

RCL DISPLAY LTD.

DATA SHEET

LCD MODULE

MBC20401B SERIES

Product specification

Version : 6

06/Jan/2005

GENERAL SPECIFICATION

MODULE NO. : MBC20401B SERIES

CUSTOMER P/N

VERSION NO.	CHANGE DESCRIPTION	DATE
0	ORIGINAL VERSION	1998/10/09
1	NEW DESIGN	2001/04/26
2	CHANGE STORAGE TEMPERATURE AND OPERATION TEMPERATURE	2001/11/07
3	ADDING VERSION	2004/02/14
4	CHANGED VLCD FROM +4.5V TO +5.0V OF MBC20401B03	2004/02/18
5	ADDING VERSION	2004/07/26
6	ADDING VERSION	2005/01/06

PREPARED BY: QIAO WEN DAN

DATE: 2005/01/06

APPROVED BY: LIU XING

DATE: 2005/01/06

CONTENTS

1. FUNCTIONS & FEATURES -----	2
2. MECHANICAL SPECIFICATIONS -----	2
3. BLOCK DIAGRAM -----	3
4. EXTERNAL DIMENSIONS -----	3
5. PIN ASSIGNMENT -----	4
6. MAXIMUM ABSOLUTE LIMIT -----	4
7. ELECTRICAL CHARACTERISTICS -----	6
8. CONTROL AND DISPLAY COMMAND -----	9
9. STANDARD CHARACTER PATTERN -----	10
10. LCM INITIALIZING BY INSTRUCTION -----	11
11. RELIABILITY TEST -----	13
12. PACKING METHOD AND DRAWING -----	13
13. THE MODULE ACCEPT QUALITY LEVEL -----	14
14. LCD MODULES HANDLING PRECAUTIONS -----	15
15. OTHERS -----	15

1.FUNCTIONS & FEATURES

- MBC20401B Series LCD Type :

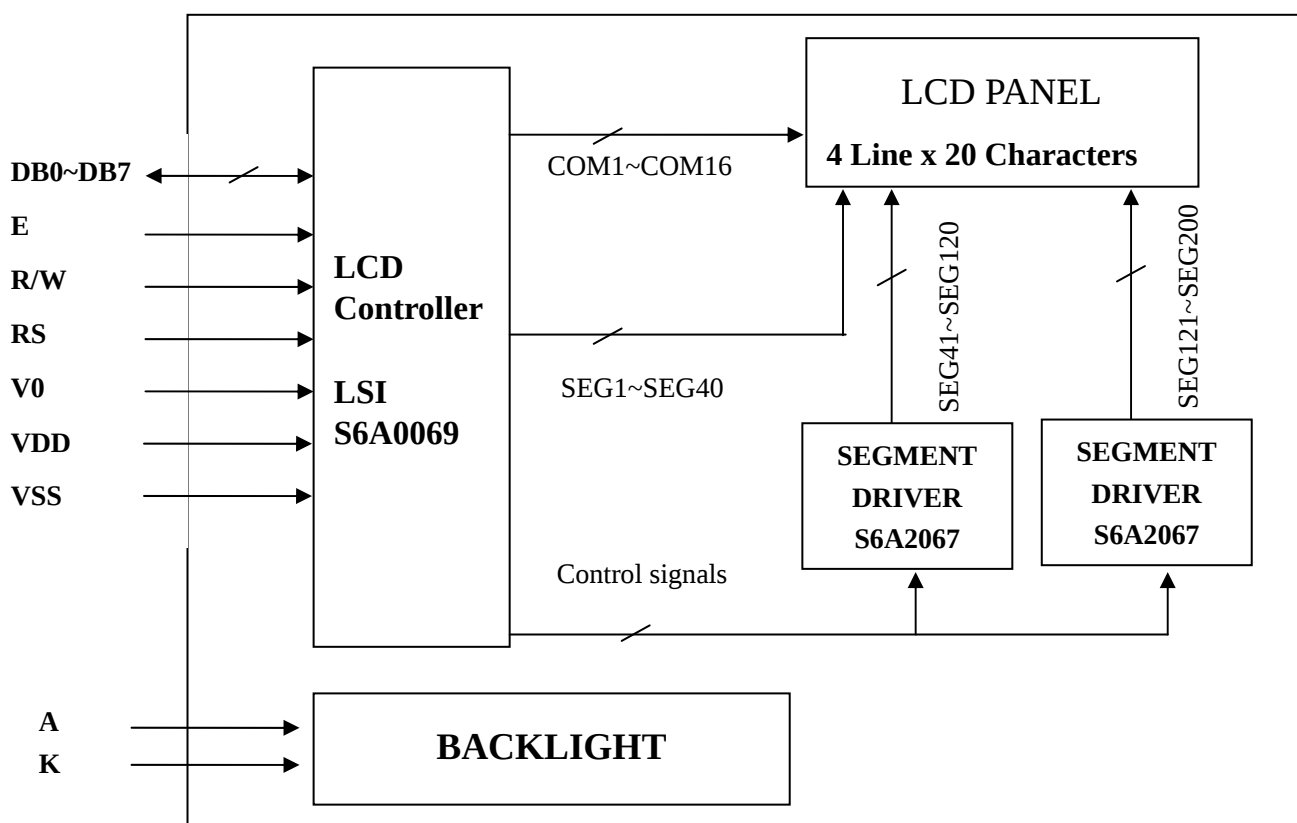
MODULE	LCD MODEL	LCD TYPE	Voltage(VLCD)
MBC20401B00	DC20408E00	TN Transflective Positive Mode	+4.5V
MBC20401B01	DC20405E00	STN Green Transflective Positive Mode	+4.5V
MBC20401B02	DC20405E02	STN Grey Transflective Positive Mode	+4.5V
MBC20401B03	DC20405E11	STN Green Transflective Negative Mode	+5.0V
MBC20401B04	DC20405E02	STN Grey Transflective Positive Mode	+4.5V
MBC20401B05	DC20405E12	STN Yellow Transflective Positive Mode	+4.5V

- Viewing Direction : 6 O'clock (**Remark:** The LCD wiring is symmetrical and thus LCD can be used as 6 O'clock and 12 O'clock with physical change of direction of the LCD.)
- Driving Scheme : 1/16 Duty Cycle, 1/5 Bias
- Power Supply Voltage : 5.0V
- Backlight Color : Yellow Green
- Display contents : 20*4Characters (5 * 8 dots, Format: 208 Kids)
- Internal Memory : CGROM (10,080 bits)
: CGRAM (64 x 8 bits)
: DDRAM (80 x 8 bits for Digits)
- Easy Interface with a 4-bit or 8-bit MPU

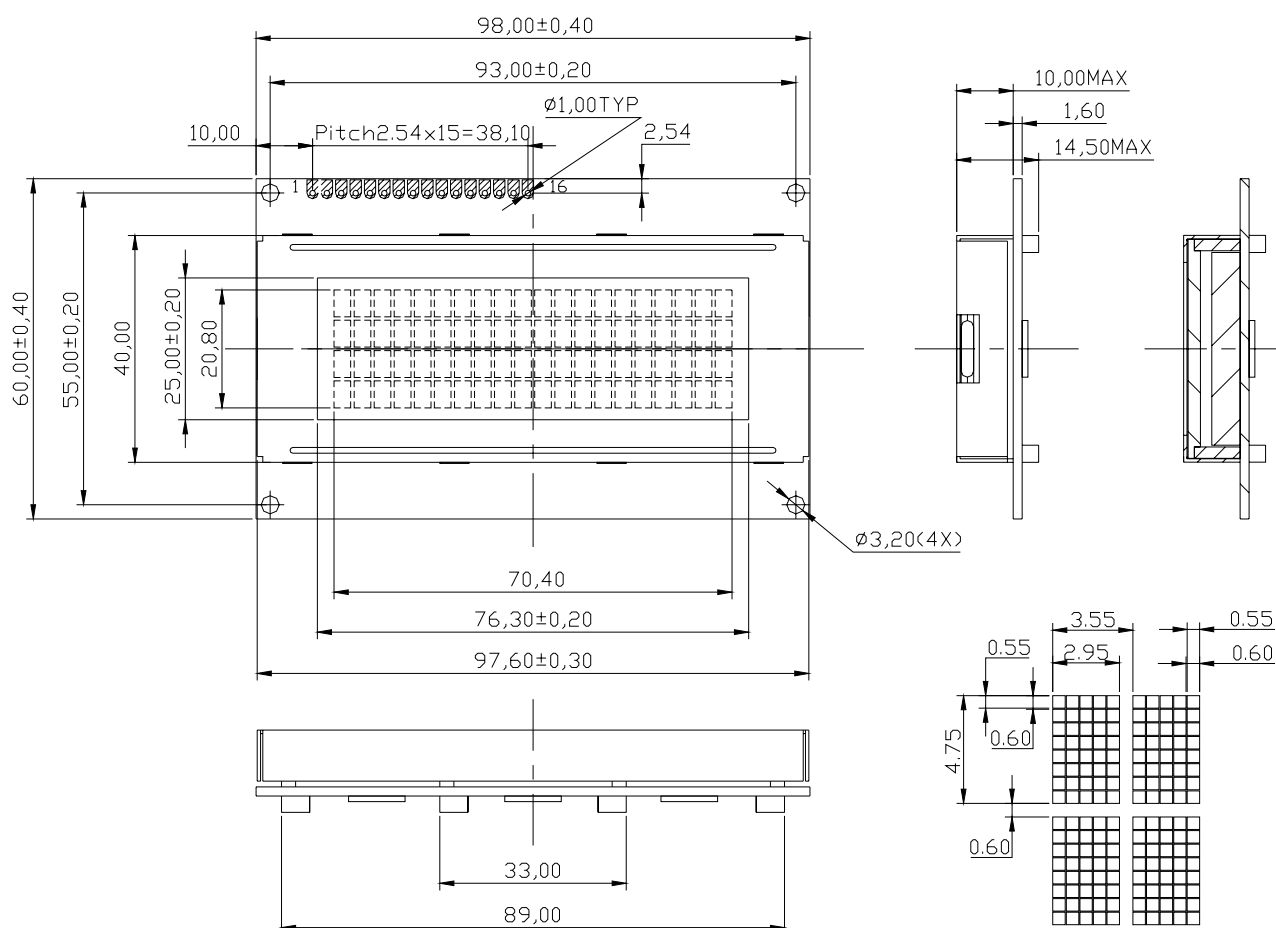
2. MECHANICAL SPECIFICATIONS

- Character Pitch : 3.55 (W) x 5.35 (H) mm
- Character Size : 2.95 (W) x 4.75 (H) mm
- Character Font : 5 x 8 dots
- Dot Size : 0.55 (W) x 0.55 (H) mm
- Dot Pitch : 0.60 (W) x 0.60 (H) mm

3. BLOCK DIAGRAM



4. EXTERNAL DIMENSIONS



5. PIN ASSIGNMENT

Pin No.	Symbol	Function	
1	V _{SS}	Ground	
2	V _{DD}	Power supply	
3	V ₀	Power Supply for LCD	
4	RS	Select Display Data("H") or Instructions("L")	
5	R/W	Read or Write Select Signal	
6	E	Read/Write Enable Signal	
7	DB0	Display Data Signal	
8	DB1		
9	DB2		
10	DB3		
11	DB4		
12	DB5		
13	DB6		
14	DB7		
15	LED-(K)	Cathode of Backlight	MBC20401B00~B03
16	LED+(A)	Anode of Backlight	
15	LED+(A)	Anode of Backlight	MBC20401B04 /B05
16	LED-(K)	Cathode of Backlight	

6. MAXIMUM ABSOLUTE LIMIT (Ta=25℃)

Item	Symbol	Standard value	Unit
Power supply voltage (1)	V _{DD}	-0.3~+7.0	V
Power supply voltage (2)	V ₀	V _{DD} -13.5~V _{DD} +0.3	V
Input voltage	V _{IN}	-0.3~V _{DD} +0.3	V
Volt. For BL	V _{LED1}	4~4.5	V
Operating temperature	T _{opr}	-20~+70	℃
Storage temperature	T _{stg}	-30~+80	℃

*Voltage greater than above may damage to the Circuit.

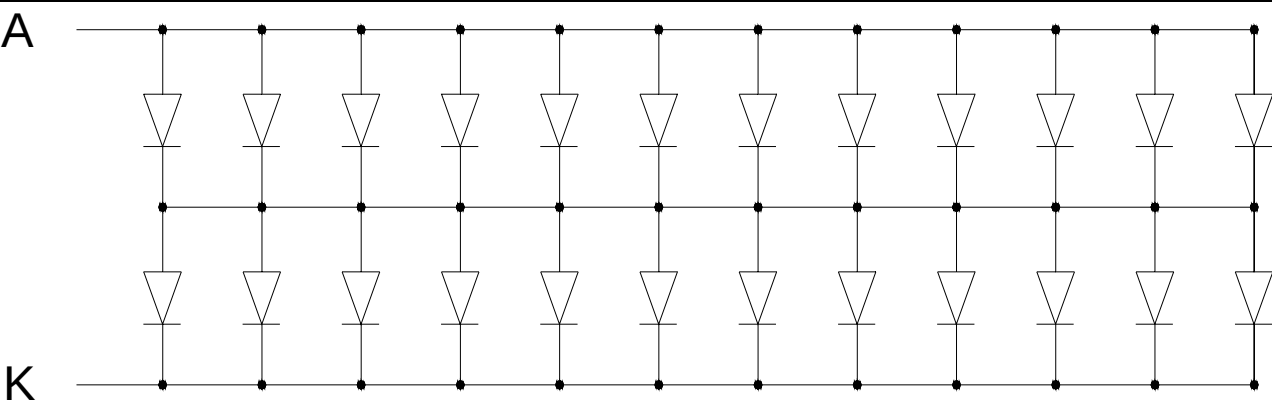
$$V_{DD} > V_1 > V_2 > V_3 > V_4 > V_5$$

7. ELECTRICAL CHARACTERISTICS

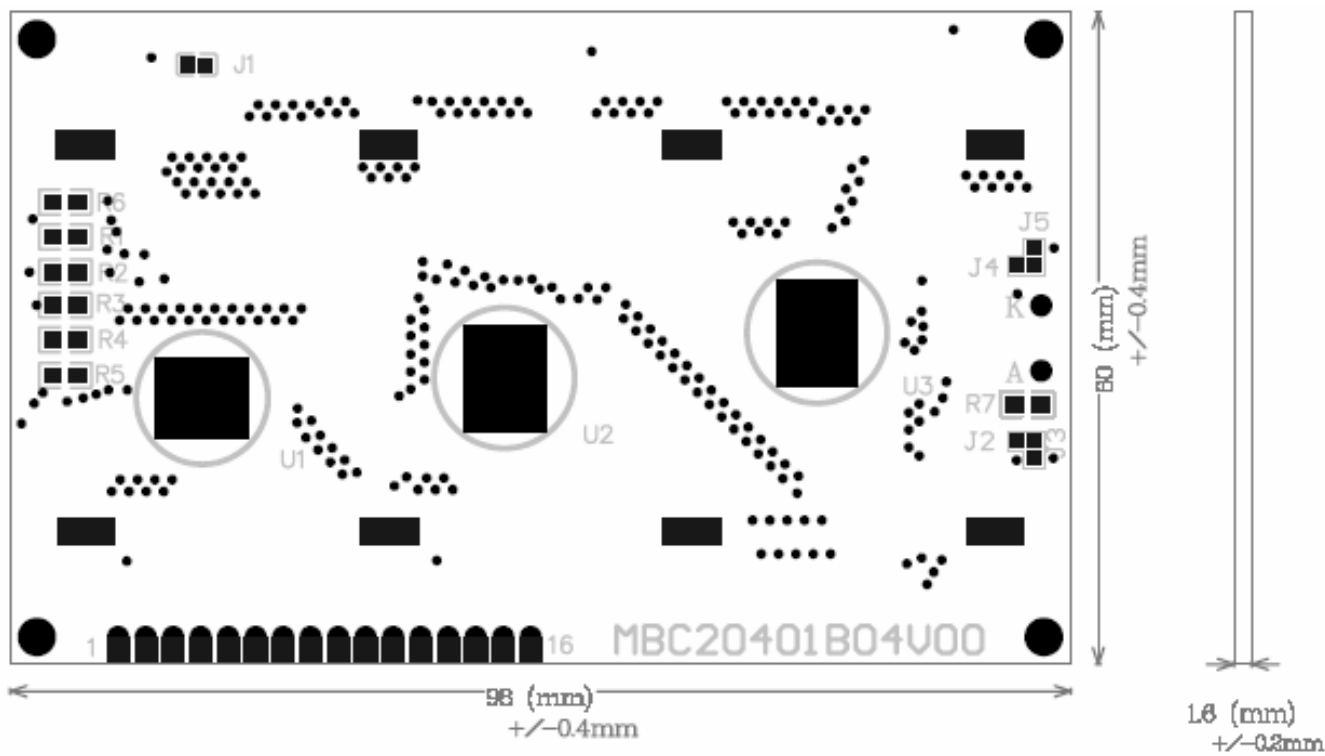
7-1 DC Characteristics(VDD=4.5V~5.5V,Ta=-20~+70℃)

Item	Symbol	Standard Value			Test Condition	Unit
		MIN	TYP	MAX		
Operating Voltage	V _{DD}	4.5	5	5.5	-----	V
Supply Current	I _{DD}	----	0.35	0.6	V _{DD} =5V,f _{osc} =270kHz	mA
Input Voltage (1) (except OSC1)	V _{IL1}	-0.3	--	0.6	-----	V
	V _{IH1}	2.2	--	V _{DD}	-----	
Input Voltage (2) (OSC1)	V _{IL2}	-0.2	--	1.0	-----	V
	V _{IH2}	V _{DD} -1.0	--	V _{DD}	-----	
Output Voltage (1) (DB0 to DB7)	V _{OL1}	---	----	0.4	I _{OL} =1.2mA	V
	V _{OH1}	2.4	---	----	I _{OH} =-0.205mA	
Output Voltage (2) (except DB0 to DB7)	V _{OL2}	-----	---	0.1V _{DD}	I _{OL} =40uA	V
	V _{OH2}	0.9V _{DD}	---	----	I _{OH} =-40uA	
Voltage Drop	V _{dCOM}	----	---	1	I _O =±0.1 mA	V
	V _{dSEG}	-----	---	1		
Input Leakage Current	I _{IKG}	-1	---	1	V _{IN} =0 V to V _{DD}	uA
Input Low Current	I _{IL}	-50	-125	-250	V _{IN} =0V,V _{DD} =5V(pull up)	uA
Internal Clock (external R _f)	f _{OSC1}	190	270	350	R _f = 91k±2% (V _{DD} =5V)	kHz
External Clock	f _{OSC}	125	270	410	----	kHz
	Duty	45	50	55	----	%
	t _R ,t _F	---	---	0.2	----	us
LCD Driving Voltage	V _{LCD}	3.0	---	13.0	V _{DD} -V ₅ (1/5,1/4 Bias)	V

7-2. BACKLIGHT & SWITCH (Ta=-20~70℃)					
Item	Symbol	Standard	Value	Unit	Applicable Terminal
Backlight Voltage	V		4.2	V	A~K
Backlight Current	I		270	mA	

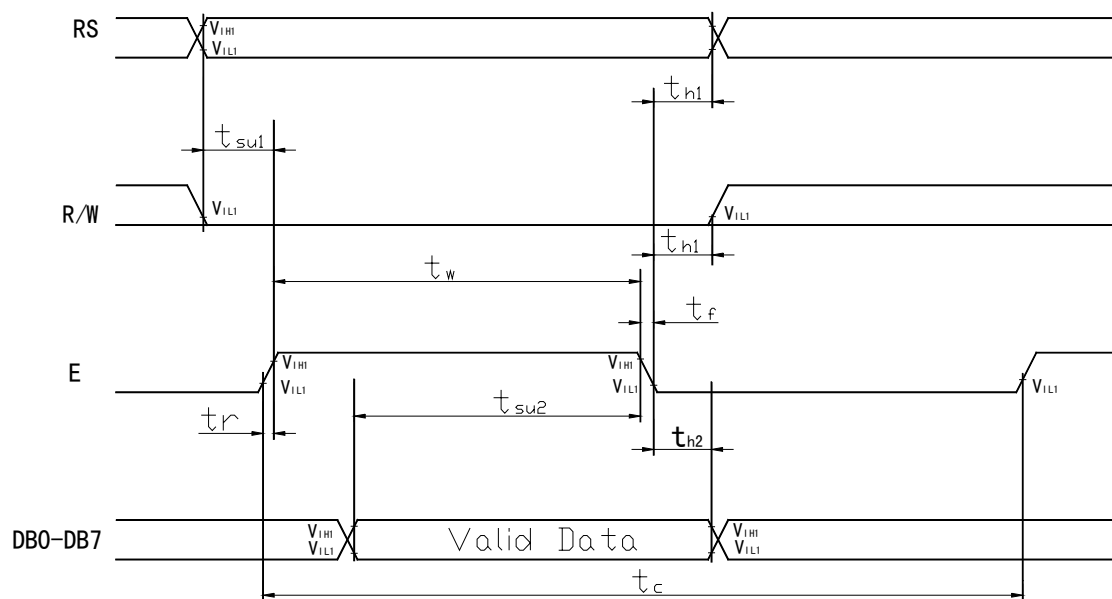


Remark:
For MBC20401B04/B05: The J2 and J5 must be connected.



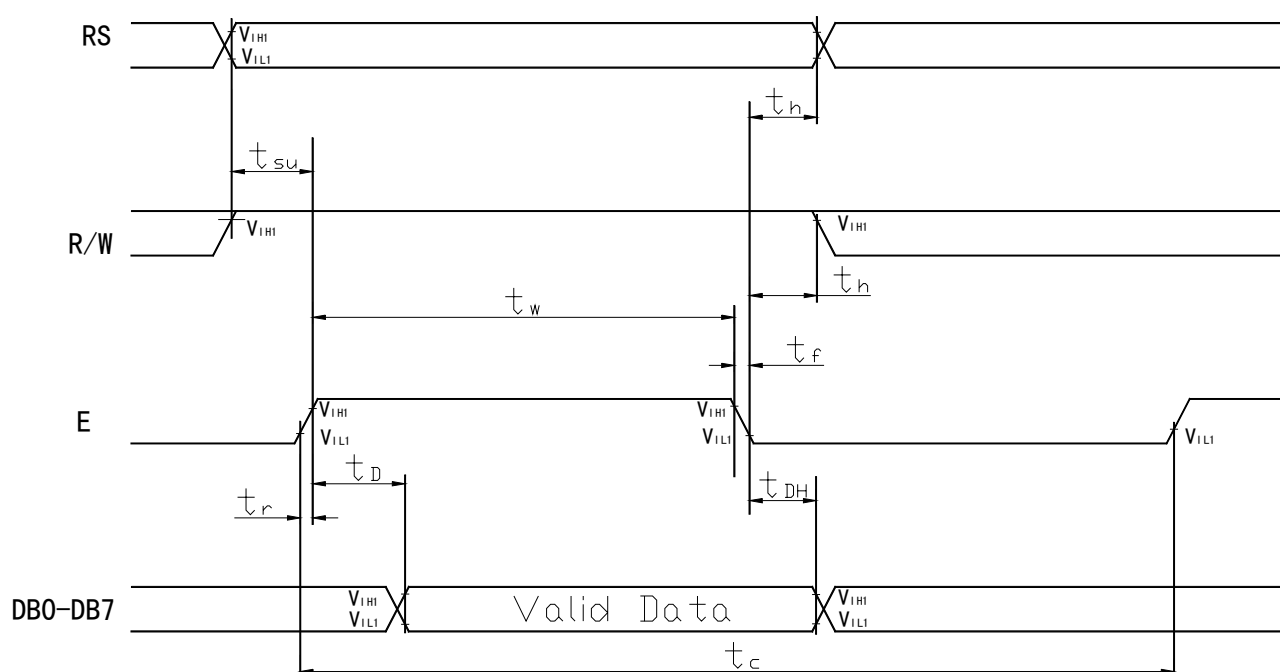
7-3. AC Characteristics (VDD=4.5V~5.5V , Ta=-20~+70°C)
7-3-1 Write mode (writing data from MPU to MBC20401B Series)

Characteristic	Symbol	Min	Type	Max	Unit	Test PIN
E Cycle Time	t_C	500	---	---	ns	E
E Rise Time	t_R	---	---	20	ns	E
E Fall Time	t_F	---	---	20	ns	E
E Pulse width (High,Low)	t_W	230	---	---	ns	E
R/W and RS Set-up Time	t_{SU1}	40	---	---	ns	R/W,RS
R/W and RS Hold Time	t_{H1}	10	---	---	ns	R/W,RS
Data Set-up Time	t_{SU2}	80	---	---	ns	DB0~DB7
Data Hold Time	t_{H2}	10	---	---	ns	DB0~DB7



7-3-2 Read mode (reading data from MBC20401B Series to MPU)

Characteristic	Symbol	Min	Type	Max	Unit	Test PIN
E Cycle Time	t_c	500	---	---	ns	E
E Rise Time	t_R	---	---	20	ns	E
E Fall Time	t_F	---	---	20	ns	E
E Pulse width (High, Low)	t_W	230	---	---	ns	E
R/W and RS Set-up Time	t_{SU}	40	---	---	ns	R/W,RS
R/W and RS Hold Time	t_H	10	---	---	ns	R/W,RS
Data Output Delay Time	t_D	---	---	120	ns	DB0~DB7
Data Hold Time	t_{DH}	5	---	---	ns	DB0~DB7



8. CONTROL AND DISPLAY COMMAND

Command	RS	R/W	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0	Execution time (fosc=270KHz)	Remark		
clear Display	L	L	L	L	L	L	L	L	L	H	1.53ms	Write “20H” to DDRAM and set DDRAM address to “00H” from AC		
Return home	L	L	L	L	L	L	L	L	H	---	1.53ms	Cursor move to first digit		
Entry mode set	L	L	L	L	L	L	L	H	I/D	SH	39us	I/D:set cursor move direction		
												I/D	H	Increase
													L	Decrease
												SH:Specifies shift of display		
												SH	H	Display is shifted
L	Display is not shifted													
Display on/off control	L	L	L	L	L	L	H	D	C	B	39us	Display		
												D	H	Display on
													L	Display off
												Cursor		
												C	H	Cursor on
													L	Cursor off
												Blinking		
B	H	Blinking on												
	L	Blinking off												
Cursor or Display Shift	L	L	L	L	L	H	S/C	R/L	---	---	39us			
												SC	H	Display shift
													L	Cursor move
												R/L	H	Right shift
L	Left shift													
function Set	L	L	L	L	H	DL	N	F	---	---	39us			
												DL	H	8bits interface
													L	4bits interface
												N	H	2 line display
													L	1 line display
												F	H	5 x 11 dots
L	5 x 8 dots													
Set CGRAM address	L	L	L	H	AC5	AC4	AC3	AC2	AC1	AC0	39us	CGRAM data is sent and received after this setting		
Set DDRAM address	L	L	H	AC6	AC5	AC4	AC3	AC2	AC1	AC0	39us	DDRAM data is sent and received after this setting		
Read busy flag& address	L	H	BF	AC6	AC5	AC4	AC3	AC2	AC1	AC0	0us			
												BF	H	Busy
													L	Ready
-Reads BF indication internal operating is being performed -Reads address counter contents														
Write data to RAM	H	L	D7	D6	D5	D4	D3	D2	D1	D0	43us	Write data into DDRAM or CGRAM		
Read data from RAM	H	H	D7	D6	D5	D4	D3	D2	D1	D0	43us	Read data from DDRAM or CGRAM		

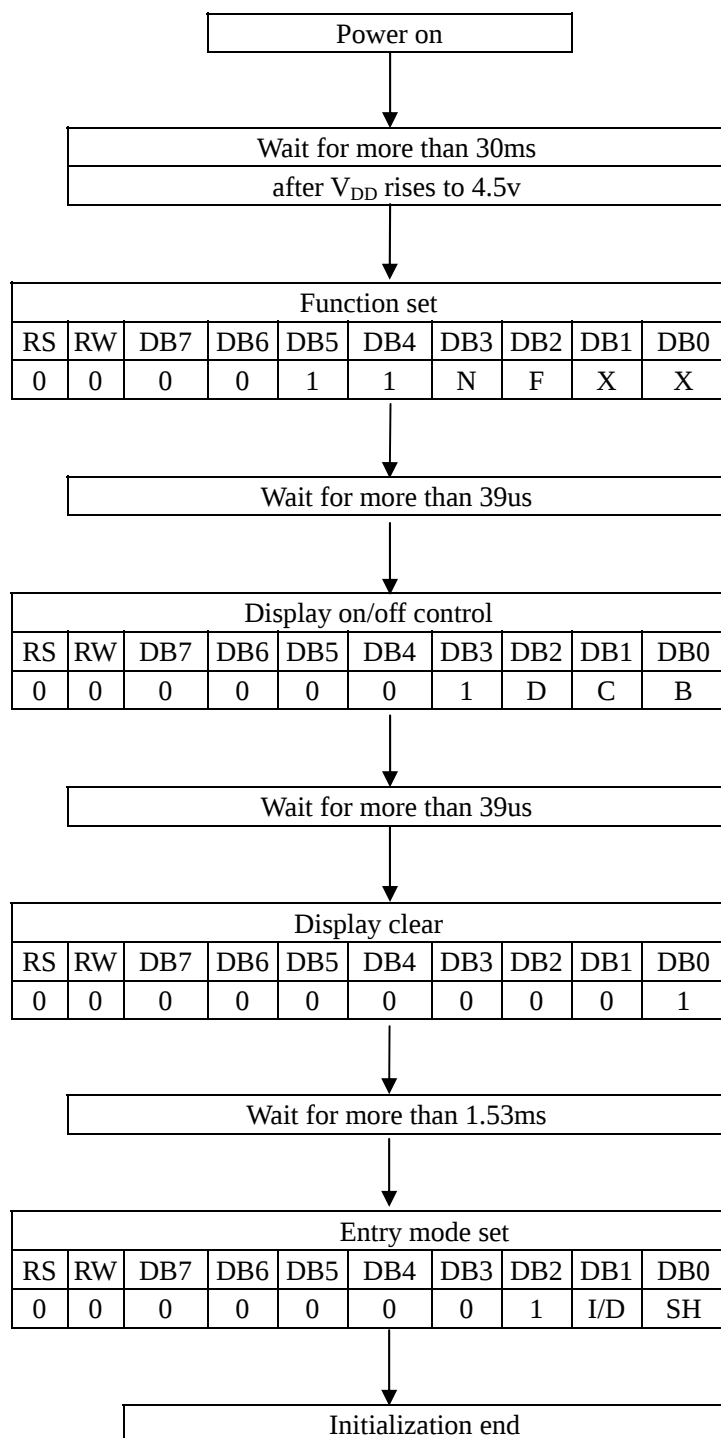
*X: Don't care

9. STANDARD CHARACTER PATTERN

Upper(4bit) Lower(4bit)		LLLL	LLH	LLHL	LLHH	LHLL	LHLH	LHHL	LHHH	HLLL	HLLH	HLHL	HLHH	HHLL	HHLH	HHHL	HHHH
CG RAM																	
LLLL	(1)																
LLH	(2)																
LLHL	(3)																
LLHH	(4)																
LHLL	(5)																
LHLH	(6)																
LHHL	(7)																
LHHH	(8)																
HLLL	(1)																
HLLH	(2)																
HLHL	(3)																
HLHH	(4)																
HHLL	(5)																
HHLH	(6)																
HHHL	(7)																
HHHH	(8)																

10. LCM INITIALIZING BY INSTRUCTION

10-1 8-bit interface mode



Condition : fosc=270khz

N	0	1-line mode
	1	2-line mode

F	0	5 x 8 dots
	1	5 x 11 dots

D	0	display off
	1	display on

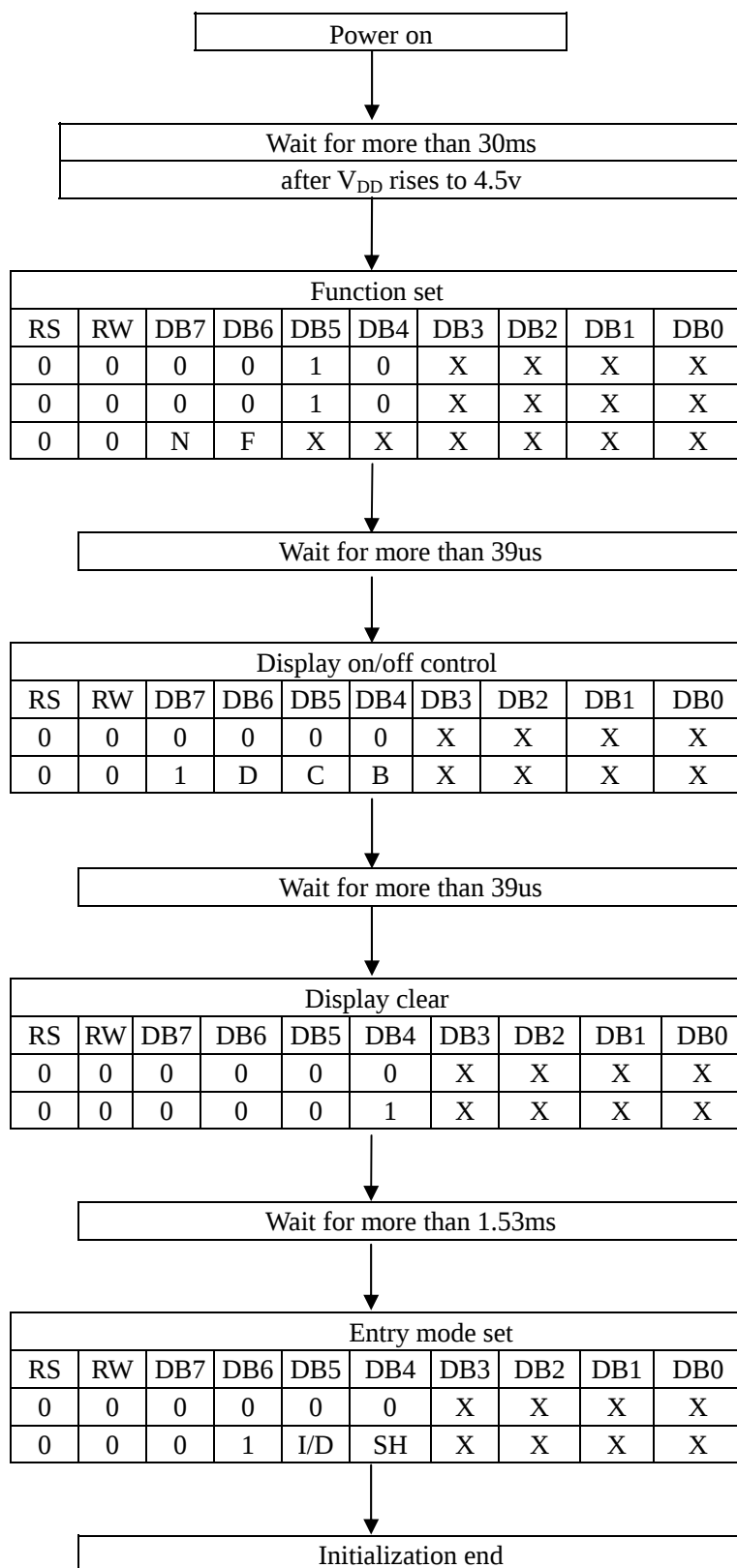
C	0	cursor off
	1	cursor on

B	0	blink off
	1	blink on

I/D	0	decrement mode
	1	increment mode

SH	0	entire shift off
	1	entire shift on

10-2 4-bit interface mode



Condition : fosc=270khz

N	0	1-line mode
	1	2-line mode
F	0	display off
	1	display on

D	0	display off
	1	Display on
C	0	cursor off
	1	cursor on
B	0	blink off
	1	blink on

I/D	0	decrement mode
	1	increment mode
SH	0	entire shift off
	1	entire shift on

11. RELIABILITY TEST

Operating life time: Longer than 50000 hours

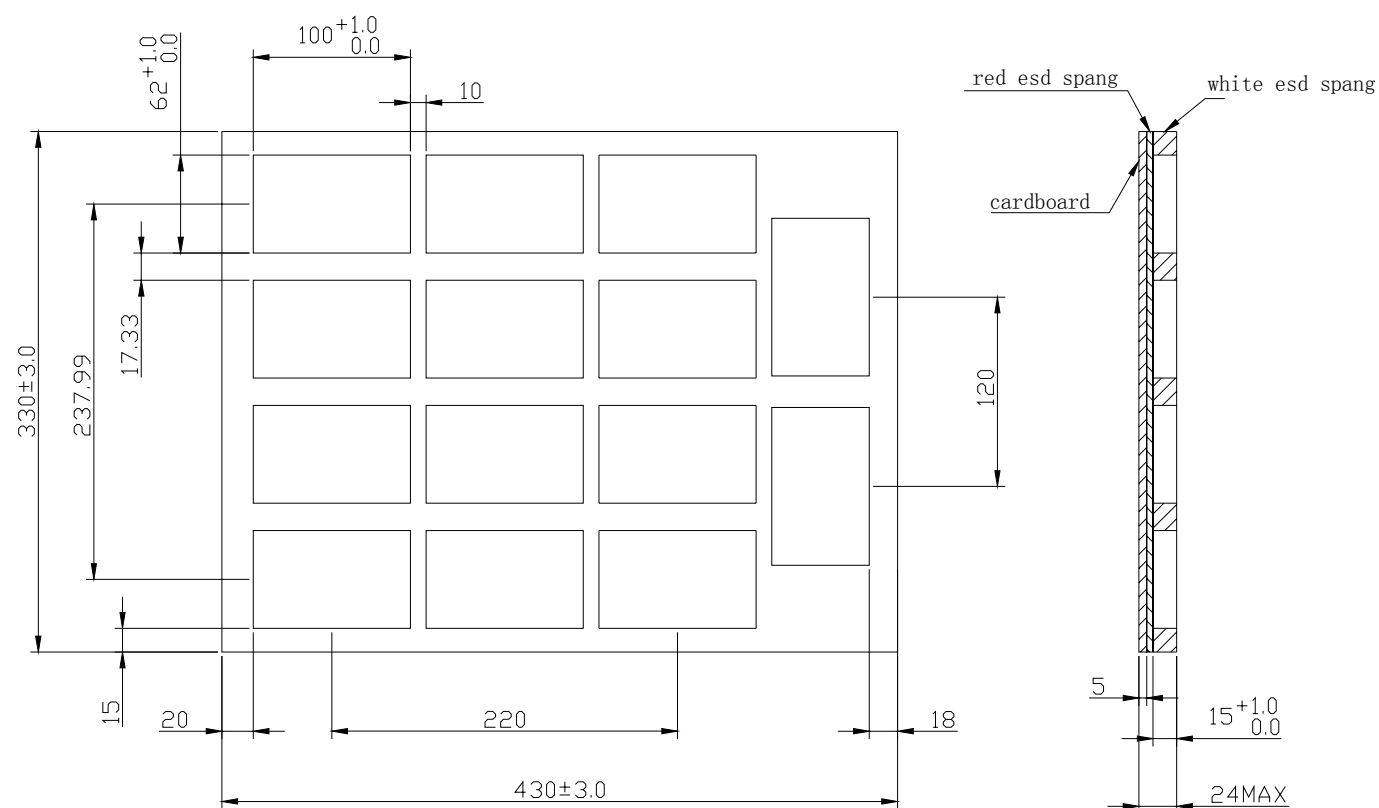
(at room temperature without direct irradiation of sunlight)

Reliability characteristics shall meet following requirements.

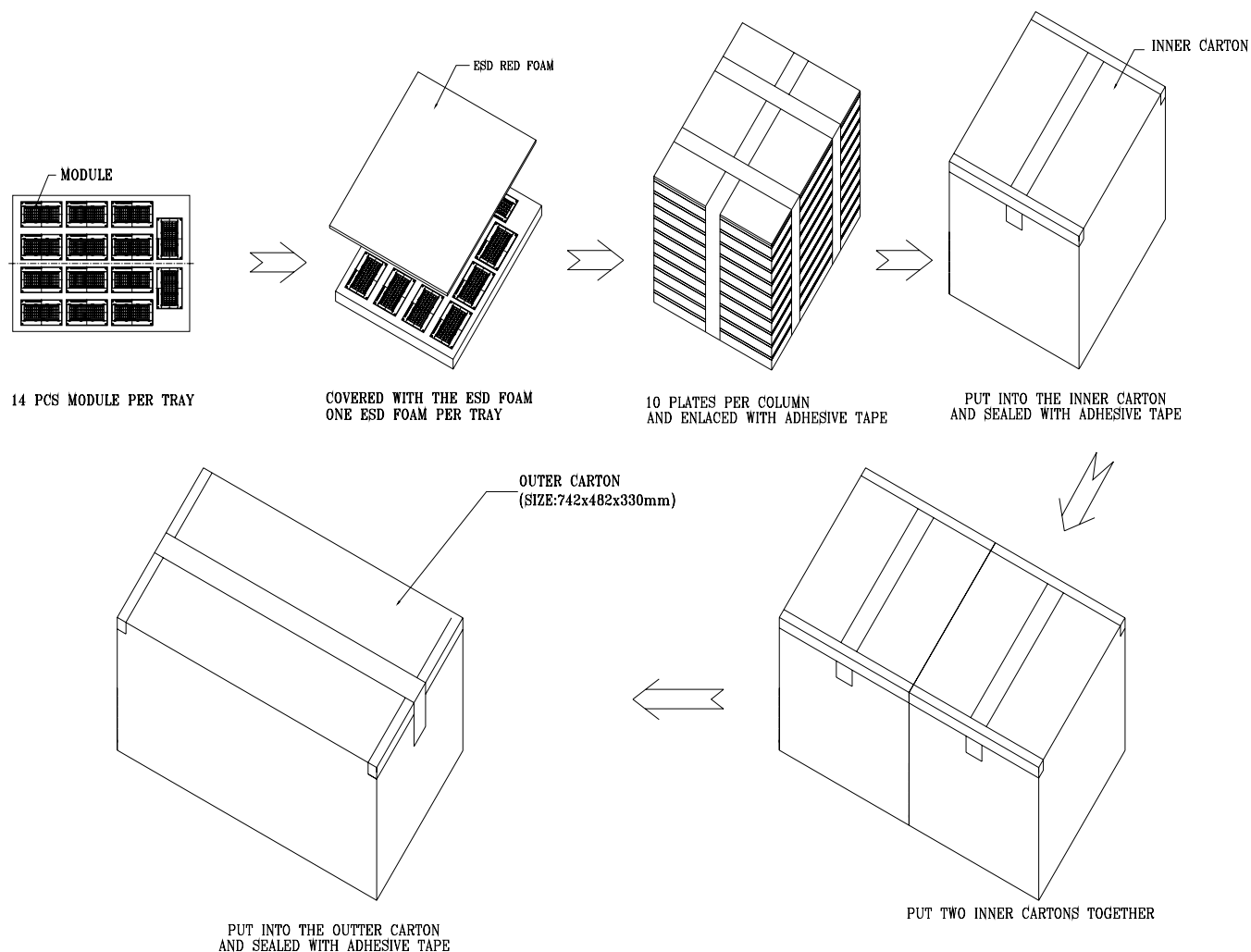
TEMPERATURE TESTS	NORMAL GRADE
High temperature storage	+80°C *96hrs (Without Polarizer)
Low temperature storage	-30°C * 4hrs
High temperature operation	+70°C *96hrs
Low temperature operation	-20°C *4hrs
High temperature, High humidity	+70°C * 95%RH *96hrs (Without Polarizer)
Thermal shock	-20°C *30min. 10s ↓ +70°C *30min. 5Cycles ↖ ↗
Vibration test	Frequency *Swing * Time 40Hz * 4mm * 4hrs
Drop test	Drop height*Times 1.0m * 6times

12. PACKING METHOD AND DRAWING

12-1. PACKING DRAWING



12-2. PACKING METHOD



13. THE MODULE ACCEPT QUALITY LEVEL (AQL).

13.1 AQL standard value: fatal defect =0.1, major defect=0.65; Minor defect =2.5.

13.2 Curtailed inspection scheme

Type	Batch Qty	inspection Qty	inspection rate	AQL value	pass	Reject
module product	<350PCS <1000PCS	125pcs	>25%	0.1	0	1
				0.65	2	3
				2.5	7	8
	<200 <350PCS	80pcs	>23%	0.1	0	1
				0.65	1	2
				2.5	5	6
	<200PCS	32pcs	>16%	0.1	0	1
				0.65	0	1
				2.5	4	5
Module sample	<200PCS	All inspected	/	/	/	The sample will be reject when the fateful defect>2pcs or main defect>5pcs.
	>200PCS	125pcs				

notes: 1) . Batch QTY is the production amount that Production department ship to QA department.

2). All of product will be inspected if the batch QTY less than inspected QTY.

3). Each batch fixed to be 500pcs.

14. LCD MODULES HANDLING PRECAUTIONS

- The display panel is made of glass. Do not subject it to a mechanical shock by dropping it from a high place, etc.
- If the display panel is damaged and the liquid crystal substance inside it leaks out, do not get any in your mouth. If the substance come into contact with your skin or clothes promptly wash it off using soap and water.
- Do not apply excessive force to the display surface or the adjoining areas since this may cause the color tone to vary.
- The polarizer covering the display surface of the LCD module is soft and easily scratched. Handle this polarize carefully.
- To prevent destruction of the elements by static electricity, be careful to maintain an optimum work environment.
 - Be sure to ground the body when handling the LCD module.
 - Tools required for assembly, such as soldering irons, must be properly grounded.
 - To reduce the amount of static electricity generated, do not conduct assembly and other work under dry conditions.
 - The LCD module is coated with a film to protect the display surface. Exercise care when peeling off this protective film since static electricity may be generated.
- Storage precautions
When storing the LCD modules, avoid exposure to direct sunlight or to the light of fluorescent lamps. Keep the modules in bags designed to prevent static electricity charging under low temperature / normal humidity conditions (avoid high temperature / high humidity and low temperatures below 0°C). Whenever possible, the LCD modules should be stored in the same conditions in which they were shipped from our company.

15. OTHERS

- Liquid crystals solidify at low temperature (below the storage temperature range) leading to defective orientation of liquid crystal or the generation of air bubbles (black or white). Air bubbles may also be generated if the module is subjected to a strong shock at a low temperature.
- If the LCD modules have been operating for a long time showing the same display patterns may remain on the screen as ghost images and a slight contrast irregularity may also appear. Abnormal operating status can be resumed to be normal condition by suspending use for some time. It should be noted that this phenomena does not adversely affect performance reliability.
- To minimize the performance degradation of the LCD modules resulting from caused by static electricity, etc. exercise care to avoid holding the following sections when handling the modules:
 - Exposed area of the printed circuit board
 - Terminal electrode sections