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MC68HC908LB8

Data Sheet

**M68HC08
Microcontrollers**

MC68HC908LB8
Rev. 1
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MC68HC908LB8

Data Sheet

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List of Sections

Chapter 1	General Description	17
Chapter 2	Memory	25
Chapter 3	Analog-to-Digital Converter (ADC)	45
Chapter 4	Op Amp/Comparator Module	53
Chapter 5	Configuration Register (CONFIG)	59
Chapter 6	Computer Operating Properly (COP) Module	63
Chapter 7	Central Processor Unit (CPU)	67
Chapter 8	External Interrupt (IRQ)	81
Chapter 9	Keyboard Interrupt Module (KBI)	85
Chapter 10	High Resolution PWM (HRP)	91
Chapter 11	Low-Power Modes	113
Chapter 12	Low-Voltage Inhibit (LVI)	119
Chapter 13	Oscillator Module (OSC)	123
Chapter 14	Input/Output (I/O) Ports	133
Chapter 15	Pulse Width Modulator with Fault Input (PWM)	141
Chapter 16	Resets and Interrupts	163
Chapter 17	System Integration Module (SIM)	171
Chapter 18	Timer Interface Module (TIM)	187
Chapter 19	Development Support	203
Chapter 20	Electrical Specifications	221
Chapter 21	Ordering Information and Mechanical Specifications	231



Table of Contents

Chapter 1 General Description

1.1	Introduction	17
1.2	Features	17
1.2.1	Standard Features of the MC68HC908LB8	17
1.2.2	Features of the CPU08	19
1.3	MCU Block Diagram	19
1.4	Pin Assignments	20
1.5	Pin Functions	21
1.6	Pin Function Priority	22
1.7	System Clock Distribution	24

Chapter 2 Memory

2.1	Introduction	25
2.2	Unimplemented Memory Locations	25
2.3	Reserved Memory Locations	25
2.4	Register Section	25
2.5	Random-Access Memory (RAM)	35
2.6	FLASH Memory (FLASH)	36
2.6.1	FLASH Control Register	37
2.6.2	FLASH Page Erase Operation	37
2.6.3	FLASH Mass Erase Operation	38
2.6.4	FLASH Program/Read Operation	39
2.6.5	FLASH Block Protection	40
2.6.6	FLASH Block Protect Register	42
2.6.7	Wait Mode	43
2.6.8	Stop Mode	43

Chapter 3 Analog-to-Digital Converter (ADC)

3.1	Introduction	45
3.2	Features	46
3.3	Functional Description	46
3.3.1	ADC Port I/O Pins	46
3.3.2	Voltage Conversion	47
3.3.3	Conversion Time	47
3.3.4	Conversion	47
3.3.5	Accuracy and Precision	47
3.4	Monotonicity	47

3.5	Interrupts	47
3.6	Low-Power Modes	48
3.6.1	Wait Mode	48
3.6.2	Stop Mode	48
3.7	I/O Signals	48
3.8	I/O Registers	48
3.8.1	ADC Status and Control Register	48
3.8.2	ADC Data Register	50
3.8.3	ADC Clock Register	50

Chapter 4 Op Amp/Comparator Module

4.1	Introduction	53
4.2	Features	53
4.3	Pin Name Conventions	53
4.4	Functional Description	54
4.5	Low Power Modes	55
4.5.1	Wait Mode	55
4.5.2	Stop Mode	55
4.6	Op Amp/Comparator Control Register	55
4.7	Application Information	56

Chapter 5 Configuration Register (CONFIG)

5.1	Introduction	59
5.2	Functional Description	59

Chapter 6 Computer Operating Properly (COP) Module

6.1	Introduction	63
6.2	Functional Description	63
6.3	I/O Signals	64
6.3.1	BUSCLKX4	64
6.3.2	COPCTL Write	64
6.3.3	Power-On Reset	64
6.3.4	Internal Reset	64
6.3.5	Reset Vector Fetch	64
6.3.6	COPD (COP Disable)	65
6.3.7	COPRS (COP Rate Select)	65
6.4	COP Control Register	65
6.5	Interrupts	65
6.6	Monitor Mode	65
6.7	Low-Power Modes	65
6.7.1	Wait Mode	65
6.7.2	Stop Mode	65

Chapter 7 Central Processor Unit (CPU)

7.1	Introduction	67
7.2	Features	67
7.3	CPU Registers	67
7.3.1	Accumulator	68
7.3.2	Index Register	68
7.3.3	Stack Pointer	69
7.3.4	Program Counter	69
7.3.5	Condition Code Register	69
7.4	Arithmetic/Logic Unit (ALU)	71
7.5	Low-Power Modes	71
7.5.1	Wait Mode	71
7.5.2	Stop Mode	71
7.6	CPU During Break Interrupts	71
7.7	Instruction Set Summary	72
7.8	Opcode Map	78

Chapter 8 External Interrupt (IRQ)

8.1	Introduction	81
8.2	Features	81
8.3	Functional Description	81
8.4	$\overline{\text{IRQ}}$ Pin	82
8.5	IRQ Module During Break Interrupts	83
8.6	IRQ Status and Control Register	83

Chapter 9 Keyboard Interrupt Module (KBI)

9.1	Introduction	85
9.2	Features	86
9.3	Functional Description	87
9.4	Keyboard Initialization	88
9.5	Low-Power Modes	88
9.5.1	Wait Mode	88
9.5.2	Stop Mode	88
9.6	Keyboard Module During Break Interrupts	88
9.7	I/O Registers	89
9.7.1	Keyboard Status and Control Register	89
9.7.2	Keyboard Interrupt Enable Register	89

Chapter 10 High Resolution PWM (HRP)

10.1	Introduction	91
10.2	Features	91

10.3	Pin Name Conventions	91
10.4	Functional Description	93
10.4.1	The Principle of Frequency Dithering	94
10.4.2	Frequency Dithering on the HRP	95
10.4.3	Duty Cycle Dithering	96
10.4.4	Frequency Generation	96
10.4.5	Variable Frequency Mode (HRPMODE = 0)	99
10.4.6	Variable Duty Cycle Mode (HRPMODE = 1)	99
10.4.7	Dithering Controller	100
10.4.8	Dithering Controller Timebase	101
10.4.9	Deadtime Insertion	101
10.5	Interrupts	104
10.6	Low-Power Modes	104
10.6.1	Wait Mode	104
10.6.2	Stop Mode	104
10.7	HRP During Break Interrupts	104
10.7.1	Input/Output Signals	104
10.8	HRP Registers	105
10.8.1	HRP Control Register	105
10.8.2	HRP Duty Cycle Registers	106
10.8.3	HRP Period Registers	107
10.8.4	HRP Deadtime Register	108
10.8.5	Frequency Dithering HRP Timebase Registers	108
10.8.6	Frequency Dithering Control Register	109
10.9	HRP Programming Examples	110

Chapter 11 Low-Power Modes

11.1	Introduction	113
11.1.1	Wait Mode	113
11.1.2	Stop Mode	113
11.2	Analog-to-Digital Converter (ADC)	113
11.2.1	Wait Mode	113
11.2.2	Stop Mode	113
11.3	Break Module (BRK)	113
11.3.1	Wait Mode	113
11.3.2	Stop Mode	114
11.4	Central Processor Unit (CPU)	114
11.4.1	Wait Mode	114
11.4.2	Stop Mode	114
11.5	Computer Operating Properly Module (COP)	114
11.5.1	Wait Mode	114
11.5.2	Stop Mode	114
11.6	External Interrupt Module (IRQ)	114
11.6.1	Wait Mode	114
11.6.2	Stop Mode	114
11.7	Keyboard Interrupt Module (KBI)	115

11.7.1	Wait Mode	115
11.7.2	Stop Mode	115
11.8	High Resolution PWM (HRP)	115
11.8.1	Wait Mode	115
11.8.2	Stop Mode	115
11.9	Low-Voltage Inhibit Module (LVI)	115
11.9.1	Wait Mode	115
11.9.2	Stop Mode	115
11.10	Op Amp/Comparator	116
11.10.1	Wait Mode	116
11.10.2	Stop Mode	116
11.11	Oscillator Module (OSC)	116
11.11.1	Wait Mode	116
11.11.2	Stop Mode	116
11.12	Pulse-Width Modulator Module (PWM)	116
11.12.1	Wait Mode	116
11.12.2	Stop Mode	116
11.13	Timer Interface Module (TIM)	117
11.13.1	Wait Mode	117
11.13.2	Stop Mode	117
11.14	Exiting Wait Mode	117
11.15	Exiting Stop Mode	118

Chapter 12 Low-Voltage Inhibit (LVI)

12.1	Introduction	119
12.2	Features	119
12.3	Functional Description	119
12.3.1	Polled LVI Operation	120
12.3.2	Forced Reset Operation	120
12.3.3	Voltage Hysteresis Protection	120
12.4	LVI Status Register	121
12.5	LVI Interrupts	121
12.6	Low-Power Modes	121
12.6.1	Wait Mode	121
12.6.2	Stop Mode	121

Chapter 13 Oscillator Module (OSC)

13.1	Introduction	123
13.2	Features	123
13.3	Functional Description	123
13.3.1	Internal Oscillator	124
13.3.1.1	Internal Oscillator Trimming	125
13.3.1.2	Internal to External Clock Switching	125
13.3.2	External Oscillator	125

13.3.3	XTAL Oscillator	126
13.3.4	RC Oscillator	126
13.4	Oscillator Module Signals	128
13.4.1	Crystal Amplifier Input Pin (OSC1)	128
13.4.2	Crystal Amplifier Output Pin (OSC2/PTC1/BUSCLKX4)	128
13.4.3	Oscillator Enable Signal (SIMOSCEN)	128
13.4.4	XTAL Oscillator Clock (XTALCLK)	128
13.4.5	RC Oscillator Clock (RCCLK)	128
13.4.6	Internal Oscillator Clock (INTCLK)	129
13.4.7	Oscillator Out 2 (BUSCLKX4)	129
13.4.8	Oscillator Out (BUSCLKX2)	129
13.5	Low Power Modes	129
13.5.1	Wait Mode	129
13.5.2	Stop Mode	129
13.6	Oscillator During Break Mode	129
13.7	CONFIG2 Options	129
13.8	Input/Output (I/O) Registers	130
13.8.1	Oscillator Status Register	130
13.8.2	Oscillator Trim Register (OSCTRIM)	131

Chapter 14 Input/Output (I/O) Ports

14.1	Introduction	133
14.2	Port A	134
14.2.1	Port A Data Register	134
14.2.2	Data Direction Register A	134
14.2.3	Port A Input Pullup Enable Register	136
14.3	Port B	136
14.3.1	Port B Data Register	136
14.3.2	Data Direction Register B	137
14.4	Port C	138
14.4.1	Port C Data Register	138
14.4.2	Data Direction Register C	138
14.4.3	Port C Input Pullup Enable Register	140

Chapter 15 Pulse Width Modulator with Fault Input (PWM)

15.1	Introduction	141
15.2	Features	141
15.3	Timebase	144
15.3.1	Resolution	144
15.3.2	Prescaler	145
15.4	PWM Generators	146
15.4.1	Load Operation	146
15.4.2	PWM Data Overflow and Underflow Conditions	148
15.4.3	Output Polarity	149
15.5	Fault Protection	149

15.5.1	Fault Condition Input Pin	149
15.5.1.1	Automatic Mode	150
15.5.1.2	Manual Mode	151
15.5.2	Software Output Disable	151
15.6	Initialization and the PWMEN Bit	152
15.7	PWM Operation in Low-Power Modes	152
15.7.1	Wait Mode	152
15.7.2	Stop Mode	153
15.8	Control Logic Block	153
15.8.1	PWM Counter Registers	153
15.8.2	PWM Counter Modulo Registers	153
15.8.3	PWMx Value Registers	154
15.8.4	PWM Control Register 1	155
15.8.5	PWM Control Register 2	156
15.8.6	PWM Disable Mapping Write-Once Register	158
15.8.7	Fault Control Register	159
15.8.8	Fault Status Register	159
15.8.9	Fault Control Register 2	160
15.9	PWM Glossary	160

Chapter 16 Resets and Interrupts

16.1	Introduction	163
16.2	Resets	163
16.2.1	Effects	163
16.2.2	External Reset	163
16.2.3	Internal Reset	163
16.2.3.1	Power-On Reset (POR)	163
16.2.3.2	Computer Operating Properly (COP) Reset	164
16.2.3.3	Low-Voltage Inhibit (LVI) Reset	164
16.2.3.4	Illegal Opcode Reset	164
16.2.3.5	Illegal Address Reset	164
16.2.4	System Integration Module (SIM) Reset Status Register	165
16.3	Interrupts	166
16.3.1	Effects	166
16.3.2	Sources	167
16.3.2.1	Software Interrupt (SWI) Instruction	169
16.3.2.2	Break Interrupt	170
16.3.2.3	IRQ Pin	170
16.3.2.4	Timer Interface Module (TIM)	170
16.3.2.5	KBD0–KBD6 Pins	170
16.3.2.6	Analog-to-Digital Converter (ADC)	170
16.3.2.7	Pulse-Width Modulator with Fault Input (PWM)	170
16.3.2.8	High Resolution PWM (HRP)	170

Chapter 17 System Integration Module (SIM)

17.1	Introduction	171
17.2	SIM Bus Clock Control and Generation	173
17.2.1	Bus Timing	173
17.2.2	Clock Start-Up from POR	173
17.2.3	Clocks in Stop Mode and Wait Mode	173
17.3	Reset and System Initialization	174
17.3.1	External Pin Reset	174
17.3.2	Active Resets from Internal Sources	174
17.3.2.1	Power-On Reset	175
17.3.2.2	Computer Operating Properly (COP) Reset	176
17.3.2.3	Illegal Opcode Reset	176
17.3.2.4	Illegal Address Reset	176
17.3.2.5	Low-Voltage Inhibit (LVI) Reset	176
17.3.2.6	Monitor Mode Entry Module Reset (MODRST)	177
17.4	SIM Counter	177
17.4.1	SIM Counter During Power-On Reset	177
17.4.2	SIM Counter During Stop Mode Recovery	177
17.4.3	SIM Counter and Reset States	177
17.5	Exception Control	177
17.5.1	Interrupts	177
17.5.1.1	Hardware Interrupts	178
17.5.1.2	SWI Instruction	180
17.5.2	Reset	180
17.5.3	Break Interrupts	180
17.5.4	Status Flag Protection in Break Mode	181
17.6	Low-Power Modes	181
17.6.1	Wait Mode	181
17.6.2	Stop Mode	182
17.7	SIM Registers	183
17.7.1	Break Status Register	183
17.7.2	SIM Reset Status Register	184
17.7.3	Break Flag Control Register	185

Chapter 18 Timer Interface Module (TIM)

18.1	Introduction	187
18.2	Features	188
18.3	Functional Description	188
18.3.1	TIM Counter Prescaler	190
18.3.2	Input Capture	190
18.3.3	Output Compare	190
18.3.3.1	Unbuffered Output Compare	190
18.3.3.2	Buffered Output Compare	191
18.3.4	Pulse Width Modulation (PWM)	191
18.3.4.1	Unbuffered PWM Signal Generation	192

18.3.4.2	Buffered PWM Signal Generation	192
18.3.4.3	PWM Initialization	193
18.4	Interrupts	193
18.5	Low-Power Modes	194
18.5.1	Wait Mode	194
18.5.2	Stop Mode	194
18.6	TIM During Break Interrupts	194
18.7	I/O Signals	194
18.8	I/O Registers	195
18.8.1	TIM Status and Control Register	195
18.8.2	TIM Counter Registers	196
18.8.3	TIM Counter Modulo Registers	197
18.8.4	TIM Channel Status and Control Registers	197
18.8.5	TIM Channel Registers	201

Chapter 19 Development Support

19.1	Introduction	203
19.2	Break Module (BRK)	203
19.2.1	Functional Description	203
19.2.1.1	Flag Protection During Break Interrupts	204
19.2.1.2	CPU During Break Interrupts	205
19.2.1.3	TIM During Break Interrupts	205
19.2.1.4	COP During Break Interrupts	205
19.2.2	Break Module Registers	205
19.2.2.1	Break Status and Control Register	205
19.2.2.2	Break Address Registers	206
19.2.2.3	Break Auxiliary Register	206
19.2.2.4	Break Status Register	206
19.2.2.5	Break Flag Control Register	207
19.2.3	Low-Power Modes	207
19.3	Monitor Module (MON)	208
19.3.1	Functional Description	208
19.3.1.1	Normal Monitor Mode	214
19.3.1.2	Forced Monitor Mode	214
19.3.1.3	Monitor Vectors	214
19.3.1.4	Data Format	215
19.3.1.5	Break Signal	215
19.3.1.6	Baud Rate	215
19.3.1.7	Commands	215
19.3.2	Security	219

Chapter 20 Electrical Specifications

20.1	Introduction	221
20.2	Absolute Maximum Ratings	221
20.3	Functional Operating Range	222

20.4	Thermal Characteristics	222
20.5	5.0-Volt Electrical Characteristics	222
20.6	5.0-Volt Control Timing	223
20.7	Oscillator Characteristics	224
20.8	5.0-Volt ADC Characteristics	225
20.9	Op Amp Parameters	226
20.10	Comparator Parameters	227
20.11	Timer Interface Module Characteristics	227
20.12	Memory Characteristics	228

Chapter 21

Ordering Information and Mechanical Specifications

21.1	Introduction	231
21.2	MC Order Numbers	231
21.3	20-Pin Small Outline Integrated Circuit (SOIC) Package — Case #751D	232
21.4	20-Pin Plastic Dual In-Line Package (PDIP) — Case #738	232

Chapter 1

General Description

1.1 Introduction

The MC68HC908LB8 is a member of the low-cost, high-performance M68HC08 Family of 8-bit microcontroller units (MCUs). All MCUs in the family use the enhanced M68HC08 central processor unit (CPU08) and are available with a variety of modules, memory sizes, memory types, and package types. The MC68HC908LB8 has peripherals dedicated to high resolution PWM and power factor correction (PFC).

1.2 Features

For convenience, features have been organized to reflect:

- Standard features of the MC68HC908LB8
- Features of the CPU08

1.2.1 Standard Features of the MC68HC908LB8

Features of the MC68HC908LB8 include:

- 8-MHz internal bus frequency
- Trimmable internal oscillator:
 - 4.0 MHz internal bus operation
 - 8-bit trim capability
 - 25% untrimmed
 - 5% trimmed
- 8 Kbytes of 10 K write/erase cycle typical on-chip in application programmable FLASH memory with security option⁽¹⁾
- 128 bytes of on-chip random-access memory (RAM)
- Dual channel high resolution PWM with dead time insertion and shutdown input. The outputs use frequency dithering to achieve a 4 ns output resolution.
- Dual channel pulse-width modulator (PWM) module to provide power factor correction capability
- Seven channel, 8-bit successive approximation analog-to-digital converter (ADC)
- Op amp/comparator for power factor correction capability or general purpose use
- 7-bit keyboard interrupt
- One 16-bit, 2-channel timer interface module with one output available on port pin (PTA6) for input capture and PWM
- 17 general-purpose input/output (I/O) pins and one input only pin
 - Three shared with high resolution PWM (HRP)
 - Three shared with PWM module

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

General Description

- Three shared with op amp/comparator
- Seven shared with ADC module (AD[0:6])
- One shared with timer channel 0
- Two shared with OSC1 and OSC2
- One shared with reset
- Seven shared with keyboard interrupt
- One input-only pin shared with external interrupt (IRQ)
- Available packages:
 - 20-pin small outline integrated chip (SOIC) package
 - 20-pin plastic dual in-line package (PDIP)
- On-chip programming firmware for use with host personal computer which does not require high voltage for entry
- System protection features:
 - Optional computer operating properly (COP) reset
 - Low-voltage reset
 - Illegal opcode detection with reset
 - Illegal address detection with reset
- Low-power design; fully static with stop and wait modes
- Standard low-power modes of operation:
 - Wait mode
 - Stop mode
- Master reset pin and power-on reset (POR)
- 674 bytes of FLASH programming routines read-only memory (ROM)
- Break module (BRK) to allow single breakpoint setting during in-circuit debugging
- Internal pullup on \overline{RST} pin to reduce customer system cost

- Selectable pullups on ports A and C
 - Selection on an individual port bit basis
 - During output mode, pullups are disengaged
- High current 8-mA sink / 10-mA source capability on all port pins

1.2.2 Features of the CPU08

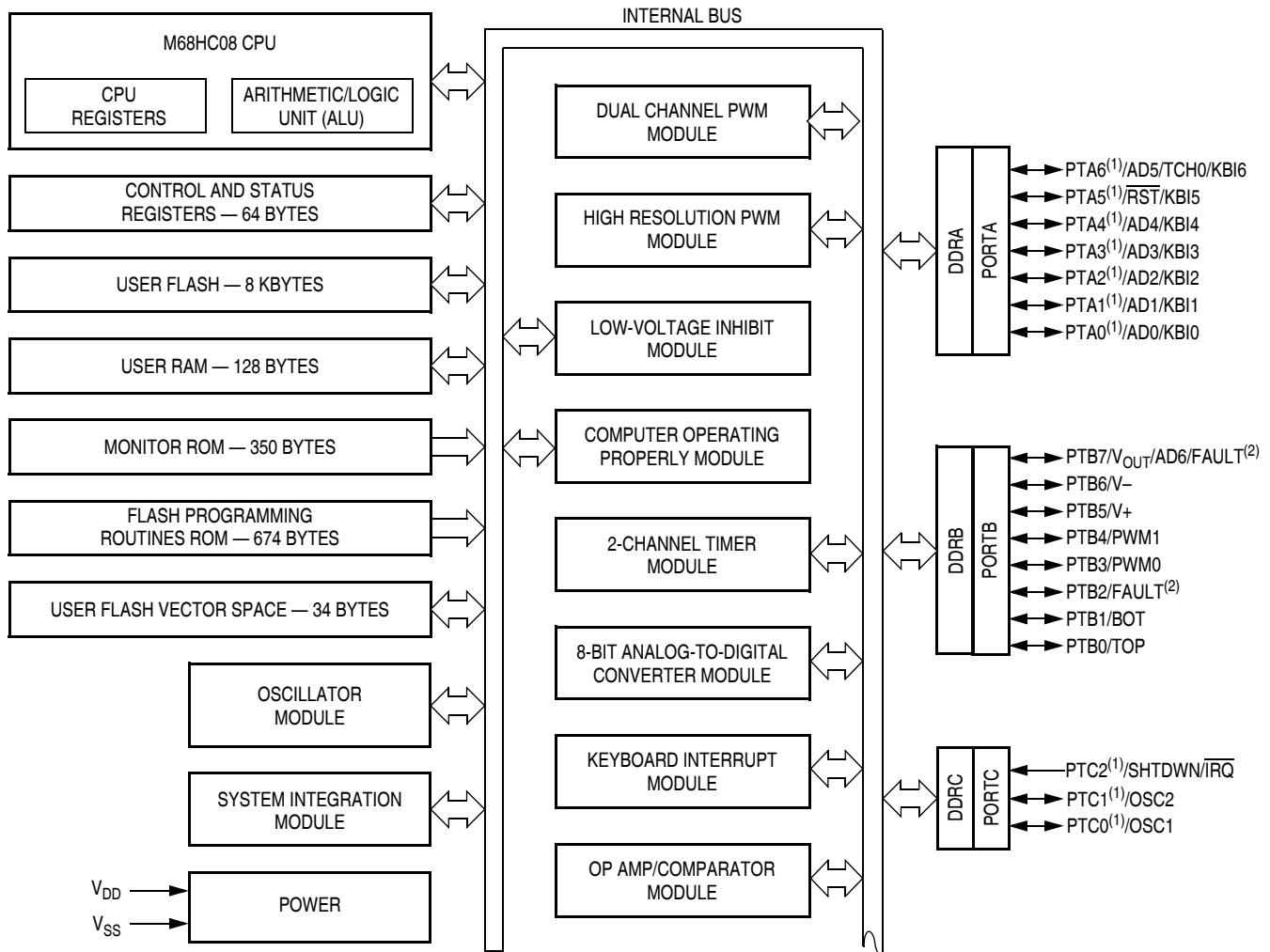
Features of the CPU08 include:

- Enhanced HC05 programming model
- Extensive loop control functions
- 16 addressing modes (eight more than the HC05)
- 16-bit index register and stack pointer
- Memory-to-memory data transfers
- Fast 8×8 multiply instruction
- Fast 16/8 divide instruction
- Binary coded decimal (BCD) instructions
- Optimization for controller applications
- Efficient C language support

1.3 MCU Block Diagram

Figure 1-1 shows the structure of the MC68HC908LB8.

General Description



Notes:

1. Pin contains integrated pullup device.
2. Fault function switchable between pins PTB2 and PTB7.

Figure 1-1. MCU Block Diagram

1.4 Pin Assignments

Figure 1-2 illustrates the pin assignments for the 20-pin SOIC package.

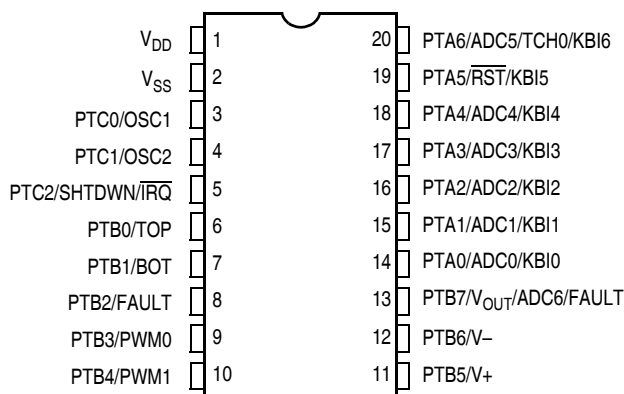


Figure 1-2. 20-Pin SOIC and PDIP Pin Assignments

1.5 Pin Functions

Table 1-1 provides a description of the pin functions.

Table 1-1. Pin Functions

Pin Name	Description	Input/Output
V _{DD}	Power supply	Power
V _{SS}	Power supply ground	Power
PTA0	PTA0 — General purpose I/O port	Input/Output
	KBI0 — Keyboard interrupt input 0	Input
	ADC0 — A/D channel 0 input	Input
PTA1	PTA1 — General purpose I/O port	Input/Output
	KBI1 — Keyboard interrupt input 1	Input
	ADC1 — A/D channel 1 input	Input
PTA2	PTA2 — General purpose I/O port	Input/Output
	KBI2 — Keyboard interrupt input 2	Input
	ADC2 — A/D channel 2 input	Input
PTA3	PTA3 — General purpose I/O port	Input/Output
	KBI3 — Keyboard interrupt input 3	Input
	ADC3 — A/D channel 3 input	Input
PTA4	PTA4 — General purpose I/O port	Input/Output
	KBI4 — Keyboard interrupt input 4	Input
	ADC4 — A/D channel 4 input	Input
PTA5	PTA5 — General purpose I/O port	Input/Output
	$\overline{\text{RST}}$ — Reset input, active low with internal pullup and Schmitt trigger	Input
	KBI5 — Keyboard interrupt input 5	Input

Table 1-1. Pin Functions (Continued)

Pin Name	Description	Input/Output
PTA6	PTA6 — General purpose I/O port	Input/Output
	KBI6 — Keyboard interrupt input 6	Input
	TCH0 — Timer Channel 0 I/O	Input/Output
	ADC5 — A/D channel 5 input	Input
PTB0	PTB0 — General purpose I/O port	Input/Output
	TOP — High resolution PWM output	Output
PTB1	PTB1 — General purpose I/O port	Input/Output
	BOT — High resolution PWM output	Output
PTB2	PTB2 — General purpose I/O port	Input/Output
	FAULT — High resolution PWM fault input (switchable between PTB2 and PTB7)	Input
PTB3	PTB3 — General purpose I/O port	Input/Output
	PWM0 — Pulse-width modulator output 0	Output
PTB4	PTB4 — General purpose I/O port	Input/Output
	PWM1 — Pulse-width modulator output 1	Output
PTB5	PTB5 — General purpose I/O port	Input/Output
	V+ — Op amp/comparator input	Input
PTB6	PTB6 — General purpose I/O port	Input/Output
	V- — Op amp/comparator input	Input
PTB7	PTB7 — General purpose I/O port	Input/Output
	V _{OUT} — Op amp/comparator output	Output
	ADC6 — A/D channel 6 input	Input
	FAULT — High resolution PWM fault input (switchable between PTB2 and PTB7)	Input
PTC0	PTC0 — General purpose I/O port	Input/Output
	OSC1 — XTAL, RC, or external oscillator input	Input
PTC1	PTC1 — General purpose I/O port	Input/Output
	OSC2 — XTAL oscillator output (XTAL option only) RC or internal oscillator output (OSC2EN = 1 in PTAPUE register)	Output Output
PTC2	PTC2 — General purpose input port	Input
	SHTDWN — High resolution PWM input	Input
	IRQ — External interrupt with programmable pullup and Schmitt trigger	Input

1.6 Pin Function Priority

Table 1-2 is meant to resolve the priority if multiple functions are enabled on a single pin.

NOTE

Upon reset all pins come up as input ports regardless of the priority table.

Table 1-2. Function Priority in Shared Pins

Pin Name	Highest-to-Lowest Priority Sequence
PTA0	ADC0 → KBI0 → PTA0
PTA1	ADC1 → KBI1 → PTA1
PTA2	ADC2 → KBI2 → PTA2
PTA3	ADC3 → KBI3 → PTA3
PTA4	ADC4 → KBI4 → PTA4
PTA5	$\overline{\text{RST}}$ → KBI5 → PTA5
PTA6	ADC5 → TCH0 → KBI6 → PTA6
PTB0	TOP → PTB0
PTB1	BOT → PTB1
PTB2	FAULT ⁽¹⁾ → PTB2
PTB3	PWM0 → PTB3
PTB4	PWM1 → PTB4
PTB5	V+ → PTB5
PTB6	V- → PTB6
PTB7	V _{OUT} / ADC6 / FAULT ⁽¹⁾⁽²⁾ → PTB7
PTC0	OSC1 → PTC0
PTC1	OSC2 → PTC1
PTC2	SHTDWN → $\overline{\text{IRQ}}$ → PTC2

NOTES:

1. Fault function is switchable between pins PTB2 and PTB7.
2. V_{OUT}, ADC6, and FAULT functions all share equal priority. All of these functions can be used simultaneously on this pin.

NOTE

Any unused inputs and I/O ports should be tied to an appropriate logic level (either V_{DD} or V_{SS}). Although the I/O ports of the MC68HC908LB8 do not require termination, termination is recommended to reduce the possibility of static damage.

1.7 System Clock Distribution

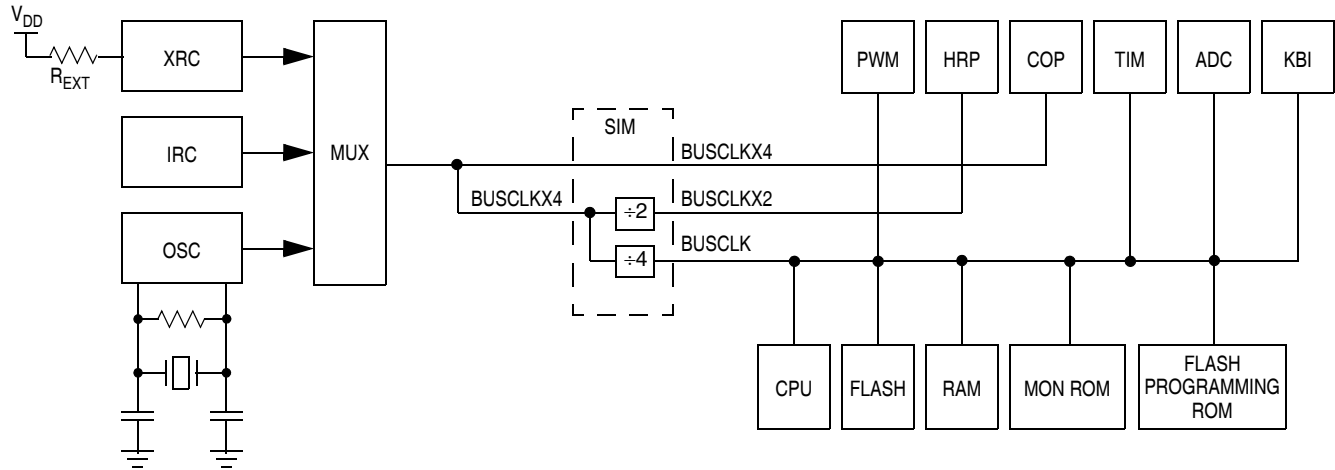


Figure 1-3. System Clock Distribution Diagram

Some of the modules inside the MCU use different clock sources. [Figure 1-3](#) shows a simplified clock connection diagram. The OSC supplies the clock sources:

- BUSCLKX4 is the basic reference clock of the device. It is either:
 - The external crystal oscillator
 - An external clock source
 - An external RC oscillator
 - The internal oscillator

Chapter 2

Memory

2.1 Introduction

The CPU08 can address 64 Kbytes of memory space. The memory map, shown in [Figure 2-1](#), includes:

- System registers
- 8192 bytes of user FLASH memory
- 128 bytes of random-access memory (RAM)
- 674 bytes of FLASH programming routines read-only memory (ROM)
- 34 bytes of user-defined vectors

2.2 Unimplemented Memory Locations

Accessing an unimplemented location can cause an illegal address reset. In the memory map ([Figure 2-1](#)) and in register figures in this document, unimplemented locations are shaded.

2.3 Reserved Memory Locations

Accessing a reserved location can have unpredictable effects on microcontroller (MCU) operation. In the [Figure 2-1](#) and in register figures in this document, reserved locations are marked with the word Reserved or with the letter R.

2.4 Register Section

Most of the control, status, and data registers are in the zero page area of \$0000–\$0058. Additional I/O registers have these addresses:

- \$FE00; break status register, BSR
- \$FE01; SIM reset status register, SRSR
- \$FE02; break auxiliary register, BRKAR
- \$FE03; break flag control register, BFCR
- \$FE04; interrupt status register 1, INT1
- \$FE05; interrupt status register 2, INT2
- \$FE06; reserved
- \$FE07; reserved
- \$FE08; FLASH control register, FLCR
- \$FE09; break address register high, BRKH
- \$FE0A; break address register low, BRKL
- \$FE0B; break status and control register, BRKSCR
- \$FE0C; LVI status register, LVISR
- \$FF7E; FLASH block protect register, FLBPR