XMC4800 Automation Board-V3

For XMC4000 Family

About this document

Scope and purpose

This document provides a hardware description of the XMC4800 Automation Board-V3 including schematics and list of material. For fast software development you can find the mapping of XMC4800 functions to the on-board components in various tables.

Intended audience

This document is intended for anyone who wants to develop software on the XMC4800 Automation Board-V3 or wants to use this kit for evaluating and demonstrating the capabilities of the XMC4800 microcontroller in combination with other Infineon Technologies products.

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1 Introduction

This document describes the features and hardware details of the XMC4800 Automation Board-V3 equipped with an ARM® Cortex®-M4 based XMC™ Microcontroller from Infineon Technologies AG.

It can be used with a wide range of development tools including Infineon's free of charge Eclipse based IDE DAVE. The XMC4800 Automation Board-V2 is designed to evaluate the capabilities of the XMC4800 Microcontroller especially in EtherCAT slave applications in combination with other products of Infineon Technologies. Table 1 shows its specification.

Table 1 Board specification

Processor	Infineon's ARM® Cortex®-M4 XMC4800 Microcontroller running at 144 MHz in LFBGA196 package (order number XMC4800-E196K2048)
Flash Memory	2048 kB
Data Memory	352 kB intern, extern SDRAM
Dimensions	103 x 86 mm
Clock Crystals	12 MHz and 32.768 kHz crystal for CPU
Power	• Via isolated DC/DC supplied by 24V ISOFACE out supply (Main supply) • Via USB (Micro-AB USB, may exceed USB standard current limits)
Connectors	• EtherCAT Slave IN and OUT interface via RJ45 jack • Ethernet via RJ45 jack • CAN Connector (D-Sub DE-9) • USB Connector (Micro-AB USB) • Serial Wire Debug interface (2x5, 50 mil pitch) to XMC™ • 6 pin (2x3, 50 mil pitch) USIC channel to interface other components like displays • 2x 10 Signal Header for ISOFACE outputs/inputs and 24V supply
Others	• 2x EtherCAT PHYs, 1x Ethernet PHY • ISOFACE™ out () and ISOFACE™ in () • OPTIGA™ Trust E () • CAN transceiver () • 1x SDRAM(Mbit), 1x FRAM (Mbit) • User RGB LED • Reset push-button

1.1 Key features

The XMC4800 Automation Board-V2 has the following key features and components:

- XMC4800 Microcontroller (ARM® Cortex®-M4 based), 144 MHz, 2048 kB Flash, 352 kB SRAM, LFBGA196 package
- EtherCAT slave components: 2 EtherCAT PHYs, Magnetics and 2 RJ45 jacks
- CAN transceiver and CAN connector (D-Sub DE-9)
- 24V ISOFACE™ 8 x IN and 8 x OUT
- USB Interface (Micro-AB USB plug)
- RG general purpose CAN LED, RGB user LED
- Reset Push-Button
- 12 MHz Crystal
- 32.768 kHz RTC Crystal

1.2 Block diagram

The block diagram in Figure 1 shows the main components of the XMC4800 Automation Board-V2 and their interconnections. There are following main building blocks:

- XMC4800 Microcontroller in a LFBGA196 package
- 2 EtherCAT PHY with 2 RJ45 plugs
- 1 Ethernet PHY with RJ45 plug
- 24V ISOFACE™ 8 x IN and 8 x OUT
- RGB LED, CAN RG LED, Reset Push-Button
- Micro-AB USB Plug
- CAN Transceiver with SUB 9 connector

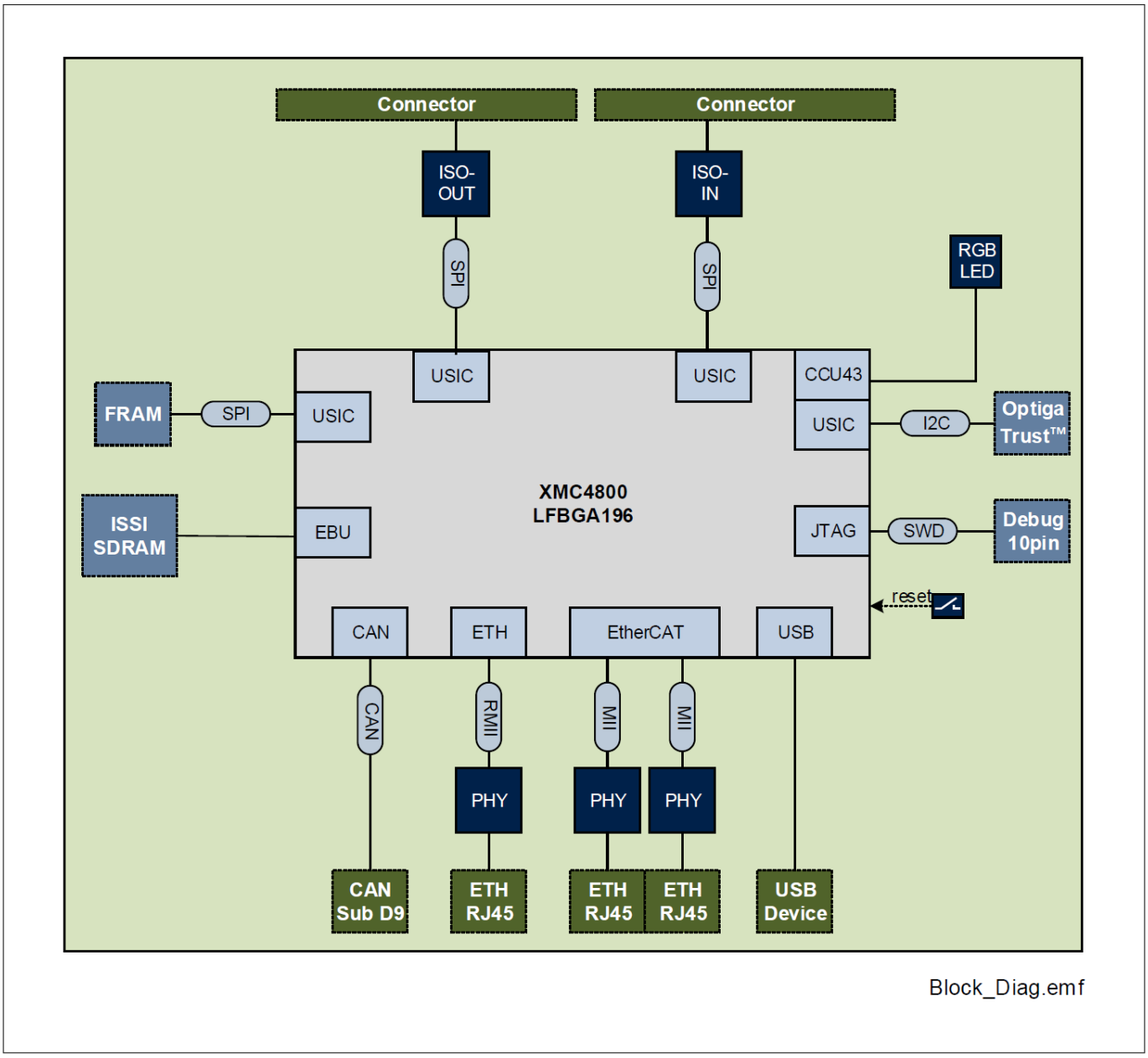

Figure 1 Block diagram of the XMC4800 Automation Board-V3

2 Hardware description

The following chapters provide a detailed description of the hardware and how it can be used. The hardware is depicted in Figure 2.

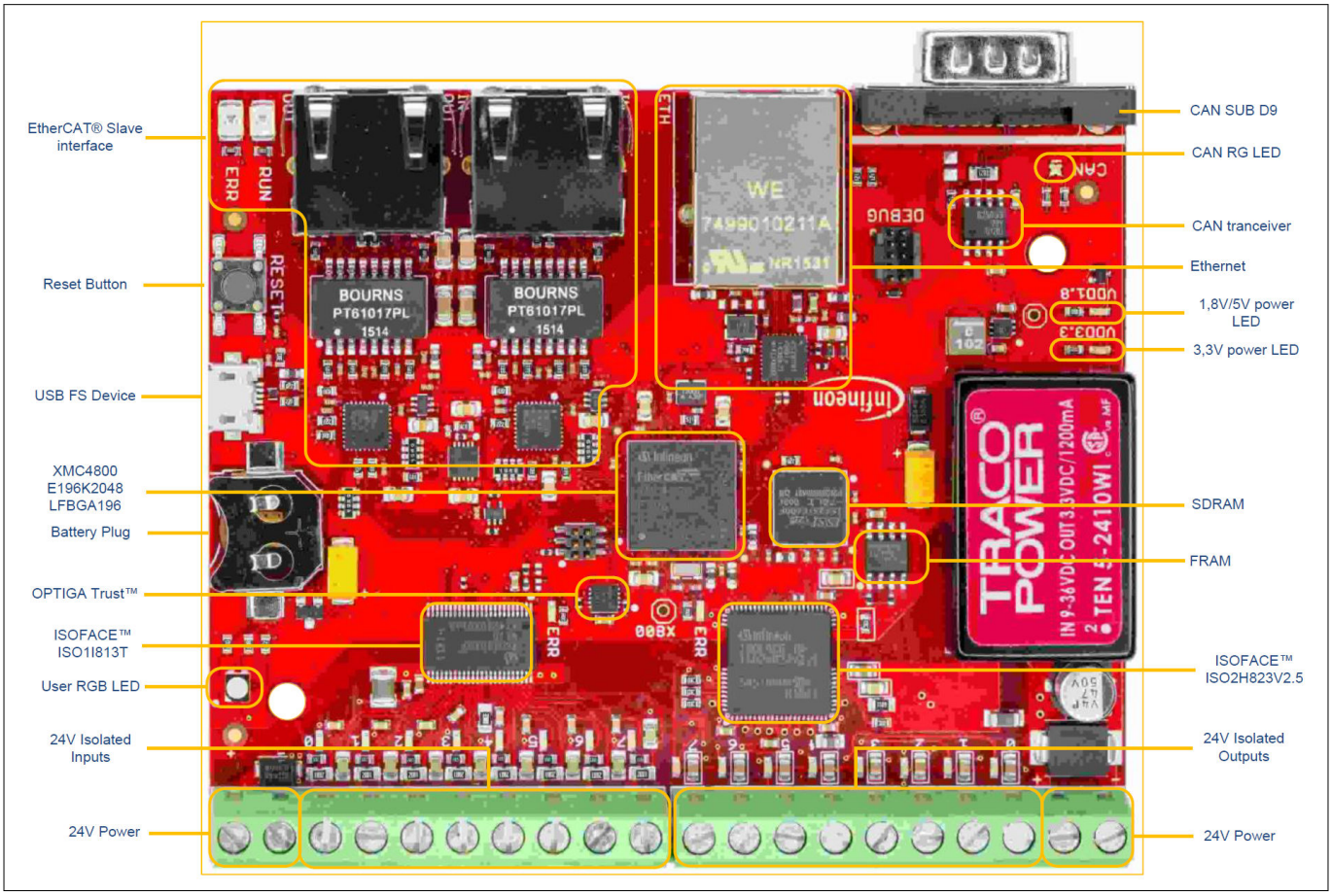

Figure 2 PCB of the Automation Board-V3

2.1 Power supply

The Automation Board-V3 consists out of 3 power islands (Figure 3) which are the 24V DC for the ISOFACE™ OUT (ISO2H823V2.5), 24V for the ISOFACE™ IN (ISO1I813T) and a 3,3V logic supply for the XMC4800 and add on / communication devices. To power up the Board, the ISOFACE™ OUT connector (X600) must be supplied by an external 24 Volt DC power supply. An isolated DC/DC converter will generate the 3,3V. The green Power LED (VDD3.3) indicates the presence of the generated 3.3 V supply voltage.

To use the ISOFACE™ IN 24V must be connected to connector X500. Both ISOFACE™ devices will signalize an error (red error LEDs) when powering up the Board and must be reset in software. In case of a not connected or insufficient supply the error will stay active. For more information please refer to the datasheets of the ISOFACE™ devices.

The two PHY's for the EtherCAT slave connection additionally require a 1,8V supply. This voltage is generated by an adjustable LDO from Infineon Technologies (IFX54441LDV).

For the CAN transceiver 5V is generated by a step-up converter out of the 3,3V. Both, 5V and 3,3V availability are signalize with a second green LED, named VDD1.8V.

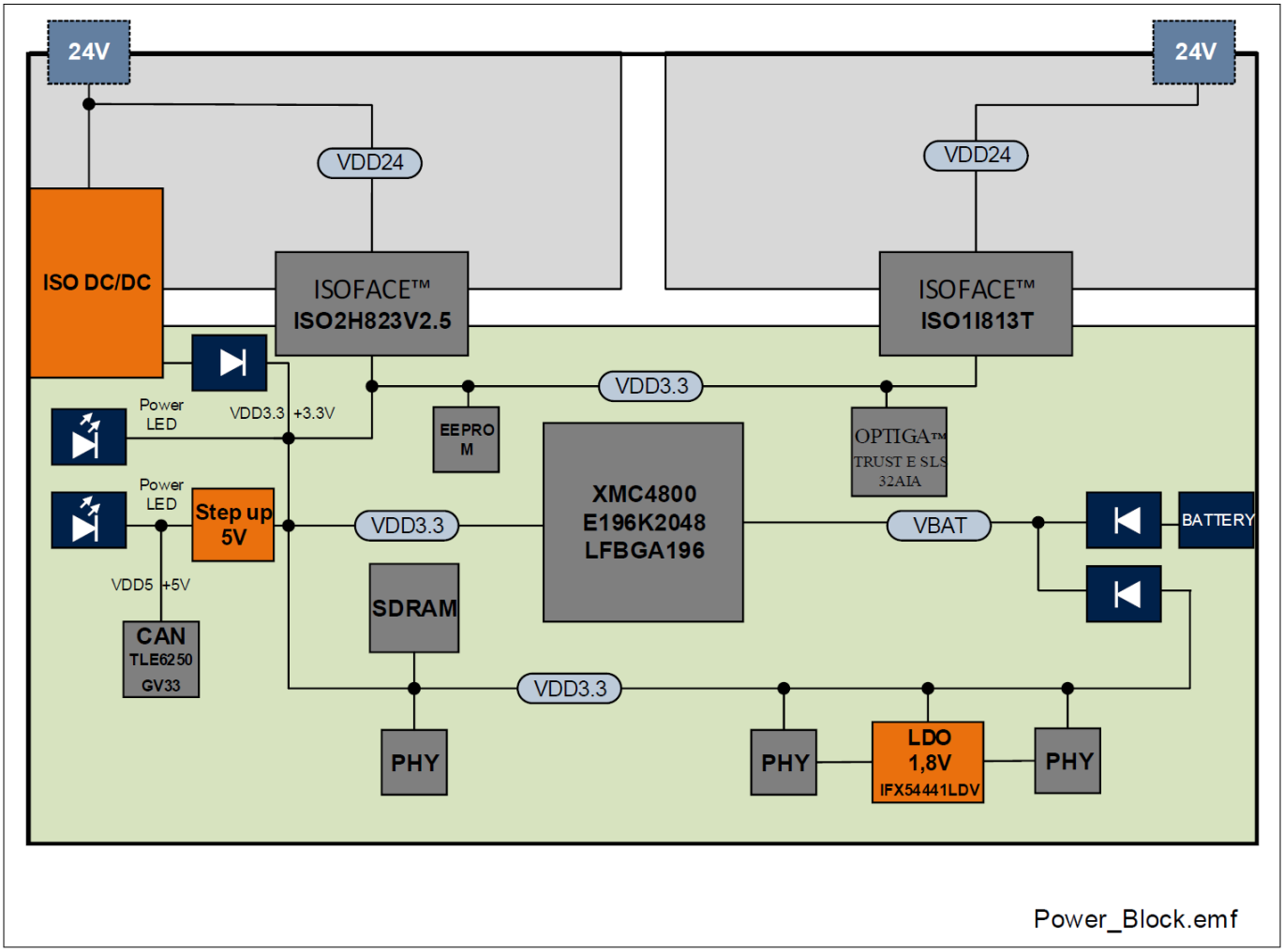

Figure 3 Power supply concept

***Note**: The 5V input form the USB device plug is not connected to the power supply of the Automation Board.*

The hibernate domain is supplied by the standard 3,3V. In addition a backup battery can be added for time keeping.

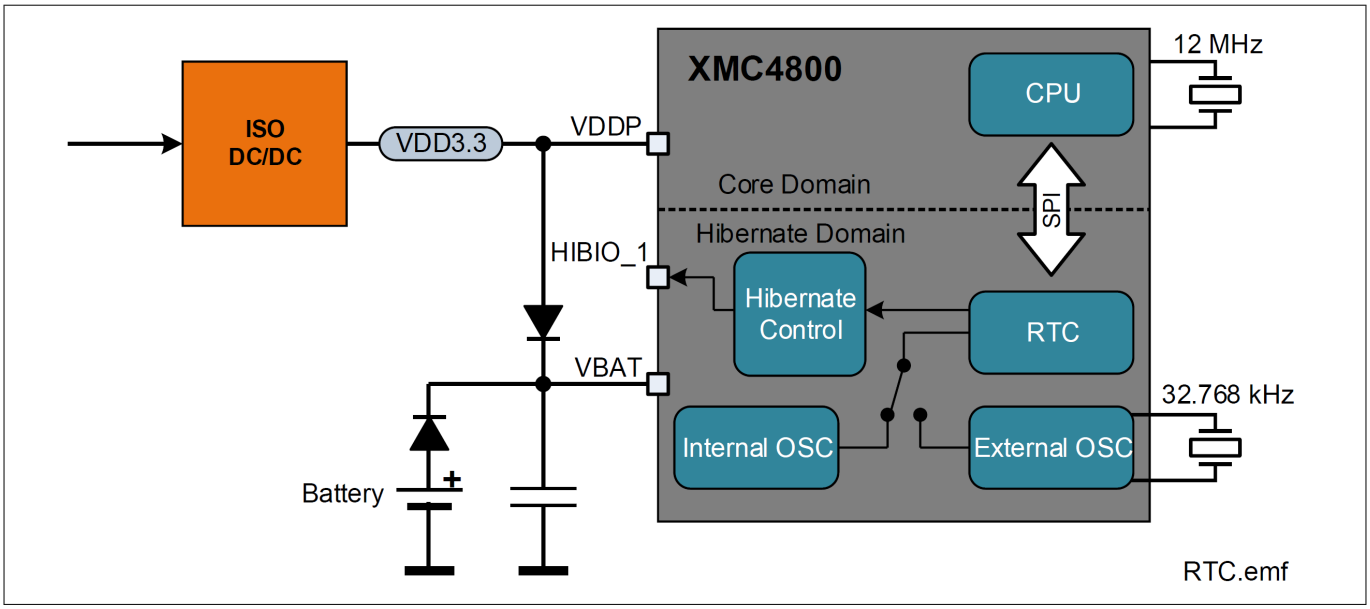

Figure 4 RTC and Battery XMC™ pin functions

***Note**: In Board delivery no battery is included. A standard 1.6 to 2.5 m m thick by 12mm maximum 3,3V lithium coin cell shell be used.*

2.2 EtherCAT® Slave interface

XMC4800 offers the EtherCAT® node integrated on an ARM® Cortex®-M controller. The XMC4800 Automation Board-V3 provides a full EtherCAT® compliant slave node. In combination with the additional components like the ISOFACE™ standard industrial components like 24V I/O's can be realized. For more information and examples please visit www.infineon.com/EtherCAT.

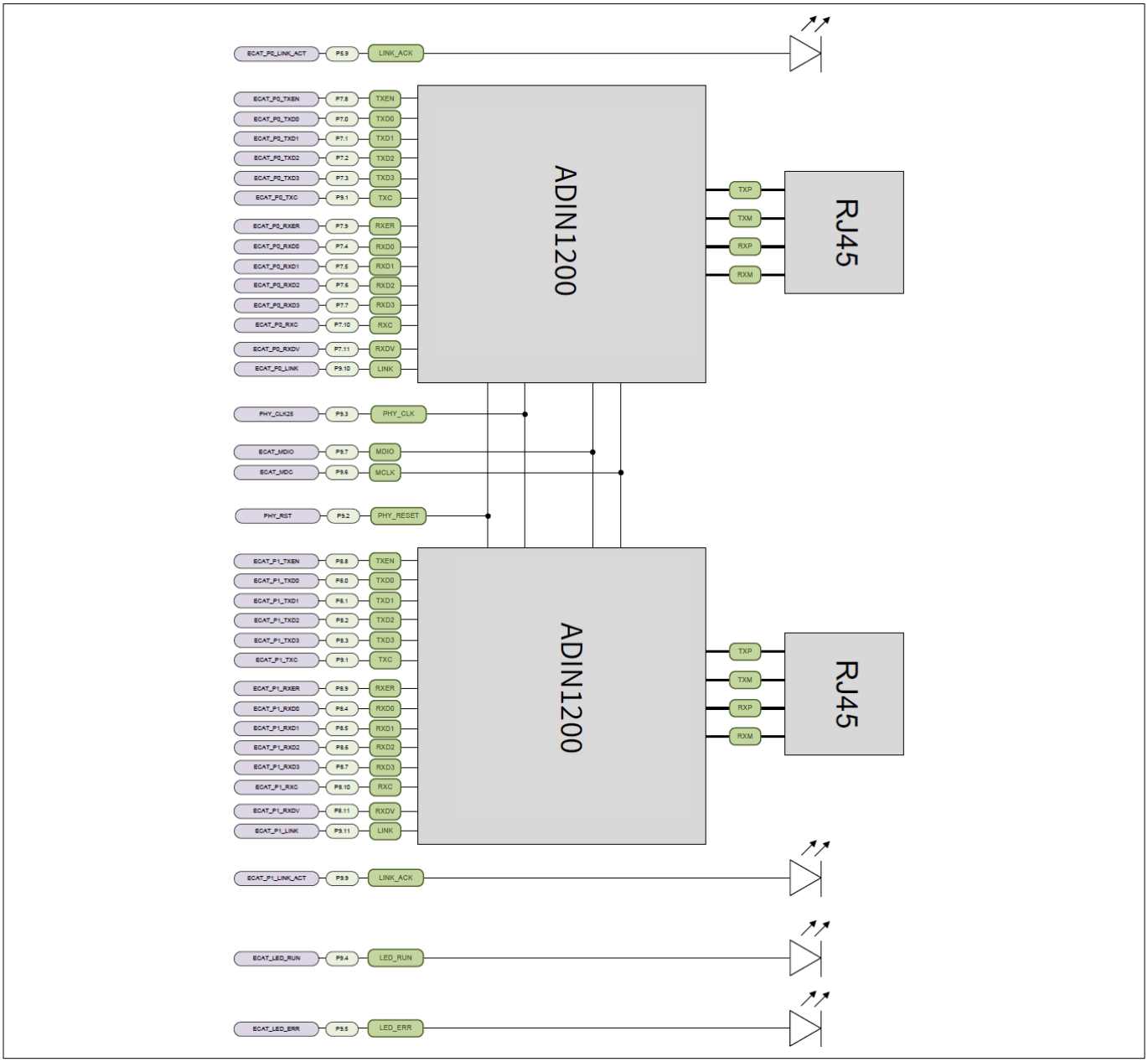

Figure 5 Mapping of EtherCAT PHY function to XMC™ pin functions

2.3 Ethernet interface

The XMC4800 Automation Board-V3 provides a standard Ethernet interface using a Micrel KSZ8081RNB PHY in RMII mode. Per default the PHY is switched on. For power saving options the PHY can be placed into permanent reset by the GPIO P6.0. In addition an Interrupt signal from the PHY is optional available connected to an ERU channel. It should be checked if R303 is soldered.

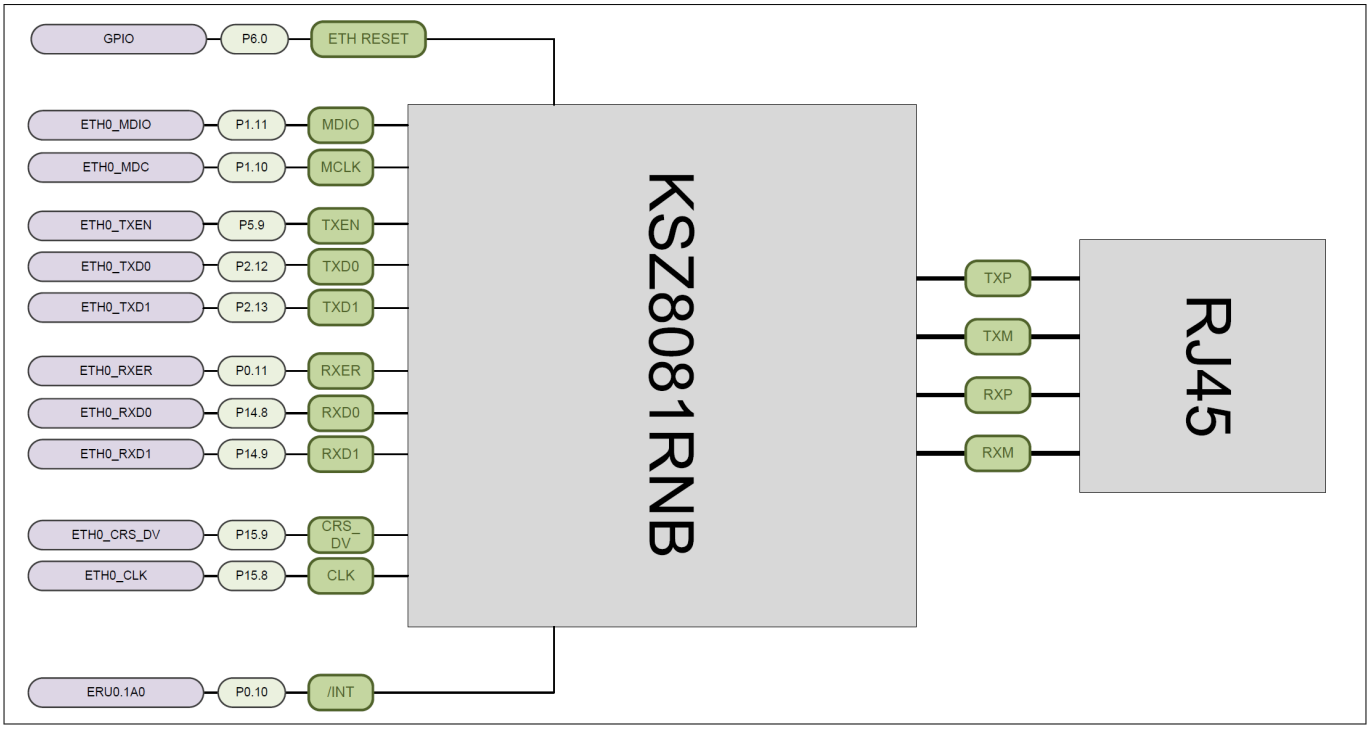

Figure 6 Mapping of Ethernet interface pins to XMC™ pin functions

2.4 CAN interface

The XMC4800 Automation Board-V3 provides a CAN interface via a D-Sub DE-9 connector. Infineon's high speed CAN transceiver IFX1051LE for industrial application supports 3.3V I/O logic and is suitable for 12V and 24V bus systems with an excellent EMC performance. The CAN bus (signals CANH, CANL) are terminated by a 120 Ohm.

Table 2 CAN signals and XMC4800 pin mapping

Signal Name	Pin no. at D-Sub DE-9 (X400)	XMC Pin, XMC Function
CANH	X400.7	-
CANL	X400.2	-
CAN_TX	-	P2.7, CAN.N1_TXD
CAN_RX	-	P2.6, CAN.N1_RXD
CAN_INH		P6.1, GPIO
GND	X400.3, X400.6	-
VDD5	X400.9	-

2.5 ISOFACE™ interfaces

ISOFACE™ is industrial interface ICs with integrated isolation that improve reliability 5-times & cuts product launch time by 50%. To minimize unscheduled down-times, ISOFACE™ sets a new standard in diagnostic capabilities. For detailed information about Infineon ISOFACE™ devices please visit: www.infineon.com/isoface .

2.5.1 ISOFACE™ Out

Infineon Technologies 2nd generation ISOFACE™ 8-channel high-side driver IC ISO2H823V2.5 offers integrated 2.5kV galvanic isolation, thus meets the IEC 61131-2 requirements for reinforced isolation. Concurrently, the ISO2H823V2.5 sets a new standard for system-level diagnostics. Each of the 8 channels is equipped with 5-fold diagnostic monitoring capabilities: Open Load (Active Mode - Driver On and Inactive Mode - Driver Off) , Short-to-Vbb, Overcurrent (Short-to-GND), Overtemperature.

With the ever increasing level of complexity and integration in industrial control systems comprehensive diagnostic monitoring is highly valuable in a vast range of industrial applications, both for preventive maintenance as well as to shorten costly un-scheduled down-times.

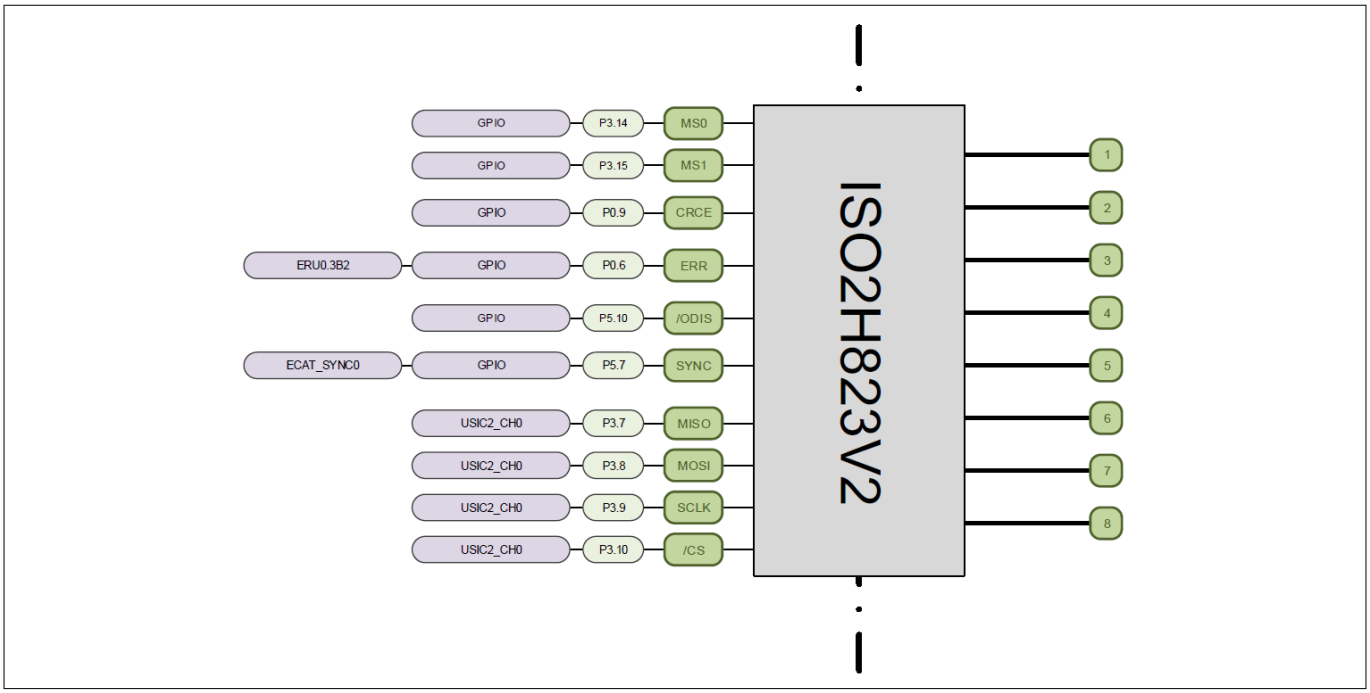

Figure 7 Mapping of ISOFACE™ Out functions to XMC™ pin functions

Using the feature of ISOFACE™ under voltage detection, the system can force storing of retain data or go to save sate in case the main 24V goes below the operation level.

2.5.2 ISOFACE™ In

The ISOFACE™ ISO1I81xT product family (ISO1I811T, ISO1I813T) of galvanically isolated 8-channel digital input ICs sample input data from digital sensors and switches. The digital input ICs can be directly connected to digital inputs like sensors or switches and the micro-controller or bus-ASIC. Robust galvanic isolation is integrated.

Up to 8 inputs according to IEC61131-2 (Type 1/2/3) can be connected per IC. The precise characteristic of the current sink of the IC's inputs reduces the power dissipation per channel by a factor of up to 2.5-times compared to solutions using resistors and opto-couplers. In consequence, more compact designs of input card solutions become possible with ISOFACE™.

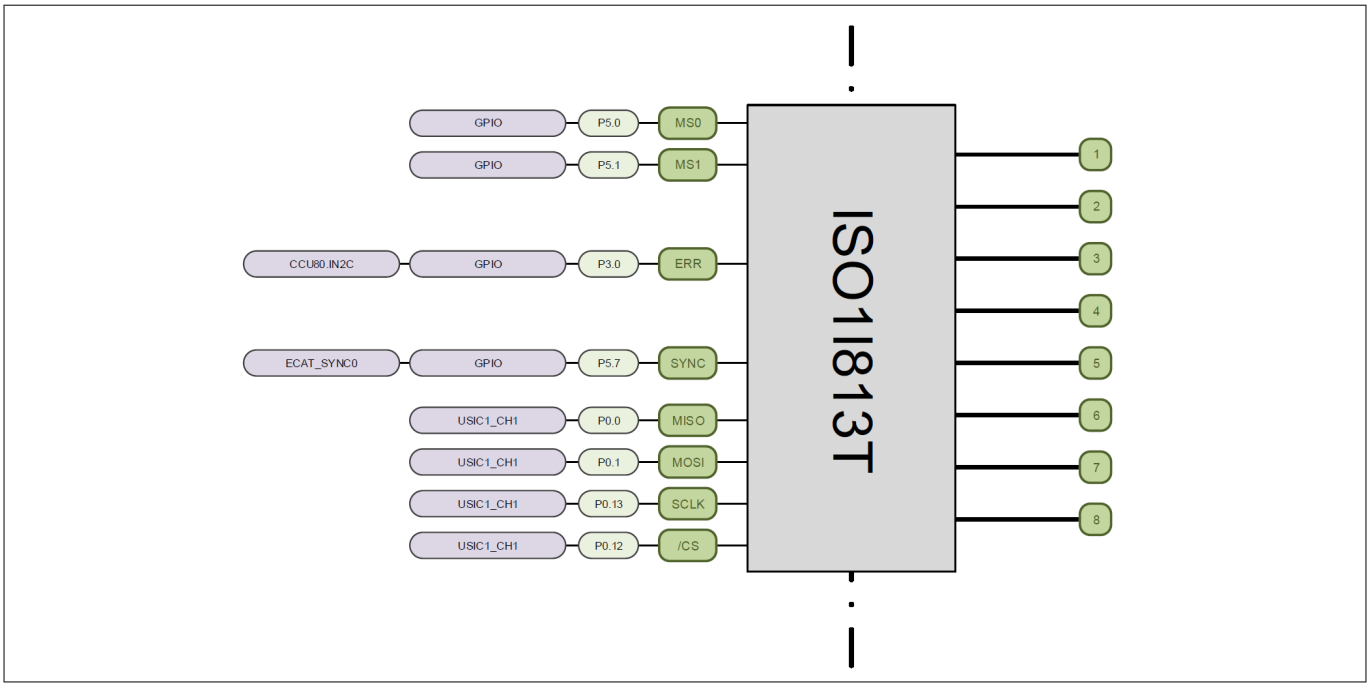

Figure 8 Mapping of ISOFACE™ In functions to XMC™ pin functions

2.6 OPTIGA Trust™ E device

OPTIGA™ Trust E is a high-security solution for industrial automation systems, smart homes, consumer or medical devices, providing enhanced protection of services, business models and user experience. Based on its 1-way authentication mechanism, it uniquely identifies objects and protects PKI networks. For more information visit: www.infineon.com/optiga.

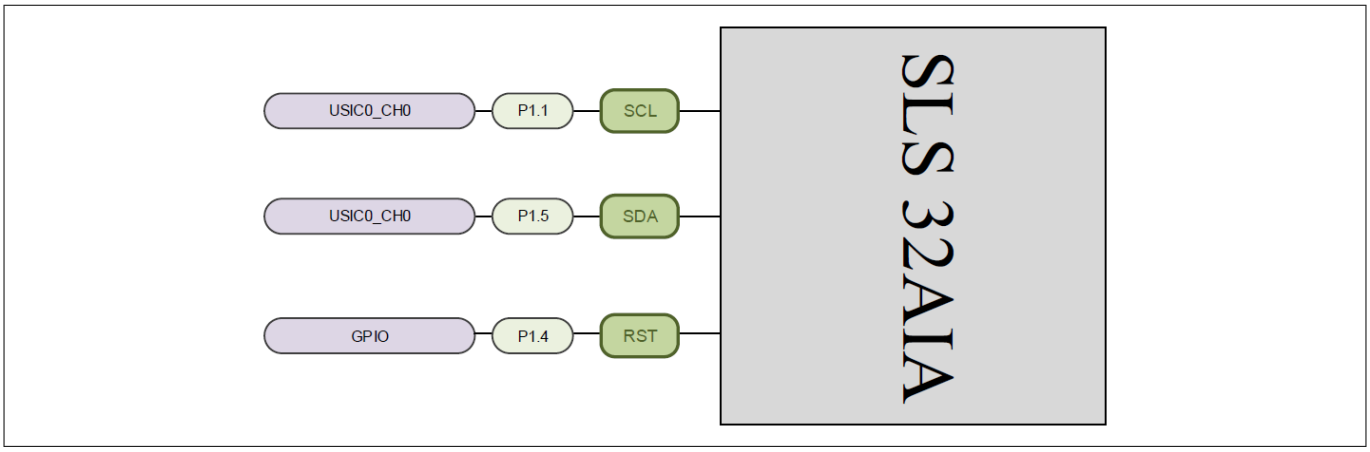

Figure 9 Mapping OPTIGA Trust™ E function to XMC™ pin functions

2.7 External Memory's devices

The XMC4800 Automation Board-V3 supports two kind of external memory. An SDRAM is connected to the board to allow Applications which requires more than the available RAM memory on the XMC to store data or execute code out of this memory. A FRAM is available and intended to be used as retained data storage.

2.7.1 SDRAM

The 64Mb SDRAM is a high speed CMOS, dynamic random-access memory designed to operate in 3,3V memory systems. This memory can be use to store code and date during runtime. Execution of code is possible after loading the code into the memory.

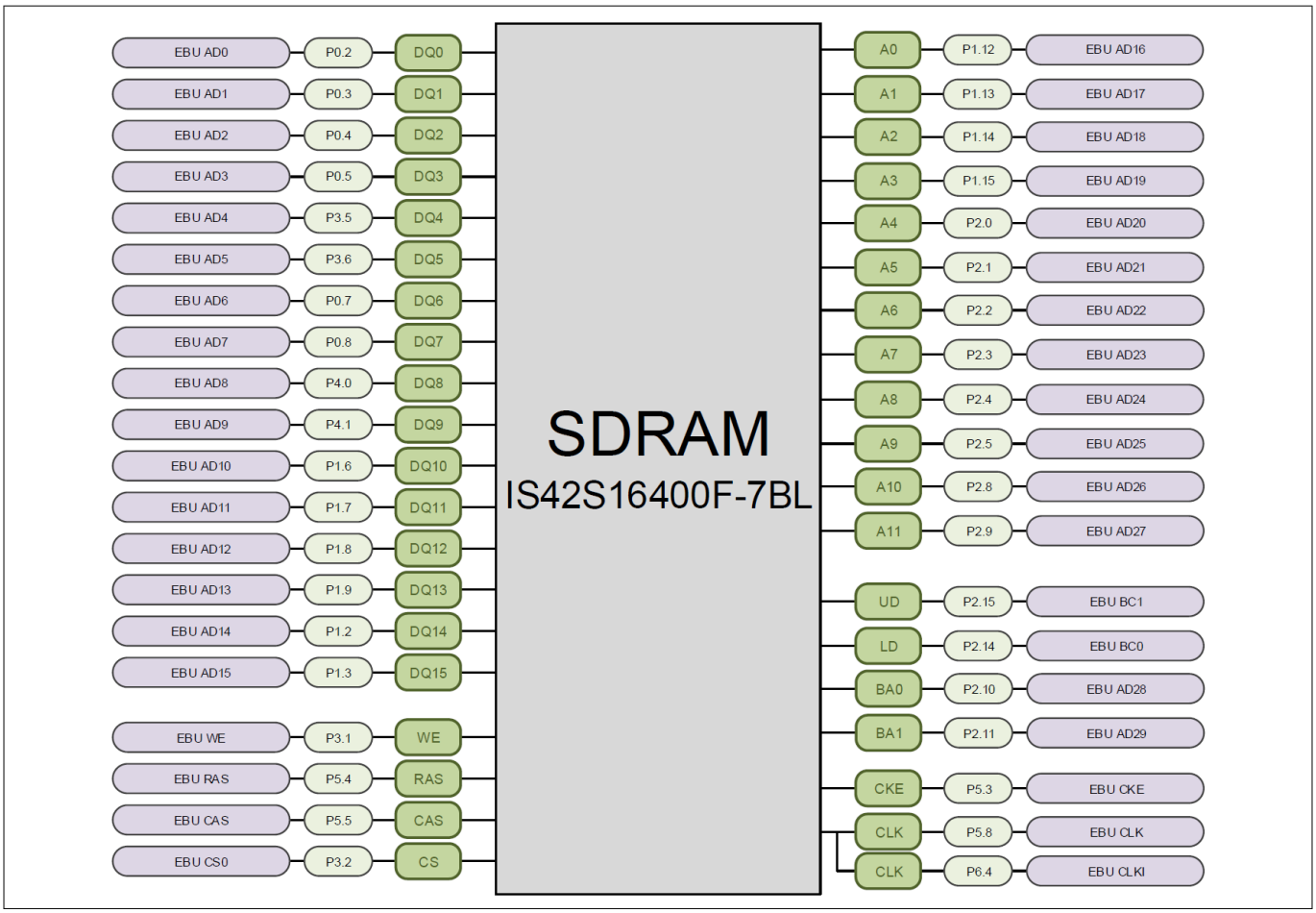

Figure 10 Mapping of SDRAM function to XMC™ pin functions

2.7.2 FRAM

The FM25CL64B is a 64-Kbit nonvolatile memory employing an advanced ferroelectric process. A ferroelectric random access memory or F-RAM is nonvolatile and performs reads and writes similar to a RAM.

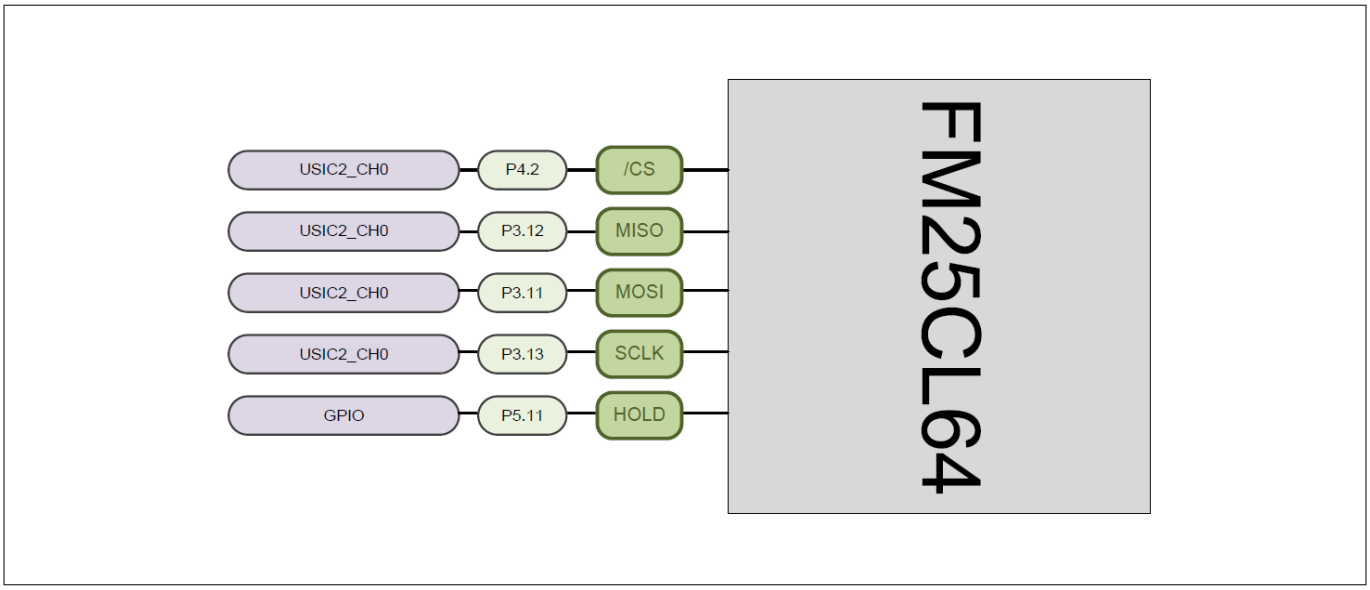

Figure 11 Mapping of FRAM function to XMC™ pin functions

2.8 6 Pin user header

The XMC4800 Automation Board-V3 provides a 6 pin header with a USIC channel to extend the functionality in Application. For example a display could be connected. This USIC channel is shared with the SPI USIC channel of the FRAM. The mapping of GPIOs and XMC™ pin functions to pin header can be found in Table 3. A pull up resistor is connected at the chip select signal at pin 1.

- SPI interface with one chip select
- I2C interface
- UART interface
- +3.3 V Supply

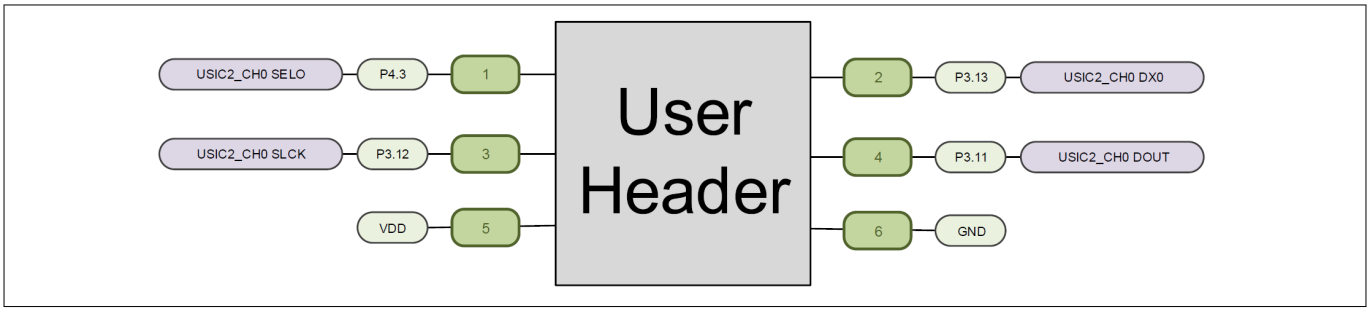

Figure 12 Mapping of User Header functions to XMC™ pin functions

Table 3 Pin Assignment of the Cortex™ Debug Connector (X102)

Pin No.	Signal Name	XMC Pin, XMC Function
1	SPI_EXT_CS2	P4.3
2	FRAM_MISO	P3.12
3	FRAM_SCLK	P3.13
4	FRAM_MOSI	P3.11
5	VDD	+3.3 V

(table continues...)

Table 3 (continued) Pin Assignment of the Cortex™ Debug Connector (X102)

Pin No.	Signal Name	XMC Pin, XMC Function
6	GND	Ground

2.9 User RGB and CAN LEDs

The XMC4800 Automation Board-V2 provides two LEDs. The port pins used can be found in Table 4 and Table 5. These pins are used exclusively for this function and they are not mapped to other devices or connectors.

Table 4 XMC4800 pin mapping for RGB LED

LED	XMC pin
LED red	P4.4
LED green	P4.5
LED blue	P4.6

Table 5 XMC4800 pin mapping for CAN LED

Button	XMC pin
LED red	P6.2
LED green	P6.3

2.10 Debugging

The XMC4800 Automation Board-V3 supports debugging via a 10-pin Cortex™ Debug Connector. To program and debug the chip every standard ARM debugger can be used.

2.10.1 Cortex™ debug connector (10-pin)

The 10-pin Cortex™ debug connector supports Serial Wire Debug (SWD) and Serial Wire Viewer (SWV). The pin assignment of the Cortex™ debug connector is shown in Table 6.

Table 6 Pin Assignment of the Cortex™ Debug Connector (X102)

Pin No.	Signal Name	Description
1	VCC	+3.3 V
2	TMS	Serial Wire Data I/O
3	GND	Ground
4	TCK	Serial Wire Clock
5	GND	Ground
6	SWV	Serial Wire Viewer (Trace Data Out)
7	Key	Key
8	NC	Not connected
9	GND_Detect	Ground detect
10	RESET	Rest (active low)

2.11 Reset

The reset pin (PORST#) of the XMC4800 is a bi-directional pin in open drain mode. An internal pull-up resistor keeps the PORST# pin high during normal operation. A low level at this pin will force a hardware reset. In case of a MCU internal reset the PORST# pin will drive a low signal.

A reset signal can be issued by

- the on-board Reset Button (SW102, “RESET”)
- the external debugger connected to the 10-pin Cortex™ Debug probe connector (X102)

An XMC™ internal circuit always ensures a save Power-on-Reset. XMC™ does not require any additional external components to generate a reset signal during power-up.

Pin 9.2 is connected to a buffer which resets both EtherCAT PHY’s by default if XMC4800 gets reseted. It’s required that both PHY’s do not establish a active Link before the ECAT module is up an running.

3 Production data

This chapter covers schematics, board dimensions, component placement and the list of material.

3.1 Schematics

Figure 13 shows the schematics of XMC4800 Automation Board hardware version 2.1.

3 Production data

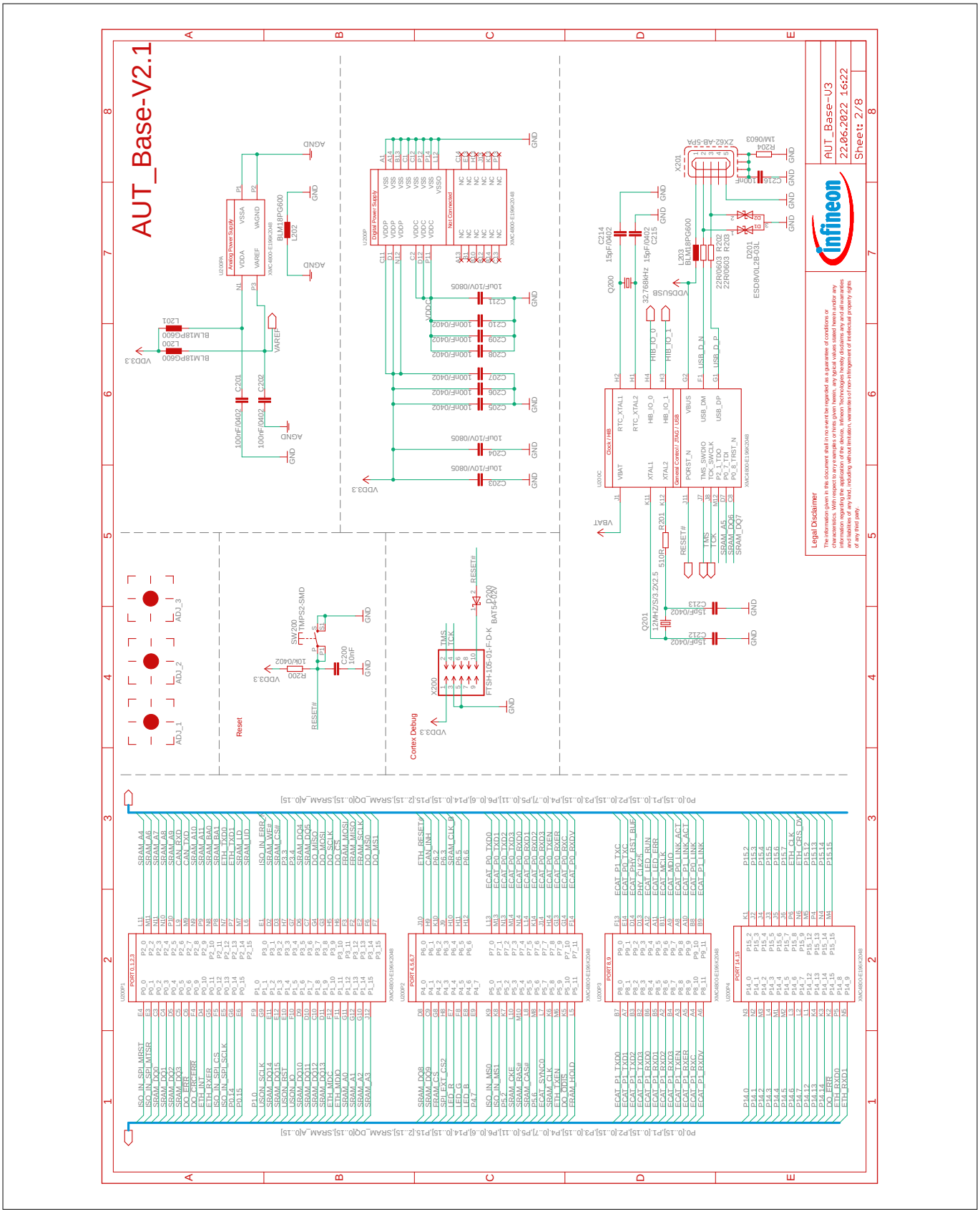

Figure 13 Schematic of the XMC4800 Automation Board-V3

3 Production data

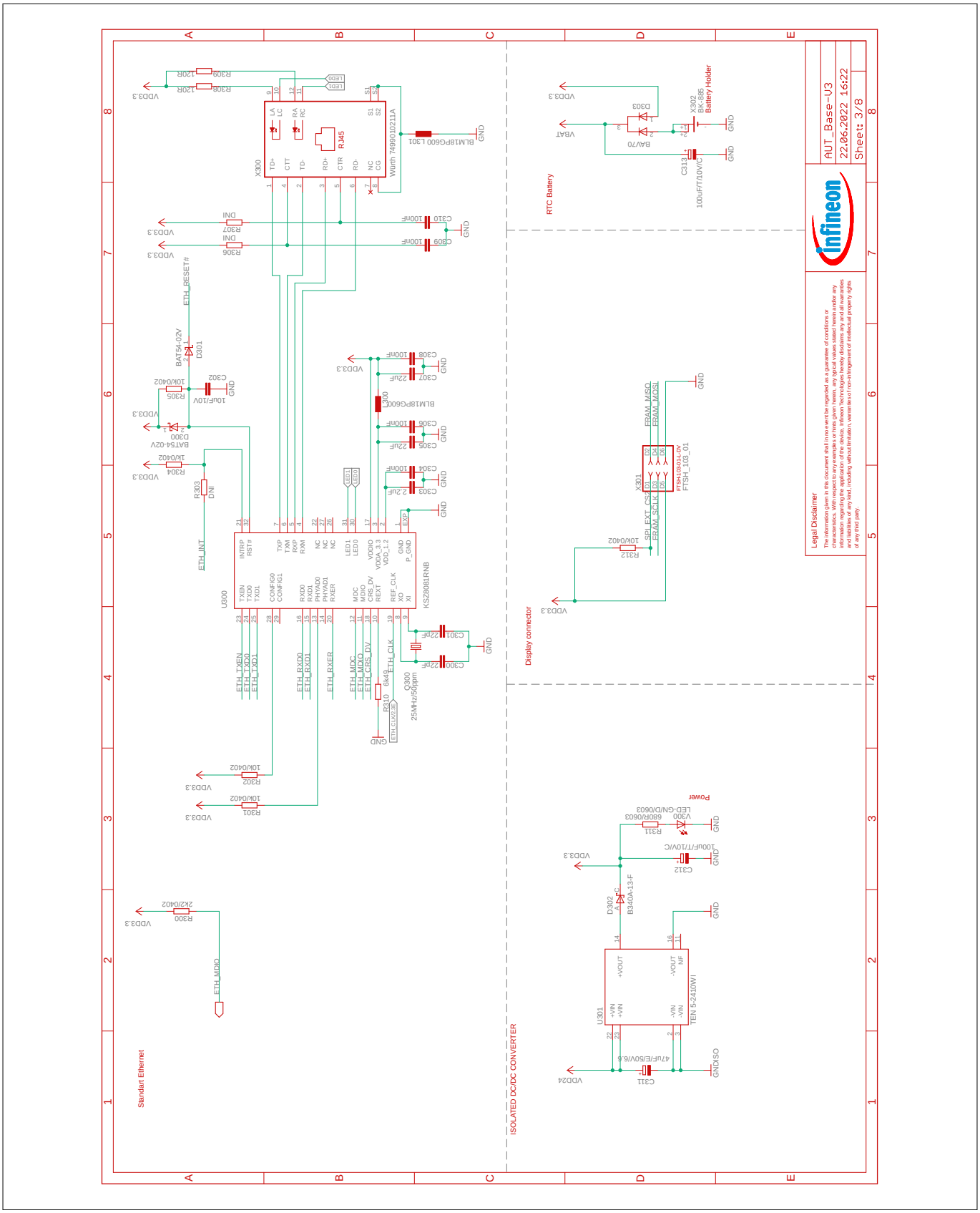

Figure 14 Schematic of the XMC4800 Automation Board-V3

3 Production data

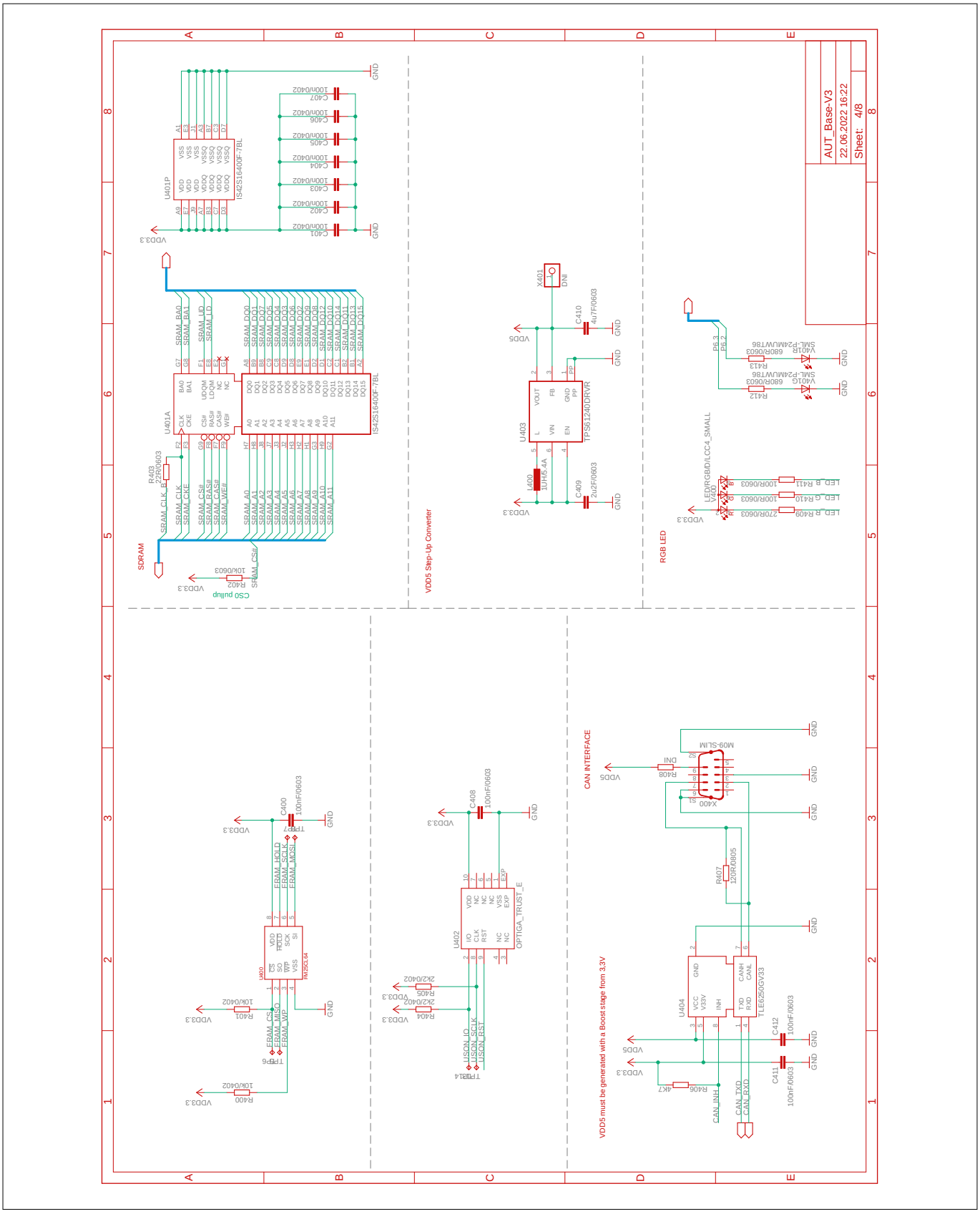

Figure 15 Schematic of the XMC4800 Automation Board-V3

3 Production data

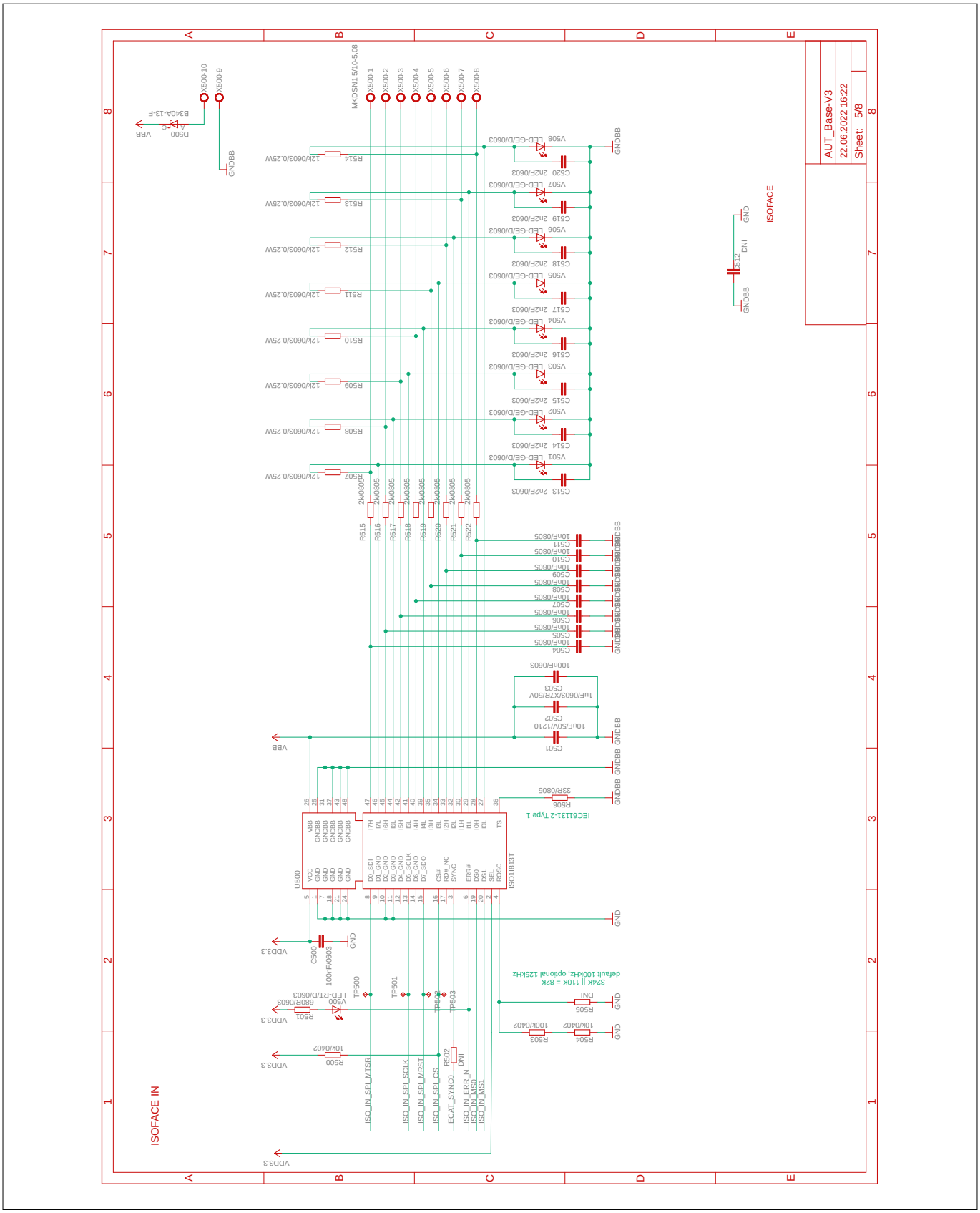

Figure 16 Schematic of the XMC4800 Automation Board-V3

3 Production data

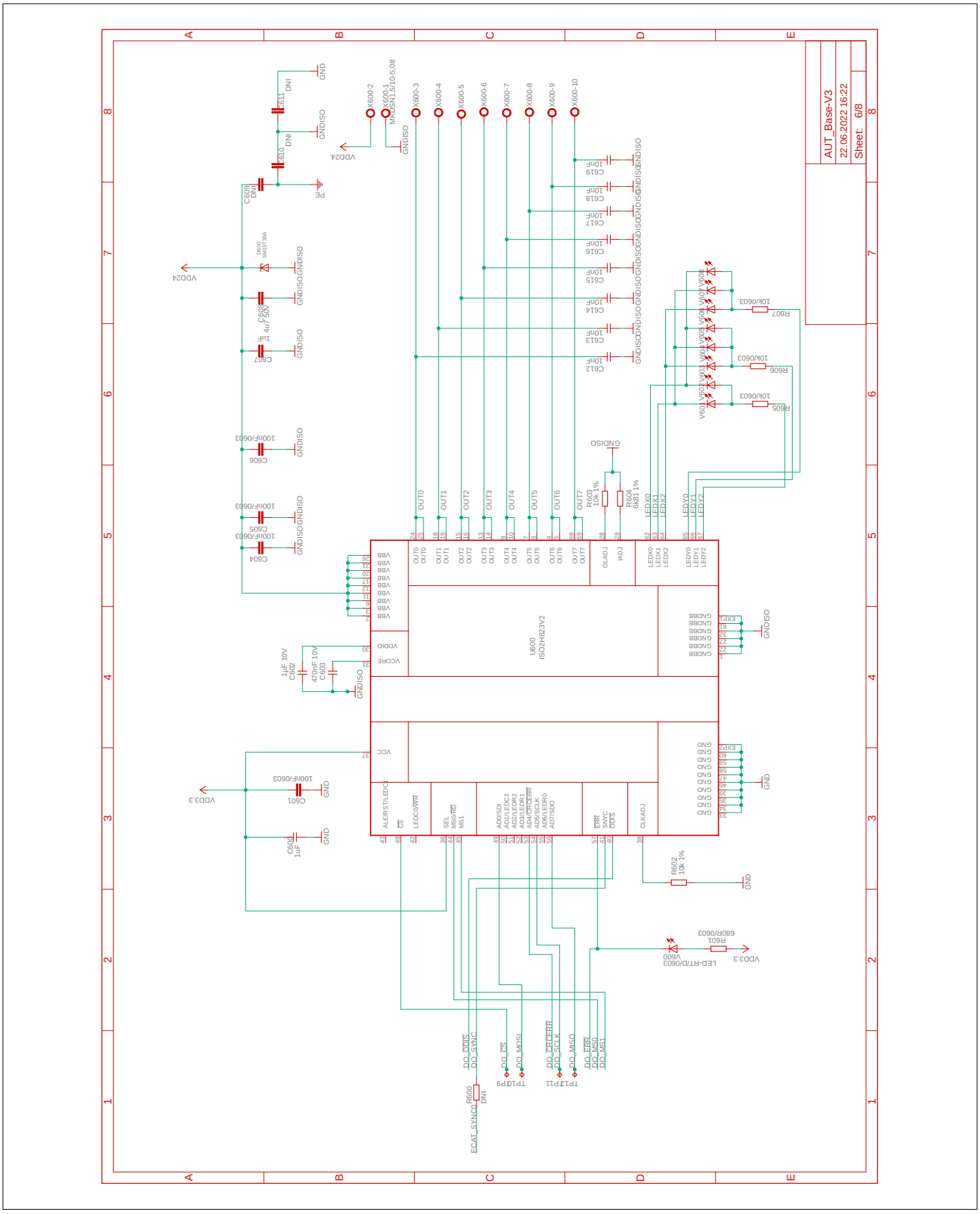

Figure 17 Schematic of the XMC4800 Automation Board-V3

3 Production data

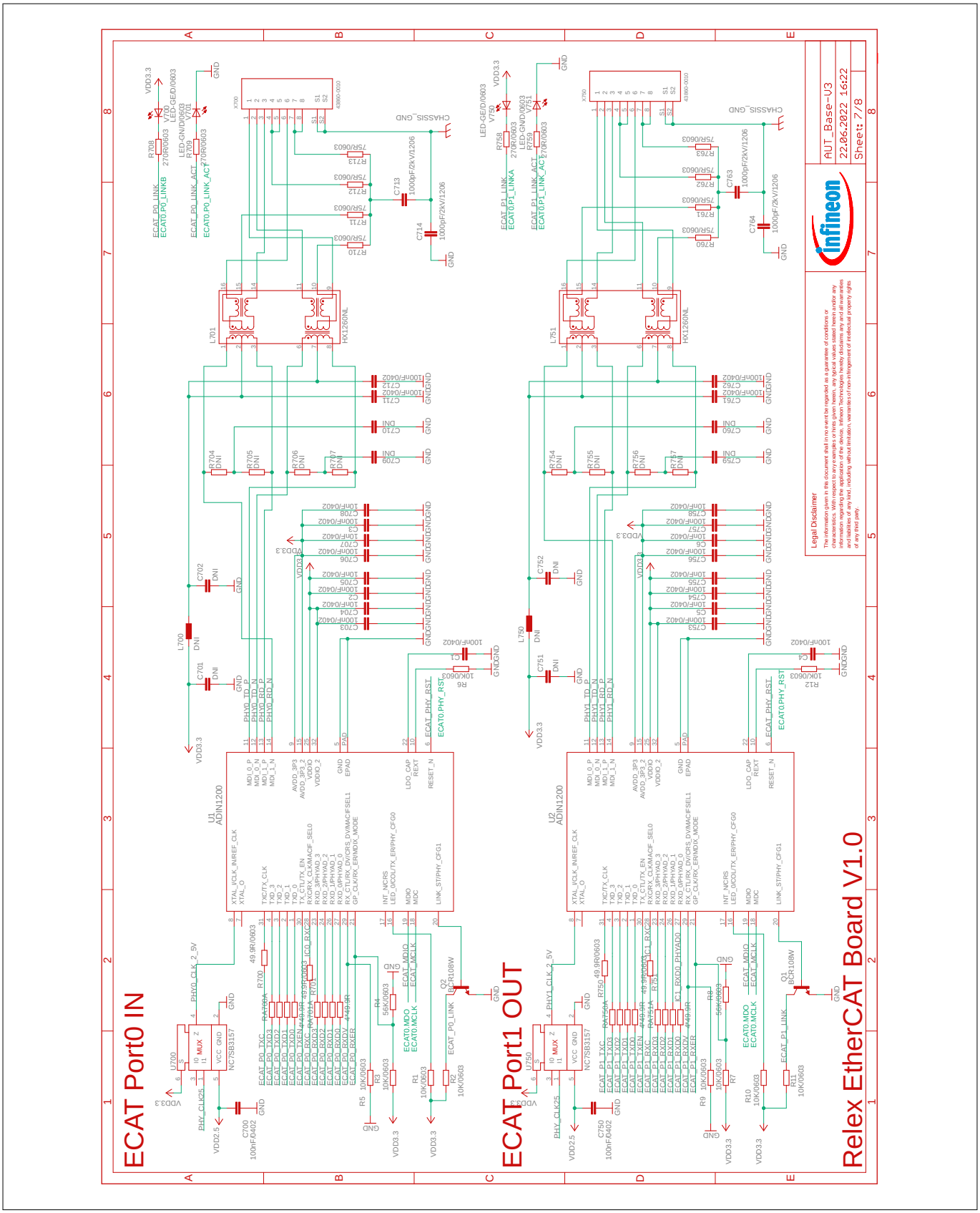

Figure 18 Schematic of the XMC4800 Automation Board-V3

3 Production data

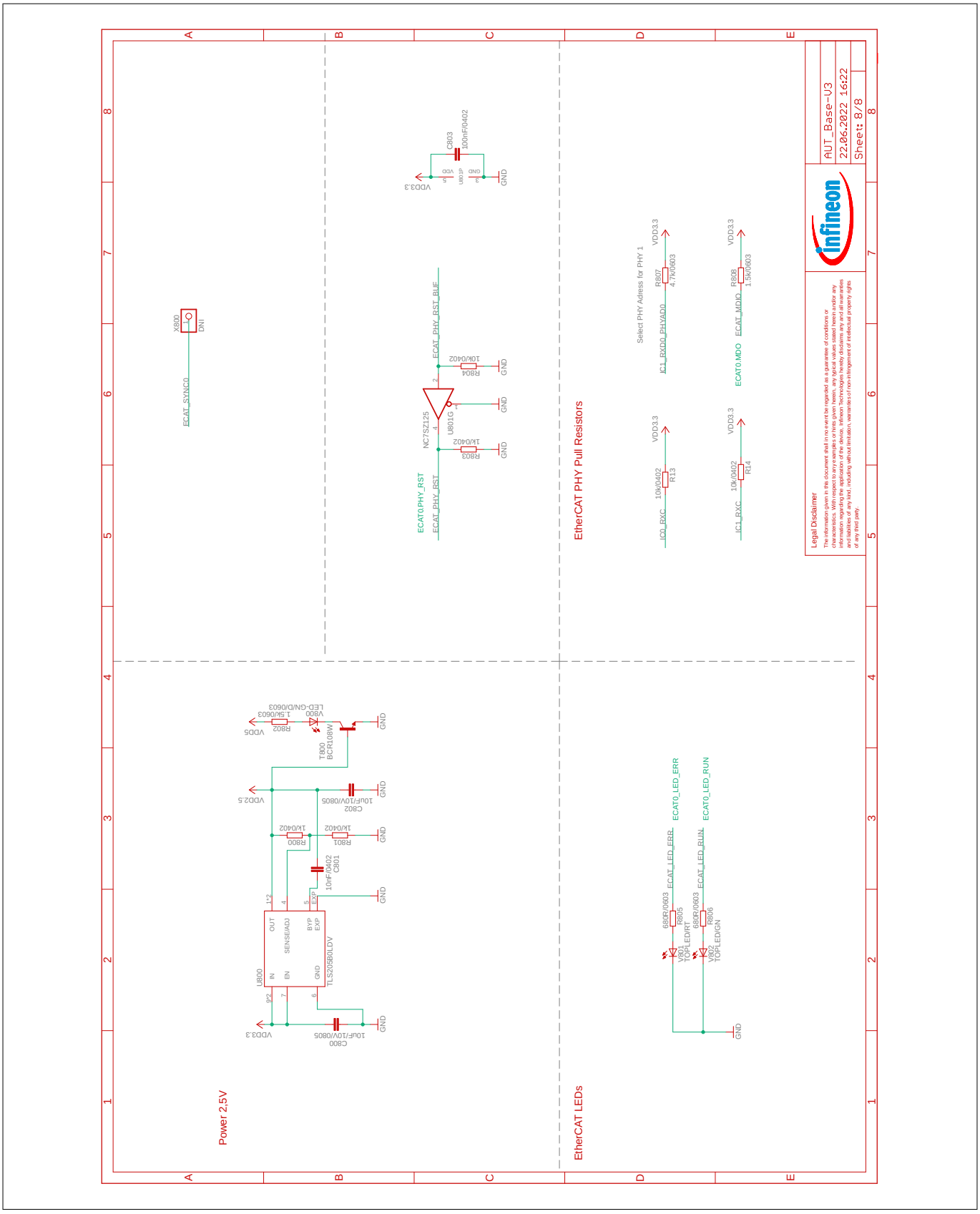

Figure 19 Schematic of the XMC4800 Automation Board-V3

3.2 Components placement and geometry

Figure 20 shows the board dimensions and the placement of components on the PCB.

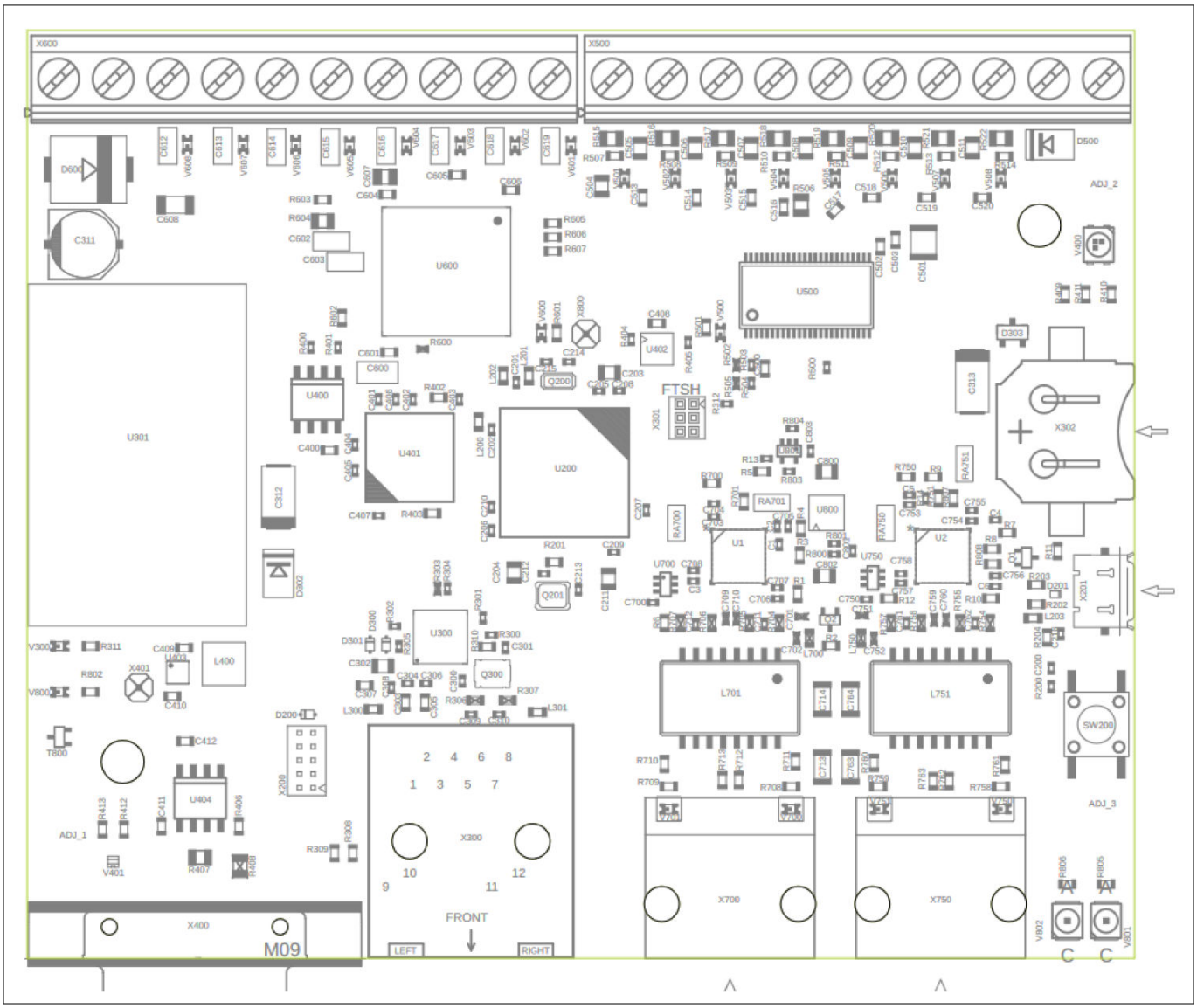

Figure 20 Components placement and geometry

3.3 List of material

The list of material is valid for the Automation Board-V3 hardware.

Table 7 List of material

Value	Device	Qty	Reference designator
NC7SZ125	NC7SZ125	1	SC70-5L
NC7SB3157	NC7SZ157	2	SC70-6L
ESD8V0L2B-03L	ESD8V0L2B-03L	1	TSLP-3-1
ISO1I813T	ISO1I811T	1	TSSOP48
ISO2H823V2	ISO2H823V2	1	PG-VQFN-70-1
FM25CL64	FM25CL64	1	SOIC8
IS42S16400F-7BL	MT48LC4M16A2B4-7E	1	VFBGA54-6X9_8MMX8MM
XMC4800-E196K2048	XMC4800-E196K2048	1	BGA196C80P14X14_1200X1200 X17 0
KSZ8081RNB	KSZ8081RNB	1	QFN32
ADIN1200	ADIN1200	2	CP_32_31
TLE6250GV33	TLE6250GV33	1	SO08
OPTIGA_TRUST_E	OPTIGA_TRUST_E	1	PG-USON-10-2
TOPLED/RT	LEDP-LCC-2	1	P-LCC-2
TOPLED/GN	LEDP-LCC-2	1	P-LCC-2
LED-GE/D/0603	LEDCHIPLED_0603	18	CHIPLED_0603
LED-RT/D/0603	LEDCHIPLED_0603	2	CHIPLED_0603
LED-GN/D/0603	LEDCHIPLED_0603	4	CHIPLED_0603
LED/RGB/D/LCC4_SMALL	LED/RGB/D/LCC4_SMALL	1	P-LCC-4-3_SMALL
SML-P24MUWT86	SML-P24	1	CHIP-LED0404
BCR108W	BCR108W	2	SOT323R_INFINEON
BCR108W	BCR108W	1	SOT323R_INFINEON
BK-885	BK-885	1	BK-885
TEN 5-2410WI	TEN_5WI	1	TEN_5WI
TPS61240DRVR	TPS61240DRVR	1	S-PWSON-N6
TLS205B0LDV	TLS205B0LDV	1	PG-TSON-10
25MHz/50ppm	NX3225_2	1	32X25_4PAD
12MHZ/S/3.2X2.5	NX3225_22PAD	1	32X25_2PAD
4*49.9R	RS_ARR4_0,8	4	R_ARRAY4_0,8
33R/0805	R-EU_R0805	1	R0805
2k/0805	R-EU_R0805	8	R0805
120R/0805	R-EU_R0805	1	R0805

(table continues...)

Table 7 (continued) List of material

Value	Device	Qty	Reference designator
6k81 1%	R-EU_R0805	1	R0805
1.5k/0603	R-EU_R0603	2	R0603
10k 1%	R-EU_R0603	2	R0603
10k/0603	R-EU_R0603	3	R0603
22R/0603	R-EU_R0603	3	R0603
56K/0603	R-EU_R0603	2	R0603
100R/0603	R-EU_R0603	2	R0603
4K7	R-EU_R0603	1	R0603
4.7k/0603	R-EU_R0603	1	R0603
1M/0603	R-EU_R0603	1	R0603
120R	R-EU_R0603	2	R0603
49.9R/0603	R-EU_R0603	4	R0603
680R/0603	R-EU_R0603	7	R0603
270R/0603	R-EU_R0603	5	R0603
510R	R-EU_R0603	1	R0603
6k49	R-EU_R0603	1	R0603
75R/0603	R-EU_R0603	8	R0603
1k/0402	R-EU_R0402	2	R0402
10K/0603	R-EU_R0603	11	R0603
10k/0402	R-EU_R0402	12	R0402
100k/0402	R-EU_R0402	1	R0402
2k2/0402	R-EU_R0402	3	R0402
12k/0603/0.25W	R-EU_R0603	8	R0603
32.768kHz	FC135-32.768KHZ	1	FC-135
1000pF/2kV/1206	C-EUC1206K	4	C1206K
1uF	C_GR0805	1	GR0805
1µF 16V	C_0805	1	0805
1uF	C-EUC0805	1	C0805
100uF/T/10V/C	CPOL-EUSMCC	2	SMC_C
47uF/E/50V/6.6	CPOL-EUD	1	PANASONIC_D
10nF/0805	C-EUC0805K	8	C0805K
470nF 10V	C_0805	1	0805
10uF/10V/0805	C-EUC0805K	5	C0805K

(table continues...)

Table 7 (continued) List of material

Value	Device	Qty	Reference designator
10uF/10V	C-EUC0805K	1	C0805K
100nF/0603	C-EUC0603	10	C0603
2n2F/0603	C-EUC0603	8	C0603
10uF/50V/1210	C-EUC1210K	1	C1210K
1uF/0603/X7R/50V	C-EUC0603	1	C0603
22uF	C-EUC0603	2	C0603
4u7 50V	C-EUC1206	1	C1206
10nF	C_0805	8	0805
10nF	C-EUC0402	1	C0402
10nF/0402	C-EUC0402	9	C0402
100nF/0402	C-EUC0402	25	C0402
100nF	C-EUC0402	6	C0402
100n/0402	C-EUC0402	7	C0402
15pF/0402	C-EUC0402	4	C0402
22pF	C-EUC0402	2	C0402
2.2uF	C-EUC0603	1	C0603
2u2F/0603	C-EUC0603	1	C0603
4u7F/0603	C-EUC0603	1	C0603
BLM18PG600	L_EU_L0603	6	L1608
1UH/5.4A	XFL4020-152ME	1	XFL4020
HX1260NL	HX1260NL	2	HX1260NL
SM15T39A	SM6T1,5KW	1	SMC
B340A-13-F	B340A-13-F	2	DO214AC
BAV70	BAV70	1	SOT23-3
BAT54-02V	BAT54-02V	3	SC79
TMPS2-SMD	FSM2JSMA	1	FSM2JSMA
M09-SLIM	M09-SLIM	1	M09G-SLIM
MKDSN1,5/10-5,08	MKDSN1,5/10-5,08	2	MKDSN1,5/10-5,08
FTSH-105-01-F-D-K	FTSH-105-01-F-D-K	1	FTSH-105-01-F-D-K
FTSH_103_01	FTSH_103_01	1	FTSH_103_01
ZX62-AB-5PA	ZX62-AB-5PA_MICRO-USB	1	ZX62-AB-5PA_MICRO-USB
43860-0010	43860-0016	2	43860-0016
Würth 7499010211A	J0011D01B	1	J0-A/B/F

(table continues...)

Table 7 (continued) List of material

Value	Device	Qty	Reference designator
FIDUCIAL	FIDUCIAL	3	FIDUCIAL
DNI	C-EUC1812	4	C1812
DNI	C-EUC0402	8	C0402
DNI	L_EU_L0603	2	L1608
DNI	R-EU_R0402	3	R0402
DNI	R-EU_R0603	2	R0603
DNI	R-EU_R0805	1	R0805
DNI	R-EU_R0402	1	R0402
DNI	R-EU_R0603	8	R0603
TPB1,27	TPB1,27	14	B1,27
DNI	PINHD-1X1	2	1X01
	Platine AUT_Base_V3 chem. Ni/Au rot	1	
	11.08.1021.0 AUT_Base_V3 bestücken	1	

Revision history

Document revision	Date	Description of changes
1.1	2023-09-23	The XMC™ EtherCAT® Phys have been redesigned due to replacement of the BCM5241XA1KMLG PHY through the ADIN1200 PHY. The redesigned PCB has got a new marking: XMC™ EtherCAT PHY Board-V3
1.2	2025-02-19	Template update; no content update

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