USER GUIDE

2014

EV-iMX287-NANO Module

Revision 1.1

Evodbg

TABLE OF CONTENTS

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

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

KIT

Name	Quantity
EV-iMX287-NANO Module	1

ORDERING INFORMATION

Name	Description
EV-iMX287-NANO-A1	iMX287, 128MB DDR2, 256MB SLC NAND Flash, -40C…+85C

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

BRIEF DESCRIPTION OF THE MODULE

Module EV-iMX287-NANO is built on high-performance microcontroller MCIMX287/MCIMX283 ARM9 core. Processor frequency is 454 MHz. Module EV-iM287-NANO has components released in industrial version (-40°C…+85°C). The list of installed components and slots:

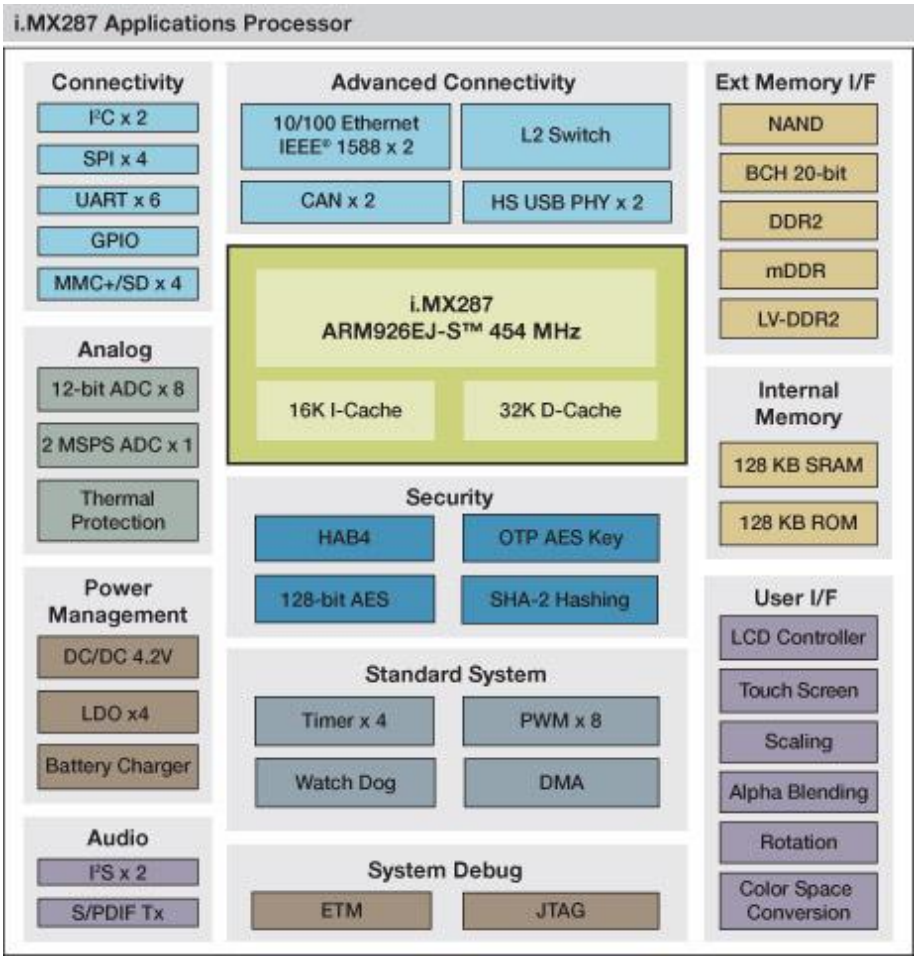
- Processor Freescale MCIMX287CVM4B или MCIMX283DVM4B
- DDR2 K4T1G164QQE 128MB memory or equivalent
- SLC NAND Flash S34ML02G100 256 MB memory or equivalent
- SPI Flash MX25LC6406 64Mb memory (optionally)
- 2 microchips of PHY Ethernet LAN8720AI
- 52-pin pcb connector
- Supply voltage of the module 5V
- Average current consumption 200 mA
- Overall dimensions 51*30*4 mm
- Net weight 10 gr.

COMPARATIVE TABLE FOR PROCESSOR FAMILY IMX28

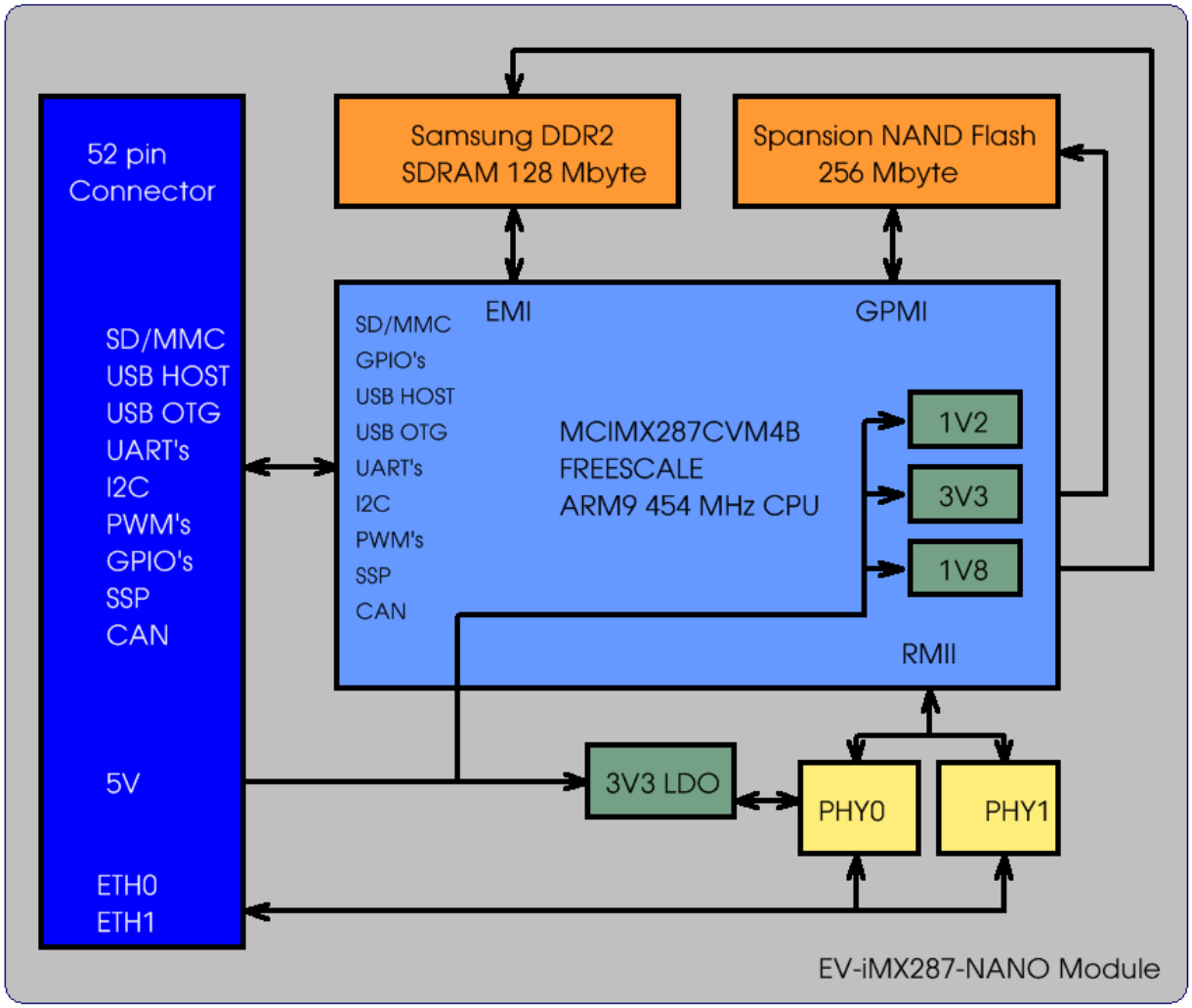
Module	i.MX280	i.MX281	i.MX283	i.MX285	i.MX286	i.MX287
Application UART	5	5	5	5	5	5
Debug UART	1	1	1	1	1	1
Flex CAN	-	2	-	2	2	2
High-speed ADC	1	1	1	1	1	1
L2Switch	-	-	-	-	-	Yes
LCD interface	No	No	Yes	Yes	Yes	Yes
LowSpeed ADC	8	8	8	8	8	8
PWM	8	8	8	8	8	8
SPDIF output	No	Yes	No	Yes	Yes	Yes
SD/SDIO/MMC	4	4	4	4	4	4
Security	Yes	Yes	Yes	Yes	Yes	Yes
SPI	4	4	4	4	4	4
Touchscreen	No	No	Yes	Yes	Yes	Yes

USB 2.0 OTG	1	1	1	1	1	1
USB 2.0 HOST	1	1	1	1	1	1

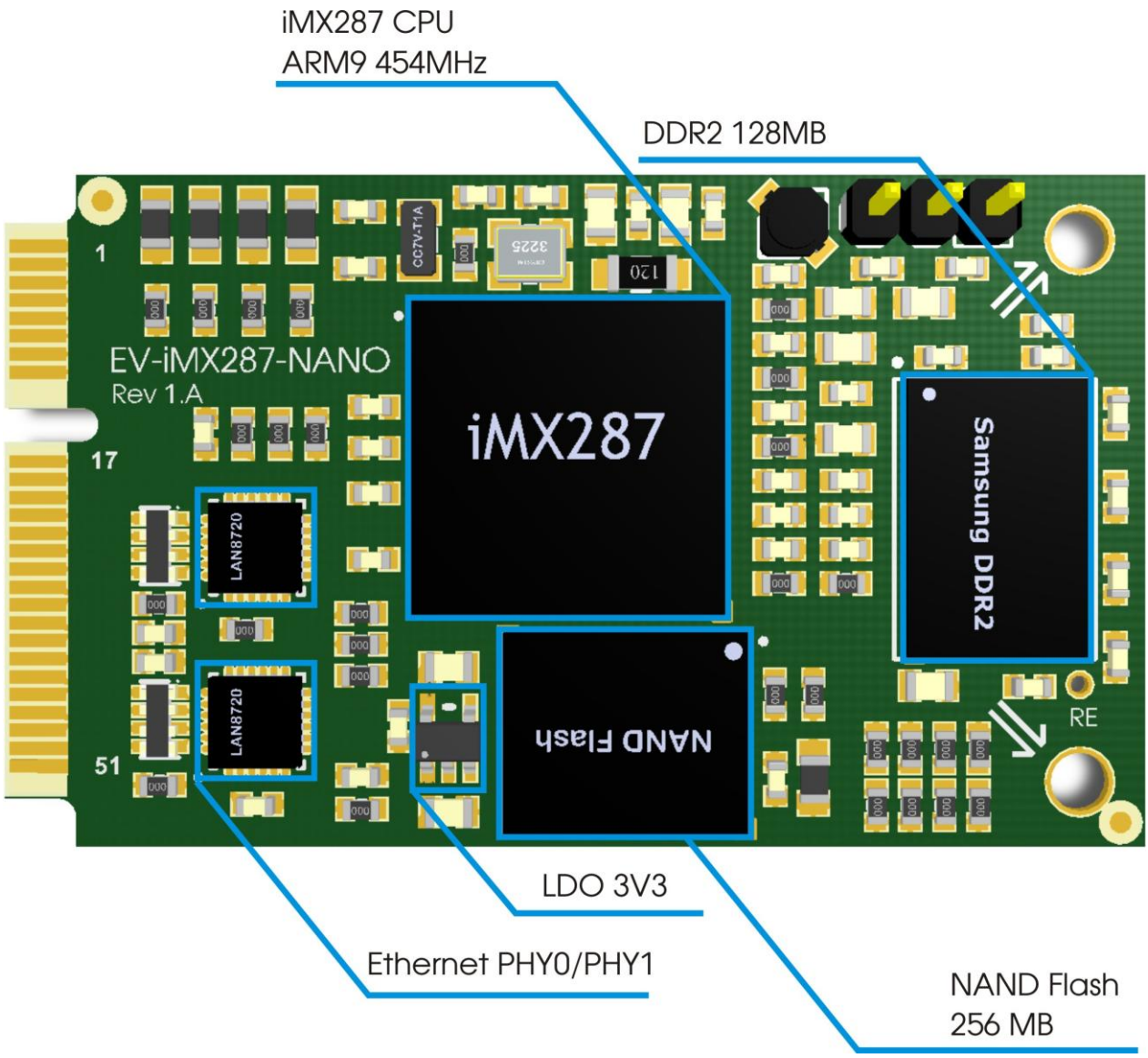
FUNCTION CHART OF THE MODULE MCIMX287



FUNCTION CHART OF THE MODULE EV-IMX287-NANO



LOCATION OF MAIN COMPONENTS ON THE MODULE BOARD



SUPPLY SYSTEM

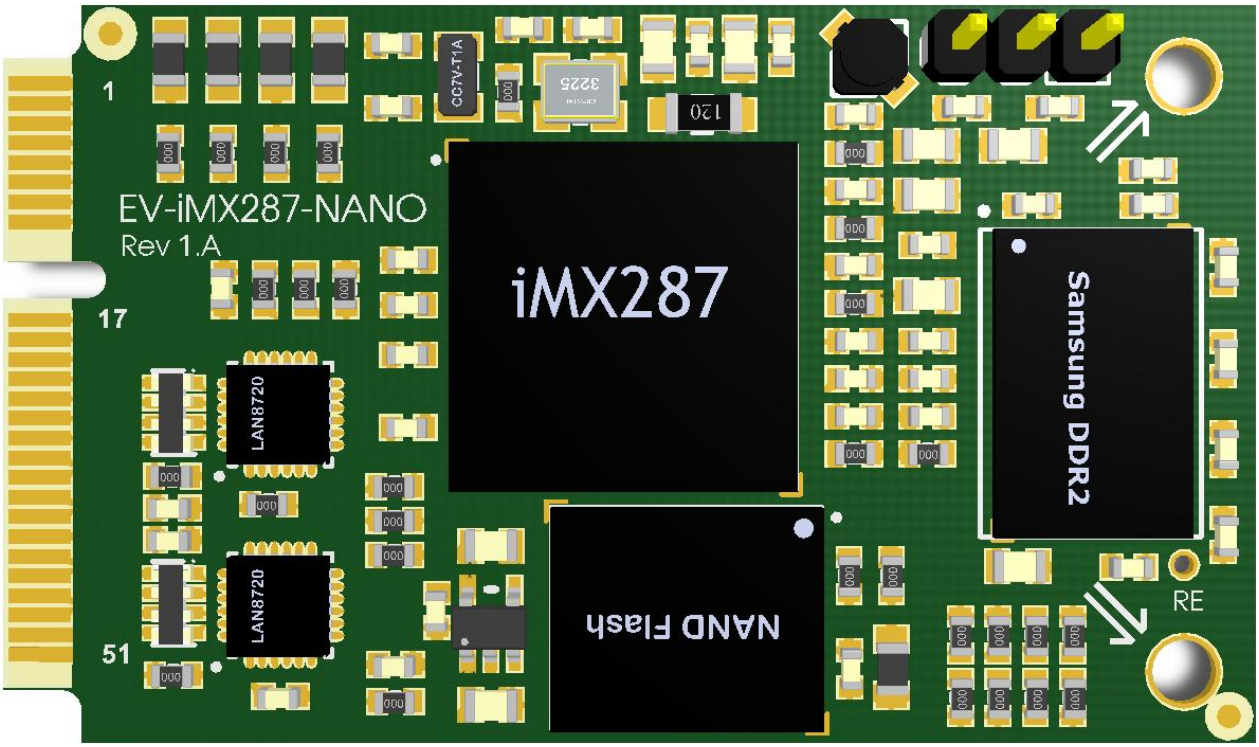
A single 5V (±5%) supply must be provided by the motherboard. Voltage 1.8V (power of DDR2 memory), 1.2V (processor core power) and 3.3V (power of chips memory NAND/SPI Flash) is generated by the processor. To power the chip of physical layer Ethernet (PHY) - LDO stabilizer TPS76333 (U1) is provided.

ETHERNET

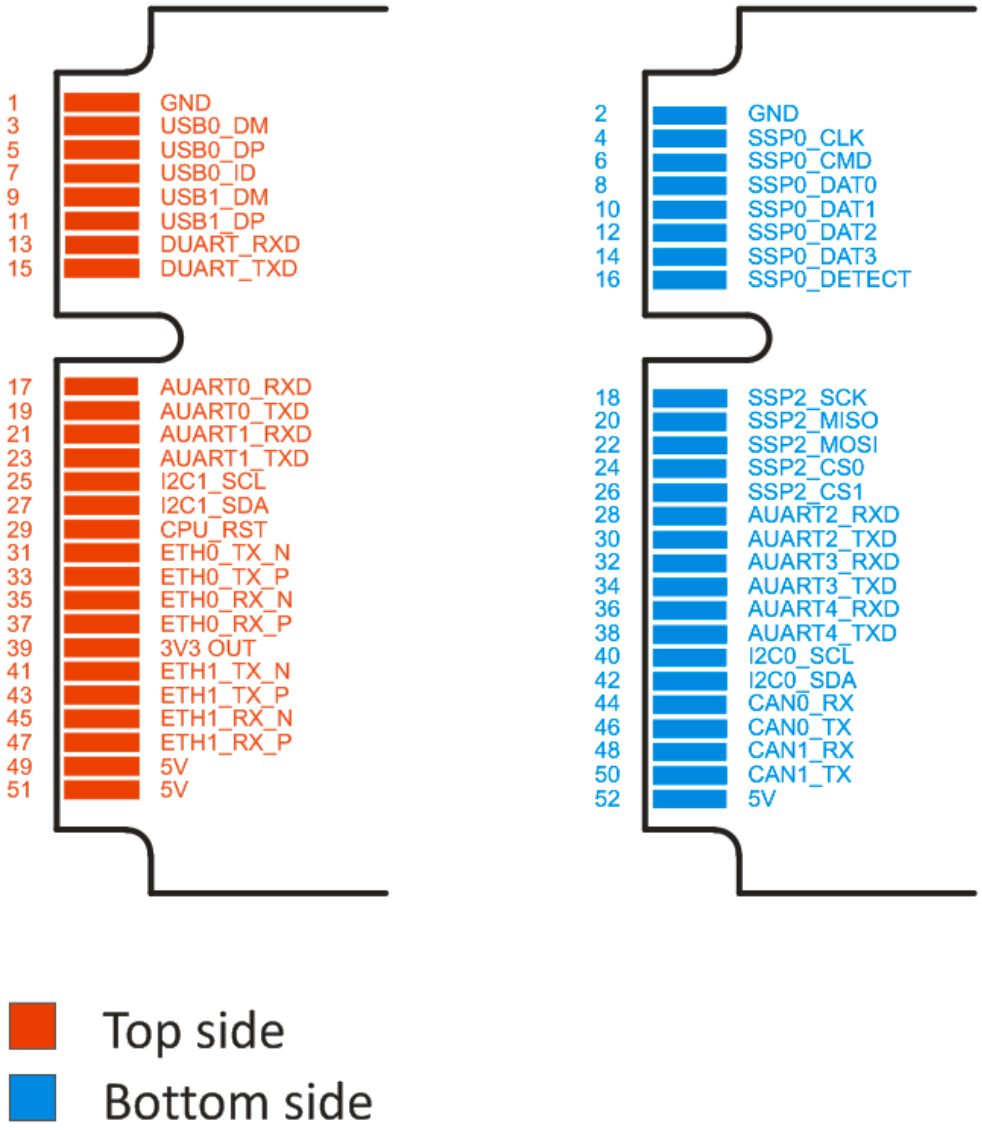
There is a two chip LAN8720 (U5/U7) PHY Ethernet 10/100Mb installed on the board and connected to the processor by interface RMII. Lines TX/RX are displayed on the module contacts. LED control signals are not displayed. 4 LEDs (two on each interface) are installed on the module for the identification of functional state of Eth0/Eth1.

PIN CONFIGURATION OF THE MODULE CONNECTOR

Top view, from components side.



EV-iMX287-NANO Module



MAIN MODULE CONNECTOR

Table 1. Module pin description

Pin №	Name	MUX1	MUX2	MUX3	GPIO	CPU pin
1	GND					
2	GND					
3	USB0DM					A10
4	SSP0_SCK	SSP0_SCK			GPIO2_10	A6
5	USB0DP					B10
6	SSP0_CMD	SSP0_CMD			GPIO2_8	A4
7	PWM2	PWM2	USB0_ID	USB1_OVERCURRENT	GPIO3_18	K8
8	SSP0_DATA0	SSP0_DATA0			GPIO2_0	B6
9	USB1DM					B8
10	SSP0_DATA1	SSP0_DATA1			GPIO2_1	C6
11	USB1DP					A8
12	SSP0_DATA2	SSP0_DATA2			GPIO2_2	D6
13	PWM0	PWM0	I2C1_SCL	DUART_RX	GPIO3_16	K7
14	SSP0_DATA3	SSP0_DATA3			GPIO2_3	A5
15	PWM1	PWM1	I2C1_SDA	DUART_TX	GPIO3_17	L7
16	SSP0_DETECT	SSP0_CARD_DETECT				D10
17	AUART0_RX	AUART0_RX	I2C0_SCL	DUART_CTS	GPIO3_0	G5
18	SSP2_SCK	SSP2_SCK	AUART2_RX	SAIF0_SDATA1	GPIO2_16	A3
19	AUART0_TX	AUART0_TX	I2C0_SDA	DUART_RTS	GPIO3_1	H5
20	SSP2_MISO	SSP2_D0	AUART3_RX	SAIF1_SDATA1	GPIO2_18	B3
21	AUART1_RX	AUART1_RX	SSP2_CARD_DETECT	PWM_0	GPIO3_4	L4
22	SSP2_MOSI	SSP2_CMD	AUART2_TX	SAIF0_SDATA2	GPIO2_17	C3
23	AUART1_TX	AUART1_TX	SSP3_CARD_DETECT	PWM1	GPIO3_5	K4
24	SSP2_SS0	SSP2_D3	AUART3_TX	SAIF1_SDATA2	GPIO2_19	C4
25	AUART2_CTS	AUART2_CTS	I2C1_SCL	SAIF1_BITCLK	GPIO3_10	H6
26	SSP2_SS1	SSP2_D4	SSP2_D1	USB1_OVERCURRENT	GPIO2_20	D3
27	AUART2_RTS	AUART2_RTS	I2C1_SDA	SAIF1_LRCLK	GPIO3_11	H7
28	AUART2_RX	AUART2_RX	SSP3_D1	SSP3_D4	GPIO3_8	F6
29	RESETN					A14
30	AUART2_TX	AUART2_TX	SSP3_D2	SSP3_D5	GPIO3_9	F5
31	ETH0_TX_N	LAN8720				
32	AUART3_RX	AUART3_RX	CAN0_TX	EN-ET0_1588_EVENT0_OUT	GPIO3_12	M5
33	ETH0_TX_P	LAN8720				
34	AUART3_TX	AUART3_TX	CAN0_RX	EN-ET0_1588_EVENT0_IN	GPIO3_13	L5
35	ETH0_RX_N	LAN8720				
36	AUART0_CTS	AUART0_CTS	AUART4_RX	DUART_RX	GPIO3_2	J6
37	ETH0_RX_P	LAN8720				
38	AUART0_RTS	AUART0_RTS	AUART4_TX	DUART_TX	GPIO3_3	J7
39	VOUT 3V3					
40	I2C0_SCL	I2C0_SCL	TIMROT_ROTARYA	DUART_RX	GPIO3_24	C7
41	ETH1_TX_N	LAN8720				
42	I2C0_SDA	I2C0_SDA	TIMROT_ROTARYB	DUART_TX	GPIO3_25	D8
43	ETH1_TX_P	LAN8720				
44	GPMI_RDY3	GPMI_RDY3	CAN0_RX	HSADC_TRIGGER	GPIO0_23	L8
45	ETH1_RX_N	LAN8720				
46	GPMI_RDY2	GPMI_RDY2	CAN0_TX	ENET0_TX_ER	GPIO0_22	M8
47	ETH1_RX_P	LAN8720				

48	GPMI_CE3N	GPMI_CE3N	CAN1_RX	SAIF1_MCLK	GPIO0_19	M9
49	5V					
50	GPMI_CE2N	GPMI_CE2N	CAN1_TX	ENET0_RX_ER	GPIO0_18	M7
51	5V					
52	5V					

The modules EV-iMX287-NANO of revision 1.C and higher, in applications that do not require the second port Ethernet (ETH1) the additional signals of the processor may be displayed on the module contacts 41, 43, 45, 47. Table of alternative signals is shown below:

Table 1A.

Module pin	Two Ethernet model	One Ethernet model
41	ETH1_TX_N	SAIF0_SDATA0
43	ETH1_TX_P	SAIF0_BITCLK
45	ETH1_RX_N	SAIF0_LRCLK
47	ETH1_RX_P	SAIF1_SDATA1

For applications that do not require a second interface CAN (CAN1), the signals of processor HSADC0 and SAIF0_MCLK may be used instead.

Table1B.

Module pin	Two Ethernet model	One Ethernet model
48	CAN1_RX	SAIF0_MCLK
50	CAN1_TX	HSADC0

Thus, instead of CAN1 and Ethernet1 interfaces the audio interface SAIF and ADC HSADC0 input can be displayed on the module slots.

SIGNALS USED INSIDE THE MODULE

Table 2. Signal used inside the module

CPU pin	Name	Used with	Main connector
G4	ENET0_MDC	LAN8720	No
H4	ENET0_MDIO	LAN8720	No
E4	ENET0_RX_EN	LAN8720	No
H1	ENET0_RXD0	LAN8720	No
H2	ENET0_RXD1	LAN8720	No
F4	ENET0_TX_EN	LAN8720	No
F1	ENET0_TXD0	LAN8720	No
F2	ENET0_TXD1	LAN8720	No
E3	ENET0_TX_CLK	LAN8720	No
F3	ENET0_RX_CLK	LAN8720	No
J1	ENET0_RXD2	LAN8720	No

J2	ENET0_RXD3	LAN8720	No
G1	ENET0_TXD2	LAN8720	No
G2	ENET0_TXD3	LAN8720	No
J4	ENET0_COL	LAN8720	No
J3	ENET0_CRS	LAN8720	No
E2	ENET_CLK	LAN8720	No
U8	GPMI_D0	NAND Flash	No
T8	GPMI_D1	NAND Flash	No
R8	GPMI_D2	NAND Flash	No
U7	GPMI_D3	NAND Flash	No
T7	GPMI_D4	NAND Flash	No
R7	GPMI_D5	NAND Flash	No
U6	GPMI_D6	NAND Flash	No
T6	GPMI_D7	NAND Flash	No
L9	GPMI_RESET	NAND Flash	No
P7	GPMI_CLE	NAND Flash	No
P6	GPMI_ALE	NAND Flash	No
P8	GPMI_WR	NAND Flash	No
R6	GPMI_RD	NAND Flash	No
N7	GPMI_CE0	NAND Flash	No
N6	GPMI_RDY0	NAND Flash	No
A3	SSP2_SCK	SPI Flash (optional)	Pin 18
C3	SSP2_MOSI	SPI Flash (optional)	Pin 22
B3	SSP2_MISO	SPI Flash (optional)	Pin 20
C4	SSP2_SS0	SPI Flash (optional)	Pin 24

SOURCES OF PROCESSOR BOOT

Boot source is determined when you reset your processor. A configuration on the module is forcibly set to boot from the chip NAND Flash. Under unprogrammed chip NAND Flash the boot is performed from USB interface. You can force the module to boot from USB, if NAND Flash is programmed. To do this you have to close contacts USB Boot and press Reset on the motherboard. In this mode, using the utility sb_loader.exe or MFGTool.exe you can boot the code and write the chip NAND Flash.

MEMORY

NAND FLASH MEMORY

The board uses a SLC NAND Flash chip memory (U3), bus width 8 bits, 256 MB. The memory is connected to the bus GPMI, GPMI_CE0 is used for sampling and GPMI_RDY0 for the signal Busy. Signal GPMI_RESET is used as a security control signal from the writing in NAND Flash. In agreement with the customer installation of another chip volume is possible.

SPI FLASH MEMORY

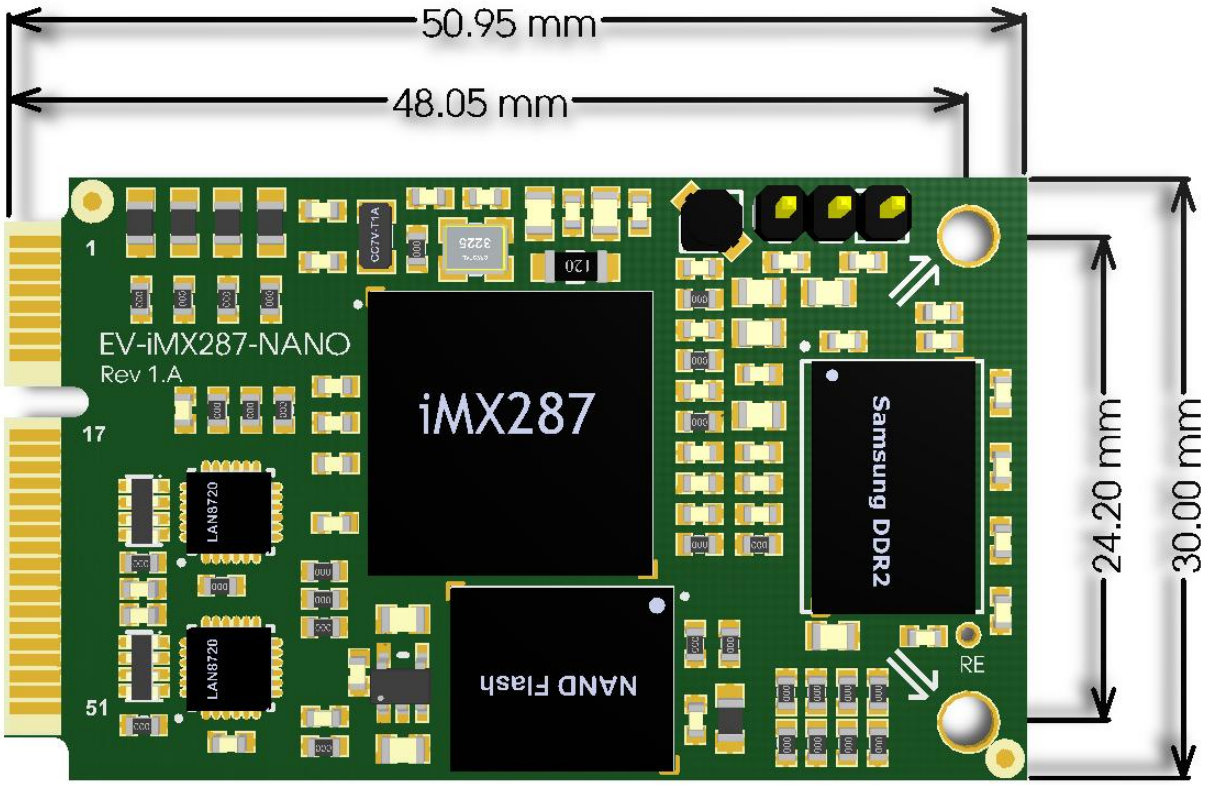
The module can be optionally installed with chip SPI Flash memory MX25LC6406 (U5) of 64 Mbit. The memory is connected to port SSP2 (CS0). In case SPI Flash is installed, its select input signal SSP2_SS0 is replicated and cannot be used.

DDR2 MEMORY

On the module there is a chip with DDR2 (U2) K4T1G164Q memory (or equivalent) of 128 MB. In agreement with the customer installation of chip of 256 MB is possible. The maximum frequency of EMI interface 205 MHz.

OVERALL DIMENSIONS

All dimensions are in mm. The maximum height of the module is 4.0mm.



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

mini PCI Express appearance.

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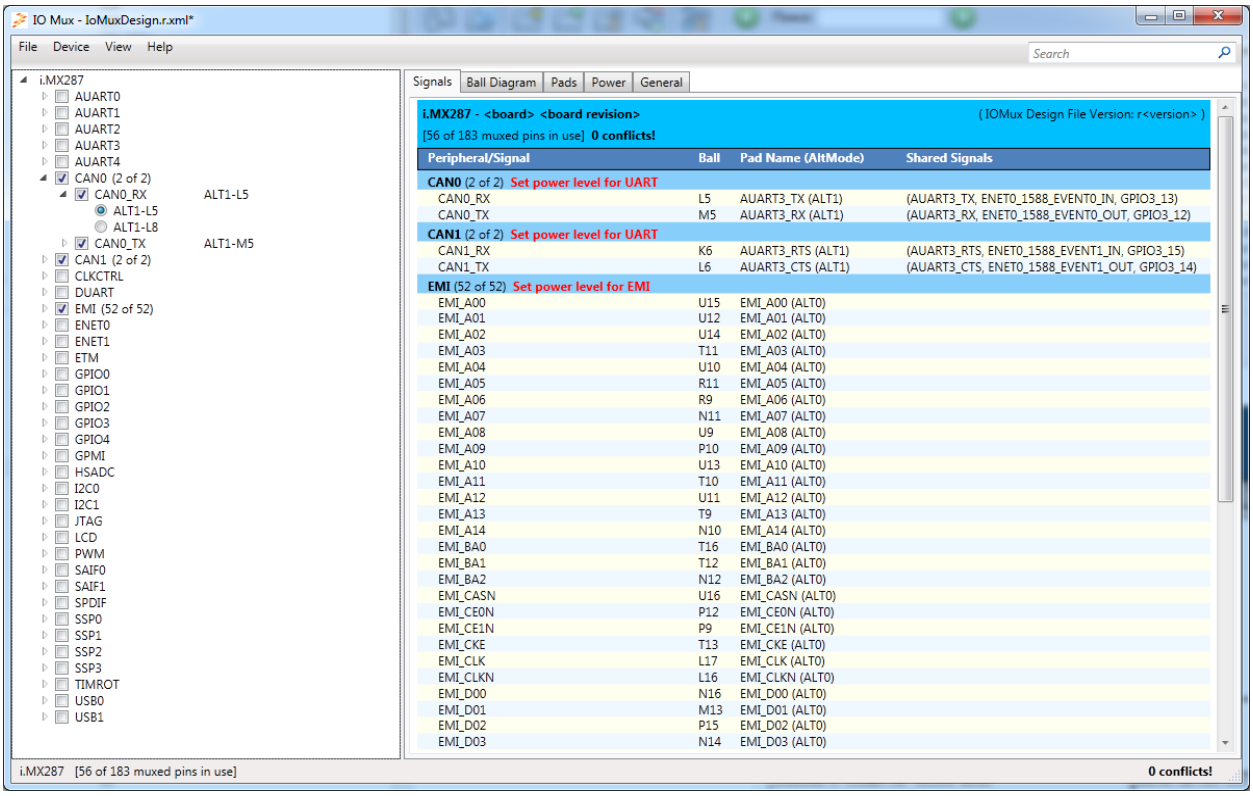
PINMUX

Output functions are not the only possible. here, they are called as well as in BSP. If necessary, you can change them, reassign PINMUX as you need. For assign purpose use utility IOMux.exe, which allows graphically designate functions for processor outputs and shows potential conflicts.



EFUSE

The module comes with an unprogrammed eFuse processor. In the final stage of development you can program their configuration using utility BitBurner.

OUTPUT-INPUT PORTS

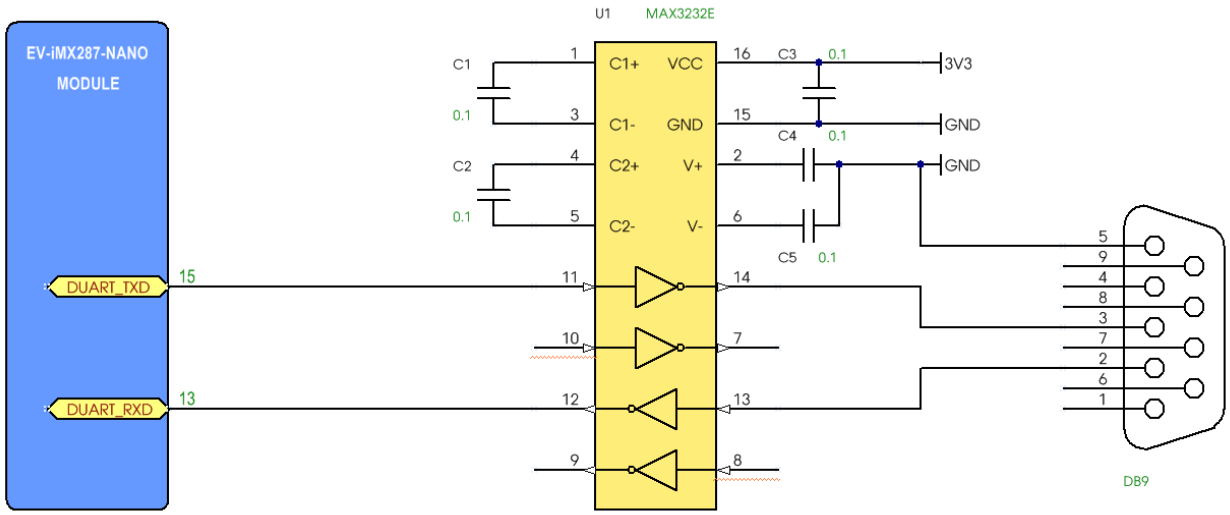
All signals of the module (except for the differential pairs) have 3.3V levels. To connect to 1.8V/5.0V peripheral use the level converter.

POWER

To power the module 5V is used. On the module pins 49,51,52 you need 5V. Ground pin 1,2 must be connected to the ground. The board has LDO (linear stabilizer with low dropout) with an output voltage 3.3V, which is used to power the chip Ethernet of PHY module. This voltage is present at the pin of module 39 and can be used to power low-power chips of your board. Mounting holes of the module are also connected to ground. It is recommended to support the motherboard with installation of threaded brass struts 2mm to fix the module to the motherboard.

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

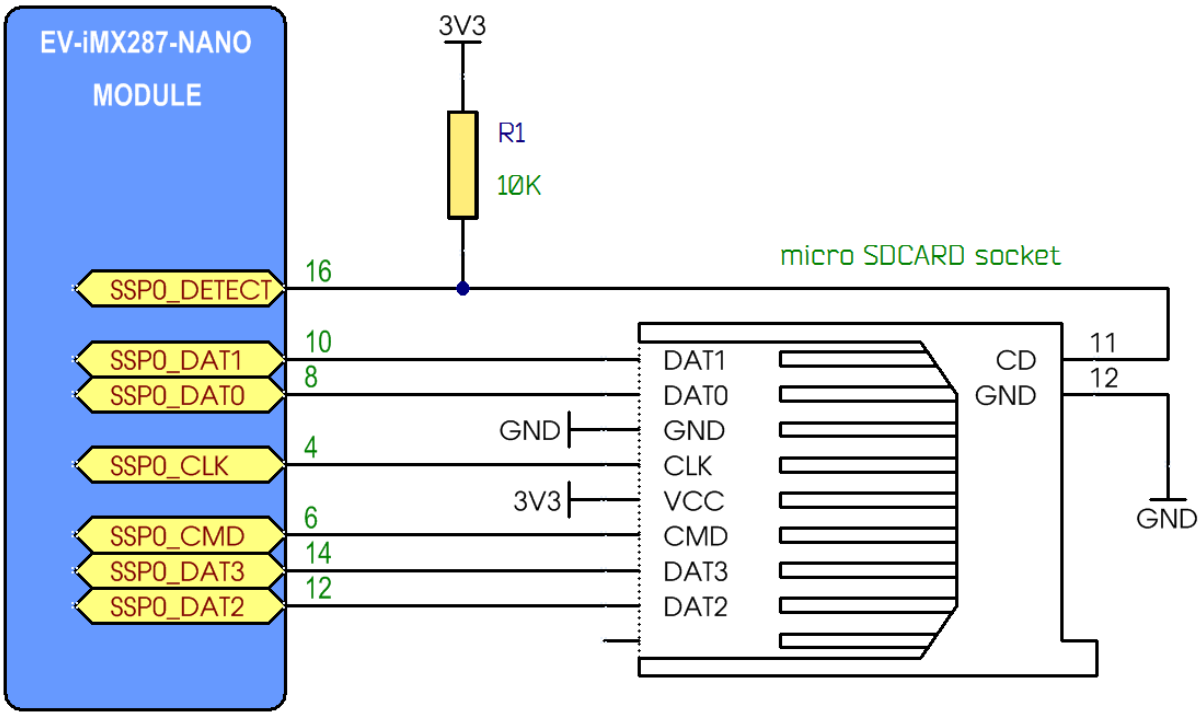
SD/MMC card holder can be connected to the port SSP0. Signals fit of SD и microSD cards is shown in the table :

Table 3. Connection of SD/uSD cards

Module Pin Number	SD pin	microSD card pin	Pin name
4	5	5	SSP0_CLK
6	2	3	SSP0_CMD
8	7	7	SSP0_DAT0
10	8	8	SSP0_DAT1
12	9	1	SSP0_DAT2
14	1	2	SSP0_DAT3
16			SSP0_DETECT (SD card detect signal)
1,2	3,6	6	GND
39	4	4	Power 3.3B

Attention! It is necessary to pull-up SSP0_DETECT to 3.3V through a resistor 10K.

EV-iMX287-NANO Module



ETHERNET CONNECTION

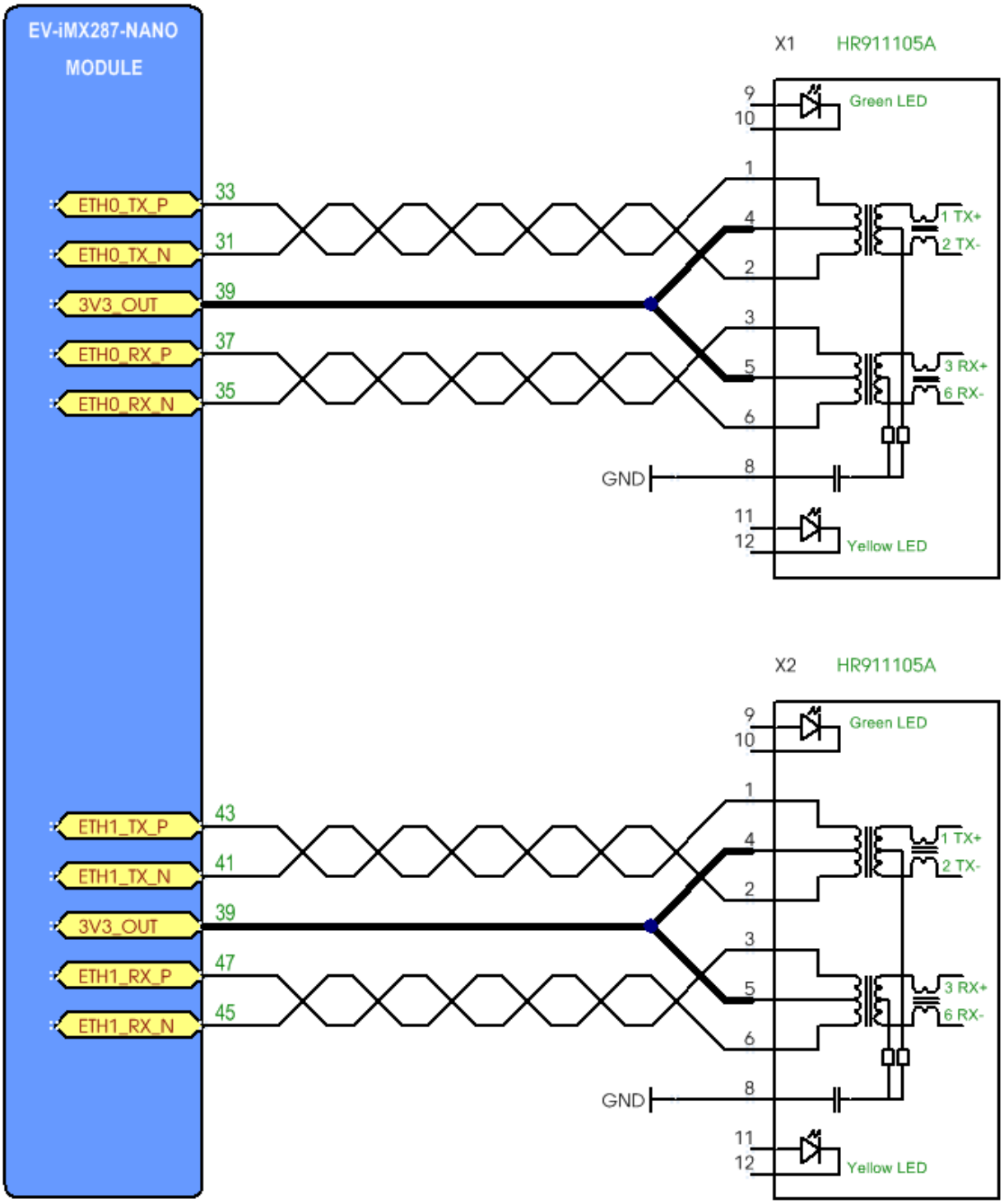
A chip of physical layer (Ethernet PHY) LAN8720AI is installed on the module board. Differential pairs RX/TX are output to the module pint. To reduce the occupied space use the slots RJ-45 with integrated transformers, for example HR911105A. You can also use a set of transformer, for example H1102 and RJ-45 connector.

Table 4.

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
43	1	TX+ (ETH1)
41	2	TX- (ETH1)
47	3	RX+ (ETH1)
45	6	RX- (ETH1)
1	8	GND
39	4,5	3.3V

Eth1 interface is connected similarly.

EV-iMX287-NANO Module

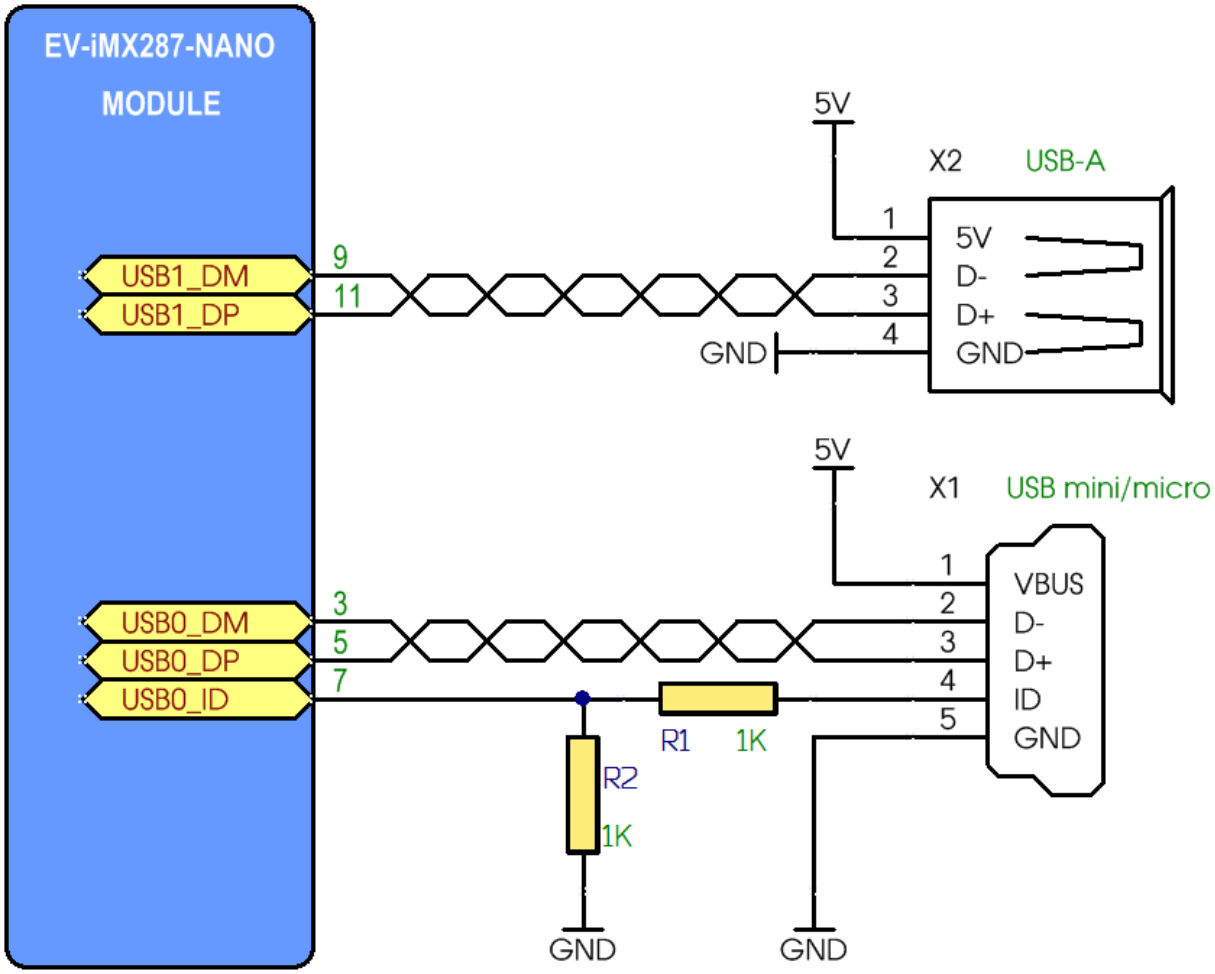


USB INTERFACE

On the contact module the signals of two interfaces USB are displayed. USB0 can be used as Host/Device, USB1 only as HOST.

Table 5.

Module Pin Number	Signal	Description
5	USB0_D+	
3	USB0_D-	
7	USB0_ID	Connect USB_ID to 3V3 via 1K resistor to set Device Mode. Connect USB_ID to GND via 1K resistor to set HOST Mode.
11	USB1_D+	
9	USB1_D-	

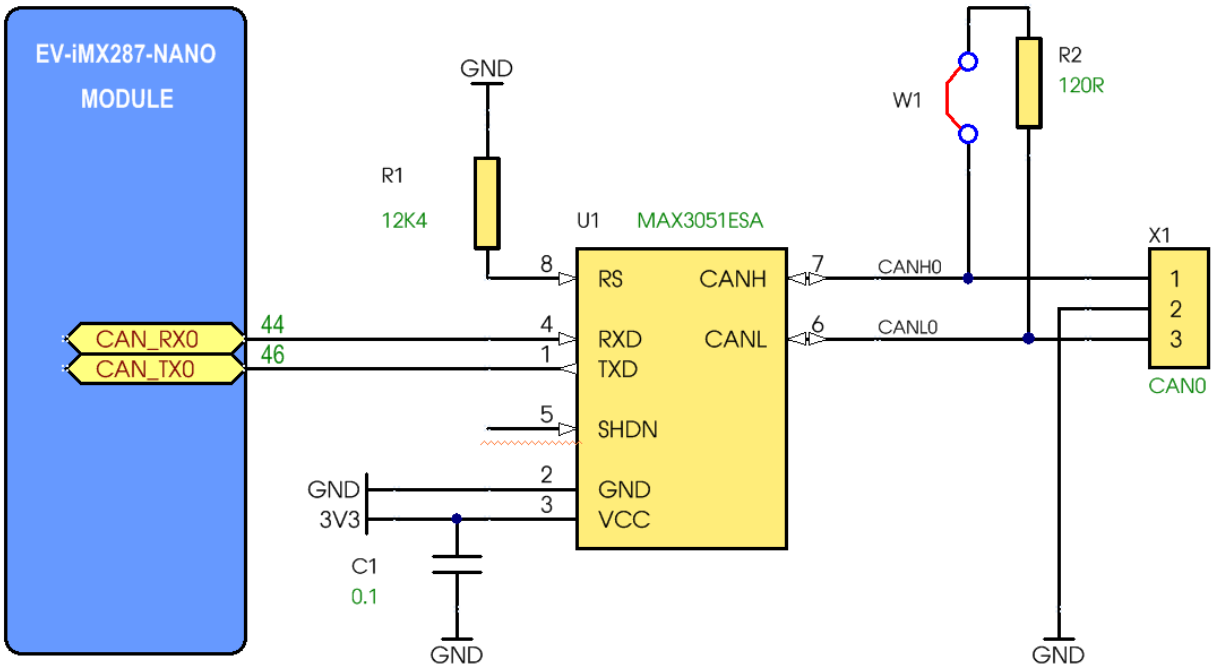


CAN INTERFACE

The boards with processor iMX287 possible to use two CAN interfaces. The processor iMX283 interface CAN is not available. You can use any 3.3V CAN bus transceivers, such as MAX3051, 65HVD230 etc.

Table 6.

Module Pin Number	Description
46	CAN0_TX
44	CAN0_RX
50	CAN1_TX
48	CAN1_RX



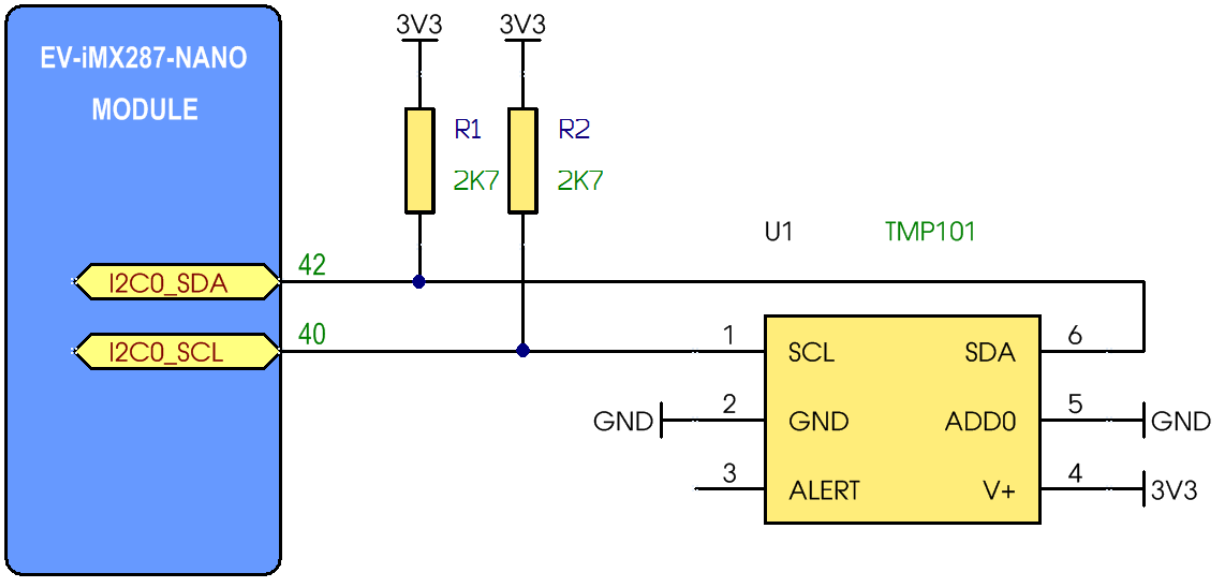
I2C INTERFACE

Interface signals I2C0 (I2C0, I2C1) are displayed on the contacts of the module EV-iMX287-NANO. The motherboard is necessary to provide with the pull-up to power via resistors 2K2 of lines SDA and SCL.

Table 7.

Module Pin Number	Signal
40	I2C0_SCL
42	I2C0_SDA
25	I2C1_SCL

27	I2C1_SDA



SPI (SSP2) INTERFACE

SSP2 interface signals are displayed on the module contacts EV-iMX287-NANO. Select input signal SSP2_SS0 can be inaccessible while the installation of SPI Flash memory on the module.

Table 8.

Module Pin Number	Signal
18	SSP2_SCK
20	SSP2_MISO
22	SSP2_MOSI
24	SSP2_SS0
26	SSP2_SS1

UART INTERFACE

Five UART interfaces are displayed on the module contacts.

Table 9.

Module Pin Number	Signal
17	UART0_RXD
19	UART0_TXD
21	UART1_RXD
23	UART1_TXD
28	UART2_RXD
30	UART2_TXD
32	UART3_RXD

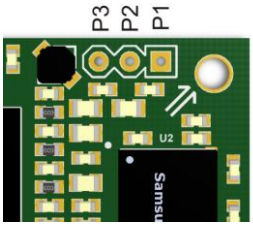
34	UART3_TXD
36	UART4_RXD
38	UART4_TXD

LI-ION BATTERY CONNECTOR

3-pin connector for Li-ION battery connection.

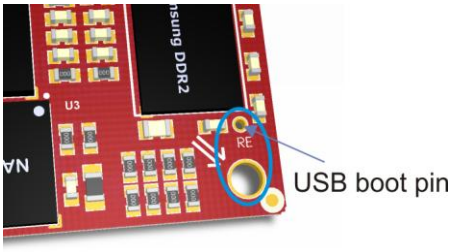
Table 10.

Module Pin Number	Signal
P1	LI-ION
P2	VCC4P2
P3	GND



KERNEL AND ROOT FILE SYSTEM RESTORING

The operation is performed on the computer with OS Windows. Unzip Ev-iMX2xx. Connect the USB cable to the computer and to the upper USB socket connector (USB0 OTG),set the boot from USB, connect the power to the board. Windows should determine the board as HID device. Run MfgTool.exe. In the drop list select MX28 Linux Update. Go to the Options-Configurations and choose EV-iMX287-NANO, click Ok. Now click Start button and wait for the reports of successful programming.



Close RE pin (USB Boot Pin) to Ground (with tweezers) and apply power to set USB Boot mode.

REFERENCES

Table 11.

Link	Description
IMX287CEC	i.MX28 Datasheet
IMX28CE	i.MX28 Errata
MCIMX28RM	Processor Reference Manual
K4T1G164 DDR2	DDR2 Datasheet
S34ML04G100 NAND Flash	NAND Flash Datasheet
LAN8720A Ethernet PHY	Ethernet PHY

24AA01 EEPROM	I2C EEPROM
MX25L6406E	SPI Flash
Altium Designer motherboard project	
Schematic of motherboard (pdf)	

WEB

Web site: www.evodbg.com

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

DOCUMENT IMPROVEMENTS

14/02/2014 – The initial revision of the document 1.0

29/08/2014 – supplementary document, revision 1.1

The list of add-ons: