



- ◆ **Shortest Time to Market**
- ◆ **Faster Design Cycle**
- ◆ **186, 286, 386 & 486 Code Compatible**

A True x86 "System-on-a-Chip"

Regardless of the level integration, no processor is a system until it boots. The ZFx86 is the only SOC that has an internal BOOT ROM that ensures your system will always be accessible, even if all external Flash memory has been corrupted. No other SOC includes a fully implemented BIOS with license included – shortens time-to-market and reduces risk.

486 CPU, North Bridge, South Bridge, Super-I/O, Boot ROM and BIOS license are all included.

Designed expressly for embedded applications, the ZFx86 32-bit microcontroller was designed from the ground up with the industry's most comprehensive set of I/O and traditional X86 PC functionality. Unique patented FailSafe® System features resolve the most critical issues that can stand in the way of creating successful and reliable OEM products.

Features

- ◆ Unequaled set of traditional PC H/W
- ◆ Ultra-low power – less than 1W at 100MHz
- ◆ Lowest BOM cost in embedded market = lowest OEM product cost
- ◆ Long product life – process, packaging technology and roadmap ensure long-term availability
- ◆ System level architecture to minimize integration complexity
- ◆ PC BIOS license included with every ZFx86
- ◆ ZF FailSafe BIOS with patented features unique to embedded market
- ◆ BIOS supports CPU, support logic, super I/O devices, IRQ routing, boot block, setup, BIOS messages, POST tasks/codes, runtime services, interrupt vectors, BIOS data area, and extended BIOS data areas.
- ◆ Proven industry standard architecture – both ISA and PCI fully implemented

Ultra-low Power

At less than 1W at 100MHz the ZFx86 is ideally suited to applications where low power is required for long battery life or 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. Created specifically to be cost-effective, the ZFx86 brings PC functionality and compatibility to high volume OEM products.

The 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 at a lower total bill of materials cost.

Long Product Life

Our goal is to serve our customers by providing stable, reliable products uniquely suited to the needs of the embedded and information appliance markets 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 incorporates the core features of a PC motherboard with the most common peripherals and enhancements developed by ZF exclusively for the embedded market. Ease of integration and reliable operation in harsh environments were the guiding factors in the design process.

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Specifications

Processor Core

- 32 bit CPU core operating up to 100MHz
- 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 rev2.1 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 1.1 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, 2.2V core voltage

Power Consumption

- Sub-1W at 100MHz

Mechanical / Environmental

- Commercial Temperature: 0 to +70C Case Temperature at 100MHz
- Industrial Temperature: -40C to +85C Case Temperature at 100MHz
- Package: 388-pin Plastic Ball Grid Array, 35mm x 35mm, fully RoHS compliant.

Embedded Features

Patented FailSafe® Boot ROM

- On-chip code and static RAM
- Allows execution of multiple instruction sets: DRAM clear, Flash erase, executable load and run, etc. and provides permanent and fail-safe mechanism to update software under 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 embedded PC BIOS
- ZF development utilities
- Sample programs and utilities

Software Compatibility

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

Ordering Information

- ZFx86BGA388-c: ZFx86 FailSafe Bootable PC-on-a-Chip (Phoenix BIOS run-time license included) commercial temperature range is rated 0C to +70C case temperature at 100Mhz.
- ZFx86BGA388-i: ZFx86 FailSafe Bootable PC-on-a-Chip (Phoenix BIOS run-time license included) industrial temperature range is rated -40C to +85C case temperature at 100Mhz.

Ordering Note: Extended lead time for ZFx86 with Z-tag. Device part numbers without NZ suffix include Z-tag. For shorter delivery time please specify you do not require Z-tag interface by adding NZ suffix. (ex: ZFx86BGA388-c-NZ or ZFx86BGA388-i-NZ)

* **Z-TAG Note:** limited Z-Tag functionality on initial shipments.

Local representative:



PN: DS-0001-1-1SEP06