User's Manual

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RH850 Evaluation Platform

RH850/U2B10 Target Board with RAA271084 Power Management IC

User's Manual: Hardware

Y-RH850-U2B10-TB-RAA271084

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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. Precaution against Electrostatic Discharge (ESD)

A strong electrical field, when exposed to a CMOS device, can cause destruction of the gate oxide and ultimately degrade the device operation. Steps must be taken to stop the generation of static electricity as much as possible, and quickly dissipate it when it occurs. Environmental control must be adequate. When it is dry, a humidifier should be used. This is recommended to avoid using insulators that can easily build up static electricity.

Semiconductor devices must be stored and transported in an anti-static container, static shielding bag or conductive material. All test and measurement tools including work benches and floors must be grounded. The operator must also be grounded using a wrist strap. Semiconductor devices must not be touched with bare hands. Similar precautions must be taken for printed circuit boards with mounted semiconductor devices.

2. Processing at power-on

The state of the product is undefined at the time 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 time 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 time 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 time when power is supplied until the power reaches the level at which resetting is specified.

3. Input of signal during power-off state

Do not input signals or an I/O pull-up power supply while the device is powered off. The current injection that results from input of such a signal or I/O pull-up power supply may cause malfunction and the abnormal current that passes in the device at this time may cause degradation of internal elements. Follow the guideline for input signal during power-off state as described in your product documentation.

4. 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 the 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.

5. Clock signals

After applying a reset, only release the reset line after the operating clock signal becomes stable. When switching the clock signal during program execution, wait until the target clock signal is 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. Additionally, 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.

6. Voltage application waveform at input pin

Waveform distortion due to input noise or a reflected wave may cause malfunction. If the input of the CMOS device stays in the area between VIL (Max.) and VIH (Min.) due to noise, for example, the device may malfunction. Take care to prevent chattering noise from entering the device when the input level is fixed, and also in the transition period when the input level passes through the area between VIL (Max.) and VIH (Min.).

7. Prohibition of access to reserved addresses

Access to reserved addresses is prohibited. The reserved addresses are provided for possible future expansion of functions. Do not access these addresses as the correct operation of the LSI is not guaranteed.

8. Differences between products

Before changing from one product to another, for example to a product with a different part number, confirm that the change will not lead to problems.

The characteristics of a microprocessing unit or microcontroller unit products in the same group but having a different part number might differ in terms of 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

1. Introduction

The RH850/U2B10 target board with RAA271084 PMIC serves as a target board with Arduino form factor. The circuit shows a possible implementation of RH850/U2B MCU and RAA271084 PMIC.

Notes

1. This document describes the functionality of the communication board and guides the user through its operation.
   For details regarding the operation of the microcontroller, refer to the device's Hardware User's Manual.
2. In this document active low signals are marked by an appended 'Z' or '#' to the pin or signal name. E.g. the reset pin is named RESETZ or RESET#.
3. In this document the following abbreviations are used:
   – H level, L level: high or low signal level of a digital signal, the absolute voltage value depends on the signal

1.1 Package Components

The Y-RH850-U2B10-TB-RAA271084 product package consists of the following items. After you have unpacked the box, check if your Y-RH850-U2B10-TB-RAA271084 package contains all these items. *Table 1.1 Package Components for RH850/U2B10 target board with RAA271084 PMIC* shows the packing components of the target board package.

Table 1.1 Package Components for RH850/U2B10 target board with RAA271084 PMIC

Item	Description	Quantity
D020090	RH850/U2B10 target board with RAA271084 PMIC	1
D017765-11	License information	1
D020165-24	Product contents list	1

Note

Please keep the target board packing box at hand for later reuse in sending the product for repairs or for other purposes. Always use the original packing box when transporting the target board Y-RH850-U2B10-TB-RAA271084. If packing of your product is not complete, it may be damaged during transportation.

1.2 Main Features

- Compact board design to promote a ‘reference’ schematic (and layout) for RH850/U2B10 device and RAA271084 PMIC
- 12V typ. (40V / 42V max.) power supply
- RH850/U2B10 (292 pin) microcontroller IC with 20MHz main oscillator
- RAA271084 automotive ASIL-D power management IC (incl. required components like FETs, L, C, etc.)
- 14-pin RH850 debug connector
- Three status LEDs
- Eight user LEDs
- Seven power LEDs
- RESET button
- Same board size as the Arduino Classic Family board.
- Port connectors placement for support of Arduino shields. Function assignment as close to Arduino function set as possible.
- One CAN FD interface
- One LIN interface
- Two PMOD connectors (Type: 1A/2A; Type 1A/6)
- One USB-C interface for UART / PC terminal communication
- Operation temperature 0°C <= Ta <= +40°C

1.3 Target Board Versions

The following versions of the piggyback board are available:

Table 1.2 Y-RH850-U2B10-TB-RAA271084 board versions

Board Version	Schematic Version
D020090_06_V01	D020090_04_V0100, not released
D020090_06_V02	D020090_04_V0211
D020090_06_V03	D020090_04_V0300

Table 1.3 lists all modifications that have been implemented in board versions D020090_06_V02 and D020090_06_V03.

Board version D020090_06_V01 has never been released to the public.

Table 1.3 Differences between board versions V02 and V03

Item	Modified Function	Detailed Description of Changes	D020090_06_V02	D020090_06_V03
1	Power management IC	Changed connection of V_LDO0 to power management IC.	V_LDO0 is connected directly to VCCP (pin 43) and via 2.2 Ohm series resistor to VCC (pin 2) on IC2 (PMIC RAA271084).	V_LDO0 is connected via 2.2 Ohm series resistor to VCCP (pin 43) and directly to VCC (pin 2) on IC2 (PMIC RAA271084).
2	GreenPAK IC SLG7RN48401-A	Added GreenPAK logo to the silk screen.	GreenPAK IC only marked as “IC6”.	Added GreenPAK logo in addition to the IC6 marking.

1.4 Target Board Views

Below pictures show top and bottom view of the RH850/U2B10 Target Board with RAA271084 PMIC.

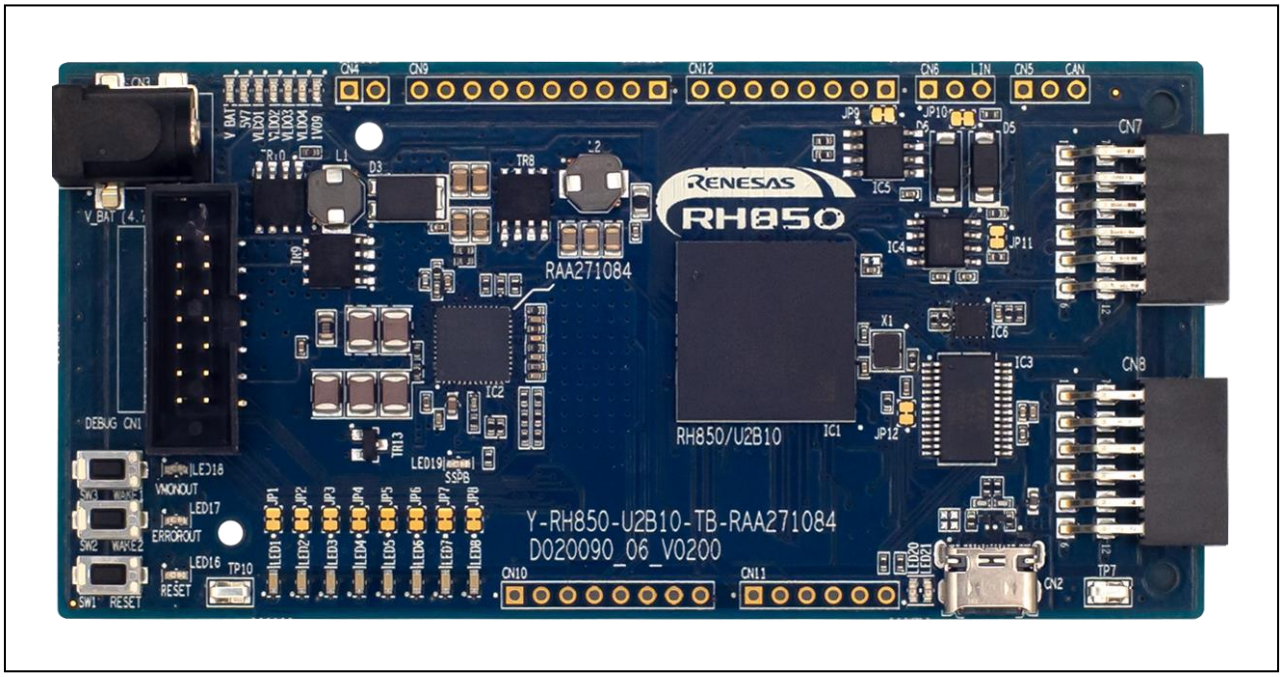


Figure 1.2 RH850/U2B10 target board with RAA271084 PMIC top view for board version D020090_06_V02

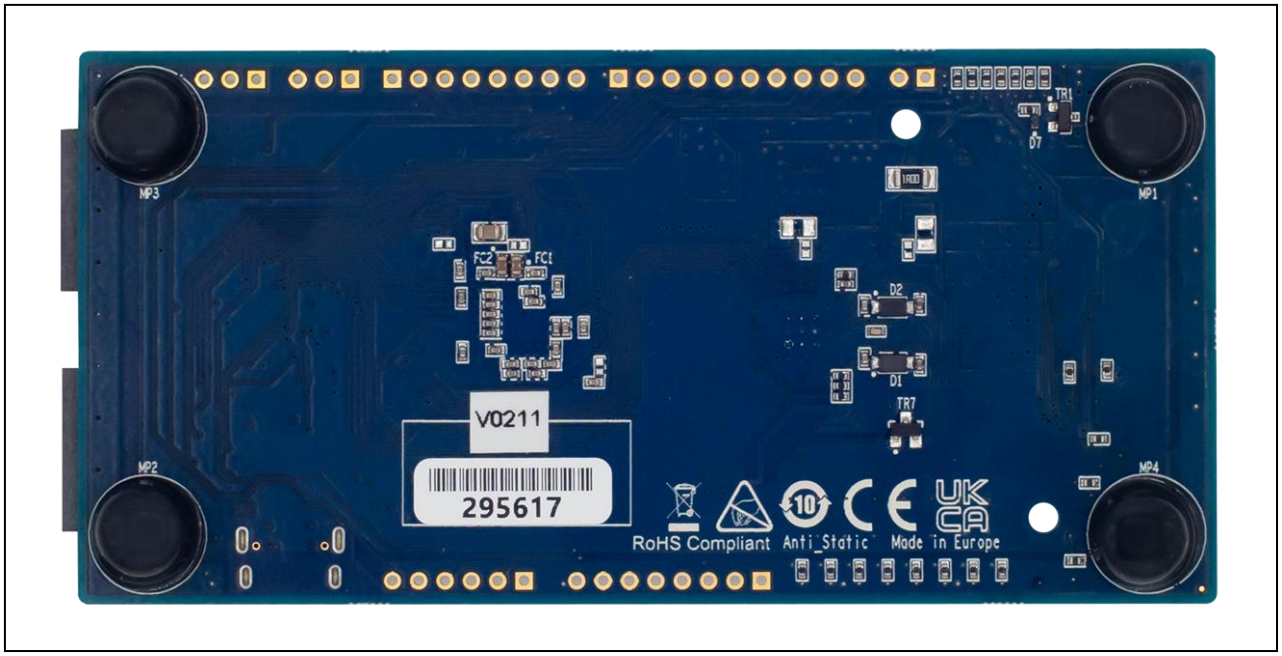


Figure 1.1 RH850/U2B10 target board with RAA271084 PMIC bottom view for board version D020090_06_V02

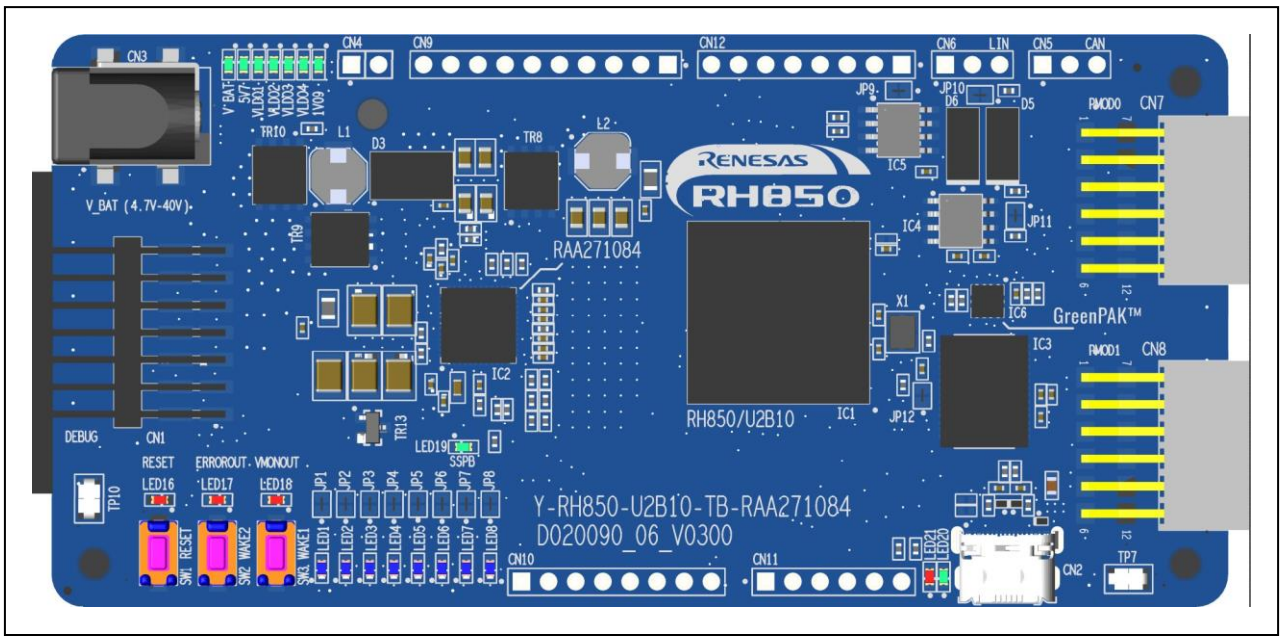


Figure 1.3 RH850/U2B10 target board with RAA271084 PMIC top view for board version D020090_06_V03

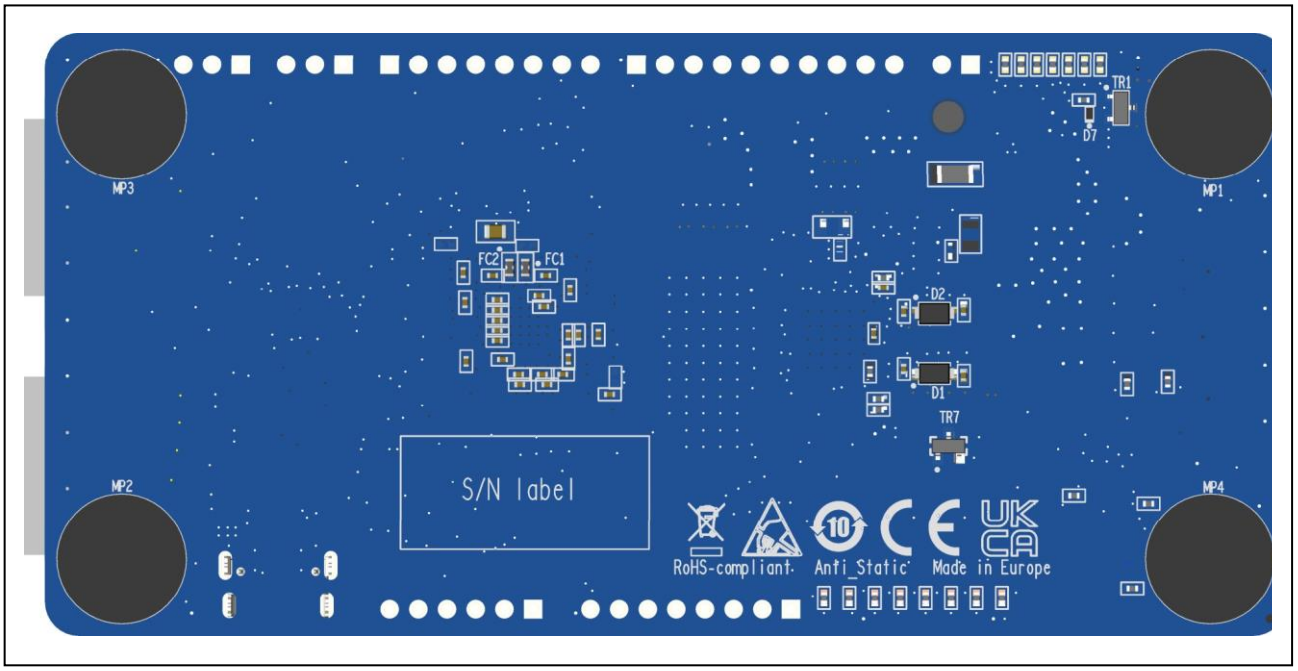


Figure 1.4 RH850/U2B10 target board with RAA271084 PMIC bottom view for board version D020090_06_V03

The following figures provide the drawings of top and bottom views of the RH850/U2B10 Target Board with RAA271084 PMIC including solder mask.

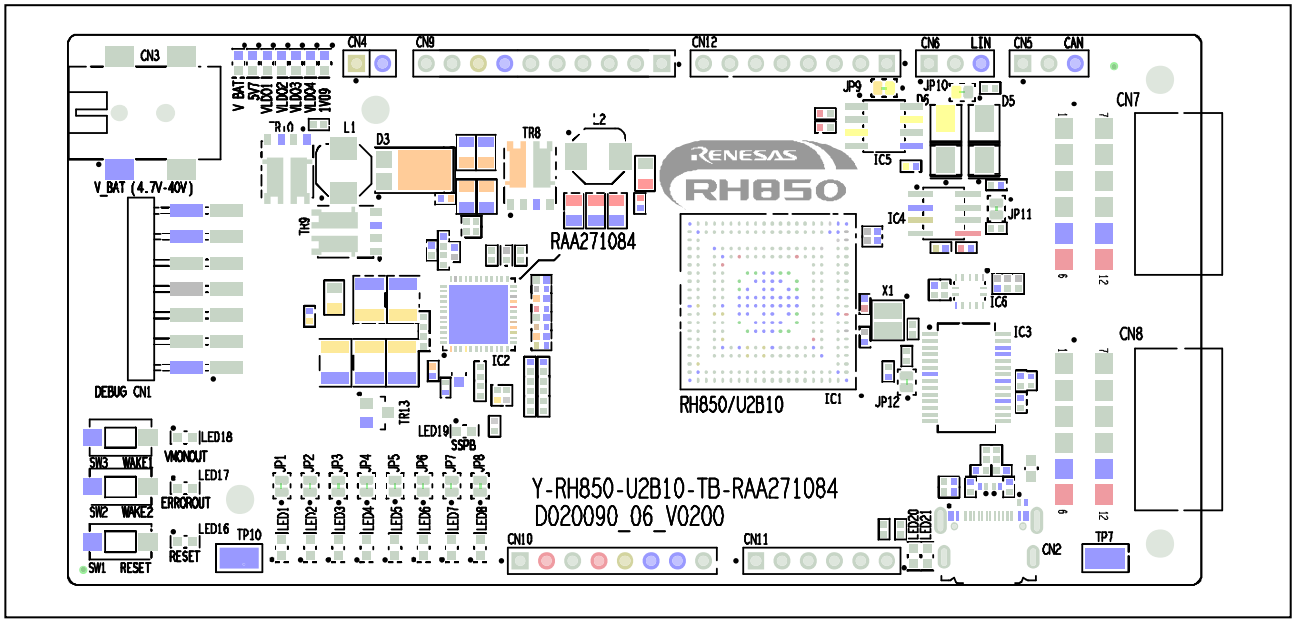


Figure 1.5 RH850/U2B10 target board with RAA271084 PMIC top view for board version D020090_06_V02

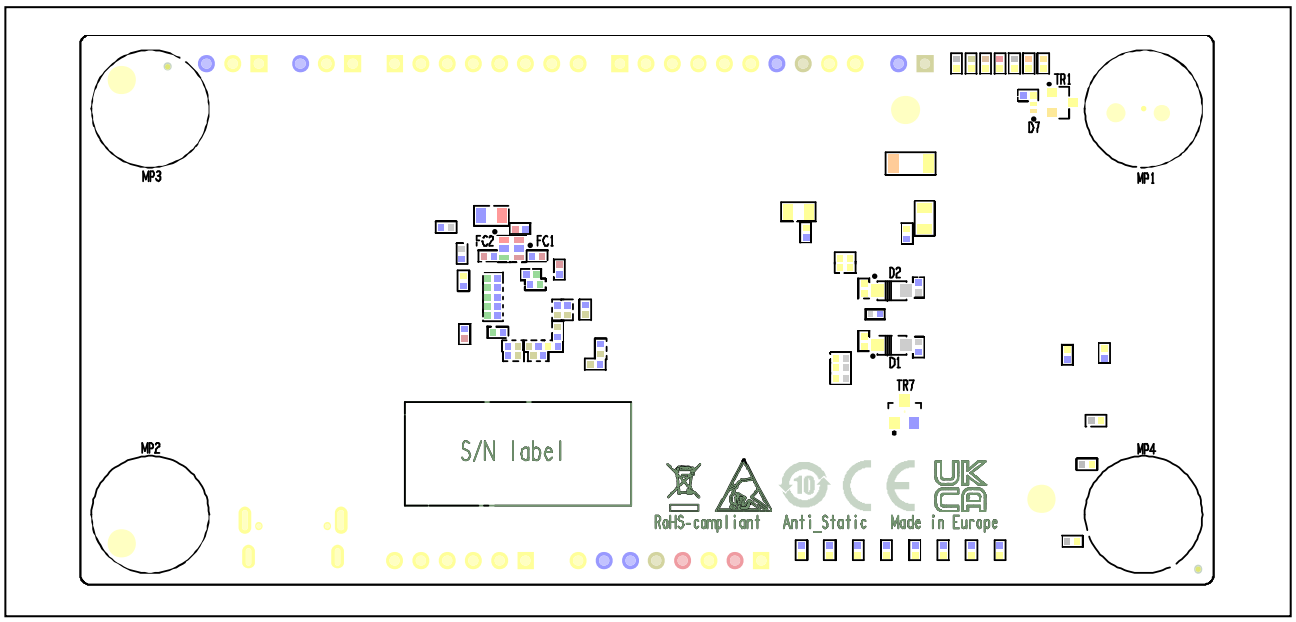


Figure 1.6 RH850/U2B10 target board with RAA271084 PMIC bottom view for board version D020090_06_V02

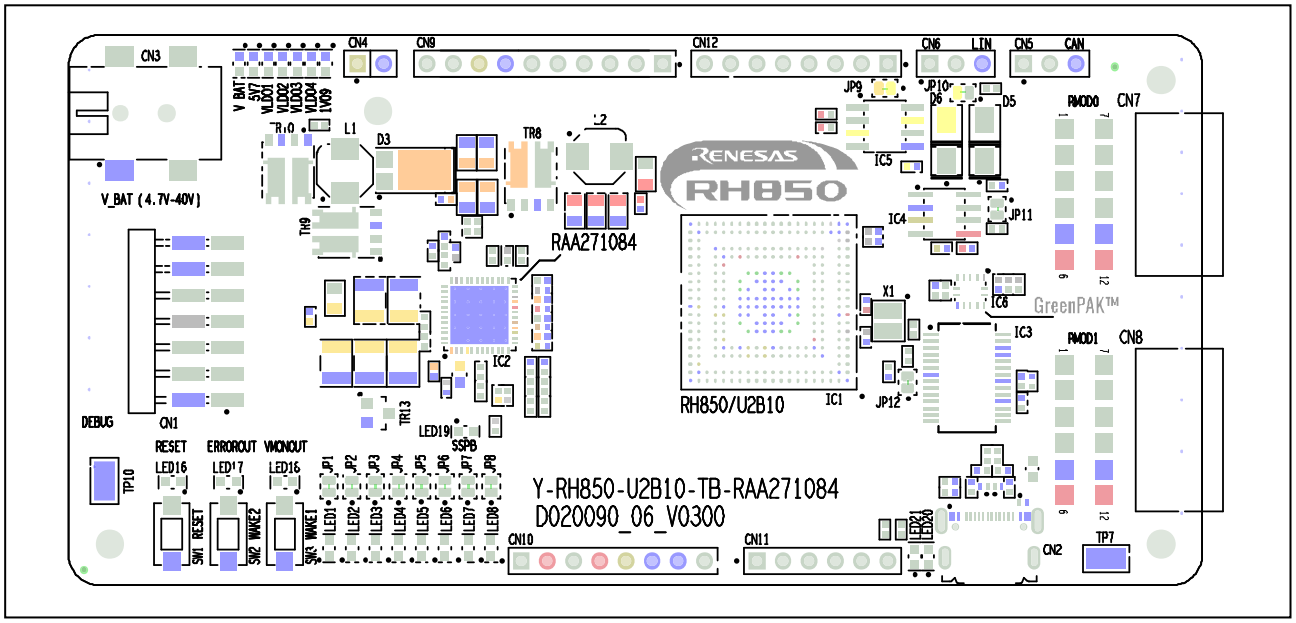


Figure 1.7 RH850/U2B10 target board with RAA271084 PMIC top view for board version D020090_06_V03

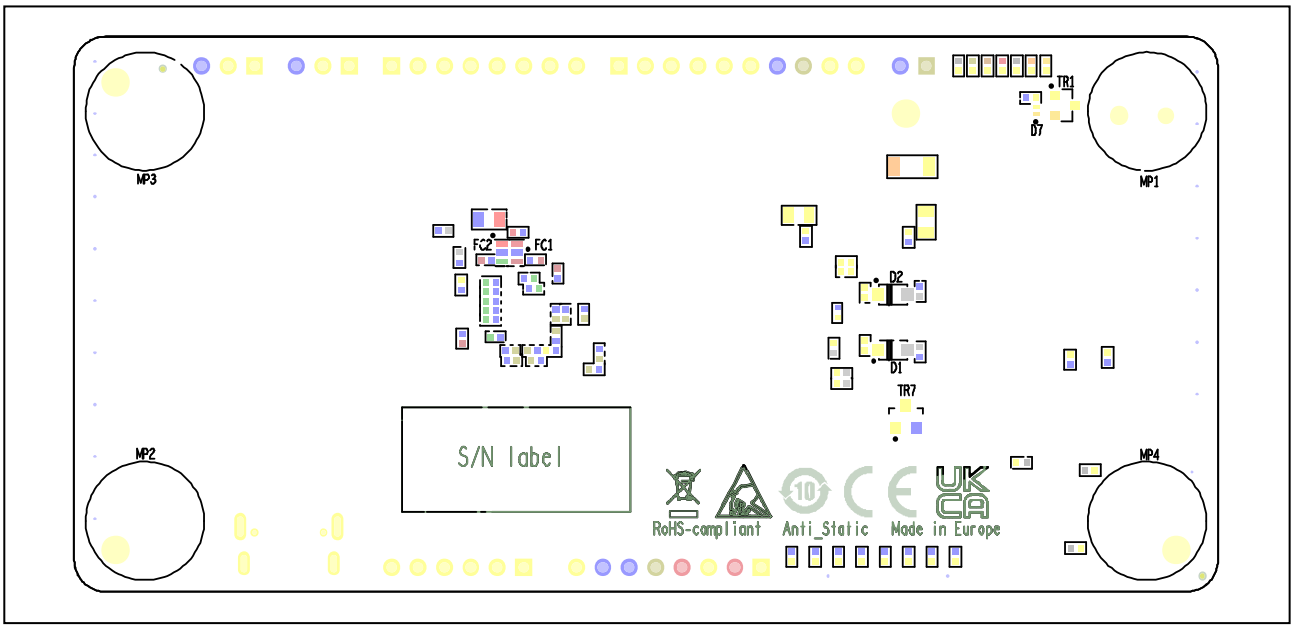


Figure 1.8 RH850/U2B10 target board with RAA271084 PMIC bottom view for board version D020090_06_V03

1.5 Used Devices

The board uses the following devices:

- MCU: R7F72054EAFABB-C (RH850/U2B10)
- PMIC: RAA271084 (OTP-1F.12)

The devices are soldered to the pcb.

2. Jumpers, Connectors, Switches and LEDs

This section provides complete lists of all jumpers, connectors, switches, and LEDs.

The placement of these components on the board is depicted in the figure below.

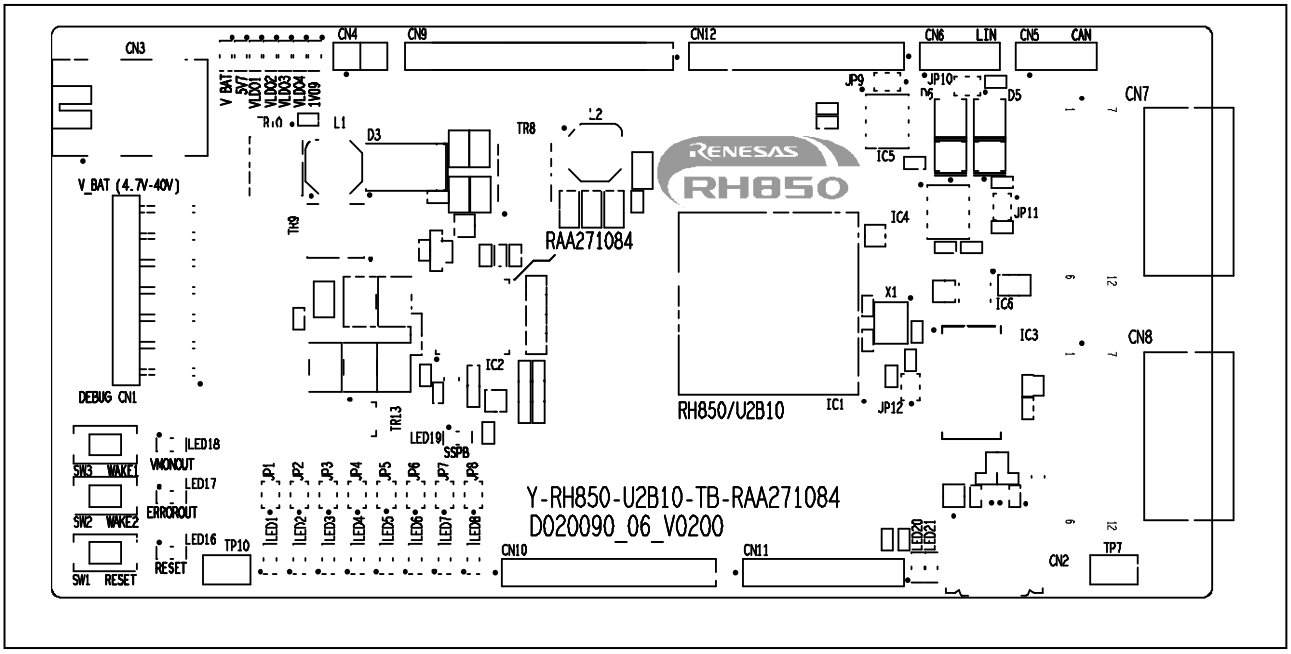


Figure 2.1 Placement of components on the top side of the target board for board version D020090_06_V02

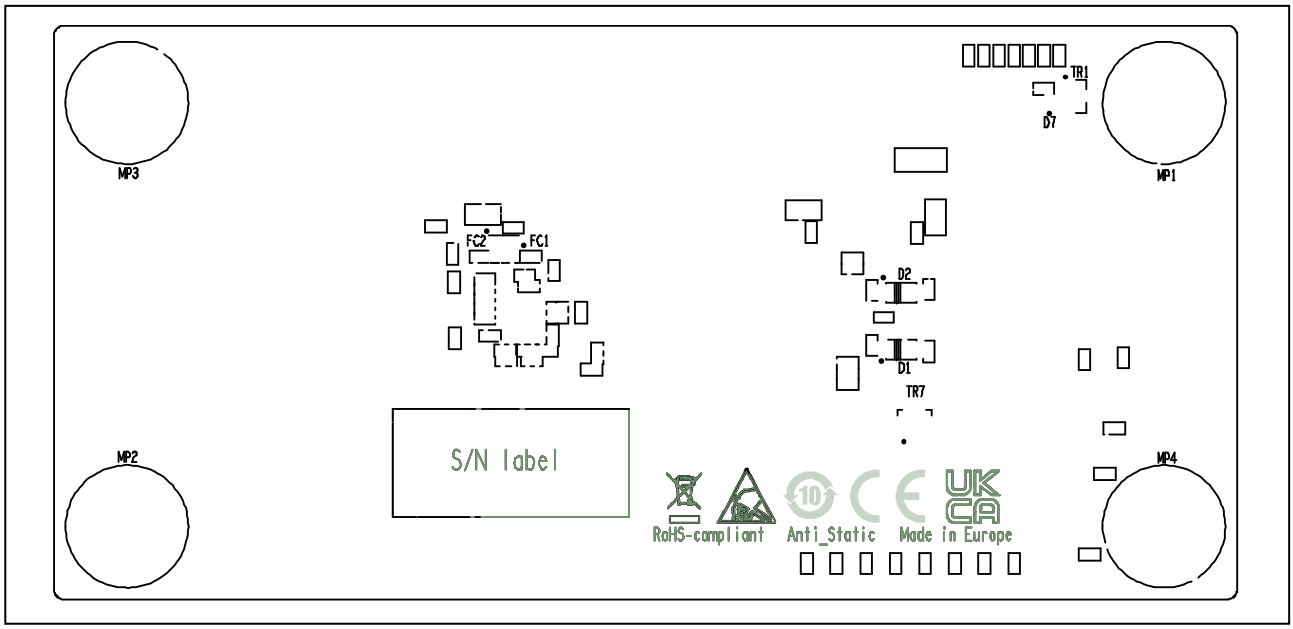


Figure 2.2 Placement of components on the bottom side of the target board for board version D020090_06_V02

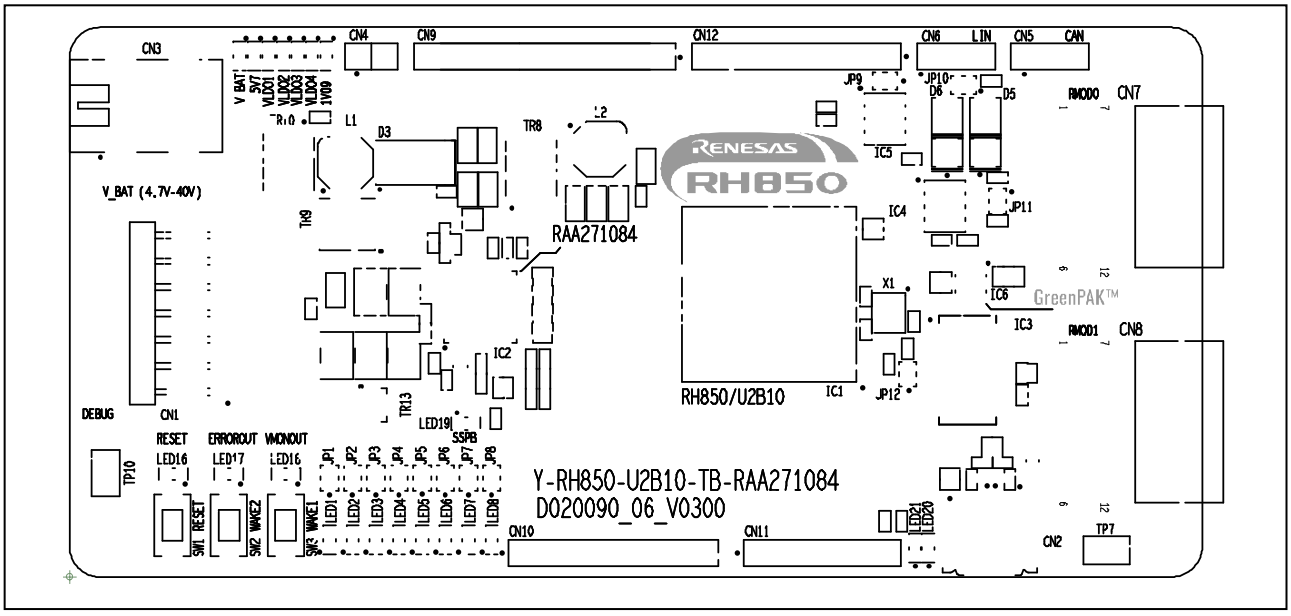


Figure 2.3 Placement of components on the top side of the target board for board version D020090_06_V03

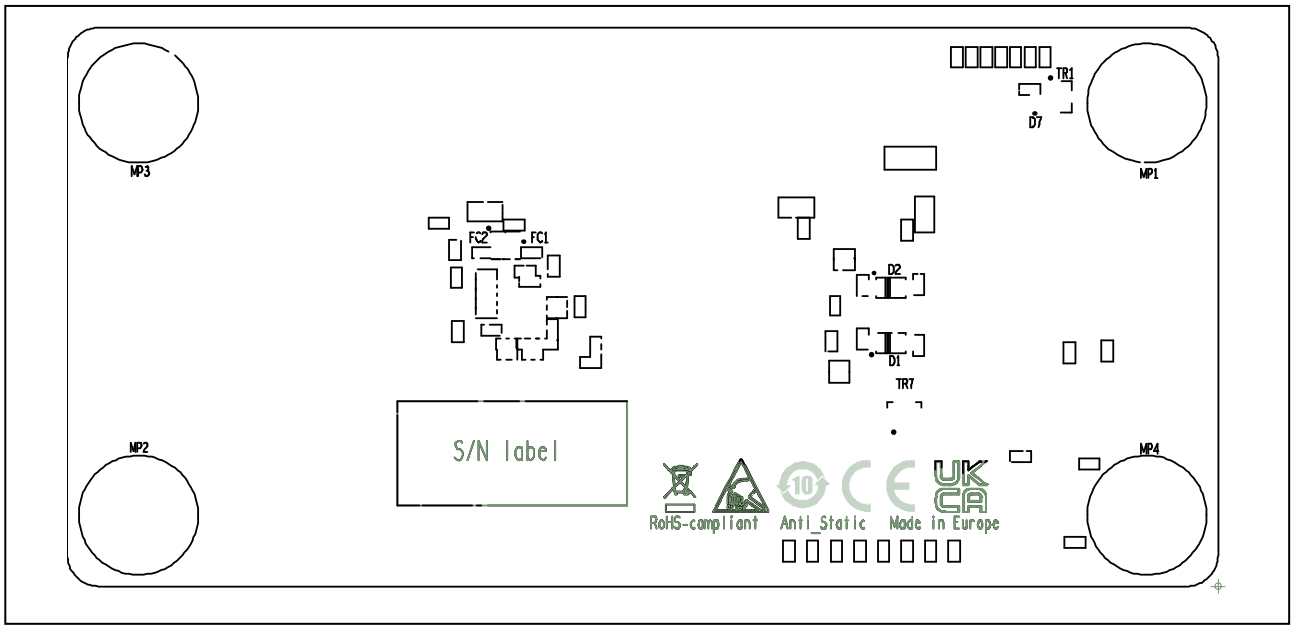


Figure 2.4 Placement of components on the bottom side of the target board for board version D020090_06_V03

2.1 Jumper Overview

On this board all jumpers are implemented as bridged solder jumpers. The following table provides an overview of all jumpers.

Table 2.1 Jumper overview

Switch	Function	Remark
JP1 – JP8	Cut traces to disconnect the user LEDs LED1 – LED8 from RH850/U2B10 ports P22[0..7].	refer to *6.7 User LEDs*
JP9	Cut trace to disconnect power supply of LIN transceiver.	refer to *6.4 LIN Interface*
JP10	Cut trace for LIN Master/Slave selection JP10[CLOSED] : Master (default) JP10[OPEN] : Slave	
JP11	Cut trace to disable load on CAN FD interface. JP11[CLOSED] : bus terminated (default) JP11[OPEN]: bus not terminated	refer to *6.3 CAN FD* Interface
JP12	Connect RESET_USB# to GreenPAK IC	refer to *6.1 System State and RESET*

2.2 Switches Overview

The following table provides an overview of all switches.

Table 2.2 Switches overview

Switch	Function	Remark
SW1	Reset switch	refer to *6.1 System State and RESET*
SW2	Control the WAKE1/WAKE2 inputs of the PMIC PMIC.	refer to *3.1 Power Management IC (PMIC)*
SW3		

2.3 Connectors Overview

The following table provides an overview of all connectors.

Table 2.3 Connectors overview (cont'd)

Connector	Function	Remark
CN1	Debug and programming interface	refer to *5 Debug and Flash Programming Interfaces*
CN2	USB-C interface	refer to *6.5 USB Interface*
CN3	+12.0 V external power supply	refer to *3.1 Power Management IC (PMIC)*
CN4	+5.0 V output voltage, not assembled	refer to *3.1 Power Management IC (PMIC)*
CN5	CAN FD interface connector, not assembled	refer to *6.3 CAN FD* Interface
CN6	LIN interface connector, not assembled	refer to *6.4 LIN Interface*

Table 2.3 Connectors overview (cont'd)

Connector	Function	Remark
CN7	PMOD connectors	refer to 6.6 PMOD Connectors
CN8		
CN9	Expansion connectors, not assembled	refer to *6.2 Expansion Connectors*
CN10		
CN11		
CN12		

2.4 LED Overview

The following table provides an overview of all LEDs.

Table 2.4 LED overview

LED	Function	Color	Remark
LED1	User LED	blue	refer to *6.7 User LEDs*
LED2			
LED3			
LED4			
LED5			
LED6			
LED7			
LED8			
LED9	12.0 V power supply V_BAT	green	refer to *3.2 Power Supply LEDs*
LED10	5.7 V power supply V_5V7		
LED11	3.3 V power supply V_LDO1		
LED12	3.3 V power supply V_LDO2		
LED13	3.3 V power supply V_LDO3		
LED14	5.0 V power supply V_LDO4		
LED15	1.09 V core voltage power supply VDD		
LED16	RESET LED	red	refer to *6.1 System State and RESET*
LED17	ERROROUT_M# LED		
LED18	VMONOUT# LED		
LED19	Operation signal from PMIC	green	refer to *3.1 Power Management IC (PMIC)*
LED20	USB LED, TX	green	refer to *6.5 USB Interface*
LED21	USB LED, RX	red	

3. Power Supply

3.1 Power Management IC (PMIC)

The target board is powered by a single 12V supply, which must be connected to connector CN3. All voltages required to operate the target board are generated by the Renesas power management IC RAA271084. For more information about this device, please refer to the RAA271084 datasheet.

Note

It is not possible to power the target board from an emulator, which is connected to the debug connector CN1. If the board does not have a 12V power supply the power management IC will be switched off.

Within this document all voltage values are considered as ‘typical’.
Refer to the 'Electrical Characteristics' section of the Hardware User's Manual for allowed voltage ranges.

The power management IC has 4 LDO regulators, each of which can be fuse programmed to 3.3V or 5.0V.

The power management IC has also a buck-boost regulator DCDC1 and a buck regulator DCDC2.

The buck-boost regulator reduces the supply voltage V_BAT to 5.7V (V_5V7).

The buck regulator then generates the RH850 core voltage of 1.09V (VDD) from the 5.7V output by DCDC1.

The power management IC on the target board is programmed to provide the following voltages for RH850:

Table 3.1 RAA271084 Power Connections

RAA271084 Regulator	Output Voltage	Max. Output Current	Usage
DCDC1	5.7 V	-	RAA271084’s VIN2, LDOVIN1/2 and LDOVIN3/4
DCDC2	1.09 V	-	RH850/U2B10’s VDDn
VCC (LDO0)	5 V	130 mA	RH850/U2B10’s SYSVCC, SVRAVCC & SCRDRVCC
LDO1	3.3 V	350 mA	RH850/U2B10’s VCCn & OSCVCC
LDO2	3.3 V	350 mA	RH850/U2B10’s E0VCC, E1VCC, E2VCC & LVDVCC
LDO3	3.3 V	200 mA	Unused
LDO4	5 V	200 mA	RH850/U2B10’s A0VCC, A1VCC, A2VCC, A0VREFH, A1VREFH, A2VREFH, ADSVCC, ADSVREFH & AFCVCC

The power management IC has an SPI interface. This is connected to the MSPI5 interface of RH850. This interface can be used by the user application to program the configuration registers in the PMIC.

LED19 on the target board is system status LED for the PMIC. If all system self-tests at power on are passed successfully this LED will be switched on.

Switches SW2 and SW3 can be used to control the WAKE1/WAKE2 inputs of the PMIC. For normal operation of the board the switches can be left open. In case the switches are closed, the EOT_ONLY State or PMIC_OFF State are entered.

The connector CN4 on the target board can be used as V_LDO4 (5.0V) output to some customer system.

The connection of V_LDO0 differs on the target board versions.

On board version D020090_06_V02 signal V_LDO0 is connected directly to VCCP (pin 43) and via 2.2 Ohm series resistor to VCC (pin 2) on IC2 (PMIC RAA271084).

On board version D020090_06_V03 signal V_LDO0 is connected via 2.2 Ohm series resistor to VCCP (pin 43) and directly to VCC (pin 2) on IC2 (PMIC RAA271084).

Figure 3.1 and *Figure 3.2* show the voltage generation circuit.

Figure 3.3 shows the RAA271084 (OTP-1F.12) connections to the RH850/U2B10.

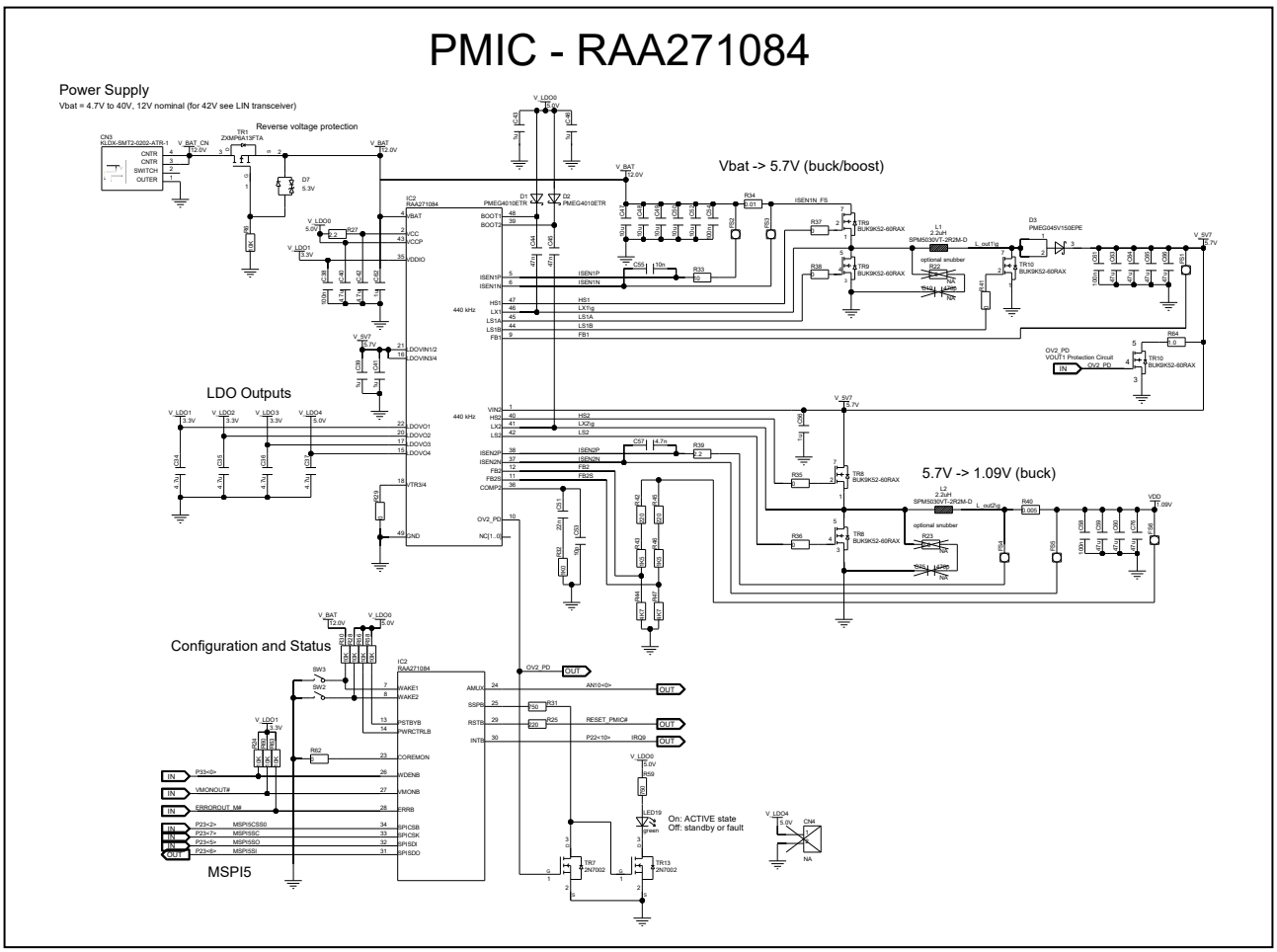


Figure 3.1 Power supply circuit on the target board for board version D020090_06_V02

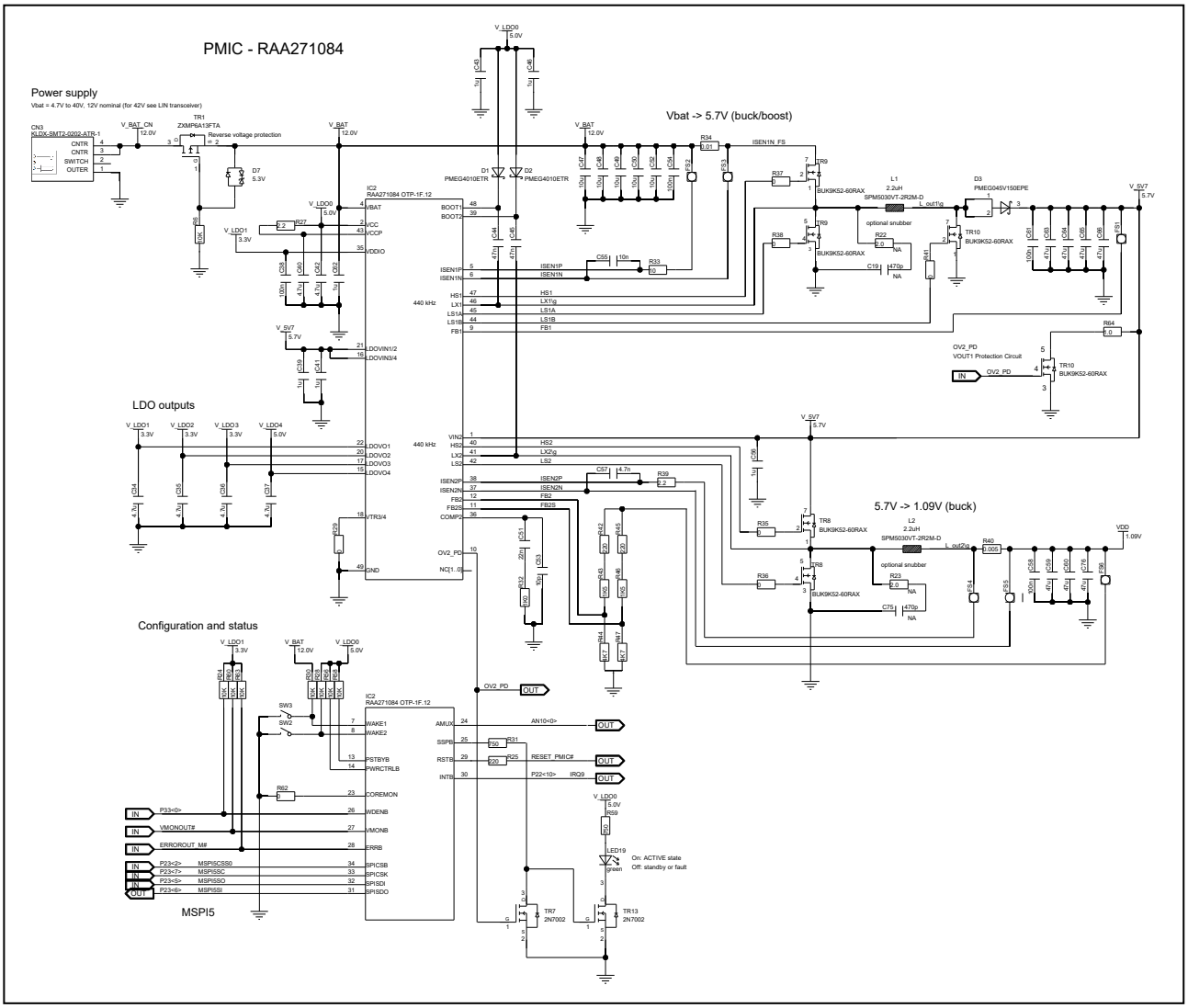


Figure 3.2 Power supply circuit on the target board for board version D020090_06_V03

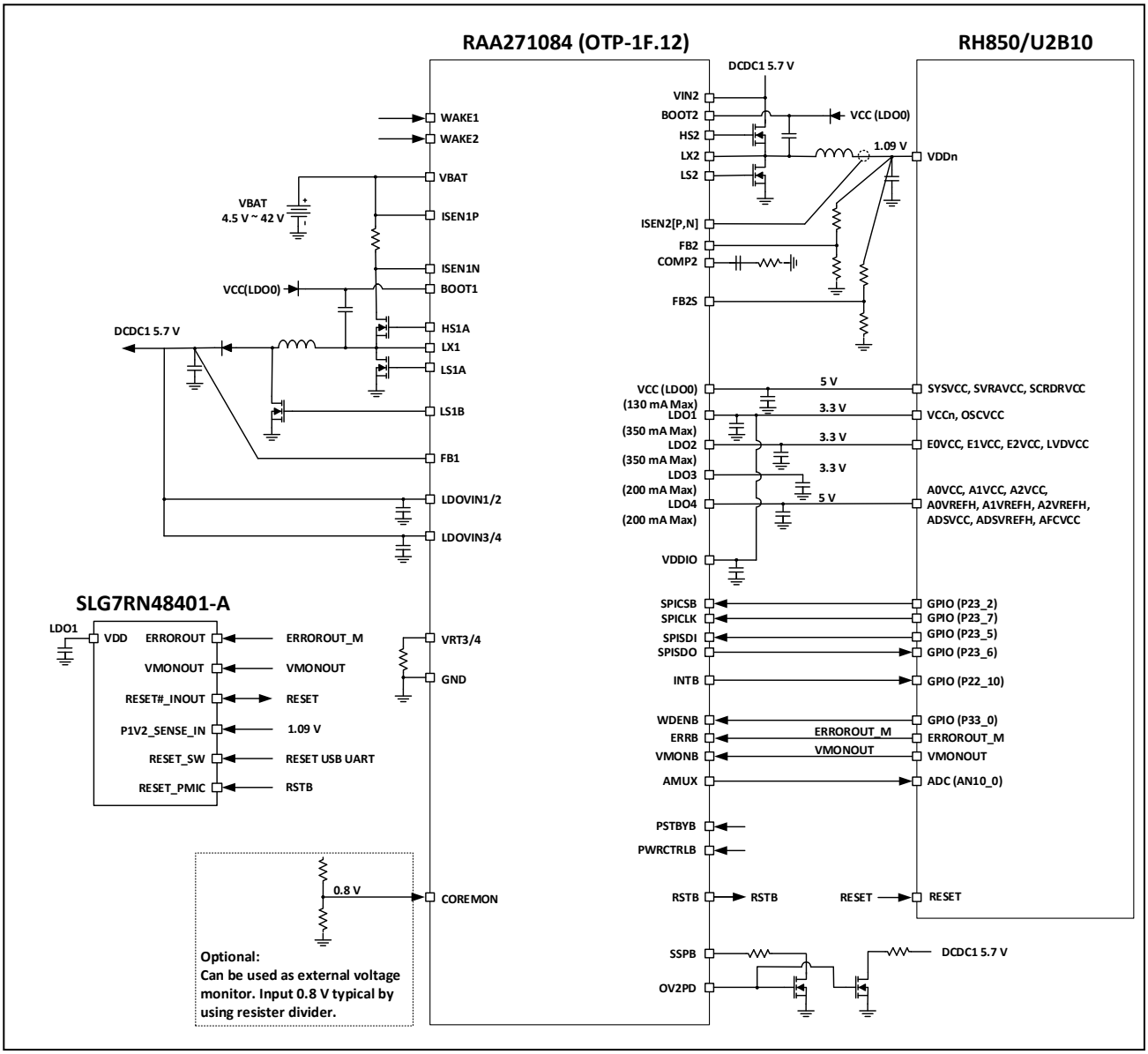


Figure 3.3 RAA271084 – RH850/U2B10 Application Diagram

Table 3.2 I/O Connections

RAA271084		RH850/U2B10	Remarks
Pin#	Pin Name	Pin Name	
7	WAKE1	N.A.	Connected to external push button
8	WAKE2	N.A.	Connected to external push button
10	OV2_PD	N.A.	Function 1: Connected to external FET to limit DCDC1 OVP Function 2: Drives an external LED: Active or Standby/Fault
13	PSTBYB	N.A.	Pulled up RAA271084's VCC (LDO0)
14	PWRCTLB	N.A.	Pulled up to RAA271084's VCC (LDO0)
23	COREMON	N.A.	Can be used as external voltage monitor. Input 0.8 V typical by using resister divider.

Table 3.2 I/O Connections (cont'd)

RAA271084		RH850/U2B10	Remarks
Pin#	Pin Name	Pin Name	
24	AMUX	ADC (AN10_0)	
25	SSPB	N.A.	Drives an external LED: Active or Standby/Fault
26	WDENB	GPIO (P33_0)	
27	VMONB	VMONOUT	
28	ERRB	ERROROUT_M	
29	RSTB	N.A.	Connected to SLG7RN48401-A (RESET_PMIC pin 14)
30	INTB	GPIO (P22_10)	
31	SPISDO	GPIO (P23_6)	
32	SPISDI	GPIO (P23_5)	
33	SPICLK	GPIO (P23_7)	
34	SPICSB	GPIO (P23_2)	

The RAA271084 has a customer configuration saved in its embedded one-time programmable (OTP) memory. *Table 3.3* provides the OTP-1F.12 settings to support the RH850/U2B10.

Table 3.3 RAA271084 OTP-1F.12 Configuration

Address	Register Name	OTP Value
0x10	OPT_SEQ_CTRL	0x00
0x11	OPT_SLOT_TIME	0x00
0x12	OPT_SLOT_DCDC	0x00
0x13	OPT_SLOT_LDO	0x00
0x14	OPT_HP	0x10
0x15	OPT_DS	0x10
0x16	OPT_TOFF_TIME	0x00
0x30	OPT_ERRB_CTRL	0x00
0x31	OPT_VMONB_CTRL	0x80
0x82	OPT_WDT_CONFIG1	0x00
0x120	OPT_FLT_RESP1	0x00
0x121	OPT_FLT_RESP2	0x00
0x122	OPT_FLT_RESP3	0x00
0x123	OPT_FLT_RESP4	0x00
0x124	OPT_FLT_RESP5	0x00

Table 3.3 RAA271084 OTP-1F.12 Configuration (cont'd)

Address	Register Name	OTP Value
0x125	OPT_FLT_RESP6	0x00
0x126	OPT_FLT_RESP7	0x00
0x127	OPT_FLT_RESP8	0x00
0x128	OPT_FLT_SHDN1	0x00
0x129	OPT_FLT_SHDN2	0x00
0x140	OPT_INTB_MASK1	0x00
0x141	OPT_INTB_MASK2	0x00
0x142	OPT_INTB_MASK3	0x00
0x143	OPT_INTB_MASK4	0x00
0x148	OPT_SSPB_MASK1	0x00
0x149	OPT_SSPB_MASK2	0x00
0x14A	OPT_SSPB_MASK3	0x00
0x14D	OPT_SSPB_MASK5	0x00
0x150	OPT_VOUT	0x20
0x151	OPT_FB1_THRESH	0x00
0x152	OPT_FB2_THRESH	0x00
0x153	OPT_LDO1_THRESH	0x50
0x154	OPT_LDO2_THRESH	0x50
0x155	OPT_LDO3_THRESH	0x00
0x156	OPT_LDO4_THRESH	0x50
0x157	OPT_COREMON_THRESH	0x00
0x158	OPT_LDO0_THRESH	0x50
0x160	OPT_FAULT_DLY1	0x00
0x161	OPT_FAULT_DLY2	0x00
0x162	OPT_FAULT_DLY3	0x00
0x163	OPT_FAULT_DLY4	0x00
0x164	OPT_FAULT_DLY5	0x00
0x200	OPT_DEV_MODE1	0x30
0x201	OPT_DEV_MODE2	0x20
0x202	OPT_DEV_MODE3	0x00

Table 3.3 RAA271084 OTP-1F.12 Configuration (cont'd)

Address	Register Name	OTP Value
0x203	SEL_DEV_MODE1	0x00
0x204	OPT_WAIT_DISCHG1	0x00
0x205	OPT_WAIT_DISCHG2	0x00
0x206	OPT_PD_CTRL	0x00
0x207	OPT_STATE_CTRL	0x20
0x208	OPT_SS	0x00
0x209	OPT_WDENB_CTRL	0x00
0x20B	OPT_PG_CTRL	0x00
0x20E	OPT_VDDIO	0x01
0x3C1	OTP ID1	0x1F
0x3D0	OTP ID2	0x12

3.2 Power Supply LEDs

The target board includes 7 green LEDs (LED9 – LED15) to indicate the availability of various voltages available on the target board:

- LED9: 12.0V board supply voltage (V_BAT)
- LED10: PMIC - 5.7V output from buck-boost regulator DCDC1 (V_5V7) of the
- LED11: PMIC - 3.3V output from LDO1 (V_LDO1)
- LED12: PMIC - 3.3V output from LDO2 (V_LDO2)
- LED13: PMIC - 3.3V output from LDO3 (V_LDO3)
- LED14: PMIC - 5.0V output from LDO4 (V_LDO4)
- LED15: PMIC - 1.09V output from buck regulator DCDC2 (VDD) (see *Figure 6.1 RESET circuit and status LEDs*)

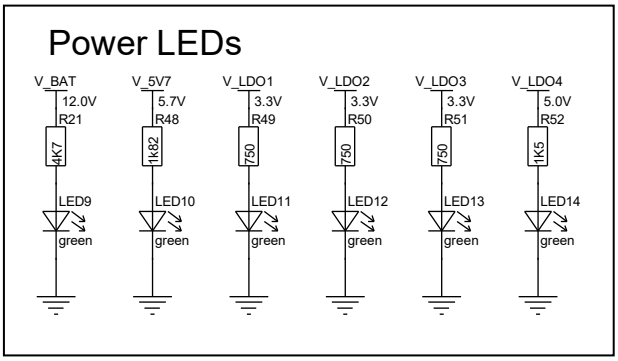


Figure 3.4 Power supply LEDs on the target board

4. Oscillator Circuit

The board has a soldered oscillator of 20MHz that is used for RH850/U2B10 clock generation.

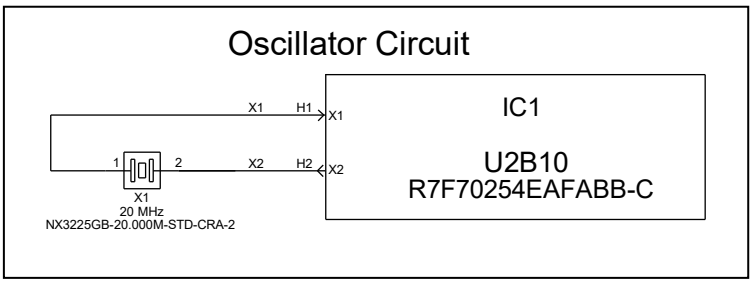


Figure 4.1 Oscillator circuit

5. Debug and Flash Programming Interfaces

For debugging and flash programming purposes debug and flash programming tools can be connected to the CN1 connector.

The Renesas standard emulator for the target board is the E2 emulator. This can be used as an emulator for debugging or as flash programmer.

To connect an E2 emulator to the debug connector on the target board, use the conversion adapter that comes with the E2 emulator, and the user system interface cable. *Figure 5.1* shows an example of the connection.

After connecting the user system interface cable to the conversion adapter, connect the conversion adapter to the debug connector CN1 on the target board.

Make sure the switch SW1 on the conversion adapter is set to position [1-2].

Refer to *7.1 Debug Connector CN1* for details about the CN1 pin assignment.

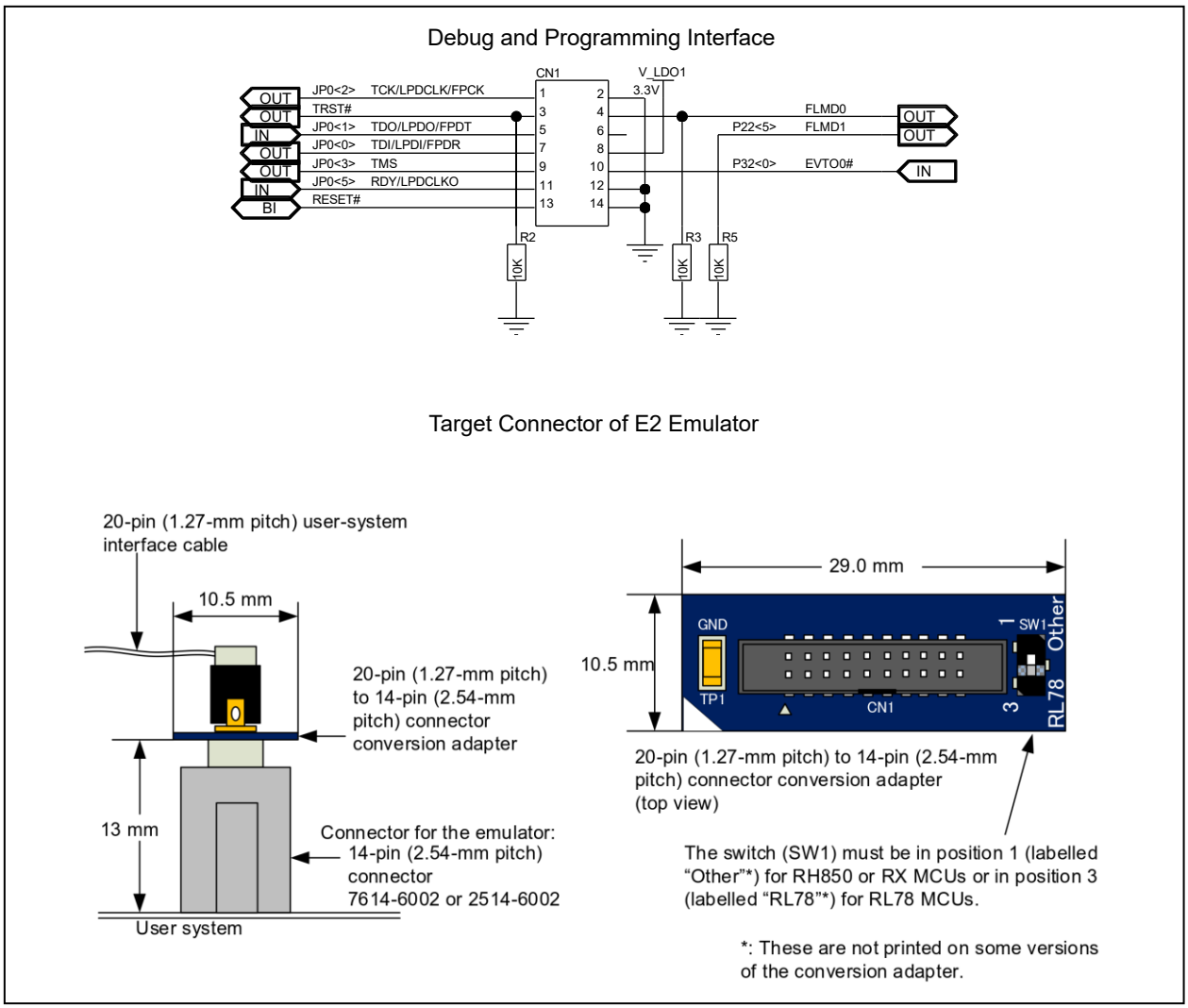


Figure 5.1 Debug and programming interface

6. Other Circuitry

6.1 System State and RESET

This target board has a special reset circuit using the Renesas GreenPAK IC SLG7RN48401-A.

This IC is designed to receive various RH850 control signals and switch control LED accordingly.

The target board has 2 LED to indicate RH850 control signals:

- LED17 for a control signal triggered by ERROROUT_M#.
- LED18 for a control signal triggered by VMONOUT#.

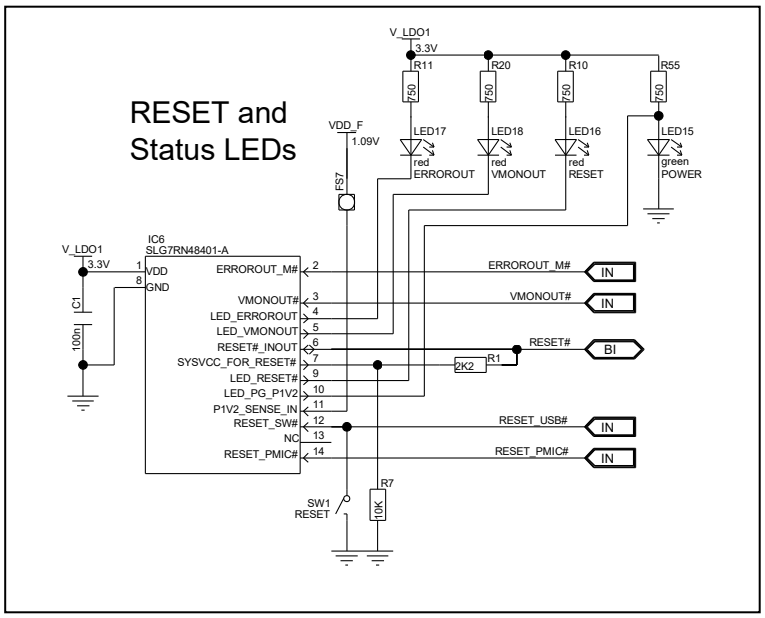


Figure 6.1 RESET circuit and status LEDs

The GreenPAK IC also receives the RESET signals from the RESET switch SW1, from the power management IC (Renesas RAA271084), and from the USB to UART converter (FTDI FT232RL). Based on these signals the GreenPAK IC generates the RESET#-signal for all circuits on the target board and controls the reset LED (LED16).

The GreenPAK IC monitors the RH850 core voltage VDD and switches LED15 on to indicate proper core voltage operation.

Figure 6.1 shows the circuit of the GreenPAK IC.

6.2 Expansion Connectors

The target board includes 4 expansion connectors, that resemble ARDUINO connectors.

For details on connectors CN9 – CN12 refer to *7.8 Expansion Connectors CN9 – CN12*.

Figure 6.2 shows the circuit diagram for the expansion connectors.

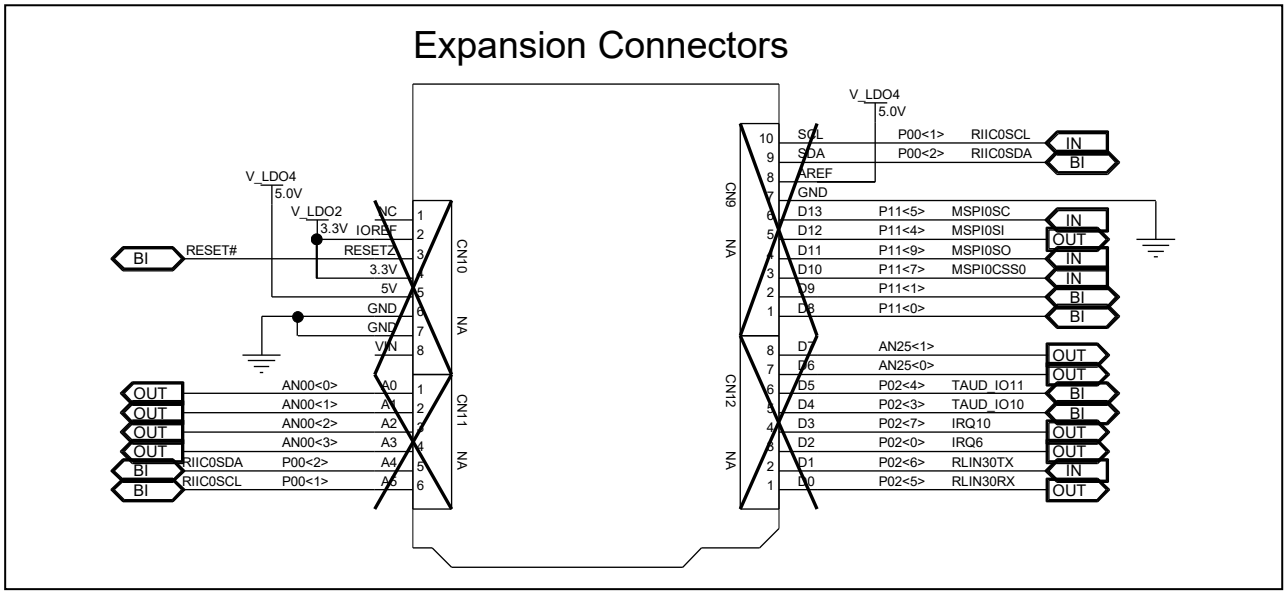


Figure 6.2 Expansion connectors

6.3 CAN FD Interface

The target board provides one CAN FD interface using a Microchip CAN FD transceiver ATA6561. The CAN signals are output to connector CN5.

For details on connector CN5 please refer to *7.5 CAN Connector CN5*.

The board uses CAN0 interface of RH850/U2B10 on ports P12_2 and P12_4 as inputs to the CAN FD transceiver.

P12_3 is a digital I/O. It can be used to switch the CAN FD transceiver to standby mode.

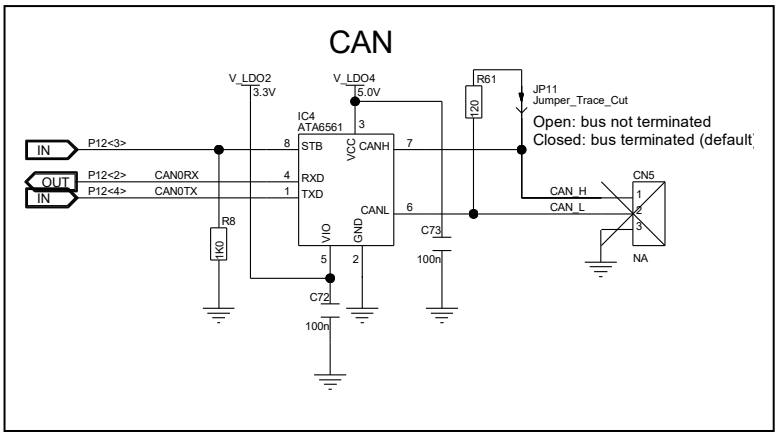


Figure 6.3 CAN FD interface circuits

The board provides a load for the CAN FD interface. This load can be disabled by opening the cut trace JP11.

6.4 LIN Interface

The target board provides one LIN interface using an NXP LIN transceiver TJA1021. The LIN signals are output to connector CN6.

For details on connector CN6 please refer to *7.6 LIN Connector CN6*.

The board uses RLIN34 interface of RH850/U2B10 on ports P12_5 and P12_6 as interface to the LIN transceiver.

The LIN transceiver is powered via the cut trace JP9. The trace can be cut to switch the power supply for the LIN transceiver off if the input voltage to the target board exceeds 40V.

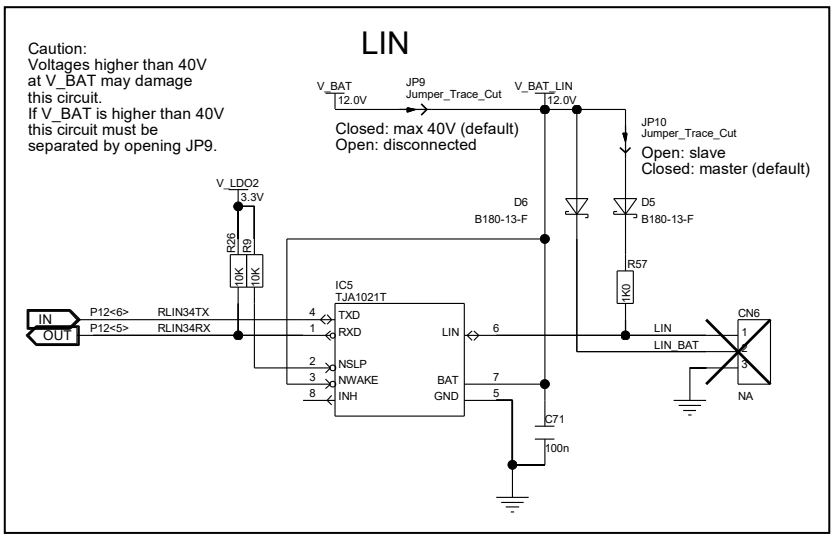


Figure 6.4 LIN interface circuit

6.5 USB Interface

The target board offers one USB interface with USB-C connector CN2 for UART communication.

It uses the RLIN32 function of RH850/U2B10 on ports P10_5 and P10_6 as UART output. The UART signals are fed to a FTDI USB to UART converter IC FT232RL. The USB to UART converter generates the USB signals, that are output to connector CN2.

Figure 6.5 shows the circuit diagram of the USB interface.

For details on connector CN2 please refer to *7.2 USB-C Connector CN2*.

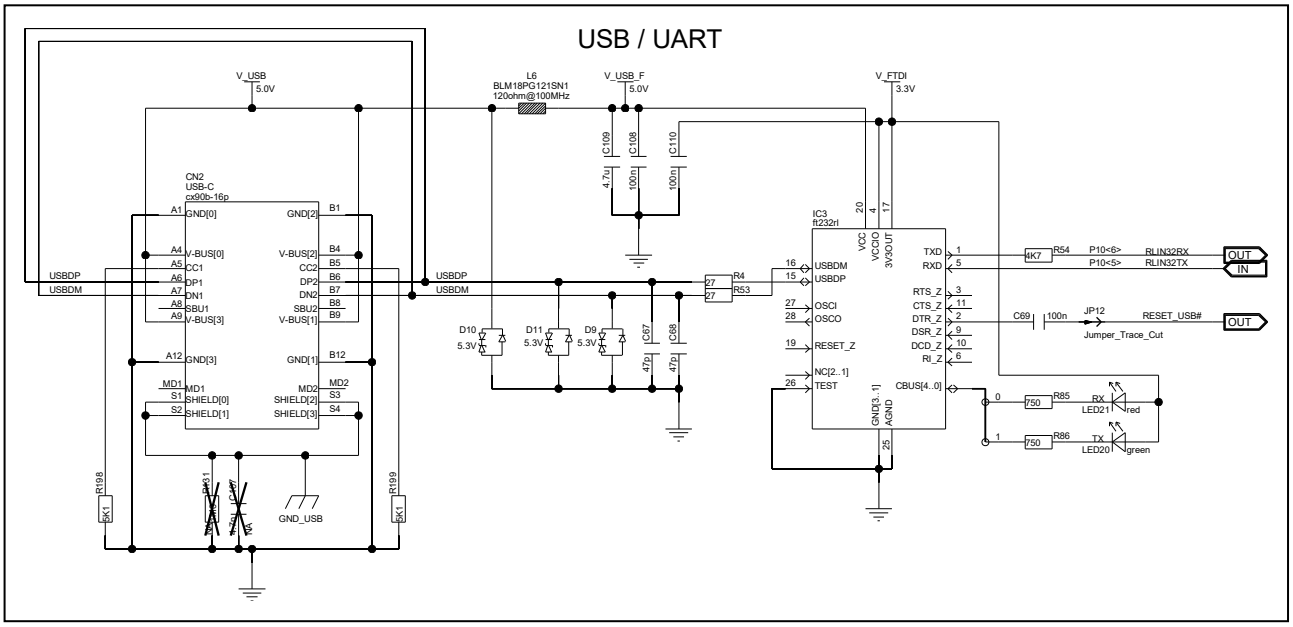


Figure 6.5 USB - UART interface circuit

6.6 PMOD Connectors

The target board has two PMOD connectors for easy connection of PMOD compatible extension boards.

The 2 interfaces differ slightly in the supported functions.

PMOD0 supports GPIO and SPI functionality.

PMOD1 supports GPIO and I2C functionality.

Table 6.1 and *Table 6.2* list the available functions and show which ports on RH850 are being used for them.

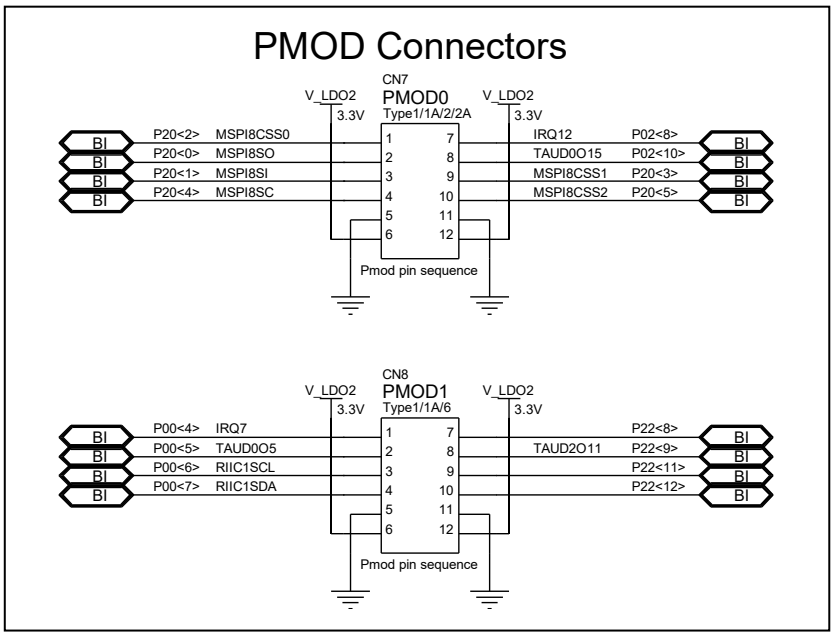


Figure 6.6 PMOD connectors

Table 6.1 PMOD0 pin configuration

Pin	GPIO (type 1)		Exp. GPIO (type 1A)		SPI (type 2)		Exp. SPI (type 2A)	
	PMOD signal	MCU signal	PMOD signal	MCU signal	PMOD signal	MCU signal	PMOD signal	MCU signal
1	GPIO	P20_2	GPIO	P20_2	CS	MSPI8CSS0	CS	MSPI8CSS0
2	GPIO (PWM)	P20_0	GPIO (PWM)	P20_0	MOSI	MSPI8SO	MOSI	MSPI8SO
3	GPIO	P20_1	GPIO	P20_1	MISO	MSPI8SI	MISO	MSPI8SI
4	GPIO	P20_4	GPIO	P20_4	SCK	MSPI8SC	SCK	MSPI8SC
5	GND	GND	GND	GND	GND	GND	GND	GND
6	VCC	V_LDO2	VCC	V_LDO2	VCC	V_LDO2	VCC	V_LDO2
7	---	---	GPIO	P02_8	---	---	GPIO (INT)	IRQ12
8	---	---	GPIO (PWM)	P02_10 TAUD0O15	---	---	GPIO (RESET)	P02_10 TAUD0O15
9	---	---	GPIO	P20_3	---	---	GPIO (CS2)	P20_3 MSPI8CSS1
10	---	---	GPIO	P20_5	---	---	GPIO (CS3)	P20_5 MSPI8CSS2
11	---	---	GND	GND	---	---	GND	GND
12	---	---	VCC	V_LDO2	---	---	VCC	V_LDO2

Table 6.2 PMOD1 pin configuration

Pin	Exp. SPI (type 1)		Exp. UART (type 1A)		I2C (type 6)	
	PMOD signal	MCU signal	PMOD signal	MCU signal	PMOD signal	MCU signal
1	GPIO	P00_4	GPIO	P00_4	NC (INT)	IRQ7
2	GPIO (PWM)	P00_5 TAUD0O5	GPIO (PWM)	P00_5 TAUD0O5	NC (RESET)	P00_5
3	GPIO	P00_6	GPIO	P00_6	SCL	RIIC1SCL
4	GPIO	P00_7	GPIO	P00_7	SDA	RIIC1SDA
5	GND	GND	GND	GND	GND	GND
6	VCC	V_LDO2	VCC	V_LDO2	VCC	V_LDO2
7	---	---	GPIO	P22_8	---	---
8	---	---	GPIO (PWM)	P22_9 (TAUD2O11	---	---
9	---	---	GPIO	P22_11	---	---
10	---	---	GPIO	P22_12	---	---
11	---	---	GND	GND	---	---
12	---	---	VCC	V_LDO2	---	---

6.7 User LEDs

The target board includes 8 user LEDs (LED1 – LED8).

The user LEDs can be controlled from ports P22_0 – P22_7 on RH850.

The LEDs are connected to RH850 via bridged solder jumpers JP1 – JP8. If an LED should not be connected to the processor the connection can easily be cut at the corresponding jumper.

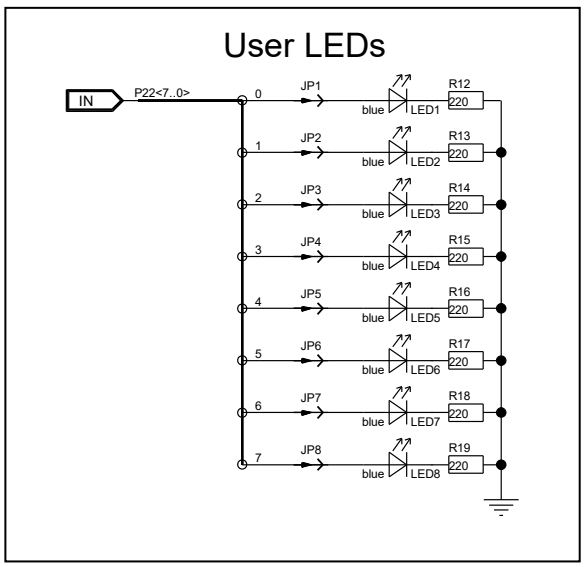


Figure 6.7 User LEDs

7. Connectors

7.1 Debug Connector CN1

Please refer to *5 Debug and Flash Programming Interfaces* for details on the function of this connector.

Table 7.1 On-chip debug connector CN1

Pin	Function	Device port	Pin	Function	Device port
1	TDCK/LPDCLK/FPCK	JP0_2	2	GND	
3	TRST#		4	FLMD0	
5	TDO/LPDO/FPDT	JP0_1	6	–	
7	TDI/LPDIO/FPDR	JP0_0	8	V_LDO1 (3.3V)	
9	TMS	JP0_3	10	EVTO0#	P32_0
11	RDY/LPDCLKOUT	JP0_5	12	GND	
13	RESET#		14	GND	

7.2 USB-C Connector CN2

Please refer to *6.5 USB Interface* for details on the function of this connector.

Table 7.2 USB-C connector CN2

Pin	Function	Signal Name	Pin	Function	Signal Name
A1	GND[0]	GND	B1	GND[2]	GND
A4	V-BUS[0]	V_USB (5.0V)	B4	V-BUS[2]	V_USB (5.0V)
A5	CC1	GND	B5	CC2	GND
A6	DP1	USBDP	B6	DP2	USBDP
A7	DN1	USBDM	B7	DN2	USBDM
A8	SBU1	---	B8	SBU2	---
A9	V-BUS[3]	V_USB (5.0V)	B9	V-BUS[1]	V_USB (5.0V)
A12	GND[3]	GND	B12	GND[1]	GND

7.3 Power Supply Connector CN3

Please refer to *3 Power Supply* for details on the function of this connector.

Table 7.3 Power supply connector CN3

Pin	Function
1	GND
2	–
3	+12V
4	+12V

7.4 Voltage Output Connector CN4

Please refer to *3.1 Power Management IC (PMIC)* for details on the function of this connector.

Table 7.4 Voltage output connector CN4

Pin	Function
1	V_LDO4
2	GND

7.5 CAN Connector CN5

Please refer to *6.3 CAN FD Interface* for details on the function of this connector.

Table 7.5 CAN connector CN5

Pin	Function
1	CAN_H
2	CAN_L
3	GND

7.6 Extension CLIN Connector CN6

Please refer to *6.4 LIN Interface* for details on the function of this connector.

Table 7.6 LIN connector CN6

Pin	Function
1	LIN
2	LIN_BAT
3	GND

7.7 PMOD Connectors CN7 and CN8

Please refer to *6.6 PMOD Connectors* for details on the function of these connectors.

Table 7.7 PMOD0 connector CN7

Pin	GPIO (type 1)		Exp. GPIO (type 1A)		SPI (type 2)		Exp. SPI (type 2A)	
	PMOD signal	MCU signal	PMOD signal	MCU signal	PMOD signal	MCU signal	PMOD signal	MCU signal
1	GPIO	P20_2	GPIO	P20_2	CS	MSPI8CSS0	CS	MSPI8CSS0
2	GPIO (PWM)	P20_0	GPIO (PWM)	P20_0	MOSI	MSPI8SO	MOSI	MSPI8SO
3	GPIO	P20_1	GPIO	P20_1	MISO	MSPI8SI	MISO	MSPI8SI
4	GPIO	P20_4	GPIO	P20_4	SCK	MSPI8SC	SCK	MSPI8SC
5	GND	GND	GND	GND	GND	GND	GND	GND
6	VCC	V_LDO2	VCC	V_LDO2	VCC	V_LDO2	VCC	V_LDO2
7	---	---	GPIO	P02_8	---	---	GPIO (INT)	IRQ12
8	---	---	GPIO (PWM)	P02_10 TAUD0O15	---	---	GPIO (RESET)	P02_10 TAUD0O15
9	---	---	GPIO	P20_3	---	---	GPIO (CS2)	P20_3 MSPI8CSS1
10	---	---	GPIO	P20_5	---	---	GPIO (CS3)	P20_5 MSPI8CSS2
11	---	---	GND	GND	---	---	GND	GND
12	---	---	VCC	V_LDO2	---	---	VCC	V_LDO2

Table 7.8 PMOD1 connector CN8

Pin	Exp. SPI (type 1)		Exp. UART (type 1A)		I2C (type 6)	
	PMOD signal	MCU signal	PMOD signal	MCU signal	PMOD signal	MCU signal
1	GPIO	P00_4	GPIO	P00_4	NC (INT)	IRQ7
2	GPIO (PWM)	P00_5 TAUD0O5	GPIO (PWM)	P00_5 TAUD0O5	NC (RESET)	P00_5
3	GPIO	P00_6	GPIO	P00_6	SCL	RIIC1SCL
4	GPIO	P00_7	GPIO	P00_7	SDA	RIIC1SDA
5	GND	GND	GND	GND	GND	GND
6	VCC	V_LDO2	VCC	V_LDO2	VCC	V_LDO2
7	---	---	GPIO	P22_8	---	---
8	---	---	GPIO (PWM)	P22_9 (TAUD2O11	---	---
9	---	---	GPIO	P22_11	---	---
10	---	---	GPIO	P22_12	---	---
11	---	---	GND	GND	---	---
12	---	---	VCC	V_LDO2	---	---

7.8 Expansion Connectors CN9 – CN12

Please refer to *6.2 Expansion Connectors* for details on the function of these connectors.

Table 7.9 Extension connector CN10 and CN11

Pin	CN10		CN11	
	RH850 Port	Arduino Function	RH850 Port	Arduino Function
1	Not connected	NC	AN00_0	A0
2	V_LDO2 (3.3V)	IOREF	AN00_1	A1
3	RESET#	RESET	AN00_2	A2
4	V_LDO2 (3.3V)	3V3	AN00_3	A3
5	V_LDO4 (5.0V)	5V	P00_2 / RIIC0SDA	A4 / SDA
6	GND	GND	P00_1 / RIIC00SCL	A5 / SCL
7	GND	GND		
8	Not connected	VIN		

Table 7.10 Extension connector CN9 and CN12

Pin	CN9		CN12	
	RH850 Port	Arduino Function	RH850 Port	Arduino Function
1	P11_0	D8	P02_5 / RLIN30RX	D0 / RX
2	P11_1	D9	P02_6 / RLIN30TX	D1 / TX
3	P11_7 / MSPI0CSS0	D10 / CS	P02_0 / IRQ6	D2
4	P11_9 / MSPI0SO	D11 / MOSI	P02_7 / IRQ7	D3
5	P11_4 / MSPI0SI	D12 / MISO	P02_3 / TAUDIO10	D4
6	P11_5 / MSPI0SC	D13 / SCK	P02_4 / TAUDIO11	D5
7	GND	GND	AN25_0	D6
8	V_LDO4 (5.0V)	AREF	AN25_1	D7
9	P00_2 / RIIC0SDA	SDA		
10	P00_1 / RIIC0SCL	SCL		

8. Dimensions

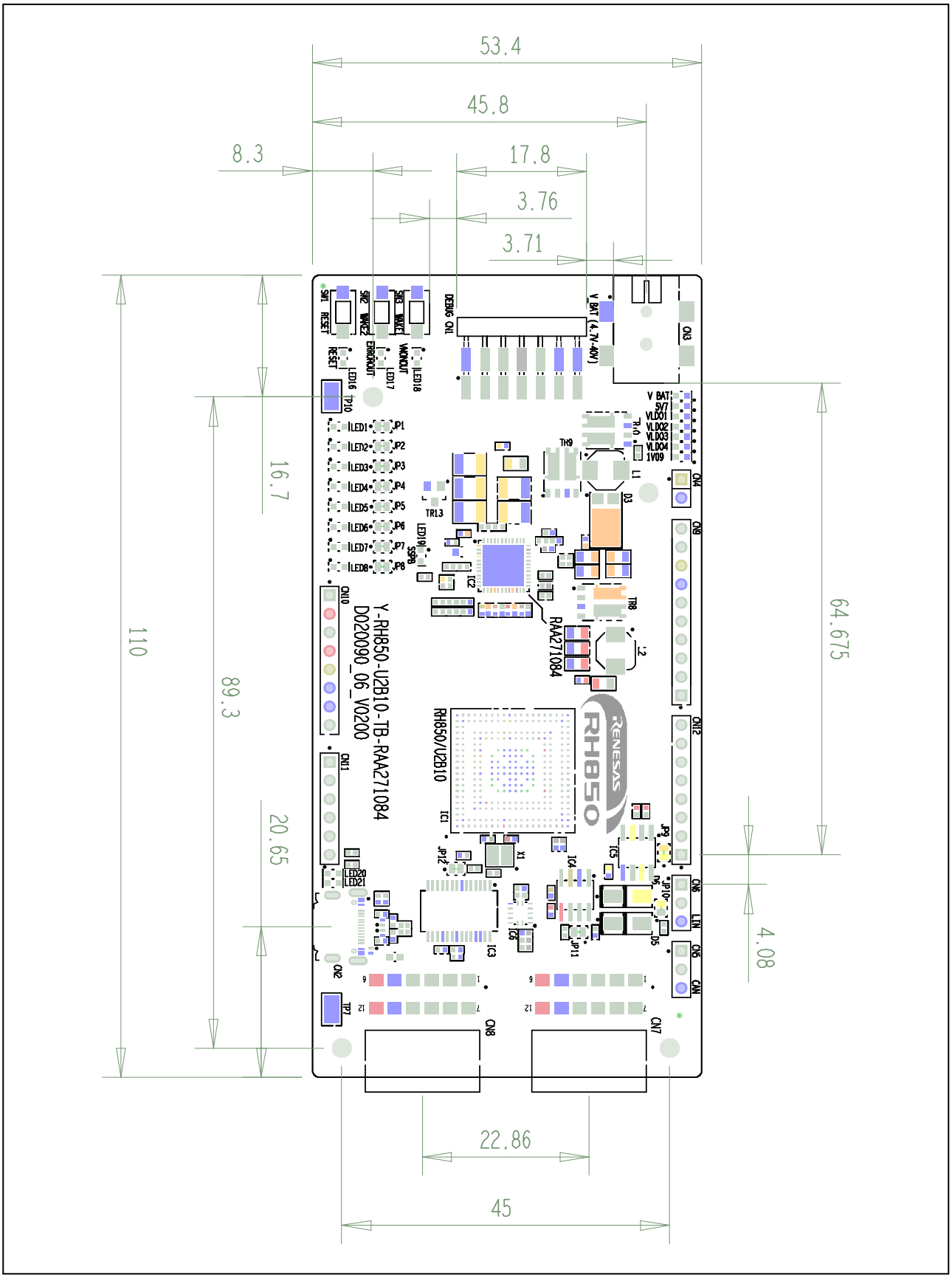


Figure 7.1 Mechanical dimensions

9. Schematics

CAUTION

The schematics shown in this document are not intended to be used as a reference for mass production. Any usage in an application design is in sole responsibility of the customer.

The following components described in the schematics are not provided with the board upon delivery:

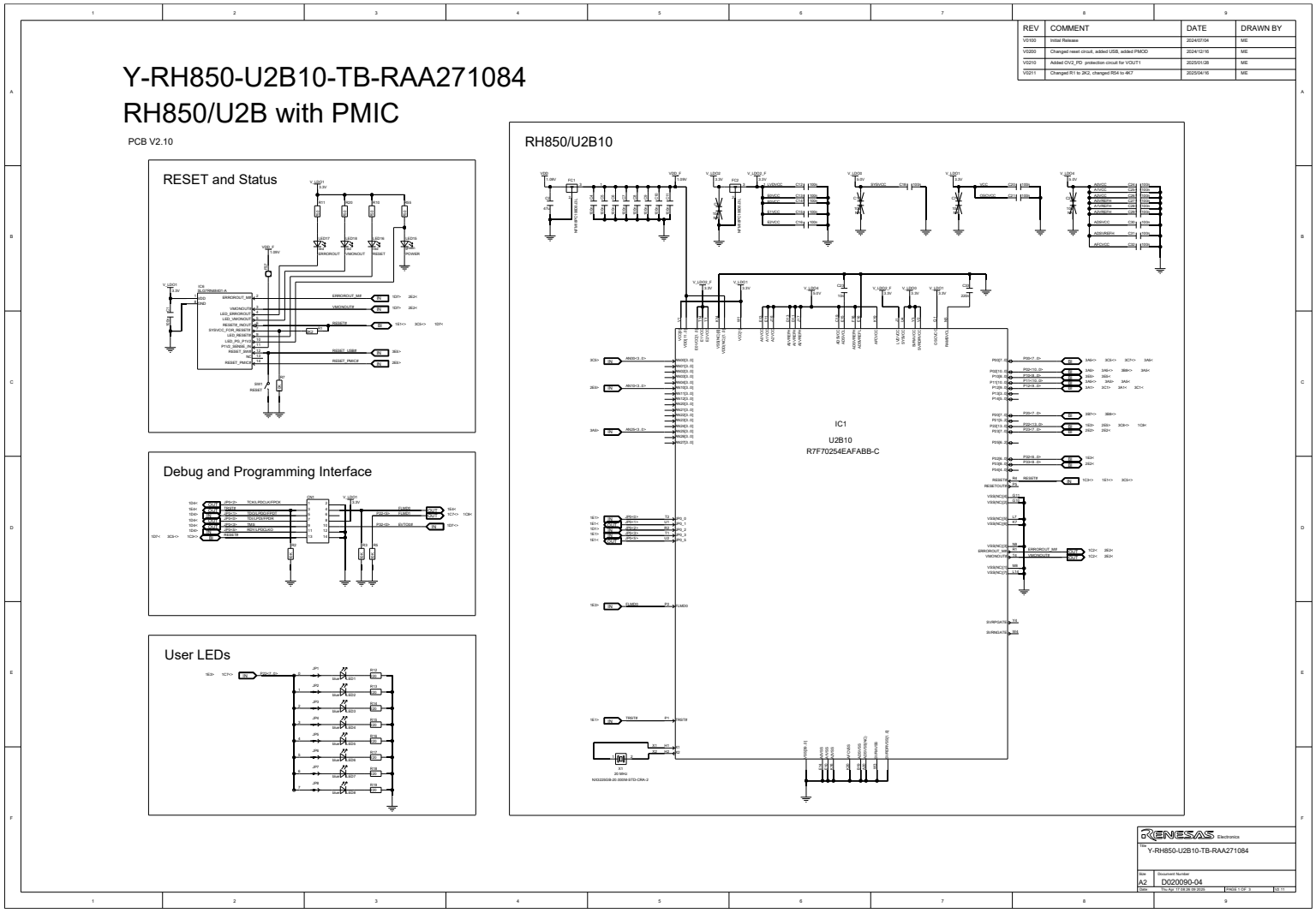
- Capacitors: C3, C17, C19, C22, C74, C75, C107
- Resistors: R22, R23, R131
- 2-pin connector: CN4
- 3-pin connectors: CN5, CN6
- 6-pin connector: CN11
- 8-pin connectors: CN10, CN12
- 10-pin connector: CN9

In board version D020090_06_V02 above components are crossed out in the schematics.

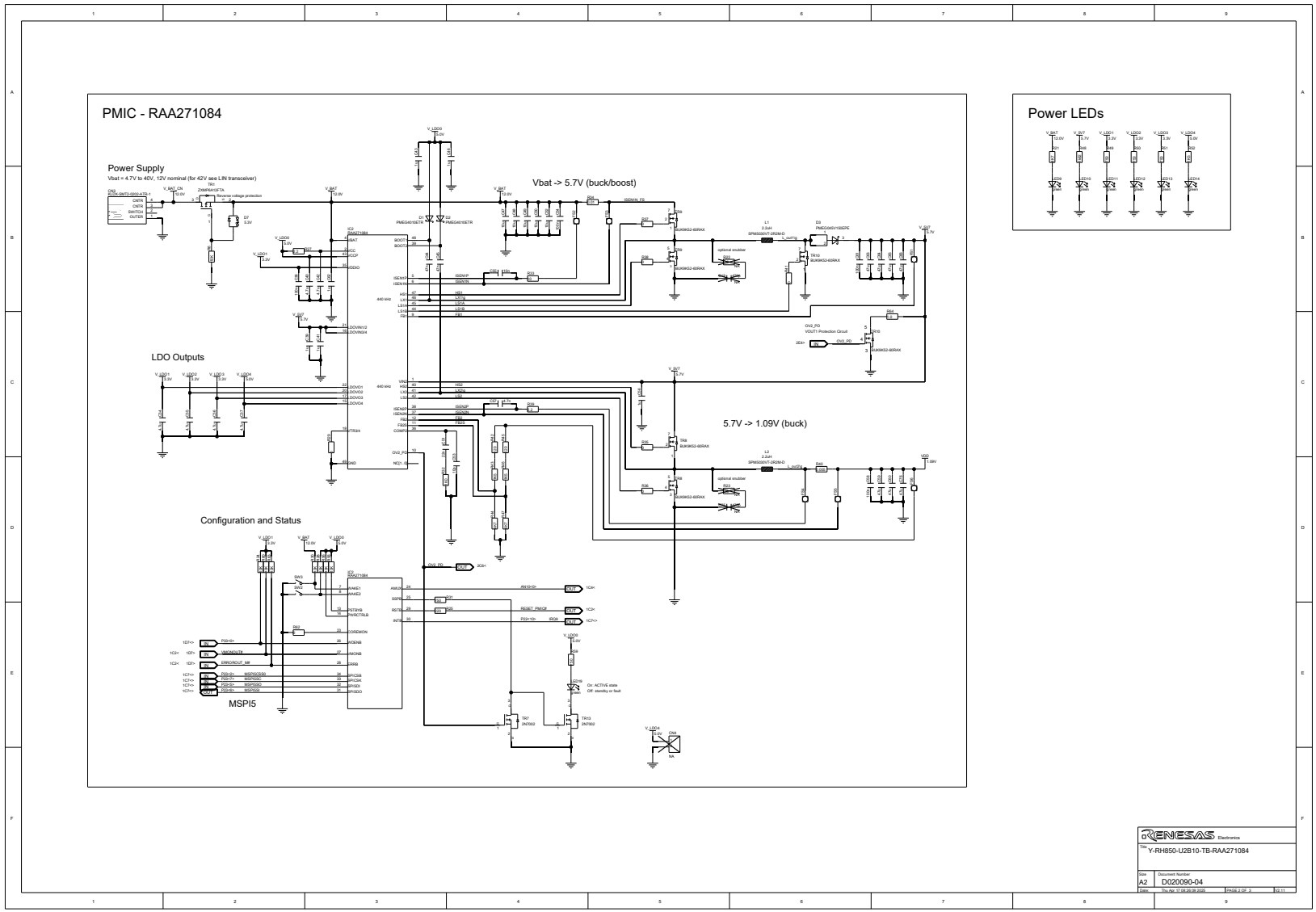
In board version D020090_06_V03 above components are marked “NA” in the schematics.

9.1 Board Version D020090_06_V02

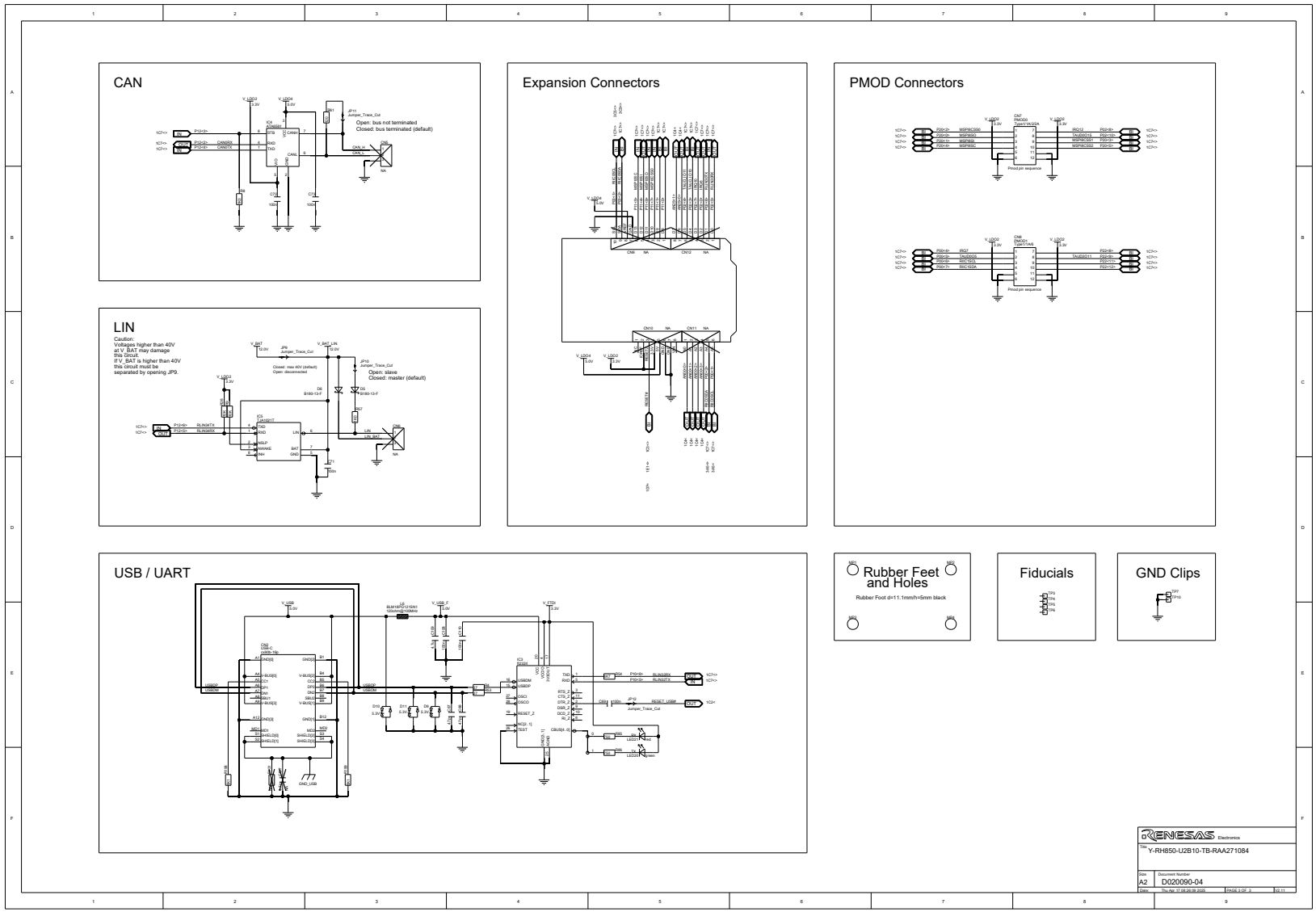
9.1.1 RH850/U2B10



9.1.2 Power Management IC RAA271084

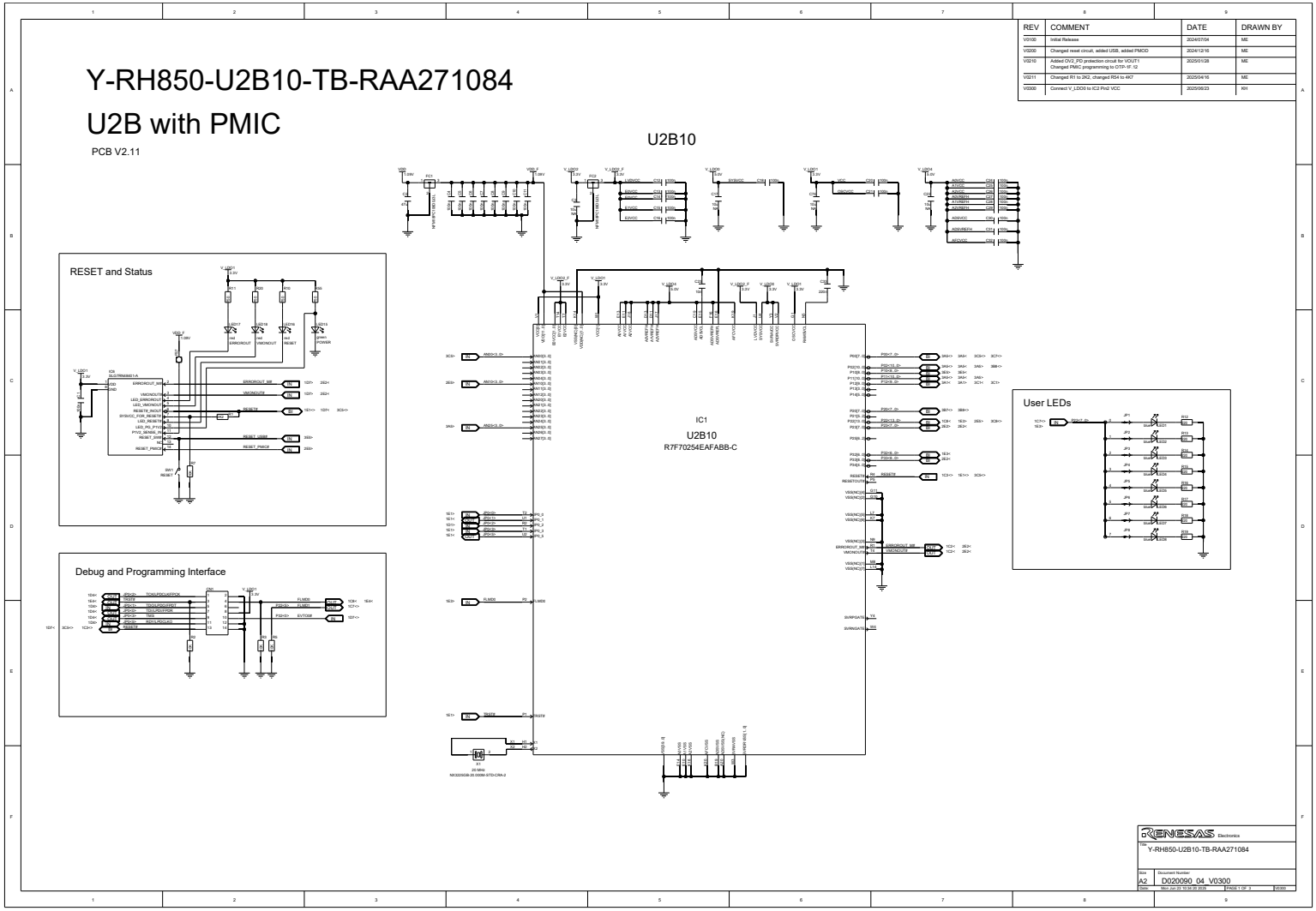


9.1.3 Interfaces

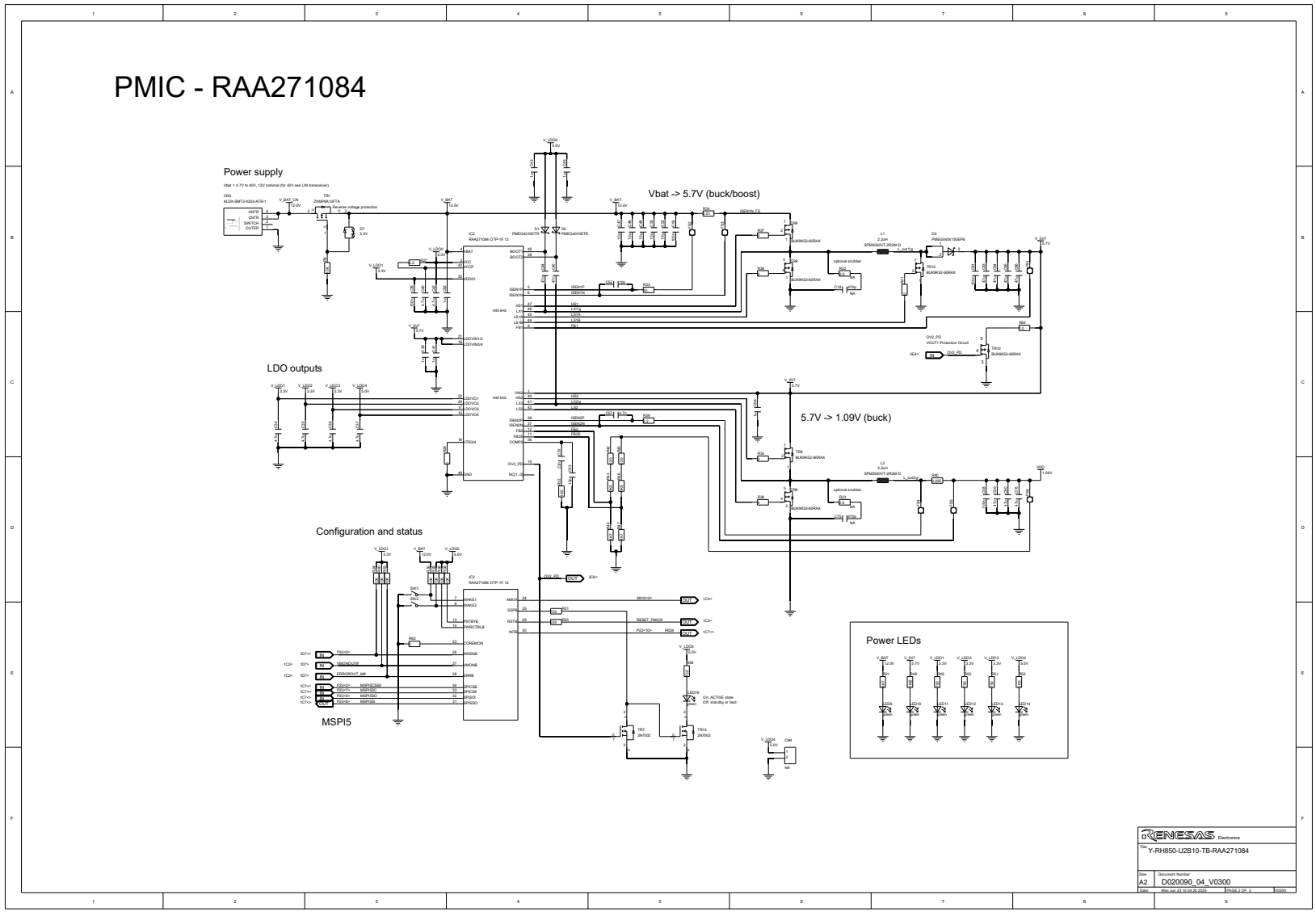


9.2 Board Version D020090_06_V03

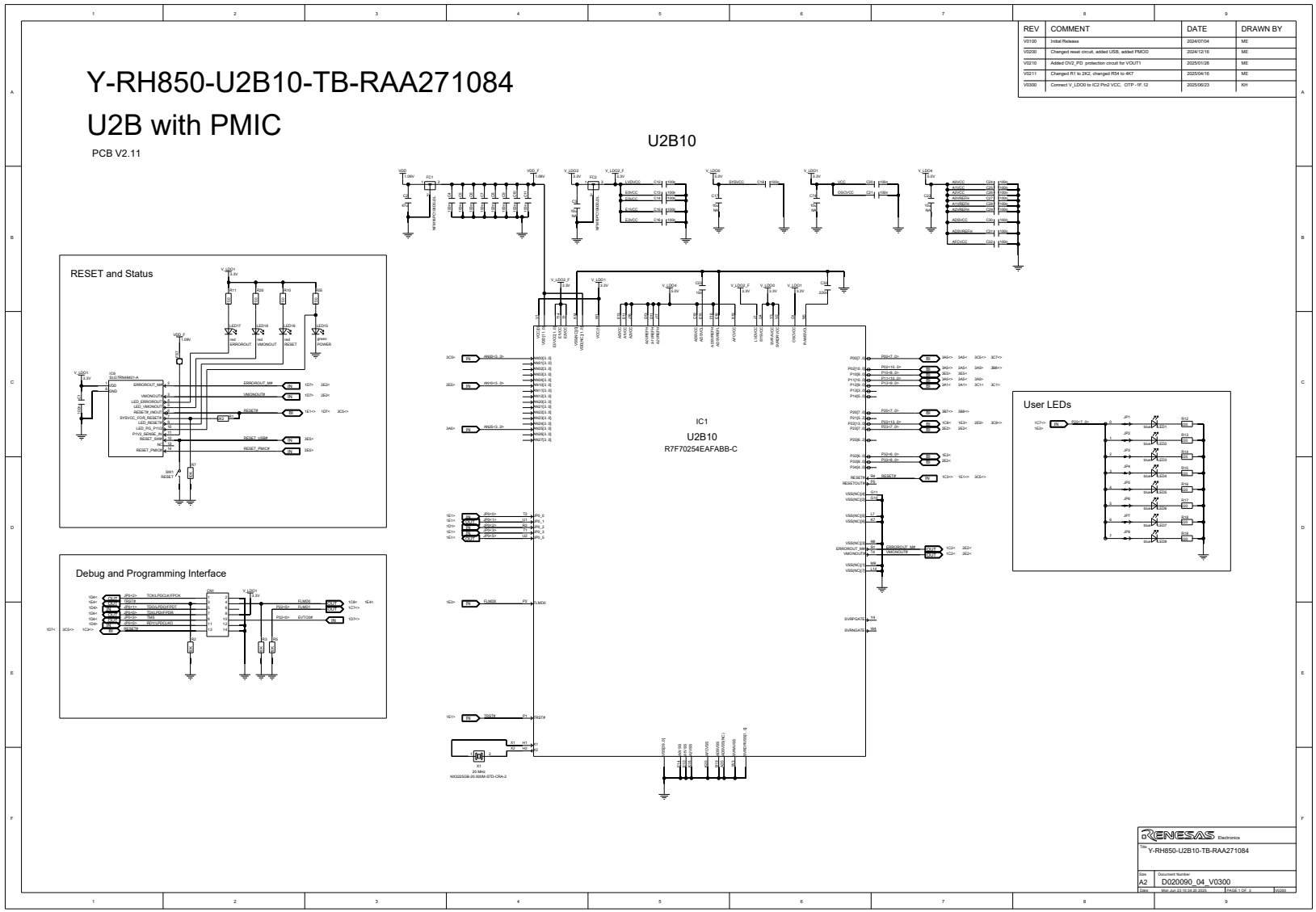
9.2.1 RH850/U2B10



9.2.2 Power Management IC RAA271084



9.2.3 Interfaces



Revision History

		Description	
Rev.	**Date**	**Page**	**Summary**
V2.00	2026-02-12	9	Added print “GreenPAK™” to the silk screen of IC6. Refer to *1.4 Target Board* Views.
		17	Modified connection of L_VDO0 on the power management IC (IC2). Refer to *3.1 Power Management IC (PMIC)*.
V1.00	2025-04-17	–	Initial release for RH850/U2B10 target board with RAA271084 PMIC

RH850/U2B10 Target Board with RAA271084 Power Management IC
User's Manual: Hardware

Publication Date: Rev.2.00 February 12, 2026

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