

Revision History				
Rev	ECN #	Approved Date	Approved by	Notes
RevB	N/A	DEC-2022	H. Zhang, T.Urban	Project taken over by Panacek, Urban, Santrac
RevC	N/A	TBD		Sitara CC #1, Wake on CAN, AGDS, Wheelie

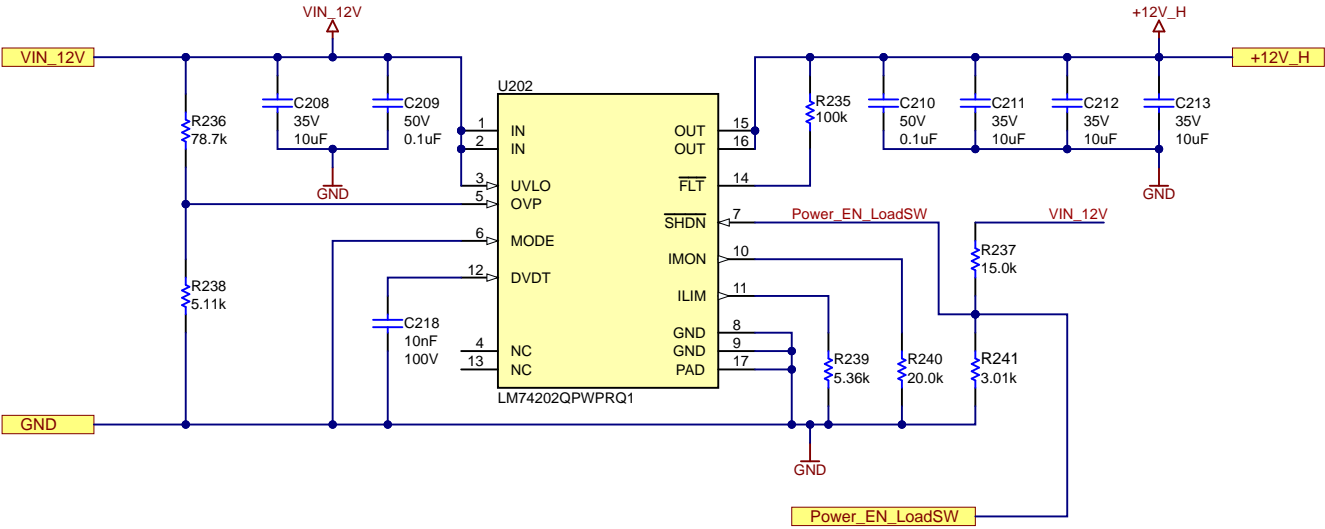
Orderable: N/A	Designed for: Public Release	Mod. Date: 7/9/2023
TID #: N/A	Project Title: WS Inverter - Ctrl Board	
Number: N/A	Rev: RevC	Sheet Title: Block diagram
SVN Rev: Not in version control	Assembly Variant: 001	Sheet: 1 of 13
Drawn By: Panacek	File: WS-inverter-control-brd-RevC-SEM-hierarchy-Schematic	
Engineer: Panacek	Contact: <a href="http://www.ti.com/support">http://www.ti.com/support</a>	



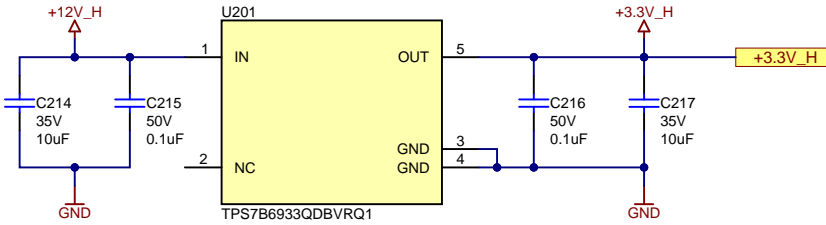
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High Side Power Rail

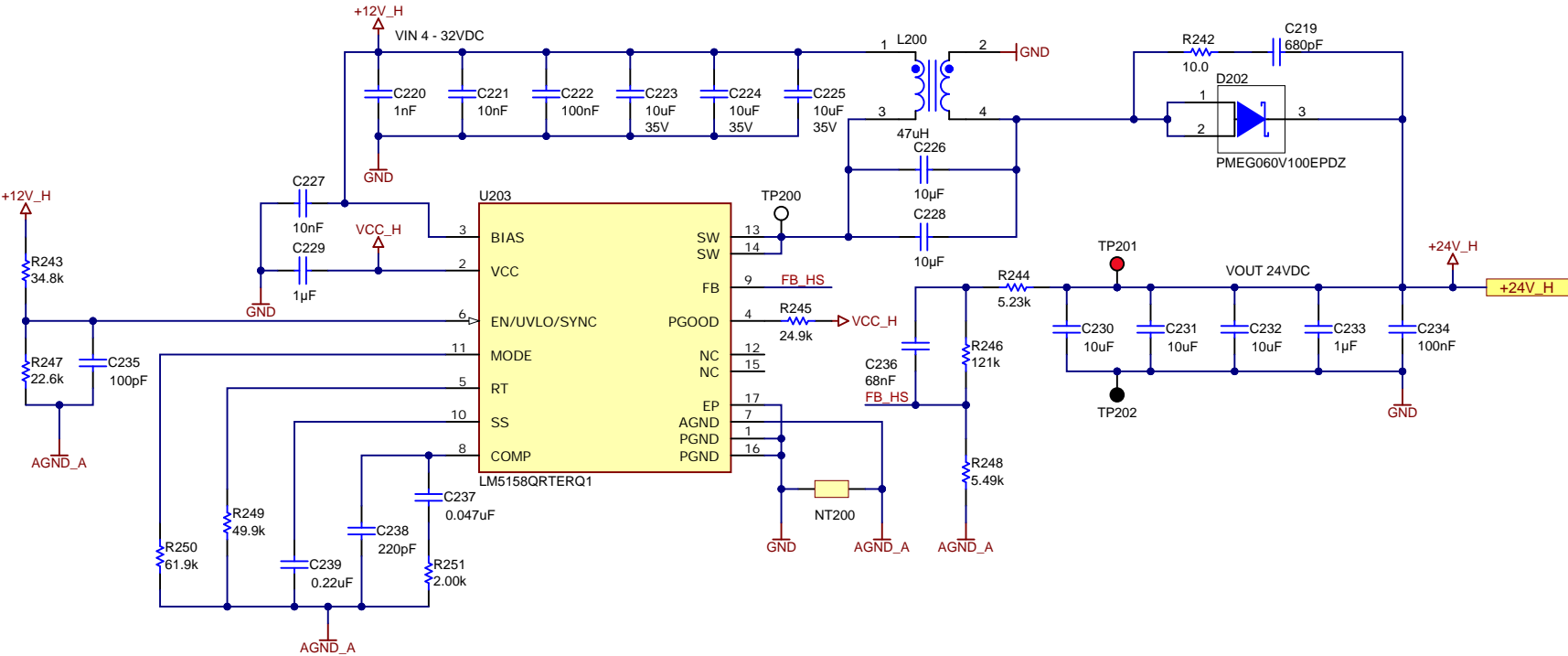
Ideal diode with integrated overvoltage and overcurrent protection



High-side logic power supply



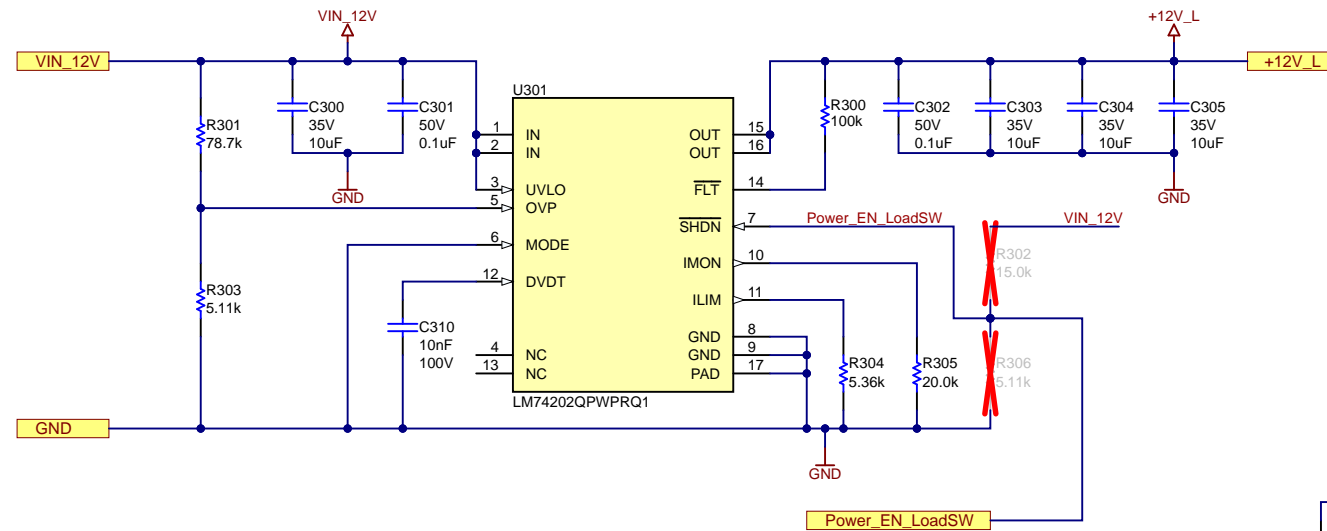
Magneto MV (UCC14240-Q1) pre-regulator



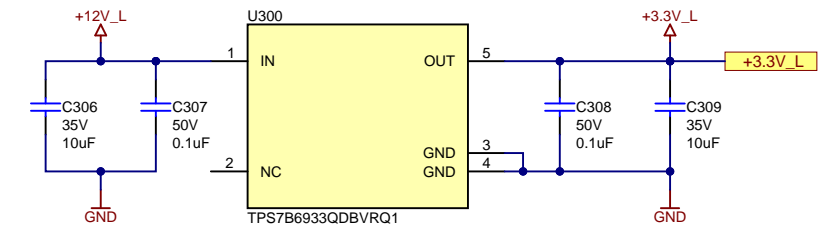
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### Low Side Power Rail

### Ideal diode with integrated overvoltage and overcurrent protection

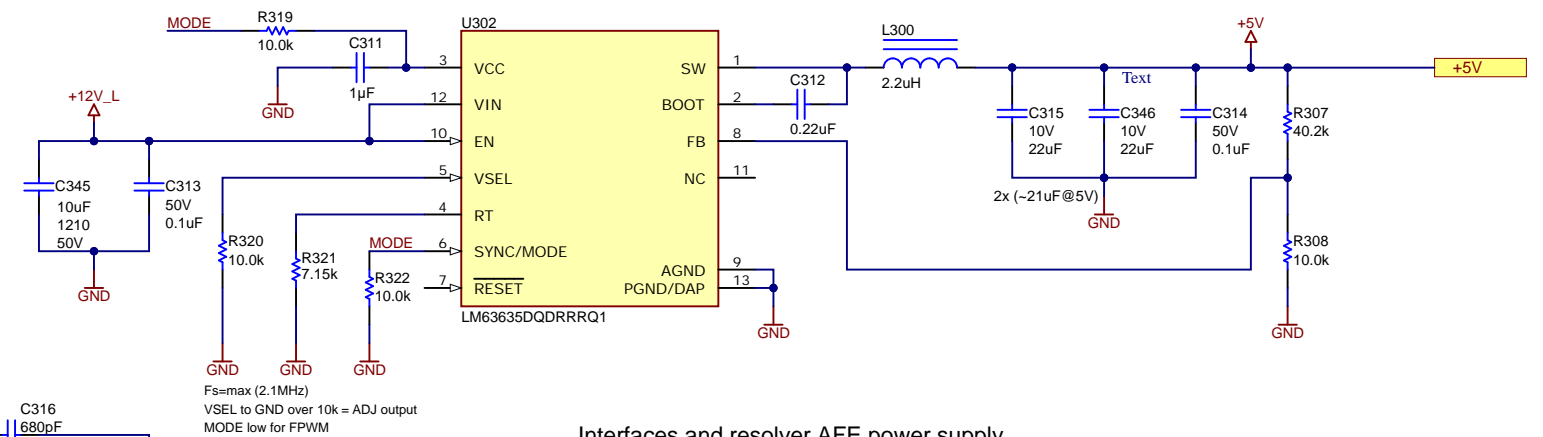


### Low-side logic power supply

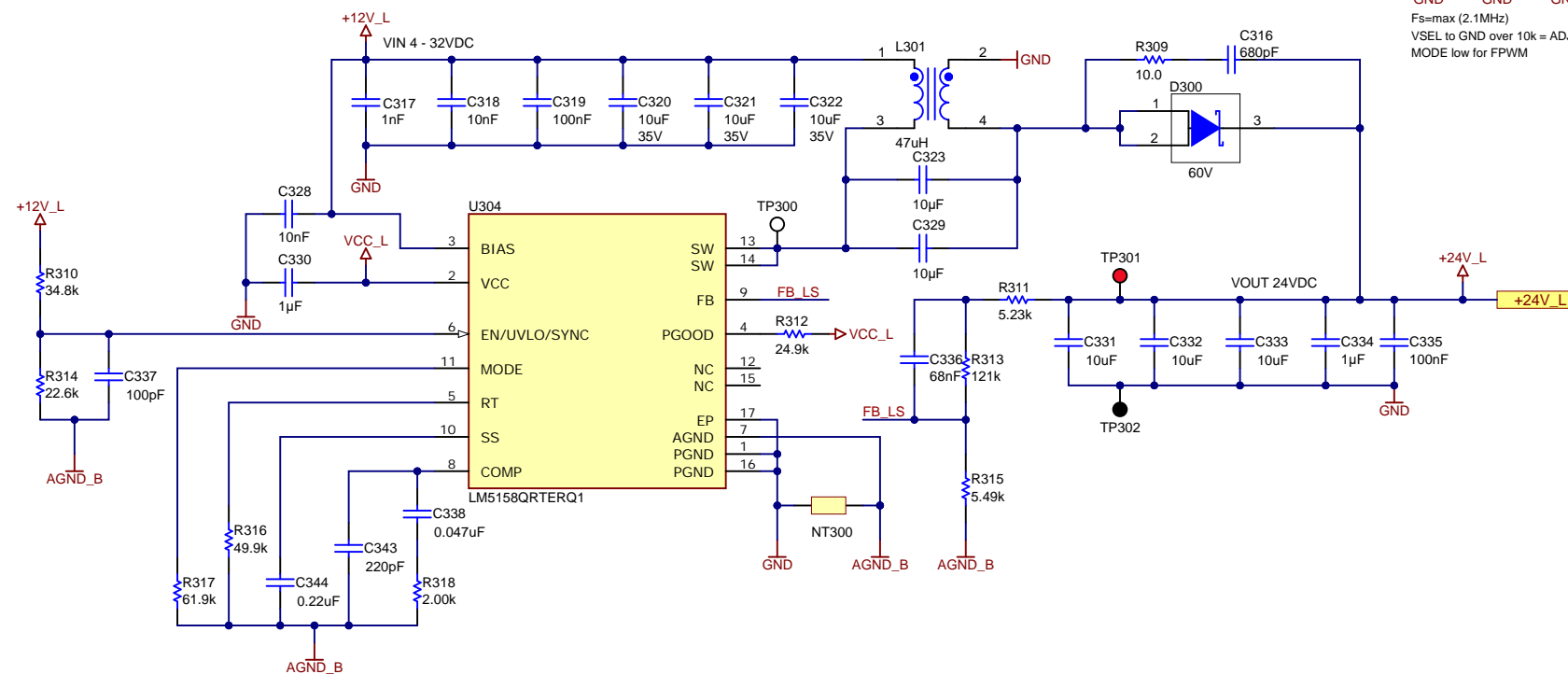


### Controlcard and interfaces power supply

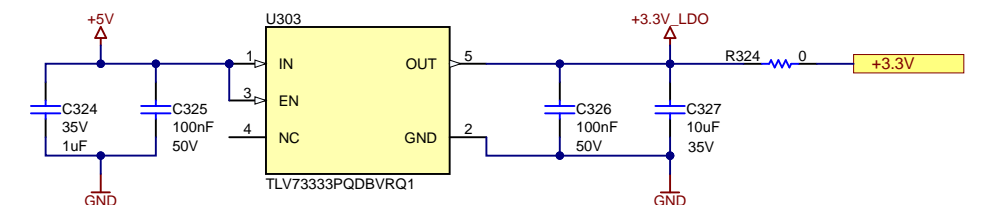
RevC Change: Swap from LMR50410Y5F (2.1MHz, Iout=1A, FPWM) to LM5365-Q1 (2MHz, Iout=3A, FPWM) - PMP30578  
RevC Change: 5V has to be always available. Power\_EN\_LoadSW is now removed from the MCU and turns on load switches as soon as voltage reaches the threshold



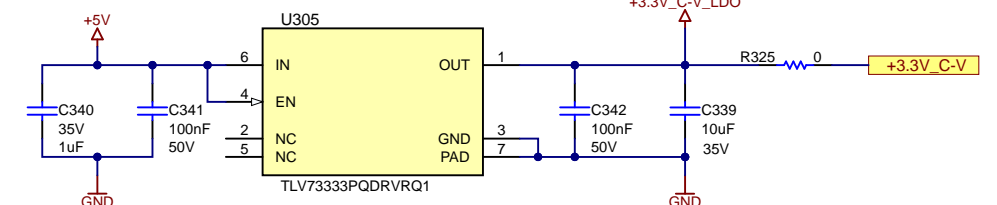
Magneto MV (UCC14240-Q1) pre-regulator



## Interfaces and resolver AFE power supply




### Voltage and current sensing power supply



Different package with higher power dissipation rating needed (T. Urban)

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Orderable: <a href="#">N/A</a>	Designed for: <a href="#">Public Release</a>	Mod. Date: 7/10/2023	
TID #: <a href="#">N/A</a>	Project Title: <a href="#">WS Inverter - Ctrl Board</a>		
Number: <a href="#">N/A</a>	Rev: <a href="#">RevC</a>	Sheet Title: <a href="#">Low-Side Power Rail</a>	
SVN Rev: Not in version control	Assembly Variant: <a href="#">001</a>	Sheet: <a href="#">3</a> of <a href="#">13</a>	
Drawn By: <a href="#">Panacek</a>	File: <a href="#">power_ls.SchDoc</a>	Size: B	
Engineer: <a href="#">Panacek</a>	Contact: <a href="#">http://www.ti.com/support</a>		<a href="#">http://www.ti.com</a> © Texas Instruments 2023

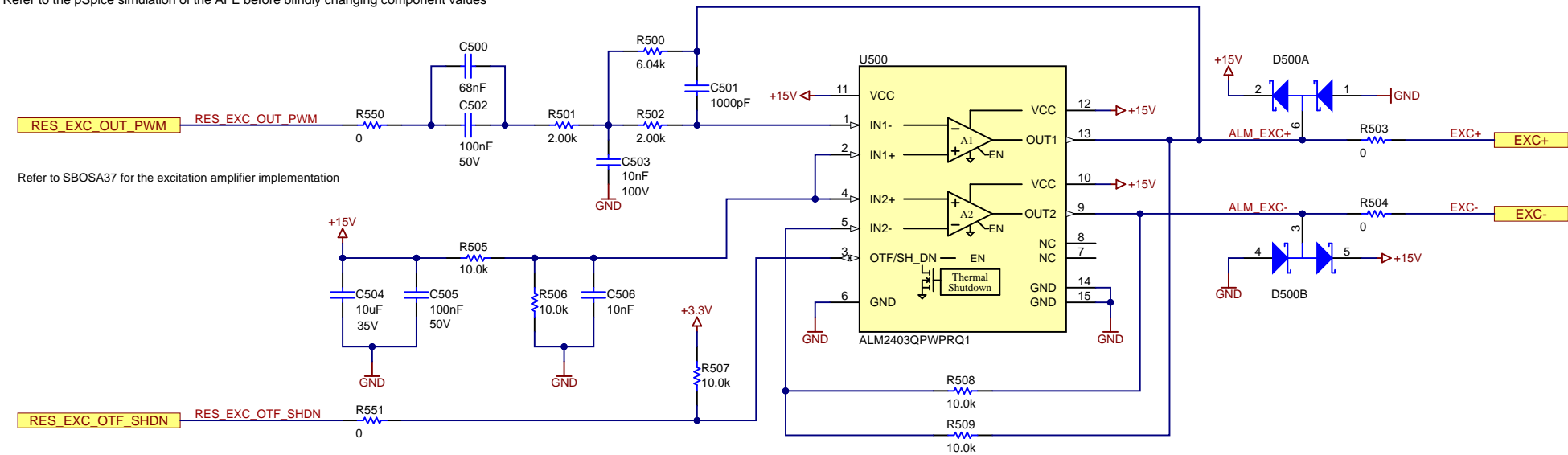


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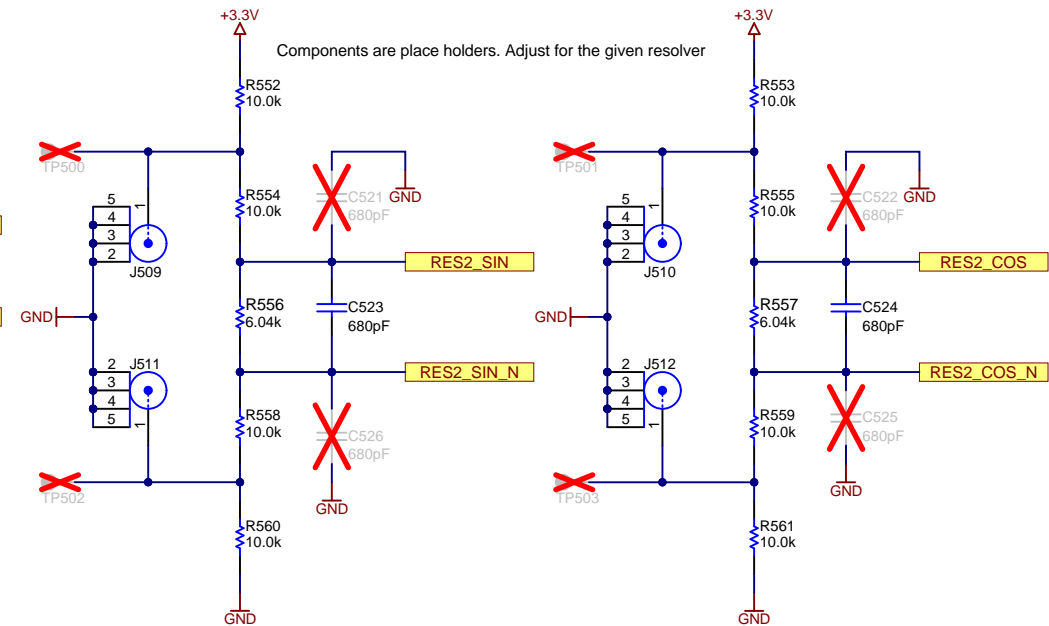
**IMPORTANT NOTES:**

Resolver sub-system optimized for 7-Vrms 10kHz resolvers  
The current resolver sub-system does not support any additional diagnostic features  
0-ohm resistors and MMCX connectors allow for single-ended & differential resolver testing with AM263p on both channels  
Refer to the pSpice simulation of the AFE before blindly changing component values

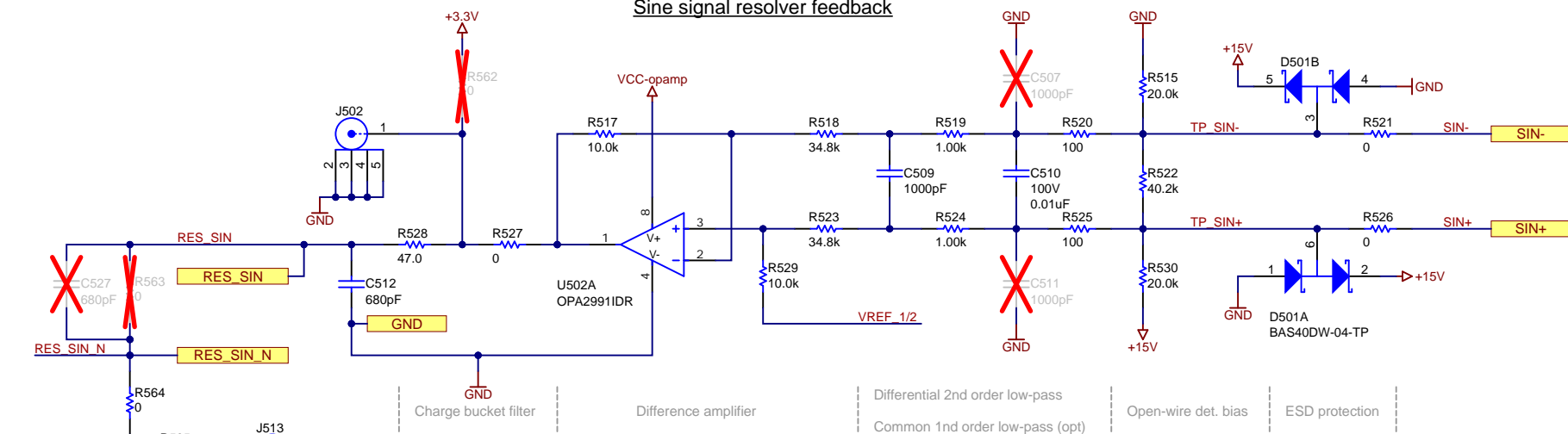
**Excitation amplifier**



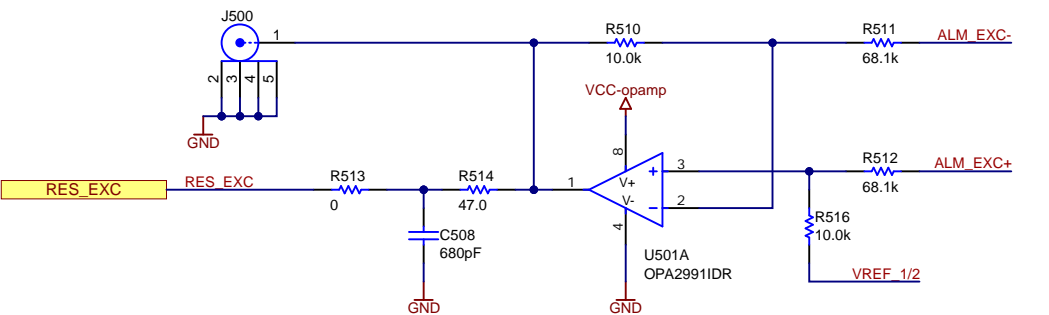
**AM263P differential resolver2 AFE support**



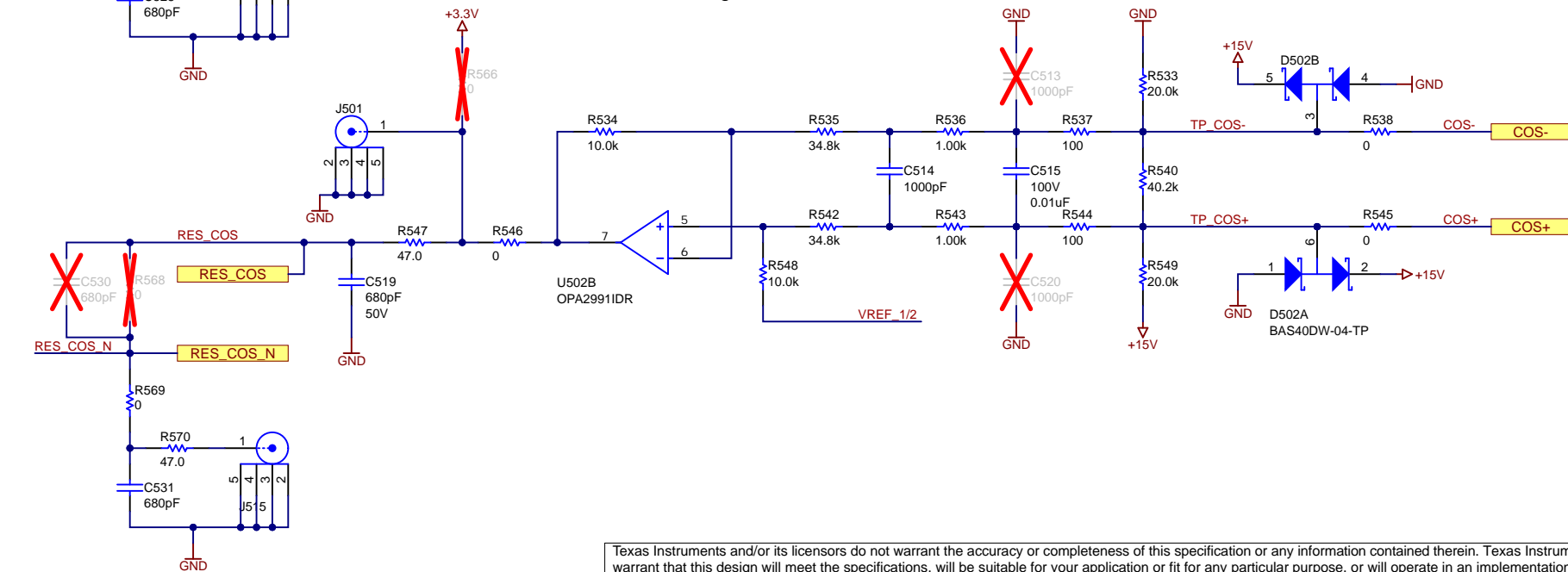
**Sine signal resolver feedback**



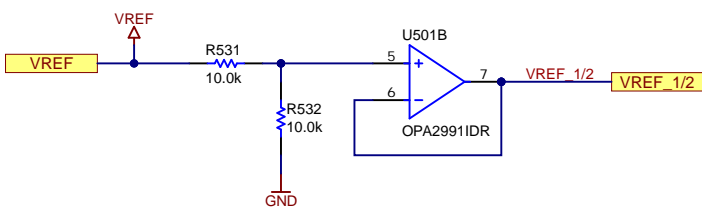
**Excitation amplifier feedback sensing (optional)**



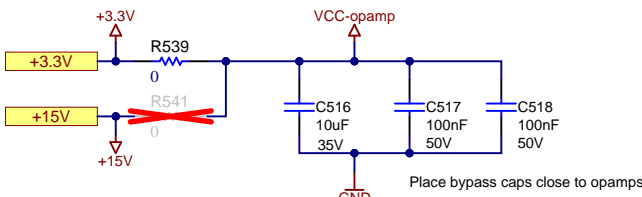
**Cosine signal resolver feedback**



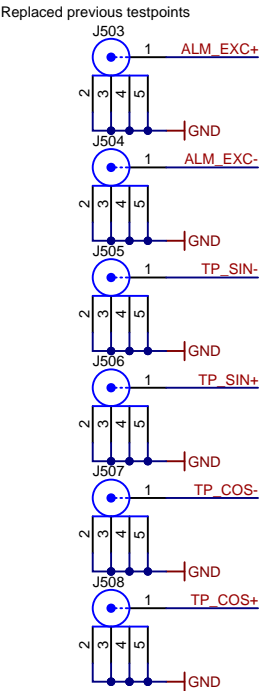
**DC offset (50% of the Vref)**



**AFE power supply selection (3.3V default)**

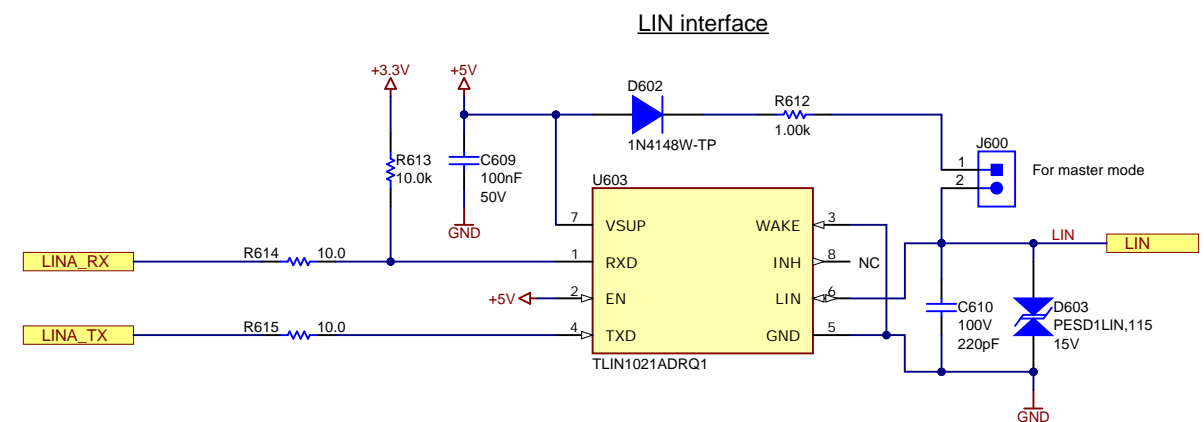
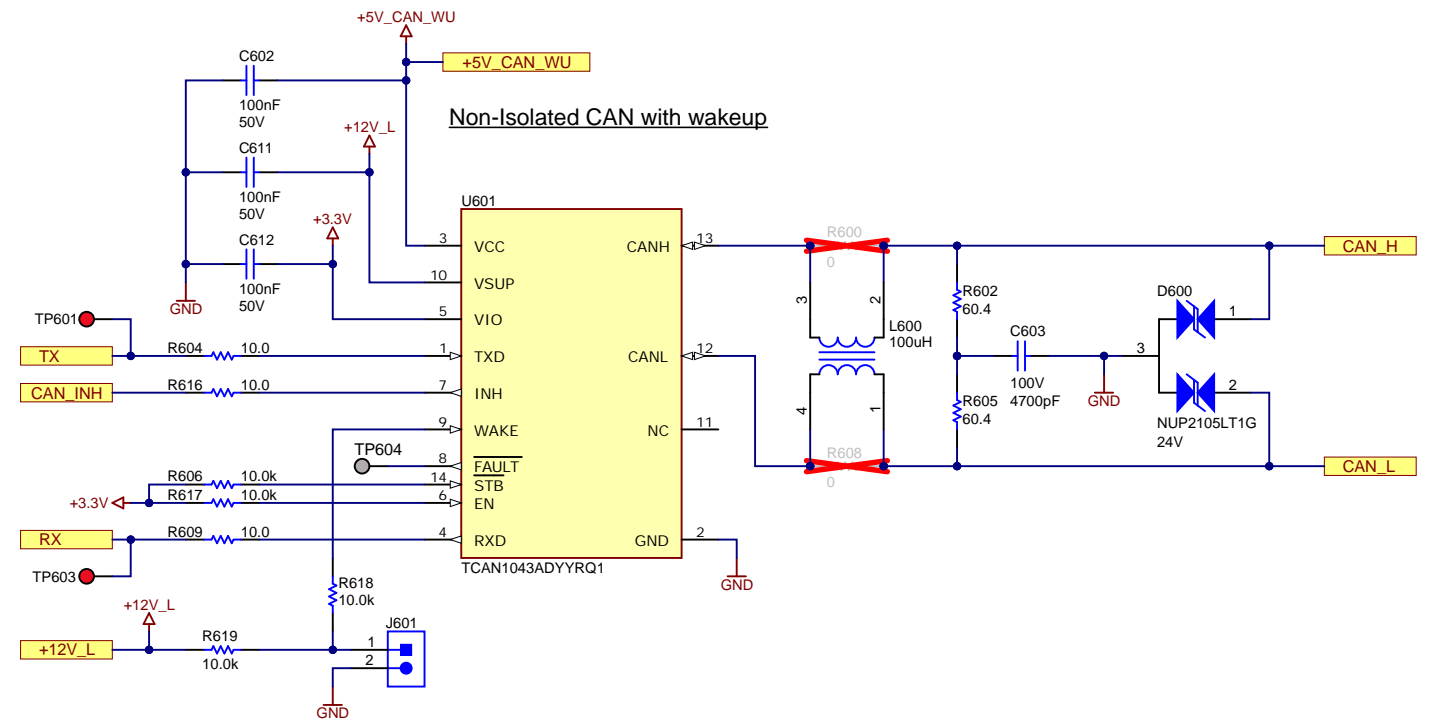
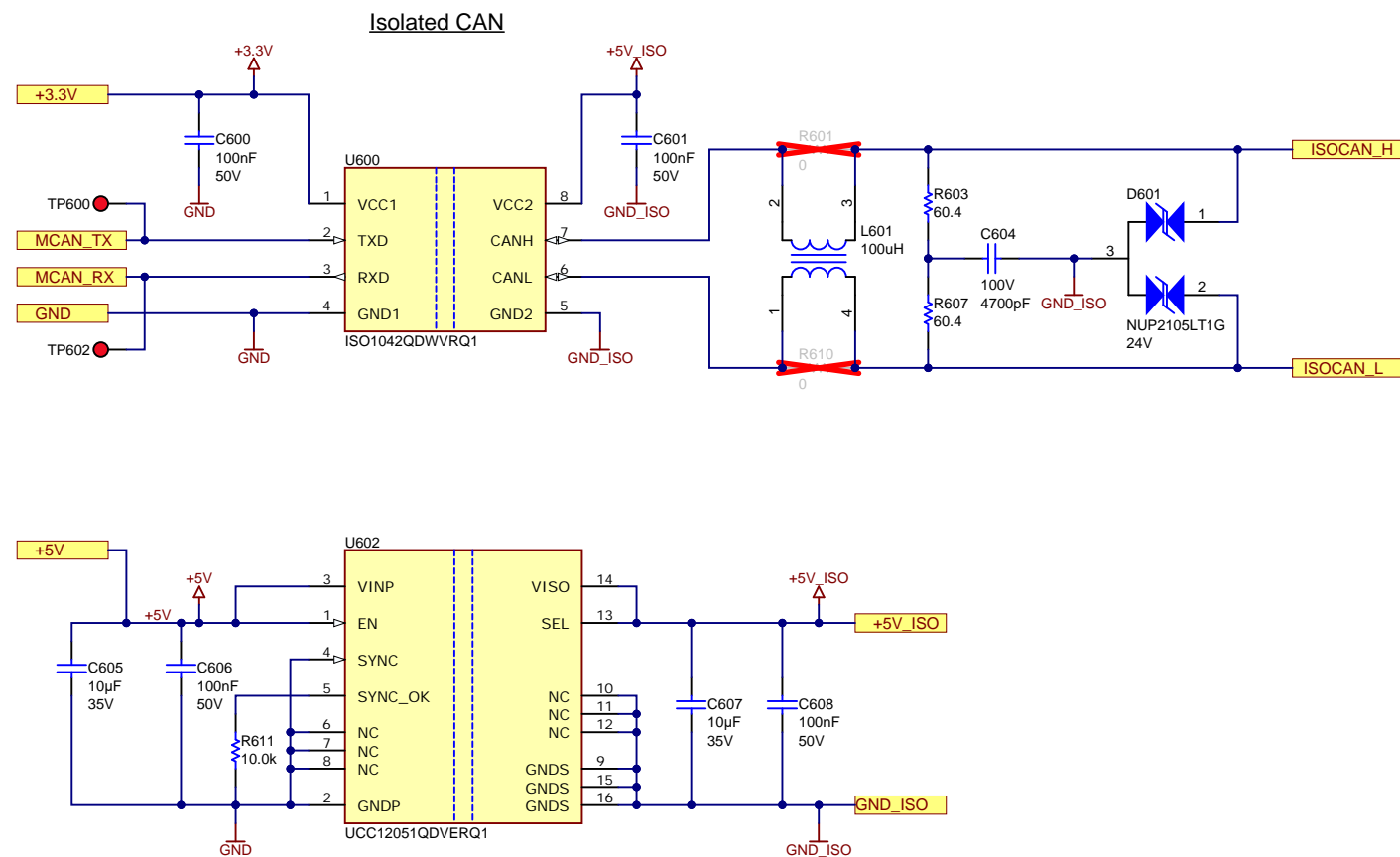


**Test MMCX (rq. H. Zhang)**



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Orderable: N/A	Designed for: Public Release	Mod. Date: 7/10/2023
TID #: N/A	Project Title: WS Inverter - Ctrl Board	
Number: N/A	Rev: RevC	Sheet Title: Resolver Analog Front-End
SVN Rev: Not in version control	Assembly Variant: 001	Sheet: 5 of 13
Drawn By: Panacek	File: resolver.SchDoc	Size: B
Engineer: Panacek	Contact: http://www.ti.com/support	



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Orderable: N/A	Designed for: Public Release	Mod. Date: 7/9/2023
TID #: N/A	Project Title: WS Inverter - Ctrl Board	
Number: N/A	Rev: RevC	Sheet Title: Communication Interfaces
SVN Rev: Not in version control	Assembly Variant: 001	Sheet: 6 of 13
Drawn By: Panacek	File: can_lin_interface.SchDoc	Size: B
Engineer: Panacek	Contact: <a href="http://www.ti.com/support">http://www.ti.com/support</a>	

A

B

C

D

A

B

C

D

LEM LF510 current output with  $G_{th}=0.2mA/A$

Inverter output operating current  $I_{out}=360A$  RMS (509A peak)

LEM sensor current output  $I_{lem\_x}=I_{out}*G_{th}=0.2e-3*509=+/- 0.1018A$

ADC input voltage range  $V_{adc} = 3.3V$

ADC headroom from rails during normal operation  $ADC_{hr} = 10\%$

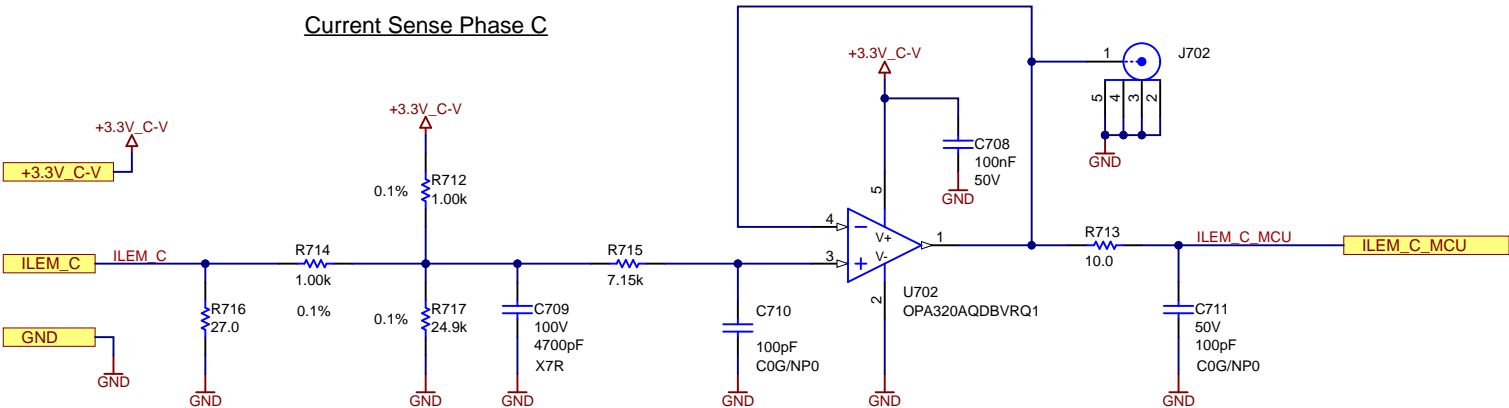
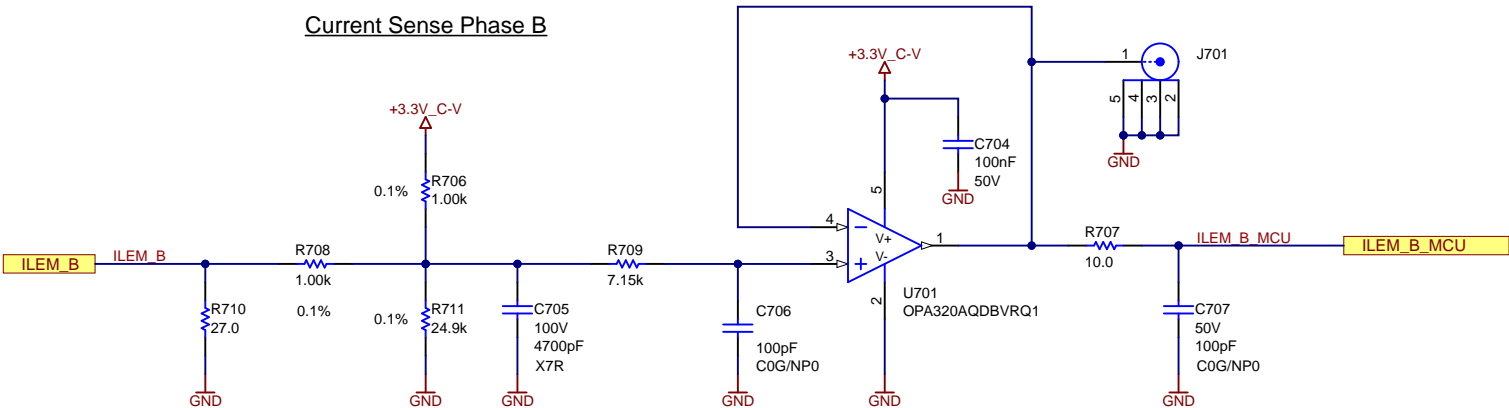
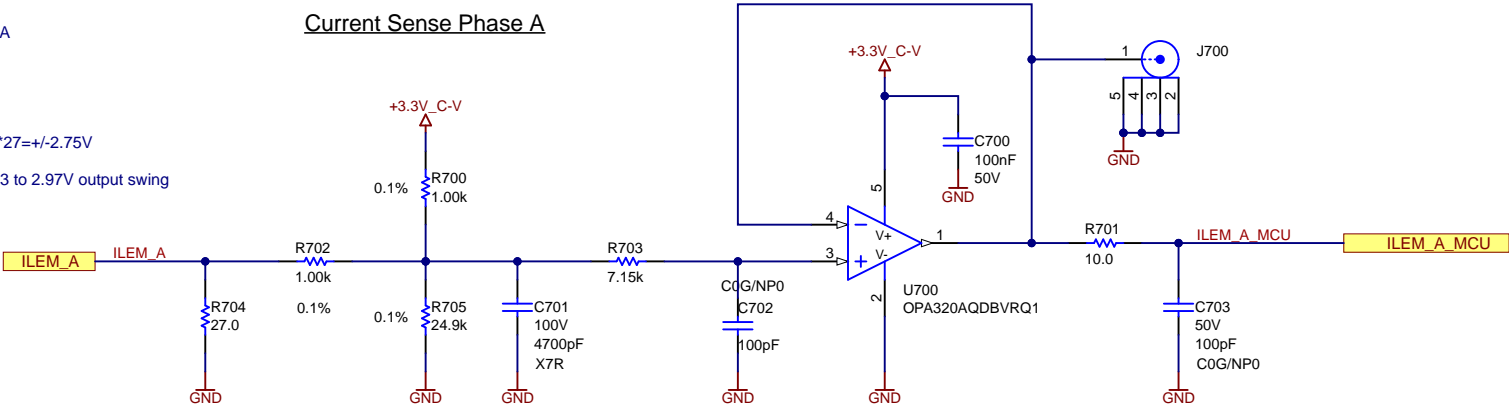
Voltage drop across the sensing resistor  $V_{sns}=I_{lem\_x}*R_{713}=0.1018*27=+/-2.75V$

With the given combination of resistors +/- 509A corresponds to cca 0.33 to 2.97V output swing

-3dB point  $f_c=61.9kHz$  (simulated)

IMPORTANT NOTES:

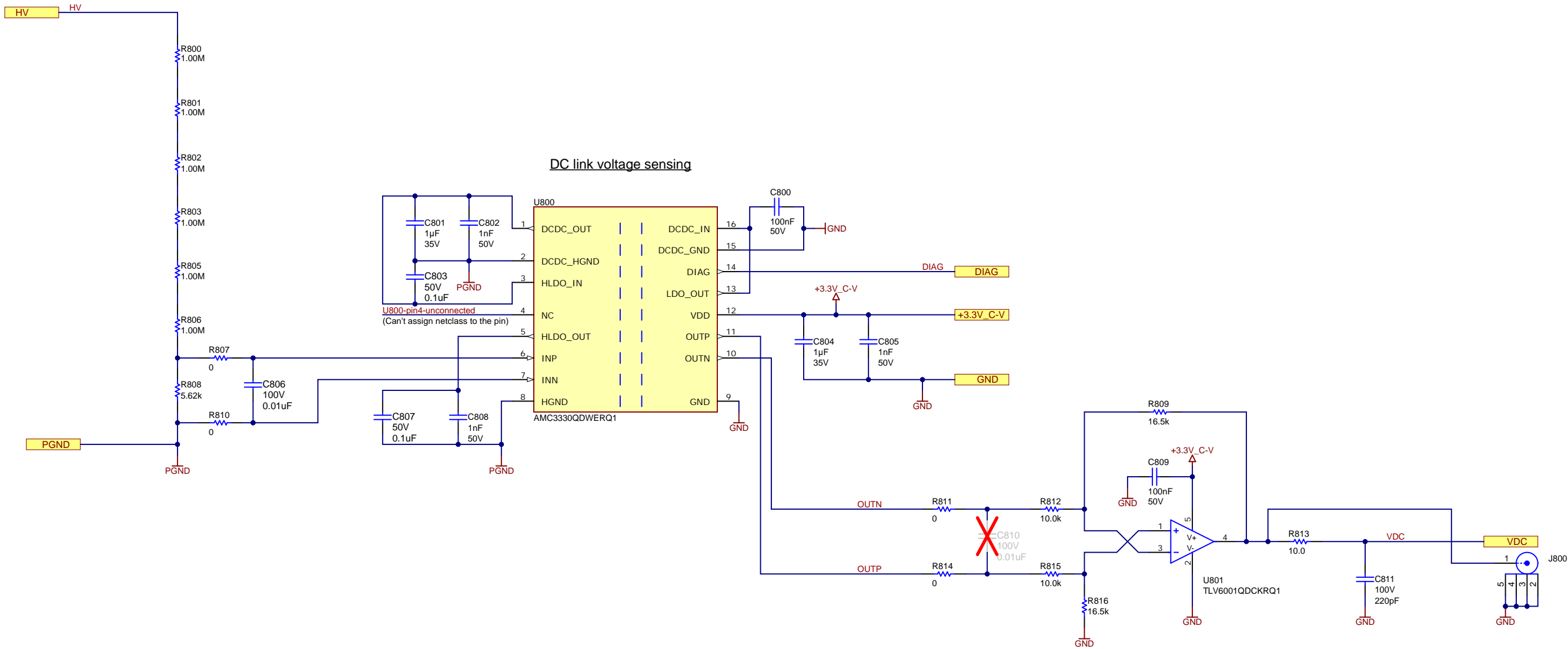
This circuit re-uses the original Wolfspeed circuitry. It would be better to use a device such INA296A (soon Q1)



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Orderable: N/A	Designed for: Public Release	Mod. Date: 1/16/2023
TID #: N/A	Project Title: WS Inverter - Ctrl Board	
Number: N/A	Rev: RevC	Sheet Title: Current Sensing Front-End
SVN Rev: Not in version control	Assembly Variant: 001	Sheet: 7 of 13
Drawn By: Panacek	File: current-sensing-lem.SchDoc	Size: B
Engineer: Panacek	Contact: http://www.ti.com/support	

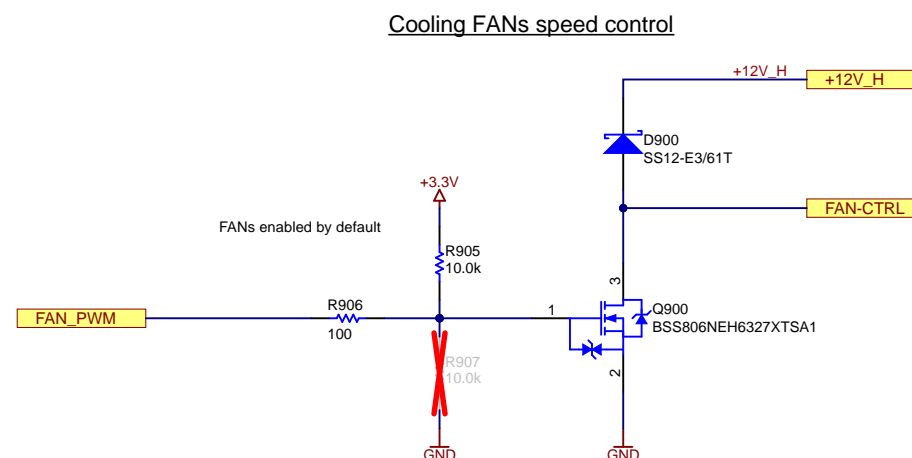
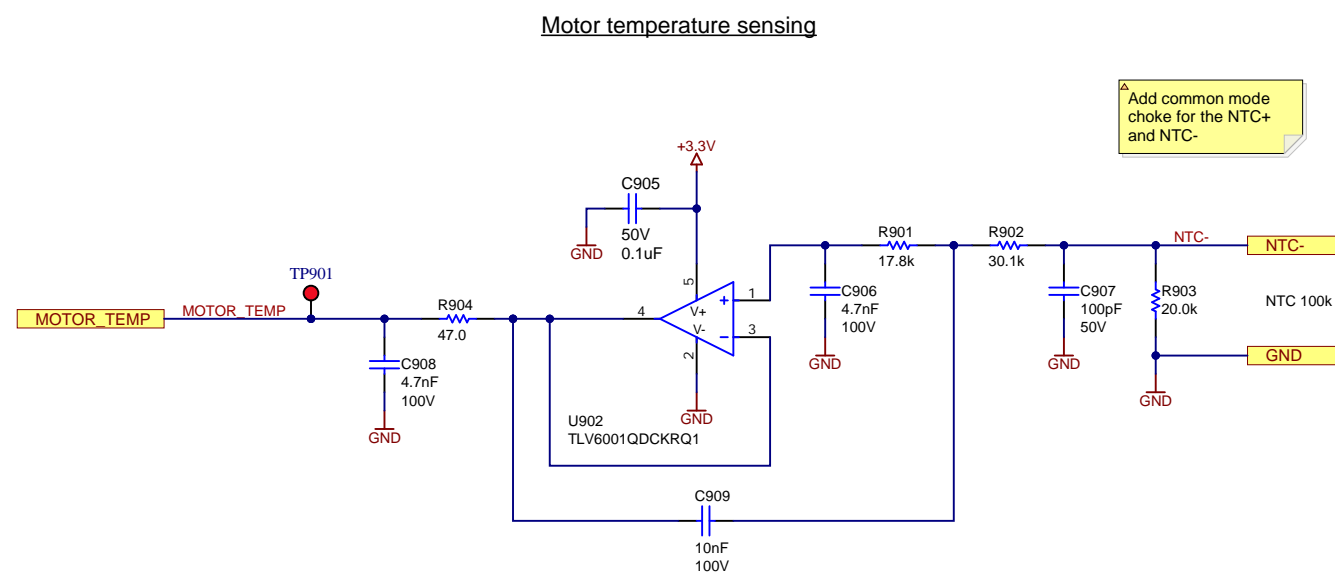
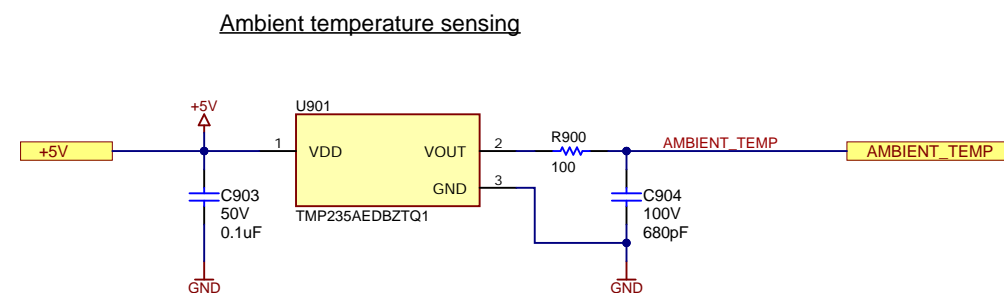
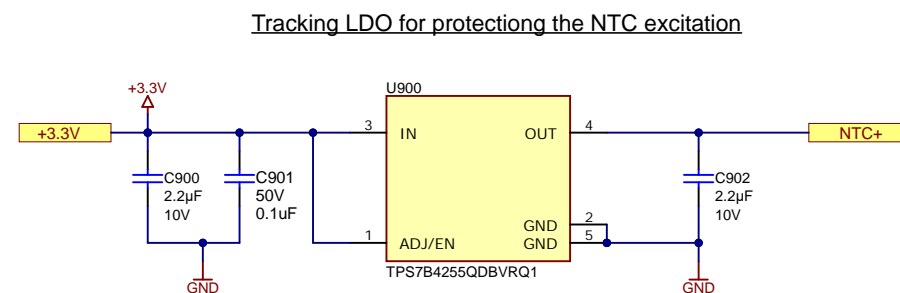





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Orderable: N/A	Designed for: Public Release	Mod. Date: 7/8/2023
TID #: N/A	Project Title: WS Inverter - Ctrl Board	
Number: N/A	Rev: RevC	Sheet Title: HV Sensing
SVN Rev: Not in version control	Assembly Variant: 001	Sheet: 8 of 13
Drawn By: Panacek	File: voltage-sensing.SchDoc	Size: B
Engineer: Panacek	Contact: http://www.ti.com/support	

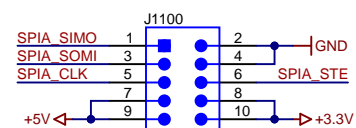
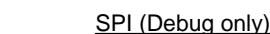




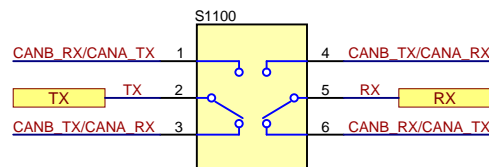
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Number: <a href="#">N/A</a>	Rev: <a href="#">RevC</a>	Sheet Title: <a href="#">Thermal Management</a>	
SVN Rev: Not in version control	Assembly Variant: <a href="#">001</a>	Sheet: <a href="#">9</a> of <a href="#">13</a>	
Drawn By: <a href="#">Panacek</a>	File: <a href="#">thermal-management.SchDoc</a>	Size: <a href="#">B</a>	
Engineer: <a href="#">Panacek</a>	Contact: <a href="#">http://www.ti.com/support</a>		



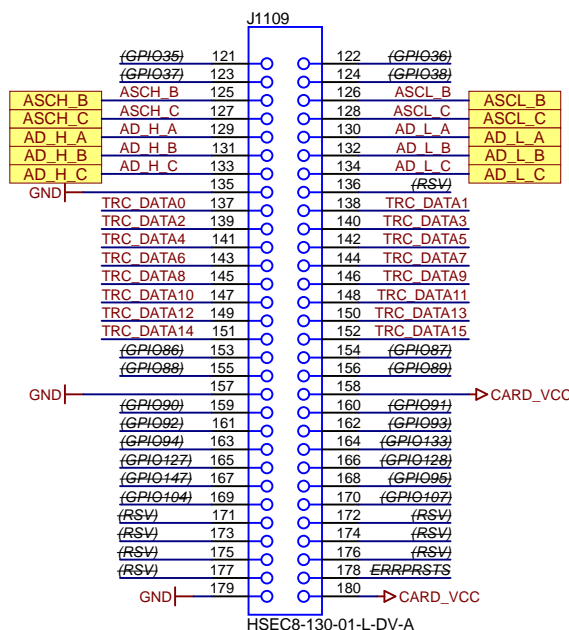


## CAN Selector



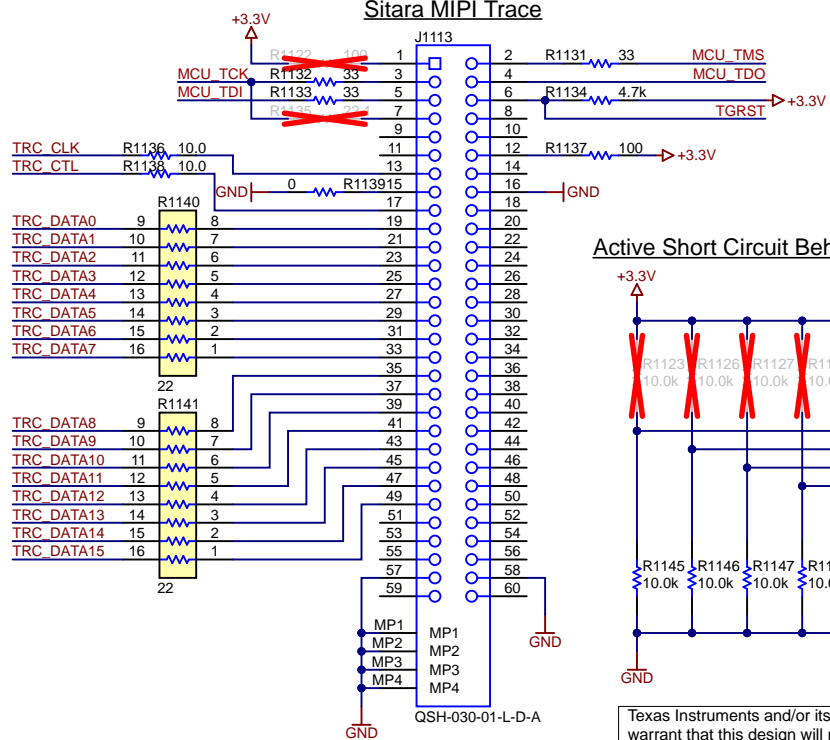
### Control Card edge connector extension

~~Strike-through text labels unused pins. This is not a net-label~~

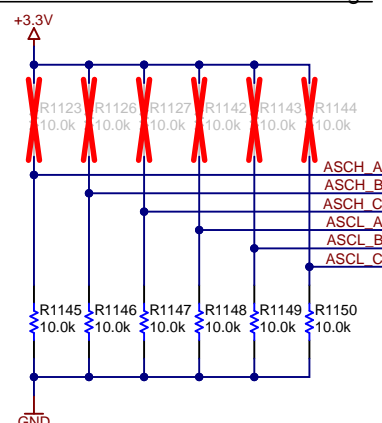


### Sitara MIPI Trace

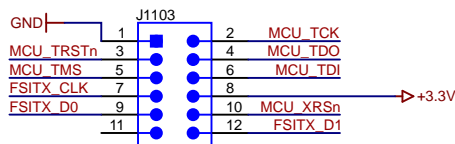
## Sitara MIPI Trace



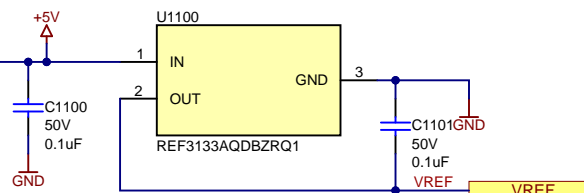
### Active Short Circuit Behavior Settings



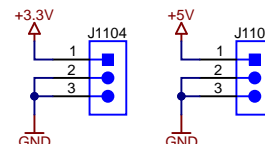
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ETAS

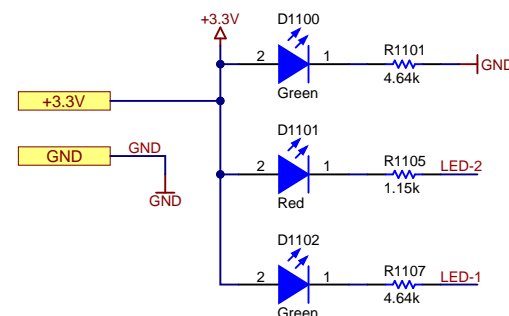
### External voltage reference



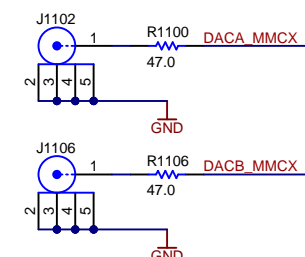
AUX power



## PWR & DEBUG LEDs



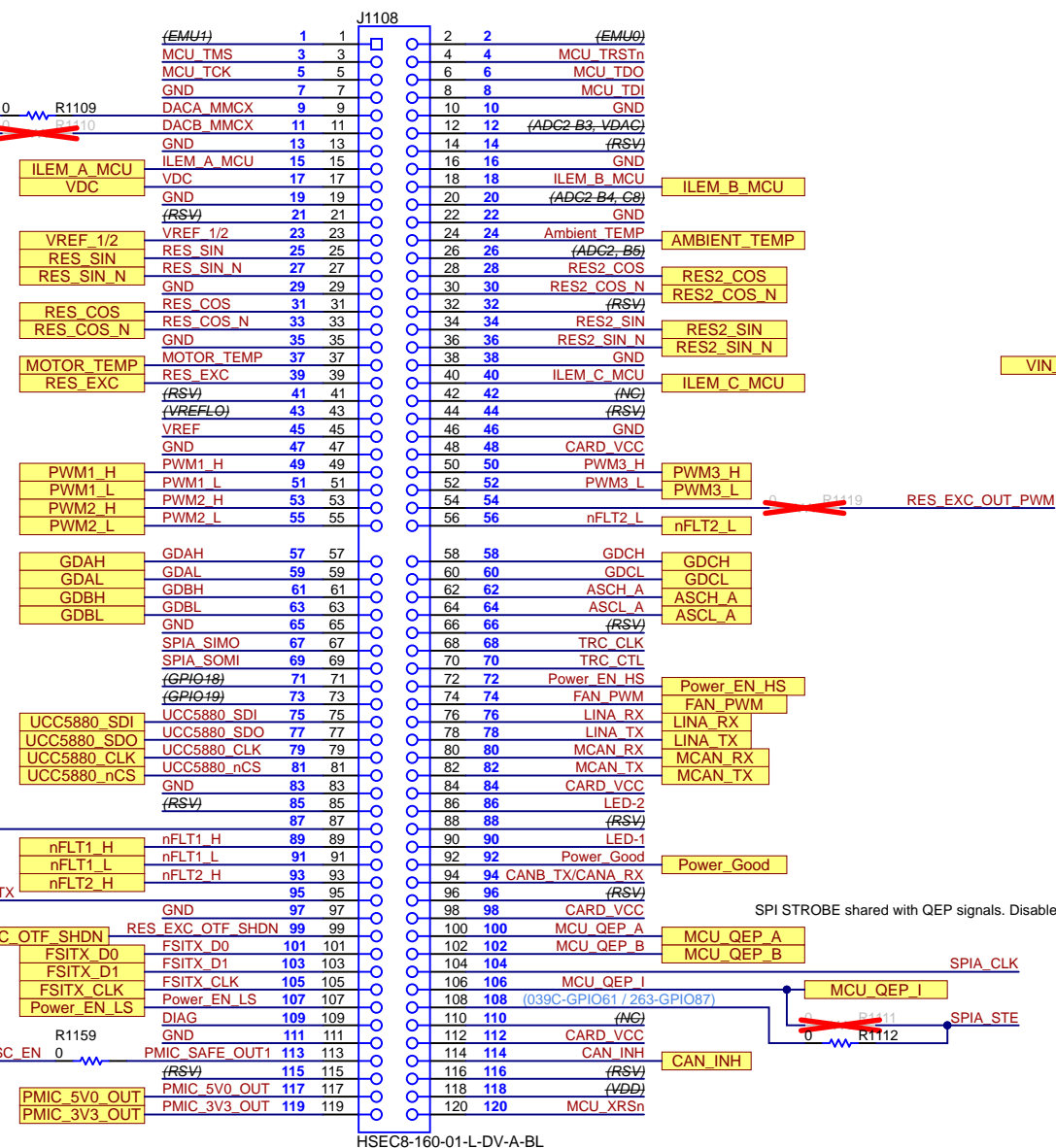
DAC (Debug only)



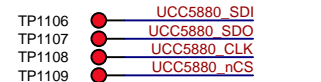
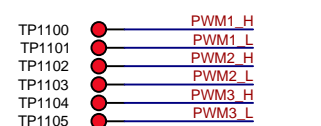
IMPORTANT NOTES:

RevC increases compatibility between Sitara AM263 and C2000 platform. Refer to the new pinout!

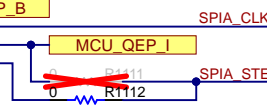
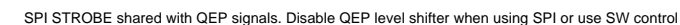
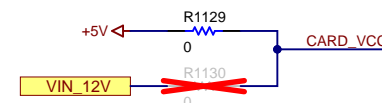
Control Card edge connector



### Debug Testpoints

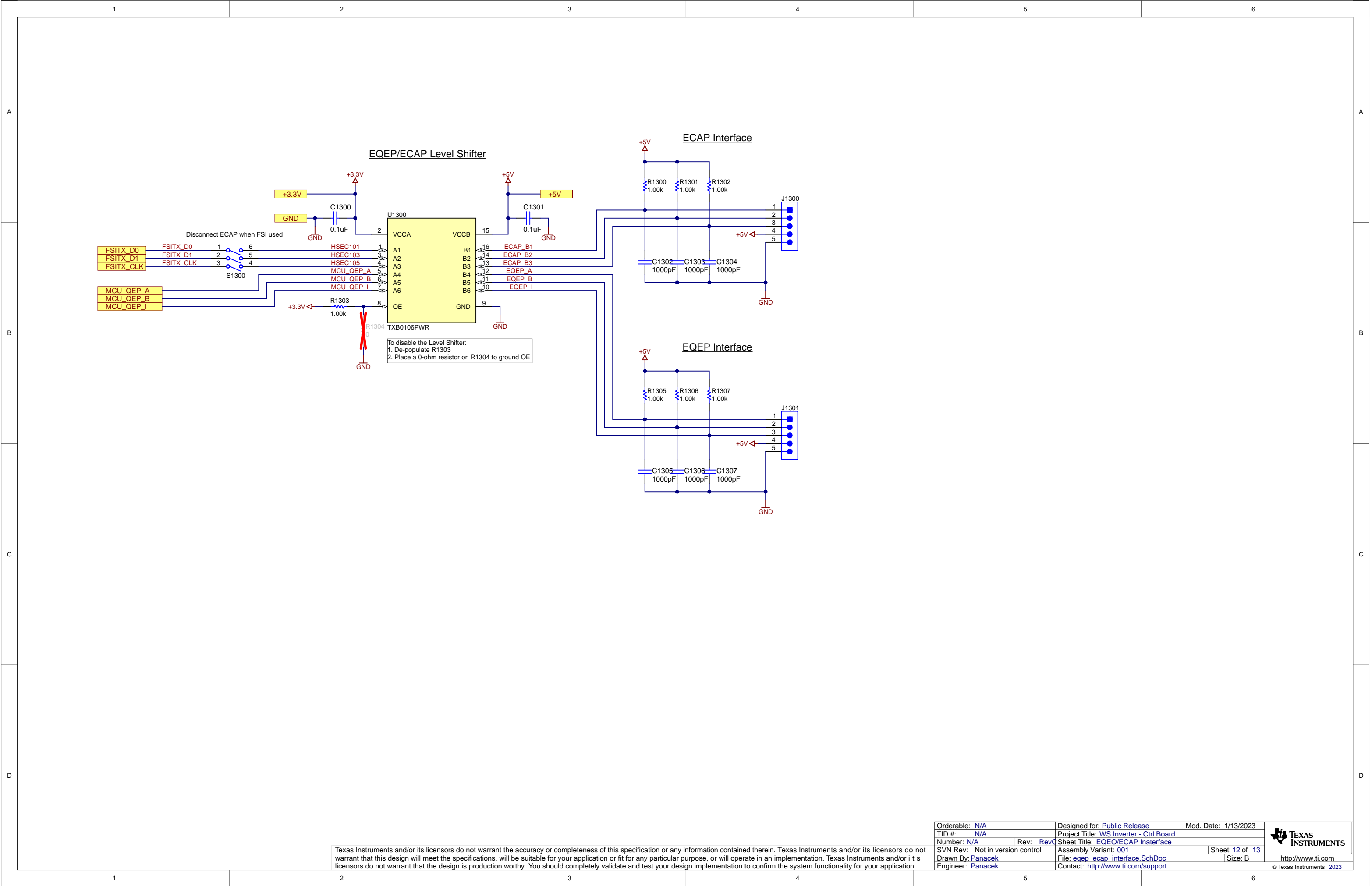


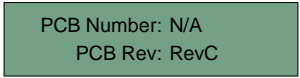
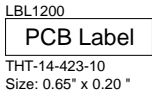
### MCU Power selection




Orderable: <a href="#">N/A</a>	Designed for: <a href="#">Public Release</a>	Mod. Date: 12/15/2023
TID #: <a href="#">N/A</a>	Project Title: <a href="#">WS Inverter - Ctrl Board</a>	
Number: <a href="#">N/A</a>	Rev: <a href="#">RevC</a>	Sheet Title: <a href="#">C2000/Sitara Interface</a>
SVN Rev: Not in version control	Assembly Variant: <a href="#">001</a>	Sheet: <a href="#">11</a> of <a href="#">13</a>
Drawn By: <a href="#">Panacek</a>	File: <a href="#">C2000_Subsystem.SchDoc</a>	Size: B
Engineer: <a href="#">Panacek</a>	Contact: <a href="#">http://www.ti.com/support</a>	

Designed for: <a href="#">Public Release</a>	Mod. Date: 12/15/2023
Project Title: <a href="#">WS Inverter - Ctrl Board</a>	
Sheet Title: <a href="#">C2000/Sitara Interface</a>	
Assembly Variant: <a href="#">001</a>	Sheet: 11 of 13
File: <a href="#">C2000_Subsystem.SchDoc</a>	Size: B
Contact: <a href="http://www.ti.com/support">http://www.ti.com/support</a>	





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TID #: N/A		Project Title: WS Inverter - Ctrl Board				
Number: N/A		Rev: RevC	Sheet Title: Hardware / Mechanical			
SVN Rev: Not in version control		Assembly Variant: 001		Sheet: 13 of 13		
Drawn By: Panacek		File: hardware.SchDoc			Size: B	
Engineer: Panacek		Contact: <a href="http://www.ti.com/support">http://www.ti.com/support</a>				