ORIENT DISPLAY

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LCD MODULE SPECIFICATIONS

DM2004A-D-BSNTD-00

20 CHARACTERS X 4 LINES
BLUE MODE STN
VIEWING ANGLE: 6H
WHITE LED BACKLIGHT
OVERALL SIZE: 98.0X60.0X13.0MM

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REVISION RECORD

REV	DATA	PAGES	DESCRIPTION

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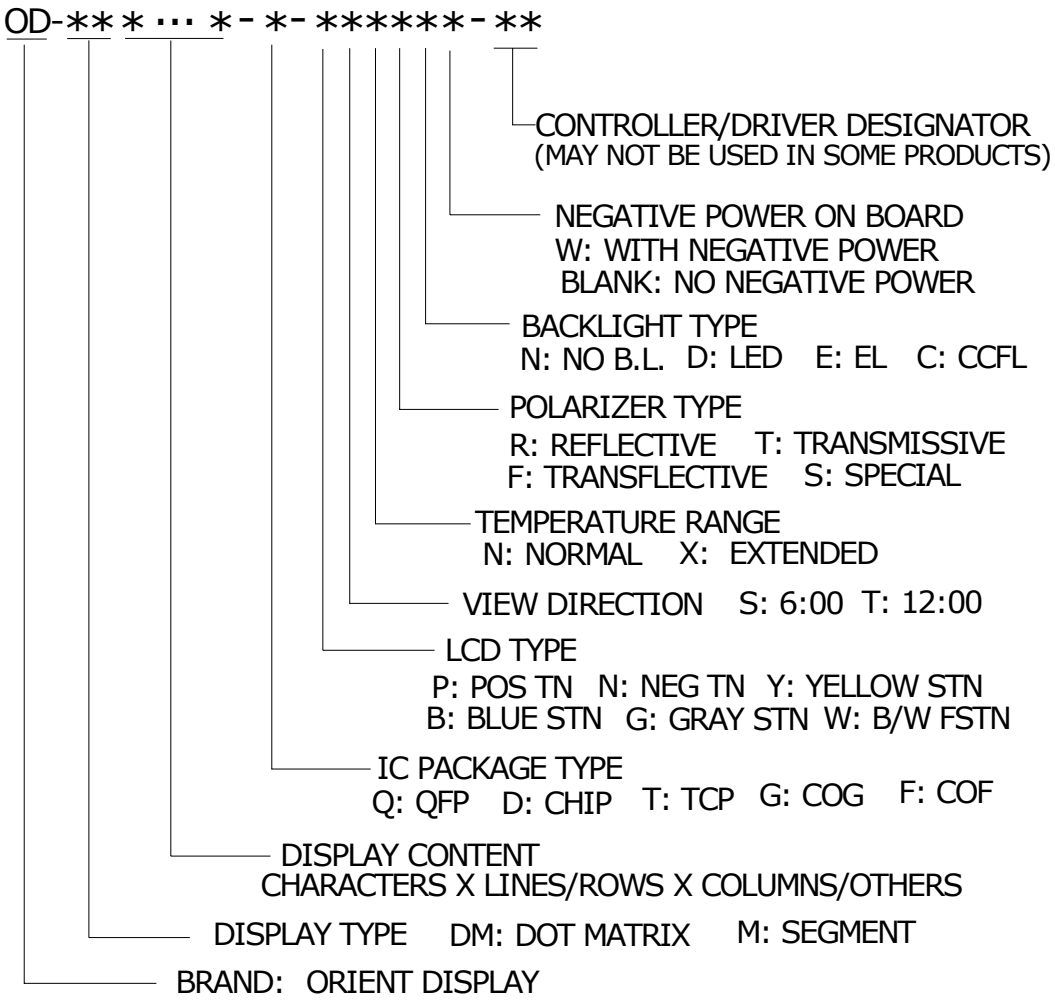
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1. TYPE NUMBER AND DESCRIPTION

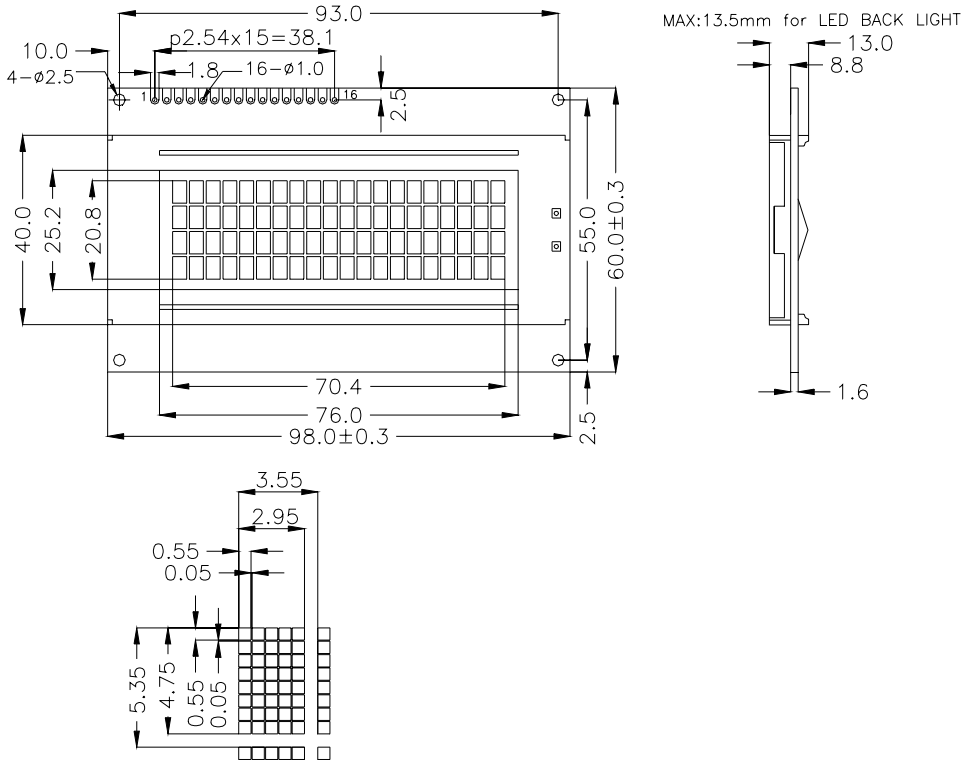
Type Number:	DM2004A-D-BSNTD-00
Description:	20 Characters X 4 Lines
LCD Panel:	Blue Mode STN
Viewing angle:	6H
Backlight:	White 3.1V
Controller:	KS0066U-00 or equivalent

2. LCD MODULE NUMBERING SYSTEM



3. MECHANICAL SPECIFICATIONS:

ITEM	STANDARD VALUE	UNIT
NUMBER OF CHARACTERS	20 CHARACTERS X 4 LINES	
CHARACTER FORMAT	5 X 7 DOTS with CURSOR	
MODULE DIMENSION	98.0(W) X 60.0(H) X 13.0(T)	mm
EFFECTTVE DISPLAY AREA	76.0(W) X 25.2(H)	mm
CHARACTER SIZE	2.95(W) X 4.75(H)	mm
CHARACTER PITCH	3.55(W) X 5.35(H)	mm
DOT SIZE	0.55(W) X 0.55(H)	mm
DOT PITCH	0.60(W) X 0.60(H)	mm
APPROX WEIGHT	74G	g
LCD TYPE	STN (Blue mode)	
DUTY AND BIAS	1/16 DUTY; 1/5 BIAS	
VIEWING DIRECTION	6:00	
BACK LIGHT	WHITE LED	

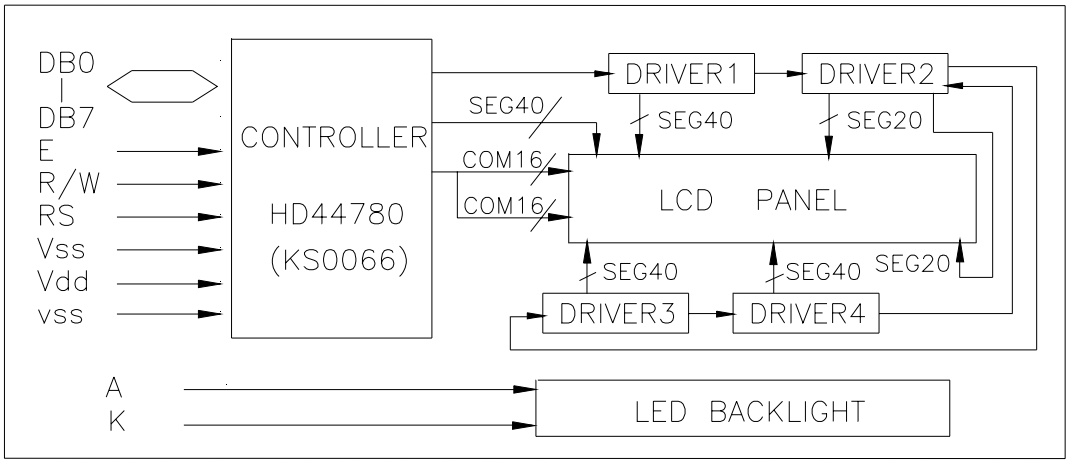


4. ELECTRICAL BLOCK DIAGRAM/PINS FUNCTION/ADDRESS CODE

4.1 PINS DEFINITION

PIN	SYMBOL	FUNCTION
1	Vss	Power Supply(GND)
2	Vdd	Power Supply(+5V)
3	Vo	Contrast Adjust
4	RS	Instruction/Data Register Select
5	R/W	Data Bus Line
6	E	Enable Signal
7-14	DB0-DB7	Data Bus Line
15	A	Power Supply for LED B/L(+)
16	K	Power Supply for LED B/L(-)

4.2 ELECTRICAL BLOCK DIAGRAM



4.3 DISPLAY CHARACTER ADDRESS CODE

DISPLAY POSITION	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
DDRAM ADDRESS	00	01	02	03	04	05	06	07	08	09	0A	0B	0C	0D	0E	0F	10	11	12	13
	40	41	42	43	44	45	46	47	48	49	4A	4B	4C	4D	4E	4F	50	51	52	53
	14	15	16	17	18	19	1A	1B	1C	1D	1E	1F	20	21	22	23	24	25	26	27
	54	55	56	57	58	59	5A	5B	5C	5D	5E	5F	60	61	62	63	64	65	66	67

5. ABSOLUTE MAXIMUM RATINGS

5.1 Electrical Maximum Ratings (Ta=25deg C)

ITEM	SYMBOL	CONDITION	MIN	MAX	UNIT
Supply Voltage (Logic)	Vdd – Vss	-	0	7.0	V
Supply Voltage (LCD Drive)	Vdd – V0	-	0	11.5	V
Input Voltage	Vi	-	-0.3	Vdd +0.3	V

5.2 Environmental Conditions

ITEM	SYMBOL	CONDITION	MIN	MAX	UNIT
Operating Temp	Topr	-	0	50	deg C
Storage Temp	Ttsg	-	-10	60	deg C
Humidity Endurance	RH	no ondensation Ta</=40 deg	-	95	%
Vibration	-	3 directions	see note (a), page 3		-
Shock	-	3 directions	see note (b), page 3		-

note (a): frequency : varying from 10 Hz in a 1-minute cycle
amplitude : 1.5mm
duration : 120 cycles, each lasting 1 minute,
for each of the 3 directions, x,y,z

note (b): nutually perpendicular directions
direction normal to surface of LCD glass
80G, half-sine pulse of duration 11ms
other 2 directions
100G, half-sine pulse of duration 11ms

6. ELECTRICAL SPECIFICATIONS

6.1 Electrical Characteristics at Ta=25 deg C, Vdd = 5V + / - 5%

ITEM	SYMBOL	CONDITION	MIN	TYP	MAX	UNIT
Supply Voltage (logic)	Vdd-Vss	-	4.5	5	5.5	V
Supply Voltage (LCD)	Vdd-V0	Vdd = 5V	4.12	4.7	5.12	V
Input signal voltage (for E, DB0-7,R/W,RS)	V-ih	"H" level	2.2	-	Vdd	V
	V-il	"L" level	0	-	0.6	V
Supply Current (logic)	Icc	-	0.9	1	1.2	mA
Supply Current (LCD)	Io	-	0.15	0.22	0.27	mA
Supply Voltage (LED)	V-bl	see note 1	-	3.1	3.2	V
Supply Current (LED)	I-bl	see note 1	-	40	75	mA

6.2 TIMING SPECIFICATIONS at Ta = 25 deg C, Vdd = 5V+/-10%, Vss =0V

6.2.1Write mode

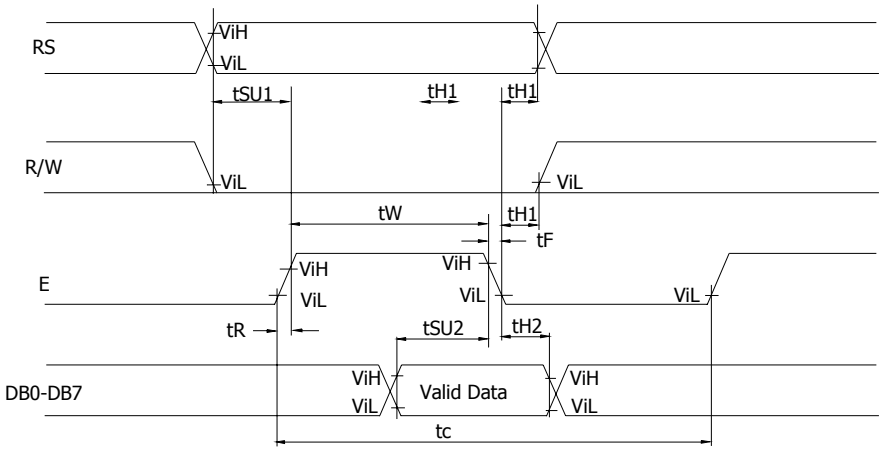
ITEM	SYMBOL	MIN	MAX	UNIT
E cycle time	tc	500	-	ns
E rise time	tR	-	25	ns
E fall time	tF	-	25	ns
E-pulse width (H, L)	tw	220	-	ns
R/W and RS set-up time	tsul	40	-	ns
R/W and RS hold time	tH1	10	-	ns
Data set-up time	tsu2	60	-	ns
Data hold time	tH2	10	-	ns

6.2.2 Read mode

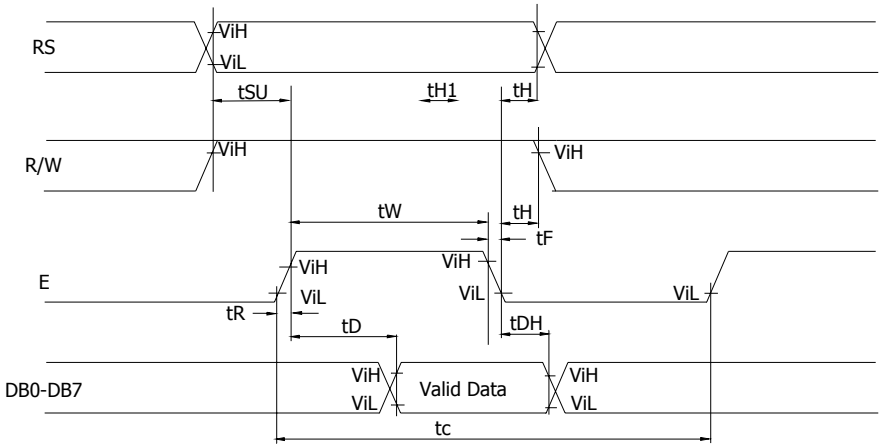
ITEM	**SYBOL**	**MIN**	**MAX**	**UNIT**
E cycle time	tc	500	-	ns
E rise time	tR	-	25	ns
E fall time	tF	-	25	ns
E-pulse width (H, L)	tw	220	-	ns
R/W and RS set-up time	tsu	40	-	ns
R/W and RS hold time	tH	10	-	ns
Data output delay	tD	-	120	ns
Data hold time	tDH	20	-	ns

6.2.3 TIMING DIAGRAM

WRITE MODE TIMING DIAGRAM

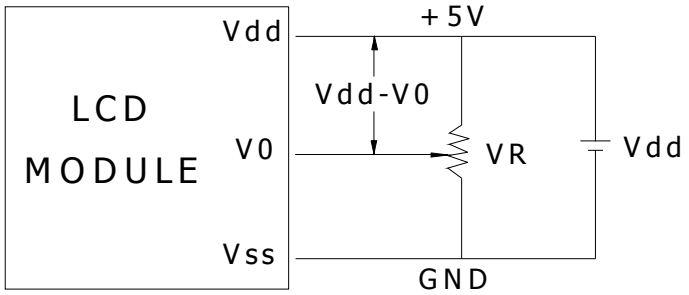


READ MODE TIMING DIAGRAM



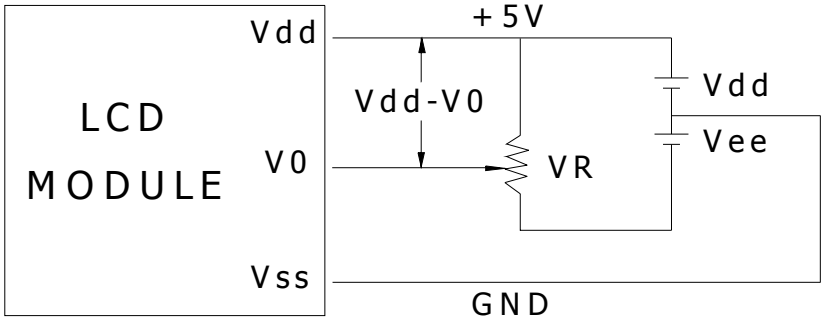
7. POWER SUPPLY FOR LCD MODULE

7.1 SINGLE SUPPLY VOLTAGE TYPE



Vdd-V0: LCD Driving Voltage
VR: 10K - 20K

7.2 DUAL SUPPLY VOLTAGE TYPE



Vdd-V0: LCD Driving Voltage
VR: 10K - 20K

8. ELECTRO-OPTICAL CHARACTERISTIC

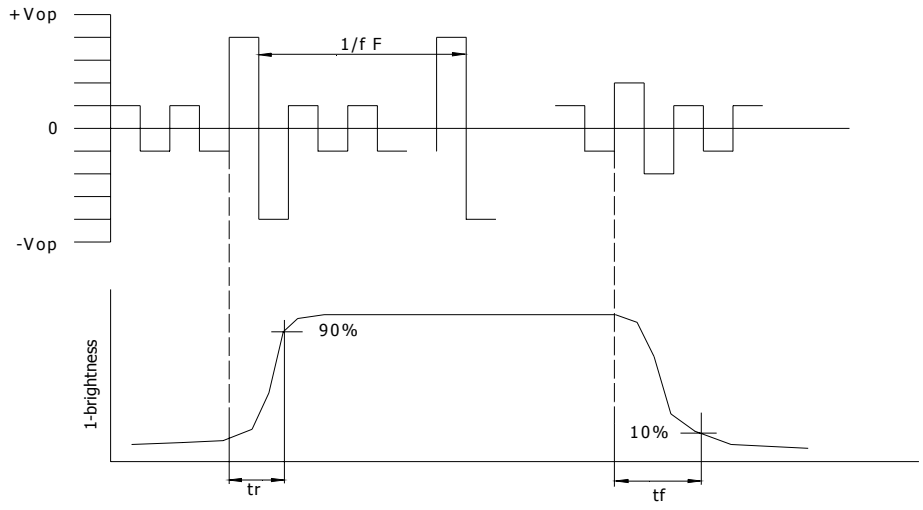
ITEM	SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNIT	REF.
Contrast	CR	25℃	--	12	--		Note1
Rise Time	tr	25℃	--	160	240	ms	Note2
Fall Time	tf	25℃	--	100	150	ms	note 2
Viewing Angle	θ 1- θ 2	25℃	--	--	60	DEG	Note 3
	Ø1, Ø2		-40	--	40		
Frame Frequency	Ff	25℃	--	70	--	Hz	note 2

Note(3): Contrast ratio is defined under the following condition:

CR= brightness of non-selected condition
brightness of non-selected condition

(a). Temperature----------25C
(b). Frame Frequency------64Hz
(c). Viewing angle---------- θ =0, Ø=0
(d). Operating Voltage---5.0V

Note(1): definition of response time:

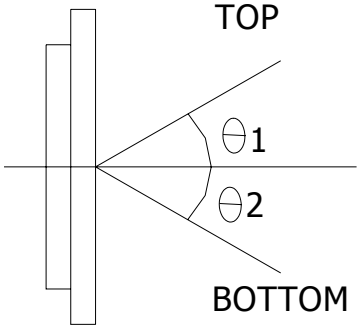


Condition:

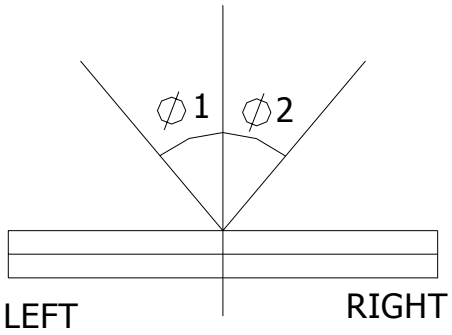
(a). Temperature----------25C
(b). Frame Frequency------64Hz
(c). Viewing angle---------- θ =0, Ø=0
(d). Operating Voltage---5.0V

Note(2): definition of view angle:

TOP-BOTTOM DIRECTION



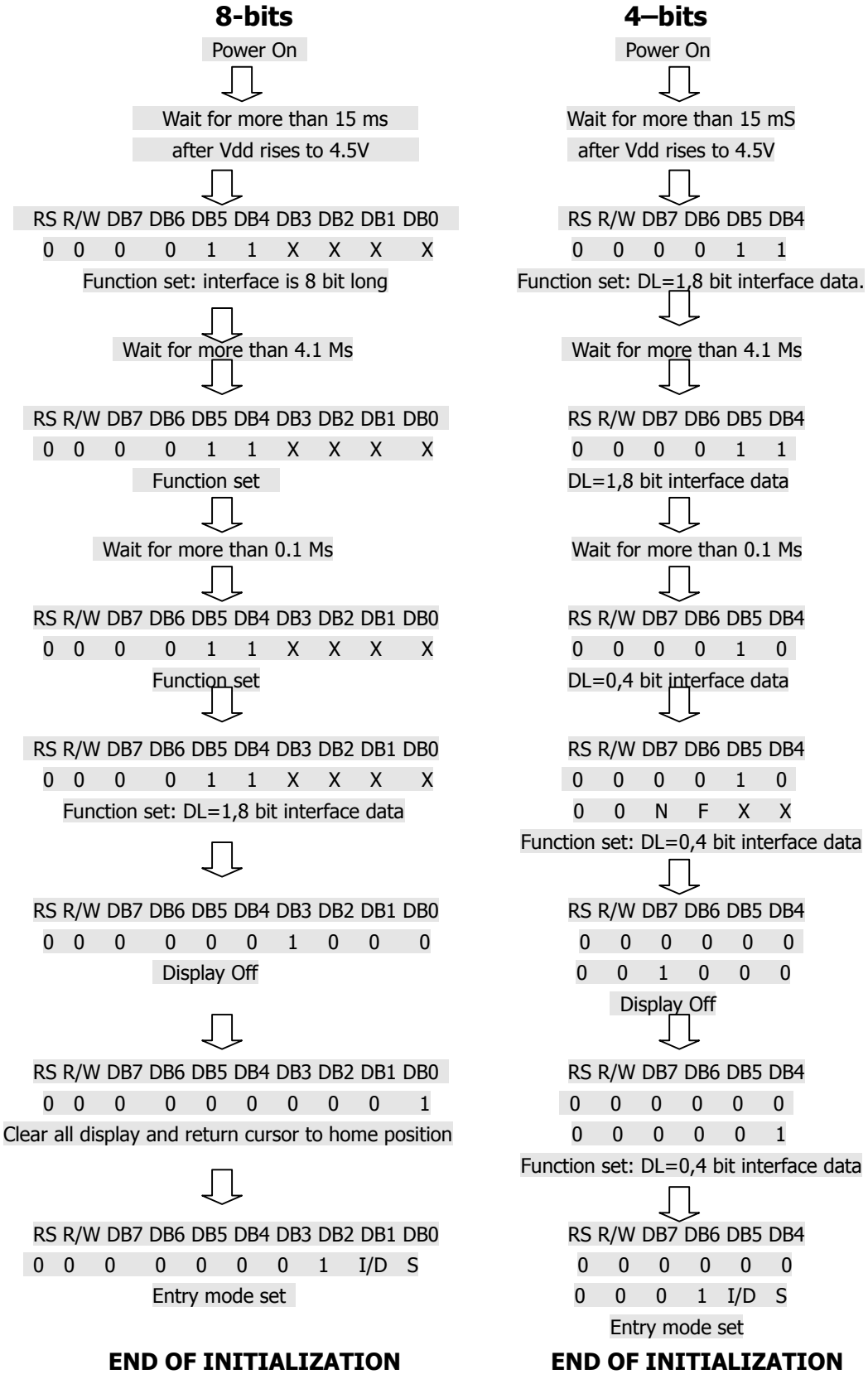
RIGHT-LEFT DIRECTION



9. INSTRUCTION TABLE

Function	RS	RW	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0	Description	Execu Time* (Max)
Clear Display	0	0	0	0	0	0	0	0	0	1	Clears entire display and returns the cursor to home position (address 0)	1.64mS
Return Home	0	0	0	0	0	0	0	0	1	X	Return the cursor to the home position. DD RAM contents remain unchanged. Set DD RAM address to zero.	1.64mS
Entry mode set	0	0	0	0	0	0	0	1	1/D	S	Set cursor moving direction and enable the shift of the display. These operations are performed during data write/read of DD RAM/CG RAM. 1/D=1: increment; 1/D=0: decrement; S=1: whole display shift when data is written.	40 μ S
Display ON/OFF control	0	0	0	0	0	0	1	D	C	B	Set display (D),cursor(C) and blinking of cursor(B) ON/OFF. D=1:display ON; D=0: display OFF. C=1:Cursor ON; C=0:cursot OFF. B=1:Blink ON; B=0, Blink OFF.	40 μ S
Cursor or Display shift	0	0	0	0	0	1	S/C	R/L	X	X	Move the cursor and shift the display without changing DDRAM contents. S/C=1: Display Shift; S/C=0:Cursor move. R/L=1:shift to right; R/L=0:shift to left.	40 μ S
Function Set	0	0	0	0	1	DL	N	F	X	X	Set interface data length (DL), number of display lines (N) and character font (F).DL=1: 8 bits; DL=0: 4 bits. N=1: 2 lines; N=0: 1 lines. F=1: 5X11 dots; F=0: 5X7 dots.	40 μ S
Set CG RAM add	0	0	0	1	ACG						Set CG RAM address. CG RAM data is sent and received after this setting.	40 μ S
Set DD RAM Add	0	0	1	ADD							Set DD RAM address. DD RAM data is sent and received after this setting.	40 μ S
Read BF & Addr	0	1	BF	AC							Read BUSY FLAG (BF) and the contents of the address counter. BF=1: internal operation; BF=0: can accept instruction.	0 μ S
Write Data to RAM	1	0	WRITE DATA								Write data into DD RAM or CG RAM.	40 μ S**
Read Data from RAM	1	0	READ DATA								Read data from DD RAM or CG RAM.	40 μ S**

10. INITIALIZATION BY INSTRUCTION



11. SOFTWARE EXAMPLES

8-BIT OPERATION 20 characters X 4 lines

Function	RS RW D7 D6 D5 D4 D3 D2 D1 D0	DISPLAY	DESCRIPTION
Power on delay			Initialization. No display appears.
Function set	0 0 0 0 1 1 0 0 X X		Sets 8-bit operation, 2-line display and 5*7 dots character font.
Display OFF	0 0 0 0 0 0 1 0 0 0		Turn off display.
Display ON	0 0 0 0 0 0 1 1 1 0		Turn on display and cursor.
Entry Mode set	0 0 0 0 0 0 0 1 1 0		Set mode to increment the address by one and to shift the cursor to the right, at the time of write to the DD/CG RAM. Display is not shifted.
Write data to CG/DD RAM	1 0 0 1 0 0 1 1 1 1	O	Write "O". Cursor incremented by one and shift to right.
Write data to CG/DD RAM	1 0 0 1 0 1 0 0 1 0	OR	Write "R". Cursor incremented by one and shift to right
Write data to CG/DD RAM	. . . . .	ORIENT	Write "I" "E" "N" "T".
Set DDRAM address	0 0 1 1 0 0 0 0 0 0	ORIENT	Set RAM address so that the cursor is positioned at the head of the Second line
Write data to CG/DD RAM	. . . . .	ORIENT DS	Write "D" "S".
Cursor or display shift	0 0 0 0 0 1 0 0 X X	ORIENT DS	Shift only the cursor position to the left.
Write data to CG/DD RAM	. . . . .	ORIENT DISPLAY	Write "I" "S" "P" "L" "A" "Y"
Set DDRAM address	0 0 0 0 0 1 0 1 0 0	ORIENT DISPLAY	Set RAM address so that the cursor is positioned at the head of the third line
Write data to CG/DD RAM	. . . . .	ORIENT DISPLAY CO.	Write "C" "O" "."
Write data to CG/DD RAM	. . . . .	ORIENT DISPLAY CO. LTD	Write "L" "T" "D"

4-bit operation (4-bits 1 line)

Function	RS RW D7 D6 D5 D4	Display	Description
power on delay			Initialization. No display appears.
Frnction set	0 0 0 0 1 0		Sets to 4 -bit operation. In this case, operation is handled as 8-bits by initialization,a nd Only this instruction completes with one write.
Frnction set	0 0 0 0 1 0 0 0 0 0 X X		Sets 4 -bit operation, 1-line display and 5*7 dot character font. (number of display lines and character fontscannot be changed hence after.)
Display ON/OFF Control	0 0 0 0 0 0 0 0 1 1 1 0	_	Turn on display and cursor.
Entry Mode Set	0 0 0 0 0 0 0 0 0 1 1 0	_	Turn on display and cursor.
Write data to CG/DD/ARM	1 0 0 1 0 0 1 0 1 1 1 1		Write "O". Curaor incrementer by one and shift to right.
same as 8-bit operation			

12. PRECAUTION FOR USING LCM

1. LIQUID CRYSTAL DISPLAY (LCD)

LCD is made up of glass, organic sealant, organic fluid, and polymer based polarizers. The following precautions should be taken when handing,

(1). Keep the temperature within range of use and storage. Excessive temperature and humidity could cause polarization degradation, polarizer peel off or bubble.

(2). Do not contact the exposed polarizers with anything harder than an HB pencil lead. To clean dust off the display surface. Wipe gently with cotton. Chamois or other soft material soaked in petroleum benzin.

(3). Wipe off saliva or water drops immediately. Contact with water over a long period of time may cause polarizer deformation or color fading, while an active LCD with water condensation on its surface will cause corrosion of ITO electrodes.

(4). Glass can be easily chipped or cracked from rough handing, especially at corners and edges.

(5). Do not drive LCD with DC voltage.

2. Liquid Crystal Display Modules

2.1 Mechanical Considerations

LCM are assembled and adjusted with a high degree of precision. Avoid excessive shocks and do not make any alterations or modifications. The following should be noted.

(1). Do not tamper in any way with the tabs on the tabs on the metal frame.

(2). Do not modify the PCB by drilling extra holes, changing its outline, moving its components or modifying its pattern.

(3). Do not touch the elastomer connector, especially insert an backlight panel (for example, EL).

(4). When mounting a LCM make sure that the PCB is not under any tress such as bending or twisting. Elastomer contacts are very delicate and missing pixels could result from slight dislocation of any of the elements.

(5). Avoid pressing on the metal bezel, otherwise the elastomer connector could be deformed and lose contact, resulting in missing pixels.

2.2. Static Electricity

LCM contains CMOS LSI's and the same precaution for such devices should apply, namely

(1). The operator should be grounded whenever he/she comes into contact with the module. Never touch any of the conductive parts such as the LSI pads, the copper leads on the PCB and the interface terminals with any parts of the human body.

(2). The modules should be kept in antistatic bags or other containers resistant to static for storage.

(3). Only properly grounded soldering irons should be used.

(4). If an electric screwdriver is used, it should be well grounded and shielded from commutator sparks.

(5). The normal static prevention measures should be observed for work clothes and working benches; for the latter conductive (rubber) mat is recommended.

(6). Since dry air is inductive to static, a relative humidity of 50-60% is recommended.

2.3. Soldering

(1). Solder only to the I/O terminals.

(2). Use only soldering irons with proper grounding and no leakage.

(3). Soldering temperature: 280 ℃±10℃

(4). Soldering time: 3 to 4 sec.

(5). Use eutectic solder with resin flux fill.

(6). If flux is used, the LCD surface should be covered to avoid flux spatters. Flux residue should be removed after wards.

2.4. Operation

(1). The viewing angle can be adjusted by varying the LCD driving voltage V0.

(2). Driving voltage should be kept within specified range; excess voltage shortens display life.

(3). Response time increases with decrease in temperature.

(4). Display may turn black or dark blue at temperatures above its operational range; this is (however not pressing on the viewing area) may cause the segments to appear "fractured".

(5). Mechanical disturbance during operation (such as pressing on the viewing area) nay cause the segments to appear "fractured".

2.5. Storage

If any fluid leaks out of a damaged glass cell, wash off any human part that comes into contact with soap and water. Never swallow the fluid. The toxicity is extremely low but caution should be exercised at all the time.

2.6. Limited Warranty

Unless otherwise agreed between Orient Display and customer, Orient Display will replace or repair any of its LCD and LC, which is found to be defective electrically and visually when inspected in accordance with Orient Display acceptance standards, for a period on one year from data of shipment. Confirmation of such date shall be based on freight documents. The warranty liability of Orient Display is limited to repair and/or replacement on the terms set forth above. Orient Display will not responsible for any subsequent or consequential events.