

# AZ Displays, Inc.

## 1. MECHANICAL DATA

(1) Product No.	<b>AGM1212D</b>
(2) Module Size	92.0 (W)mm x 106.0 (H)mm x MAX 12.0 (D)mm (W/O , EL B.L.) 92.0 (W)mm x 106.0 (H)mm x MAX 14.5 (D)mm (LED B.L.)
(3) Dot Size	0.50 (W)mm x 0.50 (H)mm
(4) Dot Pitch	0.55 (W)mm x 0.55 (H)mm
(5) Number of Dots	128 (W) x 128 (H)Dots
(6) Duty	1/128
(7) LCD Display Mode	STN: <input type="checkbox"/> Gray <input type="checkbox"/> Yellow <input type="checkbox"/> Blue FSTN: <input type="checkbox"/> Black and White(Normal White/Positive Image) <input type="checkbox"/> Black and White(Normal Black/Negative Image) Rear Polarizer: <input type="checkbox"/> Reflective <input type="checkbox"/> Transflective <input type="checkbox"/> Transmissive
(8) Viewing Direction	<input type="checkbox"/> 6 O'clock <input type="checkbox"/> 12 O'clock <input type="checkbox"/> ___O'clock
(9) LCD Controller	BUILT-IN T6963C (TOSHIBA)
(10) Backlight	<input type="checkbox"/> W/O <input type="checkbox"/> EL <input type="checkbox"/> LED
(11) Weight	W/O B/L : 90.4g EL B/L : 96.5g LED B/L : 120.5g

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## 2. ABSOLUTE MAXIMUM RATINGS

### (1) ELECTRICAL ABSOLUTE RATINGS

GND=0V Standard

ITEM	SYMBOL	MIN	MAX	UNIT	COMMENT
Power Supply for Logic	VDD-GND	0	7.0	V	
Input Voltage	VI	GND	VDD	V	
Static Electricity	-	-	-	-	Note 1

Note 1 LCM should be grounded during handling

### (2) ENVIRONMENTAL ABSOLUTE MAXIMUM RATINGS

ITEM	NORMAL TEMP.				WIDE TEMP.			
	OPERATING		STORAGE		OPERATING		STORAGE	
	MIN.	MAX.	MIN.	MAX.	MIN.	MAX.	MIN.	MAX.
Ambient Temperature	0	50	-20	70	-20	70	-30	80
Humidity (Without Condensation)	Note 1,3		Note 2,3		Note 3,4		Note 3,5	

Note 1  $T_a \leq 50^\circ\text{C}$  : 85%RH max

$T_a > 50^\circ\text{C}$  : Absolute humidity must be lower

than the humidity of 85%RH at  $50^\circ\text{C}$

Note 2  $T_a$  at  $-20^\circ\text{C}$  will be  $< 48\text{hrs}$ , at  $70^\circ\text{C}$  will be  $< 120\text{hrs}$

Note 3 Background color changes slightly depending on ambient temperature.  
This phenomenon is reversible.

Note 4  $T_a \leq 70^\circ\text{C}$  : 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 5  $T_a$  at  $-30^\circ\text{C}$  will be  $< 48\text{hrs}$ , at  $80^\circ\text{C}$  will be  $< 120\text{hrs}$

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## 3. ELECTRICAL CHARACTERISTICS

( VDD=5V ± 10% )

ITEM	SYMBOL	CONDITION		MIN.	TYP.	MAX.	UNIT
Logic Circuit Power Supply	VDD-GND	-		4.75	5.0	5.25	V
Input Voltage	V <sub>IH</sub>	H level		0.8VDD	-	VDD	V
	V <sub>IL</sub>	L level		GND	-	0.2VDD	V
Recommended LCD Driving Voltage (NORMAL TEMP. LCM)	VDD-V <sub>0</sub> (V <sub>op</sub> )	1/12 Bias	0°C	18.4	19.4	-	V
			25°C	17.2	18.2	19.2	V
			50°C	15.4	16.7	-	V
Recommended LCD Driving Voltage (WIDE TEMP. LCM)	VDD-V <sub>0</sub> (V <sub>op</sub> )	1/12 Bias	-20°C	-	17.2	-	V
			0°C	-	16.1	16.2	V
			25°C	-	16.0	16.2	V
			50°C	15.6	15.7	-	V
			70°C	-	-	-	V
Supply Current (LCD)	I <sub>DD</sub>	VDD = 5.0V V <sub>0</sub> = -13.2V		17	21	29	mA
	I <sub>0</sub>			1.5	2.0	3.0	
LED POWER SUPPLY	I <sub>LED</sub>	V <sub>BL</sub> =5V R <sub>BL</sub> =5Ω		97	101	110	mA
EL POWER SUPPLY	I <sub>EL</sub>	V <sub>BL</sub> =110Vac 400Hz R <sub>BL</sub> =0Ω		-	-	10	mA

# AZ Displays, Inc.

## 4. OPTICAL CHARACTERISTICS

(FOR NORMAL TEMPERATURE MODE LCM)

AT  $V_{OP}$

ITEM MODE		Cr(Contrast Ratio)		$\theta$ (Viewing Angle)		$\phi$ (Viewing Angle)	
		25℃		25℃		25℃	
		MIN.	TYP.	MIN.	TYP.	MIN.	TYP.
R	A	—	—	—	—	—	—
	C	3.5	7	40	60	20	28
	J	4	8	35	60	20	35
S	A	—	—	—	—	—	—
	C	3	6	35	50	20	25
	J	—	—	—	—	—	—
note		NOTE6		NOTE5			

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

ITEM	SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNIT	NOTE
Response Time (rise)	Tr	0℃	—	270	540	ms	NOTE 2
		25℃	—	140	280		
		50℃	—	50	120		
Response Time (fall)	Tf	0℃	—	760	1500	ms	NOTE 2
		25℃	—	210	420		
		50℃	—	120	240		

note:

- S: TRANSFLECTIVE
- T: TRANSMISSIVE
- A: GRAY
- C: YELLOW
- E: BLUE
- G: NORMALLY BLACK
- J: NORMALLY WHITE

# AZ Displays, Inc.

## 4-1.OPTICAL CHARACTERISTICS

(FOR WIDE TEMPERATURE MODE LCM)

AT V<sub>OP</sub>

ITEM MODE		Cr(Contrast Ratio)		$\theta$ (Viewing Angle)		$\phi$ (Viewing Angle)	
		25℃		25℃		25℃	
		MIN.	TYP.	MIN.	TYP.	MIN.	TYP.
R	A	—	3.8	—	—	—	—
	C	—	4.1	—	—	—	—
	J	—	6.5	—	26	—	33
S	A	—	4.0	—	46	—	25
	C						
	J						
T	A	—	2.5	—	—	—	—
note		NOTE6		NOTE5			

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

ITEM	SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNIT	NOTE
Response Time (rise)	Tr	-20℃	—	—	—	ms	NOTE 2
		0℃	—	350	520		
		25℃	—	120	180		
		50℃	—	70	105		
		70℃	—	55	80		
Response Time (fall)	Tf	-20℃	—	—	—	ms	NOTE 2
		0℃	—	640	900		
		25℃	—	200	300		
		50℃	—	80	120		
		70℃	—	35	50		

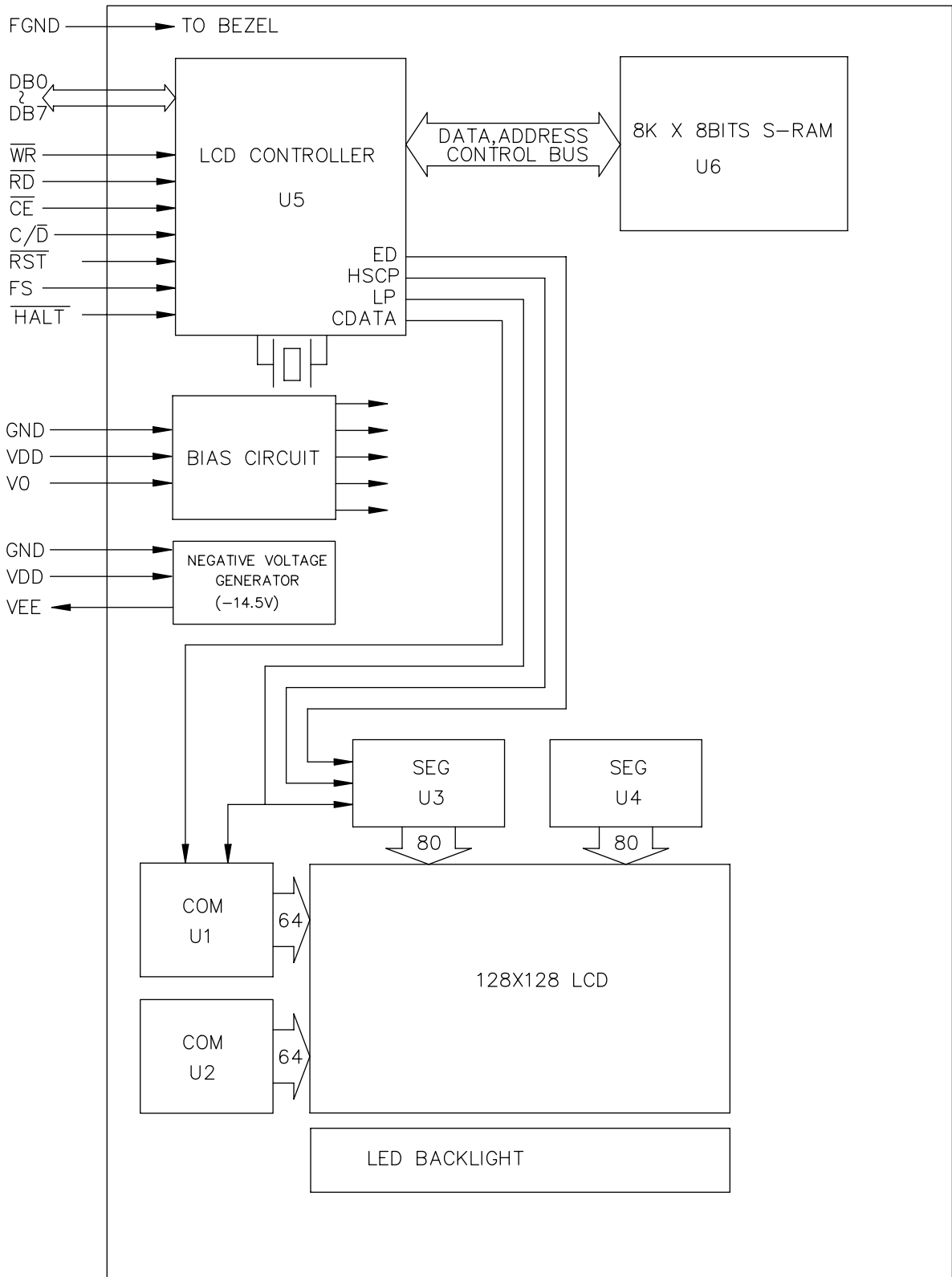
note:

S: TRANSFLECTIVE  
T: TRANSMISSIVE  
A: GRAY  
C: YELLOW

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# AZ Displays, Inc.

## 5. BLOCK DIAGRAM



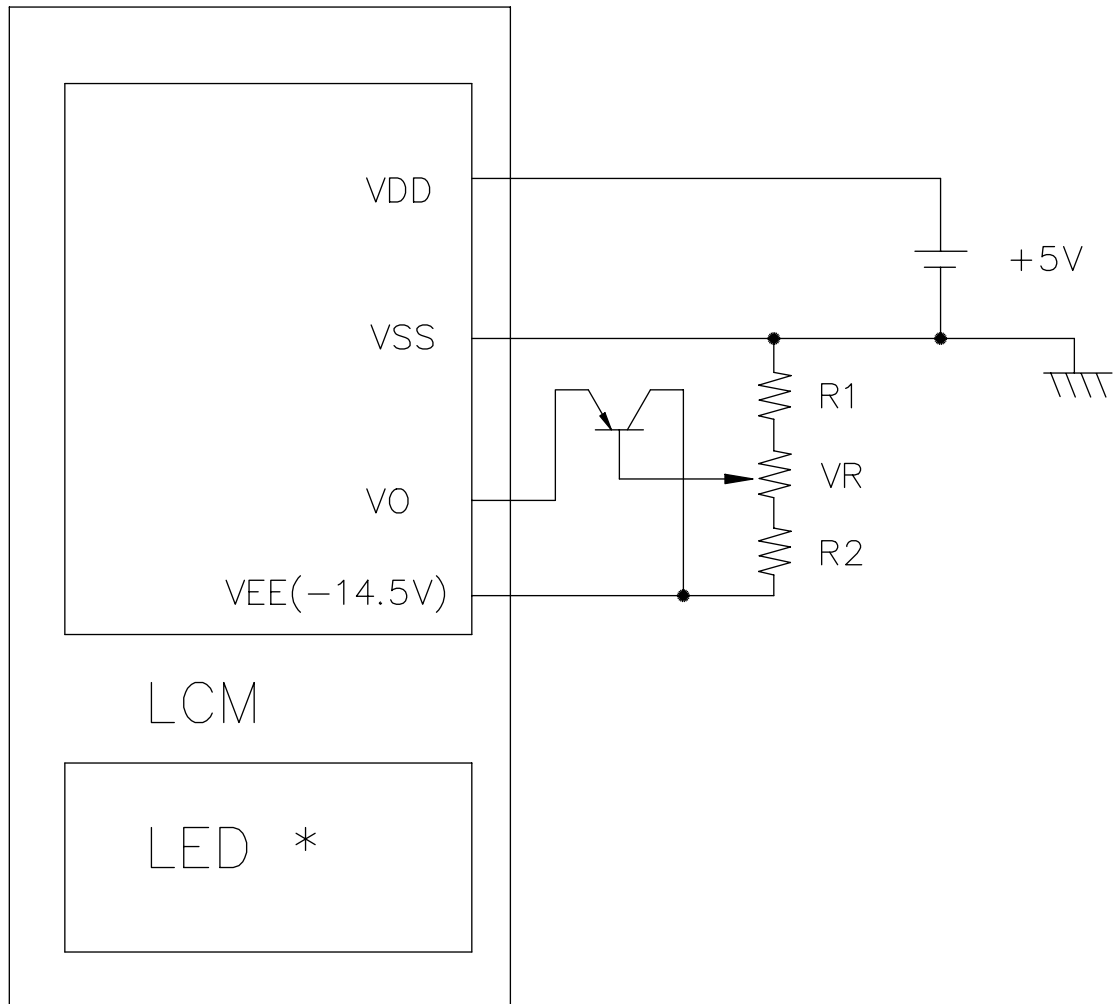
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## 6. INTERNAL PIN CONNECTION

PIN NO.	SYMBOL	FUNCTION
1	FGND	FRAME GROUND (0V)
2	V <sub>SS</sub>	GROUND
3	VDD	POWER SUPPLY FOR LOGIC (+5V)
4	V <sub>O</sub>	POWER SUPPLY FOR LC DRIVING
5	$\overline{WR}$	DATA WRITE
6	$\overline{RD}$	DATA READ
7	$\overline{CE}$	$\overline{CE}$ ="L", CHIP ENABLE
8	C/ $\overline{D}$	$\overline{WR}$ ="L",C/ $\overline{D}$ ="H" :COMMAND WRITE $\overline{WR}$ ="L",C/ $\overline{D}$ ="L" :DATA WRITE $\overline{RD}$ ="L",C/ $\overline{D}$ ="H" :STATUS READ $\overline{RD}$ ="L".C/ $\overline{D}$ ="L" :DATA READ
9	$\overline{RST}$	CONTROLLER RESET
10	D0	DATA INPUT/OUTPUT
11	D1	DATA INPUT/OUTPUT
12	D2	DATA INPUT/OUTPUT
13	D3	DATA INPUT/OUTPUT
14	D4	DATA INPUT/OUTPUT
15	D5	DATA INPUT/OUTPUT
16	D6	DATA INPUT/OUTPUT
17	D7	DATA INPUT/OUTPUT
18	FS	FONT SELECT    CONNECT TO VDD : 6X8 PIXELS/CHARACTER CONNECT TO GND : 8X8 PIXELS/CHARACTER
19	VEE	-14.5 V NEGATIVE VOLTAGE GENERATOR
20	$\overline{HALT}$	$\overline{HALT}$ ="L", CONTROLLER HALT

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## 7. POWER SUPPLY



$$R1 + VR + R2 = 10K \sim 20K$$

\*: Power is internally supplied to LEDs.



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## 8. TIMING CHARACTERISTICS

### 8-1 INTERFACE TIMING

ITEM	ITEM	CONDITION	MIN.	MAX.	UNIT
C/ $\bar{D}$ SET UP TIME	$t_{CDS}$	Fig.	100	—	ns
C/ $\bar{D}$ HOLD TIME	$t_{CDH}$	Fig.	10	—	ns
$\bar{C}\bar{E}, \bar{R}\bar{D}, \bar{W}\bar{R}$ CLOCK WIDTH	$t_{CP}, t_{RP}, t_{WP}$	Fig.	80	—	ns
DATA SET UP TIME	$t_{DS}$	Fig.	80	—	ns
DATA HOLD TIME	$t_{DH}$	Fig.	40	—	ns
ACCESS TIME	$t_{ACC}$	Fig.	—	150	ns
DATA OUTPUT HOLD TIME	$t_{OH}$	Fig.	10	50	ns

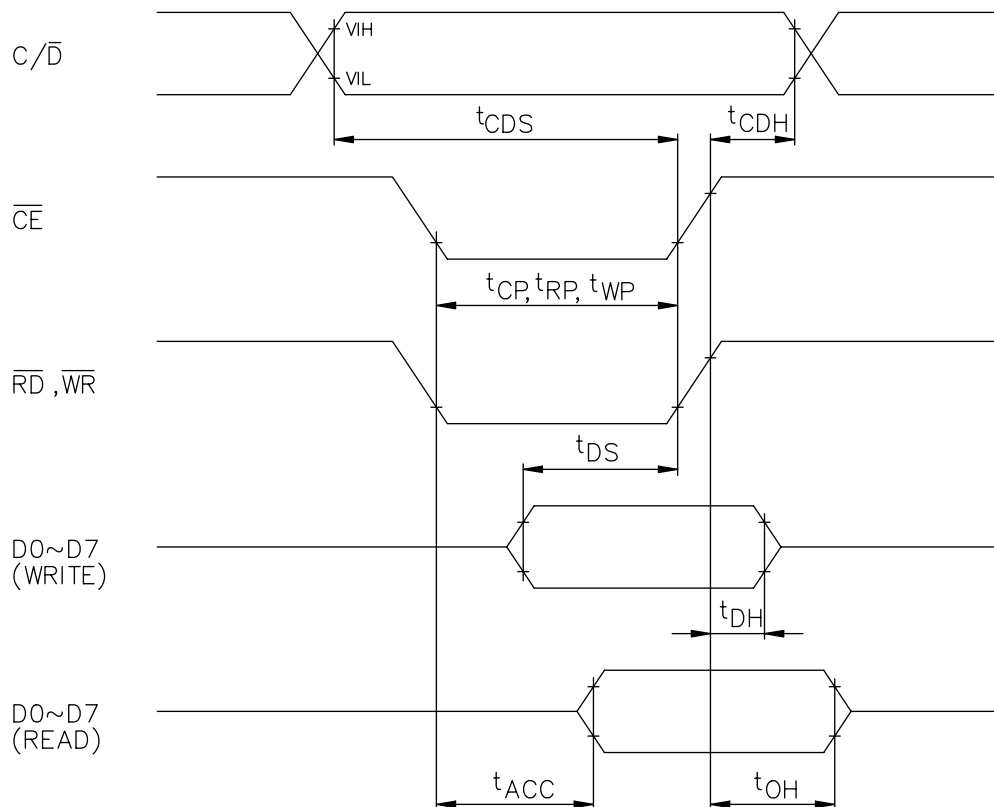
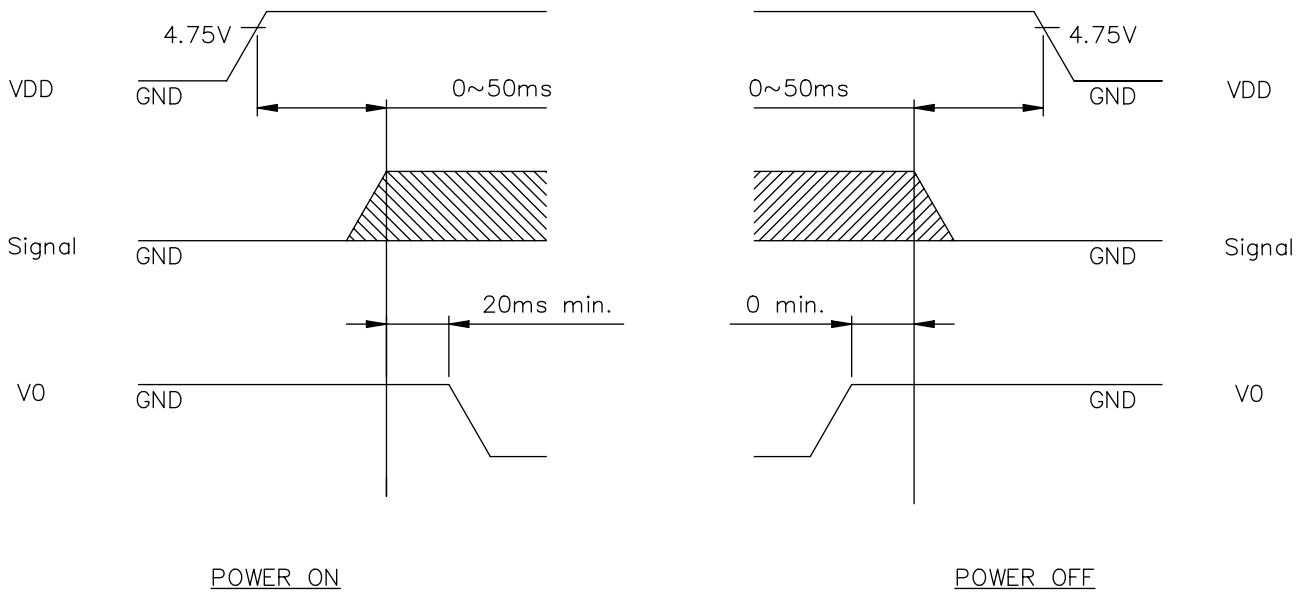


Fig. INTERFACE TIMING CHART

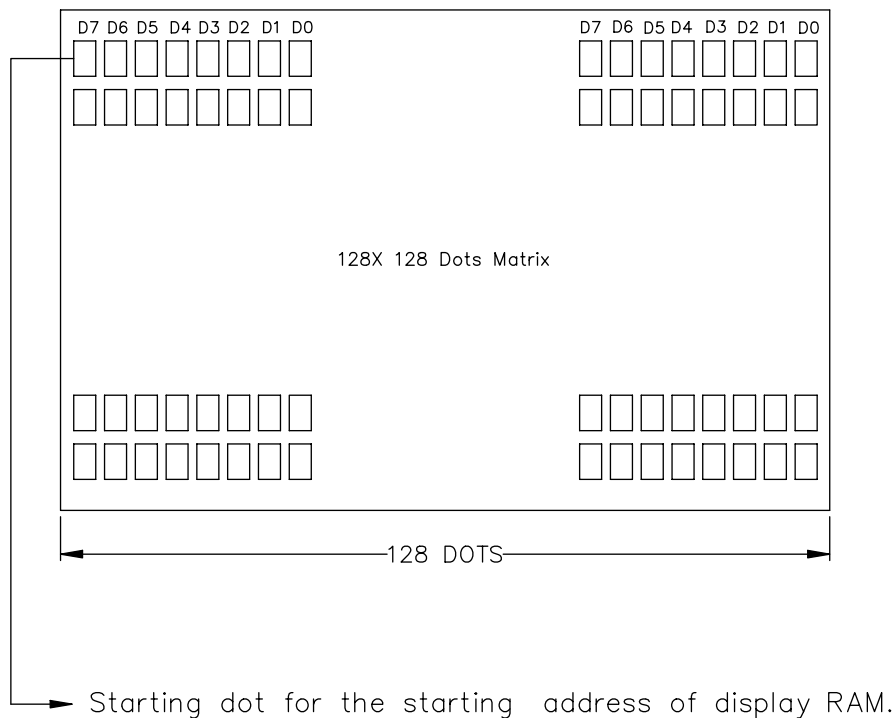
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## 8-2 POWER ON/OFF TIMING



THE RECOMMENDED POWER & INTERFACE TIMING SEQUENCE

## 9.DISPLAY PATTERN

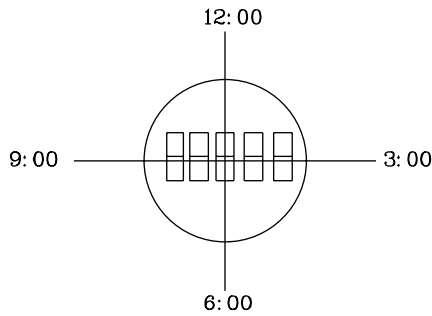


D0~D7 are 8 bits transmitted data ,where D0 is LSB and D7 is MSB.

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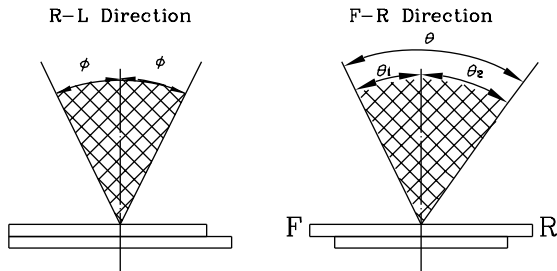
(NOTE 4)

Definition of Viewing Direction



(NOTE 5)

Definition of Viewing Angle



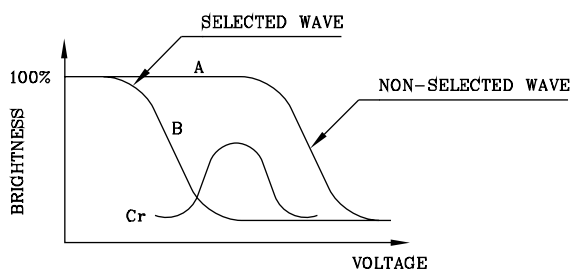
$$\theta = \theta_1 + \theta_2$$

\*Conditions

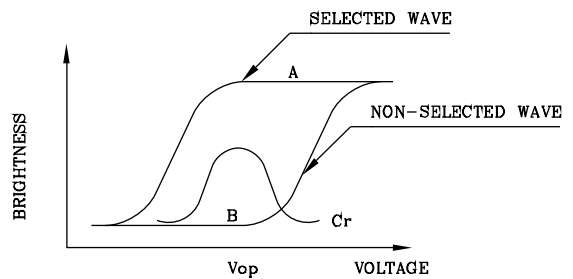
- Operating Voltage :  $V_{op}$
- Frame Frequency : 70Hz
- Applying Waveform : 1/N duty 1/a bias
- Contrast Ratio : larger than 2

(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

