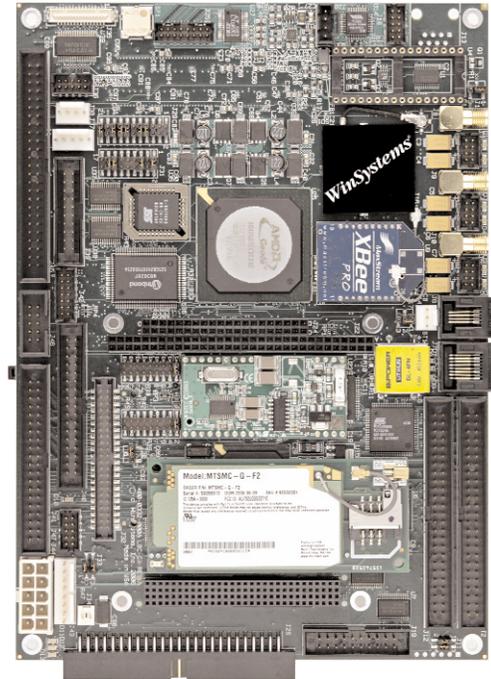## FEATURES

- AMD Geode™ GX500@1W processor
- EBX-size board, 5.75" x 8.00" (147-mm x 203-mm)
- Up to 512MB of system DDR SDRAM supported in a 200-pin SODIMM socket
- One socket for DiskOnChip®, 512KB SRAM, or 1MB EPROM
- Type I and II CompactFlash (CF) cards supported
- PC-compatible supports Linux, Windows® CE and XP embedded, plus other x86-compatible RTOS
- High resolution video controller supports
  - CRT or LCD operation
  - Supports CRT resolutions up to 1600 x 1200
  - Supports flat panel resolutions up to 1024 x 768
  - Color panels supported with up to 18-bits/pixel
  - Backlight power supported
  - LVDS and parallel panel support
- 10/100 Mbps Intel 82551ER PCI Ethernet controller
- MiniPCI connector for 802.11 wireless Ethernet
- 10 serial ports, two with RS-232/422/485, four TTL for onboard devices, and four with RS-232 interface
- Socket support for 56kbps POTS modem, GPRS/ CDMA cellular modem, and ZigBee modules
- Optional Trimble GPS receiver module supported
- Bi-directional LPT port supports EPP/ECP
- 48 bi-directional TTL digital I/O lines (WS16C48)
- Four USB 2.0 ports and two USB 1.1 ports
- ATA-5 compatible controller with 66MB per second transfers in UDMA mode
- Floppy disk controller supports one or two drives
- 12-bit A/D converter, 8 SE/4 DI channels
- PC/104 and PC/104-*Plus* expansion connectors
- AT keyboard controller and PS/2 mouse supported
- AC97 Audio supported

- Real time clock
- Activity LEDs onboard for visual status
- Interrupt and DMA controllers
- -40°C to +85°C Operating temperature
- +5 volt only operation
- Watchdog timer with reset up to 300 seconds
- Replacement for WinSystems' LBC-586Plus
- Long-term product availability

The LBC-GX500 is a highly-integrated, single board computer (SBC) designed for machine-to-machine connectivity with a wide variety of wired and wireless options.

It provides an open and powerful platform for management of geographically distributed machinery using GSM/GPRS/CDMA/802.11/ZigBee wireless communications. Also a 10/100 Ethernet port, four USB 2.0 and two USB 1.1 ports, four RS-232 COM channels, two RS-232/422/485 COM channels, plus an optional dial-up POTS modem. This allows the LBC-GX500 to be a gateway, hub, or protocol converter.

The board will operate from -40° to +85°C for rugged applications requiring an embedded PC and its associated connectivity options. The LBC-GX500 supports even more I/O expansion with video with CRT/flat panel/LVDS interfaces, 48 digital I/O lines, AC97 audio, and the PC/104 and PC/104-*Plus* connectors.

The LBC-GX500 is powered by an AMD Geode x86 processor with support for MMX® and 3DNow!™ technology extensions. Its x86 PC software compatibility assures a wide range of tools to aid in your applications program development and checkout. It has extremely low power dissipation which allows fanless operation.

FUNCTIONAL CAPABILITY

Processor - The AMD Geode™ GX 500@1.0W is the computing engine for this board. It combines low power, excellent performance, and small size. The actual processor speed is 367MHz which yields a performance of 500MHz. The CPU is x86-compatible and includes 32KB of level 1 cache; 16KB instruction and 16KB data. Also an integrated fully pipelined Floating Point Unit (FPU) that supports the IEEE 754 standard. The instruction sets supported are x87, MMX and 3DNow!

Power Management - The LBC-GX500 supports both AT and ATX style power supplies. The board has four standard power management modes to control and bring the power down on the board automatically. S0 is the full power-on mode. S1 is the standby mode. S4 suspends to disk before powering down. S5 turns all the power off (ATX mode only).

Memory - The system memory bus is 64-bits wide. Up to 512Mbytes of non-registered, unbuffered Double Data Rate (DDR) SDRAM with gold-plated fingers can be installed for the main systems memory. The board is shipped from the factory with no memory installed. A 200-pin SODIMM connector permits the user to either install and/or upgrade the memory capacity in the field.
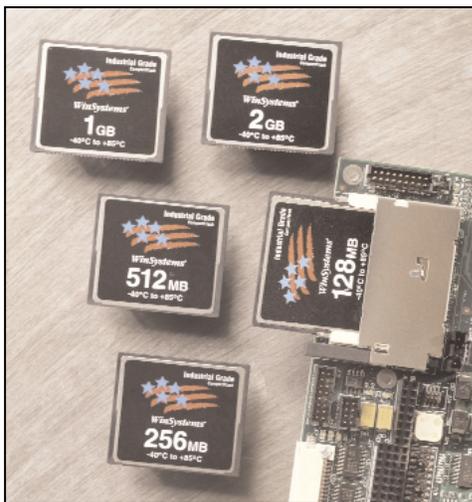
WinSystems' Industrial CompactFlash

CompactFlash - A connector is on the board that will accept Type I and II CompactFlash (CF) 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

Solid State Disk (SSD) Socket - A JEDEC standard 32-pin, machine-tooled socket is provided to accept an M-Systems' DiskOnChip® (DOC). The DOC offers various sized storage options on 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.

BIOS - An industry standard 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 videoless operation.

For video-based applications, the splash screen can be customized. Contact the factory for details.

Remote Booting - The LBC-GX500 supports this function. Please contact a WinSystems' application engineer for companies that supply remote boot software.

Floppy Disk Support - Up to two 3.5" floppy disk drives are supported by the onboard controller. Two drives can be daisy chained on a single cable. A Universal Serial Bus (USB) floppy disk drive can be attached which also has legacy DOS support.

Hard Disk Support - The LBC-GX500 incorporates an ATA-5 compatible (UDMA/66) bus mastering IDE interface. The IDE interface supports two devices that can operate in PIO modes 1 to 4, MDMA modes 0 to 2, or UDMA/66 modes 0 to 4.

The interface provides a variety of features to optimize system performance, including 32-bit disk access, post write buffers, bus master, MDMA, look-ahead read buffer and prefetch mechanism. An LED blinks automatically while data is transferred to provide visual status information.

Video - A high-performance 2D graphics controller is integrated into the AMD GX 500@1W processor that supports both CRT and flat panel displays. It provides resolutions up to 1600 x 1200 for a CRT and 1280 x 1024 for a flat panel. The video controller uses a shared memory architecture and includes hardware frame buffer compression to improve memory efficiency. The controller supports a wide variety of TFT active LCD panel displays as well as standard CRTs.

CRT Video Interface - The CRT video output signals are wired to a 14-pin dual-in-line connector at the edge of the board. 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 not supported.

Flat Panel Display Support - The LBC-GX500 supports most flat panel display technologies. The board properly sequences the power for logic voltage and the backlight inverter to provide intelligent and safe power sequencing to the panel. Go to www.winsystems.com or contact a WinSystems' Application Engineer for the most up-to-date listing.

WinSystems uses a 31-pin flat panel interface system that connects to different panel technologies and suppliers. It has power, timing, and control signals for various panel types. The logic levels are 3.3 volts but are 5.0 volt tolerant.

LVDS panels are supported by the LBC-GX500, The signals are wired to a 10-pin, 2-mm connector.

Connectivity - The key feature of this board is its flexibility and population options for both wired and wireless communications for industrial applications.

Ethernet Controller - An Intel 82551ER is a 32-bit PCI Ethernet controller chip that is used for high-speed data transfer. It 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 priorities transmit queues. There are three LEDs on the board 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 LBC-GX500. The configuration information describing the device's architecture, address, interrupt, etc. is stored in a serial EEPROM.

USB 2.0 - The LBC-GX500 module has a separate NEC uPD720101 USB 2.0 Host Controller to provide four USB 2.0 ports. It complies with the Universal Serial Bus (UBS) 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 on the board.

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. All downstream facing ports can handle high-speed (480Mbps), full-speed (12 Mbps), and low-speed (1.5Mbps) transactions.

Each port has overcurrent and in-rush protection provided by a National Semiconductor LM3526 power switch. Each device is a dual-stage design including a thermal protection circuit. During a short-circuit/overcurrent event, the switch dissipating excessive heat is turned off, allowing the second switch to continue to function uninterrupted. Therefore, a fault on one channel will not affect the other. No fuses are required since protection is done electronically.

The USB ports are wired to two, 8-pin connectors. The CBL-275-1 is the optional interface cable adapter that has two standard female USB connectors.

USB 1.1 - The LBC-GX500 has two USB 1.1 ports that offer connectivity with peripheral devices. Each port also has overcurrent and in rush protection provided by a National Semiconductor LM3526 power switch. The two USB ports are wired to an 8-pin connector. An optional CBL-275-1 is the interface cable adapter with two standard female USB connectors.

Serial Communications - Ten independent, full-duplex, RS-232 serial asynchronous channels are onboard. All serial channels are configured as Data Terminal Equipment (DTE). Both the send and receive registers of each channel has a 16-byte FIFO. This

device is a dual 16C550 compatible UART that offers 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. Plus an independent on-chip software programmable baud rate generator is selectable from 50 through 115.2 kbits/sec. Modem handshake control signals are supported for all channels.

Six of the COM ports support RS-232 interface levels, the other four are TTL levels that are wired to the POTS modem, cellular modem, Zigbee RF module, and GPS receiver. The RS-232 drivers have an on-chip charge pump to generate the plus and minus voltages so that the LBC-GX500 only requires +5 volts to operate. COM1 and COM2 also have jumper selectable RS-422/485 support. The RS-422/485 provides separate balanced transmit and receive signal pairs. For RS-485 multi-drop lines, one signal pair can be used for "party line" network structures.

802.11 Wireless - The LBC-GX500 supports 802.11 with a miniPCI socket. A user can install their own cards from Intel, Broadcom, Foxconn (Atheros), and others or with an optional Intel® PRO/Wireless 2200BG Mini-PCI card installed by WinSystems.

Normally 802.11 cards are automatically recognized by operating systems such as Windows® XP. Also, the individual miniPCI card manufacturer will typically have drivers either with their card or at their web site. Please contact them directly for specific operating systems that their card will support.

An optional Intel PRO/Wireless 2200BG card can be supplied by WinSystems. It is a standards-based and Wi-Fi Certified wireless local area network (WLAN) solution that allows up to 54 million bits of data to be transferred per second. It is designed to maintain high throughput at longer ranges depending upon the type of antenna used.

The Intel PRO/Wireless 2200BG is also software upgradeable to provide future security and other service enhancements. The Intel PRO/Wireless 2200BG network connection fully supports today's security standards such as Wi-Fi Protected Access (WPA) and can be upgraded via software downloads as future security standards, such as 802.11i, become available.

The LBC-GX500 has a reverse polarized (RP) SMA external connector to enable the selection of an antenna having characteristics best suited for the application. Range is dependent upon the type and placement of the antenna, and any sources of interference in the environment.

GPS - This board supports an optional Lassen IQ GPS receiver. This is a very low power GPS solution designed to provide position, velocity, and time (PCT) data using the most popular standard protocols: TSIP (Trimble Standard Interface Protocol) TAIP (Trimble ASCII Interface Protocol) and NMEA 0183. These protocols are compatible with most commercial navigation or map software packages. Data is accessed through a standard serial UART to the GPS receiver.

Cellular Modem - A Multitech cellular wireless modem socket is on the LBC-GX500 board. The modem module provides the controller, RF transceiver, and antenna interface in one small module. It recognizes the AT command set for easy programming. Designed for global use, the modules offer standards-based multi-band GSM/GPRS Class 10 or CDMA2000 1xRTT support.

The LBC-GX500 is shipped with an empty socket so that a user can install the cellular modem and conduct the final system installation and activation at their site. Also, the cellular modem's temperature range is typically -20° to +50° Celsius.

POTS Modem - A socket is provided to support an optional 2" x 1" DIP modem. Data rates are from 300 bps to 56kbps. The unit includes a DAA. It meets global telephone line standards including FCC Part 68, FCC Part 15, IC-CS03, CTR21, CE marking and UL certification. It recognizes the standard AT commands. A dedicated TTL compatible asynchronous serial port is wired from an onboard UART to the socket.

ZigBee - An onboard socket allows a MaxStream XBee™ or XBee Pro™ OEM RF module to be installed. It supports the IEEE 802.15.4 standard used for low-power sensor networks. The LBC-GX500 can accept modules with onboard antennas or has a SMA connector for use with remotely mounted antennas. A dedicated TTL compatible asynchronous serial port is wired from an onboard UART to the socket.

12-bit A/D - A 100KHz, 12-bit A/D provides input ranges of 0-5V, ±5V, 0-10V and ±10 volts. The board will support up to 8 single-ended or 4 differential channels or various combinations of both.

48-line parallel I/O - The LBC-GX500 contains a highly versatile WS16C48 digital I/O controller. Each I/O line is individually programmable for input, output, or output with read-back operation. Each output channel is latched and has an open collector driver (with a pull-up resistor) capable of sinking 12mA of current.

The major feature of this controller is its ability to monitor 24 of the 48 lines for both rising and falling digital edge transitions, latch them and then interrupt the processor notifying it that a change-of-input status has occurred. Transition polarity is programmable and enabled on a bit-by-bit basis.

Each line's transition is latched by the event so that even short duration pulses will be recognized. An interrupt ID register is maintained for each line for writing more efficient Interrupt Service Routines. This is an efficient way of signaling the CPU of real-time events without the burden of polling the digital I/O points.

The LBC-GX500 has its I/O lines connected to two, 50-pin connectors. Twenty-four data lines are alternated with 24 ground lines for reduced noise and crosstalk. Also +5 volts and ground are included in the cable.

The pinout is compatible with the industry standard 4 to 24 position I/O module mounting racks (Dataforth, Opto-22, etc.) for use with high-level AC and DC optically isolated solid state relays. An optional CBL-115-4, 50-pin conductor ribbon cable connects the LBC-GX500 to one I/O rack.

Line Printer Port - The LBC-GX500 has a parallel port that may be operated in standard (SPP) bi-directional as well as Extended Capabilities Port (ECP - IEEE-1284) and Enhanced Parallel Port (EPP) modes. The output drivers can support 14mA per line.

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

AC97 Audio - The LBC-GX500 has an AC97 digital audio controller. A 10-pin, 2-mm connector provides access to Line Out, Audio In, and Microphone In.

Keyboard/Mouse Controller - An 80C42-type controller supports a PC/AT-compatible keyboard. Also, a standard PS/2 mouse is supported through the multi-I/O cable as well. The mouse and keyboard can be attached via the USB cable if the operating system chosen supports this feature.

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

Status LED - A green 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 - An MC146818A-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 CMOS RAM contained within the clock section.

Watchdog Timer - A software enabled, retriggerable watchdog timer is provided. The timeout period is software adjustable to 1.5, 30, or 300 seconds. The time period can be changed by writing to a register even after initial boot up. If enabled, the watchdog timer must be updated at least once during the period otherwise a failure is assumed and the board will be reset. This circuit is important for use in remote and unattended applications.

Speaker - An onboard speaker is available for sound generation. A beep code is generated that corresponds to any BIOS error codes (if required) during the power-up or reset sequence

Power - Power is supplied to the board through a 10-pin Molex connector. Both ±12 volts are wired directly to the PC/104 and PC/104-*Plus* connector. The +12V is also wired to the switch for the panel back light control.

Power Fail Reset - A precision voltage 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 mAH battery supplies the LBC-GX500 board with standby power for the real time clock and CMOS setup RAM. It also powers the Trimble GPS module (if it is populated) so that it can store certain variables in its RAM. The power supervisory circuit senses the off-board voltage and automatically switches to internal power when it drops below normal. The board will operate without a battery since there is an EEPROM on board to store the CMOS set-up data. However, current time and date information would not be maintained after power is removed from the board.

PC/104 Expansion - The LBC-GX500 has both a 16-bit PC/104 and a 32-bit PC/104-*Plus* interface and connector. PC/104 is electrically equivalent to the ISA bus. The PC/104-*Plus* is equivalent to the PCI bus for I/O functions requiring higher data transfer speeds.

The LBC-GX500 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.
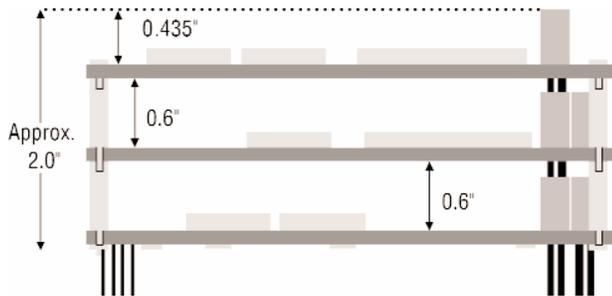
PC/104 and PC/104-Plus Module Stack

PC/104 modules are very compact, measuring only 3.6 x 3.8 inches, 90-mm x 96-mm, and are offered by WinSystems and a number of third party companies worldwide. 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

LBC-586Plus Replacement - This board is designed to be an upgrade and replacement for current users of WinSystems' LBC-586Plus. For question about any differences in the two boards or new software drivers that may be needed, please contact the factory.

SOFTWARE SUPPORT

Software - The LBC-GX500 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 as well as the applications that run on them. It also supports Linux and many other PC-compatible x86 operating systems such as QNX, VxWorks or other real-time executives that require a PC hardware environment.

Developer Kits - WinSystems offers Developer Kits to provide the necessary hardware, software and cables to begin program development with the LBC-GX500 board. The kit's packaging permits easy access to the SBC, PC/104 modules and peripherals during program development.

The kit consists 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.

Board Support Packages for select operating systems are also available with our Developer Kits. Currently Windows XP embedded, Windows CE, Linux and DOS/Sockets OS are supported. Additional support may be offered for other operating systems. Please contact a WinSystems' Applications Engineer if you need support for an OS that is not listed above.

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
LBC-GX500 CPU Clock: 367MHz, 500MHz equivalent
PC/104 Interface: 16-bit, non-stackthrough
PC/104-*Plus* Interface: 32-bit PCI, non-stackthrough
Ethernet: 10/100 megabits/second with
                    RJ-45 connector
USB 2.0:   Four ports
USB 1.1:   Two ports
Serial Interface: Four serial channels with RS-232 levels, with two channels of RS-422/485
802.11:   Optional miniPCI card
Cellular Modem: Optional GPRS/CDMA
POTS Modem: Optional 56kbps dial-up
ZigBee: Optional Maxstream module
CRT: Up to 1600 x 1200 resolution
Flat Panel: Up to 1024 x 768 resolution
GPS: Optional Trimble Lassen IQ receiver
Audio: AC97 with MIC, Line Out, and Line In
LPT Interface: Bidirectional LPT with ECP/EPP
Parallel Interface: 48 I/O lines, TTL compatible
EIDE Interface: Supports two drives
Floppy Disk Interface: BIOS supports one or two
                    3.5" 1.44M drives

Keyboard:	Standard PS/2 or USB interface	
Mouse:	Standard 5-pin or USB interface	
Vcc =	+5V ±5% at 1.6A	

Environmental
Operating Temperature: -40°C to +85°C

System Memory
Addressing:	Up to 512 Megabytes 200-pin DDR SDRAM, supplied and installed by user

Solid State Disk
Capacity:	One, 32-pin memory socket supports 1MB of EPROM, 512KB SRAM, or DiskOnChip®
CompactFlash:	CF socket supports one Type I or Type II CompactFlash card

Mechanical
Dimensions:	5.75" x 8.0" (147-mm x 203-mm)
Jumpers:	2-mm square post compatible

ORDERING INFORMATION

LBC-GX500	Single board computer designed for wired and wireless connectivity applications

Developer Kits
DV-S-332-C-CF	Windows CE Developer includes software, hardware, enclosure, and cables
DV-S-332-L20	Linux (2.6 kernel) includes software, hardware, enclosure, and cables
DV-S-332-XP-SP2	Windows CE Developer includes software, hardware, enclosure, and cables

System Memory - (DDR PC2700 SDRAM)
SODIMM200-G-27-128	128Mbyte RoHS device
SODIMM200-G-27-256	256Mbyte RoHS device
SODIMM200-G-27-512	512Mbyte RoHS device

-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

Cables
CBL-115-4	4ft., Opto rack interface cable
CBL-125-1	Ribbon floppy disk interface cable
CBL-126-9	ATA100 IDE disk cable
CBL-SET-332-1	Cable set for the LBC--GX500
CBL-173-1	20-pin ribbon to two, 9-pin male D (COM3 and COM4) adapter cable
CBL-225-1	PS/2 mouse adapter cable
CBL-234-1	14-pin ribbon to 15-pin D-sub VGA converter cable
CBL-247-1	1 ft., Multi-I/O adapter cable
CBL-265-2	Unterminated power cable
CBL-270-1	Stereo audio cable
CBL-275-1	Dual USB to 8-pin, 2-mm cable

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