Revision History				
Rev	ECN #	Approved Date	Approved by	Notes
N/A	N/A	N/A	N/A	N/A

Designator
InputPower&Protection.SchDoc

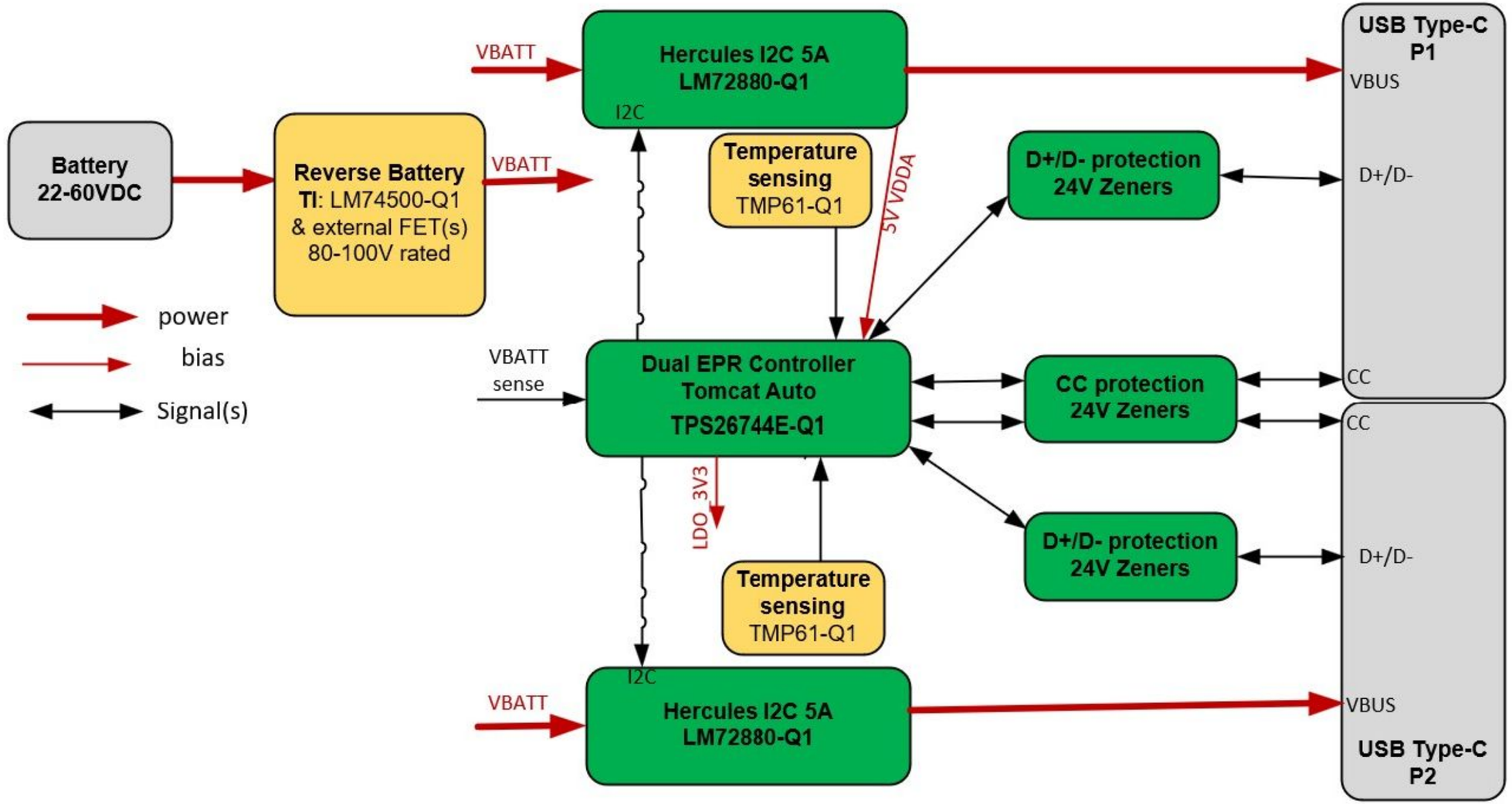
Designator
EPR_Controller_Dual.SchDoc

Designator
DCDC_A.SchDoc

Designator
USB-Cconecctors&protection.SchDoc

Designator
PMP23501_Hardware.SchDoc

Designator
DCDC_B.SchDoc



Orderable: no		Designed for:	Mod. Date: 6/13/2025
TID #: N/A		Project Title: Automotive 48Vin dual USB power	
Number: PMP23501	Rev: A	Sheet Title:	
SVN Rev: Not in version control		Assembly Variant: PMP23501_20Vout60Weach	Sheet: 1 of 7
Drawn By:		File: PMP23501.SchDoc	Size: B
Engineer: Josh Mandelcorn		Contact: http://www.ti.com/support	

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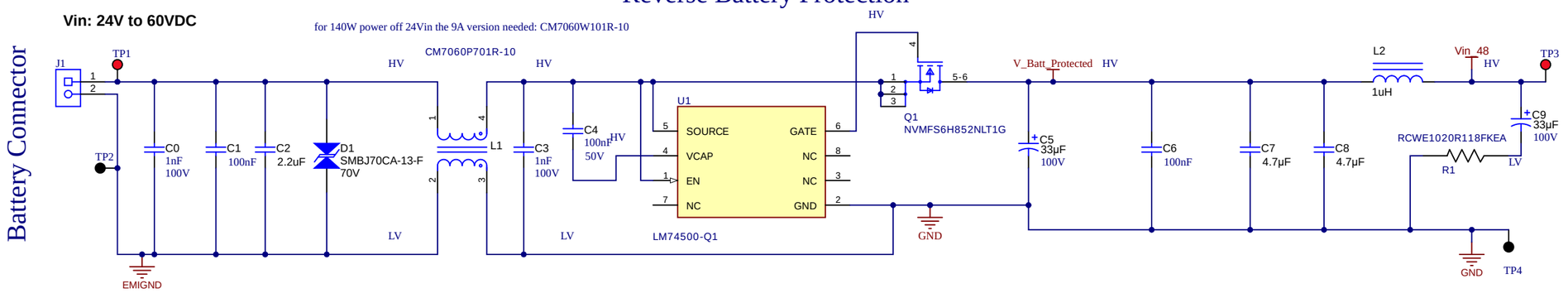
Reverse Battery Protection

Vin: 24V to 60VDC

700 ohms at 100MHz / 4A max version shown

for 140W power off 24Vin the 9A version needed: CM7060W101R-10



Orderable: no	Designed for:	Mod. Date: 6/13/2025
TID #: N/A	Project Title: Automotive 48Vin dual USB power	
Number: PMP23501 Rev: A	Sheet Title:	
SVN Rev: Not in version control	Assembly Variant: PMP23501_20Vout60Weach	Sheet: 2 of 7
Drawn By:	File: InputPower&Protection.SchDoc	Size: B
Engineer: Josh Mandelcorn	Contact: http://www.ti.com/support	

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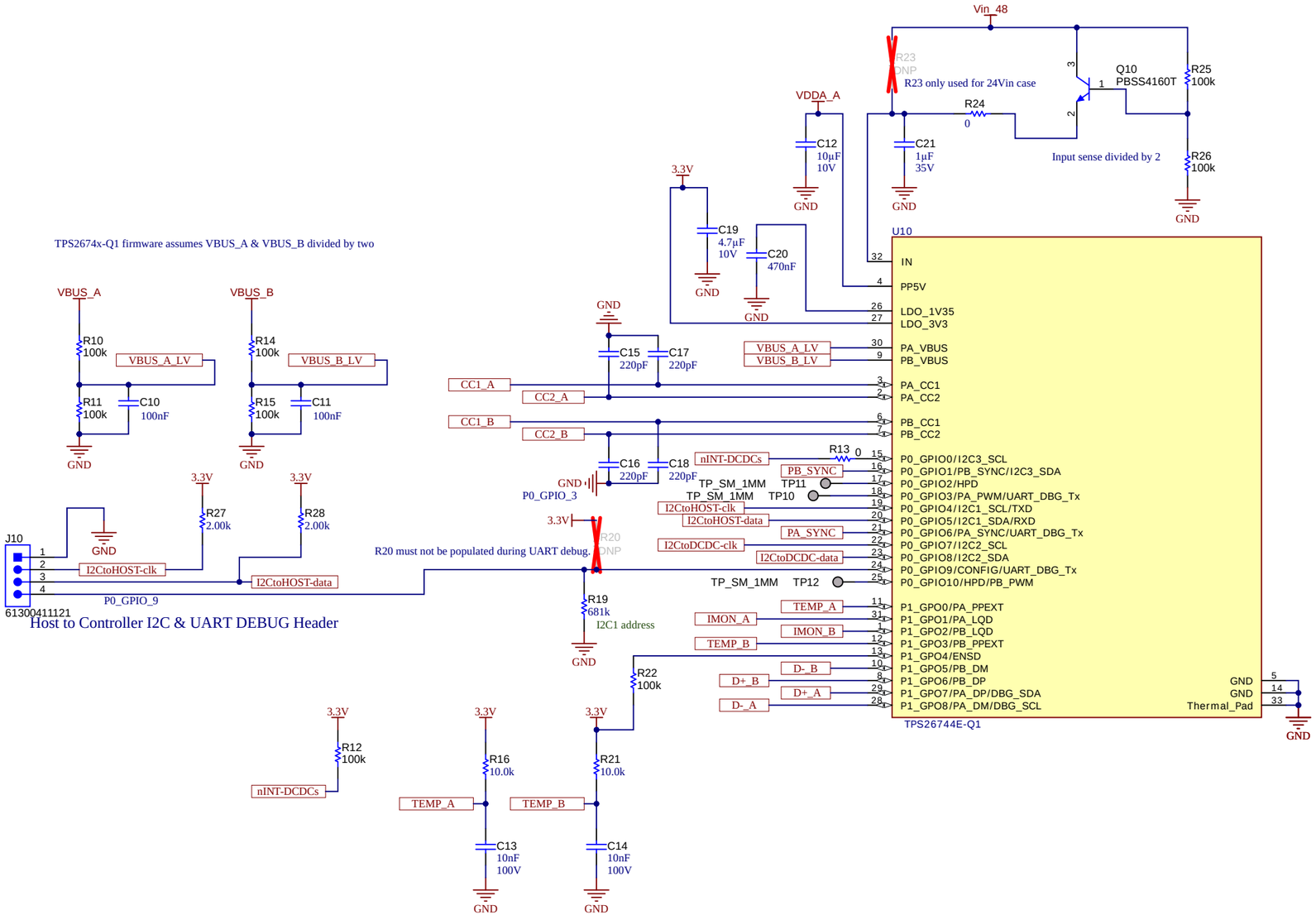

Orderable: no		Designed for:	Mod. Date: 5/29/2025
TID #: N/A		Project Title: Automotive 48Vin dual USB power	
Number: PMP23501	Rev: A	Sheet Title:	
SVN Rev: Not in version control		Assembly Variant: PMP23501_20Vout60Weach	Sheet: 3 of 7
Drawn By:		File: EPR_Controller_Dual.SchDoc	Size: B
Engineer: Josh Mandelcorn		Contact: http://www.ti.com/support	

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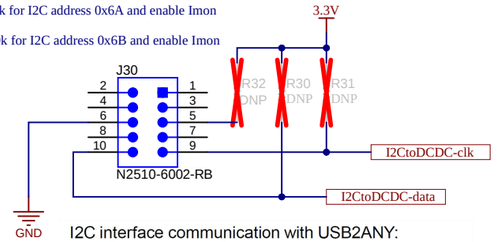
J30 only needed for external comunications with DCDC's bypassing EPR controller

Rconfig for Port A LM72650 will be 41.2k for I2C address 0x6A and enable Imon

Rconfig for Port B LM72650 will be 54.9k for I2C address 0x6B and enable Imon



I2C interface communication with USB2ANY:
VBUS is not required to be connected
USB2ANY interface has an internal 3.3V VBUS supply
Hence, R30-R31-R32 normally not populated

PCB updates for rev B to allow 5A channels without fan:

Update all 4 copper layers from 1 oz. copper to 2 oz. copper

L100/L101 footprint increased to allow 11x10mm inductors
This will allow larger inductor values to reduce ripple current / core heating.
Alternatively, larger inductor value can allow switching freqeuncy reduction and cooler DCDC converters

with current amplifier gain of 10 and 8mOhms sense: loop gain from PWM is 12.5A/V

With EN/UVLO threshold 1.00V rising and 0.9V falling

Target turn on at 20Vin and turn off at 18Vin

SW4 pin is return for Cboot internally connected to SW1-3

Bias off Vout and discharge options
Do not populate both

C117 zero at 68kHz 47uF*50mOhm

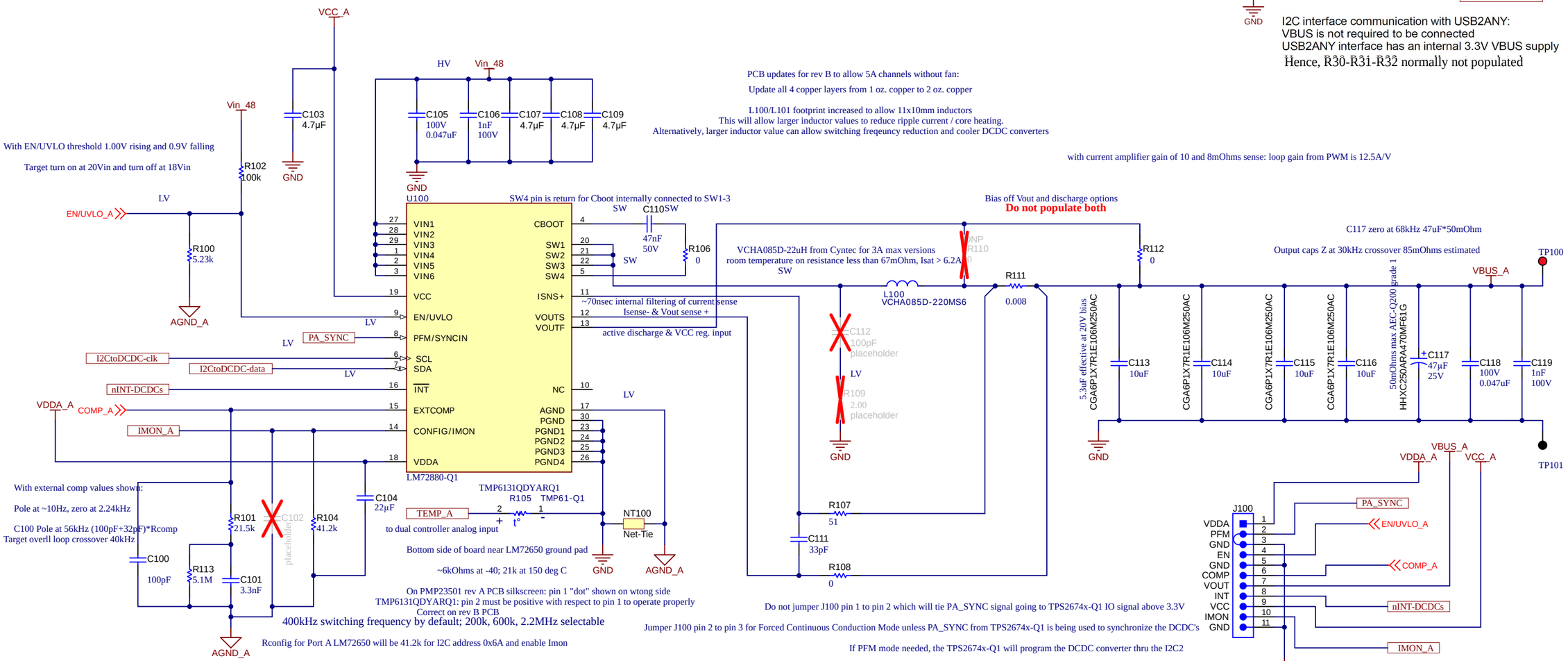
Output caps Z at 30kHz crossover 85mOhms estimated

VCHA085D-22uH from Cyntec for 3A max versions
room temperature on resistance less than 67mOhm, Isat > 6.2A

~70nsec internal filtering of current sense

Isense- & Vout sense +

active discharge & VCC reg. input



With external comp values shown:

Pole at ~10Hz, zero at 2.24kHz

C100 Pole at 56kHz (100pF+32pF)*Rcomp
Target overll loop crossover 40kHz

TMP6131QDYARQ1
R105 TMP61-Q1
TEMP_A
to dual controller analog input
NT100 Net-Tie
Bottom side of board near LM72650 ground pad
~6kOhms at -40; 21k at 150 deg C

On PMP23501 rev A PCB silkscreen: pin 1 "dot" shown on wtong side
TMP6131QDYARQ1: pin 2 must be positive with respect to pin 1 to operate properly
Correct on rev B PCB

400kHz switching frequency by default; 200k, 600k, 2.2MHz selectable

Rconfig for Port A LM72650 will be 41.2k for I2C address 0x6A and enable Imon

assumed internal voltage divider 24V to 1V or divide by 24

gm of error amplifier is 1000uS or 21.5 mid-band gain for Rcomp = 21.5k

Loop caculator of similar LM70XX0 caculator assumes 32pF parasitic cap at EXTCOMP pin

Do not jumper J100 pin 1 to pin 2 which will tie PA_SYNC signal going to TPS2674x-Q1 IO signal above 3.3V

Jumper J100 pin 2 to pin 3 for Forced Continuous Conduction Mode unless PA_SYNC from TPS2674x-Q1 is being used to synchronize the DCDC's

If PFM mode needed, the TPS2674x-Q1 will program the DCDC converter thru the I2C2

It will both set PFM pin override and then set the PFM mode

Rev B PCB will have J100 pin 1 changed to be the 3.3V or the 3.3V thru 10-100k resistor

Orderable: no		Designed for:	Mod. Date: 6/13/2025
TID #: N/A		Project Title: Automotive 48Vin dual USB power	
Number: PMP23501	Rev: A	Sheet Title: LM72880-Q1 EVM Schematic	
SVN Rev: Not in version control		Assembly Variant: PMP23501_20Vout60Weach	Sheet: 4 of 7
Drawn By: K Nielson		File: DCDC_A.SchDoc	Size: B
Engineer: Josh Mandelcorn		Contact: http://www.ti.com/support	

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PCB updates for rev B to allow 5A channels without fan:

Update all 4 copper layers from 1 oz. copper to 2 oz. copper

L200/L201 footprint increased to allow 11x10mm inductors
This will allow larger inductor values to reduce ripple current / core heating.
Alternatively, larger inductor value can allow switching freqeuncy reduction and cooler DCDC converters

With EN/UVLO threshold 1.00V rising and 0.9V falling

Target turn on at 20Vin and turn off at 18Vin

SW4 pin is return for Cboot internally connected to SW1-3

VCHA085D-22uH from Cyntec for 3A max versions
room temperature on resistance less than 67mOhm, Isat > 6.2A

L/R ~50nsec for 8mOhms

Bias off Vout and discharge options
Do not populate both

HHXC500ARA220MF61G for EPR applications

~70nsec internal filtering of current sense
Isense- & Vout sense +

active discharge & VCC reg. input

LM72880-Q1

TMP6131QDYARQ1
TMP61-Q1 R205 LV

to dual controller analog input

Bottom side of board neat LM72650 ground pad

~6kOhms at -40; 21k at 150 deg C

TMP6131QDYARQ1: pin 2 must be positive with respect to pin 1 to operate properly
On PMP23501 rev A PCB silkscreen: pin 1 "dot" shown on wtong side
Correct on rev B PCB

Rconfig for Port B LM72650 will be 54.9k for I2C address 0x6B and enable Imon

Do not jumper J200 pin 1 to pin 2 which will tie PB_SYNC signal going to TPS2674x-Q1 IO signal above 3.3V

Jumper J200 pin 2 to pin 3 for Forced Continuous Conduction Mode unless PB_SYNC from TPS2674x-Q1 is being used to synchronize the DCDC's

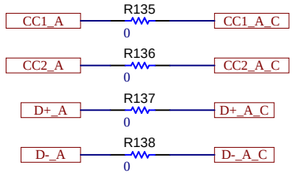
If PFM mode needed, the TPS2674x-Q1 will program the DCDC converter thru the I2C2

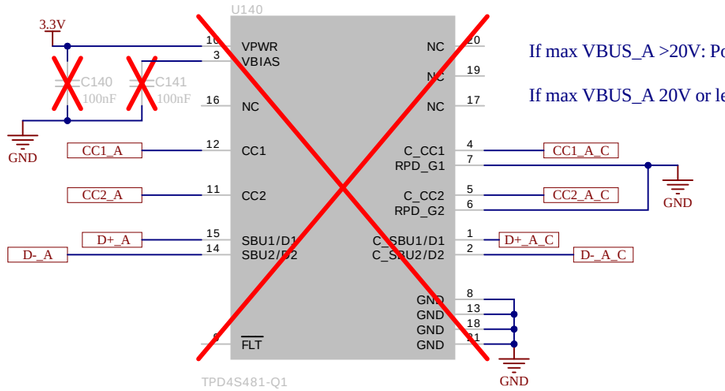
It will both set PFM pin override and then set the PFM mode

Rev B PCB will have J200 pin 1 changed to be the 3.3V or 3.3V thru 10-100k resistor

Orderable: no		Designed for:	Mod. Date: 6/13/2025
TID #: N/A		Project Title: Automotive 48Vin dual USB power	
Number: PMP23501	Rev: A	Sheet Title: LM72880-Q1 EVM Schematic	
SVN Rev: Not in version control		Assembly Variant: PMP23501_20Vout60Weach	Sheet: 5 of 7
Drawn By: K Nielson		File: DCDC_B.SchDoc	Size: B
Engineer: Josh Mandelcorn		Contact: http://www.ti.com/support	

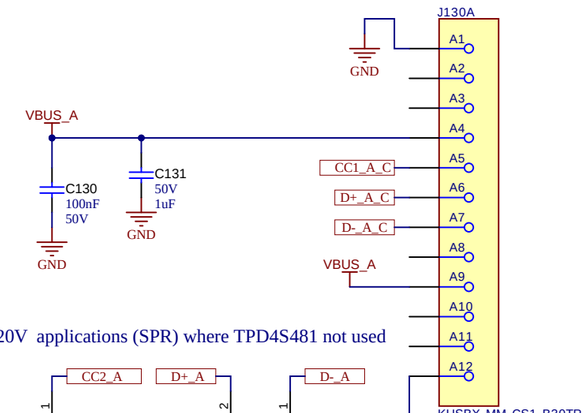
5V to 20V standard option 5A Max Current
to 28V or 48V for extended power options



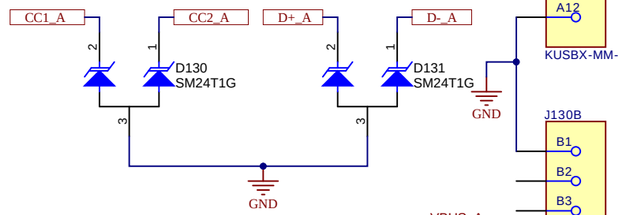


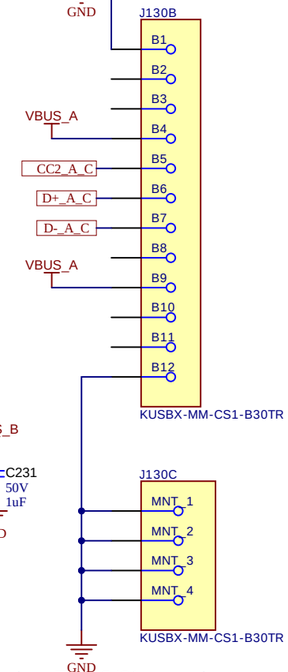
If max VBUS_A >20V: Populate U140, C140-1; omit R135-6-7-8, D130, D131

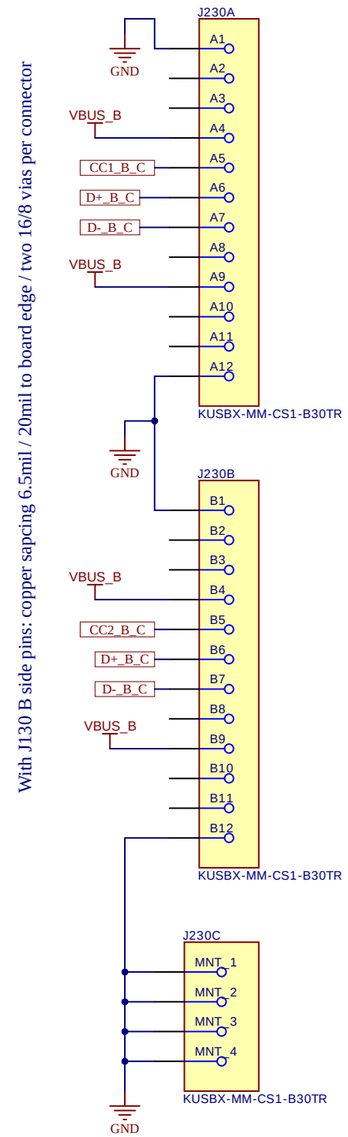
If max VBUS_A 20V or less: omit U140, C140-1. Populate R135-6-7-8, D130, D131



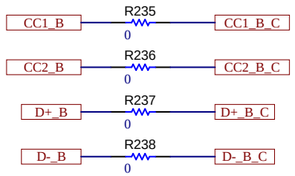
For Vout max 20V applications (SPR) where TPD4S481 not used





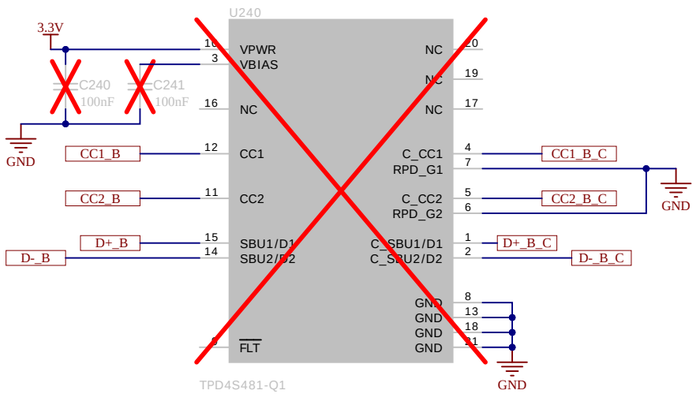


With J130 B side pins: copper sapcing 6.5mil / 20mil to board edge / two 16/8 vias per connector

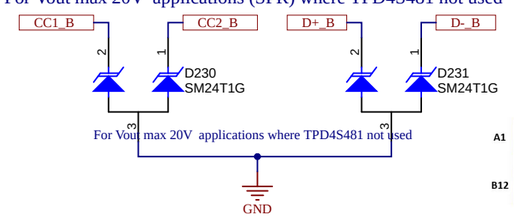


If max VBUS_B >20V: Populate U240, C240-1; omit R235-6-7-8, D230, D231

If max VBUS_B 20V or less: omit U240, C240-1. Populate R235-6-7-8, D230, D231



For Vout max 20V applications (SPR) where TPD4S481 not used



As this board is for power only and not for high speed data

All TXxx, RXxx and SBUx signal will not be used or connected

Orderable: no		Designed for:	Mod. Date: 5/29/2025
TID #: N/A		Project Title: Automotive 48Vin dual USB power	
Number: PMP23501	Rev: A	Sheet Title:	
SVN Rev: Not in version control		Assembly Variant: PMP23501_20Vout60Weach	Sheet: 6 of 7
Drawn By:		File: USB-Cconecctors&protection.SchDoc	Size: B
Engineer: Josh Mandelcorn		Contact: http://www.ti.com/support	

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H2 1 NY PMS 440 0025 PH

H4 1 NY PMS 440 0025 PH

H6 1 NY PMS 440 0025 PH

H8 1 NY PMS 440 0025 PH

H1 1902C

H3 1902C

H5 1902C

H7 1902C


CAUTION HOT SURFACE


CAUTION HOT SURFACE

FID1 FID2 FID3

PCB Number: PMP23501
PCB Rev: A

PCB LOGO
Texas Instruments


CE Mark

PCB LOGO
FCC disclaimer

PCB LOGO
WEEE logo

LBL1
PCB Label
THT-14-423-10
Size: 0.65" x 0.20 "

ZZ1
Label Assembly Note
This Assembly Note is for PCB labels only

Variant/Label Table	
Variant	Label Text
001	ChangeMe!
002	ChangeMe!

ZZ2
Assembly Note
These assemblies are ESD sensitive, ESD precautions shall be observed.

ZZ3
Assembly Note
These assemblies must be clean and free from flux and all contaminants. Use of no clean flux is not acceptable.

ZZ4
Assembly Note
These assemblies must comply with workmanship standards IPC-A-610 Class 2, unless otherwise specified.

Orderable: no		Designed for:	Mod. Date: 1/23/2025
TID #: N/A		Project Title: Automotive 48Vin dual USB power	
Number: PMP23501	Rev: A	Sheet Title:	
SVN Rev: Not in version control		Assembly Variant: PMP23501_20Vout60Weach	Sheet: 7 of 7
Drawn By:		File: PMP23501_Hardware.SchDoc	Size: B
Engineer: Josh Mandelcorn		Contact: http://www.ti.com/support	

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