DISPLAY Elektronik GmbH

DATA SHEET

LCD MODULE

DEM 16214 SYH-LY-CYR22

Version: 3

Product Specification

02/Feb/2012

GENERAL SPECIFICATION

MODULE NO. :
DEM 16214 SYH-LY-CYR22

CUSTOMER   P/N:

Version No.	Change Description	Date
0	Original Version	14.12.2007
1	Update Item And Correct Printing On The PCB	25.12.2007
2	Update PCB Description	13.01.2009
3	Add Version	02.02.2012

PREPARED BY: **WM**   **DATE: 02.02.2012**

APPROVED BY: **MH**   **DATE: 02.02.2012**

CONTENTS

1. FUNCTIONS & FEATURES

MODULE NAME	LCD Type
DEM 16214 SYH-LY-CYR22	STN Yellow Green Transflective Positive Mode

- Viewing Direction   : 6 O'clock
- Driving Scheme   : 1/16 Duty Cycle, 1/5 Bias
- Power Supply Voltage   : 5.0 Volt (typ.)
- $V_{LCD}(V_{DD} - V_0)$: 4.5 Volt (typ.)
- LCD-Driver   : ST7066U-OT (Sitronix, English-Cyrillic)
- Display Format   : 16 x 2 Characters (5 x 8 dots, Format : 192 Kinds)
- Internal Memory   : CGROM (8,320 bits)
                                                  : CGRAM (64 x 8 bits)
                                                  : DDRAM (80 x 8 bits for 80 Digits)
- Interface   : 4-bit or 8-bit MPU

2. MECHANICAL SPECIFICATIONS

- Module Size   : 100.00 x 42.00 x 13.00 mm (max.)
- Character Pitch   : 4.82 x 8.26 mm
- Character Size   : 4.07 x 7.76 mm
- Character Font   : 5 x 8 dots
- Dot Pitch   : 0.83 x 0.98 mm
- Dot Size   : 0.75 x 0.90 mm
- Dot Gap   : 0.08 mm

3. EXTERNAL DIMENSIONS (⌖⊠   unit: mm)

Remarks:
1,Unmarked tolerance is ±0.4,
2,The material comply with RoHS.
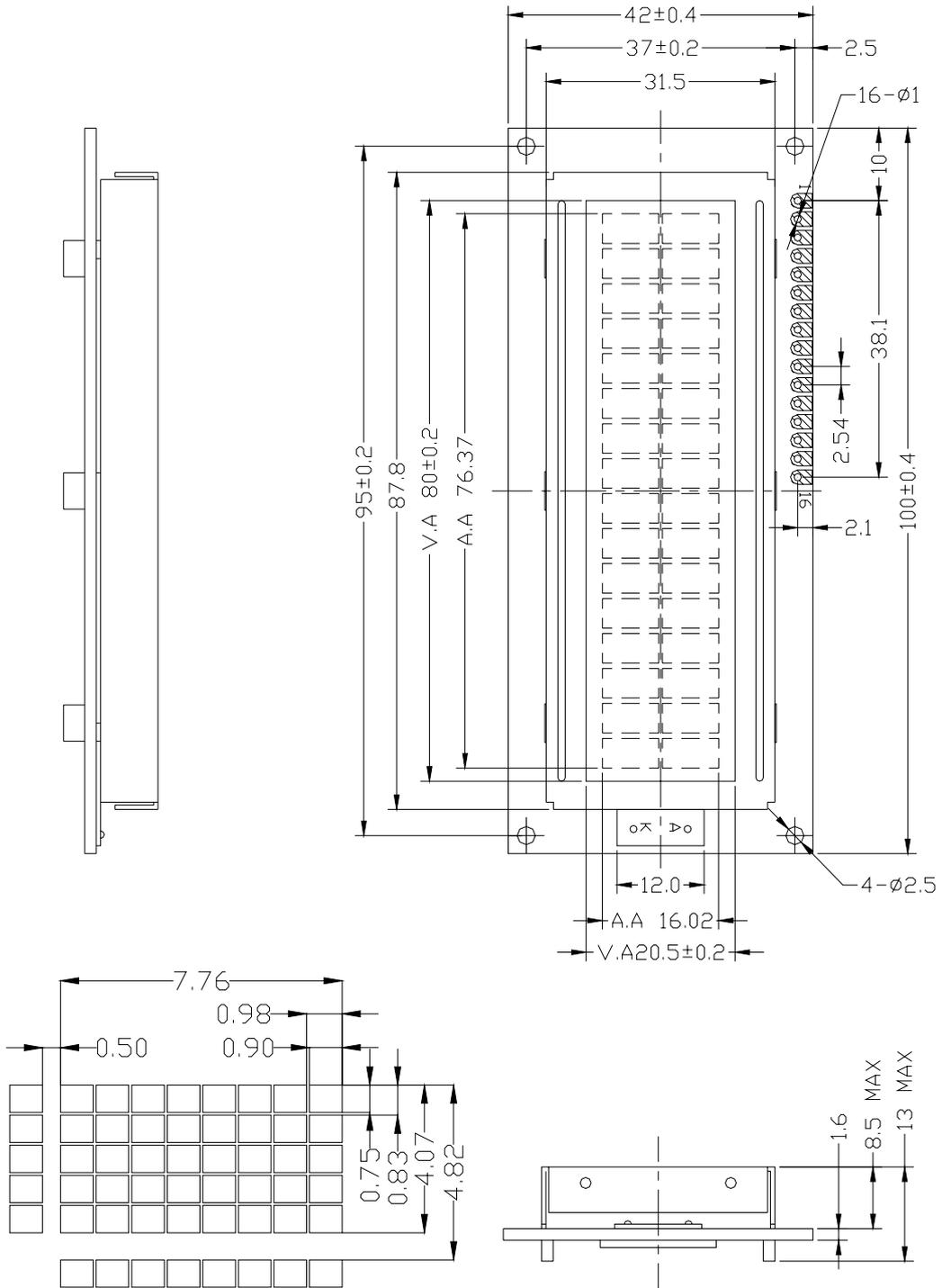
4. BLOCK DIAGRAM
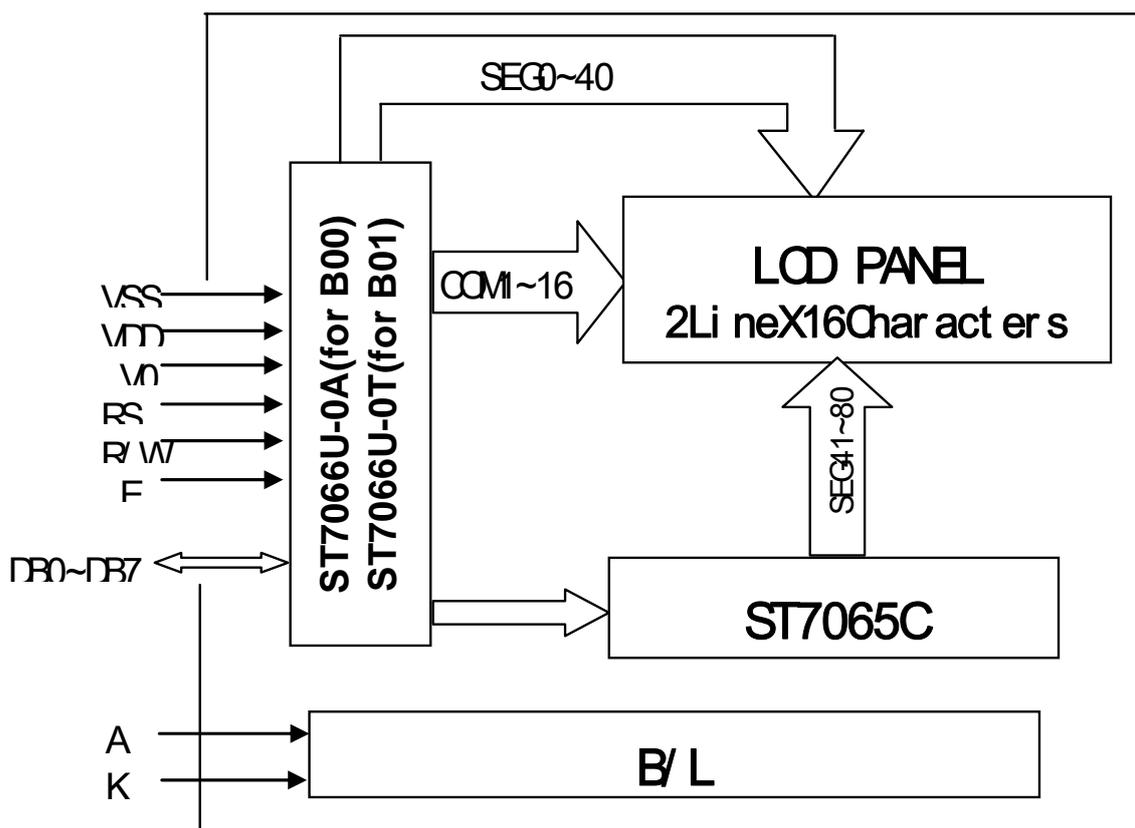
5. PIN ASSIGNMENT

| Pin No.	Symbol	Function
1	VSS	Ground terminal of module.
2	VDD	Supply terminal of module 2.7V to 5.5V.
3	V0	Power Supply for liquid crystal drive.
4	RS	Register select RS = 0 (Instruction register) RS = 1 (Data register)
5	R/W	Read /Write R/W = 1 (Read) R/W = 0 (Write)
6	E	Enable
7	DB0	Bi-directional data bus, data transfer is performed once, thru DB0 to DB7, in the case of interface data. Length is 8-bits; and twice, thru DB4 to DB7 in the case of interface data length is 4-bits. Upper four bits first then lower four bits.
8	DB1	
9	DB2	
10	DB3	
11	DB4	
12	DB5	
13	DB6	
14	DB7	
15	LED – (K)	Please also refer to 6.1 PCB drawing and description.
16	LED + (A)	Please also refer to 6.1 PCB drawing and description.

6. PCB DRAWING AND DESCRIPTION
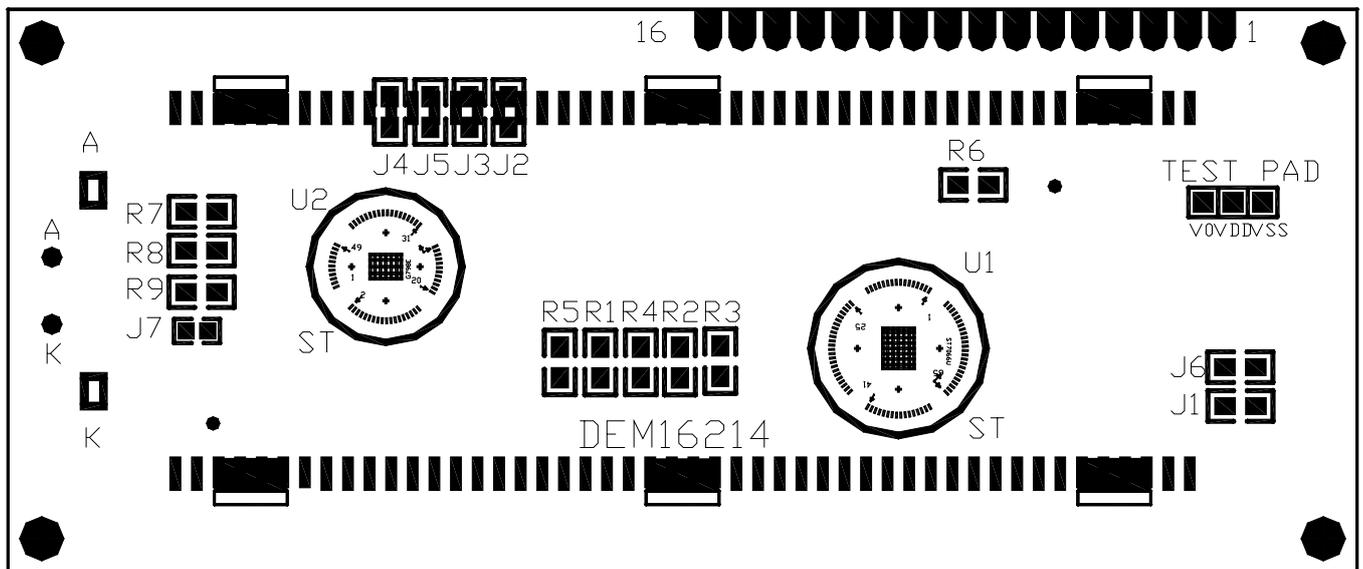
6.1 DESCRIPTION:

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

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

Note: In application module, J3=J5=0 ohm, J2=J4=open.

6-1-2. The J1 is metal-bezel GND to module GND and J6 is mounting holes GND to module GND.

Note: In application module, J1= J6=0 ohm.

6-1-3.The LED resistor should be bridged when the R7, R8, R9, J7 is closed.

Note: In application module, R7=R8=33 ohm, R9=J7=open.

6.2 Example application

6-2-1. The LED resistor should be bridged as following.

R7

R8

R9

J7
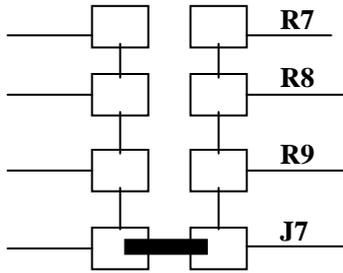
6-2-2. The pin 15 is the anode and the pin 16 is the cathode as following.

J5   J2

J4   J3
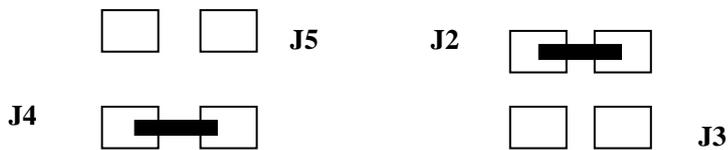
6-2-3.The pin 15 is the cathode and the pin 16 is the anode as following.

J5   J2

J4   J3
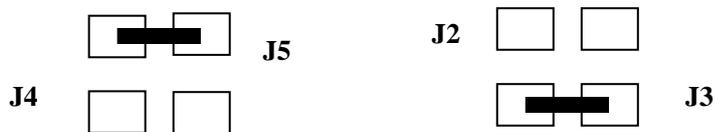
6-2-4. The metal-bezel is on ground as following.

J1

6-2-5. The mounting hole is on ground as following.

J6

7. BACKLIGHT ELECTRONICS/OPTICAL SPECIFICATIONS

Electronics/Optical Specifications:

	SYMBOL	MIN.	TYP.	MAX.	UNIT	CONDITIONS
Forward Voltage	V_f	3.85	4.05	4.25	V	If = 140 mA
Reverse Current	I_r			1.40	mA	Vr = 8 V
Peak wave length	λP		568		nm	If = 140 mA
Spectral line half width	$\triangle \lambda$		30		nm	If = 140 mA
Luminance	L_V	98.3	122.8		cd/㎡	If = 140 mA

Remarks:
1,Unmarked tolerance is ±0.3,
2,Color:Yellow-Green,
3,The material comply with RoHS.
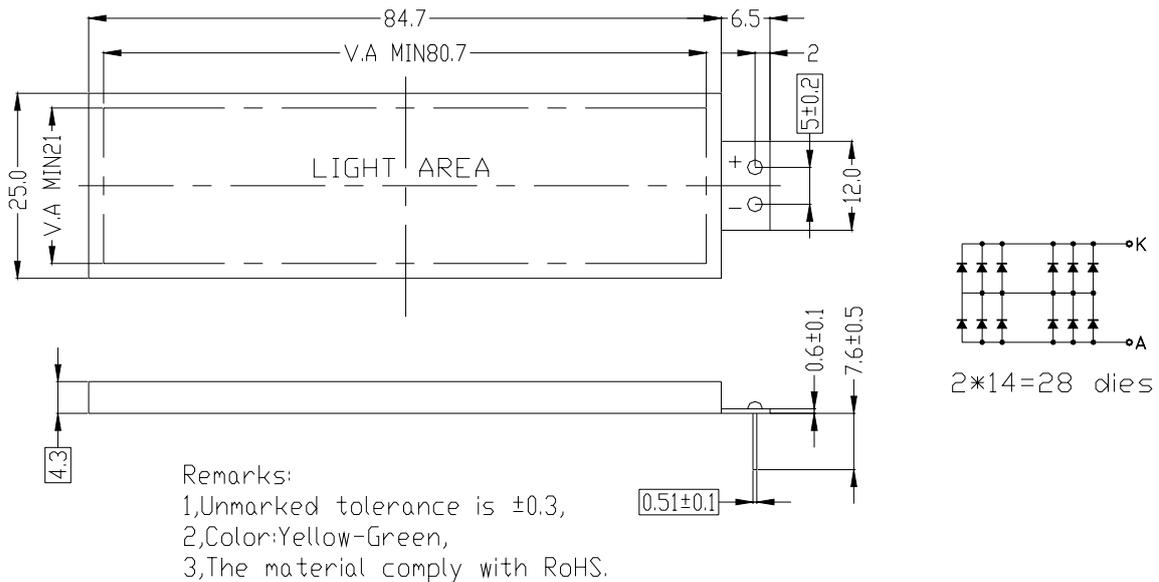
8. MAXIMUM ABSOLUTE POWER RATINGS

Item	Symbol	Standard Value	Unit
Power supply voltage(1)	V_{DD}	-0.3~+7.0	V
Power supply voltage(2)	V_{LCD}	V_{DD}-10.0~V_{DD}+0.3	V
Input voltage	V_{IN}	-0.3~V_{DD}+0.3	V
Operating temperature	Topr	-20~+70	°C
Storage temperature	Tstg	-25~+75	°C

9. ELECTRICAL CHARACTERISTICS

9-1 DC Characteristics

Item	Symbol	Standard Value			Test Condition	Unit
		MIN	TYP	MAX		
Operating Voltage	V_{DD}	4.7	5.0	5.3	-------	V
Supply Current	I_{DD1}	----	0.7	1.0	Ceramic oscillation fosc=250kHz	mA
	I_{DD2}	----	0.4	0.6	Resistor oscillation external clock operation fosc=270kHz	
LCD Driving Voltage	VLCD	4.2	4.5	4.8	V_{DD}-V5	V

9-2 AC Characteristics

9-2-1 Write mode

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_W	140	---	---	ns	E
Address Setup Time	t_{SU1}	0	---	---	ns	R/W,RS,E
Address Hold Time	t_{H1}	10	---	---	ns	R/W,RS,E
Data Set-up Time	t_{SU2}	40	---	---	ns	DB0~DB7
Data Hold Time	t_{H2}	10	---	---	ns	DB0~DB7
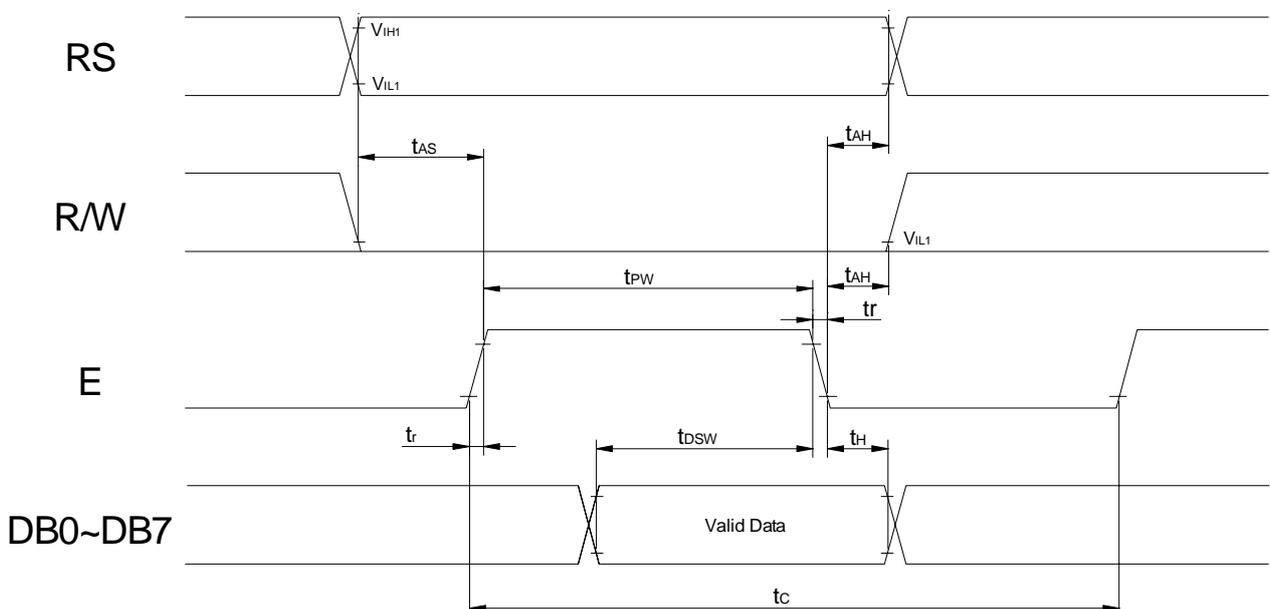
9-2-2 Read Mode

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
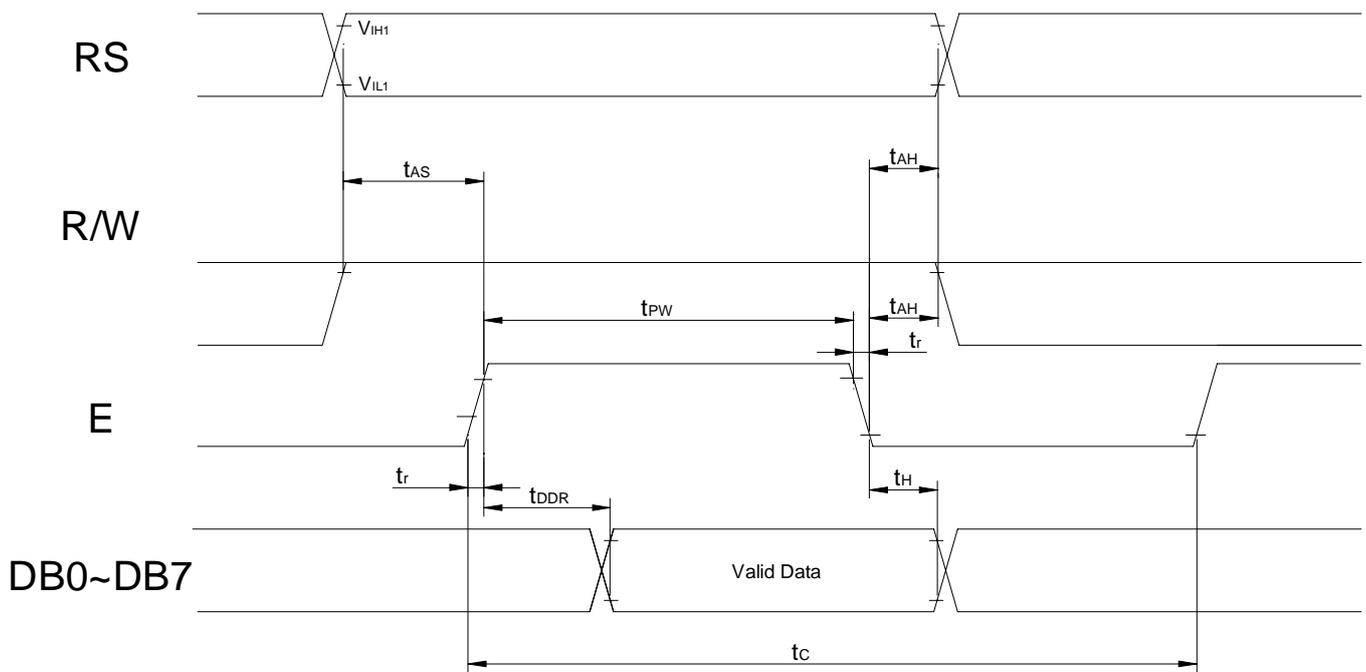
10. DISPLAY DATA RAM (DDRAM)

Display
Position

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
DDRAM Address	00	01	02	03	04	05	06	07	08	09	0A	0B	0C	0D	0E	0F
	40	41	42	43	44	45	46	47	48	49	4A	4B	4C	4D	4E	4F

For Shift Left	01	02	03	04	05	06	07	08	09	0A	0B	0C	0D	0E	0F	10
	41	42	43	44	45	46	47	48	49	4A	4B	4C	4D	4E	4F	50

For Shift Right	27	00	01	02	03	04	05	06	07	08	09	0A	0B	0C	0D	0E
	67	40	41	42	43	44	45	46	47	48	49	4A	4B	4C	4D	4E

11. INSTRUCTION TABLE

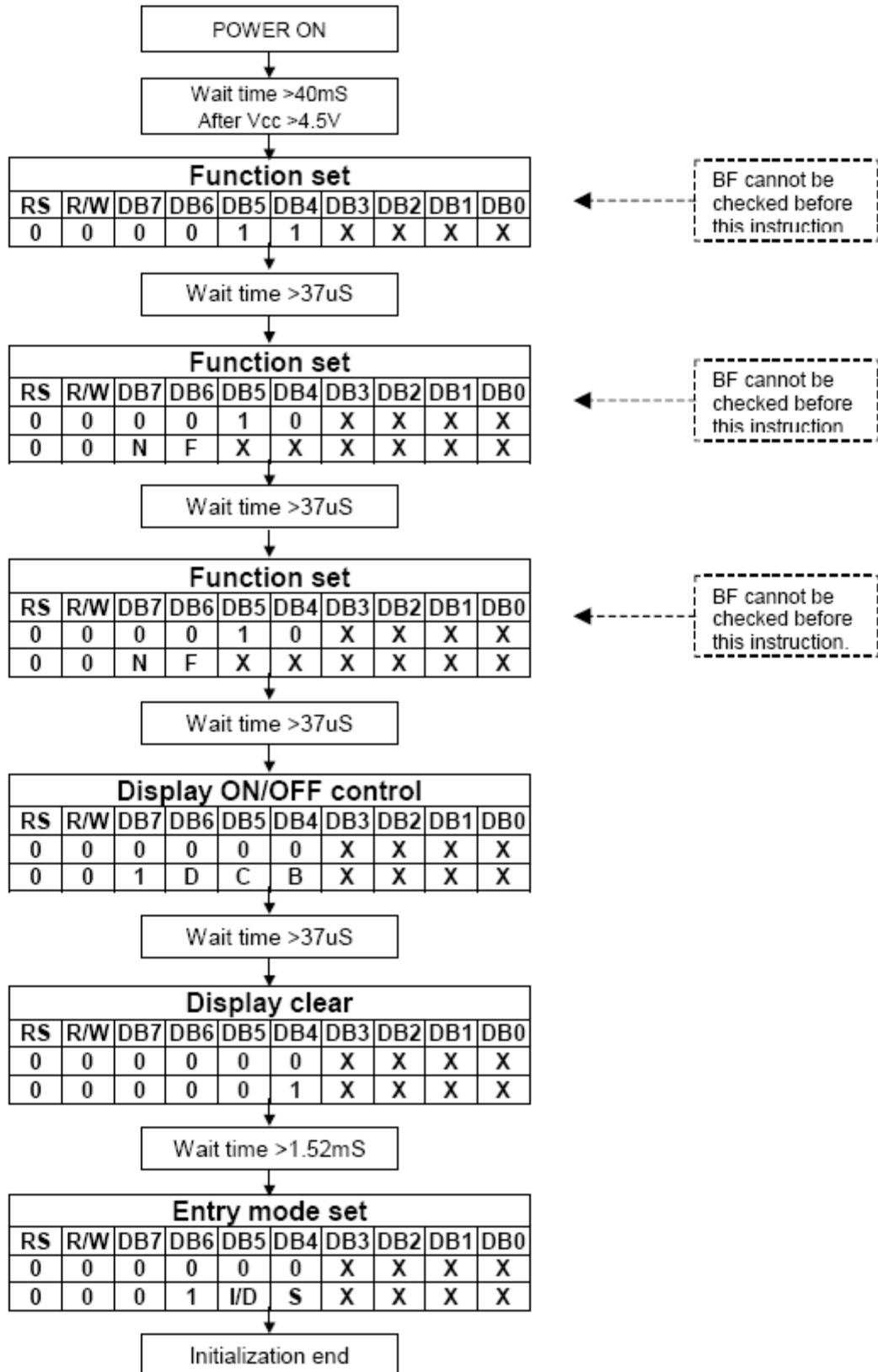| Instruction	Instruction Code										Description	Description Time (270KHz)
	RS	R/W	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0		
Clear Display	0	0	0	0	0	0	0	0	0	1	Write "20H" to DDRAM. and set DDRAM address to "00H" from AC	1.52 ms
Return Home	0	0	0	0	0	0	0	0	1	x	Set DDRAM address to "00H" from AC and return cursor to its original position if shifted. The contents of DDRAM are not changed.	1.52 ms
Entry Mode Set	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
Display ON/OFF	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
Cursor or Display Shift	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
Function Set	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
Set CGRAM address	0	0	0	1	AC5	AC4	AC3	AC2	AC1	AC0	Set CGRAM address in address counter	37 us
Set DDRAM address	0	0	1	AC6	AC5	AC4	AC3	AC2	AC1	AC0	Set DDRAM address in address counter	37 us
Read Busy flag and address	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
Write data to RAM	1	0	D7	D6	D5	D4	D3	D2	D1	D0	Write data into internal RAM (DDRAM/CGRAM)	37 us
Read data from RAM	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. INITIALIZING BY INSTRUCTION

12-1. 8-Bit Interface Mode (fosc=270 kHz)

```
                        ┌──────────────────┐
                        │    POWER ON      │
                        └──────────────────┘
                                 │
                        ┌──────────────────┐
                        │  Wait time >40mS │
                        │ After Vcc >4.5V  │
                        └──────────────────┘
                                 │
                        ┌──────────────────┐
                        │   Function set   │                    ┌─────────────────┐
                        └──────────────────┘   ◄ ─ ─ ─ ─ ─ ─ ─  │ BF cannot be    │
                                                                │ checked before  │
                                                                │ this instruction│
                                                                └─────────────────┘
```

Function set

RS	R/W	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0
0	0	0	0	1	1	N	F	X	X

Wait time >37uS

Function set

RS	R/W	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0
0	0	0	0	1	1	N	F	X	X

BF cannot be checked before this instruction.

Wait time >37uS

Display ON/OFF control

RS	R/W	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0
0	0	0	0	0	0	1	D	C	B

Wait time >37uS

Display clear

RS	R/W	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0
0	0	0	0	0	0	0	0	0	1

Wait time >1.52mS

Entry mode set

RS	R/W	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0
0	0	0	0	0	0	0	1	I/D	S

Initialization end

12-2. 4-Bit Interface Mode

POWER ON

↓

Wait time >40mS After Vcc >4.5V

↓

Function set

RS	R/W	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0
0	0	0	0	1	1	X	X	X	X

← BF cannot be checked before this instruction

↓

Wait time >37uS

↓

Function set

RS	R/W	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0
0	0	0	0	1	0	X	X	X	X
0	0	N	F	X	X	X	X	X	X

← BF cannot be checked before this instruction

↓

Wait time >37uS

↓

Function set

RS	R/W	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0
0	0	0	0	1	0	X	X	X	X
0	0	N	F	X	X	X	X	X	X

← BF cannot be checked before this instruction.

↓

Wait time >37uS

↓

Display ON/OFF control

RS	R/W	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0
0	0	0	0	0	0	X	X	X	X
0	0	1	D	C	B	X	X	X	X

↓

Wait time >37uS

↓

Display clear

RS	R/W	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0
0	0	0	0	0	0	X	X	X	X
0	0	0	0	0	1	X	X	X	X

↓

Wait time >1.52mS

↓

Entry mode set

RS	R/W	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0
0	0	0	0	0	0	X	X	X	X
0	0	0	1	I/D	S	X	X	X	X

↓

Initialization end

13. CHARACTER GENERATOR ROM

NO.7066-0T

14. LCD MODULES HANDLING PRECAUTIONS

- Please remove the protection foil of polarizer before using.
- 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