TWM325

LCD Module User Manual

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Rev.	Descriptions	Release Date
0.1	New release	2005-01-29

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1. Basic Specifications

1.1 Display Specifications

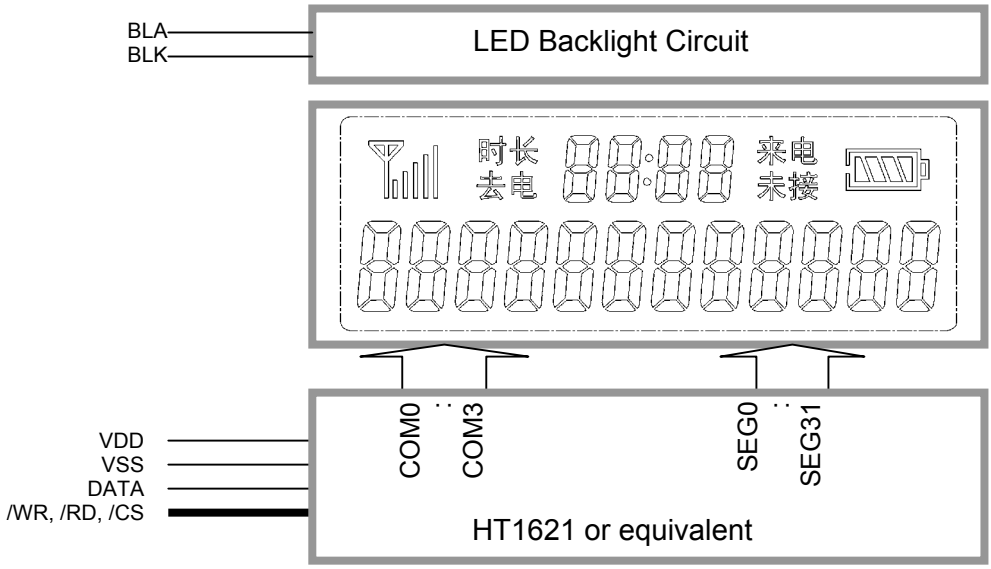
1) LCD Display Mode : TN, Positive, Transmissive
2) Display Color : Display Data = “1” : Black (*1)
: Display Data = “0” : Light Gray (*2)
3) Viewing Angle : 6 H
4) Driving Method : 1/4 duty, 1/3 bias
5) Backlight : Blue LED backlight

Note:
*1. Color tone may slightly change by Temperature and Driving Condition.
*2. The Color is defined as the inactive / background color

1.2 Mechanical Specifications

1) Outline Dimension : 74.0 x 40.2 x 12.1MAX
see attached Outline Drawing for details

1.3 Block Diagram



1.4 Terminal Functions

Pin No.	Pin Name	I/O	Descriptions
1	VDD	Power	Positive power supply
2	VSS	Power	Negative power supply, GND (0V)
3	/CS	Input	Chip Selection input with internal pull-up resistor /CS=High, disable data or command writing /CS=Low, enable data or command writing
4	/RD	Input	Read Clock input with internal pull-up resistor Data will appear the DATA pin at the low level of this signal
5	/WR	Input	Write Clock input with internal pull-up resistor. Data on the DATA pin are latched on the rising edge of this signal
6	DATA	I/O	Serial Data I/O
7	BLA	Power	LED backlight positive supply
8	BLK	Power	LED backlight negative supply

2. Absolute Maximum Ratings

Items	Symbol	Min.	Max.	Unit	Condition
Supply Voltage	V_{DD}	-0.3	5.0	V	VSS = 0V
Input Voltage	V_{IN}	V_{SS}-0.3	V_{DD}+0.3	V	VSS = 0V
Operating Temperature	T_{OP}	0	50	°C	No Condensation
Storage Temperature	T_{ST}	-10	60	°C	No Condensation

Cautions:
Any Stresses exceeding the Absolute Maximum Ratings may cause substantial damage to the device. Functional operation of this device at other conditions beyond those listed in the specification is not implied and prolonged exposure to extreme conditions may affect device reliability.

3. Electrical Characteristics

3.1 DC Characteristics

V_{SS}=0V, V_{DD} =3.0V, T_{OP} =25°C

Items	Symbol	MIN.	TYP.	MAX.	Unit	Applicable Pin
Operating Voltage (*1)	V_{DD}	2.8	-	3.5	V	VDD
Input High Voltage	V_{IN}	0.8xVDD	-	VDD	V	DATA, /RD, /WR, /CS
Input Low Voltage	V_{IN}	VSS	-	0.5	V	DATA, /RD, /WR, /CS
Operating Current (*2)	I_{DD}	-	0.3	1.2	mA	VDD

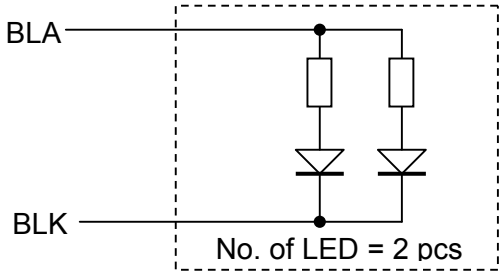
Note:
1. The variation of Operating Voltage may affect the LCD display contrast.
2. No Data transfer.

3.2 Backlight Circuit Characteristics

V_{BLK}=0V, If_{BLA}=40mA, T_{OP}=25°C

Items	Symbol	MIN.	TYP.	MAX.	Unit	Applicable Pin
Forward Voltage	Vf_{BLA}	-	3.3	-	V	BLA
Forward Current	If_{BLK}	-	-	50	mA	BLA

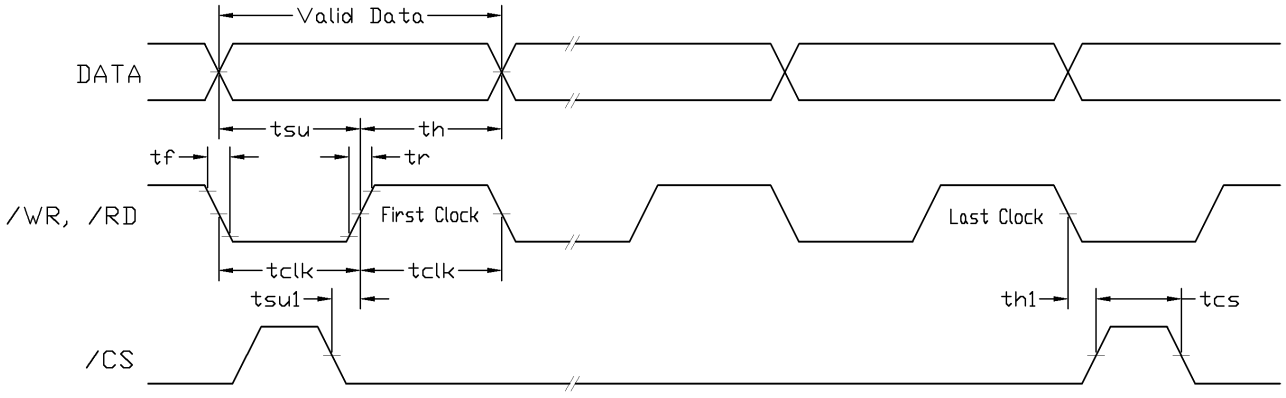
Cautions:
Exceeding the recommended driving current could cause substantial damage to the backlight and shorten its lifetime.



3.3 AC Characteristics

V_{SS}=0V, V_{DD} =3.0V, T_{OP} =25°C

Symbol	MIN.	TYP.	MAX.	Unit	Descriptions
tcs	500	-	-	ns	Serial I/F Reset Pulse Width
tclk	5	-	-	μs	/WR, /RD Input Pulse Width
tr, tf	-	-	80	ns	Rise / Fall Time Serial Data
tsu	240	-	-	ns	Setup Time for DATA to /WR, /RD
th	240	-	-	ns	Hold Time for DATA to /WR, /RD
tsu1	200	-	-	ns	Setup Time for /CS to /WR, /RD
th1	200	-	-	ns	Hold Time for /CS to /WR, /RD



4. Function Specifications

4.1 Basic Setting

To drive the LCD module correctly and provide normally display, please use the following setting

BIAS = 1/3
No. of Commons = 4
LCD Display = on

Note:
These setting/commands should issue to controllers while start up.
See the Command Listing section for details.

4.2 Command and Data format

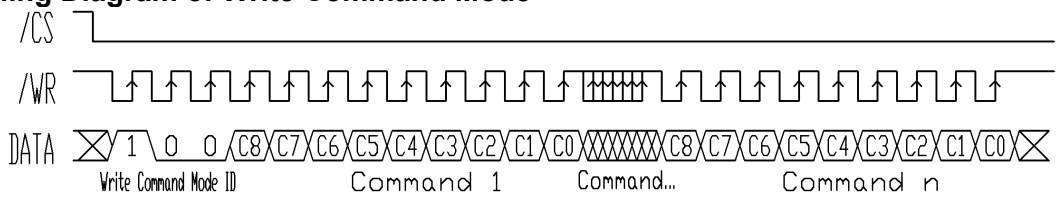
The LCD module could be controlled by software in two Operation modes. Modes are identified by "Mode ID".

Operation Mode	Mode ID
Write Command	**1 0 0**
Write Data	**1 0 1**

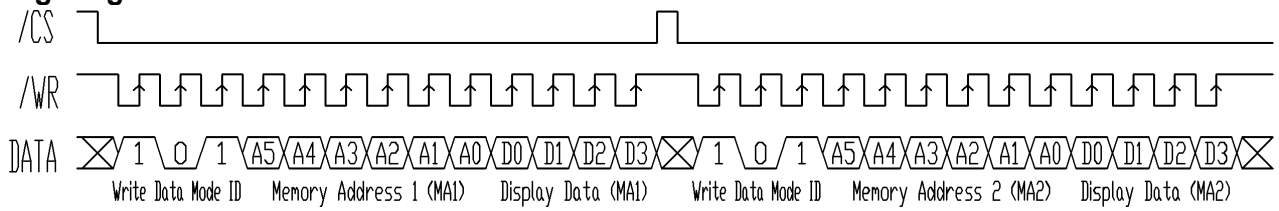
The mode ID should be issued before the data or command is transferred.
If successive commands is issuing, the command mode ID, namely **1 0 0**, can be omitted after the first command with mode ID. If successive data is issuing, the data mode ID, namely **1 0 1**, can be omitted after the first data with mode ID. In Write Data (Successive Address Writing) Mode the internal address pointer will be increased by 1 after each data received.

While the system is operating in the non-successive command or the non-successive address data mode, the /CS pin should be set to "1" and the previous operation mode will be reset also. Once the /CS pin returns to "0" a new operation mode ID should be issued first.

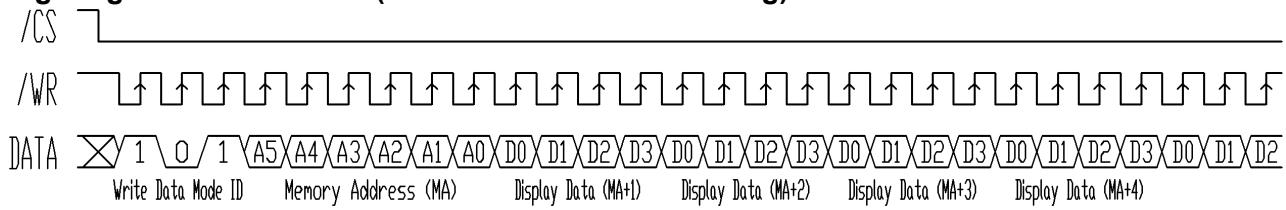
Timing Diagram of Write Command Mode



Timing Diagram of Write Data Mode



Timing Diagram of Write Data (Successive Address Writing) Mode



4.3 Interfacing

The /CS line are used to initialize the serial interface circuit and to terminate the communication between the host and LCD module. If the /CS pin is set to 1, the data or command issued between the host and the dedicated controller will be disabled and then initialized for further command or data. Before issuing a mode command or mode switching, a high level pulse is required on /CS to initialize the serial interface.

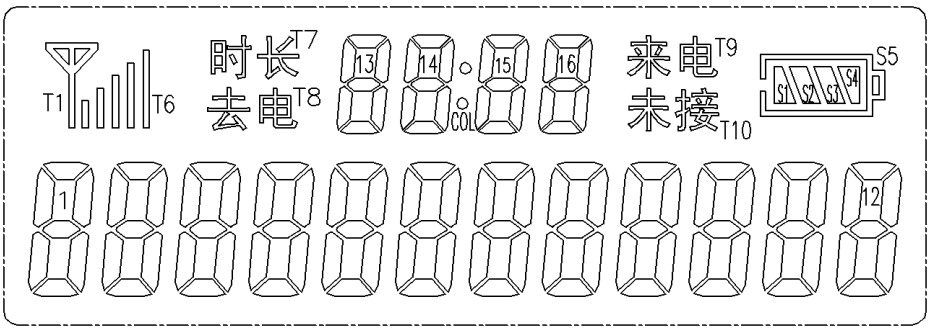
The DATA line is the serial data input line. Data or commands to be written have to be passed through the DATA line.

The /WR line is the WRITE clock input. The data, address, and command on the DATA line are all latched into the LCD module at the rising edge of the /WR signal.

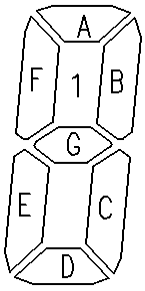
4.4 Icons Memory Mapping

	Address Location (hex)															
	00	**01**	**02**	**03**	**04**	**05**	**06**	**07**	**08**	**09**	**0A**	**0B**	**0C**	**0D**	**0E**	**0F**
D0	1A	1B	2A	2B	3A	3B	4A	4B	5A	5B	6A	6B	7A	7B	8A	8B
D1	1F	1G	2F	2G	3F	3G	4F	4G	5F	5G	6F	6G	7F	7G	8F	8G
D2	1E	1C	2E	2C	3E	3C	4E	4C	5E	5C	6E	6C	7E	7C	8E	8C
D3	1D	T6	2D	T5	3D	T4	4D	T3	5D	T2	6D	T1	7D	T10	8D	S1

	Address Location (hex)															
	10	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**1A**	**1B**	**1C**	**1D**	**1E**	**1F**
D0	9A	9B	10A	10B	11A	11B	12A	12B	13A	13B	14A	14B	15A	15B	16A	16B
D1	9F	9G	10F	10G	11F	11G	12F	12G	13F	13G	14F	14G	15F	15G	16F	16G
D2	9E	9C	10E	10C	11E	11C	12E	12C	13E	13C	14E	14C	15E	15C	16E	16C
D3	9D	S2	10D	S3	11D	S4	12D	S5	13D	T7	14D	T8	15D	COL	16D	T9



Icons Key



7-Segment Key

4.5 Command Listing

Command Mode

Command	Mode ID	Code									Function	Note
		C8	C7	C6	C5	C4	C3	C2	C1	C0		
SYS DIS	**1 0 0**	0	0	0	0	0	0	0	0	x	Turn off both system oscillator and LCD bias generator	*1
SYS EN	**1 0 0**	0	0	0	0	0	0	0	1	x	Turn on system oscillator	
LCD OFF	**1 0 0**	0	0	0	0	0	0	1	0	x	Turn off LCD by turn off LCD bias generator	*1
LCD ON	**1 0 0**	0	0	0	0	0	0	1	1	x	Turn on LCD by turn on LCD bias generator	
RC256K	**1 0 0**	0	0	0	1	1	0	x	x	x	Select System clock source to on-chip oscillator	*1
BIAS 1/2	**1 0 0**	0	0	1	0	a	b	x	0	x	1/2 bias driving option ab=00 : 2 commons option ab=01 : 3 commons option ab=10 : 4 commons option	
BIAS 1/3	**1 0 0**	0	0	1	0	a	b	x	1	x	1/3 bias driving option ab=00 : 2 commons option ab=01 : 3 commons option ab=10 : 4 commons option	
TEST	**1 0 0**	1	1	1	0	0	0	0	0	x	Test mode, not used	
NORMAL	**1 0 0**	1	1	1	0	0	0	1	1	x	Normal mode	*1

Data Mode

Command	Mode ID	Code										Function	Note
		A5	A4	A3	A2	A1	A0	D0	D1	D2	D3		
Write Display Data	**1 0 1**	Display Memory Address (00h - 3Fh)						Display Data				Write Data to Display Memory	*2

Note:
*1. Power on default setting
*2. Refer to Timing Diagram for details.
*3. x = don't care bit

4.6 Initialization

Issue the following commands for normal display.

Steps	Command	Mode ID	Code									Function
			C8	C7	C6	C5	C4	C3	C2	C1	C0	
1	SYS EN	**1 0 0**	0	0	0	0	0	0	0	1	x	Turn on system oscillator
2	RC256K	**1 0 0**	0	0	0	1	1	0	x	X	x	Using on-chip RC oscillator
3	BIAS 1/3	**1 0 0**	0	0	1	0	1	0	x	1	x	1/3 bias driving and 4 commons
4	NORMAL	**1 0 0**	1	1	1	0	0	0	1	1	x	Normal mode
5	LCD ON	**1 0 0**	0	0	0	0	0	0	1	1	x	Turn on LCD for normal display

5. Design and Handling Precaution

1. The LCD panel is made by glass. Any mechanical shock (eg. dropping form high place) will damage the LCD module.
2. Do not add excessive force on the surface of the display, which may cause the Display color change abnormally.
3. The polarizer on the LCD is easily get scratched. If possible, do not remove the LCD protective film until the last step of installation.
4. Never attempt to disassemble or rework the LCD module.
5. Only Clean the LCD with Isopropyl Alcohol or Ethyl Alcohol. Other solvents (eg. water) may damage the LCD.
6. When mounting the LCD module, make sure that it is free form twisting, warping and distortion.
7. Ensure to provide enough space (with cushion) between case and LCD panel to prevent external force adding on it, or it may cause damage to the LCD or degrade the display result.
8. Only hold the LCD module by its side. Never hold LCD module by add force on the heat seal or TAB.
9. Never add force to component of the LCD module. It may cause invisible damage or degrade of the reliability.
10. LCD module could be easily damaged by static electricity. Be careful to maintain an optimum anti-static work environment to protect the LCD module.
11. When peeling off the protective film from LCD, static charge may cause abnormal display pattern. It is normal and will resume to normal in a short while.
12. Take care and prevent get hurt by the LCD panel sharp edge.
13. Never operate the LCD module exceed the absolute maximum ratings.
14. Keep the signal line as short as possible to prevent noisy signal applying to LCD module.
15. Never apply signal to the LCD module without power supply.
16. IC chip (eg. TAB or COG) is sensitive to the light. Strong lighting environment could possibly cause malfunction. Light sealing structure casing is recommend.
17. LCD module reliability may be reduced by temperature shock.
18. When storing the LCD module, avoid exposure to the direct sunlight, high humidity, high temperature or low temperature. They may damage or degrade the LCD module