
 CCE4503 Evaluation Board

1. ABSTRACT

The CCE4503 evaluation board is designed to evaluate and demonstrate the CCE4503 IO-Link Device IC.

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2. INTRODUCTION

The board is divided into three sections:

- **IO-Link Section**
The IO-Link section contains all necessary circuitry to use one CCE4503 (with an adjustable current limit and slew rate) for IO-Link communication as well as several connectors.
- **Sensor Section**
The sensor section contains three different sensors to provide a variety of signals and measurement capabilities (temperature sensor, color sensor and proximity switch).
- **MCU Section**
The MCU section contains an LPC1347 32-bit ARM Cortex-M3 microcontroller from NXP to control the CCE4503 Device IC as well as the provided sensors.

For maximum flexibility, the sections can be used separately and independently from each other. This allows to evaluate the CCE4503 Device IC with any suitable sensor application and MCU or both.

The CCE4503 Evaluation Board is delivered with a CCE4503 with 3.3 V LDO.

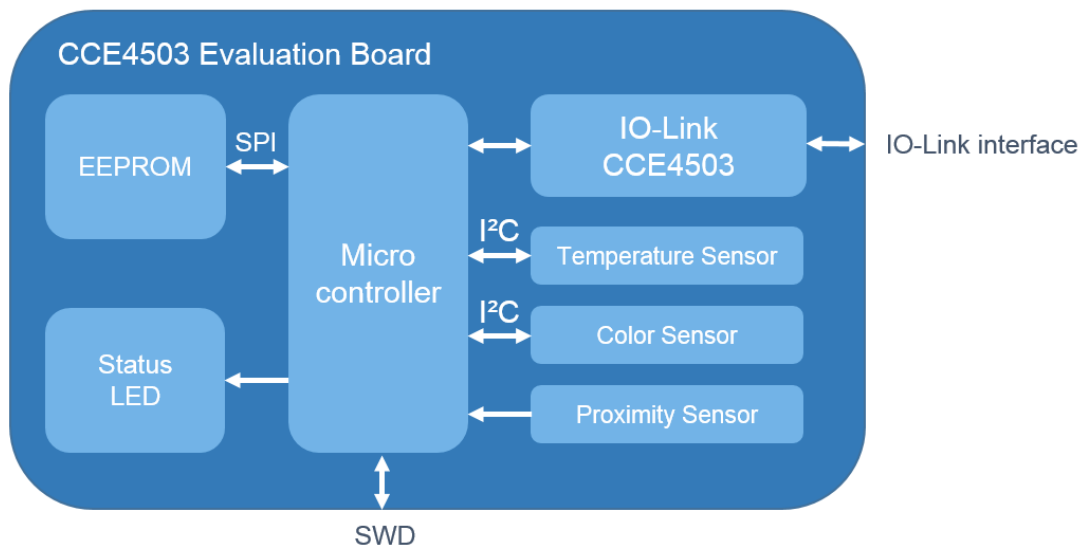


Figure 1: System Diagram

3. SYSTEM REQUIREMENTS

The CCE4503 Evaluation Board is ready to use with a preinstalled IO-Link Device Stack.

To get started, the following tools are required:

- Power Supply 24V (IO-Link Master)
- Debug probe (for programming via SWD)

4. FEATURE OVERVIEW

- ARM Cortex-M3 Microcontroller
- Programmable via SWD
- Reset Button
- Status LED indicator
- 8 Kbit EEPROM
- Additional on-board protection circuitry
- All pins accessible via pin-headers
For microcontroller and IO-Link Device IC
- CCE4503 IO-Link Device IC
- M12 connector + terminal blocks
- Three on-board sensors
 - Temperature sensor
 - Color Sensor
 - Proximity sensor / switch
- Independent use of sections (IO-Link, Sensor, MCU)

5. GETTING STARTED

Programming via SWD

1. Connect debug probe to SWD connector (X1)
2. Set R8 to the desired value (current limit)
3. Power on the Evaluation Board (IO-Link interface L+ = 24V, L- = GND)
4. Start programming with your preferred SDK (Software Development Kit)

6. POWER SUPPLY

The Evaluation Board is supplied via the L+ voltage of the IO-Link interface which has to be 24 V. The IO-Link interface comprises L+, L- and CQ, and it can be accessed via an M12 connector or terminal clamps. Three SMAJ33A TVS diodes are used to provide additional protection against high voltage bursts.

At port VDD, a regulated voltage of 3.3 V is generated by a LDO regulator. This regulator supplies the digital I/O pads of the CCE4503, the MCU and the sensors. VDD can supply additional external components, but the overall external load at VDD must not exceed 20 mA. The current consumption of the MCU, the sensors and external components must be below this limit.

7. SECTIONS OF THE CCE4503 EVALUATION BOARD

All sections can be used separately. The connection between the sections can be disconnected by cutting them open between the cutting marks (see Figure 2). Make sure not to break the evaluation board. To reestablish the connection, a pin header with 2.54 mm pitch can be used.

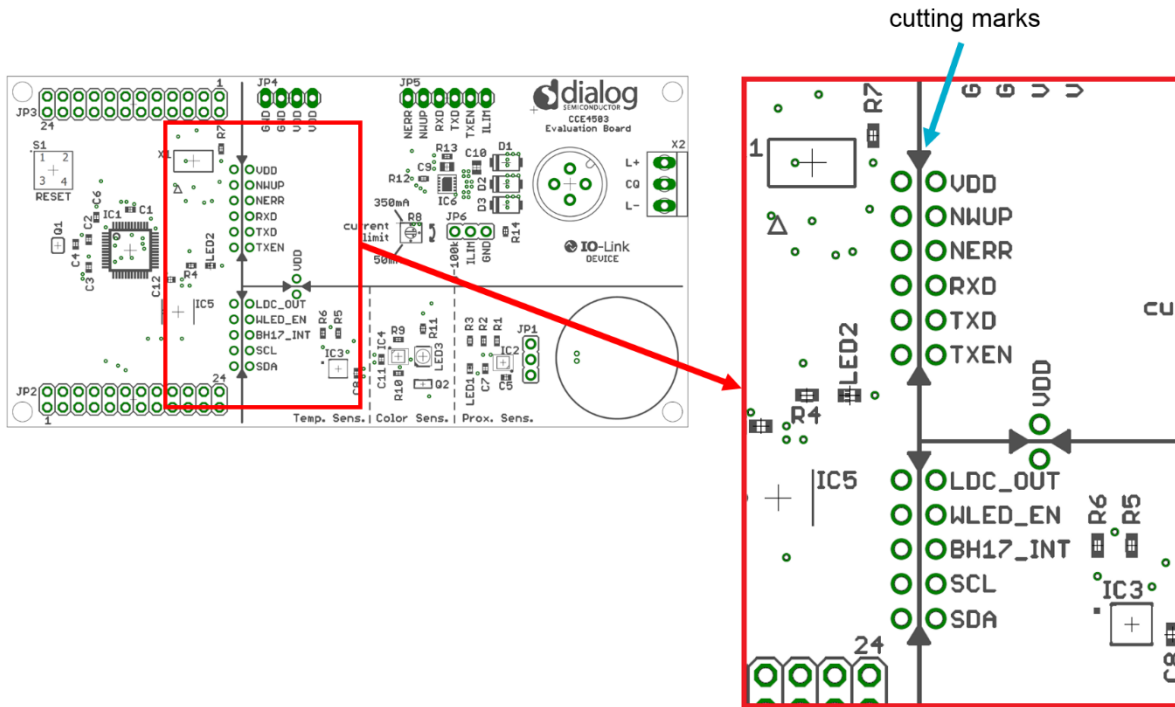


Figure 2: Cutting Marks

IO-Link Section

The IO-Link section contains the reference design for using the CCE4503. The current limit and the slew rate can be adjusted either by using the potentiometer R8, a fixed resistor R14 (not placed) or by connecting ILIM to GND or VDD. When using R14, please remove jumper on JP6.

A variety of connectors including an M12 a-coded 4-pin connector are placed on the IO-Link section.

Sensor Section

The sensor section contains three sensors which can be used for demonstration and evaluation of the IO-Link communication.

Temperature Sensor

Features of the temperature sensor:

- SI7055-A20-IM (Silicon Labs)
- I²C interface
- -40 °C to +125 °C (±0.5 °C)

Color Sensor

Features of the color sensor:

- BH1745NUC-E2 (ROHM)
- I²C interface
- 16 bit serial output RGBC

For successful measurements, activate LED3 (white LED) to illuminate the object to be measured. In order to get a better result, keep the object close to the sensor and reduce incident ambient light.

Proximity Sensor / Inductive Switch

Features of the proximity sensor / inductive switch:

- LDC0851HDSGR (Texas Instruments)
- Simple switching output

For successful measurements, the object held over the printed coils should be about the same size as the printed coils (for example a coin). The switching distance is about 5 mm. LED1 (red LED) signals a detected object.

MCU Section

All usable pins of the LPC1347 can be accessed via the connectors JP2 and JP3.

In case the on-board sensors are not used, the connection between the MCU section and the sensor section can be disconnected and the pins used for the sensor section can be used for any other purpose. Note that the pull-up resistors of the I²C communication are placed on the sensor section.

Connector X1 (JTAG) is used to program the LPC1347.

LED2 (green LED) is used as status LED and can be used for any purpose.

8. SCHEMATIC AND LAYOUT

Connectors

Figure 3 shows all connectors of the CCE4503 Evaluation Board. Via the connectors it is possible to access all necessary pins of the MCU and the CCE4503 device IC.

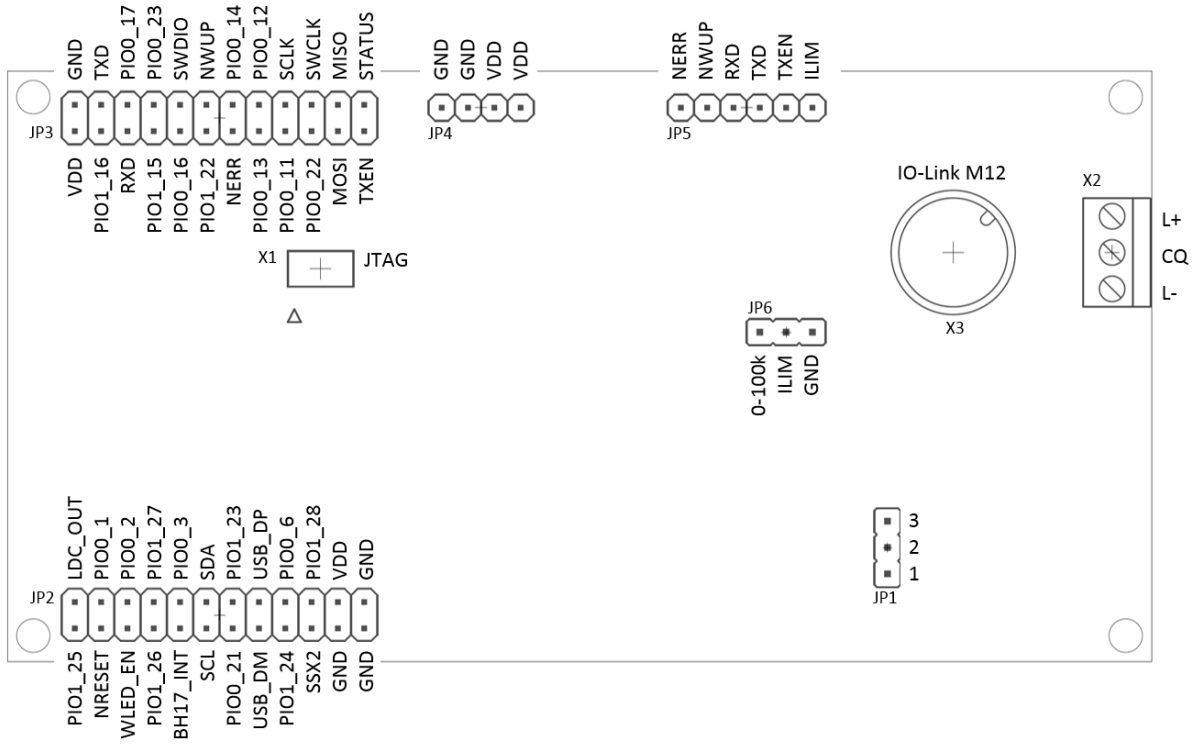


Figure 3: Connectors

Schematic

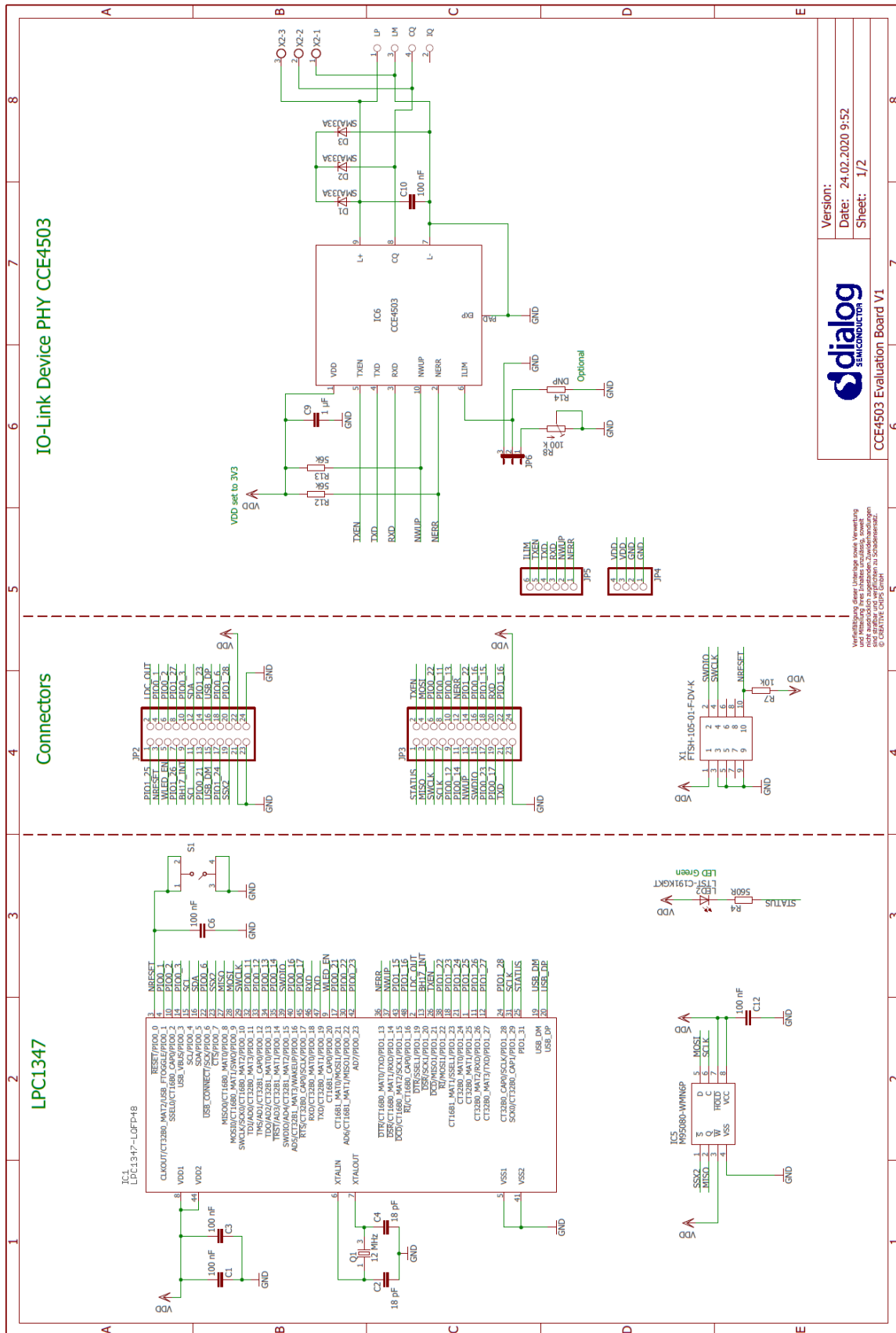


Figure 4: Schematic 1

Layout

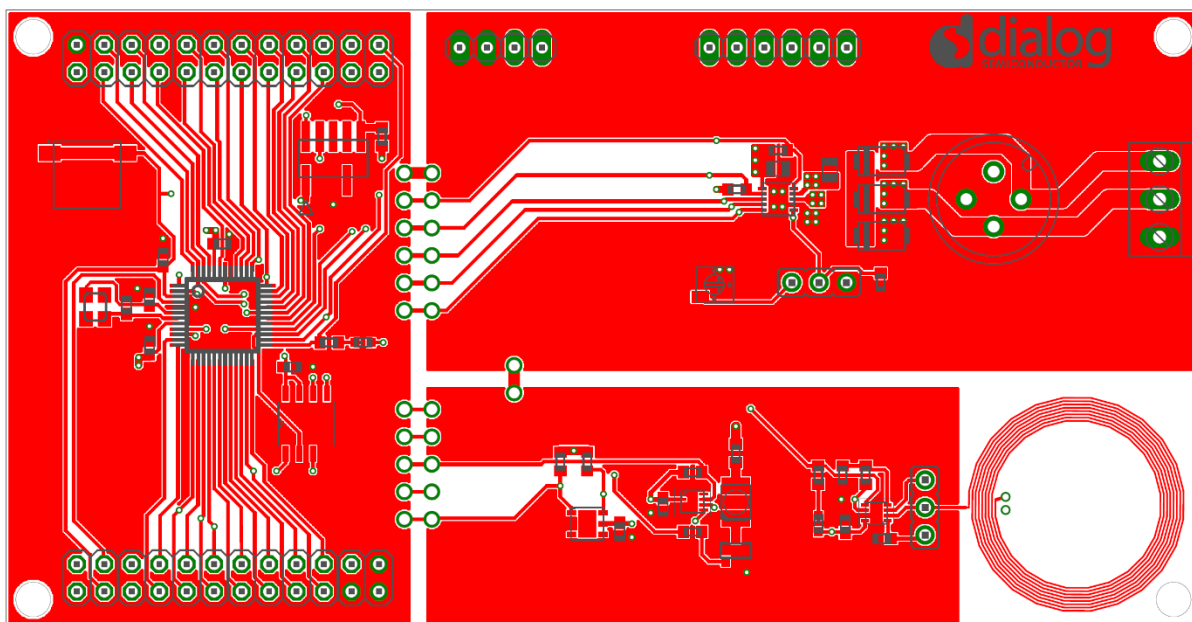


Figure 6: Layout TOP

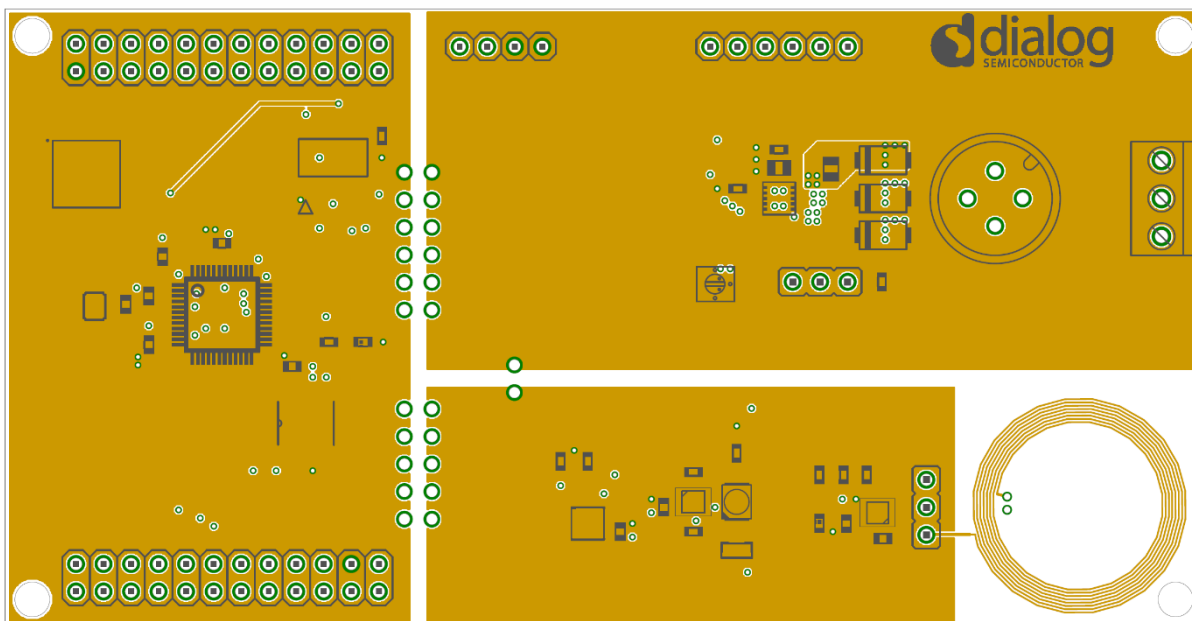


Figure 7: Layout MID 1

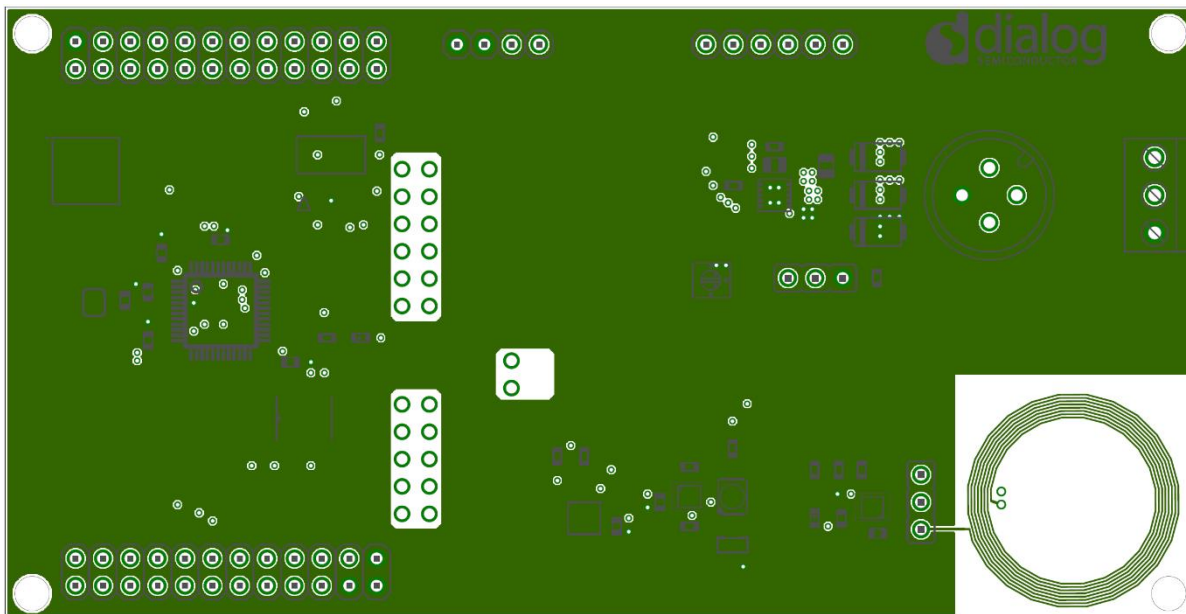


Figure 8: Layout MID 2

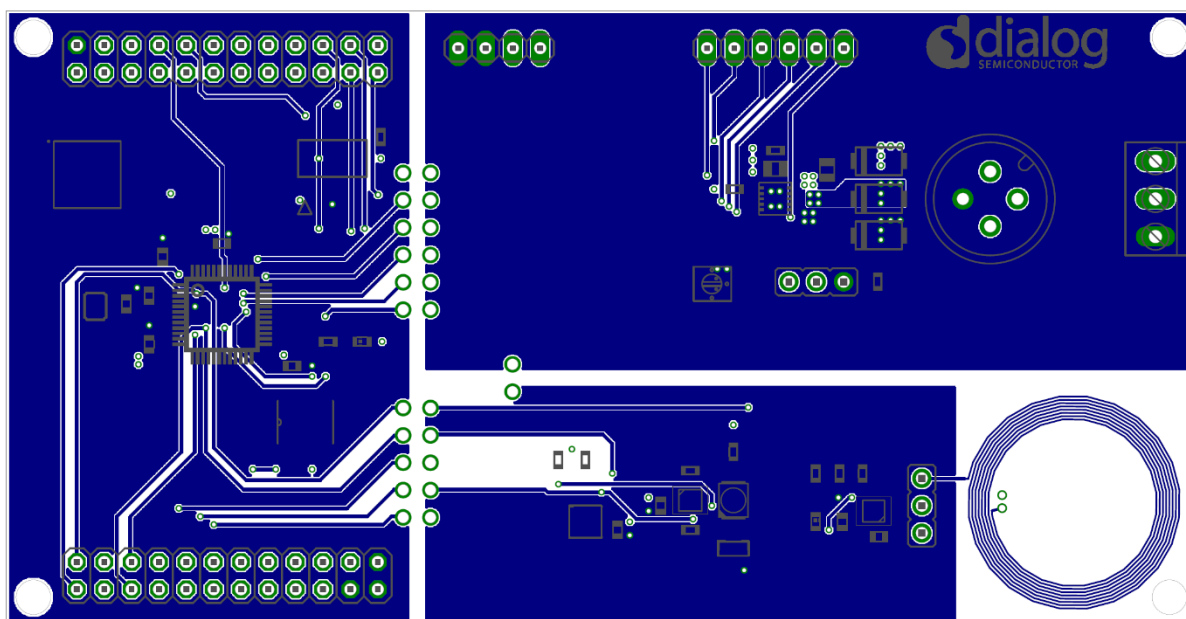


Figure 9: Layout BOTTOM

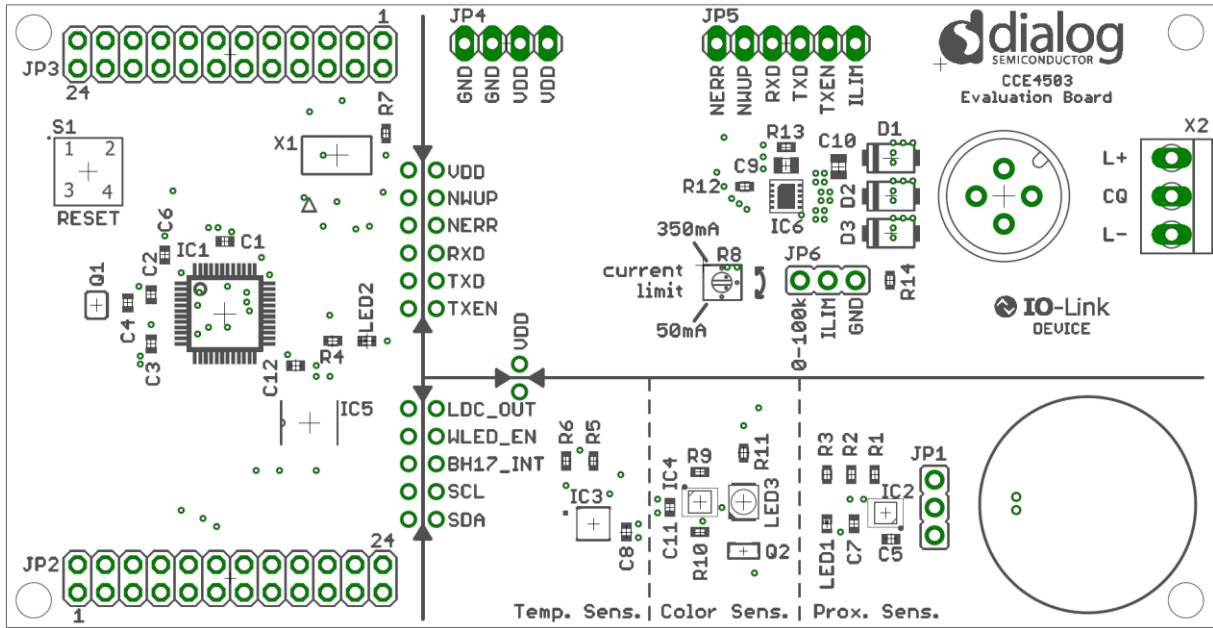


Figure 10: Layout Assembly

9. BILL OF MATERIALS

| Part | Value / Description | Manufacturer | Manufacturer Part Number |
|------------------------|---------------------------------|------------------------|--------------------------|
| C1,C3,C6,C7,C8,C11,C12 | 100 nF, 50 V, X7R, 10 %, 0603 | Any | Any |
| C2,C4 | 18 pF, 50 V, C0G, 5 %, 0603 | Any | Any |
| C5 | 1 nF, 50 V, C0G, 5 %, 0603 | Any | Any |
| C9 | 1 µF, 50 V, X7R, 10 %, 0805 | Any | Any |
| C10 | 100 nF, 50 V, X7R, 10 %, 0805 | Any | Any |
| D1,D2,D3 | SMAJ33A | Littelfuse Inc. | SMAJ33A |
| IC1 | LPC1347 Microcontroller | NXP | LPC1347FBD48,151 |
| IC2 | Proximity Sensor | Texas Instruments | LDC0851HDSGR |
| IC3 | Temperature Sensor | Silicon Labs | SI7055-A20-IM |
| IC4 | Color Sensor | ROHM | BH1745NUC-E2 |
| IC5 | EEPROM 8kbit | STMicroelectronics | M95080-WMN6P |
| IC6 | CCE4503 DFN10 | Dialog Semiconductor | CCE4503DR43 |
| JP1,JP6 | Pin Header 3-Pin 2.54 mm | Any | Any |
| JP2,JP3 | Pin Header 24-Pin 2.54 mm | Any | Any |
| JP4 | Pin Header 4-Pin 2.54 mm | Any | Any |
| JP5 | Pin Header 6-Pin 2.54 mm | Any | Any |
| LED1 | LED Red | Lite-On Inc. | LTST-C191KRKT |
| LED2 | LED Green | Lite-On Inc. | LTST-C191KGKT |
| LED3 | LED White | Broadcom Limited | ASMT-UWB1-NX3F2 |
| Q1 | 12 MHz SMD Crystal | ABRACON | ABM8G-106-12.000MHZ-T |
| Q2 | N-Channel MOSFET | ON SEMICONDUCTOR | BSS138 |
| R1 | 49.9 k, 50 V, 100 mW, 1 %, 0603 | Any | Any |
| R2 | 3.3 k, 50 V, 100 mW, 1 %, 0603 | Any | Any |
| R3 | 680 R, 50 V, 100 mW, 1 %, 0603 | Any | Any |
| R4 | 560 R, 50 V, 100 mW, 1 %, 0603 | Any | Any |
| R5,R6,R7,R9,R10 | 10 k, 50 V, 100 mW, 1 %, 0603 | Any | Any |
| R8 | Pot.100 k, 125 mW, 20 % | TT Electronics | 22AR100KLFTR |
| R11 | 270 R, 50 V, 100 mW, 1 %, 0603 | Any | Any |
| R12,R13 | 56 k, 50V, 100 mW, 1 %, 0603 | Any | Any |
| R14 | 0603 | DNP | DNP |
| S1 | SMD Switch | Würth Electronics Inc. | 430481035816 |
| X1 | SMT Micro Header | SAMTEC | FTSH-105-01-F-DV-K |
| X2 | Wire-to-Board Connector | METZ CONNECT | 31059103 |
| X3 | M12 Connector | binder | 09-0431-212-04 |

10. REVISION HISTORY

| Revision | Date | Description |
|----------|-------------|------------------|
| 1 | 13-Mar-2020 | Initial version. |
| 2 | 28-Jan-2022 | Rebrand |

11. REFERENCES

- [1] CCE4503, Datasheet, Dialog Semiconductor.
- [2] LPC1347FBD48,151, Datasheet, NXP.
- [3] IO-Link Interface and System Specification V1.1.2, IO-Link Community.

12. STATUS DEFINITIONS

| Status | Definition |
|-------------------------|--|
| DRAFT | The content of this document is under review and subject to formal approval, which may result in modifications or additions. |
| APPROVED or unmarked | The content of this document has been approved for publication. |

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Corporate Headquarters

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

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Corporate Headquarters

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

Contact Information

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