

# EP5223LVM1-1

## *Power Application Controllers*

EP5223LVM1-1 User's Guide



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## OVERVIEW

Active-Semi's EP5223LVM1-1 development platform is a complete hardware solution enabling users not only to evaluate the PAC5223 device, but also develop power applications revolving around this powerful and versatile Cortex M0 based microcontroller. The module contains a PAC5223 Power Application Controller (MCU) and all the necessary circuitry to properly energize the MCU and its internal peripherals once power is applied.

To aid in the application development the EP5223LVM1-1 offers access to each and every one of the PAC5223 device's signals by means of a series of female header connectors.

The EP5223LVM1-1 also contains access to an external USB to UART module enabling users to connect the evaluation module to a PC computer through a conventional Virtual Comm Port which can then be used in the communication efforts by taking advantage of the PAC5223's UART interface. Graphical User Interface (GUI) software suites can be employed to externally control particular application's features.

Finally, the EP5223LVM1-1 module gives access to the PAC5223's SWD port allowing users to both program their application into the device's FLASH memory, as well as debugging the application in real time. The 4 pin connector based SWD port is compatible with a fair number of debugger/programmer modules widely available.

Active-Semi's EP5223LVM1-1 evaluation kit consists of the following:

- EP5223LVM1-1 Body module
- EP5223LVM1-1 User's Guide
- Schematics, BOM and Layout Drawings

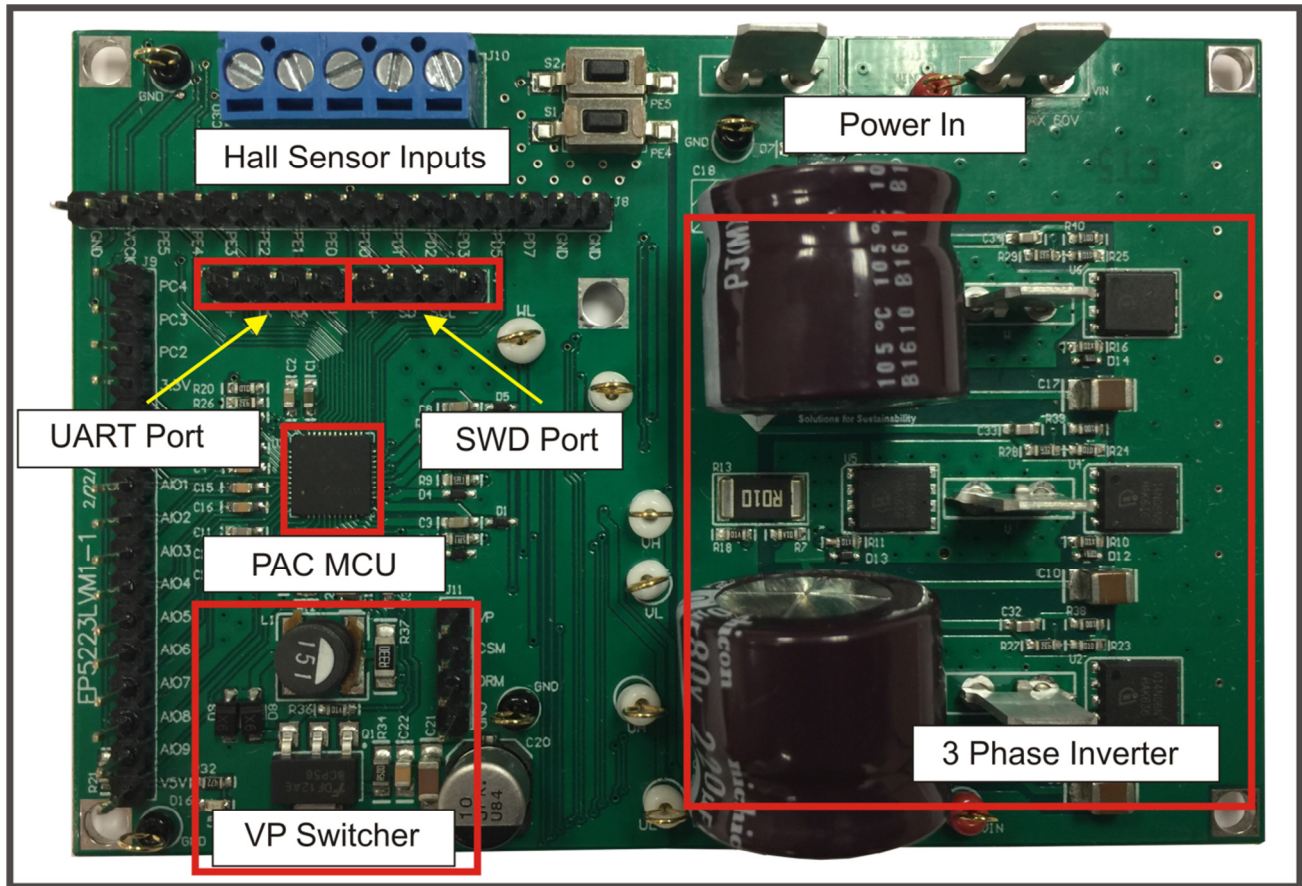


Figure 1: EP5223LVM1-1 Block Diagram

**Solution Benefits:**

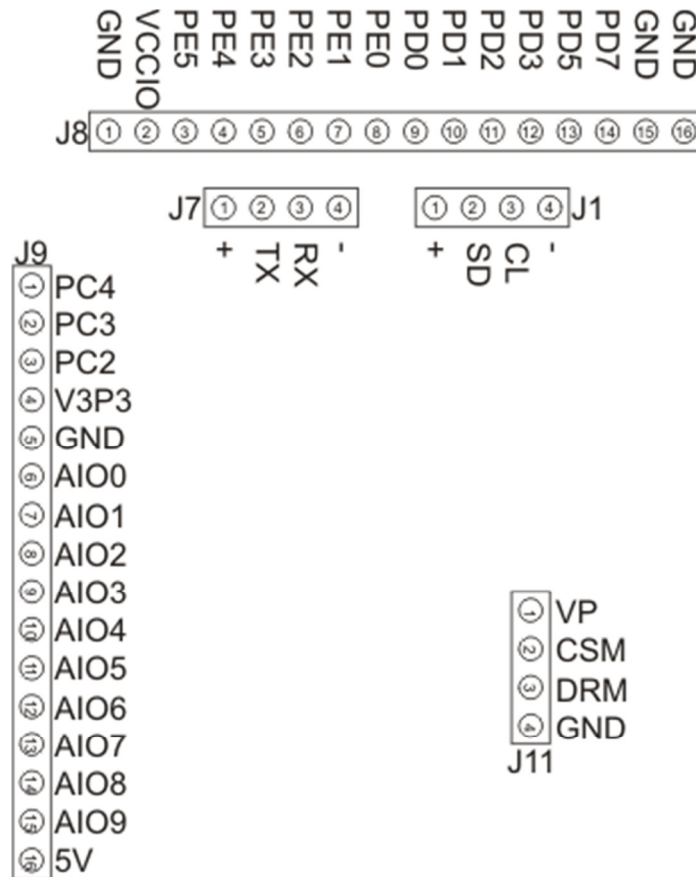
- Ideal for high voltage (up to 60V Abs Max) general purpose power applications and controllers
- Single-IC PAC5223 with 10 PWM outputs, 10 ADC inputs, I2C, UART, SPI and GPIO.
- Gate driving for up to three half H Bridge (tri phase) inverter.
- Schematics, BOM, Layout drawings available

The following sections provide information about the hardware features of Active-Semi's EP5223LVM1-1 turnkey solution.

## EP5223LVM1-1 RESOURCES

### Pinout and Signal Connectivity

The following diagram shows the male header pinout for the EP5223LVM1-1 evaluation module, as seen from above:



**Figure 2 EP5223LVM1-1 Headers and Test Stakes Pinout**

## Power Input

Power to the EP5223LVM1-1 evaluation module can be applied to the VIN and GND spade connectors. Power to the EP5223LVM1-1 evaluation module should not exceed 60V (Abs Max).

The EP5223LVM1-1 is optimized to operate with voltages ranging from 14V to 36V Nominal (60V Abs Max). When the VIN input voltage goes above 8V, the system exits UVLO protection and all subsystems, including voltage regulators, analog front end and microcontroller, are enabled.

## LED's

When an operational voltage is applied, LED D16 will light up. This is the LED which notifies VSYS (5V) rail is up and running. VP (12V gate drive), 3.3V (for analog circuitry) and 1.8V (for CPU core) regulators will also be operating at this point in time. Module is ready for use.

The following table shows the available LEDs and their associated diagnostic function.

LED	Description
D16	VSYS (5V). Light up when the PAC5223 device is successfully powered up by VIN.
D7	VIN. Lights up as VIN voltage is applied.

## SWD Debugging

Connector J1 offers access to the PAC5223 SWD port lines.

J1 Pin	Terminal	Description
1	+	VCCIO (default is 5V)
2	SD	SWD Serial Data
3	CL	SWD Serial Clock
4	-	GND (System Ground)

## Serial Communications

Connector J7 offers access to the PAC5223 UART port lines.

J7 Pin	Terminal	Description
1	+	VCCIO (default is 5V)
2	TX	MCU Transmit Line
3	RX	MCU Receive Line
4	-	GND (System Ground)

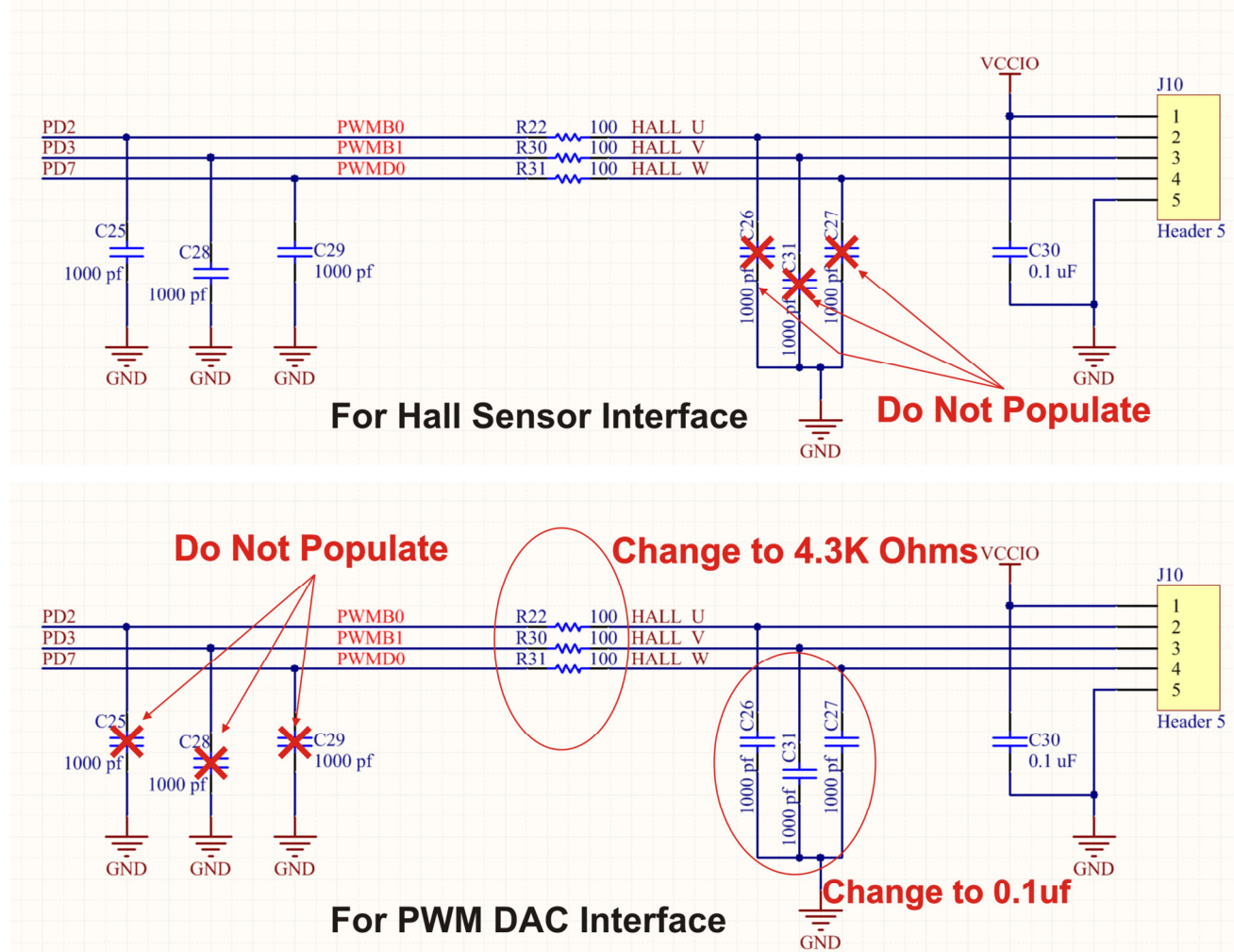
## Hall Sensor / PWM DAC Interface

Connector J10 offers access to the PAC5223 resources on PORTD utilized for hall sensor based commutation. These resources can be alternatively utilized as PWM DAC outputs for in real time debugging.

J10 Pin	Terminal	Description
1	+	VCCIO (default is 5V)
2	Hall Sensor U	PORTD2 (PWMB0 function)
3	Hall Sensor V	PORTD3 (PWMB1 function)
4	Hall Sensor W	PORTD7 (PWMD0 function)
5	GND	GND (System Ground)

## Hall Sensor / PWM DAC Interface (Continued)

The EP5223LVM1-1 module is built with the six capacitors populated (C25, C26, C27, C28, C29, C31). Depending on the interface to be utilized, the user should remove a set of three capacitors as shown below:



**Figure 7: Hall Sensor / DAC Interface Component Selection**

**NOTE:** User may also prefer to change the three resistors (R22, R30, R31) and three capacitors (C26, C27, C31) values depending on the employed PWM frequency. For provided FW default frequencies, 4.3K resistors and 0.1 uF ceramic capacitors have been tested to provide desirable results.



## EP5223LVM1-1 SETUP

The setup for the EP5223LVM1-1 evaluation module requires up to four simple connections.

1. Connect the VIN power source via spade tab connectors VIN and GND. As VIN power is applied, the LED D7 will light up. Once VIN voltage goes above 8V, the PAC5223's Multi Mode Power Manager will be engaged and the VSYS (5V) regulator will be enabled. This event will result in LED D16 lighting up.
2. Connect the 3 Phase BLDC/PMSM motor via space tab connectors PHASE U, PHASE V and PHASE W.
3. If Serial Communications are desired, connect the USB to UART module 4 pin connection to J7.
4. For debugging/programming, connect a suitable USB SWD module to J1 by using a standard 4 wire cable.

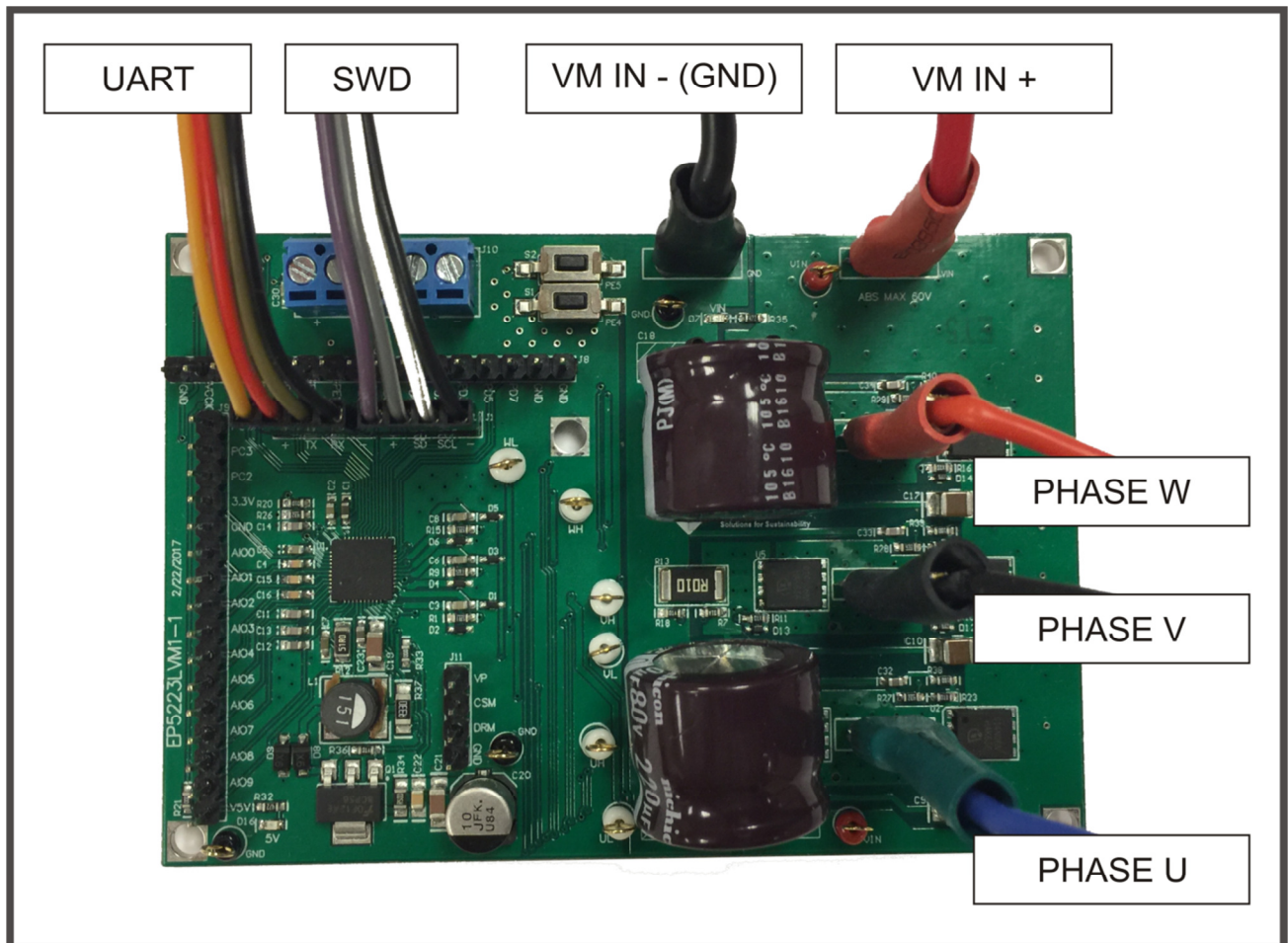


Figure 7: EP5223LVM1-1 Evaluation Module Connections

## ABOUT ACTIVE-SEMI

Founded in 2004 in Silicon Valley and headquartered in Allen, Texas, Active-Semi is a rapidly emerging leader in the multi-billion dollar power management IC and intelligent digital motor drive IC markets. The company's portfolio of analog and mixed signal SoCs (systems-on-chips) are scalable core platforms used in charging, powering and embedded digital control systems for end applications such as industrial, commercial and consumer equipment. The company offers power application microcontrollers, DC/DC, AC/DC, PMU and LED drivers that significantly reduce solution size and cost while improving system-level reliability. Active-Semi's turnkey solutions deliver energy-saving power conversion architectures that minimize energy usage and compress system development cycle-time by greater than 50 percent. Active-Semi ships 50 million power ICs per quarter and reached the "one billion units shipped" milestone in May 2012. The multi-national company focuses on commercializing industry leading power management IC solution platforms and has developed broad intellectual property with over 150 patents granted and pending. For more information visit: <http://active-semi.com/>

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