ST Industrial Communication Board - EVALCOMMBOARD

Introduction

ST Industrial Communication Board (order code: EVALCOMMBOARD) is a platform for Communication, Command and Control exchange with Industrial reference design boards.
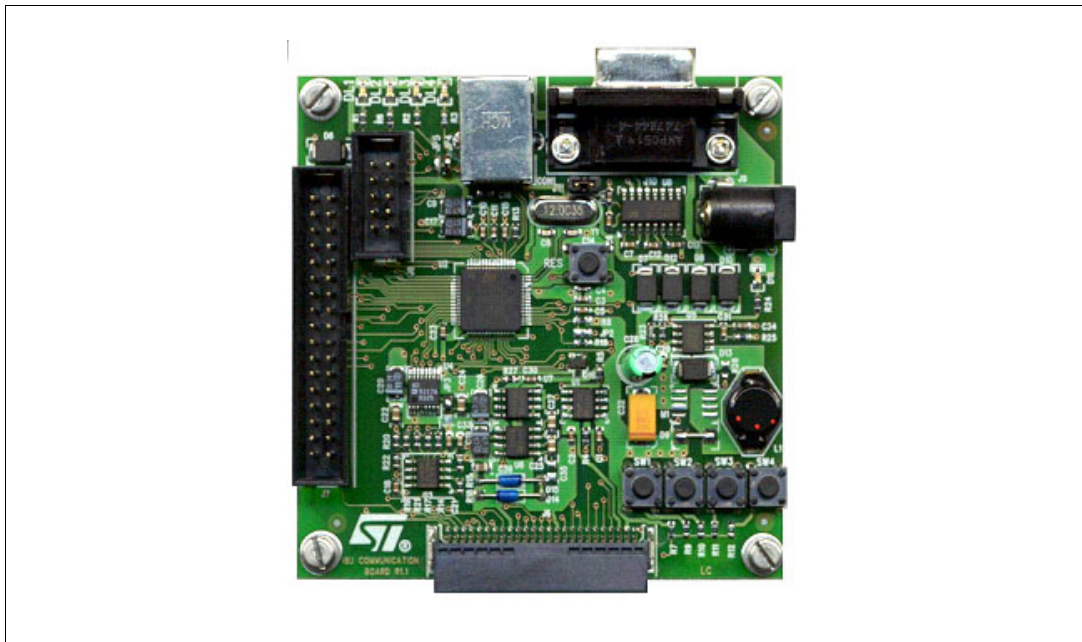
Its goal is to provide ST Industrial customers a reliable and easily accessible communication channel, between a controlling PC and Industrial reference design boards.

It is a unique platform that allows evaluating a wide range of Industrial products in their application environment.

Application fields covered by this platform are:

● Power line communication

● Motor control and gate driving

● Intelligent power switches

Industrial Communication Board

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1 System overview

The ST Industrial Communication Board is a general purpose board developed around the following principles:

● Provide a reliable communication channel between a controlling PC and Industrial reference design boards

● Provide flexibility, one board to control all Industrial reference designs

● Run dedicated firmware (FW) available for all reference designs

● Interact with dedicated software (SW) implementing reference design Graphical User Interface (GUI)

This enables ST Industrial customers to control and test all products using the same controlling platform.

The ST Industrial Communication Board is based on a ST72F651AR6 USB microcontroller, providing as main interface to controlling Personal Computer a standard 12 Mbs USB, available on all modern PCs. This provides very easy interconnections to globally available laboratory equipment. An RS232 interface is present too, and can be used as spare communication port.

Specific interfaces to reference design boards are present to provide flexibility towards different applications.

A 10-bit Digital to Analog Converter (DAC) and high gain, high bandwidth amplifiers are present on board.

Jumpers, switches and LEDs give further adaptability and visualization tools.

A full range of dedicated FW, GUIs and reference design boards are available for every ST Industrial product, fully compatible with the ST Industrial Communication Board.

2   Power supply

Board components require the following voltage supplies.

Table 1.   Voltages present on board

Function	Supply	Converter	Device	Input Range	Output Value
Main Power Supply	VDD	Switching Converter (Buck)	L5973D	5V ÷ 35V	5V
MCU Flash Programming	VPP	Regulated Charge Pump Converter	ST662A (pin VOUT)	Vdd	12V
OpAmp negative supply	-5V	Non regulated Charge Pump	ST662A (pin C1-)	Vdd	-5

These supplies are all derived from an input power supply that can be taken from four different sources:

1.   PLM 10V: connected to the 10V line of the PLM connector
2.   5V Motor: connected to the 5V line of the Motor connector
3.   Phone Jack: external connector, compatible with common notebook power supply connectors, bringing power supply in the 5V÷ 35V range
4.   USB 5V: connected to the 5V line of the USB supply

This enhanced flexibility of source and source voltage selection coexists due to diodes D7, D8, D10 and D12, which prevent the reverse current flowing in the supply inputs, keeping different sources independent.

The higher voltage input will be the dominant supply.

LED D11 is turned on when the power supply is active.

Figure 1.   Main power supply
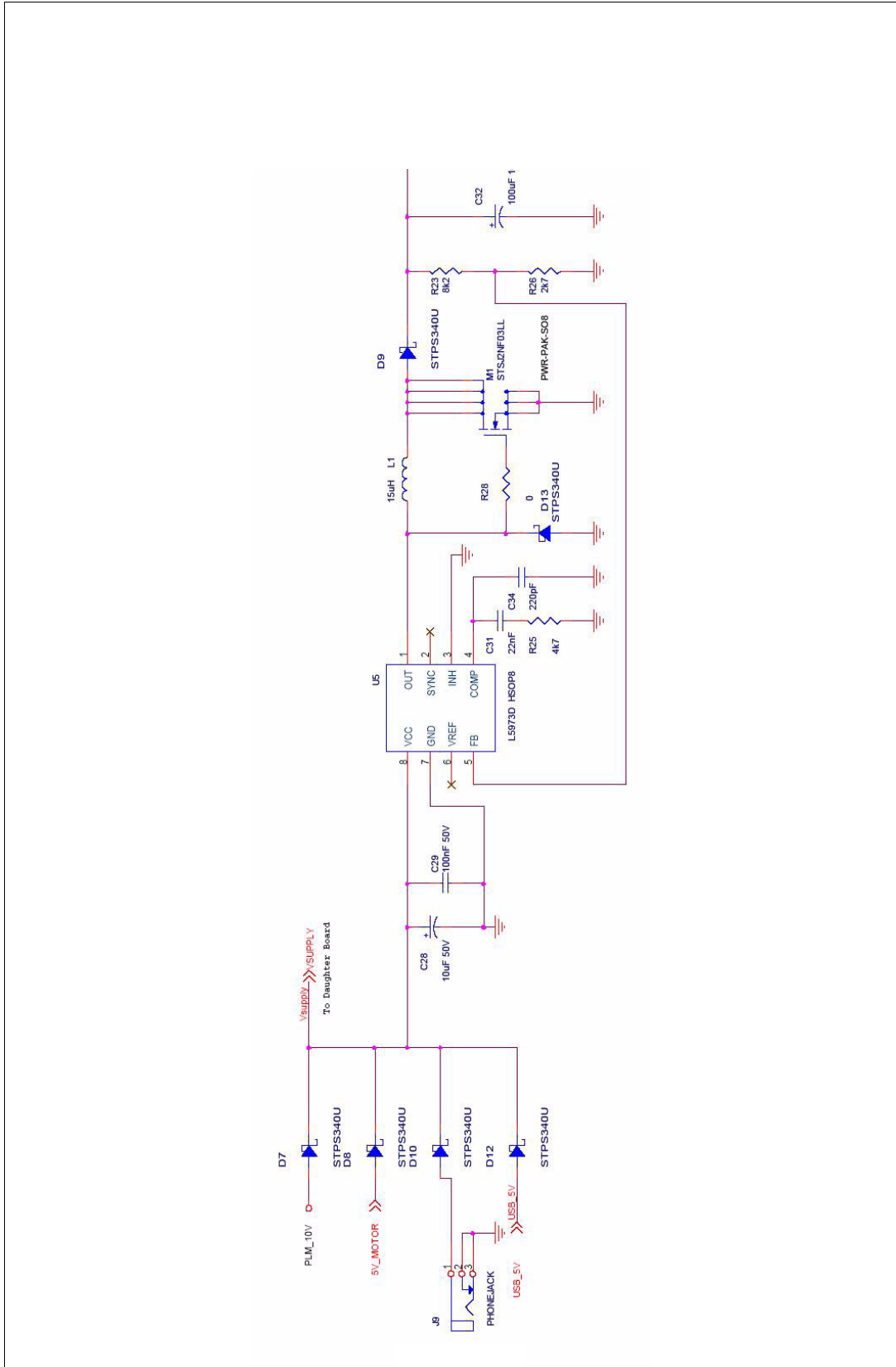
Figure 2.   Flash programming and OpAmp power supply
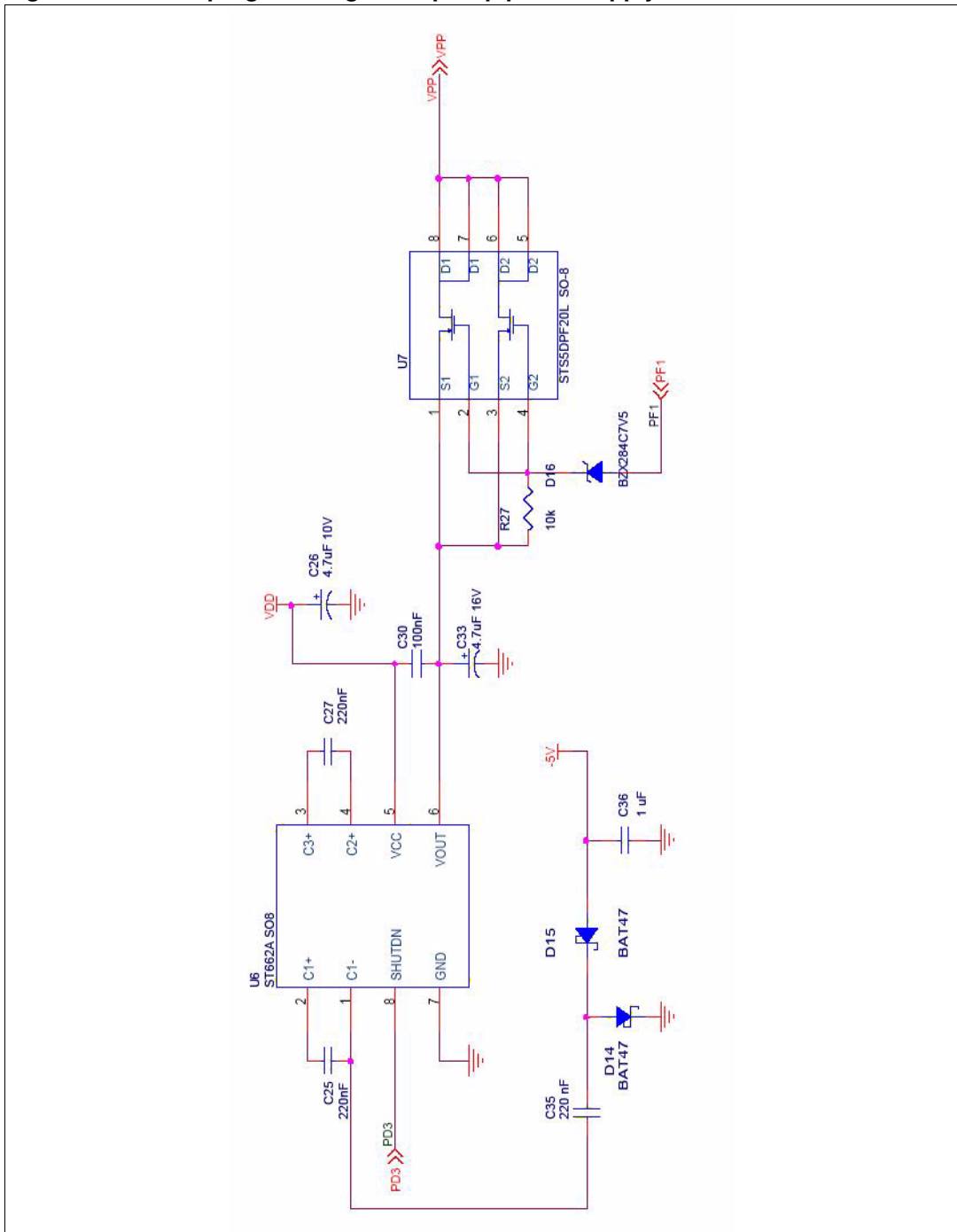
Figure 3.   Power supplies PCB area
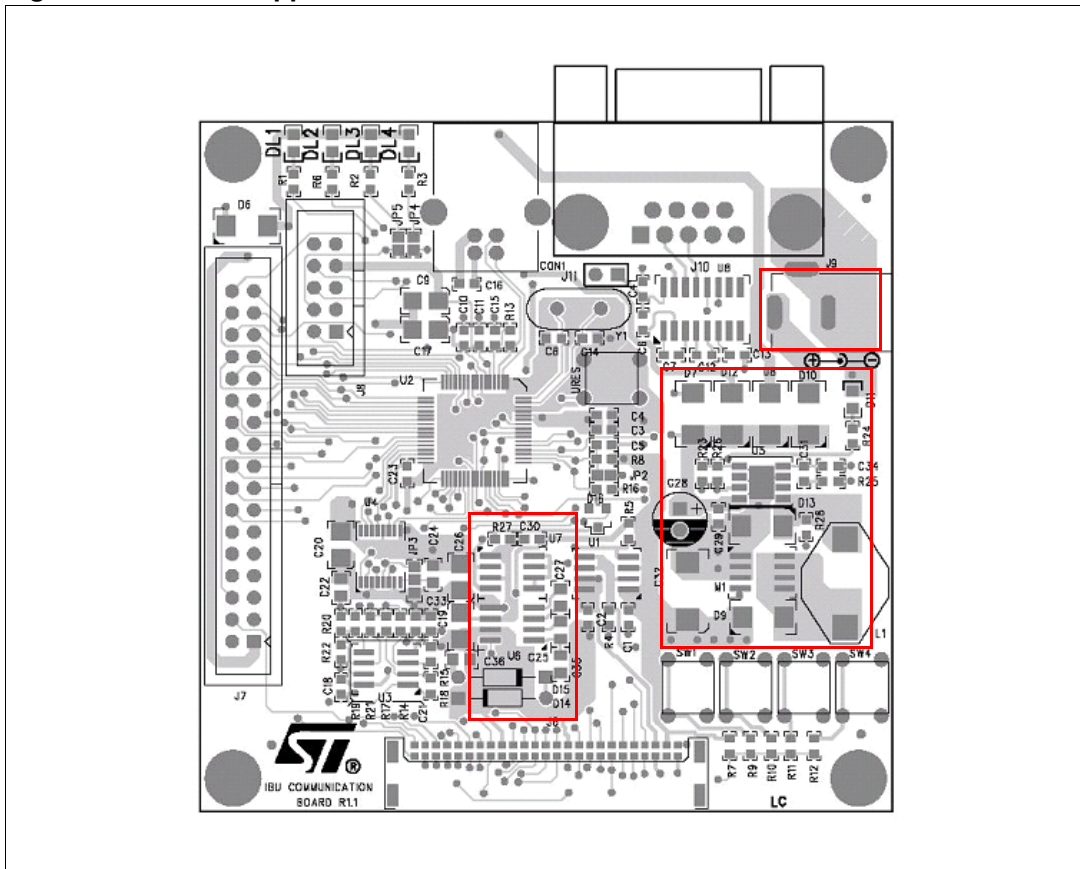
2.1   Main power supply (V_{DD})

The main power supply system of Industrial Com Board consists of a DC-DC switching converter based on step-down regulator L5973 from ST. The switching regulator is designed to provide 5V (V_{DD}) stabilized on the output with an input range 5V ÷ 35V and it can be assembled in the two following configurations:

● Buck: referring to *Figure 1*, the N-MOS M1 is removed and the diode D9 is replaced with a short

● Buck-Boost (not optimized)

2.2   MCU Flash programming (V_{PP})

A second power supply is implemented in the Industrial board, in order to provide the 12V voltage supply required by the microcontroller during the In-Application Programming (IAP) of the embedded Flash memory.

This power supply consists in a charge pump DC-DC regulator implemented by the ST device ST662A, which is a step-up converter designed for the Flash memory programming. Note that the charge pump converter is itself supplied by the switching regulator output V_{DD}.

The device can be shut down through line PD3 of the microcontroller, in order to reduce power consumption and noise when IAP is not needed.

The connection between the charge pump output and the Vpp line is switched by the P-MOS STS5DPF20L controlled by pin PF1 of the microcontroller.

This separates the IAP and In-Circuit Programming (ICP) and delivers V_{PP} with a shorter rising time.

The switch is closed when PF1 is low.

2.3 OpAmp negative supply (-5V)

The last power supply consists of a non-regulated negative charge pump derived from the pin C1- of the ST622A, which works as an oscillator between 0V and V_{CC} for the negative charge pump composed by the two diodes, D14 and D15, and the two capacitors, C35 and C36. This supply is used as negative supply for the two OPAMP U3A and U3B of LM358, in order to provide them a complete rail-to-rail output range between -5V and V_{DD}.

3 Microcontroller

3.1 Microcontroller features

The board is based on the ST72F651AR6 USB microcontroller, its mains features are:

● Up to 8MHz ST7 control unit

● 32 KBytes embedded Flash program memory

● 5 KBytes embedded RAM memory

● UVLO

● Up to 47 general purpose IOs with 3 Interrupt sources, two separated IO banks (one supplied at 5V and one between 2.7V and 5V).

This microcontroller embeds several on-chip peripherals:

● Programmable watchdog timer/counter

● Programmable DMA controller (DTC) with 256 bytes dedicated memory

● Full-speed USB controller with 5 endpoints and a 1280 bytes dedicated memory for buffers

● One 16-bit timer with 2 Output Compare units

● A 10-bit PWM generator with 2 channels

● A full-duplex SPI peripheral (master / slave)

● I²C bus interface (single master)

● 8-channels, 8-bit A/D Converter

3.2 RS-232 Interface

The RS-232 interface is emulated by software using:

● One general purpose IO () as TxD signal

● One Interrupt source IO () as RxD signal.

● One Output compare unit to generate the correct timing for transmission and reception.

The firmware implements a half-duplex RS-232 interface, whenever a simultaneous reading/writing operation occurs the writing operation is aborted and the reading operation is performed without loss of data.

3.3 Internal time base generation

An internal 1ms time base is generated using one output compare resource and a free counter. The free counter is then used to generate up to 10 programmable timeout counters (with 1ms resolution).

4 10-bit digital-to-analog converter (DAC)

The Industrial Communication Board embeds a 10(12)-bit buffered voltage-output DAC implemented by the AD5317 (AD5327) converter from Analog Devices. The IC provides four buffered rail-to-rail outputs, in the range 0 ÷ Vcc, with a slew rate of 0.7 V/μs.

The DAC is controlled by the Microcontroller (PC2, PC3, PC4) through a 3-wires serial interface and is compatible with SPI, QSPI, MICROWIRE and DSP interface standards.

The AD5317 is connected to the microcontroller through its SPI interface (MOSI to DIN and SCK to SCLK). The references for the four DACs are derived from two reference pins: VrefAB for VoutA and VoutB, VrefCD for VoutC and VoutD. These reference inputs can be configured as buffered or unbuffered inputs, through interface command.

On the Industrial board the reference for the output pair AB is connected directly to Vcc supply, while the VrefCD is available in a double option configuration, thanks to the jumper JP3:

1. Connected to the V_{CC} supply
2. Connected to the DAC output VoutB. This option is designed in order to provide a fine voltage adjustment for the CD output pair DAC reference: this function is suitable, e.g., in Motor Control Applications using Micro-stepping technique, for the synthesis of discrete sinusoidal waveforms. In fact, while the DAC output VoutC or VoutD can generate a discrete sinusoidal waveform, the DAC output VoutB is able to control the amplitude of the said signal, in order to control finely the torque of the stepper motor.

The AD5317(AD5327) DACs incorporate a power-on reset circuit, which ensures that the DAC outputs power up to 0 V and remain there until a valid write to the device takes place. There is also an asynchronous active low CLR pin, connected to the RES line of Industrial board, that clears all DACs to 0 V. The outputs of all DACs may be updated simultaneously using the asynchronous LDAC input, controlled by the MCU pin PD1.

The DAC IC contains a power-down feature that reduces the current consumption of the devices to 300 nA @ 5 V, by setting all outputs in high impedance state. The devices goes into power-down mode when the pin PD connected to the PD2 MCU line is tied low.

On the PLM connector, the four DAC outputs VOUTA, VOUTB, VOUTC and VOUTD are available directly, while on the Motor connector, VREF_A and VREF_B are available. These two signals are provided by the two difference amplifiers U3A and U3B implemented by LM358.

5 Operational amplifiers (OpAmp)

The LM358 consists of two independent, high gain (100 dB), high bandwidth (1.1 MHz) and internally compensated operational amplifiers. In the Industrial Communication Board the two amplifiers are designed in differential configuration, with a bipolar power supply 5V ÷ - 5V. The output signals consists of the difference signals VREF_A and VREF_B, obtained by:

● VREF_A = VOUTC - VOUTA

● VREF_B = VOUTD - VOUTA

The main purpose of the two OPAMPs is then to provide an analog voltage shifting of the two signals VOUTC and VOUTD, with a voltage shift equal to VOUTA. The bipolar power supply of the OPAMPs guarantees an output swing both positive and negative to the resulting signals VREF_A and VREF_B.

This feature is important, for example in Motor Control Applications using Micro-stepping techniques, for the synthesis of discrete sinusoidal waveforms: the OPAMPs analog shifting provides the centering of the sinusoidal signal generated by the DACs around the 0 voltage level.

6 Interfaces and connectors

The ST Industrial Communication Board has 6 connectors to interface with power supply (J9), Personal Computer (CON1 and J10), In Circuit Communication (J8) and ST Devices Evaluation Boards (J6 and J7).

Figure 4. Industrial Communication Board connectors schematic
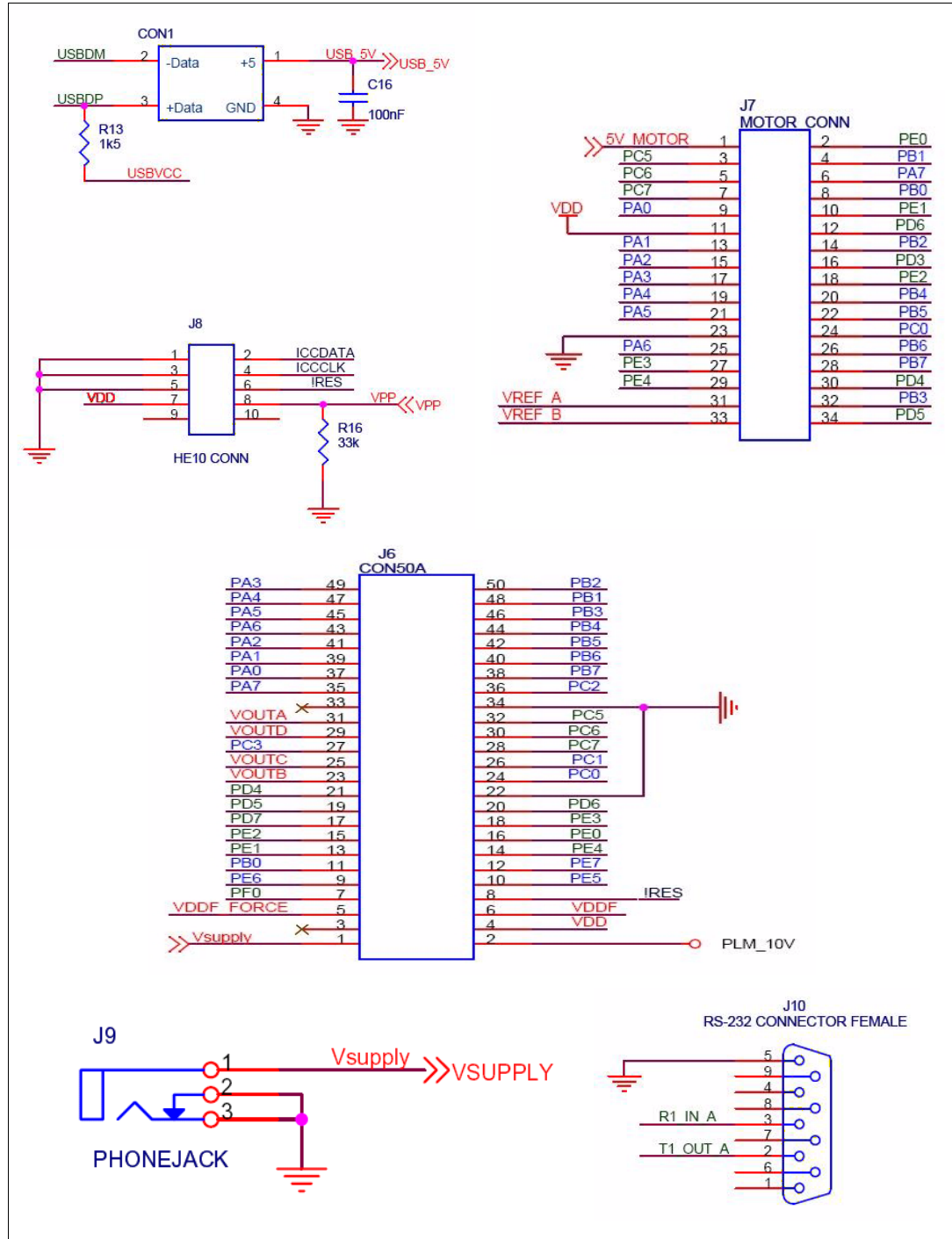
Figure 5.   Industrial Communication Board connectors pcb
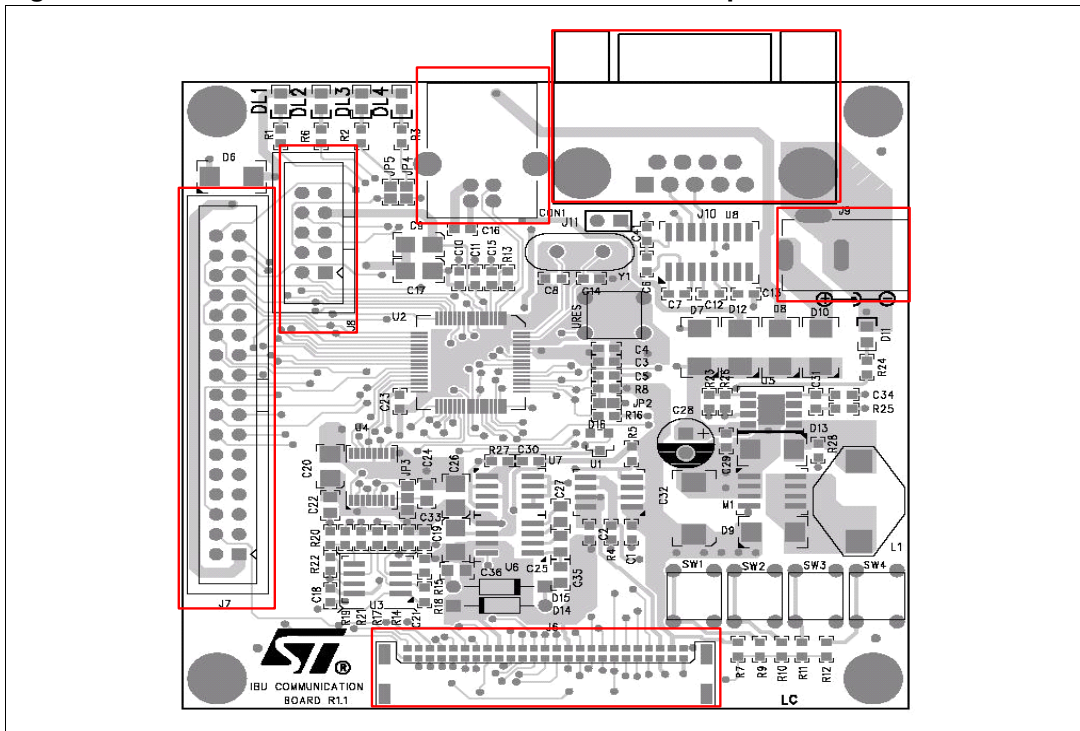
6.1   USB

The main communication channel with the controlling PC is through the ST72F651 Full Speed USB interface, based on a Vendor Specific Class embedded in the Industrial Communication Board firmware and a dedicated driver, part of the controlling software.

Once the USB cable is plugged to connector CON1, the Industrial Communication Board takes its power supply from the 5V USB interface of the PC.

A second function of the USB interface is to provide the DFU (Device Firmware Upgrade) functionality used to upgrade firmware.

The connecting cable should have a USB-B plug toward Industrial Communication Board and a USB-A plug toward the PC as shown in *Figure 6*.

Figure 6.   USB cable plugs
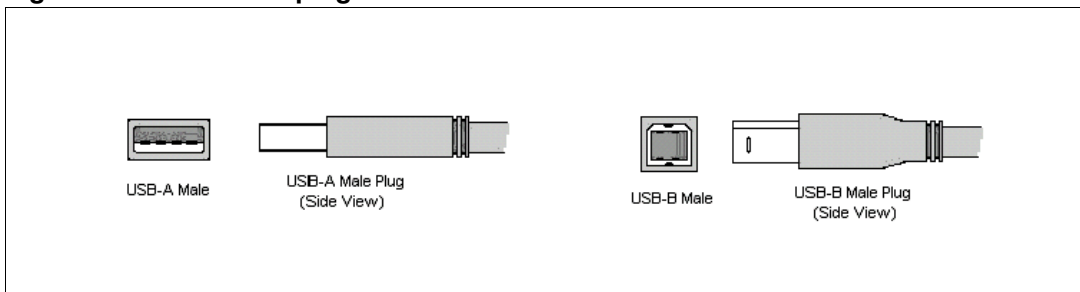
6.2   RS-232 Interface

The RS-232 interface can be used as a communication channel to a PC running control software. It consists of female connector J10, where only three pins are connected with the DCE connections:

● 5 →Ground

● 3 →DCE TX

● 2 →DCE RX

So the connection to a PC RS-232 port (DTE) must be done by a direct cable connecting:

● DTE pin3 to DCE pin 3

● DTE pin 2 to DCE pin 2

RS-232 signals are obtained and adapted to 5V circuitry by means of the ST232 multi-channel RS-232 driver and receiver connected to two general purpose IOs (PD7 and PF0). The microcontroller emulates the RS-232 interface by software.

The ST232 can be powered down, to reduce power consumption when RS232 interface is not used, by opening jumper J11. In this case, two microcontroller pins (#44 and #52) can be used as General Purpose IOs (PD7 and PF0).

6.3   Motor control

Communication with Motor Control boards is possible through connector J7. This is a 34-pin connector providing the following signals, in the EVAL6207N case:

Table 2.   Motor control interface pins

Pin number	Signal name	Description	Generated by
1	VCC_REF	5V Supply Voltage	EVAL6207N
3	SENSE_A	Channel A Sense Voltage	EVAL6207N
7	SENSE_B	Channel B Sense Voltage	EVAL6207N
11	+5V	5V Supply Voltage	MCU
23	Ground	Ground	
27	LIMIT_A	Channel A Over Current Flag	EVAL6207N
29	LIMIT_B	Channel B Over Current Flag	EVAL6207N
31	VREFA	Ch A PWM Current Control Ref Voltage	MCU
33	VREFB	Ch B PWM Current Control Ref Voltage	MCU
4	LIMIT_B	Channel A Over Current Flag	EVAL6207N
8	LIMIT_A	Channel B Over Current Flag	EVAL6207N
10	RCA	Ch A RC Monostable Voltage	EVAL6207N
14	ENA	Ch A Enable Signal	MCU
20	IN1	Ch A Input 1	MCU
22	IN4	Ch B Input 2	MCU
26	IN3	Ch B Input 1	MCU

Table 2. Motor control interface pins (continued)

Pin number	Signal name	Description	Generated by
28	IN2	Ch A Input 2	MCU
32	ENB	Ch B Enable Signal	MCU

6.4 Power line communication

The board can communicate with a Power Line Communication Board through its 50-pin J6 connector providing four kinds of signals: digital signals, analog signals, control signals and power signals.

Table 3. PLC interface digital signals

Pin number	Signal name	Description	Generated by
11	REGOK	Register Ok signal.	Modem
14	!CH2	Secondary channel select (active low).	MCU
18	CH2	Secondary channel select (active high).	MCU
35	CDPD	Carrier or preamble detected signal.	Modem
37	REG/DATA	Register or Data access.	Modem
39	RxD	Serial Data Out.	Modem
41	RxTx	Reception or Transmission select signal.	MCU
43	ZCOUT	Zero crossing detection output.	Modem
45	CLR/T	Serial Data Clock.	Modem
46	WD	Watchdog counter reset.	MCU
47	TOUT	Timeout event signal (even Thermal event on ST7538).	Modem
48	BU/THERM	Band in Use detection signal (even Thermal event on ST7540).	Modem
49	TxD	Serial Data Input.	MCU
50	PG	Power good signal.	Modem

Table 4. PLC interface analog signals

Pin number	Signal name	Description	Generated by
3	MCLK	Oscillator output (programmable)	Modem
5	VDDF_Force	Force MCU digital level to VDDF.	Modem
8	RESET	Reset Out for microcontroller	Modem
16	SMeter	Analog Signal Peak Meter output.	Modem

Table 5. **PLC interface control signals**

Pin number	Signal name	Description	Generated by
20	B_ID_PLM_1	Board ID for PLM Applications (MSB)	Modem
28	B_ID_PLM_0	Board ID for PLM Applications (LSB)	Modem

The two PLC interface control signals are connected in the PLM board either to the GND or to V_{DD} and are used to detect which modem is mounted on the board. There are four possible configurations but only two are, at present, in use:

● 00 (GND,GND) for the ST7538

● 10 (GND,V_{DD}) for the ST7540

Table 6. **Power connections**

Pin number	Signal name	Description	Generated by
2	PLM_10V	10V power supply	Modem
4	VDD	3.3V/5V power supply	Modem
6	VDDF	Digital power supply	Modem
22,34	GND	Ground	Ground

6.5 In-circuit communication

The In Circuit Communication connector provides access to several debug features and to the In Circuit Programming function that enables complete writing to the MCU Flash memory.

6.6 Power supply

As described in *Section 2: Power supply*, the ST Industrial Communication Board can take is power supply from different sources. If an external dedicated power supply is selected, it must be in the 5V ÷ 35V range.

Taking into account that the board has a power consumption in steady state of approximately 50mW, a value of 500mW is suggested.

The external power supply connector is a standard 2.5-mm phone jack that is compatible with common PC notebook power supply connectors.

6.7 Jumpers

Five jumpers are present on the board to give flexibility on the use of reset management, DAC reference voltage; In Circuit Communication and RS232 interface power supply.

Figure 7.   Industrial Communication Board jumpers and switches on PCB
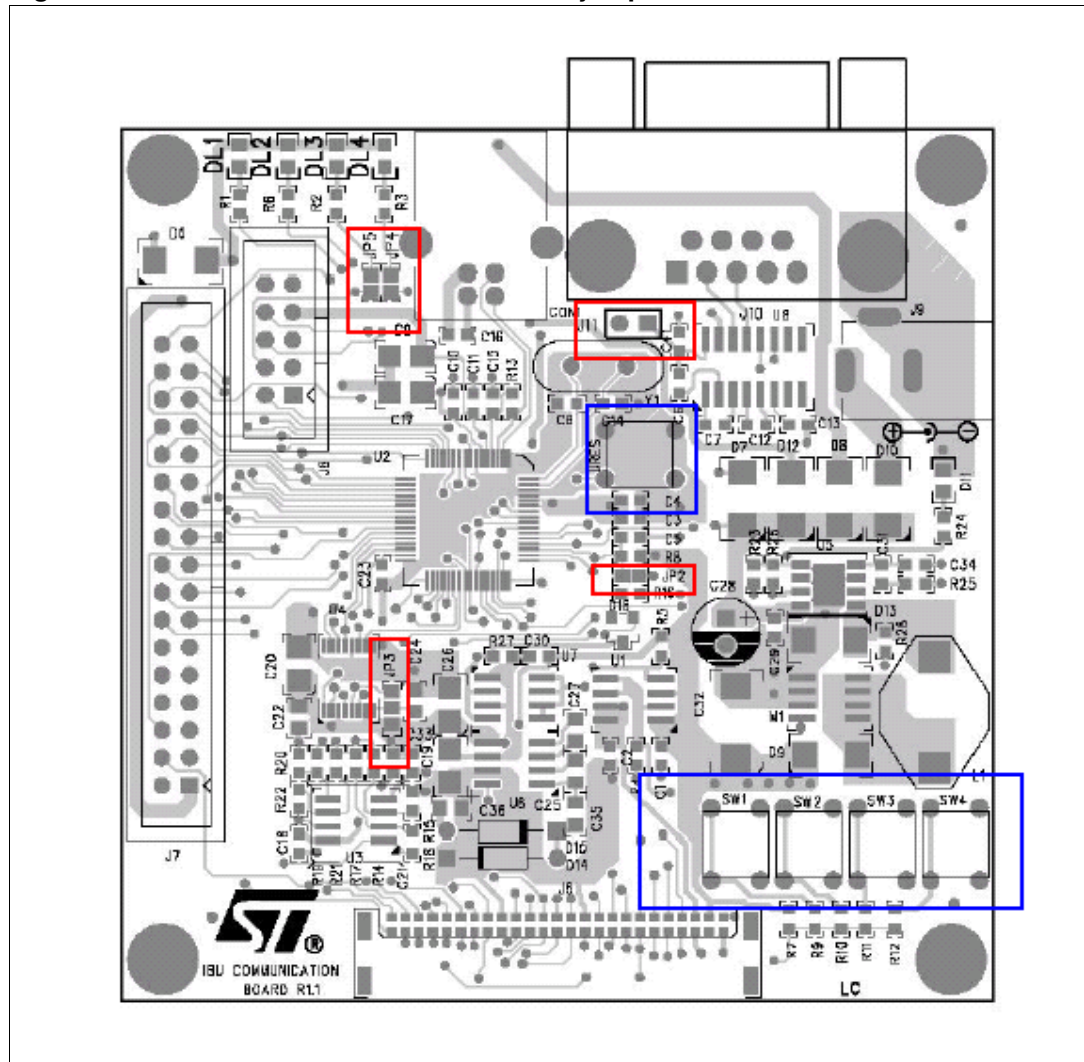
Jumper JP2 connects the ST72F651 reset pin to a reset signal coming from the PLM board. This is used to reset the MCU after a Power Line Modem reset event.

Setting:

● Open = MCU reset not connected to PLM reset
● Closed = MCU reset connected to PLM reset

Jumper JP3 selects the DAC voltage reference for the C-D output pair. *Section 4: 10-bit digital-to-analog converter (DAC)* describes JP3 use.

Setting:

● 1-2 = Reference from VDD
● 2-3 = Reference from AB output

Jumpers JP4 and JP5 disconnect LED DL3 and DL4 loads from the MCU for use with In Circuit Communication.

Setting:

● Open = for ICC use

● Closed = for LEDs use

Jumper J11 disconnects the RS-232 level shifter from the power supply.

This reduces power consumption if the RS-232 interface is not used and frees MCU pins for another use. (Level shifter pins output are in Tri-state mode when device is off.)

Setting:

● Open = RS-232 off

● Closed = RS-232 on

7 Switches

The board is equipped with five switches: a microcontroller reset switch (RES), and four general purpose switches (SW1, SW2, SW3 and SW4).

The RES switch is directly connected with the microcontroller RESET pin used to perform a hardware reset of the MCU. In order to guarantee the correct timing for the RESET negative pulse, an RC network is connected to the switch.

General purpose switches are connected to the AD converter embedded on the microcontroller (Channel 0 is used) through a resistor divider network.

Figure 8. General purpose switches
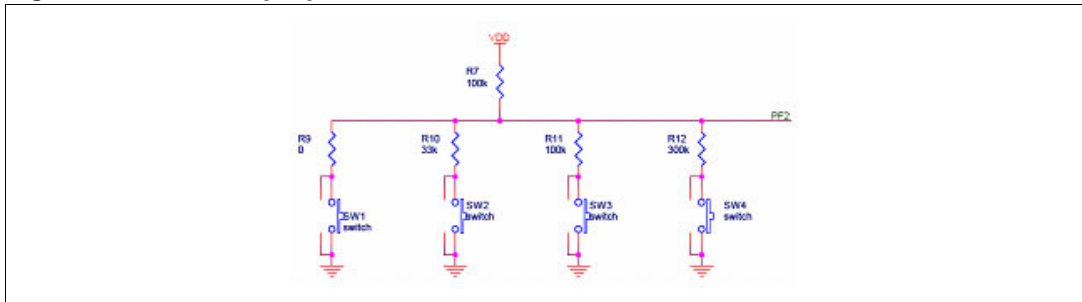
Each time a key is pressed, the corresponding resistor divider is activated. Then the voltage read by the ADC tells the microcontroller which button has been pressed.

Figure 9. General purpose switches voltages and decisions level
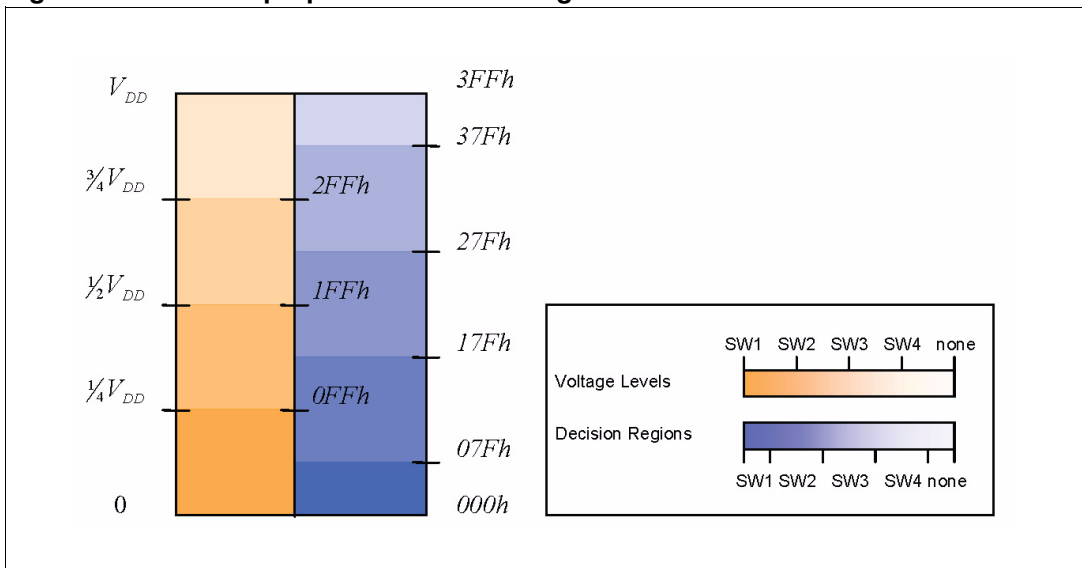
8   LEDs

Five LEDs are present on the board for visual communication with the user. DL1, DL2, DL3, DL4 are general purpose LEDs that are User Application configurable. LED D11 is power supply (5V) on indicator.

Figure 10.   Industrial Communication Board leds on PCB
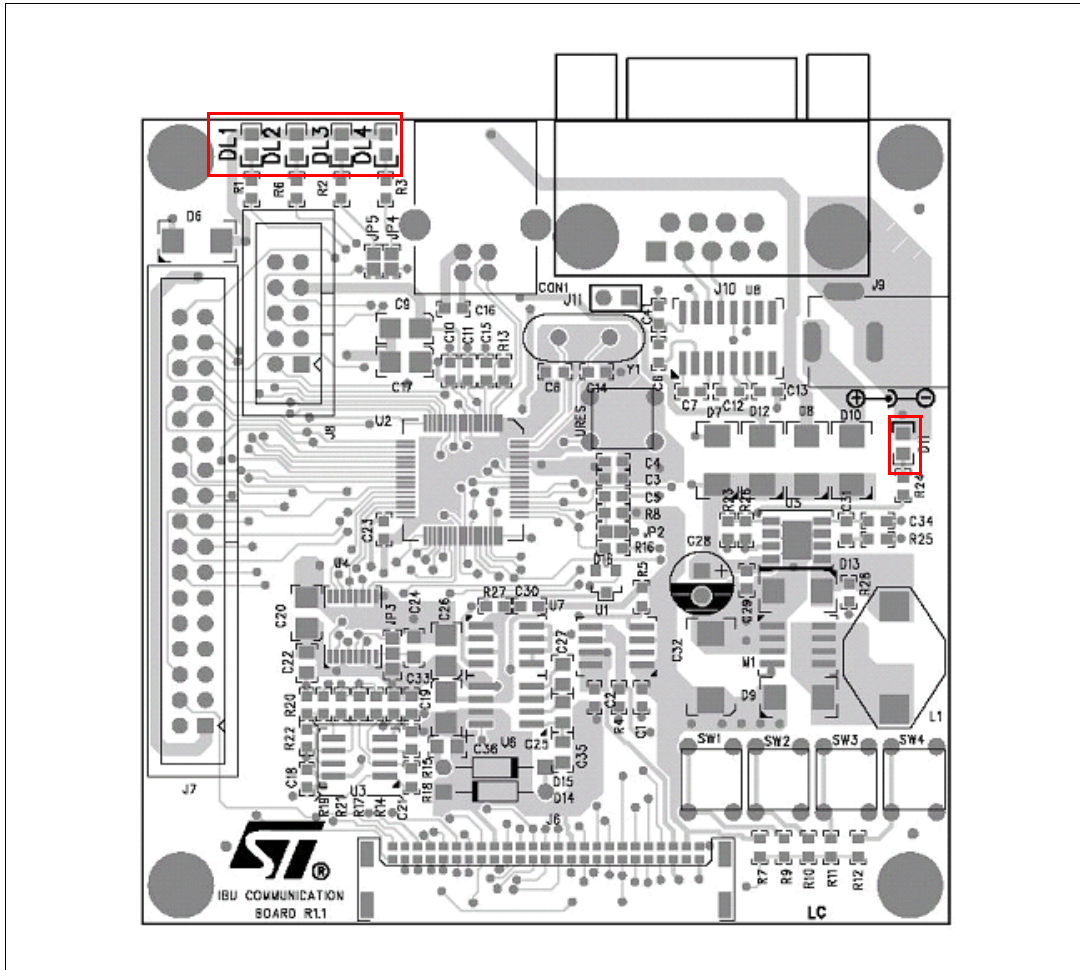
9 Applications

The ST Industrial Communication Board is designed to be a general purpose control board for all Industrial applications. Currently two application fields are supported: Power Line Communication and Motor Control. Soon Intelligent Power Switch and Gate Driver applications will be covered too. Contact your local ST sales office for availability dates.

9.1 Power line communication

The PLC connector allows the use of the Communication Board with two different PLC Evaluation Boards:

● ST7538 Dual Channel Reference Design (Rev 3.1)
● ST7540 Reference Design (Rev 2.0)

Figure 11. ST7538 dual channel reference design board (Rev 3.1)

Figure 12. ST7540 reference design board (Rev 2.0)
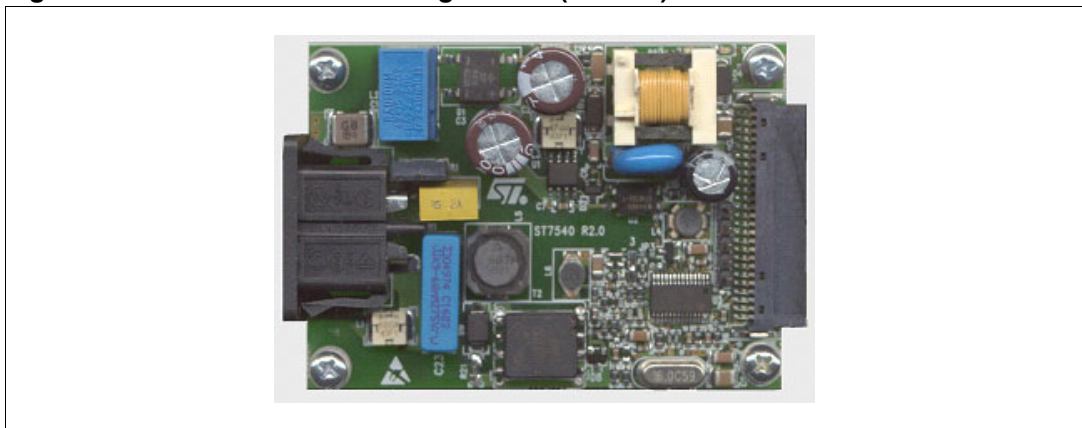
The two Reference Design boards, based respectively on ST7538 and ST7540 FSK transceivers for Power Lines, are developed as useful tools for evaluating Power Line Communication as a solution in Automatic Meter Reading and Home Automation

applications. Both PLC Reference Design boards include a Power Supply section, specifically tailored for matching Power Line coupling requirements, and a Transceiver section designed around the ST PLC chipset, including a 16-MHz crystal oscillator and an external passive coupling filter for impedance adapting and noise filtering.

The Industrial Communication Board plus a PLC Reference Design board form a complete PLC node. With the two boards together, and using the ST7538/40 Demo SW Tool, it is possible to evaluate ST PLC chipset features and their transmitting and receiving performances through an actual communication interface on the Power Line.

9.2   Motor control

ST Motor Control devices deal with many different applications, each of them having a specific evaluation board controlled by means of the ST Industrial Communication Board.

Figure 13.   Motor control evaluation board EVAL6207N

Table 7 summarizes the ST Motor Control Evaluation Board family.

Table 7.   ST motor control evaluation boards

Device	Evaluation Board
L6205 PowerDIP	EVAL6205N
L6206 PowerDIP	EVAL6206N
L6206 PowerSO	EVAL6206PD
L6207N PowerDIP	EVAL6207N
L6208 PowerDIP	EVAL6208N
L6208 PowerSO	EVAL6208PD
L6235 PowerDIP	EVAL6235N
L6225 PowerSO	EVAL6225PD
L6227 PowerSO	EVAL6227PD
L6229 PowerSO	EVAL6229PD

All Motor Control evaluation boards can be connected to the Industrial Communication Board via connector J7.

10 Firmware

The ST Industrial Communication Board FirmWare provides two main functions:

1. Upgrading the on-board firware stored in the Flash memory
2. Providing application-specific code that enables communication with different application boards

10.1 Device firmware upgrade

The DFU (Device Firmware Upgrade) feature enables the user to upgrade the application-specific firmware on the Industrial Communication Board through the PC USB port.

The DFU procedure is performed, on the PC side, by a DFU application. The application lists all the connected DFU devices. Once selected, the DFU USB device to be upgraded and loaded (through the command File→Open) using a DFU firmware image, the device can be upgraded by pressing the Upgrade button.

Figure 14. DFU graphic user interface
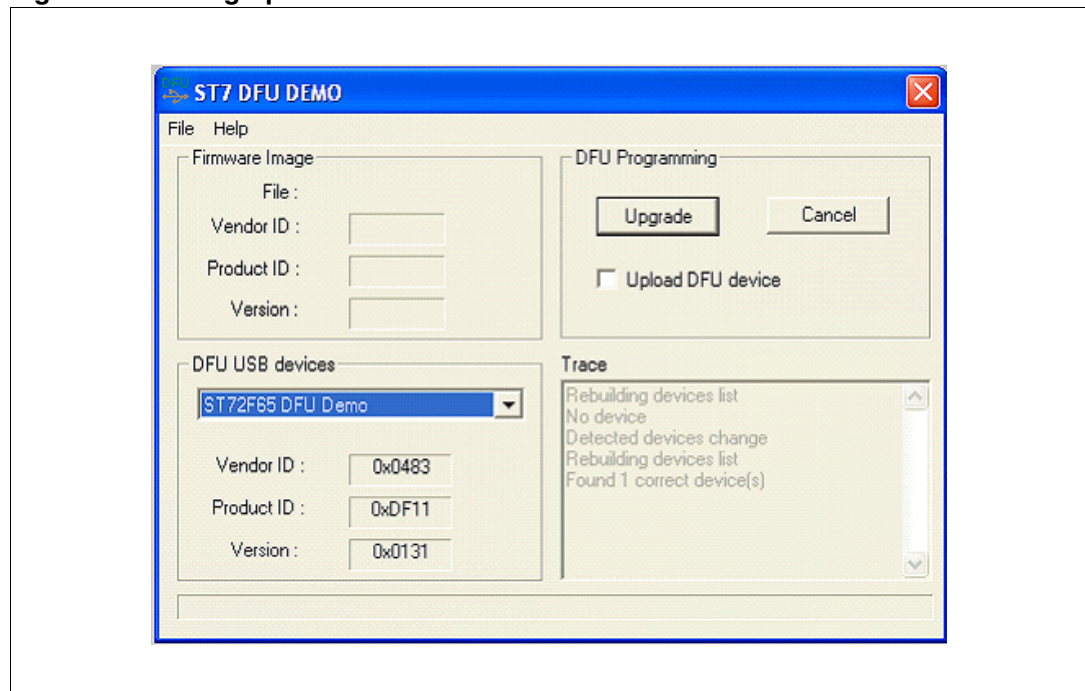
In normal operation mode, the Industrial Communication Board is not DFU capable. In order to enable the DFU capability of the device, the following two procedures are available:

● Hardware DFU Mode setting: Press and release the RES button on the Industrial Communication Board while holding the SW1 switch down.

● Software DFU Mode Setting: Send a SetDFUMode command using the application-specific software. (See the application specific software description to check the availability of this command).

10.2 Applications

Beside the DFU, application-specific firmware has been developed to enable the Industrial Communication Board to control and communicate with different application boards.

10.2.1 Power Line Communication (PLC)

Dedicated firmware is available to use in conjunction with Power Line Communication (PLC) Boards.

Power Line Communication Boards, based on ST7538 and ST7540 power line transceivers, allow communication over the main AC voltage plugs at a low baud rate. These products are designed for Home Automation, Building Automation, Automatic Meter Reading, and Street Lighting control applications as well as other applications that do not require a broad band communication link.

The PLC dedicated firmware performs basic functions such as:

● Program transceiver control parameters: channel frequency, baud rate and so on (for more options see the transceiver datasheet or the dedicated firmware application note).

● Transmit a user-defined data stream through the AC line either as single or multiple repetition.

● Receive data from the AC line either in free-running mode or after synchronization with a programmable known sequence (frame header).

● Perform a communication channel reliability test with a Client-Server application that can calculate the reachability of each node by sending messages and retrieving answers. This function implements a Forward Error Correction algorithm to detect if the network under test requires a FEC algorithm or not.

10.2.2 Motor control

Dedicated FW is available to control different Motor Control boards. In operating a stepper motor system one of the most common requirements is to execute a relative move. The move is usually specified as a fixed number of basic motor steps in the clockwise or counter-clockwise direction. It is common practice to execute this move along a trapezoidal shaped velocity vs. time profile. FW calculate moving profiles to be used as command signals to move the controlled motor in a defined position. Given the move distance, acceleration, deceleration, and peak speed requirement, a profile can be determined. The control structure is designed such that the velocity and acceleration/deceleration rate can be changed at will, the task of pre-calculating the velocity profile boils down to determining the position values where operation switches from acceleration to constant speed and then from constant speed to deceleration. Execution time for these calculations is not critical since they are done only once per move and are completed before the move begins. The heart of the stepper motor control mechanism is the 20-kHz interrupt. This interrupt invokes an Interrupt Service Routine (ISR) which executes repeatedly on a fixed time interval of 50 microseconds called TICK.

The ISR calculates real time values for velocity and position given the commanded acceleration (or deceleration) and the present values for velocity and position.

A complete description of algorithms and formulas used by the FW is present in *AN2044 Operating principles for Practispin Stepper Motor Motion Control*.

11 Software

Users can interact with application boards by means of specific control SW, developed to give user-friendly Graphical User Interfaces (GUIs).

GUIs are specific for the different supported applications.

11.1 PLC ST7538/40 DEMOKIT software evaluation tool

The "ST7538/40 DEMOKIT Software Evaluation Tool" allows interfacing one or more ST Power Line Modem Demo Boards with a Personal Computer. Supported Demo Boards are those equipped with devices ST7538 and ST7540. The Software automatically recognizes which type of device is connected to the PC and looks slightly different depending on the connected device.

Figure 15.   A simple schematic of the PLC application environment
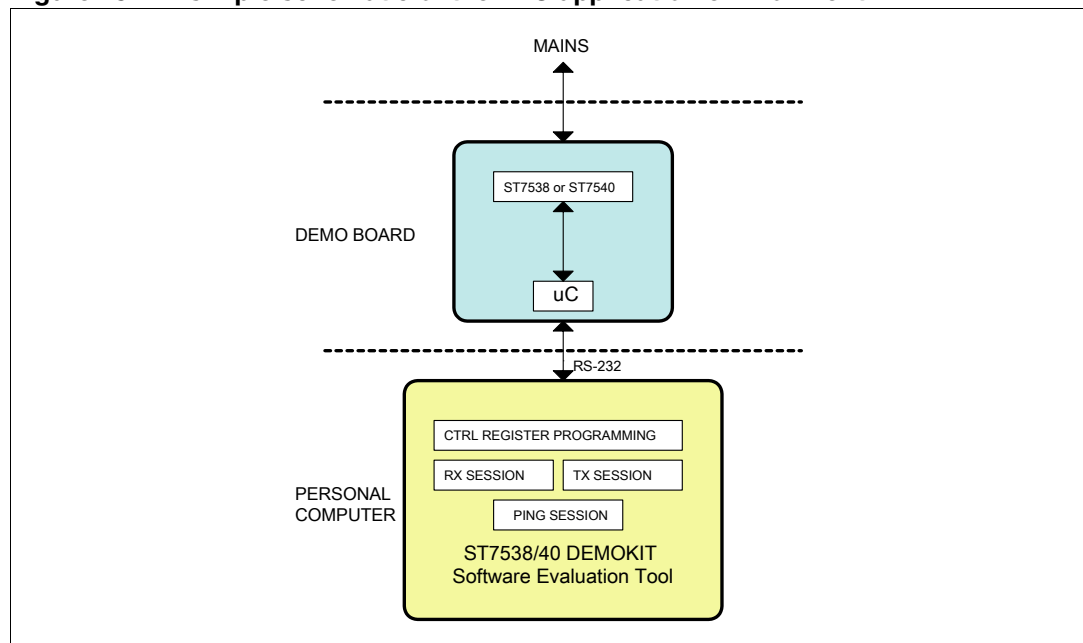
With the "ST7538/40 Software Evaluation tool" it is possible to:

● write/read ST7538 or ST7540 Control Register

● open a Tx session

● open a Rx session

● open a Ping session (two or more devices required)

11.1.1 The user interface

The Main Window of the "ST7538/40 DEMOKIT Software Evaluation Tool" Program has the following appearance:

Figure 16. The main window

Through the Main Window it is possible to access all software functions. Four different panels are available:

● Control Register Panel

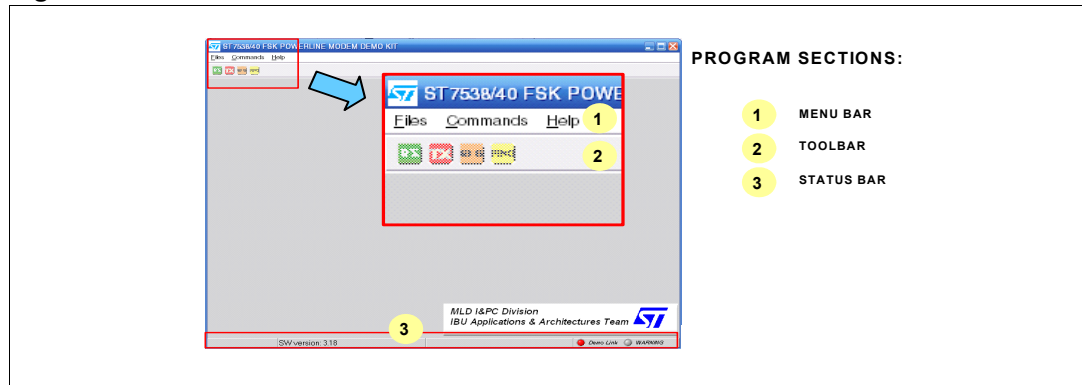 Controls present on Control Register Panel allow to modify all the Control Register Parameters and to write/read the ST7538/ST7540 Control Register.

● Transmission Panel

  Two method of transmission are available: Sequence and Continuous. With Sequence method a message can be transmitted across the Mains for n Times, with a delay between transmissions of 300ms.

  Selecting Continuous transmission mode a unique transmission session is performed and the message to transmit is sent repeatedly across the Mains until the transmission is interrupted by user or by a Time Out event.

  On Industrial Communication Board the transmission session is notified by means of orange led DL4 that is turned on when the line Rx/Tx is put to "0" logic (i.e. TX session is on going). When a Time Out Event occurs, the red led DL2 is turned on too.

● Receiving Panel

  When the device is in Reception mode the green led DL3 of Industrial Communication Board is turned on.

  Two reception methods are available:

  – Reception with synchronization

    Due to fact that is not possible to know when the ST7538/ST7540 begins to demodulate data incoming from the mains, frame synchronization can be required in order to know when data flow begins. When Frame synchronization is enabled, the data flow from modem is filtered from the MCU and only when a header is recognized the data are sent to PC. In this way is assured that, if the transmitted message is preceded by a preamble (i.e. 0xAAAA o 0x5555) and a header (i.e. 0x9B58), all the following bits are correctly sent to PC. In ST7540 this function can be performed directly by the modem itself programming the Control register so no controls are present on the reception window.

  – Reception without synchronization

    With this method, data incoming from the modem are sent directly to the PC.

● Ping Panel

  In order to evaluate the reliability of a communication between two or more devices a Ping session can be performed. A full variety of statistical data can be collected and an algorithm of error correction is also included. The ping session consists of a Master that

sends a sequence of messages to one or more Slaves. If the messages are correctly received from Slaves, they are re-sent to the Master.

11.2   Motor control

Motor Control FW loaded on Industrial Communication Board can be accessed by the user through a dedicated GUI.

SW is able to recognize the attached evaluation board and automatically set up the specific controls.

Using the control panel, the operating conditions for the application can be selected. For example for Stepper Motors, there is stepping mode selection.

From the control panel, full step (normal), half step or micro stepping mode (micro stepping is only supported for the L6208) can be selected.

Other controls on the top line let the user select the direction of rotation and the decay mode during recirculation.

Figure 17.   Stepper motor GUI
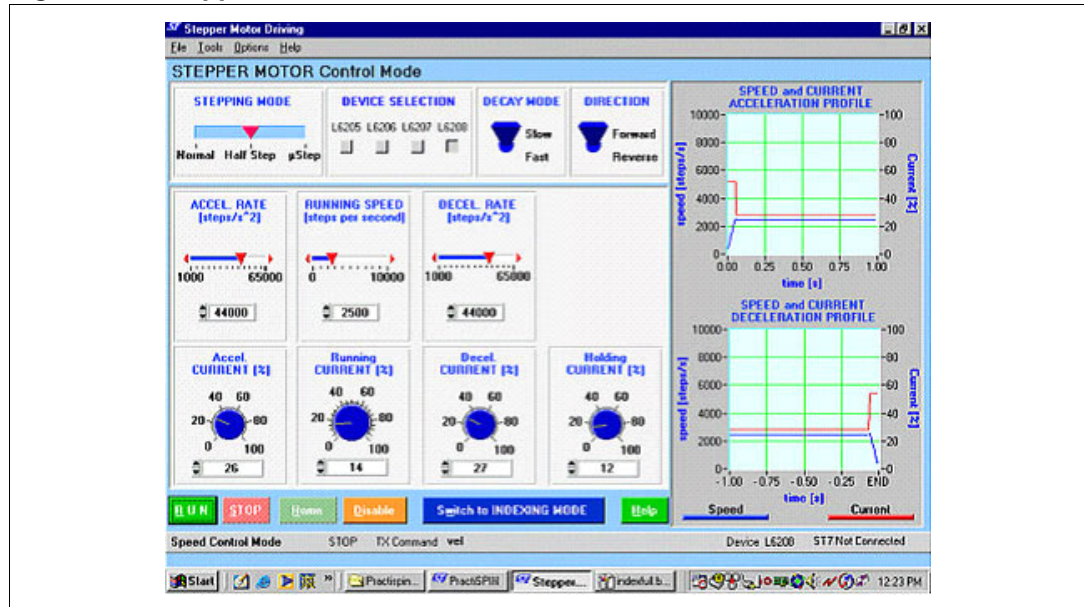
The actual movement parameters are selected in the second and third row of controls. The controls on the second row allow the user to set the top speed and the acceleration and deceleration rate.

The typical run profile for a movement includes an acceleration ramp, constant velocity run and deceleration ramp as shown here. All of these parameters are set on the control panel.

In many applications, the torque needed to accelerate and decelerate is significantly larger than that required for the constant speed running so the designer may want to drive the motor with a higher current during the acceleration and deceleration time and then drop the current to a lower level during the constant speed portion of the movement to reduce the dissipation.

The control panel allows the user to set the current, as a percentage of the maximum value determined by the hardware, for each portion of the movement and the holding time. When motor settings have been defined one can start and stop the motor by simply clicking on the RUN and STOP.

DC motors are supported too.

Figure 18.   DC motor driving GUI

In addition to driving the motors, a program to assist in the thermal evaluation of the application is present.

Figure 19.   Power dissipation and thermal analysis

The software is set up to take the operating conditions from the application including the power supply voltage, motor characteristics and information about the movement profile and use this to calculate the dissipation and operating junction temperature of the device.

12 Appendix

12.1 Reference

- Datasheets:
    - ST232 5V Powered Multi-channel RS-232 Drivers and Receivers
    - STS4DPF20L Dual P-channel 20V - 0.07 W - 4A SO-8 STripFET™ Power MOSFET
    - LM158,A-LM258,A, LM358, A Low Power Dual Operational Amplifiers
    - AD5307/AD5317/AD5327 8-/10-/12-Bit DACs
    - ST662A DC-DC Converter from 5V to 12V, 0.03A for Flash Memory Programming Supply
    - ST7265x Low-power, Full-speed USB 8-bit MCU with 32K Flash, 5K RAM, Flash Card I/F, Timer, PWM, ADC, I2C, SPI
    - L5973D 2.5A Switch Step Down Switching Regulator
- User manuals:
    - UM0239 ST7540 Power line modem Demokit GUI
    - UM0241 ST7538 Power line modem Demokit GUI
- Application note:
    - AN2044 Operating principles for Practispin stepper motor motion control

12.2 Schematics

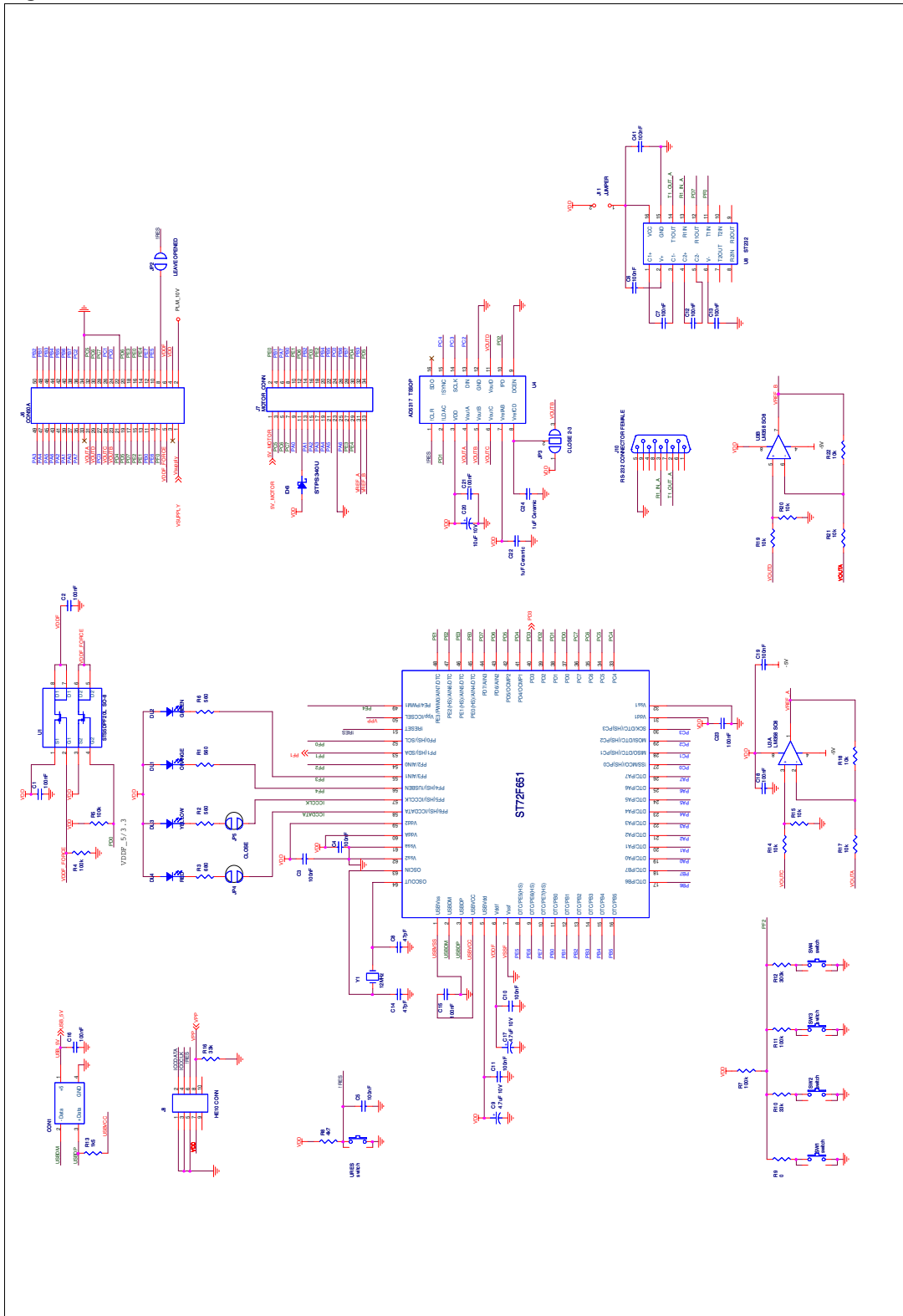**Figure 20. Industrial Communication Board**
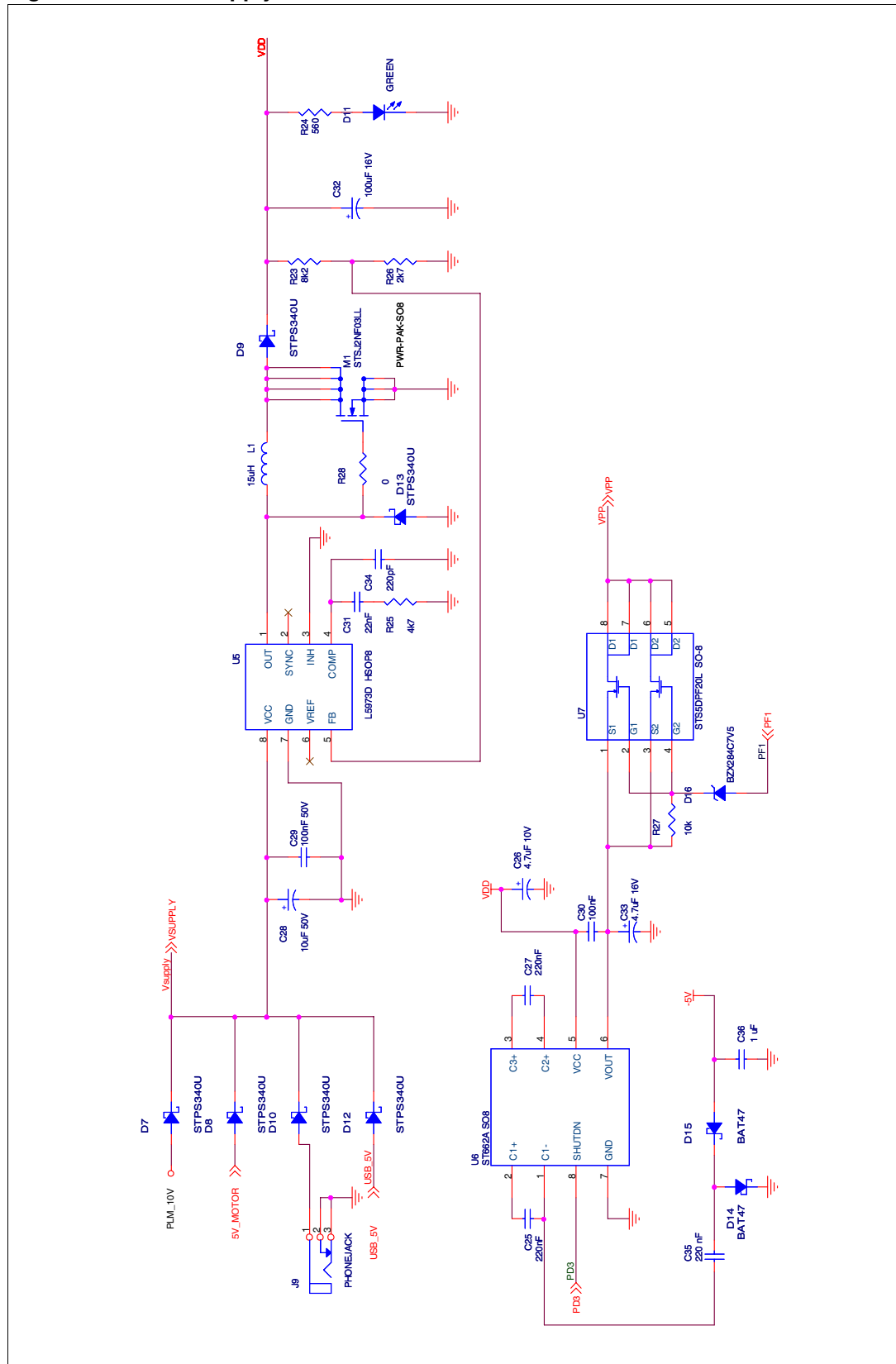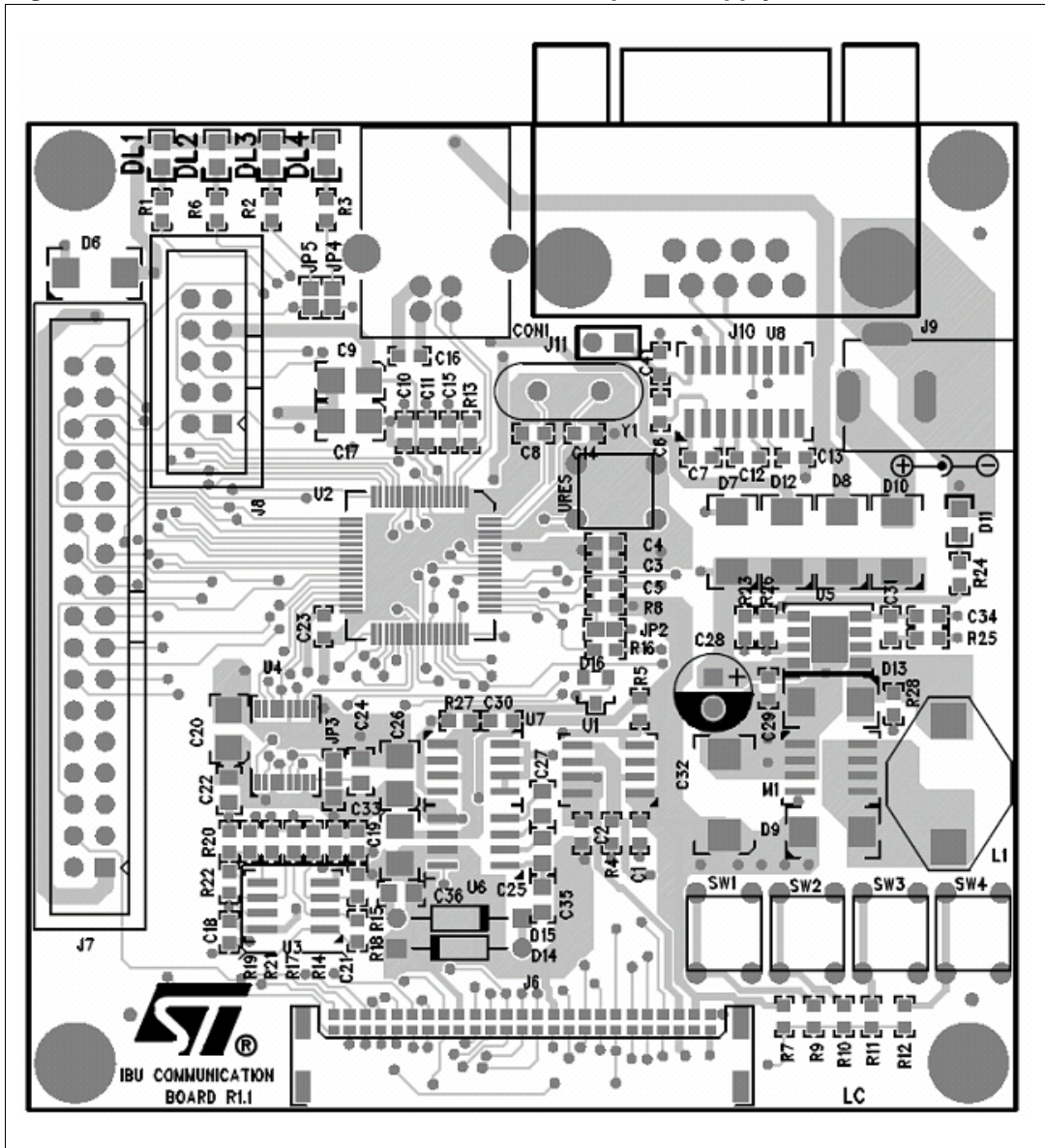
Figure 21. Power supply

12.3 PCB

Figure 22. Industrial Communication Board and power supply

12.4 Bill of materials

Table 8. Bil of materials

Qty	Reference	Description	Pkg
1	CON1	Molex Connector 67068 USB tipe B	
19	C1:C7, C10:C13, C15, C16, C18, C19, C21, C23, C29, C30, C41	Ceramic Capacitor 100nF 50V	0603

Table 8.   Bil of materials (continued)

Qty	Reference	Description	Pkg
1	C31	Ceramic Capacitor 22nF 50V	0603
2	C8, C14	Ceramic Capacitor 47pF 50V	0603
4	C9, C17, C26, C33	Tantalum Capacitor 4,7uF 16V	3528
1	C20	Tantalum Capacitor 10uF 16V	3528
3	C22, C24, C36	Ceramic Capacitor 1uF 16V	0805
2	C25, C27	Ceramic Capacitor 220nF 16V	0805
1	C28	Electrolytic Capacitor 10uF 50V P.2,54	THT
1	C32	Tantalum Capacitor 100uF 16V	7243
1	C34	Ceramic Capacitor 220pF 50V	0603
1	DL4	Red Led Diode	0603
2	DL2, D11	Green Led Diode	0603
1	DL1	Orange Led Diode	0603
1	DL3	Yellow Led Diode	0603
6	D6:D8, D10, D12, D13	Diode STPS340U	SMB
1	D9	Diode STPS340U (Not Equipped, Shorted)	SMB
2	D14, D15	Diode BAT47	DO35
1	D16	Diode BZX284C7V5	SOT23
1	JP2	Open	
1	JP3	Closed 2-3	
1	JP4, JP5	Closed	
1	J6	50 pins Male Connector ERNI SMC-B	SMT
1	J7	Male Connector Flat 17x2	
1	J8	Male Connector Flat 5x2	
1	J9	Power Supply 2,5mm Jack Connector	
1	J10	RS232 Female Connector with Grounded Shield	
1	J11	Jumper 2X1	
1	L1	Inductor 15uH D03316P COILCRAFT	
1	M1	Mosfet STSJ25NF3LL (Not Equipped)	SO8
4	R1, R2, R6, R24	Resistance 560R 1%	0603
1	R3	Resistance 680R 1%	0603
4	R4, R5, R7, R11	Resistance 100K 1%	0603
2	R8, R25	Resistance 4K7 1%	0603
1	R9	Resistance 0R 1%	0603
1	R28	Resistance 0R 1% (Not Equipped)	0603
2	R10, R16	Resistance 33K 1%	0603

Table 8.   **Bil of materials (continued)**

Qty	Reference	Description	Pkg
1	R12	Resistance 300K 1%	0603
1	R13	Resistance 1K5 1%	0603
9	R14, R15, R17:R22, R27	Resistance 10K 1%	0603
1	R23	Resistance 8K25 1%	0603
1	R26	Resistance 2K7	0603
1	SW1:SW5	Button	PTH
2	U1, U7	STS5DPF20L	SO8
1	U2	ST72F651	TQFP
1	U3	LM358	SO8
1	U4	AD5317	TSSOP
1	U5	L5973D	HSOP8
1	U6	ST662A	SO8
1	U8	ST232B	
1	Y1	12MHz Oscillator	HC49SR

13 Revision history

Table 9.   Revision history

Date	Revision	Changes
28-Jun-2006	1	Initial release.

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