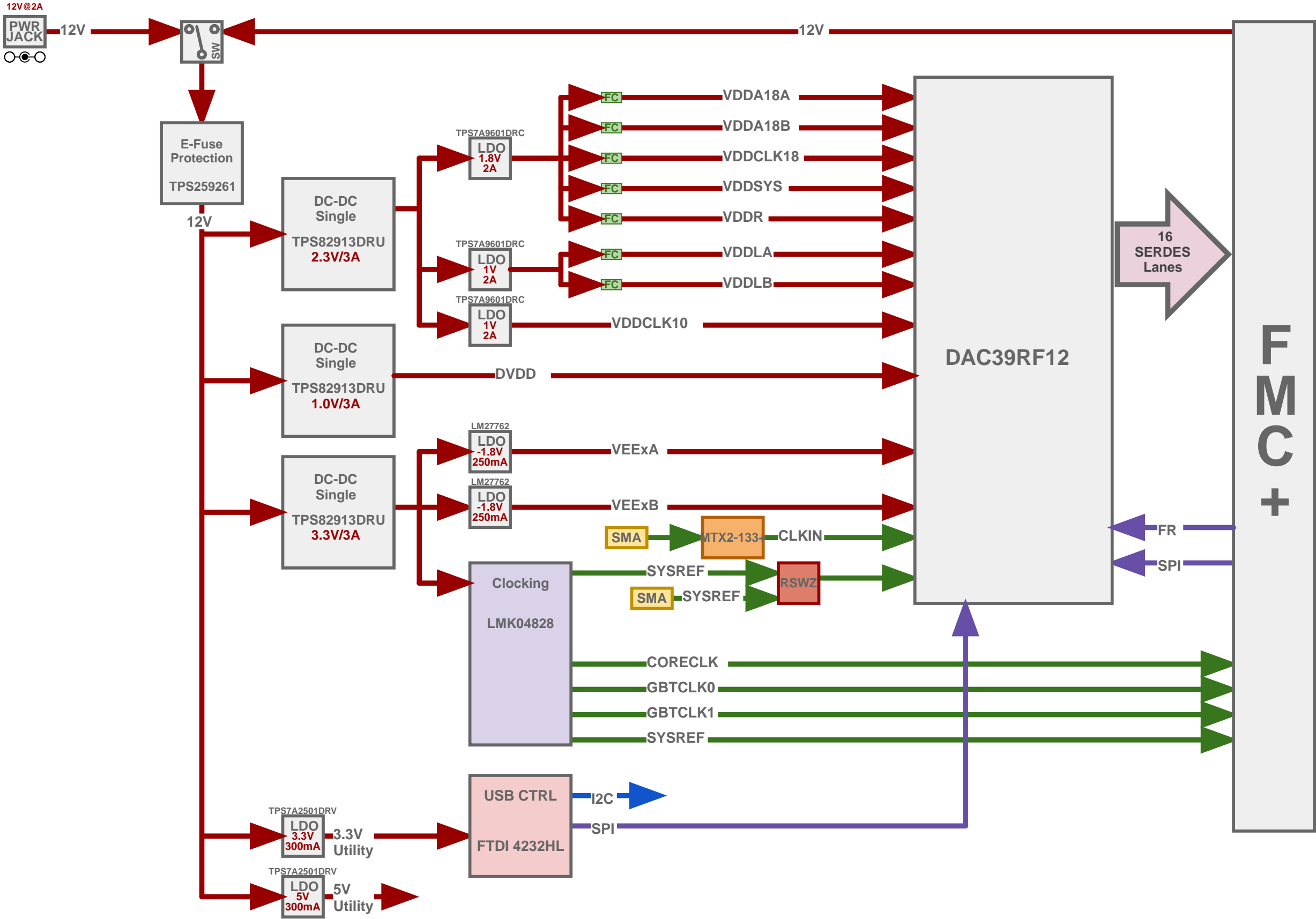


DAC39RF12EVM Block Diagram



Texas Instruments and/or its licensors do not warrant the accuracy or completeness of this specification or any information contained therein. Texas Instruments and/or its licensors do not warrant that this design will meet the specifications, will be suitable for your application or fit for any particular purpose, or will operate in an implementation. Texas Instruments and/or its licensors do not warrant that the design is production worthy. You should completely validate and test your design implementation to confirm the system functionality for your application.


| | | |
|--|--|---|
| Orderable: ChangeMe in variant | Designed for: Public Release | Mod. Date: 8/13/2024 |
| TID #: N/A | Project Title: DAC39RF12EVM | |
| Number: DC296 | Rev: C | Sheet Title: DAC39RF12EVM Block Diagram |
| SVN Rev: | Assembly Variant: 001 | Sheet: 1 of 19 |
| Drawn By: | File: Block Diagram.SchDoc | Size: B |
| Engineer: Kramer | Contact: http://www.ti.com/support | |

I2C Addresses

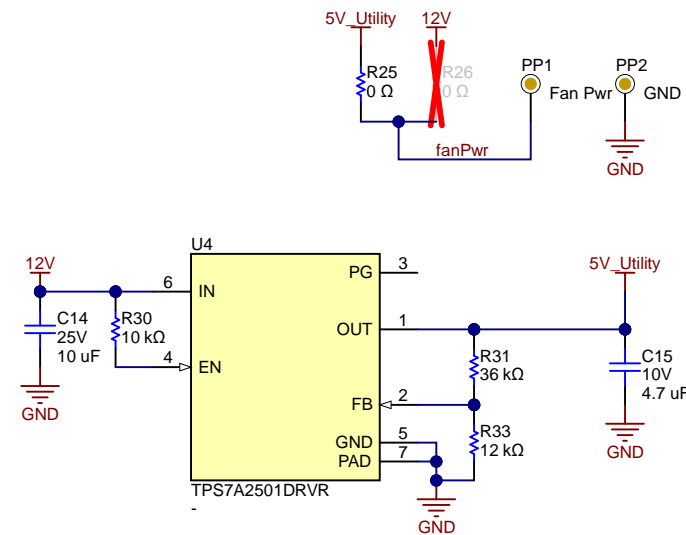
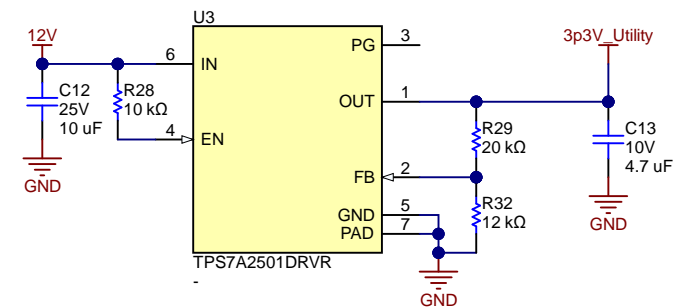
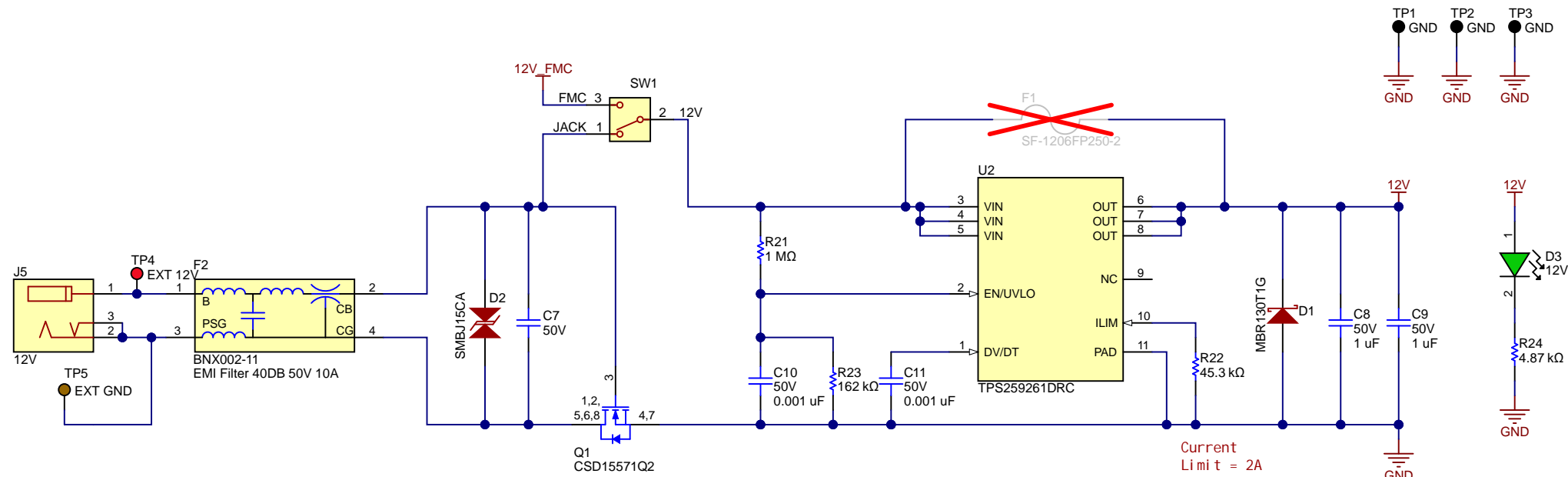
I2C Addresses

| Address | Chip | Page | Function |
|---------|----------------|------|-------------------------------------|
| 0x40 | INA226AIDGS | 5 | DAC 1.8V analog power monitor |
| 0x41 | INA226AIDGS | 7 | DAC 1.0V VDDL power monitor |
| 0x44 | INA226AIDGS | 7 | DAC 1.0V VDDCLK10 power monitor |
| 0x45 | INA226AIDGS | 9 | DAC 1.0V Digital power monitor |
| 0x51 | 24LC64FT-I/MNY | 11 | EEPROM for EVM Data |
| 0x50 | 24LC64FT-I/MNY | 15 | EEPROM for VITA57.1 compliance data |

Texas Instruments and/or its licensors do not warrant the accuracy or completeness of this specification or any information contained therein. Texas Instruments and/or its licensors do not warrant that this design will meet the specifications, will be suitable for your application or fit for any particular purpose, or will operate in an implementation. Texas Instruments and/or its licensors do not warrant that the design is production worthy. You should completely validate and test your design implementation to confirm the system functionality for your application.

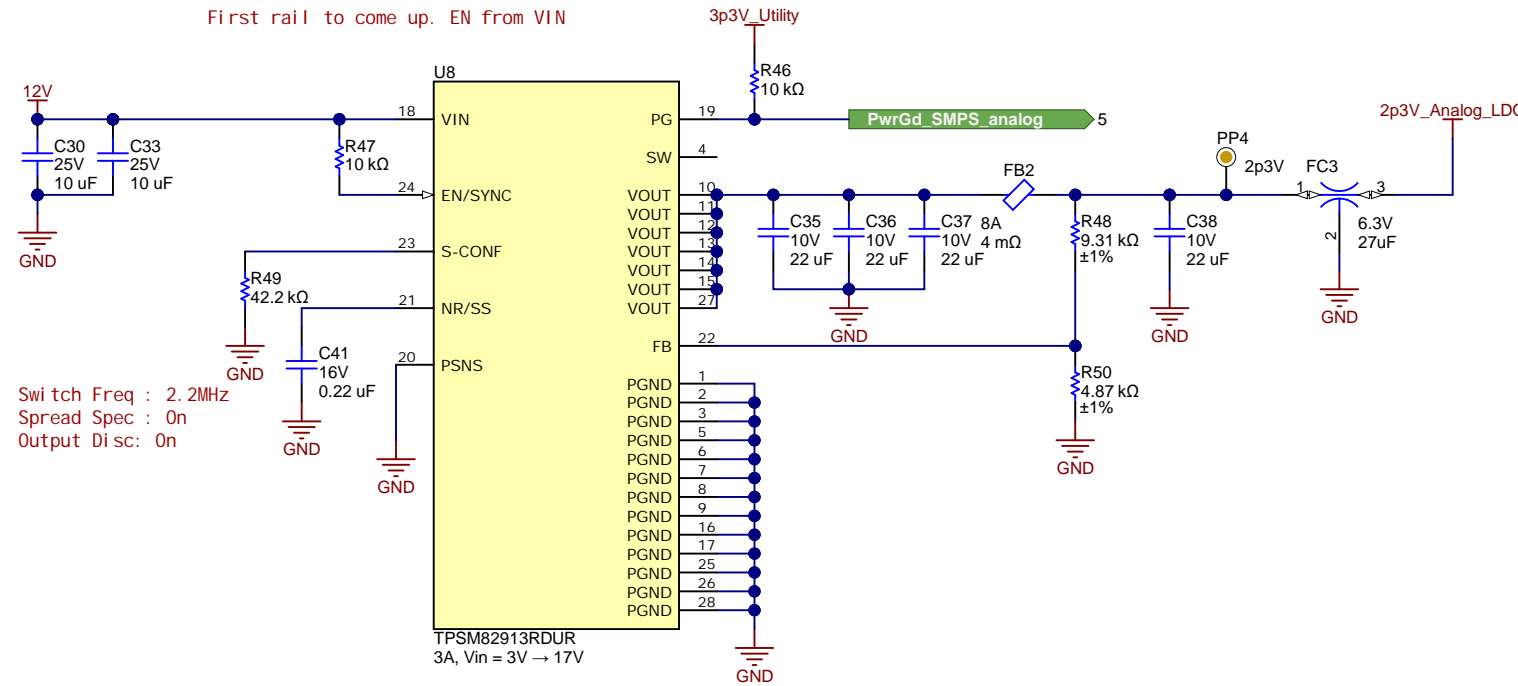
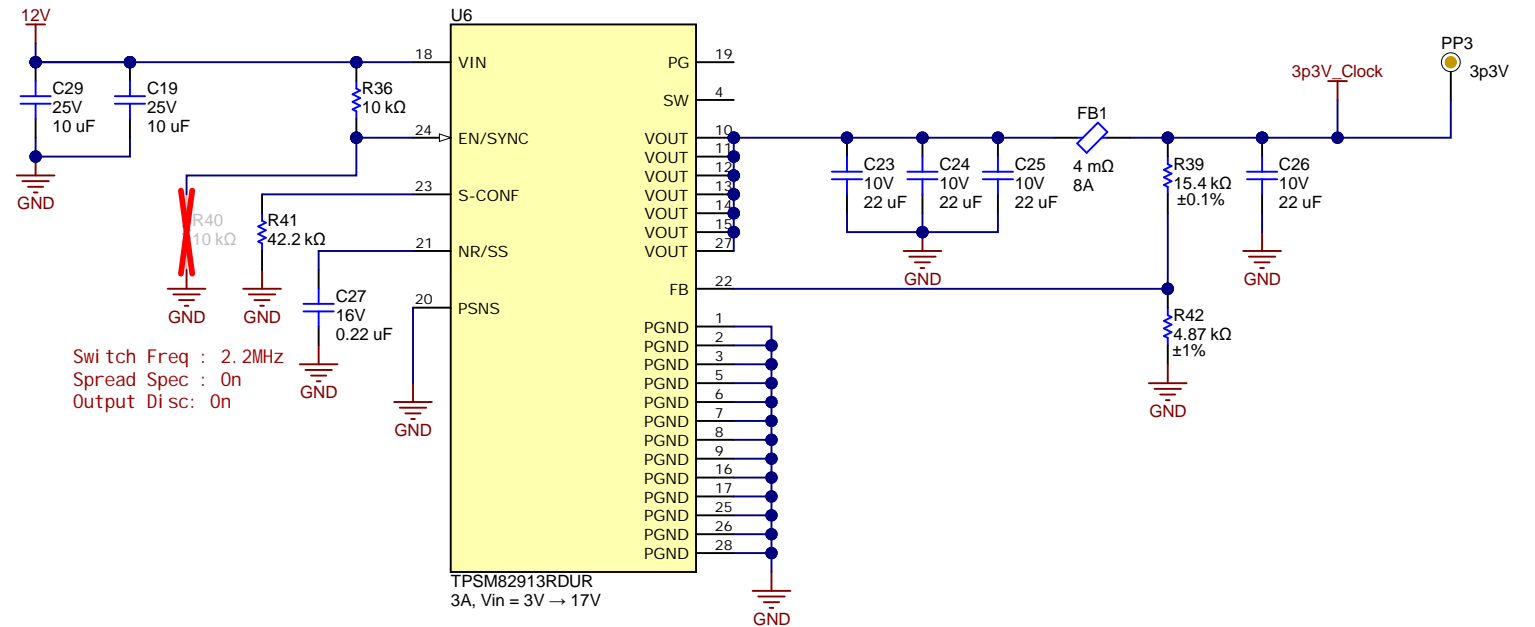
| | | | |
|--|--|--|--|
| Orderable: ChangeMe in variant | Designed for: Public Release | Mod. Date: 9/3/2024 |  TEXAS INSTRUMENTS http://www.ti.com © Texas Instruments 2025 |
| TID #: N/A | Project Title: DAC39RF12EVM | | |
| Number: DC296 | Rev: C | Sheet Title: I2C Addresses | |
| SVN Rev: | Assembly Variant: 001 | Sheet: 2 of 19 | |
| Drawn By: | File: I2C Device Addr SPI Block Diagram.SchDoc Size: B | | |
| Engineer: Kramer | Contact: http://www.ti.com/support | | |

12V Input & General Power Rails



DAC39RF12 DC-DC Analog Power

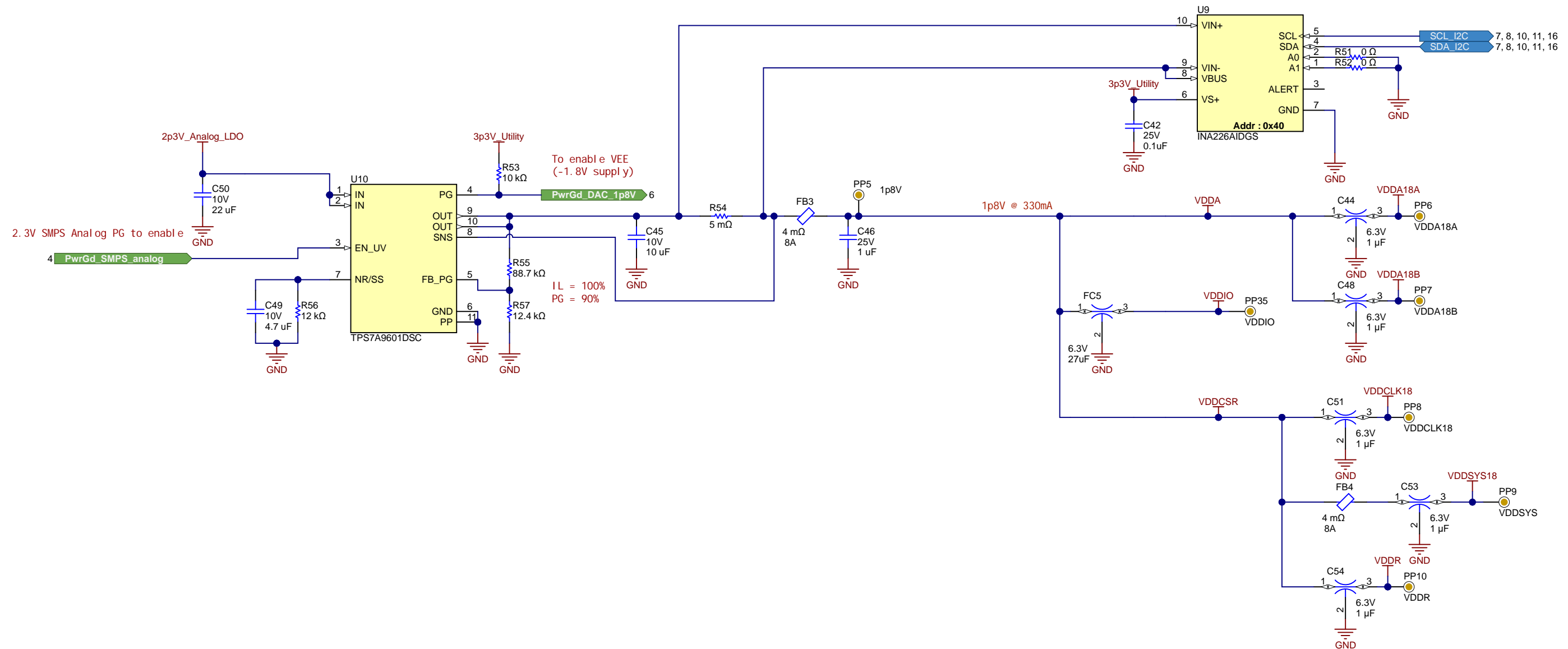
DAC Power Sequencing.
VDD1p8 -> VDDEn1p8 -> VDDCLK1p0 + VDDL1p0 -> VDDDIG




| | | |
|--|--|---|
| Orderable: ChangeMe in variant | Designed for: Public Release | Mod. Date: 8/16/2024 |
| TID #: N/A | Project Title: DAC39RF12EVM | |
| Number: DC296 | Rev: C | Sheet Title: DAC39RF12 DC-DC Analog Power |
| SVN Rev: | Assembly Variant: 001 | Sheet: 4 of 19 |
| Drawn By: | File: DC-DC Analog.SchDoc | Size: B |
| Engineer: Kramer | Contact: http://www.ti.com/support | |

DAC39RF12 LDO 1p8V

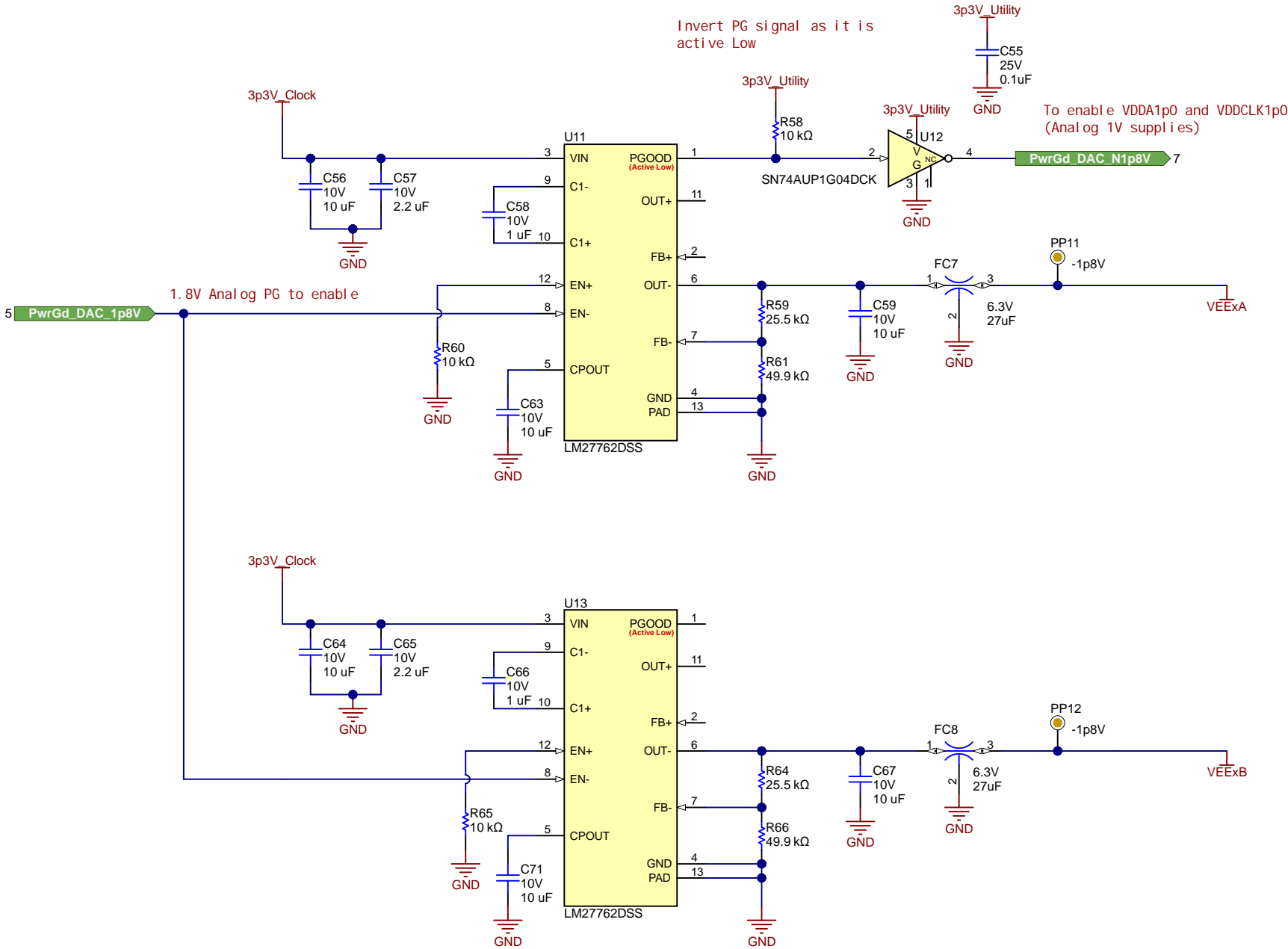
DAC Power Sequencing.
VDD1p8 -> VDDEn1p8 -> VDDCLK1p0 + VDDL1p0 -> VDDDIG



| | | | |
|--|--|---|--|
| Orderable: ChangeMe in variant | Designed for: Public Release | Mod. Date: 7/29/2024 |  TEXAS INSTRUMENTS |
| TID #: N/A | Project Title: DAC39RF12EVM | | |
| Number: DC296 | Rev: C | Sheet Title: DAC39RF12 LDO 1p8V | |
| SVN Rev: | Assembly Variant: 001 | Sheet: 5 of 19 | |
| Drawn By: | File: DAC LDO 1p8V.SchDoc | Size: B | |
| Engineer: Kramer | Contact: http://www.ti.com/support | | http://www.ti.com © Texas Instruments 2025 |

DAC39RF12 Charge Pump & LDO N1p8V

DAC Power Sequenci ng.
VDD1p8 -> VDDEn1p8 -> VDDCLK1p0 + VDDL1p0 -> VDDDIG

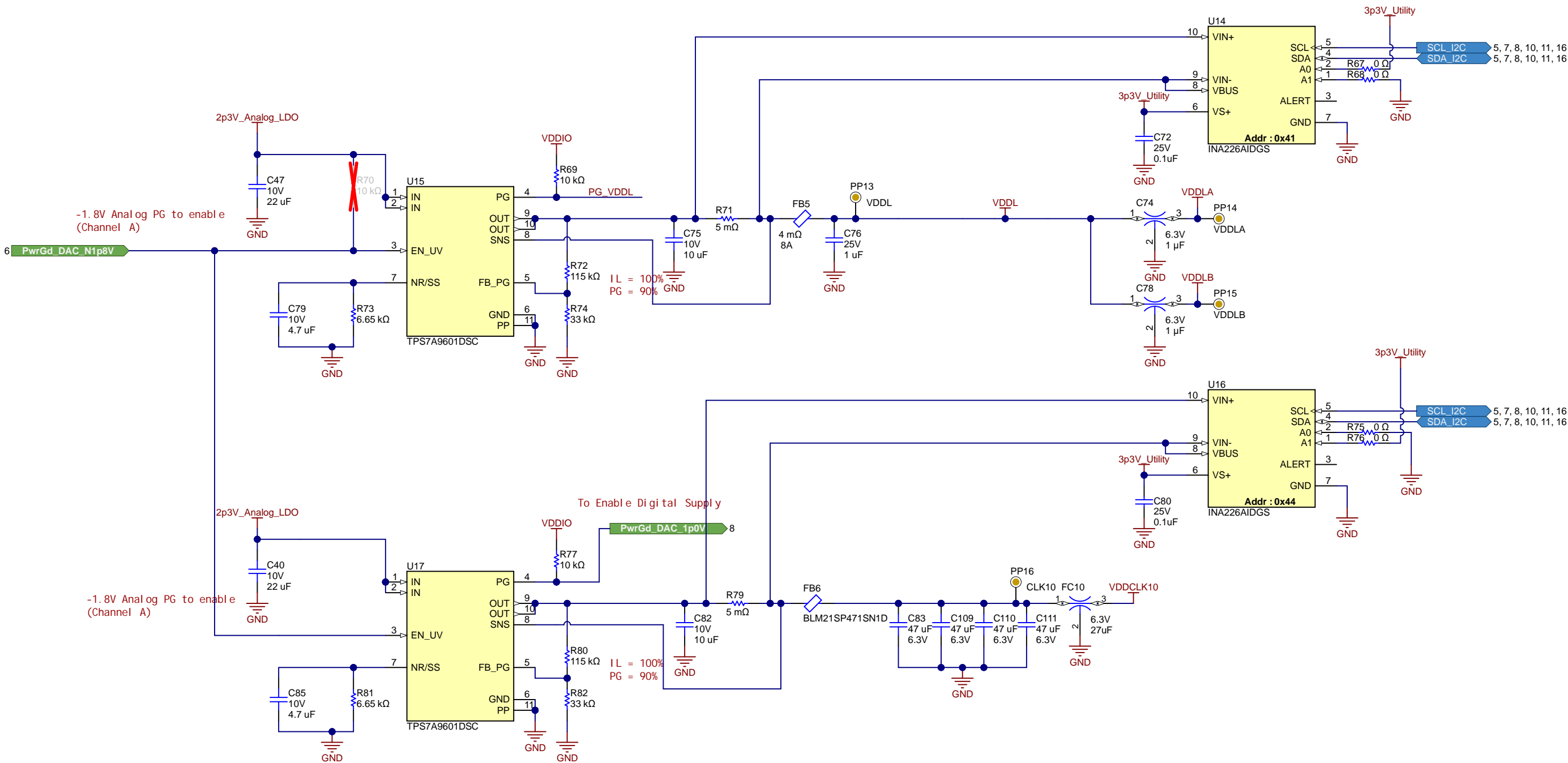


Texas Instruments and/or its licensors do not warrant the accuracy or completeness of this specification or any information contained therein. Texas Instruments and/or its licensors do not warrant that this design will meet the specifications, will be suitable for your application or fit for any particular purpose, or will operate in an implementation. Texas Instruments and/or its licensors do not warrant that the design is production worthy. You should completely validate and test your design implementation to confirm the system functionality for your application.

| | | |
|--|--|--|
| Orderable: ChangeMe in variant | Designed for: Public Release | Mod. Date: 8/15/2024 |
| TID #: N/A | Project Title: DAC39RF12EVM | |
| Number: DC296 | Rev: C | Sheet Title: DAC39RF12 Charge Pump & LDO N1p8V |
| SVN Rev: | Assembly Variant: 001 | Sheet: 6 of 19 |
| Drawn By: | File: DAC LDO N1p8V.SchDoc | Size: B |
| Engineer: Kramer | Contact: http://www.ti.com/support | |

DAC39RF12 Analog LDO 1p0V

DAC Power Sequenci ng.
VDD1p8 -> VDDEn1p8 -> VDDCLK1p0 + VDDL1p0 -> VDDDIG

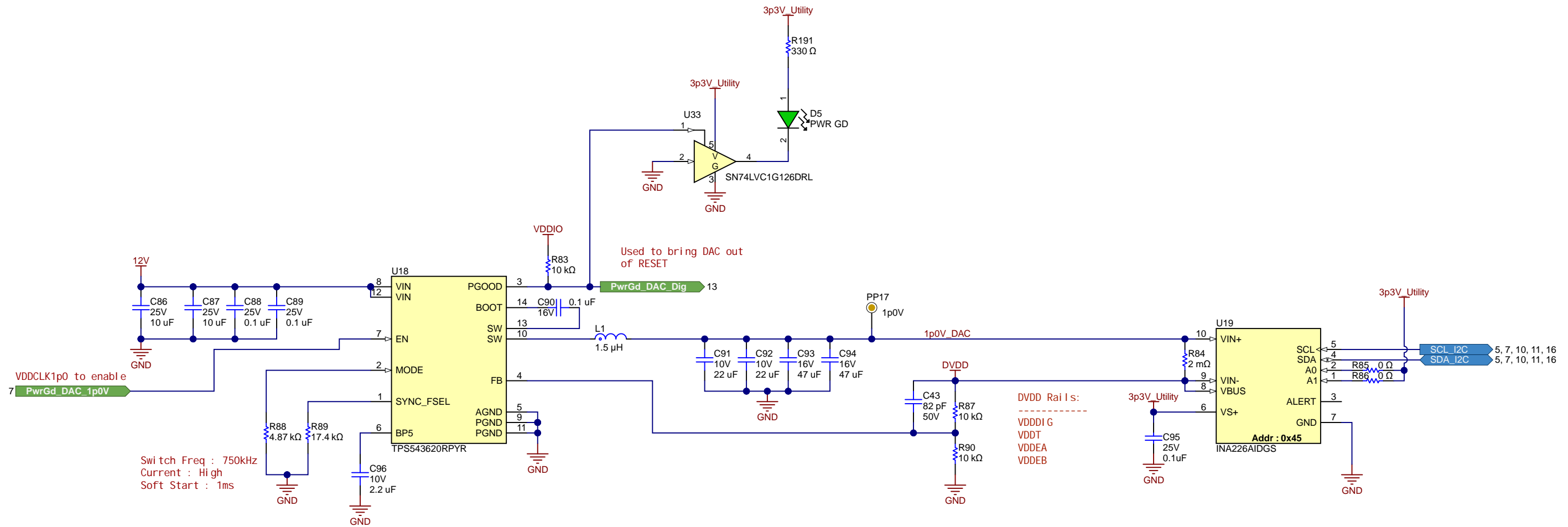



Texas Instruments and/or its licensors do not warrant the accuracy or completeness of this specification or any information contained therein. Texas Instruments and/or its licensors do not warrant that this design will meet the specifications, will be suitable for your application or fit for any particular purpose, or will operate in an implementation. Texas Instruments and/or its licensors do not warrant that the design is production worthy. You should completely validate and test your design implementation to confirm the system functionality for your application.

| | | |
|--|--|--|
| Orderable: ChangeMe in variant | Designed for: Public Release | Mod. Date: 2/11/2025 |
| TID #: N/A | Project Title: DAC39RF12EVM | |
| Number: DC296 | Rev: C | Sheet Title: DAC39RF12 Analog LDO 1p0V |
| SVN Rev: | Assembly Variant: 001 | Sheet: 7 of 19 |
| Drawn By: | File: DAC LDO 1p0V.SchDoc | Size: B |
| Engineer: Kramer | Contact: http://www.ti.com/support | |

DAC39RF10 Digital Power

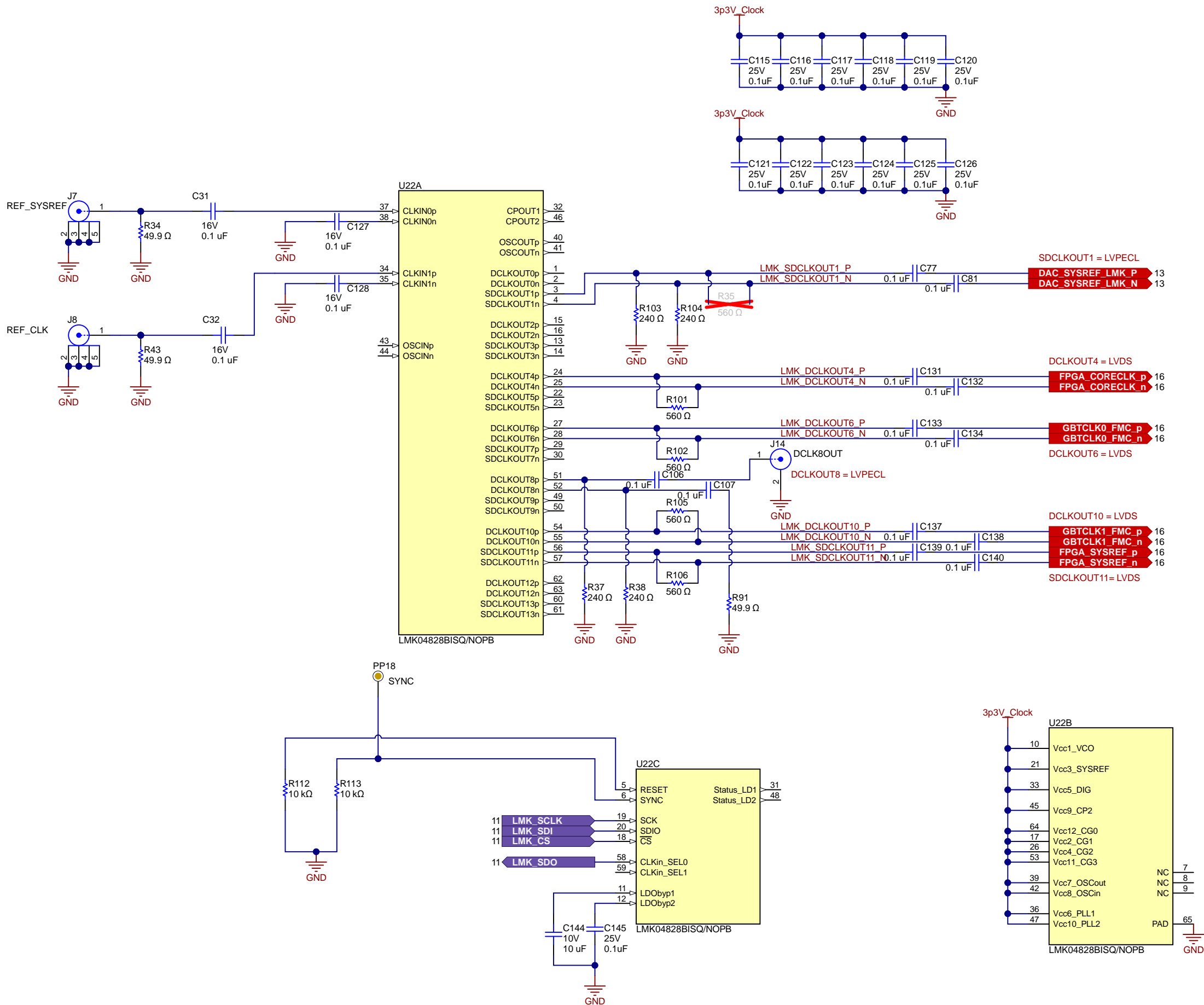
DAC Power Sequencing.
VDD1p8 -> VDDEn1p8 -> VDDCLK1p0 + VDDL1p0 -> VDDDIG



| | | | |
|--|--|--|---|
| Orderable: ChangeMe in variant | Designed for: Public Release | Mod. Date: 9/1/2024 |  TEXAS INSTRUMENTS http://www.ti.com © Texas Instruments 2025 |
| TID #: N/A | Project Title: DAC39RF12EVM | | |
| Number: DC296 | Rev: C | Sheet Title: DAC39RF10 Digital Power | |
| SVN Rev: | Assembly Variant: 001 | Sheet: 8 of 19 | |
| Drawn By: | File: DC-DC DAC Digital_SchDoc | Size: B | |
| Engineer: Kramer | Contact: http://www.ti.com/support | | |

Texas Instruments and/or its licensors do not warrant the accuracy or completeness of this specification or any information contained therein. Texas Instruments and/or its licensors do not warrant that this design will meet the specifications, will be suitable for your application or fit for any particular purpose, or will operate in an implementation. Texas Instruments and/or its licensors do not warrant that the design is production worthy. You should completely validate and test your design implementation to confirm the system functionality for your application.

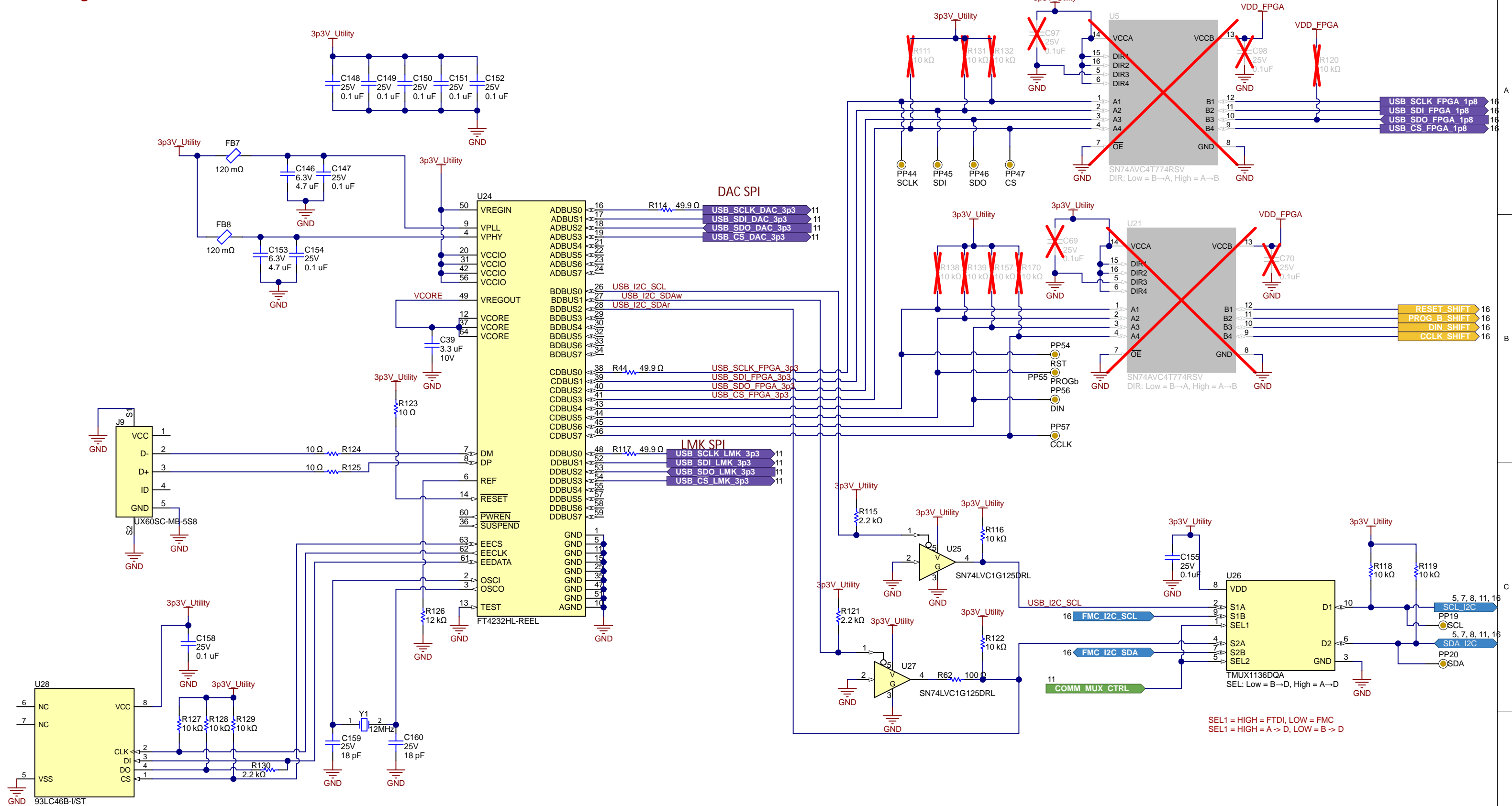
Clocking LMK04828




Texas Instruments and/or its licensors do not warrant the accuracy or completeness of this specification or any information contained therein. Texas Instruments and/or its licensors do not warrant that this design will meet the specifications, will be suitable for your application or fit for any particular purpose, or will operate in an implementation. Texas Instruments and/or its licensors do not warrant that the design is production worthy. You should completely validate and test your design implementation to confirm the system functionality for your application.

| | | |
|--|--|--------------------------------|
| Orderable: ChangeMe in variant | Designed for: Public Release | Mod. Date: 2/11/2025 |
| TID #: N/A | Project Title: DAC39RF12EVM | |
| Number: DC296 | Rev: C | Sheet Title: Clocking LMK04828 |
| SVN Rev: | Assembly Variant: 001 | Sheet: 9 of 19 |
| Drawn By: | File: Clocking LMK04828.SchDoc | Size: B |
| Engineer: Kramer | Contact: http://www.ti.com/support | |

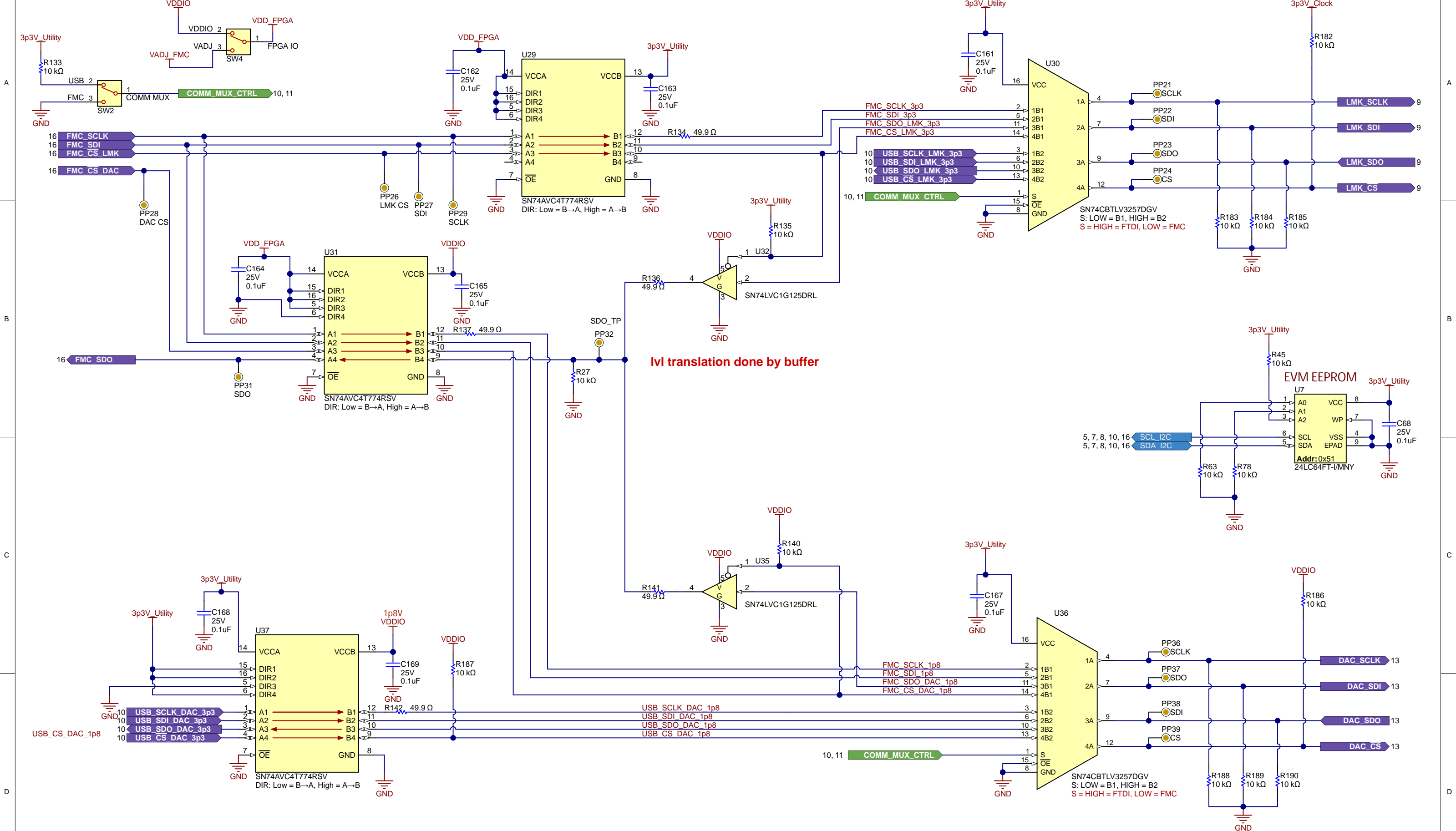
FTDI Debug Connection



| | | | | | | |
|--|------------------------|--|--|---------------------|--|---|
| Orderable: ChangeMe in variant | | Designed for: Public Release | | Mod. Date: 9/4/2024 | |  TEXAS INSTRUMENTS http://www.ti.com © Texas Instruments 2025 |
| TID #: N/A | | Project Title: DAC39RF12EVM | | | | |
| Number: DC296 | Rev: C | Sheet Title: FTDI Debug Connection | | | | |
| SVN Rev: | | Assembly Variant: 001 | | Sheet: 10 of 19 | | |
| Drawn By: | | File: Comms FTDI-Board_I2C.SchDoc | | Size: B | | |
| Engineer: Kramer | | Contact: http://www.ti.com/support | | | | |

Texas Instruments and/or its licensors do not warrant the accuracy or completeness of this specification or any information contained therein. Texas Instruments and/or its licensors do not warrant that this design will meet the specifications, will be suitable for your application or fit for any particular purpose, or will operate in an implementation. Texas Instruments and/or its licensors do not warrant that the design is production worthy. You should completely validate and test your design implementation to confirm the system functionality for your application.

Board I2C & LMK04828 SPI Level Shift and Mux

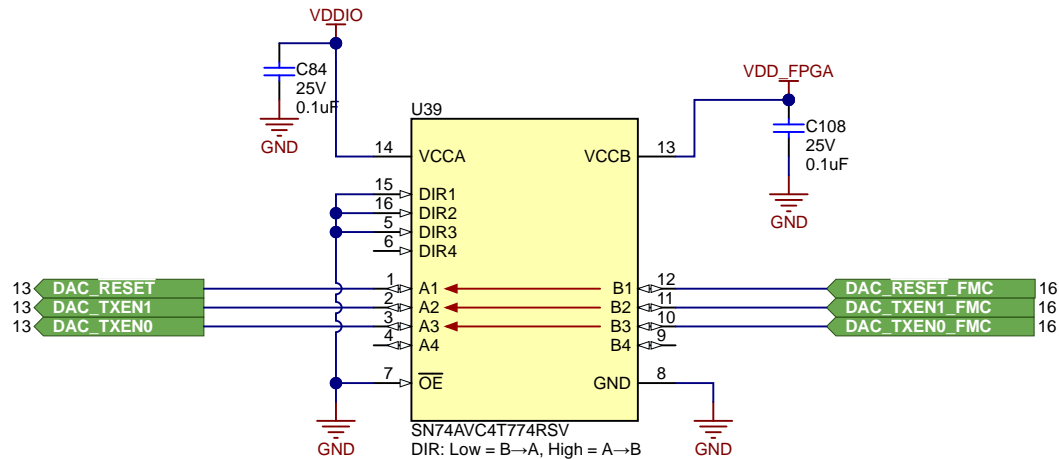
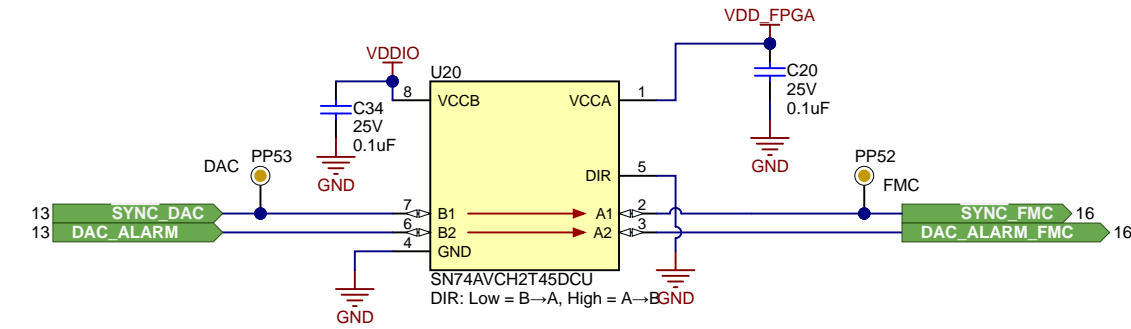


Texas Instruments and/or its licensors do not warrant the accuracy or completeness of this specification or any information contained therein. Texas Instruments and/or its licensors do not warrant that this design will meet the specifications, will be suitable for your application or fit for any particular purpose, or will operate in an implementation. Texas Instruments and/or its licensors do not warrant that the design is production worthy. You should completely validate and test your design implementation to confirm the system functionality for your application.

| | | |
|--|--|---|
| Orderable: ChangeMe in variant | Designed for: Public Release | Mod. Date: 1/20/2025 |
| TID #: N/A | Project Title: DAC39RF12EVM | |
| Number: DC296 | Rev: C | Sheet Title: Board I2C & LMK04828 SPI Level Shift and Mux |
| SVN Rev: | Assembly Variant: 001 | Sheet: 11 of 19 |
| Drawn By: | File: Comms SPI MUX & LVL Translate.SchDoc | Size: B |
| Engineer: Kramer | Contact: http://www.ti.com/support | |

© Texas Instruments 2025

<Update Title in Parameters>



| | | | | | |
|--|--|--|--|---|--|
| Orderable: ChangeMe in variant | | Designed for: Public Release | | Mod. Date: 9/4/2024 | |
| TID #: N/A | | Project Title: DAC39RF12EVM | | | |
| Number: DC296 | | Rev: C | | Sheet Title: <Update Title in Parameters> | |
| SVN Rev: | | Assembly Variant: 001 | | Sheet: 12 of 19 | |
| Drawn By: | | File: FPGA to DUT Control.SchDoc | | Size: B | |
| Engineer: Kramer | | Contact: http://www.ti.com/support | | | |

DAC39RF12 IO

A

B

C

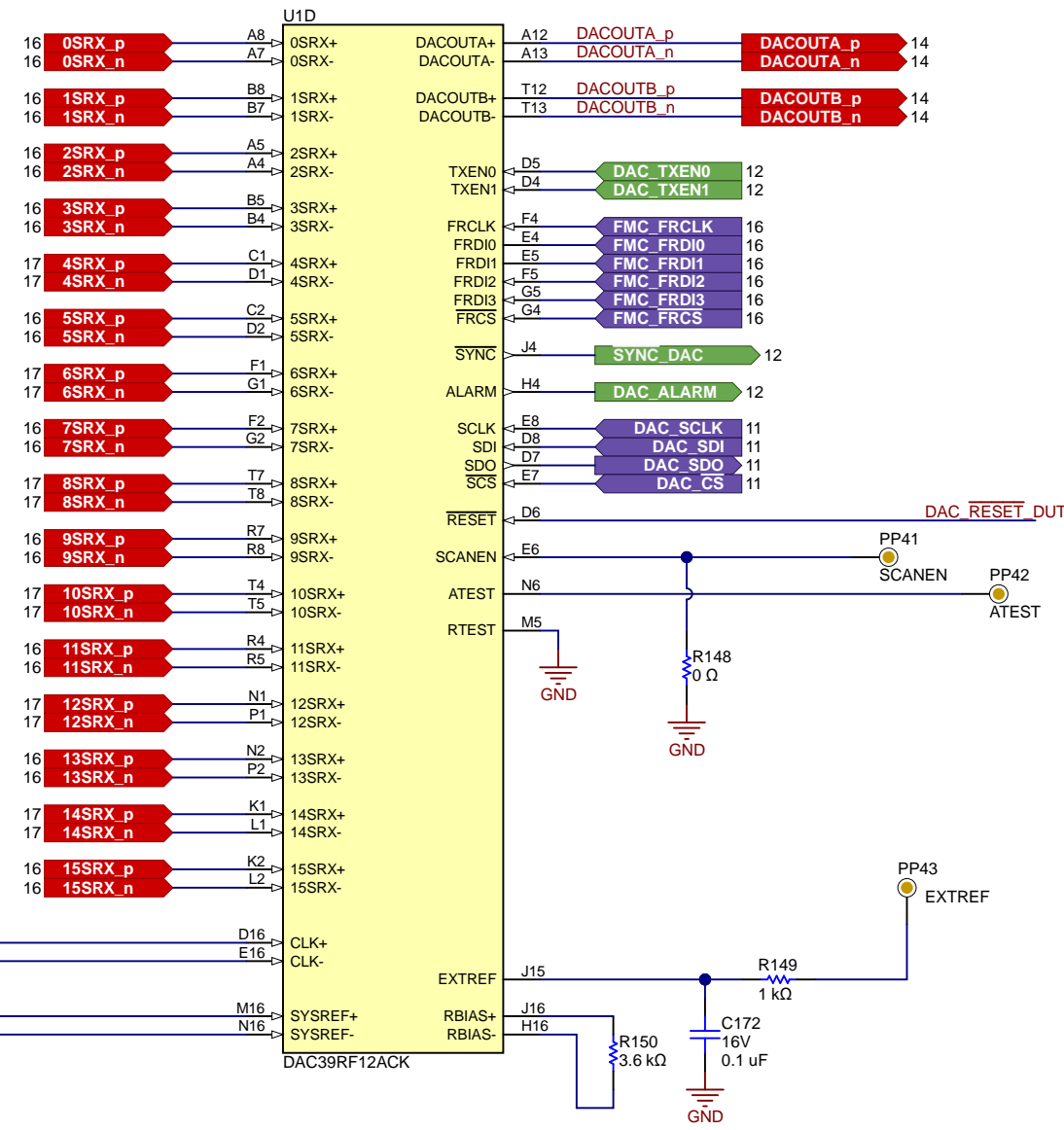
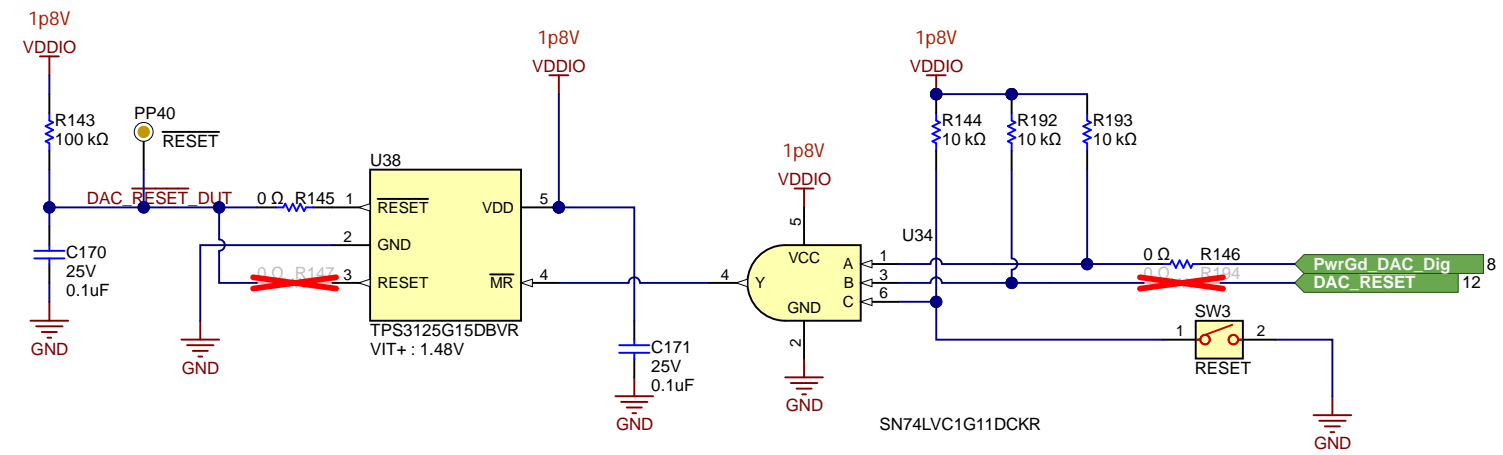
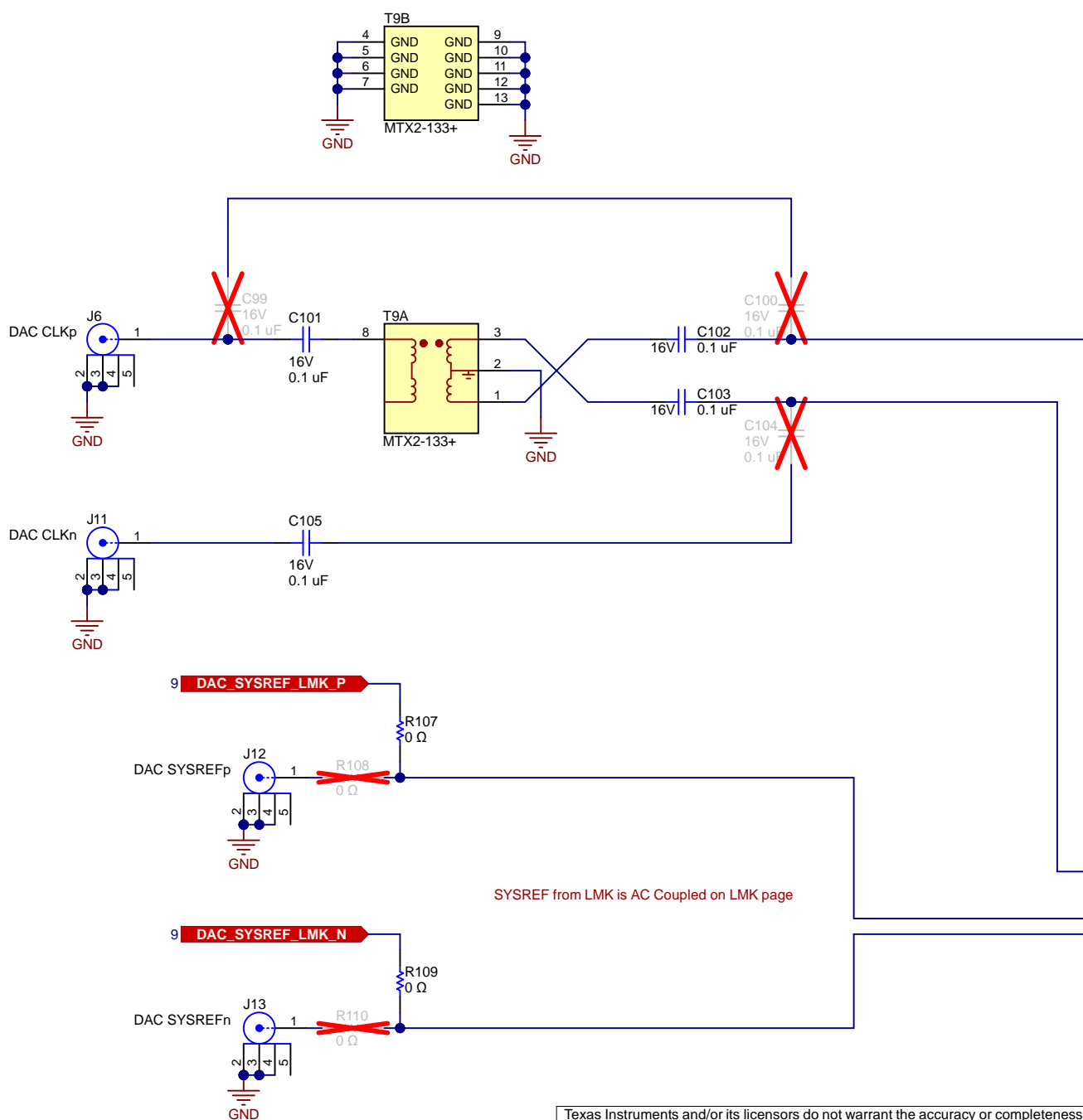
D

A

B

C

D



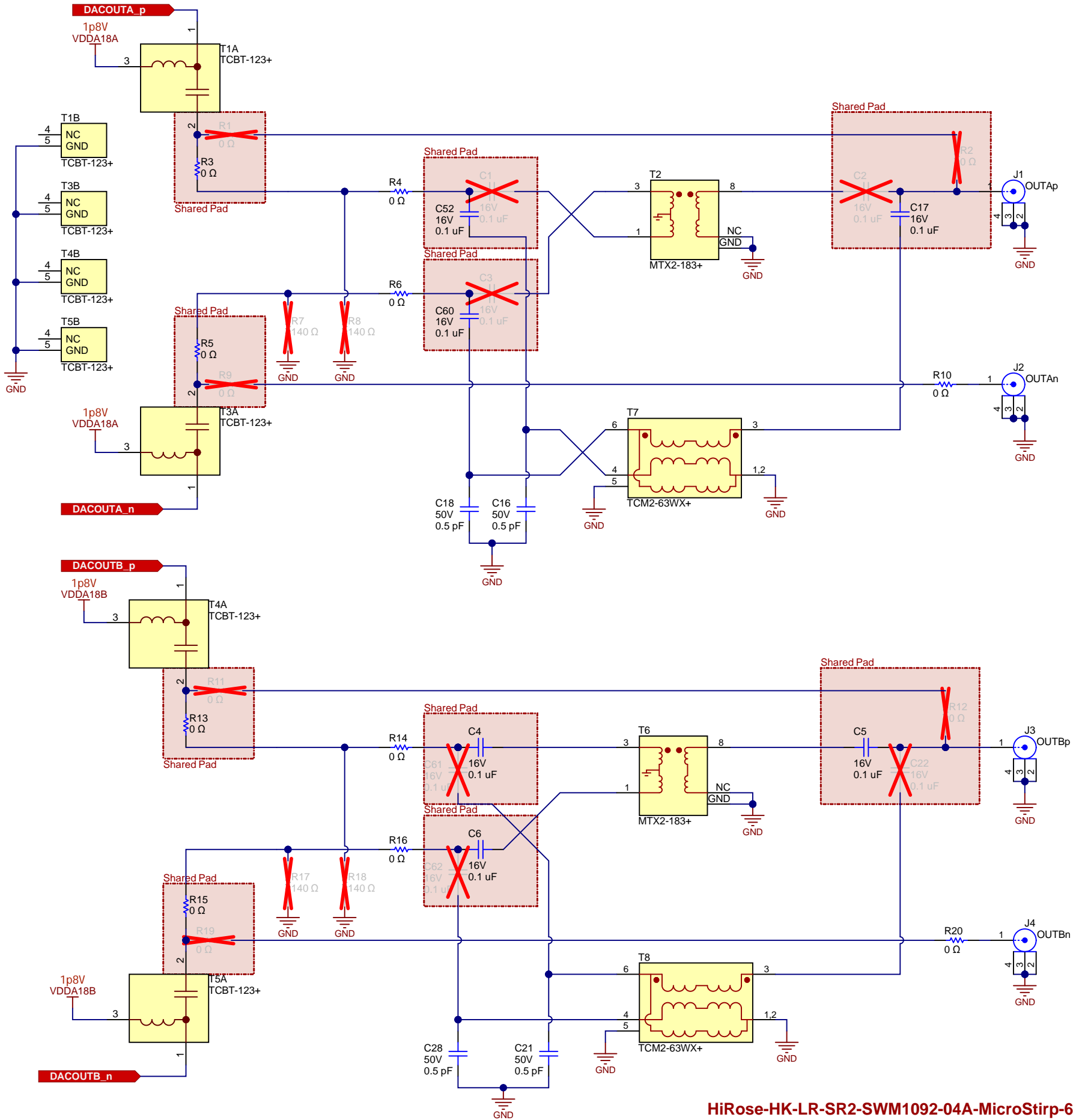
DAC39RF12 Output Baluns

| Channel | Balun | Uninstall | Install |
|---------|------------|------------------------------|-------------------------|
| A | TCM2-63WX+ | R1, R2, R9, C1, C2, C3 | R3, R5, C52, C60, C17 |
| A | MTX2-183+ | R1, R2, R9, C17, C52, C60 | R3, R5, C1, C2, C3 |
| A | Bypass | R3, R5, C2, C17 | R1, R2, R9 |
| B | TCM2-63WX+ | R11, R12, R19, C4, C5, C6 | R13, R15, C22, C61, C62 |
| B | MTX2-183+ | R11, R12, R19, C22, C61, C62 | R13, R15, C4, C5, C6 |
| B | Bypass | R13, R15, C5, C22 | R11, R12, R19 |

DACA default to lower band balun TCM2-63WX+ (1st Nyquist)

DACA 180° Phase for layout

DACB default to higher band MMIC balun MTX2-183+ (multi-Nyquist)

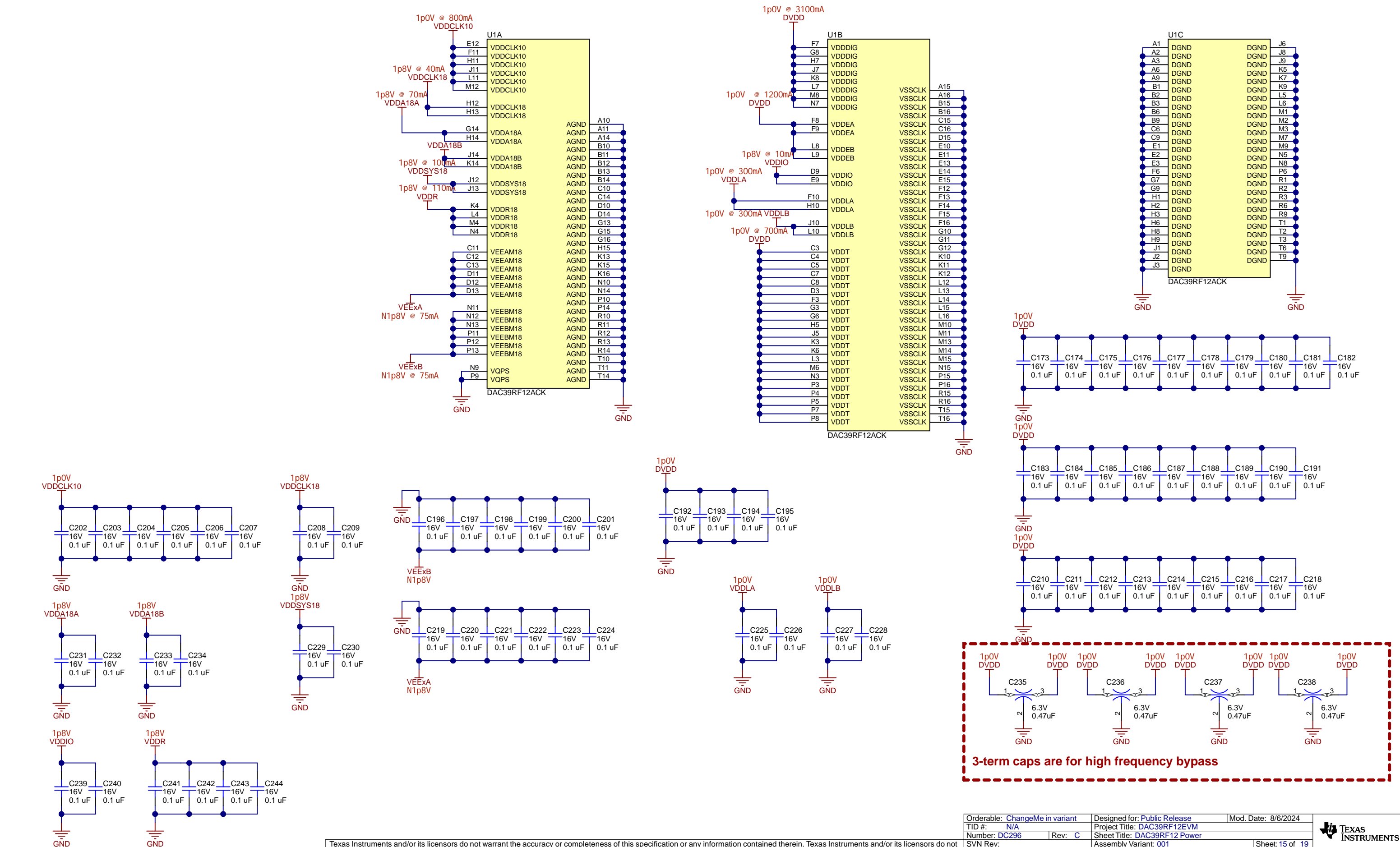


HiRose-HK-LR-SR2-SWM1092-04A-MicroStirp-6mil-Female-Backdrill

| | | |
|--|--|--|
| Orderable: ChangeMe in variant | Designed for: Public Release | Mod. Date: 9/3/2024 |
| TID #: N/A | Project Title: DAC39RF12EVM | |
| Number: DC296 | Rev: C | Sheet Title: DAC39RF12 Output Baluns |
| SVN Rev: | Assembly Variant: 001 | Sheet: 14 of 19 |
| Drawn By: | File: DAC39RF12 Outputs.SchDoc | Size: B |
| Engineer: Kramer | Contact: http://www.ti.com/support | |

Texas Instruments and/or its licensors do not warrant the accuracy or completeness of this specification or any information contained therein. Texas Instruments and/or its licensors do not warrant that this design will meet the specifications, will be suitable for your application or fit for any particular purpose, or will operate in an implementation. Texas Instruments and/or its licensors do not warrant that the design is production worthy. You should completely validate and test your design implementation to confirm the system functionality for your application.

DAC39RF12 Power



FMC+ Banks A → H

A

B

C

D

A

B

C

D

A

B

C

D

A

B

C

D

A

B

C

D

A

B

C

D

A

B

C

D

A

B

C

D

A

B

C

D

A

B

C

D

A

B

C

D

A

B

C

D

A

B

C

D

A

B

C

D

A

B

C

D

A

B

C

D

A

B

C

D

A

B

C

D

A

B

C

D

A

B

C

D

A

B

C

D

A

B

C

D

A

B

C

D

A

B

C

D

A

B

C

D

A

B

C

D

A

B

C

D

A

B

C

D

A

B

C

D

A

B

C

D

A

B

C

D

A

B

C

D

A

B

C

D

A

B

C

D

A

B

C

D

A

B

C

D

A

B

C

D

A

B

C

D

A

B

C

D

A

B

C

D

A

B

C

D

A

B

C

D

A

B

C

D

A

B

C

D

A

B

C

D

A

B

C

D

A

B

C

D

A

B

C

D

A

B

C

D

A

B

C

D

A

B

C

D

A

B

C

D

A

B

C

D

A

B

C

D

A

B

C

D

A

B

C

D

A

B

C

D

A

B

C

D

A

B

C

D

A

B

C

D

A

B

C

D

A

B

C

D

A

B

C

D

A

B

C

D

A

B

C

D

A

B

C

D

A

B

C

D

A

B

C

D

A

B

C

D

A

B

C

D

A

B

C

D

A

B

C

D

A

B

C

D

A

B

C

D

A

B

C

D

A

B

C

D

A

B

C

D

A

B

C

D

A

B

C

D

A

B

C

D

A

B

C

D

A

B

C

D

A

B

C

D

A

B

C

D

A

B

C

D

A

B

C

D

A

B

C

D

A

B

C

D

A

B

C

D

A

B

C

D

A

B

C

D

A

B

C

D

A

B

C

D

A

B

C

D

A

B

C

D

A

B

C

D

A

B

C

D

A

B

C

D

A

B

C

D

A

B

FMC+ Banks J → Z

A

B

C

D

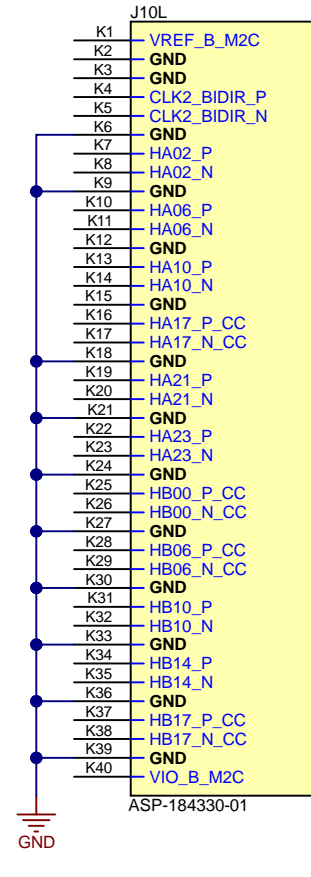
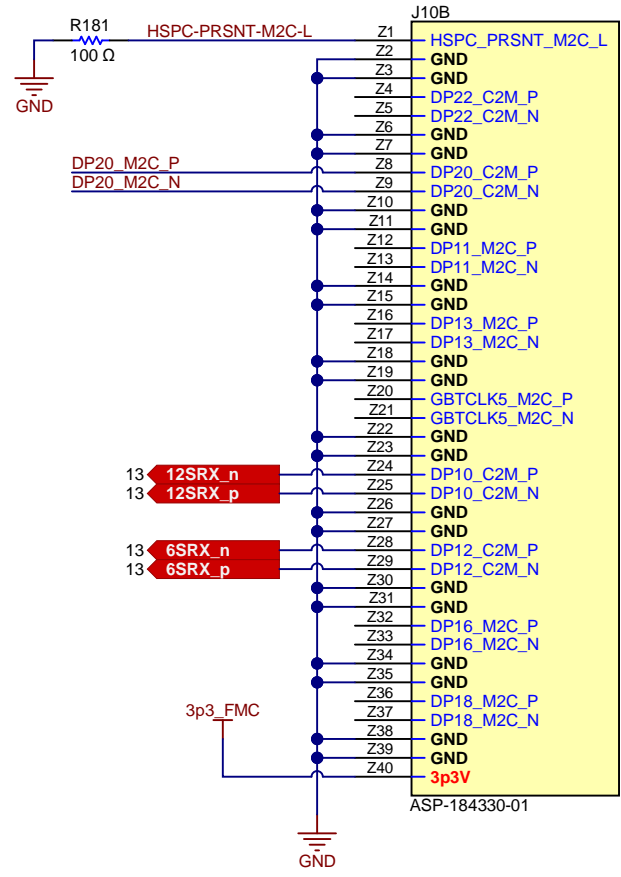
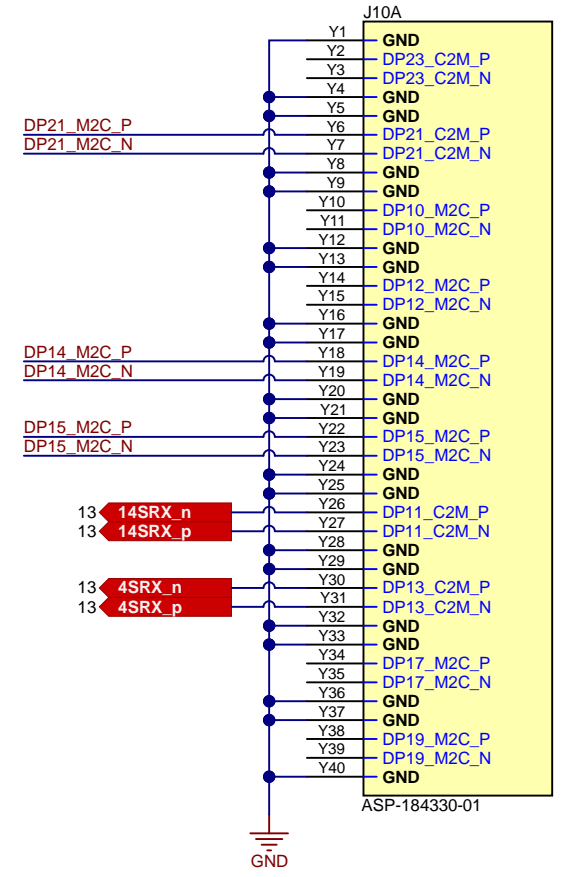
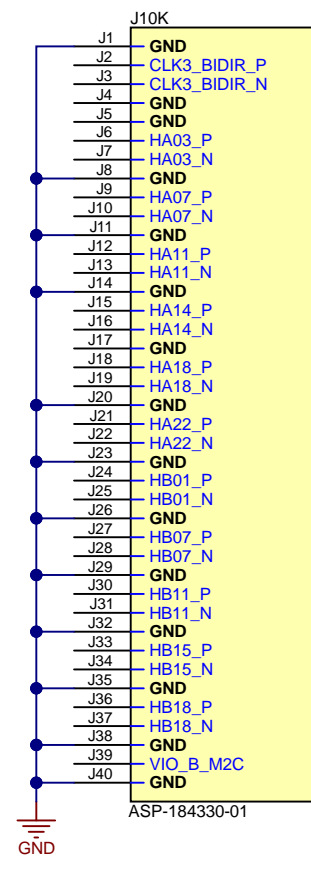
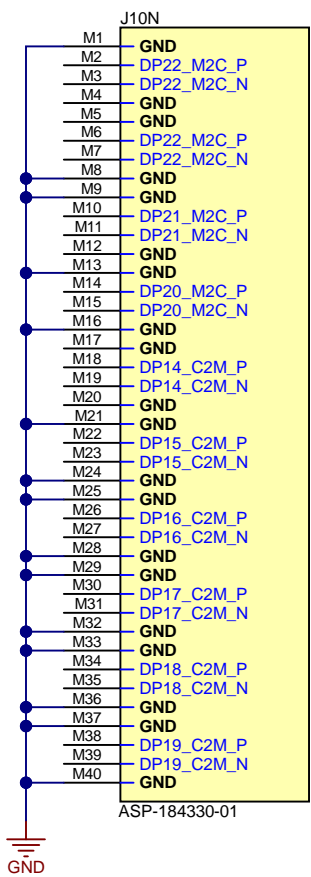
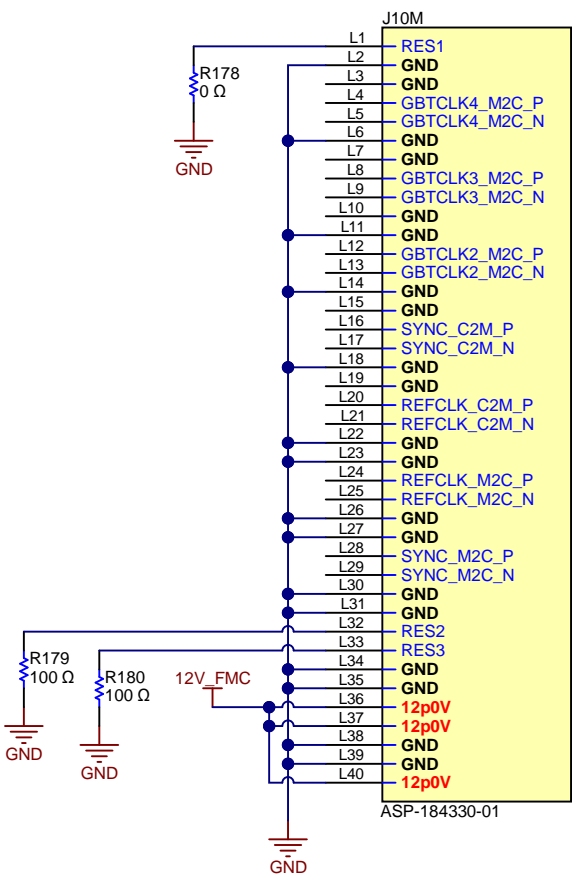
A

B

C

D

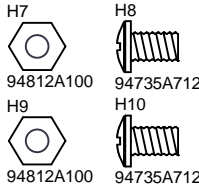
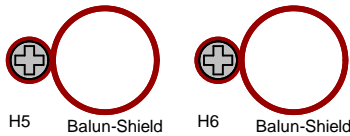
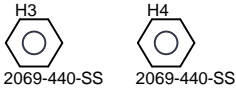
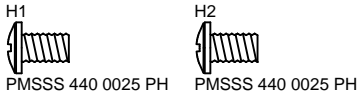
VITA SPEC or TSW14J59 compatible FMC+ connection



Texas Instruments and/or its licensors do not warrant the accuracy or completeness of this specification or any information contained therein. Texas Instruments and/or its licensors do not warrant that this design will meet the specifications, will be suitable for your application or fit for any particular purpose, or will operate in an implementation. Texas Instruments and/or its licensors do not warrant that the design is production worthy. You should completely validate and test your design implementation to confirm the system functionality for your application.



DAC39RF12 Hardware



PCB Number: DC296
PCB Rev: C



PCB
LOGO
FCC disclaimer



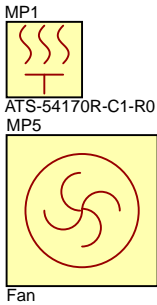
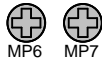
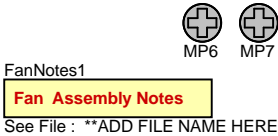
CAUTION HOT SURFACE



LBL1
PCB Label
THT-14-423-10
Size: 0.65"x0.20"

ZZ1
Assembly Note
These assemblies must comply with workmanship standards IPC-A-610 Class 2, unless otherwise specified.
These assemblies must be clean and free from flux and all contaminants. Use of no clean flux is not acceptable.

Fan Assembly



Texas Instruments and/or its licensors do not warrant the accuracy or completeness of this specification or any information contained therein. Texas Instruments and/or its licensors do not warrant that this design will meet the specifications, will be suitable for your application or fit for any particular purpose, or will operate in an implementation. Texas Instruments and/or its licensors do not warrant that the design is production worthy. You should completely validate and test your design implementation to confirm the system functionality for your application.

| | | | |
|--|--|---|----------------------|
| Orderable: ChangeMe in variant | | Designed for: Public Release | Mod. Date: 9/13/2024 |
| TID #: N/A | | Project Title: DAC39RF12EVM | |
| Number: DC296 | Rev: C | Sheet Title: DAC39RF12 Hardware | |
| SVN Rev: | Assembly Variant: 001 | Sheet: 18 of 19 | |
| Drawn By: | File: Hardware.SchDoc | Size: B | |
| Engineer: Kramer | Contact: http://www.ti.com/support | | |

| | | | | | | | | | | | |
|----------------------------------|--|---|--|---|--|---|--|---|--|---|--|
| 1 | | 2 | | 3 | | 4 | | 5 | | 6 | |
| DAC39RF12 Rev History & Variants | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |