FORDATA FOR DATA DISPLAY

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CONTROLLER CHANGE (No. FDBN0023)

Dear Respectable Customers,

As SUNPLUS brand controller has been very difficult (almost impossible) to get from market, also on the consideration that this kind of situation will last for a long time, FORDATA decides to adopt SITRONIX controller as substitute for most (not all) of our character version LCD modules.

FORDATA can not assure SITRONIX controller can be 100% substitute for SUNPLUS controller (There are slight differences in Timing, to simplify your compare, FORDATA has listed the differences as below). So, to ensure that the SITRONIX version LCD samples can be used properly at your side, we strongly suggest you to test the new samples with SITRONIX controller.

We are sorry for any inconvenience brought to you by the IC replacement.

BEST REGARDS

For and on behalf of
福德電子有限公司
FORDATA ELECTRONIC CO., LIMITED
薛靜秋
Authorized Signature(s)

FORDATA ELECTRONIC CO., LTD
(Classic Mono LCDs)
2010-May

5.0V VERSION

To simplify your compare between SUNPLUS and SITRONIX, FORDATA lights up the differences in below table by gray background. (S) = SITRONIX, (L) = SUPLUS

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}	(S) 0.7Vdd (L) 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}	(S) -1.0 (L) -2.0	---	(S) 1.0 (L) 2.0	µA	Pins (RS. R/W. DB0 - DB7) Vdd = 5.0V
INPUT LOW CURRENT	I_{IL}	(S) -50 (L) -20	(S) -110 (L) -50	(S) -180 (L) -100	µA	
OUTPUT HIGH VOLTAGE (TTL)	V_{OH1}	(S) 3.9 (L) 2.4	---	Vdd	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	(S) 1200 (L) 500	---	---	ns	Pin E
ENABLE PULSE WIDTH	t_{PW}	(S) 140 (L) 230	---	---	ns	Pin E
ENABLE RISE/ FALL TIME	t_R, t_F	---	---	(S) 25 (L) 20	ns	Pin E
ADDRESS SETUP TIME	t_{SP1}	(S) 0 (L) 40	---	---	ns	Pins RS, R/W, E
ADDRESS HOLD TIME	t_{HD1}	10	---	---	ns	Pins RS, R/W, E
DATA SETUP TIME	t_{SP2}	(S) 40 (L) 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	(S) 1200 (L) 500	---	---	ns	Pin E
ENABLE PULSE WIDTH	t_{PW}	(S) 140 (L) 230	---	---	ns	Pin E
ENABLE RISE/ FALL TIME	t_R, t_F	---	---	(S) 25 (L) 20	ns	Pin E
ADDRESS SETUP TIME	t_{SP1}	(S) 0 (L) 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	---	---	(S) 100 (L) 120	ns	Pins: DB0 - DB7
DATA HOLD TIME	t_{HD2}	(S) 10 (L) 5	---	---	ns	Pins: DB0 - DB7

5.0V VERSION

To simplify your compare between SUNPLUS and SITRONIX, FORDATA lights up the differences in below table by gray background. (S) = SITRONIX, (L) = SUPLUS

11. INSTRUCTION TABLE

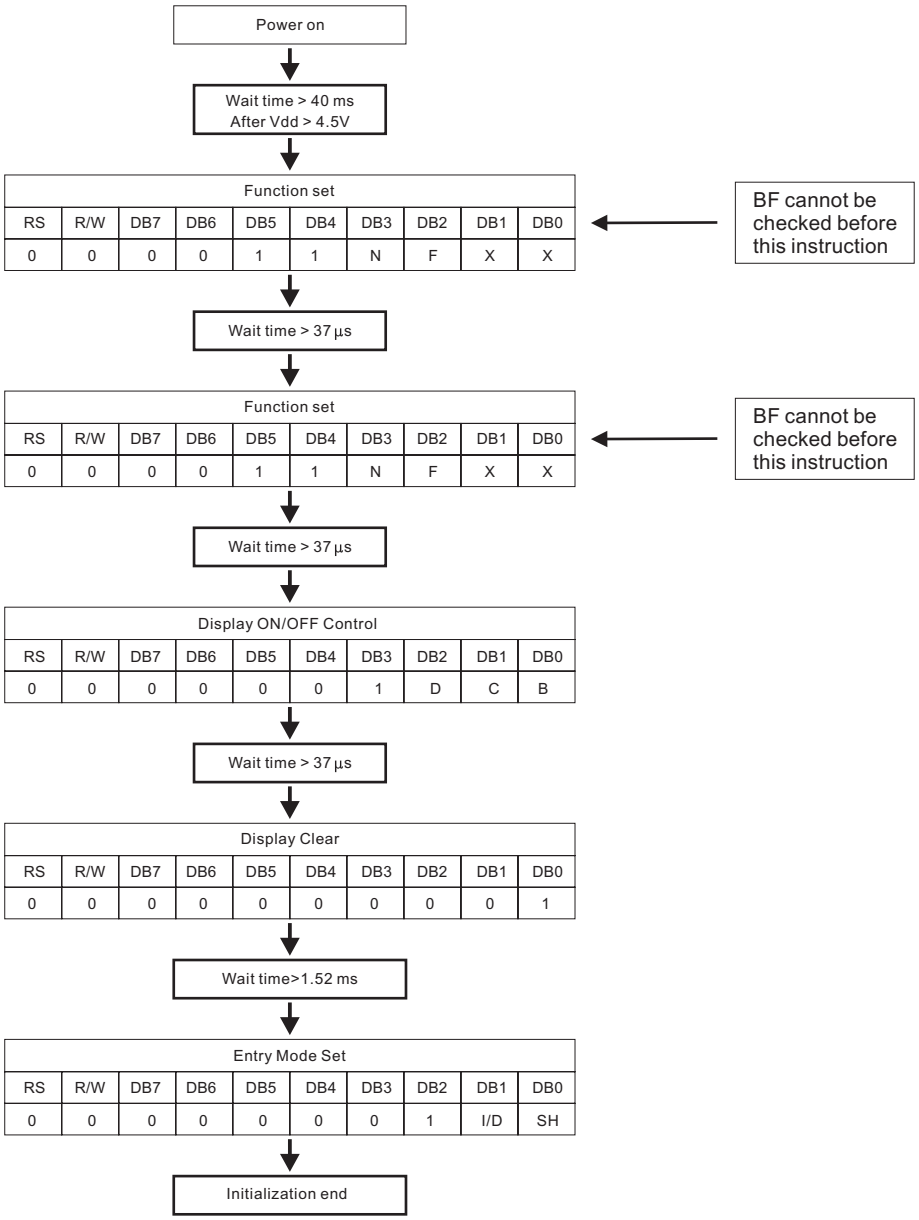
Instruction	Instruction Code										Description	Execution Time(fosc= 270kHz)
	RS	R/W	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0		
Clear Display	0	0	0	0	0	0	0	0	0	1	Write 20H to DDRAM set DDRAM address to 00H from AC	1.52ms
Return Home	0	0	0	0	0	0	0	0	1	-	Set DDRAM address to 00H from AC and return cursor to its original position if shifted. The contents of DDRAM are not changed.	1.52ms
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	(S) 37μs (L) 38μs
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	(S) 37μs (L) 38μs
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	(S) 37μs (L) 38μs
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	(S) 37μs (L) 38μs
Set CGRAM Address	0	0	0	1	AC5	AC4	AC3	AC2	AC1	AC0	Set CGRAM address in address counter	(S) 37μs (L) 38μs
Set DDRAM Address	0	0	1	AC6	AC5	AC4	AC3	AC2	AC1	AC0	Set DDRAM address in address counter	(S) 37μs (L) 38μs
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	0μs
Write Data to RAM	1	0	D7	D6	D5	D4	D3	D2	D1	D0	Write data into internal RAM (DDRAM/CGRAM)	(S) 37μs (L) 38μs
Read data from RAM	1	1	D7	D6	D5	D4	D3	D2	D1	D0	Read data from internal RAM (DDRAM/CGRAM)	(S) 37μs (L) 38μs

5.0V VERSION

To simplify your compare between SUNPLUS and SITRONIX, FORDATA listes the INITIALIZATION CHART as below for your reference

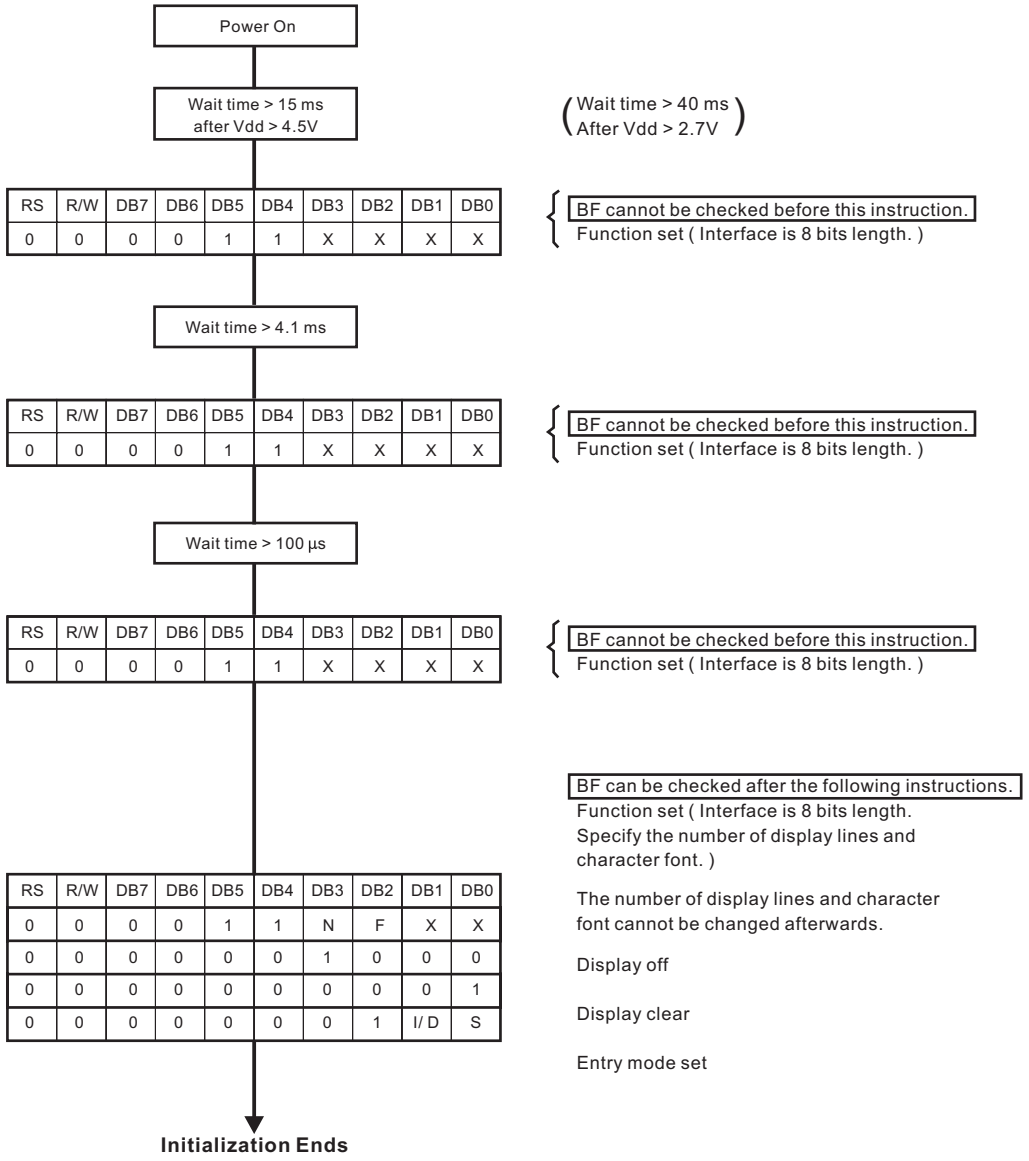
SITRONIX

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



SUNPLUS

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

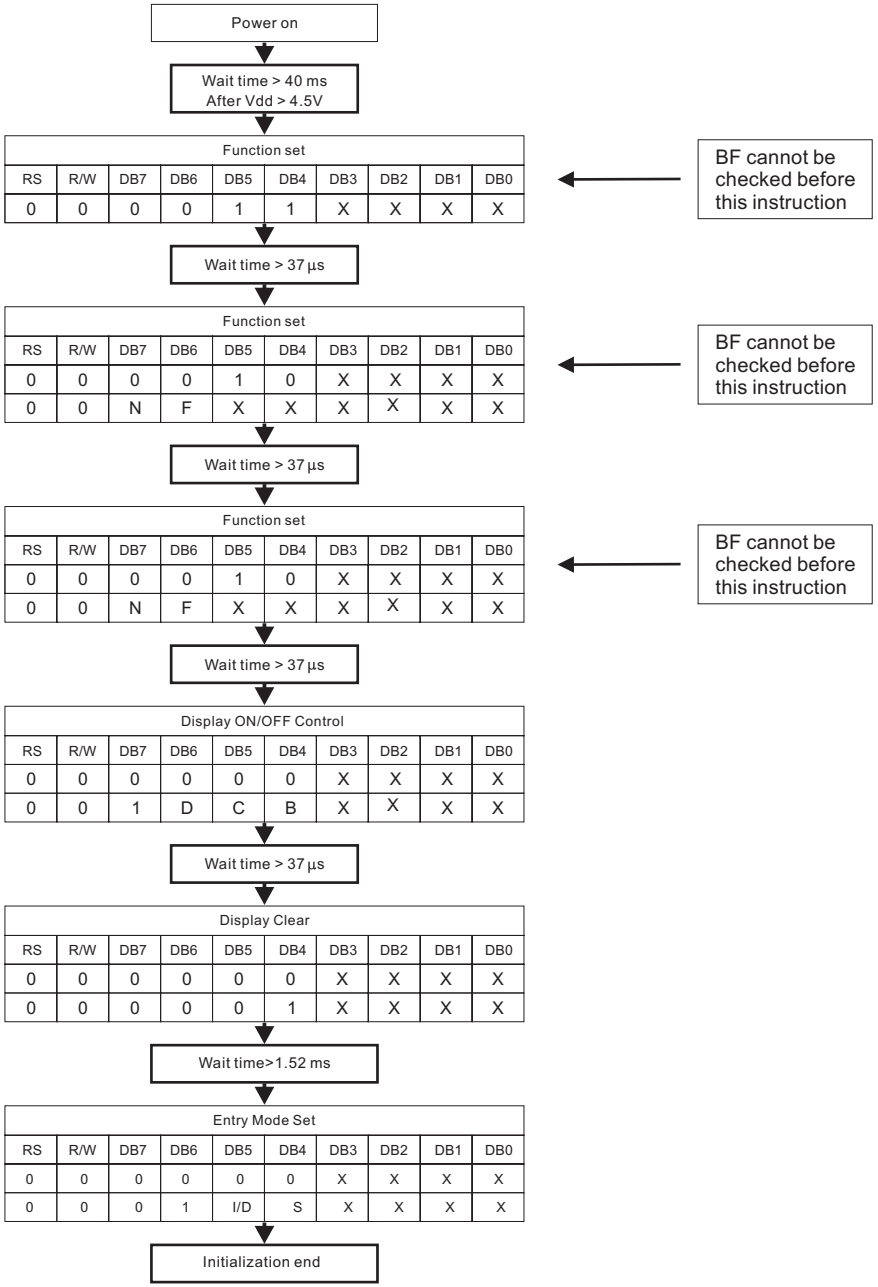


5.0V VERSION

To simplify your compare between SUNPLUS and SITRONIX, FORDATA listes the INITIALIZATION CHART as below for your reference

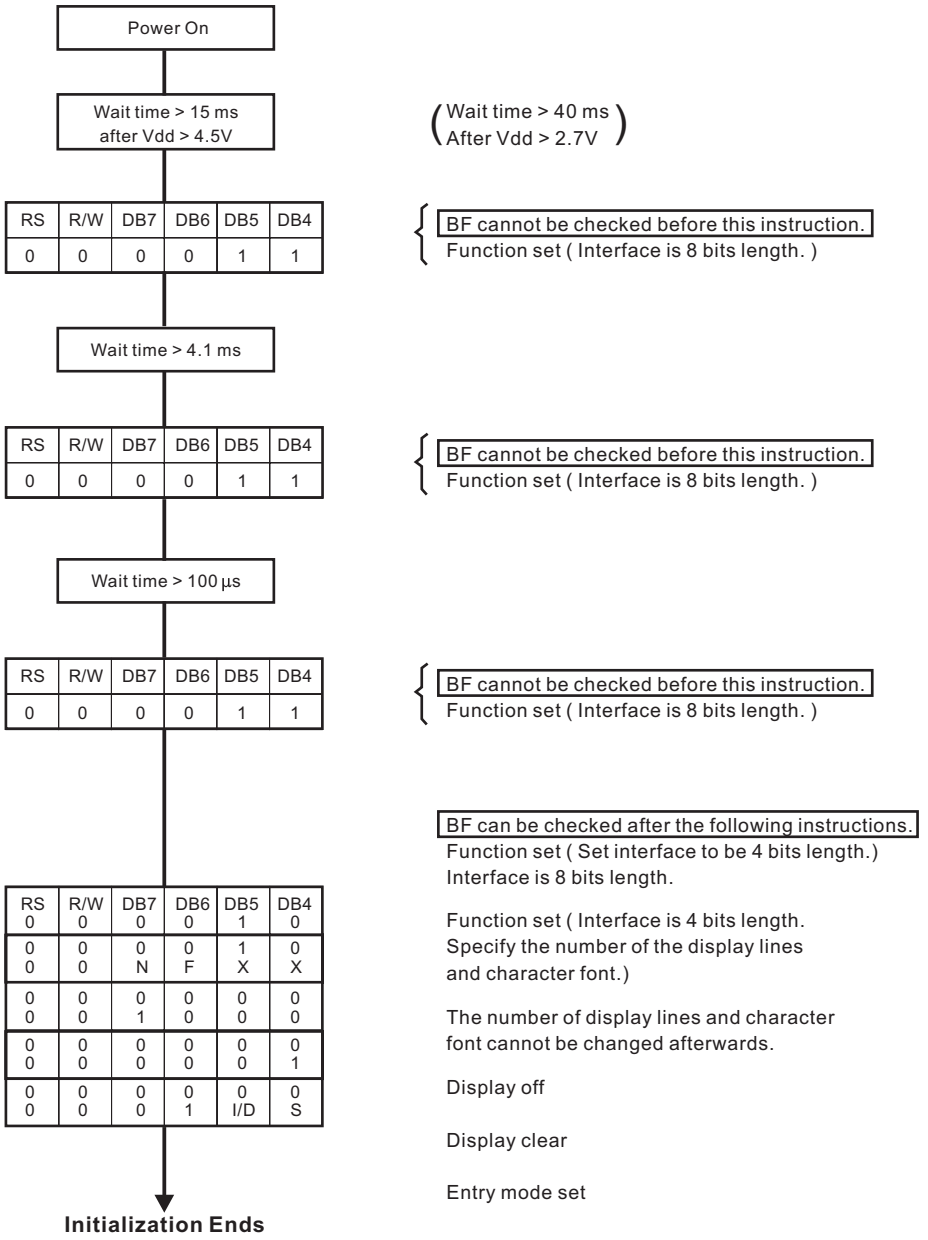
SITRONIX

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



SUNPLUS

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



3.0V / 3.3V VERSION

To simplify your compare between SUNPLUS and SITRONIX, FORDATA lights up the differences in below table by gray background. (S) = SITRONIX, (L) = SUPLUS

6. ELECTRICAL SPECIFICATIONS

6.1.1 DC CHARACTERISTICS (VDD = 2.7V to 4.5V, TA = 25° C)

CHARACTERISTICS	SYMBOL	LIMIT			UNIT	TEST CONDITION
		MIN.	TYP.	MAX.		
INPUT HIGH VOLTAGE	V_{IH1}	0.7Vdd	---	Vdd	V	Pins (E. RS. R/W. DB0 - DB7)
INPUT LOW VOLTAGE	V_{IL1}	-0.3	---	(S) 0.6 (L) 0.55	V	
INPUT HIGH CURRENT	I_{IH}	-1.0	---	1.0	µA	Pins (RS. R/W. DB0 - DB7) Vdd = 5.0V
INPUT LOW CURRENT	I_{IL}	(S) -10 (L) -5.0	(S) -50 (L) -15	(S) -120 (L) -30	µA	
OUTPUT HIGH VOLTAGE (TTL)	V_{OH1}	0.75Vdd	---	---	V	I_{OH} = - 0.1mA Pins: DB0 - DB7
OUTPUT LOW VOLTAGE (TTL)	V_{OL1}	---	---	0.2Vdd	V	I_{OL} = 0.1mA Pins: DB0 - DB7

6.1.2 AC CHARACTERISTICS (VDD = 2.7V to 4.5V, TA = 25°C)

Write mode

CHARACTERISTICS	SYMBOL	LIMIT			UNIT	TEST CONDITION
		MIN.	TYP.	MAX.		
ENABLE CYCLE TIME	t_C	(S)1200 (L)1000	---	---	ns	Pin E
ENABLE PULSE WIDTH	t_{PW}	(S) 460 (L) 450	---	---	ns	Pin E
ENABLE RISE/ FALL TIME	t_R, t_F	---	---	25	ns	Pin E
ADDRESS SETUP TIME	t_{SP1}	(S) 0 (L) 60	---	---	ns	Pins RS, R/W, E
ADDRESS HOLD TIME	t_{HD1}	(S) 10 20	---	---	ns	Pins RS, R/W, E
DATA SETUP TIME	t_{SP2}	(S) 80 (L) 195	---	---	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	(S)1200 (L)1000	---	---	ns	Pin E
ENABLE PULSE WIDTH	t_{PW}	(S)480 (L) 450	---	---	ns	Pin E
ENABLE RISE/ FALL TIME	t_R, t_F	---	---	25	ns	Pin E
ADDRESS SETUP TIME	t_{SP1}	(S) 0 (L) 60	---	---	ns	Pins RS, R/W, E
ADDRESS HOLD TIME	t_{HD1}	(S) 10 (L) 20	---	---	ns	Pins RS, R/W, E
DATA OUTPUT DELAY TIME	t_D	---	---	(S)320 (L)360	ns	Pins: DB0 - DB7
DATA HOLD TIME	t_{HD2}	(S) 10 (L) 5	---	---	ns	Pins: DB0 - DB7

3.0V / 3.3V VERSION

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11. INSTRUCTION TABLE

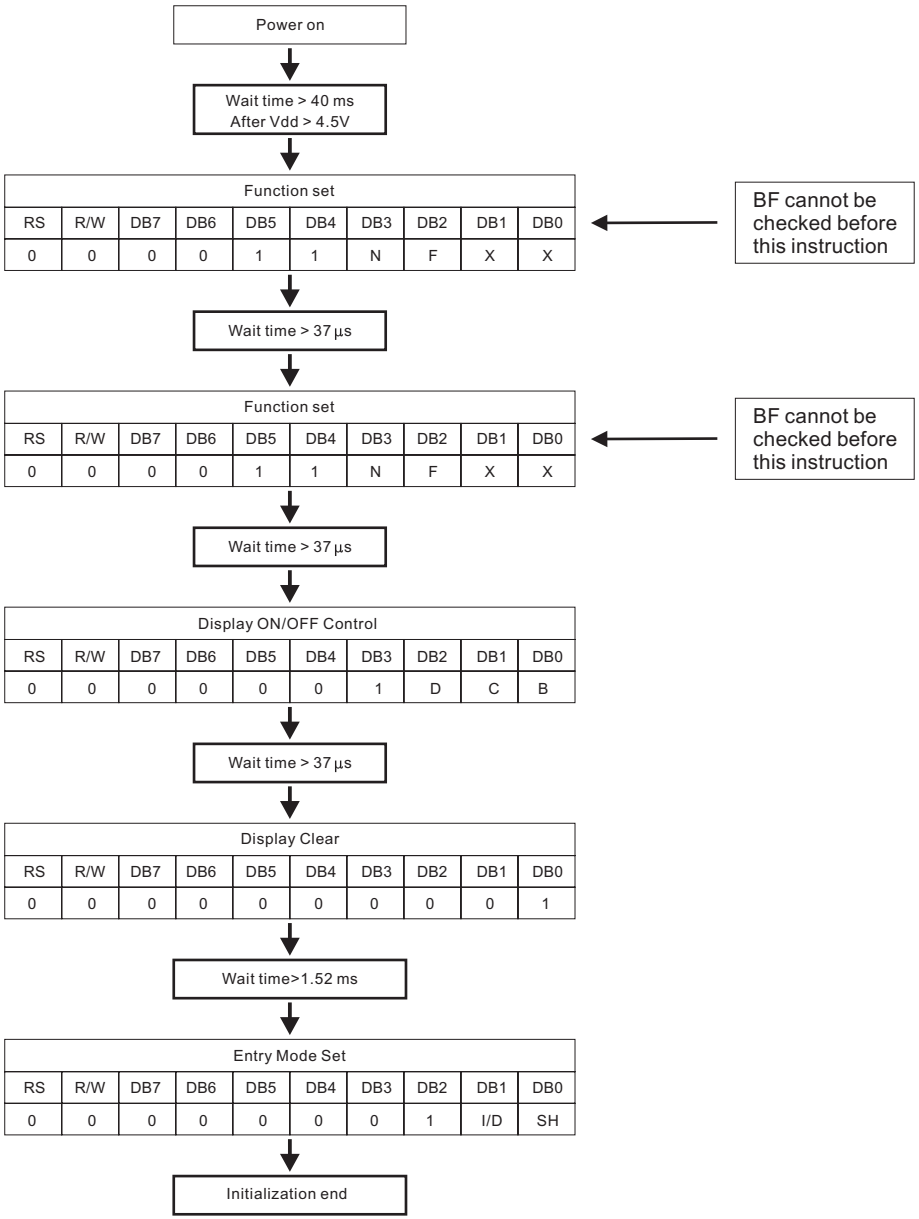
Instruction	Instruction Code										Description	Execution Time(fosc= 270kHz)
	RS	R/W	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0		
Clear Display	0	0	0	0	0	0	0	0	0	1	Write 20H to DDRAM set DDRAM address to 00H from AC	1.52ms
Return Home	0	0	0	0	0	0	0	0	1	-	Set DDRAM address to 00H from AC and return cursor to its original position if shifted. The contents of DDRAM are not changed.	1.52ms
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	(S) 37μs (L) 38μs
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	(S) 37μs (L) 38μs
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	(S) 37μs (L) 38μs
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	(S) 37μs (L) 38μs
Set CGRAM Address	0	0	0	1	AC5	AC4	AC3	AC2	AC1	AC0	Set CGRAM address in address counter	(S) 37μs (L) 38μs
Set DDRAM Address	0	0	1	AC6	AC5	AC4	AC3	AC2	AC1	AC0	Set DDRAM address in address counter	(S) 37μs (L) 38μs
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	0μs
Write Data to RAM	1	0	D7	D6	D5	D4	D3	D2	D1	D0	Write data into internal RAM (DDRAM/CGRAM)	(S) 37μs (L) 38μs
Read data from RAM	1	1	D7	D6	D5	D4	D3	D2	D1	D0	Read data from internal RAM (DDRAM/CGRAM)	(S) 37μs (L) 38μs

3.0V / 3.3V VERSION

To simplify your compare between SUNPLUS and SITRONIX, FORDATA listes the INITIALIZATION CHART as below for your reference

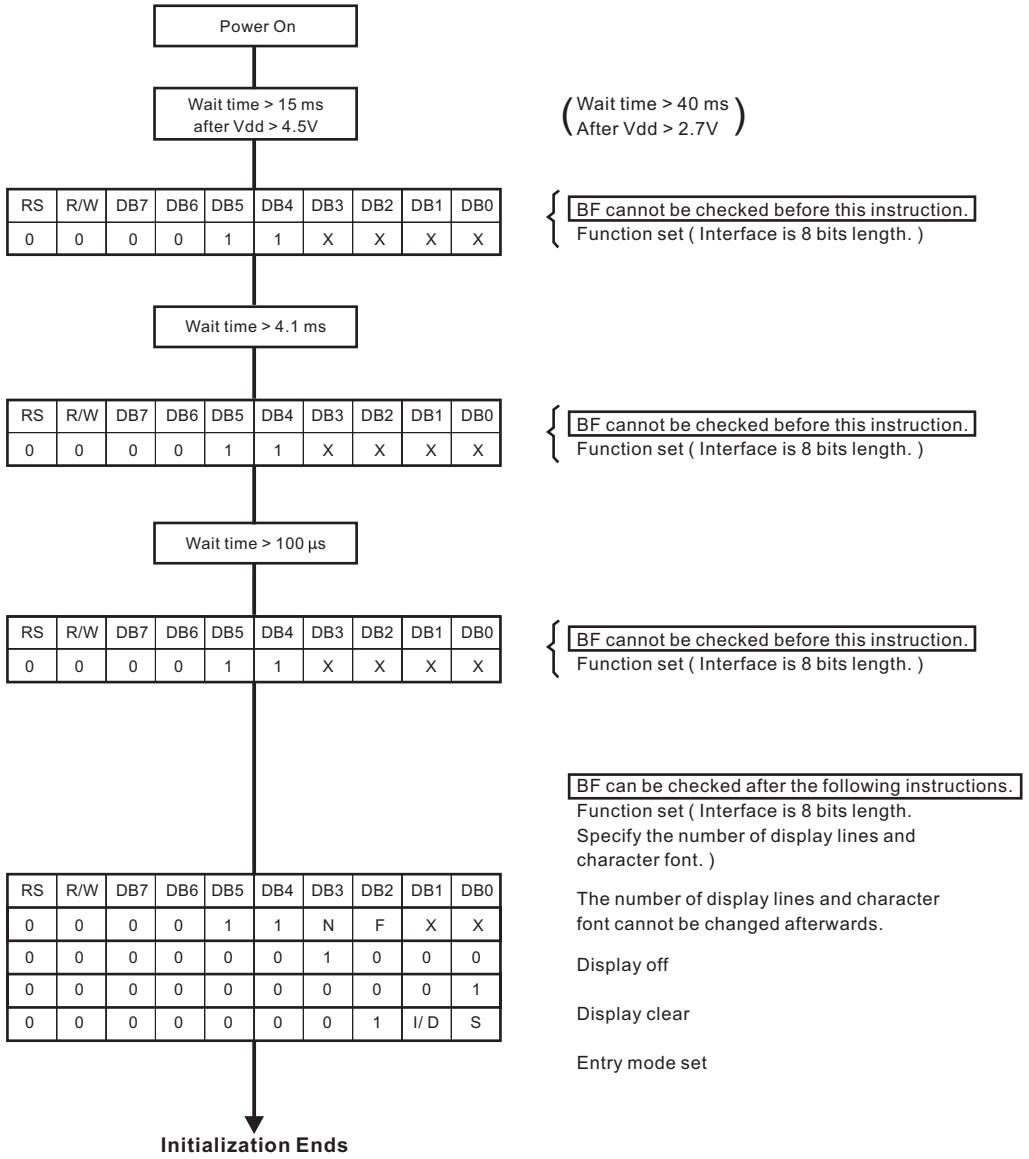
SITRONIX

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



SUNPLUS

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



3.0V / 3.3V VERSION

To simplify your compare between SUNPLUS and SITRONIX, FORDATA listes the INITIALIZATION CHART as below for your reference

SITRONIX

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

Power on

Wait time > 40 ms
After Vdd > 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 > 37 µs

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 > 37 µs

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 > 37 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

Wait time > 37 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 time>1.52 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	I/D	S	X	X	X	X

Initialization end

SUNPLUS

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

Power On

Wait time > 15 ms
after Vdd > 4.5V

(Wait time > 40 ms
After Vdd > 2.7V)

RS	R/W	DB7	DB6	DB5	DB4
0	0	0	0	1	1

BF cannot be checked before this instruction.
Function set (Interface is 8 bits length.)

Wait time > 4.1 ms

RS	R/W	DB7	DB6	DB5	DB4
0	0	0	0	1	1

BF cannot be checked before this instruction.
Function set (Interface is 8 bits length.)

Wait time > 100 µs

RS	R/W	DB7	DB6	DB5	DB4
0	0	0	0	1	1

BF cannot be checked before this instruction.
Function set (Interface is 8 bits length.)

BF can be checked after the following instructions.
Function set (Set interface to be 4 bits length.)
Interface is 8 bits length.

RS	R/W	DB7	DB6	DB5	DB4
0	0	0	0	1	0
0 0	0 0	0 N	0 F	1 X	0 X
0 0	0 0	0 1	0 0	0 0	0 0
0 0	0 0	0 0	0 0	0 0	0 1
0 0	0 0	0 0	0 1	0 I/D	0 S

Function set (Interface is 4 bits length.
Specify the number of the display lines
and character font.)

The number of display lines and character
font cannot be changed afterwards.

Display off

Display clear

Entry mode set

Initialization Ends