**NXP Semiconductors**
Application Note

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# Powering an i.MX 6SX-based system using the PF3000 PMIC

## 1 Introduction

The PF3000 is a highly integrated Power Management IC ideally suited to power NXP's i.MX 6SX, i.MX 6SL, i.MX 6S, i.MX 6DL, i.MX 6UL and the i.MX 7 series of applications processors. This Application Note discusses the power tree configuration for powering an i.MX 6SX based system using the PF3000.

NXP analog ICs are manufactured using the SMARTMOS process, a combinational BiCMOS manufacturing flow that integrates precision analog, power functions and dense CMOS logic together on a single cost-effective die.

**Contents**



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# 2 PF3000 voltage regulators

Table 1 shows a summary of the voltage regulators in the PF3000. Output voltage and startup sequence of the regulators is programmed into the PMIC through One Time Programmable (OTP) memory. For more details, refer to the product datasheet.

**Table 1. PF3000 voltage regulators**

| Regulator | Output voltage range | Load current rating |
|---|---|---|
| SW1A | 0.7 V to 1.425 V<br>1.8 V<br>3.3 V | 1000 mA |
| SW1B | 0.7 V to 1.475 V | 1750 mA |
| SW2 | 1.5 V to 1.85 V<br>2.5 V to 3.3 V | 1250 mA |
| SW3 | 0.9 V to 1.65 V | 1500 mA |
| SWBST | 5.0 V to 5.15 V | 600 mA |
| VSNVS | 3.0 V | 1.0 mA |
| VLDO1 | 1.8 V to 3.3 V | 100 mA |
| VLDO2 | 0.8 V to 1.55 V | 250 mA |
| VLDO3 | 1.8 V to 3.3 V | 100 mA |
| VLDO4 | 1.8 V to 3.3 V | 350 mA |
| VCC_SD | 1.8 V to 1.85 V<br>2.85 V to 3.3 V | 100 mA |
| V33 | 2.85 V to 3.3 V | 350 mA |
| VREFDDR | VINREFDDR/2 | 10 mA |

# 3 i.MX 6SX power management using the PF3000

The i.MX 6SX processor features NXP's advanced implementation of the a single ARM® Cortex®-A9 MPCore™ multicore processor, which operates at speeds up to 1 GHz. Table 2 shows how PF3000 can be used to power an i.MX 6SX based system. This include the voltage rails required by the processor as well as memory and common peripherals. As a programming PMIC, the PF3000 can be used in a number of ways to power the i.MX 6SX. Table 2 lists one of the many possibilities. The power tree can be optimized based on specific application requirements.

**Table 2. PF3000 + i.MX 6SX power tree**

| Regulator | Voltage | Sequence | Load domain |
|---|---|---|---|
| SW1A | 1.375 V | 2 | VDDCORE |
| SW1B | 1.375 V | 2 | VDDSOC |
| SW2 | 3.3 V | 4 | NVCC_SD4, NVCC_NAND, NVCC_GPIO, NVCC_KEY, NVCC_QSPI, NVCC_LCD1, NVCC_HIGH (SD3), LCD Connector, CAN, Sensors, SD3 (SD3.0 Card), SD4 (SD Card-boot), QSPI Flash |
| SW3 | 1.35 V | 3 | DDR3L |
| SWBST | 5.0 V | Off | N/A |
| VSNVS | 3.0 V | 0 | VDD_SNVS_IN |
| VLDO1 | 3.3 V | Off | N/A |
| VLDO2 | 1.5 V | Off | Camera Connector, MPCIE |
| VLDO3 | 2.5 V | Off | Camera Connector, Audio Codec |
| VLDO4 | 1.8 V | 4 | NVCC_LOW(SD3), NVCC_CSI |
| VCC_SD | 3.3 V | 5 | VDD_AFE_3P3, VDDA_ADC_3P3 (12-bit ADC), ADC_VREFH (12-bit ADC) |
| V33 | 3.0 V | 1 | VDD_HIGH_IN,VDD_HIGH_CAP |
| VREFDDR | 0.625 V | 3 | DRAM_VREF |

# 4 PF3000 power input

PF3000 input voltage range is 2.8 V to 4.5 V or 3.7 V to 5.5 V. 2.8 V to 4.5 V when VIN is used at input. 3.7 V to 5.5 V when VPWR is used as input.

For non-battery operated applications, when the input supply voltage exceeds 4.5 V, the front-end LDO can be activated by populating the external PMOS pass FET Q16 in Figure 1 and connecting the VPWR pin to the main supply. In this case, the LDO control block self-starts with a local bandgap reference.

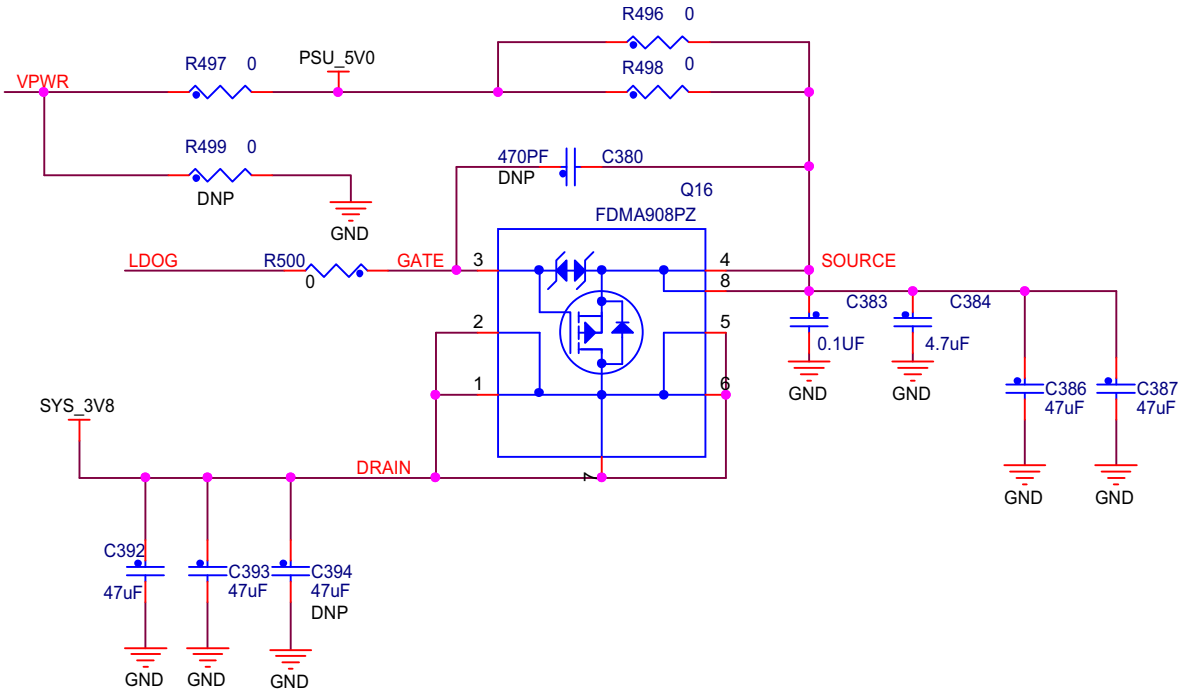



**Figure 1. PF3000 5.0 V input circuit**

In a battery operated application, BC3770 input is connected directly to the adapter. BC3770 is a fully programmable switching charger with dual-path output. One output path connect to PF3000 VIN as the system power supply. The other output path is for single-cell Li-Ion and Li-Polymer battery. (See Figure 2.) In this case, the PMOS pass FET Q16 should not be populated and VPWR pin should be grounded externally.

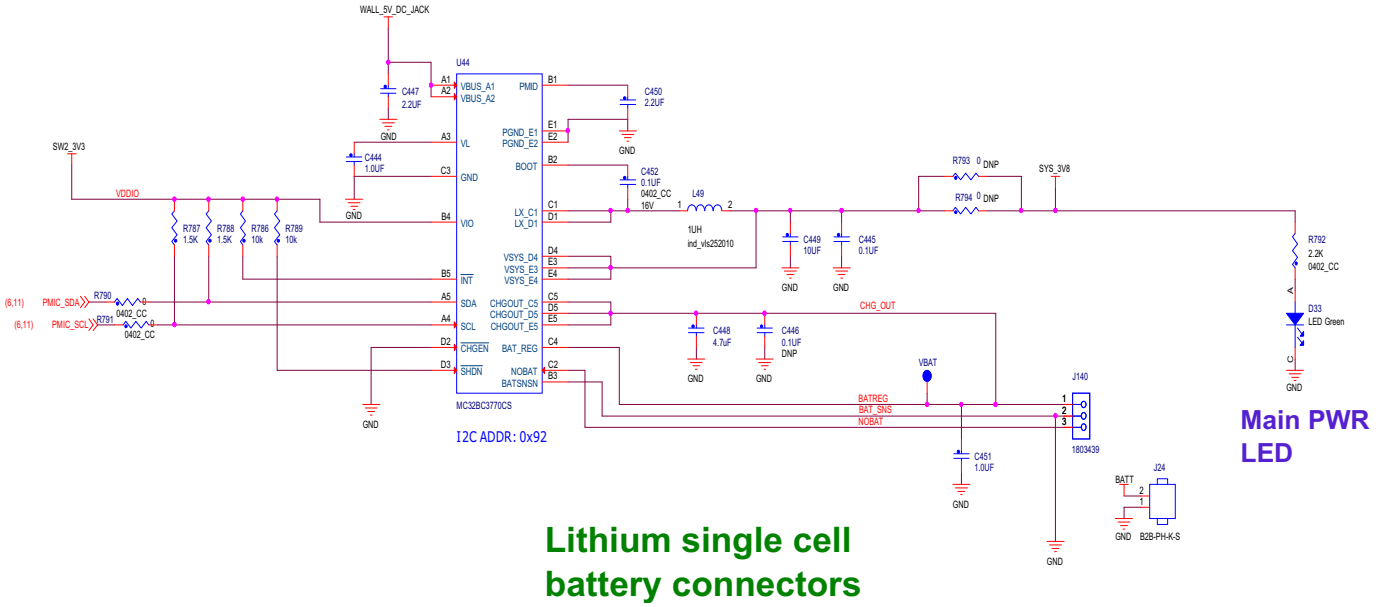



**Figure 2. BC3770 lithium charger**

# 5 PF3000 layout guidelines

The Application Note AN5094 provides best practices for the layout of the PF3000 device on printed circuit boards. To download AN5094, click on the following link: http://www.nxp.com/files/analog/doc/app_note/AN5094.pdf

# 6 PF3000 software support

NXP offers PF3000 code support for a custom i.MX 6 board at the NXP Community site https://community.nxp.com/docs/DOC-105064).

# 7 Schematics

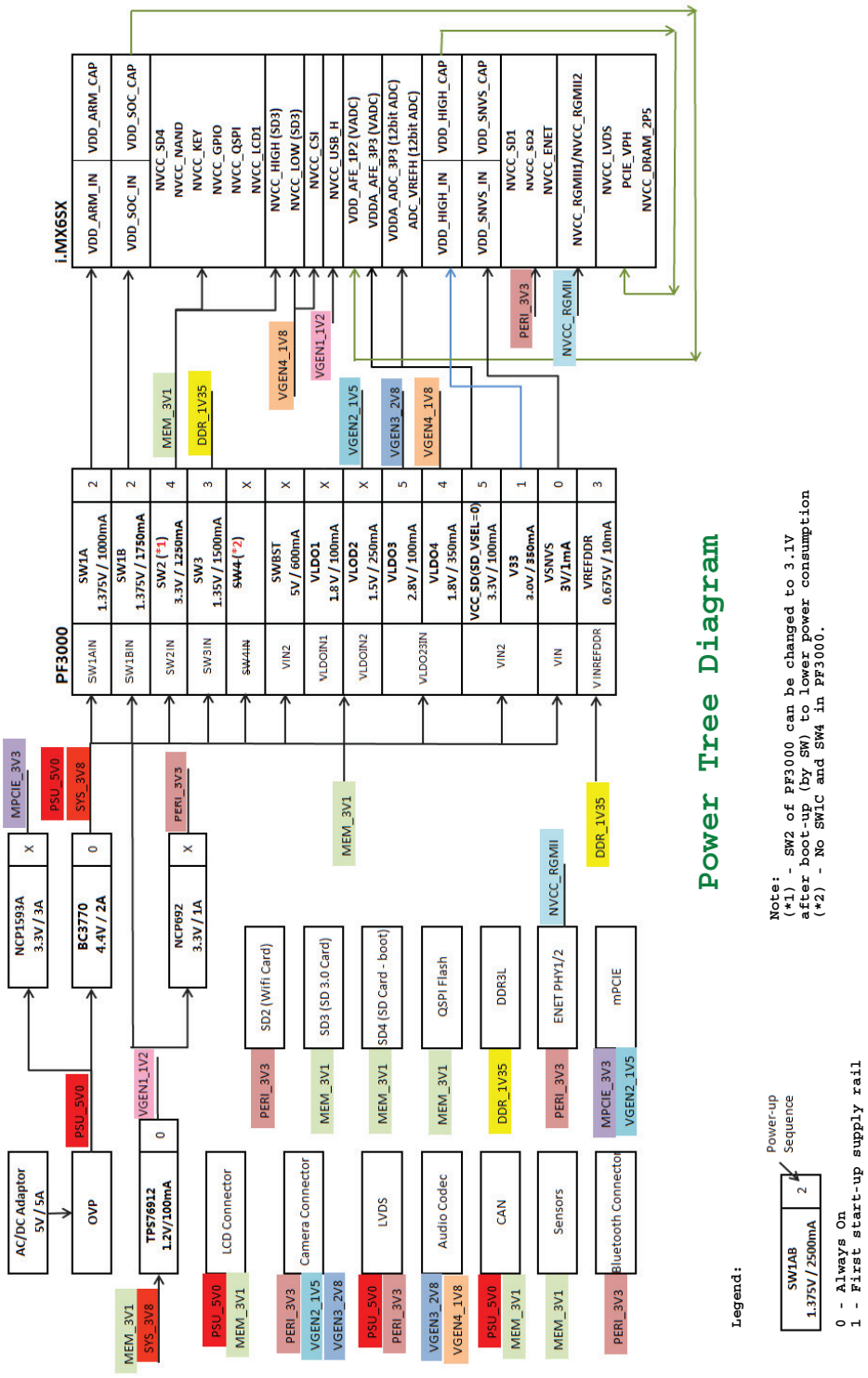



**Figure 3. Schematic part 1**

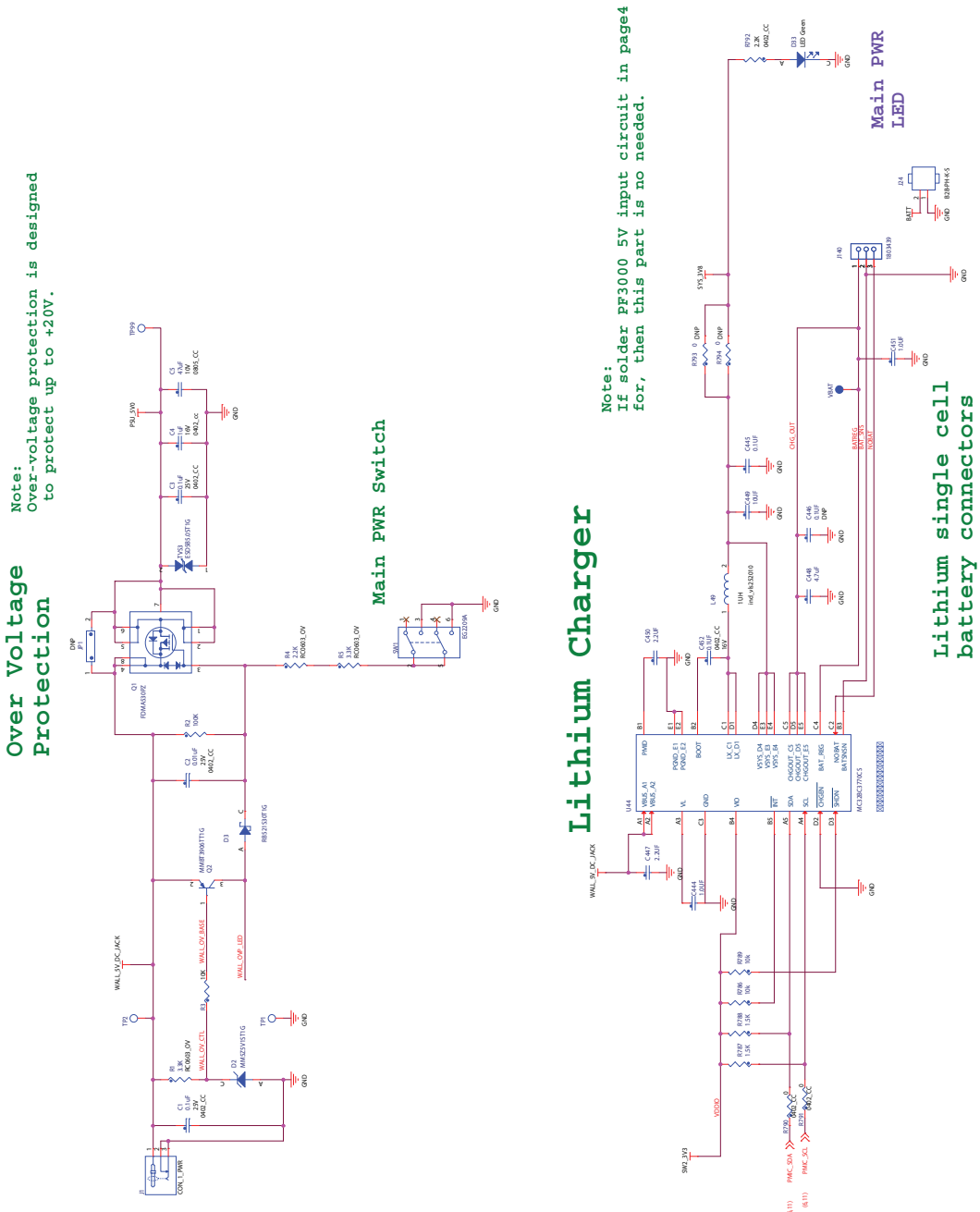



**Figure 4. Schematic part 2**

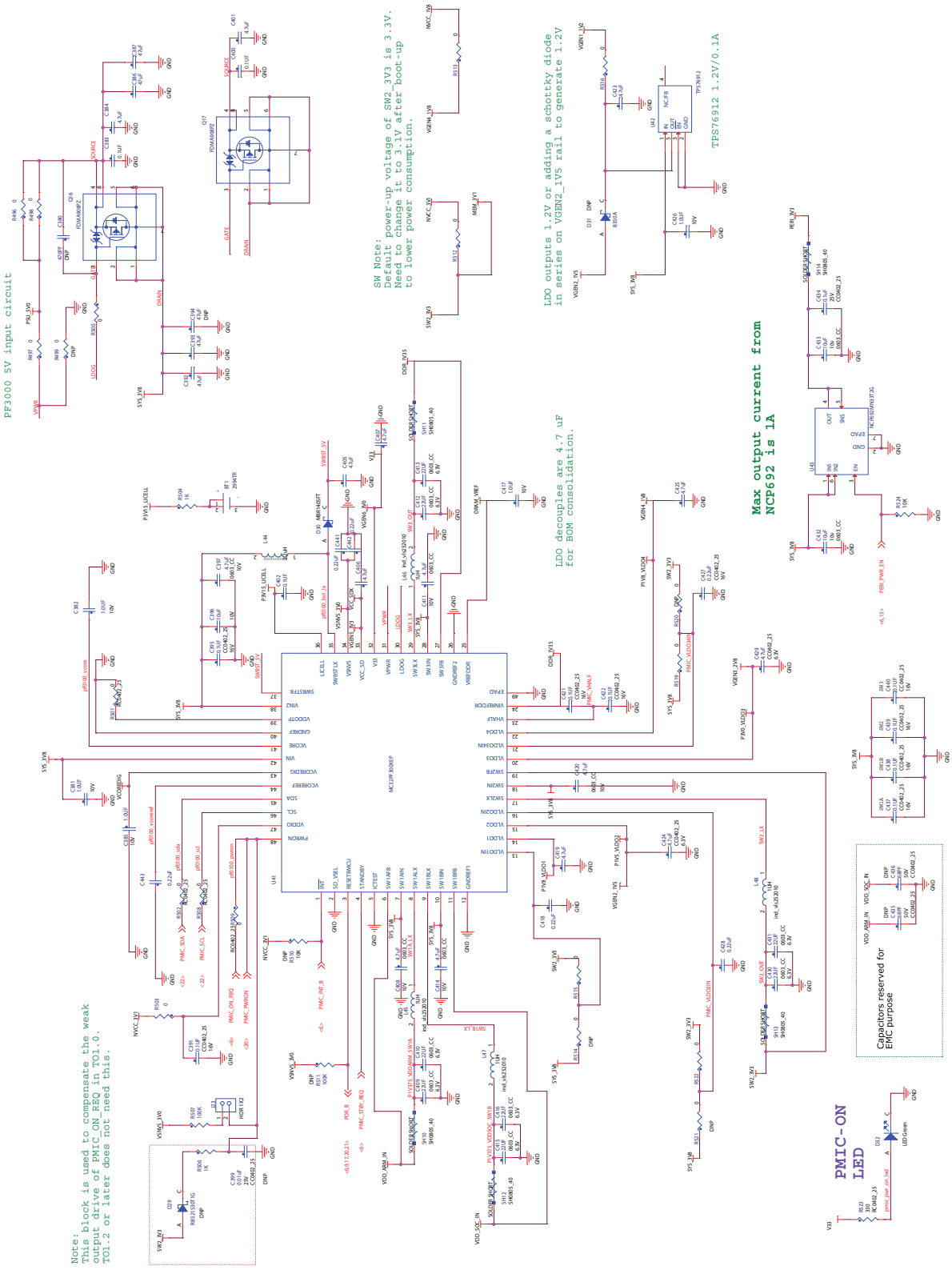



**Figure 5. Schematic part 3**

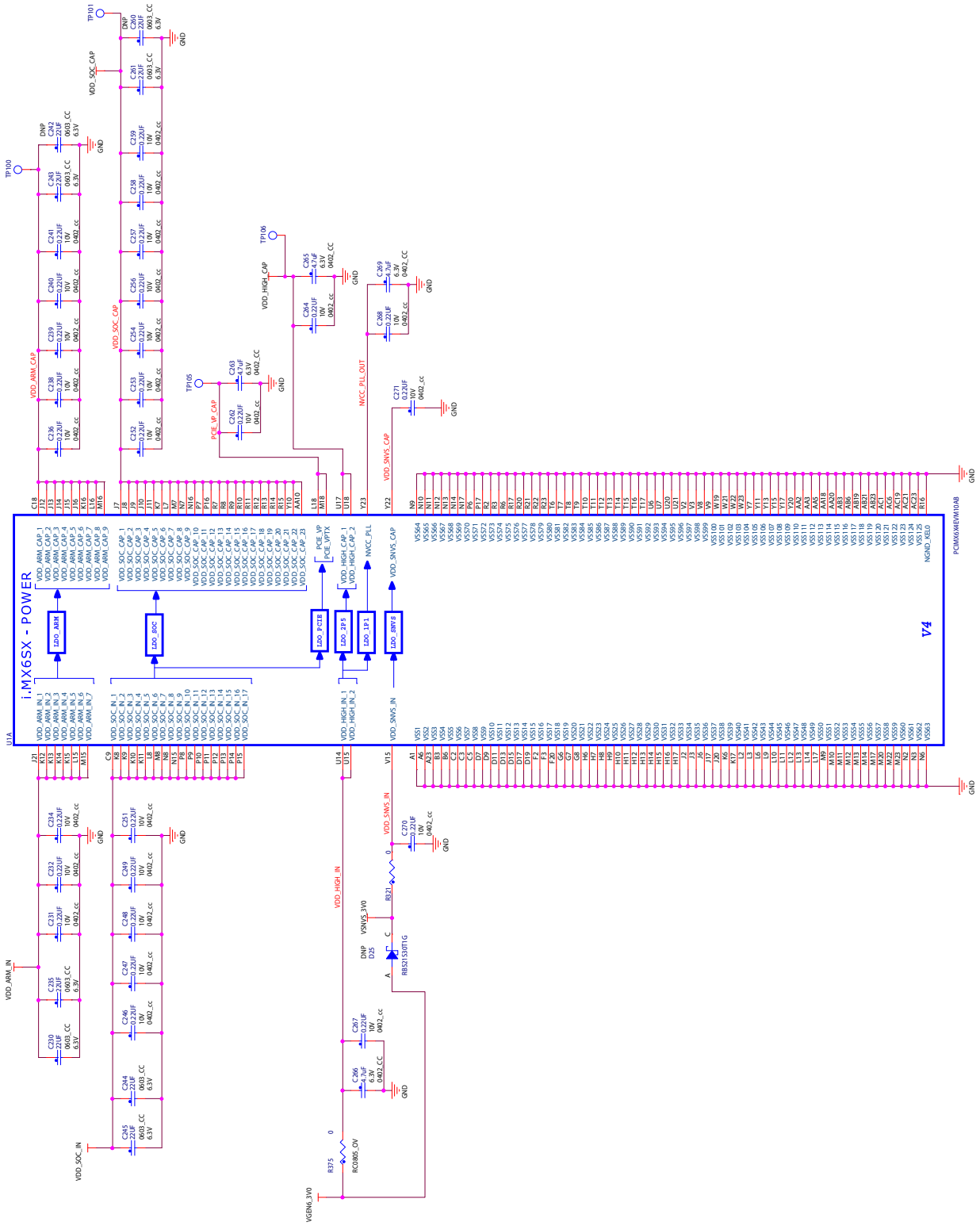



**Figure 6. Schematic part 4**

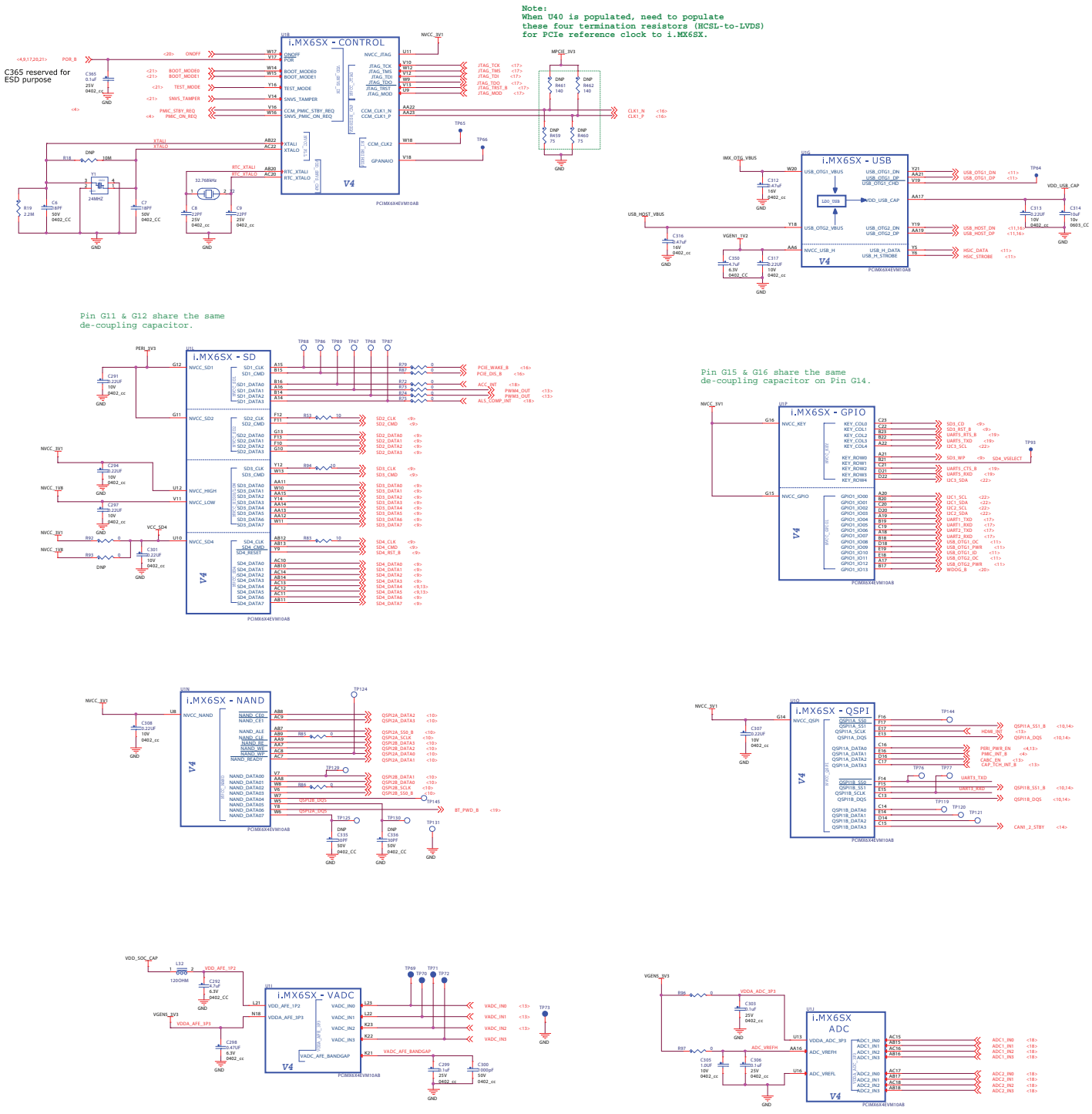



**Figure 7. Schematic part 5**

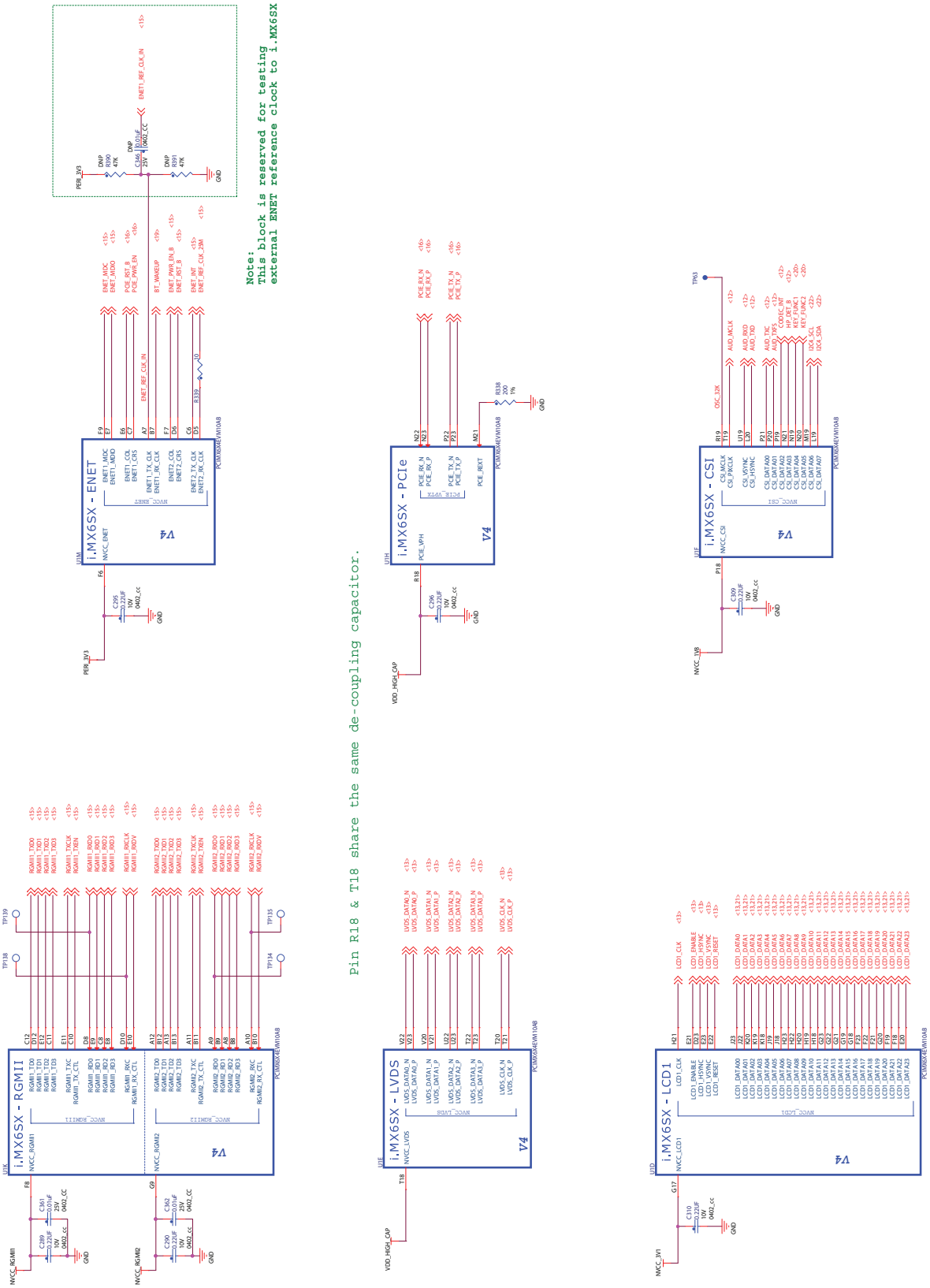



**Figure 8. Schematic part 6**

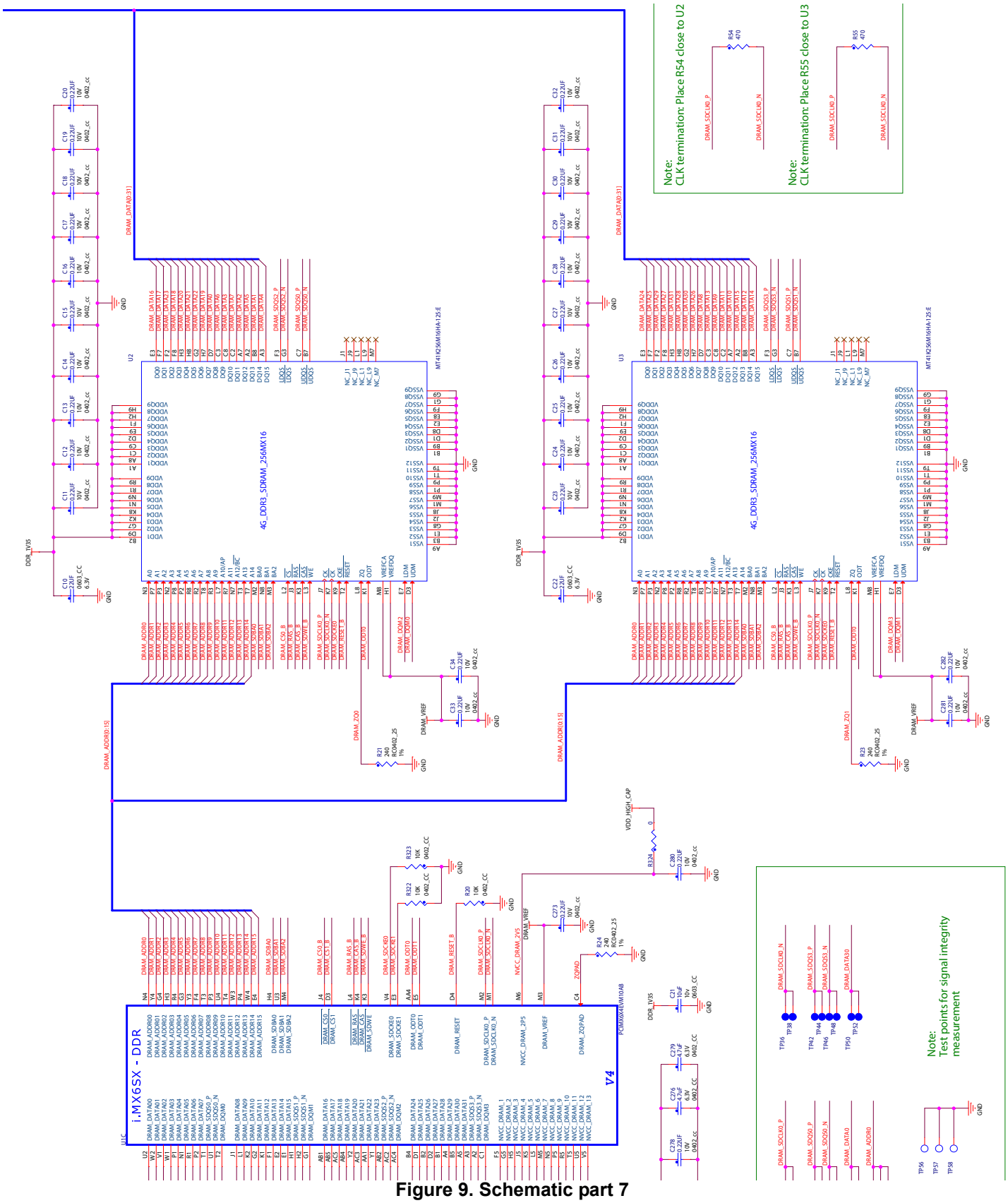



**Figure 9. Schematic part 7**

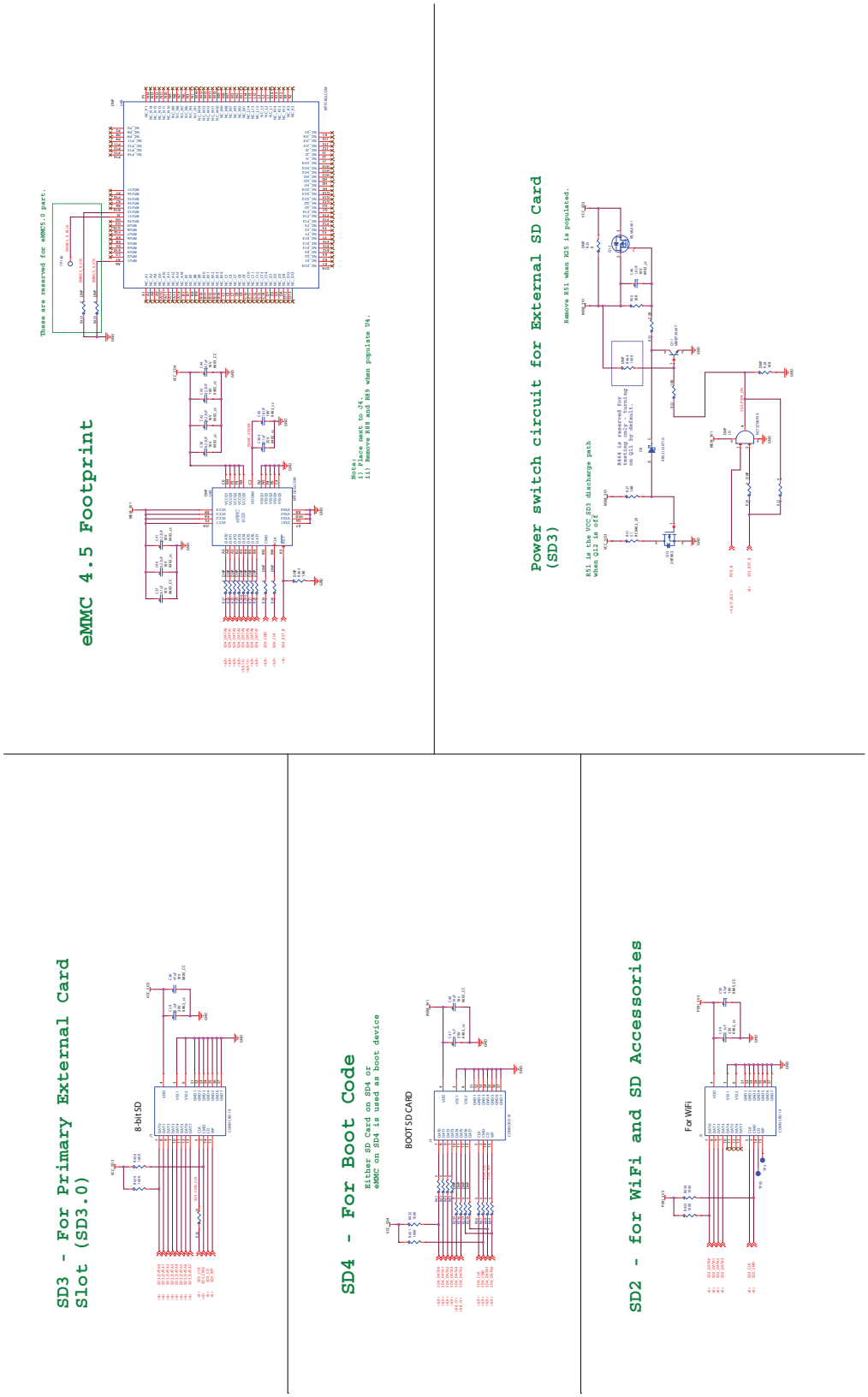



**Figure 10. Schematic part 8**

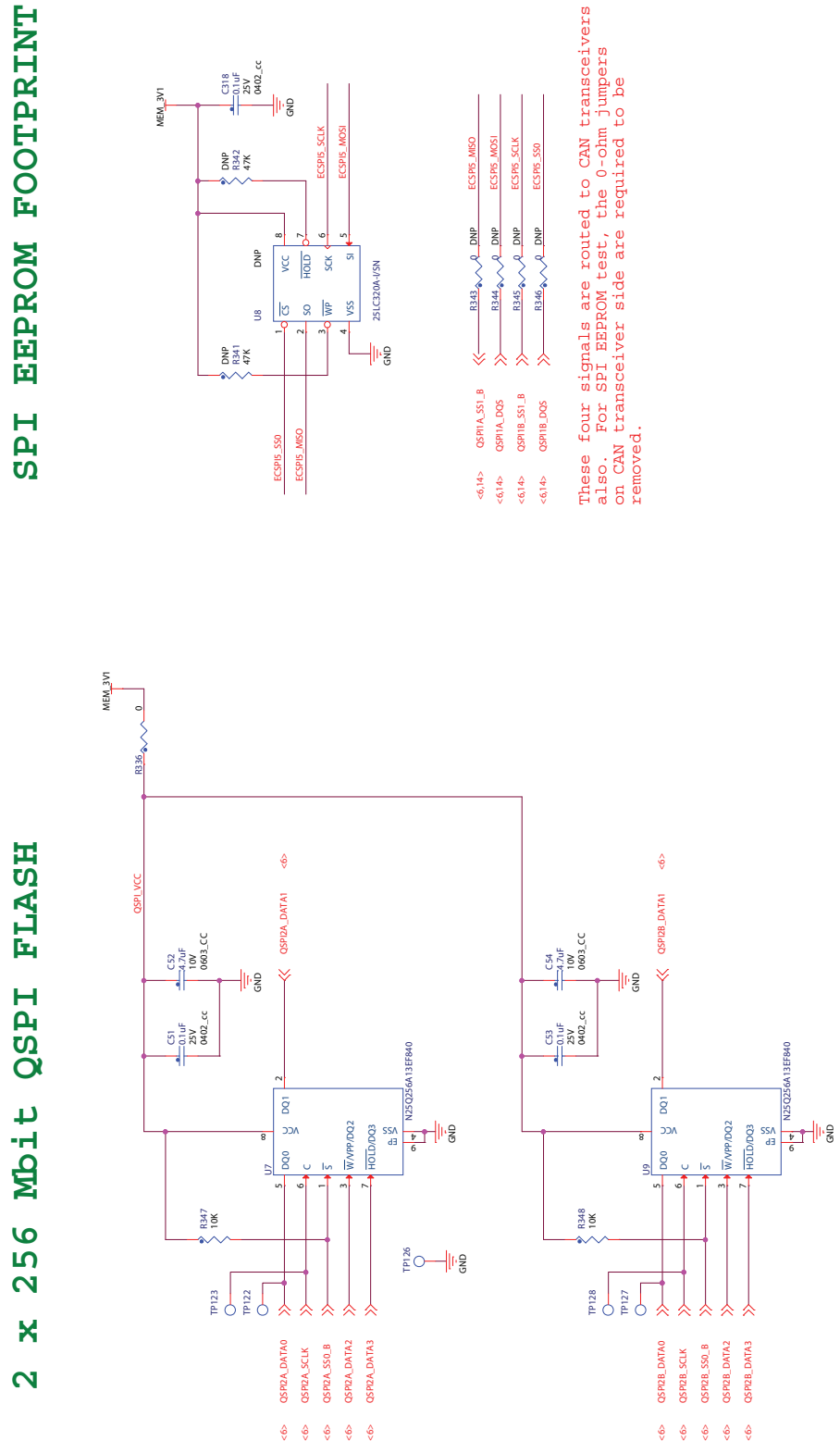



**Figure 11. Schematic part 9**

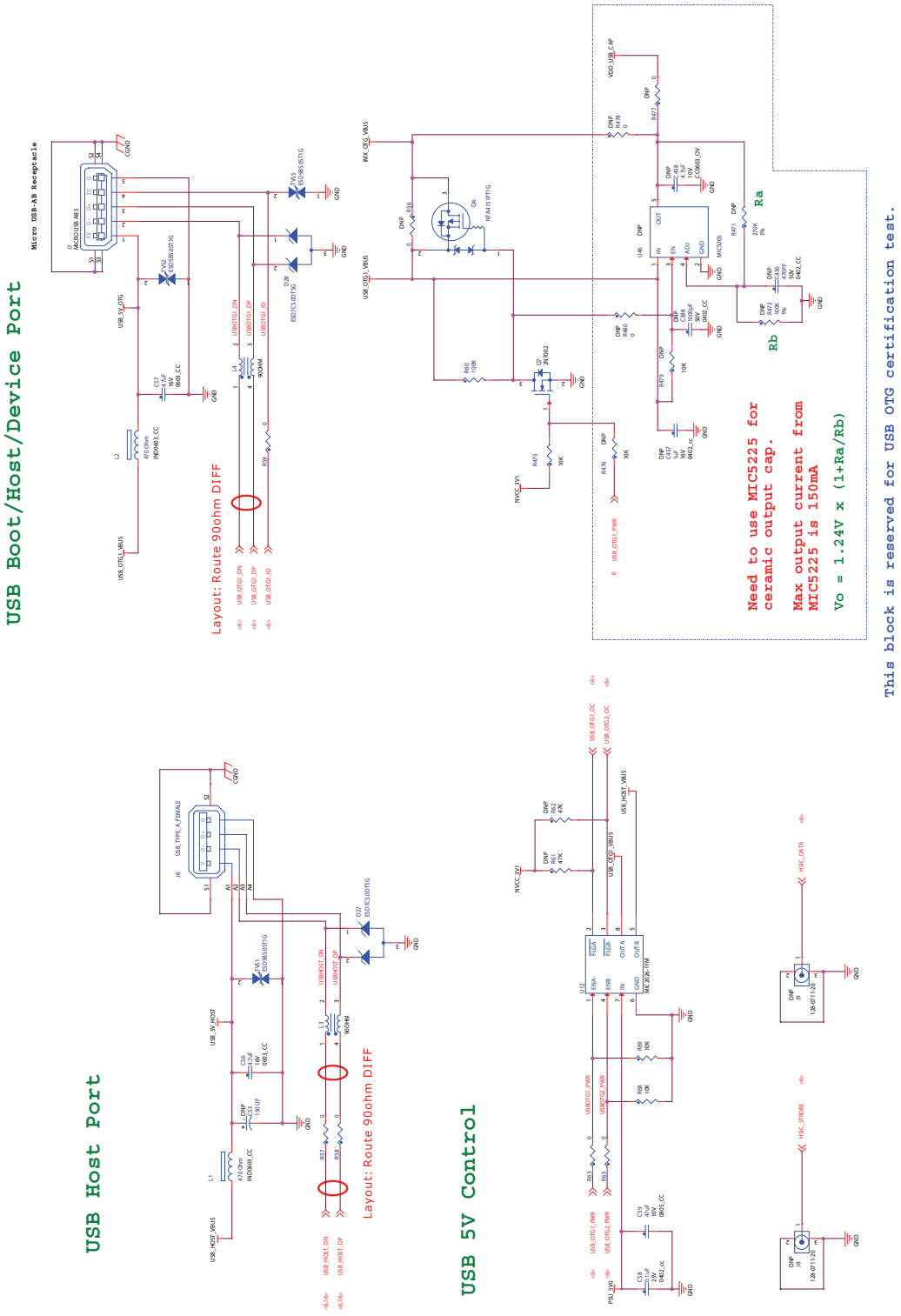



**Figure 12. Schematic part 10**

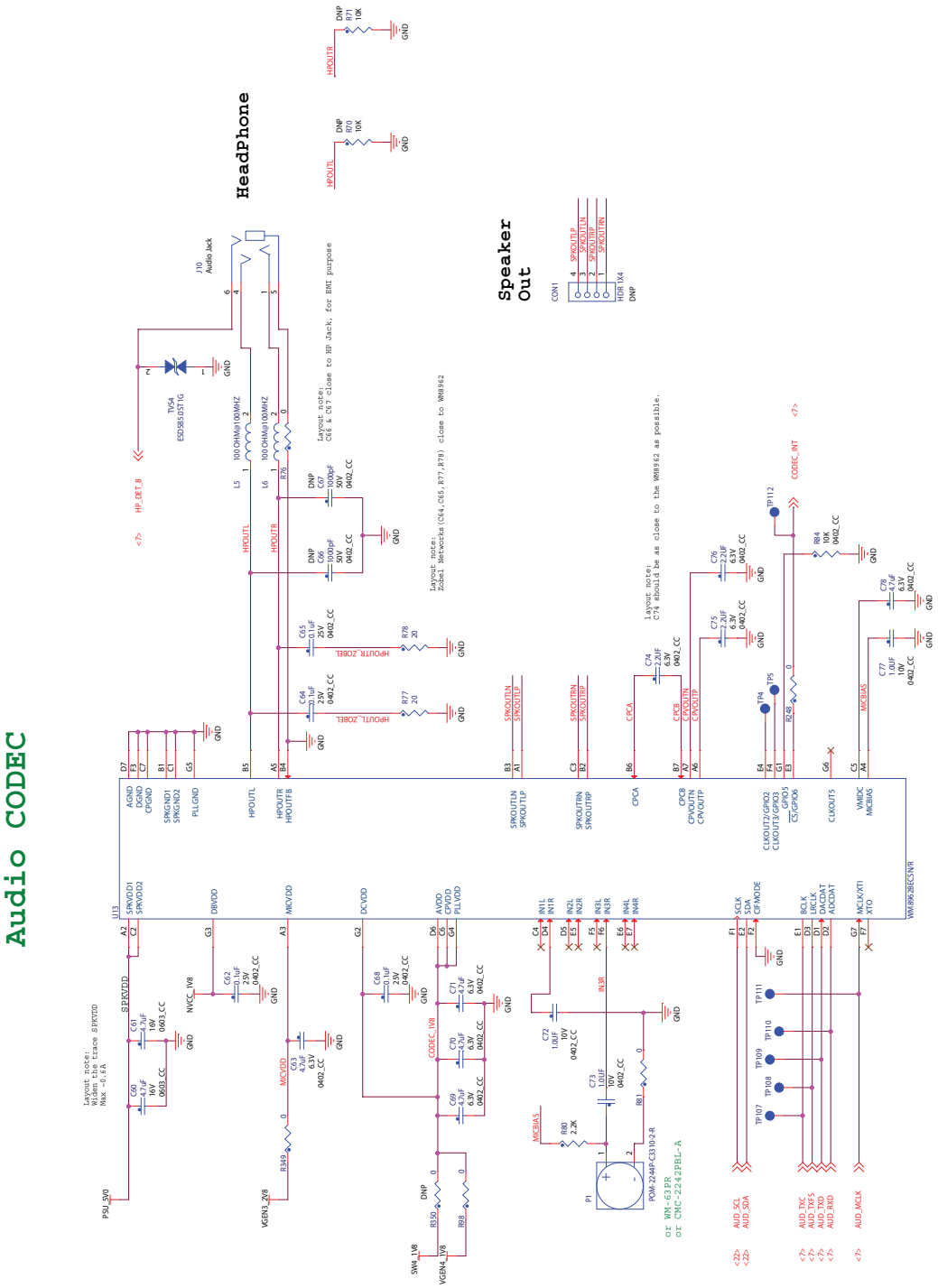



**Figure 13. Schematic part 11**

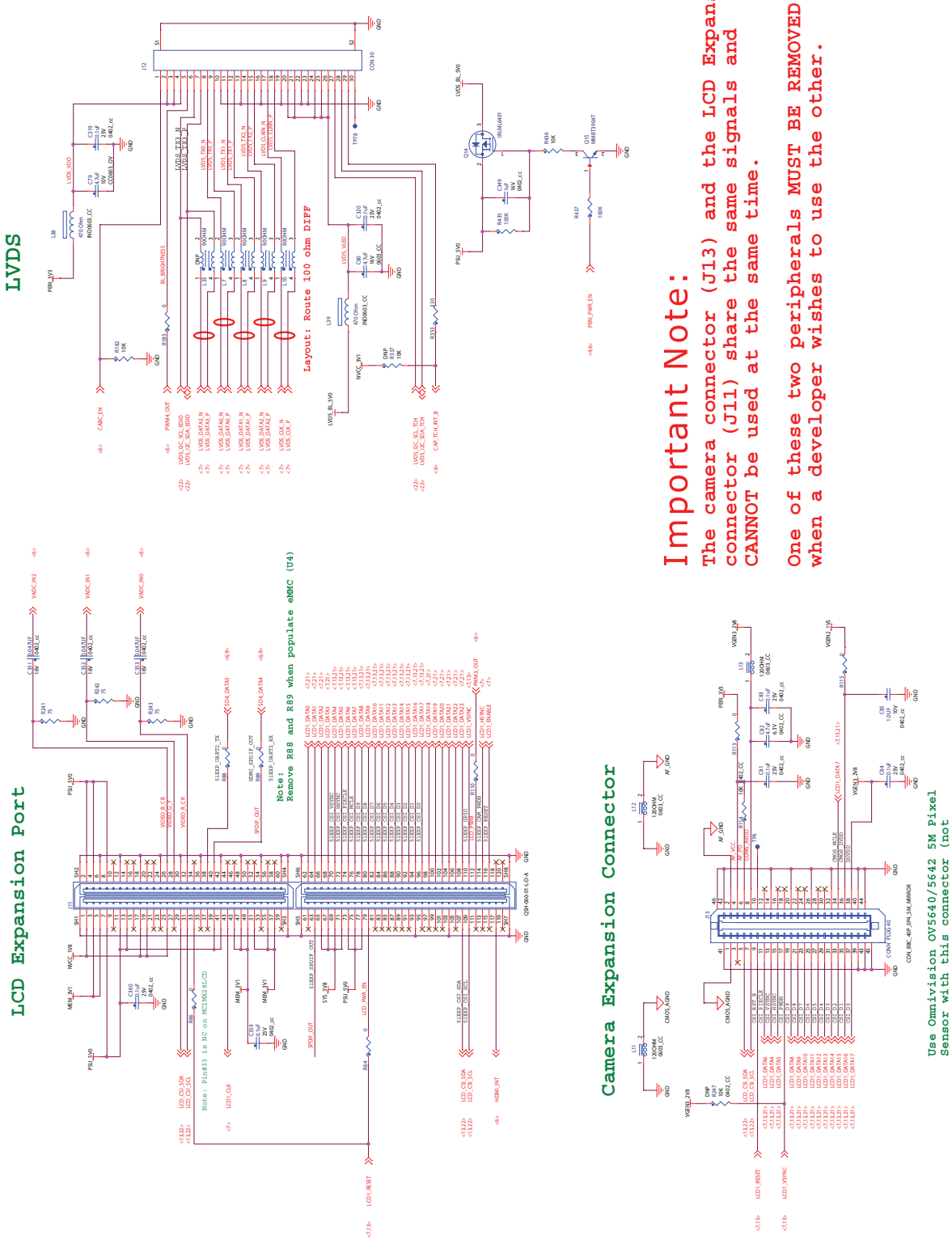
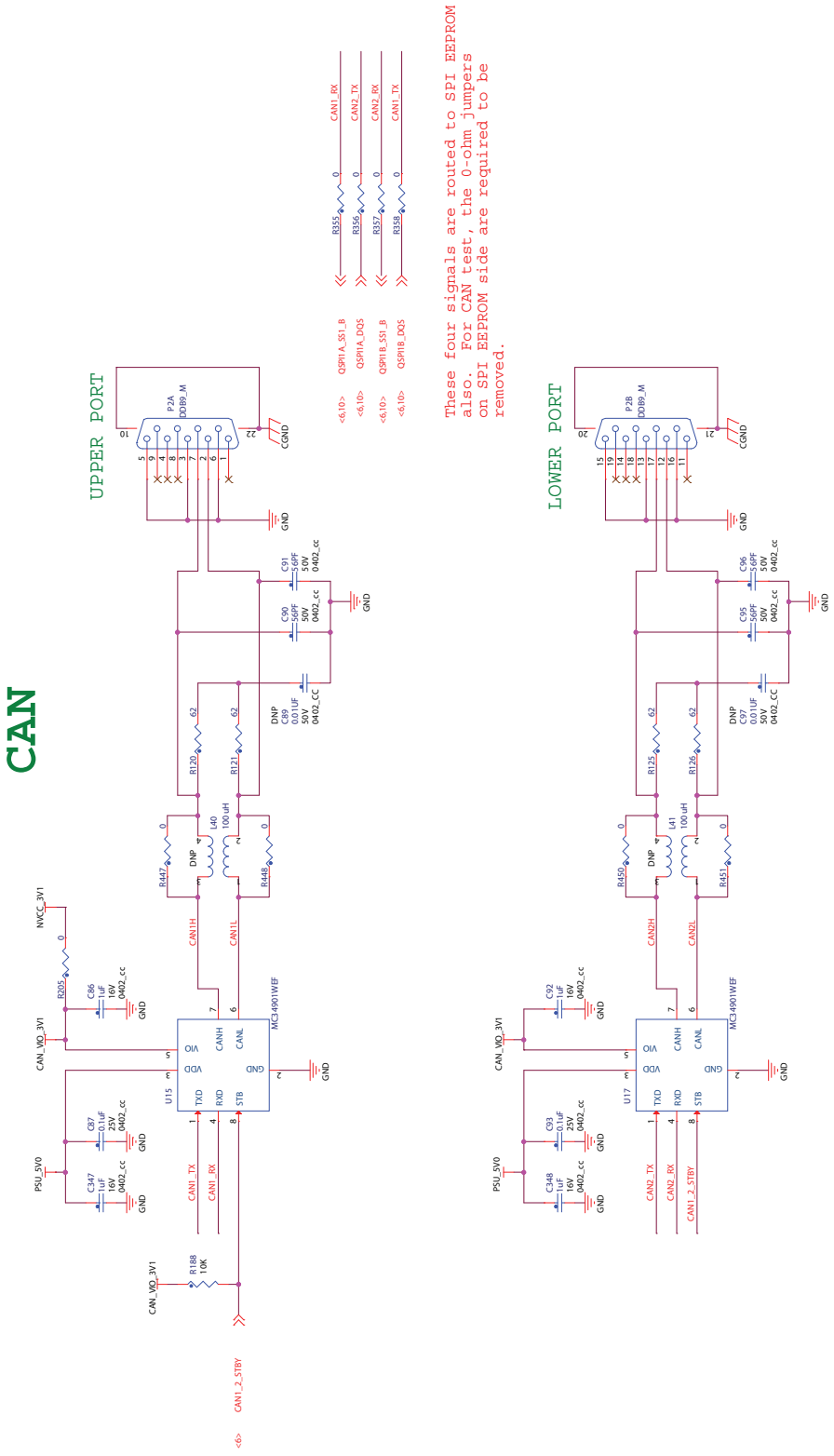



**Figure 14. Schematic part 12**

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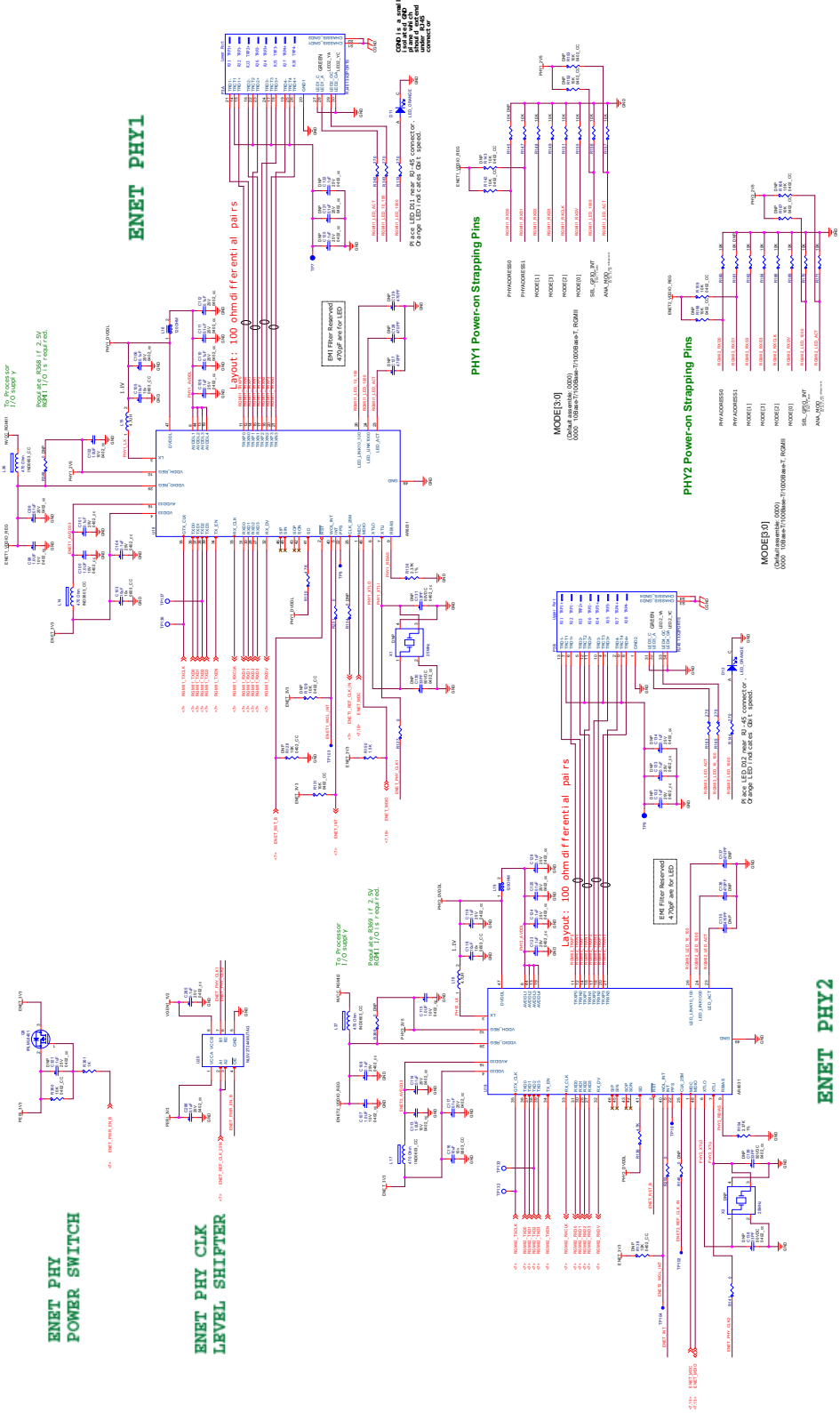



**Figure 16. Schematic part 14**

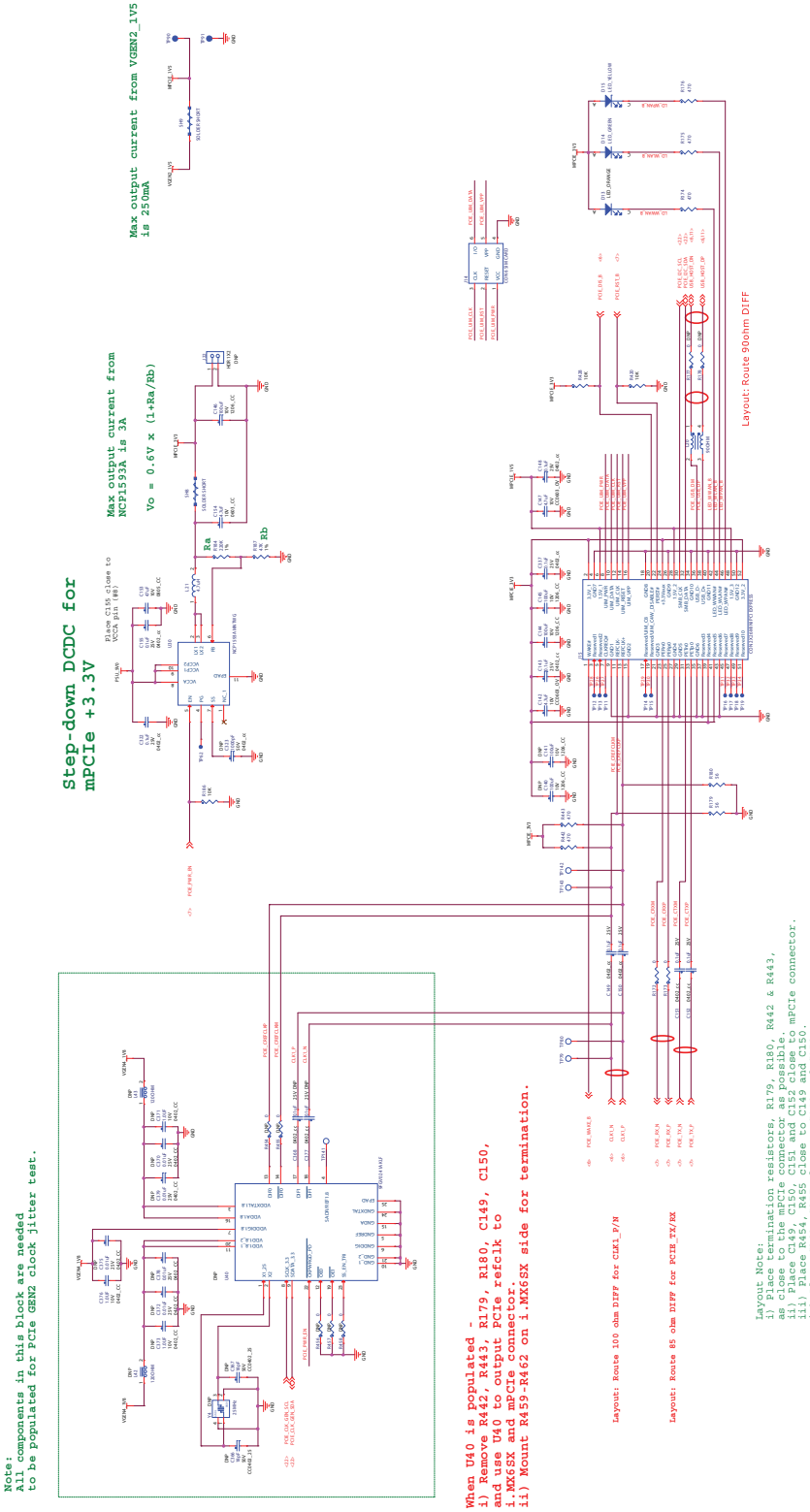
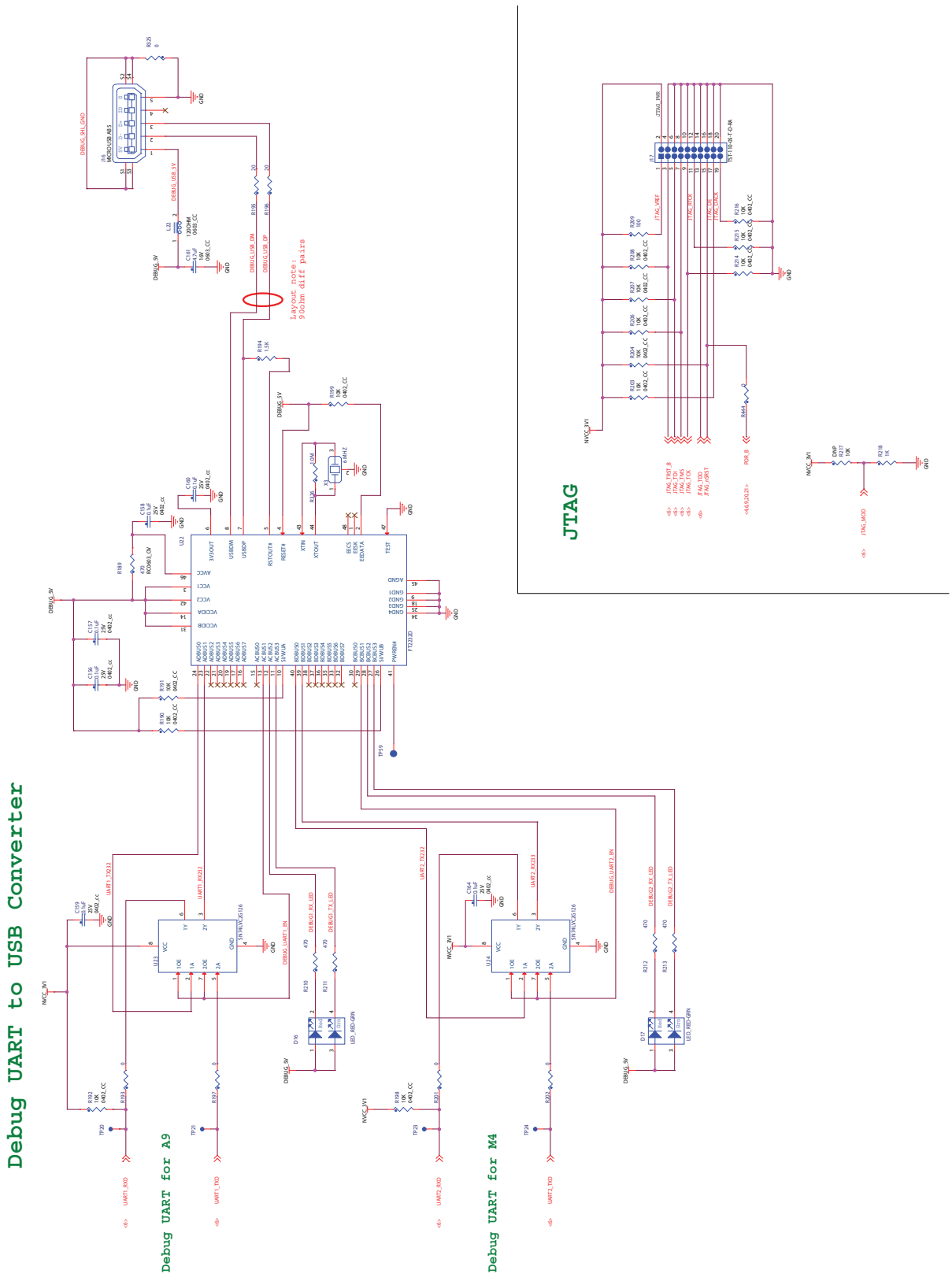



**Figure 17. Schematic part 15**

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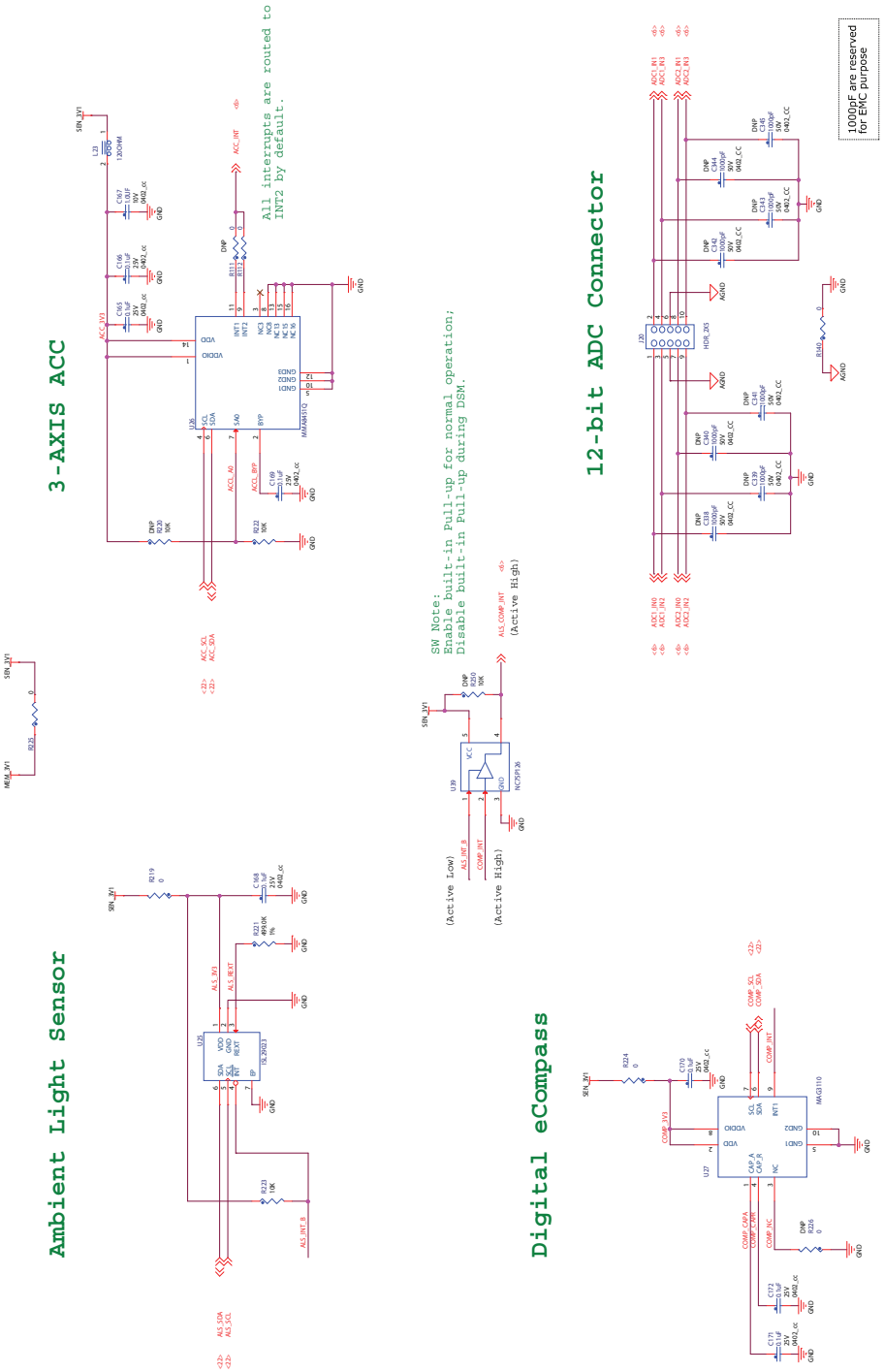


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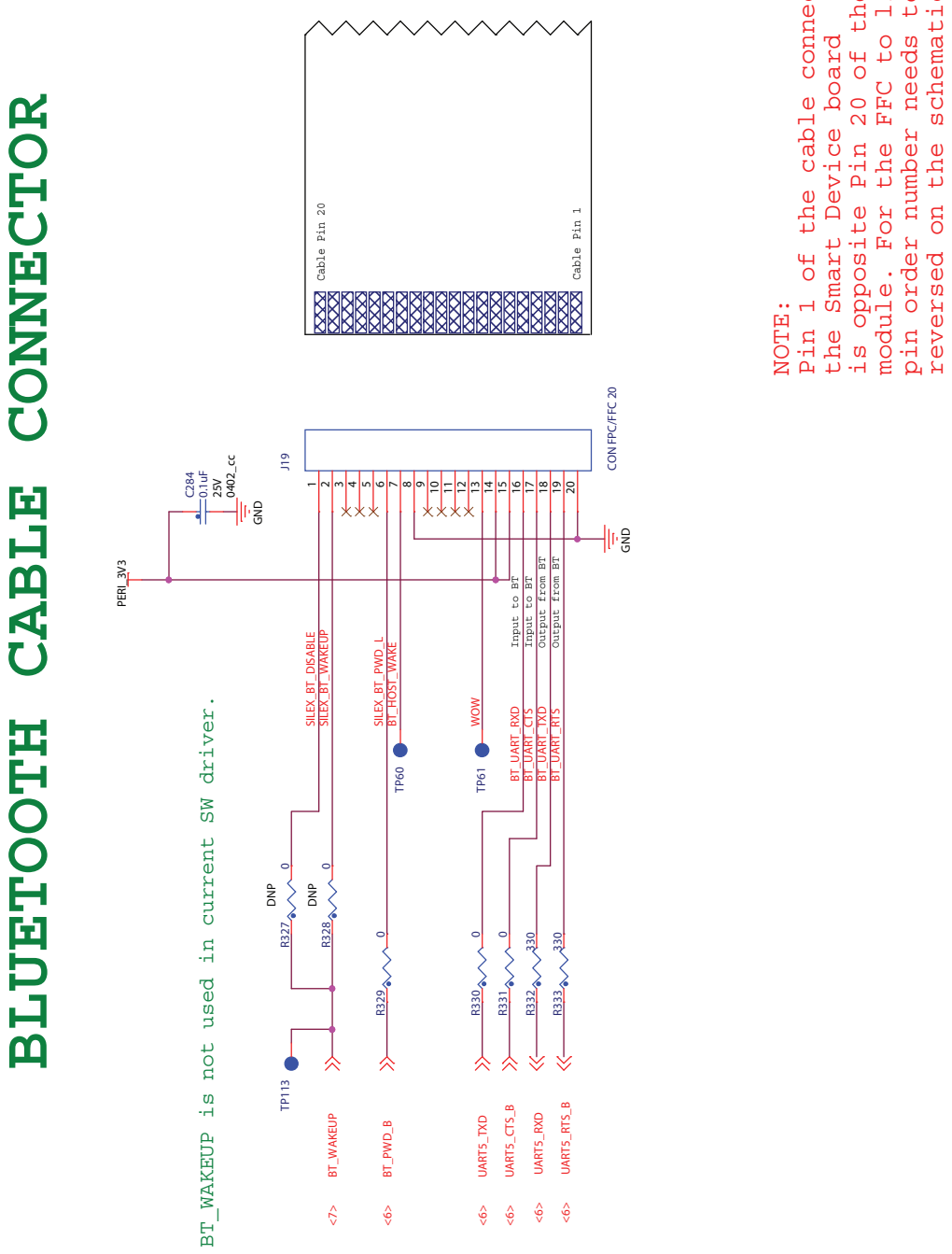


**Figure 20. Schematic part 18**

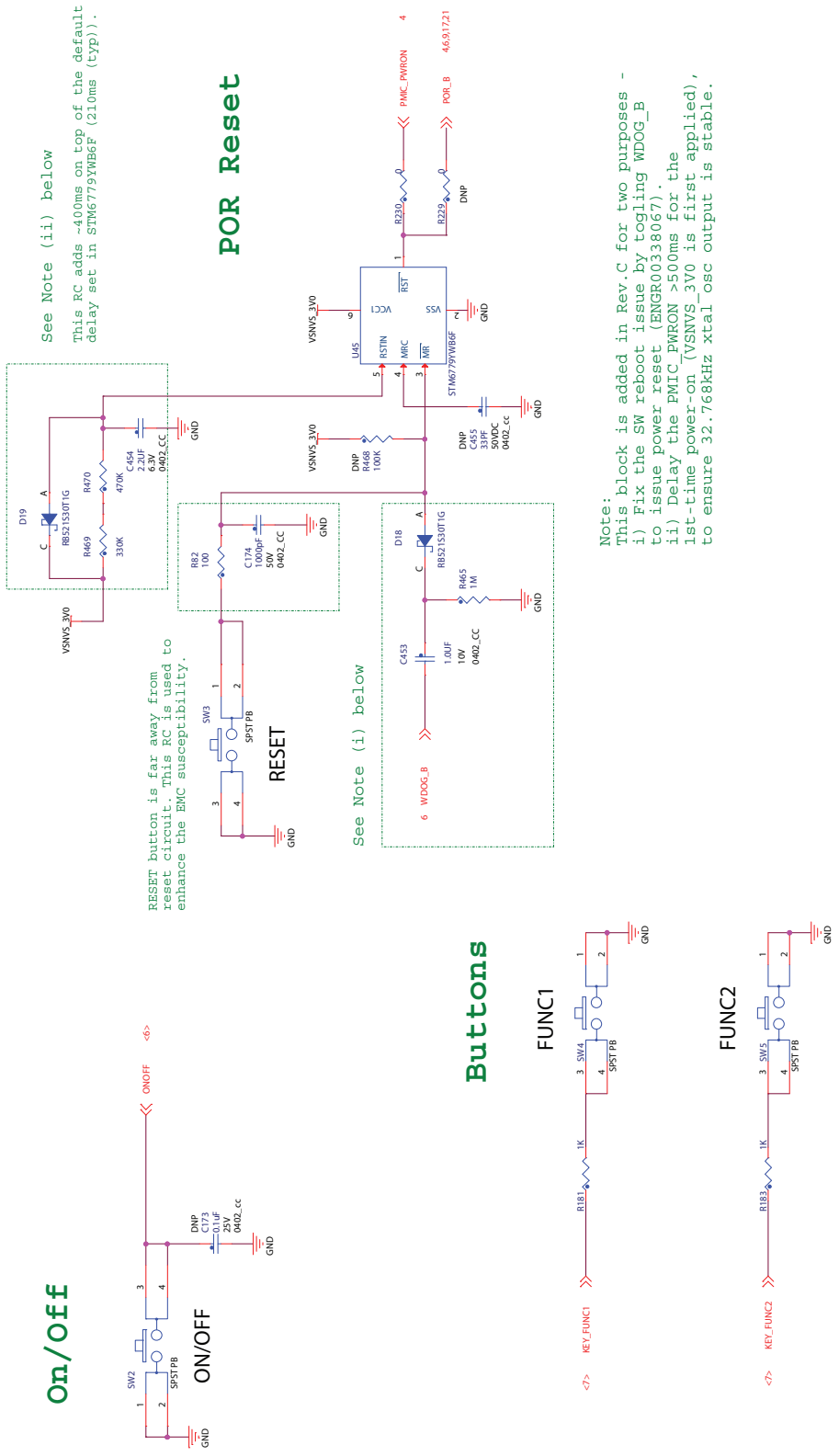


**Figure 21. Schematic part 19**

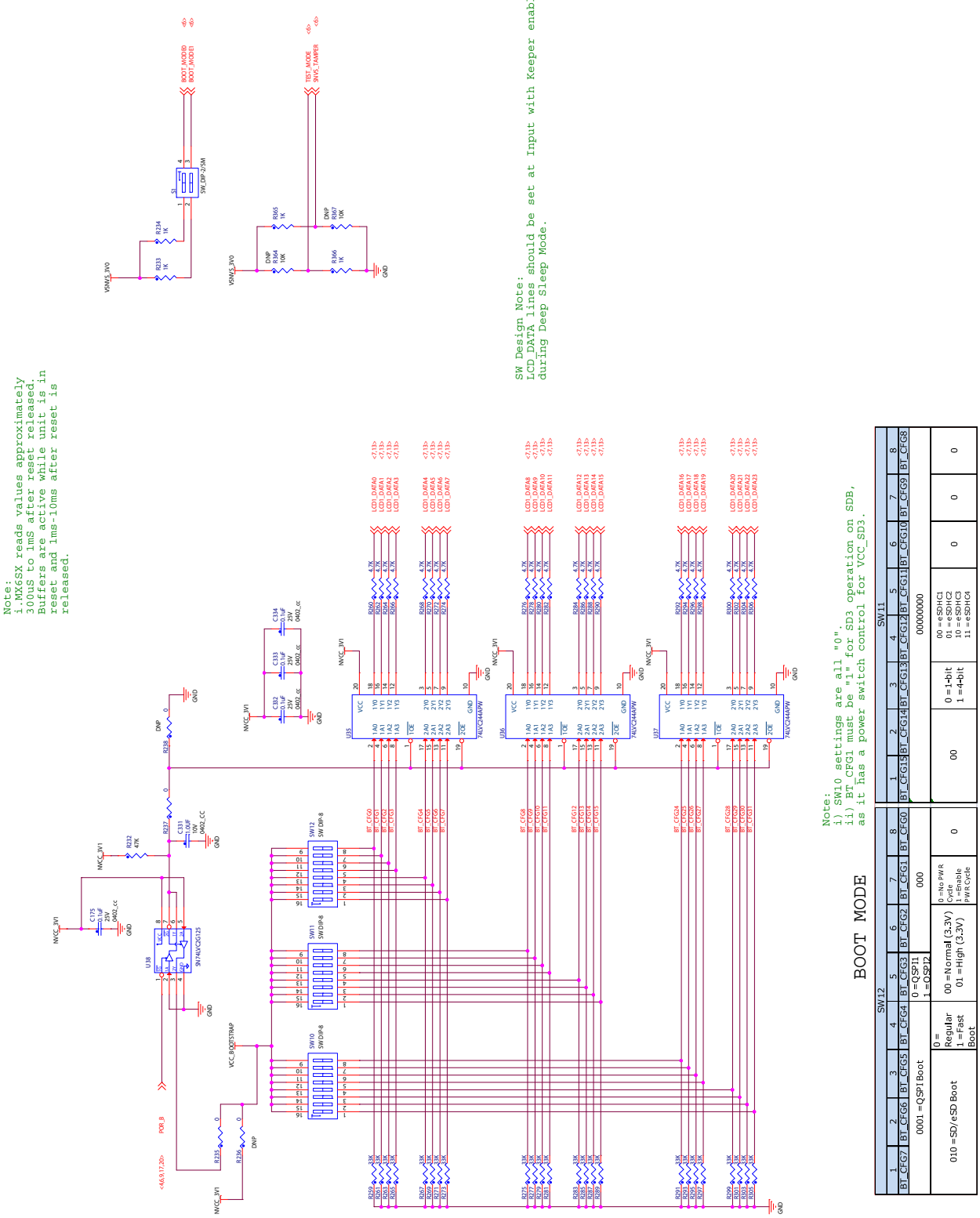


**Figure 22. Schematic part 20**

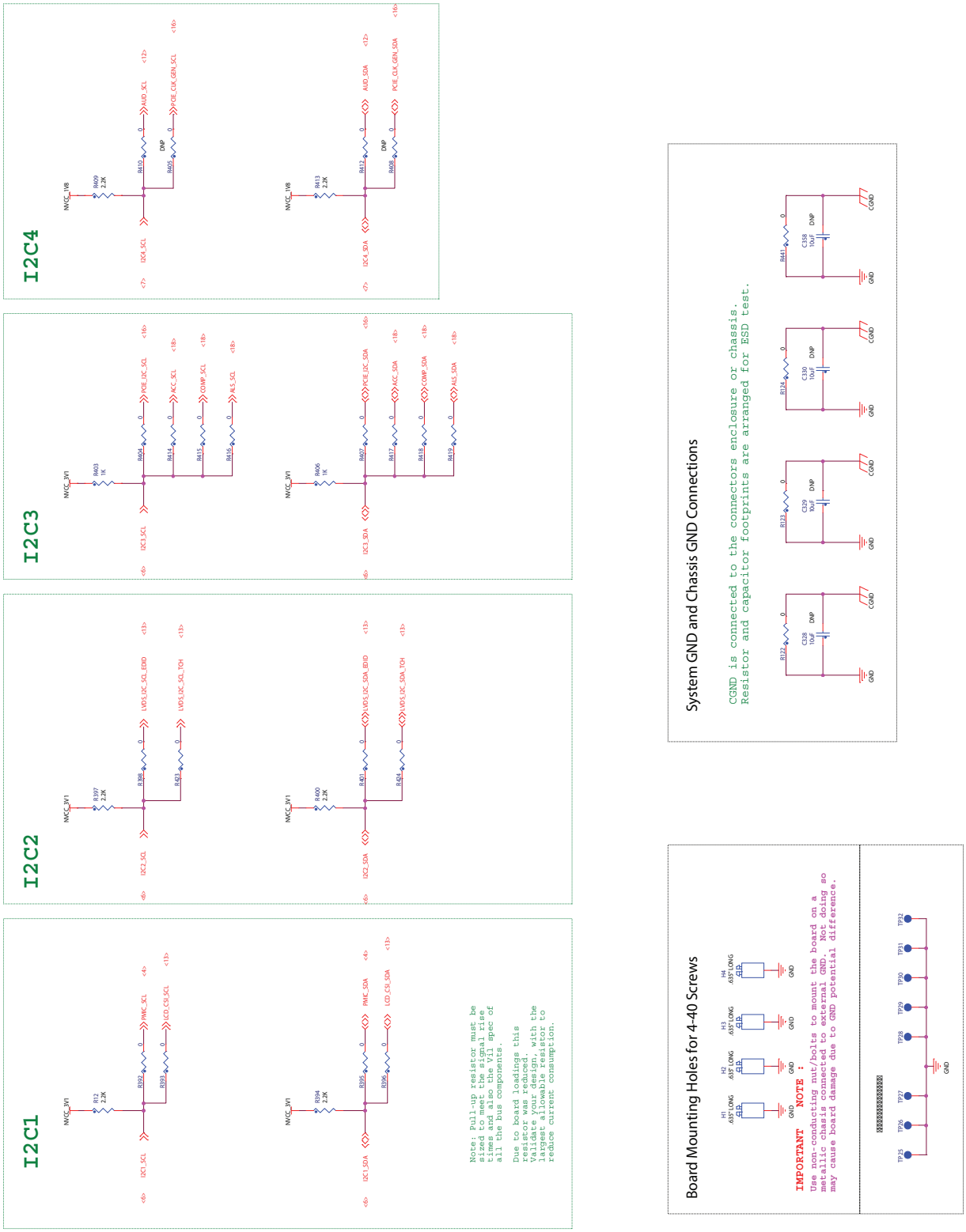


**Figure 23. Schematic part 21**

# 8 References

Following are URLs where you can obtain information on related NXP products and application solutions:

| Support pages | Description | URL |
|---|---|---|
| i.MX 6SX | Product Summary Page | http://www.nxp.com/webapp/sps/site/prod_summary.jsp?code=i.MX6SX |
| PF3000 | Product Summary Page | http://www.nxp.com/webapp/sps/site/prod_summary.jsp?code=PF3000 |
| PF3000 Layout Guidelines | Application Note | http://www.nxp.com/files/analog/doc/app_note/AN5094.pdf |
| NXP Community | Support Site | https://community.nxp.com/docs/DOC-105064 |

# 9 Revision history

| Revision | Date | Description |
|---|---|---|
| 1.0 | 7/2015 | • Initial release |
| | 7/2016 | • Updated to NXP document form and style |

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