

XC800 Family

AP08111

Hardware Description XC824 Drive Card

Application Note

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XC824**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 XC824 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 XC824 is a low pin count product of the XC800 Family from Infineon Technologies.

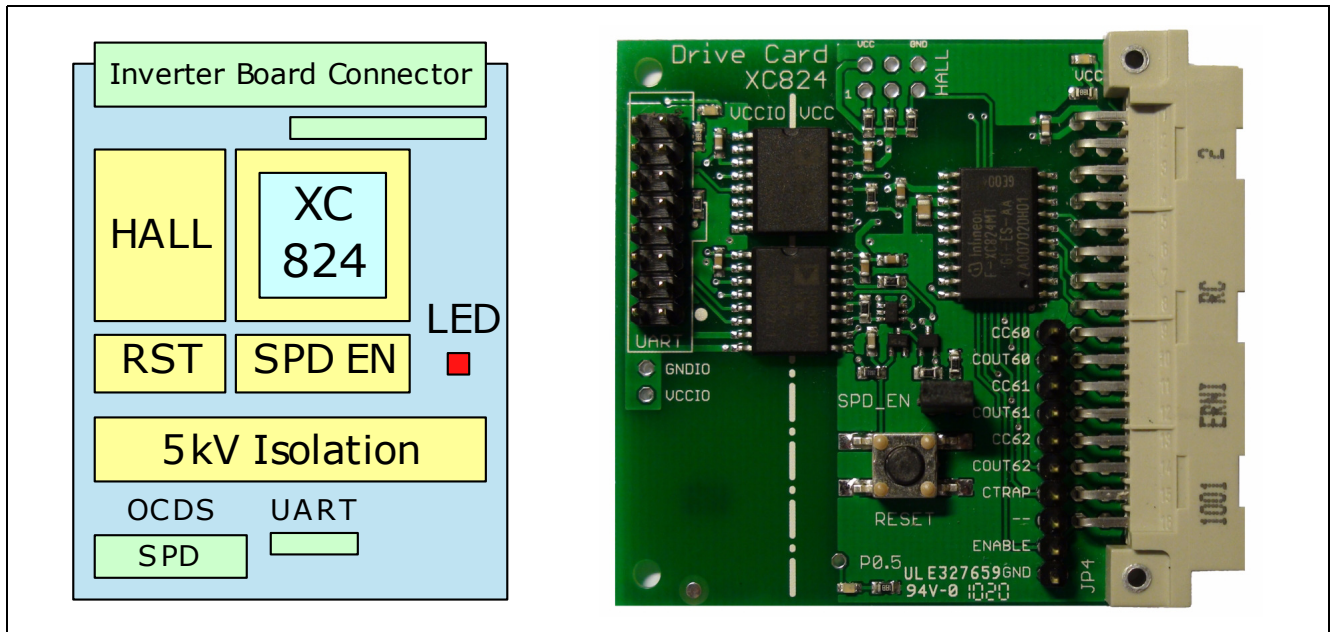


Figure 1 XC824 DriveCard

This DriveCard, featuring the cost-effective 8-bit microcontroller XC824 with 16-bit motor control performance, provides the following interfaces:

- 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 can be used as the user interface in standalone operation

Attention: The reset button is 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
- Four 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 XC824 for Motor Control Applications

- High Performance 16-bit coprocessor (MDU)
 - A Multiply and Device Unit for scaling and normalization
- 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
 - Four 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

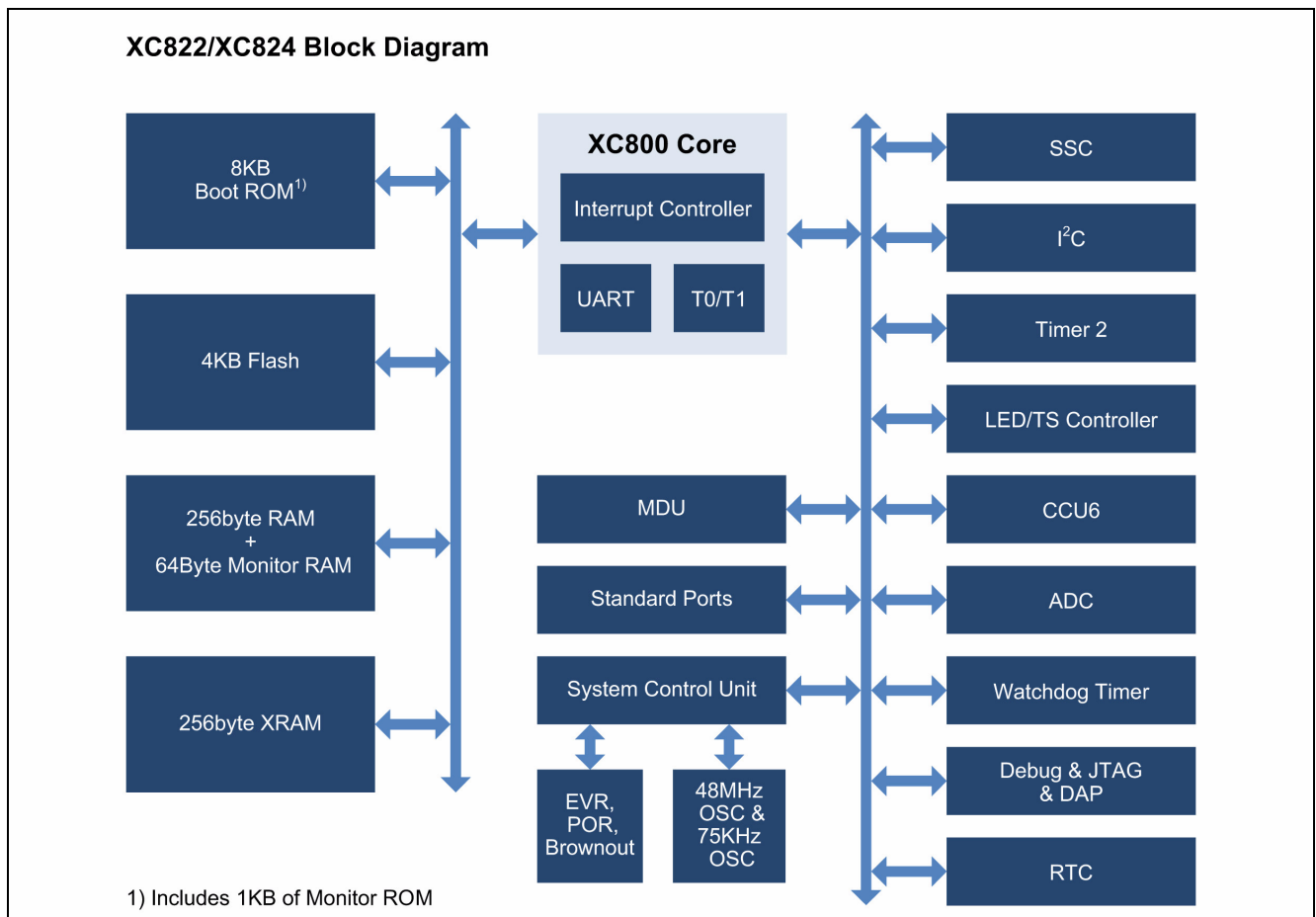


Figure 2 XC824 Block DiagramV1.0

2 Hardware Description

2.1 Power Supply

The XC824 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 XC824 is directly connected to the dedicated interfaces. A software download can be performed via SPD or UART. Note that in the case of the SPD download, the jumper SPD_EN (Single Pin Debug Enable) has to be closed, and for UART operation it has to be removed.

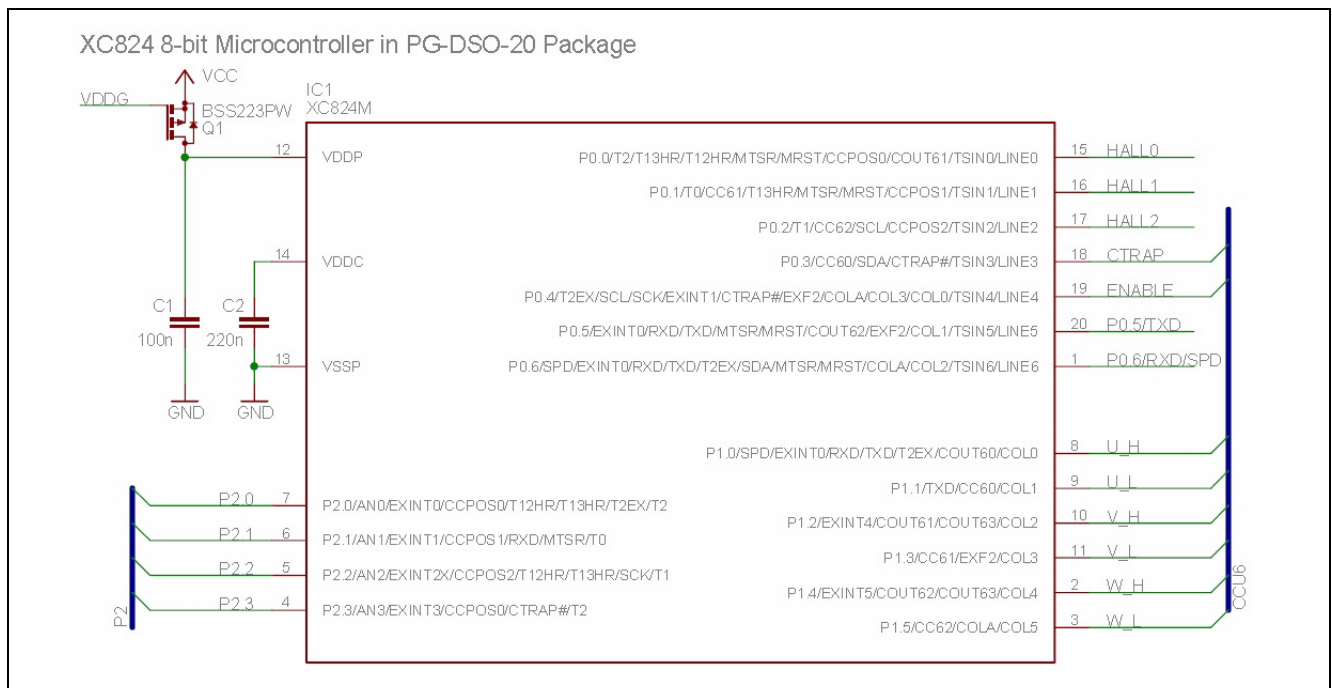


Figure 3 XC824 connections

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 reset pin available at XC824.

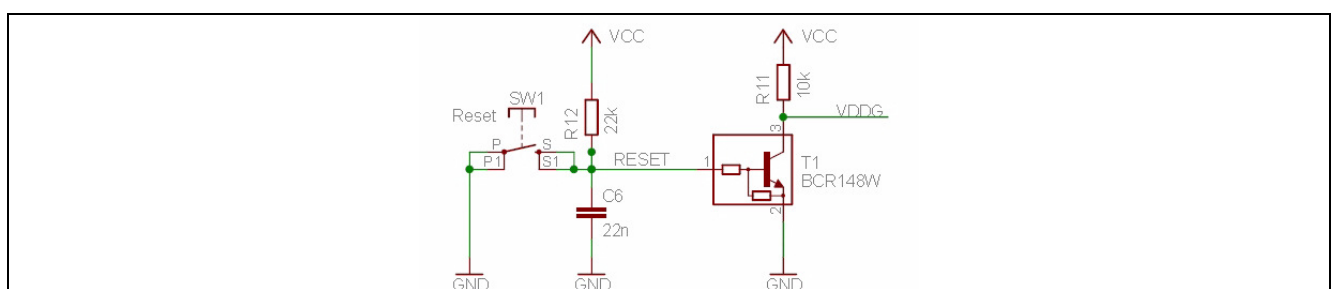


Figure 4 Reset Circuitry

2.3 User Interface

A user interface is available by making use of an LED at port 0.5 which is overlaid with the TXD signal from UART. A test pad is also connected to this port in order to measure fast signals at an oscilloscope.

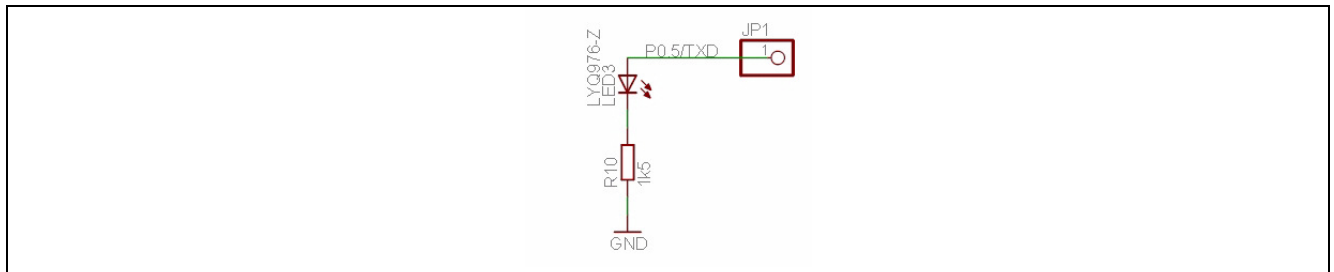


Figure 5 User interface: LED with test pad

2.4 Digitally Isolated Debug Interface (SPD and UART)

The XC824 DriveCard is equipped with a digital isolation for 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 XC824 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 not be used in parallel. When UART full duplex communication is desired, the jumper SPD_EN must be removed. A simplex (transmit) in parallel to SPD can always be utilized.

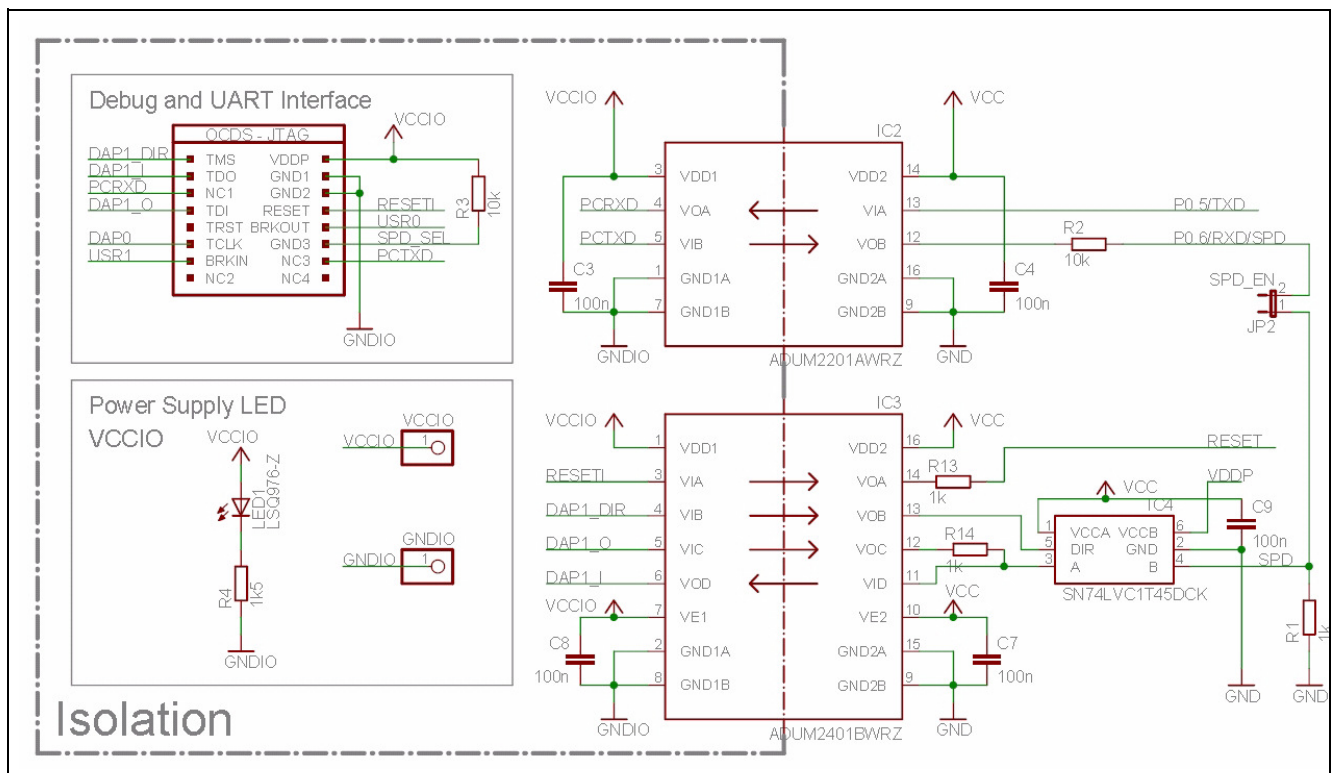


Figure 6

The digital isolation is based on unidirectional signals. As a result, three signals must be provided for SPD: in, out and direction. There is a USB Stick available at Infineon Technologies (DriveMonitor v2) that 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 details.

The boot configuration for XC824 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.

Either the UART BSL or SPD protocol can be used for BMI programming. Because both protocols share the same pin (port P0.6), UART BSL must be selected when changing from UART BSL to SPD. Changing back to UART BSL is only possible by using SPD protocol. The Infineon drive monitor USB stick V2 supports both protocols.

2.5 Inverter Board Connection

The standard 32-pin connector (DIN 41612, B/2) provides all signals needed 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 in passive state and acts as an emergency shut-down for the inverter. All CAPCOM6E signals of timer T12 are available at pin header JP4.

An enable signal for the power stages can be provided via signal ENABLE and is connected to the MCU's GPIO port 4.0.

The ADC signals are connected to the inverter board connector. Using the XC824 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.

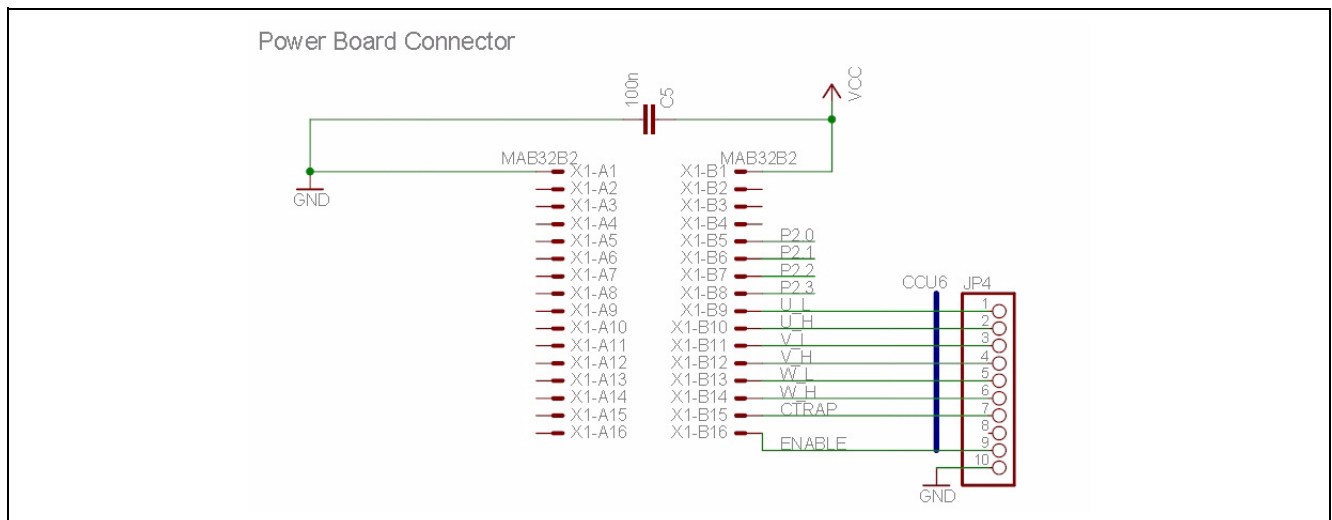


Figure 7 Inverter Board Connector

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.

2.6 Hall Sensor Interface

The MCU provides a HALL sensor interface which can be accessed via JP3. Next to the HALL signals that are pulled up to VCC = 5 V, the VCC and GND signals are also available.

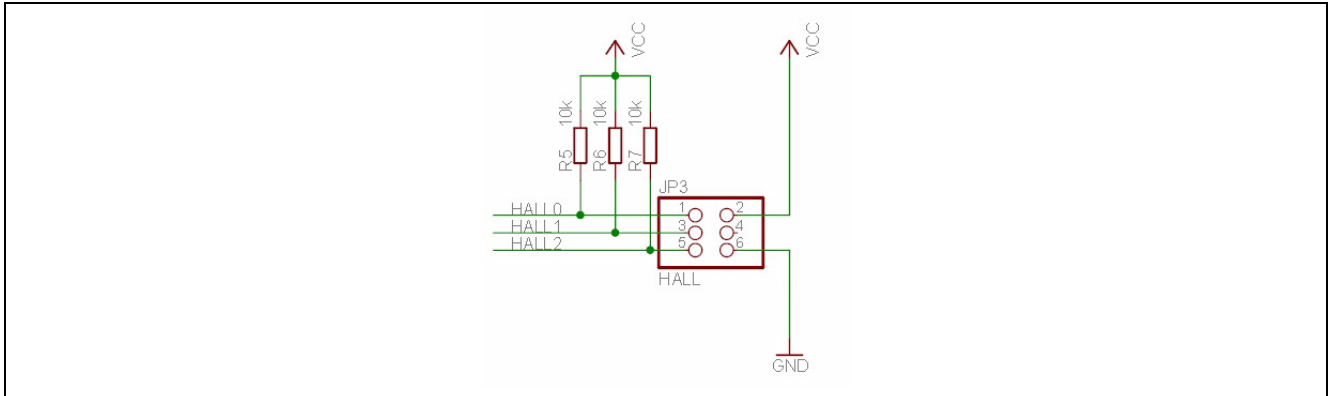


Figure 8 HALL Sensor Interface

2.7 PCB Layout

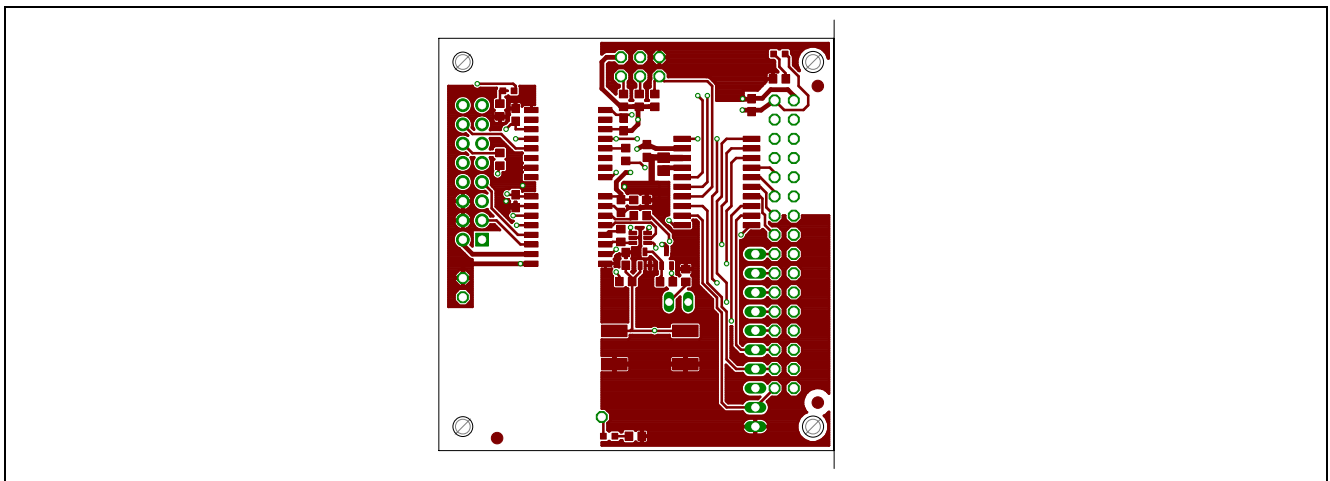


Figure 9 Top Layer

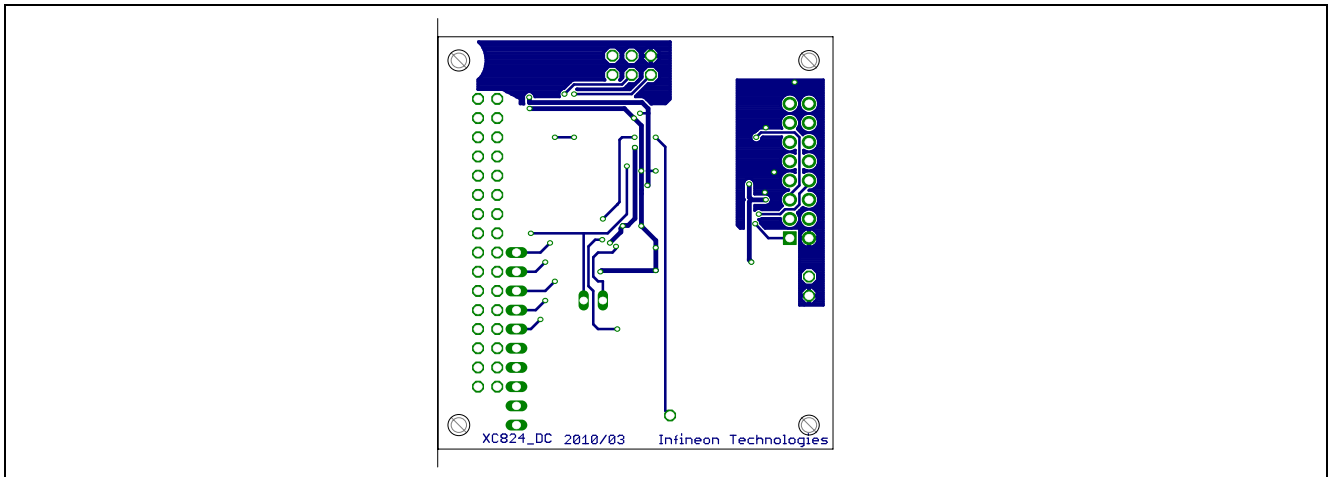


Figure 10 Bottom Layer

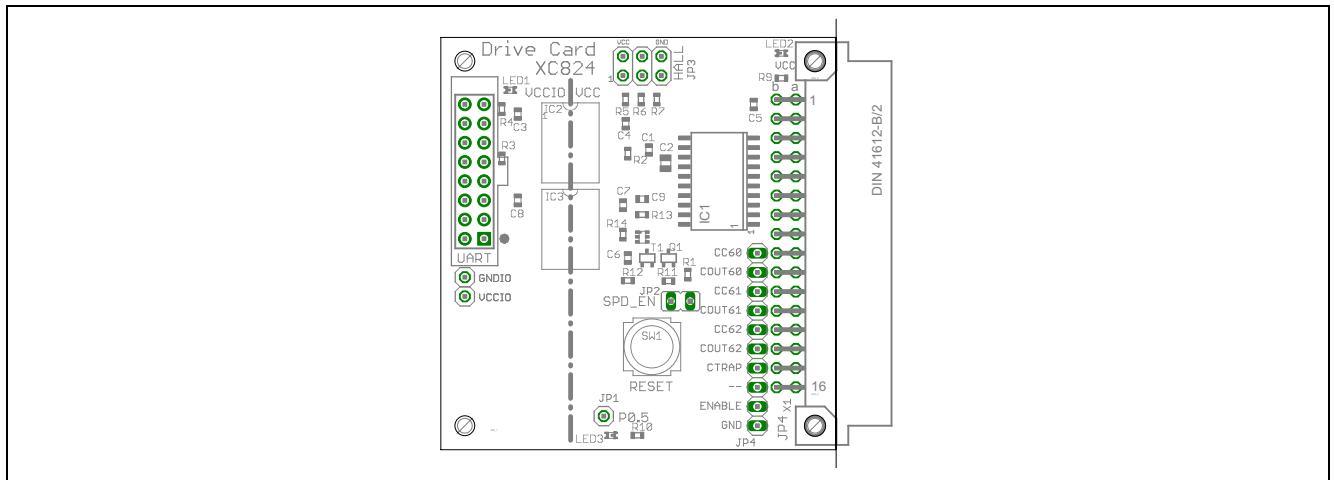
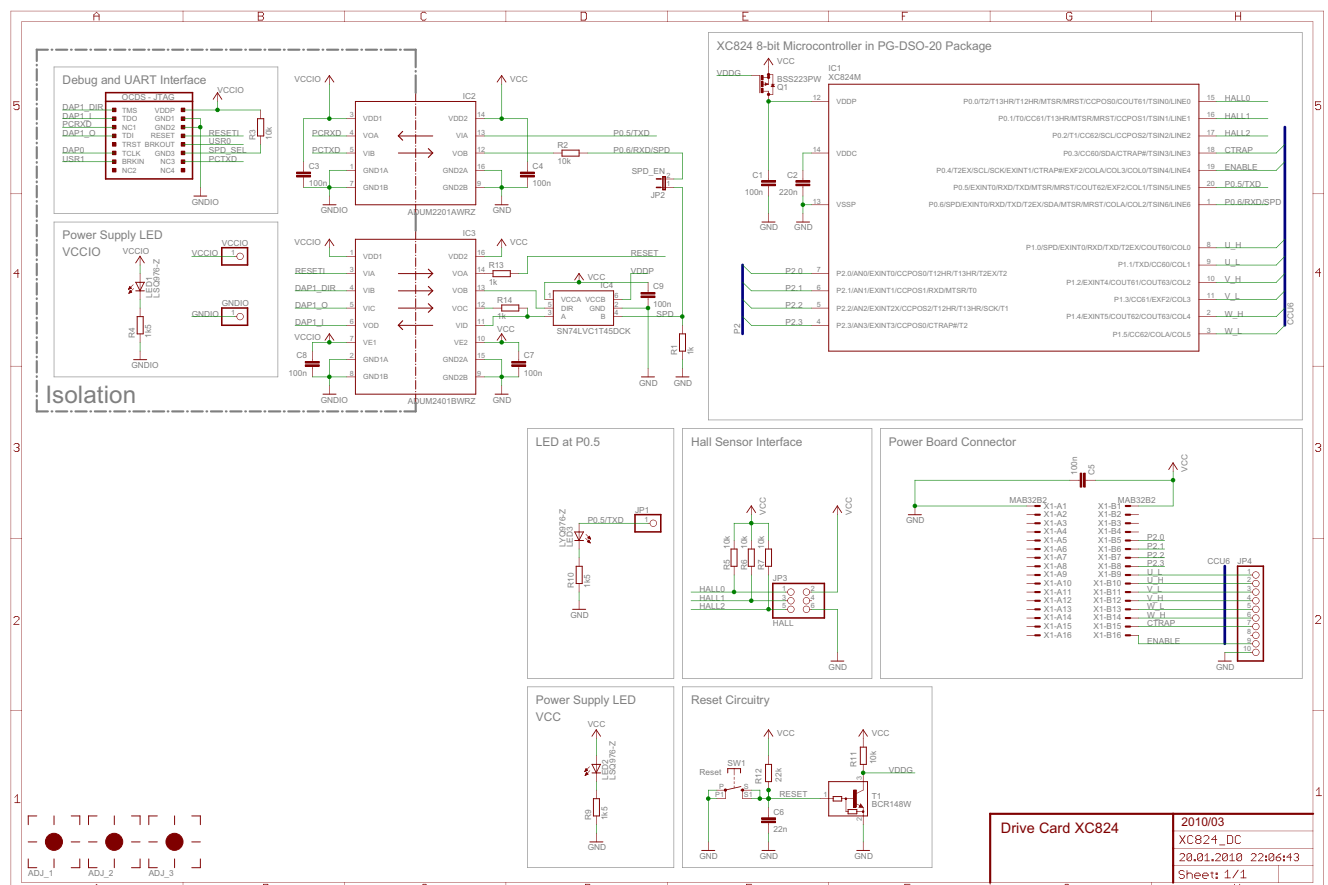


Figure 11 Placement of the Component

2.8 Schematics of XC824 Drive Card



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