

# AZ DISPLAYS, INC.

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*COMPLETE LCD SOLUTIONS*

## SPECIFICATIONS FOR LIQUID CRYSTAL DISPLAY

PART NUMBER:

AGM3224K

REVISED:

NOVEMBER 11, 2002

# Record of Revisions

DATE	REVISED NO.	REF. PAGE	SUMMARY
11/11/2002	1	5/16	The "Recommended LCD Driving Voltage" values have decreased

# AZ DISPLAYS, INC.

## 1. MECHANICAL DATA

(1) Product No.	<b>AGM3224K</b>
(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: <input type="checkbox"/> Black and White(Normally White/Positive Image)
	Rear Polarizer: <input type="checkbox"/> 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  $T_a \leq 70^\circ\text{C}$  : 75%RH max  
 $T_a > 70^\circ\text{C}$  : Absolute humidity must be lower  
than the humidity of 75%RH at  $70^\circ\text{C}$

Note 4  $T_a$  at  $-30^\circ\text{C}$  will be < 48hrs, at  $80^\circ\text{C}$  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	–20°C	17.3	17.5	17.7	V
			0°C	15.7	15.9	16.1	
		1/12 Bias	25°C	15.2	15.4	15.6	
			50°C	14.4	14.6	14.8	
			70°C	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 : <div style="display: flex; justify-content: space-around; align-items: center;"> <span>□</span><span>■</span><span>□</span><span>■</span><span>□</span><span>■</span> </div> <div style="display: flex; justify-content: space-around; align-items: center;"> <span>■</span><span>□</span><span>■</span><span>□</span><span>■</span><span>□</span> </div>	–	0.55	1.0		

## 4. OPTICAL CHARACTERISTICS

AT Vop

ITEM		Cr(Contrast Ratio)										$\theta$ (Viewing Angle)		$\phi$ (Viewing Angle)	
		-20°C		-0°C		25°C		50°C		70°C		25°C		25°C	
MODE		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

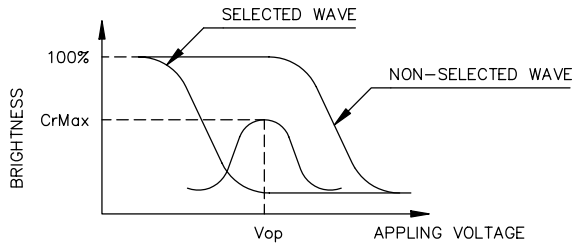
T: NORMALLY WHITE(9 O'clock)

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

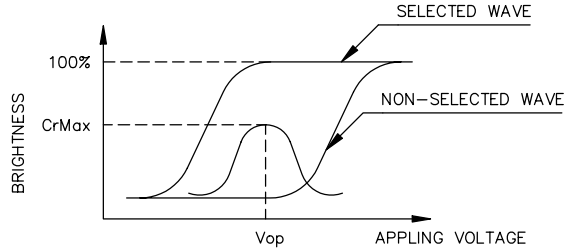
ITEM	SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNIT	NOTE
Response Time (rise)	Tr	-20°C	5200	6700	10000	ms	NOTE 2
		0°C	950	1200	1800		
		25°C	280	350	500		
		50°C	130	160	250		
		70°C	80	100	150		
Response Time (fall)	Tf	-20°C	3400	4300	6500	ms	NOTE 2
		0°C	550	700	1000		
		25°C	200	250	350		
		50°C	70	90	140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

(NOTE 1)

Definition of Operation Voltage(Vop)



(positive type)



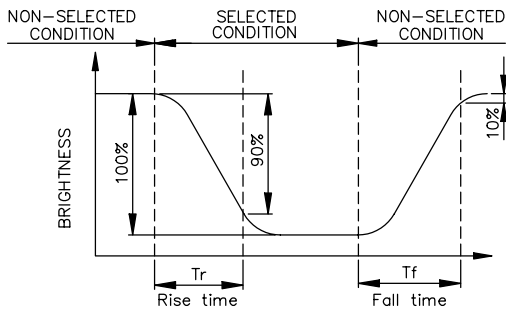
(negative type)

\*Conditions

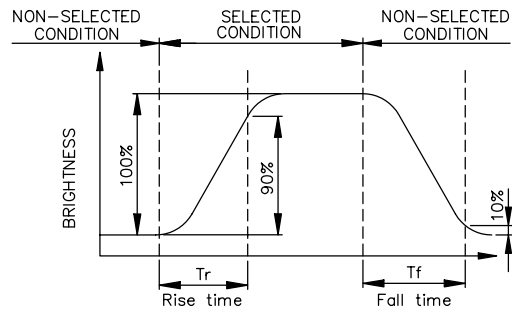
Viewing Angle : 0  
 Frame Frequency : 70Hz  
 Applying Waveform : 1/N duty 1/a bias

(NOTE 2)

Definition of Response Time(Tr,Tf)



(positive type)



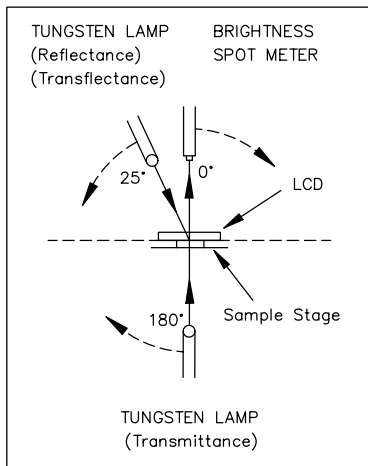
(negative type)

\*Conditions

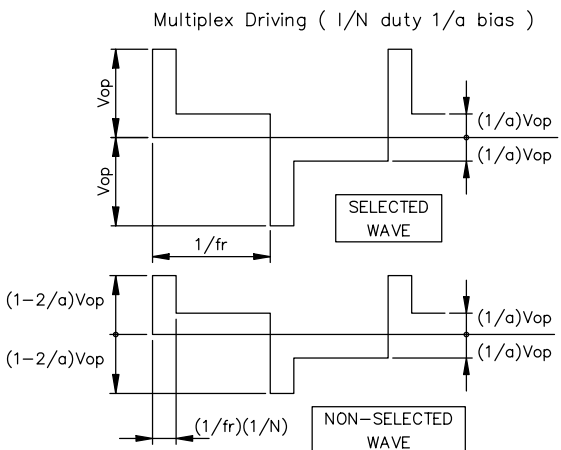
Operating Voltage : Vop  
 Viewing Angle ( $\theta, \phi$ ) : (0,0)  
 Frame Frequency : 70Hz  
 Applying Waveform : 1/N duty 1/a bias

(NOTE 3)

Description of Measuring Equipment and Driving Waveforms

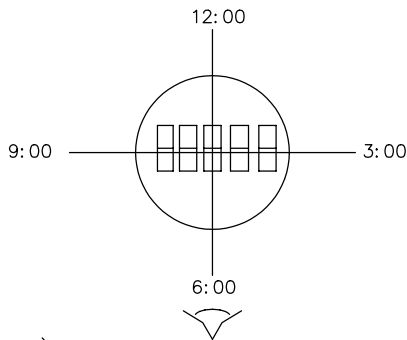


CONST.  
TEMP.  
CHAMBER



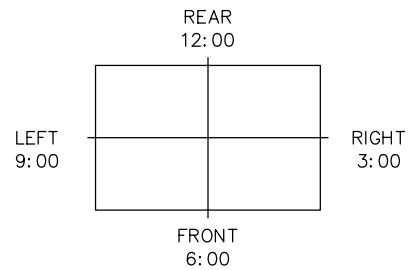
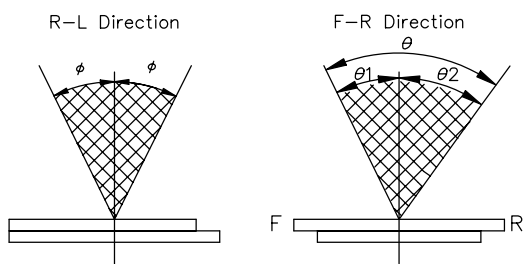
(NOTE 4)

Definition of Viewing Direction



(NOTE 5)

Definition of Viewing Angle



\*For This Product  
The Viewing Direction Is 6 O'clock  
So  $\theta_1 > \theta_2$

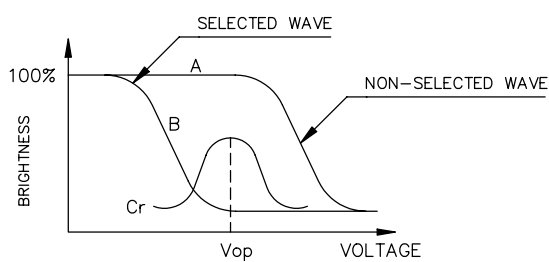
$$\theta = \theta_1 + \theta_2$$

\*Conditions

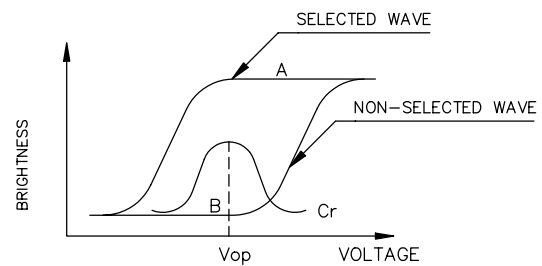
Operating Voltage :  $V_{op}$   
Frame Frequency : 70Hz  
Applying Waveform : 1/N duty 1/a bias  
Contrast Ratio : larger than 2

(NOTE 6)

Definition of Contrast Ratio (Cr)



(positive type)



(negative type)

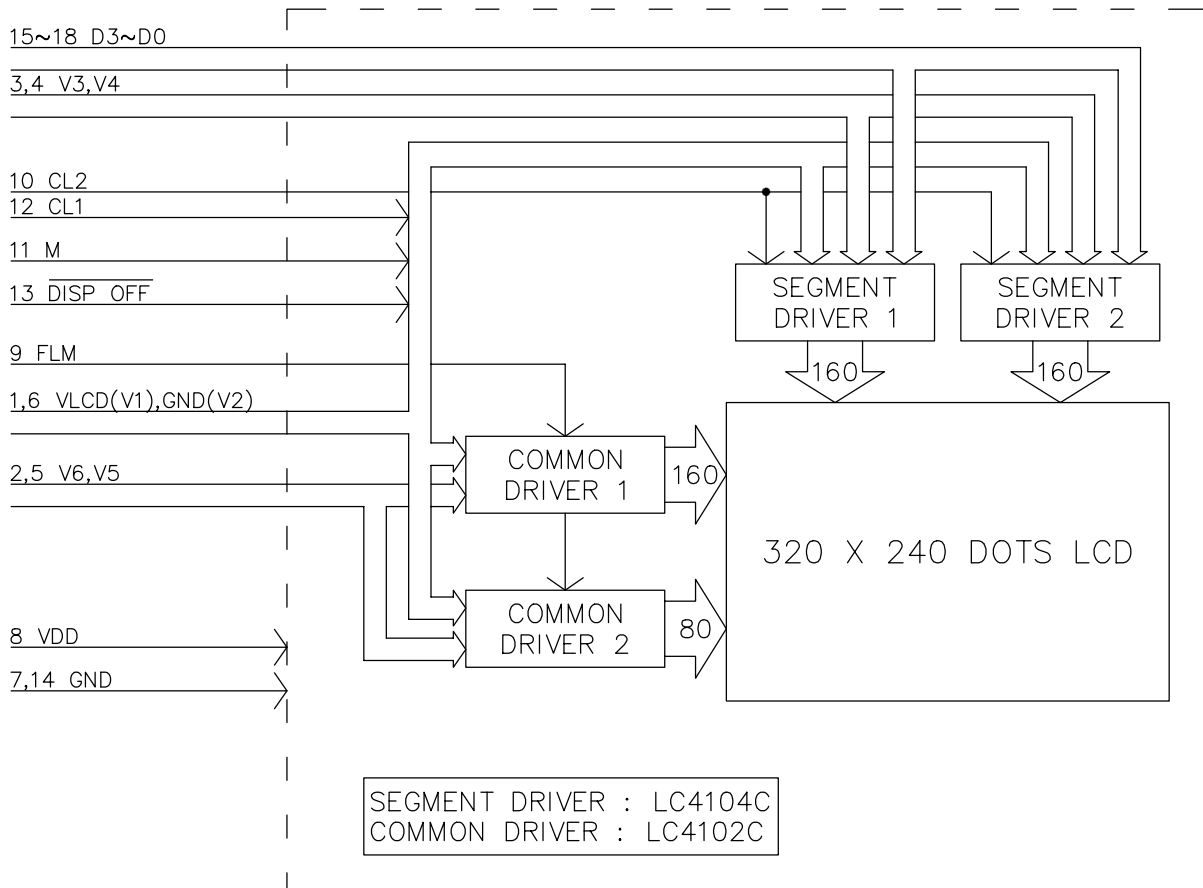
$$\text{Contrast Ratio : } Cr = A/B$$

\*Conditions

Viewing Angle : 0  
Frame Frequency : 70Hz  
Applying Waveform : 1/N duty 1/a bias



## 5. BLOCK DIAGRAM



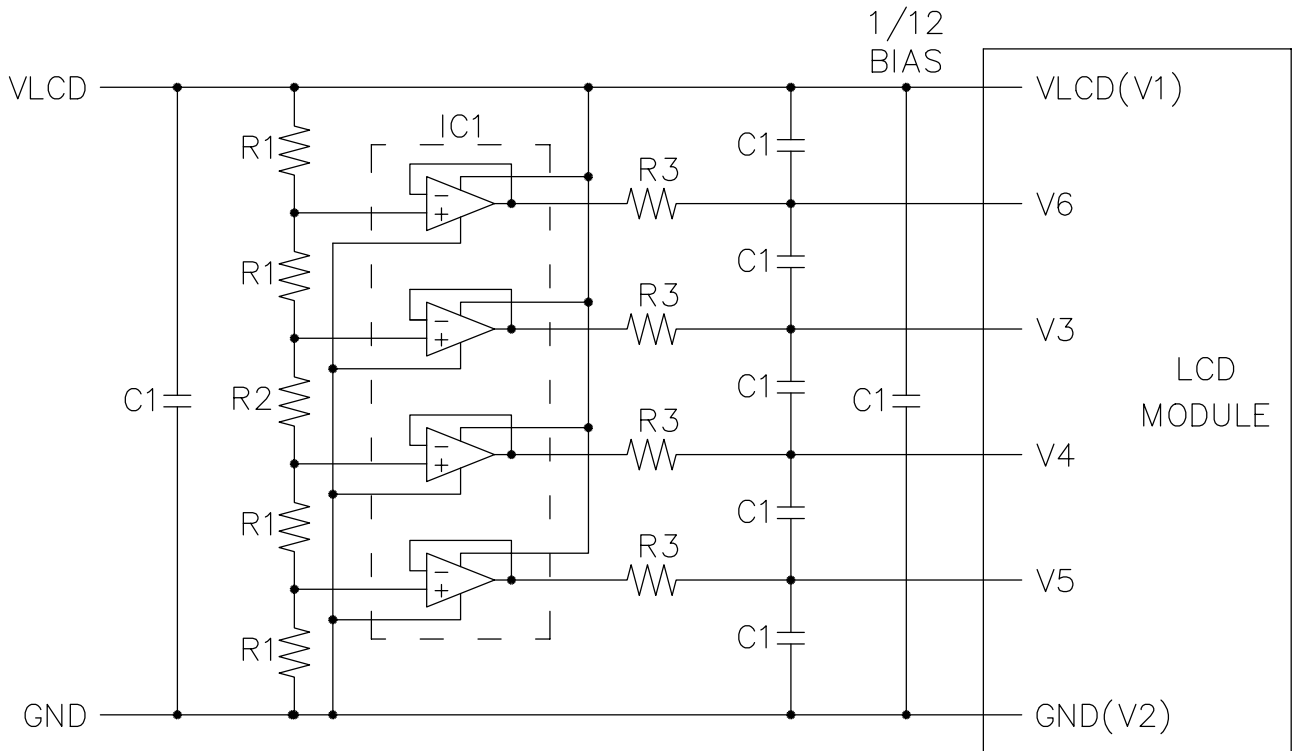
Note :

- 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(uF)

## 8. TIMING CHARACTERISTICS

### 8-1. INTERFACE TIMING

@ VDD=3.0V±10%, Ta=-20~70 °C

Item	Symbol	Test condition	Min.	Typ.	Max.	Unit
CL2 Cycle Time	t <sub>C</sub>	Fig.a	82	-	-	ns
CL2 Pulse Width	t <sub>SWH</sub> ,t <sub>SWL</sub>	Fig.a	28	-	-	ns
CL2 Rise/Fall Time	t <sub>CR</sub> ,t <sub>CF</sub>	Fig.a	-	-	50	ns
Data Set Up Time	t <sub>DSU</sub>	Fig.a , Fig.b	100	-	-	ns
Data Hold Time	t <sub>DHD</sub>	Fig.a , Fig.b	30	-	-	ns
CL1 Cycle Time	t <sub>L</sub>	Fig.b	250	-	-	ns
CL1 "H" Pulse Width	t <sub>LWH</sub>	Fig.a , Fig.b	100	-	-	ns
CL1 Rise/Fall Time	t <sub>LR</sub> ,t <sub>LF</sub>	Fig.b	-	-	30	ns
CL2 To CL1 Delay Time	t <sub>CL</sub>	Fig.a	30	-	-	ns
CL1 To CL2 Delay Time	t <sub>LC</sub>	Fig.a	-	-	200	ns
FLM TO CL1 SETUP TIME	t <sub>FLS</sub>	Fig.b	30	-	-	ns
FLM TO CL1 HOLD TIME	t <sub>FLH</sub>	Fig.b	50	-	-	ns

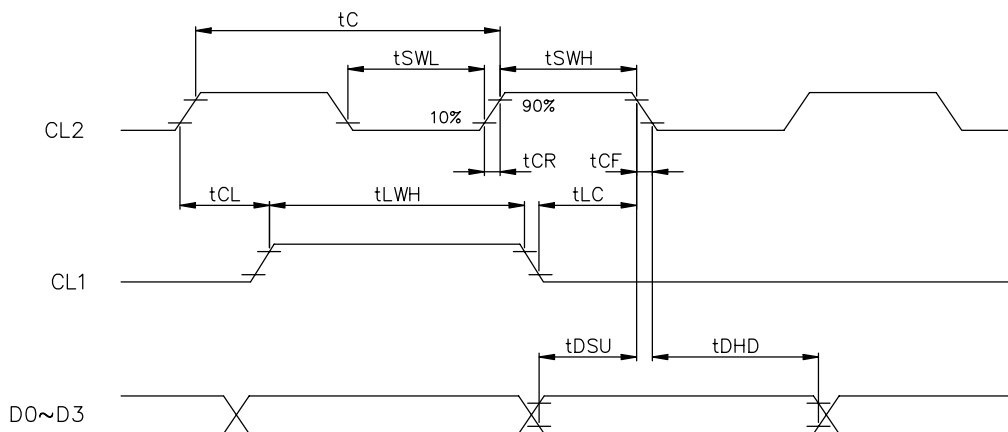


Fig . a Interface timing (SEGMENT)

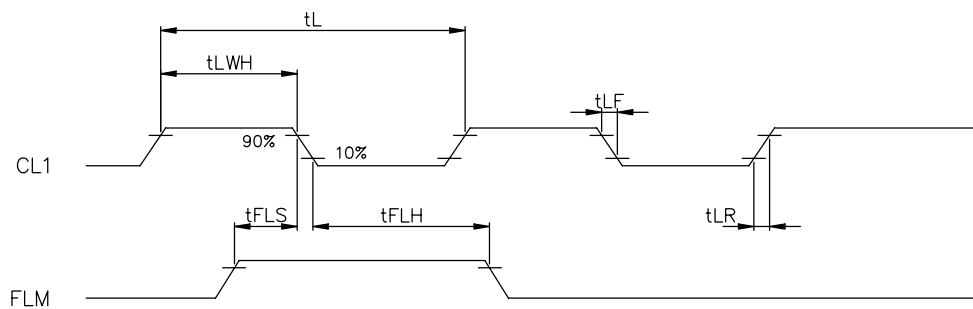
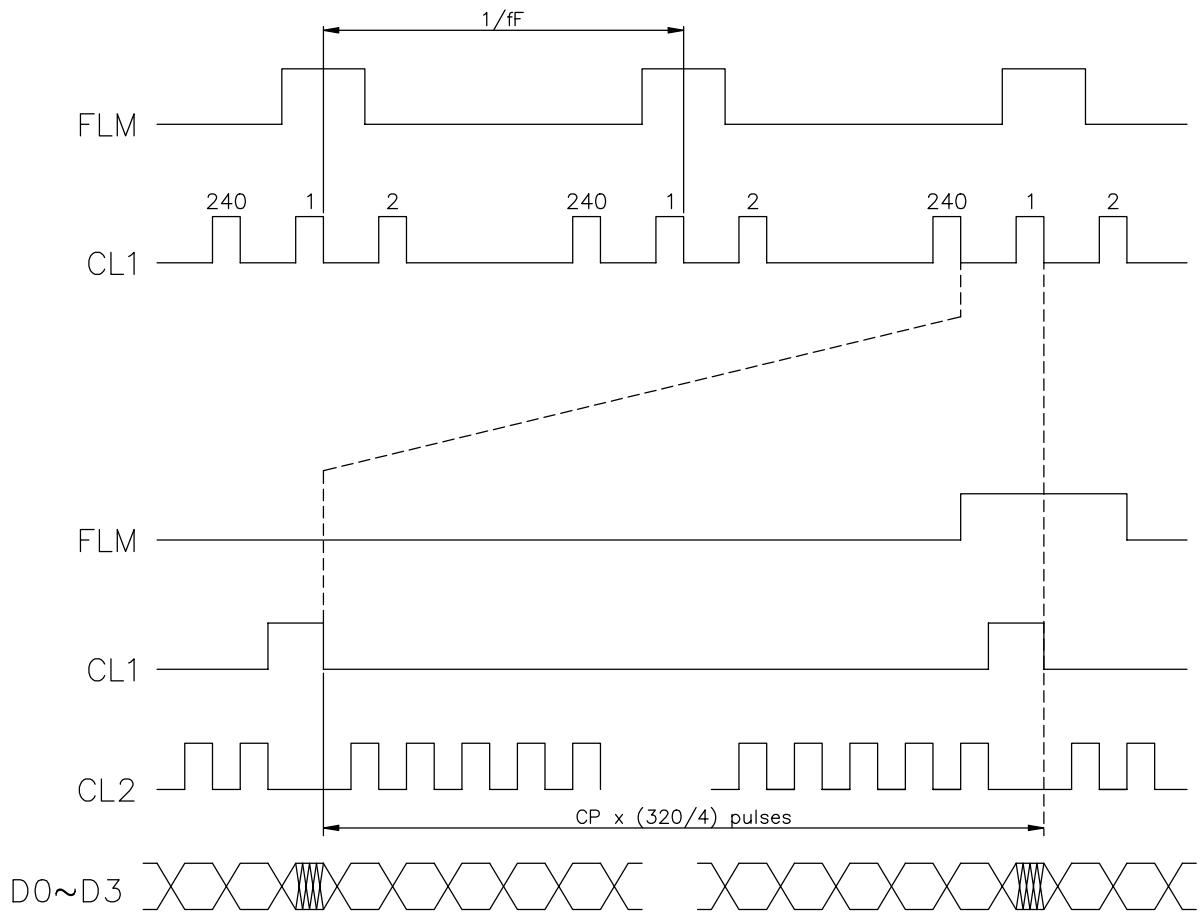
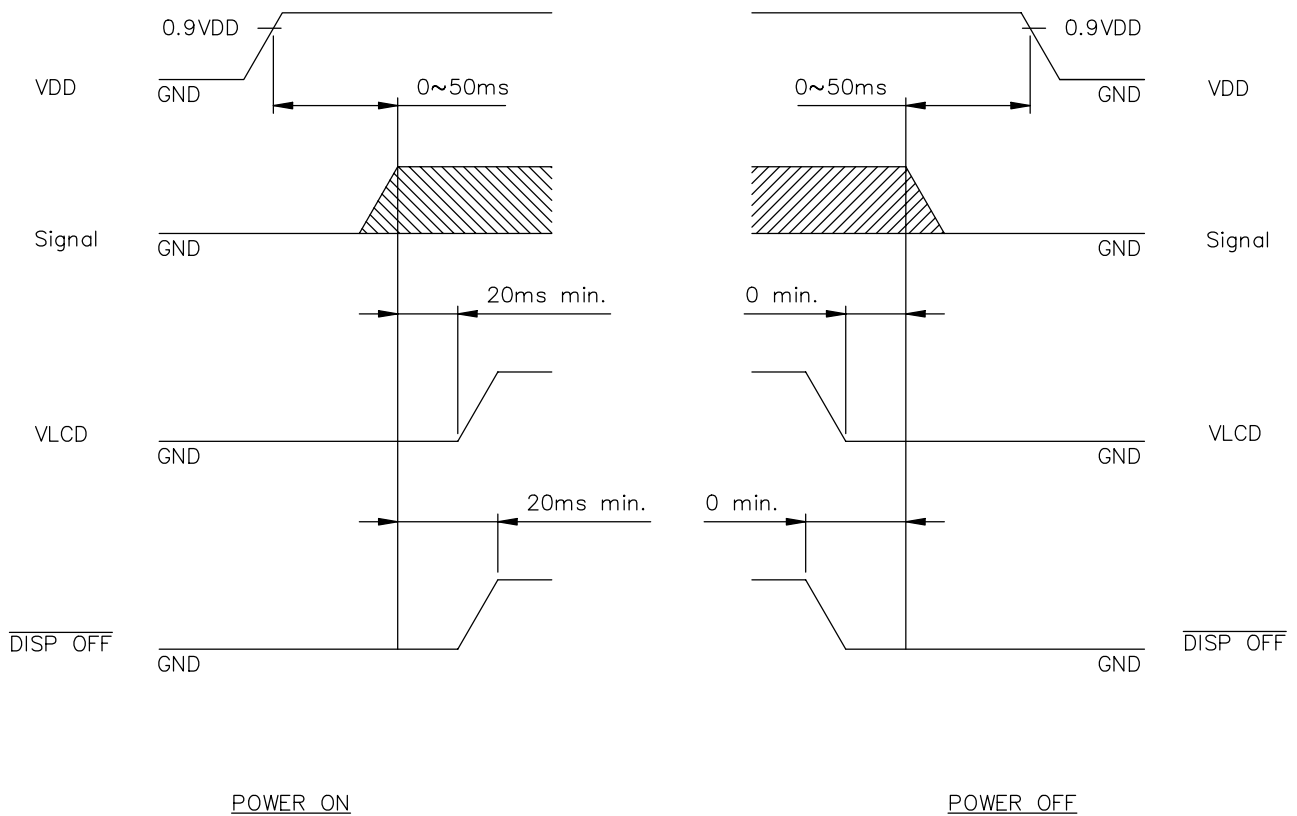


Fig . b Interface timing (COMMON)

## 8-2. TIMING CHART OF INPUT SIGNAL



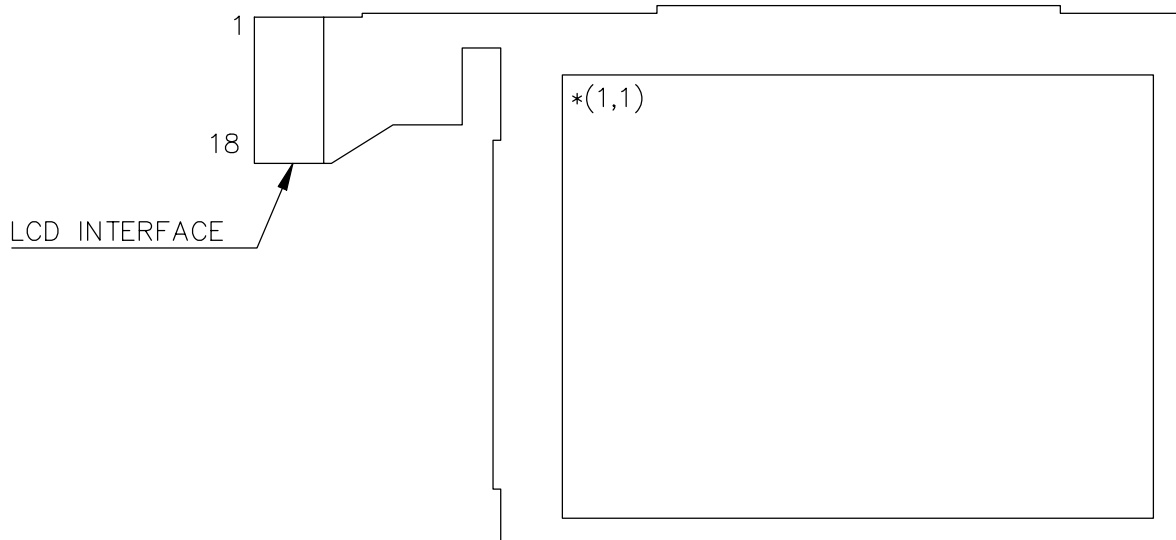
## 8-3. POWER ON/OFF TIMING

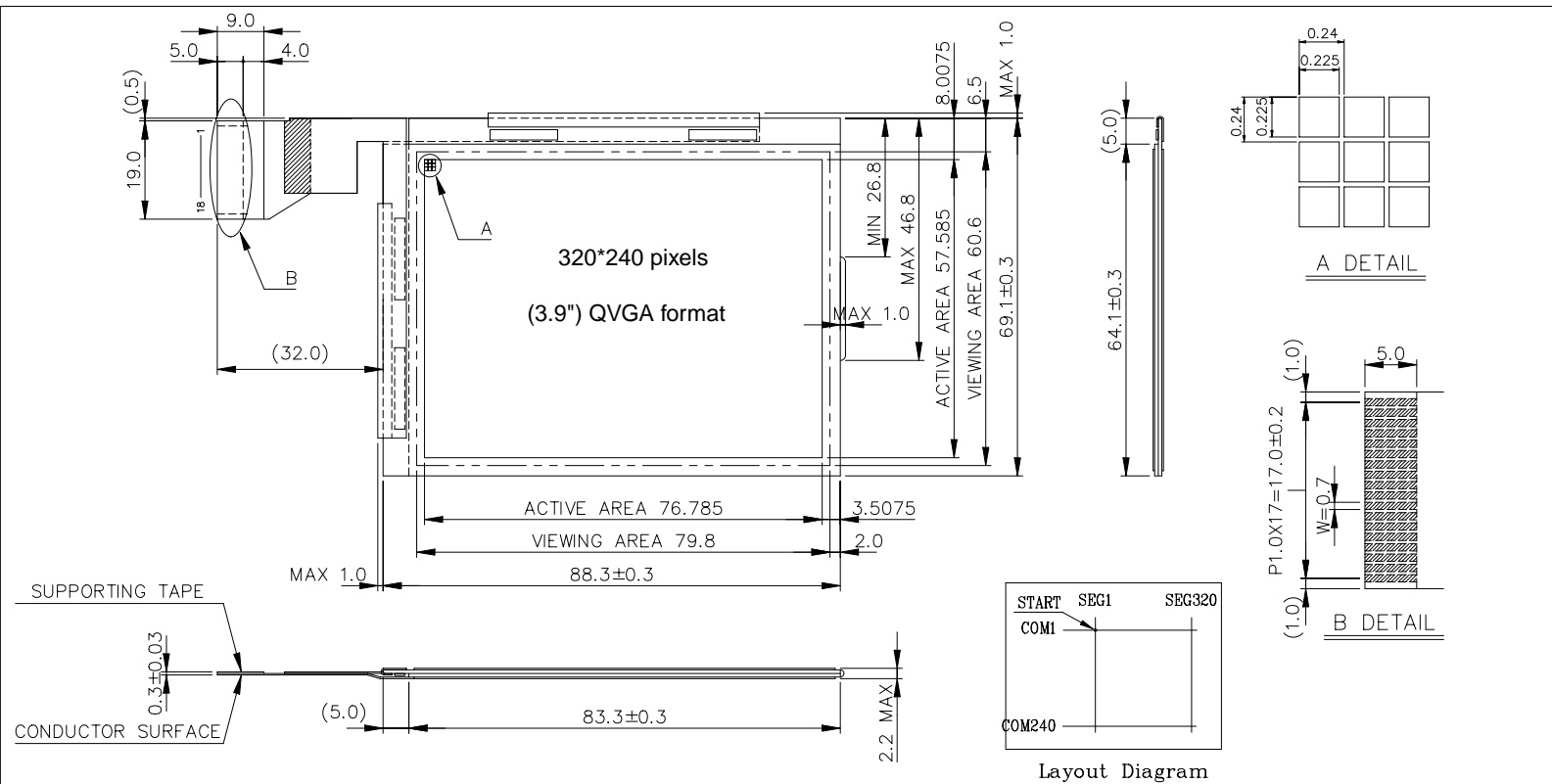


Missing pixels may occur when the LCM is driven beyond the above power interface timing sequence.

## 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





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

Note:  
1. RESOLUTION : 320x240 DOTS ◦  
2. COG IC : COM LC4102C  
SEG LC4104C

DIMENSION	TOLERANCE
L ≤ 6	±0.25 (mm)
6 < L ≤ 18	±0.3 (mm)
18 < L ≤ 50	±0.4 (mm)
50 < L ≤ 125	±0.5 (mm)
125 < L	±0.6 (mm)
ANGLE	±1° (DEG)

AZ DISPLAYS, INC.

AGM3224K

NAME DATE THIRD ANGLE P.

APPROVE									
CHECK									
DESIGN	J.Y.Lin	89.05.16							
DRAWN	Ping Ping	89.05.16							
REV. NO.	DESCRIPTION	DATE	DESIGN	CHECK	APPROVE	DWG NO.	M359-D0A		