KIT-FPG1-T2G-B-E-2M automotive fingerprint evaluation kit guide

About this document

Scope and purpose

This document provides information on how to use the Infineon fingerprint evaluation kit (KIT-FPG1-T2G-B-E-2M). The kit consists of an Infineon fingerprint evaluation board designed to work with the Infineon fingerprint match module, the Infineon fingerprint sensor module, and the software used to evaluate the hardware.

Intended audience

This document is intended for anyone who uses it to evaluate the Infineon fingerprint sensor.

Document conventions

Convention	Explanation
Bold	Emphasizes heading levels, column headings, table and figure captions, screen names, windows, dialog boxes, menus and sub-menus

Abbreviations and definitions

Abbreviation	Definition
CAN	Controller Area Network
CMSIS	Common Microcontroller Software Interface Standard
DAP	Debug Access Point
EVB	Evaluation Board
FPG	Fingerprint
FPMM	Fingerprint Matcher Module
FPSM	Fingerprint Sensor Module
GPIO	General Purpose Input Output
GUI	Graphical User Interface
LIN	Local Interconnect Network
SPI	Serial Peripheral Interface
UART	Universal Asynchronous Receiver Transmitter
USB	Universal Serial Bus

Table of contents

1 Introduction

This user guide describes the evaluation board (KIT-FPG1-T2G-B-E-2M) details and other components of the kit can be found in their respective user guides or datasheets.

Table 1-1. Contents – Infineon fingerprint kit

Quantity	Description	Part number
1	Evaluation board (EVB)	CYFPEVB-1100-0-Rev-3
1	Fingerprint match module (FPMM)	KIT-FPG1_T2G-B-E-2M Rev01
1	Fingerprint sensor module (FPSM)	CYFPSM-10000AAI-01
1	Micro USB cable	–
1	Quick start guide	–

Figure 1-1 shows the complete Infineon embedded fingerprint solution kit and all the hardware boards required in the system for evaluating the Infineon embedded fingerprint solution.

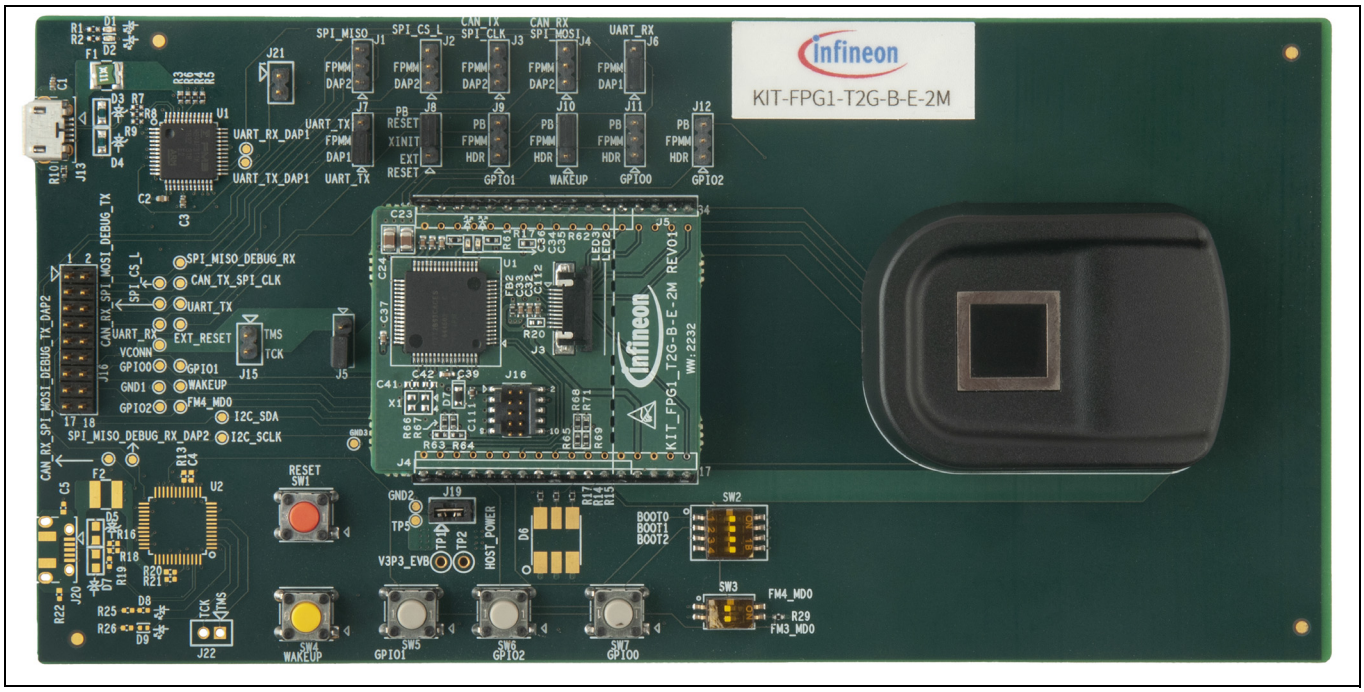

Figure 1-1. Infineon fingerprint evaluation kit

Figure 1-2 shows only the evaluation board.

Introduction

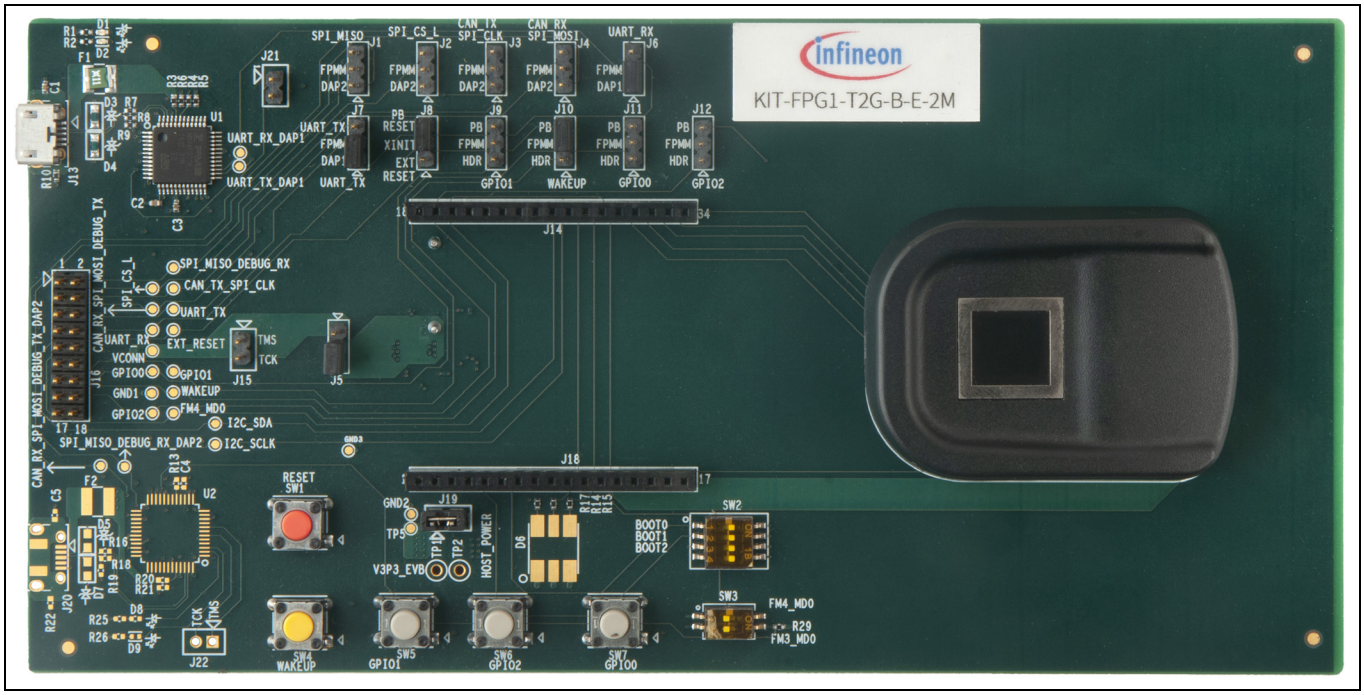

Figure 1-2. EVB - Top view

2 Overview

2.1 Functional overview

This EVB is designed for use with the FPMM and FPSM. All the modules supplied in the kit are connected to form a complete system. The evaluation board can interface with a PC through the USB port using the built-in USB-to-UART Bridge chip. The embedded framework FW and host interface command protocol are built into the FPMM module. A software GUI (FPMM SW) to interact with the FPMM module is also provided. With these components, the user can develop embedded fingerprint reader-based solutions and evaluate the Infineon embedded fingerprint solution.

The EVB is designed to allow a host processor that is using the host communication protocol to access the FPMM board through the following physical interfaces:

1. USB-to-UART Bridge: UART-to-USB Bridge is built into the evaluation board
2. UART: Direct UART connection is available on the expansion connector of the evaluation board
3. SPI: Direct SPI connection is available on the expansion connector of the evaluation board. Not supported in this revision.
4. I2C: Direct I2C connection is available on the expansion connector of the evaluation board. Not supported in this revision.
5. CAN: Direct Can connection is available on the expansion connector of the evaluation board. Not supported in this revision.
6. Standalone GPIO mode: FPMM can be controlled using only GPIOs. The status of various phases of FPMM operation returns through GPIOs. These GPIOs can either be connected to the push button switches on EVB and status returned through the three-color LED on the EVB or connected to the expansion connector for any host to use a simple GPIO-based interface to control the FPMM. Not supported in this revision.

The EVB can also be used to provide a direct connection between a host processor and the FPSM when the FPMM is not plugged in. The EVB can be used to allow any host to directly connect to the SPI interface of the FPSM by connecting jumper wires to the FPMM connector pins that run to the FPSM. In this mode, the host processor of choice is running the Infineon embedded framework software to be able to communicate with the FPSM. Details of this mode are provided in **“Direct FPSM connection to host”** on page 23.

Table 2-1. EVB functions

Function	Specification	Notes	Typical UART-USB bridge settings (DEFAULT)	Direct UART to HOST
USB CONNECTOR	Primary USB connector provides power to the system and USB connectivity to the USB-UART bridge chip (FM3)	+5V0 from USB VBUS, J13. See **“Power supply settings”** on page 9.	–	–
POWER SELECT HEADER	Select whether USB or external connector powers the system	J5. See **“Power supply settings”** on page 9.	Connect 2-3	Connect 1-2 for Host powered setup

Table 2-1. EVB functions (continued)

Function	Specification	Notes	Typical UART-USB bridge settings (DEFAULT)	Direct UART to HOST
RESET SWITCH	Reset switch	SW1. See **"RESET switch and RESET select header"** on page 10.	–	–
RESET SELECT HEADER	Selects where the system Reset is driven from	J8. See **"RESET switch and RESET select header"** on page 10.	Connect 2-3	Connect 1-2
USB-UART BRIDGE	Infineon FM3 (MB9AF312KPMC-G-JNE2) based USB-to-UART Bridge	U1. See **"USB-to-UART Bridge (CMSIS-DAP - FM3)"** on page 11.	–	–
MODE SWITCH	Mode switch for FM3	SW3. See **"USB-to-UART Bridge (CMSIS-DAP - FM3)"** on page 11.	FM3_MD0 = 0	FM3_MD0 = 0
FPMM CONNECTORS	Header for the FPMM-1100Rev2 board	J18, J14. See **"FPMM and FPSM connections"** on page 12.	–	–
FPSM CONNECTOR	10-pin ZIF connector for the FPSM	J17. See **"FPMM and FPSM connections"** on page 12.	–	–
BOOT SWITCH	FPMM configuration on boot up refer to BOOT table	SW2. See **"BOOT switches"** on page 14.	Not used	Not used
WAKEUP SWITCH	Wakeup FPMM from low power mode	SW4. See **"WAKEUP switches and WAKEUP select header"** on page 14.	–	–

Table 2-1. EVB functions (continued)

Function	Specification	Notes	Typical UART-USB bridge settings (DEFAULT)	Direct UART to HOST
WAKEUP SELECT HEADER	Select the source of the Wakeup signal	J10. See **"WAKEUP switches and WAKEUP select header"** on page 14.	Connect 2-3	Connect 1-2
GPIO SWITCH	Switches for General purpose GPIO, active high	SW5, SW6, SW7. See **"GPIO switches and GPIO select headers"** on page 15.	–	–
GPIO SELECT HEADERS	Selects if the GPIO is connected to the GPIO switch or to external connectors	J9, J11, J12. See **"GPIO switches and GPIO select headers"** on page 15.	Do not connect	Do not connect
SPI SELECT HEADER	Selects where the SPI signals are connected	J1, J2, J3, J4. See **"SPI select headers"** on page 17.	Do not connect	Do not connect
UART SELECT HEADER	Selects where the UART signals are connected	J6, J7. See **"UART select headers"** on page 18.	J6: connect 1-2 J7: connect 1-2	J6: connect 2-3 J7: connect 2-3
EXPANSION CONNECTOR	18-pin expansion connector	J16. See **"Expansion connector"** on page 19.	Not used	UART_RX, UART_TX, WAKEUP, EXT_RESET, VCONN, GND must be connected to a host system
POWER MEASUREMENT HEADER	Current measurement circuit to measure how much power is consumed by the FPMM/FPSM	J19. See **"Current measurement header"** on page 20	–	–
FPMM LED	Three- color LED indicates the status of fingerprint enrollment and matches operation	D6. See **"Three-color LED"** on page 21	Not used	Not used

2.2 Block diagram

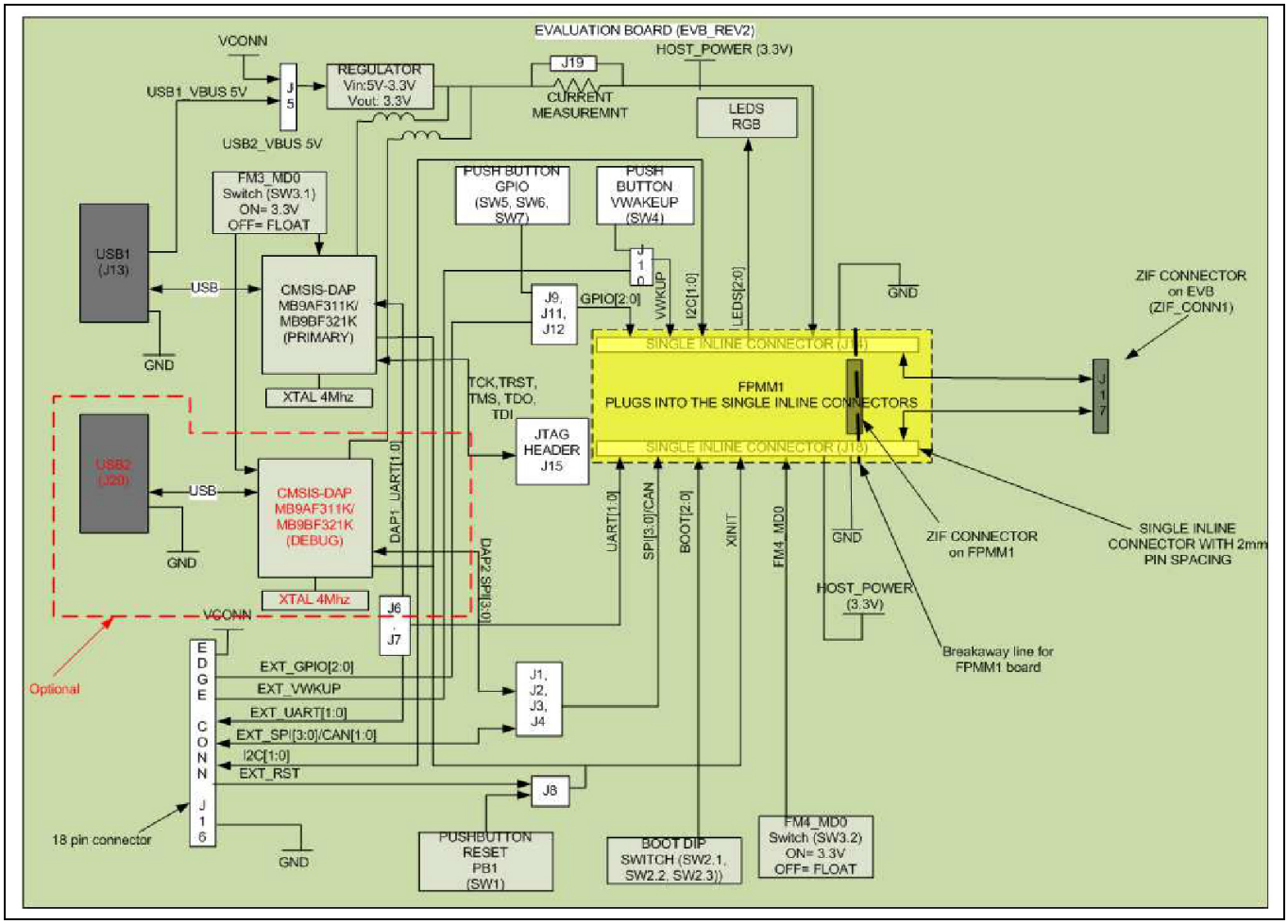

Figure 2-1. Block diagram

3 Connection and settings

This section describes the various switches and headers available on the EVB. Confirm the settings are according to the intended use or if using the EVB without modifications confirm the header jumpers and switches are at default state as indicated in the following sub-sections before turning on the power supply or connecting the USB cable.

3.1 Power supply settings

The EVB can be powered using either a 5 V DC power supply connected to the expansion connector (J16) or through USB bus power connected to J13. Power select header J1 is used to decide whether power is to be taken from the external expansion connector pin for USB bus power. **Table 3-1** shows how to configure J13. The input power supply voltage range is 3.3 V to 5 V and the current requirement of 500 mA. Do not exceed or go less than the maximum and minimum voltage requirements.

Table 3-1. Power select header

Power select header connection (J5)	Function
1-2	5 V power supplied from expansion connector J16
2-3	Power supply from USB bus power

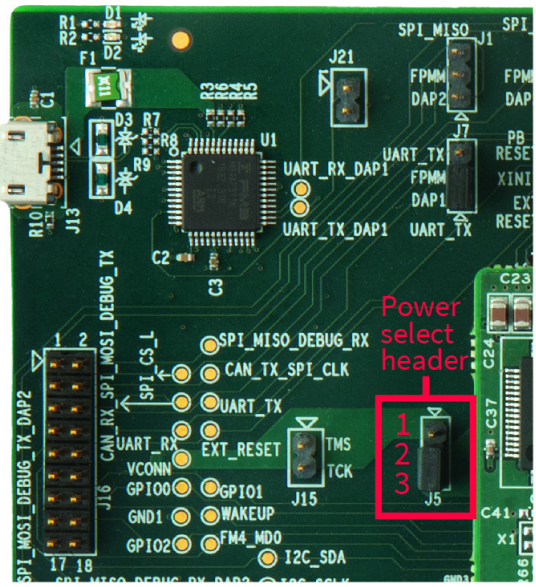

Figure 3-1. Power select header

3.2 RESET switch and RESET select header

The reset switch is a push button used to RESET the FM4 device on the FPMM. This reset signal is connected to the XINIT signal of the FPMM. The reset is an active low reset. The XINIT pin of FPMM can be driven from either the push button reset switch SW 1 or the expansion connector J16. These selections of where the reset is driven from are selected on the RESET select header.

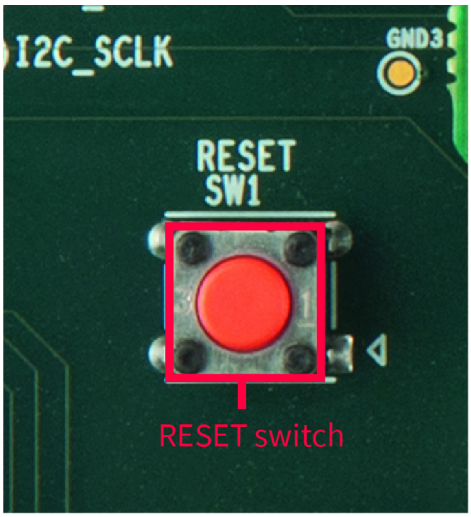

Figure 3-2. RESET switch (SW1)

Table 3-2. RESET select header configuration

RESET SELECT header connection (J8)	Function
1-2	FPMM XINIT is controlled from the RESET pin of the expansion connector
2-3	FPMM XINIT is controlled from the RESET push button switch (SW1)

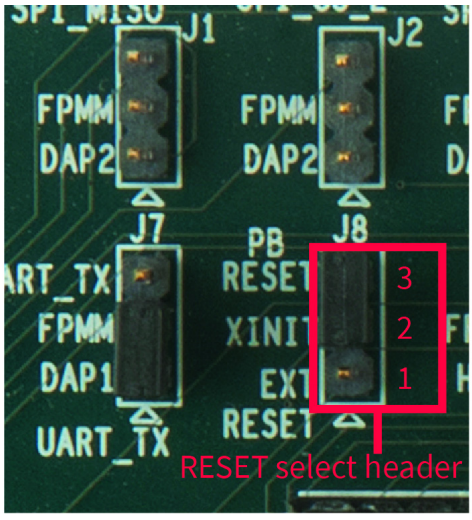

Figure 3-3. RESET select header

3.3 USB-to-UART Bridge (CMSIS-DAP -FM3)

The FM3 processor (U1) on the EVB performs the function of a USB-to-UART Bridge chip. The FM3 processor comes programmed with the correct firmware to perform the UART-to-USB bridging function. The MD0 pin of the FM3 part requires to be in the normal mode of operation when not programming this controller. **Table 3-3** shows the switch settings for the MD0 pin. The USB_UART bridge chip programming is not a user mode available option. **Table 3-3** shows the position of the switches required for the normal operation of this bridge chip.

Table 3-3. RESET select header configuration

Mode switch (SW3.1)	Description
ON	The FM3 is in normal operation mode (default). Do not change this setting.
OFF	The FM3 is in programming mode

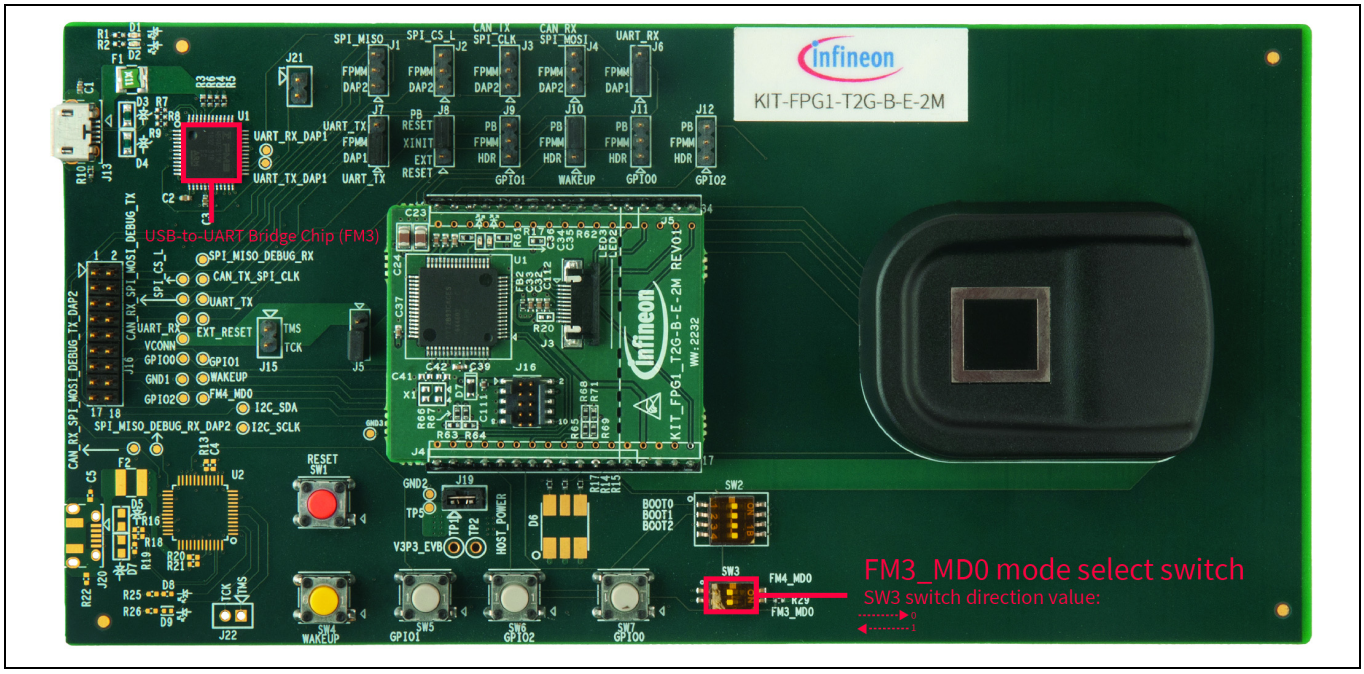

Figure 3-4. USB-to-UART Bridge and mode switch

3.4 FPMM and FPSM connections

The FPMM and FPSM modules are plugged into the EVB to form the embedded fingerprint system solution. The FPMM module is a PCB with a single in-line header on each side that plugs into the 17-pin headers (J14, J18) on the EVB. **Table 3-4** shows the signals on this header.

Table 3-4. RESET select header configuration

J18 pin#	Signal name
1	GND
2	UART_RX
3	UART_TX
4	BOOT1
5	GPIO0
6	GPIO1
7	GPIO2
8	BOOT2
9	WAKEUP
10	BOOT0
11	RGB_LED_B
12	V3P3_EVB
13	ZIF_EGND_CONN
14	ZIF_VDDA_CONN
15	ZIF_DGND_CONN
16	ZIF_V3P3_CONN
17	ZIF_SPI_MOSI
18	GND
19	FM4_MD0
20	SPI_CLK
21	SPI_MOSI
22	SPI_MISO
23	SPI_CS
24	XINIT
25	I2C_SCK
26	I2C_SDA
27	RGB_LED_G
28	RGB_LED_R
29	V3P3_EVB
30	ZIF_XRES
31	ZIF_INT
32	ZIF_SPI_MISO

Table 3-4. RESET select header configuration (continued)

J18 pin#	Signal name
33	ZIF_SPI_CS
34	ZIF_SPI_CLK

Table 3-5. RESET select header configuration

J17 pin#	Signal name
1	ZIF_XRES
2	ZIF_INT
3	ZIF_SPI_MISO
4	ZIF_SPI_CS
5	ZIF_SPI_CLK
6	ZIF_SPI_MOSI
7	ZIF_V3P3_CONN
8	ZIF_DGND_CONN
9	ZIF_VDDA_CONN
10	ZIF_EGND_CONN

The FPMM programming mode switch is located on the EVB. Because this module is not user programmable, switching to programming mode is not supported. Therefore, keep the switch position in normal operation mode.

Table 3-6. RESET select header configuration

Mode switch (SW3.2)	Description
ON	The FM4 is in normal operation mode (default). Do not change this setting.
OFF	The FM4 is in programming mode (not supported)

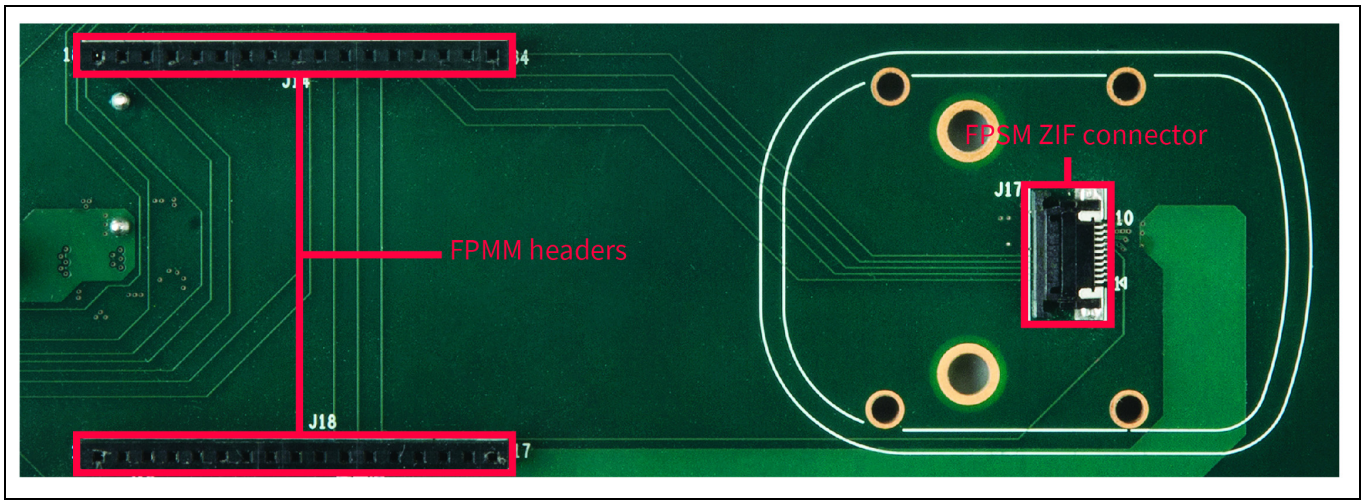

Figure 3-5. FPMM and FPSM connectors

3.5 BOOT switches

Not supported in this kit.

3.6 WAKEUP switches and WAKEUP select header

The wakeup push button switch (SW4) is used to wake up the FPMM from a low-power mode. This push button is used to provide a wakeup signal to the VBAT_wakeup pin of the FPMM. The location of this push button switch is shown in **Figure 3-6**. The wakeup signal is an active high signal.

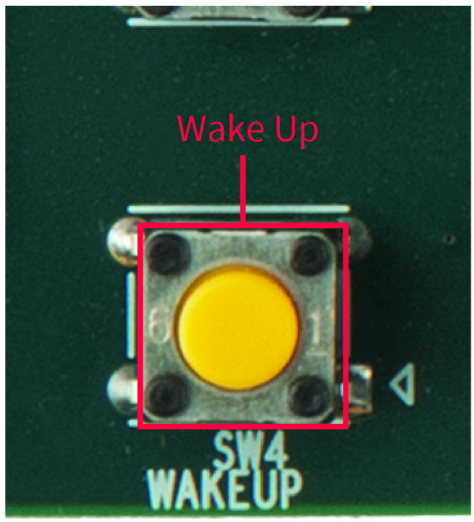

Figure 3-6. Wakeup switch

The wakeup signal to the FPMM can be driven from either push button SW4 or the external connector J10. Jumper J8 is used to select which circuit will drive the wakeup signal. **Table 3-7** shows the wakeup select jumper configurations.

Table 3-7. Wakeup select

Power select header connection (J10)	Function
1-2	Wakeup driven from expansion connector J16
2-3	Wakeup driven form push button switch SW4 (default)

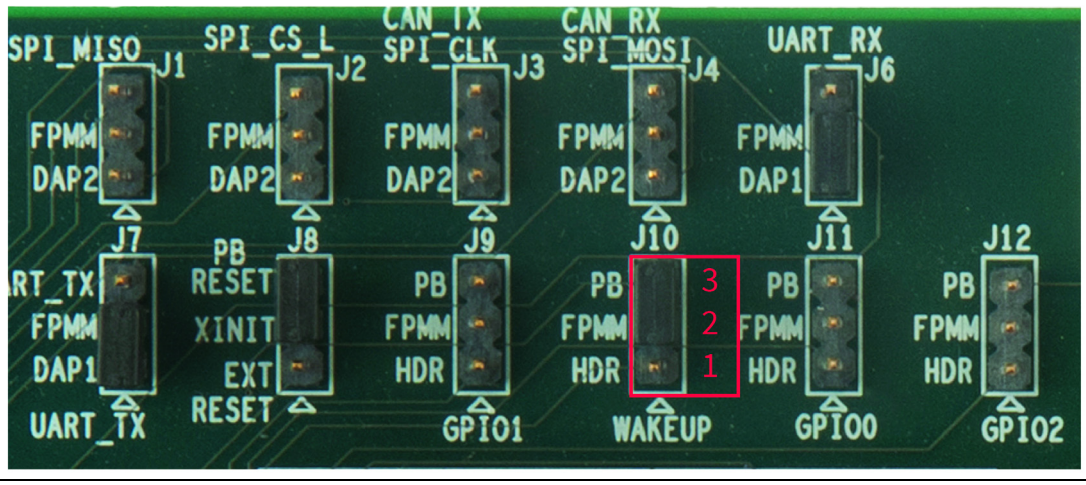

Figure 3-7. WAKEUP select header

3.7 GPIO switches and GPIO select headers

Note: GPIO functionality is not available in this revision.

Configure the GPIO switches on the EVB to perform various input/output functions according to the firmware configuration used. Primarily these switches are used in the standalone BOOT mode of operation of the FPMM (BOOT [2:0] = 100).

In this mode, the FPMM firmware configures these GPIOs to be used as fixed function inputs, e.g., one switch to enter ENROLL phase, one switch to enter VERIFY phase, and the third switch to delete the ENROLLED template. See the FPMM user guide for the firmware functionality of these switches. **Table 3-8** shows the mapping of these GPIOs to the GPIO switches.

Table 3-8. FPMM GPIO to GPIO switches mapping

FPMM GPIO	GPIO push button switch on EVB
GPIO0	SW5
GPIO1	SW6
GPIO2	SW7

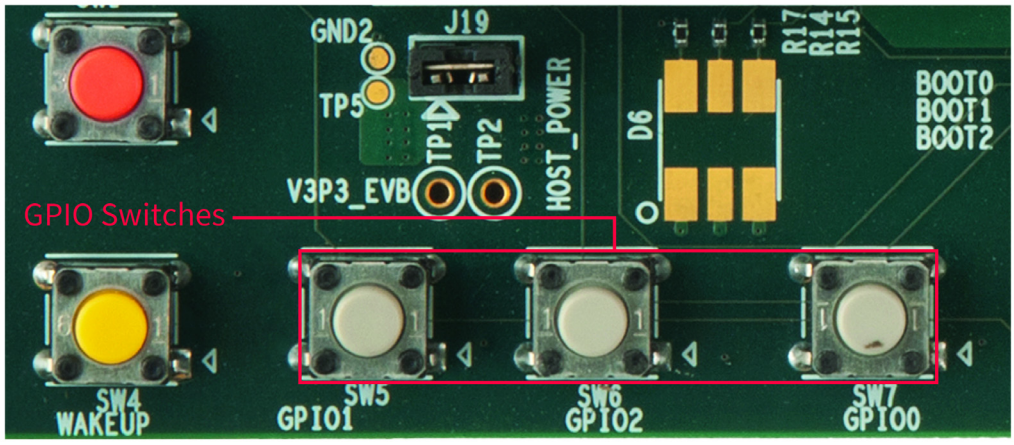

Figure 3-8. GPIO push button switches

GPIO select headers allow the FPMM GPIO signals to connect to either the push button on the EVB or the expansion connector J16.

Note: Currently, none of the GPIO push button switches are used.

Table 3-9. GPIO0 select header connection

GPIO0 select header connection (J9)	Function
1-2	GPIO0 connected to expansion connector J16
2-3	GPIO0 connected to push button switch SW5

Connection and settings

Table 3-10. GPIO1 select header connection

GPIO1 select header connection (J11)	Function
1-2	GPIO1 connected to expansion connector J16
2-3	GPIO1 connected to push button switch SW6

Table 3-11. GPIO2 select header connection

GPIO2 select header connection (J12)	Function
1-2	GPIO2 connected to expansion connector J16
2-3	GPIO2 connected to push button switch SW7

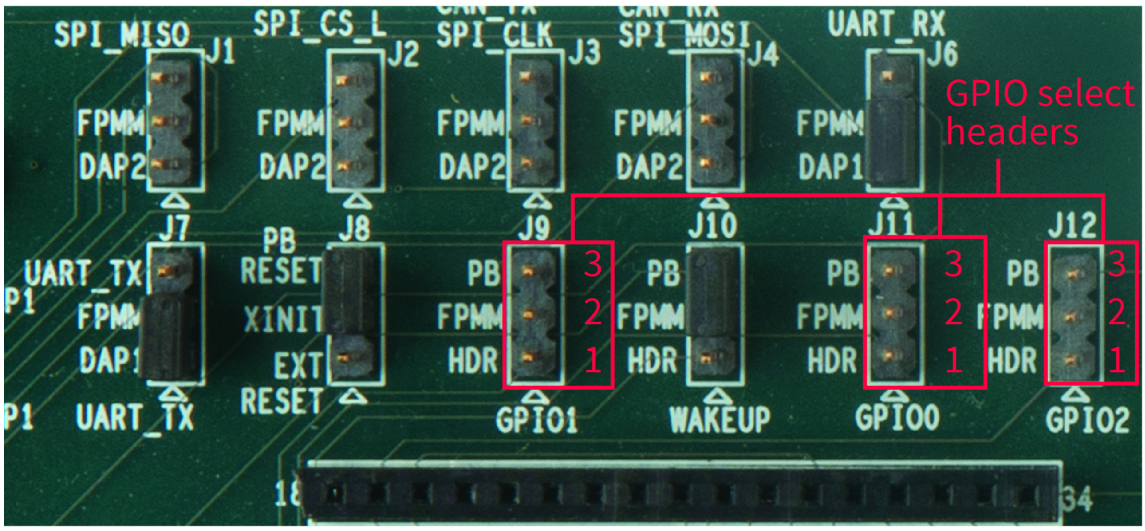

Figure 3-9. GPIO select headers

3.8 SPI select headers

Note: SPI functionality is not available in this revision.

The SPI interface from the FPMM connects to the expansion connector through this header. **Figure 3-10** shows the SPI headers. The signals CAN_TX and CAN_RX share with SPI signals. Depending on the BOOT mode settings, the FPMM can use SPI_CLKI and SPI_MOSI for either the SPI interface or the CAN interface.

Note: Do not change the default connection of the SPI headers.

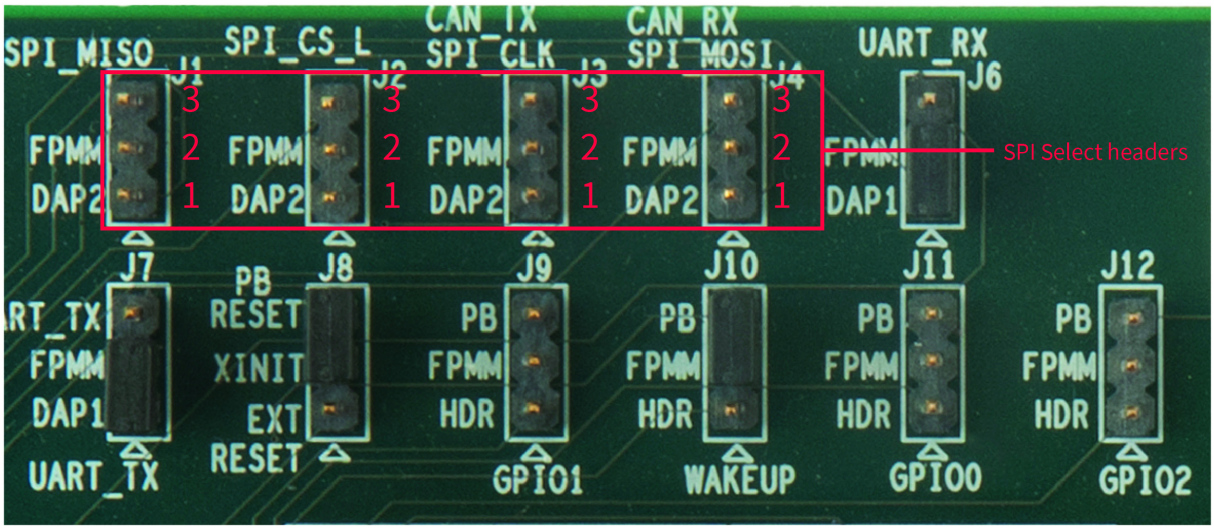

Figure 3-10. SPI select headers

The following tables show how to configure the SPI headers.

Table 3-12. SPI_MOSI select header connection

SPI_MOSI select header connection (J1)	Function
1-2	Not used
2-3	SPI_MISO connected to expansion connector J16 (default)

Table 3-13. SPI_CS_L select header connection

SPI_CS_L select header connection (J2)	Function
1-2	Not used
2-3	SPI_CS_L connected to expansion connector J16 (default)

Table 3-14. SPI_CLK select header connection

SPI_CLK select header connection (J3)	Function
1-2	Not used
2-3	SPI_CLK/CAN_TX connected to expansion connector J16 (default)

Table 3-15. SPI_MOSI select header connection

SPI_MOSI select header connection (J4)	Function
1-2	Not used
2-3	SPI_MOSI/CAN_RX connected to expansion connector J16 (default)

3.9 UART select headers

The UART interface from the FPMM can be connected either to the expansion header (J16) or the USB-UART Bridge chip. The Infineon embedded fingerprint solution uses the UART interface through the USB-to-UART Bridge to demonstrate the functionality of this solution. A PC-based software demo has been developed for this purpose. For implementations that require UART to be connected to a HOST directly, route the UART signals to the expansion connector (J16).

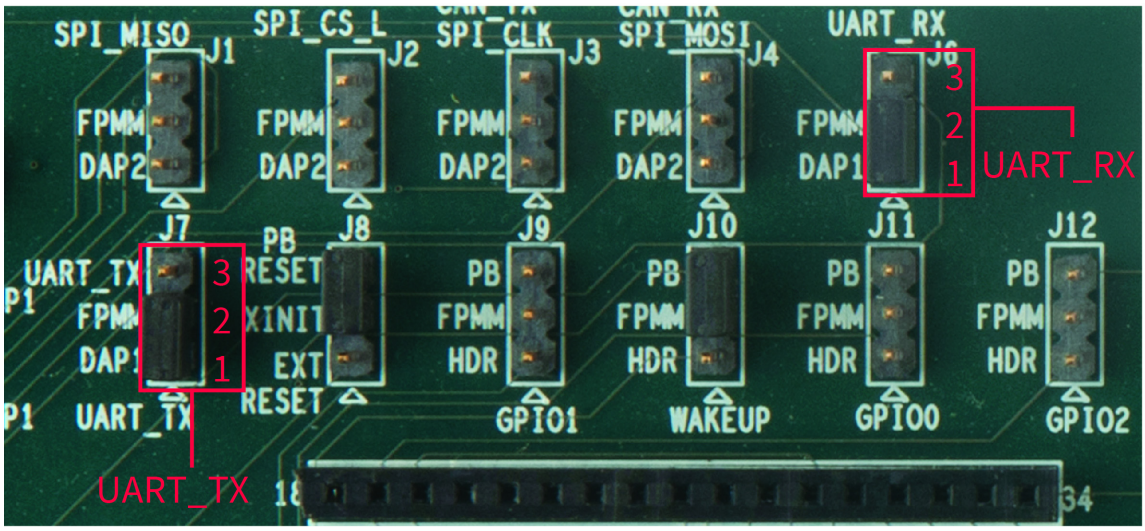

Figure 3-11. UART select headers

The following tables show the configuration of the UART RX and TX headers.

Table 3-16. UART_RX select header connection

SPI_MOSI select header connection (J7)	Function
1-2	UART_RX from FPMM connected to the USB-to-UART Bridge (default)
2-3	UART_RX from FPMM connected to the expansion connector (J16)

Table 3-17. UART_TX select header connection

SPI_MOSI select header connection (J8)	Function
1-2	UART_TX from FPMM connected to the USB-to-UART Bridge (default)
2-3	UART_TX from FPMM connected to the expansion connector (J16)

3.10 Expansion connector

The expansion connector on the EVB exposes the communication interfaces, reset, GPIOs, and wakeup signals of the FPMM to external hosts. The later sections describe the configuration of the various select headers to route signals from the FPMM to the expansion connector.

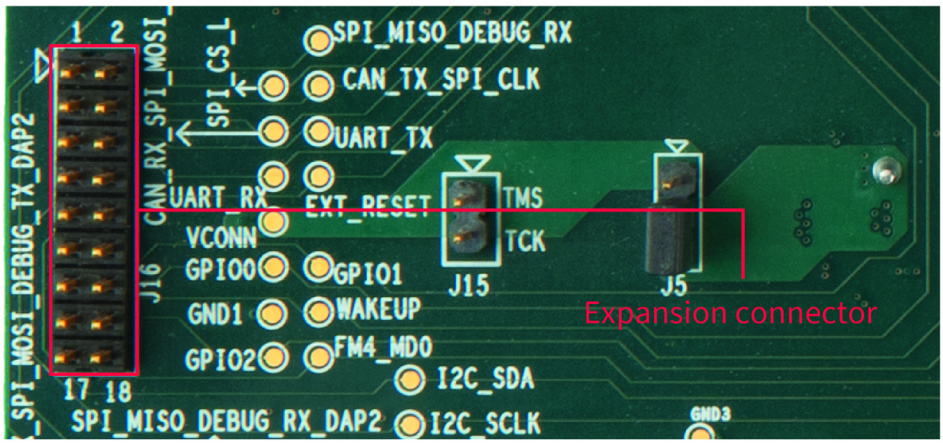

Figure 3-12. Expansion connector

Table 3-18. RESET select header configuration

J16 pin#	Signal name
1	External power (5 V)
2	SPI_MISO
3	SPI_CS_L
4	SPI_CLK/CAN_TX
5	SPI_MOSI/CAN_RX
6	UART_TX
7	UART_RX
8	I2C_SCLK
9	I2C_SDA
10	RESET
11	External power (5 V)
12	GND
13	WAKEUP
14	GPIO0
15	GPIO1
16	GPIO2
17	Not used
18	GND

3.11 Current measurement header

The current measurement header J19 provides a way to measure the current consumed by the FPMM and FPSM modules. The host power plane in the EVB is separated from the rest of the 3.3 V power plane by a 0-ohm resistor. Measures the current flowing through this resistor to determine the current consumption of the two boards. J19 header Pin 1 is placed on the EVB power plane side of the 3.3 V supply and J19 header Pin 2 on the HOST_POWER (FPMM and FPSM) side of the 3.3 V power plane.

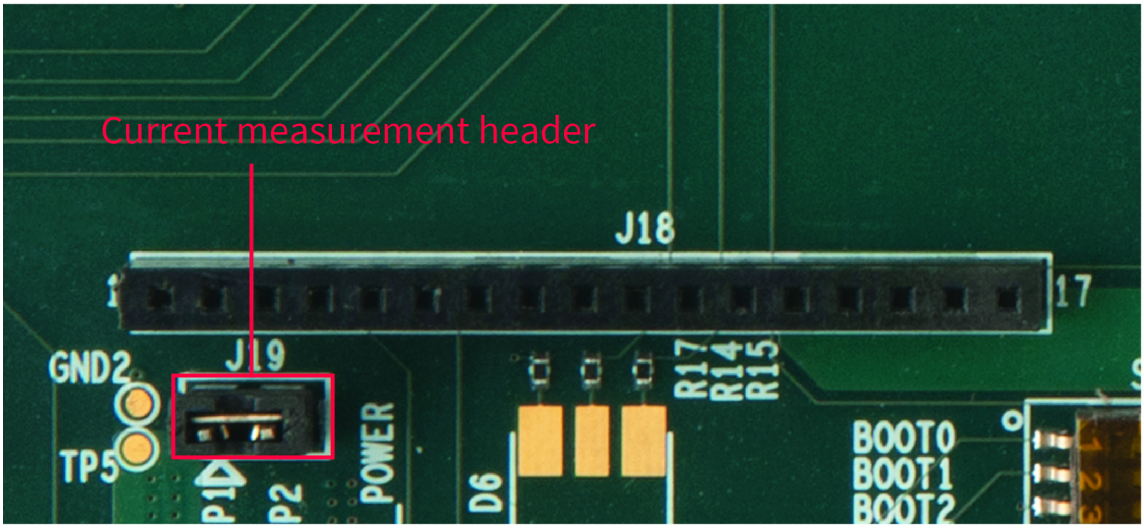

Figure 3-13. Current measurement header

3.12 Three-color LED

Note: Three-color LED is not available in this revision.

A three-color LED provides the status of the current phase of fingerprint enrollment/verification on the EVB. Connect the three colors of the LEDs to the following corresponding signal from the FPMM.

1. BLUE = RGB_LED_B
2. RED = RGB_LED_R
3. GREEN= RBG_LED_G

See the FPMM user guide for LED usage.

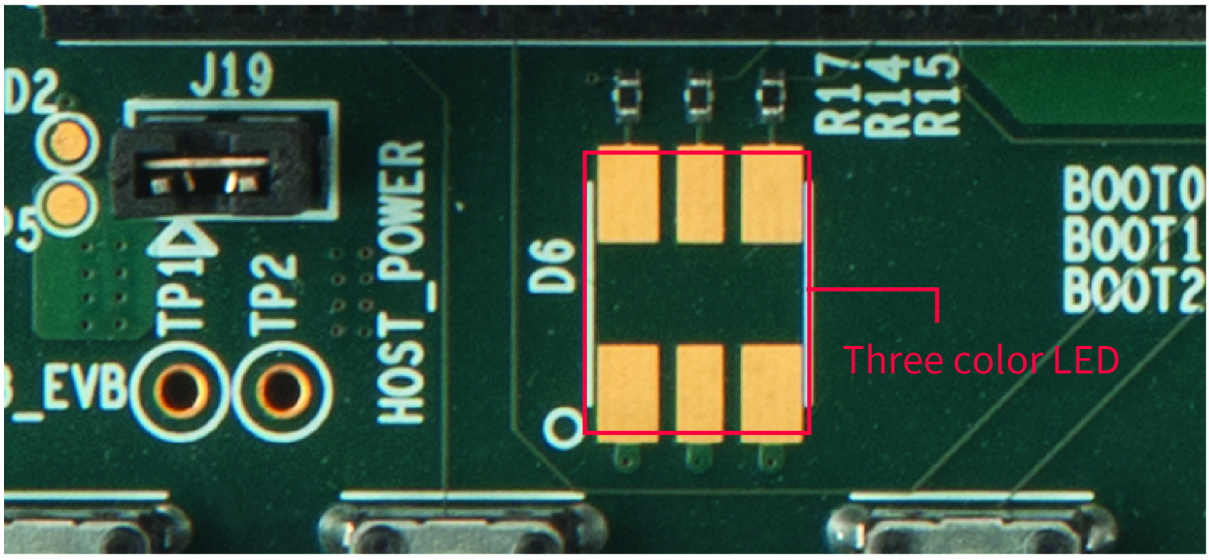

Figure 3-14. Three-color LED

4 Operation

- Supply the power from the USB or the VCONN pin of the expansion header (J16).
- Ensure all jumpers are set correctly for the proper mode of operation or set to default jumper settings.
- The fingerprint evaluation kit comes with the default jumper settings. This setting uses a USB bus-powered mode of operation. By default, the communication interface uses the USB-to-UART Bridge.
- When powering on the kit, ensure all jumpers are connected correctly. Check the ascertained FPMM is plugged into the connectors J14 and J18 and ensure it is seated firmly.
- Ensure the FPSM is in the housing and the housing is screwed down tightly to the EVB.
- Follow the quick start guide instructions on installing the FPMM switch.
- After installing the FPMM software without any errors, connect the EVB using the included USB cable. The EVB powers up and the status of the USB-to-UART Bridge will be provided through the LEDs D1 and D2.
- Launch the FPMM SW 1.0 from the Windows Start menu and displays the window shown in **Figure 4-1**. Follow instructions on how to use the FPMM software by referring to the FPMM switch user guide.

Attention: ***Verify the FPMM is plugged in correctly to the EVB. Ensure Pin 1 of J4 on the FPMM is aligned and plugs into Pin 1 of J18 on the EVB.***

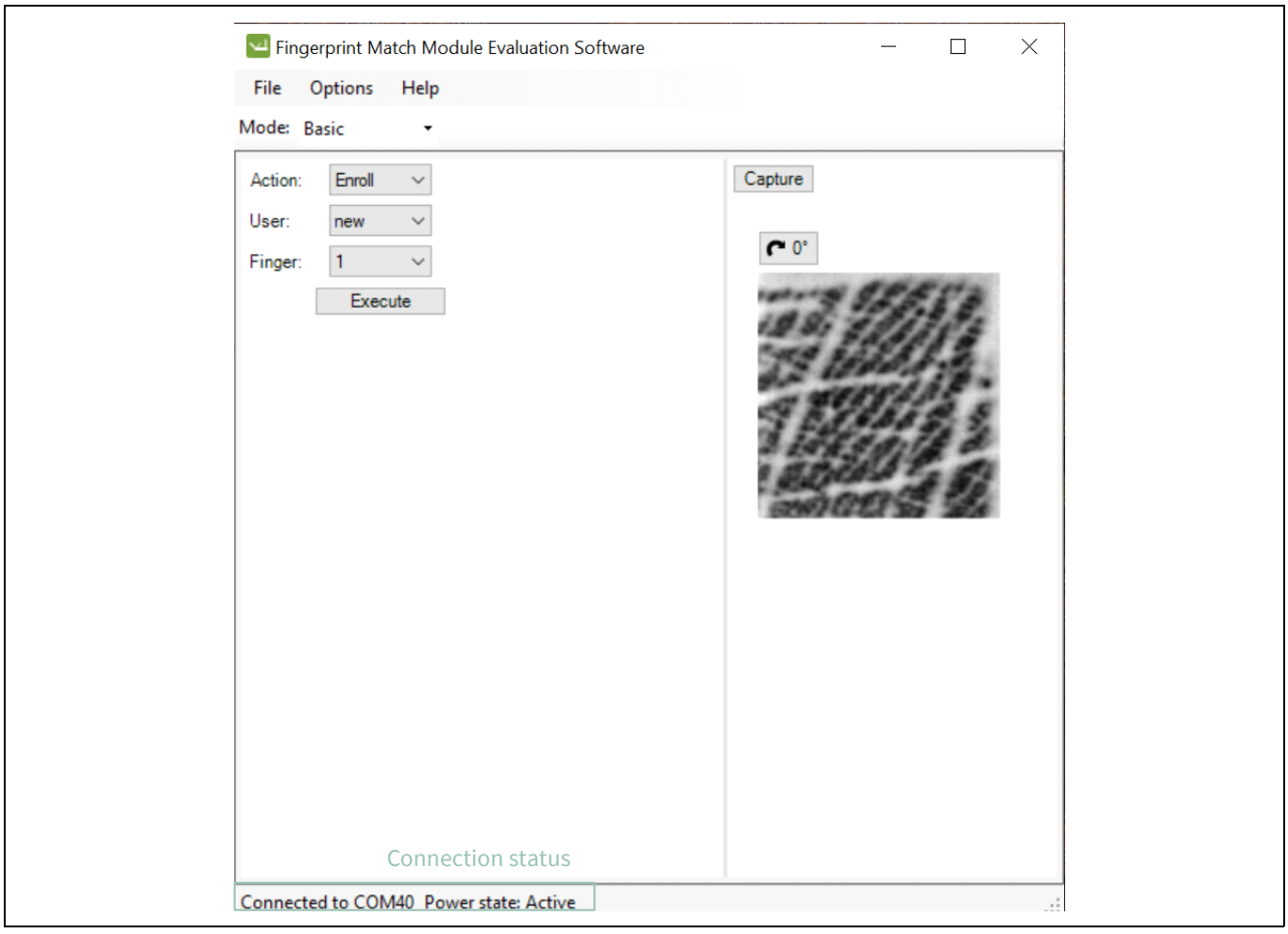

Figure 4-1. FPMM SW 1.0 GUI start screen

5 Direct FPSM connection to host

Connect the FPSM to a host directly from J14 and J18. When connecting to the host PCB ensure the host is capable of providing the necessary power required to drive the FPSM. The EVB will not need to be powered in this configuration.

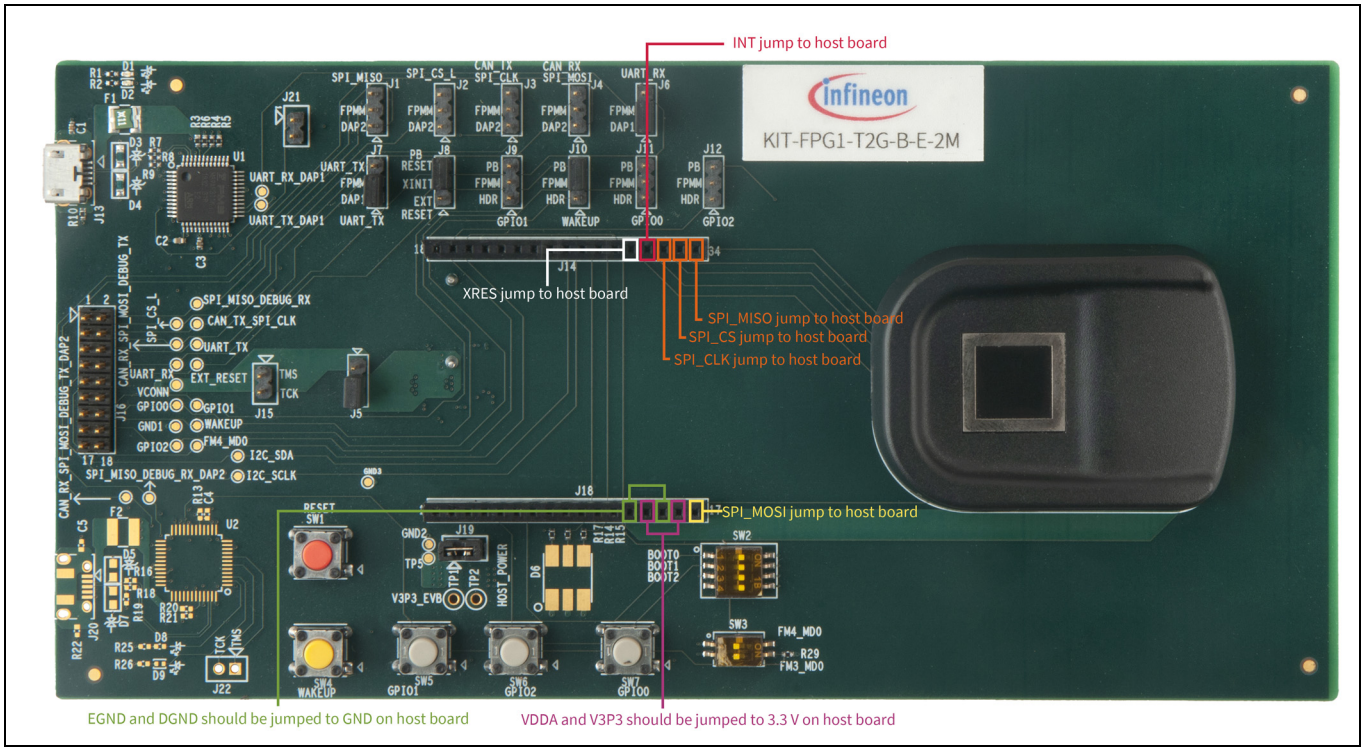

Figure 5-1. Jumper connection to host board when FPSM is connected directly to the host

Table 5-1. Mapping of FPSM signals on J14 and J18

EVB header #	Pin#	Signal name	Host board connection details
J14	30	ZIF_XRES	Connect to V3P3 through 10K pull-up
J14	31	ZIF_INT	Connect to host INT pin
J14	32	ZIF_SPI_MISO	Connect to host SPI_MISO pin
J14	33	ZIF_SPI_CS	Connect to host SPI_CS pin
J14	34	ZIF_SPI_CLK	Connect to host SPI_CLK pin
J18	13	ZIF_EGND_CONN	Connect to host GND
J18	14	ZIF_VDDA_CONN	Connect to host 3.3 V power
J18	15	ZIF_DGND_CONN	Connect to host GND
J18	16	ZIF_V3P3_CONN	Connect to host 3.3 V power
J18	17	ZIF_SPI_MOSI	Connect to host SPI_MOSI

6 Appendix A: Schematics for CYFPEVB-1100-0

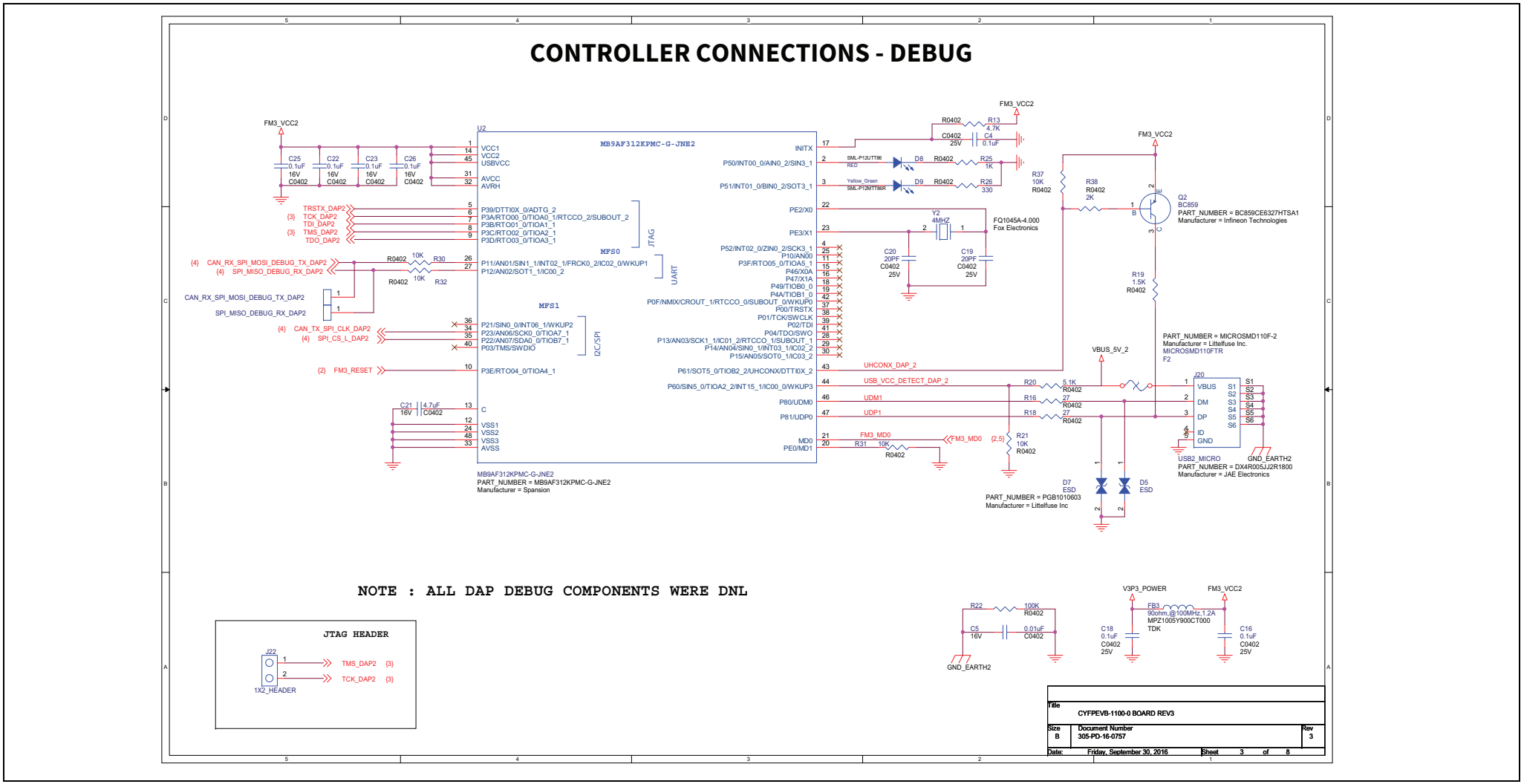

Figure 6-1. Controller connections - Primary

Appendix A: Schematics for CYFPEVB-1100-0

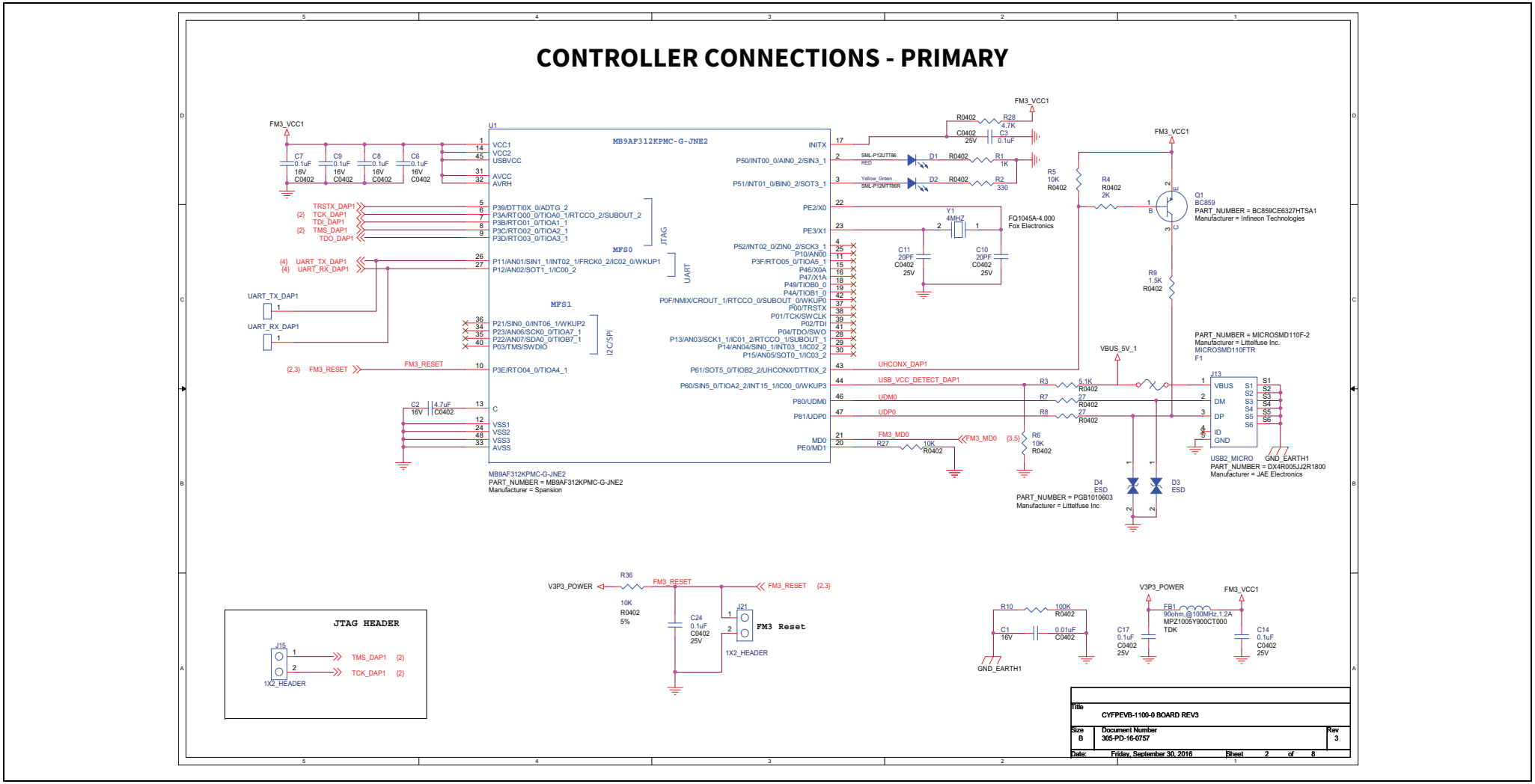

Figure 6-2. Controller connections - Debug

Appendix A: Schematics for CYFPEVB-1100-0

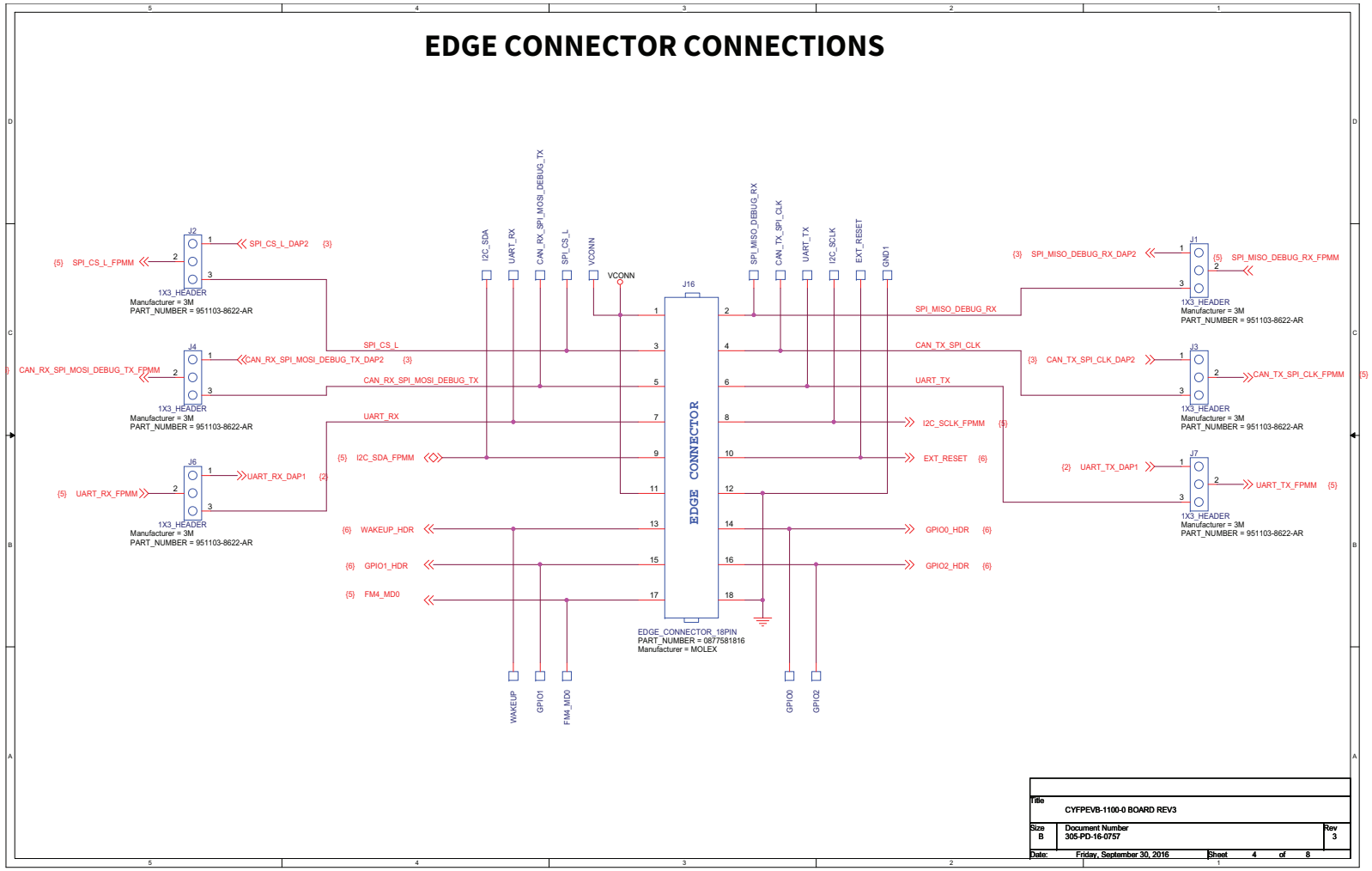

Figure 6-3. Edge connector connections

Appendix A: Schematics for CYFPEVB-1100-0

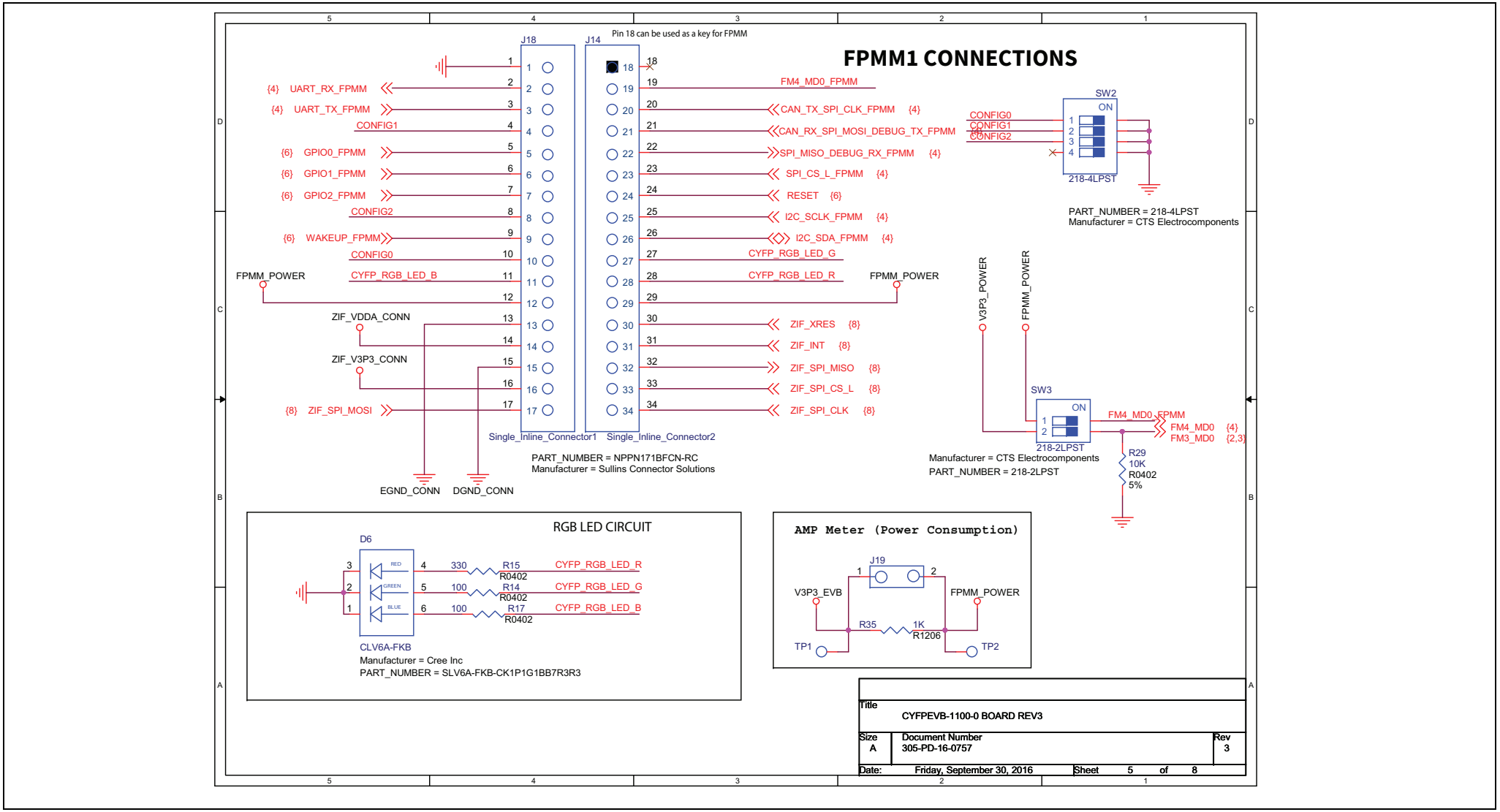

Figure 6-4. FPMM1 connections

Appendix A: Schematics for CYFPEVB-1100-0

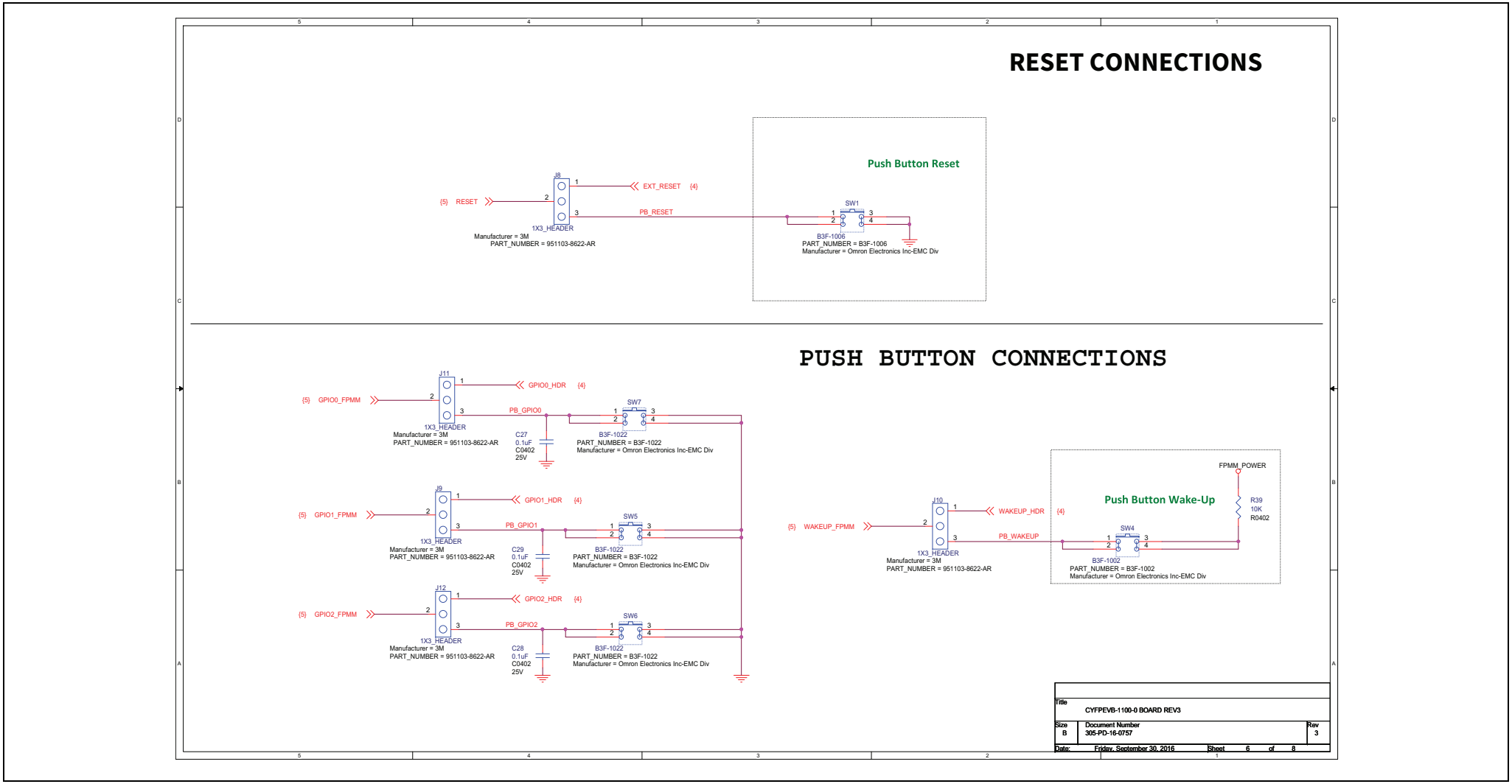

Figure 6-5. Reset and push button connections

Appendix A: Schematics for CYFPEVB-1100-0

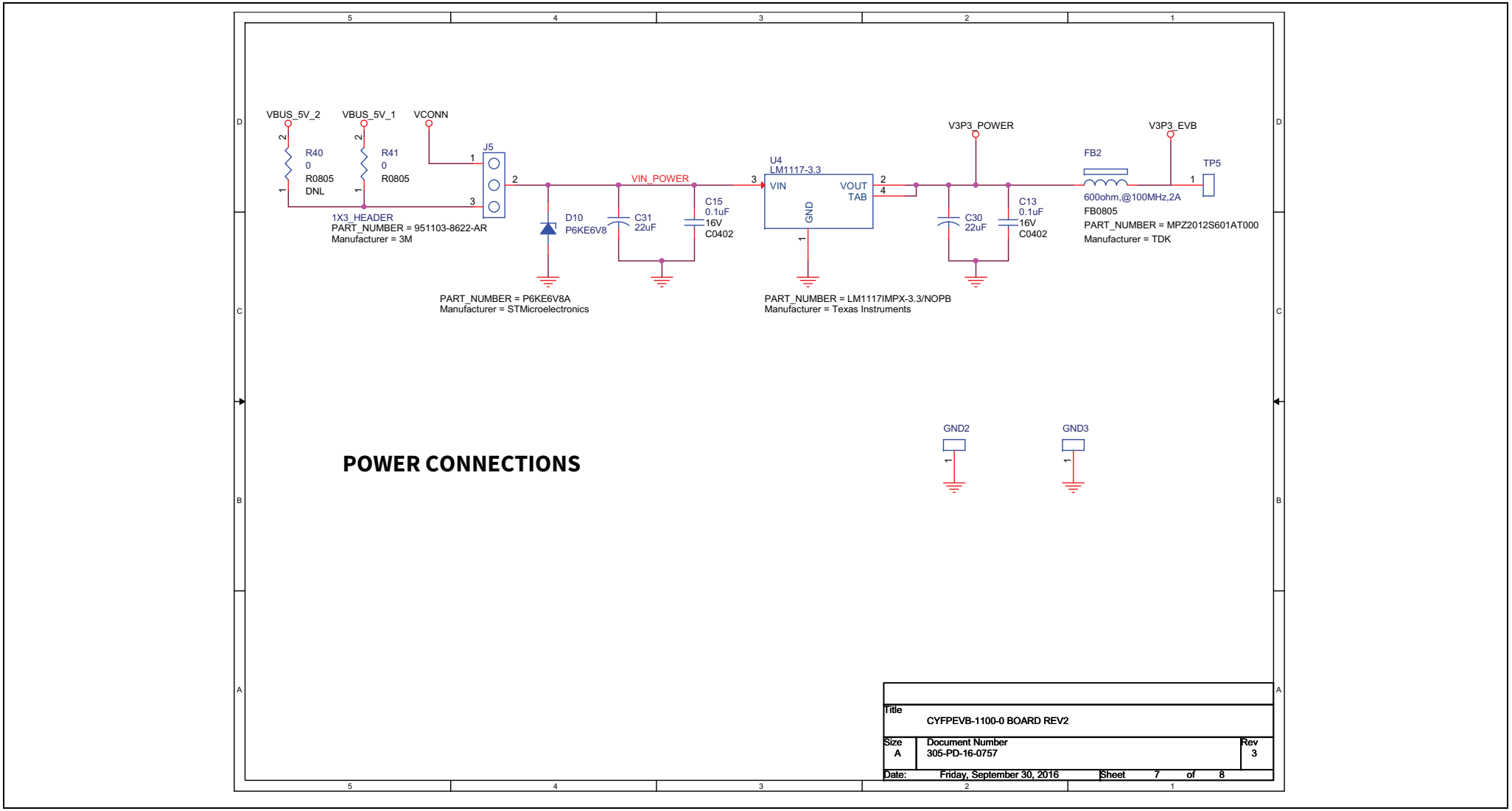

Figure 6-6. Power connections

Appendix A: Schematics for CYFPEVB-1100-0

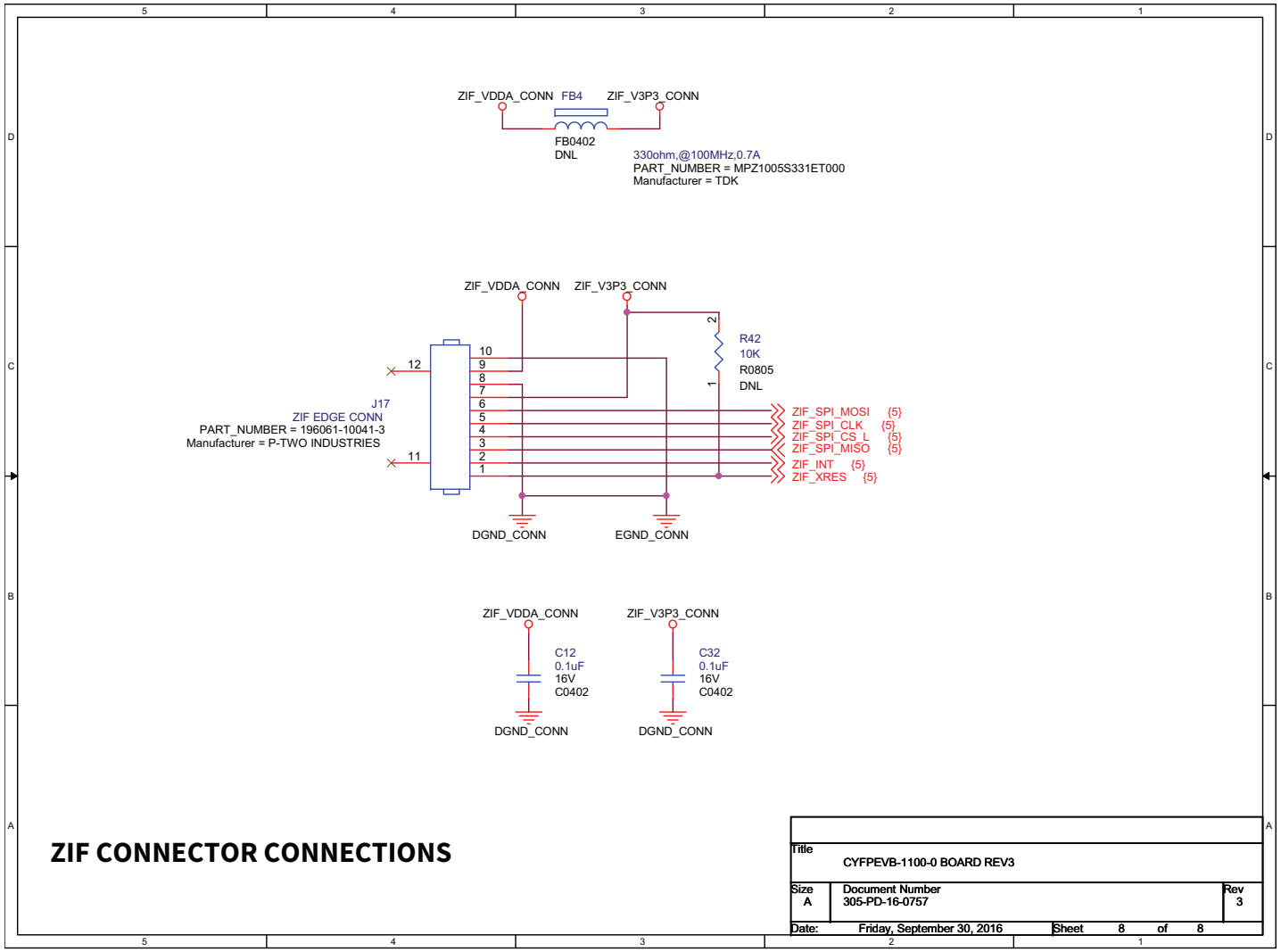

Figure 6-7. ZIF connector connections

7 Appendix B: Layout for CYFPEVB-1100-0

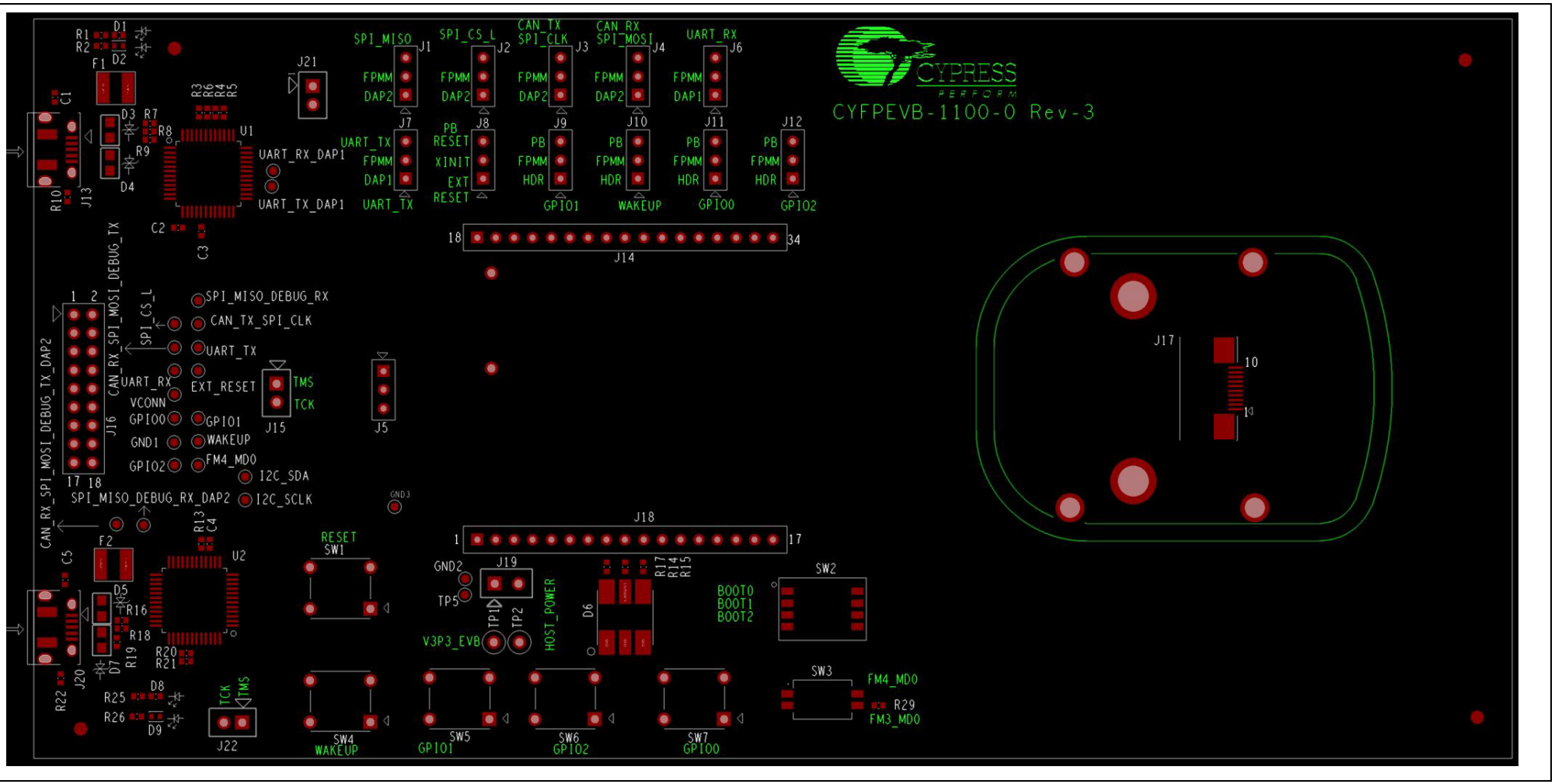

Figure 7-1. Layout (top view)

Appendix B: Layout for CYFPEVB-1100-0

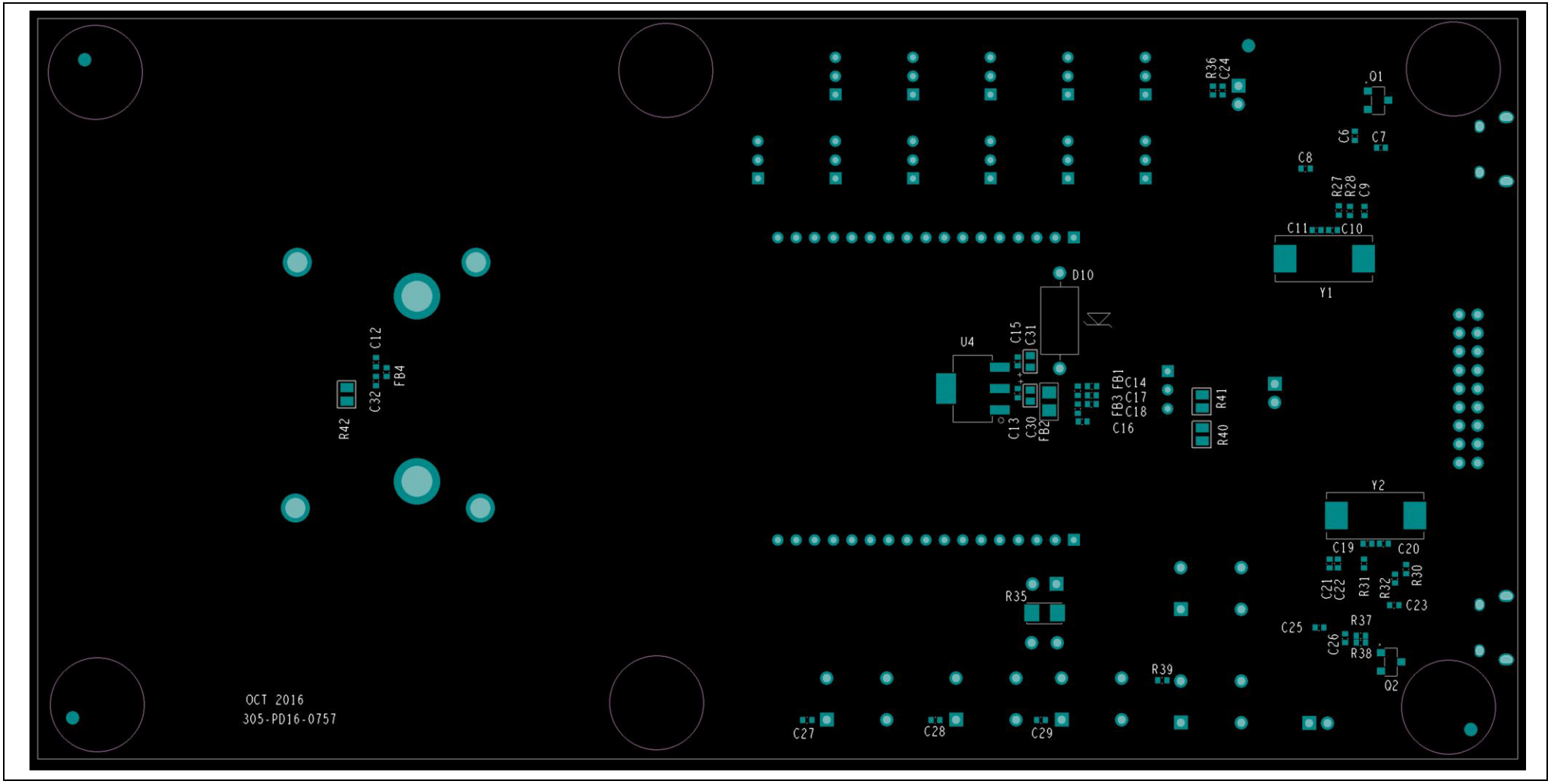

Figure 7-2. Layout (bottom view)

8 Appendix C: Schematics for KIT-FPG1-T2G-B-E-2M

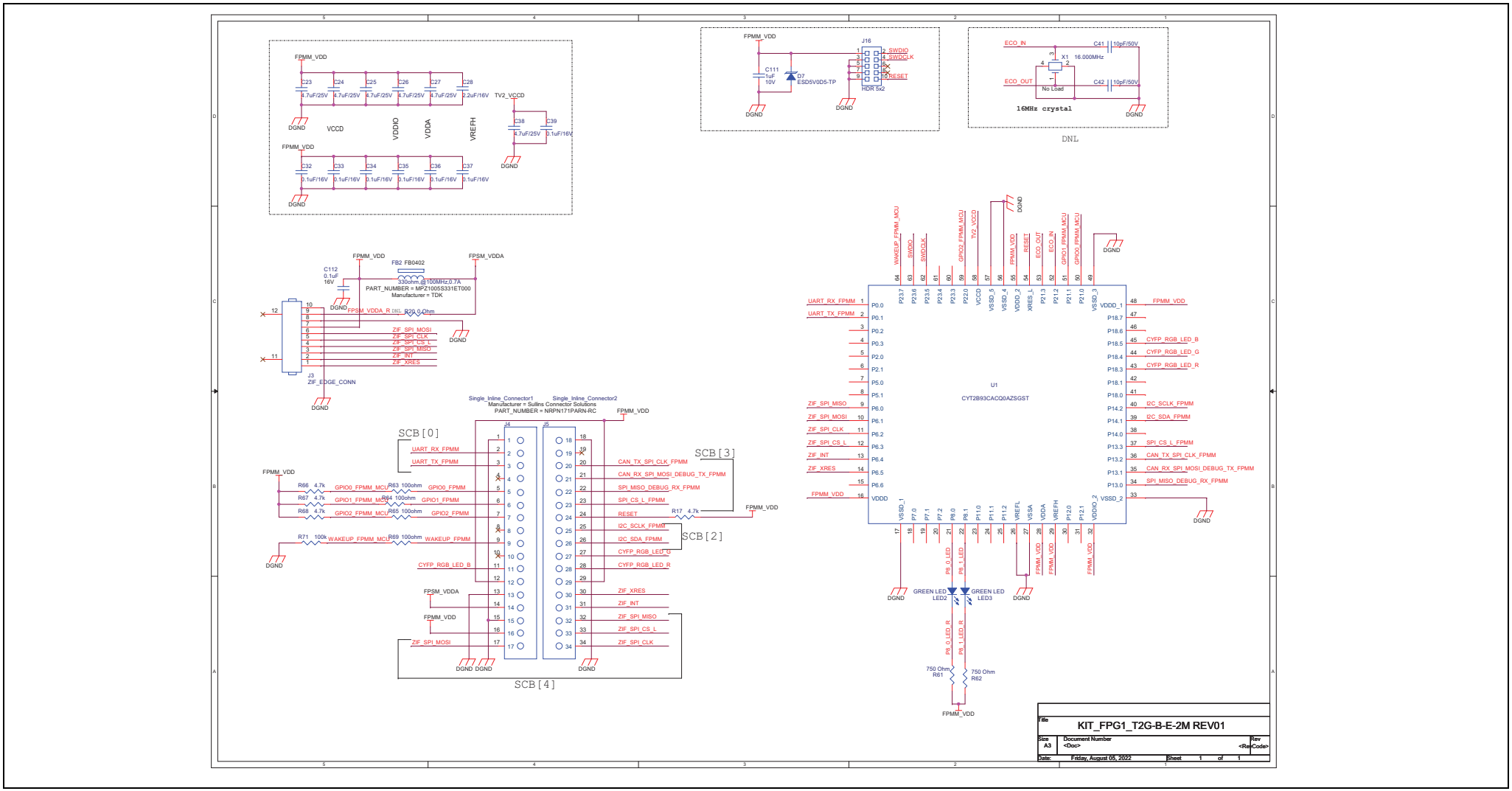

Figure 8-1. Schematics for KIT-FPG1-T2G-B-E-2M

9 Appendix B: Layout for KIT-FPG1-T2G-B-E-2M

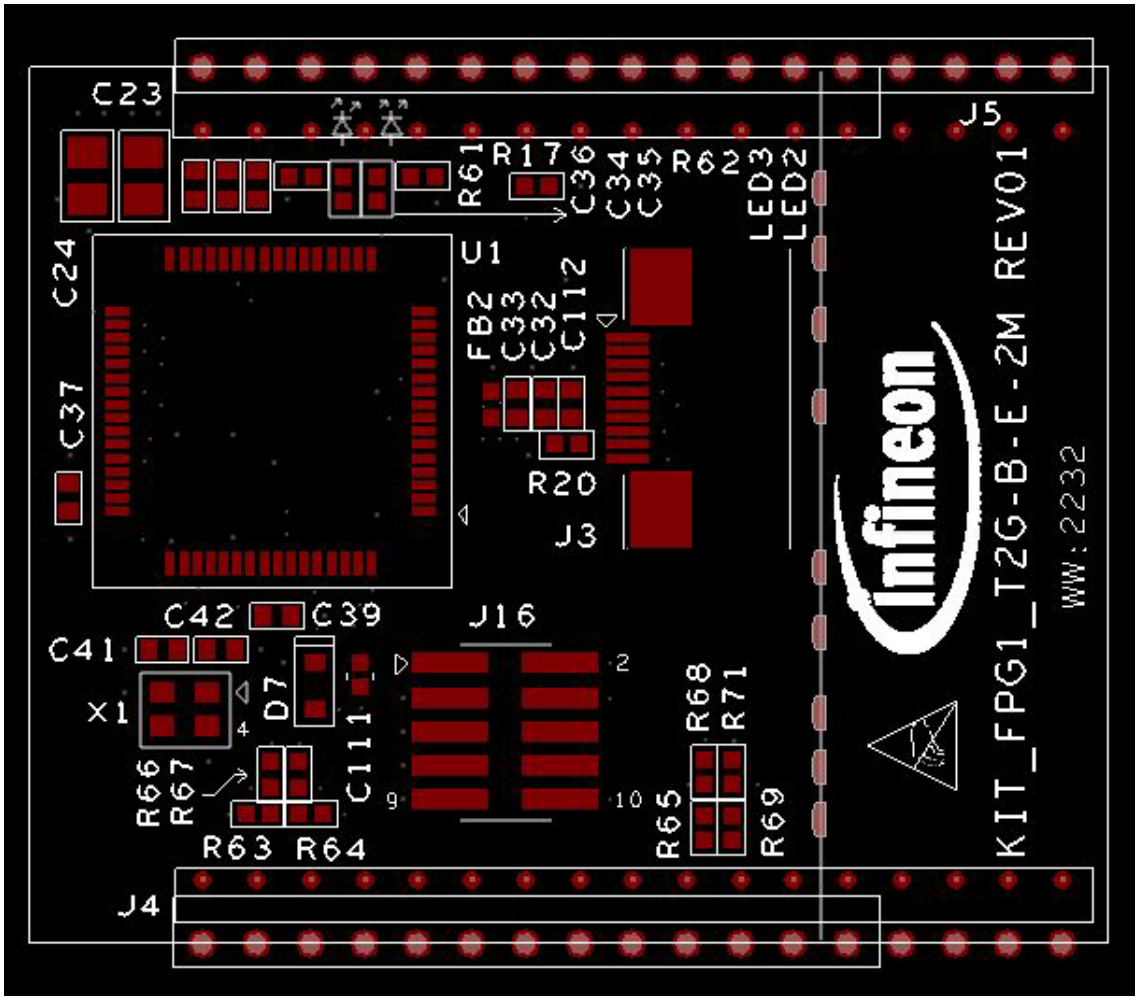

Figure 9-1. Layout (top view)

Appendix B: Layout for KIT-FPG1-T2G-B-E-2M

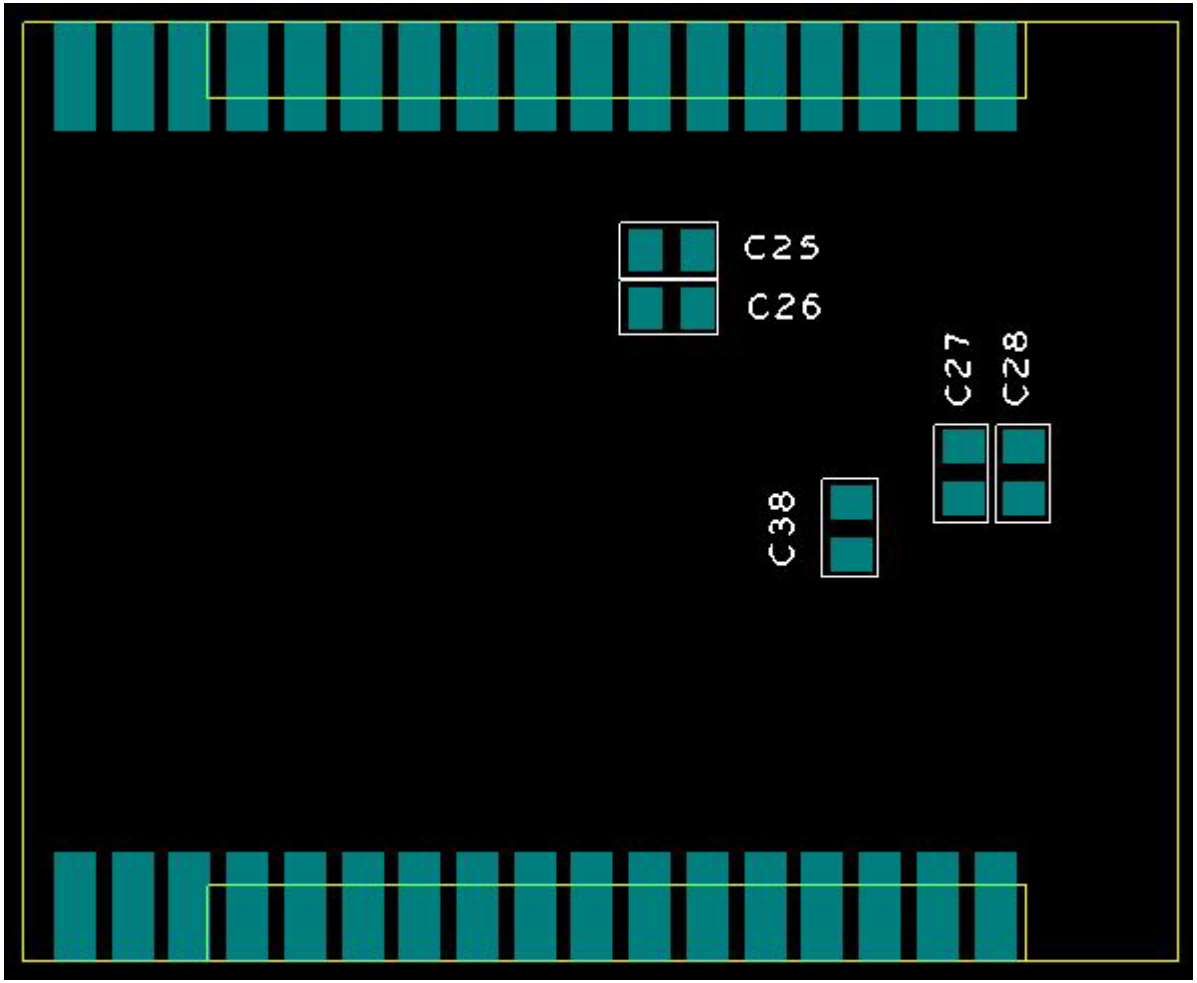

Figure 9-2. Layout (bottom view)

Revision history

Date	Version	Description
2022-11-07	**	Initial release

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Edition 2022-11-07
Published by
Infineon Technologies AG
81726 Munich, Germany

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Document reference
002-36609 Rev. **

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