
ZXBM2004 EVALUATION BOARD (ZDB212 REV3)**Specification**

Input voltage (Vcc).....12V (Min 6V, Max 20V)
Maximum Current3A
PWM output frequency 200HZ to 100KHz (25KHZ nominal)
PWM output duty cycle 0% to 100%
PWM input frequency 200HZ to 100KHz (25KHZ nominal)
PWM input voltage 3V to 5V
PWM input duty cycle 0% to 100%
Thermistor Input10k Ω NTC , 100K Ω NTC
SPD input voltage1V to 3V

Description

The ZDB212 is a demonstration board for evaluating the ZXBM2004 Two Phase Brushless DC Motor Controller. PWM input control, thermistor input control or voltage input control can be selected simply by inserting a jumper. The Hall sensor can be either a four pin naked Hall sensor or a three pin digital (buffered) Hall sensor.

Terminals

Vcc+Supply input voltage
GND..... Supply 0V
V+..... Motor supply voltage
PH1_coil..... Motor coil connection
PH2_coil..... Motor coil connection
H+ Hall sensor positive input
H- Hall sensor negative input (four pin naked Hall only)
Hall Bias Hall sensor supply (four pin naked Hall only)
Hall VccHall sensor supply (three pin digital Hall only)
FG outMotor speed output signal
PWM INPUTExternal PWM control input
ThrefThis terminal is used to monitor the internal IC voltage reference
Lock OutputHigh when rotor is locked
PH1, PH2Controller drive outputs
G1, G2MOSFET gate drive terminals (or Bipolar Transistor base drive terminals)

Jumpers

J3 – This selects a resistor network for 10K thermistor input. Not required for 100K thermistor or voltage and PWM inputs.
J4 – This selects the potential divider to the H- pin for three pin digital (buffered) Hall sensor. Leave open for 4 pin Naked Hall.
J5 – This selects the pull-up resistor for open collector (or drain) digital (buffered) Hall. Leave open for 4 pin Naked Hall or for Hall sensors with internal pull-up.
J6 – Pins 1 and 2 (PWM select and SPD_IC) select the external integrator network for PWM input. Leave open for voltage and thermistor inputs. Pins 3 and 4 (SPD_IC and SPD) connect pin 14 of connector J6 to the SPD control pin of the ZXBM2004. Select for voltage and thermistor input and leave open for PWM input.

Terminals and Jumpers Positions

Figure 1 below shows the positions on the PCB of the terminals and jumpers described above.

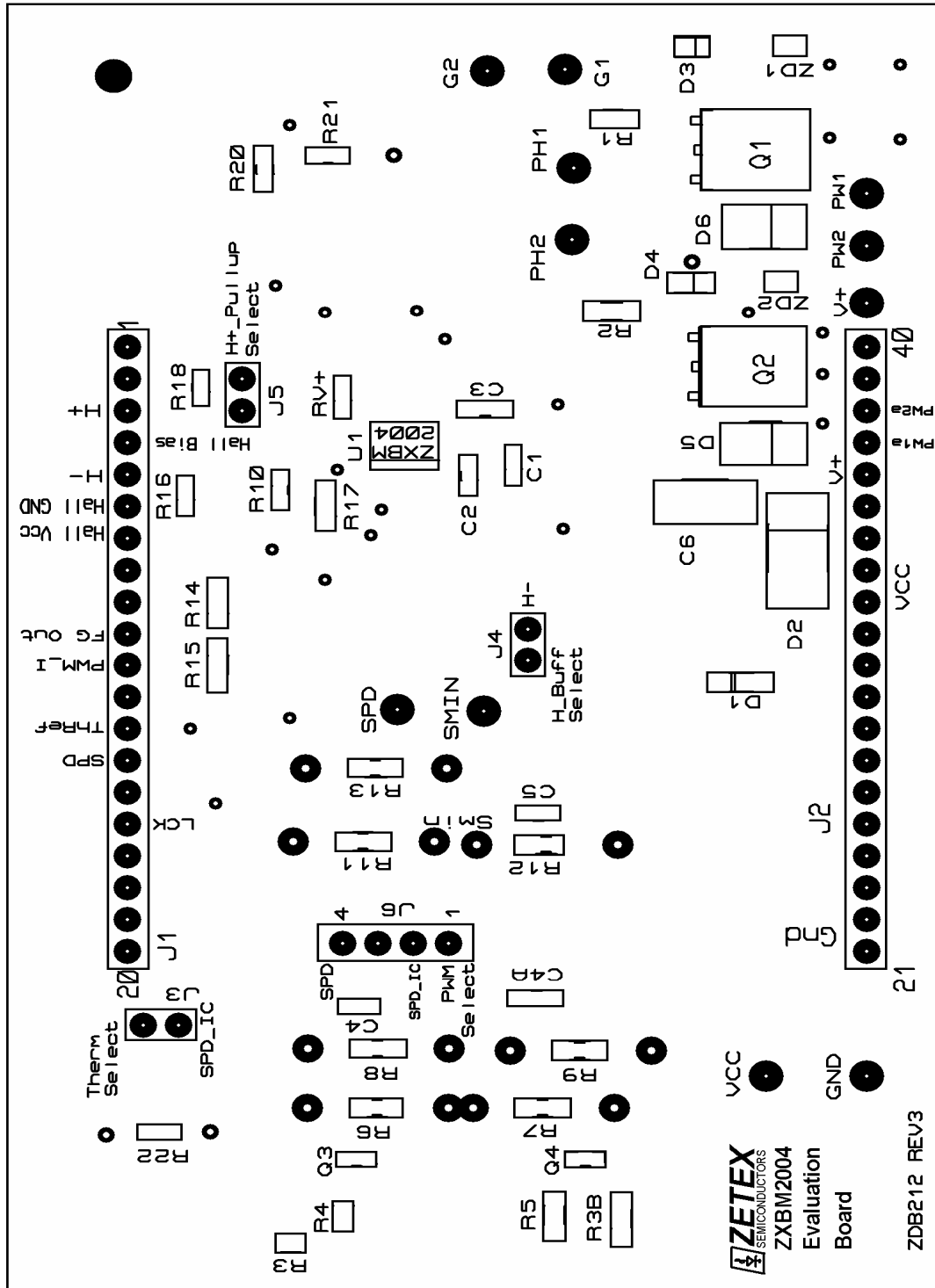


Figure 1.

Voltage Control

For voltage control, connections to the PCB are illustrated in figure 2 below. A digital (buffered) Hall Sensor with open collector output is used in this example.

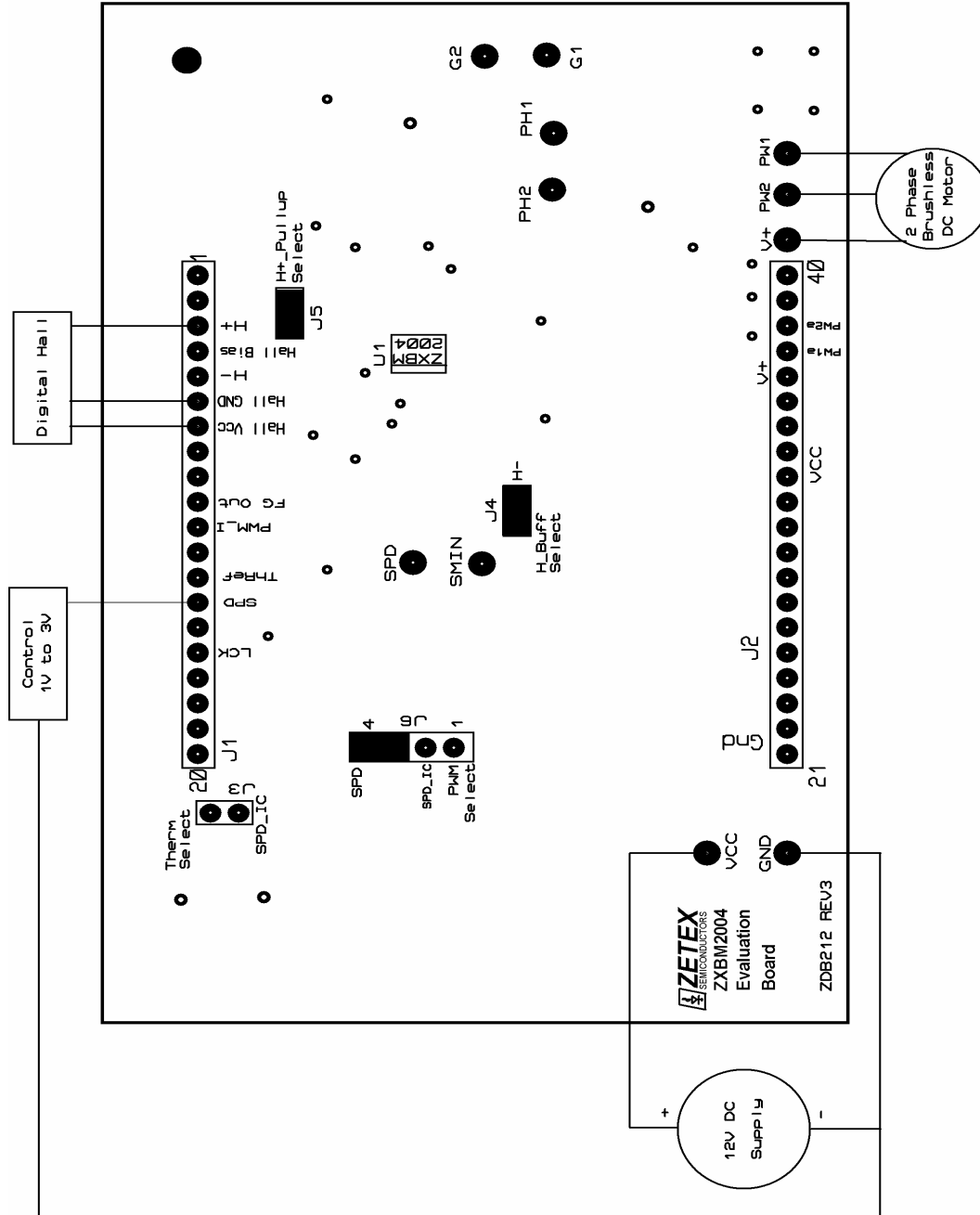


Figure 2

The control voltage is varied from 3V (0% PWM) to 1V (100% PWM). The ZXBM2004 has a linear voltage to PWM response. The speed response varies for different motor designs.

The circuit for the above configuration is figure 3 below.

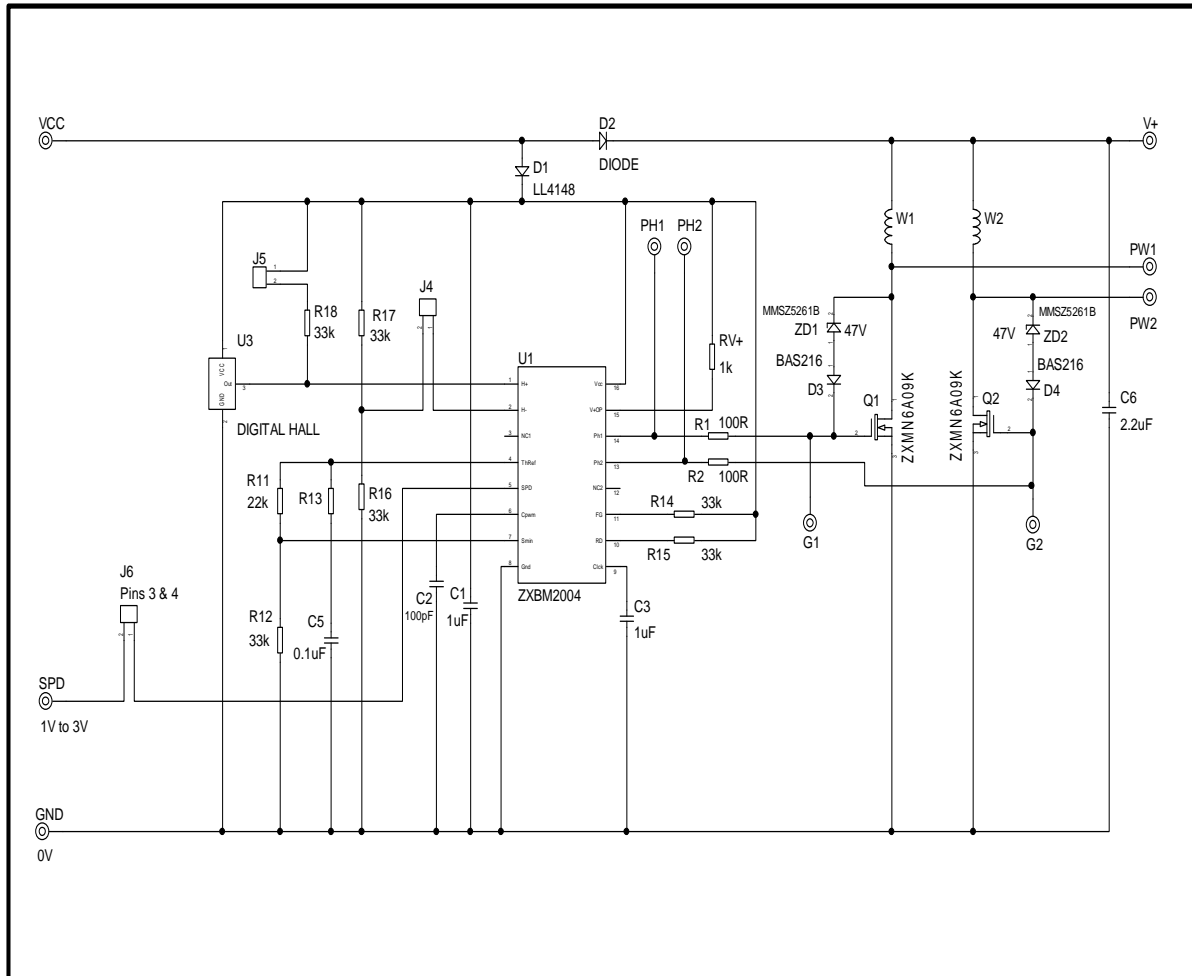


Figure 3

Thermistor Control

For thermistor control, connections to the PCB are illustrated in figure 4 below. A digital (buffered) Hall Sensor with open collector output is used in this example. The thermistor is 10KΩ NTC and J3 selects the linearization resistor network. For 100KΩ thermistor J3 would be left open and all other connections would remain as below.

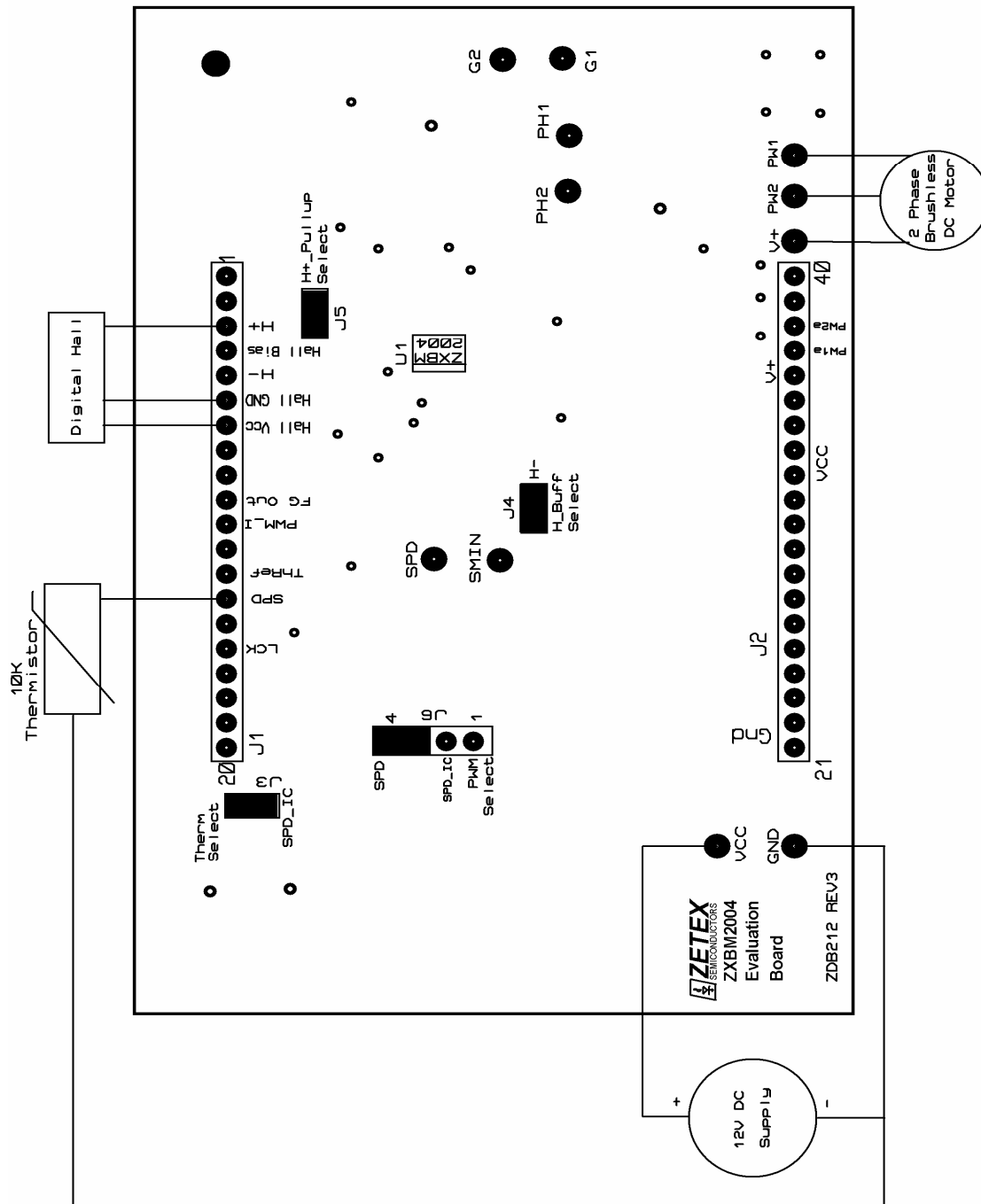


Figure 4

PWM Control

For PWM control, connections to the PCB are illustrated in figure 6 below. A Naked Hall Sensor is used in this example.

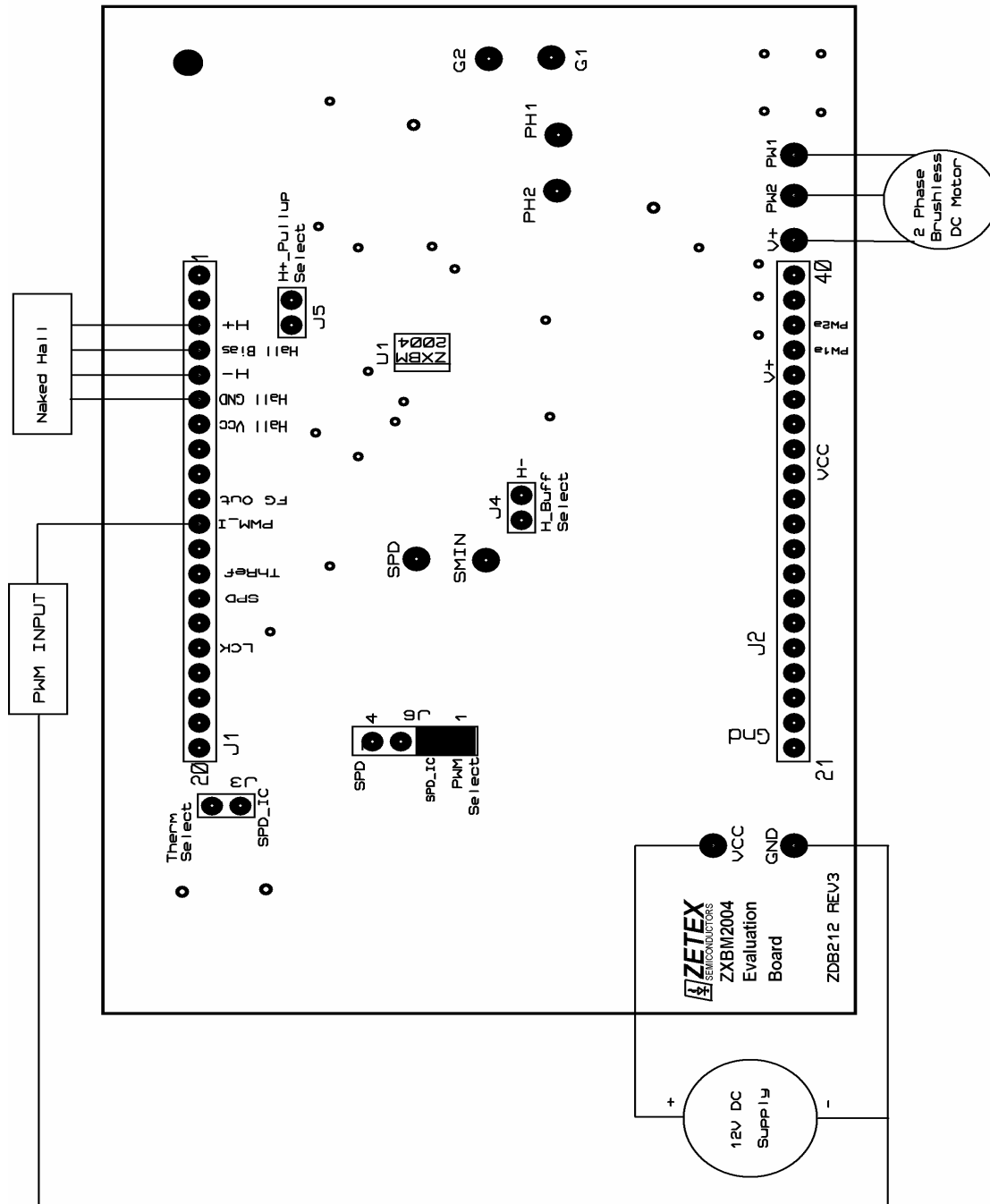


Figure 6

The circuit for the above configuration is figure 7 below

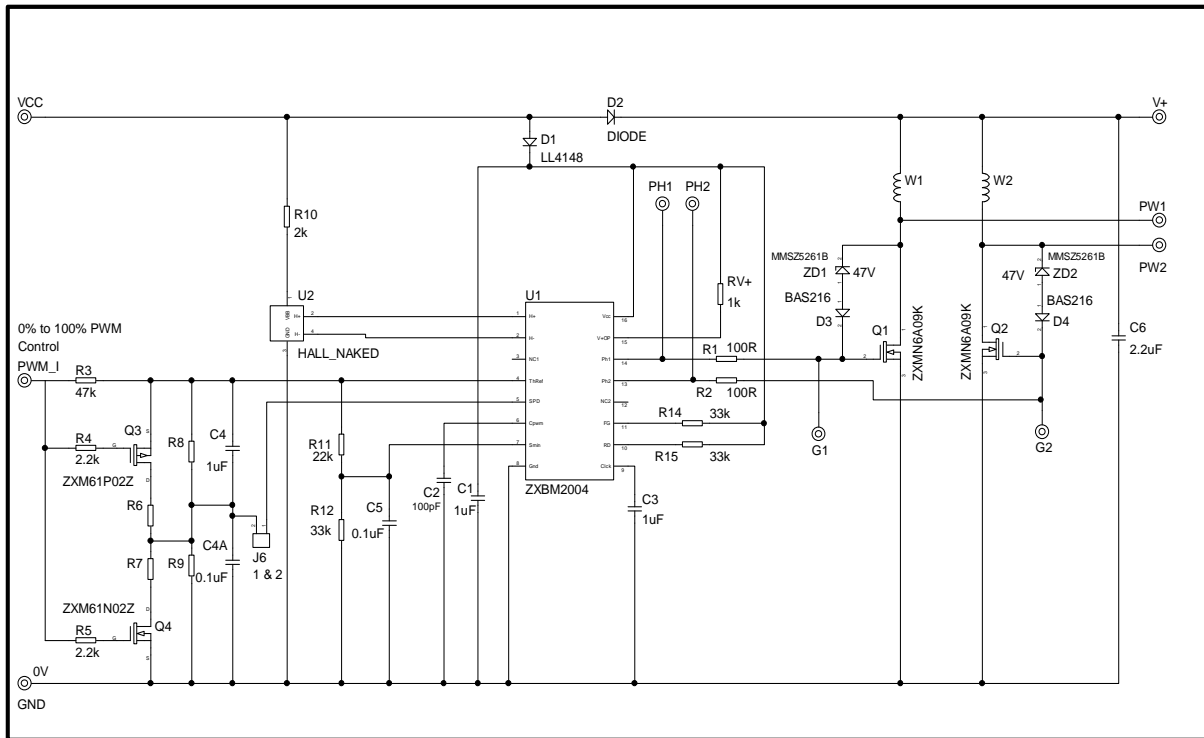
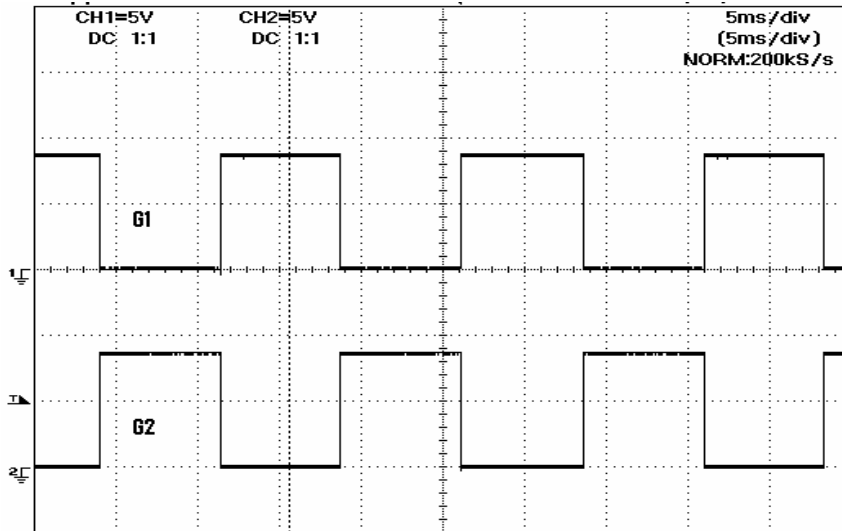


Figure 7

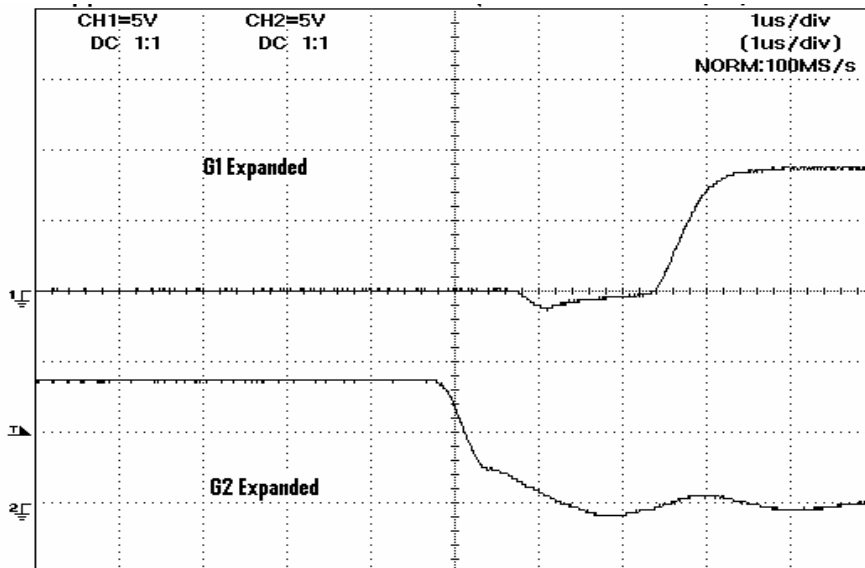
Zetex application note AN42 details the adjustment of resistors R6, R7, R8 and R9 in order to get the required response. Resistors , R7, R8 and R9 have not been assembled. Sockets have been included to enable easy changing of the through-hole resistors. Surface mount pads have been included for those that prefer soldering and de-soldering surface mount devices.

Test Point Waveforms

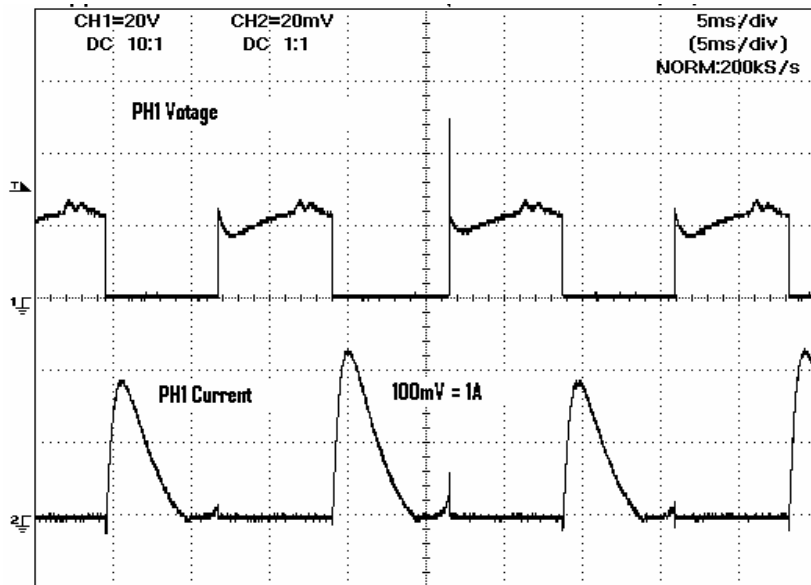
Below are some waveforms taken at test points with a running motor connected.



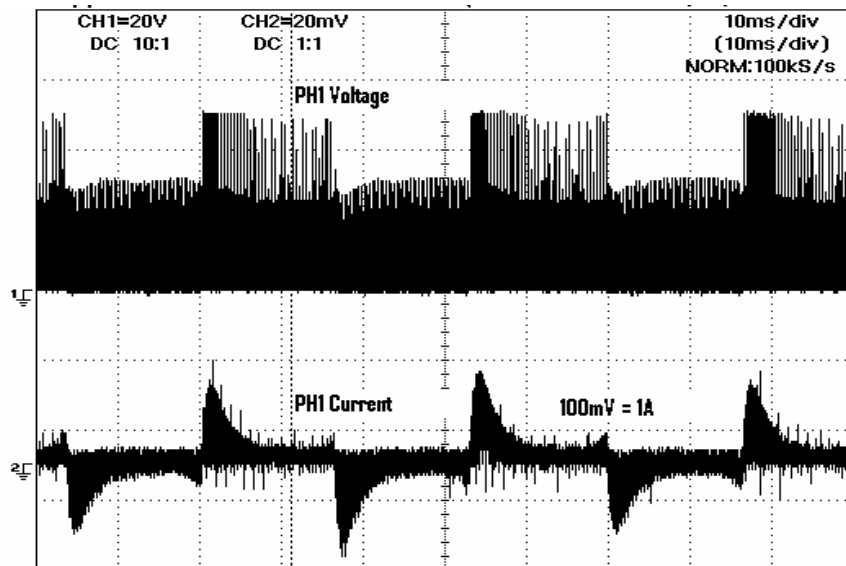
Trace 1 above is G1 and trace 2 is G2. These are the gate drives to MOSFETs Q1 and Q2. Motor is running at full speed.



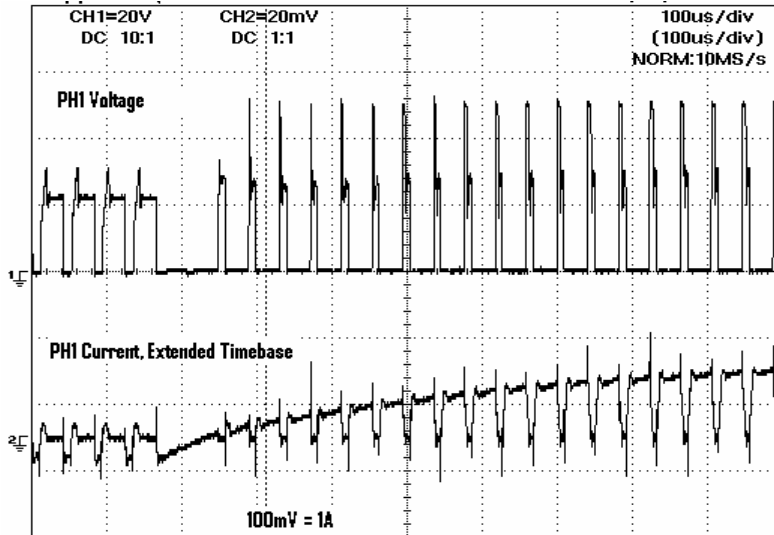
Trace 1 above is G1 and trace 2 is G2. These are the gate drives to MOSFETs Q1 and Q2 and the time base has been expanded to show the commutation delay. Motor is running at full speed.



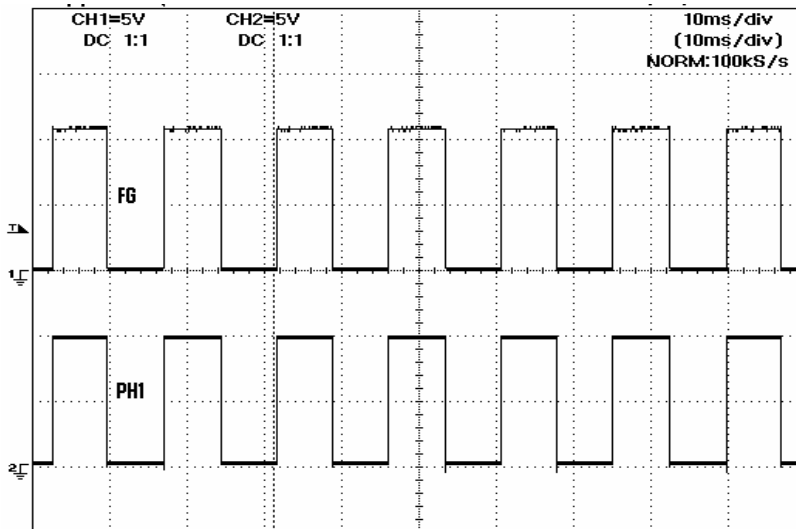
Trace 1 above is PH1 voltage and trace 2 is PH1 current. Motor is running at full speed.



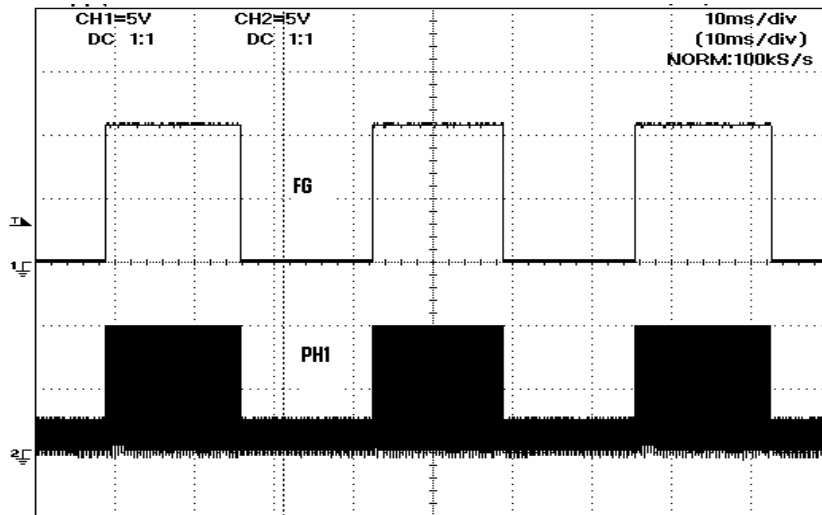
Trace 1 above is PH1_coil showing the voltage on the phase 1 coil and trace 2 is the current in Phase 1. Input voltage to the speed pin is 1.5V which is equivalent to 75% PWM.



Trace 1 above is PH1_coil showing the voltage on the phase 1 coil and trace 2 is the current in Phase 1. Input voltage to the speed pin is 1.5V which is equivalent to 75% PWM. Time-base has been extended to show PWM switching.



Trace 1 above is FG out, a signal representing twice motor rotational frequency, trace 2 is PH1 showing one of the two drive signals from the ZXBM2004. Motor is running at full speed.



Trace 1 is FG out, a signal representing twice motor rotational frequency, trace 2 is PH1 showing one of the two drive signals from the ZXBM2004. Input to SPD is 1.5V which is equivalent to 75% PWM.

Bill Of Materials

Below is the Bill Of Materials for the complete board assembly:

QUANTITY	IDENT	DESCRIPTION	
2	R1,R2	100R	SMD 1206 1% generic
1	R3	47k	SMD 1206 1% generic
2	R4,R5	2.2K	SMD 1206 1% generic
1	R10	2K	SMD 0805 1% generic
3	R14,R15,R17	33K	SMD 1206 1% generic
2	R16,R18	33K	SMD 0805 1% generic
4	R20	56K	SMD 0805 1% generic
1	R21	10K	SMD 0805 1% generic
1	R22	8.2K	SMD 0805 1% generic
1	RV+	0R	SMD 0805 1% generic
3	C1,C3,C4	1uF 25V GRM216R61E105KA12D	0805 X5R
1	C2	100pF 50V B3790K5101J60	0805 COG
1	C6	4.7uF 100V GRM55ER72A475K	2220 X7R
1	U1	ZXBM2004Q16	2 Phase Brushless Motor Controller
2	Q1,Q2	ZXMN6A09K	DPAK N MOSFET
1	Q3	ZXM61P02F	SOT23 P MOSFET
1	Q4	ZXMN2A01F	SOT23 N MOSFET
1	D1	LL4148	MINIMELF Diode
1	D2	30BQ100	SMC Diode 100V
2	D3,D4	BAS216	BAS216 Diode 85V
2	ZD1,ZD2	MMSZ5261B	SOD123 Zener Diode 47V
6	J3,J4,J5		2 Terminal Pin Header, 100thou
1	V+-PW1-PW2		3 Terminal Pin Header, 100thou
1	J6		4 Terminal Pin Header, 100thou
14	R6,R7,R8,R9,R11,R12,R13	H3153-05	Board Socket 0.5mm Gold
1	VCC, GND, V+, PW1, PW2	Test Terminal	
6	G1,G2,PH1,PH2,SPD,SMIN	Test Terminal	
1	Box	PK037	Presentation Box

ZXBM2004 (ZDB212)

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