



KNOWLES MEMS MICROPHONES FOR FULL
RANGE AUDIO AND ULTRASONIC APPLICATIONS
(CONSUMER) SELECTION GUIDE



VOICE VIBRATION SENSORS

The **V2S200D** is a high bandwidth, low-power specialized vibration sensor which improves voice call quality in noisy environments and windy conditions. It offers over 50dB acoustic isolation in noisy environments (bars, airports, windy outdoor spaces). The PDM interface facilitates seamless integration on a PDM bus together with a traditional PDM microphone and its port-less package makes it robust to particles and liquid ingress. Listen to the V2S200D difference on www.knowles.com/V2S.

	SENSOR	DESCRIPTION	SIZE	SNR*	1% THD	CURRENT	
V2S	V2S200D On flex: KAS-700-0177 *NEW*	Voice Vibration Sensor with PDM output	3.30 × 2.30 × 0.93mm	64.5 dB (A) (BW=100Hz-4kHz)	> 10g	290µA @ 768kHz 700µA @ 2.4MHz	

* SNR specs apply to normal mode. For low power mode specs, refer to the datasheet.

MEMS MICROPHONES

Knowles is the world leader in MEMS microphones across the Mobile, Ear, and IoT markets and has shipped close to 20 billion units to date. Design variables include ever-smaller sizes, lower profiles and mounting options, increased output capacities, and new digital audio options that eliminate analog noise. For manufacturers, surface mount designs eliminate off-line subassembly production costs. Our microphones have been used in applications from smart speakers and mobile phones to remote controls, automotive, laptops, smart home products, headphones and more. Let us help you choose the right microphone for your project.

DIGITAL (PDM) MICROPHONES

	MICROPHONE	DESCRIPTION	SIZE	SNR*	LFRO	1% THD 10% THD*	CURRENT	
DIGITAL	Hyperion SPK18R1LM4H-1 *NEW*	High SNR, low power, low latency for OTE	4.00 × 3.00 × 1.20mm	70.5 dB(A)	21Hz	125dB SPL 128dB SPL	200µA @ 768kHz 450µA @ 2.4MHz	
	Titan SPH18R1LM4H-1 On flex: KAS-700-0172 *CUSTOMER FAVORITE*	High SNR, low power, low latency for TWS	3.50 x 2.65 x 1.00mm†	68.5 dB(A)	30Hz	123 dB SPL 129 dB SPL	190µA @ 768kHz 430µA @ 2.4MHz	
	Cameron SPW0690LM4H-1 On flex: KAS-700-0146	Smallest and Thinnest Digital	3.10 x 2.50 x 0.85mm	66.5 dB(A)	45Hz	118 dB SPL 135 dB SPL	270µA @ 768kHz 1000µA @ 2.4MHz	
	Cornell II SPH0655LM4H-1 On flex: KAS-700-0153 *CUSTOMER FAVORITE*	Superior 1% THD performance	3.50 x 2.65 x 0.98mm	66 dB(A)	25Hz	130.5 dB SPL 132.5 dB SPL	260µA @ 768kHz 1000µA @ 2.4MHz	
	Luiso SPH0141LM4H-1 On flex: KAS-700-0157	Entry tier digital	3.50 x 2.65 x 0.98mm	64 dB(A)	45Hz	108 dB SPL 121 dB SPL	235µA @ 768kHz 620µA @ 2.4MHz	

† Also available in smaller package sizes. Please contact a Knowles representative.

ANALOG MICROPHONES

	MICROPHONE	DESCRIPTION	SIZE	SNR*	LFRO	1% THD 10% THD*	CURRENT	
ANALOG	Raptor SPK01A0LR5H-1 <i>*NEW*</i>	High SNR, high AOP, single-ended	4.00 x 3.00 x 1.20mm	72 dB(A)	17Hz	122 dB SPL 130 dB SPL	175µA @ 2.75V 180µA @ 3.6V	
	Falcon SPH11C3LR5H-1 On flex: KAS-700-0165	Differential 1.8 and 2.7V	3.50 x 2.65 x 1.00mm	68.5 dB(A)	32Hz, 18Hz †	125 dB SPL 134 dB SPL	67µA @ 1.8V 200µA @ 2.75V	
	Robin SPV61A0LR5H-1 On flex: KAS-700-0170 <i>*CUSTOMER FAVORITE*</i>	Single-ended Tochi 2 upgrade	2.75 x 1.85 x 0.90mm	66 dB(A)	35Hz	130 dB SPL 133 dB SPL	175µA @ 2.75V	
	Tochi 2 SPV21A0LR5H-1V On flex: KAS-700-0171	Single-ended Superior 1% THD performance	2.75 x 1.85 x 0.90mm	64.5dB(A)	35Hz	132 dB SPL 134 dB SPL	175µA @ 2.75V	
	Ford 2 SPV0142LR5H-1 On flex: KAS-700-0155	Single-ended	2.75 x 1.85 x 0.90mm	62.5 dB(A)	85Hz	110 dB SPL 124 dB SPL	132µA @ 1.8V	

† 18Hz LFRO variant also available (part number SPH21C3LR5H-1)

SPECIALTY MICROPHONES

	MICROPHONE	DESCRIPTION	SIZE	SNR*	LFRO	1% THD 10% THD*	CURRENT	
DIGITAL	Marina SPC18P8LM4H-1 On flex: KAS-700-0159	Slim Package Bottom-Ported	3.50 x 2.00 x 1.00mm	65 dB(A)	25Hz	119 dB SPL 122 dB SPL	260µA @ 768kHz 865µA @ 2.4MHz	
	Baracus SPG08P4HM4H-1 On flex: KAS-700-0152 <i>*CUSTOMER FAVORITE*</i>	Slim Package Top-Ported	4.00 x 2.00 x 1.10mm	64 dB(A)	30Hz	117 dB SPL 120 dB SPL	290µA @ 768kHz 715µA @ 2.4MHz	
	Crawford SPH0645LM4H-1 On flex: KAS-700-0137	I ² S Output digital microphone	3.50 x 2.65 x 0.98mm	65 dB(A)	45Hz	110 dB SPL 120 dB SPL	600µA @ 3.072MHz	

* SNR and THD specs apply to normal mode. For low power mode specs, refer to the datasheet.

DIGITAL (PDM) OR ANALOG MICROPHONES?

PDM microphones have an integrated ADC and return oversampled PDM data at the supplied clock frequency. Advantages of PDM microphones include superior noise immunity, simpler PCB layout, typically better system SNR and lower overall power consumption. PDM microphones can greatly simplify system design if the processor or CODEC supports a PDM port.

SIGNAL TO NOISE RATIO

For far field applications like smart speakers, high SNR microphones result in superior audio pickup. ANC and transparency mode features in TWS need high SNR microphones for better user experience. When comparing analog to PDM microphones, reduce the analog SNR by ~1.5dB to account for the external ADC's noise contribution.

ACOUSTIC OVERLOAD POINT (AOP)

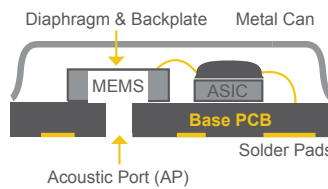
The AOP is the sound pressure level at 1kHz at which the total harmonic distortion is 10%. At this point, audio is heavily clipped and sounds very distorted. Microphones require a high AOP spec if they are subject to high sound levels (eg. close to loudspeakers, in-ear microphones in earbuds, outdoor applications exposed to wind noise).

ULTRASONIC APPLICATIONS

MEMS microphones inherently have a very usable ultrasonic response from 20kHz to 80kHz or more. The output of the u/s signal must be processed by an amp, CODEC, or ADC that can extract the needed frequencies, usually by using a higher sample rate and/or lower decimation rate.

PORT LOCATION

Bottom port microphones typically have better noise performance than an equivalent top port microphone. For this reason, bottom port microphones are preferred unless mechanical constraints dictate a top port microphone.



SENSITIVITY OF PDM MICROPHONES

Sensitivity of microphones is the reference output for 94dB SPL sound. Higher sensitivity implies more signal for a given sound. In PDM microphones, higher sensitivity does not imply higher performance because gain can simply be applied in the digital domain by multiplying the output code. Dynamic range is a better indicator of microphone performance.

LOW FREQUENCY ROLL-OFF (LFRO)

The LFRO is the -3dB point of the frequency response with respect to the sensitivity at 1kHz. A low LFRO is advantageous for bass frequency pickup and ANC, but it is more sensitive to wind noise and low frequency overload in a feedback ANC system.

MEMS VS. ELECTRET CONDENSER (ECM) MICROPHONES

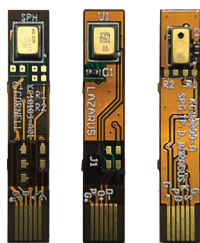
MEMS microphones are reflow capable SMT devices with stable performance under extreme conditions. They are resistant to power supply noise, humidity, and mechanical shock and vibration. Compared to ECMs, MEMS microphones have wide operating temperature and supply voltage ranges where sensitivity does not drift.

EVALUATION KITS

TEST FLEX PCBs

Knowles utilizes flex PCBs when testing microphones. We have a common size and interface such that flexes from any microphone can be used in various test fixtures. The only difference between the test boards of different microphones is the pinout and pad configuration.

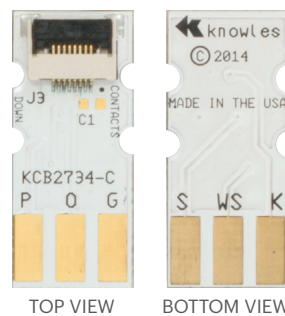
Once microphones are mounted on flex circuits or coupons, it is much easier to access the microphone signals. Testing a larger sample size of devices is facilitated if the flexes and coupons are inserted into an 8 position 0.5mm Kyocera connector (MPN 04628800800846).



Example flex PCBs (Digital bottom port, Analog differential bottom port, Digital top port)

FLEX-TO-COUPON ADAPTER

Knowles uses an adapter to be able to use flex circuits with a 2x3 Sullins connector (MPN EBM03DSEN-S243) or for convenient connection with flying wires.

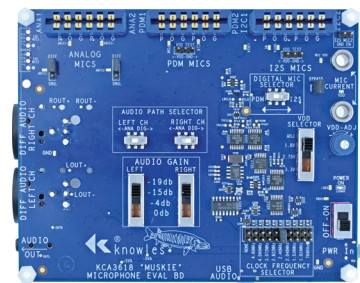


KCA2733 Flex-to-Coupon adapter

AN18: Knowles Flex Circuits and Coupons for Testing: www.knowles.com/docs/default-source/default-document-library/an18-knowles-flex-circuit-and-coupons-for-testing_updated.pdf

EVALUATION BOARD "MUSKIE"

The Muskie microphone evaluation kit allows for simple and easy evaluation of Knowles SiSonic™ MEMS microphones. Muskie implements dual 6-pin Sullins connectors for stereo pairs of Analog/Differential microphones, Digital microphones, or I²S microphones.



KAS-33100-0004 Evaluation platform 'Muskie'

User guide: https://www.knowles.com/docs/default-source/model-downloads/kas-33100-0004-muskie-users-guide-rev28jun19.pdf?sfvrsn=262976b1_9

ADDITIONAL RESOURCES

- Datasheets: www.knowles.com/SiSonic
- SiSonic Design Guide: www.knowles.com/SiSonic/Design-Guide
- Evaluation kits: www.knowles.com/SiSonic/Evaluation-Kits

- Application notes: www.knowles.com/SiSonic/Application-Notes
- Automotive: www.knowles.com/SiSonic/Automotive
- Voice Vibration Sensor: www.knowles.com/v2s

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