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## Thunderboard Sense

EFR32MG12P332F1024GL125

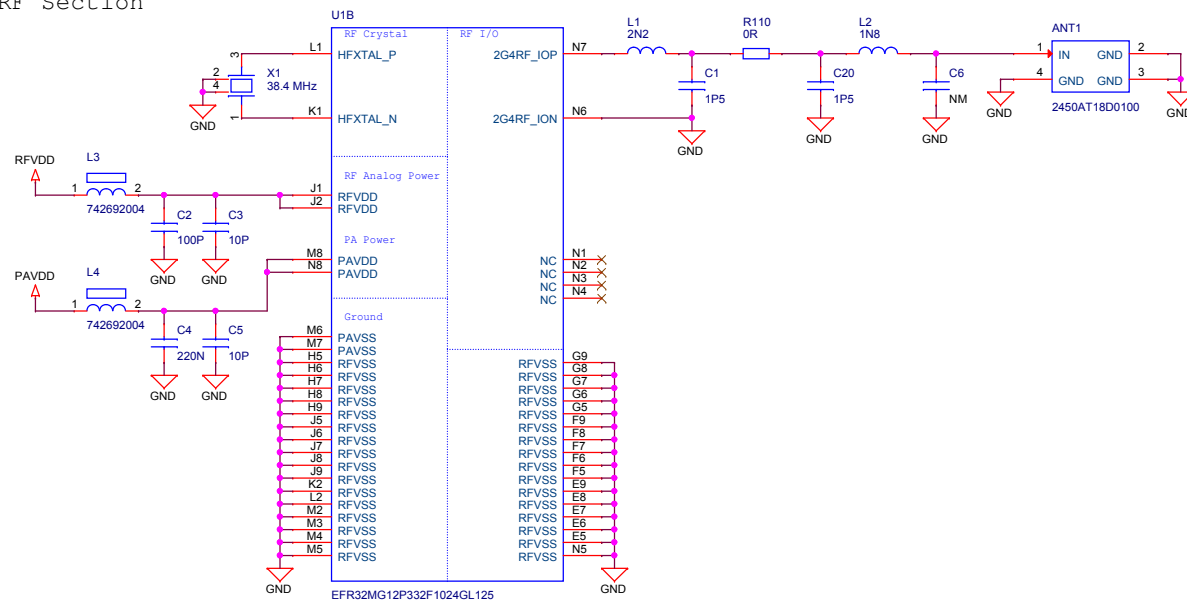
| Board Function                 | Page |
|--------------------------------|------|
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| EFR32 RF, Power & IO           | 2    |
| EFR32 connections & interfaces | 3    |
| MEMS Microphone & RGB LEDs     | 4    |
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## Revision History

| Rev. | Description                                                                                           |
|------|-------------------------------------------------------------------------------------------------------|
| A00  | Initial prototype version.                                                                            |
| B00  | Updated EFR32 and debugger IC revisions.<br>Replaced analog microphone with an I2S-based digital one. |
| B01  | Changed microphone to Knowles SPH0645LM4H-B                                                           |
| C00  | Updated microphone and SPI Flash pinout. Changed to Invensense microphone and 9-axis IMU.             |

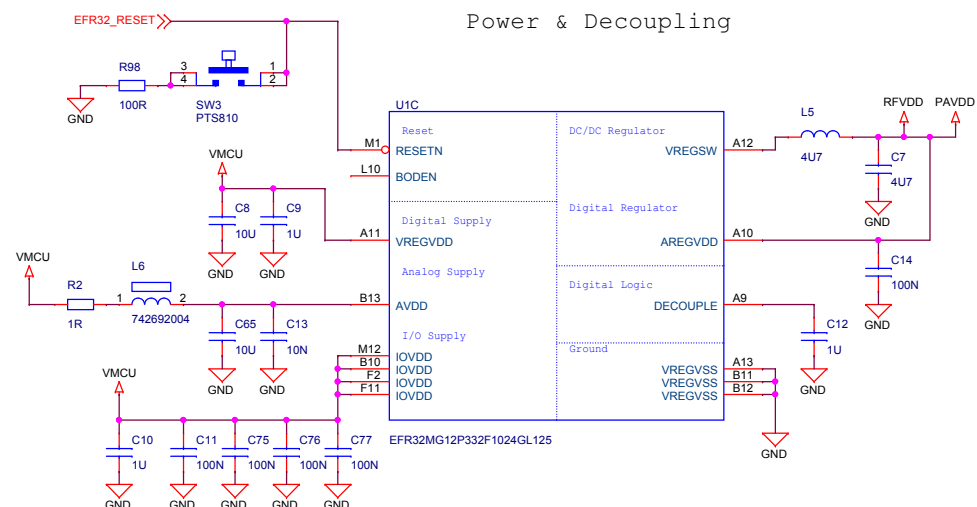
## SCHEMATIC1

|                                                                                                              |  |                                                    |  |
|--------------------------------------------------------------------------------------------------------------|--|----------------------------------------------------|--|
| <br><b>SILICON LABS</b> |  | Schematic Title                                    |  |
|                                                                                                              |  | <b>Thunderboard Sense</b>                          |  |
| Designed:<br>DDB                                                                                             |  | Approved:<br>JNO                                   |  |
| Size<br>A3                                                                                                   |  | BOM Doc No:<br><Cage Code>                         |  |
| Design Created Date:<br>Wednesday, November 30, 2016                                                         |  | Sheet Created Date<br>Wednesday, November 30, 2016 |  |
|                                                                                                              |  | Sheet Modified Date<br>Tuesday, April 04, 2017     |  |
|                                                                                                              |  | Sheet<br>1 of 7                                    |  |



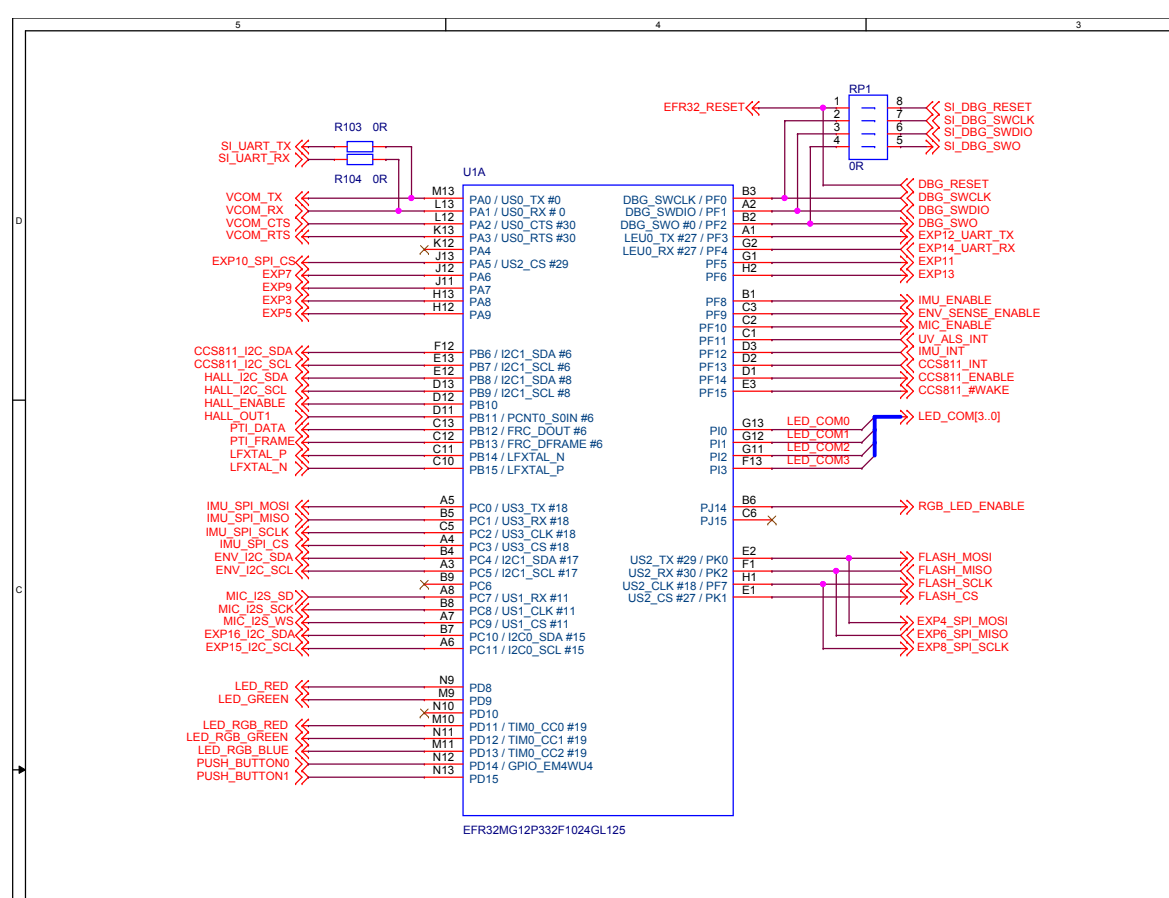
M1 2.2 MM

M2 2.2 MM

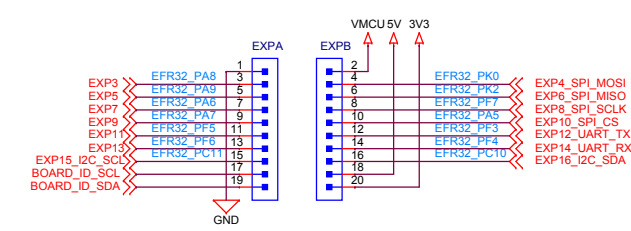


## Power & Decoupling

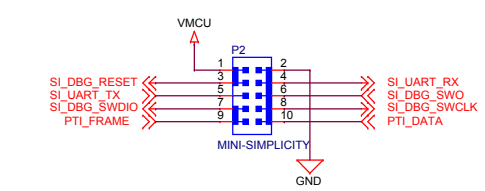
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| Sheet Modified Date<br>Tuesday, April 04, 2017 | Sheet<br>2 of |
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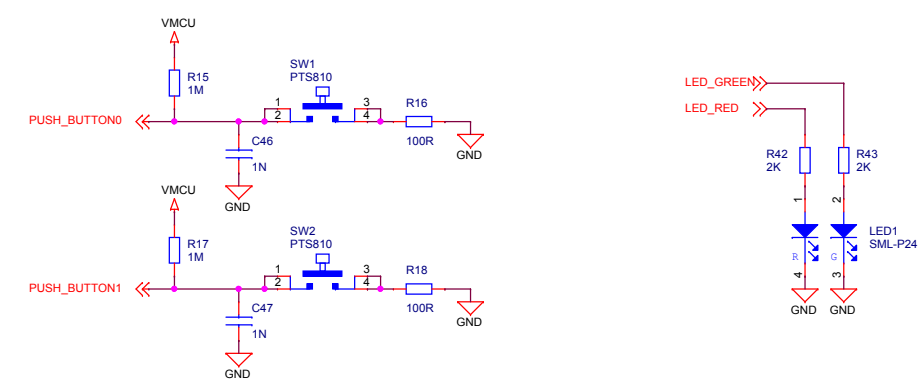
### Breakout Pads - EXP Header



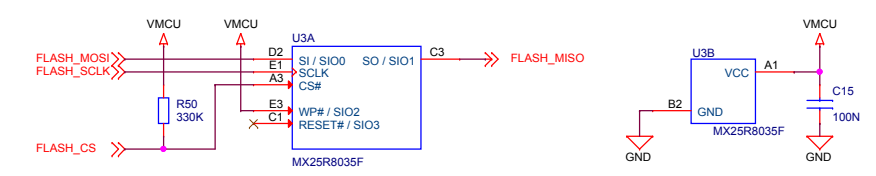
### Mini Simplicity Connector



### Push Buttons & LEDs



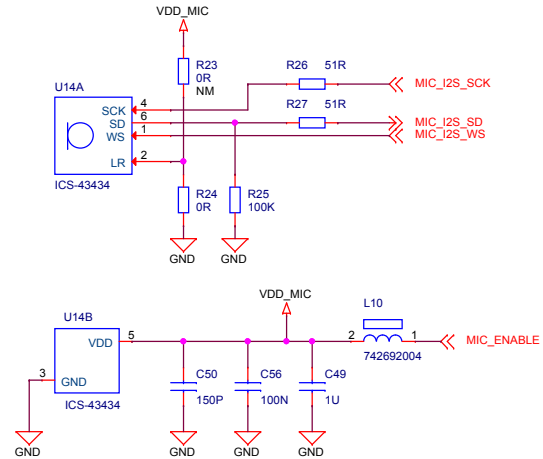
### SPI Flash



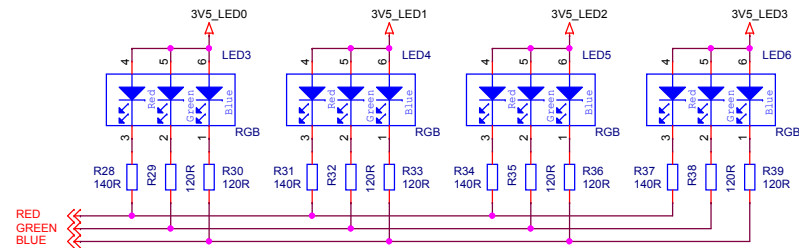
### <Schematic Path> SCHEMATIC1

|                                                                                                              |                             |                                           |
|--------------------------------------------------------------------------------------------------------------|-----------------------------|-------------------------------------------|
| <br><b>SILICON LABS</b> | Schematic Title             |                                           |
|                                                                                                              | <b>Thunderboard Sense 2</b> |                                           |
| Designed: DDB                                                                                                |                             | Page Title                                |
| Approved: JNO                                                                                                |                             | <b>EFR32 connections &amp; interfaces</b> |
| Size A3                                                                                                      |                             | Document number                           |
| BOM Doc No: <Cage Code>                                                                                      |                             | <b>BRD4166A</b>                           |
| Design Created Date: Wednesday, November 30, 2016                                                            |                             | Revision                                  |
| Sheet Created Date: Wednesday, November 30, 2016                                                             |                             | <b>C00</b>                                |
| Sheet Modified Date: Tuesday, April 04, 2017                                                                 |                             | Sheet                                     |
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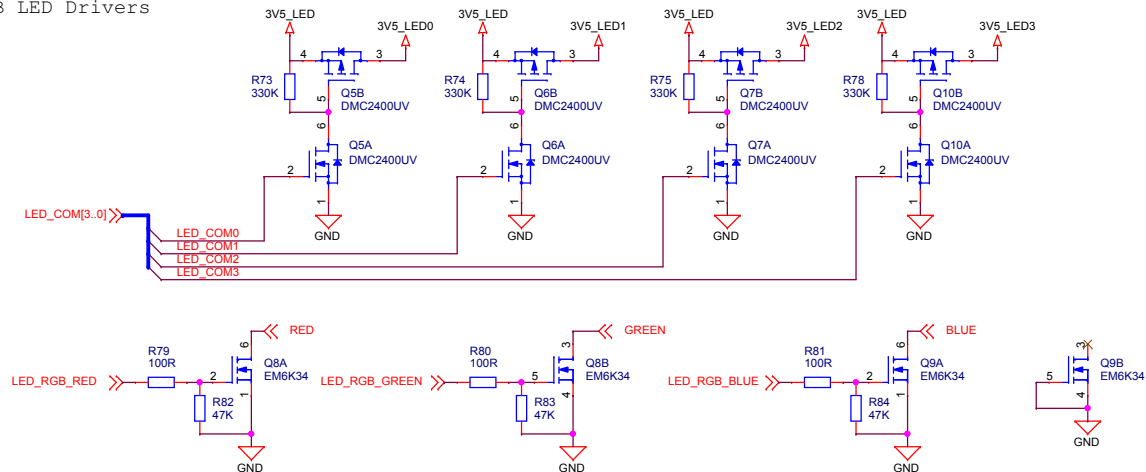
## MEMS Microphone



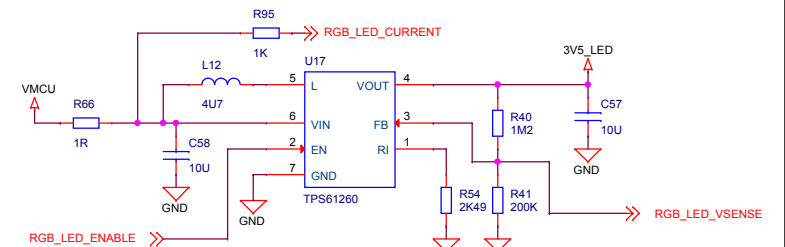
## RGB LEDs



## RGB LED Drivers



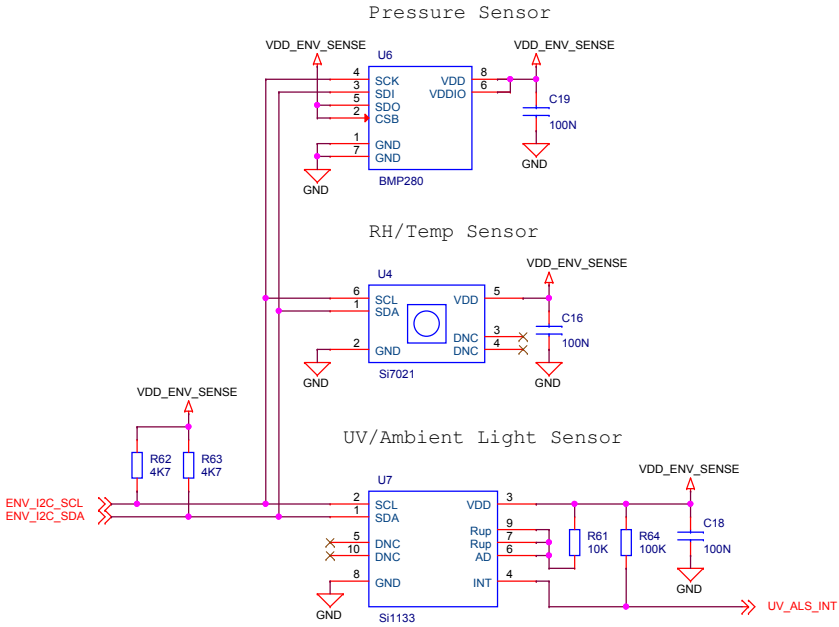
## RGB LED power supply



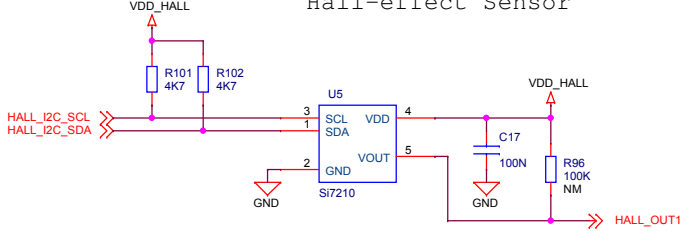
## <Schematic Path> SCHEMATIC1

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|--------------------------------------------------------------------------------------------------------------|--|----------------------------------------------------|------------------------------------------------|
| <br><b>SILICON LABS</b> |  | Schematic Title                                    |                                                |
|                                                                                                              |  | <b>Thunderboard Sense 2</b>                        |                                                |
| Designed:<br>DDB                                                                                             |  | Page Title                                         |                                                |
| Approved:<br>JNO                                                                                             |  | <b>MEMS Microphone &amp; RGB LEDs</b>              |                                                |
| Size<br>A3                                                                                                   |  | Document number                                    | Revision                                       |
| BOM Doc No:<br>~Cage Code>                                                                                   |  | <b>BRD4166A</b>                                    | <b>C00</b>                                     |
| Design Created Date:<br>Wednesday, November 30, 2016                                                         |  | Sheet Created Date<br>Wednesday, November 30, 2016 | Sheet Modified Date<br>Tuesday, April 04, 2017 |
|                                                                                                              |  |                                                    | Sheet<br>4 of 7                                |

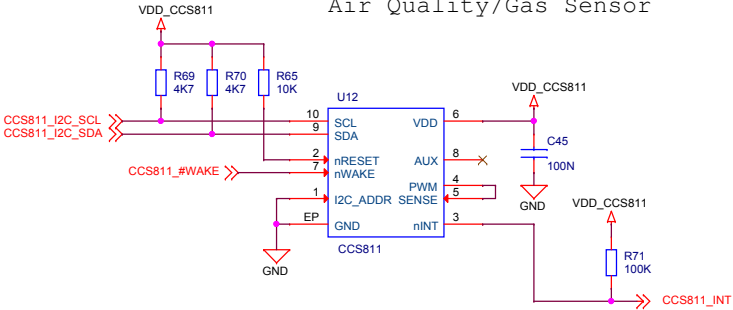
Environmental Sensors



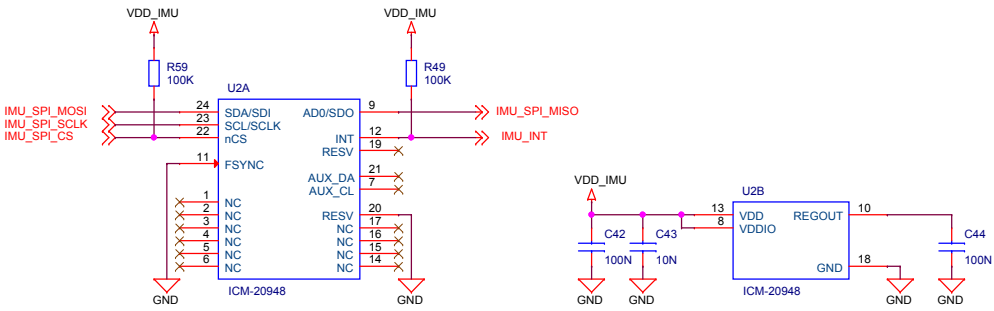
Hall-effect Sensor



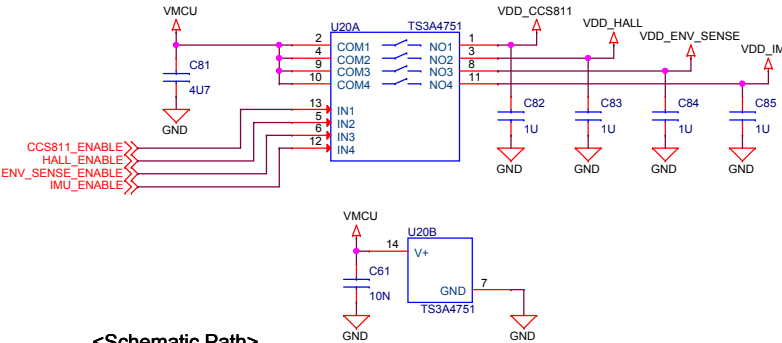
Air Quality/Gas Sensor



9-axis inertial sensor



Sensor Power Control

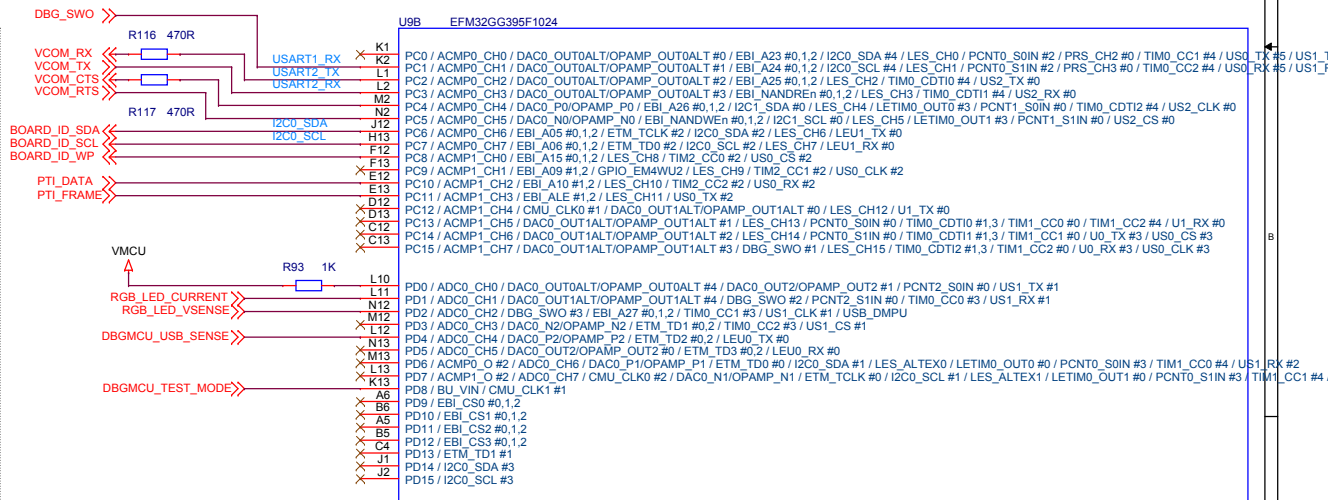


<Schematic Path>  
SCHEMATIC1

|                                                                                                              |                             |                 |
|--------------------------------------------------------------------------------------------------------------|-----------------------------|-----------------|
| <br><b>SILICON LABS</b> | Schematic Title             |                 |
|                                                                                                              | <b>Thunderboard Sense 2</b> |                 |
| Designed: DDB                                                                                                |                             | Approved: JNO   |
| Size A3                                                                                                      |                             | Document number |
| BOM Doc No: <Cage Code>                                                                                      |                             | <b>BRD4166A</b> |
| Design Created Date: Wednesday, November 30, 2016                                                            |                             | Revision        |
| Sheet Created Date: Wednesday, November 30, 2016                                                             |                             | <b>C00</b>      |
| Sheet Modified Date: Tuesday, April 04, 2017                                                                 |                             | Sheet 5 of 7    |

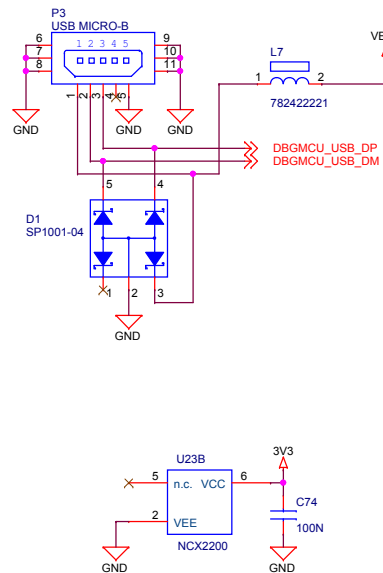
### Debug MCU Connections to Mini Simplicity Header

The diagram illustrates the connection of a Debug MCU to a Mini Simplicity Header. The MCU has pins 1-4 (DBGMCU\_SWDIO, DBGMCU\_SWCLK, DBGMCU\_SWO, DBGMCU\_RESET) and pins 8-5 (SI\_DBG\_SWDIO, SI\_DBG\_SWCLK, SI\_DBG\_SWO, SI\_DBG\_RESET). The header has pins R105 and R106. The MCU is connected to the header via a 4-pin connector.



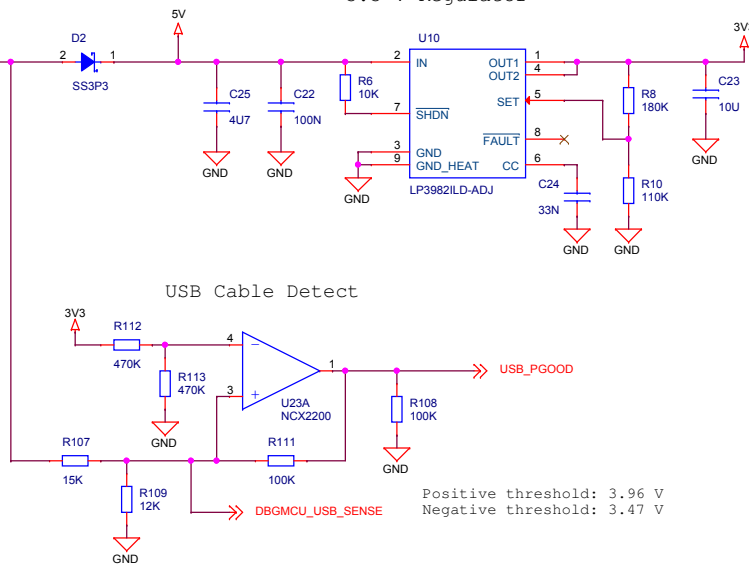
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|--------------------------------------------------------------------------------------------------------------|-----------------------------------------|-----------------------------------------------------------|-------------------------------------------------------|
| <br><b>SILICON LABS</b> |                                         | Schematic Title                                           |                                                       |
|                                                                                                              |                                         | <b>Thunderboard Sense 2</b>                               |                                                       |
| Designed: <b>DDB</b>                                                                                         |                                         | Approved: <b>JNO</b>                                      |                                                       |
| Size <b>A3</b>                                                                                               | BOM Doc No:<br><b>&lt;Cage Code&gt;</b> | Page Title<br><b>Debug MCU</b>                            |                                                       |
| Design Created Date:<br><b>Wednesday, November 30, 2016</b>                                                  |                                         | Document number<br><b>BRD4166A</b>                        | Revision<br><b>C00</b>                                |
|                                                                                                              |                                         | Sheet Created Date<br><b>Wednesday, November 30, 2016</b> | Sheet Modified Date<br><b>Tuesday, April 04, 2017</b> |
|                                                                                                              |                                         | Sheet<br><b>6</b>                                         | of <b>7</b>                                           |

## USB Connector

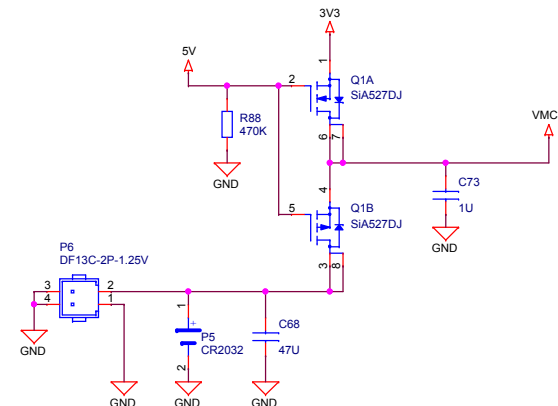


User can supply 3.6 - 5.5 on "5V" pin instead of using the USB cable

## 3.3 V Regulator



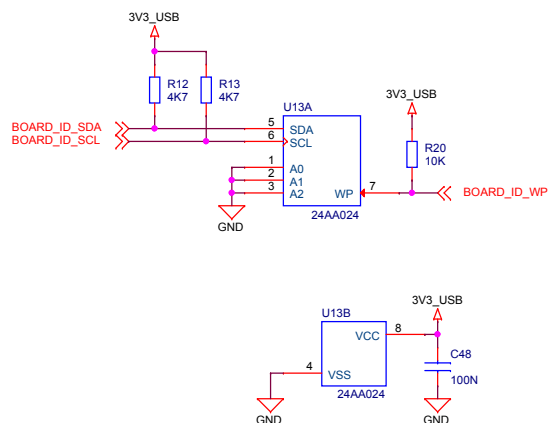
## Board power select circuit



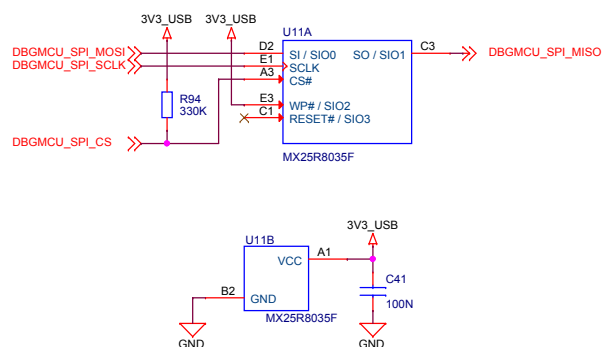
Q1 switches from battery power to USB when USB is plugged in.

Additionally, the Mini Simplicity Debug connector can supply power directly to the target voltage domain.

## Board ID EEPROM

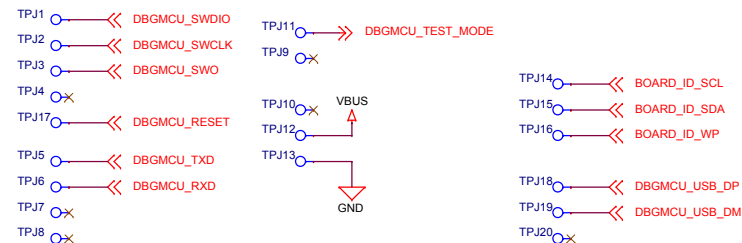


## SPI Flash



Note: The SPI flash is only available to the debug mcu when the USB cable is plugged in!

## Test Points



## <Schematic Path> SCHEMATIC1

|                                                                                       |  |                      |  |
|---------------------------------------------------------------------------------------|--|----------------------|--|
|  |  | Schematic Title      |  |
|                                                                                       |  | Thunderboard Sense 2 |  |
| Designed: DDB                                                                         |  | Page Title           |  |
| Approved: JNO                                                                         |  | Debug Misc. & Power  |  |
| Size A3                                                                               |  | Document number      |  |
| BOM Doc No: <Cage Code>                                                               |  | BRD4166A             |  |
| Design Created Date: Wednesday, November 30, 2016                                     |  | Revision             |  |
| Sheet Created Date: Wednesday, November 30, 2016                                      |  | C00                  |  |
| Sheet Modified Date: Tuesday, April 04, 2017                                          |  | Sheet 7 of 7         |  |