User Manual

32

RH850/F1x StarterKit V2

User Manual: Hardware

RENESAS MCU
RH850 F-Series

Y-ASK-RH850F1L-V2
Y-ASK-RH850F1M-V2
Y-ASK-RH850F1H-V2

For updates of the StarterKit software and documentation please check:
http://www.renesas.com/ASK-RH850F1X

Renesas Electronics
www.renesas.com

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Table of Contents

1. Introduction

The 'RH850/F1x StarterKit' serves as a simple and easy to use platform for evaluating the features and performance of Renesas Electronics' 32-bit RH850/F1x microcontrollers.

Features:

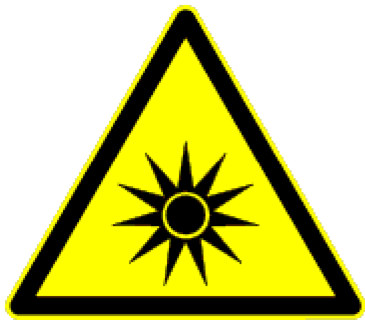
- Connections for on-chip debugging and flash memory programming
- Access to all microcontroller I/O pins
- User interaction through potentiometer, buttons and LEDs
- Serial interface connections for RS232, LIN, CAN, FLEXRAY (F1M/F1H only) and Ethernet (F1H only)
- Power supply by RENESAS E1 On-Chip debugger or externally (12V DC input)
- Support of different RH850/F1x family members (RH850/F1L, RH850/F1M and RH850/F1H)

This document will describe the functionality provided by the StarterKit and guide the user through its operation. For details regarding the operation of the microcontroller refer to the RH850/F1x User Manuals.

CAUTION

1. **Do not look into the LED beam!**

   Special care must be taken with the high power LEDs



2. **When power supply of E1 On-Chip debugger is used please note that the maximum current provided by the debugger is limited to 200mA. Thus an external power supply is required in case all functions on the StarterKit are used to full extend.**
3. **The High Power LEDs can only be used when the board is supplied by 12V externally.**

2. Quick Start Information

2.1 Connector and jumper overview

J1			
Pin	*Function*		*Pin*
1	P11_1	P11_2	2
3	P11_3	P11_4	4
5	P11_5	P11_6	6
7	P11_7	P11_8	8
9	P11_9	P11_10	10
11	P11_11	P11_12	12
13	P11_13	P11_14	14
15	P11_15	P0_0	16
17	P0_1	P0_2	18
19	P0_3	P0_4	20
21	P0_5	P0_6	22
23	P0_7	P0_8	24
25	P0_9	P0_10	26
27	P0_11	P0_12	28
29	P0_13	P0_14	30
31	JP0_6	JP0_5	32
33	JP0_4	JP0_3	34
35	JP0_2	JP0_1	36
37	JP0_0	P1_15	38
39	GND	VDD	40

J2			
Pin	*Function*		*Pin*
1	P12_5	P11_0	2
3	P12_3	P12_4	4
5	P12_1	P12_2	6
7	P10_15	P12_0	8
9	P10_13	P10_14	10
11	P10_11	P10_12	12
13	P10_9	P10_10	14
15	P10_7	P10_8	16
17	P10_5	P10_6	18
19	P10_3	P10_4	20
21	P10_1	P10_2	22
23	P18_7	P10_0	24
25	P18_5	P18_6	26
27	P18_3	P18_4	28
29	P18_1	P18_2	30
31	AP1_15	P18_0	32
33	AP1_13	AP1_14	34
35	AP1_11	AP1_12	36
37	AP1_9	AP1_10	38
39	GND	VDD	40

Table 1. J1 – J2 – Signal Assignment

J3			
Pin	*Function*		*Pin*
1	P1_14	P1_13	2
3	P1_12	P1_11	4
5	P1_10	P1_9	6
7	P1_8	P1_7	8
9	P1_6	P1_5	10
11	P1_4	P1_3	12
13	P1_2	P1_1	14
15	P1_0	IP0_0	16
17	FLMD0	RESET	18
19	P2_0	P2_1	20
21	P2_2	P2_3	22
23	P2_4	P2_5	24
25	P2_6	P8_0	26
27	P8_1	P8_2	28
29	P8_3	P8_4	30
31	P8_5	P8_6	32
33	P8_7	P8_8	34
35	P8_9	P8_10	36
37	P8_11	P8_12	38
39	GND	VDD	40

J4			
Pin	*Function*		*Pin*
1	AP1_0	AP1_1	2
3	AP1_2	AP1_3	4
5	AP1_4	AP1_5	6
7	AP1_6	AP1_7	8
9	P20_5	AP1_8	10
11	P20_3	P20_4	12
13	P20_1	P20_2	14
15	P9_6 (F1L only)	P20_0	16
17	P9_4	P9_5 (F1L only)	18
19	P9_2	P9_3	20
21	P9_0	P9_1	22
23	AP0_0	AP0_1	24
25	AP0_2	AP0_3	26
27	AP0_4	AP0_5	28
29	AP0_6	AP0_7	30
31	AP0_8	AP0_9	32
33	AP0_10	AP0_11	34
35	AP0_12	AP0_13	36
37	AP0_14	AP0_15	38
39	GND	VDD	40

Table 2. J3 – J4 – Signal Assignment

Jumper	Description	Setting	Note
J5	MCU power distribution	**1 – 2**	REGVDD supply
		3 – 4	Common VDD supply
J6	CAN0/1 transceiver enable to MCU connector	**1 – 2**	CAN0EN ↔ P1_1
		3 – 4	CAN1EN ↔ P2_6
J7	CAN0/1 transceiver TX/RX to MCU connector	**1 – 2**	CAN0TX ↔ P1_3
		3 – 4	CAN0RX ↔ P1_2
		5 – 6	CAN1TX ↔ P1_13
		7 – 8	CAN1RX ↔ P1_12
J8	FLEXRAY transceiver TX/RX to MCU connector (RH850/F1M and F1H only)	**1-2**	FR_RXD ↔ P10_14
		3-4	FR_TXEZ ↔ P10_11
		5-6	FR_TXD ↔ P11_1
J9	Digital LPS input to MCU connector	**1 – 2**	DIN ↔ P8_1
		3 – 4	SELDP0 ↔P0_4
		5 – 6	SELDP1 ↔ P0_5
		7 – 8	SELDP2 ↔ P0_6
		9 – 10	DPO ↔ P0_0
J10	Voltage regulator output to VDD	1-2	Open jumper when VDD is supplied by E1
J11	VBAT selector	1-2	VBAT ↔ external 12V
		2-3	VBAT ↔ 5V
J12	High Power LED (IPD) to MCU connector	**1-2**	PWM of HPLED1 ↔ P0_12
		3-4	PWM of HPLED2 ↔ P0_13
		5-6	A/D Feedback of HPLED1↔ AP0_1
		7-8	A/D Feedback of HPLED2↔ AP0_2
J13	High Power LED Connector	**1-2**	IPD PWM output 1 ↔ HPLED1
		2-3	IPD PWM output 2 ↔ HPLED2
J14	Potentiometer to MCU Connector	**1-2**	POT1 ↔ AP0_0
		3-4	POT2 ↔ AP1_0
		5-6	POT1 supply ↔ DP0
J15	Indication LED to MCU Connector	**1-2**	LED1 ↔ P0_11
		3-4	LED2 ↔ P8_5
J16	Interrupt Button to MCU connector	**1-2**	Button ↔ P0_9
J17	LIN Transceiver to MCU connector	**1-2**	LIN RX ↔ P0_7
		3-4	LIN TX ↔ P0_8
J18	RS232 Transceiver to MCU connector	**1-2**	R232 TX ↔ P0_2
		3-4	R232 RX ↔ P0_3

Table 3. Jumper / Connector Settings Overview

Note: Default jumper settings (Power Supply by E1 Debugger) are indicated by **bold font**.

2.2 Board Overview RH850/F1L Version [Y-ASK-RH850F1L-V2]

Figure 1 provides a top level view of the RH850/F1L Version of the RH850/F1x StarterKit.

The jumpers and DIP switches are set to default configuration. In this configuration the StarterKit is powered by the E1 Debugger (no external power supply needed).

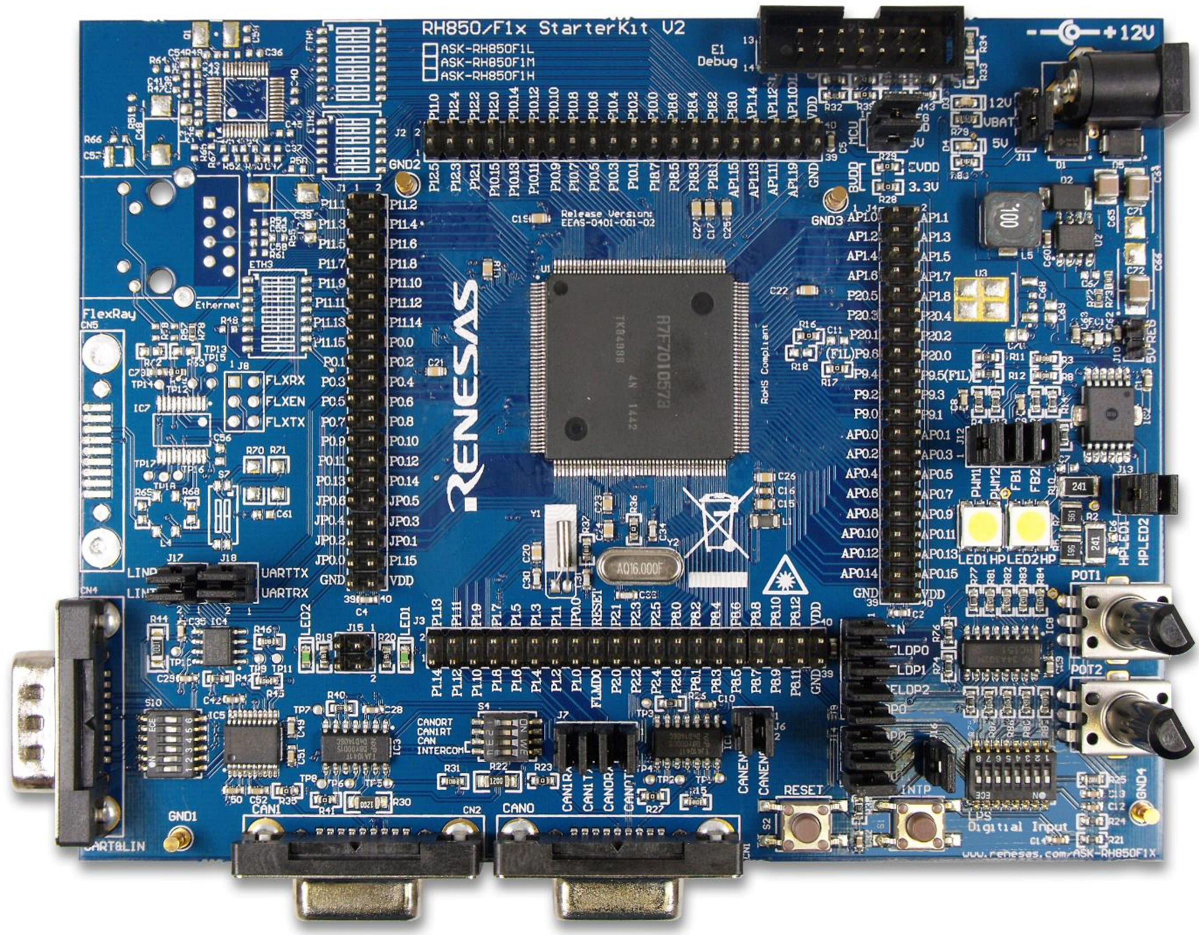


Figure 1. StarterKit top view in default configuration (RH850/F1L version)

2.3 Board Overview RH850/F1H Version [Y-ASK-RH850F1H-V2]

Figure 2 provides a top level view of the RH850/F1H Version of the RH850/F1x StarterKit.

The jumpers and DIP switches are set to default configuration. In this configuration the StarterKit is powered by the E1 Debugger (no external power supply needed).

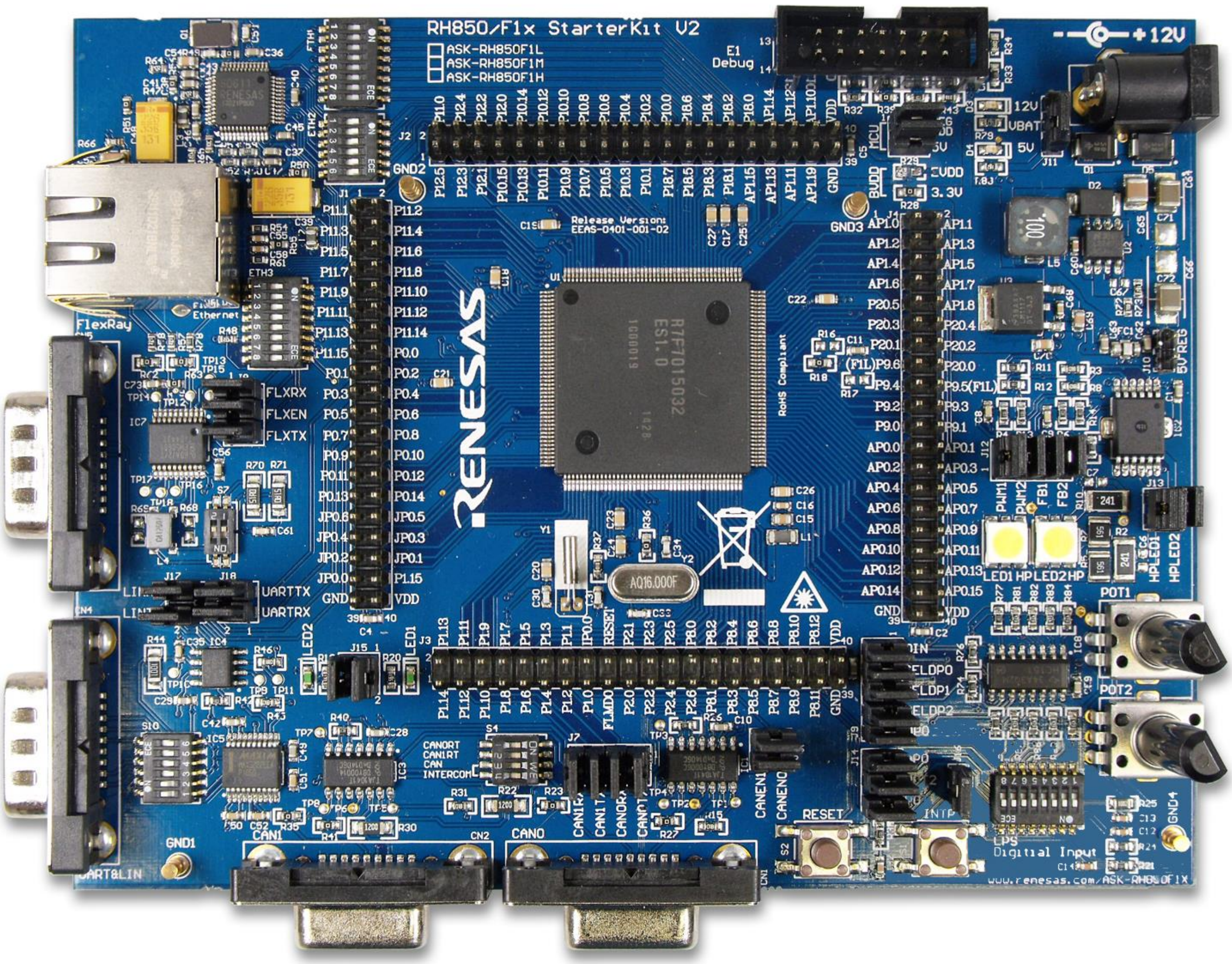


Figure 2. StarterKit top view in default configuration (RH850/F1H version)

3. StarterKit Hardware

3.1 Power Supply

The StarterKit provides two options for powering the board's integrated circuits. It is possible to supply the StarterKit by using the E1 Debugger or it is possible to supply the StarterKit by using an external 12 Volt power supply.

With the default jumper setting (see Table 3) the StarterKit is configured to be power supplied by the E1 Debugger. Details about the power supply jumper settings are shown in chapter 3.2.2.

The operation of the IPD (Intelligent Power Device), the high power LEDs and the FlexRay interface is only possible by using an external 12 Volt power supply.

3.2 Functional Areas

The functional areas provide various circuits and components useful for interacting with the microcontroller's I/O:

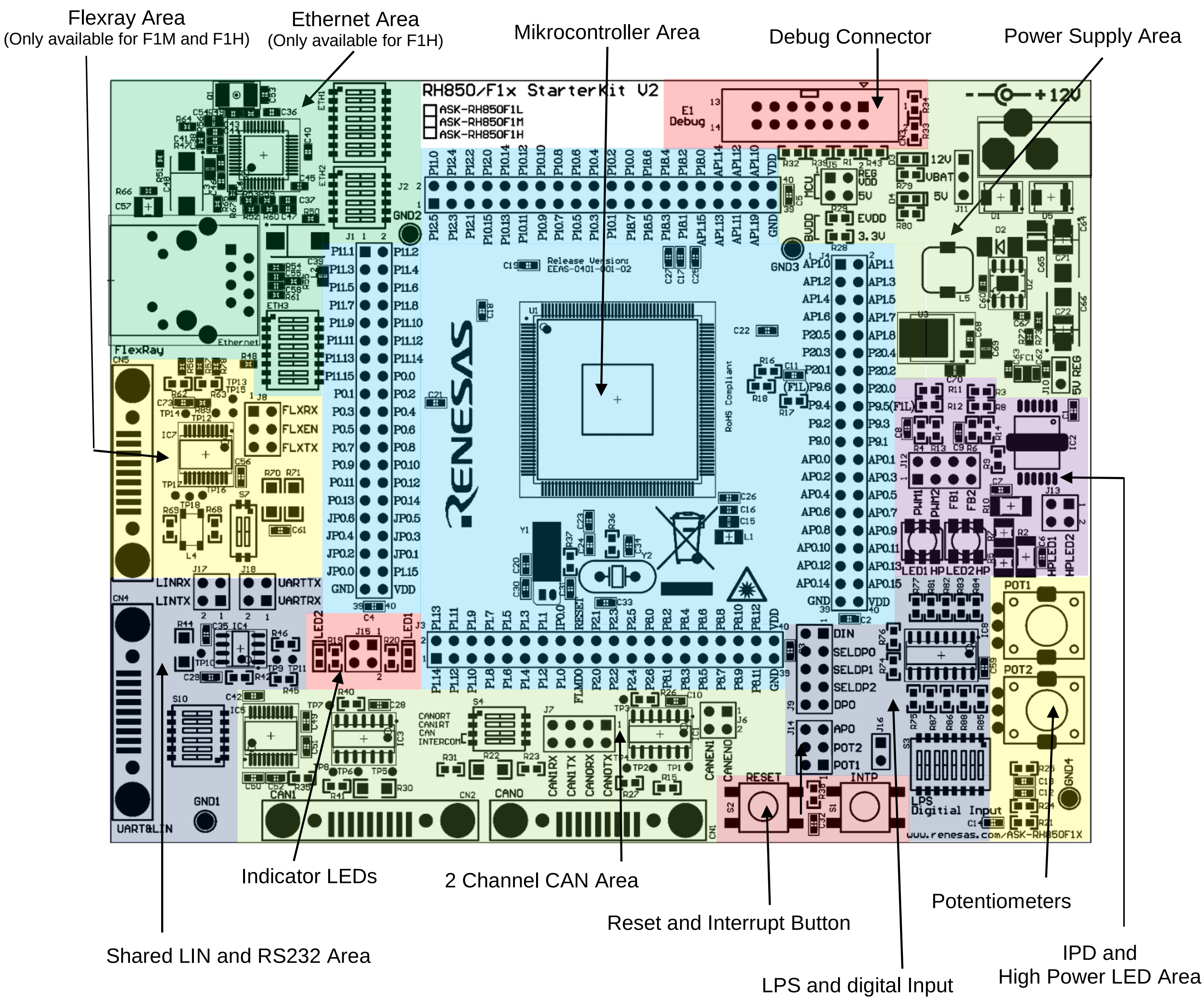


Figure 3. Functional Areas

3.2.1 Microcontroller Area and Port Pin Interfaces

On the RH850/F1x StarterKit devices the following device are assembled:

Y-ASK-RH850F1L-V2: R7F701057

Y-ASK-RH850F1M-V2: R7F701569

Y-ASK-RH850F1H-V2: R7F701503

As external clock supply for the microcontroller, a 16MHz crystal oscillator and a 32.768kHz sub-oscillator is mounted.

Each microcontroller I/O pin is connected to a pin header interface. The pin header interfaces allow easy probing of I/O pins and provide the ability to selectively connect the I/O pins to power, ground or other signals. Table 1 and Table 2 are showing the assignment of the pin header interface. Through-hole pads with 0.1" spacing are provided for signal probing and connections. These pads can be populated with standard 0.1" headers to facilitate signal probing.

3.2.2 Power Supply Area

The StarterKit provides two options for powering the board's integrated circuits (E1 On-Chip debugger supply or external supply).

When the board is supplied externally by 12 Volt, please choose the following jumper settings:

Jumper	Description	Setting	Note
J10	Voltage regulator output to VDD Connector	1-2	open
J11	VBAT selector	1-2	Closed (12V)
		2-3	open

Table 4. Jumper Setting for external 12 Volt power supply

When the board is supplied by E1 debugger, please choose the following jumper settings:

Jumper	Description	Setting	Note
J10	Voltage regulator output to VDD Connector	1-2	open
J11	VBAT selector	1-2	open
		2-3	closed (5V)

Table 5. Jumper Setting For Power Supply By E1 Debugger

The power supply area includes a DC jack type connector for providing external power supply to the StarterKit and its components. The external supply is reversibly protected against overload and overvoltage. Nevertheless, please always observe the right polarity and voltage.

Caution: Damage may occur if a voltage greater than described in Table 6 is supplied.

Connector	Description	Rail	Input Voltage Range
PowerCon	DC Power Jack ID=2.0mm, center positive	VDD	+10V to +15V

Table 6. Power Supply Connector Specification

The two indicator LEDs (D3 and D4) are showing which power supply voltages are available.

In the F1H version of the board a 3.3V regulator is supplied to provide the required voltage for the Ethernet transceiver. This voltage is supplied to the BVDD Pin Group Power Supply and will affect the ports P10, P11, P12 and P18.

3.2.3 LEDs

3.2.3.1 High Power LEDs (High Brightness)

Two white High Power LEDs (HPLED1 and HPLED2) are provided to allow visual observation of microcontroller output port state and to show the functionality of the PWM Diagnostic Macro. The High Power LEDs are driven by a Renesas 'Intelligent Power Device' (IPD). This is an N-channel high-side switch with charge pump, voltage controlled input, diagnostic feedback with proportional load current sense and embedded protection function. The diagnostic/sense feedback of the IPD is connected to the A/D converter of the microcontroller to evaluate the LED drive current. The LED PWM signals are active high.

Please use the following jumper configuration to activate the full IPD and High Power LED functionality:

Jumper	Description	Setting	Configuration	Note
J12	High Power LED (IPD) to MCU connector	1-2	close	PWM of HPLED1 ↔ P0_12
		3-4	close	PWM of HPLED2 ↔ P0_13
		5-6	close	A/D Feedback of HPLED1 ↔ AP0_1
		7-8	close	A/D Feedback of HPLED2 ↔ AP0_2
J13	High Power LED Connector	1-2	close	IPD PWM output 1 ↔ HPLED2
		2-3	close	IPD PWM output 2 ↔ HPLED1

Table 7. White HPLED Signals Configuration

Caution: The High Power LEDs and the IPD can only be used, when the power of the StarterKit is supplied with 12 Volt from external. When the power of the StarterKit is supplied by E1 debugger, the High Power LEDs and the IPD cannot be used.

3.2.3.2 Green LEDs

Two green LEDs (LED1 and LED2) are provided to allow visual observation of microcontroller output port states. The LED signals are active high.

LED	Device Port
LED1	P0_11
LED2	P8_5

Table 8. Green LED Signals

3.2.3.3 Blue LEDs

Two blue LEDs (D5 and D6) are provided to allow visual observation of the power supply status.

LED	Note
D3	12 Volt power supply
D4	5 Volt power supply

Table 9. Blue LED Signals

3.2.4 Digital inputs for Low Power Sampler (LPS)

Eight digital input signals, which are generated by a DIP switch array (S3), are provided to trigger the microcontroller's Low Power Sampler. The input signals are connected to the microcontroller via 8 to 1 Multiplexer (IC4).

Please use the following jumper configuration to connect the DIP Switch and multiplexer to the microcontroller

Jumper	Description	Setting	Configuration	Note
J9	Digital LPS input to MCU connector	1 – 2	close	DIN ↔ P8_1
		3 – 4	close	SELDP0 ↔P0_4
		5 – 6	close	SELDP1 ↔ P0_5
		7 – 8	close	SELDP2 ↔ P0_6
		9 – 10	close	DPO ↔ P0_0

Table 10. LPS Jumper Configuration

3.2.5 Pushbutton Switches

Two pushbutton switches (S1and S2) are provided to allow the switching of microcontroller input port states. The switches are active low and normally open.

Switch	Device signal	Active Level	Inactive State
S1	P0_9 (INTP12)	low	open
S2	RESET	low	open

Table 11. Pushbutton Switch Signals

Please use the following jumper configuration to connect the interrupt pushbutton switch (S1) to the microcontroller.

Jumper	Description	Setting	Configuration	Note
J16	Interrupt Button to MCU connector	1-2	close	Button ↔ P0_9

Table 12. Interrupt Pushbutton Jumper Configuration

3.2.6 Analog Input - Potentiometers

Two potentiometers (POT1 and POT2) are provided to generate analog voltages to the microcontroller's analog inputs.

By turning the potentiometer POT1, a voltage derived from the MCU output signal APO (P0_1) can be adjusted. The APO signal is generated by the Low Power Sampler (LPS) macro. If the LPS macro is not used, APO has to be set to high manually (use P0_1 as general purpose digital output). By turning the potentiometer POT2, a voltage between GND and VDD can be adjusted.

Potentiometer	Analog Input MCU
POT1	AP0_0
POT2	AP1_0

Table 13. Analog Input Signals

Please use the following jumper configuration to connect the potentiometers to the microcontroller:

Jumper	Description	Setting	Configuration	Note
J14	Potentiometer to MCU Connector	1-2	Close	POT1 ↔ AP0_0
		3-4	Close	POT2 ↔ AP1_0
		5-6	Close	POT1 supply ↔ DP0

Table 14. Potentiometer Jumper Configuration

3.2.7 Serial Communication Interfaces

3.2.7.1 RS232 and LIN

RS232 transceiver (IC5) is supplied to provide a serial interface. The transceiver can be connected to the microcontroller's UART macro (RLIN30).

Please use the following jumper configuration to connect the *RS232* transceiver to the microcontroller:

Jumper	Description	Setting	Configuration	Note
J18	RS232 Transceiver to MCU connector	1-2	Close	R232 TX ↔ P0_2
		3-4	Close	R232 RX ↔ P0_3

Table 15. RS232 Transceiver Jumper Configuration

Local Interconnect Network (LIN) transceiver (IC4) is supplied to provide a LIN interface. The transceiver can be connected to the microcontroller's LIN macro (RLIN21).

Please use the following jumper configuration to connect the LIN transceiver to the microcontroller:

Jumper	Description	Setting	Configuration	Note
J17	LIN Transceiver to MCU connector	1-2	Close	LIN RX ↔ P0_7
		3-4	Close	LIN TX ↔ P0_8

Table 16. LIN Transceiver Jumper Configuration

The serial interfaces are connected to the DB9 connector CN4 via DIP switch S10.

Caution: The DB9 connector CN13 is shared between the board's RS232 and LIN interface. Please ensure that only one interface is configured for operation at the same time (either RS232 or LIN) by using DIP switch S10.

Transceiver	Switch	Configuration	Signal
IC5 (RS232)	1	on	RS232 TX
	2	on	RS232 RX
	3	off	-
	4	off	-
	5	off	-
	6	off	-
IC4 (LIN)	1	off	-
	2	off	-
	3	on	Ground
	4	on	VBAT (12V DC)
	5	on	LIN
	6	on	Ground

Table 17. S10 - Serial Communications Interfaces Signals

3.2.7.2 CAN Interfaces

Controller Area Network (CAN) transceivers (IC1 and IC3) are supplied to provide two CAN bus interfaces. Each transceiver can be connected to one of the microcontroller's CAN interfaces (CAN3, CAN4). The CAN bus interfaces are connected to the DB9 connectors CN1 and CN2. The CAN0/1 transceiver is enabled by default and can optionally be disabled by a dedicated Microcontroller GPIO pin (P1_1 / P2_6). DIP switch S4 provides additional CAN bus interface configuration options including the ability to selectively interconnect CAN bus interfaces on-board.

Please use the following jumper configuration to connect the CAN0 transceiver (IC1) to the microcontroller:

Jumper	Description	Setting	Configuration	Note
J7 (optional)	CAN0 transceiver TX/RX to MCU connector	1 – 2	close	CAN0TX ↔ P1_3
		3 – 4	close	CAN0RX ↔ P1_2
J6 (optional)	CAN0 transceiver enable to MCU connector	1 – 2	close	CAN0EN ↔ P1_1

Table 18. CAN0 Transceiver Jumper Configuration

Please use the following jumper configuration to connect the CAN1 transceiver (IC3) to the microcontroller:

Jumper	Description	Setting	Configuration	Note
J7	CAN1 transceiver TX/RX to MCU connector	5 – 6	close	CAN1TX ↔ P1_13
		7 – 8	close	CAN1RX ↔ P1_12
J6	CAN1 transceiver enable to MCU connector (optional)	3-4	close	CAN0EN ↔ P1_6

Table 19. CAN1 Transceiver Jumper Configuration

The on-board CAN bus and the terminal resistors of each CAN channel can be activated by DIP switch S4.

Transceiver	CAN channel	Switch	Setting	Note
IC1	CAN0	1	on	Enable termination resistor
IC3	CAN1	2	on	Enable termination resistor
All	All	3	on	Connect to on-board CAN bus
		4	on	Connect to on-board CAN bus

Table 20. DIP Switch S4 - CAN Interfaces Signals

3.2.7.3 FLEXRAY Interface (RH850/F1M and RH850/F1H only)

FLEXRAY transceiver (IC7) is supplied to provide a FLEXRAY bus interface. The transceiver can be connected to the microcontroller's FLEXRAY interface (FLXA). The FR bus interface is connected to the DB9 connector CN5. The FR transceiver is enabled by default. DIP switch S7 provides additional FR bus interface configuration options including the ability to selectively interconnect FR bus interfaces on-board.

Please use the following jumper configuration to connect the FR transceiver (IC7) to the microcontroller:

Jumper	Description	Setting	Configuration	Note
J8	FLEXRAY transceiver TX/RX to MCU connector	1-2	close	FR_RXD ↔ P10_14
		3-4	close	FR_TXEZ ↔ P10_11
		5-6	close	FR_TXD ↔ P11_1

Table 21. FR Transceiver Jumper Configuration

The on-board FR bus and the terminal resistors of each FR channel can be activated by DIP switch S7.

Transceiver	Switch	Setting	Note
IC7	1	on	Enable termination resistor
	2	on	Enable termination resistor

Table 22. Dip Switch S7 - FR Interfaces Signals

3.2.7.4 Ethernet Interface (RH850/F1H only)

Ethernet transceiver (IC6) is supplied to provide an Ethernet bus interface. The transceiver can be connected to the microcontroller's Ethernet interface ETNB via the DIP switches ETH1 – ETH3.

Please use the following DIP switch configuration to connect the Ethernet transceiver to the microcontroller:

Transceiver	Switch	Setting	Note
IC6	1	on	ETH0LINK ↔ P18_0
	2	on	ETH0TXD0 ↔ P18_1
	3	on	ETH0TXD1 ↔ P18_2
	4	on	ETH0TXD2 ↔ P18_3
	5	on	ETH0TXD3 ↔ P18_4
	6	on	ETH0TXEN ↔ P18_5
	7	on	ETH0TXERR ↔ P18_6
	8	on	ETH0TXCLK ↔ P18_7

Table 23. DIP Switch ETH1

Transceiver	Switch	Setting	Note
IC6	1	on	ETH0RXCLK ↔ P10_0
	2	on	ETH0RXD0 ↔ P10_1
	3	on	ETH0RXD1 ↔ P10_2
	4	on	ETH0RXD2 ↔ P10_4
	5	on	ETH0RXD3 ↔ P10_5
	6	X	No function

Table 24. DIP Switch ETH2

Transceiver	Switch	Setting	Note
IC6	1	on	ETH0RESETB ↔ P11_9
	2	on	ETH0COLSD ↔ P11_10
	3	on	ETH0RXDV ↔ P11_11
	4	on	ETH0CRS ↔ P11_13
	5	on	ETH0RXERR ↔ P11_14
	6	on	ETH0MDIO ↔ P12_4
	7	on	ETH0MDC ↔ P12_5
	8	on	ETH0INT ↔ P11_6

Table 25. DIP Switch ETH3

3.2.8 On-chip Debug and Flash Programming Connector

Connector CN3 is provided to allow the connection of microcontroller debug and flash programming tools. Connector CN3 is a 14 pin, 0.1” pin pitch connector. The pinout of this connector supports the Renesas E1 On-chip debug emulator. For more information about E1, please see Chapter 4.1 E1 On-Chip Debug Emulator [R0E000010KCE00].

4. Development tools

4.1 E1 On-Chip Debug Emulator [R0E000010KCE00]

The E1 On-Chip Debug Emulator is a powerful debugging tool with flash programming functions which supports various Renesas microcontrollers.

Updates and User Manuals for this tool can be found on the Renesas website:

http://www.renesas.eu/e1

4.2 Compiler and Debugger Software

Trail versions of the following compiler and debugger software tools are included in the StarterKit package:

- Green Hills MULTI IDE
- IAR Embedded Workbench for Renesas RH850
- iSYSTEM winIDEA with E1 support

More information about the usage of these software tools is shown in the Quick Start Guide which is also part of the StarterKit package.

5. RH850/F1x StarterKit Example Software

The included demo software provides the following functions:

- Basic MCU Initialization
- PWM Generation for (High Power) LEDs
- PWM Diagnostic Function for High Power LEDs
- A/D-Converter for PWM-Diagnostics and Potentiometers
- Standby modes including Low Power Sampler (LPS)
- Push-Button Function
- CAN Frame Transmission
- LIN Frame Transmission
- UART Transmission with DMA support
- Operating System Timer
- Timer Array Unit J
- Timer Array Unit B

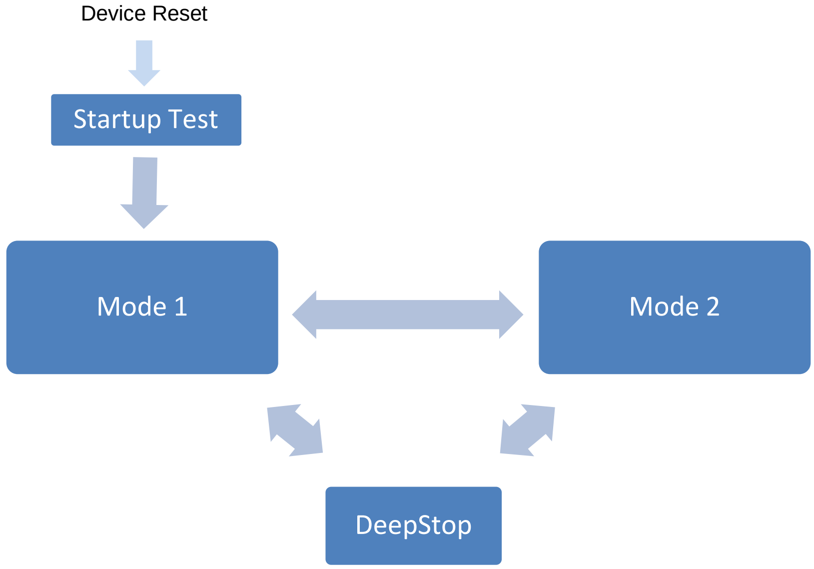


Figure 4. Software flow

The software contains a test function executed at the start and two run modes.

For live documentation of the RH850 actions connect your computer via the COM-Port to the UART connector "CN4" of the board.

Note: Use a 1:1 RS232 computer cable and a baud-rate of 9600.

StartUp Test:

Once started, the clock will be initialized and a start-up test is performed. LED1 and LED2 (and HPLED1 and HPLED2 if J12 and J13 are closed) will light for 500ms and the CAN/LIN macros are checked. After this the SW continues with Mode 1.

Mode 1:

LED1 and LED2 (and HPLED1 and HPLED2 if J12 and J13 are closed) will blink alternately in a specified frequency and intensity. The frequency is determined by the analogue value of POT1. It is converted to a corresponding TAUJ interval time while the analogue value of POT2 is converted to a corresponding PWM duty cycle. The PWM functionality is used to drive the HPLEDs with corresponding duty cycles, the TAUJ and TAUB functionalities are used to drive the LEDs with corresponding duty cycles.

A short push on button S1 will switch to Mode 2, holding it pressed for 3s or more will switch to DEEPSTOP mode.

After 30s without user action, the microcontroller will enter DEEPSTOP mode on its own.

Mode 1 is called in a 1ms cycle using the Operating System Timer.

Mode 2:

LED1 and LED2 (and HPLED1 and HPLED2 if J12 and J13 are closed) will light in a specific intensity which can be separately set by both potentiometers (POT1 and POT2). The PWM functionality is used to drive the HPLEDs with corresponding duty cycles, the TAUJ and TAUB functionalities are used to drive the LEDs with corresponding duty cycles.

A short push on button S1 will switch to mode 1, holding it pressed for 3s or more will switch to DEEPSTOP mode.

After 30s without user action, the microcontroller will enter DEEPSTOP mode on its own.

Mode 2 is called in a 1ms cycle using the Operating System Timer.

During both modes the PWM diagnostic function is performed. The load current through the HPLEDs is evaluated by converting feedback/sense signal of HPLED driver (IPD) into digital values and applying conversion result upper / lower limit check function of ADC. In case the measured current is either too high or too low, a High Power LED fault is assumed and in turn the PWM is switched OFF. By switching between Mode1 and 2 or vice versa, the PWM-diagnostic is started again.

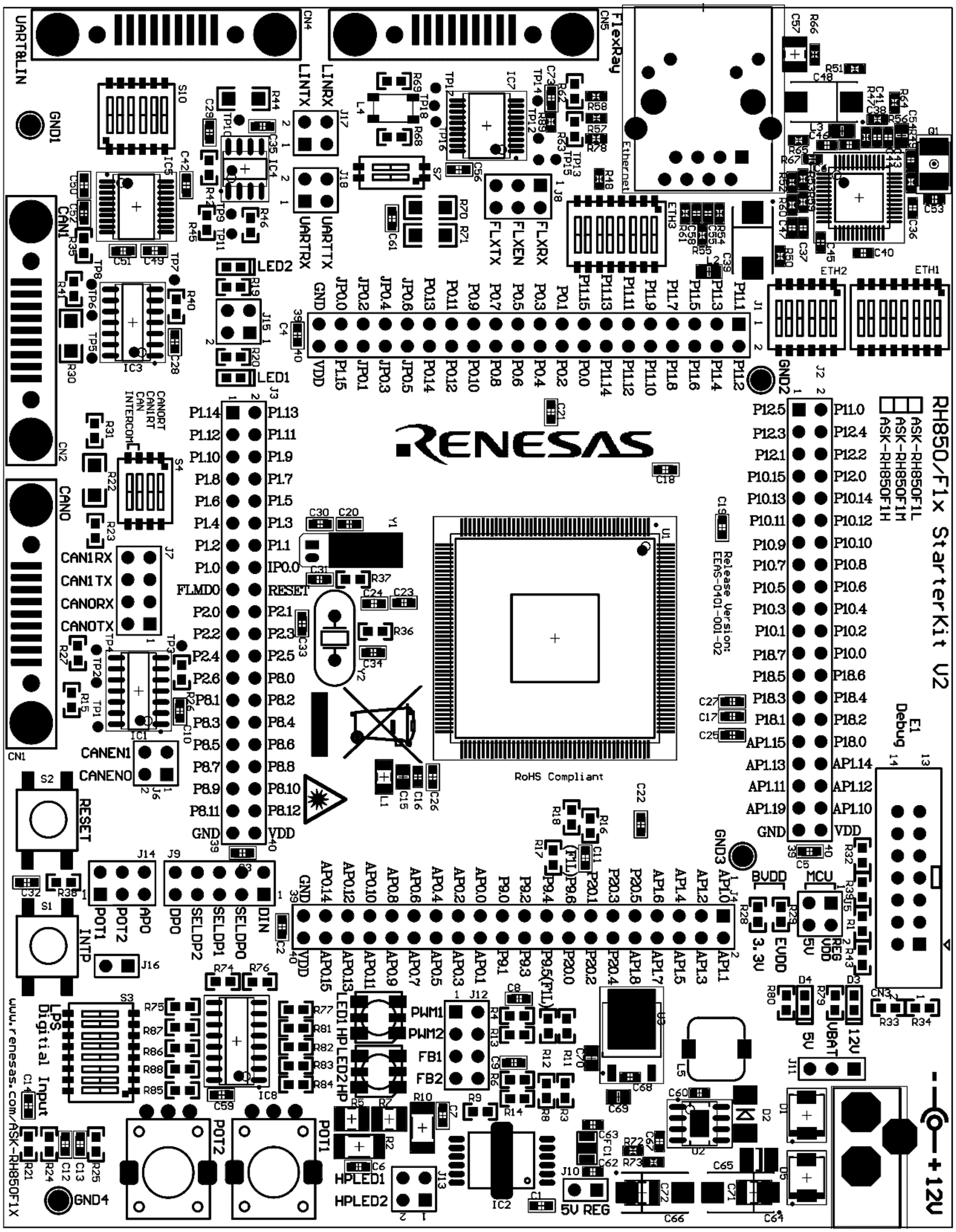
Standby:

Entering standby mode will turn off all unnecessary functions and switch the controller into DEEPSTOP for low power consumption. This is indicated by a 2s interval of LED2 generated by the Timer Array Unit J.

A wake-up can be performed by a short push the button S1, changing the configuration of the DIP switch S3 or turning potentiometer POT1 more than 25% of the actual state. DIP switch and POT1 related wake-up events are generated by using the Low Power Sampler triggered by Timer Array Unit J in a 500ms interval. Performing a wake-up will resume the last mode the SW was in before standby was entered.

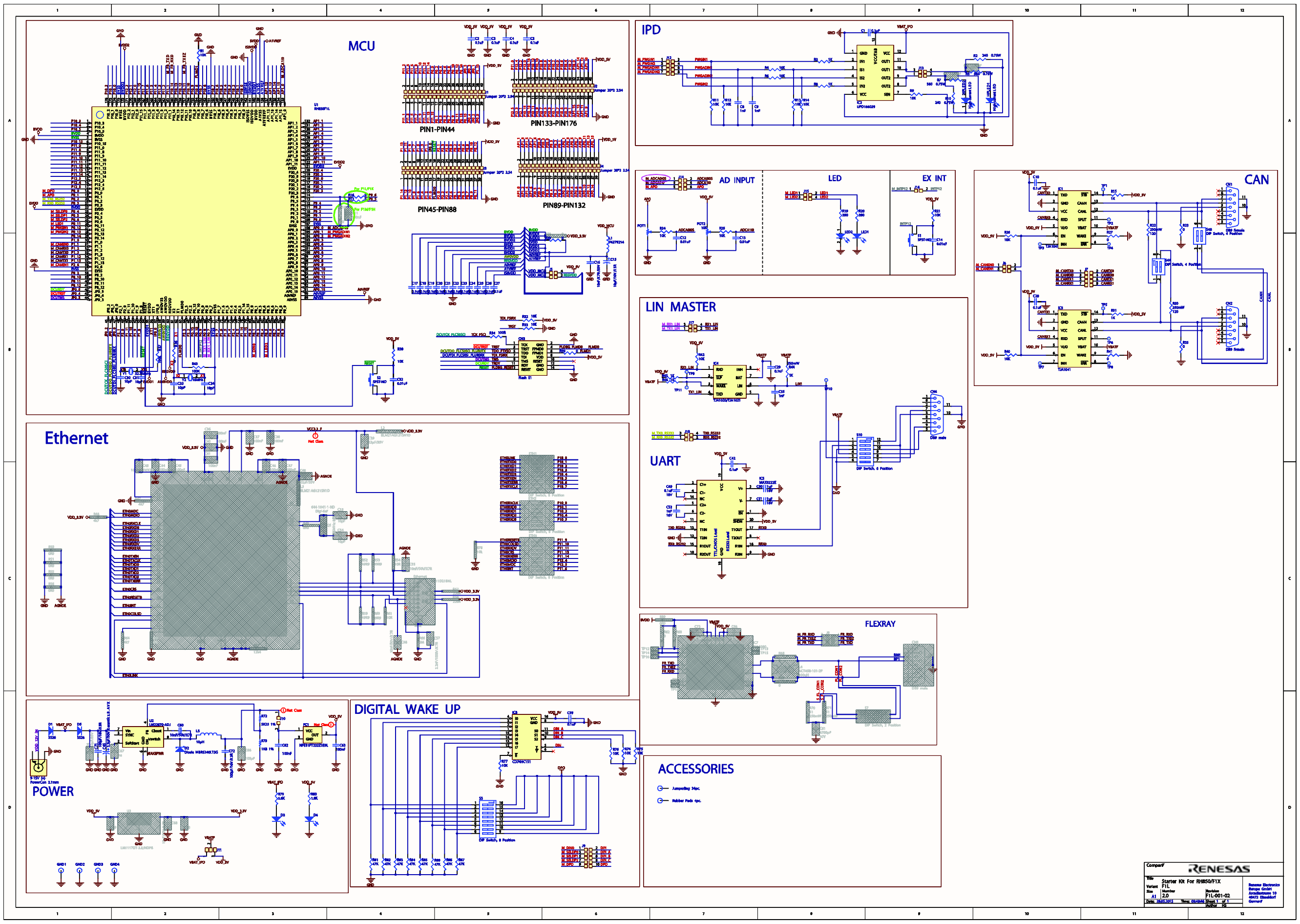
6. Component Placement and Schematics

6.1 Component placement

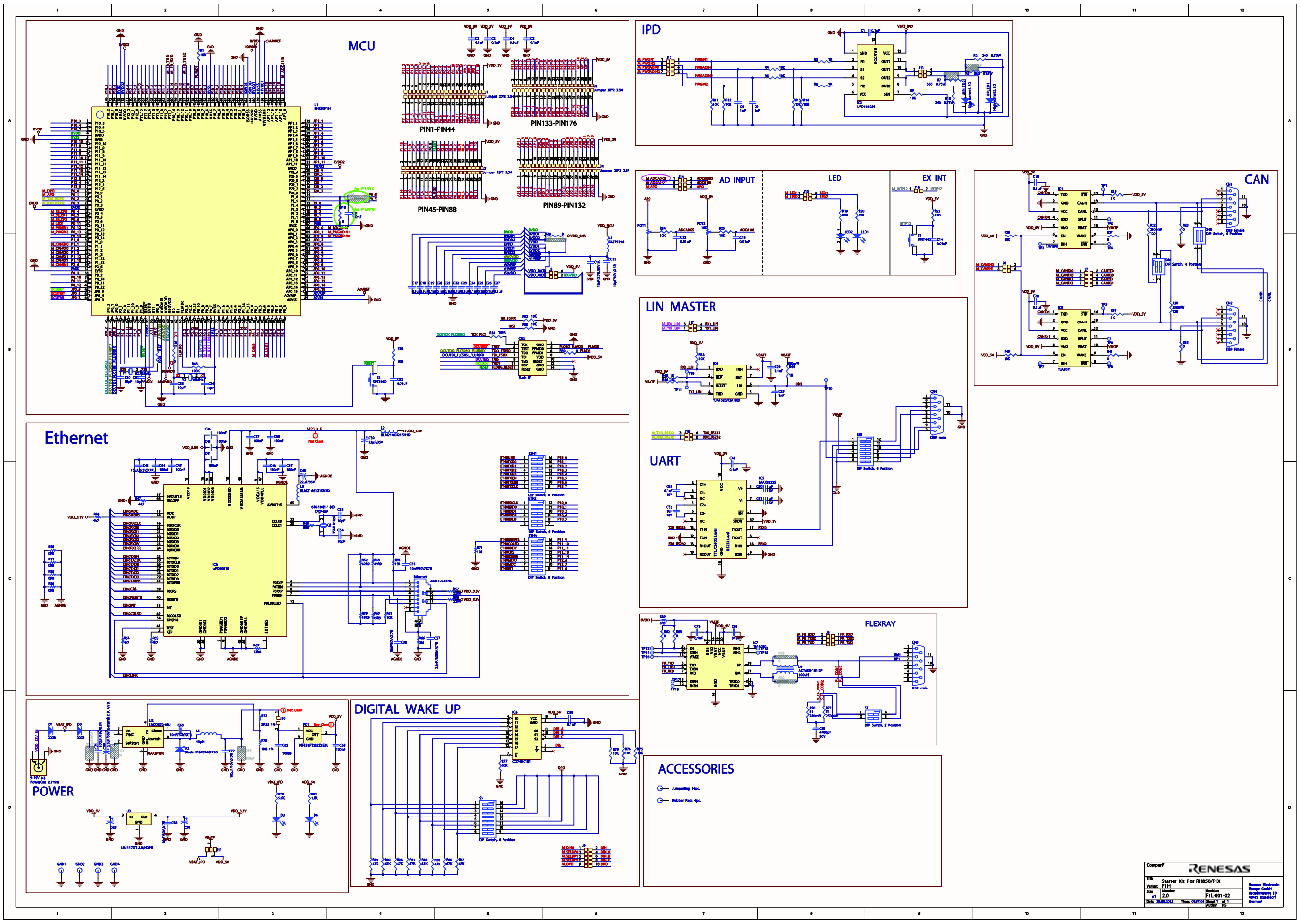


6.2 Schematics

6.2.1 Y-ASK-RH850F1L-V2 Schematics



6.2.2 Y-ASK-RH850F1H-V2 Schematics



7. Revision History

RH850/F1x StarterKit V2 User Manual: Hardware			
Rev.	**Date**	**Description**	
		Page	**Summary**
1.00	June 2015	—	First edition issued
1.01	22nd June 2015	16, 23, 24	Replaced switch name S5 with correct name S1
1.10	August 2015		General update for F1H StarterKit

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