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The ZNEO ADVANTAGE

- **16-BIT SINGLE-CYCLE CISC CORE**
- **8-, 16-, 32-BIT ALU OPERATIONS**
- **128 KB OF FLASH MEMORY**
- **16 MB OF EXTERNAL MEMORY**
- **RICH PERIPHERAL SET**

TARGET APPLICATIONS

- UNIVERSAL MOTOR CONTROL
- SYSTEMS MONITORING
- SECURITY PANELS
- SECURITY KEYPAD/DISPLAYS
- INDUSTRIAL CONTROLS

ZNEO® Z16F Series Flash Microcontroller
A 16-bit Single-Cycle CISC MCU Solution

Overview

From the company that brought you the revolutionary Z80® comes the future of 16-bit processing - the ZNEO Z16F Series Flash Microcontroller. Zilog's ZNEO Z16F is a powerful 16-bit CISC microcontroller that outperforms most RISC microcontrollers in its class. The ZNEO Z16F boasts a unique architecture that provides the power, punch, and performance of a 32-bit, with the code, current efficiency, and cost of a 16-bit. The ZNEO Z16F CPU boasts a highly optimized instruction set that achieves higher performance per clock cycle, with less code space and lower overhead than competing architectures.
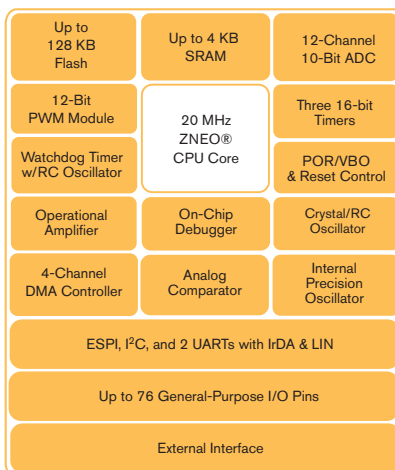
This powerful, yet simple core with sixteen 32-bit general-purpose registers supports complex CISC addressing modes and a single-cycle instruction set that includes frame pointer support, multi-bit shift, and multi-register push/pop, as well as performance enhancing instructions such as Link and Unlink for lowering overhead. Powerful signed and unsigned math operations include 32x32 multiply and 64/32 divide operations.

A rich array of intelligent peripherals and analog features make this microcontroller suitable for a large number of applications, including security panels, industrial controls and motor control, including AC Induction and Brushless DC motors.

ZNEO Z16F Key Feature Summary

- 16-bit optimized Single-Cycle CISC core
- 128 KB of in-circuit programmable Flash memory
- Highly integrated Digital/Analog peripherals
    - Operational Amplifier
    - Analog Comparator
    - Internal Precision Oscillator
    - 4-Channel DMA Controller
    - 12-bit PWM module
- Flexible communication interfaces, including two 9-bit UARTs with LIN & IrDA, I²C, ESPI
- 12-Channel, 10-bit ADC with a time tag that supports simultaneous conversions

ZNEO Z16F Block Diagram

Up to 128 KB Flash	Up to 4 KB SRAM	12-Channel 10-Bit ADC
12-Bit PWM Module	20 MHz ZNEO® CPU Core	Three 16-bit Timers
Watchdog Timer w/RC Oscillator		POR/VBO & Reset Control
Operational Amplifier	On-Chip Debugger	Crystal/RC Oscillator
4-Channel DMA Controller	Analog Comparator	Internal Precision Oscillator
ESPI, I²C, and 2 UARTs with IrDA & LIN		
Up to 76 General-Purpose I/O Pins		
External Interface		

ZNEO CPU Core Features

- Register-to-register-based architecture
- 20 MIPS throughput at 20 MHz
- 8-, 16-, and 32-bit ALU operations
- 16-bit internal and external bus widths
- Built-in 32 x 32 multiply operations (signed and unsigned)
- Built-in 64 by 32 divide (unsigned)
- Compiler friendly instruction set

ZNEO Z16F Flash Controller Detailed Feature Set

KEY HARDWARE FEATURES
- ZNEO CPU CORE
- ON-CHIP FLASH MEMORY
- ANALOG PERIPHERALS
- COMMUNICATION PERIPHERALS

ZNEO CPU CORE

Zilog's ZNEO Z16F CPU meets the continuing demand for faster and more code-efficient microcontrollers. The ZNEO Z16F CPU features are as follows:

- Pipelined architecture: Fetch, Decode, and Execute
- 16 MB of Program memory address space for object code and data with 8- or 16-bit data paths
- 8-, 16-, and 32-bit ALU operations
- 24-bit stack with overflow protection
- Direct register-to-register architecture allows each memory address to function as an accumulator. This improves execution time and decreases the required program memory
- New instructions improve execution efficiency for code developed using higher-level programming languages including 'C'

For more information on the core architecture, please refer to the ZNEO Z16F CPU User Manual (UM0188) available for download at www.zilog.com.

ON-CHIP FLASH MEMORY

The products in the ZNEO Z16F Series feature up to 128 KB of non-volatile Flash memory with read/write/erase capability. The Flash memory is programmed and erased in-circuit by either user code or through the On-Chip Debugger (OCD). The Flash memory array is arranged in 2 KB pages. The 2 KB page is the minimum Flash block size that is erased. The Flash memory is also divided into eight sectors, which is protected from programming and erase operations on a per sector basis.

ANALOG PERIPHERALS

The ZNEO Z16F Series devices include a 12-channel ADC. The ADC converts an analog input signal to a 10-bit binary number. The features of the successive approximation ADC include:

- 12 analog input sources multiplexed with GPIO ports.
- 2.5 µs conversion time
- Automatic Time-Tag of results
- Programmable timing controls

The ZNEO Z16F devices feature a general-purpose comparator and an operational amplifier.

- Moderate speed comparator (200 ns propagation delay) with a maximum input offset of 5 mV
- Two-input, one-output operational amplifier with a typical open loop gain of 10,000 (80 dB)

COMMUNICATION PERIPHERALS

The ZNEO Z16F devices feature a rich array of communication peripherals, including:

- 2 UARTs
    - LIN Master/Slave
    - IrDA Encoder/Decoder
    - Multiprocessor 9-bit Mode
- Enhanced SPI (ESPI)
- I²C Master/Slave

ZNEO Z16F Flash Controller Detailed Feature Set (continued...)

KEY HARDWARE FEATURES
- FLEXIBLE TIMERS
- DMA CONTROLLER
- INTERRUPT CONTROL
- IPO
- SINGLE-PIN DEBUG

FLEXIBLE TIMERS

The ZNEO Z16F Series contains three 16-bit reloadable timers used for timing, event counting, or generation of Pulse Width Modulator (PWM) signals. The timers include the following features:

- 3-Phase, 12-bit PWM with 6 outputs
- 3, 16-bit timers with 8 Modes
- Watchdog timer with RC Oscillator

4-CHANNEL DMA CONTROLLER

The four DMA channels are used to transfer data from memory to memory, memory to peripherals, peripherals to memory, or peripherals to peripherals. The features of DMA controller include:

- Four independent DMA channels
- Supports Internal and External Memory
- Direct and Linked List Modes
- Round-Robin Channel Priority
- Byte, word, or quad operation, up to 64K transfers (64 KByte, 64 KWord or 64 KQuad)
- Shared bandwidth ZNEO Core

FLEXIBLE INTERRUPT CONTROL

The ZNEO Z16F Series includes offers interrupt control flexibility including:

- 8 External Rising or Falling Edge
- 4 External Dual Edge
- Vectored or Polled Interrupts
- 24 Interrupts with 3 Programmable Priority Levels

INTERNAL PRECISION OSCILLATOR

The ZNEO Z16F incorporates a fully integrated Internal Precision Oscillator (IPO) that eliminates the need for external components. With nominal untrimmed accuracy of ±30%., and the ability to manually trim the oscillator to achieve a ±4% frequency accuracy over the operating temperature and supply voltage range of the device, the ZNEO Z16F provides a best-in-class IPO feature set, including:

- On-chip RC oscillator which does not require external components
- Nominal ±30% accuracy without trim or manually trim the oscillator to achieve a ± 4%
- Typical output frequency of 5.5296 MHz or 32 kHz
- Trimming possible through Flash option bits with user override
- Eliminates crystals/ceramic resonators in applications where high timing accuracy is not required

SINGLE-PIN ON-CHIP DEBUG

All of Zilog's embedded Flash devices offer a uniquely integrated On-Chip Debugger (OCD) that provides the following advanced features:

- Only 1 pin, frees up other pins
- Unlimited Software Breakpoints
- 4 Hardware Breakpoints
- In-Circuit Flash Programming
- Instruction Execution Trace

ZNEO Z16F Development Tool Support

The ZNEO Z16F devices are backed by a comprehensive development tools package that includes all the necessary design essentials to get your application up and running in record time.

- ZNEO® Z16F Series Development Board
- USB Smart Cable for PC to ZNEO® Z16F Series
- 5 V DC power supply

The ZNEO Z16F Series is also supported by ZDS II—Zilog's Integrated Development Environment (IDE) with ANSI C-Compiler (available on www.zilog.com). The ZDS II IDE includes:

- Sample Code
- Product Specifications (Data Sheets)
- Product Briefs
- ZNEO® CPU User Manual

Hardware Tools & Part Number Ordering Information

- ZNEO® Z16F Series Development Kit (part #: Z16F2800100ZCOG)

- Opto-Isolated USB Smart Cable Accessory Kit (part #: ZUSBOPTSC01ZACG)

- USB Smart Cable Accessory Kit (part #: ZUSBSC00100ZACG)

- Ethernet Smart Cable Accessory Kit (part #: ZENETSC0100ZACG)

ZNEO Z16F Design Architecture
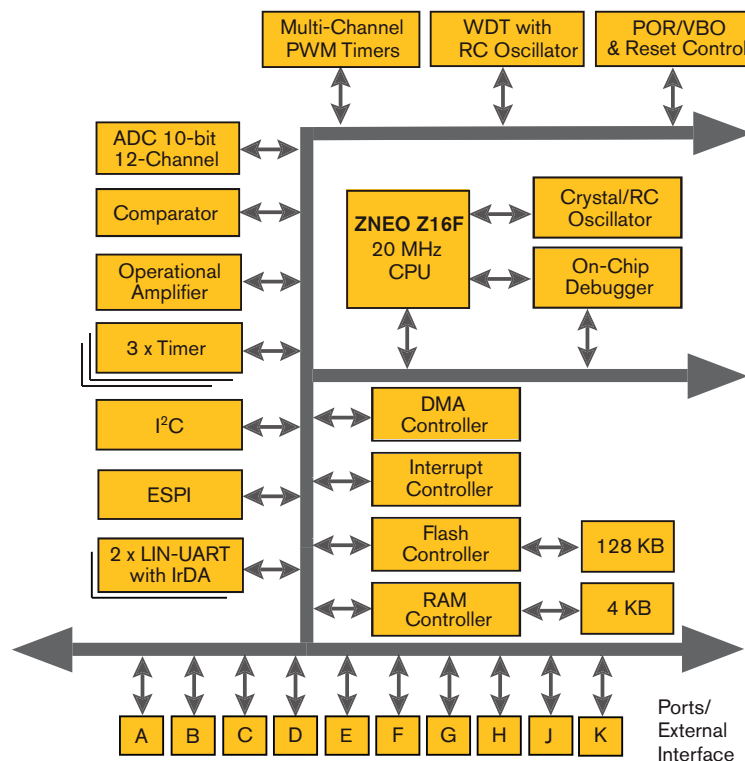
ZNEO Z16F Block Diagram & System Flow Chart

Silicon Ordering Information

Order the ZNEO Z16F Flash microcontrollers from your local Zilog sales representative by using the part numbers below. For more information, or to download product collateral and/or software, please visit us at www.zilog.com.

Part Number	Description/Options	Packages
Z16F28XXXX20XX	20 MHz; 128 KB Flash; 4 KB RAM; Up to 76 I/O; Std/Ext/AutomotiveTemp.	80-pin QFP, 100-pin LQFP 64-pin LQFP, 68-pin PLCC
Z16F64XXXX20XX	20 MHz; 64 KB Flash; 4 KB RAM; Up to 76 I/O; Std/Ext/AutomotiveTemp.	100-pin LQFP, 80-pin QFP
Z16F32XXXX20XX	20 MHz; 32 KB Flash; 2 KB RAM; Up to 76 I/O; Std/Ext/AutomotiveTemp.	100-pin LQFP, 80-pin QFP

Note: The 'X's' represented in the part numbers above refer to multiple options available at the time of ordering . The first 'XX' denotes device type (available with or without an External Interface); the second 'XX' denotes pin count and package. The final two "XX" placeholders denote temperature options. Contact your local Zilog sales representative for more information and a complete list of available devices, or visit Zilog's corporate website at www.zilog.com.

Documentation

The collateral referenced below is just a sample of the documentation available for the ZNEO Z16F Series of embedded Flash controllers. For a complete listing of all available application notes, product specifications, user manuals, and sample libraries, please visit us at www.zilog.com.

Document Number	Description
PS0220	ZNEO® Z16F Series Product Specification
QS0057	ZNEO® Z16F Series of Microcontrollers Quick Start Guide
UM0188	ZNEO® CPU User Manual
UM0202	ZNEO® Z16F Series of Microcontrollers Development Kit User Manual
UM0171	Zilog Developer Studio II—ZNEO® User Manual

LIFE SUPPORT POLICY

ZILOG'S PRODUCTS ARE NOT AUTHORIZED FOR USE AS CRITICAL COMPONENTS IN LIFE SUPPORT DEVICES OR SYSTEMS WITHOUT THE EXPRESS PRIOR WRITTEN APPROVAL OF THE PRESIDENT AND GENERAL COUNSEL OF ZILOG CORPORATION.

As used herein
Life support devices or systems are devices which (a) are intended for surgical implant into the body, or (b) support or sustain life and whose failure to perform when properly used in accordance with instructions for use provided in the labeling can be reasonably expected to result in a significant injury to the user. A critical component is any component in a life support device or system whose failure to perform can be reasonably expected to cause the failure of the life support device or system or to affect its safety or effectiveness.

Engineering Notes:

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