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LM2068ACA

LCD Module User Manual

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Date:2015-08-26	Date:	Date:

Rev.	Descriptions	Release Date
0.1	Preliminary new release	2015-08-26

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1. Basic Specifications

1.1 Power Supply Highlight

- Logic Power Supply (VDD-VSS) : 3.0V or 5V
- LCD Driver Supply (VLCD-VSS) : 22.5V

Note: Please see the "3. Electrical Characteristics" for details.

1.2 Display Specifications

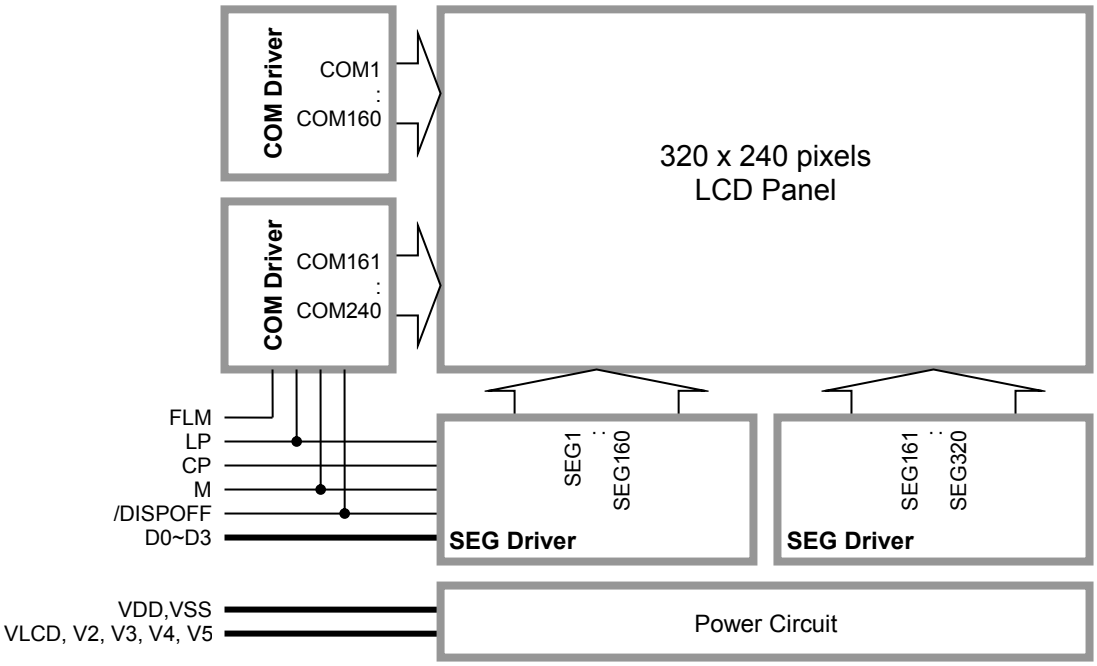
1) LCD Display Mode : FSTN, Positive, Transflective
2) Display Color : Display Data = "1" : Dark Gray (*1)
: Display Data = "0" : Light Gray (*2)
3) Viewing Angle : 9 H
4) Driving Method : 1/240 duty, 1/16 bias
5) Backlight : Nil

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

1.3 Mechanical Specifications

1) Outline Dimension : 90.3 x 70.1 x 2.0 (exclude FPC terminal)
see attached Outline Drawing for details

1.4 Block Diagram



1.5 Terminal Functions

Pin No.	Pin Name	I/O	Descriptions
1	VLCD	Power	Power supply for LCD driving and voltage bias Where VLCD > V2 > V3 > V4 > V5 > VSS
2	V2	Power	
3	V3	Power	
4	V4	Power	
5	V5	Power	
6	VSS	Power	0V Power Supply, Ground
7	VSS	Power	0V Power Supply, Ground
8	VDD	Power	Positive Power Supply
9	FLM	Input	First Line Marker
10	CP	Input	Clock Pulse signal, for shifting the data (D0~D3) into the segment buffer
11	M	Input	Controlling signal for the LCD AC driving
12	LP	Input	Line Pulse signal, for latching the segment buffer to the segment driver
13	/DISPOFF	Input	Display ON/OFF control signal, /DISPOFF = 0, display off /DISPOFF = 1, display on
14	VSS	Power	0V Power Supply, Ground
15	D3	Input	Display Data
16	D2	Input	Display Data
17	D1	Input	Display Data
18	D0	Input	Display Data

2. Absolute Maximum Ratings

Items	Symbol	Min.	Max.	Unit	Condition
Supply Voltage (1)	V_{DD}	-0.3	+6.0	V	V_{SS} = 0V
Supply Voltage (2)	V_{LCD}	-0.3	+30	V	V_{SS} = 0V
Input Voltage	V_{IN}	V_{SS}-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, T_{OP} =25°C

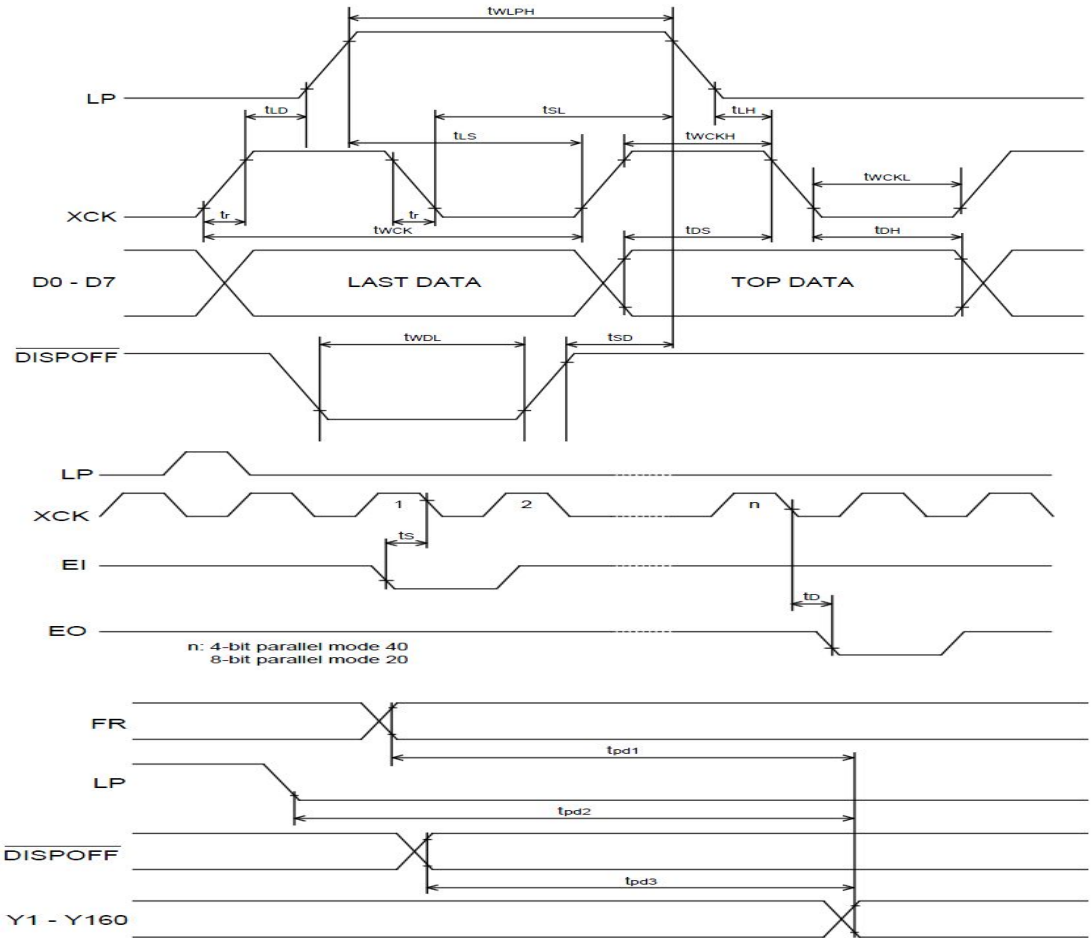
Items	Symbol	MIN.	TYP.	MAX.	Unit	Applicable Pin
Operating Voltage	V_{DD}	2.8	-	5.2	V	VDD
LCD Driving Voltage	V_{LCD}-V_{SS}	-	22.5	-	V	VLCD
Input High Voltage	V_{IN}	0.8xVDD	-	VDD	V	D0~D3, CP, LP, FLM, M /DISPOFF
Input Low Voltage	V_{IN}	0	-	0.2x VDD	V	D0~D3, CP, LP, FLM, M /DISPOFF
Operating Current	I_{DD}	-	TBD	TBD	mA	VDD

3.2 AC Characteristics

V_{SS}=0V, T_{OP}=25°C

Item	Symbol	V_{DD}=3.3V		V_{DD}=5.0V		Unit
		MIN.	MAX.	MIN.	MAX.	
Shift clock period (*1)	twck	162	-	92	-	ns
Shift clock “H” pulse width	twckh	66	-	30	-	ns
Shift clock “L” pulse width	twckl	66	-	30	-	ns
SEG Data set-up time	tds	39	-	13	-	ns
SEG Data hold time	tdh	52	-	26	-	ns
Latch pulse “H” pulse width	twlph	66	-	30	-	ns
Shift clock rise to latch pulse rise time	tld	0	-	0	-	ns
Shift clock fall to latch pulse fall time	tsl	66	-	32	-	ns
Latch pulse rise to shift clock rise time	tls	66	-	32	-	ns
Latch pulse fall to shift clock fall time	tlh	66	-	32	-	ns
Input signal rise time	tr	-	35	-	35	ns
Input signal fall time	tf	-	35	-	35	ns
Enable setup time	ts	47	-	27		ns
/DISPOFF removal time	tsd	130	-	130	-	ns
/DISPOFF enable pulse width	twdl	1560	-	1560	-	ns
Output delay time(1)	tD	-	55	-	28	ns
Output delay time(2)	tpd1,tpd2	-	840	-	840	ns
Output delay time(3)	Tpd3	-	840	-	840	ns

Note: *1. tr, tf < 11ns

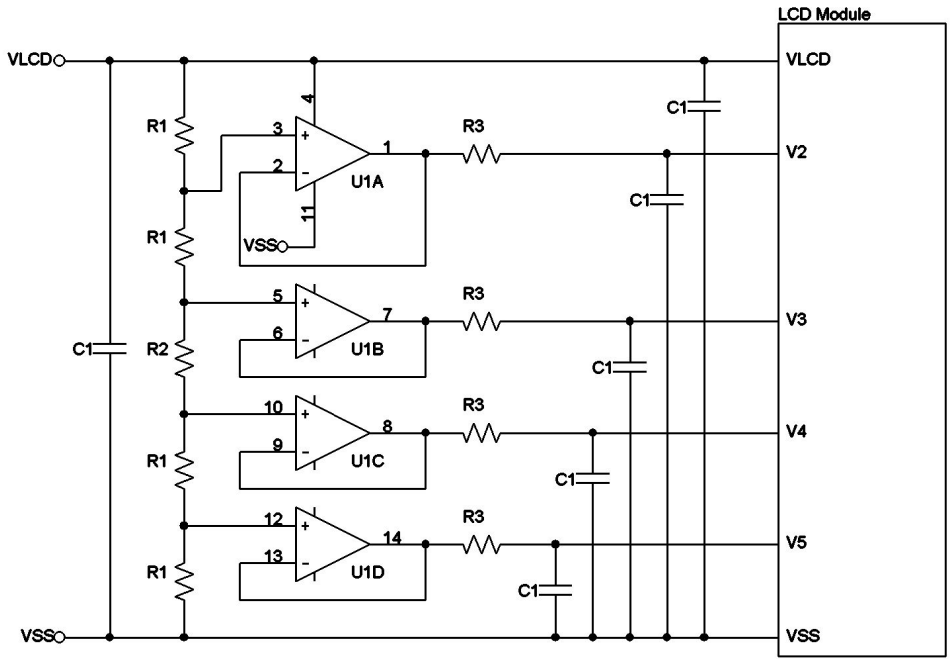


Interface Timing Digram

4. Function Specifications

4.1 Power Circuit Example

For providing bias voltage to the LCD module, an external bias circuit should be set up as follow. Note, adjusting the VLCD value will result the change of the LCD display contrast.



C1 = 1.0uF ~ 4.7uF
(25V or above)
R1 = 4.7k (1/8W)
R2 = 39k (1/8W)
R3 = 4R7 (1/8W)
U1 = LM324
(or equivalent)

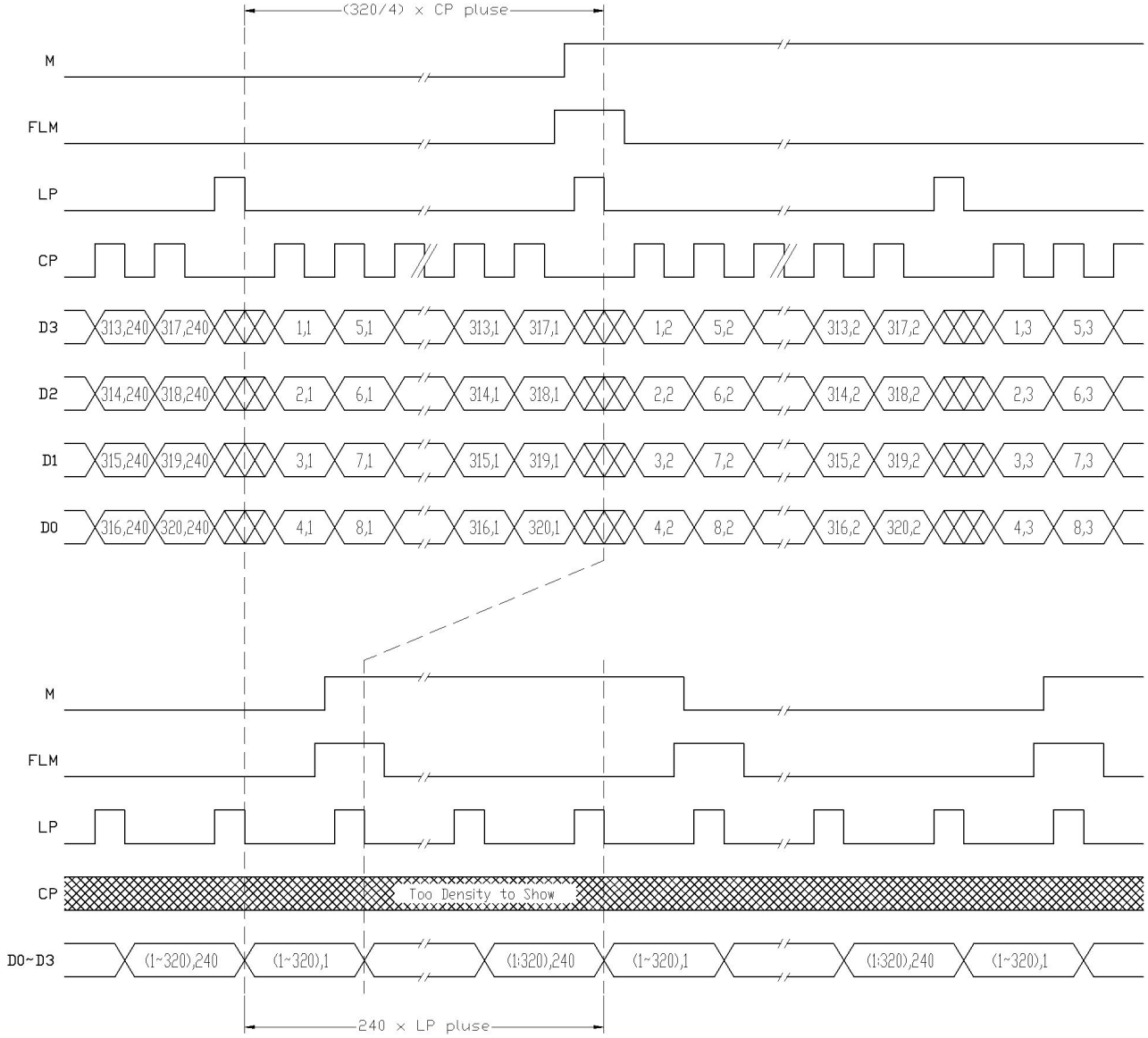
4.2 Display Pixel Map

1,1 (D3)	2,1 (D2)	3,1 (D1)	4,1 (D0)	5,1 (D3)	- - -	- - -	316,1 (D0)	317,1 (D3)	318,1 (D2)	319,1 (D1)	320,1 (D0)
1,2 (D3)	2,2 (D2)	3,2 (D1)	4,2 (D0)	5,2 (D3)	- - -	- - -	316,2 (D0)	317,2 (D3)	318,2 (D2)	319,2 (D1)	320,2 (D0)
1,3 (D3)	2,3 (D2)	3,3 (D1)	4,3 (D0)	5,3 (D3)	- - -	- - -	316,3 (D0)	317,3 (D3)	318,3 (D2)	319,3 (D1)	320,3 (D0)
: : :	: : :	: : :	: : :	: : :	: : :	: : :	: : :	: : :	: : :	: : :	: : :
1,238 (D3)	2,238 (D2)	3,238 (D1)	4,238 (D0)	5,238 (D3)	- - -	- - -	316,238 (D0)	317,238 (D3)	318,238 (D2)	319,238 (D1)	320,238 (D0)
1,239 (D3)	2,239 (D2)	3,239 (D1)	4,239 (D0)	5,239 (D3)	- - -	- - -	316,239 (D0)	317,239 (D3)	318,239 (D2)	319,239 (D1)	320,239 (D0)
1,240 (D3)	2,240 (D2)	3,240 (D1)	4,240 (D0)	5,240 (D3)	- - -	- - -	316,240 (D0)	317,240 (D3)	318,240 (D2)	319,240 (D1)	320,240 (D0)

Pixel mapping (Top View)

Based on the top view of the LCD module,
the 1, 1 (x, y) pixel is the upper-left pixel;
the 320, 240 (x, y) pixel is the lower-right pixel.

4.3 Signal Sequence



In the upper section (expended view), shows the data sequence of lines.
In the lower section (compressed view), shows the signal sequence of FLM, LP and M in frames.

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