XC800 Family

AP08112

Hardware Description XC836 Drive Card

Application Note

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Microcontrollers

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XC836
Revision History: V1.0 2010-09

Previous Version(s):

Page	Subjects (major changes since last revision)
–	First release.

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1 Overview

The XC836 DriveCard is designed to be used in motor control systems. It provides all the signals necessary to drive a power Inverter, including feedback signals. The XC836 is a low pin count product of the XC800 Family from Infineon Technologies.

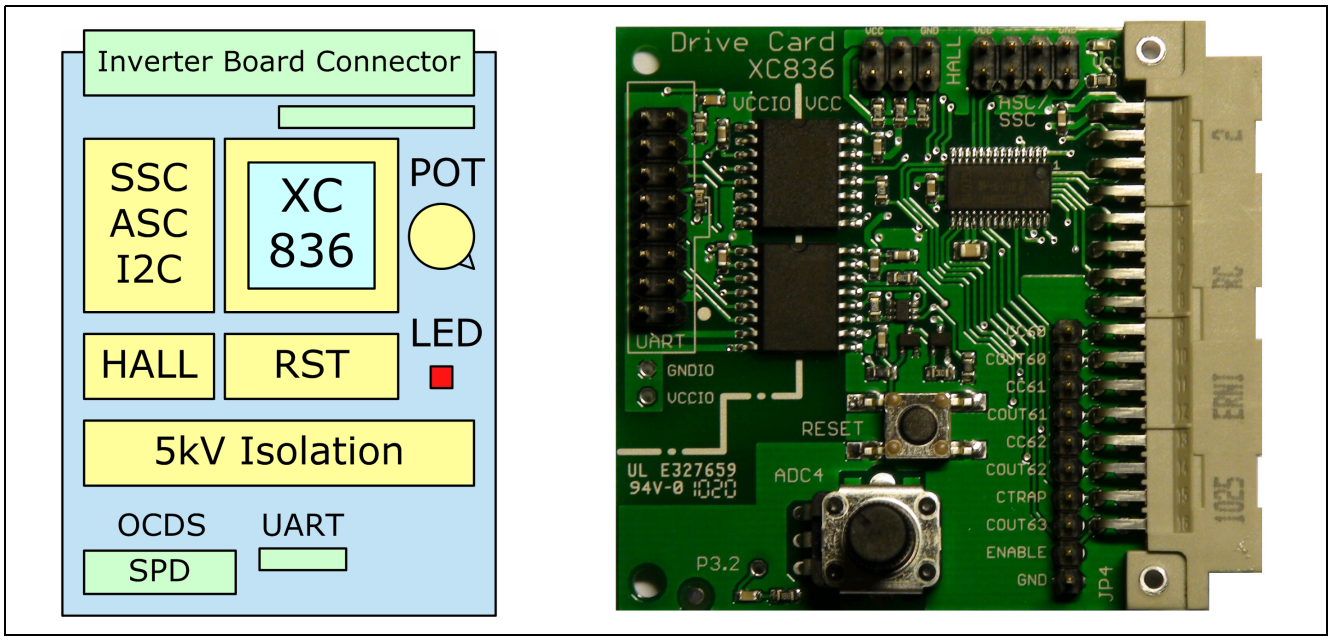


Figure 1 XC836 DriveCard

This DriveCard, featuring the cost-effective 8-bit XC836 microcontroller with 16-bit motor control performance, provides the following interfaces:

- SSC
  - Synchronous Serial Interface such as SPI
- ASC
  - Asynchronous serial interface based on UART protocol
- I2C
  - I2C compliant serial interface
- HALL
  - The HALL interface can be used to directly connect HALL motor sensors
- Digital isolated SPD
  - Single pin programming and debugging interface
- Digital isolated UART
  - Used for example for real-time monitoring and parameter setup
- User interface
  - An LED and a potentiometer can be used as the user interface in standalone operation

Attention: The potentiometer and the reset button are mounted to the power inverter's ground potential. Metal parts may carry high voltages.

The inverter board connector provides the following signals:

- Six PWM channels for 3-phase motor control (CAPCOM6E)
- Shut down signal for PWM channels (CTRAP)
- Enable signal for power inverter
- Six ADC channels for fast analog signals such as DC-link current and phase voltages, as well as slow signals such as temperatures
- The power supply (5 V) for the DriveCard

1.1 Key Features of XC836 for Motor Control Applications

- High Performance 16-bit vector computer (CORDIC + MDU)
  - Vector rotation and transformations such as Park and Clarke transformation
  - Normalizing and scaling
  - Interrupt based operation with minimum CPU load
- PWM unit for advanced motor control (CapCom6E)
  - 16-bit resolution for high precision space vector PWM generation
  - Dead time control for minimum hardware effort (direct control of MOSFET/IGBT)
  - CTRAP provides hardware overload protection
- A fast 10-bit A/D Converter
  - Hardware synchronization to PWM units reduces CPU load
  - Eight ADC channels with a sample time of less than 200 ns
  - Four result registers to maximize sampling performance
  - Enables phase current reconstruction at single shunt current measurement
- Watchdog timer based on separate 75 kHz

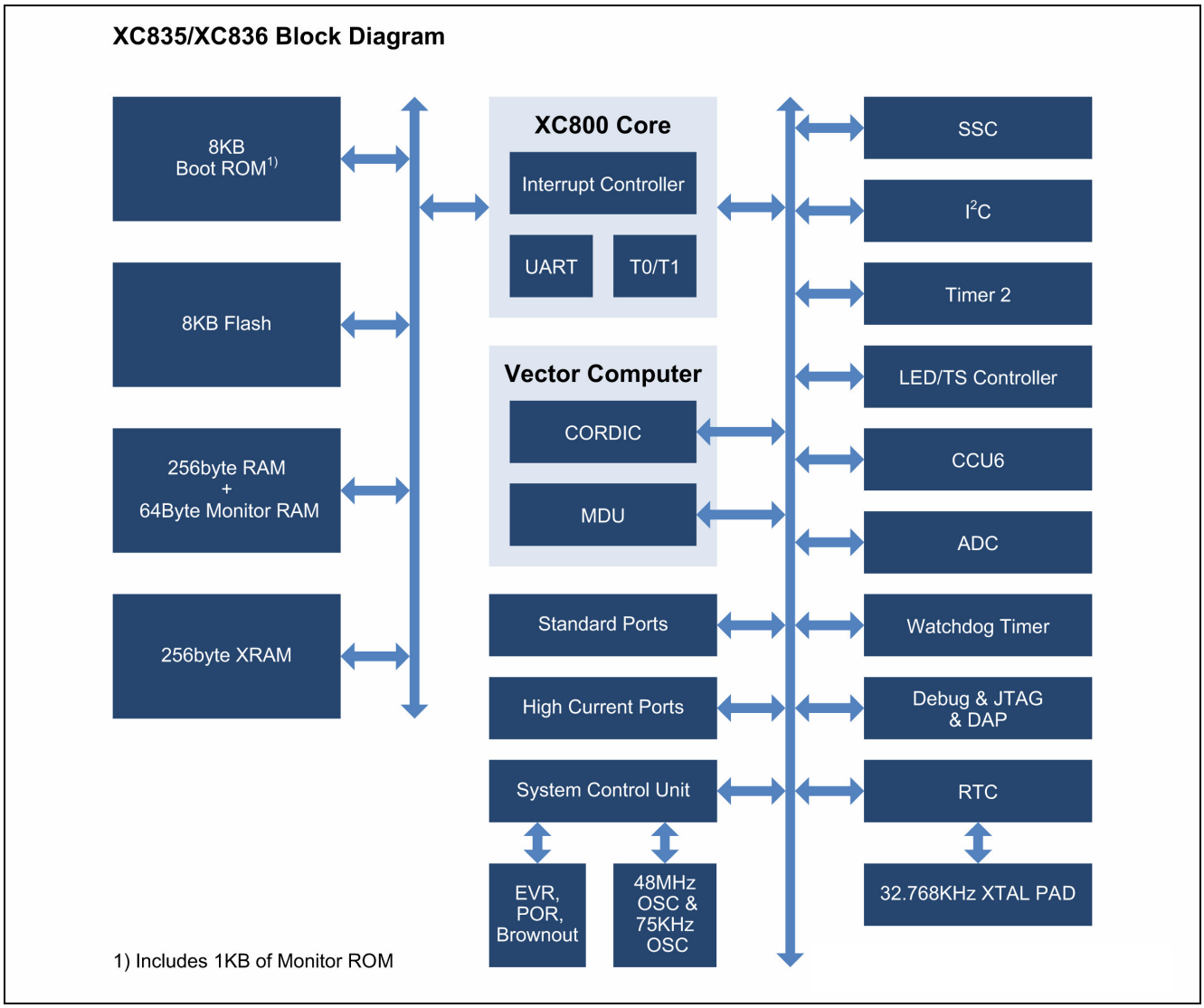


Figure 2 XC836 Block Diagram

2 Hardware Description

2.1 Power Supply

The XC836 DriveCard is supplied by two power supply domains. The main supply (VCC) is fed from the Inverter board connector (**Section 2.5**) and is connected to the MCU and all associated blocks. A second supply domain (VCCIO) exists for the digital isolation. This can be provided via the debug connector. Please refer to **Section 2.4** for details.

Two LEDs indicate the presence of these supply voltages.

2.2 MCU (Microcontroller)

The microcontroller unit XC836 is directly connected to the dedicated interfaces. A software download can be performed via SPD at port pin P3.2.

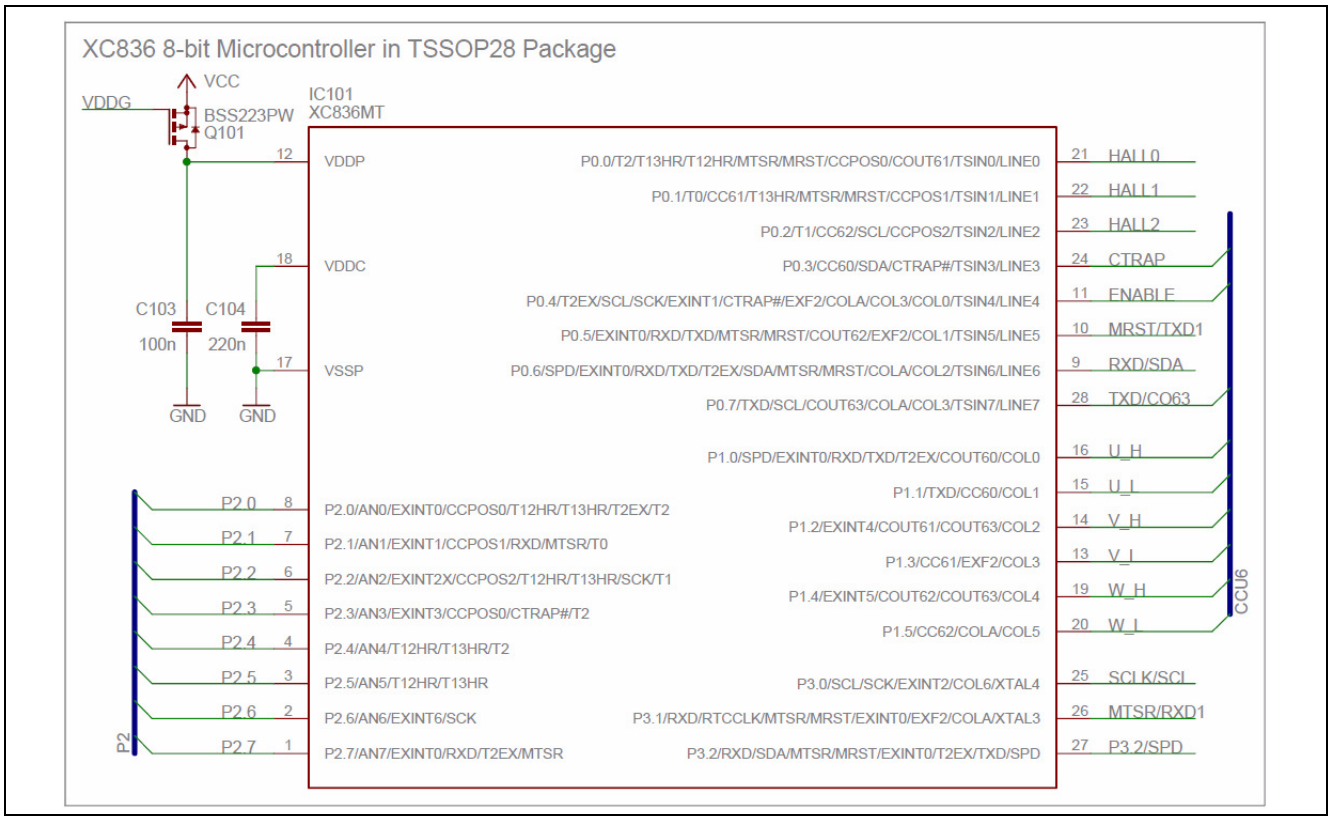


Figure 3 XC836 Connections

The drive card is shipped with Boot Mode Index (BMI) programmed to “User Mode Diagnostic” providing SPD programming access. Please refer to application note AP08108 for details on programming the BMI value.

A reset button is available to trigger a power-on reset. This is realized by a p-channel MOSFET transistor switching the power supply of the microcontroller, because there is no XC836 reset pin available.

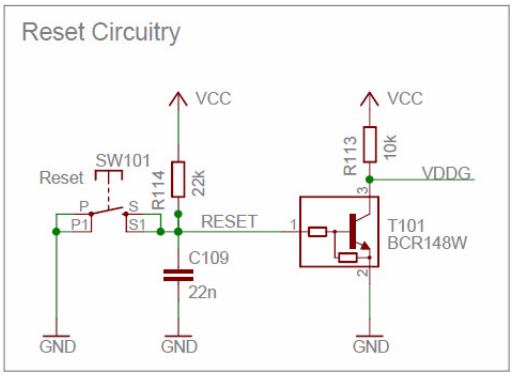


Figure 4 Reset Circuitry

2.3 User Interface

A user interface is available by making use of a potentiometer and an LED. The potentiometer is connected to ADC channel 4. The LED is connected to port pin P3.2 which is overlaid with the SPD signal. A test pad (JP101) is also connected to this port in order to measure fast signals at an oscilloscope.

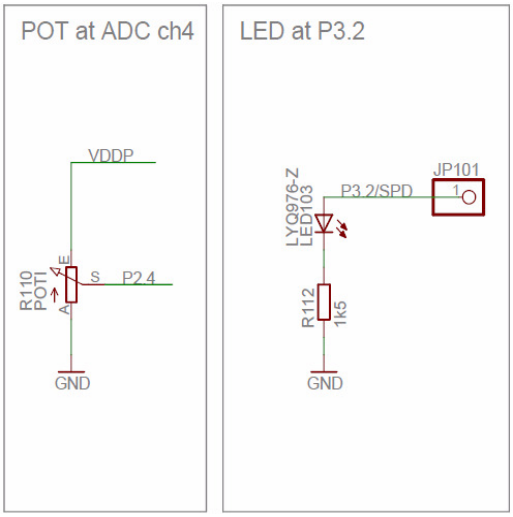


Figure 5 User Interface: LED with Test Pad and Potentiometer

2.4 Digitally Isolated Debug Interface (SPD and UART)

The XC836 DriveCard is equipped with digital isolation for the SPD and UART interfaces. The 5 kV digital isolation securely disconnects any debug and UART devices from the high voltage levels. As there is a separate power domain for the PC part of the XC836 DriveCard, a 5 V power supply must be provided separately at VCCIO and GNDIO. An LED indicates the availability of this supply domain.

The SPD and UART interfaces can be used in parallel.

The digital isolation is based on unidirectional signals. As a result, three signals must be provided for SPD: in, out and direction. Infineon's DriveMonitor V2 USB stick provides these SPD signals as well as CAN, UART and the 5 V power supply in one device. Please refer to application note AP90006 for further details.

The boot configuration for the XC836 does not depend on pin status during reset. Instead, a Boot Mode Index (BMI) configuration determines the entry to various boot modes such as User Mode, Boot-Loader (BSL) Mode and On-chip Debug (OCDS) Mode. After reset, the BMI value is taken and the respective boot mode entry is executed. Please refer to application note AP08108 for details.

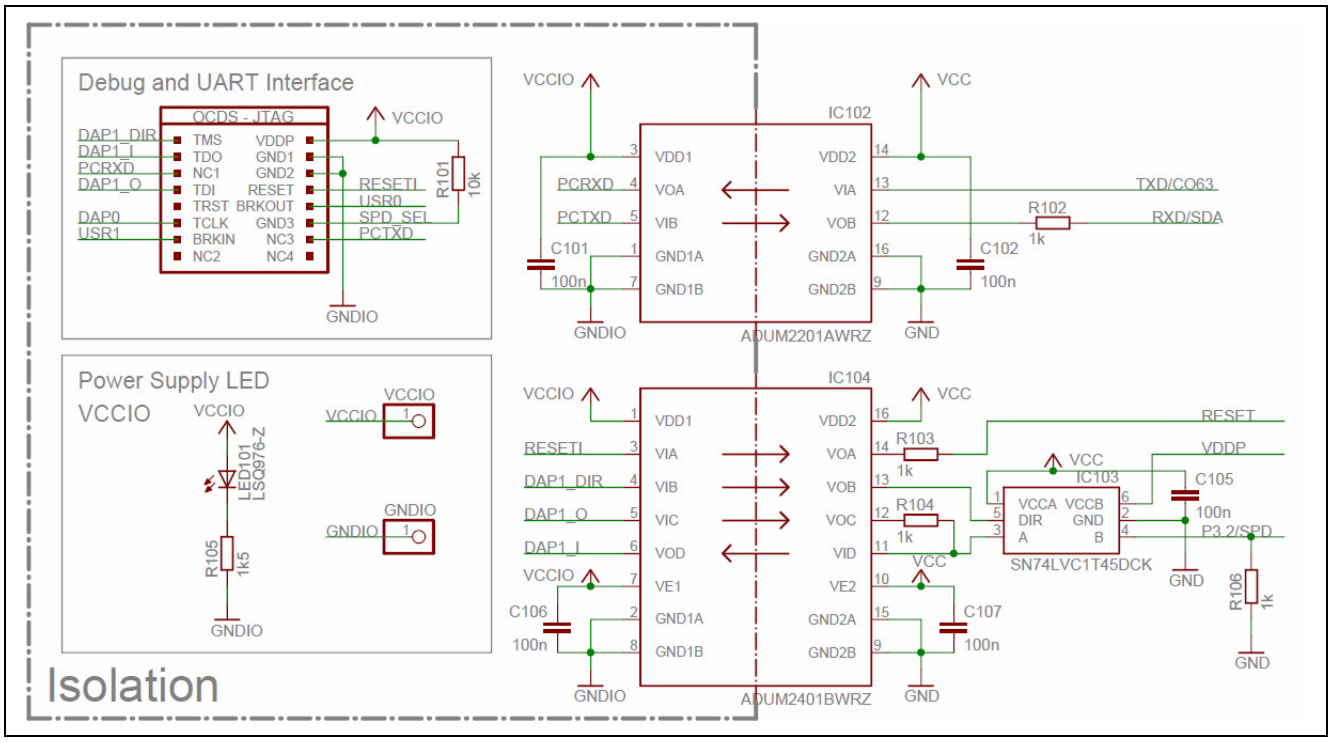


Figure 6 Digitally Isolated Debug Interface

BMI programing is only possible via the SPD protocol, because port pin P3.2 is only connected to the SPD channel of the debug interface. In case of an erroneous change of BMI to UART BSL, connect signal RXD/SDA (pin 1 of header J102) with P3.2. The UART channel of the debug interface can then be used to connect to UART BSL.

The Infineon DriveMonitor USB stick V2 supports both debug channels.

2.5 Inverter Board Connection

The standard 32-pin connector (DIN 41612, B/2) provides all the signals required for control of a 3-phase power inverter. The lowside (_L) and highside (_H) switches of the three power stages U, V and W are to be connected to the signals U_L, U_H, V_L, V_H, W_L and W_H. They are connected to the MCU's CAPCOM6E peripheral, a flexible and powerful PWM unit that is very well suited for motor control. A low signal at the CTRAP pin of the CAPCOM6E immediately switches all power stages to passive state and acts as an emergency shut-down for the inverter. All CAPCOM6E signals of timer T12 are available at pin header JP104.

An enable signal for the power stages can be provided via the ENABLE signal. This is connected to the MCU's GPIO port 0.4.

The ADC signals are connected to the inverter board connector. When using the XC836 DriveCard in motor control applications, it is recommended to use the channels as follows:

- Channel 3 is used for DC link current measurement.
- Channels 0 to 2 can be used for output voltage (e.g. BEMF detection) or phase current measurement.
- Channel 5 is used to monitor DC link voltage.
- Channel 6 is intended to be used as auxiliary analog input.

Note: A 5 V power supply is expected at pins A1-B1 of the inverter board connector in order to supply the MCU and peripheral components.

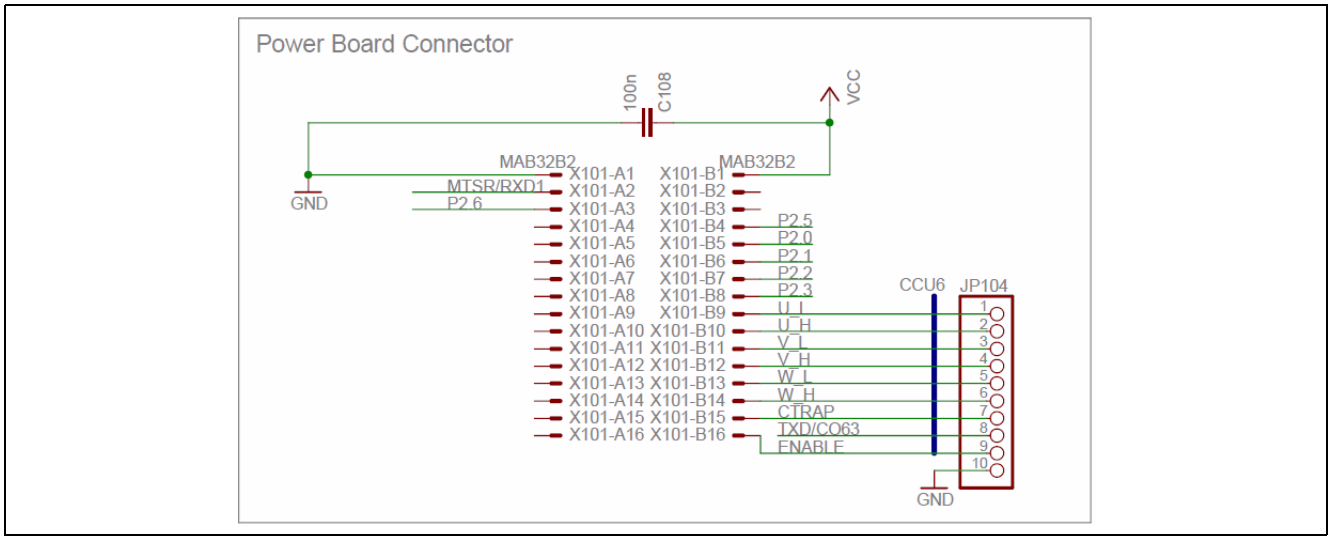


Figure 7 Inverter Board Connector

2.6 Hall Sensor Interface

The MCU provides a HALL sensor interface which can be accessed via JP103. Next to the HALL signals that are pulled up to VCC = 5 V, the VCC and GND signals are also available.

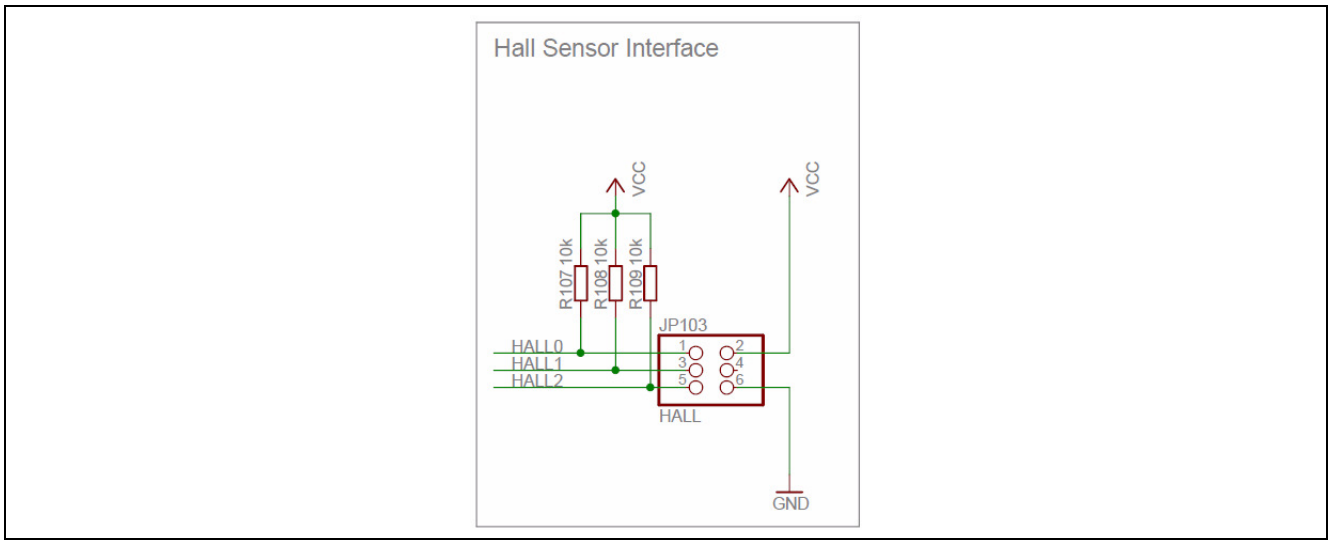


Figure 8 HALL Sensor Interface

2.7 SSC, ASC and I2C Interface

The SSC, ASC and I2C interface from the MCU are provided at JP102. These interfaces are connected directly to the MCU and are therefore not isolated form the hot ground of the power Inverter. The signals of JP102 can also be mapped to GPIOs of the MCU.

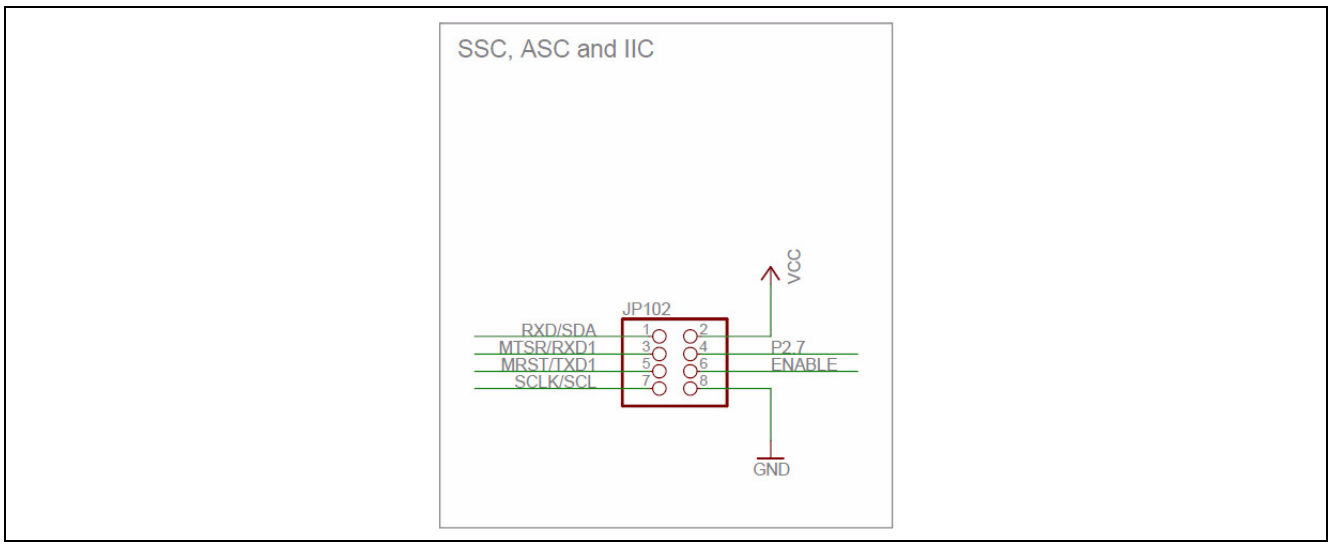


Figure 9 SSC, ASC and I2C Interface

2.8 PCB Layout

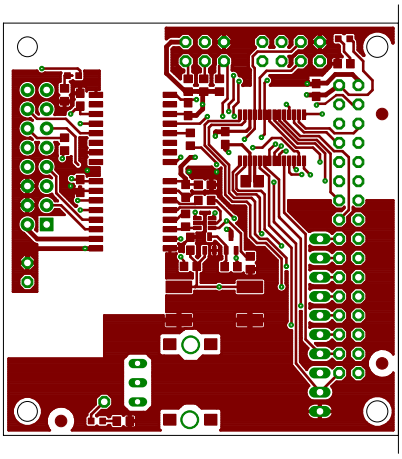


Figure 10 Top Layer

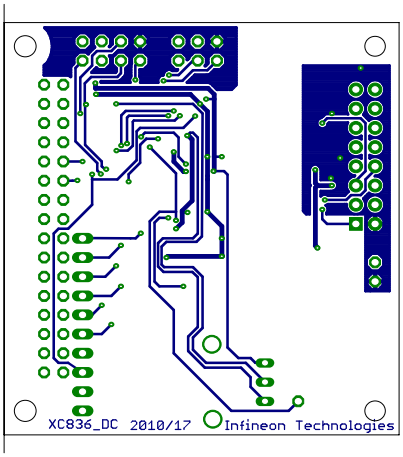


Figure 11 Bottom Layer

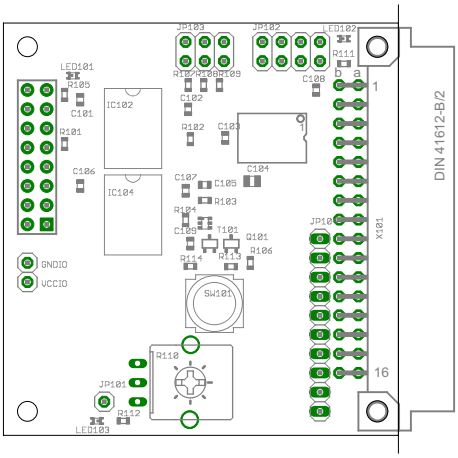
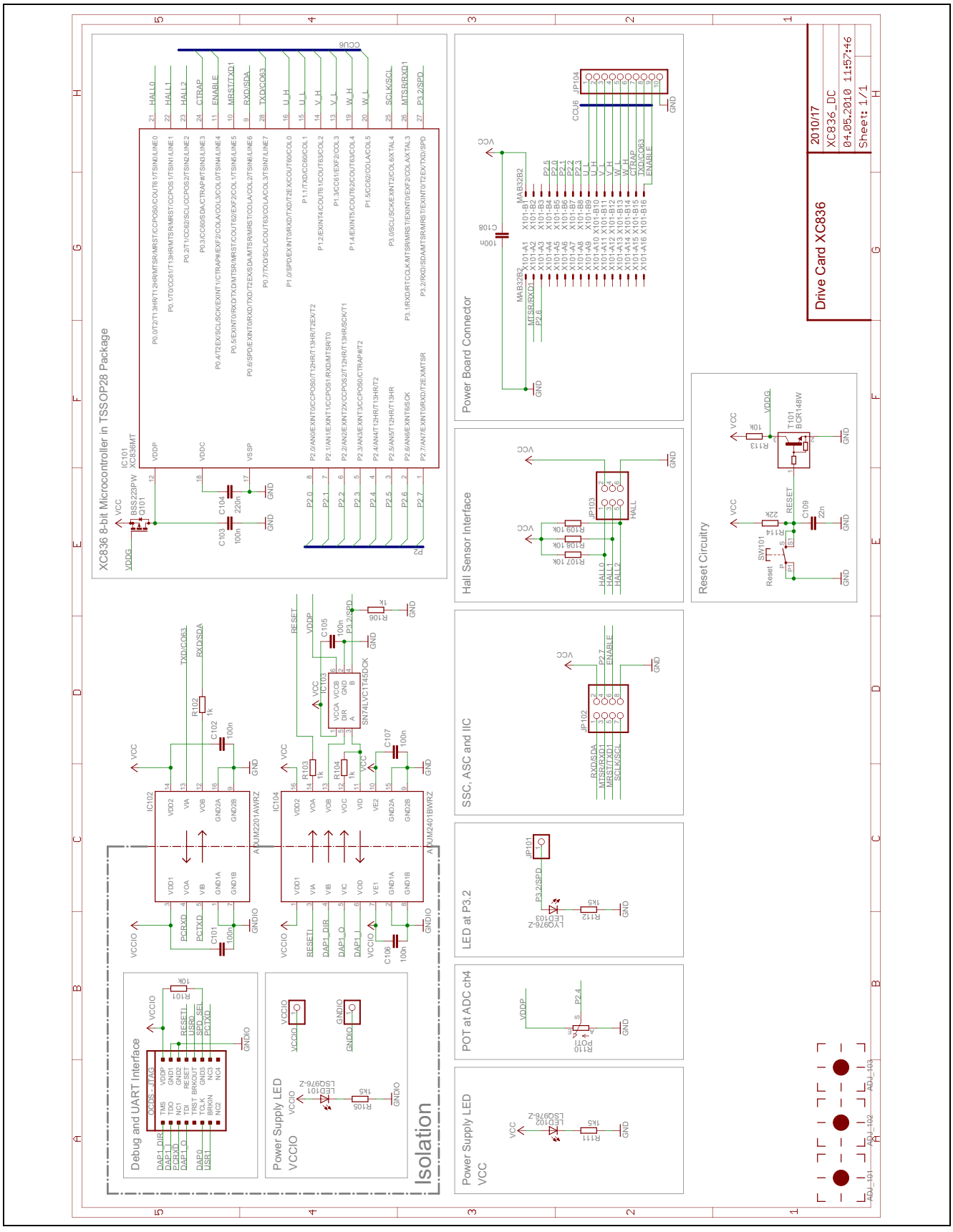


Figure 12 Placement of the Component

2.9 Schematics of XC836 Drive Card



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