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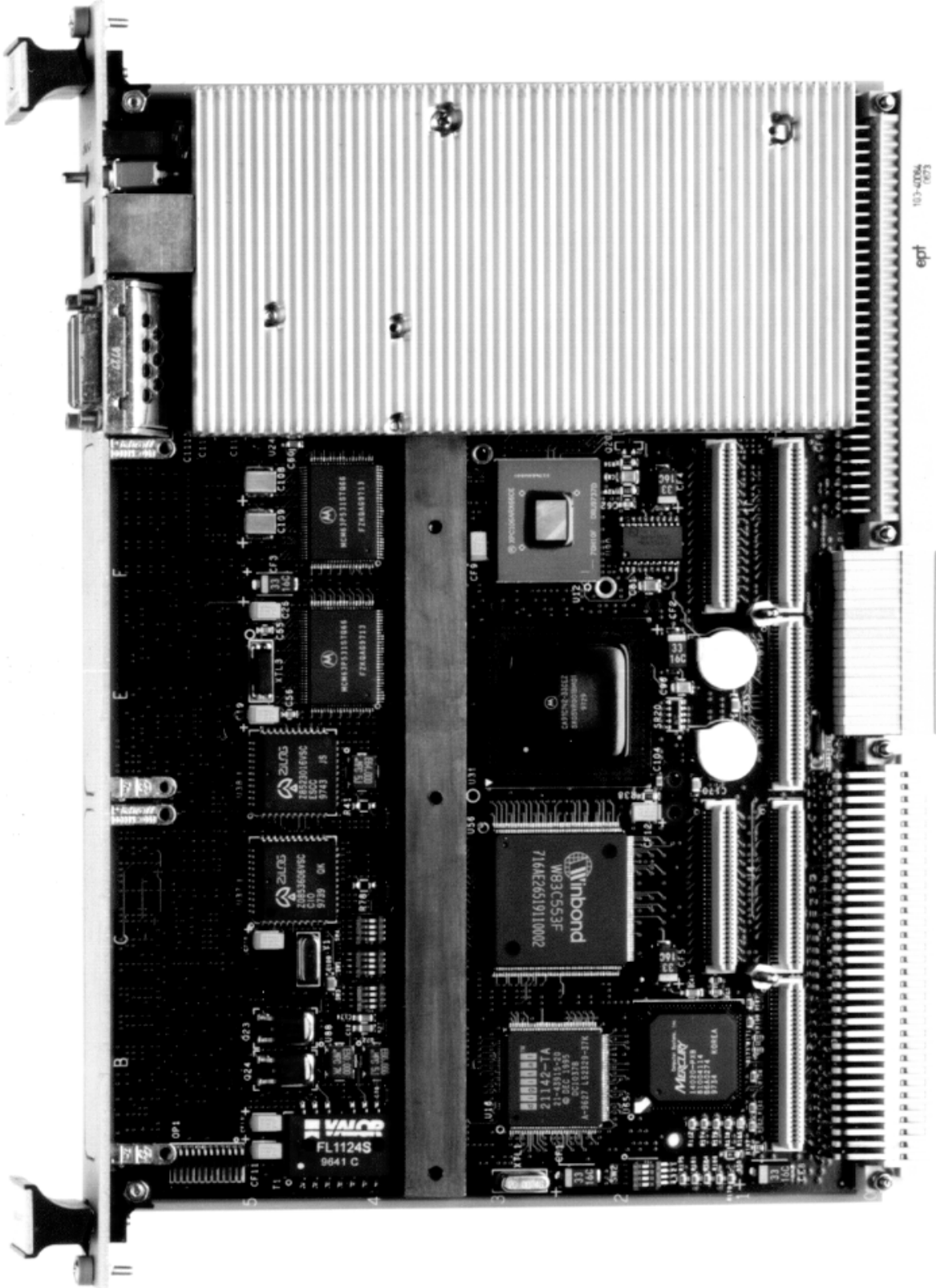
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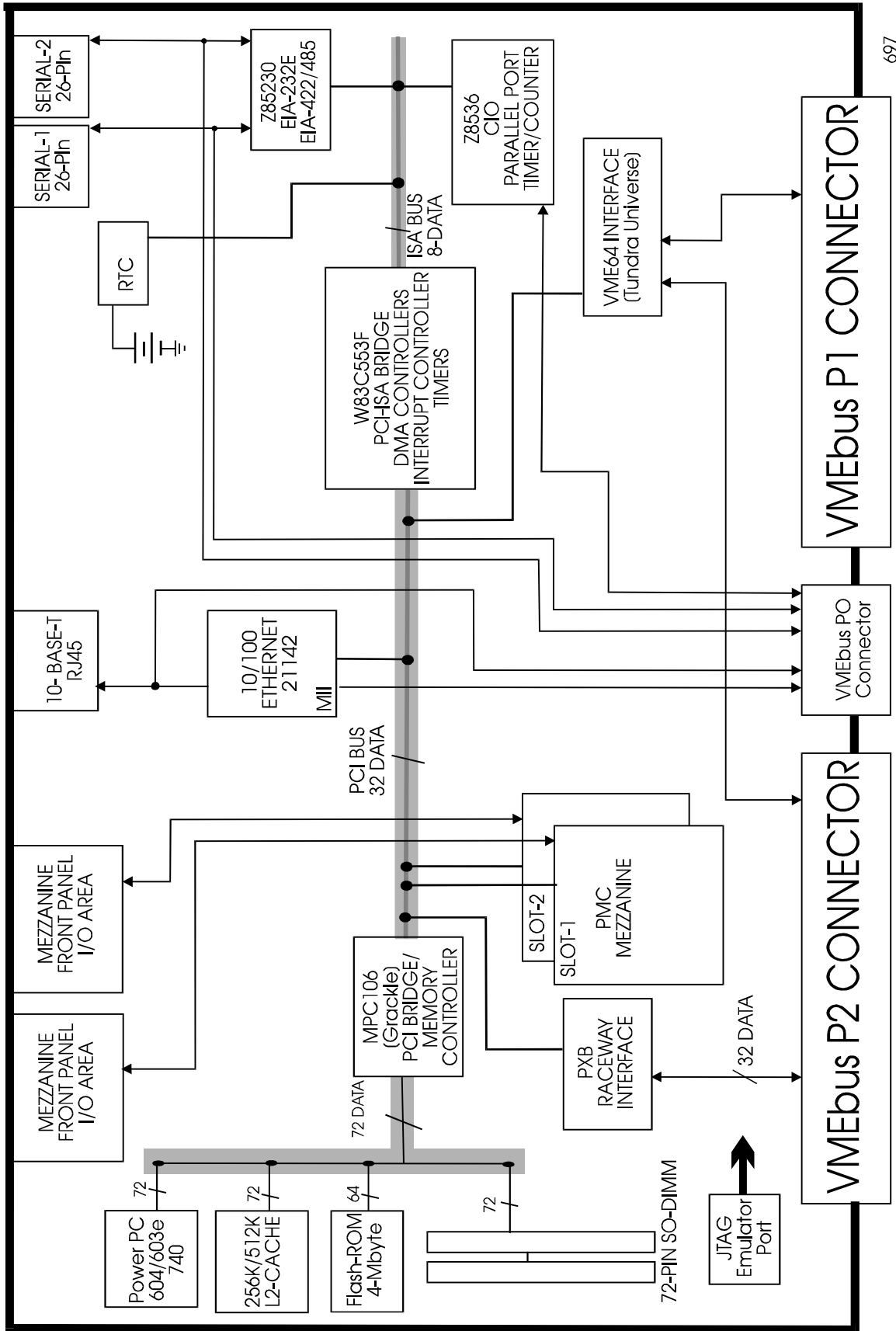
Omnibyte Galaxy PowerPC+ PowerPC based VMEbus Single Board Computer

The Omnibyte Galaxy PowerPC+ is a high performance, VMEbus based, single board computer specifically designed to address the needs of the OEM in the embedded real-time marketplace. It has been designed to use the latest generation of powerful PowerPC 603, 604 or 740 processors, running at speeds up to 350MHz. The new Galaxy PowerPC+ clearly provides the highest performance and flexibility at the lowest cost. Combine this with Omnibyte's 20+ years of experience in the bus-based single board computer business and you come up with a combination of features, quality, and price that's hard to beat.

Standard Features:

- Up to 350MHz PowerPC 604e processor (603e and 740 versions optional)
- L2 Cache (256 or 512KB)
- (2) 72-pin SO-DIMM sockets for up to 128MB of Fast Page Mode or EDO DRAM
- Up to 256MB of standard or synchronous x32, or x36 (for parity or ECC), DRAM options also available on custom modules
- 4MB of (x64) FLASH ROM for fast operation and easy software updates
- Three on-board buses (CPU, PCI and ISA), that operate independently and concurrently, provide the highest performance
- The Tundra Universe II provides a fully compliant VME-to-PCI interface (including system controller functions and VME64 capability)
- Motorola Grackle (MPC106) interfaces the processor to FLASH ROM, DRAM, L2 Cache and the on-board PCI bus
- (2) PMC module interfaces for PCI expansion
- Intelligent 10/100mbps PCI to Ethernet Interface with DMA using the Digital 21142
- PCI-to-ISA Bridge using the Winbond W83C553F. This part incorporates two 82C37A DMA controllers, one 82C54 timer, and two 82C59 interrupt controllers
- Real-Time Calendar/Clock with internal 8KB NVRAM using the Dallas DS17885 and on-board battery back-up
- (2) EIA-232E/EIA-422/485 (port selectable) sync/async serial ports with programmable baud rates and modem control using a Zilog Z85230
- (3) 16-bit timers and (2) 8-bit parallel ports are provided using the Zilog Z8536
- Diagnostic port for JTAG or CPU emulator
- DINK32 Monitor/Debugger Firmware in FLASH





GALAXY PowerPC +

Options:

The following options are available on the Galaxy PowerPC+:

- A high-speed Mercury Raceway Interface using the PXB (CY7C966) PCI to Raceway interface is available. The Raceway interface, brought out to defined pins on rows A & C of the VME P2 connector, provides an extensible high-speed secondary bus structure for moving large amounts of data *FAST*. The Raceway interface is a build time option and must be specified when ordering.
- PCI to SCSI PMC interface module using a Symbios 53C895. This industry standard PMC module supports all popular modes of single-ended and LVD (low voltage differential) SCSI operation: SCSI, Fast SCSI, Wide SCSI and Fast-Wide SCSI. It also supports Fast-20, synchronous transfer rates of 40 MB/Sec. This module replaces and enhances the SCSI functionality present on the earlier models of the Galaxy. However, this module can be ordered and added later, if desired. The SCSI module uses one of the two available PMC module sites on the Galaxy PowerPC+.
- VxWorks Board Support Package (BSP) to enable application development using the Wind River Systems “Tornado” multi-hosted development environment.

Technical Overview

The Omnibyte Galaxy PowerPC+ utilizes the added performance and capability of the latest generation of PowerPC 603, 604 or 740 RISC processors and of the VMEbus, allowing the system designer to build a high performance solution with a proven extensible system architecture.

Processor

The Omnibyte Galaxy PowerPC+ uses a single PowerPC 603e, 604e or 740 processor housed in a 256-pin BGA package and is a build-time option. The Galaxy PowerPC+ has been designed to use PowerPC processors at operating speeds of up to 350MHz, with core voltages of 3.3, 2.6, 2.5 or 1.9 (1.8) volts. Please refer to our price list or call for available processor types and speeds.

Bus Architecture

The Omnibyte Galaxy PowerPC+ is VMEbus (IEEE1014) based and was designed with three main on-board buses: CPU, PCI, and ISA. For highest performance, all buses can function independently and concurrently.

VME Interface

The Tundra Universe II chip (CA91C142) forms the bridge between the VME and PCI buses. All associated address decode registers are contained within the device. All standard VME and VME64 (block) transfers are supported. The Universe II features:

- Fully compliant, 64-bit PCI and VME interfaces
- Full VMEbus system controller functionality
- Four, 32-bit mailboxes for interrupt generation on either bus
- Location monitor for interrupts and message passing
- Seven VME software interrupts
- Two semaphore registers to control access to system resources
- PCI Target Channel coupled cycle performance enhancement (2X)
- DMA performance enhancement
- Deep FIFOs (64-bits wide, 32 entries deep)

As implemented on the Galaxy PowerPC+, several options can be selected at power-up:

- Enable auto SYSCON
- Enable auto slot ID

VME Compliance:

A32, A24 and A16 master and slave
D32, D16 and D8 master and slave
MBLT D64 master and slave
BLT, ADOH, RMW, LOCK
SGL, PRI, RRS, ROR, RWD, FAIR
IH(1,7), I(1,7), RORA, ROAK

Raceway Interface (optional)

A Mercury/Cypress PXB chip (CY7C966) is available, providing an on-board PCI to Raceway interface. Raceway is a 160MB/Sec. (40MHz. X 32-bit) auxiliary bus which can be used for moving large amounts of data in to or out of the Galaxy on-board memory at high speed. The Raceway interface is typically found on high performance array processor and DSP boards available from Mercury Computer Systems and other vendors. This Raceway implementation (to the on-board PCI bus) has a typical average transfer rate of 100MB/Sec. The Raceway bus connection is made to the Row A & C pins of the VMEbus P2 connector defined for this purpose.

SCSI Interface (PMC Module)

A SCSI PMC module using the Symbios SCSI controller chip (53C895) provides the PCI to SCSI (8 or 16-bit) interface. The device has a built-in DMA controller and supports (32-bit) burst transfer rates on the PCI bus in excess of 110MB/Sec. In addition to other SCSI modes, the "895" also supports Fast-20, allowing synchronous SCSI transfer rates of 40MB/Sec. Switchable terminators are included on the module. Control ports are available to enable the terminators and sense SCSI term power. The SCSI PMC connects directly to single-ended or LVD (low voltage differential) SCSI devices. The external SCSI bus connection is brought out to a standard high density 68-pin (SCSI 3) connector on the PMC front panel and to the PMC P4 I/O connector. On the Galaxy PowerPC+, SCSI I/O can only be brought out to the rear if the Raceway option is not installed. The SCSI rear I/O option uses rows A & C of VMEbus P2 connector, as does the Raceway interface. The SCSI option uses one of the two available PMC positions available on the Galaxy PowerPC+.

PMC Module Sites

Two PMC sites accept PMC (PCIbus based) mezzanine boards. They are single-width (75x150mm) sites, keyed to indicate capability for 5 volt signaling. If both of these sites are uncommitted, (i.e. no SCSI), a dual-width module following the PMC standard can be used. Using PMC modules, additional (new) features can be added to the Galaxy PowerPC+ easily and economically. Many PMC module types (i.e. ATM, FiberChannel, etc.) are available from a variety of vendors conforming to this emerging mezzanine board-level standard.

Each PMC module mounts on the Galaxy PowerPC+ using two (or three) 64-pin receptacles:

- If the Raceway option is selected, site 1 has P1 and P2 connectors only. These connect to the 32-bit PCI bus. This position is then capable of providing front panel I/O only.
- If the Raceway option is not populated, site 1 has a P4 connector present. These 64 connections are bused to the 64 user-defined pins on rows A & C of VMEbus P2.
- At PMC site 2, three PMC connectors are always present. P1 and P2 connect to the 32-bit PCI bus and P4 buses the first 48 pins to the 48 non-reserved pins on rows d & z of the 5-row VMEbus P2 connector.
- The PCI 64-bit extension (using PMC P3) is not supported for either module.

The PMC module interface is IEEE P1386 and P1386.1 compliant.

The CPU can verify the presence of a PCI capable card by reading a register.

Ethernet

A Digital 21142 connects the PCI bus to 10/100 mbps Ethernet. It features a built in DMA controller and Manchester Encoder and uses an in-circuit programmable EEPROM to store configuration information. Software may use a control port to power down the Ethernet. A 10mbps 10baseT connection is brought out to a RJ45 connector present on the front panel. Both the 10mbps (10baseT) and 10/100mbps MII interface signals (i.e. for a 100baseTX or fibre transceiver) are brought out to the rear P0 connector.

Grackle IC

The Motorola Grackle (MPC106) interfaces the PowerPC processor to memory and the PCI bus. It Features:

- Level 2 cache support
- Standard DRAM (supports FPM, EDO and SDRAM; ECC or parity error detection)
- FLASH ROM interface
- Performance oriented PCI interface

L2 Cache

In addition to the internal caches built into the PowerPC processor, the Galaxy PowerPC+ includes 256KB or 512KB of Level 2 Cache RAM soldered to the baseboard. This high-speed second level cache further enhances the performance of the Galaxy PowerPC+.

The L2 cache has the following features:

- Write-through or copy-back modes
- Direct mapped
- 32 byte line size and coherence granularity
- Byte parity is maintained during data transactions between the cache and processor

Through control ports, the software can:

- determine the amount of cache RAM installed
- enable or disable cache selection
- reset the cache, which has the effect of marking all entries invalid and unmodified

DRAM

The Galaxy PowerPC+ can accommodate many standard DRAM configurations as well as custom and synchronous DRAM configurations.

Standard DRAM

Two right-angle SO-DIMM sockets accept all standard commercially available 3.3 volt 72-pin SO-DIMMs. The (x32) memory modules are commonly used in IBM laptop computers, and are available from IBM as well as other sources. The Galaxy PowerPC+ can use EDO or Fast Page mode modules. Custom x36 memory modules (for ECC or parity operation) are available on special order. This flexibility comes from the use of the memory controller in the Motorola Grackle (MPC106), which supports many different modes of operation. The Grackle ECC mode corrects all single-bit errors and detects all double-bit errors.

Note that as DRAM densities increase, the total DRAM capacity of the Galaxy will also increase. The SO-DIMM standard supports modules with up to a 256MB capacity. The Galaxy PowerPC+ has a total DRAM capacity of 256MB based upon Grackle limits (2 banks of 128MB each). The following SO-DIMM configurations are currently available on the Galaxy PowerPC+. Please refer to the price list or call for the most current information.

Number of DIMMs	DIMM Depth	DIMM Width	Total Mbytes
2	16M	32	128
2	8M	32	64
2	4M	32	32
2	2M	32	16

Synchronous DRAM & Memory Performance

Omnibyte can offer optional custom memory modules containing synchronous DRAMs in x32 organization. While the possible memory configurations are similar to those of the standard DRAMs above, synchronous DRAMs will improve burst read performance. The following is a comparison of wait states for standard, EDO and synchronous DRAM in burst mode with and without ECC enabled (byte operations in ECC mode may be slower):

Memory Type	CPU Bus Speed	
	50MHz	66MHz
60ns Fast-page DRAM	6-3-3-3	7-3-3-3
60ns EDO DRAM	6-2-2-2	7-2-2-2
60ns Fast-page (ECC)	6-3-3-3 Write 8-4-4-4 Read	7-3-3-3 Write 9-4-4-4 Read
60ns EDO (ECC)	6-2-2-2 Write 8-4-4-4 Read	7-2-2-2 Write 9-4-4-4 Read
Synchronous DRAM	7-1-1-1	7-1-1-1

Note: The Galaxy PowerPC+ supports 3.3V DRAM modules only.

ROM

The Galaxy PowerPC+ has four surface mount sites for FLASH ROM. They currently accept F800 type FLASH ROMs in the word mode. Higher density (8MB) FLASH will be supported in the near future. A switch is provided to select whether the CPU boots from on-board FLASH ROM or from a PMC module.

The following FLASH ROM configurations are currently supported:

Number ROMs	ROM Type	ROM Depth	ROM Width	Total Bytes	Boot Bytes
4	F800	1024K	64-bits	4096K	64K

Clock Speeds

The Omnibyte Galaxy PowerPC+ has both 50 and 66 MHz crystal oscillators for primary clocking on-board. This selection determines the CPU bus clock frequency. Logic on the Galaxy PowerPC+ then automatically selects the fastest possible PCI bus speed and internal processor multiplier for the processor installed. A switch on the Galaxy PowerPC+ allows the user to select between fastest DMA speed or fastest internal processor speed. (See table below for details.) Software can read these PCI bus, CPU bus, and CPU internal speeds from an on-board register.

Internal Processor Speed		
66 MHz CPU bus	50 MHz CPU bus	Speed processor installed
166 MHz	175 MHz	180 MHz
200 MHz	200 MHz	200 MHz
233 MHz	200 MHz	233 MHz
266 MHz	250 MHz	266 MHz
333 MHz	325 MHz	333 MHz

Why do the faster processor speeds listed under Ordering Information seem to be non-standard?

It has to do with performance. PowerPC processors have finite numbers of internal clock multipliers, which yield different internal operating speeds based on this input clock speed. For example, the 166 MHz version actually has a 180 MHz processor installed. There is a switch on the Galaxy PowerPC+ to select fastest DMA speed or fastest processor speed. By selecting the **fastest DMA speed**, the CPU bus clock would be set to 66 MHz and the on-board logic would then choose the fastest PCI bus speed (33 MHz) and the X2.5 internal processor multiplier. This yields a 166 MHz internal processor clock speed. If you selected **fastest internal processor speed**, the CPU bus clock would be set to 50 MHz and the on-board logic would then choose a PCI bus speed of 25 MHz and the X3.5 internal processor multiplier. This setting would yield the fastest processor clock speed (175 MHz). However, DMA and memory performance at this setting would suffer. In most applications, fastest DMA speed would be the correct setting for best

overall performance. Be aware that most processor frequencies accommodate the fastest CPU bus speed (66 MHz) and the fastest PCI bus speed (33 MHz) at the maximum rated internal processor speed.

ISA Peripherals

Bridge

A Winbond W83C553F PCI to ISA bridge interfaces the ISA peripherals to the PCI bus. It incorporates two 82C37A DMA controllers, one 82C54 timer, two 82C59 interrupt controllers, and a PCI arbiter with programmable fairness modes.

Real Time Calendar Clock

A Dallas DS17885 provides the integrated calendar/clock function along with 8KB of non-volatile RAM. Battery power is supplied to the clock by two 3 volt lithium batteries that are soldered directly to the board. The on-board batteries will power the clock (and maintain the contents of the NVRAM) for approximately 10 years with no other board power applied.

Serial

A Zilog Z85230 ESCC (Enhanced Serial Communication Controller) provides two standard (port selectable) EIA-232E/EIA-422 (485 multidrop) async/sync serial ports on the Galaxy PowerPC+. Each port can be set for standard asynchronous baud rates to 250K, can run up to 4.0 Mbit/Sec. in the synchronous mode, and supports SDLC/HDLC transfers. Each port is brought out to a separate 26-pin micro-D connector on the Galaxy front panel and to the P0 user I/O connector on the rear of the board. All 232 and 422 buffered signals are available from either location.

Timers / Parallel

A Zilog Z8536 provides (3) 16-bit timers and (2) 8-bit parallel ports with (4) handshake lines each. All timers and parallel I/O are available for use by the user. Access to external timer inputs and all (unbuffered) parallel I/O signals are provided through the rear P0 connector. There are also (3) 16-bit timers in the 82C54 section of the Winbond PCI to ISA bridge chip. All these timers and parallel I/O are available for use by the user.

Software/Operating Systems

Omnibyte has ported the DINK32 Monitor/Debugger Firmware to the Galaxy PowerPC+. This useful program (written by Motorola) is included with every board and comes pre-loaded in the on-board FLASH ROM. DINK32 is a debug tool for both hardware and software debugging. It has the following features:

- Modification and display of registers
- Assembly and disassembly of PowerPC instructions
- Single-step trace and continued execution from a specific address
- Modification, display, and movement of system memory
- Setting, displaying, and removing of breakpoints
- Extensive on-line help
- Ability to execute user-assembled and/or downloaded software

- Logging function for generating a transcript of debugging session
- Two command sets for novice and experienced users
- Automatic decompression of compressed s-record files while downloading
- Omnibyte supports Wind River's VxWorks (Tornado) real-time operating system on the Galaxy PowerPC+. The Tornado development environment and VxWorks licenses must be purchased directly from Wind River Systems. Omnibyte supplies a VxWorks board support package (BSP) containing code (device drivers) for board specific devices for Tornado. The BSP must be purchased separately from Omnibyte.

Physical Specifications

Circuit Board

- VMEbus 6U x 160mm, single-slot
- VMEbus P0 connector for access to on-board I/O from the rear of the VME card rack
- (2) Serial, 10baseT Ethernet, and PMC I/O brought out to the front panel
- Omnibyte designed twelve-layer circuit board, 0.0625" thick and UL94V-O rated, provides the following benefits:
 - Low impedance greatly reduces signal crosstalk
 - Equal impedance on all six signal layers reduces reflections
 - Layers of the same bias always separated by a power plane
- Processor heat sink and stiffener bar are provided as standard
- Conformal coating and temperature screening are available as special options for use in rugged environments

Environment and Reliability

Omnibyte has designed the Galaxy PowerPC+ using only the highest grade commercial components, for use in rugged environments and to attain the maximum MTBF (Mean Time Between Failures). The estimated (calculated) MTBF is in excess of 32,000 hours (3.6 yrs) using MIL-HDBK-217 (Revision F, notice 2) reliability prediction models.

Operation is guaranteed under the following conditions:

- Ambient temperature 0 to 65 degrees centigrade and air flow of at least 400 linear feet per minute. Note: Air flow must be increased at higher altitudes.
- Relative humidity between 5% and 95% (non-condensing).

Power Requirements

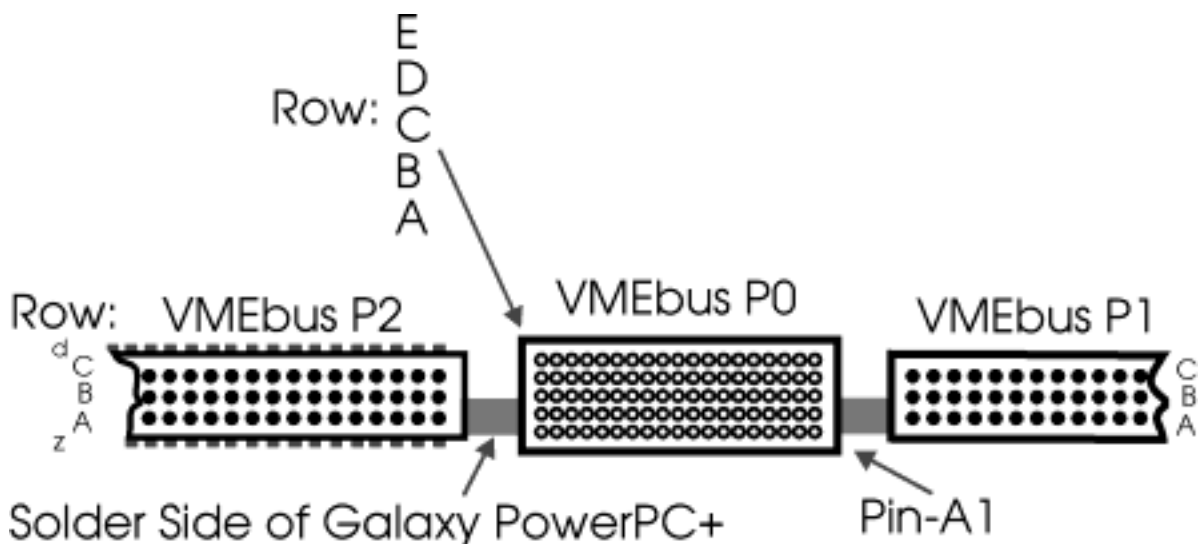
Omnibyte has designed the Galaxy PowerPC+ to conserve power. Two very efficient DC-DC converters generate 2.5V and 3.3V on-board, dissipating less than 1Watt of heat each. (Similar linear converters could dissipate up to 10 Watts each.) The 2.5V (core) supply can be reset to 2.6 or 1.9 (1.8)V as processor process technologies dictate.

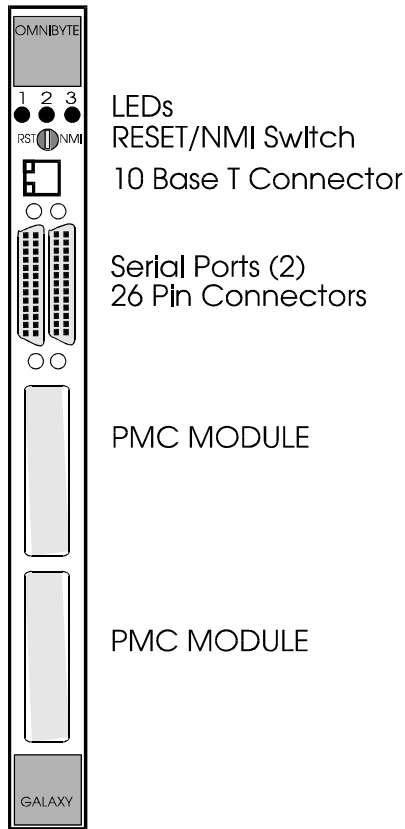
When fully populated, and using a 200MHz 604e processor, the Galaxy PowerPC+ requires:

- +5 volts +/-5% at 6.5A. (max.)
- +12 volts +/-5% at 0.2A. (max.)
- 12 volts +/-5% at 0.1A. (max.)

Galaxy PowerPC+ I/O PINOUT

VMEbus P0 Connector							
PIN:	A	B	C	D	E		DEVICE:
1	+5 V	MDIO	MDC	RXD3	RXD2	MII	Digital 21142
2	RXD1	RXD0	DV	RCLK	RXERR		
3	GND	GND	GND	GND	GND		
4	GND	GND	GND	GND	GND		
5	N/C	TCLK	TXEN	TXD0	TXD1		
6	TXD2	TXD3	CLSN	CRS	+5 V		
7	GND	GND	GND	GND	GND	SHARED	10-Base-T
8	TX+	TX-	RX+	RX-	GND		
9	TXDA-	TXDA+	TCLKA-	TCLKA+	RXDA-	Serial Port-A	Zilog Z-85230
10	RXDA+	RCLKA-	RCLKA+	RTSA-	RTSA+		
11	CTSA-	CTSA+	DTRA-	DTRA+	DCDA-		
12	DCDA+	SIOA_422_232	GND	GND	GND	Serial Port-B	
13	TXDB-	TXDB+	TCLKB-	TCLKB+	RXDB-		
14	RXDB+	RCLKB-	RCLKB+	RTSB-	RTSB+		
15	CTSB-	CTSB+	DTRB-	DTRB+	DCDB-	Timer / Counter	Zilog Z-8536
16	DCDB+	SIOB_422_232	GND	GND	GND		
17	CIO_PC<3>	CIO_PC<2>	CIO_PC<1>	CIO_PC<0>	CIO_PB<7>	Timer / Counter	
18	CIO_PB<6>	CIO_PB<5>	CIO_PB<4>	CIO_PB<3>	CIO_PB<2>		
19	CIO_PB<1>	CIO_PB<0>	GND	GND	GND		





GALAXY PowerPC+

Ordering Instructions

GALAXY-*v-t-s-c-d-r*

Where: *v* = R (Raceway interface installed),
S (SCSI interface installed,
RS (both installed),
0 (neither installed)
t = Processor type (603e, 604e or 740)
s = Processor speed (166, 200, 233,
266, or 333) MHz
c = L2 cache (256 or 512) KB
d = Main DRAM (0, 16, 32, 64, 128)
MB (DRAM supplied: x64, 60ns,
EDO) Custom modules available
r = Flash ROM (4) MB

Ordering Examples:

The **GALAXY-RS-604e-333-512-64-4** is a version of the Galaxy PowerPC+ with Raceway and SCSI interfaces, a 333MHz 604e processor, 512KB of L2 cache, 64MB (x64) EDO DRAM and 4MB of FLASH ROM.

The **GALAXY-0-603e-166-256-16-4** is a version of the Galaxy PowerPC+ without Raceway or SCSI interfaces, but includes a 166MHz 603e processor, 256KB of L2 cache, 16MB (x64) EDO DRAM and 4MB of FLASH ROM.

Note: The PowerPC processor technology and speed, and memory options are continually changing. Please refer to our price list or call for currently available configurations.

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- ITAR CERTIFIED SECURE ASSET SOLUTIONS

SERVICE CENTER REPAIRS

Experienced engineers and technicians on staff at our full-service, in-house repair center

*InstraView*SM REMOTE INSPECTION

Remotely inspect equipment before purchasing with our interactive website at www.instraview.com ↗

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