
PIC32CXMTG-EK User's Guide

Introduction

The PIC32CXMTG-EK (EV11K09A) is an evaluation kit for the PIC32CXMTG Series from Microchip Technology Inc. This is a system-on-chip solution for residential smart meter applications built around a single-core Arm® Cortex®-M4F processor. The application core runs at a maximum frequency of 200 MHz.

The PIC32CXMTG-EK is an evaluation kit to help Microchip customers evaluate the PIC32CXMTG series and its different features, such as its high processing power combined with a high memory footprint, which is required, for instance, in any wired and/or wireless connected products. Advanced embedded security and low-power are among the other features available in the series that the customer can evaluate with this kit.

This user's guide introduces the PIC32CXMTG-EK Evaluation Kit and how to get started with the board.

Contents

The Evaluation Kit includes the following:

- One PIC32CXMTG-EK board
- One Micro A/B-type USB cable

Features

The PIC32CXMTG-EK board includes the following features:

- On-Board Debugger: J-Link OB:
 - UART debug
 - SWD mode
- Jumper for ERASE signal
- Two mikroBUS sockets:
 - Socket for SPI, PWM, UART and analog input in accordance with [mikroBUS standard](#)
- One Xplained PRO EXT connector for extension boards, like [ATREB233-XPRO](#), [ATREB215-XPRO](#), [ATOLED1-XPRO](#) and [PL460-EK](#)
- User Interface:
 - Five mechanical user buttons
 - One green and one blue user LED
- Power supplies:
 - USB or DC-Jack
 - 3V coin cell battery holder
 - Power-on red LED
 - Jumpers on relevant power supply rails to allow current consumption measurements
- Memory:
 - 64-Mbit Quad IO SPI Flash
- Peripherals:
 - Most GPIO/Peripheral IOs not used for the mikroBUS and Xplained PRO Extension are made available in an I/O expander connector

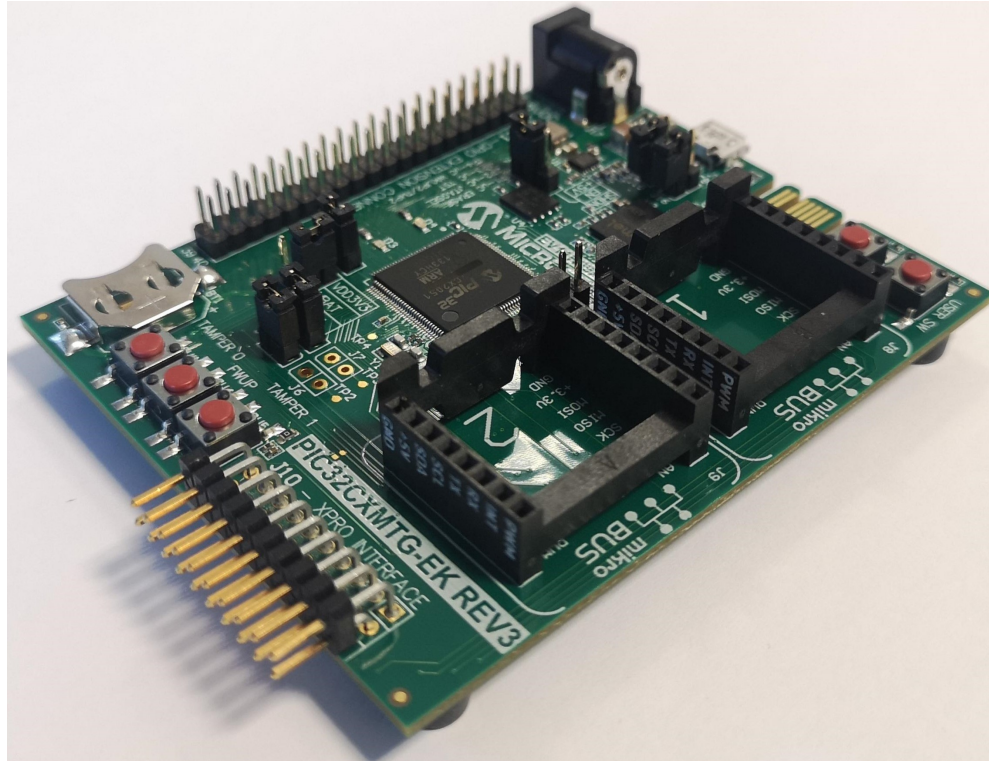


Table of Contents

Introduction.....	1
Contents.....	1
Features.....	1
1. Evaluation Kit Specifications.....	4
1.1. Safety Recommendations.....	4
1.2. Electrical and Board Characteristics.....	4
2. Getting Started.....	5
2.1. Code and Technical Support.....	5
3. PIC32CXMTG-EK Board.....	6
3.1. Overview.....	6
3.2. Block Diagram.....	7
3.3. Interface Connection.....	7
3.4. Hardware Description – System.....	12
3.5. Hardware Description – Interface and QSPI Memory.....	17
3.6. Hardware Description – Expansion Connectors.....	18
3.7. Hardware Description – J-Link Debugger.....	22
4. Ordering Information.....	24
5. Appendix. Schematics and Layouts.....	25
5.1. PIC32CXMTG-EK Schematics.....	25
5.2. PIC32CXMTG-EK Layout.....	32
6. References.....	35
7. Revision History.....	36
7.1. Rev E - 09/2022.....	36
7.2. Rev D - 04/2022.....	36
7.3. Rev C - 11/2021.....	36
7.4. Rev B - 08/2021.....	36
7.5. Rev A - 11/2020.....	36
Microchip Information.....	37
The Microchip Website.....	37
Product Change Notification Service.....	37
Customer Support.....	37
Microchip Devices Code Protection Feature.....	37
Legal Notice.....	37
Trademarks.....	38
Quality Management System.....	39
Worldwide Sales and Service.....	40

1. Evaluation Kit Specifications

1.1 Safety Recommendations

This evaluation board is intended for engineering, development, demonstration or evaluation purposes only. It is not a finished product, unless otherwise noted on the board/kit. It must only be used by expert technicians. The PIC32CXMTG-EK board is powered from an external DC or a USB Micro AB power supply, so the risk of electric shock is minimized.

For any hardware components and/or jumper configuration changes, it is required to switch off the board and disconnect it from the electrical network.

The board must not be subjected to high electrostatic potentials.

This board can be used with lithium coin batteries, which are highly contaminating products. Used batteries must always be recycled or safely treated and disposed.



Important: Microchip does not assume any responsibility for the consequences arising from any improper use of this board.

1.2 Electrical and Board Characteristics

This section contains information about the PIC32CXMTG-EK power supply requirements. The board can be powered from the DC Jack connector or from the USB Micro AB connector. For more details about the power supply system, refer to [3.4.4. Power Supply System](#).

Table 1-1. Power Supply Requirements

Electrical Parameter	Power Source	Value
Input Voltage	DC Jack Connector, J17	5V
Input Voltage	USB Micro AB connector, J14	5V

Table 1-2. Board Characteristics

Characteristic	Specification
Temperature	Operating: 0°C to +70°C Storage: -40°C to +85°C
Relative Humidity	0 to 85% (non-condensing)
Board Dimensions	87 mm × 72 mm × 14.35 mm
Power Supply	External DC or USB Micro AB power supply
RoHS Status	RoHS 3 Compliant
China RoHS Status	EFUP50
REACH Status	REACH Compliant

2. Getting Started

2.1 Code and Technical Support

Firmware developers can run the given example code and also implement their own applications based on the provided firmware stacks.

Note that the latest software code, documentation and support materials are available on www.microchip.com.

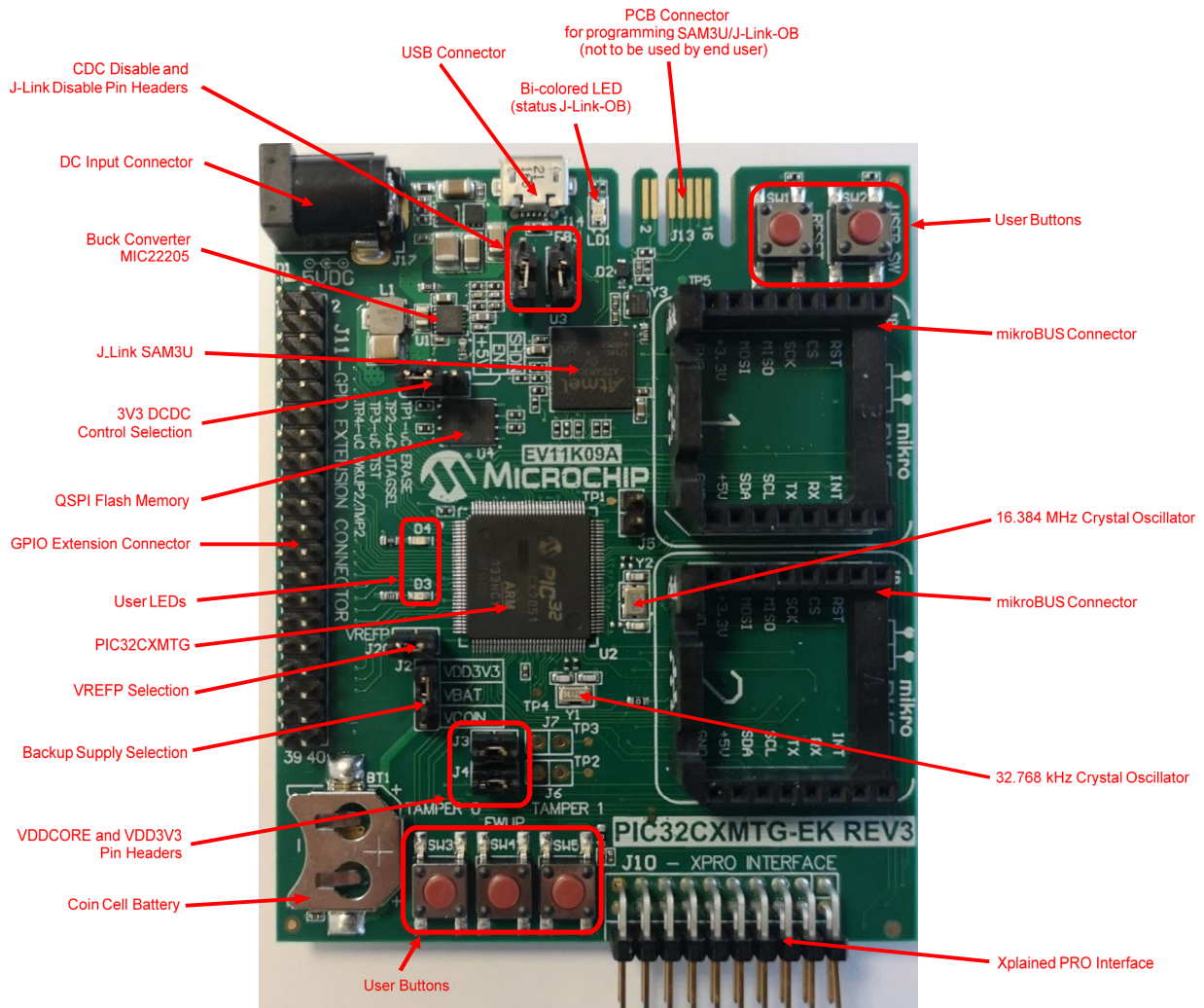
For any technical support requests, visit <http://support.microchip.com>.

3. PIC32CXMTG-EK Board

3.1 Overview

This section summarizes the PIC32CXMTG-EK board design. It provides a high-level description of the board, such as power supply, MCU, memory, peripherals and interface board. This document is not intended to provide detailed documentation about the processor or any other component used. It is expected that the user will refer to the appropriate documents of those devices to access detailed information.

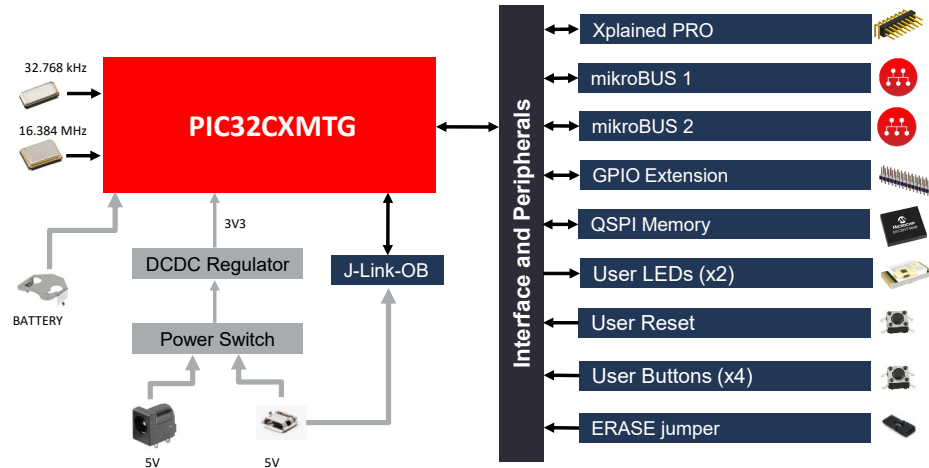
Figure 3-1. PIC32CXMTG-EK Board Description



3.2 Block Diagram

The following figure shows the block diagram of the PIC32CXMTG-EK board.

Figure 3-2. PIC32CXMTG-EK Block Diagram

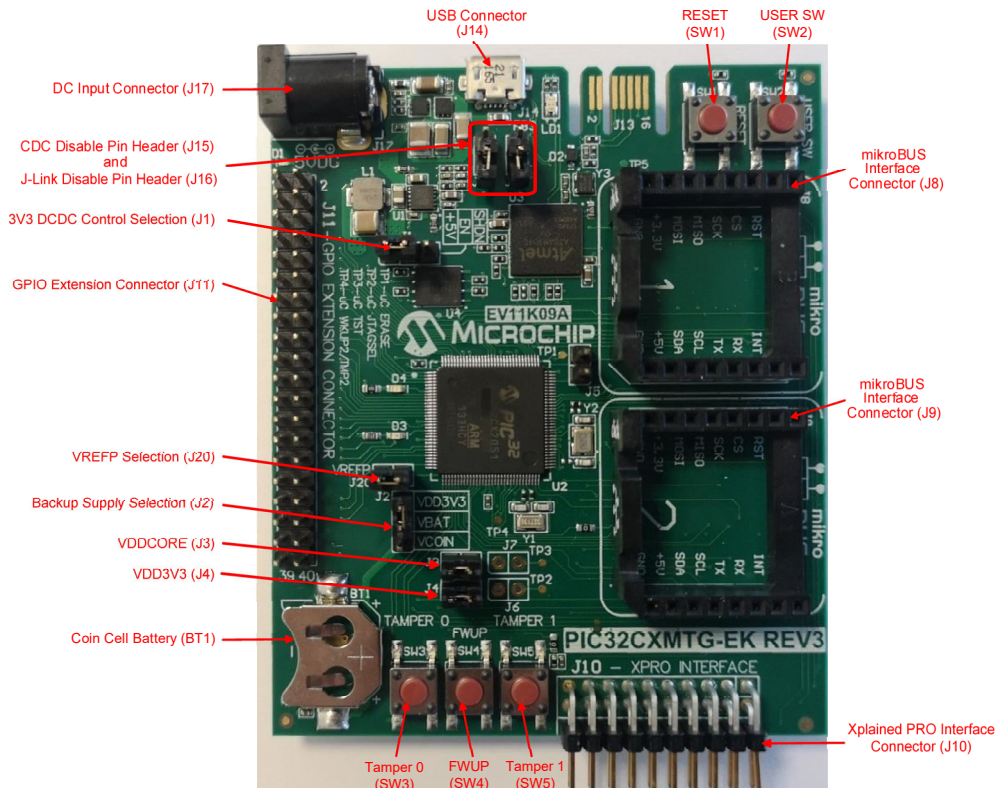


3.3 Interface Connection

The PIC32CXMTG-EK board includes hardware interfaces such as jumpers, connectors and buttons.

The following figure shows an overview of the connectors, jumpers and buttons of the PIC32CXMTG-EK board.

Figure 3-3. PIC32CXMTG-EK Connectors, Button and Jumpers Overview



3.3.1 Connectors

The PIC32CXMTG-EK board includes the following connectors:

1. mikroBUS add-on Board Connectors, J8 and J9.

Table 3-1. mikroBUS Connectors, J8 and J9

Pin	Mnemonic	Description
1	AN	Analog Input
2	RST	Reset Input
3	CS	SPI Chip Select
4	SCK	SPI Clock
5	MISO	SPI Host Input Client Output
6	MOSI	SPI Host Output Client Input
7	+3.3V	VDD: 3.3V power
8	GND	Reference Ground
9	GND	Reference Ground
10	+5V	VDD: 5V power
11	SDA	I ² C Data
12	SCL	I ² C Clock
13	TX	UART Transmit
14	RX	UART Receive
15	INT	Hardware Interrupt Output
16	PWM	Pulse-Width Modulation Input

2. Xplained PRO Connector, J10.

Table 3-2. Xplained PRO Connector, J10

Pin	Mnemonic	Description
1	ID	Not Connected
2	GND	Reference Ground
3	ADC+	Analog to digital converter, alternatively positive part of differential ADC
4	ADC-	Analog to digital converter, alternatively negative part of differential ADC
5	GPIO1	General purpose I/O
6	GPIO2	General purpose I/O
7	PWM+	Pulse width modulation, alternatively positive part of differential PWM
8	PWM-	Pulse width modulation, alternatively negative part of differential PWM
9	IRQ/GPIO	Interrupt request line and/or general purpose I/O
10	SS/GPIO	Chip Select for SPI and/or general purpose I/O
11	TWD	I ² C Data
12	TWCK	I ² C Clock
13	RXD	UART Receiver

.....continued

Pin	Mnemonic	Description
14	TXD	UART Transmitter
15	SS	SPI Chip Select
16	MOSI	SPI Host Output Client Input
17	MISO	SPI Host Input Client Output
18	SCK	SPI Clock
19	GND	Reference Ground
20	VDD	3.3V power for extension board

3. GPIO Extension Connector, J11.

Table 3-3. GPIO Extension Connector, J11

Pin	Mnemonic	Description
1	GND	Reference Ground
2	5V_MAIN	5V power for extension board
3	GND	Reference Ground
4	5V_MAIN	5V power for extension board
5	PB18	General purpose I/O
6	PB19	General purpose I/O
7	PB20	General purpose I/O
8	PB21	General purpose I/O
9	PB22	General purpose I/O
10	PB23	General purpose I/O
11	PC4	General purpose I/O
12	PC5	General purpose I/O
13	PC6	General purpose I/O
14	PC20	General purpose I/O
15	PC21	General purpose I/O
16	PC22	General purpose I/O
17	PD0	General purpose I/O
18	PD4	General purpose I/O
19	PD5	General purpose I/O
20	PD6	General purpose I/O
21	PD7	General purpose I/O
22	PD8	General purpose I/O
23	PD9	General purpose I/O
24	PD10	General purpose I/O
25	PD11	General purpose I/O

.....continued		
Pin	Mnemonic	Description
26	PD14	General purpose I/O
27	PC16	General purpose I/O
28	PC17	General purpose I/O
29	PC18	General purpose I/O
30	PC19	General purpose I/O
31	PA20	General purpose I/O
32	PA15	General purpose I/O
33	PA14	General purpose I/O
34	PA10	General purpose I/O
35	PA11	General purpose I/O
36	PA6	General purpose I/O
37	GND	Reference Ground
38	3V3	3.3V power for extension board
39	GND	Reference Ground
40	3V3	3.3V power for extension board

4. Micro-B Female USB Connector, J14.

Table 3-4. USB Device Connector, J14

Pin	Signal Name	Description
0	EARTH	Shield
1	VUSB	5V power
2	D-	Data Minus
3	D+	Data Plus
4	ID	Not Connected
5	GND	Isolated Reference

5. DC Input Connector, J17.

Table 3-5. DC Input Connector, J17

Pin	Signal Name	Description
1	DC_IN	DC Input voltage (+5V)
2	GND	Ground
3	—	—

3.3.2 Jumper Configurations

The following table describes the functionality of the jumpers.

Table 3-6. Jumper Configuration

Jumper	Label	Default Setting	Function
J1	J1	1-2	3V3 DCDC Enable Control Selection (1-2: Always On, 2-3: under SHDN signal control)
J2	J2	2-3	VBAT backup supply voltage selection (1-2: Coin Cell, 2-3: VDD3V3)
J3	VDDCORE	Closed	VDDCORE current measurement
J4	VDD3V3	Closed	VDD3V3 current measurement
J5	ERASE	Open	PIC32CXMTG Erase pin
J6	JTAGSEL	Open	JTAGSEL pin configuration
J7	TST	Open	TST pin configuration
J15	DIS_CDC	Open	Disable UART communication (CDC) between microcontroller and J-Link-OB. - Opened = Enable UART communication - Closed = Disable UART communication
J16	DIS_JLINK	Open	Disable J-Link on-board interface. - Opened = Enable J-Link on-board interface - Closed = Disable J-Link on-board interface
J20	VREFP Selection	Closed	VREFP selection between internal or external voltage reference. - Opened = Internal voltage reference¹ - Closed = External voltage reference

Note:

1.



If the ADC is configured (via SW) to use the internal voltage regulator as a positive reference (VREFP), the jumper must be removed to avoid a short circuit.

3.3.3 Test Points

Several Test Points are available to provide test measurement capabilities to some of the nets in the board. A list of accessible Test Points is described below:

Table 3-7. Test Point Pads

Reference	Function
TP1	PIC32CXMTG ERASE
TP2	JTAGSEL
TP3	TST
TP4	WKUP2/TMP2

3.4 Hardware Description – System

3.4.1 PIC32CXMTG

The Microchip PIC32CXMTG series is a family of system-on-chip solutions well suited for applications such as communication modules and split meter systems.

The PIC32CXMTG is a seamless extension of the Microchip PIC32CX. It belongs to a family of microcontrollers and solutions for smart grid security and communication applications. These devices offer an unprecedented level of integration and flexibility around single Arm Cortex-M4F processors running at a maximum speed of 200 MHz. It includes up to 2048 Kbytes of embedded Flash, 512 Kbytes of embedded SRAM as well as 16 Kb of Instruction and 8 Kb of Data Cache/Tightly Coupled Memory (TCM) on-chip.

The peripheral set includes an extensive set of embedded cryptographic features, anti-tamper, Floating Point Unit (FPU), Memory Protection Unit (MPU), FLEXCOM peripherals supporting I2C, SPI, UART/USART interfaces, three PWMs for pulse output functions, 12-channel general purpose 32-bit timers, 12-bit ADC, analog comparators and a battery backed-up RTC.

The PIC32CXMTG-EK is equipped with a PIC32CX2051MTG128 device in 128-pin EP-TQFP (14 mm x 14 mm x 1.0 mm, 0.4 mm pitch).

Figure 3-4. PIC32CXMTG Microcontroller Schematic

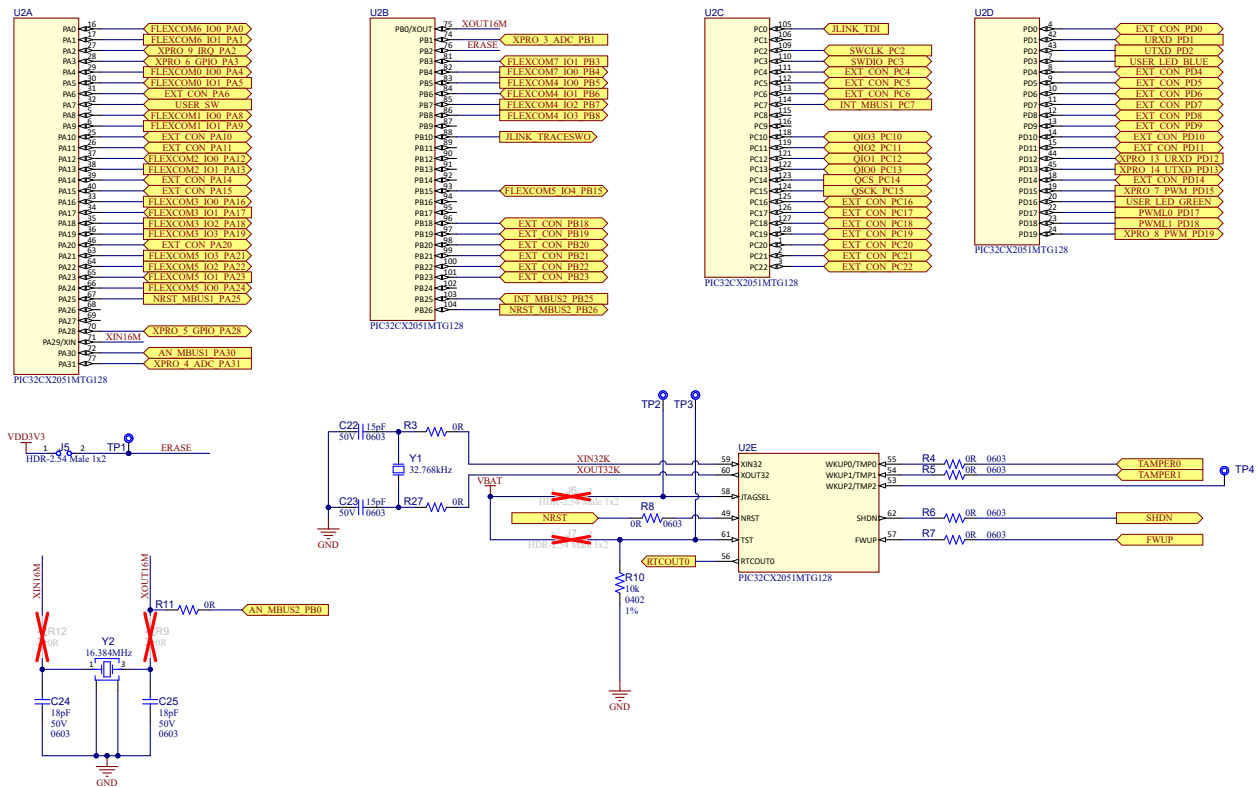
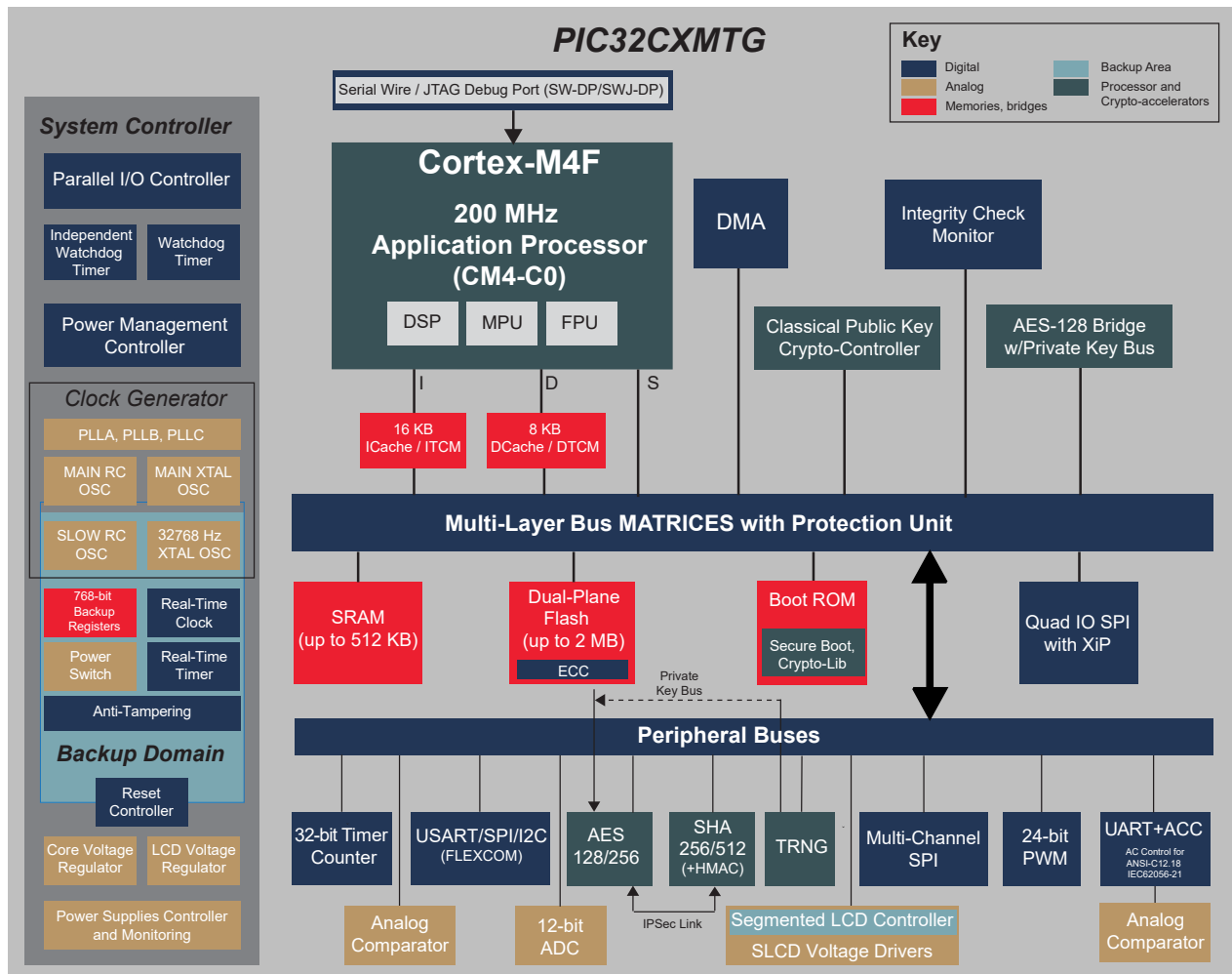


Figure 3-5. PIC32CXMTG Block Diagram



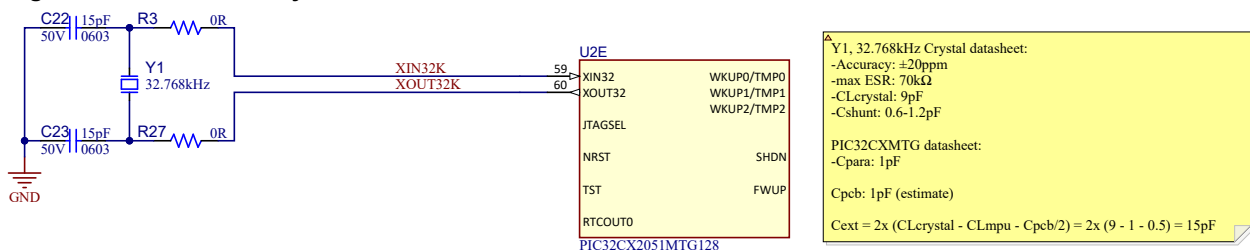
Refer to the [PIC32CXMTG Data Sheet](#) for more information.

3.4.2 Clock Circuitry

3.4.2.1 32.768 kHz Crystal

The PIC32CXMTG generates its necessary clocks based on a slow clock (SLCK) oscillator running at 32.768 kHz. By default, a low-power 32.768 kHz crystal oscillator, Y1, is assembled. For more information about this crystal, refer to the [VMK3-9001-32K7680000 Data Sheet](#).

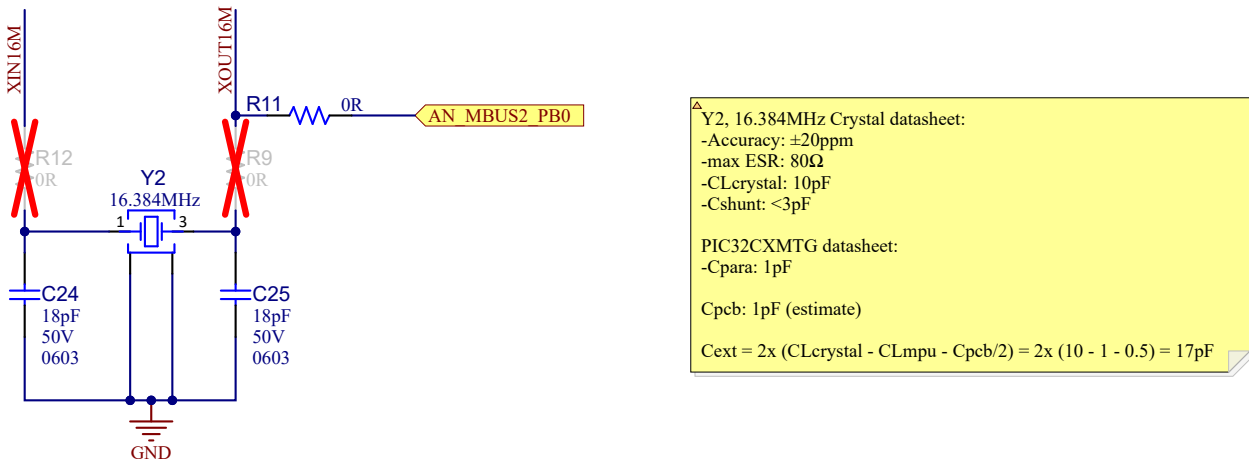
Figure 3-6. 32.768 kHz Crystal Oscillators Scheme



3.4.2.2 16.384 MHz Crystal

The PIC32CXMTG-EK board embeds a high-speed crystal set at 16.384 MHz, Y2. By default, the crystal pins are not connected to the PIC32CXMTG. For more information about this crystal, refer to the [VXM7-9060-16M3840000 Data Sheet](#).

Figure 3-7. 16.384 MHz Crystal Scheme



Note: To use the 16.384 MHz crystal, you must unsolder R11 and solder R9 and R12.

3.4.3 Reset

Three reset sources for the PIC32CXMTG-EK are placed on the board:

- Power-On Reset function, embedded in the PIC32CXMTG device
- RESET button, SW1, mounted directly on the board. When the RESET button is pressed, it will drive the PIC32CXMTG reset line (NRST) to GND
- J-Link Debugger reset

3.4.4 Power Supply System

The PIC32CXMTG-EK board can be powered from several power sources, as is shown in the following table.

Table 3-8. Power Sources for PIC32CXMTG-EK Board

Power Input	Voltage Requirements	Min Power Requirements
Auxiliar DC Input connector (J17)	+5V ($\pm 5\%$)	2.5W
USB Micro AB connector (J14)	+5V	2.5W

The PIC32CXMTG-EK board has two main voltage rails:

- +5V to supply power to the 3.3V regulator, Xplained PRO, GPIO expander and mikroBUS connectors
- +3.3V to power the IC devices, such as PIC32CXMTG, SST26VF064B and some interfaces

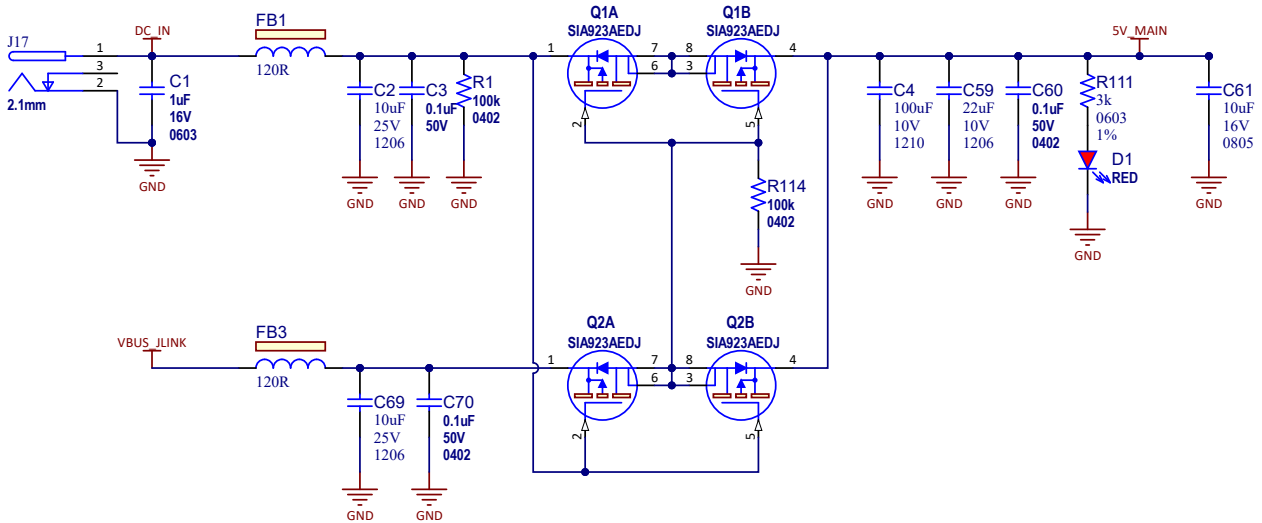
3.4.4.1 Automatic Power Switch

PIC32CXMTG-EK can be powered by a DC Input Connector or by a USB device supply.

The selection of the input supply is automatic and gives priority to the DC Input Connector. The automatic switch is made with discrete components, as shown in the figure below.

One LED, D1, is connected to the voltage rail to check whether the power supply is connected.

Figure 3-8. Automatic Power Switch Schematic



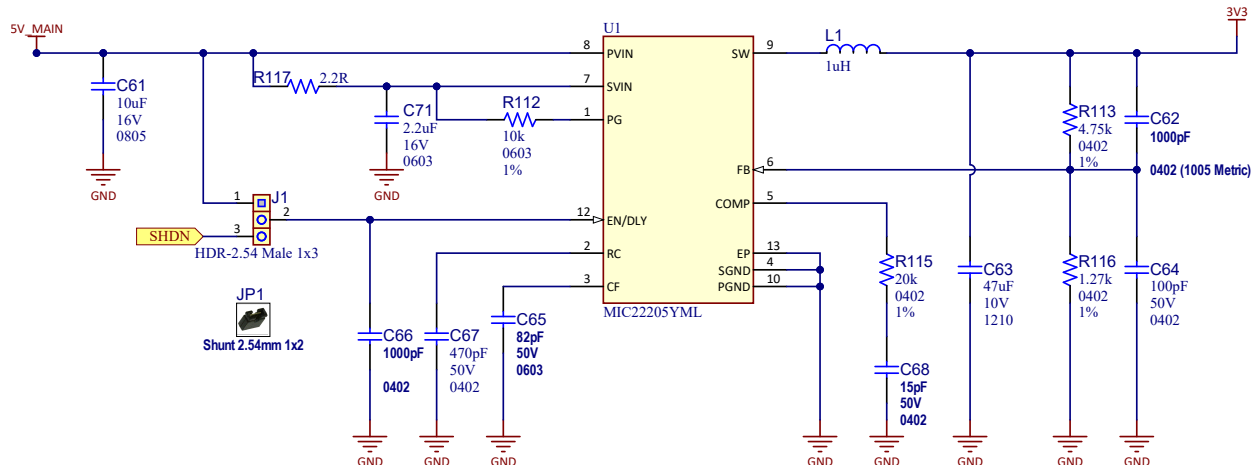
3.4.4.2 5.0V to 3.3V Supply

The +3.3V voltage rail is obtained from the Microchip [MIC22205](#) buck converter. The MIC22205 is a high-efficiency, 2A, integrated switch, synchronous buck (step-down) regulator. The MIC22205 is optimized for highest efficiency, achieving up to 95% efficiency while still switching at 1 MHz. The ultra-high speed control loop keeps the output voltage within regulation even under extreme transient load swings.

This converter is used due to its high switching frequency (> 500 kHz) to avoid working in the same band as the power line communication.

For more information, refer to the [MIC22205 product webpage](#).

Figure 3-9. 3.3V Buck Converter Design

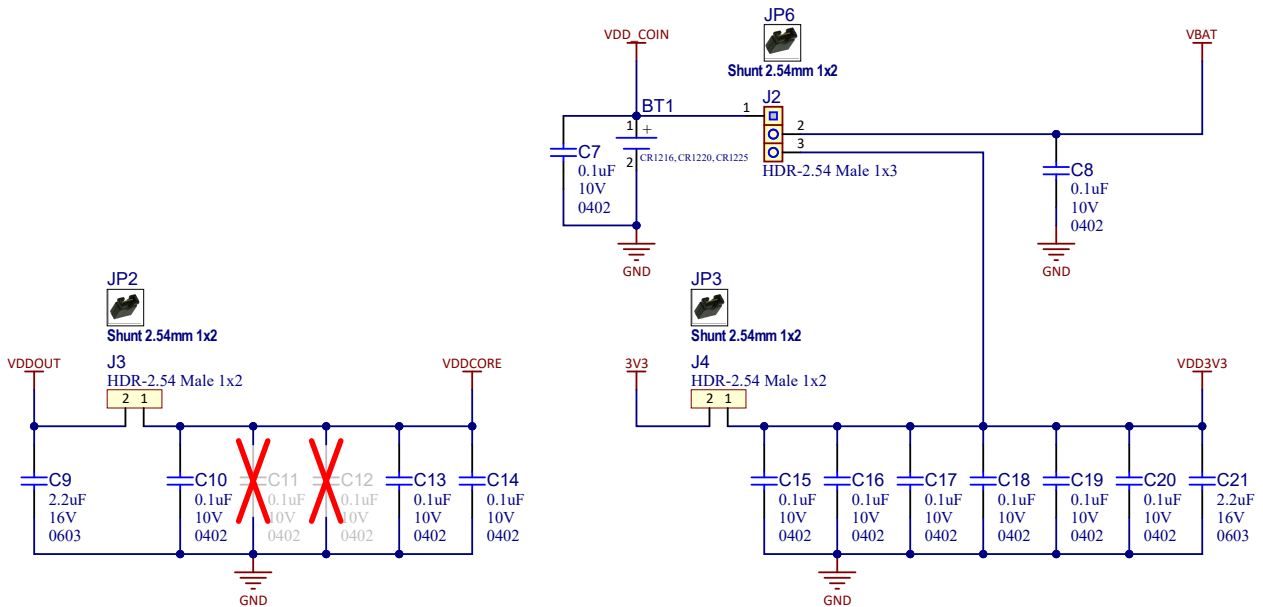


The processor can assert the SHDN signal to shut down the buck converter and make it enter the Power-Down mode. This is done by pulling the Enable pin (EN) of the buck converter to GND.

3.4.4.3 Back-Up Supply

A 3V coin battery holder, BT1, is included to insert a battery to supply VBAT voltage. It allows the microcontroller to be supplied even if a Brown-Out event occurs. The embedded firmware may switch to a low-power mode to consume as little energy as possible. While in Back-Up mode, the board can be woken up by action on the SW4 button (Force Wake-Up) or SW3 and SW5 buttons (Tamper0 and Tamper1), which signals the MCU to resume operations.

Figure 3-10. Back-Up Design

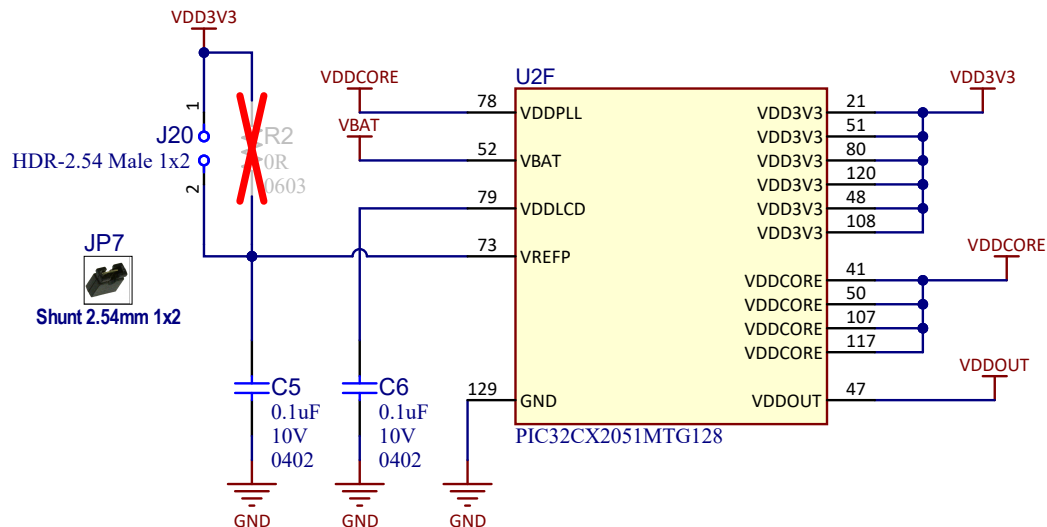


Attention: The coin battery is not provided with the kit.

3.4.4.4 MCU32 Supplies

MCU32 supplies are shown in the following schematic.

Figure 3-11. MCU32 Supplies Schematic



The function of J20 is to allow selection of the applied VREFP voltage between the internal or external voltage reference.

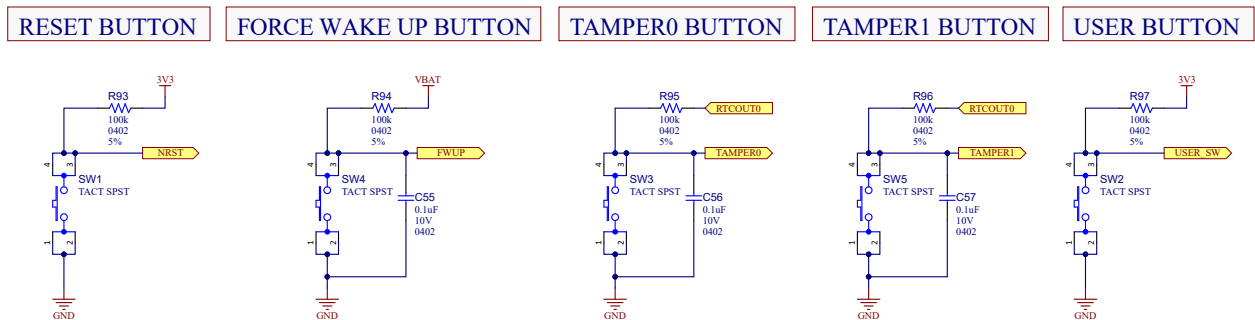
3.5 Hardware Description – Interface and QSPI Memory

3.5.1 User Buttons

The PIC32CXMTG-EK board is equipped with five buttons. The push buttons consist of momentary push button switches mounted directly on the board. When any switch is pressed, it will cause low (zero) to appear at the associated input pin.

- Reset (NRST). Besides the reset conditions managed by the reset controller peripheral of the PIC32CXMTG, such as Power-on Reset and brown-out monitor, a user can manually reset the PIC32CXMTG by using the Reset push button, SW1.
- Force Wake-Up (FWUP). Wake-up from Back-up mode can be done through the Force Wake-Up (FWUP) pin by pushing the push button, SW4.
- Tamperers (TAMPER0, pin WKUP0/TMP0 and TAMPER1, pin WKUP1/TMP1). Tamper buttons SW3 and SW5 allow the simulating of a tampering event. These pins can also be used as a wake-up function.
- User (User_SW, pin PA7): The SW2 does not have a specific function associated to it, so it can be used freely from the user application.

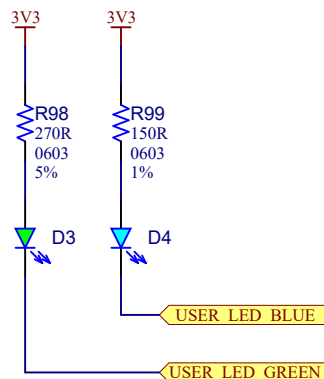
Figure 3-12. User Buttons Schematic



3.5.2 User LEDs

The PIC32CXMTG-EK embeds two LEDs, D3 (green) and D4 (blue), connected to PD16 and PD3, respectively, which are free for user application purposes.

Figure 3-13. User LEDs Schematic



3.5.3 Chip Erase

The 1x2 pin-header, J5, labelled as “ERASE” is connected to the PIC32CXMTG erase pin (PB2) and VDD3V3. This header can be used to reinitialize the Flash content (and some of its NVM bits) to an erased state (all bits read as logic level 1) by placing a jumper on the header and pressing the reset switch button (SW1). After a while, the erase jumper must be removed and the PCBA must be turned off and turned on by disconnecting and connecting it again to the selected power supply. Refer to the [PIC32CXMTG Data Sheet](#) for more information.

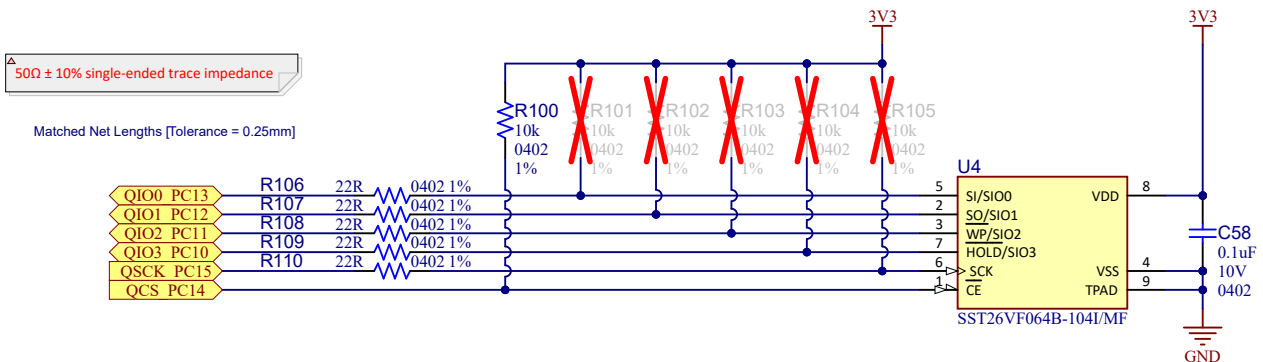
3.5.4 QSPI Memory

The PIC32CXMTG-EK board features one Quad Serial Peripheral Interface (QSPI) 64-Mbit flash memory SST26VF064B-104I/MF, U4. The [SST26VF064B](#) SQI flash device utilizes a 4-bit multiplexed I/O serial interface to boost performance at low power while maintaining full command-set compatibility to traditional Serial Peripheral Interface (SPI) protocols. The four bus signals are a clock input (SCK), a serial data input (SI), a serial data output (SO) and a chip select (CE).

The QSPI bus is a synchronous serial data link that provides communication with external devices in Host mode. The QSPI can be used in SPI mode to interface with serial peripherals (such as ADCs, DACs, LCD controllers, CAN controllers and sensors), or in Serial Memory mode to interface with serial Flash memories. With the support of the Quad SPI protocol, the QSPI allows the system to use high-performance serial Flash memories, which are small and inexpensive, instead of larger and more expensive parallel Flash memories.

For more information, refer to the [SST26VF064B product webpage](#).

Figure 3-14. QSPI Memory Schematic



3.6 Hardware Description – Expansion Connectors

3.6.1 mikroBUS Connectors

The PIC32CXMTG-EK hosts two mikroBUS sockets (J8 and J9). The [mikroBUS standard](#) defines the main board sockets and add-on boards used for interfacing the microprocessor with integrated modules having a proprietary pin configuration. For details, refer to the mikroBUS documentation on standard specification.

Figure 3-15. mikroBUS 1 Interface Schematic

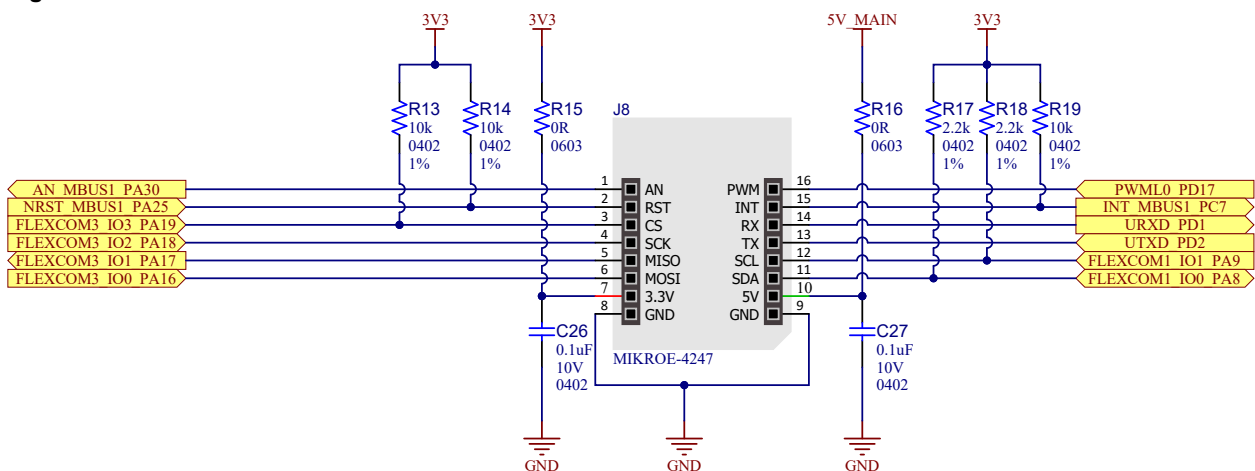


Table 3-9. mikroBUS 1 Connector Pin Assignment

Pin	PIO	Net Name	Pin	PIO	Net Name
1	PA30	AN_MBUS1_PA30	16	PD17	PWML0_PD17
2	PA25	NRST_MBUS1_PA25	15	PC7	INT_MBUS1_PC7
3	PA19	FLEXCOM3_IO3_PA19	14	PD1	URXD_PD1
4	PA18	FLEXCOM3_IO2_PA18	13	PD2	UTXD_PD2
5	PA17	FLEXCOM3_IO1_PA17	12	PA9	FLEXCOM1_IO1_PA9
6	PA16	FLEXCOM3_IO0_PA16	11	PA8	FLEXCOM1_IO0_PA8
7	3.3V Supply	3V3	10	5V Supply	5V_MAIN
8	GND	GND	9	GND	GND

Figure 3-16. mikroBUS 2 Interface Schematic

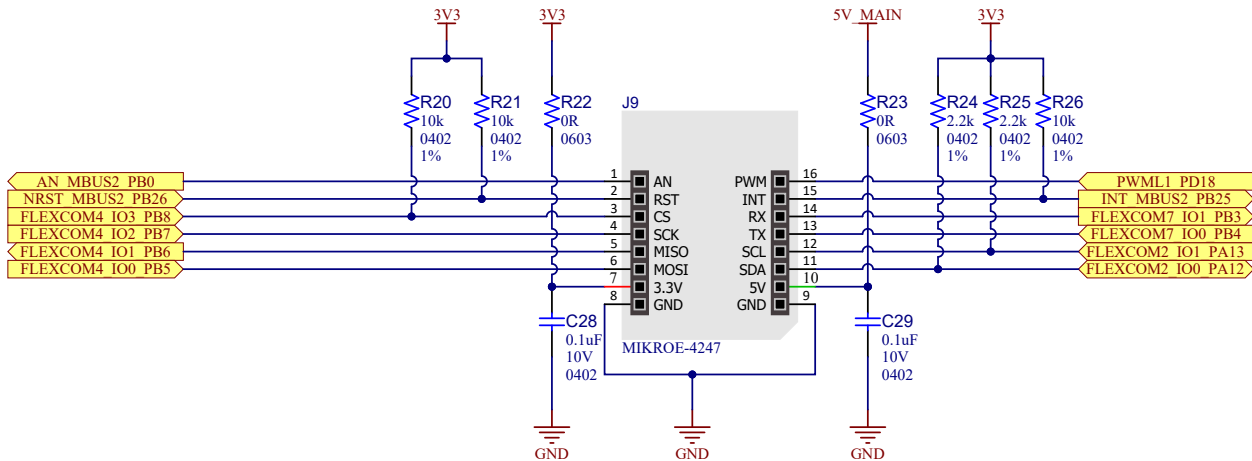


Table 3-10. mikroBUS 2 Connector Pin Assignment

Pin	PIO	Net Name	Pin	PIO	Net Name
1	PB0	AN_MBUS2_PB0	16	PD18	PWML1_PD18
2	PB26	NRST_MBUS2_PB26	15	PB25	INT_MBUS2_PB25
3	PB8	FLEXCOM4_IO3_PB8	14	PB3	FLEXCOM7_IO1_PB3
4	PB7	FLEXCOM4_IO2_PB7	13	PB4	FLEXCOM7_IO0_PB4
5	PB6	FLEXCOM4_IO1_PB6	12	PA13	FLEXCOM2_IO1_PA13
6	PB5	FLEXCOM4_IO0_PB5	11	PA12	FLEXCOM2_IO0_PA12
7	3.3V Supply	3V3	10	5V Supply	5V_MAIN
8	GND	GND	9	GND	GND

The mikroBUS connector allows for the connection of a wide range of modules for communications, sensing or power management applications out of the main scope for this board.

3.6.2 Xplained PRO Interface

The PIC32CXMTG-EK embeds one connector to the interface with Xplained PRO wings.

The design ensures that the lower connector pin row is used for power and ground. This row will provide the shortest connection with the least inductance. This header is implemented as 20-pin (J10) 100-mil right-angled headers that are male on the MCU boards (extension boards use a female 20-pin right-angled header).

All connected pins follow the defined pinout description in [Table 3-2](#).

The extension headers can be used to connect a variety of Xplained PRO extensions to Xplained PRO MCU boards or to access the pins of the target MCU on Xplained PRO MCU boards directly.

Figure 3-17. Xplained PRO Schematic

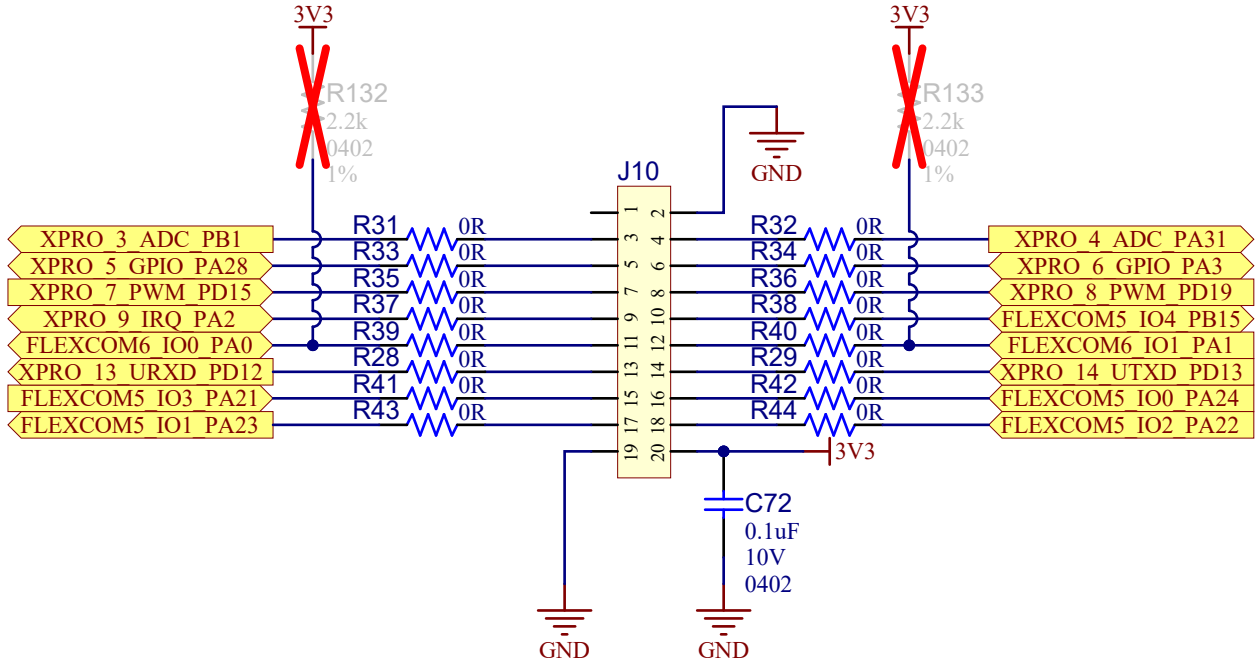


Table 3-11. Xplained PRO Connector Pin Assignment

Pin	PIO	Net Name	Pin	PIO	Net Name
1	—	NC	2	GND	GND
3	PB1	XPRO_3_ADC_PB1	4	PA31	XPRO_4_ADC_PA31
5	PA28	XPRO_5_GPIO_PA28	6	PA3	XPRO_6_GPIO_PA3
7	PD15	XPRO_7_PWM_PD15	8	PD19	XPRO_8_PWM_PD19
9	PA2	XPRO_9_IRQ_PA2	10	PB15	FLEXCOM5_IO4_PB15
11	PA0	FLEXCOM6_IO0_PA0	12	PA1	FLEXCOM6_IO1_PA1
13	PD12	XPRO_13_URXD_PD12	14	PD13	XPRO_14_UTXD_PD13
15	PA21	FLEXCOM5_IO3_PA21	16	PA24	FLEXCOM5_IO0_PA24
17	PA23	FLEXCOM5_IO1_PA23	18	PA22	FLEXCOM5_IO2_PA22
19	GND	GND	20	3.3V Supply	3V3

The Xplained PRO connector allows the connection of a wide range of modules.

3.6.3 GPIO Interface

Some GPIOs are routed to a 40-pin I/O expander. All connected pins follow the defined pinout description in [Table 3-3](#).

Figure 3-18. GPIO Extension Connector Schematic

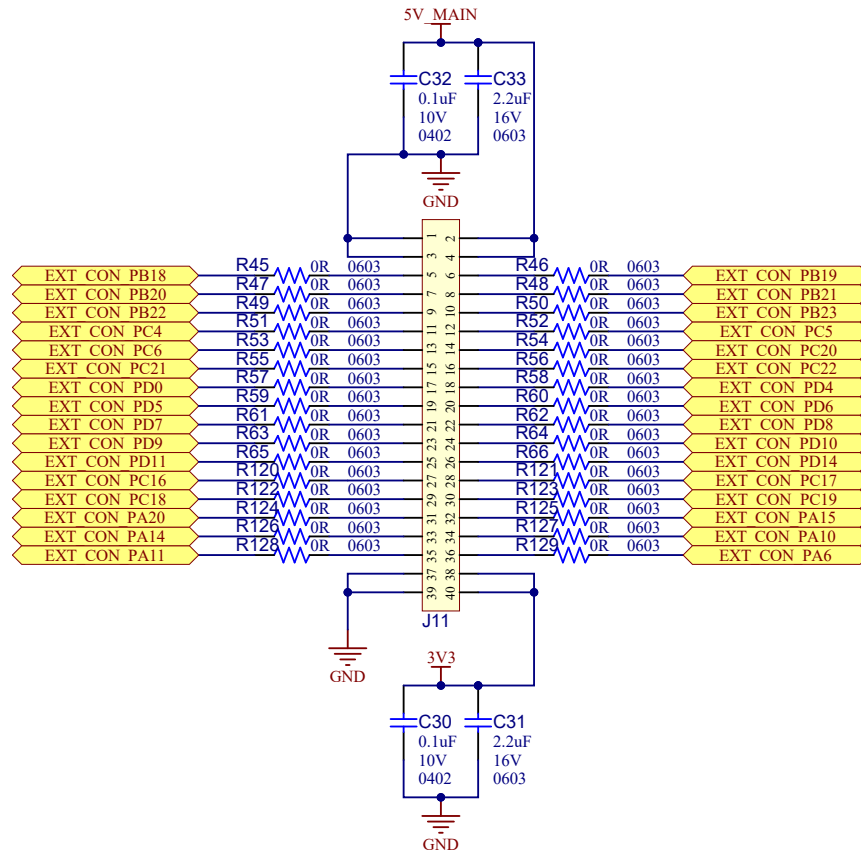


Table 3-12. GPIO Extension Connector Pinout

Pin	PIO	Net Name	Pin	PIO	Net Name
1	GND	GND	2	5V Supply	5V_MAIN
3	GND	GND	4	5V Supply	5V_MAIN
5	PB18	EXT_CON_PB18	6	PB19	EXT_CON_PB19
7	PB20	EXT_CON_PB20	8	PB21	EXT_CON_PB21
9	PB22	EXT_CON_PB22	10	PB23	EXT_CON_PB23
11	PC4	EXT_CON_PC4	12	PC5	EXT_CON_PC5
13	PC6	EXT_CON_PC6	14	PC20	EXT_CON_PC20
15	PC21	EXT_CON_PC21	16	PC22	EXT_CON_PC22
17	PD0	EXT_CON_PD0	18	PD4	EXT_CON_PD4
19	PD5	EXT_CON_PD5	20	PD6	EXT_CON_PD6
21	PD7	EXT_CON_PD7	22	PD8	EXT_CON_PD8
23	PD9	EXT_CON_PD9	24	PD10	EXT_CON_PD10
25	PD11	EXT_CON_PD11	26	PD14	EXT_CON_PD14

.....continued

Pin	PIO	Net Name	Pin	PIO	Net Name
27	PC16	EXT_CON_PC16	28	PC17	EXT_CON_PC17
29	PC18	EXT_CON_PC18	30	PC19	EXT_CON_PC19
31	PA20	EXT_CON_PA20	32	PA15	EXT_CON_PA15
33	PA14	EXT_CON_PA14	34	PA10	EXT_CON_PA10
35	PA11	EXT_CON_PA11	36	PA6	EXT_CON_PA6
37	GND	GND	38	3.3V Supply	3V3
39	GND	GND	40	3.3V Supply	3V3

3.7 Hardware Description – J-Link Debugger

The PIC32CXMTG-EK includes a built-in SEGGER J-Link-On-Board (J-Link-OB) device. The functionality is implemented with an ATSAM3U4C microcontroller in a TFBGA100 package. The ATSAM3U4C provides the functions of the JTAG interface and a bridge from the USB to the Serial debug port (known as CDC, or Communication Device Class). The bicolored LED, LD1, shows the status of the J-Link-On-Board device.

The J-Link-OB device is designed to provide an efficient, low-cost, on-board alternative to the standard J-Link Debug Probe or the Microchip J-32 Debug Probe.

Its own dedicated USB port acts as a power source for this evaluation kit, and provides the communication link to program and debug the MCU.

Figure 3-19. J-Link-OB Interface

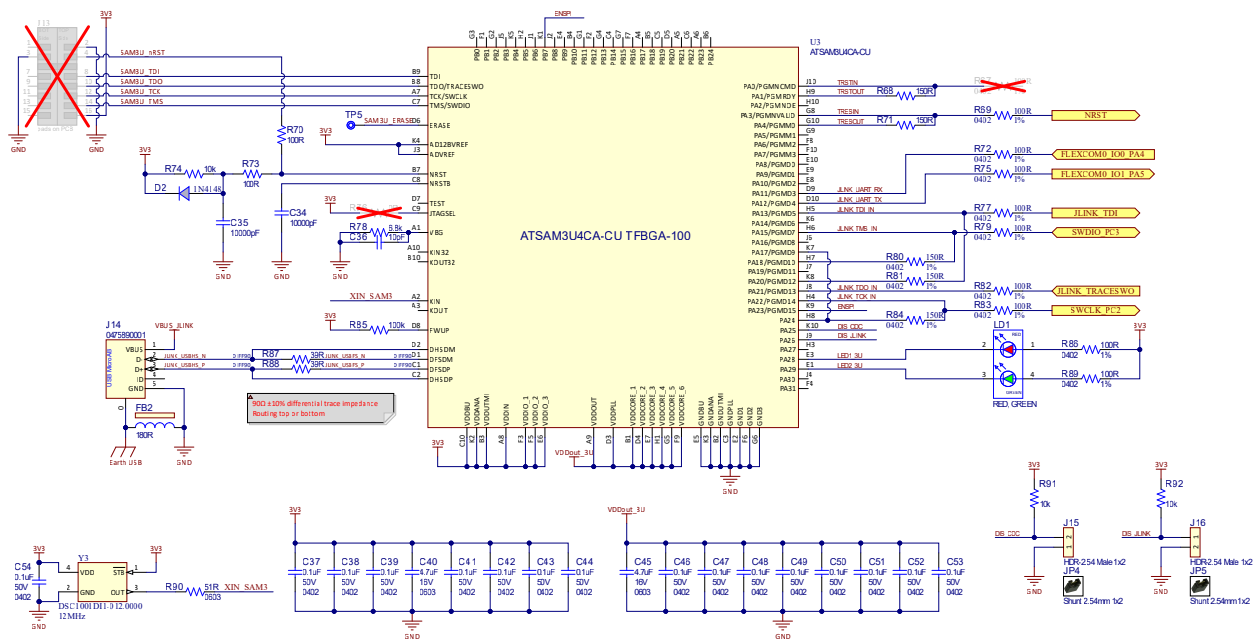


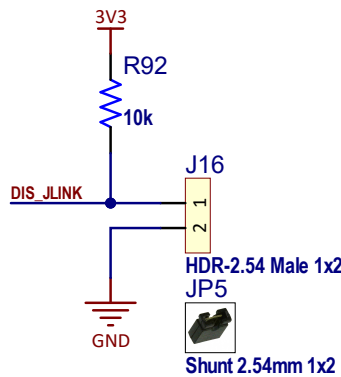
Table 3-13. J-Link-OB and J-Link-CDC LED LD1 Status

LED LD1	State	Description
Red and Green	Off	J-Link (SAM3U device) is not programmed, or J15 and J16 are installed
Red and Green	On	Reset button SW1 is pushed
Green	Flashing	J-Link is operational but the USB port is not connected
Green	On	J-Link-OB is connected and ready

The J-Link-OB feature is enabled/disabled by jumper J16.

- Shunt JP5 is not installed on J16: J-Link-OB-ATSAM3U4C is enabled and fully functional
- Shunt JP5 is installed on J16: J-Link-OB-ATSAM3U4C is disabled

Figure 3-20. Disable J-Link JTAG



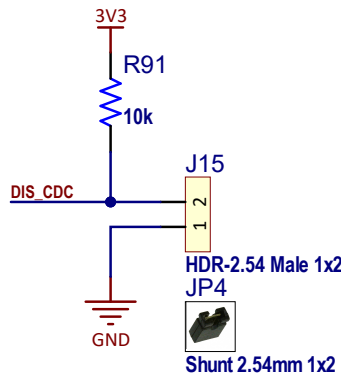
In addition to the J-Link-OB functionality, the ATSAM3U4C microcontroller provides a bridge to a debug serial port of the main board processor. The port is made accessible over the same USB connection used by JTAG by implementing a Communication Device Class (CDC), which allows a terminal communication with the target device.

The CDC feature is enabled/disabled by jumper J15.

- Shunt JP4 is not installed on J15: the J-Link-OB CDC function is enabled and fully functional
- Shunt JP4 is installed on J15: the J-Link-OB CDC function is disabled

The USB CDC converts the USB device into a serial communication device. The target device running the CDC is recognized by the host as a serial interface (USB2COM, virtual COM port) without the need of installing a special host driver (the CDC is standard). All PC software using a COM port works without modifications with this virtual COM port. Under Microsoft® Windows®, the device shows up as a COM port; under Linux®, as a /dev/ACMx device. This enables the user to use host software that was not designed to be used with a USB, such as a terminal program.

Figure 3-21. Disable J-Link CDC



4. Ordering Information

Table 4-1. Evaluation Kit Ordering Information

Ordering Code	Board Marking
EV11K09A	PIC32CXMTG-EK

5. Appendix. Schematics and Layouts

5.1 PIC32CXMTG-EK Schematics

This section contains the following schematics for the PIC32CXMTG-EK board:

- Block Diagram Schematic, [Figure 5-1](#)
- Power Supply Schematic, [Figure 5-2](#)
- PIC32CXMTG MCU Schematic, [Figure 5-3](#)
- Expansion Connectors Schematic, [Figure 5-4](#)
- Interface and QSPI Memory Schematic, [Figure 5-5](#)
- J-Link-OB Schematic, [Figure 5-6](#)

Figure 5-1. Block Diagram Schematic

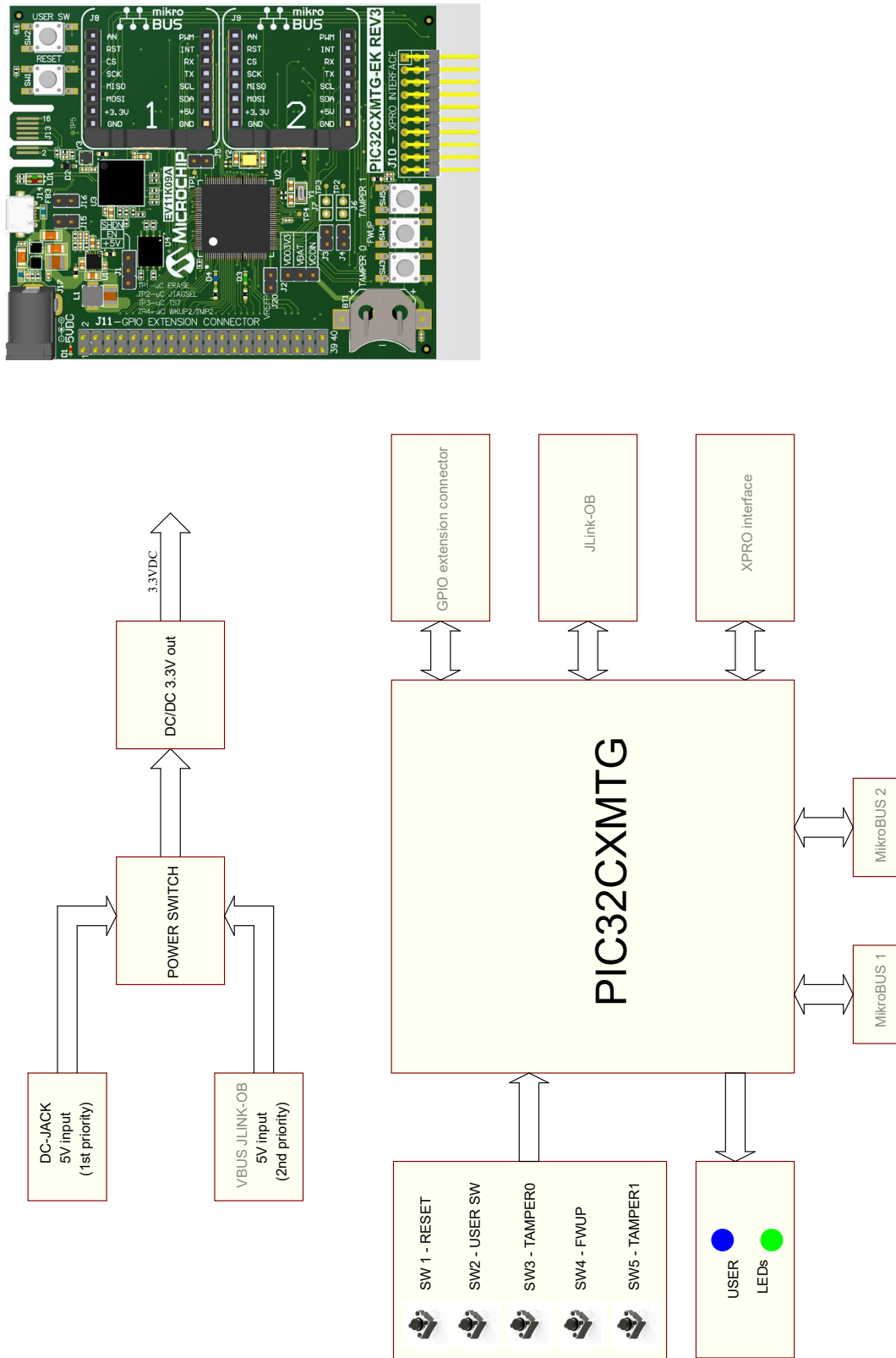


Figure 5-2. Power Supply Schematic

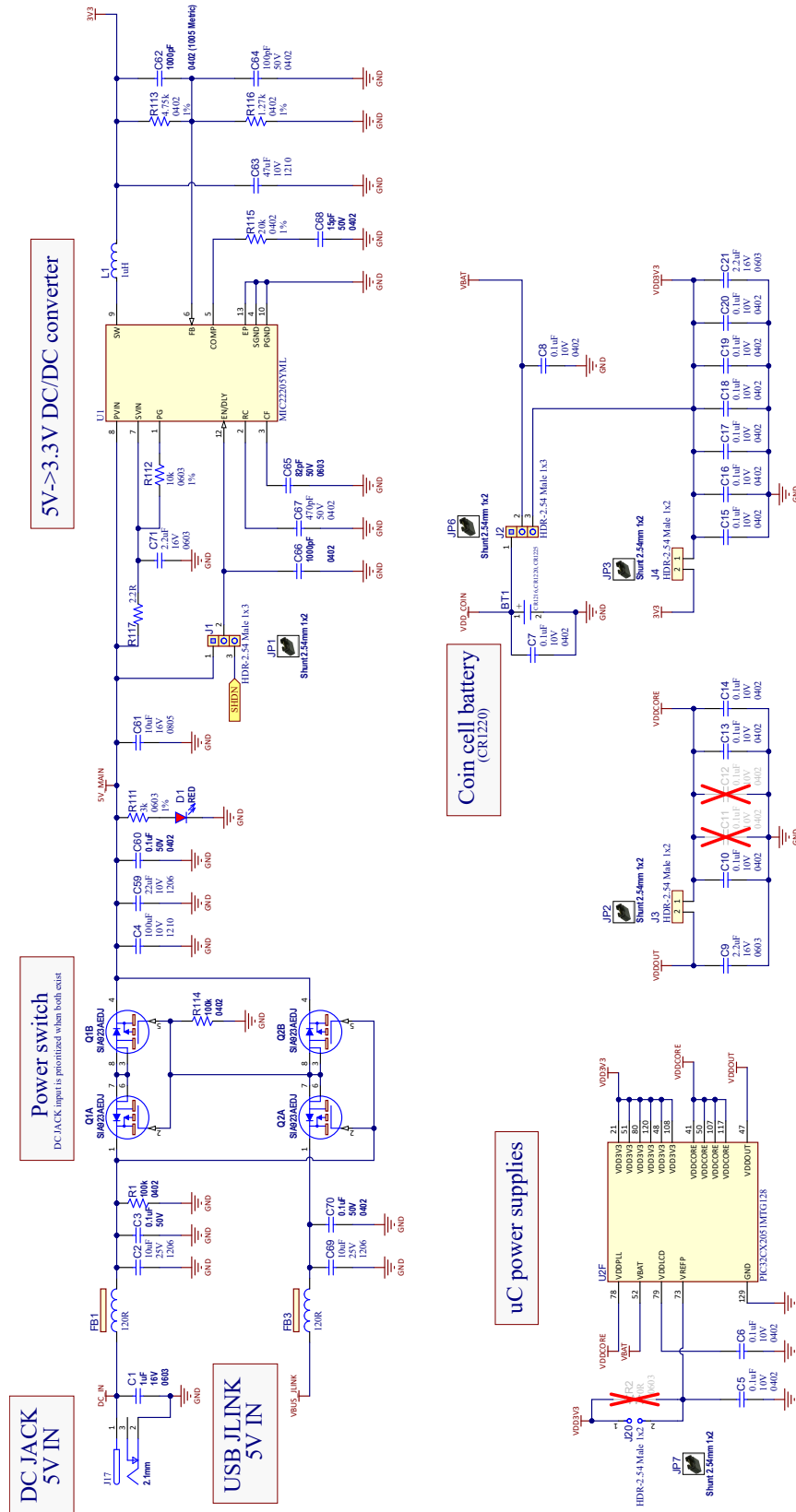


Figure 5-3. PIC32CXMTG MCU Schematic

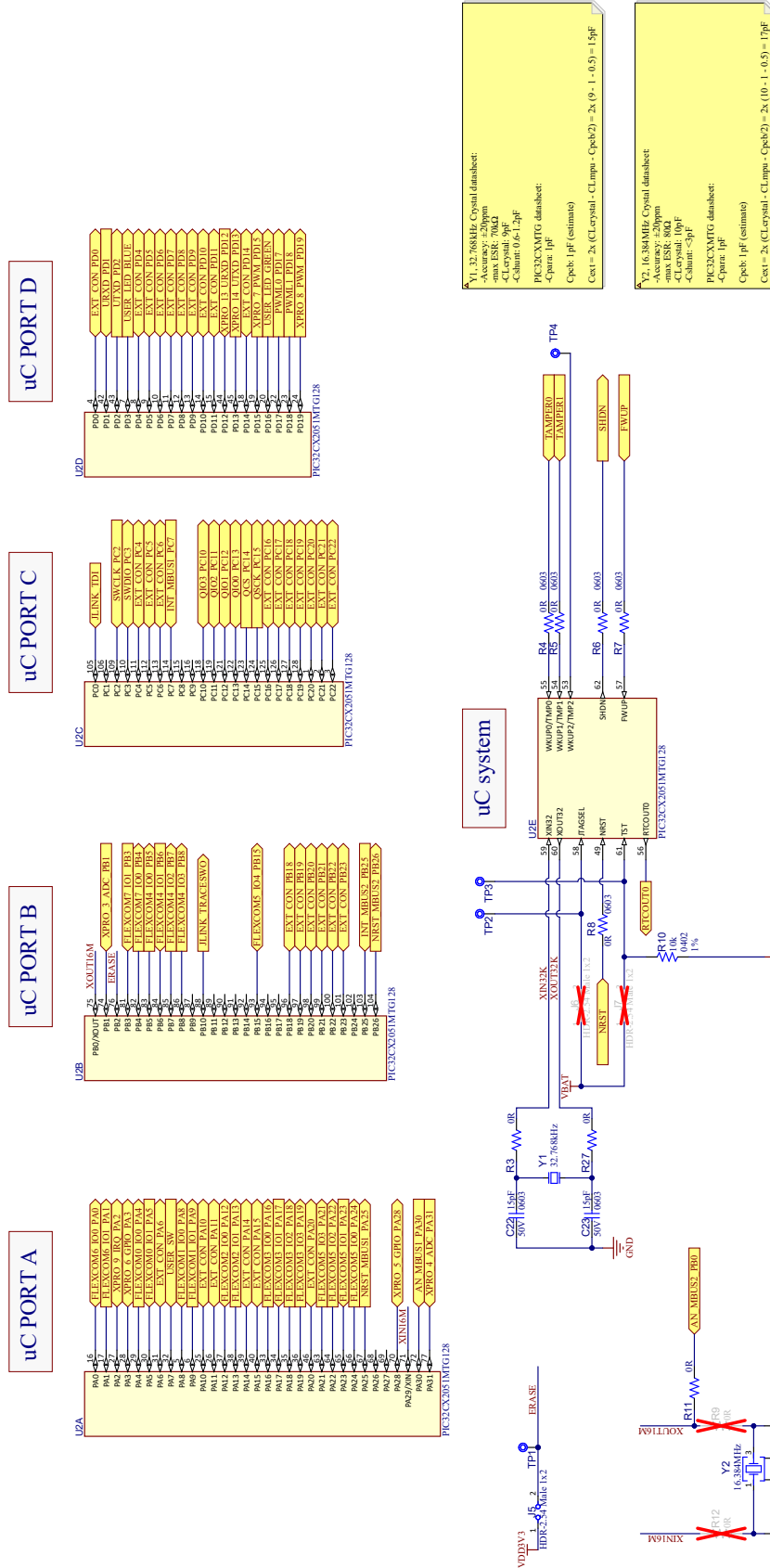
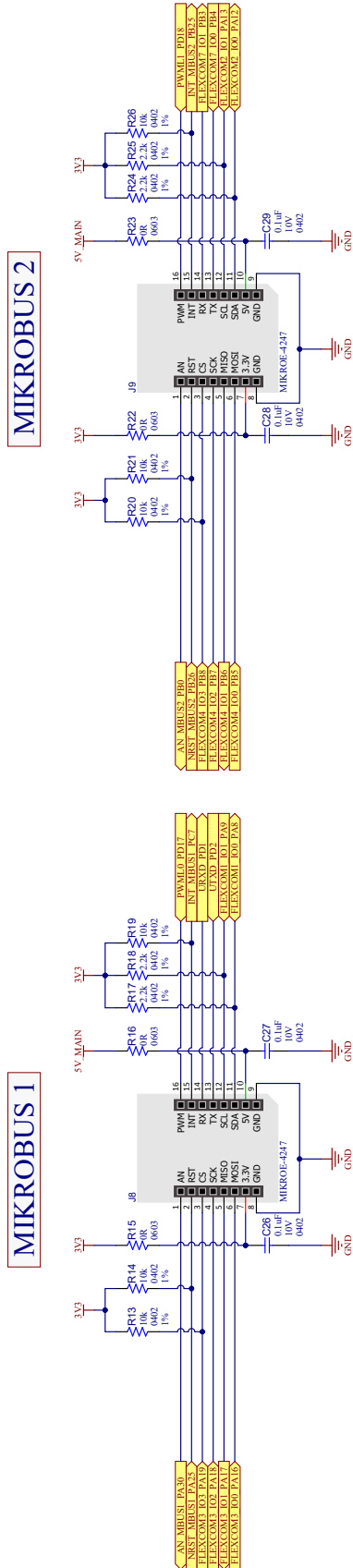
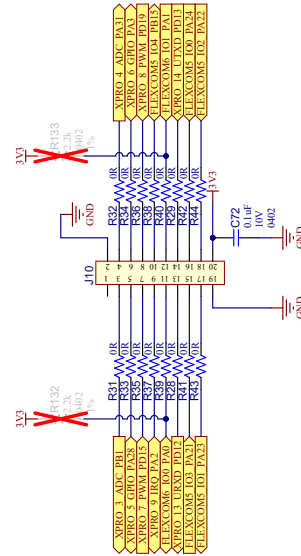


Figure 5-4. Expansion Connectors Schematic



Explained Pro Interface



GPIO EXTENSION CONNECTOR

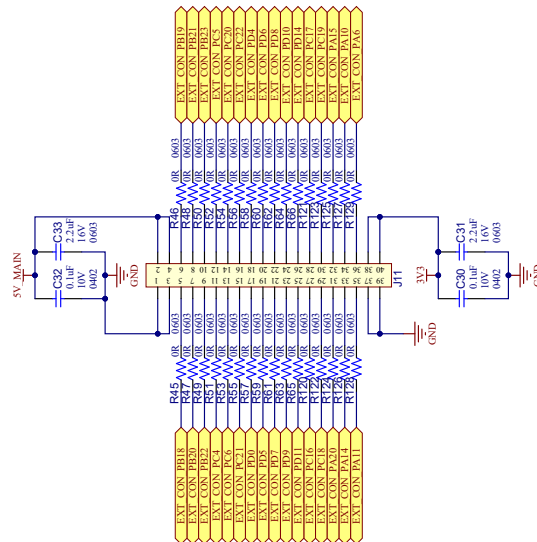


Figure 5-5. Interface and QSPI Memory Schematic

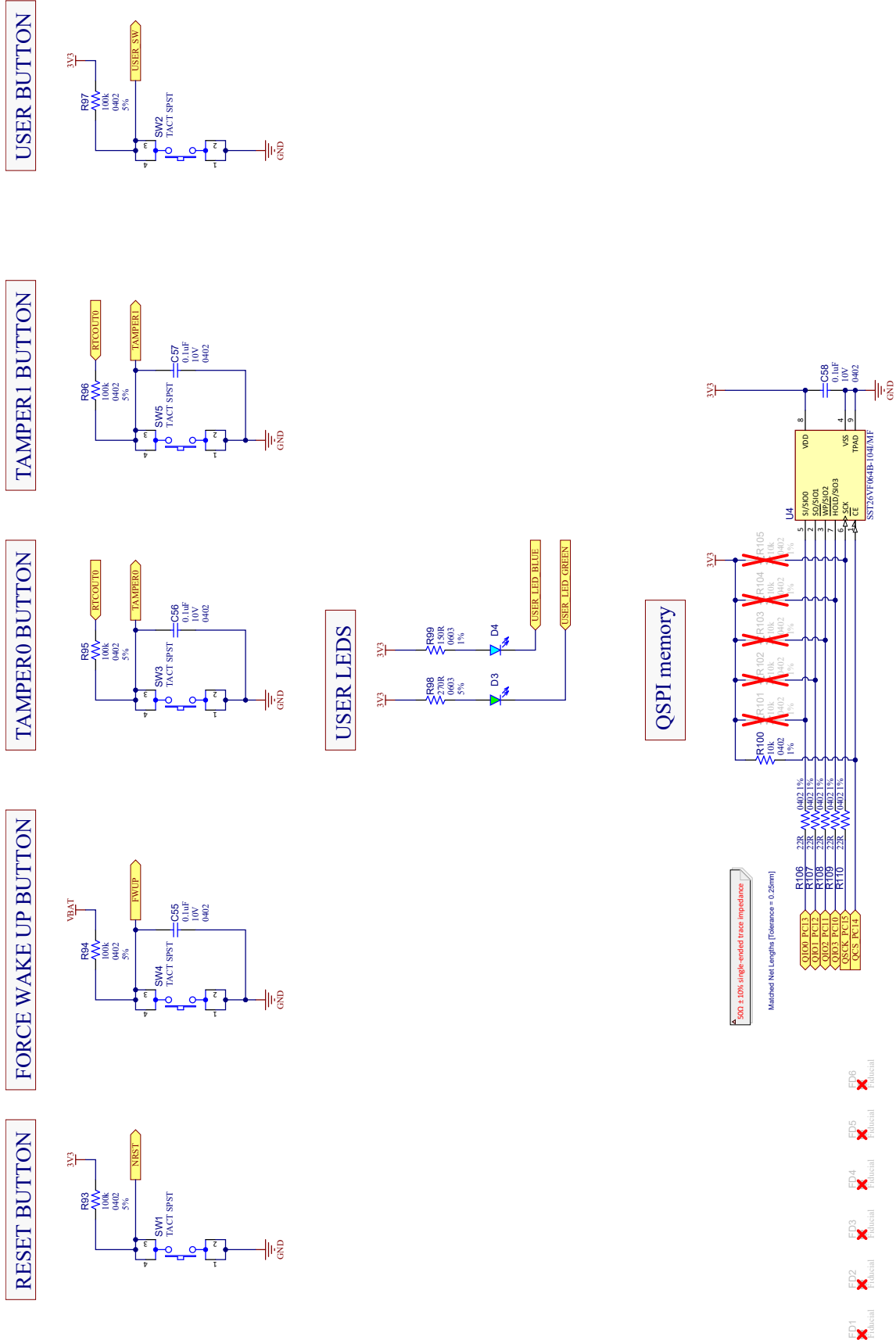
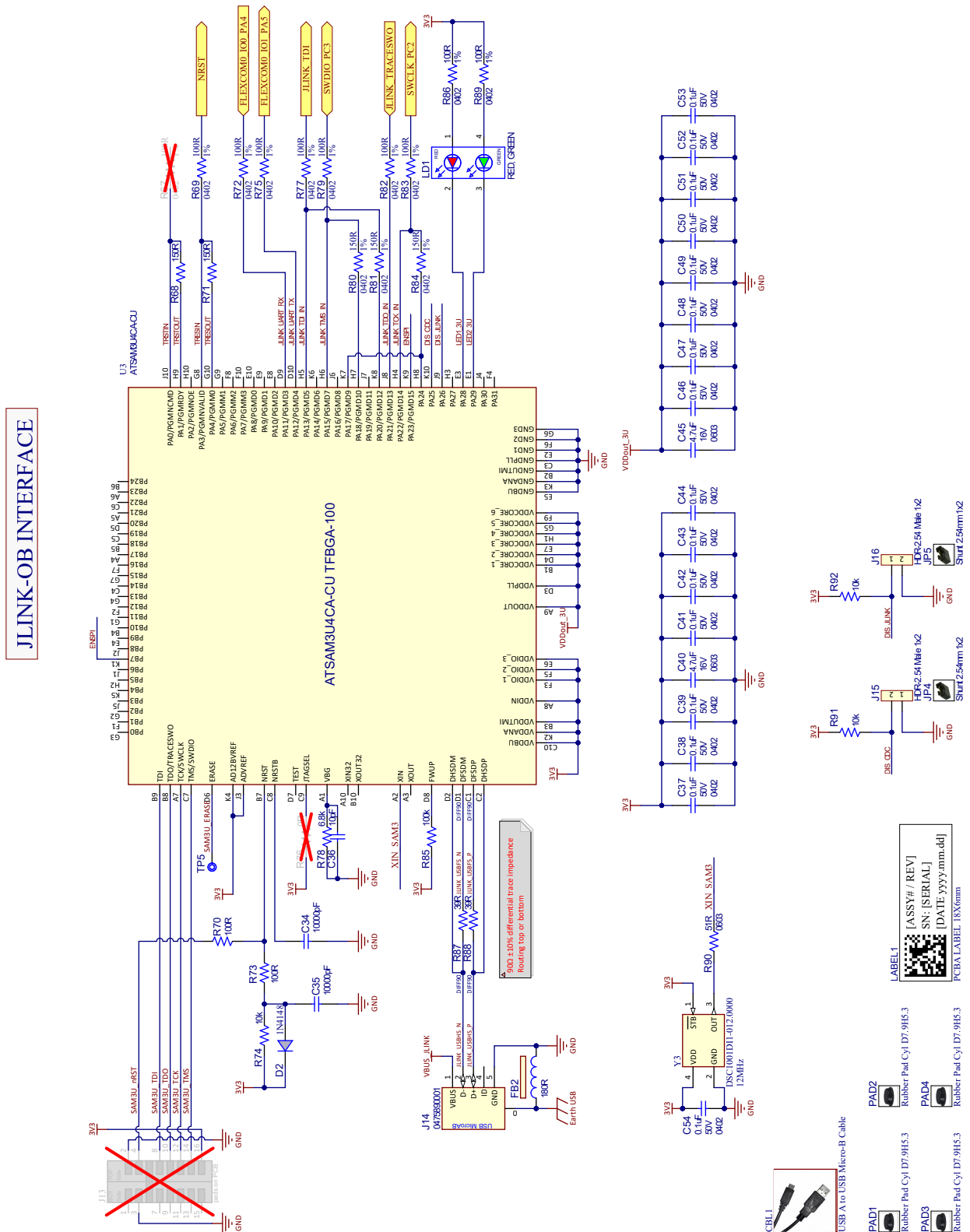


Figure 5-6. J-Link-OB Schematic



5.2 PIC32CXMTG-EK Layout

This section contains the layout graphics for the PIC32CXMTG-EK board:

- Layer 1: Top Layer, [Figure 5-7](#)
- Layer 2: Mid Layer 1, [Figure 5-8](#)
- Layer 3: Mid Layer 2, [Figure 5-9](#)
- Layer 4: Bottom Layer, [Figure 5-10](#)
- Top Components Placement, [Figure 5-11](#)
- Bottom Components Placement, [Figure 5-12](#)

Figure 5-7. PIC32CXMTG-EK Layout: Top Layer

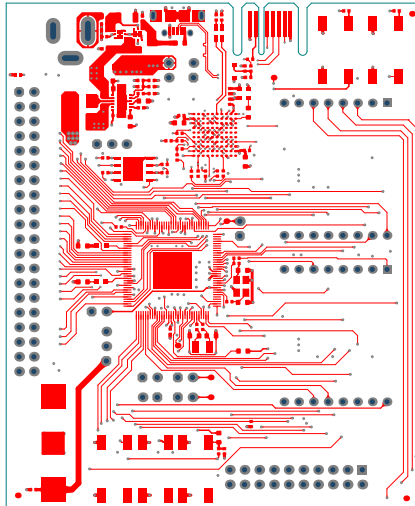


Figure 5-8. PIC32CXMTG-EK Layout: Mid Layer1 (Ground)

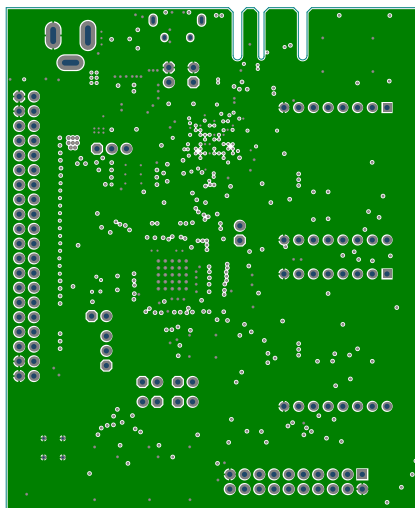


Figure 5-9. PIC32CXMTG-EK Layout: Mid Layer2 (Power Supplies)

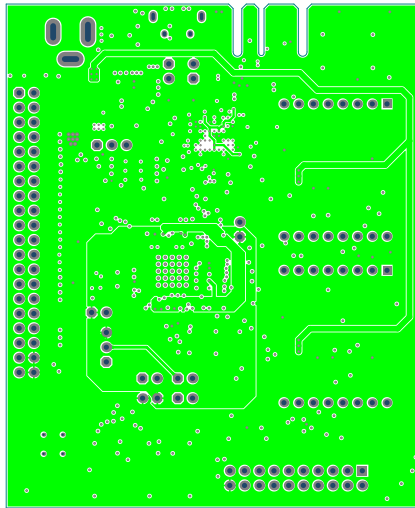


Figure 5-10. PIC32CXMTG-EK Layout: Bottom Layer

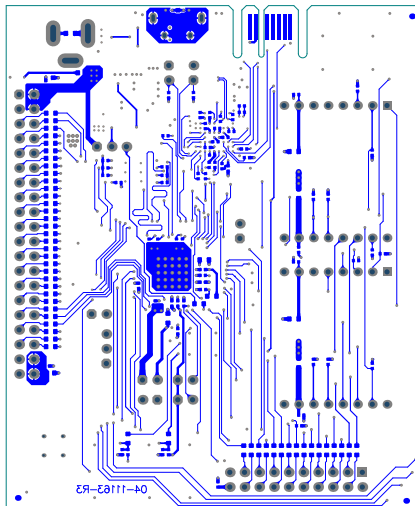


Figure 5-11. PIC32CXMTG-EK Layout: Top Silkscreen

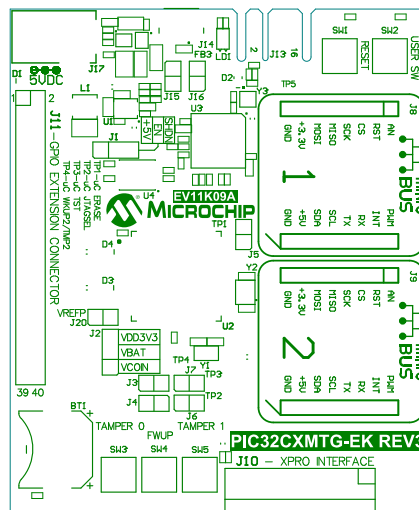
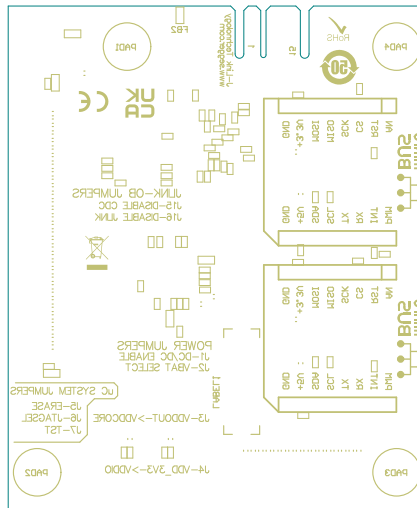


Figure 5-12. PIC32CXMTG-EK Layout: Bottom Silkscreen



6. References

The following documents are recommended as supplemental reference resources:

- PIC32CXMTG Data Sheet, reference DS60001780, on [the Microchip website](#)
- VMK3/VMK4 Data Sheet, reference 20006440, on [the Microchip website](#)
- [VXM7](#) Data Sheet, on the Microchip website
- [MIC22205](#) Data Sheet, on the Microchip website
- [SST26VF064B](#) Data Sheet, on the Microchip website
- [mikroBUS Standard Specifications, 2015](#)

7. Revision History

7.1 Rev E - 09/2022

Document	Minor updates throughout. Added ordering code.
3. PIC32CXMTG-EK Board	Updated Figure 3-19 and Table 3-13 .
5. Appendix. Schematics and Layouts	Updated Figure 5-6 .
4. Ordering Information	Added section.

7.2 Rev D - 04/2022

Document	Minor changes in the document. Updated all the figures according to PIC32CXMTG-EK Rev 3.
3. PIC32CXMTG-EK Board	Updated Table 3-3 and Table 3-6 . Updated 3.3.1. Connectors , 3.3.2. Jumper Configurations , 3.4.1. PIC32CXMTG , 3.4.2.1. 32.768 kHz Crystal , 3.5.2. User LEDs , 3.5.3. Chip Erase , 3.6.1. mikroBUS Connectors , 3.6.2. Xplained PRO Interface and 3.6.3. GPIO Interface sections. Deleted Shared GPIO and Standards Compliance sections.

7.3 Rev C - 11/2021

3. PIC32CXMTG-EK Board	Updated Figure 3-1 , Figure 3-2 , Figure 3-3 , Figure 3-4 , Figure 3-6 , Figure 3-7 and Figure 3-11
5. Appendix. Schematics and Layouts	Updated Figure 5-1 , Figure 5-2 , Figure 5-3 , Figure 5-4 , Figure 5-5 , Figure 5-6

7.4 Rev B - 08/2021

Document	Minor changes of format Updated the document according to PIC32CXMTG-EK Rev 2; modified the figures of schematic and layout
1. Evaluation Kit Specifications	Updated Table 1-1 , and added Table 1-2
6. References	Added two references

7.5 Rev A - 11/2020

Document	Initial release.
----------	------------------

Microchip Information

The Microchip Website

Microchip provides online support via our website at www.microchip.com/. This website is used to make files and information easily available to customers. Some of the content available includes:

- **Product Support** – Data sheets and errata, application notes and sample programs, design resources, user's guides and hardware support documents, latest software releases and archived software
- **General Technical Support** – Frequently Asked Questions (FAQs), technical support requests, online discussion groups, Microchip design partner program member listing
- **Business of Microchip** – Product selector and ordering guides, latest Microchip press releases, listing of seminars and events, listings of Microchip sales offices, distributors and factory representatives

Product Change Notification Service

Microchip's product change notification service helps keep customers current on Microchip products. Subscribers will receive email notification whenever there are changes, updates, revisions or errata related to a specified product family or development tool of interest.

To register, go to www.microchip.com/pcn and follow the registration instructions.

Customer Support

Users of Microchip products can receive assistance through several channels:

- Distributor or Representative
- Local Sales Office
- Embedded Solutions Engineer (ESE)
- Technical Support

Customers should contact their distributor, representative or ESE for support. Local sales offices are also available to help customers. A listing of sales offices and locations is included in this document.

Technical support is available through the website at: www.microchip.com/support

Microchip Devices Code Protection Feature

Note the following details of the code protection feature on Microchip products:

- Microchip products meet the specifications contained in their particular Microchip Data Sheet.
- Microchip believes that its family of products is secure when used in the intended manner, within operating specifications, and under normal conditions.
- Microchip values and aggressively protects its intellectual property rights. Attempts to breach the code protection features of Microchip product is strictly prohibited and may violate the Digital Millennium Copyright Act.
- Neither Microchip nor any other semiconductor manufacturer can guarantee the security of its code. Code protection does not mean that we are guaranteeing the product is "unbreakable". Code protection is constantly evolving. Microchip is committed to continuously improving the code protection features of our products.

Legal Notice

This publication and the information herein may be used only with Microchip products, including to design, test, and integrate Microchip products with your application. Use of this information in any other manner violates these terms. Information regarding device applications is provided only for your convenience and may be superseded

by updates. It is your responsibility to ensure that your application meets with your specifications. Contact your local Microchip sales office for additional support or, obtain additional support at www.microchip.com/en-us/support/design-help/client-support-services.

THIS INFORMATION IS PROVIDED BY MICROCHIP "AS IS". MICROCHIP MAKES NO REPRESENTATIONS OR WARRANTIES OF ANY KIND WHETHER EXPRESS OR IMPLIED, WRITTEN OR ORAL, STATUTORY OR OTHERWISE, RELATED TO THE INFORMATION INCLUDING BUT NOT LIMITED TO ANY IMPLIED WARRANTIES OF NON-INFRINGEMENT, MERCHANTABILITY, AND FITNESS FOR A PARTICULAR PURPOSE, OR WARRANTIES RELATED TO ITS CONDITION, QUALITY, OR PERFORMANCE.

IN NO EVENT WILL MICROCHIP BE LIABLE FOR ANY INDIRECT, SPECIAL, PUNITIVE, INCIDENTAL, OR CONSEQUENTIAL LOSS, DAMAGE, COST, OR EXPENSE OF ANY KIND WHATSOEVER RELATED TO THE INFORMATION OR ITS USE, HOWEVER CAUSED, EVEN IF MICROCHIP HAS BEEN ADVISED OF THE POSSIBILITY OR THE DAMAGES ARE FORESEEABLE. TO THE FULLEST EXTENT ALLOWED BY LAW, MICROCHIP'S TOTAL LIABILITY ON ALL CLAIMS IN ANY WAY RELATED TO THE INFORMATION OR ITS USE WILL NOT EXCEED THE AMOUNT OF FEES, IF ANY, THAT YOU HAVE PAID DIRECTLY TO MICROCHIP FOR THE INFORMATION.

Use of Microchip devices in life support and/or safety applications is entirely at the buyer's risk, and the buyer agrees to defend, indemnify and hold harmless Microchip from any and all damages, claims, suits, or expenses resulting from such use. No licenses are conveyed, implicitly or otherwise, under any Microchip intellectual property rights unless otherwise stated.

Trademarks

The Microchip name and logo, the Microchip logo, Adaptec, AVR, AVR logo, AVR Freaks, BesTime, BitCloud, CryptoMemory, CryptoRF, dsPIC, flexPWR, HELDO, IGLOO, JukeBlox, KeeLoq, Kleer, LANCheck, LinkMD, maXStylus, maXTouch, MediaLB, megaAVR, Microsemi, Microsemi logo, MOST, MOST logo, MPLAB, OptoLyzer, PIC, picoPower, PICSTART, PIC32 logo, PolarFire, Prochip Designer, QTouch, SAM-BA, SenGenuity, SpyNIC, SST, SST Logo, SuperFlash, Symmetricom, SyncServer, Tachyon, TimeSource, tinyAVR, UNI/O, Vectron, and XMEGA are registered trademarks of Microchip Technology Incorporated in the U.S.A. and other countries.

AgileSwitch, APT, ClockWorks, The Embedded Control Solutions Company, EtherSynch, Flashtec, Hyper Speed Control, HyperLight Load, Libero, motorBench, mTouch, Powermite 3, Precision Edge, ProASIC, ProASIC Plus, ProASIC Plus logo, Quiet- Wire, SmartFusion, SyncWorld, Temux, TimeCesium, TimeHub, TimePicta, TimeProvider, TrueTime, and ZL are registered trademarks of Microchip Technology Incorporated in the U.S.A.

Adjacent Key Suppression, AKS, Analog-for-the-Digital Age, Any Capacitor, AnyIn, AnyOut, Augmented Switching, BlueSky, BodyCom, Clockstudio, CodeGuard, CryptoAuthentication, CryptoAutomotive, CryptoCompanion, CryptoController, dsPICDEM, dsPICDEM.net, Dynamic Average Matching, DAM, ECAN, Espresso T1S, EtherGREEN, GridTime, IdealBridge, In-Circuit Serial Programming, ICSP, INICnet, Intelligent Paralleling, IntelliMOS, Inter-Chip Connectivity, JitterBlocker, Knob-on-Display, KoD, maxCrypto, maxView, memBrain, Mindi, MiWi, MPASM, MPF, MPLAB Certified logo, MPLIB, MPLINK, MultiTRAK, NetDetach, Omniscient Code Generation, PICDEM, PICDEM.net, PICkit, PICtail, PowerSmart, PureSilicon, QMatrix, REAL ICE, Ripple Blocker, RTAX, RTG4, SAM-ICE, Serial Quad I/O, simpleMAP, SimpliPHY, SmartBuffer, SmartHLS, SMART-I.S., storClad, SQL, SuperSwitcher, SuperSwitcher II, Switchtec, SynchroPHY, Total Endurance, Trusted Time, TSHARC, USBCheck, VariSense, VectorBlox, VeriPHY, ViewSpan, WiperLock, XpressConnect, and ZENA are trademarks of Microchip Technology Incorporated in the U.S.A. and other countries.

SQTP is a service mark of Microchip Technology Incorporated in the U.S.A.

The Adaptec logo, Frequency on Demand, Silicon Storage Technology, and Symmcom are registered trademarks of Microchip Technology Inc. in other countries.

GestIC is a registered trademark of Microchip Technology Germany II GmbH & Co. KG, a subsidiary of Microchip Technology Inc., in other countries.

All other trademarks mentioned herein are property of their respective companies.

© 2020-2022, Microchip Technology Incorporated and its subsidiaries. All Rights Reserved.

ISBN: 978-1-6683-1060-1

AMBA, Arm, Arm7, Arm7TDMI, Arm9, Arm11, Artisan, big.LITTLE, Cordio, CoreLink, CoreSight, Cortex, DesignStart, DynamiQ, Jazelle, Keil, Mali, Mbed, Mbed Enabled, NEON, POP, RealView, SecurCore, Socrates, Thumb, TrustZone, ULINK, ULINK2, ULINK-ME, ULINK-PLUS, ULINKpro, μ Vision, Versatile are trademarks or registered trademarks of Arm Limited (or its subsidiaries) in the US and/or elsewhere.

Quality Management System

For information regarding Microchip's Quality Management Systems, please visit www.microchip.com/quality.

Worldwide Sales and Service

AMERICAS	ASIA/PACIFIC	ASIA/PACIFIC	EUROPE
Corporate Office 2355 West Chandler Blvd. Chandler, AZ 85224-6199 Tel: 480-792-7200 Fax: 480-792-7277 Technical Support: www.microchip.com/support Web Address: www.microchip.com	Australia - Sydney Tel: 61-2-9868-6733 China - Beijing Tel: 86-10-8569-7000 China - Chengdu Tel: 86-28-8665-5511 China - Chongqing Tel: 86-23-8980-9588 China - Dongguan Tel: 86-769-8702-9880 China - Guangzhou Tel: 86-20-8755-8029 China - Hangzhou Tel: 86-571-8792-8115 China - Hong Kong SAR Tel: 852-2943-5100 China - Nanjing Tel: 86-25-8473-2460 China - Qingdao Tel: 86-532-8502-7355 China - Shanghai Tel: 86-21-3326-8000 China - Shenyang Tel: 86-24-2334-2829 China - Shenzhen Tel: 86-755-8864-2200 China - Suzhou Tel: 86-186-6233-1526 China - Wuhan Tel: 86-27-5980-5300 China - Xian Tel: 86-29-8833-7252 China - Xiamen Tel: 86-592-2388138 China - Zhuhai Tel: 86-756-3210040	India - Bangalore Tel: 91-80-3090-4444 India - New Delhi Tel: 91-11-4160-8631 India - Pune Tel: 91-20-4121-0141 Japan - Osaka Tel: 81-6-6152-7160 Japan - Tokyo Tel: 81-3-6880-3770 Korea - Daegu Tel: 82-53-744-4301 Korea - Seoul Tel: 82-2-554-7200 Malaysia - Kuala Lumpur Tel: 60-3-7651-7906 Malaysia - Penang Tel: 60-4-227-8870 Philippines - Manila Tel: 63-2-634-9065 Singapore Tel: 65-6334-8870 Taiwan - Hsin Chu Tel: 886-3-577-8366 Taiwan - Kaohsiung Tel: 886-7-213-7830 Taiwan - Taipei Tel: 886-2-2508-8600 Thailand - Bangkok Tel: 66-2-694-1351 Vietnam - Ho Chi Minh Tel: 84-28-5448-2100	Austria - Wels Tel: 43-7242-2244-39 Fax: 43-7242-2244-393 Denmark - Copenhagen Tel: 45-4485-5910 Fax: 45-4485-2829 Finland - Espoo Tel: 358-9-4520-820 France - Paris Tel: 33-1-69-53-63-20 Fax: 33-1-69-30-90-79 Germany - Garching Tel: 49-8931-9700 Germany - Haan Tel: 49-2129-3766400 Germany - Heilbronn Tel: 49-7131-72400 Germany - Karlsruhe Tel: 49-721-625370 Germany - Munich Tel: 49-89-627-144-0 Fax: 49-89-627-144-44 Germany - Rosenheim Tel: 49-8031-354-560 Israel - Ra'anana Tel: 972-9-744-7705 Italy - Milan Tel: 39-0331-742611 Fax: 39-0331-466781 Italy - Padova Tel: 39-049-7625286 Netherlands - Drunen Tel: 31-416-690399 Fax: 31-416-690340 Norway - Trondheim Tel: 47-72884388 Poland - Warsaw Tel: 48-22-3325737 Romania - Bucharest Tel: 40-21-407-87-50 Spain - Madrid Tel: 34-91-708-08-90 Fax: 34-91-708-08-91 Sweden - Gothenberg Tel: 46-31-704-60-40 Sweden - Stockholm Tel: 46-8-5090-4654 UK - Wokingham Tel: 44-118-921-5800 Fax: 44-118-921-5820