ANALOG DEVICES
AHEAD OF WHAT'S POSSIBLE™

THE BUILDING BLOCKS OF THE IoT

Technologies and Solutions for Building the Internet of Things

The Internet of Things Depends on the Intelligence of Things

Having information is not the same as having insight. Data is most valuable when you know it is accurate and reliable. By using the best quality data, intelligence at the edge, and reliable connectivity, you can enable your cloud to deliver deep learning and insights.

That's where our focus is.

From human biometrics to machine vibration profiles, discover how our technologies are measuring what could not be measured before. And discover how these can create new possibilities, more reliable outcomes, lower costs, and faster time to market for your IoT solutions.

Visit analog.com/IoT

Technologies

The IoT begins where the physical world connects to the digital.

Sensors. Converters. Processors. And transceivers. These are what gather and transport the data that fuel the promise and potential of the Internet of Things. That's where the IoT begins, and that's where the need for intelligence, accuracy, and reliability is crucial.

Components that sense, measure, interpret, connect, and analyze—these are the devices that live on the front lines of the IoT. These are the devices we've pioneered and advanced for more than half a century.

Power Management in IoT

Because many IoT applications require wireless, remote, or mobile solutions, power management is often a primary challenge in system design. Battery life can have significant implications on cost of ownership, and can sometimes be a barrier to viability. Analog Devices takes a system-level approach to power management. What does this mean?

- Energy harvesting technology to source power from the environment
- Ultra low power products that often achieve best-in-class benchmark scores
- System-level power management functions built in at the component level
- Unmatched design expertise around low power systems

Product Highlight: LTC3330

LTC multinode converter with energy harvesting

- Nanopower buck-boost dc-to-dc
- Energy harvesting battery life extender
- Ultralow quiescent current
- 5 mm × 5 mm, 32-lead QFN package

Sense

Sensing is the birthplace of data in the IoT. Our high performance sensing portfolio combines precision, power efficiency, and robustness to ensure the highest level of accuracy and integrity right from the start.

- MEMS inertial
- Optical
- Biopotential
- Impedance
- Temperature

Product Highlight: ADXL1001/ADXL1002

- Single in plane MEMS accelerometer with full-scale range of ±100 *g*
- Delivers ultralow noise density of 30 $\mu g/\sqrt{Hz}$ with a sensitivity of 20 mV/*g*

Measure

Our robust signal conditioning technologies play a critical role in turning the most sensitive signals into useful data and useful information—solving the most challenging measurement problems faced by our customers.

- Integrated AFEs
- Converters
- Amplifiers
- References
- Switches/multiplexers
- Power management

Product Highlight: AD8233 Electrocardiogram (ECG) Integrated AFE

- Small size enables health devices that are smaller, lighter, and easier to wear
- Microamp-range power requirements enable extended battery life and continuous monitoring
- Low electrical noise enables precise signal measurement
- On-chip integration (including multiple filtering and amplifiers) enables ease of use

Interpret

The brain of the connected solution, our processors combine hardware and advanced algorithms to deliver intelligence, functionality, and localized decision making for IoT solutions.

- Ultra low power microcontrollers and processors
- Integrated precision microcontrollers and processors
- Blackfin® low power DSP

Product Highlight: ADuCM4050

- Ultra low power ARM® Cortex®-M4 core MCU with floating-point unit and 512 kB of embedded flash memory
- Integrated power management SensorStrobe™ technology supports multiple digital and analog sensor inputs for data analysis, enabling the MCU to remain in a low power state while sensors and RF technology are still collecting data
- High performance ULPBench™ certified score of 203 points (Embedded Microprocessor Benchmark Consortium)
- Improved encryption and security, enabled by a combination of hardware and software protection mechanisms providing read protection

Connect

Our IoT radio products ensure power efficiency, reliability, and flexibility across a number of wireless protocols and range requirements. They enable robust networks in applications where reliability and timeliness of information are critical.

- Wireless sensor networks
- Long-range radio transceivers
- High data rate radio transceivers
- Integrated radio/microprocessors

Product Highlight: SmartMesh IP

- Wireless chips and precertified PCB modules built for IP compatibility, complete with ready-to-deploy wireless mesh networking software
- Enables low power consumption and >99.999% data reliability even in harsh, dynamically-changing RF environments

Industry 4.0: Smart Manufacturing for the Future

Virtual and real worlds combine to create a networked world where machines interact with each other and with humans

- Increased productivity
- Flexible manufacturing
- Cyber physical systems and human-machine interaction
- Big data and analytics
- Cybersecurity and trusted data
- The connected enterprise: the ultimate smart systems integration challenge

Measure

ADI measurement capabilities transform the most sensitive signals into information and knowledge—enabling customers to solve their most challenging measurement problems.

Sense

Intelligent sensing starts with accurate data. ADI precision sensing capabilities operate at the lowest power—ensuring the highest level of data integrity.

Analyze

As little as 1% of cloud data is important/useful. The remaining 99% is not being used to make business decisions and takes up bandwidth, storage, and time. By enabling better data at the sensing and measuring frontlines of the IoT, you can utilize the cloud more effectively. Analytics enable change and improvement for better outcomes.

Connect

ADI solutions allow you to safeguard reliable IoT connectivity with multirange wireless and wired solutions. Even 0.1% unreliability can result in downtime and cost.

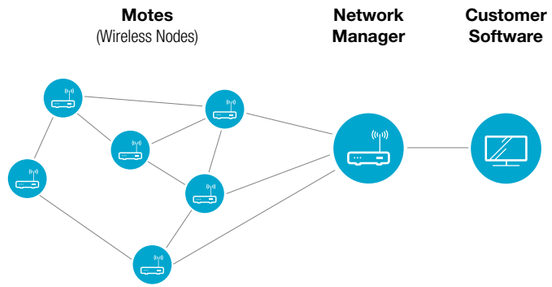
Interpret

ADI processing technology brings intelligence to the solution and enables localized decision making rather than relying solely on cloud analytics.

SmartMesh Wireless Mesh for Tough Industrial IoT Applications

Analog Devices' SmartMesh® (formerly known as Dust Networks) offers the industry's lowest power and most reliable standards-based wireless sensor networking (WSN) products. SmartMesh products are field proven with over 60,000 customer networks deployed in 120 countries. By delivering >99.999% data reliability in tough RF environments, our wireless mesh networks are entrusted by industrial IoT solution providers to deliver critical sensor and control data reliability for many years without requiring intervention.

- The only network built for industrial IoT
- Engineered for years of trouble free operation
- Complete networking software speeds time to market



SmartMesh wireless sensor networking products are chips and precertified PCB modules, complete with mesh networking software—enabling sensors to communicate in tough Industrial Internet of Things (IIoT) environments.

SmartMesh embedded wireless sensor networks deliver >99.999% data reliability and >10 year battery life, making it practical to deploy wireless sensor networks in the most challenging environments.

- Tough RF environments with extensive metal and concrete, including industrial plants, data centers, commercial building monitoring, bridges, and tunnels
- Large area networks, such as street parking applications, smart street lighting networks spanning multiple city blocks, and commercial irrigation
- Dense deployments where thousands of nodes operate within radio range of each other—for instance, data centers and utility scale solar farms
- Networks on moving vehicles, including rail cars, cargo containers, semi trucks, or aircraft
- Long, extended networks, including pipelines, mines, tunnels, bridges, fence lines, and smart street lighting
- Remote monitoring, where all nodes must be powered by battery or energy harvesting, such as oil fields, agriculture, or environmental monitoring

The Only Network Built for Industrial IoT

Delivers Business-Critical Data in Tough Industrial Environments and Scales with Your Business

>99.999% Network Reliability

SmartMesh delivers business-critical data when other RF solutions fail. Industrial applications cannot tolerate even a 1% failure rate, which translates to 3.65 days per year of unscheduled downtime.

NIST-Certified Encryption Security

All data is protected by end-to-end AES 128-bit encryption (message stays secret), message integrity checking (message is unchanged), and message authentication (sender is who they say they are).

Scalable >10,000 Nodes

SmartMesh's time-synchronized, channel hopping technology eliminates in-network packet collisions. Network optimization algorithms intelligently load-balance data traffic to efficiently route data.

Bidirectional Communication for Monitoring and Control

Receive sensor data, retrieve log files, configure sensors, and control actuators (alarms, locks, valves, HVAC dampers, etc.).

Up to 10 Messages/Second/Node for Data-Intensive Applications

Unlike other wireless solutions, this includes built-in margin for packet retries to sustain the rate even in noisy RF environments.

Engineered for Years of Trouble Free Operation

Field Proven, Wireless Networks That Are Easy to Install, Expand, and Maintain Over Years of Operation

>50,000 Installed Networks

SmartMesh is field proven, with the technology in over 120 self-monitoring and self-healing networks.

>10 Year Battery Life Enables No-Wires Installation

SmartMesh enables sensors to be placed anywhere information needs to be gathered.

No RF Skills Required

Installers do not need specialized RF expertise.

Worldwide RF License-Free Operation

Operation at 2.4 GHz enables development of one product to serve the global market.

Diagnostics Provide Visibility to Network Performance

Operation at 2.4 GHz enables development of one product to serve the global market.

Diagnostics Provide Visibility to Network Performance

Network self-monitoring and self-healing.

Built-In Self-Optimization

SmartMesh proactively maintains reliability, reduces latency, and minimizes power consumption in changing RF conditions.

Over-the-Air Software Updates

Wirelessly updates software of nodes deployed in the field.

Complete Networking Software Speeds Time to Market

No Network Software Stack Development Required

Developers can focus on sensor and application development, knowing that SmartMesh automatically maintains the network integrity and quality of service.

>1M Node-Hours Network Stack Testing

Network software is verified under real-life stress conditions, such as RF interference, heavy data traffic, environmental extremes, and multiple co-located networks.

Comprehensive API Simplifies Development

Software application programming interfaces (APIs) provide access to network configuration and performance statistics.

User-Programmable ARM Cortex-M3

SmartMesh IP wireless nodes support on-chip application software development.

Wireless Standards Compliant

SmartMesh IP is compliant to 6LoWPAN, making sensor data easily cloud accessible. SmartMesh WirelessHART products interoperate with WirelessHART devices from other vendors.

White Paper: Verifying >99.999% Data Reliability

www.linear.com/docs/52484

Ahead of What's Possible

At Analog Devices, our technologies play a critical role in bridging the physical and digital worlds, enabling the Internet of Things and empowering smarter cities, factories, energy grids, agricultural practices, healthcare systems, and more.

Working together with customers and partners, we continue to apply our knowledge of the signal chain and IoT ecosystem to create solutions at the system level that solve the toughest challenges.

Our innovations, expertise, and drive to always be Ahead of What's Possible mean Analog Devices can implement—not just theorize—greater possibilities for today's interconnected world. We consider problems at a big picture level and implement holistic, system-level technologies to address them. And the more we learn, unlock opportunities, and apply these solutions, the more our customers—and their customers—succeed.

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