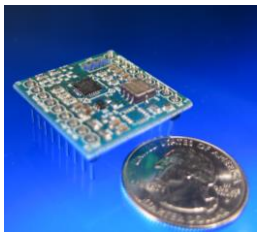
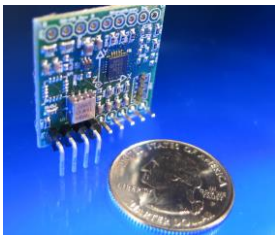
DATASHEET

SQ-SVS

SOLID-STATE VIBRATION SENSOR
WITH DUAL ANALOG OUTPUTS


SQ-SVS-HMP


SQ-SVS-VMP

FUNCTION

- 0.005 - 2 g dual axis vibration measurement

APPLICATIONS

- Motor vibration measurement and monitoring
- Vibration alarm triggering
- Fan motors, vehicle motors, machine motors

FEATURES

- 15 % accuracy
- 0.005 g resolution
- 2 g dual axis vibration range
- 1 Hz - 500 Hz bandwidth, 1 second averaging period
- Programmable alarm outputs
- Low temperature drift
- Factory calibrated average vibration output
- High reliability solid-state MEMS
- Digital filtration for stable measurement
- Direct PC interface cable

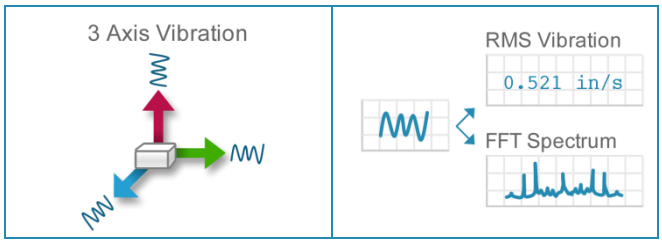
DESCRIPTION

The vibration sensor module performs calibrated averaging (root mean squared) vibration measurement with analog voltage and digital serial outputs. Because acceleration signals are extremely fast by nature, they require high speed sampling and computationally intensive processing to measure. The onboard RMS computation provides a slow moving output that can be easily measured by a low speed system to monitor the average vibration level, greatly simplifying vibration monitoring and measurement.

THEORY OF OPERATION

The vibration sensor uses 2 factory calibrated accelerometers to measure and compute combined RMS acceleration. The calibration and RMS calculations are made by an onboard processor. Additional processing filters spurious acceleration and vibrations to reduce the impact on the resulting output angle.

FUNCTIONAL DIAGRAM



TRANSFER FUNCTION

$$AveragePower(mgRMS) = \frac{Output(\mathrm{V}) - Offset(\mathrm{V})}{Sensitivity(V\ /\ mgRMS)}$$

RANGE AND SCALE

VIB1 Output

PARAMETER	UNITS	VALUE
Scale Factor	V/mgRMS	0.00253
Offset (0 mgRMS value)	V	0.147
Max (1175 mgRMS value)	V	3.121

VIB2 Output

PARAMETER	UNITS	VALUE
Scale Factor	V/mgRMS	0.00127
Offset (0 mgRMS value)	V	0.147
Max (2350 mgRMS value)	V	3.121

Thresholds

PARAMETER	UNITS	VALUE
Threshold 1	mgRMS	25
Threshold 2	mgRMS	250

* Thresholds can be customized at the factory to suit the application

10 Water St.
Lebanon, NH 03766 USA
Tel: 603.448.6266
Fax 603.218.6426
www.signalquest.com
info@signalquest.com

TABLE OF CONTENTS

10 Water St.
Lebanon, NH 03766 USA
Tel: 603.448.6266
Fax 603.218.6426
www.signalquest.com
info@signalquest.com

ABSOLUTE MAXIMUM RATINGS

PARAMETER	MIN	TYPICAL	MAX	NOTES
Voltage on +*Vcc* - without regulator - NR option	0.3 V		4.2 V	with respect to GND
Voltage on +*Vcc* - with regulator - R option	0.3 V		5.8 V	
Voltage on any input pin			5.8 V	with respect to GND
Peak-to-peak supply noise - without regulator -NR option			50 mV	
Peak-to-peak supply noise - with regulator - R option			200 mV	
Operating temperature	-40 ° C		85 ° C	
Shock survivability			500 *g*	where 1 *g* is assumed to be = 9.81 m/s^2
Operating vibration			1.7 *g*	models available up to 70 g

Note: Exposure to conditions outside of the Absolute Maximum Ratings may damage the device. Prolonged exposure to conditions at the Absolute Maximum Ratings may result in degraded performance of the device over time.

ELECTRICAL CHARACTERISTICS

[Test conditions: 3.3v regulator, 25 ° C unless otherwise specified]

PARAMETER	MIN	TYPICAL	MAX	NOTES
Supply voltage - without regulator - NR option	2.9 V		3.5 V	with respect to GND
Supply voltage - with 3.0 volt regulator - 3.0R option	3.2 V		5.8 V	12 V tolerant versions also available. Consult factory.
Supply voltage - with 3.3 volt regulator - 3.3R option	3.5 V		5.8 V	
Supply current	see note	10 mA		models available with average current of 20 uA (0.020 mA).
Output voltage*	0.3 V		0.9 × *Vcc*	See note below regarding Vcc.
Analog output current			20 µA	
Sensitivity*		0.0022 × *Vcc* / °		See note below regarding Vcc.
Full-scale output range*	0.100 × *Vcc*		0.895 × *Vcc*	See note below regarding Vcc.
Input voltage High	2.0 V			
Input voltage Low			0.8 V	

***Note:** For the NR model (without onboard regulator), *Vcc* is the voltage supplied to the device. For the 3.0R and 3.0R models (3.0 V or 3.3 V onboard regulators), *Vcc* is 3.0 V or 3.3 V respectively. If your application requires using a 12 V supply, consult factory for 12 V tolerant models.

10 Water St.
Lebanon, NH 03766 USA
Tel: 603.448.6266
Fax 603.218.6426
www.signalquest.com
info@signalquest.com

PERFORMANCE PARAMETERS

PARAMETER	TYPICAL	NOTES
Analog Range Vib1 Analog Range Vib2	0 – 1175 mgRMS 0 – 2350 mgRMS	
Analog Scale Factor Vib1 Analog Scale Factor Vib2	0.00253 V/ mgRMS 0.00127 V/ mgRMS	1000 mg = 1 g, 1 g = 9.8 m/s^2
Analog Offset value	0.147 V	0 mgRMS
Max Output Vib1 Max Output Vib2	3.121 V 3.121 V	1175 mgRMS 2350 mgRMS
Effective sampling resolution	12+ bits	
Acceleration accuracy	+/- 15%	High accuracy models also available

OUTPUT CHARACTERISTICS

PARAMETER	TYPICAL	NOTES
Analog output resolution	8 bit	9 bit actual resolution after PWM reconstruction filter
PWM modulation frequency	5 kHz to 20 kHz	
PWM reconstruction filter bandwidth	10 Hz	Single pole RC
Analog output impedance	10 kΩ	

PRECONFIGURED MODEL COMPARISON

PARAMETER	MODEL 1	MODEL 2	MODEL 3	UNITS	NOTES
Sample rate	1000	1000	1000	Hz	
Vibration bandwidth	1 - 500	10 - 100	10 - 100	Hz	
RMS averaging period	2.0	1.0	0.2	s	
Process noise	3	3	4	mgRMS	Resting state output will be approximately equal to the process noise.
Update rate	2	5	5	mS	Analog update rate and serial packet rate
Warm up time from power on	2.0	2.0	0.2	s	
Analog Range Vib1	0 – 1175	0 – 1175	0 – 1175	mgRMS	1000 mg = 1g, 1g = 9.8 m/s^2
Analog Range Vib2	0 – 2350	0 – 2350	0 – 2350	mgRMS	1000 mg = 1g, 1g = 9.8 m/s^2
Analog Scale Factor Vib1	0.00253	0.00253	0.0253	V/mgRMS	
Analog Scale Factor Vib2	0.00127	0.00127	0.00127	V/mgRMS	
Analog Offset value	0.147	0.147	0.147	0.147	Output at 0 mgRMS
Max Output Vib1	3.121	3.121	3.121	3.121	
Max Output Vib2	3.121	3.121	3.121	3.121	
Effective sampling resolution	12	12	12	12	
Acceleration accuracy	+/- 15	+/- 15	+/- 15	+/- 15	High accuracy models also available

10 Water St.
Lebanon, NH 03766 USA
Tel: 603.448.6266
Fax 603.218.6426
www.signalquest.com
info@signalquest.com

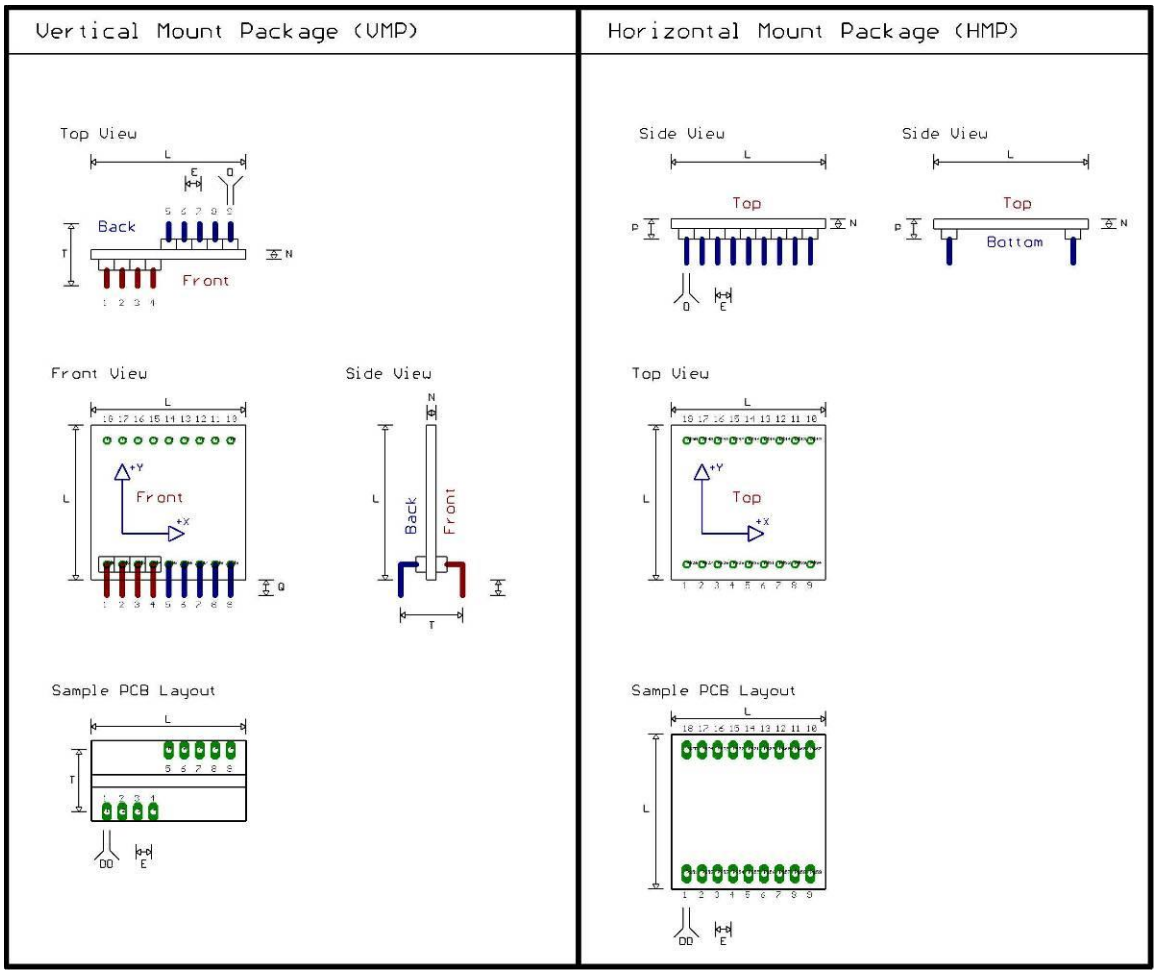
PIN CONFIGURATION

PIN	SIGNAL NAME	USAGE
1	Ground	
2	UART Transmit	Digital Output – UART transmit line. Push-pull (not open collector). If not used, solder to open circuit for mechanical stability. **Do not** connect to GND or current drain will increase.
3	UART Receive	Digital Input – UART receive line. If not used, **solder to V+.**
4	Baud Select	Digital Input – High (or open) selects high baud rate, Low selects low baud rate. If not used, **solder to V+.**
5	+Vcc Supply	
6	Vib1	Analog Output – **At power-up this signal bounces high until internal filters' initial conditions settle out.** If not used, solder to open circuit for mechanical stability. **Do not** connect to GND or current drain will increase.
7	Vib2	Analog Output – **At power-up this signal bounces high until internal filters' initial conditions settle out.** If not used, solder to open circuit for mechanical stability. **Do not** connect to GND or current drain will increase.
8	Logic	Digital Input – High (or open) selects Active High logic output on triggers, Low selects Active Low logic output on triggers. Solder to open circuit for mechanical stability if not used. **Do not** connect to GND.
9	Noise Estimator	Solder to open circuit for mechanical stability. **Do not** connect to GND
10	NC	Solder to open circuit for mechanical stability. **Do not** connect to GND
11	Trigger 1	Digital Output - Transitions logic level when trigger threshold is exceeded. Configure Logic pin to set this as High→Low or Low→High. Solder to open circuit for mechanical stability if not used. **Do not** connect to GND. Low output impedance.
12	Trigger 2	Digital Output - Transitions logic level when trigger threshold is exceeded. Configure Logic pin to set this as High→Low or Low→High. Solder to open circuit for mechanical stability if not used. **Do not** connect to GND. Low output impedance.
13	NC	Solder to open circuit for mechanical stability. **Do not** connect to GND
14	NC	Solder to open circuit for mechanical stability. **Do not** connect to GND
15	/Reset & Prog 1	Digital Input – Active low reset. Bring low for >10 mS to reset device. If not used, solder to open circuit for mechanical stability. **Do not** connect to GND. Also used for FLASH programming.
16	Prog 2	Digital Input – If not used, solder to open circuit for mechanical stability. **Do not** connect to GND. Also used for FLASH programming.
17	NC	Solder to open circuit for mechanical stability. **Do not** connect to GND
18	NC	Solder to open circuit for mechanical stability. **Do not** connect to GND

***Note:** Grey boxes indicate a function is available only on a custom application basis. NC means "no connection".

10 Water St.
Lebanon, NH 03766 USA
Tel: 603.448.6266
Fax 603.218.6426
www.signalquest.com
info@signalquest.com

SQ-SVS SERIES PACKAGE



DIMENSIONS

DIMENSION	MILLIMETERS	INCHES	DESCRIPTION	NOTES
T	10.16	0.40	N/A	Pin center to center
L	25.40	1.00	Side length	
E	2.54	0.10	Pitch	Pin center to center
D	0.80	0.032	Pin diameter	
DD	1.00	0.040	Hole diameter	
N	1.63	0.064	PCB thickness	
S	20.32	0.80	Pin row spacing	Not shown on drawing

10 Water St.
Lebanon, NH 03766 USA
Tel: 603.448.6266
Fax 603.218.6426
www.signalquest.com
info@signalquest.com

DESIGN, LAYOUT, AND ASSEMBLY CONSIDERATIONS

1. Since the device is a subassembly of surface mount components, it is not suitable for automatic assembly or wave soldering.
2. Hand soldering of pins or SMT pads is specified for 3 seconds at 218 ºC.
3. Pins labeled NC (no connect) should be soldered to open connection pads / pins for mechanical stability.
4. The designer should test the device's output voltage through its entire desired angle range during prototyping to ensure that it is working properly in the application.
5. The device can be mounted vertically or horizontally, but the direction must be oriented correctly to measure the desired angles.
6. It is recommended that pins designated "future" be connected for forward compatibility.

DIGITAL SERIAL INTERFACE

UART FORMAT: 8-N-1

8 data bits, 1 stop bit, no parity, no flow control: 115,200 baud. (Available in 19,200 baud by special order, with vibration output only.)

One byte commands can be sent from the host to control various functions of the device. The following commands can be sent to the devices via the UART. The data encoding is HEX, not ASCII.

Interrogate

0x01 (Interrogate Mode command)
The device echoes 1 data packet [10 bytes] after receiving the Interrogate Mode command. The maximum delay between a request and the data packet response is 1 Update Period. The host should not issue a new Interrogate Mode command until it has received the previous data packet.

Stream

0x02 (Stream Mode command)
The device begins sending data packets [10 bytes] continuously at the given Update Rate. The maximum delay between a request and the first data packet response is 1 Update Period.

Reset

0x83 (Reset command)
The device initiates its Power-on Reset sequence (see Power-on Reset below).

RESET SOURCES

Power-on Reset and RST pin

When the device is disconnected from power it reverts to its default settings in Interrogate Mode. It transmits 1 data packet [10 bytes] after its Warm Up time to indicate that measurements are stabilized.

10 Water St.
Lebanon, NH 03766 USA
Tel: 603.448.6266
Fax 603.218.6426
www.signalquest.com
info@signalquest.com

SERIAL PACKET FORMAT

	BYTE	NAME	NOTES
Header	0	Sync byte 1	0xFE
	1	Sync byte 2	0xFE
Payload	2	Vib 1 (high byte)	*Output_Value = Measured_Vibration(mgRMS).* For example, a measured vibration of 1275 mgRMS results in an output value of 1275.
	3	Vib 1 (low byte)	
	4	X Accel (high byte)	Format: 16-bit, signed integer. *Output_Value = Measured_Acceleration(mg).* For example, a measured acceleration of 1.275 g results in an output value of 1275.
	5	X Accel (low byte)	
	6	Y Accel (high byte)	
	7	Y Accel (low byte)	
Checksum	8	Checksum (high)	Format: 16-bit, unsigned integer sum of the 16 bit unsigned integer payload values. The checksum **does not** include the two sync bytes (0xFE 0xFE).
	9	Checksum (low)	

10 Water St.
Lebanon, NH 03766 USA
Tel: 603.448.6266
Fax 603.218.6426
www.signalquest.com
info@signalquest.com

ORDERING GUIDE

OPTIONS	CODE	OPTION	NOTES
Preconfigured model	-1	Model 1	1 – 500 Hz bandwidth. See Preconfigured Model Comparison above for more details.
	-2	Model 2	10 – 100 Hz bandwidth. See Preconfigured Model Comparison above for more details.
Power regulator option	-NR	No onboard regulator	Special order only
	-3.0R	3.0 V onboard regulator	Special order only
	-3.3R	3.3 V onboard regulator	Standard version (stock)
Pin package option	-HMP	Horizontal mount package	Fits into standard 0.100” grid circuit board
	-VMP	Vertical mount package	Available for SQ-SI family only
	-NP	No pins installed	Fits inside potting box enclosures (SQ-ENCL-1)
Trigger options	-T1[value]	Trigger 1	Specify value in mgRMS i.e. 25 for 25 mgRMS
	-T2[value]	Trigger 2	Specify value in mgRMS i.e. 250 for 250 mgRMS
RoHS (lead free)	-E	RoHS complaint, lead free	
Other option	-Custom	Customer-specific requirements	Please contact SignalQuest if you require an option not listed in this table. For example, various baud rates, setting times, update rates and voltage regulator options may be available on request.

EXAMPLE PART NUMBER

SQ-SVS-1-3.3R-HMP

ACCESSORIES

PART NUMBER	DESCRIPTION
SQ-USB2-TTL	▪ Self-powering USB cable used to directly connect device to a PC. ▪ Installs a “virtual COM port” on host PC (i.e. COM 3). ▪ Converts PC voltage levels to device voltage levels and supplies power. ▪ Allows multiple devices to be easily connected to a single computer. ▪ Compatible with SignalVIEW real time display and data logging software.

10 Water St.
Lebanon, NH 03766 USA
Tel: 603.448.6266
Fax 603.218.6426
www.signalquest.com
info@signalquest.com

	▪ DLL provide for custom application development in VC++, C#, or VB etc.
SQ-RS232-TTL	▪ Same as above cable, but external power is required for devices without –LP option.
SQ-ENCL-1	▪ Potting box enclosure. Potting box enclosure. Fits models without pins installed (-NP option).

10 Water St.
Lebanon, NH 03766 USA
Tel: 603.448.6266
Fax 603.218.6426
www.signalquest.com
info@signalquest.com

LIMITATIONS AND WARNINGS

Life safety

This product is not designed for use in life support and/or safety equipment where malfunction of the product can reasonably be expected to result in personal injury or death. Buyer uses this product in such applications at Buyer's own risk and agrees to defend, indemnify, and hold harmless SignalQuest, LLC from any and all damages, claims, suits, or expenses resulting from such misuse.

TESTING

The performance of each system is verified through build-time testing. Each system is tested before and after factory calibration to ensure reliable performance.

SYSTEM INTEGRATION TESTING

Thorough testing should be carried out prior to product release to insure system integration has not introduced unforeseen problems. The system integrator assumes the ultimate responsibility for the safety of the target application.

NOTICE

Information furnished by SignalQuest, Inc is believed to be accurate and reliable. However, this document may contain ERRORS and OMMISIONS. Accordingly, the design engineer should use this document as a reference rather than a strict design guideline and should perform thorough testing of any product that incorporates this or any other SignalQuest product. No responsibility is assumed by SignalQuest, LLC for this use of this information, or for any infringements of patents or other rights of third parties that may result from its use. Specifications are subject to change without notice. No license is granted by implication or otherwise under any patent or patent rights of SignalQuest, LLC Trademarks and registered trademarks are the property of their respective companies.

FURTHER INFORMATION

For pricing, delivery, and ordering information, please contact SignalQuest at (603) 448-6266
For updates on this and other documents, visit our website at www.signalquest.com

10 Water St.
Lebanon, NH 03766 USA
Tel: 603.448.6266
Fax 603.218.6426
www.signalquest.com
info@signalquest.com