DISPLAY Elektronik GmbH

DATA SHEET

LCD MODULE

DEM 08172 FGH-PW

Product Specification   *Version: 5.1.4*

21.11.2013

GENERAL SPECIFICATION

MODULE NO. :

DEM 08172 FGH-PW

CUSTOMER P/N:

Version No.	Change Description	Date
0	ORIGINAL VERSION	08.04.2004
1	CHANGED PCB & BACKLIGHT & MODULE DRAWING	16.06.2004
2	CHANGED PCB DESCRIPTION & MODULE DRAWING & CHARACTER PATTERN	28.08.2004
3	ADD VERSION	21.12.2004
4	ADD VERSION	13.05.2005
5	CHANGED PCB DRAWING & DESCRIPTION	25.05.2005
5.1.0	ADD VERSION	21.11.2007
5.1.1	UPDATE BACKLIGHT DRAWING	14.01.2009
5.1.2	UPDATE BACKLIGHT PARAMETER	08.04.2009
5.1.3	ADD VERSION	13.11.2013
5.1.4	CHANGE BACKLIGHT	21.11.2013

PREPARED BY: LX   **DATE:** 21.11.2013

APPROVED BY: MH   **DATE:** 21.11.2013

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CONTENTS

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1. FUNCTIONS & FEATURES

MODULE NAME	LCD Type
DEM 08172 FGH-PW	FSTN Transflective Positive Mode

- Viewing Direction : 6 O'clock
- Driving Scheme : 1/8 Duty Cycle, 1/4 Bias
- Power Supply Voltage : 5.0 Volt (typ.)
- V_{LCD} (V_{DD}-V5) : 4.5 Volt (typ.)
- Display Contents : 8 x 1Characters
- Internal Memory : CGROM (13,200 bits)
  - : CGRAM (64 x 8 bits)
  - : DDRAM (80 x 8 bits for Digits)
- CGROM : CGROM of the ST7066U-0A-B
- Interface : Easy Interface with a 4-bit or 8-bit MPU
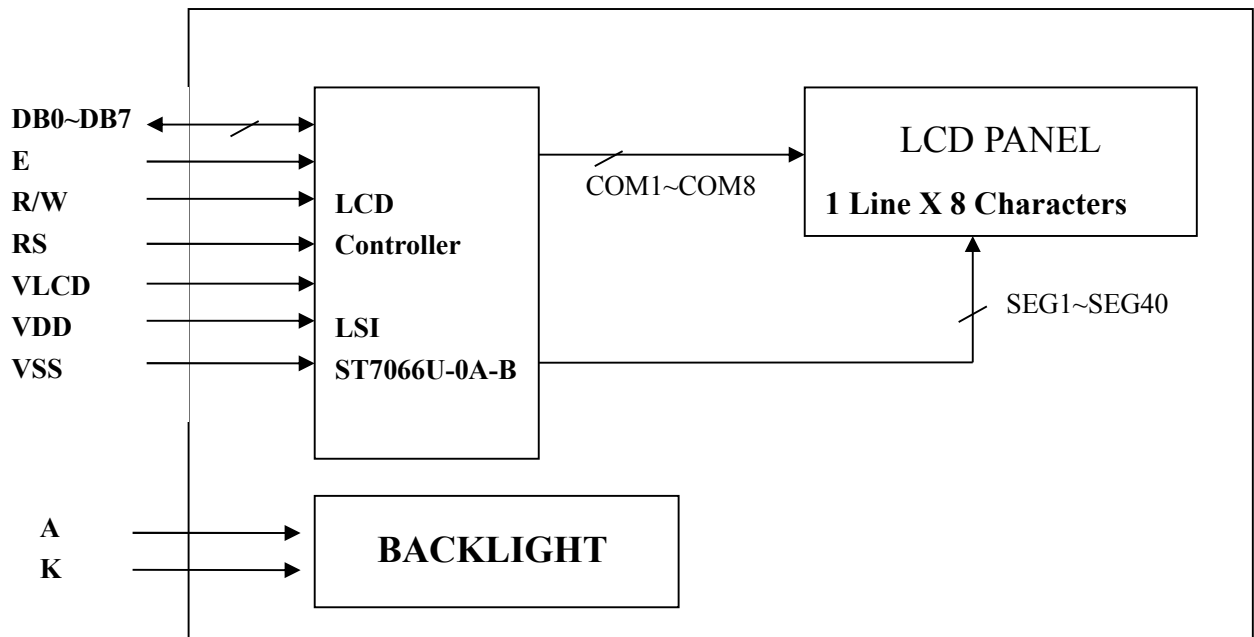
2. MECHANICAL SPECIFICATIONS

- Module Size : 84.00 x 44.00 x 10.50 mm
- Character Pitch : 7.15 x 11.45 mm
- Character Size : 6.45 x 10.75 mm
- Character Font : 5 x 8 dots
- Dot Size : 1.25 x 1.30 mm
- Dot Pitch : 1.30 x 1.35 mm
- Dot Gap : 0.05mm

3. EXTERNAL DIMENSIONS
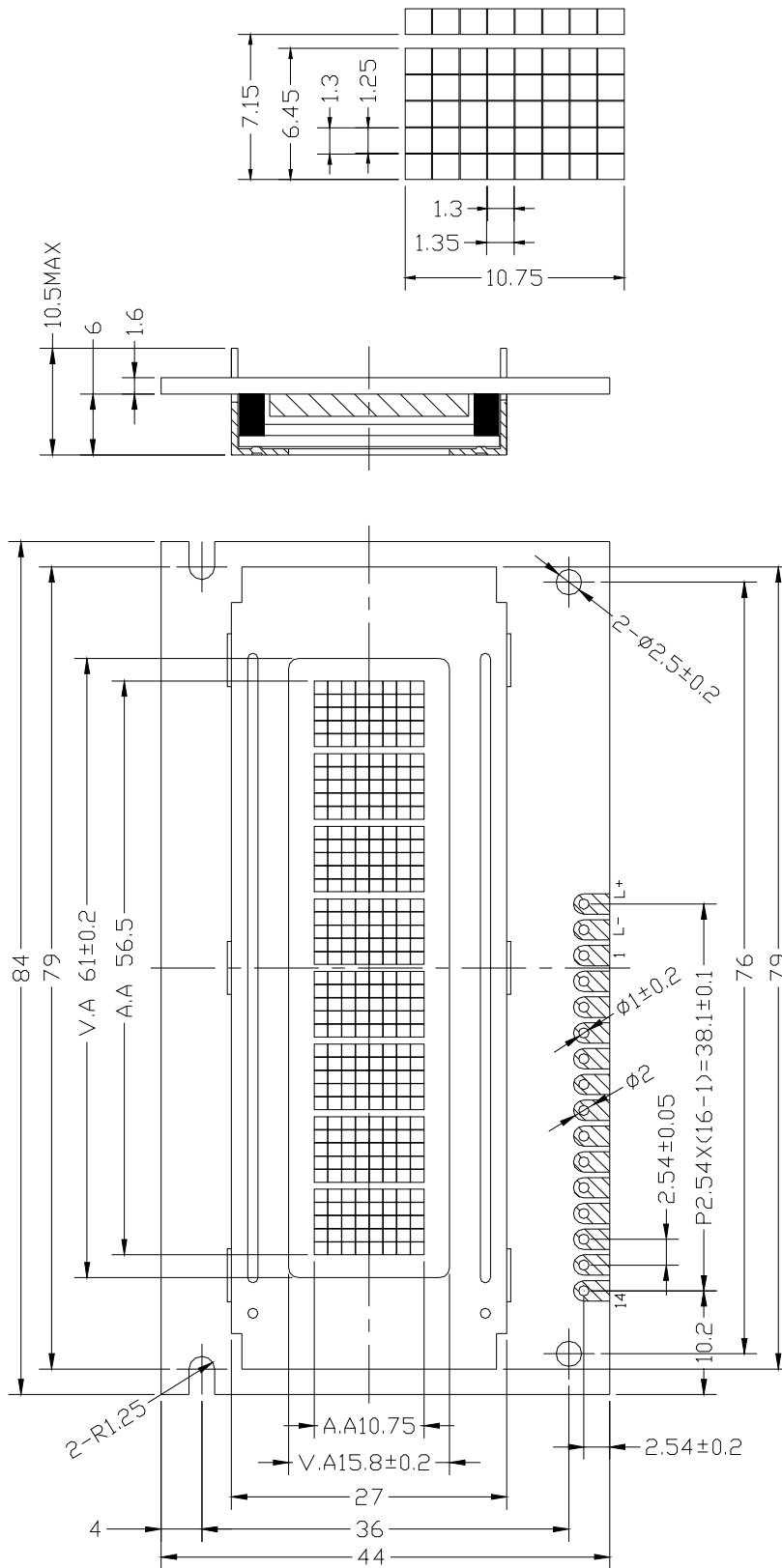
REMARKS:
1,UNMARKED TOLERANCE IS ±0.3
2,THE MATERIAL COMPLY WITH ROHS

4. BLOCK DIAGRAM

5. PIN ASSIGNMENT

Pin No.	Symbol	Function
1	VSS	Ground
2	VDD	Power supply
3	VLCD	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	
8	DB1	
9	DB2	
10	DB3	Display Data Signal
11	DB4	
12	DB5	
13	DB6	
14	DB7	
L-	LED-(K)	Place also refer to 6.1 PCB Drawing and description
L+	LED+(A)	Place also refer to 6.1 PCB Drawing and description

6. PCB DRAWING AND DESCRIPTION
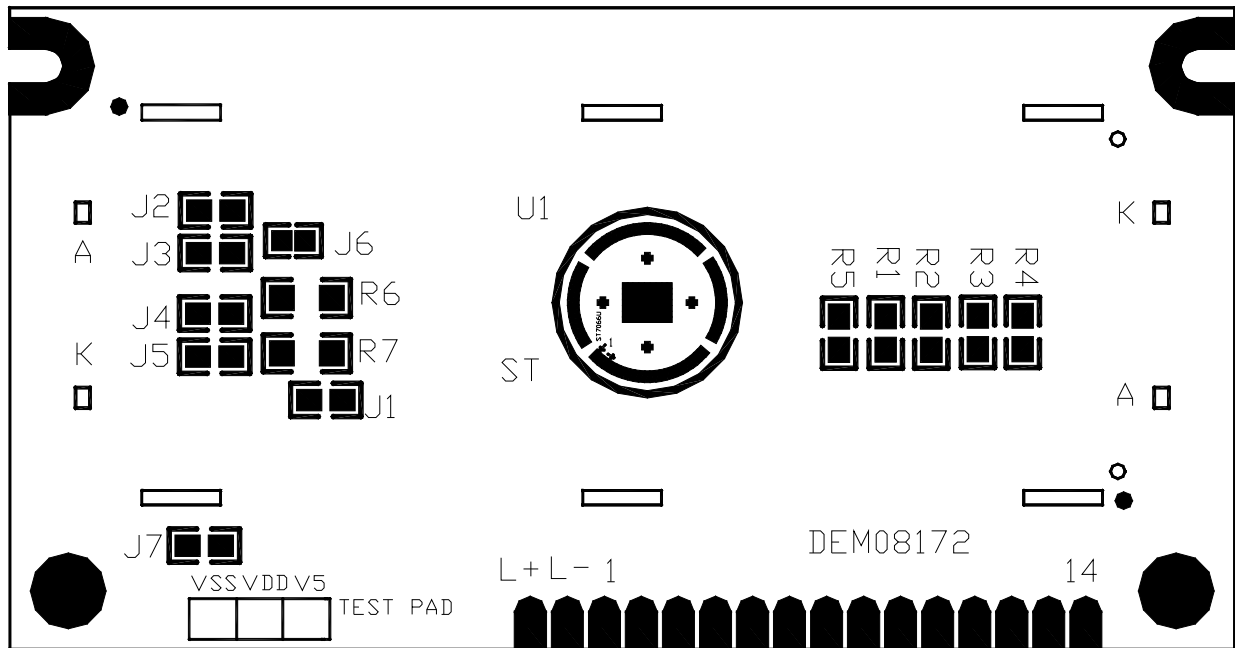
DESCRIPTION:

6-1-1 The polarity of the pin L+ and the pin L-:

J3,J5	J2, J4	LED Polarity	
		L-	L+
Each open	Each closed	Anode	Cathode
Each closed	Each open	Cathode	Anode

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

6-1-2 The metal-bezel is set on ground when the J1 is closed

Note: In application module, J1=closed

6-1-3 The mounting-holes should be on ground when the J7 is close.

Note: In application module, J7=closed

6-1-4 The LED resistor should be bridged when the J6 is closed.

Note: In application module, J6=open

6-1-5 The R6 and the R7 is the LED resistor.

Note: R6=open, R7=33 Ohm

6.2 Example application

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

J6

R6

R7
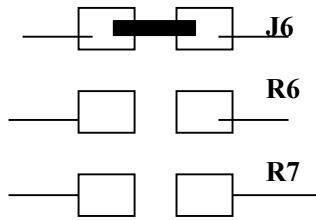
6-2-2   L- is the anode and L+ is the cathode as following.

J2   J4

6-2-3   L- is the cathode and L+ is the anode as following.

J3   J5

6-2-4   the metal-bezel is on ground as following.

J1

7. BACKLIGHT ELECTRICAL/OPTICAL CHARACTERISTICS

ELECTRICAL—OPTICAL CHARACTERISTICS

Item	Symbol	min.	typ.	max.	Unit	Condition
Forward Voltage	Vf	3.7	4.0	4.3	V	If= 30 mA
Luminance	Lv	150	200		cd/m²	
Reverse Current	Ir		2X20		uA	Vr= 0.8 V
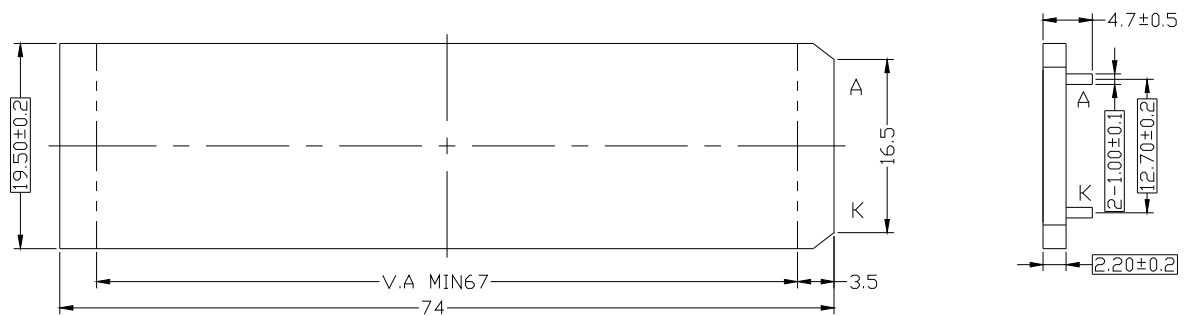
Remarks:
1,Unmarked tolerance is ±0.3,
2,Color:white,
3,The material comply with RoHS.

CIRCUIT DIAGRAM

K

A

(LED 1x2=2 dies)

x	0.296	0.287	0.330	0.330
y	0.276	0.295	0.339	0.318
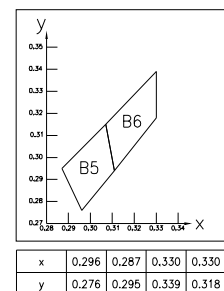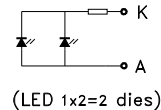
8. MAXIMUM ABSOLUTE LIMIT

Characteristics	Symbol	Value	Unit
Power Supply Voltage	V_{DD}	-0.3 to +7.0	V
LCD Driver Voltage	V_{LCD}	VDD-10.0 to VDD+0.3	V
Input Voltage	V_{IN}	-0.3 to VCC+0.3	V
Operating Temperature	T_{OPR}	-20~+70	□
Storage Temperature	T_{STR}	-25~+75	□

9. ELECTRICAL CHARACTERISTICS

9-1 DC Characteristics

Symbol	Characteristics	Test Condition	Min.	Typ.	Max.	Unit
V_{DD}	Operating Voltage	-	4.7	5.0	5.3	V
V_{LCD}	LCD Voltage	V_{DD}-V5	4.2	4.5	4.8	V
I_{DD}	Power Supply Current	f_{OSC}= 270KHz VCC=5.0V	--	0.2	0.5	mA

9-2 AC Characteristics

Symbol	Characteristics	Test Condition	Min.	Typ.	Max.	Unit
Internal Clock Operation						
fOSC	OSC Frequency	R = 91KΩ	190	270	350	KHz
External Clock Operation						
fEX	External Frequency	-	125	270	410	KHz
	Duty Cycle	-	45	50	55	%
TR,TF	Rise/Fall Time	-	-	-	0.2	μs
Write Mode (Writing data from MPU to ST7066U)						
TC	Enable Cycle Time	Pin E	1200	-	-	ns
TPW	Enable Pulse Width	Pin E	140	-	-	ns
TR,TF	Enable Rise/Fall Time	Pin E	-	-	25	ns
TAS	Address Setup Time	Pins: RS,RW,E	0	-	-	ns
TAH	Address Hold Time	Pins: RS,RW,E	10	-	-	ns
TDSW	Data Setup Time	Pins: DB0 - DB7	40	-	-	ns
TH	Data Hold Time	Pins: DB0 - DB7	10	-	-	ns
Read Mode (Reading Data from ST7066U to MPU)						
TC	Enable Cycle Time	Pin E	1200	-	-	ns
TPW	Enable Pulse Width	Pin E	140	-	-	ns
TR,TF	Enable Rise/Fall Time	Pin E	-	-	25	ns
TAS	Address Setup Time	Pins: RS,RW,E	0	-	-	ns
TAH	Address Hold Time	Pins: RS,RW,E	10	-	-	ns
TDDR	Data Setup Time	Pins: DB0 - DB7	-	-	100	ns
TH	Data Hold Time	Pins: DB0 - DB7	10	-	-	ns

Timing Characteristics

- Writing data from MPU to ST7066U
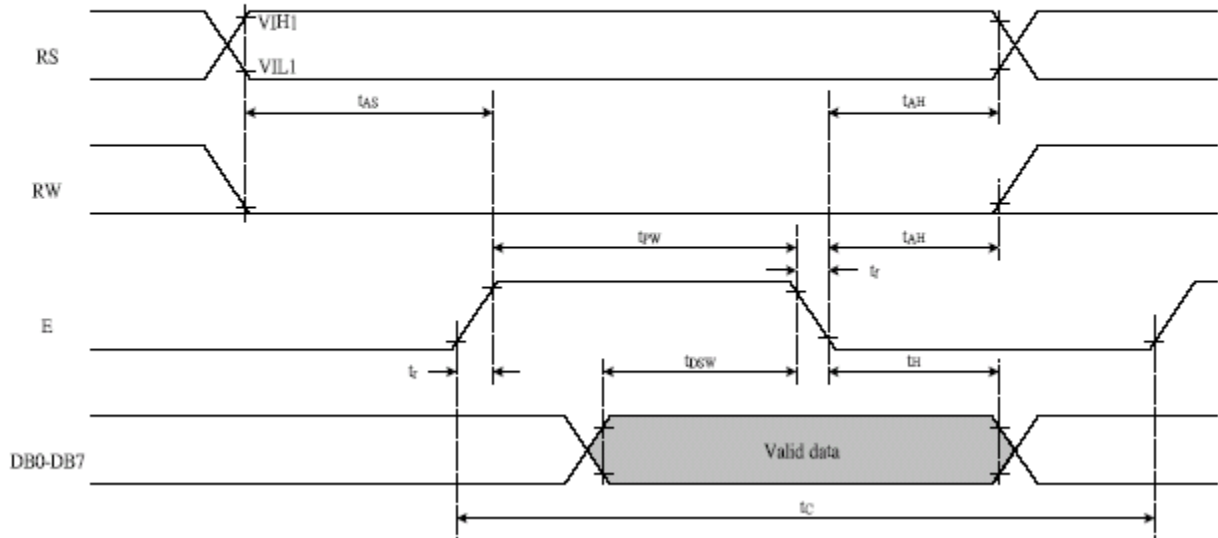
- Reading data from ST7066U to MPU
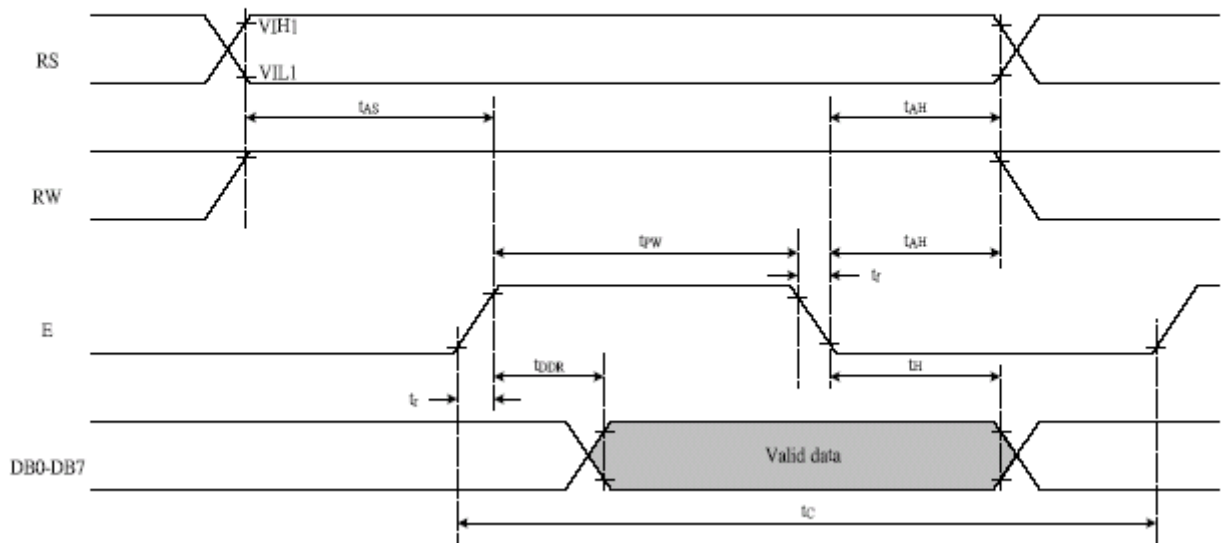
10. INSTRUCTION TABLE

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.

11. INTIALIZING BY INSTRUCTION

● 8-bit Interface (fosc=270KHz)

```
                        ┌─────────────────┐
                        │    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	N	F	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	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 │
                        └───────────────────┘
```

● 4-bit Interface (fosc=270KHz)

```
┌─────────────┐
│  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  │
└──────────────────────┘
```

12. STANDARD CHARACTER PATTERN

ST7066-0A

13. 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.

14. 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.