

### PractiSPIN™.spmd demonstration system configuration and set up guide

## Introduction

PractiSPIN™.spmd is a demonstration system that can be used with several STMicroelectronics stepper motor driver modules.

The system consists of a graphical user interface (GUI) program which runs on an IBM-PC under windows, a common ST7-based interface board that communicates with the PC and the PractiSPIN™.spmd software via a serial COMM port, and a module-specific demonstration board (target board) that connects to the ST7 interface board via a standard 34-pin ribbon cable interface, as shown in [Figure 1](#).

The module demonstration board connects to the motor and to a user-supplied DC power supply generally in the range of 12 to 48 VDC, plus a logical supply rated 5 VDC.

The PractiSPIN™.spmd system is designed to operate the target module under the control of the PractiSPIN™.spmd software.

**Figure 1. The PractiSPIN™.spmd system block diagram**



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# 1 System overview

The purpose of this document is to illustrate the operation of the complete system made up by a module specific demonstration board (target board), the control board PractiSPIN™, the SW PractiSPIN™.spmd and a stepper motor. For details concerning PractiSPIN™, STEVAL-SPMD250V1, STEVAL-SPMD250V2, STEVAL-SPMD150V1 and STEVAL-SPMD150V2, please refer to the specific application notes.

To be operated the target board needs two supply voltages and a stepper motor connected to the proper connectors.

Through the control board and friendly user interface the PractiSPIN™.spmd system supports the following measurements and demonstrations:

- to drive the module with normal or half step sequence
- to select the current recirculation mode
  - slow decay
  - fast decay
- to change the motor rotation
  - forward
  - reverse
- to fix the acceleration and deceleration ramp and the running speed
- to differentiate the motor current during the ramp
  - normal working mode
  - steady state mode

A sequence of moving and waiting times can be fixed and repeated indefinitely.

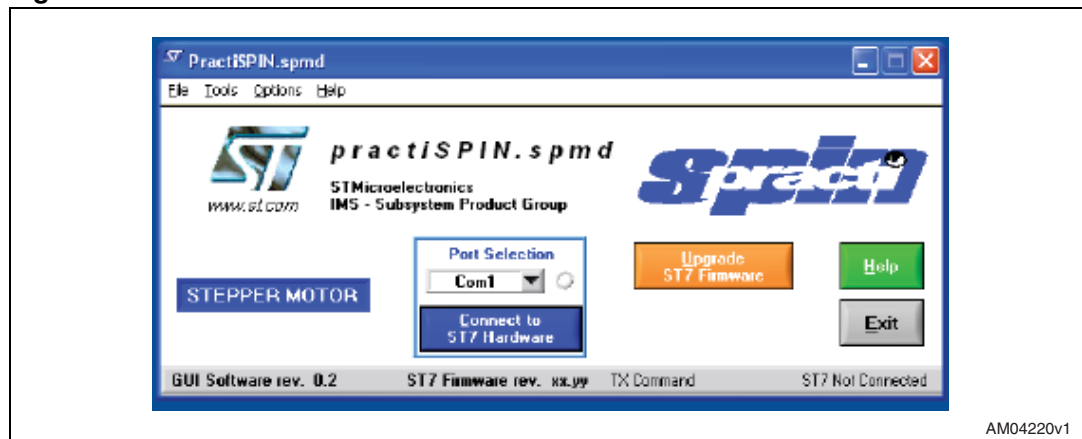
*Note: For a detailed description of the control boards please refer to the PractiSPIN™ application note.*

## 2 Starting PractiSPIN™.spmd

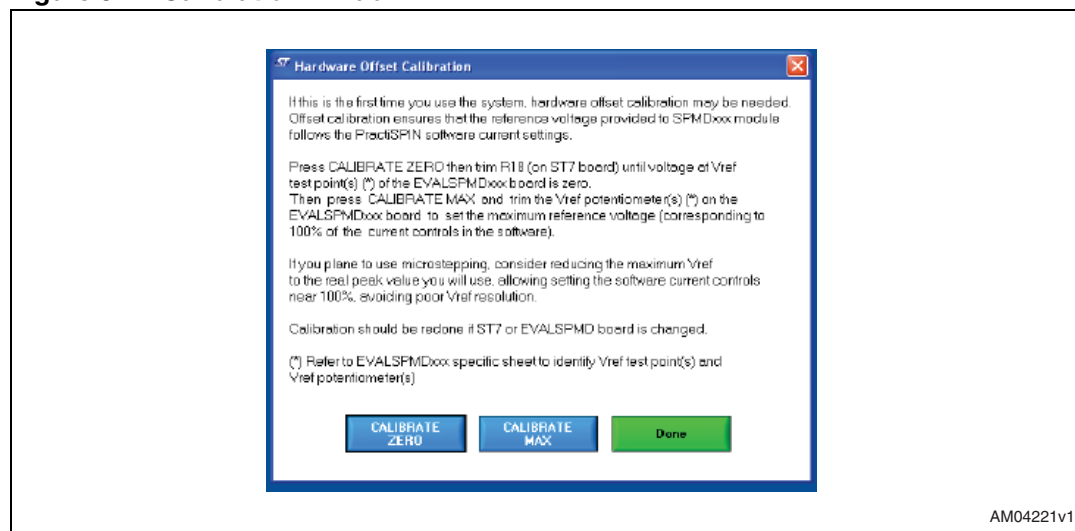
Since the PractiSPIN™.spmd system is capable of supporting several module demonstration boards the user must first select the module that is evaluated.

- Module demonstration board set up: configure the jumpers/switches on the target board and the control board as described in the paragraph for the specific demonstration board being used.
- Control board - PC connection: connect the control board to a serial COMM port of the PC via a standard (straight through) 9 pin D connector cable.
- Powerup: energize the power supply
- Start PractiSPIN™.spmd software: on the PC, start the PractiSPIN™.spmd program
- Communication settings: click the drop down list under "port selection" and select the COMM port being used. Baud rate and other communication parameters are fixed on both sides of the link and do not need to be set.
- Establish COMM link: click the "connect to ST7 hardware". At this point the PractiSPIN™.spmd software transmits several commands to the control board to initialize the processor. The PractiSPIN™.spmd software reads the revision code of the firmware currently stored in the Flash memory of the ST7 and determine if the correct version of firmware resides in the ST7. If the PractiSPIN™.spmd software detects that a firmware update is necessary, either because there is an old version of firmware or the firmware currently in the Flash memory is not the correct firmware for the motor type selected, one or more dialogue boxes appear asking if the program should proceed with the update. Accept the updates and the PractiSPIN™.spmd software automatically updates the firmware. The system then initializes the settings to the last stored settings and open the appropriate PractiSPIN™.spmd software for the selected target board.

**Figure 2. PractiSPIN™ launch window**



- Calibrate current setting: when communication is established the user has the option to adjust the offset and maximum current settings. If this is the first time you use the system, calibration may be needed to adjust out the offset in the reference bias circuitry. Calibration ensures that the reference voltage provided to target module follows the PractiSPIN™.spmd software current settings. Calibration is a two-step process; first the offset is adjusted then the maximum current is set. Clicking on "connect ST7 hardware" button, the calibration window appears.

**Figure 3. Calibration window**

- To null out the offset, click on calibrate zero (for details please refer to the specific target board section).
- To set the maximum current click on calibrate max (for details please refer to the specific target board section).
- Click done

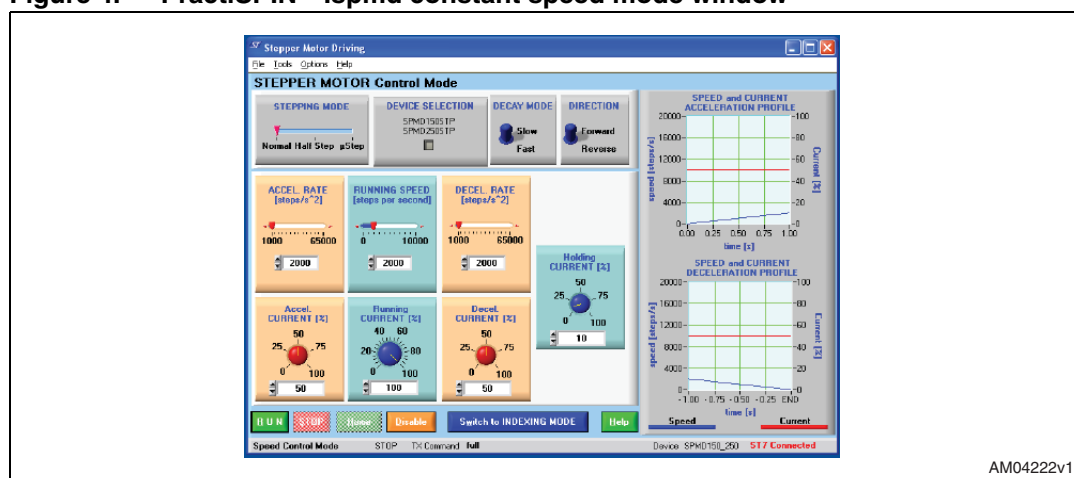
### 3 Stepper motor driver

After the system has established the connection to the control board, it initializes the settings to the last stored settings and open the PractiSPIN™.spsmd GUI. For the stepper motor, the system can operate in either a constant speed or positioning (indexing) mode. The constant speed mode can easily be used to see that the system is working.

The stepper motor driving window, from which it is possible to select the motor working configuration, appears.

#### 3.1 Constant speed mode

Figure 4. PractiSPIN™.spsmd constant speed mode window



- Speed control screen: a large blue button at the bottom of the screen should read, "switch to indexing mode". If the button reads, "switch to speed control mode", click the button once to go to speed control mode.
- Stepping mode: in the stepping mode box, select either normal or half step. Micro stepping mode is only available when using the STEVAL-SPMD150STP.
- Device selection: in the device selection box, select the device being evaluated
- Direction: in the direction box, click the toggle switch to pick forward or reverse. This is somewhat arbitrary since the direction sense of the motor is unknown. Once the motor is running, toggle this switch to reverse the motor direction if desired. To reverse the meaning of the forward and reverse designations, disable the motor (orange disable button at bottom of screen) and then swap the motor wires at either CN3 or CN4.
- Decay mode: set the toggle switch to slow decay
- Acceleration rate: set the acceleration rate to about 1000 steps per sec<sup>2</sup> (steps/sec<sup>2</sup>). In the PractiSPIN™.spsmd system all motion parameters are given in terms of the basic units of steps and seconds: position in steps, velocity in steps/sec, and acceleration/deceleration in steps/sec<sup>2</sup>. In order to relate these settings to rotations, RPM, and RPM/second it is necessary to know the number of steps (or half steps) per rotation for the stepper motor being used. A common value is 200 steps or 400 half steps per rotation.

- Running speed: set running speed to about 100 steps/sec
- Deceleration rate: set deceleration rate to about 1000 steps/sec<sup>2</sup>
- Acceleration current: set acceleration current to about 25%. This is an initial guess as to the required setting and may need further adjustment. Generally higher acceleration rate settings require higher acceleration current settings so that the stepper motor does not start to "slip poles" and fall behind the desired position. Since we have initially set the acceleration rate setting quite low, 25% is probably adequate.
- Running current: set the running current to 25%. In practice the running current can often be set to a lower value than the acceleration current since the torque requirement is generally less during the constant speed part of the move. A lower running current setting can help to keep the device and the motor running cooler.
- Deceleration current: set the deceleration current to 25%. Since friction aids in decelerating the motor it may also be possible to set the deceleration current lower.
- Holding current: set the holding current to 25%. Whenever the motor is stopped (after a run,) this level of current circulates in the motor so that it holds position against any mechanical disturbance. In the case of a strong static load (perhaps a gravity load of some sort) it may be necessary to increase this setting. If not much holding torque is required, then the setting can be reduced so that operating temperatures can be held to a minimum.

*Note: Holding current is turned off (bridge completely disabled) whenever the disable button is clicked.*

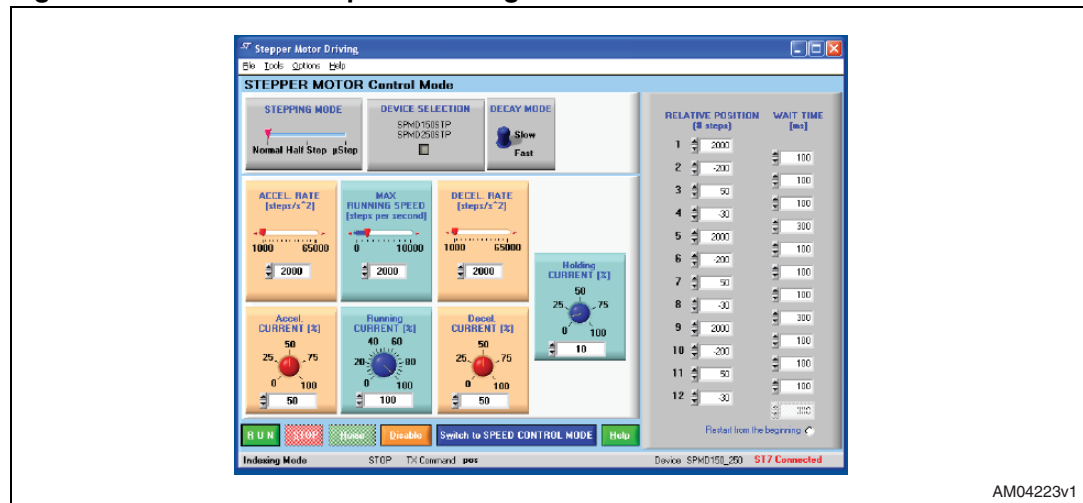
- Run: make sure that the motor is free to turn in either direction and click the run button. The motor should quickly come up to speed ( $(100 \text{ steps/sec}) / (1000 \text{ steps/sec}^2) = 0.1 \text{ sec.}$ ). To change the motor direction, click the direction toggle switch. If the motor does not run click the stop button, increase all four current settings to 50%, and click run button. If the motor still does not run an oscilloscope and current probe should be used to observe the motor current.
- Stop: click stop to stop the motor

After the basic operation of the system has been verified, the acceleration rates, top speed, and current settings can be adjusted to see how the motor responds.



## 3.2 Indexing mode

Figure 5. PractiSPIN™.spmd indexing mode window



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The system can be switched to operate in the positioning (indexing) mode by clicking on "switch to indexing mode". In the indexing mode a new box appears on the right of the screen. You can enter up to twelve indexed movements in the box and the wait time between each movement. When started, the software executes each movement by accelerating up to the peak speed, moving the required number of steps and then decelerating back to a stop so that the total distance moved is the number of steps indicated, then wait the indicated time before starting the next movement. A negative number entered in the relative position causes the motor to run in the "reverse" direction.

## 4 STEVAL-SPMD250V1, STEVAL-SPMD250V2

To make the STEVAL-SPMD250V1 and STEVAL-SPMD250V2 boards operative, perform the following simple steps:

- Connect the boards to the control board by means of the 34-wires flat cable and the control board to the host PC.
- Connect the stepper motor to the P3 and P4 connectors
- Put jumpers on JR1, JR2, JR3
- Apply 5 V to P1 connector
- Apply motor voltage VS to P2 connector
- Launch the PractiSPIN™.spmd program on the host PC
- Click on "connect to ST7 hardware" and perform calibration
  - Click on calibrate zero and verify that VTP3 is zero.
  - Click on calibrate max and set the maximum current, corresponding to 100% current setting in the PractiSPIN™.spmd software, adjusting the RV1 trimmer on the target board until the voltage on VTP3 corresponds to the motor current. The relationship between voltage/current is  $V = 0.165 I_{\text{motor}}$ .
- Click done and enter "speed control mode" or "indexing mode"

**Figure 6. STEVAL-SPMD250V1 / STEVAL-SPMD250V2 demonstration system**

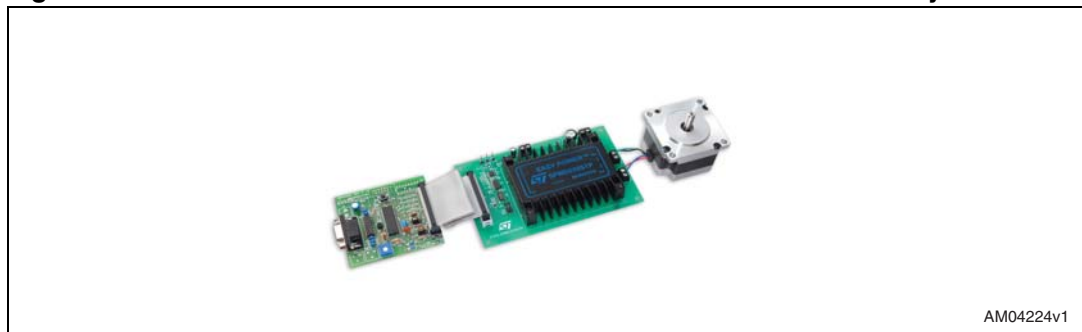
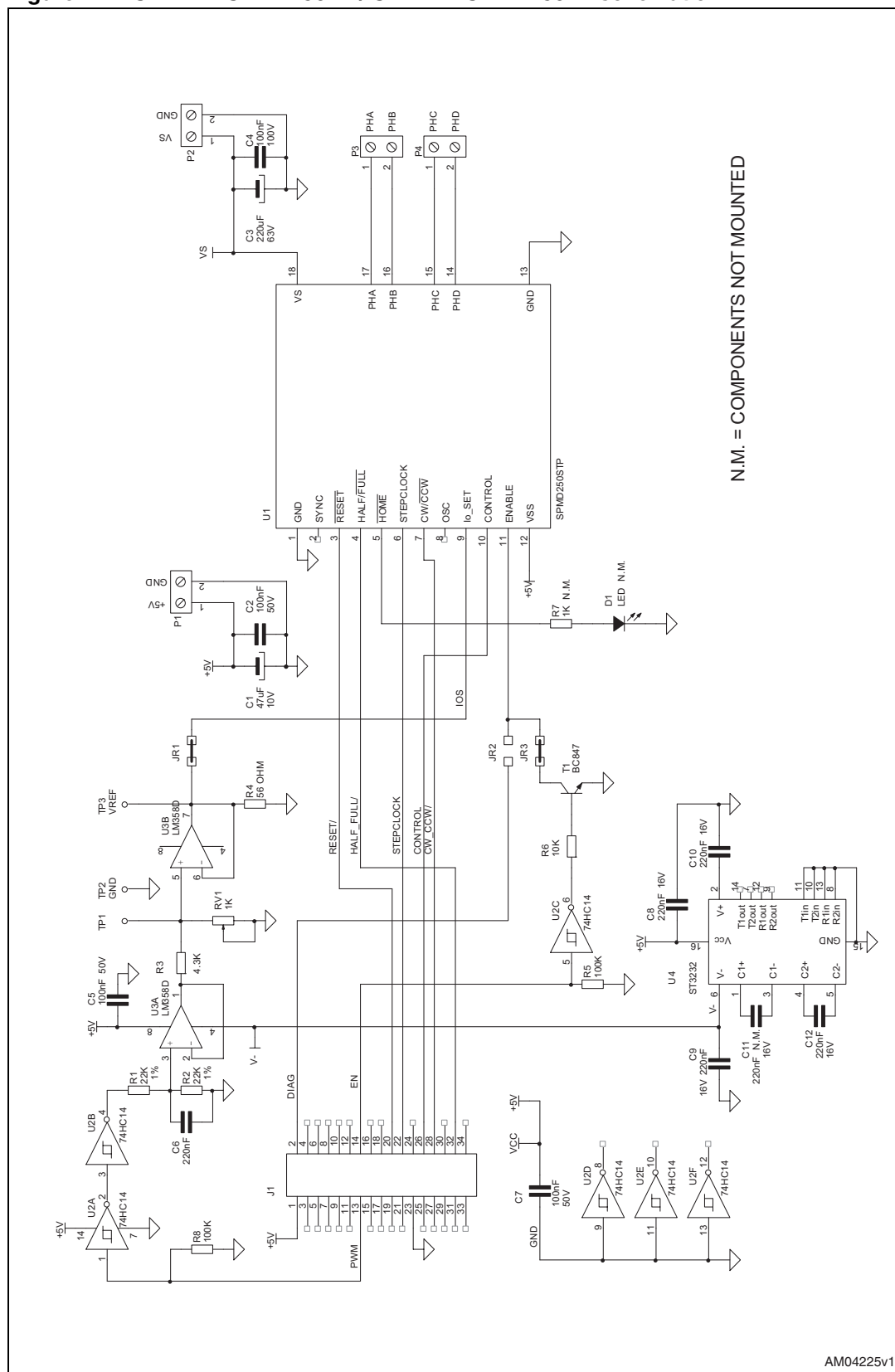


Figure 7. STEVAL-SPMD250V1 / STEVAL-SPMD250V2 schematic



## 5 STEVAL-SPMD150V1, STEVAL-SPMD150V2

To make the boards operative, perform the following simple steps:

- Connect them to the control board by means the 34-wire flat cable and the control board to the host PC
- Connect the stepper motor to P3 and P4 connector
- Put jumpers on JR1, JR2, JR3A, JR3B
- Apply 5 V to P1 connector
- Apply motor voltage VS to P2 connector
- Launch the PractiSPIN™.spmd program on the host PC
- Click on "connect to ST7 hardware" and perform calibration
  - Click on calibrate zero and trim R18 on control board until voltage on VREFA and VREFB is zero.
  - Click on calibrate max and set the maximum current, corresponding to 100% current setting in the PractiSPIN™.spmd software, adjusting RV1 (VREFA) and RV2 (VREFB) trimmers on the target board. The relationship voltage/current is  $V = 0.165 I_{\text{motor}}$
- Click done and enter in "speed control mode" or "indexing mode"

*Note:* If the internal reference of SPMD150STP is used, connect jumpers JR1, JR2, JR5, JR6; in this way the motor current is fixed and no more controlled by PractiSPIN™.spmd SW.

**Figure 8. STEVAL-SPMD150V1 / STEVAL-SPMD150V2 demonstration system**

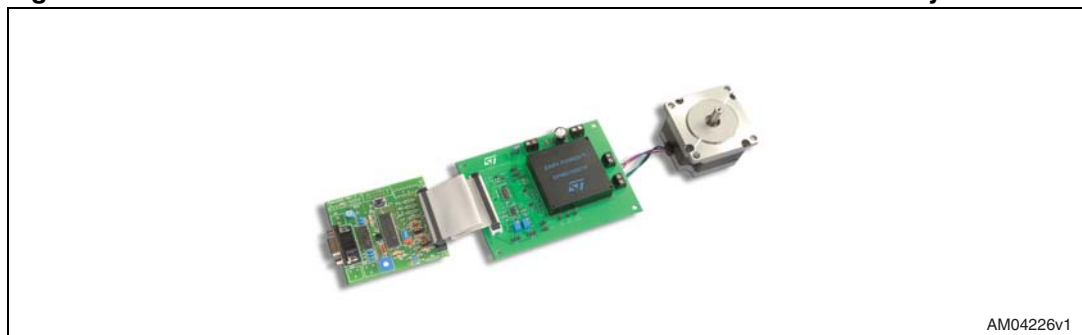
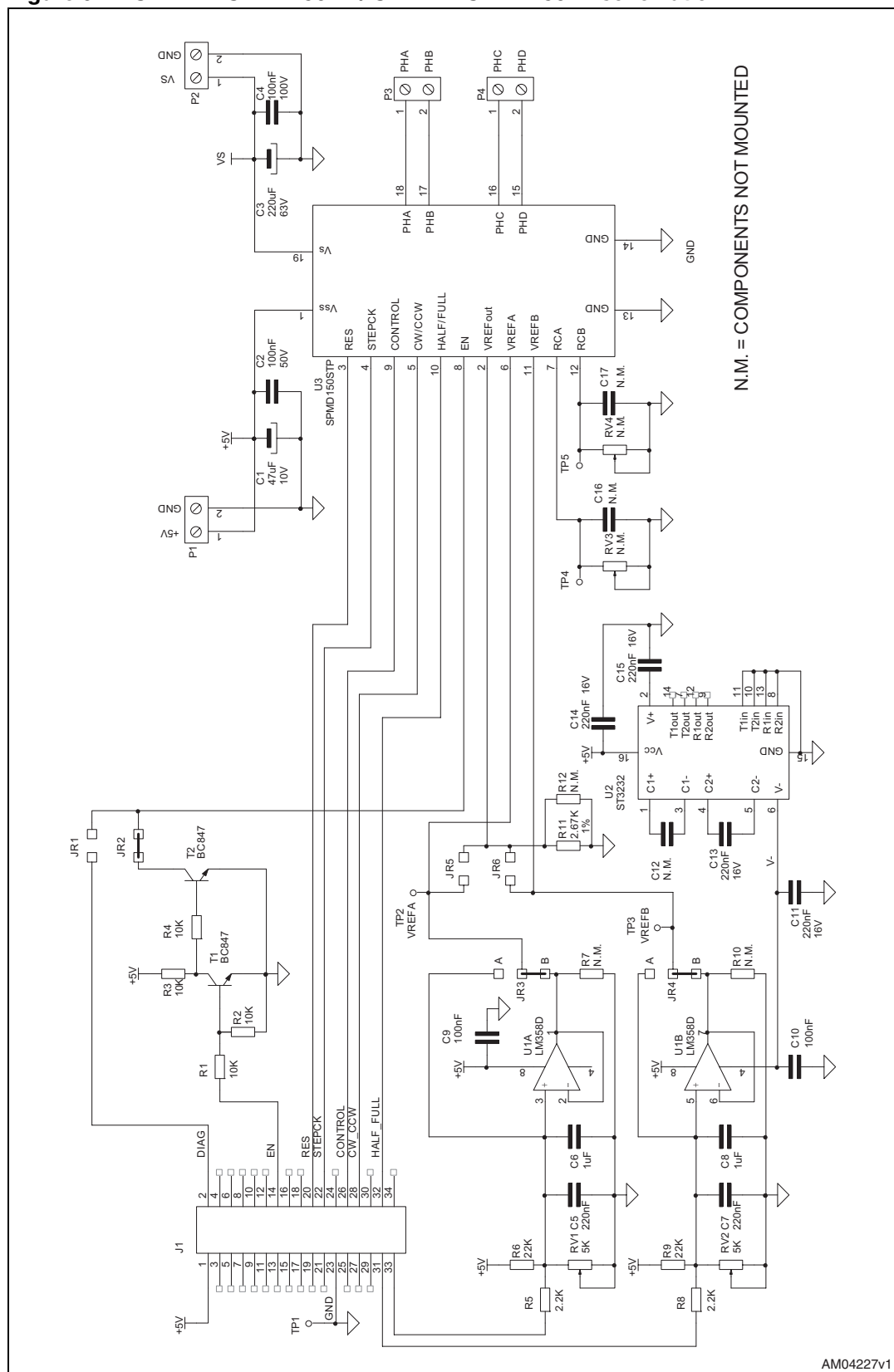


Figure 9. STEVAL-SPMD150V1 / STEVAL-SPMD150V2 schematic



## 6 Revision history

**Table 1. Document revision history**

<b>Date</b>	<b>Revision</b>	<b>Changes</b>
08-May-2009	1	Initial release.
19-Oct-2009	2	Inserted new board part numbers

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