LCD Module

Product Specification

□ : **APPROVAL FOR SPECIFICATION**

For Customer：_____ □ : **APPROVAL FOR SAMPLE**

Module No.： TSM12864-6C

Version No.: B

For Customer's Acceptance ：

Approved by	**Comment**

Team Source Display ：

Presented by	**Reviewed by**	**Organized by**

This module uses ROHS material

CONTENTS

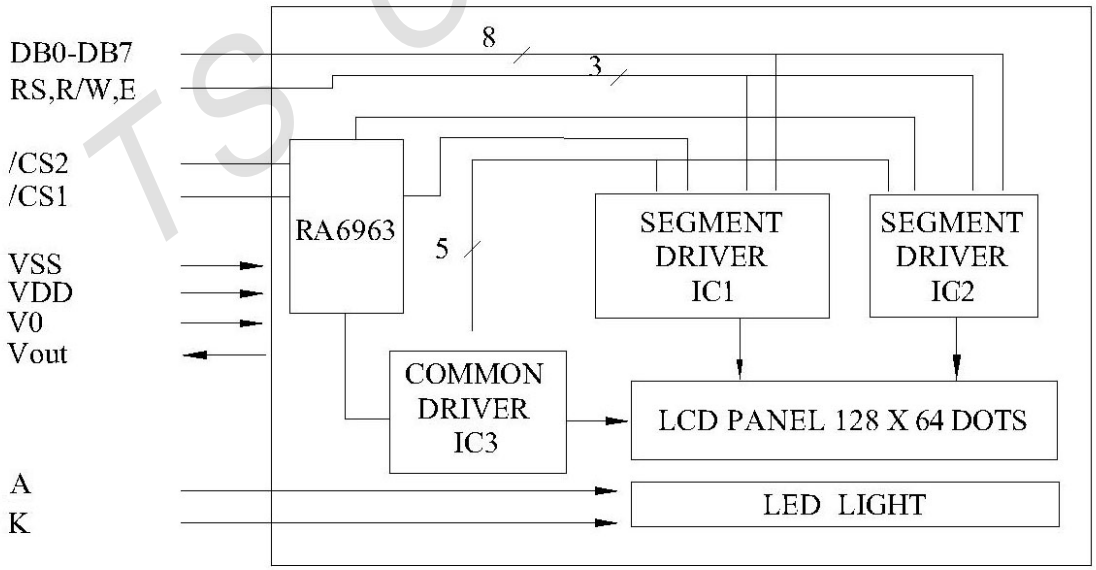
1.FUNCTIONS & FEATURES

1-1. Format	: 128X64 Dots Graphic
1-2. LCD Mode	: STN/BLUE/NEGATIVE/ TRANSMISSIVE
1-3. Viewing Angle	: 6 o'clock
1-4. Driving Method	: 1/64 duty, 1/6 bias,
1-5 Backlight Light	: White

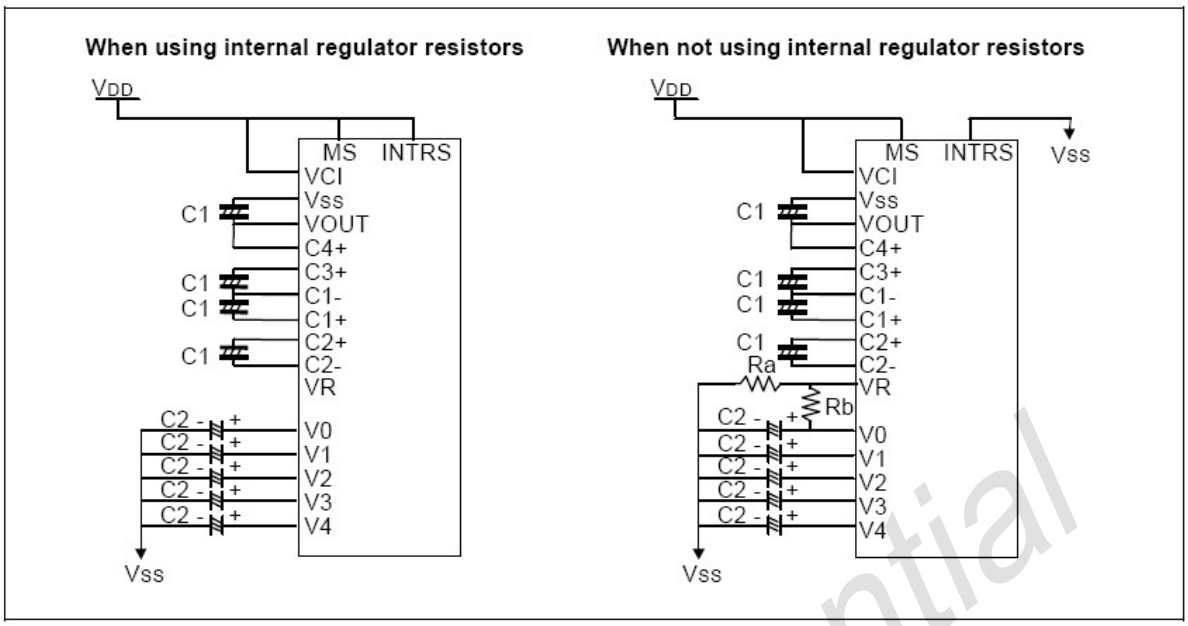
2.MECHANICAL SPECIFICATIONS

2-1. Module size	: 78.0(W) *70.0(H)*12.0(T)
2-2. Viewing area	: 62.0 (W)*44.0(H)
2-3. Dot pitch	: 0.04(W) *0.04(H)
2-4. Dot size	: 0.40(W) *0.56(H)
2-5.Weight	: about 75g

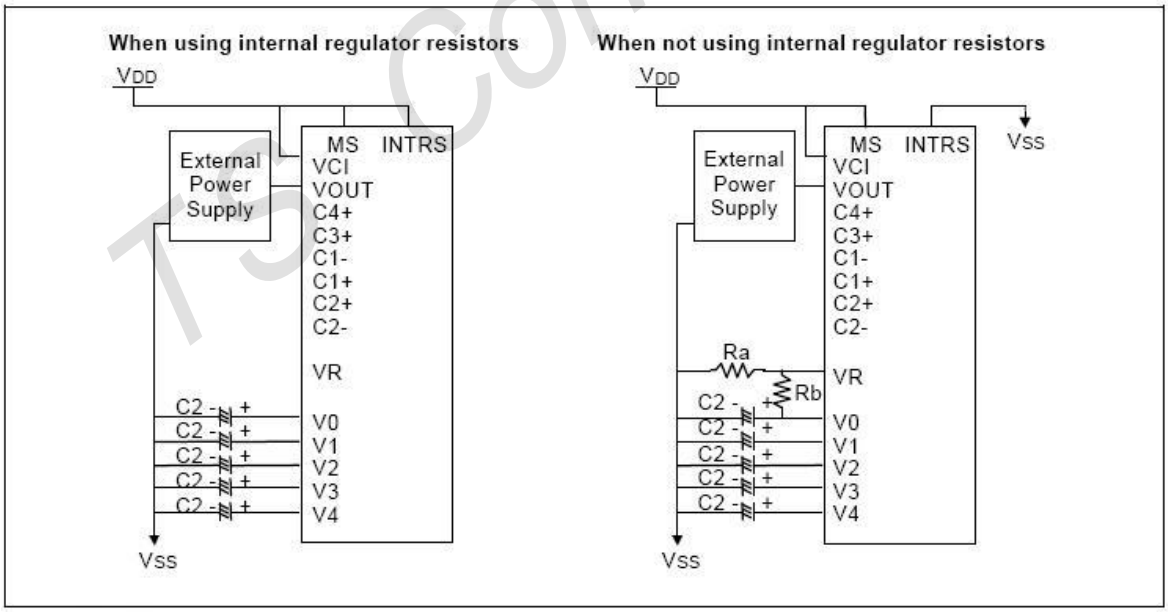
3.BLOCK DIAGRAM



4.POWER SUPPLY



When Using all Internal LCD Power Circuits (VCI = VDD, 4-time V/C: ON, V/R: ON, V/F: ON)

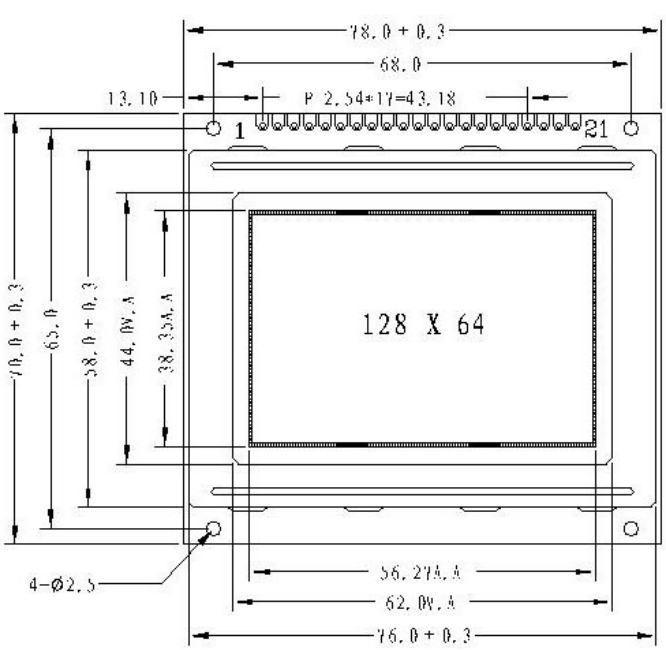


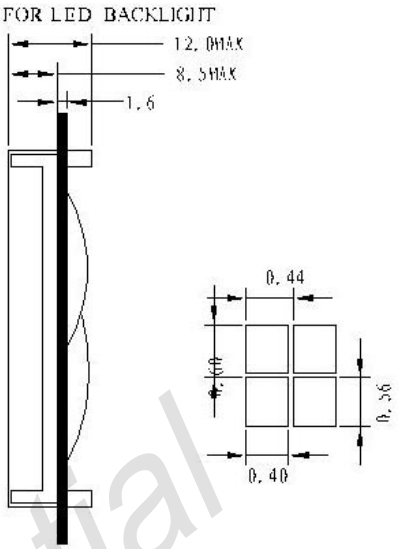
When Using some Internal LCD Power Circuits (VCI = VDD, V/C: OFF, V/R: ON, V/F: ON)

5.DIMENSIONAL OUTLINE

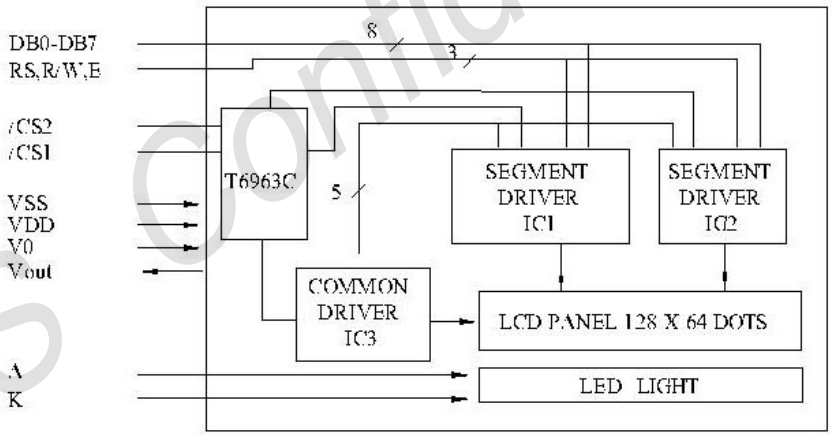
128 X 64 DOTS STN
1/64 DUTY,1/9 BIAS

EXTERNAL DIMENSIONS





BLOCK DIAGRAM



PIN CONFIGURATION

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
FGND	GND	VSS	V0	/WR	/RD	/CE	C/D	/RES	DB0	DB1	DB2	DB3	DB4	DB5	DB6	DB7	FS	LEDA	LEDK	VOUT
	5.0V	0V							H/L									5V	0V	

MECHANICAL DATA		
ITEM	SPECFICATION	UNIT
Module Size (W xH xD)	78.0 x 70.0 x 12.0	mm
Viewing Area (W xH)	62.0 x 44.0	mm
Number of Dots	128 x 64	dots
Character Size (W xH)	0.40 x 0.56	mm
Character Pitch (W xH)	0.44 x 0.60	mm

ABSOLUTE MAXMUM RATINGS				
ITEM	SYMBOL	MIN	MAX	UNIT
Supply Voltage Logic	Vdd-Vss	-0.3	7.0	V
Supply Voltage Driver	Vdd-V0	-0.3	13.5	V
Input Voltage	Vi	Vss	Vdd	V
Operating Temperature	Ta	-20	-70	° C
Storage Temperature	Tstg	-30	-80	° C

6. PIN DESCRIPTION

No	SYMBOL	LEVEL	FUNCTION
1	FGND		铁框地线
2	GND	5.0V	Power Supply
3	VDD	0V	Power Supply
4	V0	0	Supply Voltage For LCD； LCD 驱动电压
5	/WR	L-H	H:Read L:Write 写数据
6	/RD	L-H	Enable Signal 读数据
7	/CE	L	LCD 选通信号，低有效
8	C/D	H/L	命令或数据 高电平/命令 低电平/数据
9	RES	L	复位信号，低有效
10	DB0	H/L	DATA BUS
11	DB1	H/L	DATA BUS
12	DB2	H/L	DATA BUS
13	DB3	H/L	DATA BUS
14	DB4	H/L	DATA BUS
15	DB5	H/L	DATA BUS
16	DB6	H/L	DATA BUS
17	DB7	H/L	DATA BUS
18	FS	H/L	字体选择（H:6X8dots，L:8X8dots）
19	LEDA	--	LED(+5V)
20	LEDK	--	LED(0V)
21	VOUT		

7.MAXIMUM ABSOUTE LIMIT (T=25°C)

Item	Symbol	Standard value	Unit
Power supply voltage for logic	V_{DD}	Vss-0.3~ +5.5.	V
Driver supply voltage	V_0	0~18	V
Input voltage	V_{IN}	Vss-0.3~V_{DD}+0.3	V
Operating temperature	Topr	-20~+70	°C
Storage temperature	Tstg	-30~+80	°C

Note: Voltage greater than above may damage the module
All voltages are specified relative to V_{SS}=0V

8.ELECTRICAL CHARACTERISTICS

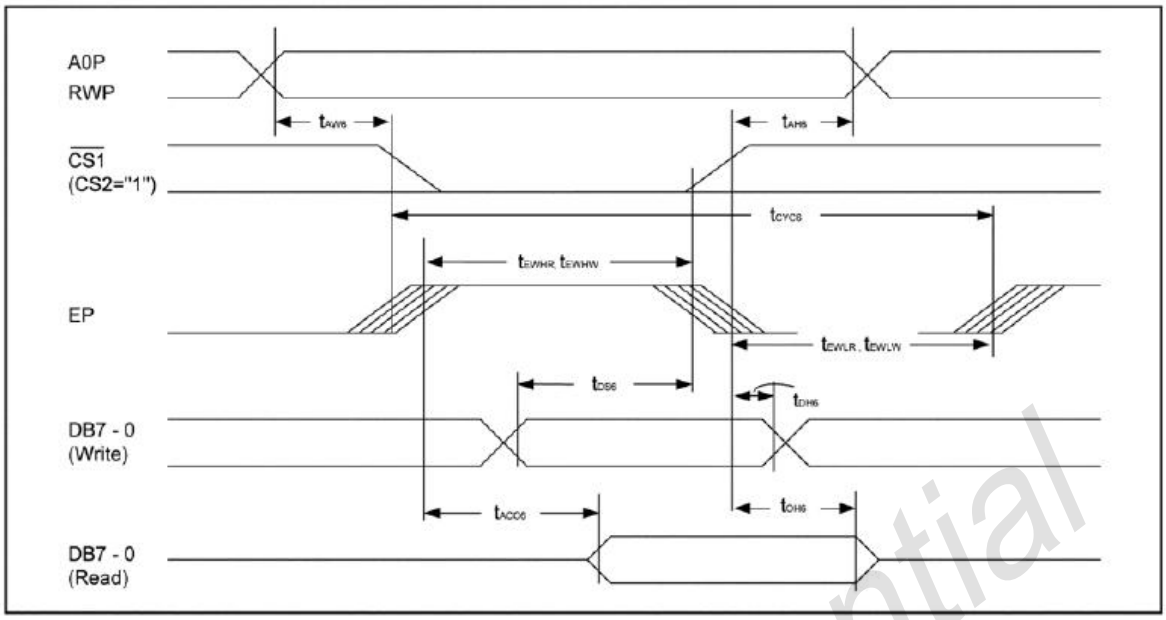
Item	Symbol	Min	Typ	Max	Unit	Test condition
Operating voltage	VDD	–	5	–	V	–
LCD driving voltage	V0-VSS	–	10	–	V	–
Input voltage	V_{IL}	–	–	0.6	V	CMOS LEVEL
	V_{IH}	2.6	–	–	V	CMOS LEVEL
Output voltage	V_{OL}	–	–	0.4	V	–
	V_{OH}	VDD-0.4	–	–	V	–
Supply current	I_{DD}	–	35	–	mA	–

9 COMMAND LIST

Instruction	RS	RW	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0	Description
Display ON / OFF	0	0	1	0	1	0	1	1	1	DON	Turn on/off LCD panel When DON = 0: display OFF When DON = 1: display ON
Initial display line	0	0	0	1	ST5	ST4	ST3	ST2	ST1	ST0	Specify DDRAM line for COM0
Set page address	0	0	1	0	1	1	P3	P2	P1	P0	Set page address
Set column address MSB	0	0	0	0	0	1	Y7	Y6	Y5	Y4	Set column address MSB
Set column address LSB	0	0	0	0	0	0	Y3	Y2	Y1	Y0	Set column address LSB
Read status	0	1	BUSY	ADC	ONOFF	RESETB	0	0	0	0	Read the internal status
Write display data	1	0	Write data								Write data into DDRAM
Read display data	1	1	Read data								Read data from DDRAM
ADC select	0	0	1	0	1	0	0	0	0	ADC	Select SEG output direction When ADC = 0: normal direction (SEG0→SEG131) When ADC = 1: reverse direction (SEG131→SEG0)
Reverse display ON / OFF	0	0	1	0	1	0	0	1	1	REV	Select normal / reverse display When REV = 0: normal display When REV = 1: reverse display
Entire display ON / OFF	0	0	1	0	1	0	0	1	0	EON	Select normal/entire display ON When EON = 0: normal display. When EON = 1: entire display ON
LCD bias select	0	0	1	0	1	0	0	0	1	BIAS	Select LCD bias
Set modify-read	0	0	1	1	1	0	0	0	0	0	Set modify-read mode
Reset modify-read	0	0	1	1	1	0	1	1	1	0	release modify-read mode
Reset	0	0	1	1	1	0	0	0	1	0	Initialize the internal functions
SHL select	0	0	1	1	0	0	SHL	×	×	×	Select COM output direction When SHL = 0: normal direction (COM0→COM63) When SHL = 1: reverse direction (COM63→COM0)
Power control	0	0	0	0	1	0	1	VC	VR	VF	Control power circuit operation
Regulator resistor select	0	0	0	0	1	0	0	R2	R1	R0	Select internal resistance ratio of the regulator resistor
Set reference voltage mode	0	0	1	0	0	0	0	0	0	1	Set reference voltage mode
Set reference voltage register	0	0	×	×	SV5	SV4	SV3	SV2	SV1	SV0	Set reference voltage register
Set static indicator mode	0	0	1	0	1	0	1	1	0	SM	Set static indicator mode
Set static indicator register	0	0	×	×	×	×	×	×	S1	S0	Set static indicator register
Power save	-	-	-	-	-	-	-	-	-	-	Compound Instruction of display OFF and entire display ON
NOP	0	0	1	1	1	0	0	0	1	1	*Non-Operation command*
Test Instruction_1	0	0	1	1	1	1	×	×	×	×	*Don't use this instruction*
Test Instruction_2	0	0	1	0	0	1	×	×	×	×	*Don't use this instruction*

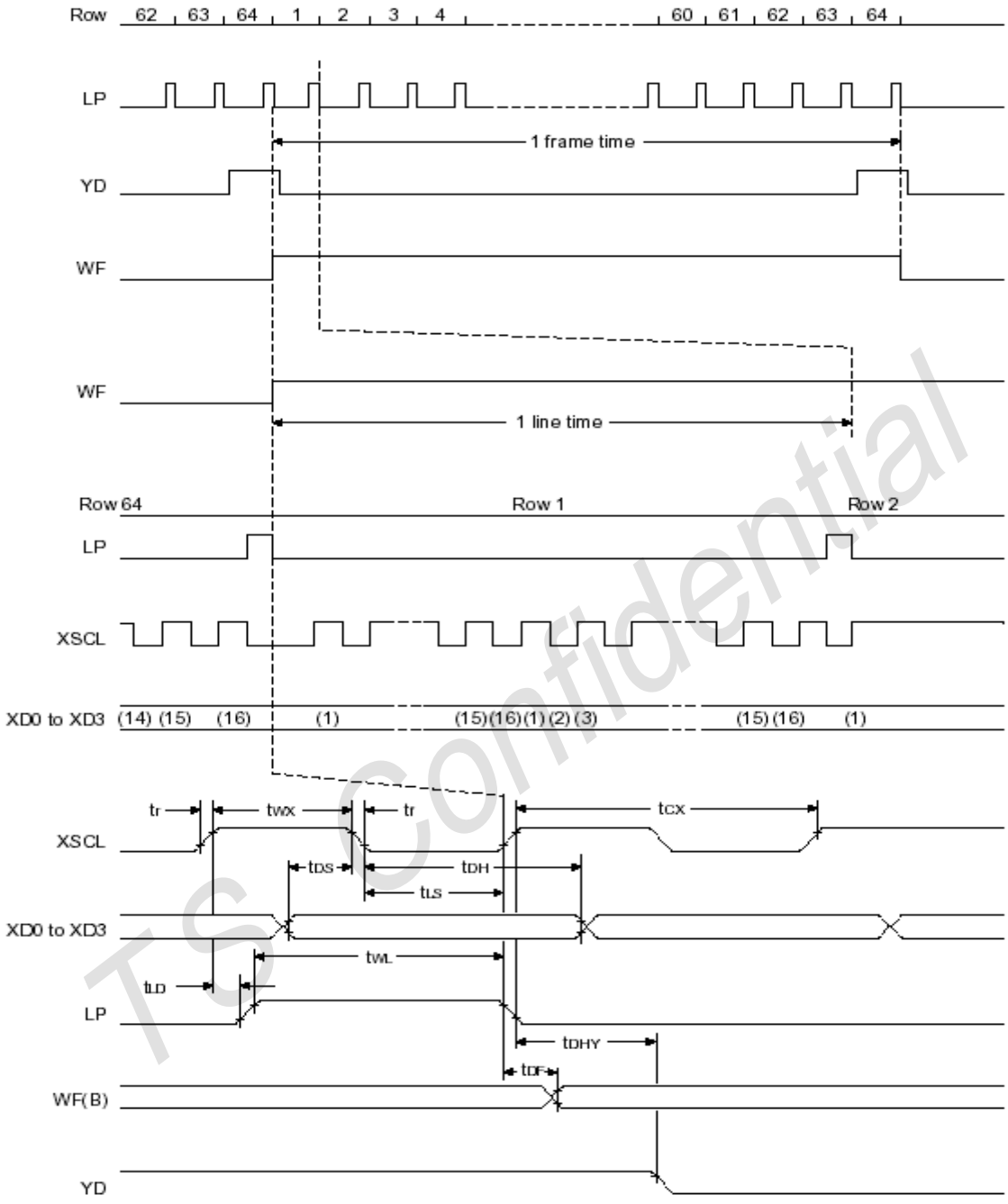
10. TIMING CHARACTERISTICS

10-1



Item		Signal	Symbol	Condition	Rating		Units
					Min.	Max.	
Address hold time		A0P	t_{AH6}		0	-	ns
Address setup time			t_{AW6}		0	-	ns
System cycle time		A0P	t_{CYC6}		300	-	ns
Data setup time		DB7 - 0	t_{DS6}	C_L = 100pF	40	-	ns
Data hold time			t_{DH6}		15	-	ns
Access time			t_{ACC6}		-	140	ns
Output disable time			t_{OH6}		10	100	ns
Enable H pulse time	Read	EP	t_{EWHR}		120	-	ns
	Write		t_{EWHW}		60	-	ns
Enable L pulse time	Read	EP	t_{EWLR}		60	-	ns
	Write		t_{EWLW}		60	-	ns

10 2 LCD Output Timing



Ta = –20 to 75°C

Signal	Symbol	Parameter	VDD = 4.5 to 5.5V		VDD = 2.7 to 4.5V		Unit	Condition
			min	max	min	max		
	tr	Rise time	—	30	—	40	ns	CL = 100 pF
	tf	Fall time	—	30	—	40	ns	
XSCL	tCX	Shift clock cycle time	4tC	—	4tC	—	ns	
	tWX	XSCL clock pulsewidth	2tC – 60	—	2tC – 60	—	ns	
XD0 to XD3	tDH	X data hold time	2tC – 50	—	2tC – 50	—	ns	
	tDS	X data setup time	2tC – 100	—	2tC – 105	—	ns	
LP	tLS	Latch data setup time	2tC – 50	—	2tC – 50	—	ns	
	tWL	LP pulsewidth	4tC – 80	—	4tC – 120	—	ns	
	tLD	LP delay time from XSCL	0	—	0	—	ns	
WF	tDF	Permitted WF delay	—	50	—	50	ns	
YD	tDHY	Y data hold time	2tC – 20	—	2tC – 20	—	ns	

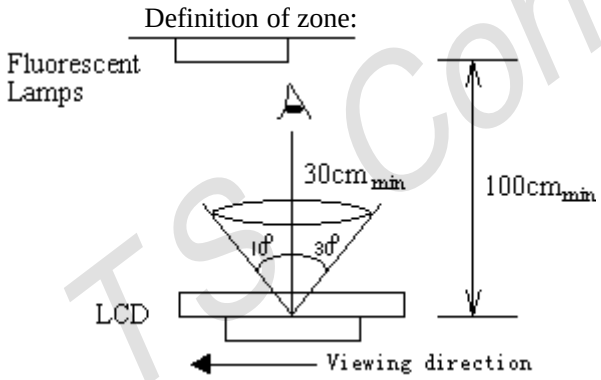
11.Quality Specifications

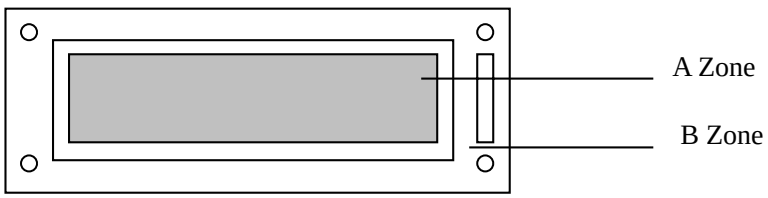
11-1. Standard of the product appearance test

Manner of appearance test: The inspection should be performed in using 20W x 2 fluorescent lamps. Distance between LCM and fluorescent lamps should be 100 cm or more. Distance between LCM and inspector eyes should be 30 cm or more.

The viewing angle is 30° from viewing direction.

The viewing angle is 10° form reversed viewing direction.



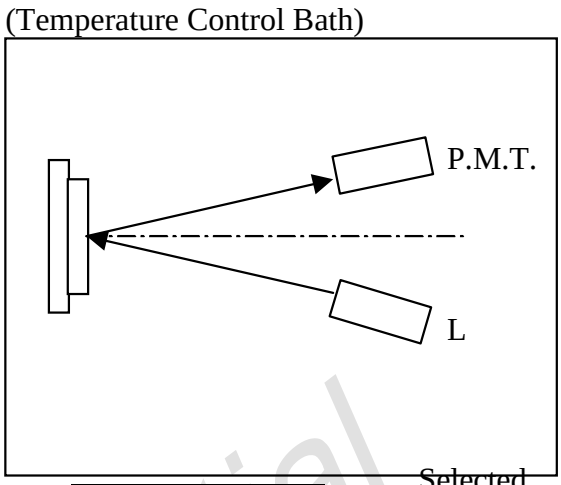


A Zone: Display area (LCD)

B Zone: PCB

Measuring Method

(e.g. Reflective Type)



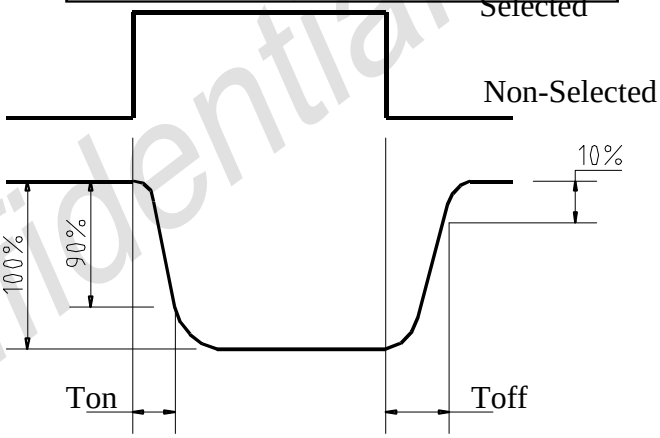
L : Light Source

P.M.T. : Photo-multiplier Tube

Equipment : LCD-5100

Maker : Otsuka Elec. Co., Ltd.

Response Time



Ton: Turn on time

Toff: Turn off time

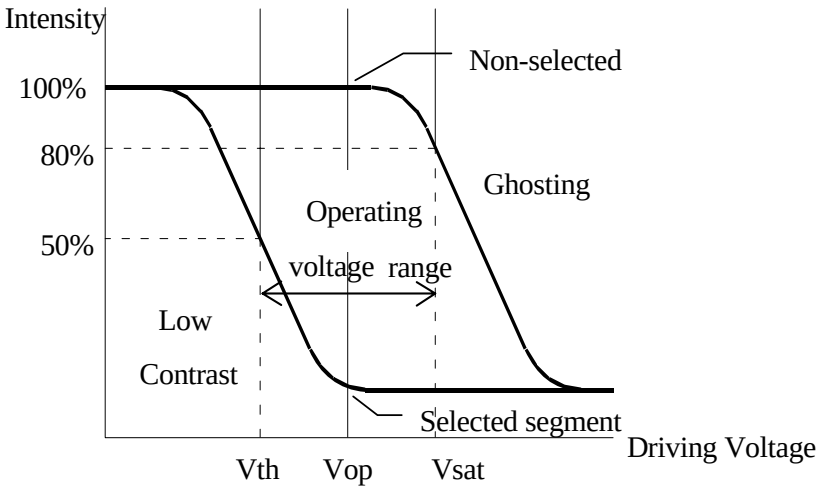
Measuring Condition:

1. Driving Voltage: Same as Vop.
2. Driving Frequency: Same as Frame Frequency.

Contrast Ratio Definition

$$\text{Contrast Ratio} = \left\{ \frac{\text{Non-selected segment intensity}}{\text{Selected segment intensity}} \right\}^{n}$$

Positive mode: n = 1
Negative mode: n = -1



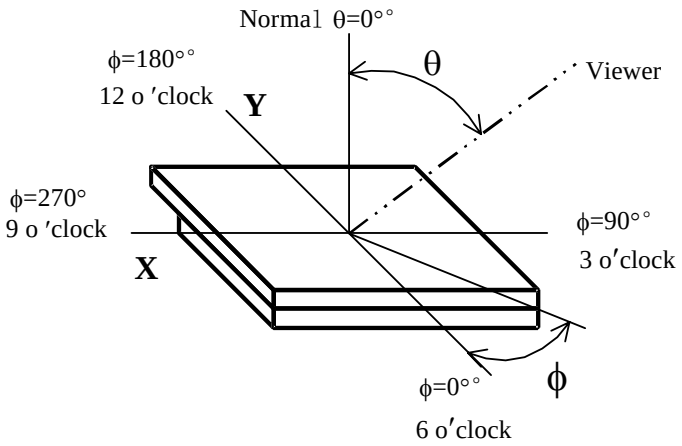
Viewing Angle

θ: Angle between Viewer Direction and Normal.

(-90°≤ θ ≤90°)

ϕ : Angle between Projection of Viewer Direction to X-Y plane and Y axis.

(0°≤ϕ≤360°)



Measuring Condition

1. Driving Voltage: Same as Vop.
2. Driving Frequency: Same as Frame Frequency.

11-2. Reliability of LCM

Reliability test condition:

Item	Condition	Time (hrs)	Assessment
High temp. Storage	80°C	24	No abnormalities in functions and appearance
High temp. Operating	70°C	24	
Low temp. Storage	-40°C	24	
Low temp. Operating	-28°C	24	
Humidity	40°C/ 90%RH	24	
Temp. Cycle	-28°C ← 25°C →70°C (30 min ← 5 min → 30min)	10cycles	

Recovery time should be 24 hours minimum. Moreover, functions, performance and appearance shall be free from remarkable deterioration within 50,000 hours under ordinary operating and storage conditions room temperature (20±8°C), normal humidity (below 65% RH), and in the area not exposed to direct sun light.

10-3. Precaution for using LCM

LCM is assembled and adjusted with a high degree of precision. Do not attempt to make any alteration or modification. The followings should be noted.

General Precautions:

1. LCD panel is made of glass. Avoid excessive mechanical shock or applying strong pressure onto the surface of display area.
2. The polarizer used on the display surface is easily scratched and damaged. Extreme care should be taken when handling. To clean dust or dirt off the display surface, wipe gently with cotton, or other soft material soaked with isoproply alcohol, ethyl alcohol or trichl or otrifl or othane, do not use water, ketone or aromatics and never scrub hard.
3. Do not tamper in any way with the tabs on the metal frame.
4. Do not made any modification on the PCB without consulting TS LCD.
5. When mounting a LCM, make 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.
6. Avoid pressing on the metal bezel, otherwise the elastomer connector could be deformed and lose contact, resulting in missing pixels and also cause rainbow on the display.
7. Be careful not to touch or swallow liquid crystal that might leak from a damaged cell. Any liquid crystal adheres to skin or clothes, wash it off immediately with soap and water.

Static Electricity Precautions:

1. CMOS-LSI is used for the module circuit; therefore operators should be grounded whenever he/she comes into contact with the module.
2. Do not 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.
3. Do not touch the connection terminals of the display with bare hand; it will cause disconnection or defective insulation of terminals.
4. The modules should be kept in anti-static bags or other containers resistant to static for storage.
5. Only properly grounded soldering irons should be used.
6. If an electric screwdriver is used, it should be grounded and shielded to prevent sparks.
7. The normal static prevention measures should be observed for work clothes and working benches.
8. Since dry air is inductive to static, a relative humidity of 50-60% is recommended.

Soldering Precautions:

1. Soldering should be performed only on the I/O terminals.
2. Use soldering irons with proper grounding and no leakage.
3. Soldering temperature: 280°C±10°C
4. Soldering time: 3 to 4 second.
5. Use eutectic solder with resin flux filling.
6. If flux is used, the LCD surface should be protected to avoid spattering flux.
7. Flux residue should be removed.

Operation Precautions:

1. The viewing angle can be adjusted by varying the LCD driving voltage Vo.
2. Since applied DC voltage causes electro-chemical reactions, which deteriorate the display, the applied pulse waveform should be a symmetric waveform such that no DC component remains. Be sure to use the specified operating voltage.
3. Driving voltage should be kept within specified range; excess voltage will shorten display life.

4. Response time increases with decrease in temperature.
5. Display color may be affected at temperatures above its operational range.

Operation Precautions:

1. Keep the temperature within the specified range usage and storage. Excessive temperature and humidity could cause polarization degradation, polarizer peel-off or generate bubbles.
2. For long-term storage over 40°C is required, the relative humidity should be kept below 60%. Avoid direct sunlight.