XE166 Family

AP16189

XE161FL/FU XC2xxx DriveCard Hardware Description
Board REV.2011/05

Application Note

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Microcontrollers

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Device1
Revision History: V1.0 2011-03

Previous Version(s):

Page	Subjects (major changes since last revision)
–	This is the first release.

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1 Introduction

The DriveCard supports all XE161FL/FU derivatives and all XC2xxx derivatives in a 48Pin VQFN package. However only the XE161FL/FU is described in this document.

XE166 Family - More Performance, More Flash, Better Peripherals

With more than 15 successful years in the microcontroller market place, the C166 has set the standard for 16-bit architectures with the highest aggregate volume share of all available 16-bit devices.

With its fast interrupt response and context switching, the C166 family is ideally suited for automotive, industrial, mass storage and wired as well as wireless communications applications.

Compared with the XC166, XE166 delivers more performance, more Flash memory, more RAM, strongly enhanced peripherals and a complete DSP library.

MCU and DSP in a Core

Infineon Technologies Real Time Signal Controller combines the traditional strengths of a Microcontroller Unit (MCU) to control peripherals, with the computing power of Digital Signal Processors (DSP), together in one enhanced XE166 core.

The Microcontroller's real-time capability and ease of use, combined with the DSP's mathematical performance and data throughput, form a powerful singe-chip solution that is ideal for many embedded applications.

For detailed technical information about the different derivatives please refer to the XE166 product family pages on the Internet: **http://www.infineon.com/XE166**

2 DriveCard Overview

The XE161FL/FU DriveCard was designed to be used in motor control systems. The DriveCard provides all the signals necessary to drive a power inverter, including feedback signals.

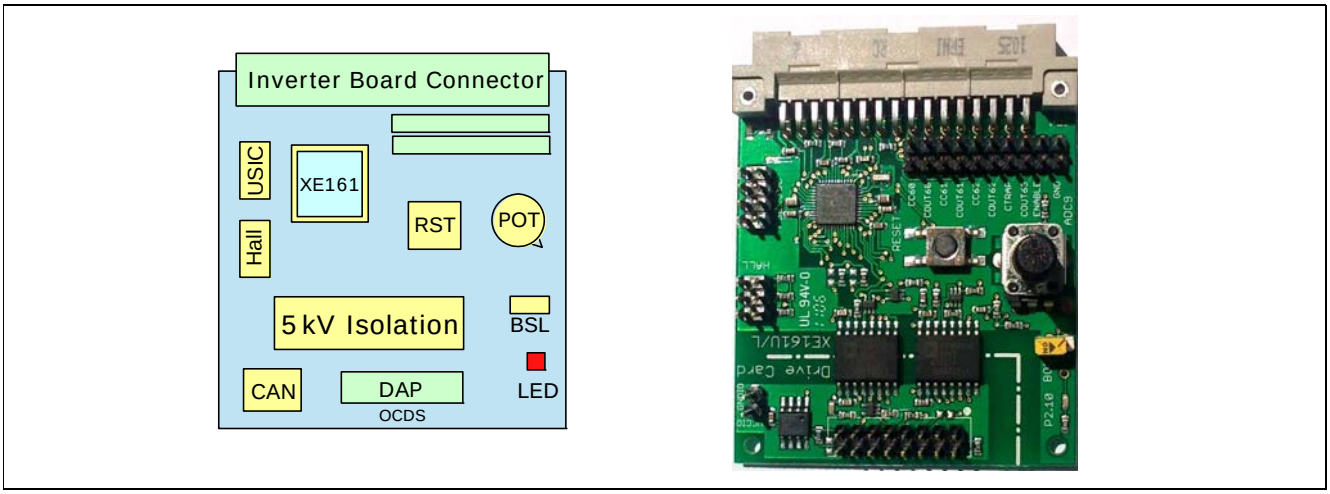

Figure 1 XE161FL/FU DriveCard

Interfaces

The DriveCard, featuring the cost-effective XE161FL/FU 16-bit microcontroller with 32-bit motor control performance, provides the following interfaces:

- USIC ASC / SSC / IIC - Asynchronous serial interface such as SPI, UART or IIC
- A HALL interface - To directly connect HALL sensors of a motor
- Encoder Interface - To directly connect Encoder signals of a motor
- Digital isolated DAP (2 wire JTAG) - Programming and debugging interface
- Digital isolated CAN - Controller Area Network; for real-time monitoring and parameter setup
- Digital isolated UART: Used for example for real-time monitoring and parameter setup
- User interface: A POTi and an LED can be used as the user interface in stand-alone operation

Signals

The inverter board connector provides the following signals:

- Two times six PWM channels for 3-phase motor control (CAPCOM6E)
- Two seperate shut down signals for PWM channels (CTRAP)
- Seperate enable signal for the two 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
- CAPCOM2 outputs for PFC and Brake Gate
- The power supply input (5 V) for the DriveCard

2.1 DriveCard Setup

Boot Mode Index (BMI) configuration is used to overcome the problem of a limited number of pins being available for start-up configuration on low pin-count devices. The advantage of using BMI is that the requirement of configuration pins for the various start-up modes can be minimized.

BMI is a value programmed into the dedicated locations in the Flash Config sector. This value will be read on power-on if the configuration pin TRST = 1.

Depending on the BMI value and the configuration pins P10.12 and P2.9 for low end devices, the devices can be started in different modes.

Note: The Boot jumper J1 is only used during production test. By default the DriveCard of the XE161FL/FU is configured for DAP debugging without Boot Loader Support.

For more Information about BMI programming and handling please refer to the Application Note AP16188.

Table 1 DriveCard Configuration Options

Name in Schematic	Configuration	Description
CAN communication	R6 = 0R R7 = open R8 = 0R R9 = open R11 = open R12 = open	Configuration used for XE161FL devices with CAN.
UART communication	R6 = open R7 = 0R R8 = open R9 = 0R R11 = 0R R12 = 0R	Configuration is used for XE161FU devices without CAN.
SPD mode	R3 = open	The DAP0 Signal is not used for debugging.

3 Hardware Description

3.1 Power Supply

The XE161FL/FU DriveCard is supplied by two power supply domains:

- The main supply (VCC) is fed from the inverter board connector (see **Section 3.5**) and is connected to the MCU and all associated blocks.
- A second supply domain (VCCIO) exists for the digital isolation and the CAN transceiver. This can be provided via the CAN or the JTAG connector. Please refer to **Section 3.4** for details.

Two LEDs indicate the presence of these supply voltages.

3.2 XE161FL/FU

The XE161FL/FU microcontroller is directly connected to dedicated interfaces. Next to the integrated current trimmed oscillator, an external resonator with 8 Mhz is available.

A software download can be performed via JTAG, UART or CAN. For a UART or CAN download, the dedicated BSL (Boot Strap Loader) has to be set (see **Section 2.1**).

For normal operation, the BMI of the XE161FL/FU is programmed during production test for DAP OCDS mode.

A reset button is also available to trigger a hardware reset.

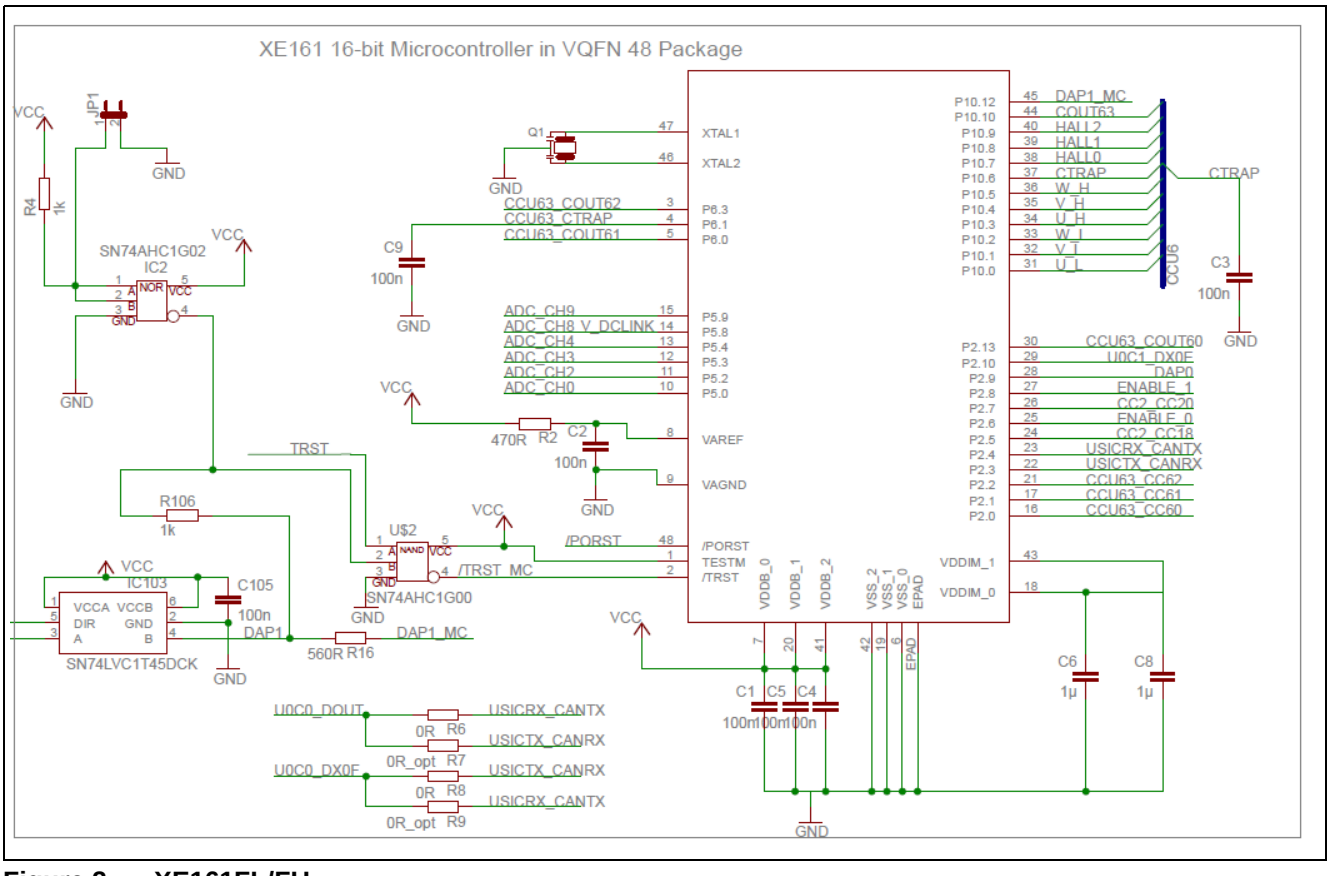

Figure 2 XE161FL/FU

3.3 User Interface

The user interface consists of a POTi and a GPIO LED. The POTi is connected to ADC0 channel 9, and the LED is connected to port 2.10.

Both the POTi and the LED signals can be used for other purposes. The port 2.10 is also used for USIC data input. The ADC channel 9 is available on the power board connector and can be disconnected from the POTi via the zero ohm resistor R15. A test pad is also connected to the LED port in order to measure fast signals on an oscilloscope.

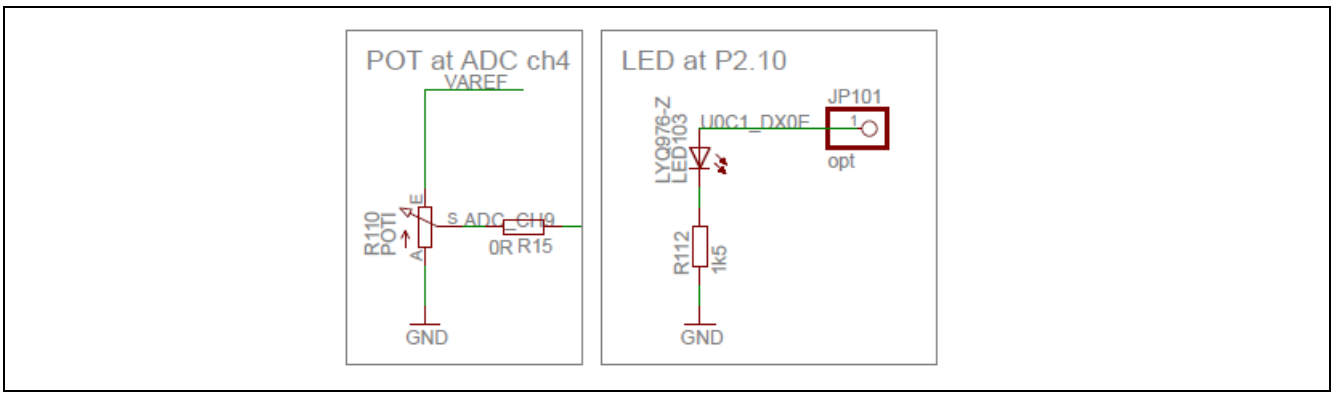

Figure 3 User Interface: POTi and LED

3.4 Digitally Isolated Debug Interface (JTAG, UART and CAN)

The XE161FL/FU DriveCard is equipped with digital isolation for DAP, UART and the CAN interface. The 5 kV digital isolation securely disconnects any debug, UART and CAN devices from the high voltage levels.

CAN will only be avalible if the DriveCard is produced with a XE161FL, but in this instance no UART is avalible on the Debug header. If the XE161FU is used, only UART is avalible, as these devices do not offer CAN.

As there is a separate power domain for the PC part of the XE161FL/FU DriveCard, a 5V power supply must be provided separately at VCCIO and GNDIO. LED1 indicates the availability of this supply.

Infineon provides the DriveMonitorII USB Stick that provides DAP, UART and CAN, as well as the 5 V power supply, in one device. Please refer to application note AP90006 for further details.

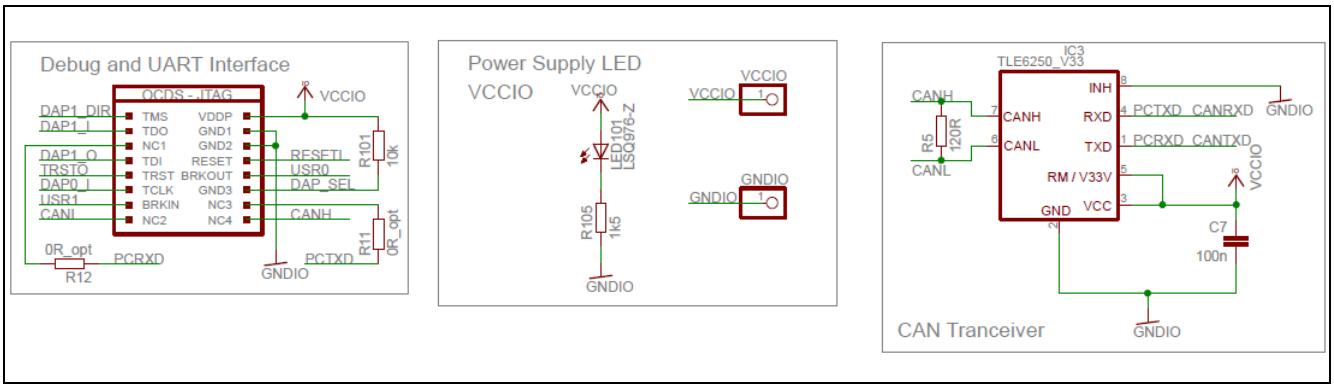

Figure 4 JTAG, UART and CAN: Debugger and Real-Time Monitoring Interface

Note: When a standard JTAG box is used, the VCCIO power supply must be provided at the seperate power connector.

3.5 Inverter Board Connection

The standard 32-pin connector (DIN 41612, B/2) provides all the signals needed for control of the two 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 CCU60 and CCU63, the flexible and powerful PWM unit that is particularly suited for motor control.

A low signal at the CTRAP pins of both CAPCOM6E immediately switches all power stages to the passive state and acts as an emergency shut-down for the inverter. All CAPCOM6E for CCU60 signals, including COUT63, are available at pin header JP104, and at pin header JP2 for CCU63.

An enable signal for the two power stages can be provided via signal ENABLE, with connections to the MCU's GPIO port 2.6 for CCU60 and port 2.8 for CCU63.

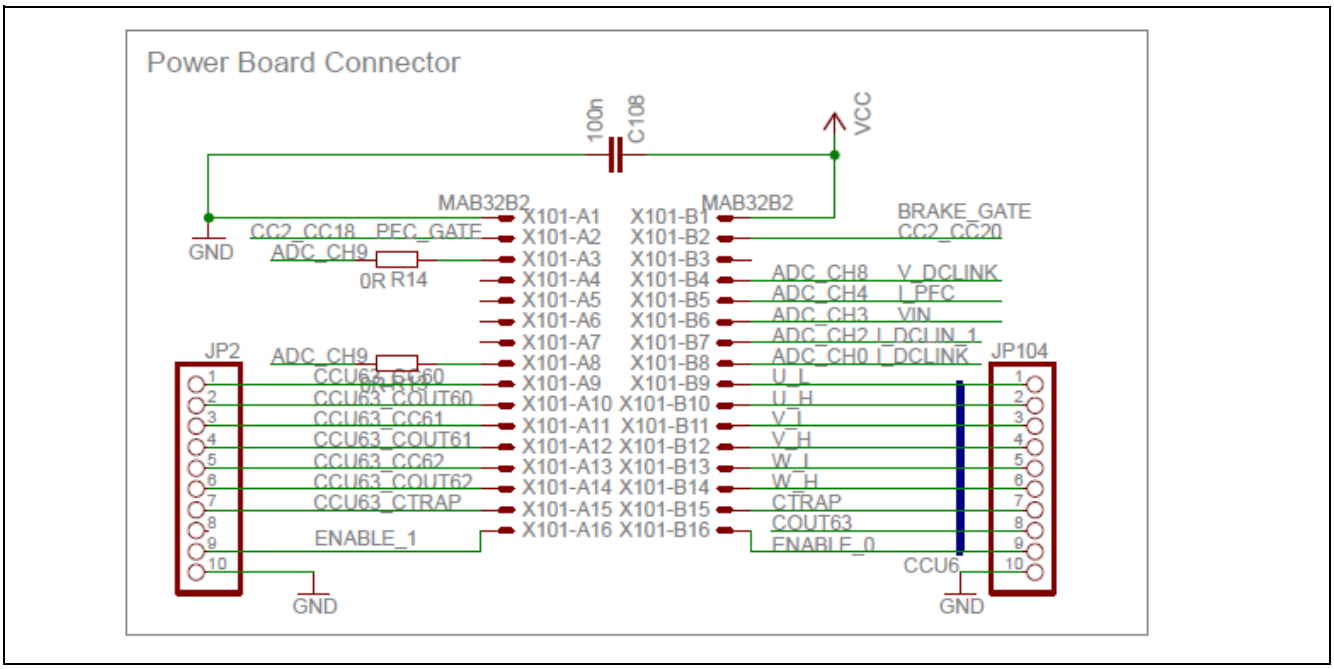

Figure 5 Power Board Connector

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

3.6 Hall Sensor and Encoder Interfaces

The MCU provides a HALL sensor interface, accessed via JP103. The HALL signals are pulled up to VCC = 5 V. The VCC and GND signals are also available on the connector.

The Encodeer Signals ENC_A and ENC_B are conected to the Timer 3 input. T3 operates in incremental interface mode automatically providing information on the sensor's current position. These pins are overlayed with the CCPOS1A (HALL1) and CCPOS2A (HALL2) pins.

In incremental interface mode, the two inputs associated with core timer T3 (T3IN, T3EUD) are used to interface to an incremental encoder. T3 is clocked by each transition on one or both of the external input pins to provide 2-fold or 4-fold resolution of the encoder input.

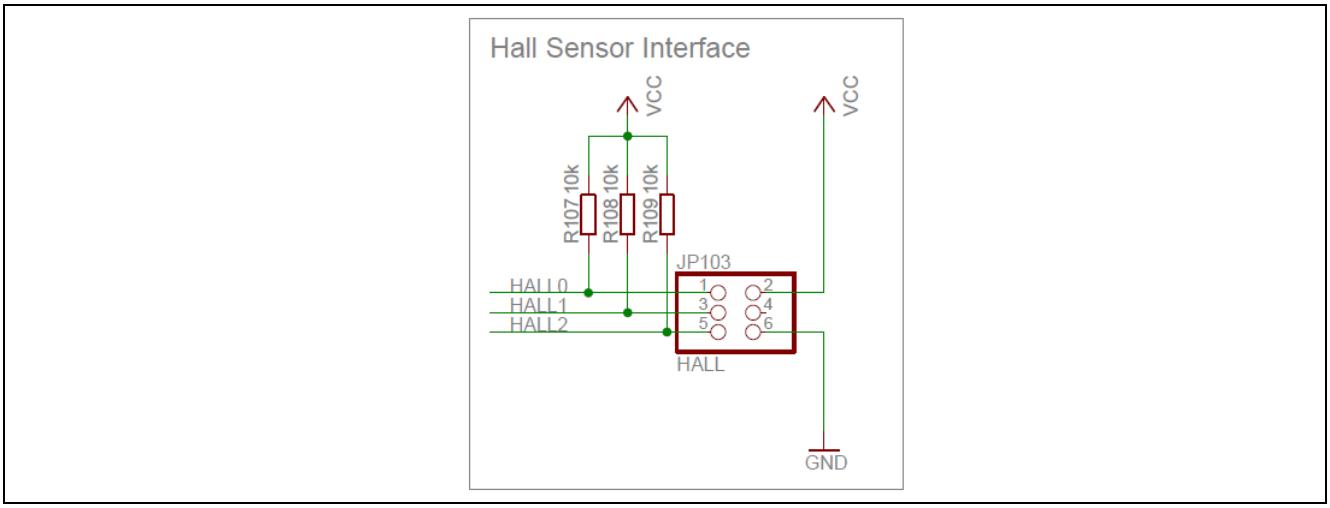

Figure 6 HALL Sensor Interfaces

3.7 USIC Interface

The USIC0 Channel1 signals from the MCU are provided at JP102. This interface is connected directly to the MCU and is therefore not isolated form the hot ground of the power inverter. The Interface can be used either as ASC or SSC. The JP102 signals can also be mapped to XS161FL/FU GPIOs.

The USIC interface can only be used if the inverter 1 signals via CCU63 are not used.

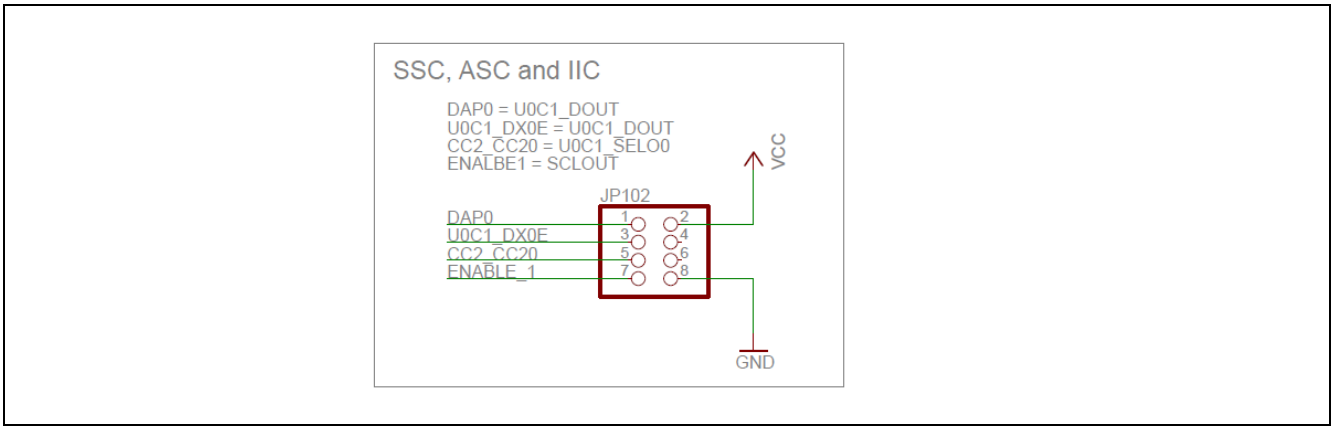

Figure 7 USIC Interface (SSC, ASC)

4 PCB Layout

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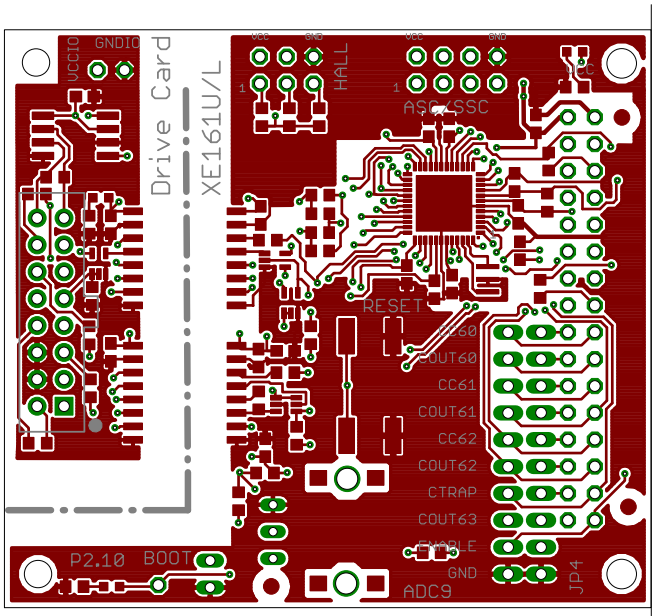

Figure 8 Top view and Text

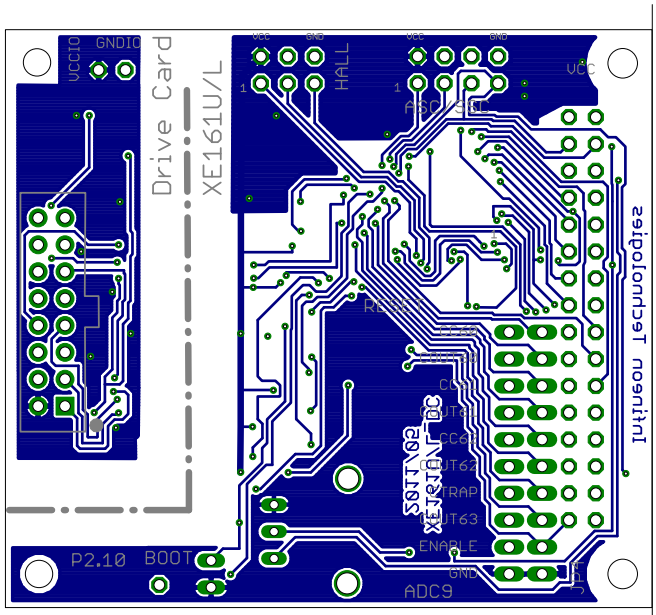

Figure 9 Bottom View

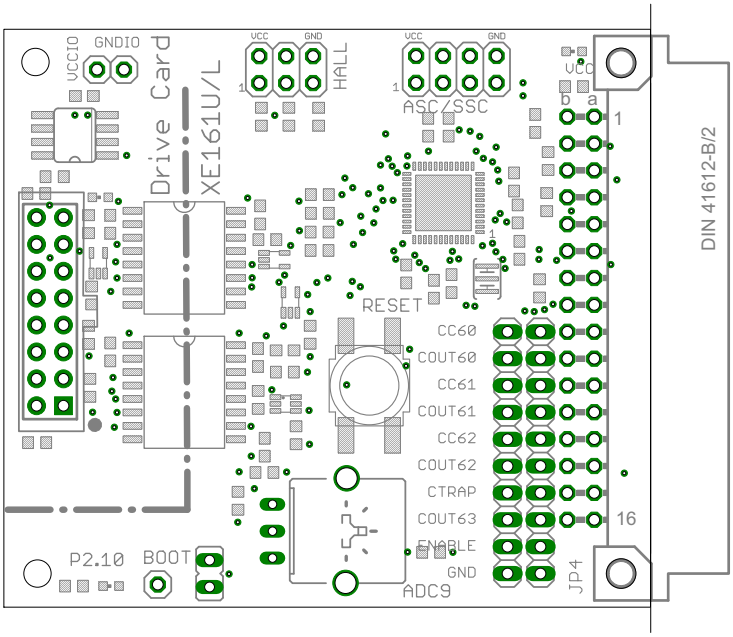

Figure 10 Solder View

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