深圳市拓普微科技开发有限公司
SHENZHEN TOPWAY TECHNOLOGY CO., LTD.

LMB162ABC
LCD Module User Manual

Prepared by:	Checked by:	Approved by:
Dong		
Date: 2017-02-13	Date:	Date:

Rev.	Descriptions	Release Date
0.1	Prelimiay release	2005-03-17
0.2	Typing Correction in 1.3 Block Diagram	2007-05-06
0.3	Typing Correction in 4.5 Display Commands	2015-07-03
0.4	Update Outline Dimension	2017-02-13

Table of Content

1. Basic Specifications

1.1 Display Specifications

|	
1) LCD Display Mode	: STN, Positive, Transflective
2) Display Color	: Display Data = "1" : Deep Blue (*1)
	: Display Data = "0" : Yellow Green (*2)
3) Viewing Angle	: 6H
4) Driving Method	: 1/16 duty, 1/5 bias
5) Back Light	: Yellow-Green 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   : 80.8 x 36.0 x 13.8MAX
                                    (See attached Outline Drawing for details)

1.3 Block Diagram
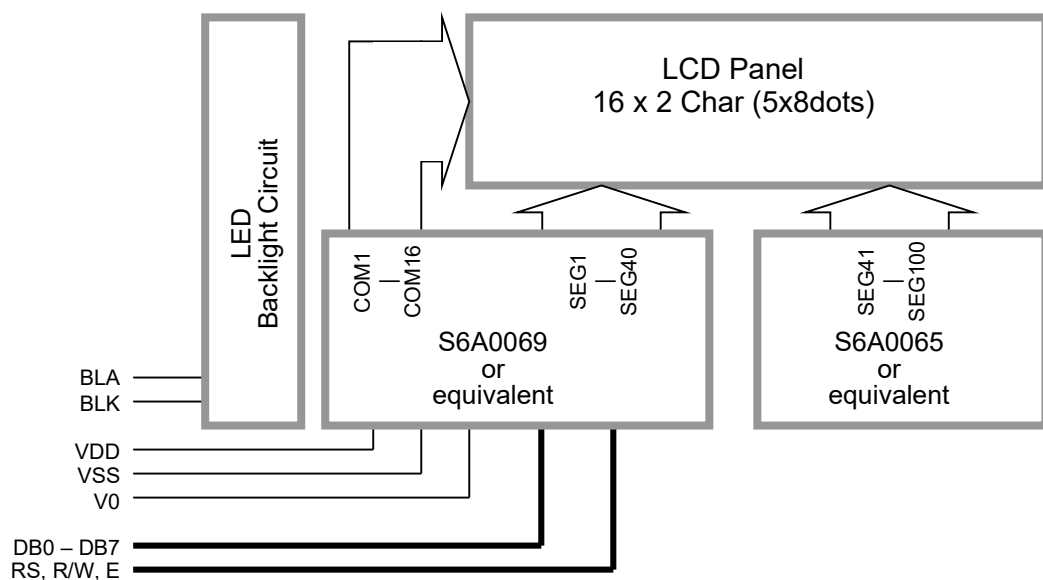
1.4   Terminal Functions

Pin No.	Pin Name	I/O	Descriptions
1	VSS	Power	Power supply, Ground (0V)
2	VDD	Power	Positive power supply
3	V0	Power	LCD contrast reference supply
4	RS	Input	Register Select RS=HIGH: transferring display data RS=LOW: transferring instruction data
5	R/W	Input	Read / Write Control bus: R/W=HIGH: Read mode selected R/W=LOW: Write mode selected
6	E	Input	Data Enable
7	DB0	I/O	Bi-directional tri-state Data bus
:	:		In 8 bit mode, DB0 ~ DB7 are in use
14	DB7		In 4 bit mode, DB4 ~ DB7 are in use, DB0~DB3 leave open
15	BLA	Power	Backlight positive supply
16	BLK	Power	Backlight negative supply

2. Absolute Maximum Ratings

Items	Symbol	Min.	Max.	Unit	Condition
Supply Voltage	V_{DD}	0	6.0	V	V_{SS} = 0V
Input Voltage	V_{IN}	0	V_{DD}	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}=5.0V T_{OP}=25°C

Items	Symbol	MIN.	TYP.	MAX.	Unit	Condition / Application Pin
Operating Voltage	V_{DD}	4.7	5.0	5.3	V	VDD
Input High Voltage	V_{IH}	$0.8 \times V_{DD}$	-	V_{DD}	V	RS, R/W, E, DB0 ~ DB7
Input Low Voltage	V_{IL}	V_{SS}	-	0.5	V	
Output High Voltage	V_{OH}	$0.7 \times V_{DD}$	-	V_{DD}	V	I_{OH}=-0.1mA, DB0 ~ DB7
Output Low Voltage	V_{OL}	V_{SS}	-	0.5	V	I_{OL}=0.1mA, DB0 ~ DB7
Operating Current	I_{DD}	-	1.3	3.0	mA	VDD

3.2 LED Backlight Circuit Characteristics

V_{BLK}=0V, If_{BLA}=100mA, T_{OP}=25°C

Items	Symbol	MIN.	TYP.	MAX.	Unit	Applicable Pin
Forward Voltage	Vf_{BLA}	-	4.9	-	V	BLA
Forward Current	If_{BLA}	-	-	150	mA	BLA

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

No. of LED = 10 x 2 pcs
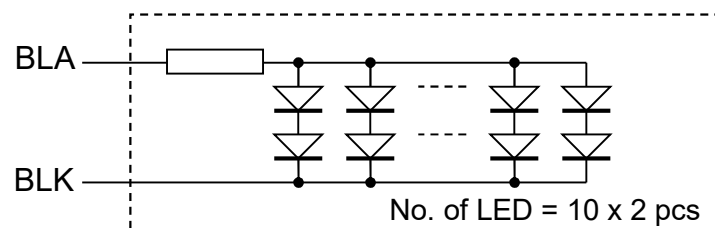
3.3 AC Characteristics

V_{SS}=0V, V_{DD} =5.0V, T_{OP} =25°C

Item	Symbol	MIN.	TYP.	MAX.	Unit
E cycle time	tc	650	-	-	ns
E high level width	tpw	290	-	-	ns
E rise time	tr	-	-	16	ns
E fall time	tf	-	-	16	ns
Address set-up time	tas	50	-	-	ns
Address hold time	tah	13	-	-	ns
Data set-up time	tdsw	100	-	-	ns
Data delay time	tddr	-	-	150	ns
Data hold time	th	13	-	-	ns
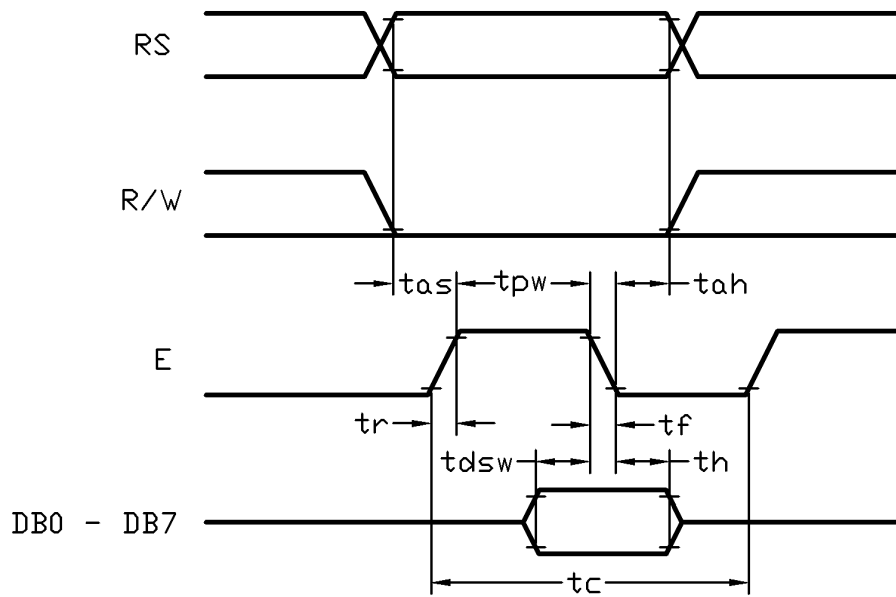
Host Write Timing Diagram
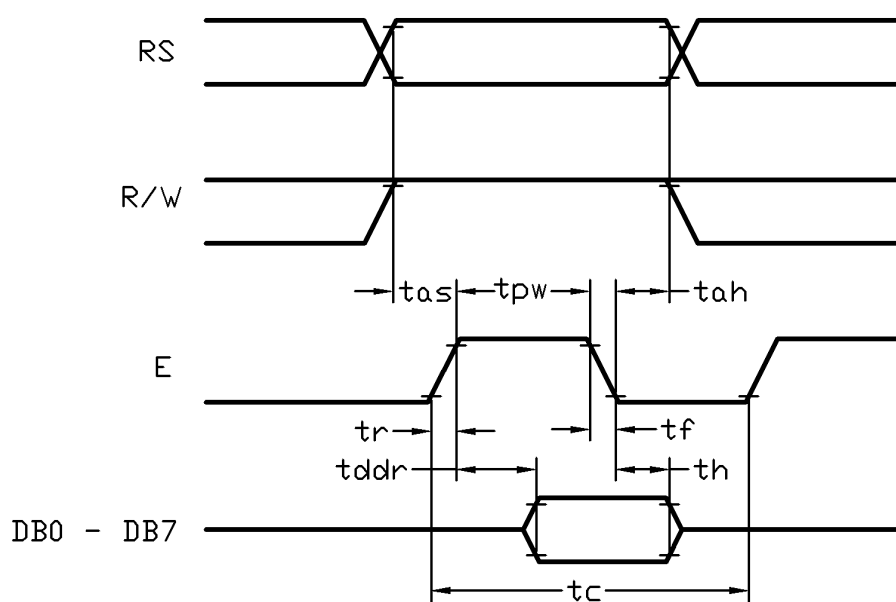
Host Read Timing Diagram

4.　Function Specifications

4.1　Basic Setting

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

- N=1, 2-line display
- F=0, 5x8 dots font
- D=1, display on

Note:

*1. These setting/commands should issue to the LCD module while start up.

*2. See the Display Commands section for details.

4.2　Resetting the LCD module

When turning on the VDD and VSS p ower supply, LCD module will execute the reset routine automatically. It takes about 50ms. After the reset routine, the LCD module status will be as follow:

- Display clear
- DL=1,　　8-bit interface
- N=0,　　1-line display
- F=0,　　5x8 dot character font
- D=0,　　Display off
- C=0,　　Cursor off
- B=0,　　Blinking off
- I/D=1,　　Increment by 1
- S=0,　　No shift

Note:

*1. Reset routine could not generate the Basic Setting

4.3　Adjusting the LCD display contrast

A Variable-Resistor must be connected to the LCD module for providing a reference supply to V0. Adjusting the VR will result the change of LCD display contrast. The recommended value of VR is 5k Ohm.

LCD Module

V0

VSS
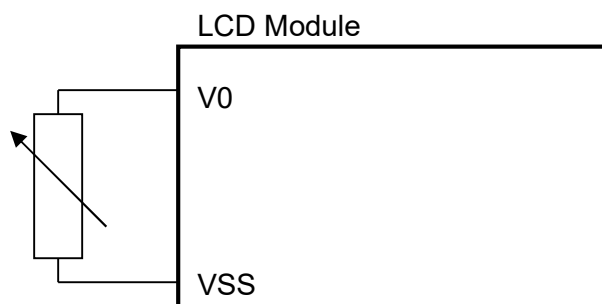
4.4   Display Memory Map

There are two main memory-areas in the LCD module for display.
- Character Generator RAM (CGRAM)
- Display Data RAM (DDRAM)

4.4.1   Character Generator RAM (CGRAM)

Character Generator RAM is for storing the User-defined Characters (5x8 dots font).
Totally 8 User-defined Characters (character code = 00h ~ 07h) could be created.

The User-defined Character Codes are 00h and 07h. They could be called into DDRAM as normal character.

User-defined Character Code	CGRAM Address	CGRAM Data (Font Pattern)	
		D7 ~ D5	D4 ~ D0
00h (08h)	00h 01h : 06h 07h	Not Use	5 x 8 dots font pattern
01h (09h)	08h 09h : 0Eh 0Fh	Not Use	5 x 8 dots font pattern
02h (0Ah)	10h 11h : 16h 17h	Not Use	5 x 8 dots font pattern
03h (0Bh)	18h 19h : 1Eh 1Fh	Not Use	5 x 8 dots font pattern
04h (0Ch)	20h 21h : 26h 27h	Not Use	5 x 8 dots font pattern
05h (0Dh)	28h 29h : 2Eh 2Fh	Not Use	5 x 8 dots font pattern
06h (0Eh)	30h 31h : 36h 37h	Not Use	5 x 8 dots font pattern
07h (0Fh)	38h 39h : 3Eh 3Fh	Not Use	5 x 8 dots font pattern

CGRAM Address Map

4.4.2   Display Data RAM (DDRAM)

ROM Characters (Character Code = 10h ~ FFh) could be written into DDRAM for displaying the Character (5x8 dots font). User-defined Characters (Character Code = 00h ~ 07h) stored in CGRAM could also be use. Calling Character Code 08h ~ 0Fh will call out User-defined Characters 00h ~ 07h respectively.

DDRAM Address									
00h	01h	02h	03h	· · · · · ·			0Ch	0Dh	0Eh	0Fh
				16 x 2 Characters (5x8 dots font)						
40h	41h	42h	43h	· · · · · ·			4Ch	4Dh	4Eh	4Fh
DDRAM Address									

DDRAM Address Map

Note:
*1. The mapping is based on top view of the LCD module
*2. N=1, 2-line display
*3. F=0, 5x8 dots font
*4. D=1, display on

4.5 Display Commands

No.	Instructions	RS	R/W	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0	Function
												Code
1	Clear Display	0	0	0	0	0	0	0	0	0	1	Write "20h" to DDRAM and set DDRAM address (AC) to "00h"
2	Return Home	0	0	0	0	0	0	0	0	1	x	Set DDRAM address (AC) to "00h" and return cursor to its original position if shifted (DDRAM contents are not change)
3	Entry Mode Set	0	0	0	0	0	0	0	1	I/D	S	Set cursor moving direction and specify display shift, during data read and write of DDRAM and CGRAM. S=1, screen shifting; S=0, no screen shifting I/D=1, AC=AC+1 and if S=1, screen shift left I/D=0, AC=AC-1 and if S=0, screen shift right
4	Display ON/OFF	0	0	0	0	0	0	1	D	C	B	D=1, display on; D=0, display off C=1, cursor on; C=0, cursor off B=1, cursor blinking on; B=0, cursor blinking off
5	Cursor or Display Shift	0	0	0	0	0	1	S/C	R/L	x	x	Move the cursor or shift the display, where DDRAM contents. S/C=1, shift screen; S/C=0, shift cursor R/L=1, to right-side; R/L=0, to left side (if S/C=1, AC will not be changed)
6	Function Set	0	0	0	1	1	DL	N	F	x	x	DL=1, 8-bit interface; DL=0, 4-bit interface N=1, 2-line display; N=0, 1-line display F=1, 5x11 dots font; F=0, 5x8 dots font
7	Set CGRAM address	0	0	0	1	AC5	AC4	AC3	AC2	AC1	AC0	Set CGRAM address in address counter
8	Set DDRAM address	0	0	1	AC6	AC5	AC4	AC3	AC2	AC1	AC0	Set DDRAM address in address counter
9	Read Busy flag & address	0	1	BF	AC6	AC5	AC4	AC3	AC2	AC1	AC0	Check the system status and get the address counter content (AC6~AC0). BF=1, busy; BF=0, ready
10	Write data to RAM	1	0	D7	D6	D5	D4	D3	D2	D1	D0	Write the data into internal RAM, where the address counter pointing at.
11	Read data from RAM	1	1	D7	D6	D5	D4	D3	D2	D1	D0	Read the data from internal RAM, where the address counter pointing at.

Note:
*1. Do not use any other command not listed, or the system malfunction may result.
*2. For the details of the Display Commands, please refer to S6A0069 datasheet.

5. Design and Handling Precaution

Please refer to "LCD-Module-Design-Handling-Precaution.pdf".

Terminal

No.	Pin Name
1	VSS
2	VDD
3	V0
4	RS
5	R/W
6	E
7	DB0
8	DB1
9	DB2
10	DB3
11	DB4
12	DB5
13	DB6
14	DB7
15	BLA
16	BLK

(*9)

Component Height

3.0MAX.

Pixels Details
Scale=10/1

Panel Wiring Details
Scale=free

C1
C8
C9
C16

S1
S80

TOPWAY

Rev	Note			Date
E	- Revise Outline		Qiu Shaop	2017-01-09
D	- Revise Component Height		Zhouhf	2012-05-04
C	- Typing Correction		K.C.	2009-08-07
B	-Update Drawing Title & note		K.C.	2009-01-17
A	-Typing Correction		Li Shuai	2004-07-16
RevNote				Date

Dwg Title: LMB162ABC Outline Dwg

Dwg No. MK-000392e-1-1

Scale 5/2	Tol. ±0.5	Unit mm	Paper Size A3

Approved		Drawn Li Shuai
Checked		

Note:
*1. LCD Display Type : STN-YG, Positive, Transflective
*2. Viewing Direction : 6H
*3. Duty : 1/16
*4. Operating Voltage : 5.0V
*5. Backlight Color : YG
*6. Backlight Supply : 4.9V TYP.
*7. Operating Temperature : -20°C~70°C
*8. Storage Temperature : -30°C~80°C
*9. An external VR(5k) must be connected for Contrast Control.