User's Manual

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RH850 Evaluation Platform

RH850/U2C Starter Kit

User's Manual: Hardware

Y-ASK-RH850U2C4(-JP)
Y-ASK-RH850U2C8(-JP)

Renesas Electronics
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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. 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/U2C Starter Kit’ serves as a simple and easy to use platform for evaluating the features and performance of Renesas Electronics’ 32-bit RH850/U2C microcontrollers.

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 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 Y-ASK-RH850U2Cx(-JP)

The Y-ASK-RH850U2Cx(-JP) product package consists of the items listed in *Table 1.1*.

The difference between the boards Y-ASK-RH850U2C4(-JP) and Y-ASK-RH850U2C8(-JP) is the RH850/U2C processor that is mounted on the PCB. Refer to chapter *1.5 Used Device* for details.

After you have unpacked the box, check if your Y-ASK-RH850U2Cx(-JP) package contains all of these items. *Table 1.1 Package Components for the Y-ASK-RH850U2Cx*(-JP) shows the packing components of the Y-ASK-RH850U2C4(-JP) and the Y-ASK-RH850U2C8(-JP) package.

Table 1.1 Package Components for the Y-ASK-RH850U2Cx(-JP)

Item	Description	Quantity
D020925	RH850/U2Cx starter kit board	1
D017765-11	RH850 starter kit license information document	1
D021012-24	Product contents list Y-ASK-RH850U2C4(-JP)	1
D020965-24	Product contents list Y-ASK-RH850U2C8(-JP)	1
226-000210-01	Renesas E2 emulator unit	1
228-000078-01	USB Cable, Type A to Type-C, 0.5m	1
230-000109-01	Parallel Cable [1x D-SUB connector 9-pin - 1x DIL connector 10-pin]	3
230-000110-01	Sub-D male to male gender changer, 9-pin	3
236-000009-05	Power supply unit, 12V/1A Incl. 4 international AC-plugs	1 (not included in starter kits with *-JP in the order code)

Note

Please keep the Y-ASK-RH850U2Cx(-JP) 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 Y-ASK-RH850U2Cx(-JP). If packing of your product is not complete, it may be damaged during transportation.

1.2 Main Features

- Supports RH850/U2C processor
- Connection for on-chip debugging and flash memory programming
- Pin headers for direct access to all microcontroller pins
- External power supply (12V DC input)
- Debugging and programming interface:
  14-pin LPD/JTAG Debug Connector (e. g. for using E2 OCD Emulator or PG-FP6 Flash Programmer)
- Reset switch
- External clock circuit with a 20 MHz ceramic resonator
- Four status LEDs
- Eight general purpose signaling LEDs
- 16 circular LEDs
- Rotary encoder with RGB LED illuminated shaft
- Two analog signal inputs using potentiometer
- Two switches for external interrupt signal input
- 128x64px OLED display
- Onboard interface connectors for :
  - Ethernet port (10BASE-T1S / 100BASE-TX / 1000BASE-T1)
  - LIN / SENT
  - UART via USB (VCP)
  - CAN
  - CAN XL
  - Pmod
- Operating temperature from 0 °C to +40 °C

1.3 Starter Kit Versions

The following versions of the Starter Kit are available:

Table 1.2 Y-ASK-RH850U2Cx(-JP) board versions

Board version	Schematic version
D020925_06_V0100	D020925_04_V0102
D020925_06_V0200	D020925_04_V0200

Table 1.3 shows the differences of the board versions.

Table 1.3 Y-ASK-RH850U2Cx(-JP) board version differences

No.	Modified Function	Detailed Description of Changes	D020925_06_V0100	D020925_06_V0200
1	Power supply test connector CN5	Changed connector pin count	Uses a 10-pin connector for CN5. Connector is assembled. Refer to *3.3 Power Supply Test Connector*	Uses a 14-pin connector for CN5. Connector is NOT assembled. Refer to *3.3 Power Supply Test Connector*
2	FLMD1 / P06_7 signal connection	Modified connection of FLMD1 signal to port P06_7	Connection of FLMD1 signal to port P06_7 is enabled by 1-of-2 multiplexer. The multiplexer is controlled by FLMD0 signal. Opening cut trace E31 disconnects FLMD1 signal from port P06_7.	FLMD1 signal and pull-down resistor R12 are always connected to port P06_7. Opening cut trace E31 disconnects FLMD1 signal and pull-down resistor from port P06_7.
3	Interrupt signal	Signal connection for switch SW2 (INT1)	Connected to ports P04_10 (INTP34) and P24_4 (INTP17)	Connected to port P04_10 (INTP34)
4	Rotary encoder	Signal connections for ENC0 and ENC1 signal	Signal ENC0 connected to P02_9 (ENCA0E0) and P06_6 (ENCA0TIN0). Signal ENC1 connected to port P10_11 (ENCA0E1). It can also be connected to B1 input on IC9 to use P06_7 (ENCA0TIN1).	Signal ENC0 connected to P02_9 (ENCA0E0). Signal ENC1 connected to port P10_11 (ENCA0E1).
5	CAN interfaces	Name change	Interfaces named “CAN1” and “CAN XL / FD”	Interfaces named “CAN 1” and “CAN 0”
6	CAN interfaces	Signals to enable CAN bus termination	Bus termination on CAN0 (CAN XL/FD) can be activated by RH850/U2C ports P21_4 and P21_10.	Bus termination on CAN0 (CAN XL/FD) can only be activated by RH850/U2C port P21_4.
7	100BASE-TX Ethernet interface	Oscillator for the Ethernet transceiver	This board uses an Epson oscillator SG8018CE and inputs the clock signal to CLK_XTAL1 pin of the Ethernet transceiver.	This board uses the on-chip oscillator circuit of the Ethernet transceiver with an external crystal oscillator connected to the pins CLK_XTAL1 and XTAL2.
8	1000BASE-T1 Ethernet Interface	RESET signal output to the Ethernet transceiver.	Ports P04_10 and P24_4 can be used as RESET signal output to the Marvell transceiver.	P04_10 can be used as RESET signal output to the Marvell transceiver.

1.4 Starter Kit Board View

Below pictures show the starter kit (*Figure 1.1*) and the accessories included in the starter kit (*Figure 1.2*).

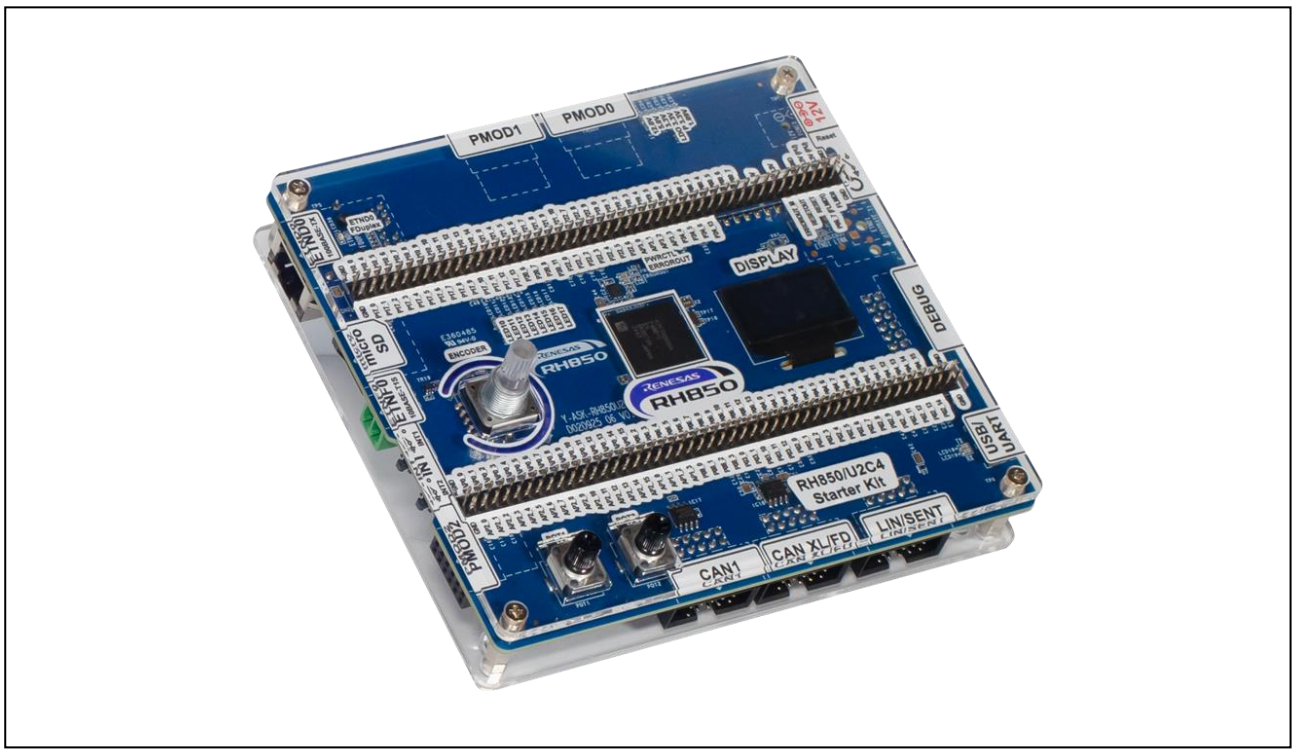


Figure 1.1 Starter kit

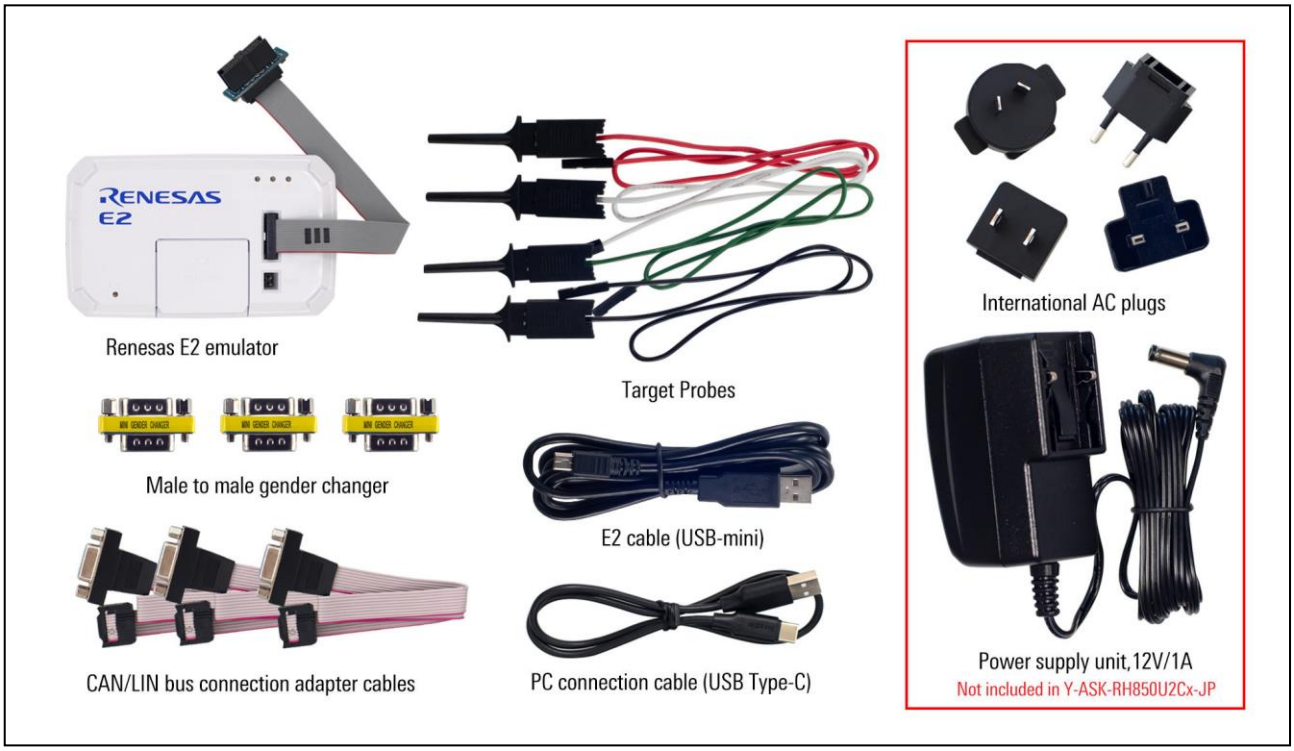


Figure 1.2 Starter kit accessories

The following figures provide the drawing of top and bottom views of the starter kit board including the solder pads.

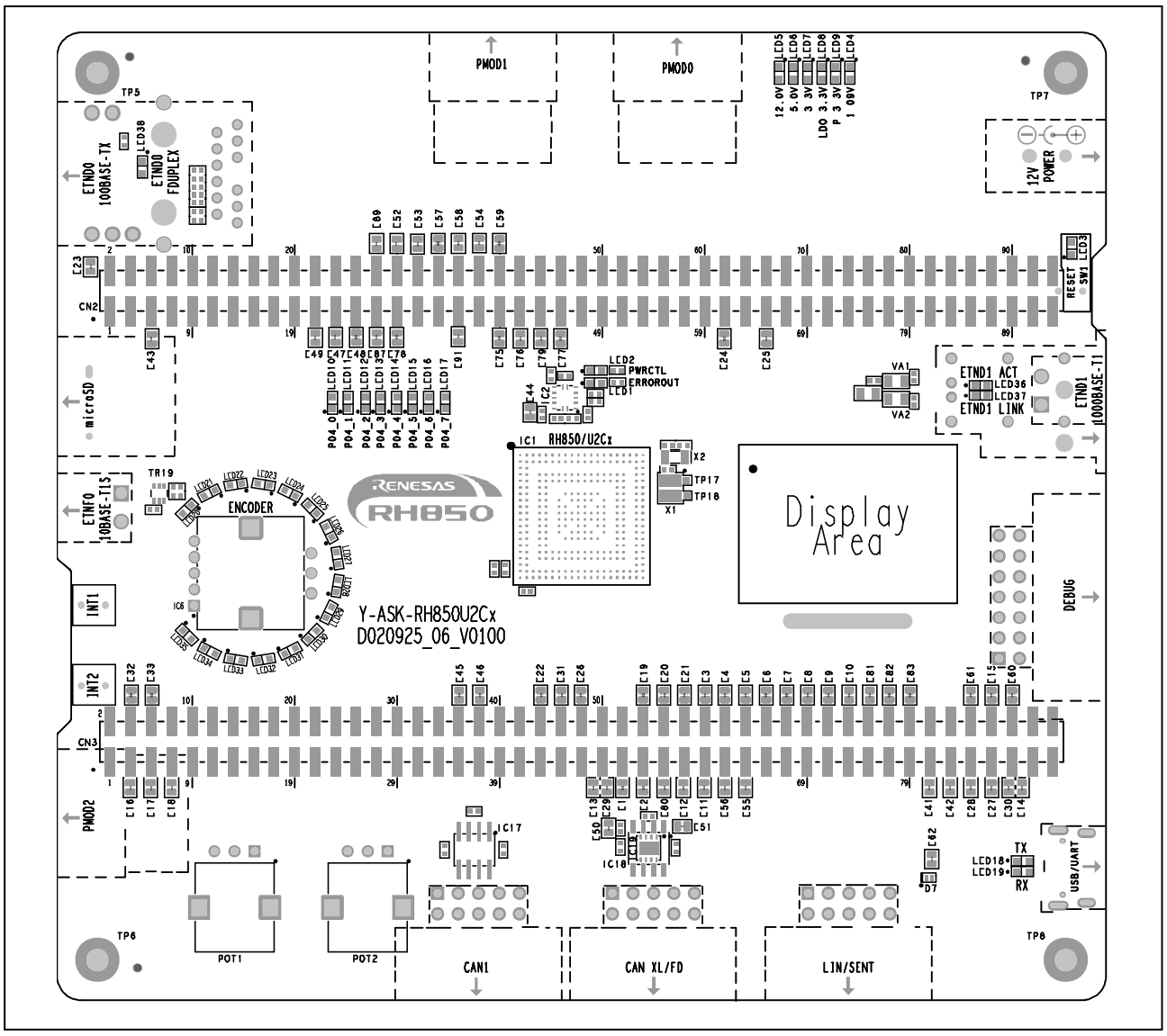


Figure 1.3 Starter kit board top view for board version D020925_06_V0100

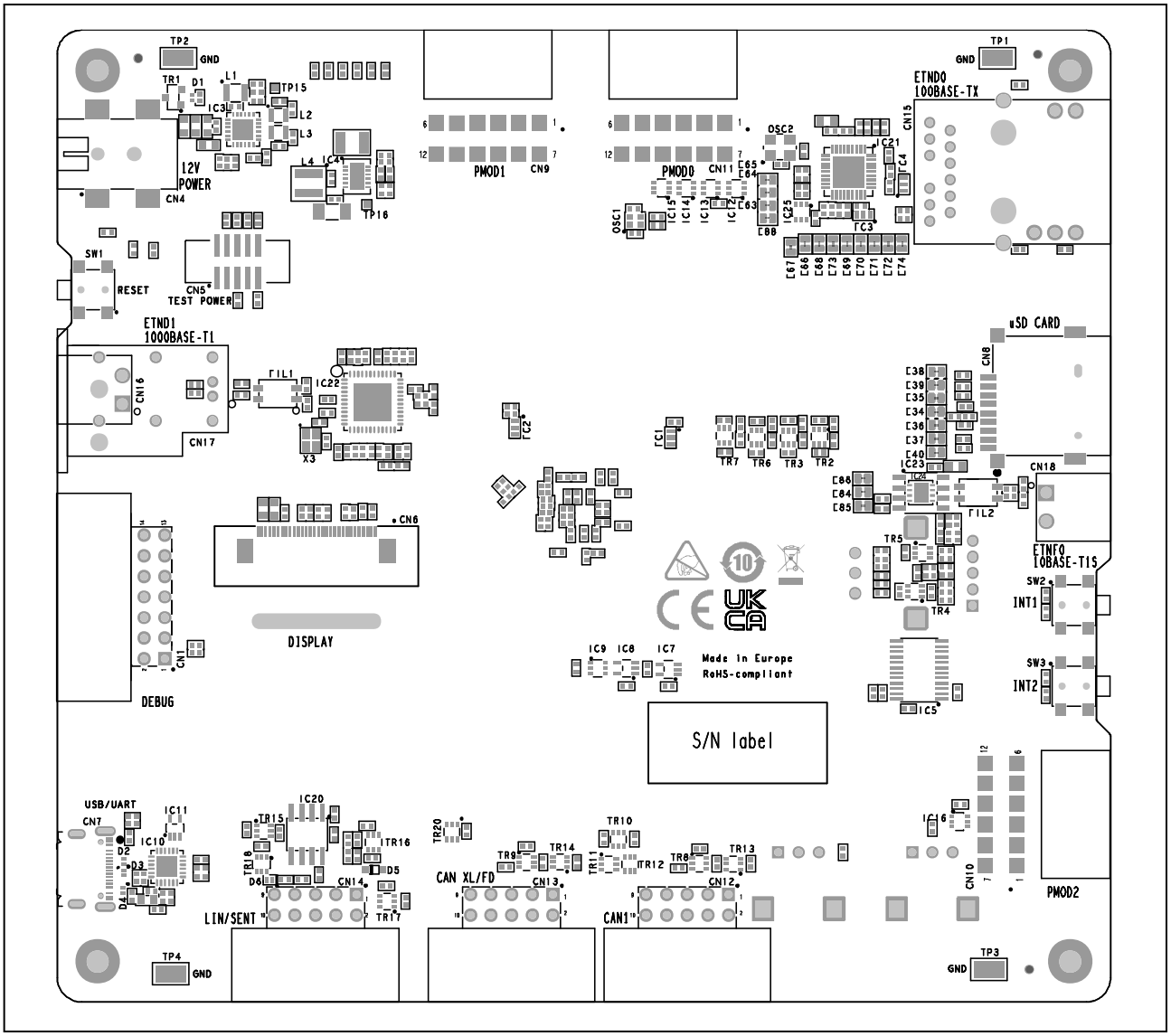


Figure 1.4 Starter kit board bottom view for board version D020925_06_V0100

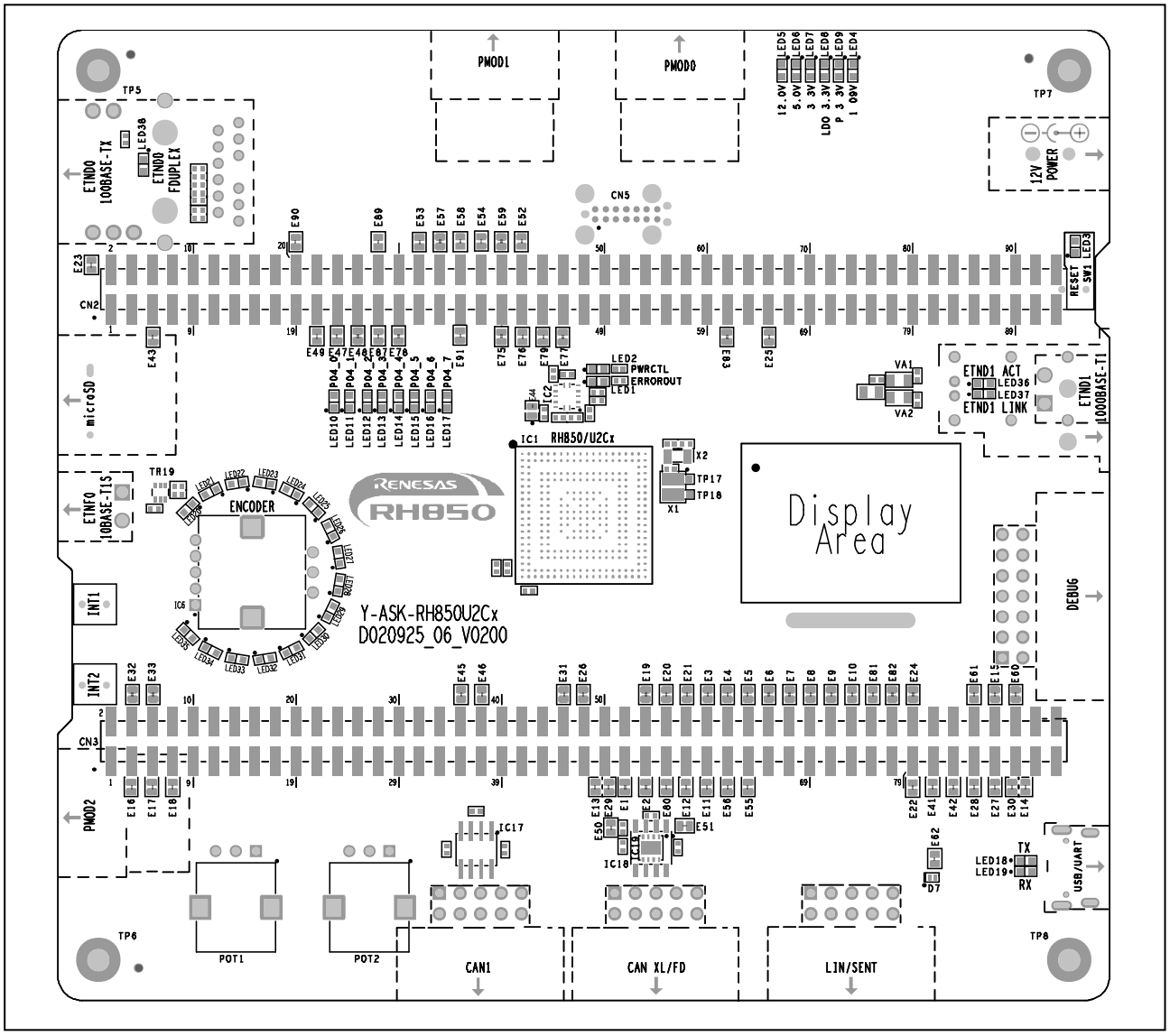


Figure 1.5 Starter kit board top view for board version D020925_06_V0200

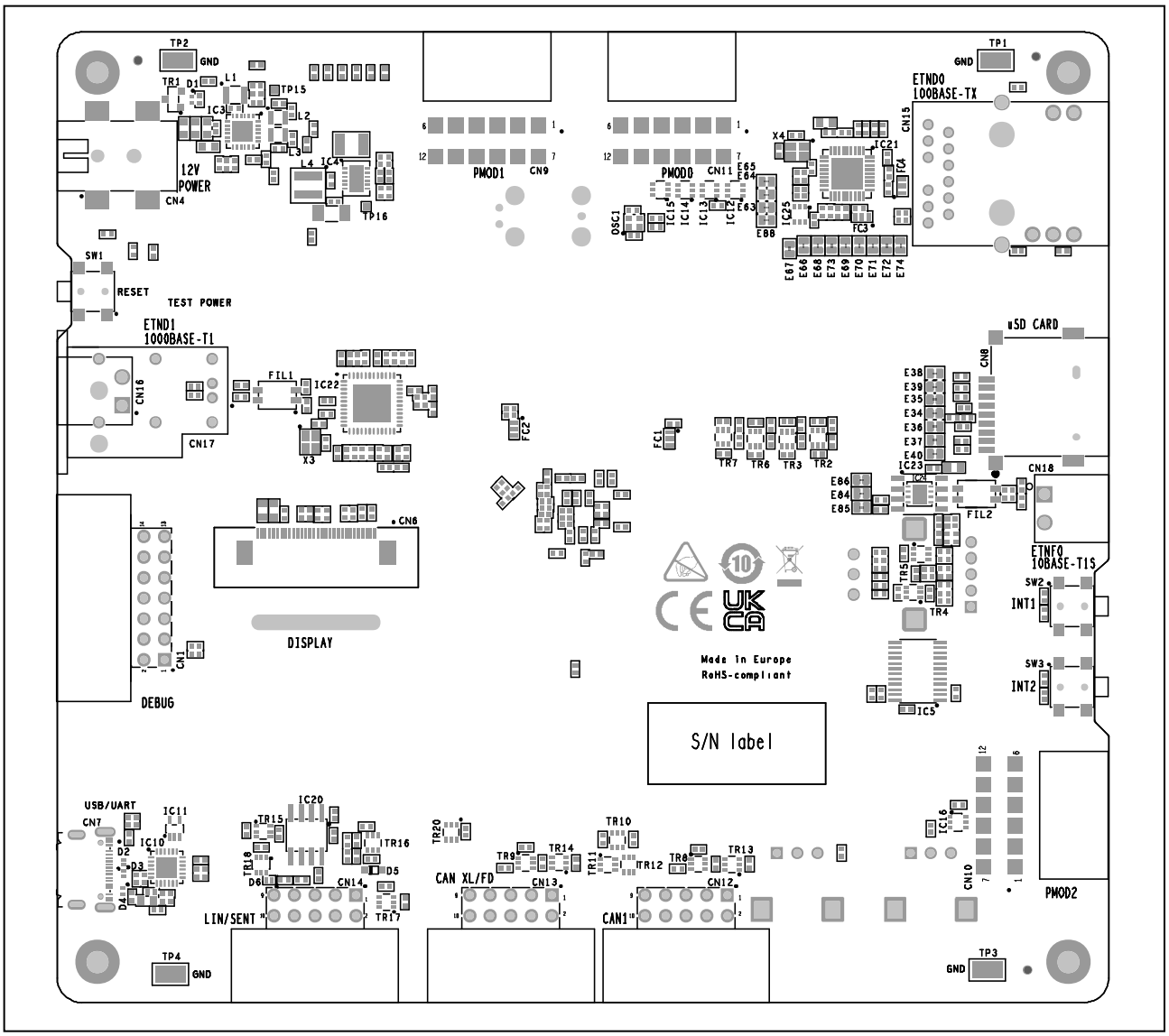


Figure 1.6 Starter kit board bottom view for board version D020925_06_V0200

1.5 Used Device

The board is designed for use with the following devices.

The device is soldered to the PCB.

Table 1.4 Type names for FCC and MP devices

Device	Type name	Comments
RH850/U2C4	R7F702606AFABB-C	DPS device
RH850/U2C8	R7F702600FABB-C	DPS device

2. Connectors, Switches and LEDs

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

The placement of these components on the board is shown in the figures below.

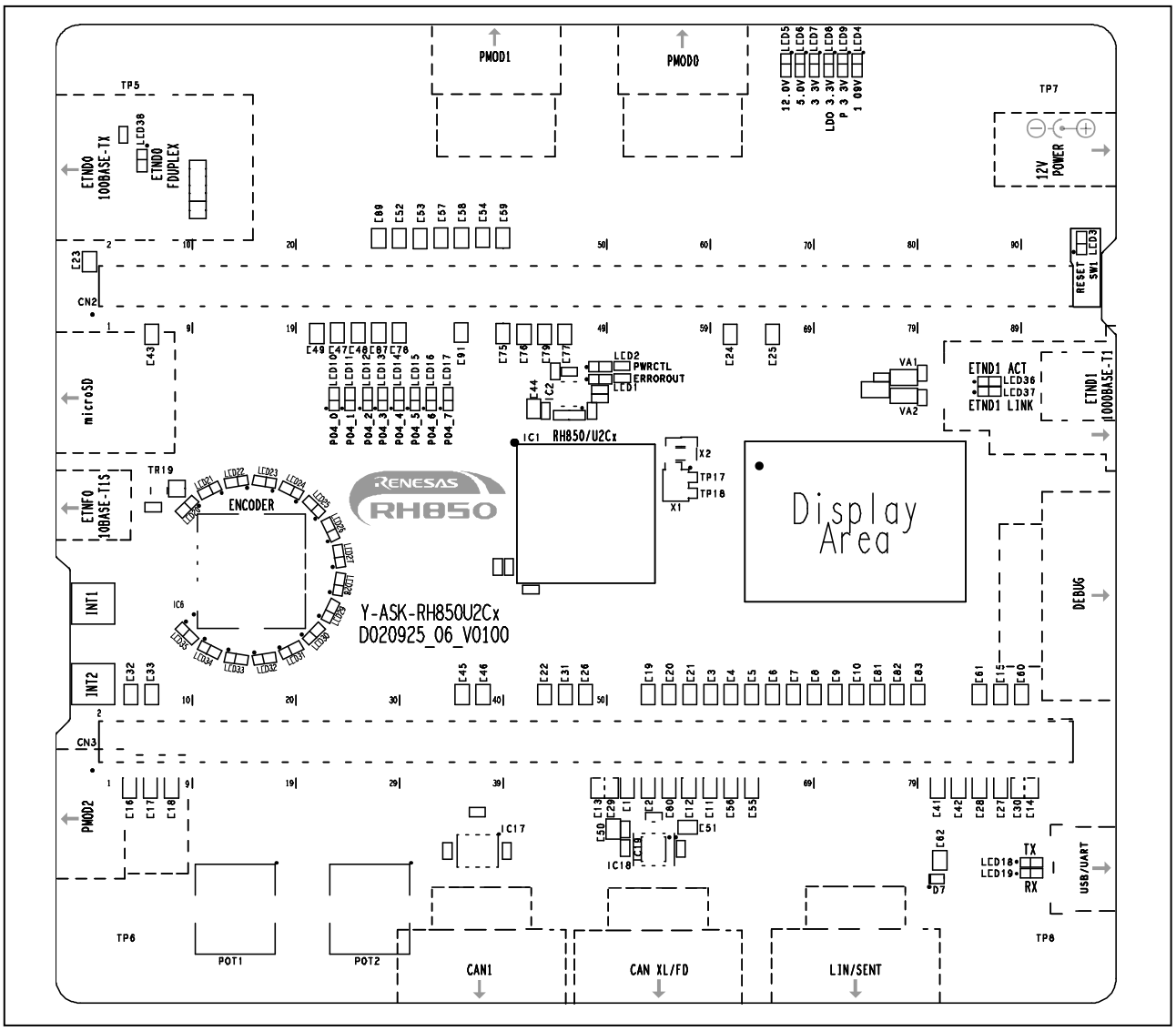


Figure 2.1 Placement of connectors and LEDs on top side of the starter for board version D020925_06_V0100

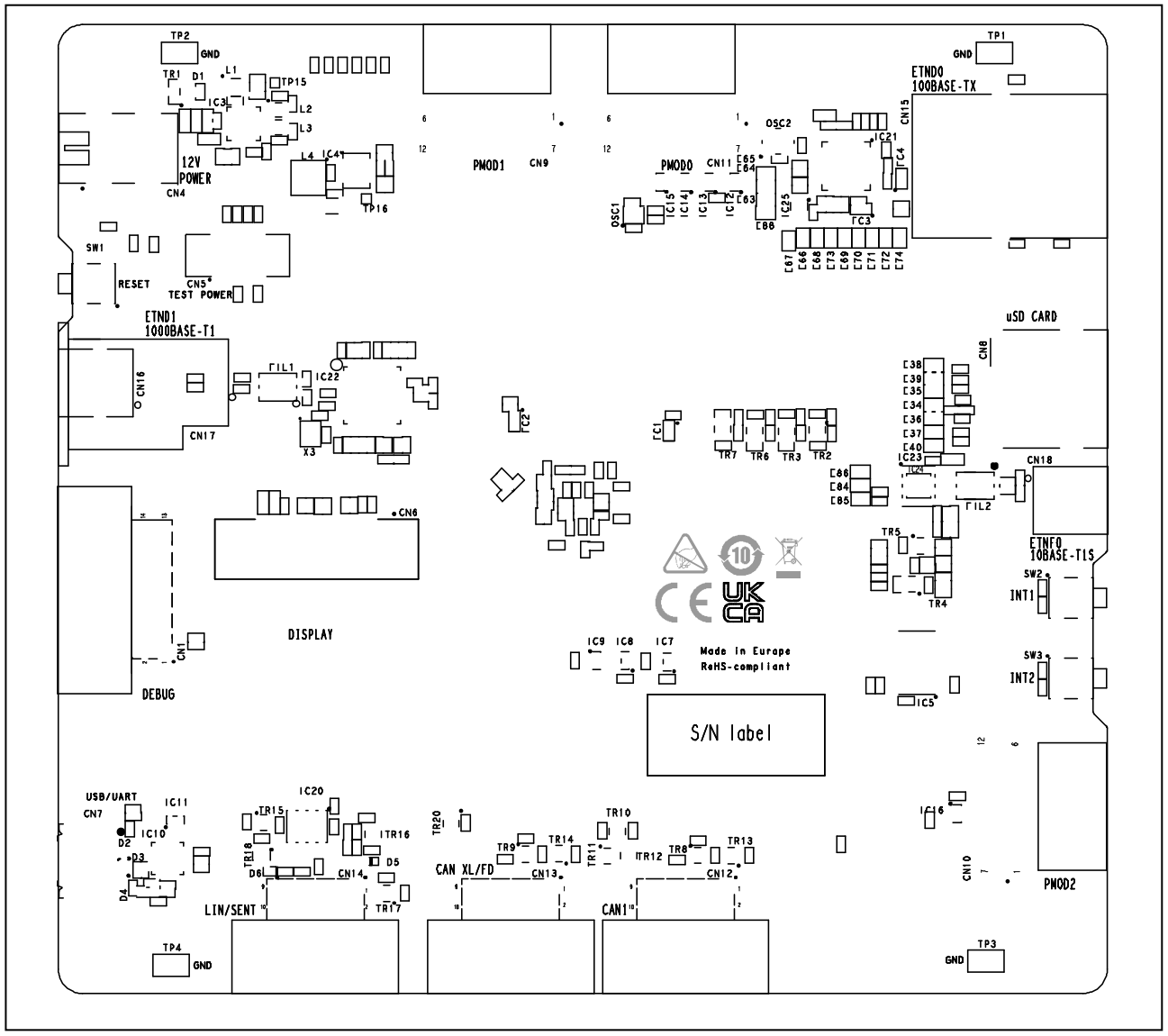


Figure 2.2 Placement of connectors on bottom side of the starter kit for board version D020925_06_V0100

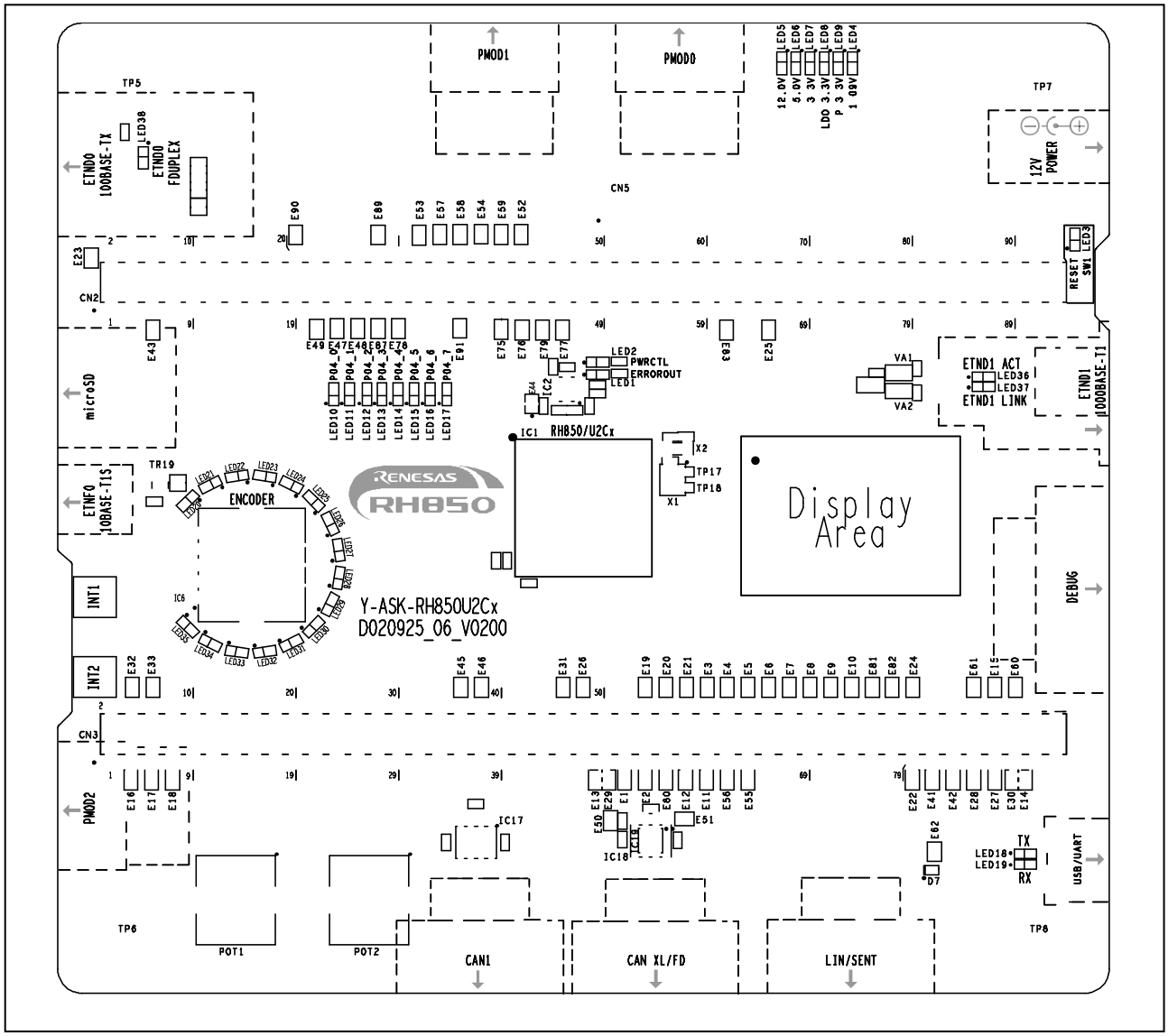


Figure 2.3 Placement of connectors and LEDs on top side of the starter for board version D020925_06_V0200

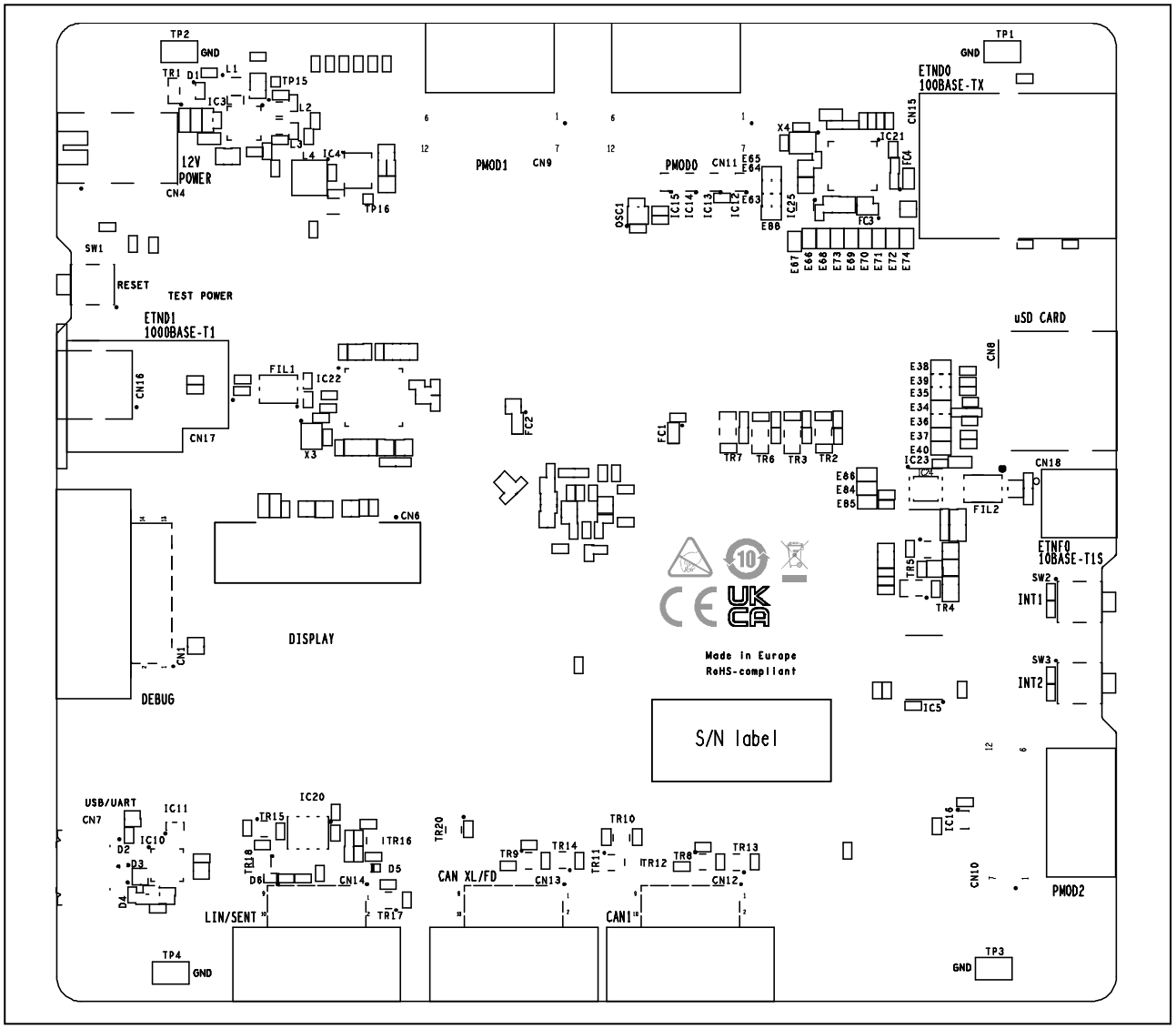


Figure 2.4 Placement of connectors on bottom side of the starter kit for board version D020925_06_V0200

2.1 Switch Overview

The following table provides an overview of all switches.

Table 2.1 Switch overview

Connector	Function	Remark
SW1	RESET switch	refer to *6.1 RESET Circuit*
SW2	External interrupt signal INT1	refer to *6.2 External Interrupt Signal*
SW3	External interrupt signal INT2	

2.2 Connector Overview

The following table provides an overview of all connectors.

Table 2.2 Connector overview

Connector	Function	Remark
CN1	Debug and programming interface	refer to *5 Debug and Flash Programming Interfaces*
CN2	Device port connectors	refer to *10.2 Device Port Connector CN2*
CN3		refer to *10.3 Device Port Connector CN3*
CN4	+12.0 V external power supply	refer to *3.1 Power Management IC (PMIC)*
CN5	Test connector for power supplies	refer to *3.3 Power Supply* Test Connector
CN6	Display connector	refer to *6.6 OLED Graphic Display*
CN7	USB C connector for UART1	refer to *6.11 USB to* UART Interface
CN8	microSD card interface	refer to *6.14 microSD Card Interface*
CN9	PMOD0 interface connector	refer to *6.13 PmodTM Interfaces*
CN10	PMOD2 interface connector	
CN11	PMOD1 interface connector	
CN12	CAN1 interface connector	refer to *6.7*
CN13	CAN XL / CAN FD interface connector	CAN Interfaces
CN14	LIN / SENT interface connector	refer to *0*

Table 6.9 Cut traces to disconnect RH850/U2C port

CAN1		
RH850/U2C Port	**Cut Trace**	**RH850/U2C**
P06_2	E45	P06_1
P06_3	E46	P06_0
P17_10	E47	P21_10
P17_11	E48	P21_5
P17_9	E49	P17_9

LIN and SENT Interfaces

CN15	Ethernet 100BASE-TX interface connector	refer to *6.12 Ethernet Interfaces*
CN16	Ethernet 1000BASE-T1 interface connector	
CN17	Ethernet 1000BASE-T1 interface connector (not assembled)	
CN18	Ethernet 10BASE-T1S interface connector	

2.3 LED Overview

The following table provides an overview of all LED.

Table 2.3 LED overview (

LED	Function	Color	Remark
LED1	ERROROUT signal	red	refer to *6.1 RESET Circuit*
LED2	PWRCTL signal	red	
LED3	RESET active signal	red	
LED4	1.09V RH850 core voltage VDD	green	
LED5	12.0 V power supply V_BAT	green	refer to *3.4 Power Supply LEDs*
LED6	5.0 V power supply VCC5V0		
LED7	3.3 V power supply VCC3V3		
LED8	3.3 V power supply VCCLDO		
LED9	3.3 V power supply VCC3V3P		
LED10	User Signal LED	blue	refer to *6.5.2 User Signal LEDs*
LED11			
LED12			
LED13			
LED14			
LED15			
LED16			
LED17			
LED18	USB communication signal RH850	red	refer to *6.11 USB to* UART Interface
LED19		green	
LED20	Circular LED	blue	refer to *6.5.1 Circular LEDs*
LED21			
LED22			
LED23			
LED24			
LED25			
LED26			
LED27			
LED28			
LED29			
LED20			

Table 2.3 LED overview (cont'd)

LED	Function	Color	Remark
LED31	Circular LED	blue	refer to *6.5.1 Circular LEDs*
LED32			
LED33			
LED34			
LED35			
LED36	Ethernet 1000BASE-T1 communication signals	red	refer to *6.12 Ethernet Interface*
LED37		green	
LED38	Ethernet 100BASE-TX communication signals	blue	

3. Power Supply

The starter kit board is powered by a single 12V supply (VCC12V0_CN), which is connected to connector CN4.

Power control on the starter kit board consists of 2 parts.

One part is used for the power supply to RH850/U2C and the peripheral 5.0 V power supply. This part uses the Renesas power management IC RAA271082.

The other part is the 3.3 V power supply to the onboard peripheral hardware. This part uses a Renesas buck regulator ISL85410.

3.1 Power Management IC (PMIC)

All voltages required to operate RH850/U2C are generated by the Renesas power management IC RAA271082. For more information about this device, please refer to the RAA271082 homepage.

The power management IC provides 3 synchronous buck regulators and one LDO regulator.

The buck regulator Buck1 can be programmed between 2.8 V to 5.05 V output voltage. It is programmed to generate the 5.0 V supply voltage VCC5V0.

The buck regulator Buck2 can be programmed between 0.85 V to 3.3 V output voltage. It is programmed to generate the 3.3 V supply voltage VCC3V3.

The buck regulator Buck3 can be programmed between 0.85 V to 3.3 V output voltage. It is programmed to generate the 1.09 V core voltage supply VDD.

The LDO can be programmed between 2.7 V to 3.4 V output voltage. It is programmed to generate the 3.3 V supply voltage VCCLDO.

Table 3.1 summarizes the settings and shows which RH850/U2C power supply uses which voltage.

Table 3.1 RAA271082 Power Connections

RAA271082 Regulator	Output Voltage	Max. Output Current	Usage
Buck1 (PHASE1)	5.0 V	1 A	RH850/U2C's AAVREFH, A1VREFH
Buck2 (PHASE2)	3.3 V	1 A	RH850/U2C's VCC , SYSVCCA2VREFH, E0VCC, E1VCC, E2VCC, GETH0PVCC GreenPAK IC's (SLG) VDD
Buck3 (PHASE3)	1.09 V	1 A	RH850/U2C's VDD
LDOOUT4	3.3 V	300 mA	Not used

The power management IC has an I2C interface. This is connected to the RI3C0 interface of RH850. This interface can be used by the user application to program the configuration registers in the PMIC.

Figure 3.1 shows the schematic of the PMIC circuit on the starter kit.

Table 3.2 lists the IO ports on the PMIC and shows what they are connected to.

RAA271082 has a customer configuration saved in its embedded one-time programmable (OTP) memory. *Table 3.3* provides the OTP-105 settings to support the RH850/U2C.

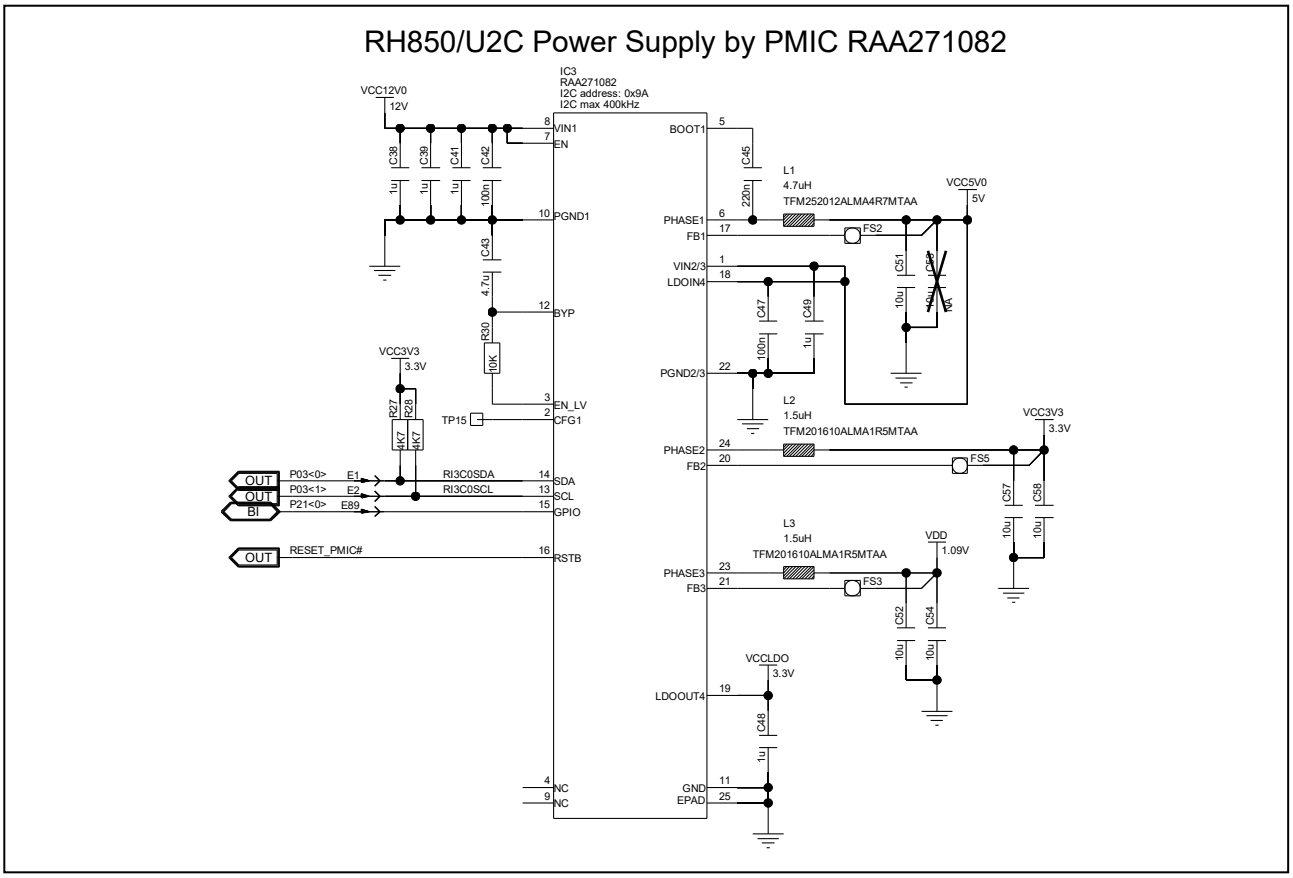


Figure 3.1 Power supply circuit for RH850/U2C on the starter kit board

Table 3.2 I/O Connections

RAA271082		RH850/U2C	Remarks
Pin#	Pin Name	Pin Name	
1	VIN2/3	N.A.	Connect to PHASE1, power supply for buck regulators 2 and 3
2	CFG1	N.A.	Not connected, buck regulator 1 configuration input
3	EN_LV	N.A.	Pull-up to BYP, enable low voltage outputs (Buck2, Buck3, LDO4)
4	NC	N.A.	
5	BOOT1	N.A.	BIAS voltage for Buck1 high-side MOSFET driver
6	PHASE1	N.A.	Buck regulator 1 output
7	EN		PMIC enable signal
8	VIN1	N.A.	Power supply for IC and for buck regulator 1
9	NC	N.A.	
10	PGND1	N.A.	GND return of buck regulator Buck1
11	GND	N.A.	System GND
12	BYP	GPIO (P22_10)	BYP LDO bypass
13	SCL	GPIO (P03_1)	I2C connection to RH850/U2C (RI3C0)
14	SDA	GPIO (P03_0)	
15	GPIO	GPIO (P21_0)	GPIO
16	RSTB	N.A.	Connected to SLG7RN48401-A (RESET_PMIC# pin 14)
17	FB1	N.A.	Buck regulator Buck1 monitor input

Table 3.2 I/O Connections (cont'd)

RAA271082		RH850/U2C	Remarks
Pin#	Pin Name	Pin Name	
18	LDOIN4	N.A.	Connect to output of buck regulator Buck1
19	LDOOUT4	N.A.	LDO4 output voltage
20	FB2	N.A.	Buck regulator Buck2 monitor input
21	FB3	N.A.	Buck regulator Buck3 monitor input
22	PGND2/3	N.A.	Shared GND of buck regulators Buck2 and Buck3
23	PHASE3	N.A.	Buck regulator 3 output
24	PHASE2	N.A.	Buck regulator 2 output

Table 3.3 RAA271082 OTP-105 Configuration

Address	Register Name	OTP Value
0x60	DEV_ID_LO_BYTE	0x82
0x61	DEV_ID_HI_BYTE	0x10
0x62	DEV_REV_LO_BYTE	0x01
0x63	DEV_REV_HI_BYTE	0xCC
0x64	BUCK_LDO_STATUS1	0xFF
0x65	BUCK_LDO_STATUS2	0x00
0x66	BUCK_LDO_REG_STATUS	0xFF
0x67	BUCK_LDO_EN	0x00
0x70	VIN1_UV_THRESH_OPT	0x01
0x71	VOUT1_VOLTAGE_OPT	0x12
0x72	VOUT1_THRESH_OPT	0x22
0x73	VOUT2_VOLTAGE_OPT	0x22
0x74	VOUT2_THRESH_OPT	0x22
0x75	VOUT3_VOLTAGE_OPT	0x06
0x76	VOUT3_THRESH_OPT	0x22
0x77	VOUT4_VOLTAGE_OPT	0x0B
0x78	VOUT4_THRESH_OPT	0x22
0x79	SEQUENCE_OPT	0x00
0x7A	SS_OPT	0x033
0x7B	MISC1_OPT	0x10
0x7C	MISC2_OPT	0x00
0x7D	MISC3_OPT	0xF2
0x7E	TRIM_CRC_LOW	0x00

Table 3.3 RAA271082 OTP-105 Configuration (cont'd)

Address	Register Name	OTP Value
0x7F	TRIM_CRC_HIGH	0x00
0x80	FLT_STATUS_1	0x00
0x81	FLT_STATUS_2	0x00
0x82	FLT_STATUS_3	0x00
0x83	FLT_STATUS_4	0x10
0x84	FLT_LATCHOFF_RESTART	0x00
0x85	FLT_RESP_MASK1	0x17
0x86	FLT_RESP_MASK2	0xBB
0x87	FLT_RESP_MASK3	0x07
0x8A	FLT_GPIO_EN1	0x60
0x8B	FLT_GPIO_EN2	0x00
0x8C	FLT_GPIO_EN3	0x00
0x8D	FLT_RSTB_EN	0x00
0xA0	WWDT_CFG	0x00
0xA1	WWDT_ULW	0x00
0xA2	WWDT_LLW	0x00
0xA3	KICK_REG	0x00
0xA4	GPIO_CTRL	0x00
0xA5	RSTB_CTRL	0xC0
0xB6	CRC_RESULT_LO_BIT	0x00
0xB7	CRC_RESULT_HI_BITS	0x14

3.2 Buck Regulators

The starter kit has one external voltage regulator circuit to generate the supply voltage of 3.3 V for onboard peripheral circuits. The circuit uses a Renesas ISL85410 buck regulator.

It generates 3.3 V from the 12V board supply, the enable signal for the buck regulator comes from the PMIC.

For more information about this device, please refer to the ISL85410 homepage.

Figure 3.2 shows the circuit diagram of the buck regulator circuit being used.

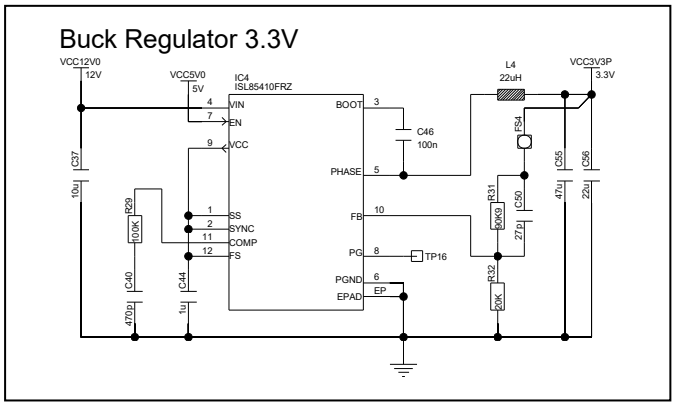


Figure 3.2 Buck reglator on the starter kit board

3.3 Power Supply Test Connector

The starter kit has a possibility to easily measure all voltage levels that are available on the starter kit board.

All voltages are connected to connector CN5.

On board version D020925_06_V0100 connector CN5 is a 10-pin connector, and it is assembled on the starter kit.

On board version D020925_06_V0200 connector CN5 is a 14-pin connector, and it is not assembled on the starter kit.

Figure 3.3 shows which voltage can be found on each pin on CN5.

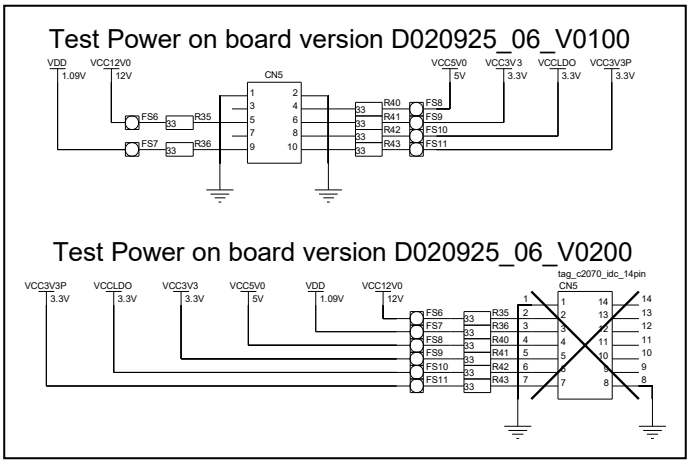


Figure 3.3 Monitor voltage levels

Table 3.4 shows pin assignments on connector CN5.

Note

The pin numbering on CN5 is different for board versions D020925_06_V0100 and D020925_06_V0200.

Table 3.4 Voltages on Test Power Connector

Pin	Board version D020925_06_V0100	Board version D020925_06_V0200 and later
1	GND	GND
2	GND	VCC12V0, 12.0 V
3	NC	VDD, 1.09 V
4	VCC5V0, 5.0 V	VCC5V5, 5.0 V
5	VCC12V0, 12.0 V	VCC3.3, 3.3 V
6	VCC3V3, 3.3 V	VCCLDO, 3.3 V
7	NC	VCC3V3P, 3.3V
8	VCCLDO, 3.3 V	GND
9	VDD, 1.09 V	NC
10	VCC3V3P, 3.3 V	NC
11	---	NC
12	---	NC
13	---	NC
14	---	NC

3.4 Power Supply LEDs

The green LEDs LED4 – LED9 indicate the availability of various voltages on the starter kit board:

- LED4 for 1.09 V core voltage VDD
- LED5 for 12.0 V power supply VCC12V0
- LED6 for 5.0 V PMIC Buck1 output VCC5V0
- LED7 for 3.3 V PMIC Buck2 output VCC3V3
- LED8 for 3.3 V LDOOUT4 output VCCLDO
- LED9 for 3.3 V buck regulator output VCC3V3P

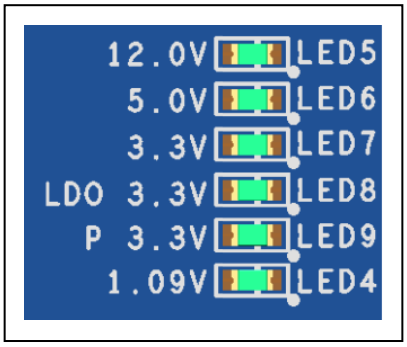


Figure 3.4 Power supply LEDs on the starter kit board

4. Clock Supply

The starter kit has 2 built-in oscillator circuits.

It has a soldered oscillator of 20MHz that can be used for RH850/U2C main clock generation.

It also has a soldered oscillator of 32.768kHz for RH850/U2C sub-clock.

The RH850/U2C starter kit does not provide a possibility to input an external clock signal. The starter kit has 2 test points TP16 and TP17. These can, sufficient technical skills provided, be used to input an external clock signal to RH850/U2C.

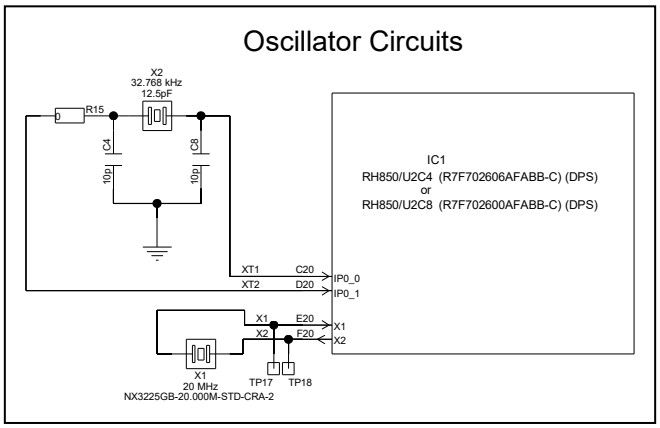


Figure 4.1 Oscillator circuit

5. Debug and Flash Programming Interfaces

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

Figure 5.1 shows the circuit diagram of connector CN1 on starter kit version D020925_06_V0100.

Figure 5.2 shows the circuit diagram of connector CN1 on starter kit version D020925_06_V0200.

RH850/U2C has two signals FLMD0 and FLMD1 to activate serial programming mode 1. There is a small difference in handling these signals between the board versions.

FLMD0 pin is a dedicated pin only for programming mode selection. This is controlled by a connected programmer.

FLMD1 pin is shared with port P06_7 and can also be used as digital I/O by the user application.

The starter kit has a pull-down resistor connected to FLMD1 to select programming mode.

On starter kit version D020925_06_V0100 the pull-down resistor is connected to port pin P06_7 automatically if FLMD0 signal is “1”. As long as FLMD0 signal is “0” the pull-down resistor is not connected to port pin P06_7.

On starter kit version D020925_06_V0200 the pull-down resistor is permanently connected to port pin P06_7. It is also present for the port function P06_7 in the user application.

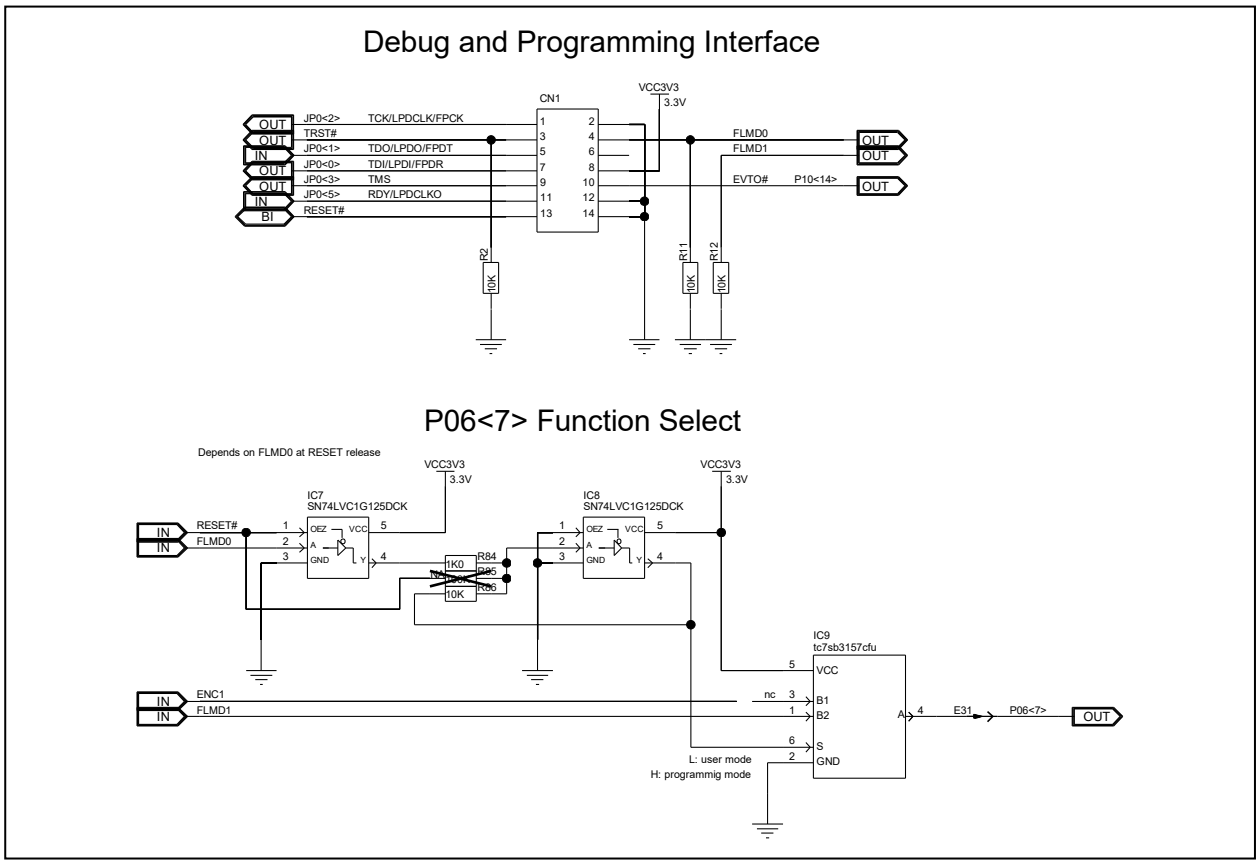


Figure 5.1 Debug and flash programming interface on starter kit version D020925_06_V0100

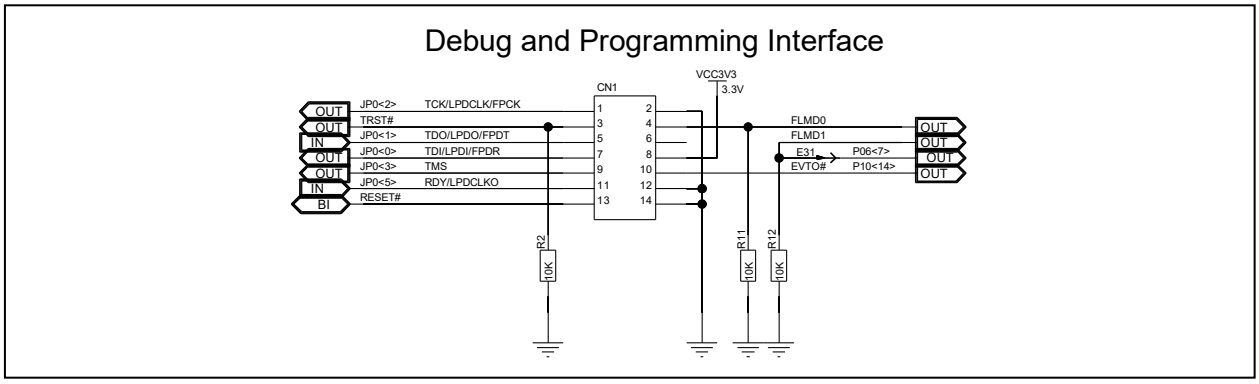


Figure 5.2 Debug and flash programming interface on starter kit version D020925_06_V0200

The Renesas standard emulator for RH850/U2C is the E2 emulator. This can be used as emulator for debugging or as flash programmer.

To connect the E2 emulator to CN1 it is necessary to use the target connector included with the E2. To use the target connector for RH850 devices make sure switch SW1 on the target connector is set to position [1-2].

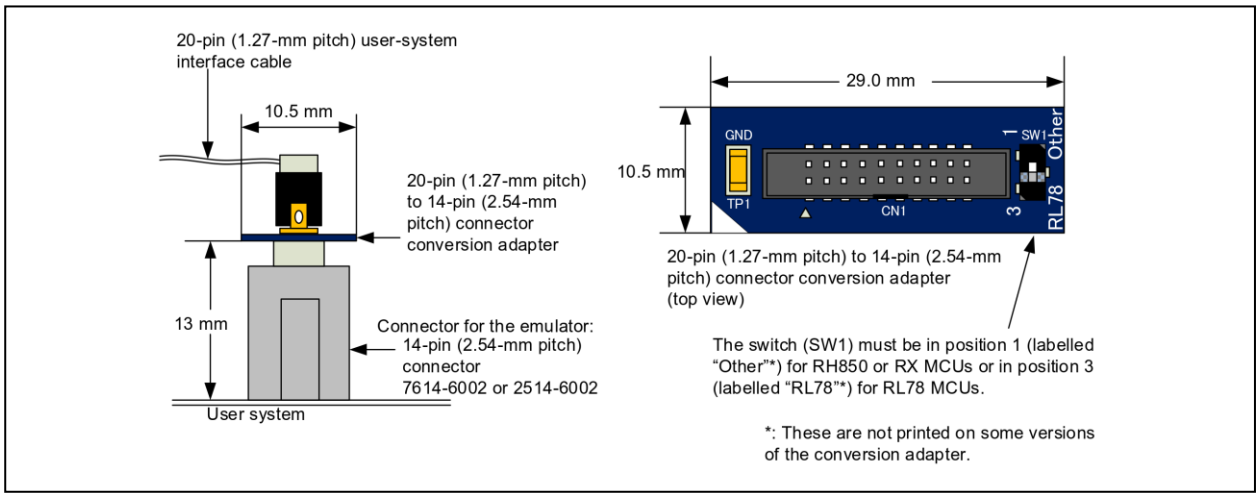


Figure 5.3 E2 target connector

6. Peripheral Circuits

6.1 RESET Circuit

The starter kit uses a GreenPAK IC SLG7RN48401-A for RESET signal control and status signal display. There are several means to trigger a RESET signal output to RH850.

The push button SW1 and the RESET signal from the power management IC are input to the GreenPAK IC and trigger the RESET signal output to RH850/U2C.

A RESET signal from an emulator, which is connected to connector CN1, and a RESET signal from the USB interface can also trigger a RESET to RH850/U2C.

The lighted red LED3 indicates that a RESET signal is output to RH850/U2C.

The GreenPAK IC also controls output LEDs for several status signals:

- LED1 - ERROROUT_M#
- LED2 - PWRCTL on RH850/U2C8, port P06_10 on RH850/U2C4
- LED3 - RESET
- LED4 - Core voltage VDD_F

The input to the PWCRCTL input on the GreenPAK IC is different for RH850/U2C4 and RH850/U2C8.

RH850/U2C8 has a dedicated PWCTRL output that is connected to GreenPAK pin 3.

RH850/U2C4 does NOT have a PWRCTL output. The digital port P06_10 is connected to GreenPAK pin 3.

Figure 6.1 shows the circuit diagram for the GreenPAK IC and the RESET signal input.

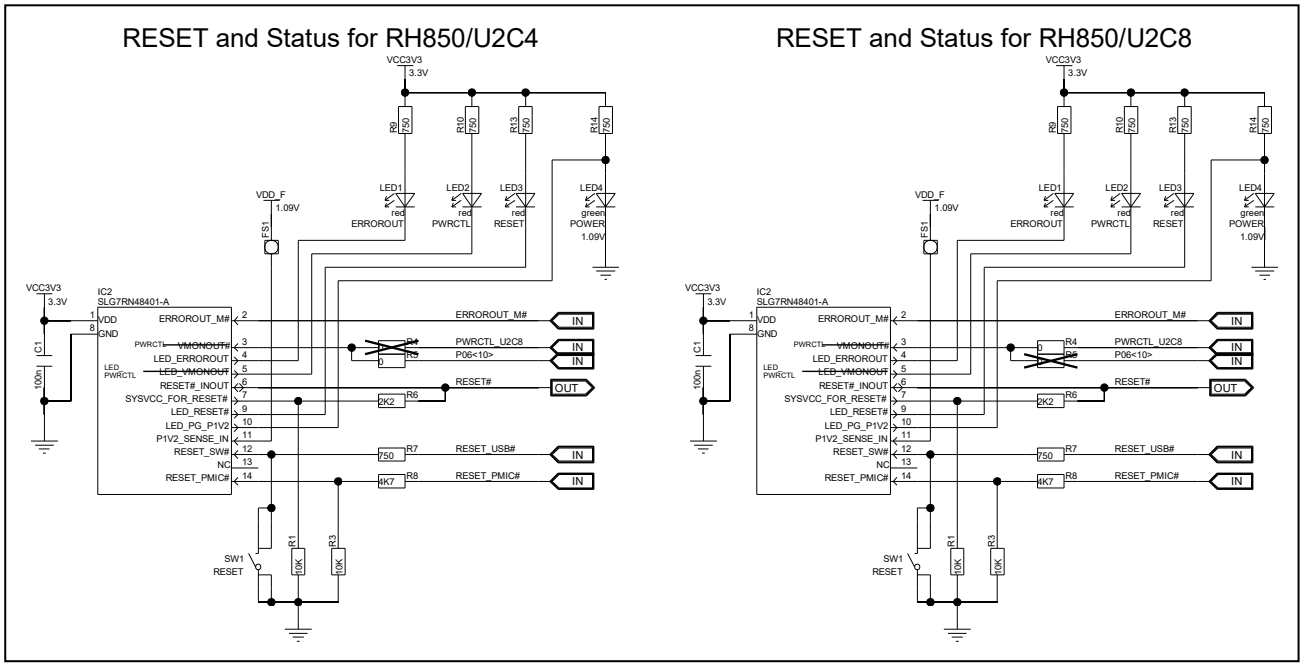


Figure 6.1 Reset circuit

6.2 External Interrupt Signal

The RH850/U2C starter kit has 2 switches, which can be used as external interrupt inputs to RH850/U2C.

SW2 generates the INT1 signal. This signal is connected to port P04_10 (IRQ25). On starter kit version D020925_06_V0100 this signal is in parallel also connected to port P24_4 (IRQ32).

SW3 generates the INT2 signal. This signal is connected to port P24_6 (IRQ33).

Table 6.1 Interrupt signal connections

Switch	Interrupt signal	Starter Kit Version D020925_06_V0100	Starter Kit Version D020925_06_V0200
SW2	INT1	IRQ25 on port P04_10 IRQ32 on port P24_4	IRQ25 on port P04_10
SW3	INT2	IRQ33 on port P24_6	IRQ33 on port P24_6

The starter kit includes 2 cut traces to disconnect the interrupt signals from the RH850 ports.

On board version D020925_06_V0100:

- Cut trace E24 is used to disconnect INT1 signal from port P24_4.
- Cut trace E25 is used to disconnect INT2 signal from port P24_6.
- Port P04_10 is always connected to INT1 signal.

On board version D020925_06_V0200:

- Cut trace E24 is used to disconnect INT1 signal from port P04_10.
- Cut trace E25 is used to disconnect INT2 signal from port P24_6.

Figure 6.2 shows the circuit diagram for the interrupt switches on different starter kit versions.

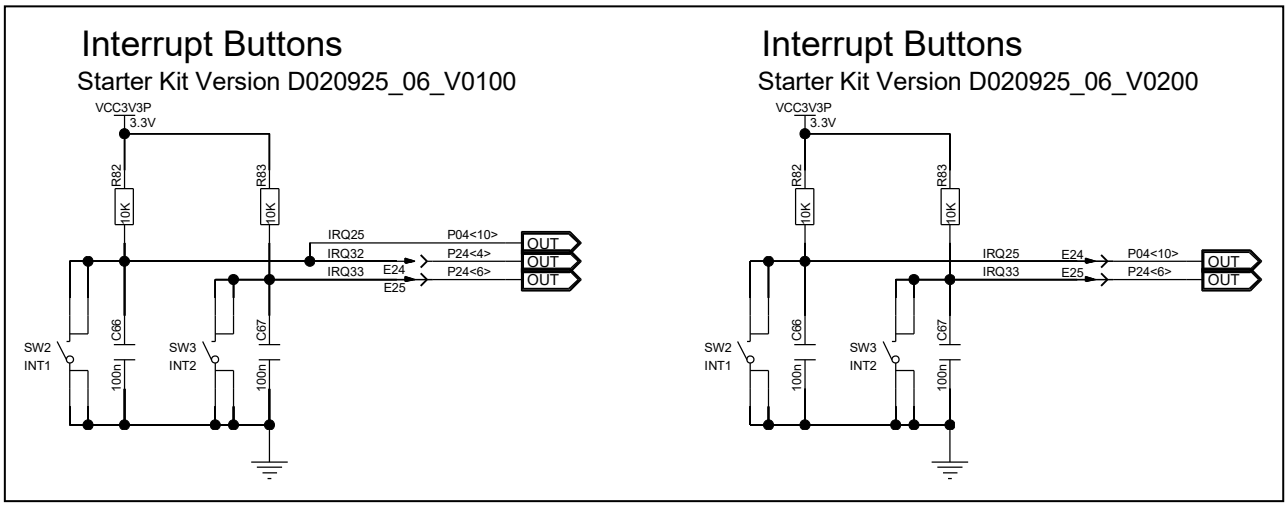


Figure 6.2 Interrupt connection

6.3 Analog Signal Input

The starter kit includes two potentiometer POT1 and POT2, that allow analog signal input to ports AP00_0 (POT1) and AP00_1 (POT2).

The cut traces E32 and E33 can be used to disconnect the potentiometers from RH850/U2C.

Figure 6.3 shows the circuit diagram for the potentiometer connection.

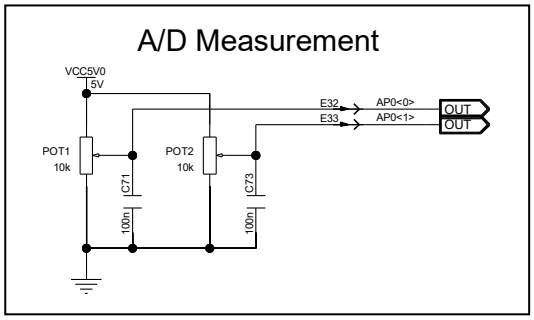


Figure 6.3 Potentiometer connection

6.4 Rotary Encoder

The starter kit incorporates a rotary encoder with illuminated shaft, built-in push button and 2 quadrature encoder outputs.

The push button is connected to RH850 interrupt input IRQ22 on port P10_0. The interrupt input can be disconnected by opening cut trace E23.

The encoder signals ENC0 and ENC1 are input to RH850 on-chip encoders ENCA0E0 on port P02_9 and ENCA0E1 on port P10_11.

On board version D020925_06_0100 the encoder signals are also input to the on-chip encoder ENCA0TIN0 on port P06_6 and ENCA0TIN1 on port P06_7.

On starter kit version D020925_06_V0100 the signal ENC0 can be disconnected from port P06_6 by opening cut trace E22.

On starter kit version D020925_06_V0200 the signal ENC0 can be disconnected from port P02_9 by opening cut trace E22, and the signal ENC1 can be disconnected from port P10_11 by opening cut trace E90.

The illumination of the encoder shaft uses RGB LEDs. These are controlled by ports P06_11 (red), P06_12 (green), and P06_13 (blue).

The analog signals of the RGB outputs are fed back to RH850/U2C using the analog inputs AP2_0 (red), AP2_1 (green), and AP2_2 (blue).

Table 6.2 lists the encoder and interrupt signals and possible cut traces to disconnect them from RH850/U2C.

Figure 6.4 shows the circuit diagram for the rotary encoder on starter kit version D020925_06_V0100.

Figure 6.5 shows the circuit diagram for the rotary encoder on starter kit version D020925_06_V0200.

Table 6.2 Encoder signal connections

Signal	Starter Kit Version D020925_06_V0100		Starter Kit Version D020925_06_V0200	
	Port, Peripheral module	Cut trace	Port, Peripheral module	Cut trace
ENC0	P02_9, ENCA0E0	None	P02_9, ENCA0E0	E22
	P06_6, ENCA0TIN0	E22		
ENC1	P10_11, ENCA0E1	None	P10_11, ENCA0E1	E90
	P06_7, ENCA0TIN0	None		
Push Button	P10_0, IRQ22	E23	P10_0, IRQ22	E23

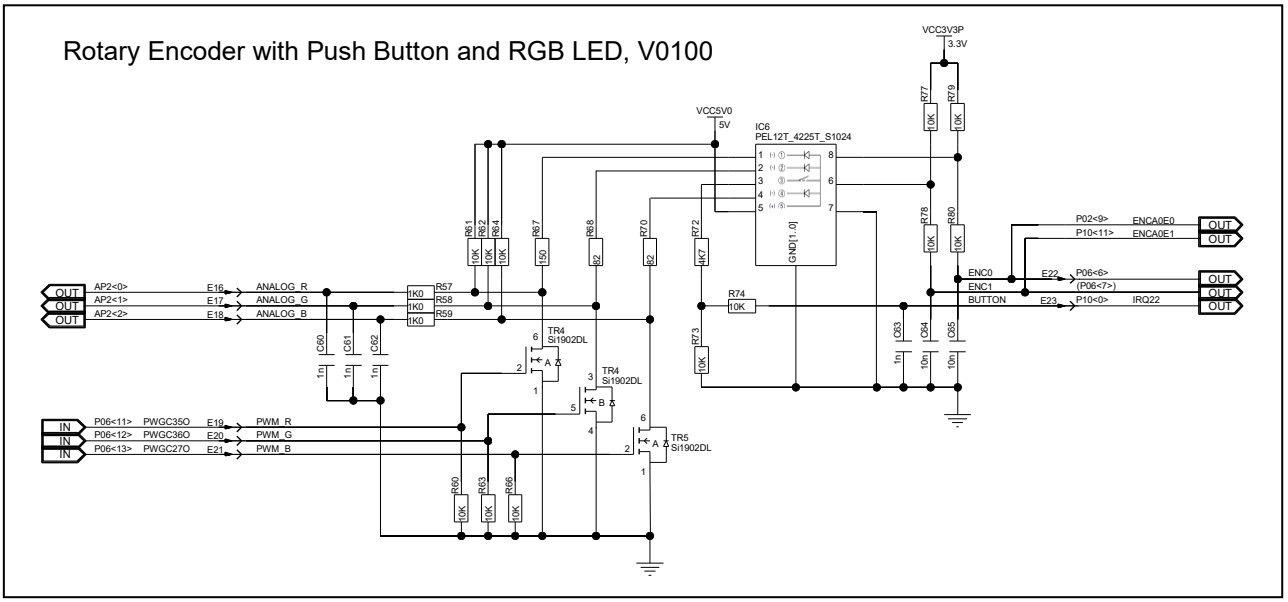


Figure 6.4 Rotary encoder on starter kit version D020925_06_V0100

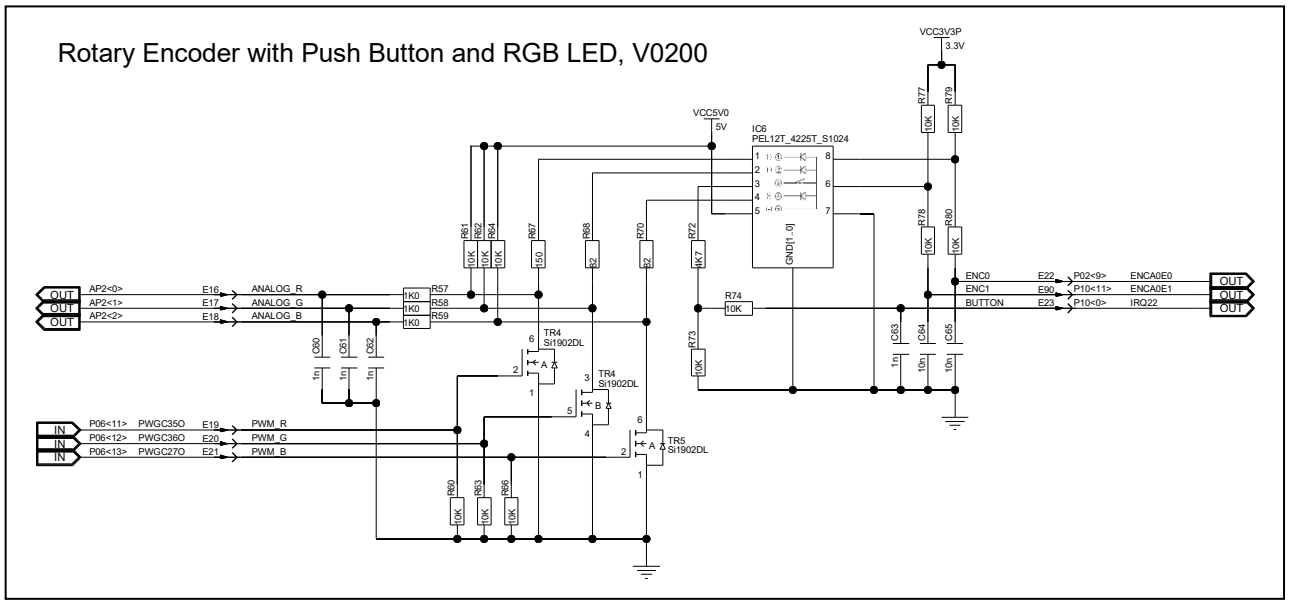


Figure 6.5 Rotary encoder on starter kit version D020925_06_V0200

6.5 LEDs

6.5.1 Circular LEDs

The board provides 16 LEDs arranged in a circle surrounding the rotary encoder.

The processor interface MSPI0 is used as clock synchronous interface to communicate to the 16 channel LED driver in IC5. The digital ports P03_11 and P03_12 are control signals for the LED driver.

All ports of RH850/U2C, that are used for the circular LED control, can be disconnected from the circular LEDs opening the corresponding cut traces.

Figure 6.6 shows the circuit diagram for the SPI LED.

Table 6.3 lists the pin functions on RH850/U2C going to the SPI LEDs and the cut traces used to disconnect the ports of RH850 /U2C.

Table 6.3 Connection of SPI LED

RH850/U2C Signal			Signal on SPI LED driver
Port	Function	Cut trace	
P08_3	MSPI0SC	E13	CLK
P02_14	MSPI0SO	E14	SDI
P04_14	MSPI0SI	E15	SDO
P03_12	P03_12	E11	OE#
P03_11	P03_11	E12	LE

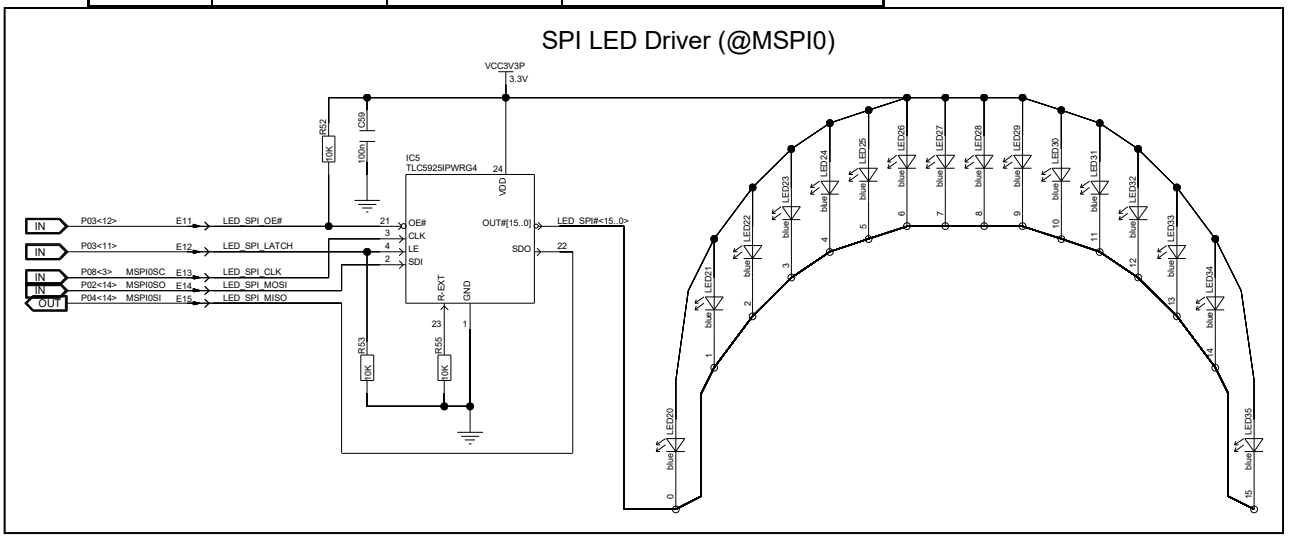


Figure 6.6 SPI LED circuit

6.5.2 User Signal LEDs

Eight LEDs are provided to allow for status outputs of the application software using RH850/U2C port pins.

The RH850/U2C ports P04_0 – P04_7 are used as LED outputs. Every port can be disconnected from the corresponding LED by opening the appropriate cut trace.

Table 6.4 lists the ports of RH850/U2C used for the user LEDs and the corresponding cut traces.

Figure 6.7 shows the circuit diagram for the user LEDs.

Table 6.4 Connection of signal LED

RH850/U2C Port	Signal LED	Cut trace
P04_0	LED10	E3
P04_1	LED11	E4
P04_2	LED12	E5
P04_3	LED13	E6
P04_4	LED14	E7
P04_5	LED15	E8
P04_6	LED16	E9

P04_7	LED17	E10

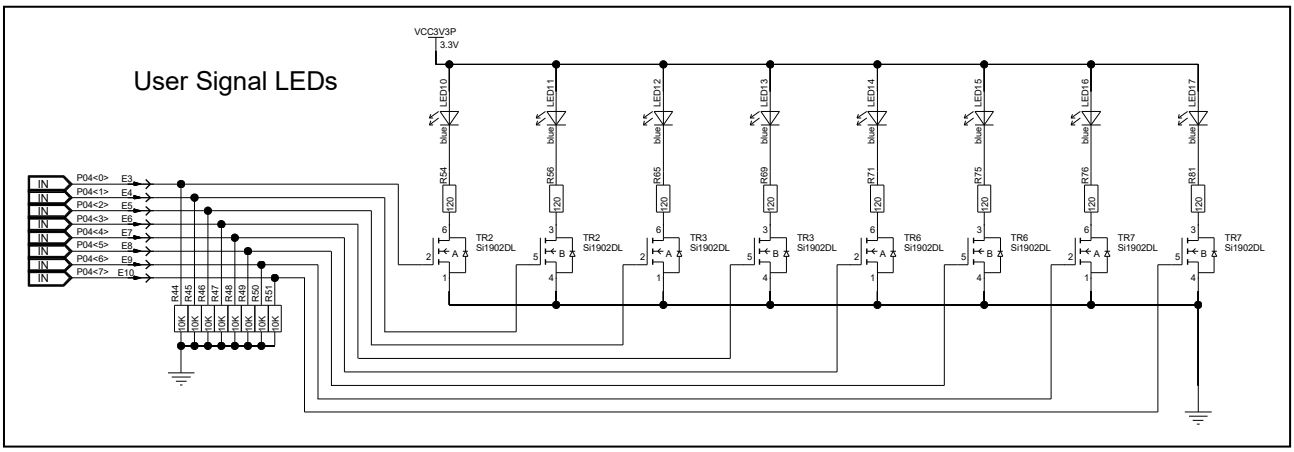


Figure 6.7 User signal LED connection

6.6 OLED Graphic Display

The RH850/U2C starter kit uses a display manufactured by EastRising Technology. The display is ER-OLED0.96-1.3B. It is a 0.96 inch display with a resolution of 128x64 pixel.

The flexible pcb coming from the display is connected to connector CN6 on the starter kit.

RH850/U2C controls the display via clock synchronous interface MSPI0. Each port of RH850/U2C can be disconnected from the OLED by openinng the corresponding cut trace.

Table 6.5 lists the ports of RH850/U2C used to control the display and the related cut traces.

Error! Reference source not found. lists the pin functions on connector CN6 going to the OLED display.

Figure 6.8 shows the circuit diagram for the OLED display connection.

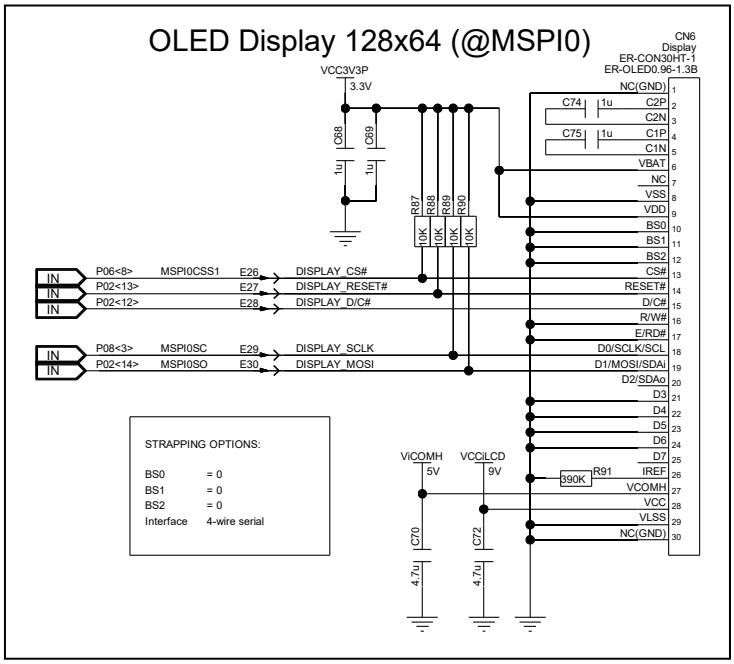


Figure 6.8 OLED display connection

Table 6.5 OLED connection of RH850/U2C

RH850/U2C Port	Function	Signal	Cut trace
P06_8	MSPI0CSS1	DISPLAY_CS#	E26
P02_12	Digital I/O	DISPLAY_D/C#	E28
P02_13	Digital I/O	DISPLAY_RESET#	E27
P02_14	MSPI0SO	DISPLAY_MOSI	E30
P08_3	MSPI0SC	DISPLAY_SCLK	E29

Table 6.6 Display connector CN6 for EastRising Technology display

Pin	Function	RH850/U2C Processor Pin
1	NC (GND)	GND
2	C2P	Capacitor for charge pump
3	C2N	
4	C1P	Capacitor for charge pump
5	C1N	
6	VBAT	VCC3V3P
7	NC	---
8	VSS	GND
9	VDD	VCC3V3P
10	BS0	GND
11	BS1	GND
12	BS2	GND
13	CS#	10kOhm pull-up to VCC3V3P, Port P06_8
14	RES#	Reset circuit with 10kOhm pull-up to VCC3V3, Port P02_13
15	D/C#	Port P02_12

Pin	Function	RH850/U2C Processor Pin
16	R/W#	GND
17	E/RD#	GND
18	D0 / SCLK / SCL	10kOhm pull-up to VCC3V3P, Port P08_3 (MSPI0SC)
19	D1 / MOSI / SDAi	10kOhm pull-up to VCC3V3P, Port P02_14 (MSPI0SO)
20	D2 / SDAo	---
21	D3	GND
22	D4	GND
23	D5	GND
24	D6	GND
25	D7	---
26	IREF	390kOhm pull-down
27	VCOMH	ViCOMH (5.0V)
28	VCC	VCCiLCD (9.0V)
29	VLSS	GND
30	NC (GND)	GND

6.7

6.8 CAN Interfaces

The starter kit includes 2 CAN interfaces:

- CAN1 supports CAN and CAN FD format.
- CAN0 (CANXL/FD on board version D020925_06_V0100) supports CAN, CAN FD and CAN XL format.

On delivery both interfaces use Microchip ATA6561 transceiver and support CAN and CAN FD format.

To support CAN XL on CAN0 (CANXL/FD) channel the transceiver has to be replaced by a suitable transceiver that supports CAN XL. The pcb is prepared for the assembly of such a transceiver.

Each CAN channel has the possibility to include bus termination on the output. This is activated by “L” on port P17_10 (channel CAN1) or port 21_4 (channel CAN0 or CANXL/FD). On starter kit version D020925_06_V0100 bus termination on channel CANXL/FD can also be activated by “L” output on port P21_10.

The CAN interfaces use the connectors CN12 (CAN1) and CN13 (CAN0 or CANXL/FD) for signal output.

For both CAN channels it is possible to activate an additional GND output on pin 3 of the output connector. On channel CAN1 it is activated by “H” output on port P17_11, on channel CAN0 or CANXL/FD it is activated by “H” output on port P21_5.

The starter kit offers the possibility to use a loop-back function between CAN0 and CAN1 (CANXL/FD). This is enabled by a “L” signal output on port P17_9.

Figure 6.9 shows the circuit diagram for the CAN interfaces on starter kit version D020925_06_V0100.

Figure 6.10 shows the circuit diagram for the CAN interfaces on starter kit version D020925_06_V0200.

Table 6.7 shows which RH850/U2C ports are used for the CAN interfaces.

Table 6.8 shows the pin configuration of the CAN output ports CN12 and CN13.

All CAN related outputs of RH850/U2C (except for port P21_10 on starter kit version D020925_06_V0100) can be disconnected from the CAN circuits by opening the corresponding cut traces.

lists which cut trace is used for which RH850 port.

Refer also to 10.12 CAN1 Connector CN12 and 10.13 CAN0 (CANXL/FD) Connector CN13 for details on the connectors.

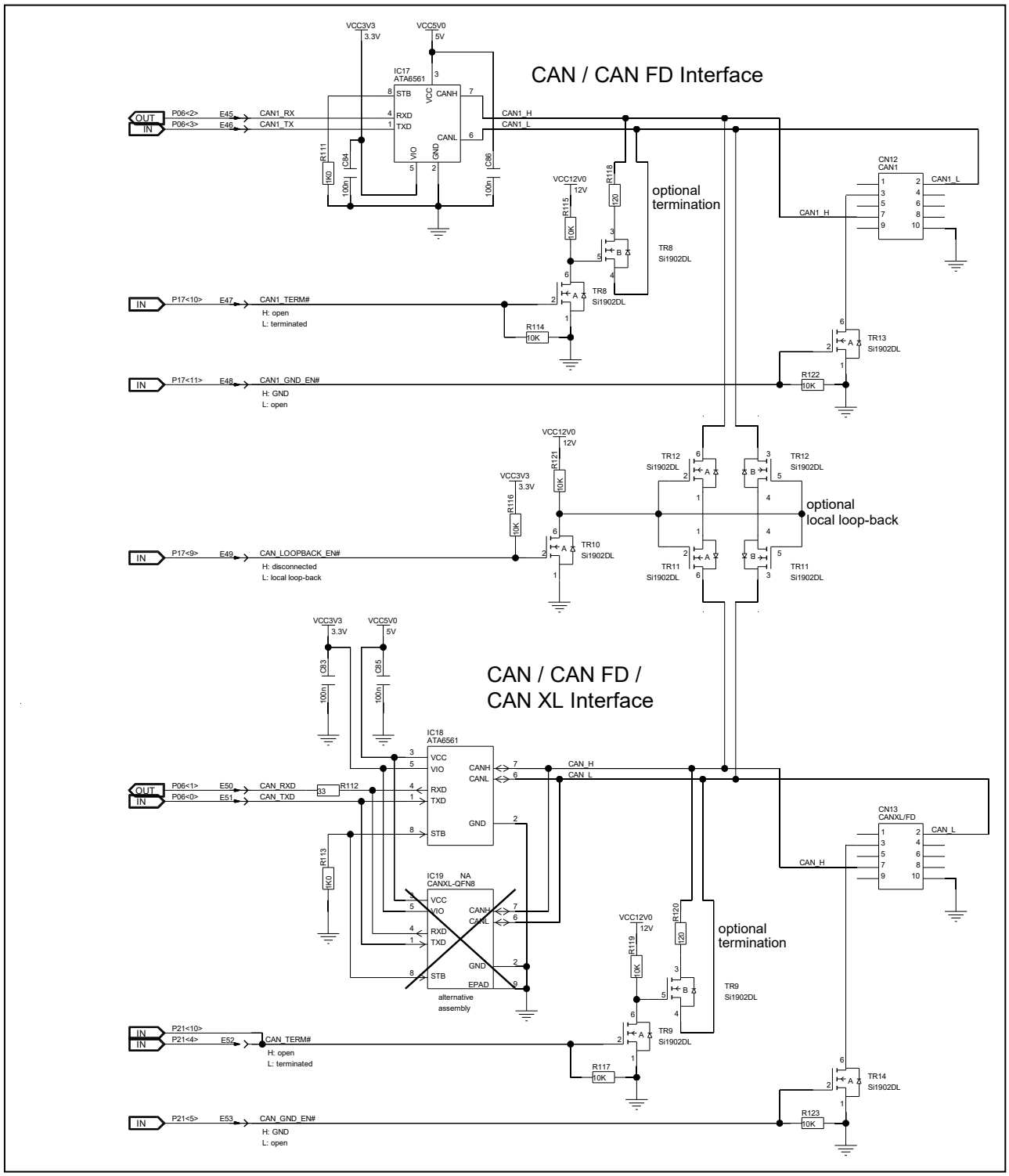


Figure 6.9 CAN interfaces on starter kit version D020925_06_V0100

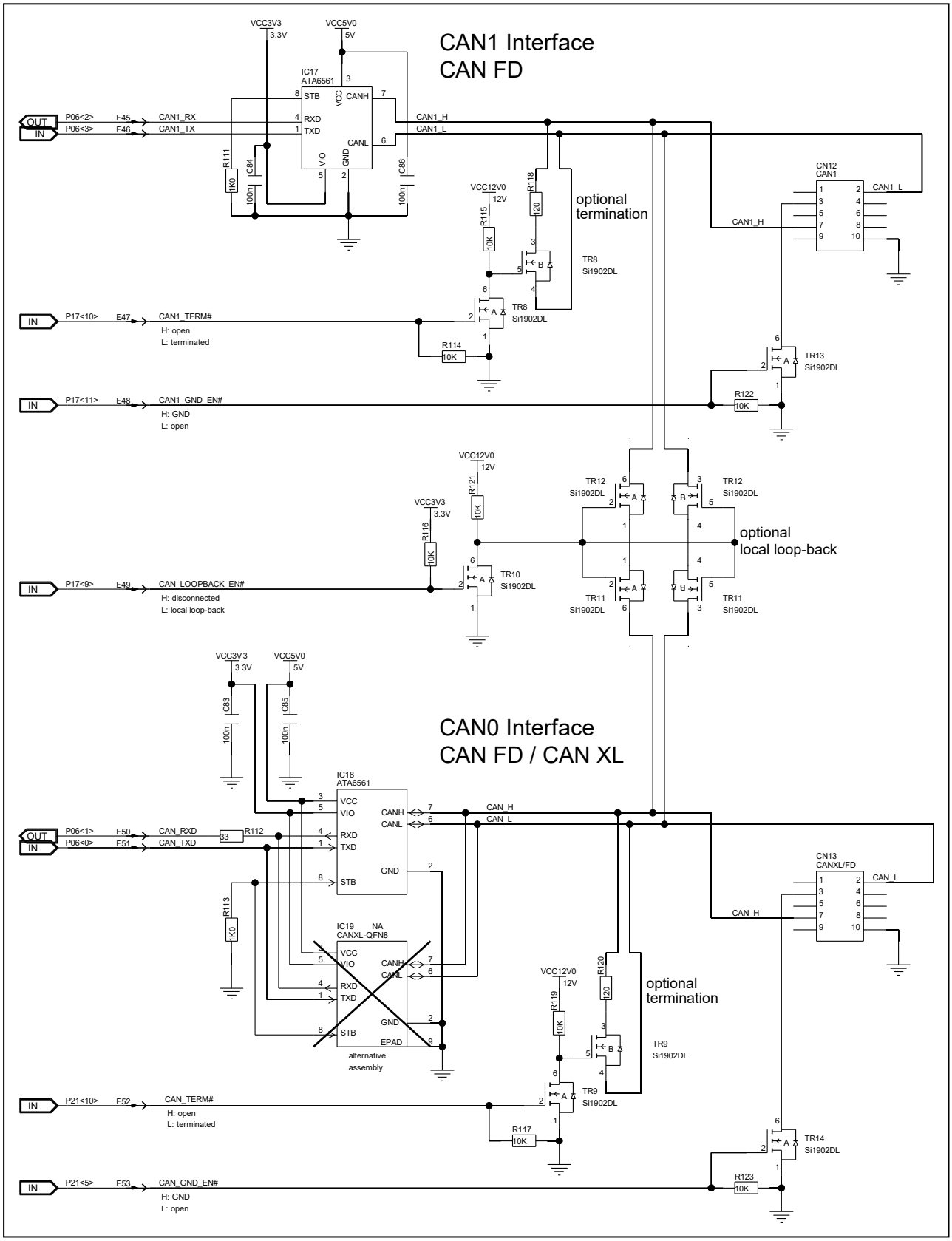


Figure 6.10 CAN interfaces on starter kit version D020925_06_V0200

Table 6.7 RH850 ports being used for CAN interfaces

CAN1			CAN0 (CANXL/FD)		
RH850 Port	**Function**	**Comment**	**RH850 Port**	**Function**	**Comment**
P06_2	CAN1RX		P06_1	CAN2RX	CAN transceiver *1
				CANXL0RXD	CAN XL transceiver *2
P06_3	CAN1TX		P06_0	CAN2RTX	CAN transceiver *1
				CANXL0TXD	CAN XL transceiver *2
P17_10	Digital I/O	P17_10[LOW]: Bus termination active	P21_10	Digital I/O	P21_10[LOW] or P21_4[LOW]: Bus termination active
			P21_4 *3		
P17_11	Digital I/O	P17_11[HIGH]: GND output on CN12_3	P21_5	Digital I/O	P21_5[HIGH]: GND output on CN12_3
P17_9	Digital I/O	P17_9[LOW]: Enable loopback between CAN1 and CAN0 (CANXL/FD)	P17_9	Digital I/O	P17_9[LOW]: Enable loopback between CAN1 and CAN0 (CANXL/FD)

*1 Starter kit equipped with CAN / CAN FD transceiver ATA6561
*2 Starter kit equipped with CAN XL compatible transceiver
*3 Only on starter kit version D020925_06_V0100

Table 6.8 CAN output ports

CAN1: Connector CN12		CAN0 (CANXL/FD): Connector CN13	
Pin	**Function**	**Pin**	**Function**
1	NC	1	NC
2	CAN1_L	2	CAN_L
3	GND (CAN1_GND_EN# enabled)	3	GND (CAN_GND_EN# enabled)
4	NC	4	NC
5	NC	5	NC
6	NC	6	NC
7	CAN1_H	7	CAN_H
8	NC	8	NC
9	NC	9	NC
10	GND	10	GND

Table 6.9 Cut traces to disconnect RH850/U2C ports from CAN transceivers

CAN1		CAN0	
RH850/U2C Port	**Cut Trace**	**RH850/U2C Port**	**Cut Trace**
P06_2	E45	P06_1	E50
P06_3	E46	P06_0	E51
P17_10	E47	P21_10	E52
P17_11	E48	P21_5	E53
P17_9	E49	P17_9	E49

6.9 LIN and SENT Interfaces

The starter kit includes one LIN and one SENT interface. The signals of both interfaces are output on connector CN14.

The SENT interface uses the RSENT4 functionality on RH850/U2C on ports P04_15 and P04_13.

The LIN interface uses the RLIN38 functionality on RH850/U2C on ports P02_0 and P02_1.

The starter kit also uses some digital I/O of RH850/U2C to configure the SENT and LIN interface.

SENT interface options:

- Port P21_9 is used to enable SENT power output.
  - P21_9 [HIGH]: no power supply output.
  - P21_9 [LOW]: 5V output on pin CN14_1.

LIN interface options:

- Port P21_6 enables sleep mode for the LIN transceiver.
  - P21_6 [HIGH]: Sleep mode disabled.
  - P21_6 [LOW]: Sleep mode enabled.
- Port P21_7 enables remote wake up for the LIN transceiver.
  - P21_7 [HIGH]: Wake up disabled.
  - P21_7 [LOW]: Wake up enabled.
- Port P21_8 is used for Master or Slave mode operation.
  - P21_8 [HIGH]: Master mode.
  - P21_8 [LOW]: Slave mode.

All pins used for SENT and LIN interface and their configurations can be disconnected from the interfaces by opening the corresponding cut traces.

For details on connector CN14 please refer to *10.14 LIN and SENT Connector CN14*.

Figure 6.11 shows the circuit diagram of the LIN and SENT interface.

Table 6.10 shows the pin configuration on connector CN14.

Table 6.11 lists all cut traces used on the LIN and SENT interface.

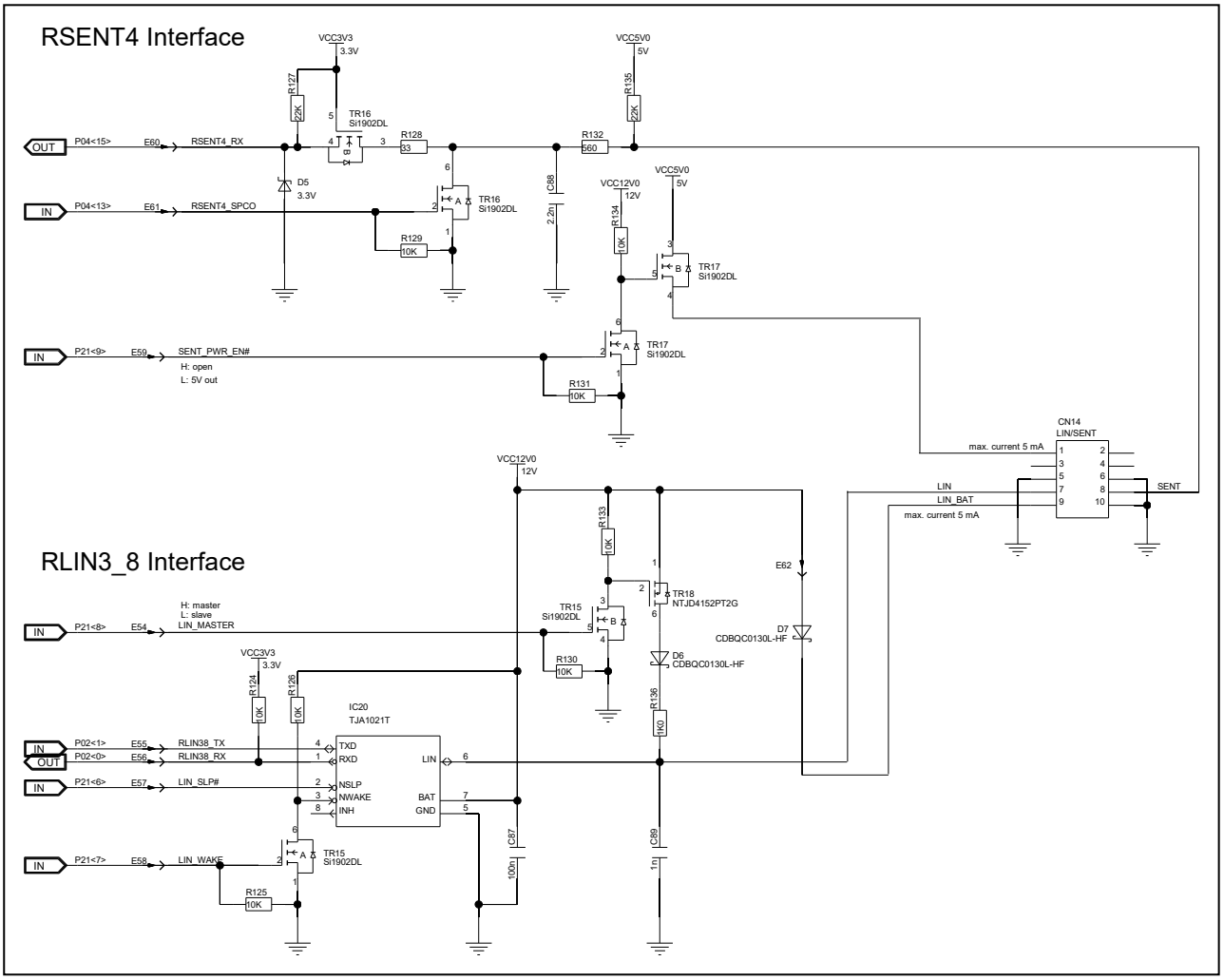


Figure 6.11 LIN and SENT interface

Table 6.10 LIN and SENT connector CN14

Pin	Function	Description	Pin	Function	Description
1	VCC5V0	SENT power	2	NC	
3	NC		4	NC	
5	GND		6	GND	
7	LIN	LIN signal line	8	SENT	SENT signal line
9	LIN_BAT	LIN power	10		

Table 6.11 Cut traces to disconnect RH850/U2C ports from LIN and SENT interfaces

LIN		SENT	
RH850/U2C Port	**Cut Trace**	**RH850/U2C Port**	**Cut Trace**
P21_8	E54	P04_15	E60
P02_1	E55	P04_13	E61
P02_0	E56	P21_9	E59
P21_6	E57		
P21_7	E58		

6.10 Connection Cable for CAN and LIN Interfaces

The starter kit includes 3 connection cables from 10-pin DIL to 9-pin D-SUB, which can be used for CAN and LIN connections to external hardware.

The DIL connector can be plugged-in to the connectors CN12 and CN13 for CAN interfaces or CN14 for LIN interface.

Table 6.12 shows the connection between the 10-pin connector and the 9-pin D- SUB connector, and the functions when the cable is connected to the CAN or LIN ports.

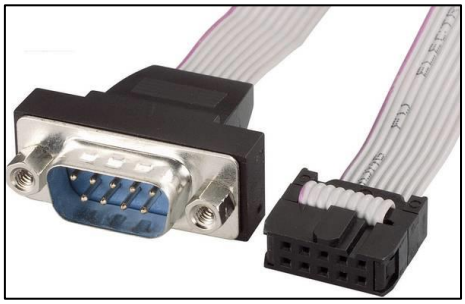


Figure 6.12 CAN / LIN cable

Table 6.12 Connection between 10-pin connector and 9-pin D-SUB connector

Pin number on DIL connector	Pin number on D-SUB connector	Function		
		When connected to CN13 (CAN0)	When connected to CN12 (CAN1)	When connected to CN14 (LIN)
1	1	–	–	VCC5V0 (when enabled on port P21_9)
2	2	CANL	CANL	NC
3	3	GND (when enabled on port P21_5)	GND (when enabled on port P17_11)	NC
4	4	–	–	NC
5	5	–	–	GND
6	6	–	–	GND
7	7	CANH	CANH	LIN
8	8	–	–	SENT
9	9	–	–	LIN_BAT
10	–			GND

6.11 USB to UART Interface

The starter kit includes one USB-C interface on connector CN7. It uses a Silicon Labs USB-to-UART bridge CP2102N.

If the USB interface is not recognized by the PC because of a missing USB driver, the USB driver can be downloaded from here: https://www.silabs.com/software-and-tools/usb-to-uart-bridge-vcp-drivers?tab=downloads

On RH850 side the USB-to-UART bridge is connected to the ports P02_10 (RLIN311RX) and P02_11 (RLIN311TX).

Port P17_2 on RH850/U2C is used to detect suspend mode of the USB-to-UART bridge.

The starter kit has 2 LEDs to show bus activity on the UART channel. LED18 and LED19 show activity on the UART interface connected to RH850/U2C.

The USB circuit has also the ability to generate a RESET signal, which is then input to the GreenPAK system control IC.

This RESET signal and the RH850/U2C ports used for the USB interface can be disconnected by opening the corresponding cut traces.

Figure 6.13 shows the circuit diagram for the USB to UART interface.

Table 6.13 shows the pin configuration on the USB-C connector CN7.

Table 6.14 summarizes the RH850/U2C ports functions related to USB control and lists the related cut traces.

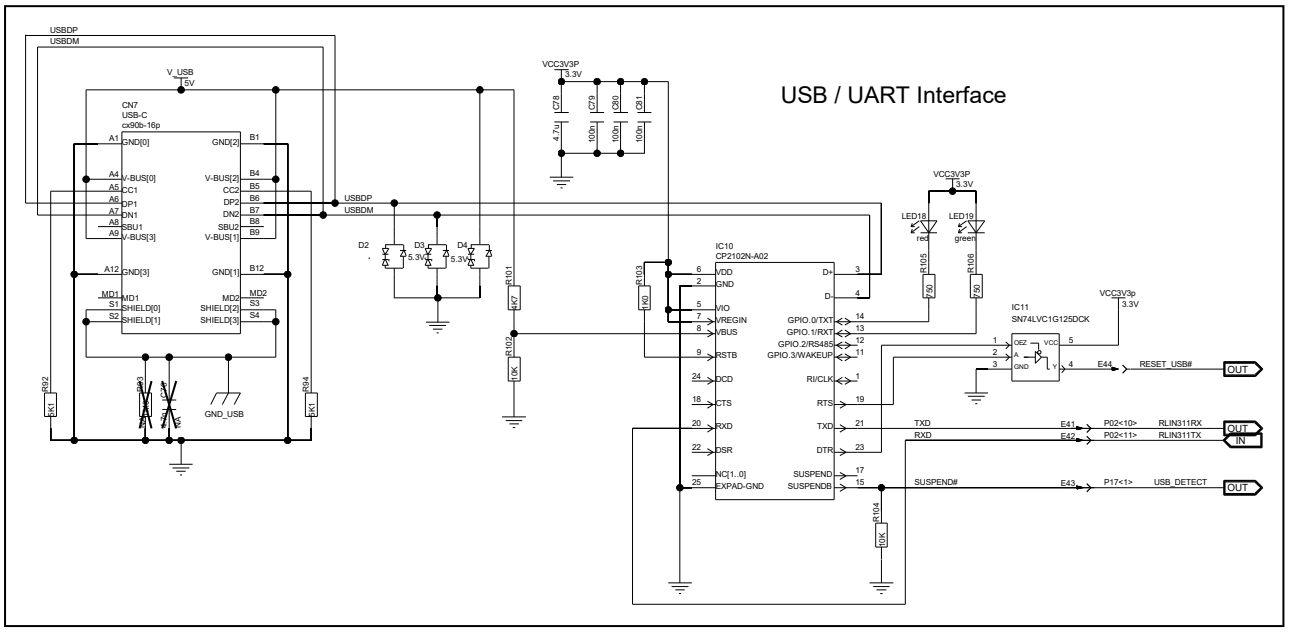


Figure 6.13 UART interface

Table 6.13 USB-C connector CN7

Pin	Function	Signal Name
A1	GND	
A2	–	–
A3	–	–
A4	V-BUS	V_USB
A5	CC1	Pull-down GND
A6	DP1	USBDP
A7	DN1	USBDM
A8	SBU1	–
A9	VBUS	V_USB
A10	–	–
A11	–	–
A12	GND	

Pin	Function	Signal Name
B12	GND	
B11	–	–
B10	–	–
B9	V-BUS	V_USB
B8	SBU2	–
B7	DP2	USBDP
B6	DN2	USBDM
B5	CC2	–
B4	VBUS	V_USB
B3	–	–
B2	–	–
B1	GND	

Table 6.14 Cut traces to disconnect RH850/U2C ports and GreenPAK IC from the USB interface

RH850/U2C		Cut Trace
Port number	Function	
P02_10	RLIN311RX	E41
P02_11	RLIN311TX	E42
P17_1	USB_DETECT	E43
Port RESET_SW# on GreenPAK IC	USB_RESET	E44

6.12 Ethernet Interfaces

The starter kit for RH850/U2C includes up to three Ethernet interfaces:

- One interface for 10BASE-T1S on connector CN18.
- One interface for 100BASE-TX (MII) on connector CN15.
- One interface for 1000BASE-T1 (SGMII) on connectors CN16 and CN17 (only on boards with RH850/U2C8 processor (Y-ASK-RH850U2C8)).

6.12.1 Ethernet Interface 10BASE-T1S

The 10BASE-T1S Ethernet on the RH850/U2C starter kit uses the ETNF0 unit on RH850/U2C.

The board is configured to use the ports P20_3, P20_4 and P20_13 for the Ethernet interface.

The starter kit also includes a termination circuit for the Ethernet signals. This termination is activated using digital I/O P17_12.

- P17_12 [LOW]: Bus termination inactive.
- P17_12 [HIGH]: Bus termination active.

All pins of RH850/U2C, which are used for Ethernet T1S interface, can be disconnected from the T1S circuit by opening the appropriate cut traces.

The Ethernet signals are output on the 2-pin connector CN18:

- Pin 1 – TRX_P signal
- Pin 2 – TRX_N signal

Figure 6.14 shows the circuit diagram for the 10BASE-T1S interface.

Table 6.15 lists all RH850/U2C ports used for the interface and the related cut traces.

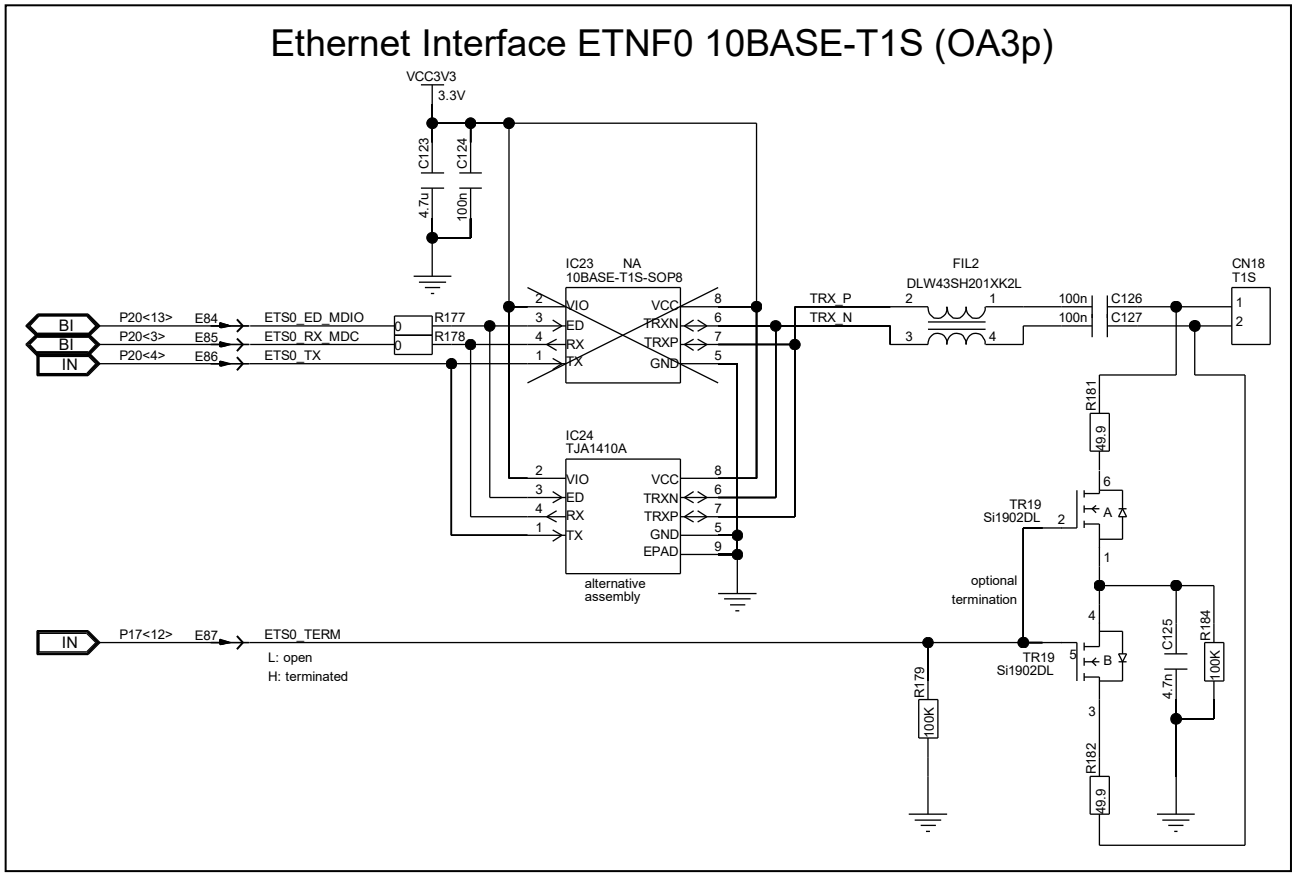


Figure 6.14 10BASE-T1S Ethernet interface

Table 6.15 Functions of RH850/U2C ports and cut traces to disconnect them from T1S interface

RH850/U2C		Cut Trace
Port number	**Function**	
P20_3	ETS0_RX_MDC	E85
P20_4	ETS0_TX	E86
P20_13	ETS0_ED_MDIO	E84
P17_12	ETS0_TERM	E87

6.12.2 Ethernet Interface 100BASE-TX

The starter kit for RH850/U2C includes one fast Ethernet interface 100BASE-TX using the ETND0 unit on RH850/U2C.

The 100BASE-TX Ethernet interface outputs its signals to a RJ45 connector (CN15).

RH850/U2C uses the RMII standard for communication with the Microchip LAN8700 Ethernet transceiver.

The board is configured to use the ports P10 and P20 – P22 for the Ethernet interface.

Port P20_0 is shared between 100BASE-TX interface and PMOD1 function. The selection is done using port P08_2 on RH850/U2C.

- P08_2 [LOW]: Port P20_0 is used for Ethernet 100BASE-TX (ETH0_RXD0 signal).
- P08_2 [HIGH]: Port P20_0 signal is used for PMOD1 interface (SSIFACK).

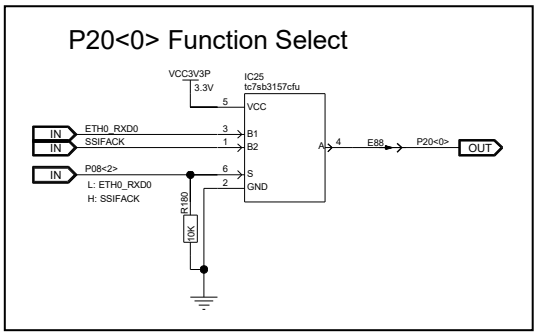


Figure 6.15 Port P20_0 function selection

The Ethernet transceiver uses different oscillator circuits, depending on the revision of the starter kit board.

- Starter kit version D0020925_06_V0100: This board uses an Epson oscillator SG8018CE and inputs the clock signal to CLK_XTAL1 pin of the Ethernet transceiver.
- Starter kit version D0020925_06_V0200: This board uses the on-chip oscillator circuit of the Ethernet transceiver with an external crystal oscillator connected to the pins CLK_XTAL1 and XTAL2.

All pins of RH850/U2C, which are used for Ethernet 100BASE-TX interface, can be disconnected from the Ethernet circuit by opening the appropriate cut traces.

Figure 6.15 shows the circuit diagram for the port P20_0 function selection.

Figure 6.16 and *Figure 6.17* show the circuit diagram for the 100BASE-TX Ethernet interface on different board revisions.

Table 6.16 shows the pin configuration on the Ethernet connector CN15.

Table 6.17 lists all RH850/U2C ports used for the interface and the related cut traces.

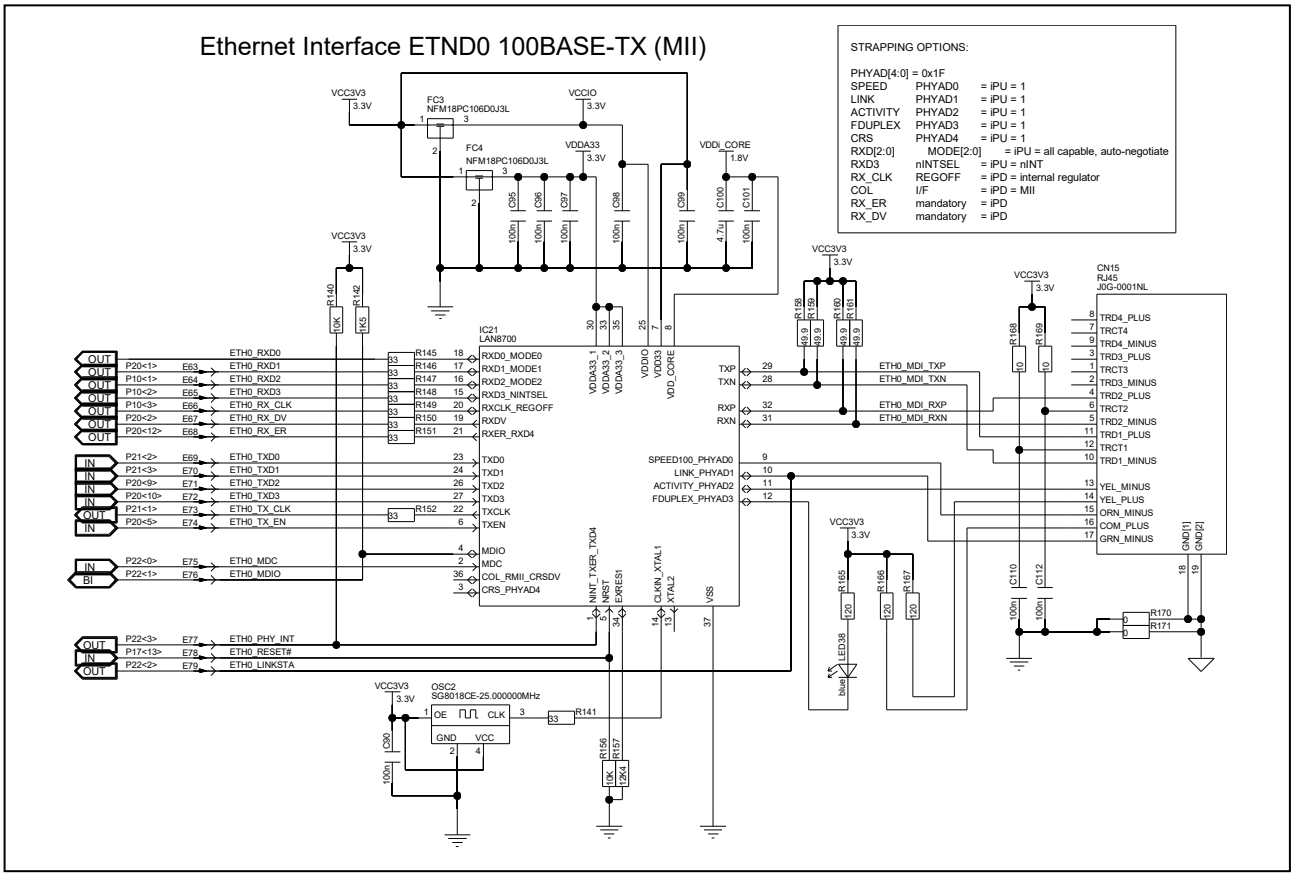


Figure 6.16 100BASE-TX Ethernet interface on board version D020925_06_V0100

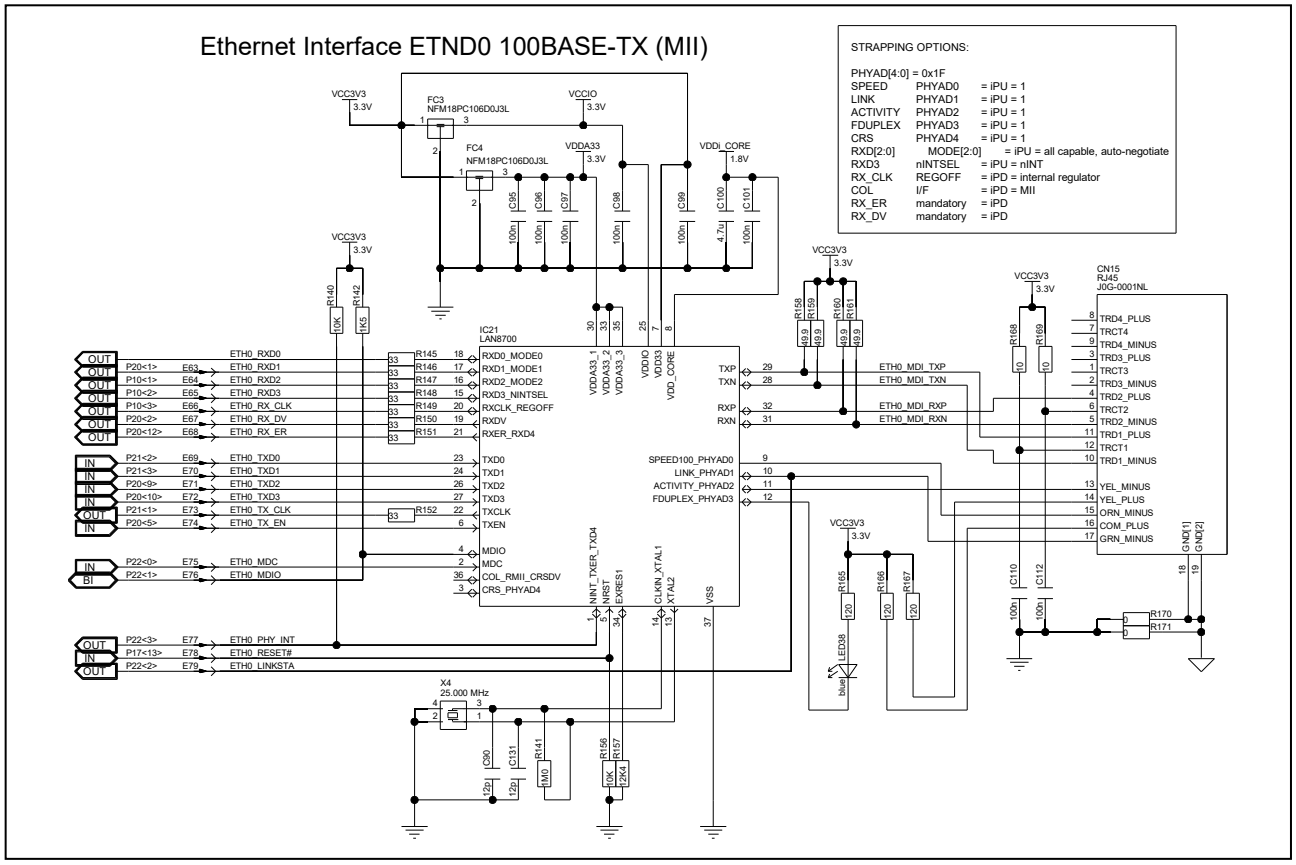


Figure 6.17 100BASE-TX Ethernet interface on board version D020925_06_V0200

Table 6.16 Connector CN15 for 100BASE-TX Ethernet

Pin	Name	Signal	Pin	Name	Signal
1	TRCT3	NC	2	TRD3_MINUS	NC
3	TRD3_PLUS	NC	4	TRD2_PLUS	RXP
5	TRD2_MINUS	RXN	6	TRCT2	VCC3V3_ETH0
7	TRCT4	NC	8	TRD4_PLUS	NC
9	TRD4_MINUS	NC	10	TRD1_MINUS	TXN
11	TRD1_PLUS	TXP	12	TRCT1	VCC3V3_ETH0
13	YEL_MINUS	Yellow LED, cathode	14	YEL_PLUS	Yellow LED, anode
15	ORN_MINUS	SPEED100_PHYAD0	16	COM_PLUS	Green LED, anode
17	GRN_MINUS	Green LED, Cathode	18	GND	
19	GND				

Table 6.17 Functions of RH850/U2C ports and cut traces to disconnect them from 100BASE-TX interface

RH850/U2C		Cut Trace
Port number	Function	
P20_0	ETH0_RXD0	E88
P20_1	ETH0_RXD1	E63
P10_1	ETH0_RXD2	E64
P10_2	ETH0_RXD3	E65
P20_2	ETH0_RX_CLK	E66
P20_12	ETH0_RX_DV	E67
P21_2	ETH0_RX_ER	E68
P21_3	ETH0_TXD0	E69
P20_9	ETH0_TXD1	E70
P20_10	ETH0_TXD2	E71
P21_1	ETH0_TXD3	E72
P20_5	ETH0_TXD_CLK	E73
P22_0	ETH0_TXD_EN	E74
P22_1	ETH0_MDC	E75
P22_3	ETH0_MDIO	E76
P17_13	ETH0_PHY_INT	E77
P22_2	ETH0_RESET#	E78
P17_12	ETH0_LINKSTA	E79

6.12.3 Ethernet Interface 1000BASE-T1

The starter kit using RH850/U2C8 processor includes one Gigabit Ethernet interface 1000BASE-T1 using the ETND1 unit on RH850/U2C.

Note

The Gigabit Ethernet interface is only available in RH850/U2C8 processors.

Thus this circuit is only populated in boards Y-ASK-RH850U2C8.

The pcb for the starter kit is designed for 2 different connectors for the 1000BASE-T1 Ethernet interface. The connectors are CN16 (Wuerth connector type 691 322 110 002, assembled on delivery) and CN17 (TE Connectivity connector type 9-2304372-1, not populated at delivery).

RH850/U2C8 uses the SGMII standard for communication with the Marvel 88Q2112-A2 Ethernet transceiver.

RH850/U2C8 has dedicated communication ports for Gigabit data lines. These are connected directly to the data lines on the Marvell transceiver.

If the starter kit is assembled for use with RH850/U2C4 the same pins work as digital I/O.

Figure 6.18 shows the port functions on RH850/U2C4 and RH850/U2C8.

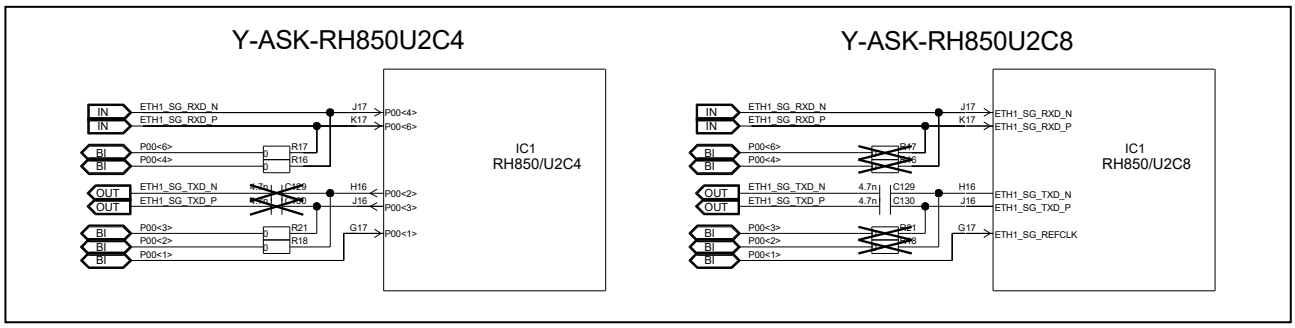


Figure 6.18 1000BASE-T1 data line connections on RH850

The starter kit has also some additional control pins.

RH850/U2C port P03_10 can be used as Ethernet interrupt input (ETH1_PHY_INT).

Ports P04_8 and P04_9 can be used be used as management interface for the Marvell transceiver:

- P04_8: ETH1_MDC, Management Interface Clock.
- P04_9: ETH1_MDIO, Management Interface Data.

On board version D020925_06_V0100 port P4_10 and P24_4 can be used as RESET signal for the Marvell transceiver.

On board version D020925_06_V0200 port P24_4 can be used as RESET signal for the Marvell transceiver.

The control pins of RH850/U2C, which are used for Ethernet 1000BASE-T1 interface, can be disconnected from the Ethernet circuit by opening the appropriate cut traces.

Figure 6.19 and *Figure 6.20* show the circuit diagram for the 1000BASE-T1 Ethernet interface on different board revisions of the starter kit Y-ASK-RH850U2C8.

On the starter kit Y-ASK-RH850U2C4 this complete circuit is not populated.

Table 6.18 shows the pin configuration on the Ethernet connectors CN16 and CN17.

Table 6.19 lists all RH850/U2C control ports used for the 1000BASE-T1 interface and the related cut traces.

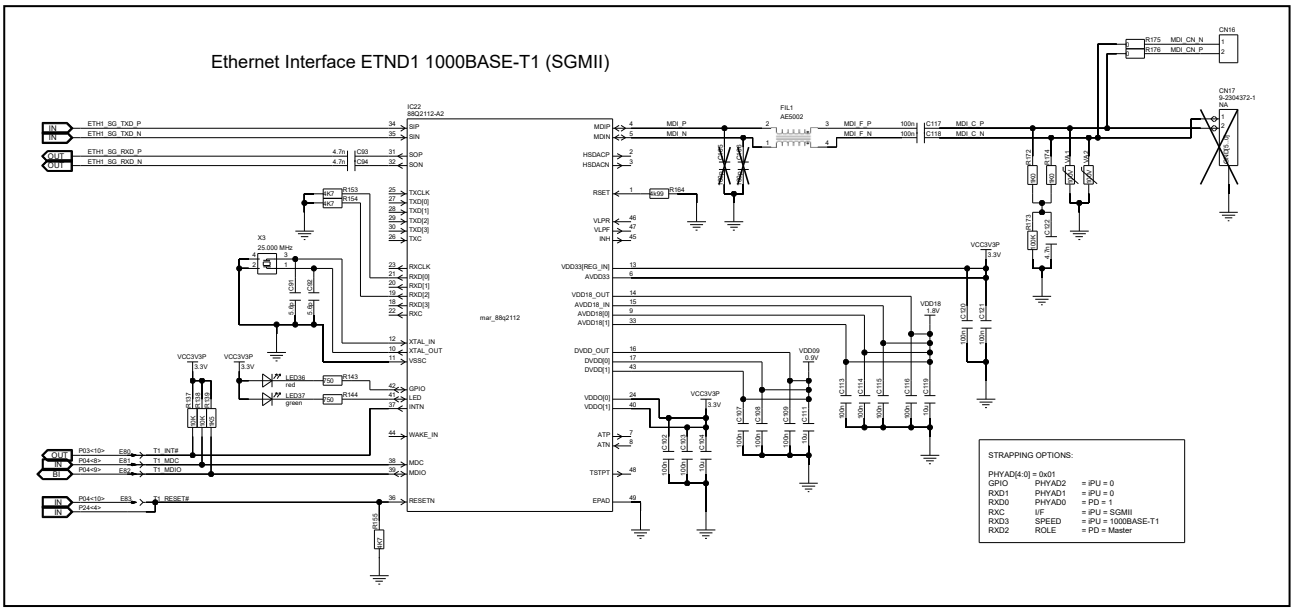


Figure 6.19 1000BASE-TX Ethernet interface on board version D020925_06_V0100

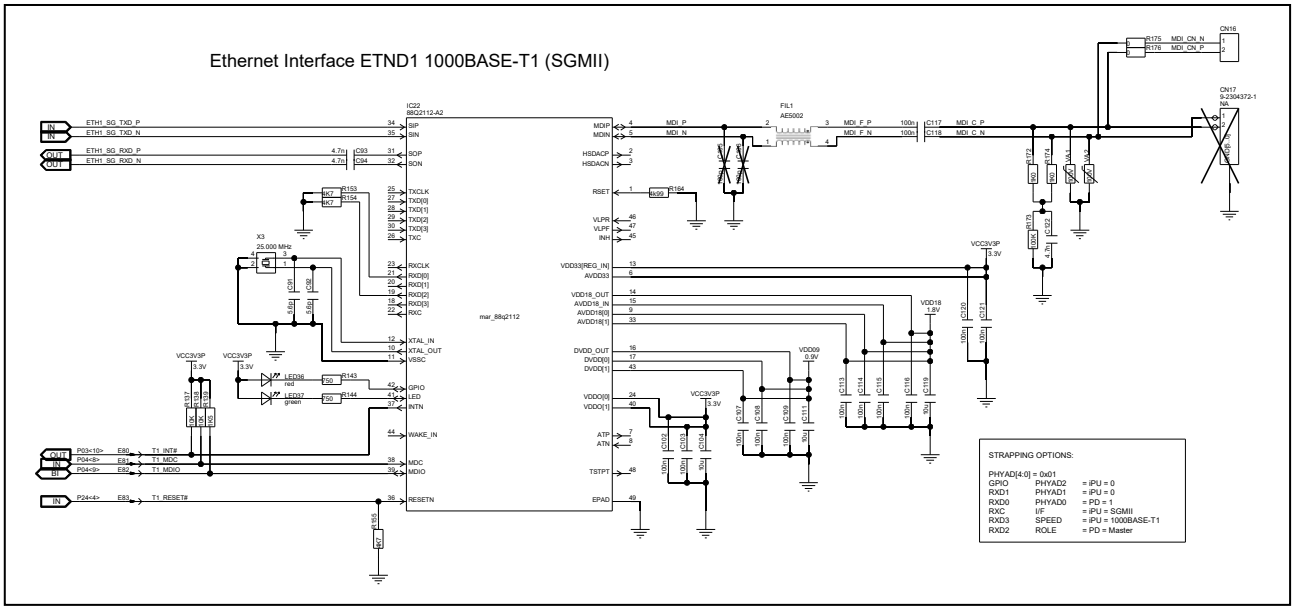


Figure 6.20 1000BASE-TX Ethernet interface on board version D020925_06_V0200

Table 6.18 Connectors CN16 and CN17 for 1000BASE-T1 Ethernet

Connector CN16			Connector CN17		
Pin	**Name**	**Signal**	**Pin**	**Name**	**Signal**
1	MDI_CN_N	MDIN	1	MDI_CN_N	MDIN
2	MDI_CN_P	MDIP	2	MDI_CN_P	MDIP
			3	GND	GND
			4	GND	GND
			5	GND	GND
			6	GND	GND
			7	GND	GND
			8	GND	GND

Table 6.19 Functions of RH850/U2C ports and cut traces to disconnect them from 1000BASE-T1 interface

RH850/U2C		Cut Trace
Port number	**Function**	
P03_10	T1_INT#	E80
P04_8	T1_MDC	E81
P04_9	T1_MDIO	E82
P24_4	T1_RESET#	--- *1 / E83 *2
P04_10 *1	T1_RESET#	E83 *1

*1 Only on starter kit version D020925_06_V0100
*2 Only on starter kit version D020925_06_V0200

6.13 Pmod™ Interfaces

The starter kit for RH850/U2C includes 3 Pmod™ interfaces. The interfaces support different operating modes:

- PMOD0: Type 2 / 2A – SPI / expanded SPI
- PMOD1: Type 2 / 7 – SPI / I2S CODEC (SSIF)
- PMOD2: Type 3 / 3A / 6 / 6A – UART / expanded UART / I2C / expanded I2C

6.13.1 PMOD0 Interface

PMOD0 is used for a clock synchronous serial interface (SPI).

It is connected to ports on P02, P10 and P22.

RH850/U2C uses the MSPI1 unit for the serial interface.

Figure 6.21 shows the circuit diagram for PMOD0 connector.

Table 6.20 shows the pin configurations of the Pmod™ connector and which RH850/U2C functions are being used.

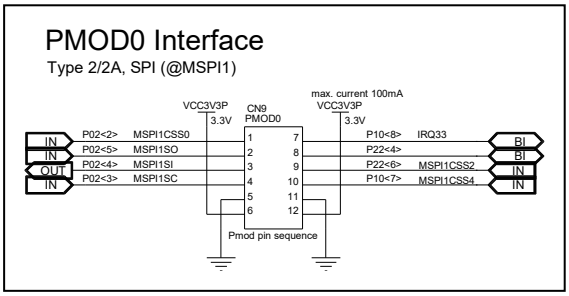


Figure 6.21 PMOD0 circuit diagram

Table 6.20 PMOD0 pin configuration

Pin	SPI (type 2)		Expanded SPI (type 2A)	
	PMOD signal	RH850 signal	PMOD signal	RH850 signal
1	CS	MSPI1CSS0 (P02_2)	CS	MSPI1CSS0 (P02_2)
2	MOSI	MSPI1SO (P02_5)	MOSI	MSPI1SO (P02_5)
3	MISO	MSPI1SI (P02_4)	MISO	MSPI1SI (P02_4)
4	SCK	MSPI1SC (P02_3)	SCK	MSPI1SC (P02_3)
5	GND	GND	GND	GND
6	VCC	VCC3V3P	VCC	VCC3V3P
7	---	---	GPIO (INT)	IRQ33 (P10_8)
8	---	---	GPIO (RESET)	P22_4
9	---	---	GPIO (CS2)	MSPI1CSS2 (P22_6)
10	---	---	GPIO (CS3)	MSPI1CSS4 (P10_7)
11	---	---	GND	GND
12	---	---	VCC	VCC3V3P

6.13.2 PMOD1 Interface

PMOD1 is used for a clock synchronous serial interface (SPI) or a serial sound interface (SSIF).

It is connected to ports on P02, P17, P and P22.

RH850/U2C uses the MSPI5 unit for the synchronous serial interface and SSIF1 unit for serial sound interface.

RH850/U2C uses 3 digital I/O ports to configure the signals on PMOD1 connector:

- P08_1: Select SPI or SSIF function for PMOD1 connector.
  - P08_1[LOW]: PMOD1 is used for SPI.
  - P08_1[HIGH]: PMOD1 is used for SSIF
- P08_2: “H” enables use of port P20_0 as SSIFACK signal.
  See also chapter *0*
- *Ethernet Interface* 100BASE-TX for more details on function selection for port P20_0.
- P20_8: MCLK_EN, enable oscillator for MCLK generation.
  - P20_8[LOW]: Disable oscillator OSC1; also default output if P20_8 is Hi-Z.
  - P20_8[HIGH]: Enable oscillator OSC1 for MCLK signal generation on the sound interface.

Figure 6.22 shows the circuit diagram for PMOD1 connector.

Table 6.21 shows the pin configurations of the Pmod™ connector and which RH850/U2C functions are being used.

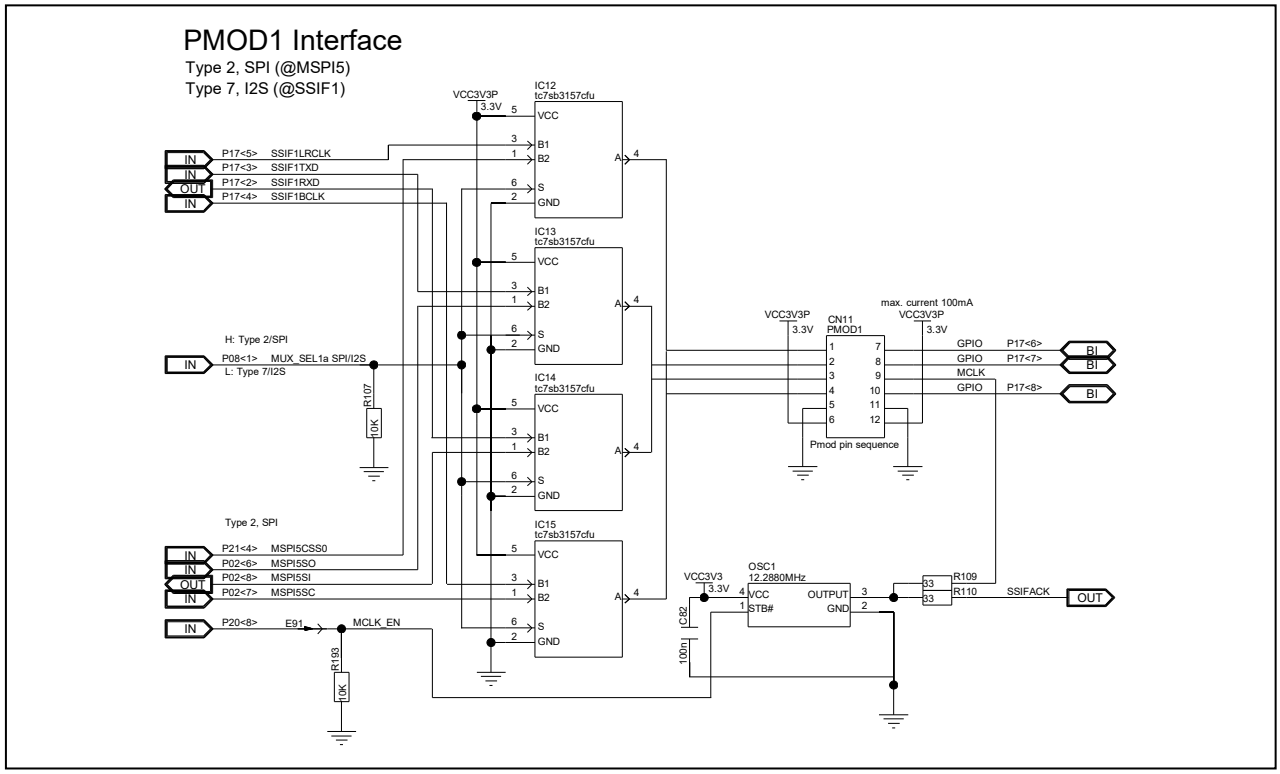


Figure 6.22 PMOD1 circuit diagram

Table 6.21 PMOD1 pin configuration

Pin	SPI (type 2)		I2S CODEC (type 7)	
	PMOD signal	RH850 signal	PMOD signal	RH850 signal
1	CS	MSPI5CSS0 (P21_4)	LRCLK	SSIF1LRCLK (P17_5)
2	MOSI	MSPI5SO (P02_6)	DAC Data	SSIF1TXD (P17_3)
3	MISO	MSPI5SI (P02_8)	ADC Data	SSIF1RXD (P17_2)
4	SCK	MSPI5SC (P02_7)	BCLK	SSIF1BCLK (P17_4)
5	GND	GND	GND	GND
6	VCC	VCC3V3P	VCC	VCC3V3P
7	GPIO	P17_6	GPIO	P17_6
8	GPIO	P17_7	GPIO	P17_7
9	---	---	GPIO (MCLK)	OSC1 clock signal (enabled by MCLK_EN on P20_8)
10	GPIO	P17_8	GPIO	P17_8
11	GND	GND	GND	GND
12	VCC	VCC3V3P	VCC	VCC3V3P

6.13.3 PMOD2 Interface

PMOD2 can be used for an asynchronous UART interface or a synchronous I2C interface.

It is connected to ports on P04, P08, P10 and P17.

RH850/U2C uses the RLIN35 unit for the UART interface and RI3C2 for I2C interface.

RH850/U2C uses port P08_0 as digital I/O to configure the signal on pin 3 of the PMOD2 connector:

- P08_0[LOW]: Pin 3 on CN10 is used for UART (RLIN35_RX).
- P08_0[HIGH]: Pin 3 on CN10 is used for I2C (RI3C2SCL).

Figure 6.23 shows the circuit diagram for PMOD2 connector.

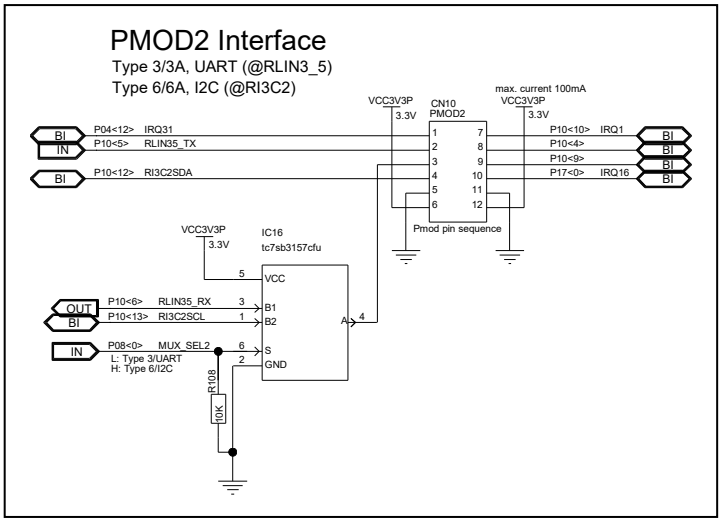


Figure 6.23 PMOD2 circuit diagram

Table 6.22 shows the pin configuration of the connector CN10 and which RH850/U2C functions are being used.

Table 6.22 PMOD2 pin configuration

Pin	UART (type 3)		Expanded UART (type 3A)		I2C (type 6)		Expanded I2C (type 6A)	
	PMOD signal	RH850 signal	PMOD signal	RH850 signal	PMOD signal	RH850 signal	PMOD signal	RH850 signal
1	CTS (GPIO)		CTS (GPIO)	P04_12	NC (INT)		NC (INT)	IRQ31 (P04_12)
2	TXD		TXD	RLIN35_TX (P10_5)	NC (RESET)		NC (RESET)	P10_5
3	RXD		RXD	RLIN35_RX (P10_6)	SCL		SCL	RI3C2SCL (P10_13)
4	RTS (GPIO)		RTS (GPIO)	P10_12	SDA		SDA	RI3C2SDA (P10_12)
5	GND		GND	GND	GND		GND	GND
6	VCC		VCC	VCC3V3P	VCC		VCC	VCC3V3P
7	---	---	GPIO (INT)	IRQ1 (P10_0)	---	---	GPIO	P10_0
8	---	---	GPIO (RESET)	P10_4	---	---	GPIO	P10_4
9	---	---	GPIO	P10_9	---	---	GPIO	P10_9
10	---	---	GPIO	P17_0	---	---	GPIO	P17_0
11	GND	GND	GND	GND	---	---	GND	GND
12	VCC	VCC3V3P	VCC	VCC3V3P	---	---	VCC	VCC3V3P

6.14 microSD Card Interface

The starter kit for RH850/U2C provides one microSD card interface on connector CN8.

On RH850/U2C the multimedia card interface (MMCA0) is used for communication.

Figure 6.24 shows the circuit diagram of the interface.

RH850/U2C can be completely disconnected from the microSD card interface connector.

Table 6.23 shows the pin configuration of the microSD card interface connector CN8, lists which ports of RH850/U2C are being used, and which cut traces have to be opened to disconnect RH850/U2C from the interface.

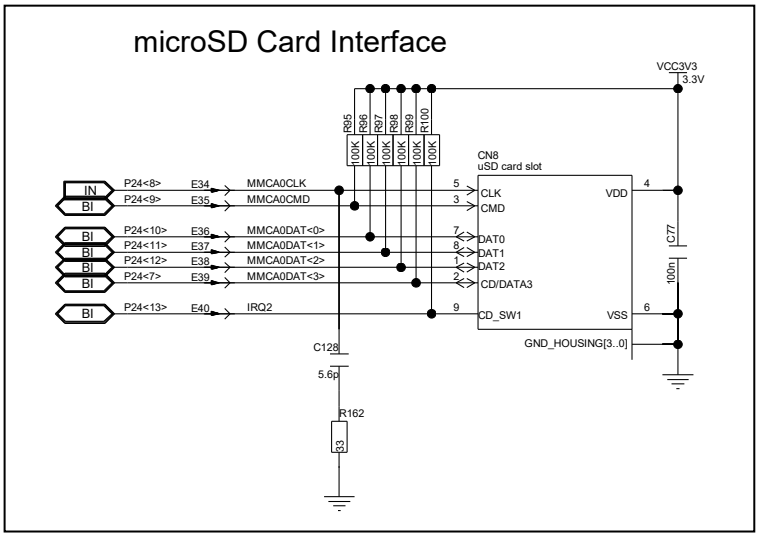


Figure 6.24 microSD card interface

For details on connector CN8 please refer to *10.8 microSD Card Connector CN8* .

Table 6.23 Connector CN8 for microSD card interface

CN8 Pin	RH850/U2C		Cut Trace
	Port number	Function	
4	VDD	VCC3V3	
6	VSS	GND	
5	P24_8	MMCA0CLK	E34
3	P24_9	MMCA0CMD	E35
7	P24_10	MMCA0DAT_0	E36
8	P24_11	MMCA0DAT_1	E37
1	P24_12	MMCA0DAT_2	E38
2	P24_7	MMCA0DAT_3	E39
9	P24_13	IRQ2	E40

7. Development Tools

7.1 E2 On-Chip Debug Emulator [RTE0T00020KCE00000R]

The E2 on-chip debug emulator is a powerful debugging tool with flash programming functions which supports various Renesas microcontrollers. It offers enhanced debug features for RH850 microcontrollers such as:

- Software Trace Function
- CAN Communications Time Measurement Solution
- Support of external trigger signals (input and output)

Technical details about E2, the latest manuals and the actual version of the USB driver can be found on the Renesas website for E2: E2 emulator [RTE0T00020KCE00000R] | Renesas

7.2 Software Development Tools

The following software development tools are included in the starter kit package:

- Green Hills MULTI IDE (90 days evaluation version)
- IAR Embedded Workbench EWRH850 for Renesas RH850 (128KB kickstart version or 30 days evaluation version)
- CS+ integrated development environment with compiler CC-RH (compiler is 60 days evaluation version, afterwards it can be used as 256KB code size limited version)
- Renesas Flash Programmer (Renesas Flash Programmer (Programming GUI) | Renesas)
- Renesas Smart Configurator (Smart Configurator | Renesas)

Installation and usage of these tools is described in the RH850 starter kit license information document (D017765-11), which is also part of the Starter Kit package.

8. RH850/U2C Starter Kit Example Software

Example software for the RH850/U2C Starter Kit can be downloaded from the following website:

Y-ASK-RH850U2C4-v0100.zip

A description of the sample software is included in each package.

9. Precautions

9.1 Silk screen for connectors CN9 and CN11

The silk screen at the connectors CN9 and CN11 saying “PMOD0” and “PMOD1” have been swapped.

The correct marking is:

CN9 – PMOD0

CN11 – PMOD1

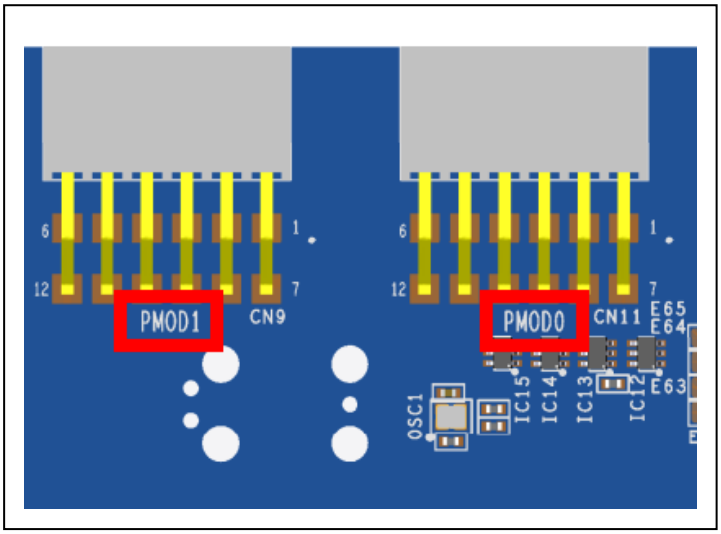


Figure 9.1 Silk screen for the connectors CN9 and CN11

10. Connectors

10.1 Debug Connector CN1

Please refer to *5 Debug and Flash Programming Interfaces* for details on the debug connection.

Table 10.1 On-chip debug connector CN1

Pin	Function	Device port
1	TDCK / LPDCLK / FPCK	JP0_2
3	TRST#	
5	TDO / LPDO / FPDT	JP0_1
7	TDI / LPDIO / FPDR	JP0_0
9	TMS	JP0_3
11	RDY / LPDCLKO / –	JP0_5
13	RESET#	

Pin	Function	Device port
2	GND	
4	FLMD0	
6	–	
8	VCC3V3	
10	ECTO#	P10_14
12	GND	
14	GND	

10.2 Device Port Connector CN2

The device port connectors provide direct access to RH850/U2C port pins.

Table 10.2 Device port connector CN2

Pin	Device port
1	GND
3	P17_0
5	P17_1
7	P17_2
9	P17_3
11	P17_4
13	P17_5
15	P17_6
17	P17_7
19	P17_8
21	P17_9
23	P17_10
25	P17_11
27	P17_12
29	P17_13
31	P20_6
33	P20_7
35	P20_8
37	P20_11
39	P22_0
41	P22_1

Pin	Device port
2	GND
4	P10_0
6	P10_4
8	P10_5
10	P10_6
12	P10_7
14	P10_8
16	P10_9
18	P10_10
20	P10_11
22	P10_12
24	P10_13
26	P10_14
28	P21_0
30	P21_4
32	P21_5
34	P21_6
36	P21_7
38	P21_8
40	P21_9
42	P21_10

Table 10.2 Device port connector CN2 (cont'd)

Pin	Device port	Pin	Device port
43	P22_2	44	AP4_0
45	P22_3	46	AP4_1
47	P22_4	48	AP4_2
49	P22_5	50	AP4_3
51	P22_6	52	AP4_4
53	AP3_0	54	AP4_5
55	AP3_1	56	AP4_6
57	AP3_2	58	AP4_7
59	AP3_3	60	PWRCTL_U2C8
61	P24_4	62	P00_0
63	P24_5	64	P00_1
65	P24_6	66	P00_2
67	P24_13	68	P00_3
69	---	70	P00_4
71	---	72	P00_5
73	---	74	P00_6
75	---	76	P00_7
77	---	78	---
79	---	80	VCC5V0
81	---	82	---
83	ERROROUT_M#	84	VCC3V3
85	RESETOUT'	86	---
87	RESET#	88	GND
89	FLMD1	90	VCC3V3
91	FLMD0	92	VCC3V3
93	GND	94	GND

10.3 Device Port Connector CN3

The device port connectors provide direct access to RH850/U2C port pins.

Table 10.3 Device port connector CN3

Pin	Device port	Pin	Device port
1	GND	2	GND
3	AP2_0	4	AP0_0
5	AP2_1	6	AP0_1
7	AP2_2	8	AP0_2
9	AP2_3	10	AP0_3
11	AP2_4	12	AP0_4
13	AP2_5	14	AP0_5

Table 10.3 Device port connector CN3 (cont'd)

Pin	Device port
15	AP2_6
17	AP2_7
19	AP2_8
21	AP2_9
23	AP2_10
25	AP2_11
27	AP2_12
29	AP2_13
31	AP2_14
33	AP2_15
35	AP1_0
37	AP1_1
39	AP1_2
41	AP1_3
43	P08_0
45	P08_1
47	P08_2
49	P08_3
51	P03_0
53	P03_1
55	P03_10
57	P03_11
59	P03_12
61	P02_0
63	P02_1
65	P02_2
67	P02_3
69	P02_4
71	P02_5
73	P02_6
75	P02_7
77	P02_8
79	P02_9
81	P02_10
83	P02_11
85	P02_12
87	P02_13
89	P02_14
91	---
93	GND

Pin	Device port
16	AP0_6
18	AP0_7
20	AP0_8
22	AP0_9
24	AP0_10
26	AP0_11
28	AP0_12
30	AP0_13
32	AP0_14
34	AP0_15
36	P06_2
38	P06_3
40	P06_4
42	P06_5
44	P06_6
46	P06_7
48	P06_8
50	P06_9
52	P06_10
54	P06_11
56	P06_12
58	P06_13
60	P04_0
62	P04_1
64	P04_2
66	P04_3
68	P04_4
70	P04_5
72	P04_6
74	P04_7
76	P04_8
78	P04_9
80	P04_10
82	P04_11
84	P04_12
86	P04_13
88	P04_14
90	P04_15
92	---
94	GND

10.4 Power Supply Connector CN4

Please refer to *3 Power Supply* for details on the function of these pins.

Table 10.4 Power supply connector CN4

Pin	Function
1	GND
2	–
3	+12V
4	+12V

10.5 Power Supply Test Connector CN5

Please refer to *3.3 Power Supply Test Connector* for details on the function of these pins.

This connector is not assembled on board version D020527_06_V0200.

Table 10.5 Voltages on Test Power Connector

Pin	Board version D020925_06_V0100	Board version D020925_06_V0200 and later
1	GND	GND
2	GND	VCC12V0, 12.0 V
3	NC	VDD, 1.09 V
4	VCC5V0, 5.0 V	VCC5V5, 5.0 V
5	VCC12V0, 12.0 V	VCC3.3, 3.3 V
6	VCC3V3, 3.3 V	VCCLDO, 3.3 V
7	NC	VCC3V3P, 3.3V
8	VCCLDO, 3.3 V	GND
9	VDD, 1.09 V	NC
10	VCC3V3P, 3.3 V	NC
11	---	NC
12	---	NC
13	---	NC
14	---	NC

10.6 OLED Display Connector CN6

Please refer to *6.6 OLED Graphic Display* for details on the display connection.

Table 10.6 Display connector CN6 for EastRising Technology display

Pin	Function	RH850/U2C Processor Pin
1	NC (GND)	GND
2	C2P	Capacitor for charge pump
3	C2N	
4	C1P	Capacitor for charge pump
5	C1N	
6	VBAT	VCC3V3P
7	NC	---
8	VSS	GND
9	VDD	VCC3V3P
10	BS0	GND
11	BS1	GND
12	BS2	GND
13	CS#	10kOhm pull-up to VCC3V3P, Port P06_8
14	RES#	Reset circuit with 10kOhm pull-up to VCC3V3, Port P02_13
15	D/C#	Port P02_12

Pin	Function	RH850/U2C Processor Pin
16	R/W#	GND
17	E/RD#	GND
18	D0 / SCLK / SCL	10kOhm pull-up to VCC3V3P, Port P08_3 (MSPI0SC)
19	D1 / MOSI / SDAi	10kOhm pull-up to VCC3V3P, Port P02_14 (MSPI0SO)
20	D2 / SDAo	---
21	D3	GND
22	D4	GND
23	D5	GND
24	D6	GND
25	D7	---
26	IREF	390kOhm pull-down
27	VCOMH	ViCOMH (5.0V)
28	VCC	VCCiLCD (9.0V)
29	VLSS	GND
30	NC (GND)	GND

10.7 USB-C Connector CN7

Please refer to *6.11 USB to UART Interface* for details on the function of these pins.

Table 10.7 USB-C connector CN7

Pin	Function	Signal Name
A1	GND	
A2	–	–
A3	–	–
A4	V-BUS	V_USBCN
A5	CC1	Pull-down GND
A6	DP1	USB_DP
A7	DN1	USB_DP
A8	SBU1	–
A9	VBUS	V_USBCN
A10	–	–

Pin	Function	Signal Name
B12	GND	
B11	–	–
B10	–	–
B9	V-BUS	V_USBCN
B8	SBU2	–
B7	DP2	USB_DP
B6	DN2	USB_DP
B5	CC2	–
B4	VBUS	V_USBCN
B3	–	–

Table 10.7 USB-C connector CN7

Pin	Function	Signal Name
A11	–	–
A12	GND	

Pin	Function	Signal Name
B2	–	–
B1	GND	

10.8 microSD Card Connector CN8

Please refer to *6.14 microSD Card Interface* for details on the function of these pins.

Table 10.8 microSD card connector CN8

Pin	RH850/U2C	
	Port number	Function
1	P24_12	MMCA0DAT_2
2	P24_7	MMCA0DAT_3
3	P24_9	MMCA0CMD
4	VDD	VCC3V3
5	P24_10	MMCA0CLK
6	VSS	GND
7	P24_10	MMCA0DAT_0
8	P24_11	MMCA0DAT_1
9	P24_13	IRQ2

10.9 PMOD0 Connector CN9

Please refer to *6.13.1 PMOD0 Interface* for details on the function of these pins.

Table 10.9 PMOD0 connector CN9

Pin	SPI (type 2)		Expanded SPI (type 2A)	
	PMOD signal	RH850 signal	PMOD signal	RH850 signal
1	CS	MSPI1CSS0 (P02_2)	CS	MSPI1CSS0 (P02_2)
2	MOSI	MSPI1SO (P02_5)	MOSI	MSPI1SO (P02_5)
3	MISO	MSPI1SI (P02_4)	MISO	MSPI1SI (P02_4)
4	SCK	MSPI1SC (P02_3)	SCK	MSPI1SC (P02_3)
5	GND	GND	GND	GND
6	VCC	VCC3V3P	VCC	VCC3V3P
7	---	---	GPIO (INT)	IRQ33 (P10_8)
8	---	---	GPIO (RESET)	P22_4
9	---	---	GPIO (CS2)	MSPI1CSS2 (P22_6)
10	---	---	GPIO (CS3)	MSPI1CSS4 (P10_7)
11	---	---	GND	GND
12	---	---	VCC	VCC3V3P

10.10 PMOD2 Connector CN10

Please refer to *6.13.3 PMOD2 Interface* for details on the function of these pins.

Table 10.10 PMOD2 connector CN10

Pin	UART (type 3)		Expanded UART (type 3A)		I2C (type 6)		Expanded I2C (type 6A)	
	PMOD signal	RH850 signal	PMOD signal	RH850 signal	PMOD signal	RH850 signal	PMOD signal	RH850 signal
1	CTS (GPIO)		CTS (GPIO)	P04_12	NC (INT)		NC (INT)	IRQ31 (P04_12)
2	TXD		TXD	RLIN35_TX (P10_5)	NC (RESET)		NC (RESET)	P10_5
3	RXD		RXD	RLIN35_RX (P10_6)	SCL		SCL	RI3C2SCL (P10_13)
4	RTS (GPIO)		RTS (GPIO)	P10_12	SDA		SDA	RI3C2SDA (P10_12)
5	GND		GND	GND	GND		GND	GND
6	VCC		VCC	VCC3V3P	VCC		VCC	VCC3V3P
7	---	---	GPIO (INT)	IRQ1 (P10_0)	---	---	GPIO	P10_0
8	---	---	GPIO (RESET)	P10_4	---	---	GPIO	P10_4
9	---	---	GPIO	P10_9	---	---	GPIO	P10_9
10	---	---	GPIO	P17_0	---	---	GPIO	P17_0
11	GND	GND	GND	GND	---	---	GND	GND
12	VCC	VCC3V3P	VCC	VCC3V3P	---	---	VCC	VCC3V3P

10.11 PMOD1 Connector CN11

Please refer to *6.13.2 PMOD1 Interface* for details on the function of these pins.

Table 10.11 PMOD1 Connector CN11

Pin	SPI (type 2)		I2S CODEC (type 7)	
	PMOD signal	RH850 signal	PMOD signal	RH850 signal
1	CS	MSPI5CSS0 (P21_4)	LRCLK	SSIF1LRCLK (P17_5)
2	MOSI	MSPI5SO (P02_6)	DAC Data	SSIF1TXD (P17_3)
3	MISO	MSPI5SI (P02_8)	ADC Data	SSIF1RXD (P17_2)
4	SCK	MSPI5SC (P02_7)	BCLK	SSIF1BCLK (P17_4)
5	GND	GND	GND	GND
6	VCC	VCC3V3P	VCC	VCC3V3P
7	GPIO	P17_6	GPIO	P17_6
8	GPIO	P17_7	GPIO	P17_7
9	---	---	GPIO (MCLK)	OSC1 clock signal (enabled by MCLK_EN on P20_8)
10	GPIO	P17_8	GPIO	P17_8
11	GND	GND	GND	GND
12	VCC	VCC3V3P	VCC	VCC3V3P

10.12 CAN1 Connector CN12

Please refer to *6.7*

CAN Interfaces for details on the function of these pins.

Table 10.12 CAN1 connector CN12

CAN1: Connector CN12	
Pin	**Function**
1	NC
2	CAN1_L
3	GND (CAN1_GND_EN# enabled)
4	NC
5	NC
6	NC
7	CAN1_H
8	NC
9	NC
10	GND

10.13 CAN0 (CANXL/FD) Connector CN13

Please refer to *6.7*

CAN Interfaces for details on the function of these pins.

Table 10.13 CAN0 (CANXL/FD) connector CN13

CAN0 (CANXL/FD): Connector CN13	
Pin	**Function**
1	NC
2	CAN_L
3	GND (CAN_GND_EN# enabled)
4	NC
5	NC
6	NC
7	CAN_H
8	NC
9	NC
10	GND

10.14 LIN and SENT Connector CN14

Please refer to *0*

Table 6.9 Cut traces to disconnect RH850/U2C ports from CAN transceivers

CAN1		CAN0	
RH850/U2C Port	**Cut Trace**	**RH850/U2C Port**	**Cut Trace**
P06_2	E45	P06_1	E50
P06_3	E46	P06_0	E51
P17_10	E47	P21_10	E52
P17_11	E48	P21_5	E53
P17_9	E49	P17_9	E49

LIN and SENT Interfaces for details on the function of these pins.

Table 10.14 LIN and SENT connector CN14

Pin	Function	Condition
1	VCC5V0	SENT power enabled by port P21_9 = “L”
2	NC	
3	NC	
4	NC	
5	GND	
6	GND	
7	LIN1	RLIN35 function
8	SENT	RSENT4 function

Table 10.14 LIN and SENT connector CN14

Pin	Function	Condition
9	LIN_BAT	LIN Power enabled in board configurator.
10	GND	

10.15 Ethernet Connector CN15

Please refer to *6.12.2 Ethernet Interface 100BASE-TX* for details on the function of these pins.

Table 10.15 Connector CN15 for 100BASE-TX Ethernet

Pin	Name	Signal	Pin	Name	Signal
1	TRCT3	NC	2	TRD3_MINUS	NC
3	TRD3_PLUS	NC	4	TRD2_PLUS	RXP
5	TRD2_MINUS	RXN	6	TRCT2	VCC3V3_ETH0
7	TRCT4	NC	8	TRD4_PLUS	NC
9	TRD4_MINUS	NC	10	TRD1_MINUS	TXN
11	TRD1_PLUS	TXP	12	TRCT1	VCC3V3_ETH0
13	YEL_MINUS	Yellow LED, cathode	14	YEL_PLUS	Yellow LED, anode
15	ORN_MINUS	SPEED100_PHYAD0	16	COM_PLUS	Green LED, anode
17	GRN_MINUS	Green LED, Cathode	18	GND	
19	GND				

10.16 Ethernet Connectors CN16 and CN17

Please refer to *6.12.3 Ethernet Interface 1000BASE-T1* for details on the function of these pins.

Table 10.16 Connectors CN16 and CN17 for 1000BASE-T1 Ethernet

Connector CN16			Connector CN17		
Pin	**Name**	**Signal**	**Pin**	**Name**	**Signal**
1	MDI_CN_N	MDIN	1	MDI_CN_N	MDIN
2	MDI_CN_P	MDIP	2	MDI_CN_P	MDIP
			3	GND	GND
			4	GND	GND
			5	GND	GND
			6	GND	GND
			7	GND	GND
			8	GND	GND

10.17 Ethernet Connector CN18

Please refer to *6.12.1 Ethernet Interface 10BASE-T1S* for details on the function of these pins.

Table 10.17 10BASE-T1S connector CN18

Pin	Function
1	TRX_P
2	TRX_N

11. Mechanical Dimensions

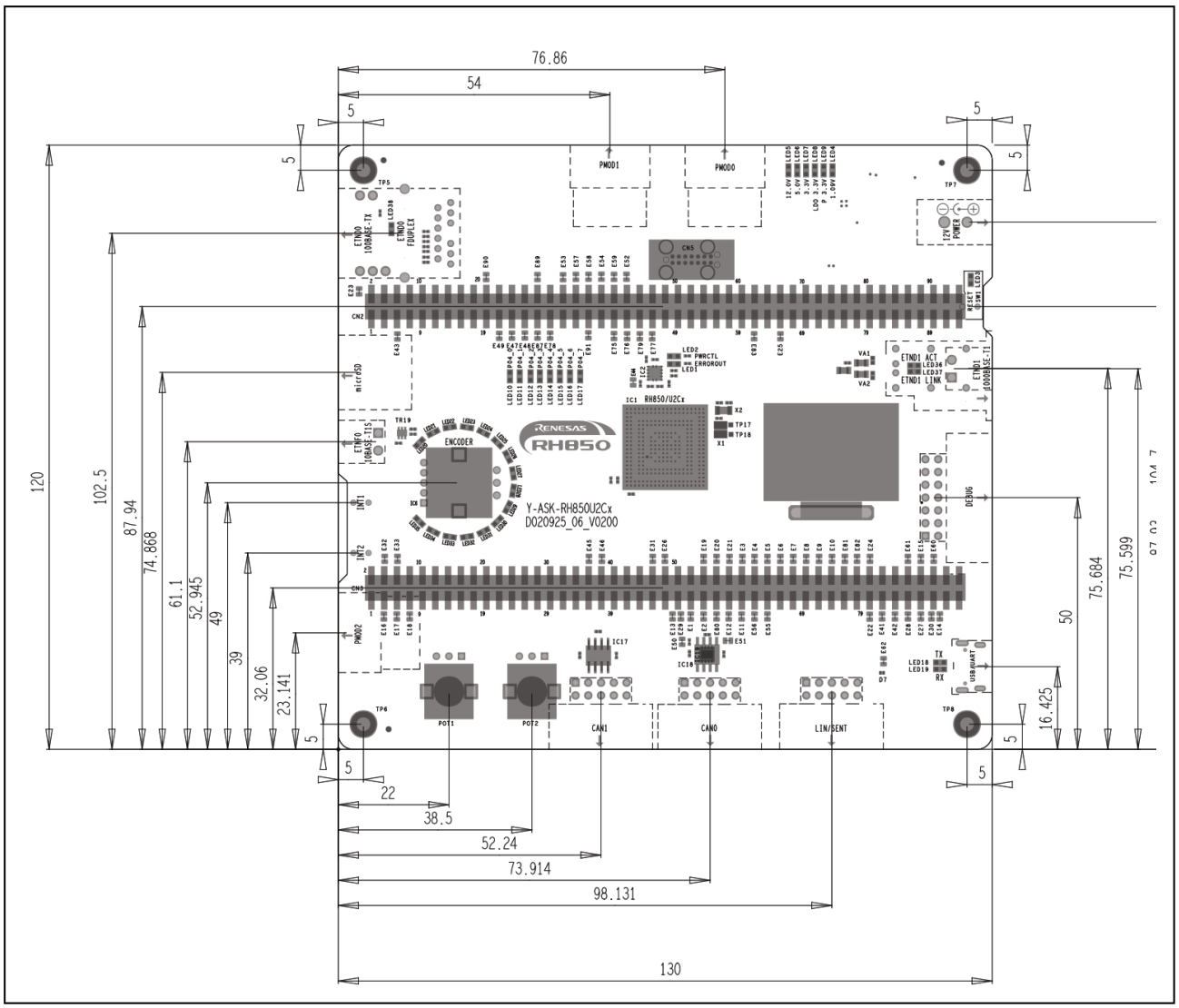


Figure 10.1 Mechanical dimensions

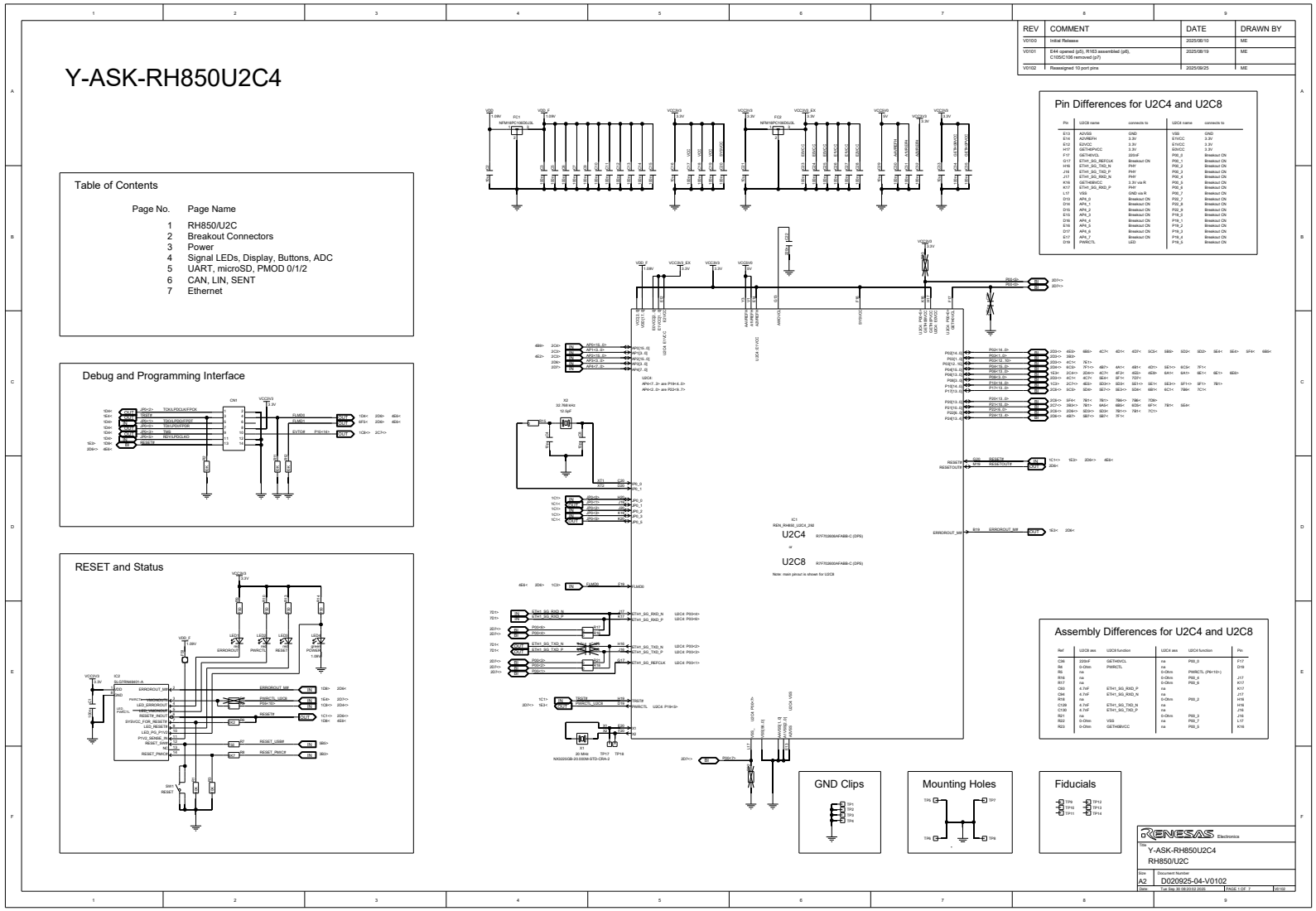
12. Schematics

CAUTION

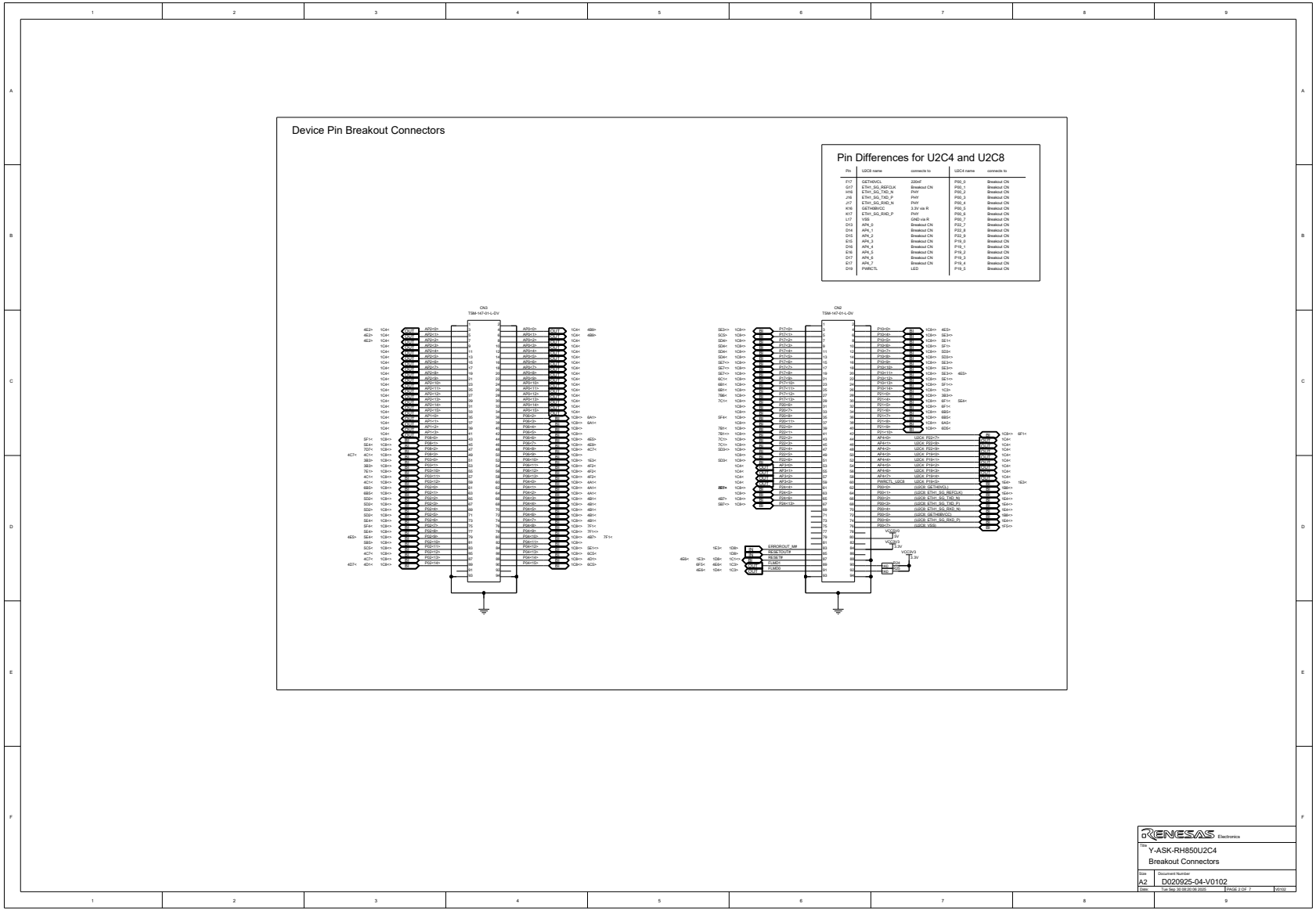
The schematics shown in this document are not intended to be used as a reference for mass production. Any usage in an application design is the sole responsibility of the customer.

12.1 Y-ASK-RH850U2C4 (D020925_06_V0100)

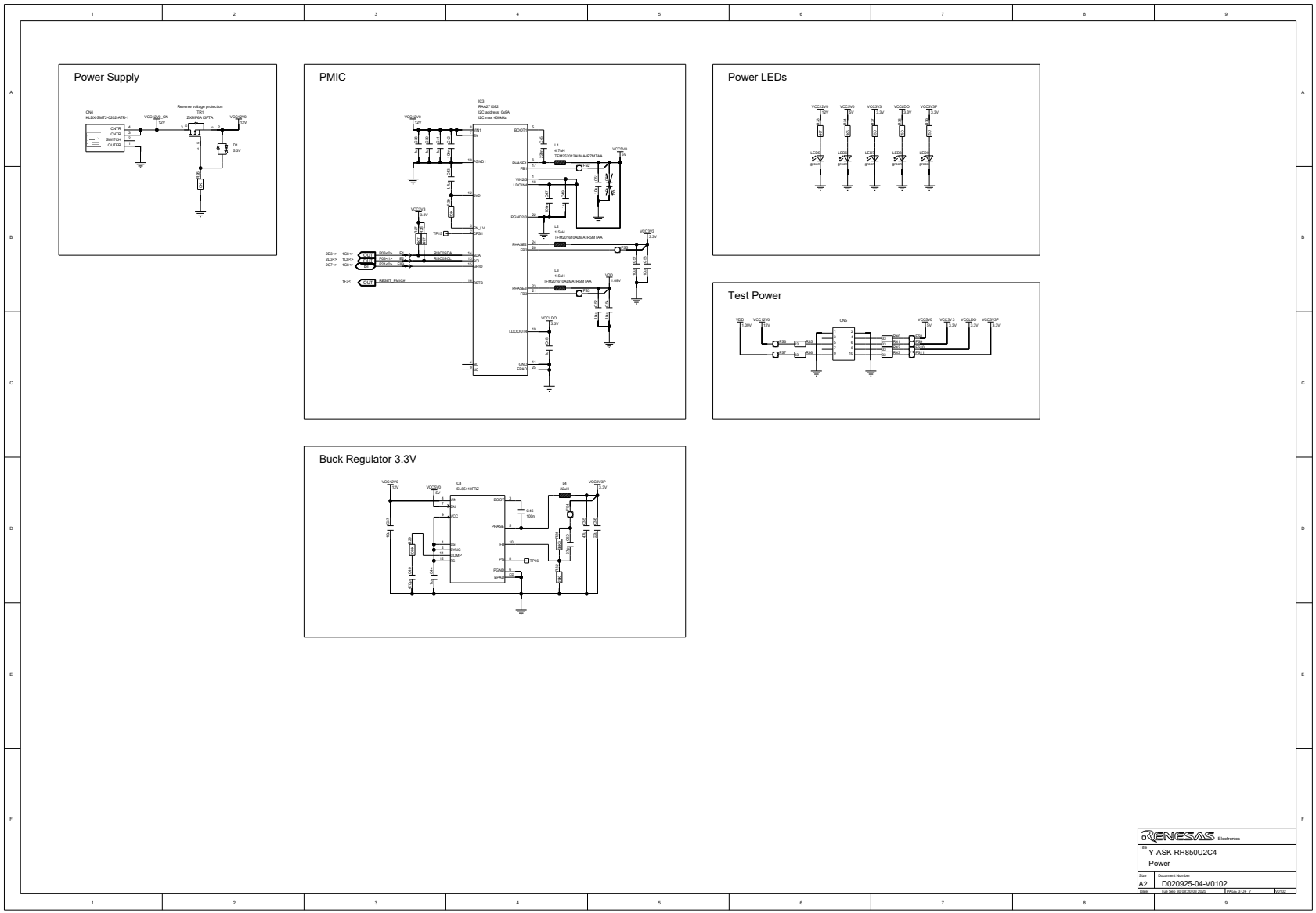
12.1.1 RH850 U2C



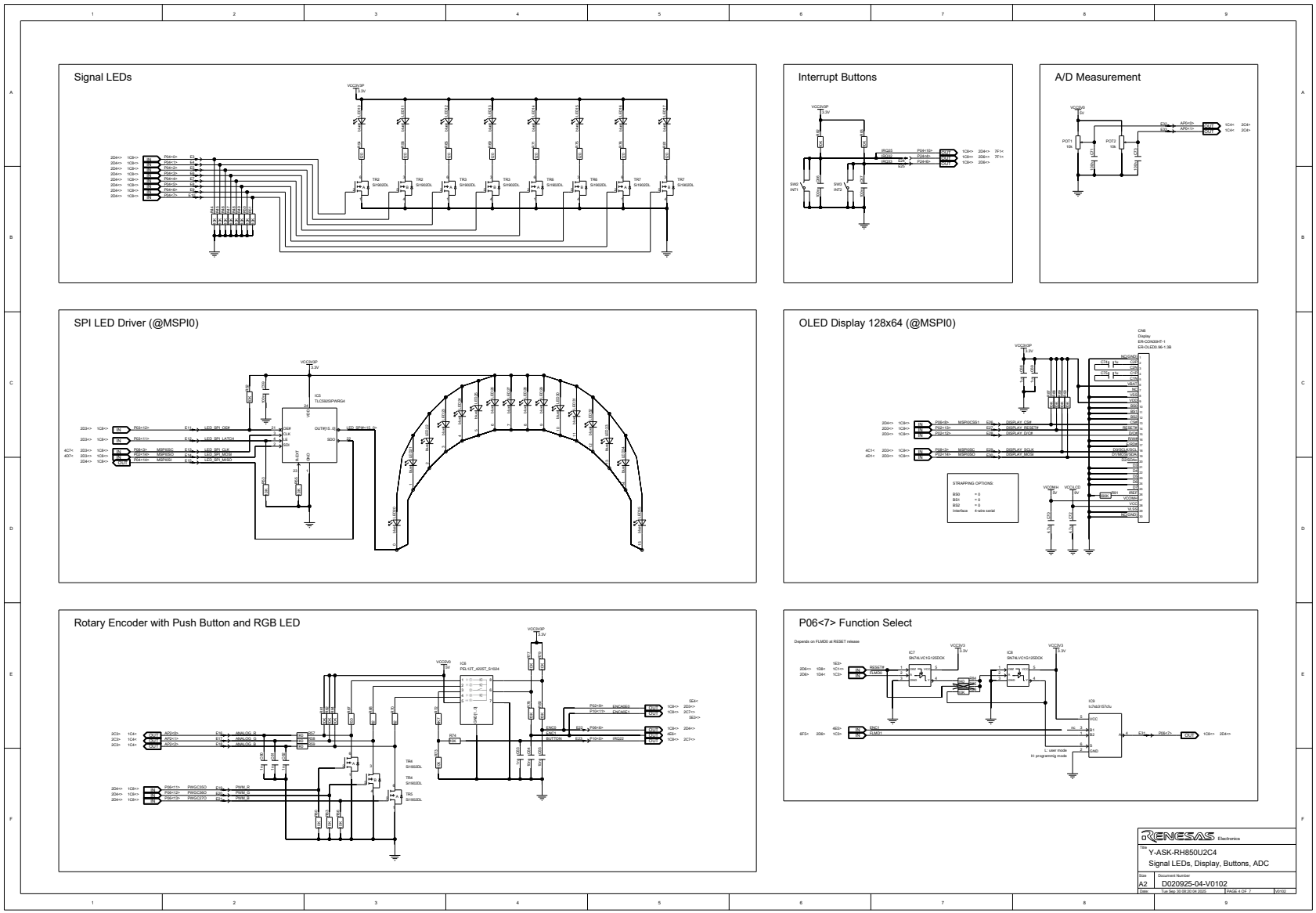
12.1.2 Breakout Connectors



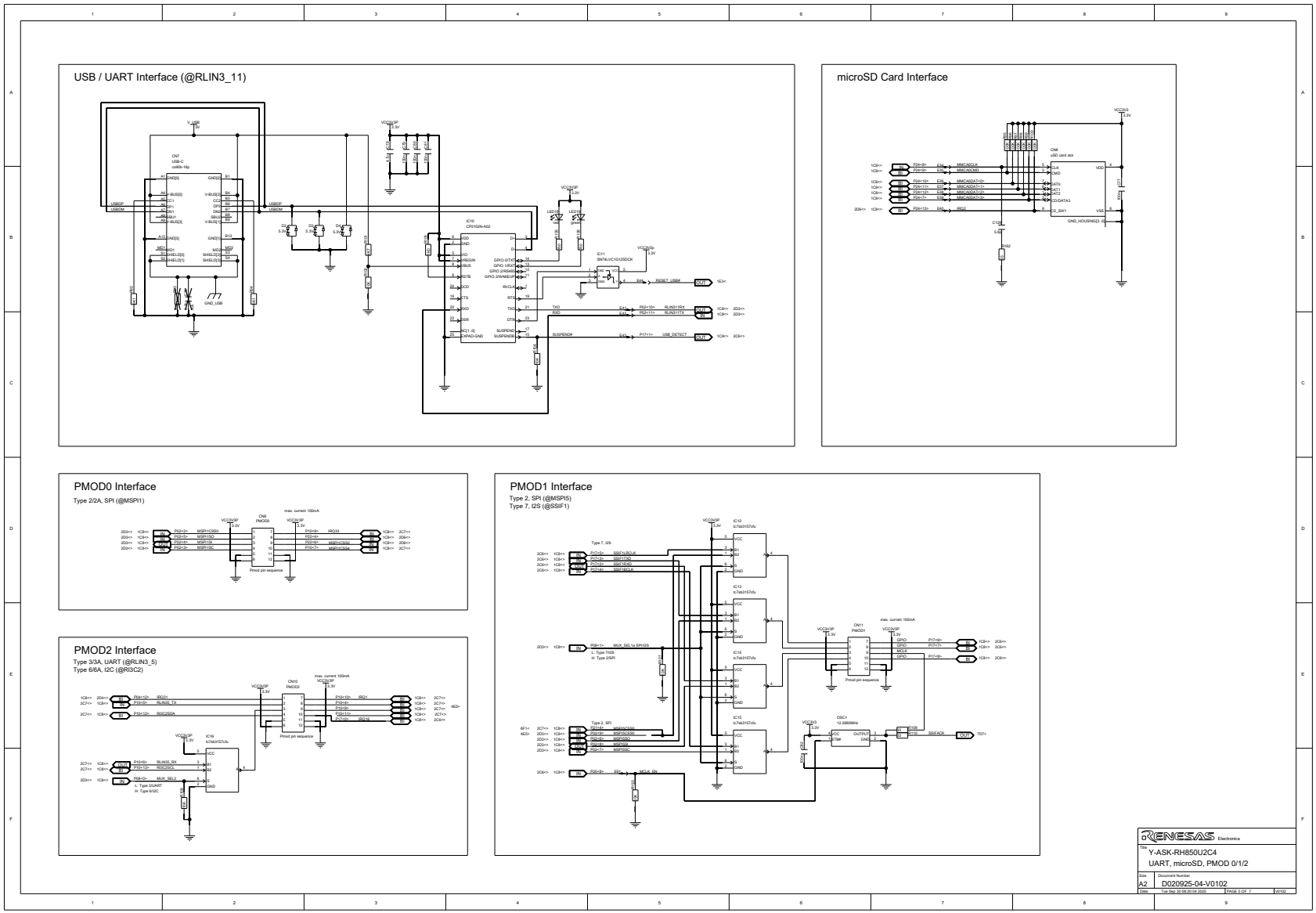
12.1.3 Power Supply



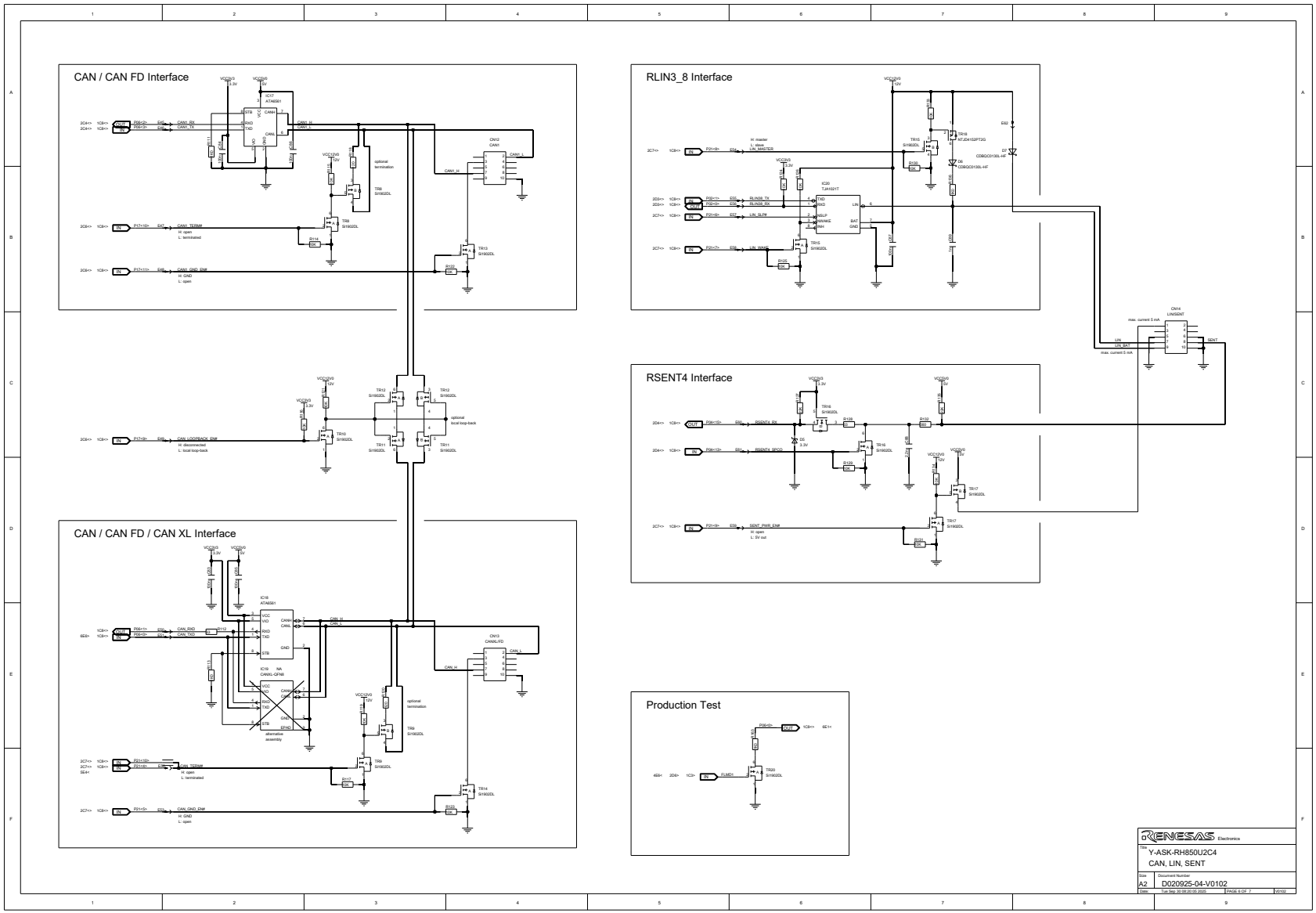
12.1.4 Signal LEDs, Display, Interrupt Buttons, ADC Input



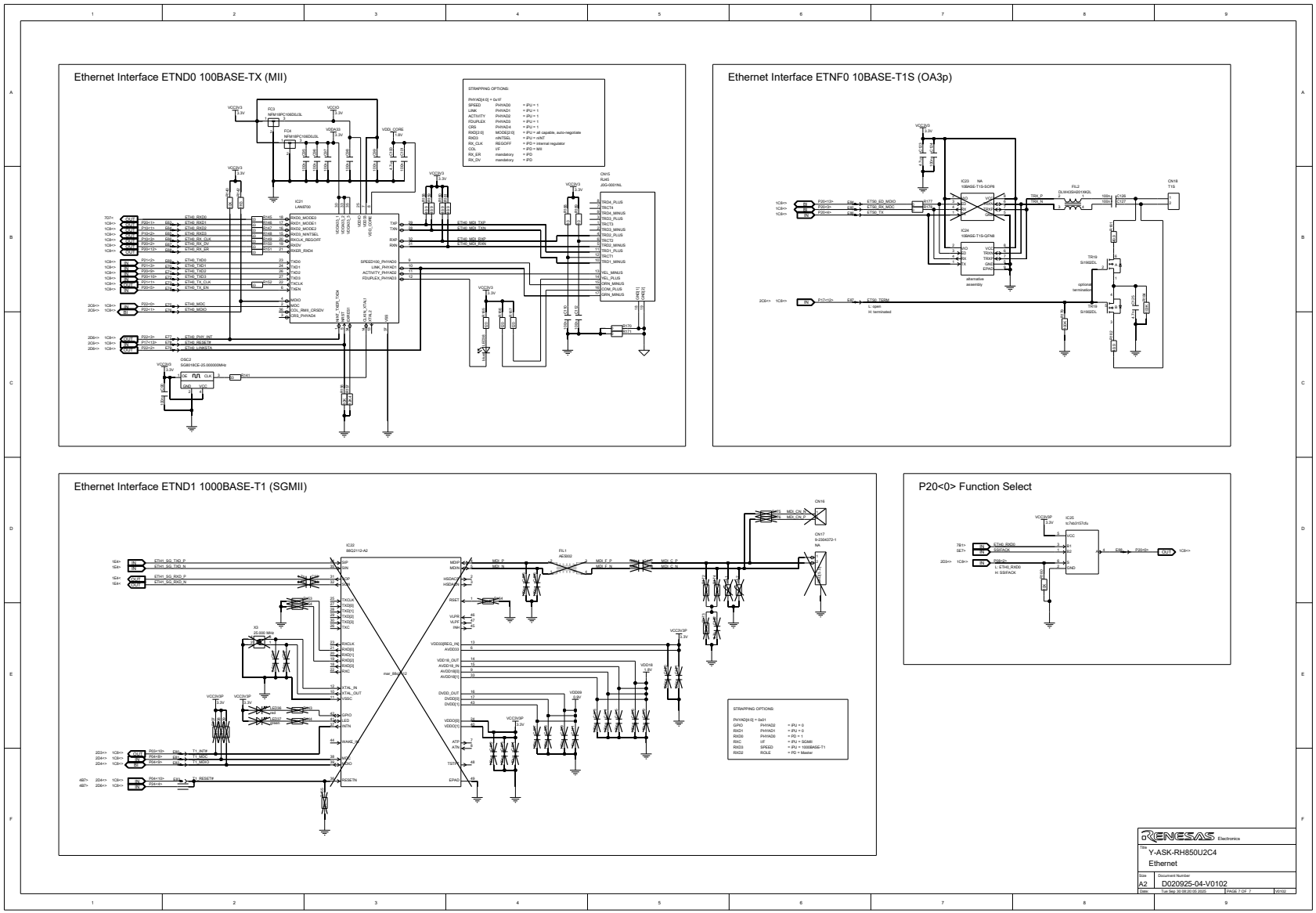
12.1.5 USB / UART, microSD Card, PMOD0/1/2



12.1.6 CAN, LIN, SENT Interfaces

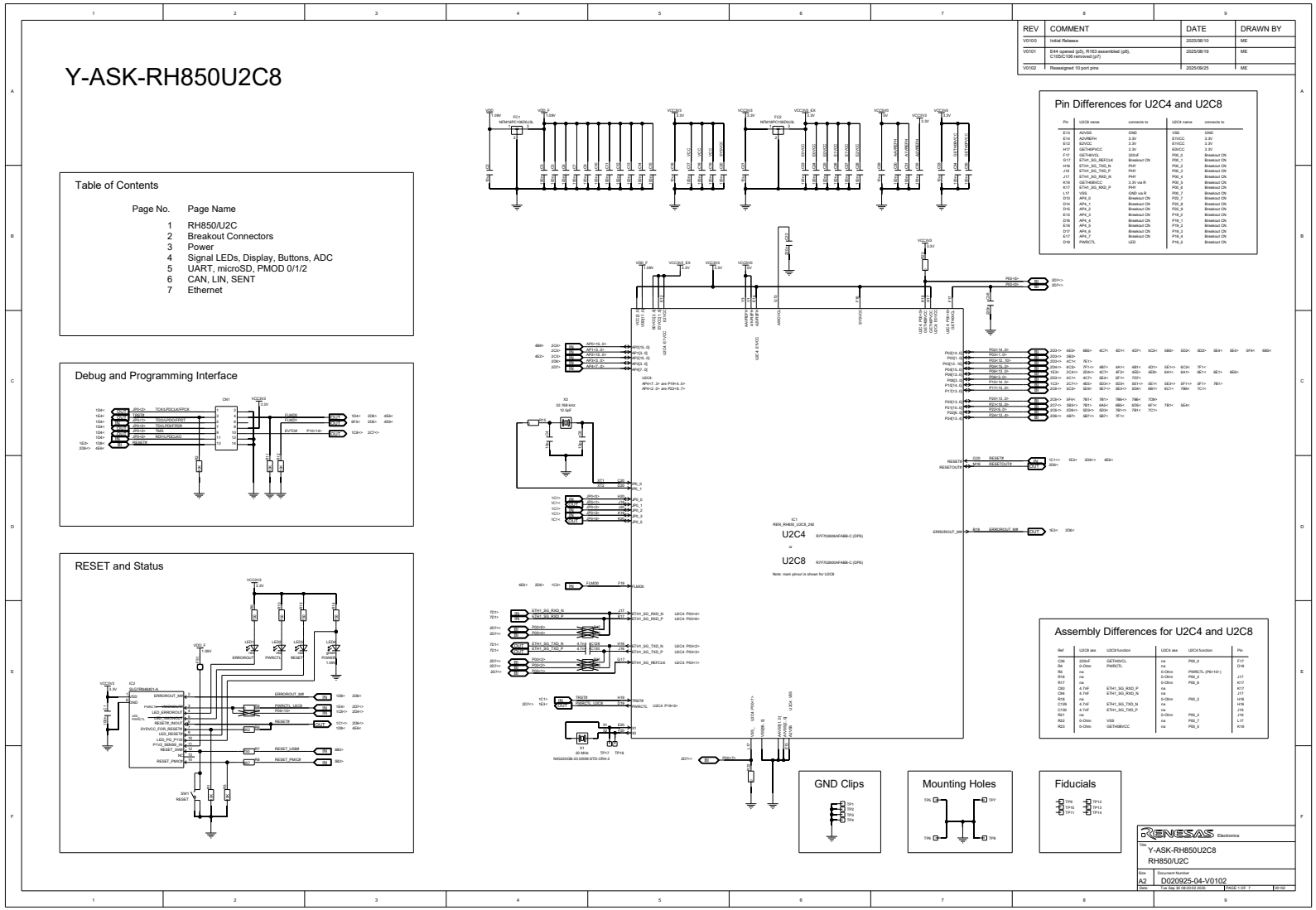


12.1.7 Ethernet Interfaces

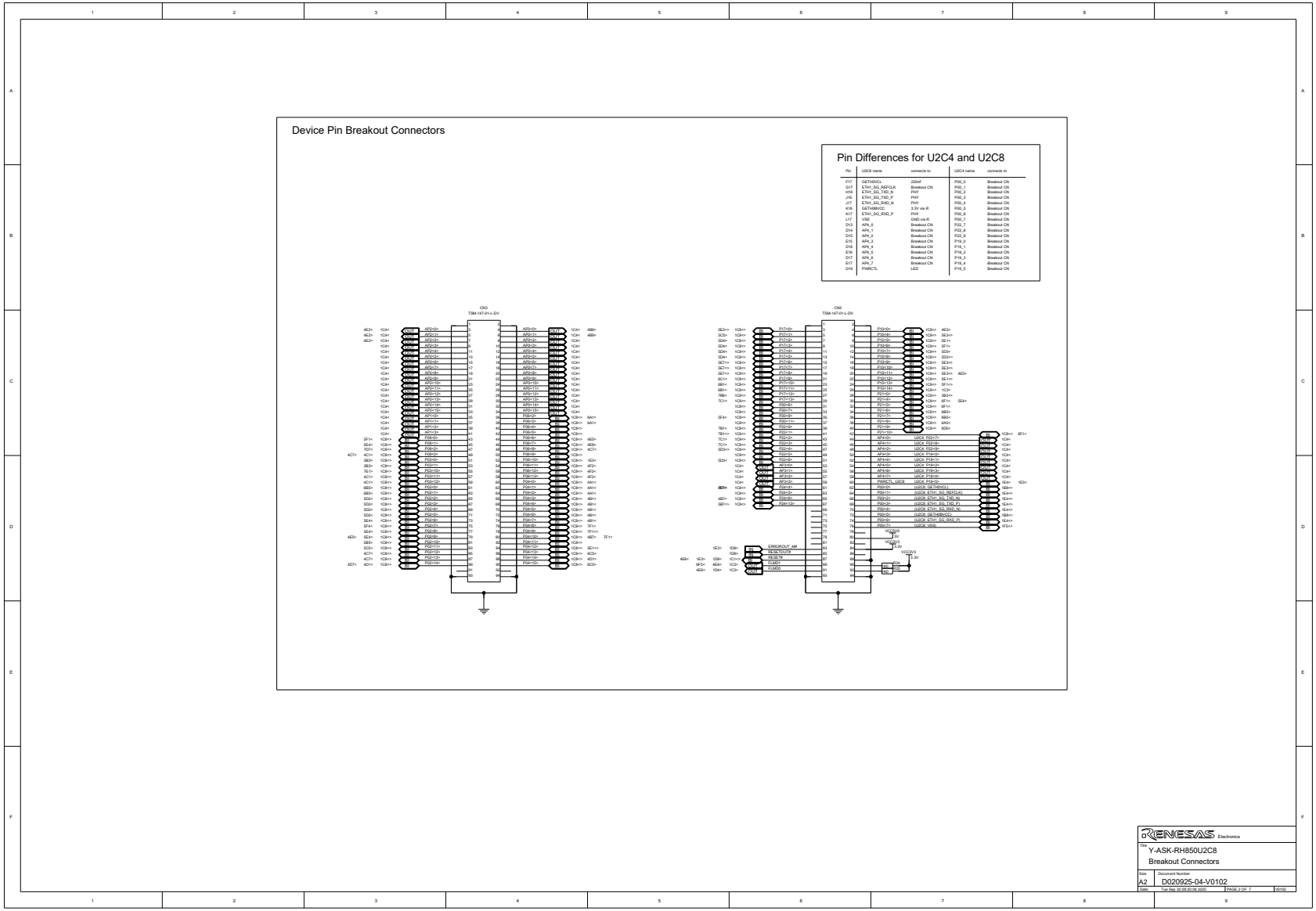


12.2 Y-ASK-RH850U2C8 (D020925_06_V0100)

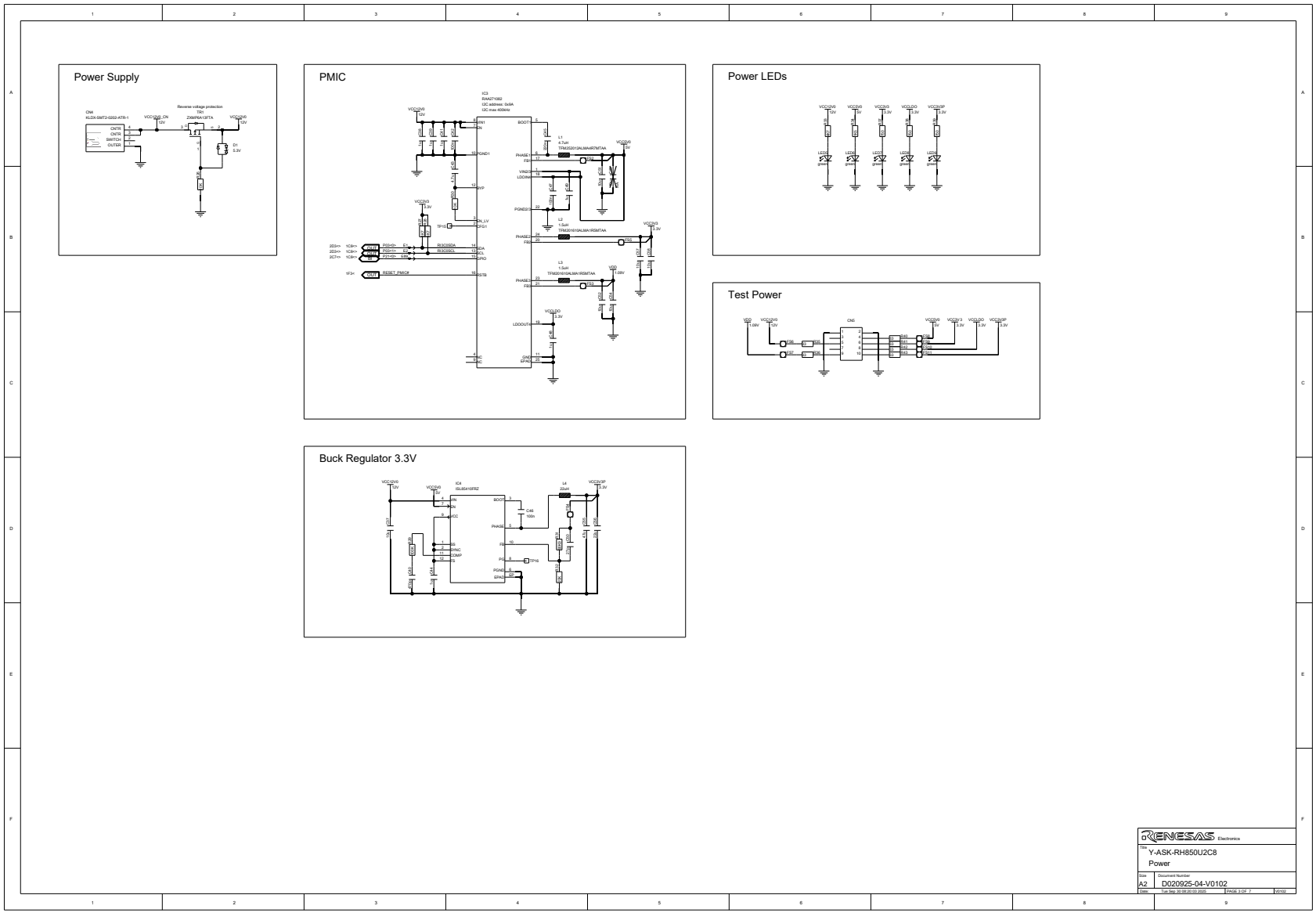
12.2.1 RH850 U2C



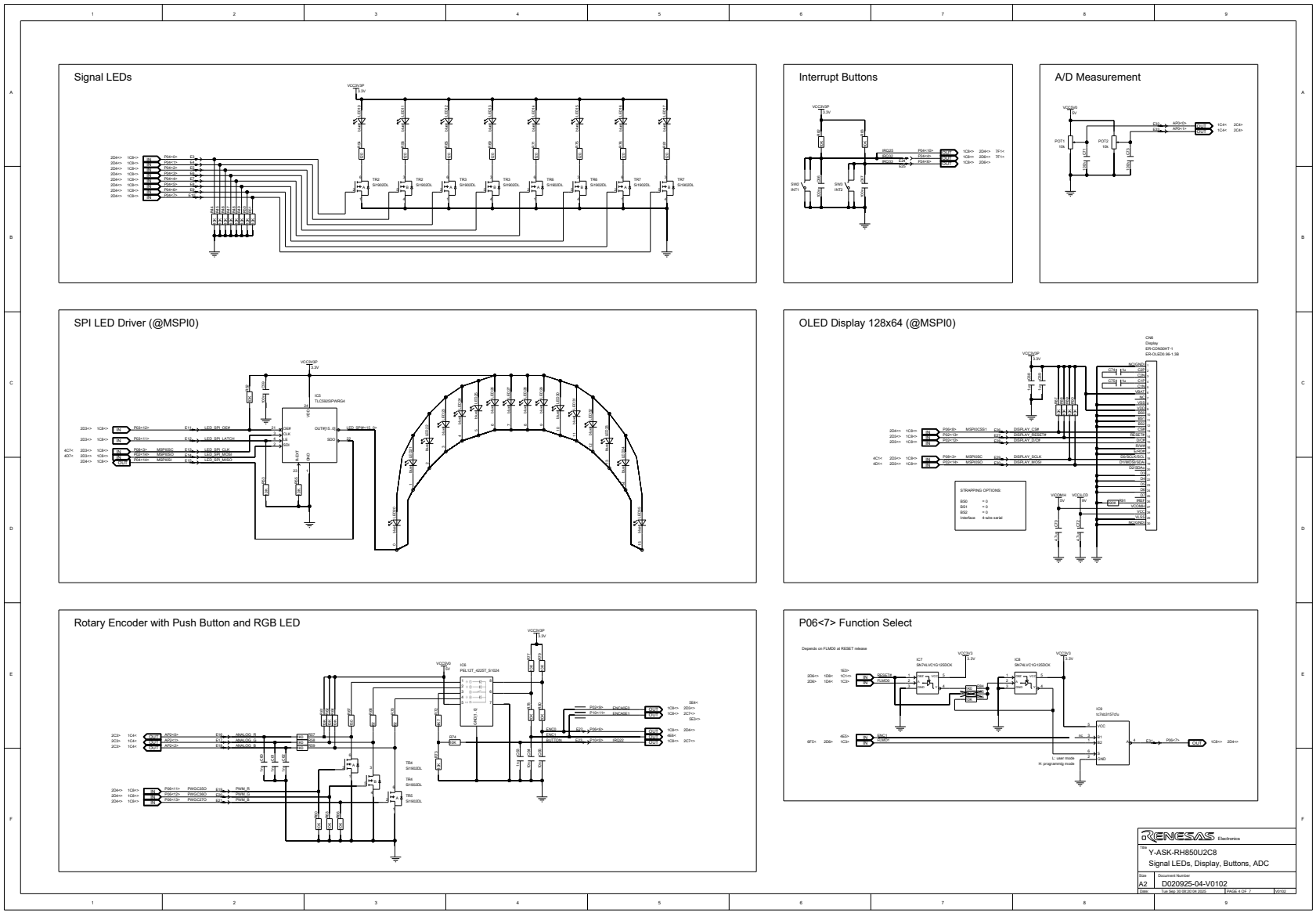
12.2.2 Breakout Connectors



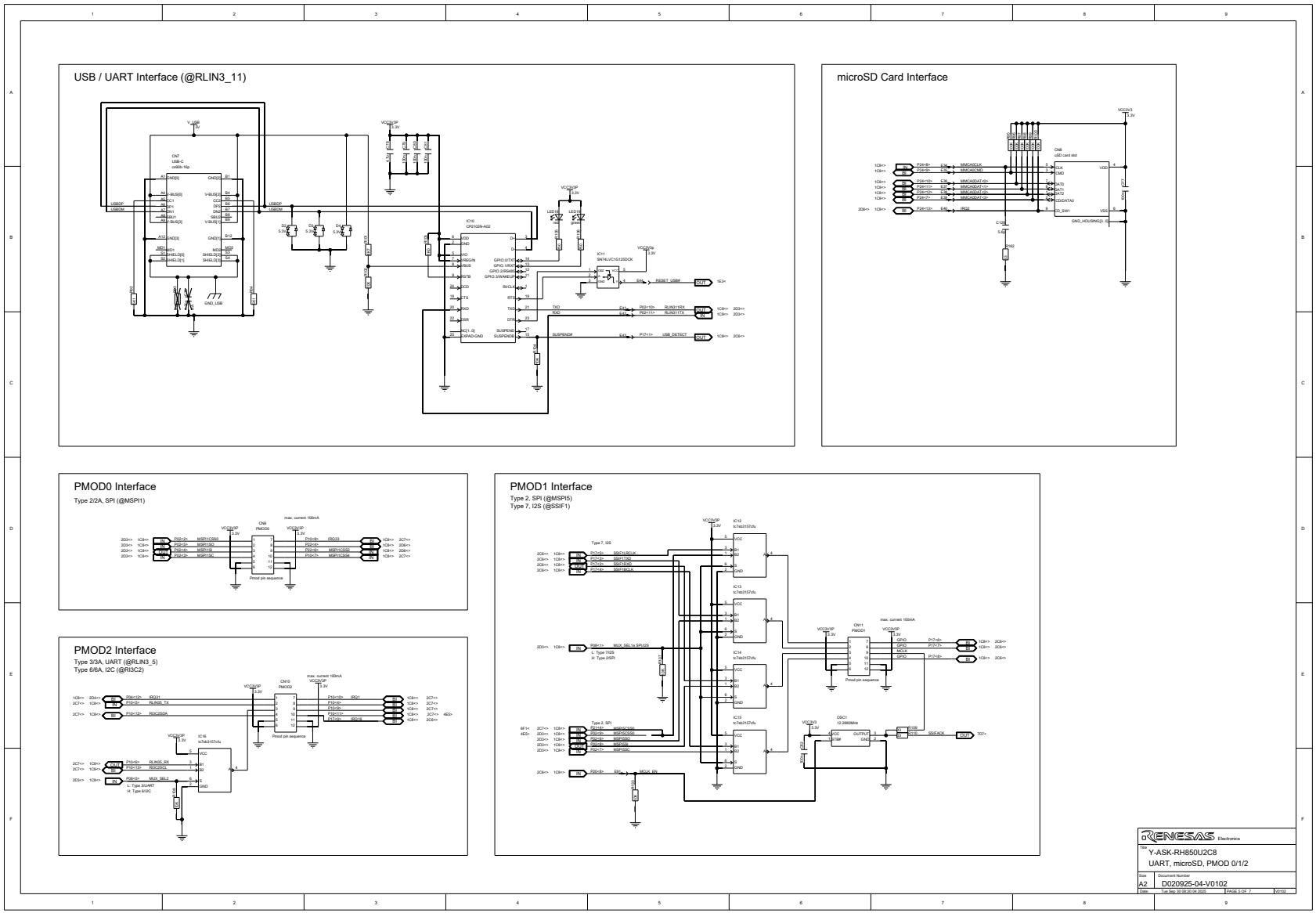
12.2.3 Power Supply



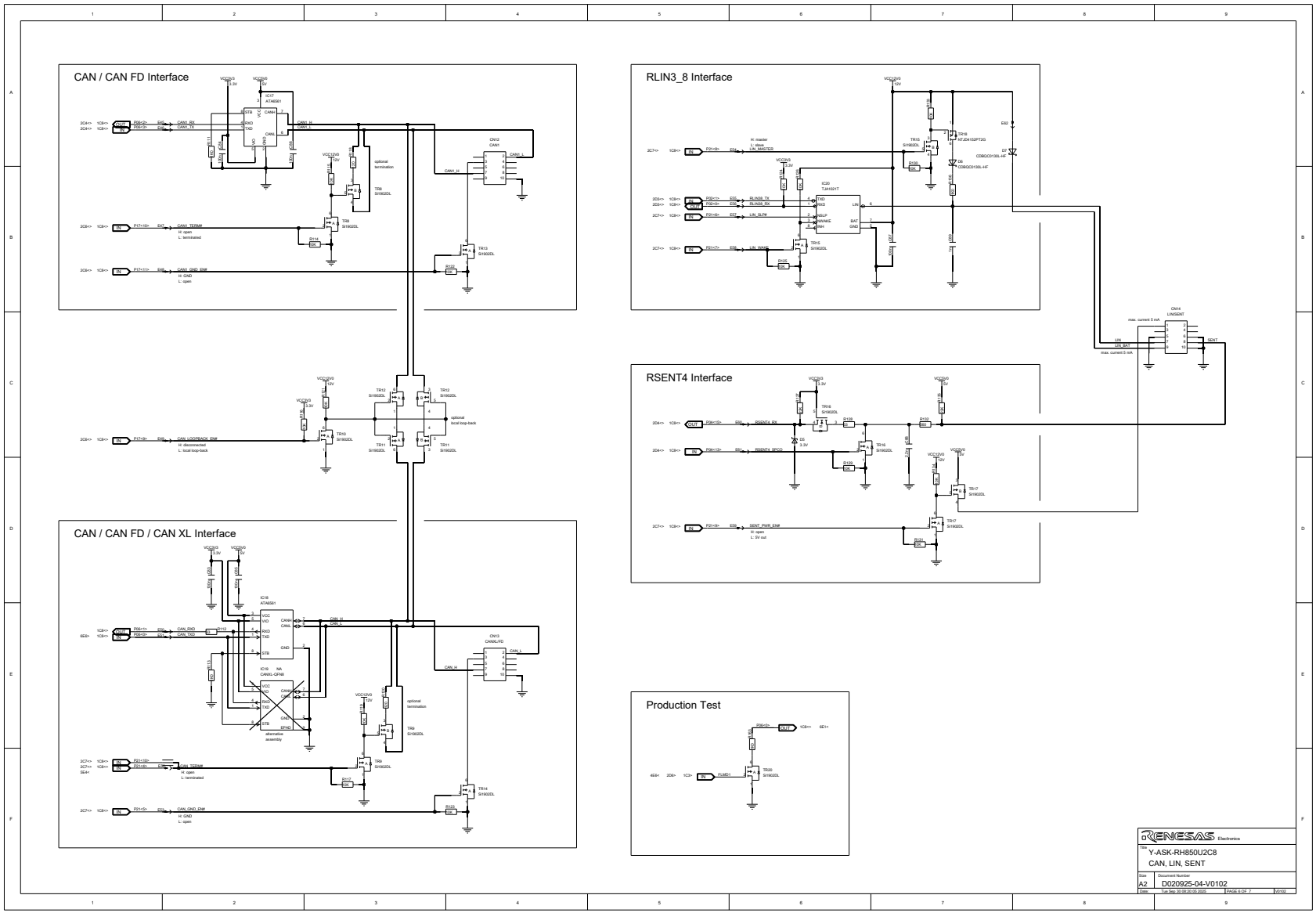
12.2.4 Signal LEDs, Display, Interrupt Buttons, ADC Input



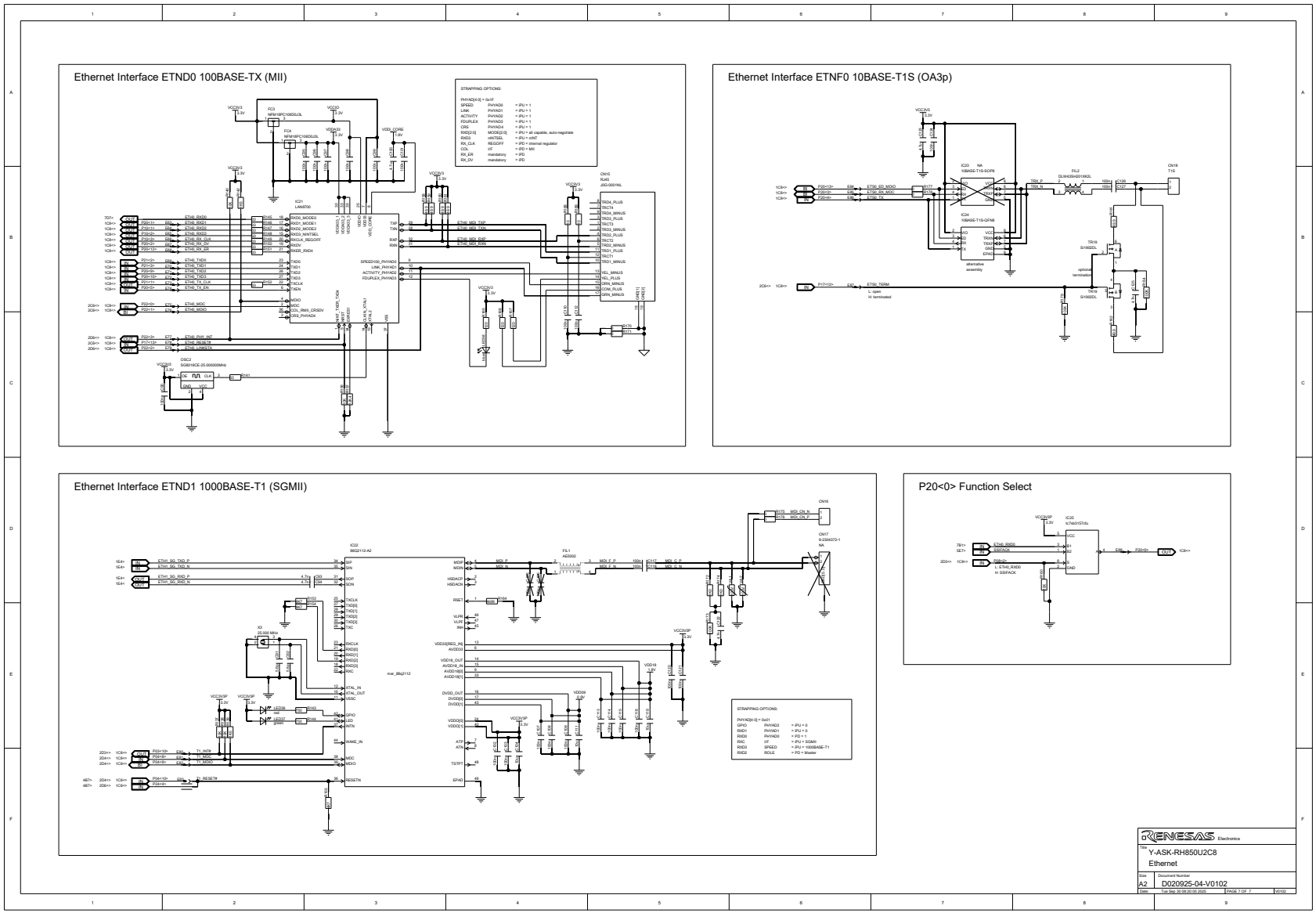
12.2.5 USB / UART, microSD Card, PMOD0/1/2



12.2.6 CAN, LIN, SENT Interfaces

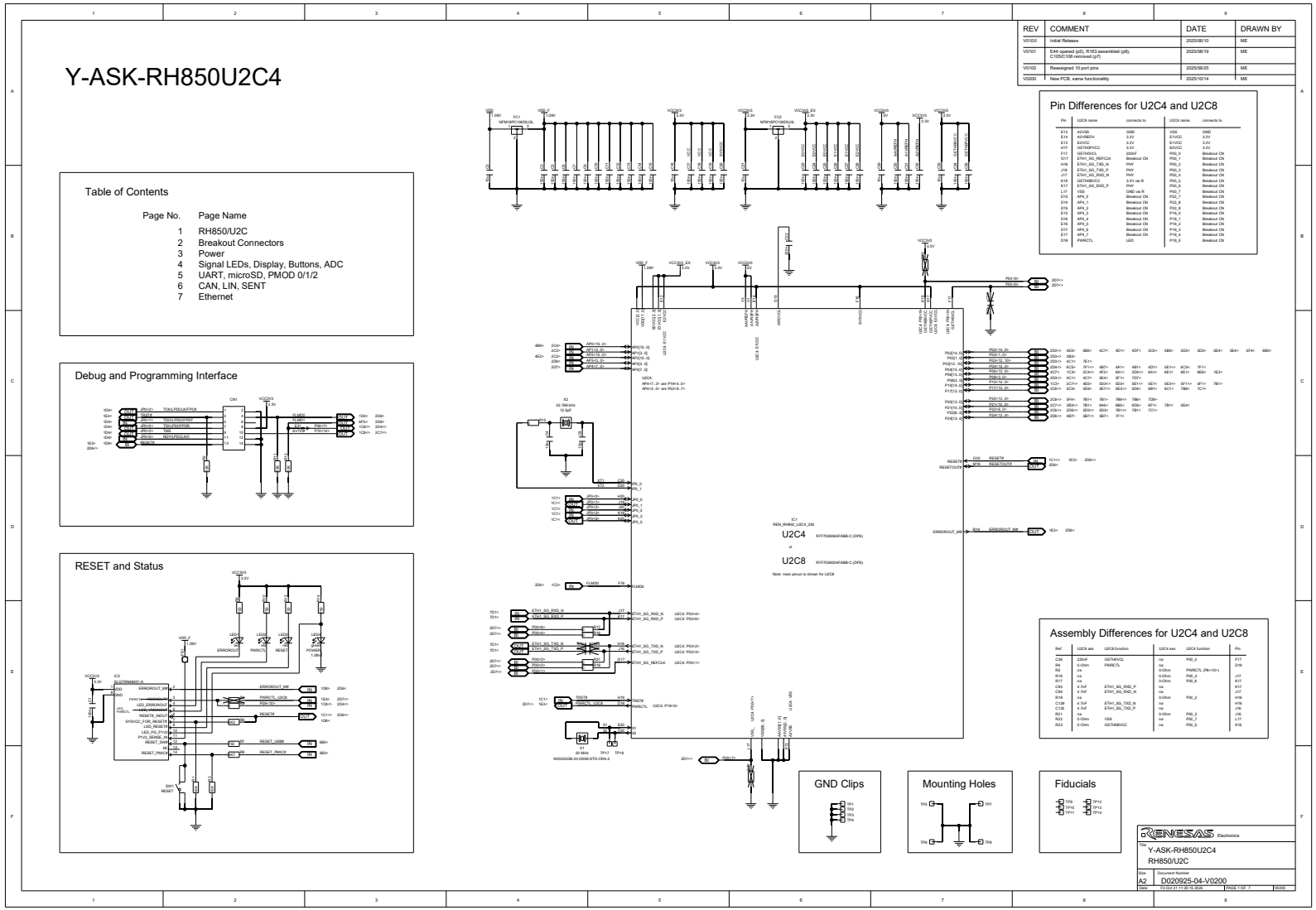


12.2.7 Ethernet Interfaces

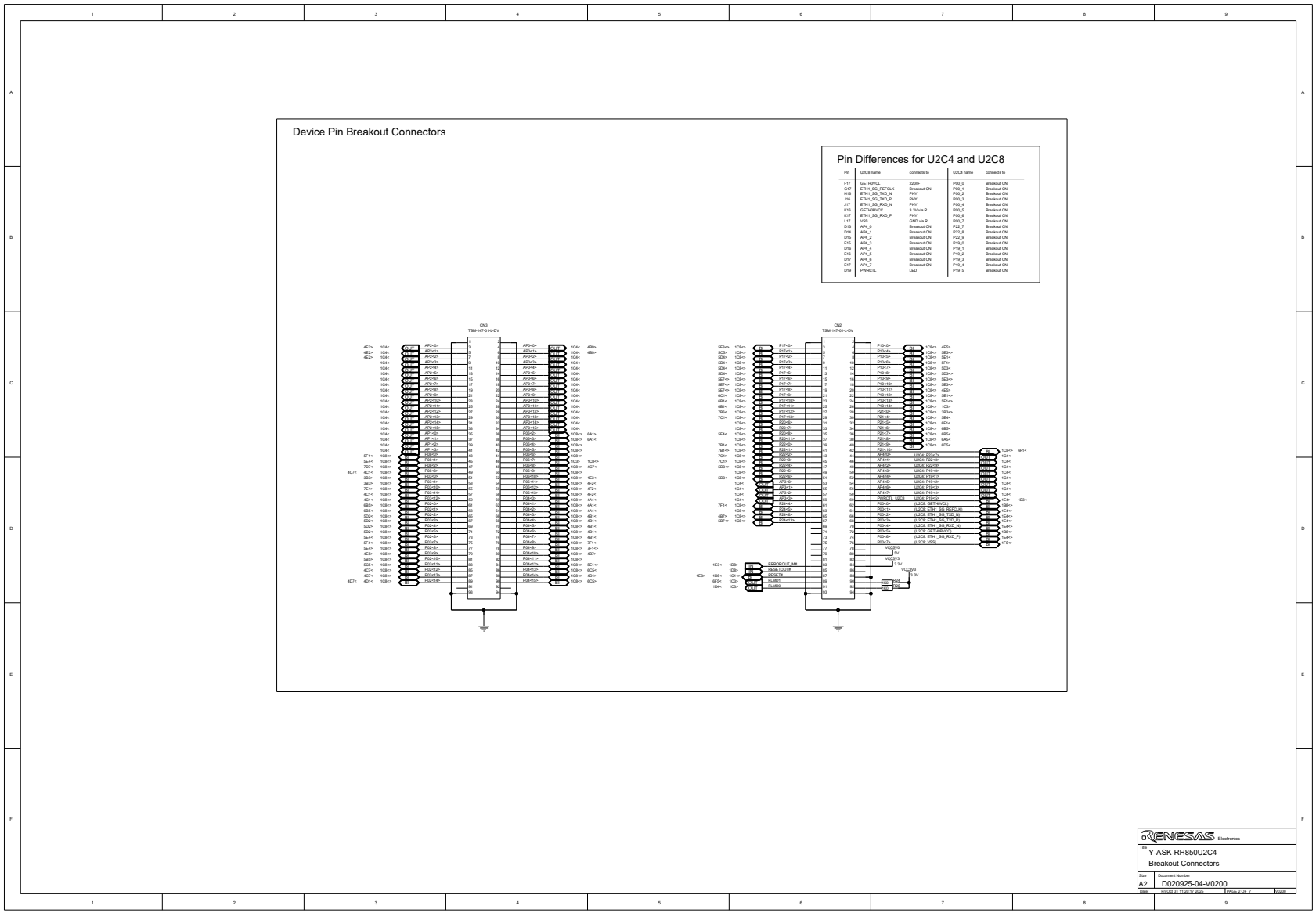


12.3 Y-ASK-RH850U2C4 (D020925_06_V0200)

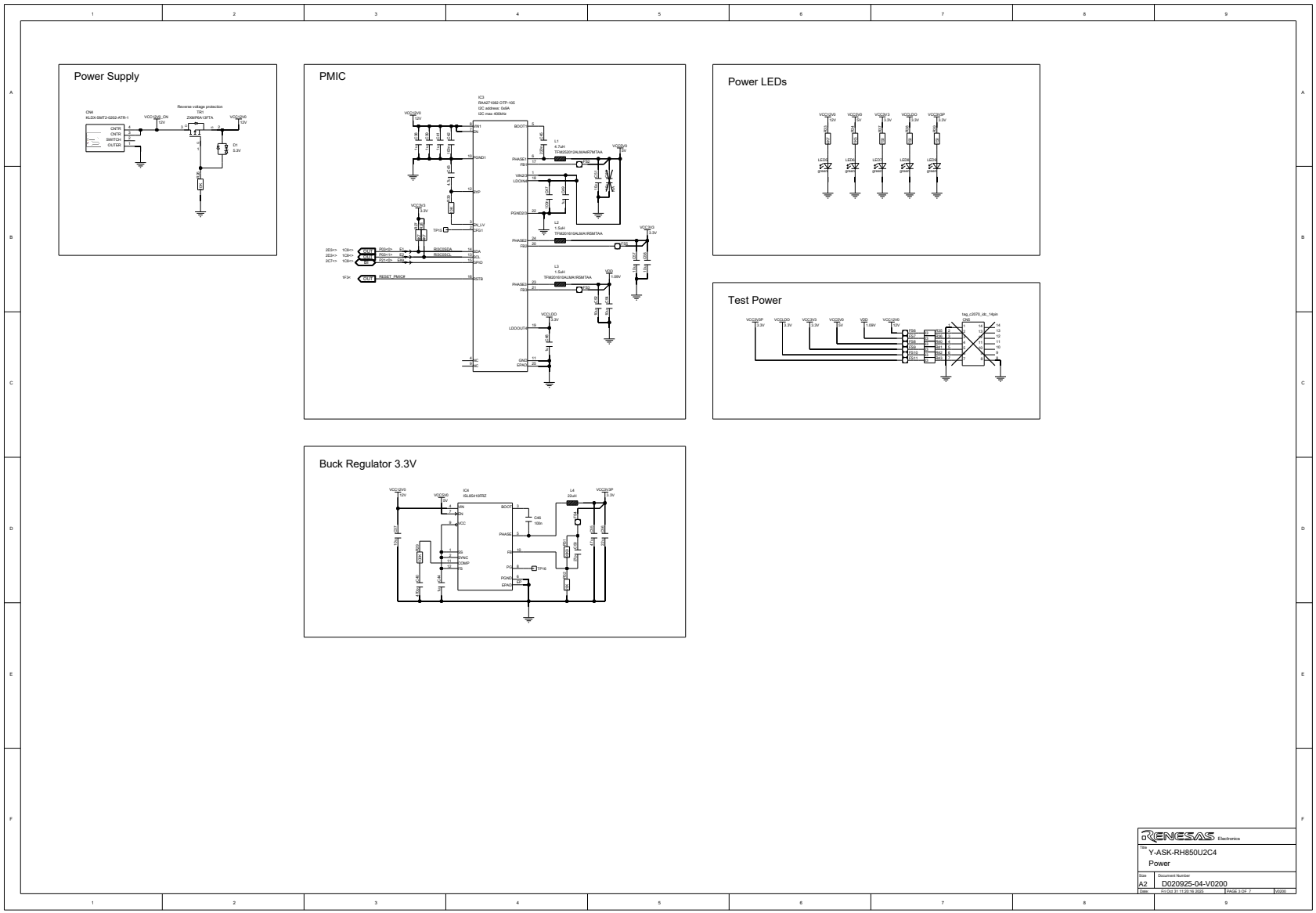
12.3.1 RH850 U2C



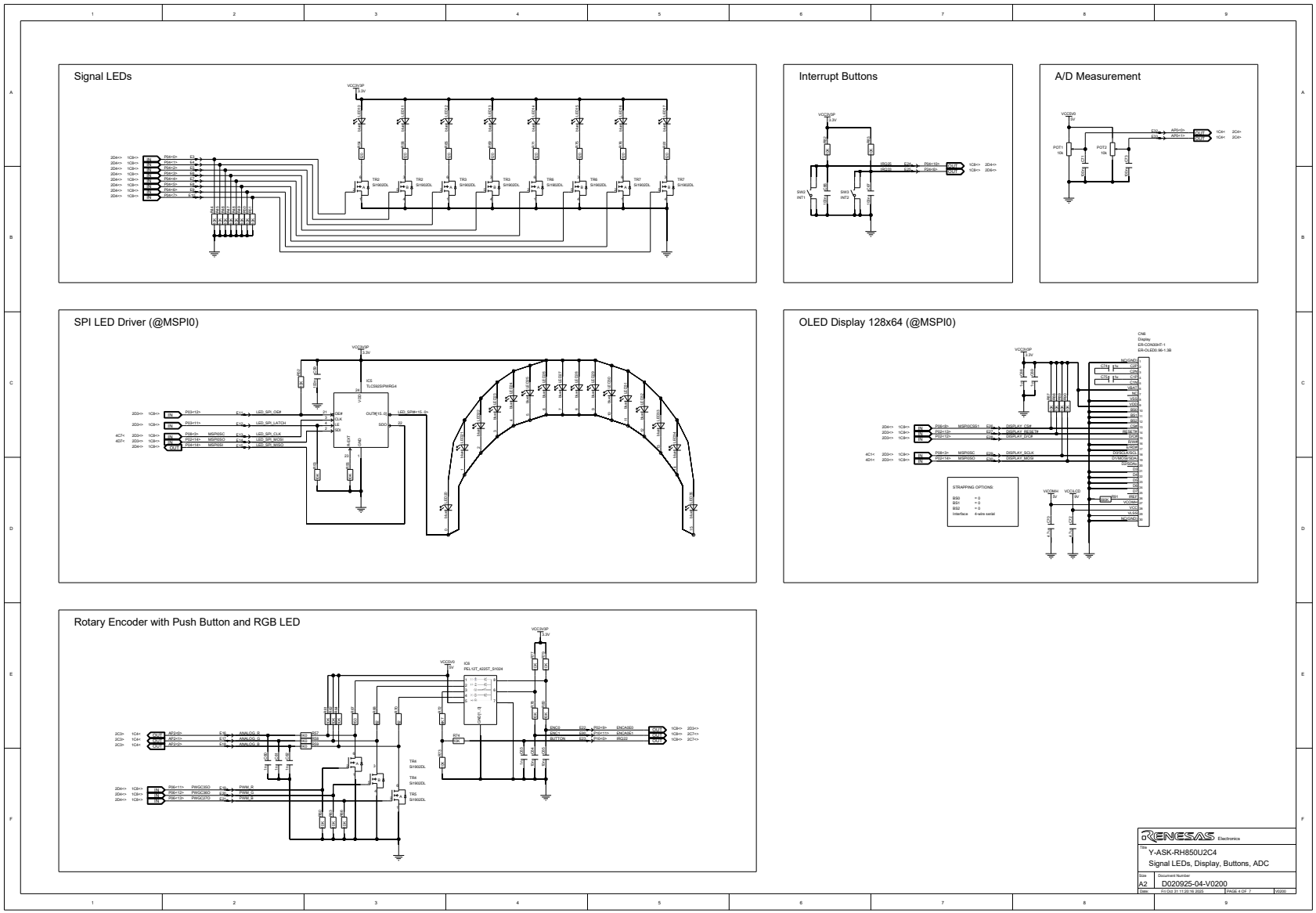
12.3.2 Breakout Connectors



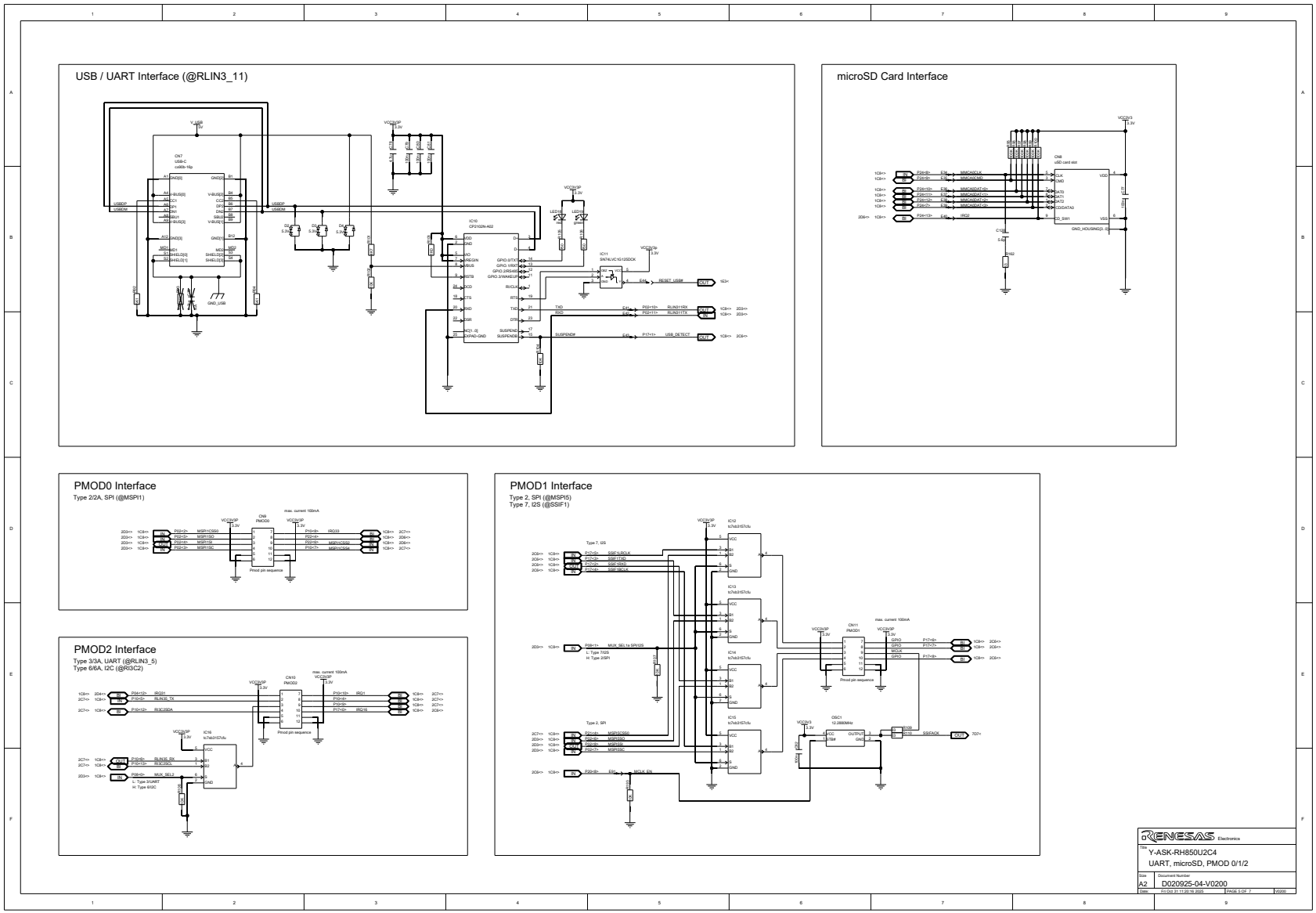
12.3.3 Power Supply



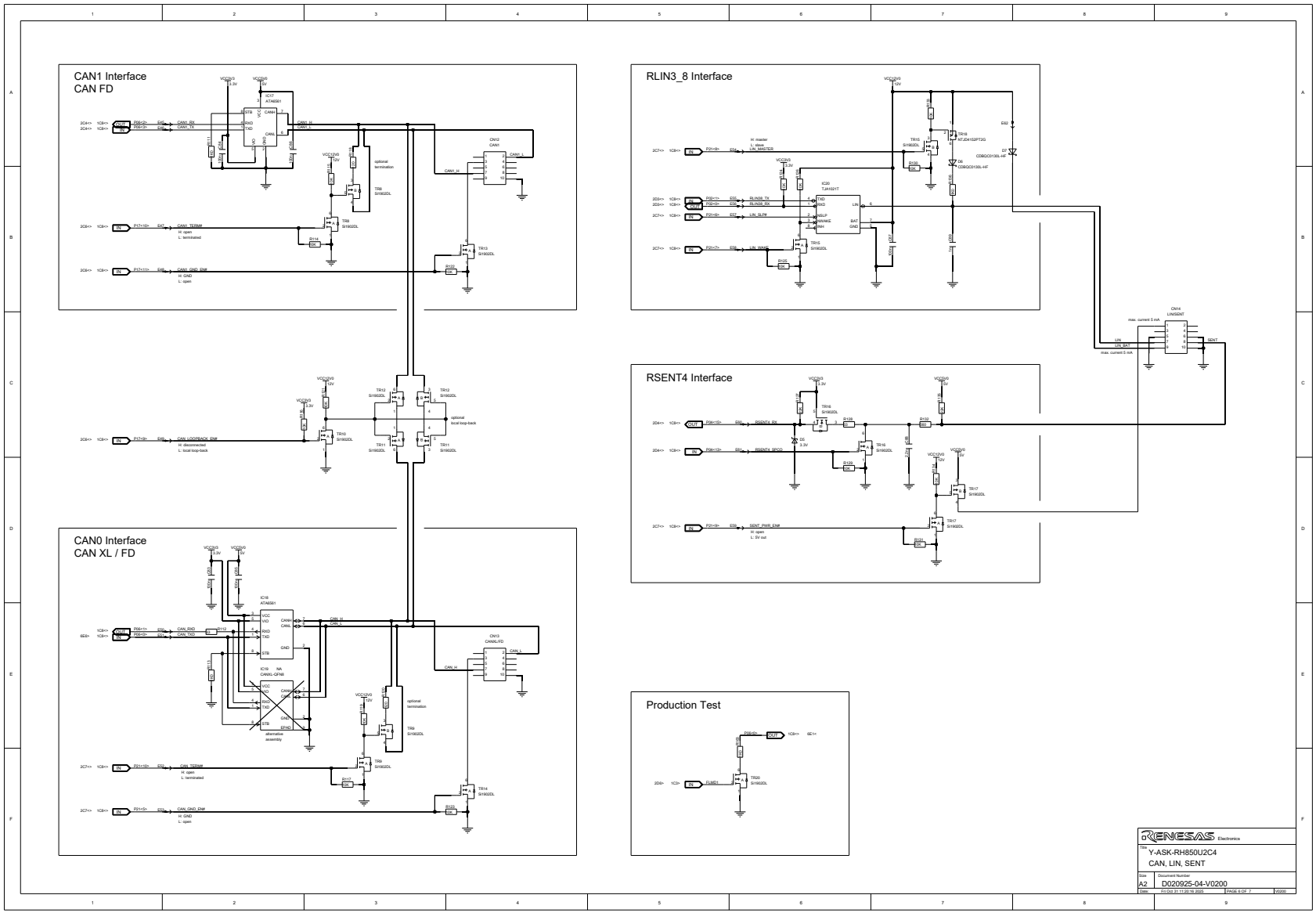
12.3.4 Signal LEDs, Display, Interrupt Buttons, ADC Input



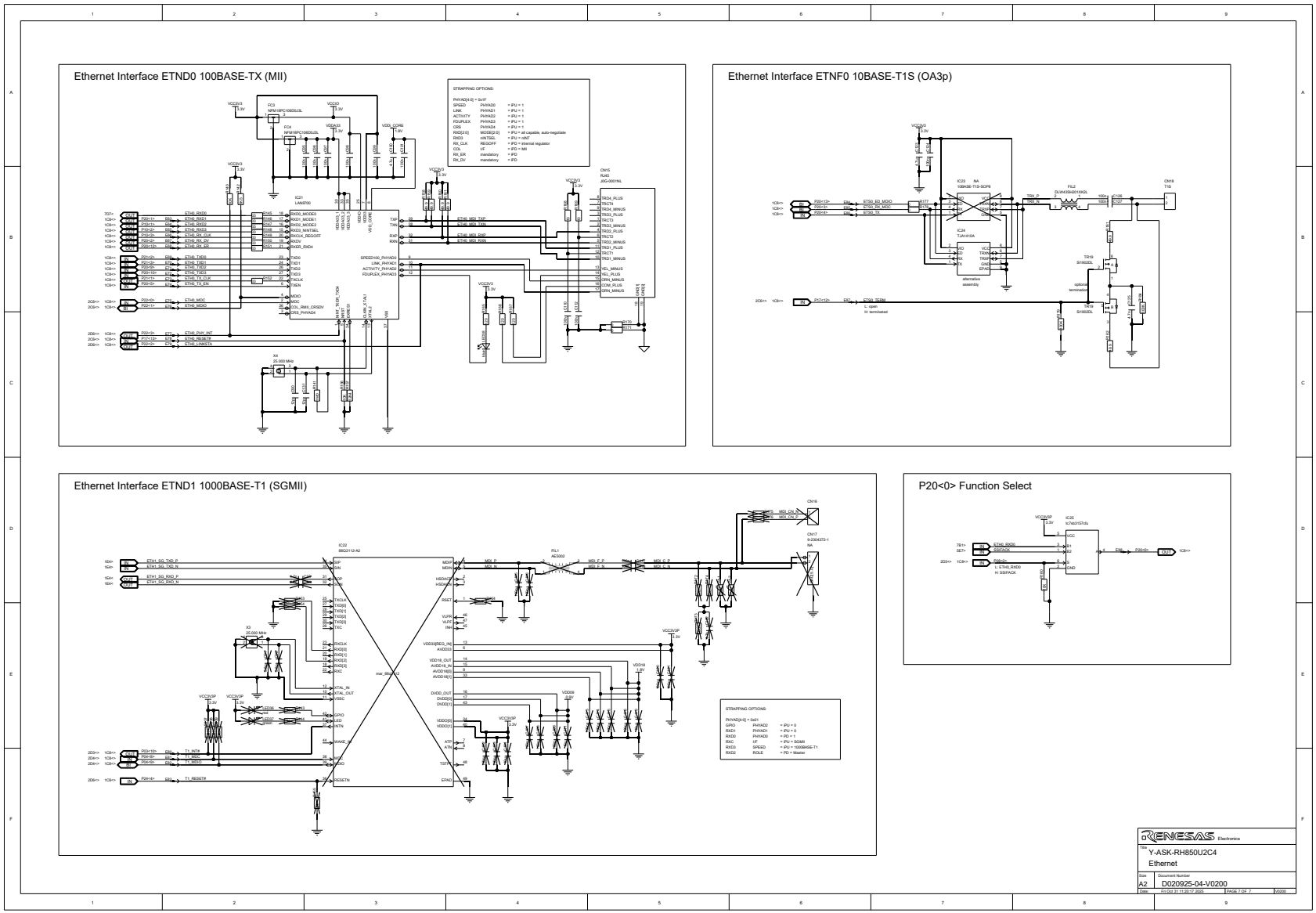
12.3.5 USB / UART, microSD Card, PMOD0/1/2



12.3.6 CAN, LIN, SENT Interfaces

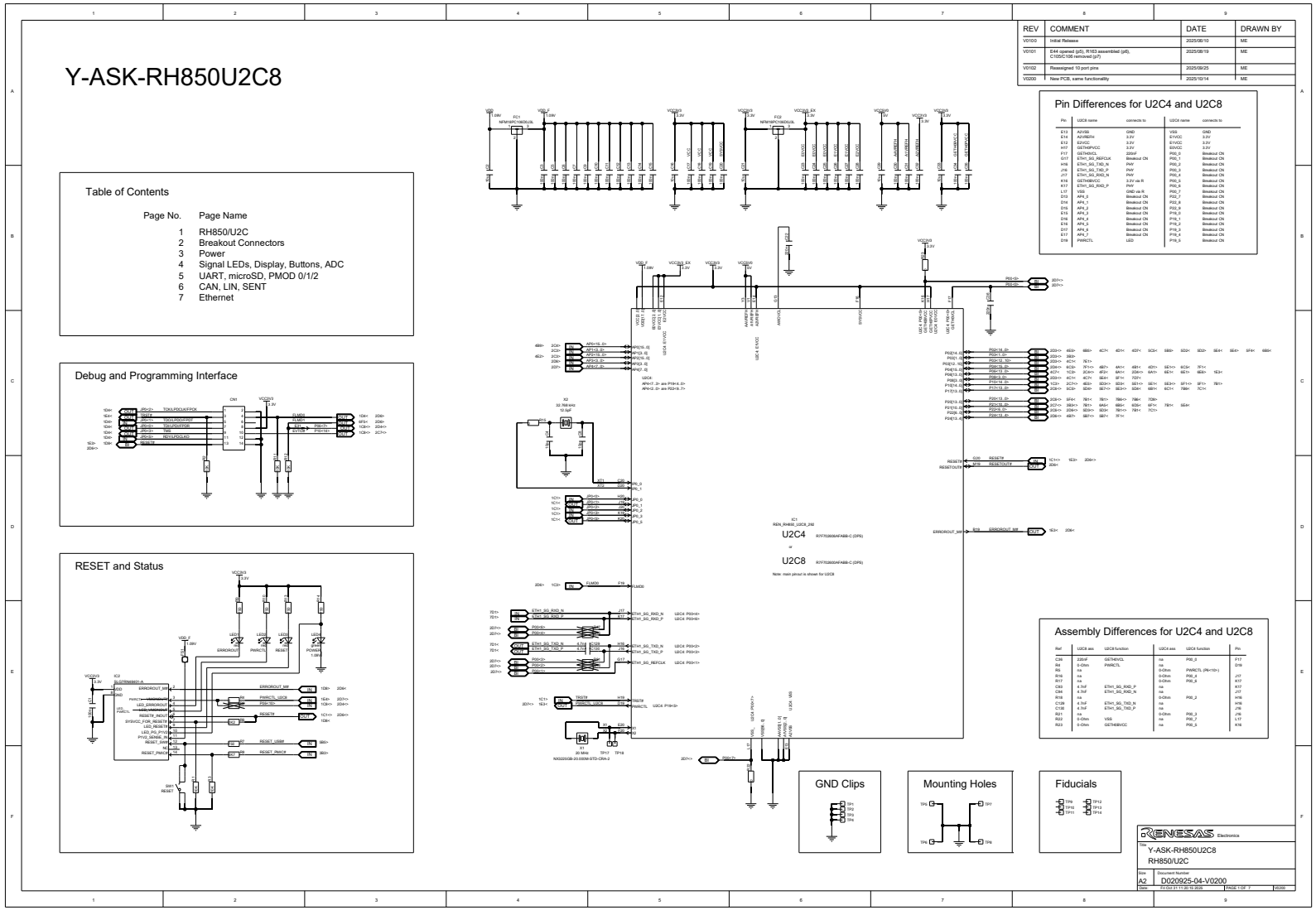


12.3.7 Ethernet Interfaces

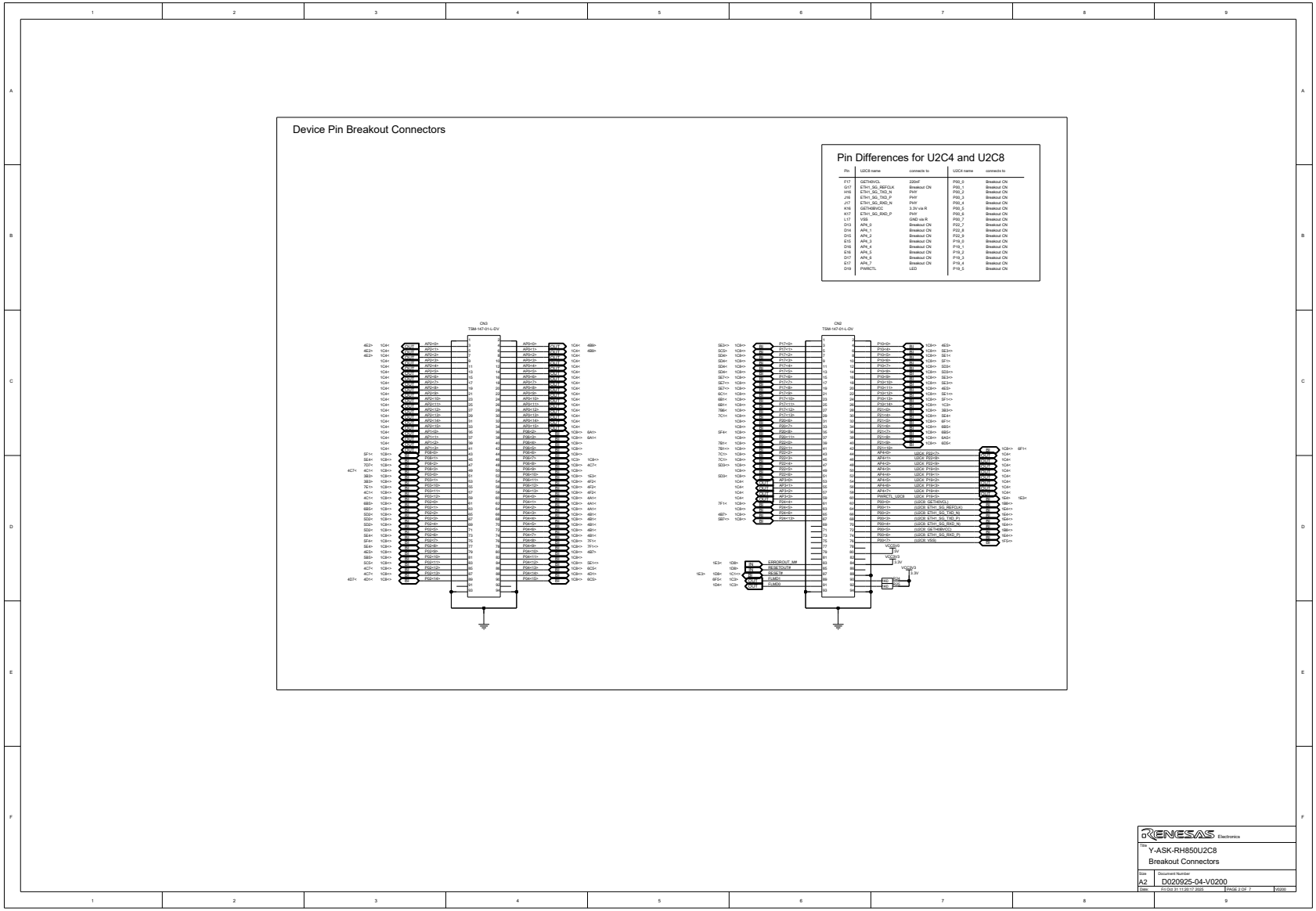


12.4 Y-ASK-RH850U2C8 (D020925_06_V0200)

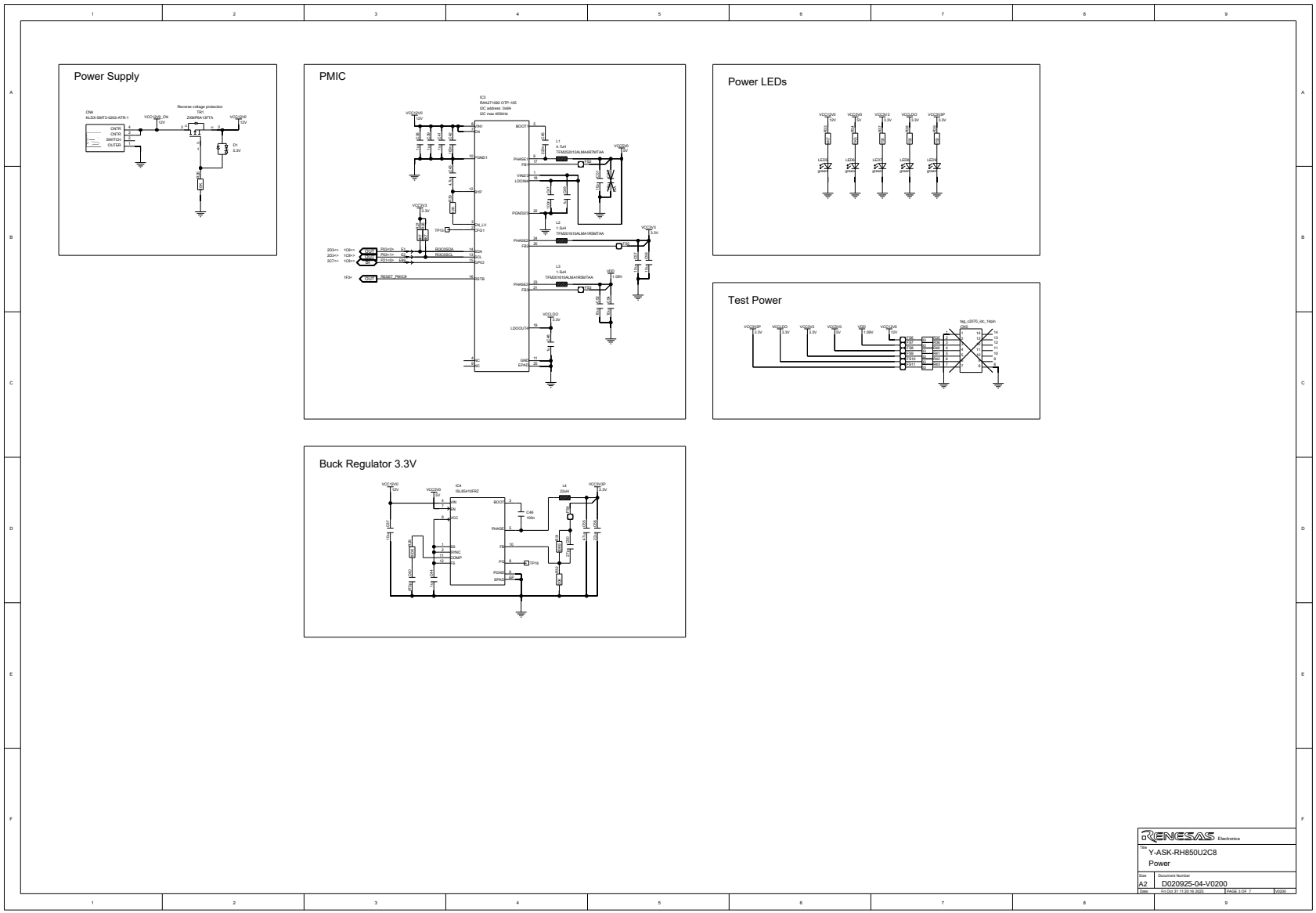
12.4.1 RH850 U2C



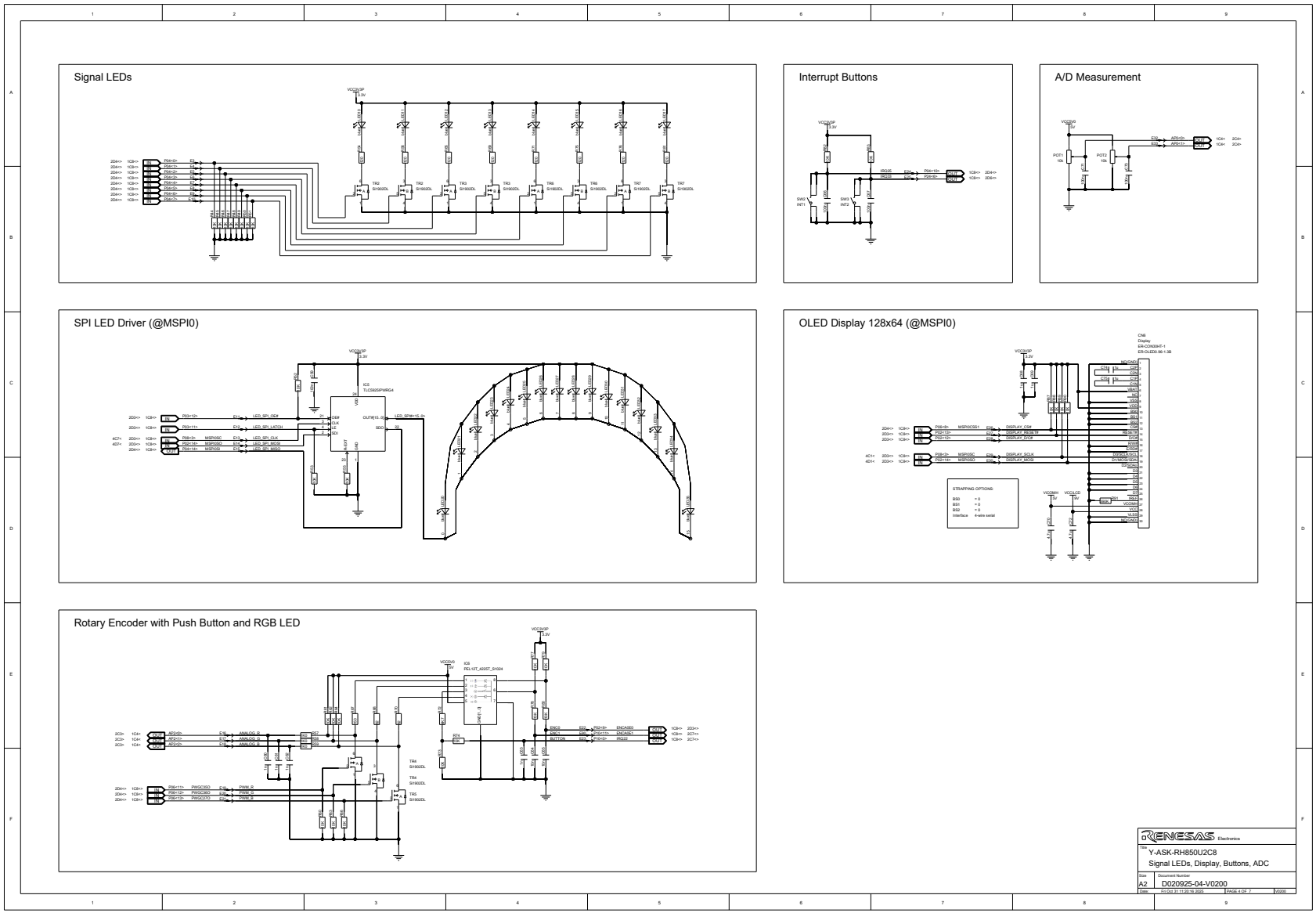
12.4.2 Breakout Connectors



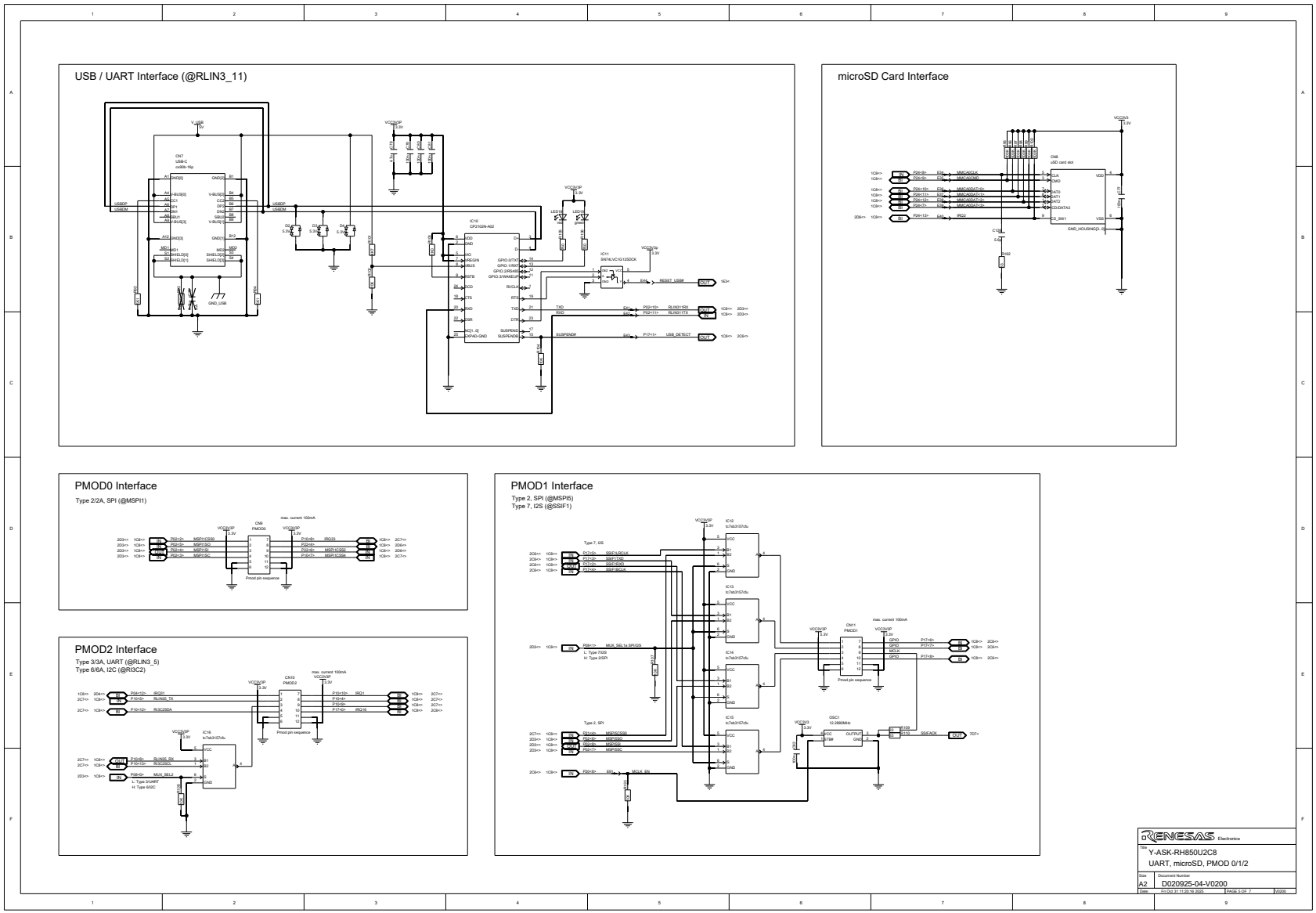
12.4.3 Power Supply



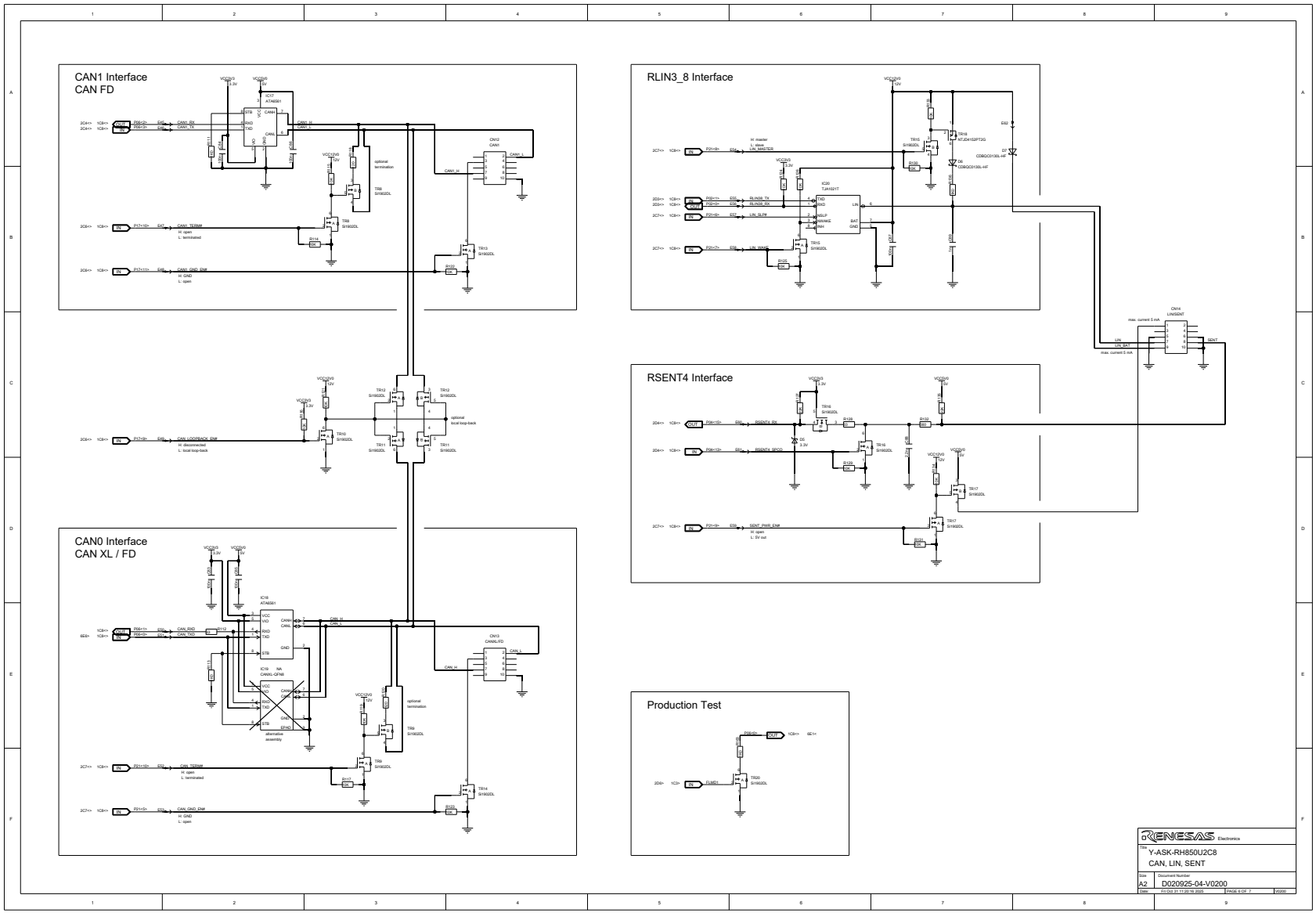
12.4.4 Signal LEDs, Display, Interrupt Buttons, ADC Input



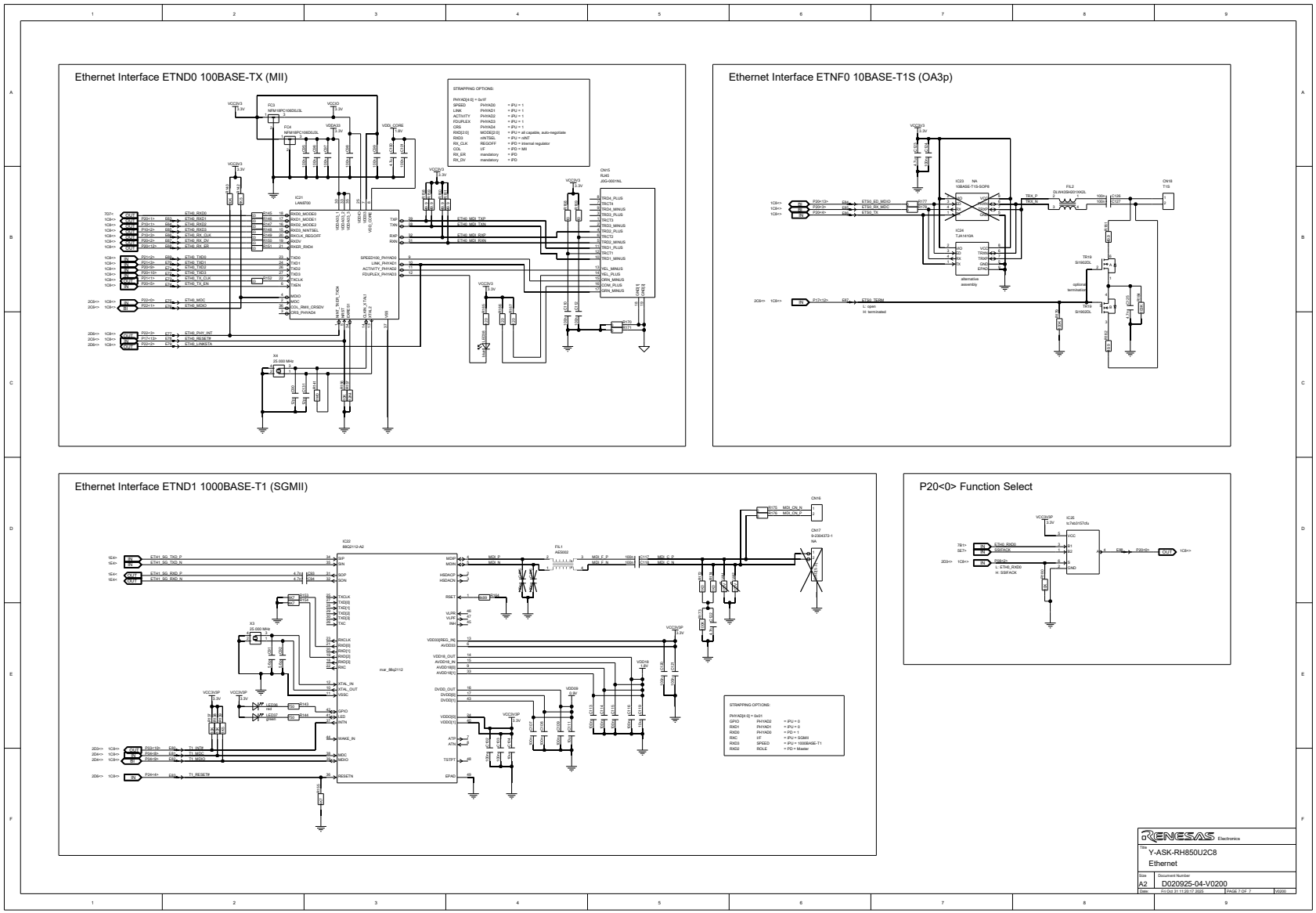
12.4.5 USB / UART, microSD Card, PMOD0/1/2



12.4.6 CAN, LIN, SENT Interfaces



12.4.7 Ethernet Interfaces



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		Description	
Rev.	**Date**	**Page**	**Summary**
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