高華電子顯示（深圳）有限公司
CLOVER CHINA DISPLAY (SHENZHEN) LIMITED

LCD MODULE SPECIFICATION

Model : ZCV4162T - LW - BT – W6

Revision	00
Engineering	DingQin
Date	09 JAN 2012
Our Reference	

MODE OF DISPLAY

Display mode	Display condition	Viewing direction
☐ TN positive	☐ Reflective type	■ 6 O' clock
☐ TN negative	☐ Transflective type	☐ 12 O' clock
STN : ☐ Yellow green	■ Transmissive type	☐ 3 O' clock
☐ Grey	☐ Others	☐ 9 O' clock
■ Blue (negative)		
☐ FSTN positive		
☐ FSTN negative		

LCD MODULE NUMBER NOTATION:

ZCV4162T- L W - B T - W 6 – _
  | | | | | | | |
(1)   (2) (3) (4) (5) (6) (7) (8)

*(1)---Model number of standard LCD Modules

*(2)---Backlight type
    N – No backlight
    E – EL backlight
    L – Side-lited LED backlight
    M– Array LED backlight
    C – CCFL

*(3)---Backlight color
    N – No backlight
    A – Amber
    B – Blue
    O– Orange
    W–White
    Y – Yellow green

*(4)---Display mode
    T – TN
    V – TN (Negative)
    S – STN Yellow green
    G – STN Grey
    B – STN Blue (Negative)
    F – FSTN
        N – FSTN (Negative)

*(5)---Rear polarizer type
    R – Reflective
    F – Transflective
    T – Transmissive

*(6)---Temperature range
    N – Normal
    W– Extended

*(7)---Viewing direction
    6 – 6 O'clock
    2 – 12 O'clock
    3 – 3 O'clock
    9 – 9 O'clock

*(8)---Special code for other requirements
    (Can be omitted if not used)
        B – Reverse the backlight A, K pin

GENERAL DESCRIPTION

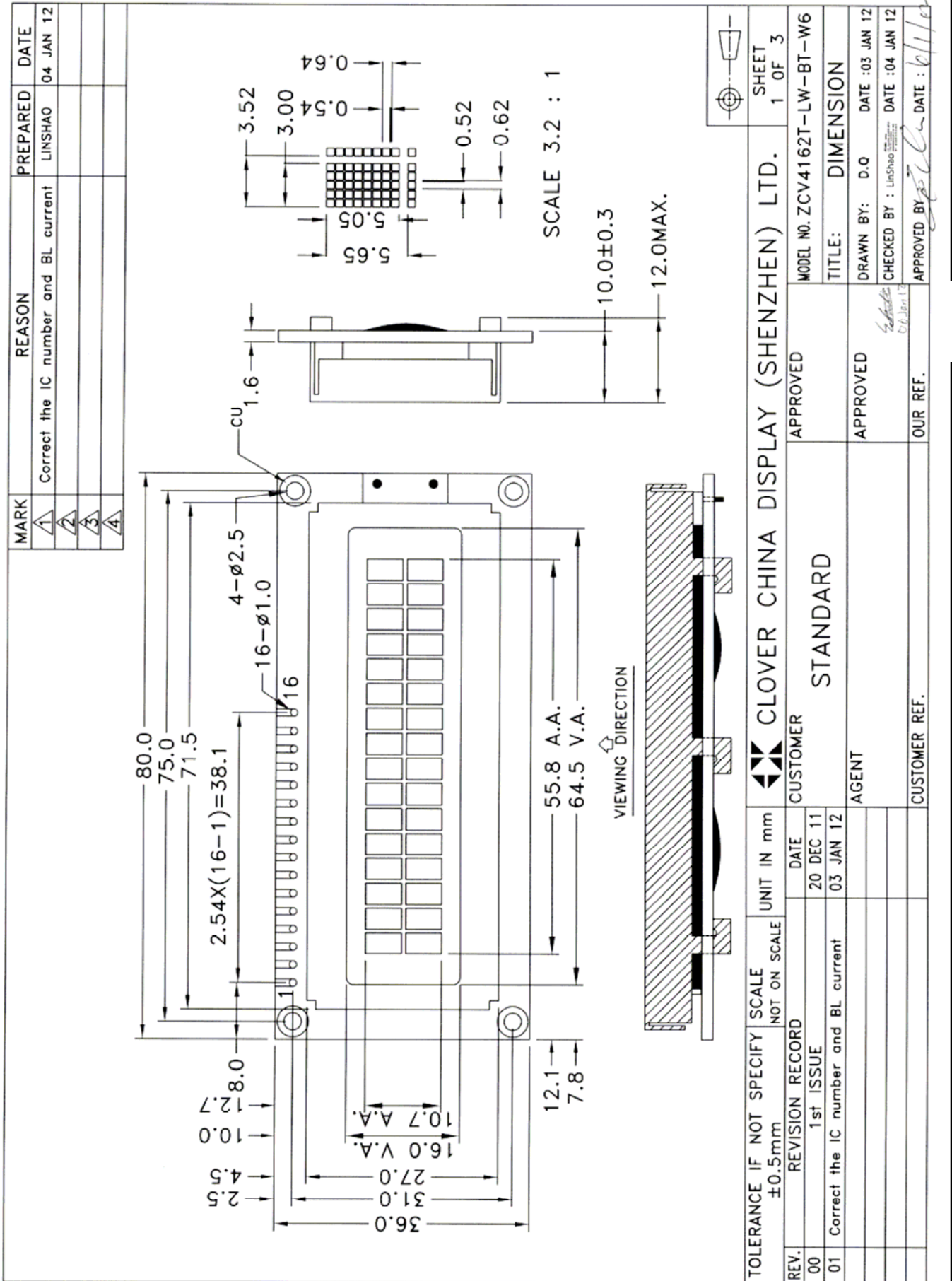|		
Display mode	:	16 characters x 2 lines LCD module
Interface	:	4-bit or 8-bit parallel
Driving method	:	1/16 duty, 1/5 bias
IC driver	:	Wuxi I-CORE **AIP31066**& **AIP31065** or Equivalence For the detailed information, please refer to IC specifications.

MECHANICAL DIMENSIONS

Item	Dimension	Unit	Item	Dimension	Unit
Outline Dimension	80.0(L) x 36.0(W) x 12.0(H)	mm	Character Pitch	3.52(L) x 5.65(W)	mm
Viewing Area	64.5(L) x 16.0(W)	mm	Dot Size	0.52(L) x 0.54(W)	mm
Character Size	3.0(L) x 5.05(W)	mm	—	—	—

CONNECTOR PIN ASSIGNMENT

Pin No.	Symbol	Function	Pin No.	Symbol	Function
1	V_{SS}	Power supply for logic (0V)	9	DB_2	Data bus
2	V_{DD}	Power supply for logic	10	DB_3	
3	V_O	Input voltage for LCD (0V to VDD)	11	DB_4	
4	RS	Register select input	12	DB_5	
5	R/W	Read/Write	13	DB_6	
6	E	Enable signal	14	DB_7	
7	DB_0	Data bus	15	A	Backlight power supply (+)
8	DB_1		16	K	Backlight power supply (-)

COUNTER DRAWING OF MODULE DIMENSION

MARK	REASON	PREPARED	DATE
1	Correct the IC number and BL current	LINSHAO	04 JAN 12
2			
3			
4			

0.64
0.54
3.52
3.00
0.52
0.62
5.05
5.65
SCALE 3.2 : 1
10.0±0.3
12.0MAX.
cu 1.6

80.0
75.0
71.5
2.54X(16−1)=38.1
4−∅2.5
16−∅1.0
16
1
55.8 A.A.
64.5 V.A.
VIEWING DIRECTION

8.0
12.7
10.0
10.7 A.A.
16.0 V.A.
4.5
2.5
27.0
31.0
36.0
12.1
7.8

CLOVER CHINA DISPLAY (SHENZHEN) LTD.

STANDARD

CUSTOMER

AGENT

CUSTOMER REF.

		UNIT IN mm	SCALE NOT ON SCALE
TOLERANCE IF NOT SPECIFY ±0.5mm			

REV.	REVISION RECORD	DATE
00	1st ISSUE	20 DEC 11
01	Correct the IC number and BL current	03 JAN 12

MODEL NO. ZCV4162T-LW-BT-W6

TITLE: DIMENSION

APPROVED

APPROVED

OUR REF.

DRAWN BY:	D.Q	DATE :03 JAN 12
CHECKED BY :	LinShao	DATE :04 JAN 12
APPROVED BY :		DATE :

SHEET 1 OF 3

COUNTER DRAWING OF PINOUT & BLOCK DIAGRAM
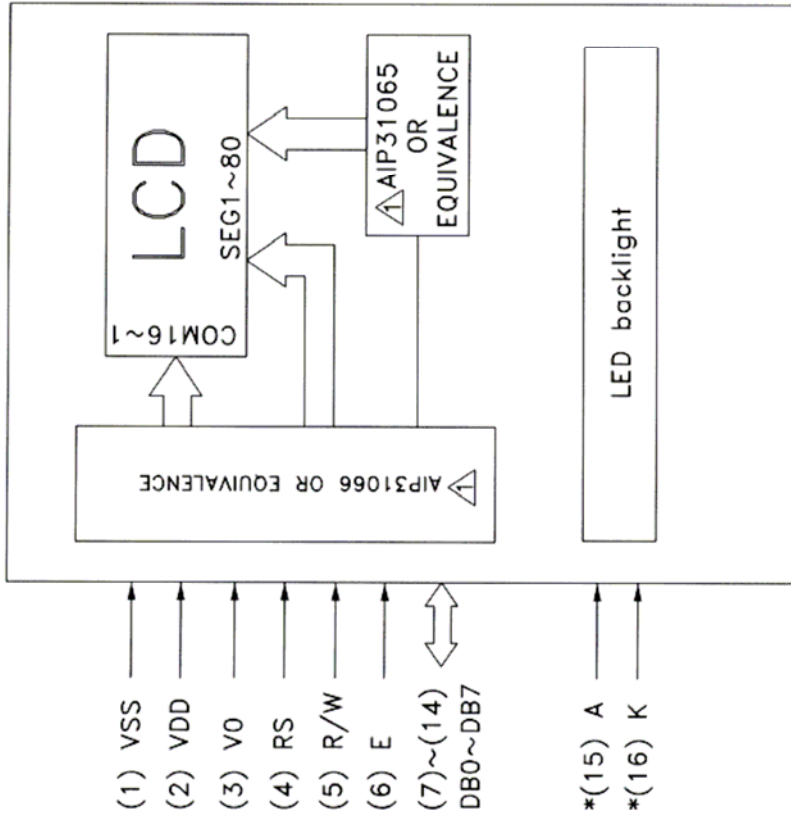
PIN NUMBER	SYMBOL	FUNCTION
1	VSS	Power supply for logic (0V)
2	VDD	Power supply for logic (VDD)
3	V0	Input voltage for LCD
4	RS	Register select input
5	R/W	Read/Write
6	E	Enable signal
7	DB0	Data bus
8	DB1	
9	DB2	
10	DB3	
11	DB4	
12	DB5	
13	DB6	
14	DB7	
*15	A	Backlight power supply(VE+)
*16	K	Backlight power supply(VE−)

BLOCK DIAGRAM

LCD SEG1~80
COM16~1
⚠ AIP31065 OR EQUIVALENCE
⚠ AIP31066 OR EQUIVALENCE
LED backlight

(1) VSS
(2) VDD
(3) V0
(4) RS
(5) R/W
(6) E
(7)~(14) DB0~DB7
*(15) A
*(16) K

NOTE (*) : Pin (15) (16) is used for backlight version only

TOLERANCE IF NOT SPECIFY ±0.5mm		SCALE NOT ON SCALE	UNIT IN mm	◆◆ CLOVER CHINA DISPLAY (SHENZHEN) LTD.		SHEET 2 OF 3
REV.	REVISION RECORD		DATE	CUSTOMER	APPROVED	MODEL NO. ZCV4162T−LW−BT−W6
00	1st ISSUE		20 DEC 11			TITLE: PINOUT & BLOCK DIAGRAM
01	Correct the IC number and BL current		03 JAN 12	AGENT	APPROVED	DRAWN BY: D.Q DATE :03 JAN 12
						CHECKED BY : LinShao DATE :04 JAN 12
				CUSTOMER REF.	OUR REF.	APPROVED BY : DATE :

STANDARD

ELECTRICAL CHARACTERISTICS

<div align="right">Conditions: VSS=0V, @Ta=25℃</div>

Item	Symbol	MIN.	TYP.	MAX.	Unit	Item	Symbol	MIN.	TYP.	MAX.	Unit
Supply Voltage	V_{DD}	4.8	5.00	5.2	V	"H"Level Input Voltage	V_{IH}	2.2	—	VDD	V
Supply Current	I_{DD}	—	1.41	1.73	mA	"L"Level Input Voltage	V_{IL}	0	—	0.6	V
Backlight Voltage						**Backlight Current**					
Array LED						**Array LED**					
Yellow Green	V_{BL}	4.8	5.0	5.2	V	Yellow Green	I_{BL}	-	14.8	17	mA

ABSOLUTE MAXIMUM RATINGS

Please make sure not to exceed the following maximum rating values under the worst application conditions

Item	Symbol	Rating (for wide temperature)	Unit
Supply Voltage	V_{DD}	-0.3 to 7	V
Input Voltage	V_T	-0.3 to V_{DD} +0.3	V
Operating Temperature	T_{opr}	-20 to 70	℃
Storage Temperature	T_{stg}	-30 to 80	℃

INSTRUCTIONS

Instruction	RS	R/W	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0	Description	Execution Time (max) (when fcp or fosc is 250 kHz)
						Code						
Clear Display	0	0	0	0	0	0	0	0	0	1	Clears entire display	1.53ms
Return Home	0	0	0	0	0	0	0	0	1	∗	Moves cursor to first position. DD RAM contents remain unchanged.	1.53ms
Entry Mode Set	0	0	0	0	0	0	0	1	I / D	S	Sets cursor move direction and specifies shift of display. These operations are performed during write and read.	39us
Display On/Off Control	0	0	0	0	0	0	1	D	C	B	Sets display (D) ON/OFF, cursor ON/OFF (C), and blinking ON/OFF (B).	39us
Cursor or Display Shift	0	0	0	0	0	1	S / C	R / L	∗	∗	Shifts display or moves cursor (S/C) and sets Displayed to shift RIGHT/LEFT (R/L)	39us
Function Set	0	0	0	0	1	DL	N	F	∗	∗	Sets 8-bit/4-bit interface (DL), no. of lines displayed (N) and character font (F).	39us
Set CG RAM Address	0	0	0	1	AC5	AC4	AC3	AC2	AC1	AC0	Sets CG RAM address. CG RAM data is sent and received after setting.	39us
Set DD RAM Address	0	0	1	AC6	AC5	AC4	AC3	AC2	AC1	AC0	Sets DD RAM address. DD RAM data is sent and received after this setting.	39us
Read Busy Flag & Address	0	1	BF	AC							Reads Busy flag (BF) indicating internal operation is being performed. Reads address counter contents.	0 us
Write Data	1	0	Write Data								Writes data into DD RAM or CG RAM.	39us
Read Data from CG or DD RAM	1	1	Read Data								Reads data from DD RAM or CG RAM.	39us

I / D = 1: Increment
I / D = 0: Decrement
S   = 1: Accompanies display shift
S / C = 1: Display shift
S / C = 0: Cursor move
R / L = 1: shift to the right
R / L = 0: shift to the left
DL   = 1: 8 bits
DL   = 0: 4 bits
N   = 1: 2 lines
N   = 0: 1 line
F   = 1: 5 x 10 dots
F   = 0: 5 x 7 dots
BF   = 1: Internally operating
BF   = 0: Can accept instruction

DD RAM: Display data RAM
CG RAM: Character generator RAM
ACG: CG RAM address
ADD: DD RAM address :
      Corresponds to cursor address
AC: Address counter used for both
    DD and CG RAM address.

∗ Don't care

DISPLAY DD RAM AND CHARACTER POSITION

16x2, 1/16 DUTY CYCLE

	1	2		16	DISPLAY POSITION
line 1	00	01	· ·	0F	DD RAM ADDRESS
line 2	40	41	· ·	4F	

FUNCTION DESCRIPTION

● **Clear Display**

	RS	RW	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0
Code	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 first line of the display. Make entry mode increment (I/D = "1").

● **Return Home**

	RS	RW	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0
Code	0	0	0	0	0	0	0	0	1	x

Return Home is cursor return home instruction. 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.

● **Entry Mode Set**

	RS	RW	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0
Code	0	0	0	0	0	0	0	1	I/D	S

Set the moving direction of cursor and display.

➢ **I/D : Increment / decrement of DDRAM address (cursor or blink)**
When I/D = "High", cursor/blink moves to right and DDRAM address is increased by 1.

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

* CGRAM operates the same as DDRAM, when read from or write to CGRAM.

➢ **S: Shift of entire display**
When DDRAM read (CGRAM read/write) operation or S = "Low", shift of entire display is not performed. If S = "High" and DDRAM write operation, shift of entire display is performed according to I/D value (I/D = "1" : shift left, I/D = "0" : shift right).

S	I/D	Description
H	H	Shift the display to the left
H	L	Shift the display to the right

FUNCTION DESCRIPTION(CONT.)

➢ **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. So to speak, DL is a signal to select 8-bit or 4-bit bus mode.

When 4-bit bus mode, it needs to transfer 4-bit data by two times.

➢ **N : Display line number control bit**
When N = "Low", it means 1-line display mode.

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

➢ **F : Display font type control bit**
When F = "Low", it means 5 x 8 dots format display mode

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

N	F	No. of Display Lines	Character Font	Duty Factor
L	L	1	5x8	1/8
L	H	1	5x11	1/11
H	x	2	5x8	1/16

● **Set CGRAM Address**

	RS	RW	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0
Code	0	0	0	1	AC5	AC4	AC3	AC2	AC1	AC0

Set CGRAM address to AC.

This instruction makes CGRAM data available from MPU.

● **Set DDRAM Address**

	RS	RW	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0
Code	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 = 0), DDRAM address is from "00H" to "4FH".

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

FUNCTION DESCRIPTION(CONT.)

● **Read Busy Flag and Address**

	RS	RW	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0
Code	0	1	BF	AC6	AC5	AC4	AC3	AC2	AC1	AC0

When BF = "High", indicates that the internal operation is being processed.So during this time the next instruction cannot be accepted.

The address Counter (AC) stores DDRAM/CGRAM addresses, transferred from IR.

After writing into (reading from) DDRAM/CGRAM, AC is automatically increased (decreased) by 1.

● **Write Data to CGRAM or DDRAM**

	RS	RW	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0
Code	1	0	D7	D6	D5	D4	D3	D2	D1	D0

Write binary 8-bit data to DDRAM/CGRAM.

The selection of RAM from DDRAM, 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 to the entry mode.

● **Read Data from CGRAM or DDRAM**

	RS	RW	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0
Code	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 address set instruction of RAM is not performed before this instruction, the data that read first is invalid, because the direction of AC is not determined. If you read RAM data several times without RAM address set instruction before read operation, you can get correct RAM data from the second, but the first data would be incorrect, because 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 transfer 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.

* In case of RAM write operation, after this AC is increased/decreased by 1 like read operation. In this time, AC indicates the next address position, but you can read only the previous data by read instruction.

TIMING CHARACTERISTICS OF COMPATIBLE CONTROLLER CHIPS

Parameters	Symbol	Recommended timing	Parameters	Symbol	Recommended timing
Enable Cycle Time	tC (min)	1000ns	Set-up Time	tB(min)	140ns
Enable Pulse Width			R/W and RS built in Time	tsu2 (min)	60ns
High level	tW(min)	450ns	R/W and RS hold Time	tH1 (min)	20ns
Low level	tL (min)	450ns	Output Data Delay Time	tD(Max)	360ns
Enable Raise Time	tr (max)	25ns	Input Data Hold Time	tH (min)	10ns
Enable Fall Time	tf (max)	25ns	Output Data Hold Time	tH2 (min)	20ns

Figure 1   Power On Timing Diagram
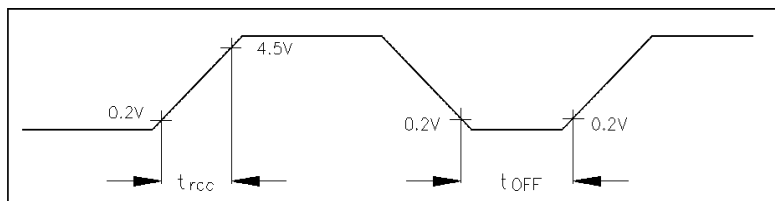
Note: Power on initialization depends on the rise time of the power supply when it is turned on. When the above power supply conditions is not met, the internal reset circuit will not operate normally and initialization will not be performed. Initialization by manual instruction is required. Use the procedure in figures 4 and 5 for initialization.

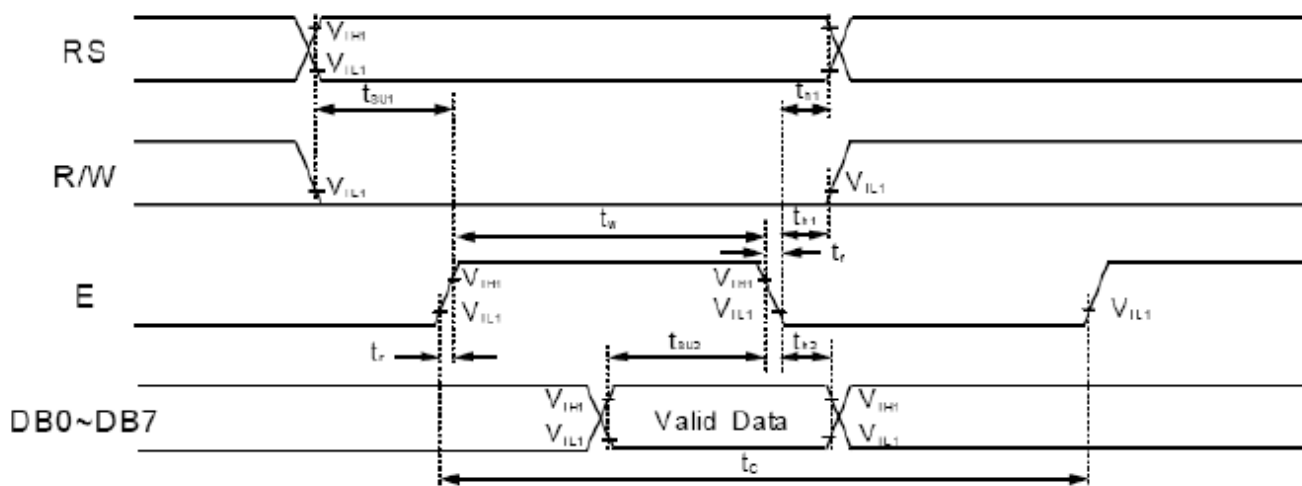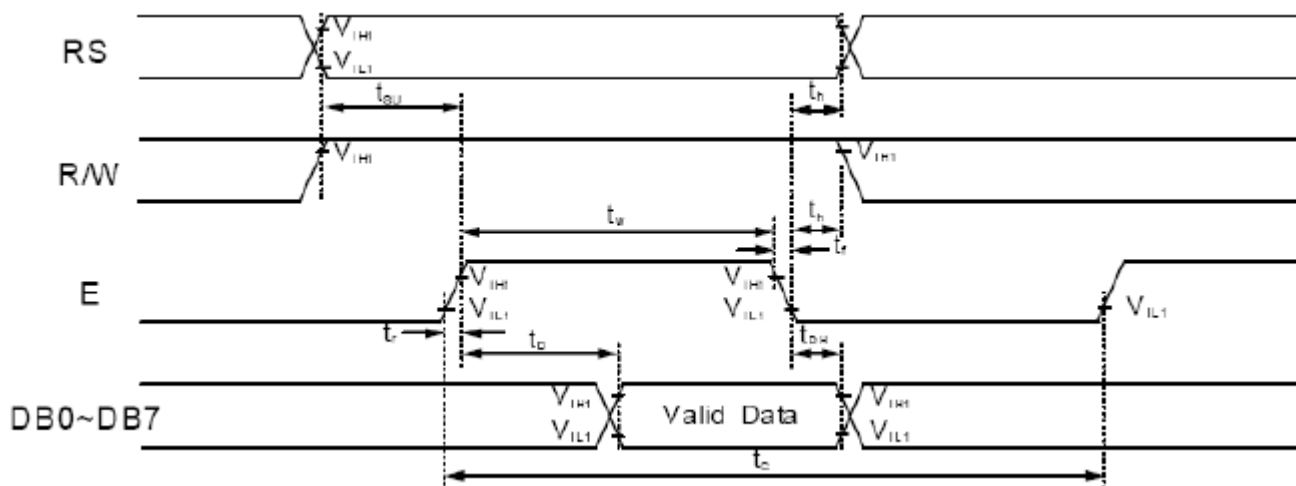## Figure 2   Timing Characteristics of Write Operation

Figure 3   Timing Characteristics of Read Operation

INITIALIZATION METHOD

The module will automatically perform initialization using internal reset circuit when power is turned on. The following instructions are executed during initialization.

1.   Display Clear
   The busy flag is kept in busy state high (BF=1).   The busy state is 15ms..
2.   Function set: DL   = 1: 8 bit long interface data
                                       N   = 0: 1 line display
                                       F   = 0: 5 x 7 dot character font
3.   Display on / off control: D   = 0: Display off
                                         C   = 0: Cursor off
                                         B   = 0: Blink off
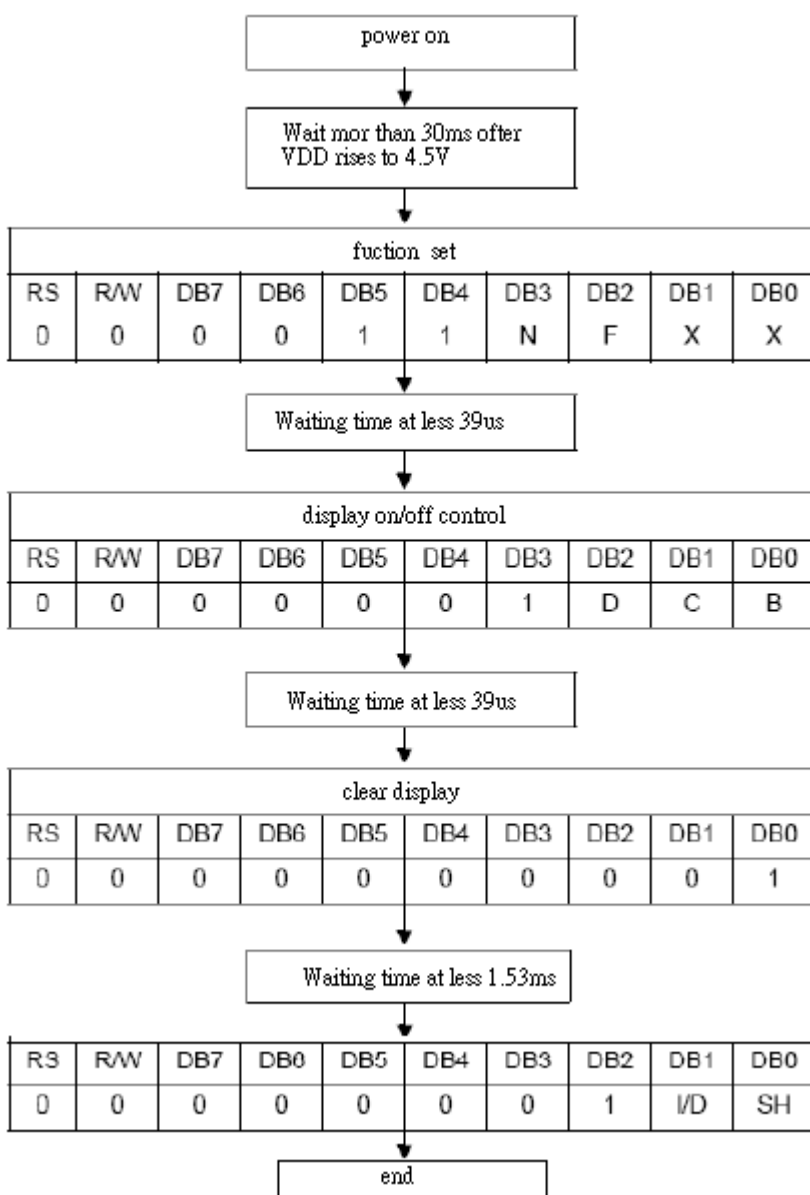4.   Entry mode set: I / D = 1: +1 (increment)
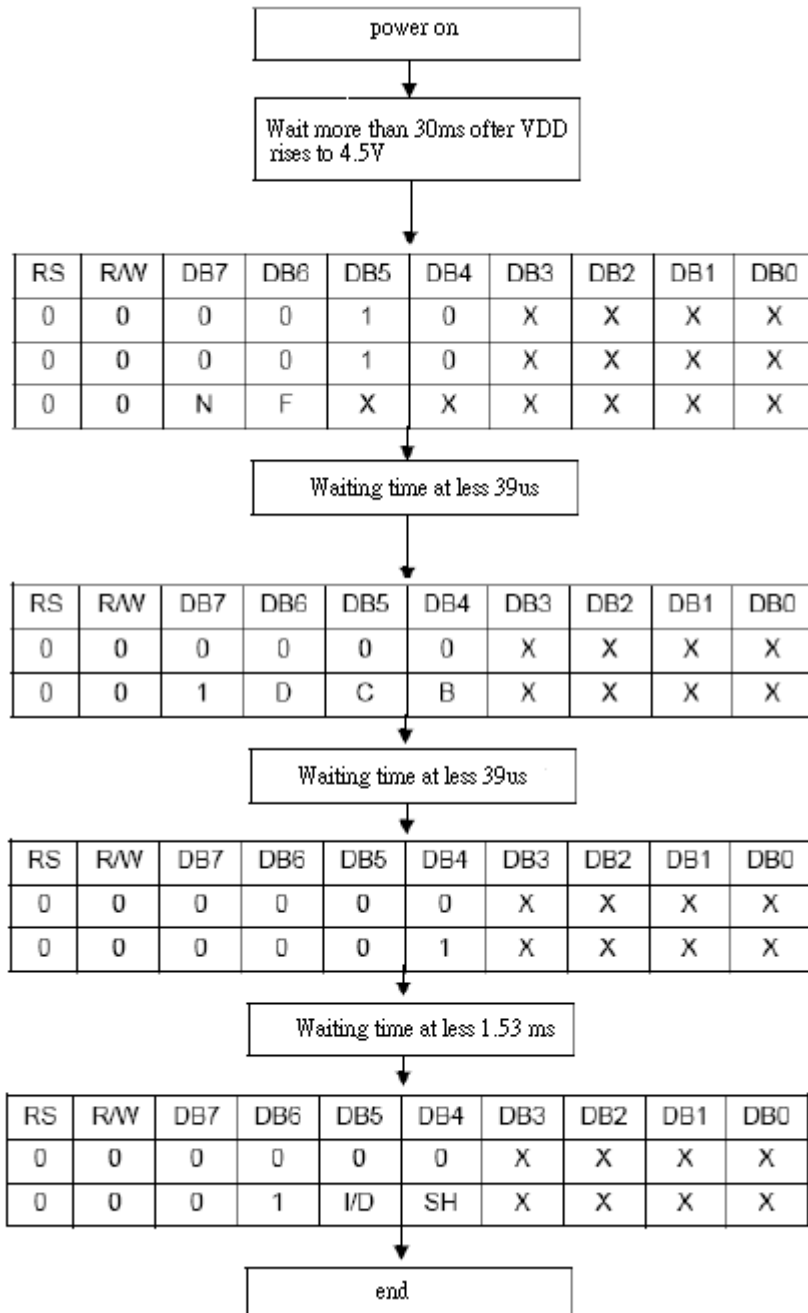   S   = 0: No shift

Figure 4   Initialization for 8-Bit Interface

Figure 5   Initialization for 4-Bit interface

```
power on
```

```
Wait more than 30ms ofter VDD
rises to 4.5V
```

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

```
Waiting time at less 39us
```

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

```
Waiting time at less 39us
```

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

```
Waiting time at less 1.53 ms
```

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	SH	X	X	X	X

```
end
```

QUALITY STANDARD OF LCD MODULE

1.0	**Sampling Method**		
	Sampling Plan : MIL STD 105 E Class of AQL : Level II/Single Sampling Critical : 0.25% Major 0.65% Minor 1.5%		
2.0	**Defect Group**	**Failure Category**	**Failure Reasons**
	Critical Defect 0.25%(AQL)	Malfunction	Open Short Burnt of dead component Missing part/improper part P.C.B. Broken
	Major Defect 0.65%(AQL)	Poor Insulation	Potential short High current Component damage or scratched or Lying too close improper coating
		Poor Conduction	Damage joint Wrong polarity Wrong spec. part Uneven/intermittent contact Loose part Copper peeling Rust or corrosion or dirt's
	Minor Defect 1.5%(AQL)	Cosmetic Defect	Minor scratch Flux residue Thin solder Poor plating Poor marking Crack solder Poor bending Poor packing Wrong size

HANDLING PRECAUTIONS

(1) CAUTION OF LCD HANDLING & CLEANING
Use soft cloth with solvent (recommended below) to clean the display surface and wipe lightly.
- Isopropyl alcohol, ethyl alcohol, trichlorotriflorothane

Do not wipe the display surface with dry or hard materials that will damage the polarizer surface. Do not use the following solvent;
-water, ketone, aromatics

(2) CAUTION AGAINST STATIC CHARGE
The LCD modules use CMOS LSI drivers, so customers are recommend that any unused input terminal would be connected to V_{DD} or V_{SS}, do not input any signals before power is turned on, and ground your body, work/assembly areas, assembly equipment to protect against static electricity.

(3) PACKAGING
Avoid intense shock and falls from a height and do not operate or store them exposed direct to sunshine or high temperature/humidity.

(4) CAUTION FOR OPERATION
It is an indispensable condition to drive LCD's within the specified voltage limit since the higher voltage than the limit causes the shorter LCD life. The use of direct current drive should be avoided because an electrochemical reaction due to direct current causes LCD's undesirable deterioration.

Response time will be extremely delayed at low temperature, and LCD's show dark color at high temperature. However those phenomena do not mean malfunction or out of order with LCD's.

Some font will be abnormally displayed when the display area is pushed hard during operation. But it resumes normal condition after turning off once.

(5) SAFETY
For crash damaged or unnecessary LCD's, it is recommended to wash off liquid crystal by either of solvents such as acetone and ethanol and should be burned up later.

When any liquid leaked out of a damaged glass cell comes in contact with your hands, wash it off with soap and water.

WARRANTY
CLOVER CHINA will replace or repair any of her LCD module in accordance with her LCD specification for a period of one year from date of shipment. The warranty liability of Clover china is limited to repair and/or replacement. Clover china will not be responsible for any subsequent or consequential event.