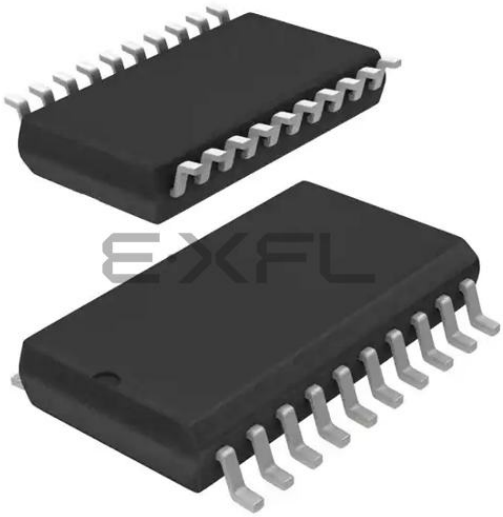

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Applications of "Embedded - Microcontrollers"

Details	
Product Status	Not For New Designs
Core Processor	HC08
Core Size	8-Bit
Speed	8MHz
Connectivity	-
Peripherals	LED, LVD, POR, PWM
Number of I/O	15
Program Memory Size	4KB (4K x 8)
Program Memory Type	FLASH
EEPROM Size	-
RAM Size	128 x 8
Voltage - Supply (Vcc/Vdd)	2.7V ~ 3.3V
Data Converters	A/D 12x8b
Oscillator Type	External
Operating Temperature	-40°C ~ 85°C (TA)
Mounting Type	Surface Mount
Package / Case	20-SOIC (0.295", 7.50mm Width)
Supplier Device Package	20-SOIC
Purchase URL	https://www.e-xfl.com/product-detail/nxp-semiconductors/mc908jk3ecdwer

List of Chapters

Chapter 1
General Description

1.1 Introduction

The MC68H(R)C908JL3E is a member of the low-cost, high-performance M68HC08 Family of 8-bit microcontroller units (MCUs). The M68HC08 Family is based on the customer-specified integrated circuit (CSIC) design strategy. All MCUs in the family use the enhanced M68HC08 central processor unit (CPU08) and are available with a variety of modules, memory sizes and types, and package types.

A list of MC68H(R)C908JL3E device variations is shown in Table 1-1.

Table 1-1. Summary of Device Variations

Device Type	Operating Voltage	LVI	ADC	Oscillator Option	Memory	Pin Count	Device
Flash	3V, 5V	Yes	Yes	XTAL	4,096 bytes Flash	28	MC68HC908JL3E
						20	MC68HC908JK3E
					1,536 bytes Flash	20	MC68HC908JK1E
				RC	4,096 bytes Flash	28	MC68HRC908JL3E
						20	MC68HRC908JK3E
					1,536 bytes Flash	20	MC68HRC908JK1E
Low Voltage Flash(1)	2.2 to 5.5V	No	Yes	XTAL	4,096 bytes Flash	28	MC68HLC908JL3E
						20	MC68HLC908JK3E
					1,536 bytes Flash	20	MC68HLC908JK1E
ROM(2)	3V, 5V	Yes	Yes	XTAL	4,096 bytes ROM	28	MC68HC08JL3E
						20	MC68HC08JK3E
				RC		28	MC68HRC08JL3E
						20	MC68HRC08JK3E
Flash, ADC-less(3)	3V, 5V	Yes	No	XTAL	4,096 bytes Flash	28	MC68HC908KL3E
						20	MC68HC908KK3E

1. Low-voltage Flash devices are documented in Appendix A MC68HLC908JL3E/JK3E/JK1E.
2. ROM devices are documented in Appendix B MC68H(R)C08JL3E/JK3E.
3. Flash, ADC-less devices are documented in Appendix C MC68HC908KL3E/KK3E.

All references to the MC68H(R)C908JL3E in this data book apply equally to the MC68H(R)C908JK3E and MC68H(R)C908JK1E, unless otherwise stated.

Addr.	Register Name		Bit 7	6	5	4	3	2	1	Bit 0
$FE04	Interrupt Status Register 1 (INT1)	Read:	0	IF5	IF4	IF3	0	IF1	0	0
		Write:	R	R	R	R	R	R	R	R
		Reset:	0	0	0	0	0	0	0	0
$FE05	Interrupt Status Register 2 (INT2)	Read:	IF14	0	0	0	0	0	0	0
		Write:	R	R	R	R	R	R	R	R
		Reset:	0	0	0	0	0	0	0	0
$FE06	Interrupt Status Register 3 (INT3)	Read:	0	0	0	0	0	0	0	IF15
		Write:	R	R	R	R	R	R	R	R
		Reset:	0	0	0	0	0	0	0	0
$FE07	Reserved	Read: Write:	R	R	R	R	R	R	R	R
$FE08	Flash Control Register (FLCR)	Read:	0	0	0	0	HVEN	MASS	ERASE	PGM
		Write:								
		Reset:	0	0	0	0	0	0	0	0
$FE09	Flash Block Protect Register (FLBPR)	Read: Write:	BPR7	BPR6	BPR5	BPR4	BPR3	BPR2	BPR1	BPR0
		Reset:	0	0	0	0	0	0	0	0
$FE0A ↓ $FE0B	Reserved	Read: Write:	R	R	R	R	R	R	R	R
$FE0C	Break Address High Register (BRKH)	Read: Write:	Bit15	Bit14	Bit13	Bit12	Bit11	Bit10	Bit9	Bit8
		Reset:	0	0	0	0	0	0	0	0
$FE0D	Break Address Low Register (BRKL)	Read: Write:	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
		Reset:	0	0	0	0	0	0	0	0
$FE0E	Break Status and Control Register (BRKSCR)	Read:	BRKE	BRKA	0	0	0	0	0	0
		Write:								
		Reset:	0	0	0	0	0	0	0	0
$FFFF	COP Control Register (COPCTL)	Read:	Low byte of reset vector							
		Write:	Writing clears COP counter (any value)							
		Reset:	Unaffected by reset							

= Unimplemented R = Reserved

Figure 2-2. Control, Status, and Data Registers (Sheet 4 of 4)

Table 2-1. Vector Addresses

Vector Priority	INT Flag	Address	Vector
Lowest ↕ Highest	—	$FFD0 ↓ $FFDD	Not Used
	IF15	$FFDE	ADC Conversion Complete Vector (High)
		$FFDF	ADC Conversion Complete Vector (Low)
	IF14	$FFE0	Keyboard Vector (High)
		$FFE1	Keyboard Vector (Low)
	IF13 ↓ IF6	—	Not Used
	IF5	$FFF2	TIM Overflow Vector (High)
		$FFF3	TIM Overflow Vector (Low)
	IF4	$FFF4	TIM Channel 1 Vector (High)
		$FFF5	TIM Channel 1 Vector (Low)
	IF3	$FFF6	TIM Channel 0 Vector (High)
		$FFF7	TIM Channel 0 Vector (Low)
	IF2	—	Not Used
	IF1	$FFFA	$\overline{\text{IRQ}}$ Vector (High)
		$FFFB	$\overline{\text{IRQ}}$ Vector (Low)
	—	$FFFC	SWI Vector (High)
		$FFFD	SWI Vector (Low)
	—	$FFFE	Reset Vector (High)
		$FFFF	Reset Vector (Low)

2.4 Random-Access Memory (RAM)

Addresses $0080 through $00FF are RAM locations. The location of the stack RAM is programmable. The 16-bit stack pointer allows the stack to be anywhere in the 64-Kbyte memory space.

NOTE

For correct operation, the stack pointer must point only to RAM locations.

Within page zero are 128 bytes of RAM. Because the location of the stack RAM is programmable, all page zero RAM locations can be used for I/O control and user data or code. When the stack pointer is moved from its reset location at $00FF, direct addressing mode instructions can access efficiently all page zero RAM locations. Page zero RAM, therefore, provides ideal locations for frequently accessed global variables.

Before processing an interrupt, the CPU uses five bytes of the stack to save the contents of the CPU registers.

NOTE

For M6805 compatibility, the H register is not stacked.

Chapter 3
Configuration Registers (CONFIG)

3.1 Introduction

This section describes the configuration registers (CONFIG1 and CONFIG2). The configuration registers enables or disables the following options:

- Stop mode recovery time (32 × 2OSCOUT cycles or 4096 × 2OSCOUT cycles)
- STOP instruction
- Computer operating properly module (COP)
- COP reset period (COPRS), 8176 × 2OSCOUT or 262,128 × 2OSCOUT
- Enable LVI circuit
- Select LVI trip voltage

3.2 Functional Description

The configuration register is used in the initialization of various options. The configuration register can be written once after each reset. All of the configuration register bits are cleared during reset. Since the various options affect the operation of the MCU it is recommended that this register be written immediately after reset. The configuration register is located at $001E and $001F, and may be read at anytime.

NOTE

The CONFIG registers are one-time writable by the user after each reset. Upon a reset, the CONFIG registers default to predetermined settings as shown in Figure 3-1 and Figure 3-2.

3.3 Configuration Register 1 (CONFIG1)

Address: $001F

	Bit 7	6	5	4	3	2	1	Bit 0
Read: Write:	COPRS	R	R	LVID	R	SSREC	STOP	COPD
Reset:	0	0	0	0	0	0	0	0

R = Reserved

Figure 3-1. Configuration Register 1 (CONFIG1)

COPRS — COP reset period selection bit

1 = COP reset cycle is 8176 × 2OSCOUT
0 = COP reset cycle is 262,128 × 2OSCOUT

Chapter 4
Central Processor Unit (CPU)

4.1 Introduction

The M68HC08 CPU (central processor unit) is an enhanced and fully object-code-compatible version of the M68HC05 CPU. The *CPU08 Reference Manual* (document order number CPU08RM/AD) contains a description of the CPU instruction set, addressing modes, and architecture.

4.2 Features

Features of the CPU include:

- Object code fully upward-compatible with M68HC05 Family
- 16-bit stack pointer with stack manipulation instructions
- 16-bit index register with x-register manipulation instructions
- 8-MHz CPU internal bus frequency
- 64-Kbyte program/data memory space
- 16 addressing modes
- Memory-to-memory data moves without using accumulator
- Fast 8-bit by 8-bit multiply and 16-bit by 8-bit divide instructions
- Enhanced binary-coded decimal (BCD) data handling
- Modular architecture with expandable internal bus definition for extension of addressing range beyond 64 Kbytes
- Low-power stop and wait modes

4.3 CPU Registers

Figure 4-1 shows the five CPU registers. CPU registers are not part of the memory map.

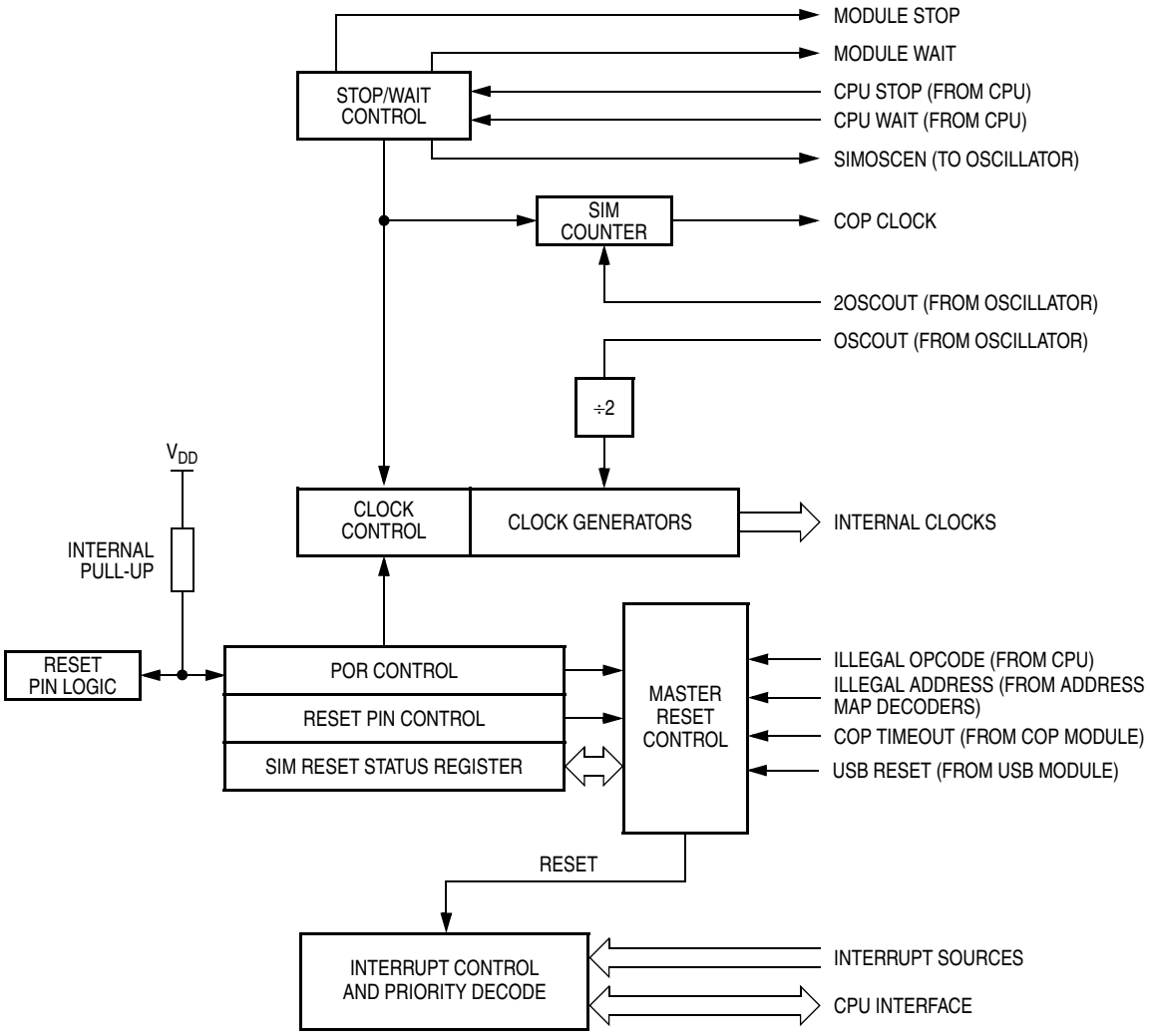


Figure 5-1. SIM Block Diagram

Addr.	Register Name		Bit 7	6	5	4	3	2	1	Bit 0
$FE00	Break Status Register (BSR)	Read: Write:	R	R	R	R	R	R	SBSW NOTE	R
		Reset:	0	0	0	0	0	0	0	0
Note: Writing a 0 clears SBSW.										
$FE01	Reset Status Register (RSR)	Read: Write:	POR	PIN	COP	ILOP	ILAD	MODRST	LVI	0
		POR:	1	0	0	0	0	0	0	0
$FE02	Reserved	Read: Write:	R	R	R	R	R	R	R	R
		Reset:								
$FE03	Break Flag Control Register (BFCR)	Read: Write:	BCFE	R	R	R	R	R	R	R
		Reset:	0							
			= Unimplemented				R	= Reserved		

Figure 5-2. SIM I/O Register Summary

5.3 Reset and System Initialization

The MCU has these reset sources:

- Power-on reset module (POR)
- External reset pin ($\overline{RST}$)
- Computer operating properly module (COP)
- Low-voltage inhibit module (LVI)
- Illegal opcode
- Illegal address

All of these resets produce the vector $FFFE–$FFFF ($FEFE–$FEFF in Monitor mode) and assert the internal reset signal (IRST). IRST causes all registers to be returned to their default values and all modules to be returned to their reset states.

An internal reset clears the SIM counter (see 5.4 SIM Counter), but an external reset does not. Each of the resets sets a corresponding bit in the reset status register (RSR). (See 5.7 SIM Registers.)

5.3.1 External Pin Reset

The $\overline{RST}$ pin circuits include an internal pull-up device. Pulling the asynchronous $\overline{RST}$ pin low halts all processing. The PIN bit of the reset status register (RSR) is set as long as $\overline{RST}$ is held low for a minimum of 67 2OSCOUT cycles, assuming that the POR was not the source of the reset. See Table 5-2 for details. Figure 5-4 shows the relative timing.

Table 5-2. PIN Bit Set Timing

Reset Type	Number of Cycles Required to Set PIN
POR	4163 (4096 + 64 + 3)
All others	67 (64 + 3)

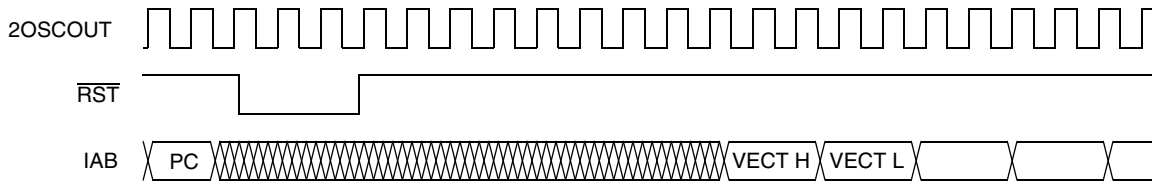


Figure 5-4. External Reset Timing

5.3.2 Active Resets from Internal Sources

All internal reset sources actively pull the $\overline{RST}$ pin low for 32 2OSCOUT cycles to allow resetting of external peripherals. The internal reset signal IRST continues to be asserted for an additional 32 cycles (Figure 5-5). An internal reset can be caused by an illegal address, illegal opcode, COP time-out, or POR. (See Figure 5-6.) Note that for POR resets, the SIM cycles through 4096 2OSCOUT cycles during which the SIM forces the $\overline{RST}$ pin low. The internal reset signal then follows the sequence from the falling edge of $\overline{RST}$ shown in Figure 5-5.

Chapter 7
Monitor ROM (MON)

7.1 Introduction

This section describes the monitor ROM (MON) and the monitor mode entry methods. The monitor ROM allows complete testing of the MCU through a single-wire interface with a host computer. This mode is also used for programming and erasing of Flash memory in the MCU. Monitor mode entry can be achieved without use of the higher test voltage, V_{TST}, as long as vector addresses $FFFE and $FFFF are blank, thus reducing the hardware requirements for in-circuit programming.

7.2 Features

Features of the monitor ROM include the following:

- Normal user-mode pin functionality
- One pin dedicated to serial communication between monitor ROM and host computer
- Standard mark/space non-return-to-zero (NRZ) communication with host computer
- Execution of code in RAM or Flash
- Flash memory security feature[1]
- Flash memory programming interface
- 960 bytes monitor ROM code size
- Monitor mode entry without high voltage, V_{TST}, if reset vector is blank ($FFFE and $FFFF contain $FF)
- Standard monitor mode entry if high voltage, V_{TST}, is applied to $\overline{IRQ}$

7.3 Functional Description

The monitor ROM receives and executes commands from a host computer. Figure 7-1 shows a example circuit used to enter monitor mode and communicate with a host computer via a standard RS-232 interface.

Simple monitor commands can access any memory address. In monitor mode, the MCU can execute host-computer code in RAM while most MCU pins retain normal operating mode functions. All communication between the host computer and the MCU is through the PTB0 pin. A level-shifting and multiplexing interface is required between PTB0 and the host computer. PTB0 is used in a wired-OR configuration and requires a pull-up resistor.

1. No security feature is absolutely secure. However, Freescale's strategy is to make reading or copying the Flash difficult for unauthorized users.

Table 7-8. READSP (Read Stack Pointer) Command

Description	Reads stack pointer
Operand	None
Data Returned	Returns stack pointer in high byte:low byte order
Opcode	$0C
Command Sequence	

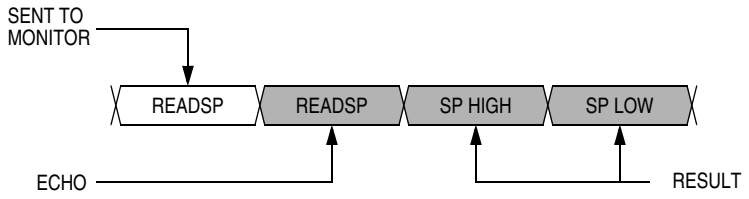
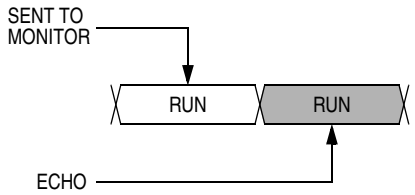


Table 7-9. RUN (Run User Program) Command

Description	Executes RTI instruction
Operand	None
Data Returned	None
Opcode	$28
Command Sequence	



7.4 Security

A security feature discourages unauthorized reading of Flash locations while in monitor mode. The host can bypass the security feature at monitor mode entry by sending eight security bytes that match the bytes at locations $FFF6–$FFFD. Locations $FFF6–$FFFD contain user-defined data.

NOTE

Do not leave locations $FFF6–$FFFD blank. For security reasons, program locations $FFF6–$FFFD even if they are not used for vectors.

During monitor mode entry, the MCU waits after the power-on reset for the host to send the eight security bytes on pin PTB0. If the received bytes match those at locations $FFF6–$FFFD, the host bypasses the security feature and can read all Flash locations and execute code from Flash. Security remains bypassed until a power-on reset occurs. If the reset was not a power-on reset, security remains bypassed and security code entry is not required. (See Figure 7-7.)

9.5.2 Stop Mode

The ADC module is inactive after the execution of a STOP instruction. Any pending conversion is aborted. ADC conversions resume when the MCU exits stop mode. Allow one conversion cycle to stabilize the analog circuitry before attempting a new ADC conversion after exiting stop mode.

9.6 I/O Signals

The ADC module has 12 channels that are shared with I/O port B and port D.

9.6.1 ADC Voltage In (ADCVIN)

ADCVIN is the input voltage signal from one of the 12 ADC channels to the ADC module.

9.7 I/O Registers

These I/O registers control and monitor ADC operation:

- ADC status and control register (ADSCR)
- ADC data register (ADR)
- ADC clock register (ADICLK)

9.7.1 ADC Status and Control Register

The following paragraphs describe the function of the ADC status and control register.

Address: $003C

	Bit 7	6	5	4	3	2	1	Bit 0
Read:	COCO	AIEN	ADCO	ADCH4	ADCH3	ADCH2	ADCH1	ADCH0
Write:								
Reset:	0	0	0	1	1	1	1	1

= Unimplemented

Figure 9-3. ADC Status and Control Register (ADSCR)

COCO — Conversions Complete Bit

When the AIEN bit is a 0, the COCO is a read-only bit which is set each time a conversion is completed. This bit is cleared whenever the ADC status and control register is written or whenever the ADC data register is read. Reset clears this bit.

1 = Conversion completed (AIEN = 0)
0 = Conversion not completed (AIEN = 0)

When the AIEN bit is a 1 (CPU interrupt enabled), the COCO is a read-only bit, and will always be 0 when read.

AIEN — ADC Interrupt Enable Bit

When this bit is set, an interrupt is generated at the end of an ADC conversion. The interrupt signal is cleared when the data register is read or the status/control register is written. Reset clears the AIEN bit.

1 = ADC interrupt enabled
0 = ADC interrupt disabled

10.2 Port A

Port A is an 7-bit special function port that shares all seven of its pins with the keyboard interrupt (KBI) module (see Chapter 12 Keyboard Interrupt Module (KBI)). Each port A pin also has software configurable pull-up device if the corresponding port pin is configured as input port. PTA0 to PTA5 has direct LED drive capability.

NOTE

PTA0–PTA5 pins are available on MC68H(R)C908JL3E only.
PTA6 pin is available on MC68HRC908JL3E/JK3E/JK1E only.

10.2.1 Port A Data Register (PTA)

The port A data register (PTA) contains a data latch for each of the seven port A pins.

Address: $0000

	Bit 7	6	5	4	3	2	1	Bit 0
Read:	0	PTA6	PTA5	PTA4	PTA3	PTA2	PTA1	PTA0
Write:								
Reset:	Unaffected by Reset							
Additional Functions:			LED (Sink)	LED (Sink)	LED (Sink)	LED (Sink)	LED (Sink)	LED (Sink)
		30k pull-up	30k pull-up	30k pull-up	30k pull-up	30k pull-up	30k pull-up	30k pull-up
		Keyboard Interrupt	Keyboard Interrupt	Keyboard Interrupt	Keyboard Interrupt	Keyboard Interrupt	Keyboard Interrupt	Keyboard Interrupt

= Unimplemented

Figure 10-2. Port A Data Register (PTA)

PTA[6:0] — Port A Data Bits

These read/write bits are software programmable. Data direction of each port A pin is under the control of the corresponding bit in data direction register A. Reset has no effect on port A data.

KBI[6:0] — Port A Keyboard Interrupts

The keyboard interrupt enable bits, KBIE[6:0], in the keyboard interrupt control register (KBIER) enable the port A pins as external interrupt pins, (see Chapter 12 Keyboard Interrupt Module (KBI)).

10.2.3 Port A Input Pull-up Enable Register (PTAPUE)

The port A input pull-up enable register (PTAPUE) contains a software configurable pull-up device for each of the seven port A pins. Each bit is individually configurable and requires the corresponding data direction register, DDRAx be configured as input. Each pull-up device is automatically and dynamically disabled when its corresponding DDRAx bit is configured as output.

Address: $000D

	Bit 7	6	5	4	3	2	1	Bit 0
Read: Write:	PTA6EN	PTAPUE6	PTAPUE5	PTAPUE4	PTAPUE3	PTAPUE2	PTAPUE1	PTAPUE0
Reset:	0	0	0	0	0	0	0	0

Figure 10-5. Port A Input Pull-up Enable Register (PTAPUE)

PTA6EN — Enable PTA6 on OSC2

This read/write bit configures the OSC2 pin function when RC oscillator option is selected. This bit has no effect for X-tal oscillator option.

1 = OSC2 pin configured for PTA6 I/O, and has all the interrupt and pull-up functions
0 = OSC2 pin outputs the RC oscillator clock (RCCLK)

PTAPUE[6:0] — Port A Input Pull-up Enable Bits

These read/write bits are software programmable to enable pull-up devices on port A pins

1 = Corresponding port A pin configured to have internal pull-up if its DDRA bit is set to 0
0 = Pull-up device is disconnected on the corresponding port A pin regardless of the state of its DDRA bit

Table 10-2 summarizes the operation of the port A pins.

Table 10-2. Port A Pin Functions

PTAPUE Bit	DDRA Bit	PTA Bit	I/O Pin Mode	Accesses to DDRA	Accesses to PTA	
				Read/Write	Read	Write
1	0	X(1)	Input, V_{DD}(2)	DDRA[6:0]	Pin	PTA[6:0](3)
0	0	X	Input, Hi-Z(4)	DDRA[6:0]	Pin	PTA[6:0](3)
X	1	X	Output	DDRA[6:0]	PTA[6:0]	PTA[6:0]

1. X = Don't care.
2. I/O pin pulled to V_{DD} by internal pull-up.
3. Writing affects data register, but does not affect input.
4. Hi-Z = High Impedance.

12.5.1 Keyboard Status and Control Register

- Flags keyboard interrupt requests
- Acknowledges keyboard interrupt requests
- Masks keyboard interrupt requests
- Controls keyboard interrupt triggering sensitivity

Address: $001A

	Bit 7	6	5	4	3	2	1	Bit 0
Read:	0	0	0	0	KEYF	0	IMASKK	MODEK
Write:						ACKK		
Reset:	0	0	0	0	0	0	0	0

= Unimplemented

Figure 12-3. Keyboard Status and Control Register (KBSCR)

KEYF — Keyboard Flag Bit

This read-only bit is set when a keyboard interrupt is pending on port-A. Reset clears the KEYF bit.

1 = Keyboard interrupt pending
0 = No keyboard interrupt pending

ACKK — Keyboard Acknowledge Bit

Writing a 1 to this write-only bit clears the keyboard interrupt request on port-A. ACKK always reads as 0. Reset clears ACKK.

IMASKK— Keyboard Interrupt Mask Bit

Writing a 1 to this read/write bit prevents the output of the keyboard interrupt mask from generating interrupt requests on port-A. Reset clears the IMASKK bit.

1 = Keyboard interrupt requests masked
0 = Keyboard interrupt requests not masked

MODEK — Keyboard Triggering Sensitivity Bit

This read/write bit controls the triggering sensitivity of the keyboard interrupt pins on port-A. Reset clears MODEK.

1 = Keyboard interrupt requests on falling edges and low levels
0 = Keyboard interrupt requests on falling edges only

Table 16-7. DC Electrical Characteristics (3V) (Continued)

Characteristic[1]	Symbol	Min	Typ[2]	Max	Unit
LVI reset voltage	V_{LVR3}	2.0	2.4	2.69	V

1. V_{DD} = 2.7 to 3.3 Vdc, V_{SS} = 0 Vdc, $T_A = T_L$ to T_H, unless otherwise noted.
2. Typical values reflect average measurements at midpoint of voltage range, 25 °C only.
3. Run (operating) I_{DD} measured using external square wave clock source (f_{OP} = 2MHz). All inputs 0.2V from rail. No dc loads. Less than 100 pF on all outputs. C_L = 20 pF on OSC2. All ports configured as inputs. OSC2 capacitance linearly affects run I_{DD}. Measured with all modules enabled.
4. Wait I_{DD} measured using external square wave clock source (f_{OP} = 2MHz). All inputs 0.2V from rail. No dc loads. Less than 100 pF on all outputs. C_L = 20 pF on OSC2. All ports configured as inputs. OSC2 capacitance linearly affects wait I_{DD}.
5. Stop I_{DD} measured with OSC1 grounded; no port pins sourcing current. LVI is disabled.
6. Maximum is highest voltage that POR is guaranteed.
7. If minimum V_{DD} is not reached before the internal POR reset is released, $\overline{RST}$ must be driven low externally until minimum V_{DD} is reached.
8. R_{PU1} and R_{PU2} are measured at V_{DD} = 5.0V.

16.9 3V Control Timing

Table 16-8. Control Timing (3V)

Characteristic[1]	Symbol	Min	Max	Unit
Internal operating frequency[2]	f_{OP}	—	4	MHz
$\overline{RST}$ input pulse width low[3]	t_{IRL}	1.5	—	µs

1. V_{DD} = 2.7 to 3.3 Vdc, V_{SS} = 0 Vdc, $T_A = T_L$ to T_H; timing shown with respect to 20% V_{DD} and 70% V_{DD}, unless otherwise noted.
2. Some modules may require a minimum frequency greater than dc for proper operation; see appropriate table for this information.
3. Minimum pulse width reset is guaranteed to be recognized. It is possible for a smaller pulse width to cause a reset.

A.5.3 Control Timing

Table A-3. Control Timing

Characteristic[1]	Symbol	Min	Max	Unit
Internal operating frequency[2]	f_{OP}	—	2	MHz
$\overline{RST}$ input pulse width low[3]	t_{IRL}	1.5	—	µs

1. V_{DD} = 2.2 Vdc, V_{SS} = 0 Vdc, $T_A = T_L$ to T_H; timing shown with respect to 20% V_{DD} and 70% V_{DD}, unless otherwise noted.
2. Some modules may require a minimum frequency greater than dc for proper operation; see appropriate table for this information.
3. Minimum pulse width reset is guaranteed to be recognized. It is possible for a smaller pulse width to cause a reset.

A.5.4 Oscillator Characteristics

Table A-4. Oscillator Component Specifications

Characteristic	Symbol	Min	Typ	Max	Unit
Crystal frequency, XTALCLK	$f_{OSCXCLK}$	—	—	8	MHz
External clock reference frequency[1]	$f_{OSCXCLK}$	dc	—	8	MHz
Crystal load capacitance[2]	C_L	—	—	—	
Crystal fixed capacitance[2]	C_1	—	$2 \times C_L$	—	
Crystal tuning capacitance[2]	C_2	—	$2 \times C_L$	—	
Feedback bias resistor	R_B	—	10 MΩ	—	
Series resistor[2], [3]	R_S	—	—	—	

1. No more than 10% duty cycle deviation from 50%
2. Consult crystal vendor data sheet
3. Not Required for high frequency crystals

A.5.5 ADC Characteristics

Table A-5. ADC Characteristics

Characteristic	Symbol	Min	Max	Unit	Comments
Supply voltage	V_{DDAD}	2.2 (V_{DD} min)	5.5 (V_{DD} max)	V	
Input voltages	V_{ADIN}	V_{SS}	V_{DD}	V	
Resolution	B_{AD}	8	8	Bits	
Absolute accuracy	A_{AD}	± 0.5	± 2	LSB	Includes quantization
ADC internal clock	f_{ADIC}	0.5	1.048	MHz	$t_{AIC} = 1/f_{ADIC}$, tested only at 1 MHz
Conversion range	R_{AD}	V_{SS}	V_{DD}	V	
Power-up time	t_{ADPU}	14	—	t_{AIC} cycles	
Conversion time	t_{ADC}	14	15	t_{AIC} cycles	
Sample time[1]	t_{ADS}	5	—	t_{AIC} cycles	
Zero input reading[2]	Z_{ADI}	00	01	Hex	$V_{IN} = V_{SS}$
Full-scale reading[3]	F_{ADI}	FE	FF	Hex	$V_{IN} = V_{DD}$
Input capacitance	C_{ADI}	—	(20) 8	pF	Not tested
Input leakage[3] Port B/port D	—	—	± 1	μA	

1. Source impedances greater than 10 kΩ adversely affect internal RC charging time during input sampling.
2. Zero-input/full-scale reading requires sufficient decoupling measures for accurate conversions.
3. The external system error caused by input leakage current is approximately equal to the product of R source and input current.

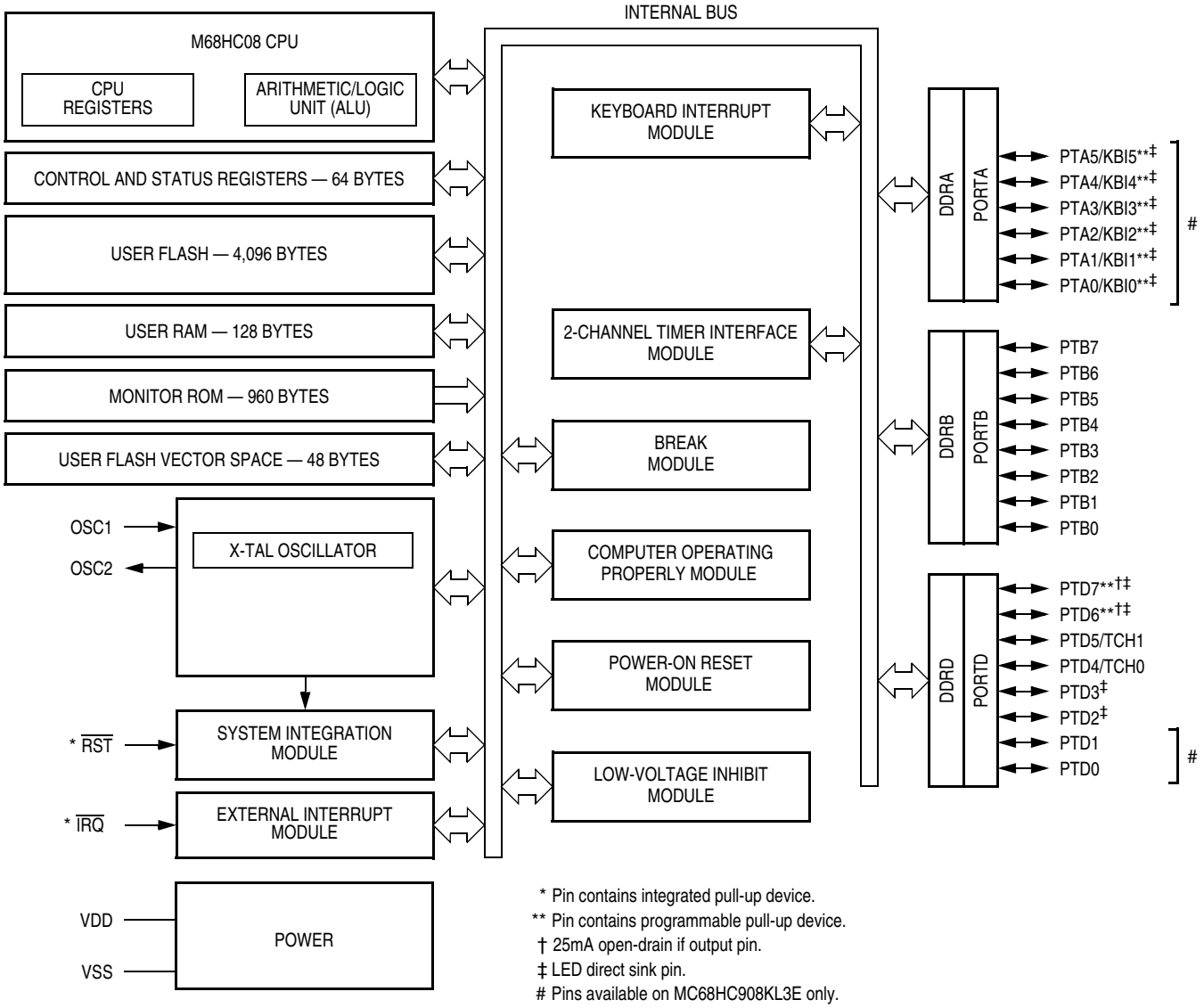


Figure C-1. MC68HC908KL3E/KK3E Block Diagram

C.4 Reserved Registers

The following registers are reserved location on the MC68HC908KL3E/KK3E.

Addr.	Register Name		Bit 7	6	5	4	3	2	1	Bit 0
$003C	Reserved	Read: Write: Reset:	R	R	R	R	R	R	R	R
$003D	Reserved	Read: Write: Reset:	R	R	R	R	R	R	R	R
$003E	Reserved	Read: Write: Reset:	R	R	R	R	R	R	R	R

Figure C-4. Reserved Registers

C.5 Reserved Vectors

The following vectors are reserved interrupt vectors on the MC68HC908KL3E/KK3E.

Table C-2. Reserved Vectors

Vector Priority	INT Flag	Address	Vector
—	IF15	$FFDE	Reserved
		$FFDF	Reserved

C.6 Order Numbers

Table C-3. MC68HC908KL3E/KK3E Order Numbers

MC order number	Package	Operating Temperature	Operating V_{DD}	OSC	Flash Memory
MC68HC908KL3ECP	28-pin PDIP	–40 to +85 °C	3V, 5V	XTAL	4096 Bytes
MC68HC908KL3ECDW	28-pin SOIC				
MC68HC908KK3ECP	20-pin PDIP				
MC68HC908KK3ECDW	20-pin SOIC				