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## OVERVIEW

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The EPX-C3-G is a VIA C3-based, EPIC-compatible single board computer (SBC). C3 processors have extremely low power dissipation which allows fanless operation, making them ideal for industrial applications. The board is configured with a 733MHz or 1GHz MMX-compatible CPU with up to 512MB of PC133 SDRAM plus a CompactFlash socket. Also, a 10/100 Ethernet controller, USB 2.0, 4X AGP video with CRT/flat panel/LVDS interfaces, four serial COM channels, 24 digital I/O lines, AC97 audio, and the standard AT peripheral feature set are included.

The board measures 4.5 x 6.5-inches (115 mm x 165 mm) and is compliant with the EPIC (Embedded Platform for Industrial Computing) standard. It supports expansion options with PC/104 and PC/104-*Plus* modules or with two high-speed USB 2.0 channels. The board will operate from -40° to +85°C for rugged applications requiring an embedded PC. Its x86-PC software compatibility assures a wide range of tools to aid in your application's program development and checkout.

## FUNCTIONAL CAPABILITY

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**Processor** - The EPX-C3-G is based upon the VIA Technologies Eden™ Embedded System Platform Processor technology to give high-performance and low power dissipation. Presently, the board ships with either a 733MHz or 1GHz MMX-compatible processor with a 133MHz front side bus. The CPU includes two 4-way 64KB Level 1 caches plus a unified 64KB Level 2 cache. The CPU and supporting chips are x86 compatible. Another unique feature of the CPU is that it contains the VIA Padlock™ Data encryption engine to enhance the confidentiality, integrity, and authenticity of electronic data for secure communication systems.

A separate 80-bit FPU is included that executes x86 floating point instructions in parallel with integer instructions. The CPU also includes a separate execution unit for MMX instructions.

**System Controllers** - A VIA VT8606 "Twister-T" is the Northbridge that provides control of the SDRAM and implements the PCI rev. 2.2-bus controller. PCI is used for onboard peripherals and for the PC/104-*Plus* bus. The VT8606 also integrates the Savage4 graphics core for video. The video drives both CRT and flat panels and supports resolutions up to 1920 x 1440 with 64K colors. The EPX-C3-G also supports LVDS panels.

An 82C686B Southbridge provides the super I/O features and the PC/104 bus controller. It contains the EIDE interface, floppy disk controller, two COM channels, LPT, mouse/keyboard interfaces plus AC97 audio controller.

**Memory** - Up to 512Mbytes of Synchronous Dynamic RAM (SDRAM) can be installed on the board by using a 144-pin SODIMM. A PC-133 compatible part (non-registered, unbuffered) with gold-plated fingers is the recommended SDRAM. They are available from WinSystems. The board is shipped from the factory with no memory installed. That permits the user to either install and/or upgrade the memory capacity in the field.

**BIOS** - An industry-standard, Award BIOS is on the board to provide configuration flexibility, performance and AT-compatibility. It is set with a factory default that can be modified by the user. The BIOS is located in an EEPROM that can be modified without removing the storage device from the board. It will support diskless, keyboardless, and videless operation as well as BIOS shadowing.

**Direct Memory Access (DMA)** - Seven DMA channels are supported with Channel 2 dedicated to the floppy disk controller. The LPT is jumper selectable for ECP operation. The other DMA channels are wired to the PC/104 connector.

**Floppy Disk Support** - Up to two 3.5" or 5.25" drives from 360KB through 1.44MB formats are supported by the CMOS 765B floppy disk controller. It has an enhanced advanced digital data separator for different data rates, programmable pre-compensation rates, plus underflow and overflow protection. Open drain, push-pull drivers are wired to a standard, single 34-pin connector on 0.100-inch centers.

**UltraDMA-100/66/33 EIDE Controller** - The EPX-C3-G incorporates a dual channel master mode PCI controller supporting four Enhanced IDE (EIDE) drives. PIO Mode 4 and Bus Master IDE transfers of up to 33 Mbytes/sec are supported. Also, it supports Ultra DMA-66 transfer protocols and UDMA-100 mode 5. The Primary interface channel is wired to a 40-pin header connector on 0.100-inch centers. The Secondary channel is wired to the CompactFlash socket. Each channel has an LED that blinks during data transfer to provide visual status information.

**Solid State Disk (SSD) Support** - A JEDEC standard 32-pin, machine-tooled socket is provided to accept an M-Systems' DiskOnChip® (DOC). The DOC offers from

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16Mbytes to 1Gbyte storage capacities in a single device. It includes an internal flash file system that provides hard disk read/write compatibility, automatic bad block management, and wear-leveling. A designer can use an onboard semiconductor device for applications where the environment is too harsh for mechanical hard disks or floppy disk drives while offering significant speed advantages.

**CompactFlash** - A connector is on the board that will accept Type I and II CompactFlash cards. The connector is wired to the IDE controller. A designer can use CompactFlash as data storage for applications where the environment is too harsh for rotational hard disks or floppy disk drives while offering significant speed advantage.

WinSystems offers industrial-grade CompactFlash cards that provide operational SSD storage from -40° to +85°C for high-capacity, harsh embedded applications. The sustained data transfer rate is very fast plus an on-card wear leveling algorithm allows over 2 million write cycles to the part. These RoHS-compliant modules will fit into any computer, SBC, or instrument with a CF socket. [www.industrialcompactflash.com](http://www.industrialcompactflash.com)

**Ethernet Controller** - An Intel 82551ER is the 32-bit PCI Ethernet controller chip used for high-speed data transfer. The controller has auto negotiation capability for speed, duplex, and flow control. It supports IEEE 802.3 10-BaseT and 100BaseT in either full- or half-duplex mode at both 10 and 100 Mbps. In full-duplex mode, it adheres to the IEEE 802.x Flow Control Specification.

Two large 3Kbyte transmit and receive FIFOs help prevent data underruns and overruns. It has fast back-to-back transmission support with minimum interframe spacing. It also has improved dynamic transmit chaining with multiple priority transmit queues. There are three LEDs on the board per controller that provide status information. The red LED indicates 100BaseT, the yellow indicates Link, and the green is the Rx/Tx packet data.

The 82551ER chip is very popular both in the commercial and industrial PC-compatible market. This means that most PC-compatible drivers, utilities and 10/100 Ethernet supported operating systems will work directly with the EPX-C3-G. The configuration information describing the device's architecture, address, interrupt, etc. is stored in a serial EEPROM.

**Remote Booting** - The EPX-C3-G supports remote booting with an onboard EPROM socket for use as a diskless network computer. Contact a WinSystems' application engineer for companies that supply remote boot software.

**Video** - A ProSavage4 2D/3D video controller is standard on the EPX-C3-G. It is a 4X AGP, high-performance PCI flat panel/CRT controller that provides a sophisticated graphics accelerator video engine. It can support 2D/3D resolutions up to 1920 x 1440. The video controller uses shared memory architecture. The controller supports a wide variety of monochrome and color active and passive LCD panel displays as well as standard CRTs.

**CRT Video Interface** - The CRT video output signals are wired to a 14-pin, 2 mm dual-in-line connector. An optional CBL-234-1 interface cable adapts it to a standard female 15-pin "D-Sub" type connector commonly used for VGA. Simultaneous operation of the CRT and LCD is supported.

**Flat Panel Display Support** - The EPX-C3-G supports most 3.3V flat panel display technologies including plasma, electroluminescent (EL), active matrix TFT/MIM LCD, passive STN and single panel, Single Drive (SS). It will support mono and color displays. The board properly sequences the power for logic voltage and the backlight inverter to provide intelligent and safe power sequencing to the panel.

**Flat Panel Interface** - WinSystems supports the Video Electronic Standards Association (VESA) FPDI-1 flat panel display interface standard. The logic levels are 3.3 volts but are 5.0V tolerant. A 31-pin, gold-plated, 2 mm connector is on the EPX-C3-G.

**LVDS** - The EPX-C3-G supports a 1-channel 110MHz LVDS interface. It is wired to a 10-pin, 2 mm header.

**USB 2.0 Host Controller** - The EPX-C3-G module has a separate NEC uPD720101 USB2.0 Host Controller. It complies with the Universal Serial Bus Specification revision 2.0 and Open Host Controller Interface (OHCI) Specification for full-/low-speed signaling and Intel's Enhanced Host Controller Interface (EHCI) Specification for high-speed signaling. The controller is wired to the internal Peripheral Component Interconnect (PCI) bus.

The 720101 architecture is optimized to deliver both high-performance and PCI bus efficiency with the lowest power and smallest size. There are two OHCI controller cores for full-/low-speed signaling and one EHCI host controller for high-speed signaling.

A root hub with two downstream facing ports is shared by the OHCI and EHCI controller cores. The ports are accessed via two individual USB 2.0 Type A connectors. All downstream facing ports can handle high-speed (480Mbps), full-speed (12Mbps), and low-speed (1.5Mbps) transactions.

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**Serial Communications** - Four independent, full-duplex, RS-232 serial asynchronous channels are onboard. Both the send and receive registers of each channel have a 16-byte FIFO. Each UART is 16C550 compatible for software compatibility with PC-type driver programs.

Independent control of transmit, receive, line status and data set interrupts are on all channels. Each channel is setup to provide internal diagnostics such as loopback and echo mode on the data stream. An independent on-chip software programmable baud rate generator is selectable from 50 through 115.2 kbits/sec. Individual modem handshake control signals are supported for all channels.

RS-232 interface levels are supported on all channels. The RS-232 drivers have an on-chip charge pump to generate the plus and minus voltages so that the EPX-C3-G only requires +5 volts to operate. RS-422 and RS-485 electrical levels are supported on COM1 and COM2.

All serial channels are configured as Data Terminal Equipment (DTE). COM1 and COM2 are wired to a 50-pin connector at the edge of the board. WinSystems offers the optional CBL-247-1, which adapts each serial channel to 9-pin male "D" connectors. COM3 and COM4 are wired to a 20-pin connector on the board. WinSystems' optional CBL-173-1 cable adapts each serial channel to 9-pin male "D" connectors.

**24-line parallel I/O** - The EPX-C3-G contains an 82C55A digital I/O controller. An 82C55A Programmable Peripheral Interface (PPI) device supports up to 24 I/O pins which may be individually programmed in two groups of 12 in three major modes of operation. The signal levels are TTL compatible. Each I/O line has a 10K ohm pull-up resistor to keep the input from floating.

The 82C55A's I/O lines are connected to a 50-pin connector. The 24 data lines are alternated with 24 ground lines for reduced noise and crosstalk. Also, the +5 volts and ground are included in the cable. The pinout is compatible with the industry standard 4 to 24 position I/O module racks (Opto-22, etc.) for use with high level AC and DC opto-isolated solid state relays. WinSystems offers the CBL-115-4 to link to the 4-, 8-, 16-, or 24-module rack.

**Audio** - The EPX-C3-G board has an AC97 digital audio controller. A 10-pin, 2 mm connector provides Line Out, Audio In, and Microphone In.

**Line Printer Port** - The EPX-C3-G has a parallel port that may be operated in standard and bidirectional as well as Extended Capabilities Port (ECP - IEEE-1284) and Enhanced Parallel Port (EPP) modes.

The printer port can also be used as two additional general-purpose I/O ports if a printer is not required. The first port is configured as 8 input or output only lines. The other port is configured as 5 input and 3 output lines.

**Keyboard/Mouse Controller** - An 80C42 equivalent controller supports a PC/AT-compatible keyboard. The optional CBL-247-1 adapter cable provides the mate to a PS/2 type keyboard plug.

A standard mouse controller is on board. Its input is accessible through a 5-pin connector. WinSystems' optional CBL-225-1 adapter cable interfaces the mouse cable connector to this board.

**Multi-I/O Connector Cable Adapter** - WinSystems offers the optional CBL-247-1, a Multi-I/O cable adapter for the COM1, COM2, LPT and keyboard. These four ports are combined into one 50-pin header at the edge of the board. The CBL-247-1 is a 1-foot adapter cable that offers a more convenient termination. COM1 and COM2 are 9-pin male "D" connectors with strain relief. LPT is a 25-pin "D" female socket with strain relief. The keyboard is a standard 5-pin PS/2 connector socket.

**Interrupts** - Two 82C59A compatible interrupt controllers accept inputs from the onboard peripherals and the PC/104 bus for a total of twelve selectable interrupt sources. Four PCI interrupt sources are supported on the PC/104-*Plus* bus that are PnP compliant.

**Status LED** - A red status LED is also available to monitor system activity. Under a user's program control, it can indicate error conditions or blink different patterns to provide a visual indication of system status.

**Real Time Clock** - A DS12885-compatible clock supports a number of features including periodic and alarm interrupt capabilities. In addition to the time and date keeping functions, the system configuration is kept in 256byte CMOS RAM contained within the clock section.

**Watchdog Timer** - A software/hardware enabled, re-triggerable watchdog timer is provided. The time period can be selected from about 1.5 seconds to over 60 seconds. This circuit is important for use in remote and unattended applications.

**Timers** - Three, independent 82C54 compatible 16-bit timers are supported. Channel 0 is wired to interrupt Channel 0, Channel 1 generates the DRAM refresh using DMA Channel 0, and the speaker port uses Channel 2.

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**Power** - Power is supplied via a 10-pin Molex connector. For most applications, the board only requires +5 volts. However, flat panels require +12 volts for the backlight inverter. Also, the  $\pm 12V$  source is wired directly to the PC/104 connector.

**Reset** - A precision voltage circuit monitors the +5 volt status. Upon detection of an out-of-tolerance condition, the board is reset. This action is critically important in order to detect brownout or power fail conditions. The reset circuit also ensures that the power is nominal before executing a power-on reset.

**Battery** - A 350 mA/H battery supplies the EPX-C3-G board with standby power for the real time clock and CMOS setup RAM. A power supervisory circuit senses the off-board voltage and automatically switches to internal power when it drops below normal.

**Standalone Operation** - The board can be used as a complete, standalone embedded controller mounted on a flat surface using standoffs. The EPX-C3-G measures 4.5 x 6.5 inches (115 mm x 165 mm).

**PC/104 Expansion** - The EPX-C3-G has both a 16-bit PC/104 and a 32-bit PC/104-*Plus* interface and connector. PC/104 is the ISA bus and PC/104-*Plus* is the PCI bus for I/O functions requiring higher data transfer speeds. The EPX-C3-G provides a common computer core from which engineers can add off-the-shelf or user-designed, application-specific PC/104 and PC/104-*Plus* modules.

These modules are self-stacking and plug together in a "piggy back" configuration to serve as a mezzanine expansion bus. Module functions include communications specialty serial I/O, digital I/O, analog I/O, GPS, GSM or CDMA cellular modems, ZigBee, SCSI. Please visit our web site for additional PC/104 information which includes white papers, products, and specifications. <http://pc104.winsystems.com/products/pc104/index.htm>

## SOFTWARE SUPPORT

**Software** - The EPX-C3-G is an x86-compatible SBC. It is designed to run both 16-bit and 32-bit x86 instruction set software and is compatible with Microsoft's Windows® CE and XP embedded operating systems (OS) as well as the applications that run on them. It also supports Linux and many other PC-compatible x86 OS such as QNX, VxWorks or other real-time executives that require a PC hardware environment.

**Developer Kits** - WinSystems' Developer Kits provide the necessary hardware, software and cables to begin program development with the EPX-C3-G board. The kit's packaging permits easy access to the SBC, PC/104 modules, and peripherals during program development.

These kits consist of a DVD-ROM drive, floppy disk drive, hard disk drive and power supply mounted in a black, light-weight, aluminum enclosure. Also included is the selected operating system, cables, and the PCM-POST, a PC/104 module, for debugging support.

In general, Developer Kits provide a specific OS "sample image" that is preloaded on a Flash disk and is ready to run right out of the box. Most kits also include Quick Start Guides, documentation designed to lead you through the process of recreating the embedded OS sample image that was provided in the kit. These Quick Start Guides provide a wealth of valuable, time-saving information that will help you quickly overcome a large portion of the learning curve if you are new to a particular operating system.

Please visit the [Developer Section](#) of our website for more details about each individual Developer Kit.

## SPECIFICATIONS

### Electrical

EPX-C3-G CPU Clock: 733MHz or 1GHz  
PC/104 Interface: 16-bit, non-stackthrough  
PC/104-*Plus* Interface: 32-bit PCI, non-stackthrough  
Ethernet: 10/100 megabits per second  
USB Interface: Two USB 2.0-compliant ports  
Serial Interface: Four serial channels with RS-232 levels plus RS-422/485 on COM1 and COM2  
LPT Interface: Bi-directional LPT with ECP/EPP  
Parallel Interface: 24 I/O lines, TTL compatible  
UDMA100/66/33 EIDE Interface: Supports two drives  
Floppy Disk Interface: BIOS supports one or two 360K/720K/1.2M/1.44M drives  
Vcc = +5V  $\pm 5\%$  at 3.3A typ: EPX-C3-G-733  
Note: A flat panel backlight inverter usually requires +12V to operate, refer to the manufacturer's specification for their current requirements.

### System Memory

Addressing: Up to 512MB 144-pin SODIMM (supplied and installed by user)

## Solid State Disk

Capacity: One, 32-pin memory socket supports up to 512KB SRAM, 1MB of EPROM or up to a 1GB DiskOnChip®  
One CompactFlash socket supports a Type I or Type II CompactFlash card

## Mechanical

Dimensions: 4.5" x 6.5" (115 mm x 165 mm)

## Connectors

Serial, Parallel, Keyboard: 50-pin on 0.100" grid  
COM3 and 4: 20-pin on 0.100" grid  
Floppy Disk Interface: 34-pin on 0.100" grid  
EIDE Interface: 40-pin on 0.100" grid (Primary)  
CompactFlash: 50-pin Type I and II  
Parallel I/O: 50-pin on 0.100" grid  
CRT: 14-pin on 2 mm grid  
Flat Panel: 31-pin on 2 mm grid  
LVDS: 10-pin on 0.100" grid  
Mouse: 5-pin in-line header  
Ethernet: RJ-45  
PC/104 Bus: 64-pin 0.100" socket  
40-pin 0.100" socket  
PC/104-Plus: 120-pin (4 x 30; 2 mm) stackthrough with shrouded header  
USB: Two, Type A  
Audio: 10-pin, 2 mm  
Power: 10-pin Molex

## Environmental

Operating Temperature:  
EPX-C3-G-733: -40°C to +85°C  
EPX-C3-G-1G: -40°C to +60°C

Non-condensing relative humidity: 5% to 95%

WinSystems reserves the right to make changes to products and/or documentation without further notification.

Product names of other companies may be trademarks of their respective companies.

## ORDERING INFORMATION

EPX-C3-G-733	733MHz VIA Eden EPIC SBC
EPX-C3-G-1G	1GHz VIA Eden EPIC SBC

For OEM applications, the EPX-C3-G can be ordered with the video and/or Ethernet circuitry depopulated. Contact a factory applications engineer for configuration, price, and delivery information.

## Developer Kits

DV-R-319-R	ROM-DOS Developer Kit with 32MB DiskOnChip
DV-S-319-C-CF	Windows CE Developer Kit for CompactFlash
DV-S-319-C-DOC	Windows CE Developer Kit for DiskOnChip
DV-S-319-L20	Linux Developer Kit
DV-S-319-S	ROM-DOS/sockets Developer Kit with 32MB DiskOnChip
DV-S-319-X	Windows XPe Developer Kit

## -40°C to +85°C Industrial CompactFlash Memory

CFLASH-G-128M-I	128MB CFlash - RoHS compliant
CFLASH-G-256M-I	256MB CFlash - RoHS compliant
CFLASH-G-512M-I	512MB CFlash - RoHS compliant
CFLASH-G-1024M-I	1GB CFlash - RoHS compliant
CFLASH-G-2048M-I	2GB CFlash - RoHS compliant
CFLASH-G-4096M-I	4GB CFlash - RoHS compliant
CFLASH-G-8192M-I	8GB CFlash - RoHS compliant

FLASH-MD2000-Dxx DiskOnChip®, where x = storage capacities from 16MB to 1GB

## Cables

CBL-115-4	4 ft. Opto rack interface cable
CBL-125-1	Floppy disk adapter cable
CBL-173-1	20-pin ribbon to two 9-pin male D connector adapter cable
CBL-225-1	PS/2 mouse adapter cable
CBL-234-1	14-pin ribbon to 15-pin D-sub CRT adapter cable
CBL-247-1	Multi-I/O adapter cable
CBL-265-1	Power cable (unterminated)
CBL-270-1	Audio access cable
CBL-SET-319-1	Six various cables for the EPX-C3-G

