knowles

KNOWLES MICROPHONE SELECTION GUIDE

INTRODUCTION

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.

CHOOSING THE RIGHT MICROPHONES

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)

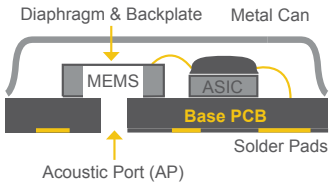
The AOP is the sound pressure level at 1kHz at which the total harmonic distortion is 10%. At this point, audio is heavily clipped and sounds very distorted. Microphones require a high AOP spec if they are subject to high sound levels (eg. close to loudspeakers, in-ear microphones in earbuds, outdoor 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 94dBSPL 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.

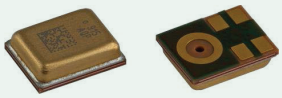
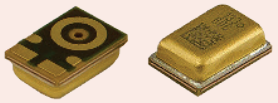
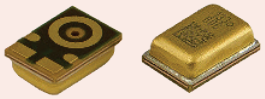
LOW FREQUENCY ROLL-OFF (LFRO)

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.

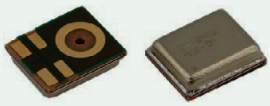
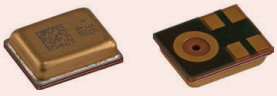
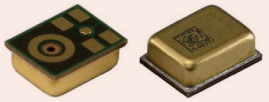
MEMS VS. ELECTRET CONDENSER (ECM) MICROPHONES

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.

VERSATILE FOR MOST APPLICATIONS

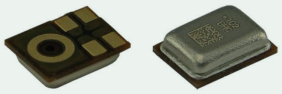
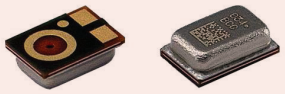
	MICROPHONE	DESCRIPTION	SIZE	SNR*	LFRO	1%/10% THD*	CURRENT	
DIGITAL	**Cornell II SPH0655LM4H-1**	Versatile for most applications	3.50 x 2.65 x 0.98mm	66 dB(A)	25Hz	130.5 dBSPL / 132.5 dBSPL	260µA @ 768kHz 1000µA @ 2.4MHz	
ANALOG	**Robin SPV61A0LR5H-1**	Single-ended S = -40dBV/Pa	2.75 x 1.85 x 0.90mm	66 dB(A)	35Hz	130 dBSPL / 133 dBSPL	175µA @ 2.75V	
ANALOG	**Tochi 2 SPV21A0LR5H-1V**	Single-ended S = -42dBV/Pa	2.75 x 1.85 x 0.90mm	64.5dB(A)	35Hz	132 dBSPL / 134 dBSPL	175µA @ 2.75V	

HIGH PERFORMANCE

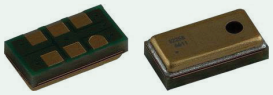
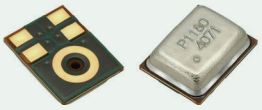
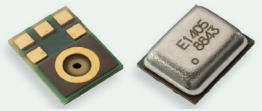
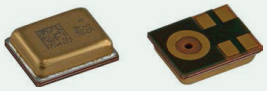
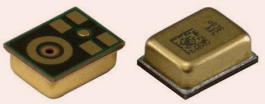
	MICROPHONE	DESCRIPTION	SIZE	SNR*	LFRO	1%/10% THD*	CURRENT	
DIGITAL	**Everest SPH0690LM4H-1**	High SNR	3.50 x 2.65 x 0.98mm	68 dB(A)	30Hz	117 dBSPL / 130 dBSPL	260µA @ 768kHz 1000µA @ 2.4MHz	
DIGITAL	**Cameron SPW0690LM4H-1**	Smallest and Thinnest Digital	3.10 x 2.50 x 0.85mm	66.5 dB(A)	45Hz	118 dBSPL / 135 dBSPL	270µA @ 768kHz 1000µA @ 2.4MHz	
ANALOG	**Falcon SPH11C3LR5H-1**	Differential 1.8 and 2.7V	3.50 x 2.65 x 1.00mm	68.5 dB(A)	32Hz	127 dBSPL / 132 dBSPL	63µA @ 1.8V 200µA @ 2.75V	
ANALOG	**Lovato SPH8878LR5H-1**	Low-LFRO	3.50 x 2.65 x 1.26mm	67 dB(A)	7Hz	124 dBSPL / 134 dBSPL	100µA @ 1.8V 250µA @ 2.75V	

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

ENTRY TIER

	MICROPHONE	DESCRIPTION	SIZE	SNR*	LFRO	1%/10% THD*	CURRENT	
DIGITAL	**Luiso SPH0141LM4H-1**	Entry tier digital	3.50 x 2.65 x 0.98mm	64 dB(A)	45Hz	108 dBSPL / 121 dBSPL	235µA @ 768kHz 620µA @ 2.4MHz	
ANALOG	**Ford 2 SPV0142LR5H-1**	Single-ended	2.75 x 1.85 x 0.90mm	62.5 dB(A)	85Hz	110 dBSPL / 124 dBSPL	132µA @ 1.8V	

SPECIALTY MICROPHONES

	MICROPHONE	DESCRIPTION	SIZE	SNR*	LFRO	1%/10% THD*	CURRENT	
DIGITAL	**Marina SPC18P8LM4H-1**	Slim Package Bottom-Ported	3.50 x 2.00 x 1.00mm	65 dB(A)	25Hz	119 dBSPL / 122 dBSPL	260µA @ 768kHz 865µA @ 2.4MHz	
	Baracus SPG08P4HM4H-1	Slim Package Top-Ported	4.00 x 2.00 x 1.10mm	64 dB(A)	30Hz	117 dBSPL / 120 dBSPL	290µA @ 768kHz 715µA @ 2.4MHz	
	More SPH0641LU4H-1	Flat frequency response for ultrasonic	3.50 x 2.65 x 0.98mm	64.3 dB(A)	45Hz	108 dBSPL / 120 dBSPL	235µA @ 768kHz 845µA @ 3.07MHz	
	Crawford SPH0645LM4H-1	I²S Output digital microphone	3.50 x 2.65 x 0.98mm	65 dB(A)	45Hz	110 dBSPL / 120 dBSPL	600µA @ 3.072MHz	
	SPH9855 SPH9855LM4H-1	Automotive AECQ-100/103	3.50 x 2.65 x 0.98mm	66 dB(A)	25Hz	130.5 dBSPL / 132.5 dBSPL	260µA @ 768kHz 1000µA @ 2.4MHz	
ANALOG	**SPH1878 SPH1878LR5H-1**	Automotive AECQ-100/103	3.50 x 2.65 x 1.26mm	67 dB(A)	7Hz	124 dBSPL / 134 dBSPL	100µA @ 1.8V 250µA @ 2.75V	

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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