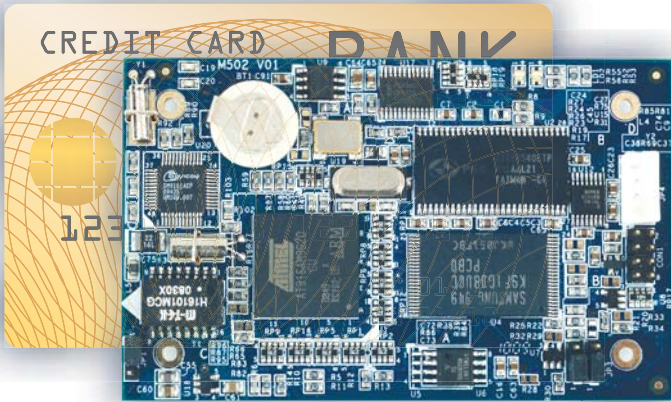


M-502 Industrial ARM9 Linux-based System-on-Module



- ▶ 32 x GPIOs, CMOS/3.3V compatible
- ▶ Compact size, 50 x 80mm only
- ▶ Ultra low power consumption of less than 2.5W
- ▶ GNU C/C++ tool chain is included

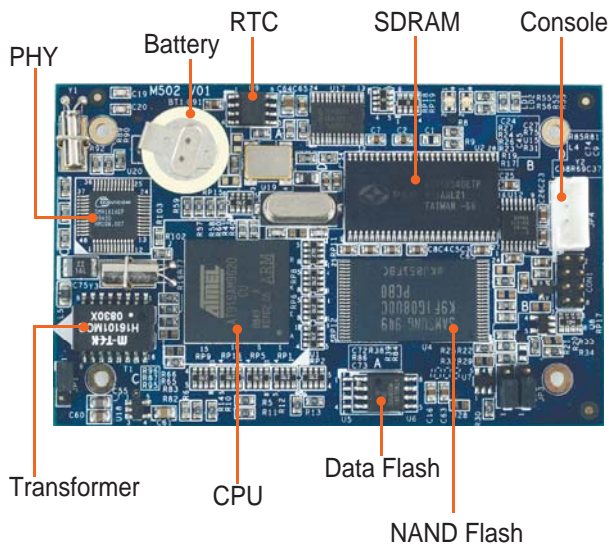
- ▶ ATMEL 400MHz AT91SAM9G20 CPU w/ MMU
- ▶ Linux kernel 2.6.29 with file system
- ▶ 64MB SDRAM/128MB NAND Flash
- ▶ 2MB DataFlash for system recovery
- ▶ On-board real-time clock w/ backup battery
- ▶ 1 x 10/100Mbps Ethernet
- ▶ On-board Ethernet PHY/transformer
- ▶ 2 x USB 2.0 Hosts supporting full speed of 12Mbps
- ▶ 1 x SD (secure digital) interface
- ▶ 4 x 921.6Kbps UARTs w/ hardware flow control
- ▶ I2C Interface
- ▶ I2S Interface, one transmitter and one receiver
- ▶ SPI w/ 3 x chip select signals



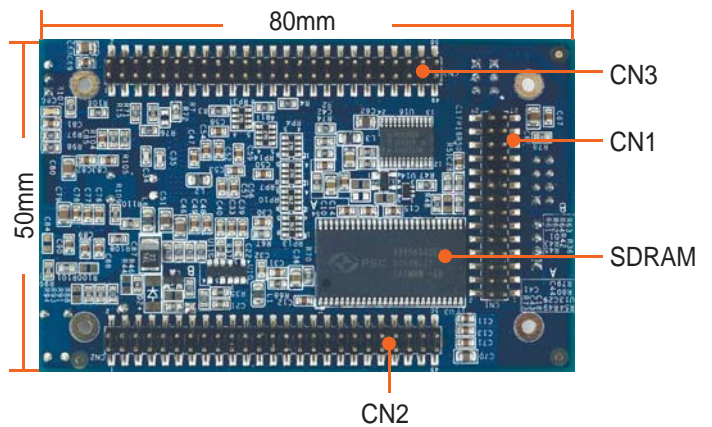
Overview

M-502 is a credit card size ARM9 Linux-based System on Module (SoM). M-502 is powered by 400MHZ ARM926EJ-S ARM Thumb Processor with memory management unit, and equipped with 64MB SDRAM, 128MB NAND Flash, and 2MB DATAFlash. M-502 is also pre-installed with Linux 2.6.29 OS, busybox utility collection, lighttpd Web server, and various hardware device drivers. M-502 comes with one 10/100Mbps Ethernet, two USB 2.0 hosts, four UARTs with hardware/software flow control, and 32 programmable digital I/Os. In addition, Secure Data Card (SD) interface, Serial Peripheral Interface (SPI), Inter-IC(I2C) bus, Inter-IC Sound (I2S) bus, and 8-bit local bus are included. M-502 is a reliable SoM to be used in various embedded systems. It is ideal for all kinds of industrial applications, including intelligent transportation system (ITS), building automation, energy-saving system, and scenario control systems.

Front View of M-502



Back View of M-502



Hardware Specifications

CPU/Memory

CPU: ATMEL 400MHz AT9SAM9G20 w/MMU
SDRAM: 64MB
NAND Flash: 128MB
DataFlash®: 2MB, for system backup

Network Interface

Type: Ethernet, 10/100Mbps
PHY: DAVICOM DM9161
Protection: 1.5KV magnetic isolation

UART

Port 0: TXD0, RXD0, RTS0, CTS0, GND
Port 1: TXD1, RXD1, RTS1, CTS1, DCD1, DTR1, DSR1, GND
Port 2: TXD2, RXD2, RTS2, CTS2, GND
Port 3: TXD3, RXD3, RTS3, CTS3, GND
Signal Level: CMOS/3.3V compatible

Common UART Parameters

Baud Rate: up to 921.6Kbps
Parity: None, Even, Odd, Mark, Space
Data Bits: 5, 6, 7, 8
Stop Bit: 1, 1.5, 2
Flow Control: RTS/CTS, XON/XOFF, None

UART Advanced Feature (when used as RS-485)

Supports 9-bit Multi-drop mode
Supports hardware auto direction control

USB Ports

Hosts: Two, USB 2.0 compliant
Host Signals: UdataA+, UdataA-, UdataB+, UdataB-
Device (Client): One, USB 2.0 compliant
Device (Client) Signals: Uddata+, Uddata-, Udio

I2C (Inter-IC Bus)

Signals: TWD, TWCK
Supported Devices: (driver has been built-in)

I2S (Inter-IC Sound)

Transmitter Signals: TSCK, TWS, TSD
Receiver Signals: 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
Additional watchdog timer is available for user applications

General-Purpose IOs (GPIO)

32 x GPIOs can be programmed as digital input or output
Supports interrupt function when GPIOs are 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

Real Time Clock

Chip: ST M41T81
Backup Battery: Lithium, 48mAh

Debug Ports

JTAG Port: for low level debug
Console Port: RS-232(Tx/Rx) serial console

Local Bus

Data Bus: 8-bit (D0~D7)
Address Bus: 8-bit (A0~A7)
Chip Select: x 3 (CS0, CS5, CS6)
Control Bus: RD, WR
Signal Level: CMOS/3.3V Compatible

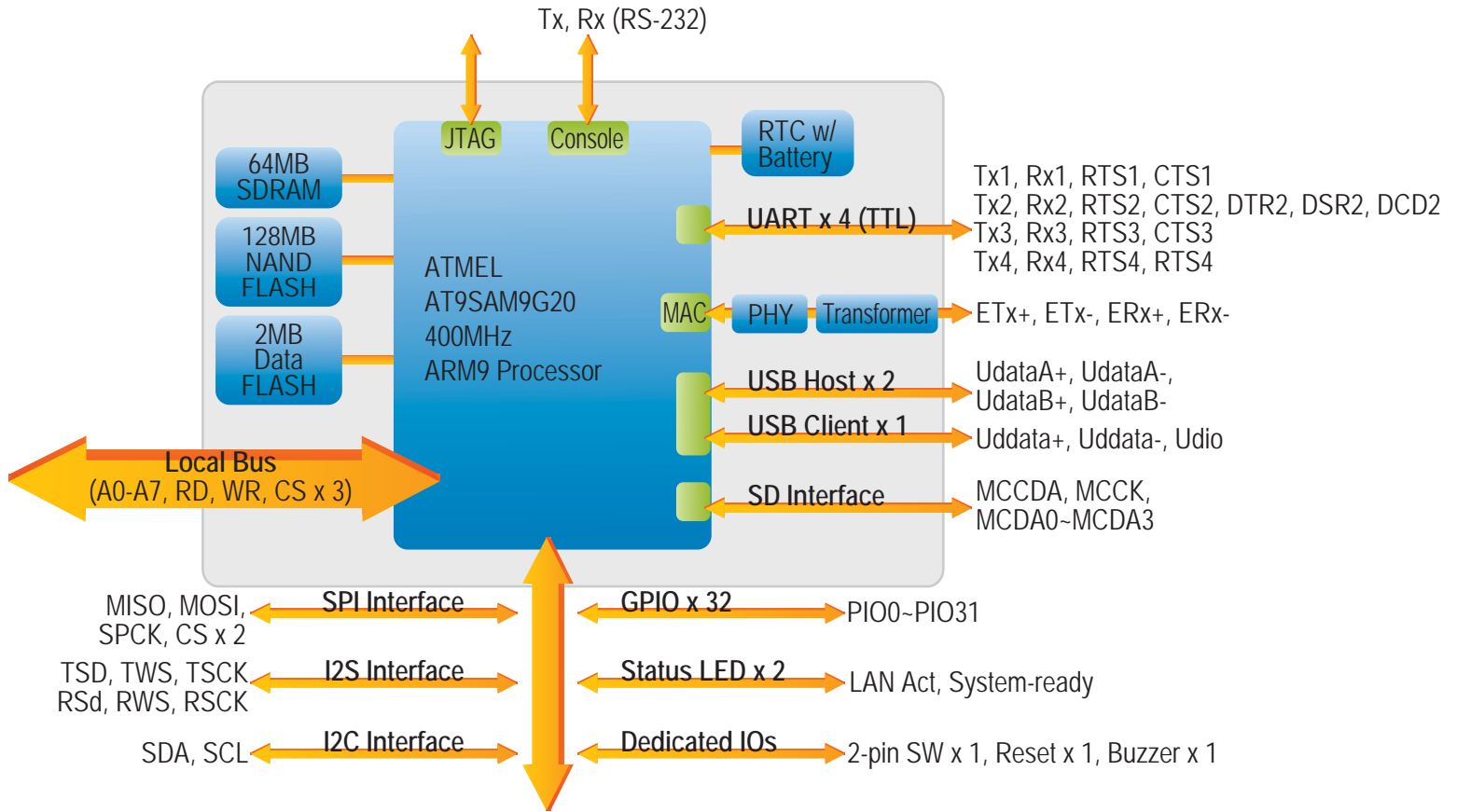
Power Consumption

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

Power Consumption

Board Dimension: 50 x 80mm
2.0mm pitch Connectors
CN1: 28 pins; CN2: 50 pins; CN3: 50 pins
Mounting Holes: x 4, 2.0mm (M2) in diameter

Block Diagram



Software Specifications

General

OS: Linux, Kernel 2.6.29
 Boot Loader: U-Boot 1.3.4
 File Systems: UBI, JFFS2, ETX2/ETX3, VFAT/FAT, NFS

Pre-installed Utilities

bash, busybox, sysvinit, wget, ipkg, procps (for webmin), psmics, lighttpd, vsftpd, iptable, ppp, ssh, wireless_tools, util-linux-mount/umount, usbtutils, Artila utility. (More utilities can be found in the product CD.)

Daemons Started by Default

ssh (secured shell) with sftp
 syslog/klogd (system and kernel log)
 telnet server (disable root with/etc/security)
 ftp server (vsftpd)
 Web server (lighttpd)
 amgrd (Artila broadcast search daemon)

Package Management & System Administration

Supports ipkg to manage the package installation, upgrade and removal
 Supports webmin (use ipkg install webmin to install) for web-based system administration

Tool Chain for Linux

GCC: C/C++ PC cross compiler
 GLIBC: POSIX Library

Standard Device Drivers

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

Pre-load USB Host Drivers (customizable)

Flash thumb disk
 IEEE-802.11b/g WiFi adapter (Ralink rt73usb, Ralink rt2500usb, Realtek RTL8187, ZyDAS zd1211rw)
 10/100Mbps Fast Ethernet adapter (RT8150)
 RS-232 adapter (prolific PL-2303)
 ADSL modem
 ISDN modem (CDC/ACM compatible)

PIN Assignments

| | | CN1 | | | |
|----------------|---------|-----|----|------------|---------------|
| (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) |
| (USB Device) | Uddata- | 19 | 20 | CS5 | (Chip Select) |
| (Chip Select) | CS6 | 21 | 22 | CS0 | (Chip Select) |
| (USB Device) | Uddata+ | 23 | 24 | PIO32/IRO0 | (GPIO/IRQ) |
| (Console) | TX 232 | 25 | 26 | RX 232 | (Console) |
| | VCC3 | 27 | 28 | GND | |

| | | CN2 | | | |
|-------------|---------|-----|----|-----------|----------------|
| (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/CLK | (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 Bln) | RST#1 | 35 | 36 | Udio | (USB Device) |
| (Buzzer) | BUZR | 37 | 38 | RDY LED | (Ready LED) |
| (I2S) | TWS | 39 | 40 | TSCK | (I2S) |
| (I2S) | TSD | 41 | 42 | RSD | (I2S) |
| (I2S) | RSCK | 43 | 44 | RWS | (I2S) |
| | GND | 45 | 46 | GND | |
| | GND | 47 | 48 | GND | |
| | VCC3 | 49 | 50 | VCC3 | |

| | | CN3 | | | |
|-----------|---------|-----|----|------------|--------|
| | 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) | NPCSO | 15 | 16 | NPCS3 | (SPI) |
| (SD) | MCCK | 17 | 18 | MCCDA | (SD) |
| (SD) | MCDA0 | 19 | 20 | MCDA1 | (SD) |
| (SD) | MCDA2 | 21 | 22 | MCDA3 | (SD) |
| (SD) | SDCD | 23 | 24 | SDWP | (SD) |
| (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/IRO1 | (GPIO) |
| (GPIO) | PIO0 | 41 | 42 | PIO2 | (GPIO) |
| (COM1) | TXD1 | 43 | 44 | RWS | (COM1) |
| (COM1) | CTS1 | 45 | 46 | RTS1 | (COM1) |
| (COM2) | DTR2 | 47 | 48 | TXD2 | (COM2) |
| (COM2) | RXD2 | 49 | 50 | DCD2 | (COM2) |

Ordering Information

M-502

ATMEL9G20 + Linux 2.6.29 System on Module with
128MB Flash, 64MB SDRAM

Module Dimensions

