User´s Manual

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RH850 Evaluation Platform

# RH850/F1x 80pin
# RH850/R1x 80pin
# RH850/F1Kx 80pin

# PiggyBack board V1

## Y-RH850-F1X-080PIN-PB-T1-V1

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R20CS0004ED0140, Rev. 1.40
2018-11-23

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## General Precautions in the Handling of Microprocessing Unit and Microcontroller Unit Products

The following usage notes are applicable to all Microprocessing unit and Microcontroller unit products from Renesas. For detailed usage notes on the products covered by this document, refer to the relevant sections of the document as well as any technical updates that have been issued for the products.

1. Handling of Unused Pins
   Handle unused pins in accordance with the directions given under Handling of Unused Pins in the manual.
   – The input pins of CMOS products are generally in the high-impedance state. In operation with an unused pin in the open-circuit state, extra electromagnetic noise is induced in the vicinity of LSI, an associated shoot-through current flows internally, and malfunctions occur due to the false recognition of the pin state as an input signal become possible. Unused pins should be handled as described under Handling of Unused Pins in the manual.
2. Processing at Power-on
   The state of the product is undefined at the moment when power is supplied.
   – The states of internal circuits in the LSI are indeterminate and the states of register settings and pins are undefined at the moment when power is supplied.
   In a finished product where the reset signal is applied to the external reset pin, the states of pins are not guaranteed from the moment when power is supplied until the reset process is completed.
   In a similar way, the states of pins in a product that is reset by an on-chip power-on reset function are not guaranteed from the moment when power is supplied until the power reaches the level at which resetting has been specified.
3. Prohibition of Access to Reserved Addresses
   Access to reserved addresses is prohibited.
   – The reserved addresses are provided for the possible future expansion of functions. Do not access these addresses; the correct operation of LSI is not guaranteed if they are accessed.
4. Clock Signals
   After applying a reset, only release the reset line after the operating clock signal has become stable.
   When switching the clock signal during program execution, wait until the target clock signal has stabilized.
   – When the clock signal is generated with an external resonator (or from an external oscillator) during a reset, ensure that the reset line is only released after full stabilization of the clock signal.
   Moreover, when switching to a clock signal produced with an external resonator (or by an external oscillator) while program execution is in progress, wait until the target clock signal is stable.
5. Differences between Products
   Before changing from one product to another, i.e. to a product with a different part number, confirm that the change will not lead to problems.
   – The characteristics of Microprocessing unit or Microcontroller unit products in the same group but having a different part number may differ in terms of the internal memory capacity, layout pattern, and other factors, which can affect the ranges of electrical characteristics, such as characteristic values, operating margins, immunity to noise, and amount of radiated noise. When changing to a product with a different part number, implement a system-evaluation test for the given product.

# Table of Contents

# Chapter 1 Introduction

The RH850/F1x & RH850/R1x Application Board is part of the RH850 Evaluation Platform and serves as a simple and easy to use platform for evaluating the features and performance of Renesas Electronics 32-bit RH850/F1x & RH850/R1x microcontrollers. The piggyback board (Y-RH850-F1X-080PIN-PB-T1-V1) can be used as a standalone board, or can be mated with a mainboard (e.g. Y-RH850-X1X-MB-Tx-Vx) for extended functionality.

Main features:

- Socket for mounting of device
- Standalone operation of the board
- Direct supply of device voltage (typ. 3.3V-5.0V)
- Device programming capability
- Device debugging capability
- Pin headers for direct access to each device pin
- Reset switch
- MainOSC circuitry
- Connectors to MainBoard

This document describes the functionality provided by the piggyback board and guides the user through its operation.

# Chapter 2 Overview

## 2.1 Overview

Figures 1 and 2 provide the views of the Piggyback Board.

Device pin #1

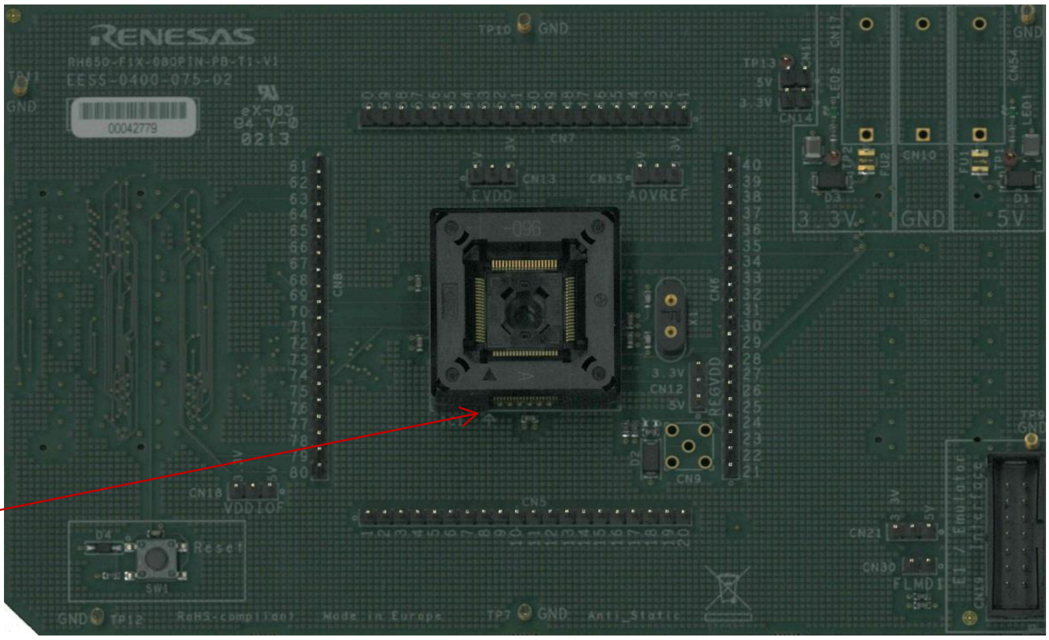



*Figure 1 – PiggyBoard top view*

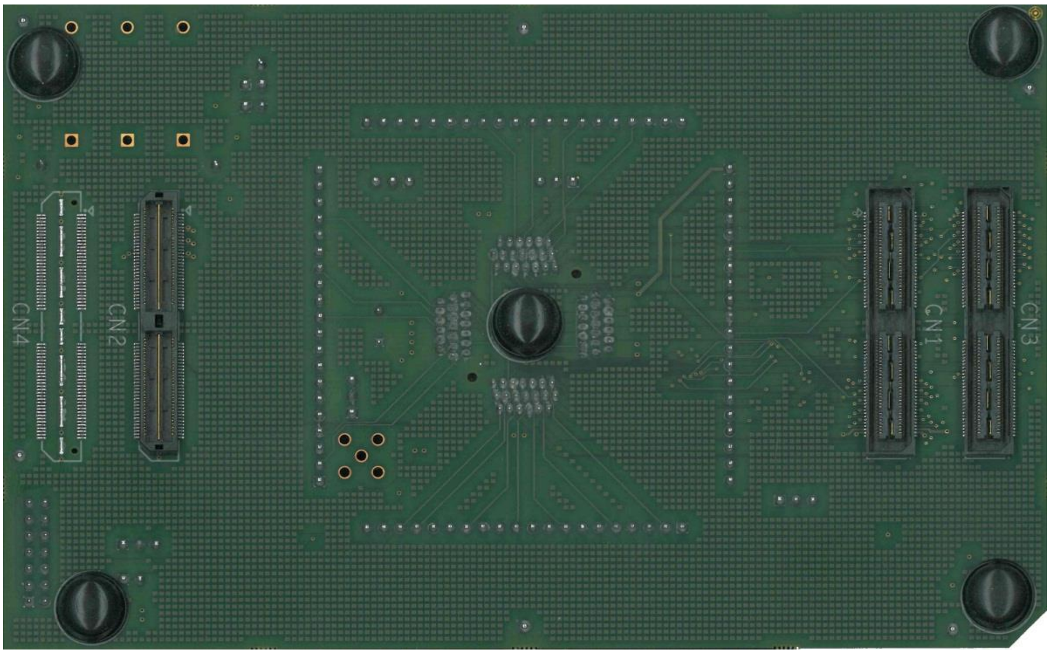



*Figure 2 – PiggyBoard bottom view*

## 2.2 Mounting of the device

The board is designed for use with the following devices:

- RH850/F1L 80pin
- RH850/R1x 80pin
- RH850/F1KM-S1 80pin

The device must be placed inside the socket IC1. To insert the device, press down the lid, align the #1 pin of the device to the #1pin of the socket, insert the device inside the socket and release the lid.

For details regarding the operation of the microcontrollers, refer to the RH850/F1L,RH850/R1x or RH850/F1KM User’s Manual.

# Chapter 3 Power supply

## 3.1 Board power connections

For operation of the device, a supply voltage must be connected to the board. Though a single supply voltage is sufficient for the operation of the device, two (different) voltages can be supplied to the board.

Within this document the following voltages are considered as 'typical' connections:

*Voltage1* = 5.0V

*Voltage2* = 3.3V

The following connectors are available to supply those voltages:

- Three 4mm 'banana-type' connectors:
  - Two red connectors for voltages *Voltage1* (CN54) and *Voltage2* (CN17).
  - A black connector for VSS connection (CN10).

  **Note:** The three connectors are supplied with the board but not assembled.
- The E1 emulator that is used for debug purposes and flash programming can also supply a single operating voltage ('Dbg_Voltage').
  The voltage is programmable via the E1 GUI as 3.3 or 5.0V (typ).
  See the documentation of the E1 and chapter 5 'Debug and Programming interface' for details.
- In case the PiggyBoard is mounted on a MainBoard, the voltages *Voltage1* and *Voltage2* are supplied by the on-board regulators of the MainBoard.

***NOTE:*** *Do not supply any voltage directly to the PiggyBoard in case it is mounted on the MainBoard.*

For each of the two voltages, 'Voltage 1 ' and 'Voltage 2', a green LED (LED1 and LED2) is available to signal that the related voltage is available on the PiggyBoard.

## 3.2 Voltage distribution

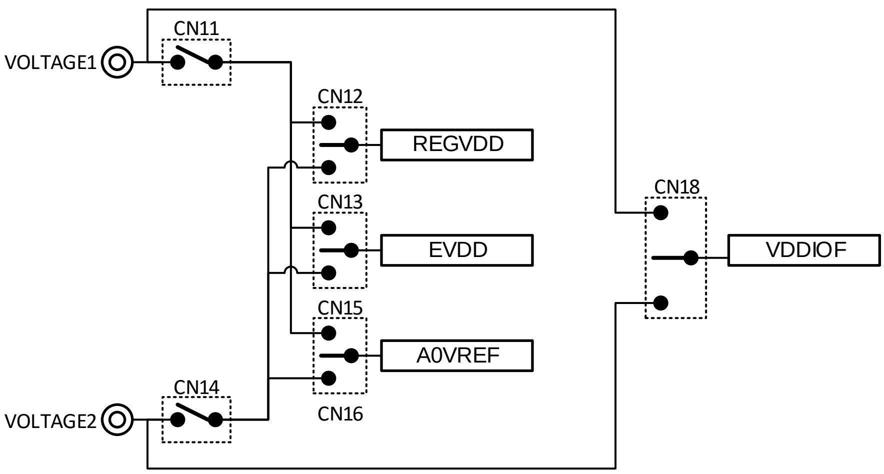
The table shows the required device power supply pins and their function:

| Device supply pin | Function |
|---|---|
| REGVDD | Supply for the device internal regulators for the digital logic. |
| EVDD | Supply for ports of AWO/ISO area. |
| A0VREF | Supply for ports and analog functions of ADC0. |

Additionally one power supply for MainBoard can be selected:

| Supply voltage | Function |
|---|---|
| VDDIOF | IO supply voltage for components located on a connected mainboard. |

For each of the above voltages, the voltage source can be selected from *Voltage1* (typ. 5.0V) or *Voltage2* (typ. 3.3V) by the jumpers CN12, CN13, CN15, CN18, respectively the jumpers CN11 and CN14.



# Chapter 4 Clock sources

An external crystal oscillator for the device clock supply is provided with the board.

### 4.1.1 MainOsc

A crystal or ceramic resonator in the range of 8MHz to 24MHz can be mounted on socket X1.

A 8MHz and 16Mhz oscillator is supplied with the board.

# Chapter 5 Debug and Programming interface

For connection of the microcontroller debug and flash programming tools, the connector CN19 is provided.

The signal connection of the connector CN19 is shown in the picture below:

| CN19 pin | Device Port | Device signal |
|---|---|---|
| 1 | JP0_2 | DCUTCK / LPDCLK |
| 2 | GND | GND |
| 3 | JP0_4 | DCUTRST |
| 4 | FLMD0 | FLMD0 |
| 5 | JP0_1 | DCUTDO / LPDO |
| 6 | P10_8* | FLMD1 |
| 7 | JP0_0 | DCUTDI / LPDI |
| 8 | 'Dbg_Voltage' | - |
| 9 | JP0_3 | DCUTMS |
| 10 | - | - |
| 11 | JP0_5 | DCURDY / LPDCLKOUT |
| 12 | GND | - |
| 13 | RESET | - |
| 14 | GND | - |

* When using the debug and programming interface, the pin header CN30 must be closed.

Refer to chapter "3.1 Board power connections" for information about the 'Voltage 1' connection on CN19 pin 8.

The 'Dbg_Voltage' (on CN19 pin 8) is monitored or supplied by the debug and flash programming tools. Therefore, it is necessary to select either Voltage1 (5V) or the Voltage2 (3.3V) by pin header CN21:

| CN21 pin | Selection for Dbg_Voltage |
|---|---|
| 1-2 | 5V is selected |
| 2-3 | 3.3V is selected |

# Chapter 6 Connectors for ports of device

Connection to each pin of the device is possible via the connectors CN5 to CN8.

*Note :The pin headers are directly connected to the pins, therefore special care must be taken to avoid any electrostatic or other damage to the device.*

## 6.1 Push button for RESET

In order to issue a RESET to the device, the push-button SW1 is available.

## 6.2 Connectors to MainBoard

Three connectors (CN1 to CN3) are available to connect the PiggyBoard to a MainBoard.

The signal connection of each connector is described in the following tables:

### 6.2.1 Connector CN1

| Pin | Function | Device Port | | Pin | Function | Device Port |
|---|---|---|---|---|---|---|
| 1 | VDDA | - | | 2 | VDDA | - |
| 3 | VDDA | - | | 4 | VDDA | - |
| 5 | RESET | _RESET | | 6 | NMI | P9_0 |
| 7 | WAKE | - | | 8 | - | - |
| 9 | INT0 | P9_1 | | 10 | INT1 | P0_6 |
| 11 | INT2 | P9_2 | | 12 | INT3 | P9_3 |
| 13 | - | - | | 14 | - | - |
| 15 | UART0TX | P10_10 | | 16 | UART1TX | P0_5 |
| 17 | UART0RX | P10_9 | | 18 | UART1RX | P0_4 |
| 19 | LIN0TX | P10_10 | | 20 | LIN1TX | P0_8 |
| 21 | LIN0RX | P10_9 | | 22 | LIN1RX | P0_7 |
| 23 | IIC0SDL | P10_3 | | 24 | IIC1SDL | - |
| 25 | IIC0SDA | P10_2 | | 26 | IIC1SDA | - |
| 27 | CAN0TX | P10_1 | | 28 | CAN1TX | P0_3 |
| 29 | CAN0RX | P10_0 | | 30 | CAN1RX | P0_2 |
| 31 | SENTIN0 | - | | 32 | SENTIN1 | - |
| 33 | SENTOUT0 | - | | 34 | SENTOUT1 | - |
| 35 | PSI50Rx | - | | 36 | PSI51Rx | - |
| 37 | PSI50Tx | - | | 38 | PSI51Tx | - |
| 39 | PSI50Snyc | - | | 40 | PSI51Sync | - |
| 41 | FLX0TX | P11_1 | | 42 | FLX0EN | P10_11 |
| 43 | FLX0RX | P10_14 | | 44 | - | - |

| | | | | | |
|---|---|---|---|---|---|
| 45 | FLX1TX | - | 46 | FLX1EN | - |
| 47 | FLX1RX | - | 48 | - | - |
| 49 | - | - | 50 | - | - |
| 51 | ETH0MDIO | - | 52 | ETH0MDC | - |
| 53 | ETH0RXD0 | - | 54 | EH0TXD0 | - |
| 55 | ETH0RXD1 | - | 56 | EH0TXD1 | - |
| 57 | ETH0RXD2 | - | 58 | EH0TXD2 | - |
| 59 | ETH0RXD3 | - | 60 | EH0TXD3 | - |
| 61 | ETH0RXDCLK | - | 62 | ETH0TXCLK | - |
| 63 | ETH0RXER | - | 64 | ETH0TXER | - |
| 65 | ETH0CRSDV | - | 66 | ETH0TXEN | - |
| 67 | ETH0RXDV | - | 68 | ETH0COL | - |
| 69 | ETH0RESET | - | 70 | - | - |
| 71 | - | - | 72 | - | - |
| 73 | USB0UDMF | - | 74 | USB0UDMH | - |
| 75 | USB0UDPF | - | 76 | USB0UDPH | - |
| 77 | - | - | 78 | - | - |
| 79 | - | - | 80 | - | - |
| 81 | - | - | 82 | - | - |
| 83 | - | - | 84 | - | - |
| 85 | F1L: DIGIO_0<br>R1x: CVMOUT | F1L: P8_0<br>R1x: CVMOUT | 86 | DIGIO_1 | P8_1 |
| 87 | DIGIO_2 | P8_2 | 88 | DIGIO_3 | P8_3 |
| 89 | DIGIO_4 | P8_4 | 90 | DIGIO_5 | P8_5 |
| 91 | DIGIO_6 | P8_6 | 92 | DIGIO_7 | P11_0 |
| 93 | DIGIO_8 | P10_0 | 94 | DIGIO_9 | P10_7 |
| 95 | DIGIO_10 | P10_8 | 96 | DIGIO_11 | P10_15 |
| 97 | DIGIO_12 | P0_9 | 98 | DIGIO_13 | P0_10 |
| 99 | DIGIO_14 | P0_11 | 100 | DIGIO_15 | P0_12 |
| 101 | - | - | 102 | - | - |
| 103 | MUX0 | P10_4 | 104 | MUX1 | P10_5 |
| 105 | MUX2 | P10_6 | 106 | - | - |
| 107 | ADC0 | AP0_0 | 108 | ADC1 | AP0_1 |
| 109 | ADC2 | AP0_2 | 110 | ADC3 | AP0_3 |
| 111 | ADC4 | AP0_4 | 112 | ADC5 | AP0_5 |
| 113 | ADC6 | AP0_6 | 114 | ADC7 | AP0_7 |
| 115 | VDDIOF | - | 116 | VDDIOF | - |
| 117 | VDDB | - | 118 | VDDB | - |
| 119 | VDDB | - | 120 | VDDB | - |

### 6.2.2 Connector CN2

| Pin | Function | Device Port | Pin | Function | Device Port |
|---|---|---|---|---|---|
| 1 | CAN2Tx | - | 2 | CAN3Tx | - |
| 3 | CAN2Rx | - | 4 | CAN3Rx | - |
| 5 | CAN4Tx | - | 6 | CAN5Tx | - |
| 7 | CAN4Rx | - | 8 | CAN5Rx | - |
| 9 | LIN2Tx | P0_10 | 10 | LIN3Tx | - |
| 11 | LIN2Rx | P0_9 | 12 | LIN3Rx | - |
| 13 | LIN4Tx | - | 14 | LIN5Tx | - |
| 15 | LIN4Rx | - | 16 | LIN5Rx | - |
| 17 | LIN6Tx | P0_12 | 18 | LIN7Tx | - |
| Q | LIN6Rx | P0_11 | 20 | LIN7Rx | - |
| 21 | LIN8Tx | - | 22 | LIN9Tx | - |
| 23 | LIN8Rx | - | 24 | LIN9Rx | - |
| 25 | LIN10Tx | P10_10 | 26 | LIN11Tx | P0_5 |
| 27 | LIN10Rx | P10_9 | 28 | LIN11Rx | P0_4 |
| 29 | LIN12Tx | - | 30 | LIN13Tx | - |
| 31 | LIN12Rx | - | 32 | LIN13Rx | - |
| 33 | LIN14Tx | - | 34 | LIN15Tx | - |
| 35 | LIN14Rx | - | 36 | LIN15Rx | - |
| 37 | - | - | 38 | - | - |
| 39 | - | - | 40 | - | - |
| 41 | MLBCLK | - | 42 | MLBRESET | - |
| 43 | MLBSIG | - | 44 | MLBDAT | - |
| 45 | - | - | 46 | - | - |
| 47 | - | - | 48 | - | - |
| 49 | - | - | 50 | - | - |
| 51 | - | - | 52 | - | - |
| 53 | - | - | 54 | - | - |
| 55 | - | - | 56 | - | - |
| 57 | - | - | 58 | - | - |
| 59 | - | - | 60 | - | - |
| 61 | - | - | 62 | - | - |
| 63 | - | - | 64 | - | - |
| 65 | - | - | 66 | - | - |
| 67 | - | - | 68 | - | - |
| 69 | - | - | 70 | - | - |
| 71 | - | - | 72 | - | - |
| 73 | - | - | 74 | - | - |
| 75 | - | - | 76 | - | - |
| 77 | - | - | 78 | - | - |
| 79 | - | - | 80 | - | - |

| | | | | | |
|---|---|---|---|---|---|
| 81 | - | - | 82 | - | - |
| 83 | - | - | 84 | - | - |
| 85 | - | - | 86 | - | - |
| 87 | - | - | 88 | - | - |
| 89 | - | - | 90 | - | - |
| 91 | - | - | 92 | - | - |
| 93 | - | - | 94 | - | - |
| 95 | - | - | 96 | - | - |
| 97 | - | - | 98 | - | - |
| 99 | - | - | 100 | - | - |
| 101 | - | - | 102 | - | - |
| 103 | - | - | 104 | - | - |
| 105 | - | - | 106 | - | - |
| 107 | - | - | 108 | - | - |
| 109 | - | - | 110 | - | - |
| 111 | - | - | 112 | - | - |
| 113 | - | - | 114 | - | - |
| 115 | - | - | 116 | - | - |
| 117 | - | - | 118 | - | - |
| 119 | - | - | 120 | - | - |

### 6.2.3 Connector CN3

| Pin | Function | Device Port | Pin | Function | Device Port |
|---|---|---|---|---|---|
| 1 | PWM00 | P10_0 | 2 | PWM01 | P10_1 |
| 3 | PWM02 | P10_2 | 4 | PWM03 | P10_3 |
| 5 | PWM04 | P10_7 | 6 | PWM05 | P10_8 |
| 7 | PWM06 | P10_9 | 8 | PWM07 | P10_10 |
| 9 | PWM08 | P9_0 | 10 | PWM09 | P9_1 |
| 11 | PWM10 | P0_4 | 12 | PWM11 | P0_1 |
| 13 | PWM12 | P0_2 | 14 | PWM13 | P0_3 |
| 15 | F1L: PWM14<br>R1x: CVMOUT | F1L: P8_0<br>R1x: CVMOUT | 16 | PWM15 | P8_1 |
| 17 | PWM16 | P10_11 | 18 | PWM17 | P10_12 |
| Q | PWM18 | P10_13 | 20 | PWM19 | P10_14 |
| 21 | PWM20 | P9_2 | 22 | PWM21 | P9_3 |
| 23 | PWM22 | P8_2 | 24 | PWM23 | P8_3 |
| 25 | PWM24 | P10_15 | 26 | PWM25 | P11_0 |
| 27 | PWM26 | P11_1 | 28 | PWM27 | P11_2 |
| 29 | PWM28 | P11_3 | 30 | PWM29 | P11_4 |
| 31 | PWM30 | - | 32 | PWM31 | - |
| 33 | PWM32 | - | 34 | PWM33 | P9_4 |
| 35 | PWM34 | P9_5 | 36 | PWM35 | P9_6 |

| | | | | | |
|---|---|---|---|---|---|
| 37 | PWM36 | P8_4 | 38 | PWM37 | P8_5 |
| 39 | PWM38 | P8_6 | 40 | PWM39 | - |
| 41 | PWM40 | - | 42 | PWM41 | - |
| 43 | PWM42 | - | 44 | PWM43 | - |
| 45 | PWM44 | - | 46 | PWM45 | P0_12 |
| 47 | PWM46 | - | 48 | PWM47 | - |
| 49 | PWM48 | - | 50 | PWM49 | - |
| 51 | PWM50 | - | 52 | PWM51 | - |
| 53 | PWM52 | - | 54 | PWM53 | - |
| 55 | PWM54 | - | 56 | PWM55 | - |
| 57 | PWM56 | - | 58 | PWM57 | - |
| 59 | PWM58 | - | 60 | PWM59 | - |
| 61 | PWM60 | - | 62 | PWM61 | - |
| 63 | PWM62 | - | 64 | PWM63 | - |
| 65 | PWM64 | - | 66 | PWM65 | - |
| 67 | PWM66 | - | 68 | PWM67 | - |
| 69 | PWM68 | - | 70 | PWM69 | - |
| 71 | PWM70 | - | 72 | PWM71 | - |
| 73 | PWM72 | - | 74 | PWM73 | - |
| 75 | PWM74 | - | 76 | PWM75 | - |
| 77 | PWM76 | - | 78 | PWM77 | - |
| 79 | PWM78 | - | 80 | PWM79 | - |
| 81 | PWMADC00 | AP0_8 | 82 | PWMADC01 | AP0_9 |
| 83 | PWMADC02 | AP0_10 | 84 | PWMADC03 | - |
| 85 | PWMADC04 | - | 86 | PWMADC05 | - |
| 87 | PWMADC06 | - | 88 | PWMADC07 | - |
| 89 | PWMADC08 | - | 90 | PWMADC09 | - |
| 91 | PWMADC10 | - | 92 | PWMADC11 | - |
| 93 | PWMADC12 | - | 94 | PWMADC13 | - |
| 95 | PWMADC14 | - | 96 | PWMADC15 | - |
| 97 | - | - | 98 | - | - |
| 99 | - | - | 100 | - | - |
| 101 | - | - | 102 | - | - |
| 103 | - | - | 104 | - | - |
| 105 | - | - | 106 | - | - |
| 107 | - | - | 108 | - | - |
| 109 | - | - | 110 | - | - |
| 111 | - | - | 112 | - | - |
| 113 | - | - | 114 | - | - |
| 115 | - | - | 116 | - | - |
| 117 | - | - | 118 | - | - |
| 119 | - | - | 120 | - | - |

## 6.3 Device differences

The pin out of the RH850/F1L-80pin, RH850/F1KM-S1 and the RH850/R1L-80pin device differs on the following port/pin:

| Device Pin (80pin package) | Function on RH850/F1L, RH850/F1KM-S1 | Function on RH850/R1x |
|---|---|---|
| 35 | P8_0 | CVMOUT |

# Chapter 7 Precautions

## 7.1 Product versions

The connector CN21 is only available on PCB versions 2, or later.

PCB version overview:

| Version | Number | Change information |
|---|---|---|
| 1 | EESS-0402-077-01 | Initial version |
| 2 | EESS-0400-075-02 | Added CN21. |

## 7.2 CAN1 signals for R1L

When using this PiggyBoard in conjunction of R1L 80-pin device and the RH850-X1X-MB-T1-Vx mainboard the following details must be noted:

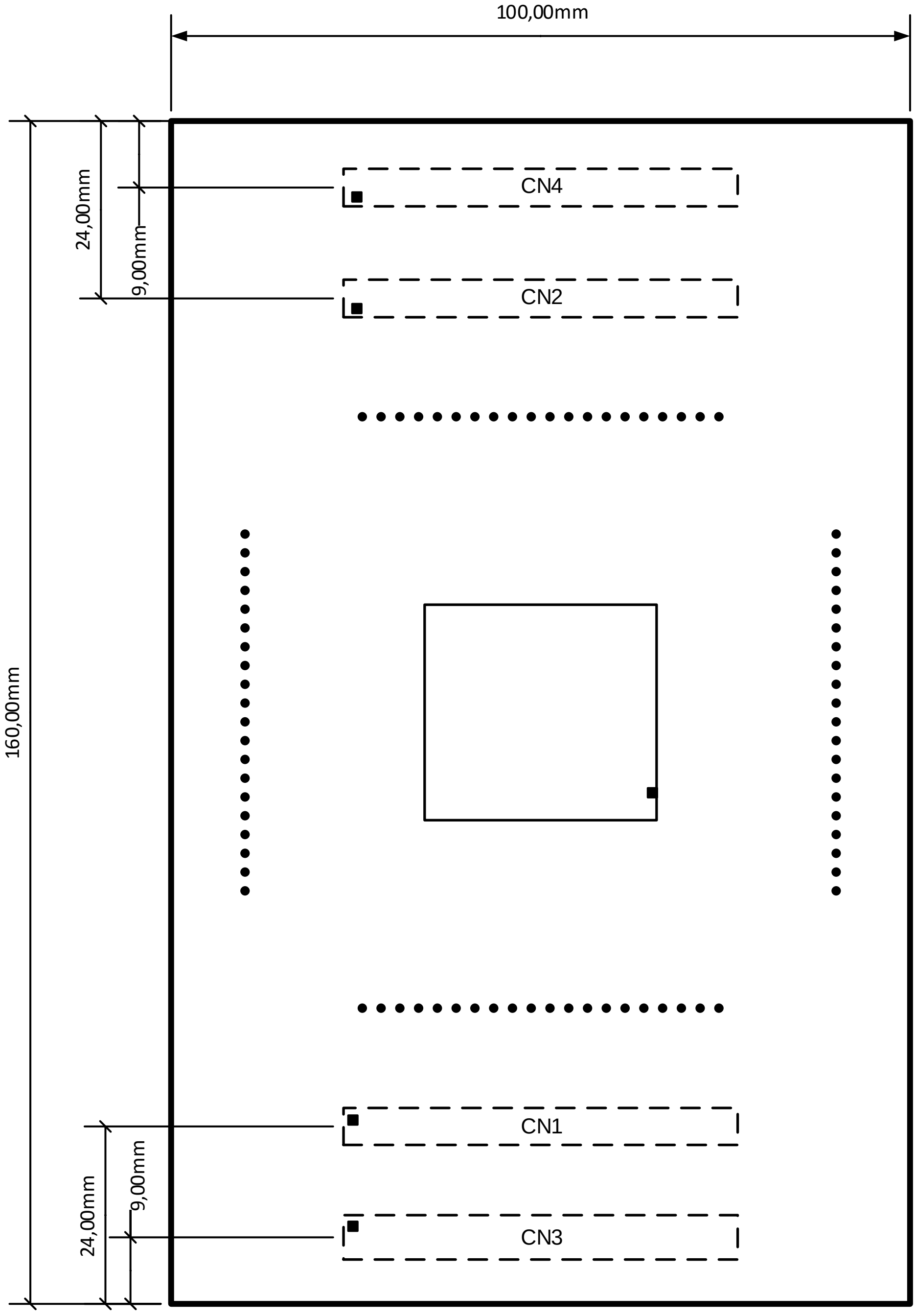
On the PiggyBoard the signals of P0_2 and P0_3 are connected the CN1 pins 30 and 28 for usage as CAN1Rx and CAN1Tx signals.

The ports P0_2 and P0_3 on the R1L 80-pin device do not carry those CAN1 signals, they are available (only) at ports P10_6 (CAN1RX) and P10_7 (CAN1TX).

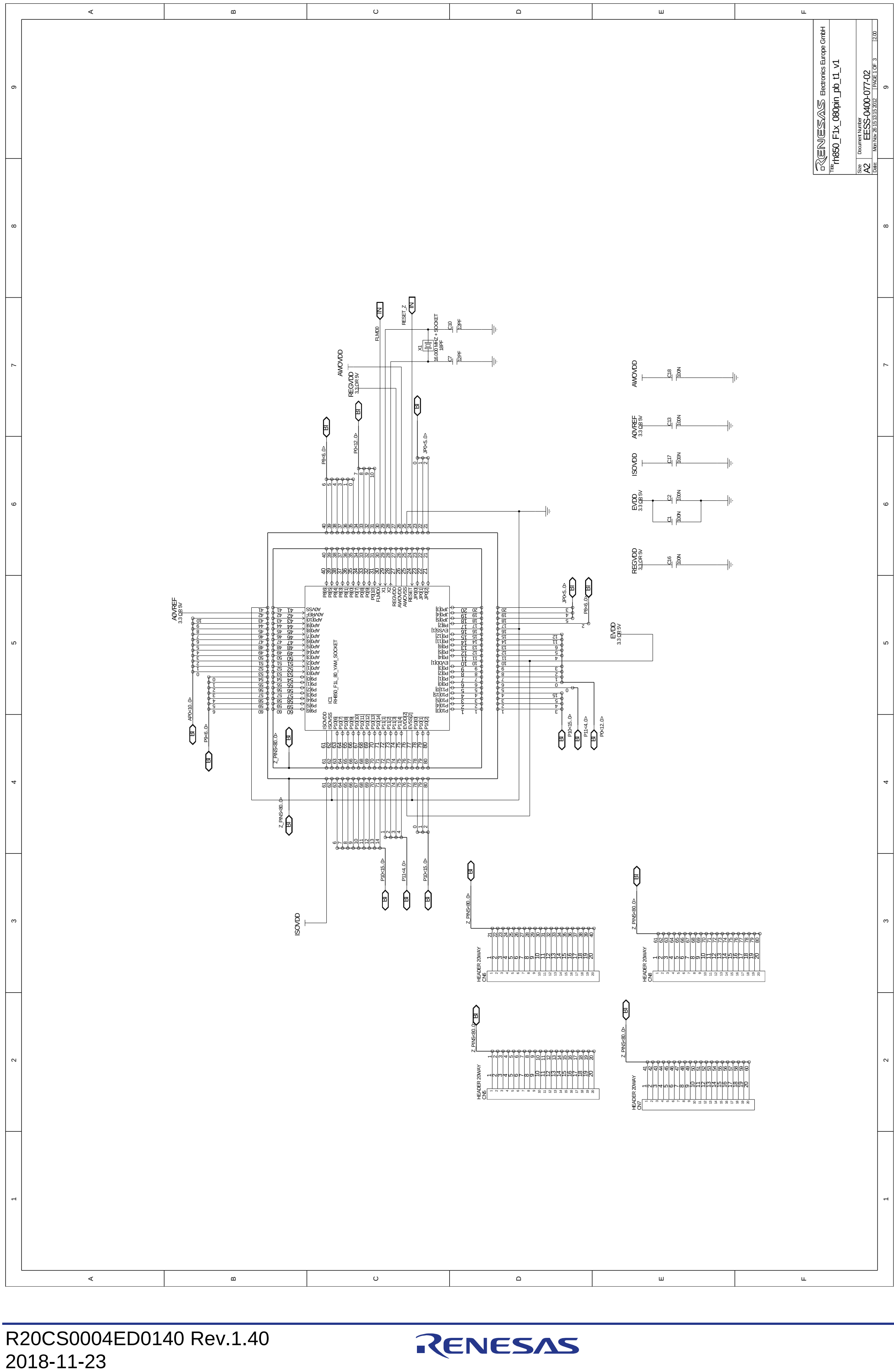
In order to use the CAN1 instance of the R1L device on the MainBoard a manual wire connection must be made between the related pins of the device and pin headers on the MainBoard. See the connection below for details:

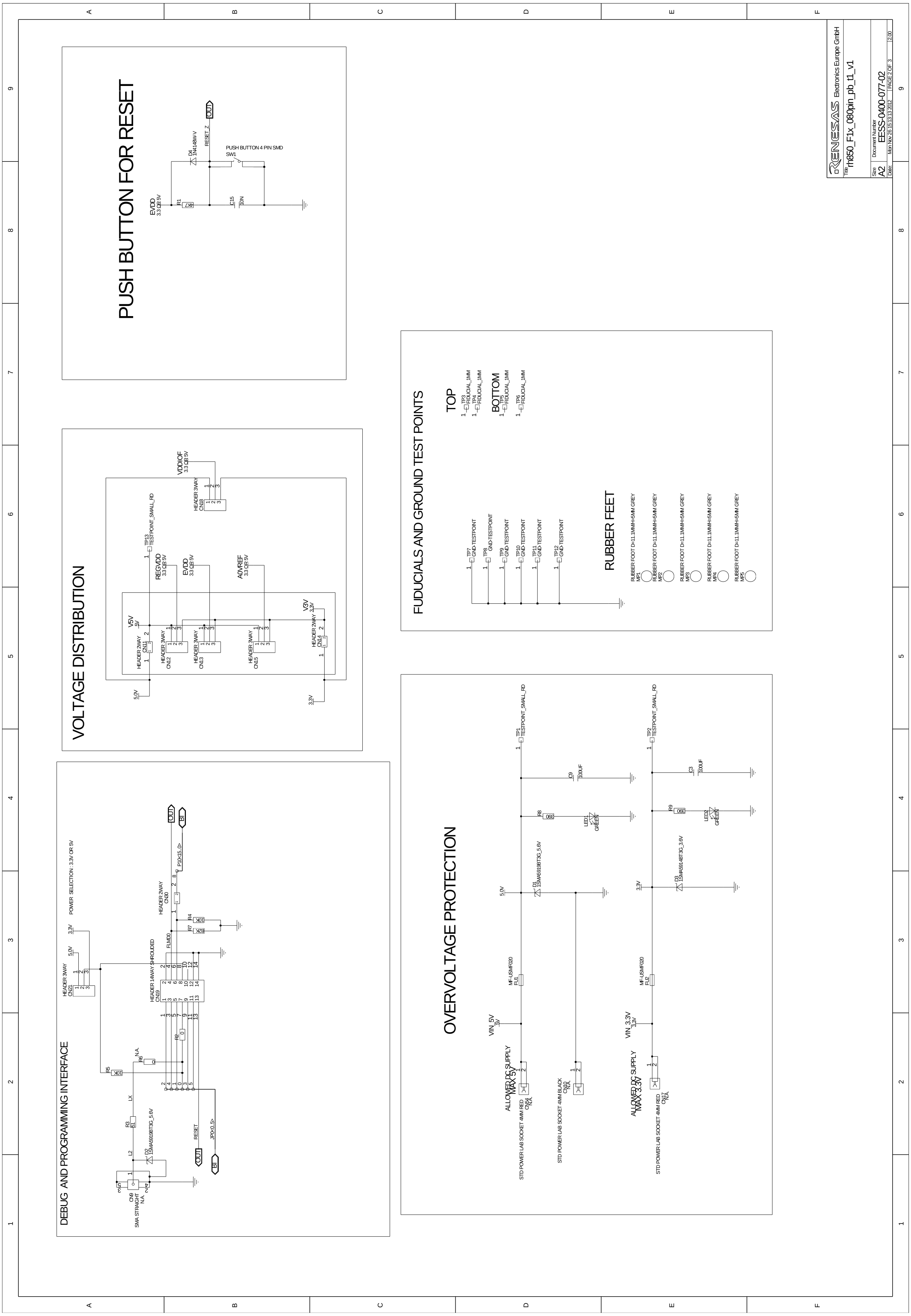
| CAN1 signals | PiggyBoard | MainBoard |
|---|---|---|
| CAN1Tx | Pin 64 (P10_7) | CN5 pin 1 |
| CAN1Rx | Pin 63 (P10_6) | CN5 pin 2 |

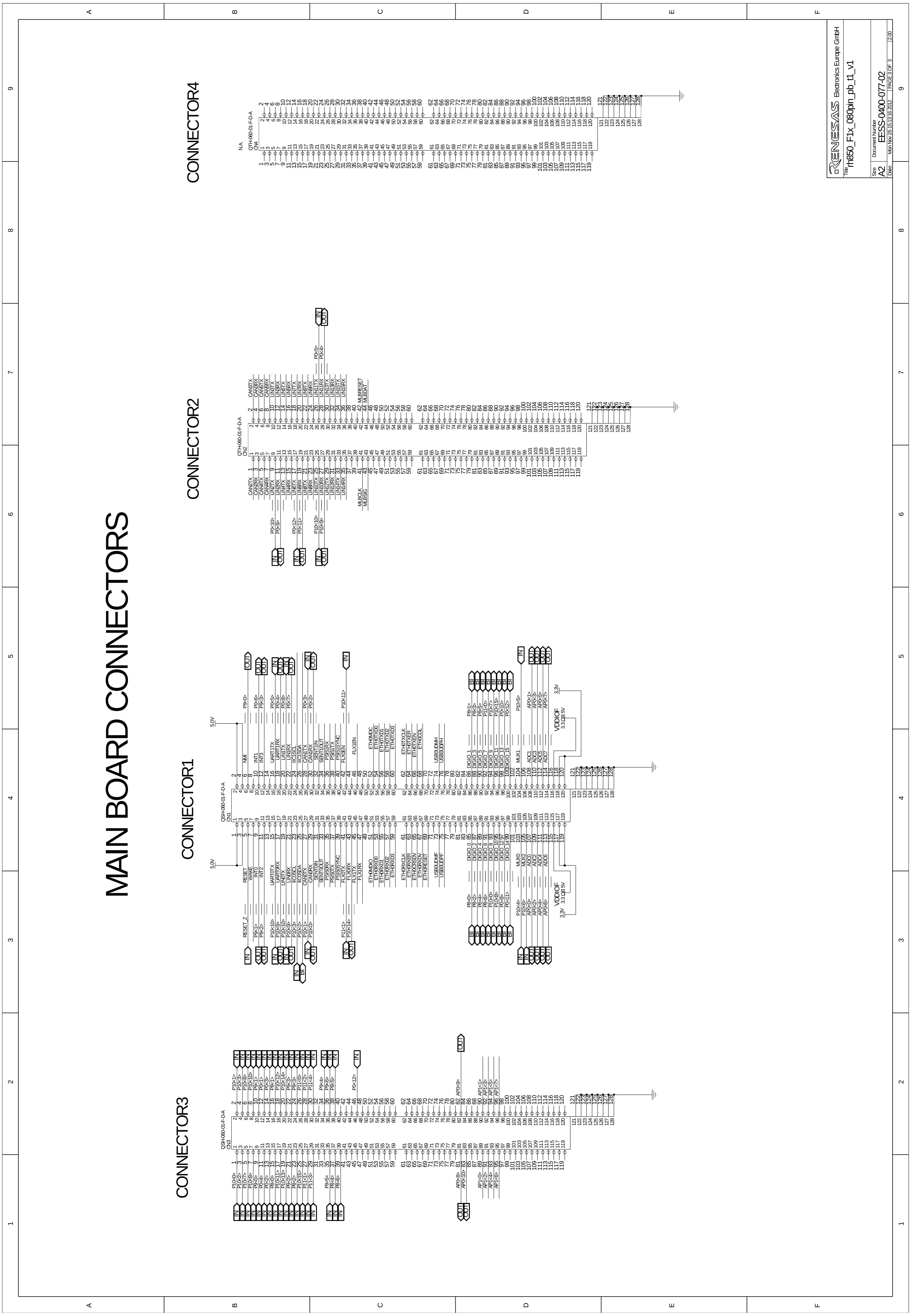
# Chapter 8 Mechanical dimensions



# Chapter 9 Schematic




PUSH BUTTON FOR RESET
VOLTAGE DISTRIBUTION
DEBUG AND PROGRAMMING INTERFACE
FUDICIALS AND GROUND TEST POINTS
TOP
BOTTOM
RUBBER FEET
OVERVOLTAGE PROTECTION
Electronics Europe GmbH
rh850_F1x_080pin_pb_t1_v1
EESS-0400-077-02


MAIN BOARD CONNECTORS
CONNECTOR1
CONNECTOR2
CONNECTOR3
CONNECTOR4
Electronics Europe GmbH
rh850_F1x_080pin_pb_t1_v1
EESS-0400-077-02

# Chapter 10 Revision History

The table provides information about the major changes of the document versions.

| Date | Version | Description |
|---|---|---|
| 2012-11-12 | 1.0 | Initial release |
| 2013-03-21 | 1.1 | • Updated description of debug interface<br>• Updated schematic<br>• Added chapter 'Chapter 7 Precautions' |
| 2014-06-10 | 1.2 | • Update description of usage of CN30 in chapter 5.<br>• Added description for CAN1 with R1L and MainBoard (chapter 7.1) |
| 2015-10-21 | 1.3 | • Updated description in chapter '3.2 Voltage distribution'<br>• Updated description of CN19, pin 6 , chapter 5<br>• Updated description of CN1, pin 115, pin 115, chapter 6.2.1 |
| 2018-11-23 | 1.40 | • Added reference to F1KM-S1 device |