

# Automotive FPGAs and SoC FPGAs



ADAS

Vehicle Connectivity

Engine Control Units

Device Selection Advisor

Automotive Grade Products

Design Resources



# The New Benchmark for Security and Reliability in Automotive

The automotive industry is going through a paradigm shift with the focus squarely moving to safety and fuel efficiency. Automotive systems need to enable these capabilities while meeting the high reliability and security regulations prevalent in the industry. Today, the focus is on:

- High reliability for ensuring zero-defect systems
- Best-in-class security for secured data and connectivity
- Supply assurance from a credible supplier with high-reliability experience
- Low power for optimal power efficiency
- Lowest cost of ownership

## Uniquely Positioned for Automotive Supplier Leadership

Microsemi offers automotive-grade (AEC-Q100) system-on-chip (SoC) field programmable gate arrays (FPGAs) and FPGAs with industry-leading reliability and security features. These devices are power and cost optimized to provide customers with the lowest total cost of ownership.

Microsemi has a strong heritage of supplying components to industries that require the highest levels of reliability and security, including military, automotive, and commercial aviation. This heritage makes us ideally positioned to be the supplier of choice for the automotive industry. The new automotive-grade SmartFusion2 SoC FPGAs and IGLOO2 FPGAs are specifically designed to address the requirements of the automotive sector.



## Automotive Capabilities and Support

- Automotive-grade devices meet or exceed AEC-Q100 qualification
- Customer engineering support team
- Automotive quality and failure analysis team
- Access to TS16949-certified fabs and assembly houses
- Extensive high-reliability heritage

# Enabling High Reliability and Security in Automotive

Microsemi enables automotive original equipment manufacturers (OEMs) and suppliers to achieve the lowest total cost of ownership with its award-winning SmartFusion2 SoC FPGAs and IGLOO2 FPGAs, which offer best-in-class security, exceptional reliability, and the lowest static power.



## Security

- Information assurance: private keys using device PUF, crypto accelerators
- Anti-tamper: secure bitstream, active mesh
- Hardware security: CRI-licensed DPA resistance, NIST-certified crypto accelerator



## Reliability

- Flash FPGA fabric provides SEU immunity
- Error-corrected memories
- Extended temperature support
- AEC-Q100 qualified



## Low Power

- Industry's lowest static power
- Low-power modes for on-chip peripherals
- Industry's lowest power SerDes



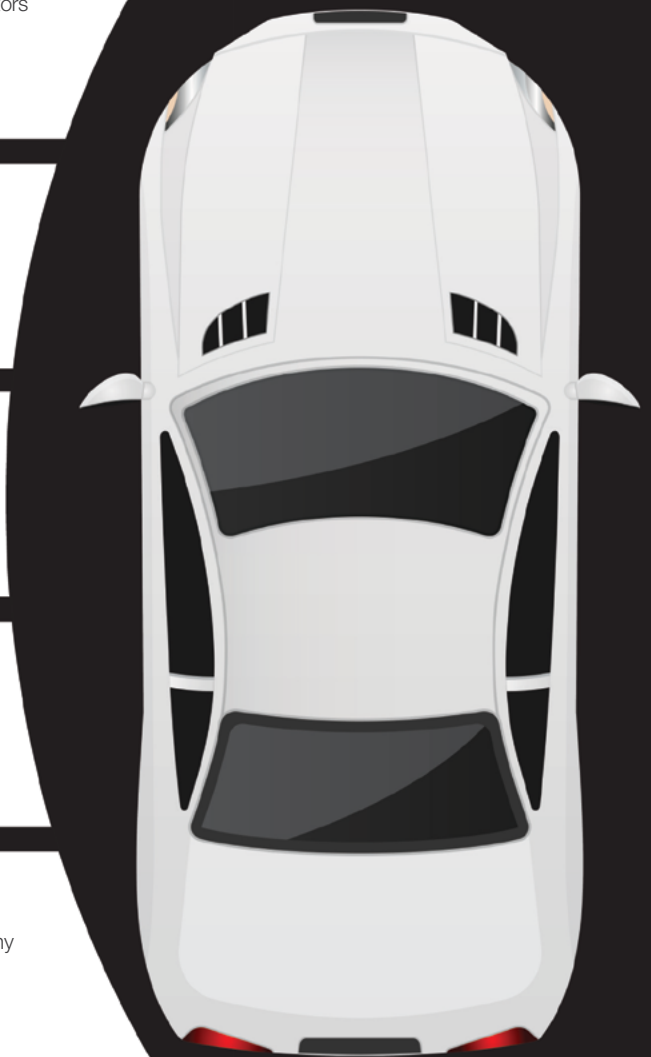
## Supply Assurance

- Over 30 years of aviation, military, and automotive heritage
- Typical product lifetime = 15+ years
- Supply chain security from fab to system using device "fingerprint"



## Total Cost of Ownership

- Microsemi automotive products provide multi-platform support for many generations
- Small form factor available to provide cost-optimized system solution
- Diverse portfolio of DirectCore and CompanionCore IPs



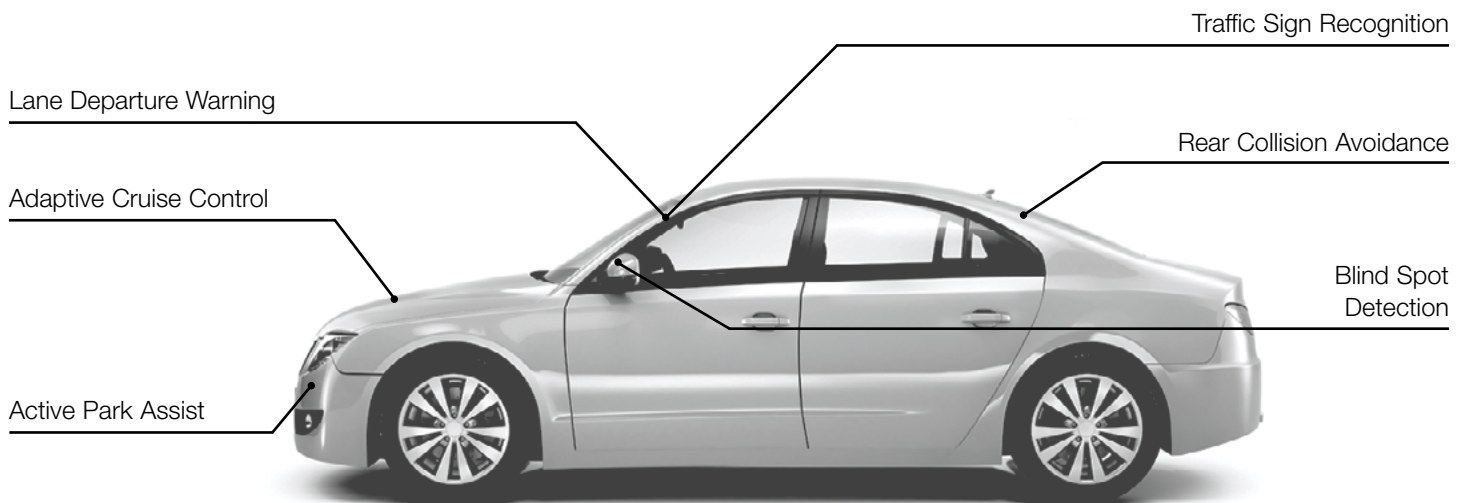
# Advanced Driver Assist Systems



Advanced driver assist systems (ADAS) are a category of electronic systems that provide passive and active feedback to improve driver safety and comfort. These systems are seeing increased adoption by OEMs due to an increase in awareness of consumer safety and government legislations.

Microsemi enables automotive OEMs and suppliers to build innovative safety applications such as adaptive cruise control, collision avoidance, and blind spot warning by leveraging the high security, reliability, and low-power capabilities of Microsemi FPGAs and SoC FPGAs.

As consumer demand grows for more features, better performance, and increased connectivity in smaller form factors, designers can easily incorporate design complexity while consuming less power using low-power Microsemi FPGAs. Unlike SRAM-based FPGAs, Microsemi flash FPGAs have dramatically low static power due to low leakage and can operate in low-power Flash\*Freeze mode for low duty cycle operations.



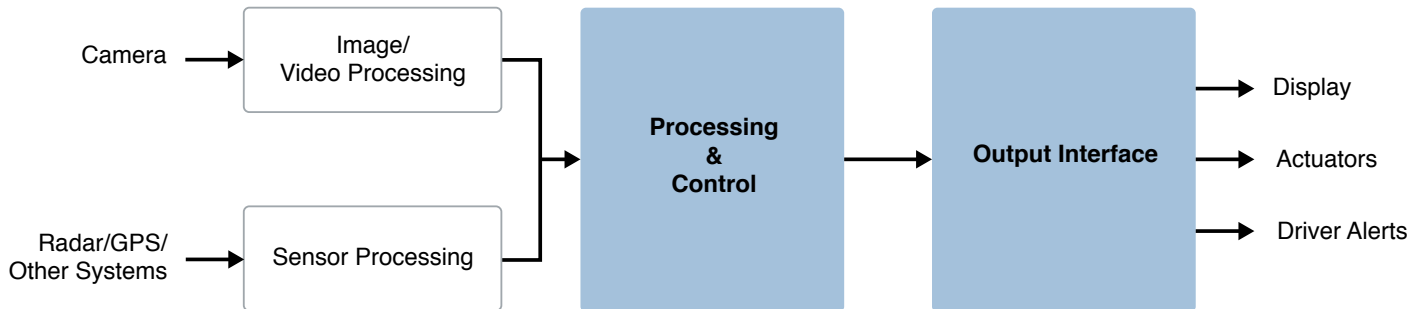
## Features

- Diverse portfolio of IP for critical data acquisition and processing
- Zero FIT rate and immunity against environmental factors
- Advanced data and design security
- Secure supply chain ensures device authenticity
- Low power consumption
- Small form factor provides real estate advantage
- Multi-sensor interface support

# Secure Driver Assist Systems

The ADAS solution from Microsemi works on a complex network of sensors to relay information like speed, temperature, object, signal, and lane detection to the processing and control unit. These inputs are processed for image enhancement, distortion correction, object identification, motion estimation, and further analyzed to take corrective actions.

The control system takes processed inputs and controls outputs such as braking, giving driver alerts, and so on. To ensure the benefits of ADAS, the control system must adhere to its functionality and so needs a secure and fail-safe system implementation.



Sensor interface units support various communication interfaces (such as cameras, radar, and so on) for capturing data. The sensor and image processings are available as hardware or software IPs.

The processing and control units enable decision-making based on the processed inputs. FPGAs offer a crucial advantage over digital signal processing (DSP) in providing parallel processing by enabling faster responses to potential hazards.

The output interfaces unit involves driver controls, displays, and communication peripherals, and enables risk mitigation. FPGAs are comparable or have lower power consumption to application-specific standard product (ASSP)-based solutions for complex processing in multi-input and output interfaces systems.

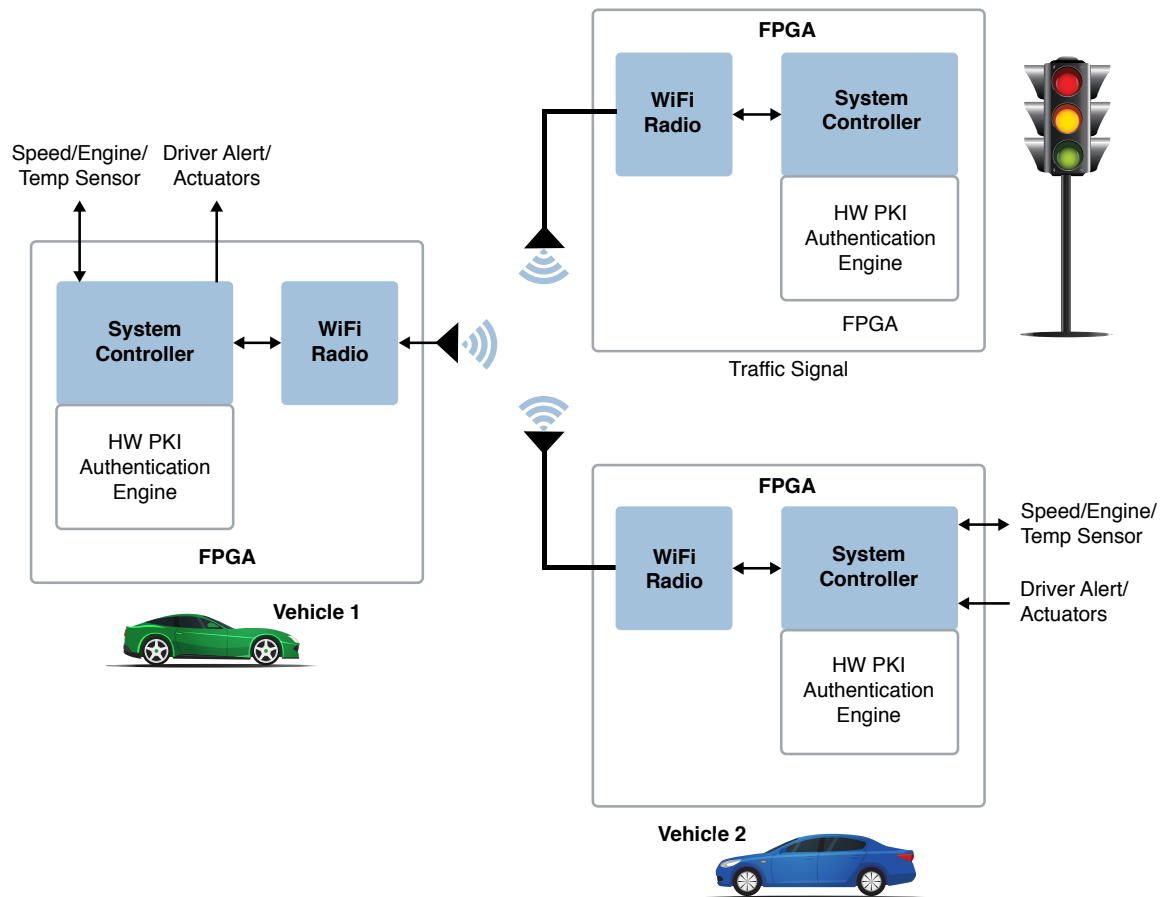


# Vehicle Connectivity

Vehicle-to-vehicle (V2V) or vehicle-to-everything (V2X) communications are expected to have a bigger impact on road safety, given that they are able to perceive danger sooner than traditional safety applications.

V2V/V2X communications use the on-board dedicated short-range radio communication devices to transmit information about the vehicle (such as speed, heading, brake status, and so on) to other vehicles and receive the same information in return, or to communicate with any source (such as a traffic signal). If the vehicle connectivity is to be used safely and with confidence, that communication must be secured. With the increasing adoption of vehicle connectivity applications, the number of vehicles and sources talking to each other will grow exponentially, and nearly all this traffic is vulnerable to malicious monitoring and modification.

Microsemi offers a secure communications infrastructure for vehicle connectivity. With Microsemi's advanced data and design security features, messaging between two sources is protected against tamper and corruption. Secure hardware using the device's PUF forms the basis of the root-of-trust. Secure communications involve multiple key authentications for simultaneous and serial interactions. Microsemi offers a dedicated hardware processing engine for faster and reliable key authentication, offloading the system controller.

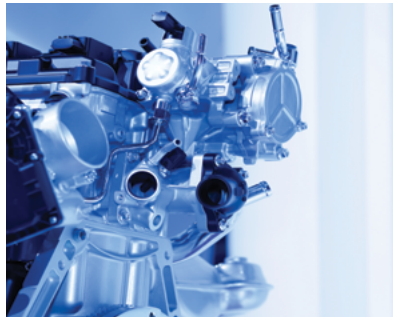


## Features

- Tamper protection and detection of physical attacks on a device
- Advanced biometric signature-based PUF-protected data
- Zeroization erases sensitive data during tamper
- Public key infrastructure (PKI)-based secure communication ensures device authenticity
- Hardware processing engine for reliable and faster real-time key authentication

# Engine Control Units (ECU)

The rise in fuel prices, recent legislations on emissions, and customer demand for better performance and quality are propelling the automotive industry to emerge with solutions that offer better alternatives to the internal combustion engine.



Electrification of the powertrain is emerging as a leading trend with a variety of options offered to customers—hybrid, plug-in hybrid, and fully electric. Automotive electronics play an important role in this context of electrification, leading to new and complex configurations of the engine control unit.

Hybrid/electric engine control units pose some challenges to designers in terms of:

- Integration of various components
- Ease of configuration
- Platform scalability and migration
- Immunity against neutron errors
- Security against tamper and copying
- Low power consumption
- Total cost of application

Microsemi's non-volatile flash-based FPGAs offer the benefits of reprogrammability, best-in-class security, high reliability, SEU immunity, hardware configurability, low power, and extended temperature support. Unlike SRAM-based FPGAs, Microsemi's SoC FPGAs and FPGAs are instant-on and require no external configuration devices, greatly minimizing component count, configuration errors, and vulnerability to hacking.

Flash-based Microsemi FPGAs give the additional advantage of 30%–50% lower static power than SRAM-based FPGAs. This is possible due to the inherent flash technology, which requires no configuration current. Also, lower dynamic power can be achieved through lowest-power SerDes, low-power modes for on-chip peripherals, and low-power operation for low-duty cycle applications.

For highly integrated designs, Microsemi offers a secure platform with easy configuration and support in case of migration or changes in application design. Microsemi offers long-lifetime product support, typically in the range of 15+ years.

## Features

- Secure platform for design integration with anti-tamper and biometric PUF-protected data
- Immunity against single event upsets (SEUs) and firms errors
- Advanced security for protection of customer “secret sauce”
- High reliability ensures zero FIT rates
- Lower power consumption
- Support for various interfaces, standards, and IPs, as well as easy configuration during migration

# Device Selection Advisor

Microsemi offers a broad range of automotive-grade FPGAs and ARM®-enabled SoC FPGAs so designers can choose the best fit for their design requirements. Device selection includes a host of parameters including logic element density, required security features, on-chip peripherals, and so on.

The following table serves as a guide for choosing the right device for your applications. In addition, Microsemi offers more detailed product tables, product briefs, and datasheets to assist with device selection.

Family	Logic Elements	Temperature Range	Max User I/Os	Max SerDes	Security
IGLOO2	6K to 86K	Grade 1 (–40° C to 135° C) Grade 2 (–40° C to 125° C)	Up to 425	4 <sup>1</sup>	<ul style="list-style-type: none"> <li>• Zeroization of data on tamper detection</li> <li>• Secure supply chain assurance</li> <li>• Key storage using physically unclonable function</li> <li>• CRI pass-through DPA patent portfolio</li> <li>• Advanced cryptographic services</li> </ul>
SmartFusion2	6K to 86K	Grade 2 (–40° C to 125° C)	Up to 425	4	
ProASIC3	330 to 11K	Grade 1 (–40° C to 135° C) Grade 2 (–40° C to 115° C)	Up to 300		Secure configuration bitstreams with DPA protection licensed from CRI Inc.

1. SerDes is only supported in the IGLOO2 devices for the Grade 2 temperature range and not on Grade 1 temperature range.

## Other considerations when selecting the device for your design include:

- Power Consumption—power calculators are readily available for all the devices to compute power consumption as per design requirements.
- Intellectual Property—Microsemi has a diverse portfolio of DirectCores and CompanionCores that speed up development time and reduce time-to-market.



# Automotive-Grade Products

Microsemi offers dedicated automotive-grade devices in various densities, features, footprints, and temperature grades. All devices and packages are AEC-Q100 qualified and tested at extended temperatures. PPAP documentation is available for ProASIC3 devices on request.

## SmartFusion2 SoC FPGA Product Family

	Features <sup>2</sup>	M2S005S	M2S010TS	M2S025TS	M2S060TS	M2S090TS
Logic/DSP	Maximum Logic Elements (4LUT + DFF) <sup>1</sup>	6,060	12,084	27,696	56,520	86,184
	Math Blocks (18 × 18)	11	22	34	72	84
	Fabric Interface Controllers (FICs)	1				
	PLLs and CCCs	2		6		
	Data Security	AES256, SHA256, RNG			AES256, SHA256, RNG, ECC, PUF	
MSS	Cortex-M3 + Instruction Cache	Yes				
	eNVM (K Bytes)	128	256		512	
	eSRAM (K Bytes)	64				
	eSRAM (K Bytes) Non-SECDED	80				
	CAN, 10/100/1000 Ethernet, HS USB	1 each				
	Multi-Mode UART, SPI, I2C, Timer	1 each				
High-Speed	DDR Controllers (Count × Width)	1 × 18				
	SerDes Lanes (T)	0	4			
	PCIe Endpoints	0	1		2	
User I/Os	MSIO (3.3 V)	115	123	157	271	309
	MSIOD (2.5 V)	28	40	40	40	40
	DDRIO (2.5 V)	66	70	70	76	76
	Total User I/O	209	233	267	387	425

1. Total logic may vary based on utilization of DSP and memories in the design.

2. Feature availability is package dependent.

# Automotive-Grade Products

## IGLOO2 FPGA Product Family

	Features <sup>2</sup>	M2GL005S	M2GL010TS	M2GL025TS	M2GL060TS	M2GL090TS
Logic/DSP	Maximum Logic Elements (4LUT + DFF) <sup>1</sup>	6,060	12,084	27,696	56,520	86,184
	Math Blocks (18x18)	11	22	34	72	84
	PLLs and CCCs	2		6		
	SPI/HPDMA/PDMA	1 each				
	Fabric Interface Controllers (FICs)	1				
	Data Security	AES256, SHA256, RNG			AES256, SHA256, RNG, ECC, PUF	
Memory	eNVM (K Bytes)	128	256			512
	LSRAM 18 K Blocks	10	21	31	69	109
	uSRAM1 K Blocks	11	22	34	72	112
	eSRAM (K Bytes)	64				
	Total RAM (K bits)	703	912	1104	1826	2586
High Speed	DDR Controllers (Count x Width)	1 x 18				
	SerDes Lanes (T)	0	4			
	PCIe Endpoints	0	1		2	
User I/Os	MSIO (3.3V)	115	123	157	271	309
	MSIOD (2.5V)	28	40	40	40	40
	DDRIO (2.5V)	66	70	70	76	76
	Total User I/O	209	233	267	387	425

1. Total logic may vary based on utilization of DSP and memories in the design.

2. Feature availability is package dependent.

## Package Options IGLOO2 and SmartFusion2

Type	VFG256 <sup>1</sup>		VFG400 <sup>1</sup>		TQG144 <sup>1</sup>		FGG484 <sup>1</sup>		FGG676 <sup>1</sup>	
Pitch (mm)	0.8		0.8		.5		1		1	
Length x Width (mm)	14 x 14		17 x 17		20 x 20		23 x 23		27 x 27	
Device Density	I/O	Lanes	I/O	Lanes	I/O	Lanes	I/O	Lanes	I/O	Lanes
005	161		171		84		209			
010	138	2	195	4	84		233	4		
025	138	2	207	4			267	4		
060			207	4			267	4	387	4
090							267	4	425	4

1. All Automotive packages are RoHS compliant and available in lead-free options only.

# Automotive-Grade Products

## ProASIC3 FPGA Product Family

	Features	A3P060	A3P125	A3P250	A3P1000
Logic	System Gates	60,000	125,000	250,000	1,000,000
	Equivalent LEs	700	1,500	3,000	11,000
	VersaNet Globals	18	18	18	18
	AES-Protected ISP1	Yes	Yes	Yes	Yes
	Integrated PLL in CCCs	1	1	1	1
Fabric Memory	RAM (1,024 bits)	18	36	36	144
	4,608-Bit Blocks	4	8	8	32
	FlashROM K Bits (1,024 bits)	1	1	1	1
User I/O	I/O Banks	2	2	4	4
	Maximum User I/Os	96	133	157	300
Speed Grade	Speed Grades	Std., -1	Std., -1	Std., -1	Std., -1

1. Six chip (main) and three quadrant global networks are available for A3P060 and above.

## Package Options

Features	A3P060	A3P125	A3P250	A3P1000
Pitch (mm)	0.5	1	1	1
Length × Width (mm)	16 × 16	13 × 13	17 × 17	23 × 23
Device	I/O	I/O	I/O	I/O
A3P060	71	96		
A3P125	71	97		
A3P250	68/13	97/24	157/38	
A3P1000		97/25	177/44	300/74

# Design Resources

## Design Software

The Libero SoC design suite offers high productivity with its comprehensive, easy-to-learn, easy-to-adopt development tools that are used for designing with Microsemi's power-efficient flash-based IGLOO and ProASIC3 devices. The suite integrates industry-standard Synopsys Synplify Pro synthesis and Mentor Graphics ModelSim simulation with best-in-class constraints management, debug capabilities, timing analysis, power analysis, secure production programming, and push button design flow.

For more information on Libero SoC, visit: <http://www.microsemi.com/products/fpga-soc/design-resources/design-software/libero-soc>

## Intellectual Property

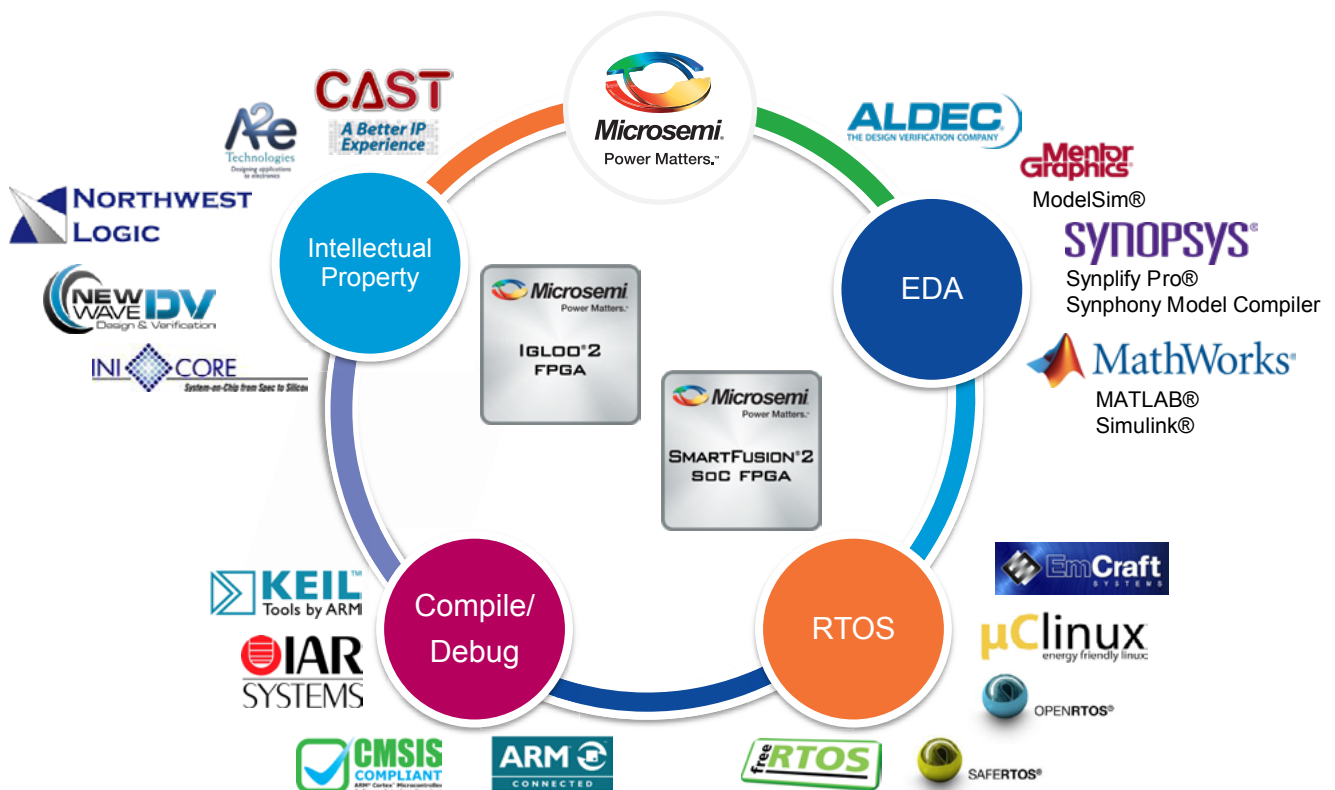
Microsemi enhances your design productivity by providing an extensive suite of proven and optimized IP cores for use with Microsemi FPGAs and SoC FPGAs that cover key markets and applications. IPs are organized as either Microsemi-developed DirectCores or third-party-developed CompanionCores.

- DirectCore IPs are integrated into Libero SoC or IDE software suite, enabling you to quickly find and configure them in your Microsemi FPGA and SoC FPGA designs.
- CompanionCore IPs are easily integrated into your design using the Libero SoC or IDE software suite and are available for purchase from Microsemi partners.

CompanionCores are available at: <http://www.microsemi.com/products/fpga-soc/design-resources/ip-cores#companioncores>.

## Design Hardware

Microsemi offers a broad selection of development kits to use with flash-based FPGAs and SoC FPGAs. For a list of all the available kits, visit: <http://www.microsemi.com/products/fpga-soc/design-resources/dev-kits-boards>



# Microsemi's Automotive Product Portfolio

## Solving Automotive Design Complexities

Microsemi delivers a portfolio of products for demanding automotive requirements. With the car becoming a highly complex, communications network, auto manufacturers require reliability, low-cost, and ease-of-use in their components and systems.

## Advanced Driver Assist Systems (ADAS)

ADAS continue evolving to deliver not only improved passenger experience and comfort, but also provide optimum safety to the driver. Microsemi's portfolio is designed to help you deliver robust next-generation ADAS designs that meet stringent regulatory mandates and pave the way for autonomous vehicles.

- Automotive-grade FPGAs and SoCs
- Sensor interface ICs
- Security software

## Powertrain and EV Charging

Microsemi is focused on delivering the right combination of performance, durability, reliability, and quality to help you optimize your most demanding designs as the number of engine control units (ECUs) within the car grows exponentially.

- Sensor interface ICs
- IGBTs, IGBT modules, MOSFETs, MOSFET modules, SiC MOSFETs, SiC Schottky diodes, SiC power modules, and power line communication (PLC) line drivers
- Automotive-grade FPGAs and SoCs

## Infotainment

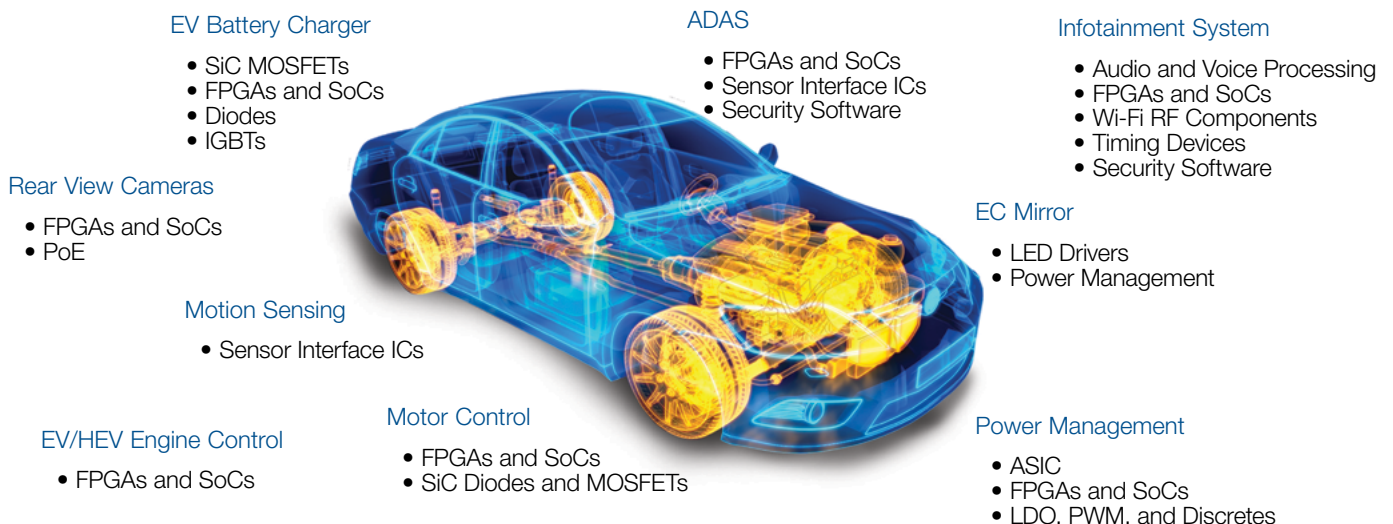
Transforming the in-car experience—ranging from in-vehicle navigation, audio, video, and internet connectivity—increasingly represents an important technology driver among car manufacturers. For automotive infotainment, Microsemi offers a broad portfolio designed to help you meet your stringent performance, durability, reliability, and quality requirements, while reducing your design cycles and time-to-market.

- Audio-voice processors
- Automotive-grade FPGAs and SoCs
- Power amplifiers (PAs), linear amplifiers, (LNAs), and front-end modules (FEMs)
- Timing ICs
- Security software

## Body Electronics

Protecting car electronics from transient surges and other electrical hazards poses one of the largest challenges in automotive systems designs. Microsemi delivers high-reliability protection for automotive electronics with its field-proven family of transient voltage suppressor (TVS) diodes and high-performance high-voltage (HV) stack diodes.

- TVS diodes
- High-voltage stack diodes







Visit our website for more information on Microsemi's automotive-grade SmartFusion2 SoC FPGAs and IGLOO2 FPGAs:

<http://www.microsemi.com/products/fpga-soc/automotive-grade-fpgas-socs>

For the comprehensive Microsemi Automotive Solution, visit

<http://www.microsemi.com/applications/automotive>

**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:**

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