SoM-250ES

SoM 200-pin Carrier Board

User Manual

REV. 1.4

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1 SoM-250 Product Summary

Features

- **200 Pin SODIMM SoM Connector**
- **Inexpensive Open-Frame Design**
- **10/100BaseT Ethernet**
- **3 RS232 & 1 RS232/422/485 Port**
- **2 USB 2.0 (High Speed) Host port**
- **1 USB 2.0 (High Speed) OTG port**
- **1 CAN 2.0B port**
- **Socketed Battery**
- **1 SD/MMC Flash Card Socket**s
- **1 I2S Audio CODEC with Line-In/Line-Out**
- **1 Audio Beeper**
- **Operating Voltage of 12 to 26 Vdc.**
- **800 x 480 (WVGA) or 1024 x 600 (WSVGA) LCD with LED Backlight**
- **Touchscreen Interface and Software Controlled Backlight On/Off & Brightness**
- **FREE Qt Creator IDE with GCC & GDB development tools**

1.1 Specifications

LCD – 7” LCD (SoM-250ES-000)

- **Display Type:** 7" TFT Color LCD
- **Resolution:** 800 x 480 WVGA @ 256K Colors
- **Dot pitch:** 0.19mm x 0.19mm
- **Luminance:** 330 (cd/m²)
- **Viewing Angle:** 55°
- **Brightness:** Software controlled
- **Backlight:** White LED (33 LEDS)
- **Light Transparency:** 80%
- **Durability:** Over one million touches

LCD – 10” LCD (SoM-250ES-001)

- **Display Type:** 10" TFT Color LCD
- **Resolution:** 1024 x 600 WSVGA @ 256K Colors
- **Dot pitch:** 0.22mm x 0.22mm
- **Luminance:** 250 (cd/m²)
- **Viewing Angle from Center:** From top, 40° min. (50° typ.), From bottom, 50° min. (60° typ.), Left and Right, 60° min. (70° typ.)
- **Brightness:** Software controlled
- **Backlight:** White LED
- **Durability:** Over one million touches

Touchscreen Controller

- **Type:** 4 Wire Analog Resistive
- **Resolution:** Continuous
- **Controller:** Built-In
- **Driver:** WinCE, Linux

Ethernet interface

- **Ethernet Type:** 10/100 Base-T Ethernet
- **Ethernet Interface:** On-Board RJ-45 connector

Solid-state Flash Disk

- **Removable:** 8+ GB of SD, MMC, or SDHC Flash Disk

Mechanical and Environmental

- **Dimensions:** 7.55" L x 4.15" W x 1.5" H
- **Weight:** 1.06 lbs..
- **Power Supply Voltage:** +12 to +26 Vdc.
- **Power Consumption:** typical ~200 ma. @ 24 Vdc.
- **Operating Temperature**: 0 ~ 60° C (32 ~ 140° F)

Standard Parts Inventory

- SoM-250 Assembly with 7.0” Touchscreen LCD
- Stainless Steel Mounting Bracket
- Three Serial Port cables
- CDROM with manuals, schematics, and drivers

2 SoM-250 Product Details

2.1 Jumper Configuration & Connector Descriptions

The SoM-250 comes factory configured. In the event that jumpers need to be verified or modified this section provides the information required, including instructions on setting jumpers and connecting peripherals, switches and indicators. Be sure to read all the safety precautions before you begin any configuration procedure. See Appendix A for connector pinouts and Appendix B for Jumper Settings.

Table 1: Jumpers (see SoM manual for correct Boot settings)

Label	Function	Default
JB1	Boot0 Source Selection	Position B
JB2	Boot1 Source Selection	Position A
JB3	Resident Flash Write Protect	Position B
JB4	RTC Battery ON/OFF	Off
JB5	Serial Port RS422/485 Tx Enable	422
JB6	Serial Port RS232 or 422/485 Mode	232

Table 2: Connectors

Label	Function
CN1	7” Touch Screen Connector
CN2	Serial Port COM A
CN3	10” Touch Screen Connector
CN4	7” LCD Backlight Connector
CN5	CAN Port
CN6	7” LCD Data Connector
J1	Vin Locking Connector
JK1	Vin Power Barrel Jack
JK2	Ethernet
JK3	USB Host Port A & B
JK4	USB OTG Port C
JK5	Audio Input Jack
JK6	Audio Output Jack
HDR1	Misc. I/O Connector
HDR2	Serial Port COM D
HDR3	Serial Port COM B
HDR4	Serial Port COM C
HDR5	Bulkhead USB Connector Port A & B
HDR6	LVDS & Touch Signal Connector
SOK1	MicroSD Card Socket
SOK2	200 pin SOM Socket
ABJ1	PCD-E12 Expansion Module Connector

2.2 Power Connectors

The SoM-250 provides two power connectors. J1 is an AMP/Tyco locking power connector (part# 640445-3), three-pin type connector that mates with TE Connectivity part# 3-640600-3 power connector. Using this power input provides for a more rugged/industrial locking connection. JK1 is a standard 5.5mm barrel jack with an inner diameter of 2.1mm with a center V+ connection. This jack allows for easy connection to a wall mount power supply (EMAC part number PER-PWR-00035). The SOM-250's power input uses a switching regulator and allows a voltage input of +12V DC to +26V DC.

The pinout for the J1 power connector is as follows:

Pin	Signal
1	+Vin (+12Vdc to 26Vdc)
2	Chassis GND
3	System GND

2.3 Ethernet

The SoM-250 provides 10/100 Base-T full duplex Ethernet and uses a standard RJ-45 connector (JK2). It can be connected straight to a hub, or another computer via a crossover Ethernet cable. The Ethernet MAC & PHY are integrated into the SoM processor module. Activity and Link LEDs are integrated into the RJ45 connector.

2.4 CAN Port

The SoM-250 includes a CAN 2.0B port utilizing the TI SN65HVD232 CAN Transceiver chip. Note the CAN controller must be supported by the SOM in order to have CAN functionality.

The pinout for the CN5 power connector is as follows:

Pin	Signal
1	CAN_H
2	CAN_L
3	GND

2.5 Serial Ports

The SoM-250 is equipped with four serial ports, one of which terminates to a male DB9 and the other three which terminate to 10pin header connectors (see table 2, 3, & 4 below). Three 10-pin header to male DB9 connector cables are provided, giving easy access to these ports. Baud Rate, stop bits, etc. are all programmable for each port via software.

COM A is an RS232 compatible port with a full complement of handshaking lines allowing it to communicate with modems and other devices requiring hardware flow control.

COM B is an RS232 port. This port offers no handshake lines.

COM C can be configured to RS232, RS422, and RS485 via 2 jumpers. To select RS232 set jumper JB6 to 232 (this is the default). For RS422 set jumper JB6 to 4xx and jumper JB5 to 485. To select RS485, set jumper JB6 to 4xx and jumper JB5 to 422.

When using COM C in the RS422/485 mode, a terminating resistor (~120 Ohm) is recommended on the two far ends of the network.

COM D is an RS232 port. This port offers no handshake lines.

Table 1 (COM A Pinout)

#	Pin Description for DB9 Connector
1	DCD
2	RxD
3	TxD
4	DTR
5	GND
6	DSR
7	RTS
8	CTS
9	RI
10	Shield

Table 2 (COM B Pinout)

#	Pin Description for 10-Pin Header	Pin Description for DB9 Connector
1	NC	NC
2	NC	RxD
3	RxD	TxD
4	NC	NC
5	TxD	GND
6	NC	NC
7	NC	NC
8	NC	NC
9	GND	NC
10	NC	-

Table 3 (COM C Pinout)

#	Pin Description for 10-Pin Header	Pin Description for DB9 Connector
1	422/485 TX-	422/485 TX-
2	NC	232 RX, 422/485 TX+
3	232 RX, 422/485 TX+	232 TX, 422/485 RX+
4	RTS	422/485 RX-
5	232 TX, 422/485 RX+	GND
6	CTS	NC
7	422/485 RX-	RTS
8	NC	CTS
9	GND	NC
10	NC	-

Table 4 (COM D Pinout)

#	Pin Description for 10-Pin Header	Pin Description for DB9 Connector
1	NC	NC
2	NC	RxD
3	RxD	TxD
4	NC	NC
5	TxD	GND
6	NC	NC
7	NC	NC
8	NC	NC
9	GND	NC
10	NC	-

2.5 USB Host Ports

The SoM-250 provides one dual USB 2.0 (USB Port A & B) high speed host port (JK3). USB PortA and PortB can be accessed from the bulkhead connector (HDR5). EMAC can provide a cable (CAB-40-004) to access these ports.

In addition to the one USB Host port, the SoM-250 provides a USB On-The-Go (OTG) port. This port can be used as either a USB Host or USB Device port.

All of the USB ports are equipped with 500mA re-settable Polyfuses. If a USB Device tries to draw more than 500mA from the port, the fuse will open until the device is unplugged or its current requirement is reduced. There is no software provision for shutting down power to the Ports or detecting when a port is drawing too much current.

Note: When sizing a power supply, make sure to allow for USB Device consumption. A device can potentially draw 500mA, therefore these devices could use a total of up to 1 amp of power.

2.6 Audio Port

The SoM-250 provides Audio Line Out and Line In capability through two standard audio jacks (JK5 & JK6). Audio Jack JK5 is stereo line level input and Audio Jack JK6 is stereo line level output. The processor interfaces to the Audio CODEC through its I^2S interface. Command control of the CODEC is done using the processor's SPI interface. The CODEC is the Cirrus CS4271, which is a high performance 24-bit Stereo CODEC offering superior sound quality.

Both the input and output are line level. You will probably not be able to drive an unamplified speaker although standard headphones will work. Likewise, an un-amplified microphone probably will not work as an input although the line out of a CD player will work.

2.7 LCD Brightness Control

The SoM-250 offers LCD brightness control that can change the brightness of the LCD via software. The LCD utilizes LED backlighting. The board provides the backlight with approximately 10 volts at about 220mA. The processor provides a PWM (SoM pin# 85) that is used to drive the LCD backlight. Changing the duty-cycle of the PWM directly affects the brightness of the LCD. In addition, the backlight can be turned off or on via SoM port line GPIO0 (SoM pin#114). This allows screensaver software to automatically turn off the backlight when the unit is not being used and to automatically turn it back on when the touchscreen is touched.

2.8 MicroSD Card Socket

The SoM-250 provides a high capacity MicroSD socket. This socket is hot-swappable and can accept a wide variety of Flash Cards. A green activity light (LED LD3) is located towards the left side of the socket. When the processor is accessing the Flash card this LED will be lit and the card should not be removed at this time. A card that is written to by the SoM-250 can be read by another computer using an MicroSD card reader. The MicroSD interface is compatible with Standard and High Capacity MicroSD cards.

2.9 Keyboard/Mouse

The SoM-250 does not provide a PS/2 type keyboard/mouse interface. However, a USB keyboard and mouse can be used if required.

2.10 Analog Inputs

The analog inputs are available on HDR1 (see table 5 below) and are labeled as analog_04, analog_05, analog_06 and analog_07. These may or may not be supported by the SoM plugged into this carrier.

2.11 I/O Expansion

The Processor used by the SoM-250 provides a number of unused I/O lines. The SoM-250 provides access to these lines on connector HDR1. This 44-pin dual row header contains GPIO lines, SPI bus, I²C bus, A/D lines, interrupts and power pins. Signal names listed in the table below are the SoM names as defined in the SoM 200 pin specification.

Pin	**Signal**	**Pin**	**Signal**
1	3.3V	2	3.3V
3	GPIO1	4	GPIO4
5	GPIO2	6	GPIO5
7	GPIO3	8	GPIO6
9	INT0	10	GPIO7
11	INT1	12	GND
13	OSC0	14	GND
15	OSC1	16	GND
17	ADC4	18	GND
19	ADC5	20	GND
21	ADC6	22	GND
23	ADC7	24	GND
25	SPI_MISO	26	GND
27	SPI_MOSI	28	GND
29	SPI_CLK	30	GND
31	SPI_CS3	32	GND
33	SPI_CS1	34	GND
35	I2C_DAT	36	GND
37	I2C_CLK	38	GND
39	*SOM_RSTOUT	40	GND
41	5V_VCC	42	5V_VCC
43	GND	44	GND

2.12 Real-Time Clock

The SoM-250 is equipped with an external battery for backing up the module's Real-Time Clock (RTC). Drivers to access the RTC are included in the operating systems. Jumper JB4 should be placed in the ON position in order to retain system time when powered down.

2.13 Reset

The SoM-250 provides a Reset Button (PB1). Pressing this button will cause the system to reset.

3 Software

3.1 Introduction

Whatever module is used in the SoM-250 can be programmed in a variety of languages and utilize a variety of Operating Systems. There are a number of Free compilers, interpreters, and assemblers available allowing the processor module to be programmed in C, BASIC or Assembly languages. EMAC has Board Support Package available for Linux. For more information on these particular Operating Systems, contact EMAC, Inc.

For more information on Software, see the module's User's Manual.

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

4 Appendix A: Connector Pinouts

4.1 Ethernet 10/100 Base-T connector (JK2)

Pin	Signal
1	XMT+
2	XMT-
3	RCV+
4	N/C
5	N/C
6	RCV-
7	N/C
8	N/C

4.2 USB Connector (JK3, JK4, HDR5)

4.2.1 PortA & B (JK3 - Host)

Pin	Signal
1	USB_PWR (5V DC)
2	USB_Data-
3	USB_Data+
4	GND

4.2.2 PortC (JK4 – OTG)

Pin	Signal
1	USB_VBUS
2	USB_Data-
3	USB_Data+
4	USB_ID
5	GND

4.2.3 PortA/B (HDR5)

Pin	Signal	Pin	Signal
1	USB_PWR_A	2	USB_PWR_B
3	USB_HOSTA-	4	USB_HOSTB-
5	USB_HOSTA+	6	USB_HOSTB+
7	GND	8	GND
9	Chassis GND	10	NC

4.3 Power Jack (JK1)

Pin	Signal
Center	5V DC
Barrel	GND

4.4 Power Connector (J1)

Pin	Signal
1	Vin
2	Chassis GND
3	System GND

4.5 MicroSD Socket (SOK1)

Pin	Signal
1	DAT2
2	CD/DAT3
3	CMD
4	VCC (3.3V)
5	SCLK
6	GND
7	DAT0
8	DAT1
9	SD Card Detect
10	GND

4.6 CAN (CN5)

Pin	Signal
1	CAN_H
2	CAN_L
3	GND

4.7 TTL LCD/Touch/Backlight (CN6)

Pin	Signal
1	CLK
2	HSYNC
3	VSYNC
4	GND
5	R0
6	R1
7	R2
8	R3
9	R4
10	R5
11	GND
12	G0
13	G1
14	G2
15	G3
16	G4
17	G5
18	GND
19	B0
20	B1
21	B2
22	B3
23	B4
24	B5
25	GND
26	DEN
27	VCC
28	VCC
29	R/L
30	U/D

4.8 LVDS LCD/Touch/Backlight (HDR6)

Pin	Signal	Pin	Signal
1	GND	2	GND
3	3.3V	4	3.3V
5	RED -	6	RED +
7	GND	8	GND
9	GREEN -	10	GREEN +
11	GND	12	GND
13	BLUE -	14	BLUE +
15	GND	16	GND
17	CLOCK -	18	CLOCK +
19	VLED +5V	20	VLED +5V
21	BRIGHTNESS	22	GND
23	EDID DATA	24	EDID CLOCK
25	3.3V	26	VLED +5V
27	Y2	28	X2
29	Y1	30	X1
31	GND	32	GND
33	VIN	34	VIN

4.9 Misc. General Purpose I/O (HDR1)

Pin	Signal	Pin	Signal
1	3.3V	2	3.3V
3	GPIO1	4	GPIO4
5	GPIO2	6	GPIO5
7	GPIO3	8	GPIO6
9	INT0	10	GPIO7
11	INT1	12	GND
13	OSC0	14	GND
15	OSC1	16	GND
17	ADC4	18	GND
19	ADC5	20	GND
21	ADC6	22	GND
23	ADC7	24	GND
25	SPI_MISO	26	GND
27	SPI_MOSI	28	GND
29	SPI_CLK	30	GND
31	SPI_CS3	32	GND
33	SPI_CS1	34	GND
35	I2C_DAT	36	GND
37	I2C_CLK	38	GND
39	*SOM_RSTOUT	40	GND
41	5V_VCC	42	5V_VCC
43	GND	44	GND

4.10 COMA RS-232 Serial Port (CN2)

Pin	DB9 Signal
1	DCD
2	RxD
3	TxD
4	DTR
5	GND
6	DSR
7	RTS
8	CTS
9	RI

4.11 COMB RS-232 Serial Port (HDR3)

Pin	HD3 Signal	DB9 Signal
1	NC	NC
2	NC	RxD
3	RxD	TxD
4	NC	NC
5	TxD	GND
6	NC	NC
7	NC	NC
8	NC	NC
9	GND	NC
10	NC	--

4.12 COMC RS-232/422/485 Serial Port (HDR4)

Pin	HD4 Signal	DB9 Signal
1	422/485 TX-	422/485 TX-
2	NC	232 RX, 422/485 TX+
3	232 RX, 422/485 TX+	232 TX, 422/485 RX+
4	RTS	422/485 RX-
5	232 TX, 422/485 RX+	GND
6	CTS	NC
7	422/485 RX-	RTS
8	NC	CTS
9	GND	NC
10	NC	-

4.13 COMD RS-232 Serial Port (HDR2)

Pin	HD2 Signal	DB9 Signal
1	NC	NC
2	NC	RxD
3	RxD	TxD
4	NC	NC
5	TxD	GND
6	NC	NC
7	NC	NC
8	NC	NC
9	GND	NC
10	NC	--

4.14 PCD Expansion Connector (ABJ1)

Pin	Signal	Pin	Signal
1	VIN	2	RESET OUT
3	GND	4	SPI_MOSI
5	INT2 (5V)	6	SPI_MISO (5V)
7	SPI_CS0	8	SPI_CLK
9	5V	10	GPIO15

4.15 Touch Screen Connector (CN1)

Pin	Signal
1	Y+
2	X+
3	Y-
4	X-

4.16 Touch Screen Connector (CN3)

Pin	Signal
1	Y+
2	X+
3	Y-
4	X-

4.17 LCD Backlight Connector (CN4)

Pin	Signal
1	VOUT (+)
2	SWITCHED GND (-)

5 Appendix B: *Jumper Settings*

(See SoM manual for correct Boot jumper settings)

JB1 Boot0 Source Selection

Jumper	**Position**	**Setting**
Pins 2 & 3	A	Line pulled LOW
Pins 1 & 2*	B	Line pulled HIGH

* Default setting

JB2 Boot1 Option Selection

Jumper	**Position**	**Setting**
Pins 2 & 3*	A	Line pulled LOW
Pins 1 & 2	B	Line pulled HIGH

* Default Setting

JB3 Flash Write Protect

Jumper	**Position**	**Setting**
Pins 2 & 3	A	Resident Flash Disable
Pins 1 & 2*	B	Resident Flash Enable

* Default setting

JB4 RTC Battery Enable

Jumper	**Position**	**Setting**
Pins 1 & 2	ON	Enable Battery Backup
Pins 2 & 3*	OFF	Disable Battery Backup

* Default setting

JB5 RS485/RS422 Select

Jumper	**Position**	**Setting**
Pins 1 & 2	485	Select RS485
Pins 2 & 3*	422	Select RS422

* Default setting

JB6 RS232/RS4xx Select

Jumper	**Position**	**Setting**
Pins 1 & 2*	232	Select RS232
Pins 2 & 3	4xx	Select either RS422 or RS485 depending on JB5

* Default setting

6 Appendix C: *Mechanical drawing with dimensions*