



深圳市拓普微科技开发有限公司

SHENZHEN TOPWAY TECHNOLOGY CO., LTD.

LM256160ACA-2

LCD Module User Manual

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Rev.	Descriptions	Release Date
0.1	Preliminary release	2015-12-31

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1. Basic Specifications

1.1 Display Specifications

- 1) LCD Display Mode : FSTN, Positive, Transflective, Anti-Glare Hard Coating
- 2) Display Color : Display Data = "1" : Dark Gray (*1)
: Display Data = "0" : Light Gray (*2)
- 3) Viewing Angle : 6H
- 4) Driving Method : 1/160 duty, 1/12 bias
- 5) Back Light : White LED backlight

Note:

*1. Color tone may slightly change by Temperature and Driving Condition.

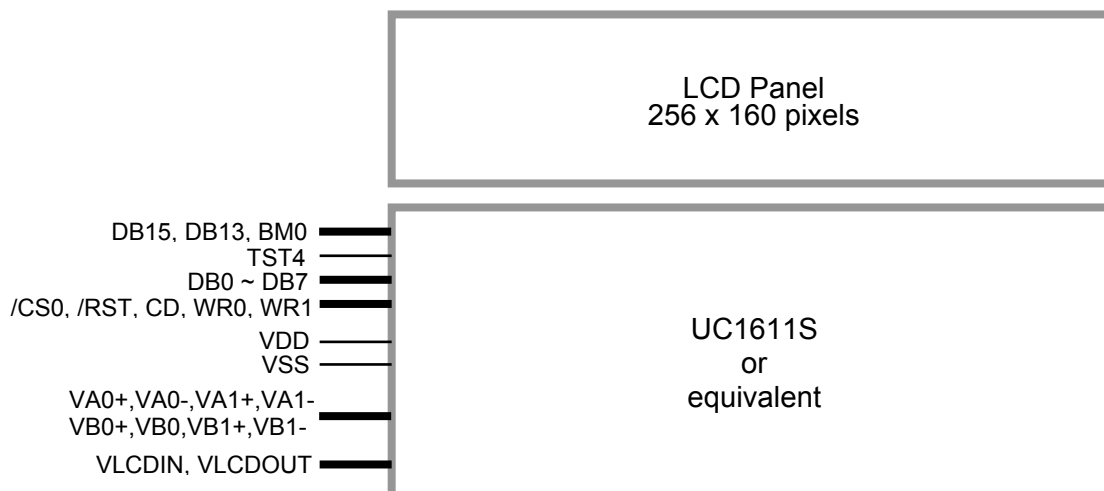
*2. The Color is defined as the inactive / background color

*3. Fine Contrast adjustment function is necessary in the application design for optimal display result

1.2 Mechanical Specifications

- 1) Outline Dimension : 84.5 x 61.0x 8.4MAX
(See attached Outline Drawing for details)

1.3 Block Diagram



1.4 Terminal Functions

Pin No.	Pin Name	I/O	Descriptions					
			8-bit parallel 8080 mode	8-bit parallel 6800 mode	Serial mode			
					4Line	3Line	IIC	
1	VSS2	Power	Connect to VSS					
2	DB15	Input	L	L	H	H	H	
3	DB13	Input	L	L	L	L	H	
4	DB7	I/O	8-bit Data bus; Three state I/O terminal for display data or instruction data when /CS =H, DB0~DB7=High Impedance			Not use, Connect to VSS		
:	:					Serial data input(DB3)		
8	DB3(SDA)					Not use, Connect to VSS		
:	:					Serial clock input(DB0)		
11	DB0(SCL)							
12	/RST	Input	Reset: /RST=LOW: Initialization is executed /RST=HIGH: Normal					
13	/CS0	Input	Chip Select /CS0=LOW : Data IO is enabled					
14	CD	Input	Register Select CD=HIGH: data on DB0 to DB7 is display data CD=LOW: data on DB0 to DB7 is control data					
15	WR0	Input	WR0=L→H, WR1=H; Data or Instruction latch into the LCD module	WR0=H,WR1=H; Data or Status read from the LCD module	Not used, Connect to VSS			
16	WR1	Input	WR0=H, WR1=L; Data or Status read form the LCD module	WR0=L,WR1=H→L; Data or Status latch into the LCD module				
17	BM0	Input	L	H	L	H	H	
18	TST4	-	Not use(Leave open)					
19	VSS	Power	0V Supply, Ground (0V)					
20	VDD	Power	Positive Power Supply					
21	VLCDIN	Power	High voltage LCD Power Input, connect to VLCDOUT					
22	VLCDOUT	Power	High voltage LCD Power Supply, connect to VLCDIN					
23	VSS1	Power	0V Supply, Ground (0V)					
24	VA0-	Power	LCD driving voltage supply terminals					
25	VSS1	Power	0V Supply, Ground (0V)					
26	VA1-	Power	LCD driving voltage supply terminals					
27	VA1+	Power						
28	VSS1	Power	0V Supply, Ground (0V)					
29	VA0+	Power	LCD driving voltage supply terminals					
30	VB0-	Power						
31	VSS1	Power	0V Supply, Ground (0V)					
32	VB1-	Power	LCD driving voltage supply terminals					
33	VB1+	Power						
34	VSS1	Power	0V Supply, Ground (0V)					
35	VB0+	Power	LCD driving voltage supply terminals					
36	VSS2	Power	0V Supply, Ground (0V)					

Note: About Interface setting, please refer to UC1611 datasheet for more detail.

2. Absolute Maximum Ratings

Items	Symbol	Min.	Max.	Unit	Condition
Supply Voltage	V_{DD}	-0.3	+4.0	V	$V_{SS} = 0V$
Input Voltage	V_{IN}	-0.3	$V_{DD}+0.3$	V	$V_{SS} = 0V$
Operating Temperature	T_{OP}	-20	+70	°C	No Condensation
Storage Temperature	T_{ST}	-30	+80	°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

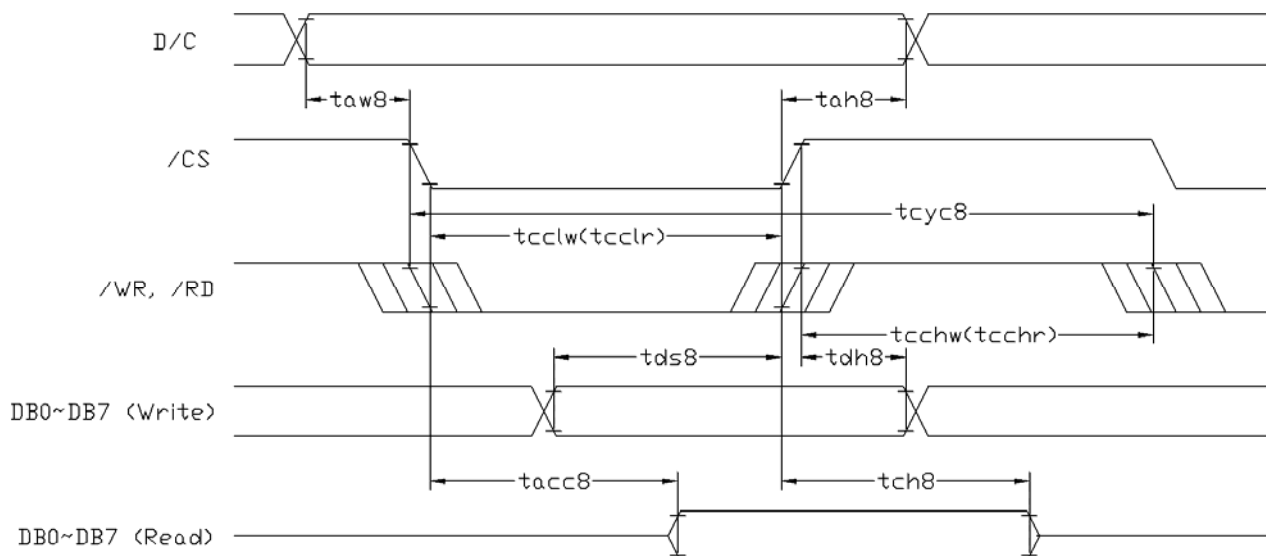
3.1 DC Characteristics

$V_{SS}=0V, V_{DD}=3.3V, T_{OP}=25^{\circ}C$

Items	Symbol	MIN.	TYP	MAX.	Unit	Condition / Application Pin
Operating Voltage	V_{DD}	3.0	3.3	3.6	V	VDD
Input High Voltage	V_{IH}	$0.8 \times V_{DD}$	-	V_{DD}	V	/RST, /CS, CD, WR0,
Input Low Voltage	V_{IL}	0	-	$0.2 \times V_{DD}$	V	WR1, DB0~DB7
Operating Current	I_{DD}	-	1.0	3.8	mA	VDD

3.2 AC Characteristics

3.2.1 8080 Mode System Bus Timing



$V_{SS}=0V, V_{DD}=3.3V, T_{OP}=25^{\circ}C$

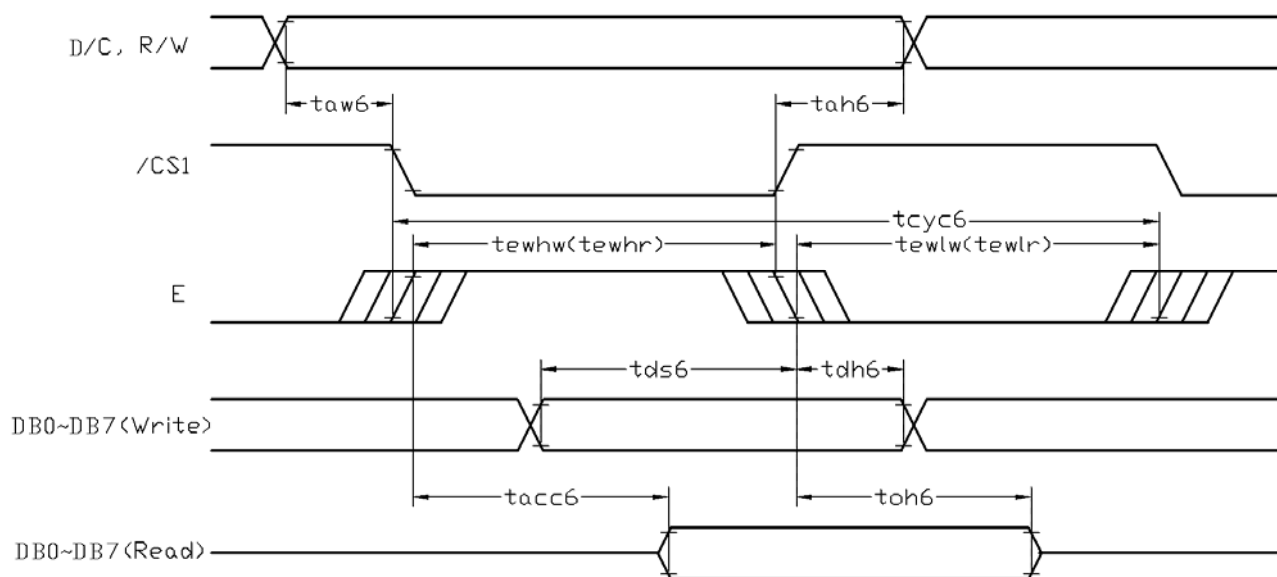
Item	Symbol	MIN.	TYP.	MAX.	Unit
System cycle time	t_{cyc8}	185	-	-	ns
Address setup time (D/C)	t_{aw8}	10	-	-	ns
Address hold time (D/C)	t_{ah8}	10	-	-	ns
Control LOW pulse width (/WR)	t_{cclw}	93	-	-	ns
Control LOW pulse width (/RD)	t_{cclr}	93	-	-	ns
Control HIGH pulse width (/WR)	t_{cchw}	93	-	-	ns
Control HIGH pulse width (/RD)	t_{cchr}	93	-	-	ns
Data setup time	t_{ds8}	43	-	-	ns
Data hold time	t_{dh8}	10	-	-	ns
/RD access time (*2)	t_{acc8}	-	-	85	ns
Output disable time (*2)	t_{ch8}	21	-	-	ns

Note:

*1. Input signal rise/fall time should be less than 12ns

*2. $C_L=100pF$

3.2.2 6800 Mode System Bus Timing



$V_{SS}=0V, V_{DD}=3.3V, T_{OP}=25^{\circ}C$

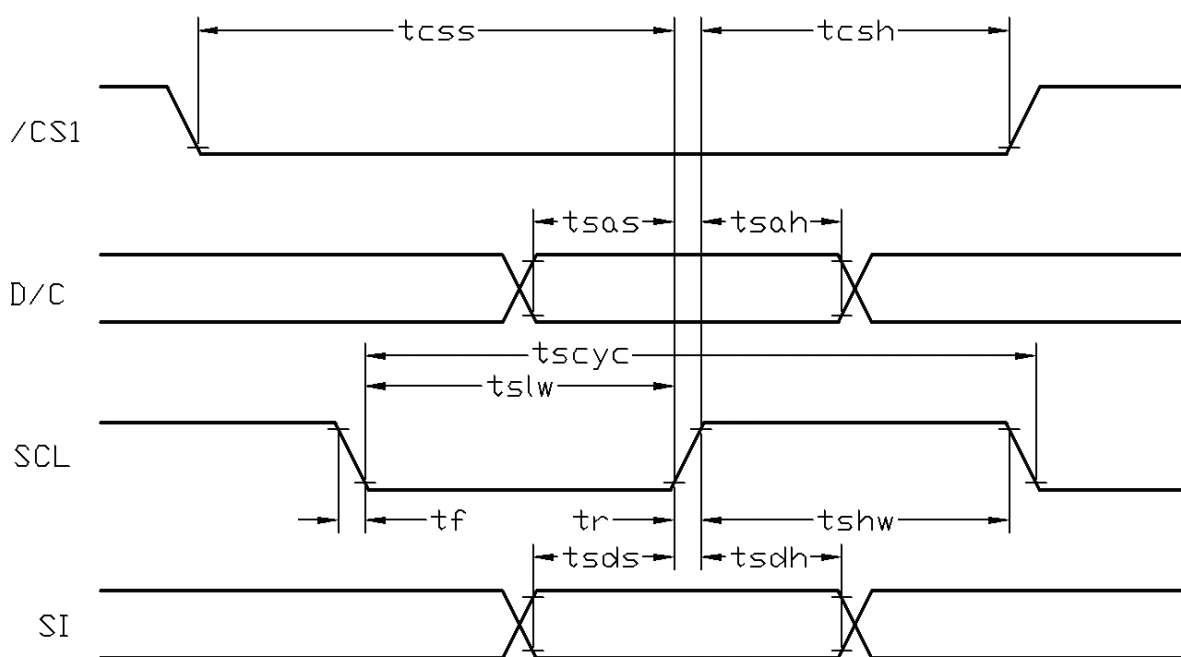
Item	Symbol	MIN.	TYP.	MAX.	Unit
System cycle time	t_{cyc6}	185	-	-	ns
Address setup time (D/C)	t_{aw6}	10	-	-	ns
Address hold time (D/C)	t_{ah6}	10	-	-	ns
Control LOW pulse width (R/W)	t_{ewlr}	93	-	-	ns
Control LOW pulse width (R/W)	t_{ewlw}	93	-	-	ns
Control HIGH pulse width (/RD)	t_{ewhr}	93	-	-	ns
Control HIGH pulse width (R/W)	t_{ewhw}	93	-	-	ns
Data setup time	t_{ds6}	43	-	-	ns
Data hold time	t_{dh6}	10	-	-	ns
/RD access time (*2)	t_{acc6}	-	-	85	ns
Output disable time (*2)	t_{oh6}	21	-	-	ns

Note:

*1. Input signal rise/fall time should be less than 12ns

*2. $CL=100pF$

3.2.3 Serial Mode Interface



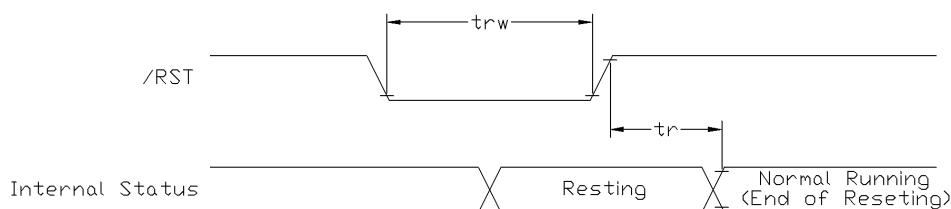
$V_{SS}=0V, V_{DD}=3.3V, T_{OP}=25^{\circ}C$

Item	Symbol	MIN.	TYP.	MAX.	Unit
Serial Clock Period	tscyc	51	-	-	ns
Address setup time (D/C)	tsas	10	-	-	ns
Address hold time (D/C)	tsah	10	-	-	ns
SCL "H" pulse width	tshw	26	-	-	ns
SCL "L" pulse width	tslw	26	-	-	ns
Data setup time	tsds	21	-	-	ns
Data hold time	tsdh	10	-	-	ns
CS-SCL time	tcss	10	-	-	ns
CS-SCL time	tcsh	10	-	-	ns

Note:

*1. Input signal rise/fall time should be less than 12ns

3.3 Reset Timing



$V_{SS}=0V, V_{DD}=3.3V, T_{OP}=25^{\circ}C$

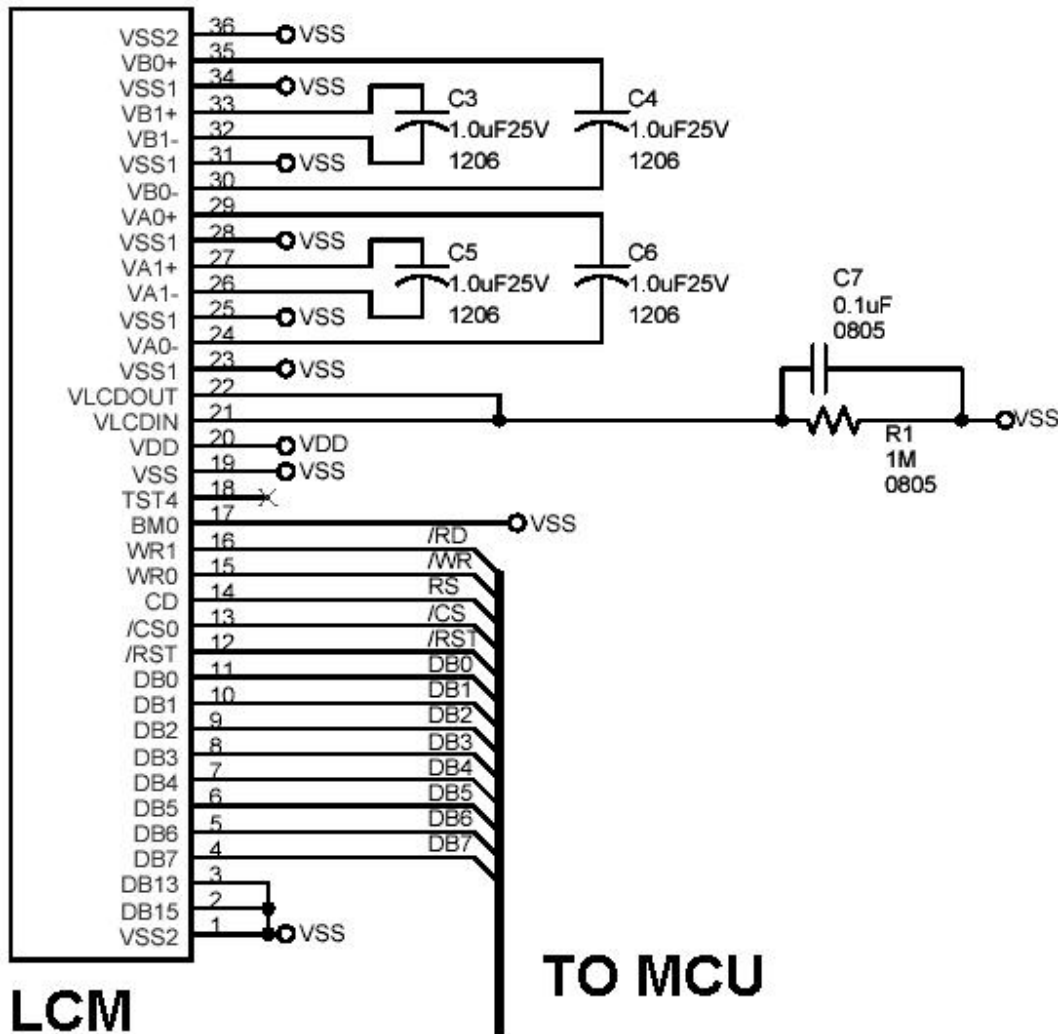
Item	Symbol	MIN.	TYP.	MAX.	Unit
Reset time	tr	-	-	15	ms
Reset LOW pulse width	trw	4	-	-	μs

Note:

*1. Input signal rise/fall time should be less than 12ns

4. Function Specifications

4.1 Application circuit (Example)



NOTE: 8080 mode (Default setting), please refer to UC1611 datasheet for details.

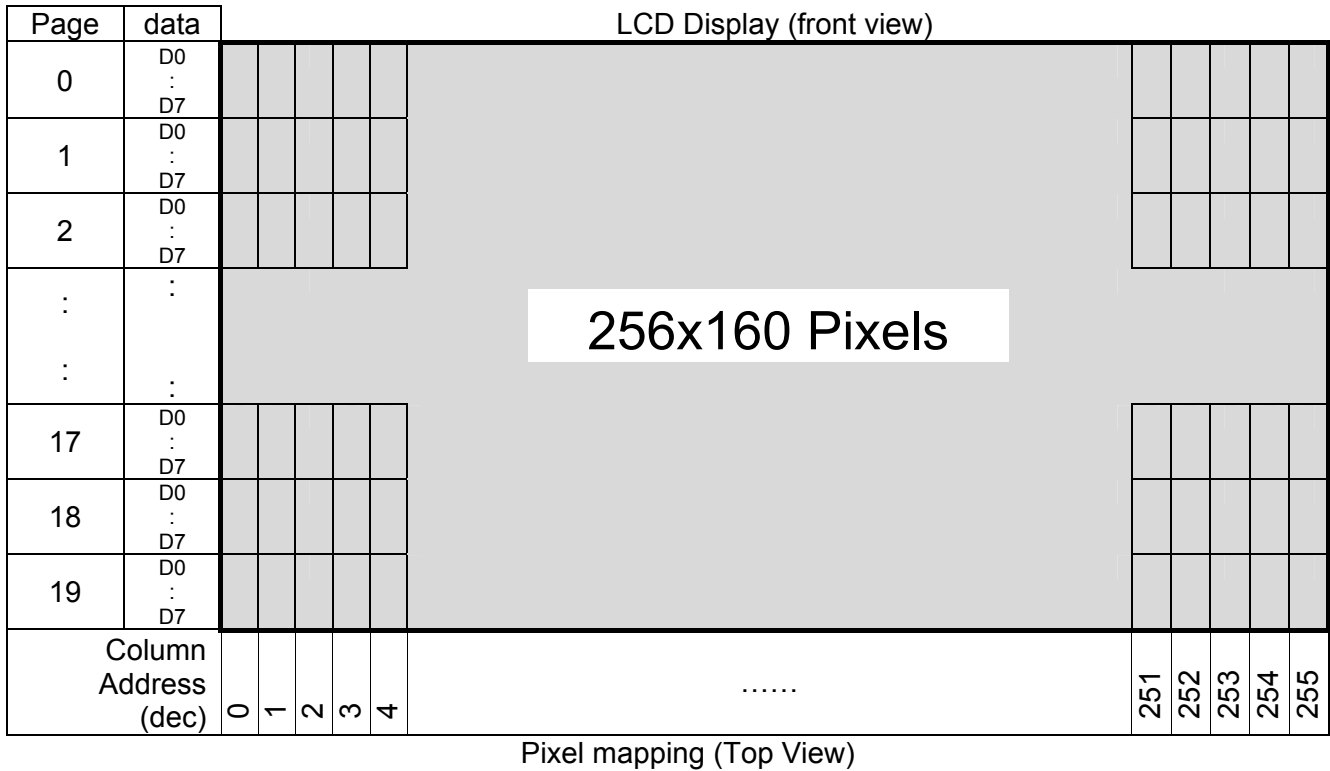
4.2 Adjusting the Display Contrast

- This LCD module equipped with latest digital contrast adjustment function. Its display contrast could be adjusted by MCU command. (Please see the command tables for details)
- It is recommended to provide a contrast adjustment interface for end-user, where the best display result could meet the individual preference in mass production.

4.3 Resetting the LCD module

The LCD module should be initialized by using /RST terminal. While turning on the VDD and VSS power supply, maintain /RST terminal at LOW level. After the power supply stabilized, release the reset terminal (/RST=HIGH)

4.4 Display Memory Map



Note:

- *1. Based on the top view of the LCD module,
- *2. The above is memory map based on:
 On/Off mode setting, DC[5:3]=100 (1bpp), the Page value range:0~19
 LC[0]=MSF=0
 LC[1]=MX=1
 LC[2]=MY=0
 SL=0
- *3. For 4,8 and 16 Gray-shade operation please refer to UC1611 datasheet.

4.5 Command Table

The following setting should be issue to LCD module after hardware reset.
(It is an example only; it could be adjusted if necessary.)

	Command	D/C	W/R	D7	D6	D5	D4	D3	D2	D1	D0	Action	Default
1.	Write Data Byte	1	0	#	#	#	#	#	#	#	#	Write 1 byte	N/A
2.	Read Data Byte	1	1	#	#	#	#	#	#	#	#	Read 1 byte	N/A
3.	Get Status	0	1	Ver	MX	MY	WA	DE	WS	MD	MS	Get Status	N/A
				ID[1:0]				PMO[5:0]					
				Product Code				0	0	0	EF		
4.	Set Column Addr. LSB	0	0	0	0	0	0	#	#	#	#	Set CA[3:0]	0
	Set Column Addr. MSB	0	0	0	0	0	1	#	#	#	#	Set CA[7:4]	0
5.	Temp. Compensation.	0	0	0	0	1	0	0	1	#	#	Set TC[1:0]	00b: -0.05%/°C
6.	Set Panel Loading	0	0	0	0	1	0	1	0	#	#	Set PC [1:0]	11b: 33~55 nF
7.	Set Pump Control	0	0	0	0	1	0	1	1	#	#	Set PC [3:2]	11b
8.	Set Adv. Program Control (double-byte command)	0	0	0	0	1	1	0	0	R	R	Set APC[R][7:0] R = 0~3	N/A
				#	#	#	#	#	#	#	#		
9.	Set Scroll Line LSB	0	0	0	1	0	0	#	#	#	#	Set SL[3:0]	0
	Set Scroll Line MSB			0	1	0	1	#	#	#	#	Set SL[7:4]	0
10.	Set Page Address LSB	0	0	0	1	1	0	#	#	#	#	Set PA[3:0]	0
	Set Page Address MSB			0	1	1	1	0	#	#	#	Set PA[6:4]	0
11.	Set Potentiometer (double-byte command)	0	0	1	0	0	0	0	0	0	1	Set PM[7:0]	PM=EAH
				#	#	#	#	#	#	#	#		
12.	Set Isolation Clock Front	0	0	1	0	0	0	0	0	1	0	Set ISOF[3:0]	1H
				0	0	0	1	0	0	1	1		
13.	Set Isolation Clock Back	0	0	-	-	-	-	#	#	#	#	Set ISOB[3:0]	0H
				1	0	0	0	0	0	1	0		
14.	Set Partial Display Control	0	0	1	0	0	0	0	1	#	#	Set LC[9:8]	00b: Disable
15.	Set RAM Address Control	0	0	1	0	0	0	1	#	#	#	Set AC[2:0]	001b
16.	Set Fixed Lines	0	0	1	0	0	1	#	#	#	#	Set FL[3:0]	0
17.	Set Line Rate	0	0	1	0	1	0	0	0	#	#	Set LC[5:4]	10b:28klps
18.	Set All-Pixel-ON	0	0	1	0	1	0	0	1	0	#	Set DC[1]	0
19.	Set Inverse Display	0	0	1	0	1	0	0	1	1	#	Set DC[0]	0
20.	Set Display Enable	0	0	1	0	1	0	1	#	#	#	Set DC[4:2]	110b
21.	Set LCD Mapping Control (double-byte command)	0	0	1	1	0	0	0	0	0	0	Set LC[3:0]	0
				0	0	0	0	#	#	#	#		
22.	Set N-line Inversion (double-byte command)	0	0	1	1	0	0	1	0	0	0	Set NIV[6:0]	00H
				-	#	#	#	#	#	#	#		
23.	Set Display Pattern	0	0	1	1	0	1	0	#	#	#	Set DC[7:5]	000b
24.	System Reset	0	0	1	1	1	0	0	0	1	0	System Reset	N/A
25.	NOP	0	0	1	1	1	0	0	0	1	1	No operation	N/A
26.	Set test control (double-byte command)	0	0	1	1	1	0	0	1	TT		For testing only. Do not use.	N/A
				#	#	#	#	#	#	#	#		
27.	Set LCD Bias Ratio	0	0	1	1	1	0	1	0	#	#	Set BR[1:0]	10b: 11
28.	Set COM End	0	0	1	1	1	1	0	0	0	1	Set CEN[7:0]	159
		0	0	#	#	#	#	#	#	#	#		
29.	Set Partial Display Start	0	0	1	1	1	1	0	0	1	0	Set DST[7:0]	0
		0	0	#	#	#	#	#	#	#	#		
30.	Set Partial Display End	0	0	1	1	1	1	0	0	1	1	Set DEN[7:0]	159
		0	0	#	#	#	#	#	#	#	#		

4.6 Command Table (continue)

Command		D/C	W/R	D7	D6	D5	D4	D3	D2	D1	D0	Action	Default				
31.	Set Window Program Starting Column Address	0	0	1	1	1	1	0	1	0	0	Shared with MTP Commands	Set WPC0	0			
				#	#	#	#	#	#	#	#		Set WPP0	0			
32.	Set Window Program Starting Row Address	0	0	1	1	1	1	0	1	0	1		Set WPC1	255			
				-	-	#	#	#	#	#	#		Set WPP1	79			
33.	Set Window Program Ending Column Address	0	0	1	1	1	1	0	1	1	0	Set AC[3]	Set MTPC[5:0]	0:Inside			
				#	#	#	#	#	#	#	#						
34.	Set Window Program Ending Column Address	0	0	1	1	1	1	0	1	1	1				Set MTPM[5:0]	Set MTP1	N/A
				-	-	#	#	#	#	#	#						
35.	Window Program Mode	0	0	1	1	1	1	1	0	0	#	Shared with Window Program Commands	Set MTP2	N/A			
				#	#	#	#	#	#	#	#						
36.	Set MTP Operation Control	0	0	1	0	1	1	1	0	0	0				Set MTP3	Set MTP4	N/A
				-	-	#	#	#	#	#	#						
37.	Set MTP Write Mask	0	0	1	0	1	1	1	0	0	1	Set MTP4	N/A				
				-	-	#	#	#	#	#	#						
38.	Set V _{MTP1} Potentiometer	0	0	1	1	1	1	0	1	0	0			Set MTP4	N/A		
				#	#	#	#	#	#	#	#						
39.	Set V _{MTP2} Potentiometer	0	0	1	1	1	1	0	1	0	1	Set MTP4	N/A				
				#	#	#	#	#	#	#	#						
40.	Set MTP Write Timer	0	0	1	1	1	1	0	1	1	0			Set MTP4	N/A		
				#	#	#	#	#	#	#	#						
41.	Set MTP Read Timer	0	0	1	1	1	1	0	1	1	1	Set MTP4	N/A				
				#	#	#	#	#	#	#	#						
SERIAL READ COMMAND (ENABLE IN S8 OR S9 BUS MODES ONLY)																	
42.	Get Status	0	0	1	1	1	1	1	1	1	0			Get Status till Chip Disable	N/A		
				Ver	MX	MY	WA	DE	WS	MD	MS						
				ID[1:0]	PMO[5:0]												
				Product Code			0	0	0	EF							

Note:

Please refer to UC1611 data sheet for details

R/W=0 means it is a write function, R/W=1 means it is a read function

D/C=0 means it is a control data, D/C=1 means it is a display data

5. Design and Handling Precaution

1. The LCD panel is made by glass. Any mechanical shock (eg. dropping from 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 from 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