

CCE4511 Evaluation Board V1

8-Channel IO-Link Master with PMOD interface

This document provides a short description on how to start using the CCE4511 Evaluation Board that is designed to evaluate the CCE4511 IO-Link Master Transceiver with integrated Frame Handler.

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1. Introduction

CCE4511 devices can be evaluated by using the CCE4511 Evaluation Board connected to any suitable external MCU.

The CCE4511 Evaluation Board contains two CCE4511 devices including all necessary periphery to use them for IO-Link communication on 8 channels with any suitable external MCU.

The CCE4511 Evaluation Board is compliant with the [IO-Link Interface and System Specification V1.1.3](#), and it can be controlled by either of the following methods:

- Via SPI, using the PMOD interface (JP7 or JP8)
- Control each channel directly via UART interface (JP2, JP3, JP5 and JP6)

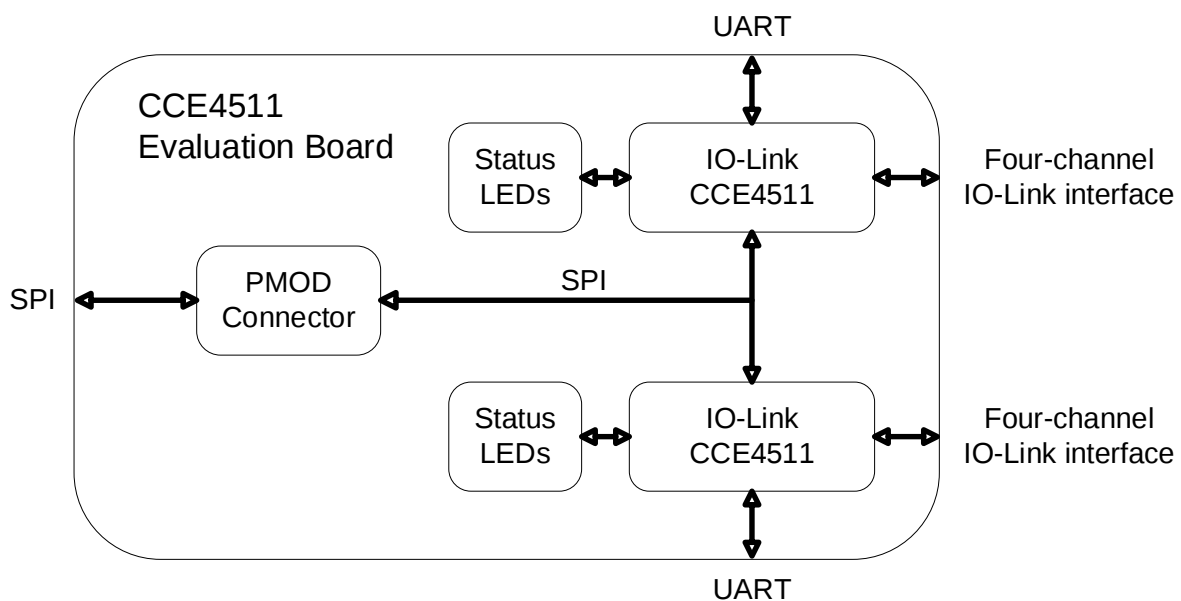


Figure 1. System Diagram

2. System Requirements

For evaluation, the following tools are required:

- External MCU (for example, Renesas YCONNECT-IT-RZN2L)
- 24V Power supply
- 3.3V Power supply for the CCE4511 Evaluation Board and the external MCU
- IDE and coding tool (e.g. Renesas e² Studio)

The following tools are optional depending on the user setup:

- Connection cable to connect external MCU to PMOD interface (JP7 or JP8), use it if no PMOD interface is available on MCU side.
- Connection cables to connect UART interfaces to external MCU

3. Board Hardware Overview

The CCE4511 Evaluation Board has the following features (for placement of parts and connectors, see Figure 2):

- M12 A-Coded IO-Link connectors (8 channels)
- Optional IO-Link Port Class B power supply for all IO-Link channels
- Two CCE4511 IO-Link Master Transceiver ICs
- Two status LED indicators per channel
- External NMOS gate drivers
- Additional on-board protection circuitry
- Power LED indicators
- PMOD type 2A (expanded SPI)
- UART interface pin-headers
- +3.3V power select jumper

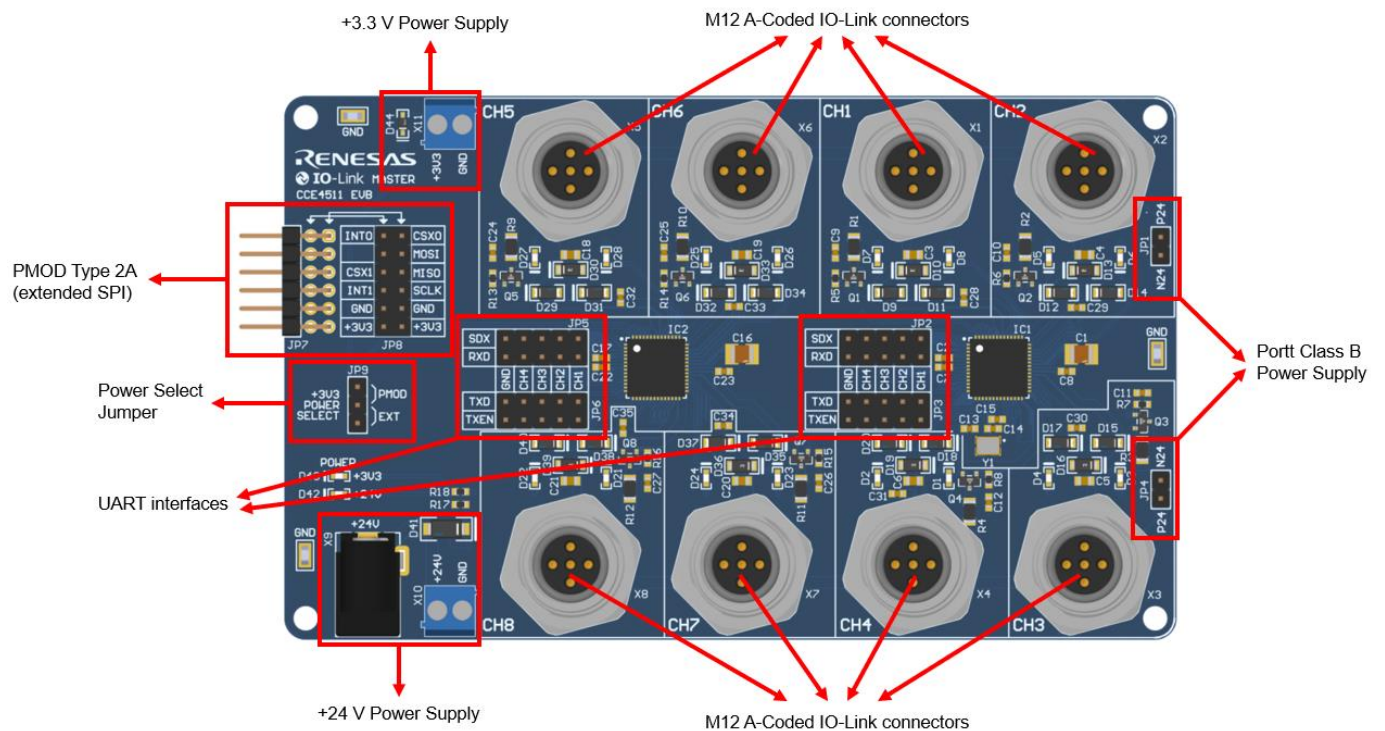


Figure 2. Board Overview

3.1 Power Supply

The Evaluation Board needs to be powered by two external power supplies: the main supply voltage V_{VS} (+24V, X9 or X10) and the pad supply voltage V_{VDDIO} (+3.3V, X11).

Note: Both supply voltages are mandatory for proper functionality!

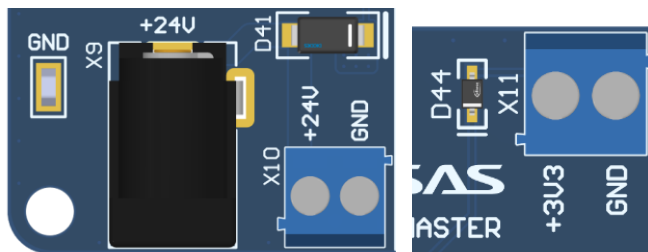


Figure 3. Power Supply Connectors

X9 is a standard DC Power Jack (Würth Elektronik PN 694106301002) with a center pin diameter of 2mm. The recommended plug inner diameter is 2.1mm, recommended plug outer diameter is 5.5mm.

It is possible to supply the connected IO-Link devices with a port class B power supply via JP1 and JP4, where:

- JP1 supplies CH1, CH2, CH5, CH6
- JP4 supplies CH3, CH4, CH7, CH8.

It is possible to power the pad supply voltage V_{VDDIO} (+3.3V) via the connected MCU using the PMOD interface. If a jumper is placed at the PMOD position of the power select jumper (JP9), the connected MCU powers the pad supply voltage. If a jumper is placed at the EXT position, the pad supply voltage needs to be sourced externally (see Figure 4).

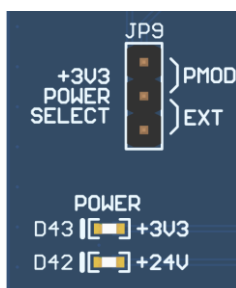


Figure 4. Power Select and Power LEDs

Two LEDs (D42 and D43) indicate if the power supplies are available.

3.2 Connectivity

The CCE4511 Evaluation Board contains two CCE4511 IO-Link Master Transceiver ICs, implementing 8 IO-Link Master ports. Each IO-Link Master port uses a standard M12 A-Coded connector to connect an IO-Link Device.

Table 1 shows the assignment of the channels of each CCE4511 (IC1 and IC2) to the channel names of the Evaluation Board.

Table 1. Channel Assignment

Channel Name	IC1 Channel	IC2 Channel
CH1	Channel 1	
CH2	Channel 2	
CH3	Channel 3	

Channel Name	IC1 Channel	IC2 Channel
CH4	Channel 4	
CH5		Channel 1
CH6		Channel 2
CH7		Channel 3
CH8		Channel 4

Each channel is using an external NMOS (Q1 for CH1) to switch the LP voltage of the channel on or off, and an 0.5Ω resistor (R1 for CH1) to limit the channels maximum current to 500mA utilizing the CCE4511s LPx over-current detection feature.

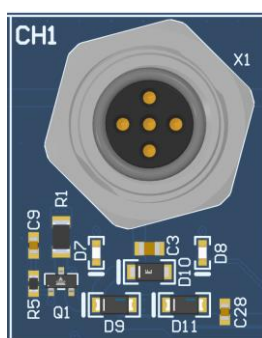


Figure 5. Channel 1

Each channel is protected against surge, burst and reverse polarity using two TVS diodes and one Schottky diode, see section 5 for details.

Two LEDs (D7 and D8 for CH1) with programmable 8-bit pattern can be used to indicate the channels status.

To connect the CCE4511 Evaluation Board to an MCU, use the PMOD connector (JP7 or JP8) and the UART interface connectors (JP2 and JP3 for IC1, JP5 and JP6 for IC2).

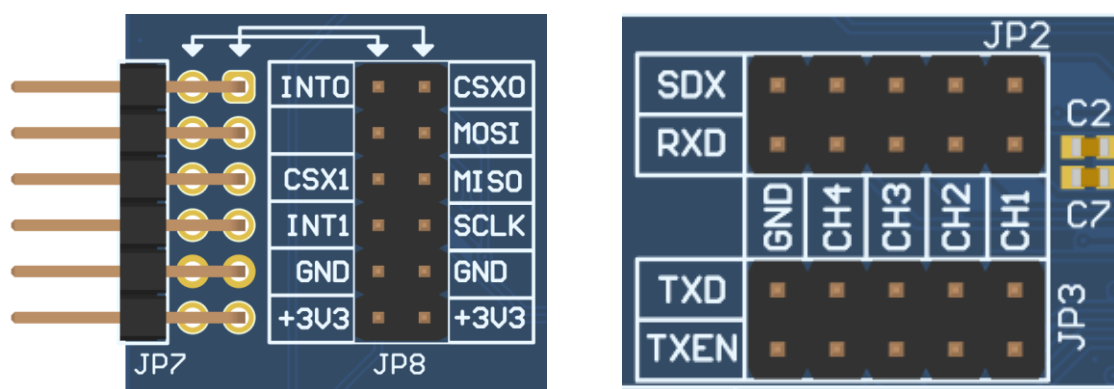


Figure 6. PMOD and UART Interface

JP7 and JP8 have the same pin assignment. JP8 allows for easy access to the SPI signals for measurements while the CCE4511 Evaluation Board is connected to any host MCU via JP7.

It is possible to directly control the channels using the UART interface of each CCE4511, see the *CCE4511 Datasheet* document for more information about directly controlling the channels.

4. Getting Started

To start evaluating devices using the CCE4511 Evaluation Board, follow these steps:

1. Connect the PMOD interface (JP7 or JP8) to an external MCU.
2. Set jumper JP9 to use either the PMOD power supply or an external power supply for 3.3V (pad supply voltage V_{DDIO})
If external 3.3V: connect the external 3.3V power supply (X11)
3. Connect the 24V power supply (X10)
4. Power on the 3.3V power supply
5. Power on the 24V power supply
6. Start customer specific evaluation.

6. Bill of Materials

Qty	Reference Designator	Description	Manufacturer	Manufacturer Part Number
2	C1, C16	CAP, SMD, 1210, 10 μ F, 63V, 10%, X7R	Any	Any
2	C2, C17	CAP, SMD, 0603, 100 nF, 50 V, 10%, X5R,	Any	Any
8	C3, C4, C5, C6, C18, C19, C20, C21	CAP, SMD, 0805, 1 μ F, 100 V, 10%, X7R	Any	Any
2	C7, C22	CAP, SMD, 0603, 4.7 μ F, 16 V, 10%, X7R	Any	Any
2	C8, C23	CAP, SMD, 0603, 1 μ F, 16 V, 10%, X7R	Any	Any
9	C9, C10, C11, C12, C13, C24, C25, C26, C27	CAP, SMD, 0603, 470 pF, 50 V, 10%, X7R,	Any	Any
2	C14, C15	CAP, SMD, 0603, 18 pF, 50 V, 10%, X7R	Any	Any
8	C28, C29, C30, C31, C32, C33, C34, C35	CAP, SMD, 0603, 270 pF, 100 V, 10%, X7R	Any	Any
16	D1, D2, D3, D4, D5, D6, D7, D8, D21, D22, D23, D24, D25, D26, D27, D28	WL-SMCW Mono-color Chip LED Waterclear, size 0603, Blue, 3.2V, 140°	Würth Elektronik	150060BS75000
16	D9, D11, D12, D14, D15, D17, D18, D20, D29, D31, D32, D34, D35, D37, D38, D40	Rectifier Schottky Diode, 1 Phase, 1 Element, 2A, 60V V(RRM), Silicon	Diodes	SBR2U60S1F-7
8	D10, D13, D16, D19, D30, D33, D36, D39	Trans Voltage Suppressor Diode, 400W, 33V V(RWM), Unidirectional, 1 Element, Silicon	Littelfuse	SMF4L33A

Qty	Reference Designator	Description	Manufacturer	Manufacturer Part Number
1	D41	DIODE SBR 50V 5A SMA	Diodes Inc.	SBRT5A50SA-13
2	D42, D43	Single Color LED, Ultra Bright Green, Water Clear, 1.1mm	Vishay Lite-On	LTST-C191KGKT
1	D44	Rectifier Diode, Schottky, 1 Phase, 1 Element, 3A, 10V V(RRM), Silicon	Infineon	BAT60AE6327HTSA1
2	IC1, IC2	CCE4511 4 Channel IO-Link Master	Renesas	CCE4511
2	JP1, JP4	Pin Header, THT, Vertical, pitch 2.54mm, 1 Row, 2P	Würth Elektronik	61300211121
4	JP2, JP3, JP5, JP6	Pin Header, THT, Vertical, pitch 2.54mm, 2 Row, 10P	Würth Elektronik	61301021121
1	JP7	Pin Header, THT, Angled, pitch 2.54mm, 2 Row, 12P (PMOD)	Würth Elektronik	61301221021
1	JP8	WR-PHD Pin Header, THT, Vertical, pitch 2.54mm, 2 Row, 12P (PMOD)	Würth Elektronik	61301221121
1	JP9	WR-PHD Pin Header, THT, Vertical, pitch 2.54mm, 1 Row, 3P	Würth Elektronik	61300311121
8	Q1, Q2, Q3, Q4, Q5, Q6, Q7, Q8	Single N-Channel 40 V 3 W 13 nC Silicon Surface Mount Mosfet - SOT-23	Vishay Siliconix	SQ2318AES-T1_GE3
8	R1, R2, R3, R4, R9, R10, R11, R12	RES, SMD, 1216, 0.5R, 500 mW, 1%	Any	Any
8	R5, R6, R7, R8, R13, R14, R15, R16	RES, SMD, 0603, 100 k Ω , 50 V, 1.0%, 100 mW	Any	Any
1	R17	RES, SMD, 0603, 10k Ω , 50 V, 1.0%, 250 mW	Any	Any
1	R18	RES, SMD, 0603, 560 Ω , 50 V, 1.0%, 100 mW	Any	Any
3	TP1, TP2, TP3	Test Point	Keystone Electronics	5015
8	X1, X2, X3, X4, X5, X6, X7, X8	WR-CIRC Panel Mount Connector, THT, Vertical, Female, 5p	Würth Elektronik	643260100605
1	X9	WR-DC DC Power Jack Connector, Male, Right Angled, 24V, 5A	Würth Elektronik	694106301002
2	X10, X11	WR-TBL Series 1031 Horizontal Entry Modular, THT, pitch 3.5mm, 2p	Würth Elektronik	691103110002
1	Y1	WE-XTAL Quartz Crystal, SMT, CFPX-180, 14.7456MHz, +/-20ppm	Würth Elektronik	830055293

1. The components used may vary due to limited availability.

7. Ordering Information

Part Number	Description
CCE4511-EVAL-V1	CCE4511 Evaluation Board V1

8. Glossary

Term	Description
CAP	Capacitor
DC	Direct current
IC	Integrated circuit
IDE	Integrated development environment
IO	Input output
LED	Light emitting diode
LPx	IO-Link interface LP pins
MCU	Micro controller unit
NMOS	N-type metal-oxide semiconductor
PMOD	Peripheral module
RES	Resistor
RWM	Reverse working maximum voltage
SMD	Surface mount device
SPI	Serial peripheral interface
THT	Through hole technology
TVS	Transient voltage suppressor
UART	Universal asynchronous receiver transmitter

9. Revision History

Revision	Date	Description
0.1	Jul 24, 2024	Preliminary release.

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