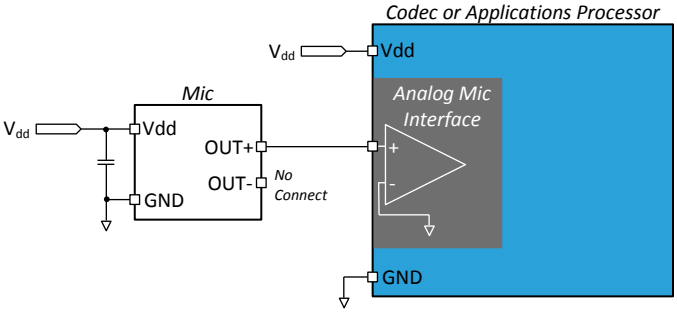
AN10

Using Differential Microphones in a Single-Ended Configuration

Differential output microphones were designed to interface with the differential inputs of a codec or other differential input circuitry. They can also be used with a single-ended codec input with slight impact to the differential performance specifications. This application note describes how to implement single-ended operation for differential output microphones and highlights the performance impacts.

Connecting Differential Output Microphone in Single-Ended Mode

The recommended circuit for connecting a differential output microphone to a single-ended codec uses only the positive output (OUT+); the negative output (OUT-) should not be connected and will be floating.



Recommendations from the manufacturer of the specific codec being used are expected to be followed.

Performance Changes in Single-Ended Mode

When using only the positive output, roughly half of the microphone signal is used. This implies that the output of the microphone will be approximately 6dBV lower in single-ended mode compared to differential mode. This will be true for the signal as well as noise—thus SNR will not change significantly.

For SPA1687LR5H-1 as an example, the table shown below summarizes the key microphone performance parameters in single-ended and differential modes.

	Average (Single-Ended)	Average (Differential)	Difference	Units
Sensitivity	-43.48	-38.29	-5.20	dBV/Pa
SNR	64.52	64.45	0.07	dB(A)
THD	0.09	0.09	0.00	%
AOP (THD=10%)	133.14	133.13	0.01	dBSPL
DC Offset	0.72	0.00	0.71	V
PSR (100mVpp)	-106.65	-101.62	-5.03	dBV(A)
PSRR (1kHz)	87.65	87.36	0.29	dB

Summary

The main impact of using a differential output microphone in single-ended mode will be a drop in microphone sensitivity. Layout and design should use standard best practices for optimal mechanical, acoustic, RF, and ESD performance.

To assure maximum adherence of the microphone to your application's PCB, we recommend using the full landing pattern with a solder stencil covering all pads, however, the OUT- pad should be electrically floating and not connected to any signal or ground. It will provide additional mechanical bonding of the microphone to your PCB but no other functionality.