MODEL: TDTMSC053DMLA

(SPECIFICATION FOR LCD MODULE)

Design :

Check :

Approval :

Customer:

Customer Approval:

TRUEDISPLAY TECHNOLOGY CO., LTD. SHANGHAI

REV. NO	DATE	PAGE	ITEMS
1.0		ALL	

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           2.INSPECTION CRITERIA

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1   Scope

This specification defines general provision as well as inspection standards for LCD module supplied by TrueDisplay Technology Co.,Ltd.

If the event of unforeseen problem or unspecified items may occur, naturally shall negotiate and agree to solution.

2   Warranty

Module products manufactured to this specification will be capable of meeting all the characteristics for a minimum period of 12 months, which calculates from the date of shipping from TrueDisplay Technology. All the products should be stored or used as specified conditions described in these sheets.

If module products are not stored or used as specified conditions, herein, it will be void the 12 months warranty.

3   Features

1)   Display Type: FSTN/WITH 3M-TDF FILM

2) Polarizer Mode: Transflective and Positive Type

3) Viewing Angle: 6:00

4)Viewing Area:56mm×39.27mm

5) Driving Method: 12.6V, 1/105Duty, 1/11Bias

6) Controller/Driver: S6B0719

7) Dot Matrix: 160×104 Dots +ICON

8) Outline Dimensions: Refer to outline drawing

9)Dot Size:0.305mm×0.315mm

10)Dot Pitch:0.32mm×0.33mm

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4 Maximum ratings

Item	Symbol	Standard Value		Unit	Remark
		Min.	Max.		
Power Supply Voltage For Logic	V_{DD}, V_{DD2}	-0.3	7.0	V	
Power Supply Voltage For LCD	V0	3.0	17.0	V	
Input Voltage	V_{IN}	- 0.3	V_{DD}+0.3	V	
Operating Temperature	T_{op}	-10	+60		No Condensation
Storage Temperature	T_{st}	-20	+70		No Condensation

5 Electrical characteristics

DC CHARACTERISTICS

Table 19. DC Characteristics

(Vss = 0V, VDD = 2.4 to 3.6V, Ta = -40~85°C)

Item		Symbol	Condition	Min.	Typ.	Max.	Unit	Pin used
Operating voltage (1)		Voo		2.4	-	3.6	V	VDD *1
Operating voltage (2)		V0		4.0	-	15.0	V	V0. *2
Input voltage	High	VIH		0.8Voo	-	Voo	V	*3
	Low	VIL		Vss	-	0.2Voo		
Output voltage	High	VOH	IoH = -0.5mA	0.8Voo	-	Voo	V	*4
	Low	VOL	IoL = 0.5mA	Vss	-	0.2Voo		
Input leakage current		IIL	VIN = Voo or Vss	- 1.0	-	+ 1.0	μA	*3
Output leakage current		Ioz	VIN = Voo or Vss	- 3.0	-	+ 3.0	μA	*5
LCD driver ON resistance		RoN	Ta = 25°C, V0 = 8V	-	2.0	3.0	kΩ	SEGn COMn *6
Frame frequency		fFR	Ta = 25°C	70	85	100	Hz	*7 FR

Table 20. DC Characteristics

Item	Symbol	Condition	Min.	Typ.	Max.	Unit	Pin used
Voltage converter circuit output voltage	VOUT	×3 / ×4 / ×5 / ×6 voltage conversion (no-load)	95	99	-	%	VOUT
Voltage regulator circuit operating voltage	VOUT		6.0	-	17.0	V	VOUT
Voltage follower circuit operating voltage	V0		4.0	-	15.0	V	V0 *8
Reference voltage	VREF	Ta = 25°C	1.94	2.00	2.06	V	*9

AC CHARACTERISTICS
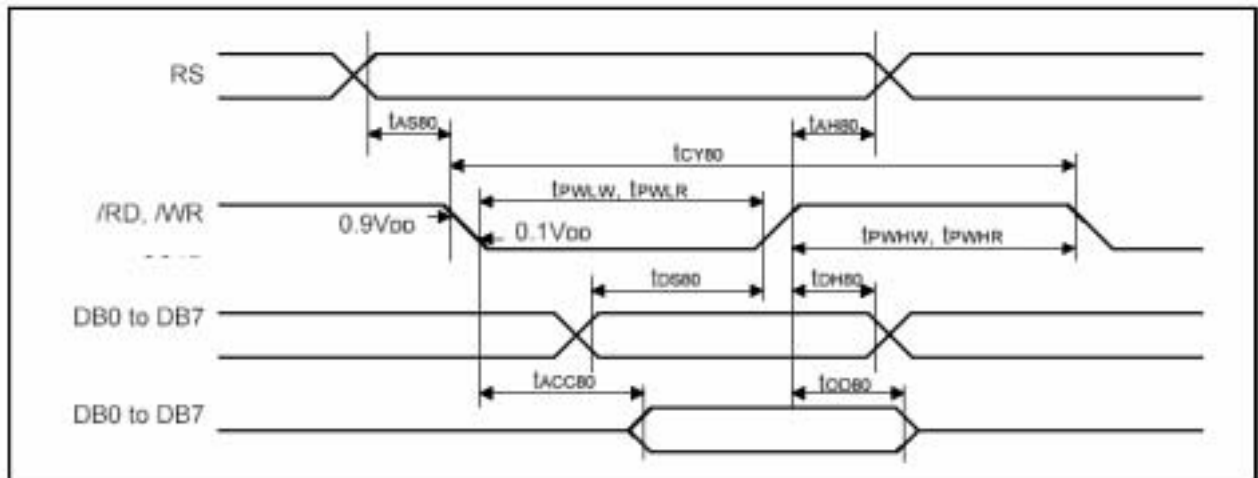
Read / Write Characteristics (8080-series MPU)

Figure 39. Parallel Interface (8080-series MPU) Timing Diagram

Table 27. AC Characteristics (8080-series Parallel Mode)

$(V_{DD} = 2.4 \sim 3.6V, Ta = -40 \sim +85°C)$

Item	Signal	Symbol	Condition	Min.	Max.	Unit
Address setup time Address hold time	RS	t_{AS80} t_{AH80}		0 0	- -	ns
System cycle time		t_{CY80}		300	-	ns
Pulse width low for write Pulse width High for write	RW_WR (/WR)	t_{PWLW} t_{PWHW}		60 60	- -	ns
Pulse width low for read Pulse width high for read	E_RD (/RD)	t_{PWLR} t_{PWHR}		120 60	- -	ns
Data setup time Data hold time	DB0 to DB7	t_{DS80} t_{DH80}		40 15	- -	ns
Read access time Output disable time		t_{ACC80} t_{ODB0}	CL = 100 pF	- 10	140 100	ns

NOTE: *1. The input signal rise time and fall time (tr, tf) is specified at 15 ns or less.
$(tr + tf) < (tCY80 - tPWLW - tPWHW)$ for write, $(tr + tf) < (tCY80 - tPWLR - tPWHR)$ for read

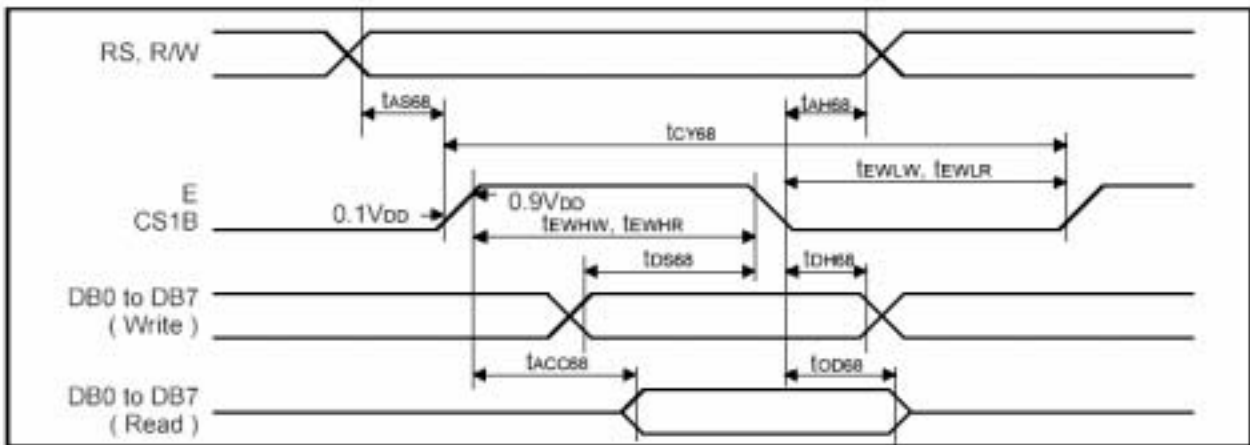## Read / Write Characteristics (6800-series Microprocessor)

Figure 40. Parallel Interface (6800-series MPU) Timing Diagram

Table 28. AC Characteristics (6800-series Parallel Mode)

(VDD = 2.4 ~ 3.6V, Ta = -40 ~ +85°C)

Item	Signal	Symbol	Condition	Min.	Max.	Unit
Address setup time Address hold time	RS RW	tAS68 tAH68		0 0	- -	ns
System cycle time		tCY68		300	-	ns
Enable width high for write Enable width low for write	E_RD (E)	tEWHW tEWLW		60 60	- -	ns
Enable width high for read Enable width low for read	E_RD (E)	tEWHR tEWLR		120 60	- -	ns
Data setup time Data hold time	DB0 to DB7	tDS68 tDH68		40 15	- -	ns
Read access time Output disable time		tACC68 tOD68	CL = 100 pF	- 10	140 100	ns

NOTE: *1. The input signal rise time and fall time (tr, tf) is specified at 15 ns or less.
(tr + tf) < (tCY68 - tEWHW - tEWLW) for write, (tr + tf) < (tCY68 - tEWHR - tEWLR) for read
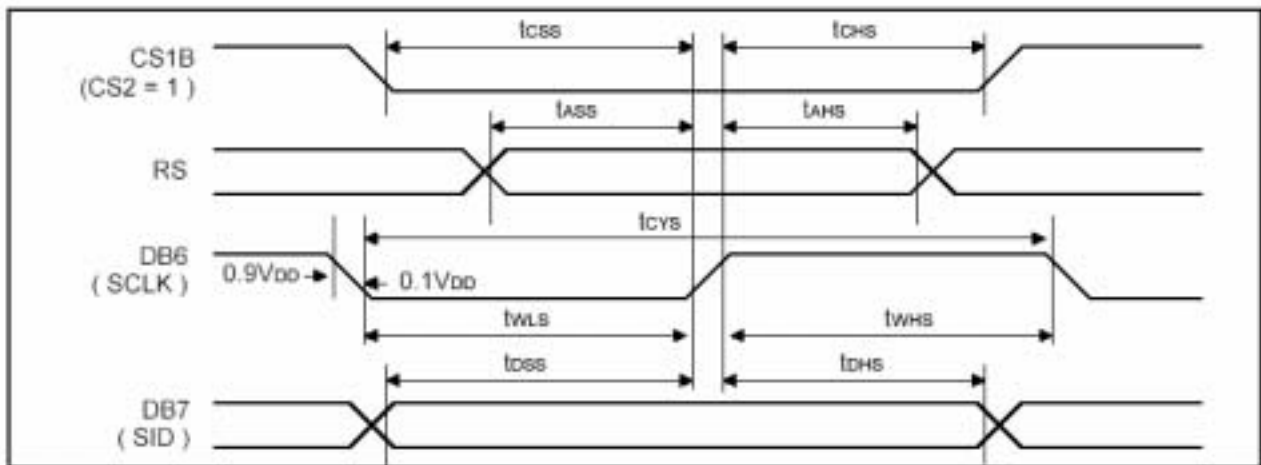
Serial Interface Characteristics

Figure 41. Serial Interface Timing Diagram

Table 29. AC Characteristics (Serial Mode)

(VDD = 2.4 ~ 3.6V, Ta = -40 ~ +85°C)

Item	Signal	Symbol	Condition	Min.	Max.	Unit
Serial clock cycle SCLK high pulse width SCLK low pulse width	DB6 (SCLK)	tSCY tSHW tSLW		250 100 100	- - -	ns
Address setup time Address hold time	RS	tASS tAHS		150 150	- -	ns
Data setup time Data hold time	DB7 (SID)	tDSS tDHS		100 100	- -	ns
CS1B setup time CS1B hold time	CS1B	tCSS tCHS		150 150	- -	ns

NOTE: *1. The input signal rise time and fall time (tr, tf) is specified at 15 ns or less.

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6 Electro –optical Characteristics

6.1 Electro-optical Characteristics

| Item		Symbol	Condition		Standard Value			Unit
					Min.	Typ.	Max.	
Viewing Angle		θx	Cr 2	θy =0°	-30	-	30	Deg
		θy		θx =0°	-15	-	30	
Contrast Ratio		Cr	θx =0° θy =0°		-	4	-	
Response Time	Turn on	Ton	θx =0°		-	250	300	ms
	Turn off	Toff	θy =0°		-	250	350	

6.2 Definition of Electro-optical Characteristics

6.2.1 Definition of Viewing Angle
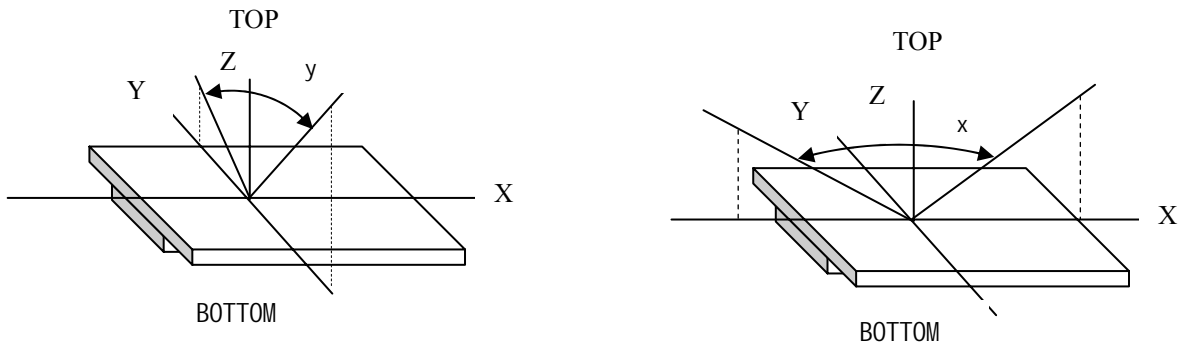
6.2.2 Definition of Contrast Ratio

$$\text{Contrast Ratio} = B2/B1 = \frac{\text{Unselected state brightness}}{\text{Selected state brightness}}$$
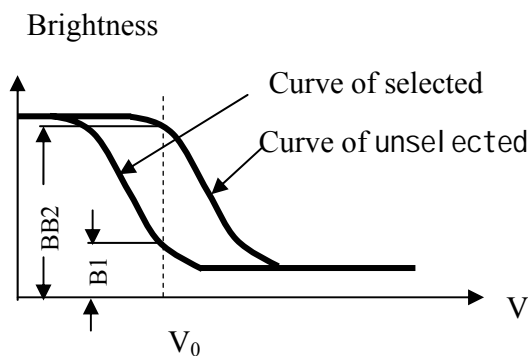
Measuring Conditions
1) Ambient Temperature: 25
2) Frame frequency : 60Hz
3) θx= θy=0°

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7 I/O terminal

NO.	Symbol	Description
1	VR	V0 Voltage adjustment
2	V0	Power supply for LCD
3	V1	Power supply for LCD
4	V2	Power supply for LCD
5	V3	Power supply for LCD
6	V4	Power supply for LCD
7	CAP4+	DC-DC voltage convert capacitor
8	CAP2-	DC-DC voltage convert capacitor
9	CAP2+	DC-DC voltage convert capacitor
10	CAP1+	DC-DC voltage convert capacitor
11	CAP1_	DC-DC voltage convert capacitor
12	CAP3+	DC-DC voltage convert capacitor
13	CAP5+	DC-DC voltage convert capacitor
14	VOUT	Power supply for logic
15	VSS	Power supply GND
16	VDD	Power supply VDD
17	D7-	Data bit
18	D6	Data bit
19	D5	Data bit
20	D4	Data bit
21	D3	Data bit
22	D2	Data bit
23	D1	Data bit
24	D0	Data bit
25	/RD	Read signal for 8080MCU
	E	Enable clock for 6800 MCU
26	/WR	Write signal for 8080 MCU
	R/W	Read/Write signal for 6800 MCU
27	A0	Data/Command select
28	/RESET	Reset signal
29	/CS1	Chip select(active low)
30	C68	H:6800 MCU; L:8080 MCU
31	P/S	Parellel/Serial

8. INSPECTION CRITERIA

Refer to Appendix: INSPECTION CRITERIA

9   Reliability

9.1   Content of Reliability Test

	No	Test Item	Content of Test	Test Condition
Environment Test	1	High Temperature Storage	Endurance test of high temperature for a long time.	70± 2 96H
	2	Low Temperature Storage	Endurance test of low temperature for a long time.	-20± 2 96H
	3	High Temperature Operation	Endurance test of electrical stress (Voltage & Current) and the thermal stress to the element.	60± 2 96H
	4	High Temperature /Humidity Storage	Endurance Test of high temperature and high humidity for a long time.	40± 2 90± 2%RH 96H
	5	Thermal shock	Endurance test of low and high temperature cycles.(air to air) -10± 2 ⟷ 60± 2 (60min) (60min) 1 cycle	-20± 2 /70± 2 10 cycle

Note: 1) When making the low temperature test, not to dewy.

2) Driving condition for operation test.
    Power Supply Voltage for Logic System (VDD) =3.0V

9.2   Failure Judgment Criterion
        After the above mentioned test.
        (For Environmental Test, after 2 hours in room temperature.)
    1) There should not be conspicuous failure of display quality and appearance.
    2) Contrast ratio should be 50% of the initial contrast ratio.
    3) There should not have any abnormality of functions.

1O Precaution for use of LCD module

10.1 Handling Precautions

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

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.

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

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

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

6) Do not attempt to disassemble or process the LCD module.

1O.2 Assembling Precautions

1) When mounting the LCD module make sure that it is free of twisting, warping, and distortion. Distortion has great influence upon display quality. Also keep the stiffness enough regarding the outer case.

2) Please handle the LCD module by its side.

3) NC terminal should be open. Do not connect anything.

4) If the logic circuit power is OFF, do not apply the input signals.

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

·Be sure to ground the body when handling the LCD module.

·Tools required for assembly, such as soldering irons, must be properly grounded.

·To reduce the amount of static electricity generated, do not conduct assembly and other work under dry conditions.

·The LCD module is coated with a film to protect the display surface. Exercise care when peeling off this protective film since static electricity may be generated.

6) Be careful when treating the glass panel because it has very sharpened edge.

1O.3 Storage Precautions

1) When storing the LCD module, avoid exposure to direct sunlight of to the light of fluorescent lamps and high temperature/high humidity. Whenever possible, the LCD module should be stored in the same conditions in which they were shipped from our company.

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2) Exercise care to minimize corrosion of the electrode. Corrosion of the electrodes is accelerated by water droplets or a current flow in a high-humidity environment.

10.4 Design Precautions

1) The absolute maximum ratings represent the rated value beyond which LCD module can not exceed. When the LCD modules are used in excess of this rated value, their operation characteristics may be adversely affected.

2) To prevent the occurrence of erroneous operation caused by noise, attention must be paid to satisfy V_{IL}, V_{IH} specification values including taking the precaution of using signal cables that are short.

3) The LCD exhibits temperature dependency characteristics. Since recognition of the display becomes difficult when the LCD is used outside its designated operating temperature range, be sure to use the LCD within this range. Also keep in mind that the LCD driving voltage levels necessary for clear displays will vary according to temperature.

4) We recommended that power supply lines (VDD) have over-current protection line. (Fuse etc. Recommend Value:0.5A)

5) Sufficiently notice the mutual noise interference occurred by peripheral devices.

6) To cope with EMI, take measures basically on outputting side.

7) When installing an LCD module, fasten it at the LCD panel.

8) The display panel is made of general float glass which is not guaranteed for strength. So please consider about following.
·Do not subject panel to a mechanical shock by dropping directly.
·Do not let case to touch to panel directly.

10.5 Others

1) Liquid crystal solidifies under low temperature (below the storage temperature range) leading to defective orientation or the generation of air bubbles (black or white). Air bubbles may also be generated if the LCD module is subjected to a strong shock at a low temperature.

2) If the LCD modules have been operating for a long time showing the same display patterns, the display patterns may remain on the screen as ghost images and a slight contrast irregularity may also appear. A normal operating status can be regained by suspending use for some time. It should be noted that this phenomenon does not adversely affect performance reliability.

3) To minimize the performance degradation of the LCD module's resulting from destruction caused by static electricity, etc., exercise care to avoid touching the following section when handling this module: LCD's Terminal electrode sections.

4) Optimum voltage to obtain best contrast value depending on products. Therefore voltage adjustment with electric volume is required in each display.

5) Precaution for disposal of LCD module. When disposal of LCD module, ask specialization company of industrial waste which is permitted by the government. When burn up LCD module, obey the law of environmental hygienics.

11   Outline dimensions

Refer to Appendix: OUTLINE DRAWING OF MODULE

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