# M-501

Linux-ready ATMEL AT91RM9200 System-on-Module

- ☑ ATMEL AT91RM9200 CPU, 200MIPS @180MHz, with MMU.
- ☑ 64MB SDRAM, 16MB NOR FLASH memory
- ☑ One 10/100 Mbps Ethernet interface with on-board PHY and transformer
- ☑ Two USB 2.0 Host ports, supports full speed (12 Mbps)
- ☑ One SD (secure digital) interface, supports SD mode.
- ☑ Four 921.6kbps UARTs supports hardware flow control
- ☑ I2C (Inter-IC) bus
- ☑ I2S (Inter-IC Sound) bus, one transmitter and one receiver
- ☑ SPI (Serial Peripheral Interface) with 2x chip select signals
- ☑ 32x general-purpose IOs (GPIO), CMOS/3.3V compatible
- ☑ External local bus (A0-A7, D0-D7), with 4x chip select signals
- ☑ Small footprint, 80x50mm only
- ☑ Ultra low power consumption, less than 2.5W
- ☑ Linux 2.6.x OS is pre-built in the FLASH, supports file system
- ☑ GNU C/C++ tool chain is included

Introduction

The M-501 is a credit card size ARM9-based SoM (System-on-Module). It includes an ATEML AT91RM9200 ARM9 CPU, 64MB SDRAM and 16MB Flash. The operation system, Linux kernel 2.6.x with file system support, is pre-built in the M-501.

M-501 Hardware Black Diagram
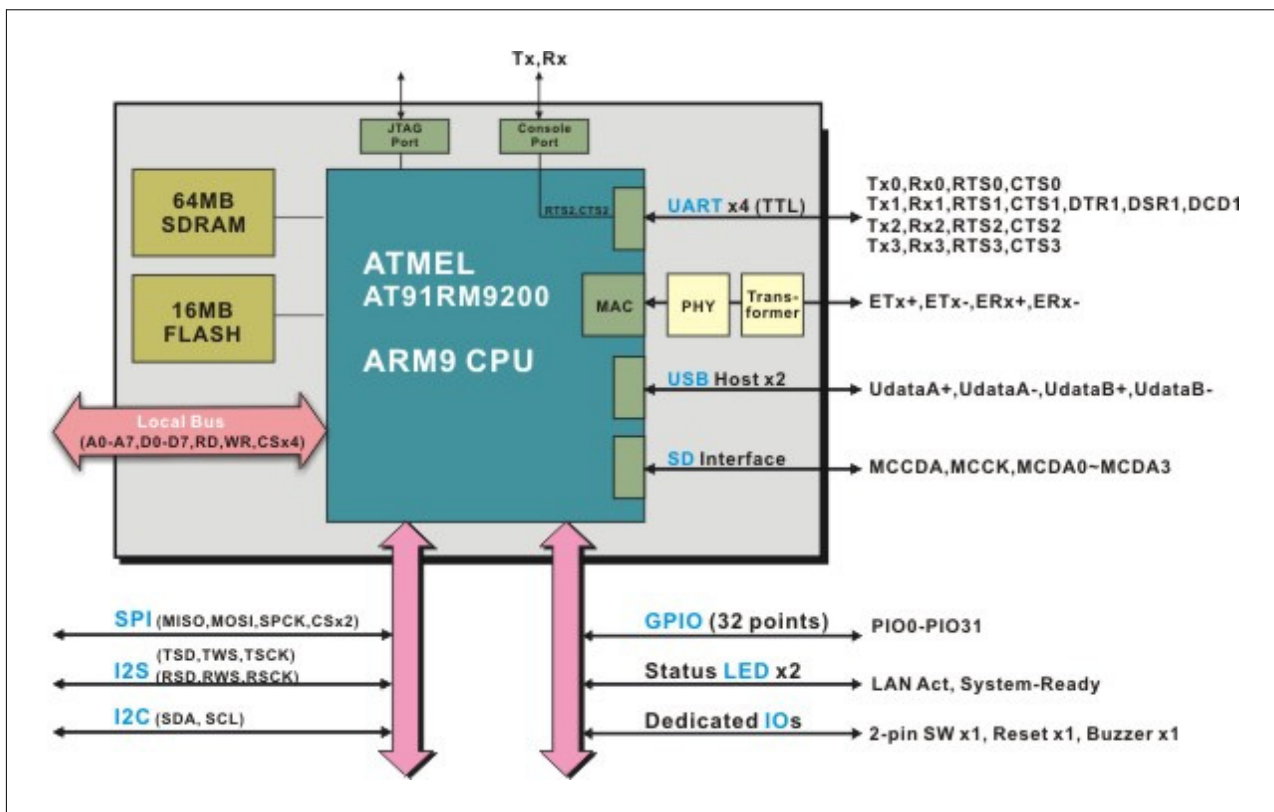
H/W Specifications

CPU/Memory
- CPU: ATMEL 180MHz AT91RM9200 (ARM9, w/MMU)
- Memory: 64MB SDRAM, 16MB Flash

Network
- Type: Ethernet, 10/100 Mbps
- PHY: DAVCOM DM9161
- Isolation: 1.5 KV

USB
- Host: x2, USB 2.0 compliant
- Signals: UdataA+, UdataA-,UdataB+,UdataB-

UART
- Port0: TXD0, RXD0, RTS0, CTS0, GND
- Port1: TXD1, RXD1, RTS1, CTS1, DCD1, DTR1, DSR1,GND
- Port2: TXD2, RXD2, RTS2, CTS2,GND
- Port3: TXD3, RXD3, RTS3, CTS3,GND
- Signal Level: CMOS/3.3V compatible

Common UART Parameters
- Baud Rate: Up to 921.6 Kbps
- Data Bits: 5 to 8 bits
- Parity: None, Even, Odd, Mark, Space
- Stop: 1, 1.5, 2 bits
- Flow Control: RTS/CTS, XON/XOFF, None

UART Port 0 advanced feature,
(when Port0 used as RS-485)
- Supports 9-bit Multi-drop mode
- Supports hardware auto direction control

I2C (Inter-IC Bus)
- Signals: TWD, TWDK
- Supported devices: (driver has been built-in)
  Real-time Clock: Ricoh RS5C372
  EEPROM: ATMEL AT24C16 and compatibles

I2S (Inter-IC Sound)
- Signals:
- Transmitter: TSCK, TWS, TSD
- Receiver: RSCK, RWS, RSD

SPI (Serial Peripheral Interface)
- Signals: MISO, MOSI, SPCK, CS1, CS2

SD (Secure Digital Card Interface)
- Signals: MCCDA, MCCK, MCDA0~MCDA3
- Compatible with SD memory card Specification 1.0

Watchdog timer
- CPU built-in internal watchdog timer, used by Linux kernel

General-Purpose IOs (GPIO)
- 32 GPIOs, can be programmed as digital input or output
- Support interrupt function when GPIO set as digital input
- Signal Level: CMOS/3.3V Compatible

Pre-defined Pins
- Reset Button (CN2, pin#35), input
- Buzzer (CN2, pin#37), output
- 2-pin DIP SW (CN2, pin#12,13), input
- System ready LED (CN2, pin#38), output
- LAN activity LED (CN3, pin#11), output

Undefined Digital IO Pins (reserved)
- CN1: pin#23, #24, #25, #26
- CN3: pin#23, #24

Debug ports
- JTAG port: for low level debug
- Console port: Tx/Rx serial console (share RTS2, CTS2)

Local Bus
- Data bus: 8-bit (D0~D7)
- Address bus: 8-bit (A0~A7)
- Chip select: x4 (NCS3~NCS6)
- Control bus: RD, WR
- Signal Level: CMOS/3.3V Compatible

Power Consumption
- Input range: 3.0 to 3.6VDC (3.3V nominal)
- Consumption: 2W

Mechanism
- Board dimension: 50 x80mm
- Connectors (2.0mm pitch)
- CN1: 28 pins; CN2: 50 pins; CN3: 50 pins
- Mounting holes: x4, 2.0mm(M2) diameter
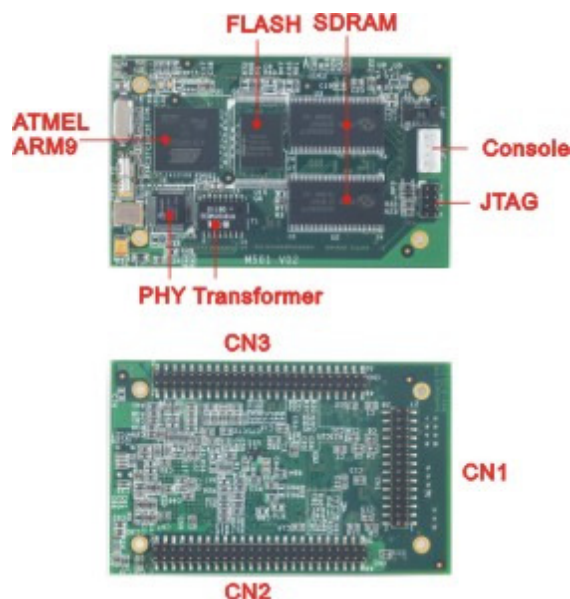
S/W Specifications

General

▷ OS: Linux kernel 2.6.X
▷ Boot Loader: U-Boot 1.1.2
▷ File systems: JFFS2, EXT2/EXT3, VFAT/FAT, NFS

Protocol Stacks

▷ support IPV4, ICMP, ARP, DHCP, NTP, TCP, UDP, FTP, Telnet, HTTP, PPP, PPPoE, CHAP, PAP, SMTP, SNMP V1/V3,SSL, SSH 1/2

Pre-load Utilities

▷ Bash: Shell Command
▷ Telnet: Telnet client program
▷ Busybox: Linux utility collection
▷ FTP: FTP client program

Pre-load Daemons

▷ pppd: Dial In/out over serial port and PPPoE
▷ snmpd: SNMP agent program
▷ telnetd: Telnet server program
▷ inetd: TCP server program
▷ ftpd: FTP server program
▷ boa: Web server program
▷ sshd: secured shell server
▷ iptables: Firewall service manager
▷ armd: Artila manager daemon

Tool Chain for Linux/Windows

▷ GCC: C/C++ PC cross compiler
▷ GLIBC: POSIX Library
▷ To use the tool chain for Windows, users have to install Cygwin first, and Invoke the cross-compiler in the Cygwin console. Cygwin package 1.5.19-x is already included in the CD.
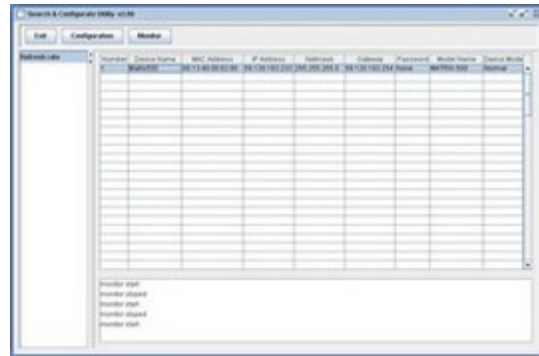
Standard Device Drivers

▷ SD/MMC, UART, Ethernet, GPIO, Buzzer
▷ Real Time Clock: supports Ricoh RS5C372
▷ EEPROM: supports ATMEL AT24C16 and compatibles

Pre-load USB Host Drivers (could be customized)

▷ Flash thumb disk
▷ IEEE-802.11b/g WiFi adapter (Ralink)
▷ 10/100Mbps Fast Ethernet adapter (RT8150)
▷ RS-232 adapter (prolific)
▷ ADSL modem
▷ ISDN modem (CDC/ACM compatible)
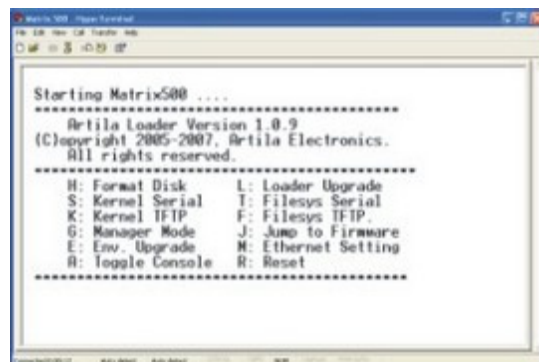
Screenshots

Search utility to find all the M-501 on the network
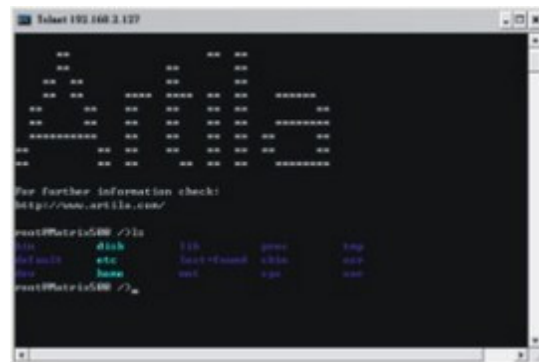
M-501 login screen (telnet)

Cross compile user applications in Cygwin Console

Serial Console for advanced debug and maintenance

Pin Assignment

CN1

Function		#	#		Function
(Addr Bus)	A0	1	2	D0	(Data Bus)
(Addr Bus)	A1	3	4	D1	(Data Bus)
(Addr Bus)	A2	5	6	D2	(Data Bus)
(Addr Bus)	A3	7	8	D3	(Data Bus)
(Addr Bus)	A4	9	10	D4	(Data Bus)
(Addr Bus)	A5	11	12	D5	(Data Bus)
(Addr Bus)	A6	13	14	D6	(Data Bus)
(Addr Bus)	A7	15	16	D7	(Data Bus)
(Write Enable)	WR	17	18	RD	(Read Enable)
(Chip Select)	CS3	19	20	CS4	(Chip Select)
(Chip Select)	CS5	21	22	CS6	(Chip Select)
(N/A)	N/A	23	24	N/A	(N/A)
(N/A)	N/A	25	26	N/A	(N/A)
	VCC3	27	28	GND	

CN2

Function		#	#		Function
(COM2)	CTS2	1	2	DSR2	(COM2)
(COM2)	RTS2	3	4	RXD3	(COM3)
(COM3)	TXD3	5	6	CTS3	(COM3)
(COM3)	RTS3	7	8	TXD4	(COM4)
(COM4)	RXD4	9	10	RTS4	(COM4)
(COM4)	CTS4	11	12	SW#0	(DIP SW)
(DIP SW)	SW#1	13	14	PIO16	(GPIO)
(GPIO)	PIO17	15	16	PIO18	(GPIO)
(GPIO)	PIO19	17	18	PIO20	(GPIO)
(GPIO)	PIO21	19	20	PIO22	(GPIO)
(GPIO)	PIO23	21	22	PIO24	(GPIO)
(GPIO)	PIO25	23	24	PIO26	(GPIO)
(GPIO)	PIO27	25	26	PIO28	(GPIO)
(USB B+)	UdataB+	27	28	UdataB-	(USB B-)
(USB A-)	UdataA-	29	30	UdataA+	(USB A+)
(GPIO)	PIO29	31	32	PIO30	(GPIO)
(GPIO)	PIO31	33	34	RST#0	(System Reset)
(Reset Btn)	RST#1	35	36	RST#2	(JTAG Reset)
(Buzzer)	BUZR	37	38	RDY LED	(System Ready LED)
(I2S transmitter)	TWS	39	40	TSCK	(I2S transmitter)
(I2S transmitter)	TSD	41	42	RSD	(I2S receiver)
(I2S receiver)	RSCK	43	44	RWS	(I2S receiver)
	GND	45	46	GND	
	GND	47	48	GND	
	VCC3	49	50	VCC3	

CN3

Function		#	#		Function
	VCC3	1	2	VCC3	
	GND	3	4	GND	
	GND	5	6	GND	
(LAN)	ERX0-	7	8	ERX0+	(LAN)
(LAN)	ETX0-	9	10	ETX0+	(LAN)
(LAN LED)	ACT LED	11	12	MISO	(SPI)
(SPI)	MOSI	13	14	SPCK	(SPI)
(SPI)	NPCS0	15	16	NPCS1	(SPI)
(SD)	MCCK	17	18	MCCDA	(SD)
(SD)	MCDA0	19	20	MCDA1	(SD)
(SD)	MCDA2	21	22	MCDA3	(SD)
(N/A)	N/A	23	24	N/A	(N/A)
(I2C)	TWD	25	26	TWCK	(I2C)
(GPIO)	PIO1	27	28	PIO3	(GPIO)
(GPIO)	PIO4	29	30	PIO5	(GPIO)
(GPIO)	PIO6	31	32	PIO7	(GPIO)
(GPIO)	PIO8	33	34	PIO9	(GPIO)
(GPIO)	PIO10	35	36	PIO11	(GPIO)
(GPIO)	PIO12	37	38	PIO13	(GPIO)
(GPIO)	PIO14	39	40	PIO15	(GPIO)
(GPIO)	PIO0	41	42	PIO2	(GPIO)
(COM1)	TXD1	43	44	RXD1	(COM1)
(COM1)	CTS1	45	46	RTS1	(COM1)
(COM2)	DTR2	47	48	TXD2	(COM2)
(COM2)	RXD2	49	50	DCD2	(COM2)

Module Dimension
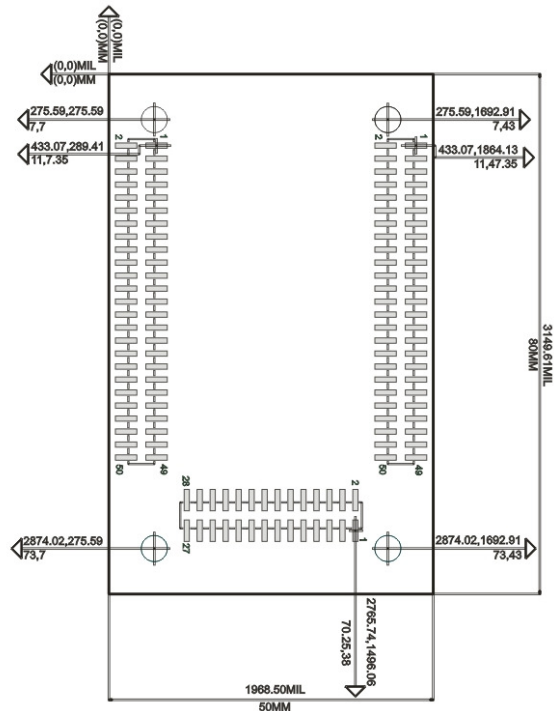
Ordering Information

M-501-16

Linux-ready ATMEL91RM9200 128-pin System-on-Module

M-501-16 Starter Kit

Includes one M-501-16 SoM and one carrier board with power circuitry, 3x RS-232 ports, 1x RS-232/422/485 port, 1x Ethernet port, 2x USB hosts, 1x SD socket (at back side), 2x GPIO connectors, RealTime Clock, EEPROM, and local bus connector.