FORDATA ELECTRONIC CO.,LTD
PROFESSIONAL LCD SUPPLIER FROM CHINA

SPECIFICATION
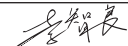## CHARACTER TYPE
DOT MATRIX LCD MODULE

✓ **RoHS**

ITEM NUMBER:	**FDCC2004B-NSWBTW-51XR**
ESTABLISHED DATE:	**1999.06**
INITIAL ISSUED DATE:	**2005.05**
CHECKED BY:	**WU WEIJIA**
APPROVED BY:	**LU BOO**

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STANDARD DOC.	REVISION RECORD	PAGE	1/20

NO.	DATE	DESCRIPTION	ITEM	PAGE	APPROVED
1	2005.05	INITIAL ISSUED	ALL	ALL	LU BOO
2	2007.01	Reduced the current for LED backlight	4	4/20	

FORDATA ELECTRONIC CO.,LTD PROFESSIONAL LCD SUPPLIER FROM CHINA	STANDARD DOC.	CODE SYSTEM	PAGE	2/20
		STANDARD COB		

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
FD	C	C	08	01	A	F	L	Y	Y	B	W	5	2	X	E

No.	REMARKS	DESCRIPTION
1	COMPANY ABBRAVIATED	FD = FORDATA
2	IC packing	C = Chip On Board G = Chip On Glass T = TAB N = NO IC
3	LCM type	C = Character G = Graphic
4	Chyaracter	08, 10, 12, 16, 20, 24, 40, = Character number Per line
	Graphic	80, 100, 120, 122, 128, 160 ... ... = Row Dots Quantity
5	Character	01, 02, 04, = Character Lines
	Graphic	32, 64, 80, 128, 160 ... ... =Column Dots Quantity
6	Serial Number	A~Z
7	Polarizer type	R = Positive Reflective F = Positive Transflective M = Positive Transmissive N = Negative Transmissive E = Negative, Transflective
8	Backlight type	N = No Backlight L = Array Type LED Backlight S = Edge Type LED Backlight E = EL backlight without Invertor F = EL backlight with Invertor C = CCFL backlight without Invertor T = CCFL backlight with Invertor
9	Backlight color	N = No Backlight Y = Yellow-Green W = White R = Red A = Amber C = Blue-Green B = Blue G = Green
10	LCD panel type	T = TN H = HTN Y = Yellow-Green STN G = Gray STN B = Blue STN F = FSTN
11	Viewing angle	B = Bottom 6:00 T = Top 12:00 R = Right 3:00 L = Left 9:00
12	Operation temperature range	S = $0^{\circ}C \sim 50^{\circ}C$ (Single Supply Voltage) D = $0^{\circ}C \sim 50^{\circ}C$ (Dual Supply Voltage) W = $-20^{\circ}C \sim 70^{\circ}C$ (Single Supply Voltage) H = $-20^{\circ}C \sim 70^{\circ}C$ (Dual Supply Voltage) T = $-30^{\circ}C \sim 80^{\circ}C$ (Single Supply Voltage) E = $-30^{\circ}C \sim 80^{\circ}C$ (Dual Supply Voltage)
13	Driving Voltage	1 : Vlcm = 3.0V, No / EL / CCFL Backlight or Vlcm = 3.0V, Vled = LED voltage, (Via AK) 2 : Vlcm = 3.6V, Vled = 5.0V (Not via AK) 3 : Vlcm = 3.6V, Vled = LED voltage, (Not via AK) 4 : Vlcm = 5.0V, Vled = LED voltage, (Not via AK) 5 : Vlcm = 5.0V, Vled = 5.0V (Not via AK) 6 : Vlcm = 5.0V, No / EL / CCFL Backlight or Vlcm = 5.0V, Vled = LED voltage, (Via AK) 7 : Vlcm = 3.6V, No / EL / CCFL Backlight or Vlcm = 3.6V, Vled = LED voltage, (Via AK) 8 : Vlcm = 3.0V, Vled = 5.0V 9 : Vlcm = 3.0V, Vled = LED voltage, (Not via AK)
14	Backlight Connect Method	0 = PIN1 LED-, PIN2 LED+ 1 = PIN15(17/19) LED+, PIN16(18/20) LED- 2 = PIN15(17/19) LED-, PIN16(18/20) LED+ 3 = PIN15(17/19) LED+, PIN16(18/20) NC 4 = PIN15(17/19) NC, PIN16(18/20) LED+ 5 = PINA LED+, PINK LED- 6 = No / EL / CCFL Backlight
15	IC Manufacturer	X = SAMSUNG L = SUNPLUS S = SITRONIX T = TOSHIBA E = EPSON H = HOLTEK Q = ASLIC N = CIMTEK P = PRINCETON
16	Font Set	R = English - Russia E = English - Japanese U = English - Europe H = English - Hebrew K = English - Europe N = NO FONT SET

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PRODUCT SPEC.	MODE NO. FDCC2004B-NSWBTW-51XR	PAGE	4/20

1. GENERAL SPECIFICATIONS

ITEM	NOMINAL DIMENSIONS / AVAILABLE OPTIONS
DISPLAY FORMAT	20 Characters by 4 Lines
LCD PANEL OPTIONS	STN (Blue color)
POLARIZER OPTIONS	Negative, Transmissive
BACKLIGHT OPTIONS	Edge type LED backlight (White color)
VIEWING ANGLE OPTIONS	12:00 (Top)
TEMPERATURE RANGE OPTIONS	Wide temp. range (-20°C ~ 70°C)
CONTROLLER IC	SAMSUNG
DISPLAY DUTY	1/16
DRIVING BIAS	1/5

2. MECHANICAL SPECIFICATIONS

OVERALL SIZE	LED backlight version : 98.0 x 60.0 x max 14.0				mm
VIEWING AREA	76.0W x 25.2H	mm	HOLE-HOLE	93.0W x 55.0H	mm
CHARACTER SIZE	2.95W x 4.75H	mm	CHARACTER PITCH	0.60W x 0.60H	mm
DOT SIZE	0.55W x 0.55H	mm	DOT PITCH	0.05W x 0.05H	mm

3. ABSOLUTE MAXIMUM RATINGS

ITEM	SYMBOL	CONDITION	MIN	MAX	UNIT
POWER SUPPLY (LOGIC)	Vdd	25°C	-0.3	7.0	V
POWER SUPPLY (LCD)	V0	25°C	Vdd -13.5	Vdd +0.3	V
INPUT VOLTAGE	Vin	25°C	-0.3	Vdd +0.3	V
OPERATING TEMPERATURE	Vopr	———	-20	70	$^\circ$C
STORAGE TEMPERATURE	Vstg	———	-30	80	$^\circ$C

4. ELECTRONICAL CHARACTERISTIC

ITEM	SYMBOL	CONDITION	STANDARD			UNIT
			MIN	TYP	MAX	
Input voltage	Vdd	+5V	4.7	5.0	5.5	V
Supply current	Idd	Vdd=5V	———	2.0	4.0	mA
Recommended LCD driving voltage for normal temp. Version module	Vdd - V0	0°C	4.7	5.0	5.5	V
		25°C	4.3	4.5	4.7	
		50°C	4.1	4.3	4.5	
LED forward voltage	VF	25°C	———	3.2	3.6	V
LED forward current	IF	25°C	———	34.0	40.0	mA

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5. OPTICAL CHARACTERISTIC

FOR TN TYPE LCD MODULE (T$_A$=25 $^{\circ}$C, Vdd=5.0V ± 0.25V)

ITEM	SYMBOL	CONDITION	MIN	TYP	MAX	UNIT
VIEWING ANGLE	$\Phi2 - \Phi1$	K=4	30	———	———	deg
	θ		25			
CONTRAST RATIO	K	———	———	2	———	———
RESPONSE TIME(RISE)	T$_R$	———	———	120	150	ms
RESPONSE TIME(FALL)	T$_F$	———	———	120	150	ms

FOR STN TYPE LCD MODULE (T$_A$=25 $^{\circ}$C, Vdd=5.0V ± 0.25V)

ITEM	SYMBOL	CONDITION	MIN	TYP	MAX	UNIT
VIEWING ANGLE	$\Phi2 - \Phi1$	K=4	40	———	———	deg
	θ		60			
CONTRAST RATIO	K	———	———	6	———	———
RESPONSE TIME(RISE)	T$_R$	———	———	150	250	ms
RESPONSE TIME(FALL)	T$_F$	———	———	150	250	ms

DEFINITION OF ANGLE Φ & θ

Y (θ = 180°)
$\Phi2$
$\Phi1$
X
X`
θ
Y (θ = 0°)
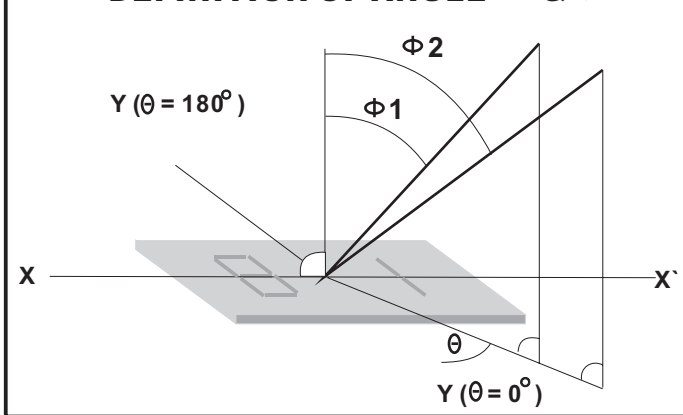
DEFINITION OF VIEWING ANGLE $\Phi1$ & $\Phi2$

Contrast Ratio K
1.4
$\Phi1$ $\Phi2$ Viewing Angle
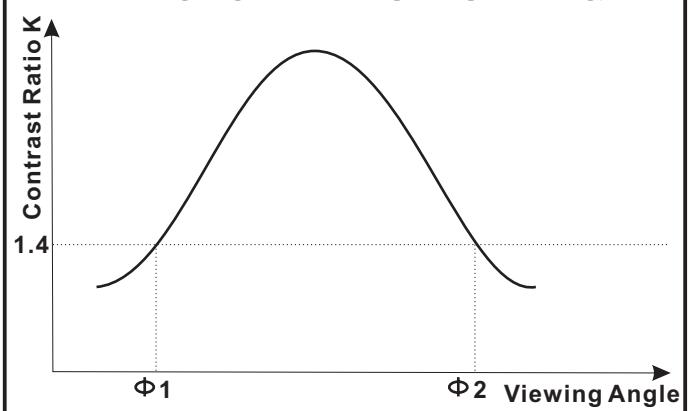
DEFINITION OF CONTRAST RATIO K(=B$_2$/B$_1$)

Brightness(%)
B$_2$
Brightness Curve for Non- selected Segment
Brightness Curve for selected Segment
B$_1$
Setpoint Driving Voltage
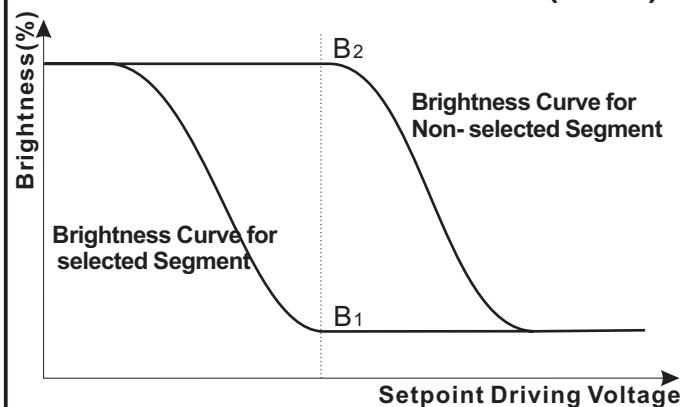
DEFINITION OF OPTICAL RESPONSE TIME T$_R$ & T$_F$

Brightness(%)
Non-Select   Select Signal   Non-Select
90%   100%   10%
T$_R$ T$_F$ Time(ms)
Rise Time   Fall Time
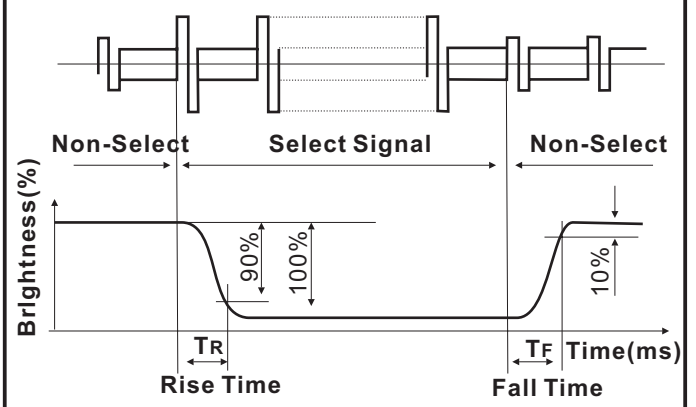
6. ELECTRICAL SPECIFICATIONS

6.1 DC CHARACTERISTICS (VDD = 4.5V to 5.5V, TA = 25 °C)

CHARACTERISTICS	SYMBOL	LIMIT			UNIT	TEST CONDITION
		MIN.	TYP.	MAX.		
INPUT HIGH VOLTAGE	V_{IH1}	2.2	---	Vdd	V	Pins (E. RS. R/W. DB0 - DB7)
INPUT LOW VOLTAGE	V_{IL1}	-0.3	---	0.6	V	
INPUT HIGH CURRENT	I_{IH}	-1.0	---	1.0	µ A	Pins (RS. R/W. DB0 - DB7) Vdd = 5.0V
INPUT LOW CURRENT	I_{IL}	-50	-125	-250	µ A	
OUTPUT HIGH VOLTAGE (TTL)	V_{OH1}	2.4	---	---	V	I_{OH} = - 0.1mA Pins: DB0 - DB7
OUTPUT LOW VOLTAGE (TTL)	V_{OL1}	---	---	0.4	V	I_{OL} = 0.1mA Pins: DB0 - DB7

6.2 AC CHARACTERISTICS (VDD = 4.5V to 5.5V, TA = 25 °C)

Write mode

CHARACTERISTICS	SYMBOL	LIMIT			UNIT	TEST CONDITION
		MIN.	TYP.	MAX.		
ENABLE CYCLE TIME	t_C	500	---	---	ns	Pin E
ENABLE PULSE WIDTH	t_{PW}	230	---	---	ns	Pin E
ENABLE RISE/ FALL TIME	t_R, t_F	---	---	20	ns	Pin E
ADDRESS SETUP TIME	t_{SP1}	40	---	---	ns	Pins RS, R/W, E
ADDRESS HOLD TIME	t_{HD1}	10	---	---	ns	Pins RS, R/W, E
DATA SETUP TIME	t_{SP2}	80	---	---	ns	Pins: DB0 - DB7
DATA HOLD TIME	t_{HD2}	10	---	---	ns	Pins: DB0 - DB7

Read mode

CHARACTERISTICS	SYMBOL	LIMIT			UNIT	TEST CONDITION
		MIN.	TYP.	MAX.		
ENABLE CYCLE TIME	t_C	500	---	---	ns	Pin E
ENABLE PULSE WIDTH	t_{PW}	230	---	---	ns	Pin E
ENABLE RISE/ FALL TIME	t_R, t_F	---	---	20	ns	Pin E
ADDRESS SETUP TIME	t_{SP1}	40	---	---	ns	Pins RS, R/W, E
ADDRESS HOLD TIME	t_{HD1}	10	---	---	ns	Pins RS, R/W, E
DATA OUTPUT DELAY TIME	t_D	---	---	120	ns	Pins: DB0 - DB7
DATA HOLD TIME	t_{HD2}	5	---	---	ns	Pins: DB0 - DB7

6.3.1 WRITE MODE TIMING DIAGRAM
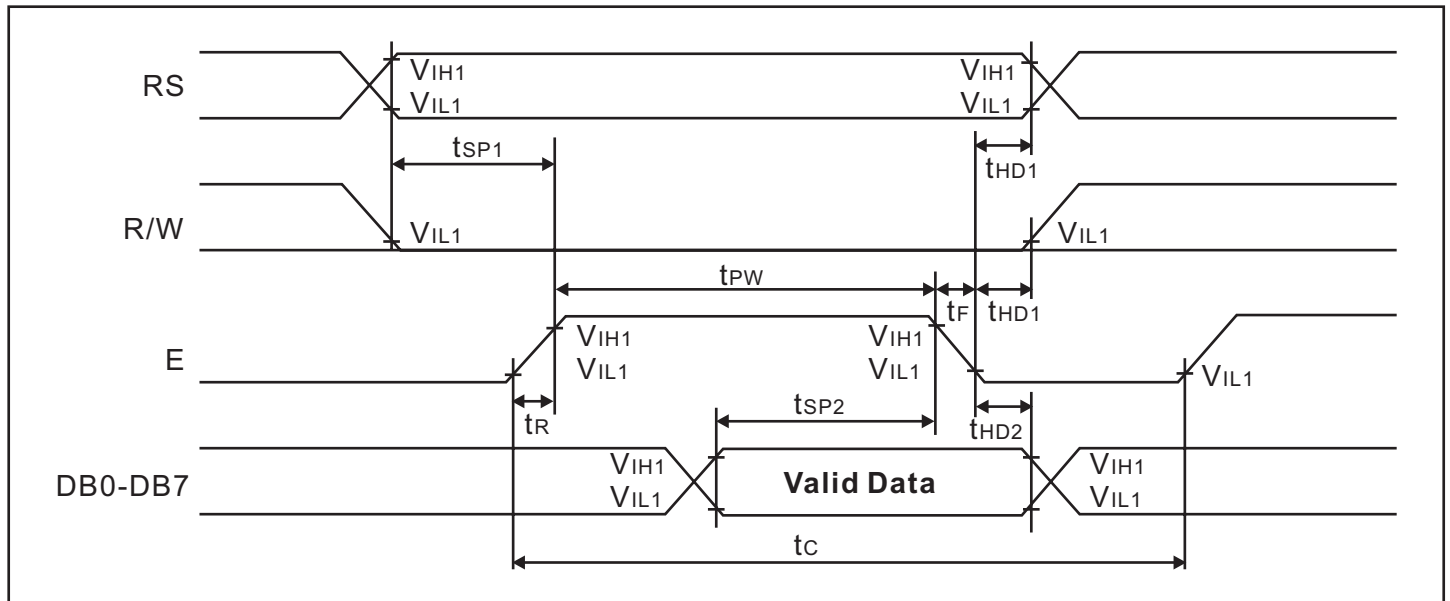
6.3.2 READ MODE TIMING DIAGRAM

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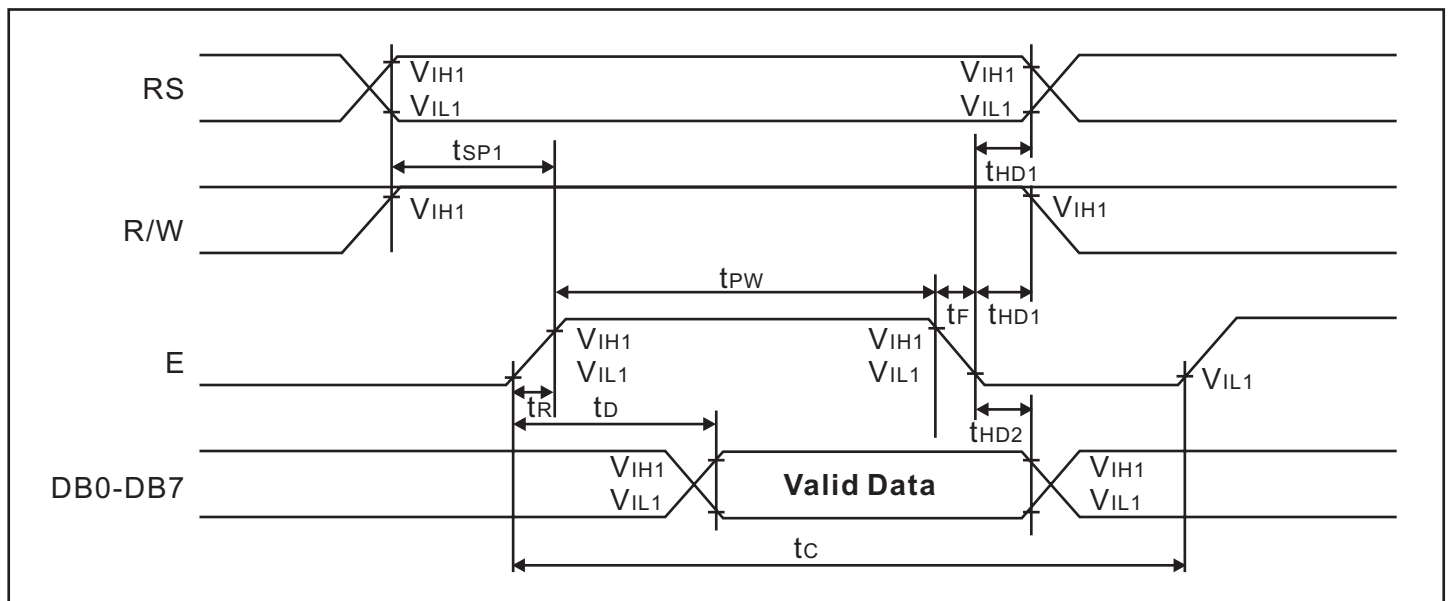
7. EXTERNAL DIMENSIONS
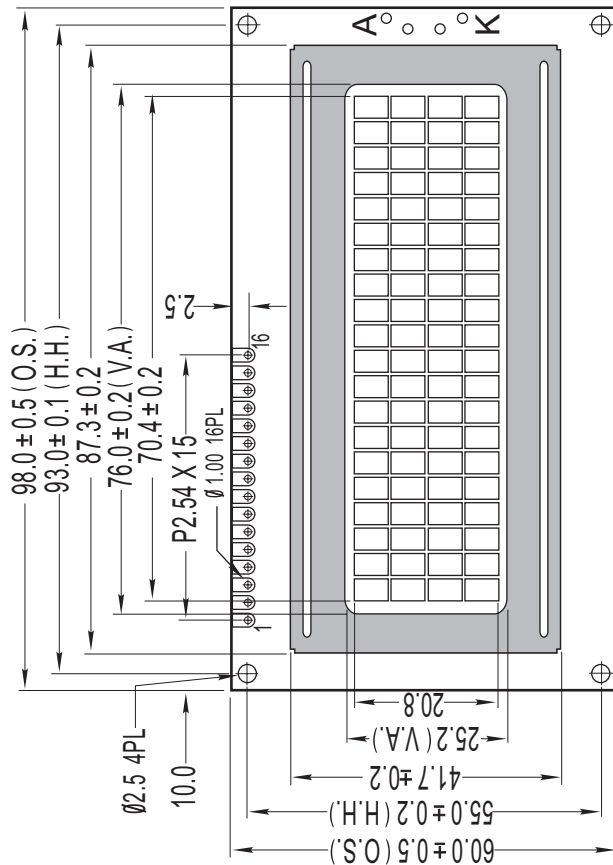
ITEM	T1	T2	UNIT
LED backlight	9.3	14.0	mm
EL or without backlight	4.6	9.5	mm
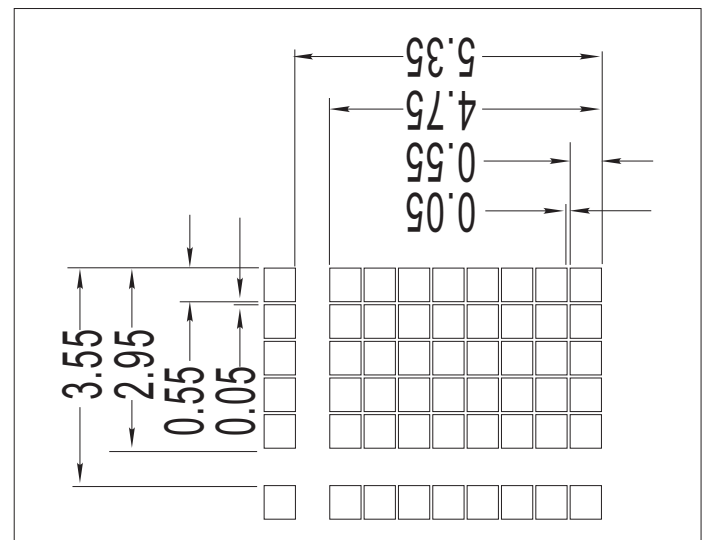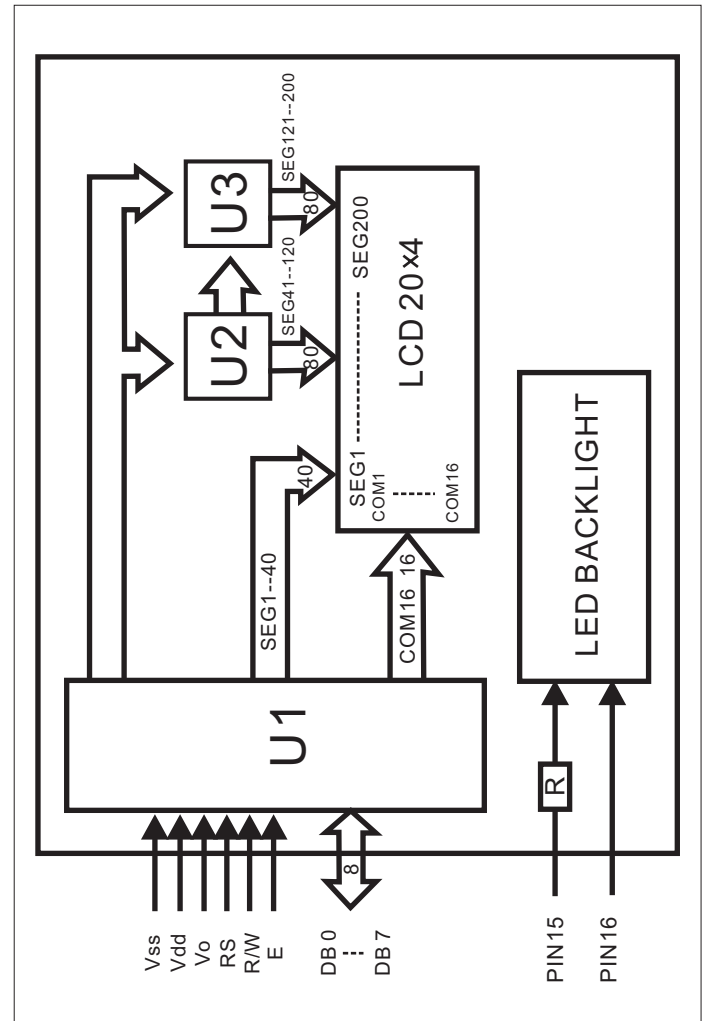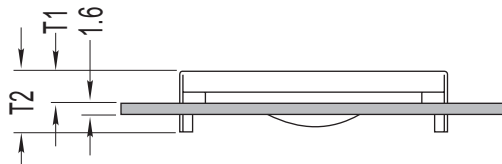
8.PIN ASSIGNMENT

PIN	SYMBOL	FUNCTION
1	Vss	GND
2	Vdd	Power supply for LCM (+5.0V)
3	V0	Contrast Adjust
4	RS	Register Select Signal
5	R/W	Data Read / Write
6	E	Enable Signal
7-14	DB0 - DB7	Data bus line
15	LED+	Power supply for BKL (+5.0V)
16	LED-	Power supply for BKL (0V)

9.POWER SUPPLY

SINGLE SUPPLY TYPES

Vss   V0   Vdd

Vdd ~V0

R_{POT}

Vdd

+5V

VDD-VO: LCD DRIVING VOLTAGE
RPOT: 10K-20K
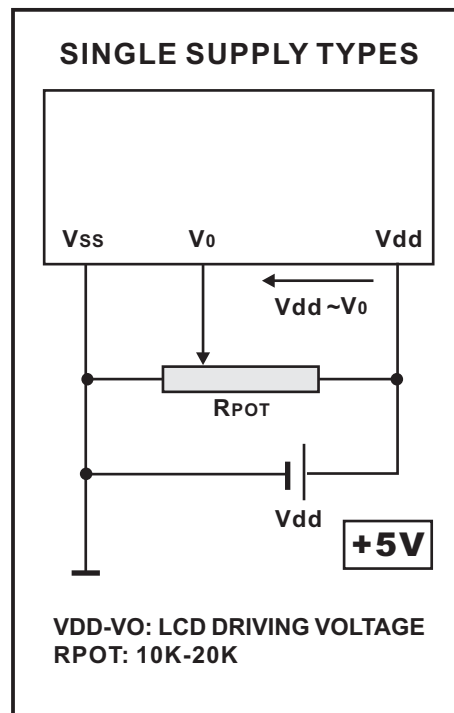
10. REFLECTOR OF SCREEN AND DDRAM ADDRESS

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

1-1 means first character of line 1 on screen

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11. INSTRUCTION TABLE

Instruction	Instruction Code										Description	Execution Time(fosc= 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 set DDRAM address to 00H from AC	1.53ms
Return Home	0	0	0	0	0	0	0	0	1	-	Set DDRAM address to 00H from AC and return cursor to its original position if shifted. The contents of DDRAM are not changed.	1.53ms
Entry Mode Set	0	0	0	0	0	0	0	1	I/D	SH	Assign cursor moving direction and enable the shift of entire display	39μs
Display ON/OFF Control	0	0	0	0	0	0	1	D	C	B	Set display(D) cursor(C) and blinking of cursor(B) on/off	39μs
Cursor or Display Shift	0	0	0	0	0	1	S/C	R/L	-	-	Set cursor moving and display shift control bit, and the direction, without changing DDRAM data	39μs
Function Set	0	0	0	0	1	DL	N	F	-	-	Set interface data length(DL:8bit/4bit), number of display line (N:2line/1line) and,display font type F:5X11dots / 5X8dots	39μs
Set CGRAM Address	0	0	0	1	AC5	AC4	AC3	AC2	AC1	AC0	Set CGRAM address in address counter	39μs
Set DDRAM Address	0	0	1	AC6	AC5	AC4	AC3	AC2	AC1	AC0	Set DDRAM address in address counter	39μs
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 μs
Write Data to RAM	1	0	D7	D6	D5	D4	D3	D2	D1	D0	Write data into internal RAM (DDRAM/CGRAM)	43μs
Read data from RAM	1	1	D7	D6	D5	D4	D3	D2	D1	D0	Read data from internal RAM (DDRAM/CGRAM)	43μs

12. INSTRUCTION DESCRIPTION

A. Clear Display

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

Clear all the display data by writing 20H (space code) to all DDRAM address, and set DDRAM address to 00H into AC (address counter).

Return cursor to the original status, namely, bring the cursor to the left edge on the first line of the display.

Make the entry mode increment (I/D = HIGH)

B. Return Home

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

Set DDRAM address to 00H into the address counter.

Return cursor to its original site and return display to its original status,if shifted.

Contents of DDRAM does not change.

C. Entry Mode Set

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

Set the moving direction of cursor and display.

I/D:Increment /decrement of DDRAM address(cursor or blink)

 I/D=High,cursor/blink moves to right and DDRAM address is increased by 1.

 I/D=low,cursor/blink moves to left and DDRAM address is decreased by 1.

*CGRAM operates the same way as DDRAM, when reading from or writing to CGRAM.

SH:Shift of entire display

 When DDRAM read (CGRAM read/write) operation or SH=Low,shifting of entire display is not performed.if SH=High, and DDRAM write operation,shift of entire display is performed according to I/D value(I/D=High,shift left, I/D=Low, shift right).

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D. 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

D:Display ON/OFF control bit

When D=High, entire display is turned on.

When D=Low, display is turned off, but display data remains in DDRAM.

C:Cursor ON/OFF control bit

When C=High, cursor is turned on.

When C=Low, cursor is disappeared in current display ,but I/D register preserves its data.

B:Cursor Blink ON/OFF control bit

When B=High, cursor blink is on, which performs alternately between all the High data and display characters at the cursor position.

When B=Low ,blink is off.

E. Cursor or Display Shift

RS	R/W	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0
0	0	0	0	0	1	S/C	R/L	-	-

Shifting of right/left cursor position or display without writing or reading of display data.

This instruction is used to correct or search display data.

During 2-line mode display, cursor moves to the 2nd line after the 40th digit of the 1st line.

Note that display shift is performed simultaneously in all the lines.

When displayed data is shifted repeatedly, each line is shifted individually.

When display shift is performed, the contents of the address counter are not changed.

S/C	R/L	Operation
0	0	Shift cursor to the left, AC is decreased by 1
0	1	Shift cursor to the right, AC is increased by 1
1	0	Shift all the display to the left,cursor moves according to the display
1	1	Shift all the display to the right,cursor moves according to the display

BOOKBINDING AREA

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F. Function set

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

DL:Interface data length control bit

When DL=High, it means 8-bit bus mode with MPU.

When DL=Low, it means 4-bit bus mode with MPU.

When 4-bit bus mode, it needs to transfer 4-bit data twice.

N:Display line number control bit

When N=Low, 1-line display mode is set.

When N=High, 2-line display mode is set.

F:Display font type control bit

When F=Low, 5x8 dots format display mode is set.

When F=High, 5x11 dots format display mode.

G. Set CGRAM Address

RS	R/W	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0
0	0	0	1	AC5	AC4	AC3	AC2	AC1	AC0

Set CGRAM address to AC.

This instruction makes CGRAM data available from MPU.

H. Set DDRAM Address

RS	R/W	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0
0	0	1	AC6	AC5	AC4	AC3	AC2	AC1	AC0

Set DDRAM address to AC.

This instruction makes DDRAM data available from MPU.

When 1-line display mode (N=Low), DDRAM address is from 00H to 4FH

In 2-line display mode(N=High),DDRAM address in the 1st line is from 00H to 27H and DDRAM address in the 2nd line is from 40H to 67H

I. Read Busy Flag & Address

RS	R/W	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0
0	1	BF	AC6	AC5	AC4	AC3	AC2	AC1	AC0

This instruction shows whether IC is in internal operation or not .

If BF is High, internal operation is in progress and shall wait until BF is to be

Low, which by then the next instruction can be performed. In this instruction

you and also read the value of the address counter.

J. Write data to RAM

RS	R/W	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0
1	0	D7	D6	D5	D4	D3	D2	D1	D0

Write binary 8-bit data to DDRAM/CGRAM.

The selection of RAM from DDRAM,and CGRAM,is set by the previous address set instruction(DDRAM address set,CGRAM address set).

RAM set instruction can also determine the AC direction to RAM.

After write operation, the address is automatically increased /decreased by 1,according the entry mode.

K. Read data from RAM

RS	R/W	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0
1	1	D7	D6	D5	D4	D3	D2	D1	D0

Read binary 8-bit data from DDRAM/CGRAM.

The selection of RAM is set by the previous address set instruction.If the address set instruction of RAM is not performed before this instruction, the data that has been read first is invalid, as the direction of AC is not yet determined. If RAM data is read several times without RAM address instructions set before read operation,the correct RAM data can be obtained from the second. But the first data would be incorrect,as there is no time margin to transfer RAM data.

In case of DDRAM read operation,cursor shift instruction plays the same role as DDRAM address set instruction,it also transfers RAM data to output data register.

After read operation,address counter is automatically increased/decreased by 1 according to the entry mode.

After CGRAM read operation,display shift may not be executed correctly.

Note:In case of RAM write operation,AC is increased/decreased by 1 as in read operation. At this time,AC indicates the next address position, but only the previous data can be read by the read instruction.

13. RELATIONSHIP BETWEEN CHARACTER CODE AND CGRAM

Character code								CGRAM Address						CGRAM Data								Pattern number
D7	D6	D5	D4	D3	D2	D1	D0	A5	A4	A3	A2	A1	A0	P7	P6	P5	P4	P3	P2	P1	P0	
0	0	0	0	x	0	0	0	0	0	0	0	0	0	x	x	x	0	1	1	1	0	pattern 1
											0	0	1	x	x	x	1	0	0	0	1	
											0	1	0	x	x	x	1	0	0	0	1	
											0	1	1	x	x	x	1	1	1	1	1	
											1	0	0	x	x	x	1	0	0	0	1	
											1	0	1	x	x	x	1	0	0	0	1	
											1	1	0	x	x	x	1	0	0	0	1	
											1	1	1	x	x	x	0	0	0	0	0	
0	0	0	0	x	1	1	1	0	0	0	0	0	0	x	x	x	1	0	0	0	1	pattern8
											0	0	1	x	x	x	1	0	0	0	1	
											0	1	0	x	x	x	1	0	0	0	1	
											0	1	1	x	x	x	1	1	1	1	1	
											1	0	0	x	x	x	1	0	0	0	1	
											1	0	1	x	x	x	1	0	0	0	1	
											1	1	0	x	x	x	1	0	0	0	1	
											1	1	1	x	x	x	0	0	0	0	0	

14. DISPLAY DATA RAM(DDRAM)

DDRAM stores display data of maximum 80x8 bits(80 characters).

DDRAM address is set in the address counter(AC) as a hexadecimal number

MSB   LSB

AC6	AC5	AC4	AC3	AC2	AC1	AC0

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15. INITIALIZATION

15.1   8-bit interface mode (Condition: fosc = 270KHZ)

```
                    ┌─────────────────────────┐
                    │        Power on          │
                    └─────────────────────────┘
                                 │
                                 ▼
        ┌───────────────────────────────────────────────┐
        │ Wait for more than 30 ms after VDD rises to 4.5 v │
        │ Wait for more than 40 ms after VDD rises to 2.7 v │
        └───────────────────────────────────────────────┘
                                 │
                                 ▼
```

Function set

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

N	0	1-line mode
	1	2-line mode

F	0	display off
	1	display on

Wait for more than 39 μs

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

D	0	display off
	1	display on

C	0	cursor off
	1	cursor on

B	0	blink off
	1	blink on

Wait for more than 39 μs

Display Clear

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

Wait for more than 1.53 ms

Entry Mode Set

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

I/D	0	decrement mode
	1	increment mode

SH	0	entire shitf off
	1	entire shitf on

Initialization end

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15.2 4-bit interface mode (Condition: fosc = 270KHZ)

Power on

↓

Wait for more than 30 ms after V$_{DD}$ rises to 4.5 v Wait for more than 40 ms after V$_{DD}$ rises to 2.7 v

↓

Function set (4-bit mode change)

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

DL	0	4-bit mode
	1	8-bit mode

↓

Wait for more than 39 μs

↓

Function set (display mode set)

0	0	0	0	1	0	X	X	X	X
0	0	N	F	X	X	X	X	X	X

N	0	1-line mode
	1	2-line mode

F	0	display off
	1	display on

↓

Wait for more than 39 μs

↓

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

D	0	display off
	1	display on

C	0	cursor off
	1	cursor on

B	0	blink off
	1	blink on

↓

Wait for more than 39 μs

↓

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 for more than 1.53 ms

↓

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	1/D	SH	X	X	X	X

I/D	0	decrement mode
	1	increment mode

SH	0	entire shitf off
	1	entire shitf on

↓

Initialization end

FORDATA ELECTRONIC CO.,LTD
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16.INTERFACE TO MPU

INTERFACE TO 8-BIT MPU

RS
R/W
E
Internal — Internal Operation
DB7 — Data / Busy / Busy / No Busy

Instruction Write | Busy flag Check | Busy flag Check | Busy flag Check | Instruction Write

D0-D7 → DB0-DB7
A0 → RS
A4, A5, A6, A7 → A B C (LS 138) Y1 1K 200 → E
Z80
MI → G2A G2B G
IORQ
RD → R/W
LCD Unit

If Interface Data Is 8-bits Long

Data transfer is made through all 8 bus lines from DB0 to DB7

INTERFACE TO 4-BIT MPU

RS
R/W
E
Internal — Internal Operation
DB7 — R7 / IR3 / Busy / Ac3 / Busy / Ac3 / D7 / D3

Instruction Write | Busy flag Check | Busy flag Check | Instruction Write

Note: IR7,IR3: Instruction 7th bit,3rd bit
Ac3: Address Counter 3rd bit

D15 → RS
D14 → R/W
D13 → E
R10-R13 → 4 → DB4-DB7
HMCS43C
LCD Unit

If Interface Data Is 4-bit Long

Data transfer is accomplished through 4 bus lines from DB4 to DB7.(while the rest of 4 bus lines from DB0 toDB3 are not used.)
Data transfer is completed when 4-bits of data is transferred twice.(upper 4-bits of data, then lower 4-bits of data.)

Features

1. **Interface to an 8-bit or 4-bit MPU is available.**
2. **192 types of alphanumeric, symbols and special characters can be displayed with the built - in character generator (ROM).**
3. **Other preferred characters can be displayed by character generator (RAM).**
4. **Various instructions may be programmed.**
   - **Clear display**
   - **Cursor at home**
   - **On/Off cursor**
   - **Blink character**
   - **Shift display**
   - **Shift cursor**
   - **Read/Write display data   .etc.**
5. **Compact and light weight design which can easily be integrated into end products.**
6. **Single power supply +5V drive (except for extended temperature type).**
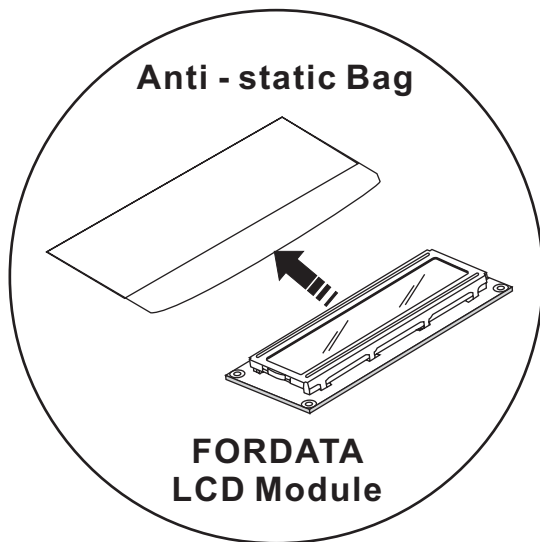7. **Low power consumption.**

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17. STANDARD FONT MAP

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18. PACKING DETAIL

WITH LED BKL
30 PCS/BOX
8 BOXES/CARTON
240 PCS/CARTON
18.00 KGS/CTN(G.W.)
0.07 M^3/CARTON

WITHOUT LED BKL
30 PCS/BOX
8 BOXES/CARTON
240 PCS/CARTON
17.00 KGS/CTN(G.W.)
0.07 M^3/CARTON

NOTE
1. The weight is estimated for reference only.
2. Packing detail may be changed without notice.
3. FORDATA prefer 200PCS order quantity to 250PCS for full packing cause.

Anti - static Bag

FORDATA
LCD Module

BOX

CARTON