ZK-HC08LX-A
Starter Kit for Freescale
MC68HC908LJ/LK Family
(80-Pin QFP ZIF Socket)

User's Manual

1. Introduction

Overview

The ZK-HC08LX-A Starter Kit has been designed for the evaluation of the Freescale MC68HC908LJ/LK family and the debugging of user applications. The ZK-HC08LX-A Starter Kit can be used as a standalone application, or via its built-in USB to MON08 bridge, or together with an external debugger through a MON08-compatible connection.

Starter Kit Features

The ZK-HC08LX-A Starter Kit features the following sections.

1. An "MCU" section containing:

   - An MC68HC908LJ24 microcontroller (in 80-pin QFP package, already programmed with a demo application—in addition, you can also use any other pin-to-pin-compatible device);

- ZIF socket for the microcontroller;
- A connector area to access the I/O pins of the microcontroller for expansion prototyping;
- Two clock sources: a 8 MHz clock module and a 32.768 KHz crystal, selectable via the **"OSC SEL"** jumper;
- A jumper (**"CGMXFC SEL"**) allowing either the provided RC loop filter (needed for the microcontroller's internal PLL) or a user-made RC loop filter to be enabled;
- A connector (J105) with RST_IN# and RST_OUT# signals.

2. A "POWER SUPPLY" section which accepts a 12 V DC, thanks to the built-in switching power supply, provides a regulated VDD voltage for the rest of the board. A jumper (**"VDD SEL"**) allows two different microcontroller VDD voltages (3.3 V or 5.0 V) to be selected. A circuitry (driven by the "MON08 CONNECTORS" and "USB TO MON08 INTERFACE" sections of the board) is present which allows the automatic power on and off of the board for entering the "monitor mode". An additional linear power supply regulator provides the 5.0 V voltage required by the "USB TO MON08 INTERFACE" section.

3. A built-in "USB TO MON08 INTERFACE" section which allows the host PC to communicate with the microcontroller through a standard USB interface. USB 2.0 is fully supported. When using an external in-circuit debugger (via the **"MON08"** or **"EMON08"** connectors), the "USB TO MON08 INTERFACE" circuitry must be bypassed by removing all of the **"ENA"** jumpers in this area.

4. Two connectors for external in-circuit debugging/programming. Even though the Starter Kits feature a built-in USB to MON08 interface, two additional, separate MON08 connectors are present which allow an external in-circuit debugger to be used. The **"EMON08"** (Enhanced MON08) connector is used by in-circuit debugging tools such the Freescale ICS system or the SofTec Microsystems inDART-HC08; other tools, instead, use the **"MON08"** connector. If you use an external in-circuit debugger/programmer, an additional **"VDD CTRL"** connector allows you to control the Starter Kit's VDD voltage using the external tool's power control. The output impedance (both low and high) of the external tool driving the **"VDD CTRL"** connector's VDD_CTRL signal is not important.

5. A "RESET" section containing the push-button connected to the MCU's reset pin through a basic RC network.

6. An "INPUTS" section containing:

- Four push-buttons, together with jumpers to connect/disconnect them to/from the microcontroller's PTA[4..1] lines;
- Eight general-purpose DIP-switches, together with jumpers to connect/disconnect them to/from the microcontroller's PTD[7..0] lines;
- A potentiometer, together with a jumper to connect/disconnect it to/from the microcontroller's PTA5/ADC1 pin.

7. An "OUTPUTS" section containing:

- An 8-digit, 14-segment Liquid Crystal Display (LCD).

- Eight high-efficiency (low-current) LEDs connected to port PTF, together with eight jumpers to connect/disconnect each of the eight LEDs to/from their respective port PTF pins;

8. A "RS-232" section providing one RS-232 channel connected to the microcontroller's SCI serial communication interface. The microcontroller's PTB0/TXD and PTB1/RXD lines are used by the RS-232 channel. Use the **"TX ENA"** and **"RX ENA"** jumpers in the "RS-232" section of the board to select whether to use the RS-232 or to free the microcontroller's PTB0/TXD and PTB1/RXD lines. A 9-pin, D-Sub female connector is provided for the RS-232 channel.

9. A prototype area features both a standard, thru-hole area (for mounting traditional components) and a SMD area (for soldering SMD components). Additionally, all of the board's supply lines (12 V, VDD, 5V and GND lines) are provided.
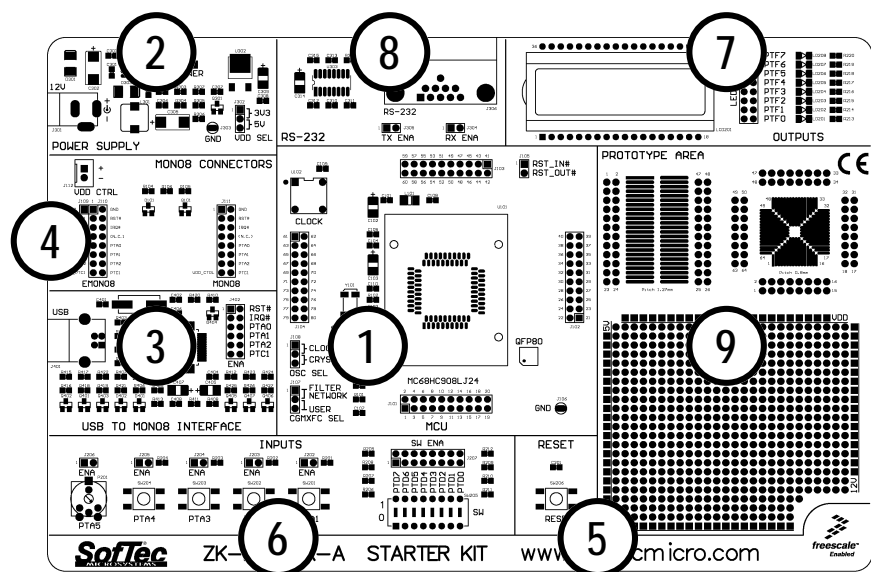
The ZK-HC08LX-AStarter Kit

Supported Devices

The ZK-HC08LX-A Starter Kit supports the following devices:

- MC68HC908LJ family;
- MC68HC908LK family;
- And any future pin-to-pin compatible device.

Recommended Reading

- Freescale HC08 microcontroller-specific datasheets;
- SK-HC08 and ZK-HC08 Series Starter Kit User's Manual;
- ZK-HC08LX-A Schematic.

2. The "RST_IN/RST_OUT" Connector

Introduction

All of the HC08 family devices feature a monitor code resident in ROM which, through a serial communication line, allows the programming and the in-circuit debugging of the user application. The monitor code is executed in "monitor mode"; the user application is executed in "user mode".

To enter the monitor mode some microcontroller lines must be properly driven. In the case of the MC68HC908LJ and LK families, these lines are PTA0 (serial communication line), PTA1, PTA2 and PTC1.

Additionally, to enter the monitor mode, a high-level voltage signal (VTST) must be generated on the IRQ and RST pins of the microcontroller.

The "RST_IN#/RST_OUT#" Connector

The **"RST_IN#/RST_OUT#"** connector, in the "MCU" section of the board, features the RST_IN# and RST_OUT# signals.

Depending on what in-circuit debugger/programmer you are using (built-in USB to MON08 interface, external tool connected to the **"EMON08"** connector or external tool connected to the **"MON08"** connector) the RST_IN# and RST_OUT# signals assume different meanings.

Using the "EMON08" Connector

Interfacing an external in-circuit debugger/programmer via the **"EMON08"** connector allows the number of wasted lines required to enter the monitor mode and executing the monitor code to be reduced.

In addition to the RST# line, the **"EMON08"** connector features two special lines, RST_IN# and RST_OUT#, which allow your target application to be interfaced to the target microcontroller's reset line without worrying about the high voltage that is generated on the RST# line.

When using the **"EMON08"** connector:

- The RST_OUT# signal in the **"RST_IN#/RST_OUT#"** connector is the reset signal generated by the external in-circuit debugger/programmer to the target system: it can be GND or open drain.
- The RST_IN# signal is the reset signal generated by your target application: it is adapted by the external in-circuit debugger/programmer which properly drives the microcontroller's RST# line.

Using the "MON08" Connector

When using the **"MON08"** connector, the RST_IN# and RST_OUT# signals in the **"RST_IN#/RST_OUT#"** connector coincide with the microcontroller's RST# signal.

Using the Built-In USB to MON08 Interface

When using the built-In USB to MON08 Interface, the RST_IN# and RST_OUT# signals in the **"RST_IN#/RST_OUT#"** connector coincide with the microcontroller's RST# signal.

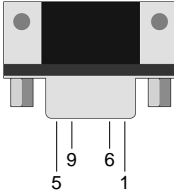# 3. Summary of Jumper and Connector Settings

Jumpers Summary

Name	Reference	Description/Pinout
J107	1 2 3	**CGMXFC SELECTION** **1-2 (FILTER NETWORK)** **The on-board RC PLL loop filter is selected (default)** 2-3 (USER) The XFC PLL loop filter pin is connected to signal pin connector
J108	1 2 3	**OSCILLATOR SELECTION** **1-2 (CLOCK)** **Clock selected (default)** 2-3 (CRYSTAL) Crystal configuration selected
J109 J110	1 1	**EMON08 CONNECTOR** **Installed** **When using the built-in USB to MON08 interface or an external in-circuit debugger/programmer connected to the "MON08" connector (default)** Not Installed When using an external in-circuit debugger/programmer connected to this connector
J201	1	**LED ENABLE** **Installed** **Each jumper, when installed, connects a LED to the respective microcontroller's pin (default)** Not Installed The LEDs are not connected to the microcontroller.
J202		**PTA1 PUSH-BUTTON ENABLE** **Installed** **The PTA1 push-button is connected to the microcontroller's PTA1 pin (default)** Not Installed The PTA1 push-button is not connected to the microcontroller
J203		**PTA2 PUSH-BUTTON ENABLE** **Installed** **The PTA2 push-button is connected to the microcontroller's PTA2 pin (default)** Not Installed The PTA2 push-button is not connected to the microcontroller
J204		**PTA3 PUSH-BUTTON ENABLE** **Installed** **The PTA3 push-button is connected to the microcontroller's PTA3 pin (default)** Not Installed The PTA3 push-button is not connected to the microcontroller

Name	Reference	Description/Pinout	
J205		**PTA4 PUSH-BUTTON ENABLE**	
		Installed	**The PTA4 push-button is connected to the microcontroller's PTA4 pin (default)**
		Not Installed	The PTA4 push-button is not connected to the microcontroller
J206		**POTENTIOMETER ENABLE**	
		Installed	**The potentiometer is connected to the microcontroller's PTA5 pin (default)**
		Not Installed	The potentiometer is not connected to the microcontroller
J207		**SWITCH ENABLE**	
		Installed	**Each jumper, when installed, connects a DIP-switch to the respective microcontroller's pin (default)**
		Not Installed	The DIP-switches are not connected to the microcontroller.
J302		**VDD SELECTION**	
		1-2 (3V3)	VDD = 3.3 V
		2-3 (5V)	**VDD = 5 V (default)**
J304		**RX ENABLE**	
		Installed	**Microcontroller's PTB1/RXD pin connected to RS-232 transceiver (default)**
		Not Installed	Microcontroller's PTB1/RXD pin floating
J305		**TX ENABLE**	
		Installed	**Microcontroller's PTB0/TXD pin connected to RS-232 transceiver (default)**
		Not Installed	Microcontroller's PTB0/TXD pin floating
J402		**USB TO MON08 ENABLE**	
		Installed	**The USB to MON08 interface is enabled**
		Not Installed	The USB to MON08 interface is disabled

Connectors Summary/Pinout

Name	Reference	Description/Pinout
J101, J102, J103, J104		**MCU I/O Connectors** See schematic for pin explanation

Name	Reference	Description/Pinout
J105	1 ■ 2 ●	**RST_IN# and RST_OUT#** 1. RST_IN# 2. RST_OUT#
J106		**Ground Test Point**
J109	1 ■	**EMON08 Connector** 1. RST#
J110	1 ■ ● 2 3 ● ● 4 5 ● ● 6 7 ● ● 8 9 ● ● 10 11 ● ● 12 13 ● ● 14 15 ● ● 16	**EMON08 Connector** 1. RST_OUT# 2. GND 3. RST_IN# 4. RST# 5. TGT_IRQ# 6. IRQ# 7. N.C. 8. N.C. 9. TGT_PTA0 10. PTA0 11. TGT_PTA1 12. PTA1 13. TGT_PTA2 14. PTA2 15. TGT_PTC1 16. PTC1
J111	1 ■ ● 2 3 ● ● 4 5 ● ● 6 7 ● ● 8 9 ● ● 10 11 ● ● 12 13 ● ● 14 15 ● ● 16	**MON08 Connector** 1. N.C. 2. GND 3. N.C. 4. RST# 5. N.C. 6. IRQ# 7. N.C. 8. N.C. 9. N.C. 10. PTA0 11. N.C. 12. PTA1 13. N.C. 14. PTA2 15. VDD_CTRL 16. PTC1
J112	1 ■ 2 ●	**VDD CTRL** 1. VDD_CTRL 2. GND
J301	2 ─◉─ 1	**12 V DC Power Supply Input Connector** 1. 12 V DC 2. GND
J303		**Ground Test Point**

Name	Reference	Description/Pinout
J306	9 6 5 1	**RS-232 Connector** 1. N.C. 2. TX 3. RX 4. N.C. 5. GND 6. N.C. 7. N.C. 8. N.C. 9. N.C.
J401		**USB Connector** 1. 5 V DC USB Bus Power Supply Line 2. USB D- 3. USB D+ 4. GND