Application Note

Migration from Z8 Encore!® F0830 Series to F083A Series

AN024504-0408

Abstract

This application note highlights the differences between Zilog's Z8 Encore!® F083A series and Z8 Encore! F0830 series MCUs and reviews the key features when migrating an application/design from Z8 Encore! F0830 series to Z8 Encore! F083A series MCUs. It also mentions silicon differences between Z8 Encore! F083A series and Z8 Encore! F0830 series MCUs from block-level, software, and register-level perspective.

In addition, it also provides an example application along with snippets of source code for accomplishing the Analog-to-Digital Converter (ADC) functionality in Z8 Encore! F083A MCU.

Note: *The source code file associated with this application note,* `AN0245-SC01.zip`*, is available for download at* www.zilog.com.

Z8 Encore! F083A Series Overview

Z8 Encore! MCU series of products are the first in line of Zilog® microcontroller products, based on the 8-bit eZ8™ CPU. Z8 Encore! F083A series MCUs expand on Zilog's extensive line of 8-bit microcontrollers. The Flash in-circuit programming capability allows the faster development time and program changes in the field (customer applications). The new eZ8 CPU is upward compatible with existing Z8® CPU instructions. The rich peripheral set of Z8 Encore! F083A series makes it suitable for various applications including motor control, security systems, home appliances, personal electronic devices, and sensors.

Features

The Z8 Encore! F083A series MCUs include the following features:

- 20 MHz eZ8 CPU
- Up to 8 KB Flash memory with in-circuit programming capability
- 256 B register RAM
- 100 B Non-Volatile Data Storage (NVDS)
- Up to 23 I/O pins
- Internal precision oscillator with accuracy of +/-4% full voltage/temperature range
- External crystal oscillator
- Two enhanced 16-bit timers with capture, compare, and pulse-width modulation (PWM) capability
- Watchdog Timer (WDT) with dedicated internal RC oscillator
- On-chip debugger
- On-chip analog comparator
- 17 vectored interrupts
- Voltage Brownout (VBO) protection
- Power-On Reset (POR)
- 2.7 V to 3.6 V operating voltage
- Eleven 5 V tolerant input pins
- 20- and 28-pin packages
- 0 °C to +70 °C standard temperature ranges and -40 °C to +105 °C extended operating temperature ranges

Discussion

Figure 1 displays an overview of the modules which are different between Z8 Encore!® F083A series and Z8 Encore! F0830 series MCUs. The changes occur in the following blocks:

- Modified and enhanced (gray)

  Modules in this category contain some modified and/or enhanced features. Application designs are impacted by this feature.

- No change (green)

  Modules in this category contain identical features, and are functionally compatible. The application design is not impacted.

- Blocks different (yellow)

  Modules in this category contain a new implementation of the block, and are not functionally compatible. The application design is impacted.

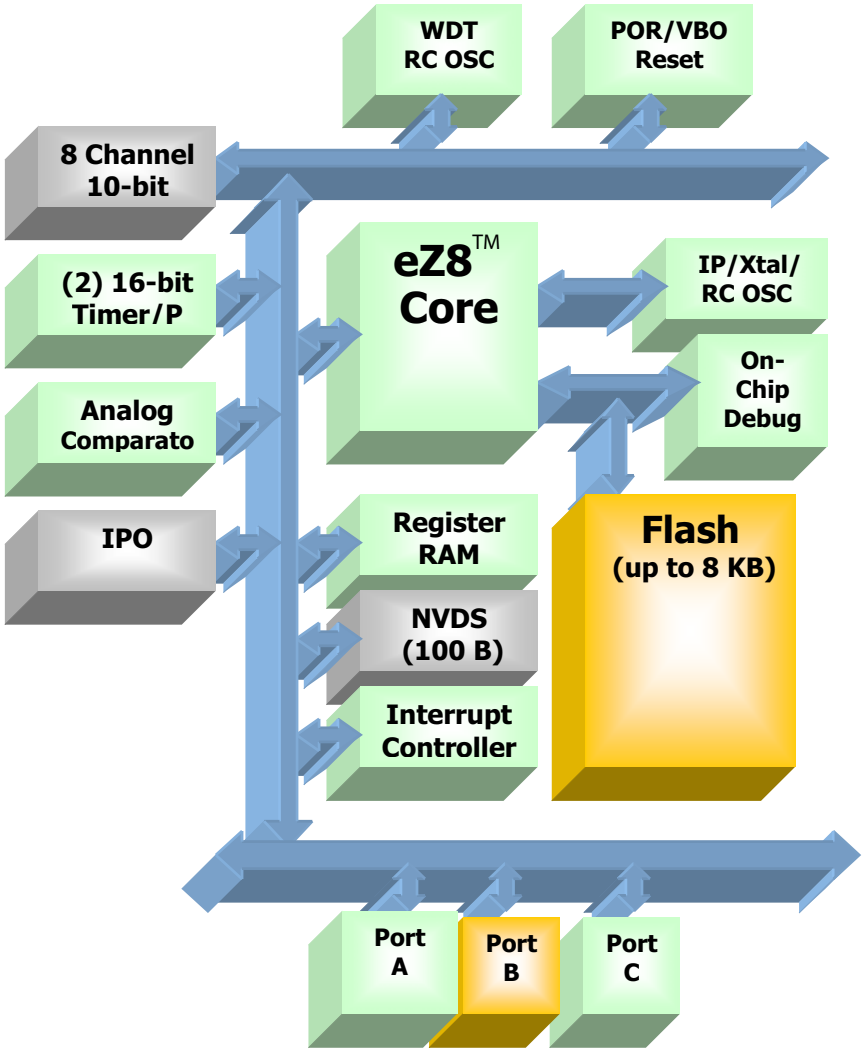

Figure 1. Z8 Encore! Z8F083A Series MCUs Block Diagram

Table 1 summarizes the feature differences and impact in the existing design/application note when migrating from Z8 Encore! F0830 series to Z8 Encore! F083A series MCUs.

Table 1. Feature Differences Between Z8 Encore!® F083A Series and Z8 Encore! F0830 Series MCUs

Feature	Z8 Encore! F0830 Series	Z8 Encore! F083A Series	Difference	Description	Existing Design Impact
eZ8 CPU			No change	20 MHz operation	No impact
GPIO	Up to 25 I/O	Up to 23 I/O	Blocks different	PB6/PB7 not available on F083A	25 I/O version not offered
Interrupts	Up to 17	Up to 17	No change	No change	No impact
Pin Compatibility			No change	Pin-to-pin compatible	No impact
Assembly compatibility			No change	Assembly code compatible	No impact
Packaging	PDIP, QFN, SOIC, SSOP	SSOP and SOIC	Blocks different	28-pin DIP package not offered	Impact
PWM			No change		No impact
Comparator			No change		No impact
Flash	Up to 12 KB	Up to 8 KB	Blocks different	Less Flash for application code	12 KB version not offered
RAM			No change		No impact
NVDS	64 B	100 B	Modified and/or enhanced	Non-Volatile Data Storage	No impact
ADC	Successive approximation (SAR)	Successive approximation (SAR)	Modified and/or enhanced	A fast ADC with a conversion time of 2.8 µs	Initialize new ADC control register ADCCP for higher clock speed
IPO	5.53 MHz 32 kHz	20 MHz 119 kHz	Modified and/or enhanced	4x faster system clock with IPO	Adjust the software for higher speed if necessary

Modifications and Migration from Z8 Encore! F0830 Series to F083A Series MCUs

This section describes the features that are different/enhanced/modified and changes to be done in the software while migrating from Z8 Encore! F0830 series to Z8 Encore! F083A series MCUs.

Table 2 shows a top level view of peripheral initialization and usage from software perspective.

Table 2. Top Level View of Peripheral Initialization and Usage

Peripheral Initialization and Usage	Software Initialization	Usage
GPIO	Same	Same
Flash	Same	Same
IPO	Same	Same
Comparator	Same	Same
ADC	Different (see Dual Fan Controller Implementation)	Different
Timer	Same	Same

Table 3 shows the register differences between Z8 Encore! F083A series and Z8 Encore! F0830 series MCUs.

Table 3. Register Differences Between Z8 Encore! F083A Series and Z8 Encore! F0830 Series MCUs

	Z8 Encore! F0830 Series	Z8 Encore! F083A Series	Difference	Description	Design Impact
RAM	000-0FF	000-0FF	Same	256 B	No impact
Special Function Registers					
Peripheral registers except ADC and oscillator	Same		Same	None of the peripheral registers, other than ADC and oscillator, definitions has changed	No impact
ADC registers	ADC div16	ADC clock divider selectable	Different	New ADC control register ADCCP to select clock divider for div1, div2, div4, div8, or any combination	Use the new ADCCP register for faster conversion time 10 MHz maximum for 2.8 µs conversion
Oscillator Control Register	5.53 MHz/ 32 kHz	20 MHz or 119 kHz	Enhanced	Oscillator control register SCK set bits 2-0 when 000= 20 MHz 001=119 kHz	Adjust software to new system clock speed

Successive Approximation Analog-to-Digital Converter

When migrating from Z8 Encore! F0830 series to Z8 Encore! F083A series MCUs, all the peripherals are same except ADC and the new ADC Clock Prescale Control Register ADCCP, which is used to provide a divided system clock to the ADC.

At 20 MHz, this provides a fast conversion time of 2.8 µs. The ADCCP register needs to be initialized when migrating from Z8 Encore!® F0830 series to Z8 Encore! F083A series MCUs.

Analog-to-Digital Converter Initialization Code

The sample code to initialize the SAR ADC for Analog Channel "1" is shown below.

```
//////////////////////////////////////////////////////
// Initialize ADC for Analog Ch "1"
//////////////////////////////////////////////////////

void init_adc(void)
{
   PBAF= 0x02;                  //0000 0010b PB1
   PBAFS1 |= 0x02;              //Select Alternate Function for Port B1
                                //(ANA1)

   PBAF   = 0x20;               //0010 0000b PB5
   PBAFS1 |= 0x20;              //Select Alternate Function for Port
                                //B5 (Vref)
   ADCCP = 0x01;                //Select 20 MHz system clock divide by 2
                                //(div2) for 2.8 us conversion.
   ADCCTL0 = 0x31;              //0011 0001
                                //Bit 5 = 1 Internal reference
                                //voltage for ADC is Enabled
                                //Bit 4 = 1 ADC is Enabled for normal use
                                //Bit [2:0] = 001 Conversion on ANA1
   ADCSST = 0x0F ;              //Sample Settling Time Register
   ADCST = 0x7F;                //Sample Hold Time

}
```

Sample Code to Read ADC

Once the ADC channel is initialized, the sample code to read the initialized channel, is as shown below.

```
{
   ADCCTL0 |= 0x80;             //Start conversion

   while ( (ADCCTL0 & 0x80) == 0x80);
                                //Wait until conversion is done

   ADC_CH1 = ADCD_H;            //Read in Speed Command
}
```

To switch between channels, modify the ADC control register least three (3) significant bits to reflect the channel that needs to be sampled. For example, if channel 3 needs to be read, followed by channel 6, see the following sample code.

```
{
   ADCCTL0 &= 0xF8;
   ADCCTL0  |=  0x03;          //Assign channel-3

   ADCCTL0 |= 0x80;            //Start conversion

   while ( (ADCCTL0 & 0x80) == 0x80);
                               //Wait until conversion is done

   ADC_CH3 = ADCD_H;           //Read in Speed Command

   ADCCTL0 &= 0xF8;
   ADCCTL0  |=  0x06;          //Assign channel-6

   ADCCTL0 |= 0x80;            //Start conversion

   while ( (ADCCTL0 & 0x80) == 0x80);
                               //Wait until conversion is done
   ADC_CH6 = ADCD_H;           //Read in Speed Command
}
```

Dual Fan Controller Implementation

The following I/O configurations are used:

- One PWM output for Fan 1, PWM0 - T0OUT(PA1).
- One PWM output for Fan 2, PWM1 - T1OUT(PA7).
- One Fan Select, PB0.
- One Current Sense Input, Comparator Positive Input, and CINP (PC0).
- One ADC input for speed, ANA1 (PB1).

Tools Used

The 28-pin Z8 Encore!® F083A MCU is used with Zilog Developer Studio (ZDS II) v4.10.0 on the dual fan controller board. The fan controller board with a Z8 Encore! F083A MCU is used to test the final application.

Testing the Application

Testing of the dual fan controller application uses the demonstration board as per the schematic provided using the 28-pin Z8 Encore! F083A MCU and ZDS II for Z8 Encore!®—ZDS II v4.10.0.

Some of the settings in the application code are as follows:

- Set system clock to 20 MHz IPO.
- ADC (Channel 1 with Pre-scale = 1, and default values used for Sampling Hold/Settling Time registers).
- Comparator (internal 0.2 V used as negative input for comparator).
- Both PWMs (in single mode) with automatic shutdown.
- ADC Clock Prescale set to div2 for 2.8 µs conversion.

Summary

This application note highlights the differences between Z8 Encore! F083A series and Z8 Encore! F0830 series MCUs. The code snippets for some of the changed blocks provide an easy migration path. The Dual Fan Controller application with the schematic and the complete source code is provided as a demo to highlight some of the functionality of the Z8 Encore!® F083A series MCUs.

References

Further details about the Z8 Encore!® F083A series MCUs are available in the references below:

- eZ8™ CPU User Manual (UM0128)
- Z8 Encore!® F083A Series Product Specification (PS0263)
- Z8 Encore!® F0830 Series Product Specification (PS0251)

Appendix A—Schematic Diagrams

Figure 2 displays the schematic diagram of a dual fan controller.

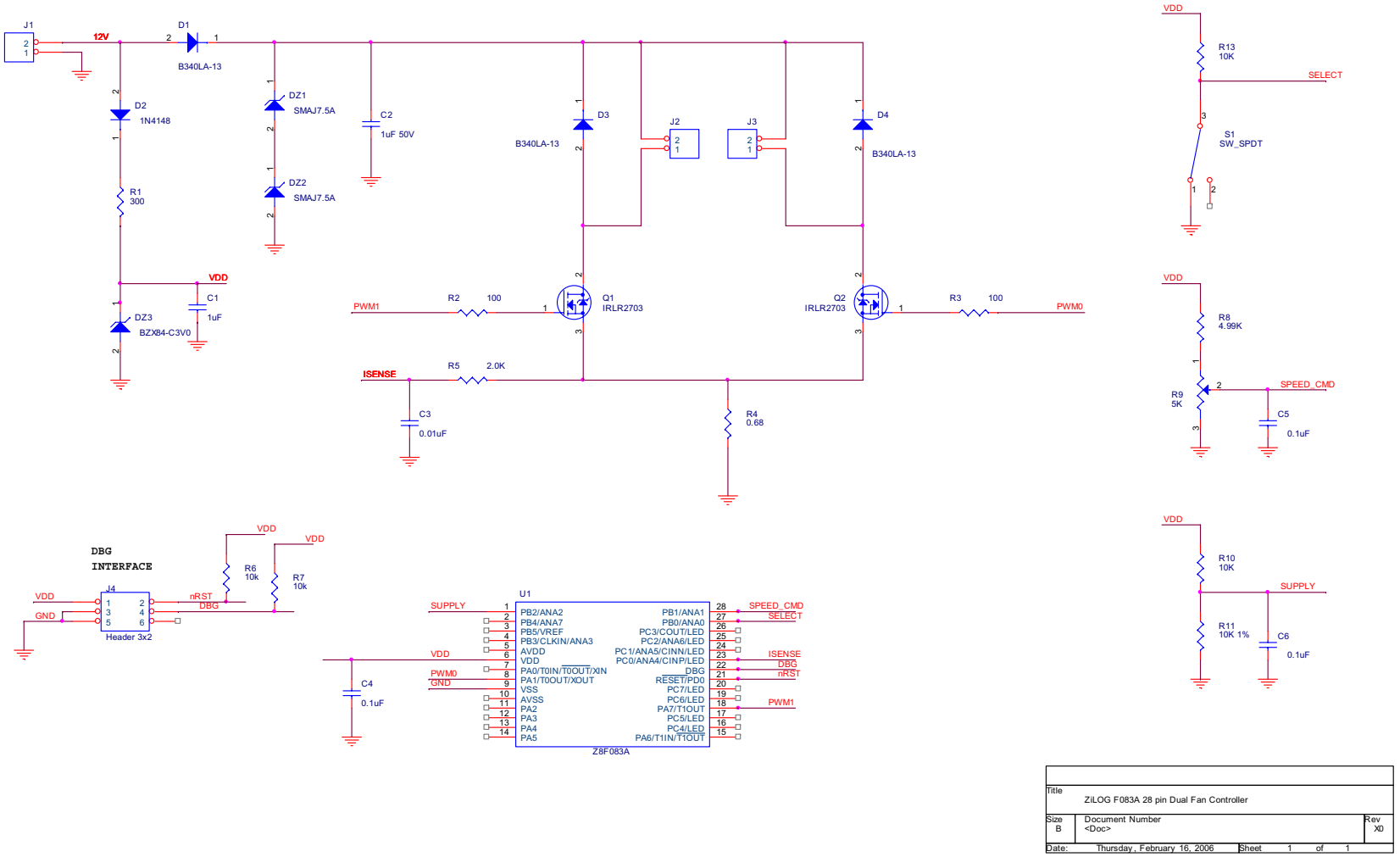

Figure 2. Schematic Diagram of Dual Fan Controller

Appendix B—Flowchart

Figure 3 displays the flowchart for the dual fan controller application code.

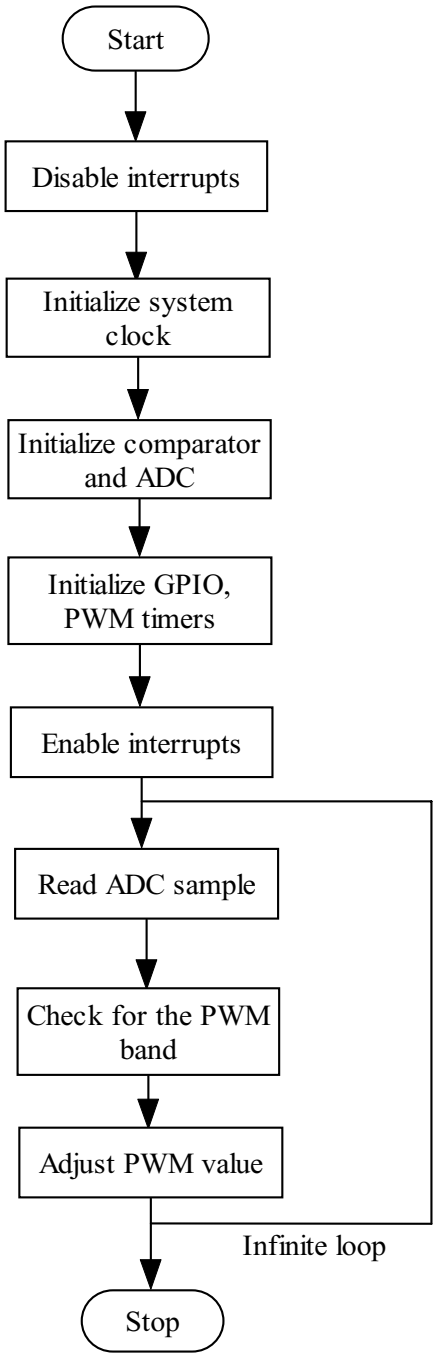

Figure 3. Flowchart for the Dual Fan Controller Application Code

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