KIT_XMC45_RELAX_V1 and KIT_XMC45_RELAX_LITE_V1 Evaluation Board guide

About this document

Scope and purpose

This document explains about the KIT_XMC45_RELAX_V1 and KIT_XMC45_RELAX_LITE_V1 Evaluation board: kit operation, out-of-the-box example and its operation, and the hardware details of the board.

Intended audience

This document is intended for all embedded developers using the KIT_XMC45_RELAX_V1 and KIT_XMC45_RELAX_LITE_V1 Evaluation board.

Evaluation board

This board is to be used during the design-in process for evaluating and measuring characteristic curves, and for checking datasheet specifications.

***Note**:* *PCB and auxiliary circuits are NOT optimized for final customer design.*

Important notice

“Evaluation Boards and Reference Boards” shall mean products embedded on a printed circuit board (PCB) for demonstration and/or evaluation purposes, which include, without limitation, demonstration, reference and evaluation boards, kits and design (collectively referred to as “Reference Board”).

Environmental conditions have been considered in the design of the Evaluation Boards and Reference Boards provided by Infineon Technologies. The design of the Evaluation Boards and Reference Boards has been tested by Infineon Technologies only as described in this document. The design is not qualified in terms of safety requirements, manufacturing and operation over the entire operating temperature range or lifetime.

The Evaluation Boards and Reference Boards provided by Infineon Technologies are subject to functional testing only under typical load conditions. Evaluation Boards and Reference Boards are not subject to the same procedures as regular products regarding returned material analysis (RMA), process change notification (PCN) and product discontinuation (PD).

Evaluation Boards and Reference Boards are not commercialized products, and are solely intended for evaluation and testing purposes. In particular, they shall not be used for reliability testing or production. The Evaluation Boards and Reference Boards may therefore not comply with CE or similar standards (including but not limited to the EMC Directive 2004/EC/108 and the EMC Act) and may not fulfill other requirements of the country in which they are operated by the customer. The customer shall ensure that all Evaluation Boards and Reference Boards will be handled in a way which is compliant with the relevant requirements and standards of the country in which they are operated.

The Evaluation Boards and Reference Boards as well as the information provided in this document are addressed only to qualified and skilled technical staff, for laboratory usage, and shall be used and managed according to the terms and conditions set forth in this document and in other related documentation supplied with the respective Evaluation Board or Reference Board.

It is the responsibility of the customer’s technical departments to evaluate the suitability of the Evaluation Boards and Reference Boards for the intended application, and to evaluate the completeness and correctness of the information provided in this document with respect to such application.

The customer is obliged to ensure that the use of the Evaluation Boards and Reference Boards does not cause any harm to persons or third party property.

The Evaluation Boards and Reference Boards and any information in this document is provided "as is" and Infineon Technologies disclaims any warranties, express or implied, including but not limited to warranties of non-infringement of third party rights and implied warranties of fitness for any purpose, or for merchantability.

Infineon Technologies shall not be responsible for any damages resulting from the use of the Evaluation Boards and Reference Boards and/or from any information provided in this document. The customer is obliged to defend, indemnify and hold Infineon Technologies harmless from and against any claims or damages arising out of or resulting from any use thereof.

Infineon Technologies reserves the right to modify this document and/or any information provided herein at any time without further notice.

Safety precautions

***Note**: Please note the following warnings regarding the hazards associated with development systems.*

Table 1 Safety precautions

	**Warning:** *The DC link potential of this board is up to 1000 V or more. When measuring voltage waveforms by oscilloscope, high voltage differential probes must be used. Failure to do so may result in personal injury or death.*
	**Warning:** *The evaluation or reference board contains DC bus capacitors which take time to discharge after removal of the main supply. Before working on the drive system, wait five minutes for capacitors to discharge to safe voltage levels. Failure to do so may result in personal injury or death. Darkened display LEDs are not an indication that capacitors have discharged to safe voltage levels.*
	**Warning:** *The evaluation or reference board is connected to the grid input during testing. Hence, high-voltage differential probes must be used when measuring voltage waveforms by oscilloscope. Failure to do so may result in personal injury or death. Darkened display LEDs are not an indication that capacitors have discharged to safe voltage levels.*
	**Caution:** *Only personnel familiar with the drive, power electronics and associated machinery should plan, install, commission and subsequently service the system. Failure to comply may result in personal injury and/or equipment damage.*
	**Caution:** *The evaluation or reference board contains parts and assemblies sensitive to electrostatic discharge (ESD). Electrostatic control precautions are required when installing, testing, servicing or repairing the assembly. Component damage may result if ESD control procedures are not followed. If you are not familiar with electrostatic control procedures, refer to the applicable ESD protection handbooks and guidelines.*

Table of contents

About this document . . . 1
Important notice . . . 2
Safety precautions . . . 3
Table of contents . . . 4
1 Introduction . . . 5
1.1 Overview . . . 5
1.2 Key Features . . . 5
1.3 Block Diagram . . . 6
2 Hardware Description . . . 7
2.1 Power Supply . . . 9
2.2 Pin Header Connector . . . 10
3 Production Data . . . 12
3.1 Schematics . . . 12
3.2 Components Placement and Geometry . . . 15
3.3 List of Material . . . 16
Revision history . . . 18
Disclaimer . . . 19

1 Introduction

This document describes the features and hardware details of the XMC4500 Relax Kit-V1 and the XMC4500 Relax Lite Kit-V1, both equipped with the Arm® Cortex™-M4 based XMC4500 microcontroller from Infineon Technologies AG.

1.1 Overview

The XMC4500 Relax Kit-V1 and the XMC4500 Relax Lite Kit-V1 are designed to evaluate the capabilities of the XMC4500 Microcontroller and the powerful, free of charge tool chain ModusToolbox™. The XMC4500 Relax Kit extends the feature set with an Ethernet-enabled communication option, e.g. to run an embedded web server. You can store your own HTML web pages on a microSD Card or control the XMC4500 via the web browser on your PC. The XMC4500 Relax Lite Kit-V1 does not support the web server application, because the components for the Ethernet are not assembled. Both boards are marked with “XMC4500 Relax/Relax Lite Kit-V1”. These boards are neither cost nor size optimized and do not serve as a reference design.

1.2 Key Features

Table 2 summarizes the features of both the XMC4500 Relax Kit-V1 and the XMC4500 Relax Lite Kit-V1.

Table 2 Features

Feature	XMC4500 Relax Kit-V1	XMC4500 Relax Lite Kit-V1
XMC4500 Microcontroller (Arm® Cortex™-M4F based)	✓	✓
Detachable on-board Debugger	✓	✓
Power over USB	✓	✓
2 x User Button and 2 x User LED	✓	✓
Reset Button	✓	✓
Power Regulator from 5 V to 3.3V	✓	✓
4 x SPI-Master, 3x I2C, 3 x I2S, 3 x UART, 2 x CAN, 17 x ADC (12 bit), 2 x DAC, 31x PMW mapped on 2 Pin Headers 2 x 20	✓	✓
USB-OTG (Micro USB Plug)	✓	✓
Ethernet PHY and RJ45 jack	✓	
Real Time Clock Crystal	✓	
32 Mbit Quad-SPI Flash Memory	✓	
microSD Card Slot	✓	

1.3 Block Diagram

The block diagram in Figure 1 shows the main components of the XMC4500 Relax/Relax Lite Kit-V1 and their interconnections. There are following main building blocks:

- XMC4500 Microcontroller in a LQFP100 package
- On-board USB debugger realized with a 2nd XMC4500 for serial wire debug
- Ethernet Phy with RJ45 Plug
- Two 40 pin header X1 and X2
- On-board power generation for power supply of the XMC45000 Microcontroller and the debug IC
- 2 User Buttons and 2 User LEDs
- USB Plug
- microSD Card Slot

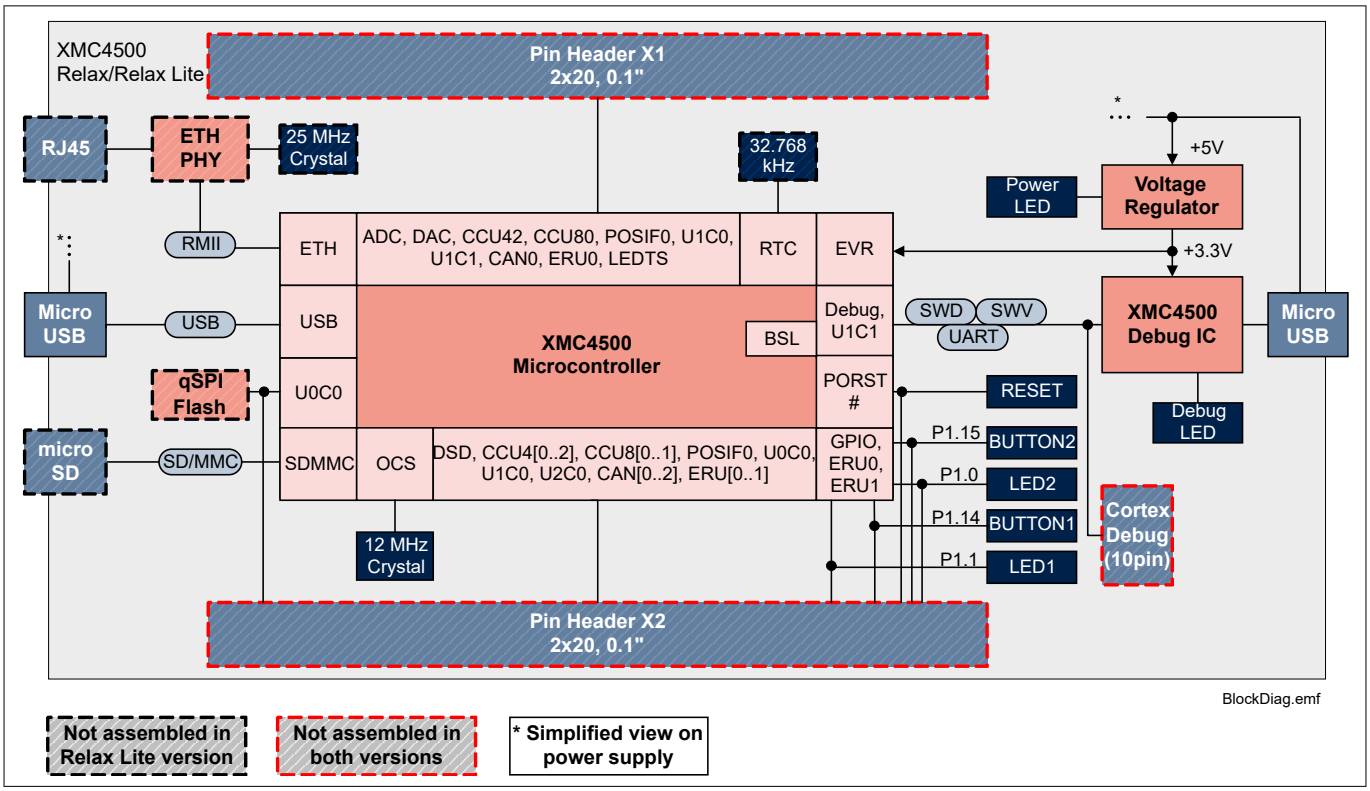

Figure 1 Block Diagram of the XMC4500 Relax/Relax Lite Kit-V1

2 Hardware Description

The following sections give a detailed description of the board hardware and how it can be used. Figure 2 shows the XMC4500 Relax Lite Kit-V1, Figure 3 shows the XMC4500 Relax Kit-V1.

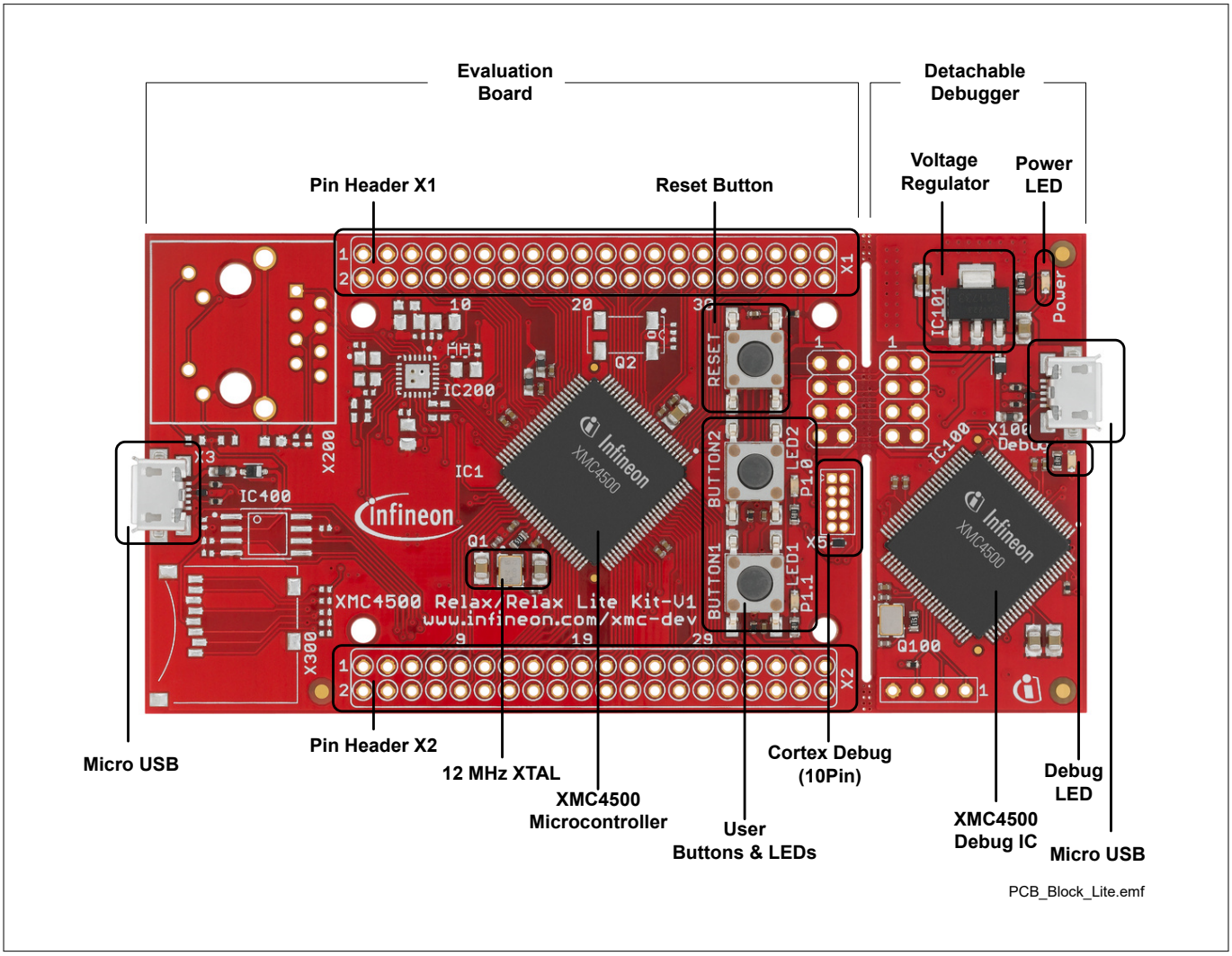

Figure 2 XMC4500 Relax Lite Kit-V1

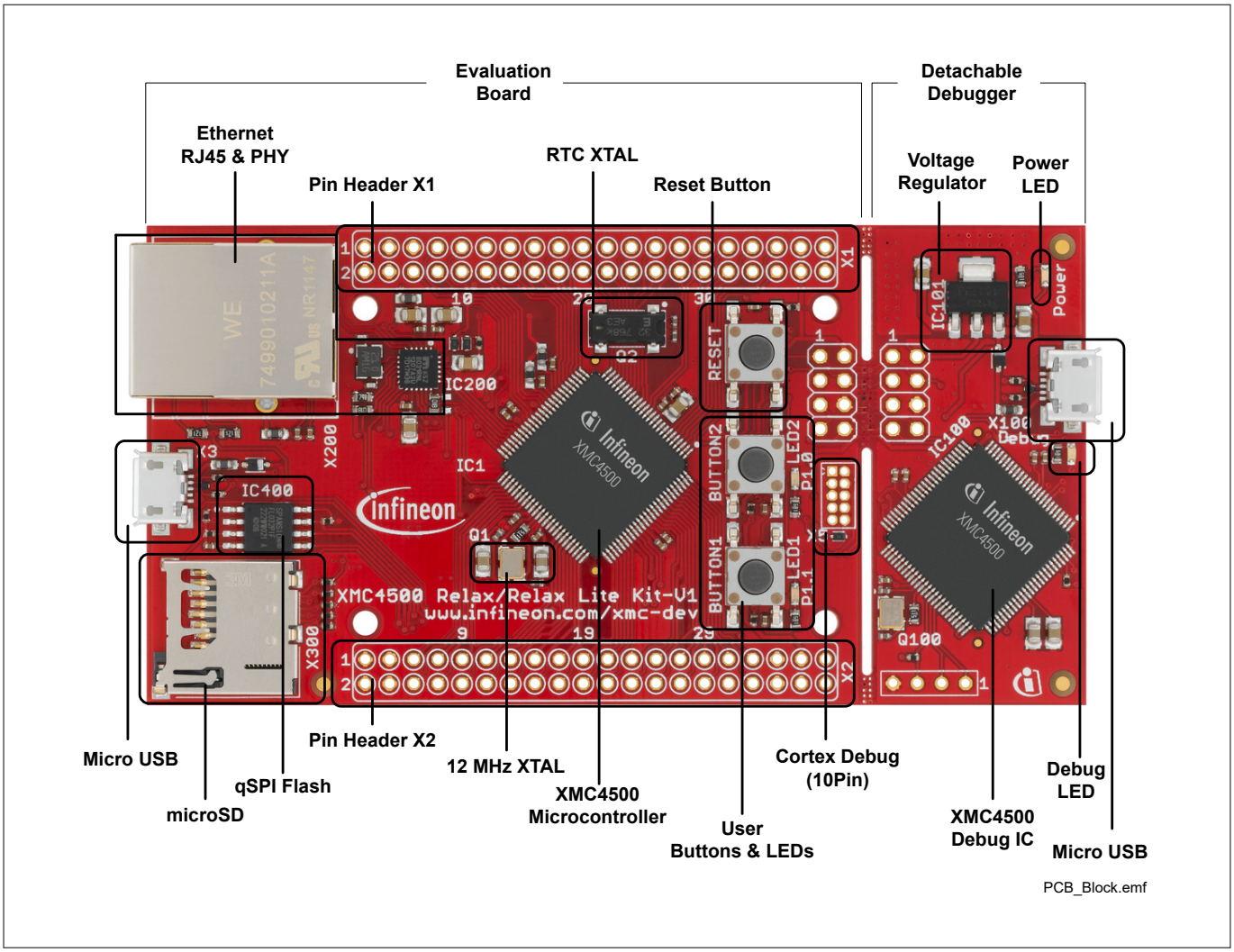

Figure 3 XMC4500 Relax Kit-V1

2.1 Power Supply

The XMC4500 Relax/Relax Lite Kit-V1 must be supplied by an external 5 Volt DC power supply connected to any of the Micro UBS plugs (X3, X100). Out of the box with the pre-programmed web server application and the on-board debugger in operation the XMC4500 Relax Kit-V1 typically draws about 250 mA. The XMC4500 Relax Lite Kit-V1 without the web server capabilities draws about 200 mA. This current can be delivered via the USB plug of a PC, which is specified to deliver up to 500 mA. The Power LED indicates the presence of the generated 3.3V supply voltage.

On-board reverse current protection diodes will ensure safe operation in case power is provided through both USB plugs at the same time. These protection diodes allows to use the on-board debugger connected with a PC/Notebook via X100 and a second host PC/Laptop connected with the XMC4500 Relax Kit via X3.

If the board is powered via a USB plug, it's not recommended to apply an additional 5 Volt power supply to one of the 5 Volt power pins (VDD5) on the pin headers X1 or X2, because there is no protection against reverse current into the external power supply. These power pins can be used to power an external circuit. But care must be taken not to draw more current than USB can deliver. A PCs as USB host typically can deliver up to 500 mA current. If higher currents are required and in order to avoid damages on the USB host the use of an external USB power supply unit which is able to deliver higher currents than 500 mA is strongly recommended.

After power-up the Debug LED starts blinking. In case there is a connection to a PC via the Debug USB plug X100 and the USB Debug Device drivers are installed on this PC, the Debug LED will turn from blinking to constant illumination.

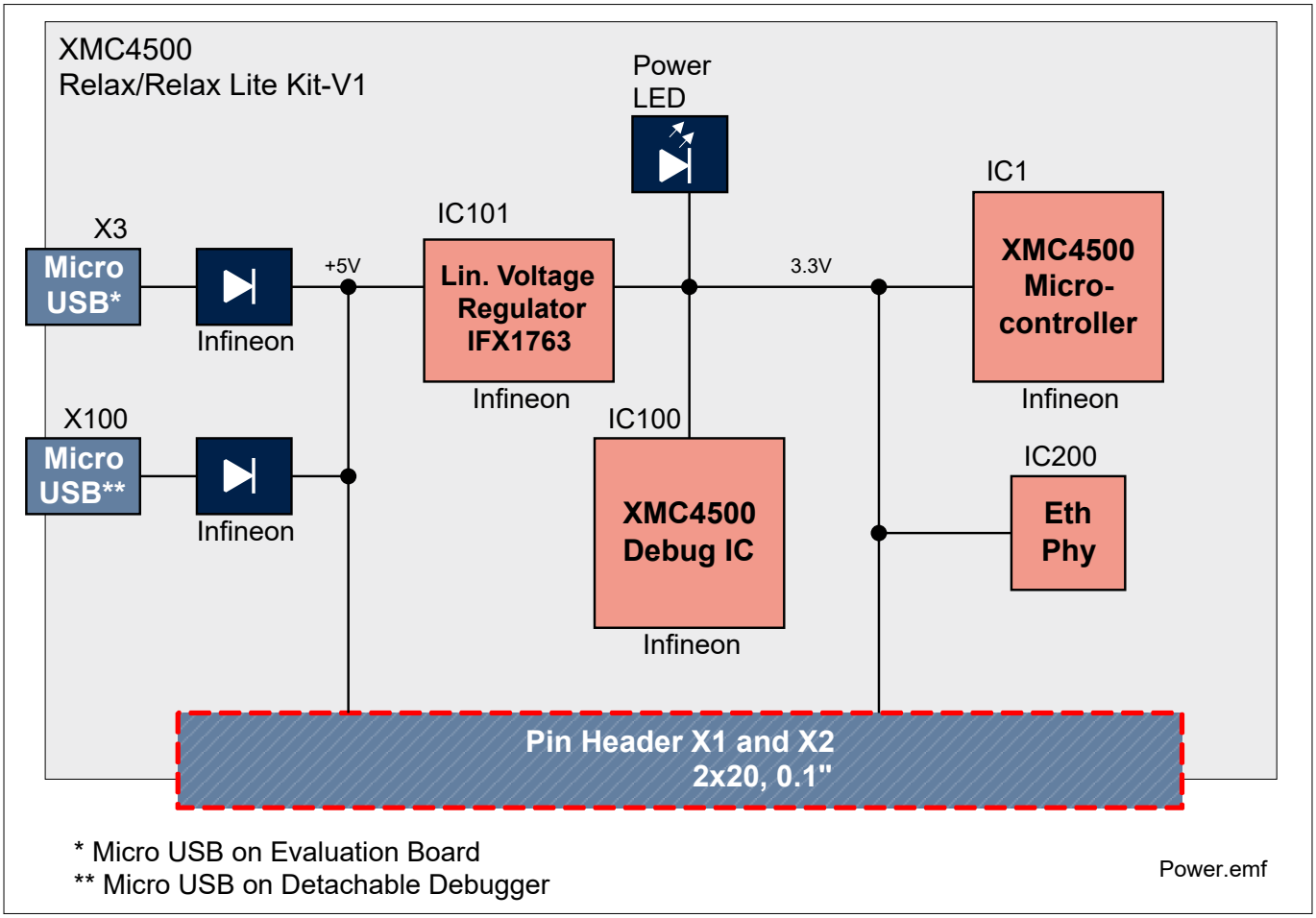

Figure 4 Power Supply Concept

2.2 Pin Header Connector

The pin headers X1 and X2 can be used to extend the evaluation board or to perform measurements on the XMC4500. Figure 5 shows the available GPIOs/signals at the pin headers. The pinning table is also printed onto the bottom side of the PCB.

Pin Header X2 (Top View) **Pin Header X1**

	2	1	
	GND	GND	
4	GND	GND	3
6	P5.7	P2.6	5
8	P5.1	P5.2	7
10	P1.15**	P5.0	**9**
12	P1.13	P1.14**	11
14	P1.11	P1.12	13
16	P1.5***	P1.10***	15
18	P1.3***	P1.4***	17
20	P1.1*	P1.2***	**19**
22	P1.9	P1.0*	21
24	P0.8	P1.8***	23
26	P3.4	P0.7	25
28	P0.12	P3.3	27
30	P0.6	P0.11	**29**
32	P0.2	P0.5	31
34	P0.4	P0.3	33
36	GND	GND	35
38	VDD3.3	VDD3.3	37
40	VDD5	VDD5	39

	2	1	
	GND	GND	
4	GND	GND	3
6	RESET#	GND	5
8	P2.10	P2.1	7
10	P14.8	P2.14	9
12	P14.9	P2.15	11
14	P14.0	VAREF	13
16	P14.2	P14.1	15
18	P14.4	P14.3	17
20	P14.6	P14.5	19
22	P14.12	P14.7	21
24	P14.14	P14.13	23
26	P15.2	P14.15	25
28	HIB_IO_0	P15.3	27
30	P3.0	HIB_IO_1	29
32	P3.2	P3.1	31
34	P0.1	P0.9	33
36	P0.0	P0.10	35
38	VDD3.3	VDD3.3	37
40	VDD5	VDD5	39

* P1.1 is connected to LED1, P1.0 is connected to LED2 (2 mA load, ~2 V clip of input signal)

** P1.14 is connected to BUTTON1, P1.15 is connected to BUTTON 2 (both with a 100 nF capacitor in parallel)

*** These pins are connected to the on-board SPI Fash Memory (not valid for Relax Lite):

X2.23 = Port 1.8 = SPI Flash CS#

X2.15 = Port 1.10 = SPI Flash CLK

X2.16 = Port 1.5 = SPI Flash DI (IO0)

X2.17 = Port 1.4 = SPI Flash DO (IO1)

X2.18 = Port 1.3 = SPI Flash WP# (IO2)

X2.19 = Port 1.2 = SPI Flash HOLD# (IO3)

Figure 5 Signal mapping of the pin headers

The XMC4500 provides a flexible mapping of functions to different pins. Figure 6 shows an example how the communication peripheral functions UART, I2C, SPI, CAN and I2S can be mapped to XMC4500's GPIOs.

GPIOs with the same colour code belong to the same group of physical pins and cannot be choosen twice. For instance UART-3 has got a pin overlap with I2C-Master1 and therefore this combination cannot work in parallel.

Please also avoid pheripheral combinations which are using the same USIC channel. For example I2C-Master2 and UART-3 utilizing USIC 0 Channel 0 (U0C0), therefore this combination does not work in parallel.

UART	UART-1	UART-2	UART-3	UART-4
TX	P0.1/ U1C1.DOUT0	P1.5 / U0C0.DOUT0	P5.1/ U0C0.DOUT0	P0.5 / U1C0.DOUT0
RX	P0.0 / U1C1.DX0D	P1.4 / U0C0.DX0B	P5.0 / U0C0.DX0D	P0.4 / U1C0.DX0A

I2C Master/Slave	I2C-Master1	I2C-Master2	I2C-Master3	I2C-Slave1	I2C-Slave2
SCL (clock)	P5.2 / U2C0.SCLKOUT	P1.10 / U0C0.SCLKOUT	P0.11/ U1C0.SCLKOUT	P5.2 / U2C0.DX1A	P0.11/ U1C0.DX1A
SDA (data)	P5.0 / U2C0.DOUT0 / .DX0B	P1.5/ U0C0.DOUT0 /.DX0A	P0.5/ U1C0.DOUT0 /.DX0B	P5.0 /U2C0.DOUT0 / .DX0B	P0.5/ U1C0.DOUT0 /.DX0B

SPI Master/Slave	SPI-Master1	SPI-Master2	SPI-Master3	SPI-Master4	SPI-Slave1	SPI-Slave2
MOSI	P0.1/ U1C1.DOUT0	P5.0 / U2C0.DOUT0	P1.5 / U0C0.DOUT0	P0.5 / U1C0.DOUT0	P0.0 / U1C1.DX0D	P0.4 / U1C0.DX0A
MISO	P0.0 / U1C1.DX0D	P5.1/ U2C0.DX0A	P1.4 / U0C0.DX0B	P0.4 / U1C0.DX0A	P0.1/ U1C1.DOUT0	P0.5 / U1C0.DOUT0
SCK (clock)	P0.10 / U1C1.SCLKOUT	P5.2 / U2C0.SCLKOUT	P1.10 / U0C0.SCLKOUT	P0.11/ U1C0.SCLKOUT	P0.10 / U1C1.DX1A	P0.11/ U1C0.DX1A
CS (chip select)	P0.9 / U1C1.SELO0*	P2.6 / U2C0.SELO4	P1.11/ U0C0.SELO0**	P0.6 / U1C0.SELO0	P0.9 / U1C1.DX2A	P0.6 / U1C0.DX2A

CAN	CAN-1	CAN-2
TX	P1.12 / CAN.N1_TXD	P1.4 / CAN.N0_TXD
RX	P1.13 / CAN.N1_RXDC	P1.5 / CAN.N0_RXDA

I2S Master/Slave	I2C-Master1	I2C-Master2	I2C-Master3	I2C-Slave1
SCK (clock)	P5.2 / U2C0.SCLKOUT	P1.10 / U0C0.SCLKOUT	P0.11/ U1C0.SCLKOUT	P0.11/ U1C0.DX1A
SD (data)	P5.0 / U2C0.DOUT0 / .DX0B	P1.5 / U0C0.DOUT0 /.DX0A	P0.5/ U1C0.DOUT0 /.DX0B	P5.0 / U2C0.DOUT0 / .DX0B
WS (wait)	P2.6 / U2C0.SEL04	P1.11/ U0C0.SELO0	P0.6 / U1C0.SELO0	P0.6 / U2C0.DX2A

* more chip select signals for U1C1 can be found at P3.3, P3.4, P3.5, P3.6

** another chip select signal for U0C0 can be found at P1.8

Figure 6 Mapping of communication peripherals to GPIOs and it's corresponding functions

3 Production Data

3.1 Schematics

This chapter contains the schematics for the XMC4500 Relax/Relax Lite Kit-V1:

- Figure 7: CPU, Pin Headers, Buttons, LEDs, Reset
- Figure 8: On-board Debugger, Power Supply, Ethernet, Quad-SPI Memory, SD Card Slot, RTC Crystal

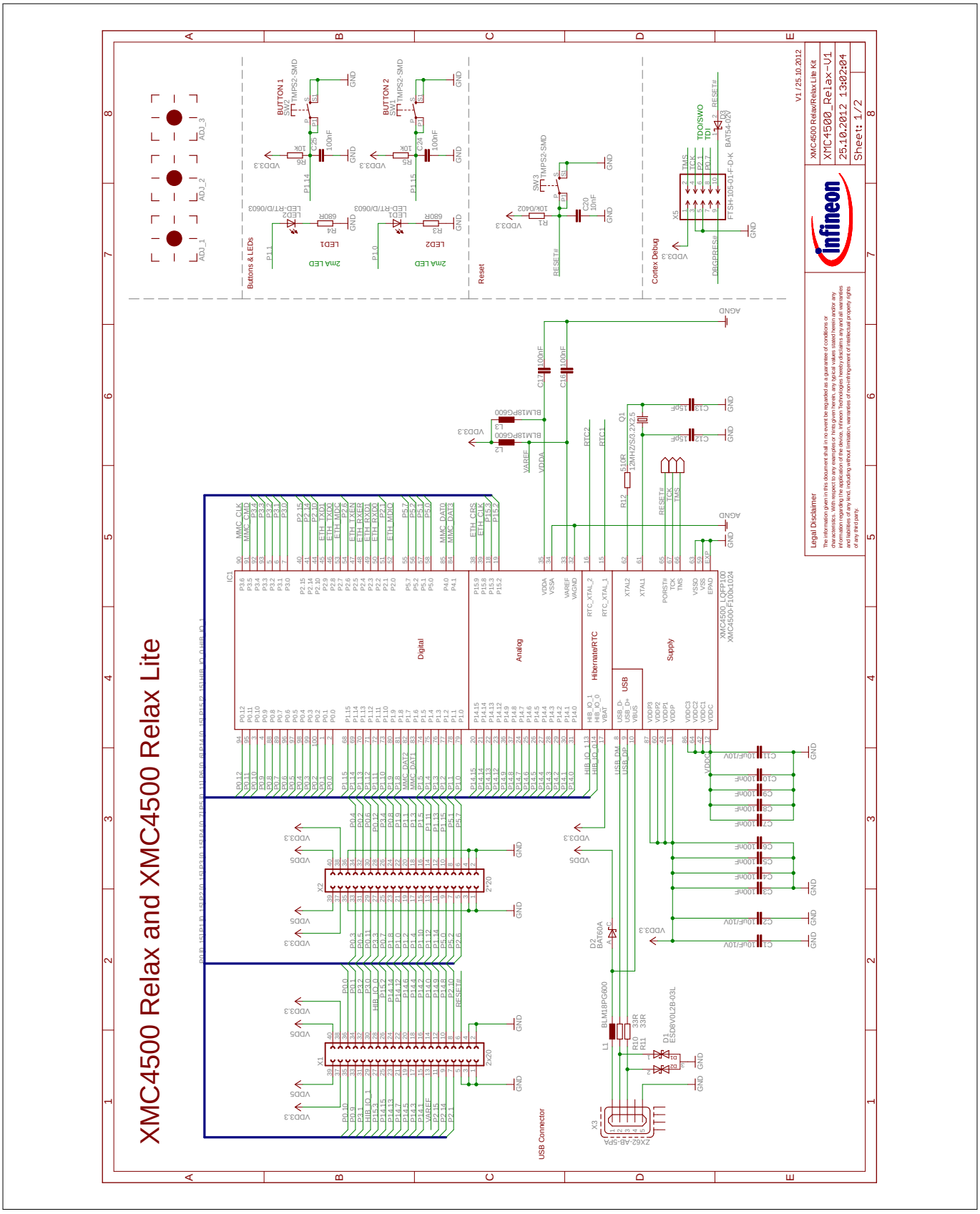

Figure 7 CPU, Pin Headers, Buttons, LEDs, Reset

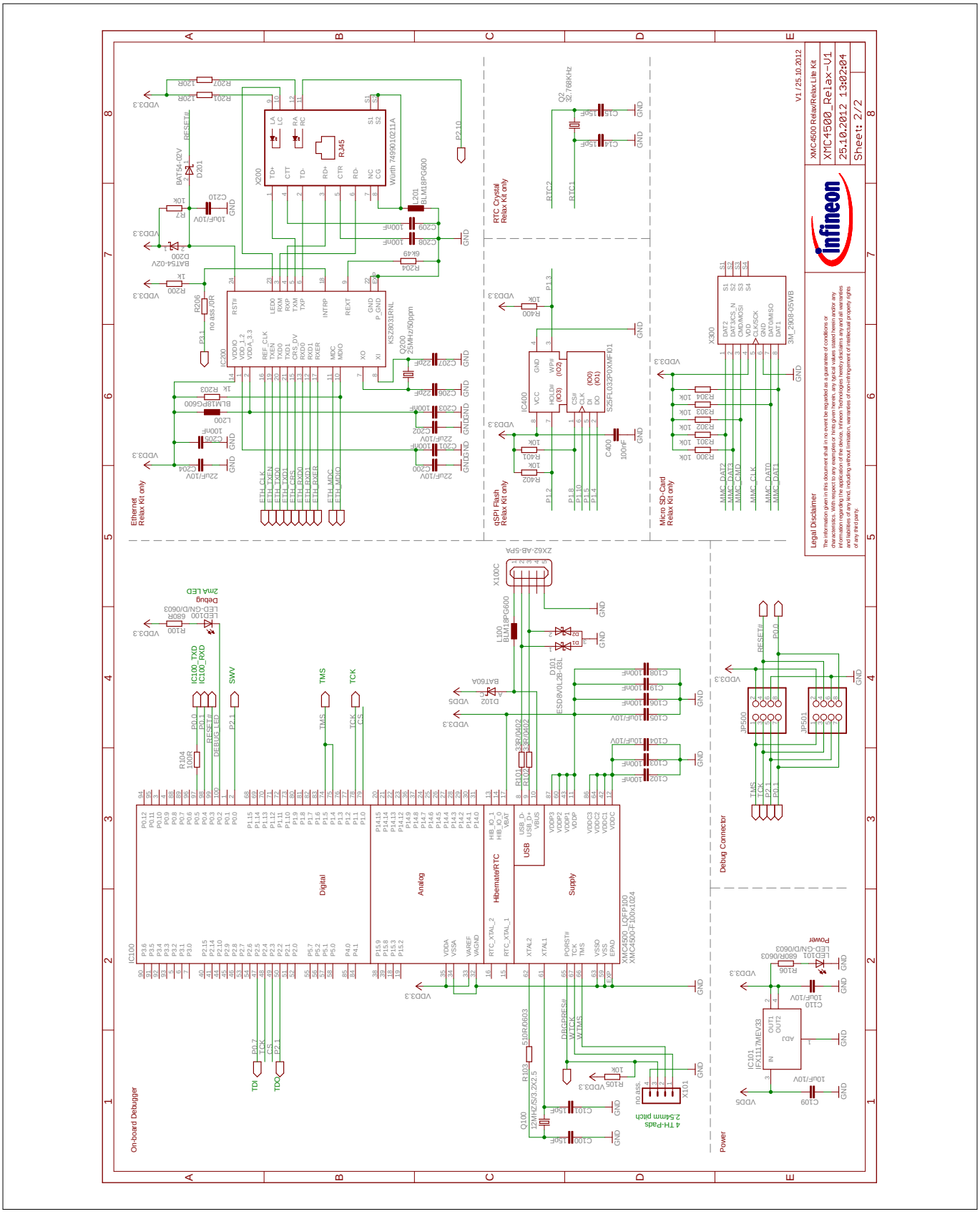

Figure 8 **On-board Debugger, Power Supply, Ethernet, Quad-SPI Memory, SD Card Slot, RTC Crystal**

3.2 Components Placement and Geometry

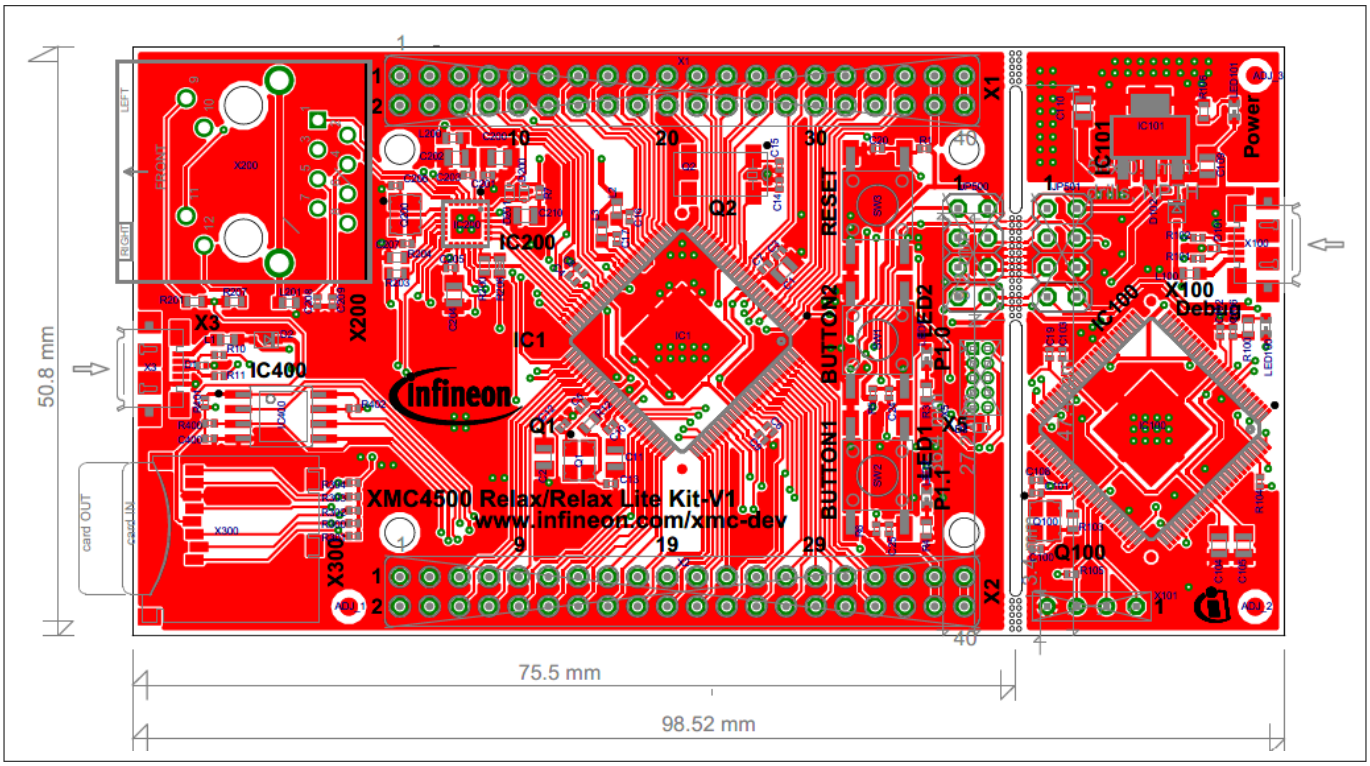

Figure 9 Components Placement and Geometry

3.3 List of Material

The list of material is valid for the XMC4500 Relax/Relax Lite Kit-V1.

Table 3 List of Material

No.	Qty	Value	Device	Reference Designator
1	2	2x4	Pin Header 0.1” TH	JP500, JP501
2	2	1k	Resistor	R200, R203
3	1	2*20	Pin Header 0.1” TH	X2
4	1	2x20	Pin Header 0.1” TH	X1
5	1	3M_2908-05WB	microSD Card Holder	X300
6	1	6k49	Resistor	R204
7	12	10k	Resistor	R5, R6, R7, R105, R300, R301, R302, R303, R304, R400, R401, R402
8	1	10k/0402	Resistor	R1
9	1	10nF	Capacitor	C20
10	8	10uF/10V	Capacitor	C1, C2, C11, C104, C105, C109, C110, C210
11	2	12MHz/S/ 3.2X2.5	Crystal 12 MHz	Q1, Q100
12	6	15pF	Capacitor	C12, C13, C14, C15, C100, C101
13	2	22pF	Capacitor	C206, C207
14	3	22uF/10V	Capacitor	C200, C202, C204
15	1	25MHz/50ppm	Crystal 12 MHz	Q200
16	1	32.768KHz	Crystal 32 kHz	Q2
17	2	33R	Resistor	R10, R11
18	2	33R/0402	Resistor	R101, R102
19	1	100R	Resistor	R104
20	23	100nF	Capacitor	C3, C4, C5, C6, C7, C8, C9, C10, C16, C17, C19, C24, C25, C102, C103, C106, C108, C201, C203, C205, C208, C209, C400
21	2	120R	Resistor	R201, R207
22	1	510R	Resistor	R12
23	1	510R/0603	Resistor	R103
24	3	680R	Resistor	R3, R4, R100
25	1	680R/0603	Resistor	R106

(table continues...)

Table 3 (continued) List of Material

No.	Qty	Value	Device	Reference Designator
26	3	BAT54-02V	Schottky Diode, Infineon	D3, D200, D201
27	2	BAT60A	Schottky Diode, Infineon	D2, D102
28	6	BLM18PG600	Inductor	L1, L2, L3, L100, L200, L201
29	2	ESD8V0L2B-03L	TVS Diode, Infineon	D1, D101
30	3	FIDUCIAL	FIDUCIAL	ADJ_1, ADJ_2, ADJ_3
31	1	FTSH-105-01-F-D-K	Connector 2x5, Samtec	X5
32	1	IFX1117MEV33	Linear Voltage Regulator, Infineon	IC101
33	1	KSZ8031RNL	Ethernet Phy, Micrel	IC200
34	2	LED-GN/D/0603	LED green	LED100, LED101
35	2	LED-RT/D/0603	LED red	LED1, LED2
36	1	S25FL032P0XMFI01	Quad-SPI Flash, Spansion	IC400
37	3	TMPS2-SMD	Push Button	SW1, SW2, SW3
38	1	7499010211A	Ethernet RJ45 Plug, Würth	X200
39	2	XMC4500-F100F1024	Microcontroller Cortex M4F, Infineon	IC1, IC100
40	2	ZX62-AB-5PA	Micro USB Plug	X3, X100
41	1	no ass.	Pin Header 1x4	X101
42	1	no ass./0R	Resistor	R206

Revision history

Document revision	Date	Description of changes
1.0	2012-11-07	Initial version
1.1	2012-11-09	Correction of DAVE™ 3 trademark
1.2	2014-01-13	Notes have been added to Figure 5 (Pins of Pin Header X1/X2 are partly used also for on-board circuits)
1.3	2025-01-23	Template update. Replaced Dave™ with ModusToolbox™.

Trademarks

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

Edition 2025-01-23

Published by

Infineon Technologies AG

81726 Munich, Germany

© 2025 Infineon Technologies AG

All Rights Reserved.

Do you have a question about any aspect of this document?

Email: erratum@infineon.com

Document reference
IFX-cnj1726209616474

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.

Mouser Electronics

Authorized Distributor

Click to View Pricing, Inventory, Delivery & Lifecycle Information:

Infineon:

KIT_XMC45_RELAX_V1 KITXMC45RELAXV1TOBO1