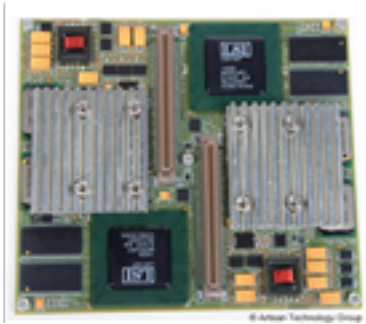
Mercury Computer Systems

RACE++ Series 400-MHz PowerPC 7410 Daughter Card



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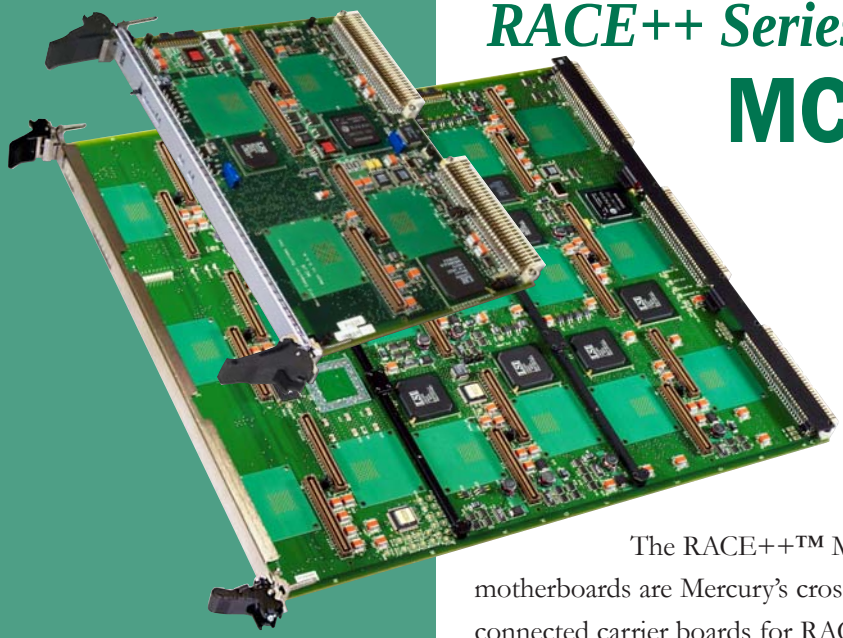
RACE++ Series

MCJ Motherboards



66-MHz RACE++ Switched Interconnect

Crossbar Connected on Board and Between Boards

Up to 18 PowerPC Processors on a 9U Board; 4 on a 6U

Dual-Port Ready for Two RACE++ Ports

Adaptive Routing

RACE 1.0 Compatibility Mode

The RACE++™ MCJ motherboards are Mercury's crossbar-connected carrier boards for RACE++ and RACE™ 1.0 daughtercards in VME systems. These motherboards are used in conjunction with RACE++ Interlink backplane overlays and RACE++ compatible daughtercards containing processors, memory, and I/O to provide compute power for a scalable, high-performance embedded computer system.

Available in both 6U and 9U form factors, the MCJ motherboards can be used with VME backplanes equipped with either single- or dual-ported RACE++ Interlink modules attached to the VME P2/J2 backplane.

RACE++ Switched Interconnect

As the latest version of the RACE architecture, RACE++ technology represents an architectural evolution that includes increased communication speed, more richly connected topologies, and augmented adaptive routing. Together these enhancements amount to a performance revolution yielding significantly higher bisection bandwidth and lower latency to attack the most challenging real-time problems.

Crossbar-Connected Communication

All communication paths among compute nodes, memory nodes, and I/O nodes are connected using eight-port crossbars, both on and between boards. By providing these point-to-point connections, the RACE++ architecture eliminates the bottlenecks found in systems that use buses to connect processors together on a board or between boards.

Each node on a RACE++ daughtercard is connected to the RACEway switched fabric through an interface ASIC on the daughtercard. The RACE++ motherboard contains the first level of crossbars in the RACEway switched fabric. This architecture assures each compute node direct and unblocked access to the RACEway network.

High Bandwidth, Low Latency

Each connection through a RACE++ crossbar can run at 66.66 MHz for a peak bandwidth of 267 MB/s. Each crossbar can connect four simultaneous communication paths for a total peak bandwidth of over 1 GB/s.

Low latency is often as important, if not more important, than high bandwidth. When making a connection through a RACE++ system at 66.66 MHz, each crossbar along the data transfer path adds only 75 ns to the latency. Once the connection is established, each crossbar adds only 15 ns of latency.

Adaptive Routing

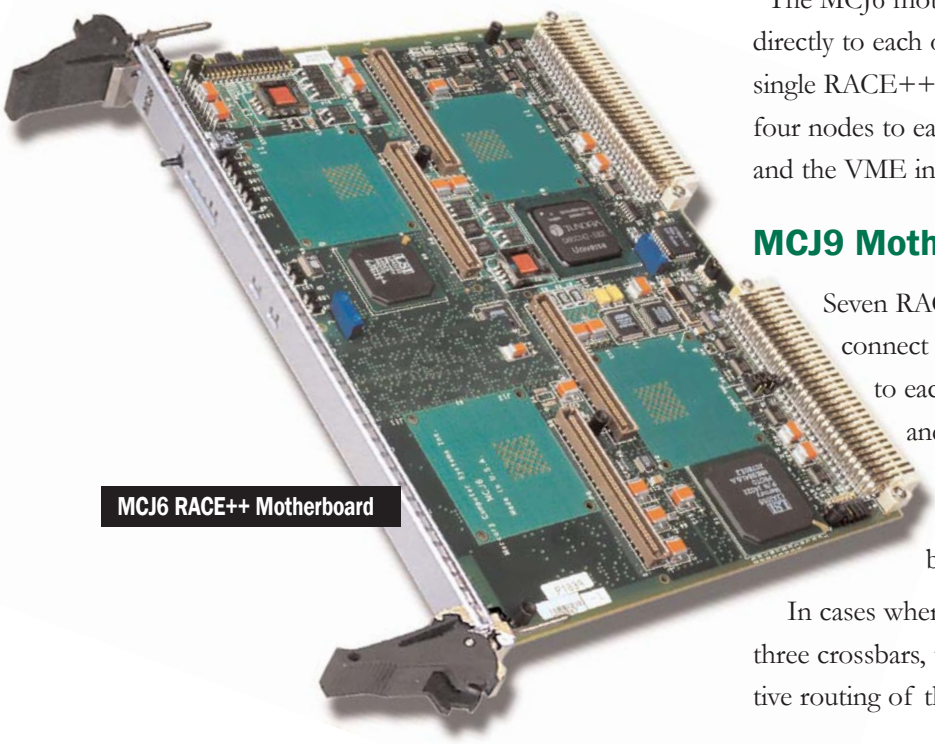
The RACE++ crossbars adaptively route data using alternate path selections to actively avoid any congestion in the network without user intervention. For example, on the MCJ9 there are six possible paths connecting node 2 to node 14 that can be selected based on availability.

Dual-Port Ready

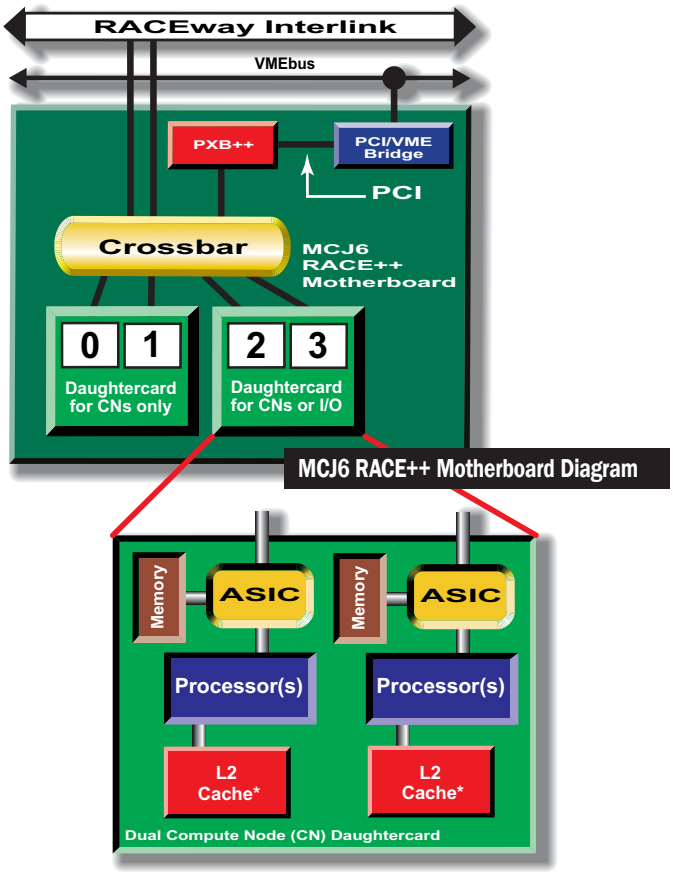
When operating with a dual-ported Interlink, the two RACE++ Interlink ports on an MCJ motherboard will provide 533 MB/s data communication with the backplane. These RACE++ ports operate simultaneously with a high-speed VME interface. All three interfaces operate concurrently with processing and I/O.

MCJ6 Motherboard

The MCJ6 is a 6U VME board that accepts two RACE++ daughtercards. Each daughtercard can contain up to two



MCJ6 RACE++ Motherboard



MCJ6 RACE++ Motherboard Diagram

*L2 Cache only available on certain processors.

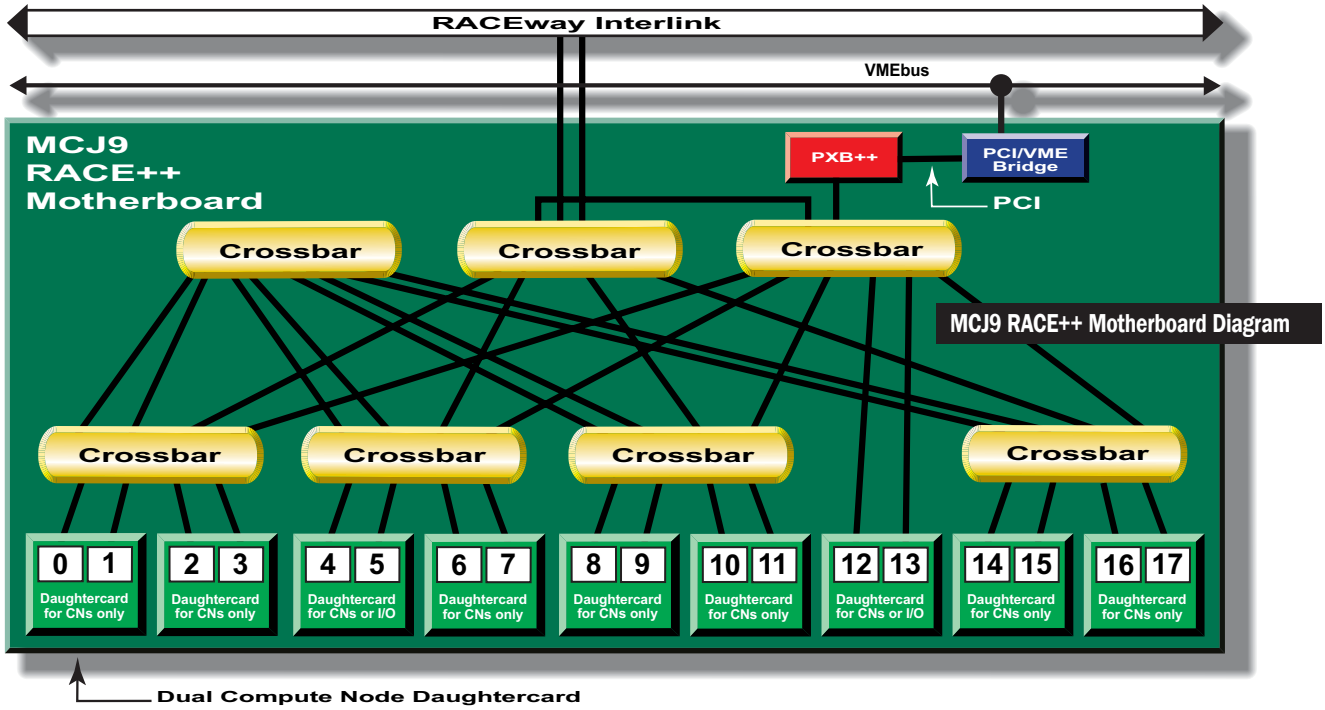
RACE++ nodes with processors, memory, or I/O. For example, a PowerPC daughtercard contains two compute nodes (CNs), each with a PowerPC processor, L2 cache, local SDRAM, and the compute node ASIC.

The MCJ6 motherboard provides a RACE++ connection directly to each of the four nodes on the daughtercards. A single RACE++ crossbar on the motherboard connects the four nodes to each other, the two RACE++ Interlink ports, and the VME interface.

MCJ9 Motherboard

Seven RACE++ crossbars on the MCJ9 motherboard connect up to 18 compute nodes on 9 daughtercards to each other, the two RACE++ Interlink ports, and the VME interface. The crossbar connections are organized to maximize both the on-board bisection bandwidth and the number of alternative paths for adaptive routing.

In cases where the path between two nodes is through three crossbars, there are six alternative paths. The adaptive routing of the RACE++ crossbars will automatically



MCJ9 RACE++ Motherboard Diagram

route traffic toward underutilized paths. Two of these paths also can adaptively route again after getting halfway to other nodes on the same motherboard.

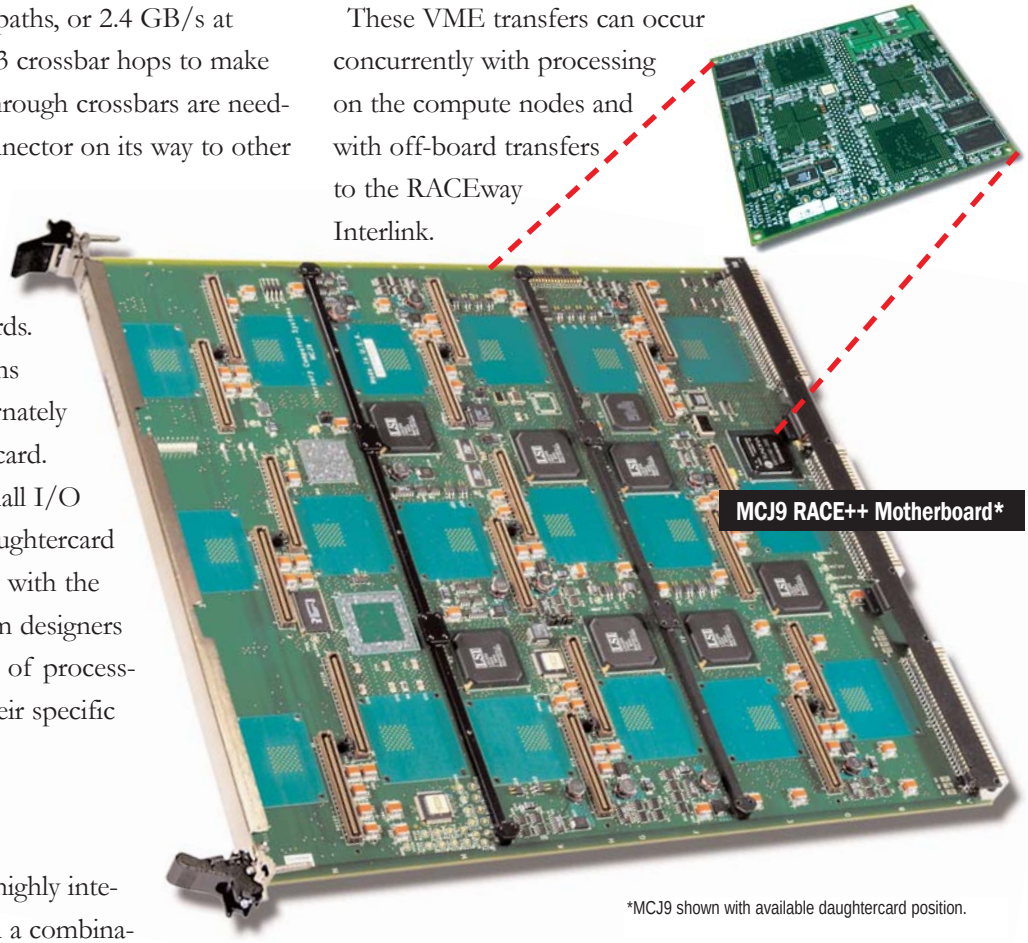
The bisection bandwidth of 18 nodes communicating on an MCJ9 motherboard is a full 9 paths, or 2.4 GB/s at 66.66 MHz, with a maximum of 3 crossbar hops to make the connection. Only two hops through crossbars are needed to get data through the P2 connector on its way to other RACEway boards.

Any of the daughtercard locations may be alternately populated with memory-only daughtercards. Two of the daughter-card locations along the front panel may be alternately populated with an I/O daughter-card. Some I/O daughtercards with small I/O connectors also fit in the third daughtercard position along the front panel. As with the MCJ6, this flexibility allows system designers to configure just the right balance of processing, memory, and I/O to meet their specific application requirements.

VME64 Interface

The MCJ motherboards have a highly integrated VME64 interface based on a combination of the Tundra Universe II VME/PCI bridge and the Mercury PXB++ PCI-to-RACEway bridge. The Universe II chip provides the full range of VME64 transfer modes at high performance.

These VME transfers can occur concurrently with processing on the compute nodes and with off-board transfers to the RACEway Interlink.



MCJ9 RACE++ Motherboard*

*MCJ9 shown with available daughtercard position.

For full VME64x (VITA 1.1-1997) compatibility, the motherboards come by default with 160-pin VME64x connectors. These connectors are required to access the second RACEway port through VME P2.

For compatibility with backplanes that use 96-pin connectors, the MCJ motherboards do not require the presence of 3.3V power on the backplane. Only 5V power is drawn from the VME backplane, and all other voltages are derived by DC-to-DC converters.

Backward Compatibility

MCJ motherboards may be intermixed with MCH Series motherboards in the same system. The MCH motherboards in these mixed systems may contain SHARC and PowerPC 603e daughtercards. Any system with MCH motherboards must be set to run at 40 MHz to ensure correct operation.

PowerPC 750 daughtercards were designed to be RACE++ ready. Previously introduced for 40-MHz systems, these daughtercards are capable of running at the full 66.66-MHz speed on the MCJ motherboards. Some older versions of the PowerPC 750 daughtercards require a firmware update by the factory for use with MCJ motherboards.

Ordering Information

Part Number	Model	Description
910-08000	MCJ6	6U VME RACE++ motherboards 160-pin (5-row) connectors
910-08001	MCJ9	9U VME RACE++ motherboards 160-pin connectors for P1 and P2

Call Mercury for information on ordering 96-pin (3-row) versions. Some daughtercard configurations require 5-row connectors on both motherboards and VME backplane to provide required power.

Electrical/Mechanical Specifications

Input voltage	**4.75 to 5.25 VDC**
Power (exclusive of daughtercards):	
MCJ6	**5 Watts at 5 VDC**
MCJ9	**15 Watts* at 5 VDC**

*Maximum configuration. Power consumption of MCJ9 varies with the number and type of daughtercards due to power conversion circuitry on the motherboard. Minimum efficiency in conversion from 5 volt to 3.3 volt used by some daughtercards is 85%.

Dimensions:	
MCJ6	**6.30 x 9.19 inches**
MCJ9	**14.44 x 15.75 inches**
Slot-to-slot spacing	**0.8 inches**
Weight without daughtercards:	
MCJ6	**0.8 pounds**
MCJ9	**3.0 pounds**

Environmental Specifications

Mercury offers multiple categories of environmental ruggedness for MCJ Series motherboards. The specifications detailed below are for the MCJ Series motherboards for standard commercial environments.

Recommended minimum airflow (per slot):	
MCJ6	**10 CFM**
MCJ9	**24 CFM**
Operating temperature:	**0°C to 40°C up to an altitude of 10,000 ft (inlet air temperature at recommended minimum airflow)**
Storage temperature:	**-40°C to 85°C**
Relative humidity:	**10 to 90% (non-condensing)**

As altitude increases, air density decreases, hence the cooling effect of a particular number of CFM decreases. Many manufacturers specify altitude and temperature ranges that are not simultaneous. Notice that the above operating temperature is specified simultaneously with an altitude. Different limits can be achieved by trading among altitude, temperature, performance, and airflow. Contact Mercury for more information.

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