Quick Start

The main header on the right-hand side of the board is to provide power and inputs from the microcontroller board. There is also a current sensing output. J1-J3 disable the gate drivers; they are enabled by default and can be disabled by shorting the header pins.

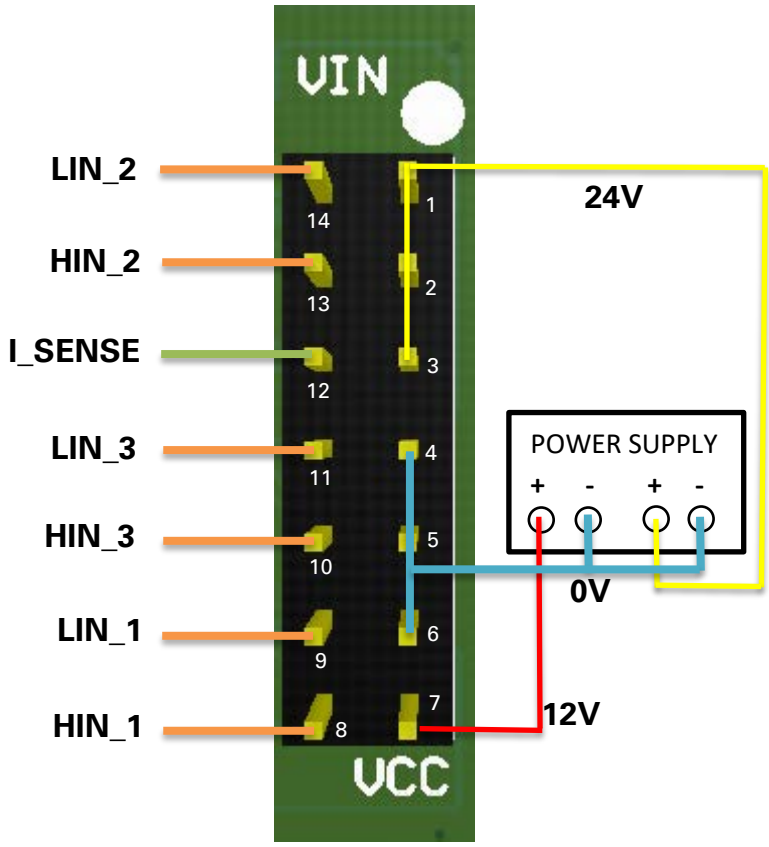


Figure 1: DDB094R2 Connector Pinout

Pin	Description
1-3	Bridge Voltage Input VIN Max 24V
4-6	Ground 0V
7	Gate driver supply Voltage VCC, Max 14V
8	High-side Phase 1 input (SW1)
9	Low-side Phase 1 input (SW2)
10	High-side Phase 3 input (SW5)
11	Low-side Phase 3 input (SW6)
12	Current sense output
13	High-side Phase 2 input (SW3)
14	Low-side Phase 2 input (SW4)

Table 1: Pin Legend

Connect the three motor phases to the output connections on the PCB – ensure to correctly connect the motor phases according to the micro inputs (and directly connect the motor Hall sensors back to the micro).

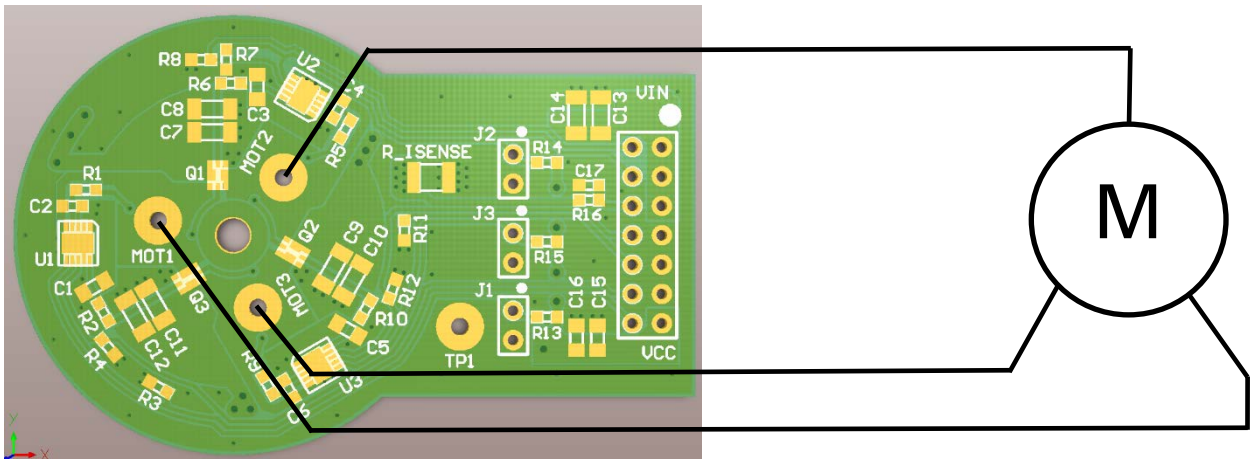


Figure 2: Motor Output Connections

Description

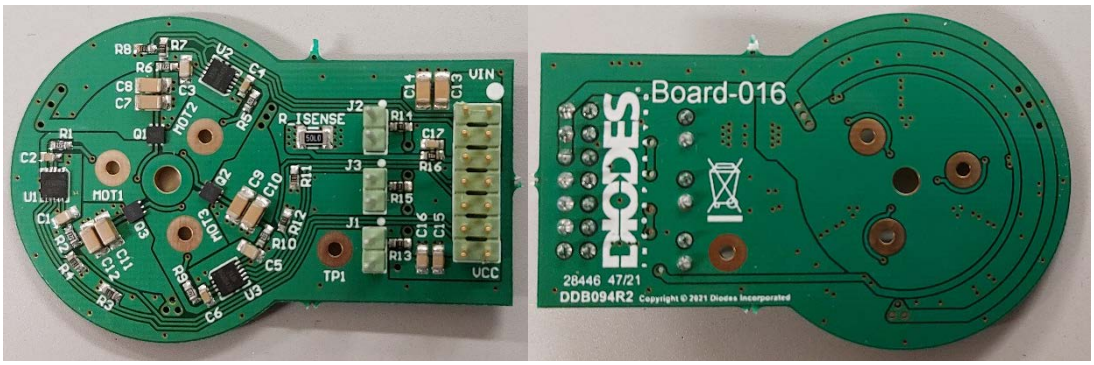


Figure 3: DDB094R2 Frontside View (Left) Backside View (Right)

The DDB094R2 demo board is a three-phase motor driver board with three gate drivers and three dual N-channel MOSFETs in DFN2020-6. This board can run a 24V motor up to 3A input current (72W input power). It is designed to take control inputs from a microcontroller or motor control IC and drive the windings of a three-phase brushless DC motor. It is targeted to typical 30-50W three-phase 45mm BLDC applications.

The DMN3032LFDBQ dual N-channel MOSFETs are in the DFN2020-6 package, only 2mm x 2mm x 0.6mm. With an $R_{DS(ON)}$ of 30mΩ these offer remarkable power density, able to handle continuous currents of up to 6A. The board is designed to offer good thermal performance and is capable of driving up to 3A maximum continuous current.

On this board the output MOSFETs are driven by the DGD05473FNQ gate driver device – this is a high and low-side gate driver with integrated charge pump for high-side N-channel MOSFETs. This device can source 1.5A and sink 2.5A to ensure rapid (and therefore efficient) switching of the output devices and provides output gate drive voltage up to 14V to ensure that the MOSFETs are fully enhanced.

The gate drive resistors are set at 27Ω to match the gate capacitance of the DMN3032LFDBQ and provide fast switching with no ringing, as seen in
Figure ***4***:

Figure 4: MOSFET Gate Voltage

Commutation and dead time control will be handled by the external microcontroller.

Thermal Performance

To assess the thermal capabilities of the DDB094 board two tests have been done. For all the tests 36W were supplied to the PCB, this is 24V and a maximum of 1.5A and were done at a room temperature of 25°C. The following graph shows the average curve of 4 different PCBs. Measurements were taken every second. All the tests were done at a room temperature of 25°C, but as can be noticed in the graph the PCB was at 30°C at the beginning due to previous tests.

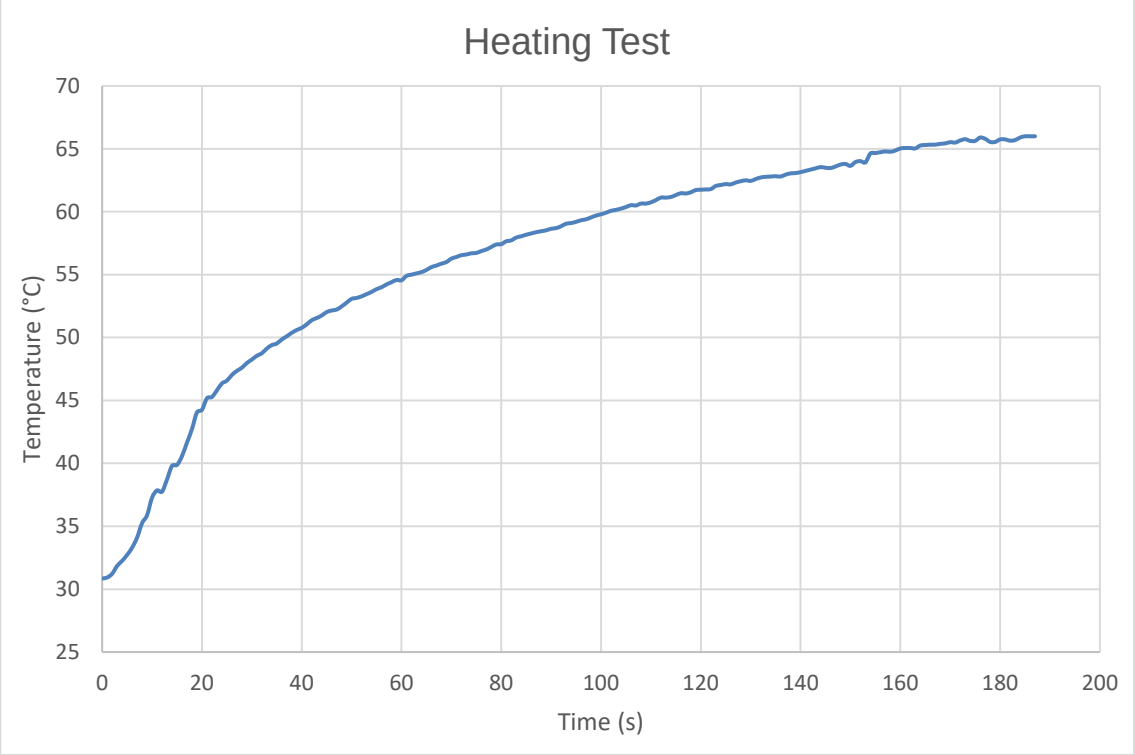


Figure 5: Rapid PCB Heating Test

A long-term soak test reaches a maximum of 75°C at 36W continuous input power.
The PCB design contains solid copper areas and good thermal paths to distribute and dissipate the heat:

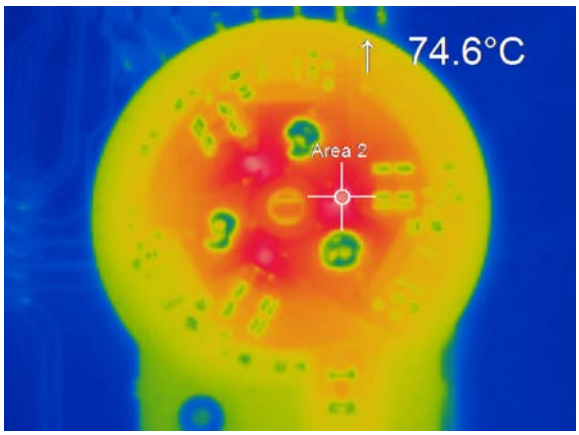
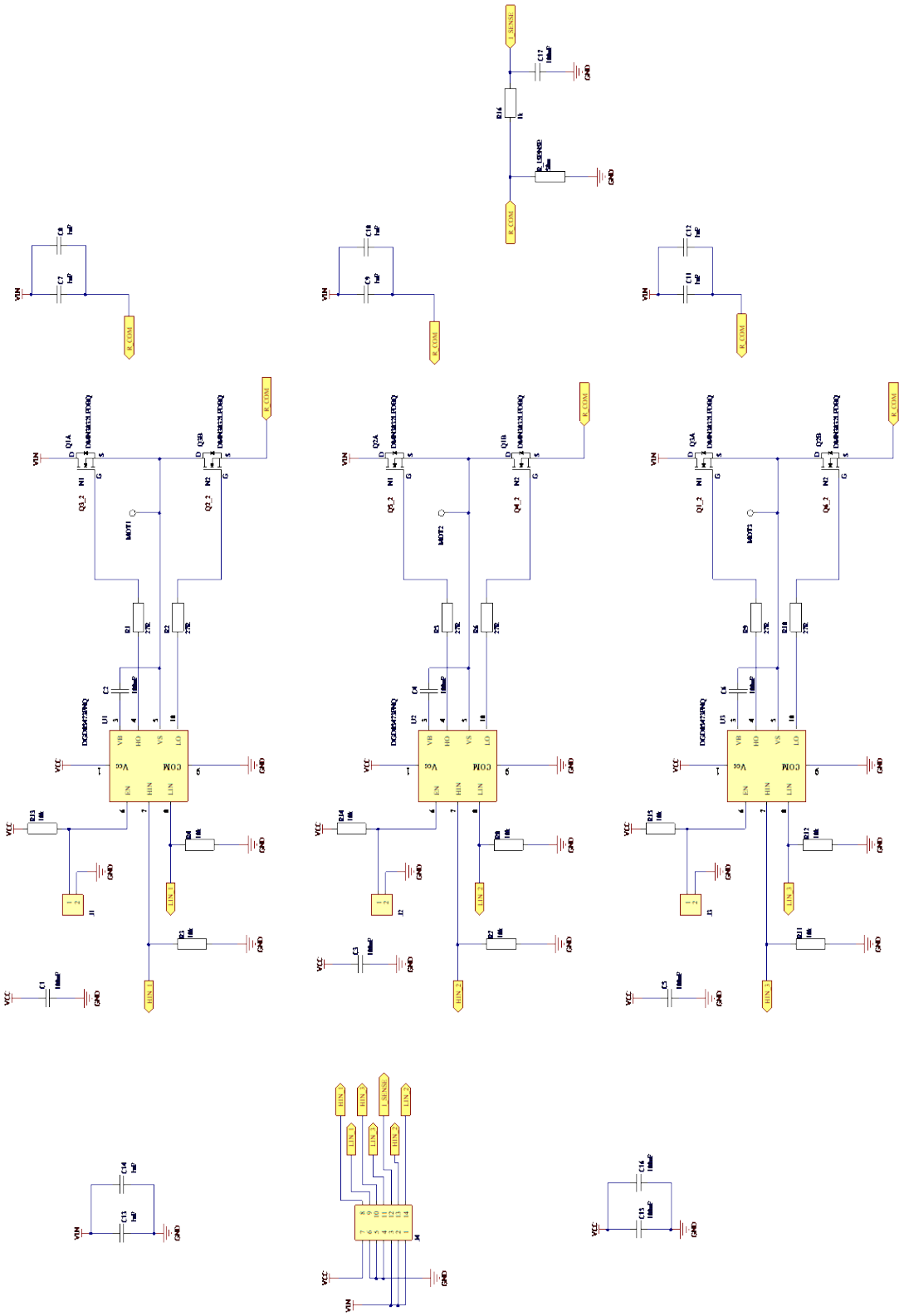


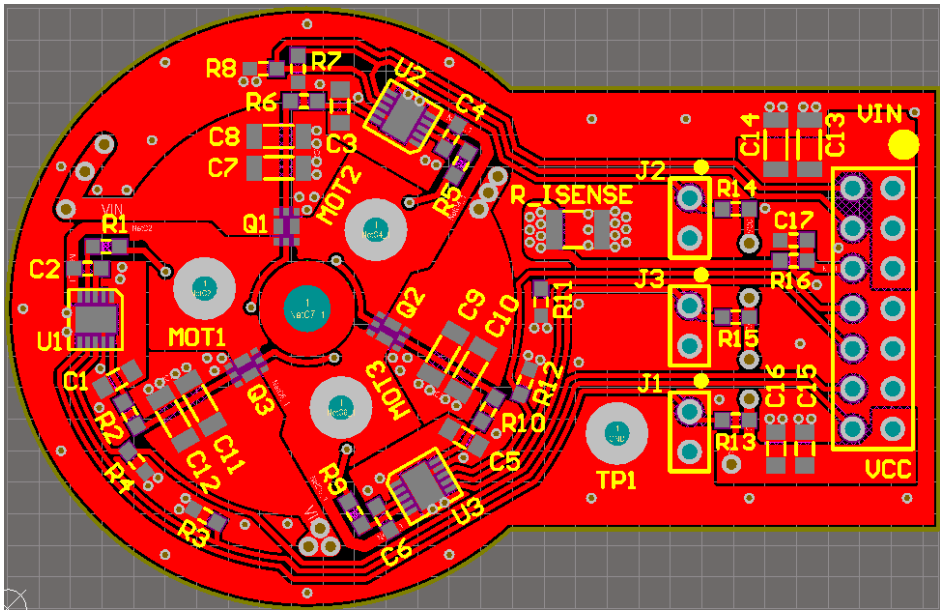
Figure 6: PCB Thermal Test Image

Appendix 1: Board Schematic

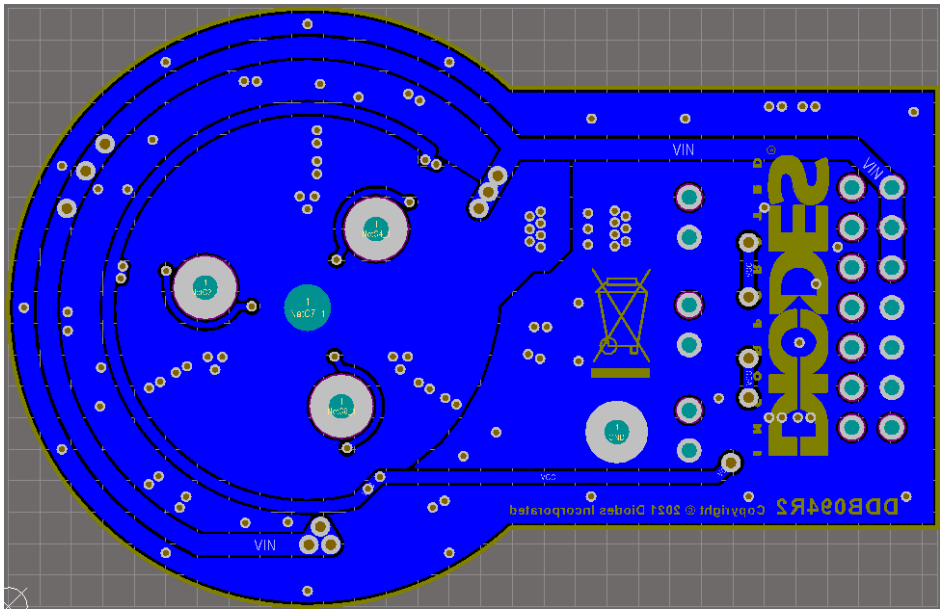


Appendix 2: Board Layers (all from top view perspective)

Top Layer:



Bottom Layer:



Bill Of Materials

Qty	Idents	Description	Footprint
5	C1, C3, C5, C15, C16	100nf X7R 50V Capacitor	0805
4	C2, C4, C6, C17	100nF X7R 50V Capacitor	0603
8	C7, C8, C9, C10, C11, C12, C13, C14	1uF X7R 50V Capacitor	1206
9	R3, R4, R7, R8, R11, R12, R13, R14, R15	10k Ω Thick film resistor 1%	0603
6	R1, R2, R5, R6, R9, R10	27 Ω Thick film resistor 1%	0603
1	R16	1K Ω Thick film resistor 1%	0603
1	R_SENSE	50m Ω Current Sense Resistor	1210
3	Q1, Q2, Q3	DMN3032LFDBQ Dual MOSFET	U-DFN2020-6
3	U1, U2, U3	DGD05473FNQ Gate Driver	U-DFN3030-10
3	J1, J2, J3	0.1” 2-way Header	
1		0.1” 14-way, 2 rows Header	

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