深圳市拓普微科技开发有限公司
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TWM14007

LCD Module User Manual

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Date: 2015-01-29	Date:	Date:

Rev.	Descriptions	Release Date
0.1	Preliminary release	2015-01-29

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1. Basic Specifications

1.1 Display Specifications

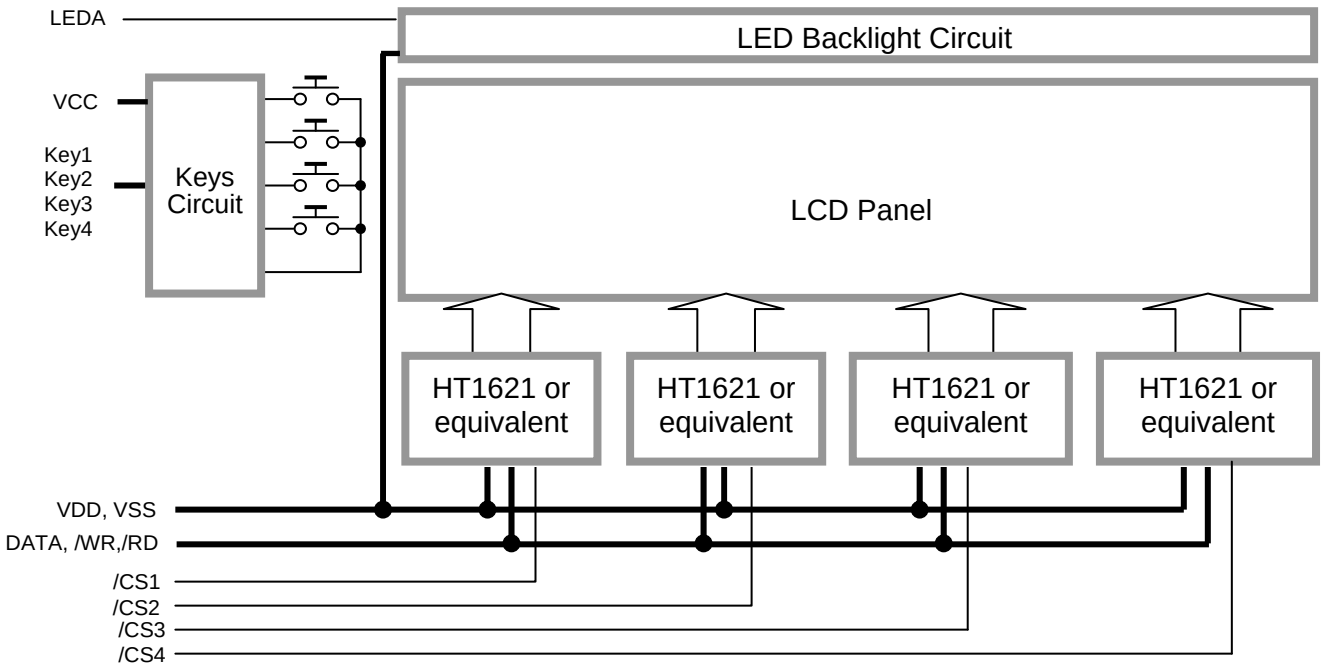
1) LCD Display Mode :FSTN, Positive, Transflective
2) Display Color : Display Data = “1” : Dark (*1)
: Display Data = “0” : White (*2)
3) Viewing Angle : 6 H
4) Driving Method : 1/4 duty, 1/3 bias
5) Backlight : White LED backlight

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 : 85.4 x84.6 x 14.1MAX (mm)
(see attached Outline Drawing for details)

1.3 Block Diagram



1.4 Terminal Functions

Pin No.	Pin Name	I/O	Descriptions
K1			
1	VSS	Power	Negative Power Supply, Ground
2	/WR	Input	Write Clock input with internal pull-up resistor /WR=L→H; Data or Instruction latch into the LCD module
3	/RD	Input	Read Clock input with internal pull-up resistor /RD=L→H; Data read from the LCD module
4	DATA	I/O	Serial Data input/output with internal pull-up resistor
5	/CS1	Input	Chip selection input of left IC1 /CS1=High, disable data or command writing /CS1=Low, enable data or command writing
6	/CS2	Input	Chip selection input of middle IC2 /CS2=High, disable data or command writing /CS2=Low, enable data or command writing
7	VCC(3.3V)	Power	Positive Power Supply，for KEY circuit
8	/CS3	Input	Chip selection input of right IC3 /CS3=High, disable data or command writing /CS3=Low, enable data or command writing
9	/CS4	Input	Chip selection input of right IC4 /CS4=High, disable data or command writing /CS4=Low, enable data or command writing
10	LEDA	Input	HIGH: Backlight on; LOW: Backlight off
11	VSS	Power	Negative Power Supply, Ground
12	VSS	Power	Negative Power Supply, Ground
13	VSS	Power	Negative Power Supply, Ground
14	VSS	Power	Negative Power Supply, Ground
15	VSS	Power	Negative Power Supply, Ground
16	VDD(5.0V)	Power	Positive Power Supply
17	VSS	Power	Negative Power Supply, Ground
18	VSS	Power	Negative Power Supply, Ground
19	VSS	Power	Negative Power Supply, Ground
20	VSS	Power	Negative Power Supply, Ground
21	KEY4	-	Keyboard Circuit
22	KEY3	-	Keyboard Circuit
23	KEY2	-	Keyboard Circuit
24	KEY1	-	Keyboard Circuit

2. Absolute Maximum Ratings

Items	Symbol	Min.	Max.	Unit	Condition
Supply Voltage	V_{DD}	-0.3	5.5	V	V_{SS} = 0V
Input Voltage	V_{IN}	V_{SS}-0.3	V_{DD}+0.3	V	V_{SS} = 0V
Operating Temperature	T_{OP}	-25	70	°C	No Condensation
Storage Temperature	T_{ST}	-35	85	°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} =5.0V, T_{OP} =25°C

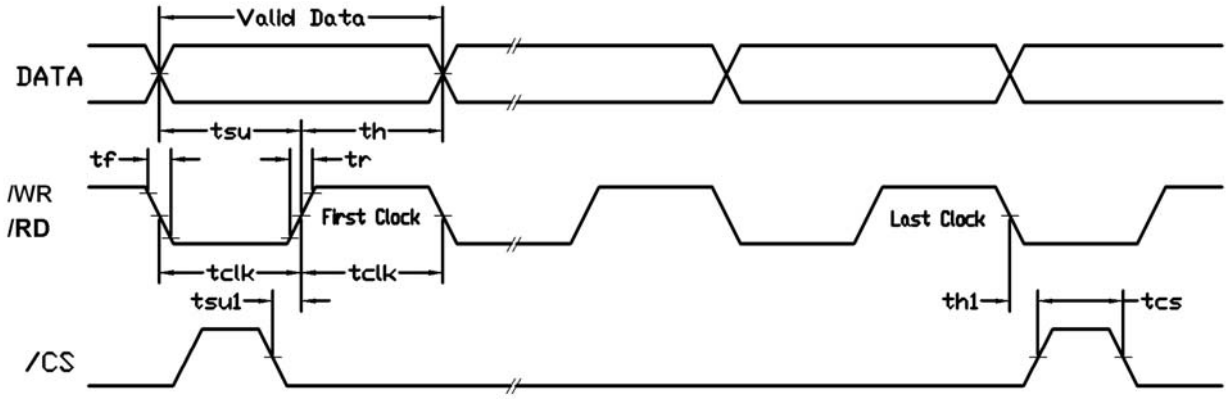
Items	Symbol	MIN.	TYP.	MAX.	Unit	Applicable Pin
Operating Voltage (*1)	V_{DD}	4.8	5.0	5.2	V	VDD
Input High Voltage	V_{IN}	0.8xVDD	-	VDD	V	DATA, /WR, /CS1~/CS4
Input Low Voltage	V_{IN}	VSS	-	0.5	V	DATA, /WR, /CS1~/CS4
Operating Current 1	I_{DD}	-	0.95	2.4	mA	VDD, VSS(OFF Backlight)
Operating Current 2	I_{DD}	-	45	68	mA	VDD, VSS(ON Backlight)

Note:
*1. The variation of Operating Voltage may affect the LCD display contrast.

3.2 AC Characteristics

V_{SS}=0V, V_{DD} =5.0V, T_{OP} =25°C

Symbol	MIN.	TYP.	MAX.	Unit	Descriptions
tcs	325	-	-	ns	Serial I/F Reset Pulse Width
tclk	4.5	-	-	µs	/WR, /RD Input Pulse Width
Tr, tf	-	-	112	ns	Rise / Fall Time Serial Data
tsu	160	-	-	ns	Setup Time for DATA to /WR
th	330	-	-	ns	Hold Time for DATA to /WR
tsu1	650	-	-	ns	Setup Time for /CS to /WR
th1	65	-	-	ns	Hold Time for /CS to /WR



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 both controllers while start up.
See the Command Listing section for details.

4.2 Command and Data format

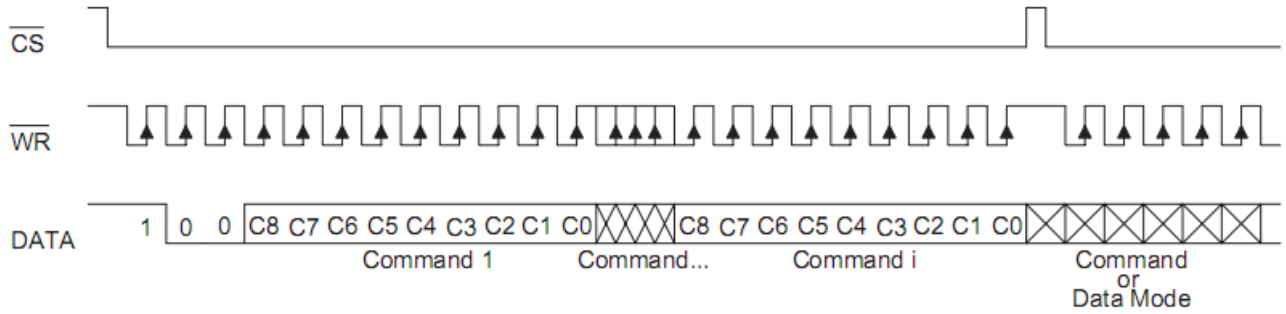
The LCD module could be controlled by software in two Operation modes. Modes are identified by "Mode ID".

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

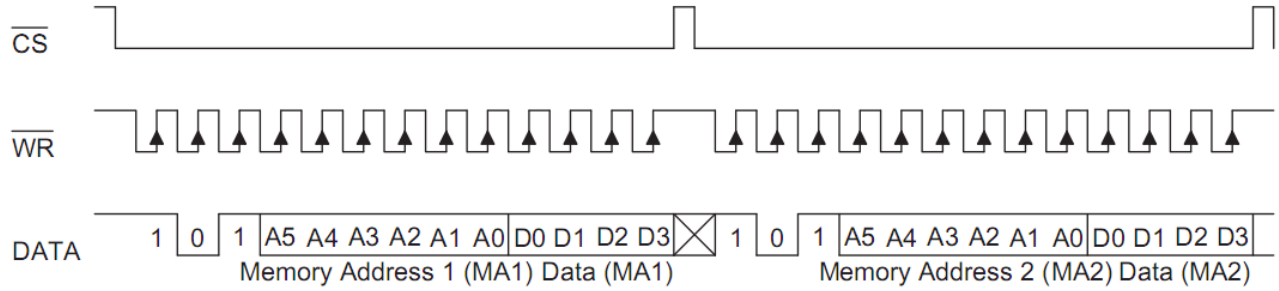
The mode ID should be issued before the data or command is transferred.
If successive commands is issuing, the command mode ID, namely **1 0 0**, can be omitted after the first command with mode ID. If successive data is issuing, the data mode ID, namely **1 0 1**, can be omitted after the first data 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 /CS1 or /CS2 or /CS3 or /CS4 pin should be set to "1" and the previous operation mode will be reset also.
Once the /CS1 or /CS2 or /CS3 or /CS4 pin returns to "0" a new operation mode ID should be issued first.

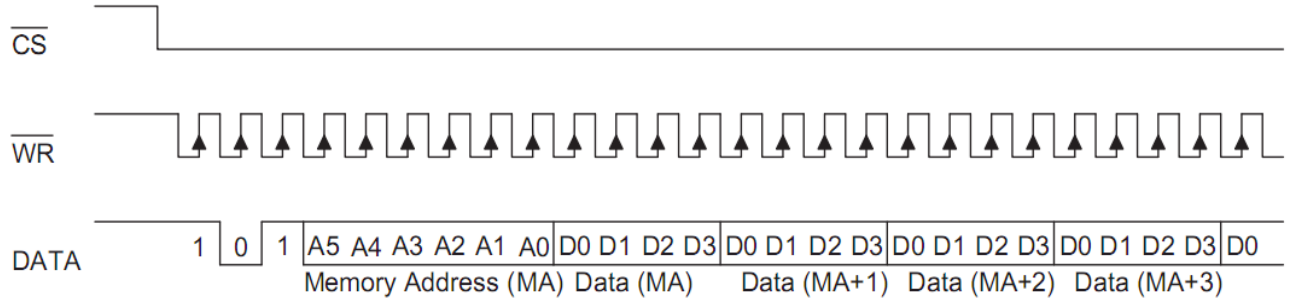
Timing Diagram of Write Command Mode



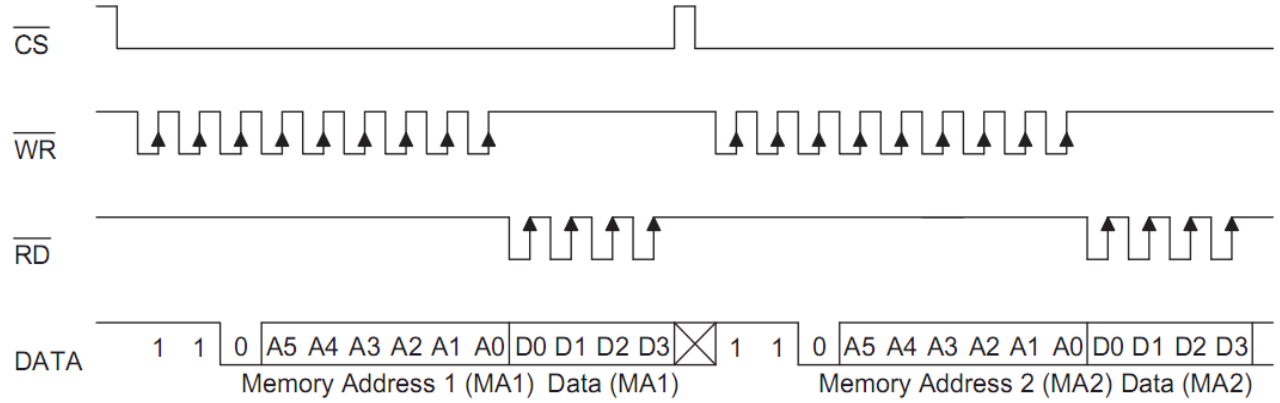
Timing Diagram of Write Data Mode



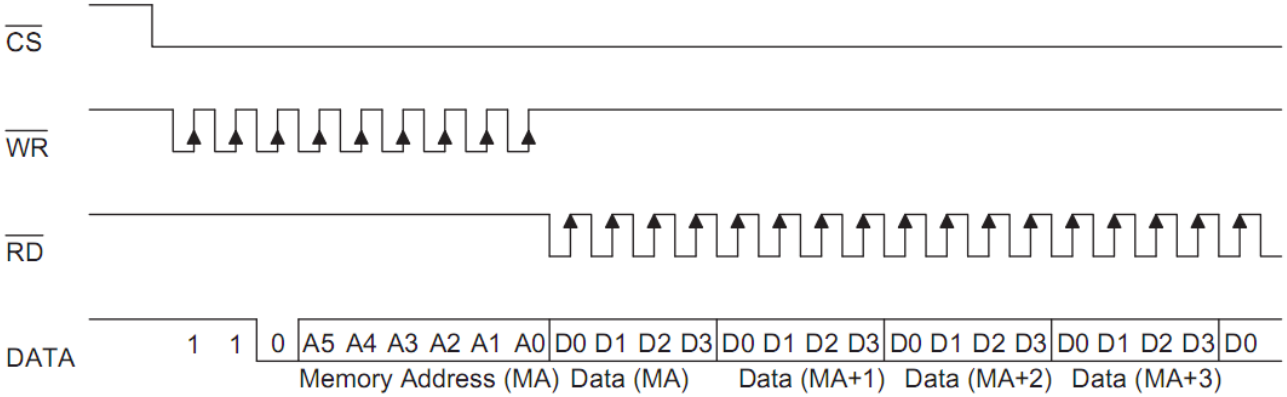
Timing Diagram of Write Data (Successive Address Writing) Mode



Timing Diagram of Read Data Mode



Timing Diagram of Read Data (Successive Address Writing) Mode



4.3 Interfacing

The /CS1, /CS2, /CS3 and/CS4 line are used to initialize the serial interface circuit and to terminate the communication between the host and the LCD module. If the /CS1 or /CS2 or/CS3 or/CS4 pin is set to 1, the data or command issued between the host and the dedicated controller will be disabled. Before issuing a mode command or mode switching, a high level pulse is required on /CS1 or /CS2 or/CS3 or/CS4to 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.

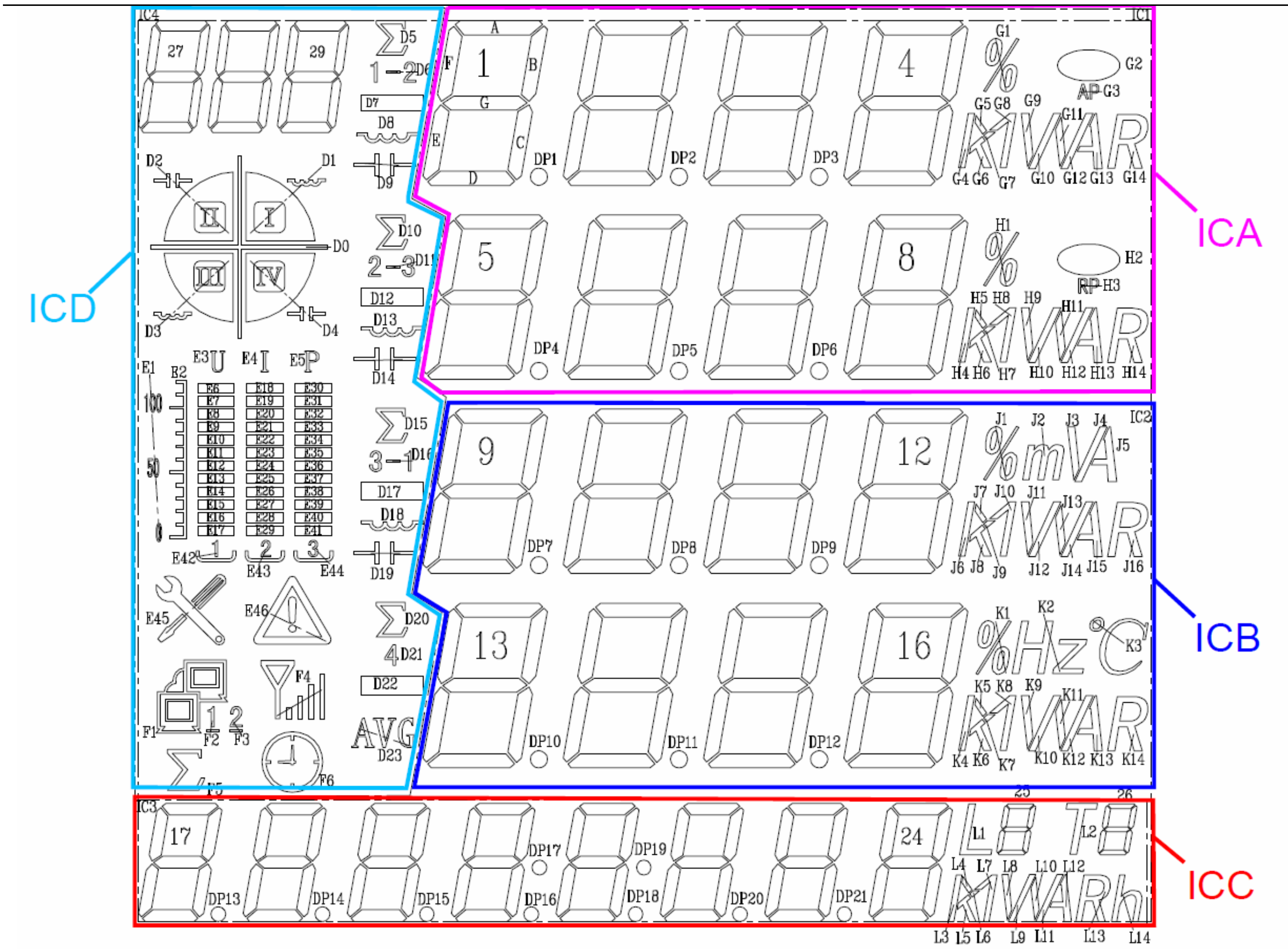
4.4 Memory Map

ICA	/CS1=0, /CS2=1,/CS3=1,/CS4=1			
Add. (hex)	D3 COMA3	D2 COMA2	D1 COMA1	D0 COMA0
00	1A	1F	1E	1D
01	1B	1G	1C	DP1
02	2A	2F	2E	2D
03	2B	2G	2C	DP2
04	3A	3F	3E	3D
05	3B	3G	3C	DP3
06	4A	4F	4E	4D
07	4B	4G	4C	G4
08	G3	G2	G1	G5
09	G10	G9	G8	G7
0A	G11	G12	G13	G14
0B	H2	H3	H1	G6
0C	H14	H13	H12	H11
0D	H7	H8	H9	H10
0E	H6	H4	H5	\
0F	\	8C	8G	8B
10	8D	8E	8F	8A
11	DP6	7C	7G	7B
12	7D	7E	7F	7A
13	DP5	6C	6G	6B
14	6D	6E	6F	6A
15	DP4	5C	5G	5B
16	5D	5E	5F	5A
17	\	\	\	\
18	\	\	\	\
19	\	\	\	\
1A	\	\	\	\
1B	\	\	\	\
1C	\	\	\	\
1D	\	\	\	\
1E	\	\	\	\
1F	\	\	\	\

ICB	/CS1=1, /CS2=0,/CS3=1,/CS4=1			
Add. (hex)	D3 COMB3	D2 COMB2	D1 COMB1	D0 COMB0
00	J5	J4	J3	J2
01	J16	J15	J14	J13
02	J9	J10	J11	J12
03	J8	J7	\	J1
04	12B	12G	12C	J6
05	12A	12F	12E	12D
06	11B	11G	11C	DP9
07	11A	11F	11E	11D
08	10B	10G	10C	DP8
09	10A	10F	10E	10D
0A	9B	9G	9C	DP7
0B	9A	9F	9E	9D
0C	13D	13E	13F	13A
0D	DP10	13C	13G	13B
0E	14D	14E	14F	14A
0F	DP11	14C	14G	14B
10	15D	15E	15F	15A
11	DP12	15C	15G	15B
12	16D	16E	16F	16A
13	\	16C	16G	16B
14	\	K1	K2	K3
15	K11	K12	K13	K14
16	K10	K9	K8	K7
17	K4	K6	K5	\
18	\	\	\	\
19	\	\	\	\
1A	\	\	\	\
1B	\	\	\	\
1C	\	\	\	\
1D	\	\	\	\
1E	\	\	\	\
1F	\	\	\	\

ICC	/CS1=1, /CS2=1,/CS3=0,/CS4=1			
Add. (hex)	D3 COMC3	D2 COMC2	D1 COMC1	D0 COMC0
00	17D	17E	17F	17A
01	DP13	17C	17G	17B
02	18D	18E	18F	18A
03	DP14	18C	18G	18B
04	19D	19E	19F	19A
05	DP15	19C	19G	19B
06	20D	20E	20F	20A
07	DP16	20C	20G	20B
08	21D	21E	21F	21A
09	DP18	21C	21G	21B
0A	22D	22E	22F	22A
0B	DP20	22C	22G	22B
0C	23D	23E	23F	23A
0D	DP21	23C	23G	23B
0E	24D	24E	24F	24A
0F	L3	24C	24G	24B
10	\	L4	L6	L5
11	L10	L9	L8	L7
12	L11	L12	L13	L14
13	L2	26C	26G	26B
14	26D	26E	26F	26A
15	L1	25C	25G	25B
16	25D	25E	26F	25A
17	\	\	DP19	DP17
18	\	\	\	\
19	\	\	\	\
1A	\	\	\	\
1B	\	\	\	\
1C	\	\	\	\
1D	\	\	\	\
1E	\	\	\	\
1F	\	\	\	\

ICD	/CS1=1, /CS2=1,/CS3=1,/CS4=0			
Add. (hex)	D3 COMD3	D2 COMD2	D1 COMD1	D0 COMD0
00	F3	F2	F6	F5
01	F4	E46	F1	E45
02	D23	D22	D21	D20
03	E42	E41	E29	E17
04	E43	E40	E28	E16
05	E44	E39	E27	E15
06	D19	E38	E26	E14
07	D18	E37	E25	E13
08	D17	E36	E24	E12
09	\	E35	E23	E11
0A	\	\	E1	E2
0B	\	E34	E22	E10
0C	D16	E33	E21	E9
0D	3	E32	E20	E8
0E	D15	E31	E19	E7
0F	D14	E30	E18	E6
10	D13	E5	E4	E3
11	D12	D4	D0	D3
12	D11	2	D1	D2
13	27D	27E	27F	27A
14	D10	27C	27G	27B
15	28D	28E	28F	28A
16	D9	28C	28G	28B
17	29D	29E	29F	29A
18	D8	29C	29G	29B
19	D7	D6	1	D5
1A	\	\	\	\
1B	\	\	\	\
1C	\	\	\	\
1D	\	\	\	\
1E	\	\	\	\
1F	\	\	\	\


ICD
ICA
ICB
ICC
IC1
IC2
IC3
IC4

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 1/3	**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