

Freescale's Networking ASIC/SoC Solutions

Scalability Meets Flexibility



ASIC/SoC Solutions

The application-specific products operation (ASPO) develops standard-cell application-specific integrated circuit (ASIC), as well as highly integrated, customized System-on-Chip (SoC) products built on a foundation of Freescale and partner-proven process technologies and intellectual property (IP). We provide solutions to customers that desire differentiation, maximum performance and high levels of integration by taking advantage of our platforms built on Power Architecture™ technology and a growing IP portfolio. These solutions are designed to provide our customers with the benefits of scalable performance, fast time to market, low system cost, as well as the flexibility to allow easy migration to next-generation system designs.

We have leveraged our technology leadership, extensive IP portfolio, systems engineering and architectural expertise to provide a comprehensive solution.

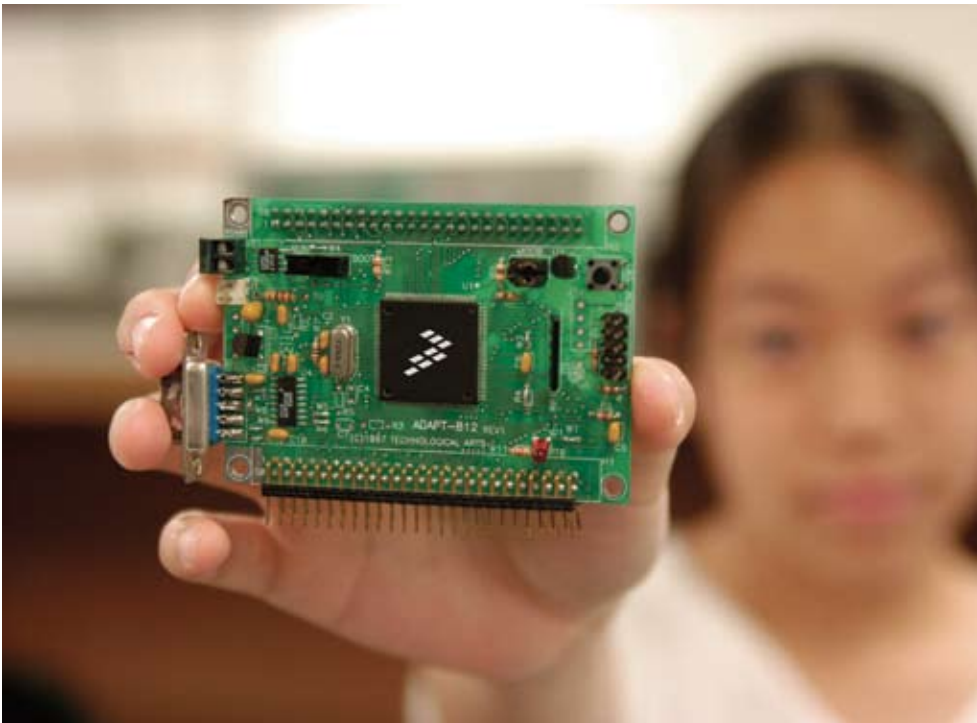
Customer Engagement

A hallmark of Freescale's ASIC capability is our flexible customer engagement model and design flow. We support the use of industry-standard tools for conformance with customer development systems. Our Freescale design services are available to accommodate customer inputs, from architecture definition through mask preparation, with the option of multiple hand-off points in the development cycle.

With more than 20 years of experience in customer-specific semiconductor design, Freescale has strategically located design centers throughout the world to enable our customers with the highest level of support through the intricate design development phase. At any of these locations you can use our tools, consult with our experienced technical staff, receive training on design-related software and utilize regional applications support units during the design and prototype phase. We use full-time project planning, control and analysis resources for each project to provide product quality and a high level of customer service.

Design Building Blocks

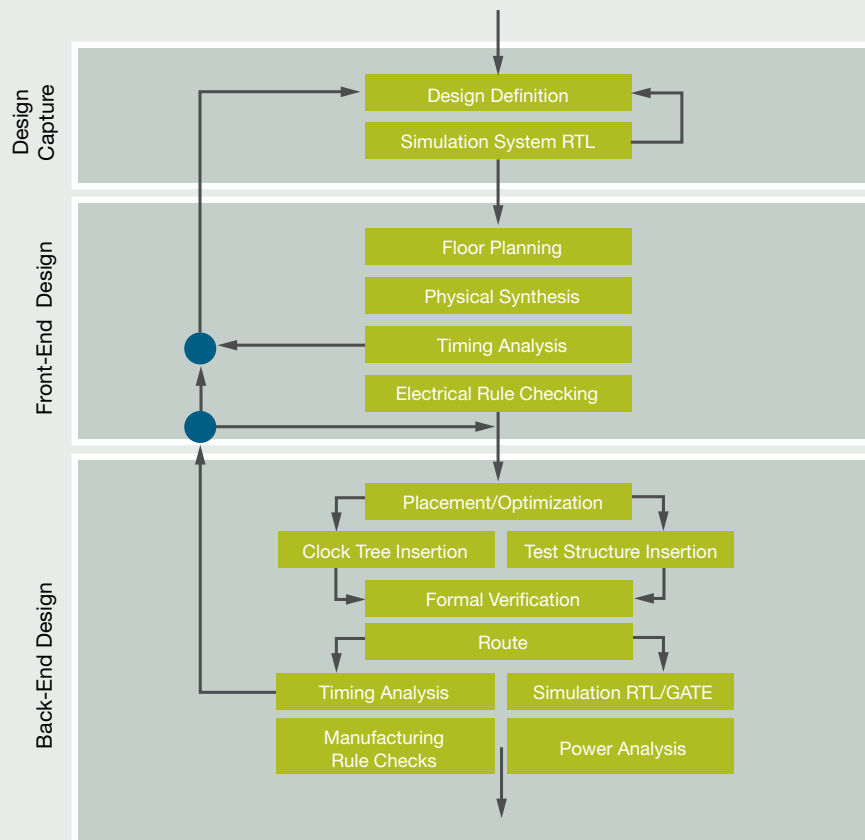




“Freescale worked with us to develop a complex ASIC critical to our product launch requirements, and not only delivered it on time for our development cycle, but on target for the exacting specifications of our interactive satellite communications application.”

John Corrigan
 Senior Vice-President,
 VLSI and Wireless Systems,
 Hughes Network Systems

Design Flow: Customer Specified Logic



Freescale’s flexible customer engagement model approaches ASIC and SoC design solutions from a system approach for each of our customers.

Design Capabilities

Since today's integrated circuits incorporate more functionality, Freescale's ASPO offers greater services in addressing system-level requirements. Using our vast design engineering expertise, we develop ASIC and SoC design solutions from a system approach for each of our customers. Freescale enables successful design solutions by leveraging our IP portfolio, reusing the same modules and verification environment for our standard and ASIC products.

Freescale's design methodology uses a hierarchical and iterative approach designed to enable flexibility, fast turnarounds and first pass silicon success. Our team employs a rigorous design approach using block-level physical synthesis to optimize frequency and area while minimizing power through the support of multi-Vt transistors. Top-level netlist integration, clock-tree synthesis and scan insertion are designed incorporating customer inputs, and are completed meticulously by expert engineers and tool flows. Design accuracy is verified through electrical rules checking (ERC), formal

verification and design for test (DFT). Static timing analysis incorporating both signal integrity (SI) and on-chip variation (OCV) is a critical element of our methodology to ensure timing accuracy across a variety of manufacturing conditions. Power and IR drop analysis also guarantees optimal power routing for top performance while verifying power levels meet packaging, application and customer needs. Our comprehensive methodology addresses the reliability, maintainability and testability necessary for market leadership.

Flexible Processing Platform Options

Scalable Integration

Integration Structures

System Integration

Mixed Signal

Memory Controllers

Customer IP

Scalable Performance

e300

e500

e600

e700

SC1400

SC140

SC3400

Scalable Connectivity

Interconnect

Host Peripheral Bus

General Peripherals

System Fabric

Networking

Network Acceleration

Protocols

Security

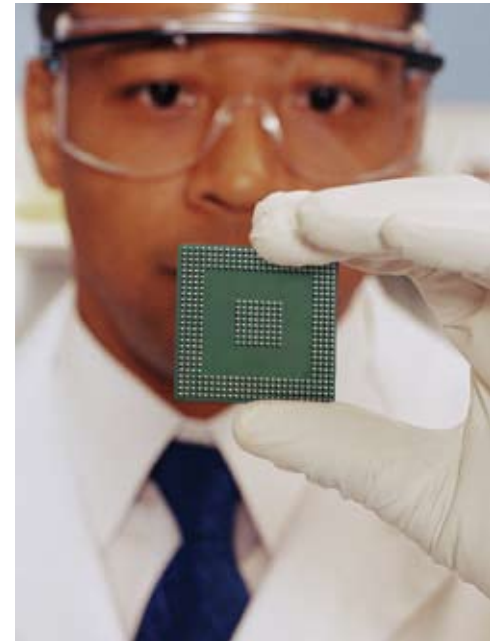
Customer IP

Cores Built on Power Architecture Technology and StarCore™ Based DSPs

Freescale has a rich history of delivering performance, connectivity and integration to the networking, communications and pervasive computing markets. During more than ten years of Power Architecture technology and core development, Freescale has delivered increasingly higher performance cores, including Altivec™ vector processing and more advanced processing technologies, such as silicon-on-insulator (SOI). Combining the company's processing and connectivity capabilities, Freescale has pioneered processor integration in the communications market and continues to lead the way with the PowerQUICC™ III family. Leveraging its advanced chip-level integration capabilities, Freescale is now delivering common processor built on Power Architecture

technology SoC platforms that combine the company's processor core portfolio with its broad IP portfolio. Freescale's e300, e500, e600 and e700 SoC platforms are engineered to deliver scalable performance to meet a wide spectrum of processing and I/O requirements.

In addition, the expanding StarCore DSP core-based family of processors takes full advantage of the scalable StarCore architecture, and can be integrated with multiple peripherals, customer logic or our other core processors. The raw processing power of these highly integrated SoC devices enables developers to create next-generation networking products that offer tremendous channel densities while maintaining system flexibility, scalability and upgradability. The ease with which these DSP devices can be programmed allows companies to bring new products to market significantly faster, with longer time in market and lower development costs. The cores are designed with C compilation in mind, and the compiler provides efficient code optimization while maintaining optimum code density.



Freescale's standard cell ASIC and SoC solutions combine scalable integration with scalable performance and connectivity. Our solutions offer the ability to integrate customer IP onto scalable SoC platforms using Power Architecture or StarCore-based DSP cores and a robust IP portfolio. This marriage of custom IP with Freescale's technology portfolio enables us to develop a large variety of products quickly, enabling market entry acceleration for your next product.

Technology Portfolio

Integration Structures: Freescale SRS Buses, OCeaN Integrated Fabric, Coherent SystemBus, Gaskets for Standard Buses

System Integration: Bus Controllers, Timers, DMA, Arbiters, Bridges, Interrupt Controllers, GPIO

Mixed Signal: PLLs/DLLs, D/A, A/D, Clock Data Recovery, TIA, LDD

Memory Controllers: DDR SDRAM, DDRII SDRAM, SDRAM, Flash, EPROM, SRAM, DRAM Host Peripheral

Host Peripheral Bus: PCI, PCI-X, PCMCIA, 60x, MPX, Local Bus

System Fabric: RapidIO®, Serdes

Networking: Utopia, GMII, MII, RGMII, TBI, XAUI

General Peripherals: USB 2.0, USB1.1, PC, DUART

Protocols: Ethernet (10, 100, 1000), Serial (TX, RX), HDLC, T1/E1/T3/E3 TDM, ATM, BPON

Security: Encryption, Authentication, Public Key, RNG

Leading-Edge Process Technology

Our die manufacturing specializes in a broad range of process technologies, including leading-edge CMOS (complementary metal oxide semiconductor), SOI, as well as specialty technologies such as SiGe, SMARTMOS and GaAs. Over the last several years, our company has consolidated its manufacturing facilities into fewer, more efficient manufacturing operations. We have seven wholly owned die manufacturing facilities, one joint 300 mm pilot line and two final manufacturing sites.

CMOS

Freescale's high-performance CMOS technology enables fast and cost-effective solutions for consumers. These process technologies offer the functionality for a broad range of market applications ranging from ultra-low leakage low-power mobile applications to high-performance computing and networking systems. Technology nodes begin at 0.18 micron and extend well beyond 45 nanometers. We continue our long-term investment into advanced CMOS processes from 90-nanometer down to the 32-nanometer technology node with 300 mm wafer.


Silicon On Insulator

SOI is a semiconductor wafer technology that produces higher performing, lower power devices than traditional bulk silicon techniques. SOI works by placing a thin insulating layer, such as silicon oxide or glass, between a thin layer of silicon and the silicon substrate. SOI also offers the opportunity to enjoy the benefit of low-noise and high-quality passives for RF and mixed signal applications

to truly enhance SoC applications. Additionally, in 2006, Freescale demonstrated an advanced CMOS technology that utilizes strained silicon-on-insulator (sSOI) substrates, delivering further performance improvements and reduced power consumption for next-generation semiconductor devices. Freescale now has in production and/or development SOI technologies at 0.18-micron, 0.13-micron, 90 nm and 65 nm generations.

Silicon Germanium (SiGe)

Freescale offers cost-competitive, high-performance BiCMOS (Bipolar CMOS) with a low-noise SiGe:C HBT (silicon germanium carbon heterojunction bipolar transistor) and world-class embedded passives to meet RF and mixed-signal needs across all markets. Freescale is in volume production on multiple products based on the 90 nm generation of RF BiCMOS and the 45 nm generation of RF CMOS.

Package Type	Performance	Max Power @ 45C amb.	Package Pitch	Ball Count	Body Size
Overmolded PBGA 	Design Dependant	1.75–2.25W	1.0–1.27 mm	144–900	15–40 mm
MAPBGA 	Design Dependant	1.25–1.75W	0.5–1.0 mm	16–480	8–19 mm
Quad Flat No Lead (QFN) 	Design Dependant (High Speed)	3–4W Design Dependant	0.5–1.0 mm	4–80	3–8 mm
QFP 	Design Dependant (Medium Speed)	1.25–1.75W	0.5–1.0 mm	34–304	7–40 mm
Modules/SIP 	200–5 GHz	Up to 100W	1.0–1.5 mm	20–300	Custom
4 Layer PBGA 	Design Dependant	2.25–2.5W	1.0–1.27 mm	144–900	17–40 mm
TE-PBGA-2 	Design Dependant	2.5–2.75W	1.0–1.27 mm	144–900	17–40 mm
Tape BGA 	Design Dependant	2.75–4.5W	1.0–1.27 mm	276–1036	23–45 mm
Flip Chip 	Design Dependant (High Speed)	2–45W	0.5–1.27 mm	119–1000	16–35 mm

As an Integrated Device Manufacturer (IDM), Freescale maintains a broad spectrum of manufacturing capabilities to meet the needs of our customers. In addition to its wafer manufacturing sites, Freescale owns bump, assembly and test operations. Freescale's Technology Centers are focused on future advanced packaging and test technology development that adds value to Freescale's product portfolio. In addition, they enable effective implementation of new technologies in both internal and external manufacturing sites.

Package and Assembly Technology

Freescale has over 30 years of leadership in semiconductor packaging and manufacturing technology for automotive, industrial, networking and wireless markets. We help customers overcome size, cost and temperature challenges as markets increasingly require smaller, faster and higher performing devices.

We offer a broad array of packaging alternatives for customers, including quad flat pack and quad flat no-lead devices, a variety of wire-bond and flip-chip ball grid array solutions, as well as more advanced System in Package and Redistributed Chip Packaging technologies.

RoHS Compliant and Environmentally Friendly

Freescale is proactively driving the implementation of environmentally friendly materials for its products to ensure we meet customer and legislative requirements. Freescale Environmental Products incorporate environmentally preferred materials and design features for low toxicity, greater recyclability and low energy consumption. Freescale Environmental Product activities include RoHS (Restriction of Hazardous Substances) Waste of Electrical and Electronic Equipment Directive Compliance and lead- (Pb) free and Halogen-free initiatives.

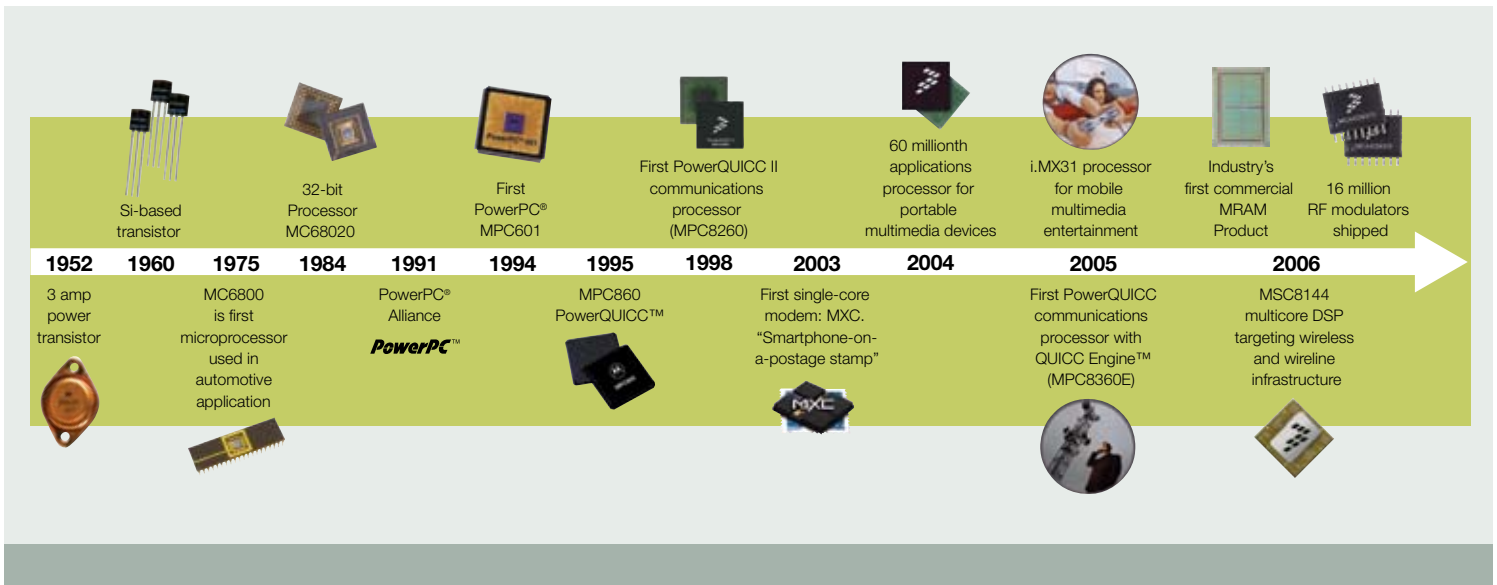
Test Technology

At Freescale, design for test is initiated early on in the design cycle, taking advantage of full-time test engineers. We provide scan and built-in self test (BIST) coverage across multiple testing platforms and dedicated Automated Test Engineering (ATE) for test development of ASIC and SoC solutions.

Quality by Design

Every day, we continue to build on our 50-year legacy of innovation and customer service. By listening to our customers, we push quality and reliability at every level of our organization. Through the implementation of robust internal processes from the beginning of the development cycle, we help ensure quality-driven technology for our customers. Our pledge is to create solutions that exceed expectations and raise the bar on quality.

Building on a 50+ Year Heritage of Innovation





Comprehensive Design and Manufacturing

Design Services

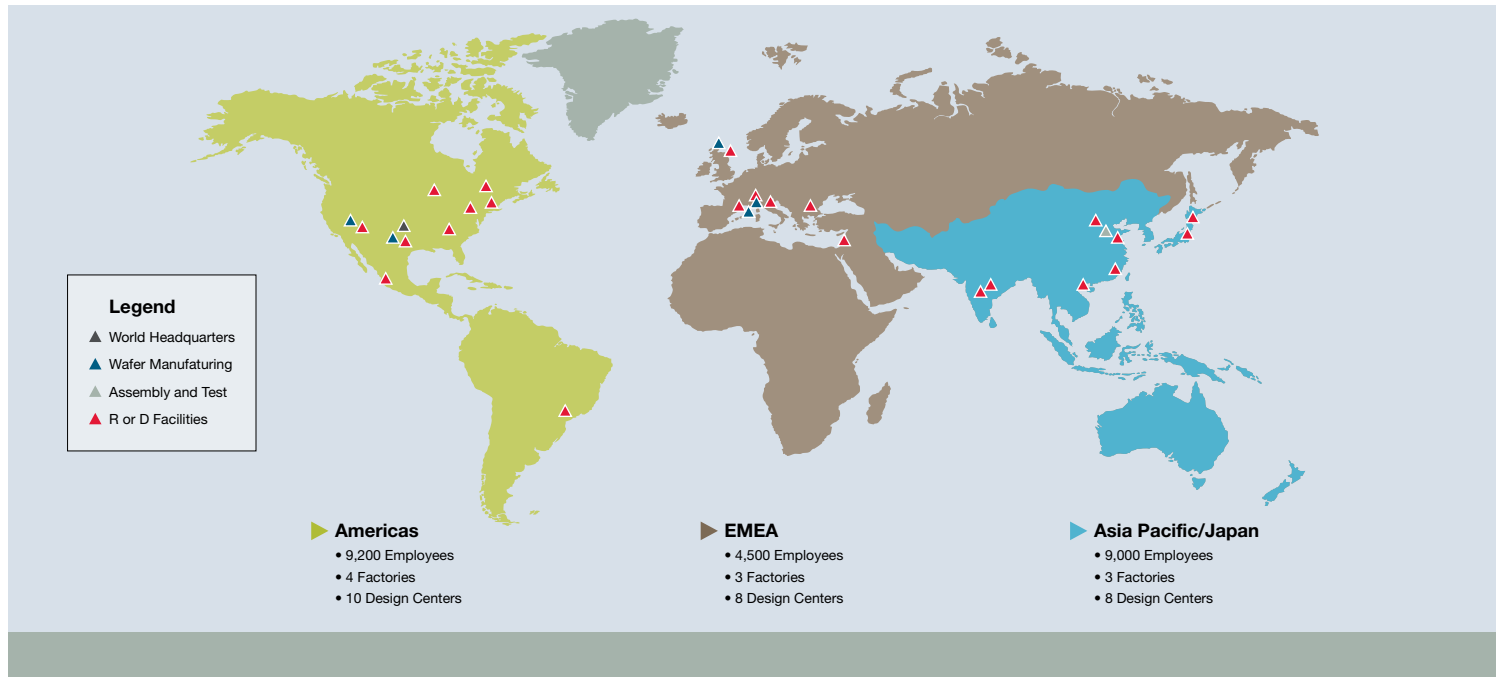
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receive training on design-related software and use Freescale's regional applications support units during the design and prototype phase. We use full-time project planning, control and analysis resources for each project. Program plans are captured, tracked and analyzed to provide product quality and a high level of customer service.

Freescale's advanced design capabilities are backed by our industry leading back-end manufacturing capabilities for fabrication,

assembly and final test, which provide our customers a full-service approach. Senior process, product and test engineers support these manufacturing operations, and our engineering resources drive programs and products efficiently and aggressively to the sampling stage. After the customer product evaluation and the receipt of device approval, Freescale conducts thorough device reliability testing at the die and package level before releasing the device to production.

Worldwide Design Centers



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Learn More: For current information about Freescale products and documentation, please visit www.freescale.com.



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