



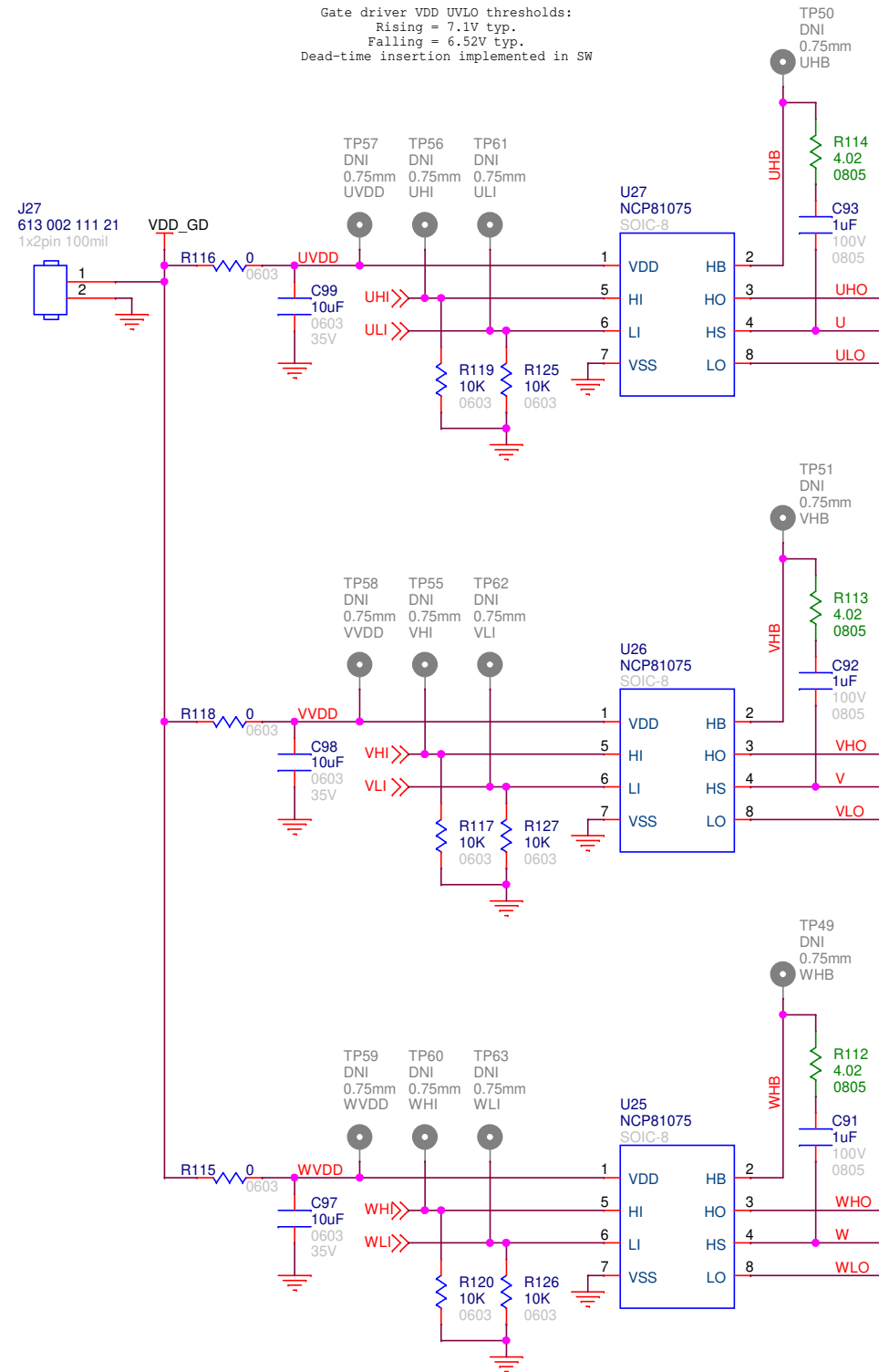
3-Phase BLDC Motor Driver MDK Power Board

Variant	OPN
12-16V	STR-10-16V-BLDC-MDK-GEVB
16-30V	STR-16-30V-BLDC-MDK-GEVB
30-60V	STR-30-60V-BLDC-MDK-GEVB
60-100V	STR-60-100V-BLDC-MDK-GEVB

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Title 3-Phase BLDC Motor Driver MDK Power Board	Orderable Part Number See Table	
Variant Name VIN 16V to 30V Xilinx UCB	Document Number ONSEC-20-023	Rev REV1
Date: Wednesday, September 15, 2021	Sheet	1 of 6

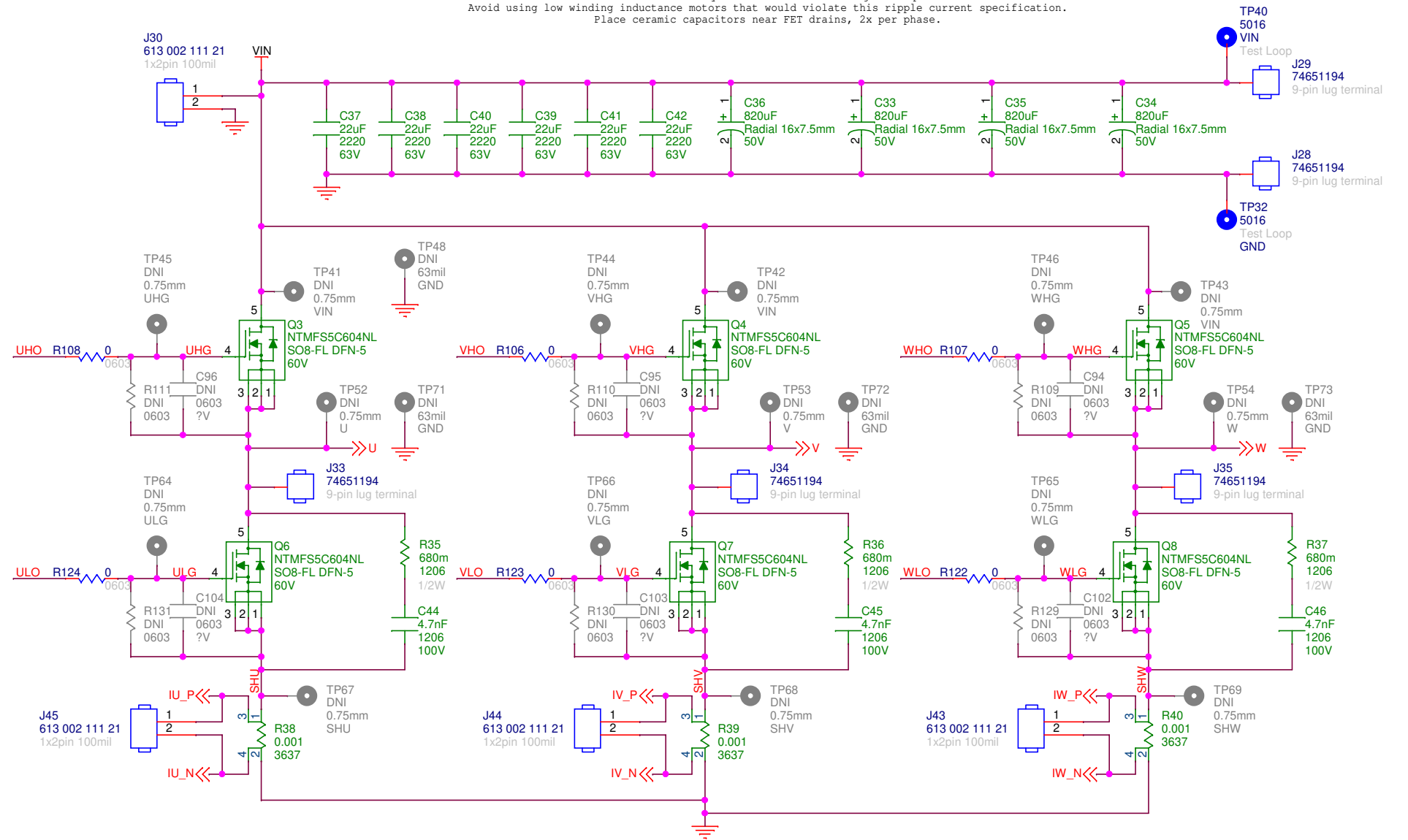
MOSFET Inverter and Gate Drivers

3x Half H-Bridge Gate Drivers



Inverter Power Stage

Max 3A RMS ripple current per input bulk capacitor.
 RMS current over this limit may cause excessive heating and capacitor failure.
 Avoid using low winding inductance motors that would violate this ripple current specification.
 Place ceramic capacitors near FET drains, 2x per phase.



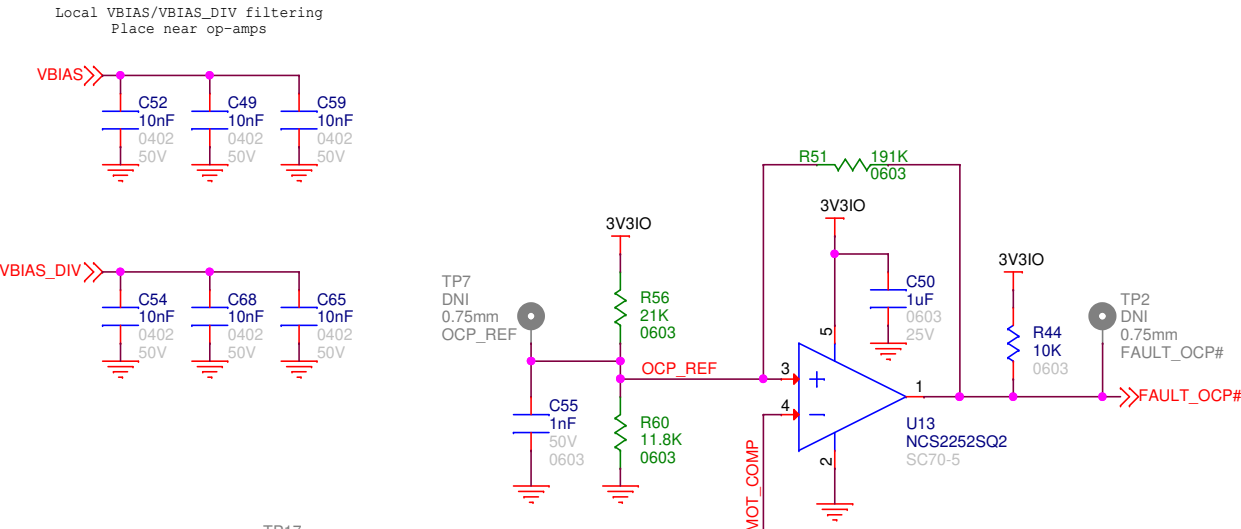
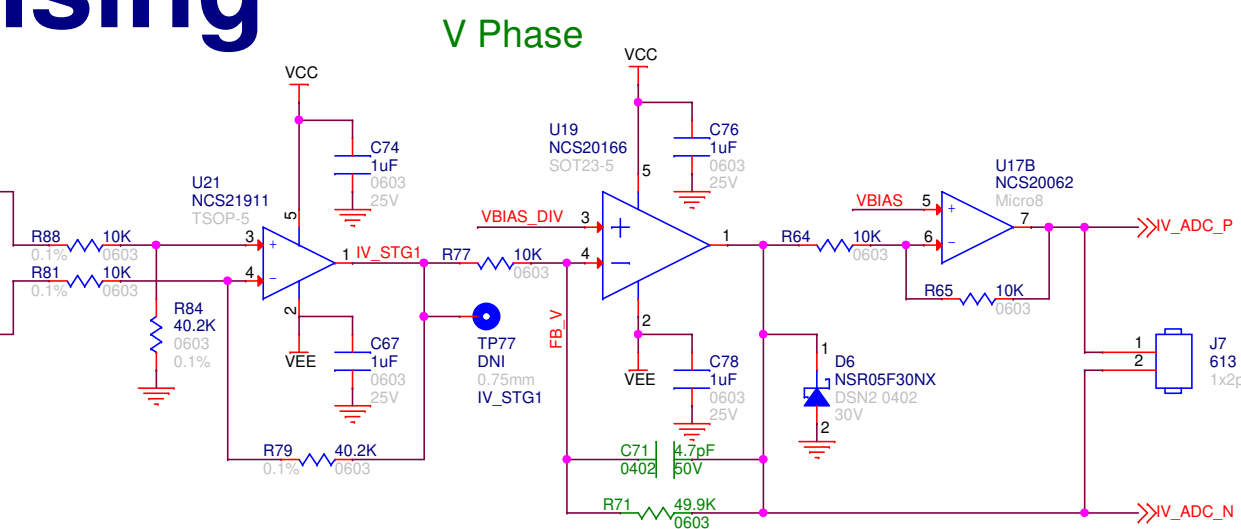
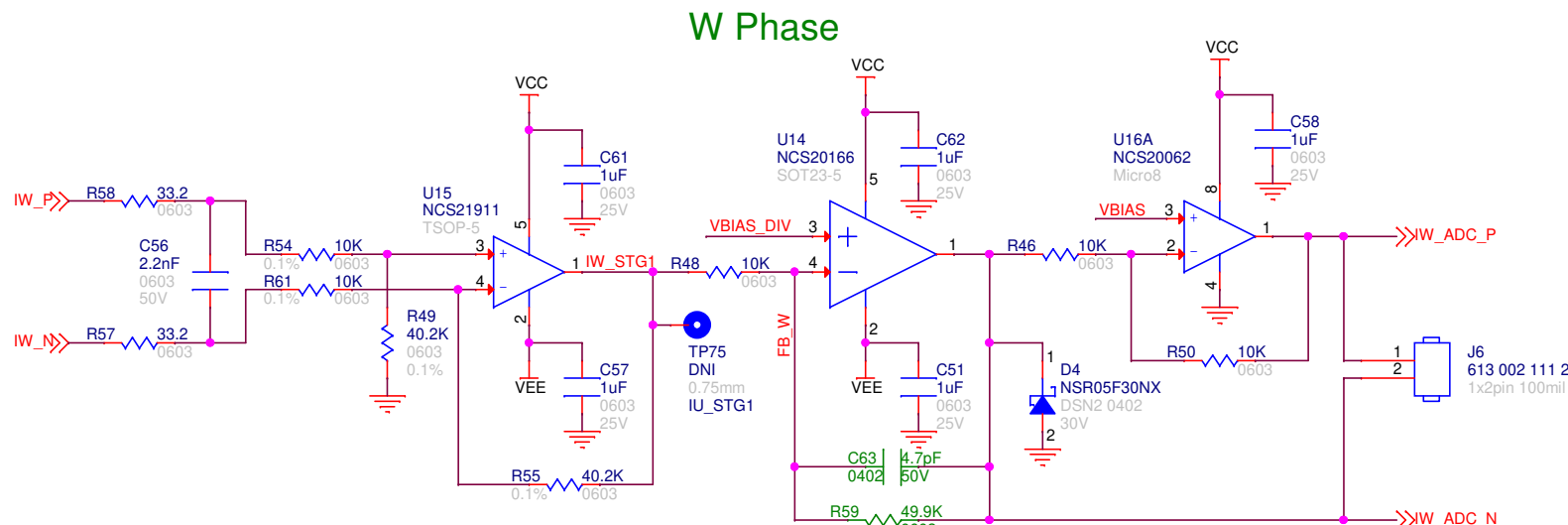
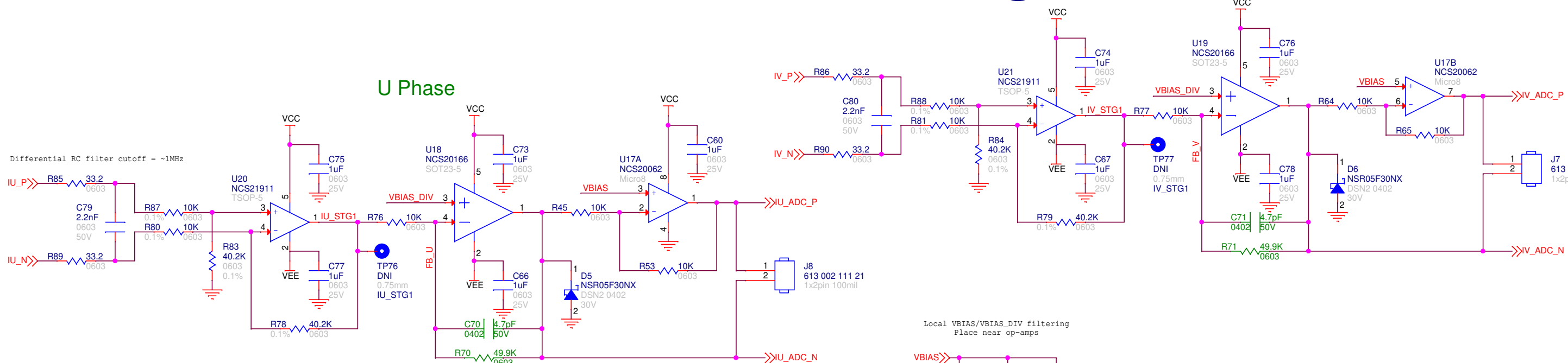
Input/Output Parameters

VARIANT	MAX ELECTRICAL OUTPUT POWER [W]	VIN RANGE [V]	MAX AVG IOUT @ MIN VIN/MAX VIN [A]
10-16V	600	10-16	60/37.5
16-30V	960	16-30	60/37.5
30-60V	1200	30-60	40/20
60-100V	1200	60-100	20/12

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Title 3-Phase BLDC Motor Driver MDK Power Board		Orderable Part Number See Table	
Variant Name VIN 16V to 30V Xilinx UCB		Document Number ONSEC-20-023	Rev REV1
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Current Sensing



Current sensing is bi-directional
 Total bandwidth = ~500kHz
 First stage gain fixed at ~4V/V
 Approximate FS phase current sense voltage range (Ix_ADC_P-Ix_ADC_N):
 -3.2V -> 3.2V (Xilinx UCB)
 -1.7V -> 1.7V (MOAB UCB)

Current Sense Parameters

	CURRENT SENSE VOLTAGE GAIN [V/V]				APPROX. FULL-SCALE (+/-) PHASE CURRENT [A]				APPROXIMATE CURRENT RESOLUTION [mA]			
	VARIANT				VARIANT				VARIANT			
UCB	10-16V	16-30V	30-60V	60-100V	10-16V	16-30V	30-60V	60-100V	10-16V	16-30V	30-60V	60-100V
Xilinx	19.993	19.993	13.302	9.977	80	80	60	40	40	40	20	20
MOAB	10.697	10.697	7.132	5.329								

Overcurrent Protection

Peak motor current OCP
 Trip thresholds per variant:
 Board A/B = 120A
 Board C = 80A
 Board D = 40A

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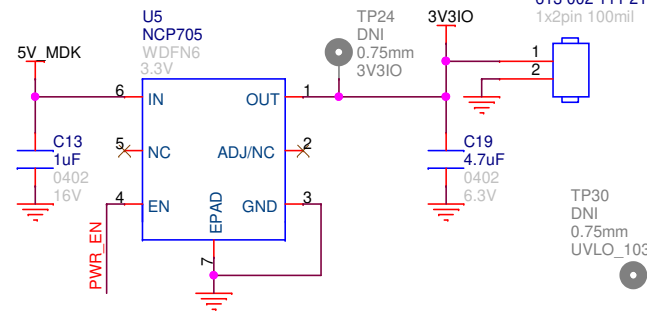
Title: 3-Phase BLDC Motor Driver MDK Power Board
 Orderable Part Number: See Table

Variant Name: VIN 16V to 30V Xilinx UCB
 Document Number: ONSEC-20-023
 Rev: REV1

Date: Wednesday, September 15, 2021
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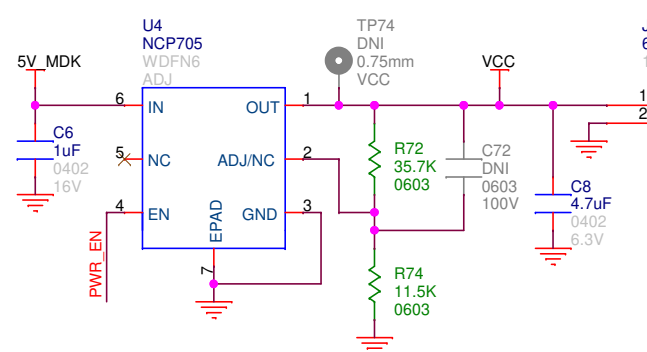
Power

3.3V Digital Supply



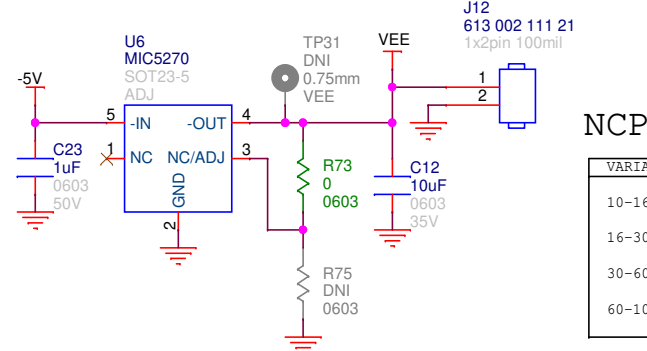
Positive Analog Supply

VCC = 3.3V (Xilinx UCB), 1.8V (MOAB UCB)



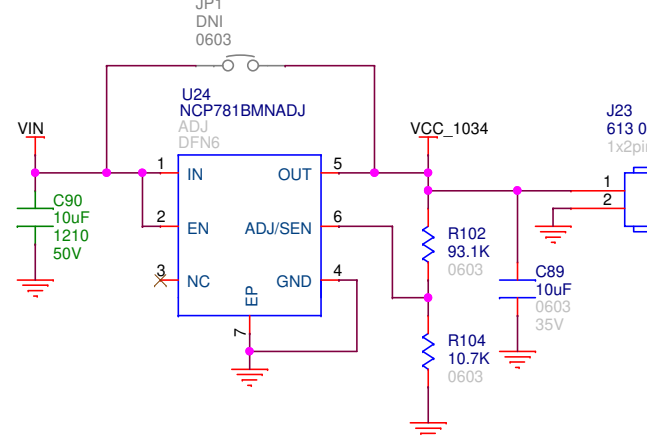
Negative Analog Supply

VEE = -1.2V (Xilinx UCB), -2.4V (MOAB UCB)



NCP1034 VCC Supply

10-16VIN: VIN shorted to VCC
Other variants: VCC = 12V

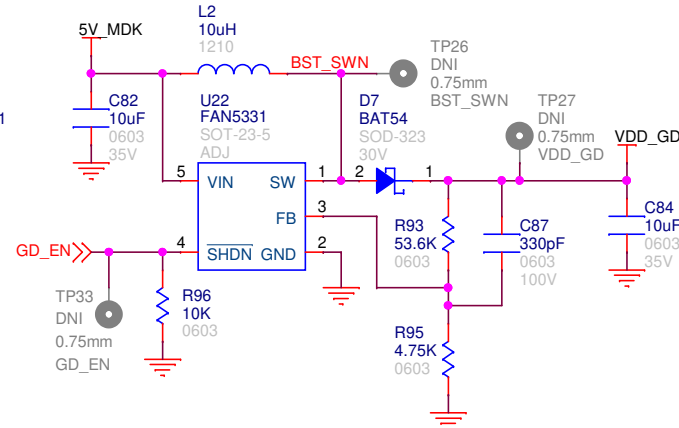


NCP1034 Parameters

VARIANT	FSW	UVLO RISE	UVLO FALL
10-16V	440kHz	9.8V	9.0V
16-30V	440kHz	15.4V	14.1V
30-60V	200kHz	26.9V	24.7V
60-100V	100kHz	54V	49.7V

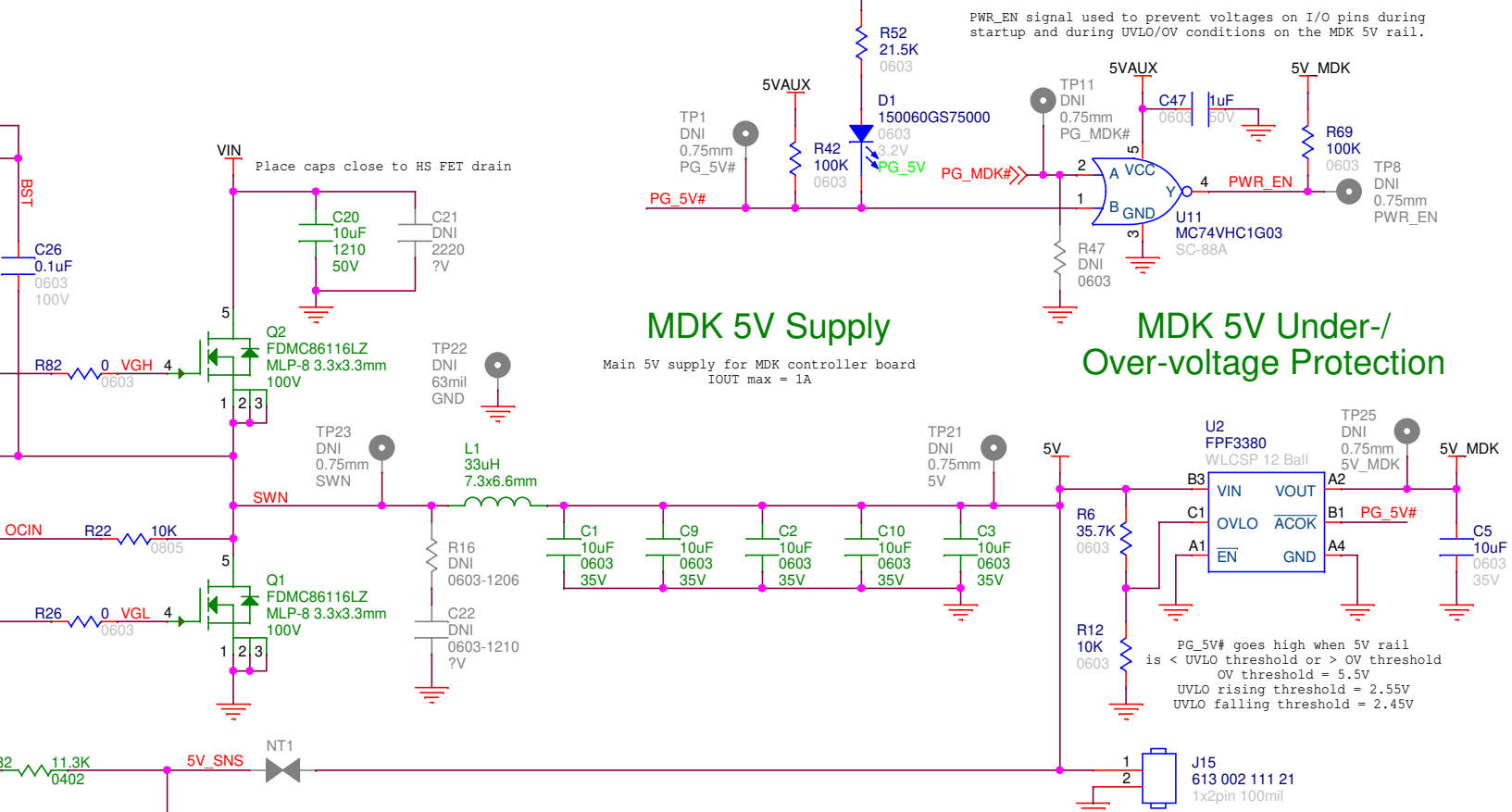
15V Gate Driver Supply

VDD_GD = 15.1V
Max output current = 150mA

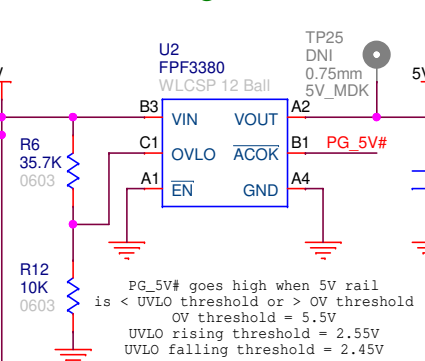


MDK 5V Supply

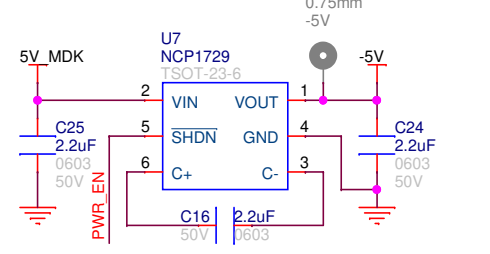
Main 5V supply for MDK controller board
IOUT max = 1A



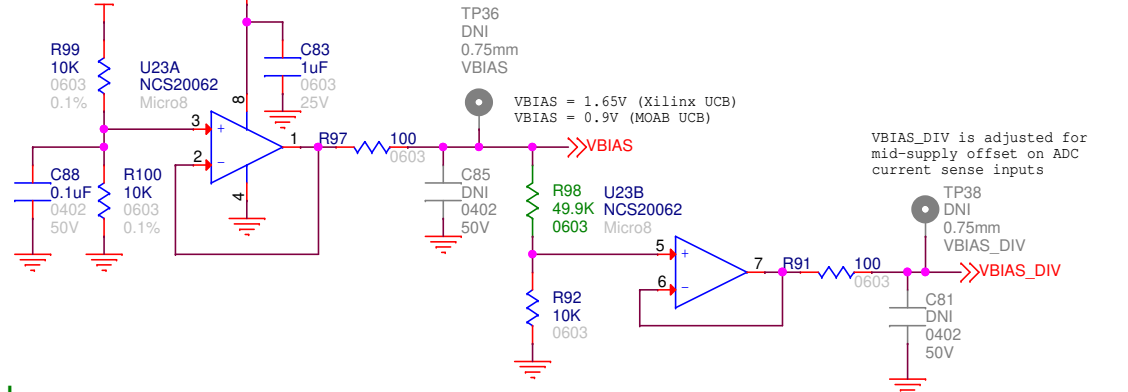
MDK 5V Under-/Over-voltage Protection



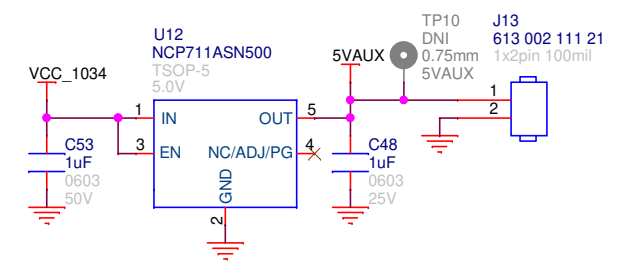
-5V Supply



ADC Offset Voltage



5V Auxiliary Supply

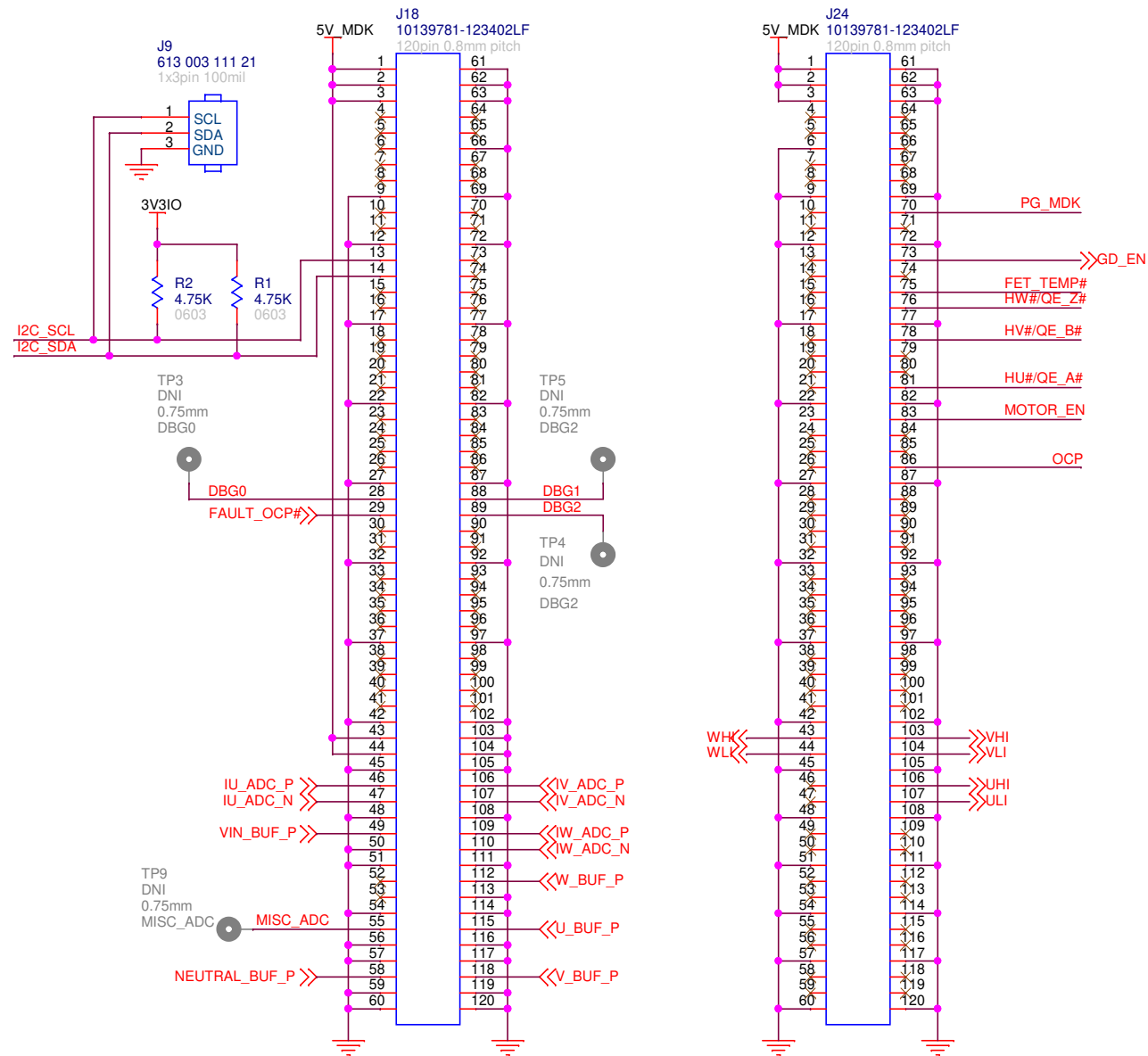


Title 3-Phase BLDC Motor Driver MDK Power Board		Orderable Part Number See Table	
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Connectors/Mechanical/Misc. I/O

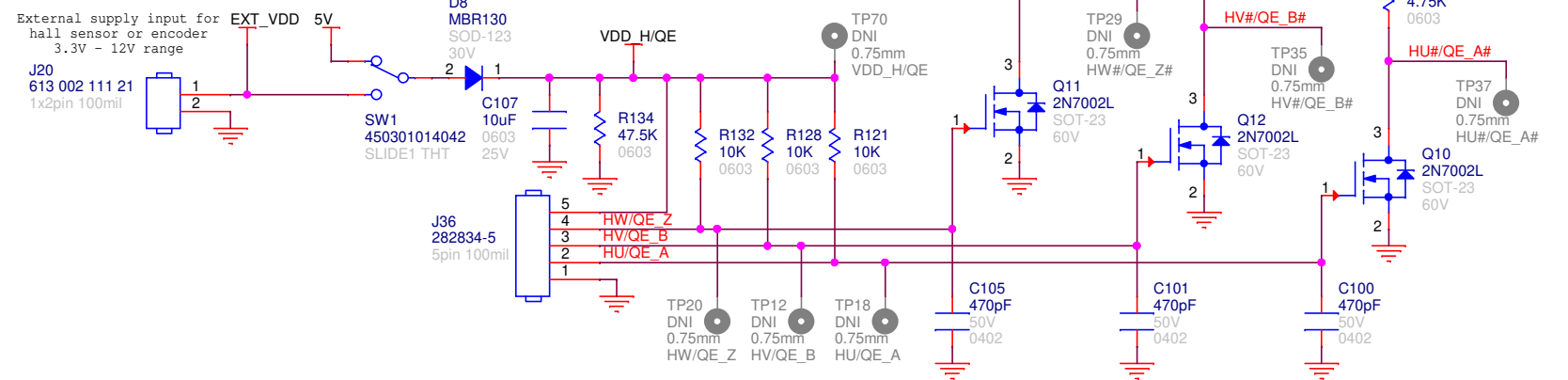
MDK Controller Board Connectors

Connector pinouts compatible with both the Xilinx UCB and MOAB UCB
 J17 mates with JP1 on controller board
 J23 mates with JP2 on controller board

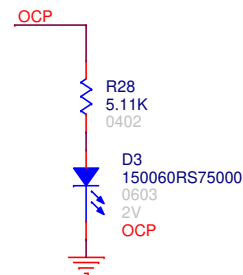


Hall Sensor/Quadrature Encoder Connections

Default supply voltage = 5V
 Can change to external supply with SW
 Current limit for 5V = 100mA recommended
 Current limit for external supply = 500mA absolute max
 Pullup resistors on inputs can be removed for push/pull sensor outputs

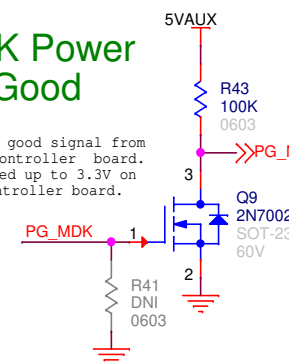


OCP Fault Indicator

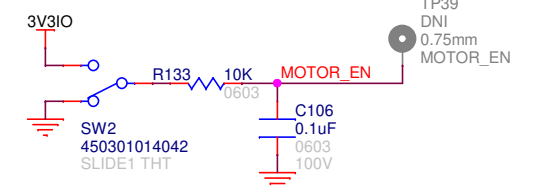


MDK Power Good

Power good signal from MDK controller board. Pulled up to 3.3V on controller board.

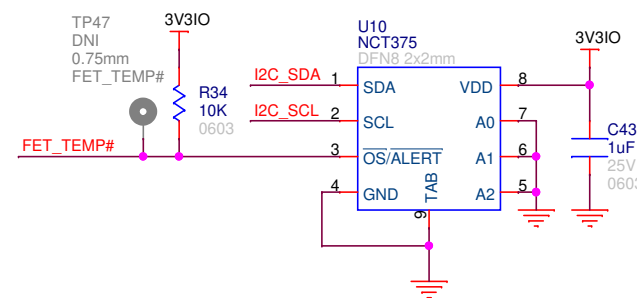


Manual Motor Enable

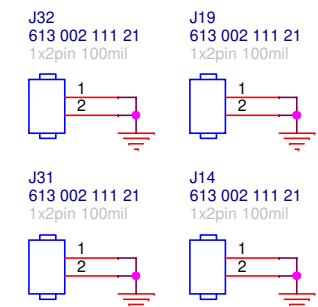


H-Bridge Temperature Monitor

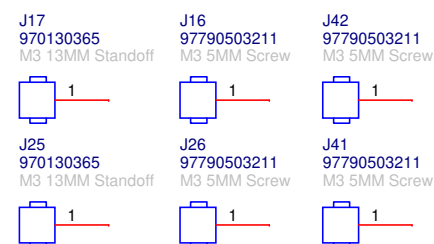
Monitors inverter H-bridge FET temperature
 I2C slave address = 0x48



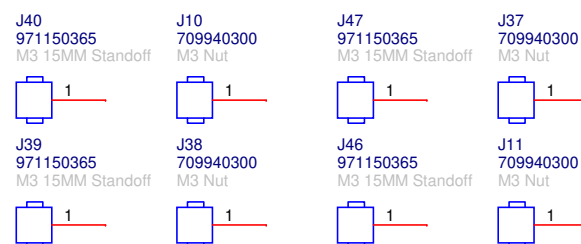
GND Headers



MDK Mounting Standoffs/Screws



Board Standoffs/Nuts



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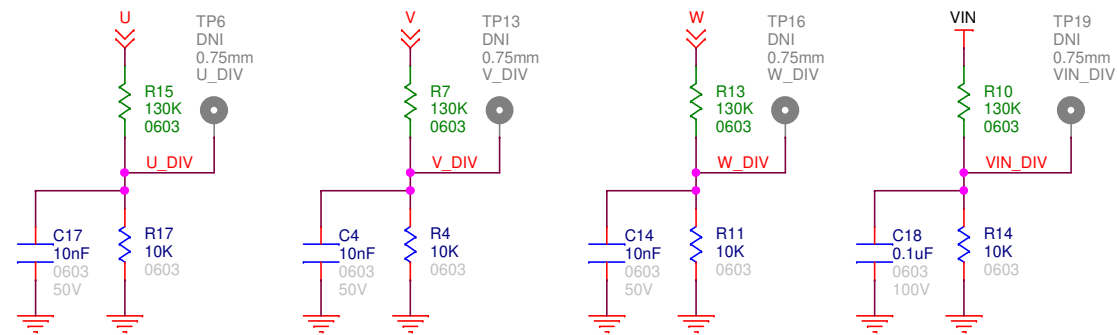
Title 3-Phase BLDC Motor Driver MDK Power Board		Orderable Part Number See Table
Variant Name VIN 16V to 30V Xilinx UCB	Document Number ONSEC-20-023	Rev REV1
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Voltage Sensing

Virtual Motor Neutral Recreation for Zero-Crossing Detection

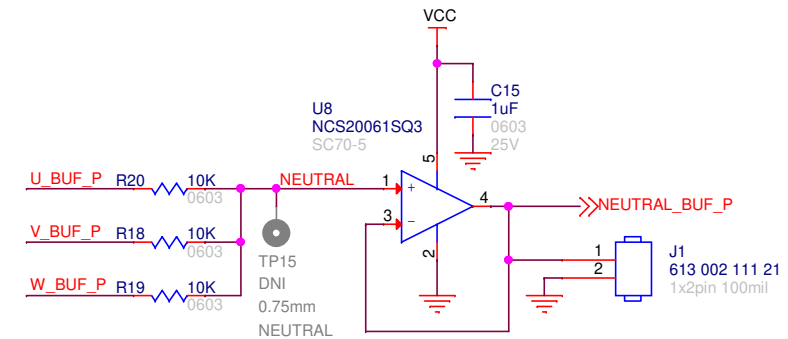
Phase/Bus Voltage ADC Dividers

All voltage dividers scaled to produce 3.2V (Xilinx UCB) or 1.7V (MOAB UCB) at 150% of max DC bus voltage

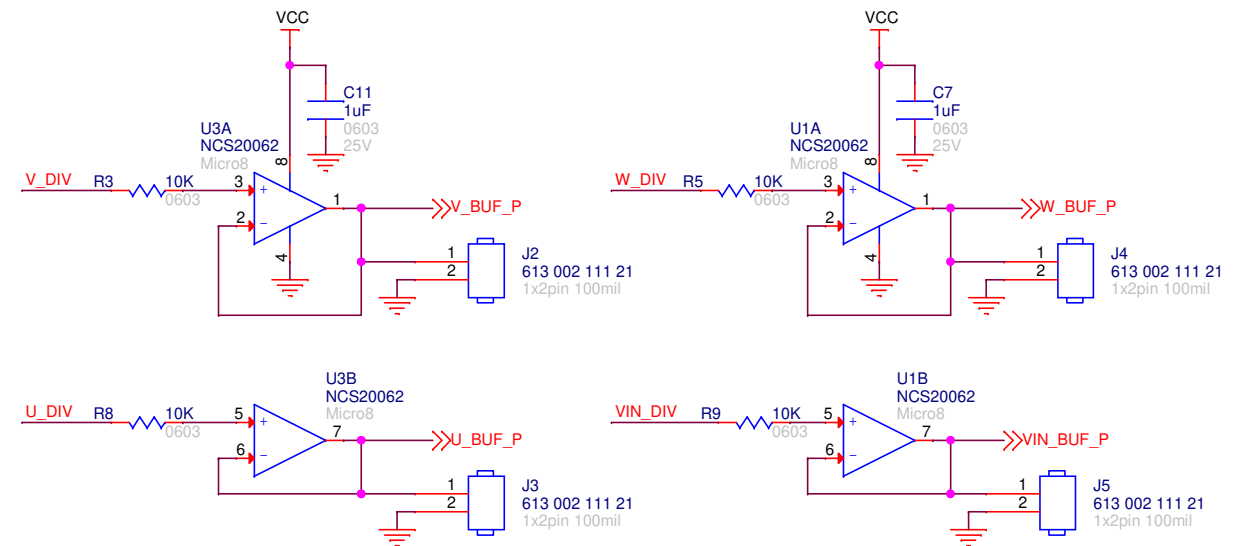


Divider parameters

VARIANT	DIVIDER SCALING FACTOR		FILTER CUTOFF FREQUENCY [Hz]	
	Xilinx UCB	MOAB UCB	Xilinx UCB	MOAB UCB
10-16V	0.1335	0.0714	1836	1713
16-30V	0.0714	0.0377	1713	1653
30-60V	0.0352	0.0188	1649	1621
60-100V	0.0211	0.0111	1625	1609



ADC Divider Buffers



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Title 3-Phase BLDC Motor Driver MDK Power Board		Orderable Part Number See Table
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