CLOVER DISPLAY LTD.

LCD MODULE SPECIFICATION

Model : CV4204B - _ _ - _ _ - _ _ - _

Represented by:

first FC components
FIRST Components s.r.l.
www.first-components.com
sales@first-components.com
+39 0332 1888005

Revision	10
Engineering	Timmy Kwan
Date	09 Jun 2008
Our Reference	4953

ADDRESS : 1st FLOOR, EFFICIENCY HOUSE, 35 TAI YAU STREET, SAN PO KONG, KOWLOON, HONG KONG.
TEL : (852) 2341 3238 (SALES OFFICE) (852) 2342 8228 (GENERAL OFFICE)
FAX : (852) 2357 4237 (SALES OFFICE)
E-MAIL : cdl@cloverdisplay.com
URL : http://www.cloverdisplay.com

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:

CV4204B- 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)

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GENERAL DESCRIPTION

Display mode : 20 characters x 4 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 the IC specifications

MECHANICAL DIMENSIONS

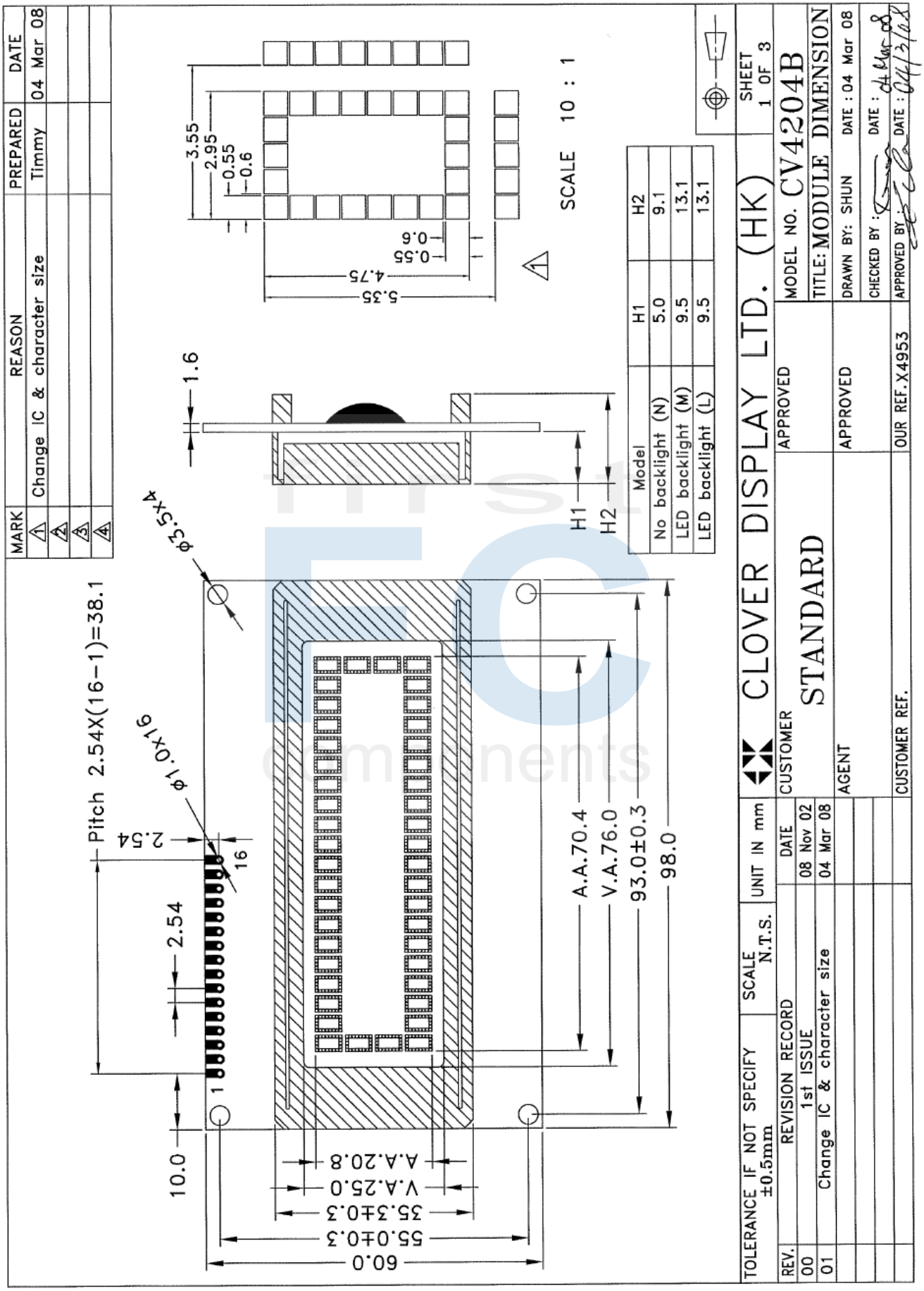
Item	Dimension		Unit	Item	Dimension		Unit
Outline Dimension	98.0(L)x60.0(W)x (H1/H2)		mm	Character Pitch	3.55(L)x5.35(W)		mm
Viewing Area	76.0(L)x25.0(W)		mm	Dot Size	0.55(L)x0.55(W)		mm
Character Size	2.95(L)x4.75(W)		mm	—	—		—
No Backlight (N)	H1	5.0	mm	Side Backlight (L)	H1	9.5	mm
	H2	9.1	mm		H2	13.1	mm
EL Backlight (M)	H1	—	mm	Array Backlight (M)	H1	9.5	
	H2	—	mm		H2	13.1	

CONNECTOR PIN ASSIGNMENT

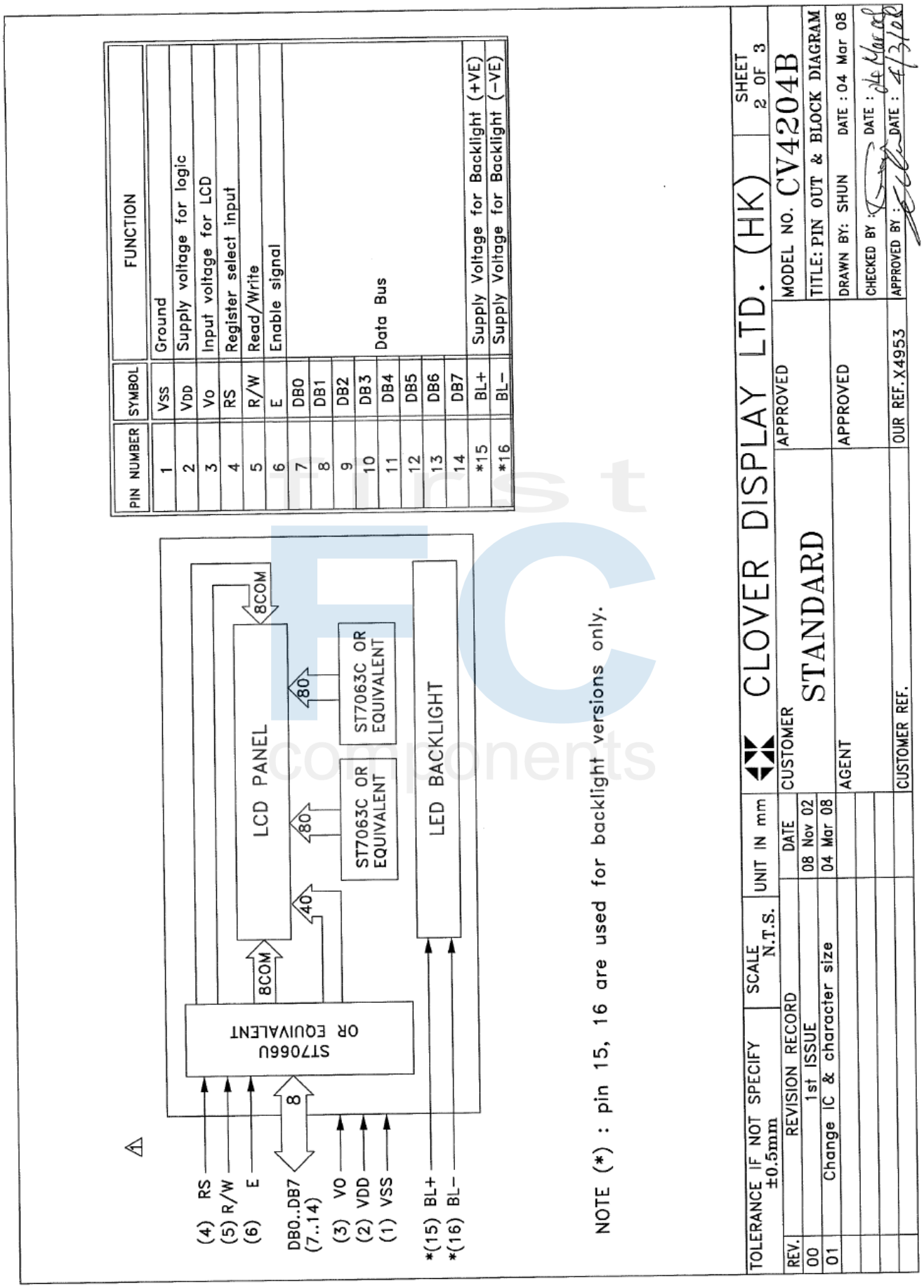
Pin No.	Symbol	Function	Pin No.	Symbol	Function
1	V_{SS}	Ground	9	DB_2	Data Bus
2	V_{DD}	Supply voltage for logic	10	DB_3	Data Bus
3	V_O	Input voltage for LCD	11	DB_4	Data Bus
4	RS	Register Select Input	12	DB_5	Data Bus
5	R/W	Read/Write	13	DB_6	Data Bus
6	E	Enable Signal	14	DB_7	Data Bus
7	DB_0	Data Bus	*15	BL+	Supply voltage for Backlight (+VE)
8	DB_1	Data Bus	*16	BL -	Supply voltage for Backlight (-VE)

Note (*) : Pin 15, 16 are used for backlight version

COUNTER DRAWING OF MODULE DIMENSION



COUNTER DRAWING OF PIN OUT & BLOCK DIAGRAM



ELECTRICAL CHARACTERISTICS

Conditions: VSS=0V, Ta=25℃

Item	Symbol	MIN.	TYP.	MAX.	Unit	Item	Symbol	MIN.	TYP.	MAX.	Unit
Supply Voltage	V_{DD}	4.5	5.00	5.5	V	"H"Level Input Voltage	V_{IH}	0.7VDD	—	V_{DD}	V
Supply Current	I_{DD}	—	0.44	1.21	mA	"L"Level Input Voltage	V_{IL}	-0.3	—	0.6	V
LCD Drive	V0	-0.20	0.00	0.20	V	—	—	—	—	—	—
Backlight Voltage						**Backlight Current**					
EL(@ Frequency 400Hz)	V_{EL}	—	—	—	V_{rms}	—	—	—	—	—	—
Side-lited LED						**Side-lited LED**					
White	V_{BL}	—	3.2	3.5	V	White	I_{BL}	—	40	50	mA
Blue	V_{BL}	—	—	—	V	Blue	I_{BL}	—	—	—	mA
Yellow Green	V_{BL}	—	—	—	V	Yellow Green	I_{BL}	—	—	—	mA
Array LED						**Array LED**					
Yellow Green	V_{BL}	3.85	4.05	4.25	V	Yellow Green	I_{BL}	—	180	360	mA
Amber	V_{BL}	3.70	3.90	4.10	V	Amber	I_{BL}	—	180	360	mA
Orange	V_{BL}	—	—	—	V	Orange	I_{BL}	—	—	—	mA
Red	V_{BL}	—	—	—	V	Red	I_{BL}	—	—	—	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	V_{DD}	-0.3 to 7	-0.3 to 7	V
Input Voltage	V_T	-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	℃

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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.

DISPLAY DD RAM AND CHARACTER POSITION

20x4, 1/16 DUTY CYCLE

	1	2		20
line 1	00	01	. . . . .	13
line 2	40	41	. . . . .	53
line 3	14	15	. . . . .	27
line 4	54	55	. . . . .	67

DISPLAY POSITION
DD RAM ADDRESS

TIMING CHARACTERISTICS OF COMPATIBLE CONTROLLER CHIPS

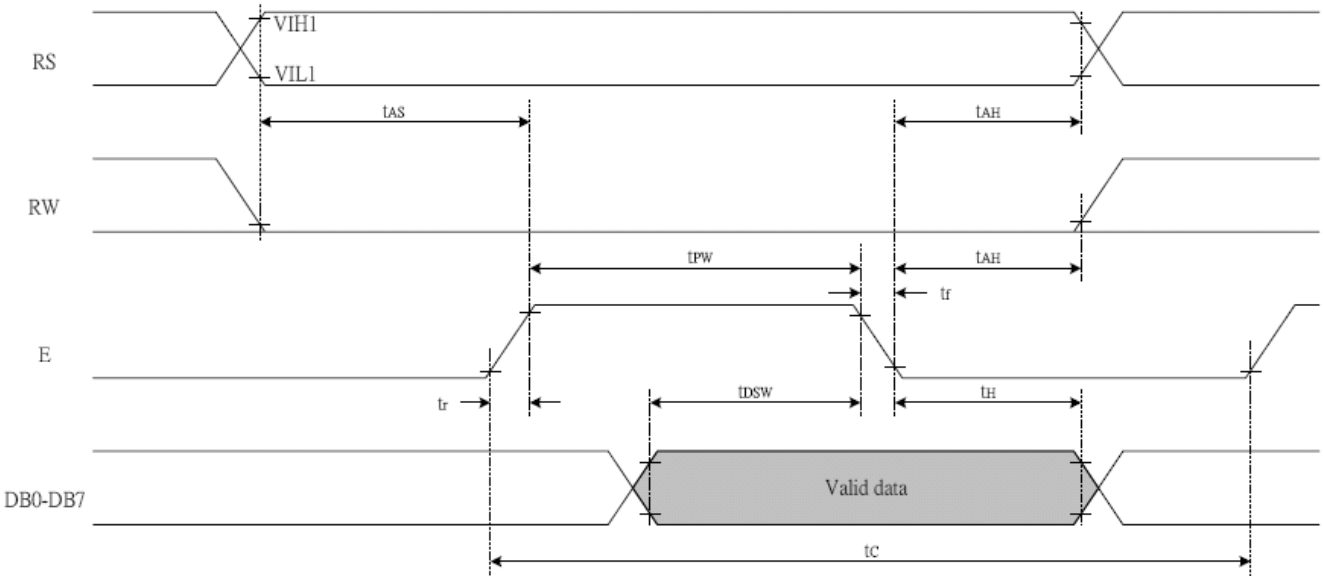
TA = 25℃, VCC = 2.7V

Write Mode (Writing data from MPU to ST7066U)						
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
Read Mode (Reading Data from ST7066U to MPU)						
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

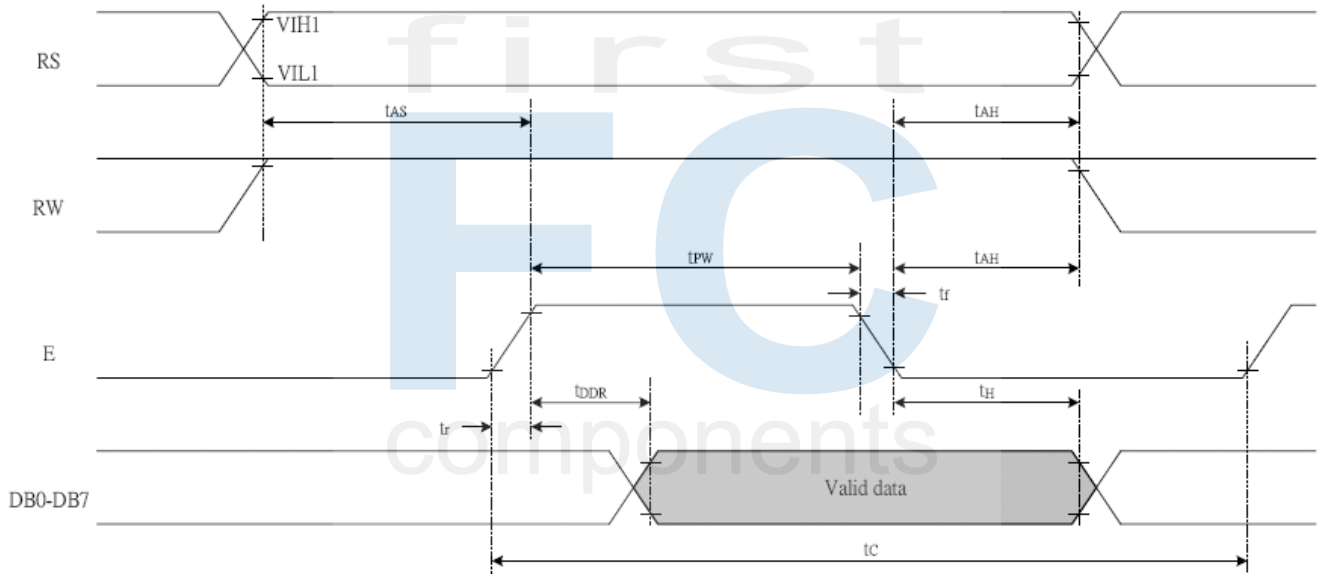
TA = 25℃, VCC = 5V

Write Mode (Writing data from MPU to ST7066U)						
T_C	Enable Cycle Time	Pin E	1200	-	-	ns
T_{PW}	Enable Pulse Width	Pin E	140	-	-	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	40	-	-	ns
T_H	Data Hold Time	Pins: DB0 - DB7	10	-	-	ns
Read Mode (Reading Data from ST7066U to MPU)						
T_C	Enable Cycle Time	Pin E	1200	-	-	ns
T_{PW}	Enable Pulse Width	Pin E	140	-	-	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	-	-	100	ns
T_H	Data Hold Time	Pins: DB0 - DB7	10	-	-	ns

Write Mode Timing Diagram (Writing Data from MPU to ST7066U)



Read Mode Timing Diagram (Reading Data from ST7066U to MPU)

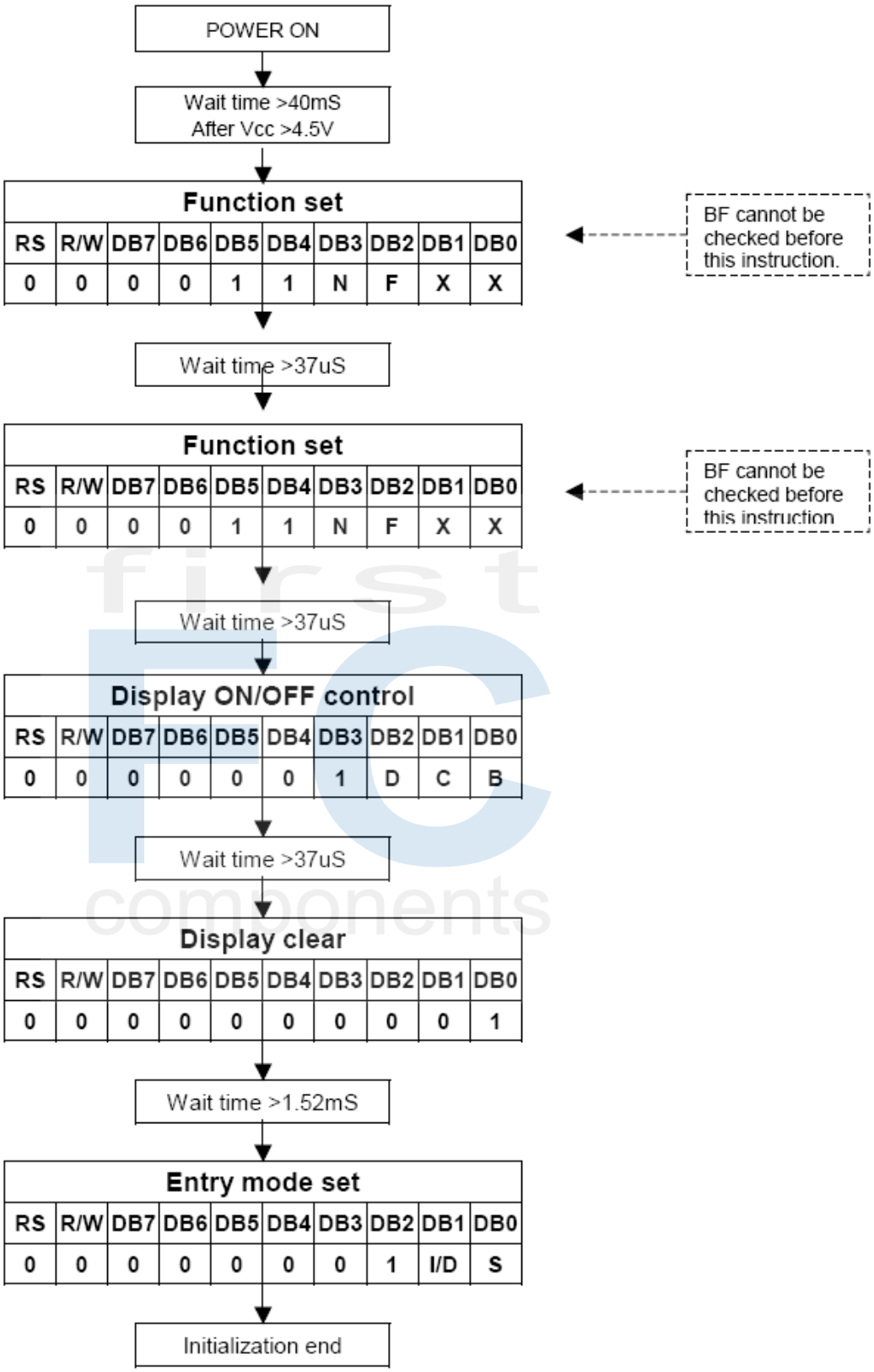


INITIALIZATION METHOD

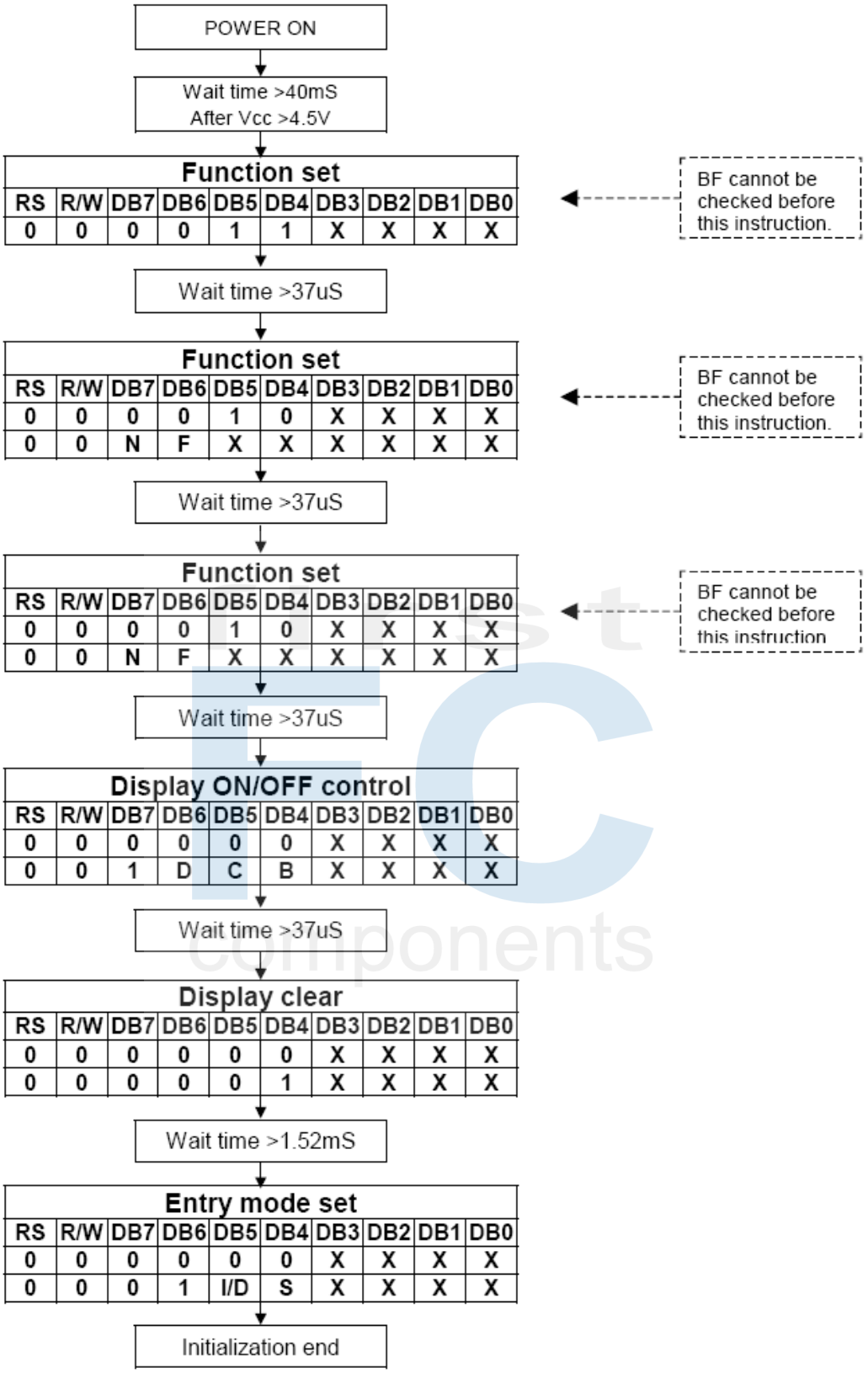
The module will automatically perform initialization using internal reset circuit when power is turned on. The following instructions are executed during initialization.

1.	Display Clear		
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

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	130	150
	Toff	ms	170	190
CONTRAST RATIO	Cr	-	8	15
VIEWING ANGLE (6 O'clock) (Cr ≥ 2)	$V_{3:00}$	°	70	45
	$V_{6:00}$	°	45	70
	$V_{9:00}$	°	70	45
	$V_{12:00}$	°	5	60

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
Vibration Test at LCM Level	Freq 10-55 Hz Sweep rate: 10-55-10 at 1 min Sweep mode Linear Displacement: 2 mm p-p 1 Hour each for X, Y, Z	Freq 10-55 Hz Sweep rate: 10-55-10 at 1 min Sweep mode Linear Displacement: 2 mm p-p 1 Hour each for X, Y, Z	—

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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 or 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

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HANDLING PRECAUTIONS

(1) CAUTION OF LCD HANDLING & CLEANING

The polarizing plate on the surface of the panel is made from organic substances. Be very careful for chemicals not to touch the plate or it leads the polarizing plate to deteriorate.

If the use of a chemical is unavoidable, wipe the panel lightly with soft materials, such as gauze and absorbent cotton, soaked in a solvent.

*Usable solvent: Alcohol (ethanol, IPA and the like)
*Appropriate solvent: Ketones, ethyl alcohol

Avoid wiping with a dry cloth, since it could damage the surface of the polarizing plate and others.

(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 to direct sunshine or high temperature/humidity for long periods.

(4) CAUTION FOR OPERATION

The viewing angle can be adjusted by varying the LCD driving voltage VO.

Driving voltage should be kept within specified range, excess voltage shortens display life.

Response time increases with decrease in temperature.

Display may turn black or dark Blue at temperature above its operational range; this is however not destructive and the display will return to normal once the temperature falls back to range.

Mechanical disturbance during operation (such as pressing on the viewing area) may cause the segments to appear “fractured”. They will recover once the display is turned off.

Condensation at terminals will cause malfunction and possible electrochemical reaction. Relative humidity of the environment should therefore be kept below 60%.

(5) SAFETY

Liquid crystal may leak out of a damaged LCD, it is recommended to wash off the liquid crystal by using solvents such as acetone or ethanol and should be burned up later.

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

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.

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