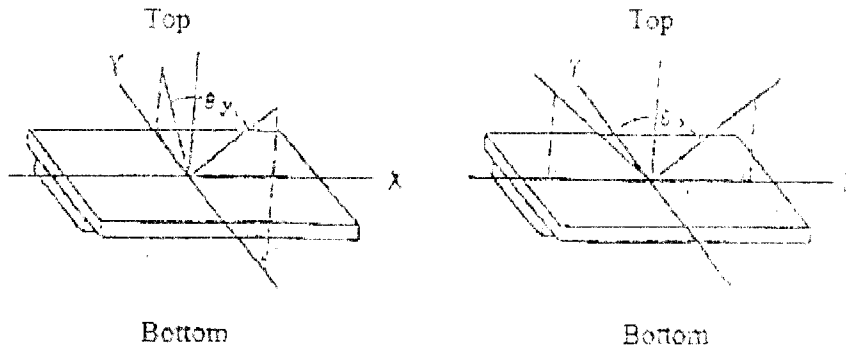
6.1 Optical Characteristics

$T_1=25^{\circ}\text{C}$

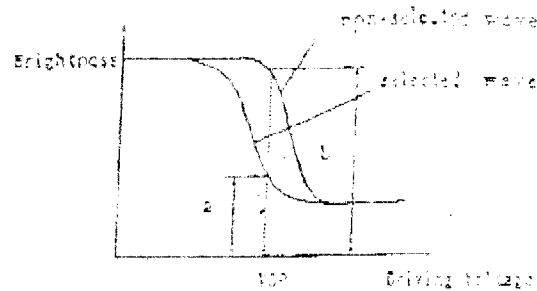
Item	Symbol	Condition	Min.	Typ.	Max	Unit	Remark
Viewing Angle	$\theta_x$	$Cr>3$	-20	--	20	Deg	
	$\theta_y$		-25	--	25		
Contrast Ratio	$C_r$	$\theta_x=0^{\circ}$ $\theta_y=15^{\circ}$	3.0				
Response Time	Turn on	$T_{on}$			200	ms	4
	Turn off	$T_{off}$			360		

## 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)

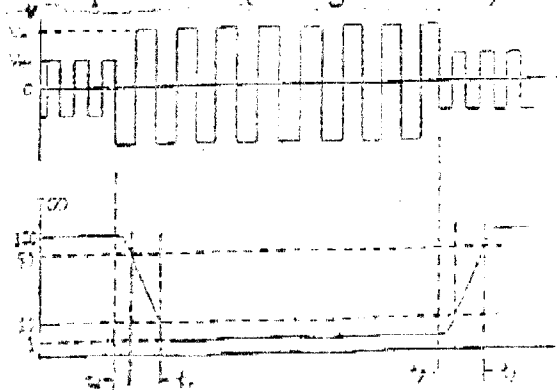


$$\text{Contrast Ratio} = b / a = \frac{\text{non-selected state brightness}}{\text{selected state brightness}}$$

Measuring Conditions:

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

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



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

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

Measuring Condition:

- 1) Operating Voltage: 15.0V ;
- 2) Frame frequency: 64Hz

## 7. Reliability

### 7.1 Content of Reliability Test

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

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	0°C 96H
4	Low Temperature Operation	Endurance test applying the electric stress under low temperature for a long time	50°C 96H
5	High Temperature /Humidity Storage	Endurance test applying the high temperature and high humidity storage for a long time	60°C 95%RH 96H
6	Temperature Cycle	Endurance test applying the low and high temperature cycle $-20^{\circ}C \longleftrightarrow 25^{\circ}C \longleftrightarrow 60^{\circ}C \longleftrightarrow 25^{\circ}C$ $30min \quad 5min \quad 30min \quad 5min$ <p style="text-align: center;">←————— 1 cycle —————→</p>	-20°C/60°C 10 cycles
7	Vibration Test (package state)	Endurance test applying the vibration during transportation	10Hz~500Hz, 100m/s <sup>2</sup> , 120min
8	Shock Test (package state)	Endurance test applying the shock during transportation	Half-sinewave, 100m/s <sup>2</sup> , 11ms
9	Atmospheric Pressure Test	Endurance test applying the atmospheric pressure during transportation by air	25kPa 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 alcohol
- Solvents 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. Especially, do not attempt to peel off the heat seal.
- 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.