Low-Cost Starter Kit RK2

User's Manual

Preliminary version

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Introduction

The Motorola 68HC08 is a very strong and useful product family. The excellent FLASH memory, various peripheral subsystems, large variety of packages, programming and debugging on-chip support brings designer's dreams reality.

The Beta Control's Low Cost Starter Kit represents very good entry gate to design in. Various Target Boards could be used as a stand alone board or together with the universal debugger module. Some instant on board demo peripheral components and associated tutorial programs enable users to start immediately.

This is ideal tool for any distributors seminars, for the teachers at schools, users clubs and also for anybody who is interested in application with modern microcontrollers.

Jiri Gutman
Motorola consultant

Who is Beta Control

Beta Control Ltd. is an innovation based company. Its basic strategy consists in utilizing its own know how of modern technologies in the field of electronic control and information systems. More then sixty percent of employees are focused on design and development. As the most products of Beta Controls are based on Motorola technology and products, the Beta Control became a cooperation partner in promoting Motorola 68HC08 family.

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Features of LCSK-RK2

- MCU 68HC908RK2
  - Ultra low power design (up to 10nA in STOP mode)
  - 1,8 V/3 V power supply
  - 2 kB of on-chip FLASH memory with in-circuit programming (ISP) capabilities
  - 128 B of on-chip static RAM
  - Internal clock generator
  - One 16-bit dual channel timer
  - 14 general purpose I/O ports (some shared with dedicated peripherals)
  - 20pin SOIC
- miniMON header for programming/debugging purposes
- Basic application peripherals
  - Red LED
  - Infrared LED
  - 4 push-buttons
- Expansion connector
- Small area for user application
- Housing in remote control style

Software

LCSK-RK2 is fully compatible with MON08 debugging/programming scheme. Any MON08 compatible software can be used, e.g. CodeWarrior for HC08, P&E Micro's development environment and many more 3rd party software.

For easy beginning with HC08 MCUs there is also several dedicated examples, which gives the user basic experience in HC08's world.

Quick start instructions

The RK2 MCU can work in two different modes: User mode, where user's application runs and monitor mode, where the MCU's functions are accessible via miniMON connector. Purpose of the monitor mode is observing, debugging and FLASH programming. MCU starts in user or monitor mode depending on logical values on signals IRQ, PTA0, PTB0 and PTB2 (see RK2 user manual – monitor mode section for more information). To preserve the monitor mode function (for SW development mandatory), using these signals in user application must keep the appropriate logic values.

To get RK2 kit to work, connect J1 on RK2 kit and miniMON output connector on debugger with 10wire flat cable and remove batteries from the kit. Debugger will power the kit itself. The debugger must be switched to 3 V operation, 5 V mode can damage the kit.

According to debugger manual, select dummy mode debugging (MON08 backwards compatibility) and start the debugging software (e.g. P&E Micro's WinIDE or Metrowerks's CodeWarrior for HC08)

***Note**: The LCSK-RK2 is shipped with erased FLASH ROM, the initial password is blank (FF:FF:FF:FF:FF:FF:FF:FF).*

***Note**: Tbe deskription of the miniMON interface you can find on* www.hc08.cz/minimon/

***ESD caution**: Ordinary amounts of static electricity from clothing or the work environment, can damage or degrade electronic devices and equipment. For example, the electronic components installed on printed circuit boards are extremely sensitive to electrostatic discharge (ESD). Wear a grounding wrist strap whenever handling any printed circuit board. This strap provides a conductive path for safely discharging static electricity to ground.*

Configuring the LCSK-RK2 for MON08 mode

This chapter explains how to configure the HC908RK2 development board for ISP and debugging from a host PC using miniMON interface. LCSK-RK2 uses an external miniMON programmer/debugger. You can build your own miniMON programmer/debugger according to free schematic from www.hc08.cz. Here you can find useful application notes and schematic of simple miniMON programmer/debugger.

Warning: The miniMON debugger must be switched to 3V operation. 5V mode can damage the LCSK-RK2 kit!

According to the miniMON debugger manual, select dummy mode debugging (MON08 backward compatibility) and start the debugging software (e.g. P&E Micro's WinIDE or Metrowerks's CodeWarrior HC08).

Assembling the HC908RK2 target board for the MON08 mode for using with a host PC:

1. Check the miniMON-DBG configuration. Select 3V-power supply output on miniMON interface.
2. Remove batteries from LCSK-RK2. The miniMON debugger (miniMON-DBG) will power the kit itself.
3. To get HC908RK2 kit to work, connect J1 on RK2 kit and miniMON output connector on the debugger with the 10wire flat cable.
4. Connect miniMON-DBG to a serial COM port on the host PC. Set up baud rate for communication with MCU in the MON08 mode. Select correct Target Hardware Type: e.g. Class III – Direct serial to target w/MON08 serial port circuitry build in. Note: The communication baud rate in the MON08 mode depends on used external clock oscillator. Typical external oscillator frequency is 9,83MHZ or 4,915MHz. See the MC68HC908RK2 Technical Data - Section 10. MonitorRead-Only Memory(MON)
5. Connect the power supply. The miniMON-DBG can power the HC90RK2 target board.
6. Start the Integrated Development Environment.

***Note**: The LCSK-RK2 is shipped with empty FLASH. The initial password is blank (FF-FF-FF-...-FF).*

Accessing the MCU and security mechanism

Every HC08 microcontroller has the security mechanism for code readout prevention. The FLASH memory contents is secured by eight byte password, which must be sent to the MCU in time of monitor mode entering. The password secures FLASH memory only, other functions are accessible regardless the password is correct or not.

The password resides in top of the FLASH (0xFFF6-0xFFFD), where interrupt vector table is as well. It can be said, that the password is made automatically, when the program is compiled, because the interrupt vector table is usually used. It also means, that different versions of the same software usually have different passwords.

When the user doesn't need to use the FLASH (e.g. in circuit simulation), the password is not mandatory. The correct password enables to the user the access to the FLASH and FLASH control, like readout its contents, erasing, programming or program running (instruction and data fetching). The only feature not locked out by wrong password is MASS-ERASE of whole FLASH. This is also the only way, how to regain access to the FLASH in case of unknown password.

The WinIDE debugging environment uses special file SECURITY.INI where holds last programmed passwords and where gets the entry passwords from. This mechanism works fine until the MCU is changed, or programmed by other programmer (which doesn't update this file) than PROG08. In case, that the password is somehow lost, the only way, how to regain control of the FLASH is to erase whole of the FLASH, which erases the password too and then use blank password (FF:FF:FF:FF:FF:FF:FF:FF).

Troubleshooting

Debugging software can't establish communication with the kit
Check, if the debugger is working and is in dummy mode (if so, the debugging software should report that echo works), check the proper installation of miniMON cable.

LCSK-RK2 don't enter monitor mode
Check the batteries, they must not be in the kit when debugging. Usual way to reset MCU and the only way to enter monitor mode is through POR – power on reset. Debugger can't do power cycling, when the kit is powered from other supply than via miniMON cable.

Debugger reports security failure
If the debugger, simulator or programmer reports invalid security code, go to programmer module, ignore the security failure and clear the whole FLASH. This is the only way, how to access the MCU with unknown password. (For further information about the security mechanism, see the RK2 user manual – monitor mode section).

Schematic description

The core of the RK2 kit is Motorola MC68HC908RK2 microcontroller (U1). This MCU is designed for very low power devices such as battery powered measurement device or remote control. The kit contains peripherals for simple infrared remote control, but is not limited to this aplication only because there is also a wire-wrap area for user application.

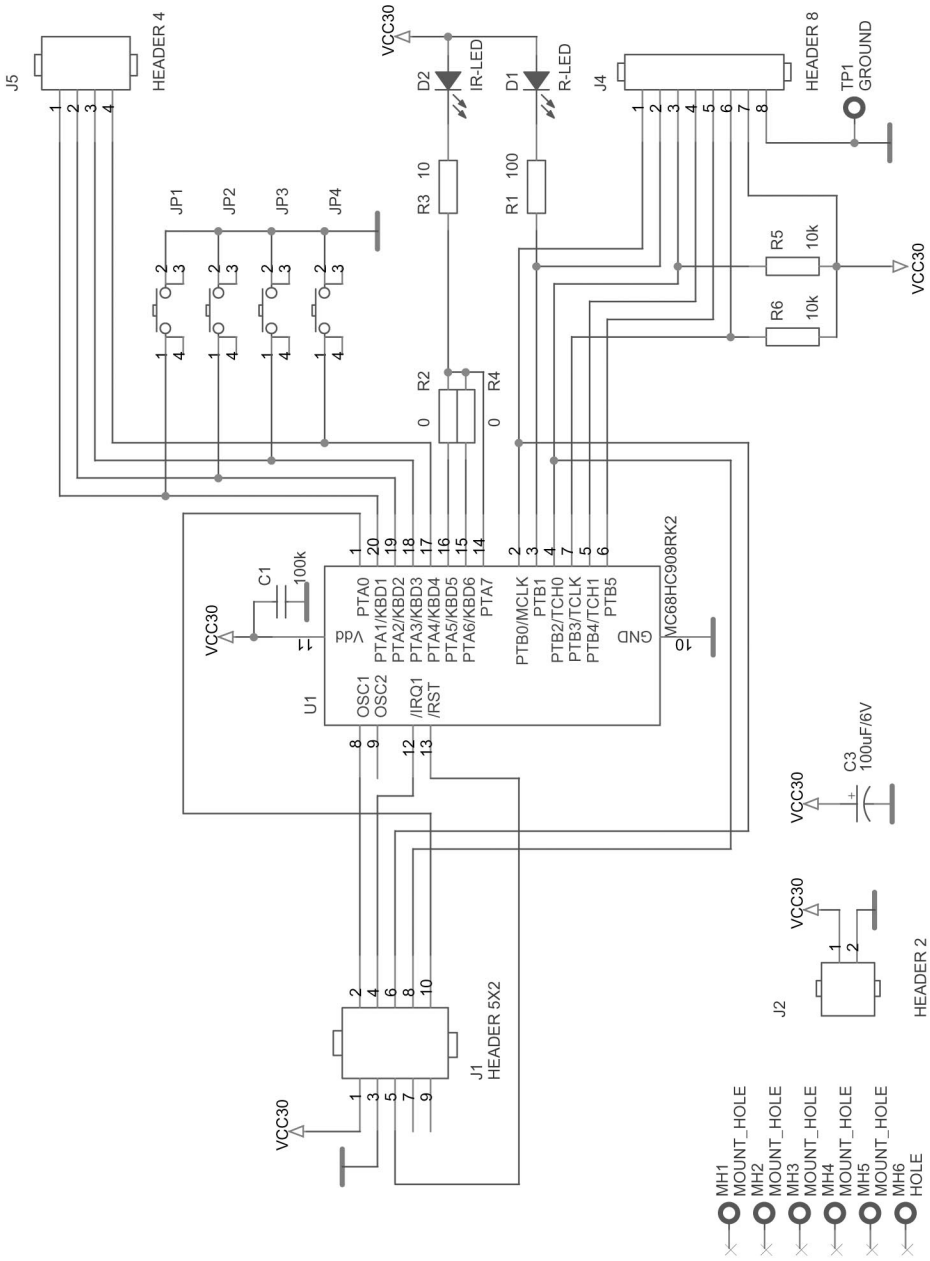
Kit is primarily powered from two AAA battery cells via J2 connector. External power supply can be provided as well, but the kit doesn't have a regulator, so 3,5V must not be exceeded!.

As example the kit is equipped with four pushbuttons (JP1-JP4) connected to PTA1-PTA4 , red LED connected to PTB1 and infrared LED connected to PTA5-PTA7. Both LEDs are connected to the MCU by cathode side, logic 0 on the appropriate pin(s) turns LEDs on. Pushbuttons close the circuit to ground (log0) in case of press. Internal pull-up must be activated, to provide log1 in case the button is not pressed. Note: PTA5-PTA7 are shorted together to provide enough current to the infrared LED. Because of this, different logical levels on these pins (in output mode) can damage the MCU.

For user applications, there is small solder area and expansion connectors (J4 and J5) on the board (see appendix for the pinout).

***Limitations**: The RK2 MCU can work in two different modes: User mode, where user's application runs and monitor mode, where the MCU's functions are accessible via miniMON connector. Purpose of the monitor mode is observing, debugging and FLASH programming. MCU starts in user or monitor mode depending on logical values on signals IRQ, PTA0, PTB0 and PTB2 (see RK2 user manual – monitor mode section for more information). To preserve the monitor mode function (for SW development mandatory), using these signals in user application must keep the appropriate logic values.*

RK2 schematic diagram



Pinouts

J1 – miniMON header

OSC1 (CLK)	IRQ	PTB0	PTB2	PTA0
2	4	6	8	10
1	3	5	7	9
+3V	GND	RESET	N.C.	N.C.

J2 – Power supply

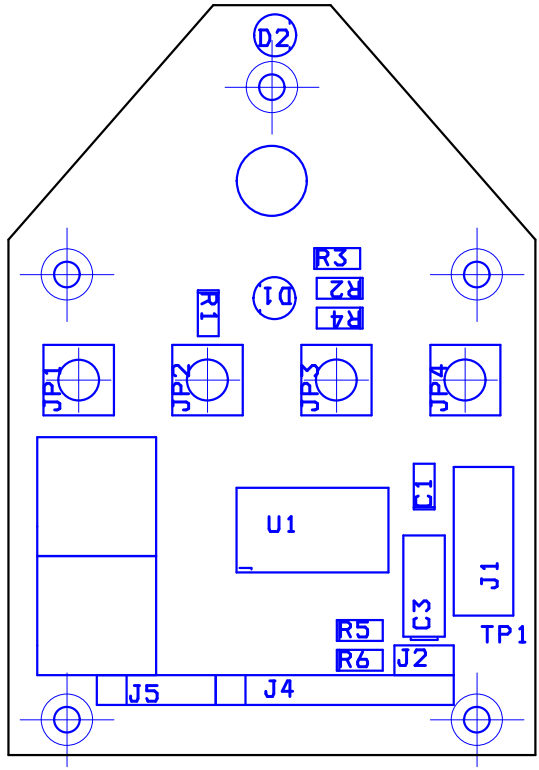
+3V	GND
1	2

J4, J5 – Expansion connectors

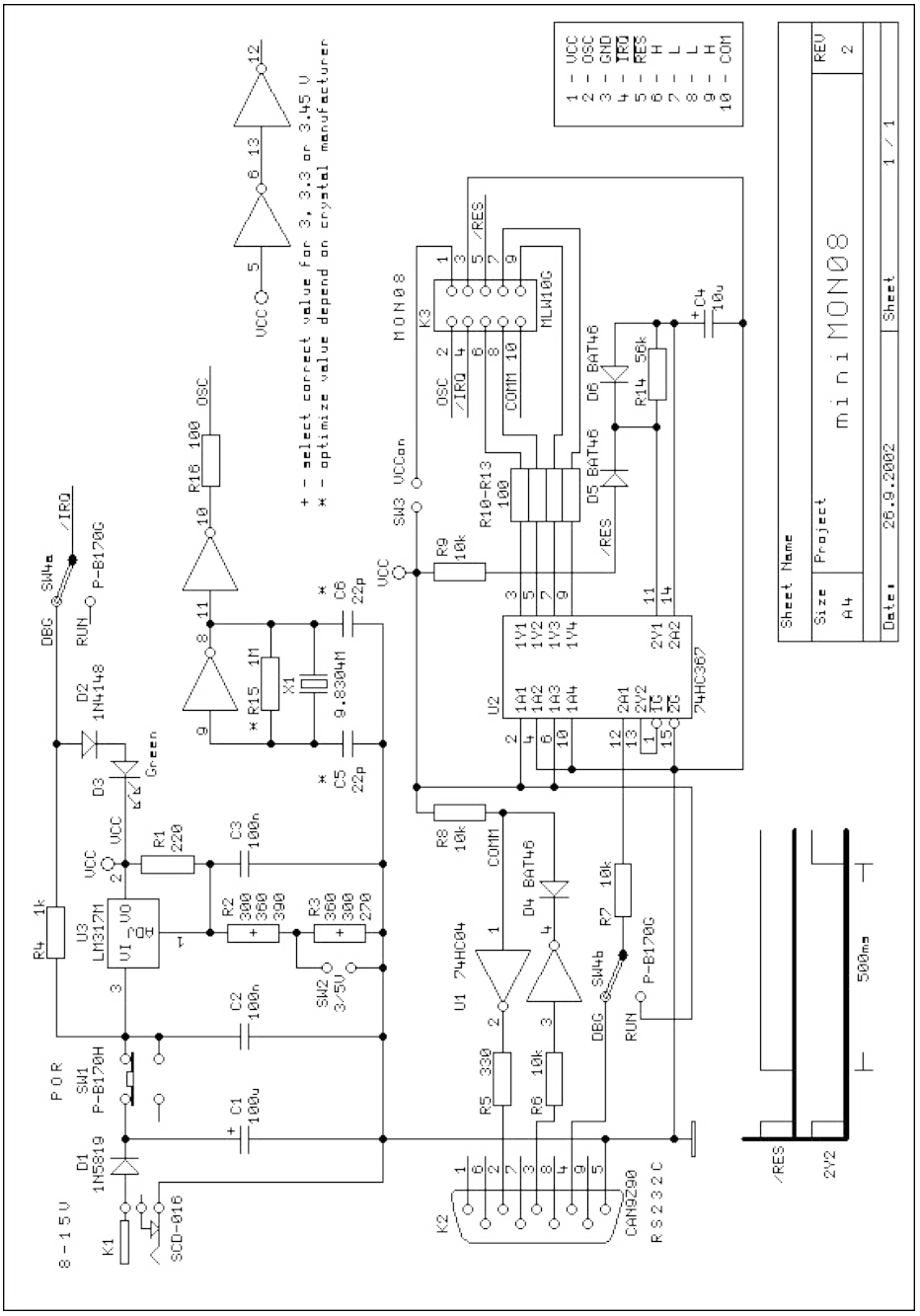
PTA1	PTA2	PTA3	PTA4
1	2	3	4

PTB0	PTB1	PTB2	PTB4	PTB5	PTB3	+3V	GND
1	2	3	4	5	6	7	8

Parts location diagram and jumpers setting



Simple miniMON debugger schematic



You can build your own miniMON programmer/debugger according to free schematic from www.hc08.cz/minimon/. Here you can find useful application notes and schematic of simple miniMON programmer/debugger.