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M68ICS08RKUM/D
REV. 1

M68ICS08RK

In-Circuit Simulator

User's Manual

MOTOROLA

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Section 1. Introduction

1.1 Contents

1.2 Overview

This section provides an overview of the Motorola M68ICS08RK in-circuit simulator (RKICS).

The RKICS board, a 4-inch × 6-inch printed circuit board (PCB), is a stand-alone development and debugging aid for designers using MC68HC908RK2 microcontroller unit (MCU) devices. The RKICS contains both the hardware and software needed to develop and simulate source code for, and to program, Motorola's MC68HC908RK2 microcontrollers.

The RKICS and the RKICS software form a complete editor, assembler, programmer, simulator, and limited real-time I/O (input/output) emulator for the MC68HC908RK2 MCUs. When the RKICS is connected to a host PC (personal computer) and target hardware, the actual inputs and outputs of the target system can be used during simulation of code.

Depending on the software, the uses of the RKICS development package are:

- The WINIDE and CASM08Z software may be used as editor and assembler.
- With ICS08RKZ, the RKICS is used as a simulator.
- With the PROG08SZ software, the RKICS is used to program MCU FLASH memory.
- With the ICD08SZ software, the RKICS is used as a limited real-time emulator.

The RKICS connects to the target machine via the provided 20-pin ribbon cable or an optional Motorola M68CLB05A flex cable (available separately). It connects to the software host via a single RS-232 connection and a standard DB-9 serial cable.

Use the RKICS with any IBM® Windows 95®-based computer (or later version) with a serial port.

1.3 RKICS Components

The complete RKICS system includes hardware, software, and documentation. **Table 1-1** lists the RKICS product components.

Table 1-1. M68ICS08RK Product Components

Part Number	Description
ICS08RK	RKICS software development package
MC68HC908RK2	MCU
M68ICS08RK2	RKICS board
	Ribbon target cable
	Serial cable
	Power supply
	MON08 cable

1.3.1 M68ICS08RK Hardware

Table 1-2 lists the RKICS hardware components.

Table 1-2. Hardware Components

Components	Description
XU1 XU2 XU3	Test sockets for the Motorola MC68HC908RK2 MCU: 20-pin SSOP (small shrink outline package) 20-pin SOIC (small outline integrated circuit) 32-pin QFP (quad flat pack)
J4	User-selectable 2.0-volt to 3.3-volt variable voltage level shifter (V_{DD})
P2	RS-232 to interface the RKICS to the host serial connector
J3	One 2-row × 10-pin, 0.3-inch spacing dual in-line package (DIP) socket to allow the RKICS to be connected to the target using a ribbon cable
J1	One 2-row × 20-pin, 0.1-inch spacing connector to connect the RKICS to a target using an optional M68CLB05A flex cable
J2	One 2-row × 8-pin, 0.1-inch spacing connector to connect to a remote target via the MON08 debug circuit

1.3.2 ICS Interface Software

Windows-optimized software components are referred collectively to as the RKICS software (part number ICS08RK). The ICS08RK software package is a product of P&E Microcomputer Systems, Inc., and is included in the RKICS kit. **Table 1-3** lists these software components.

Table 1-3. Software Components

Components	Description
WINIDE.EXE	Integrated development environment (IDE) software interface for editing and interfacing with the items below
CASM08Z.EXE	CASM08Z command-line cross-assembler
ICS08RKZ.EXE	In-circuit/stand-alone simulator software for the MC68HC908RK2 MCU
PROG08SZ.EXE	FLASH memory programming software
ICD08SZ.EXE	In-circuit debugging software for limited, real-time emulation

1.4 RKICS Features

The RKICS is a low-cost development system that supports editing, assembling, in-circuit simulation, in-circuit emulation, and FLASH memory programming. Its features include:

- Editing with WinIDE
- Assembling with CASM08Z
- FLASH memory programming with PROG08SZ
- In-circuit and stand-alone simulation of MC68HC908RK2 MCUs with ICS08RKZ, including:
  - Simulation of all instructions, memory, and peripherals
  - Optional simulator pin inputs from the target
  - Conditional breakpoints, script files, and logfiles

- Limited real-time emulation and debugging with ICD08SZ, including:
  - Loading code into RAM
  - Executing real-time in RAM or FLASH
  - One hardware breakpoint in FLASH
  - Multiple breakpoints in RAM
- On-line help documentation for all software
- Software integrated into the WinIDE environment, allowing function key access to all applications
- MON08 emulation connection to the target, allowing:
  - Limited in-circuit emulation
  - In-circuit simulation
  - In-circuit programming

1.5 Hardware and Software Requirements

The RKICS software requires this minimum hardware and software configuration:

- An IBM-compatible host computer running Windows 95 or later version operating system
- Approximately 2 Mbytes of available random-access memory (RAM) and 5 Mbytes of free disk space
- A serial port for communications between the RKICS and the host computer

1.6 Specifications

Table 1-4 summarizes the M68ICS08RK hardware specifications.

Table 1-4. M68ICS08RK Board Specifications

Characteristic	Specification
Temperature: Operating Storage	 0° to 40°C –40° to +85°C
Relative humidity	0 to 95%, non-condensing
Power requirement	+5 Vdc, from included ac/dc adapter

1.7 About This Manual

The procedural instructions in this manual assume that the user is familiar with the Windows interface and selection procedures.

1.8 Customer Support

To obtain information about technical support or ordering parts, call the Motorola help desk at 800-521-6274.

Section 2. Hardware Installation

2.1 Contents

2.2 Overview

This section explains:

- Configuration of the M68ICS08RK2 in-circuit simulator board
- Limitations of the RKICS
- Installing the hardware
- Installing the software
- Connecting the board to a target system

In interactive mode, the RKICS is connected to the serial port of a host PC. The actual inputs and outputs of a target system can be used during simulation of source code.

In software stand-alone mode, the RKICS is not connected to the PC. The ICS08RKZ software can be used as a stand-alone simulator running on the PC.

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 the printed circuit board 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.*

2.3 Configuring the In-Circuit Simulator Board

The RKICS includes a single 4-inch × 6-inch printed circuit board (PCB) (M68ICS08RK2). **Figure 2-1** shows a diagram of the RKICS board, **Figure 2-2** shows a block diagram of the RKICS board, and **Figure 2-3** is the functional block diagram.

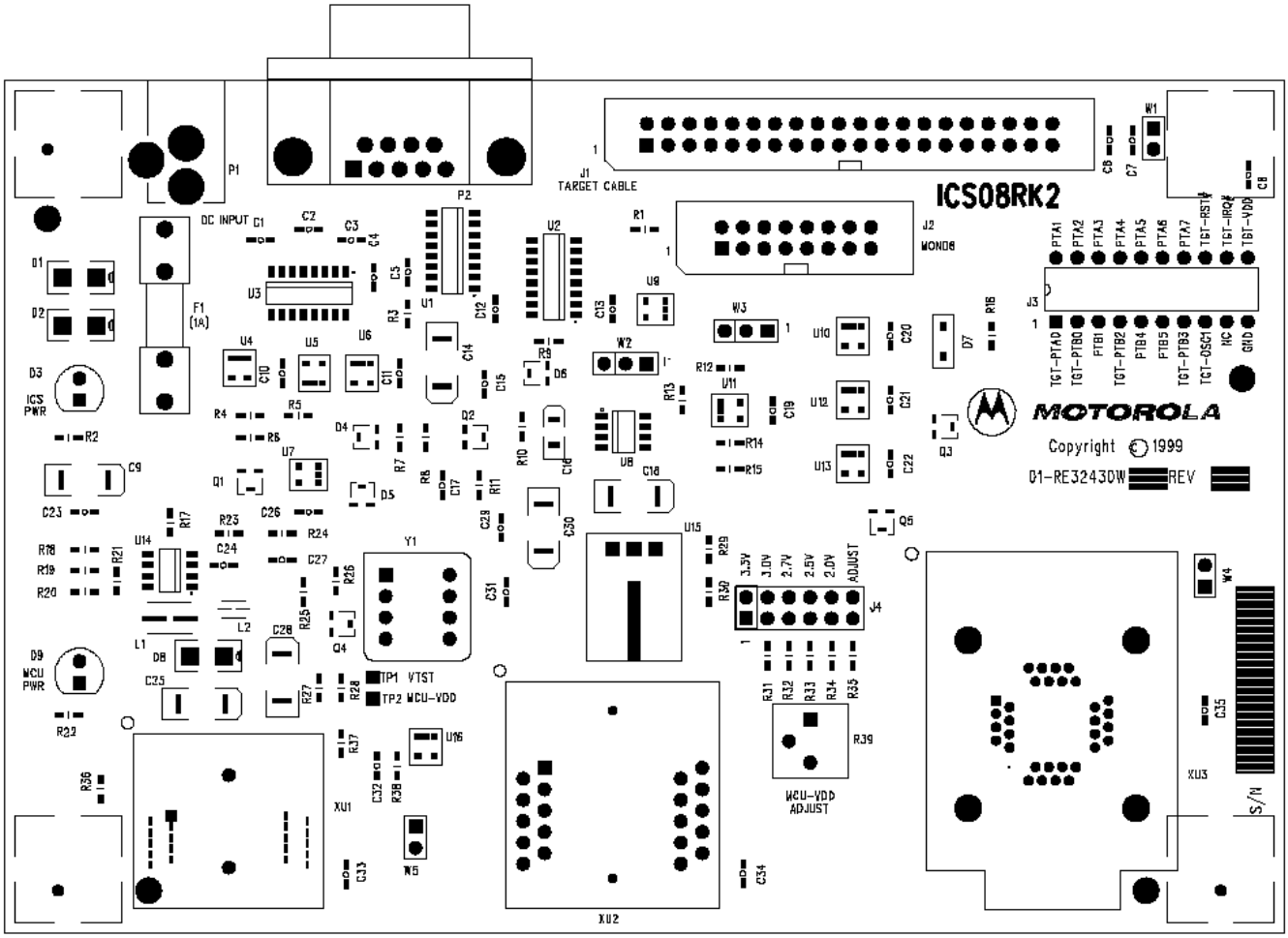


Figure 2-1. RKICS Board Layout

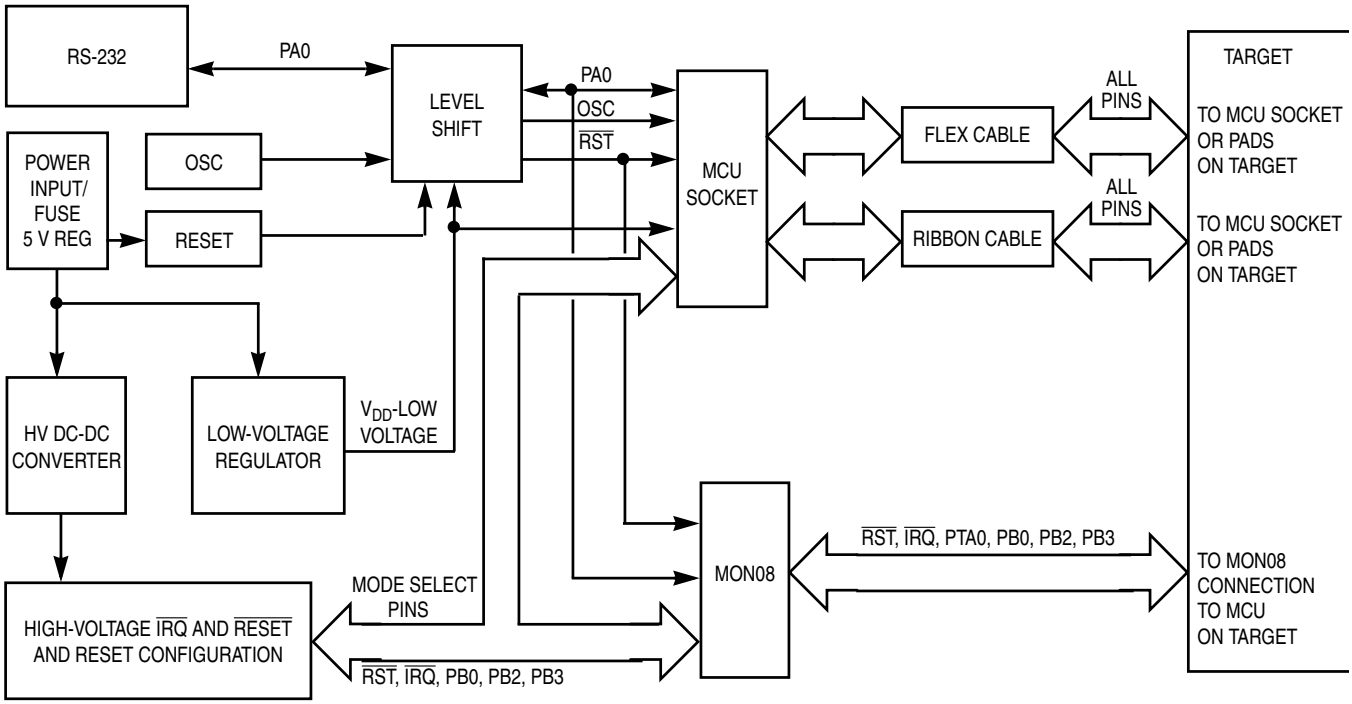


Figure 2-2. M68ICS08RK2 In-Circuit Simulator Block Diagram

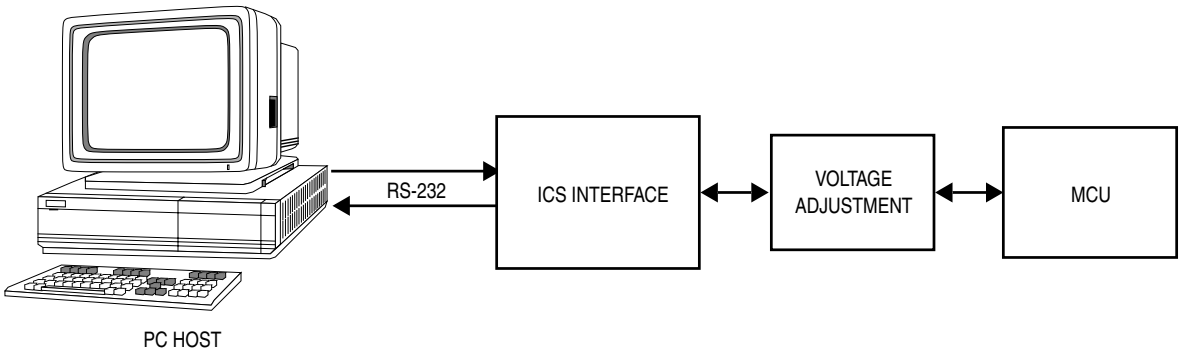


Figure 2-3. ICS Functional Diagram

2.3.1 RKICS Limitations

This section describes system limitations of the RKICS.

2.3.1.1 Bus Frequency

The RKICS communicates using the MON08 features. This forces the communication rate to $f_{bus}/256$. Therefore, the bus frequencies are limited by standard baud rates allowed by the host software. See **2.3.2.2 MCU Bus Frequency Selection Header (W2)** for available options.

2.3.1.2 Port A0

Port A0 is used for communications, so it is unavailable for emulation.

2.3.1.3 MC68HC908RFRK2 RF Features

The RF features of an MC68HC908RFRK2 installed in the QFP socket are not available. For RF emulation, use the optional flex cable (order number M68CLB05A) and QFP target head adapter (order number M68TA08RK2FA32).

2.3.1.4 Low Voltage Interrupt (LVI)

The LVI is disabled by default in monitor mode. It is enabled by a dummy write to LVISR.

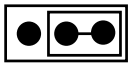
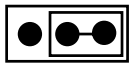
2.3.1.5 Internal Clock Generator (ICG)

The ICG is bypassed in monitor mode, so it is not available for use.

2.3.2 RKICS Configurable Jumper Headers

Five jumper headers on the RKICS are used to reconfigure the hardware options. **Table 2-1** is a quick reference to these optional settings, while subsections **2.3.2.1** through **2.3.2.4** describe jumper header configuration in greater detail.

Table 2-1. RKICS Jumper Header Description

Jumper Header	Type	Description		
W1 Power source		No jumper installed (factory default) — RKICS board power is disconnected from the target system. Target circuitry requires an separate supply. Jumper on pins 1 and 2 — Target power is supplied by the RKICS board. Only limited power is available for the target. (See **2.3.2.1 RKICS Power Source Selection Header (W1) (For Target Cable Connection)** for more information.)		
W2 Bus frequency selection		Jumper on pins 1 and 2 (factory default) — MCU bus frequency is set to 2.4576 MHz (OSC ÷ 4) and the I/O baud rate is set to 9600. Jumper on pins 2 and 3 — MCU bus frequency is set to 4.9152 MHz (OSC ÷ 2) and the I/O baud rate is set to 19,200.		
W3 Board reset		Jumper on pins 1 and 2 (factory default) — The MC68HC908RK2 MCU RESET signal initiates resets out to the target system. Jumper on pins 2 and 3 — The target-system RESET signal initiates resets in to the RKICS on-board MC68HC908RK2 MCU.		
W4 W5 Clock source	 	**W4**	**W5**	
		1	1	Jumpers installed on W4 and W5 — The RKICS MCU and the target system OSC1 signals are supplied by the on-board oscillator at location Y1.
		1	0	Jumper installed on W4 and no jumper on W5 — The RKICS MCU OSC1 signal is supplied by the target system.
		0	1	No jumper installed on W4 and a jumper on W5 (factory default) — The RKICS MCU OSC1 signal is supplied by the on-board oscillator at location Y1.
		0	0	No jumpers installed on jumper headers W4 and W5 — Connect an external clock source to the RKICS MCU OSC1 input pin via W5 pin 2.

2.3.2.1 RKICS Power Source Selection Header (W1) (For Target Cable Connection)

Use W1 to select the power source for the RKICS and target system's MCU and external circuitry (refer to **Figure 2-4**). To isolate the RKICS and target system power, ensure that no jumper is installed on jumper header W1 (factory default). Install a jumper header on W1 to use the RKICS on-board power to supply power to the the target system's MCU and external circuitry. When a jumper is installed on jumper header W1, power is supplied to the target system via J1 pins 24, 26, and 18 and J3 pin 11 (TGT-VDD).

NOTE: *The target system V_{DD} must match the ICS voltage setting in either case.*

NOTE: *This is not applicable to the MON08 connection. There is no TGT-VDD on the MON08 connector, J2.*

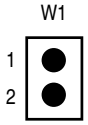


Figure 2-4. RKICS Power Source Selection Header

2.3.2.2 MCU Bus Frequency Selection Header (W2)

Use jumper header W2 to select the MCU bus speed and the I/O baud rate. Install a jumper on jumper header W2 pins 1 and 2 (factory default) to set the MCU bus frequency to 2.4576 MHz and the I/O baud rate to 9600. (Refer to **Figure 2-5**.) Install a jumper on jumper header W2 pins 2 and 3 to set the MCU bus frequency to 4.9152 MHz and the I/O baud rate to 19,200. Refer to **Table 2-2** for the MCU bus frequency formula.

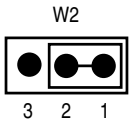


Figure 2-5. MCU Bus Frequency Selection Header

Table 2-2. MCU Bus Frequency Formula

W2 Setting	Formula
1-2 (factory default)	Crystal Oscillator Frequency divided by 4 = Bus Frequency Bus Frequency divided by 256 = Baud Rate
2-3	Crystal Oscillator Frequency divided by 2 = Bus Frequency Bus Frequency divided by 256 = Baud Rate