



CLOVER DISPLAY LTD.

LCD MODULE SPECIFICATION

Model : CV4402B - _ _ - _ _ - _ _

Revision	05
Engineering	Timmy Kwan
Date	15 July 2009
Our Reference	4907

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MODE OF DISPLAY**Display mode**☐ TN positive☐ TN negativeSTN : ☐ Yellow green☐ Grey☐ Blue (negative)☐ FSTN positive☐ FSTN negative**Display condition**☐ Reflective type☐ Transflective type☐ Transmissive type☐ Others**Viewing direction**☐ 6 O' clock☐ 12 O' clock☐ 3 O' clock☐ 9 O' clock**LCD MODULE NUMBER NOTATION:**CV4402B- M Y - S F - N 6 - T

(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)

T – Touch panel (Analog)

P – Touch panel (Digital)

GENERAL DESCRIPTION

Display mode : 40 characters x 2 lines LCD module
 Interface : 4-bit or 8-bit parallel
 Driving method : 1/16 duty, 1/5 bias
 Controller IC : Sitronix ST7066U or equivalent
 For the detailed information, please refer to IC specifications.

MECHANICAL DIMENSIONS

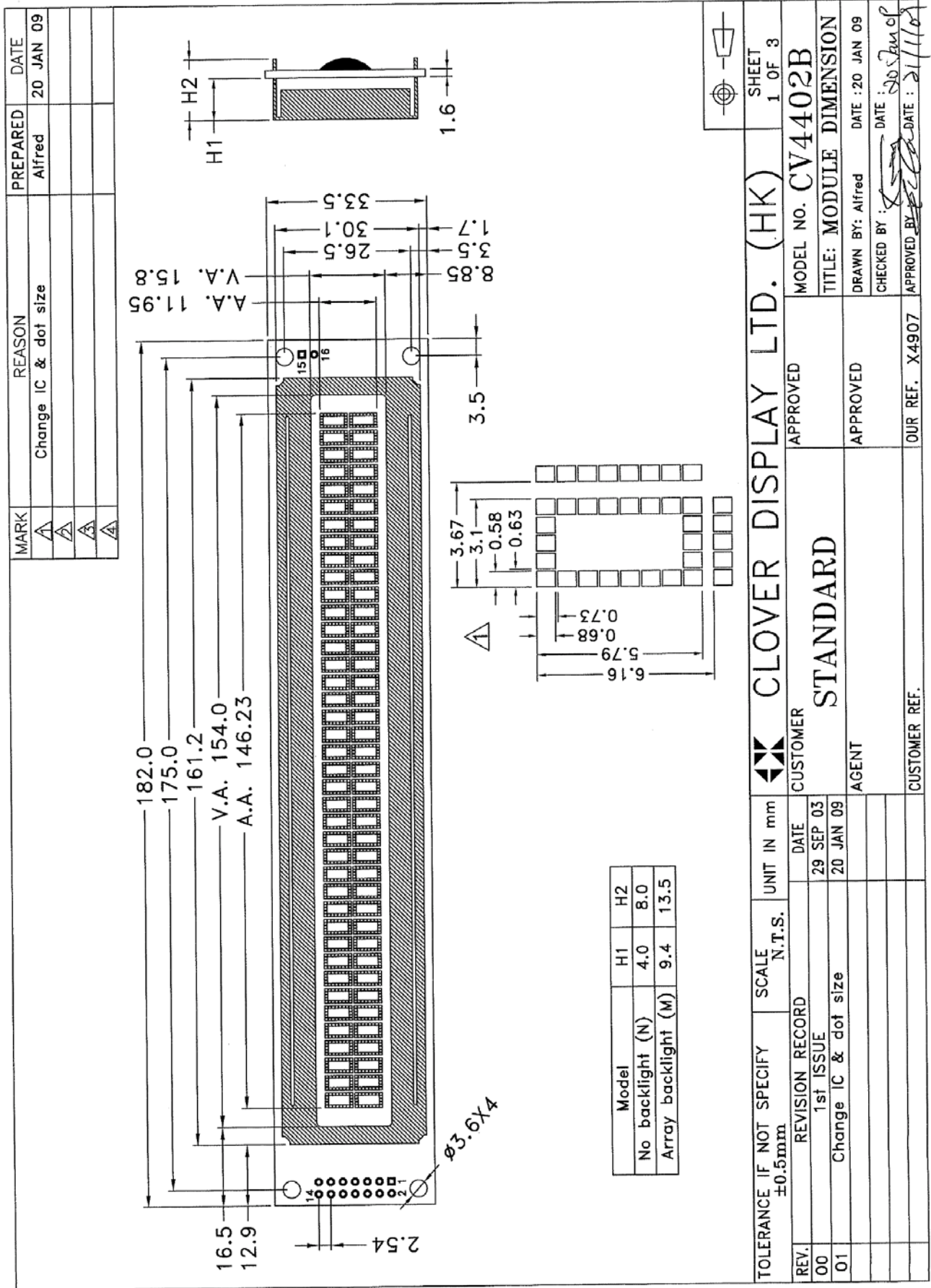
Item	Dimension		Unit	Item	Dimension		Unit
Outline Dimension	182.0(L)x33.5(W)x (H1/H2)		mm	Character Pitch	3.67(L)x6.16(W)		mm
Viewing Area	154.0(L)x15.8(W)		mm	Dot Size	0.58(L)x0.68(W)		mm
Character Size	3.1(L)x5.79(W)		mm	—	—		—
No Backlight (N)	H1	4.0	mm	Side Backlight (L)	H1	—	mm
	H2	8.0	mm		H2	—	mm
Array Backlight (M)	H1	9.4	mm				
	H2	13.5	mm				

CONNECTOR PIN ASSIGNMENT

Pin No.	Symbol	Function	Pin No.	Symbol	Function
1	Vss	Ground	9	DB2	Data Bus Line
2	VDD	Supply Voltage for Logic	10	DB3	
3	Vo	Input Voltage for LCD	11	DB4	
4	RS	Register Select Signal	12	DB5	
5	R/W	Read/Write Signal	13	DB6	
6	E	Enable Signal	14	DB7	
7	DB0	Data Bus Line	15*	BL+	Supply Voltage for Backlight (+VE)
8	DB1		16*	BL -	Supply Voltage for Backlight (-VE)

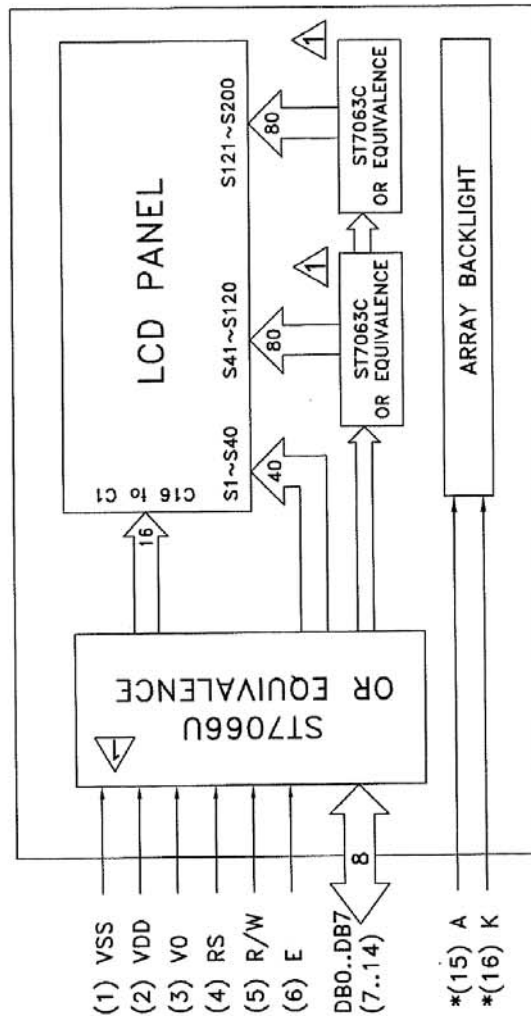
Note (*): Pin 15, 16 are used for backlight versions only.

COUNTER DRAWING OF MODULE DIMENSION



COUNTER DRAWING OF PIN OUT & BLOCK DIAGRAM

PIN NO.	SYMBOL	FUNCTION
1	VSS	Ground
2	VDD	Supply voltage for logic
3	V0	Input voltage for LCD
4	RS	Register select signal
5	R/W	Read/write signal
6	E	Enable signal
7	DB0	Data bus line
8	DB1	
9	DB2	
10	DB3	
11	DB4	
12	DB5	
13	DB6	
14	DB7	
*15	A	Supply voltage for backlight (+VE)
*16	K	Supply voltage for backlight (-VE)



Note(*) : Pin 15 , 16 are used for backlight versions only.

TOLERANCE IF NOT SPECIFY ±0.5mm		SCALE N.T.S.	UNIT IN mm	CLOVER DISPLAY LTD. (HK)		SHEET 2 OF 3
REV.	REVISION RECORD	DATE	CUSTOMER	APPROVED	MODEL NO. CV4402B	
00	1st ISSUE	29 SEP 03	STANDARD		TITLE: PIN OUT & BLOCK DIAGRAM	
01	Change IC & dot size	20 JAN 09	AGENT	APPROVED	DRAWN BY: Alfred	DATE : 20 JAN 09
					CHECKED BY: <i>[Signature]</i>	DATE : <i>20 Jan 09</i>
					APPROVED BY: <i>[Signature]</i>	DATE : <i>21/1/09</i>
				OUR REF. X4907		
				CUSTOMER REF.		

ELECTRICAL CHARACTERISTICS

Conditions: VSS=0V, @Ta=25℃

Item	Symbol	MIN.	TYP.	MAX.	Unit	Item	Symbol	MIN.	TYP.	MAX.	Unit
Supply Voltage	VDD	4.75	5.00	5.25	V	“H”Level Input Voltage	VIH	0.7VDD	—	VDD	V
Supply Current	IDD	—	0.62	0.93	mA	“L”Level Input Voltage	VIL	-0.3	—	0.6	V
Backlight Voltage						Backlight Current					
EL (@ Frequency 400Hz)	VEL	—	—	—	V _{rms}	—	—	—	—	—	—
Side-lited LED						Side-lited LED					
White	VBL	—	—	—	V	White	IBL	—	—	—	mA
Blue	VBL	—	—	—	V	Blue	IBL	—	—	—	mA
Yellow Green	VBL	—	—	—	V	Yellow Green	IBL	—	—	—	mA
Array LED						Array LED					
Yellow Green	VBL	3.85	4.05	4.25	V	Yellow Green	IBL	—	360	640	mA
Amber	VBL	—	—	—	V	Amber	IBL	—	—	—	mA
Orange	VBL	—	—	—	V	Orange	IBL	—	—	—	mA
Soft Orange	VBL	—	—	—	V	Soft Orange	IBL	—	—	—	mA

ABSOLUTE MAXIMUM RATINGS

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

Item	Symbol	Rating (for normal temperature)	Rating (for wide temperature)	Unit
Supply Voltage	VDD	-0.3 to +7	-0.3 to +7	V
Input Voltage	VI	-0.3 to VDD +0.3	-0.3 to VDD +0.3	V
Operating Temperature	T _{opr}	0 to 50	-20 to 70	℃
Storage Temperature	T _{stg}	-10 to 60	-30 to 80	℃

INSTRUCTIONS

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.

I / D	= 1: Increment	x : Don't care
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	

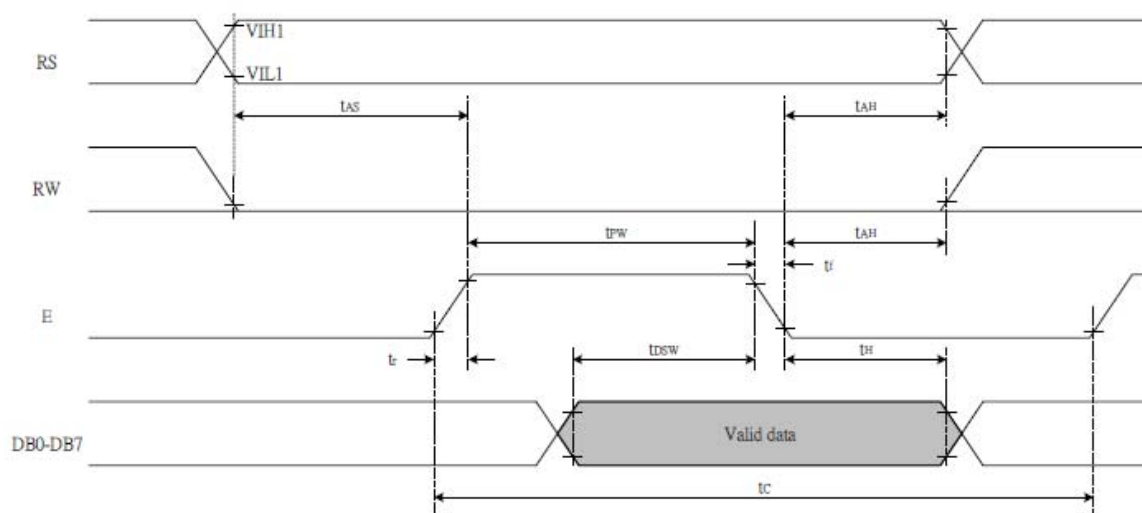
DISPLAY DD RAM AND CHARACTER POSITION

40x2, 1/16 DUTY CYCLE

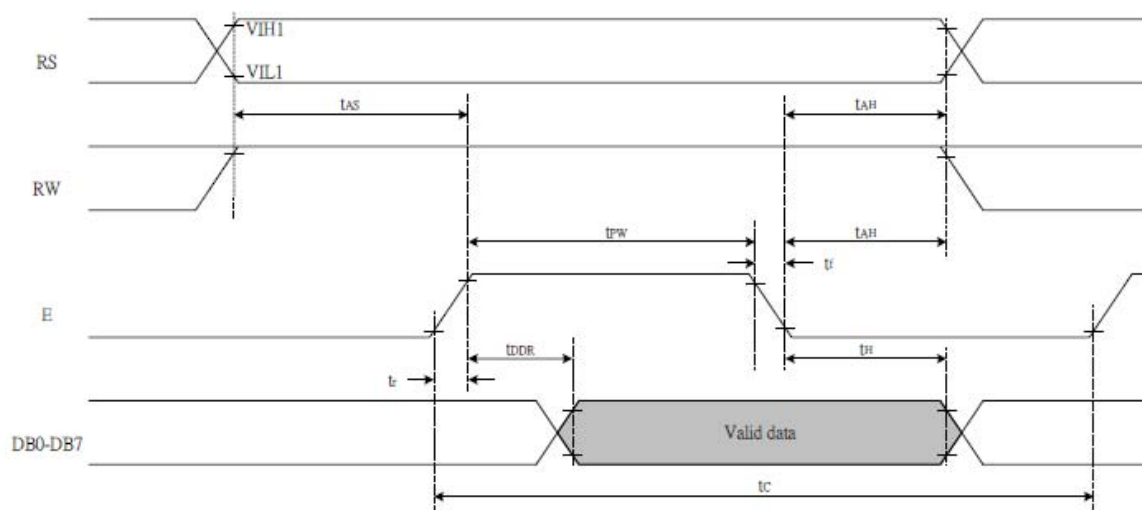
	1	2		40	DISPLAY POSITION DD RAM ADDRESS
line 1	00	01		27	
line 2	40	41		67	

PARALLEL INTERFACE TIMING DIAGRAM

● Writing data from MPU to ST7066U



● Reading data from ST7066U to MPU



TIMING CHARACTERISTICS

<i>Write Mode (Writing data from MPU to ST7066U)</i>						
T_C	Enable Cycle Time	Pin E	1200	-	-	ns
T_{PW}	Enable Pulse Width	Pin E	460	-	-	ns
T_R, T_F	Enable Rise/Fall Time	Pin E	-	-	25	ns
T_{AS}	Address Setup Time	Pins: RS,RW,E	0	-	-	ns
T_{AH}	Address Hold Time	Pins: RS,RW,E	10	-	-	ns
T_{DSW}	Data Setup Time	Pins: DB0 - DB7	80	-	-	ns
T_H	Data Hold Time	Pins: DB0 - DB7	10	-	-	ns
<i>Read Mode (Reading Data from ST7066U to MPU)</i>						
T_C	Enable Cycle Time	Pin E	1200	-	-	ns
T_{PW}	Enable Pulse Width	Pin E	480	-	-	ns
T_R, T_F	Enable Rise/Fall Time	Pin E	-	-	25	ns
T_{AS}	Address Setup Time	Pins: RS,RW,E	0	-	-	ns
T_{AH}	Address Hold Time	Pins: RS,RW,E	10	-	-	ns
T_{DDR}	Data Setup Time	Pins: DB0 - DB7	-	-	320	ns
T_H	Data Hold Time	Pins: DB0 - DB7	10	-	-	ns

INITIALIZATION METHOD

Initializing by Internal Reset Circuit

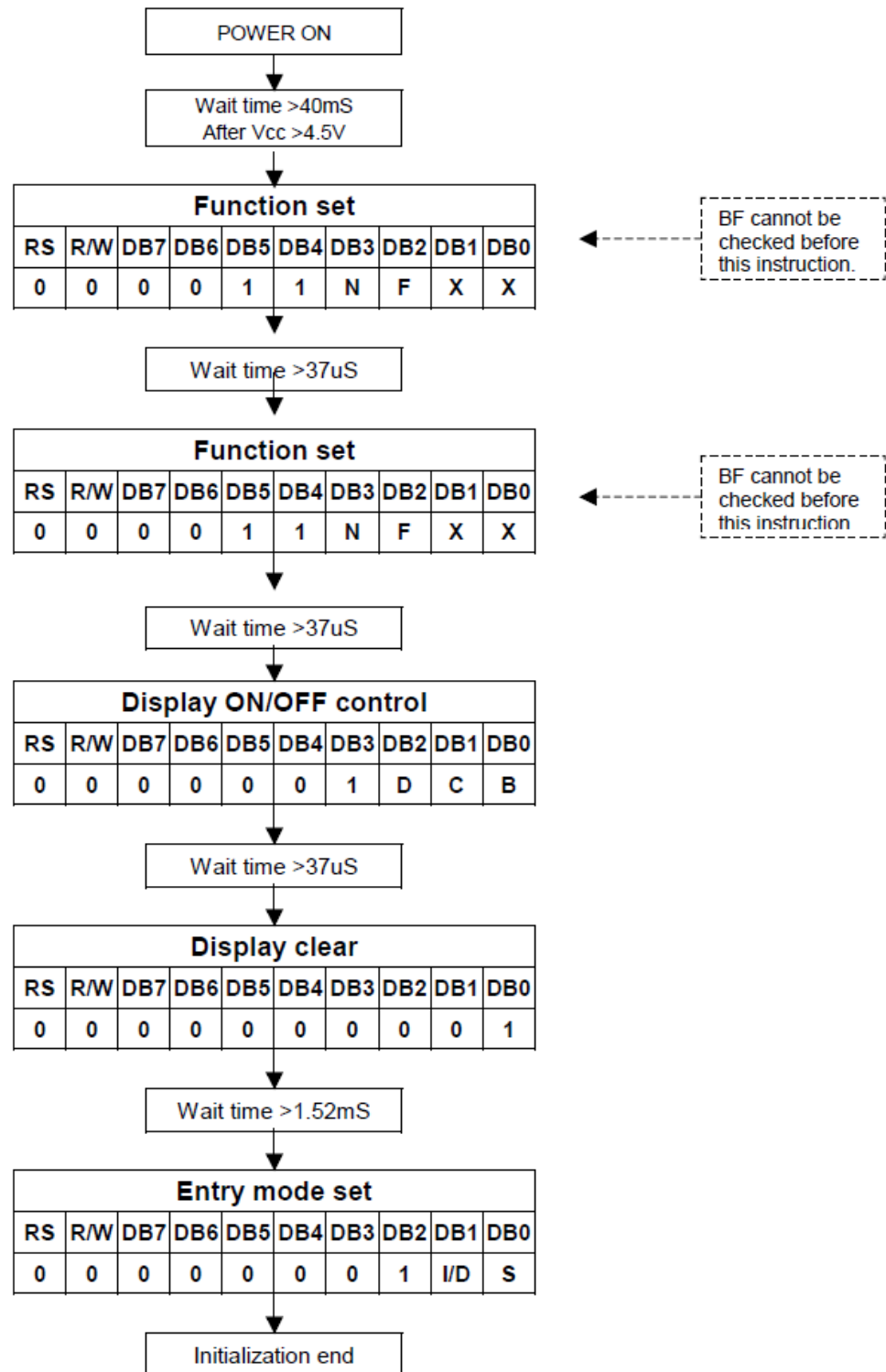
An internal reset circuit automatically initializes the ST7066U when the power is turned on. The following instructions are executed during the initialization. The busy flag (BF) is kept in the busy state until the initialization ends (BF = 1). The busy state lasts for 40 ms after VCC rises to 4.5 V.

1. Display clear
2. Function set:
 - DL = 1; 8-bit interface data
 - N = 0; 1-line display
 - F = 0; 5x8 dot character font
3. Display on/off control:
 - D = 0; Display off
 - C = 0; Cursor off
 - B = 0; Blinking off
4. Entry mode set:
 - I/D = 1; Increment by 1
 - S = 0; No shift

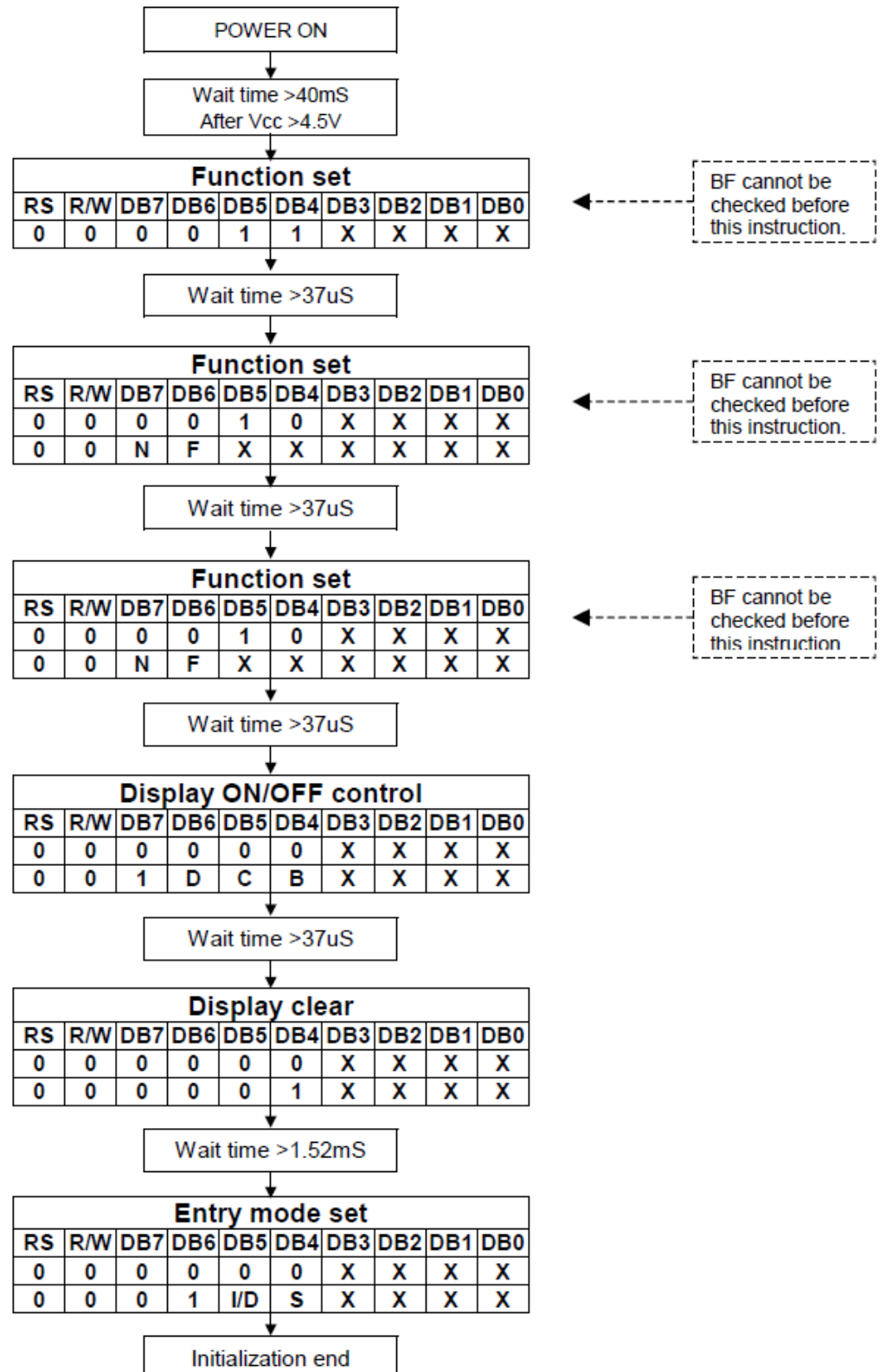
Note:

If the electrical characteristics conditions listed in the table Power Supply Conditions (Page 31) are not met, the internal reset circuit will not operate normally and will fail to initialize the ST7066U. For such a case, initialization must be performed by the MPU as explain by the following figures.

Initialization for 8-Bit Interface



Initialization for 4-Bit interface



ELECTRO-OPTICAL CHARACTERISTICS

MEASURING CONDITION: POWER SUPPLY = V_{OP} / 64 Hz
 TEMPERATURE = 23 ± 5 °C
 RELATIVE HUMIDITY = 60 ± 20 %

ITEM	SYMBOL	UNIT	TYP. TN	TYP. STN
RESPONSE TIME	Ton	ms	100	200
	Toff	ms	80	200
CONTRAST RATIO	Cr	-	10	10
VIEWING ANGLE (6 O'clock) (Cr ≥ 2)	V3:00	°	20	20
	V6:00	°	20	40
	V9:00	°	20	20
	V12:00	°	10	10

THE ELECTRO-OPTICAL CHARACTERISTICS ARE MEASURED VALUE BUT NOT GUARANTEED ONES.

RELIABILITY OF LCD MODULE

ITEM	TEST CONDITION FOR NORMAL TEMPERATURE	TEST CONDITION FOR WIDE TEMPERATURE	TIME
High temperature operating	50°C	70°C	240 hours
Low temperature operating	0°C	-20°C	240 hours
High temperature storage	60°C	80°C	240 hours
Low temperature storage	-10°C	-30°C	240 hours
Temperature-humidity storage	40°C 90% R.H.	60°C 90% R.H.	96 hours
Temperature cycling	-10°C to 60°C 30 Min Dwell	-30°C to 80°C 30 Min Dwell	5 cycles

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, trichlorotrifluoroethane

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 recommended 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 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 is limited to repair and/or replacement. Clover will not be responsible for any subsequent or consequential event.