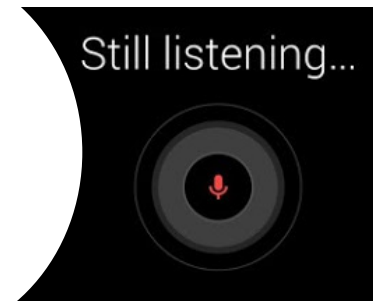




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## VoiceBoost™ Speech Command and Control

**Low power embedded automatic speech recognition for DSPs, microcontrollers and SOCs allows high accuracy voice commands entirely on device**

### The Challenge

Mobile, wearable and automation devices continue to benefit the consumer by packing more functions into smaller, lower power, and less expensive products. However, smaller products lack keyboards and large touch screen displays for user input, resulting in cumbersome user interfaces for accessing the functions of the device. Smaller products also mean smaller batteries, resulting in a need for an alternate interface to control the functions of the device while operating at low power to maximize battery life.

### The Solution

Malaspina Labs' VoiceBoost™ suite of products offer solutions to a number of real-time audio signal processing problems involving detecting, isolating and recognizing speech-of-interest from background noise within audio signals. VoiceBoost solutions are available for noise reduction, voice activation, phrase spotting, biometric speaker verification and automatic speech recognition.

The VoiceBoost™ Speech Command and Control solution allows manufacturers to add a speech interface to devices which executes in real-time entirely on the device's DSP, microcontroller or SOC. There is no requirement for internet connectivity or operating system support.

The Speech Command and Control solution has small memory footprint and minimal power requirements and is designed specifically to address the needs of mobile, wearable and IoT devices. The solution recognizes any combination of discrete words, connected phrases and continuous speech, spoken by any user either near-field or from a distance. There is no need for speakers to pause between words when giving complex commands. Because the VoiceBoost Speech Command and Control solution is a speaker-independent recognition engine, there is also no need for speakers to train the system to their voice; the solution works "out of the



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box”, even for speakers with accents and non-native language speakers.

Grammar size is limited only by available device memory and compute resources. Typical low cost microcontrollers used in battery operated devices can accommodate grammars of one hundred to several hundred words.

The Speech Command and Control solution is designed for robust performance in noisy environments and with speech from a distance or with off-axis speech, as is typical with wrist-worn devices. Market-leading recognition levels ensure robust performance, while OEM-selectable recognition confidence thresholds allow the application to request user confirmation whenever desired.

The Speech Command and Control solution can be used standalone or in combination with VoiceBoost “always listening” voice activation solutions. When used in combination with the speaker-independent voice activation solution, a device can remain in an ultra-low power state while continuously listening for a wakeup word or phrase from any user, after which the user may issue voice commands to control the device. This allows manufacturers to offer a complete speech command and control interface which works “out of the box” for any user while still providing always-listening operation with less than 1mA average power consumption†.

When used in combination with the biometric speaker verification solution, a device can remain in an ultra-low power state while continuously listening for wakeup words spoken only by an enrolled user’s voice, after which the user may issue voice commands to control the device. Use of the Speech Command and Control solution in combination with the Biometric Speaker Verification solution allows manufacturers to support user-specific device functionality such as parental controls and device unlock, as well as adding multi-user capabilities such as personalized functions and information to mobile, wearable and IoT devices, while still consuming less than 1mA average power†.

## Key Features

- Speaker independent speech recognition executes entirely on device
- Effective with accents and non-native language speakers
- Effective to several metres distance in noisy environments
- Effective with off-axis speech and inverted device orientations
- OEM selectable recognition confidence thresholds
- Flexible grammar generation tools
- Multiple language support
- Field-selectable grammar models for device localization
- Supports Over The Air updates

† typical value for a low cost MCU.



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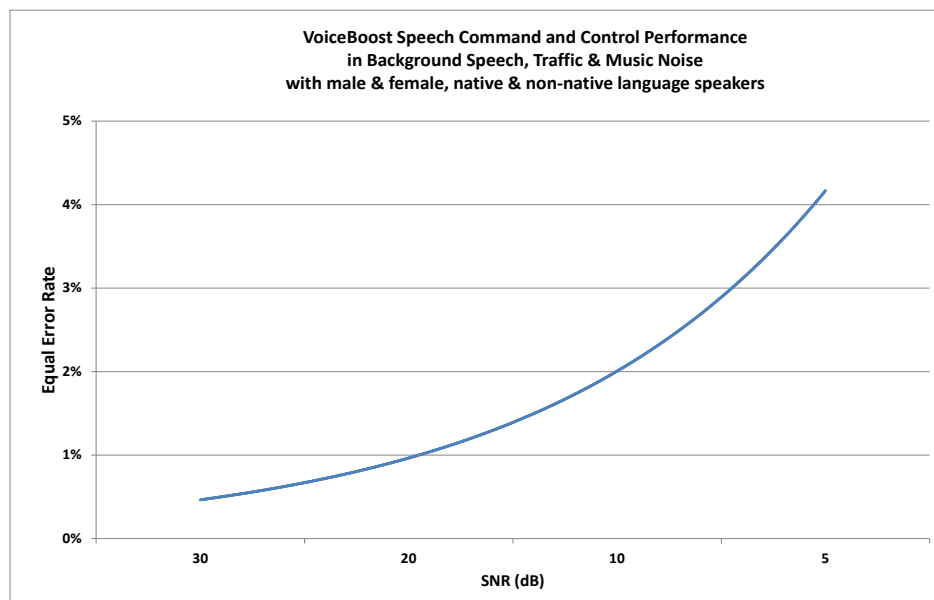
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## Performance

The Malaspina Labs' VoiceBoost™ Speech Command and Control solution provides market-leading recognition rates, equal error rates, and accent tolerance in low and high noise environments at distances from near-field to several meters. The solution is available for DSP, MCU and SOC devices from several hardware partners to meet varying performance, resource or operational design constraints.

Recognition performance is dependent upon the size and choice of grammar to be recognized and the type and level of background noise. Typical wearable and IoT devices provide functionality that requires command and control grammars of 20-30 words. If the grammar may also include digits, days, months, names, or other variables, then typical command and control grammar sizes approach 50-60 words or more. The results below show performance in typical operational environments for wearable and IoT devices, including urban environments with background traffic noise, music, background babble (multi-person background speech) and background conversation (single-person background speech).

Benchmark results along with memory and power requirements are published for various configurations and devices.



## Software Framework

VoiceBoost solutions do not impose any restriction upon your selection of operating environment (nor is the presence of an operating system even required). No particular software task management or inter-task communication mechanism is imposed. VoiceBoost solutions easily integrate into existing audio and sensor processing pipelines used within mobile phones, tablets, wearable devices and automation devices.

To learn more about how the VoiceBoost™ Speech Command and Control solution can help increase user satisfaction of your mobile, wearable and IoT products, contact Malaspina Labs or a Malaspina Labs channel partner today.

## About Malaspina Labs

Malaspina Labs performs applied research in the field of speech processing. Malaspina Labs and its subsidiaries provide portable software implementations of proprietary algorithms which execute in real-time on ultra-low power processors.

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