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Applications of "Embedded - Microcontrollers"

Details	
Product Status	Obsolete
Core Processor	eZ8
Core Size	8-Bit
Speed	20MHz
Connectivity	I²C, IrDA, SPI, UART/USART
Peripherals	Brown-out Detect/Reset, POR, PWM, WDT
Number of I/O	19
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	A/D 5x10b
Oscillator Type	Internal
Operating Temperature	-40°C ~ 105°C (TA)
Mounting Type	Surface Mount
Package / Case	28-SOIC (0.295", 7.50mm Width)
Supplier Device Package	-
Purchase URL	https://www.e-xfl.com/product-detail/zilog/z8f0422sj020ec00tr

Introduction

This Product Specification provides detailed operating information for Z8 Encore! XP® F0822 Series devices within the Z8 Encore! XP Microcontroller (MCU) family of products. Within this document, Z8 Encore! XP® F0822 Series is referred as Z8 Encore! XP or the F0822 Series unless specifically stated otherwise.

About This Manual

Zilog recommends that you read and understand everything in this manual before setting up and using the product. We have designed this Product Specification to be used either as a *how to* procedural manual or a reference guide to important data.

Intended Audience

This document is written for Zilog customers who are experienced at working with microcontrollers, integrated circuits, or printed circuit assemblies.

Manual Conventions

The following assumptions and conventions are adopted to provide clarity and ease of use:

Courier Typeface

Commands, code lines and fragments, bits, equations, hexadecimal addresses, and various executable items are distinguished from general text by the use of the `Courier` typeface. Where the use of the font is not indicated, as in the Index, the name of the entity is presented in upper case.

- **Example:** FLAGS[1] is `smrf`.

Hexadecimal Values

Hexadecimal values are designated by uppercase *H* suffix and appear in the `Courier` typeface.

- **Example:** R1 is set to `F8H`.

Brackets

The square brackets [ ], indicate a register or bus.

- **Example:** For the register R1[7:0], R1 is an 8-bit register, R1[7] is the most significant bit, and R1[0] is the least significant bit.

- 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 Brownout 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 31. IRQ1 Enable and Priority Encoding

IRQ1ENH[*x*]	IRQ1ENL[*x*]	Priority	Description
0	0	Disabled	Disabled
0	1	Level 1	Low
1	0	Level 2	Nominal
1	1	Level 3	High

where *x* indicates the register bits from 0 through 7.

Table 32. IRQ1 Enable High Bit Register (IRQ1ENH)

BITS	7	6	5	4	3	2	1	0
FIELD	PA7ENH	PA6ENH	PA5ENH	PA4ENH	PA3ENH	PA2ENH	PA1ENH	PA0ENH
RESET	0							
R/W	R/W							
ADDR	FC4H							

PA*x*ENH—Port A Bit[*x*] Interrupt Request Enable High Bit

Table 33. IRQ1 Enable Low Bit Register (IRQ1ENL)

BITS	7	6	5	4	3	2	1	0
FIELD	PA7ENL	PA6ENL	PA5ENL	PA4ENL	PA3ENL	PA2ENL	PA1ENL	PA0ENL
RESET	0							
R/W	R/W							
ADDR	FC5H							

PA*x*ENL—Port A Bit[*x*] Interrupt Request Enable Low Bit

IRQ2 Enable High and Low Bit Registers

Table 34 describes the priority control for IRQ2. The IRQ2 Enable High and Low Bit Registers (Table 35 and Table 36) form a priority encoded enabling for interrupts in the Interrupt Request 2 register. Priority is generated by setting bits in each register.

Clear To Send Operation

The CTS pin, if enabled by the CTSE bit of the UART Control 0 register, performs flow control on the outgoing transmit datastream. The Clear To Send ($\overline{CTS}$) input pin is sampled one system clock before beginning any new character transmission. To delay transmission of the next data character, an external receiver must deassert $\overline{CTS}$ at least one system clock cycle before a new data transmission begins. For multiple character transmissions, this would be done during STOP bit transmission. If $\overline{CTS}$ deasserts in the middle of a character transmission, the current character is sent completely.

Multiprocessor (9-bit) Mode

The UART has a MULTIPROCESSOR (9-bit) mode that uses an extra (9th) bit for selective communication when a number of processors share a common UART bus. In MULTIPROCESSOR mode (also referred to as 9-bit mode), the multiprocessor bit is transmitted following the 8-bits of data and immediately preceding the STOP bit(s) as displayed in Figure 14. The character format is as displayed in Figure 14.

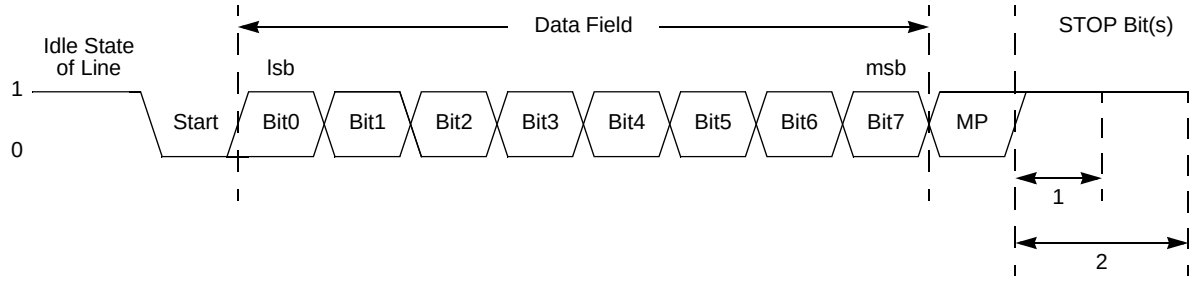


Figure 14. UART Asynchronous MULTIPROCESSOR Mode Data Format

In MULTIPROCESSOR (9-bit) mode, the Parity bit location (9th bit) becomes the Multiprocessor control bit. The UART Control 1 and Status 1 Registers provide Multiprocessor (9-bit) mode control and status information. If an automatic address matching scheme is enabled, the UART Address Compare Register holds the network address of the device.

MULTIPROCESSOR (9-bit) Mode Receive Interrupts

When multiprocessor mode is enabled, the UART only processes frames addressed to it. The determination of whether a frame of data is addressed to the UART can be made in hardware, software, or combination of the two depending on the multiprocessor configuration bits. In general, the address compare feature reduces the load on the CPU, because it does not need to access the UART when it receives data directed to other devices on the

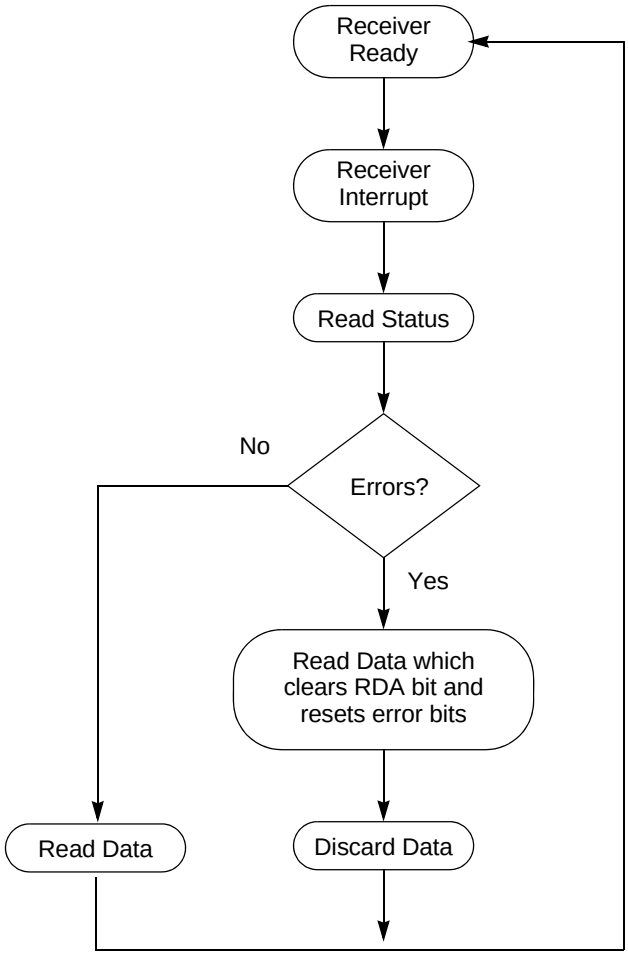


Figure 16. UART Receiver Interrupt Service Routine Flow

UART Baud Rate Generator

The UART Baud Rate Generator creates a lower frequency baud rate clock for data transmission. The input to the BRG is the system clock. The UART Baud Rate High and Low Byte Registers combine to create a 16-bit baud rate divisor value (BRG[15:0]) that sets the data transmission rate (baud rate) of the UART. The UART data rate is calculated using the following equation:

$$\text{UART Data Rate (bits/s)} = \frac{\text{System Clock Frequency (Hz)}}{16 \times \text{UART Baud Rate Divisor Value}}$$

UART Receive Data Register

Data bytes received through the RXD*x* pin are stored in the UART Receive Data Register (Table 53). The Read-only UART Receive Data Register shares a Register File address with the Write-only UART Transmit Data Register.

Table 53. UART Receive Data Register (U0RXD)

BITS	7	6	5	4	3	2	1	0
FIELD	RXD							
RESET	X							
R/W	R							
ADDR	F40H							

RXD—Receive Data
UART receiver data byte from the RXD*x* pin

UART Status 0 Register

The UART Status 0 and Status 1 registers (Table 54 and Table 55 on page 102) identify the current UART operating configuration and status.

Table 54. UART Status 0 Register (U0STAT0)

BITS	7	6	5	4	3	2	1	0
FIELD	RDA	PE	OE	FE	BRKD	TDRE	TXE	CTS
RESET	0					1		X
R/W	R							
ADDR	F41H							

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.

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.

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

During an SPI transfer, data is sent and received simultaneously by both the Master and the Slave SPI devices. Separate signals are required for data and the serial clock. When an SPI transfer occurs, a multi-bit (typically 8-bit) character is shifted out one data pin and an multi-bit character is simultaneously shifted in on a second data pin. An 8-bit shift register in the Master and another 8-bit shift register in the Slave are connected as a circular buffer. The SPI shift register is single-buffered in the transmit and receive directions. New data to be transmitted cannot be written into the shift register until the previous transmission is complete and receive data (if valid) has been read.

SPI Signals

The four basic SPI signals are:

- MISO (Master-In, Slave-Out)
- MOSI (Master-Out, Slave-In)
- SCK (Serial Clock)
- $\overline{SS}$ (Slave Select)

The following sections discuss these SPI signals. Each signal is described in both Master and Slave modes.

Master-In/Slave-Out

The Master-In/Slave-Out (MISO) pin is configured as an input in a Master device and as an output in a Slave device. It is one of the two lines that transfer serial data, with the most significant bit sent first. The MISO pin of a Slave device is placed in a high-impedance state if the Slave is not selected. When the SPI is not enabled, this signal is in a high-impedance state.

Master-Out/Slave-In

The Master-Out/Slave-In (MOSI) pin is configured as an output in a Master device and as an input in a Slave device. It is one of the two lines that transfer serial data, with the most significant bit sent first. When the SPI is not enabled, this signal is in a high-impedance state.

Serial Clock

The Serial Clock (SCK) synchronizes data movement both in and out of the device through its MOSI and MISO pins. In MASTER mode, the SPI's Baud Rate Generator creates the serial clock. The Master drives the serial clock out its own SCK pin to the Slave's SCK pin. When the SPI is configured as a Slave, the SCK pin is an input and the clock signal from the Master synchronizes the data transfer between the Master and Slave devices. Slave devices ignore the SCK signal, unless the $\overline{SS}$ pin is asserted. When configured as a slave, the SPI block requires a minimum SCK period of greater than or equal to 8 times the system (XIN) clock period.

SPI Status Register

The SPI Status Register indicates the current state of the SPI. All bits revert to their reset state if the SPIEN bit in the SPICTL Register equals 0.

Table 65. SPI Status Register (SPISTAT)

BITS	7	6	5	4	3	2	1	0
FIELD	IRQ	OVR	COL	ABT	Reserved		TXST	SLAS
RESET	0							1
R/W	R/W*				R			
ADDR	F62H							
R/W* = Read access. Write a 1 to clear the bit to 0.								

IRQ—Interrupt Request
If SPIEN = 1, this bit is set if the STR bit in the SPICTL Register is set, or upon completion of an SPI Master or Slave transaction. This bit does not set if SPIEN = 0 and the SPI Baud Rate Generator is used as a timer to generate the SPI interrupt.
0 = No SPI interrupt request pending.
1 = SPI interrupt request is pending.

OVR—Overrun
0 = An overrun error has not occurred.
1 = An overrun error has been detected.

COL—Collision
0 = A multi-master collision (mode fault) has not occurred.
1 = A multi-master collision (mode fault) has been detected.

ABT—SLAVE mode transaction abort
This bit is set if the SPI is configured in SLAVE mode, a transaction is occurring and $\overline{SS}$ deasserts before all bits of a character have been transferred as defined by the NUMBITS field of the SPIMODE Register. The IRQ bit also sets, indicating the transaction has completed.
0 = A SLAVE mode transaction abort has not occurred.
1 = A SLAVE mode transaction abort has been detected.

Reserved—Must be 0

TXST—Transmit Status
0 = No data transmission currently in progress.
1 = Data transmission currently in progress.

SLAS—Slave Select
If SPI enabled as a Slave
0 = $\overline{SS}$ input pin is asserted (Low)
1 = $\overline{SS}$ input is not asserted (High).
If SPI enabled as a Master, this bit is not applicable.

Receive interrupts occur when a byte of data has been received by the I2C Controller (Master reading data from Slave). This procedure sets the RDRF bit of the I2C Status Register. The RDRF bit is cleared by reading the I2C Data Register. The RDRF bit is set during the acknowledge phase. The I2C Controller pauses after the acknowledge phase until the receive interrupt is cleared before performing any other action.

Transmit interrupts occur when the TDRE bit of the I2C Status register sets and the TXI bit in the I2C Control Register is set. Transmit interrupts occur under the following conditions when the Transmit Data Register is empty:

- The I2C Controller is enabled
- The first bit of the byte of an address is shifting out and the RD bit of the I2C Status register is deasserted.
- The first bit of a 10-bit address shifts out.
- The first bit of write data shifts out.

Note: *Writing to the I2C Data Register always clears the TRDE bit to 0. When TDRE is asserted, the I2C Controller pauses at the beginning of the Acknowledge cycle of the byte currently shifting out until the data register is written with the next value to send or the STOP or START bits are set indicating the current byte is the last one to send.*

The fourth interrupt source is the BRG. If the I2C Controller is disabled (IEN bit in the I2CCTL Register = 0) and the BIRQ bit in the I2CCTL Register = 1, an interrupt is generated when the BRG counts down to 1. This allows the I2C Baud Rate Generator to be used by software as a general purpose timer when IEN = 0.

Software Control of I2C Transactions

Software controls I2C transactions by using the I2C Controller interrupt, by polling the I2C Status register or by DMA. Note that not all products include a DMA Controller.

To use interrupts, the I2C interrupt must be enabled in the Interrupt Controller. The TXI bit in the I2C Control Register must be set to enable transmit interrupts.

To control transactions by polling, the interrupt bits (TDRE, RDRF and NCKI) in the I2C Status Register should be polled. The TDRE bit asserts regardless of the state of the TXI bit.

Either or both transmit and receive data movement can be controlled by the DMA Controller. The DMA Controller channel(s) must be initialized to select the I2C transmit and receive requests. Transmit DMA requests require that the TXI bit in the I2C Control Register be set.

Caution: *A transmit (write) DMA operation hangs if the slave responds with a Not Acknowledge before the last byte has been sent. After receiving the Not Acknowledge, the I2C Controller sets the NCKI bit in the Status Register and pauses until either the STOP or*

I²C Baud Rate High and Low Byte Registers

The I²C Baud Rate High and Low Byte registers (Tables 73 and 73) 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 73. I²C Baud Rate High Byte Register (I2CBRH)

BITS	7	6	5	4	3	2	1	0
FIELD	BRH							
RESET	FFH							
R/W	R/W							
ADDR	F53H							

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].*

Table 74. I²C Baud Rate Low Byte Register (I2CBRL)

BITS	7	6	5	4	3	2	1	0
FIELD	BRL							
RESET	FFH							
R/W	R/W							
ADDR	F54H							

BRL = I²C Baud Rate Low Byte
Least significant byte, BRG[7:0], 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 I2CBRL register returns the current value of the I²C Baud Rate Counter [7:0].*

I²C Diagnostic State Register

The I²C Diagnostic State register (Table 75) provides observability of internal state. This is a read only register used for I²C diagnostics and manufacturing test.

frequency range for the device. The Flash Frequency High and Low Byte Registers must be loaded with the correct value to insure proper program and erase times.

Table 87. Flash Frequency High Byte Register (FFREQH)

BITS	7	6	5	4	3	2	1	0
FIELD	FFREQH							
RESET	0							
R/W	R/W							
ADDR	FFAH							

Table 88. Flash Frequency Low Byte Register (FFREQL)

BITS	7	6	5	4	3	2	1	0
FIELD	FFREQL							
RESET	0							
R/W	R/W							
ADDR	FFBH							

FFREQH and FFREQL—Flash Frequency High and Low Bytes

These 2 bytes, {FFREQH[7:0], FFREQL[7:0]}, contain the 16-bit Flash Frequency value.

Reserved
These Option Bits are reserved for future use and must always be 1.

The following information applies only to the Flash versions of the F0822 Series devices:

FWP—Flash Write Protect
These two Option Bits combine to provide three levels of Program Memory protection:

FWP	Description
0	Programming, Page Erase, and Mass Erase using User Code is disabled. Mass Erase is available through the OCD.
1	Programming and Page Erase are enabled for all of Flash Program Memory.

Flash Memory Address 0001H

Table 90. Options Bits at Flash Memory Address 0001H

BITS	7	6	5	4	3	2	1	0
FIELD	Reserved							
RESET	U							
R/W	R/W							
ADDR	Program Memory 0001H							

Note: U = Unchanged by Reset. R/W = Read/Write.

Reserved
These Option Bits are reserved for future use and must always be 1. This setting is the default for unprogrammed (erased) Flash.

transmission is half-duplex, in that transmit and receive cannot occur simultaneously. The serial data on the DBG pin is sent using the standard asynchronous data format defined in RS-232. This pin can interface the Z8 Encore! XP F0822 Series products to the serial port of a host PC using minimal external hardware.Two different methods for connecting the DBG pin to an RS-232 interface are displayed in Figure 38 and Figure 39.

Caution: *For operation of the OCD, all power pins (V_{DD} and AV_{DD}) must be supplied with power, and all ground pins (V_{SS} and AV_{SS}) must be properly grounded. The DBG pin is open-drain and must always be connected to V_{DD} through an external pull-up resistor to insure proper operation.*

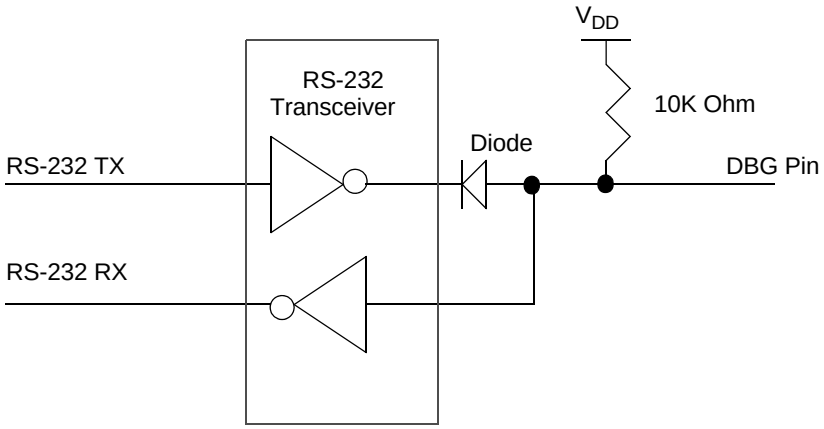


Figure 38. Interfacing the On-Chip Debugger's DBG Pin with an RS-232 Interface (1)

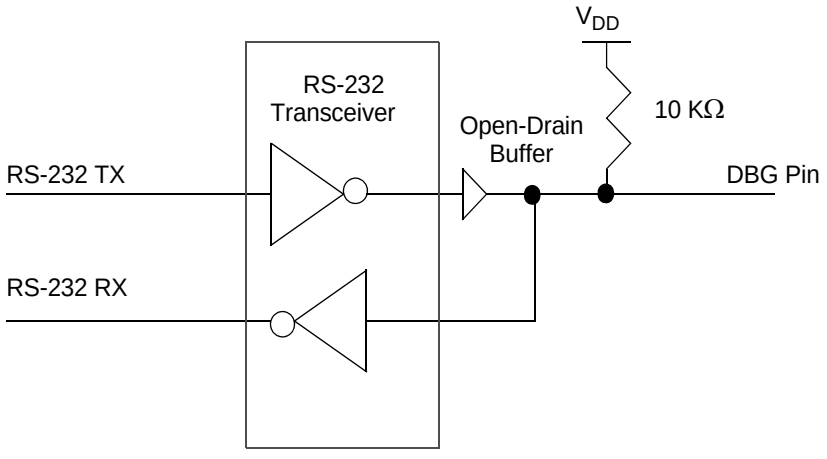


Figure 39. Interfacing the On-Chip Debugger's DBG Pin with an RS-232 Interface (2)

A “reset and stop” function can be achieved by writing 81H to this register. A “reset and go” function can be achieved by writing 41H to this register. If the device is in DEBUG mode, a “run” function can be implemented by writing 40H to this register.

Table 94. OCD Control Register (OCDCTL)

BITS	7	6	5	4	3	2	1	0
FIELD	DBGMODE	BRKEN	DBGACK	BRKLOOP	BRKPC	BRKZRO	Reserved	RST
RESET	0							
R/W	R/W			R				R/W

DBGMODE—Debug Mode
Setting this bit to 1 causes the device to enter DEBUG mode. When in DEBUG mode, the eZ8 CPU stops fetching new instructions. Clearing this bit causes the eZ8 CPU to start running again. This bit is automatically set when a BRK instruction is decoded and Breakpoints are enabled. If the Read Protect Option Bit is enabled, this bit can only be cleared by resetting the device, it cannot be written to 0.
0 = The Z8 Encore! XP F0822 Series device is operating in NORMAL mode.
1 = The Z8 Encore! XP F0822 Series device is in DEBUG mode.

BRKEN—Breakpoint Enable
This bit controls the behavior of the BRK instruction (opcode 00H). By default, Breakpoints are disabled and the BRK instruction behaves like an NOP instruction. If this bit is set to 1 and a BRK instruction is decoded, the OCD takes action dependent upon the BRKLOOP bit.
0 = BRK instruction is disabled.
1 = BRK instruction is enabled.

DBGACK—Debug Acknowledge
This bit enables the debug acknowledge feature. If this bit is set to 1, then the OCD sends an Debug Acknowledge character (FFH) to the host when a Breakpoint occurs.
0 = Debug Acknowledge is disabled.
1 = Debug Acknowledge is enabled.

BRKLOOP—Breakpoint Loop
This bit determines what action the OCD takes when a BRK instruction is decoded if breakpoints are enabled (BRKEN is 1). If this bit is 0, then the DBGMODE bit is automatically set to 1 and the OCD enter DEBUG mode. If BRKLOOP is set to 1, then the eZ8 CPU loops on the BRK instruction.
0 = BRK instruction sets DBGMODE to 1.
1 = eZ8 CPU loops on BRK instruction.

BRKPC—Break when PC == OCDCNTR
If this bit is set to 1, then the OCDCNTR register is used as a hardware breakpoint. When the program counter matches the value in the OCDCNTR register, DBGMODE is

Table 116 contains additional symbols that are used throughout the Instruction Summary and Instruction Set Description sections.

Table 116. Additional Symbols

Symbol	Definition
dst	Destination Operand
src	Source Operand
@	Indirect Address Prefix
SP	Stack Pointer
PC	Program Counter
FLAGS	Flags Register
RP	Register Pointer
#	Immediate Operand Prefix
B	Binary Number Suffix
%	Hexadecimal Number Prefix
H	Hexadecimal Number Suffix

Assignment of a value is indicated by an arrow. For example,

dst ← dst + src

indicates the source data is added to the destination data and the result is stored in the destination location.

Flags Register

The Flags Register contains the status information regarding the most recent arithmetic, logical, bit manipulation or rotate and shift operation. The Flags Register contains six bits of status information that are set or cleared by CPU operations. Four of the bits (C, V, Z and S) can be tested with conditional jump instructions. Two flags (H and D) cannot be tested and are used for Binary-Coded Decimal (BCD) arithmetic.

The two remaining bits, User Flags (F1 and F2), are available as general-purpose status bits. User Flags are unaffected by arithmetic operations and must be set or cleared by instructions. The User Flags cannot be used with conditional Jumps. They are undefined at initial power-up and are unaffected by Reset. Figure 56 illustrates the flags and their bit positions in the Flags Register.

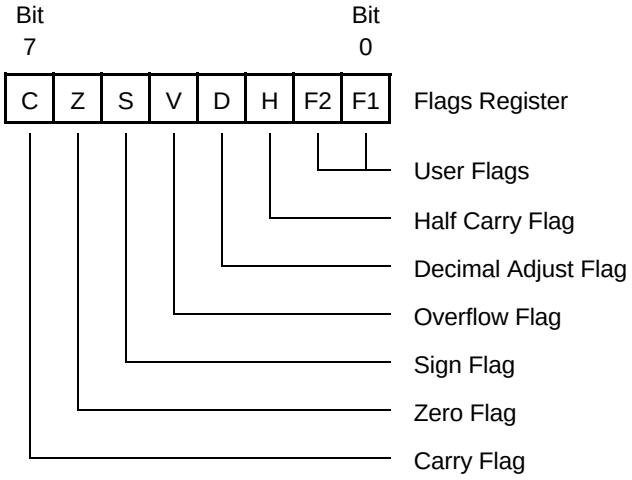


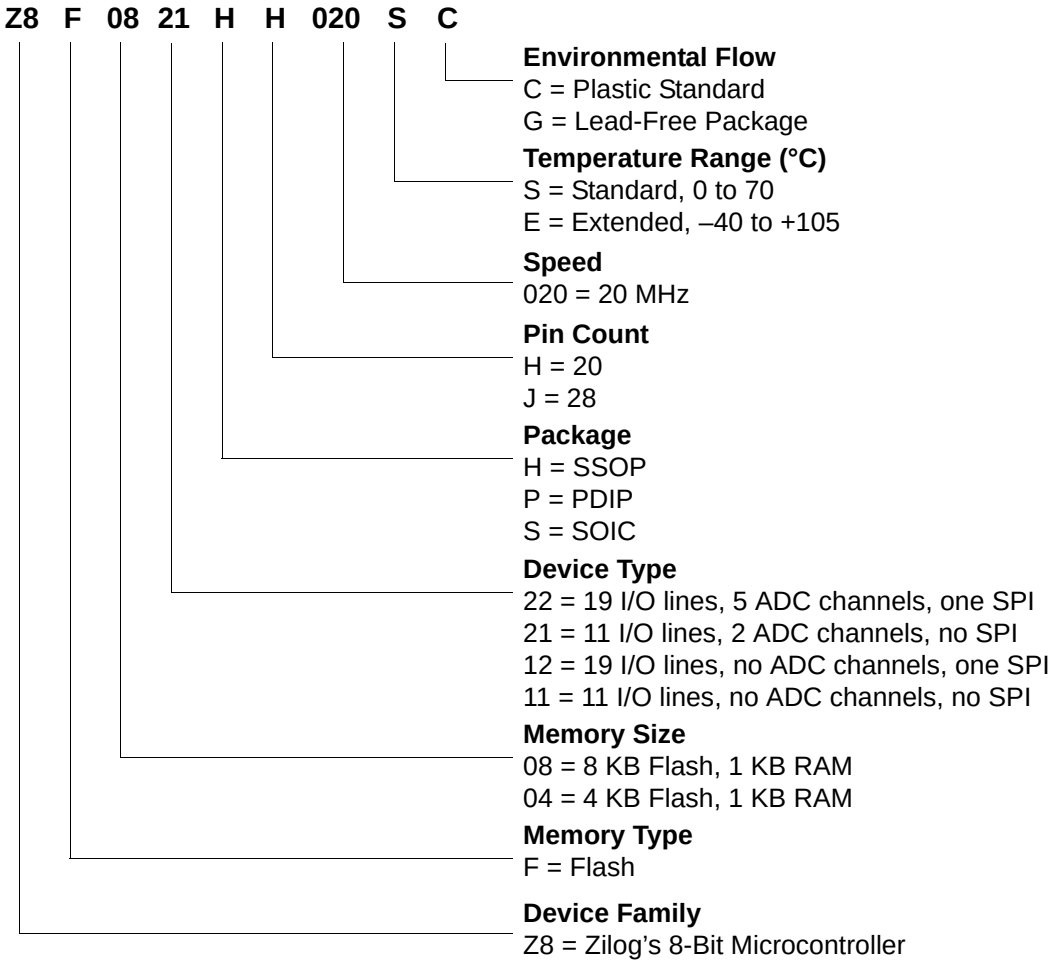
Figure 56. Flags Register

Interrupts, the Software Trap (TRAP) instruction, and Illegal Instruction Traps all write the value of the Flags Register to the stack. Executing an Interrupt Return (IRET) instruction restores the value saved on the stack into the Flags Register.

Upper Nibble (Hex) \ Lower Nibble (Hex)	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
0	1.2 **BRK**	2.2 **SRP** IM	2.3 **ADD** r1,r2	2.4 **ADD** r1,Ir2	3.3 **ADD** R2,R1	3.4 **ADD** IR2,R1	3.3 **ADD** R1,IM	3.4 **ADD** IR1,IM	4.3 **ADDX** ER2,ER1	4.3 **ADDX** IM,ER1	2.3 **DJNZ** r1,X	2.2 **JR** cc,X	2.2 **LD** r1,IM	3.2 **JP** cc,DA	1.2 **INC** r1	1.2 **NOP**
1	2.2 **RLC** R1	2.3 **RLC** IR1	2.3 **ADC** r1,r2	2.4 **ADC** r1,Ir2	3.3 **ADC** R2,R1	3.4 **ADC** IR2,R1	3.3 **ADC** R1,IM	3.4 **ADC** IR1,IM	4.3 **ADCX** ER2,ER1	4.3 **ADCX** IM,ER1						See 2nd Opcode Map
2	2.2 **INC** R1	2.3 **INC** IR1	2.3 **SUB** r1,r2	2.4 **SUB** r1,Ir2	3.3 **SUB** R2,R1	3.4 **SUB** IR2,R1	3.3 **SUB** R1,IM	3.4 **SUB** IR1,IM	4.3 **SUBX** ER2,ER1	4.3 **SUBX** IM,ER1						
3	2.2 **DEC** R1	2.3 **DEC** IR1	2.3 **SBC** r1,r2	2.4 **SBC** r1,Ir2	3.3 **SBC** R2,R1	3.4 **SBC** IR2,R1	3.3 **SBC** R1,IM	3.4 **SBC** IR1,IM	4.3 **SBCX** ER2,ER1	4.3 **SBCX** IM,ER1						
4	2.2 **DA** R1	2.3 **DA** IR1	2.3 **OR** r1,r2	2.4 **OR** r1,Ir2	3.3 **OR** R2,R1	3.4 **OR** IR2,R1	3.3 **OR** R1,IM	3.4 **OR** IR1,IM	4.3 **ORX** ER2,ER1	4.3 **ORX** IM,ER1						
5	2.2 **POP** R1	2.3 **POP** IR1	2.3 **AND** r1,r2	2.4 **AND** r1,Ir2	3.3 **AND** R2,R1	3.4 **AND** IR2,R1	3.3 **AND** R1,IM	3.4 **AND** IR1,IM	4.3 **ANDX** ER2,ER1	4.3 **ANDX** IM,ER1						1.2 **WDT**
6	2.2 **COM** R1	2.3 **COM** IR1	2.3 **TCM** r1,r2	2.4 **TCM** r1,Ir2	3.3 **TCM** R2,R1	3.4 **TCM** IR2,R1	3.3 **TCM** R1,IM	3.4 **TCM** IR1,IM	4.3 **TCMX** ER2,ER1	4.3 **TCMX** IM,ER1						1.2 **STOP**
7	2.2 **PUSH** R2	2.3 **PUSH** IR2	2.3 **TM** r1,r2	2.4 **TM** r1,Ir2	3.3 **TM** R2,R1	3.4 **TM** IR2,R1	3.3 **TM** R1,IM	3.4 **TM** IR1,IM	4.3 **TMX** ER2,ER1	4.3 **TMX** IM,ER1						1.2 **HALT**
8	2.5 **DECW** RR1	2.6 **DECW** IRR1	2.5 **LDE** r1,Irr2	2.9 **LDEI** Ir1,Irr2	3.2 **LDX** r1,ER2	3.3 **LDX** Ir1,ER2	3.4 **LDX** IRR2,R1	3.5 **LDX** IRR2,IR1	3.4 **LDX** r1,rr2,X	3.4 **LDX** rr1,r2,X						1.2 **DI**
9	2.2 **RL** R1	2.3 **RL** IR1	2.5 **LDE** r2,Irr1	2.9 **LDEI** Ir2,Irr1	3.2 **LDX** r2,ER1	3.3 **LDX** Ir2,ER1	3.4 **LDX** R2,IRR1	3.5 **LDX** IR2,IRR1	3.3 **LEA** r1,r2,X	3.5 **LEA** rr1,rr2,X						1.2 **EI**
A	2.5 **INCW** RR1	2.6 **INCW** IRR1	2.3 **CP** r1,r2	2.4 **CP** r1,Ir2	3.3 **CP** R2,R1	3.4 **CP** IR2,R1	3.3 **CP** R1,IM	3.4 **CP** IR1,IM	4.3 **CPX** ER2,ER1	4.3 **CPX** IM,ER1						1.4 **RET**
B	2.2 **CLR** R1	2.3 **CLR** IR1	2.3 **XOR** r1,r2	2.4 **XOR** r1,Ir2	3.3 **XOR** R2,R1	3.4 **XOR** IR2,R1	3.3 **XOR** R1,IM	3.4 **XOR** IR1,IM	4.3 **XORX** ER2,ER1	4.3 **XORX** IM,ER1						1.5 **IRET**
C	2.2 **RRC** R1	2.3 **RRC** IR1	2.5 **LDC** r1,Irr2	2.9 **LDCI** Ir1,Irr2	2.3 **JP** IRR1	2.9 **LDC** Ir1,Irr2		3.4 **LD** r1,r2,X	3.2 **PUSHX** ER2							1.2 **RCF**
D	2.2 **SRA** R1	2.3 **SRA** IR1	2.5 **LDC** r2,Irr1	2.9 **LDCI** Ir2,Irr1	2.6 **CALL** IRR1	2.2 **BSWAP** R1	3.3 **CALL** DA	3.4 **LD** r2,r1,X	3.2 **POPX** ER1							1.2 **SCF**
E	2.2 **RR** R1	2.3 **RR** IR1	2.2 **BIT** p,b,r1	2.3 **LD** r1,Ir2	3.2 **LD** R2,R1	3.3 **LD** IR2,R1	3.2 **LD** R1,IM	3.3 **LD** IR1,IM	4.2 **LDX** ER2,ER1	4.2 **LDX** IM,ER1						1.2 **CCF**
F	2.2 **SWAP** R1	2.3 **SWAP** IR1	2.6 **TRAP** Vector	2.3 **LD** Ir1,r2	2.8 **MULT** RR1	3.3 **LD** R2,IR1	3.3 **BTJ** p,b,r1,X	3.4 **BTJ** p,b,Ir1,X								

Figure 58. First Opcode Map

Part Number Suffix Designations



For example, part number Z8F0821HH020SC is a Z8 Encore! XP Flash 8 KB microcontroller in a 20-pin SSOP package, operating with a maximum 20 MHz external clock frequency over a 0 ºC to +70 ºC temperature range and built using the Plastic-Standard environmental flow.

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