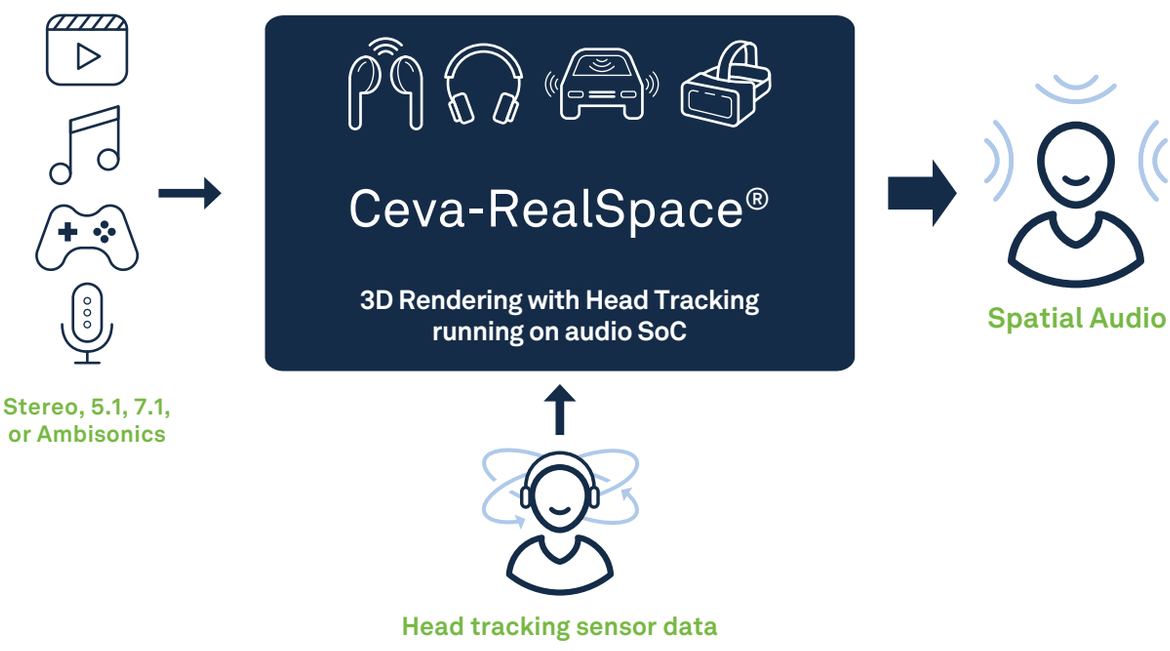
SENSING & AUDIO SOFTWARE

CONTENT LIST

Ceva-RealSpace® – Complete Spatial Audio Software Solution

Ceva-RealSpace® is a fully embedded solution supporting multiple system architectures, whether you want to render spatial audio on a TWS earbud, headphone, mobile phone, gaming system, PC, or a car. This means a great experience isn't tied to a particular device ecosystem, content provider, or codec.

Ceva-RealSpace® powered earbuds and headphones can render any content in exceptional 3D.
Ceva-RealSpace® is pre-integrated on some of the top audio SoCs in the industry, letting you bring cutting-edge products to market faster and with less risk.



Key Benefits

- Fully immersive experience with precise head tracking and realistic 3D rendering in one solution
- Lowest latency with the full solution running embedded on the TWS/headphone audio SoC
- Agnostic to codec, content provider, or device ecosystem with rendering done right on the ear
- Supports stereo, 5.1, 7.1, and ambisonics audio content
- Give your customers the best audio experience with available THX tuning
- Eliminate drift with multiple auto-recentering modes
- Tuned presets available for Movies, Games, Music, and Speech
- Reduced fatigue with spatialized video calls thanks to Bluetooth Hands Free Profile support
- Longer battery life and more features thanks to RealSpace's small memory and compute requirements
- Pre-integrated with the full audio pathway on top Audio SoC's from BESTechnic and Beken for fast time to market with lower risk
- Available for Ceva-BX DSPs or Arm Cortex-M CPUs and Windows APO implementations

As consumers demand more immersive and seamless experiences, Spatial Audio has become a key technology in a broad range of applications.

Overview

When we listen to sound through headphones or TWS earbuds, our brains are denied much of the key information they use to interpret the world. As a result, sound, even surround sound, seems to come from inside the head. Spatial audio recreates the missing information – like the exact position of the sound source or the design of the listening room – in order to create a more realistic, immersive experience.

3D rendering on its own externalizes your perception of where audio is coming from, bringing it out of your head and into the world around you. But the brain is a very sensitive instrument and interprets subtle differences between reflections, reverberations, and how it all interacts with your ears. That's why, for a truly realistic experience, you need to track head motion and know where the ears are located relative to the source of the sound.

Stereo/Surround Sound

Sound comes directionally, but from a limited number of sources.

The brain interprets sounds as coming from inside the head.

The guitarist is inside your left ear.

Spatial Audio

The brain interprets the sound as coming from outside the head.

Soundfield is externalized and fixed to the head.

The guitarist is always at 10 o'clock.

Spatial Audio + Head Tracking

Soundfield is externalized and fixed in place as you move.

The guitarist stays at the left of the virtual stage even as you dance and move.

Ceva-RealSpace is a complete spatial audio solution, combining proven best-in-class 3D rendering with precise head tracking to bring total immersion to any audio content in an easy-to-integrate package. Get out of your head and into the action with Ceva-RealSpace.

USA (HQ)
15245 Shady Grove Road
Suite 400
Rockville
MD, 20850
Tel: +1 (240) 308 8328

Israel
2 Maskit Street
P.O. Box 4047
Herzelia 4612001
Tel: +972 9 961 3700l

France
Les Bureaux Green Side 5
400, Avenue Roumanille
06410 Biot
Sophia Antipolis
Tel: +33 4 83 76 06 00

Ireland
Unit A2, First Floor
Building 6500
Airport Business Park
Kinsale Road, Cork
Tel: +353 1 237 3900

USA (West)
1174 Castro Street
suite 275
Mountain View
CA 94040
Tel: +1 (650) 417 7900

For more information:

Ceva-ClearVox™-ENC Solution - Neural Network-based Environmental Noise Cancellation Software for Voice-Enabled Devices

Ceva-ClearVox-ENC is a voice-processing software package providing bi-directional enhanced speech clarity and intelligibility for resource-constrained devices.

Key Benefits

- **Advanced NN-based algorithm focuses on human speech to improve intelligibility in nearly any situation**
  - Bi-directional, cancelling noise from outgoing and incoming speech
  - Clear speech for both parties on a call
  - Cancels both transient and stationary noises
- **Low-latency and high performance**
  - Fully-embedded inferencing
  - No privacy concerns or lock-in to a cloud ecosystem
  - 6KHz sample rate provides clear communication without overburdening system resources
- **Optimized NN model with small memory and compute footprint**
  - Runs side-by-side with other features like Ceva RealSpace® even on resource-constrained devices
  - Lowers power utilization
  - Reduces BOM costs
  - Removes the need for device configuration and tuning

Figure 1 - Outbound ENC

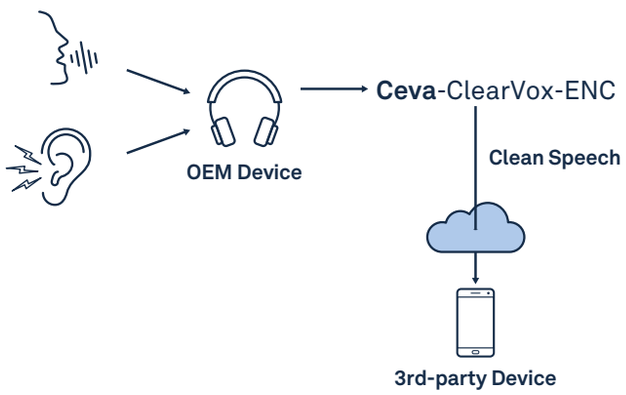
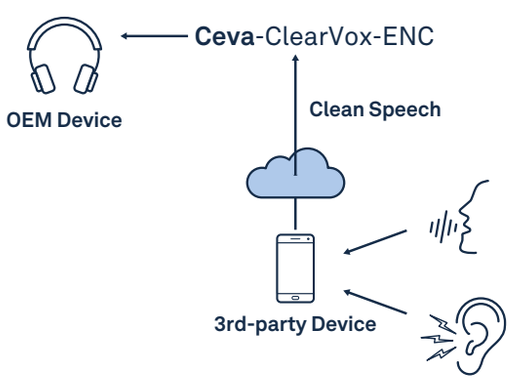
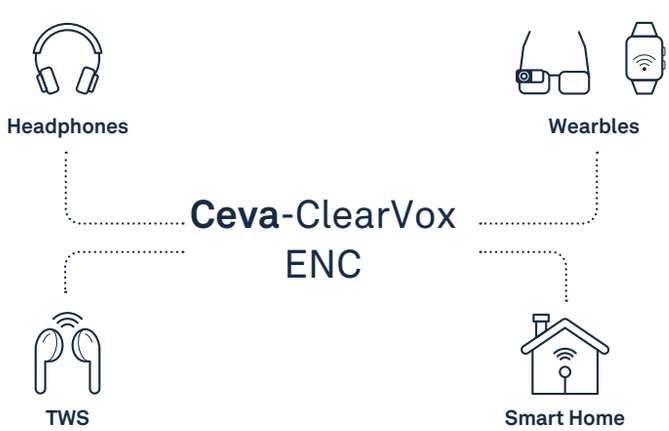


Figure 2 - Inbound ENC





Availability

- **Ceve-ClearVox-ENC is available for Ceva's DSPs - Ceva-BX1, Ceva-BX2 and SensPro2 family, as well as Arm CPUs**
- **Appropriate for multiple use cases:**
  - Voice calls on TWS, headsets, and other hearables
  - Group chat via gaming headsets
  - Voice notes and other communication on smartwatches and wearables

USA (HQ)
15245 Shady Grove Road
Suite 400
Rockville
MD, 20850
Tel: +1 (240) 308 8328

Israel
2 Maskit Street
P.O. Box 4047
Herzelia 4612001
Tel: +972 9 961 3700l

France
Les Bureaux Green Side 5
400, Avenue Roumanille
06410 Biot
Sophia Antipolis
Tel: +33 4 83 76 06 00

Ireland
Unit A2, First Floor
Building 6500
Airport Business Park
Kinsale Road, Cork
Tel: +353 1 237 3900

USA (West)
1174 Castro Street
suite 275
Mountain View
CA 94040
Tel: +1 (650) 417 7900

For more information:

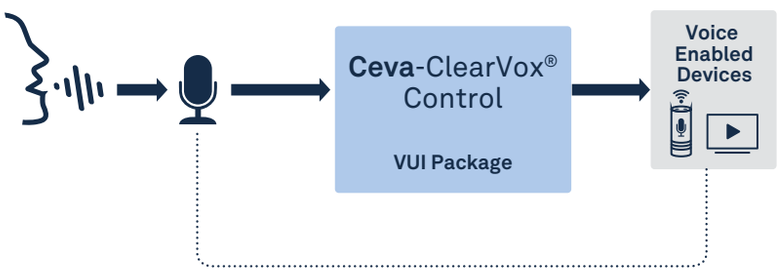
ClearVox Control is an advanced VUI software package providing the key building blocks for low power always listening voice enabled devices

ClearVox® Control is a neural network-based software package, providing customers with a comprehensive solution for building voice enabled IoT devices.

Key Benefits

- Optimized for always listening resourceconstrained devices, enabled by customizable, brandable keywords
- Amazon Voice Services (AVS) qualified wake word solution, ready for Alexa enabled devices.
- Application specific and customer specific tailored voice commands
- Low power and low memory footprint model on Ceva-BX2 DSP, that can also run on resource constrained MCUs as small as Cortex M0+.
- Scalable RNN speech AI technology is capable of handling a single wake word, as well as simultaneous multi wake words, for supporting multiple AI assistants.
- Speaker independent, pronunciation agnostic, and support multiple languages.
- Built-in noise immunity to improve user experience in noisy environments at home, car, and outdoors.

ClearVox Control System Architecture



Target Markets

Availability

ClearVox Control is available for licensing for Ceva-BX1, Ceva-BX2, Ceva-NeuPro-Nano, family, as well as Arm CPUs. ClearVox Control is Amazon Voice Services (AVS) qualified.

Customization

ClearVox Control can be customized to work with any set of customer defined wake words and commands to deliver a cost-efficient, high-accuracy, and noise-immune VUI engine.

Evaluation

ClearVox Control is provided with Windows/ Linux/ Android packages for quality evaluation, integration, and testing in customer's system.

ClearVox Control Android Application

Smart Speaker Reference Design

- **Combined input and output processing:**
  - Speech recognition and noise reduction with number of mics from 1 to 8
  - Audio playback – decode and post-processing
- **Full suite of drivers and audio codes avilable for Ceva-BX1, Ceva-BX2 and Ceva-NeuPro-Nano**

USA (HQ)
15245 Shady Grove Road
Suite 400
Rockville
MD, 20850
Tel: +1 (240) 308 8328

Israel
2 Maskit Street
P.O. Box 4047
Herzelia 4612001
Tel: +972 9 961 3700l

France
Les Bureaux Green Side 5
400, Avenue Roumanille
06410 Biot
Sophia Antipolis
Tel: +33 4 83 76 06 00

Ireland
Unit A2, First Floor
Building 6500
Airport Business Park
Kinsale Road, Cork
Tel: +353 1 237 3900

USA (West)
1174 Castro Street
suite 275
Mountain View
CA 94040
Tel: +1 (650) 417 7900

For more information:

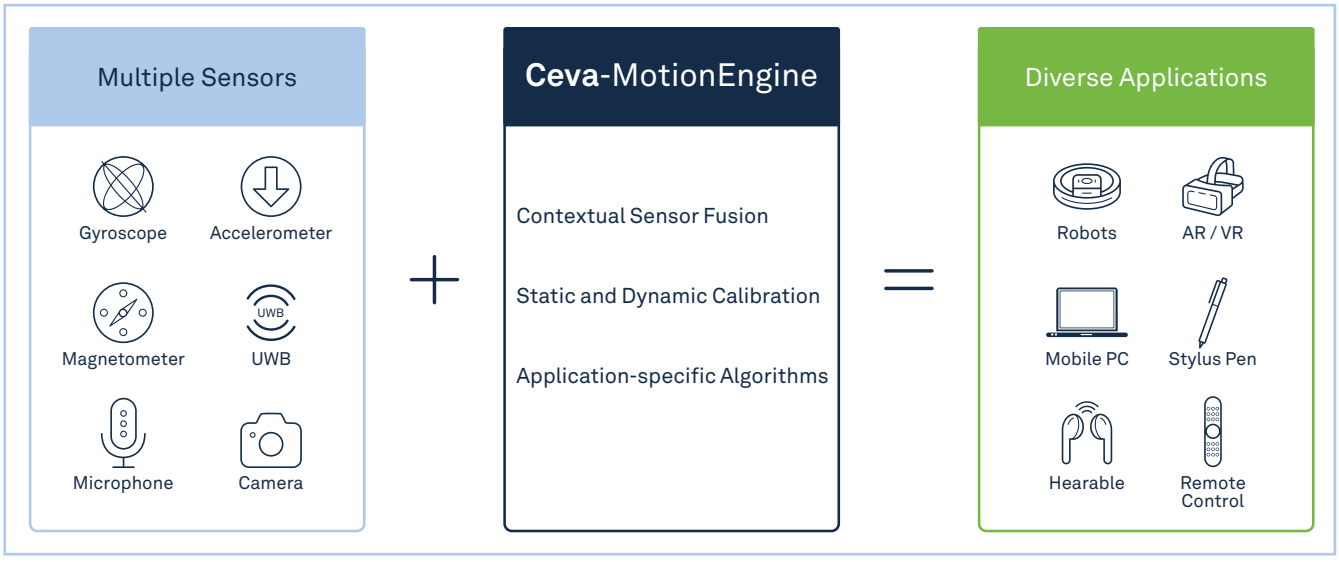
Ceva MotionEngine

MotionEngine is a robust and feature-packed software system designed to solve the complex motion problems of today's consumer applications. Its broad reaching capability has aided with hearables, handheld remote controls, fitness devices, medical devices, mobile computing, XR, robotics, livestock tracking, and more. If an application needs to track motion, MotionEngine can help.

Introduction

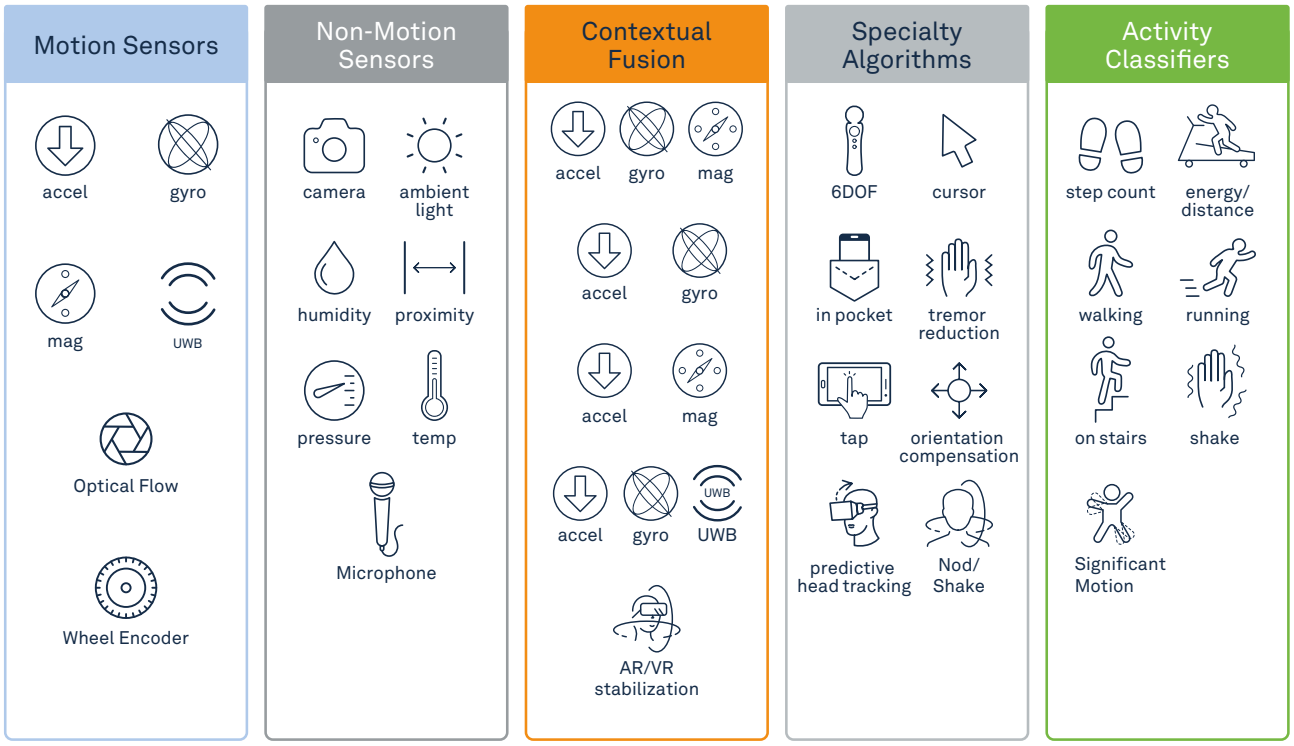
Ceva MotionEngine, which was developed and has been consistently improved over our 20+ years of sensor expertise, produces best-in-class sensor fusion. This claim is backed by customers who chose us for our distinct accuracy advantage. Additional features like calibration algorithms, contextual sensor fusion, and application specific features only add to that value. This sensor agnostic solution works with a variety of sensor types that enable a diverse set of applications.

Holistic Smart Sensing



Comprehensive Sensor Fusion & Algorithms

Application-specific solutions are created by assembling packages of algorithms that are customized to the needs of each unique application in order to provide the right solution with the lowest memory footprint.



Key Benefits of Ceva MotionEngine

- **Dynamic Calibration** that adjusts for accelerometer and gyroscope bias changes over factors like time and temperature
- **Magnetic Interference Rejection** algorithms designed to ignore sudden changes in magnetic field
- **Sensor independent** - utilize a wide variety of inertial and environmental sensors from leading industry suppliers
- **Drivers and sensor management** available for:
  - Android™, Linux®, Windows®, macOS®, WebOS™
  - arm, Ceva DSP, RISC-V, other RISC-based processor architectures

Specialized algorithms to cover various applications:

- **Cursor Control** with Single Pixel Accuracy - software designed for in-air pointing applications for using with motion remote controls
- **Gesture Recognition** - including flick, twist, flip, shake, in-air symbol recognition, virtual controls, tap, double tap, and in-ear detection
- **AR/VR Stabilization and Predictive Head Tracking -** algorithms designed specifically to enhance and smooth AR/VR and 3D Audio user experiences
- **Device Operation Mode Identification** - quickly determines the current orientation of a mobile computing device
- **Personal Activity Tracking** - step counter and context detection, including walking, running, standing, in-vehicle, and on-bike
- **Robust Motion Outputs** - including orientation, heading and tilt
- **Orientation Compensation** - algorithms designed to ignore changes in orientation with respect to the movement of a cursor on a display
- **Interactive Calibration** - boosts performance of lowcost sensors in terrestrial robotic applications
- **Robotic Dead Reckoning** - Dead reckoning algorithm that offers a cost-reduced alternative to VSLAM or LIDAR solutions

Distinct Software Packages

To better accommodate our customers, we have developed specialized software packages for the markets that we serve:

Ceva-MotionEngine - Air

Handheld controllers deserve more than antiquated button-based interfaces. Cursor and gesture controls can be easily added to enhance interactivity. MotionEngine Air enables similar cursor capability as our SmartTV package, but also enables unique gestures (like twist, flip, pick-up) to help streamline workflows whether you're presenting, creating, or controlling.

Ceva-MotionEngine - Smart TV

Did you ever wish you could more easily interact with your TV? The SmartTV package enables this by utilizing irelaxed, nstinctual hand motion and translating it intuitively on the screen. Movement (both physical and digital) feels natural with features like cursor control, orientation compensation, button motion suppression, and virtual controls.

Ceva-MotionEngine - Hex

Users today often desire a more direct, touch screen-like experience with smart displays like PC monitors, commercial displays, and Smart TVs. The Hex package provides this by fusing position from UWB sensors and orientation from IMUs for an absolute poining experience that isn't limited by the screen edge. Movement is smooth and natural with features like cursor control, orientation compensation, button motion suppression, and virtual controls

Ceva-MotionEngine - Robotics

Automated robots need to move intelligently through their spaces, and our algorithms ensure they can. After all, a robot's convenience is based on its autonomy. Our algorithms achieve precise heading with minimal drift. And with our interactive and dynamic calibration algorithms, robots can achieve great performance both right out of the box, and over time and changing temperature.

Ceva-MotionEngine - Scout

Intelligent automated robots use complex Simultaneous Localization And Mapping (SLAM) algorithms to determine a robot's location. MotionEngine Scout determines a robot's position with the fusion of IMU, wheel encoder, and optical flow sensor data. This removes the reliance on cameras and LIDAR systems and adds robustness under crucial circumstances where typical visual sensors would fail.

Hardware Product Line

Our best-in-class MotionEngine sensor fusion is available in a variety of hardware products seen below. Development kits are available for the BNO085, BNO086, and FSP201.

BNO085/086

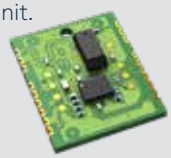
- **The BNO08X family (BNO085/086)** is a series of full System in Package (SiP) combining a 9-axis sensor and Cortex-M0+ processor running Ceva's MotionEngine Software
- **The BNO08X line** delivers
  - High quality heading and orientation outputs based on sensor fusion from both 6- and 9-axis sensing
  - Activity Classification for Stability, Tap, Steps, Walk, Run, Still, Significant Motion, Shake
- **The BNO08X line** is applicable to robotics, XR headsets and peripherals, 3D audio headsets, wearables, motion controllers, medical devices, fixed assets (antennas, lighting, etc), livestock tracking, and more
  - If motion is involved, the BNO085 or BNO086 are likely to help, especially if it requires a magnetometer and/or precise real-time tracking
  - The BNO085 and BNO086 have special compatibility with host-side libraries for fast magnetometer calibration and 6DOF XR
  - The BNO086 can utilize Interactive Calibration, an algorithm that minimizes heading drift in terrestrial robots.
- **I2C, SPI, and UART interface**

FSP201

- **The FSP201** is a standard Cortex-M based microcontroller programmed with Ceva's MotionEngine software
- **The FSP201** delivers high quality sensor fusion outputs including heading and orientation when paired with a 6-axis sensor (accelerometer + gyroscope) from a pre-qualified list of sensors from multiple suppliers
  - Bosch BMI088
  - ST LSM6DSR
- **The FSP201** is applicable to terrestrial robots, XR and 3D audio headsets, motion controllers, medical devices, and any other application that requires precise 6-axis heading and orientation measurements
- **I2C and UART interfaces**

FSM300/305

- **The FSM300/305** is a turn-key module built using the BNO080 for easy prototyping and integration
- **The FSM300/305 delivers**
  - Higher accuracy heading and orientation over the BNO08X due to its per-device calibration
    - FSM300 calibrated about the yaw axis
    - FSM305 tri-axis calibrated (yaw, pitch, and roll)
  - Full 6- and 9-axis sensor fusion
  - Activity Classification for Stability, Tap, Steps, Walk, Run, Still, Significant Motion, Shake
- **The FSM300/305** is applicable to the fast development of robotics, XR headsets and peripherals, 3D audio headsets, wearables, motion controllers, medical devices, fixed assets (antennas, lighting, etc), livestock tracking, and more
  - The FSM300/305 is well suited for customers in the prototyping, early development, or low volume production when you need a calibrated unit. Customers are advised to switch to
- **The BNO085/086 in their next iteration**
- **I2C, SPI, and UART interface**



USA (HQ)
15245 Shady Grove Road
Suite 400
Rockville
MD 20850
Tel: +1 (240) 308 8328

Israel
2 Maskit Street
P.O. Box 4047
Herzelia 4612001
Tel: +972 9 961 3700l

France
Les Bureaux Green Side 5
400, Avenue Roumanille
06410 Biot
Sophia Antipolis
Tel: +33 4 83 76 06 00

Ireland
Unit A2, First Floor
Building 6500
Airport Business Park
Kinsale Road, Cork
Tel: +353 1 237 3900

USA (West)
1174 Castro Street
suite 275
Mountain View
CA 94040
Tel: +1 (650) 417 7900

For more information:

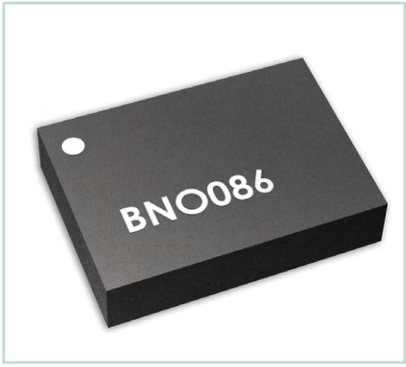
Product Note

BNO085/BNO086

9-AXIS SYSTEM IN PACKAGE (SIP) IMU

Consisting of the BNO085 and BNO086, our BNO08X family of SiPs (System-in-Package) is perfect for robotics, AR/VR, HIDs (Human Interface Devices, such as remote controls) and other motion-sensing applications. Leveraging our advanced sensor fusion software and a Bosch Sensortec sensor, this powerful platform is highly flexible, and we'll work with your technology teams so you can easily configure it to bring out the best in your product.

The BNO086 delivers high performance, shortens development times and simplifies BOMs by combining a 9-axis sensor (AGM) with sensor fusion capabilities in a single package. By addressing popular sensor anomalies with proprietary algorithms that are continually perfected through rigorous testing, our motion sensors deliver more accurate dynamic heading than the competition. We've built a deep and flexible sensor platform so you can pick what works best for you – stay focused on innovating in other product areas while speeding time to market. Leave the sensor fusion to the experts.

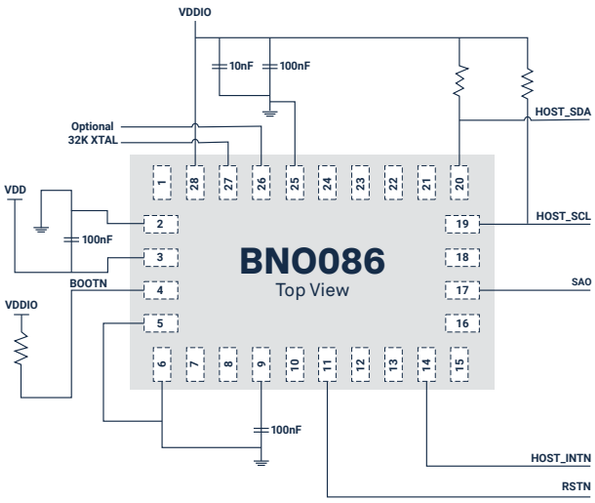


FEATURE HIGHLIGHTS

- **MotionEngine™ 9-Axis and 6-Axis Sensor Fusion** – Provides raw, calibrated sensor orientation data for more accurate heading and orientation
- **Intelligent Power Management** – Manages sensor states to conserve power without sacrificing quality of motion data
- **Calibration** – Supports both dynamic and factory-based calibration to deliver the highest performance. The BNO086 includes Ceva's Interactive Calibration, bringing even greater accuracy to robotics applications
- **Compatibility** – BNO086 is backwards compatible with BNO085 and both are pin-for-pin replacements for Bosch Sensortec's BNO055 and BMF055
- **Always-on Capabilities** – Includes software to enable low power, step counter and gesture recognition
- **Control via I2C, SPI or UART Interfaces** – Freedom to optimize overall circuit design requirements
- **Secondary I2C interface** – Allows attachment of additional environmental sensors
- **OS Independent** – Driver example code is available for ease of integration
- **Software Library Support** – Includes support for external MotionElements software libraries for advanced applications such as 6DOF VR controllers and attitude monitoring (e.g., antennas)

PHYSICAL ATTRIBUTES

SOFTWARE	motion engine	Hillcrest Labs' proprietary sensor fusion software	
SENSORS	Accel	Gyro	Mag
PROCESSOR	mcu	ARM Cortex-M0+	
INTERFACES	I2C	SPI	UART



BNO085/BNO086

9-AXIS SYSTEM IN PACKAGE (SIP) IMU

AR/VR

The BNO08X line delivers more accurate orientation information with low latency - even during rapid motion - eliminating motion sickness and other negative user experiences. Low power consumption, predictive motion, high output rate of 1 kHz, and compact size (5.2 x 3.8 x 1.1 mm³) all make the BNO08X line ideal for VR/AR devices such as HMD (head mounted displays), glasses and controllers, where both power and space are at a premium. Our MotionElements software combines camera data with the sensor data from the BNO085 or BNO086 to deliver a more cost-effective 6DOF controller experience.

Features & Benefits

- **1 kHz Sample Rate** – Enables flawless, smooth head- tracking with low latency and support for time-warping for immersive experiences
- **Predictive Head Tracking and AR/VR Stabilization** – Adjust angular position gradually over time to avoid "jumps" and compensate for system latency
- **Enhanced Controller Tracking** – Utilizes camera data to significantly improve VR controller performance
- **Tare** – Allows for arbitrary mounting of any BNO08X SiP in the end product
- **Context and Activity Tracking** – Step-based activity features for head-mounted devices, including stationary, running, walking and step count

ROBOTICS

The BNO08X family is optimized for service robots that employ Simultaneous Localization and Mapping (SLAM) or other "intelligent" navigation solutions, such as robotic vacuum cleaners. Our combination of proprietary sensor fusion software and multi-axis sensors delivers superior heading performance, even when the robot runs over uneven surfaces, such as a floor transition from one material to another. Interactive Calibration (BNO086 only) uses the robot's knowledge of its own motion state to provide even greater levels of performance right out of the box. Whether your robot cleaner relies mainly on an IMU for navigation or leverages an IMU to complement a LIDAR, VSLAM system or optical sensor (optical flow), our product will help you meet your requirements.

Features & Benefits

- **Accurate Heading Angle** – Less than 0.16°/min (10°/hr) typical error rate when using Interactive Calibration
- **Tilt Independent Heading** – Allows for proper heading output when surface is uneven
- **Bump Detection** – Calibrated accelerometer output provides data to support a bump detection algorithm without having to use a separate sensor
- **Inclination Detection** – Provides full 3DOF robot orientation, allowing detection of surface and device issues

About Ceva

At Ceva, we are passionate about bringing new levels of innovation to the smart edge. Our wireless communications, sensing and Edge AI technologies are at the heart of some of today's most advanced smart edge products. From Bluetooth connectivity, Wi-Fi, UWB and 5G platform IP for ubiquitous, robust communications, to scalable Edge AI NPU IPs, sensor fusion processors and embedded application software that make devices smarter, we have the broadest portfolio of IP to connect, sense and infer data more reliably and efficiently. We deliver differentiated solutions that combine outstanding performance at ultra-low power within a very small silicon footprint. Our goal is simple - to deliver the silicon and software IP to enable a smarter, safer, and more interconnected world. This philosophy is in practice today, with Ceva powering more than 17 billion of the world's most innovative smart edge products from AI-infused smartwatches, IoT devices and wearables to autonomous vehicles and 5G mobile networks.

1000-3962 v4.0

For more information:

Ceva Technologies, Inc. • 15245 Shady Grove Road • Suite 400 • Rockville, MD 20850
www.ceva-ip.com

Product Note

FSP201

6-AXIS SENSOR HUB DEVELOPMENT SUITE

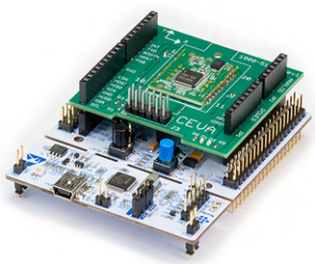
The FSP201 is an application specific standard product (ASSP) integrating Ceva's high-performance sensor hub software stack into a low-power 32-bit ARM Cortex-M23 processor.

Providing superior planar heading and 6-axis IMU performance, the FSP201 is ideal for high-volume, cost-conscious consumer robots, XR, 3D audio, and other motion-based devices.

The FSP201 Development tools are designed to support the development of consumer product applications from evaluation all the way through prototyping and production.

FSP201 with USB

FSP201 Module



FSP201 Development Kit

Development Kit

- Designed as a 'shield', the development board simply plugs into the STM32 Nucleo-F411RE prototyping platform. The board includes the FSP201 module and Bosch BMI088 motion sensor.
- Evaluation Toolset with Graphical Interface — MotionStudio 2 is a PC application that provides a graphical interface for evaluating functionality, configuring devices, plotting and logging motion data, and developing products with Ceva's MotionEngine™ technology.
- ST Microelectronics STM32 Nucleo-F411RE Development Platform — Pre-installed with the Communications Software Driver that fully implements the communications protocol used by the FSP201.
- Technical Collateral and Documentation — Includes all necessary source code, guides, reference manuals, datasheets, and schematics for a quick and straightforward installation.

FSP201 Modules

- Two FSP201 Modules are offered with different 6-axis sensors to meet the performance-cost target that fits the end product requirements. Each module is available for rapid prototyping and testing, including FSP201-BMI088 and FSP201-LSM6DSR.
- Measures 20 x 25mm and includes 18 castellations on 2mm pitch spacing.
  Supports I2C-SHTP, UART-SHTP, and UART-RVC.

FSP201 with USB

- Designed for instantaneous evaluation, the FSP201 board with USB provides the FSP201-BMI088 module with a USB interface.
- Simply connect to a PC and receive an always-on stream of the most commonly used sensor data. If deeper interaction and configuration is needed, the included MotionStudio 2 PC application supports the full set of FSP201 functionality.

About Ceva

At Ceva, we are passionate about bringing new levels of innovation to the smart edge. Our wireless communications, sensing and Edge AI technologies are at the heart of some of today's most advanced smart edge products. From Bluetooth connectivity, Wi-Fi, UWB and 5G platform IP for ubiquitous, robust communications, to scalable Edge AI NPU IPs, sensor fusion processors and embedded application software that make devices smarter, we have the broadest portfolio of IP to connect, sense and infer data more reliably and efficiently. We deliver differentiated solutions that combine outstanding performance at ultra-low power within a very small silicon footprint. Our goal is simple - to deliver the silicon and software IP to enable a smarter, safer, and more interconnected world. This philosophy is in practice today, with Ceva powering more than 17 billion of the world's most innovative smart edge products from AI-infused smartwatches, IoT devices and wearables to autonomous vehicles and 5G mobile networks.

1000-5118 v2.0

Ceva Technologies, Inc. • 15245 Shady Grove Road • Suite 400 • Rockville, MD 20850
www.ceva-ip.com

For more information:

Product Note

FSM30X

9-AXIS IMU / AHRS MODULE

The FSM30X is a self-contained AHRS/IMU module integrating a 3-axis accelerometer, 3-axis gyroscope, and 3-axis magnetometer, along with a low-power 32-bit ARM Cortex-M0+ MCU running Ceva's Hillcrest Labs business unit's high-performance sensor hub software stack.

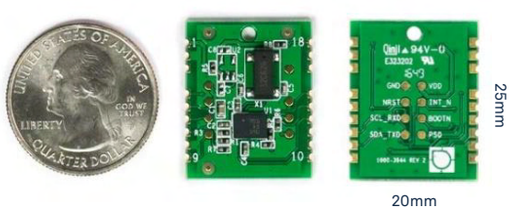
The FSM30X provides superior AHRS and IMU performance for all human and machine motions in many consumer and IoT applications. This small, turn-key component benefits developers and integrators through faster time-to-market, reduced BOM cost, and the highest precision and quality.

FEATURE HIGHLIGHTS

- **MotionEngine™ 9-Axis and 6-Axis Sensor Fusion** – Provides raw, calibrated and fused sensor orientation data with best-in-class accuracy and stability
- **Configurable Sampling Rate** – Sampling rates up to 1 kHz to create seamless experiences
- **Calibration** – Both dynamic and factory-based calibration to deliver the highest performance
- **Intelligent Power Management** – Manages sensor states to conserve power without sacrificing quality of motion data
- **Simplified UART interface** – Requires no configuration and simply outputs data
- **Magnetic Interference Rejection** – Algorithms detect and remove effects of hard and soft iron interference
- **Always-on Capabilities** – Low power, high accuracy algorithms like step counter, tap, and shake detectors
- **Activity Tracking** – Walking, Running, On Bike, and In Vehicle state detection for context-aware applications
- **Suitable for Android, Linux, and Embedded Designs** – Driver example code is available for ease of integration
- **Firmware Upgradeable** – Embedded bootloader enables factory and in-field firmware updates

PHYSICAL ATTRIBUTES

SOFTWARE	motion engine	Hillcrest Labs' proprietary sensor processing software	
SENSORS	Accel	Gyro	mag
PROCESSOR	mcu	ARM Cortex-M0+	
INTERFACES	I2C	SPI	UART



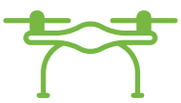
FSM30X

9-AXIS IMU / AHRS MODULE

TYPICAL CONSUMER AND IOT APPLICATIONS

Robots/ Autonomous Vehicles

Navigation



Flight Control

AR/VR
Motion Tracking

3D Audio

Fitness & Health
Monitoring

Industrial Monitoring

Attitude Monitoring

Asset Tracking

Body Motion
Capture

Sports Analysis

Long-term Heading Drift	
Sampling Rate	Up to 1 kHz
Latency	2.0 msec
Rotation Vector Accuracy	3.0° - Dynamic* 1.0° - Static*
Long-term Heading Drift	0.5 °/min
Max Rate Angle	± 2000 °/s

Calibration Option

The FSM300 is calibrated about the z-axis, providing increased precision and consistency across devices for applications involving planar motion. Proprietary dynamic calibration algorithms improve performance over time. The FSM305 features full 3D factory calibration for applications demanding high-accuracy orientation measurements beyond what dynamic calibration provides.

About Ceva

At Ceva, we are passionate about bringing new levels of innovation to the smart edge. Our wireless communications, sensing and Edge AI technologies are at the heart of some of today's most advanced smart edge products. From Bluetooth connectivity, Wi-Fi, UWB and 5G platform IP for ubiquitous, robust communications, to scalable Edge AI NPU IPs, sensor fusion processors and embedded application software that make devices smarter, we have the broadest portfolio of IP to connect, sense and infer data more reliably and efficiently. We deliver differentiated solutions that combine outstanding performance at ultra-low power within a very small silicon footprint. Our goal is simple - to deliver the silicon and software IP to enable a smarter, safer, and more interconnected world. This philosophy is in practice today, with Ceva powering more than 17 billion of the world's most innovative smart edge products from AI-infused smartwatches, IoT devices and wearables to autonomous vehicles and 5G mobile networks.

1000-4097 v3.0

For more information:

Ceva Technologies, Inc. • 15245 Shady Grove Road • Suite 400 • Rockville, MD 20850
www.ceva-ip.com