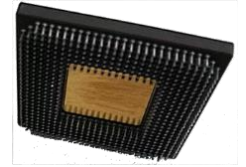# Rad-hardened SPARC LEON4 SOC

OCE's Ocean E698PM radiation hardened processor is a high performance, high reliability, high integration and low power multi-core system-on-chip (SOC). Its symmetric multi-processing (SMP) architecture is compliant with the SPARC V8 standard and the product is flying on 30 satellites.

OCEOS Real-time Operating System (flight-quality)

OCEOS is a small footprint real-time operating system developed for ESA to flight category B standards. It schedules tasks of fixed priorities using the stack resource policy. Initial architectures supported are RISC-V, ARM & SPARC (single-core & multicore). OCEOS provides some unique precision timing control capabilities. OCEOS is based on stack resource policy which prevents unbounded priority inversion, chained blocking, and deadlocks.
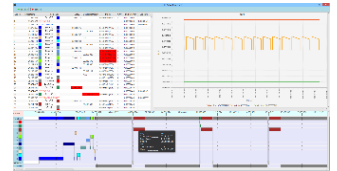
Rad-hard Artificial Intelligence SOC

HISAOR (from the Irish words for AI) is a next-generation rad-hard SOC for Areospace applications. It is a heterogenous design consisting of four ARM CPUs with eight AI coprocessors each consisting of a GPU and neural network accelerator. Floating-point performance is 64 GFLOPS with integer performance of 12 TOPS at power dissipation of less than 12W. OPENCL\OPENVX\OPENCV software libraries are suported.

Rad-tolerant SIP memories/OBCs/devices

OCE's Ocean system-in-package (SIP) prodcuts that are ideal for harsh environments such as space. The range includes SDRAM, SRAM, NOR Flash, NAND Flash, MRAM, EEPROM, DDR, OBC (SPARC+Flash+RAM), MCES (FPGA+Flash+RAM) and custom designed parts.
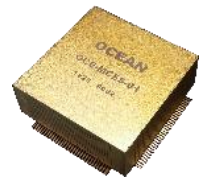
DMON debug software

DMON helps improve productivity by speeding up debugging of embedded software running on system-on-chips (SOCs) with one or more SPARC/ARM processor cores. It's unique GUI with register drill down, Python/Tcl scripting, data monitoring and remote access features facilitate testing and the quick identification and correction of bugs.
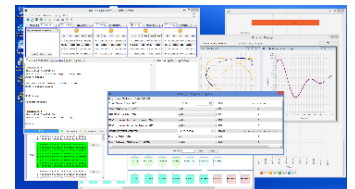
Solar Cells/Arrays

OCE's solar cells are GaInP2/GaAs/Ge on Ge substrate triple junction solar cells. The solar cell assembly is equipped with an external Si bypass diode, interconnectors and cover glass. The cells have high efficiency and high radiation resistance.

Attitude Control System

The OCE ACS is a complete 1U self-contained attitude control system. The 1U unit consists of 2 star trackers, 1 sun sensors, 3 reaction wheels, 3 magnetic torquers, a magnetomer, gyroscope, and a controller to take commands over CAN or RS422 from the spacecraft. Its mass os 0.6kg and is designed for satellites up to 20kg.
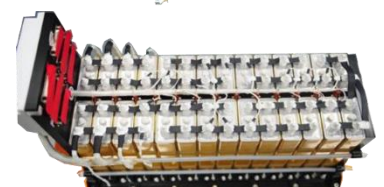
Star trackers

More than 100 of these star trackers are in commission on satellites such as NS-1/2 and the JILIN-1 group. The majority of these satellites are used for earth observation, providing video and high resolution remote sensing data.

Li-Ion Batteries

OCE's Li-ion batteries are fully-enclosed in an aluminum alloy. Characteristics include high mechanical strength, resilience to impact and vibration during launch, high specific energy, long lifetime, and a wide working temperature range.

O.C.E. Technology is a European company set up to provide high-reliability products and related software and services for demanding applications including aerospace. The company is supported by the Irish government and cooperates with the European Space agency in developing products to improve the productivity of embedded software developers.

Located in Dublin, OCE's products include a flight-ready real-time operating system, debug software tool for system-on-chip (SOC) devices, a range SPARC SOCs including the radiation hardened quad-core LEON4 E698PM, new high performance rad-tolerant edge AI SOC, system-in-package (SIP) devices, and satellite subsystems.

Products, capability and partners

OCE's ECSS category B real-time operating system OCEOS offers some unique features enabling high-reliability applications to be policed and impending failures to be anticipated and thus avoided. OCE has also developed a complimentary degug tool DMON with support from the European Space Agency (ESA). The tool provides graphic insight into the scheduling and interrupt behaviour of tasks running on OCEOS. Enhanced debug support for the AGGA-4 and GR716 SOCs is also provided. DMON's unique features make it a valuable asset in helping to speed up development of embedded applications. DMON continues to be developed to support new SOCs, and is available to prospective customers for evaluation. OCE's real-time operating system, OCEOS, is one of two ESA flight approved operating systems.

Of particular interest in a space context are the Ocean system-in-package (SIP) products which are extremely robust, compact, light weight, and in many cases radiation hardened. Only a few companies in the world have mastered this technology. OCE offers a custom SIP design service for companies wishing to produce proprietary OBCs or other systems housed in a SIP package.

OCE also has agreements with other suppliers of space qualified products allowing it to provide a range of satellite subsystems. These subsystems include star trackers, batteries, solar cells and arrays, and attitude control systems.

OCE has distribution partners in Europe, China, and South Korea.

All registered trademarks are respected

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