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By Thomas Hopkins
Dennis Nolan

Main components	
L6506	Current Controller For Stepping Motors
L6384E	High-voltage half bridge driver

Specification

- 2 phase bipolar motor driver
- Full Step, half Step and microstep operation
- Output current >4A*
- Motor voltage >50V *

Circuit description

When the voltage or current is outside of the capabilities of the integrated driver ICs, discrete power devices can be used with integrated gate driver ICs and a current controller to implement a high power stepper motor driver. The circuit shown in Figure 1 can easily be adapted to a wide range of current and voltage levels to meet the application requirements.

The power stage is a dual full H-bridge configuration needed for a 2-phase bipolar stepper motor. Each leg of the bridge is implemented using discrete power MOS devices and an L6384E half bridge gate driver IC. The L6384E was selected for its logical compatibility with the L6506 current controller and its built-in dead time to prevent cross conduction in the bridge. The test board included a MOS device rated at 80A and 100V in a TO-220 package. By changing the power MOS devices, the design can be modified for a wide range of voltage and current. The series gate resistors may need to be changed for different power MOS devices and can be selected to set the switching time of the power MOS.

The test board used power transistors in the TO-220 package that allows a very simple heat sink configuration. For moderate power levels, in the range of 5 to 10A, it's possible to build a very compact drive using power transistors in D2PAK with just the copper area on the PCB for heat sink and the L6384ED and L6506D in SO package.

* Depends on selected power MOS device.

Figure 1b. Schematic diagram, page 2

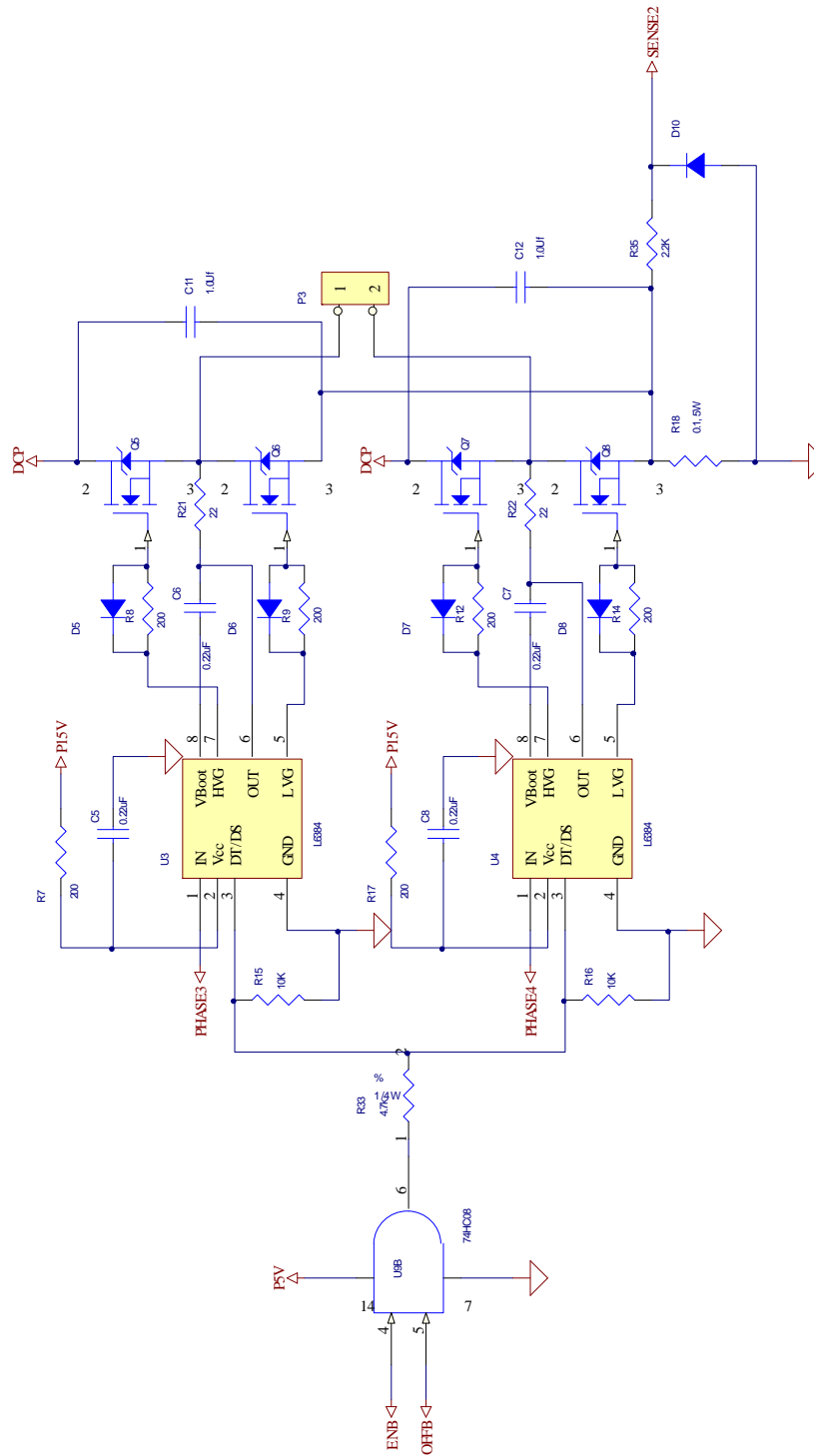
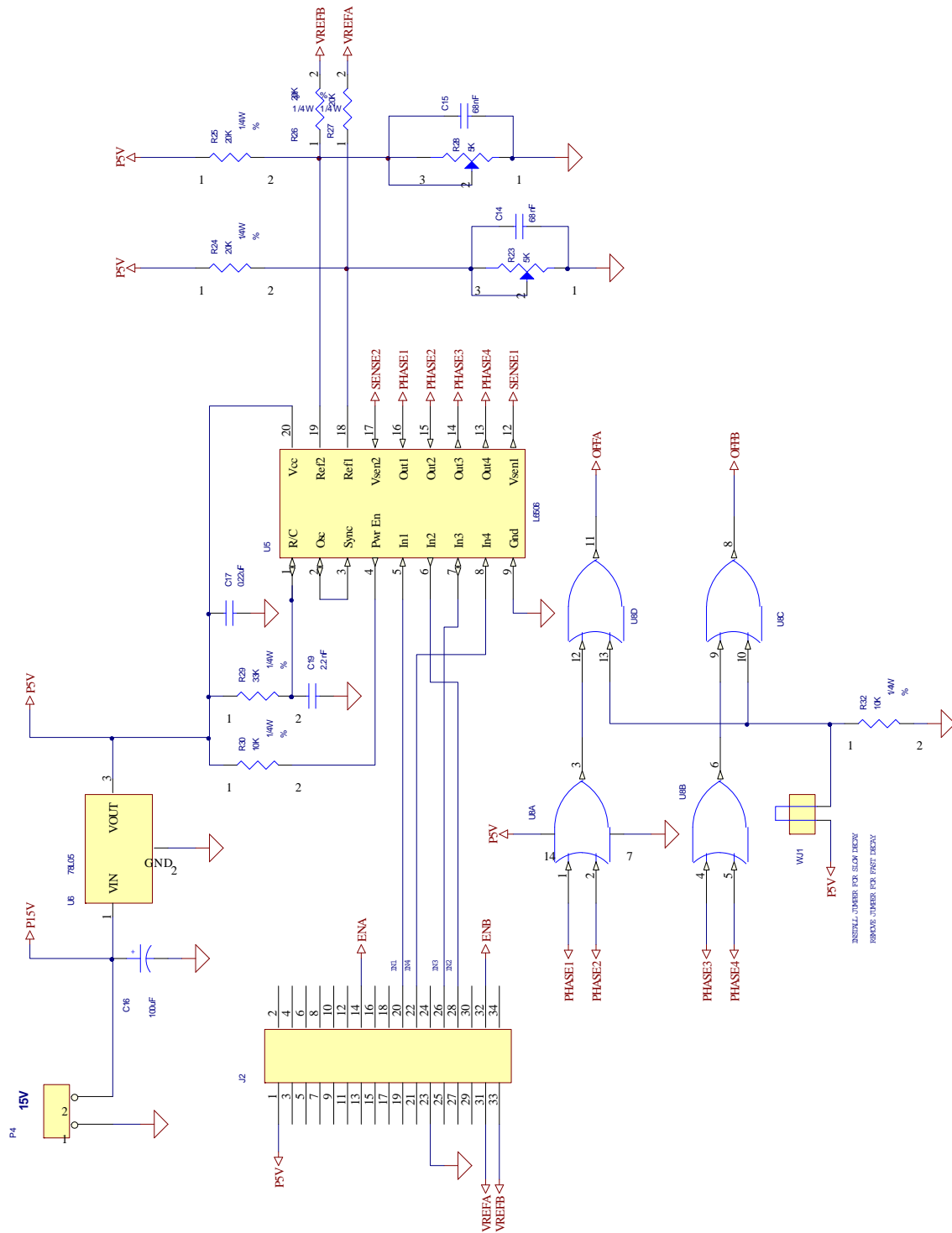


Figure 1c. Schematic diagram, page 3



The L6506 regulates the motor current by comparing the voltage across sense resistors R10 and R18 to the voltage references. When the voltage across the sense resistor exceeds the reference voltage, the L6506 turns off the output and allows the current to recirculate until the oscillator turns the bridge back on. The value of the sense resistor and the reference voltage set the peak motor current according to the equation:

$$I_{\text{peak}} = V_{\text{REF}} / R_{\text{sense}}$$

For a typical application, the value of R_{sense} is chosen so that the voltage across the sense resistor at maximum motor current is between 0.5 and 0.75 V.

Inputs IN1- IN4 control the phases of the bridge. If an input is high, the high side transistor of the corresponding half bridge will be turned on. If the input is low, the low side transistor of the corresponding half bridge will be turned on. Since the L6384 uses a bootstrap diode to power the high side gate driver, operation at 100% duty cycle on the high side is not possible. However, the L6506 ANDs the PWM signal to control the current with the logic input so that, as long as current is being regulated, the high side is switched at the chopping frequency and the bootstrap is always refreshed. ENA and ENB are the enable for the bridges. When ENA or ENB is low, all four transistors of the corresponding bridge are turned off.

Jumper WJ1 is used to select fast or slow decay mode.

Connector J2 is compatible with the PractiSPIN evaluation system. The board may be controlled from the PractiSPIN interface by selecting the L6207 in the device list.

Variations

The L6384E was selected for its logic compatibility with the L6506 and that it included dead time control. Other gate drivers that may be used are the L6390, L6391, L6392 and L6393 that are also logic compatible with the L6506.

Support material

Documentation
Datasheet L6506, Current Controller For Stepping Motors
Datasheet L6384E, High-voltage half bridge driver

Appendix A, Bill of Materials

Comment	Description	Designator
0.22uF	capacitor 1206	C1, C2, C3, C4, C5, C6, C7, C8, C17
1.0Uf	capacitor 1206	C9, C10, C11, C12
680uF	capacitor 1206	C13
68 nF		C14, C15
100uF	100uF, 200V, Electrolytic	C16
2.2 nF		C19
1N4148WS		D1, D2, D3, D4, D5, D6, D7, D8, D9, D10
	34 pin flat ribbon connector	J2
	connector, Phoenix, 2 pos	P1, P2, P3
	connector, Phoenix, 2 pos	P4
STP80NF10	MOSFET 60V TO220	Q1, Q2, Q3, Q4, Q5, Q6, Q7, Q8
200	capacitor 1206	R1, R2, R3, R4, R5, R6, R7, R8, R9, R12, R14, R17
0.1, 5W	capacitor 1206	R10, R18
10K	capacitor 1206	R11, R13, R15, R16
22	capacitor 1206	R19, R20, R21, R22
5K	trimmer pot	R23, R28
20K		R24, R25, R26, R27
33K		R29
10K		R30, R32
4.7k		R31, R33
2.2K	resistor1206	R34, R35
L6384E	Gate Driver	U1, U2, U3, U4
L6506	Current Regulator	U5
L78L05	5V regulator	U6
74HC32	2 input OR gate	U8
74HC08	2 input NAND gate	U9
	Jumper	WJ1

Revision history

Date	Version	Changes
15-Apr-2012	1	Initial release

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