1. MECHANICAL DATA

(1) Product No.		AGM1212E
(2) Module Size		92.0 (W)mm x 106.0 (H)mm x MAX12.0(D)mm (W/O, EL B.L.) 92.0 (W)mm x 106.0 (H)mm x MAX15.0(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:	☐ Gray Mode ☐ Yellow Mode ☐ Blue Mode
	FSTN:	☐ Black and White(Normal White/Positive Image)
		☐ Black and White(Normal Black/Negative Image)
	Rear Polarizer:	☐ Reflective ☐ Transflective ☐ Transmissive
(8) Viewing Direction		☐ 6 O'clock ☐ 12 O'clock ☐____O'clock
(9) Backlight		☐ W/O ☐ LED B/L ☐ EL B/L
(10) LCD Controller		T6963C
(11) Weight		W/O B/L: 90.4g EL B/L: 96.5g LED B/L: 120.5g

Revised: May 24, 2000

2. ABSOLUTE MAXIMUM RATINGS

(1) ELECTRICAL ABSOLUTE RATINGS

Vss=0V

	SYMBOL	MIN	MAX	UNIT	COMMENT
Power Supply for Logic	VDD−VSS	−0.3	5.5	V	
Input Voltage	VI	−0.3	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 2,4		Note 3,4		Note 4,5		Note 4,6	

Note 2 Ta≦50°C : 85%RH max
Ta>50°C : Absolute humidity must be lower than the humidity of 85%RH at 50°C

Note 3 Ta at −20°C will be < 48hrs, at 70°C will be < 120hrs

Note 4 Background color changes slightly depending on ambient temperature. This phenomenon is reversible.

Note 5 Ta≦70°C : 75%RH max
Ta>70°C : Absolute humidity must be lower than the humidity of 75%RH at 70°C

Note 6 Ta at −30°C will be < 48hrs, at 80°C will be < 120hrs

3. ELECTRICAL CHARACTERISTICS

(VDD = 5V±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 (NORMAL TEMP. LCM)	VDD−V0	DUTY= 1/128 Bias= 1/12	0°C	18.4	19.4	–	V
			25°C	17.2	18.2	19.2	
			50°C	15.4	16.7	–	
Recommended LC Driving Voltage (WIDE TEMP. LCM)	VDD−V0		−20°C	16.8	17.2	17.6	V
			0°C	15.7	16.1	16.5	
			25°C	15.6	16.0	16.4	
			50°C	15.3	15.7	16.1	
			70°C	15.1	15.5	15.9	
Power Supply Current for LCM	IDD	VDD = 5.0V		17	22	29	mA
Power Supply Current for LED	ILED	VBL = 5.0V RBL = 0Ω		95	101	111	mA
Power Supply Current for EL	IEL	VBL = 110Vac 400Hz RBL = 0Ω		–	–	10	mA

4. OPTICAL CHARACTERISTICS

(FOR NORMAL TEMPERATURE MODE LCM)

AT Vop

ITEM / MODE		Cr(Contrast Ratio) 25℃ MIN.	Cr(Contrast Ratio) 25℃ TYP.	θ(Viewing Angle) 25℃ MIN.	θ(Viewing Angle) 25℃ TYP.	φ(Viewing Angle) 25℃ MIN.	φ(Viewing Angle) 25℃ TYP.
R	A	–	–	–	–	–	–
	C	–	7	–	60	–	28
	J	–	8	–	60	–	35
S	A	–	–	–	–	–	–
	C	–	6	–	50	–	25
	J	–	–	–	–	–	–
T	E	–	–	–	–	–	–
	G	–	–	–	–	–	–
NOTE		FIG 6		FIG 5			

NOTE :

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

AT φ=0° θ=0°

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

4-1. OPTICAL CHARACTERISTICS

(FOR WIDE TEMPERATURE MODE LCM)

AT Vop

ITEM / MODE		Cr(Contrast Ratio)		θ(Viewing Angle)		φ(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		FIG 6		FIG 5			

NOTE :

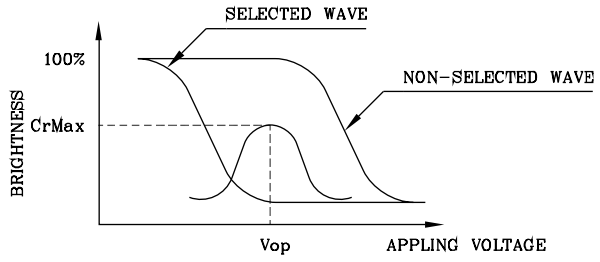
R: REFLECTIVE
S: TRANSFLECTIVE
T: TRANSMISSIVE
A: GRAY
C: YELLOW
E: BLUE
G: NORMALLY BLACK
J: NORMALLY WHITE

AT ø=0° θ=0°

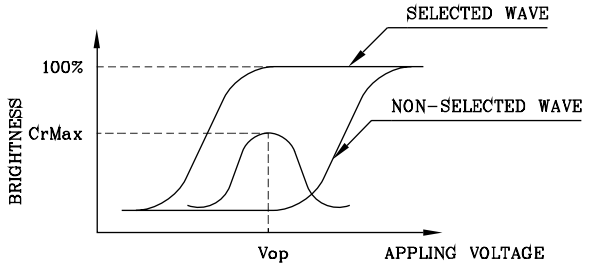
ITEM	SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNIT	NOTE
Response Time (rise)	Tr	-20℃	–	1620	2400	ms	FIG 2
		0℃	–	350	520		
		25℃	–	120	180		
		50℃	–	70	105		
		70℃	–	55	80		
Response Time (fall)	Tf	-20℃	–	1330	2000	ms	FIG 2
		0℃	–	640	900		
		25℃	–	200	300		
		50℃	–	80	120		
		70℃	–	35	50		

(FIG 1)

Definition of Operation Voltage(Vop)



(positive type)



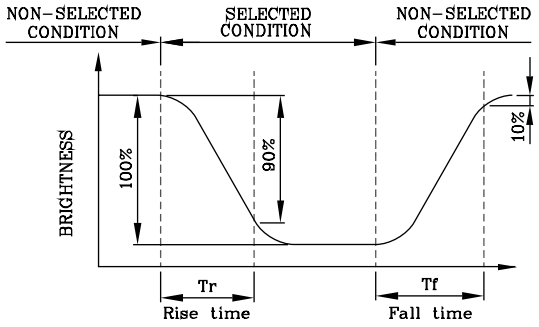
(negative type)

*Conditions

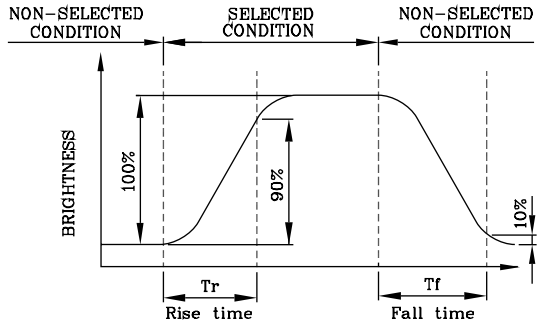
Viewing Angle : 0
Frame Frequency : 70Hz
Appling Waveform : I/N duty 1/a bias

(FIG 2)

Definition of Response Time(Tr,Tf)



(positive type)



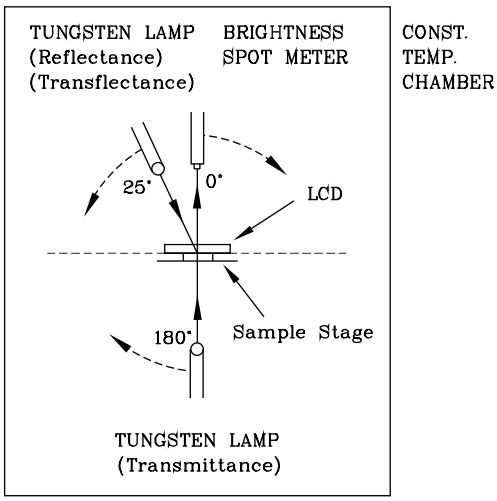
(negative type)

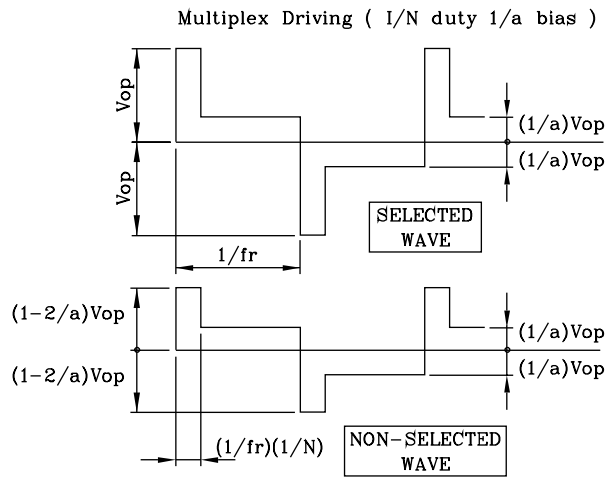
*Conditions

Operating Voltage : Vop
Viewing Angle (θ,ϕ) : (0,0)
Frame Frequency : 70Hz
Appling Waveform : I/N duty 1/a bias

(FIG 3)

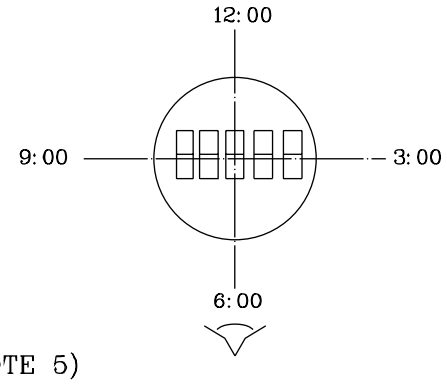
Description of Measuring Equipment and Driving Waveforms





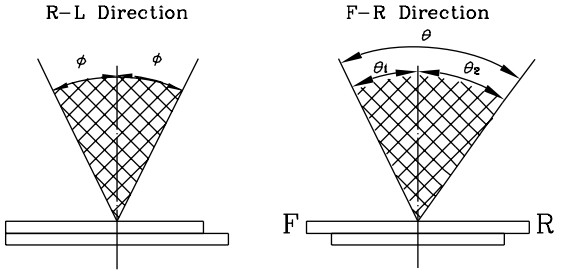
(NOTE 4)

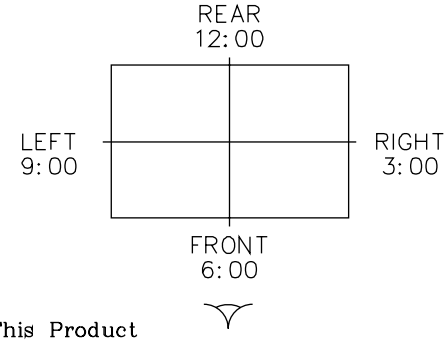
Definition of Viewing Direction



(NOTE 5)

Definition of Viewing Angle





*For This Product

The Viewing Direction Is 6 O'clock

So $\theta 1 > \theta 2$

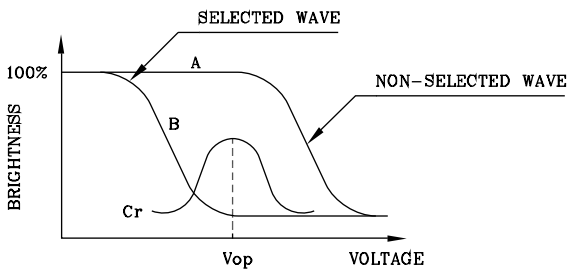
$$\theta = \theta_1 + \theta_2$$

*Conditions

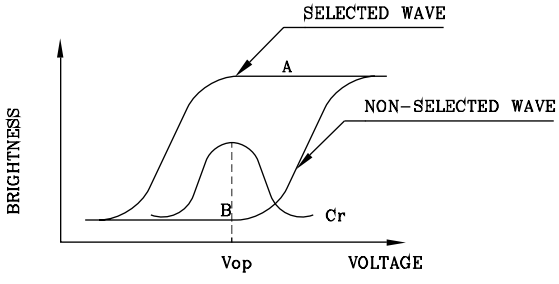
Operating Voltage : Vop
Frame Frequency : 70Hz
Appling Waveform : 1/N duty 1/a bias
Contrast Ratio : larger than 2

(NOTE 6)

Definition of Contrast Ratio (Cr)



(positive type)



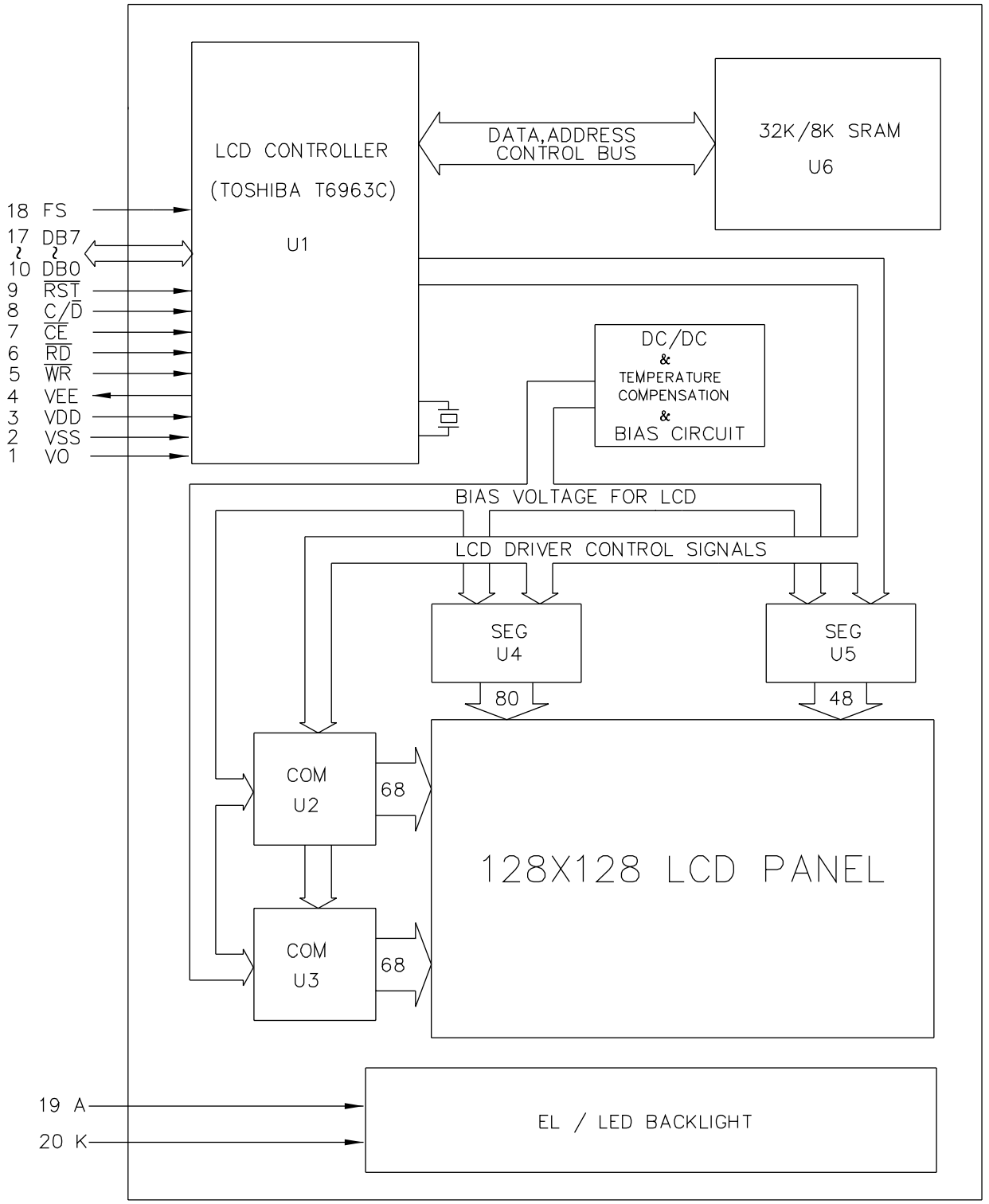
(negative type)

Contrast Ratio : Cr=A/B

*Conditions

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

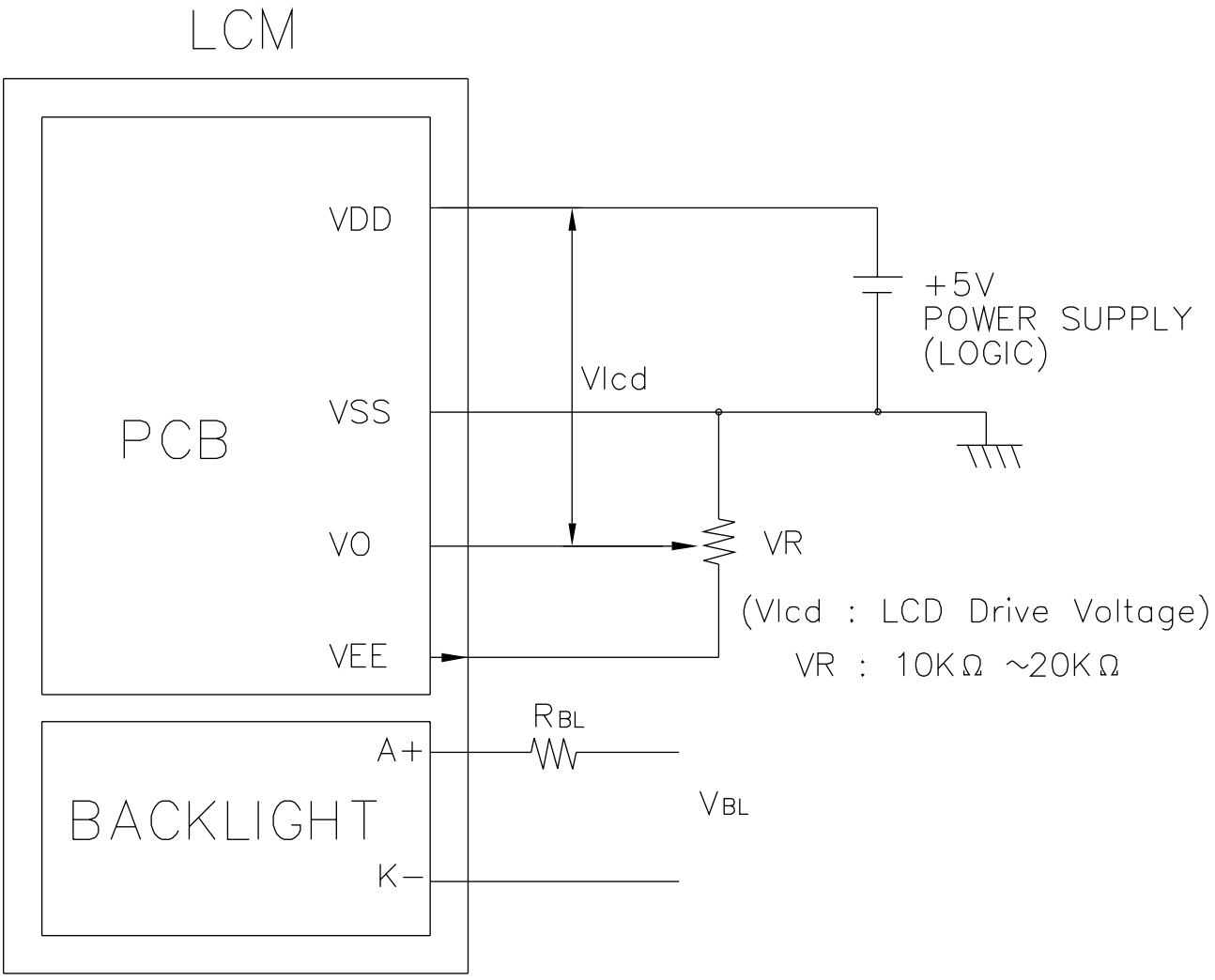
5. BLOCK DIAGRAM



6. INTERNAL PIN CONNECTION

No	Symbol	Function	
1	Vo	Adjust LCD Contrast	
2	VSS	0V	Ground
3	VDD	+5V	Power Supply for Logic
4	VEE	LCD Contrast Voltage Output	
5	$\overline{WR}$	L	Data Write
6	$\overline{RD}$	L	Data Read
7	$\overline{CE}$	L	Chip Enable
8	C/$\overline{D}$	H/L	H=Command ; L=Data
9	$\overline{RST}$	L	Reset
10	DB0	H/L	(LSB)
11	DB1	H/L	Data Bus
12	DB2	H/L	
13	DB3	H/L	
14	DB4	H/L	
15	DB5	H/L	
16	DB6	H/L	
17	DB7	H/L	(MSB)
18	FS	H/L	Font Select
19	A(+)	Power Supply for LED/EL	
20	K(−)	Power Supply for LED/EL	

7. POWER SUPPLY



Recommended Value for V_{BL} and R_{BL}

ITEM / B.L. / VALUE	V_{BL}	R_{BL}
LED	5V	0Ω
EL	110VAC 400HZ	0Ω

8. TIMING CHARACTERISTICS

8-1. INTERFACE TIMING

ITEM	ITEM	CONDITION	MIN.	MAX.	UNIT
C/$\overline{D}$ SET UP TIME	t_{CDS}	Fig.	100	–	ns
C/$\overline{D}$ HOLD TIME	t_{CDH}	Fig.	10	–	ns
$\overline{CE}$,$\overline{RD}$,$\overline{WR}$ 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

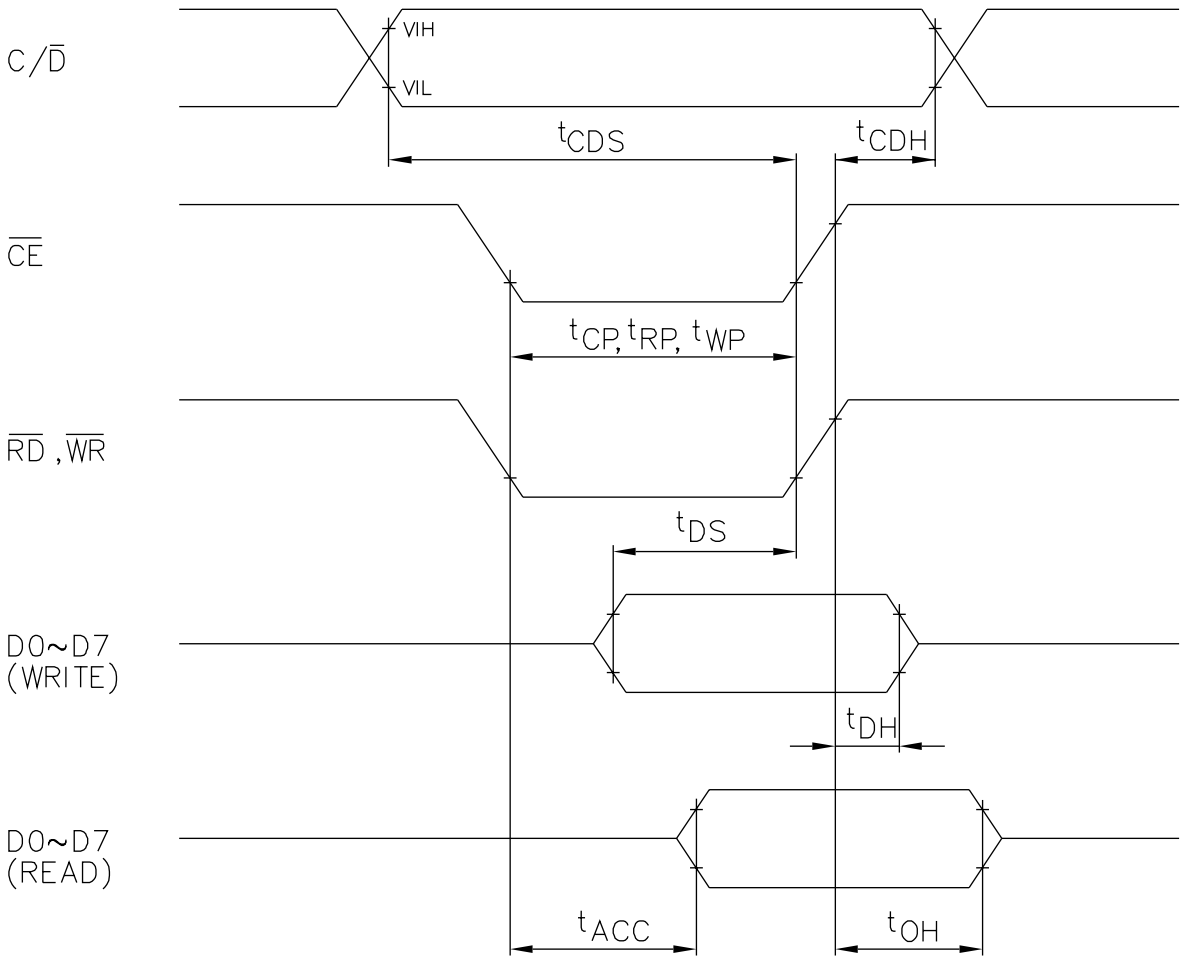
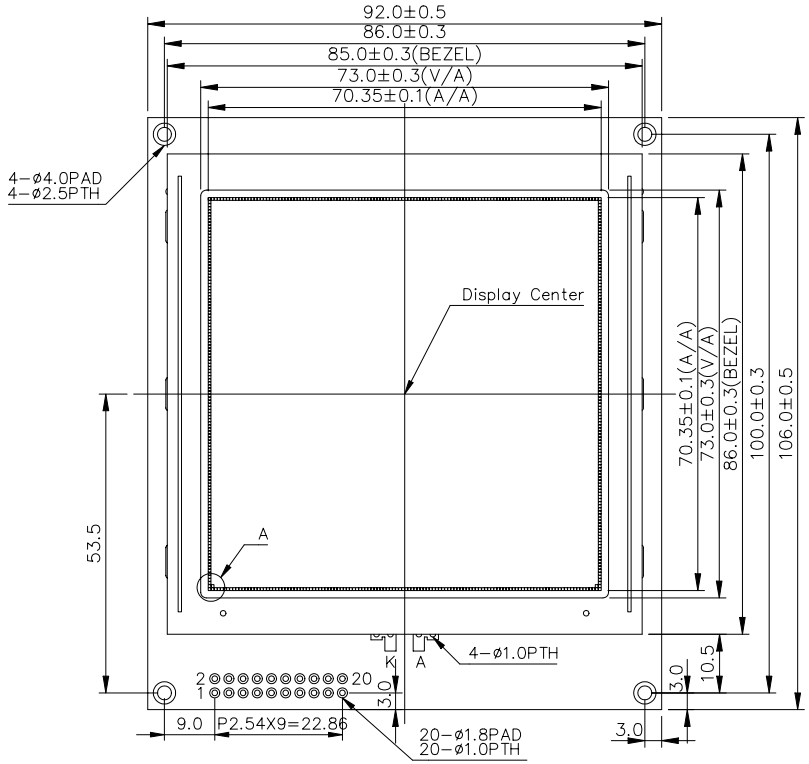
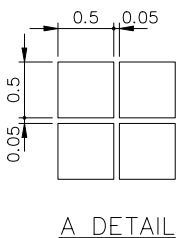


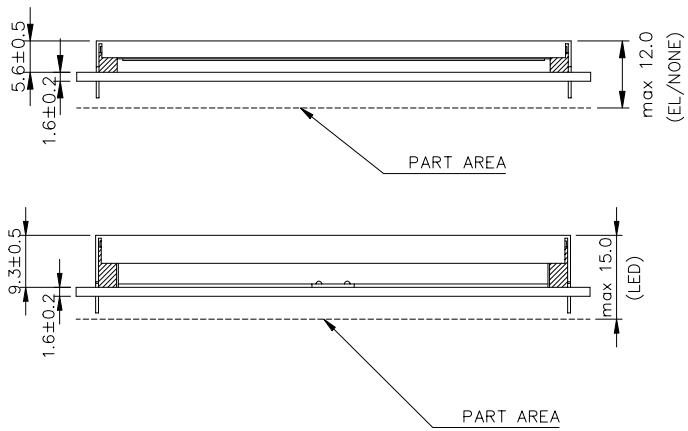
Fig. INTERFACE TIMING CHART

No	Symbol	Function	
1	Vo	Adjust LCD Contrast	
2	VSS	0V	Ground
3	VDD	+5V	Power Supply for Logic
4	VEE	LCD Contrast Voltage Output	
5	$\overline{WR}$	L	Data Write
6	$\overline{RD}$	L	Data Read
7	$\overline{CE}$	L	Chip Enable
8	C/$\overline{D}$	H/L	H=Command ; L=Data
9	$\overline{RST}$	L	Reset
10	DB0	H/L	(LSB)
11	DB1	H/L	
12	DB2	H/L	
13	DB3	H/L	
14	DB4	H/L	Data Bus
15	DB5	H/L	
16	DB6	H/L	
17	DB7	H/L	(MSB)
18	FS	H/L	Font Select
19	A(+)	Power Supply for LED/EL	
20	K(−)	Power Supply for LED/EL	





A DETAIL



NOTE :

1. RESOLUTION : 128 X 128 Dots
2. GENERAL TOLERANCE : ±0.5mm
3. LOGIC VOLTAGE : 5V
4. CONTROLLER : T6963C
5. BACKLIGHT : LED AND EL/NONE
6. DC TO DC : Built−in
7. Temp. Comp. CKT : Built−in

	AGM1212E		AZ DISPLAYS, INC.		
	NAME	DATE			
APPROVE		5-23-00	TITLE		
CHECK			DWG−NO	MX−X193X	Rev.A
DESIGN			THIRD ANGLE PROJECT	UNIT : mm	
DRAW				SCALE :	