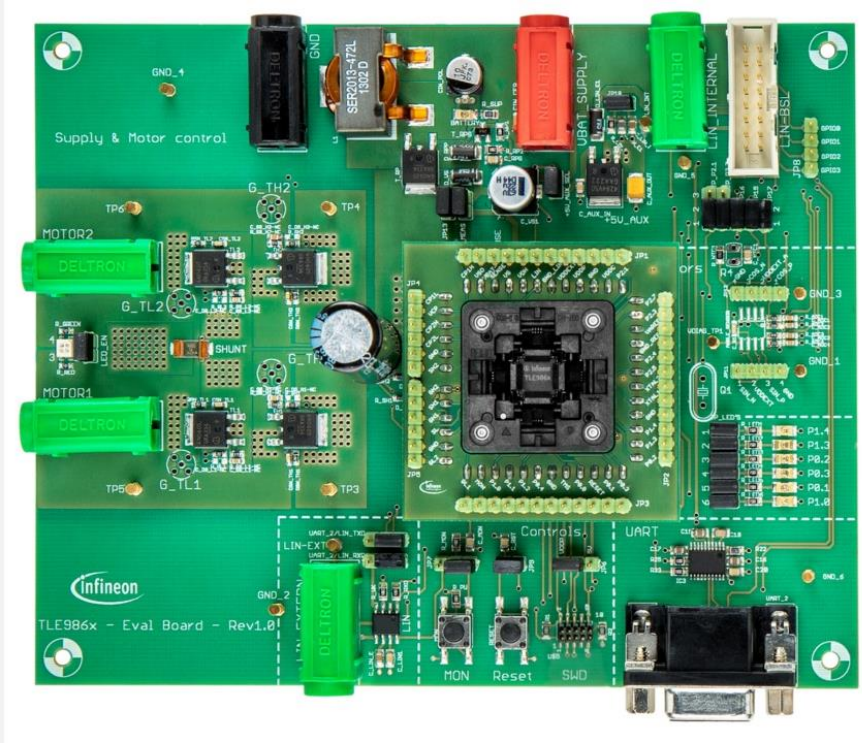
TLE986x EvalBoard User Manual



About this document

Scope and purpose

This user manual is intented to help users using the TLE986x Evalboard. This Evalboard is designed to evaluate hardware and software functionalities of the TLE986x device family.

This manual provides additional information about the board's layout, jumper settings, interface and debug options. It introduces the evaluation platform as well as how to write software and download it to the TLE986x.

Intended audience

This document is for everyone who works with the TLE986x Evalboard.

About this document

Abbreviations and definitions

Table 1 Abbreviations

Abbreviation	Definition
BLDC	Brushless direct current
BSL	Bootstrap loader
GH 1, 2	Gate high-side MOSFET for phases 1, 2
GL 1, 2	Gate low-side MOSFET for phase 1, 2
GPIO	General purpose input / output
ISP	In-system programmer
LIN	Local interconnect network
MON	Monitor
n.c.	Not connected
n/u	Not used
OP1	Negative operational amplifier input
OP2	Positive operational amplifier input
RST	Reset
SL	Source low-side MOSFETs
SWD	Arm® serial wire debug
TMS	Test mode select
UART	Universal asynchronous receiver transmitter
VAREF	Reference voltage
VBAT	Battery voltage supply
VCOM	Virtual COM-port
VCP	Voltage charge pump
VDDC	Core supply
VDDEXT	External voltage supply output
VDDP	I/O port supply
VDH	Voltage drain high-side MOSFET
VS	Battery supply input
VSD	Battery supply input for MOSFET driver

Table of contents

1 Concept

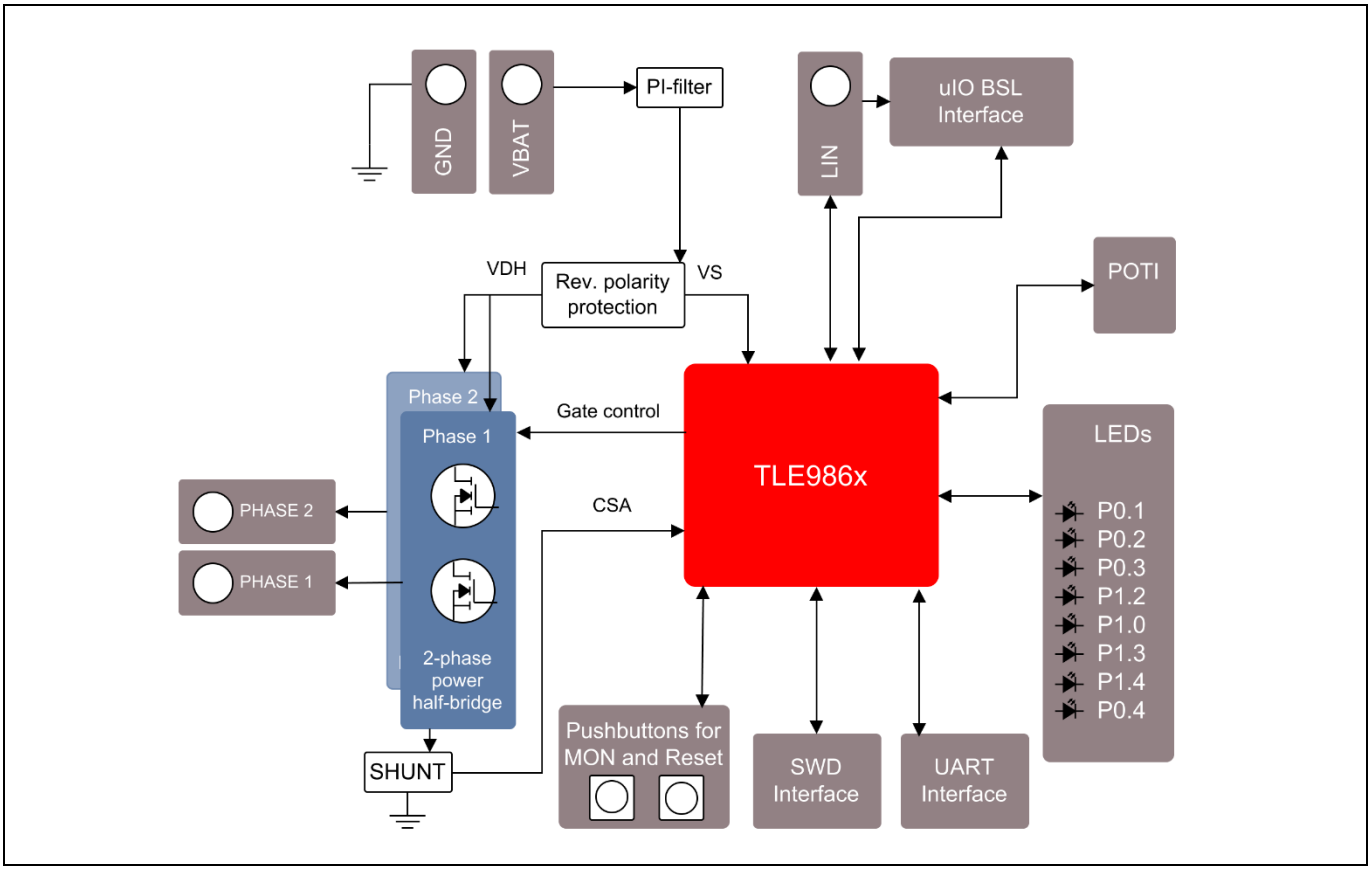


Figure 1 Board concept

This board is designed to provide a simple, easy-to-use tool for getting familiar with Infineon's Embedded Power IC TLE986x devices. A socket provides the possibility to test and evaluate all ICs of the TLE986x family. Every pin of the IC is connectable via rows of pin headers. The board is protected against reverse polarity of input voltage supply.

Two MOSFET half bridges are assembled on the board to drive a DC motor. The board is ready to be connected to a car supply or similar and offers a SWD port to connect an external debugger.

The evaluation board can be operated by standard laboratory equipment as power supply and LIN communication are working via banana jacks.

There is a battery LED that indicates that the board is connected to supply in the correct way. Otherwise reverse polarity protection secures the board from damage by cross connection.

2 Interconnects

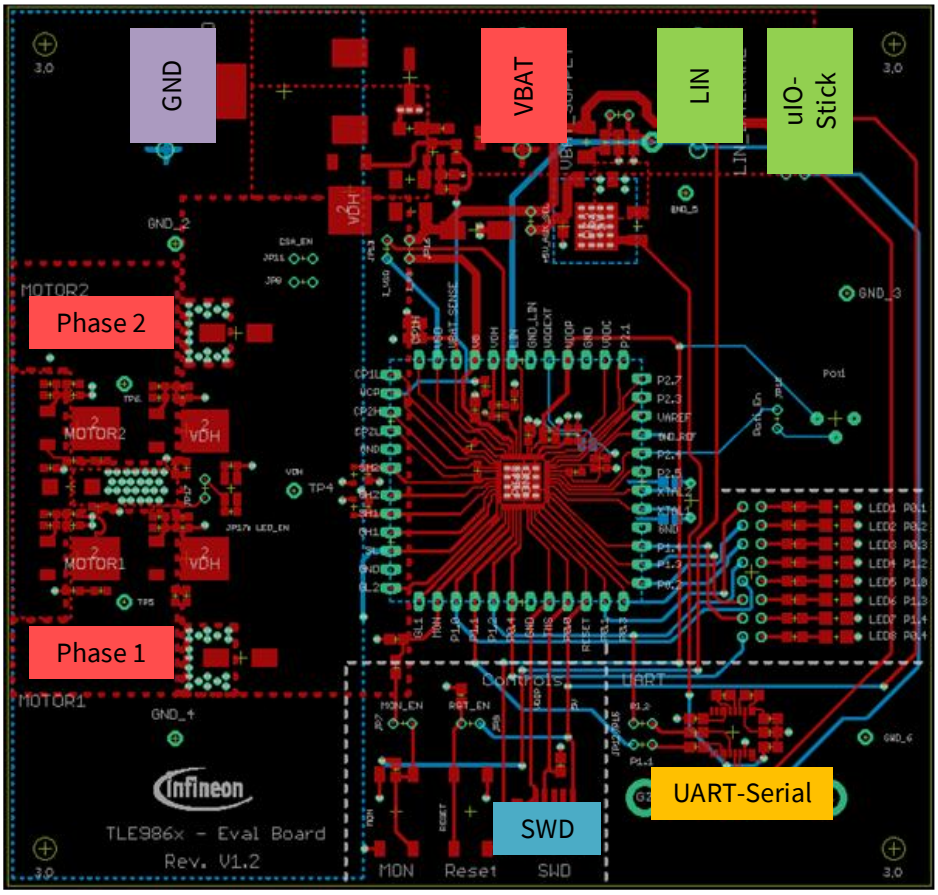


Figure 2 Interconnects

Banana jacks for ground, supply and LIN

There are jacks in different colors for ground, supply (max. 28 V) and LIN communication via banana jack. The following jacks are available: GND (marked purple), VBAT (marked red), motor phase 1 & 2 (marked red) and LIN (marked green).

Banana jacks for motor connection (marked red)

The two jacks Phase1 and Phase2 provide access to the two half bridges and are intended to connect a motor.

uIO Stick connector (marked green)

This uIO bootstrap loader is a 16-pin header (2 x 8) with 2.54 mm pitch.

It is intended to connect additional hardware for bootstrap loading. This interface can be used to program the TLE986x via LIN (see **www.infineon.com/uio** or **www.hitex.com/uio**).

Interconnects

TXD1	1	2	GND
RXD1	3	4	VDD5
LIN	5	6	VS
RESET	7	8	GPIO3
SCS	9	10	GPIO2
SCLK	11	12	GPIO1
MISO	13	14	GPIO0
MOSI	15	16	AD0

Figure 3 Pin configuration uIO BSL

Pin header for SWD (marked blue)

There is a 10 pin header (2 x 5) with 1.27 mm pitch on the evaluation board. This interface is meant to be used for debugging.

5 V	1	2	SWDIO (TMS)
GND	3	4	SWCLK (P0.0)
GND	5	6	n.c.
n.c.	7	8	n.c.
DBPRE	9	10	RESET

Figure 4 Pin configuration SWD interface

3 Test points and LEDs

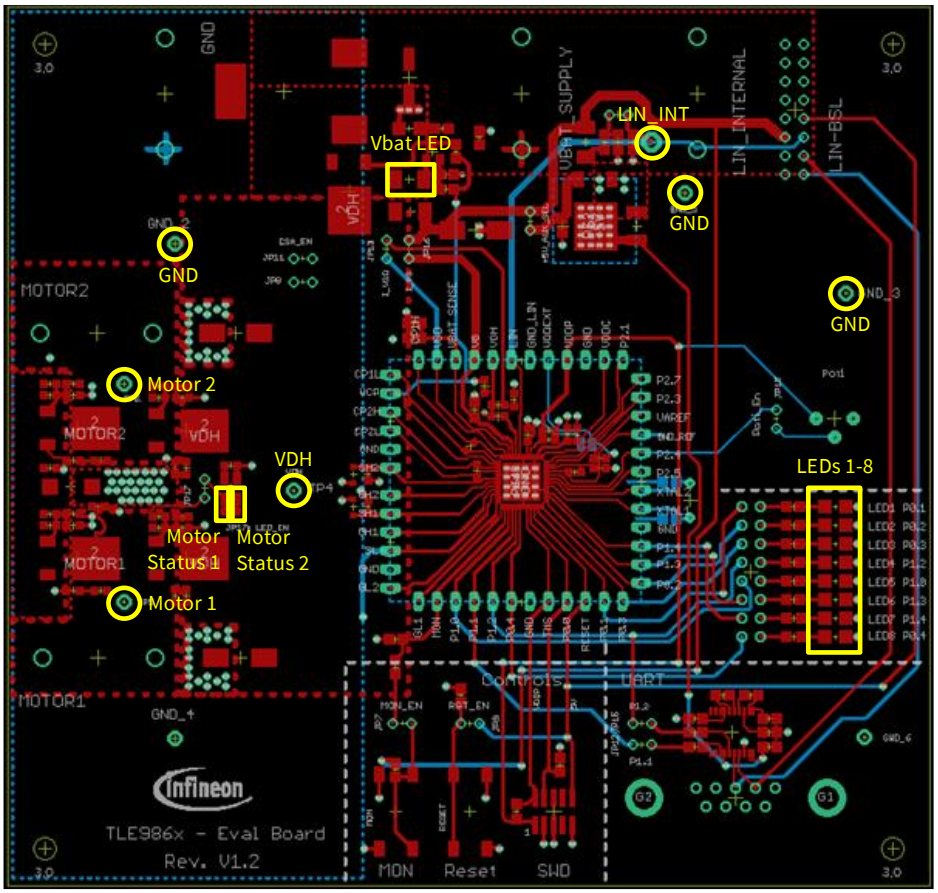


Figure 5 Test points

Several ground test points are provided.

Test point LIN_INT is used to measure the LIN voltage.

Test point VDH is used to measure the voltage on the VDH pin.

Tests points Motor 1 and Motor 2 can be used to measure the voltage at phase 1 and 2 of the motor.

There are 11 LEDs for visual validations on the board:

- LED 1 to 8 can be connected to GPIOs (see **Table 3**).
- LED 9 (Vbat LED) indicates power supply.
- LED 10 (Motor Status 1) lights up if the motor is running forward.
- LED 11 (Motor Status 2) lights up if the motor is running backward.

4 Jumper settings

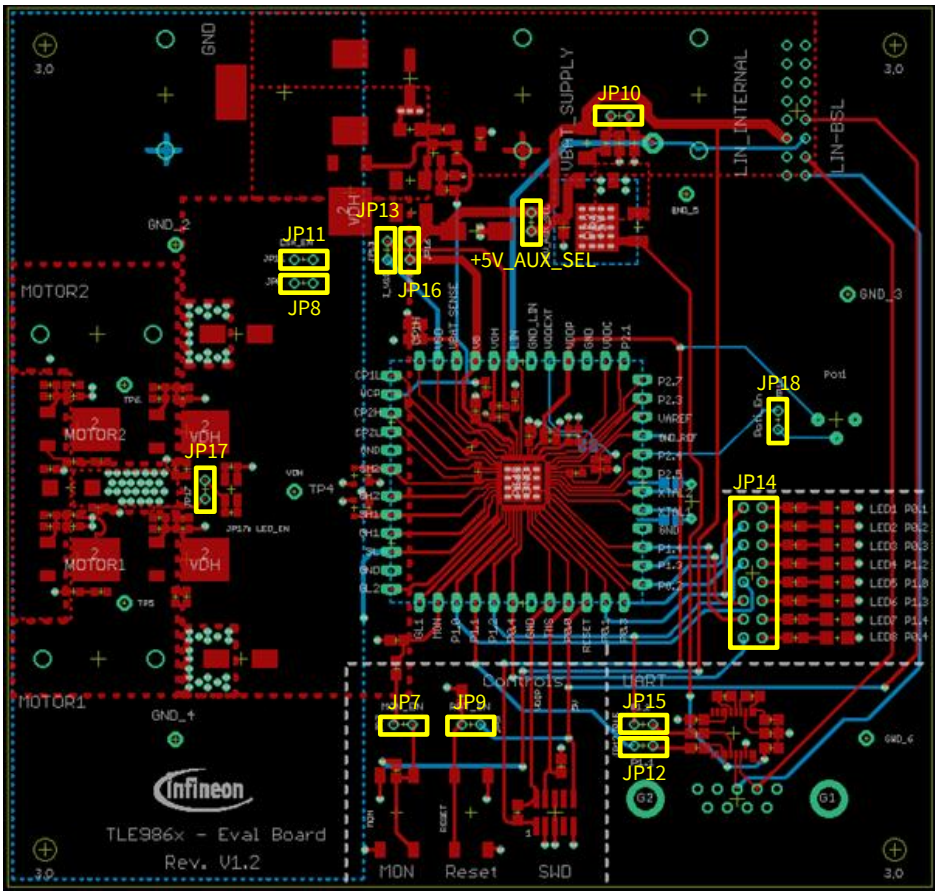


Figure 6 Jumpers

Table 2 Jumpers

JP7	Close this jumper to connect MON button to MON input. Open it to disconnect MON button from MON input.
JP8 / JP11	Open or close these jumpers to enable or disable the measurement shunt of the current sense amplifier.
JP9	Close this jumper to connect RESET button to RESET input. Open it to disconnect RESET button from RESET input.
JP10	Close this jumper to connect an additional 1 kΩ pull-up resistor. This is intended for LIN master communication. Open the jumper to use the TLE986x as slave in a LIN network. Software for LIN low level driver can be found at the homepage of IHR (**www.ihr.de**).
JP12	Close this jumper to enable UART communication.
JP13	This jumper is closed by default. If this jumper is left open the device is not supplied. It is intended to open the VSD line in order to measure the current flowing into the TLE986x device.
JP14	Open or close these jumpers to connect or disconnect the LEDs (see **Table 3**).
JP15	Close this jumper to enable UART communication.

Jumper settings

JP16	This jumper is closed by default. If this jumper is left open the device is not supplied. It is intended to open the VS line in order to measure the current flowing into the TLE986x device.
JP17	Close this jumper to connect the motor status LEDs. Open it to disconnect the LEDs.
JP18	Close this Jumper to connect the potentiometer to P2.4. Open this jumper to disconnect the potentiometer.
+5V_AUX_SEL	Open this jumper to disable the board's voltage regulator.

Table 3 GPIOs' function

P0.1	LED 1
P0.2	LED 2
P0.3	LED 3
P0.4	LED 8
P1.0	LED 5
P1.1	UART
P1.2	LED 4 / UART
P1.3	LED 6
P1.4	LED 7

5 Communication interfaces

5.1 LIN (via banana jack and uIO BSL)

The device integrated LIN transceiver is connected to a banana jack and additionally to the uIO BSL interface. To integrate the device in a LIN network it is sufficient to use the single wire banana interface. The BSL interface is intended to program the device via LIN. For further information about the uIO interface see **www.infineon.com/uio** or **www.hitex.com/uio**.

5.2 UART

A RS232 connector on the board enables a serial communication.

5.3 Debugging

Debugging is possible via the SWD interface; the signals are routed through the 10 pin header SWD interface (see **Figure 4**).

6 Software toolchain

6.1 Keil µVision 5

The recommended Integrated Software Development Environment is Keil® µVision5®.

Infineon's Embedded Power family is supported. For more information about the installation process, go to **www.keil.com**.

6.2 Infineon ConfigWizard

In addition to the IDE, Infineon provides ConfigWizard. The tool is designed for code configuration, in combination with the IDE. Infineon ConfigWizard can be downloaded via the Infineon Toolbox. The Infineon Toolbox is a central place to download and update all your Infineon tools. It can be downloaded from **www.infineon.com/toolbox**.

6.3 TLE986x SDK

All Embedded Power products can be installed to Keil® µVision5® via "Pack Installer". Browsing to the Infineon chapter in "All Devices" will lead to the "TLE98xx Series". The ".pack" file comes with several code examples, to provide an easy start up and speed up software development.

6.4 Debug connection setup

For a proper Flash and Debug Connection, install V5.10 (or newer) from: **www.segger.com/jlink-software.html**. Keil® µVision5® has to be configured in the IDE Menu "Options for Target". After connecting the USB-cable and power up the EvalBoard, go to the "Debug" register-card, choose "J-LINK / J-TRACE Cortex" and press "Settings".

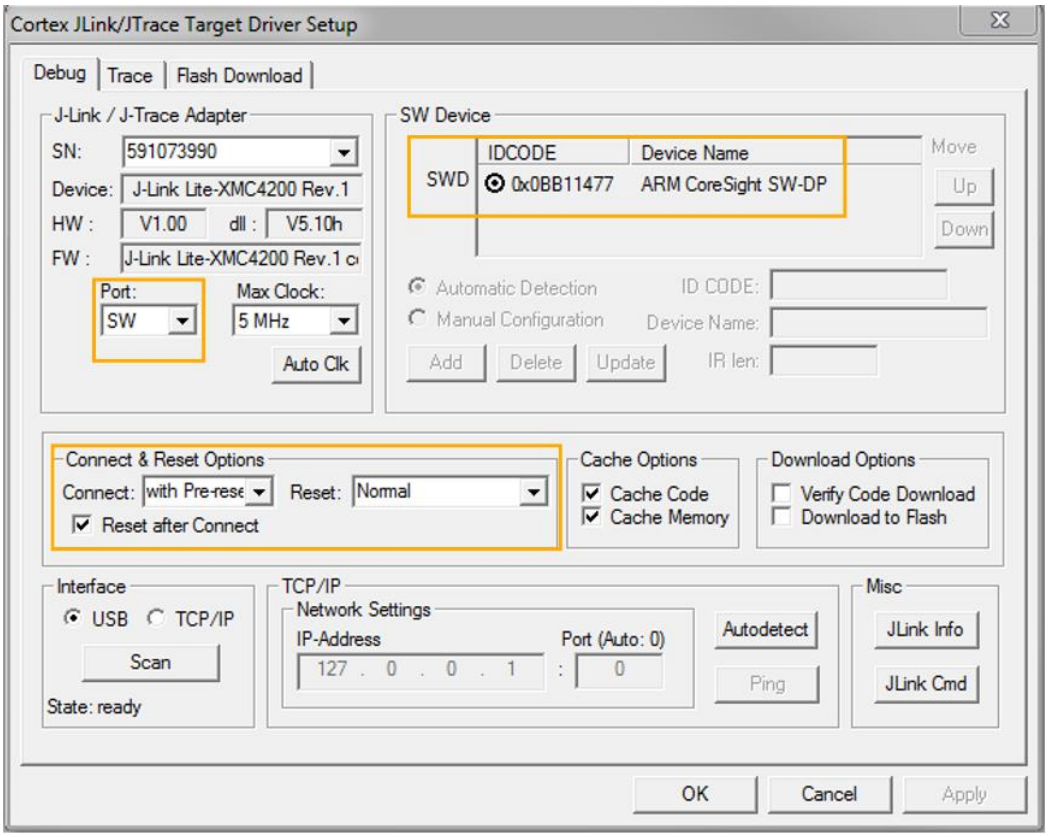


Figure 7 Debug and flash configuration

If the board is connected successfully, the Arm® IDCODE will be visible in the SW Device Window. If connection fails, “Connect & Reset Options” and “Port” window has to be checked.

7 Technical data

Table 4 Technical data

Voltage supply:	max. 28 V
Motor current:	max. 20 A
Pin ports:	5 V

8 Optional additional placements

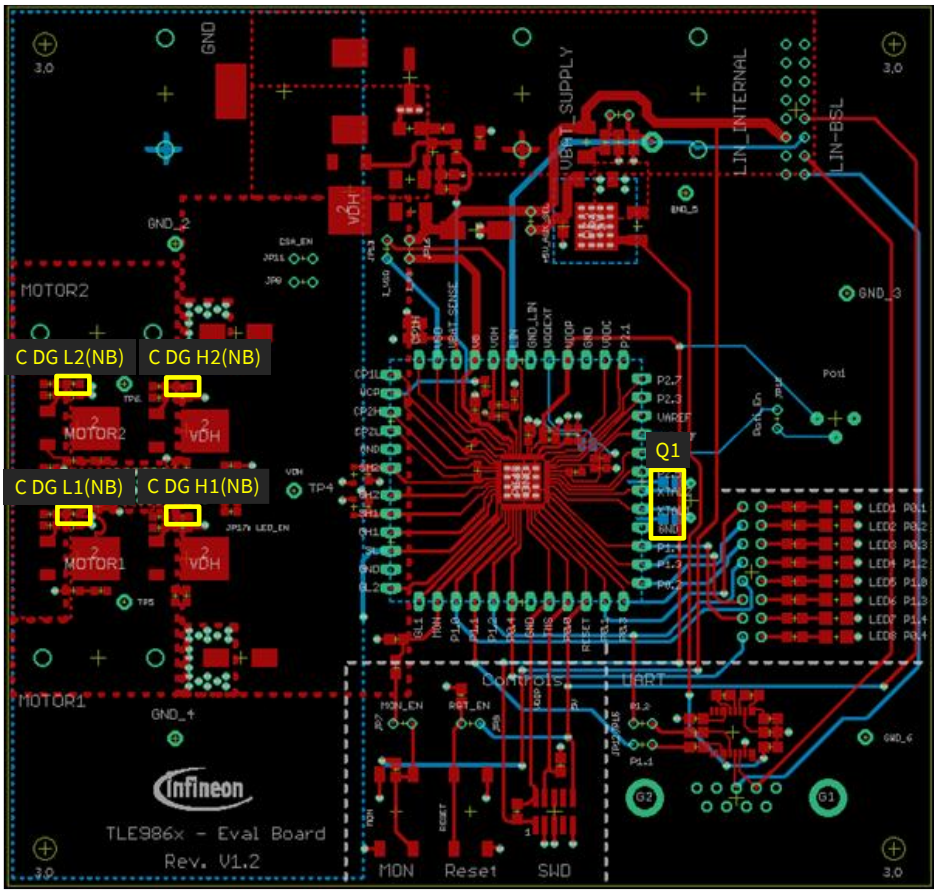


Figure 8 Additional placements' positions

Values for these optional additional placements have to be determined depending on application.

Table 5 Additional placements

Component	Description	Value
Q1	External oscillator	/
C_DG_H1(NB)	Gate drain capacitor high-side MOSFET phase 1	33 - 330 pF
C_DG_L1(NB)	Gate drain capacitor low-side MOSFET phase 1	33 - 330 pF
C_DG_H2(NB)	Gate drain capacitor high-side MOSFET phase 2	33 - 330 pF
C_DG_L2(NB)	Gate drain capacitor low-side MOSFET phase2	33 - 330 pF

9 Schematics and layout

9.1 Schematic

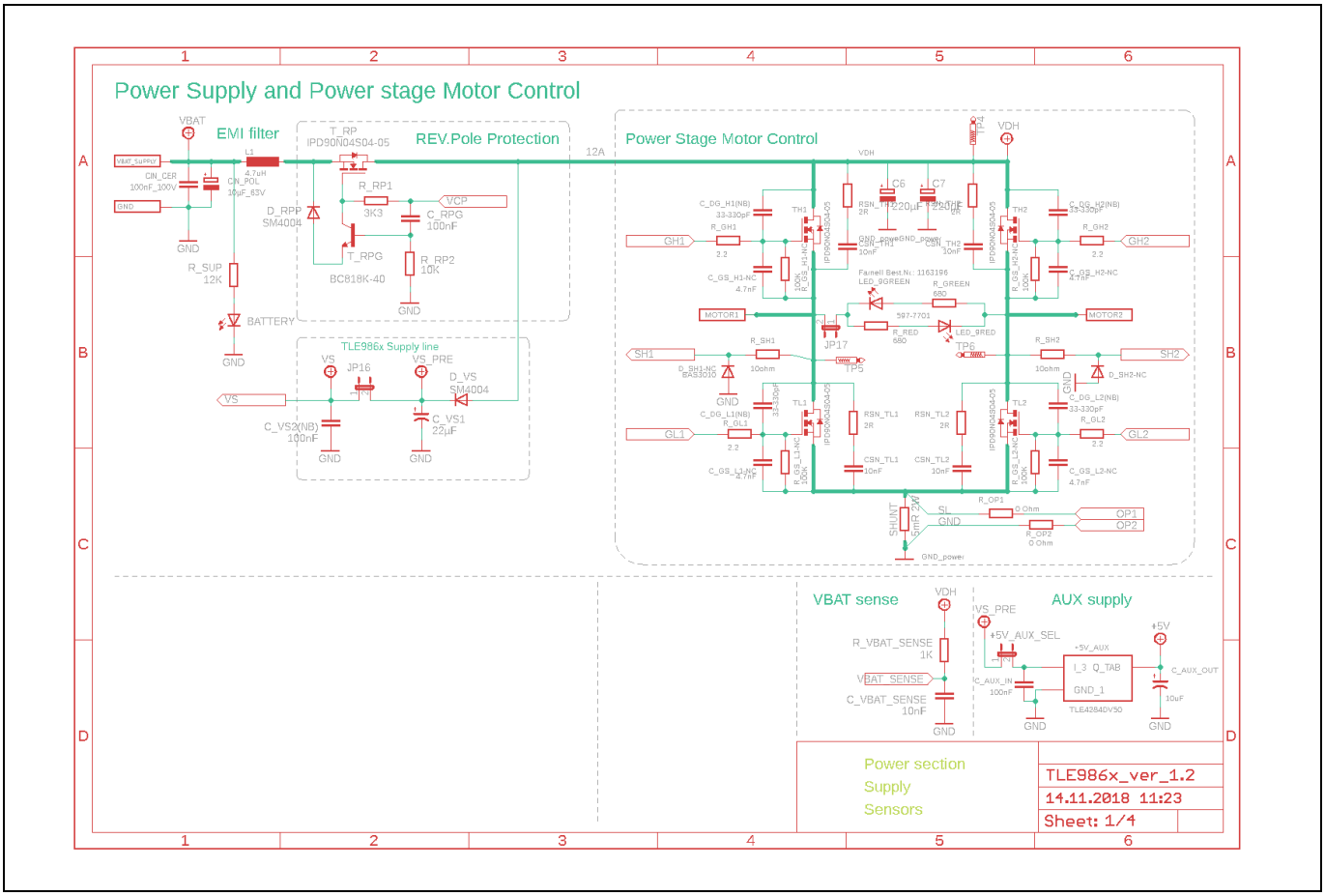


Figure 9 Schematics: Sheet 1

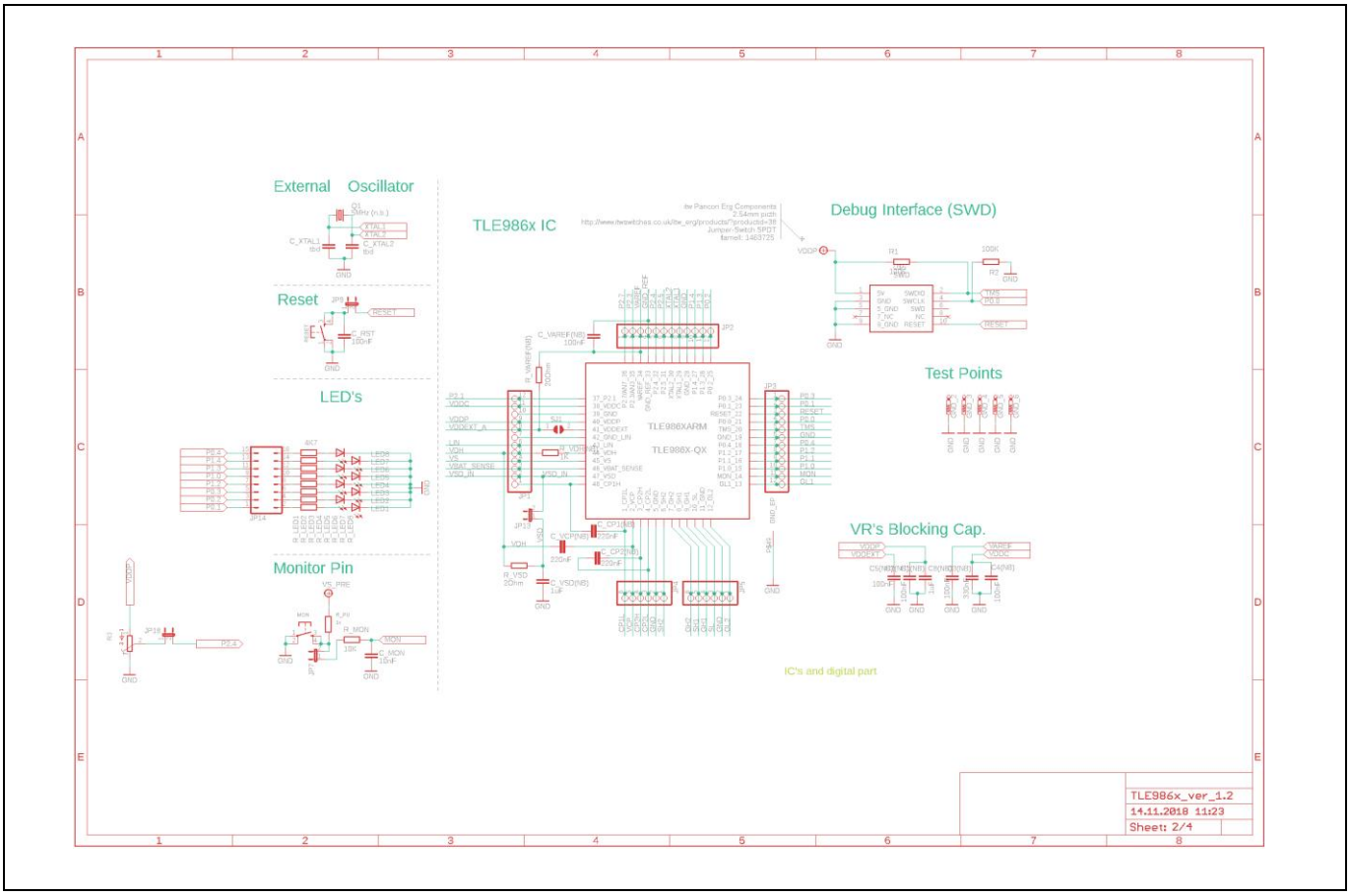


Figure 10 Schematics: Sheet 2

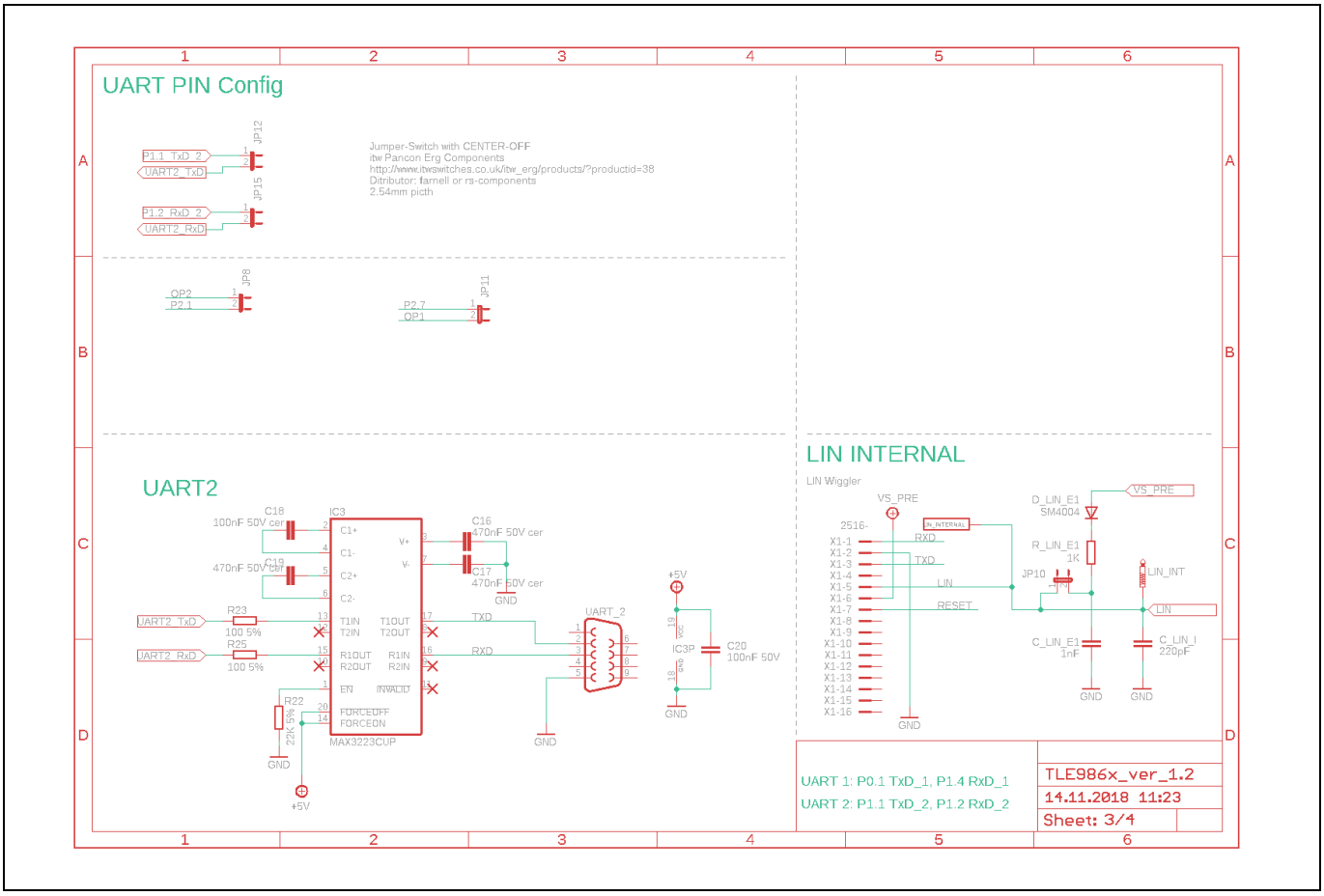


Figure 11 Schematics: Sheet 3

9.2 Layout

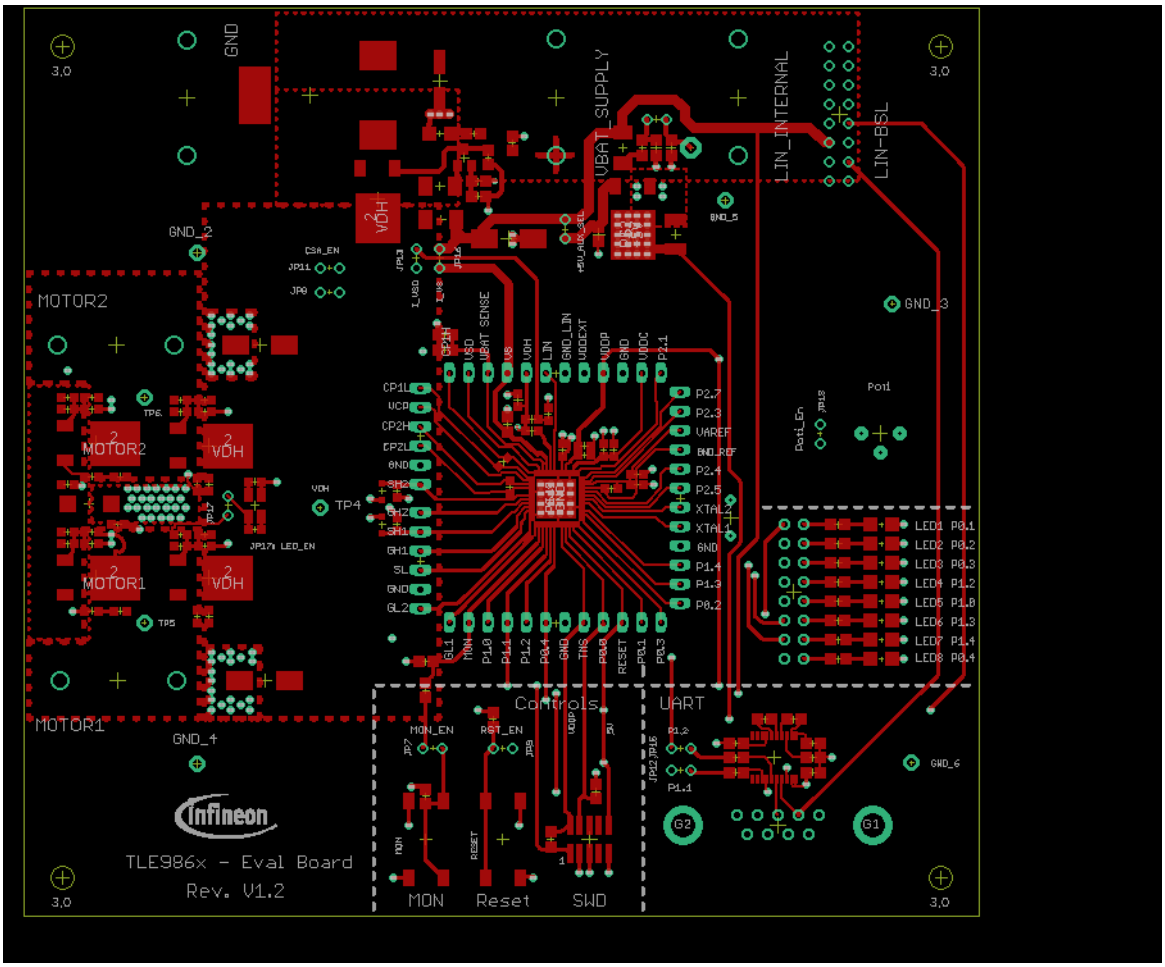


Figure 12 Top layer

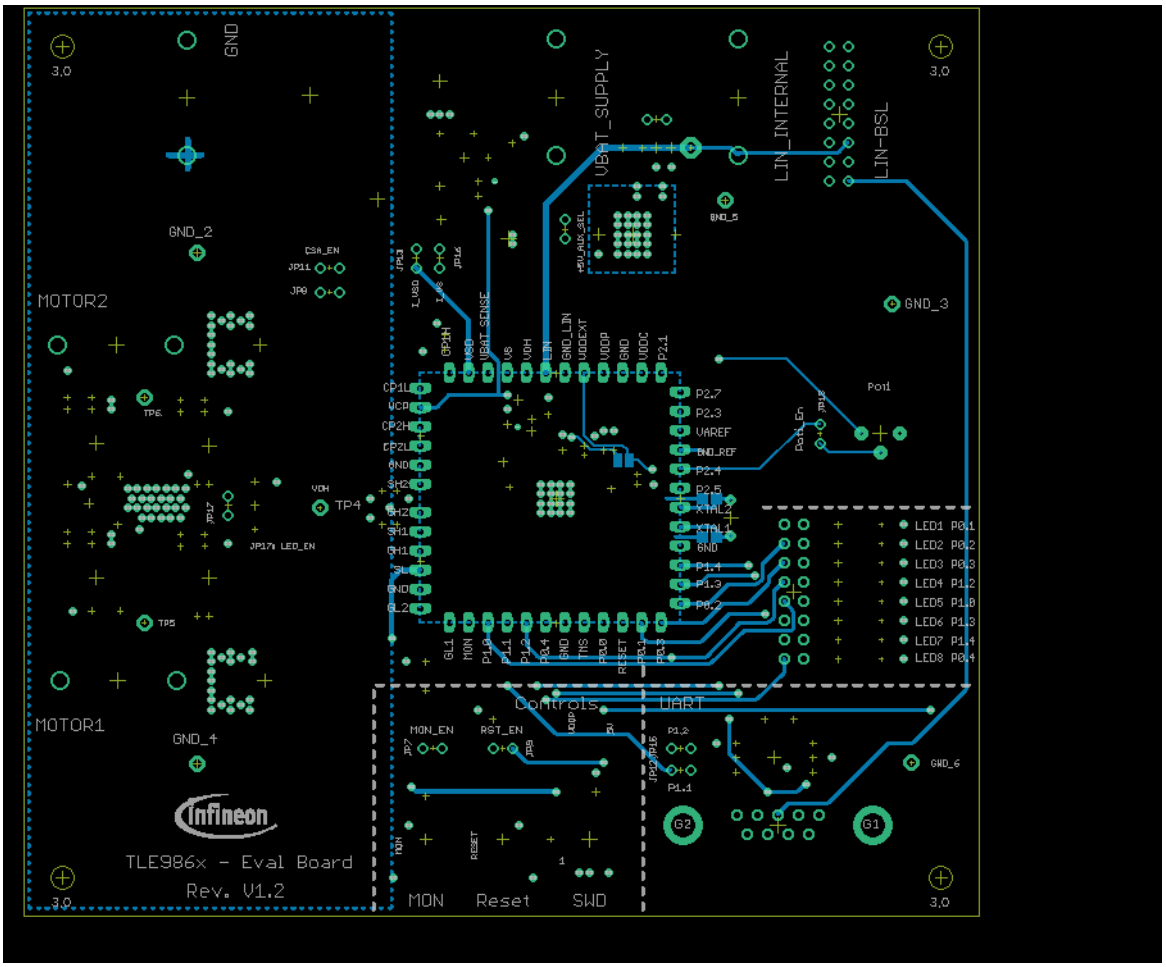


Figure 13 Bottom layer

Trademarks
All referenced product or service names and trademarks are the property of their respective owners.

Edition 2019-04-04
Published by

Infineon Technologies AG

81726 Munich, Germany

Do you have a question about this document?

Email: erratum@infineon.com

Document reference

IMPORTANT NOTICE

The information given in this document shall in no event be regarded as a guarantee of conditions or characteristics ("Beschaffenheitsgarantie").

With respect to any examples, hints or any typical values stated herein and/or any information regarding the application of the product, Infineon Technologies hereby disclaims any and all warranties and liabilities of any kind, including without limitation warranties of non-infringement of intellectual property rights of any third party.

In addition, any information given in this document is subject to customer's compliance with its obligations stated in this document and any applicable legal requirements, norms and standards concerning customer's products and any use of the product of Infineon Technologies in customer's applications.

The data contained in this document is exclusively intended for technically trained staff. It is the responsibility of customer's technical departments to evaluate the suitability of the product for the intended application and the completeness of the product information given in this document with respect to such application.

For further information on the product, technology, delivery terms and conditions and prices please contact your nearest Infineon Technologies office (**www.infineon.com**).

WARNINGS

Due to technical requirements products may contain dangerous substances. For information on the types in question please contact your nearest Infineon Technologies office.

Except as otherwise explicitly approved by Infineon Technologies in a written document signed by authorized representatives of Infineon Technologies, Infineon Technologies' products may not be used in any applications where a failure of the product or any consequences of the use thereof can reasonably be expected to result in personal injury.