



Programming the Internal Flash Memory of the ZNEO® Z16F Series

AN021302-0508



Abstract

This application note describes how to use sample code to program the internal Flash memory of Zilog's ZNEO® Z16F Series.

► **Note:** *The source code file associated with this application note, AN0213-SC01.zip is available for download at www.zilog.com.*

Product Overview

The ZNEO Z16F Series Flash microcontrollers are based on Zilog's advanced ZNEO 16-bit CPU core. The ZNEO Z16F Series MCU family of devices set a new standard of performance and efficiency with up to 20 MIPS at 20 MHz. It supports 16-bit internal and external bus widths and provides near single cycle instruction execution.

The external interface allows seamless connection to external memory and peripherals. A 24-bit address bus and a selectable 8-bit or 16-bit data bus allows parallel access up to 16 MB. Up to 128 KB internal Flash memory is accessible by the ZNEO CPU, 16-bits at a time to improve processor throughput. Up to 4 KB internal RAM provides storage of data, variables, and stack operations. Like the Flash memory, the internal RAM can be accessed with 16-bit access paths for improved processor performance.

The ZNEO Z16F Series features a high speed 12-channel 10-bit SAR Analog-to-Digital Converter (ADC) with a sample and hold circuit. The ADC facilitates analog input signal to a 10-bit binary number conversion. It also features an operational amplifier and an analog comparator.

The 12-bit Pulse-Width Modulation (PWM) module provides three complementary pairs or six independent PWM outputs with deadband generation and fault protection trip input. These features provide multiphase control capability for a variety of motor types. It ensures safe operation of the motor by pulse-by-pulse or latched fast shutdown of the PWM pins during fault condition.

The ZNEO Z16F Series features two full-duplex Universal Asynchronous Receiver/Transmitter (UART) providing 8-bit asynchronous data transfer and supporting the Local Interconnect Network (LIN) serial communications protocol.

Two fully functional, high performance UART to Infrared Encoder/Decoders (Endecs), allowing Infrared Data Association (IrDA) encoding and decoding capability.

The Enhanced Serial Peripheral Interface (ESPI) and I²C Master/Slave Controller allows easy data exchange between ZNEO Z16F Series and peripheral devices.

The new single-pin on-chip debugger (OCD) and programming interface simplifies code development and allows for easy in-circuit programming.

The ZNEO Z16F Series also includes an internal precision oscillator (5.52960 MHz) and 4-channel Direct Memory Access (DMA) Controller that supports internal or external requests.

Figure 1 on page 2 displays the ZNEO Z16F Series block diagram.

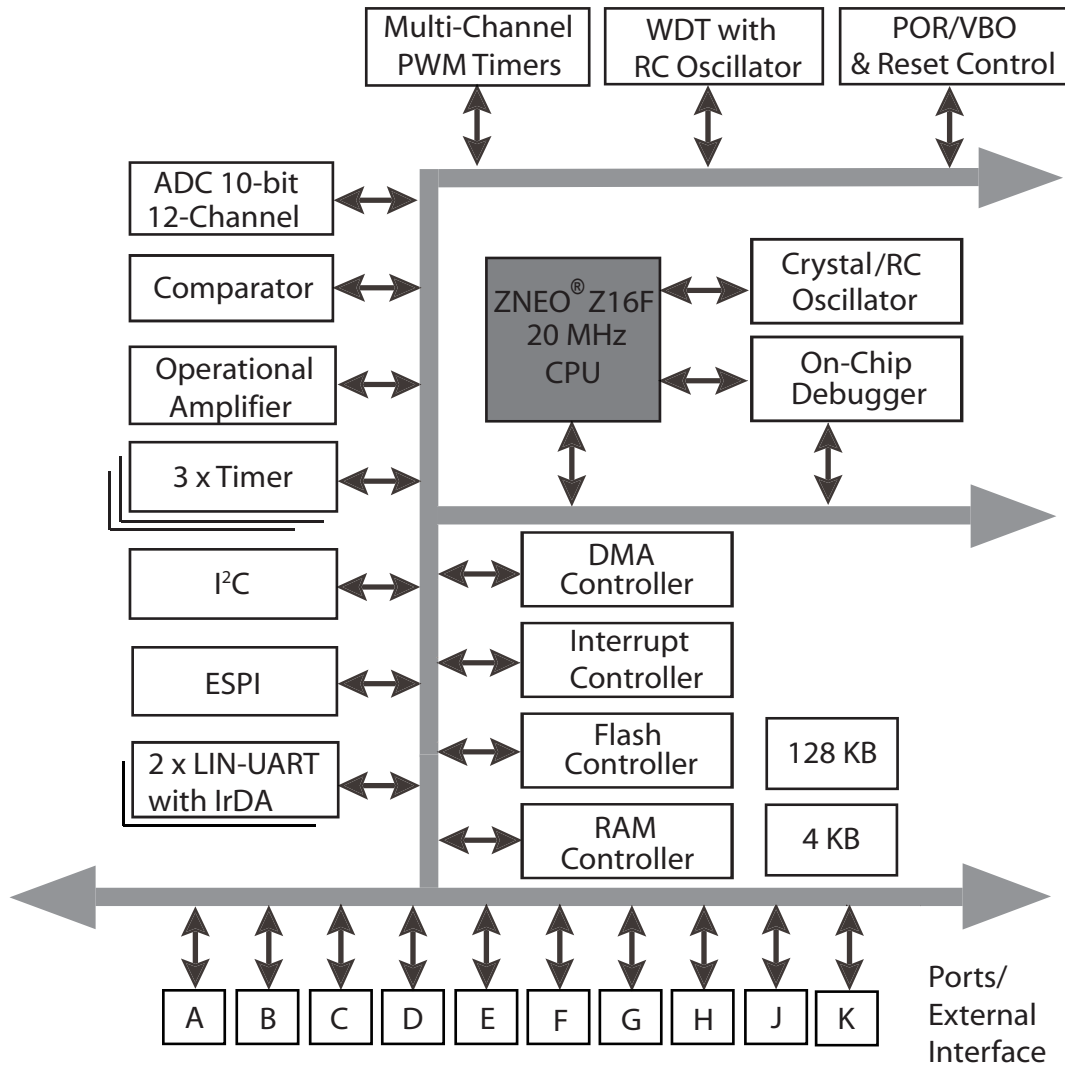


Figure 1. ZNEO Z16F Series Block Diagram



Features

The key features of ZNEO Z16F Series include:

- 20 MHz ZNEO CPU Core
- Up to 128 KB internal Flash program memory with 16-bit access and in-circuit programming capability
- Up to 4 KB internal RAM with 16-bit access
- External Interface allows seamless connection to external data memory and peripherals with the following
 - Six chip selects with programmable Wait states
 - 24-bit address bus supports up to 16 MB
 - Selectable 8-bit or 16-bit data bus widths
 - Programmable Chip Select signal polarity
 - ISA-compatible mode
- 12-channel, 10-bit ADC
- Operational Amplifier
- Analog Comparator
- 4-channel DMA controller supports internal or external DMA requests
- Two full-duplex 9-bit UARTs with support for LIN and IrDA
- Internal Precision Oscillator
- I²C master/slave controller
- ESPI controller
- 12-bit PWM module with three complementary pairs or six independent PWM outputs with dead-band generation and fault trip input
- Three standard 16-bit timers with capture, compare, and PWM capability
- Watchdog Timer (WDT) with internal RC oscillator
- Up to 76 I/O pins
- Up to 24 interrupts with programmable priority
- Single-pin OCD

- Power-On Reset (POR)
- Voltage Brownout Protection (VBO)
- 2.7 V to 3.6 V operating voltage with 5 V tolerant inputs
- 0 °C to +70 °C standard temperature, –40 °C to +105 °C extended temperature, and –40 °C to +125 °C automotive operating ranges

Flash Architecture

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 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.

Table 1 lists the Flash memory configuration for each device in the ZNEO Z16F Series.

Table 1. Flash Memory Configurations

Part Number	Internal Flash Size	Number of Pages	Program Memory Addresses
Z16F2811	128 KB	64	000000H-01FFFFH
Z16F2810	128 KB	64	000000H-01FFFFH
Z16F6411	64 KB	32	0000H-FFFFH
Z16F3211	32 KB	16	0000H-7FFFH

Figure 2 displays the Flash memory arrangement

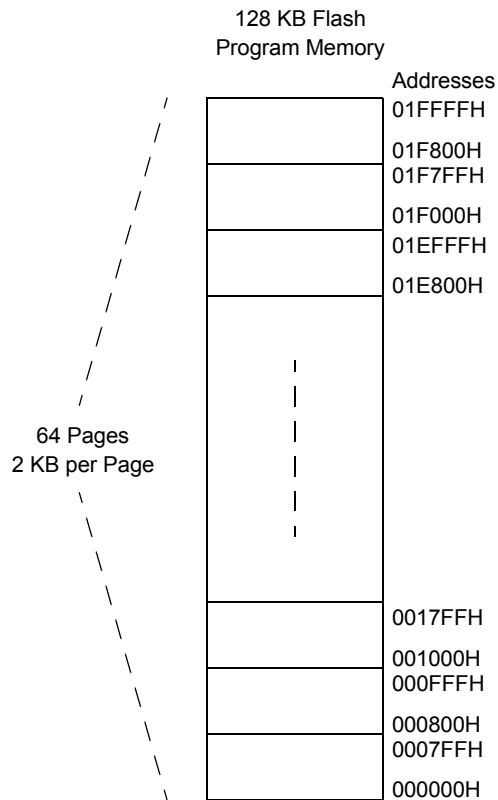


Figure 2. Flash Memory Arrangement

Materials Required

The materials required for programming the internal Flash memory of ZNEO Z16F Series include:

- Z16F2800100ZCOG or ZNEO® application board
- Zilog Developer Studio (ZDS) II integrated development environment (IDE) and documentation (available from www.zilog.com)
- USB Smart Cable
- 5 V DC Power Supply
- ZNEO Series of Microcontrollers Quick Start Guide (QS0057)
- Flash sample project

Procedure

Follow the steps below to program the internal Flash memory of ZNEO Z16F Series:

1. Install the ZDS II IDE and documentation as described in [Installing the ZDSII-ZNEO® Software](#).
2. If you are using the Z16F2800100ZCOG development board, follow the “Setting Up the Development Board” section in the ZNEO-Series of Microcontrollers Quick Start Guide (QS0057).

3. Run the ZDS II software. By default, the ZDS II program is located in the Start menu under

```
Programs → Zilog ZDSII ZNEO
<version_number> → ZDSII ZNEO
<version_number>
```

4. From the File menu, select **Open Project** to display the **Open Project** dialog box.
5. Open the flashsample.zdsproj project.

► **Note:** The source code file associated with this application note, AN0213-SC01.zip is available for download at www.zilog.com.

6. From the **Project** menu, select **Settings** to display the **Project Settings** dialog box.
 - a. Select the **Debugger** page.
 - b. If you are using the USB Smart Cable, ensure that **USBSmartCable** is selected in the Current drop-down list box.
 - c. In the Debug Tool area, click **Setup** to ensure that the USB Smart Cable serial number is available.
 - d. Click **OK** to confirm changes and exit the **Project Settings** dialog box.
7. From the **Build** menu, select **Rebuild All**.
8. From the **Debug** menu, select **Reset** to connect and download the code on the target board.

9. In the **Project Workspace** window, double-click on the `test.c` file to display it in the **Edit** window.
10. Double-click in the **Gutter** to the left of line 52 to set a breakpoint.
11. From the **Debug** menu, select **Go**. The yellow arrow (program counter code line indicator) stops at the breakpoint for a pass condition.
12. On the **Debug Windows** toolbar, click on the **Memory Window** button to display the **Memory window**. Examine address `M#001F000`. The data written starts with a value of `0x0000` and increments by 1.

► **Note:** *Another option is to use a hyperterminal to view the pass or fail message.*

Installing the ZDSII-ZNEO® Software

Perform the following steps to install the software tools:

1. Insert the ZDS II CD into your computer's CD-ROM drive. DemoShield launches automatically. If it does not automatically launch, go to the root of the CD-ROM and double-click the file `launch.exe`.
2. DemoShield provides several installation choices. Select "Install Zilog Developer Studio" to install now. You can install other software and accompanying documentation later.
3. Follow the instructions on the screen to complete the installation.

Summary

This application note demonstrates how to use sample code to program the internal Flash memory of the ZNEO Z16F Series. The internal Flash memory is accessed with 16-bit access paths for improved processor performance.

References

The documents associated with ZNEO Z16F Series available on www.zilog.com are provided below:

- *ZNEO Series of Microcontrollers Quick Start Guide (QS0057)*
- *ZNEO Z16F Series Product Specification (PS0220)*



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