Commercial Aviation Solutions

Intelligent Power Solutions

FPGAs and SoCs

Power Switching Discrete and Modules

Transient Voltage Suppression (TVS) Diodes

Analog Mixed Signal ICs

Radio Frequency (RF) and Microwave Solutions

Ethernet Switches, PHYs, Software and Power-over-Ethernet

Memory and Storage Solutions

Advanced Packaging Capability

Security

Microsemi

Power Matters.™

Giving Wings to Innovation in Commercial Aviation

Electronics

Take Flight with Microsemi

Microsemi technology has been used in all major commercial and military aerospace platforms for many decades. With our broad product and capability portfolio and a proven track record of innovation, quality and reliability on aerospace platforms over the past 20 years, Microsemi is well-positioned as a key partner on existing and future aerospace and defense platforms. We have extensive design, product, packaging and test capabilities both within Microsemi and with select external partners.

We continue to leverage our technology and extensive capabilities in this segment to support the ever-increasing electronic content in today's aircraft. Microsemi has evolved to become a leading-edge systems solution provider for the most demanding aerospace applications. We invest significant R&D funds in technology and capability development to augment our portfolio of high reliability products for the next generation of aircraft, but also to become a full technical service provider as a supplier of innovative, highly integrated, flexible, scalable and intelligent solutions as an extension of our customers design teams.

Microsemi has invested in a new Aviation Centre of Excellence (CoE) for Intelligent Power Solutions (IPS). This R&D lab and system integration facility will be responsible for the design, development and manufacture of a new product line of IPS for power conversion applications on the more electric aircraft (MEA). The facility's new research and development laboratory is fully resourced with modeling, simulation, analysis and algorithm development capabilities providing accelerated product innovation. The state-of-the-art measuring equipment enables extensive product testing while a dedicated reliability laboratory facilitates product qualification and long-term application specific life testing. As the aviation sector continues to demand higher levels of reliability and integration in the area of power electronics in order to realize the goal of MEA, Microsemi's Aviation Centre of Excellence will play a critical role in supporting this objective.

Learn more about Microsemi commercial aviation solutions at:
www.microsemi.com/applications/commercial-aviation

Microsemi

AVIATION CENTRE OF EXCELLENCE

Electric Aircraft Increasing Microsemi Semiconductor Content

Microsemi offers an industry-leading range of high-reliability products and solutions for flight-critical avionics and power conversion applications. Microsemi products and solutions provide smaller size, lower weight, increased performance, security, reliability, and continuity of supply to address the evolving needs of the aviation industry.

Cockpit Avionics

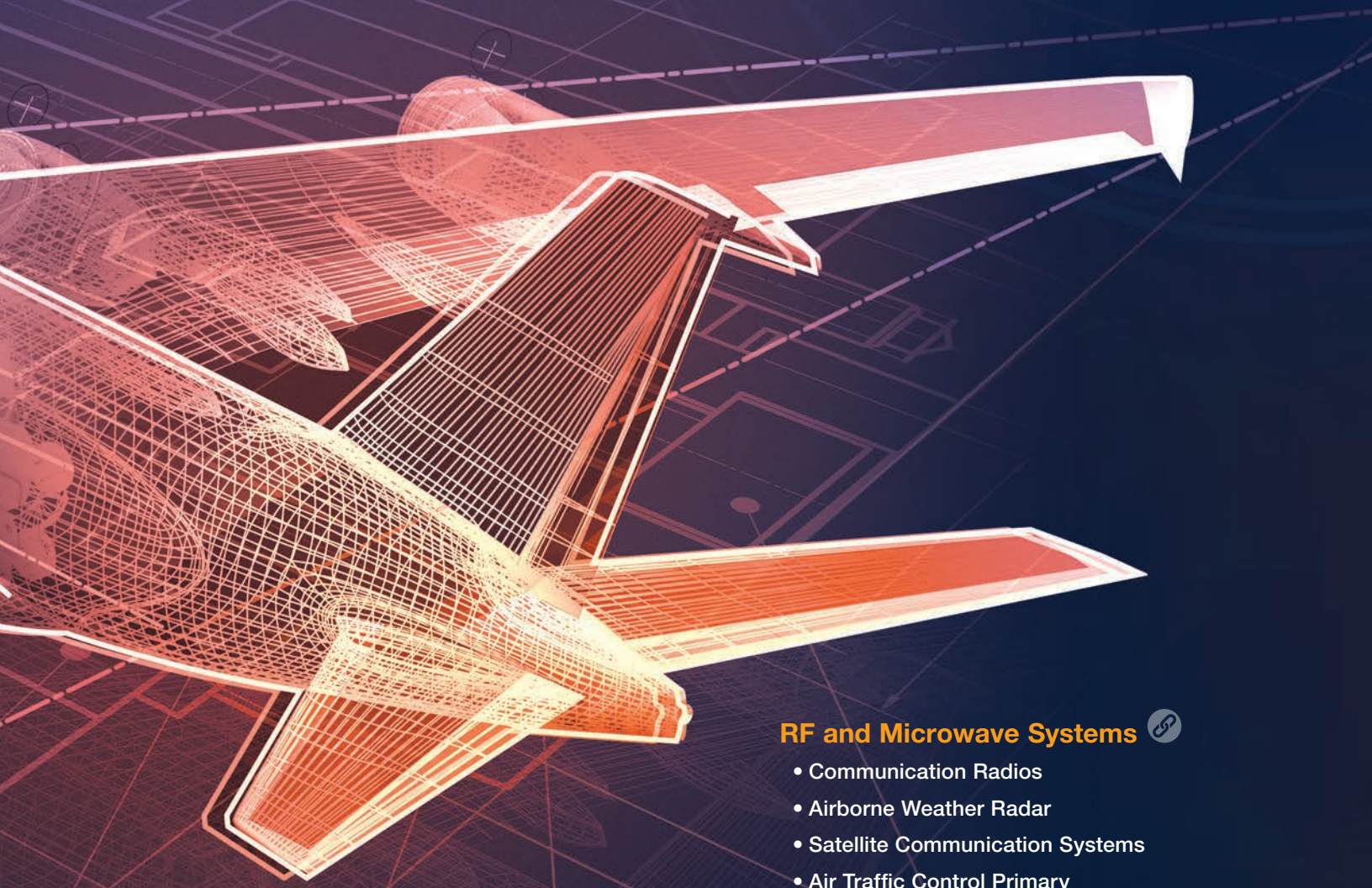
- Flight Control Systems
- Data Management Systems
- Health Monitoring Systems
- Crew Interface Systems

Actuation Systems

- Landing Systems
- De-icing Systems
- Wheels and Braking Systems
- High Lift Control and Monitoring
- Primary and Secondary Actuation Systems

Cabin Management Systems

- Cabin Lighting and Control
- Flight Entertainment Systems
- Air Conditioning and Management Systems



RF and Microwave Systems

- Communication Radios
- Airborne Weather Radar
- Satellite Communication Systems
- Air Traffic Control Primary Surveillance Radars

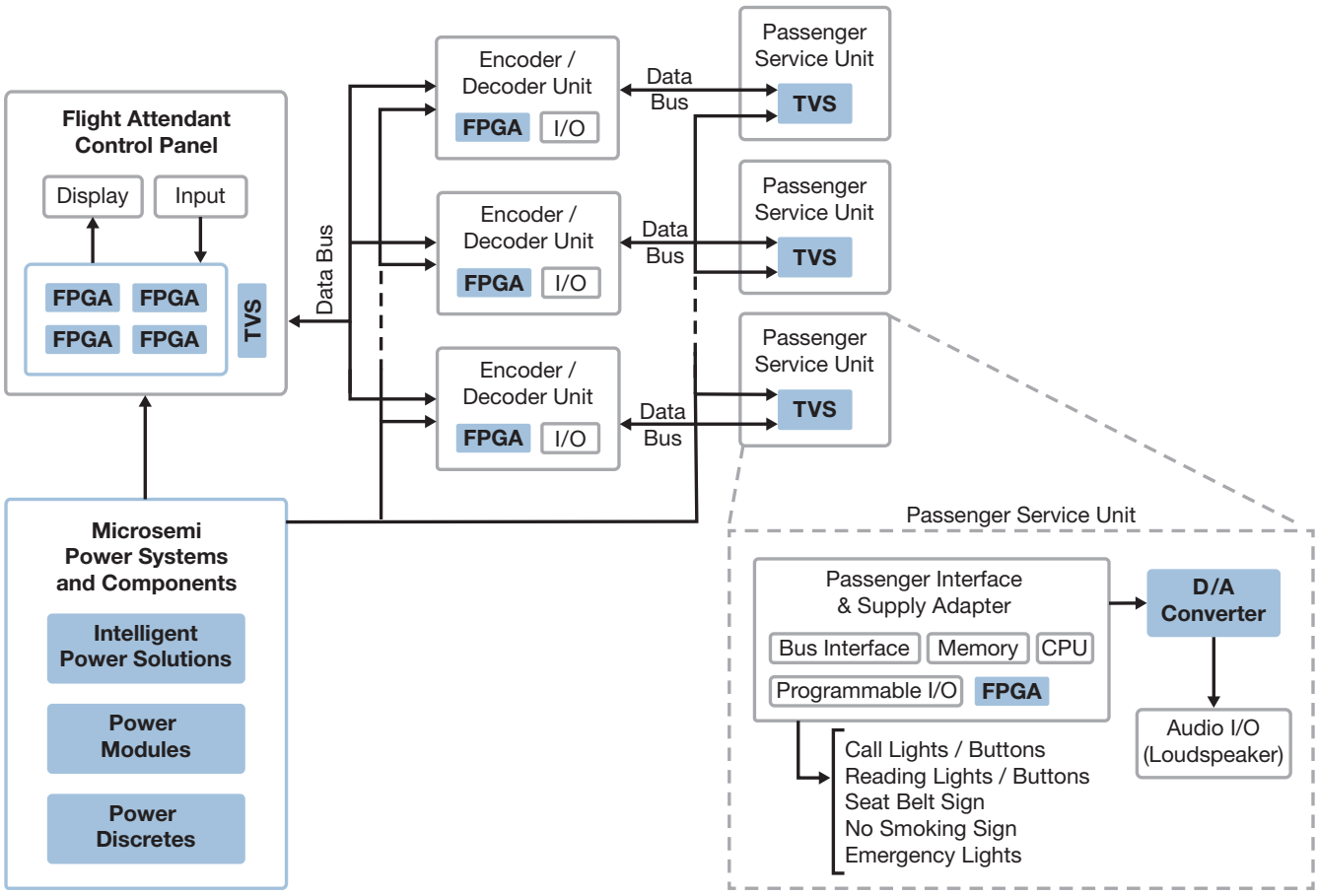
Engine Systems and Controls

- Engine and APU Controls
- Starter Generator Systems
- Fuel Management Systems
- Power Conversion and Distribution Systems
- FADEC (Full Authority Digital Engine Control)

Cabin Data Management

A cabin data management system involves the use of a central control unit to display data and receive input. This system collects and displays status from each passenger service unit relating to emergency lights, seat belt signs and so on.

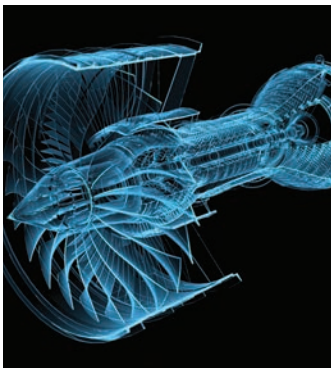
This system leverages FPGAs throughout, benefiting from high levels of integration, high reliability, SEU immune configuration and I/O expansion. It is also complemented by TVS and discrete power technologies.

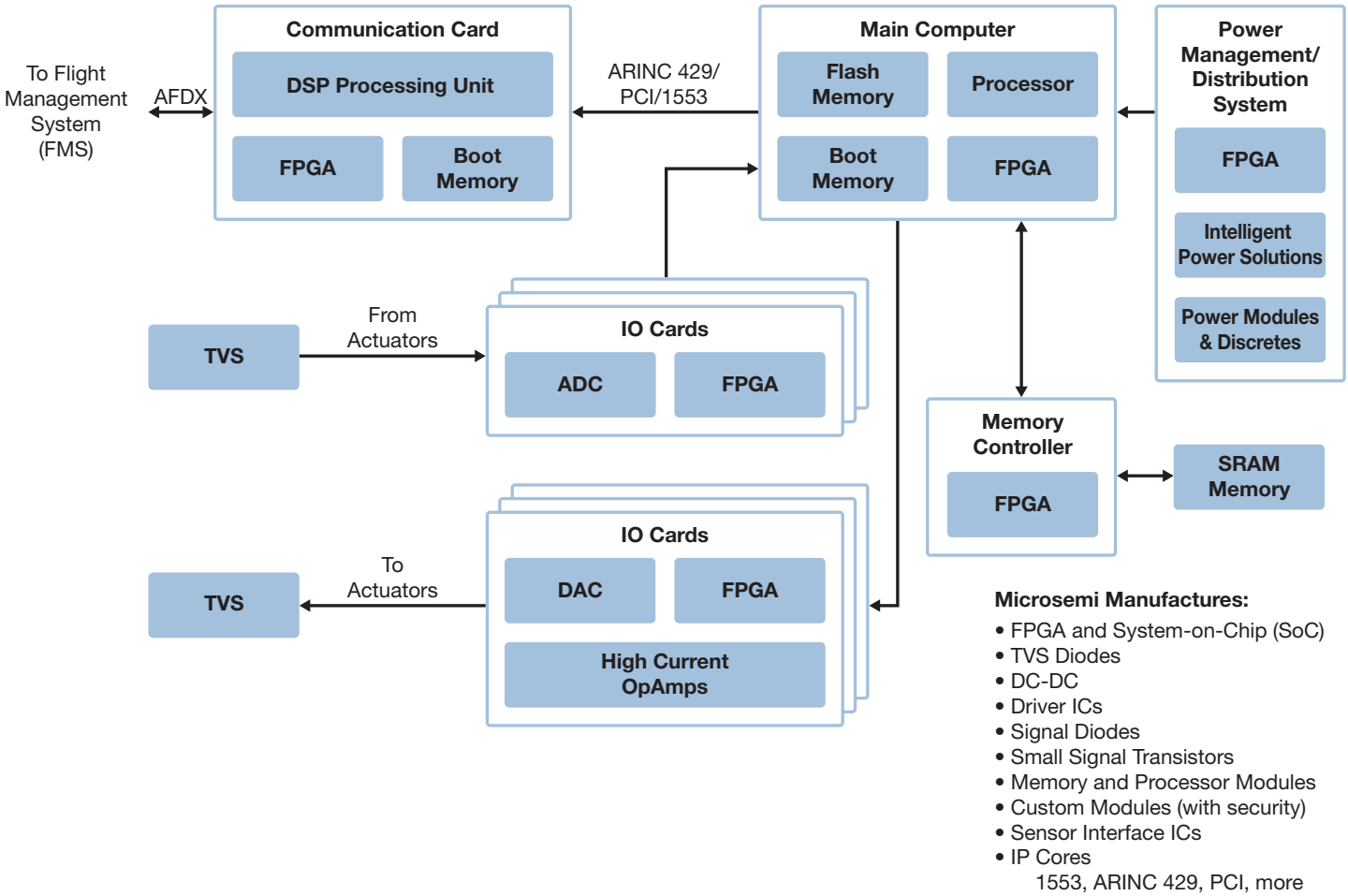


Engine Control System

In a full authority digital engine control (FADEC) system, all engine control parameters are set by FADEC with no pilot overrides. This is classified as a DAL-A (design assurance level), a safety-critical, highly redundant system.

Microsemi's high-reliability products - including FPGAs, TVS, ICs, and high temperature SiC transistor drivers - are trusted by many manufacturers and proven in the field for these applications.



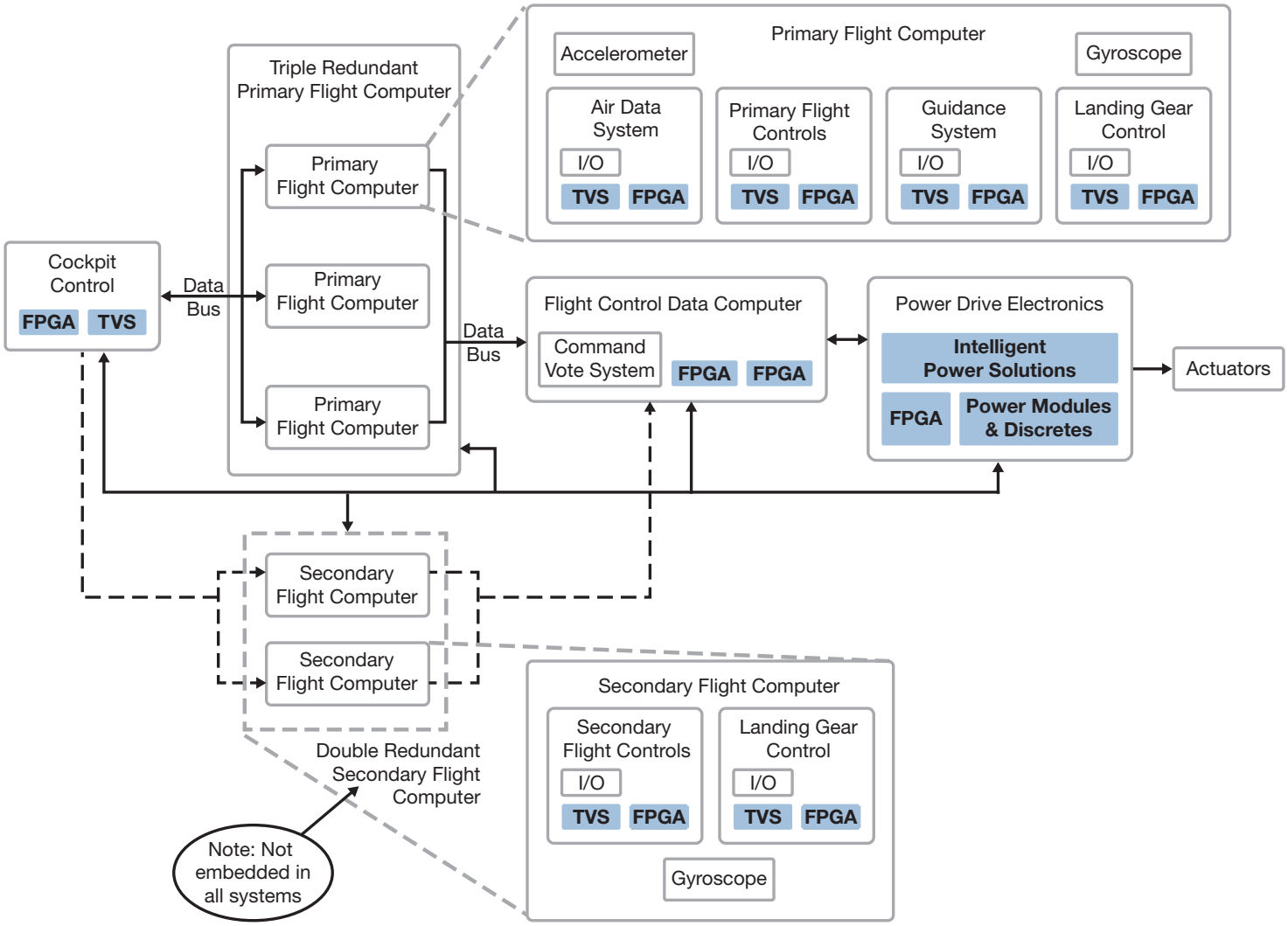
Microsemi Manufactures:

- FPGA and System-on-Chip (SoC)
- TVS Diodes
- DC-DC
- Driver ICs
- Signal Diodes
- Small Signal Transistors
- Memory and Processor Modules
- Custom Modules (with security)
- Sensor Interface ICs
- IP Cores
  1553, ARINC 429, PCI, more

Flight Control System

With the introduction of the fly-by-wire (FBW) electronic flight control avionics system, the movement of flight controls are converted to electronic signals transmitted by wires and the flight control computers determine how to move the actuators at each control surface to provide the expected response.

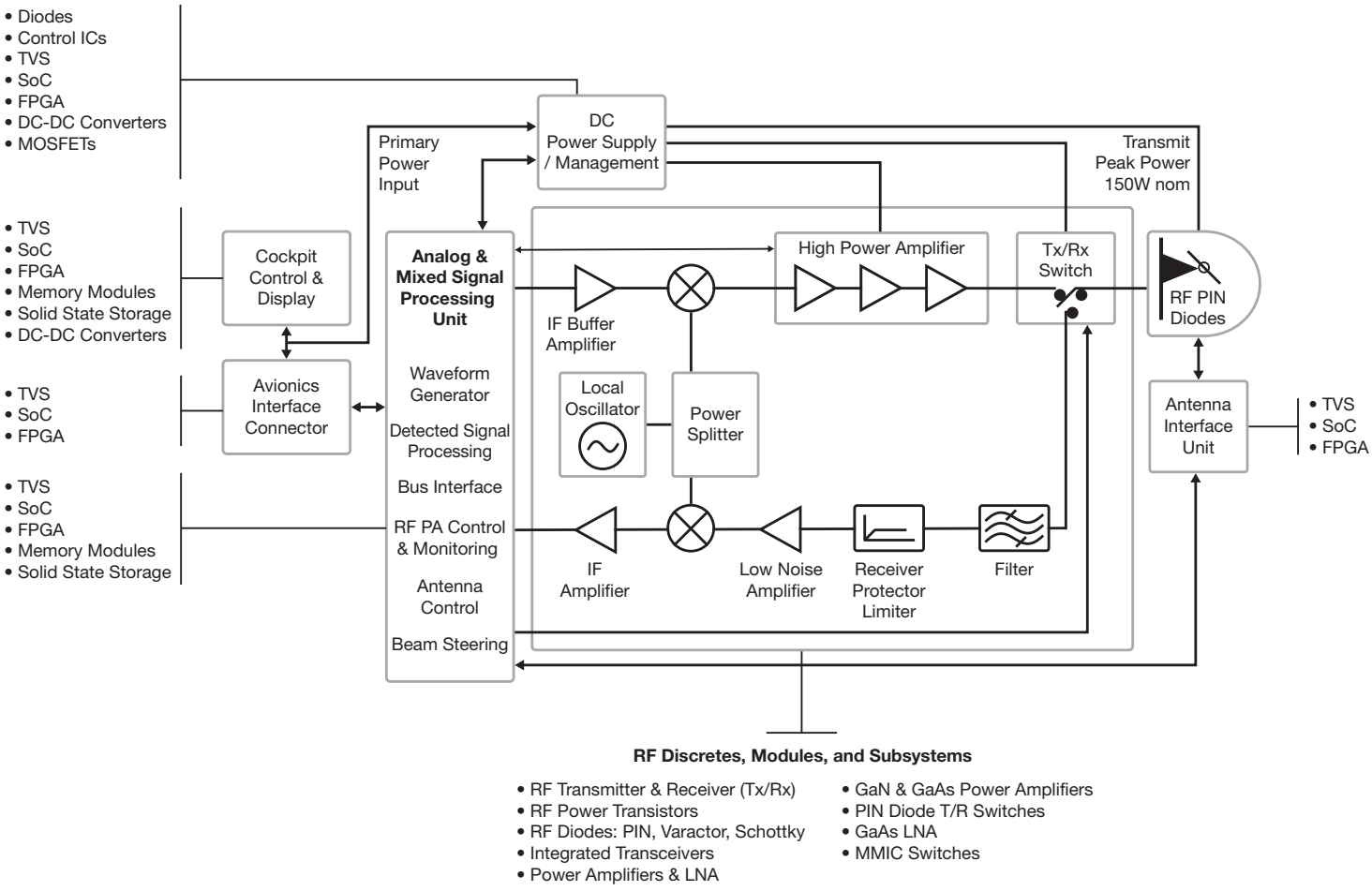
Due to the critical nature of the functions performed, technology is selected based on the highest levels of reliability, including configuration SEU immunity. Redundancy is typically built into the system design, and common failure modes are eliminated by the use of dissimilar technologies. Microsemi has supported these flight-critical electronic flight control avionics applications over many aircraft generations with its innovative FPGA (antifuse and flash) and TVS technologies.



Airborne Weather Radar

Today's modern airborne weather radar systems are lightweight, multicolor, digital systems designed to provide flight crew with weather location and analysis. The intent is to detect and avoid storms along the flight path of the aircraft. Most modern airborne weather radar systems are X-band systems that radiate anywhere between 18 watts and 10 kW of power.

Microsemi's broad portfolio of RF and microwave technology is perfectly positioned to solve complex engineering problems at the discrete, RFIC, MMIC, module and subsystem levels for these application areas. It is also complemented by a wide variety of FPGA, analog mixed signal, and discrete power technologies for an overall solution.



Aviation Electrical Power Systems

Recent technological advancements in the field of power electronics, fault-tolerant architecture, electrohydraulic actuators, flight control systems, high density electric motors, power generation, and conversion systems are expected to drive the adoption of MEA. The key technology drivers for electrical power systems will continue to be lower weight, higher reliability, and improved power quality and thermal control. Microsemi's growing capability as a solutions provider of Intelligent Power Solutions offers the best cost of ownership for our aviation partners where we integrate our state-of-the-art power, digital, and analog mixed signal technologies to offer highly integrated, high-reliability, flexible and scalable solutions for different aircraft power system applications.

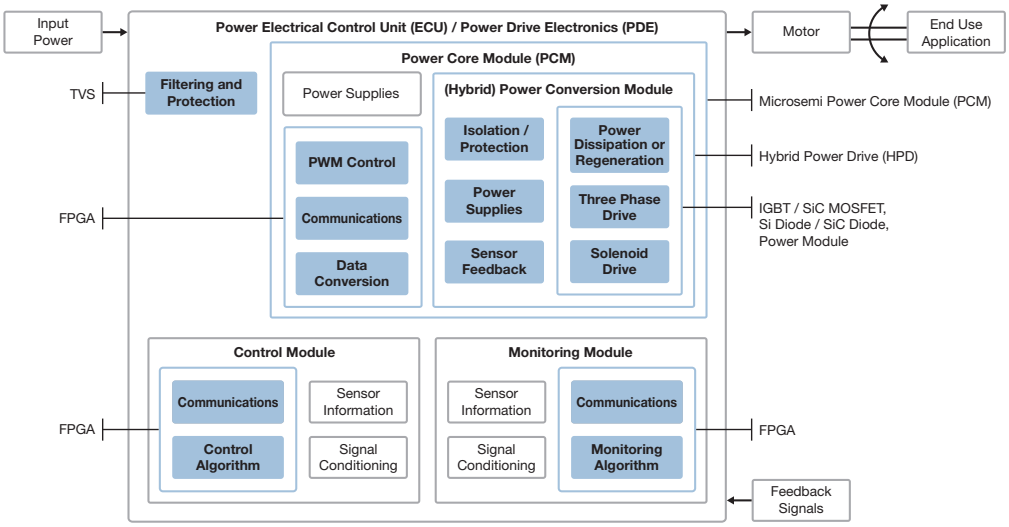
Intelligent Power Electrical Control System

Designed Power Ratings:

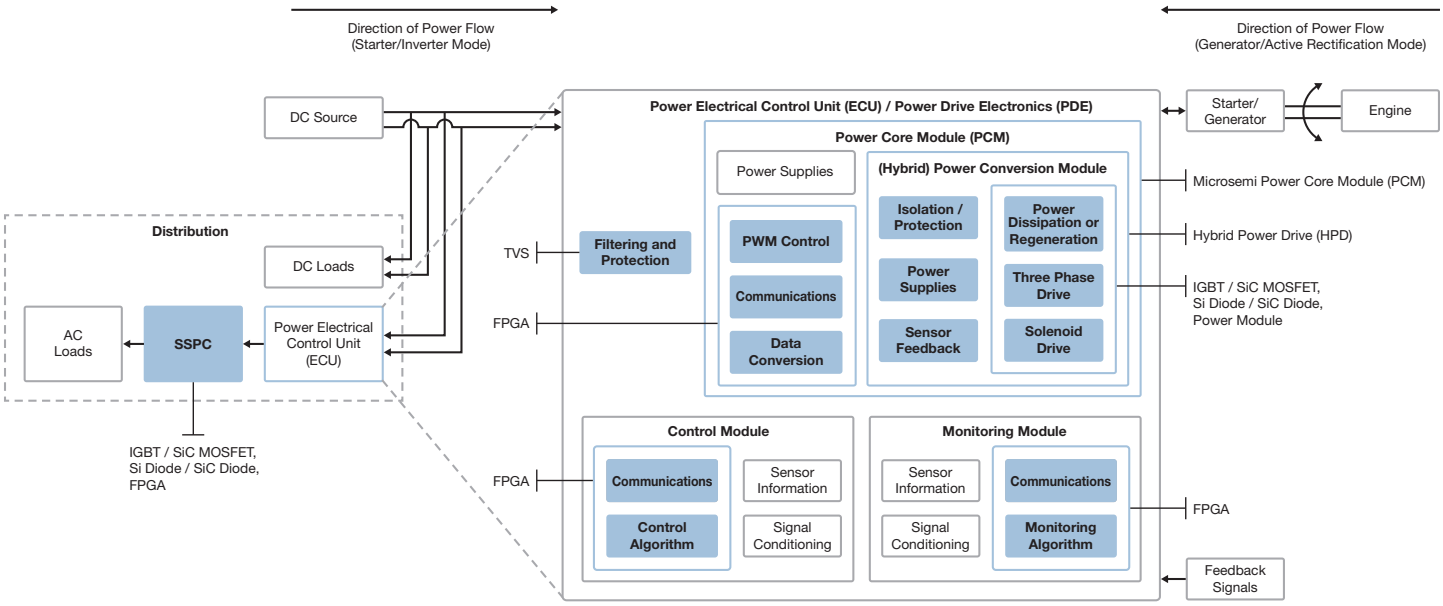
5 KVA – 40 KVA
(115VAC – 230VAC variable frequency, 270VDC – 540VDC)

Application Areas:

- Primary Flight Control Actuator Systems such as:
  - Flaps and Slats
  - Aileron
  - Rudder
  - Elevator
  - Spoiler
- Air management systems
- Fuel Pumps
- Electro-hydraulic pumps
- Landing Gear and braking systems
- Engine Starters



Bi-Directional Intelligent Power Solution

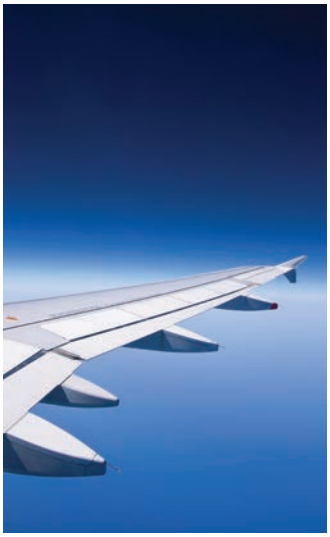


Intelligent Power Solutions

Among the flagship products is the aviation power core module (PCM) with an integrated FPGA and hybrid power drive (HPD) stage. The PCM controls the electrical motors used in applications such as primary flight control actuation and landing gear systems. It interfaces seamlessly with the aircraft power supplies and flight computers, providing vital sensor feedback for health monitoring. Customization options are available to ensure an optimized product offering. The HPD with integrated solenoid drive is also available as a stand-alone product.

Key Features

- Fully engineered solution with a high-level of integration
- Design optimized for size, weight, cost, and functionality
- Excellent performance, efficiency, and reliability
- Customized options available, leveraging standard building blocks, and reducing development time and cost
- High-power density options with power ratings starting at 5 kVA
- Extensive modeling, simulation, and analysis support
- Documentation package with qualification and reliability data
- Long-term reliability program



FPGAs and SoCs

Microsemi supplies innovative FPGAs based on antifuse and flash technologies, and also offers high-performance intellectual property (IP) cores, software development tools, and design services that are optimized for the high-reliability commercial aviation market. Our FPGA families have a 20-plus-year heritage of proven performance across product deployments in hundreds of commercial aviation systems on Airbus, Boeing, and other aircraft.

These devices perform critical functions in design assurance level (DAL) A and B applications such as flight computers, braking systems, cockpit displays, engine controls, actuator systems, safety warning systems, cabin management and more.

Key Features

- Best-in-class integration, power, reliability and security
- Extended temperature support
- SEU immunity of configuration cells on both flash and antifuse-based devices
- Dissimilar technologies (antifuse and flash) to meet system redundancy needs
- More than 20 years of continuous product supply
- Motor control IP and development platform
- IP support for ARINC 429 and MIL-STD-1553 standards
- Validation artifacts to assist with DO-254 certification

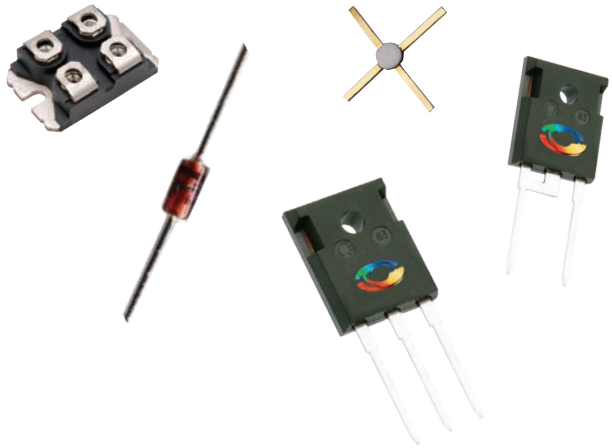
Power Switching Discrete and Modules

Microsemi is investing in the development of a wide range of silicon carbide (SiC) discrete semiconductors including SiC Schottky diodes and MOSFETs.

In addition, Microsemi offers a portfolio of silicon fast recovery diodes and MOSFETs and high voltage, high current IGBT transistor technologies including: non-punch-through (NPT), punch-through (PT) and field stop in various industry-standard plastic packages such as TO-220, TO-247, T0-264, D3PAK, and SOT-227.

Key Features

- Extended temperature range up to 150°C
- SiC diodes offering lower power losses and higher frequency
- Best-in-class SiC MOSFETs
- Lowest conduction losses at operating temperature
- Highest short circuit withstand rating
- Lowest gate resistance.
- Superior stability



Ruggedized Power Modules

Microsemi is an industry leader in power module solutions for aviation and military applications. For more than 20 years, the company's rugged power module solutions have been designed into key aviation applications including actuation, air conditioning, supplemental cooling, power generation, power control units, transformers and active rectification systems.

Microsemi has been delivering a wide range of hermetic and non-hermetic power switching module solutions for aircraft systems and we continue to evolve our product and capability roadmap to increase functionality, reduce weight and size, and improve reliability.

Key Features

- Broad portfolio of SiC FETS, IGBTs, and rectifier power modules
- Wide operating temperatures
- Superior thermal performance
- Mix of semiconductor and assembly technologies
- Low weight assembly materials with temperature expansion matching

Transient Voltage Suppression Diodes

An aircraft is hit by lightning approximately once every 1000 flight hours. TVS diodes provide critical protection by going into avalanche breakdown within no more than a few nanoseconds after a strike, clamping the transient voltage, and routing its current to the ground.

Between 2,000 and 5,000 Microsemi TVS devices have been deployed, per plane, across all major commercial airframes that are now in use throughout the industry. The company's TVS products are used in various flight-critical applications including flight control systems, multiple engine control units, and actuator controls, as well as a variety of power distribution, environmental control, communications and instrumentation systems.

Key Features

- Wide voltage and power range of both unidirectional and bi-directional TVS devices
- Industry-leading applications support and solutions for DO-160 and special requirements
- Innovative packaging technology
- Low capacitance signal protection
- Controlled die foundries, assembly, and screening locations
- Extensive electrical test capability and continuous reliability monitoring

Analog Mixed Signal ICs

Microsemi has an established history of providing standard and custom high-reliability ICs to the aviation market. Our access to several process technologies and expertise in application specific, highly integrated circuit design has enabled us to offer leading solutions for embedded aviation systems.

Our integrated circuit technology has been designed into multiple aviation applications including LVDT controllers, navigation gyro controllers, solid-state circuit breakers and ARINC 429 TX/RX/ID systems. Our high temperature SiC transistor driver supports galvanic isolation and overcurrent or saturation detection applications while our sensor interface ICs support multiple sensing applications including proximity and position sensing.

Key Features

- Best-in-class functional integration
- Significant space saving benefits
- Extended temperature range to 225°C
- Single event immunity
- Standard and full custom capability
- Extensive flight heritage
- Innovative custom packaging
- Telemetry and motor control capability

RF and Microwave Solutions

Microsemi brings a comprehensive high-reliability product portfolio to air traffic control and commercial aviation applications, and has supplied high-performance RF solutions, microwave and millimeter wave devices, components and integrated assemblies for more than 30 years.

Microsemi offers microwave and millimeter wave antenna-to-bits solutions with a progressive emphasis on high-performance semiconductor (CMOS, SiGe, GaAs, GaN, and InP) and packaging technologies. This approach allows us to work continuously with industry leaders in the company's target markets to solve complex engineering problems at the discrete, RFIC, MMIC, module, and subsystem levels.

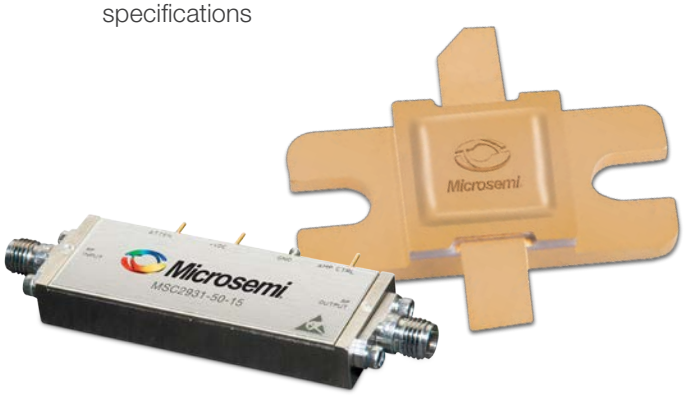
Key Features

Discretes and MMICs

- Extensive portfolio spanning 10 MHz to 140 GHz frequency range
- Broad range of high-speed, high-power RF and microwave diodes
- GaN-on-SiC HEMT RF power transistors for VHF/UHF/L/S/C-band to 1400 W
- Si BJTs RF power transistors through 3.5 GHz to 1200 W
- Broadband MMICs to 65 GHz

Microwave Modules and Subsystems

- High-power amplifiers to 4 kW
- Low noise, limiting, and low phase noise amplifiers
- Up/Down converters and full transceivers
- RF/microwave, analog, and digital integration
- Packaging, form-factor, and screening to custom specifications



Ethernet Switches, PHYs, Software and Power-over-Ethernet

With over 300 million Gigabit Ethernet ports shipped, Microsemi is a global leader in Ethernet switch and physical layer IC technology and IP. As industrial networks and other market segments worldwide have transitioned to Ethernet, Microsemi has been at the forefront of this transition with a growing portfolio of products with advanced features and efficient architectures that result in low power, scalability and highly reliable performance in the transmission of voice, video and data.

Key Features

- Faster time to production with complete hardware and software solutions
- Ethernet switch solutions with up to 100 Gbps of bandwidth
- Small package footprint designs
- Industrial temperature range operation
- Complete IEEE 1588-compliant 1Gbit/s and 10Gbit/s PHYs with time nanosecond stamping while performing AES-256 MACSec
- Solutions with low-alpha mold compound, improving overall SEU immunity
- Power-over-Ethernet PSE and PD ICs for powering entertainment units

Memory and Storage Solutions

Microsemi offers a broad range of high density compact memory solutions and high capacity secure solid state storage devices for applications where size, weight, and security are critical. Typical memory products offered include Flash, SRAM, DDR2, DDR3, and DDR4. Microsemi gives designers the ability to cut the area on their board occupied by memory up to 70 percent!

These products are designed to work over the industrial temperature range and are well suited for high vibration applications. Our high density solutions reduce board I/O and significantly enhance reliability.

Key Features

- Highly integrated space saving memory solutions
- Simplified memory interface design
- Enhanced board reliability suitable for rugged applications
- Long product shelf life of up to 10 years
- Extensive microelectronic multi-chip packaging expertise
- Rugged BGA SSDs of up to 16 GB
- Rugged 2.5” SSDs of up to 1 TB

Advanced Packaging Capability

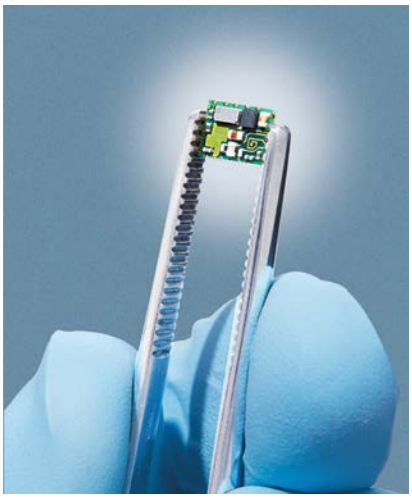
Microsemi’s Advanced Packaging team delivers a competitive advantage by miniaturizing electronic components to create smaller, smarter, and more reliable circuit solutions.

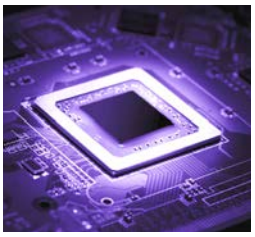
With a dedicated engineering group supported by the latest hardware and software design tools, we offer one of the most experienced advanced packaging capabilities available today.

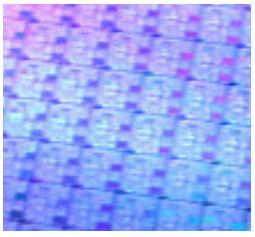
Microsemi is able to provide seamless customer service that integrates research, design, and manufacturing supported by on-site business services, sales and project management capabilities.

Key Features

- Embedded die technology packaging
- High temperature electronics packaging
- Analog, digital, RF and antenna circuit design
- Design verification—modeling, simulation and FMEA
- Design validation—test system design and implementation
- Commercial evaluation—design for manufacture and value engineering







Security

Aircraft data networks (ADN) have increased dramatically in complexity and functionality throughout the history of powered flight. A coordinated step change to fibre-optic technology will further reduce size, weight and cost, and improve the modularity, flexibility and scalability of the network. Moreover, fibre optics brings other implicit advantages including EMC immunity and improved security. These optical-based architectures will provide connectivity between the aircraft avionics, cabin control and entertainment functions and will need a redundant failsafe design that ensures data security.

Microsemi's industry-leading portfolio includes solutions providing security for data-in-motion, data-in-use and data-at-rest along with cryptography and hardware roots-of-trust. In addition to our security product portfolio encompassing anti-tamper solutions, cryptography, secured Ethernet connectivity, FPGAs & SoCs, secure solid state drives (SSDs), an Intellectual Property (IP) and firmware, our professional security-related service capabilities provided through our Security Center of Excellence (SCoE) include:

- Risk assessment services – threat-driven security analysis identifying potential vulnerabilities
- Protection planning services – system-level protection design providing recommended mitigations
- Red and blue teaming services – hands-on penetration testing and platform security assessment
- Security engineering services – software, firmware and hardware application-specific engineering
- Side-channel analysis & mitigation – cryptographic leakage evaluation for hardware and software

Microsemi has performed numerous system and architecture security assessments for defense and commercial platforms. These applications range from securing mobile payment transactions to embedded-system security implementations involving microcontrollers and FPGAs to firmware on avionics systems.

Microsemi is continually adding new products to its industry-leading portfolio.

For the most recent updates to our product line and for detailed information and specifications, please call, email or visit our website:

Toll-free: 800-713-4113

sales.support@microsemi.com

www.microsemi.com

www.microsemi.com/applications/commercial-aviation

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Microsemi Corporation (Nasdaq: MSCC) offers a comprehensive portfolio of semiconductor and system solutions for communications, defense & security, aerospace and industrial markets. Products include high-performance and radiation-hardened analog mixed-signal integrated circuits, FPGAs, SoCs and ASICs; power management products; timing and synchronization devices and precise time solutions, setting the world's standard for time; voice processing devices; RF solutions; discrete components; Enterprise Storage and Communication solutions, security technologies and scalable anti-tamper products; Ethernet solutions; Power-over-Ethernet ICs and midspans; as well as custom design capabilities and services. Microsemi is headquartered in Aliso Viejo, Calif., and has approximately 4,800 employees globally. Learn more at www.microsemi.com.

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