User's Manual

32

V850E2/Px4 Application Board

User's Manual: Hardware

RENESAS MCU
V850 P Series

AB-050-PX4 Rev.: 1.0

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Table of Contents

1. Introduction

The AB-050-Px4 is designed as a simple and easy to use Starter Board to support users with the first steps when starting with the V850E2/Px4.

The Starter Board is prepared to hold a V850E2/Px4 device (uPD70350x),

With the Nexus Debug interface and the Flash Programming interface for the Renesas PG-FP5 Flash Programmer the standard Renesas programming interfaces are directly available.

To enable further application development the board features drivers for 2 high speed CAN interfaces, 3 RS-232 interfaces, 3 LIN bus interfaces and 2 FlexRay interfaces.

With on-board voltage regulator and reset generator a simple external DC power supply is sufficient to operate the board.

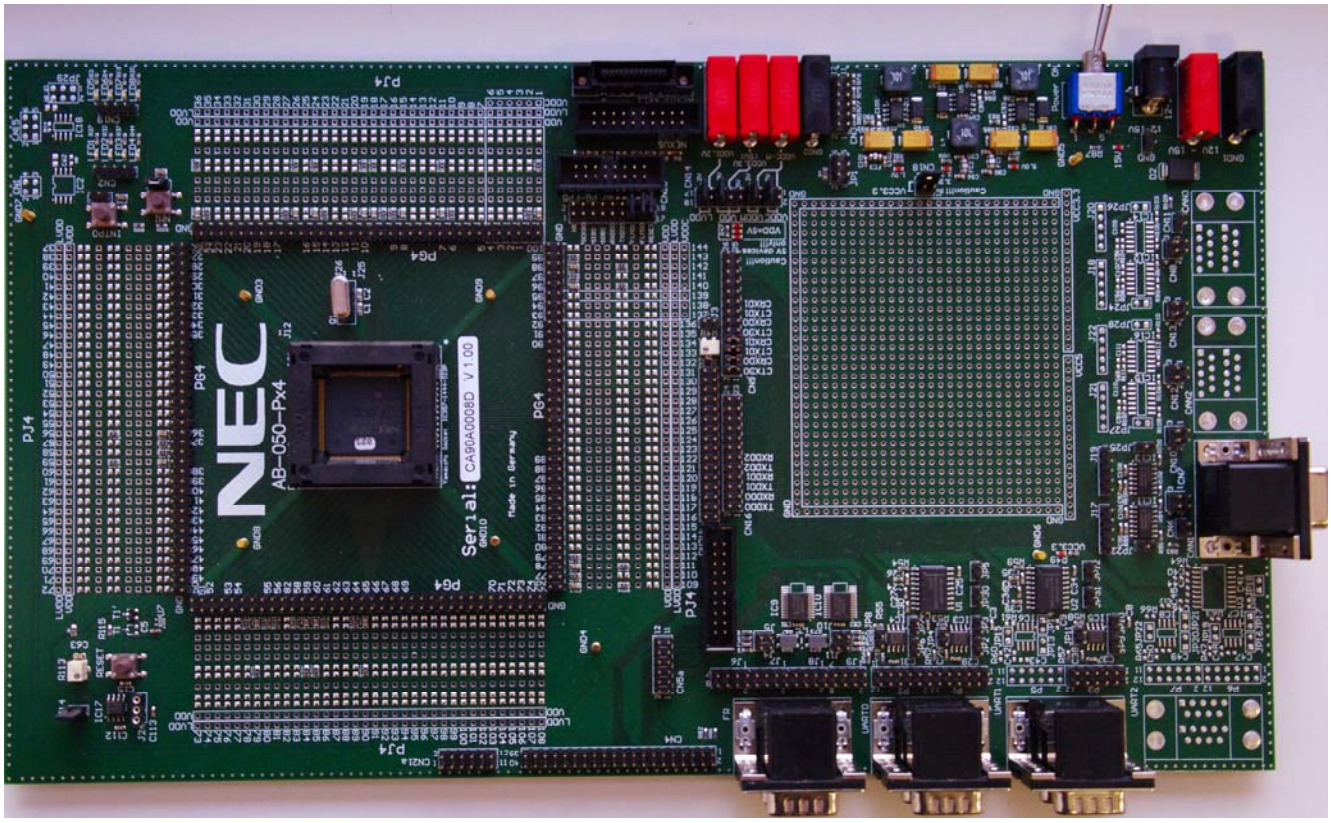

Figure 1. AB-050-Px4

2. Board description

2.1 Overview

Basically the board is divided into two areas, an ‘Electrical Area’ and a ‘Functional Area’.

In Figure 2 the Electrical Area is marked yellow and the Functional Area is marked blue.

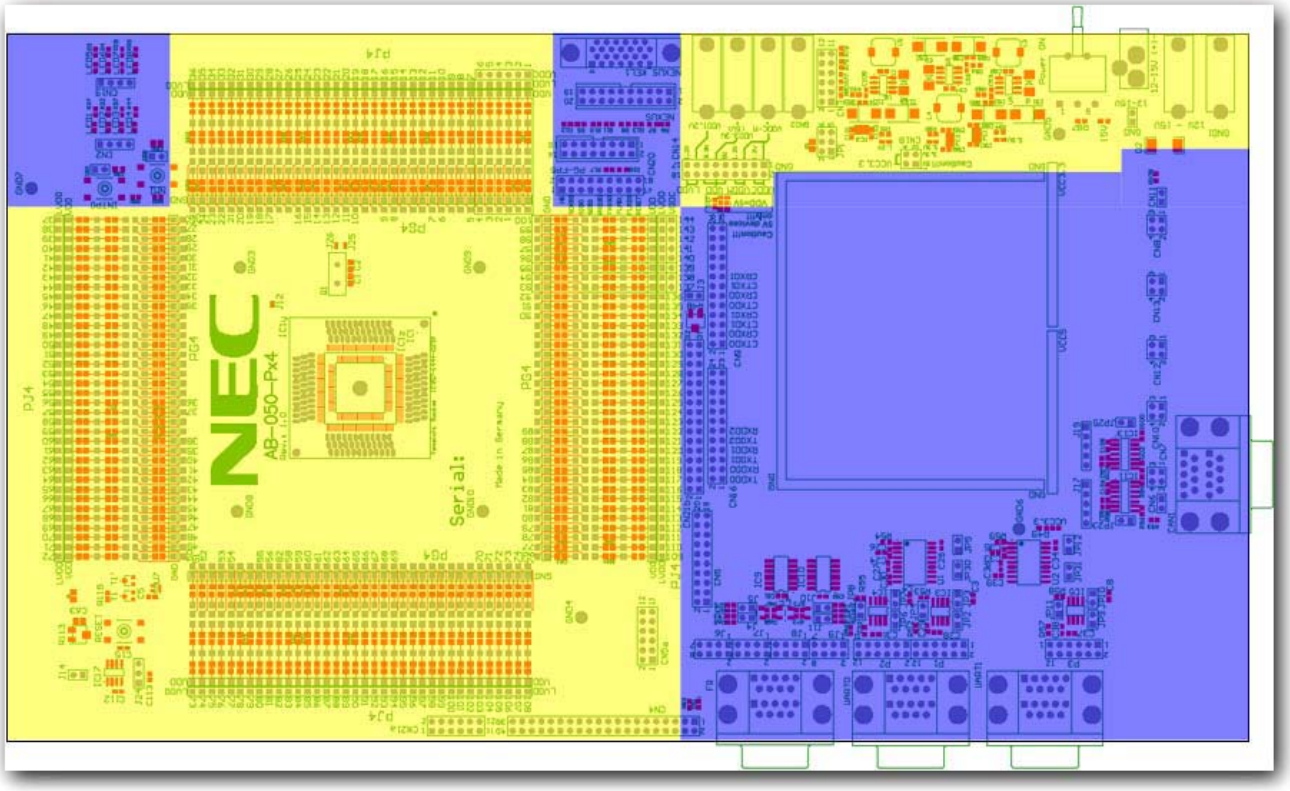

Figure 2. Board overview

2.1.1 Electrical Area

The yellow marked Electrical Area comprised the power supply, the reset circuit and the device socket with a surrounding Pin Patch Area. The core voltage supply is divided into a master and a checker domain, which is mandatory to fulfill the safety concept of the Px4 redundant core architecture.

In the centre of the Electrical Area the device socket is soldered either on a 100 pin or a 144 pin SMD pad field. On each side of the package/socket a “Pin Patch Area” is located.

In this patch area access is given to:

- each pin of the device (Note)
- VSS (GND)
- LVDD (1.2V)
- VDD (3.3V)

Further more SMD and through-hole components can directly be soldered onto the Pin Patch Area to allow simple networks to be easily built up.

Note:

The Board supports the 144pin PJ4 and the 100pin PG4 packaging. Inside pin labeling is for PG4, outside pin labeling for PJ4.

2.1.2 Functional Area

The blue marked Functional Area holds the drivers for RS-232, LIN bus, CAN and FlexRay. Additionally other patch areas are available as well to directly assembled LEDs, PowerDrivers and connectors to the board. Additional 2 EEPROM devices are available.

Note:

For detailed information about the operation of the used RS-232, LIN bus, CAN and FlexRay drivers refer to the related datasheets of those devices.

2.1.3 Connecting both areas

The Electrical and Functional Areas are not connected to each other except by a common VSS plane. Nevertheless by use of Jumpers a signal connection between the Electrical Area and the Functional Area is possible.

The following signals are available on the related jumper fields:

Signal	Jumper
FlexRay	CN5+CN5a
UART - URTHn (n=0..2)	CN16
CAN - FCNn (n=0..1)	CN9

Table 1. Overview of functional signals

2.1.4 Minimal configuration for quick start

To run the device without the Functional Area the following minimal configuration has to be done.

- select with CN14 the used power supply and VDD voltage
- assemble an 8MHz or an 16MHz oscillator to Q1
- set the required jumper setting to CN20

2.2 Reset

The V850E2/Px4 can be reset by asserting RESETZ input pin.

2.2.1 RESETZ input

The RESETZ input of the V850E2/Px4 is controlled via a pull-up resistor and transistor to GND. With J14 the connection to this circuit can be established.

2.3 Connecting the Power Supply

There are two different ways to supply the board with power:

a) Switching power supply

By supplying 12-15V to the 12-15V power connector jacket or to the 12-15V banana jacket. This will supply the on board voltage regulators for VCC5, VCC3.3 and VCC1.2 as well as directly supply VCC15.

b) Linear power supply

Optional the device voltages VDDC, VDDM, VDD and LVDD can be supplied separately by supplying the required voltages carefully to the corresponding banana jackets VDDC/M, VDD3.3V and VDD1.2V.

Use CN14 to select the device voltage supply source:

Supply voltage	Supply Source	CN14
VDDC	Extern	1-2
VDDC	Regulator	3-4
VDDM	Extern	5-6
VDDM	Regulator	7-8
VDD	Regulator 5V	9-10
VDD	Extern	11-12
LVDD	Extern	15-16
LVDD	Regulator	17-18

Table 2. Power Supply

VDDC and VDDM are the separated core voltage. VDDM supplies the Master Core and VDDC the Checker Core.

The board supports a voltage supply of 5V VDD. If the device should run with 5V, the voltage of the Functional Area and the Electrical Area has to be changed separately.

- With CN18 the voltage for the components of the Functional Area can be set to 5V.
- To switch the voltage of the device to 5V pin 9-10 of CN14 has to be connected.

Caution: Applying a voltage to the device outside the specified device operating voltage range may damage the device!

2.4 Nexus connection

The Nexus debug cable from a Renesas Debug Tool (e.g. MiniCube) can be connected to the Nexus Connector on the board.

KEL connector (Nexus_KEL1) is not supported by the AB-050-Px4 evaluation board.

The following jumpers must be closed in order to physically connect some of the Nexus signals from the Nexus Connector to the corresponding pins of the V850E2/Px4 device:

Jumper	Pin number
CN20	17-18
CN20	15-16

Table 3. Nexus

2.5 PG-FP5 connection

The programming cable of the PG-FP5 Flash programmer can be connected to 'PG-FP5' Connector.

To program the device via the CSI interface the following jumpers must be closed:

Connector	Pin number
CN20	3-4
CN20	5-6
CN20	7-8
CN20	13-14
CN20	15-16
CN20	17-18

Table 4. FP5 (CSI) Jumpers

To program the device via the UART interface the following jumpers must be closed:

Connector	Pin number
CN20	1-2
CN20	9-10
CN20	11-12
CN20	13-14
CN20	15-16
CN20	17-18

Table 5. FP5 (UART) Jumpers

Note:

For Flash programming, using the PG-FP5 device, power must be supplied by the AB-050-Px4. Please make sure to switch of power monitoring in PG-FP5 setup.

For Flash programming, using the PG-FP5, clock supply is done by the AB-050-Px4. Please make sure to enter the right crystal value in PG-FP5 setup.

2.6 RS-232 / LIN

2.6.1 RS-232 Transmission

VBAT of the LIN bus driver is direct connected to the 12- 15V power supply jacket and the corresponding banana jackets. If the 12- 15V power supply is not used as power supply, a voltage in the range of 5V to 12V must be supplied to the jackets. For the exact specification refer to the Datasheet of the LIN Drivers.

Close the following jumpers on CN16 to physically connect the URTH signals from the Electrical Area to the Functional Area.

Signal		CN16
URTH0	TXD0	1-2
	RXD0	3-4
URTH1	TXD1	5-6
	RXD1	7-8
URTH2	TXD2	9-10
	RXD2	11-12

Table 6. URTHn signal jumpers

To connect the RS-232 bus driver signals to the RS-232 / LIN bus connecters close the following jumpers:

Signal		Connector	Pin #
URTH0	TXD0	P1	1-2
	RXD0		3-4
	GND		5-6
URTH1	TXD1	P2	1-2
	RXD1		3-4
	GND		5-6
URTH2	TXD2	P3	1-2
	RXD2		3-4
	GND		5-6

Table 7. RS-232 signal jumpers

To enable RS-232 transmission the disable Jumper must be removed from the corresponding RS232 transceiver. In addition the corresponding LIN-Transceiver must be send into SLEEP-Mode, otherwise it will disturb the transmission by limiting the level on RXD-Signal to 1,5V max. In most cases this high-level of 1,5V will not be recognized by the RS-232 controller.

To send LIN-Transceiver into SLEEP-Mode all 3 Jumpers must be removed from the LIN-Transceiver!

A falling edge must be generated on the NSLP-pin. This can either be done by setting and immediately removing the NSLP-Jumper after powering the board or by connecting both pins of the NSLP-Jumper via a 4,7nF capacity. By this the potential on the NSLP-Pin will follow the 5V power up and then it will be pulled down by the NSLP-Pin internal pull down resistor. This will generate the required falling edge.

2.6.2 LIN Transmission

To connect the LIN bus driver signals to the related RS-232/LIN bus connector close the following jumpers:

Signal		Connector	Pin #
LIN0	12V	P1	7-8
	LIN		9-10
	GND		11-12
		JP30	1-2
LIN1	12V	P2	7-8
	LIN		9-10
	GND		11-12
LIN2	12V	P3	7-8
	LIN		9-10
	GND		11-12
		JP31	1-2
LIN3	12V	P5	7-8
	LIN		9-10
	GND		11-12
LIN4	12V	P6	7-8
	LIN		9-10
	GND		11-12
LIN5	12V	P7	7-8
	LIN		9-10
	GND		11-12

Table 8. LIN bus signal jumpers

To enable the LIN drivers (IC3, IC4, IC5, IC6, IC7, IC8) the NSLP pin of the drivers must be pulled high. To do so a Jumper is available to connect the pin to VDD.

LIN channel	NLSP Jumper
0	JP3
1	JP7
2	JP10
3	JP14
4	JP17
5	JP21

Table 9. LIN NLSP Pin

At same time the RS232 Transceiver RX Pin must be disabled for the LIN-enabled channel. This must be done by the Disable Jumper connected to the EN-Pin of RS232 Transceiver.

LIN channel	RS232 Jumper
0	JP5
1	JP5
2	JP12
3	JP12
4	JP18
5	JP18

Table 10. LIN RS232 Jumper

Note: The Disable Jumper will disable 2 channels at same time!

The RxD pin of the LIN driver (pin #1) is an open drain output. The necessary pull-up resistor in order to interface to the Px4 device is not assembled on the board. To enable operation of the RxD signal user has either

- To connect an appropriate pull up resister to the related RxD input pin of the LIN channel,

Or

- To enable the internal Pull-Up resistors available in the Px4 devices for each LIN input pin.

For additional information on the LIN driver refer to its User's Manual / Datasheet.

2.7 CAN

Power is permanently supplied to the CAN drivers by VCC5 and VCC3.3 and VCC15. These power lines are decoupled from Px4 power supply areas VDDC, VDDM, VDD, LVDD.

Close the following jumpers to physically connect the devices CAN signals to the CAN interface drivers located on the Functional Area of the board:

Signal		CN9
FCN0	CTXD0	1-2
	CRXD0	3-4
FCN1	CTXD1	5-6
	CRXD1	7-8
FCN2	CTXD2	9-10
	CRXD2	11-12
FCN3	CTXD3	13-14
	CRXD3	15-16
FCN4	CTXD4	17-18
	CRXD4	19-20
FCN5	CTXD5	21-22
	CRXD51	23-24
FCN6		25-26
	CRXD6	27-28 Note

Table 11. FCNn signal jumpers

Note: CAN6 of V850E2/Px4 is for diagnosis purpose and has only receive functionality. The physical interface on the Px4-Board is shared with the one for CAN5. Please make sure to jumper only one of them.

2.8 FlexRay

Power is permanently supplied to the FlexRay drivers by VCC5 and VCC3.3 and VCC15. These power lines are decoupled from Px4 power supply areas VDDC, VDDM, VDD, LVDD.

Close the following jumpers to physically connect the devices FlexRay signals to the FlexRay interface drivers located on the Functional Area of the board:

Signal		CN5a
FlexRay	FTXDA	1-2
	FRXDA	3-4
	FTXENA	5-6
	FTXDB	7-8
	FRXDB	9-10
	FTXENB	11-12

Table 12. FlexRay signal jumpers

Note: To control the operating mode of FlexRay interface drivers, the following jumpers have to be closed:

Signal	CN5
FR_EN1	1-2
FR_EN2	3-4
FR_STBN1	5-6
FR_STBN2	7-8
FR_WAKE1	9-10
FR_WAKE2	11-12
FR_RXEN1	13-14
FR_RXEN2	15-16
FR_ERRN1	17-18
FR_ERRN2	19-20

Table 13. FlexRay control jumpers

To connect the FlexRay bus driver signals to the related FlexRay bus connector close the following jumpers according to your requirements (refer to the AB-050-PJ4-Schematics for details):

Signal		Connector	Pin #
FlexRay	CH0_A	J6	x-y
	CH0_B	J7	x-y
	CH1_A	J8	x-y
	CH1_B	J9	x-y

Table 14. FlexRay bus jumpers

To terminate the FlexRay bus close the following jumpers:

Signal		Connector	Pin #
FlexRay	CH0_A	J4	1-2
	CH0_B	J5	1-2
	CH1_A	J10	1-2
	CH1_B	J11	1-2

Table 15. FlexRay bus termination jumpers

3. FlexRay / UART / LIN / CAN DSUB connectors

To physically connect the Starter Board to other UART / LIN / CAN devices DSUB type connectors are available.

3.1 UART / LIN connectors

To interface the AB-050-Px4 board to external to UART / LIN devices a 9 pin male D-SUB connector is supplied for each of the six available UART / LIN interfaces.

The signal layout of the UART/LIN DSUB connector can be seen in Table 16.

Male D-SUB, 9pin	Function
1	n/c
6	n/c
2	RS-232 TxD
7	LIN
3	RS-232 RxD or GND
8	n/c
4	n/c
9	+12V
5	GND

Table 16. UART / LIN DSUB connectors

3.2 FlexRay connectors

To interface the AB-050-Px4 board to external to FlexRay devices a 9 pin male D-SUB connector is supplied for each of the two available FlexRay interfaces.

The signal layout of the FlexRay D-SUB connector can be seen in Table 17.

Male D-SUB, 9pin	Function
1	n/c
6	n/c
2	CH0_A or CH1_A
7	CH0_B or CH1_A
4	CH0_A or CH1_A
8	CH0_B or CH1_A
3	n/c
9	n/c
5	n/c

Table 17. FlexRay DSUB connectors

Figure 3 displays the assignment of each DSUB connector to its related peripheral:

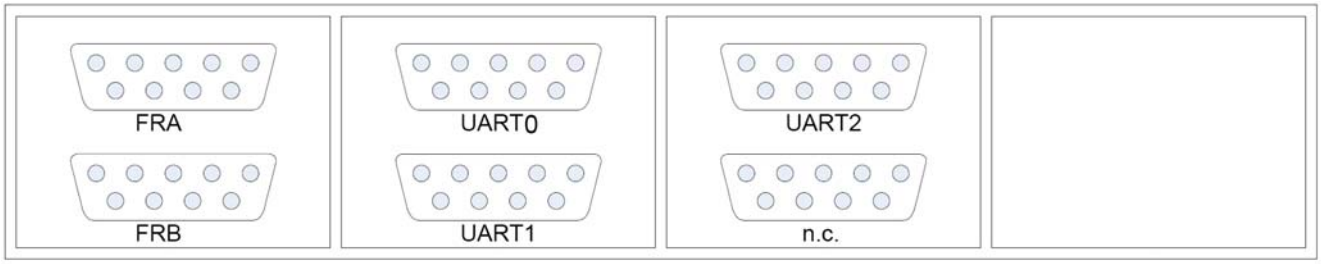

Figure 3. FlexRay / UART / LIN DSUB connectors

3.3 CAN connectors

To interface the AB-050-Px4 board to external CAN devices a 9 pin female D-SUB connector is supplied for each of the six available CAN interfaces.

The pin functions of the CAN DSUB connectors can be seen in Table 18.

Male D-SUB, 9pin	Function
1	n/c
6	GND
2	CANL
7	CANH
3	GND (if jumpered)
8	n/c
4	n/c
9	n/c
5	n/c

Table 18. CAN DSUB connectors

Figure 4displays the assignment of each DSUB connector to its related peripheral:

Figure 4. CAN DSUB connectors

3.4 Pin connection

The pin connection, which is described below, is already done on the board.

3.4.1 Power supply pins

Connect the devices power supply pins to the related power lines using the available SMD pads in the Pin Patch Areas.

Refer to the V850E2/Px4 User's Manual and Electrical Target Specification for the location of the VDD and VSS pins on the different devices.

Connect the VDD and VSS pins in the Pin Patch Areas like this:

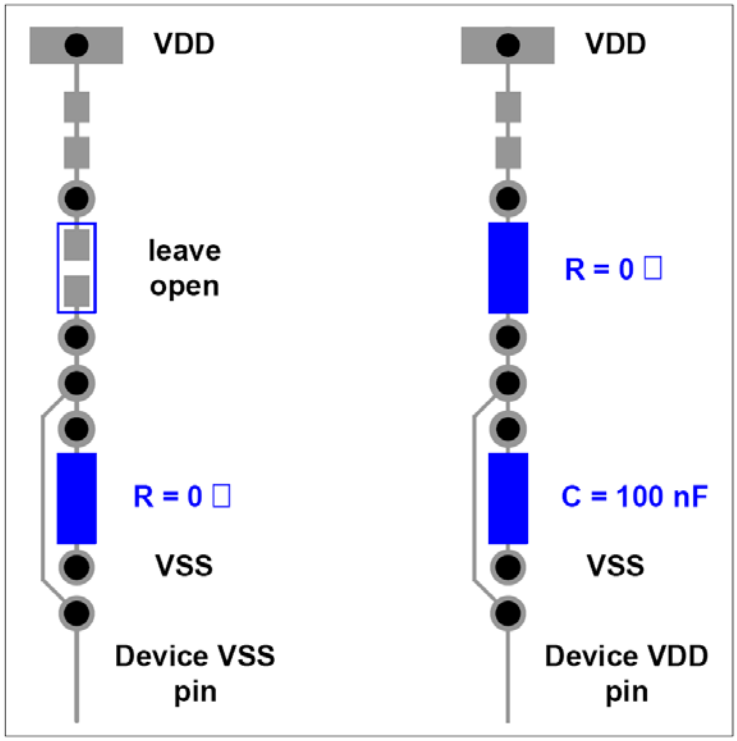

Figure 5. Device power supply

To connect the devices VSS pins to the VSS lane of the board place a 0 Ohm resistor on the SMD1 pad.

To connect the devices VDD pins to the VDD lane of the board place a 0 Ohm resistor on the SMD2 pad and place a 100 nF buffering capacitor on the SMD1 pad.

3.4.2 REGC pin

A buffering capacitor between the devices REGC pin(s) and VSS should be placed. Assemble the capacitor to the SMD1 pad field.

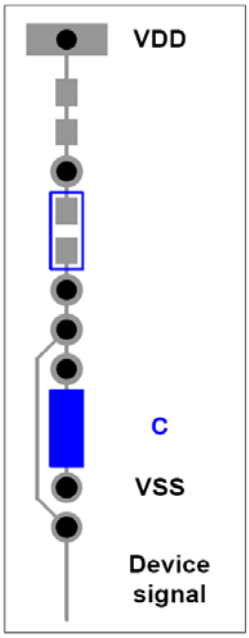

Figure 6. REGC pin components

Refer to the Px4 User's Manual and Electrical Target Specification for the location of the REGC pin on the different devices.

3.4.3 X1, X2 pins

The external crystal can be connected to the socket Q1. Alternatively An external oscillator can be connected to the X1 and X2 pins of the device. Connect the oscillator between the X1 and X2 pins and place a small capacitor on the SMD1 areas of those pins. For size of the capacitor refer to the oscillator manufacturer specification / recommendation.

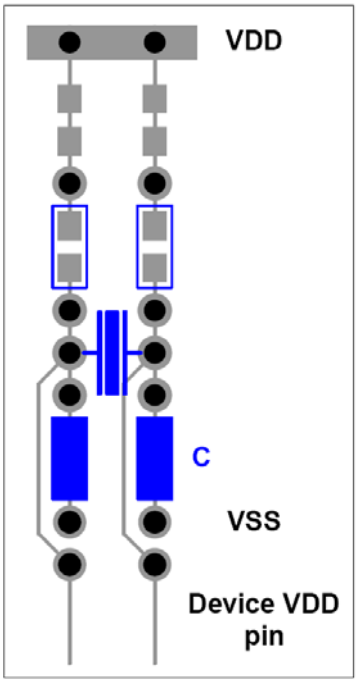

Figure 7. X1, X2 pin components

In this case you have to connect the J25 and J26 with solder.

Refer to the Px4 User's Manual and Electrical Target Specification for the location of the X1 and X2 pins on the different devices.

3.4.4 XT1, FLMD0

A pull-down resistor should be connected to input pin FLMD0.

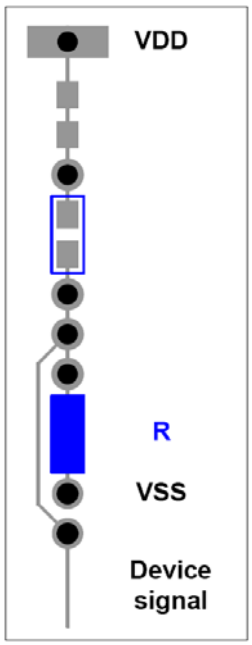

Figure 8. Pins with Pull-Down

Refer to the Px4 User's Manual and Electrical Target Specification for the location of the FLMD0 pins on the different devices.

3.5 Functional pin connection

As the routing of the functional signals (Reset, UARTHn, CANn, NWIRE and FP5) between the device SMD pad area and the Jumpers connecting the Electrical Area and Functional Area is based on the Px4 device, the routing of those signals for other Px4 devices must be place manually.

To do so, connect a wire between the device pin (e.g. from one of the through holes in the Pin Patch areas) and the functional side of the related signal jumper.

Caution: Do not close the related Jumpers of any of the newly routed signals as this can lead to a direct connection between different device pins. Be aware that no further disconnection by the use of jumpers between the Electrical Area and Functional Area is possible after wiring the signals for other than Px4 devices.

3.5.1 Jumper and connector overview

The location of all jumpers located on the board can be seen in the Figure 9.

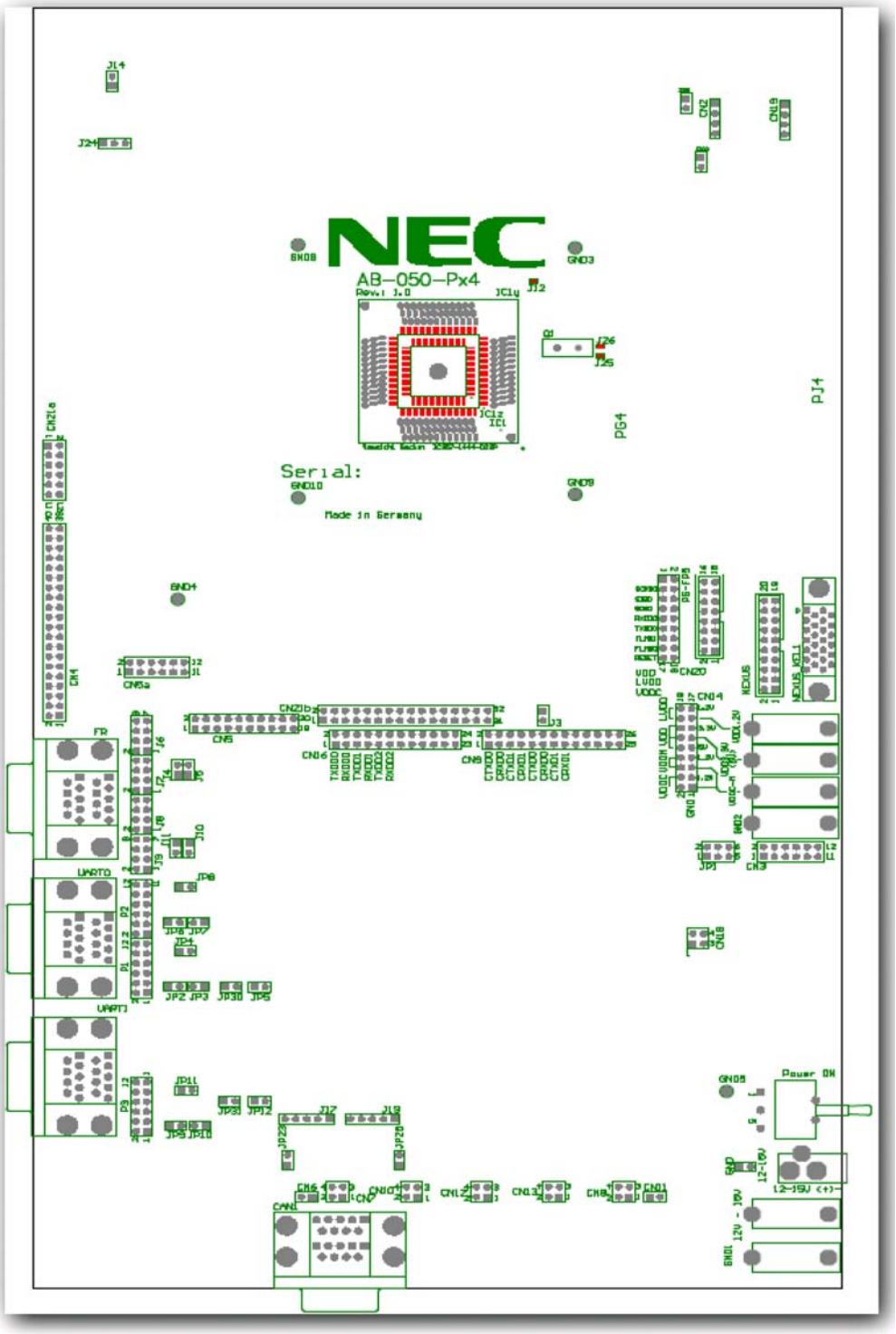

Figure 9. Jumper and connector location

4. Revision History

Version	Chapter	Comment
0.1-0.4		Initial releases incl. bug fixes
0.5-0.6		Modification due to merger of Renesas Technologies and NEC Electronics.
0.7		Socket board schematics attached.
0.8		Included information: KEL connector not supported.
0.09		Modified document template and document numbering format.

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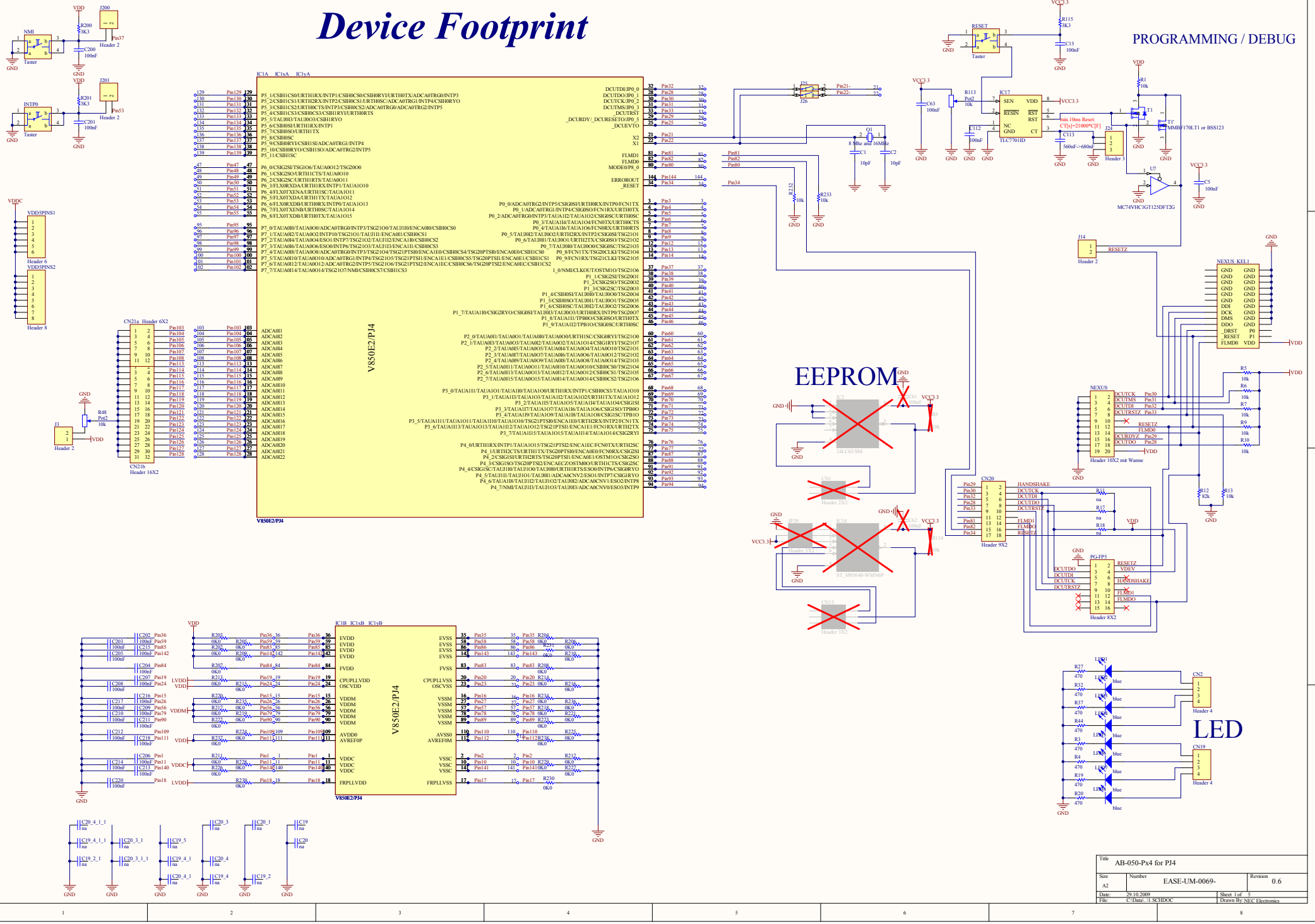
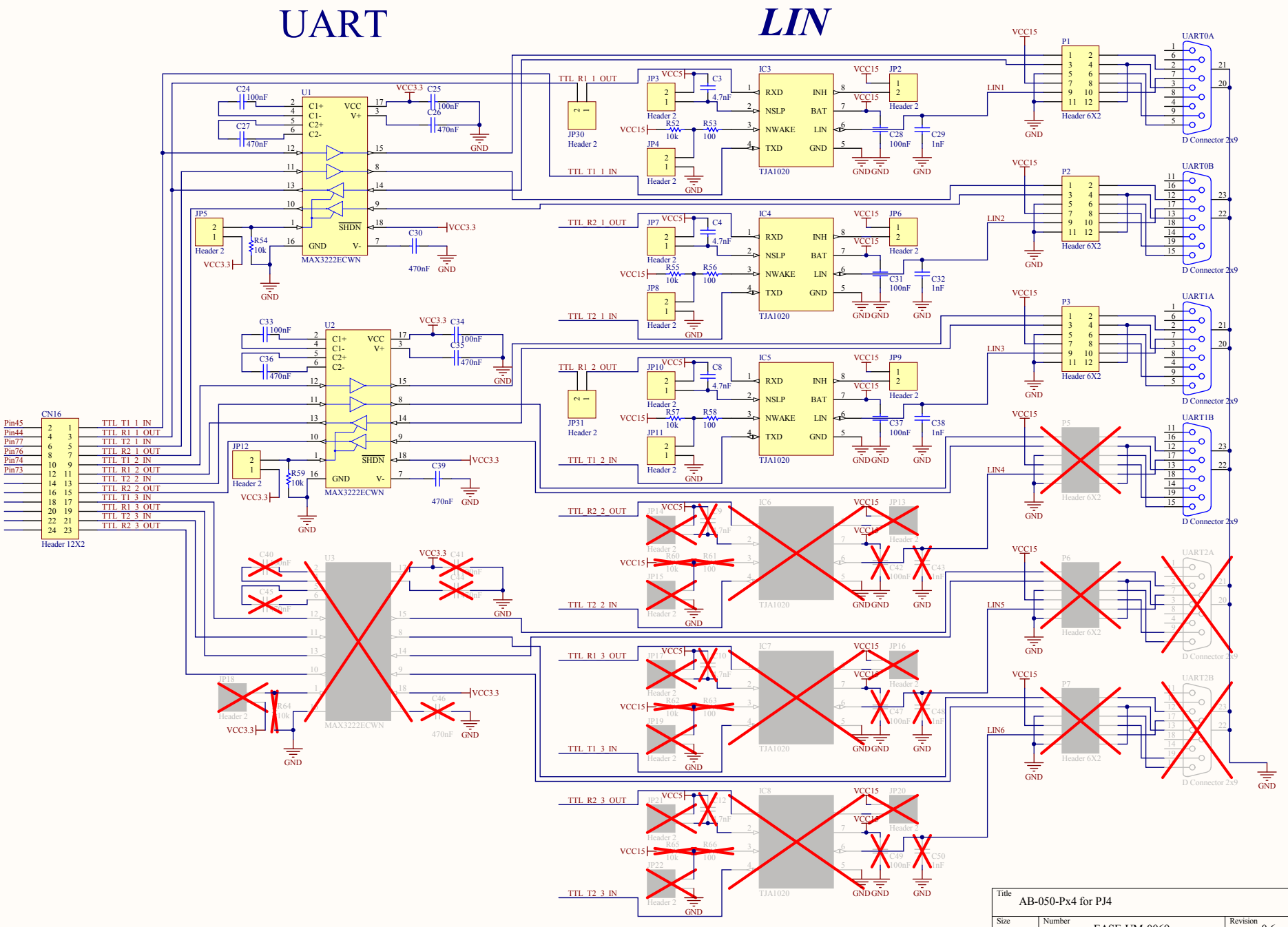
Renesas Electronics Taiwan Co., Ltd.
7F, No. 363 Fu Shing North Road Taipei, Taiwan
Tel: +886-2-8175-9600, Fax: +886 2-8175-9670
Renesas Electronics Singapore Pte. Ltd.
1 harbourFront Avenue, #06-10, keppel Bay Tower, Singapore 098632
Tel: +65-6213-0200, Fax: +65-6278-8001
Renesas Electronics Malaysia Sdn.Bhd.
Unit 906, Block B, Menara Amcorp, Amcorp Trade Centre, No. 18, Jln Persiaran Barat, 46050 Petaling Jaya, Selangor Darul Ehsan, Malaysia
Tel: +60-3-7955-9390, Fax: +60-3-7955-9510
Renesas Electronics Korea Co., Ltd.
11F., Samik Lavied' or Bldg., 720-2 Yeoksam-Dong, Kangnam-Ku, Seoul 135-080, Korea
Tel: +82-2-558-3737, Fax: +82-2-558-5141

V850E2/Px4 Application Board

Device Footprint





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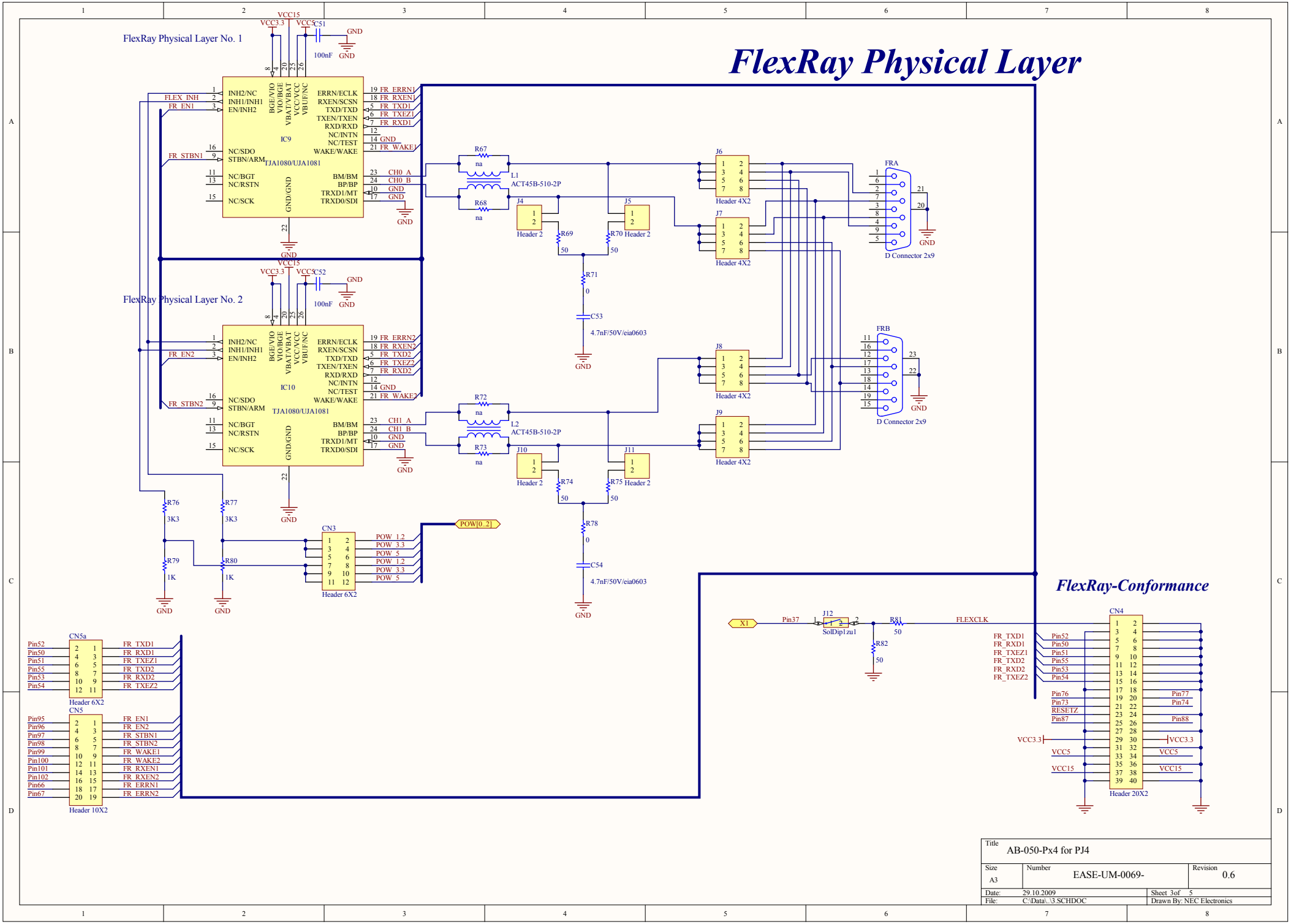
Date: 29.10.2009		Sheet 2 of 5	
File: C:\Data\..\2.SCHDOC		Drawn By: NEC Electronics	

FlexRay Physical Layer



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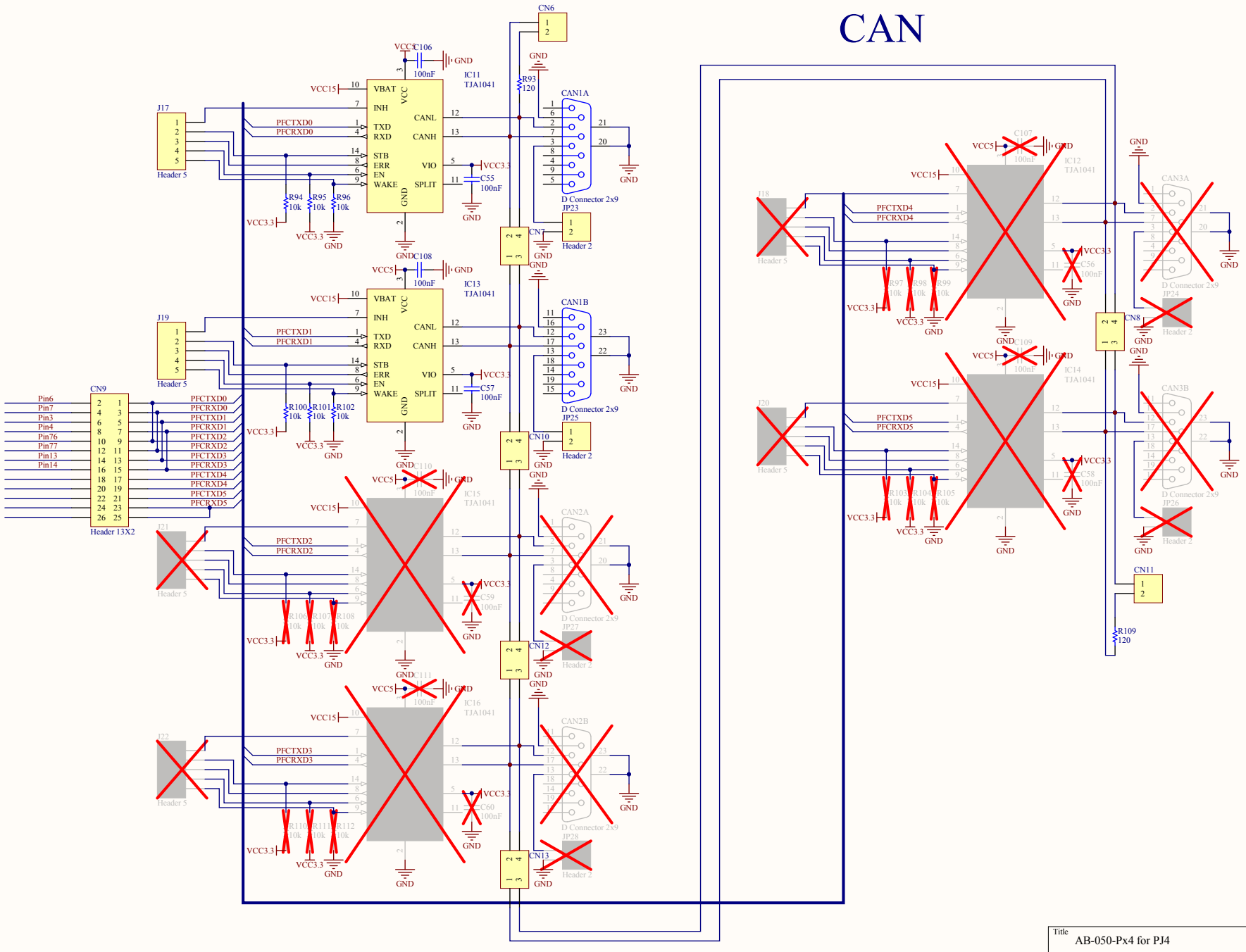
File: C:\Data\..\3.SCHDOC	Drawn By: NEC Electronics	

CAN



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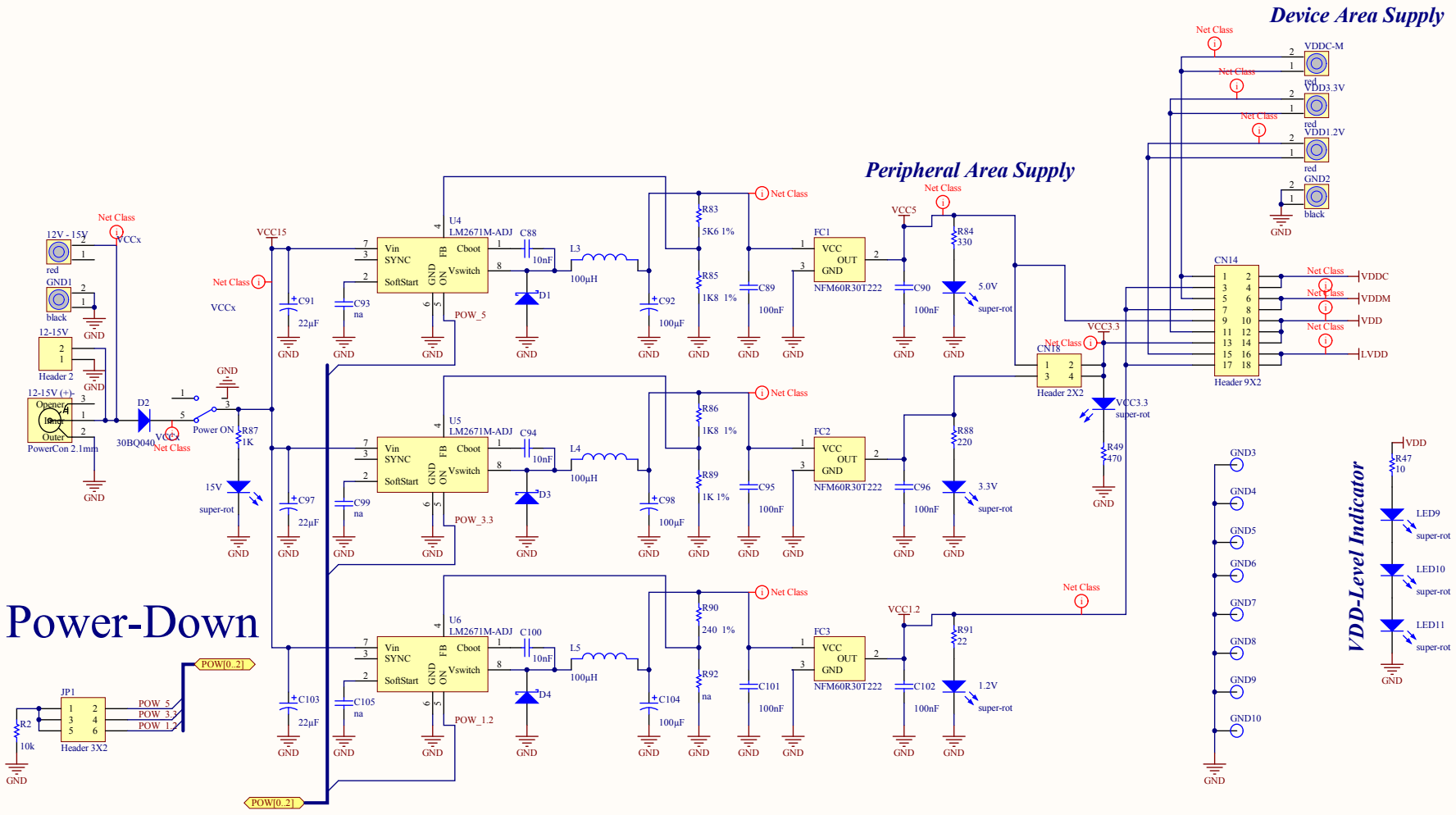
Power Supply



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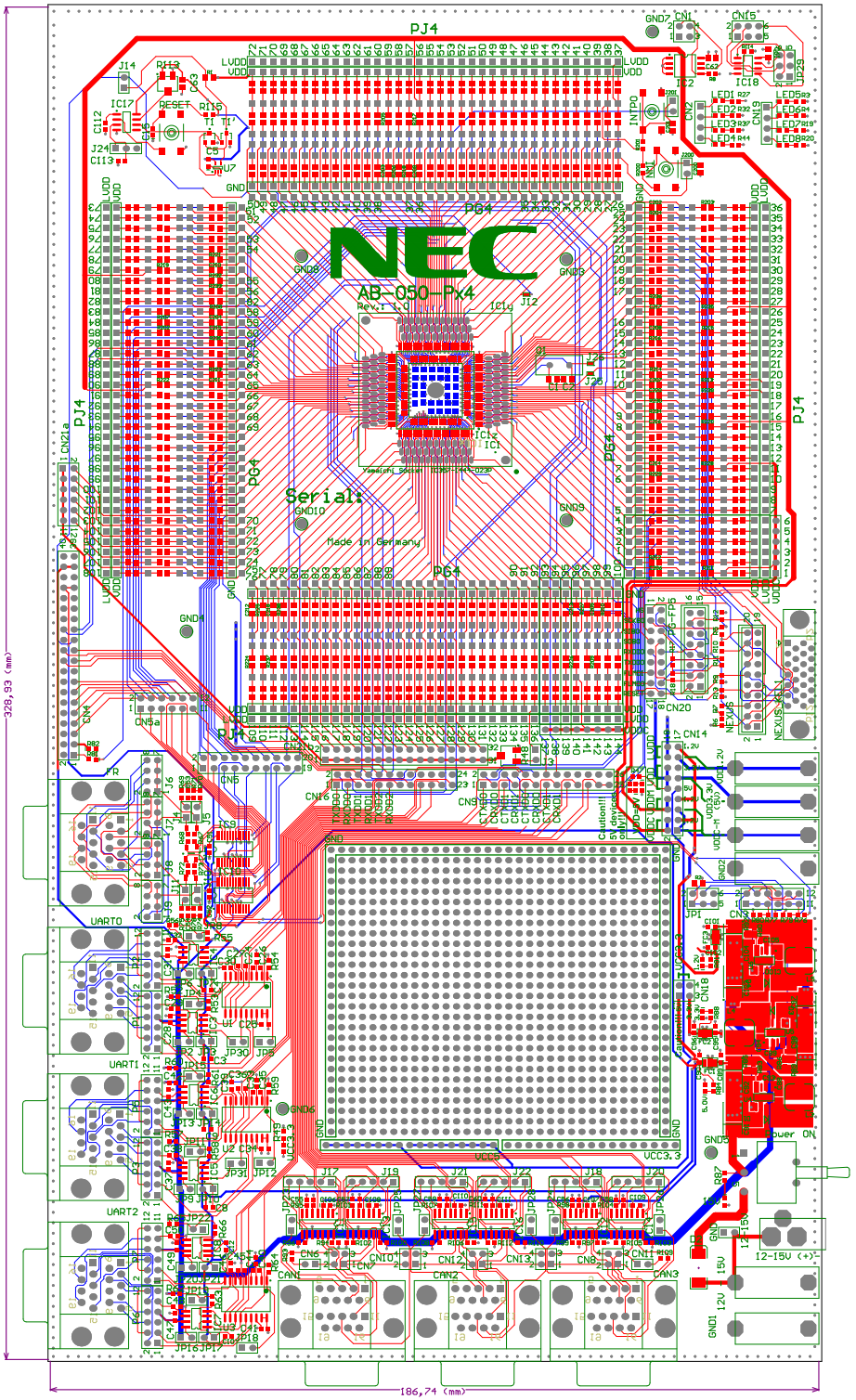
NEC
AB-050-Px4
Serial:
Made in Germany
328,93 (mm)
186,74 (mm)