# Wake-on-Shake User's Guide

The Wake-on-Shake is intended to allow you to design a project which will remain inert for long periods of time (possibly up to several years, depending on the battery type used to power the project) until someone bumps, touches, or moves it. Its extremely low power consumption (<2uA @ 3.7V) means that, in most cases, aging related self-discharge of the battery is the limiting factor of the deployed lifespan.

Operation of the device is simple: connect a power supply (2.0-5.5V) to the input side, a circuit to the output side, and you're done! By default, the board will activate the load when it experiences a mild bump or tilt; the load will be powered for 5 seconds after that. Using a serial data connection, the sensitivity can be increased or decreased, as can the delay time.

Additionally, the "WAKE" pin allows the load to control when its power is discontinued. By pulling the wake signal positive (to at least 2.7V), the load will remain energized until it releases the pin.

While it is possible to connect the load to the on-board serial port, allowing the load to access the ADXL362 and EEPROM storage of the ATTiny2313A, caution must be exercised when doing this to avoid sourcing current to the load through the serial port data lines on the ATTiny2313A, which could damage the ATTiny2313A as well as causing excessive off-state power dissipation.

Connection Reference
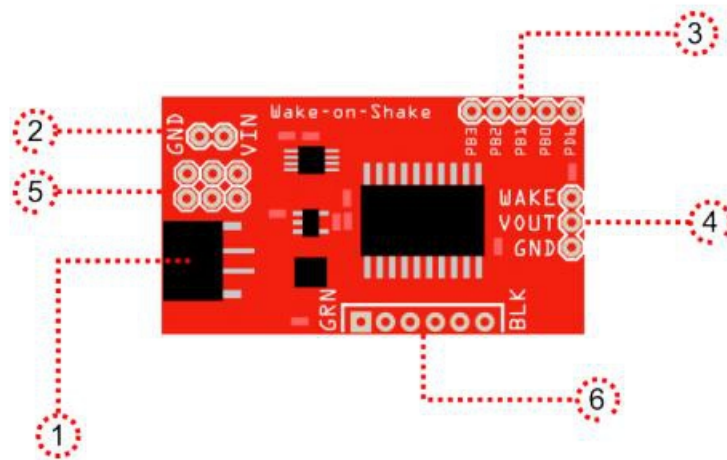
1. 2.0mm JST connection for power input: mates to SparkFun's single-cell LiPo batteries, or to SparkFun cable PRT-09914.

2. .1" header connection for power input

3. .1" header for I/O pins: pulls out the unused pins from the ATTiny2313A- PB0:3 and PD6. Serial commands exist to read and write the status of these pins.

4. .1" header connection for load: power, ground, and wake. When held above ~2.7V, the wake line will force the pass transistor on the Wake-on-Shake to remain on until it is released, to allow the load to gate its own power for as long as needed.

5. ISP header: standard 6-pin AVR programming header for the ATTIny2313A. No bootloader is available on this device.

6. Serial header: mates to 3.3V SparkFun FTDI Basic boards (DEV-09873) or 3.3V FTDI usb-to-serial cables (DEV-09718).

Electrical Specifications

Parameter	Min	Typ	Max
Supply Voltage[1]	2.0V	3.7V	5.5V
I_q (active mode)[2]		520uA	
I_q (sleep mode)[3]	<1uA		2uA
I_{pass}			2A
Pass element $R_{ds(on)}$		350mΩ	
Wake signal	2.7V	3.3V	15V

[1]: Exceeding this voltage may damage the Wake-on-Shake.

[2]: Without any load connected at 3.7V.

[3]: At 3.7V.

Communication Settings

- Baud rate: 9600bps

- Data size: 8 bits

- Parity: none

- Stop bits: 1

- Voltage level: 3.3V

Command Reference

Standard commands

- t<0-2048><cr>|<lf> - Set the threshold level at which the device will wake from sleep. Default value from the factory is 150mg- for most applications, this is sensitive enough. Accepts a number between 0 and 2,048.

- d<2000-65535><cr>|<lf> - Set the delay between wake up and return to sleep. Default value is 5s. This number is in milliseconds and can range from 2,000 to 65,535.

- z – Send the device to sleep. Functionally, this simply moves the sleep timer close to zero, giving the device a chance to wrap up any bookkeeping it needs to do before powering down. Typically, sleep mode will occur within about 35ms of the device receiving this command.

Power user commands

- p<0-3 | 6> - Print the state ('1' or '0') of the appropriate pin on the .1" header on the board. Number corresponds to the number of the pin, i.e., 0 is PB0, 1 is PB1, and 6 is PD6.

- L<0-3 | 6> - Drive the appropriate pin on the .1" header low.

- H<0-3 | 6> - Drive the appropriate pin on the .1" header high.

- b<0-255><cr>|<lf> - Place an 8-bit value into the device's write buffer. This value can be written to either an arbitrary EEPROM address -or- to an arbitrary register in the ADXL362, depending on the next command.

- w<0-64><cr>|<lf> - Write the previously buffered value into the register of the ADXL362 specified in this command. Please refer to the ADXL362 datasheet for information about the registers.

- e<0-127><cr>|<lf> - Write the previously buffered value into the ATTiny2313A EEPROM memory at the address specified in this command. This can be used to store data in non-volatile memory by the user's application, or to alter operational settings not normally exposed to the user.

- r<0-64><cr>|<lf> - Print the contents of specified ADXL362 register to the serial port.

- E<0-127><cr>|<lf> - Print the contents of specified ATTiny2313A EEPROM address to the serial port.

EEPROM Memory Space Reference

The Wake-on-Shake uses on-board EEPROM memory to store configuration parameters even if power is removed. The EEPROM is exposed through the serial interface; users can alter these values as they see fit. The most important parameters are the on-time delay and the motion sensitivity; these have their own special commands.

There are three other things stored in EEPROM memory that advanced users may want to explore: the inactivity threshold, the inactivity time delay, and the key address.

The key address is used to record whether the EEPROM values have been configured or not. On the first power up, the firmware will check to see if that location is set to a specific value (123), and if not, will initialize the other memory locations, along with the key address itself. A reset to factory settings can be forced by writing this location to any value other than 123 and power cycling the board.

The inactivity threshold is level below which the ADXL362 must sense before it resets and begins waiting for motion again. By default, this is 50mg.

The inactivity time delay is the time the motion threshold must be below the inactivity threshold before the reset to motion trigger occurs. By default, this value is 15, which translates to about 2.5 seconds.

Addr	Name	Default	Description
0-1	ATHRESH	150	Activity threshold setting (0-2048)
2-3	WAKE_OFFS	5000	Time after wake-up before returning to sleep mode (0-65535)
4-5	ITHRESH	50	Inactivity threshold setting (0-2048)
6-7	ITIME	15	# samples (12.5Hz) below ITHRESH before wake interrupt enabled
127	KEY_ADDR	123	If != 123, restore EEPROM locations to defaults.