ZeroPower Listening™ FAQ

How does ZeroPower Listening (ZPL) work?

ZPL uses the piezoelectric effect to make the acoustic transducer operate as an acoustic switch. When a soundwave hits a piezoelectric cantilever, it moves the cantilever. This motion creates a voltage via the piezoelectric effect. This voltage is sensed by a very low-power comparator circuit, which sends a wake signal to the rest of the system.

Does ZPL wake for any kind of sound?

Any kind of sound will create a voltage on the piezoelectric MEMS cantilever, but not all sounds will activate the companion circuit. The circuit is designed to only respond to sounds between 300Hz and 6kHz, which includes the human vocal range. Sounds outside of this range such as wind, heartbeats, etc. will not activate the microphone. The sound must also exceed a specified sound pressure level (SPL). Choosing an external resistor value configures this SPL setting. This is specified in the application note.

Does ZPL do keyword check?

Keyword check is still done in the digital domain by a companion DSP. In one example of our reference design, the DSP from DSP Group running the Sensory Truly Handsfree keyword algorithm will accomplish this.

Does ZPL miss any of the keyword?

No. Piezoelectric MEMS microphones start up very quickly at around 50 microseconds and do not miss the keyword. Capacitive MEMS microphones take about 1000X more time to start up because they require time to charge their MEMS to a high bias voltage. Piezoelectric MEMS microphones, in contrast, do not require any bias voltage and are low-voltage devices.

Why don't capacitive microphones have this feature?

Capacitive MEMS microphones require a high bias voltage generated by a charge pump. This charge pump must be controlled by a larger circuit and cannot be activated by voice energy. It is impossible to have ZeroPower Listening without a piezoelectric MEMS microphone.

How does ZPL work with low power voice activity detect?

ZPL is compatible with existing low-power voice-detect algorithms. The ZPL mode is a power mode that runs below the lowest power voice activity detect (VAD) modes. In a very noisy environment, the system will move into VAD mode.

Does ZPL really extend battery life?

Yes. ZPL greatly extends the life of a battery in systems that are often in sleep mode. For example, with a typical smartphone-size battery, a system can stay in wake-on-sound mode for approximately 5 years. If a system is used more frequently, then the battery consumption from active use mode will dominate the battery life. A good analogy is the standby time versus talk time in a cellular phone. You can think of ZPL as drastically extending the standby time but not affecting the talk time.

What are some good applications for ZPL?

ZPL is great for applications that:

1. Use voice as an interface or do acoustic event detection
2. Are battery-powered or benefit from reduced system power consumption

Some great examples include?

- Smart TV remotes
- Security cameras/standard cameras
- Noise monitors
- Hearables with voice interface
- Augmented reality systems with voice interface
- Battery-powered smart speakers
- Voice-activated tablets
- Voice-activated smartphones
- Voice-activated laptops

Can ZPL be used in systems that are plugged into an external power source?

Yes. Although ZPL is primarily intended for systems with tight power budgets, but systems do not need to be battery-powered. A huge percentage of household power consumption goes to plugged-in devices with high-power hibernate modes. For example, TV sets consume a lot of power even when they are turned off. Using ZPL would save these systems a tremendous amount of power by powering them off completely when nobody is home.

Are there circumstances where ZPL can increase power consumption?

No. As long as a system has an always-listening voice interface, ZPL will decrease power consumption and extend battery life. If, however, a system is constantly and continually used, the power savings will be negligible.