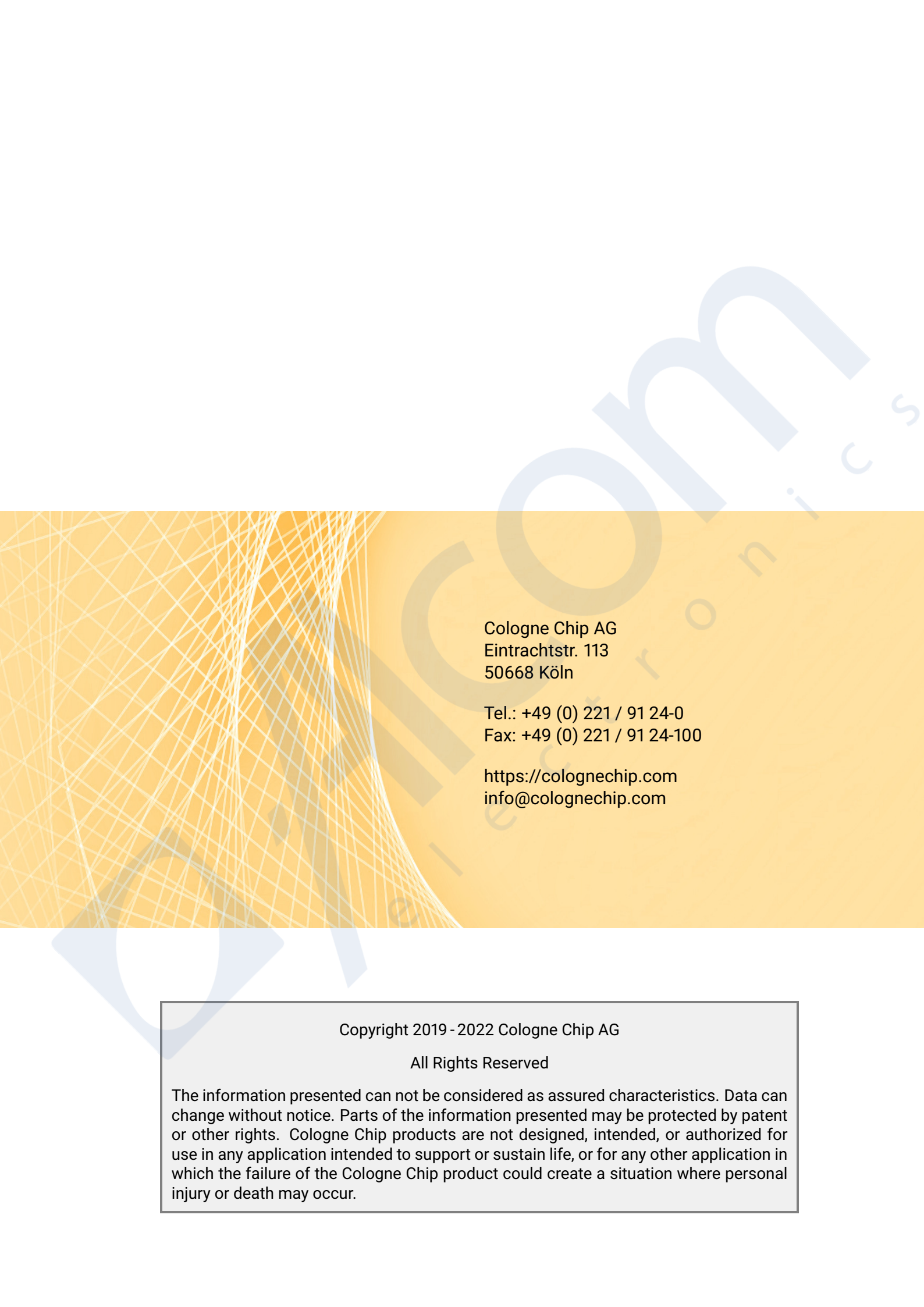




# GateMate™ FPGA Programmer Datasheet

## Programmer Version 1.3





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# About this Document

This datasheet covers the GateMate™ FPGA Programmer of Cologne Chip and is part of the GateMate™ FPGA documentation collection.

For more information please refer to the following documents:

- [Technology Brief of GateMate™ FPGA](#)
- [DS1001 – GateMate™ FPGA CCGM1A1 Datasheet](#)
- [UG1002 – GateMate™ FPGA Toolchain Installation User Guide](#)

Cologne Chip provides a comprehensive technical support. Please visit our website for more information or contact our support team.

## Revision History

This Datasheet is constantly updated. The latest version of the document can be found following the link below:

[DS1002 – GateMate™ FPGA Programmer Board Ver. 1.3 Datasheet](#)

Date	Remarks
March 2022	Initial release.



# Chapter 1

## Introduction



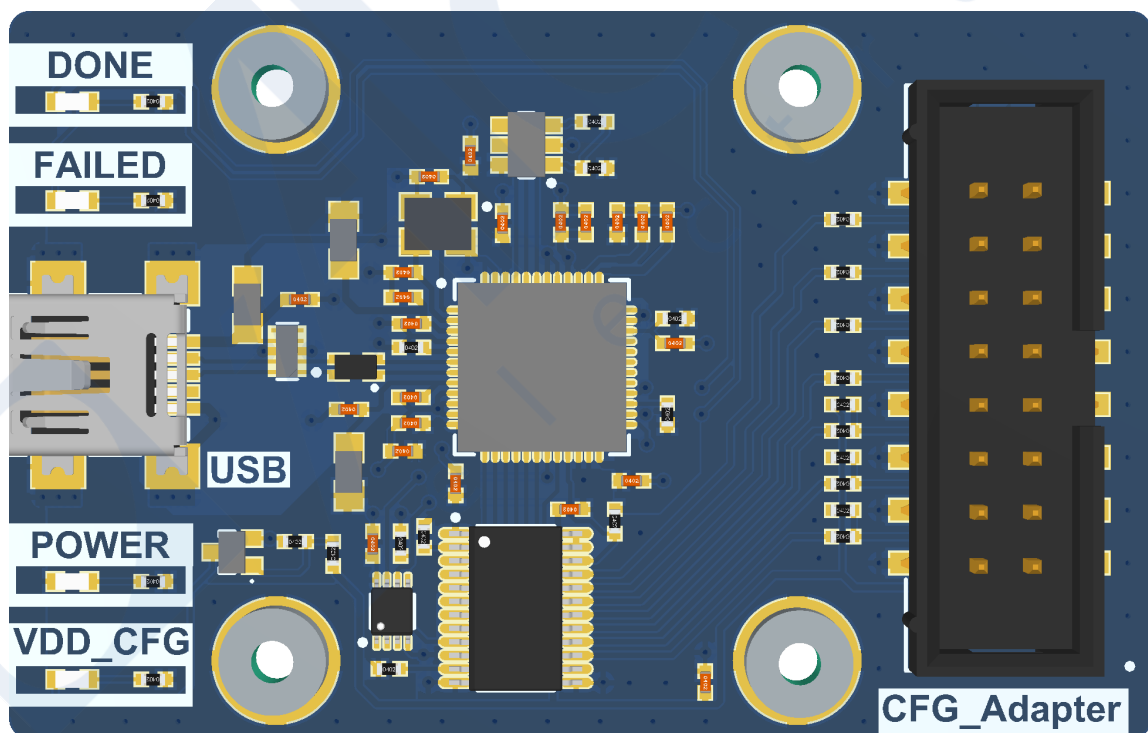
Figure 1.1: Top view of the GateMate™ FPGA Programmer (including module cover)

The GateMate™ FPGA Programmer allows an easy and flexible access to the GateMate™ FPGA. The configuration can be loaded from any host computer via USB interface into the FPGA. Furthermore, the flash memory, which is typically available at the user application can be accessed as well.

The main features of the programmer are

- FTDI FT232HQ USB bridge
- USB 2.0 to JTAG and SPI bridge provided by FTDI's Multi-Protocol Synchronous Serial Engine (MPSSE)
- Mini-USB B connector
- USB-powered
- Configuration voltage VDD\_CFG required from user application
- 4 status LEDs
- Form factor 35×55 mm

This document describes how to set up the GateMate™ FPGA Programmer and explains the different use cases.



**Figure 1.2:** Top view of the GateMate™ FPGA Programmer (module cover removed)



# Chapter 2

## Block Diagram

Figure 2.1 shows the block diagram of the GateMate™ FPGA Programmer and its embedding between the host controller and the user application.

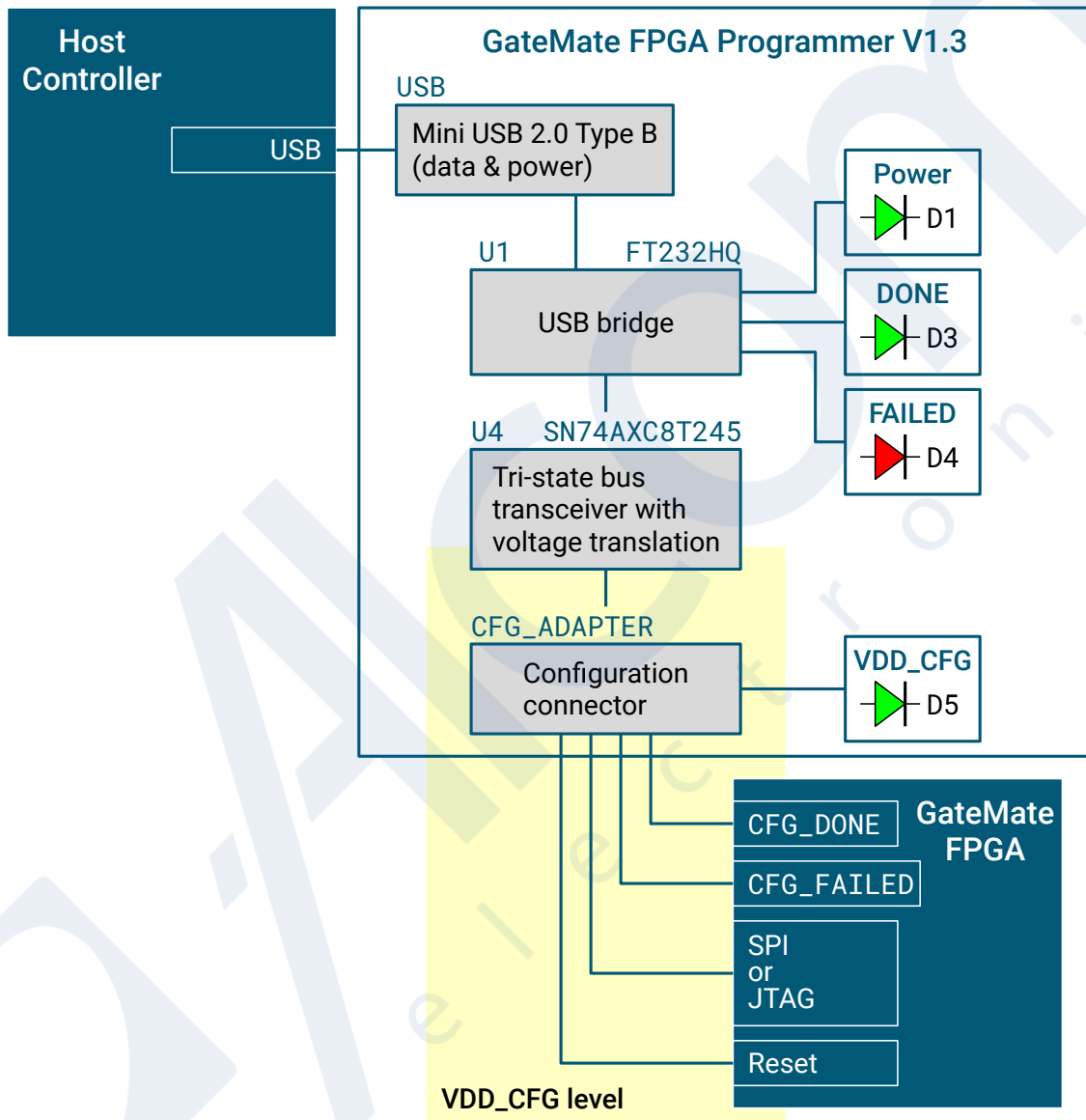
Typically, the host controller is any computer that comes with an USB interface. The programmer software runs on both Microsoft Windows and Linux.

Four LEDs display the current state of the GateMate™ FPGA Programmer device as described in Table 2.1.

**Table 2.1:** GateMate™ FPGA Programmer LED signaling

LED	color	Description
D1	green	USB power available from host controller
D3	green	Configuration Done signaling
D4	red	Configuration Failed signaling
D5	green	Power from FPGA application (configuration GPIO bank) available

The location of the main components can be found in Figure 2.2. Table 2.2 gives a short specification of these components. For more details, please see the schematics in Appendix A.



**Figure 2.1:** Block diagram of the GateMate™ FPGA Programmer

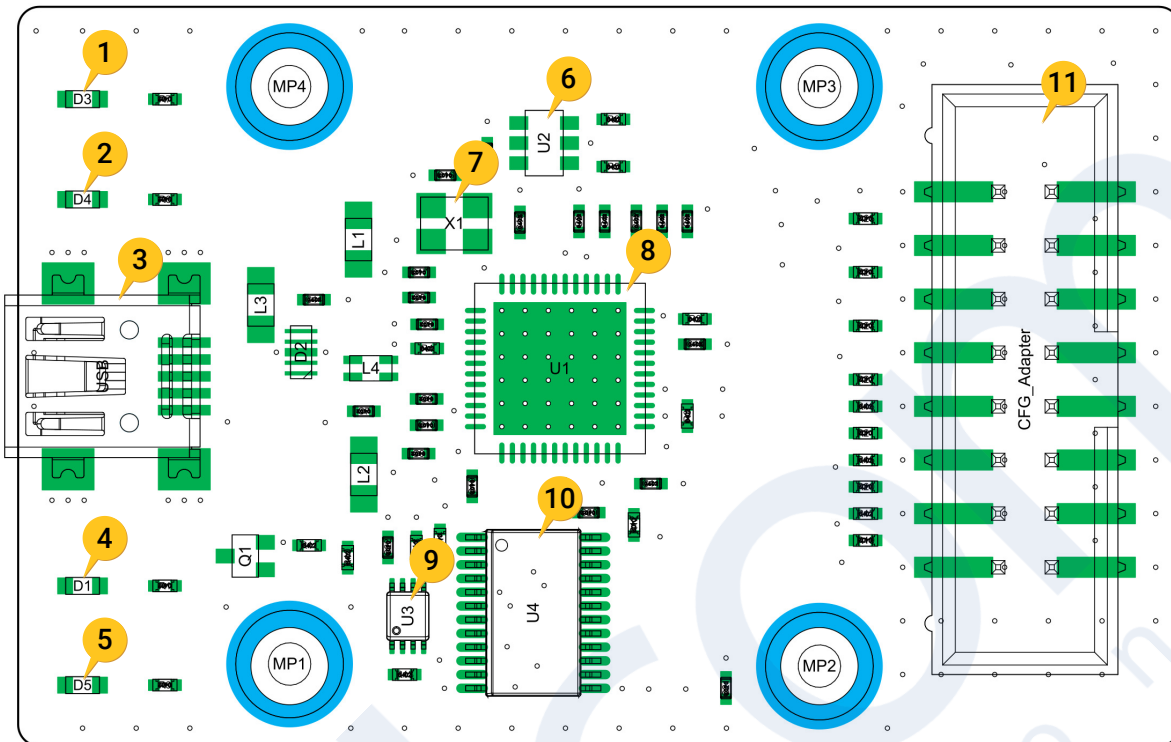


Figure 2.2: Main components of the GateMate™ FPGA Programmer (top side)

Table 2.2: Main components of the GateMate™ FPGA Programmer (top side)

Number	Designator	Component
1	D3	Status LED CFG_DONE (from USB bridge)
2	D4	Status LED CFG_FAILED_N (from USB bridge)
3	USB	Mini USB 2.0 Type B Receptacle
4	D1	Status LED for power from USB host
5	D5	Status LED for GPIO power from CFG_Adapter
6	U2	Microchip 93LC56BT-I/OT, 2 Kbit 128×16, 2.5 V, FTDI configuration EEPROM
7	X1	Oscillator 12.000 MHz ±30ppm, 8 pF
8	U1	Microchip FTDI FT232HQ-Tray
9	U3	Microchip SN74AUP2G00DCUR, failed detection latch
10	U4	Microchip SN74AXC8T245PWR, bus transceiver U1 / CFG_Adapter
11	CFG_Adapter	Male box header, pitch 2.54 mm, 2×8 pins



# Chapter 3

## Startup

### 3.1 Connection to the User Application

To connect the GateMate™ FPGA Programmer to the user application, the connector CFG\_Adapter must be used. Figure 3.1 shows the signals of this connector. Depending on the user's requirements, it can act as JTAG or SPI bus. The detailed BGA connection is described in Table 3.1 for both interfaces.

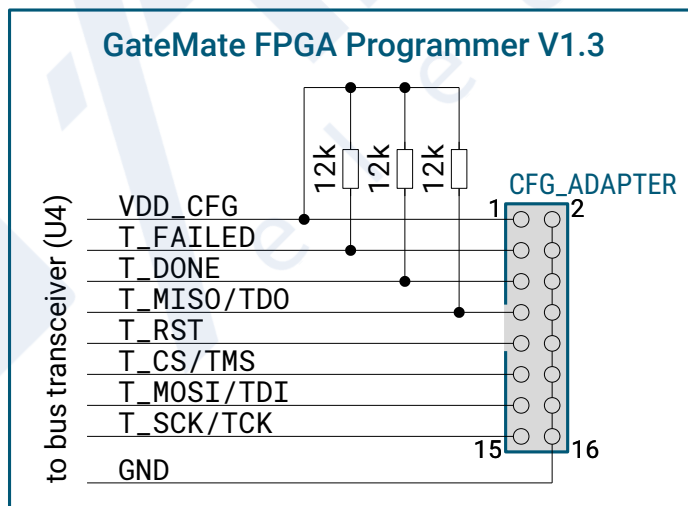


Figure 3.1: Connecting the GateMate™ FPGA Programmer with the GateMate FPGA

The GateMate™ FPGA Programmer is USB bus powered. The connector CFG\_Adapter requires power supply from the FPGA configuration GPIO bank (signal VDD\_CFG) for opera-

tion. The pull-up resistors shown in Figure 3.1 are populated on the programmer’s printed circuit board (PCB).

No further hardware setup is required.

**Table 3.1:** GateMate™ FPGA Programmer configuration adapter

GateMate™ FPGA Programmer CFG_ADAPTER		GateMate FPGA JTAG interface		GateMate FPGA SPI interface	
pin	signal name	ball	signal name	ball	signal name
1	VDD_CFG	U3 <sup>1</sup>	VDD_WA	U3 <sup>1</sup>	VDD_WA
3	T_FAILED	V2	CFG_FAILED_N	V2	CFG_FAILED_N
5	T_DONE	V3	CFG_DONE	V3	CFG_DONE
7	T_MISO / TDO	U2	JTAG_TDO	P1	SPI_D1
9	T_RST	T15	RST_N	T15	RST_N
11	T_CS / TMS	T3	JTAG_TMS	N3	SPI_CS_N
13	T_MOSI / TDI	T2	JTAG_TDI	P2	SPI_D0
15	T_SCK / TCK	R3	JTAG_TCK	N4	SPI_CLK
2,4,6,...,16	GND	V18 <sup>1</sup>	GND	V18 <sup>1</sup>	GND


<sup>1</sup>and others

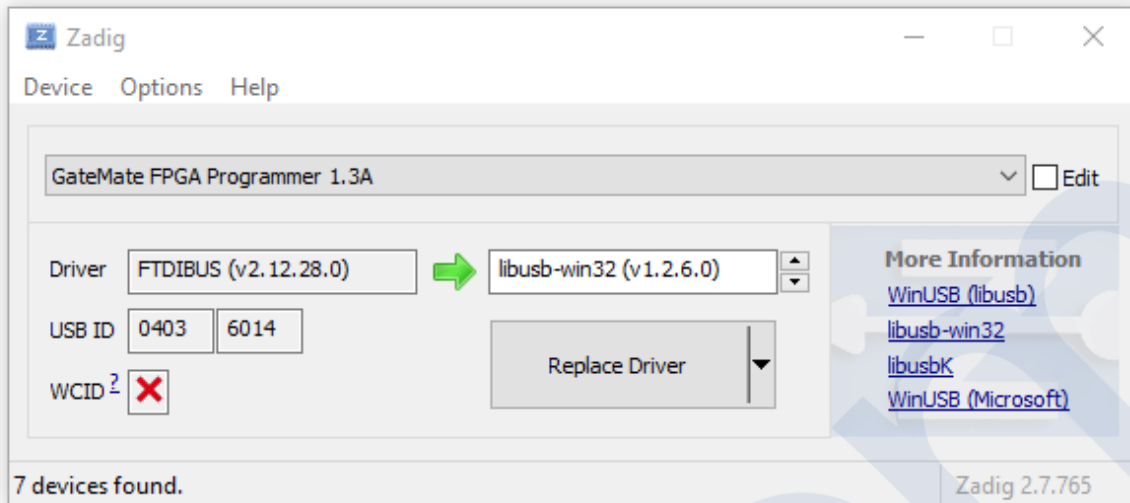
### 3.2 Connection to the Host Controller

The GateMate™ FPGA Programmer requires a computer with Linux or Windows operating system as follows:

- Supported Linux environments:
  - Debian-based Linux (Debian, Ubuntu, ...) with apt package manager
  - Arch-based Linux (Arch, Manjaro, ...) with pacman package manager
  - Red Hat-based Linux (Fedora, ...) with dnf or yum package manager
- Windows environments:
  - Windows 7 or later, 64 bit
  - Zadig USB driver installer  
<https://zadig.akeo.ie/>

When first plugged into the computer’s USB port, drivers should load by default.

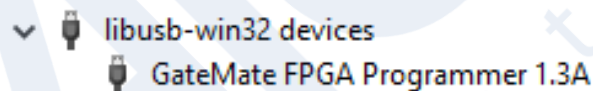
In Windows environments, however, it is necessary to change the default USB driver using Zadig . Download the software and connect the GateMate™ FPGA Programmer to any USB port. In the Zadig Window, select **Options > List All Devices** to refresh the device list. From the drop-down list, select **GateMate FPGA Programmer 1.3A**. Now select **libusb-win32 (any version)** from the driver list and replace the drivers (see Figure 3.2).



**Figure 3.2:** Zadig Window with selected GateMate™ FPGA Programmer

Replacing drivers might take a moment. Your GateMate™ FPGA Programmer should then be listed as **libusb-win32** device in the Device Manager as shown in Figure 3.3.

In Linux environments, no driver installation is required. The device should enumerate as FT232H using the `lsusb` command.



**Figure 3.3:** GateMate™ FPGA Programmer in Device Manager

The tool setup for the Cologne Chip GateMate™ series is described in the user guide [UG1002 – GateMate™ FPGA Toolchain Installation User Guide](#)





# Chapter 4

## Loading the FPGA Configuration

GateMate FPGA configuration can be loaded either via the JTAG or SPI interfaces. Both options are described in this chapter.

It is assumed that the user application has, among other things, a GateMate FPGA and a flash memory from which the configuration is loaded during normal operation. In this chapter it is described, how configuration bit files can be handled alternatively with the GateMate™ FPGA Programmer during the application development.

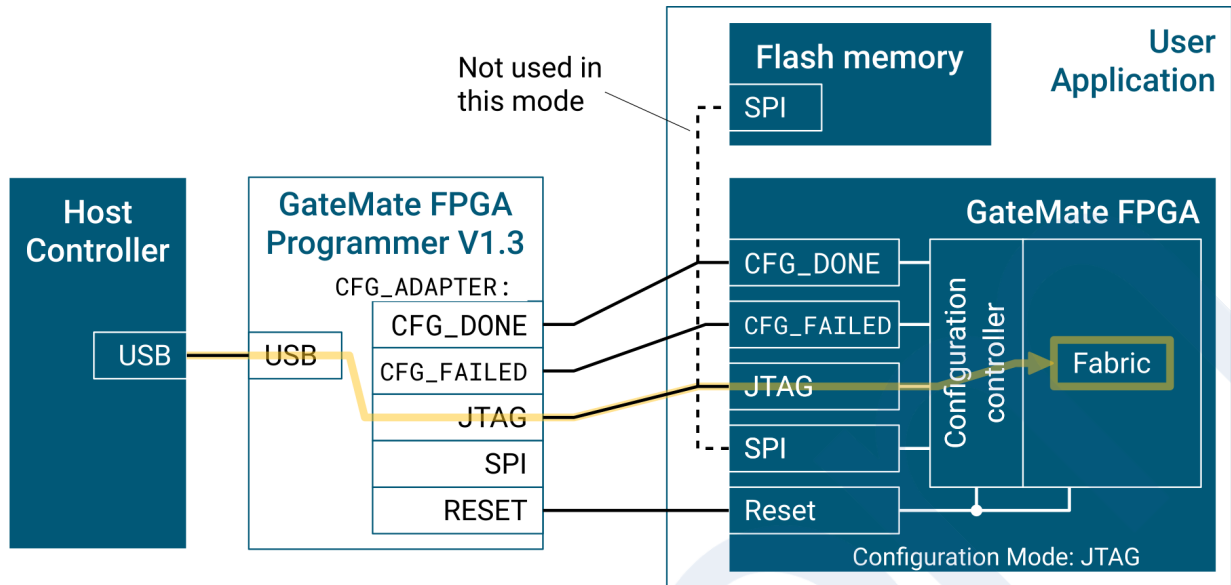
### 4.1 Loading the FPGA Configuration via the JTAG Interface

In this mode, the programmer is configured to send the configuration bitstream directly to the FPGA via JTAG as shown in Figure 4.1. The FPGA configuration mode pins CFG\_MD[3:0] must be set to 0xC (JTAG).

An active CFG\_DONE and inactive CFG\_FAILED signal indicates successful configuration. The CFG\_FAILED signal may send a pulse during configuration in case of any error. Note that the CFG\_DONE and CFG\_FAILED pins can be configured as user GPIO. In this case no configuration status can be read back.

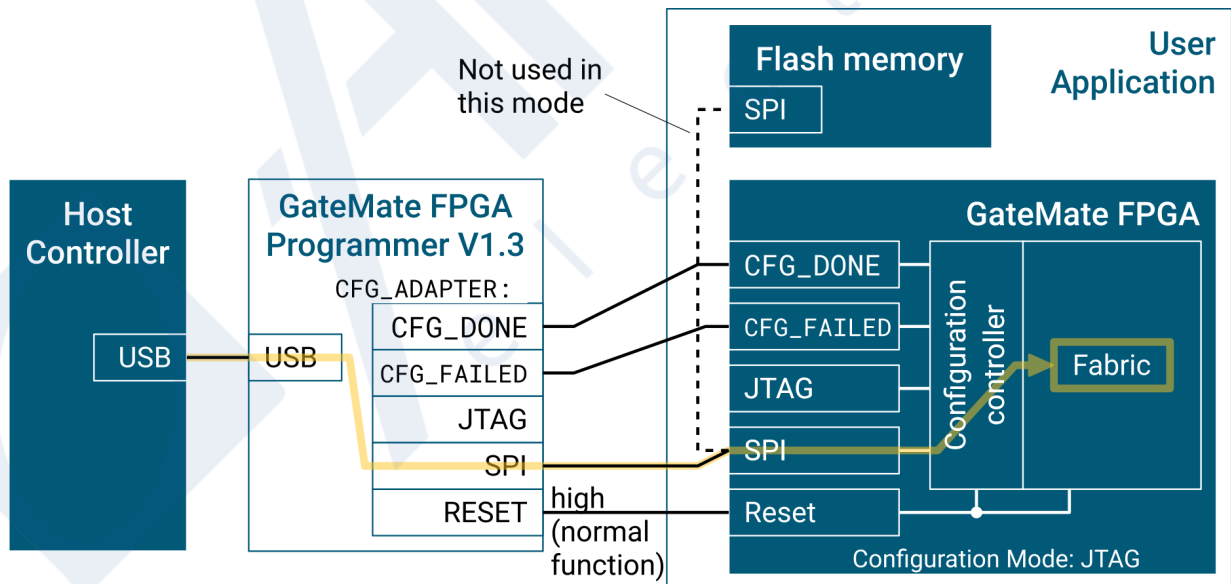
### 4.2 Loading the FPGA Configuration via the SPI Interface

In this mode, the programmer is configured to send the configuration bitstream directly to the FPGA via SPI as shown in Figure 4.2. The FPGA configuration mode pins CFG\_MD[3:0] must be set to 0x4 (SPI slave mode).



**Figure 4.1:** Loading the FPGA configuration via the JTAG interface

An active CFG\_DONE and inactive CFG\_FAILED signal indicates successful configuration. The CFG\_FAILED signal may send a pulse during configuration in case of any error. Note that the CFG\_DONE and CFG\_FAILED pins can be configured as user GPIO. In this case no configuration status can be read back.



**Figure 4.2:** Loading the FPGA configuration via the SPI interface

# Chapter 5

## Access to the Flash Memory

The GateMate™ FPGA Programmer offers an easy way to access the user application's flash memory. Again, two ways are possible as described in this chapter.

### 5.1 Access to the Flash Memory via the JTAG Interface

The GateMate™ FPGA configuration controller has a built-in JTAG-SPI-bridge to access an external SPI flash memory using the JTAG interface.

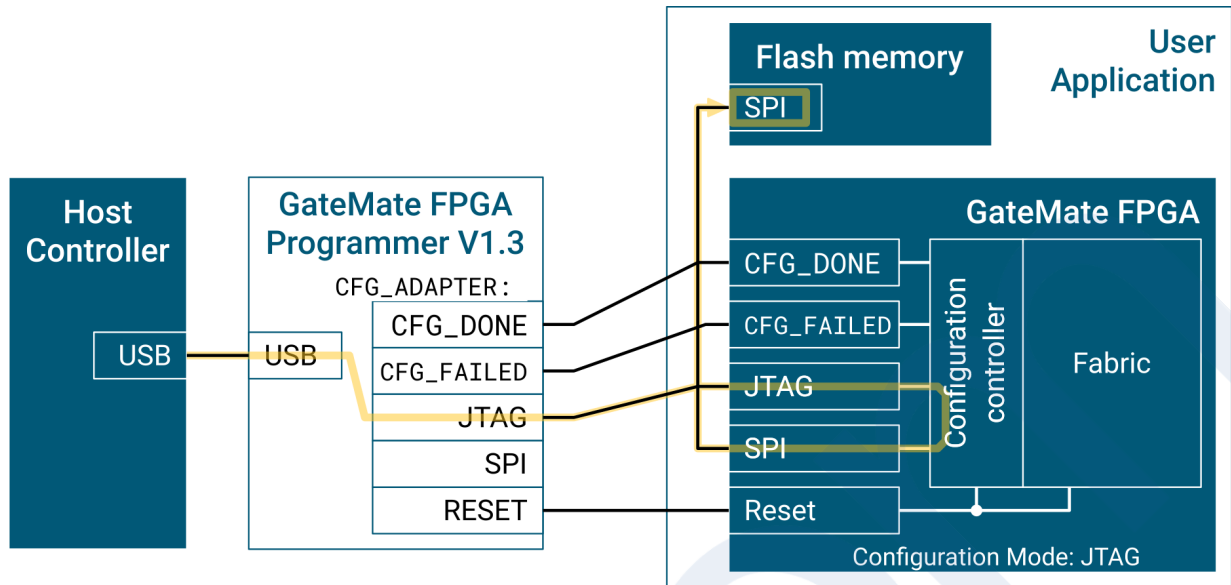
Handling of the JTAG-SPI-bridge is described in the GateMate™ FPGA datasheet [↗](#).

In this mode, the programmer is configured to send the configuration bitstream or any other data to the external SPI flash memory via JTAG as shown in Figure 5.1. The FPGA configuration mode pins `CFG_MD[3:0]` must be set to `0xC` (JTAG). Further prerequisite is that the FPGA configuration bank is not configured as user GPIO.

In this configuration, both `CFG_DONE` and `CFG_FAILED` signals don't output any status information.

### 5.2 Access to the Flash Memory via the SPI Interface

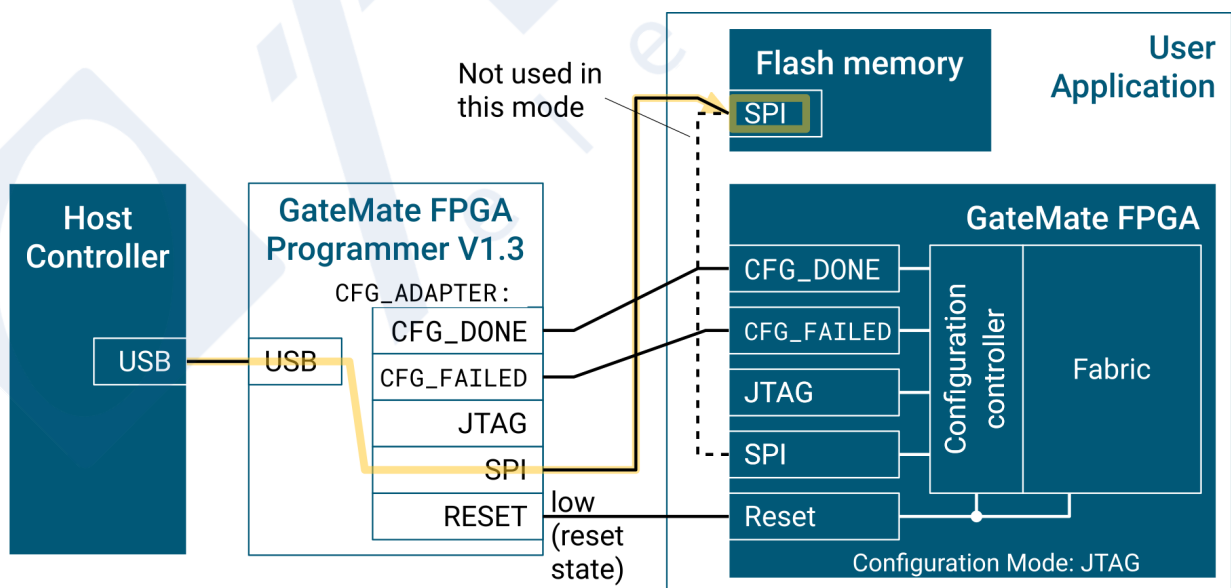
The following configuration requires a direct connection of the SPI signals to the external flash memory. Both external flash memory and GateMate™ FPGA may share the same signals.



**Figure 5.1:** Access to the flash memory via the JTAG interface

In this mode, the programmer is configured to send the configuration bitstream or any other data directly to the external SPI flash memory as shown in Figure 5.2. Prerequisite is that the FPGA acts passively on the SPI bus. If both FPGA and external flash memory share the same bus signals, it is required to keep the FPGA in active reset while programming the external flash memory.

After successful programming, the reset signal may be released to start the FPGA configuration e.g. in SPI master mode.



**Figure 5.2:** Access to the flash memory via the SPI interface

# Chapter 6

## Electrical Characteristics

**Table 6.1:** Absolute maximum characteristics of the GateMate™ FPGA Programmer

Symbol	Min	Typ	Max	Unit	Description
	-40		125	°C	Junction temperature
$V_{BUS}$	-0.3		5.8	V	USB Voltage
$V_{DD_{CFG}}$	-0.5		4.2	V	Target Supply Voltage
$V_i$	-0.5		4.2	V	Input Signals on CFG_ADAPTER
$V_o$	-0.5		4.2	V	Output Signals on CFG_ADAPTER
$T_{stg}$	-55		150	°C	Storage temperature

**Table 6.2:** Operating characteristics of the GateMate™ FPGA Programmer

Symbol	Min	Typ	Max	Unit	Description
	-40		85	°C	Operating temperature
$V_{BUS}$	4.75	5.0	5.25	V	USB Voltage
$V_{DD_{CFG}}$	1.4		2.75	V	Target Supply Voltage
$V_i$	0		2.75	V	Input Signals
$V_o$	0		2.75	V	Output Signals Active
	0		$V_{DD_{CFG}}$	V	Output Signals Tri-State



# Chapter 7

## Mechanical Dimensions

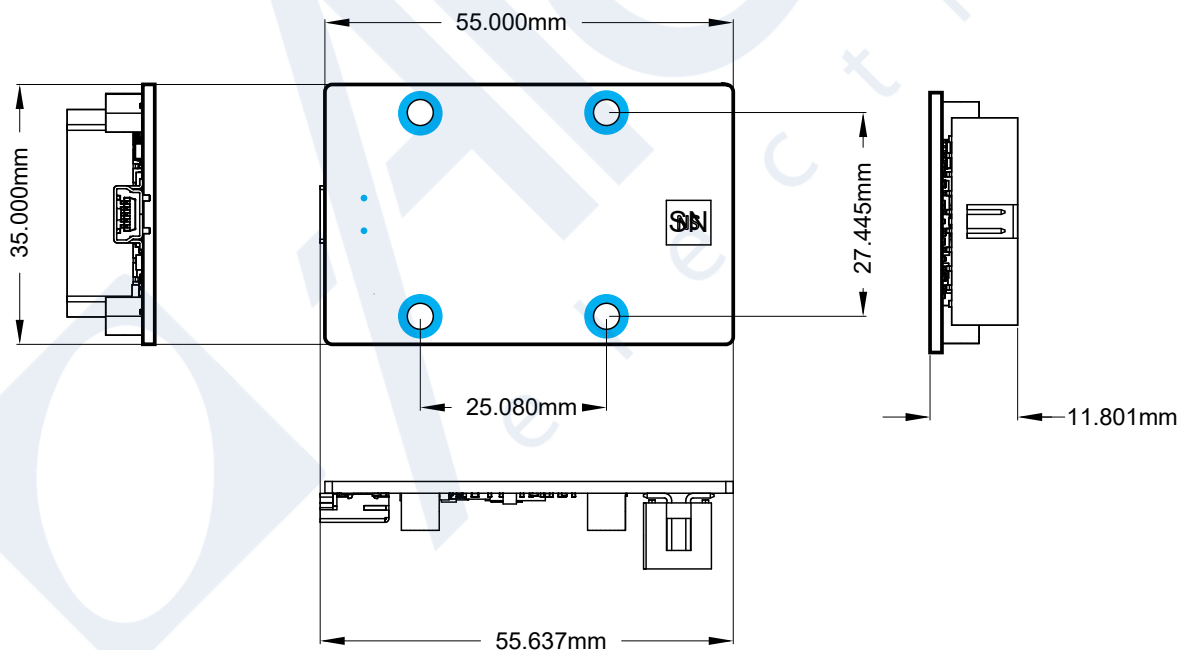


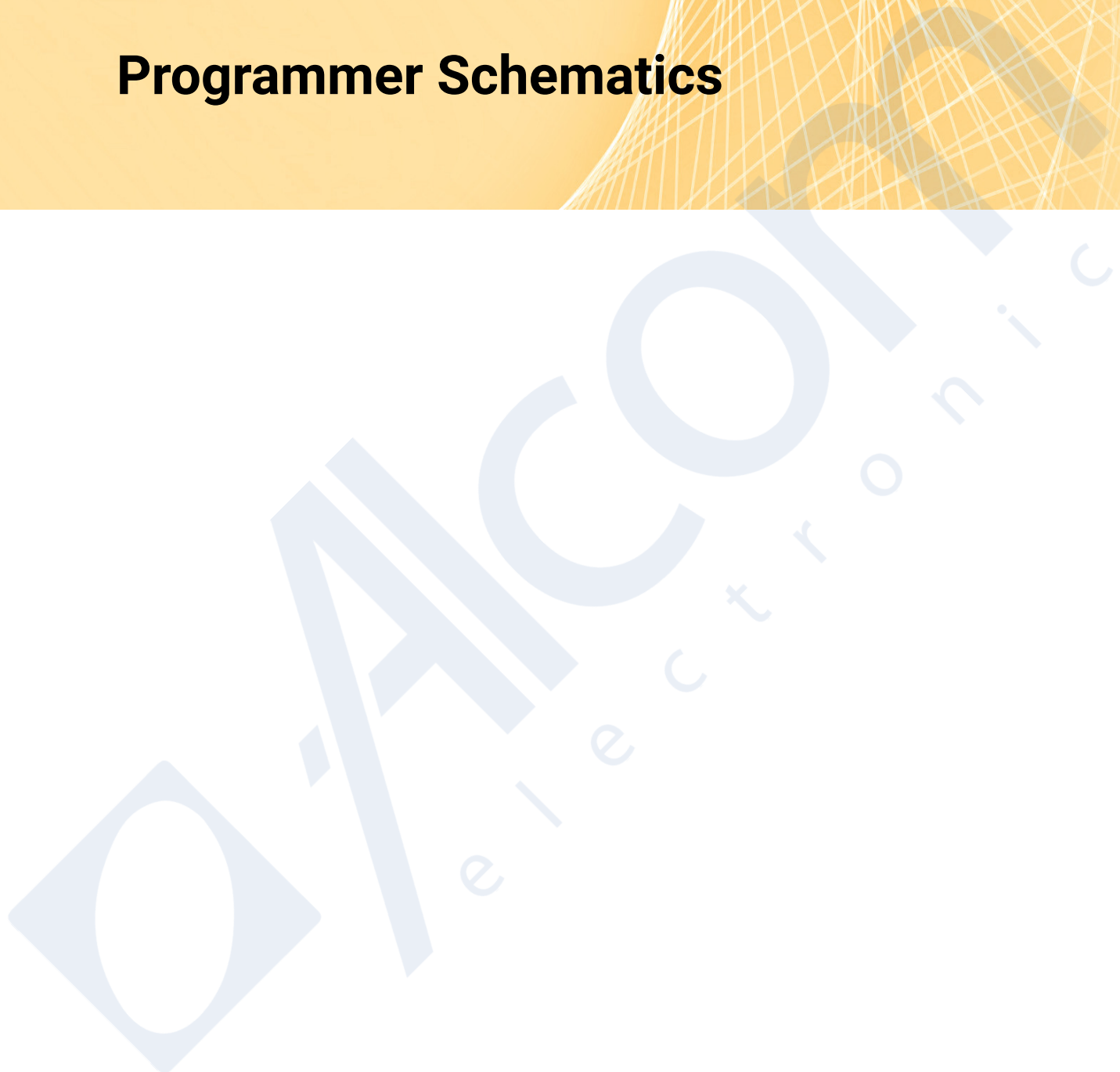
Figure 7.1: Mechanical dimensions of the GateMate™ FPGA Programmer (top side)

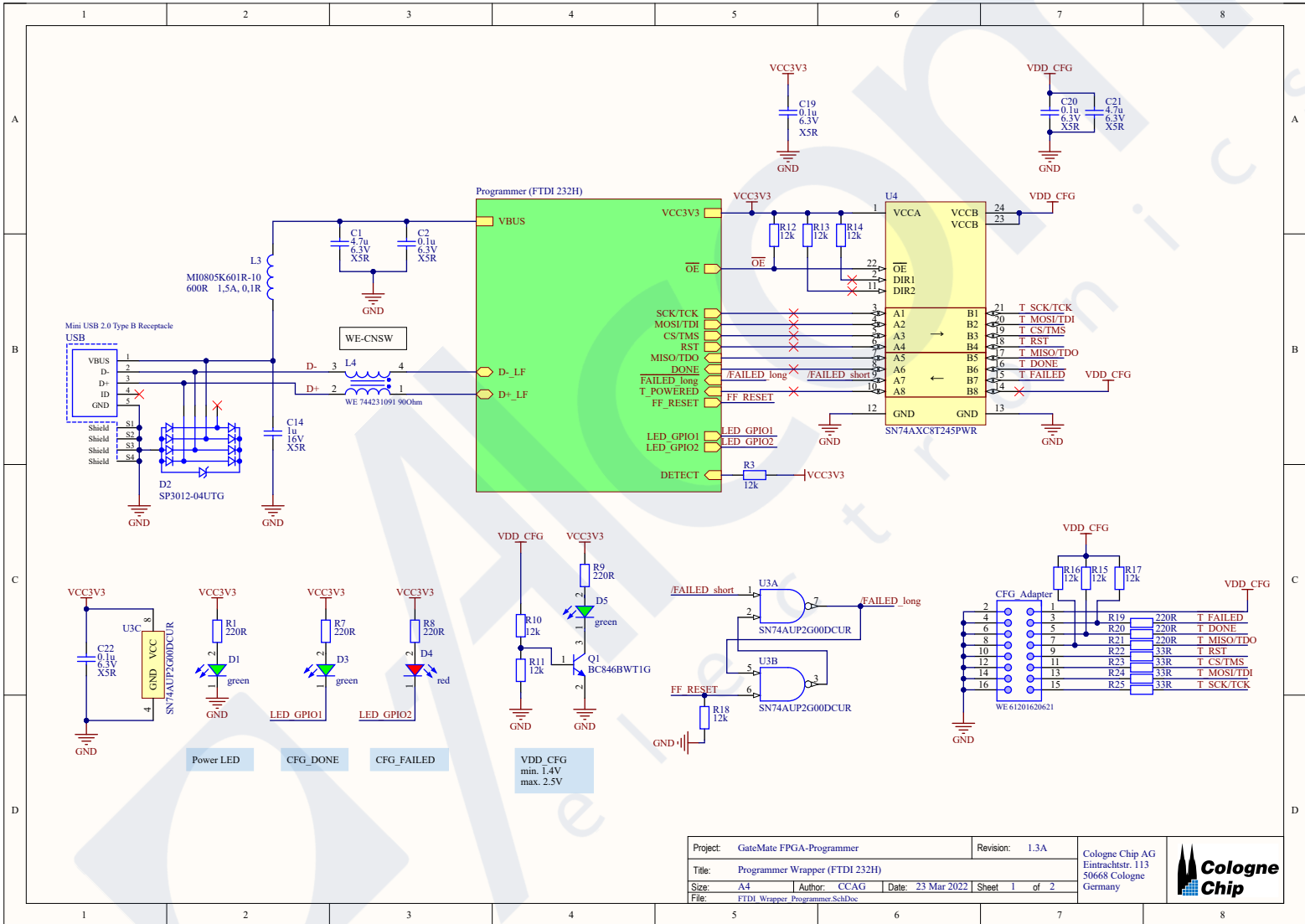




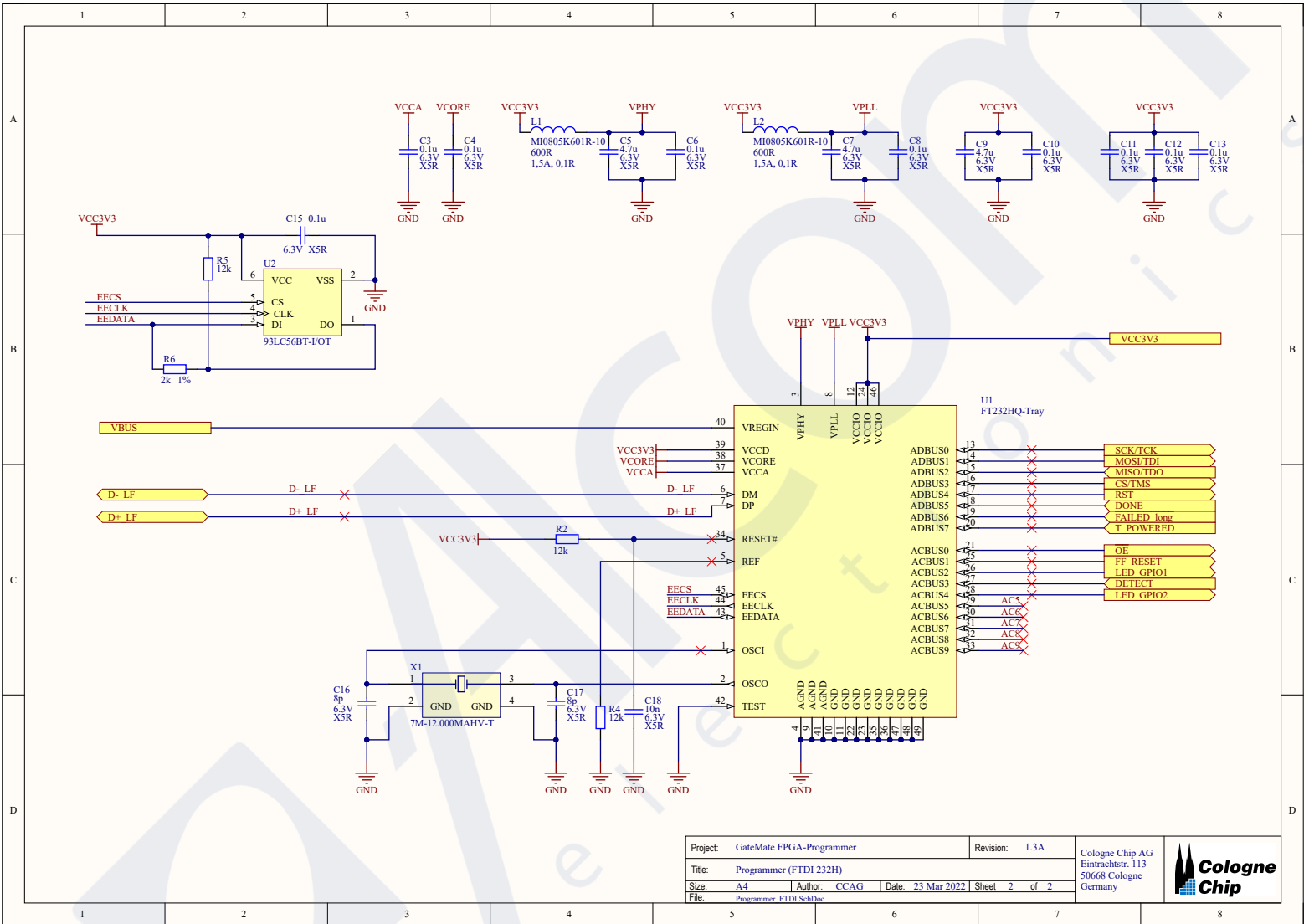
# Appendix A

## Programmer Schematics





Project:	GateMate FPGA-Programmer	Revision:	1.3A	<p>Cologne Chip AG Eintrachtstr. 113 50668 Cologne Germany</p>				
Title:	Programmer Wrapper (FTDI 232H)							
Size:	A4	Author:	CCAG		Date:	23 Mar 2022	Sheet	1 of 2
File:	FTDI Wrapper Programmer_Sch.Doc							



Project:	GateMate FPGA-Programmer	Revision:	1.3A
Title:	Programmer (FTDI 232H)		
Size:	A4	Author:	CCAG
File:	Programmer_FTDI_SchDoc	Date:	23 Mar 2022
		Sheet:	2 of 2

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