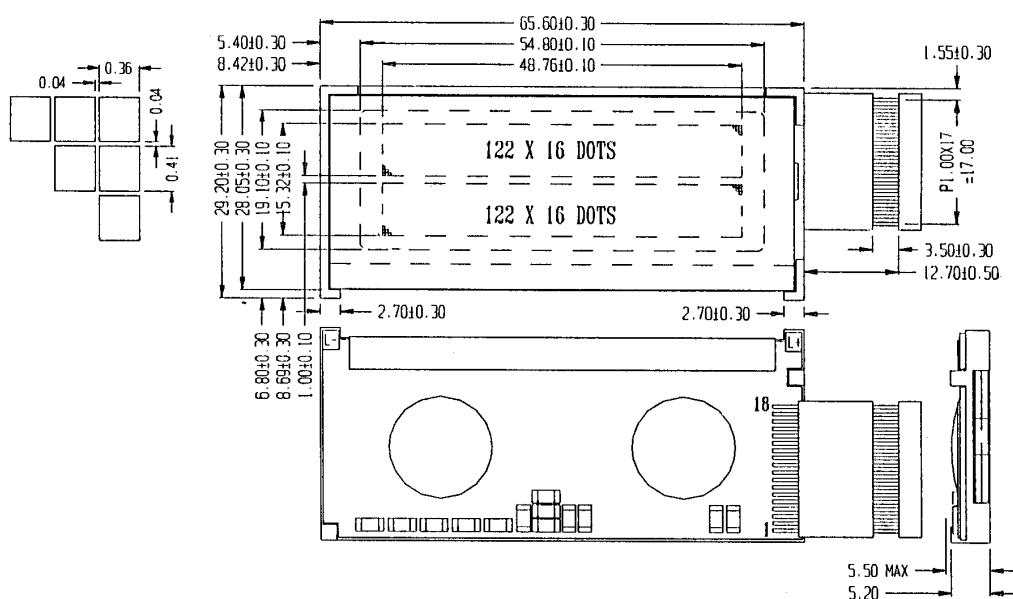


1. PHYSICAL DATA

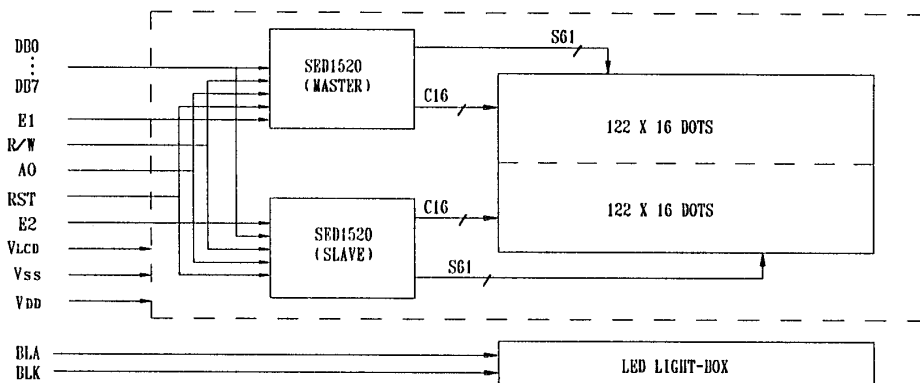
- 1.1 LCD TYPE : STN
- 1.2 VIEWING DIRECTION : 6 o'clock or 12 o'clock
- 1.3 MODULE SIZE : 65.6mm(2.58") L x 29.2mm(1.15") W x 5.5mm(0.22") H (Max.)
- 1.4 VIEWING AREA : 54.8mm(2.16") W x 19.1mm(0.75") H (Min.)
- 1.5 NUMBER OF DOTS : 122 x 32 Dots
- 1.6 DOT SIZE : 0.36mm(0.014") W x 0.41mm(0.016") H
- 1.7 DOT PITCH : 0.40mm(0.016") W x 0.45mm(0.018") H
- 1.8 LCD DUTY : 1/32, LCD BIAS : 1/5

2. EXTERNAL DIMENSIONS



3. BLOCK DIAGRAM

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
V _{DD}	V _{SS}	V _{LCD}	RST	E1	E2	R/W	A0	DB0	DB1	DB2	DB3	DB4	DB5	DB6	DB7	BLA	BLK



4. ABSOLUTE MAXIMUM RATINGS FOR LED BACK-LIGHT

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
LED Forward Consumption Current	I _f	T _a = 25°C, V _f = 2.25V	---	150	200	mA
LED Allowable Dissipation	P _d	V _f = 5.0V max	---	324	432	mW

5. ABSOLUTE MAXIMUM RATINGS

PARAMETER		SYMBOL	MIN.	MAX.	UNIT
Supply Voltage for Logic		V_{DD}	0	6.7	V
Supply Voltage for LCD		$V_{DD} - V_{Lcb}$	0	10.0	V
Input Voltage		V_I	0	V_{DD}	V
Normal Type	Operating temperature	T_{op}	0	+50	°C
	Storage temperature	T_{stg}	-10	+60	°C
Extended Type	Operating temperature	T_{op}	-20	+70	°C
	Storage temperature	T_{stg}	-30	+80	°C

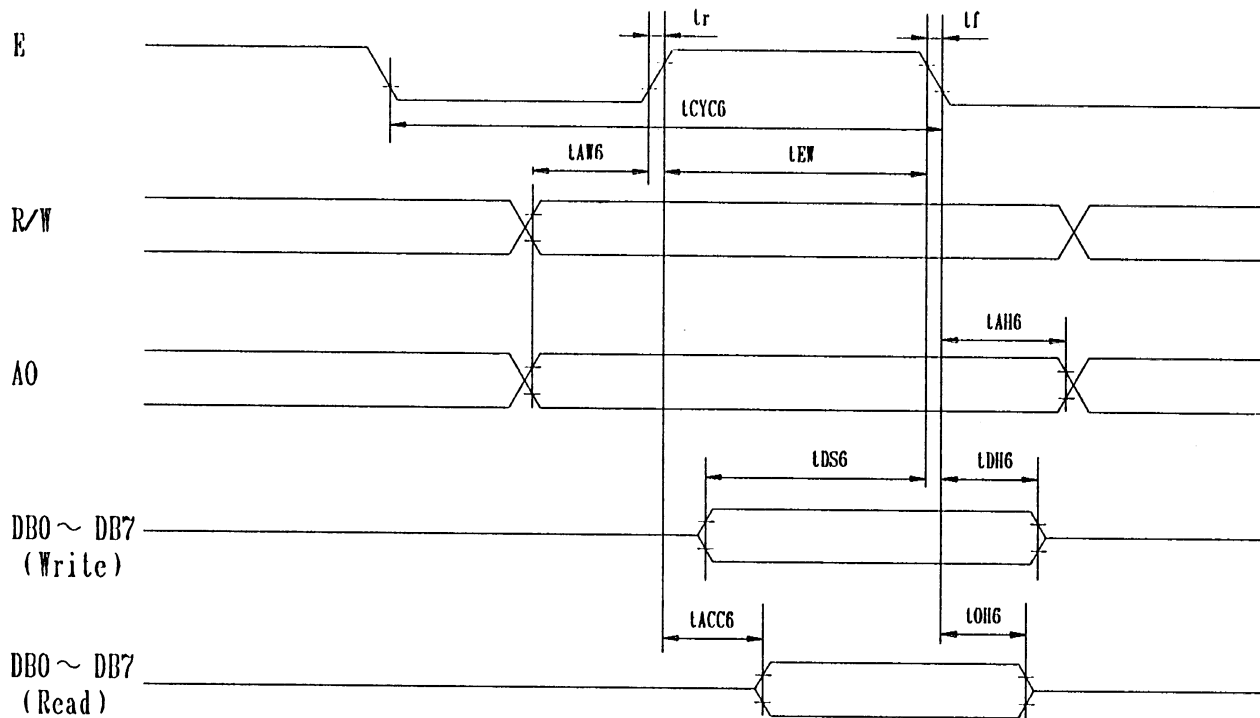
6. ELECTRICAL CHARACTERISTICS ($V_{DD} = 2.7V \sim 4.5V$, $V_{SS} = 0V$, $T_a = 25^\circ C$.)

6.1 DC characteristics

Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit
Supply Voltage	V_{DD}	---	2.7	3.0	4.5	V
Power Supply Current	I_{DD}	---	---	150	240	μA
LCD Power Supply Current	I_{LCD}	---	---	130	220	μA
Operating Voltage for LCD (Recommended)	$V_{DD} - V_{Lcb}$	0°C	---	5.7	---	V
		25°C	---	5.5	---	V
		50°C	---	4.9	---	V
Input Voltage 'H' Level	V_{IH}	---	0.8 V_{DD}	---	V_{DD}	V
Input Voltage 'L' Level	V_{IL}	---	0	---	0.2 V_{DD}	V

6.2 AC characteristics

Parameter	Symbol	Min.	Max.	Unit	Condition
System cycle time	t_{CYC6}	2000	---	ns	---
Address setup time	t_{AW6}	40	---	ns	---
Address hold time	t_{AH6}	20	---	ns	---
Data setup time	t_{DS6}	160	---	ns	---
Data hold time	t_{DH6}	20	---	ns	---
Output disable time	t_{OH6}	20	120	ns	$CL = 100pF$
Access time	t_{ACC6}	---	180	ns	$CL = 100pF$
Enable pulse width (read)	t_{EW}	200	---	ns	---
Enable pulse width (write)	t_{jW}	160	---	ns	---
Input wave form rise time	t_r	---	15	ns	---
Input wave form fall time	t_f	---	15	ns	---

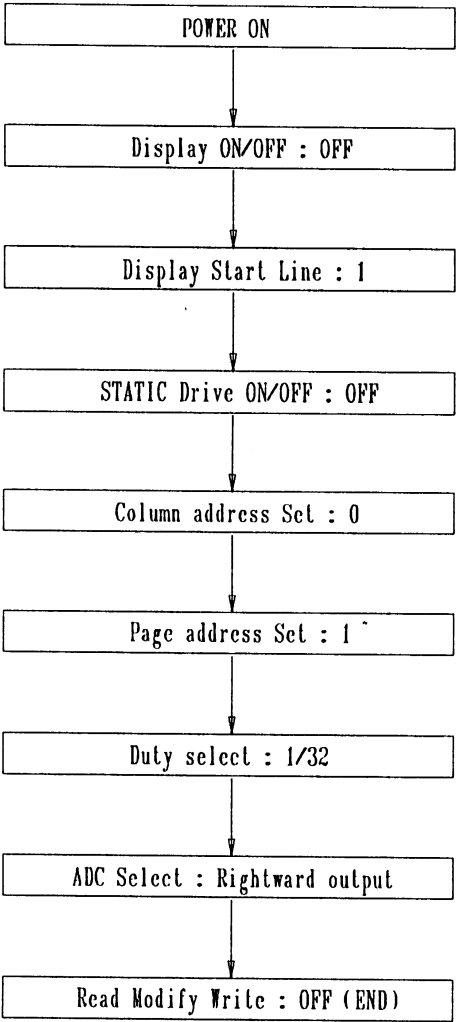


7. DISPLAY CONTROL INSTRUCTION

Command	R/W	A0	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0	Function
Display ON/OFF	0	0	1	0	1	0	1	1	1	0/1	Switches the entire display ON or OFF, regardless of the display RAM's data or the internal status. 1 : ON, 0 : OFF *1
Display Start Line	0	0	1	1	0	Display Start Address (0 ~ 31)					Determines the line of RAM data to be displayed at the display's top line (COM0).
Page Address Set	0	0	1	0	1	1	1	0	Page (0 ~ 3)		Sets the page of the Display RAM in the Page Address register.
Column Address Set	0	0	0	Column Address (0 ~ 79)							Sets the column of the Display RAM in the Column Address register.
Status Read	1	0	B U S Y	A D C	O N / O F F	R E S E T	0	0	0	0	Reads status. BUSY 0 : Ready 1 : Busy ADC 0 : Leftward output 1 : Rightward ON/OFF 0 : output 1 : Display ON RESET 0 : Display OFF 1 : Normal : Reset
Write Display Data	0	1	Display Data								Writes the data on the data bus to Display RAM. These commands access a previously-specified address of the display RAM, after which the column address is incremented by one.
Read Display Data	1	1	Display Data								Reads the data from the Display RAM onto the data bus. These commands access a previously-specified address of the display RAM, after which the column address is incremented by one.
ADC Select	0	0	1	0	1	0	0	0	0	0/1	Used to reverse the correspondence between the Display RAM's column address and segment driver output ports. 0 : Rightward output 1 : Leftward output
Static Drive ON/OFF	0	0	1	0	1	0	0	1	0	0/1	Selects normal display operation or static all-lit drive display operation. 0 : Normal display operation 1 : Static drive (Power save) *1
Duty Select	0	0	1	0	1	0	1	0	0	0/1	Select LCD duty cycle. 1: 1/32, 0: 1/16
Read Modify Write	0	0	1	1	1	0	0	0	0	0	Increments the column address counter by one only when display data is written but not when it is read.
End	0	0	1	1	1	0	1	1	1	0	Cancels the Ready Modify Write mode.
Reset	0	0	1	1	1	0	0	0	1	0	Resets the Display Start Line to the 1st line in the register. Resets the column address counter to 0 and page address register to 3.

*1. Power Save Mode is entered by selecting static drive in the Display OFF status.

8. INITIALIZATION



RES :  (with MPU)

DB7.....DB0
10101110

DB7.....DB0
11000000

DB7.....DB0
10100100

DB7.....DB0
00000000

DB7.....DB0
10111011

DB7.....DB0
10101001

DB7.....DB0
10100000

DB7.....DB0
11101110

9. DISPLAY DATA RAM ADDRESS MAP

Page	DATA		Com No.	Driver
2	DB0 ⋮ DB7	1 2 2 X 1 6 P i x e l s	0 ↓ 15	Slave
3	DB0 ⋮ DB7			
0	DB0 ⋮ DB7	1 2 2 X 1 6 P i x e l s	16 ↓ 31	Master
1	DB0 ⋮ DB7			
Column Addr.	ADC=0	00 ————— 3C	00 ————— 3C	
	Seg No.	0 ————— 60	0 ————— 60	
	Driver	Master	Slave	

INTERFACE PIN CONNECTIONS

PIN NO.	SYMBOL	LEVEL	DESCRIPTION
1	V _{DD}	3.0V	Supply voltage for logic and LCD (+)
2	V _{SS}	0V	Ground
3	V _{LCD}	---	Operating voltage for LCD (variable)
4	RST	L → H	Reset the System
5	E1	H	Read/Write enable signal (Master)
6	E2	H	Read/Write enable signal (Slave)
7	R/W	H/L	H : Read (MPU ← Module), L : Write (MPU → Module)
8	A0	H/L	H : Data, L : Instruction code
9	DB0	H/L	Data bit 0
10	DB1	H/L	Data bit 1
11	DB2	H/L	Data bit 2
12	DB3	H/L	Data bit 3
13	DB4	H/L	Data bit 4
14	DB5	H/L	Data bit 5
15	DB6	H/L	Data bit 6
16	DB7	H/L	Data bit 7
17	BLA	---	Back-Light Anode
18	BLK	---	Back-Light Cathode