

Evodbg

EV-9X35-NANO System on Module

User manual



Revision 1.0
2-1-2016

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ATTENTION!

This module does not pin compatible with standard mini PCI-e card! Do not use it in laptops and computers with standard miniPCI-e connector.

IMPORTANT INFORMATION AND DISCLAIMER

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ABBREVIATIONS AND DEFINITIONS

Table 1.

Abbreviation	Definition
ADC	Analog to Digital converter
ARM	Advanced Risc Machine
BSP	Board Support Package
CAN	Controller Area Network
CPU	Central Processing Unit
DDR	Double Data Rate
GPIO	General Purpose Input Output
I2C	Inter Integrated Circuit
JTAG	Joint Test Action Group
LCD	Liquid Crystal Display
Mb	Megabit
MB	Megabyte
MMC	Multimedia Card
NAND	
NC	Not Connected
OTG	On-The-Go
PHY	Physical
PWM	Pulse Width Modulation
RMII	Reduced Media Independent Interface
RTC	Real Time Clock
SD	Secure Digital
SLC	Single Layer Cell
SPI	Serial Peripheral Interface
SSI	Synchronous Serial Interface
UART	Universal Asynchronous Receiver Transmitter
USB	Universal Serial Bus
WP	Write Protect
WVGA	Wide Video Graphics Array

FEATURE SUMMARY

- Atmel AT91SAM9X35 or AT91SAM9G25
- Up to 128 MB DDR2 RAM
- Up to 256 MB Parallel SLC NAND Flash
- 4 MB SPI based NOR Flash (optional)
- 1 Kbit I2C EEPROM (optional)
- On-board 10/100 Mbit PHY Ethernet
- 2 * USB 2.0 Host, 1 * OTG
- 1 * SD/MMC
- Serial Interfaces (I2C, SPI, CAN, UART)
- LCD RGB24 Display interface (only for AT91SAM9X35 version)
- Touch panel interface (Only for AT91SAM9X35 version)

APPLICATIONS

- Industrial Instrumentation
- Test and Measurement
- Remote monitoring and control
- Vending
- Building automation

KIT

Table 2.

Name	Quantity
EV-9X35-NANO Module	1

ORDERING INFORMATION

Table 3.

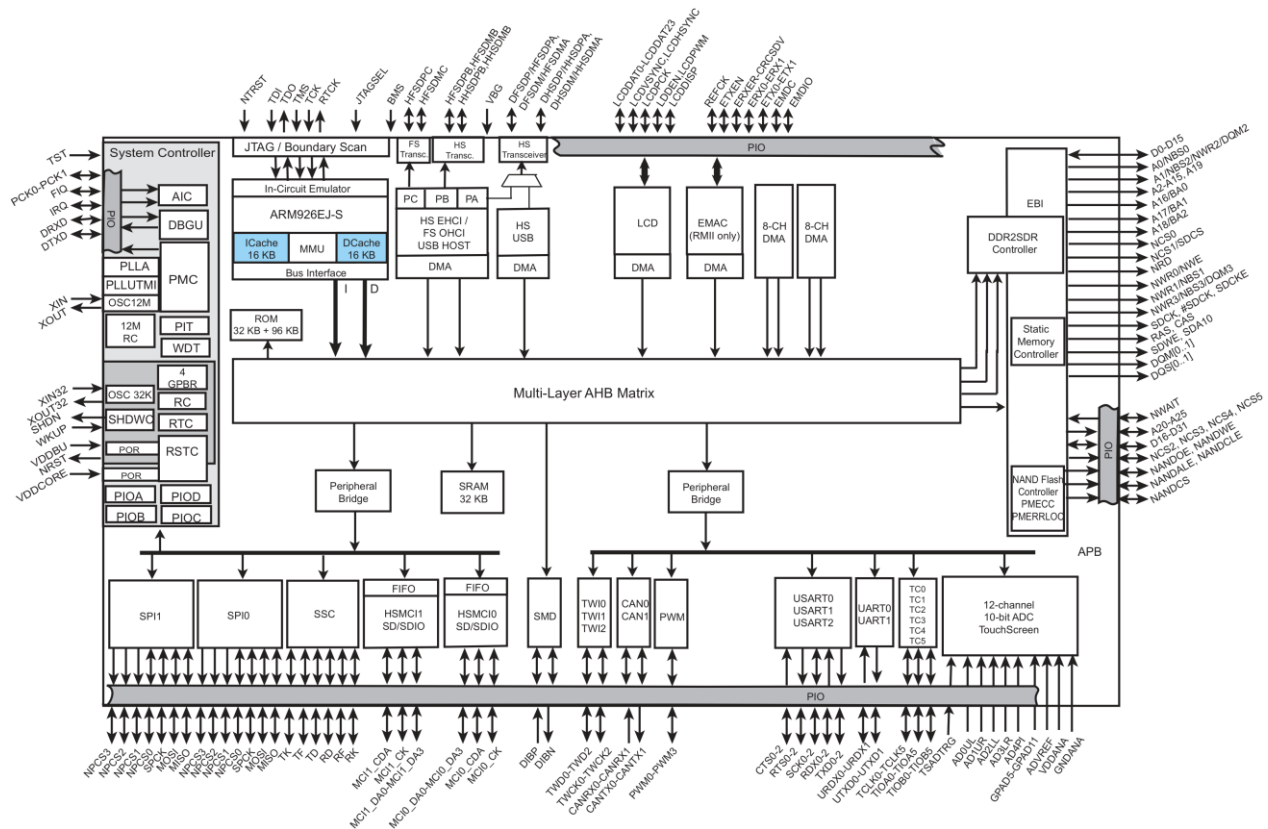
Name	Description
EV-9X35-NANO-A1	AT91SAM9X35, 128MB DDR2, 256MB SLC NAND Flash, -40C...+85C
EV-9X35-NANO-A2	AT91SAM9G25, 128MB DDR2, 256MB SLC NAND Flash, -40C...+85C

Note - on the acquisition of other configurations, please contact info@evodbg.com

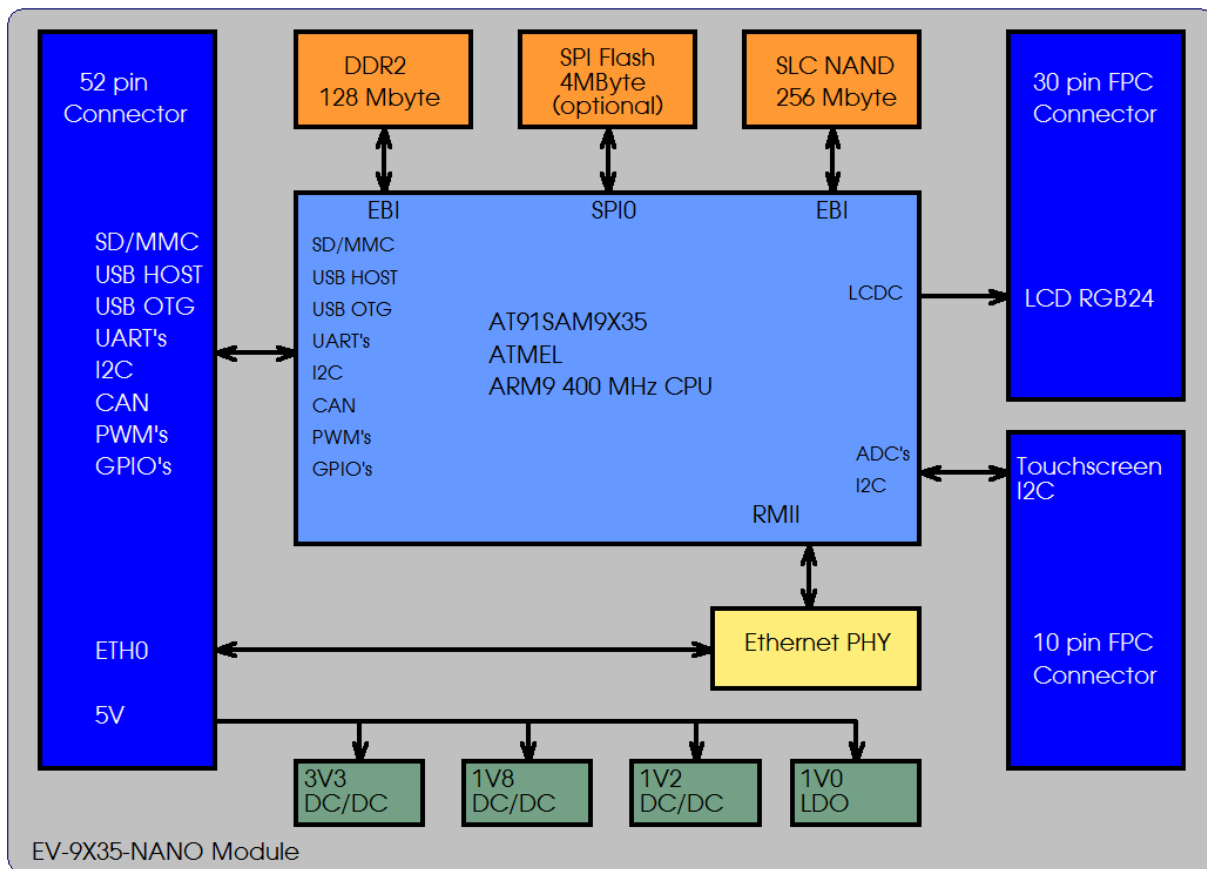
DESCRIPTION

The EV-9X35-NANO is a highly configurable, small form-factor processor module that features a Atmel AT91SAM9X35 400 MHz processor tightly integrated with the NAND Flash and DDR2 memory. The EV-9X35-NANO is a cost-effective System-on-Module (SoM) thought of to drastically reduce the development time needed to design a low-power and low-EMI Linux Embedded device. The more complex hardware like CPU, RAM, Flash, Ethernet and power components are integrated on a single mini PCI Express form factor pcb in just 51x30 mm (2.0x1.18 inch) using an complex six layers PCB permitting hardware designers to create their simple and low cost carrier boards.

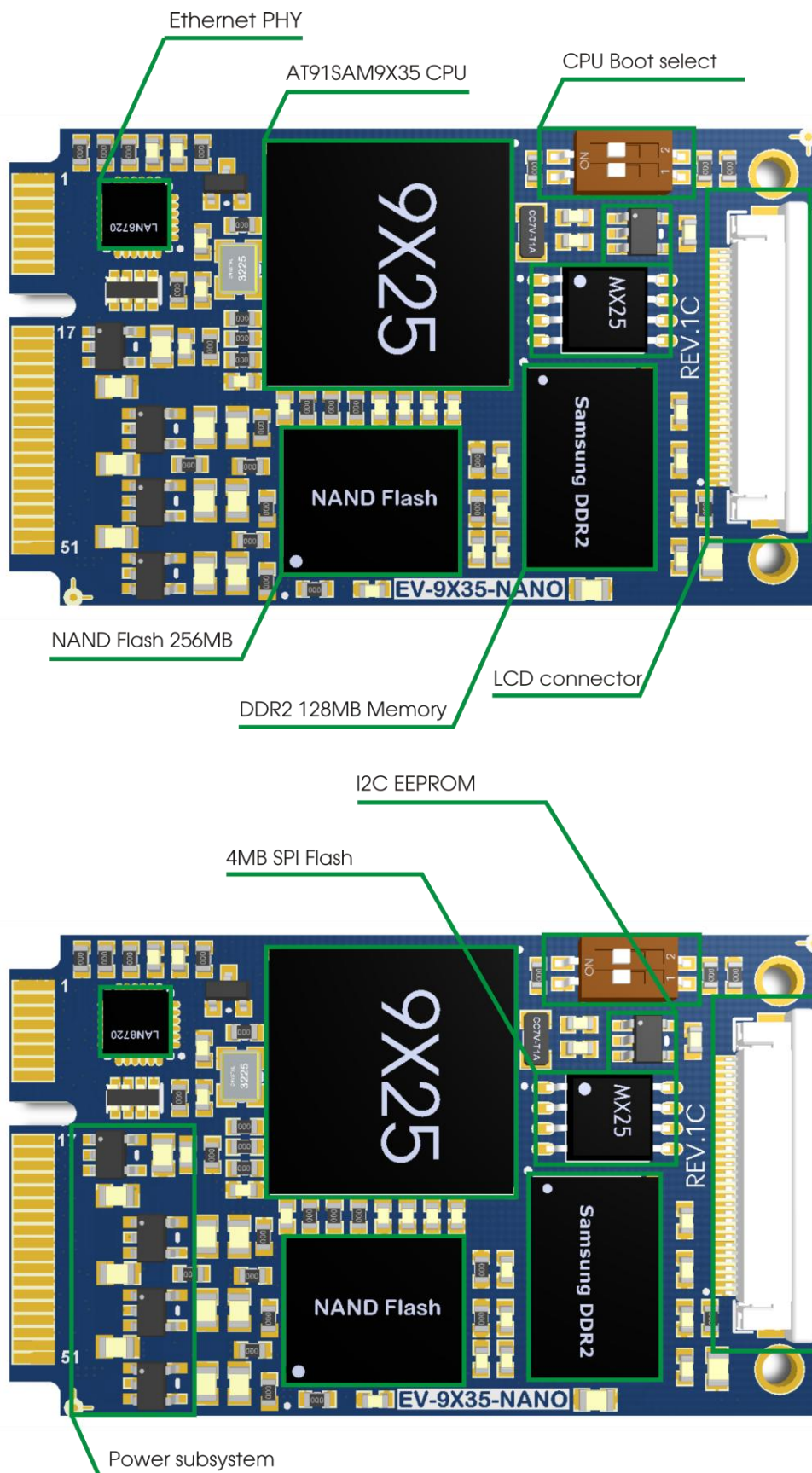
BLOCK DIAGRAM OF AT91SAM9X35 PROCESSOR



BLOCK DIAGRAM OF THE EV-9X35-NANO MODULE

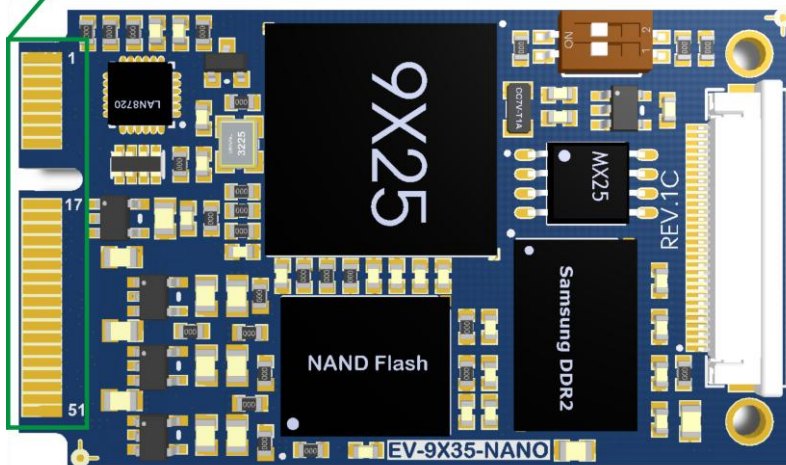


LOCATION OF MAIN COMPONENTS ON THE MODULE

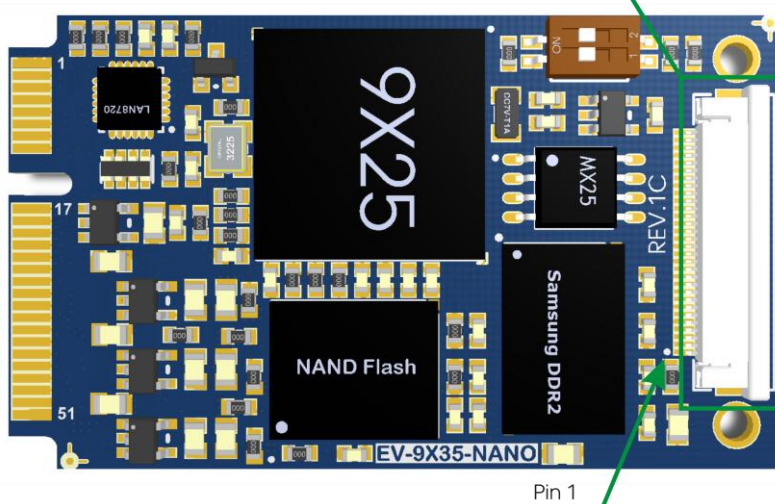


CONNECTORS

Main connector

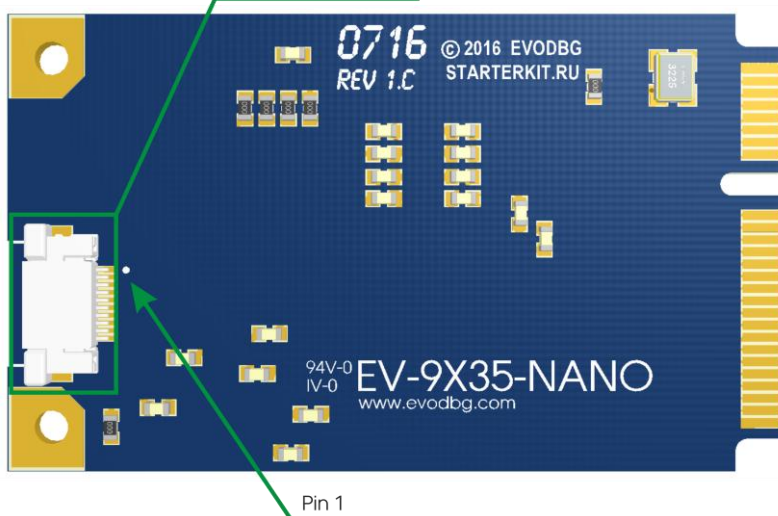


FPC30 connector

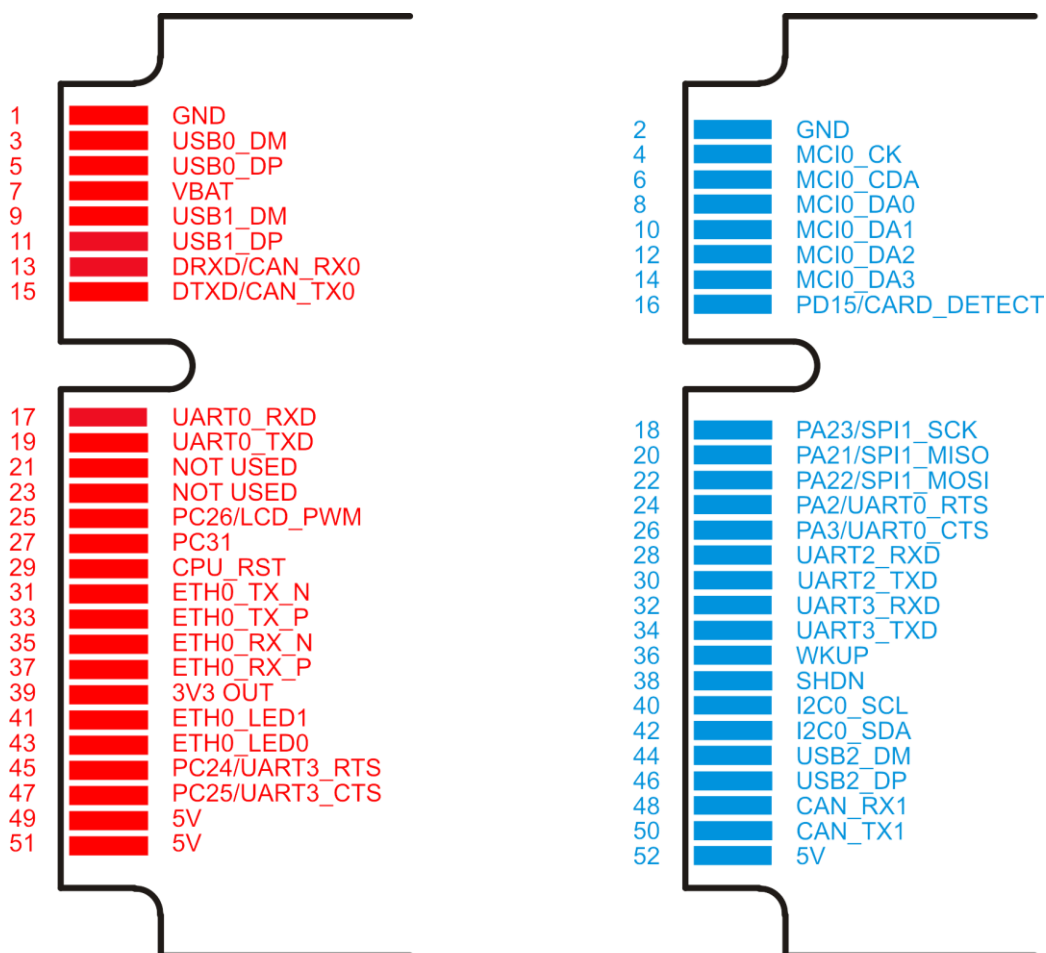


Pin 1

FPC10 connector



PIN CONFIGURATION OF THE MAIN MODULE CONNECTOR



 Top side
 Bottom side

MAIN MODULE CONNECTOR

Table 4. Main Module connector pin description

Pin №	Name	Peripheral A	Peripheral B	Peripheral C	Port	Ball
1	GND					
2	GND					
3	USB0DM					U15
4	MCIO_CK				PA17	R5
5	USB0DP					U14
6	MCIO_CDA				PA16	P5
7	VBAT					K8
8	MCIO_DA0				PA15	U4
9	USB1DM					P17
10	MCIO_DA1				PA18	U5
11	USB1DP					R17
12	MCIO_DA2				PA19	T5
13	DRXD/CAN_RX0	DRXD	CANRX0		PA9	U3
14	MCIO_DA3				PA20	U6
15	DTXD/CAN_TX0	DTXD	CANTX0		PA10	T1
16	PD15/CARD_DETEC T	D25	A20		PD15	M16
17	UART0_RX	RXD0	SPI0_NPCS2		PA1	P1
18	PA23/SPI1_SCK	TIOA2	SPI1_SPCK		PA23	U7
19	UART0_TX	TXD0	SPI1_NPCS1		PA0	L3
20	PA21/SPI1_MISO	TIOA0	SPI1_MISO		PA21	T6
21						
22	PA22/SPI1_MOSI	TIOA1	SPI1_MOSI		PA22	R6
23						
24	PA2/UART0_RTS	RTS0	MC11_DA1	ETX0	PA2	L4
25	PC26/LCD_PWM	LCDPWM			PC26	P2
26	PA3/UART0_CTS	CTS0	MC11_DA2	ETX1	PA3	N4
27	PC31	FIQ		PCK1	PC31	N2
28	UART2_RXD	RXD2	SPI1_NPCS0		PA8	P4
29	CPU_RST					P10
30	UART2_TXD	TXD2	SPI0_NPCS1		PA7	R3
31	ETH0_TX_N	LAN8720				
32	UART3_RXD		LCDDAT23	RXD3 (only for 9G25)	PC23	J4
33	ETH0_TX_P	LAN8720				
34	UART3_TXD		LCDDAT22	TXD3 (only for 9G25)	PC22	P3
35	ETH0_RX_N	LAN8720				
36	WKUP					A7
37	ETH0_RX_P	LAN8720				
38	SHDN					D8
39	VOOUT 3V3					
40	I2C0_SCL	TWCK0	SPI1_NPCS2	ETXEN	PA31	U9
41	ETH1_TX_N	LAN8720				
42	I2C0_SDA	TWD0	SPI1_NPCS3	EMDC	PA30	R8
43	ETH1_TX_P	LAN8720				

44	USB2_DM					M17
45	ETH1_RX_N	LAN8720				
46	USB2_DP					L17
47	ETH1_RX_P	LAN8720				
48	CAN_RX1	RXD1	CANRX1		PA6	R4
49	5V					
50	CAN_TX1	TXD1	CANTX1		PA5	R1
51	5V					
52	5V					

LCD MODULE CONNECTOR

Table 5. FPC 30-pin connector

FPC Pin	Name	Peripheral A (only for AT91SAM9X35)	Peripheral B	Peripheral C	Name	Ball
1	GND					
2	BLUE0	LCDDAT0		TWD1	PC0	E2
3	BLUE1	LCDDAT1		TWCK1	PC1	F4
4	BLUE2	LCDDAT2		TIOA3	PC2	F3
5	BLUE3	LCDDAT3		TIOB3	PC3	H2
6	BLUE4	LCDDAT4		TCLK3	PC4	E1
7	BLUE5	LCDDAT5		TIOA4	PC5	G4
8	BLUE6	LCDDAT6		TIOB4	PC6	F2
9	BLUE7	LCDDAT7		TCLK4	PC7	F1
10	GREEN0	LCDDAT8		UTXD0	PC8	G1
11	GREEN1	LCDDAT9		URXD0	PC9	G3
12	GREEN2	LCDDAT10		PWM0	PC10	G2
13	GREEN3	LCDDAT11		PWM1	PC11	H3
14	GREEN4	LCDDAT12		TIOA5	PC12	J3
15	GREEN5	LCDDAT13		TIOB5	PC13	L2
16	GREEN6	LCDDAT14		TCLK5	PC14	H1
17	GREEN7	LCDDAT15		PCK0	PC15	J2
18	RED0	LCDDAT16		UTXD1	PC16	J1
19	RED1	LCDDAT17		URXD1	PC17	L1
20	RED2	LCDDAT18		PWM0	PC18	K2
21	RED3	LCDDAT19		PWM1	PC19	N3
22	RED4	LCDDAT20		PWM2	PC20	K1
23	RED5	LCDDAT21		PWM3	PC21	M3
24	RED6	LCDDAT22			PC22	P3
25	RED7	LCDDAT23			PC23	J4
26	LCD_DISP	LCDDISP			PC24	K3
27	LCD_VSYNC	LCDVSYNC		RTS1	PC27	M1
28	LCD_HSYNC	LCDHSYNC		CTS1	PC28	K4
29	LCD_EN	LCDDEN		SCK1	PC29	N1
30	LCD_PCK	LCDPCK			PC30	R2

LCD TOUCHSCREEN CONNECTOR

Table 6. FPC 10-pin connector (Module bottom side)

FPC Pin	Name	Peripheral A	Peripheral B	Peripheral C	Name	Ball
1	GND					
2	I2C0_SDA	TWD0	SPI1_NPCS3	EMDC	PA30	R8
3	I2C0_SCL	TWCK0	SPI1_NPCS2	ETXEN	PA31	U9
4	AD0_XP			PWM0	PB11	F3
5	AD1_XM			PWM1	PB12	H2
6	AD2_YP			PWM3	PB13	E1
7	AD3_YM			PWM4	PB14	G4
8	VCC_3V3					
9	VCC_3V3					
10	VCC_3V3					

SIGNALS USED INSIDE THE MODULE

Table 7. Signals used inside the module

Ball	Name	Used with	Main connector
B3	ENET0_MDC	LAN8720	No
E3	ENET0_MDIO	LAN8720	No
E4	ENET0_RX_EN	LAN8720	No
D3	ENET0_RXD0	LAN8720	No
D4	ENET0_RXD1	LAN8720	No
C2	ENET0_TX_EN	LAN8720	No
C1	ENET0_TXD0	LAN8720	No
B2	ENET0_TXD1	LAN8720	No
D1	ENET0_CLK	LAN8720	No
P13	NANDOE	NAND Flash	No
R14	NANDWE	NAND Flash	No
R13	NANDALE	NAND Flash	No
P15	NANDCLE	NAND Flash	No
P12	NCS3	NAND Flash	No
P14	NWAIT	NAND Flash	No
N14	D16	NAND Flash	No
R15	D17	NAND Flash	No
M14	D18	NAND Flash	No
N16	D19	NAND Flash	No
N17	D20	NAND Flash	No

N15	D21	NAND Flash	No
K15	D22	NAND Flash	No
M15	D23	NAND Flash	No
U1	SPI0_MISO	SPI Flash (optional)	No
T2	SPI0_MOSI	SPI Flash (optional)	No
T4	SPI0_SPCK	SPI Flash (optional)	No
U2	SPI0_NPCS0	SPI Flash (optional)	No
R8	I2C0_SDA	I2C EEPROM (optional)	Pin 42
U9	I2C0_SCL	I2C EEPROM (optional)	Pin 40

SOURCES OF PROCESSOR BOOT

In order to use SAM-BA boot, the NAND Flash and SPI Flash must be deselected.

Table 8. Boot configuration

Boot mode	Switch1	Switch2	
SAM-BA	Off	Off	
NAND Flash	On	Off	
SPI Flash	Off	On	

MEMORY

NAND FLASH MEMORY

Up to 256 MB of on-board SLC NAND Flash memory is connected to the AT91SAM9X35 using the EBI bus. The NAND Flash memory is 8 bits wide and is connected to NCS3 chip select line of the EBI. The NAND Flash memory is typically used to store the following types of data:

- Bootstrap Loader
- U-boot
- Linux Kernel
- Embedded root file system

SPI FLASH MEMORY

The module can be optionally installed with SPI Flash memory AT25DF321 (U10) of 64 Mbit. The memory is connected to port SPI0 (CS0). The SPI Flash memory is typically used to store the following types of data:

- Bootstrap Loader
- U-boot
- Kernel with initramfs

DDR2 MEMORY

The EV-9X35-NANO includes up to 128 MB of DDR2 RAM integrated with AT91SAM9X35 processor using EBI bus. Maximum bus frequency is 133 MHz.

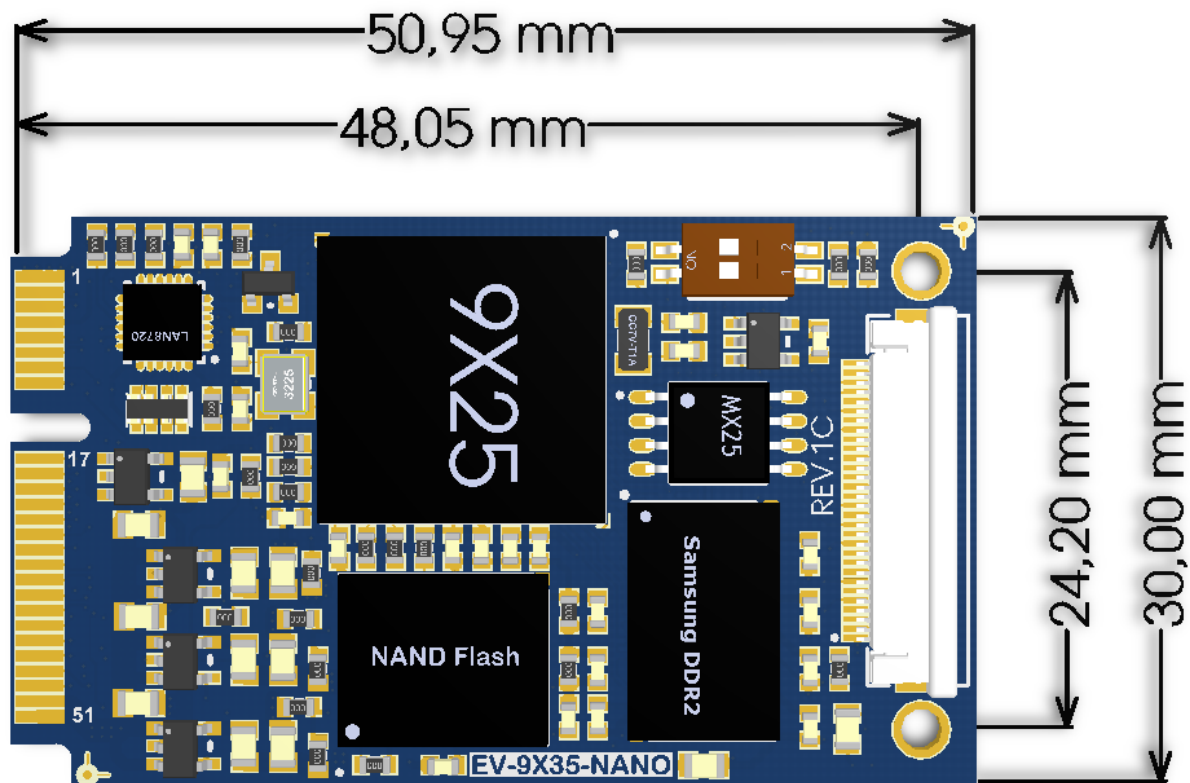
I2C EEPROM MEMORY

The module can be optionally installed with I2C EEPROM memory 24AA01 (U10) of 1 kbit. The EEPROM is typically using to store:

- Serial Number
- MAC address
- UID

OVERALL DIMENSIONS

All dimensions are in mm. The maximum height of the module is 5.0mm.



CONNECTOR FOR MODULE INSTALL

To install the module you can use any standard slot mini PCI Express, for example:

Molex - [0679100002](#)

TE Connectivity - [292443](#)

JAE Electronics – [MM60-52B1-G1-R850](#)



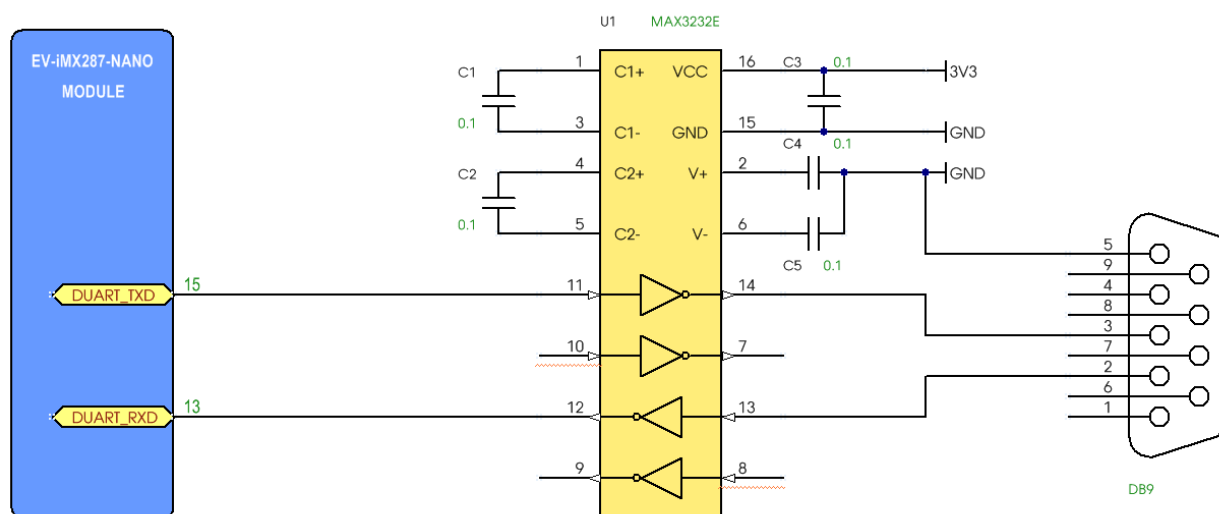
PERIPHERALS

OUTPUT-INPUT PORTS

All signals of the module (except for the differential pairs) have 3.3V levels. To connect to 1.8V/5.0V peripheral use the level converter.

DUART INTERFACE

For debugging the port DUART is used. Output DUART_TXD (the pin of 15 module) and input DUART_RXD (pin of 13 module) can be connected to the chip MAX3232 (or equivalent) in the typical application. Also, you can use any UART-USB chip (FT232, PL2303 etc.).



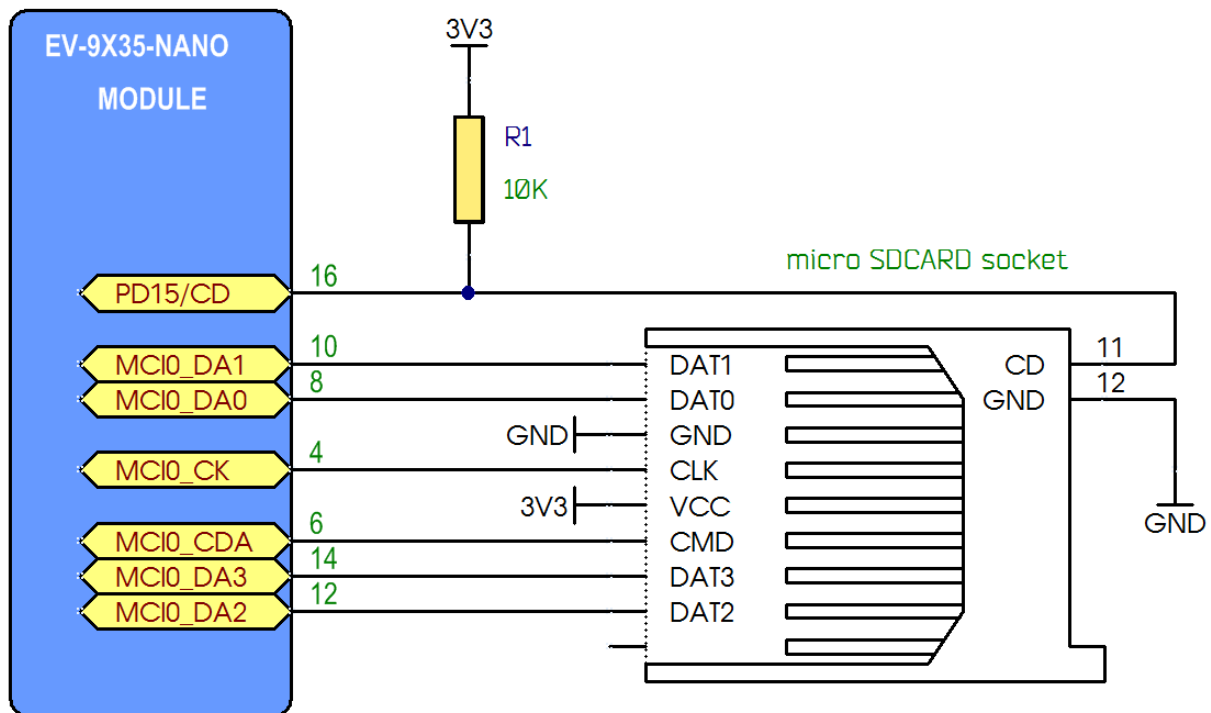
SDMMC INTERFACE

SD/MMC card holder can be connected to the port MCI0.

Table 9. Connection of SD/uSD cards

Module Pin Number	SD card pin	microSD card pin	Pin name
4	5	5	MCI0_CK
6	2	3	MCI0_CDA
8	7	7	MCI0_DA0
10	8	8	MCI0_DA1
12	9	1	MCI0_DA2
14	1	2	MCI0_DA3
16			PD15/Card_detect
1,2	3,6	6	GND
39	4	4	Power 3.3B

Attention! It is necessary to pull-up PD15/CARD_DETECT to 3.3V through a resistor 10K.

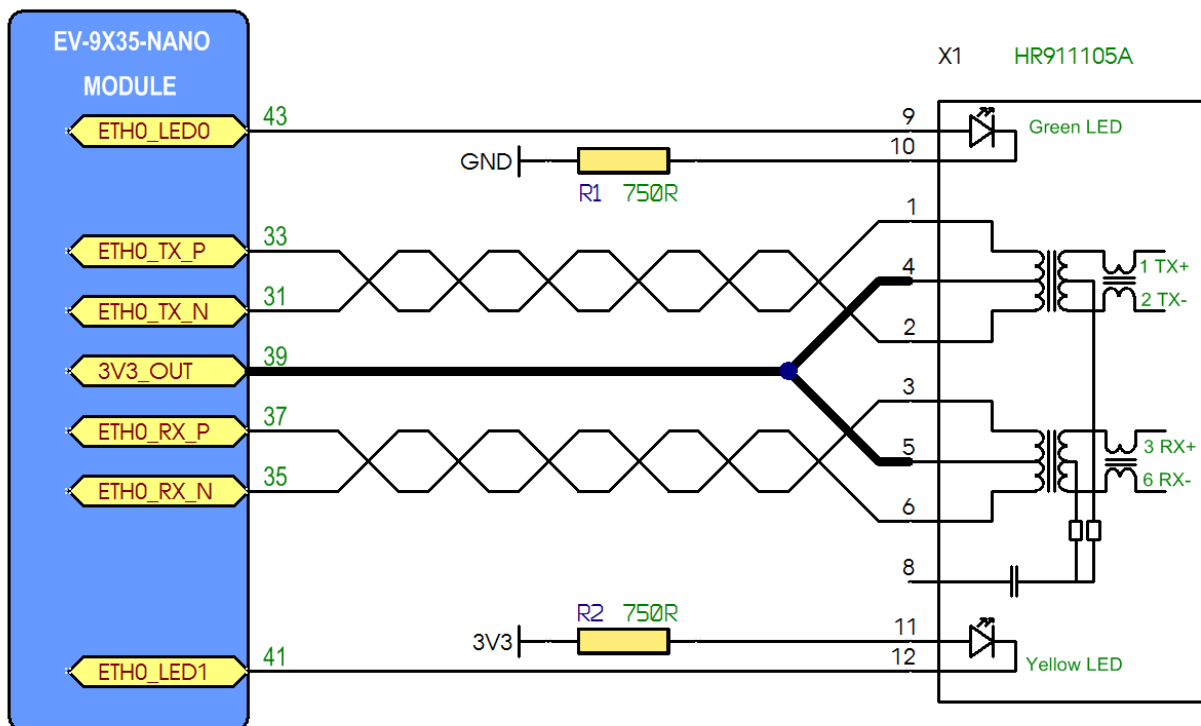


ETHERNET CONNECTION

The EV-9X35-NANO uses an Microchip (SMSC) 10/100 Mbit LAN8720AI Ethernet PHY provide an easy-to-use networking interface.

Table 10.

Module Pin Number	HR911105A pin	Signal
33	1	TX+
31	2	TX-
37	3	RX+
35	6	RX-
1	8	GND
39	4,5	3.3V
41	11	ETH0_LED1
43	9	ETH0_LED0

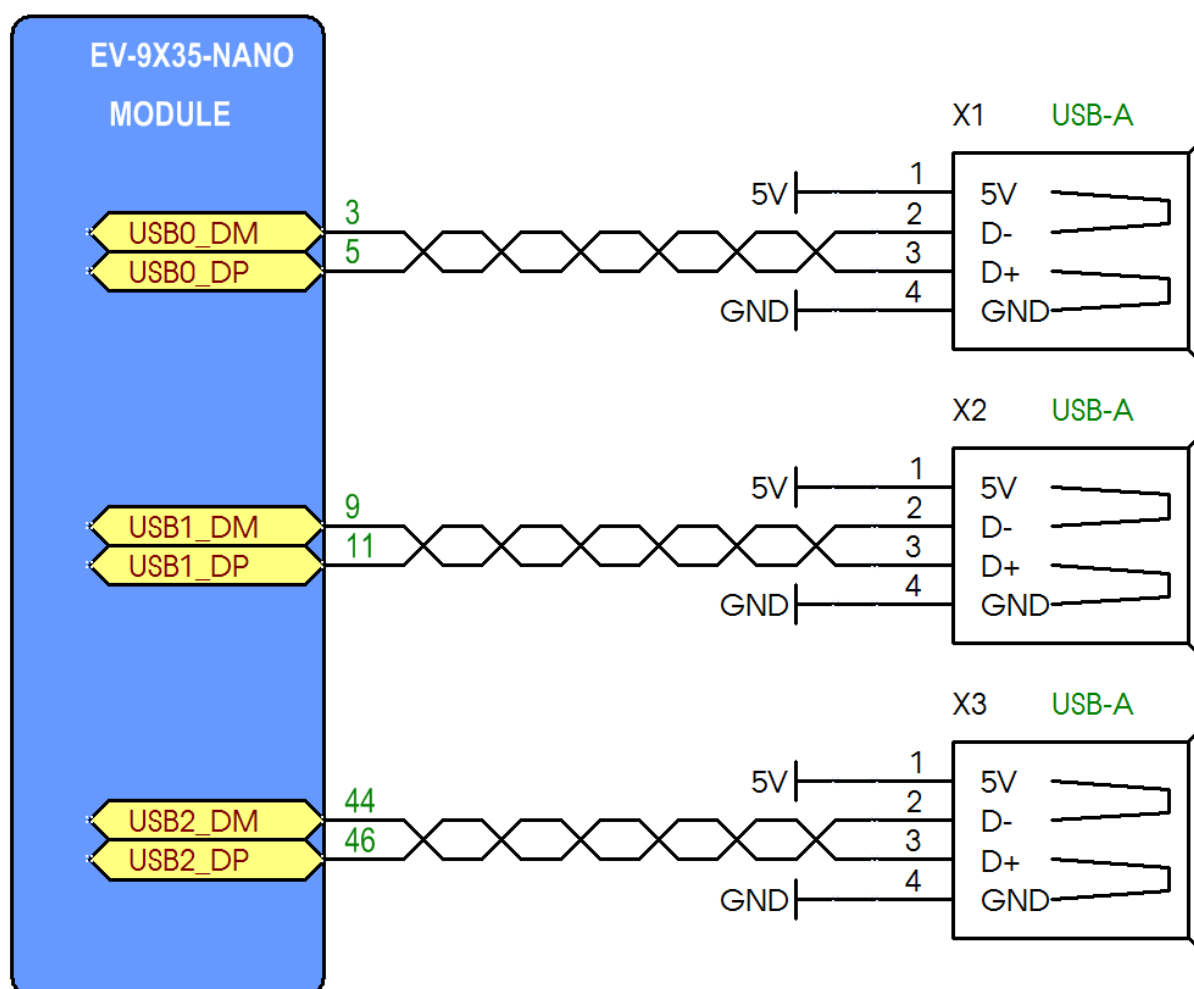


USB INTERFACE

The EV-9X35-NANO support three USB 2.0 ports. USB0 can be used as Host/Device, USB1 and USB2 only as HOST.

Table 11.

Module Pin Number	Signal	Description
5	USB0_D+	
3	USB0_D-	
11	USB1_D+	
9	USB1_D-	
46	USB2_D+	
44	USB3_D-	

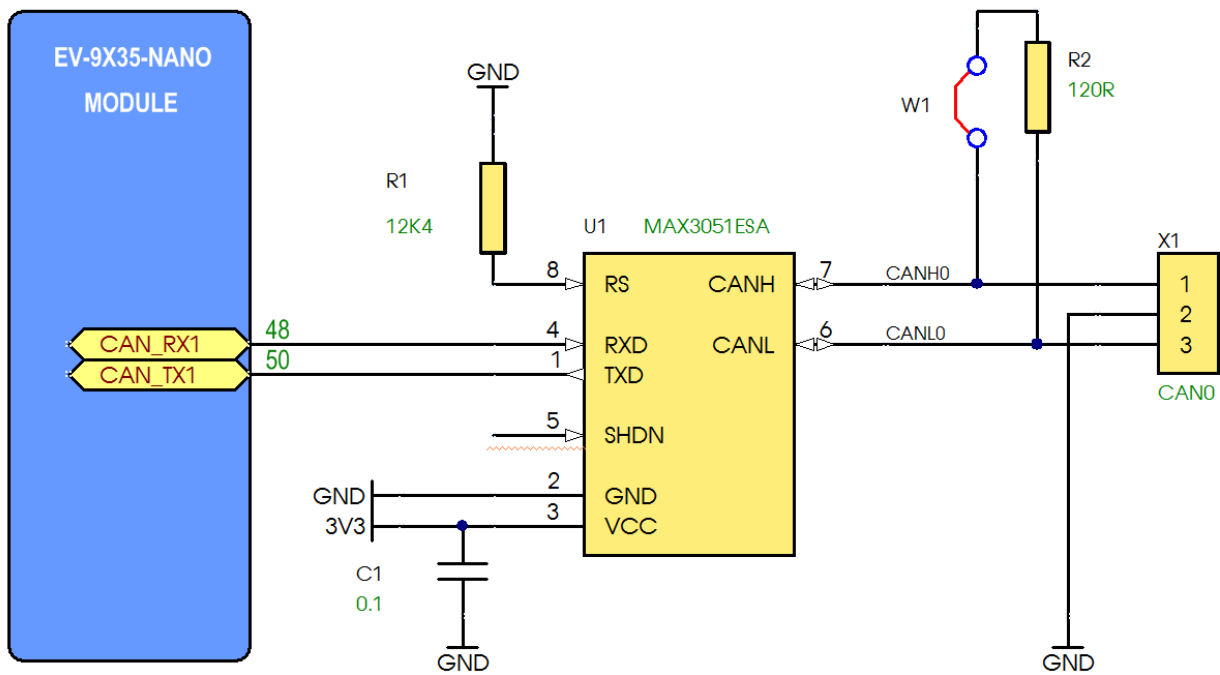


CAN INTERFACE

The EV-9X35 provide two CAN interfaces. CAN0 muxed with Debug interface (DTXD/DRXD). CAN1 muxed with UART1 interface. Use any 3.3V CAN bus transceivers, such as MAX3051, 65HVD230 etc.

Table 12.

Module Pin Number	Description
15	CAN0_TX
13	CAN0_RX
50	CAN1_TX
48	CAN1_RX

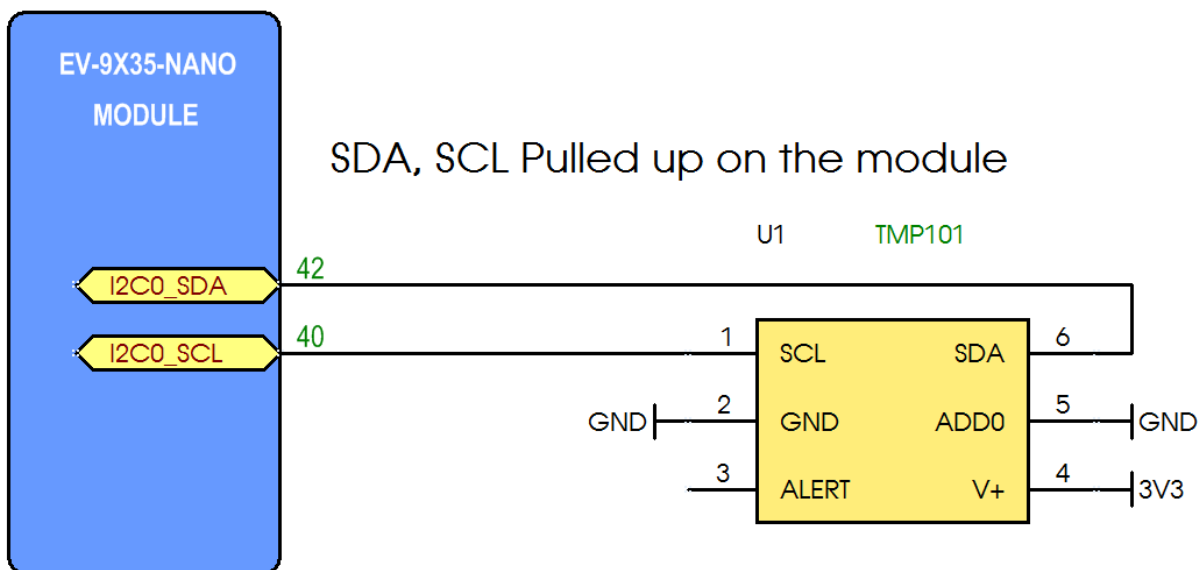


I2C INTERFACE

The EV-9X35-NANO provide one I2C0 port. The clock and data signals have a 2K2 pull-up resistors to 3V3 power.

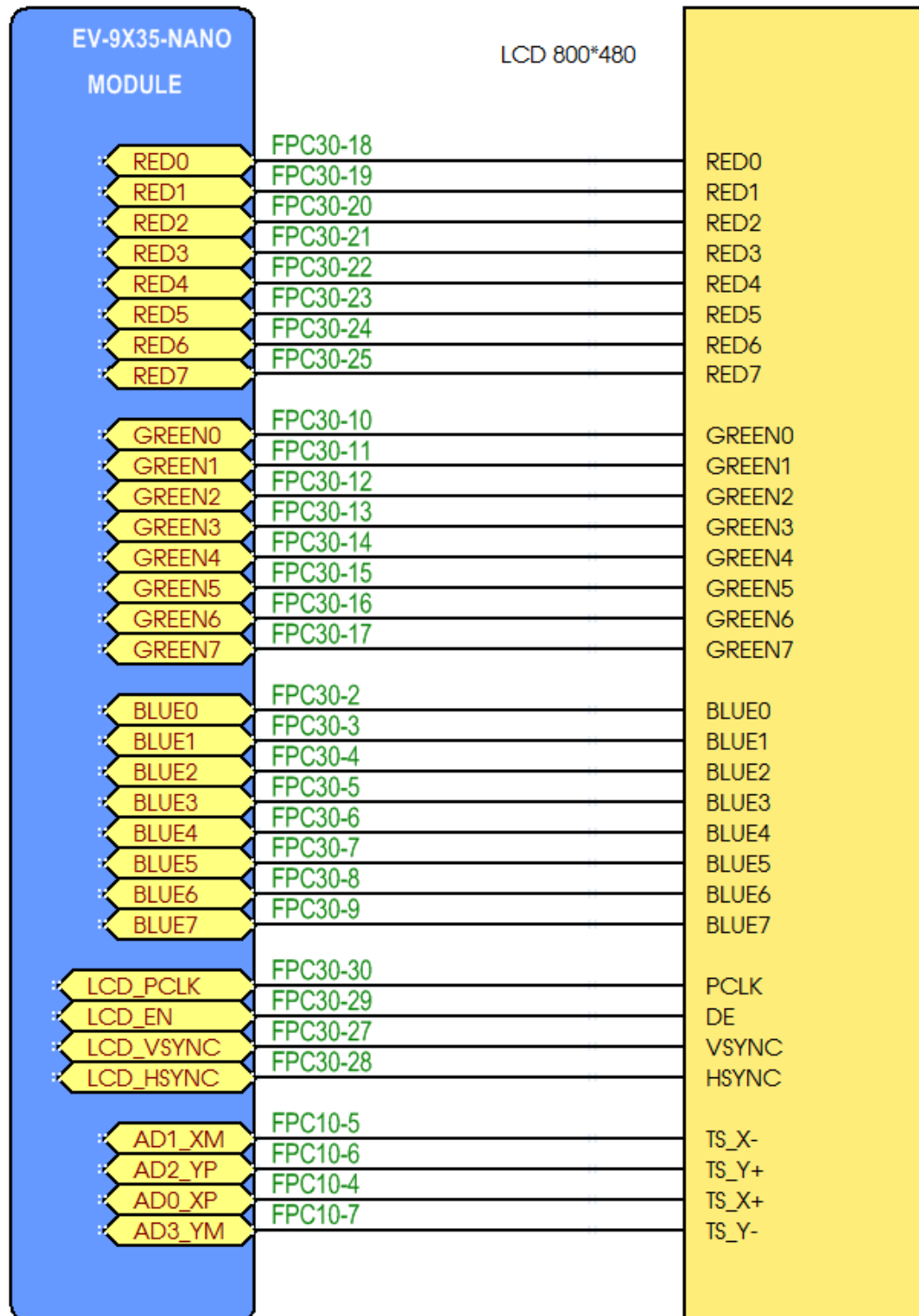
Table 13.

Module Pin Number	Signal
40	I2C0_SCL
42	I2C0_SDA



LCD INTERFACES (ONLY FOR 9X35)

The AT91SAM9X35 has a built-in LCD controller with resolution of up to 800 X 600 X 24 bit color. The signals from AT91SAM9X35 LCD controller interfaced to the 30-pin FPC connector. The ADC signals for touchscreen from AT91SAM9X35 interfaced to the 10-pin FPC connector.



SPI (SPI1) INTERFACE

The EV-9X35-NANO provide one SPI port with two chip-selects.

Table 14.

Module Pin Number	Signal
18	SPI1_SCK
20	SPI1_MISO
22	SPI1_MOSI
28	SPI1_NPCS0 (muxed with UART2_RXD)
19	SPI1_NPCS1 (muxed with UART0_TXD)

UART INTERFACE

The EV-9X35-NANO provides three UART ports for AT91SAM9X35 processor and four UART ports for AT91SAM9G25 processor.

Table 15.

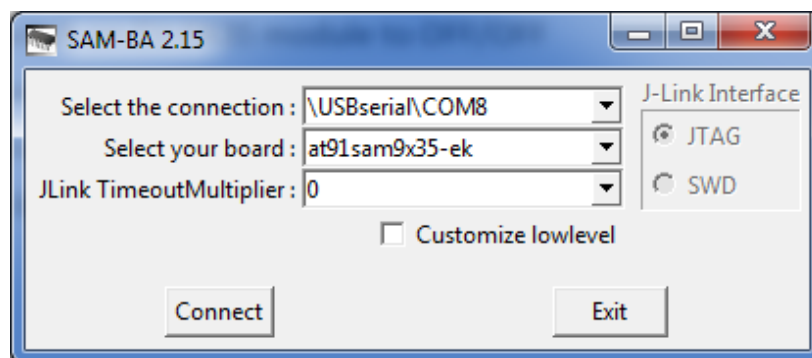
Module Pin Number	Signal
17	UART0_RXD
19	UART0_TXD
24	UART0_RTS
26	UART0_CTS
48	UART1_RXD (muxed with CAN1)
50	UART1_TXD (muxed with CAN1)
28	UART2_RXD
30	UART2_TXD
45	UART3_RTS (only for 9G25)
47	UART3_CTS (only for 9G25)

Table 16.

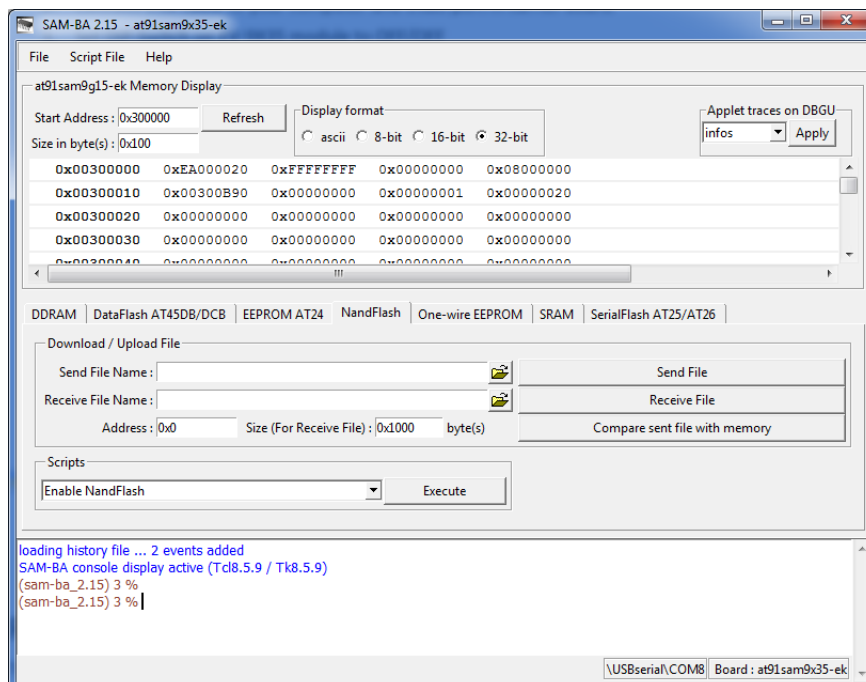
FPC30 Pin Number	Signal
25	UART3_RXD
24	UART3_TXD

BURNING NAND FLASH WITH SAM-BA

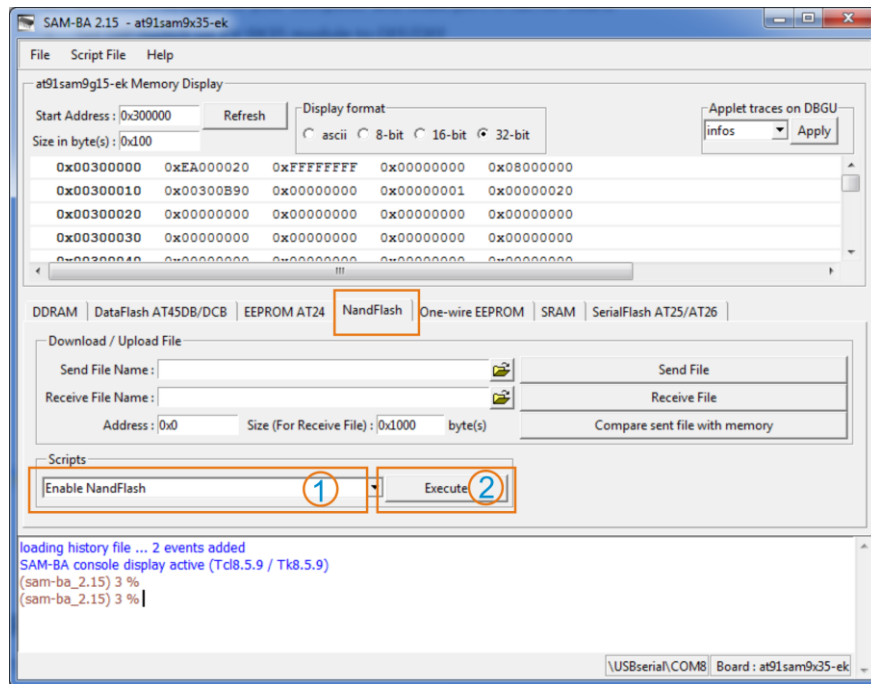
1. Install SAM-BA software
2. Connect USB cable to your computer and USB0 port in carrier board
3. Set DIP-Switch on EV-9X35 module to OFF/OFF
4. Apply power
5. Install Atmel driver
6. Run SAM-BA software, select the connections and type of board (at91sam9x35-ek)



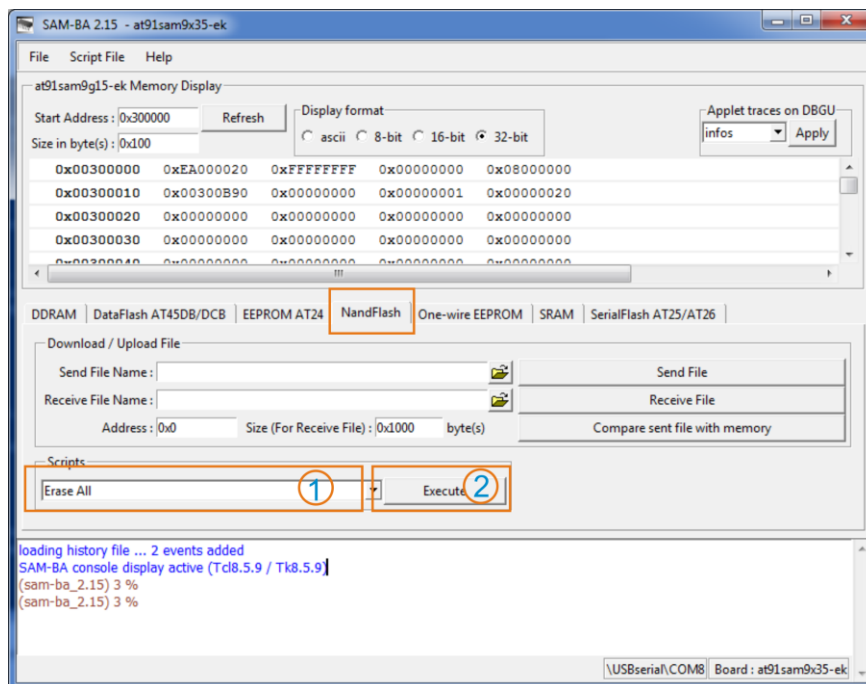
7. Press **Connect**



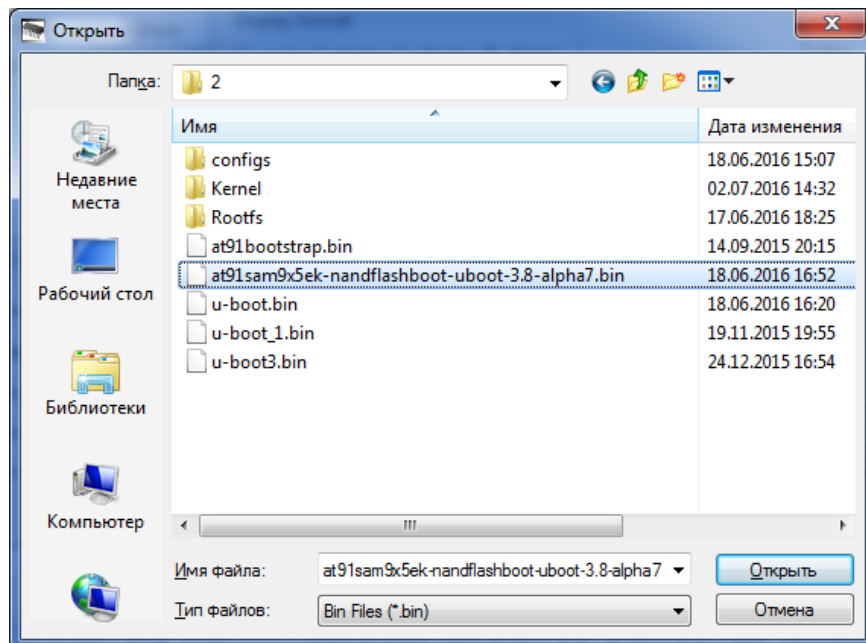
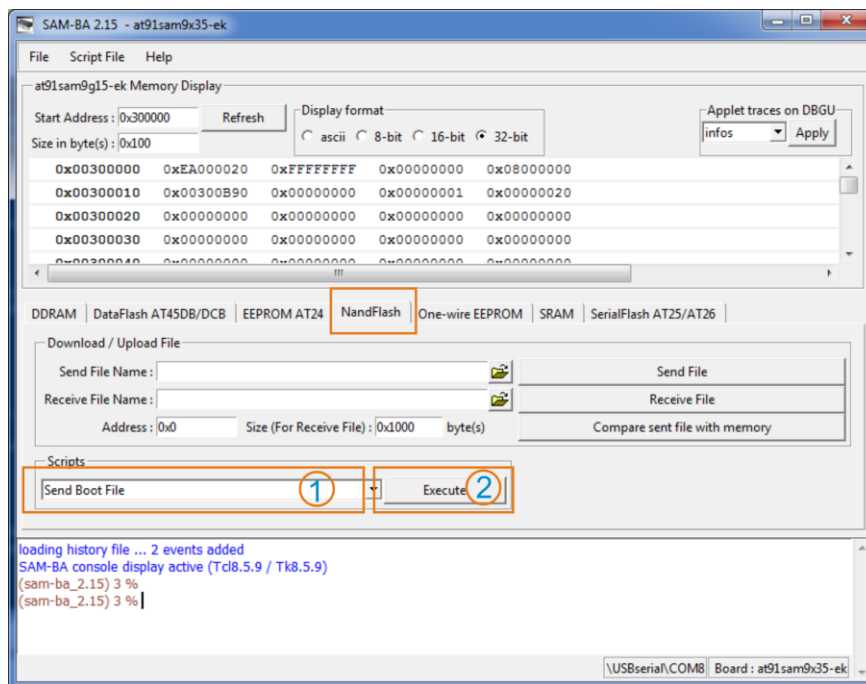
8. Set DIP-Switch to ON/OFF position.
9. Go to **NandFlash** tab



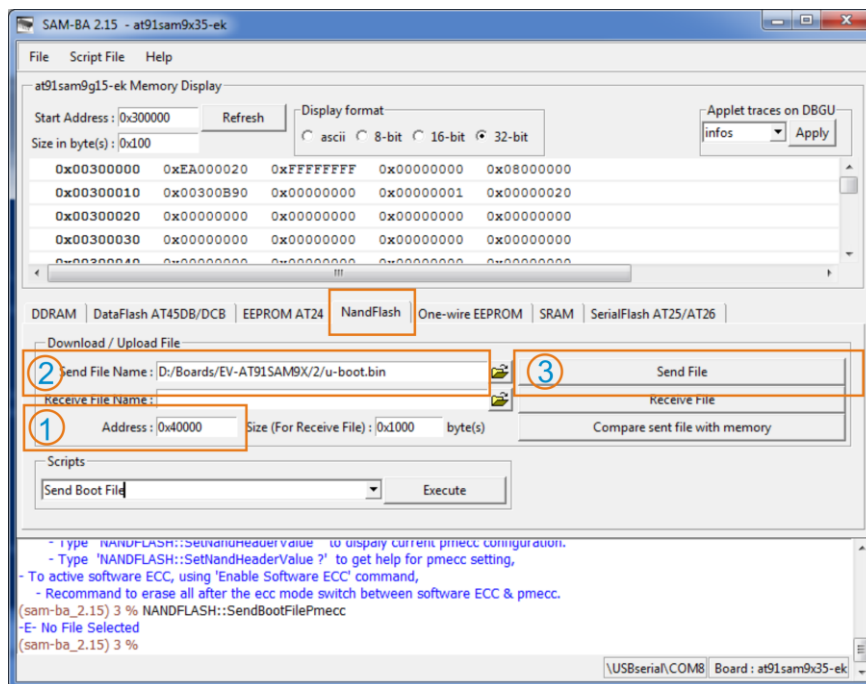
10. Select **Enable NandFlash** script and press **Execute**



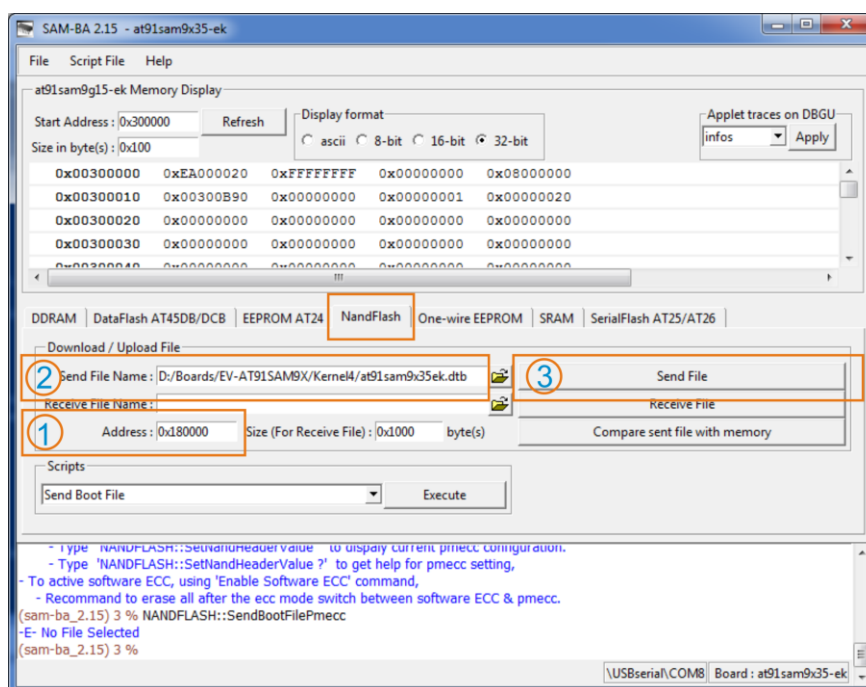
11. Select **Erase All** script and press **Execute**



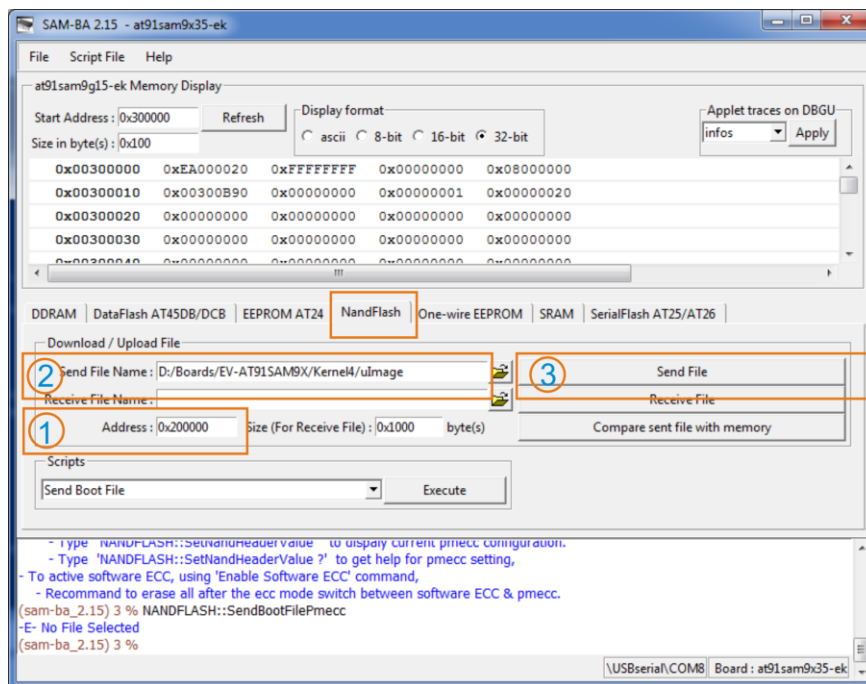
12. Select **Send Boot File** and press **Execute**, select **at91sam9x5ek-nandflashboot-uboot-3.8-alpha7.bin** file



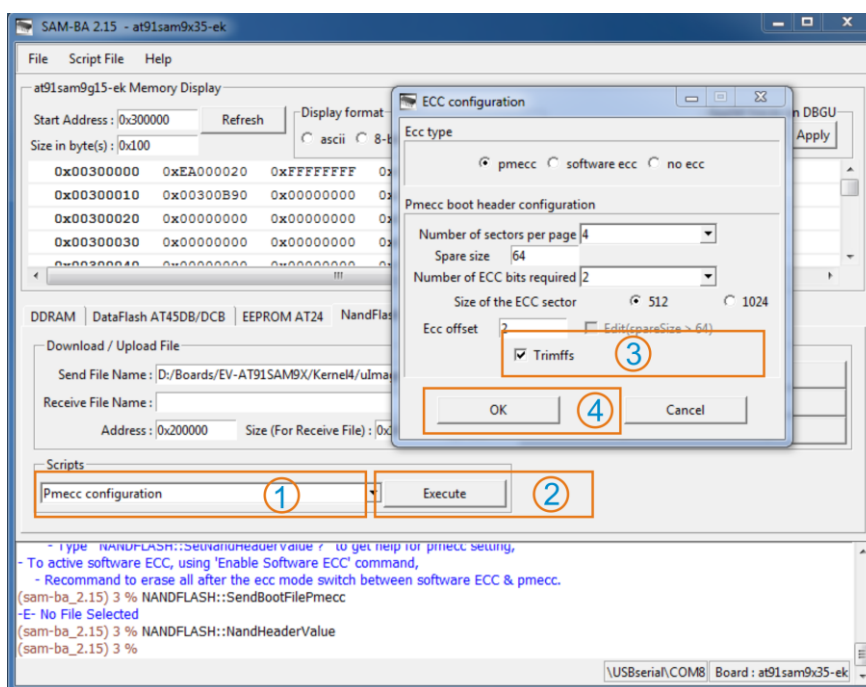
13. Set **Address** to **0x40000**, select **u-boot.bin** in **Send File Name** File Open Dialog and press **Send File**



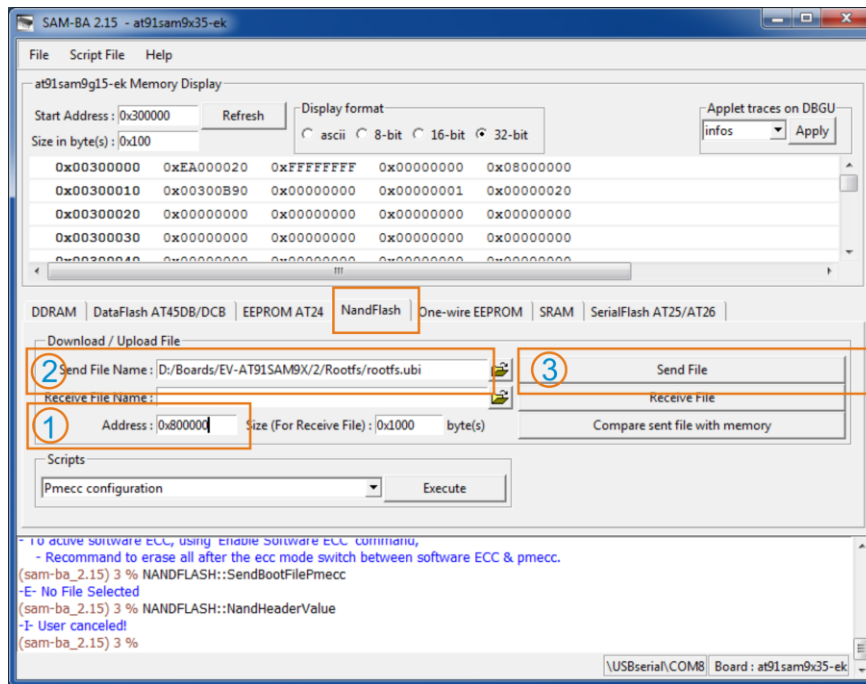
14. Set **Address** to **0x180000**, select **at91sam9x35ek.dtb** in **Send File Name** File Open Dialog and press **Send File**



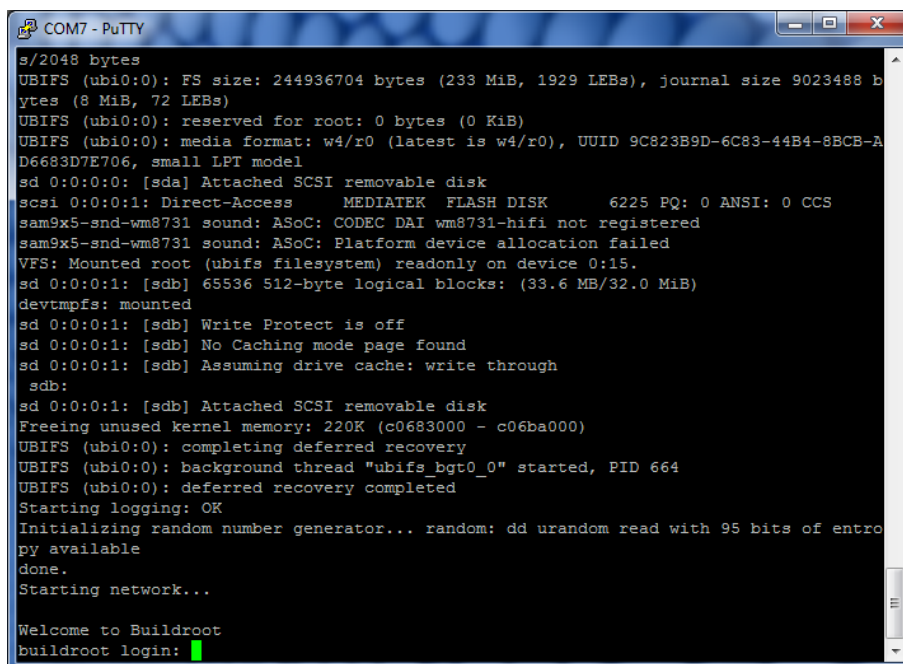
15. Set **Address** to **0x200000**, select **ulmage** in **Send File Name** File Open Dialog and press **Send File**



16. Select **PMECC configuration** script, press **Execute** set **Trimffs** and press **OK**



17. Set **Address** to **0x800000**, select **rootfs.ubi** in **Send File Name** File Open Dialog and press **Send File**
18. Close SAM-BA software
19. Connect DUART to your PC, run terminal software (for example PuTTY) and apply power.



REFERENCES

Table 17.

Link	Description
AT91SAM9G25	CPU Datasheet
AT91SAM9X35	CPU Datasheet
K4T1G164 DDR2	DDR2 Datasheet
S34ML04G100 NAND Flash	NAND Flash Datasheet
LAN8720A Ethernet PHY	Ethernet PHY
24AA01 EEPROM	I2C EEPROM
AT25DF321	SPI Flash

WEB

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If you need to change the design of this board, please contact pcb@evodbg.com



DOCUMENT IMPROVEMENTS

02/01/2016 – The initial revision of the document 1.0

The list of add-ons: