



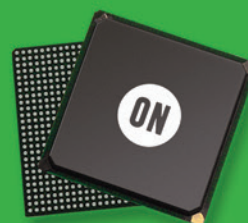
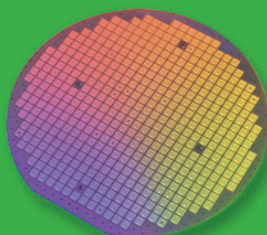
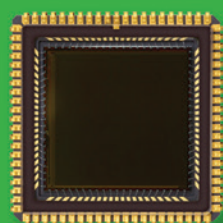
BRD8079/D
Rev. 9, Oct-2019

Energy Efficient Innovations

Aerospace & Defense Solutions



*Specialized products, processes, and
services from ON Semiconductor.*



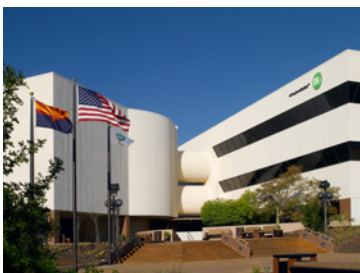
Trusted Source

With headquarters in Phoenix, Arizona, and on-shore design and manufacturing centers, ON Semiconductor offers a secure, stable environment for the development of advanced semiconductor solutions for aerospace and defense applications.

ON Semiconductor has been granted Category 1A Trusted Design, Trusted Test, and Trusted Foundry accreditation by the Defense Microelectronics Activity (DMEA), enabling trusted support from design through product shipment. The Trusted Foundry accreditation allows ON Semiconductor to support its digital and mixed signal designs at the 40,000 square foot (ft²) clean room manufacturing space in Pocatello, ID, as well as the Gresham, OR, 100,000 ft² clean room. The accreditation program is part of the DoD strategy to ensure that electronic components used in U.S. military and national security applications are trustworthy and secure. An assured “chain of custody”, supply chain integrity, and prevention of tampering are critical for Application Specific Integrated Circuits (ASIC) used by national security agencies. A key part of the Trusted Foundry program is that it uniquely provides the US Government with guaranteed access to leading edge trusted microelectronics services for low volume applications. ON Semiconductor’s accreditation confirms their commitment to meet these government requirements.

ON Semiconductor has also been granted “Trusted Broker” accreditation by DMEA, enabling the company to support the entire trusted manufacturing process through engagement with other trusted suppliers. The combination of the four accreditations benefits military and defense customers by providing a fully integrated trusted manufacturing solution.

In addition, ON Semiconductor maintains ITAR certification and QML flows required for military designs.



Processes and Capabilities

ON Semiconductor is certified to the following process standards:

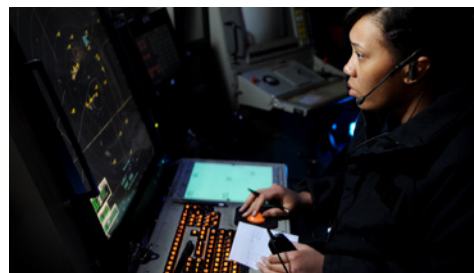
- MIL-PRF-38535
- AS 9100 Rev. D
- QS9000
- ESCC-2269000
- MIL-STD-750
- STACK
- TL9000
- IATF 16949
- ISO 9000
- ESCC-9020

Environmental Performance

ON Semiconductor provides robust silicon technologies for ASIC products that are characterized over an extended temperature range from cryogenic to 150°C, as well as a portfolio of plastic and hermetic packaging suitable for high reliability end applications.

Process Longevity

ON Semiconductor operates modularized wafer fabrication processes that enable the company to offer extended process lifetimes, meeting the market need for secure, long life-cycle processes to support long product lives of ten years or more. This approach also allows the company to support low volume requirements of aerospace and defense customers. An established, flexible EOL process enables adequate transition or EOL planning.



ON Semiconductor is adding 300 mm production capability, through the recently announced acquisition of a 300 mm fab located in East Fishkill, New York. The agreement includes a technology transfer and development agreement, and a technology license agreement. ON Semiconductor has immediate access to advanced CMOS capability, including 45 nm and 65 nm technology nodes. ON Semiconductor is expected to assume full operational control of the fab at the end of 2022. ON Semiconductor also plans to include the East Fishkill fab and technologies within the portfolio of Trusted, ITAR, and QML capable manufacturing technologies.

Solutions Characterized for Neutron Soft Error Rates

Robust ASICs for Aerospace Applications

ON Semiconductor offers Application Specific Integrated Circuit (ASIC) solutions critical for aerospace applications and products requiring rigorous FIT rates due to terrestrial radiation exposure. A combination of characterization test data, soft-error-aware design flow methodology, qualification, and handling flows allow customers multiple options in planning and designing ASICs in a wide variety of applications. Available in the company’s 110 nm and 180 nm digital processes, the standard cell and SRAM architectures achieved superior neutron test results across voltage and temperature. To further reduce Single Event Effects (SEE), the design offering includes enhanced substrates, redundancy and error correction code (ECC) options. Leveraging the company’s existing commercial digital ASIC flow, customers benefit from superior pricing, development spans and manufacturing cycle times.

ONC18 FIT (Sea Level, NYC)	1.8 V FIT Per M Bit	1.5 V FIT Per M Bit
Dual Port SRAM	618	778
Single Port SRAM	492	704
Flip Flop*	313	529
* Single bit FIT only. Redundancy will significantly reduce FIT. No SEL at 85°C, 1.93 V. No MBU or SEFI.		

ONC110 FIT (Sea Level, NYC)	1.20 V FIT Per M Bit
HDSP SRAM	360
DP SRAM	290
Flip Flop*	358
* Single bit FIT only. Redundancy will significantly reduce FIT. No SEL at 125°C, 1.26 V. No MBU or SEFI.	

Soft Error Mitigation Solutions for Aerospace

ON Semiconductor has a wide range of design solutions to mitigate soft errors while taking density, power, and performance into account. A combination of proven Rad Hard by Design (RHBD) techniques and process enhancements deliver outstanding neutron test results. Be it partial, sequential, or full Triple Modular Redundancy (TMR), ON Semiconductor can tailor an ASIC development flow to meet the design and application needs of a wide range of aerospace applications.



Radiation Hardened By Design Solutions

Robust ASICs for Space and High Reliability Applications

ON Semiconductor offers Radiation Hardened by Design (RHBD) solutions critical for space and Hi-Rel applications. Available in the company's 110 nm digital Application Specific Integrated Circuit (ASIC) processes, the design offering includes a novel flip-flop architecture called Self Restoring Logic (SRL). SRL remains hard to single event effects at high Linear Energy Transfer (LET) while operating up to 700 MHz, far exceeding the capability of legacy RHBD flip-flop architectures. A latch-up resistant Dual Port SRAM with on-board error correction code (ECC), hardened clock elements, high-speed I/O cells, and a single event latch up protection cell expand the design portfolio. These cells are compatible with the existing digital ASIC flows resulting in superior pricing, development spans and manufacturing cycle times.

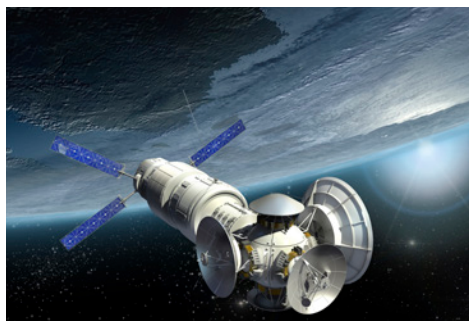
ONC110 Test Results

Total Ionizing Dose (Si)	300 kRads
SRL Onset LET (700 MHz)	107 Mev cm ² /mg (Si)
SEL Tolerant	Tested to 125 Mev cm ² /mg (Si) at 150°C and V _{dd} +10%
Dose Rate Upset	Tested to 1 x 10 ⁹ rad(si)/s
Dose Rate Latch-Up	Tested to 3 x 10 ⁸ rad(si)/s
Neutron SEE	8 x 10 ¹³ n/cm ² (1 MeV equivalent)

Proven Rad-Hard Solutions for Space

ON Semiconductor has a wide range of design solutions to mitigate radiation effects. Hardened IP and a proven commercial ASIC development flow combine to achieve results that meet the design and application needs of a wide range of applications. The company's ASIC legacy spans five decades and includes thousands of design-from-spec, customer interactive, and FPGA conversion success stories. RHBD capabilities enable ON Semiconductor to expand our ASIC heritage and service the needs of existing and new customers.

ON Semiconductor is developing an RHBD ASIC capability for a 65 nm CMOS technology node that will balance density, performance, power consumption, and cost of ownership. This platform will include IP, library, compiler, implementation flow, and test chip development.



Product Processing

Special Packaging

- Custom package developments
- Drop in replacement for ASICs / FPGAs
 - No need to modify the board footprint
- Aerospace / defense packaging
 - From ceramic packages to complex flip-chip BGAs
 - On-shore assembly and test capabilities
 - Thermally enhanced packages

Extended Temperature

- ON Semiconductor supports extended temperature in several technologies
 - -55 to +125°C for 0.5 μ m and 0.35 μ m process technology
 - -55 to +150°C for 180 nm process technology
 - -55 to +150°C for 110 nm process technology

Security Capability

- ON Semiconductor partners with third party IP providers
- Offers anti-tamper, error correction, and encryption capabilities with third parties

Avionics

- Demonstrated SEL immunity
- Soft error rate data available for logic and memories for 110 nm and 180 nm process technologies

Non-Volatile Memory

- 0.5 μ m and 0.35 μ m process technologies offer up to 1 kb EEPROM with a maximum configuration of 32 x 32; temperature ranges vary
- ONC18 (180 nm) offers two memory options
 - One Time Programmable (OTP) up to 256 kb; -40 to +125°C
 - EE Array up to 1 kb
- SP110 (110 nm) capable of supporting OTP
 - -40 to +125°C up to 312 kb



Advanced Processes and Intellectual Property

Digital Standard Cell Product Families

Standard Cell Product Families					
Family	Core Voltage (V)	I/O Voltage (V)	I/O Types	System Performance	Special Features
SC5 0.5 μ m	5.0	5.0, 3.3	PCI, TTL, LVTTTL, LVCMOS	75 MHz	Long-Term 5 V Support, High Temp
SC3 0.35 μ m	3.3, 2.5	5.0, 3.3	PCI, GTL, HSTL, SSTL, LVTTTL, LVCMOS, LVPECL	100 MHz	EEPROM, High Temp
ONC18 180 nm	3.3, 1.8, 1.5, 5.0	3.3, 2.5, 1.8, 5.0	PCI33/66, DCI, HSTL, SSTL, LVTTTL, LVCMOS, LVPECL, LVDS	266 MHz	NVM, OTP, High Vt, High Temp
SP110 110 nm	1.2	3.3, 2.5, 1.8, 1.5, 1.2	PCI33/66, DCI, HSTL, SSTL, LVTTTL, LVCMOS, LVPECL, LVDS, CML, PCIX	450 MHz	OTP, Dual Source Capability, Mil Temp
SP65/55 65 nm, 55 nm	1.2, 1.0	3.3, 2.5, 1.8, 1.5, 1.2	PCI33/66, DCI, HSTL, SSTL, LVTTTL, LVCMOS, LVPECL, LVDS, CML, PCIX	600 MHz	Extensive IP Portfolio
SP45/40 45 nm, 40 nm	1.1, 0.9	3.3, 2.5, 1.8, 1.5, 1.2	PCI33/66, DCI, HSTL, SSTL, LVTTTL, LVCMOS, LVPECL, LVDS, CML, PCIX	850 MHz	Extensive IP Portfolio
SP32/28 32 nm, 28 nm	0.85 ~ 1.05	3.3, 2.5, 1.8	PCI, DCI, HSTL, SSTL, LVCMOS, LVPECL, LVDS, CML	1000 MHz	Extensive IP Portfolio
GF22 FDX/FDSOI	0.88, 0.72, 0.40	3.3, 1.8, 1.5, 1.2	PCI, DCI, HSTL, SSTL, LVCMOS, LVPECL, LVDS, CML	1.8 GHz, 2.1 GHz w/BB	Body Bias, Ultra Low Power, Extensive IP Portfolio

Comprehensive Intellectual Property Offering

ON Semiconductor offers a suite of system IP suitable for a variety of applications, including those requiring high-speed serial I/O (SerDes), external high performance memory interfaces, processors and a variety of other hard and soft IP. Combined with support for a rich family of I/O standards, our digital ASIC technologies and IP provide optimal solutions for aerospace/defense, automotive, communications, industrial, consumer, computing, and medical applications. ON Semiconductor is an Arm® microprocessor licensee, and has access to multiple Arm cores for integration into silicon products.

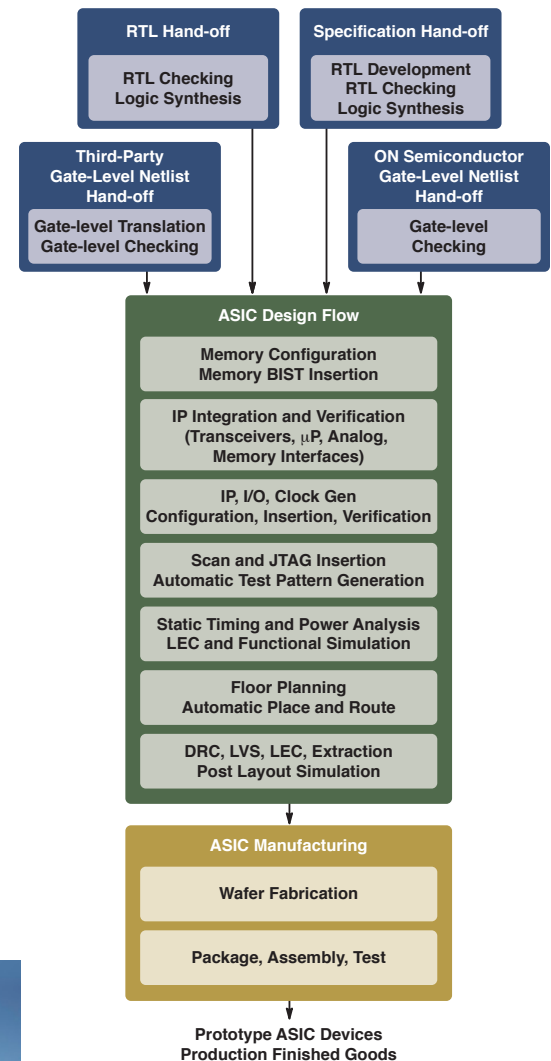
Category	IP Cores
Hi-Speed SerDes	PCI Express Gen 1/2/3, XAUI, SATA I/II/III, EPON, Serial Rapid I/O (SRIO), 1G Ethernet, 10G Ethernet
Serial Interfaces	USB 3.0/2.0/1.1, HDMI, I2C, CAN, UART
Application Layer Support	10/100 Ethernet, 1G Ethernet, 10G Ethernet, PCI Express Gen 1/2/3, SATA I/II/III, SRIO, USB 3.0/2.0/1.1, DDRX Controllers, EMAC4, MII, RMII, SMII, XFI, HDMI
Bus Interfaces	PCI, AMBA/AHB, ARM7, PLB, PCMCIA
Microprocessors	Arm, ARC, PowerPC, R-Core, M8051, AMBA/AHB Peripherals
Memory Interfaces	DDR, DDR2, DDR3, DDR4, QDR-II
Data Converters	ADC, DAC
Memory	SRAM, DPRAM, Register File, ROM, OTP
Clocking	PLLs, DLLs, MSDLL
Error Correction, Encryption & Anti-Tamper	ECC, DES, 3DES, Reed-Solomon, RNG, PK Processor, Secure SRAM
DSP Functions	FFT, Mult, Divide, Accumulate, Up/Down Converter, FIR
FPGA Conversion IP	Memory Wrappers, LUT RAM, I/O Standards, Hardware DSP Functions, FIFOs, Clocking Emulation



Custom ASIC Designs

Digital solutions from 0.5 μm to 28 nm

- Flexible ASIC design interfaces including whole or partial RTL, Netlist, and GDSII content
- Robust FPGA proof-of-concept validation flow when targeting an ASIC
- FPGA-to-ASIC, ASIC-to-ASIC, and multi-chip-to-ASIC conversions
- EOL support with ASIC-to-ASIC conversion approach
- Big D (Digital) / Small A (Analog) ASIC capability to increase integration and simplify board design
- Up to 50 million gates and 50 Mb of memory
- System architects to advise on best overall solution
- Proven technologies to ensure long term, continuous supply
- Secure supply with domestic manufacturing
- Support for long-life, small volume applications
- High reliability, high temperature, special packaging and handling
- Complete solutions including product development, test, package engineering, quality engineering, and failure analysis
- Full ITAR handling available
- QML Flow, Trusted Supplier
- DO-254 compliance support
- Custom packaging capability to match most pin-outs and package types

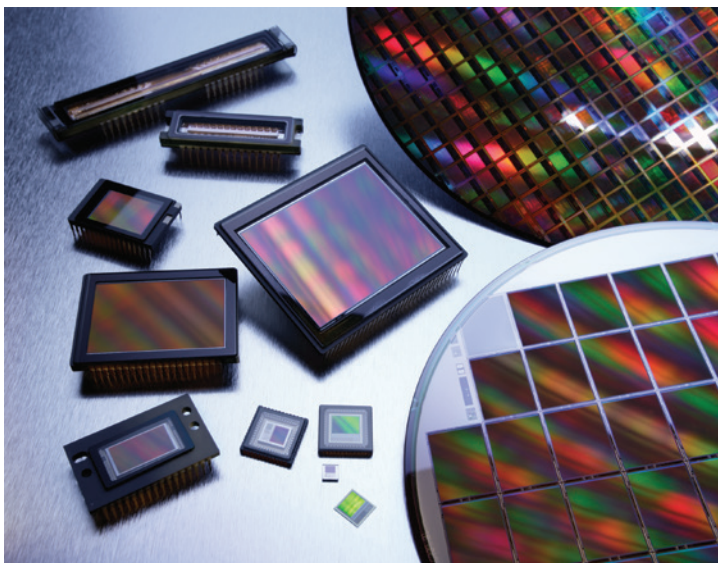
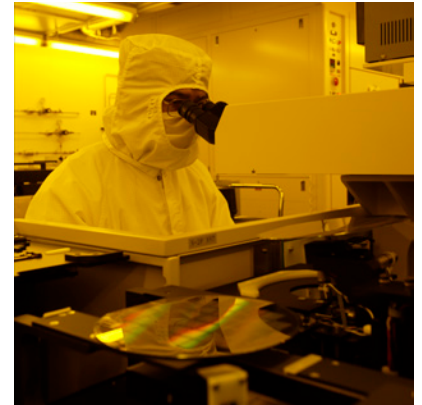


High Performance Image Sensors

With over 40 years of imaging expertise, ON Semiconductor is a leading supplier of high performance CMOS image sensors. Our broad portfolio of products includes devices with resolutions ranging from VGA to over 26 megapixels, and our advanced design and processing techniques can be utilized in the development of custom products specifically designed to address the most demanding imaging applications.

Broad Portfolio of Standard Devices

- Rolling and Global Shutter for high speed, low power, and readout flexibility
- Radiation tolerant designs for use in high radiation environments



Advanced Technology Base

- Electron Multiplication
- High-speed readout architectures
- CMOS Backside Illumination
- SOC integration
- Specialized Color Filter Array (CFA) configurations
- Dedicated co-processors
- Military qualification grades available
- Custom TDI linear image sensor design experience for Remote Sensing applications

Integrated Passive Devices (IPD) An Efficient RF System-in-Package Solution

Integrating passive devices into our HighQ™ copper platform gives a cost-effective, smaller footprint solution for all RF needs.

IPD Technology Characteristics

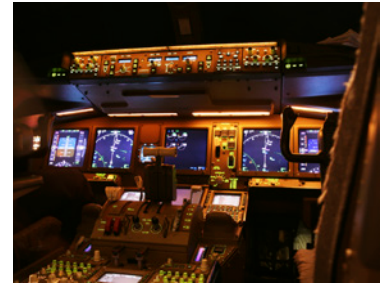
- Target frequency: 500 MHz to 40 GHz
- Low profile, minimal footprint
- Tight tolerance
- High reliability

Typical RF Applications

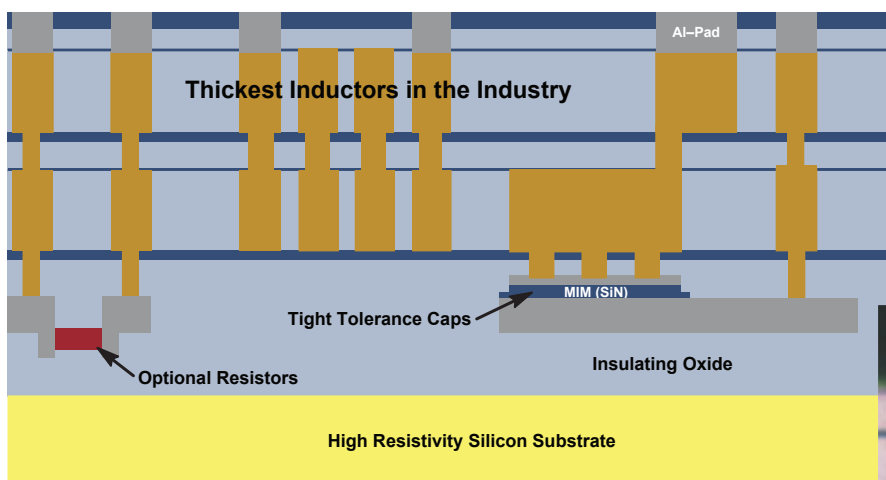
- Cellular – front end and base stations
- 5G solutions for handheld and infrastructure
- IoT solutions
- Data centers
- WiFi™/Bluetooth®/Zigbee® solutions
- Aerospace and defense

Typical IPD Designs

- Baluns
- Couplers
- Diplexers
- Low pass and band pass filters
- Splitters
- Matching networks
- Interposers



IPD Technology (R, L, C)



Performance

- Guaranteed $\pm 5.0\%$ capacitor tolerance
- Typical $< 1\%$ variance between capacitors on common IPD
- Dual Cu stack up of $12\text{ }\mu\text{m}$ for high Q inductors

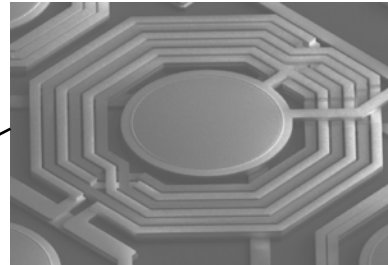
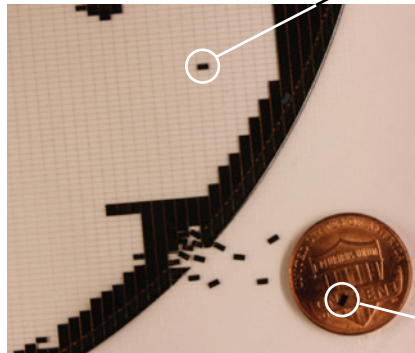


Dual Copper Stackup with Full Length Stitched Via

IPD Technology

Advantages

- Smaller than discrete solutions
- Thinner & higher precision than LTCC
- Lower cost than GaAs
- Best performance among silicon-based IPDs



Inductor Coil

Dual Low Pass Filter

State of the Art Fab

- Standard Mechanical InterFace system (SMIF) results in high and consistent yields
- Located in Gresham, Oregon
- Fab Certifications:
 - » ISO 14001
 - » QML (DoD)
 - » IATF 16949
 - » ITAR (DoD)
 - » AS 9100 Rev. D
 - » Trusted Foundry Status
 - » OHSAS-18001



Design and Foundry Services

- Complimentary feasibility study
- Design services available
- Self-service design with full featured PDK for Cadence and Agilent
- 8-inch high resistivity silicon wafers
- Shuttles with multiple designs/variants

Sales and Design Assistance from ON Semiconductor

ON Semiconductor Technical Support
www.onsemi.com/support

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