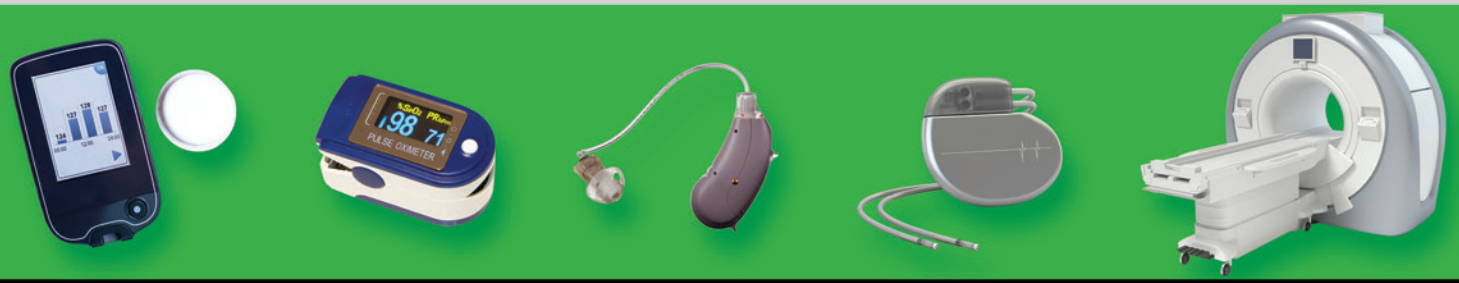
BRD8081/D
Rev. 8, Aug-2020

Energy Efficient Innovations

Medical Solutions

Improving lives through innovative solutions from ON Semiconductor.



Bringing Silicon to Life

An aging population and the pressure of rising healthcare costs are driving a shift towards home healthcare. This shift, along with an increased interest in health and wellness and the adoption of intelligent and connected portable devices, are driving medical device innovation and the consumerization of medicine.

Semiconductor technology plays a significant role in that innovation. With a diverse portfolio of products and services, talented engineering staff with system expertise, a deep understanding of the quality, reliability and longevity requirements of the medical market, and global manufacturing and logistics capability, ON Semiconductor enables developers of medical technology to solve their unique design challenges with high performance silicon solutions.

Expertise and Experience

- 30+ years of custom silicon experience, including high-reliability implantable applications
- Heritage of serving the hearing aid industry since early 1970s
- Extensive system knowledge in focus applications
- Fully certified and robust custom development process
- Rich portfolio of ultra-low-power analog, digital, and memory IP
- System architects for product concept and architecture review
- Highly skilled and experienced silicon, packaging, and test engineers
- Dedicated program managers for development tracking and reporting

Quality, Reliability, and Commitment

- Process and product longevity to support extended product life-cycles
- Traceability and data retention processes that meet the special needs of medical applications
- Lot Acceptance Testing (LAT) performed on each individual lot
- World-class owned and operated fabs
- Reliability and failure analysis lab
- Quality certifications including ISO/TS 16949, ISO 9001, AS 9100, ISO 14001, MIL-PRF-38535, QML, C-TPAT and STACK
- ISO 13485 for advanced packaging facility
- FDA compliance
- REACH compliance
- IEC 62304 compliance

Products and Capabilities

- Industry's lowest power Bluetooth Low Energy technology System-on-Chip (SoC)
- System-in-Package (SiP)
- Precision mixed-signal microcontrollers
- Preconfigured and open-programmable audio DSP systems
- Mixed-signal ASIC development services with flexible engagement models
- CMOS image sensors for medical imaging
- Large portfolio of power management and discrete components
- FPGA and ASIC conversions
- Custom and semi-custom ultra-low-power SRAM and EEPROM
- Foundry and value-added front- and back-end services
- Advanced packaging and product miniaturization techniques
- Customization of many portfolio products
- High voltage and low power processes

Medical ASIC Design and Manufacturing Services

ON Semiconductor has over three decades of experience designing and manufacturing complex ASICs for medical applications, offering both mixed-signal and digital solutions.

With an increasing number of medical devices becoming portable, more intelligent, and connected, medical device manufacturers are looking for highly integrated semiconductor solutions that enable higher performance, smaller size, lower power consumption, and higher reliability.

With proven design methodologies, dedicated system architects, an extensive IP portfolio, wide selection of fab process technologies, and advanced packaging solutions, ON Semiconductor helps customers transform their concept and initial specifications into volume production of a finished device.

Intellectual Property

ON Semiconductor offers an extensive library of IP blocks for use in ASIC designs, including signal conversion, signal processing, ADCs, memory, communication interfaces, power management, and low-noise circuits. System architects work with customers to identify the most appropriate technology and IP selection.

ASIC Development Flow

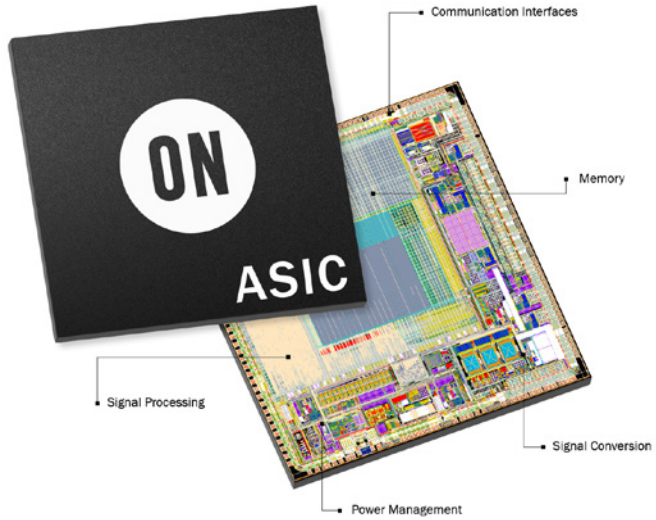
CONCEPT
Define the basic building blocks and chip architecture

PLAN
Product specification, test spec and planning

DEVELOPMENT
Design, manufacture, and test the product

QUALIFICATION
Optimize production and yields, and qualification

PRODUCTION LAUNCH
Volume delivery of high quality ASICs



System Architects

System architects help to refine design specifications to ensure feasibility and maximize functionality, while optimizing performance, power consumption, and size.

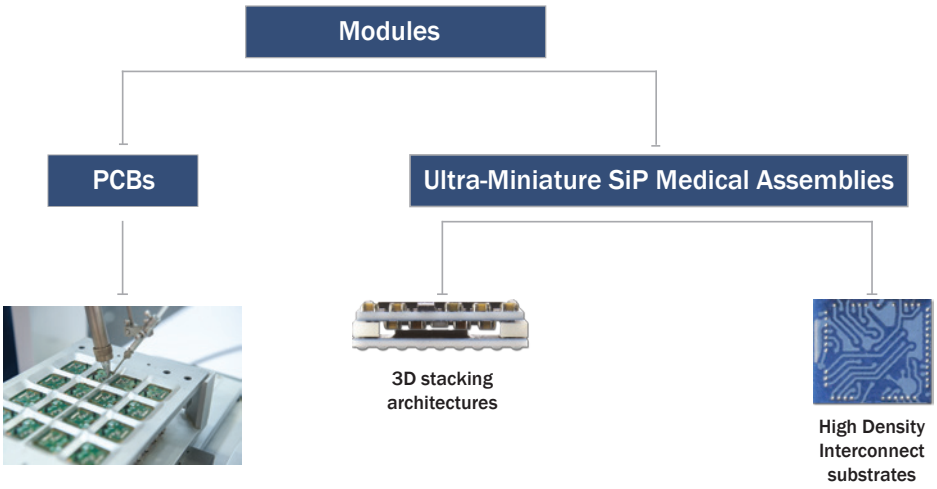
Some of the ASIC devices that ON Semiconductor system architects and engineering staff have recently developed include:

- Sensor interface for blood gas monitoring
- Vital sign patch monitor
- Data acquisition system devices for CT scanners, X-Ray, Ultrasound, and PET machines
- Precision analog front-end for ECG

Flexible Engagement

Whether the requirement is full or partial definition and design, design services after an RTL or netlist handoff, foundry services, custom advanced packaging of existing designs, or full turnkey service, ON Semiconductor tailors services to the unique requirements of medical customers. FPGA to ASIC conversions are also available.

Miniaturization Through Medical-Grade Modules



ON Semiconductor is a pioneer in the development of miniaturized packaging solutions for the medical microelectronics industry.

The company offers turnkey solutions for medical applications where size, performance, and system integration are critical. ON Semiconductor has proven leadership in miniature System-in-Package (SiP) solutions, addressing the highly space-constrained requirements of hearing aid manufacturers for over four decades. As other medical devices shrink in size, they too can benefit from the same miniaturization techniques and technologies.

Whether the need is for a custom component such as a complete tested printed circuit board or a fully integrated SiP, ON Semiconductor offers custom package development and manufacturing services, from design and test through volume manufacturing.

The ON Semiconductor facility located in Burlington, Canada, offers manufacturing compliance with US Food & Drug Administration (FDA) regulations.

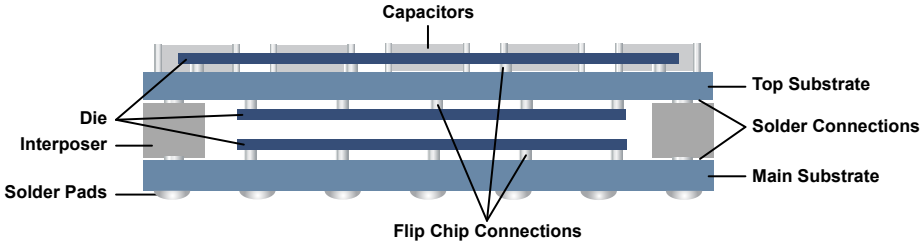
Printed Circuit Board Modules

ON Semiconductor offers printed circuit board module design, manufacturing, assembly, and test services to standards of quality and traceability demanded by medical device manufacturers. Features like 2D barcodes screened onto every board for individual tracing is just one example of how our standard process is tailored to medical needs.

Advanced 3D Packaging

Custom 3D packaging connects different silicon die and discrete components together in the same package to dramatically save space and improve electrical performance by decreasing signal distances.

- Stacking with or without wirebonds
- Modular, scalable architectures with high degree of manufacturing testability
- Mature, robust technologies and structures
- RoHS-compliant and ISO-certified
- For applications with high reliability requirements



Ezairo 7160 SL Wireless-Enabled DSP for Hearing Aids

Foundry Services

ON Semiconductor offers foundry services specifically tailored to the medical market. With analog, high voltage, and low power options, these world-class processes are ideally suited for applications such as cardiac rhythm management, neurostimulation, patient monitoring, and hearing aid devices.

The company provides process design kits (PDKs) and design guides for our technology. Customers are ensured direct technical communication with the foundry through a development customer service representative (DCSR). The DCSR coordinates the project through the engineering and prototype stages and responds to customer inquiries.

Value-Added Services

Other front-end and back-end services are available, such as wafer probe, custom short flow wafer processing, backgrind, backmetal, custom packaging, test, logistics, and supply chain management.

Features

- Optimized in-house process technologies tailored to medical applications
- Process longevity to support long product life cycle requirements
- World-class, high-reliability manufacturing sites certified to multiple international standards
- Access to extensive IP including configurable SRAM and EEPROM
- Multi-project wafer (MPW) prototyping support
- Extensive failure analysis capability
- Low cost shuttle service for development
- Flexible manufacturing: process modifications and lot splits

Mixed-Signal Process Technologies

ON Semiconductor offers ultra-low-power and low-leakage CMOS processes, as well as high voltage CMOS and BCD, tailor-made for the stringent demands of medical applications.

Process Name	Min Drawn Poly (μm)	No. Metal Layers	Wafer Size (in)	Max Operating Voltage	Max Operating Voltage (V_{gs})	NVM	Linear Cap	Other Devices
GF55	55	5-8	12	3.3	1.2/1.8/2.5/3.3	Y	MOM	Resistors
ONC110	110	4-7	8	3.3	1.2/2.5/3.3	Y	MIM	Resistors
I4T70	180	4-6	8	70	1.8/3.3	Y	MIM	Resistors
I4T45	180	4-6	8	45	1.8/3.3	Y	MIM	Resistors
ONC18TG	180	4-6	8	30	1.8/5/18	Y	MIM	Resistors
ONC18 5V30V	180	4-6	8	30	1.8/5	Y	MIM	Resistors
ONC18G/MS	180	4-6	8	15	1.8/3.3	Y	MIM	Resistors
ONC25	250	2-5	8	5	2.5/3.3/5	Y	MIM	Resistors
ONBCD25	250	2-5	8	40	5/12	Y	MIM	Resistors

RSL10 Bluetooth® Low Energy Technology Radio SoCs

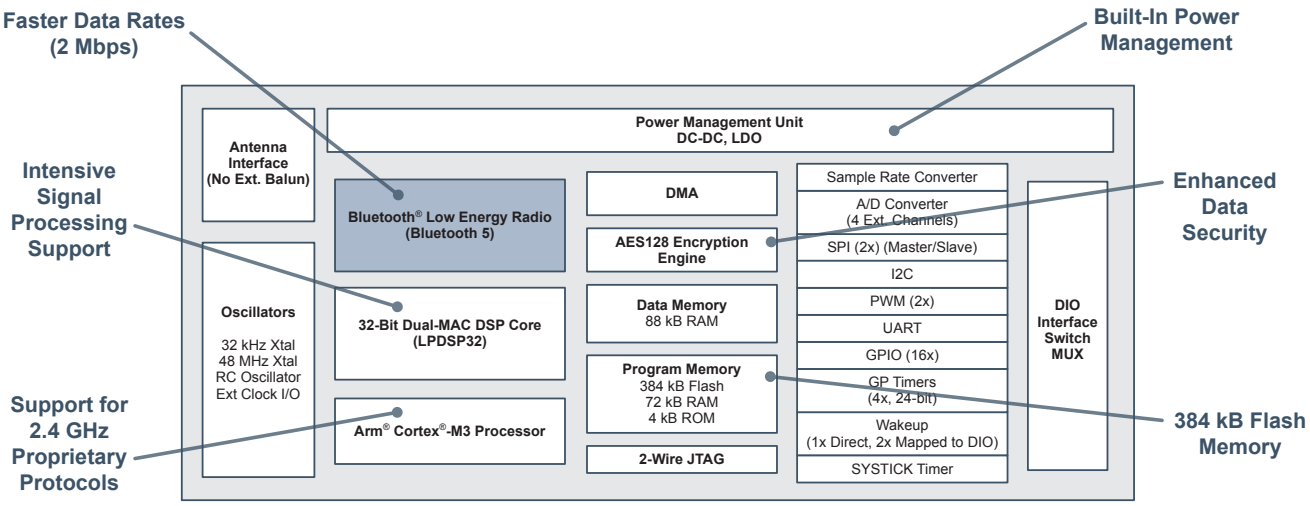
With so many options for wireless available, what sets the RSL10 radio SoC family apart? Simple. It is the industry's lowest power Flash-based Bluetooth Low Energy wireless MCU. Supporting 2 Mbps data rates provided by Bluetooth 5 (twice the speed as with previous Bluetooth generations), RSL10 enables advanced wireless functionality without compromising battery life. RSL10 can be easily integrated into any device.

SoC Features

- Industry's lowest power consumption (62 nW in Deep Sleep, 7 mW in Receive Mode)
- Supports Bluetooth Low Energy and 2.4 GHz proprietary protocols
- Flexible Voltage Supply Range (1.1 - 3.3 V)
- IP protection feature
- Available packages WLCSP-51, QFN-48

SIP Features

- All-in-one solution
  - RSL10 radio SoC
  - Integrated antenna, filtering, power management, passives
- Fully certified to worldwide regulatory standards
  - Bluetooth SIG, FCC (USA), CE (Europe), IC (Canada), KCC (Korea), MIC (Japan)



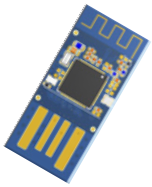
Development Tools

Software Development Kit (SDK)

- IDE support for Eclipse, Keil, and IAR
- Bluetooth Low Energy protocols, sample code and libraries, technical documentation

RSL10 Development Board

- Compliance with Arduino form factor
- Integrated PCB antenna
- On-board J-link adapter for easy debugging

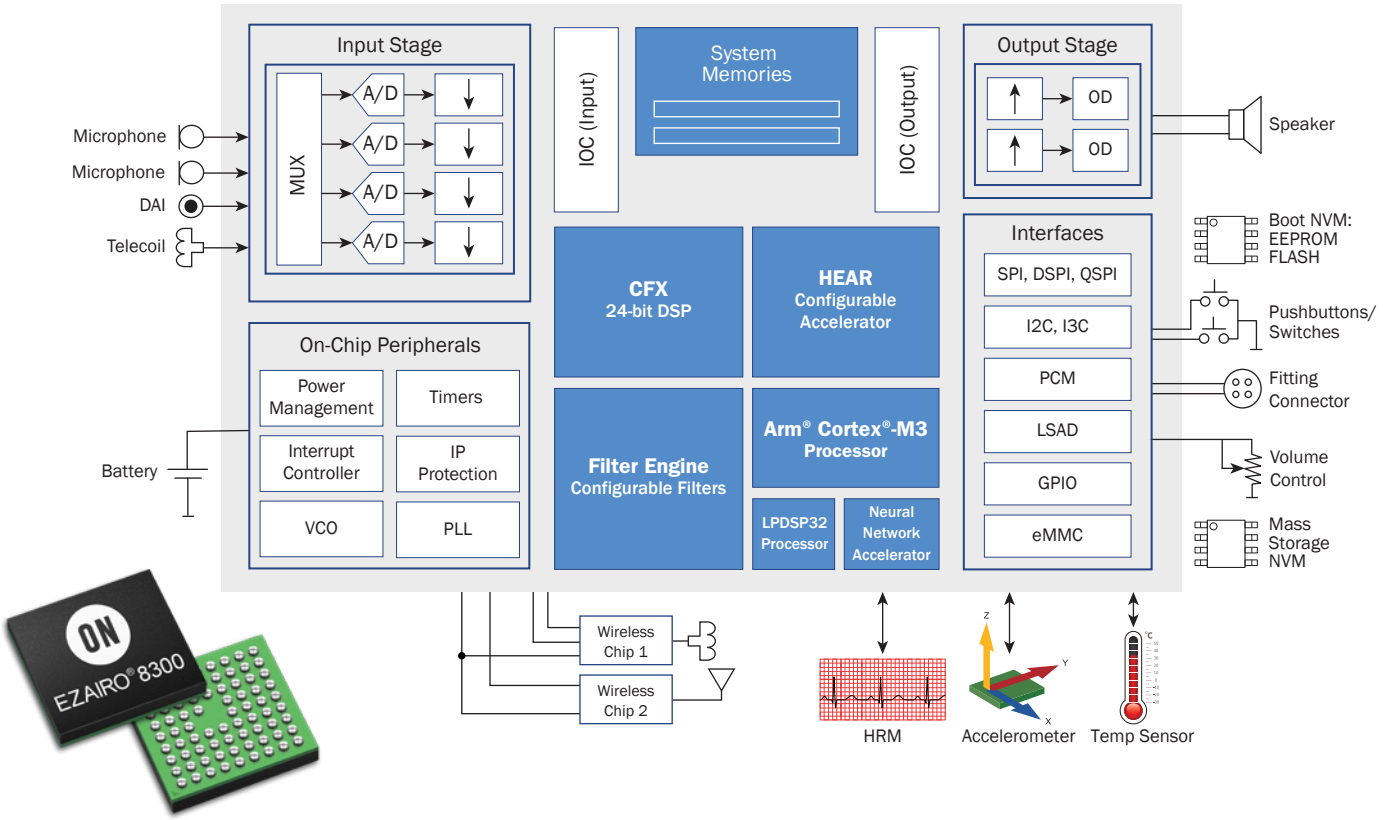


RSL10 USB Dongle

- Provided with Bluetooth Low Energy Explorer software to help verify or diagnose wireless connections during development

Ezairo® 8300 High-End Audio DSP for Wireless-Enabled Hearing Aids and Hearables

Ezairo 8300 is an advanced audio processor with 6 programmable and configurable processing cores, providing a high degree of parallelism and flexibility. Its high fidelity operation at ultra-low power consumption, along with its multiple interfaces, flexibility to maximize performance against power consumption, and support for Bluetooth® Low Energy connectivity make Ezairo 8300 an excellent choice for high-end wireless-enabled audio applications.



Features and Benefits

- 6 programmable and configurable processing cores
  - High degree of parallelism and flexibility
- Ultra-low power consumption of <0.7 mA @ 15.24 MHz system clock
  - Extended battery life of end product
- High fidelity audio system with 108 dB system dynamic range and up to 64 kHz of sampling frequency
  - High quality audio
- Dynamically selectable system clock speeds from 1.28 MHz to 61.44 MHz
  - Maximum flexibility to optimize computing performance against power consumption
- Versatile memory architecture for the 1433 kB of memory
  - Flexible sharing between the 6 cores for maximum system efficiency

Applications

- High resolution stereo audio streaming
- Intensive audio processing
- Wireless connectivity
- Control over Bluetooth Low Energy

End Products

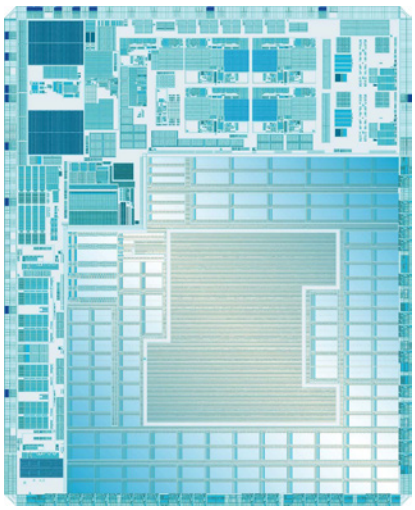
- Wireless-Enabled Hearing Aids
- Earbuds / Hearables
- Personal Sound Amplification Products (PSAPs)
- Over-the-Counter (OTC) Hearing Aids
- Headsets / Headphones

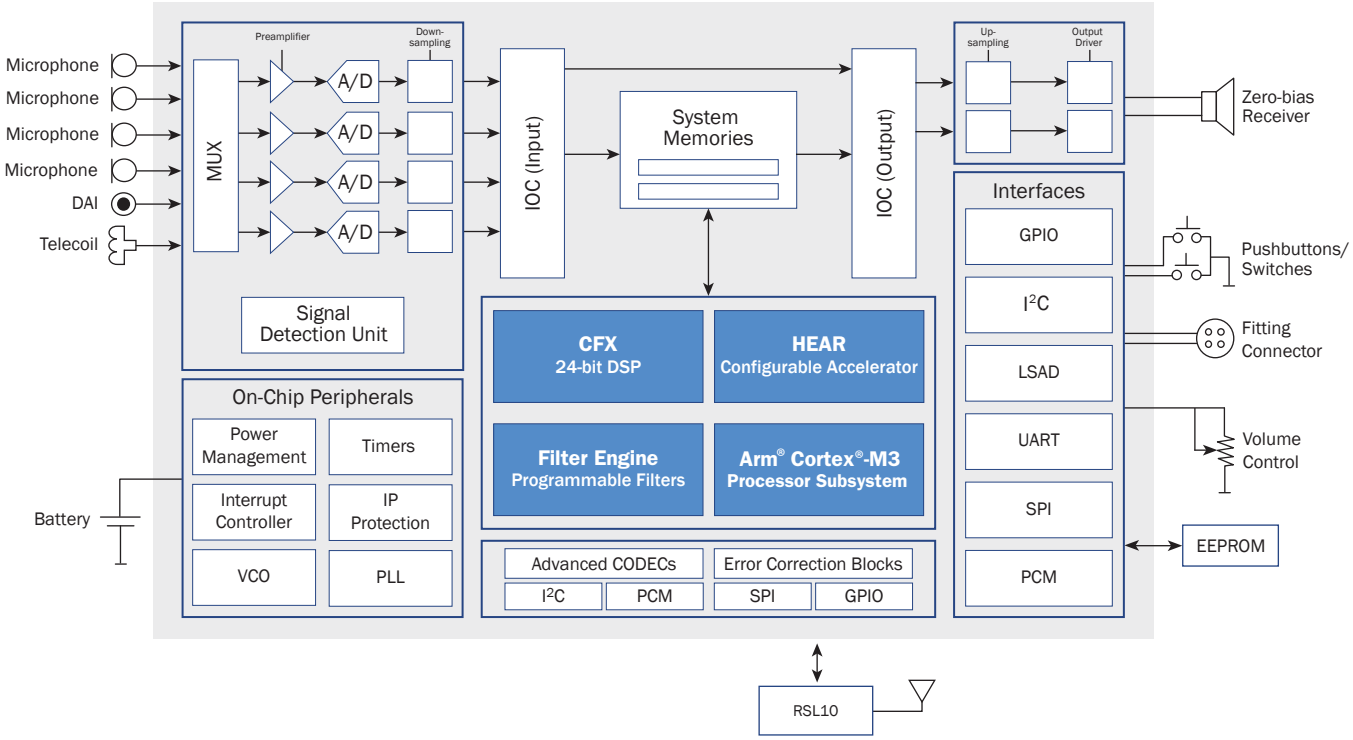
Ezairo® 7100 Open-Programmable DSPs for Hearing Aids

The highly customizable Ezairo 7100 series of open-programmable DSP systems enables manufacturers to build hearing aids with high precision sound. With processing power to run several advanced software algorithms simultaneously, Ezairo DSP systems' unique and patented architecture optimally balances processing power, power consumption, and design flexibility.

Features and Benefits

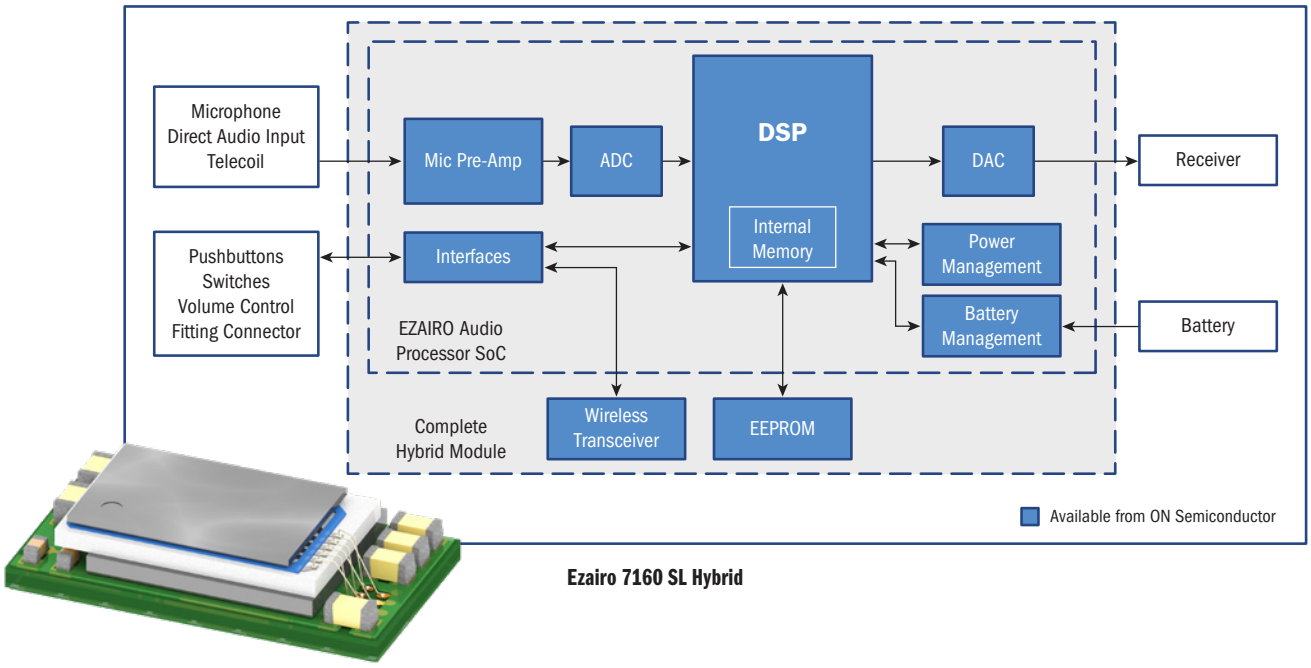
- High-precision sound with 24-bit precision computing
  - Enables development of more complex and efficient hearing aid algorithms
- Quad-core computing
  - Balances processing power and optimizes power consumption and design flexibility
- Ultra-high audio fidelity
  - Enables enhanced performance, especially for mild to moderate hearing loss profiles that demand more natural sound
- Ultra-low-power consumption
  - Extends life of small batteries
- Wireless capability
  - Seamless control of low-power radios for wireless-enabled hearing aids





Ezairo-based Hybrid Modules for Hearing Aids

The Ezairo systems are available in several hybrid package configurations designed for specific types of hearing aids – from sophisticated, wireless-enabled Behind-the-Ear (BTE) devices to discrete, Receiver-in-Canal (RiC) applications. Offering enhanced system miniaturization, the Ezairo-based hybrid modules combine functionality including audio processing, wireless, and peripherals into a single package.



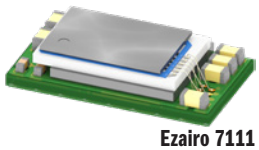
Ezairo 7160 SL Hybrid

	Ezairo 5920	Ezairo 7110	Ezairo 7111	Ezairo 7160 SL
Pre Suite Compatible			Yes	Yes
Wireless-Enabled				Bluetooth Low Energy Technology (Bluetooth 5)
Typical Power Consumption	~850 mA @ 5.12 MHz	~700 mA @ 10.24 MHz	~700 mA @ 10.24 MHz	~700 mA @ 10.24 MHz
Clock Speed	Max 5.12 MHz	Max 15.36 MHz	Max 15.36 MHz	Max 15.36 MHz
Max MIPS	45	375	375	375
EEPROM	512 kbit	2048 kbit	2048 kbit	2048 kbit
Program Memory	12 kwords	40 kwords	40 kwords	40 kwords
Data Memory	20 kwords	44 kwords	44 kwords	44 kwords

Development Tools for Ezairo DSP Systems

ON Semiconductor's development tools provide the flexibility for any manufacturer to easily design high-performance hearing aids based on the Ezairo platform. Whether you need an implementation-ready solution or an open-platform on which to develop your own innovative algorithms, ON Semiconductor's development tools can help you bring a hearing aid based on the industry-leading Ezairo platform to market as quickly as possible.

Pick a Platform

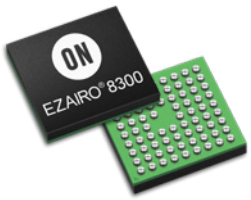


Ezairo 7111

Ezairo 7160 SL

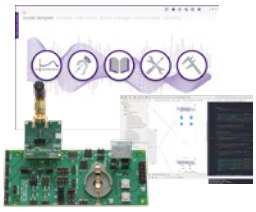
Ultra-miniature hybrid
incl. audio DSP, wireless, memory, etc.

OR



High-end wireless-enabled audio DSP*

Add your Algorithms



Ezairo Preconfigured Suite

Complete framework including firmware, configuration software, cross-platform SDK

Open-Programmable Evaluation & Development Kit (EDK)

Fully-integrated environment for manufacturers using their own or 3rd party algorithms

High-Performance Hearing Aid

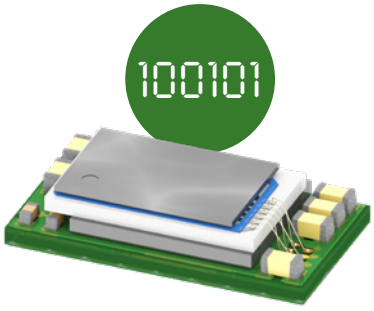
Development Hardware	Part Number
Ezairo 8300 Open-Programmable Development Kit	E8300-001-x-GEVK
Ezairo 7160 SL Hybrid Development Board	E7160SL-001GEVB
Ezairo 7111 Hybrid Development Board	E7111-001GEVB
Ezairo 7110 Hybrid Development Board	0W693001GEVB
Ezairo 5920 Hybrid Development Board	0W604001GEVB
Ezairo 7100 Open-Programmable Development Kit	0W683001EVK

* Open-programmable EDK only

Ezairo Preconfigured Suite

The Ezairo Preconfigured Suite (Pre Suite) is a complete toolkit which enables the development of high-performance hearing aids based on the Ezairo 7100 DSP. The Ezairo Pre Suite contains algorithms and firmware bundles, software for fine-tuning algorithms and features, and a cross-platform Software Development Kit (SDK) which can be used to easily develop fitting software and wireless applications.

Building Hearing Aids Made Easy



Firmware Bundles

- Designed and optimized for specific Ezairo-based hybrids
- Complete framework including advanced audio algorithms and features
- Built-in wireless support for audio streaming and Control over Bluetooth Low Energy (CoBLE) (optional)

Ezairo Sound Designer Software Application

- Complete end-to-end interface to customize, fine-tune, and calibrate Ezairo-based hearing aids
- Includes plug-ins to model transducers, construct product libraries, tune parameters, calibrate hearing aids

Ezairo Sound Designer Software SDK

- Easily develop fitting software and mobile applications
- Enables wireless device fitting using Bluetooth Low Energy technology
- Cross-platform (Windows®, Android™, IOS®)

Advanced Algorithms

- Multi-Channel Wide Dynamic Range Compression
- Adaptive Feedback Cancellation
- Static and Adaptive Directional Sound Processing
- Automatic Gain Control and Limiting
- Adaptive Noise Reduction
- Environmental Classification
- Tinnitus Management
- Tone and Voice Alert Indicators
- Stereo Audio Streaming
- Binaural Synchronization
- Remote Control and Fitting over BLE

Open-Programmable Development Tools for Ezairo DSP Systems

The Ezairo Open-Programmable Evaluation and Development Kit (EDK) provides a complete environment for manufacturers wishing to develop high-performance hearing aids based on their own innovative audio algorithms.

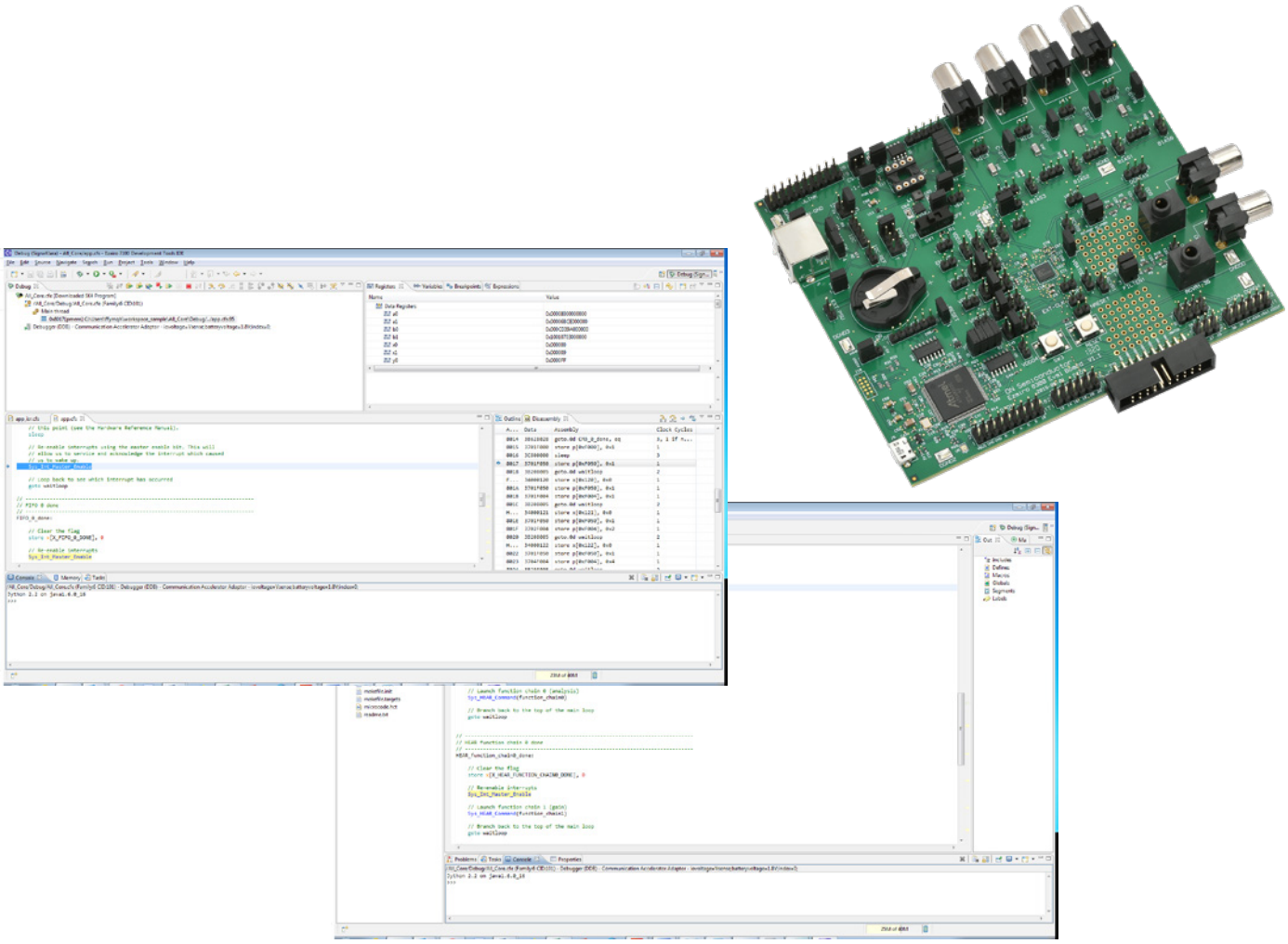
The Ezairo Open-Programmable EDK includes:

Ezairo 8300 or Ezairo 7100 Evaluation and Development Board: Hardware for the development, demonstration, testing and debugging of hearing aid algorithms. The Ezairo 7100 includes motherboard and daughterboard.

Promira™ Serial Platform: Facilitates high-speed I2C communication between the Ezairo board and PC

Integrated Development Environment: Fully-integrated software environment that enables coding, compiling, debugging and validation of hearing aid algorithms

Communication Tool Kit (CTK): An easy-to-use universal software component library that facilitates communication with the DSP system for development, fitting system, manufacturing, and testing environments

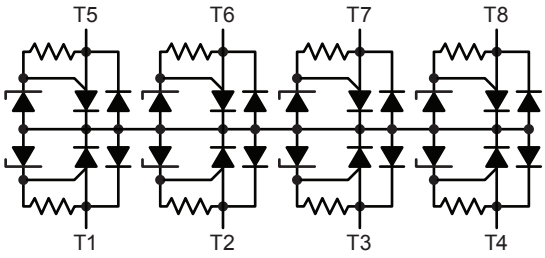


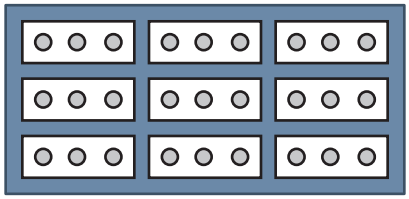
Transient Surge Suppressors

Multi-channel transient surge suppressors (TSS) from ON Semiconductor guard life-critical implantable devices against potentially devastating electrical fluxes resulting from defibrillation or other emergency treatment.

Offering reliable defense against electrical surge currents as high as 12 A, these devices protect the patient and prevent unnecessary repairs or replacement of equipment.

- Available as standard devices, or customized for unique electrical characteristics
- Extremely fast turn-on
- Maximum surge currents of greater than 12 A
- Forward breakdown voltage requirements can be tuned to application needs
- Off-state leakage currents of 100 nA
- Customizable physical footprint
- Specific to the number of terminals/leads needed
- Physical layout can be linear terminals or matrix terminals
- Device can be wire bonded or bumped for reflow
- Devices are tested, bumped (if needed) and shipped in wafer form
- Lot Acceptance Testing (LAT) performed on wafer lots





Example of a 9-Lead Wirebond Device with a 3 by 3 Matrix Layout

Medical Discretes

ON Semiconductor offers a broad catalogue of standard discrete components for use in medical applications, including diodes, MOSFETs, IGBTs, and power regulators. These devices are suitable for use in life critical medical applications, including FDA Class III and implanted, life-critical devices.

For medical applications, customized support for value-added services is available to address the specific needs of medical customers:

- Lot Acceptance Testing (LAT)
- Visual inspection
- Bare die flows
- Custom multi-chip packaging
- Labeling and Certificate of Compliance
- Record retention
- Lot traceability
- Process longevity to support extended product life cycles
- Security/continuity of supply commitments
- Extensive portfolio of AEC qualified discretes

Device Examples
LDO Regulator
MOSFET, 1000 V
RF NPN Wideband Transistor
Schottky Barier Diode, 40 V, SOT-23
Schottky Barrier Diode, Dual, Common Cathode, 30 V
Schottky Diode, 30 V, 200 mA, SOD-723
Schottky Diode, 30 V, 200 mA, SOD-923
Schottky Diode, 30 V, SOD-323
Schottky Diode, 30 V, SOD-523
Schottky Diode, Dual, Common Cathode, 30 V, SOT-323
Schottky Diode, Dual, Series, 30 V, SOT-323
Schottly Barier Diode, Dual, 40 V, SOT-23
Switching Diode, 75 V
Switching Diode, Dual, Common Cathode
TVS, 24 V, SC-74
Zener Diode Voltage Regulator, 22 V
Zener Diode, 16 V
Zener Diode, 6.8 V, 200 mW, SOD-323
Zener Diode, 6.8 V, 200 mW, SOD-523
Zener Voltage Regulator, 11 V, 1.5 W, SMA

Other discrete devices may be qualified to life-critical standards upon request.

Ultra-Low-Power SRAM Memory

SRAM memory from ON Semiconductor consumes the least power consumption, and is specifically designed and qualified for implantable medical applications. In patients with pacemakers, these SRAMs remember the last day's ECG signals, which facilitates much more accurate clinical diagnoses when needed and provides the best possible patient outcomes.

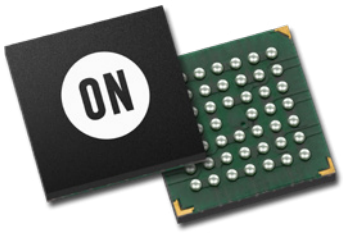
Parallel SRAM for Implantable Medical Devices

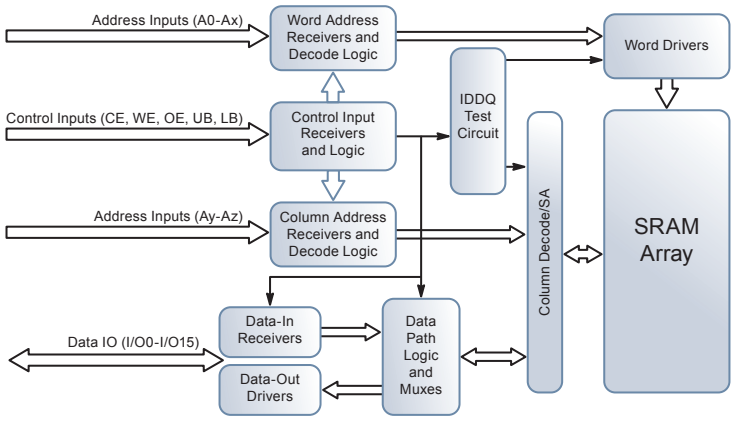
Features and Benefits

- Optimized for ultra-low-power operation
  - Low voltage operation down to 1 V
  - Typical leakage of ~100 nA for 8 Mb SRAM
- 1 Mb through 8 Mb densities
- Mature technology; in production for over 10 years
- Quality driven design and manufacturing
  - RIGID ID Traceability requirements are in place for all medical products
  - Design For Test/Quality (DFQ) incorporated into products
  - Soft Error protection expertise

Applications

- Pacemakers
- Implantable cardioverter defibrillators (ICDs)
- Neurostimulators





Typical Parallel Medical Memory Implementation

Serial SRAM for Medical Applications

Features and Benefits

- Easy-to-use 4-pin SPI interface
  - Programmable DUAL and QUAD I/O functionality
- High voltage operation
  - 5 V added capability (in addition to existing 1.8 V and 3 V power supplies)
- 20 MHz serial operation, fast write cycles (no wear-out)
- Ultra-low-power (1 µA typical standby current)

Applications

- Patient monitors
- Pulse oximeters
- Electrocardiographs
- Cardiac monitoring devices
- Blood glucose meters

Low-Power Serial EEPROMs

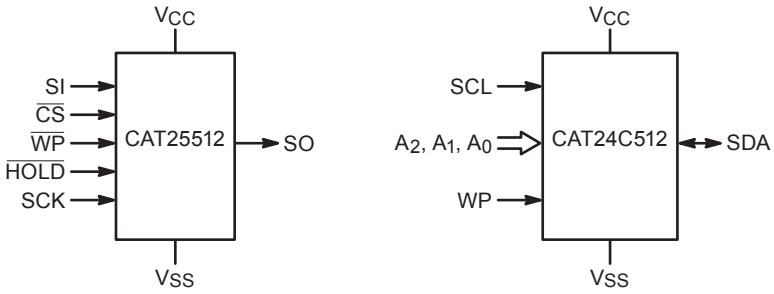
ON Semiconductor offers a range of low-power serial EEPROM products ideally suited for storing system configuration and user data in medical devices.

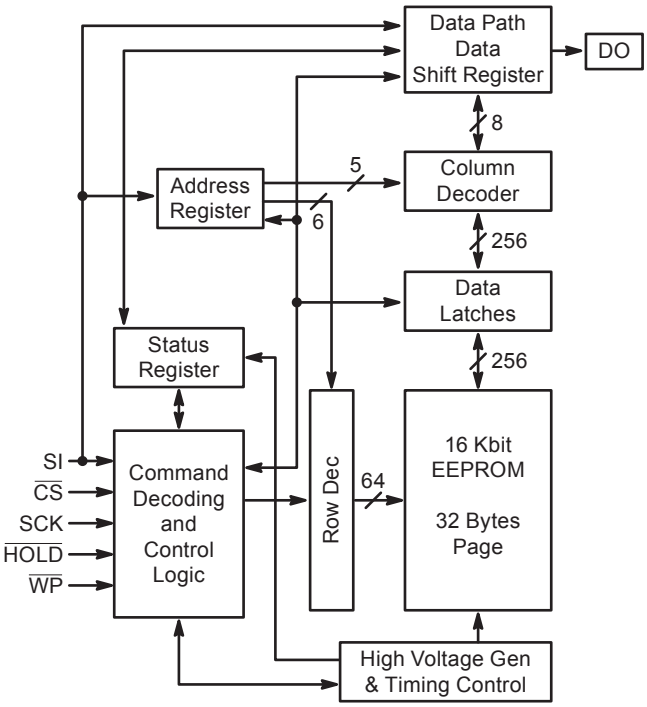
Features and Benefits

- Full range of densities from 1 kb to 2 Mb
- Flexible interface protocols including SPI and I2C
- Supply voltage range from 1.7 V to 5.5 V
- Optimized versions available for hearing aids where low absolute power consumption and low write current operation is essential
- Available in industry-standard and space-optimized packages (also available in die form)

Applications

- Hearing aids
- Blood glucose meters
- Patient monitors
- Test strips
- Medical patches

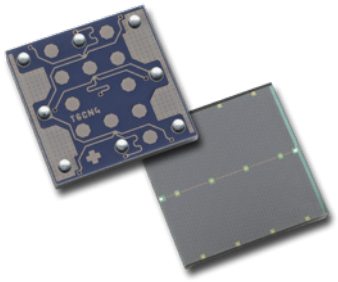




Silicon Photomultipliers (SiPM)

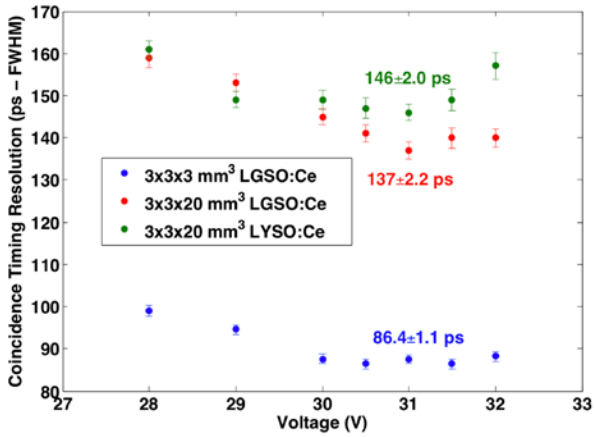
for high performance, time-of-flight positron emission tomography

Time-of-Flight Positron Emission Tomography (ToF-PET) systems seek to optimize the coincidence resolving time (CRT) between a pair of radiation detection elements in order to provide the best image quality. ON Semiconductor has a range of high performance Silicon Photomultipliers (SiPM) that can be used as the photosensor element in PET detectors to provide excellent CRT performance.

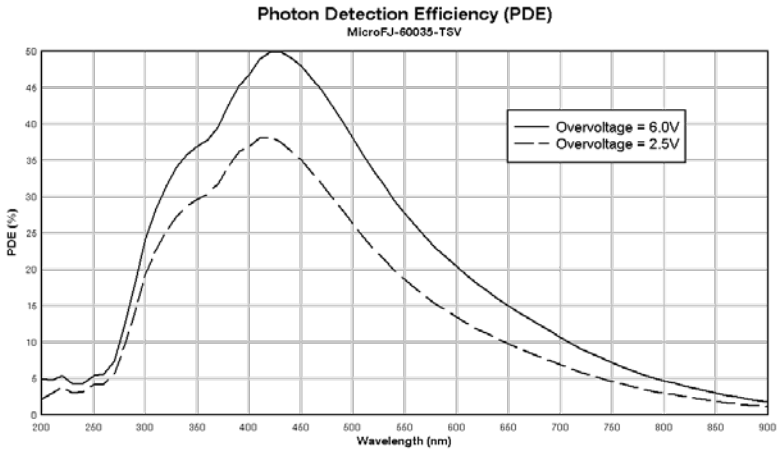


J-Series SiPM Features

- 50% PDE @ 420 nm
- High fill factor package, giving a packing fraction of >90%
- Optimized for fast timing applications and featuring unique fast output
- Low dark count rate of <100 kHz/mm^2
- Available as single sensors (3 mm, 4 mm, or 6 mm) or as pre-fabricated arrays



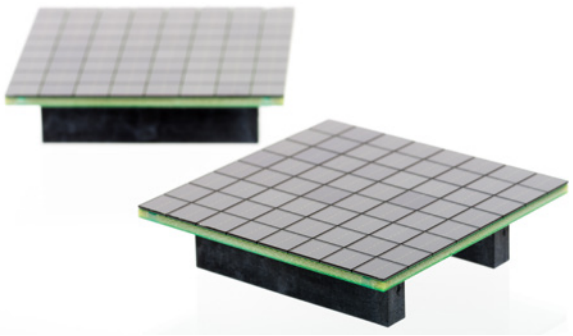
CRT values as a function of bias voltage for different crystals, obtained with the fast outputs from two MicroFJ-30035-TSV sensors in coincidence, results courtesy of J. Cates and C. Levin of Stanford University.



PDE (photon detection efficiency) of J-Series SiPM sensors, showing 50% at 420 nm, which is the peak emission of the commonly used LYSO scintillator.

Device	Sensor Size (mm)	Cell Size (μm)	Package
MicroFJ-30035-TSV	3	35	TSV Chip Scale
MicroFJ-40035-TSV	4	35	TSV Chip Scale
MicroFJ-60035-TSV	6	35	TSV Chip Scale

These sensors are also available in a selection of arrays.



ArrayJ-60035-64P-PCB array of SiPM

CMOS Image Sensors

ON Semiconductor offers a large selection of mainstream CMOS image sensors and image sensor SOCs. The 80+ devices are available with various combinations for the specifications list below for a wide range of medical applications. Please visit www.onsemi.com/imagesensors for the most complete and up-to-date listing of available devices.

Resolution (MP)	Pixel Count (H x V)	Pixel Size (µm)	Optical Format	CFA[1]	Shutter Type[2]	Frame Rate[3]	Output Interface	Package Size (mm)	Package[4]
0.13 to 18, VGA, WVGA	560 x 560 to 4912 x 3684	1.0 to 4.2 BSI, 1.4 to 6.0 FSI, 1.1 BSI Super PD	1/13" to 1"	C, M, NIR, RGB-IR, Clarity+	ERS, GRR	13 to 360 fps, 1.2 to 18 MP, 1080p60	Parallel, MIPI, HiSPi, LVDS, NTSC/PAL	2.7 x 2.7 to 14.22 x 14.22	ODCSP, IBGA, PLCC, CLCC, Die

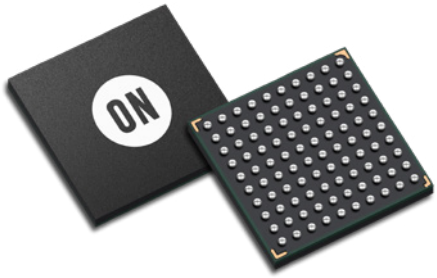
1. C = Color, M = Mono. 2. ERS = Electronic Rolling Shutter, GRR = Global Reset Release, GS = Global Shutter. 3. Higher frame rates can be achieved in subsampling modes. 4. Some devices are also offered without a package in bare die or wafer form. * Pending 4Q19.

Co-Processors for Mainstream CMOS Image Sensors

Device	Resoution (MP)	Video	Output Format	Package
AP0100	1	1.2 MP/45 fps; 720p/60 fps	NTSC/PAL; YUV	VFBGA-100
AP0101	1	1.2 MP/45 fps; 720p/60 fps	SMPTE 296M; YUV	VFBGA-81
AP0102	2	1.2 MP/45 fps; 720p/60 fps; 1080p/30 fps	RGB; YUV	VFBGA-100
AP0200	2	1.2 MP/45 fps; 720p/60 fps; 1080p/30 fps	H.264; MJPEG	VFBGA-100
AP0201	2	1.2 MP/45 fps; 720p/60 fps; 1080p/30 fps	H.264; MJPEG	VFBGA-100
AP0202	2	1.2 MP/45 fps; 720p/60 fps; 1080p/30 fps	RGB565; RGB888; YUV	VFBGA-100
AP1302	13	13 MP/30 fps; 1080p/120 fps	JPEG; RAW; RGB565; RGB888; YUV	VFBGA-120

Available SOC and Co-Processor Functionality*

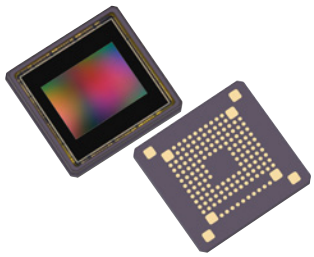
- Spatial Transform Engine (STE) with dual transform support/software add-on
- Optimized for use with HDR (High Dynamic Range) sensors/HDR with ALTM
- Full auto-functions support (AWB and AE) and ALTM (Adaptive Local Tone Mapping) to enhance HDR images
- Pre-rendered graphical overlays
- Multi-camera synchronization support
- LED flicker detection and avoidance
- Dewarp, up to 165 degrees
- Overlays
- GPIOs, up to 5
- Next generation color pipe with improved noise filtering & reduced chromatic aliasing
  - Demosaic
  - Gamma correction
  - Auto white balance
  - Defect correction
  - Noise reduction
  - Auto exposure



* See product information for device-specific functionality.

X-Class CMOS Image Sensor Platform

The X-Class image sensor platform enables a new dimension in camera design by supporting multiple CMOS pixel architectures within the same image sensor frame. This enables a single camera design to not only support multiple product resolutions but also different pixel functionality through a common high bandwidth, low power interface, allowing camera manufacturers to leverage existing parts inventory and accelerate time to market for new camera designs.



The initial devices in this platform are based on the advanced 3.2 µm XGS Global Shutter CMOS pixel that features superior imaging performance, high image uniformity, and low noise. Available speed grades match imaging performance to application, with a compact package that enables 29 x 29 mm^2 camera designs.

Device	Resolution (MPix)	Pixel Count (H x V)	Pixel (µm)	Diagonal (mm)	Lens	CFA[1]	Shutter Type	FPS Max	Output Interface	Evaluation Kit
XGS 8000	8.8	4096 x 2160	3.2	14.8	1 /1.1"	C/M	GS	130	HiSPi	✓
XGS 12000	12.6	4096 x 3072	3.2	16.4	1"	C/M	GS	90	HiSPi	✓

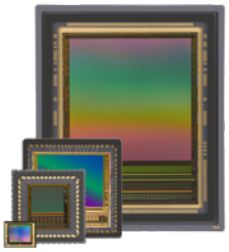
1. CFA Options – Bayer Color (C), Monochrome (M).

PYTHON Global Shutter CMOS Image Sensors

With resolutions from VGA to 26 megapixels, the PYTHON family of image sensors addresses the needs of medical imaging applications, ranging from microscopy to cameras used for surgical theater monitoring and automation. Combining flexibility in configuration and resolution with high speed and high sensitivity, these devices capture fast moving scenes without distortion by combining low read noise and high sensitivity with frame rates up to 815 fps.

Features

- CDS pipelined and triggered global shutter technology with low noise performance
- True HW scalable family concept
- High configurability and fast adaptability
- Quadratic speed increase with ROI windowing
- Multiple regions of interest
- High dynamic range
- Color, Monochrome, and Enhanced NIR configurations
- Standard and protective tape configurations
- Low power, cost efficient configurations
- LVDS output interface

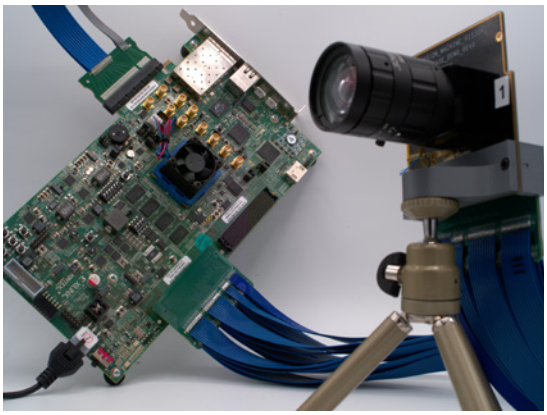


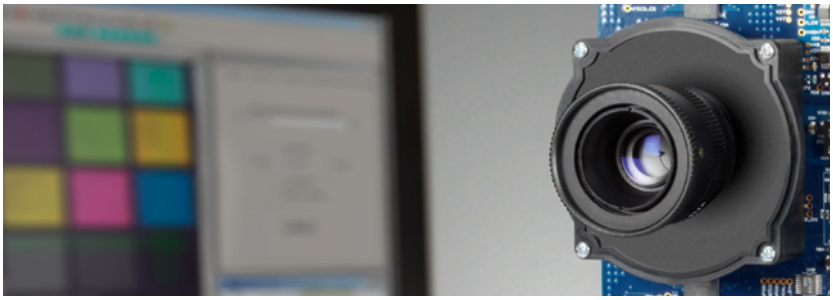
Device	Resolution (MPix)	Pixel Count (H x V)	Pixel (µm)	Diagonal (mm)	Lens	CFA[1]	FPS Max	Evaluation Kit
PYTHON 300	0.3	640 x 480	4.8	3.8	1/4"	C/M/NIR	815	✓
PYTHON 480	0.5	800 x 600	4.8	4.8	1/3.6"	C/M	120	✓
PYTHON 500	0.5	800 x 600	4.8	4.8	1/3.6"	C/M/NIR	545	✓
PYTHON 1300	1.3	1280 x 1024	4.8	7.9	1/2"	C/M/NIR	210	✓
PYTHON 2000	2.3	1920 x 1200	4.8	10.9	2/3"	C/M/NIR	225	✓
PYTHON 5000	5.3	2592 x 2048	4.8	15.9	1"	C/M/NIR	100	✓
PYTHON 16K	16.8	4096 x 4096	4.5	26.1	APS-H	C/M/NIR	120	✓
PYTHON 25K	26.2	5120 x 5120	4.5	32.6	APS-H	C/M/NIR	80	✓

1. CFA Options – Bayer Color (C), Monochrome (M), Enhanced NIR (NIR).

Image Sensor Evaluation Support

ON Semiconductor provides supporting hardware and software to qualified engineering teams to accelerate product development. From support for detailed product evaluation, to tools that facilitate FPGA programming and provide detailed reference designs, these kits contain everything necessary to simplify and accelerate your camera designs.





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