

ZFx86™

Most Complete x86 PC Microcontroller



**A CPU with BIOS, OS and Boot
ROM—A Single Chip PC!**

Designed expressly for general industrial embedded applications, the ZFx86 microcontroller was designed from the ground up with the industry's most comprehensive set of I/O and traditional X86 PC functionality. Unique proprietary FailSafe System features resolve the most critical issues that can stand in the way of creating successful and reliable OEM products. As part of a family of ZFx86 PC-compatible microcontrollers, you're also assured of consistent tools, support and future-safe product evolution.

Features

- Unequaled set of traditional PC H/W features
- Ultra-low power—less than 500mW@100MHz w/APM
- Lowest BOM cost in embedded market for lowest OEM product cost
- Long product life—process and packaging technology and roadmap ensure longterm availability†
- System level architecture to minimize integration complexity
- Bundled S/W & firmware:



License for ZFx86 port of Phoenix Rev 4.0 Standard PC BIOS included with ZFx86. Phoenix BIOS executable image, VxWorks RTOS Demonstration†, Linux, Windows CE evaluation package†, and various RTOS evaluation packages† are included in the ZF Micro Devices Integrated Development System.

- Patented ZF FailSafe H/W and S/W features unique to embedded market
- Proven industry standard architecture, both ISA and PCI fully implemented with minimal multiplexing

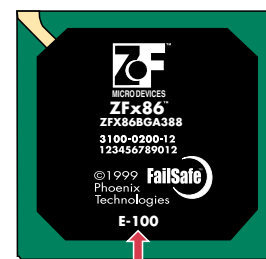
Ultra-low Power

Ideally suited to applications where low power is required for long battery life or in harsh environments where airflow for heat dissipation is restricted and heatsinks and fans are unacceptable.

Lowest BOM Cost

Of prime importance in the design of any OEM product is the overall system cost in production. The ZFx86 architecture was created specifically to be cost-effective, allowing PC functionality and compatibility to be incorporated in high volume OEM products. Designed from inception for use in cost-sensitive embedded systems, ZFx86 requires minimal external components. Its 16/32-bit switchable DRAM bus makes it possible to run with as little as one DRAM chip in the system. No other device of its kind makes possible the inclusion of the equivalent of a PC motherboard in OEM devices for a lower total bill of materials cost. ZFx86 is also the only such family that includes a BIOS license (ZFx86 port of Phoenix Rev 4.0 Standard PC BIOS)†.

*Perfect
For Embedded
Applications*



Extended Temperature Version Available!

Unique FailSafe™ System Features

Long Product Life

ZF Micro Devices' goal is to serve our customers by providing stable, reliable products uniquely suited to the needs of the embedded and information appliance markets. We understand that many companies using embedded processors want to provide their products to their customers over an extended lifetime.[‡]

System Level Architecture

Designing a product with an embedded PC is not a trivial matter. The product architecture must be conceived of from the beginning as a system or delays in both software and hardware development is inevitable.

PC compatibility issues (both hardware and software) must be carefully considered because the consequences of any incompatibility can manifest themselves as field failures. The ZFx86-family of PC-compatible microcontrollers—including the ZFx86— incorporate the core features of a PC motherboard with all the most common peripherals and a number of enhancements developed by ZF exclusively for the embedded market. Ease of integration, reliability and failsafe operation in harsh environments were the guiding factors in the design process.

Bundled S/W & Firmware Completes PC "System"

Included with every ZF Micro Devices Integrated Development System are a Phoenix BIOS executable image, Windows CE Platform Builder evaluation, various RTOS evaluation packages, and a Linux OS. A license for the ZFx86 port of Phoenix Rev 4.0 Standard PC BIOS[†] is included with each device at no extra cost.

There are no licensing hassles, no porting, and no searching for drivers to support peripherals. Time-to-market is shortened and system reliability is increased.

Patented Embedded Features

FailSafe Boot ROM

Today the operating system in most devices utilizing computer intelligence resides in flash memory. The flash memory is also often used to store program data and other transient information. Under certain conditions power irregularities or other operating anomalies can corrupt the flash memory. The ZF FailSafe circuitry combined with the ZF Integrated Boot ROM allows total system recovery if such a corruption takes place. This can even be achieved remotely when no operator is in attendance.

ZF-Logic

As increasing numbers of everyday devices incorporate computer intelligence, the microprocessor architecture knowledge required by system designers becomes more demanding. ZF-Logic allows access to X86 system architecture with a minimal amount of high-level microprocessor experience. ZF-Logic gives you simple and reliable control of chip selects and GPIO. Lower system integration costs are achieved because devices can be added to the ISA bus with no external logic. The result is shorter time-to-market cycles and more reliable products.

Z-Tag — lowest cost Flash downloads

As the capacity of flash memory devices in which BIOS, operating system and application S/W is stored increases, the time required to program these devices can become a significant factor in the production cost of an end product. Z-Tag allows this programming to be accomplished on-board in a fraction of the time. Transfer rates under Z-Tag exceed 2,500,000 bits per second whereas typical transfer rates are only 19,200 bits per second. In a high-volume manufacturing environment dramatic savings in programming time can be realized. Easy field upgrades are accomplished by just plugging in the Z-Tag programming tool included with all ZFx86 Integrated Development Systems — in seconds your upgrade is complete!

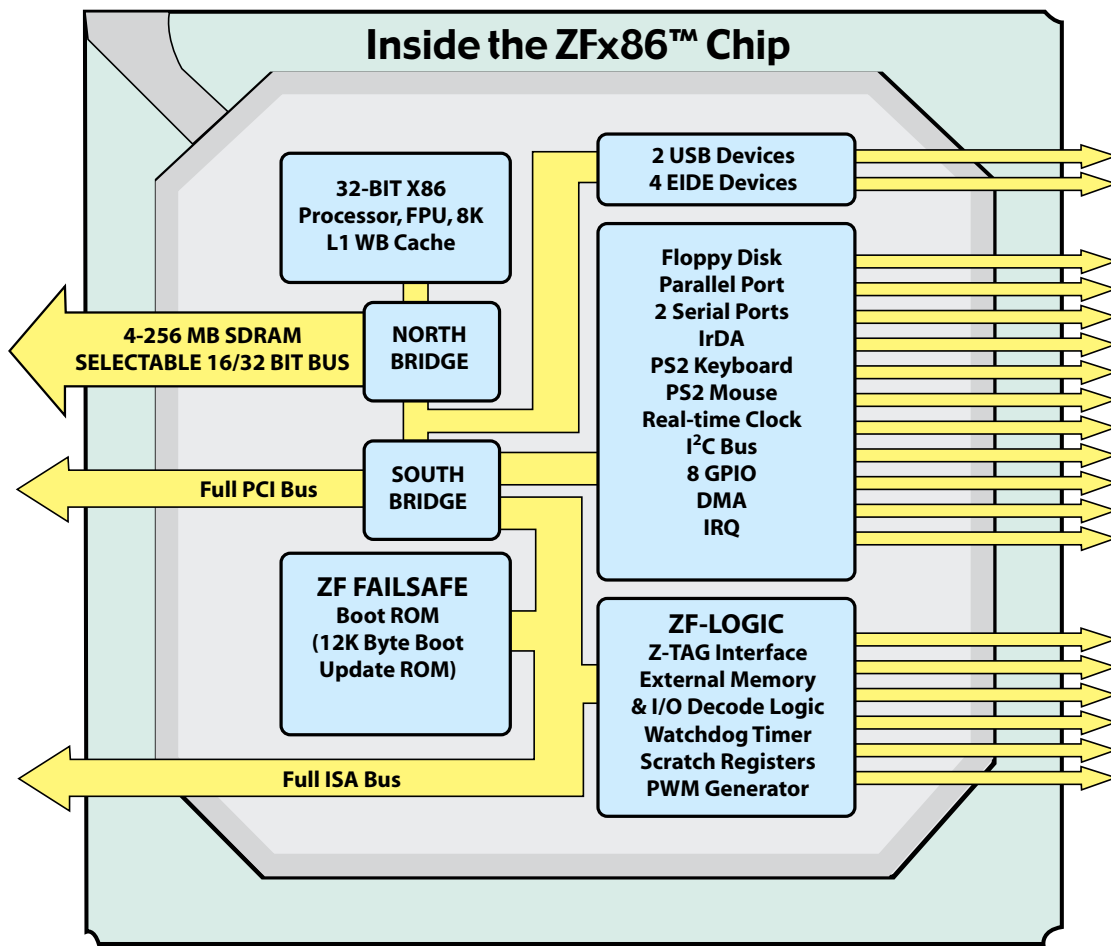
Dual Watchdog Timer

With both software and hardware control of the WDT event, maximum protection from downtime losses is provided.

Industry Standard Architecture Completely Implemented

The PC is the architecture of choice for embedded applications because of ease of software development, low manufacturing system cost and fast time-to-market. If the embedded processor selected is not fully PC compatible all these key measures of success can be lost. ZFx86 provides the ultimate combination of a high integration device at the lowest BOM cost in the industry without sacrificing full PC compatibility. There are minimal multiplexed signals, no missing interrupts, and a full complement of standard peripherals. It is the fastest, most cost-effective means of integrating full PC motherboard functionality in an OEM product.

Accelerate Your Time-to-Market



A high speed 32 bit processor is married to a superior SDRAM memory controller and a PCI expansion bus with an Ultra DMA IDE controller. A full ISA bus brings with it all the well-understood ISA devices to help solve many of the potential challenges unique to embedded applications. Enhanced with such ZF proprietary embedded features as Fail-safe Boot ROM, the Z-Tag interface, Dual Watchdog timer and ZF-logic, integrated ISA bus decoding, ZFx86 allows for seamless and glueless system integration.

By combining the hardware and software needed to implement full PC compatibility in a single device, it lowers the exposure to development risks and significantly reduces time-to-market.

This unique integrated design makes it ideal for applications that require computing intensive processes, low power consumption, high reliability and a small overall product size. Since the ZFx86 is fully PC compatible you gain access to:

- ◆ Widest selection of hardware and software available.
- ◆ Proven architecture supported by hundreds of ISA, PCI, USB and I2C bus suppliers.
- ◆ Cost-effective, readily available development tools and operating systems.

The First True PC "System-on-a-Chip"

IT'S NOT A SYSTEM UNTIL IT BOOTS

No processor— regardless of the level of integration—is a system until it boots. If it doesn't come with a fully implemented PC BIOS and an operating system it won't run. ZFx86 is the first and only System-on-a-Chip that includes the BIOS combined with an internal FailSafe boot ROM that ensures your system will always be accessible, even if all external Flash memory has been corrupted.

Software Compatibility

The ZFx86 is fully compatible with all standard PC software. It will run any standard operating system capable of running on a fully compatible PC with FPU such as Linux, DOS, many RTOS, Windows CE, Windows 9x, and Windows NT.

**ZFx86 runs at a cool
1/2 Watt—not a typical
8 to 10 Watts**

COOL



Specifications

Processor Core

- ◆ 32 bit CPU core operating up to 128MHz
- ◆ Floating point unit (FPU)
- ◆ 8K cache
- ◆ Level one write back and write through cache support

DRAM Controller

- ◆ SDRAM (Synchronous DRAM) support
- ◆ Memory configurations to a 32 bit or 16 bit data interface in up to four memory banks
- ◆ 16/64/128 Mb symmetric or asymmetric SDRAM chips
- ◆ Maximum 256MB memory space

PCI Host Bridge controller

- ◆ 32 bit 33MHz rev. 2.1 compliant
- ◆ Bus speed is system clock or system clock/2.
- ◆ Burst transfers up to 120MB per second.
- ◆ South Bridge and external masters can access SDRAM connected to DRAM controller
- ◆ Supports up to three external PCI masters

Full ISA Bus

- ◆ Full set of ISA bus signals
- ◆ Complete IRQ set
- ◆ 16 and 8 bit DMA support
- ◆ 16 and 8 bit device support; full set of control lines

IDE Controller

- ◆ Support two channels with 4 devices
- ◆ PCI master burst reads and writes
- ◆ Ultra DMA (ATA-4) support
- ◆ Programmed IO (PIO) Modes 0-4 support

Universal Serial Bus (USB)

- ◆ Two independent USB interfaces which are Open Host Controller (Open HCI) compliant
- ◆ Second generation proven core design

Integrated Super IO

- ◆ Floppy disk controller
- ◆ Two standard serial ports
- ◆ Infrared communications port off one of the serial ports
- ◆ IEEE 1284 compatible parallel port
- ◆ Real-time clock
- ◆ 8042 AT keyboard and PS/2 mouse controller
- ◆ Access Bus interface compatible with SM Bus and I2C

AT Compatibility

- ◆ 8259A equivalent interrupt controllers
- ◆ 8254 equivalent timer
- ◆ 8237 equivalent DMA controllers
- ◆ Port A, B, and NMI logic

Power Management and GPIO

- ◆ I/O traps and idle timers for peripheral power management
- ◆ 8 GPIOs
- ◆ Wake-up on USB
- ◆ Keyboard/mouse activity detect for screen wake-up

Processor Interface

- ◆ Suspend clock protocol with connection through North Bridge
- ◆ NMI and maskable interrupt

Electrical Characteristics

- ◆ Dual voltage device — 5V tolerant, 3.3V I/O, 2.5V core voltage

Power Consumption (APM)

- ◆ 33MHz 627mW (251mW), 66MHz 798mW (319mW), 100MHz 956mW (382mW), 128MHz 1789mW (716mW)

Mechanical / Environmental

- ◆ Standard Part—Up to 128Mhz (0 to +70°C) Ambient Temperature
- ◆ Extended Temperature Range Part—Up to 100Mhz (-40 to +85°C) Case Temperature
- ◆ Package: 388-pin Plastic Ball Grid Array, 35mm x 35mm

Embedded Features

FailSafe Boot ROM

- ◆ On-chip code and static RAM
- ◆ Allows execution of multiple instruction sets: DRAM clear, Flash erase, executable load and run, etc. Provides permanent and fail-safe mechanism to update software under all adverse operating conditions

ZF-Logic

- ◆ PWM generator
 - Programmable Pulse Width Modulator output (2Hz-4MHz)
 - Free running
 - Ideal for switching power supplies or LCD back-light inverter control
- ◆ External memory decode logic
 - Four memory mapped chip selects
 - Base address and size registers
 - Automatic overlap check
- ◆ General Purpose Chip Select mapper
 - Four I/O mapped chip selects
 - Base address and size registers
 - Automatic overlap check
- ◆ Boot strap register (can be set by external DIP switches)
 - Allows customized booting conditions

Z-Tag Interface

- ◆ High speed interface to download S/W
- ◆ Uses floppy interface when "Drive Select" signal is inactive
- ◆ Communication protocol compatible with serial EEPROMs
- ◆ Can be driven by standard parallel port
- ◆ Z-Tag programming tool allows easy field upgrades

ZF-DWDT

- ◆ Embedded application Dual Watchdog Timer (WDT) with software and hardware control of the WDT event
- ◆ 16 bit counter primary watchdog connected to SW IRQ/NMI/SMI reset by Watch Dog Timer Input (WDI)
- ◆ Second 8 bit counter output connected to H/W reset line enabled by primary counter output
- ◆ Counter values can be read anytime
- ◆ Counter enable and disable control

Software Included with ZFx86 Integrated Development System

- ◆ Executable image of ZFx86 port of Phoenix Rev 4.0 PC BIOS
- ◆ Linux
- ◆ Microsoft Windows CE, various RTOS evaluation packages[†], and VxWorks RTOS Evaluation tools[†]

Software Compatibility

- ◆ Linux
- ◆ Most PC-compatible RTOS
- ◆ DOS, Windows CE™, Windows™ 9x, and Windows NT™

Ordering Information

- ◆ ZFx86BGA388 — ZFx86 FailSafe Bootable PC-on-a-Chip (Phoenix BIOS run-time license included). Standard temperature range: 0 to +70°C at speeds up to 128Mhz.
- ◆ ZFx86BGA388E100 — ZFx86 FailSafe Bootable PC-on-a-Chip (Phoenix BIOS run-time license included). Extended temperature range: -40°C to +85°C case temperature at speeds up to 100Mhz.
- ◆ ZFx86IDS-K-01 — Integrated Development System for US. Includes ATX-MZP-Q-01 board, case with power supply, hard disk, floppy and CD-ROM, cables, S/W images, manuals, reference design and CAD files
- ◆ ZFx86IDS-KE-01 — Integrated Development System for export outside the US.

[†] Customers of ZF Micro Devices products are responsible for obtaining any development tools and/or additional licenses required to support their specific applications

[†] Full ZF Micro Devices Long Term Availability statement is available upon request



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