

ISO-DONGLE-EV1Z Rev.D

Communications Dongle

Introduction

This manual provides an overview of the hardware layout for the ISO-DONGLE-EV1Z Rev.D communications dongle and includes a description of the connectors, jumpers, available communication interfaces, power and programming options.

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1. Communications Dongle Overview

The ISO-DONGLE-EV1Z Rev.D dongle is designed to serve 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). Its galvanic isolation helps preventing any ground loops and issues when testing and evaluating the BFE performance. 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. ISO-DONGLE-EV1Z Rev.D Isolated Communications Dongle Specifications

Item	Specification
Board size	Size: 48.0 mm x 80.0 mm
Power-supply voltage	USB connector: 5V input
	Power-supply ICs: <ul style="list-style-type: none"> ▪ LDO Regulator: 5.0V input, 3.3V output ▪ Isolated DC/DC Converter: 5.0V input, 5.0V output
	Evaluation board connector J1: 3.3V input
Current drawn	Max 100mA
Renesas® RA4E1 MCU	Part No.: R7FA4E10B2CNE
	Package: 48-pin QFN
	ARM Cortex-M4 Core with Floating Point Unit
	On-chip memory: 256KB ROM, 128KB SRAM, 8KB data flash memory
Communication interfaces	I ² C bus interface
	Serial Peripheral Interface (SPI)
	USB 2.0 Full-Speed Module
Push switches	Reset switch
LEDs	Power indicator: 1 Red
	User: 2 Red
Evaluation board connector	Angular, 16 pins, SPI/I ² C interface, synchronization signals, GPIOs, and power supply
USB Type-B connector	Connector for a USB device or serial-conversion interface

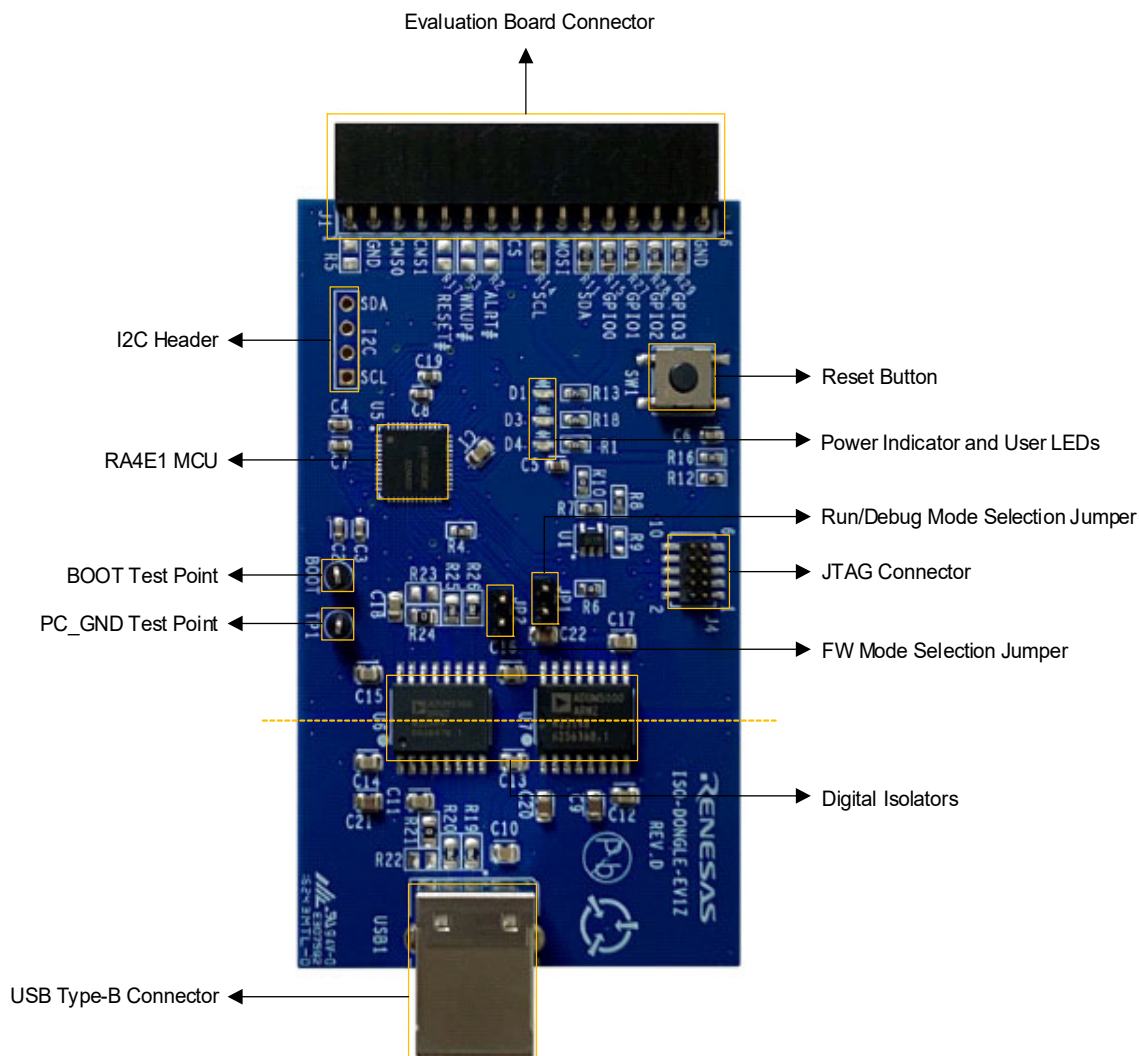


Figure 2. ISO-DONGLE-EV1Z Rev.D Isolated Communications Dongle Parts Description

1.1 Assumptions and Advisory Notes

- A basic understanding of microcontrollers, embedded systems hardware, battery management systems, and secondary battery cells is assumed.
- Be familiar with the MCU in use, Renesas recommends reviewing the Renesas *RA4E1 Group 32-Bit MCU Datasheet* (see the [RA4E1](#) product page).
- In addition to this document, Renesas recommends reviewing the *ISO-DONGLE-EV1Z Rev.D Communications Dongle Software Manual*.

2. Hardware Layout

2.1 System Block Diagram

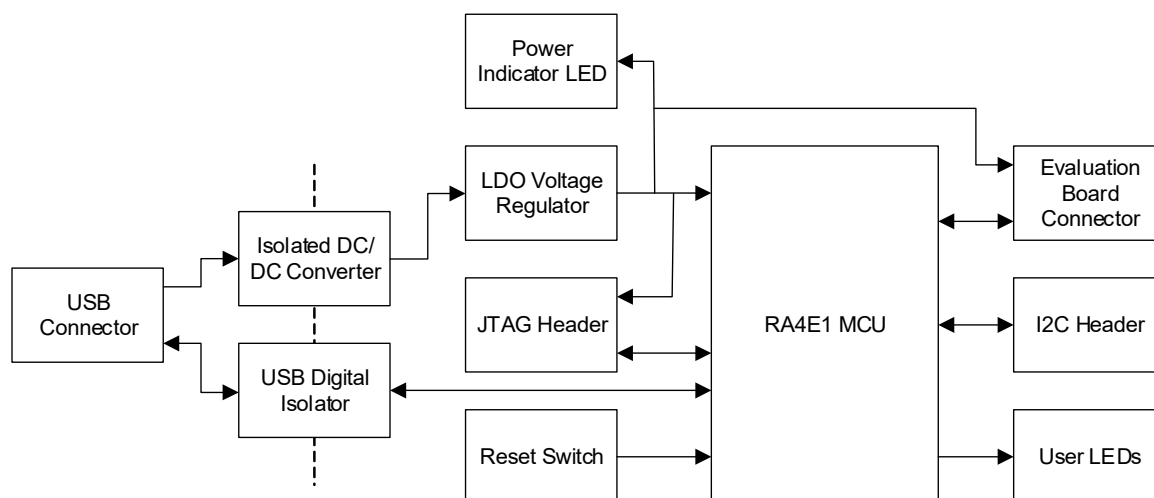


Figure 3. ISO-DONGLE-EV1Z Rev.D Block Diagram

2.2 Power Supply Options

The power source for the ISO-DONGLE-EV1Z Rev.D Isolated Communication Dongle is the 5V supplied from an external host to the USB Type-B connector USB1 of the dongle. Figure 4 shows the power supply scheme of the dongle. The isolated DC/DC converter U7 transfers power to the isolated side of the dongle with a maximum power limit up to 500mW. The Low Dropout (LDO) voltage regulator U1 converts and stabilizes the 5V (from the DC/DC converter) to 3.3V, which powers the MCU. Also, it is possible to back power the dongle from the evaluation board; in that case, R6 must be removed, and R5 must be populated with an 0Ω resistor.

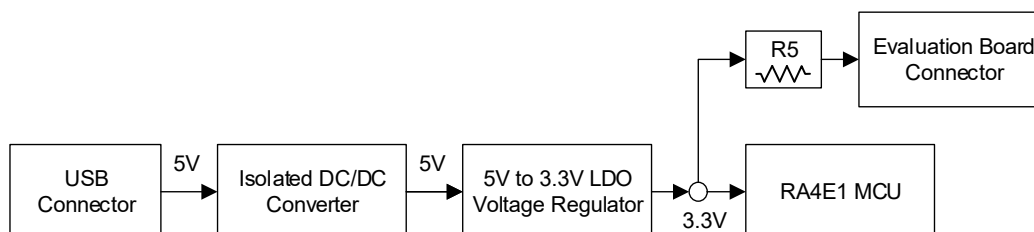


Figure 4. ISO-DONGLE-EV1Z Rev.D Power Supply Scheme

2.3 MCU Overview

The ISO-DONGLE-EV1Z Rev.D 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 a USB 2.0 Full-Speed Module (USBFS), Controller Area Network (CAN) module, 12-bit A/D Converter, and security and safety features.

Jumper J1 is used to connect the P201/MD and the P300/SWCLK/TCK pins, so select between On-chip Debug mode (closed) and Normal Operating mode (open).

Jumper J2 is used to select between different two firmware modes. For more information, refer to the *ISO-DONGLE-EV1Z REV.D Communications Dongle Software Manual*.

2.4 LEDs

The ISO-DONGLE-EV1Z Rev.D Isolated Communication Dongle has three red LEDs that are grouped on the board. D1 is a power indicator for the isolated MCU side of the dongle. When running the default firmware, D3 indicates a successfully connected USB driver; D4 indicates a communication error (Table 2). The LEDs are directly controlled by the MCU with open-drain outputs. A LED is illuminated when the output has a low level.

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-DONGLE-EV1Z Rev.D Isolated Communication Dongle has a reset switch SW1. It pulls down the RES pin of U5 and resets the MCU.

2.6 Supported Communication Interfaces

The ISO-DONGLE-EV1Z Rev.D Isolated Communication Dongle supports the following communication interfaces:

- Simple I²C Interface – The Simple I²C interface is available on the evaluation board connector, J1 (Pins 9 and 11) and on the I²C interface connector (Pins 1 and 4). It supports I²C bus format (master-only). The data rate is up to 400kHz. The dongle has DNP pull-up resistors for the SDA and SCL signals (R11 and R14).
- Simple Serial Peripheral Interface – The Simple SPI interface is available on the evaluation board connector, J1 (Pins 8, 9, 10, and 11). The MCU supports full duplex, synchronous serial communication.

Important: The Simple I²C and SPI interfaces share Pins 9 and 11 of the evaluation board connector, J1. Therefore, they cannot operate simultaneously.

Important: Both interfaces are galvanically isolated from the USB connector.

2.7 Device USB

The ISO-DONGLE-EV1Z Rev.D Isolated Communication Dongle is equipped with USB Device interface that provides data exchange with an external host (workstation) through the USB Type-B Connector USB1 (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 Type-B Connector (USB1)		ISO-DONGLE-EV1Z Rev.D
Pin	Description	Signal
1	+5VDC	USB_PWR
2	Data-	U6-6/UD- (U5-P915/USB_DM through digital isolator)
3	Data+	U6-7/UD+ (U5-P914/USB_DP through digital isolator)
4	GND	PC_GND
5	Mount	PC_GND
6	Mount	PC_GND

2.8 Evaluation Board Connector

The ISO-DONGLE-EV1Z Rev.D Isolated Communication Dongle connects with the BFE evaluation board using the header J1. Table 4 describes the pinout of the header. All pins are galvanically isolated from the USB port. The two supported communication interfaces, SPI and I²C, are sharing pins, so they cannot be used simultaneously. The SDA, SCL, ALRT, RESET, WKUP, and GPIO0 to GPIO3 have pull-up resistors to V3P3 (R2, R3, R11, R14, R15, R17, R27, R28, and R29). However, they are all left as DNP components because they have corresponding pull-ups on the evaluation board side.

Table 4. Evaluation Board Connector (J1) Pin Assignment

J1 Pin	J1 Signal	U5 (MCU) Pin	Port/Signal
1	VDD	2, 9, 12, 16, 30	VBATT, VCC, VBUS, VCC_USB (Selectable with R5)
2	GNDISO	4, 6, 13, 31, 43, 44, 49	XCIN, VSS, VSS/USB, AVSS0/VREFL, VREFL0
3	CMS0	29	P112/GPIO
4	CMS1	28	P111/GPIO
5	RESET	39	P014/GPIO
6	WKUP	38	P015/GPIO
7	ALRT	32	P104/GPIO
8	CS	33	P103/GPIO
9	SCL	11, 34	P408/SCL3, P102/SCK0
10	MOSI	35	P101/MOSI0
11	SDA	10, 36	P409/SDA3, P100/MISO0
12	GPIO0	48	P000/GPIO
13	GPIO1	47	P001/GPIO
14	GPIO2	46	P002/GPIO
15	GPIO3	40	P013/GPIO
16	GNDISO	4, 6, 13, 31, 43, 44, 49	XCIN, VSS, VSS/USB, AVSS0/VREFL, VREFL0

2.9 I²C Interface Connector

The ISO-DONGLE-EV1Z Rev.D Isolated Communication Dongle has an additional I²C interface connector that can be used with some evaluation boards. Table 5 describes the connector pinout. *Note:* The I²C signals are the same as on the evaluation board connector J1, so that only one of them can be used at a time. There are pull-up resistors for SDA and SCL (R11 and R14) that are DNP by default.

Table 5. I²C Interface Connector (I²C) Pin Assignment

J1 Pin	J1 Signal	U5 (MCU) Pin	Port/Signal
1	SCL	11, 34	P408/SCL3, P102/SCK0
2	GNDISO	4, 6, 13, 31, 43, 44, 49	XCIN, VSS, VSS/USB, AVSS0/VREFL, VREFL0
3	GNDISO	4, 6, 13, 31, 43, 44, 49	XCIN, VSS, VSS/USB, AVSS0/VREFL, VREFL0
4	SDA	10, 36	P409/SDA3, P100/MISO0

2.10 JTAG Connector

The ISO-DONGLE-EV1Z Rev.D 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 pinout 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. When using the Renesas E2 Emulator, verify 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-DONGLE-EV1Z Rev.D Isolated Communication Dongle as an MCU development platform. Any programming or debugging requires deep knowledge of the used RA4E1 MCU, Renesas E2 Emulator, and the IDE tool. The debug connector erases the default bootloader and firmware.

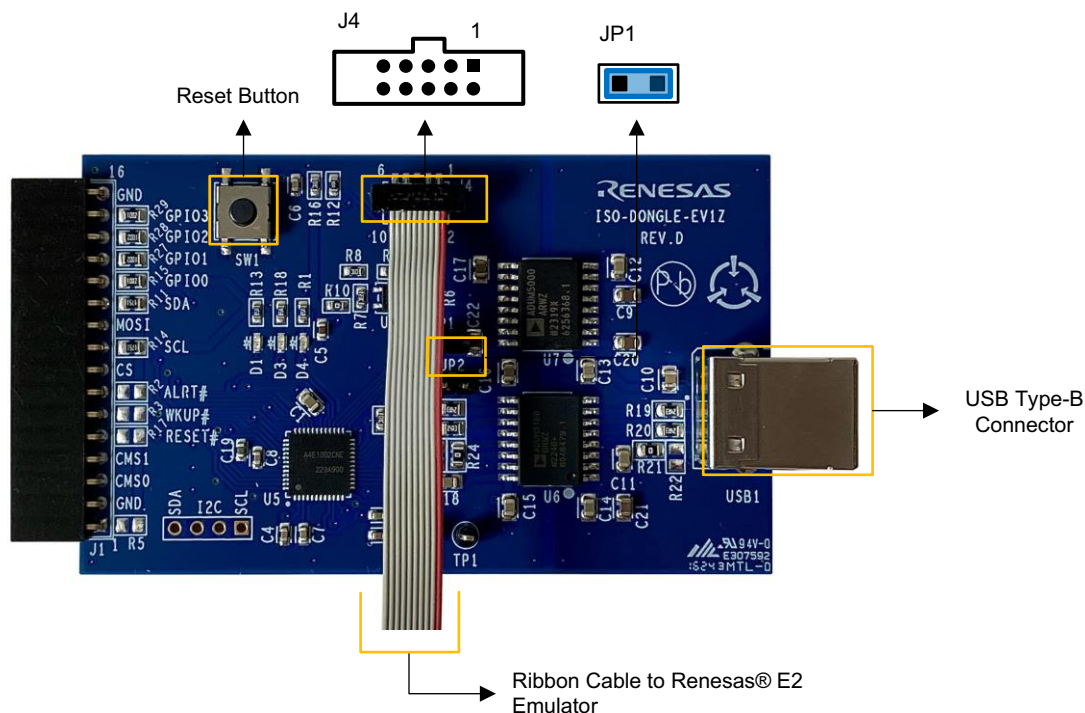


Figure 5. Communications Dongle with Attached Renesas E2 Emulator

Table 6. JTAG Connector Description

Pin	JTAG Connector (J11)	ISO-DONGLE-EV1Z Rev.D
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)

3. Technical Details

3.1 Schematic Diagrams

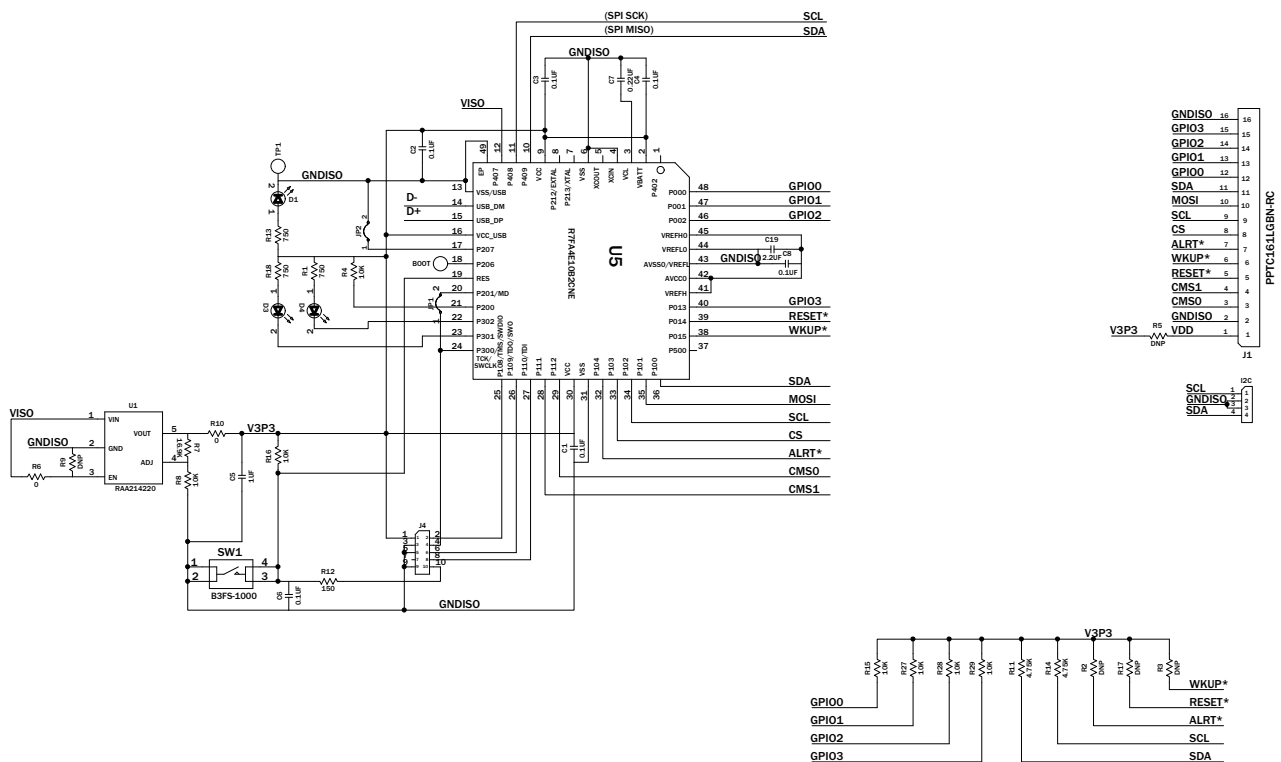


Figure 6. Schematic Diagram (1 of 2)

PC GROUND SIDE (EARTH GROUND)

FLOATING GROUND SIDE (GNDISO)

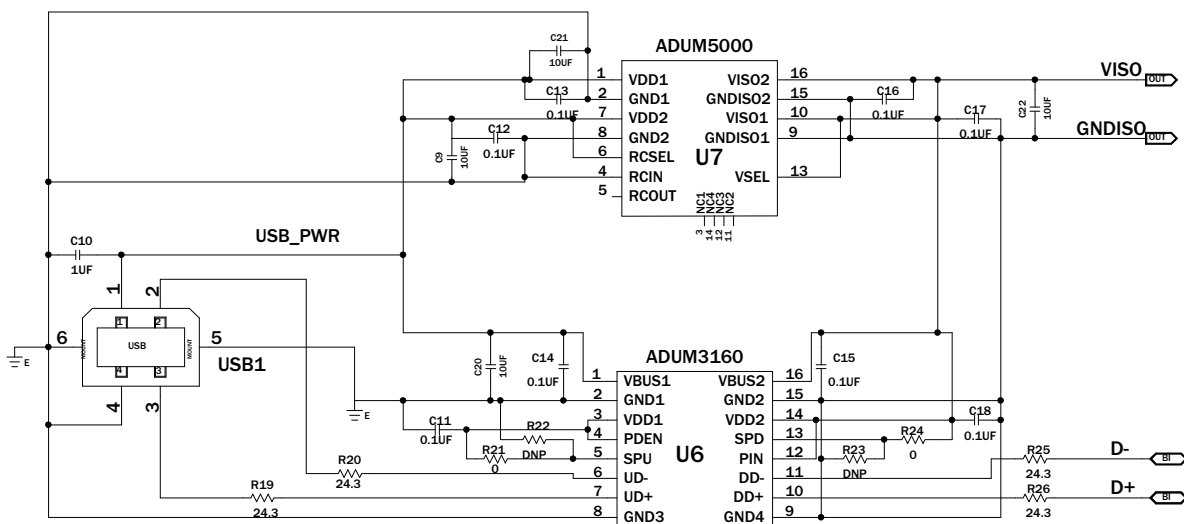


Figure 7. Schematic Diagram (2 of 2)

3.2 PCB Layout

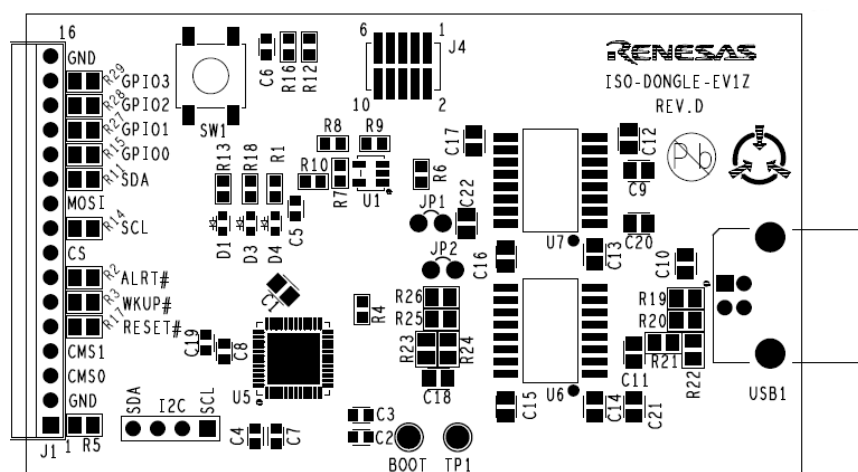


Figure 8. Top Overlay

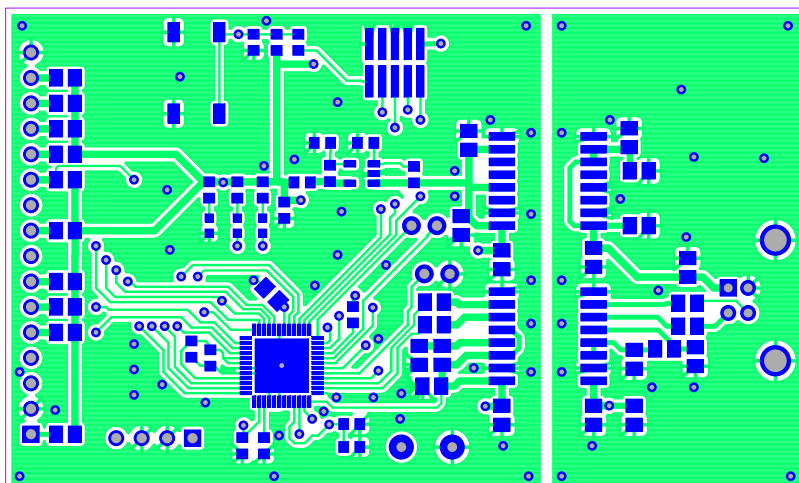


Figure 9. Top Layer

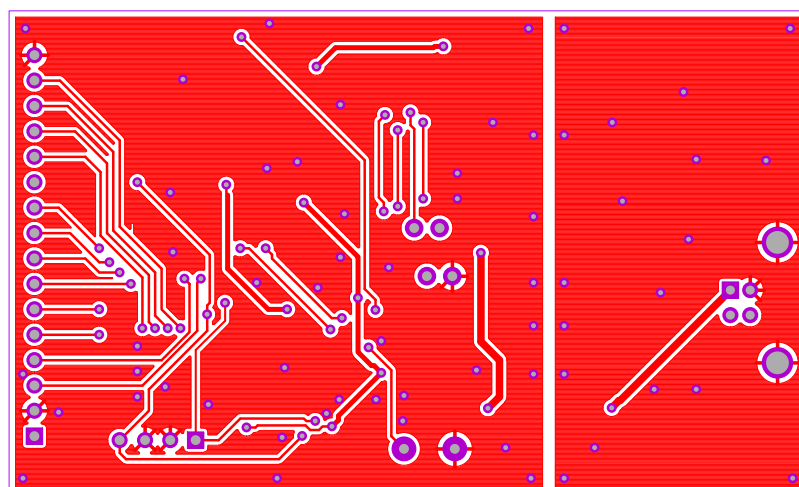


Figure 10. Bottom Layer

3.3 Bill of Materials

Reference Designator	Qty	Value	Description	Manufacturer	Manufacturer Part
I2C	1	-	Inline 4 pins × 0.1 inch Connector Strip	Various	CONN-1X4
BOOT, TP1	2	-	Miniature Black Test Point 0.100 Pad 0.040 Thole	Keystone	5001
USB1	1	-	Type B Receptacle USB Connector (RoHS compliant)	Mil-Max	897-43-004-90-000
U6	1	-	Full/Low Speed Digital 2.5kV Isolator with Integrated Iso Power.	Analog Devices	ADUM3160BRWZ
U7	1	-	2.5kV Isolator Power.	Analog Devices	ADUM5000ARWZ
SW1	1	-	SPST-NO General Purpose Pushbutton SMT Switch	Omron	B3FS-1000
C5	1	1μ	Multilayer Ceramic Capacitor	TDK	C1608X7R1C105K
C19	1	2.2μ	Multilayer Ceramic Capacitor	Taiyo Yuden	EMK107BJ225KA
J4	1	-	Male 10 Pin 2 × 5 at 50 mil pitch SMT Micro Header Connector	Samtec	FTS-105-01-F-DV
C2, C3, C4, C6, C8	5	0.1μ	Multilayer Ceramic Capacitor	Various	Generic
C7	1	0.22μ	Multilayer Ceramic Capacitor	Various	Generic
C1, C11, C12, C13, C14, C15, C16, C17, C18	9	0.1μ	Multilayer Ceramic Capacitor	Various	Generic
C10	1	1μ	Multilayer Ceramic Capacitor	Various	Generic
C9,C20,C21,C22	4	10μ	Chip Monolithic Cap	Various	Generic
R9	1	DNP	Metal Film Chip Resistor	Various	Generic
R2, R3, R5, R17, R22, R23	6	DNP	Thick Film Chip Resistor	Various	Generic
R6, R10	2	0	Thick Film Chip Resistor	Various	Generic
R4, R8, R16	3	10k	Thick Film Chip Resistor	Various	Generic
R12	1	150	Thick Film Chip Resistor	Various	Generic
R7	1	16.9k	Thick Film Chip Resistor	Various	Generic
R1, R13, R18	3	750	Thick Film Chip Resistor	Various	Generic
R21, R24	2	0	Thick Film Chip Resistor	Various	Generic
R15, R27, R28, R29	4	10k	Thick Film Chip Resistor	Various	Generic
R19, R20, R25, R26	4	24.3	Thick Film Chip Resistor	Various	Generic
R11, R14	2	4.75k	Thick Film Chip Resistor	Various	Generic
JP1, JP2	2	-	100 mil Spacing Two Pin Jumper	Various	JUMPER2_100
D1, D3, D4	3	-	SMT 0603 Red 1.8V 2mA 630nm 4.5MCD LED	OSRAM	LS L29K-G1J2-1-0-2-R18-Z-T
J1	1	-	FeMale Right Angle Inline 16 pins × 0.1 inch Header Connector	Sullins	PPTC161LGBN-RC
U5	1	-	256K Flash Memory Micro Controller	Renesas	R7FA4E10B2CNE
U1	1	-	150mA 20V Wide Input Voltage Range LDO Linear Regulator	Renesas	RAA2142204GP3#JA0

4. Revision History

Revision	Date	Description
1.01	Jul 24, 2025	Corrected board number throughout.
1.00	May 22, 2025	Initial release.

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