

**RCL DISPLAY LTD.**

# DATA SHEET

**LCD MODULE**

## **MBCF20453B SERIES**

*Product specification*

*Version: 2*

**25/Nov/2008**



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**1. FUNCTIONS & FEATURES**

- MBCF20453B Series LCD Type :

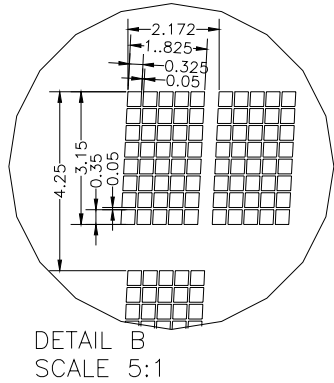
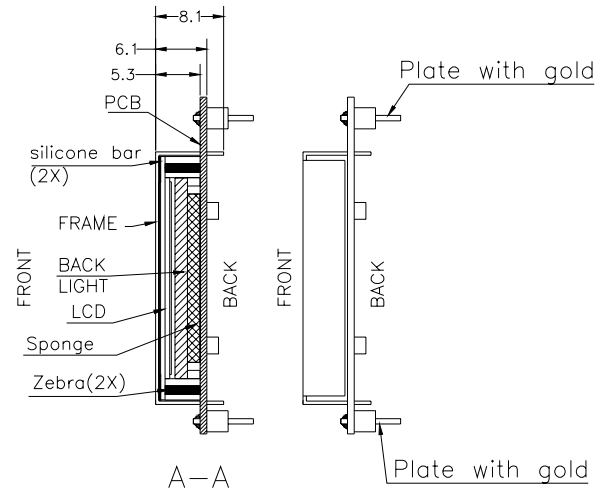
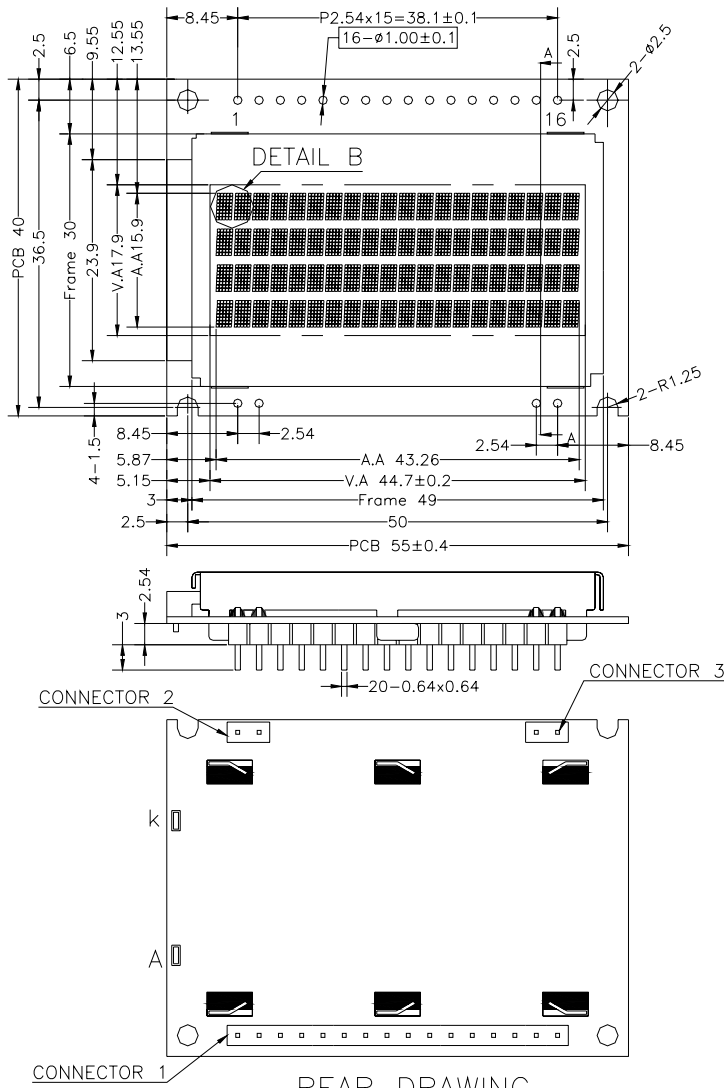
<b>MODULE</b>	<b>LCD MODEL</b>	<b>LCD TYPE</b>	<b>REMARK</b>
MBCF20453B00	DC20418H00	STN-Blue Transmissive Negative Mode	
MBCF20453B01	DC20420E00	STN-Blue Transmissive Negative Mode	

- Viewing Direction : 12 O'clock
- Driving Scheme : 1/16 Duty Cycle, 1/5 Bias
- Power Supply Voltage : 5.0V
- $V_{LCD}$  (VDD-V0) : 4.5V
- Backlight Color : white
- Display contents : 20\*4Characters
- RoHS Conformed

**2. MECHANICAL SPECIFICATIONS**

- Module Size : 55mm(L)\*40mm(W)\*8.1mm(T)
- Character Pitch : 2.172mm (W) x 4.25mm(H)
- Character Size : 1.825mm (W) x 3.15mm(H)
- Character Font : 5 x 8 dots
- Dot Size : 0.325 mm(W) x 0.35 mm(H)
- Dot Pitch : 0.375 mm(W) x 0.40 mm(H)



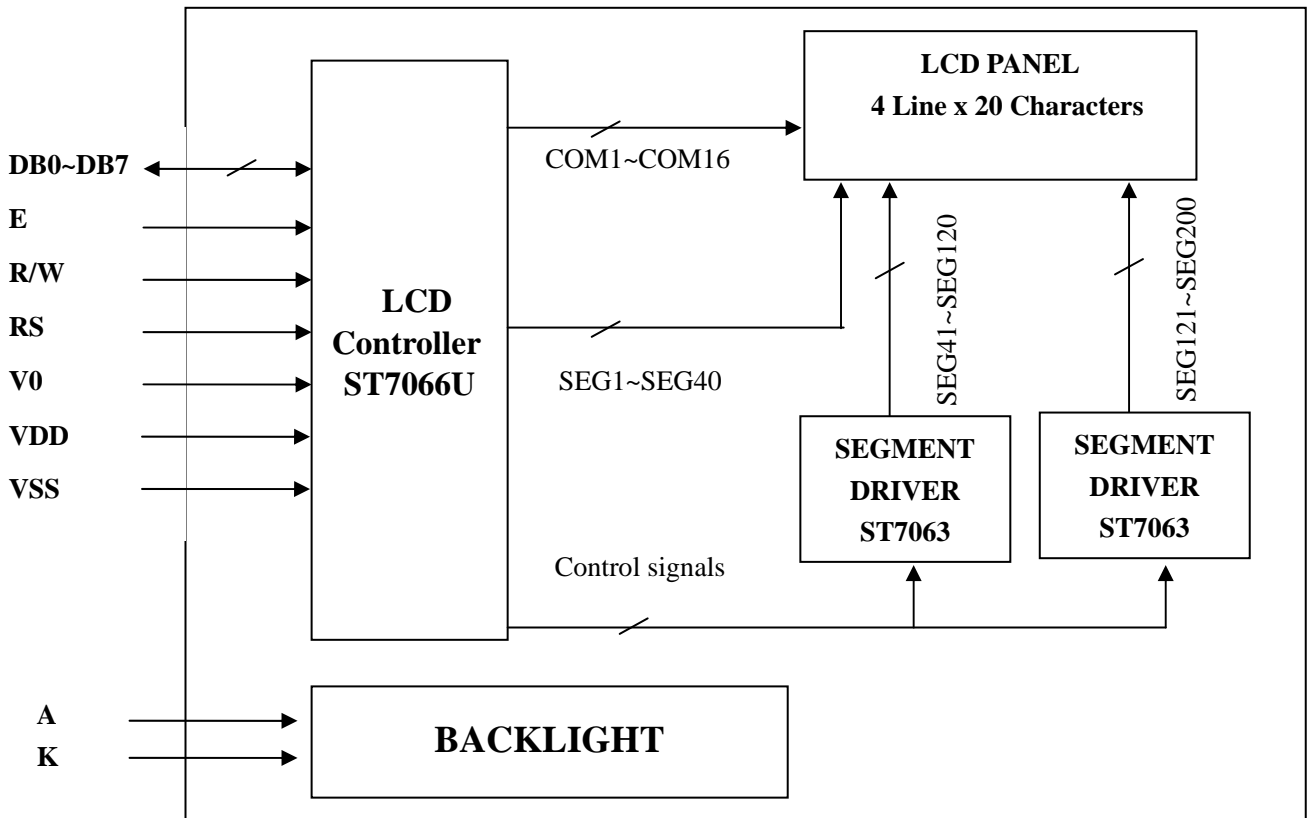


REAR DRAWING

Remarks:  
 1.Unmarked tolerance is ±0.3  
 2.All materials comply with RoHs

**MBCF20453B01**

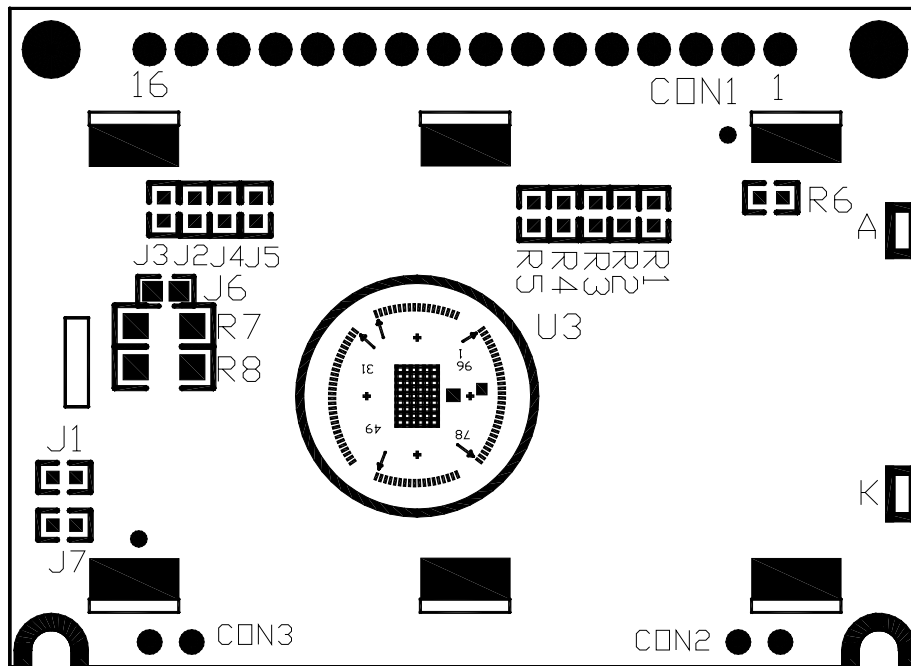
**4. BLOCK DIAGRAM**



**5. PIN ASSIGNMENT**

Pin No.	Symbol	Function
1	V <sub>SS</sub>	Ground
2	V <sub>DD</sub>	Power supply
3	V <sub>0</sub>	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+(A)	Anode of Backlight
16	LED-(K)	Cathode of Backlight

6. SOLDER-BRIDGE SETUP DESCRIPTION



6-1. The polarity of the pin 15 and the pin 16:

symbol state	J2, J4	J3, J5	LED Polarity	
			15 Pin	16 Pin
Each solder-bridge	Each open	Each closed	Anode	Cathode
Each solder-bridge	Each closed	Each open	Cathode	Anode

※Note: In application module: J2=J4= open and J3=J5=closed

6-2. The J1 is metal-bezel GND to module GND and J7 is mounting holes GND to module GND.

※Note: In application module: J1= J7=0 Ohm

6-3. The LED resistor should be bridged when the J6 is solder-Bridge.

※Note: on application module: J6= open

6-4. The R7 and the R8 are the LED resistor.

※Note: on application module: R7= open R8=68 Ohm.

7. MAXIMUM ABSOLUTE LIMIT (Ta=25°C)

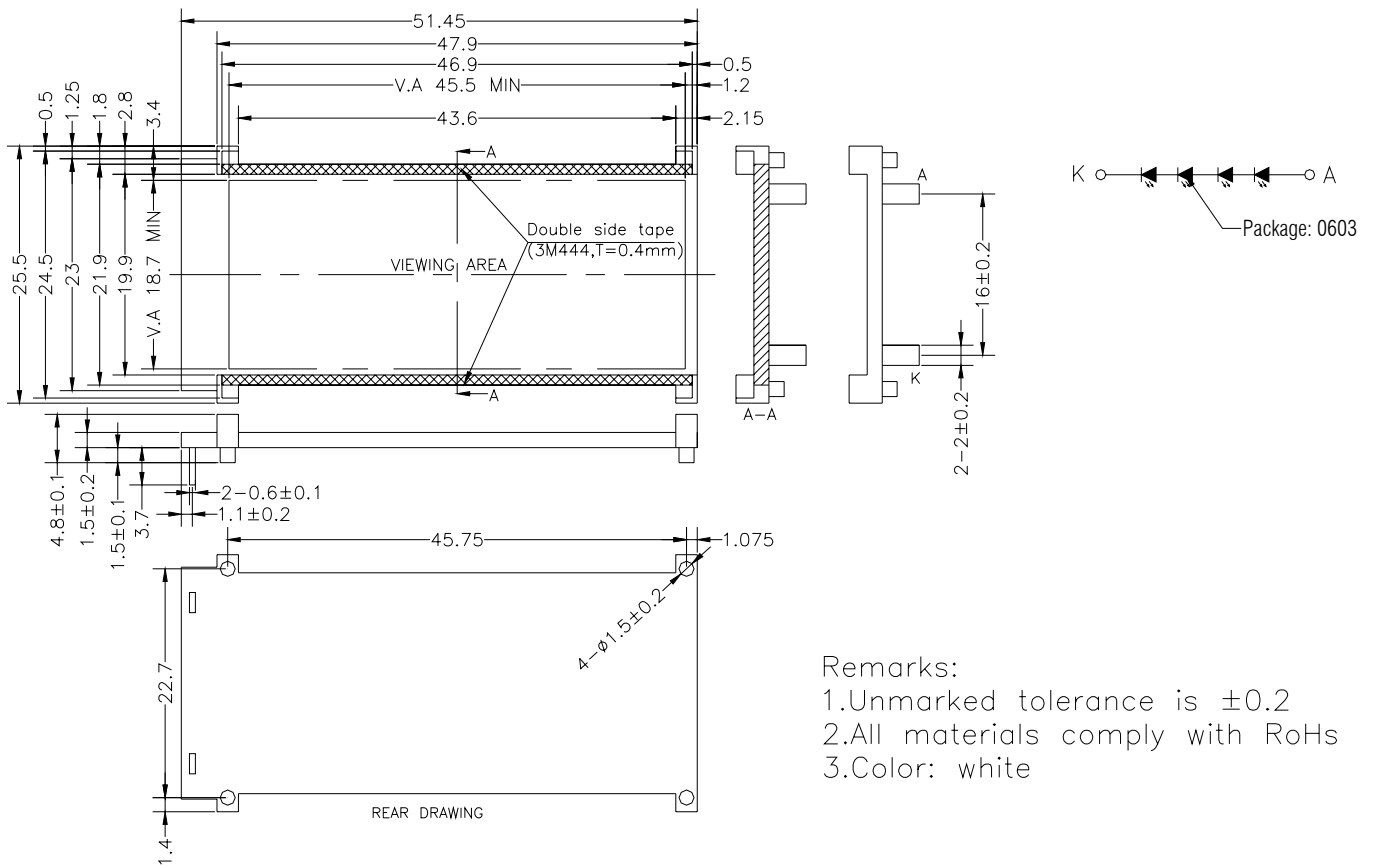
Item	Symbol	Standard value	Unit
Power supply voltage	V <sub>DD</sub>	-0.3~+7.0	V
LCD Driver Voltage	V <sub>LCD</sub>	V <sub>DD</sub> -10.0~V <sub>DD</sub> +0.3	V
Input voltage	V <sub>IN</sub>	-0.3~V <sub>DD</sub> +0.3	V
Operating temperature	T <sub>opr</sub>	0 ~ +50	°C
Storage temperature	T <sub>stg</sub>	-20 ~ +70	°C



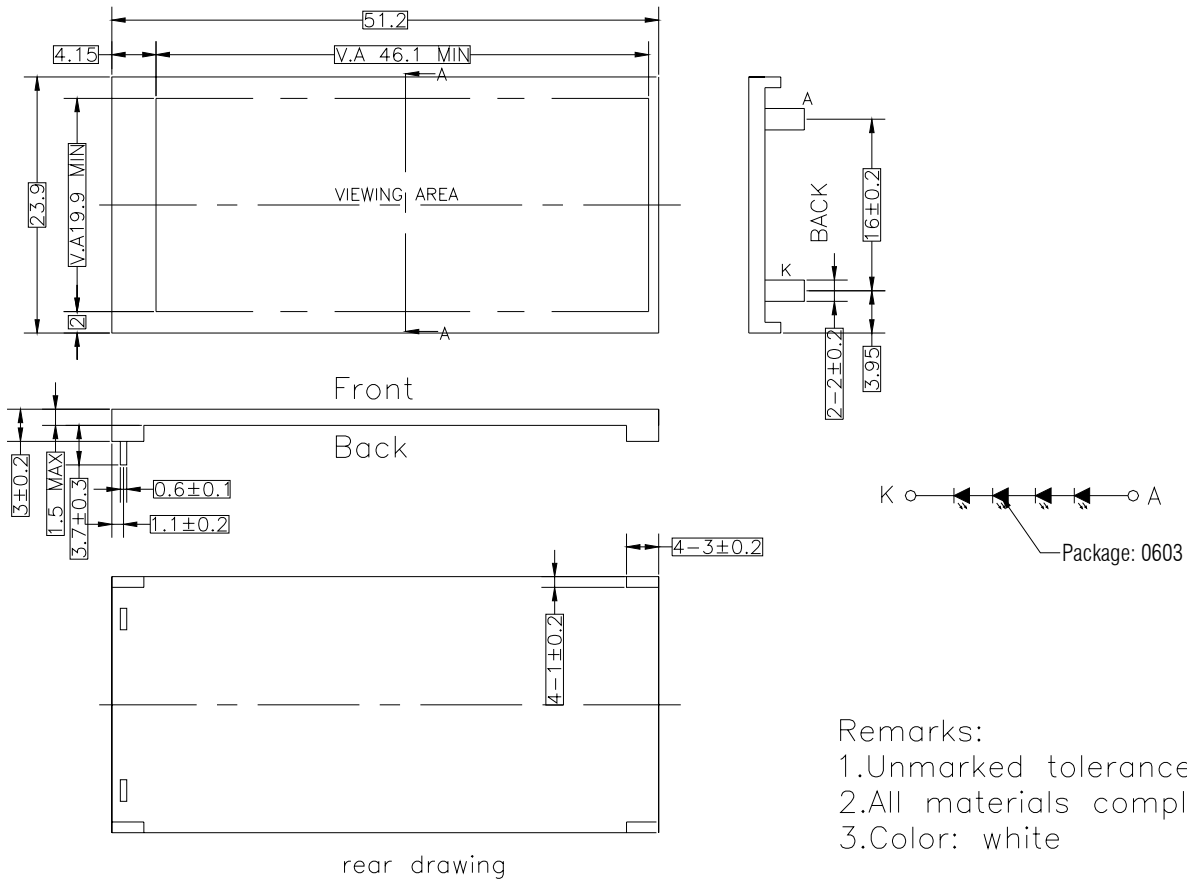
**8. BACKLIGHT COMPONENT ELECTRICAL/OPTICAL SPECIFICATIONS**

**2. Electrical-Optical Characteristics (Ta= 25° C)**

Item	Symbol	MIN.	TYP.	MAX.	Unit	Condition
Forward Voltage	Vf		12.4	14	V	
Forward Current	If		15	25	mA	
Power Disdipation	Pd			0.35	W	If= 15 mA
Colour Coordinate (Tolerances is ±0.01)	x	0.25		0.31	--	
	y	0.25		0.31	--	
Uniformity	Avg	70			%	
Luminance	Lv		700		cd/m <sup>2</sup>	



**MBCF20453B00**



**MBCF20453B01**

**9. DISPLAY DATA RAM (DDRAM)**

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	← Display position
00	01	02	03	04	05	06	07	08	09	0A	0B	0C	0D	0E	0F	10	11	12	13	← DDRAM Address
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	

When the display shift operation is performed, the DDRAM Address moved as follow:

After the left shift instruction

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	← Display position
01	02	03	04	05	06	07	08	09	0A	0B	0C	0D	0E	0F	10	11	12	13	14	← DDRAM Address
41	42	43	44	45	46	47	48	49	4A	4B	4C	4D	4E	4F	50	51	52	53	54	
15	16	17	18	19	1A	1B	1C	1D	1E	1F	20	21	22	23	24	25	26	27	28	
55	56	57	58	59	5A	5B	5C	5D	5E	5F	60	61	62	63	64	65	66	67	68	

After the right shift instruction

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

**10. ELECTRICAL CHARACTERISTICS**

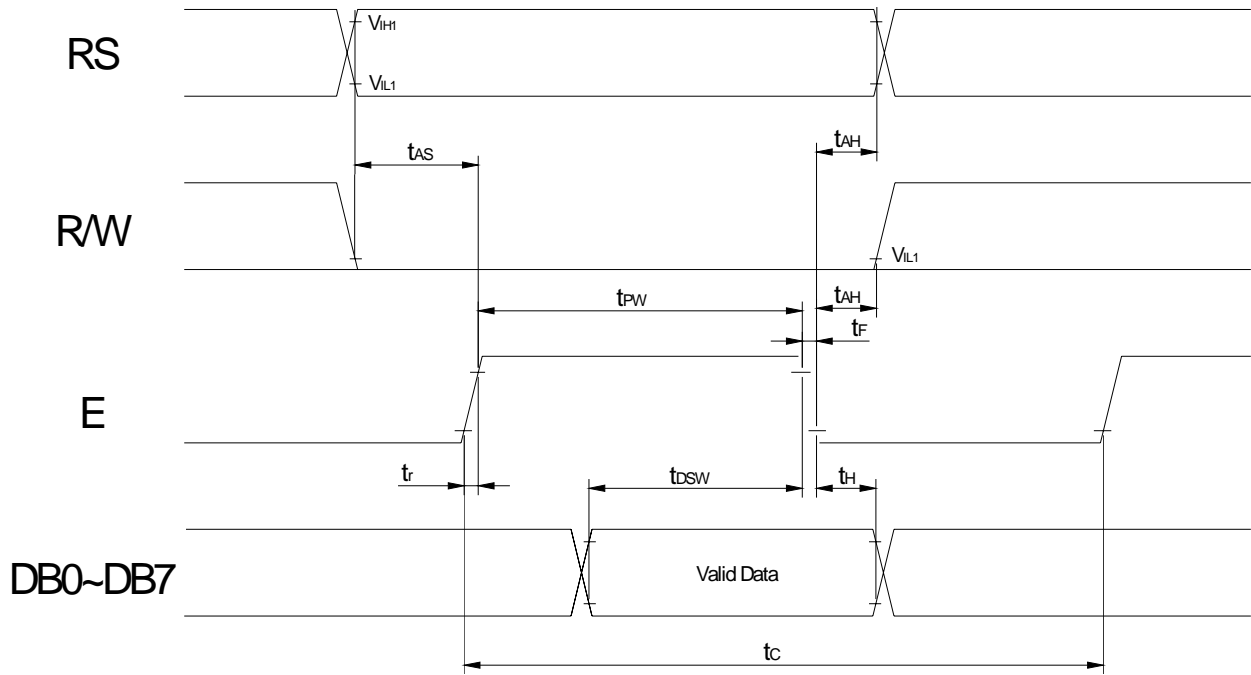
**10-1 DC Characteristics(VDD=4.5V~5.5V,Ta=25°C)**

Item	Symbol	Standard Value			Test Condition	Unit
		MIN	TYP	MAX		
Operating Voltage	V <sub>DD</sub>	4.7	5.0	5.3	-----	V
LCD Voltage	V <sub>LCD</sub>	--	4.5	--	V <sub>DD</sub> -V <sub>0</sub>	V
Power Supply Current	I <sub>DD</sub>	---	1.8	2.5	V <sub>DD</sub> =5.0V,fosc=270kHz	mA
LCD Supply Current	I <sub>LCD</sub>	---	1.0	1.3	V <sub>DD</sub> =5.0V	mA
Input Voltage (1) (except OSC1)	V <sub>IL1</sub>	-0.3	--	0.6	-----	V
	V <sub>IH1</sub>	0.7V <sub>DD</sub>	--	V <sub>DD</sub>	-----	
Input Voltage (2) (OSC1)	V <sub>IL2</sub>	---	---	1.0	-----	V
	V <sub>IH2</sub>	V <sub>DD</sub> -1	--	V <sub>DD</sub>	-----	
Output Voltage (1) (DB0 to DB7)	V <sub>OL1</sub>	---	----	0.4	I <sub>OL</sub> =0.1mA	V
	V <sub>OH1</sub>	3.9	---	V <sub>DD</sub>	I <sub>OH</sub> =-0.1mA	
Output Voltage (2) (except DB0 to DB7)	V <sub>OL2</sub>	0.9V <sub>DD</sub>	---	V <sub>DD</sub>	I <sub>OL</sub> =0.04mA	V
	V <sub>OH2</sub>	---	---	0.1V <sub>DD</sub>	I <sub>OH</sub> =-0.04mA	
Common Resistance	R <sub>COM</sub>	---	2	20	V <sub>LCD</sub> =4V,I <sub>d</sub> =0.05mA	K Ω
Segment Resistance	R <sub>SEG</sub>	---	2	30	V <sub>LCD</sub> =4V,I <sub>d</sub> =0.05mA	
Input Leakage Current	I <sub>LIKG</sub>	-1	---	1	V <sub>IN</sub> =0 V to V <sub>DD</sub>	uA
Pull Up MOS Current	I <sub>PUP</sub>	-50	-110	-180	V <sub>DD</sub> =3V	uA

**10-2. AC Characteristics (VDD=4.5V~5.5 V , Ta=25°C)**

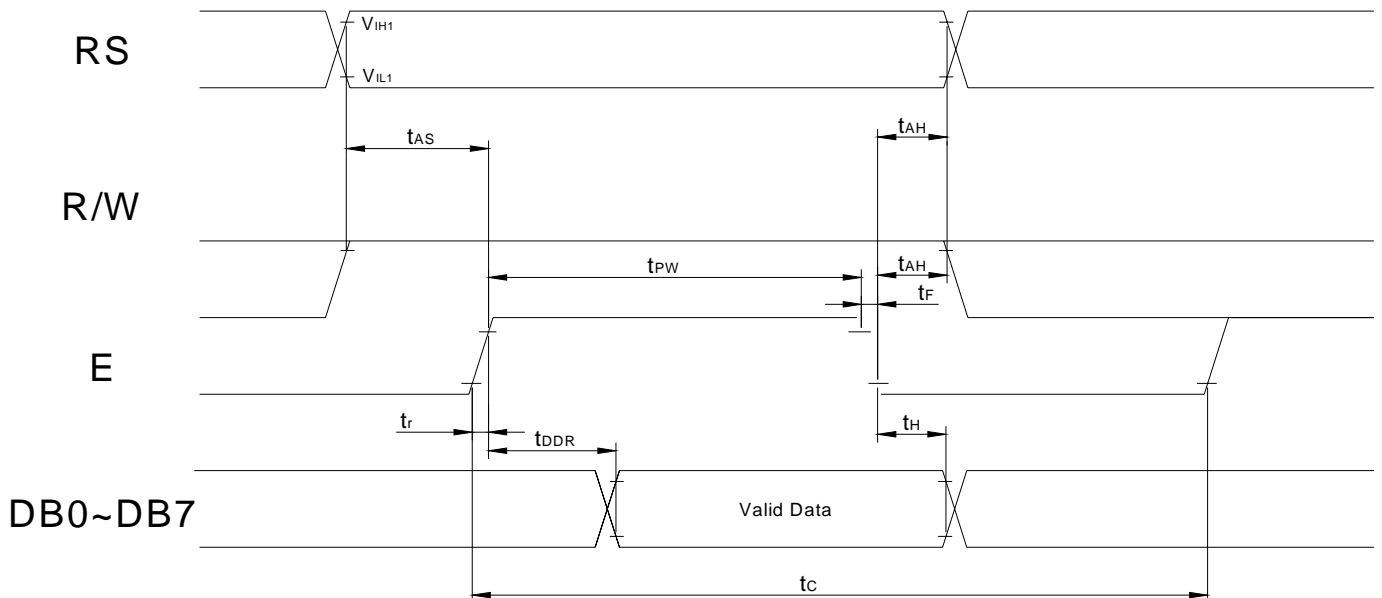
**10-2-1 Write mode (writing data from MPU to MBC20453B Series)**

Characteristic	Symbol	Min	Type	Max	Unit	Test PIN
E Cycle Time	t <sub>C</sub>	1200	---	---	ns	E
E Rise Time	t <sub>R</sub>	---	---	25	ns	E
E Fall Time	t <sub>F</sub>	---	---	25	ns	E
E Pulse width	t <sub>pW</sub>	140	---	---	ns	E
Address Setup Time	t <sub>AS</sub>	0	---	---	ns	R/W,RS,E
Address Hold Time	t <sub>AH</sub>	10	---	---	ns	R/W,RS,E
Data Setup Time	T <sub>DSW</sub>	40	---	---	ns	DB0~DB7
Data Hold Time	t <sub>H</sub>	10	---	---	ns	DB0~DB7



**10-2-2 Read mode (reading data from MBC20453B Series to MPU)**

Characteristic	Symbol	Min	Type	Max	Unit	Test PIN
E Cycle Time	$t_c$	1200	---	---	ns	E
E Rise Time	$t_r$	---	---	25	ns	E
E Fall Time	$t_f$	---	---	25	ns	E
E Pulse width	$t_{pW}$	140	---	---	ns	E
Address Setup Time	$t_{AS}$	0	---	---	ns	R/W,RS,E
Address Hold Time	$t_{AH}$	10	---	---	ns	R/W,RS,E
Data Setup Time	$t_{DDR}$	---	---	100	ns	DB0~DB7
Data Hold Time	$t_H$	10	---	---	ns	DB0~DB7



**11. CONTROL AND DISPLAY COMMAND**

Instruction	Instruction Code										Description	Description Time (270KHz)	
	RS	R/W	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0			
<b>Clear Display</b>	0	0	0	0	0	0	0	0	0	0	1	Write "20H" to DDRAM. and set DDRAM address to "00H" from AC	1.52 ms
<b>Return Home</b>	0	0	0	0	0	0	0	0	0	1	X	Set DDRAM address to "00H" from AC and return cursor to its original position if shifted. The contents of DDRAM are not changed.	1.52 ms
<b>Entry Mode Set</b>	0	0	0	0	0	0	0	0	1	I/D	S	Sets cursor move direction and specifies display shift. These operations are performed during data write and read.	37 us
<b>Display ON/OFF</b>	0	0	0	0	0	0	0	1	D	C	B	D=1:entire display on C=1:cursor on B=1:cursor position on	37 us
<b>Cursor or Display Shift</b>	0	0	0	0	0	0	1	S/C	R/L	X	X	Set cursor moving and display shift control bit, and the direction, without changing DDRAM data.	37 us
<b>Function Set</b>	0	0	0	0	0	1	DL	N	F	X	X	DL:interface data is 8/4 bits N:number of line is 2/1 F:font size is 5x11/5x8	37 us
<b>Set CGRAM address</b>	0	0	0	1	AC5	AC4	AC3	AC2	AC1	AC0		Set CGRAM address in address counter	37 us
<b>Set DDRAM address</b>	0	0	1	AC6	AC5	AC4	AC3	AC2	AC1	AC0		Set DDRAM address in address counter	37 us
<b>Read Busy flag and address</b>	0	1	BF	AC6	AC5	AC4	AC3	AC2	AC1	AC0		Whether during internal operation or not can be known by reading BF. The contents of address counter can also be read.	0 us
<b>Write data to RAM</b>	1	0	D7	D6	D5	D4	D3	D2	D1	D0		Write data into internal RAM (DDRAM/CGRAM)	37 us
<b>Read data from RAM</b>	1	1	D7	D6	D5	D4	D3	D2	D1	D0		Read data from internal RAM (DDRAM/CGRAM)	37 us

Note: Be sure the ST7066U is not in the busy state (BF = 0) before sending an instruction from the MPU to the ST7066U. If an instruction is sent without checking the busy flag, the time between the first instruction and next instruction will take much longer than the instruction time itself. Refer to Instruction Table for the list of each instruction execution time.

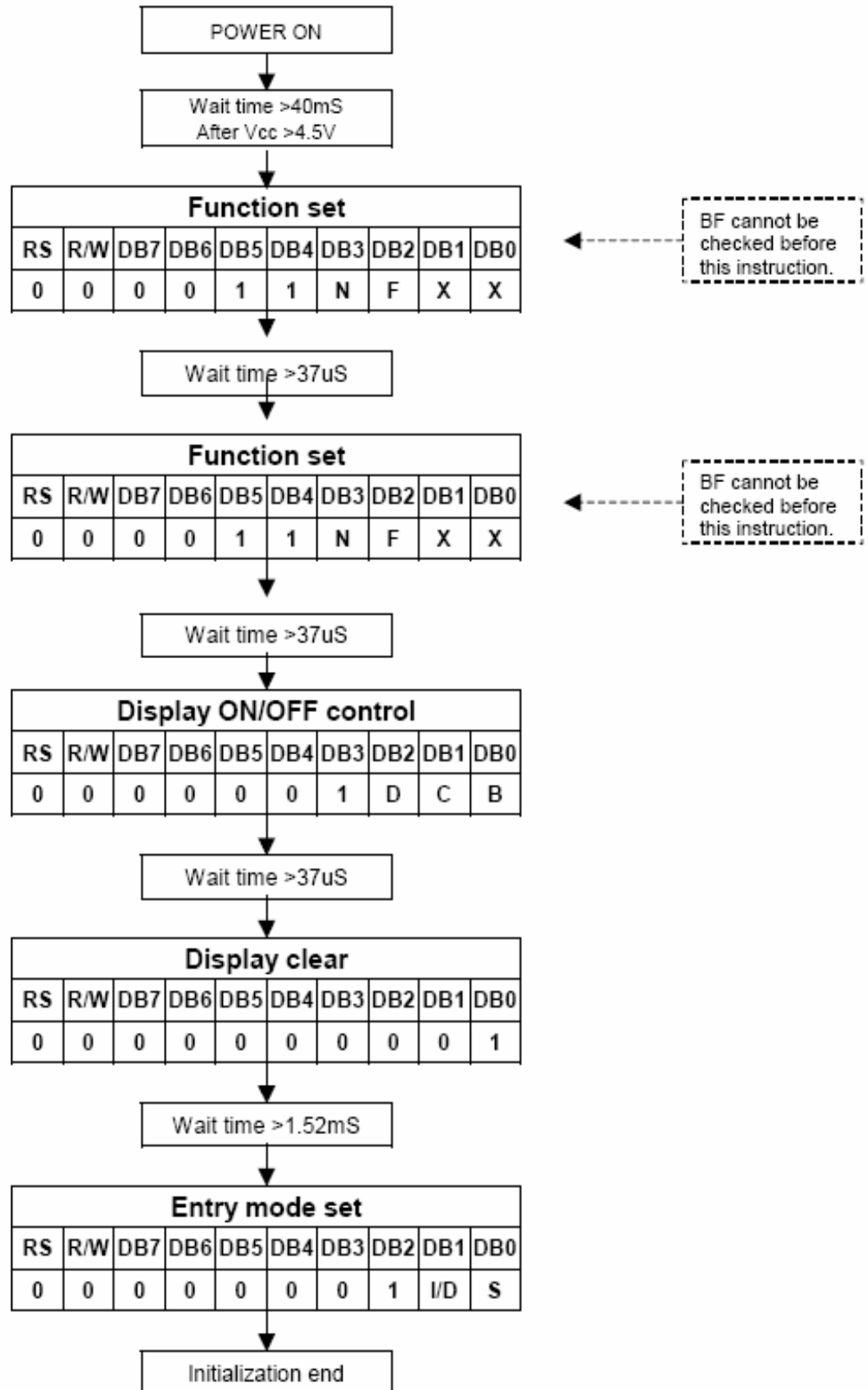
12. STANDRD CHARACTERA PATTERN

NO.7066-0A

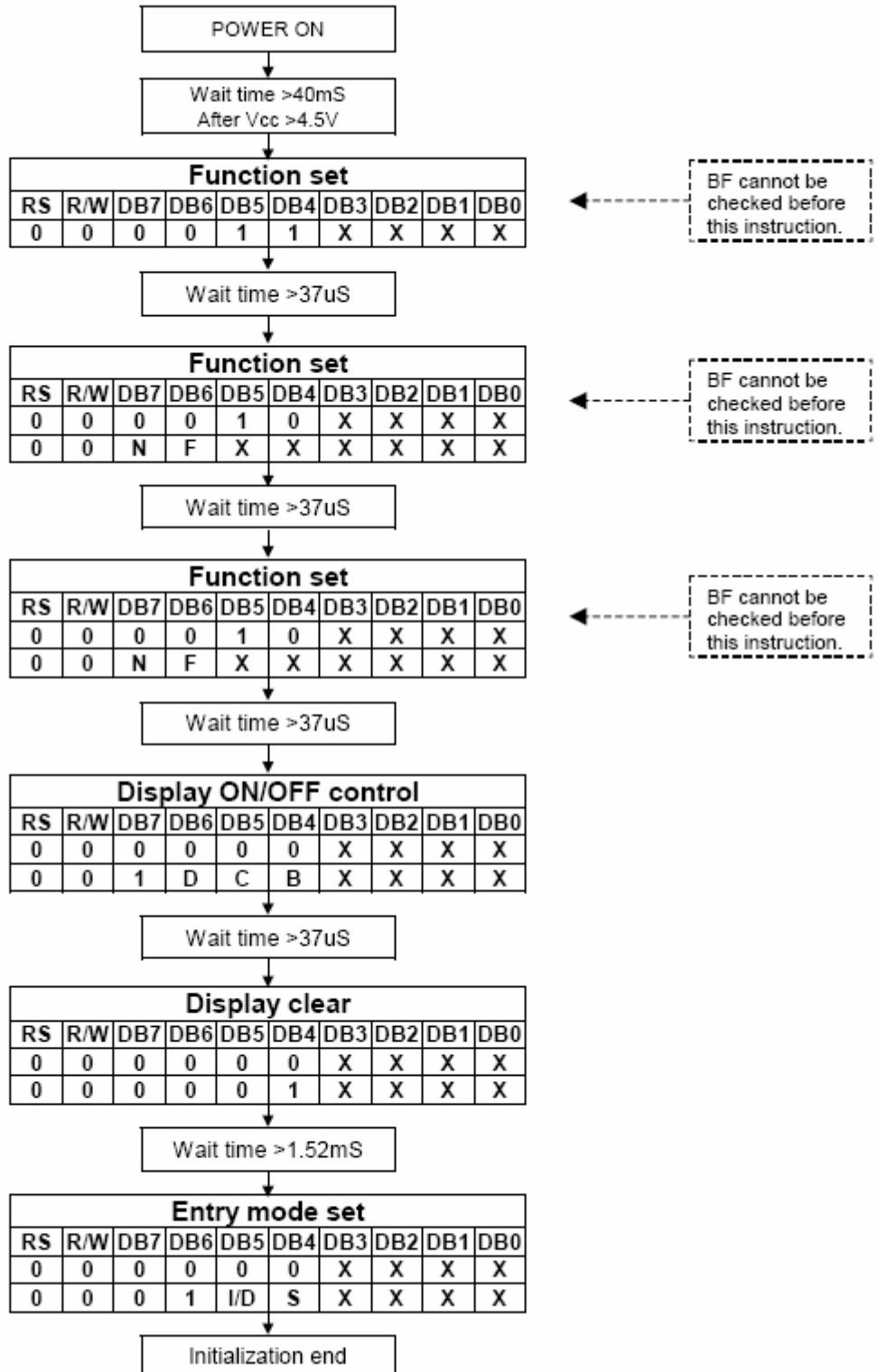
b7-b4 b3-b0	0000	0001	0010	0011	0100	0101	0110	0111	1000	1001	1010	1011	1100	1101	1110	1111
0000	CG RAM (1)			0	1	2	3	4	5	6	7	8	9	A	B	C
0001	(2)	!	"	#	\$	%	&	'	(	)	*	+	,	-	.	/
0010	(3)	"	2	B	R	b	r									
0011	(4)	#	3	C	S	c	s									
0100	(5)	\$	4	D	T	d	t									
0101	(6)	%	5	E	U	e	u									
0110	(7)	&	6	F	V	f	v									
0111	(8)	'	7	G	W	g	w									
1000	(1)	(	8	H	X	h	x									
1001	(2)	)	9	I	Y	i	y									
1010	(3)	*	+	J	Z	j	z									
1011	(4)	+	*	K	L	k	l									
1100	(5)	,	-	L	M	l	m									
1101	(6)	-	=	M	N	m	n									
1110	(7)	.	>	N	O	n	o									
1111	(8)	/	?	O	L	o	*									

13. LCM INITIALIZING BY INSTRUCTION

- 8-bit Interface (fosc=270KHz)



● 4-bit Interface (fosc=270KHz)





**14. 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	+70°C *96hrs
Low temperature storage	-20°C * 96hrs
High temperature operation	+50°C *96hrs
Low temperature operation	0°C *96hrs
High temperature, High humidity	+50°C * 95%RH *96hrs
Thermal shock	<p>0°C *30min. 10s ↓ 5Cycles +50°C *30min.</p>
Vibration test	Frequency *Swing * Time 40Hz * 4mm * 4hrs
Drop test	Drop height*Times 1.0m * 6times

**15. THE MODULE ACCEPTS QUALITY LEVEL (AQL).**

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

15.2 Curtailed inspection scheme

Type	Batch Qty	AQL value	pass	Reject
module product	<350PCS <1000PCS	0.1	0	1
		0.65	2	3
		2.5	7	8
	<200 <350PCS	0.1	0	1
		0.65	1	2
		2.5	5	6
	<200PCS	0.1	0	1
		0.65	0	1
		2.5	4	5
Module sample	<200PCS			The sample will be reject when the fateful defect>2pcs or main defect>5pcs.
	>200PCS			

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.

**16. 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.

**17. 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