ARTESYN™
EMBEDDED TECHNOLOGIES

VMEbus Technology™

VME BEYOND 2020

VMEbus Solutions

Best of breed, rugged and enduring high-performance products

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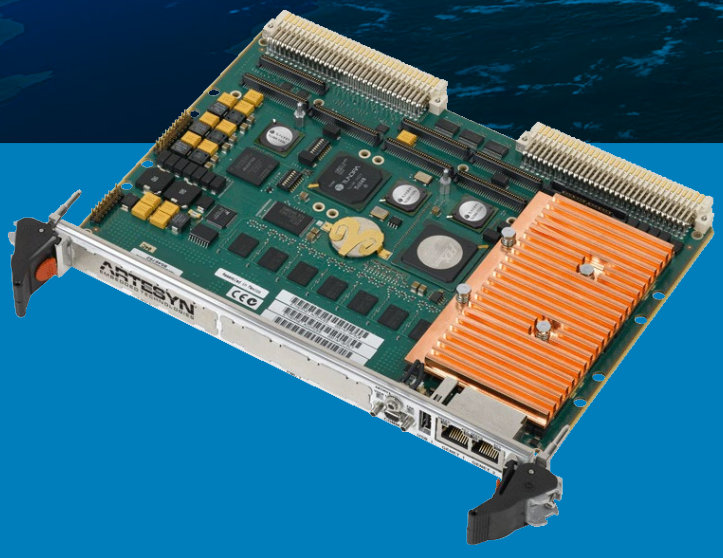
VME

BEYOND 2020

As VME remains an ideal architecture for mission-critical applications requiring high reliability and extended life cycles, Artesyn continues to be committed to the technology.



Our industry-leading track record of cost, performance, quality and longevity of supply speaks for itself.

As part of the group of innovative companies that invented VME technology nearly 35 years ago, Artesyn has laid the groundwork and consistently worked to enhance and extend VME technology.

To underline our commitment, we have been investing heavily in our VME offerings. We have secured a number of critical EOL components, including the Tsi148 VME to PCI-X chip and the Marvell system controller chip, to ensure that we can continue to offer an extensive portfolio of VME boards up to at least 2025.

While extending the life cycle of our VME products for another 10 years, Artesyn is also planning to develop new VME boards that will enhance our tiered product portfolio, which includes committed research on VME bridge solutions for future portfolio additions.

Artesyn's extensive VME portfolio based on Power Architecture processors offers customers flexibility to migrate between boards when they seek optimal solutions for their applications. With a deep understanding that software compatibility is vital to make a product migration successful, Artesyn always goes the extra mile to provide technical support to help customers migrate smoothly.

Why VME?

VME is used in applications that are event-driven. These applications – controlling motors and actuators, moving gun turrets and missile launch-frames into position – are control system applications. VME's interrupt structure is the only architecture that can handle these kinds of applications in real time. No other architecture, especially the fabrics and parallel PCI bus-based systems, can handle the requirements. Therefore, VME will remain the primary architecture in these platforms for many years to come. An enormous ecosystem of vendors exists around VME, with hundreds of products and ready availability of support.

The VME architecture was specifically optimized for real-time computing, and it offered a full 32-bit data path and 32-bit addressing. It can support multi-master CPU configurations to boost performance and processing bandwidth. Backplane I/O gives it significant configuration flexibility and high maintainability. Rather than using edge connectors, it uses pin and socket connectors for greater robustness and reliability.

VME: A Brief History

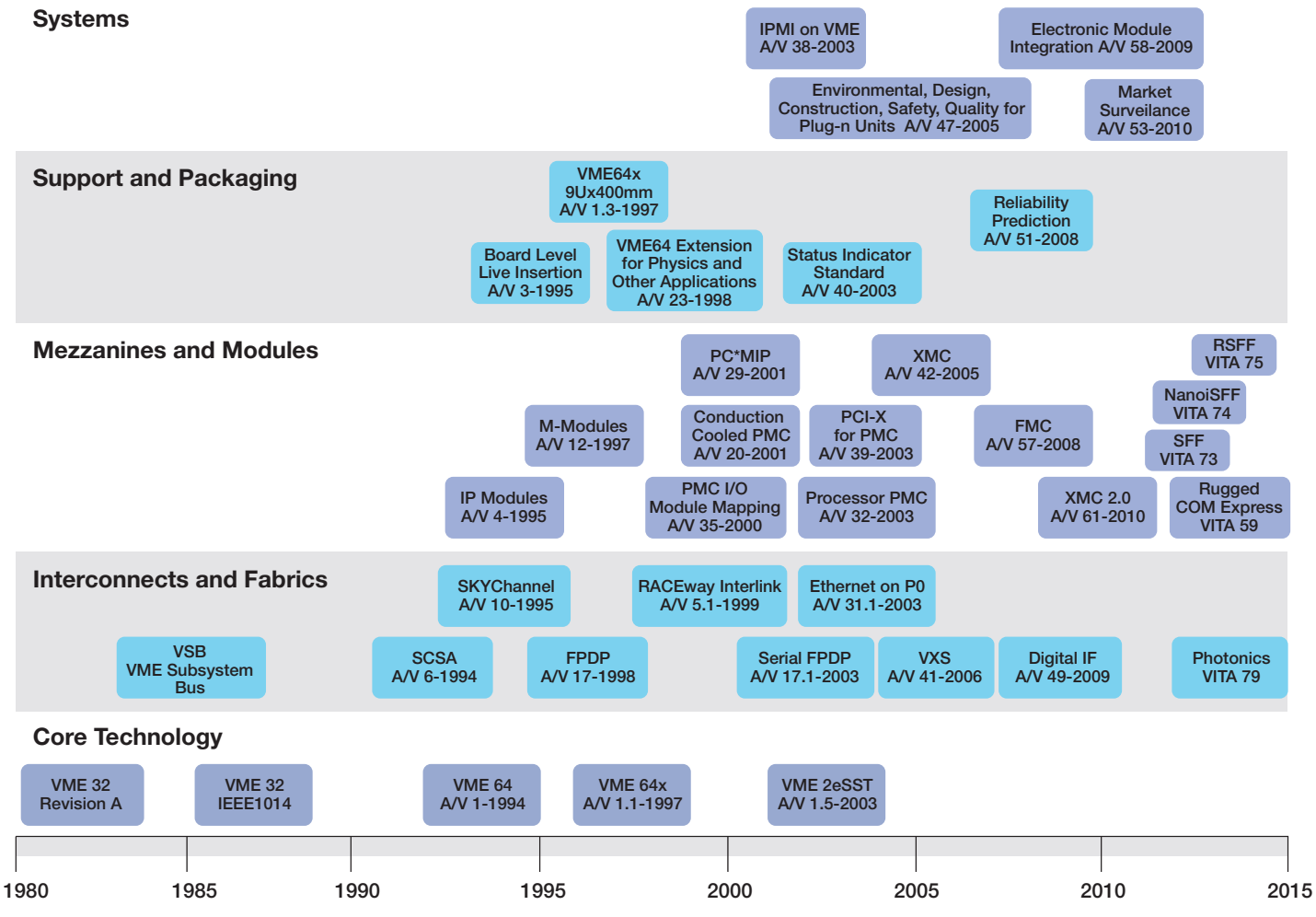
The architectural concepts of VMEbus are based on the VERSAbus developed by Motorola in the late 1970s. Motorola's European Microsystems group (now part of Artesyn Embedded Technologies) proposed the development of a VERSAbus-like product line of computers and controllers based on the Eurocard mechanical standard.

VMEbus has been a successful technology standard for nearly 35 years and has moved with the times through the decades.

VME has substantially increased the processing power it delivers in line with increasing user demands and successive generations of more powerful processing devices. Originally capable of transfer speeds of 40 Mbps in its 16-bit guise, 32-bit and 64-bit technology delivered bandwidths of 80 Mbps, with five-row VME64x bringing four times the original capacity of VMEbus. VITA 1.5 2eSST, a high-performance synchronous protocol ratified in 2003, brought backplane transfers up to 320 Mbps. What's more, VME has evolved in a way that leverages investment in it by maintaining absolute compatibility with what had gone before.

This industry-wide commitment to backwards compatibility, while maintaining the processor performance and I/O connectivity demanded by successive generations of users, helped VME become one of the most widely adopted embedded computing technologies ever.

VME Development Timeline



A/V = ANSI/VITA Ratified

Applications

After early success in industrial control applications, often replacing DEC PDP minicomputers, the VME processor board, I/O board and packaging/backplane infrastructure grew quickly, and VME was well established in the market by 1987. In the early 90s, the military began adopting VME as a standard computer architecture for their platforms and has been deploying VME for many years. Clearly, the largest users of VME technology today are military and aerospace equipment makers. A recent report published by the VITA standards organization suggests that 80% of VME products are now used by defense organizations.

VME can be found in battlefield command and control systems, ground and flight radar control systems, tank and gun controls, communications and other applications. Aerospace applications include avionics, fly-by-wire control systems, in-flight video servers, spacecraft experiment control, missile countdown sequencers and many others.

Some of the most popular applications outside the military and aerospace markets include:

- **Industrial controls**: Factory automation, robotics, injection molding machines, automotive body assembly and painting, sawmill controls, metal working, steel manufacturing, cardboard cutters
- **Transportation**: Railway controls, smart highway systems, light-rail transit systems
- **Telecom**: Intelligent switch gear, cellular telephone base stations
- **Medical**: CATSCAN / MRI imaging, various acoustical systems
- **High Energy Physics**: Particle accelerators, particle detectors

VME technology has even been on Mars with the Mars Rovers, Opportunity and Spirit. Opportunity is still moving, gathering scientific observations and reporting back to Earth – now for over 37 times its designed lifespan. Control systems for the “Tower of Terror” at Disney World, a voting system in the parliament of China and the Chyron text overlay system for television were also based on VME!

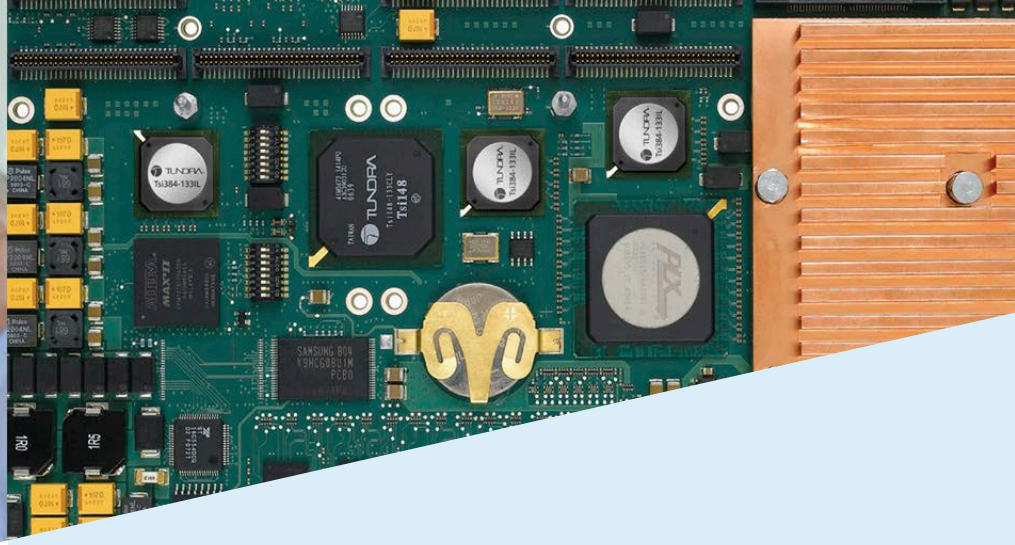
As a highly mature and widely proven technology, VME remains a cornerstone for military programs in the era of constrained defense budgets. VME is expected to continue its important role in system refreshes and upgrades as sequestration has extended the life cycle and altered the terms of maintenance and upgrade for many existing programs. On the other hand, VME still represents an optimal solution for the new programs requiring low risk and low cost with its salient competitive advantages of low power, small system size and proven experience in deployment.

Artesyn and VME Technology

As part of the group of innovative companies that invented VME technology almost 35 years ago, Artesyn has laid the groundwork and consistently worked to enhance and extend VME technology. This process continues with VXS and 2eSST technologies, which boost the performance and capability of VME technology while maintaining compatibility with existing systems over long product life cycles.

Multi-core processors in our latest VME boards and ruggedized, extended temperature boards are just two of the other ways in which we are continuing to push the boundaries of performance and flexibility.

Artesyn products compliant with VME standards are supported by our industry alliance members – specialist companies that can tailor VME based solutions to fit your application. This ecosystem, together with a worldwide sales and support network, helps to rapidly integrate the optimum solutions into your applications. For example, special features including extended temperature, conformal coating and ruggedized variants are options for select VME boards from our alliance members.



Artesyn's Leading Position

Artesyn's success in VME is built on excellence in technology and engineering, and outstanding technical support and service.

Advanced Technology

As one of the founders of the VME architecture and the VME International Trade Association (VITA) decades ago, Artesyn has made significant contributions to the evolution of the technology. We have developed unmatchable expertise in the design of industry-leading VME products and have been a long-standing, trusted supplier for highly demanding applications.

Consistent Focus

With a dedication to VME single board computers (SBCs) based on Power Architecture processors, Artesyn's valuable know-how has made our VME products the top choice for VME SBCs based on Power Architecture.

Extensive Portfolio

Through years of development, Artesyn has built one of the most extensive Power Architecture-based VME portfolios and we have structured our product lines to meet various cost/performance requirements.

Supply Longevity

Artesyn has a track record of supplying VME boards with a life cycle of 10 years or longer. Some of our boards have been shipping for almost 17 years! This dedication to life cycle management enables our customers to consistently focus on the differentiation of their applications.

Superior Quality

Along with world-class manufacturing facilities, Artesyn's established quality management system ensures our VME products can operate reliably in harsh environments without compromising the system uptime that is demanded by mission-critical applications.

Business Flexibility

With a flexible and agile organization, Artesyn is able to effectively and efficiently address different levels of customization smoothly and promptly. At Artesyn, ease of doing business is always one of our top priorities. This business flexibility has been also demonstrated by our pricing and branding strategy that aims at long-term and mutual success with our customers.

Global Support

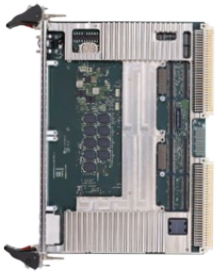
As a global enterprise, Artesyn has a strong geographic presence and network worldwide to ensure customer proximity and collaborative product service. Our customers have been enjoying convenient access to both our local sales and technical teams in their regions when they need a trusted partner for their design and development.

Artesyn VME Portfolio

While extending the life cycle of our VME products for another 10 years, Artesyn is also planning to develop new VME boards that will enhance our tiered product portfolio.

MVME8100

- Freescale QorIQ™ P5020 1.8/2.0 GHz
- Up to 8GB DDR3-1333 MHz ECC memory
- 512KB FRAM
- Two (2) PMC/XMC sites
- Embedded NAND Flash (8GB eMMC)
- 2 x 4 PCIe or 2 x 4 SRIO connectivity to VXS backplane P0
- Up to three (3) USB 2.0 ports
- Up to five (5) Ethernet ports
- Up to five (5) Serial ports
- Four (4) GPIO pins
- Extended temperature and conduction cooled variants

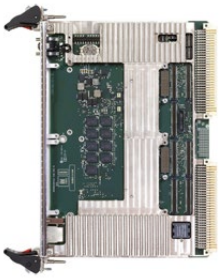


MVME8105

- Freescale QorIQ™ P5020 2.0 GHz
- 4GB DDR3-1333 MHz ECC memory soldered down
- 512KB MRAM
- Two (2) PMC/XMC sites
- Embedded NAND Flash (8GB eMMC)
- Up to two (2) USB 2.0 ports
- Up to three (3) Ethernet ports (two ports on front panel)
- Up to five (5) Serial ports
- Two (2) GPIO pins

MVME2500/2502

- 800 MHz or 1.2 GHz Freescale QorIQ™ P2010 or P2020 processors
- 1GB or 2GB DDR3-800 ECC memory soldered down
- Three (3) on-board Gigabit Ethernet interfaces (one front, one rear, one configurable by customer to front or rear)
- Five (5) Serial ports
- One (1) USB 2.0 port
- One (1) PCM/XMC site
- Optional rear transition module
- Hard drive mounting kit available
- Extended temperature (-40 °C to +71 °C) and rugged variants
- MVME2502 - 2 PMC variant



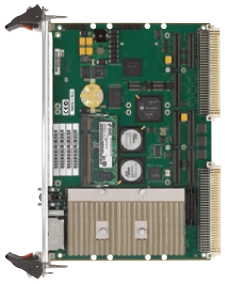
MVME8110

- Freescale QorIQ™ P5010 1.2 GHz
- Up to 4GB DDR3-1200 MHz ECC memory
- 512KB MRAM
- Two (2) PMC/XMC sites
- Embedded NAND Flash (8GB eMMC)
- Up to three (3) USB 2.0 ports
- Up to three (3) Ethernet ports
- Up to five (5) Serial ports
- Two (2) GPIO pins

MVME7100

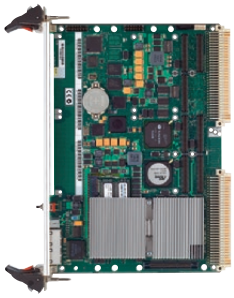
- System-on-chip Freescale MPC864xD processsor with dual PowerPC® e600 processor cores
- Up to 2GB of DDR2 ECC memory, 128MB NOR Flash and 2, 4 or 8GB NAND Flash
- USB 2.0 controller for integrating cost-effective peripherals
- 2eSST VMEbus protocol with 320MB/s transfer rate across the VMEbus technology
- Dual 33/66/100 MHz PMC-X sites for expansion via industry standard modules
- x8 PCI Express expansion connector for PMC-X and XMC expansion using XMCspan
- Extended temperature variant (-40 °C to +71 °C)

VMEbus Technology™



MVME4100

- System-on-chip Freescale MPC8548E processsor at 1.3 GHz
- 2GB of DDR2 ECC memory, 128MB NOR Flash and 4GB NAND Flash
- 512KB of MRAM
- 2eSST VMEbus protocol with 320MB/s transfer rate across the VMEbus technology
- Four (4) Gigabit Ethernet ports
- Five (5) Serial ports
- One (1) USB 2.0 port on front panel
- Dual 33/66/100 MHz PMC sites
- 8x PCI/PCI-X expansion connection to support Artesyn XMCspan carrier
- Extended temperature (-40 °C to +71 °C)



MVME3100

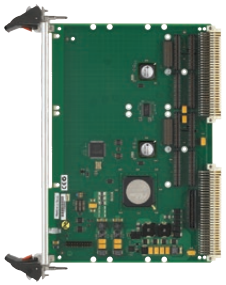
- System-on-chip Freescale MPC8540 processsor at 667/833 MHz
- Up to 512MB of DDR333 ECC memory
- 2eSST VMEbus protocol with 320MB/s transfer rate across the VMEbus technology
- Two (2) Gigabit Ethernet ports plus an additional 10/100BaseTX port
- One (1) USB 2.0 port on front panel
- Two (2) SATA ports
- Dual 33/66/100 MHz PMC-X sites

• MVME6100

- MPC7457 PowerPC® processor running at up to 1.267 GHz
- 128-bit AltiVec® coprocessor for parallel processing
- Up to 2GB of on-board DDR ECC memory
- 128MB of Flash memory
- 2eSST VMEbus protocol with 320MB/s transfer rate across the VMEbus technology
- Two 33/66/100 MHz PMC-X sites
- Dual GbE interfaces for high performance networking

MVME5500

- MPC7457 PowerPC® processor at 1GHz
- 512KB of on-chip L2 cache and 2MB of L3 cache
- AltiVec coprocessor for high-performance computational applications
- Two banks of soldered Flash memory (32MB and 8MB)
- Dual independent 64-bit PCI buses and PMC sites with a bus speed of up to 66 MHz
- Gigabit Ethernet interface plus an additional 10/100BaseTX Ethernet interface
- 64-bit PCI expansion mezzanine connector allowing up to four more PMCs
- I/O compatibility with MVME51xx family
- Support for processor PMCs (PrPMCs)



XMCspan

- Single-slot 6U VMEbus format
- PLX PEX8533 PCI Express 6-port switch
- Tundra Tsi384 PCI Express to PCI-X interface bridges
- Support for two single-wide, or one double-wide XMC or PMC per XMCspan
- Stacking capability
- Front-panel I/O
- Single 4-lane interface with P15 connector for XMCs
- Injector/ejector handles per VME64 extensions
- Compatible with Artesyn's MVME7100 and MVME4100 VMEbus SBCs

Artesyn VME Product Overview

	MVME8105	MVME8110	MVME8100	MVME2502	MVME2500
Power Architecture Processor	QorIQ P5020	QorIQ P5010	QorIQ P5020	QorIQ P2020	QorIQ P2010/P2020
Clock Speed	2.0 GHz	1.2 GHz	1.8/2.0 GHz	1.0/1.2 GHz	800 MHz/1.2 GHz
Cache	L1: 32KB L2: 512KB L3: 2MB	L1: 32KB L2: 512KB L3: 2MB	L1: 32KB L2: 512KB L3: 2MB	L1: 32KB L2: 512KB	L1: 32KB L2: 512KB
Memory	4GB DDR3-1333 ECC	2GB DDR3-1200 ECC	4GB DDR3-1333 ECC	2GB DDR3-800 ECC	1/2GB DDR3-800 ECC
Flash Memory	16MB SPI Flash; 8GB NAND	16MB SPI Flash; 8GB NAND	16MB SPI Flash; 8GB NAND	16MB SPI Flash; 8GB eMMC	16MB SPI Flash
NVRAM	512KB MRAM	512KB MRAM	512KB MRAM	64KB EEPROM; 512KB MRAM	64KB EEPROM; 512KB MRAM
Ethernet	3 GbE (2 Front, 1 Rear)	3 GbE (1 Front, 2 Rear)	5 GbE (1 Front, 4 Rear)	3 GbE (1 Front, 1 Rear, 1 Configurable)	3 GbE (1 Front, 1 Rear, 1 Configurable)
Serial	5 RS-232/422/485 (1 Front, 4 Rear)	5 RS-232/422/485 (1 Front, 4 Rear)	5 RS-232/422/485 (1 Front, 4 Rear)	5 RS-232 (1 Front, 4 Rear)	5 RS-232 (1 Front, 4 Rear)
SRIO	--	--	2 SRIO x4 Links	--	--
USB 2.0	2 Rear	3 (1 Front, 2 Rear)	3 (1 Front, 2 Rear)	1 Front	1 Front
SATA	Optional SATA Drive Kit	Optional SATA Drive Kit	1 Rear or Optional SATA Drive Kit	Optional SATA Drive Kit	Optional SATA Drive Kit
GPIO	2	2	4	--	--
PMC Site	Dual 32/64-bit PCI/X 100/133 MHz	Dual 32/64-bit PCI/X 100/133 MHz	Dual 32/64-bit PCI/X 100/133 MHz	Dual 32/64-bit PCI/X 33/66/100/133 MHz	One 32/64-bit PCI/X 33/66/100/133 MHz
XMC Site	2	2	2	2	1
PMC Expansion	--	--	--	--	--
VMEbus Interface	VME64x/2eSST	VME64x/2eSST	VME64x/2eSST; VXS	VME64x/2eSST	VME64x/2eSST
Extended Temp	--	--	Available	Available	Available
Conduction Cooled	--	--	Available	--	--
Conformal Coating	Optional	Optional	Optional	Optional	Optional
Rear Transition Module	Available	Available	Available	Available	Available
BSP Support	VxWorks; Linux; Green Hill Integrity (Optional); LynxOS (Optional)	VxWorks; Linux; Green Hill Integrity (Optional); LynxOS (Optional)	VxWorks; Linux; Green Hill Integrity (Optional); LynxOS (Optional)	VxWorks; Linux; Green Hill Integrity (Optional); LynxOS (Optional)	VxWorks; Linux; Green Hill Integrity (Optional); LynxOS (Optional)

Artesyn VME Product Overview

	MVME7100	MVME4100	MVME3100	MVME6100	MVME5500
Power Architecture Processor	MPC864xD	MPC8548E	MPC8540	MPC7457	MPC7457
Clock Speed	1.06/1.3 GHz	1.3 GHz	667/833 MHz	1.267 GHz	1.0 GHz
Cache	L1: 32KB L2: 1MB	L1: 32KB L2: 256KB	L1: 32KB L2: 512KB	L1: 32KB L2: 512KB L3: 2MB	L1: 32KB L2: 512KB L3: 2MB
Memory	1/2GB DDR2-533 ECC	2GB DDR2-533 ECC	256/512MB DDR333 ECC	512MB/1GB DDR 266 ECC	512MB PC133 ECC
Flash Memory	128MB NOR; 2/4/8GB NAND	128MB NOR; 2/4GB NAND	64/128MB	128MB	8MB/32MB
NVRAM	128KB SEEPROM; 512KB MRAM	128KB SEEPROM, 512KB MRAM	128KB SEEPROM	4KB SEEPROM	4KB SEEPROM
Ethernet	4 GbE (2 Front, 2 Rear)	4 GbE (2 Front, 2 Rear)	2 GbE (1 Front, 1 Rear); 1 10/100Base-TX Rear	2 GbE (1 Front, 1 Rear)	1 GbE Front; 1 10/100Base-TX Rear
Serial	5 RS-232 (1 Front, 4 Rear)	5 RS-232 (1 Front, 4 Rear)	5 RS-232 (1 Front, 4 Rear)	2 RS-232 (1 Front, 1 Planar)	2 RS-232 (1 Front, 1 Planar)
SRIO	--	--	--	--	--
USB 2.0	1 Front	1 Front	1 Front	--	--
SATA	--	--	2 (1 Front, 1 Planar)	--	--
GPIO	--	--	--	--	--
PMC Site	Dual 32/64-bit PCI/X 33/66/100 MHz	Dual 32/64-bit PCI/X 33/66/100 MHz	Dual 32/64-bit PCI/X 33/66/100 MHz	Dual 32/64-bit PCI/X 33/66/100 MHz	Dual 32/64-bit PCI 33/66 MHz
XMC Site	--	--	--	--	--
PMC Expansion	Available	Available	Available	Available	Available
VMEbus Interface	VME64x/2eSST	VME64x/2eSST	VME64x/2eSST	VME64x/2eSST	VME64
Extended Temp	Available	Available	--	--	--
Conduction Cooled	--	--	--	--	--
Conformal Coating	Optional	Optional	Optional	Optional	Optional
Rear Transition Module	Available	Available	Available	Available	Available
BSP Support	VxWorks; Linux; Green Hill Integrity (Optional); LynxOS (Optional)	VxWorks; Linux; Green Hill Integrity (Optional); LynxOS (Optional)	VxWorks; Linux; Green Hill Integrity (Optional); LynxOS (Optional)	VxWorks; Linux; Green Hill Integrity (Optional); LynxOS (Optional)	VxWorks; Linux; Green Hill Integrity (Optional); LynxOS (Optional)

About Artesyn Embedded Technologies

Artesyn Embedded Technologies is a global leader in the design and manufacture of highly reliable embedded computing solutions for a wide range of industries including communications, military, aerospace and industrial automation.

Building on the acquired heritage of industry leaders such as Motorola Computer Group and Force Computers, Artesyn is a recognized leading provider of advanced network computing solutions ranging from application-ready platforms, single board computers, enclosures, blades and modules to enabling software and professional services.

For more than 40 years, customers have trusted Artesyn to help them accelerate time-to-market, reduce risk and shift development efforts to the deployment of new, value-add features and services that build market share.

Artesyn has over 20,000 employees worldwide across nine engineering centers of excellence, four world-class manufacturing facilities, and global sales and support offices.

www.artesyn.com

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