



**F1680 ADVANTAGE**

- LOW POWER - 1.8 V
- HIGHLY INTEGRATED PERIPHERALS
- FLEXIBLE MEMORY OPTIONS
- OPTIMIZED COST/PERFORMANCE

**TARGET APPLICATIONS**

- TOUCH SCREEN PANELS
- STEPPER MOTOR CONTROL
- TOUCH PAD/PANEL CONTROL
- HOME FITNESS EQUIPMENT
- INDUSTRIAL CONTROL
- SECURITY CONTROL PANELS
- CONSUMER ELECTRONICS

## Z8 Encore! XP® F1680 Series 8-Bit Flash Solution with Extended Peripherals

### Overview

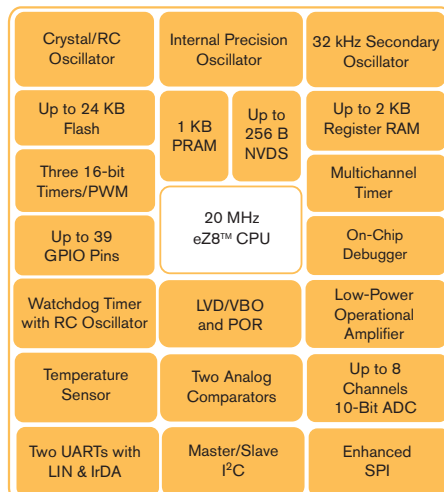
The Z8 Encore! XP F1680 Series of flash microcontrollers is a family of highly integrated, low voltage/low power, best cost/performance 8-bit mixed-mode Flash microcontrollers. The devices are based on the popular eZ8™ CPU core with highly integrated analog and digital peripheral features that are optimized for the touch screen panel and motor control markets. The F1680 Series of flash microcontrollers, Zilog's first 1.8 volt, low power flash MCU series, supports 1.8–3.6 V operation with very low ACTIVE, HALT and STOP mode currents, and many power saving features.

The Z8 Encore! XP F1680 Series ties together key peripherals to offer a perfect solution for those looking for a device that can accommodate such features as capacitive and resistive sensing, touch screen functionality, backlit control, panel control and temperature compensation. Additionally, the F1680 Series incorporates a best-in-class feature set that is optimized for stepper motor/micro stepping control, making it an excellent product of choice for applications that require both touch screen and step motor functionality. This fully integrated, single-chip solution helps simplify your overall system design, afford a better system Bill of Materials (BOM) cost, and allows a fast time-to-market advantage over competing solutions. The F1680 Series is also a full drop-in/pin compatible replacement to any existing Z8 Encore! XP 20- or 28-pin device.

### F1680 Series Key Feature Summary

- 20 MHz register-based eZ8 CPU core with memory-to-memory arithmetic operation
- Memory: up to 24 KB Flash memory, up to 2 KB register RAM and 256 Bytes EEPROM capability
- Up to 8-channels, 10-bit Analog-to-Digital Converter (ADC) with fast 4.9 μs conversion time
- On-chip temperature sensor, low-power Op Amp, two analog comparators, and programmable LVD
- Three enhanced 16-bit Timers with Capture/Compare/PWM and demodulation capability
- Built-in internal precision oscillator with programmable output from 43.2 kHz to 11 MHz
- Multiple serial interfaces with two LIN UARTs, ESPI, and I²C
- Single-pin On-Chip Debugger (OCD) for ultimate design flexibility

### F1680 Series Block Diagram



### eZ8 CPU Core Features

- New instructions for improved performance including BIT, BSWAP, BTJ, CPC, LDC, LDCI, LEA, MULT, and SRL
- New instructions supporting 12-bit linear addressing of the Register File
- Compatible with existing Z8® code
- Up to 10 MIPS operation
- C-Compiler friendly
- 2 to 9 clock cycles per instruction

## F1680 Series Flash Microcontroller Detailed Feature Set

### KEY HARDWARE FEATURES

- eZ8 CPU CORE
- MEMORY
- ANALOG PERIPHERALS
- COMMUNICATIONS PERIPHERALS

### eZ8™ CPU CORE

The Zilog's eZ8 CPU, latest 8-bit CPU meets the continuing demand for faster and more code efficient microcontrollers. It executes a super set of the original Z8® instruction set. The eZ8 CPU features include:

- Pipelined instruction fetch and execution
- Direct register-to-register-based architecture
- Software stack allows greater depth in sub-routine calls and interrupts over hardware stacks
- Expanded internal Register File allows access up to 4 KB
- New instructions improve execution efficiency for code development

### MEMORY

The products in the Z8 Encore! XP F1680 Series feature either 24 KB, 16 KB, and 8 KB of on-chip, non-volatile Flash memory with read/write/erase and in-circuit programming capability. The Flash memory can be programmed and erased by either user code or through the On-Chip Debugger (OCD).

The Z8 Encore! XP F1680 Series supports EEPROM capability through a Non-Volatile Data Storage (NVDS) element of up to 256 bytes. This memory can perform over 100,000 write cycles. The NVDS is implemented by special purpose Zilog® software stored in areas of Program memory not accessible to you. These special-purpose routines use the Flash memory to store the data. The routines incorporate a dynamic addressing scheme to maximize the Write/Erase endurance of the Flash.

### ANALOG PERIPHERALS

The Z8 Encore! XP F1680 Series includes an eight-channel Successive Approximation Register Analog-to-Digital converter (SAR ADC). The features of the ADC include:

- Eight analog input sources multiplexed with general-purpose I/O ports
- Fast conversion time of 4.9  $\mu$ s
- Programmable timing controls
- Internal 1.6 V voltage reference generator

The Z8 Encore! XP F1680 Series devices also feature two same general-purpose comparators and a low-power operational amplifier (LPO) for use in current sense applications. The LPO output can be internally routed to the ADC or externally to a pin.

### COMMUNICATIONS PERIPHERALS

The Z8 Encore! XP F1680 Series devices feature a rich array of communication peripherals, including:

- 2 LIN UARTs (Master/Slave)
- Enhanced SPI (ESPI)
- I<sup>2</sup>C Master/Slave

## F1680 Series Flash Microcontroller Detailed Feature Set (continued...)

### KEY HARDWARE FEATURES

- FLEXIBLE TIMERS
- IPO
- ON-CHIP TEMP SENSOR
- SINGLE-PIN DEBUG

### FLEXIBLE TIMERS

The Z8 Encore! XP F1680 Series products contain three 16-bit reloadable timers that can be used for timing, event counting, or generation of pulse-width modulation (PWM) signals. The timers' features include:

- 16-bit reload counter
- Programmable prescaler with prescale values ranging from 1 to 128
- PWM output generation
- Two independent capture/compare channels which reference the common timer
- External input pin for timer input, clock gating, or capture signal
- Timer output pin and timer interrupt
- Operation in any mode with 32 kHz secondary oscillator

### INTERNAL PRECISION OSCILLATOR

The Internal Precision Oscillator (IPO) has an accuracy of  $\pm 4\%$  over temperature and voltage, and is designed for use without external components. You can either manually trim the oscillator for a non-standard frequency or use the automatic factory-trimmed version to achieve a 0.0432–11.0592 MHz frequency. IPO features include selectable output frequency (11.0592 MHz, 5.5296 MHz, 2.7648 MHz, 1.3824 MHz, 0.6912 MHz, 0.3456 MHz, 0.0864 MHz, and 0.0432 MHz) and the ability to eliminate crystals or ceramic resonators in applications where high timing accuracy is not required.

### ON-CHIP TEMPERATURE SENSOR

The on-chip Temperature Sensor on the Z8 Encore! XP F1680 Series allows you to measure temperature on the die to an accuracy of roughly  $\pm 7^\circ\text{C}$  over a range of  $-40^\circ\text{C}$  to  $+105^\circ\text{C}$  or  $\pm 1.5^\circ\text{C}$  accuracy over the range of  $20^\circ\text{C}$  to  $30^\circ\text{C}$ . This sensor is capable of flash recalibration, and is a moderately accurate temperature sensor for low-power applications where high 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 allow the developer to perform the following actions:

- Read/Write Register File
- Read/Write Program and Data Memory
- Set breakpoints
- Execute eZ8™ CPU instructions

## F1680 Series Development Tool Support

The Z8 Encore! XP F1680 Series is backed by a comprehensive development tools package that includes all the necessary design essentials to get your application up and running in record time.

- Z8 Encore! XP F1680 Series with two different development boards available
- USB Smart Cable for connecting the PC to the F1680 Series development board
- 5 V DC power supply

The Z8 Encore! XP F1680 Series is also supported by ZDS II—Zilog's Integrated Development Environment (IDE) with ANSI C-Compiler (available on [www.zilog.com](http://www.zilog.com)). The ZDS II IDE CD-ROM includes:

- Sample Code
- Product Specifications (Data Sheets)
- Product Briefs
- Z8 Encore! XP® F1680 Series CPU User Manual

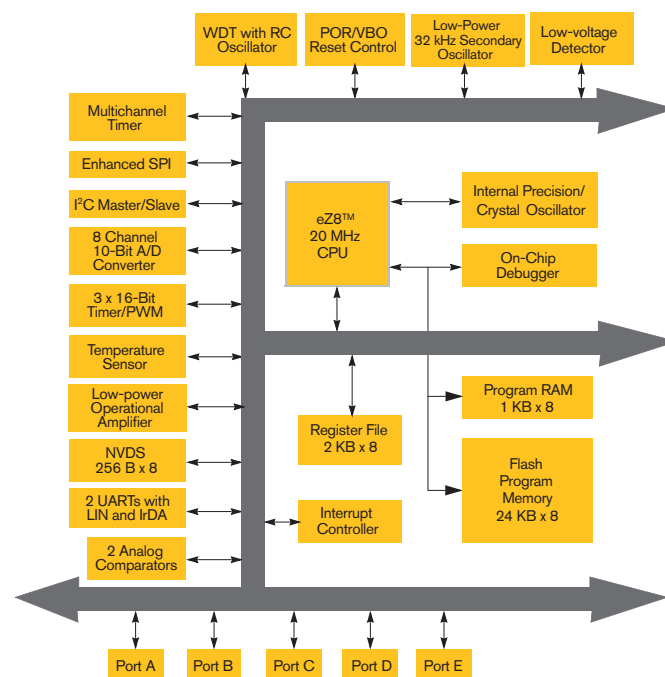
### Hardware Tools & Part Number Ordering Information

- Z8 Encore! XP® F1680 Series 28-pin Series Development Kit (part #: Z8F16800128ZCOG)
- Z8 Encore! XP® Dual F1680 Series Development Kit (part #: Z8F16800144ZCOG)
- USB Smart Cable Accessory Kit (part #: ZUSBSC00100ZACG)
- Opto-Isolated USB Smart Cable Accessory Kit (part #: ZUSBOPTSC01ZACG)

### Software Tools & Support

- Full ANSI C-Compiler
- Zilog Developer's Studio Integrated Development Environment (ZDS II IDE) including an assembler, linker, debugger, and simulator

## F1680 Series Design Architecture



F1680 Series Block Diagram & System Flow Chart

## Silicon Ordering Information

Order the Z8 Encore! XP F1680 Series Flash microcontroller 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](http://www.zilog.com).

Part Number	Description/Options	Packages
Z8F2480XX20XXSG	24 KB Flash; 2048 B RAM; 1024 PRAM 7-8 ADC inputs; 17-37 GPIO; Std Temp.	20-, 28-, 40- & 44-pin SSOP/SOIC/PDIP/QFN/LQFP
Z8F2480XX20XXEG	24 KB Flash; 2048 B RAM; 1024 PRAM 7-8 ADC inputs; 17-37 GPIO; Ext. Temp.	20-, 28-, 40- & 44-pin SSOP/SOIC/PDIP/QFN/LQFP
Z8F1680XX20XXSG	16 KB Flash; 2048 B RAM; 1024 PRAM 7-8 ADC inputs; 17-37 GPIO; Std. Temp.	20-, 28-, 40- & 44-pin SSOP/SOIC/PDIP/QFN/LQFP
Z8F1680XX20XXEG	16 KB Flash; 2048 B RAM; 1024 PRAM 7-8 ADC inputs; 17-37 GPIO; Ext. Temp.	20-, 28-, 40- & 44-pin SSOP/SOIC/PDIP/QFN/LQFP
Z8F0880XX20XXSG	8 KB Flash; 1024 B RAM; 1024 PRAM 7-8 ADC inputs; 17-37 GPIO; Std. Temp.	20-, 28-, 40- & 44-pin SSOP/SOIC/PDIP/QFN/LQFP
Z8F0880XX20XXEG	8 KB Flash; 1024 B RAM; 1024 PRAM 7-8 ADC inputs; 17-37 GPIO; Ext. Temp.	20-, 28-, 40- & 44-pin SSOP/SOIC/PDIP/QFN/LQFP

**Note:** The 'XX' represented in the part number above refers to multiple options available at the time of ordering. The first 'X' denotes package style; the second 'X' denotes pin count. The 'G' denotes "green" tools that are ROHS compliant. 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](http://www.zilog.com).

## Documentation

The collateral referenced below is just a sample of the documentation available for the Z8 Encore! XP F1680 Series of embedded Flash microcontrollers. For a complete listing of all available application notes, product specifications, user manuals, and sample libraries, please visit us at [www.zilog.com/encorexp](http://www.zilog.com/encorexp).

Document Number	Description
PS0250	Z8 Encore! XP® F1680 Series Product Specification
UM0212	Z8 Encore! XP® Dual F1680 Series Development Kit User Manual
UM0203	Z8 Encore! XP® F1680 28-Pin Series Development Kit User Manual
UM0181	USB Smart Cable User Manual
UM0207	Ethernet Smart Cable User Manual
UM0128	eZ8™ CPU User Manual



#### LIFE SUPPORT POLICY

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#### **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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