



SPEC. NO	
ISSUED DATE	

CUSTOMER	:	
M O D E L	:	OCM-20416B-A0000
DESCRIPTION	:	LCD MODULE

THIS SPECIFICATION IS APPLIED FOR LCD MODULE DELIVERED TO YOUR COMPANY BY ORION DISPLAY TECHNOLOGY CO., LTD

◆ CUSTOMER APPROVAL


	CHECKED	CHECKED	APPROVAL
APPROVAL			
REMARK			

◆ SUPPLIER APPROVAL

PREPARED	CHECKED		APPROVAL

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NOTE: When using this specification, the reader should keep the followings in mind.

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## 1. FEATURES

OCM-20416B-A0000 is a low-power consumption dot-matrix liquid crystal display ( LCD ) module with a built-in controller. The controller has a built-in CG ROM, CG RAM for user's patterns and DD RAM. All the display functions are controlled by instructions and the module can be easily interfaced with a MPU.

- Driving method : 1/16 duty
- Display type : STN-Yellow mode, Reflective, 06 o'clock, positive.
- Capable of interfacing to 4-bit or 8-bit MPU.
- Instruction functions are available by programming
  - display clear , cursor home , display ON/OFF , cursor ON/OFF
  - display character blink , display shift , cursor shift
- Internal automatic reset circuit at power on.
- Internal oscillation circuit.
- Built in memory capacity
  - CG ROM ( character generator ROM )
    - 160 characters with 5x7 dots and
    - 32 characters with 5x10 dots
  - CG RAM ( character generator RAM )
    - 8 characters with 5x7 dots or
    - 4 characters with 5x10 dots
  - DD RAM ( display data RAM ) — Max. 80 characters ( 80 X 8 bits )
- Operating temperature : Outdoor
- Controller IC : KS0066UPCC or Equivalent ( Bare chip )
- Driver IC : KS0065BPCC or Equivalent ( Bare chip )

## 2. MECHANICAL DATA

ITEM		WIDTH	HEIGHT	THICKNESS	UNIT
Module size		98.0	60.0	10.0	mm
Viewing area		76.0	25.2	-	mm
Character	Construction	5 x 7			dots
	Size	2.95	4.15	-	mm
	Pitch	3.55	5.35	-	mm
Dot	Size	0.55	0.55	-	mm
	Pitch	0.60	0.60	-	mm
Diameter of mounting hole		2.5			mm
Weight		About 50			g


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### 3. ABSOLUTE MAXIMUM RATINGS

ITEM	SYMBOL	CONDITION	STANDARD VALUE		UNIT
			MIN.	MAX.	
Power supply for logic	$V_{DD}-V_{SS}$	$T_a=25^{\circ}\text{C}$	0	7.0	V
Power supply for LCD	$V_{DD}-V_L$	$T_a=25^{\circ}\text{C}$	0	13.5	V
Input voltage	$V_{IN}$	$T_a=25^{\circ}\text{C}$	$V_{DD}$	$V_{SS}$	V
Operating temperature	$T_{OP}$	-	0	50	$^{\circ}\text{C}$
Storage temperature	$T_{STG}$	-	-20	70	$^{\circ}\text{C}$

### 4. ELECTRICAL CHARACTERISTICS

ITEM	SYMBOL	CONDITION	STANDARD VALUE			UNIT
			MIN.	TYP.	MAX.	
Power supply for logic	$V_{DD}$	$T_a = 25^{\circ}\text{C}$	4.5	5	5.5	V
Input high voltage	$V_{IH}$	-	2.2	-	$V_{DD}$	V
Input low voltage	$V_{IL}$	-	$V_{SS}$	-	0.6	V
Output high voltage	$V_{OH}$	$I_{OH} = -0.205 \text{ mA}$	2.4	-	$V_{DD}$	V
Output low voltage	$V_{OL}$	$I_{OL} = 1.2 \text{ mA}$	$V_{SS}$	-	0.4	V
Power supply current	$I_{DD}$	$V_{DD}=5.0\text{V}, V_{LCD}=4.4\text{V}$	-	2.5	3.5	mA
Power supply for LCD = $V_{LCD}$	$V_{DD}-V_L$	$T_a = 0^{\circ}\text{C}$	-	-	-	V
		$T_a = 25^{\circ}\text{C}$	-	4.4	-	V
		$T_a = 50^{\circ}\text{C}$	-	-	-	V

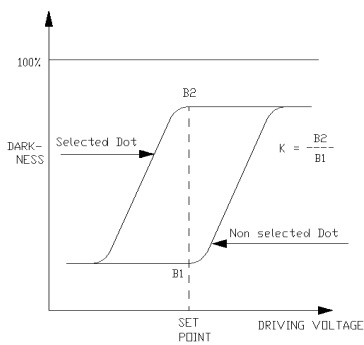
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## 5. ELECTRO-OPTICAL CHARACTERISTICS ( STN )

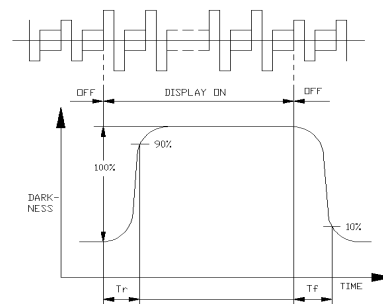
( Ta = 25 °C )

ITEM	SYMBOL	MIN.	TYP.	MAX.	UNIT	NOTE
Contrast ratio	K	-	4	-	-	1
Response time ( rise )	T <sub>r</sub>	-	200	-	ms	2
Response time ( fall )	T <sub>f</sub>	-	200	-	ms	2
Viewing angle	φ	-20 ~ +30			deg.	3,4
	θ	-55 ~ +55				

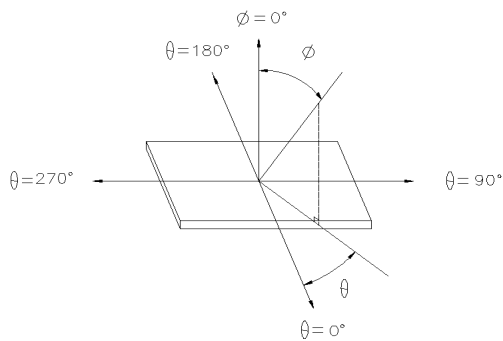
NOTE1. Definition of contrast K



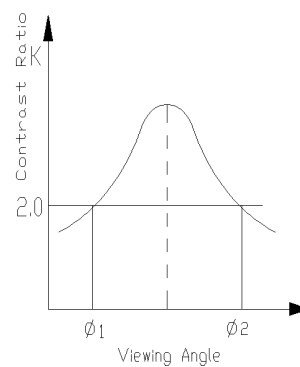
NOTE2. Definition of optical response




NOTE3. Definition of angle θ and φ



NOTE4. Definition viewing angle φ1 and φ2



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## 6. RELIABILITY


- Operating life time : Longer than 50,000 hours  
( at room temperature without direct irradiation of sunlight )
- Reliability characteristics shall meet following requirements.

ITEM	TEST	CRITERION
High temp.	70°C / 200 Hrs	* Total current consumption should be below double of initial value
Low temp.	-20°C / 200 Hrs	
High humidity	40°C X 90%RH / 200 Hrs	
Thermal shock	-20°C → 25°C → 70°C → 25°C / 5 Cycles (30min) (5min) (30min) (5min)	* Contrast ratio should be within initial value ±50%
Vibration	1. Operating time : Thirty minutes exposure in each direction( x,y,z ) 2. Sweep frequency (1min) : 10Hz →55Hz →10Hz 3. Amplitude : 0.75mm double amplitude	* No defect in cosmetic and operational function is allowable

\* Remarks : Samples subjected to the tests shall be “ Not operating ” condition .

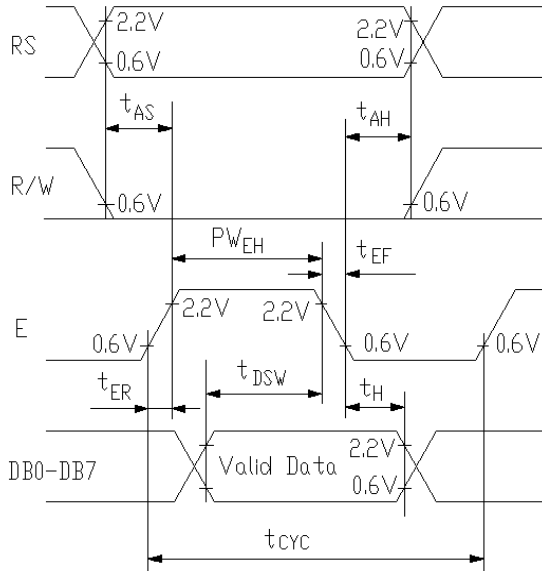
## 7. PIN CONNECTIONS

PIN NO.	SYMBOL	LEVEL	FUNCTION	
1.	V <sub>SS</sub>	-	0V	Ground
2.	V <sub>DD</sub>	-	5.0 V	Power supply for logic
3.	V <sub>L</sub>	-	-	Power supply for LCD
4.	RS	H / L	H : Data input L : Instruction data input	
5.	R/W	H / L	H : Data read ( CPU ← LCM ) L : Data write ( CPU → LCM )	
6.	E	H.H→L	Enable ( Operating start signal for data read / write )	
7.	D0	H / L	Data bus line	
8.	D1	H / L		
9.	D2	H / L		
10.	D3	H / L		
11.	D4	H / L		
12.	D5	H / L		
13.	D6	H / L		
14.	D7	H/L	These pins are used LED back lighting module.	
15.	N/C	-		
16.	N/C	-		

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## 8. TIMING DIAGRAM

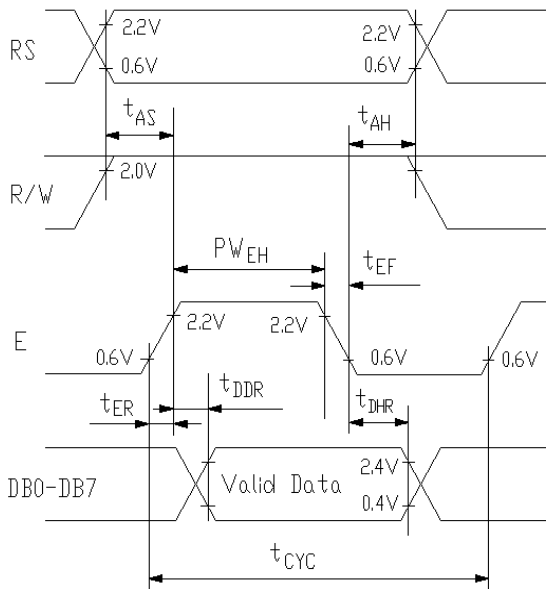
### 10.1 WRITE OPERATION



### 10.2 TIMING OF DATA WRITE

ITEM	SYMBOL	VALUE
Enable cycle time	$t_{CYC}$	666 nS min.
Enable Pulse width	$PW_{EH}$	300 nS min.
Enable rise/fall time	$t_{ER}, t_{EF}$	25 nS max.
Address set up time	$t_{AS}$	100 nS min.
Address hold time	$t_{AH}$	10 nS min.
Data set up time	$t_{DSW}$	100 nS min.
Data hold time	$t_H$	10 nS min.


### 10.3 READ OPERATION



### 10.4 TIMING OF DATA READ

ITEM	SYMBOL	VALUE
Enable cycle time	$t_{CYC}$	666 nS min.
Enable Pulse width	$PW_{EH}$	300 nS min.
Enable rise/fall time	$t_{ER}, t_{EF}$	25 nS max.
Address set up time	$t_{AS}$	100 nS min.
Address hold time	$t_{AH}$	10 nS min.
Data set up time	$t_{DSW}$	190 nS max.
Data hold time	$t_H$	20 nS min.



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## 9. INSTRUCTION SET

INSTRUCTION	CODE										DESCRIPTION	E.T. $f_{osc}=125\text{KHz}$	
	RS	R/W	D7	D6	D5	D4	D3	D2	D1	D0			
Clear display	0	0	0	0	0	0	0	0	0	1	Clears entire display	3.28 mS	
Return home	0	0	0	0	0	0	0	0	0	1	Returns display being shifted to original position	3.28 mS	
Entry mode set	0	0	0	0	0	0	0	0	1	I/D	S	Sets cursor move direction and specifies shift of display	80 $\mu\text{S}$
Display on/off control	0	0	0	0	0	0	0	1	D	C	B	D : Display ON/OFF C : Cursor ON/OFF B : Cursor blink/not	80 $\mu\text{S}$
Cursor or display shift	0	0	0	0	0	0	1	S/C	R/L	*	*	Moves cursor and shifts display	80 $\mu\text{S}$
Function set	0	0	0	0	1	DL	N	F	*	*		DL : Interface data length L : Number of display lines F : Character font	80 $\mu\text{S}$
Set CG RAM address	0	0	0	1	CG RAM address						Sets CG RAM address	80 $\mu\text{S}$	
Set DD RAM address	0	0	1	DD RAM address:corresponds to cursor address						Sets DD RAM address	80 $\mu\text{S}$		
Read busy flag and address	0	1	BF	Address counter used for both DD and CG RAM address						BF : Busy flag Reads address counter contents	1 $\mu\text{S}$		
Write data to CG or DD RAM	1	0	Write data						Writes data into DD RAM or CG RAM.	80 $\mu\text{S}$			
Read data from CG or DD RAM	1	1	Read data						Reads data from DD RAM or CG RAM.	80 $\mu\text{S}$			

**\*\* REMARK \*\***

I/D=1: Increment

S =1: Accompanies display shift

S/C=1: Display shift

R/L=1: Shift to the right

DL =1: 8 bits

N =1: 2 lines

F =1: 5 x 10 dots

BF =1: Internally operating

DD RAM : Display data RAM

\* : No effect (Don't care)

I/D =0: Decrement

S/C =0: Cursor move

R/L =0: Shift to the left


DL =0: 4 bits

N =0: 1 line

F =0: 5 x 7 dots

BF =0: Can accept instruction

CG RAM : Character generator RAM

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## 10. INITIALIZATION SEQUENCE

POWER ON

( 8-Bit interface )

↓  
Wait more than 15 mS after  
V<sub>DD</sub> rises to 4.5 V

\*\* In case of 4-bits interface, refer to PIN CONNECTIONS and INSTRUCTION SET.

RS	R/W	D7	D6	D5	D4	D3	D2	D1	D0
0	0	0	0	1	1	1	0	*	*

BF cannot be checked before this instruction.

Function set (Interface is 8 bits long.)

↓  
Wait more than 4.1 mS

RS	R/W	D7	D6	D5	D4	D3	D2	D1	D0
0	0	0	0	1	1	1	0	*	*

BF cannot be checked before this instruction.

↓  
Wait more than 100 μS

RS	R/W	D7	D6	D5	D4	D3	D2	D1	D0
0	0	0	0	1	1	1	0	*	*

BF cannot be checked before this instruction.

Function set (Interface is 8 bits long.)

BF can be checked after the following instruction.  
When BF is not checked, the waiting time between instructions is longer than the execution instruction time.

RS	R/W	D7	D6	D5	D4	D3	D2	D1	D0
0	0	0	0	1	1	1	0	*	*

Function Set(Interface is 8 bits long. Specify the number of display lines and character font.)  
The number of display lines and character font cannot be changed afterwards.

Display off

Display clear

Entry mode set → Initialization ends.

0	0	0	0	0	0	1	0	0	0
---	---	---	---	---	---	---	---	---	---

0	0	0	0	0	0	0	0	0	1
---	---	---	---	---	---	---	---	---	---

0	0	0	0	0	0	0	1	I/D	S
---	---	---	---	---	---	---	---	-----	---

0	0	1	ADDR:DD	RAM	Address(1)				
---	---	---	---------	-----	------------	--	--	--	--

1	0	DATA	(2)						
---	---	------	-----	--	--	--	--	--	--

\* : No effect

(1) ADDR is the setting data of cursor position to debug.

In data, MSB(D7) should be '1' and other 7 bits ( D0 to D6 ) are cursor position.

(2) DATA means the ASCII CODES.


## 11. DD RAM ADDRESS

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

DISPLAY POSITION

DD RAM ADDRESS



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## 14. PRECAUTION FOR USING

- HANDLING

- \* Refrain from storing mechanical shock and from applying any force to LCD MODULE. It may cause mis\_operation or damage of LCD.
- \* Do not touch, press or rub the display panel with a hard, stiff tool or object as the polarizers in the panel are easily scratched.
- \* If LCD is broken and liquid crystal material flow out, ingestion, inhalation, or contact with skin should be avoided. If liquid crystal material contact with skin, wash immediately with alcohol and rinse thoroughly with water.
- \* Never use organic solvents to clear the display panel as these solvent may adversely affect the polarizer. To clean the display panel dampen a bit of absorbent cotton with petroleum benzene and gently wipe the panel, or contaminations by using a scotch tape.
- \* Refrain from discharge of high electro-static voltage, it will damage C-MOS LSI in the MODULE.
- \* Do not leave the MODULE in high temperature, especially in high humidity for a long time. It is recommended to store the MODULE where the temperature is in the range of 0°C to 35°C and the humidity is lower than 70%.
- \* Store the MODULE without exposure to direct sunlight or fluorescent lamp.
- \* Ultra violet cut filter is necessary for outdoor operation.
- \* Avoid condensation of water, it may cause misoperation or disconnection of electrode.

- OPERATION

- \* Never connect or disconnect the LCD MODULE from the main system while power is being supplied.
- \* When supplying the M signal from the external unit to a GRAPHIC MODULE, set the duty to 50%±1%.  
If the duty deviates too greatly from the value, a DC voltage will be applied to the liquid crystal, which could induce an electrochemical reaction and reduce the life of the MODULE.
- \* Do not exceed the maximum rating values under the worst conditions taking account of the supply voltage variation, input voltage variation, and environmental temperature, etc. Otherwise LCD module may be damaged.

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### 13. MODULE EXTERNAL DIMENSION

