

AZ DISPLAYS, INC.

COMPLETE LCD SOLUTIONS

SPECIFICATIONS FOR LIQUID CRYSTAL DISPLAY

PART NUMBER:

AGM3224K

REVISED:

NOVEMBER 11, 2002

Record of Revisions

[illegible]

AZ DISPLAYS, INC.

1. MECHANICAL DATA

(1) Product No.	AGM3224K			
(2) Module Size	88.3 (W)mm	X	69.1 (H)mm	X 2.2MAX (D)mm
(3) Dot Size	0.225 (W)mm	X	0.225 (H)mm	
(4) Dot Pitch	0.24 (W)mm	X	0.24 (H)mm	
(5) Number of Dots	320 (W)	X	240 (H)	Dots
(6) Duty	1/240			
(7) LCD Display Mode	FSTN: ☐ Black and White(Normally White/Positive Image)			
	Rear Polarizer: ☐ Transflective			
(8) Viewing Direction	9 O'clock			
(9) Backlight	W/O			
(10) Weight	24.5 g(Approx)			
(11) Controller	Excluded			
(12) DC/DC Converter	Excluded			

2.ABSOLUTE MAXIMUM RATINGS

(1) ELECTRICAL ABSOLUTE RATINGS

GND=0V

ITEM	SYMBOL	MIN	MAX	UNIT	COMMENT
Power Supply for Logic	VDD-GND	-0.3	7.0	V	
Power Supply for LC Drive	VLCD-GND	-0.3	36.0	V	
Input Voltage	VI	-0.3	VDD+0.3	V	
Static Electricity	-	-	-	-	Note 1

(2) ENVIRONMENTAL ABSOLUTE MAXIMUM RATINGS

ITEM	WIDE TEMP.			
	OPERATING		STORAGE	
	MIN.	MAX.	MIN.	MAX.
Ambient Temperature	-20	70	-30	80
Humidity(Without Condensation	Note 2,3		Note 2,4	

- Note 1 LCM should be grounded during handling
- Note 2 Background color will change slightly depending on ambient temperature.
This phenomenon is reversible.
- Note 3 Ta ≤ 70℃ : 75%RH max
Ta > 70℃ : Absolute humidity must be lower
than the humidity of 75%RH at 70℃
- Note 4 Ta at -30℃ will be < 48hrs, at 80℃ will be < 120hrs

3. ELECTRICAL CHARACTERISTICS

(VDD = 3.0V ± 10%)

ITEM	SYMBOL	CONDITION		MIN.	TYP.	MAX.	UNIT
Input Voltage	VIH	H level		0.8VDD	—	VDD	V
	VIO	L level		0	—	0.2VDD	V
Recommended LC Driving Voltage (WIDE TEMP. LCM)	VLCD—GND (Vop)	1/240 Duty 1/12 Bias	−20℃	17.3	17.5	17.7	V
			0℃	15.7	15.9	16.1	
			25℃	15.2	15.4	15.6	
			50℃	14.4	14.6	14.8	
			70℃	13.5	13.7	13.9	
Power Supply Current	IDD	VDD=3.0V GND=0V VDD—GND=22.7V FLM=70Hz		—	0.1	0.3	mA
	ILCD	PATTERN : □ ■ □ ■ □ ■ ■ □ ■ □ ■ □		—	0.55	1.0	

4.OPTICAL CHARACTERISTICS

AT Vop

ITEM MODE		Cr(Contrast Ratio)										θ (Viewing Angle)		ϕ (Viewing Angle)	
		-20℃		-0℃		25℃		50℃		70℃		25℃		25℃	
		MIN.	TYP.	MIN.	TYP.	MIN.	TYP.	MIN.	TYP.	MIN.	TYP.	MIN.	TYP.	MIN.	TYP.
Z	T	2.5	3.0	3.5	4.0	5.0	5.5	3.0	3.5	2.0	2.5	—	F: 30 R: 25	—	±30
note		NOTE 6										NOTE 5			

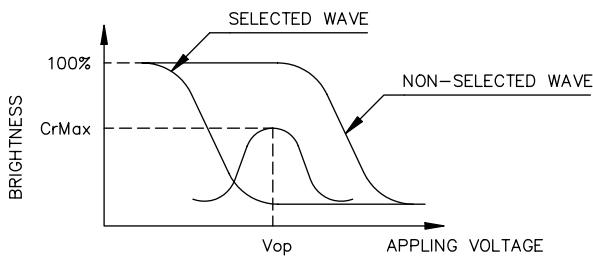
NOTE :
Z: OTHER
T: NORMALLY WHITE(9 O'clock)

AT $\phi=0^{\circ}$ $\theta=0^{\circ}$

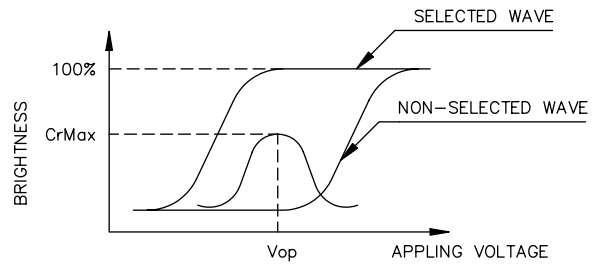
ITEM	SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNIT	NOTE
Response Time (rise)	Tr	-20℃	5200	6700	10000	ms	NOTE 2
		0℃	950	1200	1800		
		25℃	280	350	500		
		50℃	130	160	250		
		70℃	80	100	150		
Response Time (fall)	Tf	-20℃	3400	4300	6500	ms	NOTE 2
		0℃	550	700	1000		
		25℃	200	250	350		
		50℃	70	90	140		
		70℃	50	70	110		

(NOTE 1)

Definition of Operation Voltage(V_{op})



(positive type)



(negative type)

*Conditions

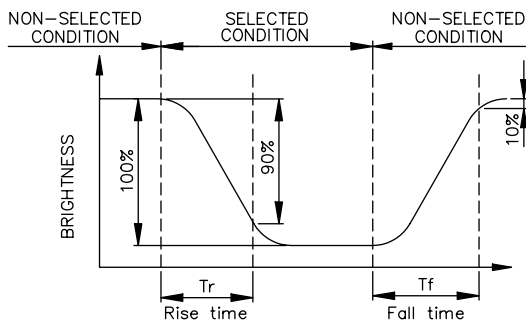
Viewing Angle : 0

Frame Frequency : 70Hz

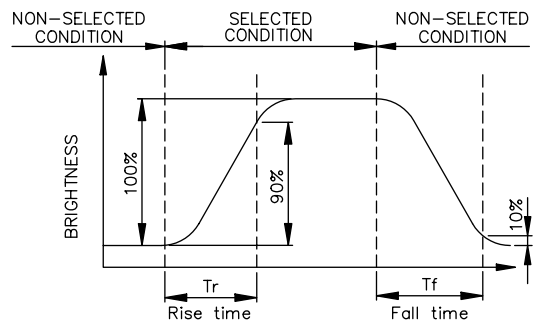
Applying Waveform : 1/N duty 1/a bias

(NOTE 2)

Definition of Response Time(T_r, T_f)



(positive type)



(negative type)

*Conditions

Operating Voltage : V_{op}

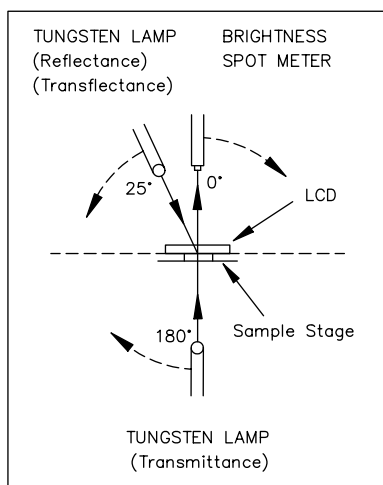
Viewing Angle (θ, ϕ) : (0,0)

Frame Frequency : 70Hz

Applying Waveform : 1/N duty 1/a bias

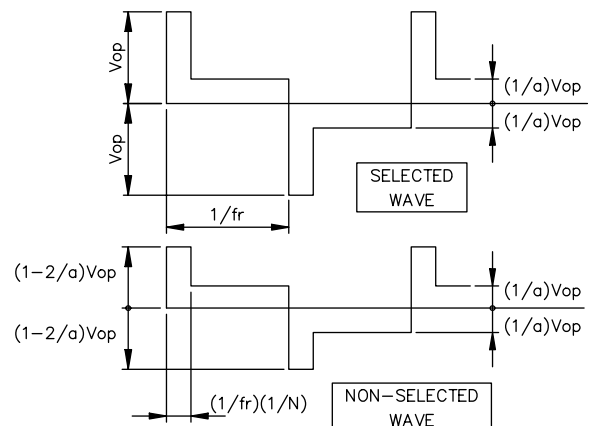
(NOTE 3)

Description of Measuring Equipment and Driving Waveforms



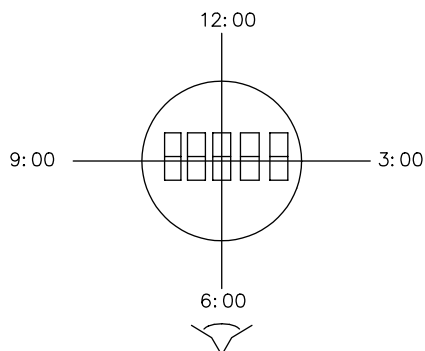
CONST.
TEMP.
CHAMBER

Multiplex Driving (1/N duty 1/a bias)



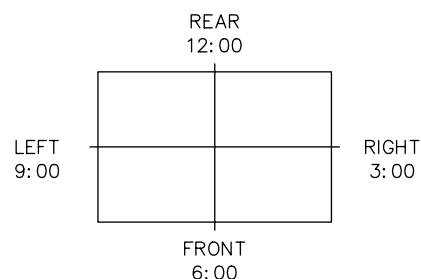
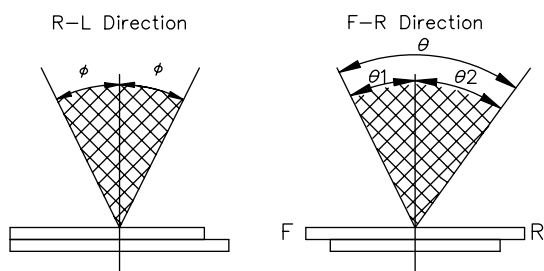
(NOTE 4)

Definition of Viewing Direction



(NOTE 5)

Definition of Viewing Angle



*For This Product

The Viewing Direction Is 6 O'clock
So $\theta_1 > \theta_2$

$$\theta = \theta_1 + \theta_2$$

*Conditions

Operating Voltage : V_{op}

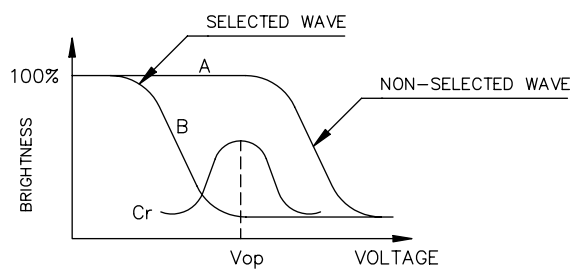
Frame Frequency : 70Hz

Applying Waveform : 1/N duty 1/a bias

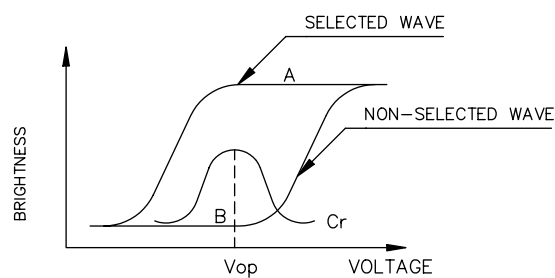
Contrast Ratio : larger than 2

(NOTE 6)

Definition of Contrast Ratio (Cr)



(positive type)



(negative type)

$$\text{Contrast Ratio : } Cr = A/B$$

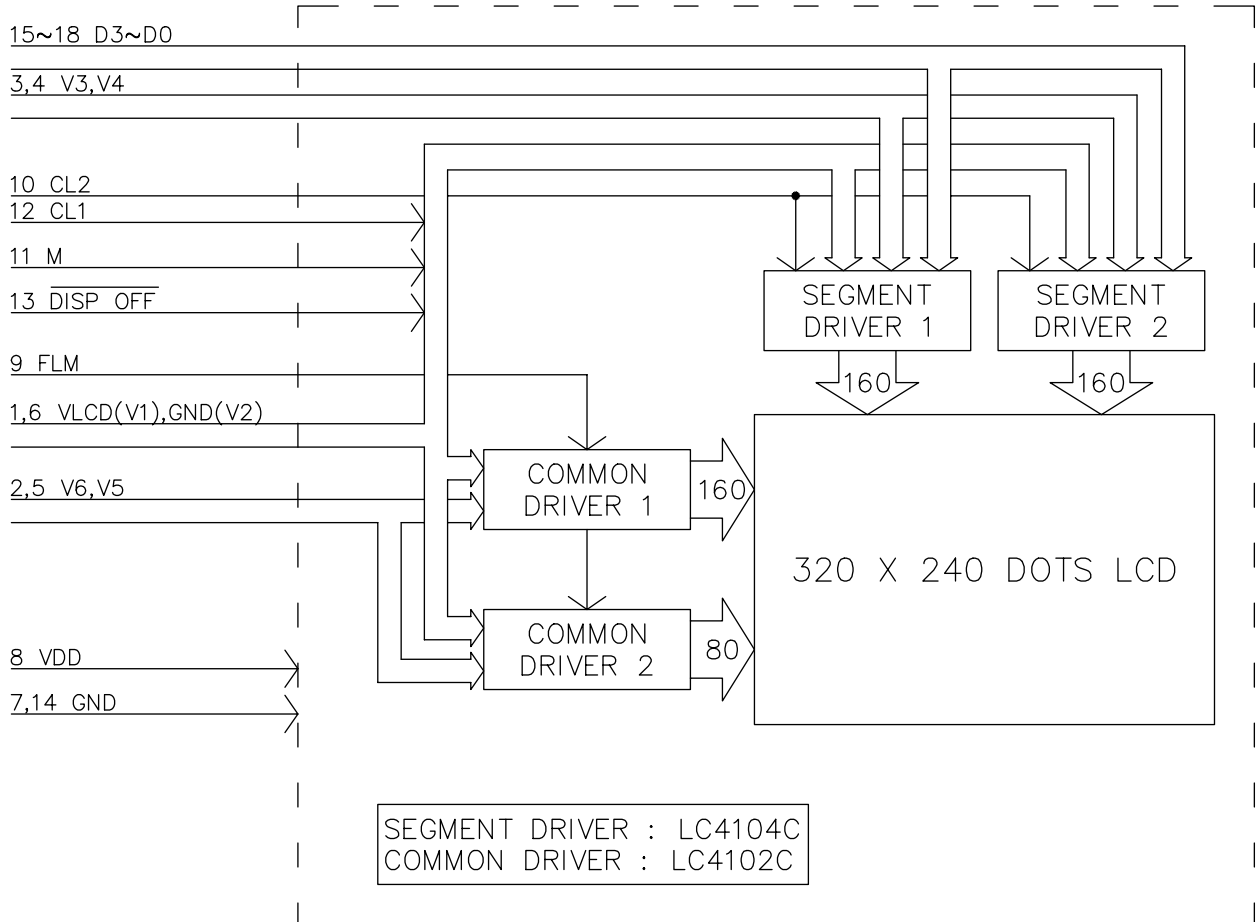
*Conditions

Viewing Angle : 0

Frame Frequency : 70Hz

Applying Waveform : 1/N duty 1/a bias

5. BLOCK DIAGRAM



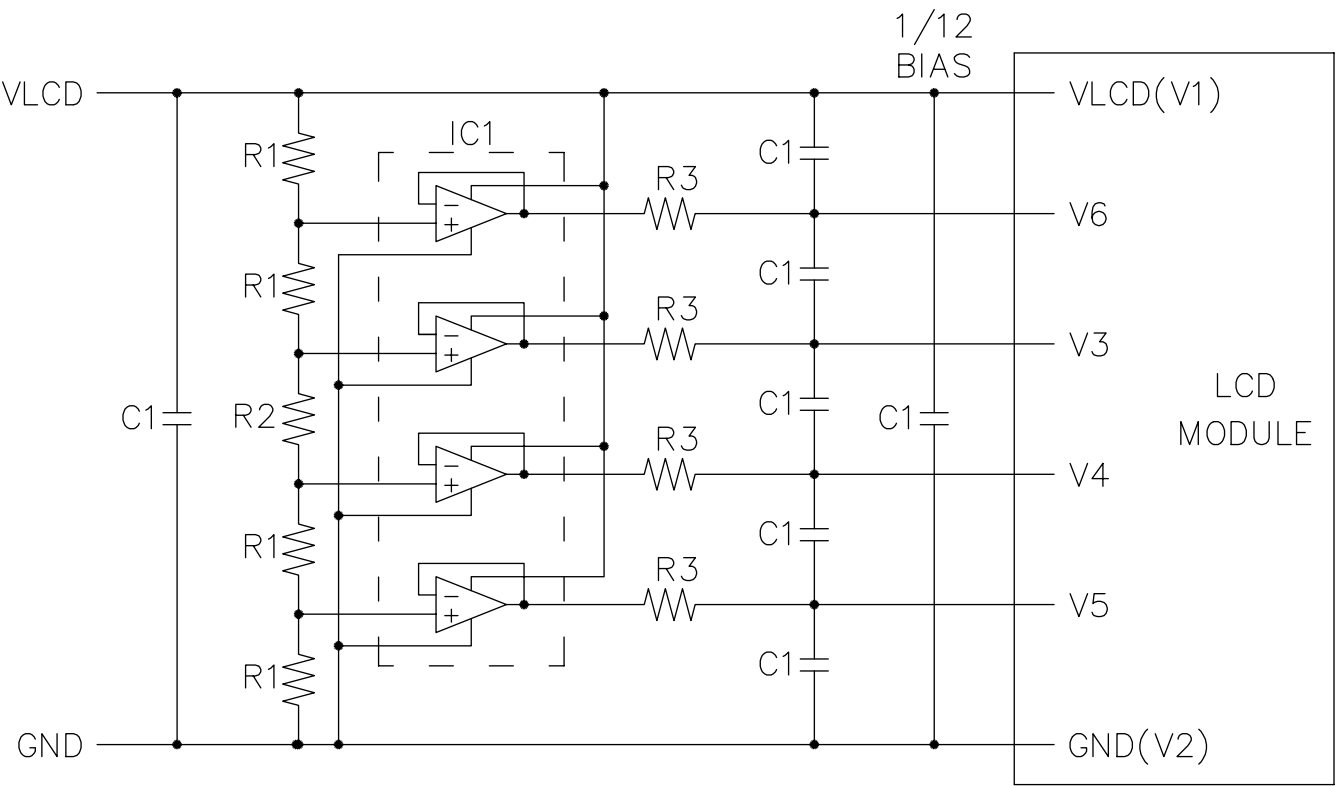
Note :

- 1)Controller and bias voltage supply circuit are not included.
- 2)VLCD(V1),GND(V2),V6,V3,V4 and V5 are power supply voltage for LCD.
(V1>V6>V3>V4>V5>V2)

6.INTERNAL PIN CONNECTION

PIN NO.	SYMBOL	FUNCTION
1	VLCD(V1)	Bias voltage(Liquid crystal drive voltage)
2	V6	Bias voltage(V1>V6>V3>V4>V5>V2)
3	V3	
4	V4	
5	V5	
6	GND(V2)	(GND: 0V)
7	GND	0V
8	VDD	Power supply voltage: +3.0V typ
9	FLM	Frame signal
10	CL2	Display data shift clock
11	M	LCD drive signal(AC signal)
12	CL1	Display data latch signal
13	<u>DISP OFF</u>	Display ON/OFF control signal("H":Display ON,"L":Display OFF)
14	GND	0V
15	D3	Display data
16	D2	
17	D1	
18	D0	

7. POWER SUPPLY



IC1 : LP324M(NATIONAL SEMICONDUCTOR)
R1 : 22(KOHM) $\pm$ 0.5%, R2 : 180(KOHM) $\pm$ 2%, R3 : 4.7(OHM) $\pm$ 5%
C1 : 2.2–4.7(μ F)

8.TIMING CHARACTERISTICS

8-1.INTERFACE TIMING

@ VDD=3.0V±10%, Ta=-20~70 ℃

Item	Symbol	Test condition	Min.	Typ.	Max.	Unit
CL2 Cycle Time	tC	Fig.a	82	—	—	ns
CL2 Pulse Width	tSWH,tSWL	Fig.a	28	—	—	ns
CL2 Rise/Fall Time	tCR,tCF	Fig.a	—	—	50	ns
Data Set Up Time	tDSU	Fig.a , Fig.b	100	—	—	ns
Data Hold Time	tDHD	Fig.a , Fig.b	30	—	—	ns
CL1 Cycle Time	tL	Fig.b	250	—	—	ns
CL1 "H" Pulse Width	tLWH	Fig.a , Fig.b	100	—	—	ns
CL1 Rise/Fall Time	tLR,tLF	Fig.b	—	—	30	ns
CL2 To CL1 Delay Time	tCL	Fig.a	30	—	—	ns
CL1 To CL2 Delay Time	tLC	Fig.a	—	—	200	ns
FLM TO CL1 SETUP TIME	tFLS	Fig.b	30	—	—	ns
FLM TO CL1 HOLD TIME	tFLH	Fig.b	50	—	—	ns

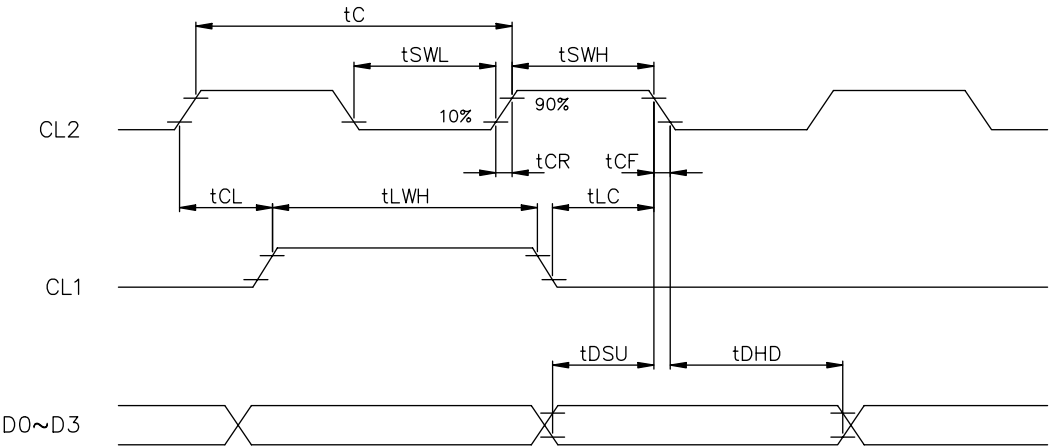


Fig . a Interface timing (SEGMENT)

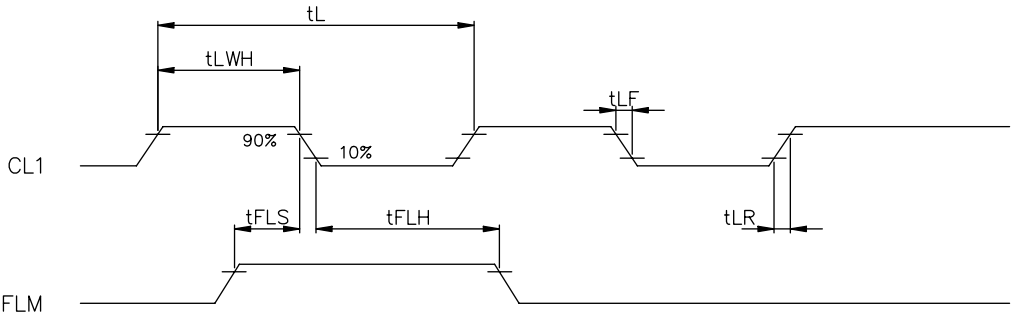
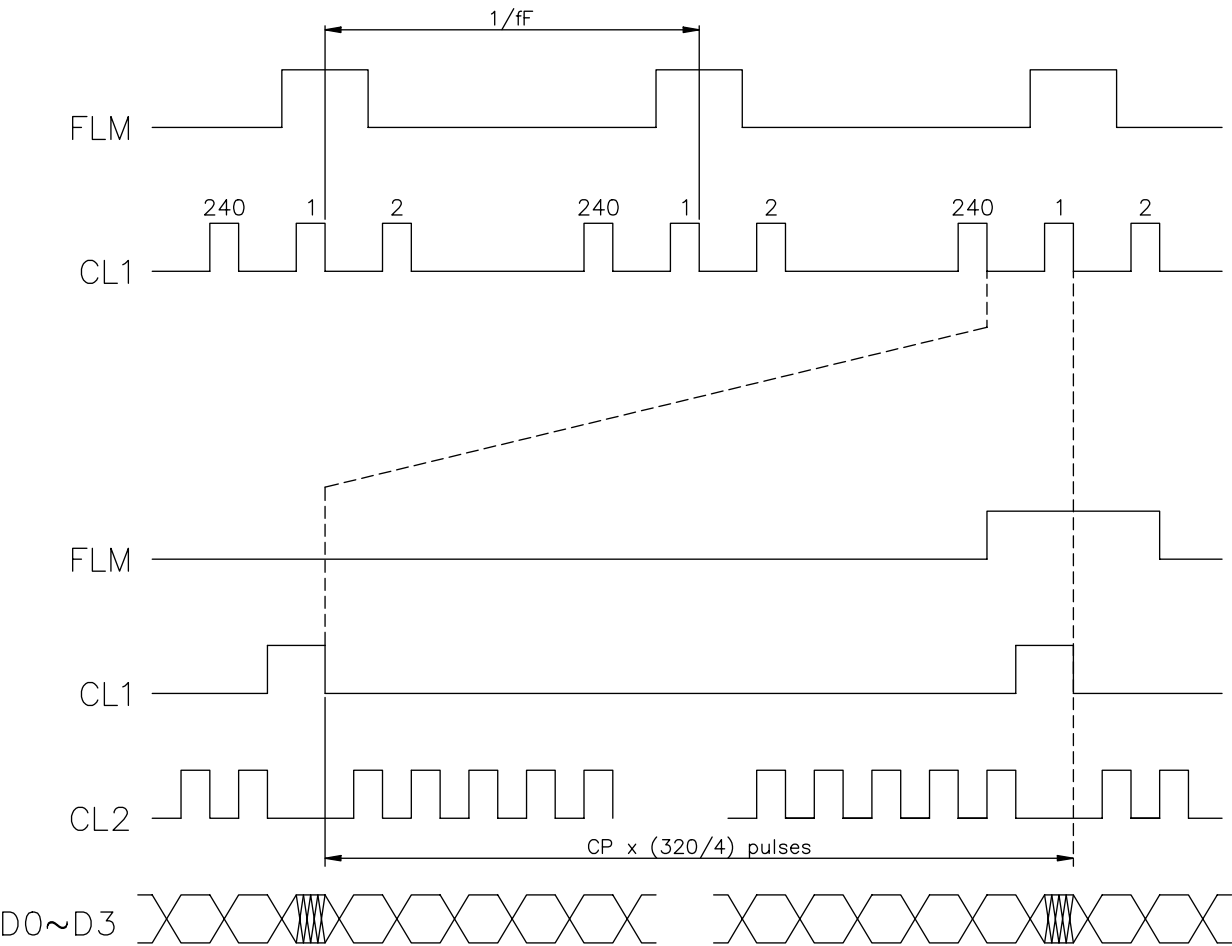
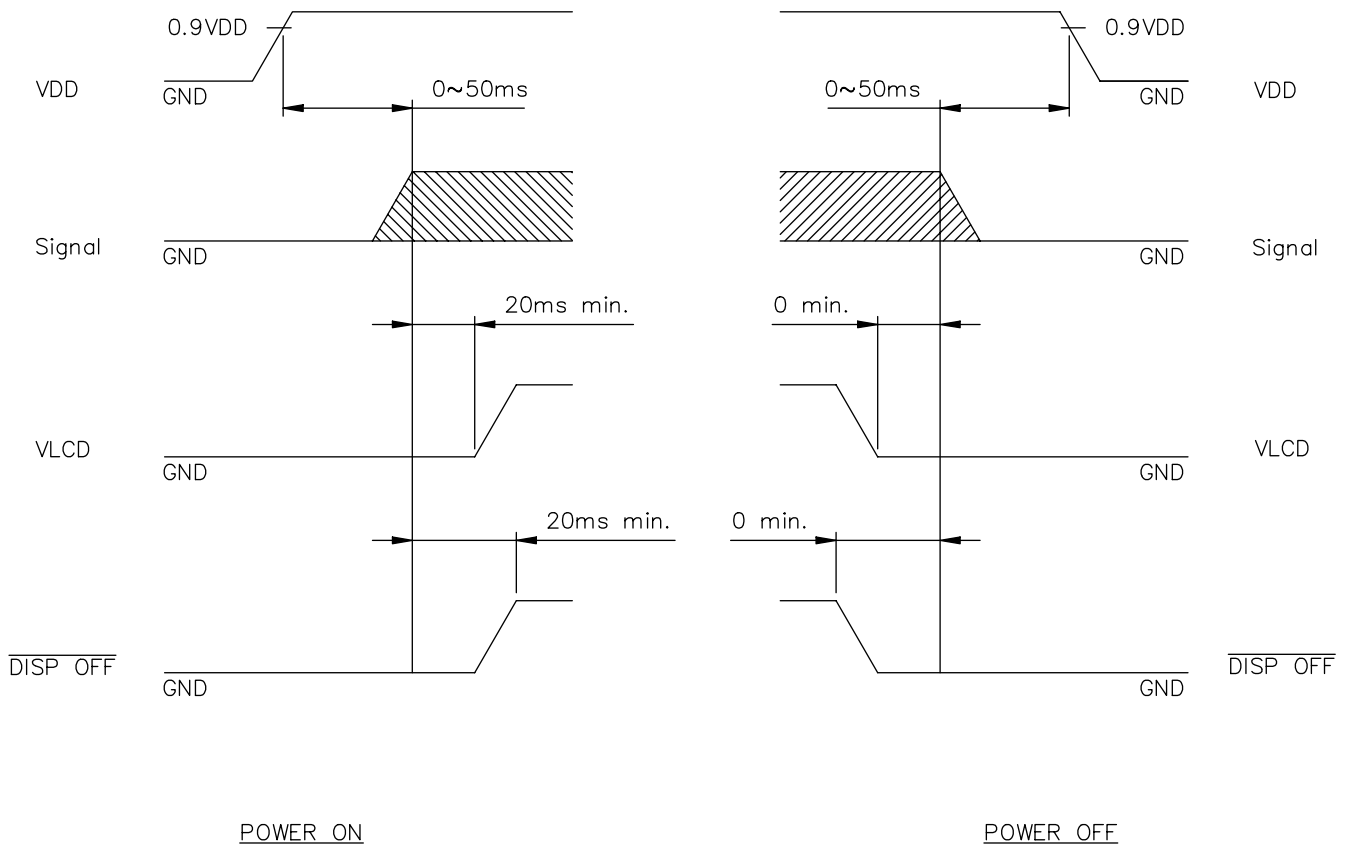


Fig . b Interface timing (COMMON)

8-2.TIMING CHART OF INPUT SIGNAL



8-3. POWER ON/OFF TIMING



Missing pixels may occur when the LCM is driven beyond the above power interface timing sequence.

8-4.DISPLAY PATTERN

	Column1	Column2	Column3	Column4	Column320
Row 1	1 • 1	1 • 2	1 • 3	1 • 4	1 • 320
Row 2	2 • 1	2 • 2	2 • 3		
Row 3	3 • 1	3 • 3			
	D0: (1 • 4) ↘ (1 • 8) • • • • • (240 • 320) D1: (1 • 3) ↘ (1 • 7) • • • • • (240 • 319) D2: (1 • 2) ↘ (1 • 6) • • • • • (240 • 318) D3: (1 • 1) ↘ (1 • 5) • • • • • (240 • 317)				
Row 240	240 • 1				240 • 320

