User Manual

CCE4503 Evaluation Board

UM-IO-003

Abstract

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

Contents

Figures

CCE4503 Evaluation Board

1   References

[1]   CCE4503, Datasheet, Dialog Semiconductor.

[2]   LPC1347FBD48,151, Datasheet, NXP.

[3]   IO-Link Interface and System Specification V1.1.2, IO-Link Community.

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.
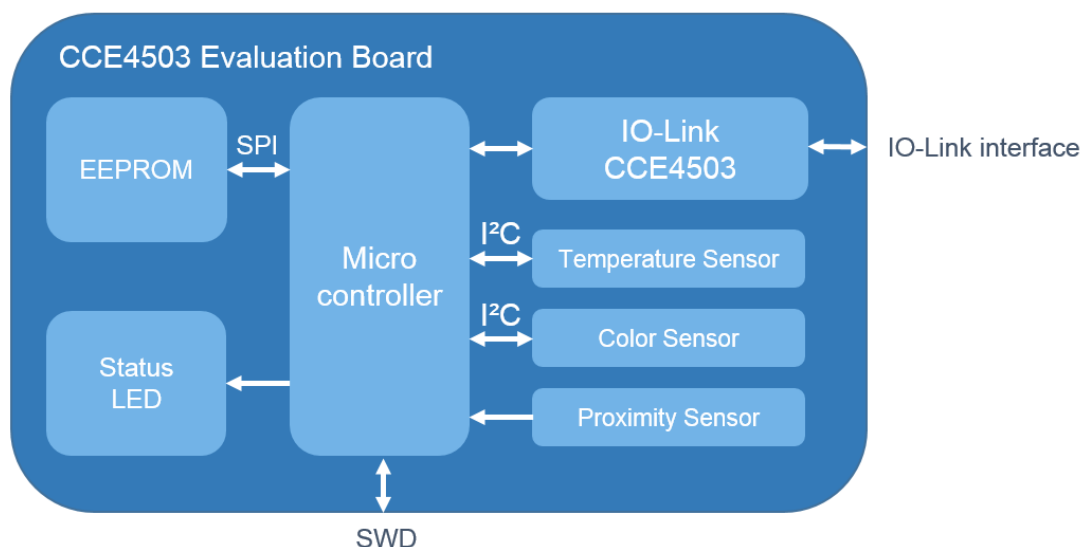

Figure 1: System Diagram

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.
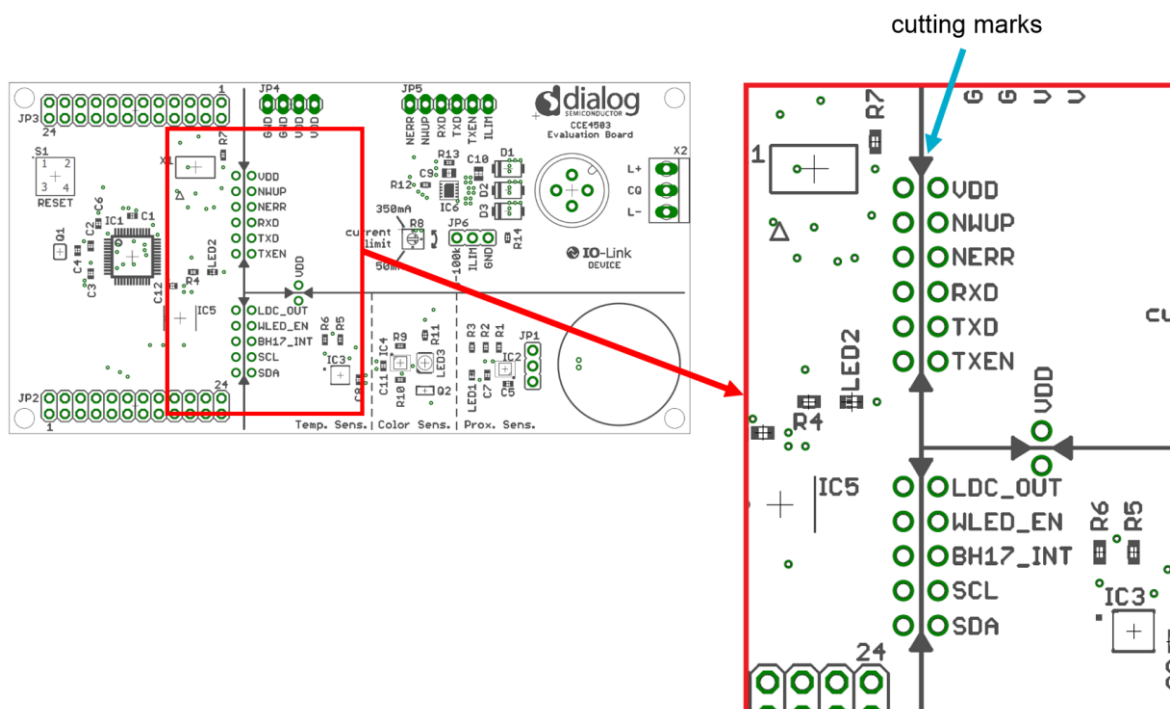

Figure 2: Cutting Marks

7.1 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.

7.2 Sensor Section

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

7.2.1 Temperature Sensor

Features of the temperature sensor:

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

7.2.2 Color Sensor

Features of the color sensor:

- BH1745NUC-E2 (ROHM)
- I^2C 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.

7.2.3 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.

7.3 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 I^2C 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.

CCE4503 Evaluation Board

8 Schematic and Layout

8.1 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.
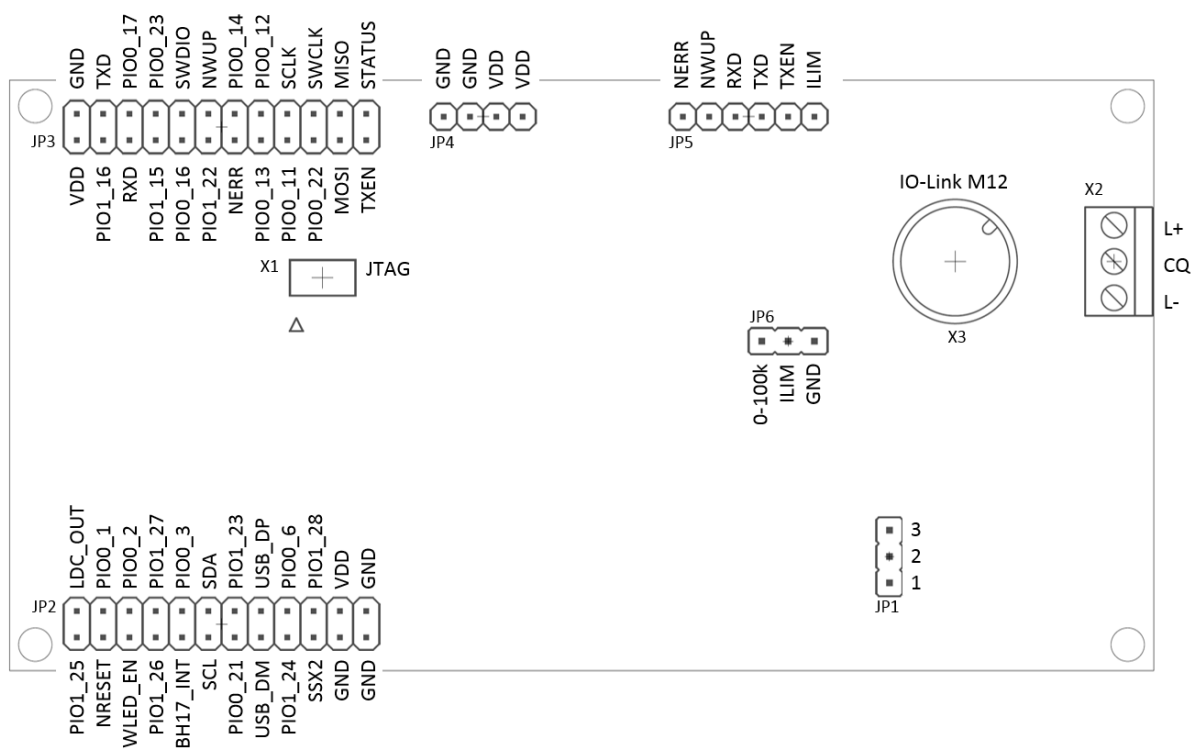
Figure 3: Connectors

CCE4503 Evaluation Board

8.2   Schematic

Figure 4: Schematic 1
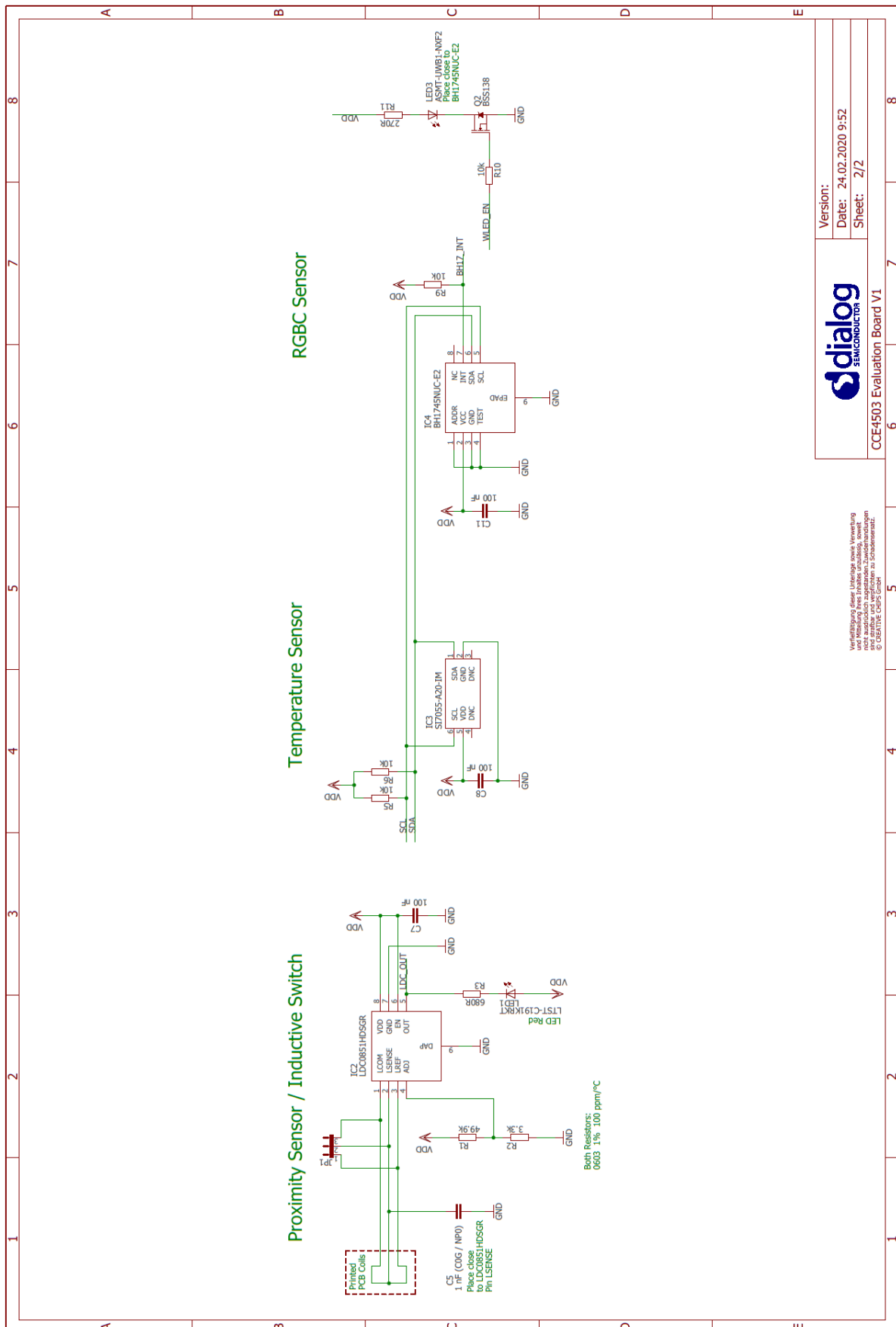
Figure 5: Schematic 2

8.3 Layout
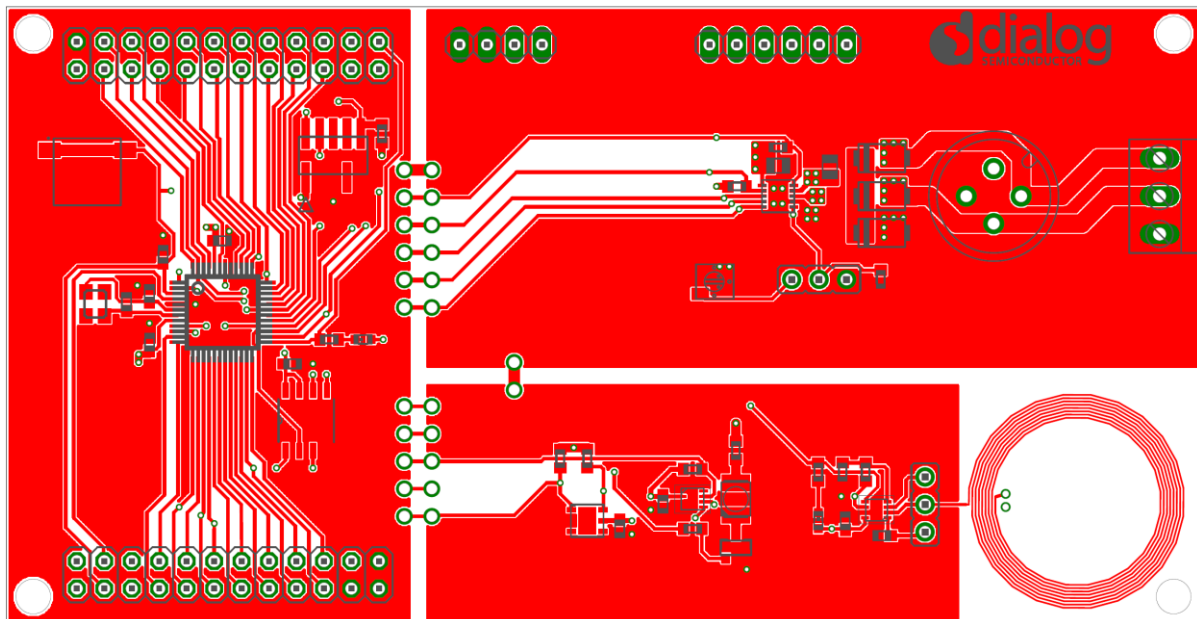
Figure 6: Layout TOP

Figure 7: Layout MID 1

User Manual

Revision 1

13-Mar-2020

CFR0012

10 of 15

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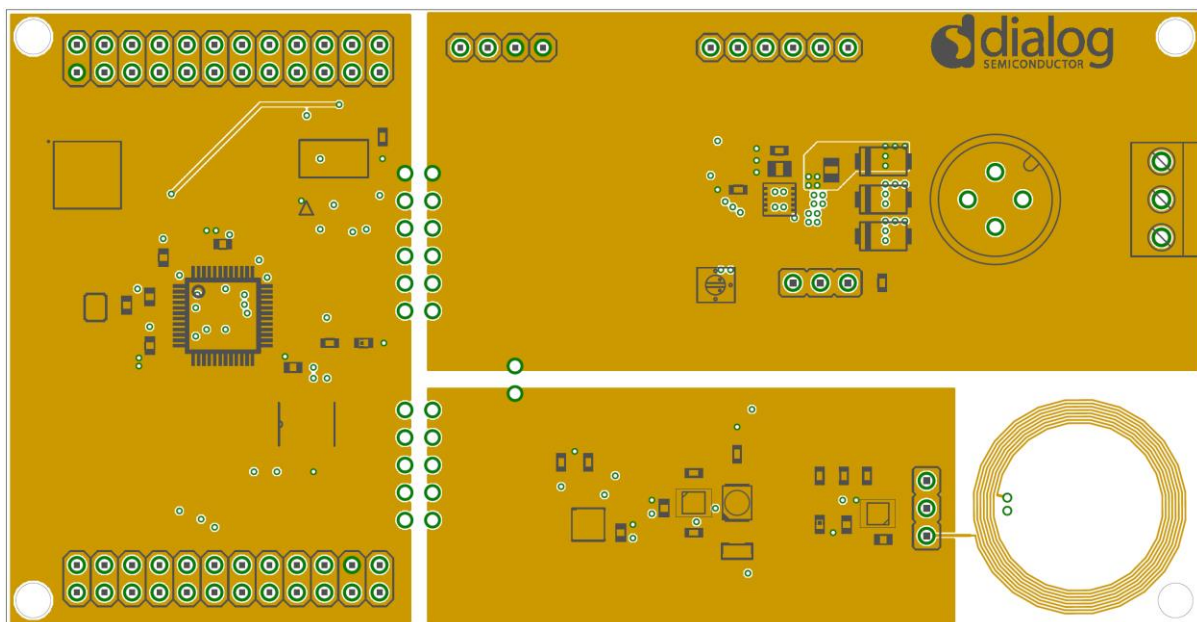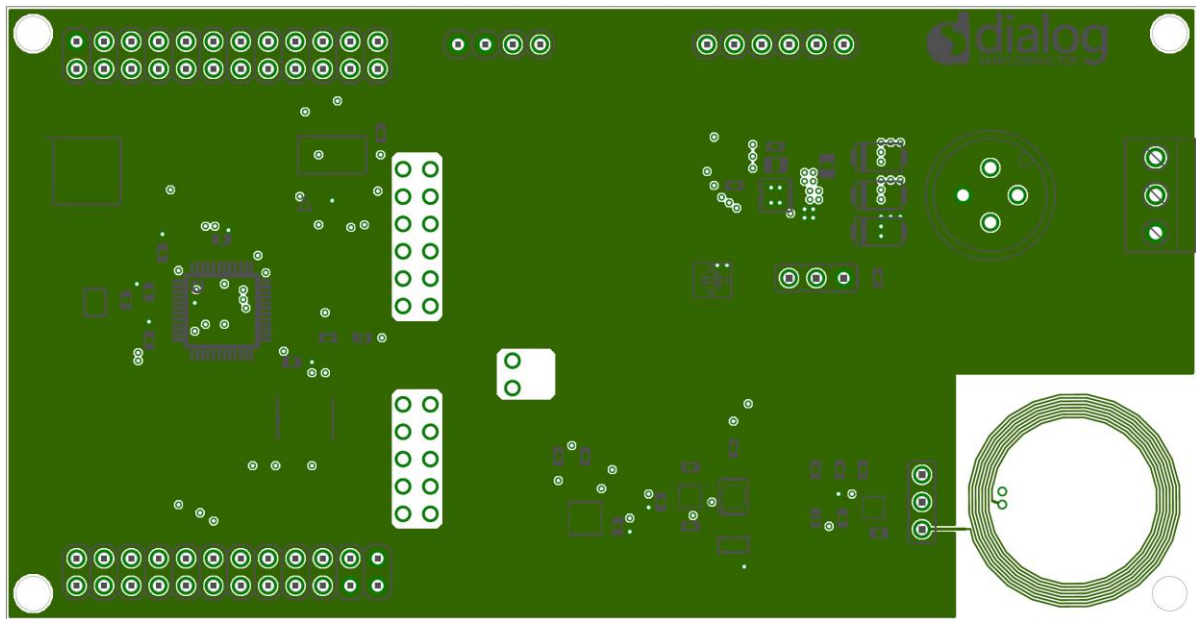
CCE4503 Evaluation Board
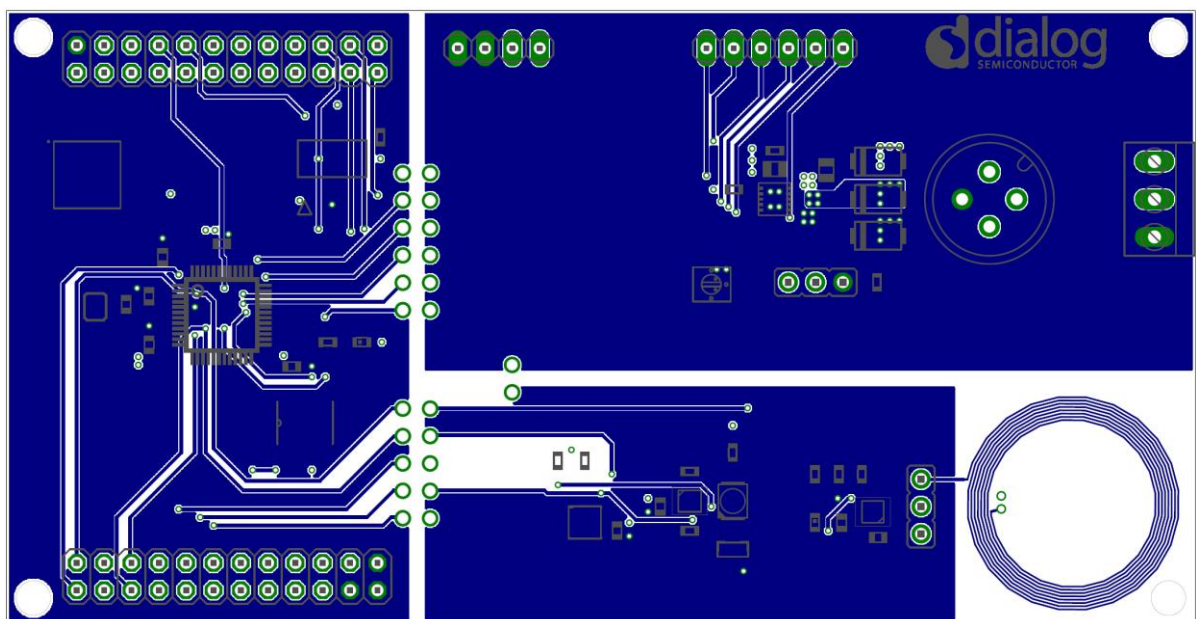

Figure 8: Layout MID 2

Figure 9: Layout BOTTOM
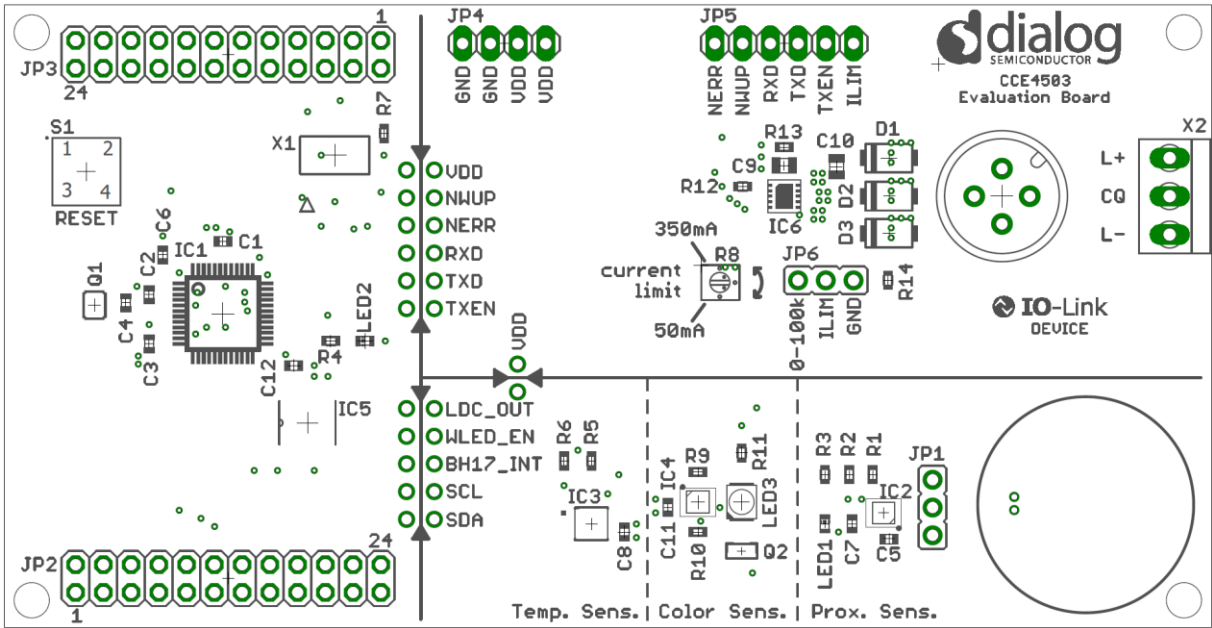
CCE4503 Evaluation Board

Figure 10: Layout Assembly

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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	STMicroeletronics	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	Wurth 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

Revision History

Revision	Date	Description
1	13-Mar-2020	Initial version.

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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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User Manual · **Revision 1** · **13-Mar-2020**

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