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What is "Embedded - Microcontrollers"?

"Embedded - Microcontrollers" refer to small, integrated circuits designed to perform specific tasks within larger systems. These microcontrollers are essentially compact computers on a single chip, containing a processor core, memory, and programmable input/output peripherals. They are called "embedded" because they are embedded within electronic devices to control various functions, rather than serving as standalone computers. Microcontrollers are crucial in modern electronics, providing the intelligence and control needed for a wide range of applications.

Applications of "Embedded - Microcontrollers"

Details	
Product Status	Active
Core Processor	eZ8
Core Size	8-Bit
Speed	20MHz
Connectivity	I²C, IrDA, UART/USART
Peripherals	Brown-out Detect/Reset, POR, PWM, WDT
Number of I/O	11
Program Memory Size	4KB (4K x 8)
Program Memory Type	FLASH
EEPROM Size	-
RAM Size	1K x 8
Voltage - Supply (Vcc/Vdd)	2.7V ~ 3.6V
Data Converters	-
Oscillator Type	Internal
Operating Temperature	0°C ~ 70°C (TA)
Mounting Type	Surface Mount
Package / Case	20-SSOP (0.209", 5.30mm Width)
Supplier Device Package	-
Purchase URL	https://www.e-xfl.com/product-detail/zilog/z8f0411hh020sg

Pin Characteristics

Table 4 provides detailed information about the characteristics for each pin available on Z8 Encore! XP® F0822 Series products. The data in Table 4 is sorted alphabetically by pin symbol mnemonic.

Table 4. Pin Characteristics

Symbol Mnemonic	Direction	Reset Direction	Active Low or Active High	Tri-State Output	Internal Pull-Up or Pull-Down	Schmitt-Trigger Input	Open Drain Output
AV_{DD}	N/A	N/A	N/A	N/A	No	No	N/A
AV_{SS}	N/A	N/A	N/A	N/A	No	No	N/A
DBG	I/O	I	N/A	Yes	No	Yes	Yes
PA[7:0]	I/O	I	N/A	Yes	Programmable pull-up	Yes	Yes, programmable
PB[4:0]	I/O	I	N/A	Yes	Programmable pull-up	Yes	Yes, programmable
PC[5:0]	I/O	I	N/A	Yes	Programmable pull-up	Yes	Yes, programmable
RESET	I	I	Low	N/A	Pull-up	Yes	N/A
V_{DD}	N/A	N/A	N/A	N/A	No	No	N/A
V_{REF}	Analog	N/A	N/A	N/A	No	No	N/A
V_{SS}	N/A	N/A	N/A	N/A	No	No	N/A
X_{IN}	I	I	N/A	N/A	No	No	N/A
X_{OUT}	O	O	N/A	No	No	No	No

clock cycles, the device progresses through the System Reset sequence. While the $\overline{\text{RESET}}$ input pin is asserted Low, Z8 Encore! XP® F0822 Series device continues to be held in the Reset state. If the $\overline{\text{RESET}}$ pin is held Low beyond the System Reset time-out, the device exits the Reset state immediately following $\overline{\text{RESET}}$ pin deassertion. Following a System Reset initiated by the external $\overline{\text{RESET}}$ pin, the EXT status bit in the Watchdog Timer Control Register (WDTCTL) is set to 1.

On-Chip Debugger Initiated Reset

A POR is initiated using the OCD by setting the RST bit in the OCD Control Register. The OCD block is not reset but the rest of the chip goes through a normal system reset. The RST bit automatically clears during the system reset. Following the system reset, the POR bit in the WDT Control Register is set.

Stop Mode Recovery

STOP Mode is entered by execution of a stop instruction by the eZ8 CPU. For detailed information about STOP Mode, see the Low-Power Modes chapter on page 27. During Stop Mode Recovery, the device is held in reset for 66 cycles of the WDT oscillator followed by 16 cycles of the system clock. Stop Mode Recovery only affects the contents of the WDT Control Register and does not affect any other values in the Register File including the Stack Pointer, Register Pointer, Flags, Peripheral Control registers, and General-Purpose RAM.

The eZ8 CPU fetches the Reset vector at Program memory addresses 0002H and 0003H and loads that value into the Program Counter. Program execution begins at the Reset vector address. Following Stop Mode Recovery, the stop bit in the WDT Control Register is set to 1. Table 10 lists the Stop Mode Recovery sources and resulting actions. The text following provides more detailed information about each of the Stop Mode Recovery sources.

Table 10. Stop Mode Recovery Sources and Resulting Action

Operating Mode	Stop Mode Recovery Source	Action
STOP Mode	WDT time-out when configured for Reset	Stop Mode Recovery
	WDT time-out when configured for interrupt	Stop Mode Recovery followed by interrupt (if interrupts are enabled)
	Data transition on any GPIO Port pin enabled as a Stop Mode Recovery source	Stop Mode Recovery

- System clock is enabled and continues to operate
- eZ8 CPU is stopped
- Program counter stops incrementing
- WDT's internal RC oscillator continues to operate
- If enabled, the WDT continues to operate
- All other on-chip peripherals continue to operate

The eZ8 CPU can be brought out of HALT Mode by any of the following operations:

- Interrupt
- WDT time-out (interrupt or reset)
- Power-On Reset
- Voltage Brown-Out reset
- External $\overline{\text{RESET}}$ pin assertion

To minimize current in HALT Mode, all GPIO pins which are configured as inputs must be driven to one of the supply rails (V_{CC} or GND).

Table 42. Timer 0–1 Reload Low Byte Register (TxRL)

Bit	7	6	5	4	3	2	1	0
Field	TRL							
RESET	1							
R/W	R/W							
Address	F03H, F0BH							

Bit	Description
[7] TRH, TRL	**Timer Reload Register High and Low** These two bytes form the 16-bit reload value, {TRH[7:0], TRL[7:0]}. This value sets the maximum count value which initiates a timer reload to 0001H. In COMPARE Mode, these two bytes form the 16-bit Compare value.

Timer 0–1 PWM High and Low Byte Registers

The Timer 0–1 PWM High and Low Byte (TxPWMH and TxPWML) registers, shown in Tables 43 and 44, are used for Pulse-Width Modulator (PWM) operations. These registers also store the Capture values for the CAPTURE and CAPTURE/COMPARE modes.

Table 43. Timer 0–1 PWM High Byte Register (TxPWMH)

Bit	7	6	5	4	3	2	1	0
Field	PWMH							
RESET	0							
R/W	R/W							
Address	F04H, F0CH							

Table 44. Timer 0–1 PWM Low Byte Register (TxPWML)

Bit	7	6	5	4	3	2	1	0
Field	PWML							
RESET	0							
R/W	R/W							
Address	F05H, F0DH							

Watchdog Timer Reload Upper, High and Low Byte Registers

The Watchdog Timer Reload Upper, High and Low Byte (WDTU, WDTH, WDTL) registers, shown in Tables 50 through 52, form the 24-bit reload value that is loaded into the WDT, when a WDT instruction executes. The 24-bit reload value is {WDTU[7:0], WDTH[7:0], WDTL[7:0]}. Writing to these registers sets the required reload value. Reading from these registers returns the current WDT count value.

! **Caution:** The 24-bit WDT reload value must not be set to a value less than 000004H.

Table 50. Watchdog Timer Reload Upper Byte Register (WDTU)

Bit	7	6	5	4	3	2	1	0
Field	WDTU							
RESET	1							
R/W	R/W*							
Address	FF1H							

Note: *R/W = a read returns the current WDT count value; a write sets the appropriate reload value.

Bit	Description
[7:0] WDTU	**WDT Reload Upper Byte** Most significant byte (MSB), bits [23:16] of the 24-bit WDT reload value.

Table 51. Watchdog Timer Reload High Byte Register (WDTH)

Bit	7	6	5	4	3	2	1	0
Field	WDTH							
RESET	1							
R/W	R/W*							
Address	FF2H							

Note: *R/W = a read returns the current WDT count value; a write sets the appropriate reload value.

Bit	Description
[7:0] WDTH	**WDT Reload High Byte** Middle byte, bits [15:8] of the 24-bit WDT reload value.

UART Status 0 Register

The UART Status 0 and Status 1 registers, shown in Tables 55 and 56, identify the current UART operating configuration and status.

Table 55. UART Status 0 Register (U0STAT0)

Bit	7	6	5	4	3	2	1	0
Field	RDA	PE	OE	FE	BRKD	TDRE	TXE	CTS
RESET	0					1		X
R/W	R							
Address	F41H							

Bit	Description
[7] RDA	**Receive Data Available** This bit indicates that the UART Receive Data Register has received data. Reading the UART Receive Data Register clears this bit. 0 = The UART Receive Data Register is empty. 1 = There is a byte in the UART Receive Data Register.
[6] PE	**Parity Error** This bit indicates that a parity error has occurred. Reading the UART Receive Data Register clears this bit. 0 = No parity error has occurred. 1 = A parity error has occurred.
[5] OE	**Overrun Error** This bit indicates that an overrun error has occurred. An overrun occurs when new data is received and the UART Receive Data Register has not been read. If the RDA bit is reset to 0, then reading the UART Receive Data Register clears this bit. 0 = No overrun error occurred. 1 = An overrun error occurred.
[4] FE	**Framing Error** This bit indicates that a framing error (no stop bit following data reception) was detected. Reading the UART Receive Data Register clears this bit. 0 = No framing error occurred. 1 = A framing error occurred.
[3] BRKD	**Break Detect** This bit indicates that a break occurred. If the data bits, parity/multiprocessor bit, and stop bit(s) are all zeros then this bit is set to 1. Reading the UART Receive Data Register clears this bit. 0 = No break occurred. 1 = A break occurred.
[2] TDRE	

Serial Peripheral Interface

The Serial Peripheral Interface (SPI) is a synchronous interface allowing several SPI-type devices to be interconnected. SPI-compatible devices include EEPROMs, Analog-to-Digital Converters, and ISDN devices. Features of the SPI include:

- Full-duplex, synchronous, and character-oriented communication
- Four-wire interface
- Data transfers rates up to a maximum of one-half the system clock frequency
- Error detection
- Dedicated Baud Rate Generator

The SPI is not available in 20-pin package devices

Architecture

The SPI is be configured as either a Master (in single- or multiple-master systems) or a Slave, as shown in Figures 20 through 22.

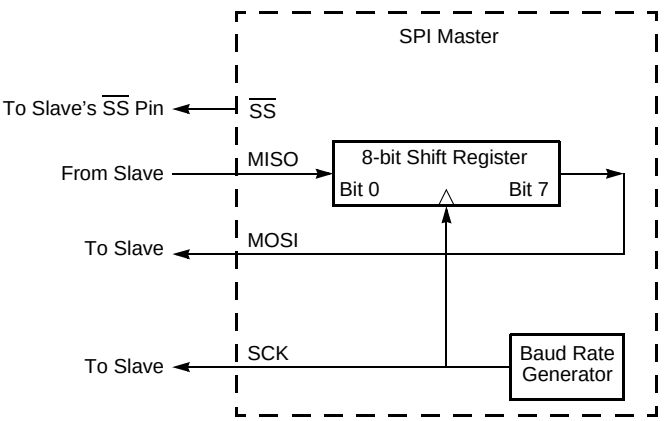


Figure 20. SPI Configured as a Master in a Single Master, Single Slave System

Transfer Format PHASE is 1

Figure 24 displays the timing diagram for an SPI transfer in which PHASE is one. Two waveforms are depicted for SCK, one for CLKPOL reset to 0 and another for CLKPOL set to 1.

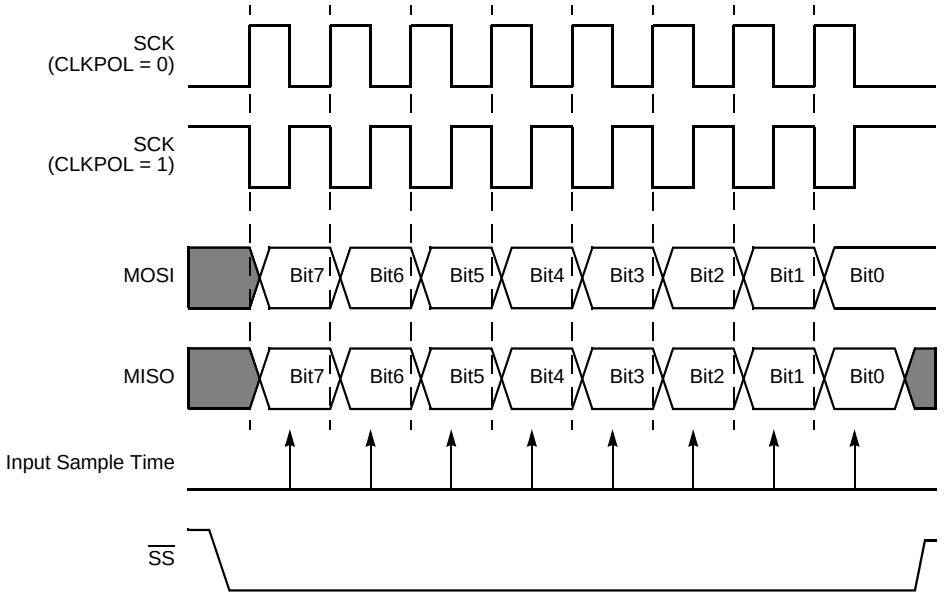


Figure 24. SPI Timing When PHASE is 1

Multimaster Operation

In a multimaster SPI system, all SCK pins are tied together, all MOSI pins are tied together and all MISO pins are tied together. All SPI pins must then be configured in OPEN-DRAIN Mode to prevent bus contention. At any one time, only one SPI device is configured as the Master and all other SPI devices on the bus are configured as Slaves. The Master enables a single Slave by asserting the $\overline{SS}$ pin on that Slave only. Then, the single Master drives data out its SCK and MOSI pins to the SCK and MOSI pins on the Slaves (including those which are not enabled). The enabled Slave drives data out its MISO pin to the MISO Master pin.

For a Master device operating in a multimaster system, if the $\overline{SS}$ pin is configured as an input and is driven Low by another Master, the COL bit is set to 1 in the SPI Status Register. The COL bit indicates the occurrence of a multimaster collision (mode fault error condition).

SPI Control Register

The SPI Control Register, shown in Table 65, configures the SPI for transmit and receive operations.

Table 65. SPI Control Register (SPICTL)

Bit	7	6	5	4	3	2	1	0
Field	IRQE	STR	BIRQ	PHASE	CLKPOL	WOR	MMEN	SPIEN
RESET	0							
R/W	R/W							
Address	F61H							

Bit	Description
[7] IRQE	**Interrupt Request Enable** 0 = SPI interrupts are disabled. No interrupt requests are sent to the Interrupt Controller. 1 = SPI interrupts are enabled. Interrupt requests are sent to the Interrupt Controller.
[6] STR	**Start an SPI Interrupt Request** 0 = No effect. 1 = Setting this bit to 1 also sets the IRQ bit in the SPI Status Register to 1. Setting this bit forces the SPI to send an interrupt request to the Interrupt Control. This bit can be used by software for a function similar to transmit buffer empty in a UART. Writing a 1 to the IRQ bit in the SPI Status Register clears this bit to 0.
[5] BIRQ	**BRG Timer Interrupt Request** If the SPI is enabled, this bit has no effect. If the SPI is disabled: 0 = BRG timer function is disabled. 1 = BRG timer function and time-out interrupt are enabled.
[4] PHASE	**Phase Select** Sets the phase relationship of the data to the clock. For more information about operation of the PHASE bit, see the SPI Clock Phase and Polarity Control section on page 104.
[3] CLKPOL	**Clock Polarity** 0 = SCK idles Low (0). 1 = SCK idle High (1).
[2] WOR	**Wire-OR (Open-Drain) Mode Enabled** 0 = SPI signal pins not configured for open-drain. 1 = All four SPI signal pins (SCK, $\overline{SS}$, MISO, MOSI) configured for open-drain function. This setting is typically used for multimaster and/or multislave configurations.
[1] MMEN	**SPI MASTER Mode Enable** 0 = SPI configured in SLAVE Mode. 1 = SPI configured in MASTER Mode.
[0] SPIEN	**SPI Enable** 0 = SPI disabled. 1 = SPI enabled.

Bit	Description (Continued)
[1] FLUSH	**Flush Data** Setting this bit to 1 clears the I2C Data Register and sets the TDRE bit to 1. This bit allows flushing of the I2C Data Register when a Not Acknowledge interrupt is received after the data has been sent to the I2C Data Register. Reading this bit always returns 0.
[0] FILTEN	**I2C Signal Filter Enable** This bit enables low-pass digital filters on the SDA and SCL input signals. These filters reject any input pulse with periods less than a full system clock cycle. The filters introduce a 3-system clock cycle latency on the inputs. 1 = Low-pass filters are enabled. 0 = Low-pass filters are disabled.

I2C Baud Rate High and Low Byte Registers

The I2C Baud Rate High and Low Byte registers, shown in Tables 74 and 75, combine to form a 16-bit reload value, BRG[15:0], for the I2C Baud Rate Generator. When configured as a general purpose timer, the interrupt interval is calculated using the following equation:

Interrupt Interval (s) = System Clock Period (s) ×BRG[15:0]

Table 74. I2C Baud Rate High Byte Register (I2CBRH)

Bit	7	6	5	4	3	2	1	0
Field	BRH							
RESET	FFH							
R/W	R/W							
Address	F53H							

Bit	Description
[7:0] BRH	**I2C Baud Rate High Byte** Most significant byte, BRG[15:8], of the I2C Baud Rate Generator's reload value. **Note:** If the DIAG bit in the I2C Diagnostic Control Register is set to 1, a read of the I2CBRH Register returns the current value of the I2C Baud Rate Counter[15:8].

Bit	Description (Continued)	
[4:0] TXRXSTATE	**Internal State** Value of the internal I^2C state machine.	
	TXRXSTATE	**State Description**
	0_0000	Idle State.
	0_0001	Start State.
	0_0010	Send/Receive data bit 7.
	0_0011	Send/Receive data bit 6.
	0_0100	Send/Receive data bit 5.
	0_0101	Send/Receive data bit 4.
	0_0110	Send/Receive data bit 3.
	0_0111	Send/Receive data bit 2.
	0_1000	Send/Receive data bit 1.
	0_1001	Send/Receive data bit 0.
	0_1010	Data Acknowledge State.
	0_1011	Second half of data Acknowledge State used only for not acknowledge.
	0_1100	First part of stop state.
	0_1101	Second part of stop state.
	0_1110	10-bit addressing: Acknowledge State for 2nd address byte; 7-bit addressing: Address Acknowledge State.
	0_1111	10-bit address: Bit 0 (Least significant bit) of 2nd address byte; 7-bit address: Bit 0 (Least significant bit) (R/W) of address byte.
	1_0000	10-bit addressing: Bit 7 (Most significant bit) of 1st address byte.
	1_0001	10-bit addressing: Bit 6 of 1st address byte.
	1_0010	10-bit addressing: Bit 5 of 1st address byte.
	1_0011	10-bit addressing: Bit 4 of 1st address byte.
	1_0100	10-bit addressing: Bit 3 of 1st address byte.
	1_0101	10-bit addressing: Bit 2 of 1st address byte.
	1_0110	10-bit addressing: Bit 1 of 1st address byte.
	1_0111	10-bit addressing: Bit 0 (R/W) of 1st address byte.
	1_1000	10-bit addressing: Acknowledge state for 1st address byte.
	1_1001	10-bit addressing: Bit 7 of 2nd address byte; 7-bit addressing: Bit 7 of address byte.
	1_1010	10-bit addressing: Bit 6 of 2nd address byte; 7-bit addressing: Bit 6 of address byte.
	1_1011	10-bit addressing: Bit 5 of 2nd address byte; 7-bit addressing: Bit 5 of address byte.
	1_1100	10-bit addressing: Bit 4 of 2nd address byte; 7-bit addressing: Bit 4 of address byte.
	1_1101	10-bit addressing: Bit 3 of 2nd address byte; 7-bit addressing: Bit 3 of address byte.
	1_1110	10-bit addressing: Bit 2 of 2nd address byte; 7-bit addressing: Bit 2 of address byte.
	1_1111	10-bit addressing: Bit 1 of 2nd address byte; 7-bit addressing: Bit 1 of address byte.

Table 83. Z8 Encore! XP® F0822 Series Information Area Map

Flash Memory Address (Hex)	Function
FE00H–FE3FH	Reserved
FE40H–FE53H	**Part Number** 20-character ASCII alphanumeric code Left-justified and filled with zeros
FE54H–FFFFH	Reserved

Operation

The Flash Controller provides the proper signals and timing for the Byte Programming, Page Erase, and Mass Erase functions within Flash memory. The Flash Controller contains a protection mechanism, using the Flash Control Register (FCTL), to prevent accidental programming or erasure. The following subsections provide details about the various operations (Lock, Unlock, Sector Protect, Byte Programming, Page Erase and Mass Erase).

Timing Using the Flash Frequency Registers

Before performing a program or erase operation in Flash memory, you must first configure the Flash Frequency High and Low Byte registers. The Flash Frequency registers allow programming and erasure of Flash memory with system clock frequencies ranging from 20kHz through 20MHz (the valid range is limited to the device operating frequencies).

The Flash Frequency High and Low Byte registers combine to form a 16-bit value, FFREQ, to control timing for Flash program and erase operations. The 16-bit Flash Frequency value must contain the system clock frequency in kHz. This value is calculated using the following equation:

$$\text{FFREQ[15:0]} = \frac{\text{System Clock Frequency (Hz)}}{1000}$$

Caution: Flash programming and erasure are not supported for system clock frequencies below 20kHz, above 20MHz, or outside of the device operating frequency range. The Flash Frequency High and Low Byte registers must be loaded with the correct value to ensure proper Flash programming and erase operations.

Flash Control Register

The Flash Control Register, shown in Table 84, is used to unlock the Flash Controller for programming and erase operations, or to select the Flash Sector Protect Register. The write-only Flash Control Register shares its Register File address with the read-only Flash Status Register.

Table 84. Flash Control Register (FCTL)

Bit	7	6	5	4	3	2	1	0
Field	FCMD							
RESET	0							
R/W	W							
Address	FF8H							

Bit	Description
[7:0] FCMD	**Flash Command*** 73H = First unlock command. 8CH = Second unlock command. 95H = Page erase command. 63H = Mass erase command. 5EH = Flash Sector Protect Register select.

Note: *All other commands, or any command out of sequence, lock the Flash Controller.

Exiting Debug Mode

The device exits DEBUG Mode following any of the following operations:

- Clearing the DBGMODE bit in the OCD Control Register to 0
- Power-On Reset
- Voltage Brown-Out reset
- Asserting the RESET pin Low to initiate a Reset
- Driving the DBG pin Low while the device is in STOP Mode initiates a System Reset

OCD Data Format

The OCD interface uses the asynchronous data format defined for RS-232. Each character is transmitted as 1 start bit, 8 data bits (least-significant bit first), and 1 stop bit; see Figure 37.

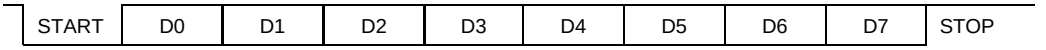


Figure 37. OCD Data Format

OCD Autobaud Detector/Generator

To run over a range of baud rates (bits per second) with various system clock frequencies, the OCD contains an Autobaud Detector/Generator. After a reset, the OCD is idle until it receives data. The OCD requires that the first character sent from the host is the character 80H. The character 80H has eight continuous bits Low (one start bit plus 7 data bits). The Autobaud Detector measures this period and sets the OCD Baud Rate Generator accordingly.

The Autobaud Detector/Generator is clocked by the system clock. The minimum baud rate is the system clock frequency divided by 512. For optimal operation, the maximum recommended baud rate is the system clock frequency divided by 8. The theoretical maximum baud rate is the system clock frequency divided by 4. This theoretical maximum is possible for low-noise designs with clean signals. Table 92 lists minimum and recommended maximum baud rates for sample crystal frequencies.

Electrical Characteristics

The data in this chapter represents all known data prior to qualification and characterization of the Z8 Encore! XP® F0822 Series of products, and is therefore subject to change. Additional electrical characteristics may be found in the individual chapters of this document.

Absolute Maximum Ratings

These ratings are stress ratings only. Operation of the device at any condition outside those indicated in the operational sections of these specifications is not implied. Exposure to absolute maximum rating conditions for extended periods can affect device reliability. For improved reliability, unused inputs must be tied to one of the supply voltages (V_{DD} or V_{SS}).

! **Caution:** Stresses greater than those listed in Table 97 can cause permanent damage to the device.

Table 97. Absolute Maximum Ratings

Parameter	Minimum	Maximum	Units	Notes
Ambient temperature under bias	–40	+105	°C	1
Storage temperature	–65	+150	°C	
Voltage on any pin with respect to V_{SS}	–0.3	+5.5	V	2
Voltage on AV_{SS} pin with respect to V_{SS}	–0.3	+0.3	V	2
Voltage on V_{DD} pin with respect to V_{SS}	–0.3	+3.6	V	
Voltage on AV_{DD} pin with respect to V_{DD}	–0.3	+0.3	V	
Maximum current on input and/or inactive output pin	–5	+5	µA	
Maximum output current from active output pin	–25	+25	mA	
20-pin SSOP Package Maximum Ratings at –40°C to 70°C				
Total power dissipation		430	mW	
Maximum current into V_{DD} or out of V_{SS}		120	mA	

Note: This voltage applies to all pins except the following: V_{DD}, AV_{DD}, V_{REF}, pins that support analog input (Port B), and where otherwise noted.

AC Characteristics

Table 99 provides information about the AC characteristics and timing. All AC timing information assumes a standard load of 50pF on all outputs.

Table 99. AC Characteristics

		V_{DD} = 2.7–3.6V T_A = –40°C to 105°C			
Symbol	**Parameter**	**Minimum**	**Maximum**	**Units**	**Conditions**
F_{SYSCLK}	System Clock Frequency (ROM)	–	20.0	MHz	
F_{SYSCLK}	System Clock Frequency (Flash)	–	20.0	MHz	Read-only from Flash memory.
		0.032768	20.0	MHz	Program or erasure of Flash memory.
F_{XTAL}	Crystal Oscillator Frequency	0.032768	20.0	MHz	System clock frequencies below the crystal oscillator minimum require an external clock driver.
T_{XIN}	System Clock Period	50	–	ns	$T_{CLK} = 1/F_{SYSCLK}$
T_{XINH}	System Clock High Time	20	30	ns	T_{CLK} = 50ns
T_{XINL}	System Clock Low Time	20	30	ns	T_{CLK} = 50ns

eZ8 CPU Instruction Set

This chapter describes the following features of the eZ8 CPU instruction set:

Assembly Language Programming Introduction

The eZ8 CPU assembly language provides a means for writing an application program without having to be concerned with actual memory addresses or machine instruction formats. A program written in assembly language is called a source program. Assembly language allows the use of symbolic addresses to identify memory locations. It also allows mnemonic codes (op codes and operands) to represent the instructions themselves. The op codes identify the instruction while the operands represent memory locations, registers, or immediate data values.

Each assembly language program consists of a series of symbolic commands called statements. Each statement can contain labels, operations, operands and comments.

Labels can be assigned to a particular instruction step in a source program. The label identifies that step in the program as an entry point for use by other instructions.

The assembly language also includes assembler directives that supplement the machine instruction. The assembler directives, or pseudo-ops, are not translated into a machine instruction. Rather, the pseudo-ops are interpreted as directives that control or assist the assembly process.

The source program is processed (assembled) by the assembler to obtain a machine language program called the object code. The object code is executed by the eZ8 CPU. An example segment of an assembly language program is detailed in the following example.

Table 119. Arithmetic Instructions (Continued)

Mnemonic	Operands	Instruction
MULT	dst	Multiply
SBC	dst, src	Subtract with Carry
SBCX	dst, src	Subtract with Carry using Extended Addressing
SUB	dst, src	Subtract
SUBX	dst, src	Subtract using Extended Addressing

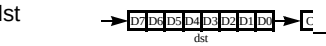
Table 120. Bit Manipulation Instructions

Mnemonic	Operands	Instruction
BCLR	bit, dst	Bit Clear
BIT	p, bit, dst	Bit Set or Clear
BSET	bit, dst	Bit Set
BSWAP	dst	Bit Swap
CCF	—	Complement Carry Flag
RCF	—	Reset Carry Flag
SCF	—	Set Carry Flag
TCM	dst, src	Test Complement Under Mask
TCMX	dst, src	Test Complement Under Mask using Extended Addressing
TM	dst, src	Test Under Mask
TMX	dst, src	Test Under Mask using Extended Addressing

Table 121. Block Transfer Instructions

Mnemonic	Operands	Instruction
LDCI	dst, src	Load Constant to/from Program memory and Auto-Increment Addresses
LDEI	dst, src	Load External Data to/from Data Memory and Auto-Increment Addresses

Table 127. eZ8 CPU Instruction Summary (Continued)

Assembly Mnemonic	Symbolic Operation	Address Mode dst	Address Mode src	Op Code(s) (Hex)	Flags C	Z	S	V	D	H	Fetch Cycles	Instr. Cycles
SRL dst		R		1F C0	*	*	0	*	-	-	3	2
		IR		1F C1							3	3
SRP src	RP ← src		IM	01	-	-	-	-	-	-	2	2
STOP	STOP Mode			6F	-	-	-	-	-	-	1	2
SUB dst, src	dst ← dst – src	r	r	22	*	*	*	*	1	*	2	3
		r	Ir	23							2	4
		R	R	24							3	3
		R	IR	25							3	4
		R	IM	26							3	3
		IR	IM	27							3	4
SUBX dst, src	dst ← dst – src	ER	ER	28	*	*	*	*	1	*	4	3
		ER	IM	29							4	3
SWAP dst	dst[7:4] ↔ dst[3:0]	R		F0	X	*	*	X	-	-	2	2
		IR		F1							2	3
TCM dst, src	(NOT dst) AND src	r	r	62	-	*	*	0	-	-	2	3
		r	Ir	63							2	4
		R	R	64							3	3
		R	IR	65							3	4
		R	IM	66							3	3
		IR	IM	67							3	4
TCMX dst, src	(NOT dst) AND src	ER	ER	68	-	*	*	0	-	-	4	3
		ER	IM	69							4	3

Note: Flags Notation:
* = Value is a function of the result of the operation.
– = Unaffected.
X = Undefined.
0 = Reset to 0.
1 = Set to 1.

Hex Address: F63

Table 165. SPI Mode Register (SPIMODE)

Bit	7	6	5	4	3	2	1	0
Field	Reserved		DIAG	NUMBITS[2:0]			SSIO	SSV
RESET	0							
R/W	R		R/W					
Address	F63H							

Hex Address: F64

Table 166. SPI Diagnostic State Register (SPIDST)

Bit	7	6	5	4	3	2	1	0
Field	SCKEN	TCKEN	SPISTATE					
RESET	0							
R/W	R							
Address	F64H							

Hex Address: F65

This address is reserved.

Hex Address: F66

Table 167. SPI Baud Rate High Byte Register (SPIBRH)

Bit	7	6	5	4	3	2	1	0
Field	BRH							
RESET	1							
R/W	R/W							
Address	F66H							