

RH4Z2501-PMOD

HW revision 1.1

This document explains the hardware design of the RH4Z2501-PMOD, its main features and the necessary hardware setup to implement an IO-Link device.

Target device: RH4Z2501 single channel IO-Link physical layer transceiver with integrated protection

Contents

- 1. Overview 2**
 - 1.1 RH4Z2501 Features 2
 - 1.2 RH4Z2501-PMOD Capabilities..... 3
- 2. Getting Started 3**
 - 2.1 System Block Diagram 3
 - 2.2 Default Board Configuration 3
- 3. RH4Z2501-PMOD Components 4**
 - 3.1 X1: M12 Connector..... 4
 - 3.2 X2: Block Terminal..... 4
 - 3.3 JP1: PMOD Connector 4
 - 3.4 JP2: Voltage Regulation Options (Onboard) 5
 - 3.5 JP3: Voltage Regulation Options (External)..... 5
 - 3.6 JP4: 3.3V PMOD Interface 5
 - 3.7 D1: C/Q-LED..... 5
- 4. Glossary..... 6**
- 5. Revision History 6**

Figures

- Figure 1. RH4Z2501-PMOD (Default Jumper Setting).....3
- Figure 2. System Block Diagram3
- Figure 3. X1: Pin Numbering (Front View).....4
- Figure 4. JP1: Pin Numbering (Front View).....4

Tables

- Table 1. Default Board Configuration3
- Table 2. X1: Pin Assignment4
- Table 3. JP1: Pin Assignment.....4

1. Overview

1.1 RH4Z2501 Features

The RH4Z2501-PMOD is a PMOD module for the RH4Z2501 Renesas silicon solution. The purpose of the module is to be used with a standard MCU evaluation board with a PMOD interface to implement an IO-Link Device.

The RH4Z2501 offers the following features:

- Voltage range from 9V to 36V
- Over voltage peak robustness of $\pm 60V$
- Configurable driver output current 50mA DC to 600mA DC
- $R_{DS(on)}$ of less than 2.5Ω
- Adjustable driver slew rate
- Integrated wake-up detection
- MCU assisted Wake-up generation (typically 600mA)
- OWI digital communication and calibration interface
- Integrated linear voltage regulators: 3.3V and 5V
- Ambient temperature range $-40^{\circ}C$ to $125^{\circ}C$
- Glitch filter for receiver
- Integrated Protection
 - $\pm 1.25kV/2.5A$ (peak) surge protection for VDD, CQ, GND (8/20 μs pulse according to IEC 61000-4-5)
- Reverse polarity protection for L+, CQ, GND/L-
- On-chip diagnostics:
 - Over-temperature detection
 - Supply voltage monitor
 - Broken chip detection

For more information, refer to the *RH4Z2501 Datasheet* document.

1.2 RH4Z2501-PMOD Capabilities

The RH4Z2501-PMOD integrates an IO-Link PHY to equip MCU Evaluation Boards containing PMOD with the IO-Link interface.



Figure 1. RH4Z2501-PMOD (Default Jumper Setting)

Note: Do NOT adjust any jumper settings on the RH4Z2501-PMOD during powered operation!

2. Getting Started

2.1 System Block Diagram

Figure 2 shows the system overview for the RH4Z2501-PMOD.

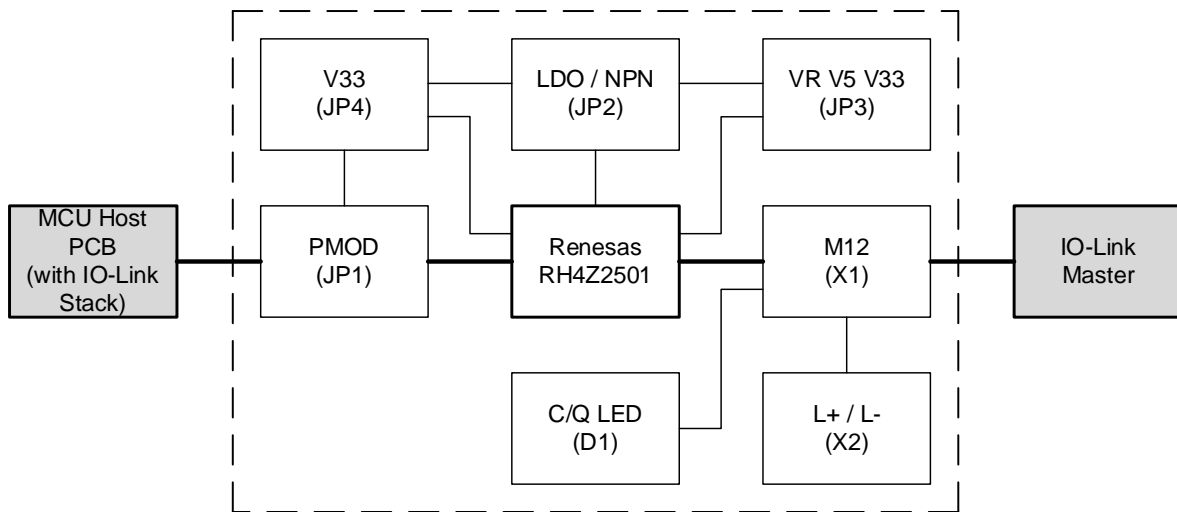


Figure 2. System Block Diagram

2.2 Default Board Configuration

Table 1 lists the default configuration for the RH4Z2501-PMOD.

Table 1. Default Board Configuration

Jumper/Switch	Default Position
JP2	LDO
JP3	Open
JP4	Closed

3. RH4Z2501-PMOD Components

3.1 X1: M12 Connector

X1 is a male 4-pin M12-A-coded connector. It enables an easy connection between the RH4Z2501-PMOD and an IO-Link Master. IO-Link is a serial, bidirectional point-to-point connection for signal transmission and power supply to sensors and actuators. The RH4Z2501-PMOD features a 4 pin Class A device port with the pin assignment as in Figure 3 and Table 2. For usage of Pin 2, populate R6 with a 0 Ohm resistor.

Table 2. X1: Pin Assignment

Pin	Signal	Designation
1	L+	Power Supply (+), 24V
2	I/Q	NC/DI(OSSDe)/DO/ AI/AO, Routed to pin 8 of JP1
3	L-	Power Supply (-), 0V / GND
4	C/Q	SIO(OSSDe)/SDCI, SIO (DI/DO) or SDCI (IO-Link coded data)

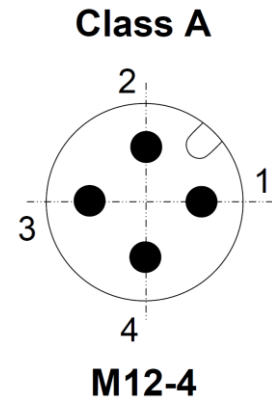


Figure 3. X1: Pin Numbering (Front View)

3.2 X2: Block Terminal

X2 offers direct access to L+ and L- from the M12 connector.

3.3 JP1: PMOD Connector

The RH4Z2501-PMOD is connected to Host MCU PCB (with IO-Link device stack) via JP1 carrying a PMOD interface.

Table 3. JP1: Pin Assignment

Pin	Function
1	OWI/DIAG
2	TxD
3	RxD
4	NC
5	GND
6	3V3
7	/WU
8	I/Q (connected to X1 pin 2)
9	TxEN
10	NC
11	GND
12	3V3

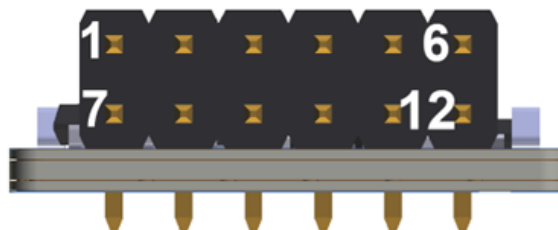


Figure 4. JP1: Pin Numbering (Front View)

3.4 JP2: Voltage Regulation Options (Onboard)

The RH4Z2501-PMOD enables the following methods to regulate the voltage supplied from the IO-Link Master:

- Set jumper to position LDO to use the internal LDO to regulate the voltage (maximum 50mA).
- Set jumper to position NPN to use the external NPN transistor (Q2) to regulate the voltage. The heat from voltage drop between 24V and 5V is generated in the external transistor and not in the RH4Z2501 IC. Current is limited by maximum supply current from Master and PCB thermal limits.

3.5 JP3: Voltage Regulation Options (External)

All voltage regulation pins are accessible on JP3 to implement external power options, for example, an external transistor or DC-DC converter. For more information, refer to the *RH4Z2501 Datasheet* document.

3.6 JP4: 3.3V PMOD Interface

When JP4 is closed, 3.3V power supply on PMOD interface is enabled (maximum 50mA if internal LDO is used).

3.7 D1: C/Q-LED

The RH4Z2501-PMOD has an LED that indicates the status of the C/Q line (IO-Link communication status). Its signal is regulated by NPN transistor Q1 and its voltage divider.

4. Glossary

Term	Description
C/Q	C/Q line of IO-Link interface. Connection for communication (C) or switching (Q) signal.
DC	Direct Current
DC-DC	Direct Current - Direct Current
GND	Ground
IC	Integrated Circuit
IO	Input Output
LDO	Low Drop Out
LED	Light Emitting Diode
MCU	Microcontroller
NPN	Negative-Positive-Negative
OWI	One Wire Interface
PCB	Printed Circuit Board
PHY	Physical Layer
PMOD	Digilent Pmod™ Connector

5. Revision History

Revision	Date	Description
1.0	Apr.15.24	Initial release.

Notice

1. Descriptions of circuits, software and other related information in this document are provided only to illustrate the operation of semiconductor products and application examples. You are fully responsible for the incorporation or any other use of the circuits, software, and information in the design of your product or system. Renesas Electronics disclaims any and all liability for any losses and damages incurred by you or third parties arising from the use of these circuits, software, or information.
2. Renesas Electronics hereby expressly disclaims any warranties against and liability for infringement or any other claims involving patents, copyrights, or other intellectual property rights of third parties, by or arising from the use of Renesas Electronics products or technical information described in this document, including but not limited to, the product data, drawings, charts, programs, algorithms, and application examples.
3. No license, express, implied or otherwise, is granted hereby under any patents, copyrights or other intellectual property rights of Renesas Electronics or others.
4. You shall be responsible for determining what licenses are required from any third parties, and obtaining such licenses for the lawful import, export, manufacture, sales, utilization, distribution or other disposal of any products incorporating Renesas Electronics products, if required.
5. You shall not alter, modify, copy, or reverse engineer any Renesas Electronics product, whether in whole or in part. Renesas Electronics disclaims any and all liability for any losses or damages incurred by you or third parties arising from such alteration, modification, copying or reverse engineering.
6. Renesas Electronics products are classified according to the following two quality grades: "Standard" and "High Quality". The intended applications for each Renesas Electronics product depends on the product's quality grade, as indicated below.
 - "Standard": Computers; office equipment; communications equipment; test and measurement equipment; audio and visual equipment; home electronic appliances; machine tools; personal electronic equipment; industrial robots; etc.
 - "High Quality": Transportation equipment (automobiles, trains, ships, etc.); traffic control (traffic lights); large-scale communication equipment; key financial terminal systems; safety control equipment; etc.
- Unless expressly designated as a high reliability product or a product for harsh environments in a Renesas Electronics data sheet or other Renesas Electronics document, Renesas Electronics products are not intended or authorized for use in products or systems that may pose a direct threat to human life or bodily injury (artificial life support devices or systems; surgical implantations; etc.), or may cause serious property damage (space system; undersea repeaters; nuclear power control systems; aircraft control systems; key plant systems; military equipment; etc.). Renesas Electronics disclaims any and all liability for any damages or losses incurred by you or any third parties arising from the use of any Renesas Electronics product that is inconsistent with any Renesas Electronics data sheet, user's manual or other Renesas Electronics document.
7. No semiconductor product is absolutely secure. Notwithstanding any security measures or features that may be implemented in Renesas Electronics hardware or software products, Renesas Electronics shall have absolutely no liability arising out of any vulnerability or security breach, including but not limited to any unauthorized access to or use of a Renesas Electronics product or a system that uses a Renesas Electronics product. RENESAS ELECTRONICS DOES NOT WARRANT OR GUARANTEE THAT RENESAS ELECTRONICS PRODUCTS, OR ANY SYSTEMS CREATED USING RENESAS ELECTRONICS PRODUCTS WILL BE INVULNERABLE OR FREE FROM CORRUPTION, ATTACK, VIRUSES, INTERFERENCE, HACKING, DATA LOSS OR THEFT, OR OTHER SECURITY INTRUSION ("Vulnerability Issues"). RENESAS ELECTRONICS DISCLAIMS ANY AND ALL RESPONSIBILITY OR LIABILITY ARISING FROM OR RELATED TO ANY VULNERABILITY ISSUES. FURTHERMORE, TO THE EXTENT PERMITTED BY APPLICABLE LAW, RENESAS ELECTRONICS DISCLAIMS ANY AND ALL WARRANTIES, EXPRESS OR IMPLIED, WITH RESPECT TO THIS DOCUMENT AND ANY RELATED OR ACCOMPANYING SOFTWARE OR HARDWARE, INCLUDING BUT NOT LIMITED TO THE IMPLIED WARRANTIES OF MERCHANTABILITY, OR FITNESS FOR A PARTICULAR PURPOSE.
8. When using Renesas Electronics products, refer to the latest product information (data sheets, user's manuals, application notes, "General Notes for Handling and Using Semiconductor Devices" in the reliability handbook, etc.), and ensure that usage conditions are within the ranges specified by Renesas Electronics with respect to maximum ratings, operating power supply voltage range, heat dissipation characteristics, installation, etc. Renesas Electronics disclaims any and all liability for any malfunctions, failure or accident arising out of the use of Renesas Electronics products outside of such specified ranges.
9. Although Renesas Electronics endeavors to improve the quality and reliability of Renesas Electronics products, semiconductor products have specific characteristics, such as the occurrence of failure at a certain rate and malfunctions under certain use conditions. Unless designated as a high reliability product or a product for harsh environments in a Renesas Electronics data sheet or other Renesas Electronics document, Renesas Electronics products are not subject to radiation resistance design. You are responsible for implementing safety measures to guard against the possibility of bodily injury, injury or damage caused by fire, and/or danger to the public in the event of a failure or malfunction of Renesas Electronics products, such as safety design for hardware and software, including but not limited to redundancy, fire control and malfunction prevention, appropriate treatment for aging degradation or any other appropriate measures. Because the evaluation of microcomputer software alone is very difficult and impractical, you are responsible for evaluating the safety of the final products or systems manufactured by you.
10. Please contact a Renesas Electronics sales office for details as to environmental matters such as the environmental compatibility of each Renesas Electronics product. You are responsible for carefully and sufficiently investigating applicable laws and regulations that regulate the inclusion or use of controlled substances, including without limitation, the EU RoHS Directive, and using Renesas Electronics products in compliance with all these applicable laws and regulations. Renesas Electronics disclaims any and all liability for damages or losses occurring as a result of your noncompliance with applicable laws and regulations.
11. Renesas Electronics products and technologies shall not be used for or incorporated into any products or systems whose manufacture, use, or sale is prohibited under any applicable domestic or foreign laws or regulations. You shall comply with any applicable export control laws and regulations promulgated and administered by the governments of any countries asserting jurisdiction over the parties or transactions.
12. It is the responsibility of the buyer or distributor of Renesas Electronics products, or any other party who distributes, disposes of, or otherwise sells or transfers the product to a third party, to notify such third party in advance of the contents and conditions set forth in this document.
13. This document shall not be reprinted, reproduced or duplicated in any form, in whole or in part, without prior written consent of Renesas Electronics.
14. Please contact a Renesas Electronics sales office if you have any questions regarding the information contained in this document or Renesas Electronics products.

(Note1) "Renesas Electronics" as used in this document means Renesas Electronics Corporation and also includes its directly or indirectly controlled subsidiaries.

(Note2) "Renesas Electronics product(s)" means any product developed or manufactured by or for Renesas Electronics.

(Disclaimer Rev.5.0-1 October 2020)

Corporate Headquarters

TOYOSU FORESIA, 3-2-24 Toyosu,
Koto-ku, Tokyo 135-0061, Japan
www.renesas.com

Trademarks

Renesas and the Renesas logo are trademarks of Renesas Electronics Corporation. All trademarks and registered trademarks are the property of their respective owners.

Contact Information

For further information on a product, technology, the most up-to-date version of a document, or your nearest sales office, please visit:
www.renesas.com/contact/