SoM-9307M

User Manual

REV. 1.1

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2. Introduction

This document describes EMAC's SoM-9307M (SBC) module. The SoM-9307M is a System on Module, designed to be compatible with EMAC's 200-pin SODIMM form factor. This module is built around the Cirrus EP9307 microcontroller, which provides several of its key features.

The SoM-9307M has an on-board Ethernet PHY, 3 serial ports, a RTC, a programmable clock synthesizer, onboard NOR flash, Serial EEPROM, and SDRAM.

In addition to these standard SoM features, the SoM-9307M also features a fast 32-bit core, open source software support, and a wide range of controller IO pins.

2.1. Features

- **Small, 200 pin SODIMM form factor (2.66" x 2.375")**
- **Cirrus ARM9 EP9307 200Mhz Processor**
- **MaverickCrunch Hardware Floating Point Math Coprocessor**
- **10/100BaseT Ethernet with on-board PHY**
- **3 Serial ports with handshake**
- **3 USB 2.0 (Full Speed) Host ports**
- **Up to 128 MB of SDRAM**
- **Up to 64 MB of Flash**
- **128K Bytes of Serial Flash**
- **Battery backed Real Time Clock**
- **SD/MMC Flash Card Interface**
- **1 SPI port**
- **1 I2S Audio port**
- **Timers and Pulse Width Modulation (PWM) ports**
- **8 Channel 12-bit Analog-to-Digital converter**

- **Graphic LCD Interface with 2D acceleration up to 1024 x 768 Resolution**
- **Touchscreen Interface**
- **Typical power requirement less than 1 Watt**
- **JTAG for debug, including real-time trace**
- **FREE Eclipse IDE with GCC & GDB development tools**
- **WinCE 6.0 BSP**

3. **Hardware**

3.1. Specifications

- **CPU:** Embedded Cirrus EP9307 processor running at 200 MHz with MaverickCrunch Hardware Floating Point Math Engine
- **Flash:** 32 MB External NOR Intel P30 Flash & 128K of utility serial Flash.
- **RAM:** 32 MB 100 MHz SDRAM.
- **Video:** 2D Accelerated Video Interface with up 1024 x 768 resolution.
- **Touchscreen:** 12-Bit 4, 5, 7 or 8-wire analog resistive Touchscreen interface.
- **Keypad:** 64-key (8x8) with auto debounce, scanning & decoding.
- **Flash Disk:** SPI serial SDHC/MMC interface.
- **System Reset:** Supervisor with external Reset Button provision.
- **RTC:** Battery backed Real Time Clock/Calendar.
- **Timers:** 2 general purpose 16-bit, 1 32-bit timer, & 2 16-bit PWMs.
- **Watchdog Timer:** Reset-on-Timeout
- **Digital I/O:** 32 General Purpose I/Os with 8 mA drive when used as an output.
- **Analog I/O:** 8-channel, 12-bit Analog-to-Digital converter (ADC)
- **Power:** Power Management Controller allows selectively shutting down on processor I/O functionality and running from a slow clock.
- **JTAG**: JTAG for debug, including real-time trace
- **CLOCKS**: PLL synthesized 8M and 200K clock outputs

Serial Interfaces

- **UARTS:** Two serial TTL level serial ports with Auto RS485 and some with handshaking (each UART requires external RS level shifting).
- **SPI:** One High-Speed SPI port with Chip Selects.
- **Audio:** I2S Synchronous Serial Controller with analog interface support
- **USB:** Three USB 2.0 Full Speed Host ports

Ethernet Interface

- **MAC:** EP9307 on chip MAC
- **PHY:** Intel/Cortina LXT927ALC with software PHY shutdown control
- **Interface:** IEEE 802.3u 10/100 BaseT Fast Ethernet (requires external magnetics and Jack)

Bus Interface

- Local ARM EP9307 Bus accessible through SODIMM provides 22 address lines, 16 data bus lines, and control lines.

Mechanical and Environmental

- **Dimensions:** SODIMM form factor with the length dimension extended (2.66" x 2.375")
- **SODIMM TYPE:** 200 Pin DDR1 (not compatible with DDR2)
- **Power Supply Voltage:** +3.3 Volts DC +/- 5%
- **Power Requirements:** Typical 3.3 Volts @ 300 mA. (less than 1 watt)
- **Operating Temperature:** 0 ~ 70° C (32 ~ 158° F), fan-less operation
- **Operating Humidity:** 0%~90% relative humidity, non-condensing

3.2. Real Time Clock

The SoM-9307M is equipped with an external, battery-backed, Real-Time Clock (RTC). The EP9307 processor provides an internal RTC but there is no provision for battery backing it. The external RTC is based on the I2C PCA8565TS chip from NXP. The EP9307 does not have a true I2Cinterface but does offer a couple of lines that can act in that capacity. These are referred to as EECLK and EEDAT. Since there is no I2C circuitry, “bit-banging” these two lines is required. This functionality is provided by Linux and WinCE drivers.

In addition, processor line EGPIO[9] / RTC_~INTRQ is connected to the IRQ line of the RTC. Using this line, the RTC can wake the processor up from sleep modes on the second, minute, hour, day of the week, or month. For example the processor can be placed in Sleep mode and then later awakened via the Alarm function. The RTC also provides 32.768 kHz clock (CLKOUT) required by the processor.

> **NOTE:** Avoid modifying CLKOUT in software because there is risk of accidentally shutting it off. The processor will not boot or run without it. Power will need to be turned off and the battery will have to be removed to restore the SoM to normal functionality.

3.3. External Connections

The SoM-9307M connects to a carrier board containing its connectors, power supply and any expansion IO, through a standard gold-plated SODIMM 200-pin connection shown below.

The SoM model will fit in any standard 200-pin SODIMM socket. These connections are designed to be compatible with all EMAC 200-pin SoM products. See EMAC SoM 200-pin SODIMM Pinout Specification to see how other 200-pin SoMs pinouts line up with the SoM-9307M's pinout.

The use of the DDR SODIMM form-factor for EMAC's SoMs is a sound choice that has been proven rugged and reliable in the laptop and embedded SBC markets.

The remainder of this section describes the pinout as it applies specifically to the SoM-9307M processor.

3.3.1. System Control & External Bus

The SoM-9307M provides a flexible external bus for connecting peripherals. The CPLD of the SoM-200ES connects through a subset of these connections.

SODIMM Pin#	SoM Pin Name	Processor Pin Name(s)	Description
145	GP_CSA	~CS0	General Purpose Processor Chip Select CS0
146	GP_CSB	~CS1/Watchdog	General Purpose Processor Chip Select CS1
147	GP_CSC	~CS2/Reset	General Purpose Processor Chip Select CS2
148	GPCSD	~CS3	General Purpose Processor Chip Select CS3
149	WR	~WR	Write Signal
150	RD	~RD	Read Signal
151	RST_IN	~PRST	Processor Reset
152	RST_OUT	~RSTO	Processor Reset
153	WAIT	~WAIT	Shutdown Control
154	WAKEUP	NC	Wake-Up Input
157	BOOT_OPTION0	BOOT0	Boot0 Option Select
158	BOOT_OPTION1	BOOT1	Boot1 Option Select
175 – 196	A0 - A21	A0 - A21	Address Bus
159 – 174	D0 - D15	D0 - D15	Data Bus

3.3.2. USB

The SoM 200-pin specification provides for 2 USB hosts and 1 USB device or OTG port. The EP9307 does not provide USB device or USB OTG capability but does provide a third USB host. Therefore the USB device port is actually connected to the third USB host port. There is a GPIO line that can be utilized

to enable USB power if necessary. This is SoM pin# 125, GPIO[11] and is not required if power will always be on. Remember the USB Data lines are differential pairs and need to be routed as such.

SODIMM Pin#	SoM Pin Name	Processor Pin Name(s)	Description
5	Host_A+	USBP0	Host USB 2.0 Port0 + pin
7	Host_A-	USBM0	Host USB 2.0 Port0 - pin
6	Host_B+	USBP2	Host USB 2.0 Port2 + pin
8	Host_B-	USBM2	Host USB 2.0 Port2 - pin
9	Host/Device/OTG_C-	USBM1	Host USB 2.0 Port1 - pin
11	Host/Device/OTG_C+	USBP1	Host USB 2.0 Port1 + pin
10	USB_OTG_VBUS	NC	OTG VBUS
40	USB_OTG_ID	NC	OTG ID

3.3.3. JTAG

The SoM specifications allows for access to the JTAG lines for the EP9307 processor. These connections will allow the Flash to be programmed in circuit via a program running from the processor and also the capability to debug software.

SODIMM Pin#	SoM Pin Name	Processor Pin Name(s)	Description
139	JTAG_TCK	JTAG_TCK	JTAG clock
140	JTAG_TDI	JTAG_TDI	JTAG serial in
141	JTAG_TDO	JTAG_TDO	JTAG serial out
142	JTAG_TMS	JTAG_TMS	JTAG operation mode
143	JTAG_TRST	~JTAG_TRST	Test Reset Signal
144	JTAG_RTCK	NC	Dynamic clock sync

3.3.4. Ethernet

The SoM-9307M provides a Cortina LXT972 Ethernet 10/100 PHY IC on board. Carrier designers need only run these lines through the appropriate magnetics layer to have a functional Ethernet connection. Remember the RX and TX lines are differential pairs and need to be routed as such.

The LED/configuration pins' state at reset determines the Ethernet's configuration (10-baseT, 100-baseT, autoconfig) and the function of the LED's. The SoM-200ES pull them all high, which configures the chip for network autoconfig, with LED2 functioning as active low link, and LED3 functioning as active low Activity status (Refer to Carrier schematics).

SODIMM Pin#	SoM Pin Name	LXT972 Pin Name	Description
12	GIG D-	NC	GIG Ethernet D- pin
14	GIG D+	NC	GIG Ethernet D+ pin
13	GIG C-	NC	GIG Ethernet C- pin
15	GIG C+	NC	GIG Ethernet C+ pin
16	Ethernet_Rx-/GIG B-	Etherent_Rx-	Low differential Ethernet receive line
18	Ethernet_Rx+/GIG B+	Ethernet_Rx+	High differential Ethernet receive line
17	Etherent_Tx-/GIG A-	Etherent_Tx-	Low differential Ethernet transmit line
19	Ethernet_Tx+/GIG A+	Ethernet_Tx+	High differential Ethernet transmit line
38	LED_LINK/CFG_2	LED_LINK/CFG_2	Ethernet Link LED/Configuration pin
39	LED_ACT/CFG_3	LED_ACT/CFG_3	Ethernet Activity LED/Configuration pin

3.3.6. I^2C

The SoM-200 specification calls for a two-wire I^2C port. The SoM-9307M does not have a native hardware I^2C port but does provide two general purpose lines that can be used in this capacity when "bit-banged". Both Linux and CE provide this functionality.

SODIMM Pin#	SoM Pin Name	Processor Pin Name(s)	Description
29	I2CCLK	EECLK	Clock pin
30	I2CDATA	EEDAT	Data pin

3.3.7. SPI

The EP9307 processor provides an SPI module for communicating with peripheral devices. The SPI bus is connected internally to the serial flash, which uses EGPIO[7] as its SPI Chip Select. (EGPIO[7] is not brought out to the card fingers). Linux users can use the open source driver provided by EMAC. A driver is also available for WinCE 6.0. The first Table below lists the lines for the SPI module. While the SoM pin specification allows for three SPI chip selects, there are not three natively available, so other GPIOs were selected for SPI slave selects. The EP9307 uses a SPI Frame signal to sometimes qualify the Chip Selects. This line is also made available.

SODIMM Pin#	SoM Pin Name	Processor Pin Name(s)	Description
22	SPI_MI	SSPRX	SPI serial data in
23	SPI_MO	SSPTX	SPI serial data out
24	SPI_SCK	SCLK1	SPI serial clock out

SODIMM Pin#	SoM Pin Name	Processor Pin Name(s)	Description
25	SPI_CS0	EGPIO2	SPI slave select line 0
26	SPI_CS1	EGPIO4	SPI slave select line 1
27	SPI_CS2	EGPIO8	SPI slave select line 2
28	SPI_CS3	SFRM1	SPI Frame

3.3.8. CAN

The SoM-200 specification provides for a CAN port. The SoM-9307M does not have a CAN port. EMAC has therefore applied GPIO lines to these SoM pins.

SODIMM Pin#	SoM Pin Name	Processor Pin Name(s)	SoM Description
93	CANTX	COL4/DPIO4	CAN Transmitt
94	CANRX	COL5/DPIO5	CAN Receive

3.3.9. IRQs

The SoM-200 specification allocates three pins as IRQs. Some processors can use virtually any GPIO pin as an IRQ others use predefined pins. The EP9307 uses predefined pins.

SODIMM Pin#	SoM Pin Name	Processor Pin Name(s)	SoM Description
129	IRQA	INT0	Interrupt A
130	IRQB	INT1	Interrupt B
131	IRQC	INT2	Interrupt C

3.3.10. Oscillators

The SoM-200 specification provides for two general-purpose oscillators. These frequencies can vary slightly between modules depending on how they are generated and some modules may not provide 50% duty cycles. The EP9307 uses a clock generator chip and therefore produces very accurate frequencies at 50% duty cycle.

SODIMM Pin#	SoM Pin Name	Processor Pin Name(s)	SoM Description
132	OSC0	NA	8 MHz
133	OSC1	NA	200 KHz

3.3.11. SD/Multimedia Card

The EP9307 processor does not provide a native 4-bit MMC/SD card interface. Therefore EMAC has utilized the SPI bus with a unique chip select.

The SoM-200ES Carrier board can use a parallel SPI MMC/SD interface if available. Since the SoM-9307M cannot be used in this mode, the drivers provided are written to utilize it as a serial SPI interface.

The SoM-200 specification provides for three optional SD/MMC control lines. Since these lines are optional and will not always be used they are not part of the SD/MMC group but are part of the GPIO group. SoM pin#s 122, 123, and 124 can be used as SD_LED, SD_Power, and SD_protect respectively.

SODIMM Pin#	SoM Pin Name	Processor Pin Name(s)	Description
31	SDCLK	SCLK1	MCI Clock
32	CMD	SSPTX	MCIA Command
33	DAT0	SSPRX	MCIA D0
34	DAT1	EGPIO12	MCIA D1
35	DAT2	EGPIO13	MCIA D2
36	DAT3	EGPIO15	MCIA D3
37	Card_Detect	DPIO6	Card Detect

3.3.12. Serial Ports

The SoM-200 pin specification has the provision for 4 serial ports. However, the EP9307 provides only 3 serial ports. The additional serial port is connected to EP9307 GPIO lines since they were available. Typically, the SoM specification calls for COM0 to be the terminal port, which is the default SoM-9307M. SoM pin# 113 provides for Auto 485 enable on COM2.

SODIMM Pin#	SoM Pin Name	Processor Pin Name(s)	SoM Description
95	COMA_TXD	TXD0	COM0 transmit/GPIO
96	COMA_RXD	RXD0	COM0 receive/GPIO
97	COMA_CTS	CTS0	COM0 CTS/GPIO
98	COMA_RTS	RTS0	COM0 RTS/GPIO
99	COMA_DTR	DTR0	COM0 DTR/GPIO
100	COMA_DSR	DSR0/DCD0	COM0 DSR /GPIO
101	COMA_RI	RI/EGPIO0	COM0 RING/GPIO
102	COMB_TXD	TXD1	COM1 transmit/GPIO
103	COMB_RXD	RXD1	COM1 receive/GPIO
104	COMB_CTS	FGPIO5	COM1 CTS/GPIO
105	COMB_RTS	FGPIO0	COM1 RTS/GPIO
106	COMC_TXD	TXD2	COM2 transmit/GPIO
107	COMC_RXD	RXD2	COM2 receive/GPIO
108	COMC_CTS	GGPIO2	COM2 CTS/GPIO
109	COMC_RTS	FGPIO7	COM2 RTS/GPIO

SODIMM Pin#	SoM Pin Name	Processor Pin Name(s)	SoM Description
110	COMD_TXD	ROW4	COM3 transmit/GPIO
111	COMD_RXD	ROW5	COM3 receive/GPIO
112	COMD_CTS	EGPIO1	COM3 CTS/GPIO
113	COMD_RTS	EGPIO3/485EN	COM3 RTS/GPIO

3.3.13. I2S Audio

The EP9307 provides an I2S audio port which is accommodated within the SoM specification. Note that there is no CODEC on the SoM and therefore must be provided on the Carrier. In addition the CODEC will require either SPI or I2C for control.

SODIMM Pin#	SoM Pin Name	Processor Pin Name(s)	Description
86	AudioA_SCLK	ABITCLK	I2S Serial Clock
87	AudioA_LRCLK/Frame	ASYNC	I2S Left / Right Clock
88	AudioA_MCLK	ARST	I2S Master Clock
89	AudioA_DIN	ASDI	I2S Data Input
90	AudioA_DOUT	ASDO	I2S Data Output

3.3.14. GPIO

This section provides for the SoM general purpose IO section. All of these pins can be configured to be general-purpose digital ports. They can also be configured to take advantage of several alternate functions of the EP9307 processor. Five of these lines have been delineated for other optional functionality. For compatibility with other SoMs it is a good idea to not utilize these lines as GPIO unless required.

SODIMM Pin#	SoM Pin Name	Processor Pin Name(s)	Description
114	GPIO0	ROW0/GPIOC0	GPIO/LCD Backlight On/Off
115	GPIO1	ROW1/GPIOC1	GPIO
116	GPIO2	ROW2/GPIOC2	GPIO
117	GPIO3	ROW3/GPIOC3	GPIO
118	GPIO4	COL0/GPIODO	GPIO
119	GPIO5	COL1/GPIOD1	GPIO
120	GPIO6	COL2/GPIOD2	GPIO
121	GPIO7	COL3/GPIOD3	GPIO
122	GPIO8	ROW6/CPIO6	GPIO/SD_LED
123	GPIO9	COL7/DPIO7	GPIO/SD_Power
124	GPIO10	ROW7/CPIO7	GPIO/SD_Protect
125	GPIO11	EGPIO6	GPIO/USB_Power_Enable
126	GPIO12	EGPIO10/DREQ1	GPIO
127	GPIO13	EGPIO11/DACK1	GPIO
128	GPIO14	PWMOUT/EGPIO14	Pulse Width Mod / GPIO
134	GPIO15	HGPIO7	GPIO

3.3.15. Touchscreen / Analog-to-Digital Convertor (ADC)

The SoM-200 specification allocates SoM pins that can be utilized as Touchscreen or ADC inputs. Also if a touchscreen is not used, the lines that would normally be used in this capacity can also be used as ADC inputs. The EP9307 features an 8 channel, 12-bit ADC. The first four lines are used for a typical resistive 4-wire touchscreen. If an 8-wire touchscreen is utilized then all eight lines are used.

SODIMM Pin#	SoM Pin Name	Processor Pin Name(s)	Description
45	X+/Xr/ADC0	XP/ADC0	X+ or ADC0
46	X-/Xl/ADC1	XM/ADC1	X- or ADC1
47	Y+/Yu/ADC2	YP/ADC2	Y+ or ADC2
48	Y-/Yd/ADC3	YM/ADC3	Y- or ADC3
49	SX+/ADC4	SXP/ADC4	SX+ or ADC4
50	SX-/ADC5	SXM/ADC5	SX- or ADC5
51	SY+/ADC6	SYP/ADC6	SY+ or ADC6
52	SY-/ADC7	SYM/ADC7	SY- or ADC7

3.3.16. LCD

The SoM-200 specification has provision for up to 24-bit LCDs (8-bits per RGB color). The EP9307 processor only supports 18-bit color so the two low order data lines of each color are connected to the lease significant bit of that color. These lines can also be used to provide analog VGA connectivity for use with a conventional monitor. A Brightness PWM is also provided to allow for software control of the LCD's Brightness. SoM pin# 114 can be used to turn the LCD backlight On and Off if desired.

SODIMM Pin#	SoM Pin Name	Processor Pin Name(s)	SoM Description
57	LCD_BLUE0	P0	LCD BLUE0
58	LCD_BLUE1	P0	LCD BLUE1
59	LCD_BLUE2	P0	LCD BLUE2
60	LCD_BLUE3	P1	LCD BLUE3
61	LCD_BLUE4	P2	LCD BLUE4
62	LCD_BLUE5	P3	LCD BLUE5
63	LCD_BLUE6	P4	LCD BLUE6
64	LCD_BLUE7	P5	LCD BLUE7
65	LCD_GREEN0	P6	LCD GREEN0
66	LCD_GREEN1	P6	LCD GREEN1
67	LCD_GREEN2	P6	LCD GREEN2
68	LCD_GREEN3	P7	LCD GREEN3
69	LCD_GREEN4	P8	LCD GREEN4
70	LCD_GREEN5	P9	LCD GREEN5
71	LCD_GREEN6	P10	LCD GREEN6
72	LCD_GREEN7	P11	LCD GREEN7
73	LCD_RED0	P12	LCD RED0
74	LCD_RED1	P12	LCD RED1
75	LCD_RED2	P12	LCD RED2
76	LCD_RED3	P13	LCD RED3
77	LCD_RED4	P14	LCD RED4
78	LCD_RED5	P15	LCD RED5
79	LCD_RED6	P16	LCD RED6
80	LCD_RED7	P17	LCD RED7
81	LCD_HORZ/LP	HSYNC	Horizontal Sync
82	LCD_VERT/FP/FLM	VSYNC	Vertical Sync
83	LCD_ENABLE/DE/M	BLANK	Enable
84	LCD_CLK/SFK/SHFCLK	SPCLK	LCD Clock
85	BCKLIGHT	BRIGHT/GPIOM7	Backlight Brightness Control

3.3.17. Boot Options

The SoM specification provides two pins for boot-time configuration. On the SoM-9307M, these are BOOT[0] and BOOT[1]. The BOOT[0] pin, if pulled high, allows the SoM-9307M to boot from its serial port and if pulled low, it can boot from the NOR flash. The BOOT[1] pin is reserved and should always be jumpered to GND, however to allow for compatibility with future products, it is recommended that custom carriers designed initially for the SoM-9307M make this pin jumper configurable to pull to GND or 3.3V.

SODIMM Pin#	SoM Pin Name	Processor Pin Name(s)	Description
157	BOOT_OPTION0	Boot[0]	Serial Boot Mode Select
158	BOOT_OPTION1	Boot[1]	Reserved (Always jumper to GND)

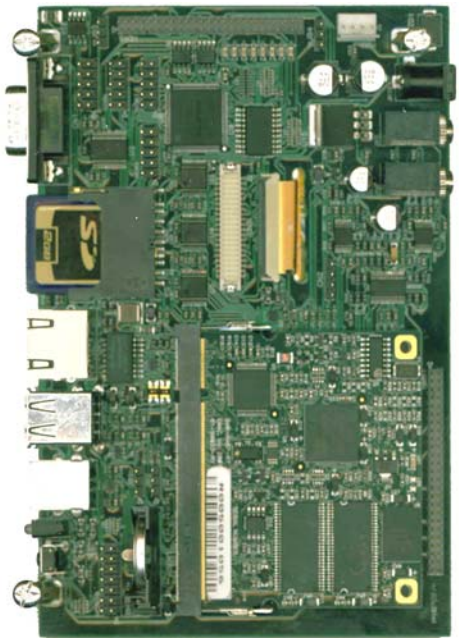
3.3.18. Power Connections

The SoM-9307M requires a 3.3V supply for the Bus and I/O voltages. The 1.8V core voltage is regulated on module from the 3.3V. Unlike some other modules no other supply voltage other than 3.3V is required.

SODIMM Pin#	SoM Pin Name	Processor Pin Name(s)	Description
3,4,43,44,135, 136,197,198	3.3VCC	3.3VCC	3.3 Volt SoM Supply Voltage
1,2,20,21,41, 42,91,92,137, 138,155,156, 199,200	GND	GND	Digital Ground
53,54	Analog GND	ADC_GND	Analog Ground
56	VSTBY	Vstandby_3.3	Voltage standby, this is the backup voltage provided to the SoM's RTC. If RTC readings are not important for the application, this can be attached to the 3.3V rail.
55	AV_REF	ADC_VDD	Analog power/reference. This voltage provides power to the internal analog circuitry of the 9307 processor. It can be typically connected to 3.3V. LC filtering for this power signal is provided on-module.

5. Design Considerations

One of the goals of the SoM-9307M is to provide a modular, flexible and inexpensive solution capable of delivering high-end microcontroller performance.



5.1. The EMAC SoM Carrier-SoM-200ES

EMAC provides an off the shelf carrier for the SoM-9307M module, the SoM-200ES, which provides power to the SoM module as well as wealth of peripheral I/O including audio and LCD. This board comes with full schematics and BOM, and can be used as is, or as a reference for a customer's own design.

http://www.emacinc.com/som/som200ES.htm

NOTE: When making your carrier be sure to use a DDR1 socket instead of the more common DDR2 socket. The DDR2 socket is keyed in such a way as to prevent the SoM from being inserted into it. The part number for a compatible DDR1 socket made by Tyco is 1473005-1.

EMAC also offers a semi-custom engineering service. By modifying an existing design, EMAC can offer quick-turn, low-cost engineering, for your specific application.

5.2. Power

The SoM-9307M is requires voltage of 3.3V at 300mA for a normal operation, users can get away with using only 3.3V, and simply provide this to all the voltage inputs listed in 3.6. This however, will not provide battery backup for the RTC. Additionally, 5V is required if USB Host capability is required.

5.2.1. Analog Reference

A clean 3.3 Volt source should be provide to this pin if it the A/Ds are required to be accurate. The SoM-9307M filters this input before submitting it to the processor. Typically using the 3.3 Volt supply is adequate for Touchscreen use.

5.2.2. Analog Voltage

When designing power for the Analog subsystem there are 4 major considerations, range and accuracy output drive, and rise time.

- **Range**
  The AV_REF pins provide the range. This pin provides power to the analog subsystem, and can take any voltage from 0 to 3.9 Volts. The power supplied to the analog subsystem limits the range of voltages that can be accurately measured. The internal analog converters cannot measure a voltage higher than their power rail. The Analog input range is ~0 to 3.0V when powered by 3.3V. Note if the AV_ACC is powered with less than 3.3V, the full 0 to 3.0V span may not be had.

- **Accuracy**
  The accuracy of the A/D converters is determined by the quality of the voltage applied to the AV_REF pin, which provides the supply/reference voltage to the analog subsystem. The stability of the voltage between this pin and ground will affect the accuracy of the subsystem's measurements. For highly accurate A/D readings it is recommended to use a 3.3V reference on the carrier board.

5.2.3. Battery Backup

The SoM-9307M contains 3 potentially non-volatile memory areas, the NOR flash, the real time clock, and the serial flash. The flash is always non-volatile, the real time clock requires a backup voltage to maintain its data. This backup voltage comes from the VSTBY pin, and should be connected to 3.3 volts.

The RTC used is the Philips PCA8565, which draws under 1.4uA while its interface is inactive and CLKOUT is disabled. If the RTC is not needed, this can just be tied to 3.3V.

The SoM-200ES provides battery backup voltage through a replaceable BR2032, which is a standard 3V 190mA/H 20MM coin battery that can be picked up from most electronics stores.

6. Software

The SoM-9307M offers a wide variety of software support from both open source and proprietary sources. The hardware core was designed to be software compatible with the Cirrus EP9307-EK reference design, which is supported by Linux and WinCE 6.0.

6.1. Eclipse

EMAC provides sample code for the SoM-9307M as CDT projects within the free Eclipse IDE. Eclipse is a powerful open-source Java based IDE. It has plug-ins for development and debugging in Java and C, as well as several other languages.

http://www.eclipse.org/

EMAC offers a free download of Eclipse pre-integrated with the CDT plug-in and plug-ins for remote debugging and SVN. Eclipse requires the Java Runtime Environment to be installed on the development system. Currently EMAC only supports the use of Eclipse under the Linux environment for the SoM-9307M. The Eclipse environment and JRE for Linux are available online along with user manuals.

ftp://ftp.emacinc.com/PCSBC/Development_Kits/EMAC_Open_Tools/

6.1.1. Eclipse CDT plug-in

The Eclipse CDT plug-in provides a powerful graphical IDE for C development. This plug-in relies on GNU Make to build its files, so its projects are highly portable to other IDE's (or lack of them completely). It also offers a MI based debugger, for plugging into newer gdbs.

http://www.eclipse.org/cdt/

6.2. RedBoot Bootloader

The SoM-9307M is distributed with RedBoot installed. RedBoot is an open source/cross-architecture platform independent bootloader. It supports reading and writing to the flash, auto-booting, environmental variables, and tftp. RedBoot can be used to upload and run and/or reflash the OS on the SoM-9307M without the use of a JTAG cable, or to run stand-alone programs without an OS. SoM-9307M modules are shipped with a valid MAC address installed in the serial EEPROM on the module. At boot time RedBoot automatically loads the MAC address from the EEPROM and stores this address in a register within the MAC, which effectively provides it to any OS loaded after that point.

6.3. Embedded Linux

EMAC Open Embedded Linux is an open source Linux distribution for use in embedded systems. The current SoM-9307M build uses a Linux 2.6 kernel that has been has been patched to support the SoM-9307M and SoM-200ES devices.

The distribution contains everything a user could expect from a standard Linux kernel, powerful networking features, advanced file system support, security, debugging utilities, and countless other features.

The SoM-9307M will work out of the box with EMAC's Embedded Linux distribution, and EMAC provides the most up to date distribution via FTP. The SoM-9307M comes preinstalled with a 2.6.20 or later Linux kernel.

6.3.1. Linux Modules

EMAC provides support for many Linux modules such as: Lighttpd Web Server, PHP, SQLite, Perl, SNMP, DHCP Server, etc. Also, other modules can be added to the standard Linux filesystem and are available for an inexpensive one-time support/installation fee.

6.3.2. Linux 2.6 patches

In addition to standard Embedded Linux support, EMAC has released a number of patches and device drivers from the open source community and from internal EMAC engineering into its standard distribution. Currently, the kernel patches and some useful scripts may be downloaded from EMAC's SoM ftp site at:

ftp://ftp.emacinc.com/Controllers/SoM/SoM-9307M/Software/Linux-Kernel/

Along with kernel patches, EMAC provides the binaries for the kernel and root file system.

6.4. Open Embedded

The Linux build for the SoM-9307M is based on the Open Embedded (www.openembedded.org) Linux build system. The current kernel is Linux 2.6.20 or higher patched to support the SoM-9307M. Open Embedded is a superior Linux distribution for embedded systems. Custom Linux builds are also available on request.

The basic root filesystem includes:

- Busybox 1.11.1 or higher
- Hotplugging support
- Dropbear SSH server
- Telnet/FTP support running under inetd
- busybox-httpd HTTP server
- JFFS2 filesystem with utilities

6.5. ARM EABI Cross Compiler

The popular open source gcc compiler has a stable build for the ARM family. The Embedded Linux kernel and EMAC Eclipse CDT projects use this compiler for building ARM stand alone, and OS specific binaries. The EMAC Eclipse SDK provides source level debugging over either the JTAG port or over Ethernet or serial using gdbserver. The Linux binaries for the ARM EABI cross compiler are available online along with the SDK for the SoM-9307M at the following location.

ftp://ftp.emacinc.com/Controllers/SoM/SoM-9307M/Tools/

6.6. Windows CE 6.0

In addition to the open source community, a WinCE 6.0 BSP for the SoM-9307M is under development and will be available soon.

Note: All of the links in this document are subject to change. Please contact EMAC for updated link locations if necessary.

