KSZ8851-16MLL

48-pin Single-Port Ethernet Controller

With 8-bit or 16-bit Non-PCI Interface

Evaluation Board User's Guide

Revision 1.0
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Revision History

Revision	Date	Summary of Changes
1.0	2/20/2008	Initial Release

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1.0 Introduction

The KSZ8851-16MLL-Eval Evaluation Board is intended to provide a convenient and fast way to evaluate or demonstrate the functionality and performance of this new Single-Port Ethernet Controller KSZ8851-16MLL device from Micrel.

The KSZ8851-16MLL comes in a 48-pin, lead-free LQFP (7mm x 7mm) package and provides an ideal solution for applications requiring high-performance from single-port Ethernet Controller with 8-bit or 16-bit generic processor interface. The KSZ8851-16MLL offers the most cost-effective solution for adding high-throughput Ethernet connectivity to traditional embedded systems.

This evaluation board is designed as a stand alone without microcontroller or M16C on board. By default the KSZ8851-16MLL-Eval board comes with an operation of 16-bit bus mode, Little Endian mode and disabled EEPROM for KSZ8851-16MLL device. Customer may wire the board for his desired interface. The purpose is to provide a simple tool that can be used to evaluate the KSZ8851-16MLL device by connecting via headers to customer provided Microcontroller or Non-PCI hardware platform.

Micrel provides a basic software driver based on the 8 or 16-bit bus solution and different operating system platforms to evaluate the KSZ8851-16MLL functionality and performance. The software includes a configuration utility to allow quick and easy device setup, initialization and transmit/receive packet. All KSZ8851-16MLL configuration pins and host interface signals are accessible either by jumpers, test points or headers.

2.0 Board Features

- One KSZ8851-16MLL 48-pin Single-Port Ethernet Controller with shared data bus for host interface
- Single +5V/GND power input from headers
- RJ-45 Jack for Fast Ethernet cable interface
- HP Auto-MDIX for automatic detection and correction for straight-through and crossover cables
- Two on board LDO voltage regulators, one for VDD_IO and the other for VDD_A3.3
- One AT93C46 for external EEPROM interface
- Two LED indicators for port status and activity
- One LED indicator for 3.3V output ready
- One LED indicator for Power Management Event (PME) output status
- Jumpers to configure strapping pins and VDD_IO voltage option
- Headers to wire the host interface from external hardware platform
- Manual reset button for quick reboot after re-configuration of strapping pins

3.0 Evaluation Kit Contents

The KSZ8851-16MLL Evaluation Kit includes the following hardware:

- KSZ8851-16MLL Evaluation Board

The KSZ8851-16MLL Data Sheet and Hardware Design Package with the following collaterals that can be downloaded from Micrel's website at http://www.micrel.com

- KSZ8851-16MLL Eval Board Schematic (PDF and OrCAD DSN file)
- KSZ8851-16MLL Eval Boards Gerber Files (PDF version included)
- KSZ8851-16MLL Eval Board User's Guide (this document and included BOM)
- KSZ8851-16MLL IBIS Model

4.0 Hardware Description

The KSZ8851-16MLL-Eval (shown in Figure 1) comes in a compact form factor and plugs directly into industry standard test equipment such as Spirent SmartBits, the other side of board is wired to external host interface through headers. Configuration of the KSZ8851-16MLL is accomplished through on-board jumper selections and/or by register access via the host shared data/control bus Interface.

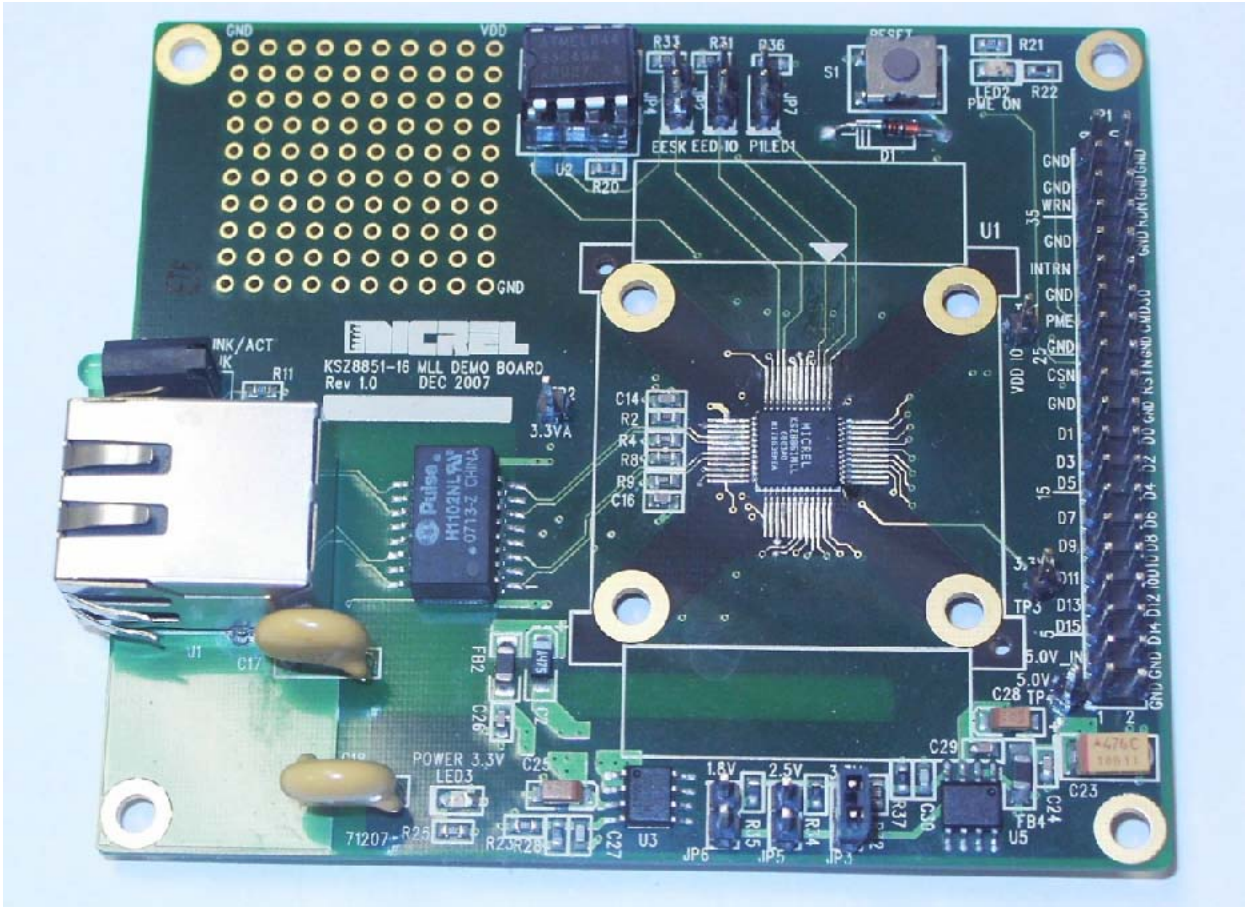

Figure 1. KSZ8851-16MLL Evaluation Board

Other features include a RJ-45 Jack for Fast Ethernet cable connection, transformer (Pulse H1102) to block DC level and provide a true AC coupling, EEPROM (Atmel AT93C46) to load MAC address when it is enabled, jumper to select LDO output for VDD_IO voltage, programmable LED indicators for reporting port link status and activity, and a manual reset button for quick reboot after re-configuration of strapping pins.

The KSZ8851-16MLL-Eval receives +5V DC input power supply from its Headers JP1.

4.1 Host Interface

The KSZ8851-16MLL-Eval board receives +5V power from the header JP1 (pin 1/3). Figure 2 shows the Host interface connection with Spirent SmartBits for system set-up and performance test.

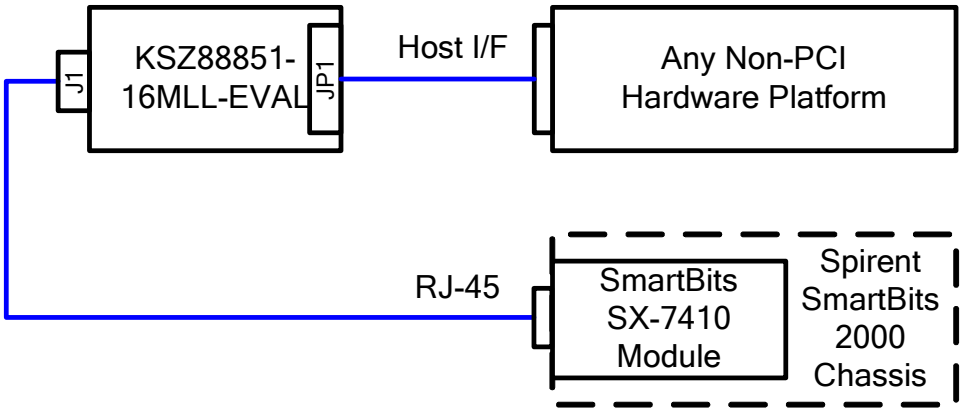

Figure 2. KSZ8851-16MLL-Eval Host Interface Connection with Spirent SmartBits

The KSZ8851-16MLL-Eval has a 40-pin header (JP1) for Host interface to external any Non-PCI hardware platform. Table 1 lists Shared Data SD[15:0] pin outs for the Host interface on header JP1. Table 2 lists the rest of control signals and power/ground pin outs for the Host interface on header JP1.

Pin # (JP1)	Shared Data Bus Signal	16-Bit Bus Mode (pin 1 pull-up)		8-Bit Bus Mode (pin 1 pull down)	
		CMD = 0 (low)	CMD = 1 (high)	CMD = 0 (low)	CMD = 1 (high)
20	SD0	D0	x (don't care)	D0	A0
19	SD1	D1	x (don't care)	D1	A1
18	SD2	D2	A2	D2	A2
17	SD3	D3	A3	D3	A3
16	SD4	D4	A4	D4	A4
15	SD5	D5	A5	D5	A5
14	SD6	D6	A6	D6	A6
13	SD7	D7	A7	D7	A7
12	SD8	D8	x (don't care)	GND	GND
11	SD9	D9	x (don't care)	GND	GND
10	SD10	D10	x (don't care)	GND	GND
9	SD11	D11	x (don't care)	GND	GND
8	SD12	D12	BE0	GND	GND
7	SD13	D13	BE1	GND	GND
6	SD14	D14	BE2	GND	GND
5	SD15	D15	BE3	GND	GND

Table 1. Header JP1 – Host Interface Connection for SD[15:0]

Pin # (JP1)	Power & Control Signal Names	Description
1, 3	5.0V_IN	+5V power supply inputs for this board
2, 4, 21, 22, 25, 26, 29, 33, 34, 37, 38, 39, 40	GND	Ground inputs/pins
23	CPU_CSN	Chip Select input from host CPU
24	CPU_RSTN	Reset input from host CPU
27	CPU_PME	Power Management Event output to host CPU
28	CPU_CMD	Command type input from host CPU
31	CPU_INTRN	Interrupt output to host CPU
35	CPU_WRN	Write input from host CPU
36	CPU_RDN	Read input from host CPU
30, 32	Spares	For customer to use

Table 2. Header JP1 – Host Interface Connection for Control and Power

4.2 Jumper Setting & Definition

The KSZ8851-16MLL-Eval does not require any jumper for normal operation except the VDD_IO option. During power-up, the KSZ8851-16MLL is configured using the chip's internal pull-up and pull-down resistors with its default strapping pin values which will set this device in operation of 16-bit bus mode, little endian and without EEPROM. Jumpers are provided to override the default settings, allowing for quick configuration and re-configuration of the board. To override the default settings, simply select and close the desired jumper setting(s) and toggle the on-board manual reset button (S1) for the new setting(s) to take effect.

The KSZ8851-16MLL-Eval jumper settings are defined in Table 3 below.

Jumper	Definition	Setting	Description
JP2	EED_IO	OFF (Default)	OFF: EEPROM is not present ON: EEPROM is present
JP3	3.3V	ON (Default)	ON: to select 3.3V (JP5 and JP6 must be OFF) OFF: De-select 3.3V
JP4	EESK	OFF (Default)	OFF: Little Endian ON: Big Endian
JP5	2.5V	OFF (Default)	ON: to select 2.5V (JP3 and JP6 must be OFF) OFF: De-select 2.5V
JP6	1.8V	OFF (Default)	ON: to select 1.8V (JP3 and JP5 must be OFF) OFF: De-select 1.8V
JP7	P1LED1	OFF (Default)	OFF: 16-Bit bus mode ON: 8-Bit bus mode

Table 3. KSZ8851-16MLL-Eval Jumper Definition

4.3 Power Supply and Test Point Definition

The KSZ8851-16MLL-Eval is supplied from external +5.0V DC power through a jumper (pin 1 and 3 at JP1), this +5.0V DC input is converted to both +3.3V with a Micrel LDO voltage regulator (U3, MIC5209BM) for VDD_A3.3 analog power and VDD (option for 3.3V, 2.5V or 1.8V) with a Micrel LDO voltage regulator (U5, MIC5209BM) for VDD_IO digital power. The KSZ8851-16MLL contains an internal +1.8V LDO, to provide its core, analog and PLL voltages.

The KSZ8851-16MLL-Eval has four test points. They are defined in the following Table 4.

Test Point	Definition
TP1	Power supply measurement for VDD_IO
TP2	Power supply measurement for VDD_A3.3
TP3	1.8V digital core voltage output measurement from KSZ8851-16MLL internal LDO
TP4	External power supply 5.0V_IN measurement

Table 4. KSZ8851-16MLL-Eval Test Point Definition

4.4 RJ-45 Connector and Transformer

The RJ-45 Jack (J1) connects to standard CAT-5 Ethernet cable to interface with 10Base-T/100Base-TX Ethernet devices. The LAN interface on the KSZ8851-16MLL is connected to a transformer (T1) with 50 ohm termination resistors for both TX+/- and RX+/- differential pairs. The line side of the transformer is connected to the RJ-45 connectors (J1).

J1 also supports Auto-MDIX and Auto-Negotiation / Forced Modes.

4.5 EEPROM and LED Indicators

It is optional in the KSZ8851-16MLL to use an external EEPROM. The EED_IO (JP2) must be pulled high (ON) to use external EEPROM.
An external serial EEPROM with a standard microwire bus interface is used for non-volatile storage of information such as the host MAC address. The KSZ8851-16MLL can detect if the EEPROM is either a 1KB (93C46) or 4KB (93C66) EEPROM device. The EEPROM must be organized as 16-bit mode.

The KSZ8851-16MLL EEPROM format is given in Table 5.

WORD	15 8	7 0
0H	Reserved	
1H	Host MAC Address Byte 2	Host MAC Address Byte 1
2H	Host MAC Address Byte 4	Host MAC Address Byte 3
3H	Host MAC Address Byte 6	Host MAC Address Byte 5
4H – 6H	Reserved	
7H-3FH	Not used for KSZ8851-16MLL (available for user to use)	

Table 5. KSZ8851-16MLL EEPROM Format

A dual LED indicator (LED1) is located adjacent to the RJ-45 Connector (J1). The top LED is connected to P1LED1 (pin 1) and bottom LED is connected to P1LED0 (pin 2) of the KSZ8851-16MLL.
The two LEDs are programmable to LED mode '0' or '1' via register 0xC6 bits [9], and are defined in the following Table 6.

	LED Mode	
	0 (Default)	**1**
LED1 (Top)	100BT	ACT
LED1 (Bottom)	LINK/ACT	LINK

Table 6. KSZ8851-16MLL-Eval Port Status LED Definition

Table 7 shows the rest of LEDs definition.

LED	Color	Description
LED2	Green	Power Management Event (PME) Status
LED3	Red	3.3V Power available indicator

Table 7. KSZ8851-16MLL-Eval LED Definition

4.6 Board Reset

The KSZ8851-16MLL-Eval generates a reset signal from the reset circuitry during power up. It also provides a push button S1 reset circuit to reset the KSZ8851-16MLL device. During power up, the board is automatically reset. User can also press reset button S1 on the board for a manual reset.

5.0 Bill of Materials

KSZ8851-16MLL Eval Board (Revision 1.0)

Item	Quantity	Reference	Part	Footprint	Vendor	Remark
1	4	C1,C2,C3,C6	4.7uF	SIZE A	Digikey 4932361-1	
2	13	C4,C5,C7,C9,C10,C11,C12,	0.1uF	603		
		C14,C16,C20,C24,C26,C29				
3	2	C8,C13	0.01uF	603		
4	4	C15,C19,C25,C28	10uF	SIZE A	Digikey 4932351-1	
5	2	C18,C17	1000pF/2KV	1808	399-3443-1-ND	
6	2	C21,C22	22pF	603		
7	1	C23	47uF	SIZE C		
8	2	C30,C27	470pF	603		
9	1	D1	1N4148	DIODE\.400		
10	2	D2,D3 (for reference & not design in)	GBLC03C_0	SOD-323		Option
11	4	FB1,FB2,FB3,FB4	FBEAD (Steward HI1206N101R-00)	1206		
12	1	JP1	HEADER	20x2 (TH 0.1mm)		
13	6	JP2,JP3,JP4,JP5,JP6,JP7	JUMPER	SIP\2P		
14	1	J1	RJ-45 Jack			
15	1	LED1	LEDx2 (Dialight 553-0122-300 Green)			
16	2	LED2 (green)	LED GRN (67-1553-1-ND 0805)		Digikey	
		LED3 (red)	LED RED (67-1553-1-ND 0805)		Digikey	
17a	4	RN1,RN2,RN3,RN4	33 x 4 (resistor net)	1206		
17b	7	R10,R12,R14,R16,R17,R18,R22	33	603		
18	2	R1,R20	0	603		
19	4	R2,R4,R8,R9	49.9	603		
20	4	R3,R5,R6,R7	75	603		
21	4	R11,R13,R21,R25	220	603		
22	1	R15	10K	603		
23	1	R19	3.01K	603		
24	2	R32,R23	1.5K	603		
25	7	R24,R26,R27,R29,R30,R31,R33	4.7K	603		
26	2	R37,R28	2.49K	603		
27	1	R34	2.46K	603		
28	1	R35	5.54K	603		
29	1	R36	1K	603		
30	1	S1	SW PUSHBUTTON			
31	4	TP1,TP2,TP3,TP4	TestPoint			
32	1	T1	SINGLE H1102		PULSE	
33	1	U1	KSZ8851-16MLL (48-pin 7mmx7mm LQFP)		Micrel	w/Socket
34	1	U2	AT93C46 SO8	DIP8	ATMEL	w/Socket
35	2	U3,U5	MIC5209BM	SOIC-8	Micrel	
36	1	U4 (for reference & not design in)	SRV05-4	SOT23-6		Option
37	1	Y1	25MHZ Crystal	CA-301	Digikey	SE3441-ND