User Manual

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Starter Kit for V850E2/FG4-L

User Manual: Hardware

RENESAS MCU
V850E2 F-Series

Y-ASK-V850E2-FG4L

Renesas Electronics
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1. Introduction

The Starter Kit for V850E2/FG4-L serves as a simple and easy to use platform for evaluating the features and performance of Renesas Electronics' 32-bit V850E2/FG4-L™ 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 and CAN
- Power supply by E1 On-Chip debugger or externally (3,3V to 5V DC input)

This document will describe the functionality provided by the Starter Kit and guide the user through its operation. For details regarding the operation of the microcontroller, refer to the V850E2/FG4-L User Manual which is available at www.renesas.eu

CAUTIONS

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

   Special care must be taken with the high power LED D1 and RGB LED D6!

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 external power supply is required in case all functions on the Starter Kit are used to full extend. In case High power LED D1 is used while electrically supplied by E1 On-Chip debugger, configure CN14 to "1-2 position" only.**

2. Quick Start – Connector and jumper overview

CN1			
Pin	*Function*		*Pin*
1	GND	JP0_0	2
3	GND	JP0_1	4
5	GND	JP0_2	6
7	GND	JP0_3	8
9	GND	JP0_4	10
11	GND	JP0_5	12
13	GND	P0_0	14
15	GND	P0_1	16
17	GND	P0_2	18
19	GND	P0_3	20
21	GND	P0_4	22
23	GND	P0_5	24
25	GND	P0_6	26
27	GND	P0_7	28
29	GND	P0_8	30
31	GND	P0_9	32
33	GND	P0_10	34
35	GND	P0_11	36
37	GND	P0_12	38
39	VDD	VDD	40

CN2			
Pin	*Function*		*Pin*
1	GND	P1_1	2
3	GND	P1_2	4
5	GND	P1_3	6
7	GND	P1_4	8
9	GND	P1_5	10
11	GND	P1_6	12
13	GND	P1_7	14
15	GND	P1_8	16
17	GND	P1_9	18
19	GND	P1_10	20
21	GND	P1_11	22
23	GND	P1_12	24
25	GND	P1_13	26
27	GND	P1_14	28
29	GND	P1_15	30
31	GND	P11_0	32
33	GND	P11_1	34
35	GND	P11_2	36
37	GND	P11_3	38
39	VDD	VDD	40

Table 1. CN1 – CN2 – Signal assignment

CN3			
Pin	*Function*		*Pin*
1	GND	P11_8	2
3	GND	P11_9	4
5	GND	P10_0	6
7	GND	P10_1	8
9	GND	P10_2	10
11	GND	P10_3	12
13	GND	P10_4	14
15	GND	P10_5	16
17	GND	P10_6	18
19	GND	P10_7	20
21	GND	P10_8	22
23	GND	P10_9	24
25	GND	P10_10	26
27	GND	P10_11	28
29	GND	P10_12	30
31	GND	P10_13	32
33	GND	P10_14	34
35	GND	P10_15	36
37	GND	P4_0	38
39	VDD	VDD	40

CN4			
Pin	*Function*		*Pin*
1	GND	P4_1	2
3	GND	P4_2	4
5	GND	P4_3	6
7	GND	P4_4	8
9	GND	P4_5	10
11	GND	P4_6	12
13	GND	P4_7	14
15	GND	P4_8	16
17	GND	P4_9	18
19	GND	P4_10	20
21	GND	P3_2	22
23	GND	P3_3	24
25	GND	P3_4	26
27	GND	P3_5	28
29	GND	P3_6	30
31	GND	P3_7	32
33	GND	P0_13	34
35	GND	P0_14	36
37	GND	P0_15	38
39	VDD	VDD	40

Table 2. CN3 – CN4 – Signal assignment

Jumper / Connector	Description	Setting	Note
CN5	Micro Controller power distribution	**1 – 2**	Common VDD rail (Note 2)
		3 – 4	A0VDD to µC
		5 – 6	REG1VDD to µC
		7 – 8	E1VDD to µC
		9 – 10	E0VDD to µC
		11 – 12	REG0VDD to µC
		13 – 14	OSCVDD to µC
		15 – 16	I0VDD to µC
CN6	Board supply selection	**3 – 4**	Supply by E1 Debugger (Note 3)
CN7	External supply (optional)	-	+3.3V to +5.0V DC (optional) (Note 3)
CN8	RS232	**1 – 2**	TX signal to DB9 CN12
		3 – 4	RX signal to DB9 CN12
	LIN	7 – 8	VBAT (12V externally) to CN12
		9 – 10	LIN Signal to DB9 CN12
		11 – 12	Ground to DB9 CN12
CN9		1 – 2	Sleep disabled
CN10	CAN0	1 – 2	If bus termination is needed
	CAN1	3 – 4	
CN13	12V external supply (VBAT) for LIN and CAN	1	12V DC from external
		2	Ground from external
CN14	Power selection LED D1	**1 – 2**	Low power setting
		3 – 4	High power setting (CAUTION)
CN15	E1 Debugger interface	-	Connect E1 Debugger
CN18	Test pin	1	VDD on board
		2	Ground on board

Table 3. Jumper / Connector settings overview

Notes:

1. **Bold font** indicates default setting.

2. Pins 1 – 2 can be used to measure µC total supply current.

3. In case CAN is used, the supply voltage must be 5.0V

Board Overview

Figure 1 provides a top level view of the Starter Kit. Highlighted in the image are several areas of functionality.

Blue: Microcontroller Area

Red: Power Supply Area

Green: Functional Areas

These areas are described in detail in the following sections.

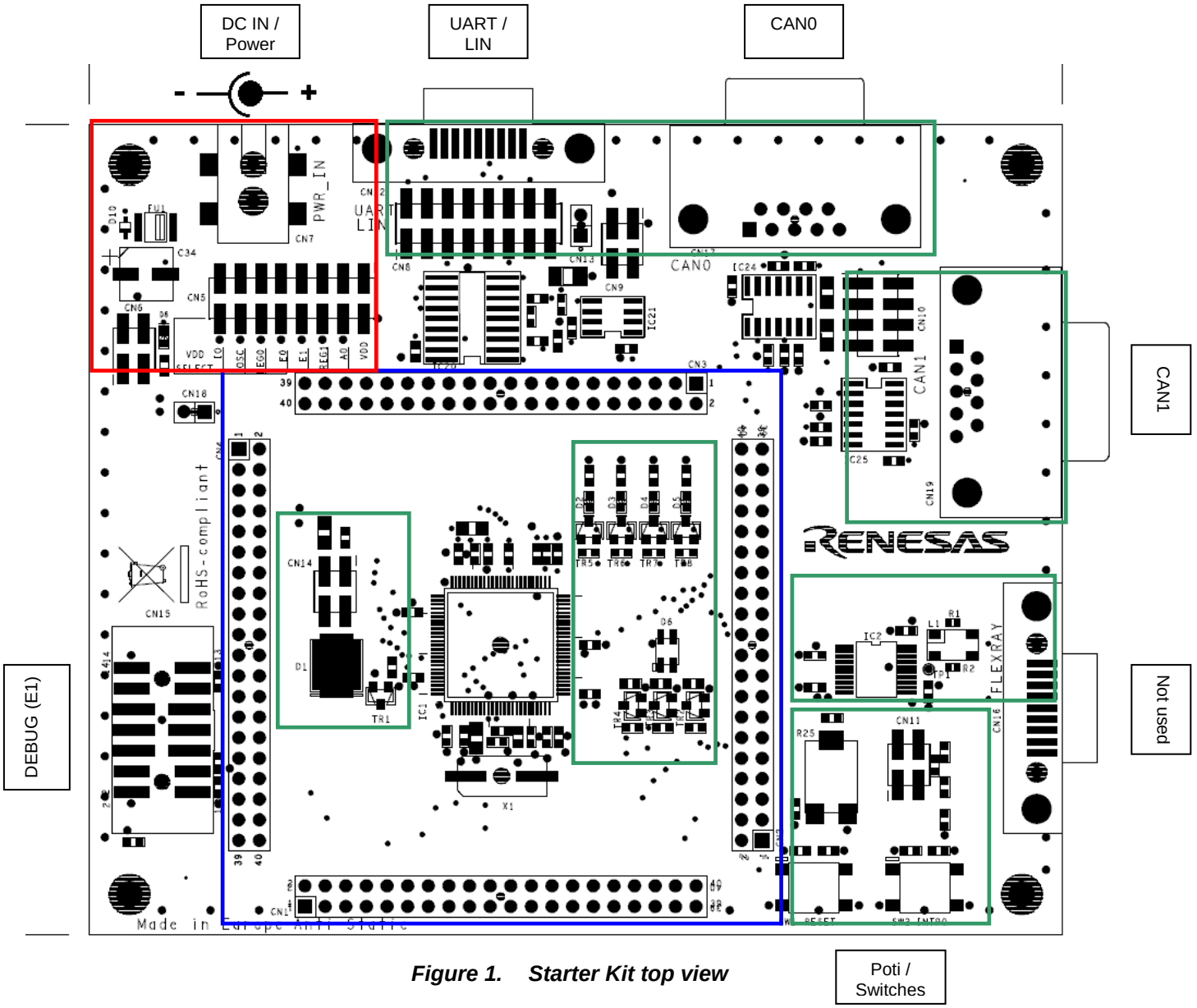


Figure 1. Starter Kit top view

2.1 Microcontroller Area

The Microcontroller Area of the Starter Kit includes the following features:

- Interfaces to all microcontroller I/O pins
- Clock supply for microcontroller (16MHz)

2.2 Pin Interfaces

Each microcontroller I/O pin is connected to a *Pin Interface*. The Pin Interface is a group of pads that allow easy probing of I/O pins, and provide the ability to selectively connect the I/O pins to power, ground or other signals. Figure 2 shows a picture of unpopulated pin interfaces CN1 to CN 4. 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.

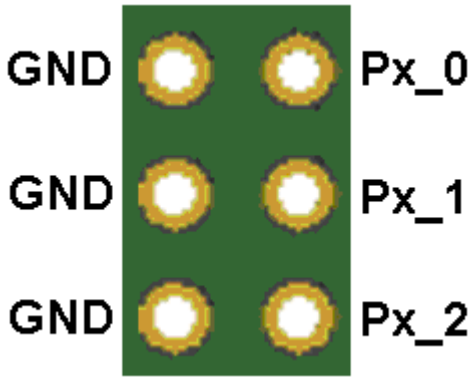


Figure 2. Pin Interfaces

2.3 Power Supply Area

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

Caution: The voltage provided by connector CN7 is not regulated and is supplied to the integrated circuits. Damage may occur if a voltage greater than that described in Table 4 is supplied.

Connector	Description	Rail	Input Voltage Range
CN7	DC Power Jack ID=2.0mm, center positive	VDD	+3.3V to +5.0V

Table 4. CN7 - Power Supply Connector Specification

2.3.1 Voltage Rail

The Main Board provides two options for powering the board's integrated circuits. Jumper CN6 is provided to select from the available voltage sources (E1 On-Chip debugger or external supply), or to completely disconnect the rail. A green indicator LED, D8, is provided to easily observe the power state of the VDD voltage rail

Jumper	Description	Setting	Supply by
CN6	Starter Kit supply voltage selection	1 - 2	External (CN7)
		3 - 4	E1 Debugger (CN15)

Table 5. CN6 - Supply Voltage Selection

2.4 Functional Areas

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

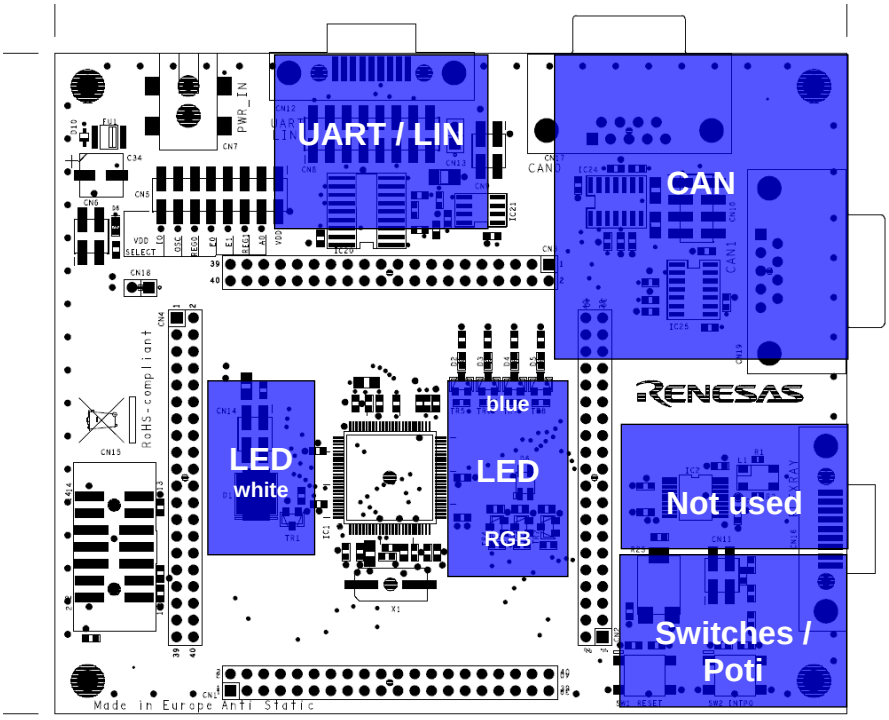


Figure 3. Functional Areas

2.4.1 LEDs

2.4.1.1 White LED (High Brightness)

A RGB white high brightness / high power LED, D1, is provided to allow visual observation of microcontroller output port state. The LED signal is active high.

LED	Device Port
D1	P0_15

Table 6. White LED Signal

The maximum output power of D1 can be limited by jumper CN14:

Jumper	Setting	Description
CN14	1 - 2	Low output power
	3 - 4	High output power (CAUTION)
	open	LED disabled

Table 7. CN14 - White LED Power selection

2.4.1.2 Blue LEDs

Four blue LEDs, D2 to D5, are provided to allow visual observation of microcontroller output port states. The LED signals are active high.

LED	Device Port
D2	P1_3
D3	P1_4
D4	P1_5
D5	P1_6

Table 8. Blue LED Signals

2.4.1.3 RGB LED

An RGB (red / green / blue) LED, D6, is provided to allow visual observation of microcontroller output port states. The LED signals are active high.

LED	Device Port
D6_Red	P1_14
D6_Green	P1_13
D6_Blue	P1_12

Table 9. RGB LED Signals

2.4.2 Pushbutton Switches

Two pushbutton switches, SW1 and SW2, 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
SW1	RESET	low	open
SW2	P0_0 (INTP0)	low	open

Table 10. Pushbutton Switch Signals

2.4.3 Analog Input - Potentiometer

Potentiometer R25 is provided to generate analog voltages to the microcontroller's analog input ADAA0I0. By turning the potentiometer screw, a voltage between GND and VDD can be adjusted.

Potentiometer	Analog Input FG4-L
R25	ADAA0I0

Table 11. Analog Input Signals

Note: R23 acts as overload protection in case P10_0 is configured to output accidentally.

2.4.4 Serial Communications Interfaces

2.4.4.1 RS232 and LIN

One *RS232* transceiver, IC20, is supplied to provide a serial interface. The transceiver is connected to the microcontroller's UART interface (URTE10).

One *Local Interconnect Network* transceiver, IC21, is supplied to provide a LIN interface. The transceiver is connected to the microcontroller's LIN capable UART interface (URTE11).

The serial interfaces are connected to the DB9 connector CN12 via jumper CN8.

Caution: The DB9 connector CN12 is shared between the board's RS232 and LIN interface. Ensure that each interface is configured for the operation of only one, RS232 or LIN, using jumper CN8.

Transceiver	UART instance	CN8 Setting	Device signal
IC20 (RS232)	URTE10	1 – 2	URTE10TX
		3 – 4	URTE10RX
IC21 (LIN)	URTE11	5 – 6	Ground
		7 – 8	VBAT (12V DC)
		9 – 10	URTE11
		11- 12	Ground
-	-	13 - 16	Not used

Table 12. CN8 - Serial Communications Interfaces Signals

In order to operate the LIN interface, a 12V supply (*VBAT*) from external is required. This can be achieved by connecting **12V DC to CN13 Pin1**.

Connector	Position	Description
CN13	1	External 12V supply
	2	Ground

Table 13. CN13 – External 12V supply LIN

Caution: Ensure to NOT connect 12V DC to CN18 pin 1. This would create an overvoltage condition for all electrical devices on the Starter Kit and will lead to irrecoverable damage!

Connector	Position	Description
CN18	1	VDD Test point
	2	Ground

Table 14. CN18 – Starter kit supply test points

The operation modes of the LIN transceiver can be controlled by jumper CN9:

Jumper	Position	Description
CN9	1 – 2	Sleep disabled
	3 - 4	Local wake-up input (negative edge triggered)

Table 15. CN9 – LIN transceiver mode control

Please refer to the LIN transceiver's data sheet for details.

2.4.4.2 CAN Interfaces

CAN transceivers, IC24 and IC25, are supplied to provide two CAN bus interfaces. Each transceiver is connected to one of the microcontroller's CAN interfaces (FCN0, FCN1). The CAN bus interfaces are connected to the DB9 connectors CN17 and CN19 (not assembled on starter kit). Jumper CN10 provides additional CAN bus interface configuration options including the ability to selectively interconnect CAN bus interfaces on-board.

In order to achieve CAN bus communication, it is necessary to supply the transceivers with a nominal 12 volt supply voltage in addition to the I/O voltage. This can be achieved by connecting **12V DC to CN13 Pin1**.

Connector	Position	Description
CN13	1	External 12V supply
	2	Ground

Table 16. CN13 – External 12V supply CAN

Caution: Ensure to NOT connect 12V DC to CN18 pin 1. This would create an overvoltage condition for all electrical devices on the Starter Kit and will lead to irrecoverable damage!

Note: The Starter Kit's supply voltage must be chosen with 5.0V to operate the CAN transceivers.

Transceiver	FCAN instance	CN10 Setting	Device signal
IC24 (CAN0)	FCN0	1 – 2	Enable termination resistor
IC25 (CAN1)	FCN1	3 – 4	Enable termination resistor
All	All	5 – 6	Connect to on-board CAN bus
		7 – 8	Connect to on-board CAN bus

Table 17. CN10 - CAN Interfaces Signals

2.5 On-chip Debug and Flash Programming Connector

Connectors CN15 is provided to allow the connection of microcontroller debug and flash programming tools. Connector CN15 is a 14 pin, 0.1” pin pitch connector. The pinout of this connector allows the connection of the Renesas E1 On-chip debugger.

3. Software

For a detailed description of the demonstration SW already programmed to the microcontroller, please refer to the documentation that can be found in the related application folder on the CD provided with the starter kit.

Precautions

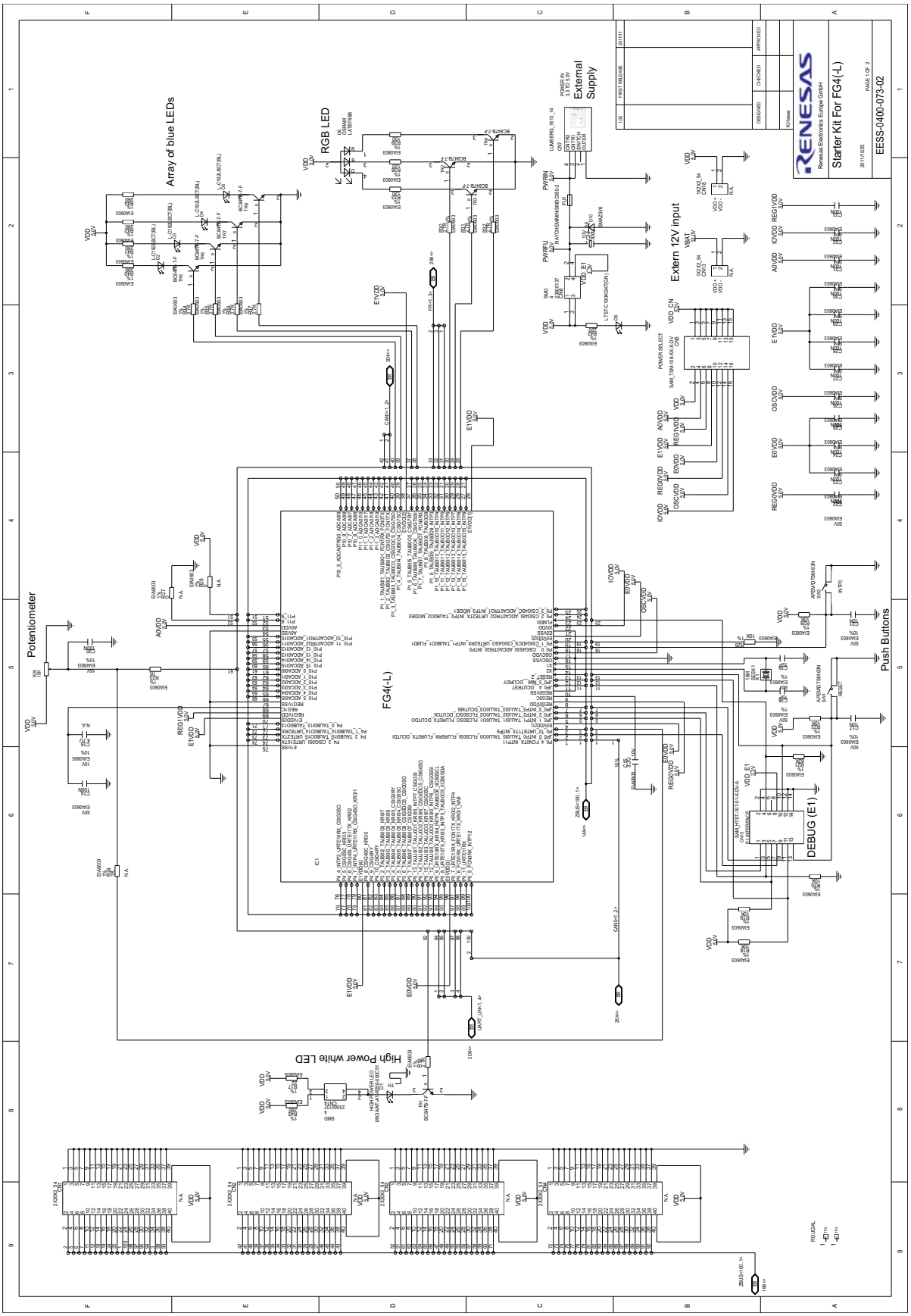
3.1 Do not look into the LED beam!

Special care must be taken with the high power LED D1 and RGB LED D6!

3.2 Power supply limitation of E1 Debugger

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 external power supply is required in case all functions on the Starter Kit are used to full extend. In case High power LED D1 is used while electrically supplied by E1 On-Chip debugger, configure CN14 to “1-2 position” only.

4. Schematics


Array of blue LEDs
RGB LED
External Supply
Extern 12V input
Potentiometer
FG4(-L)
Push Buttons
DEBUG (E1)
High Power white LED
Starter Kit For FG4(-L)
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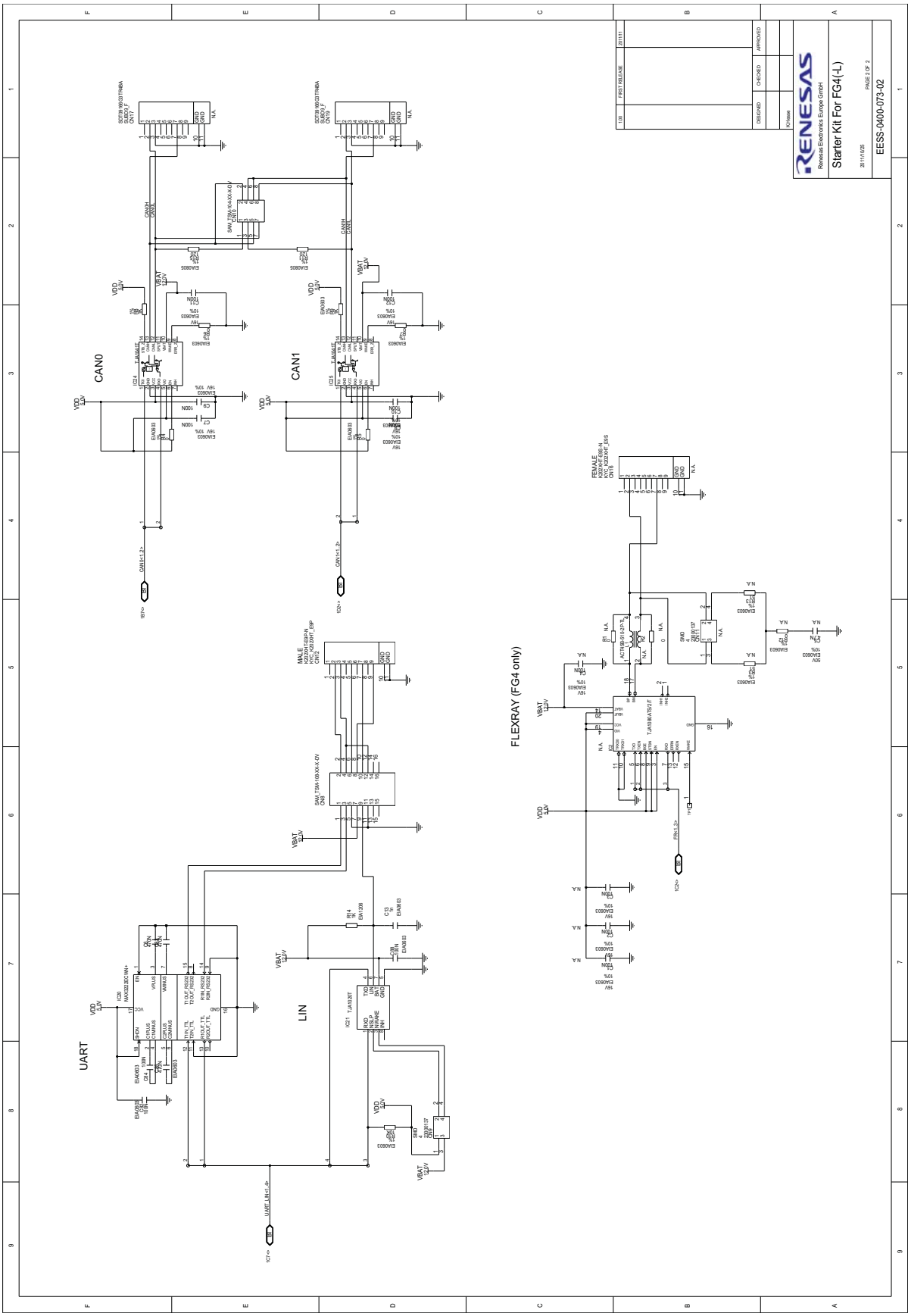
CAN0
CAN1
LIN
UART
FLEXRAY (FG4 only)
Starter Kit For FG4(-L)
EESS-0400-073-02

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Colophon 1.0

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