

- ♦ **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
- ♦ **FailSafe PC BIOS** with features unique to embedded market (included with every ZFx86)
- ♦ **DR-DOS 7.03** license included with every ZFx86
- ♦ 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 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.

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 for HID low speed devices only (keyboard, mouse, tablet)

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

- Executable image of ZFx86 embedded PC BIOS
- DR-DOS 7.03
- 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.
- NOTE: Devices with lead (Pb) balls available for high reliability applications.

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)



Features

- ◆ License for ZFx86 port of Phoenix™ Rev 4.0 Standard PC BIOS included with every ZFx86
- ◆ ZF FailSafe™ BIOS employs patented H/W and S/W features unique to embedded market for product robustness and longevity
- ◆ BIOS supports industry standard software and hardware architectures
- ◆ ZF FailSafe BIOS is a custom version of Phoenix BIOS, the world's most powerful and popular BIOS in existence on x86 processors. Large installed base ensures future compatibility with hardware and peripherals
- ◆ BIOS supports CPU, support logic, super I/O devices, IRQ routing, boot block, setup, BIOS messages, POST tasks/codes, run-time services, interrupt vectors, BIOS data area, and extended BIOS data areas
- ◆ BIOS updates posted free on ZF website

BIOS License Included With Every ZFx86 Chip — Saves Time and Cost!

Every ZFx86 System-on-a-Chip includes a fully paid run time license for the ZF FailSafe BIOS™ based on the Phoenix™ 4.x PC BIOS. Our FailSafe BIOS takes the industry leading Phoenix BIOS and extends it for the ultimate in embedded BIOS features.

There is no requirement for you to negotiate or secure a separate license agreement with Phoenix Technologies, Ltd. Our agreement with Phoenix allows us to distribute the ZF FailSafe BIOS to our customers for use on every ZFx86 chip purchased.

The BIOS included with every ZF chip allows our customers, contract manufacturers, and distributors, to incorporate the ZF FailSafe BIOS within any products that use the ZFx86 System-on-a-Chip. You may resell the CPU itself or any subassembly or end product that includes a ZFx86 CPU and pass on the fully paid Phoenix/ZF BIOS. No further licensing requirement with Phoenix or any third party is required as long as the BIOS used is that supplied by ZF.

A full-featured BIOS, the ZF FailSafe BIOS supports the entire array of system features present in the ZFx86 System-on-a-Chip. The BIOS itself is not a source code distribution, but rather an easily-used executable binary that runs on the ZFx86 within your product. ZF takes care of the cost overhead, paying Phoenix all royalty fees for every ZFx86 sold worldwide.

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 and the included BIOS license further reduces your BOM total.

BIOS Features

Built on the world standard Phoenix BIOS for 32-bit x86 desktop architecture, the ZF FailSafe BIOS supports features designed by ZF expressly for embedded applications. These ZF-unique features include:

- ◆ Default Configuration Settings selectable by OEM product designers. This means that no battery backed CMOS is required to retain your customized settings, resulting in increased reliability at a lower BOM cost.
- ◆ ZEB BIOS Editor. This free development utility provides a way to custom configure the ZF FailSafe BIOS without recompiling or difficult scripting. A simple user interface allows you to change BIOS settings even after your design is finished. Manufacturing engineers find ZEB especially useful.
- ◆ Eight user defined Chip Selects. This enables I/O and Flash Memory devices such as Disk-On-Chips to be connected without additional glue logic, again increasing reliability and reducing BOM cost.
- ◆ Enhanced error checking that not only increases field reliability, but helps pin-point, "bring up" design problems resulting in faster time to market.
- ◆ Built in ZFlash™ Boot-OS-from-Flash capability.
- ◆ Headless (No Video/Keyboard) console support with Redirect terminal (includes POST code outputs).

Video Extension BIOS

The ZF FailSafe BIOS supports a load feature for custom PCI video BIOS binaries. Using our ZEB utility's main menu you may combine the ZFx86 BIOS with your own PCI video BIOS. The BIOS shadows the PCI video BIOS and treats it as if it were a standard PCI Extension ROM and initializes the matching embedded PCI Video chip.

Extended Features

- ◆ In addition to the standard features documented in the PhoenixBIOS™ User's Manual (available for download on our website <http://www.zfmicro.com/downloadtable.html>), the ZF86 FailSafe BIOS includes the following extended features important for embedded applications:
- ◆ ZFlash OS Loader Hookenables operating systems such as Linux and VxWorks to boot from the same flash chip that contains the BIOS.
- ◆ ZFlash legacy ISA extension processorallows user extension ROMs to be placed in the same flash device as BIOS.
- ◆ Configuration settings that manage ZF86 ZF Logic Memory and I/O Chip Selects for Disk-On-Chip, flash based extensions and custom I/O hardware.
- ◆ Advanced Power Management 1.2 Functions
- ◆ Universal Serial BUS 1.1 Host Controller and Legacy Configuration Settings
- ◆ Infrared support
- ◆ Watchdog Timer Function
- ◆ Remote Management from PC Host
- ◆ Resident Flash Disk Function

Making Internet Connected Equipment Crash proof with FailSafe Boot ROM

What happens when you send a software upgrade to an Internet connected system in the field and there is a hardware or software crash while the download is in process? The software is corrupted and the system cannot re-boot. If the download was being sent to hundreds or even thousands of systems at the same time the result can be catastrophic.

FailSafe vs. Non-Failsafe Systems

When a watchdog timer scheme other than ZF's FailSafe system reaches a point where it cannot recover a hard reset is performed. If the system software has been corrupted, the system will continuously try to re-boot without success. The system will not come up until it has been repaired. This usually requires sending out a field service technician or sending the equipment in for repair.

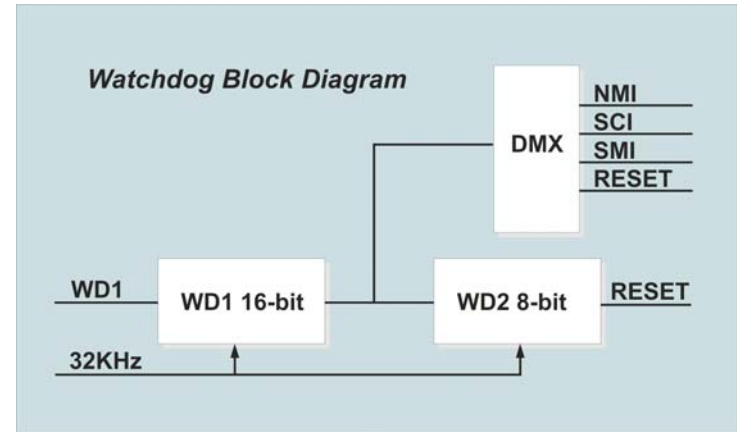
With ZF's FailSafe Boot ROM system in a product, if a failure occurs, the system will reach a hard reset, enable the FailSafe mechanism and allow recovery of the software from any of a number of sources (backup chips, dial-out through a modem, etc.). Once the system software is reloaded the device can re-boot and resume operation.

Protecting your system with the embedded features of the ZF86™ can be accomplished simply and reliably. The devices you will use include the dual watchdog timer, the FailSafe Boot ROM, the Z-Tag interface, the bootstrap register and a bit of code. The result will be a system that always boots, can diagnose the failure and always recovers.

Watchdog Timer Role

The watchdog timer checks against possible failures and bugs in the application program or operating system that make the system-on-a-chip (SOC) uncontrollable. Both watchdog timers generate events to notify the system of an error condition. These timers are individually initialized to a preset value. After initialization, WD1 begins a countdown that is reset to the initial value by software writing into the watchdog control register (tickle function) or external hardware driving logical "1" to an external control pin.

If WD1 reaches zero, it indicates that the software has been unable to reset the timer in the allotted time and an event is generated to take corrective actions or to reset the device. Once the first watchdog timer expires, the software can attempt to gain control of the system using an interrupt handler routine triggered by any of the events connected to the WD1 output line. If the software is successful, the program can resume as normal. The expired WD1 counter also enables the second watchdog counter (WD2). The second WDT is used to monitor the success of the software recovery mechanism. If the second timer expires it triggers a hardware system reset.



Bootstrap Register Role

A bit on the bootstrap register indicates to the system that a WD timer reset has occurred thereby triggering a FailSafe Boot.

Failsafe Boot Role

The FailSafe Boot ROM is built-in code that initializes the SOC device and uses the Z-Tag™ interface to load the information it needs to recover the system. This code has multiple features that can allow any designer complete flexibility and control over the system.

Z-Tag™ Role

The EEPROM containing the software required to execute the system mandated recovery mechanism (including the contact number for code downloads) is connected to the SOC via the Z-Tag interface. The code in the EEPROM can be as simple as dial-up instructions for an internet appliance that would allow remote surfing of the device, or as complex as a full set of diagnostics and repair programs.

BIOS Resources On Our Website

(<http://www.zfmicro.com/downloadtable.html>)

ZF86 BIOS Users Supplement

ZF86 BIOS Routing Interrupts

Phoenix BIOS (4.x Rev 6) User Manual

Notes:

The ZF FailSafe BIOS is unique to ZF and cannot be purchased from Phoenix Technologies Ltd. The ZF FailSafe system and ZF-Logic support are proprietary to ZF Micro Devices Inc. and are not available in any other embedded BIOS.



254mm (10.0")



177mm (6.97")

Features

- ◆ Unequaled set of traditional PC H/W
- ◆ Ultra-low power sub-5W (with solid state disk only) at 100MHz
- ◆ Lowest embedded x86 PC BOM cost
- ◆ Long product life assured by component suppliers focused on embedded market ensures long-term availability
- ◆ A Complete System level architecture to minimize integration complexity
- ◆ ZF PC BIOS (Phoenix Technologies based) and DR-DOS 7.03 licenses included with every ZF86 - no additional licensing or royalties
- ◆ BIOS supports CPU, support logic, super I/O devices, IRQ routing, boot block, setup, etc.
- ◆ Industry standard ISA & PCI busses
- ◆ Field configurable BIOS: Boot device select, com port configuration, remote console enable, and more

EEPC™ — A Complete Open Source Embedded PC Reference Design — Build as is or Make It Your Own

- ◆ OrCad schematic
- ◆ PadsPCB Layout Design Files
- ◆ Bill of Materials
- ◆ \$100 Target BOM cost at 10K (without modem module)
- ◆ BIOS and DR-DOS 7.03 licenses included with ZF86
- ◆ S/W drivers to support all hardware
- ◆ ZF stocked parts kit: ZF86, RTL8139DL, CY2292F*, AT29C040A*. All other parts available online at DigiKey, Mouser, RS Components (Allied), Symmetry (SST Nandrive) *pre-programmed

- ◆ **Open Source Design**
- ◆ **Known Good Design Reduces Time to Market**
- ◆ **Runs Legacy x86 S/W**
186, 286, 386, 486 Code Compatible

A Complete x86 Board-level System

Just adapt the layout to your space and feature requirements and you can be shipping product in record time. All components were selected for easy sourcing and availability of software drivers. The design is based on the FailSafe® ZF86 PC-on-a-chip, the only SOC that has an internal BIOS Update ROM that ensures your system will always be accessible, even if all Flash memory has been corrupted. The design also includes a fully implemented BIOS with free license to further shorten time-to-market and reduce cost and risk. ZF's design files, design guides and parts kits enable you to do it yourself.

486 CPU, Graphics and Ethernet Controller, and the entire design can be Powered Over Ethernet.

The **EEPC** was designed expressly for embedded applications with the most commonly used set of I/O, memory and traditional X86 PC functionality. It is the quickest way to create successful and reliable OEM products.

The **EEPC** incorporates all the features of a 486 PC including the most common peripherals in an easy to implement, ready to manufacture design. Ease of programming and reliable operation in embedded environments were the guiding factors in the design process.

Ultra-low Power Requirement

At less than 5W with the ZF86 running at 100MHz the **EEPC** is ideal 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 **EEPC** can be manufactured in 10K annual quantities for \$100. No other design with as complete a feature list can be produced at a lower total bill of materials cost.

Long Product Life

Components were selected from manufacturers agreeing to make functionally pin compatible devices available for long life cycle embedded applications. Your **EEPC** based product will be stable, reliable and suited to the needs of embedded control markets over an extended lifetime.

ZF Micro Solutions, Inc.

926 Industrial Avenue, Palo Alto, CA 94303 USA
Tel: +1-650-846-6500 www.zfmicro.com

Feature Set

PROCESSOR - ZFx86 SOC

ZFx86 FailSafe PC-on-a-Chip embedded processor with legacy PC features

- 486 DX4 with FPU and 8K L1 cache
- Operates at: 25, 33, 50, 66 or 100MHz
- Runs Intel® x86 compatible operating systems and application software
- Integrated Chipset
- Super-I/O
- ISA, PCI & I²C buses
- IDE hard disk interface (2 drives per primary and secondary interface)
- Floppy disk controller (1)
- 1 parallel, 2 serial ports
- 2 USB 1.1 ports for HID only
- Real Time Clock
- PS2 keyboard and mouse
- 256MB SDRAM controller

GRAPHICS CONTROLLER

Silicon Motion SM712 - 2D multimedia controller

- 4MB integrated memory
- Ultra Low-Power: Functional blocks and engine clock can be dynamically controlled to reduce overall power consumption.
 - Supports Standby and Suspend
- Full Feature Set
 - Dual-display technology supports a primary and secondary display and complete dual-display capability in Windows®95, 98, CE through Silicon Motion API
 - QuickRotate allows image rotation to 90X, 180X, and 270X
 - TFT/DSTN panel support for typical high-resolution panels
 - VGA CRT support
 - Up to 1024 x 768 resolution
- Software Support
 - Driver/BIOS support for Windows®95, 98, CE and Linux

SDRAM

Integrated Silicon Solution Inc. (ISSI)

IS42S32800D configured as a quad 2M x 32 DRAM

- 32M, 64M, 96M, or 128MB - Fully synchronous operation
- Four internal banks (2M x 32bit x 4bank)
- Long-term availability

MODEM (option)

RADICOM TINY MODEM ultra compact, integrated in an RJ11 jack (uses one RS232 port)

- Serial TTL Interface
- AT Command Set
- Up to 56 kbps data speeds downstream
- Fax / Voice-remote playback and recording
- Generates and detects DTMF tones in voice mode

POWER SUPPLY

LINEAR TECHNOLOGY LT1963A

- Output Current: 1.5A
- Dropout Voltage: 340mV
- Low Noise: 40µVRMS (10Hz to 100kHz)

ORDERING INFORMATION:

ZFx86-IDK-B-EPC board kit includes SCX-EPC-Q-01 board, Z-tag dongle, licensed SW images, manuals, reference design and CAD files.

DUAL SOLID STATE IDE DISK OPTIONS

APACER ADC III

- ATA/IDE bus interface / ATA command set compatible
- Connector Type: 32-pin male connector
- Low power consumption, supply voltage: 3.3V and 5V
- Sustained read: up to 35 MB/sec
- Sustained write: up to 25 MB/sec
- Intelligent endurance design: Advanced wear-leveling, Built-in Hardware ECC, Enhanced Data Integrity
- Intelligent power failure recovery
- Enhanced security: Secure Protection Zone, Quick Erase and / or

SST NAND Drive SST85LD0128

- ATA/IDE Bus Interface
- Low Power, 3.3V Power Supply
- Endurance: 100K write cycles
- Data Retention: 10 years
- Fast Sustained Write (Host-to-Flash) up to 5 MByte/sec
- Fast Sustained Read (Flash-to-Host) up to 10 MByte/sec

ETHERNET

Realtek 10/100 RTL8139DL

Integrated Fast Ethernet MAC and PHY

- 10/100 Mb/s and 10/100 Mb/s N-way Auto-negotiation
- PCI local bus single-chip Fast Ethernet controller
 - PCI bus master data transfers and PCI space or I/O space mapped data transfers of RTL8139D(L)'s operational registers
 - PCI VPD (Vital Product Data)
 - ACPI, PCI power management
 - PCI multi-function - incorporate with other PCI master device
- Compliant to PC99 and PC2001 standards
- Auxiliary power-on internal reset, to be ready for remote wake-up when main power remains off
- Auxiliary power auto-detect, and sets the related capability of power management registers in PCI configuration space
- Loopback capability
- Half/Full duplex capability

ELECTRICAL

- Power
 - ATX power supply connector
 - Battery (2032)
- Connectors
 - Combo DSUB: VGA 15 pin, RS232 9 pin (COM1), Parallel 25 pin
 - RS232 - 10 pin (COM2) / 56Kbps modem (COM2) optional
 - LCD (40 pin)
 - PS2 keyboard/mouse
 - USB dual, stacked
 - Ethernet RJ45 (integrated transformer and LEDs)
 - Disk Drives: IDE two 40 pin; Floppy one 34 pin
 - Z-tag header
 - PCI- one 32 bit
 - ISA- one 16 bit
- Jumpers: CMOS RAM reset; Clock selection; Aux memory socket select
- Switches: Power rocker; DIP switches - two bootstrap and one LCD configuration
- LEDs: Ethernet activity (RJ45 connector), Hard Disk and power

PHYSICAL: 254mm x 177mm (10" x 6.97"), commercial temperature grade (0-70C)

INFORMATION SUBJECT TO CHANGE WITHOUT NOTICE

Rapid Deployment of Embedded Systems Requires Easy Access to Parts for Prototyping

Quick Start your EEPC-based embedded system design with a starter kit that will save time and cost, and facilitate first pass success. The EEPC was designed to be available long-term and easy to source. Almost all the components on the EEPC Bill Of Materials are available from DigiKey, Mouser, RS Components (Allied), Nu Horizons (Silicon Motion), or Symmetry Electronics (SST Nandrive).

For those components that are not readily available through distribution, there is the EEPC Quick Start Parts Kit. The kit includes the ZFx86 FailSafe® PC-on-a-Chip, RealTek RTL8139DL Single-Chip 10/100M Fast Ethernet Controller, Cypress Semiconductor CY2292F General Purpose Field Programmable Clock Generator, and the Atmel AT29C040A Flash memory.

The Cypress CY2292F Clock Generator and the Atmel AT29C040A Flash are pre-programmed by ZF to save additional time.

**ZFx86 FailSafe® PC-on-a-Chip**
Sub 1Watt 486 DX4
with FPU and 8K L1 cache

- Operates at: 25, 33, 50, 66 or 100MHz
- Runs Intel® x86 compatible operating systems and application software
- Integrated Chipset
- Super-I/O
- ISA, PCI & I²C buses
- IDE interface (2 drives, primary & secondary interface)
- Floppy disk controller
- 1 parallel, 2 serial ports
- 2 USB 1.1 ports for HID only
- Real Time Clock
- PS2 keyboard and mouse
- 256MB SDRAM controller
- 388BGA
- Includes Phoenix Technologies based ZF Embedded BIOS License with each chip
- DR-DOS 7.03 license included with each ZFx86

**Atmel AT29C040A Flash***

4-megabit (512K x 8) AT29C040A

- Fast Read Access Time 70 ns
- 5-volt Only Reprogramming
- Internal Program Control and Timer
- Hardware and Software Data Protection
- Two 8K Bytes Boot Blocks with Lockout
- Fast Sector Program Cycle Time - 10 ms
- DATA Polling for End of Program Detection
- Low Power Dissipation 40 mA Active Current
100 µA CMOS Standby Current
- Typical Endurance > 10,000 Cycles
- Single 5V ±10% Supply
- CMOS and TTL Compatible Inputs and Outputs

**Cypress Semiconductor CY2292F***

General Purpose Clock Generator

Three clocks: Sys (selectable 25, 33.3, 50 or 66.6MHz), USB (48MHz), PIT (14.318MHz)

**RealTek RTL8139DL Single-Chip**
10/100M Fast Ethernet Controller

- Integrated Fast Ethernet MAC and PHY
- 10/100 Mb/s
- PCI local bus single-chip Fast Ethernet controller

ORDERING INFORMATION:

Part # ZFx86-QSTART-EEPC

Starter Parts Kit includes ZFx86, RTL8139DL, CY2292F* and AT29C040A* (*pre-programmed)

Cost Effective, Reliable, Rapid Deployment of Embedded Systems

- ♦ DR DOS on the ZFx86 gets products to market quickly at the lowest development and ownership cost.
- ♦ Thousands of compatible applications, drivers and utilities available free or at minimal cost.
- ♦ Full documentation available.

DR DOS 7.03

The ideal embedded DOS system, designed for out-of-the-box implementation into ROM or Flash ROM with tools and associated documents available in the DRDOS OEM Documentation Kit.



- ♦ 100% MS-DOS 6.22 compatible..
- ♦ Comprehensive DOS utility set
- ♦ Multitasking, with API for developers
- ♦ DPMS memory manager in addition to DPMI
- ♦ Stacker disk compression
- ♦ NWCACHE - disk caching program
- ♦ EMM386 memory manager
- ♦ DOS Protected Mode Services (DPMS)
- ♦ Multitasking
- ♦ DR-DOS provides a full multitasking environment on Pentium, 486, or 386-based hardware. This is built into the memory management extensions provided in the operating system, and is accessible for standard un-aware applications when using the Task manager (Taskmgr) utility. Programs however can have direct access to create separate threads etc, via the extended Application Programming Interface.
- ♦ DPMS - A memory manager that allows device drivers to reside outside of the regular DOS application area. Drivers or Terminate stay-resident applications can thereby avoid using valuable application memory.
- ♦ ROM tools available

DR DOS History

DRDOS originated in 1987 at Digital Research, Inc.; was then acquired by Novell in the early 90s; in 1996, DR-DOS was acquired by Caldera, Inc., the same company that sued and settled out-of-court with Microsoft Corporation over DOS-related anti-trust allegations; in 1998, it was spun out to Lineo, Inc. where it underwent enhancements targeted at the embedded market and, in October 2002, was acquired by a new company aptly called DRDOS, Inc.

Key Features of DR DOS

Online Manual - DRDOS is supplied with a complete online manual that contains detailed information about all of the features of the operating system including the basic commands, and the advanced utilities. It also has online help available for all its commands.

Memory Management - Memory management features include a set of device drivers and commands that enable you to manage memory efficiently and make as much memory as possible available to your applications.

DOS Protected Mode Services - DOS Protected Mode Services (DPMS) interface allows specially-implemented device drivers and TSRs to operate in extended memory. This makes more memory within the first megabyte available to applications and other conventionally-written drivers and TSRs. Both Stacker* (the disk compression program), and NWCACHE (the disk cache) use DPMS.

Disk Compression - The disk compression component enables you to store more information by compressing the data. Once installed and run, this component automatically uncompresses and compresses data read from or written to the disk.

Disk Performance - NWCACHE and DISKOPT improve disk performance: .

* NWCACHE increases disk access speed by reducing time taken for data to be read from or written to the disk.

* DISKOPT optimizes disk performance by reorganizing the arrangement of the data on the disk.

Server Networking - The network component, Personal NetWare, allows you to set up your device as a server so that you can share your data, programs, and printers with other devices on the network.

Client Networking - When you install the client software on your computer, not only can it act as a client of a Personal NetWare server on the network, but it can also be a client of a NetWare server. Thus, creating a Personal NetWare network does not conflict with existing NetWare server-based networks. You can also add NetWare servers to your Personal NetWare network to increase the network services available.

Multitasking - Multitasking allows running tasks in the background simultaneously with a task in the foreground.

File Recovery - The DELWATCH and UNDELETE commands enable the system to keep track of deleted files, and recover them if accidentally deleted. The backup component, Fastback Express, allows saving files to any logical DOS device regularly and recover them later if needed.

DR DOS documentation available at <http://www.drDOS.com/dosdoc/>

DRDOS 7.03 is documented in the online hypertext documentation (DOSBook) within the product. Documentation is also available in HTML format from the following links. Source files for the user guides are available in the OEM/DOC/SOURCE directory. These are provided for OEM's to customize and redistribute as required.

— User Documentation —

DR-DOS

DR-DOS
User Guide



DRDOS User Guide

Complete guide to DRDOS including how to install and set up DRDOS and Personal NetWare.

<http://www.drDOS.com/dosdoc/usergeng/uglontoc.htm>

DR-DOS

DR-DOS
Quick Start
Guide



DRDOS Quick Start Guide

A reduced version of the full user guide with the basics of DRDOS.

<http://www.drDOS.com/dosdoc/qkstart/index.htm>

DR-DOS

Customizing
DOSBook



Customizing DOSBook

Explains how to edit the online help for DRDOS.

<http://www.drDOS.com/dosdoc/custdb/index.htm>

DR-DOS

System and
Programmer's
Guide



System and Programmer's Guide

A full reference guide for the internal structures of DRDOS and the invariant programming interface.

<http://www.drDOS.com/dosdoc/sysprog/httoc.htm>

— Programmer's Documentation —

DR-DOS

System Builder Kit
Redistribution &
Customization



DRDOS Customization and Redistribution Guide

Describes how to customize DRDOS to your requirements and build a new version for redistribution.

<http://www.drDOS.com/dosdoc/custred/index.htm>

DR-DOS

DOS Protected
Mode Services
(DPMS) 1.0 API



DOS Protected Mode Services API (DPMS)

Contains full details of how to program DPMS aware programs.

<http://www.drDOS.com/dosdoc/dpms/dpms.htm>

DR-DOS

Multitasking
API Guide



DRDOS Multitasking API Guide

Contains a full reference guide to the DRDOS Multitasking API.

<http://www.drDOS.com/dosdoc/multtask/index.htm>

DR-DOS

Implementing
Power Management
in DR-DOS



DRDOS Power Management

Explains how to implement DRDOS power management features.

<http://www.drDOS.com/dosdoc/bmaxhtml/front.htm>

DR-DOS

Embedding
DR-DOS
in ROM



Embedding DRDOS in ROM

Explains how to embed DRDOS into ROM using a fixed or flash disk.

<http://www.drDOS.com/dosdoc/romhtml/romtoc.htm>

DR-DOS

Implementing
DR-Flash



Implementing DR-Flash

Explains how you use the DR-Flash file system for embedded solutions.

<http://www.drDOS.com/dosdoc/drflash/index.htm>

TCP/IP

DOS Utilities



DOS Utilities

Explains how to use the DOS utilities.

http://www.drDOS.com/dosdoc/Tcpip/dos_util/dosutil.htm

— TCP/IP Documentation —

TCP/IP

DOS API
Socket
Library
Reference



TCP/IP Programming Information

The DOS Toolkit provides facilities to develop applications suitable for TCP/IP-based communication.

http://www.drDOS.com/dosdoc/Tcpip/dos_api/index.htm

TCP/IP

Transport
for DOS



Transport for DOS

The TCP/IP Transport for DOS consists of the following software components: TCP/IP Transport software, Network drivers (including DOS ODI drivers), Utilities.

<http://www.drDOS.com/dosdoc/Tcpip/transprt/trans.htm>

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FEATURE ↓	SOC ¹ ⇒	ZF Micro Solutions ZFx86 PC-on-a-Chip	AMD Élan SC520	AMD Geode LX900 + CS5536 chipset	Intel ATOM Z530 + US15W chipset
CPU Speed		100MHz	133MHz	LX900 600Mhz	1.6GHz
Power Requirement ²		100MHz sub-1W	133MHz 2.0W	LX900 5.1W + CS5536 @ .6W	Z530 2.3W + US15W Chipset 4.3W
L1 Cache		8K	16K	64K	512K
FPU		YES	YES	YES	YES
Total Active Devices Required ³		ZFx86, 1 DRAM, 1 Flash, Clk Gen	SC520, 2 DRAM, 1 Flash	LX800, CS5536, 4 DRAM, 1 Flash, Clk Gen	Z530, US15W, 8 DRAM, Flash, Clk Gen
Fully PC Compatible		YES	NO	YES	YES
DMA Controller		YES	YES	YES	YES
Interrupt Controller		YES	YES	YES	YES
Timer / Counters		(3) 8254 compatible	YES (3)	8254-equivalent	(1) 8254
Z-TAG™ ⁴		YES	NO	NO	NO
ZF-Logic™ ⁵		YES	NO	NO	NO
FailSafe BOOT® ⁶		YES	NO	NO	NO
BIOS license		YES, included & ready-to-run	NO	NO	NO
Linux Image		YES	NO	NO	NO
DR DOS 7.03 license		YES, included	NO	NO	NO
ISA BUS ⁷		YES	NO	NO	NO
PCI BUS ⁶		YES	YES	YES	PCI Express
I²C BUS ⁶		YES	YES	YES	YES
USB		YES 1.1 (2 ports)	NO	YES 2.0 (4 ports)	YES 1.1 & 2.0 (6 ports)
Serial Ports ⁶		YES, 2 (16550)	2 (16550) (1 multiplexed)	NO	NO
Parallel Port ⁶		YES	NO	NO	NO
Floppy Controller ⁶		YES	NO	NO	NO
HDD Interface		YES, EIDE	YES, IDE	YES, ATA-6	YES, PATA
Graphics Controller		NO	NO	NO	NO
Keyboard Controller ⁶		YES ⁴	NO	NO	NO

FEATURE ↓	SOC ¹ ⇒	ZF Micro Solutions ZFx86 PC-on-a-Chip	AMD Élan SC520	AMD Geode LX900 + CS5536 chipset	Intel ATOM Z530 + US15W chipset
Mouse ⁶		YES	NO	NO	NO
IrDA infrared port		YES	NO	YES	NO
DRAM Bus ⁸		16/32 bit	32 bit only	64 bit only	64 bit only
DRAM Controller		SDRAM	SDRAM	DDR	DDR2
Real-Time Clock		YES	YES	YES	YES
GPIO		YES 8	YES 32 (all multiplexed)	YES	YES 14 (not 5V tolerant)
Watchdog Timer		YES (dual H/W-S/W)	YES (dual H/W-S/W)	NO	NO
Pulse Width Modulator		YES (up to 100KHz)	NO	NO	NO
FLASH decode logic		YES - internal	NO – external device required	NO – external device required	NO – external device required
Software Compatibility		Linux, WinCE, Windows 9x, Windows NT, Various DOS & RTOS	Linux, WinCE, Windows 9x, Windows NT, Various DOS & RTOS	Linux, WinCE, Windows 9x, NT, XP, VISTA & Various RTOS	Linux, WinCE, Windows 9x, NT, XP, VISTA & Various RTOS
Standard Temp Rating		100MHz (0 to 70C) Commercial 100MHz (-40 to 85C) Industrial	133MHz (0 to 85C case temperature operating in free air)	0-85C (max case temp)	-40 to 85C
Voltage		2.2 core, 3.3 I/O, 5V tolerant	2.5 core, 3.3 I/O	2.5 core, 3.3 I/O, 5V tolerant	1.1V
Advanced Power Management		YES	YES	YES	YES
Package		388-ball grid array	388-ball grid array	LX = 481 BGA 5536 = 208 BGA	Z530 = 441 FCBGA US15W = 1249 FCBGA
Production Guarantee		YES	NO	NO	YES

¹ Note that neither the AMD LX900 nor the Intel Z530 are true SOC's. They are CPUs that require additional components to perform "computer" functions. The AMD SC520, is more highly integrated but it lacks the ability to BOOT autonomously like the ZFx86.

² Total system power could be significantly higher due to requirement for additional components i.e. Super I/O, memory requirement

³ Total number of active devices required by ZFx86 competitors to boot and run an operating system with ONLY the features shown in the respective column. Additional components are required to match all functions of the ZFx86.

⁴ Z-Tag high-speed serial access allows field or factory software downloads at more than 100 times normal serial speeds.

⁵ ZF-Logic chip select controls ease system integration.

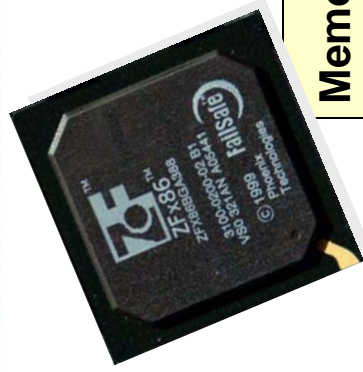
⁶ Fail-Safe Boot® ROM redundant boot mechanism for full recovery even if BIOS and OS are corrupted.

⁷ ISA, PCI, Floppy, Mouse, parallel port, serial ports with no multiplexing allows all devices to be used simultaneously.

⁸ ZFx86 has a selectable memory bus allowing a fully working system with 1, 2, 4, 8 or 16 SDRAM chips – a significant cost advantage over 64-bit bus devices requiring 8 DRAMs to operate. Intel and ATOM Z530 are trademarks of Intel Corporation. AMD, Élan SC520 and Geode LX900 are trademarks of Advanced Micro Devices, Inc. ZFx86, Z-tag, ZF-Logic and FailSafe are trademarks of ZF.

are built with the FailSafe® ZFx86 PC-on-a-Chip.

Other processors would have to be **FREE*** to compete!



	Intel ATOM Z530	AMD LX900	AMD SC520	ZF Micro ZFx86
Memory Bus Width ¹	64	64	32	16/32
Price 10K units ²	\$65.00	\$56.43	\$41.20	\$33.70
SDRAM @ ~\$4 / chip	\$32	\$32	\$8	\$4
Additional Components	\$42	\$22	\$16	\$0
Fan and/or Heatsink	\$18	\$8	\$0	\$0
BIOS & OS ³ Licenses	\$10	\$10	\$10	\$0
Sub-Total (w/ free CPU from others but ZFx86 at full price)	\$102.00	\$72.00	\$34.00	\$37.75
Total <u>with</u> CPU cost added	\$167.00	\$128.43	\$72.50	\$37.75

*** When was the last time you saw a FREE processor?**

¹ ZFx86 has a selectable DRAM bus allowing a fully operational system with 1 SDRAM.

² Estimates based on web searches as of date of this document.

³ Embedded BIOS and DR DOS 7.03 included in ZFx86 price.

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