

ISO-DONGLE1Z Rev.B

Communications Dongle

This manual provides an overview of the hardware layout of the ISO-DONGLE1Z Rev.B communications dongle. A description of the headers' pins, jumper configurations, available communication interfaces, power, and programming options is provided.

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1. Communications Dongle Overview

The ISO-DONGLE1Z Rev.B dongle serves as an isolated communications dongle between a Battery Front End (BFE) evaluation board and a Graphical User Interface (GUI) available on a workstation (Figure 1). It provides a galvanic isolation and has flexible hardware configuration, making it compatible with multiple BFEs and GUIs. The dongle uses an entry-line Renesas Advanced Family RA4 ARM-based microcontroller. Table 1 shows the specifications of the communications dongle and Figure 2 provides a description of the different functional parts.



Figure 1. GUI, Communications Dongle and Battery Front End Connection

Table 1. Isolated Communications Dongle Specifications

Item	Specification
Board Size	30.0mm×88.0mm
Power-Supply Voltage	USB connector: 5V input
	Power-supply ICs: <ul style="list-style-type: none"> ▪ LDO Regulator 1: 5V input, 3.3V output ▪ LDO ▪ Regulator 2: 3.3V input, 2.5V output
	Expansion header J3: 3.3V input
	JTAG connector: 3.3V input (Optional during programming and debug)
Current Drawn	Max 200mA
Renesas RA4E1 MCU	Part No.: R7FA4E10B2CNE
	Package: 48-pin QFN
	ARM Cortex-M4 Core with Floating Point Unit
	On-chip memory: 256-KB ROM, 128-KB SRAM, 8-KB data flash memory
Communication Interfaces	I ² C bus interface
	Serial Peripheral Interface (SPI)
	Serial Communications Interface (SCI) – UART, Simple I2C
	Controller Area Network (CAN) module
	USB 2.0 Full-Speed Module
Push Switches	Reset switch
LEDs	Power indicator: 2 Red
	User: 2 Red
Isolated I2C Connector	Angle type, 4 pins, power supply and I ² C interface
USB Type-B Connector	Connector for a USB device or serial-conversion interface
Expansion Header 1	7 pins
Expansion Header 2	4 pins

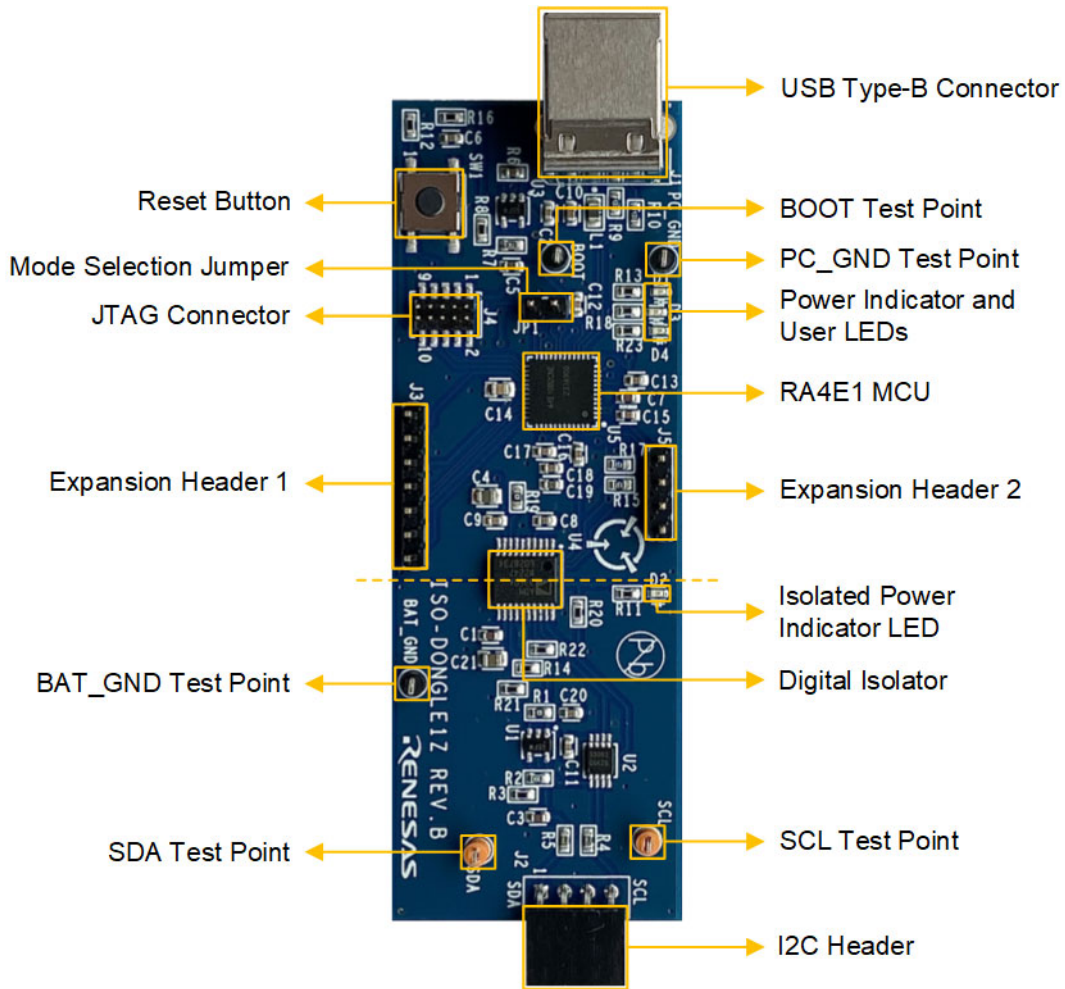


Figure 2. Isolated Communications Dongle Parts Description

1.1 Assumptions and Advisory Notes

- It is assumed that users possess a basic understanding of microcontrollers, embedded systems hardware, battery management systems, and secondary battery cells.
- Renesas recommends reviewing the Renesas RA4E1 Group 32-Bit MCU Datasheet, available on the [product page](#), to become familiar with the MCU in use.
- Renesas recommends reviewing the ISO-DONGLE1Z Rev.B Communications Dongle Software Manual in addition to this document.

2. Hardware Layout

2.1 System Block Diagram

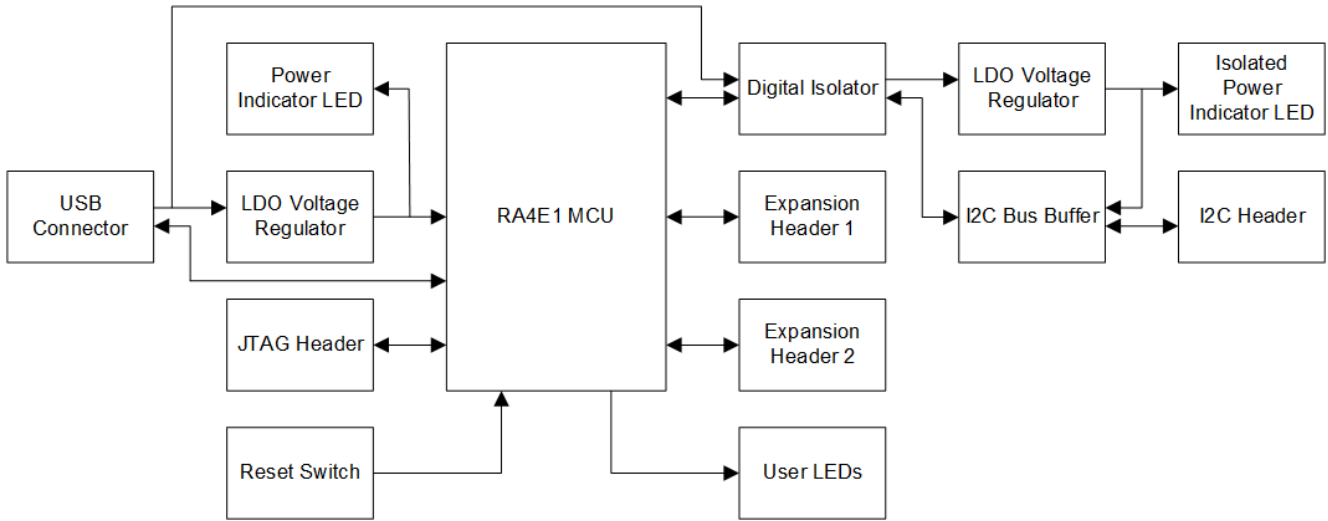


Figure 3. Block Diagram

2.2 Power Supply Options

The power source for the ISO-DONGLE1Z Rev.B Isolated Communication Dongle is 5V supplied from an external host to the USB Type-B connector J1 of the dongle. The Low Drop-Out (LDO) voltage regulator U3 converts and stabilizes the 5V (from USB) to 3.3V, which then powers the MCU. The digital isolator U4 has a built-in DC/DC converter (5V to 5V) that transfers power to the isolated side of the dongle. A second low dropout (LDO) voltage regulator U1 converts and stabilizes the 5V (from U4) to 2.5V, which then powers the secondary side of the I²C buffer U2, so that the isolated I²C interface supports 2.5V signal levels.

Note: It is possible to switch to 3.3V signal levels of the isolated I²C interface. To do so, the value of the SMD resistor R2 (Figure 7) of the LDO voltage regulator must be changed from 10.5kΩ (2.5V) to 16.9kΩ (3.3V)!

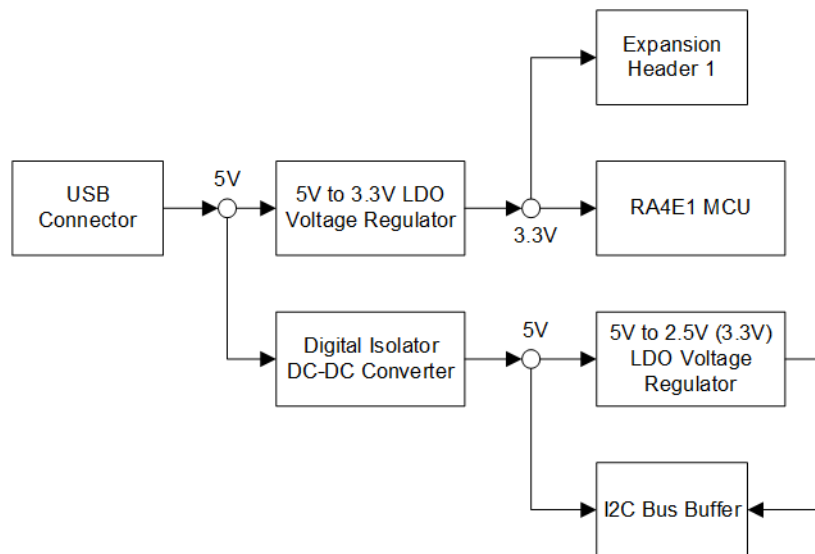


Figure 4. Power Supply Scheme

2.3 MCU Overview

The ISO-DONGLE1Z Rev.B Isolated Communication Dongle uses an entry-line MCU from the Renesas Advanced Microcontroller Family supporting multiple communication interfaces. RA4E1 uses leading-performance 100MHz ARM® Cortex®-M4 core with 256KB code flash memory, 8KB data flash memory and 128KB SRAM. It has USB 2.0 Full-Speed Module (USBFS), Controller Area Network (CAN) module, 12-bit A/D Converter, security, and safety features.

2.4 LEDs

The ISO-DONGLE1Z Rev.B Isolated Communication Dongle has four red LEDs, grouped on two places on the board. D1 is a power indicator for the MCU side of the dongle whereas D2 is an isolated power supply indicator for the I²C buffer side. When running the default firmware D3 indicates successfully connected USB driver and D4 - a communication error. They are directly controlled by the MCU with open-drain outputs. A LED is illuminated when the relevant digital output of the MCU has low level. [Table 2](#) demonstrates the function and connections of the user LEDs.

Table 2. User LEDs Description

Designator	Default Function	Color	MCU Port	MCU Pin
D3	Successful USB connection indicator	Red	U5-P301	U5-23
D4	Error indicator	Red	U5-P302	U5-22

2.5 Reset Switch

The ISO-DONGLE1Z Rev.B Isolated Communication Dongle has a reset switch SW1. It pulls down the RES pin of U5 and resets the MCU.

2.6 Device USB

The ISO-DONGLE1Z Rev.B Isolated Communication Dongle is equipped with USB Device interface that provides data exchange data with an external host (workstation) through the USB Type-B Connector J1 ([Table 3](#)) using the USB Full-Speed Module of the MCU. The RA4W1 MCU is equipped with USB2.0 Full-Speed on-chip transceiver. The USB peripheral module driver in the MCU emulates a virtual COM port connection.

Table 3. USB Type-B Connector Description

USB Micro-B Connector (J1)		ISO-DONGLE1Z Rev.B
Pin	Description	Signal
1	+5VDC	VUSB (V3P3 is connected to U5-P407/USB_VBUS)
2	Data-	U5-P915/USB_DM
3	Data+	U5-P914/USB_DP
4	GND	PC_GND
5	Mount	PC_GND
6	Mount	PC_GND

2.7 Expansion Headers

The ISO-DONGLE1Z Rev.B Isolated Communication Dongle has two expansion headers that allow connection of additional external circuitry. [Table 4](#) and [Table 5](#) describe the header pin assignments and jumper configuration options.

Table 4. Expansion Header 1 (J3) Pin Assignment

J3 Pin	Port/Signal	U5 (MCU) Pin
1	PC_GND	6, 13, 31, 41, 49
2	U5-P111/ IRQ4/ SCK9/ RSPCKA/ AGTOA5	28
3	V3P3, U5-VCC, U5-P407/USB_VBUS, U5-VCC_USB	9, 12, 16, 30
4	U5-P103/ CTX0/ SS0/ GTIOC2A	33
5	U5-P102/ CRX0/ SCK0/ GTIOC2B	34
6	U5-P101/ TXD0/ MOSI0/ SDA0/ GTIOC5A	35
7	U5-P100/ RXD0/ MISO0/ SCL0/ GTIOC5B	36

Table 5. Expansion Header 2 (J5) Pin Assignment

J13 Pin	Port/Signal	U3 (MCU) Pin
1	U5-P000/ AN000	48
2	U5-P001/ AN001	47
3	U5-P015/ IRQ13/ AN013	38
4	PC_GND	6, 13, 31, 41, 49

2.8 Supported Communication Interfaces

The ISO-DONGLE1Z Rev.B Isolated Communication Dongle supports the following communication interfaces:

- Simple I2C Interface – The Simple I2C interface is available on the isolated I2C header - J2 (pins #1 and #4). It supports I2C bus format (master-only). The supported data rate is up to 400kHz. The dongle has 4.74k Ω pull-up resistors for the SDA and SCL signals available on J2.
- I2C Bus Interface – The I2C interface is available on Expansion header 1 (pins #6 and #7). It supports I2C bus or SMBus communications format. The supported data rate is up to 400kHz.
Note: External pull-up resistors are required! This interface is not isolated from the USB connector!
- Serial Peripheral Interface – The SPI interface is available on Expansion header 1 (pins #4, #5, #6 and #7). The MCU supports full duplex synchronous serial communication (3- or 4-wire operation).
Note: This interface is not isolated from the USB connector!
- UART Interface – The UART interface is available on Expansion header 1 (pins #6 and #7).
Note: This interface is not isolated from the USB connector!
- CAN module – The CAN module interface is available on Expansion header 1 (pins #4 and #5). It complies with the ISO 11898-1 standard and supports both 11-bit and 29-bit messaging formats.
Note: An external CAN transceiver is required. This interface is not isolated from the USB connector!

2.9 Supported Analog Inputs

The ISO-DONGLE1Z Rev.B Isolated Communication Dongle supports up to 3 analog inputs available on Expansion header 2 (pins #1, #2 and #3). The 12-bit successive approximation A/D converter uses internal reference voltage. *Note:* These analog inputs are not isolated from the USB connector!

2.10 JTAG Connector

The ISO-DONGLE1Z Rev.B Isolated Communication Dongle has a 10-pin Cortex® Debug Connector J4 that provides access to the JTAG/SWD interface of the MCU. Table 6 describes the pin assignments of the connector. *Note:* The SWD interface GNDDetect pin #9 is hardwired to GND. Renesas recommends using the Renesas E2 Emulator/E2 Emulator Lite for programming or debugging of the dongle. Figure 5 shows the correct attachment of the JTAG connector and the ribbon cable position. Ensure that the MCU Operating Mode selection jumper JP1 is placed. **Important:** When using Renesas E2 Emulator, ensure that the emulator is not supplying power to the dongle through the JTAG connector.

Important: This debug connector must be used only by advanced users who wish to use the ISO-DONGLE1Z Rev.B Isolated Communication Dongle as a MCU development platform. Any programming or debugging requires deep knowledge for the RA4E1 MCU, Renesas E2 Emulator and the IDE tool, and erases the default bootloader and firmware.

Table 6. JTAG Connector Description

JTAG Connector (J11)		ISO-DONGLE1Z Rev.B
Pin	SWD Pin Name	Signal/Bus
1	VTref	V3P3
2	SWDIO/ TMS	U5-P108/ SWDIO/ TMS (U5-25)
3	GND	PC_GND
4	SWCLK/ TCK	U5-P300/ SWCLK/ TCK (U5-24)
5	GND	PC_GND
6	SWO/ TDO	U5-P109/ SWO/ TDO (U5-26)
7	N.C.	N.C.
8	TDI	U5-P110/ TDI (U5-27)
9	GNDDetect	PC_GND
10	nRESET	U5-RES (U5-19)

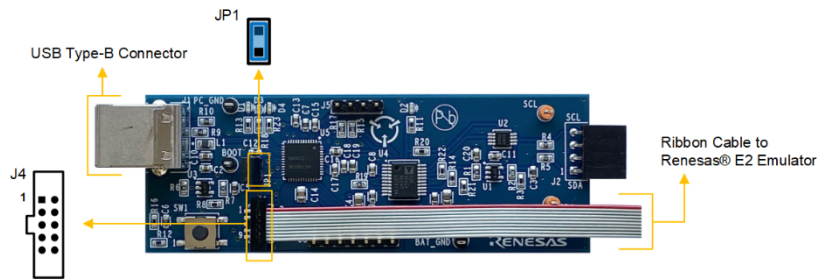


Figure 5. Isolated Communications Dongle with Attached Renesas E2 Emulator

3. Technical Details

3.1 Schematic

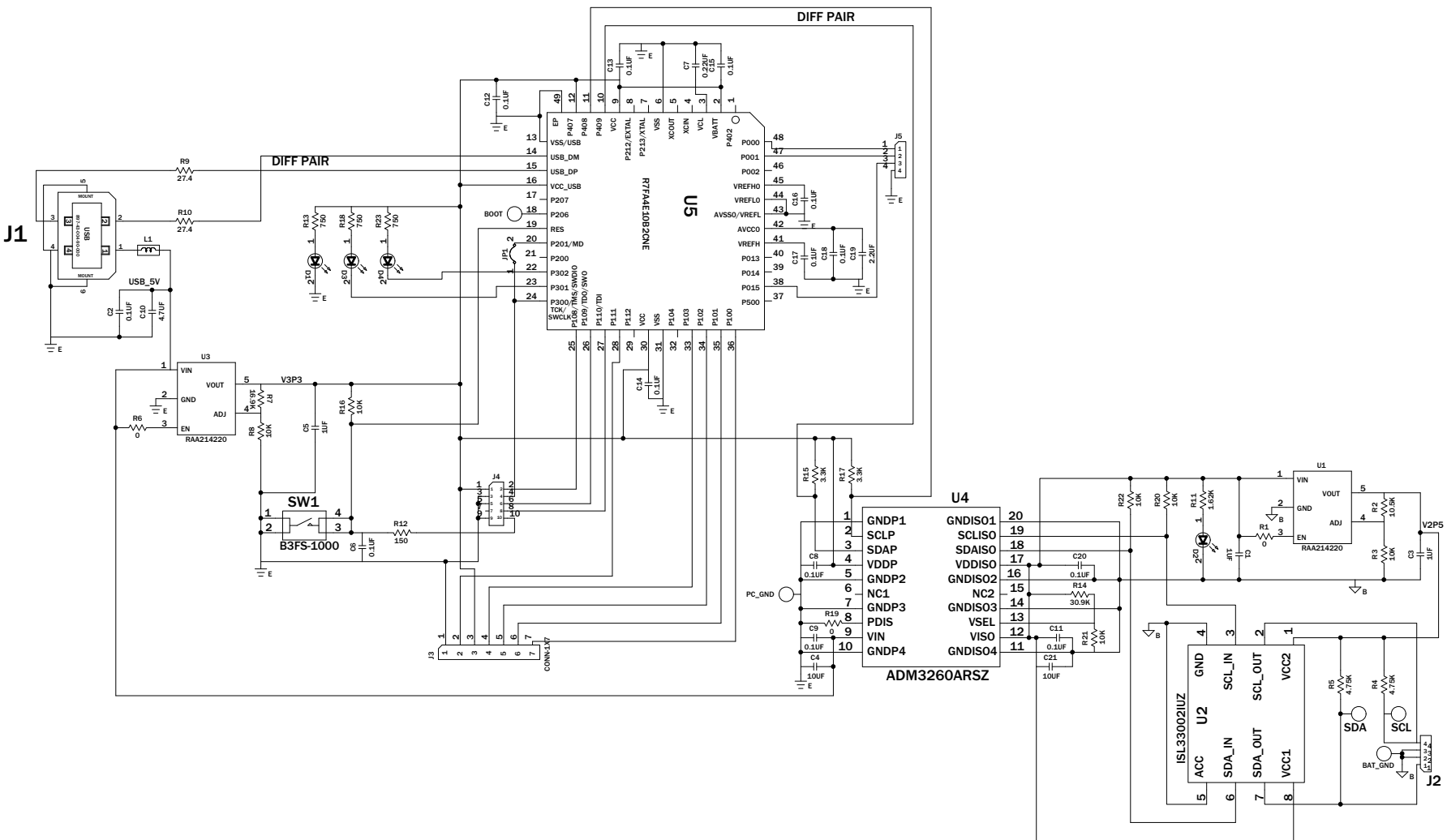


Figure 6. Schematic

3.2 PCB Layout

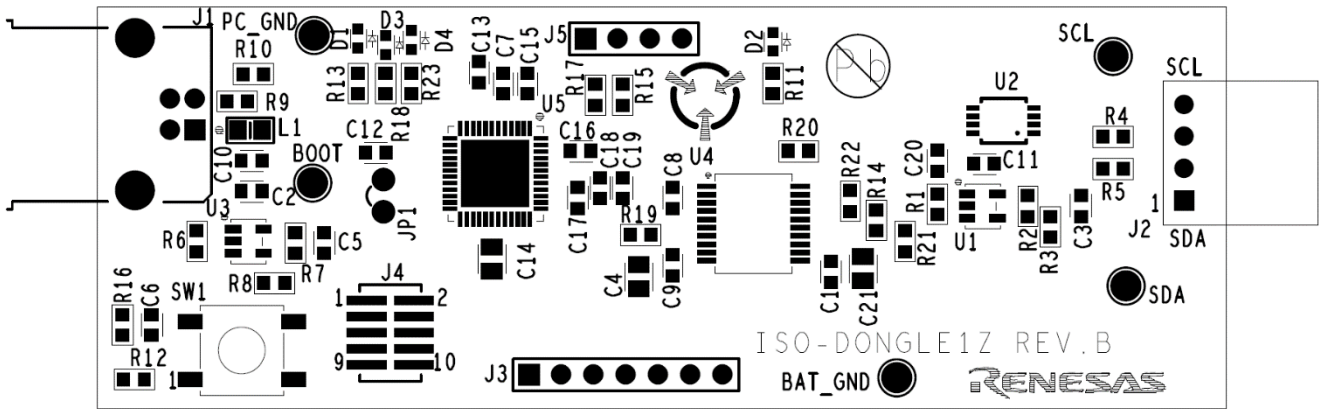


Figure 7. Top Overlay

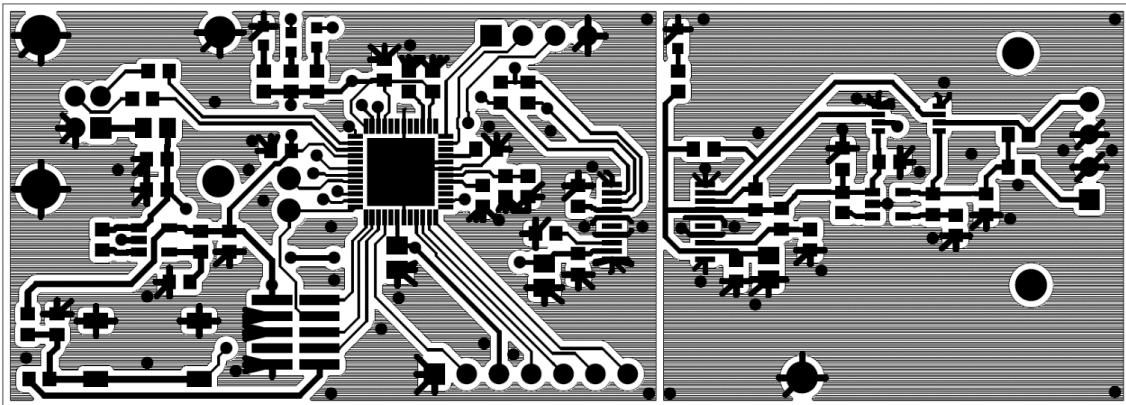


Figure 8. Top Layer

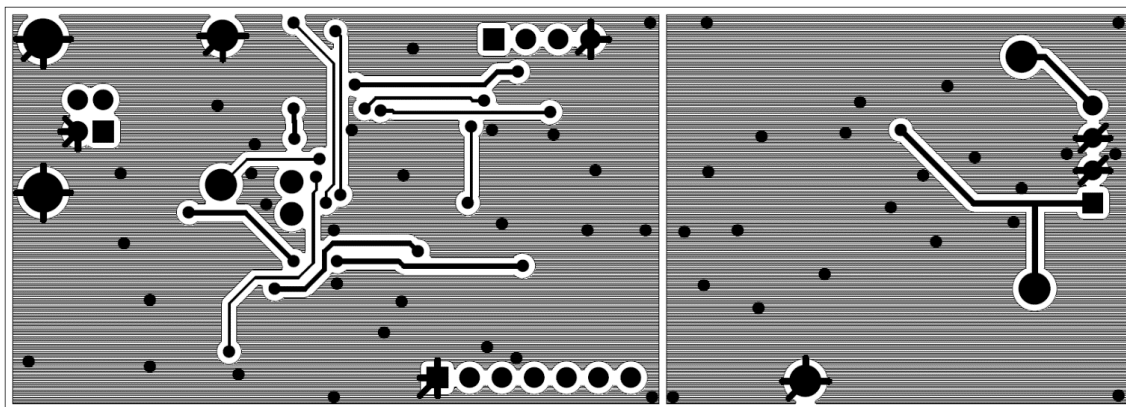


Figure 9. Bottom Layer

3.3 Bill of Materials

Qty	Reference Designator	Description	Manufacturer	Manufacturer Part
3	BAT_GND, BOOT, PC_GND	Miniature Black Test Point 0.100 Pad 0.040 Thole	Keystone	5001
2	SCL, SDA	Miniature Orange Test Point 0.100 Pad 0.040 Thole	Keystone	5003
1	J1	Type B Receptacle USB Connector (RoHS compliant)	Mil-Max	897-43-004-90-000
1	U4	Hot Swappable Dual I2C Isolators with Integrated DC/DC Converter	Analog Devices	ADM3260ARSZ
1	SW1	SPST-NO General-Purpose Pushbutton SMT Switch	Omron	B3FS-1000
3	C1, C3, C5	Multilayer Cap	TDK	C1608X7R1C105K
1	J5	Inline 4 pins X 0.1-inch Connector Strip	Generic	CONN-1X4
1	J3	Male Inline 7 pins X 0.1-inch Connector Strip	Generic	CONN-1X7
1	C19	Multilayer Ceramic Capacitor	Taiyo Yuden	EMK107BJ225KA
1	J4	Male 10 Pin 2x5 @ 50 mil pitch SMT Micro Header Connector	Samtec	FTS-105-01-F-DV
1	C10	Ceramic Chip Cap	Murata	GRM188R61C475KAAJD
12	C2, C6, C8, C9, C11-C13, C15-C18, C20	Multilayer Cap	Various	Generic
1	C7	Multilayer Cap	Various	Generic
1	C14	Multilayer Cap	Various	Generic
2	C4,C21	Chip Monolithic Cap	Various	Generic
3	R1, R6, R19	Thick Film Chip Resistor	Various	Generic
6	R3, R8, R16, R20-R22	Thick Film Chip Resistor	Various	Generic
1	R2	Thick Film Chip Resistor	Various	Generic
1	R12	Thick Film Chip Resistor	Various	Generic
1	R11	Thick Film Chip Resistor	Various	Generic
1	R7	Thick Film Chip Resistor	Various	Generic
2	R9, R10	Thick Film Chip Resistor	Various	Generic
1	R14	Thick Film Chip Resistor	Various	Generic
2	R15, R17	Thick Film Chip Resistor	Various	Generic
2	R4, R5	Thick Film Chip Resistor	Various	Generic
3	R13, R18, R23	Thick Film Chip Resistor	Various	Generic
1	U2	I2C Bus Buffer with Rise Time Accelerators and Hot Swap Capability	Intersil	ISL33002IUZ
1	JP1	100 mil Spacing Two Pin Jumper	Generic	JUMPER2_100
4	D1-D4	SMT 0603 Red 1.8v 2ma 630nm 4.5mcd LED	Osram	LS L29K-G1J2-1-0-2-R18-Z-T

Qty	Reference Designator	Description	Manufacturer	Manufacturer Part
1	L1	Chip Ferrite Bead	Murata	MI0805K601R-10
1	J2	Female 3A In-line 4 pin X 100 mil pitch Female Connector	Sullins	PPTC041LGBN-RC
1	U5	256K Flash Memory Micro Controller	Renesas	R7FA4E10B2CNE
2	U1,U3	150mA 20V Wide Input Voltage Range LDO Linear Regulator	Renesas	RAA214220

4. Revision History

Revision	Date	Description
1.00	Dec 12, 2023	Initial release.

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