KS8695/KS8695X
Demo Board User's Guide

Integrated 5-Port Gateway Processor

Rev 1.3 December 2003

MICREL, Inc. 1849 Fortune Drive, San Jose, CA 95131 USA
TEL 1 (408) 944-0800 FAX 1 (408) 955-1577 WEB **HTTP://WWW.MICREL.COM**

TABLE OF CONTENTS

FIGURES AND TABLES

1.0 General Information

1.1 Revision History

Revision	Date	Name	Description
1.0	7-16-02	M. Odani	Preliminary
1.1	11-4-02	M. Odani	Added SOHO router software guides.
1.2	3-10-03	M. Odani	Changed logo and contact information
1.3	12-12-03	M. Odani	Updated to included KS8695X

1.2 Introduction

The KS8695/KS8695X Demo board revision 1.0 is intended to provide a convenient means to evaluate the functionality of the new KS8695 or KS8695X SOHO router and jump start software development. Micrel provides a complete Linux based SOHO Router software solution with which to evaluate the KS8695/KS8695X functionality. The SOHO router software includes a web based configuration utility to allow quick and easy device setup.

1.3 Packing List

The Evaluation Kit includes:

- 1 KS8695/KS8695X Demo Board Revision 1.0
- 1 5.0 V, 2.4A DC power supply
- 1 Micrel Evaluation Kit CD

1.4 Software Features

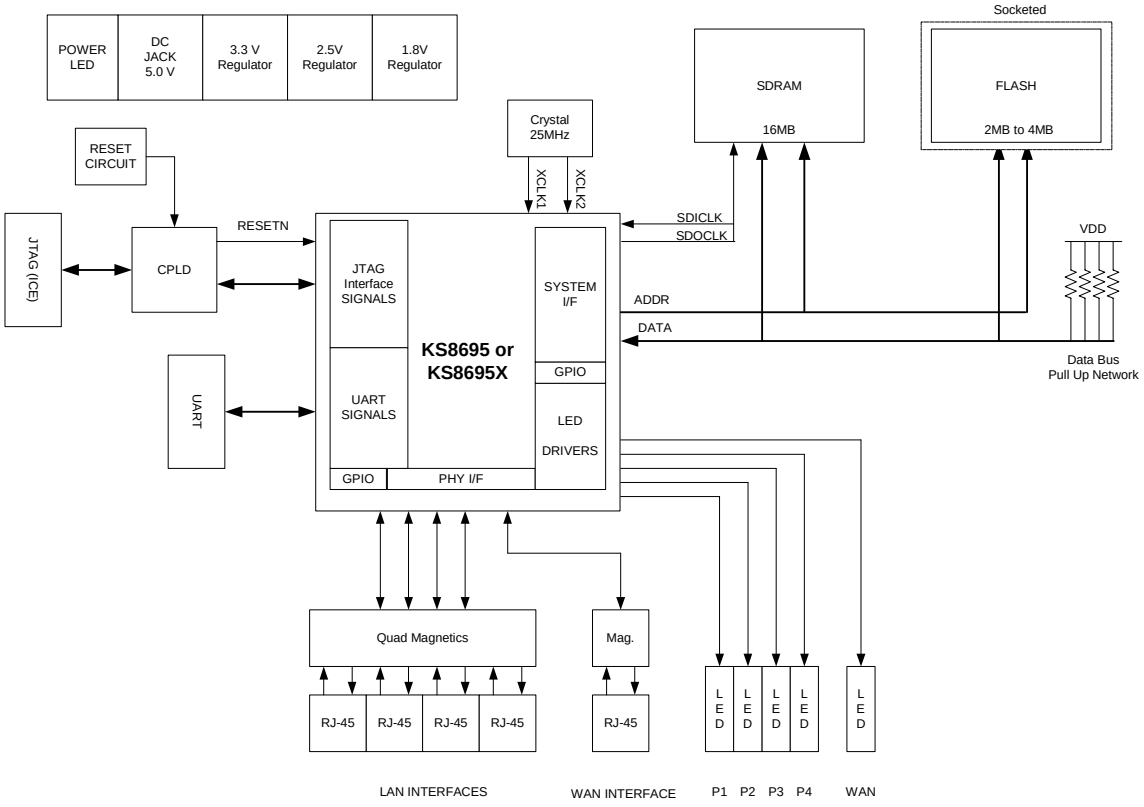
- Ethernet Drivers for LAN/WAN
- TCP/IP Protocol Stack
- DHCP Server/Client
- HTTP Server
- TFTP
- Support for PPPoE
- Network Address Translation (NAT) Network Address Port Translation (NAPT)
- DMZ
- VPN Pass Thru
- Stateful Packet Inspection Firewall

1.5 Hardware Features

- KS8695 or KS8695X SOHO Router
- 16 MB of SDRAM in a 4M x 32 bit configuration
- 2 MB of FLASH Memory expandable to 4 MB
- 4 LAN 10/100 Ethernet Ports with 2 LED's Per Port
- 1 WAN 10/100 Ethernet Port with 2 LED's
- JTAG port for Multi-ICE connection
- UART DB-9 connector
- 1 MAC Mode Female MII Connector (KS8695 only)
- 1 PHY Mode Male MII Connector (KS8695 only)
- Power LED

2.0 Functional Block Diagram

Figure 1 KS8695/KS8695X Demo Board Block Diagram



3.0 Getting Started

This section describes how to get the KS8695/KS8695X Demo Board up and running with Micrel's SOHO router software and your PC. You will need:

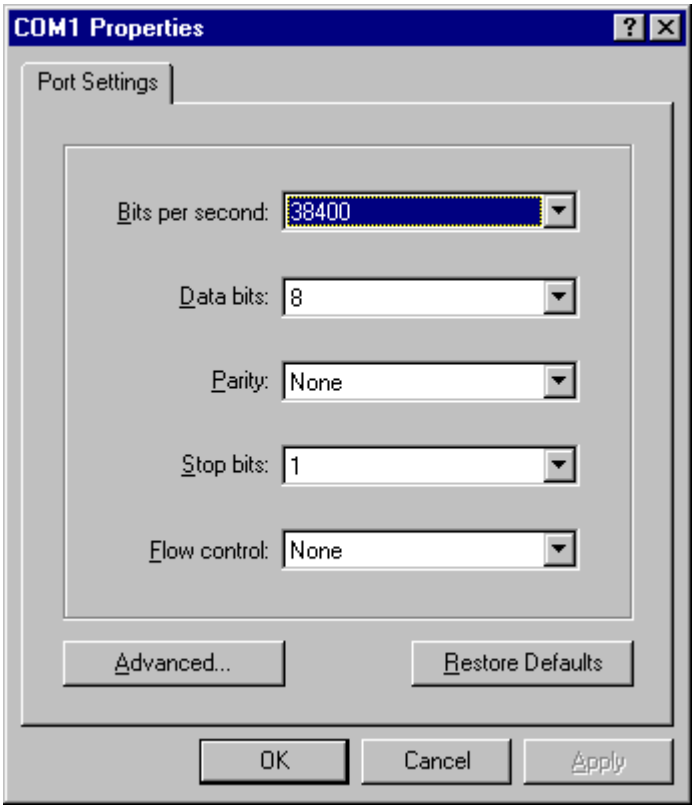
- Micrel KS8695/KS8695X Demo Board
- Micrel provided 5.0 V power supply.
- 1 Category 5 ethernet cable for the LAN, 1 Category 5 ethernet cable for the WAN.
- 1 Null serial cable with female to female connectors. (Optional).
- 1 PC.

1. Connect the included 5.0 V power supply to the KS8695/KS8695X Demo board and plug into a wall socket. When the board is plugged in, or when the reset button on the board is depressed, you should see a flashing LED pattern. This is the power on self test (POST).
2. The ports on the KS8695/KS8695X board are labeled as WAN and LAN. Connect a PC to one of the LAN ports and Internet service to the WAN port on the board. Internet service can be replaced with a PC running a web server.
3. Connect a null serial cable (Optional) from the serial port of the KS8695/KS8695X Demo Board to a PC to monitor Linux kernel boot time messages. After the boot, a shell prompt is displayed for accepting Linux shell commands. For instance, type the "ls" command to list the files of the current directory.

3.1 Configuring PC COM port settings

The Windows Hyper Terminal can be used as a console to communicate with the KS8695/KS8695X demo board. The configuration settings for serial communication are shown below.

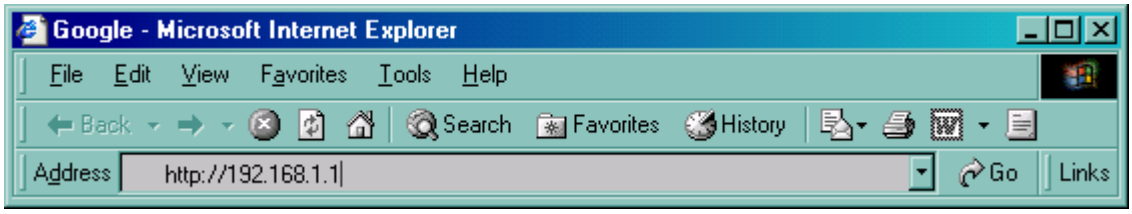
Figure 2 COM Port Configuration



3.2 SOHO Router Administration

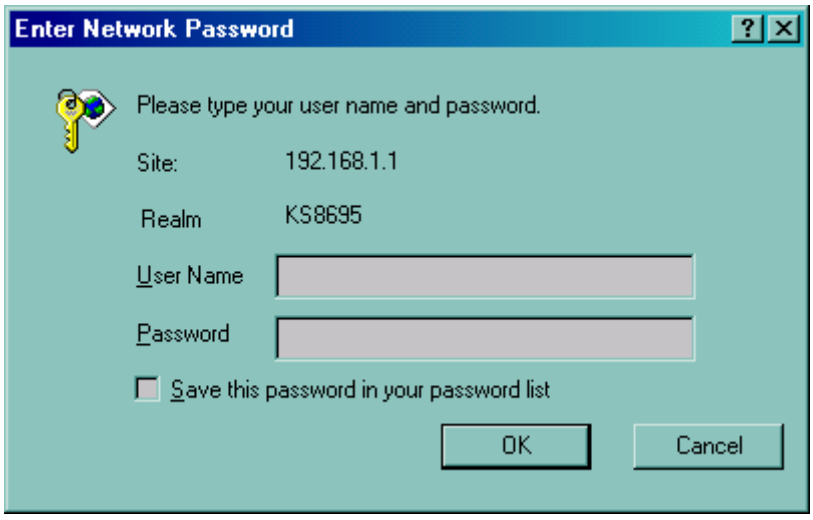
The KS8695/KS8695X SOHO Router Software uses a web browser-based administrative utility. All administrative tasks for the router are performed through this web browser-based utility. The setup pages can be accessed through any PC on the LAN side network by typing **http://192.168.1.1** into the web browser's Address field. See below.

Figure 3 SOHO Router Administration Address



After entering the address value into the web browser, a password request page will appear as shown below. Type "**admin**" into the Password field and leave the User Name field blank. Then click the **OK** button to log in.

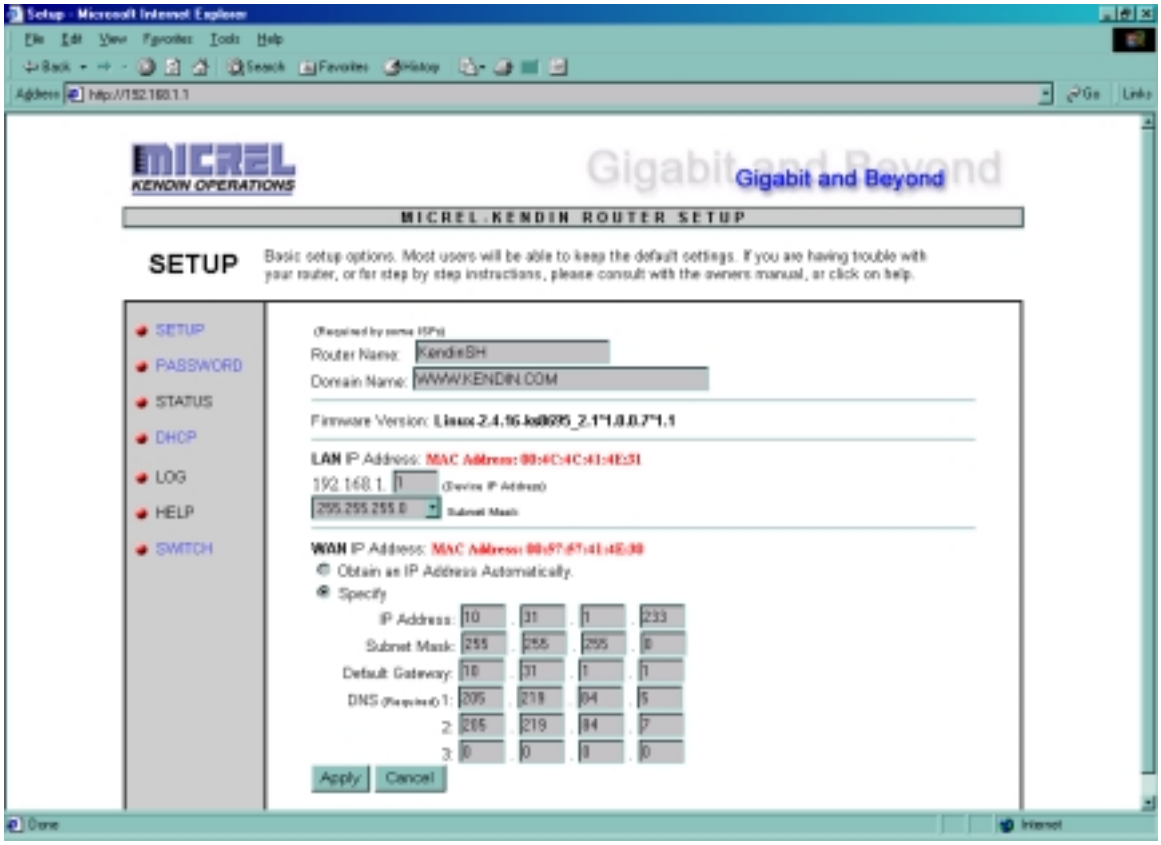
Figure 4 Password Prompt



To apply any of the settings you change on a page, click the **Apply** button. Then click the **Continue** button. To clear any values you've entered on a page, click the **Cancel** button.

3.3 Setup

Figure 5 SOHO Router Setup Page



The Setup page is the first screen that appears when you log in. It displays the following:

- **Host Name & Domain Name** These fields allow you to supply a host and domain name for the Router. Some ISPs require these names as identification.

- **Firmware Version** This entry shows the version and date of the firmware you are using.

- **LAN IP Address and Subnet Mask** The values for the Router's IP Address and Subnet Mask are shown here. The default value is 192.168.1.1 for the IP address and 255.255.255.0 for the Subnet Mask.

- **WAN IP Address** This is the IP address that your Router has, when seen from the external WAN, or the Internet.

- **Subnet Mask** This is the Router's Subnet Mask, as seen by external users on the Internet. If you select **Obtain an IP address automatically**, your ISP will assign these values.

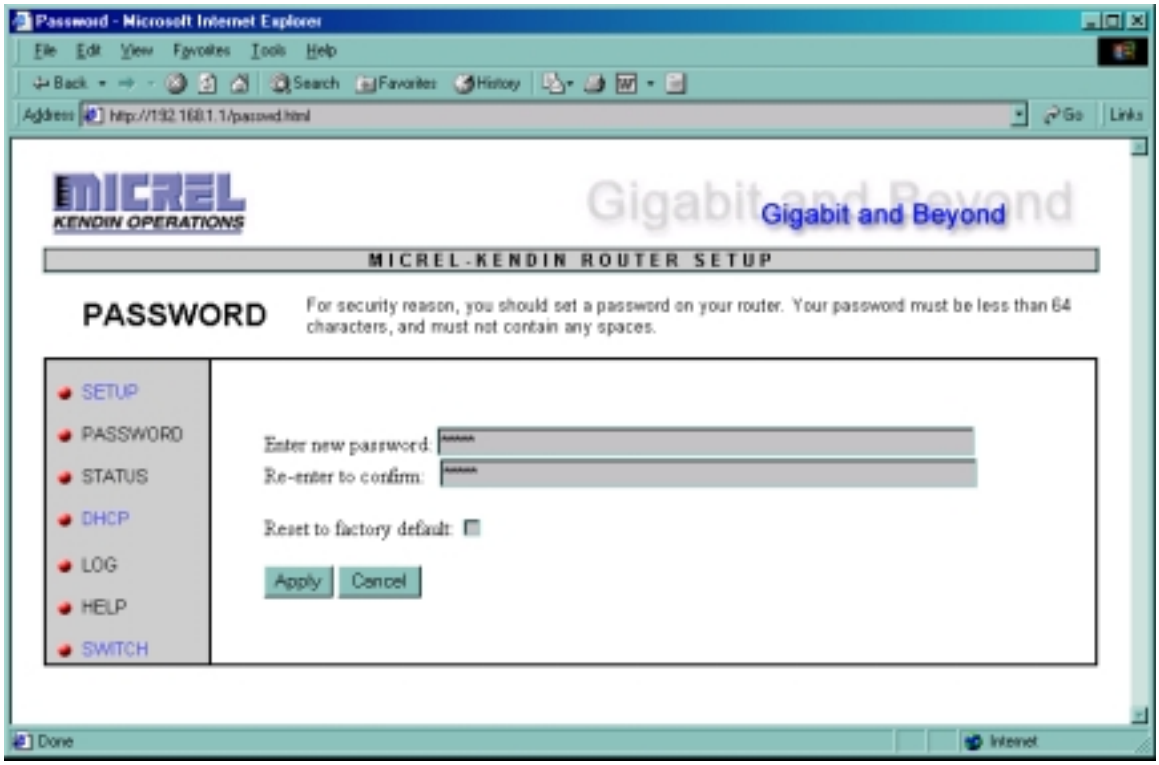
- **Default Gateway Address** Your ISP will provide you with the Default Gateway IP Address. If you select **Obtain an IP address automatically**, your ISP will assign these values.

- **DNS (Domain Name Server) IP Address** Your ISP will provide you with at least one DNS Server IP Address. If you select **Obtain an IP address automatically**, these values will be assigned by your ISP.

3.4 Password

This page allows users to change their log in password.

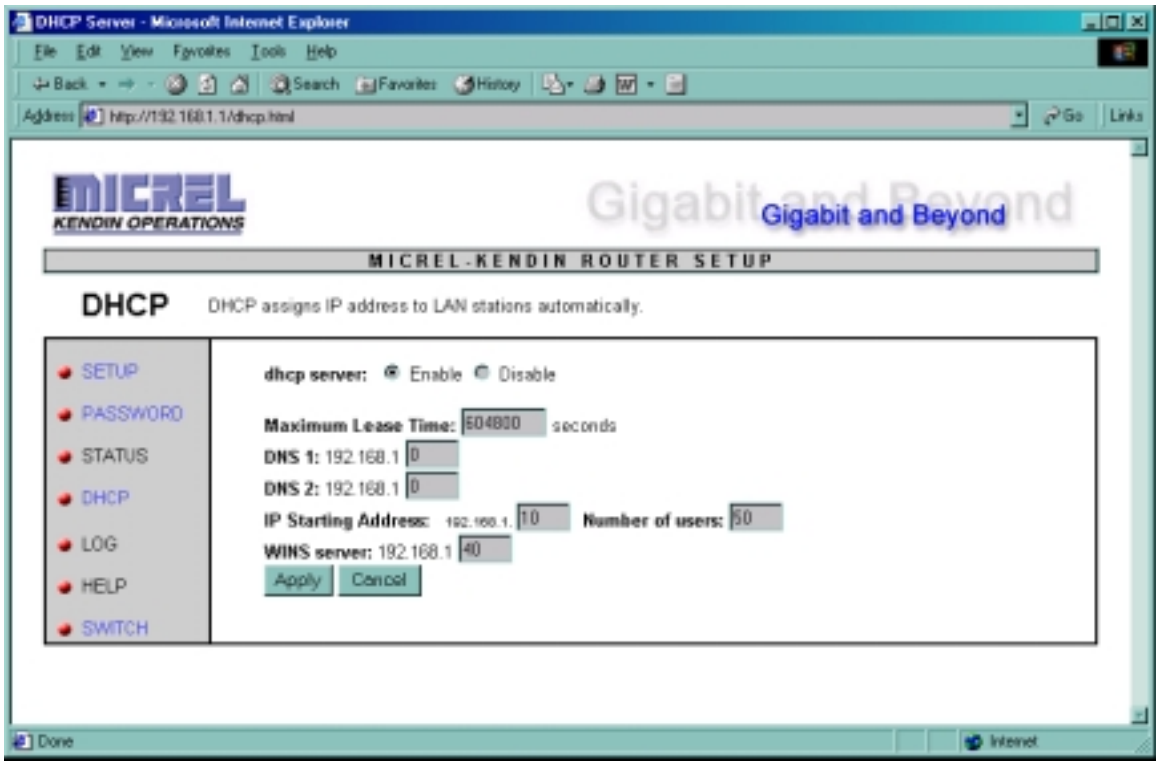
Figure 6 Password Page



3.5 DHCP

A DHCP (Dynamic Host Configuration Protocol) server automatically assigns IP addresses to each PC on your network for you.

Figure 7 DHCP Configuration Page



- **Starting IP Address** Enter a value for the DHCP server to start with when issuing IP addresses. This value must be (192.168.1.2) or greater, because the default IP address for your Router is 192.168.1.1.

- **Number of DHCP Users** Enter the maximum number of PCs that you want the DHCP server to assign IP addresses to. This number can not be greater than 253.

4.0 Hardware Description

4.1 Memory Map

Upon power up, the KS8695/KS8695X memory map is configured as shown below.

Table 1 Default Memory Map

Address Range	Region Size	Description
0x03FF0000-0x04000000	64 kbytes	KS8695 Configuration Register Space
0x02000000-0x03FEFFFF	32Mbytes	Not Configured
0x00000000-0x01FFFFFF	32Mbytes	Flash Bank 0

The default base address for the KS8695/KS8695X system configuration registers is 0x03ff0000. After power up, the user is free to re-map the memory for his/her specific application. Here is an example of the memory space remapped for operation:

Table 2 Memory Map Example

Address Range	Region Size	Description
0x03FF0000-0x04000000	64 kbyte	KS8695 Configuration Register Space
0x02900000-0x03FEFFFF	23 Mbyte	Spare (External I/O)
0x02100000-0x028FFFFF	8 Mbyte	FLASH
0x00100000-0x020FFFFF	32 Mbyte	SDRAM
0x00000000-0x0007FFFF	512 kbyte	SRAM

Please see the KS8695 Register Description for more details.

4.2 KS8695/KS8695X

4.2.1 Board Reset

The KS8695/KS8695X demo board provides both a power-on reset and a push button reset, as well as circuitry to reset the board using the Multi-ICE. At power on, the board is automatically reset. The user can also press S1, the reset button on the board, for a manual reset. After any reset, expect the LED's to flash indicating the power on self-test.

4.2.2 System Clock

The system clock is generated using a 25 MHz crystal (Y1). The crystal is connected to the XCLK1 (pin 150) and XCLK2 (pin 151) inputs on the KS8695/KS8695X. The clock is specified as +/- 100 ppm.

4.2.3 Configuration Jumpers

There are 4 configuration jumpers on the KS8695/KS8695X Demo Board. For normal operation JP1, JP2 and JP3 should be unconnected. JP4 Sets the mode of the Ethernet MAC MII interface.

Table 3 Configuration Jumpers

Configuration	Jumper	Settings	Recommended
WANFXSD	JP1	No Connection	No Connection
Test1	JP2	No Connection	No Connection
Test2	JP3	No Connection	No Connection
MPMSEL	JP4	PU= PHY Mode MII; PD = MAC Mode MII.	No Connection

If JP4 is in the pull up position (PU) then the PHY Mode MII connector (J6) is active. If JP4 is in the pull down position (PD) then the MAC Mode MII connector (J7) is active.

4.2.4 Chip Select Assignments

Table 4 Chip Select Assignments

KS8695/KS8695X Chip Select Signal	KS8695/KS8695X Pin #	Device
SDCSN0	17	SDRAM0 (U2)
SDCSN1	16	Not assigned
RCSN0	82	FLASH (U3)
RCSN1	81	Not assigned
ECSN0	77	Not assigned
ECSN1	76	Not assigned
ECSN2	75	Not assigned

The KS8695/KS8695X board only uses 2 chip selects which means there is plenty of room for expansion to support a variety of applications.

4.2.5 SDRAM

The KS8695/KS8695X demo board supports 16 MB of SDRAM in a 4Mx32 bit configuration. The KS8695/KS8695X SOHO router provides a glueless interface to the SDRAM as shown in Figure 2. The SDRAM interface can also be programmed to support 16 bit SDRAM.

Figure 8 KS8695/KS8695X SDRAM Interface

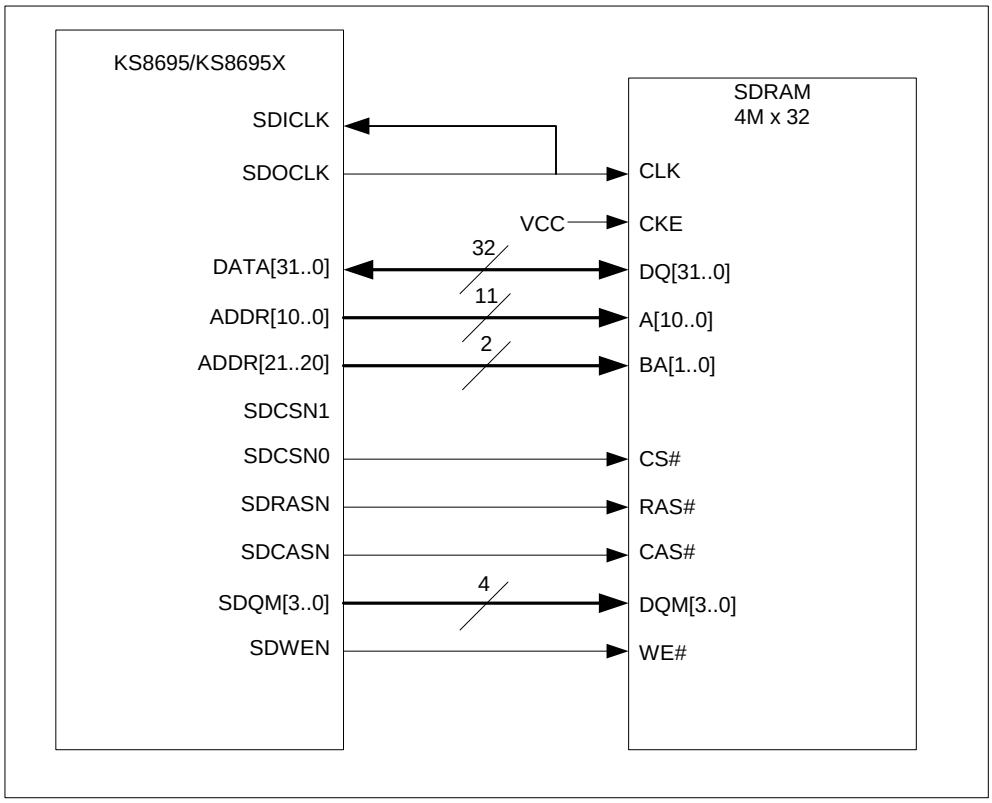


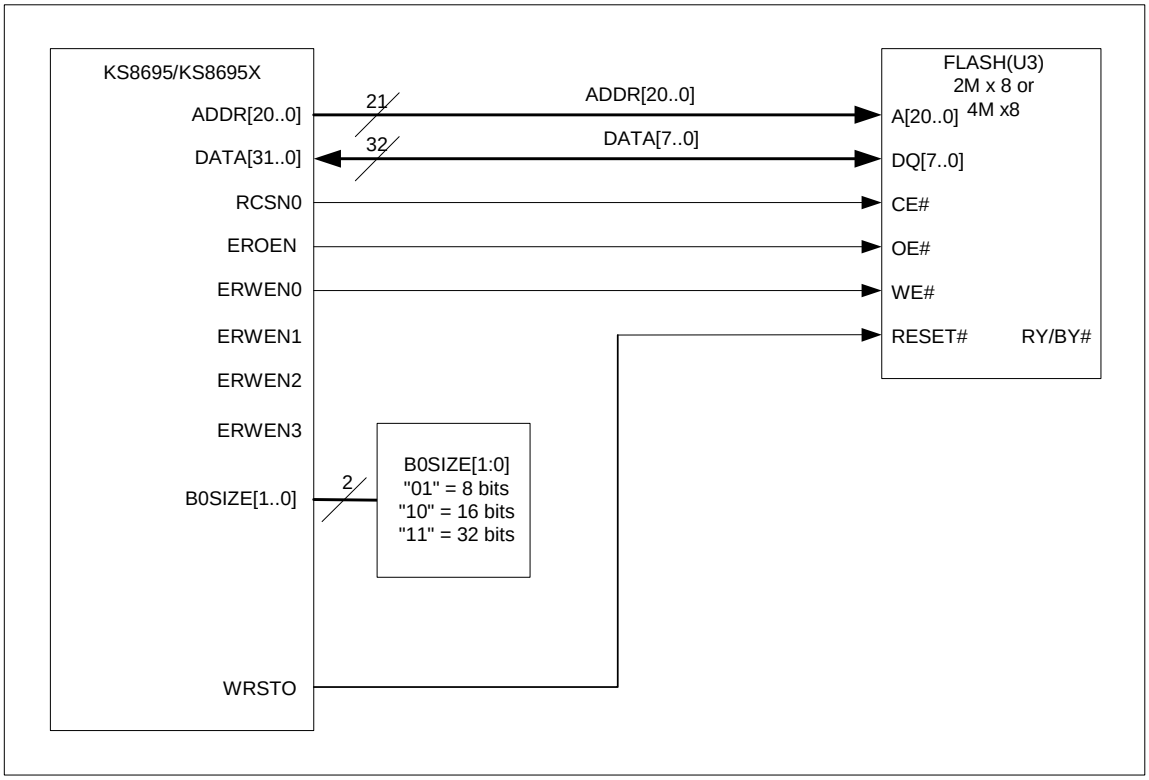
Table 5 KS8695/KS8695X SDRAM Signals

KS8695/KS8695X Signal	SDRAM Signal	Description
SDOCLK	CLK	Clock from KS8695 to SDRAM via clock buffer.
SDICLK	N/A (Feedback from SDOCLK)	Clock feedback from clock buffer for KS8695 internal PLL
DATA[31..0]	DQ[31..0]	Bi-directional data bus
ADDR[11..0]	A[11..0]	Address bus
ADDR[21..20]	BA[1..0]	Bank Address Inputs
SDCSN0	CS# (Chip 0)	SDRAM chip select (active low)
SDCSN1	CS# (Chip1)	SDRAM chip select (active low)
SDRASN	RAS#	SDRAM row address strobe (active low)
SDCASN	CAS#	SDRAM column address strobe (active low)
SDQM[3..0]	DQM[3..0]	SDRAM input/output mask.
SDWEN	WE#	SDRAM write enable

4.3 Flash

The KS8695/KS8659X SOHO Router provides a glueless interface to flash memory as shown in figure 3. The KS8695/KS8695X Demo board supports 1 flash memory chip either in a socket or mounted directly. The layout supports either a 2Mx8 or 4Mx8 bit flash chip. The flash memory occupies external static memory bank 0. The KS8695/KS8695X flash data bus width is programmable for 8, 16, or 32 bits. The system addressing is determined by the B0SIZE[1:0] inputs (pins 118 and 119). The KS8695/KS8695X will automatically adjust the system addressing for byte wide, half word wide (16 bit), or word wide (32 bit) flash configurations. B0SIZE[1:0] is hard coded to "01" for 8 bit flash on the KS8695 Demo board.

Figure 9 KS8695/KS8695X Flash Interface



4.4 CPLD

The KS8695/KS8695X Demo Board features a low cost CPLD (U6), which is used to provide reset circuitry to support reset assertion and monitoring via the JTAG Multi-ICE. This CPLD is not required in a normal system design. Below are the CPLD equations.

```
TITLE "Demoreset";

FUNCTION OPNDRN (in)
  RETURNS (out);

SUBDESIGN demoreset
(
        % Reset Interface %
        ICE_SRSTN, PORST, ICE_TRST, WRSTO        : INPUT;
        SRSTN, RESETN, TRSTN, FLASH_RSTN         : OUTPUT;
)

VARIABLE
a : NODE;
odrn: OPNDRN;

BEGIN
% Reset Circuitry %

TRSTN = not(PORST or ICE_TRST);
RESETN = ICE_SRSTN;
a= not(PORST);
odrn.in = a;
SRSTN = odrn.out;
FLASH_RSTN = ICE_SRSTN;

END;
```

4.5 External Interfaces

4.5.1 WAN Interface

The WAN interface on the KS8695/KS8695X is connected to a single transformer with a 50 ohm differential termination on the transmit side. The line side of the transformer will be connected to pins 3 (TX+) and 6 (TX-) on the RJ-45 connector (J5). The WAN interface can also support 100 Base FX with additional circuitry to interface with fiber optic modules.

4.5.2 LAN Interfaces

The LAN interfaces on the KS8695/KS8695X are connected to a quad transformer with a 50 ohm differential termination on the transmit side for each port. The line side of the transformer is connected to pins 3 (TX+) and 6 (TX-) on the RJ-45 connectors for LAN ports 1-4 (J1, J2, J3, J4).

4.5.3 MII Interface

The PHY mode MII interface (J6) is a male connector used to connect the KS8695's to an external MAC or CPU. (KS8695 only)

4.5.4 Reverse MII Interface

The MAC mode MII interface (J7) is a female connector used to connect the KS8695's internal switch to an external PHY. (KS8695 only)

4.5.5 UART

The KS8695/KS8695X provides a high speed UART interface. The UART supports up to 120 kbps. The UART interface is a male DB9 connector (P1) used for dial up back up or a console port.

Connector Pin No.	KS8695/KS8695X Signal Name	I/O	KS8695/KS8695X Signal Description
1	UDCDN	I	UART Data Carrier Detect
2	URXD	I	UART Receive Data
3	UTXD	O	UART Transmit Data
4	UDTRN	O	Data Terminal Ready (active low)
5	N/A	N/A	Ground
6	UDSRN	I	UART Data Set Ready
7	URTSN	O	UART Request To Send
8	UCTSN	I	Clear To Send
9	URIN	I	Ring Indicator

4.5.6 Multi-ICE/JTAG Connector

The KS8695/KS8695X JTAG interface (JP5) is a standard 20-pin connector for the Multi-ICE. This connector can be used to download code to flash, and for debugging purposes.

Pin No.	Signal
1	3.3V
2	3.3V
3	NTRST
4	GND
5	TDI
6	GND
7	TMS
8	GND
9	TCK
10	GND
11	RTCK
12	GND
13	TDO
14	GND
15	SRST
16	GND
17	DBGRQ
18	GND
19	DBGACK
20	GND

The DBGRQ and DBACK signals are not supported on the KS8695/KS8695X Demo Board.

4.5.7 LEDs

The KS8695/KS8695X SOHO Router provides 2 LED's per LAN or WAN port. The top LED is LED1 for the port, and the bottom LED is LED0 for the port. These LED indicators are fully programmable. Please see the KS8695/KS8695X Datasheet for more information. The KS8695/KS8695X Demo board features a power LED so that the user may easily determine if the board is on.

1. Power LED (D1)
2. WAN LEDs (U7)
3. LAN Port 1 LEDs (U8)
4. LAN Port 2 LEDs (U9)
5. LAN Port 3 LEDs (U10)
6. LAN Port 4 LEDs (U11)

4.6 Power and Ground

Voltage to the demo board is supplied through a 5.0 V DC power jack. The dc power is then regulated down to the voltage levels required with Micrel voltage regulators. These voltage regulators were chosen for stability in evaluation and testing. A mass production design can use low cost voltage regulators to supply the KS8695 SOHO Router. Please contact your Micrel Sales Representative to meet your low cost regulator needs.

Voltages	Test Points
V2.5A	TP1
V1.8A	TP2
V1.8 (Digital Core)	TP3
V3.3 (Digital I/O)	TP4
GND	TP5, TP6, TP7

Note that the KS8695 requires 3.3V, 2.5V and 1.8V. The KS8695X can use three voltage supplies like the KS8695, or it can use just the 3.3V and 1.8V. This ensures that it can be used as a drop in replacement for current KS8695 designs, or it can reduce the voltages required in new designs.