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Revision History

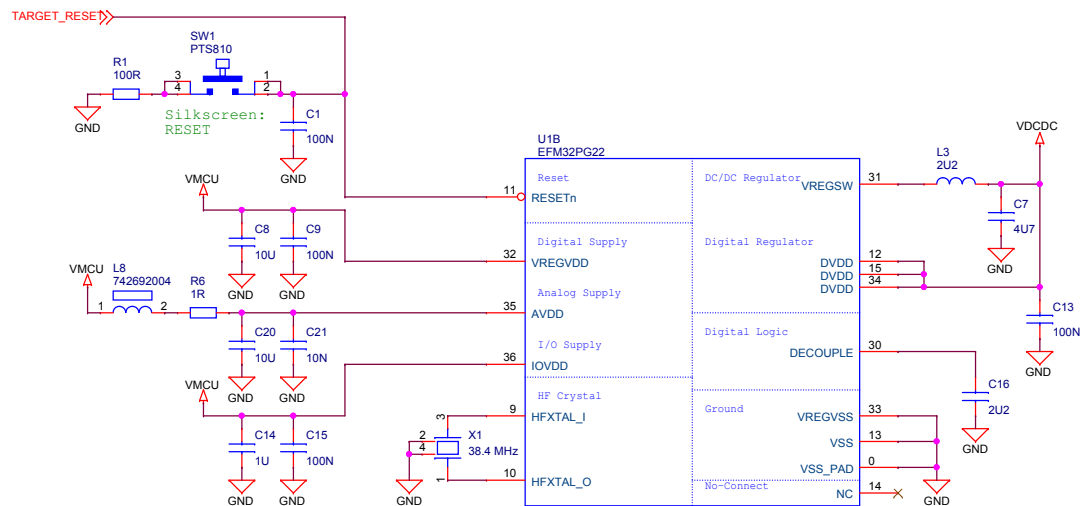
Rev. Description

A00	Initial version
A01	Changed LF crystal (X2), ESD diodes (D902), and updated PCB revision

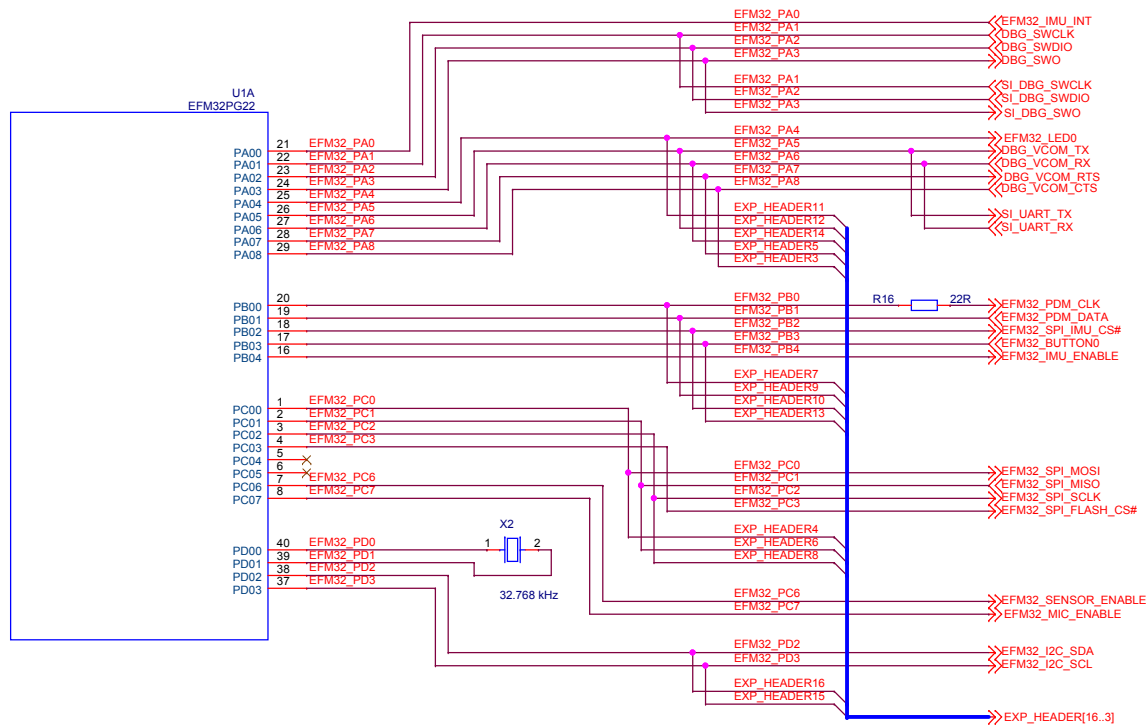


Schematic Title			
Thunderboard EFM32PG22			
Page Title			
Title Page			
Designed: FM	Approved: JSH	Document number BRD2503A	Revision A01
Size A3	BOM Doc No:	Sheet Created Date Monday, June 15, 2020	Sheet Modified Date Wednesday, October 14, 2020
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EFM32PG22 Power Section



EFM32PG22 IOs & Signal Assignments



		Schematic Title	
		Thunderboard EFM32PG22	
Designed: FM		Page Title	
Size A3		EFM32PG22	
BOM Doc No:		Document number	
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Sensor Power/Isolation

There are no pull-down resistors on the enable pins, and software should therefore immediately drive the line to prevent the pins from floating.

EFM32 I2C Sensor Connections:

- MCU Pins:** VMCU (2), 4, 9, 10, 13, 5, 6, 12
- Sensor Pins:** EFM32_I2C_SCL (4), EFM32_I2C_SDA (9), EFM32_SENSOR_ENABLE (13)
- Isolator (U2A):** COM1 (2), COM2 (4), COM3 (9), COM4 (10), IN1 (13), IN2 (5), IN3 (6), IN4 (12)
- Power:** VDD_SENSOR (1, 3, 8, 11)

EFM32 PDM Sensor Connections:

- MCU Pins:** VMCU (2), 4, 9, 10, 13, 5, 6, 12
- Sensor Pins:** EFM32_PDM_CLK (4), EFM32_PDM_DATA (9), EFM32_MIC_ENABLE (13)
- Isolator (U5A):** COM1 (2), COM2 (4), COM3 (9), COM4 (10), IN1 (13), IN2 (5), IN3 (6), IN4 (12)
- Power:** VDD_MIC (1, 3, 8, 11)

EFM32 SPI Sensor Connections:

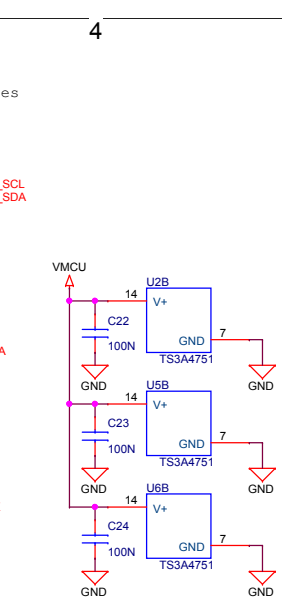
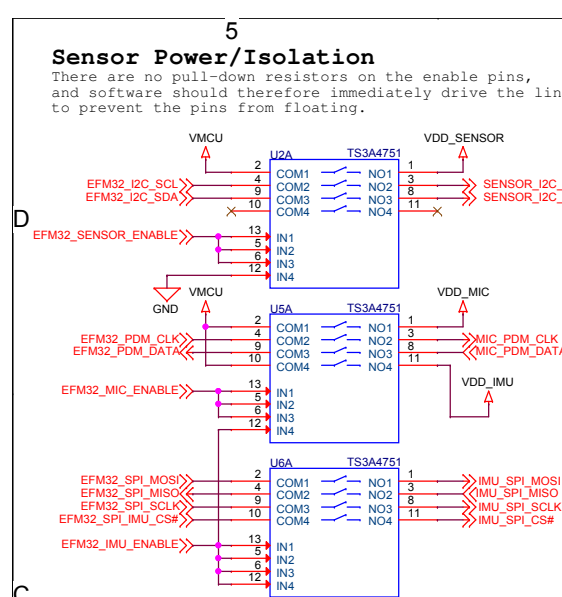
- MCU Pins:** VMCU (2), 4, 9, 10, 13, 5, 6, 12
- Sensor Pins:** EFM32_SPI_MOSI (4), EFM32_SPI_MISO (9), EFM32_SPI_SCLK (10), EFM32_SPI_IMU_CS# (13), EFM32_IMU_ENABLE (13)
- Isolator (U6A):** COM1 (2), COM2 (4), COM3 (9), COM4 (10), IN1 (13), IN2 (5), IN3 (6), IN4 (12)
- Power:** VDD_IMU (1, 3, 8, 11)

Sensor Power/Isolation

There are no pull-down resistors on the enable pins, and software should therefore immediately drive the line to prevent the pins from floating.

The diagrams illustrate the power and isolation connections for the EFM32 sensor's I2C, PDM, and SPI interfaces. Each diagram features a TS3A4751 multiplexer IC.

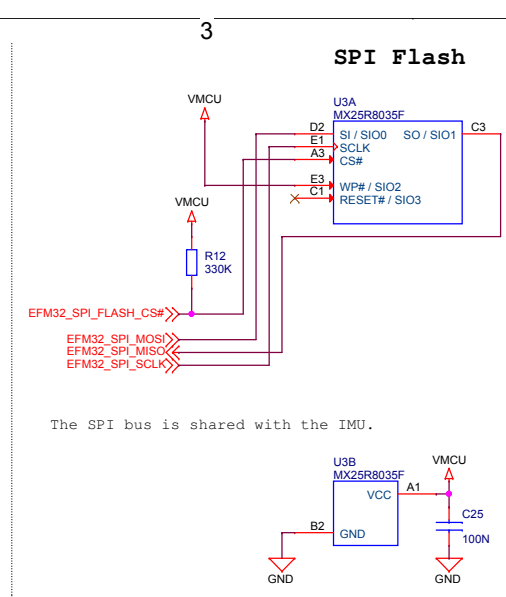
- I2C Interface:** The VMCU pin is connected to the sensor's I2C_SCL pin. The VDD_SENSOR pin is connected to the sensor's I2C_SDA pin. The EFM32_SENSOR_ENABLE pin is connected to the sensor's I2C_ENABLE pin. The EFM32_I2C_SCL and EFM32_I2C_SDA pins are connected to the sensor's I2C_SCL and I2C_SDA pins.
- PDM Interface:** The VMCU pin is connected to the sensor's PDM_CLK pin. The GND pin is connected to the sensor's PDM_DATA pin. The VDD_MIC pin is connected to the sensor's PDM_ENABLE pin. The EFM32_PDM_CLK and EFM32_PDM_DATA pins are connected to the sensor's PDM_CLK and PDM_DATA pins.
- SPI Interface:** The VMCU pin is connected to the sensor's SPI_MISO pin. The GND pin is connected to the sensor's SPI_MISO pin. The VDD_IMU pin is connected to the sensor's SPI_SCLK pin. The EFM32_SPI_MISO, EFM32_SPI_MISO, EFM32_SPI_SCLK, and EFM32_SPI_CS# pins are connected to the sensor's SPI_MISO, SPI_MISO, SPI_SCLK, and SPI_CS# pins.



SPI Flash

The diagram shows the connection of two SPI Flash chips, U3A and U3B, to the VMCU. U3A (MX25R8035F) is connected to VMCU pins D2, E1, A3, E3, and C1. The CS# pin of U3A is connected to the EFM32_SPI_FLASH_CS# pin. U3B (MX25R8035F) is connected to VMCU pins B2 and A1. The VCC pin of U3B is connected to VMCU and a 100nF capacitor (C25) to GND. The GND pin of U3B is connected to GND. The EFM32_SPI_MOSI, EFM32_SPI_MISO, and EFM32_SPI_SCLK pins are connected to the SIO/SIO1, SCLK, and CS# pins of both U3A and U3B.

The SPI bus is shared with the IMU.



SPI Flash

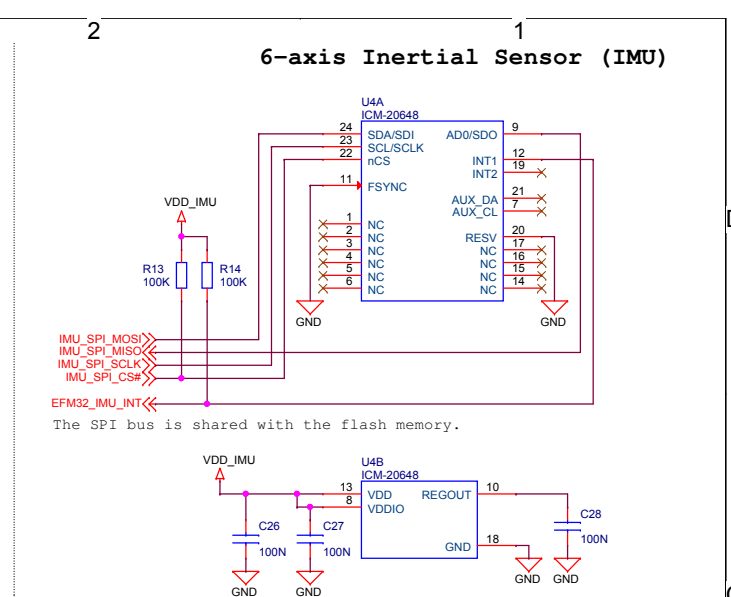
The diagram shows the connection of two SPI Flash chips, U3A and U3B, to the VMCU. U3A (MX25R8035F) is connected to VMCU pins D2, E1, A3, E3, and C1. The CS# pin of U3A is connected to the EFM32_SPI_FLASH_CS# pin. U3B (MX25R8035F) is connected to VMCU pins B2 and A1. The VCC pin of U3B is connected to VMCU and a 100nF capacitor (C25) to GND. The GND pin of U3B is connected to GND. The EFM32_SPI_MOSI, EFM32_SPI_MISO, and EFM32_SPI_SCLK pins are connected to the SIO/SIO1, SCLK, and CS# pins of both U3A and U3B.

The SPI bus is shared with the IMU.

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6-axis Inertial Sensor (IMU)

The SPI bus is shared with the flash memory.



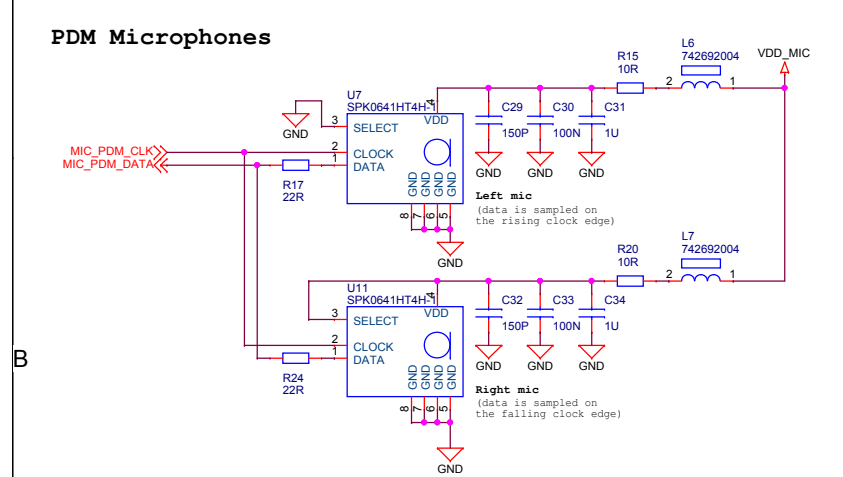
2

6-axis Inertial Sensor (IMU)

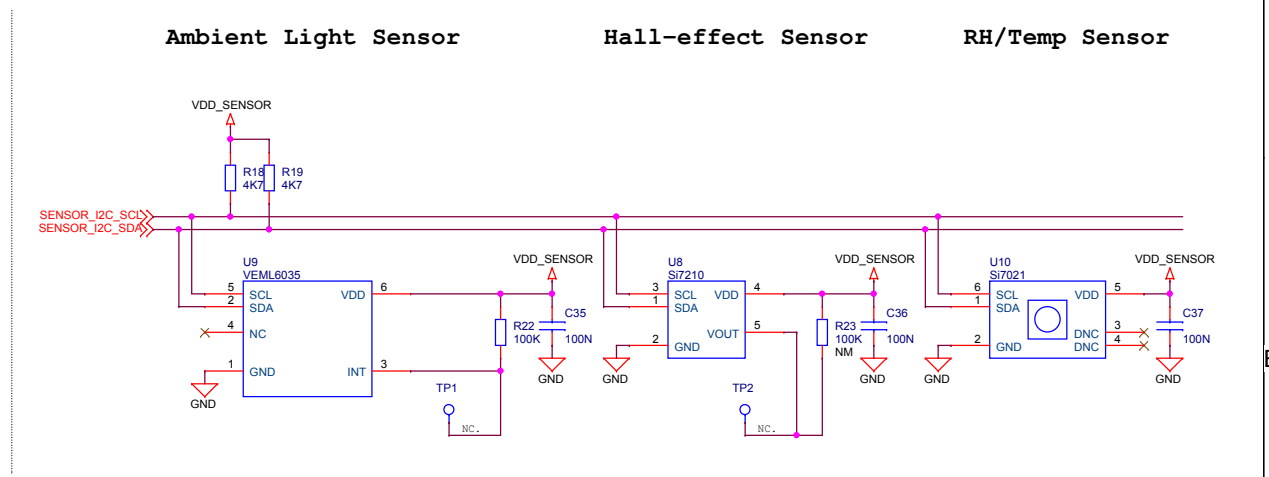
The SPI bus is shared with the flash memory.

PDM Microphones

The schematic shows two PDM microphones, U7 and U11, connected to an STM32F405. Both microphones are SPK0641HT4H-5. U7 is labeled 'Left mic' and U11 is labeled 'Right mic'. The microphones are connected to the STM32F405 via I2C (SCL, SDA) and PDM (CLK, DATA) lines. The PDM clock (MIC_PDM_CLK) and data (MIC_PDM_DATA) lines are shown. The microphones are powered by VDD_MIC and ground. The schematic includes various passive components: resistors R15 (10R), R17 (22R), R20 (10R), and R24 (22R); capacitors C29 (150P), C30 (100N), C31 (1U), C32 (150P), C33 (100N), and C34 (1U); and inductors L6 and L7 (742692004). The microphones are connected to the STM32F405 via I2C (SCL, SDA) and PDM (CLK, DATA) lines. The PDM clock (MIC_PDM_CLK) and data (MIC_PDM_DATA) lines are shown. The microphones are powered by VDD_MIC and ground. The schematic includes various passive components: resistors R15 (10R), R17 (22R), R20 (10R), and R24 (22R); capacitors C29 (150P), C30 (100N), C31 (1U), C32 (150P), C33 (100N), and C34 (1U); and inductors L6 and L7 (742692004).

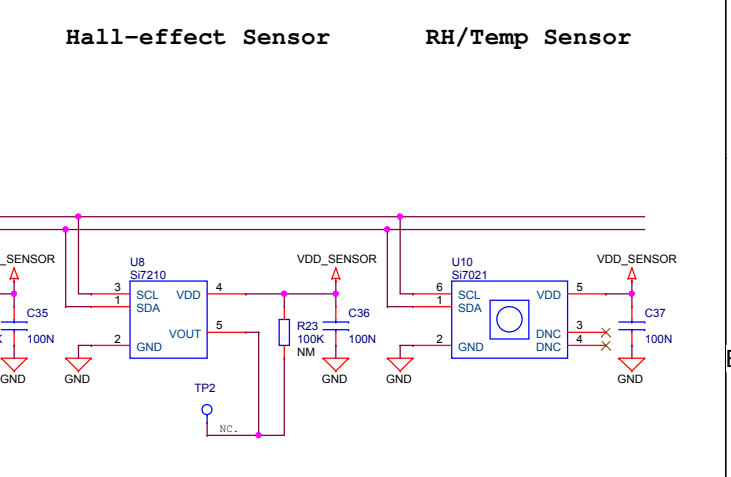


The schematic diagram illustrates the internal wiring of the sensor module. It features three main components: an Ambient Light Sensor (U9, VEML6035), a Hall-effect Sensor (U8, SI7210), and an RH/Temp Sensor (U10, SI7021). All three sensors are powered by a common VDD_SENSOR line and connected to a common ground. The Ambient Light Sensor (U9) has its SCL pin connected to the I2C_SCL line and its SDA pin connected to the I2C_SDA line. The Hall-effect Sensor (U8) has its SCL pin connected to the I2C_SCL line and its SDA pin connected to the I2C_SDA line. The RH/Temp Sensor (U10) has its SCL pin connected to the I2C_SCL line and its SDA pin connected to the I2C_SDA line. The output of the Ambient Light Sensor (U9) is connected to the I2C_SDA line. The output of the Hall-effect Sensor (U8) is connected to the I2C_SCL line. The output of the RH/Temp Sensor (U10) is connected to the I2C_SDA line. The diagram also shows the connection of the sensors to the I2C bus and the power supply.



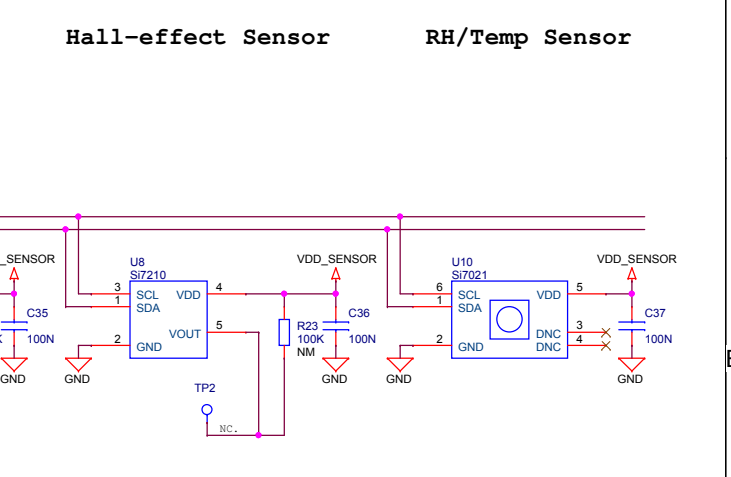
Hall-effect Sensor RH/Temp Sensor

The diagram illustrates the connection of two sensors to a common I2C bus. The Hall-effect sensor (U8: SI7210) is connected to the bus via its SCL (pin 3) and SDA (pin 1) pins. Its VOUT (pin 5) is connected to a voltage divider consisting of a 100k resistor (R23) and a 100nF capacitor (C36), which is then connected to the VDD pin of the RH/Temperature sensor (U10: SI7021). The RH/Temperature sensor's SCL (pin 6) and SDA (pin 1) pins are also connected to the bus. The SDA and SCL pins of the RH/Temperature sensor are marked with 'X' and 'DNC' (Do Not Connect). Both sensors share a common GND. The RH/Temperature sensor's VDD is also connected to a 100nF capacitor (C37) and a voltage divider (R23, C36) connected to the VOUT of the Hall-effect sensor. The RH/Temperature sensor's SCL and SDA pins are marked with 'X' and 'DNC'.



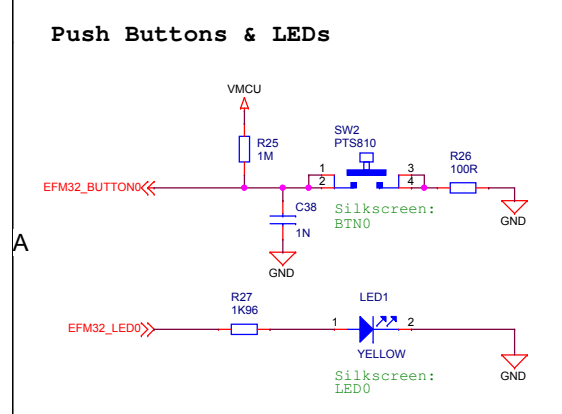
Hall-effect Sensor RH/Temp Sensor

The diagram illustrates the connection of two sensors to a common I2C bus. The Hall-effect sensor (U8: SI7210) is connected to the bus via its SCL (pin 3) and SDA (pin 1) pins. Its VOUT (pin 5) is connected to a voltage divider consisting of a 100k resistor (R23) and a 100nF capacitor (C36), which is then connected to the VDD pin of the RH/Temperature sensor (U10: SI7021). The RH/Temperature sensor's SCL (pin 6) and SDA (pin 1) pins are also connected to the bus. The SDA and SCL pins of the RH/Temperature sensor are marked with 'X' and 'DNC' (Do Not Connect). Both sensors share a common GND. The RH/Temperature sensor's VDD is also connected to a 100nF capacitor (C37) and a voltage divider (R23, C36) connected to the VOUT of the Hall-effect sensor. The RH/Temperature sensor's SCL and SDA pins are marked with 'X' and 'DNC'.



Push Buttons & LEDs

The diagram illustrates the electrical connections for a push button (SW2) and an LED (LED1) on a PCB. The push button, labeled SW2 PTS810, is connected to the VMCU supply through a 1M resistor (R25) and to the EFM32_BUTTON pin. The button is also connected to a 1N capacitor (C38) to ground. The button's other terminal is connected to the EFM32_LED0 pin through a 100R resistor (R26). The LED, labeled LED1, is connected to the EFM32_LED0 pin and is labeled 'YELLOW' and 'Silkscreen: LED0'. The circuit is powered by VMCU and GND.



Breakout Pads – EXP Header

All signals routed to the EXP header are used on the board as well.
Take care to avoid signal conflicts (see page 2 for signal assignments).

EXP_HEADER[16..3] >>>

EXP1A

EXP1B

VMCU5V 3V0

PC00 EXP_HEADER4

PC01 EXP_HEADER6

PC02 EXP_HEADER8

PB02 EXP_HEADER10

PA05 EXP_HEADER12

PA06 EXP_HEADER14

PD02 EXP_HEADER16

EXP_HEADER3 PA08

EXP_HEADER5 PA07

EXP_HEADER7 PB00

EXP_HEADER9 PB01

EXP_HEADER11 PA04

EXP_HEADER13 PB03

EXP_HEADER15 PD03

BOARD_ID_SCL >>>

BOARD_ID_SDA >>>

GND

Breakout Pads – EXP Header

All signals routed to the EXP header are used on the board as well.
Take care to avoid signal conflicts (see page 2 for signal assignments).

EXP_HEADER[16..3] >>>

EXP1A

EXP1B

VMCU5V 3V0

PC00 EXP_HEADER4

PC01 EXP_HEADER6

PC02 EXP_HEADER8

PB02 EXP_HEADER10

PA05 EXP_HEADER12

PA06 EXP_HEADER14

PD02 EXP_HEADER16

EXP_HEADER3 PA08

EXP_HEADER5 PA07

EXP_HEADER7 PB00

EXP_HEADER9 PB01

EXP_HEADER11 PA04

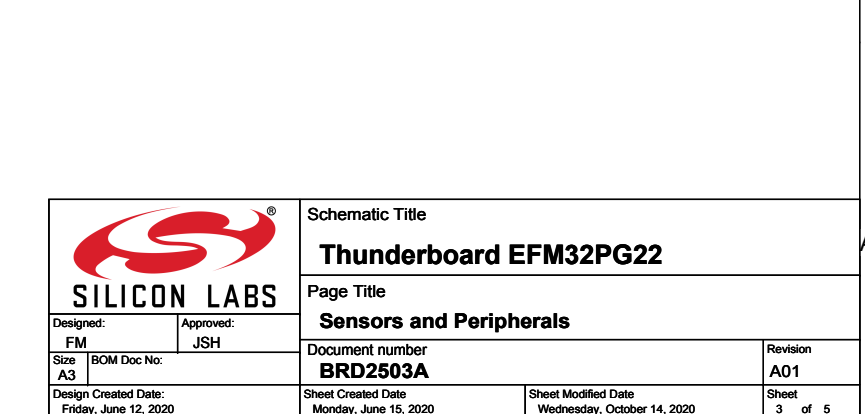
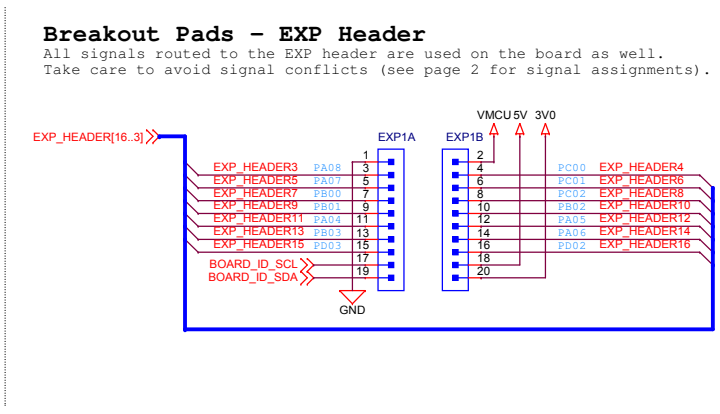
EXP_HEADER13 PB03

EXP_HEADER15 PD03

BOARD_ID_SCL >>>

BOARD_ID_SDA >>>

GND



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		Thunderboard EFM32PG22	
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Revision: 1.0		Revision: 1.0	
Document number BRD2503A		Revision A01	
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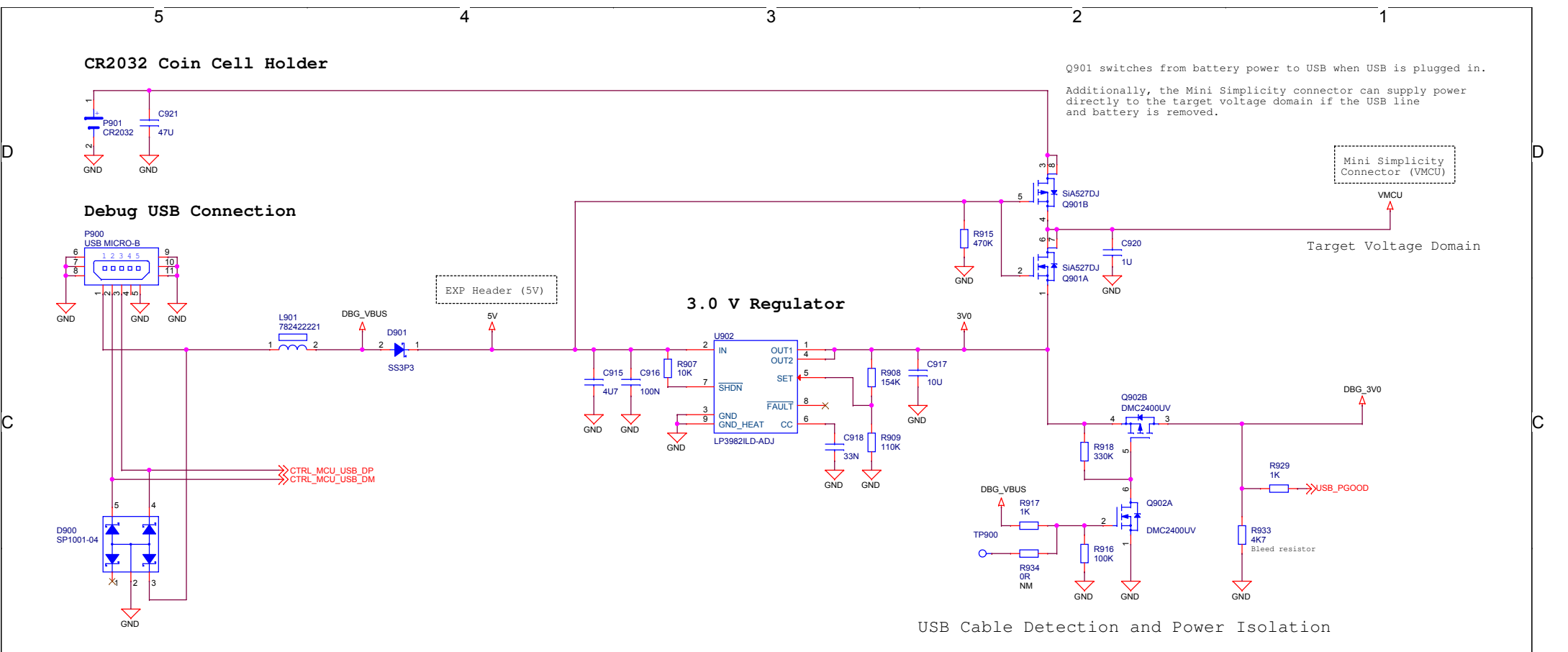
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		Thunderboard EFM32PG22	
Designed: FM		Approved: JSH	
Size A3		BOM Doc No:	
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Document number BRD2503A		Revision A01	
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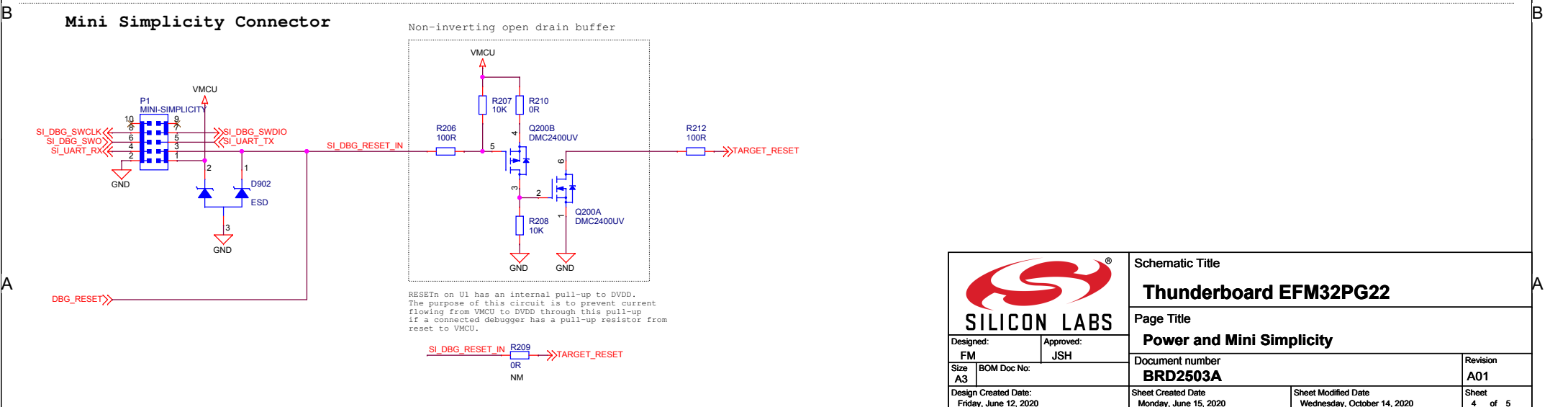
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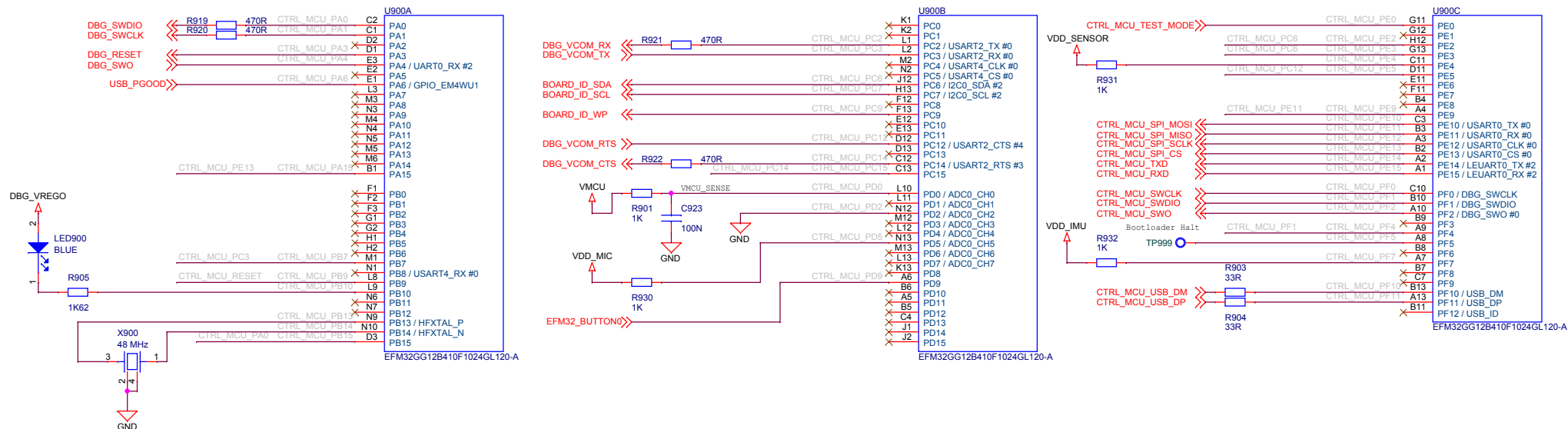
Q901 switches from battery power to USB when USB is plugged in. Additionally, the Mini Simplicity connector can supply power directly to the target voltage domain if the USB line and battery is removed.



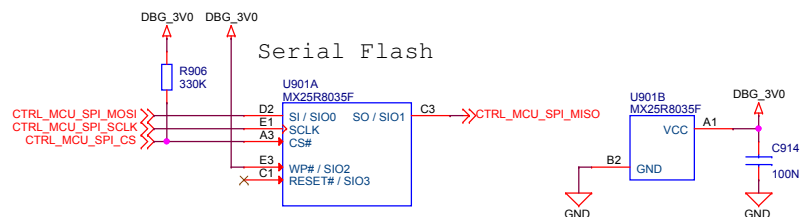
RESETn on U1 has an internal pull-up to DVDD. The purpose of this circuit is to prevent current flowing from VMCU to DVDD through this pull-up if a connected debugger has a pull-up resistor from reset to VMCU.

 SILICON LABS		Schematic Title	
		Thunderboard EFM32PG22	
Designed: FM	Approved: JSH	Page Title	
Size A3	BOM Doc No:	Power and Mini Simplicity	
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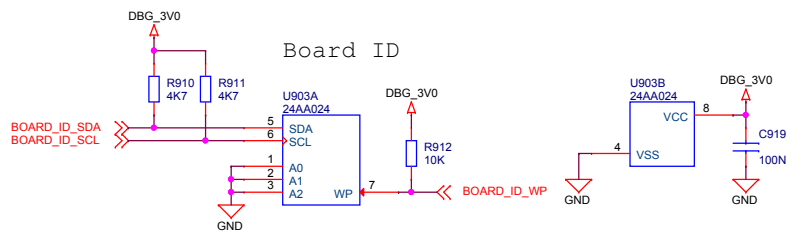
On-board Debugger



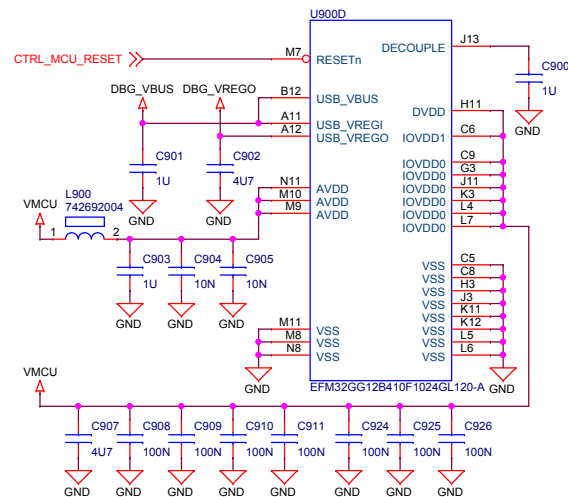
Serial Flash



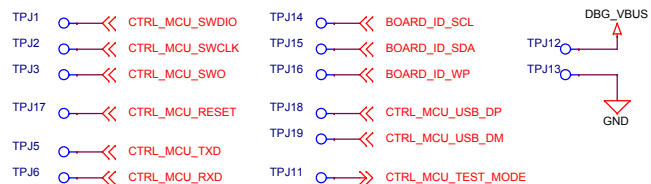
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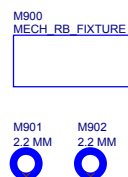
On-board Debugger Power



Test Points



Mech



		Schematic Title	
		Thunderboard EFM32PG22	
Designed: FM Size: A3 Design Created Date: Friday, June 12, 2020		Page Title	
		On-board Debugger	
BOM Doc No:		Document number	Revision
BRD2503A		BRD2503A	A01
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