Motor Control Application Kit

For XMC4000 Family

KIT_XMC4400_DC_V1

XMC4400 Drive Card V1.0

Board User's Manual

Revision 1.0, 2013-11-05

Microcontroller

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Revision History

Page or Item	Subjects (major changes since previous revision)
Revision 1.0, 2013-11-05	Initial release

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Introduction

This document describes the features and hardware details of the DriveCard XMC4400 V1 (KIT_XMC4400_DC_V1) designed to work with Infineon's inverter boards. This board is part of Infineon's Motor Control Application Kits.

1 Overview

The drive card KIT_XMC4400_DC_V1 houses the XMC4400 Microcontroller from Infineon Technologies, a power board connector, two sets of position interface circuits with hall and encoder connectors, a multi feedback interface and an isolated on-board debug interface with CAN capability. The board along with a three phase inverter demonstrates the capabilities of the XMC4400. The main use case for this board is to demonstrate the motor control features of the XMC4400 device including tool chain. The focus is safe operation under evaluation conditions. The board is neither cost nor size optimized and does not serve as a reference design.

1.1 Key Features

The KIT_XMC4400_DC_V1 board is equipped with the following features

- Infineon XMC4400 (ARM$^®$ Cortex™-M4-based) Microcontroller, 512 kByte on-chip Flash, LQFP-100
- Connection to power inverter via the power board connector
- 2 combined hall sensor and encoder interfaces
- Multi feedback interface connectors for connection of resolver circuitry, UART, SPI, I2C, USB, etc
- 8 LEDs
    − 2 Power indicating LEDs
    − 2 User LEDs (P2.2 and P2.15)
    − 2 Encoder enable LEDs
    − 2 Debug LEDs (DEBUG, COM)
- Potentiometer, connected to analog input P14.13 (ADC group 1, channel 5)
- Reset push button
- Isolated Debug options
    − On-Board Debugger (SEGGER J-Link LITE) via USB connector
    − Infineon Debug connector 16-pin (0.1") with DriveMonitor USB Stick V2 (KIT_DRIVEMONI_USB_V2)
- Isolated Connectivity
    − UART channel of On-Board Debugger (SEGGER J-Link LITE) via USB connector
    − CAN node
- Power supply of MCU domain
    − Via power board connector (5V)
    − Via multi feedback interface connector
- Power supply of isolated debug domain
    − Via Debug USB connector
    − Via Infineon Debug connector 16-pin
    − Via CAN interface connector

1.2 Block Diagram

Figure 1 shows the functional block diagram of the KIT_XMC4400_DC_V1 board. For more information about the power supply domains please refer to chapter 2.1.

The drive card has got the following building blocks:

- 1 Power Board Connector
- 2 sets of position interface connectors (HALL, ENCODER)
- Encoder Enable signals via GPIOs (P1.0 and P2.10)
- 2 User LEDs connected to GPIOs (P2.2 and P2.15)
- Variable resistor (POTI) connected to GPIO P14.13 (ADC group 1, channel 5)
- Multi Feedback Interface
- Isolated On-board Debugger via Debug USB connector (Micro-USB) with UART channel (USIC0, channel 0)
- Optional Infineon Debug interface connector for Drive Monitor USB Stick V2 (KIT_DRIVEMONI_USB_V2)
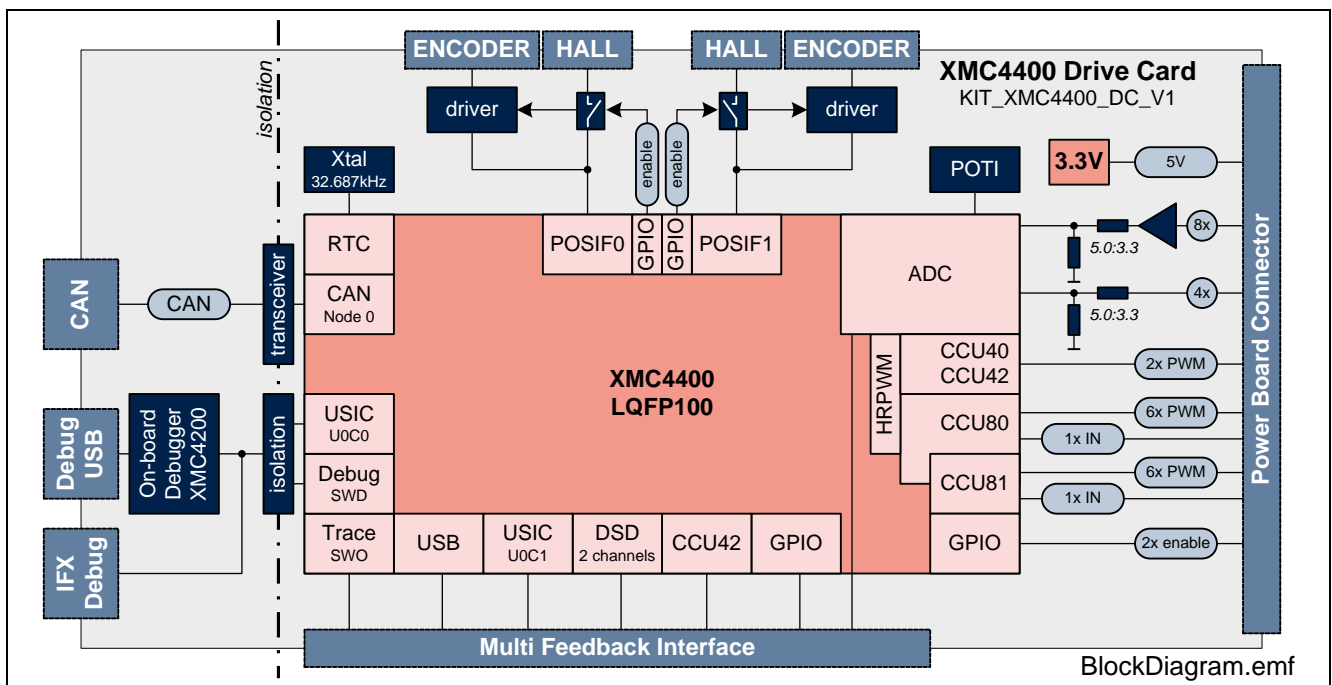- Isolated CAN interface connector at CAN node 0

Figure 1   Block Diagram of KIT_XMC4400_DC_V1

2 Hardware Description

The following sections give a detailed description of the hardware and how it can be used.
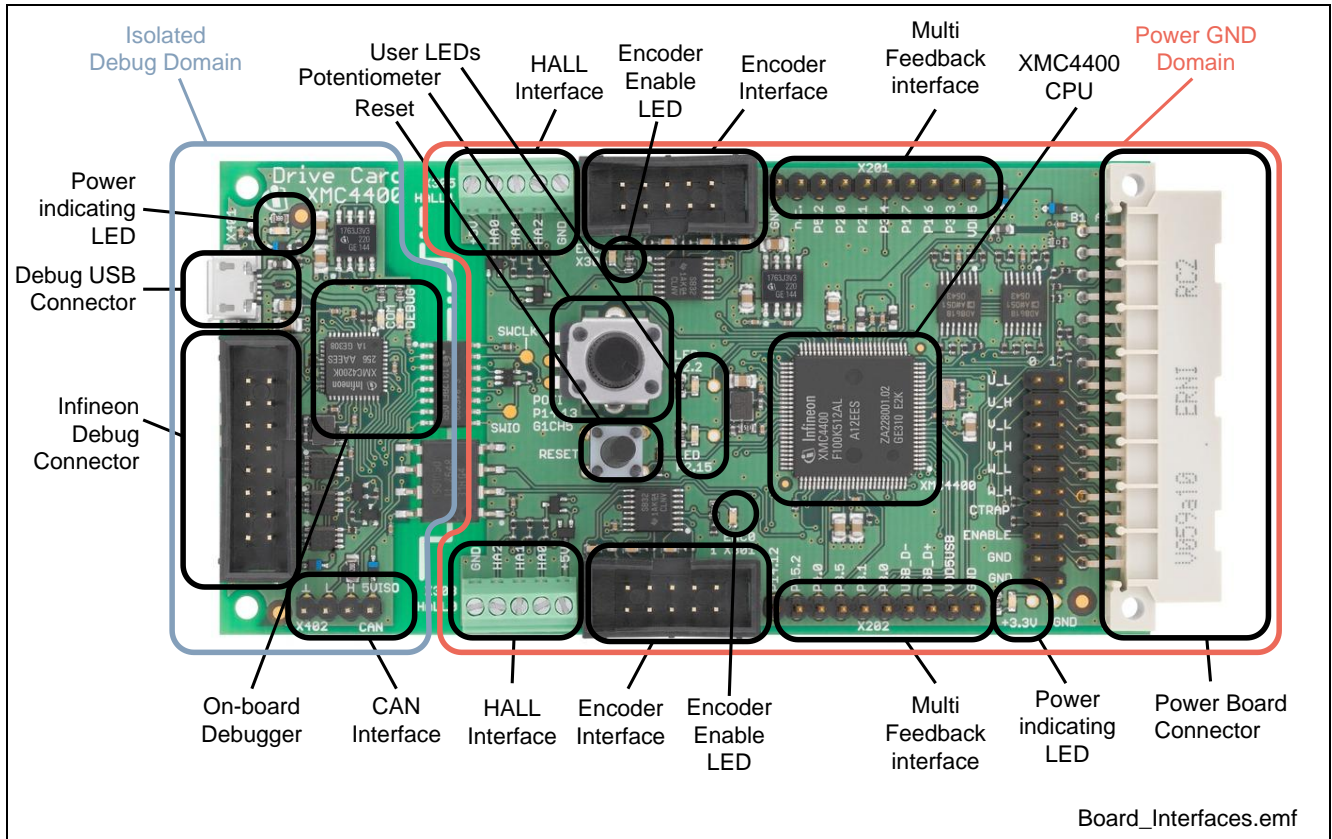

Figure 2   XMC4400 Drive Card (KIT_XMC4400_DC_V1)

2.1 Power Supply

The KIT_XMC4400_DC_V1 board is designed with two galvanically isolated supply domains. On the left side, there is the debug domain, which contains a XMC4200 MCU as on-board debug controller (OBD) as well as level shifters to a 5V debug interface like the drive monitor USB stick (KIT_DRIVEMONI_USB_V2). The debug domain can be powered via the USB plug (5V) as well as the CAN connector or the Infineon debug connector. On the middle to the right side there is the power GND supply domain, which provides the power supply for the MCU and the peripheral components. This supply domain is usually powered from the power board connector. If the current provided by the power board is not sufficient, then the multi feedback interface connectors can be used as well.

For both supply domains a separate power indicating LED is available.

The typical current drawn by the drive card at the power GND domain is about 180 mA.

To indicate the power status of the KIT_XMC4400_DC_V1 board two power indicating LED's are provided on board (see Figure 3). The LED will be "ON" when the corresponding power rail is powered.

Table 1   Power status LED's

LED Reference	Power Rail	Voltage	Note
LED201	VDD3.3	3.3 V	Power GND domain, must always be "ON"
LED401	VISO5	5 V	Debug supply domain, "ON" if debug domain is intened to be used.

Figure 3 and Figure 4 show details of the power supply concept of the drive card.
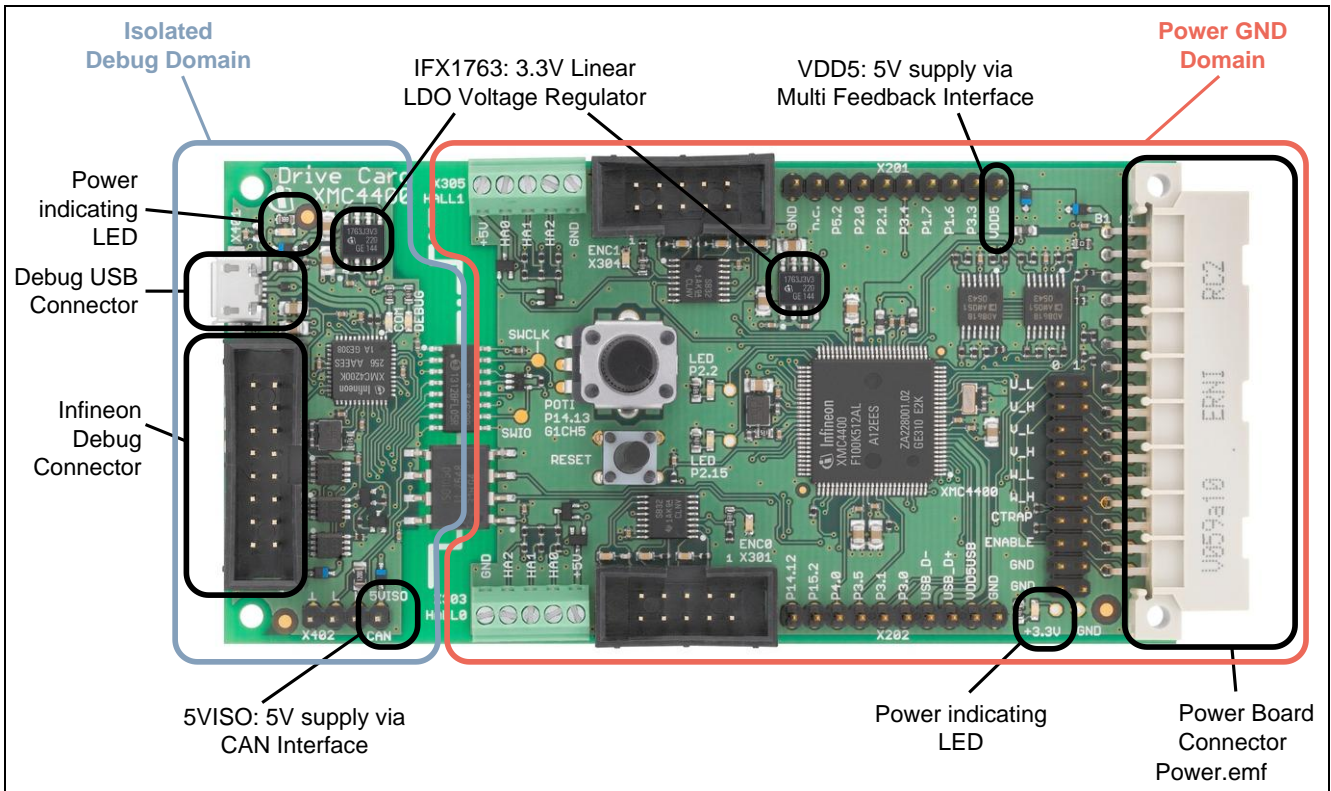
Figure 3   Power Supply Concept and Powering Options
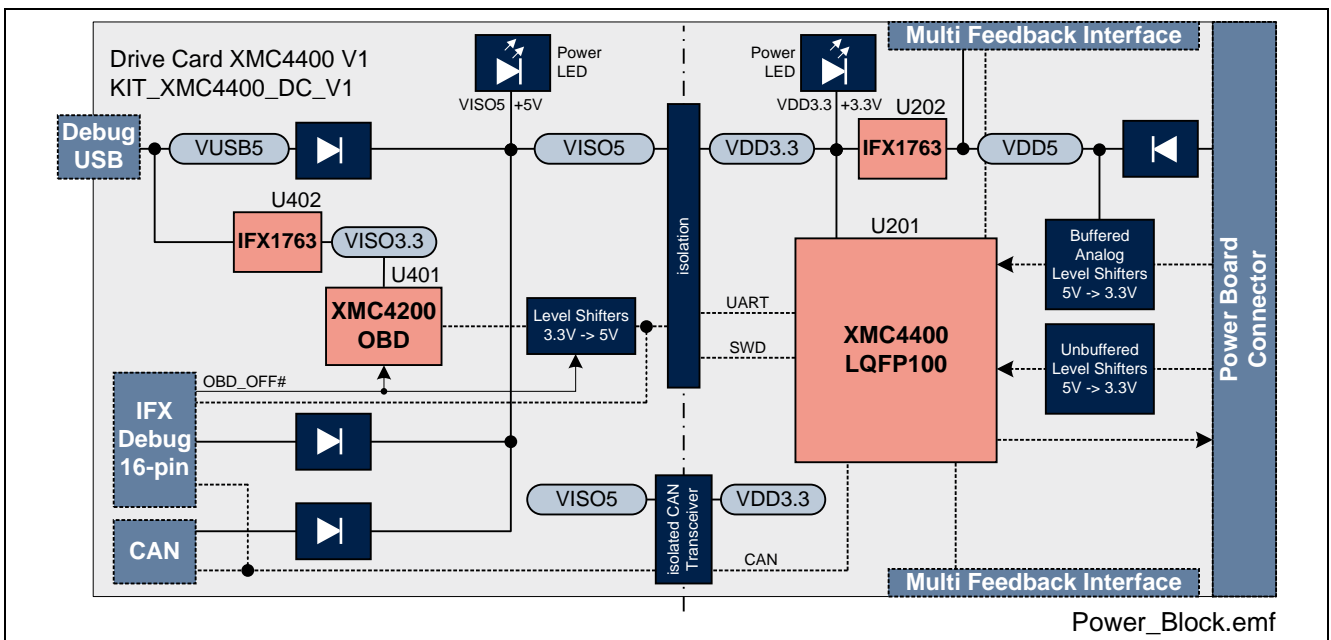
Figure 4   Block Diagram of Power Supply Concept

2.2 Reset

A reset signal connected to the low-active PORST# pin of the target CPU (U201, see Figure 4) can be issued by the on-board Reset Button (SW201, RESET) only. A reset debug command can be issued by the on-board debug device (U401) or an external debugger connected to the Infineon Debug connector. Figure 5 shows the reset button.

Reset

Potentiometer_LED.emf
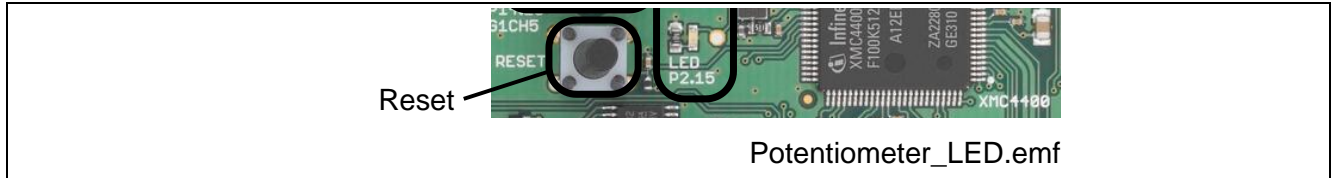
Figure 5   Reset Button

2.3 Clock Generation

An external 12 MHz crystal provides the clock signal to the XMC4400 microcontroller. The drive strength of the oscillator is set to maximum by default, in order to ensure a safe start-up of the oscillator even under worst case conditions. Therefore a serial 510 Ohm resistor will attenuate the oscillations during operations.

For the RTC clock a separate external 32.768 kHz crystal is used on board.
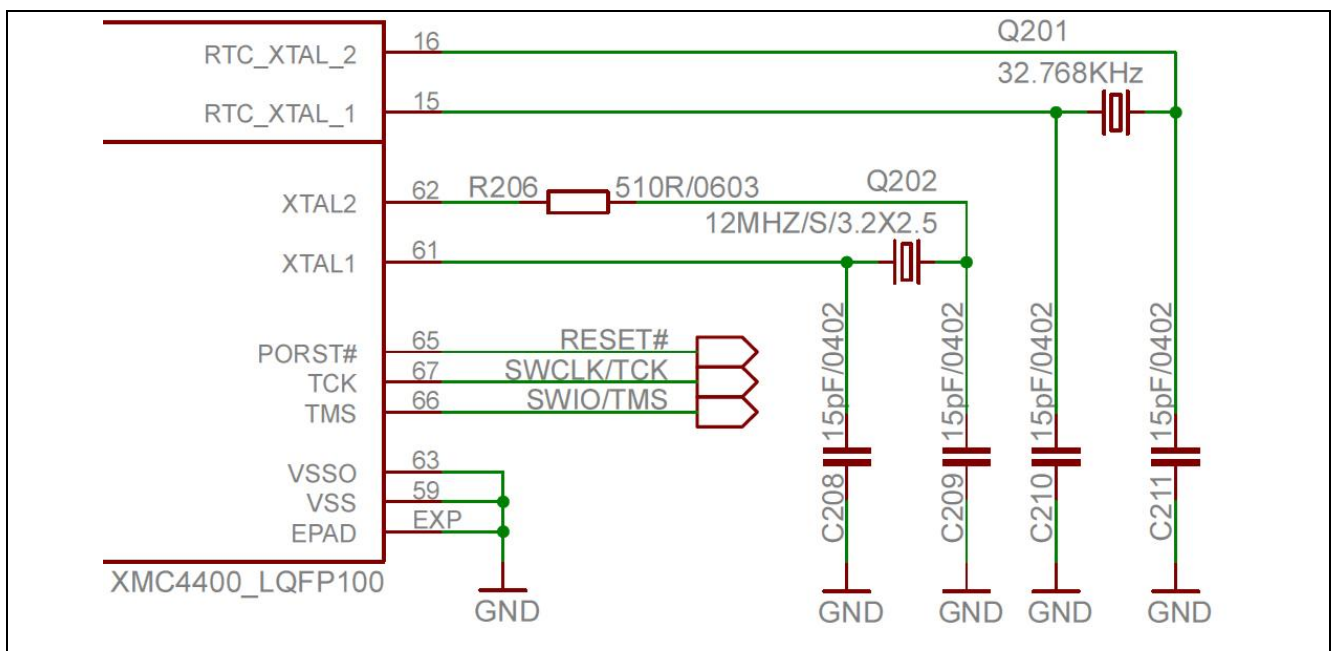
Figure 6   Clock Generation

2.4 Debug Interface

The KIT_XMC4400_DC_V1 is designed to use "Serial Wire Debug" (SWD) as debug interface and JTAG debug is not supported. It supports debugging via different channels which are all galvanically isolated from the power GND supply domain:

- On-board Debugger
- Infineon Debug Connector (16-pin) with Debug and UART interface
- CAN interface (X402)

2.4.1   On-board USB Debugger

The on-board debugger [1] supports
- Serial Wire Debug

- Full Duplex UART communication via a Virtual COM port
    - PC_RXD   P5.1 USIC0CH0.DOUT0
    - PC_TXD   P5.0 USIC0CH0.DX0D

[1]   Attention: The firmware of the on-board debugger requires the latest J-Link driver (V4.62 or higher) and a Serial Port Driver (CDC driver) installed on your computer. Please check "Install J-Link Serial Port Driver" when installing the latest J-Link driver (see Figure 7)
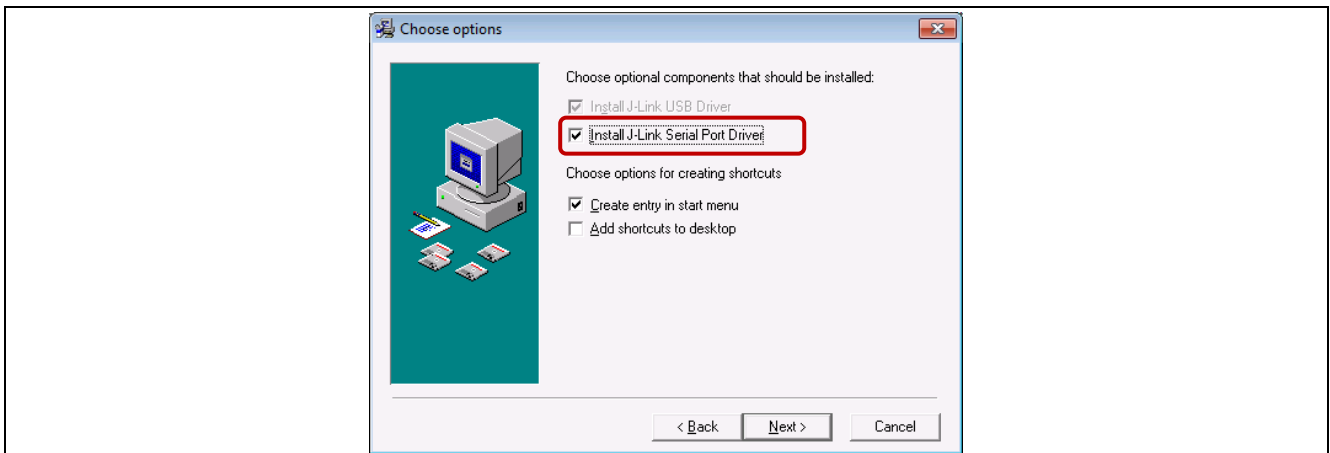
Figure 7   Installation of Serial Port Driver

The on-board debugger can be accessed through the Debug USB connector shown in Figure 8. The Debug LED V402 shows the status during debugging.
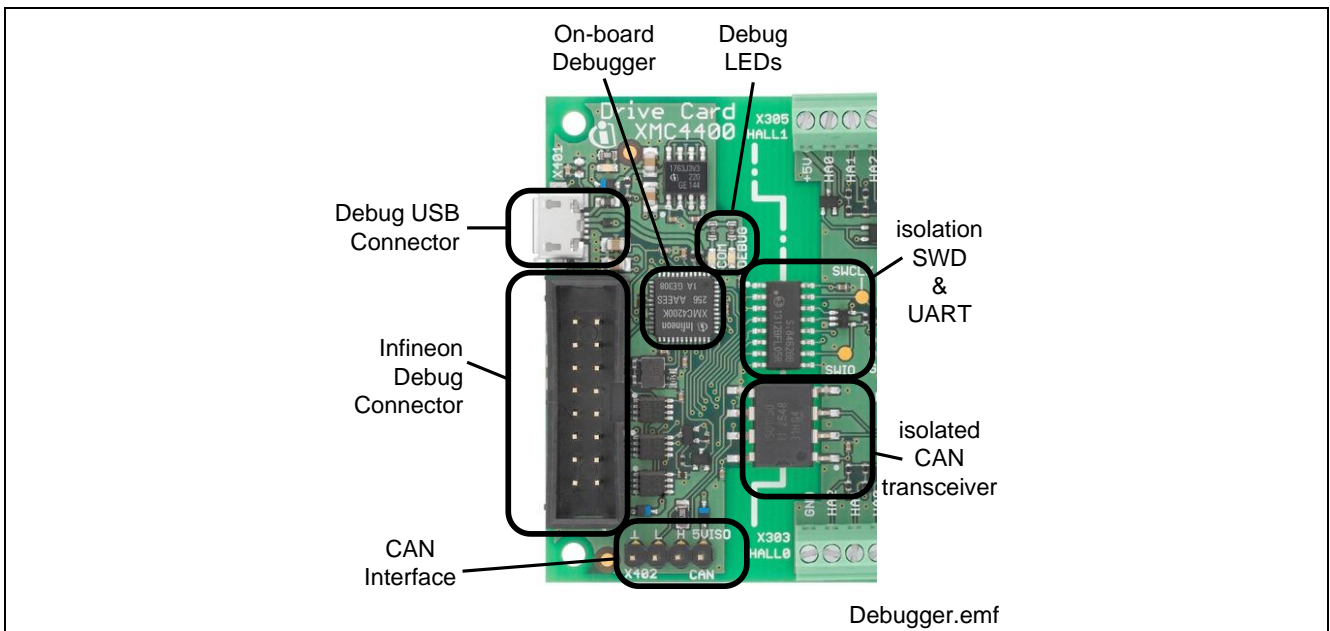
Figure 8   On-Board USB Debugger

2.4.2   Infineon Debug Connector (16-pin)

The KIT_XMC4400_DC_V1 board supports debugging via Infineon's device access server (DAS), when using KIT_DRIVEMONI_USB_V2 as interface device. The latest release of DAS software can be downloaded from **http://www.infineon.com/das**. When using an external debugger, the on-board debugger has to be switched off. This is done by connecting pin 6 to GNDISO. KIT_DRIVEMONI_USB_V2 already provides this connection and the OBD is disabled as soon as the connector is plugged in.

Next to the SWD debug signals which are provided as unidirectional signals because of the galvanic isolation, UART and CAN signals can be accessed through this connector as well. Figure 9 shows the pin assignment of the connector, the following table lists the signals as well.
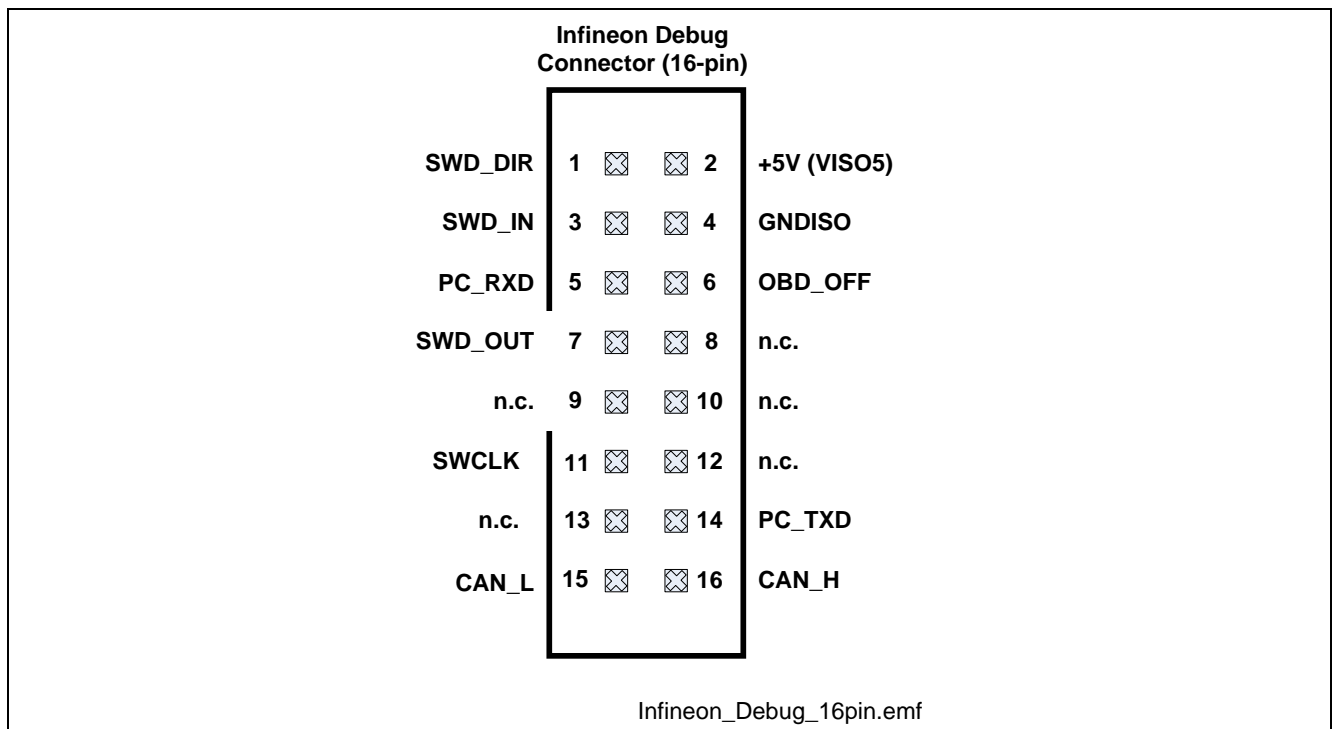
Figure 9   Infineon Debug Connector (16-pin)

Pin No.	Signal Name	I/O	Serial Wire Debug
1	SWD_DIR	O	Defines the direction of SWIO
2	+5V (VISO5)	-	+5V supply of isolated debug domain
3	SWD_IN	I	Input signal of SWIO
4	GNDISO	-	Ground of isolated debug domain
5	PC_RXD	I	UART Receive signal (P5.1, DOUT0 USIC0, channel0)
6	OBD_OFF#	I	Disable on-board debug device (Low active)
7	SWD_OUT	O	Output signal of SWIO
8	n.c.	-	Not connected
9	n.c.	-	Not connected
10	n.c.	-	Not connected
11	SWCLK	O	SWD clock signal
12	n.c.	-	Not connected
13	n.c.	-	Not connected
14	PC_TXD	I	UART Transmit signal (P5.0, DX0D, USIC0, channel0)
15	CAN_L	I/O	Low signal of CAN bus
15	CAN_H	I/O	High signal of CAN bus

2.4.3 CAN Interface (X402)

The KIT_XMC4400_DC_V1 board provides an isolated CAN interface with 120Ω termination (see Figure 10 for details).
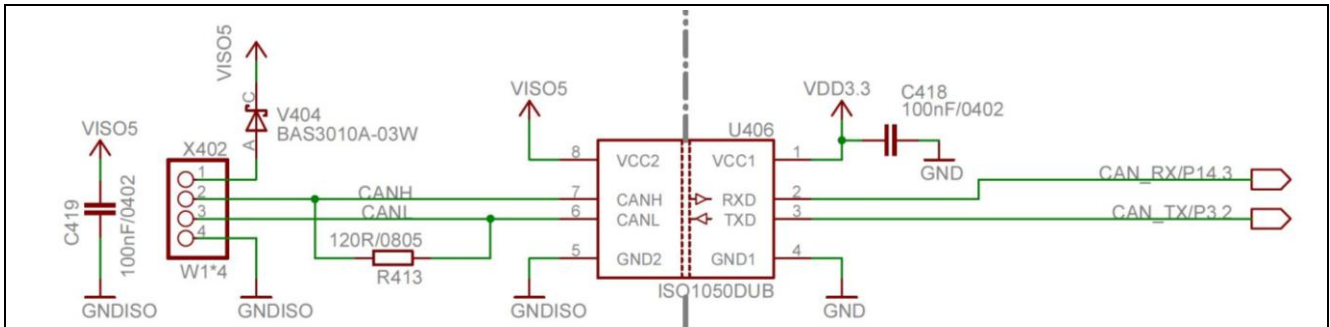
Figure 10   Isolated CAN Interface with Termimation

The isolated CAN transceiver (U406) is connected to CAN node 0 of XMC4400 via port pins P14.3 (RX) and P3.2 (TX).

2.5 Potentiometer and User LEDs

The KIT_XMC4400_DC_V1 provides a potentiometer which is connected to ADC group1, channel5 and two user LEDs (P2.2 and P2.15). Next to the LEDs, a testpoint is available in order to easily connect an oscilloscope's probe for software controlled trigger signals.
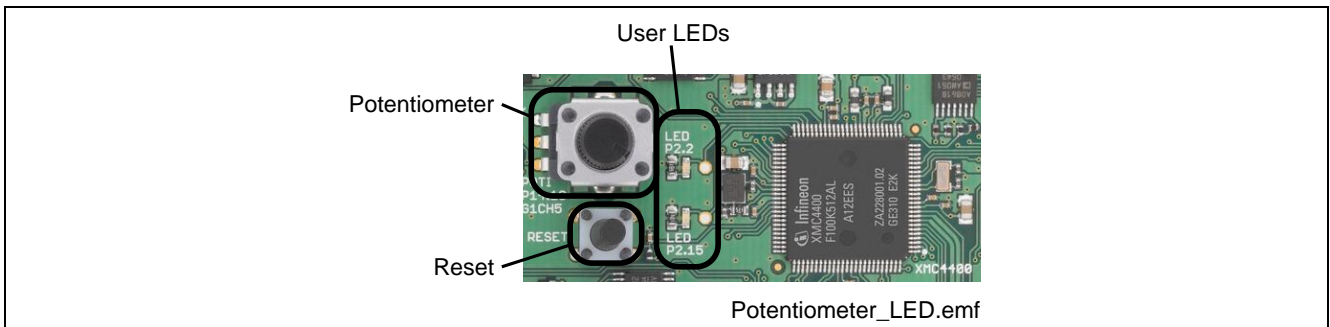
Figure 11   Potentiometer and LEDs

Table 2   Potentiometer

Potentiometer	Connected to Port Pin
R201	P14.13 / G1_CH5 (Group 1, channel 5)
User LEDs	**Connected to Port Pin**
LED202	P2.2 (LED0)
LED203	P2.15 (LED1)

Attention:** **The testpoints are referenced to power GND supply domain. Hence they may carry hazzardous voltages.

2.6 Multifeedback Connectors

The multifeedback interface can be used as extension to the HALL sensor and encoder interface and provides access to the DSD, USIC, ADC, CCU4, CCU8 and USB peripherals. As a result, a piggy-back board with rotary resolver interface can be easily plugged onto the drive card and extends the functionallity. The USIC channel, which supports SPI, UART I2C and IIS communication protocolls can be used to connect to dedicated position feedback ICs. Two ADC channels of different groups are available for synchronous sampling of analog signals.
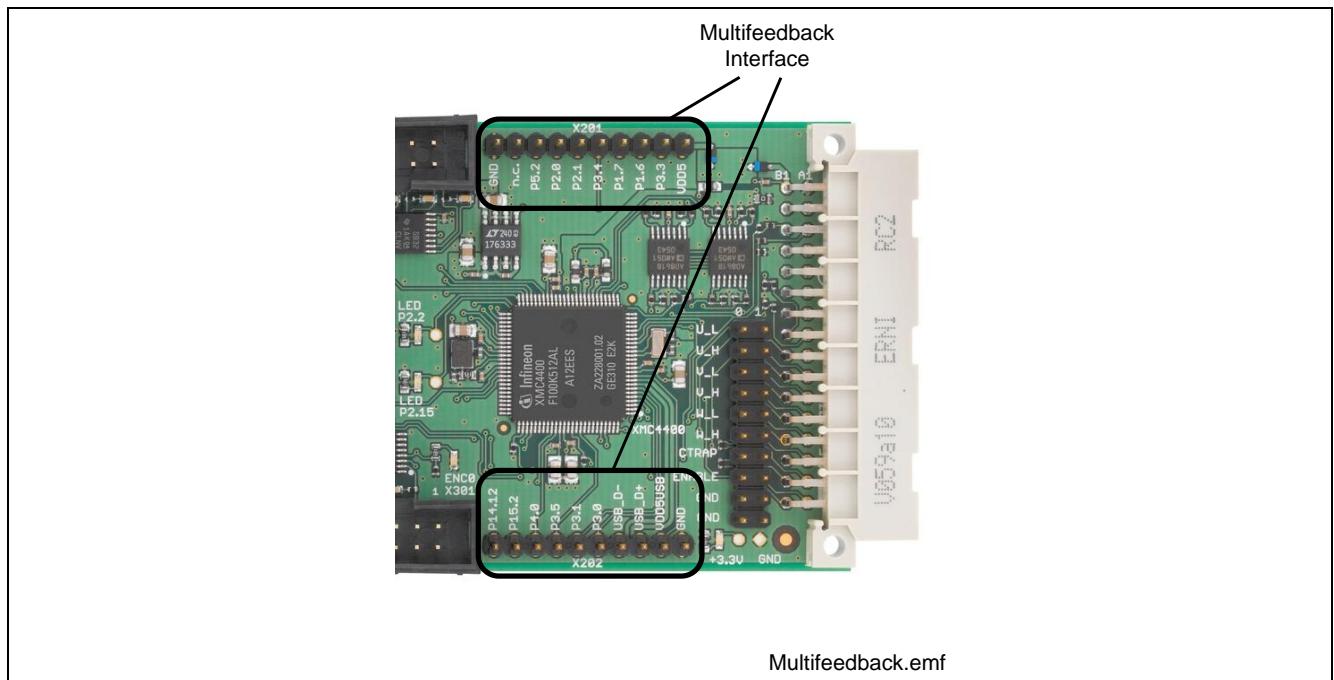
Figure 12   Multifeedback Interface Connectors

Table 3   Multifeedback Interface Connector X201 and X202

Pin	Port	Peripherals			
Top Row X201					
X201-1	GND				
X201-2	-				
X201-3	P5.2	GPIO	CCU81.OUT23	CCU81.IN1B	
X201-4	P2.0	DSD.CGPWMN	CCU81.OUT21		
X201-5	P2.1	DSD.CGPWMP	CCU81.OUT11		TRACE.SWO
X201-6	P3.4	DSD.MCLK3B		CCU42.OUT2	CCU42.IN2A
X201-7	P1.7	DSD.MCLK2A			
X201-8	P1.6	DSD.DIN2A			
X201-9	P3.3	DSD.DIN3B	CCU80.IN3B	CCU42.OUT3	CCU42.IN3A
X201-10	VDD5				
Bottom Row X202					
X202-1	P14.12		VADC0.G1CH4		
X202-2	P15.2			VADC0.G2CH2	
X202-3	P4.0	U0C1.DX0E			
X202-4	P3.5	U0C1.DOUT0		CCU42.OUT1	
X202-5	P3.1	U0C1.SELO0	U0C1.DX2B		
X202-6	P3.0	U0C1.SCLKOUT	U0C1.DX1B	CCU42.OUT0	
X202-7	USB_DM				
X202-8	USB_DP				
X202-9	VBUS				
X202-10	GND				

2.7   Hall Sensor and Encoder Connectors

The KIT_XMC4400_DC_V1 provides two pairs of HALL and incremental encoder connectors as indicated in Figure 13. The encoder interface connector provides a differential input which is transformed into single ended signals by an interface IC. The HALL sensor interface provides a pull-up resistor for each HALL sensor signal as well as power supply for the HALL sensors
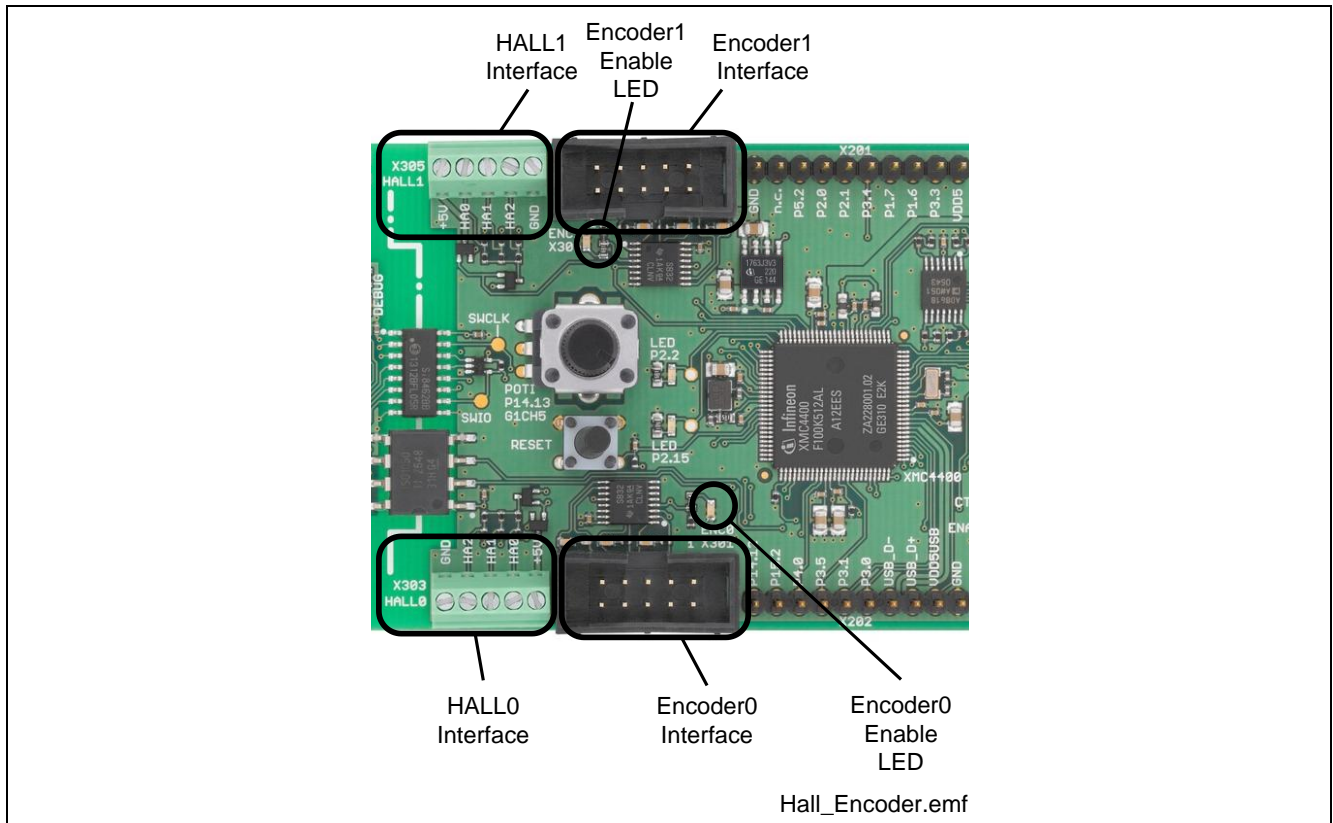
Figure 13   Hall Sensor and Encoder Connectors

Both the HALL and the encoder signals are connected to the same POSIF interface. The ENENC-signal is used to either enable the output signals of the encoder IC or to activate the power supply and pull-up resistor supply of the HALL sensor interface. As a result, both interfaces can be connected at the same time and the user can select by software which interface to use. Figure 14 shows the HALL sensor and encoder interface circuitry of interface 0. Please refer to Table 4 for details on pin and peripheral assignment.
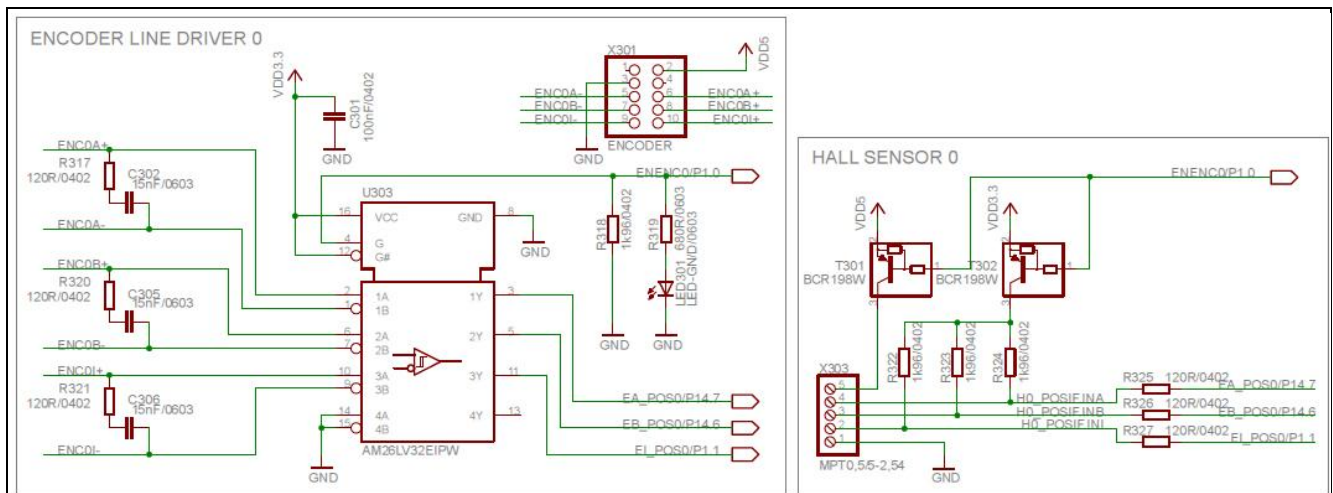
Figure 14   Hall Sensor and Encoder Interface Circuitry

Table 4   HALL Sensor and Encoder Interfaces

Pin	Port	Peripheral
HALL Sensor Interface X303		
1	GND	
2	P1.1	POSIF0.IN2A
3	P14.6	POSIF0.IN1B
4	P14.7	POSIF0.IN0B
5	VDD5	HALL sensor power supply
Encoder Interface X301		
1	n.c.	
2	VDD5	Encoder power supply
3	GND	
4	n.c.	
5	ENCA-	POSIF0.IN0B
6	ENCA+	
7	ENCB-	POSIF0.IN1B
8	ENCB+	
9	ENCI-	POSIF0.IN2A
10	ENCI+	
Enable Encoder 0		
LED301	P1.0	High: Enable Encoder Interface Low: Enable HALL Interface including supply
HALL Sensor Interface X305		
1	GND	
2	P2.3	POSIF1.IN2A
3	P2.4	POSIF1.IN1A
4	P2.5	POSIF1.IN0A
5	VDD5	HALL sensor power supply
Encoder Interface X304		
1	n.c.	
2	VDD5	Encoder power supply
3	GND	
4	n.c.	
5	ENCA-	POSIF1.IN0A
6	ENCA+	
7	ENCB-	POSIF1.IN1A
8	ENCB+	
9	ENCI-	POSIF1.IN2A
10	ENCI+	
Enable Encoder 1		
LED302	P2.10	High: Enable Encoder Interface Low: Enable HALL Interface including supply

2.8 Power Board Connector

The KIT_XMC4400_DC_V1 board provides a power board connector with all the signals required to control the power inverter. Next to the PWM output signals of CCU4, CCU8 and HRPWM as well as the ADC signals, there are the power supply pins for the power GND domain.

Figure 16 shows a picture of the power board connector. The pin and peripheral assignment can be found in Table 5. In addition, different use cases for three phase inverters can be found in Table 6.
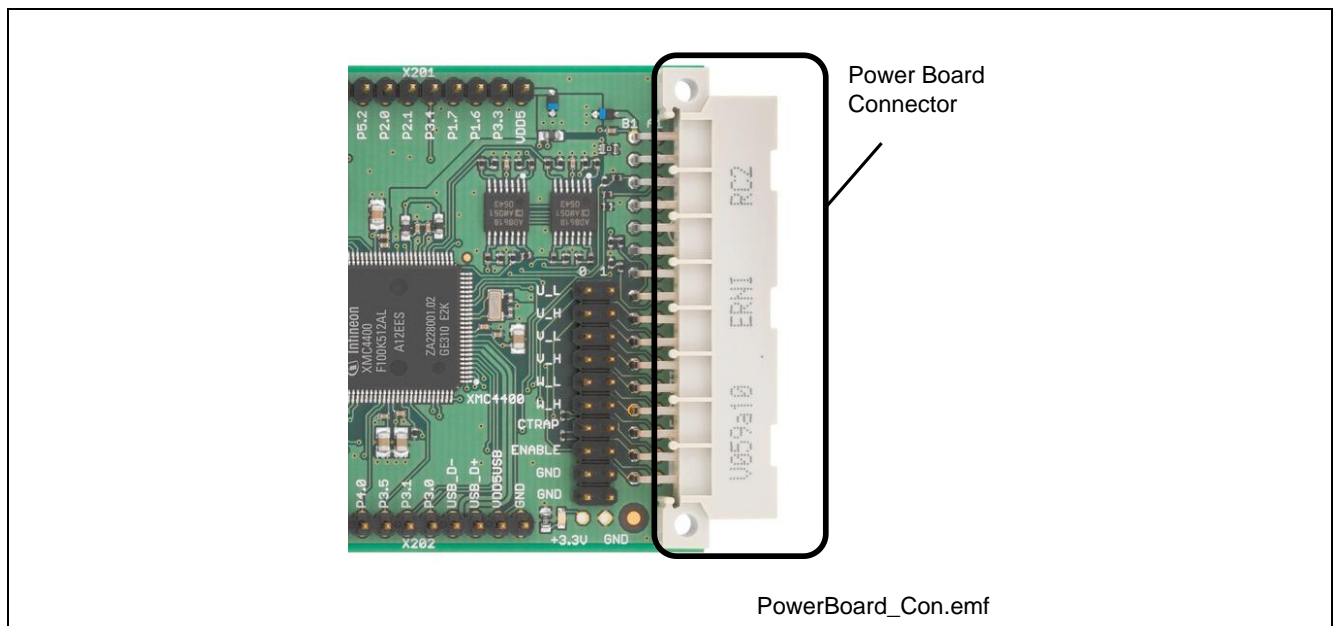
Figure 16   Power Board Connector

Attention: The power board connector is also providing the power supply for the power GND supply domain. Hence it may carry hazzardous voltages.

2.8.1   Level Shifters for Analog Signals

The board is designed to be powered by 5V although the XMC4400 is a 3.3V MCU. As a result all input signals to the MCU are connected via level shifters. For low impedance signals (A3/B3, A8/B8, A15/B15), a resistor divider is used. For high impedance signals, an additional analog buffer is provided (see Figure 17).

The level shifter ratio from power board signals towards the MCU is 0.662.

Figure 17   Buffered Level Shifter for High Impedance Analog Signals

Table 5   Power Board Connector

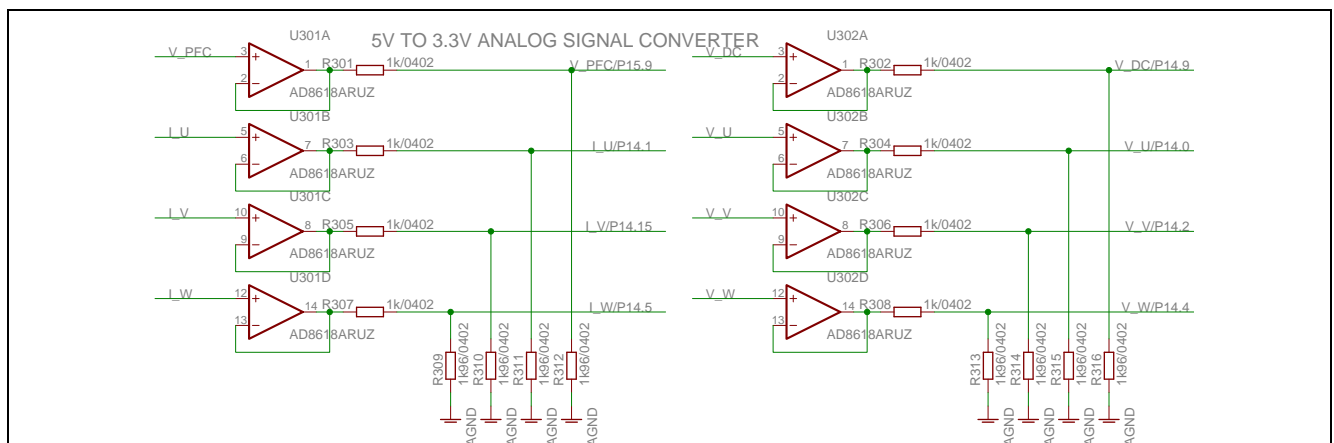| X302 MAB32B2	Female FAB32Q2	Function on Power Inverter	Port	Peripherals			
A1	A16	GND	VSS				
A2	A15	PFC Gate	P1.3 & P0.8	(CCU40.OUT0)	ERU1.PDOUT0	HROUT10	
A3	A14	I_{PFC}	P15.8 & P0.0			HR.C1INB	VADC0.G3CH0
A4	A13	V_{PFC}	P15.9				VADC0.G3CH1
A5	A12	V_{BEMF_U} / I_U (2)	P14.1	VADC0.G0CH1			
A6	A11	V_{BEMF_V} / I_V (2)	P14.15		VADC0.G1CH7		G1ORC7
A7	A10	V_{BEMF_W} / I_W (2)	P14.5	VADC0.G0CH5		VADC0.G2CH1	
A8	A9	I_AVG / I_{DClink} (2)	P14.8	(DAC0.OUT)	VADC0.G1CH0		VADC0.G3CH2
A9	A8	U1_L	P1.12 & P0.10	CCU81.OUT01	CCU80.OUT02		
A10	A7	U1_H	P1.15 & P2.7	CCU81.OUT00	CCU80.OUT03		
A11	A6	V1_L	P1.11 & P2.9	CCU81.OUT11	CCU80.OUT22		
A12	A5	V1_H	P1.5	CCU81.OUT10	CCU80.OUT23		
A13	A4	W1_L	P1.10 & P2.8	CCU81.OUT21	CCU80.OUT32		
A14	A3	W1_H	P1.4	CCU81.OUT20	CCU80.OUT33		
A15	A2	CTRAP1	P1.2	ERU1.2B0 (PDOUT1 -> CCU81.IN0I, IN1I,IN2I,IN3I)			
A16	A1	ENPOW1	P4.1	GPIO			
B1	B16	VCC 5V	VDD				
B2	B15	Brake Gate	P3.6	CCU42.OUT0			
B3	B14	Brake temp	P15.3			VADC0.G2CH3	
B4	B13	V_{DClink}	P14.9	(DAC1.OUT)	VADC0.G1CH1		VADC0.G3CH3
B5	B12	V_{BEMF_U} / I_U (1)	P14.0	VADC0.G0CH0			
B6	B11	V_{BEMF_V} / I_V (1)	P14.2	VADC0.G0CH2	VADC0.G1CH2		
B7	B10	V_{BEMF_W} / I_W (1)	P14.4	VADC0.G0CH4		VADC0.G2CH0	
B8	B9	I_{DClink} (1)	P14.14		VADC0.G1CH6		G1ORC6
B9	B8	U0_L	P0.2	CCU80.OUT01		HROUT01	
B10	B7	U0_H	P0.5	CCU80.OUT00		HROUT00	
B11	B6	V0_L	P0.1 & P0.3	CCU80.OUT11	CCU80.OUT20	HROUT20	
B12	B5	V0_H	P0.4 & P2.14	CCU80.OUT10	CCU80.OUT21	HROUT21	
B13	B4	W0_L	P0.11 & P0.9	CCU80.OUT31	CCU80.OUT12	HROUT31	
B14	B3	W0_H	P0.6 & P2.6	CCU80.OUT30	CCU80.OUT13	HROUT30	
B15	B2	CTRAP0	P0.7	CCU80.IN0A, IN1A,IN2A, IN3A			
B16	B1	ENPOW0	P0.12	GPIO	CCU40.OUT3	ERU0.2B2	

Note: Please note that the numbering of the power boards connector at the drive card is inverse to the numbering at the power board.

Table 6   Use Cases of PWM Signals

| X302 (MAB32B2)	Function	Port	Peripheral
2-Level Inverter with CCU80			
B9	U0_L	P0.2	CCU80.OUT01
B10	U0_H	P0.5	CCU80.OUT00
B11	V0_L	P0.1	CCU80.OUT11
B12	V0_H	P0.4	CCU80.OUT10
B13	W0_L	P0.11	CCU80.OUT31
B14	W0_H	P0.6	CCU80.OUT30
B15	CTRAP0	P0.7	CCU80.IN0A,IN1A,IN2A,IN3A
B16	ENPOW0	P0.12	GPIO
2-Level Inverter with CCU81			
A9	U1_L	P1.12	CCU81.OUT01
A10	U1_H	P1.15	CCU81.OUT00
A11	V1_L	P1.11	CCU81.OUT11
A12	V1_H	P1.5	CCU81.OUT10
A13	W1_L	P1.10	CCU81.OUT21
A14	W1_H	P1.4	CCU81.OUT20
A15	CTRAP1	P1.2	ERU1.2B0 (PDOUT1 -> CCU81.IN0I,IN1I,IN2I,IN3I)
A16	ENPOW1	P4.1	GPIO
2-Level Inverter with CCU80 (2 slices only)			
B9	U0_L	P0.2	CCU80.OUT01
B10	U0_H	P0.5	CCU80.OUT00
B11	V0_L	P0.1	CCU80.OUT11
B12	V0_H	P0.4	CCU80.OUT10
B13	W0_L	P0.9	CCU80.OUT12
B14	W0_H	P2.6	CCU80.OUT13
B15	CTRAP0	P0.7	CCU80.IN0A,IN1A,IN2A,IN3A
B16	Enable0	P0.12	GPIO
2-Level Inverter with HRPWM			
B9	U0_L	P0.2	HROUT01
B10	U0_H	P0.5	HROUT00
B11	V0_L	P0.3	HROUT20
B12	V0_H	P0.4	HROUT21
B13	W0_L	P0.9	HROUT31
B14	W0_H	P0.6	HROUT30
B15	CTRAP0	P0.7	CCU80.IN0A,IN1A,IN2A,IN3A
B16	Enable0	P0.12	GPIO
3-Level Inverter with CCU80			
A9	U1_L	P0.10	CCU80.OUT02
B9	U0_L	P0.2	CCU80.OUT01
A10	U1_H	P2.7	CCU80.OUT03
B10	U0_H	P0.5	CCU80.OUT00
A11	V1_L	P2.9	CCU80.OUT22
B11	V0_L	P0.3	CCU80.OUT20
A12	V1_H	P1.5	CCU80.OUT23
B12	V0_H	P2.14	CCU80.OUT21
A13	W1_L	P2.8	CCU80.OUT32
B13	W0_L	P0.11	CCU80.OUT31
A14	W1_H	P1.4	CCU80.OUT33
B14	W0_H	P0.6	CCU80.OUT30
B15	CTRAP0	P0.7	CCU80.IN0A,IN1A,IN2A,IN3A
B16	ENPOW0	P0.12	GPIO

3 Production Data

3.1 Schematics

This chapter contains the schematics for the drive card:
- XMC4400 MCU, Power Supply, Multifeedback Interface
- Hall Sensor and Encoder Interfaces, Power Board Connector
- Isolated On-board Debugger and CAN Interface

The board has been designed with Eagle. The full PCB design data of this board can also be downloaded from www.infineon.com/xmc-dev.
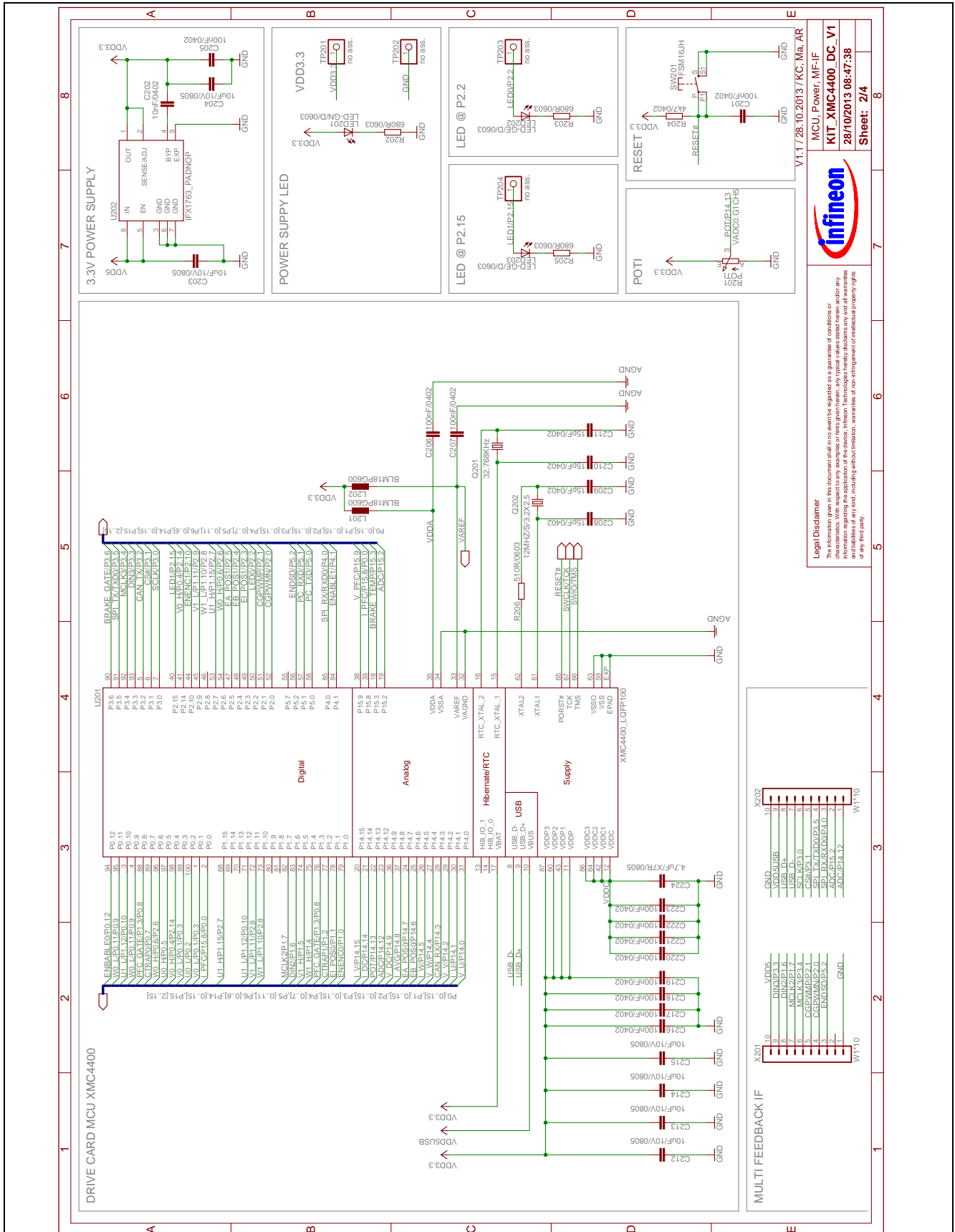
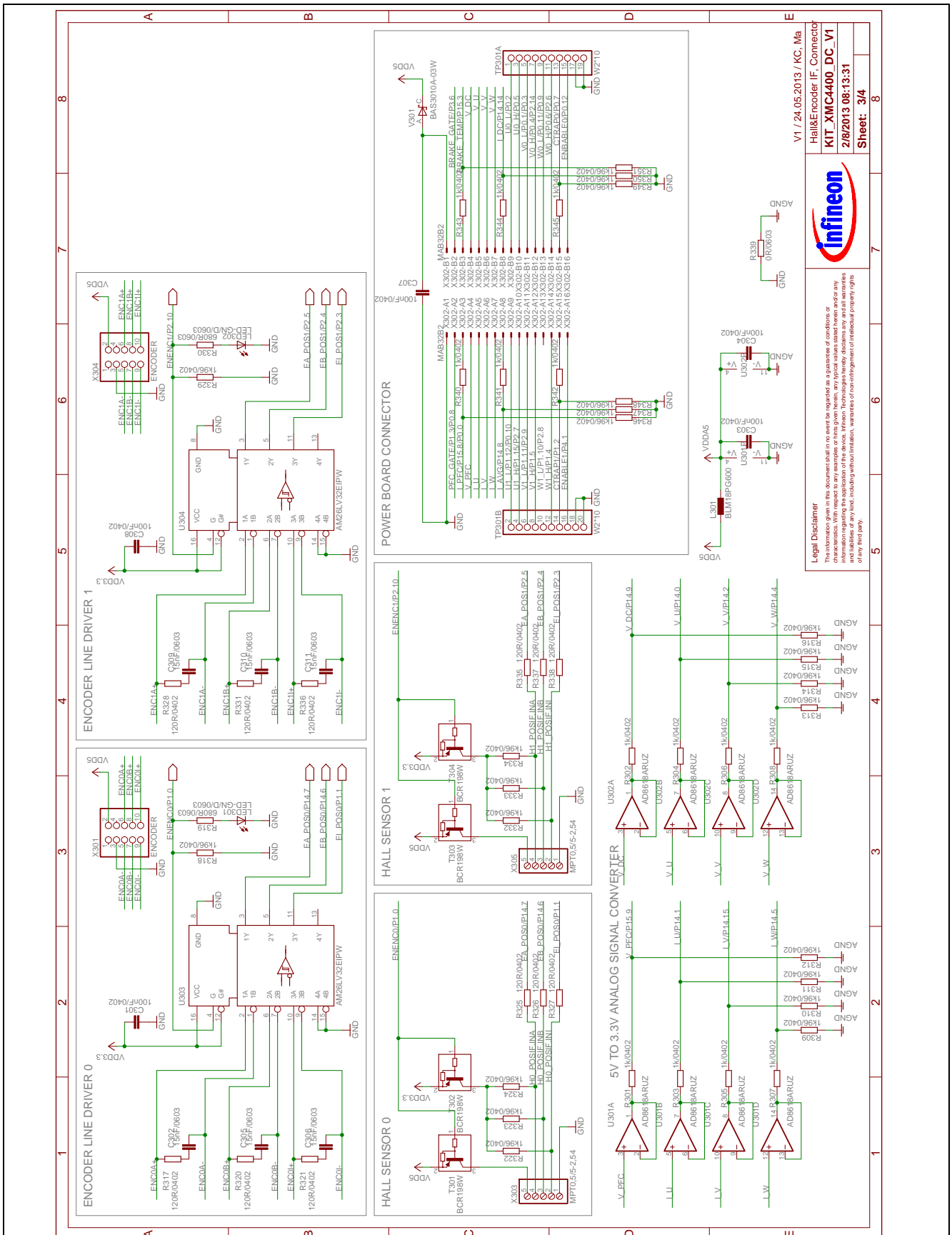**Figure 18   XMC4400 MCU, Power Supply, Multifeedback Interface**

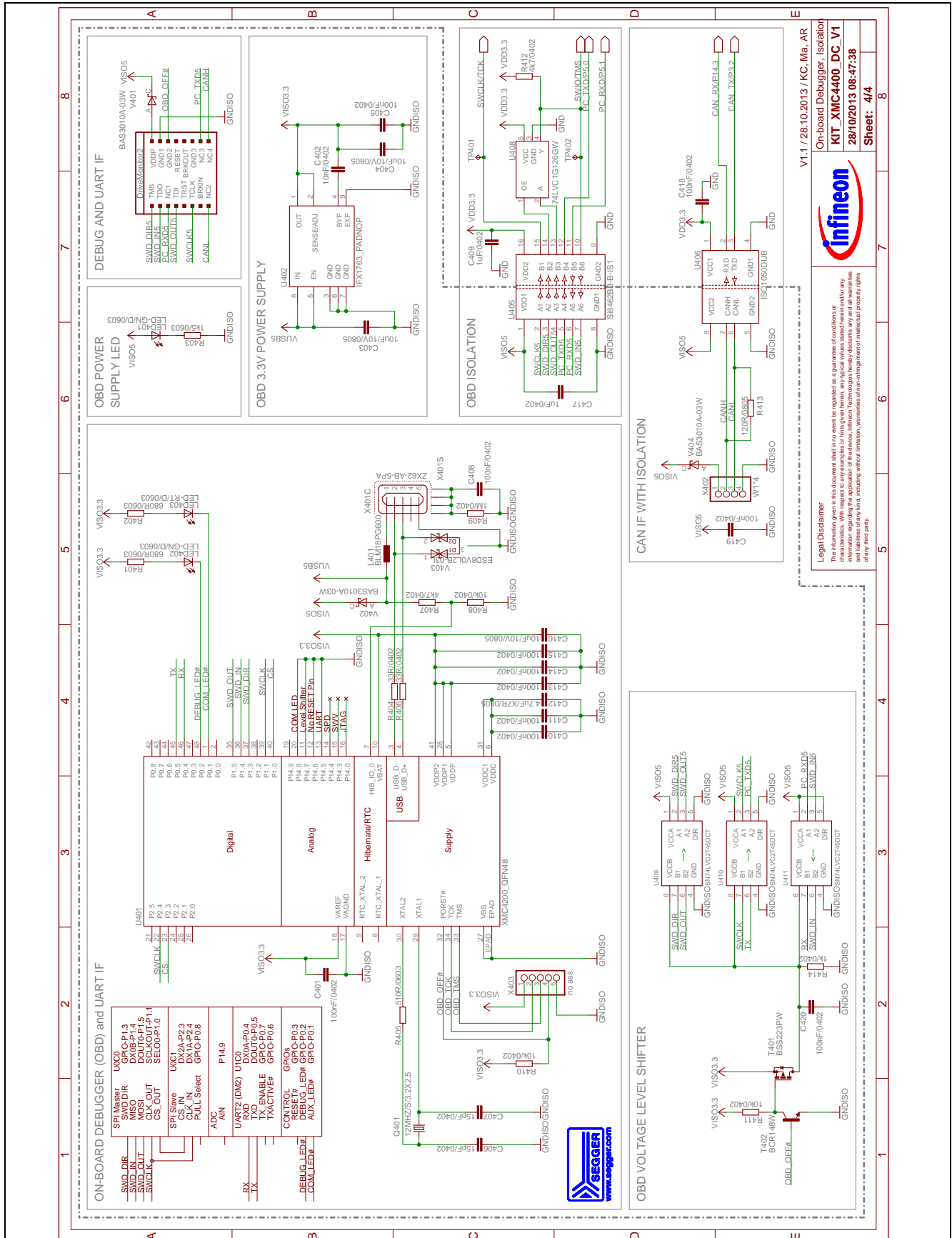**Figure 19   Hall Sensor and Encoder Interfaces, Power Board Connector**

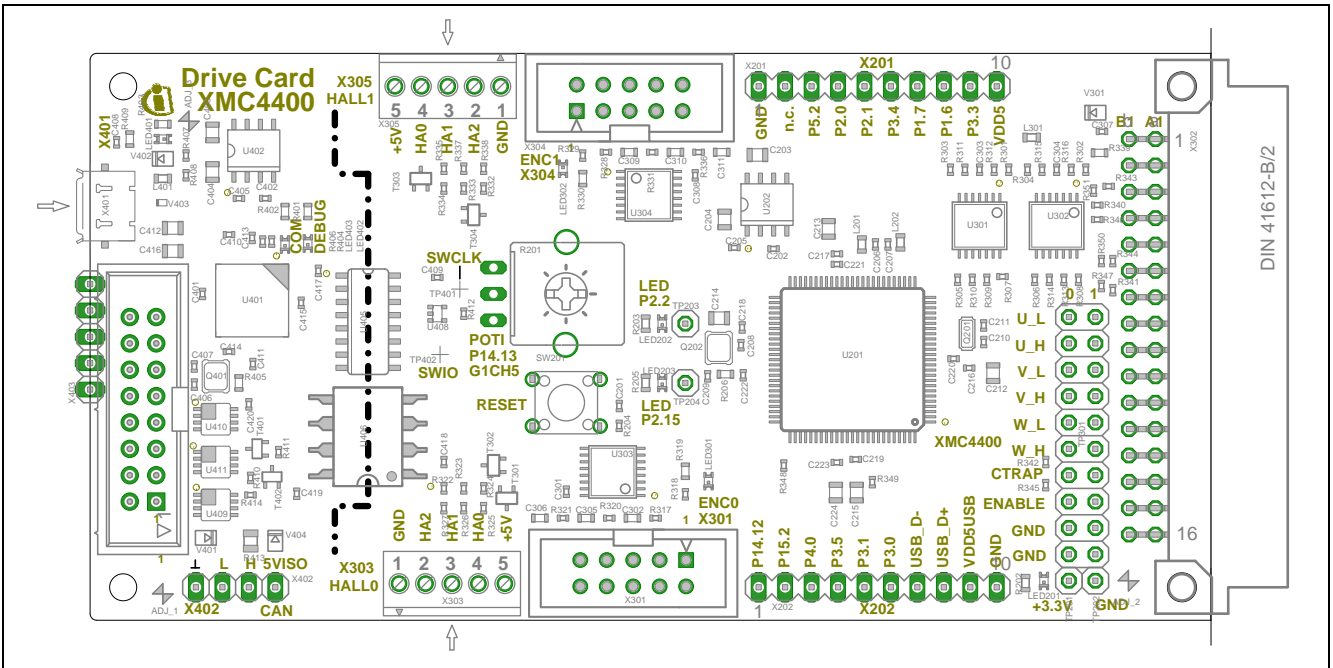Figure 20   Isolated On-board Debugger and CAN Interface

3.2 Component Placement

Figure 21 Component Placement

3.3　Bill of Material (BOM)

Table 7　BOM of KIT_XMC4400_DC_V1 Board

Pos. No.	Qty	Value	Device	Reference Des.
1	1	10k	potentiometer	R201
2	7	680R/0603	RESISTOR 0603	R202, R203, R205, R319, R330, R401, R402
3	3	4k7/0402	RESISTOR 0402	R204, R407, R412
4	2	510R/0603	RESISTOR 0603	R206, R405
5	15	1k/0402	RESISTOR 0402	R301, R302, R303, R304, R305, R306, R307, R308, R340, R341, R342, R343, R344, R345, R414
6	22	1k96/0402	RESISTOR 0402	R309, R310, R311, R312, R313, R314, R315, R316, R318, R322, R323, R324, R329, R332, R333, R334, R346, R347, R348, R349, R350, R351
7	12	120R/0402	RESISTOR 0402	R317, R320, R321, R325, R326, R327, R328, R331, R335, R336, R337, R338
8	1	0R/0603	RESISTOR 0603	R339
9	1	1k5/0603	RESISTOR 0603	R403
10	2	33R/0402	RESISTOR 0402	R404, R406
11	3	10k/0402	RESISTOR 0402	R408, R410, R411
12	1	1M/0402	RESISTOR 0603	R409
13	1	120R/0805	RESISTOR 0805	R413
14	28	100nF/0402	CAPACITOR 0402	C201, C205, C206, C207, C216, C217, C218, C219, C220, C221, C222, C223, C301, C303, C304, C307, C308, C401, C405, C408, C410, C411, C413, C414, C415, C418, C419, C420
15	2	10nF/0402	CAPACITOR 0402	C202, C402
16	2	4.7u/X7R/0805	CAPACITOR 0805K	C224, C412
17	9	10uF/10V/0805	CAPACITOR 0805K	C203, C204, C212, C213, C214, C215, C403, C404, C416
18	6	15pF/0402	CAPACITOR 0402	C208, C209, C210, C211, C406, C407
19	6	15nF/0603	CAPACITOR 0603	C302, C305, C306, C309, C310, C311
20	2	1uF/0402	CAPACITOR 0402	C409, C417
21	4	BLM18PG600	FERRIT BEAD 0603	L201, L202, L301, L401
22	5	LED-GN/D/0603	LEDCHIPLED 0603	LED201, LED301, LED302, LED401, LED402
23	2	LED-GE/D/0603	LEDCHIPLED 0603	LED202, LED203
24	1	LED-RT/D/0603	LEDCHIPLED 0603	LED403
25	1	32.768KHz	CRYSTAL	Q201
26	2	12MHZ/S/3.2X2.5	CRYSTAL	Q202, Q401
27	1	FSM16JH	SWITCH	SW201
28	4	BCR198W	TRANSISTOR	T301, T302, T303, T304
29	1	BSS223PW	TRANSISTOR	T401
30	1	BCR148W	TRANSISTOR	T402
31	1	XMC4400_LQFP100	INFINEON MCU	U201

32	2	IFX1763	INFINEON LDO	U202, U402
33	2	AD8618ARUZ	OPAMP	U301, U302
34	2	AM26LV32EIPW	ENCODER IC	U303, U304
35	1	XMC4200_QFN48	INFINEON MCU	U401
36	1	Si8462BB-B-IS1	ISOLATED DIGITAL	U405
37	1	ISO1050DUB	ISOLATED CAN	U406
38	1	74LVC1G126GW	LOGIC	U408
39	3	SN74LVC2T45DCT	LOGIC	U409, U410, U411
40	4	BAS3010A-03W	SCHOTTKY	V301, V401, V402, V404
41	1	ESD8V0L2B-03L	ESD DIODE	V403
42	2	W1*10	PINHEADER	X201, X202
43	2	CONP_2X05	CONNECTOR	X301, X304
44	1	MAB32B2	CONNECTOR	X302
45	2	MPT0,5/5-2,54	CONNECTOR	X303, X305
46	1	ZX62-AB-5PA	MICRO-USB	X401
47	1	W1*4	CONNECTOR	X402
48	1	W2*8	CONNECTOR	X404