SoM-1062M

User Manual

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1 Introduction

This document describes EMAC's SoM-1062M System on Module (SoM). The SoM-1062M is a System on Module, designed to be compatible with EMAC's 200-pin SODIMM form factor. This module is built around the NXP MIMXRT1062 microcontroller which provides several of its key features. Designed and manufactured in the USA, this industrial temperature 600 MHz SoM utilizes 16MB of Serial Data Flash, 32 MB of onboard NAND Flash and has 17MB of SDRAM. Additional Flash storage can be had using the modules SDIO interface allowing the use of external SD flash cards. In addition to the standard SoM features, the SoM-1062M also features a fast 32-bit core, open source software support, and a wide range of controller I/O pins.

1.1 Features

- **NXP RT1062 ARM Coretx-M7 Crossover MCU Microcontroller**
- **Small, 200 pin SODIMM form factor (2.66" x 2.375")**
- **Up to 17 MB SDRAM (1 MB on CPU, 16 MB external)**
- **16MB of Serial Data Flash (32MB optional)**
- **1x 10/100 BASE-T Ethernet with On-board PHY**
- **1x RMII Interface for additional 10/100 BaseT Ethernet PHY**
- **1x WiFi 802.11b/g/n, Bluetooth v5.1 (Optional)**
- **2x USB 2.0 Host Port (1x on Bare-Bones) & 1x USB 2.0 OTG Port**
- **4x Serial Ports**
- **2x SPI Ports**
- **16x GPIOs**
- **1x SD/MMC Flash Card Interface**
- **1x I2S Audio Port**
- **1x CAN Port**
- **2x Programmable Timer Output Ports**
- **2x I2C Ports (1x I2C internal to SoM, 1x external to card edge)**
- **4x A/D Channels (12-Bit)**
- **4x Wire Resistive Touch**
- **Typical Running Current Consumption 175mA**
- **JTAG for debug**

2 Hardware

2.1 Specifications

- **CPU:** NXP RT1062 ARM Coretx-M7 Crossover MCU Microcontroller
- **Flash:** 16MB of Serial Data Flash (32MB optional)
- **RAM:** Up to 17 MB SDRAM (1 MB on CPU, 16 MB external)
- **Flash Disk:** 1x SD/MMC Flash Card Interface
- **System Reset:** External Reset Button
- **RTC:** Internal real time clock with external battery backup
- **Timer/Counters:** 2x Programmable Timer Output Ports
- **Watchdog Timer:** External Watchdog Timer (ADM8320)
- **Digital I/O:** 16x GPIO
- **Analog I/O:** 4x A/D Channels (12-Bit)
- **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:** Programmable clock output

Serial Interfaces

- **UARTS:** 4x Serial Ports
- **SPI:** 2x SPI Port
- **Audio:** I2S Synchronous Serial Controller with analog interface support
- **USB:** 2x USB 2.0 Host Port (1x on Bare-Bones) & 1x USB 2.0 OTG Port
- **I2C:** 2x I2C Ports (1x I2C internal to SoM, 1x external to card edge)

Ethernet Interfaces

- **MAC:**
  - 1x 10/100 BaseT Ethernet MAC with Real Time PHY
  - 1x RMII 10/100 BASE-T Ethernet output for second LAN
- **PHY:** Microchip Technology KSZ8081 10/100 Ethernet PHY
- **Interface:** 10/100 BaseT Ethernet

Bus Interface:

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

Mechanical and Environmental

- **Dimensions:** Small, 200 pin SODIMM form factor (2.66" x 2.375")
- **Power Supply Voltage:** 3.3 Volts DC +/- 5%
- **Power Requirements (typical):**
  - 3.3 Volts @ mA (XXX watts)
  - Max current draw during boot process: TBD
  - Constant busy loop: TBD
  - Idle system: TBD
  - Idle system with Ethernet PHY disabled: TBD
  - APM sleep mode with Ethernet PHY disabled: TBD
  - APM sleep mode with Ethernet PHY enabled: TBD
- **Operating Temperature:** 0 to 85°C / -30 to 70°C / -40 to 85°C
- **Operating Humidity:** 0% ~ 90% relative humidity, non-condensing

2.2 Real-Time Clock

The SoM-1062M uses an external to the processor, Maxim DS1337U Real-time Clock. Battery backup is provided from the carrier board by providing 3.0V to the VSTBY pin. The SoM-1062M will retain the RTC during reset. The RTC has the provision to set alarms that can interrupt the processor. For example, the processor can be placed in sleep mode and then later awakened using the alarm function.

2.3 Watchdog Timer

The SoM-1062M provides an external Watchdog Timer/ Supervisor (ADM8320) with an extended watchdog timeout period of 1.6 seconds. Upon power-up the Watchdog is disabled and does not require pulsing. To start the Watchdog, it must first be enabled. This is done by configuring port line GPIO_AD_B1_10 as an output and setting it low in software. Once enabled, the Watchdog should be pulsed, using port line GPIO_AD_B1_10, continually every 1.40 seconds or faster to prevent the Watchdog from timing out and resetting the module. If you are using the watchdog to force a system reset, you may need up to 2.24 seconds of inactivity before the Watchdog reset will occur. The watchdog is automatically disabled upon reset but it can also be disabled by setting GPIO_AD_B1_10 high.

2.4 External Connections

The SoM-1062M connects to a carrier board containing its connectors, power supply and any expansion IO, through a standard ENIG-plated (Electroless Nickel Immersion Gold) SODIMM 200-pin edge card 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 SoM pinouts line up with the SoM-1062M'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-1062M processor.

2.4.1 External Bus

The SoM-1062M provides a flexible external bus for connecting peripherals. The CPLD of the SoM-200GS carrier connects through a subset of these connections. The WKUP pin has a Maximum input voltage of 3.3V and Shutdown has a maximum output voltage of 3.3V. The Flash WP for the Serial Flash is active-low and pulled up on-module.

Table 1: External Bus

SODIMM Pin#	SoM Pin Name	Processor Pin Name(s)	Port Line	Description
145	GP_CSA	SEMC_CSX_0	GPIO_EMC_41	General Purpose Chip Select
146	GP_CSB	SEMC_CSX3	N/A*	General Purpose Chip Select
147	GP_CSC	No Connect	N/A	N/A
148	GP_CSD/Shutdown	ON_OFF	N/A	Processor On/Shutdown Output
149	WR	SEMC_WE#	GPIO_EMC_28	Write Signal
150	RD	SEMC_RE#	N/A	Read Signal
151	RST_IN	RST_IN#	N/A	Processor Reset Input
152	RST_OUT	POR	N/A	Processor Reset Output
153	WAIT	No Connect	N/A	N/A
154	~FLASH WP	No Connect	N/A	N/A
54	WKUP	WAKEUP	N/A	Processor Wakeup Input
157	BOOT_OPTION0	BOOT_0	GPIO_AD_B0_04	Boot0 Option Select
158	BOOT_OPTION1	BOOT_1	GPIO_AD_B0_05	Boot1 Option Select
175-190	A0 - A15	D0 - D15	GPIO_EMC_DATA	Address Bus
191-196	A16 - A21	No Connect	N/A	N/A
159-174	D0 - D15	D0 - D15	GPIO_EMC_DATA	Data Bus

***** In order for SEMC_CSX3 to be available as a chip select, a 0 ohm resistor needs to be populated at R1. Note this pin is muxed with LCDIF_HSYNC which will not be available when used as a chip select.

2.4.2 JTAG

The SoM-1062M provides access to the MIMXRT1062's JTAG interface for programming and debugging. The pins listed in the table below (e.g., JTAG_TCK for clock, JTAG_TDI for data input, and JTAG_TDO for data output) facilitate these operations, ensuring effective communication with the processor.

Table 2: Processor JTAG

SODIMM Pin#	SoM Pin Name	Processor Pin Name(s)	Description
139	JTAG_TCK	GPIO_AD_B0_07	JTAG Clock
140	JTAG_TDI	GPIO_AD_B0_09	JTAG Serial In
141	JTAG_TDO	GPIO_AD_B0_10	JTAG Serial Out
142	JTAG_TMS	GPIO_AD_B0_06	JTAG Operation Mode
143	JTAG_TRST	GPIO_AD_B0_11	Test Reset Signal
144	JTAG_RTCK	No Connect	Dynamic Clock Sync

2.4.3 I2C

The SoM-1062M provides two low power I2C ports.

Table 3: External I2C Port

SODIMM Pin#	SoM Pin Name	Processor Pin Name(s)	Port Line	Description
29	CLK	LPI2C1_SCL	GPIO_SD_B1_04	Clock Pin
30	DATA	LPI2C1_SDA	GPIO_SD_B1_05	Data Pin

The second I2C interface is shared with the Touchscreen, ADC, RTC, and GPIO. The I2C addresses already used by SOM devices are as follows:

LPI2C3 Addresses: Touch Controller 0x48, ADC 0x21, RTC 0x68, GPIO Expander 0x20.

Table 3.1: Internal I2C Port

SODIMM Pin#	SoM Pin Name	Processor Pin Name(s)	Port Line	Description
N/C	CLK	LPI2C3_CLK	GPIO_AD_B1_07	Clock Pin
N/C	DATA	LPI2C3_DATA	GPIO_AD_B1_06	Data Pin

2.4.4 Ethernet

The SoM-1062M provides a Microchip Technology KSZ8081 10/100 Ethernet 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.

Table 4: Ethernet

SODIMM Pin#	SoM Pin Name	{PHY} Pin Name	Description
12	GIG D-	No Connect	GIG Ethernet D- pin
14	GIG D+	No Connect	GIG Ethernet D+ pin
13	GIG C-	No Connect	GIG Ethernet C- pin
15	GIG C+	No Connect	GIG Ethernet C+ pin
16	Ethernet_Rx-/GIG B-	RXM	Low differential Ethernet receive
18	Ethernet_Rx+/GIG B+	RXP	High differential Ethernet receive
17	Ethernet_Tx-/GIG A-	TXM	Low differential Ethernet transmit
19	Ethernet_Tx+/GIG A+	TXP	High differential Ethernet transmit
38	LED_LINK/CFG_2	LED0/NWAYEN	Ethernet Link LED/Configuration
39	LED_ACT/CFG_3	LED1/SPEED	Ethernet Activity LED/Configuration

2.4.5 Wi-Fi/Bluetooth [Optional]

The SoM-1062M provides one Wi-Fi/Bluetooth antenna jack (JK1) which utilizes the on-board Wi-Fi/Bluetooth Murata module (LBEE5KL1DX). This module interfaces to the processor using SDHC1 SDIO interface for Wi-Fi and LPUART5 for Bluetooth. The antenna jack, (U.FL-R-SMT(10)) offers high frequency performance from DC to 6GHz, with a V.S.W.R of 1.3 to 1.5 max. EMAC provides an antenna kit: 2.4GHz Duck Antenna RP-SMA and U.FL.(IPEX) to RP-SMA male pigtail cable that plugs into the SoM's antenna jack. Alternatively, EMAC can provide a 2.4GHz IPEX MHF flat adhesive patch antenna.

WLAN/Bluetooth Features:

- 2.4GHz functionality
- 802.11 b/g/n data rates
- IC/Firmware: Infineon/CYW4343W
- Bluetooth 5.1 +EDR

2.4.6 USB

The SoM-1062M has the provision for 2 USB 2.0 Host ports and 1 USB OTG (On-The-Go) port.

Table 5: USB

SODIMM Pin#	SoM Pin Name	Processor Pin Name(s)	Description
5	Host_A+ (To USB Hub)	USBDN_DP2 (From Hub)	Host USB 2.0 Port A+
7	Host_A- (To USB Hub)	USBDN_DM2 (From Hub)	Host USB 2.0 Port A-
6	Host_B+ (To USB Hub)	USBDN_DP3 (From Hub)	Host USB 2.0 Port B+
8	Host_B- (To USB Hub)	USBDN_DM3 (From Hub)	Host USB 2.0 Port B-
9	HostC/Device/OTC_C-	USB_OTG1_DN	OTG USB 2.0 PortC -
11	HostC/Device/OTG_C+	USB_OTG1_DP	OTG USB 2.0 Port C+
10	USB_OTG_VBUS	USB_OTG1_VBUS	OTG VBUS
40	USB_OTG_ID	GPIO_AD_B0_11	OTG ID

2.4.7 SPI

The SoM-1062M provides 2 SPI Ports. The second SPI port is utilized by the external serial flash. The SPI_MI and SPI_MO lines are for data input and output, SPI_SCK for clock signals, and multiple chip select lines (e.g., SPI_CS0, SPI_CS1…) to enable communication with various peripherals.

Table 6: Serial Peripheral Interface Channel 0

SODIMM Pin#	SoM Pin Name	Processor Pin Name(s)	Description
22	SPI_MI	GPIO_AD_B0_02	LPSPI3 serial data in
23	SPI_MO	GPIO_AD_B0_01	LPSPI3 serial data out
24	SPI_SCK	GPIO_AD_B0_00	LPSPI3 serial clock out
25	SPI_CS0	GPIO_AD_B0_03	LPSPI3 chip select line 0
26	SPI_CS1	GPIO_AD_B0_04	LPSPI3 chip select line 1
27	SPI_CS2	GPIO_AD_B0_05	LPSPI3 chip select line 2
28	SPI_CS3/SPI_Frame	GPIO_AD_B0_06	*LPSPI3 chip select line 3

***** This SOM pin defaults to JTAG_TMS. To use as CS3, R7 should be populated with a 0 ohm resistor.

2.4.8 SDIO Multimedia Card

The SoM-1062M provides one MMC/SD card interface through an external Microchip Technology USB Hub (USB2660i). This interface facilitates communication with external memory devices such as MMC or SD cards. Key pins include SCLK for the clock signal, CMD for sending commands, and DAT0 through DAT3 for transferring data. The SDIO port can also be used to interface to WiFi modules should wireless communication be needed.

Table 7: MMC/SD Card Interface

SODIMM Pin#	SoM Pin Name	USB2660i Pin Name(s)	Description
31	SCLK	SD2_CLK/GPIO26	SDIO Clock
32	CMD	SD2_CMD_GPIO27	SDIO Command
33	DAT0	SD2_D0/GPIO18	SDIO D0
34	DAT1	SD2_D1/GPIO19	SDIO D1
35	DAT2	SD2_D2/GPIO20	SDIO D2
36	DAT3	SD2_D3/GPIO21	SDIO D3
37	Card_Detect	SD2_nCD/GPIO16	Card Detect

2.4.9 UART

UART (Universal Asynchronous Receiver-Transmitter) enables asynchronous serial communication between devices. The SoM-1062M utilizes four communications ports, COMA (includes Handshaking), COMB, COMC, and COMD. These communication ports facilitate connections with peripherals, sensors, and other devices providing flexibility for developers to implement serial communication in their applications. These signals are all logic level at the card edge. Any physical layer signal levels need to be generated by the carrier board.

Table 8: Serial Ports

SODIMM Pin#	SoM Pin Name	Processor Pin Name(s)	Description
95	COMA_TXD	GPIO_AD_B1_02	LPUART2 Transmit
96	COMA_RXD	GPIO_AD_B1_03	LPUART2 Receive
97	COMA_CTS	GPIO_AD_B1_00	LPUART2 CTS
98	COMA_RTS	GPIO_AD_B1_01	LPUART2 RTS
99	COMA_DTR	No Connect	LPUART2 DTR
100	COMA_DSR	No Connect	LPUART2 DSR
101	COMA_RI	No Connect	LPUART2 RI
102	COMB_TXD	GPIO_AD_B0_12	LPUART1 Transmit
103	COMB_RXD	GPIO_AD_B0_13	LPUART1 Receive
104	COMB_CTS	No Connect	LPUART1 CTS
105	COMB_RTS	No Connect	LPUART1 RTS
106	COMC_TXD	GPIO_SD_B1_00	LPUART4 Transmit
107	COMC_RXD	GPIO_SD_B1_01	LPUART4 Receive
108	COMC_CTS	No Connect	LPUART4 CTS
109	COMC_RTS	No Connect	LPUART4 RTS
110	COMD_TXD	GPIO_B1_12	LPUART5 Transmit
111	COMD_RXD	GPIO_B1_13	LPUART5 Receive
112	COMD_CTS	No Connect	LPUART5 CTS
113	COMD_RTS	No Connect	LPUART5 RTS

2.4.10 I2S

The SoM-1062M provides one I2S audio port. 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.

Table 9: I2S

SODIMM Pin#	SoM Pin Name	Processor Pin Name(s)	Description
86	AudioA_SCLK	GPIO_AD_B1_14	I2S Serial Clock
87	AudioA_LRCLK/Frame	GPIO_AD_B1_15	I2S Left / Right Clock
88	AudioA_MCLK	GPIO_AD_B1_09	I2S Master Clock
89	AudioA_DIN	GPIO_AD_B1_12	I2S Data Input
90	AudioA_DOUT	GPIO_AD_B1_13	I2S Data Output

2.4.11 CAN

The SoM-1062M has one CAN (Control Area Network) port. This port is available at the card edge as listed in the table below.

Table 10: CAN

SODIMM Pin#	SoM Pin Name	Processor Pin Name(s)	Description
93	CANTX	GPIO_SD_B1_02	CAN Transmit
94	CANRX	GPIO_SD_B1_03	CAN Receive

2.4.12 IRQs

The SoM-1062M provides 3 dedicated Interrupt requests (IRQs) lines. However, any GPIOs coming directly from the RT1062 processor may be programmed for interrupts.

Table 11: Interrupt Lines

SODIMM Pin#	SoM Pin Name	Processor Pin Name(s)	Description
129	IRQA	*GPIO_AD_B1_05	Interrupt A
130	IRQB	PMIC_STBY_REQ	Interrupt B
131	IRQC	PMIC_ON_REQ	Interrupt C

* This IRQ is shared with the Wi-Fi. If the Wi-Fi option is installed then IRQA is not available.

2.4.13 Oscillators

The SoM-1062M features one clock input/output that provides precise clock signal for various peripheral devices and system operations. Note the CCM_CLK1 pins are differential clock input to the processor and not a typical clock output. See the RT1062 user manual for further information.

Table 12: Oscillators

SODIMM Pin#	SoM Pin Name	Processor Pin Name(s)	Description
132	OSC0	CCM_CLK1_P	Clock
133	OSC1	CCM_CLK1_N	Clock

2.4.14 ADC

The SoM-1062M has an onboard four channel 12-bit analog to digital converter. The SoM uses an Analog Devices AD7994 A/D converter.

Table 13: Analog to Digital Converters

SODIMM Pin#	SoM Pin Name	AD7994 Pin Name(s)	Description
49	SX+/ADC4	IN1	ADC0
50	SX-/ADC5	IN2	ADC1
51	SY+/ADC6	IN3	ADC2
52	SY-/ADC7	IN4	ADC3

2.4.15 GPIO

The GPIO section outlines the SoM's General-Purpose Input/Output capabilities, where pins can be configured as digital input/output ports or utilized for specific internal SoM-1062M functions. The I2C GPIO expander (Microchip MCP23017T) extends flexibility for additional peripherals or custom applications with I2C control. These configurable pins offer versatility for controlling and monitoring various hardware components.

Table 14: General Purpose IO

SODIMM Pin#	SoM Pin Name	GPIO Expander Pin Name(s)	Description
114	GPIO0	GPA0	General Purpose 0 Input/Output
115	GPIO1	GPA1	General Purpose 1 Input/Output
116	GPIO2	GPA2	General Purpose 2 Input/Output
117	GPIO3	GPA3	General Purpose 3 Input/Output
118	GPIO4	GPA4	General Purpose 4 Input/Output
119	GPIO5	GPA5	General Purpose 5 Input/Output
120	GPIO6	GPA6	General Purpose 6 Input/Output
121	GPIO7	GPA7	General Purpose 7 Input/Output
122	GPIO8	GPB0	General Purpose 8 Input/Output
123	GPIO9	GPB1	General Purpose 9 Input/Output
124	GPIO10	GPB2	General Purpose 10 Input/Output
125	GPIO11	GPB3	General Purpose 11 Input/Output
126	GPIO12	GPB4	General Purpose 12 Input/Output
127	GPIO13	GPB5	General Purpose 13 Input/Output
128	GPIO14	GPB6	General Purpose 14 Input/Output
134	GPIO15	GPB7	General Purpose 15 Input/Output

2.4.16 LCD & Touchscreen

The resistive touch screen LCD utilizes a four-wire I2C touchscreen controller (TI TSC2004IRTJR) allowing for accurate touch detection. This interface works by measuring voltage changes across the layers of the touchscreen providing reliable input in various environmental conditions. The touch lines are listed below.

Table 15: Touch Screen Controller

SODIMM Pin#	SoM Pin Name	Controller Pin Name(s)	Description
45	X+/ADC0	X+	X+ Channel Input
46	X-/ADC1	X-	X- Channel Input
47	Y+/ADC2	Y+	Y+ Channel Input
48	Y-/ADC3	Y-	Y- Channel Input

The display is driven by a 16-bit LCD controller that facilitates high-resolution color depth and precise pixel control and provides a PWM for Display brightness control. Since only 16 LCD data lines are available the low order bits of each color are tied together.

Table 15.1: LCD

SODIMM Pin#	SoM Pin Name	Processor Pin Name(s)	Description
57	LCD_BLUE0	GPIO_B0_04	LCD Blue
58	LCD_BLUE1	GPIO_B0_04	LCD Blue
59	LCD_BLUE2	GPIO_B0_04	LCD Blue
60	LCD_BLUE3	GPIO_B0_04	LCD Blue
61	LCD_BLUE4	GPIO_B0_05	LCD Blue
62	LCD_BLUE5	GPIO_B0_06	LCD Blue
63	LCD_BLUE6	GPIO_B0_07	LCD Blue
64	LCD_BLUE7	GPIO_B0_08	LCD Blue
65	LCD_GREEN0	GPIO_B0_09	LCD Green
66	LCD_GREEN1	GPIO_B0_09	LCD Green
67	LCD_GREEN2	GPIO_B0_09	LCD Green
68	LCD_GREEN3	GPIO_B0_10	LCD Green
69	LCD_GREEN4	GPIO_B0_11	LCD Green
70	LCD_GREEN5	GPIO_B0_12	LCD Green
71	LCD_GREEN6	GPIO_B0_13	LCD Green
72	LCD_GREEN7	GPIO_B0_14	LCD Green
73	LCD_RED0	GPIO_B0_15	LCD Red
74	LCD_RED1	GPIO_B0_15	LCD Red
75	LCD_RED2	GPIO_B0_15	LCD Red
76	LCD_RED3	GPIO_B0_15	LCD Red
77	LCD_RED4	GPIO_B1_00	LCD Red
78	LCD_RED5	GPIO_B1_01	LCD Red
79	LCD_RED6	GPIO_B1_02	LCD Red
80	LCD_RED7	GPIO_B1_03	LCD Red
81	LCD_HORZ/LP	GPIO_B0_02	LCD Horizontal Sync
82	LCD_VERT/FP/FLM	GPIO_B0_03	LCD Vertical Sync
83	LCD_ENABLE/DE/M	GPIO_B0_01	LCD Enable
84	LCD_CLK/SFK/SHFCLK	GPIO_B0_00	LCD Clock
85	BCKLIGHT	GPIO_AD_B1_08	Backlight Brightness

2.5 Power Connections

The SoM-1062M requires a 3.3V supply for the bus and I/O voltages. The 1.26V core voltage is regulated on the module from the 3.3V. Unlike some other modules, no supply voltage other than 3.3V is required.

Table 16: Power Connections

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	Analog_GND	GND	System 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	No Connection Requires L25	Analog power/reference. It can be typically connected to 3.3V. LC filtering for this power signal is provided on-module.

2.6 Boot Options

The SoM-1062M provides two pins for boot-time configuration.

Table 17: Boot Options

SODIMM Pin#	SoM Pin Name	Processor Pin Name(s)	Description
157	BOOT_OPTION0	GPIO_AD_B0_04	Boot0 Option Select
158	BOOT_OPTION1	GPIO_AD_B0_05	Boot1 Option Select

BOOT_MODE[1:0] -> Boot Type

00 -> Boot From Fuses [Works like Internal Boot, except it ignores GPIO boot pins]
01 -> Serial Downloader [Provides means to download Program Image to on-chip RAM over USB or UART]
10 -> Internal Boot from Flash
11 -> Reserved

The boot code performs the hardware initialization, loads the program image from the chosen boot device, performs the image validation using the HAB library (see Boot security settings), and then jumps to an address derived from the program image. If an error occurs during the internal boot, the boot code jumps to the Serial Downloader (see Serial Downloader (BOOT_MODE[1:0] = 01b)). A secure boot using the HAB is possible in all the three boot modes.

3 Design Considerations

One of the goals of the SoM-1062M is to provide a modular, flexible and inexpensive solution capable of delivering high-end microcontroller performance with low power requirements.

3.1 Off-the-Shelf Carriers

Many SoM-1062M applications can make use of EMAC's off-the-shelf carriers. These carriers provide power to the SoM as well as a wealth of connectors and interfaces to access peripheral I/O including audio and LCD.

3.1.1 SoM-200GS

This is a Half-EBX mounting hole form factor (4.37" x 6.00") carrier that comes with a 4.3" LCD interface as well as full schematics and a BOM, and can be used as is, or as a reference for a customer's own design.

- 10/100/1000 BaseT Ethernet with Status LEDs
- 3x serial RS232 ports and 1 RS232/422/485 port
- Resistive Touchscreen interface
- 480 x 272 Graphic LCD with Touchscreen
- Battery for nonvolatile RAM and Real Time Clock
- Micro SD Card Socket
- 2x USB Host & 1 USB OTG ports
- 1x I2S Audio port with Line-In/Line-Out
- 5 VDC Power Requirement

http://emacinc.com/products/system_on_module/SoM-200GS

3.1.2 SoM-250GS

This is a 6.55" x 4.15" carrier designed as a basis for a 7" or 10" Panel PC.

- 10/100/1000 BaseT Ethernet with onboard Magnetics and RJ45
- 3x serial RS232 ports and 1 RS232/422/485 port
- Resistive Touchscreen interface
- 800 x 480 (WVGA) or 1024 x 600 (WSVGA) Graphic LCD with Touchscreen
- Battery for nonvolatile RAM and Real Time Clock
- Micro SDHC/MMC Flash Card Socket
- 2x USB Host & 1 USB OTG ports
- 1x I2S Audio port with Line-In/Line-Out
- 1x Audio Beeper
- Timer/Counters and Pulse Width Modulation (PWM) ports
- Operating Voltage of 12 to 28 Vdc
- Graphic LCD Interface

http://emacinc.com/products/system_on_module/SoM-250GS

3.2 Semi-Custom Carriers

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

3.3 Designing Your Own Carrier

It is best to start with the SoM-200GS as a reference. When designing a carrier be sure to use a 200 pin DDR1 SODIMM 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. This socket will provide 3.0 mm of height from the top of carrier PCB to the bottom of the module PCB. The module specification allows for a 1.5 mm maximum height for bottom components. Therefore, this allows the user < 1.5 mm for placing components safely under the module. If more height is needed, Tyco as well as other manufacturers make SODIMM sockets with additional height, although these are more expensive.

If using the SoM-1062M's external bus, it is highly recommended to buffer the bus on the carrier board in close proximity to the SoM SODIMM connector (see the SoM-200 carrier schematics for reference).

3.4 Power

The SoM-1062M requires a voltage of 3.3V. For a bare-bones population, users can get away with using only 3.3V, and simply provide this to all the voltage inputs listed in Power Connections section. This however, will not provide battery backup for the RTC.

3.4.1 Shutdown Logic Pins

The ON/OFF is a digital input tied to 3.3V, which is driven by the Shutdown Controller on the processor and is not accessible.

The WKUP pin has a Maximum input voltage of 3.3V.

Both of these pins are connected directly to the processor.

3.4.2 Battery Backup

The SoM-1062M Real-Time Clock (Maxim DS1337U) requires a backup voltage to maintain its data. This backup voltage comes from the VSTBY pin, and should be connected to 3.0 volt Li-ion battery.

The I2C RTC will draw approximately ~1.5uA when the processor is not powered by the 3.3V supply. When the module is powered no current is drawn from the backup battery supply. If the RTC is not needed, this can be tied to 3.3V.

The SoM-200GS and SoM-250GS provide battery backup voltage through a socketable BR2032, which is a standard 3V 190mA/H 20MM coin battery that can be picked up from most electronics stores.

3.4.3 Analog Reference

No external Analog Reference voltage (VREF) is required for the SoM-1062M so this pin is normally a No Connect on the Module. The ADC (AD AD7994BRUZ) VREF is tied to filtered 3.3V. To utilize an external reference utilizing the ADC_VCC SOM pin (pin 55), the inductor at L24 needs to be relocated to L25.

3.4.4 Analog Voltage

When designing power for the Analog subsystem there are 2 main considerations: range and accuracy.

- **Range**
  The AV_VCC and V_REF pins normally will have an effect on the range, however, on the SoM-1062M these pins are no-connects since the processor's Analog VCC is directly connected to filtered 3.3V. This voltage reference defines the voltage range of the A/D convertor to 0v to 3.3V.

- **Accuracy**
  The accuracy of the A/D converters is determined by the voltage reference that is provided to the analog subsystem. Since the stability of the voltage between this reference and ground will affect the accuracy of the subsystem's measurements, this has been built into the SoM in this design.

  - **Range**
    The V_REF pin provides the range. This pin provides power to the analog subsystem, and can take any voltage from 0 to 3.3 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_VCC 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 V_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.

4 Software

The SoM-1062M offers a wide variety of software support from both open source and proprietary sources. The hardware core utilizes the NXP RT1062 ARM Coretx-M7 Crossover MCU Microcontroller.

The SoM-1062M offers the ability to use different operating systems to meet different customer needs. There are available board support packages (BSPs) for the SoM-1062M from EMAC that uses MicroPython and FreeRTOS. EMAC provides a fully functional MicroPython and FreeRTOS BSPs loaded on the SoM-1062M at no additional charge. Middleware has been added to compliment the already available middleware to make these packages available for easy integration into user developed applications targeted for the SoM-1062M.

4.1 MicroPython

MicroPython is one of the packages that is offered for the SoM-1062M. It is an implementation of the Python 3 programming language optimized to run on microcontrollers in a constrained environment. The SoM-1062M can be preloaded with the MicroPython BSP at no charge. For more information on MicroPython support, please visit the following links:

https://micropython.org/

http://wiki.emacinc.com/wiki/Micropython

4.2 FreeRTOS

FreeRTOS is one of the many packages available for application development that can be included when using the SoM-1062M. The FreeRTOS package can be downloaded from https://www.freertos.org/.

FreeRTOS has their own board support package for many of the available NXP RT development platforms. When using the SoM-1062M, a wrapper is provided for most of the FreeRTOS functionality to make development even more simple.

https://www.freertos.org/FreeRTOS-Plus/BSP_Solutions/ST/index.html