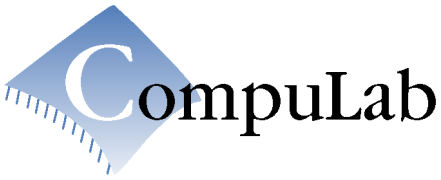


SBC-FITPC2i
Single-Board PC

Reference Guide

Table of Contents

1. Revision Notes

22-Feb-2009	Initial release SBC-FITPC2i Rev 1.2
15-Apr-2010	Audio subsystem reviewed USB connector P37 added
5-Aug-2010	Mini-PCI Express slot removed
25-Aug-2010	LVDS connector added

2. Overview

2.1. Highlights

▪ Full-featured PC single board computer, tiny and power saving ▪ Intel Atom Z510@1.1GHz or Z530@1.6GHz CPU ▪ Intel US15W chipset ▪ Up to 2GB DDR2 ▪ DVI Digital display interface, up to 1920x1080 ▪ LVDS interface ▪ Serial ATA interface ▪ Bootable onboard solid-state disk (SSD) ▪ Analog audio: line input/output, mic in ▪ Coaxial S/PDIF output ▪ Two 1000BASE-T Ethernet port ▪ 802.11b/g/n WiFi ▪ 7 x USB 2.0 ports ▪ miniSD Card socket ▪ Serial COM port, RS-232 signalling ▪ Consumer IR receiver ▪ Watchdog ▪ GPIOs ▪ LPC and I2C extension buses ▪ Phoenix BIOS ▪ Single 12V supply, 6-9.6W, fanless operation ▪ Dimensions - 104 x 100.7 x 22.9 mm ▪ Runs Windows XP, Windows 7 and Linux ▪ Also available as a fit-PC2i computer with enclosure and hard disk.	The SBC-FITPC2i is a tiny, single board PC based on Intel's Atom processor and US15W chipset. It runs all standard operating systems and software packages. The SBC-FITPC2i's unique advantages include exceptionally small size, quiet, fanless operation and very low power consumption. The rich feature set of the SBC-FITPC2i is customizable according to the price / performance targets of the user's application. It makes an ideal platform for implementation applications such as home entertainment and point-of-sale.

2.2. Features

"Option" column specifies the configuration code required to control the particular feature. "+" means that the feature is available always.

Feature	Specifications	Option
CPU	Intel Atom Processor: Z530@1.6Ghz 533MHz FSB or Z510@1.1GHz 400MHz FSB. L2: 512KB (dynamic sizing), L1: 32KB IC, 24KB DC. Intel Deep Power Down (C6) technology support	C
Chipset	Poulsbo US15 Intel System Controller Hub (INTEL SCH)	+
Memory	1GB or 2GB DDR2, 533/400 MHz, 64-bit	D
SSD	Bootable onboard Solid-State Disk	N
Display interface	SDVO-based DVI interface. Hot plug support.	+
Audio	Realtek ALC260, High Definition Audio, Line Out, Line In, Microphone In.	A
Ethernet	Up to two integrated Gigabit PCI-Express controllers Realtek RTL8111	E
HDD Interface	SATA-II, using Marvell 88SA8052	S
Serial COM port	RS-232 serial port	Y
WiFi	802.11 b/g capabilities, Ralink chipset. Up to 54 Mbps, 2.4 GHz band.	W
USB	4 external USB ports + 3 additional onboard connectors: data rate up to 480 Mb/s	+
Infrared	USB based consumer infra red receiver	I
BIOS	Phoenix SecureCore BIOS	+
SDIO/LVDS	MiniSD Card connector supporting SDIO1.1 and MMC4.1 LVDS connector	+ L
GPIOs	3 GPIOs are available	+

Electrical, Mechanical and Environmental Specifications

Active consumption	All contents, excluding off-board components 6-9.6 W
Sleep consumption	0.7-1.2 W, depending on configuration and mode
Dimensions	104 x 96 mm, not including connectors, 104x100.7 including connectors and buttons. Height: 22.9mm
Weight	90 g
MTBF	> 100,000 hours
Operation temperature	Commercial: 0^o to 70^o C Extended: -20^o to 70^o C Industrial: -40^o to 85^o C * specified for board only, measured on component case * industrial and extended temperature certifications are not applicable for RTC backup battery
Storage temperature	-40^o to 85^o C
Relative humidity	10% to 90% (operation) 05% to 95% (storage)

3. System Components

3.1. Intel Atom CPU

The SBC-FitPC2i utilizes an Intel® Atom Z5xx series CPU.

The Intel® Atom Z5xx series processor is built on 45-nanometer process technology — the first generation of low-power IA-32 micro-architecture specially designed for the new class of Mobile Internet Devices (MID).

The following list provides some of the key features on this processor:

- New single-core processor for mobile devices with enhanced performance
- On die, primary 32-kB instructions cache and 24-kB write-back data cache
- 100-MHz and 133-MHz Source-Synchronous front side bus (FSB)
- Supports Hyper-Threading Technology 2-threads
- On die 512-kB, 8-way L2 cache
- Support for IA 32-bit and Intel® 64 architecture
- Intel® Virtualization Technology (Intel® VT)
- Intel® Streaming SIMD Extensions 2 and 3 (Intel® SSE2 and Intel® SSE3) and Supplemental Streaming SIMD Extensions 3 (SSSE3) support

- Supports new CMOS FSB signaling for reduced power
- Micro-FCBGA8 packaging technologies
- Thermal management support via TM1 and TM2
- FSB Lane Reversal for flexible routing
- Supports C0/C1(e)/C2(e)/C4(e)
- New C6 Deep Power Down Technology
- L2 Dynamic Cache Sizing
- New Split-VTT support for lowest processor power state
- Advanced power management features including Enhanced Intel SpeedStep® Technology
- Execute Disable Bit support for enhanced security

3.2. Chipset

The SBC-FitPC2i uses an Intel® System Controller Hub (Intel® SCH) US15W chipset.

The Intel® SCH chipset component of the Atom low power platform, combines functionality normally found in separate GMCH (integrated graphics, processor interface, memory controller) and ICH (on-board and end-user I/O expansion) components into a single component consuming less than 2.3 W of thermal design power.

3.3. Graphics System

The SBC-FitPC2i graphics system is based on the Intel® SCH integrated graphics controller, based on Intel® GMA500 architecture. The SBC-FitPC2i board features an HDMI connector (J14) providing DVI output. DVI output is formed using a Chrontel CH7307C DVI transmitter in revisions 1.2 and 1.2x.

Graphics Controller Description:

The Intel SCH provides integrated graphics (2D and 3D) and high-definition video decode capabilities with minimal power consumption.

The highly compact IGD contains advanced shader architecture (model 3.0+) that performs pixel shading and vertex shading within a single hardware accelerator. The processing of pixels is deferred until they are determined to be visible, which minimizes access to memory and improves render performance.

The Intel SCH supports full hardware acceleration of video decode standards such as H.264, MPEG2, MPEG4, VC1, and WMV9.

3.4. Audio System

The audio system of the SBC-FitPC2i is implemented using Realtek ALC662 – a 5.1 channel high-definition audio codec chip in a 2-channel mode.

- The line stereo output connects to the on-board audio jack (P9).
- The line-in and microphone inputs are connected together to a 3.5mm audio jack (P4).

Audio Specifications:

Parameter	Min	Typ	Max	Units
Full Scale Input Voltage				
All Inputs (gain=0dB)	-	1.6	-	Vrms
All ADC	-	1.4	-	Vrms
Full Scale Output Voltage				
All DAC	-	1.4	-	Vrms
S/N (A Weighted)				
Headphone amp	-	98	-	dB FSA
ADC	-	90	-	dB FSA
DAC	-	98	-	dB FSA
THD+N				
Headphone amp (32 Ohm load)	-	-75	-	dB FS
ADC	-	-85	-	dB FS
DAC	-	-92	-	dB FS
Frequency Response				
ADC, DAC	20000	-	-	Hz
Crosstalk Between Output Channels				
1kHz	-	-90	-	dB
20 kHz	-	-80	-	dB
Input Impedance (gain=0dB)		40		kOhm
Output Impedance				
Line Output	-	100	-	Ohm

3.5. Power System and Power Consumption

The SBC-FitPC2i is designed to work with a large range of power sources. It provides stable system functionality with input voltage in the range of 7.5V-15V. An unregulated power supply may be used as long as peaks of supply voltage don't exceed the input voltage range.

Power Modes and Power Consumption

There are three typical working modes: Off, Suspend to RAM (STR) and Full Operating mode.
During Full Operating mode, power consumption may vary depending on both the software installed on the system and on the CPU / system load.

Current consumption
Measuring conditions: Vin = 12V, no peripheral devices connected

Mode	Min	Max
Off	70mA	90mA
Suspend to RAM	70mA	100mA
Full Operating	0.45A	0.8A

Backup Power for RTC and CMOS memory

The SBC-FitPC2i implements backup power for RTC and CMOS settings. There is an on-board rechargeable Li-AL battery, 18mAh. The battery is constantly charged while the power supply is connected. The RTC will retain system time and CMOS setting for at least 100 days when the system is unpowered (as long as the system was connected to a power supply for at least 24 hours prior to power-down).

It's possible to reset CMOS data to default shorting J4B2 connector pins for several seconds once the system is unpowered.

Power Supply for USB Devices

The SBC-FitPC2i has 6 USB ports, each one capable of providing up to 500mA. Total power consumption from USB ports should not exceed 1.5A.

Wake-up Events

The system can wake-up from STR state by the following events:

- On/Off button
- RTC
- USB keyboard/mouse activity

Note: USB and RTC wakeup events are available only with BIOS from 21-Jul-2009 or later.

In order to enable wake on USB keyboard / mouse in Windows XP, do the following:

- Open REGEDIT
- Create a new key called *HKLM\System\CurrentControlSet**USB***
- Create a new DWORD value *HKLM\System\CurrentControlSet\USB**USBBIOSx*** and set it to 00000000

Restart the computer

The Power management TAB in HID should be available - check “bringing device out of the standby” option.

3.6. Watchdog

The SBC-FitPC2i implements watchdog timer using 8-bit count-down timer clocked by 1Hz. Watchdog generates system-reset event when the counter reaches zero.

Note: watchdog functionality is available only with BIOS from 21-Jul-2009 or later.

Operation

Using watchdog requires an appropriate driver to be installed before enabling a watchdog in BIOS. To enable or disable the watchdog enter BIOS Setup (F2), go to "Advanced" menu and change "Watchdog Timer" option to On/Off accordingly. Once the "Watchdog Timer" option enabled the timeout can be set 31-255 seconds. Entering setup temporary disables watchdog operation regardless to current state.

Reference code

```
/*This code will work in DOS only.*/

  void SendData( unsigned char command ,unsigned char data )
{
        outp(0x4c,command);
        delay(100);
        outp(0x48,data);
        delay(200);
}

/*Set watchdog timeout.
This function must be called before timeout ends to prevent system reset. */
void EnableWatchd(unsigned char time)
{
      SendData(1,1);
      SendData(2,time);
}
void DisableWatchd()
{
      SendData(1,0);
      SendData(2,0);
}
```

4. Peripheral Interfaces & Connectors

4.1. USB Interface (P1, P2, U27, P37, P32)

The SBC-FitPC2i USB provides a total of 7 USB ports. The USB interface is provided directly by Intel® SCH USB controller that implements UHCI and EHCI host controller architecture and complies with USB 1.1 and 2.0 standards.

Connectors P1, P2 - miniUSB type AB:

Pin	Name
1	USB_VCC
2	USB_N
3	USB_P
4	N/C
5	GND

Connectors P38, P40 – shrouded headers for internal add-indevices:

Pin	Name
1	USB_VCC (3.3V)
2	USB_N
3	USB_P
4	GND
5	LED (DS2) Enable#
6	N/C

Note: P38 and P40 provide 3.3V as a USB_VCC.
Note: P40 is routed to the same port as P32 pins 5..8.
Note: USB port on connectors P40 and P38 are connected to the EHCI USB 2.0 controller only. Therefore they will only work with high-speed devices (480Mbps) such as storage devices, advanced cameras, etc.

Connector U27 – USB, dual stacked type A connector. Optionally may be installed low-profile single USB connector P37.

Pin	Name
1	USB_VCC
2	USB_N
3	USB_P
4	GND

Connector P32 – optional USB dual-port 100-mil header:

Pin	Name

1	USB_VCC
2	USB_N
3	USB_P
4	GND
5	USB_VCC
6	USB_N
7	USB_P
8	GND

Note: USB port on connector P32 pins 5..8 is connected to the EHCI USB 2.0 controller only. Therefore it works only with high-speed devices (480Mbps) such as storage devices, advanced cameras, etc.

4.2. MMC/SDIO/SD (P7)

The SBC-FitPC2i MMC/SDIO/SD interface is based on the SDIO controller of the Intel® SCH chipset.
The controller supports MMC4.0 and SDIO1.1 specifications. MMC 4.0 transfer rates can be up to 48 MHz with bus widths of 1 or 4 bits. SDIO 1.1 supports transfer rates of up to 24 MHz and bus widths of 1 or 4 bits.

The MMC controller signals are routed to the on-board mini-SD socket (P7). This socket is available only if option “L” (LVDS interface) is not selected.

Connector P7, standard mini-SDIO socket:

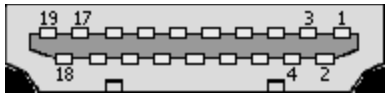
Pin	Name	Pin	Name
1	SD_DAT3	8	SD_DAT1
2	SD_CCMD	9	SD_DAT2
3	GND	10	N/C
4	VCC_SDIO	11	N/C
5	SD_CLK	12	SD_CD
6	GND	13	GND
7	SD_DAT0		

4.3. HDMI Connector (J14)

The SBC-FitPC2i provides a DVI interface using an HDMI connector.

Connector J14, standard HDMI-A connector:

Pin	Name	
1	TMDS_Data2+	

2	GND	
3	TMDS_Data2-	
4	TMDS_Data1+	
5	GND	
6	TMDS_Data1-	
7	TMDS_Data0+	
8	GND	
9	TMDS_Data0-	
10	TMDS_Clock+	
11	GND	
12	TMDS_Clock-	
13	N/C	
14	N/C	
15	DDC_SCL	
16	DDC_SDA	
17	GND	
18	+5 V	
19	Hot_Plug_Detect	

4.4. Main Power Connector (J8, P29)

The main power connector is a round DC jack with a 3.9mm external diameter and a 1.5mm internal diameter. Outer contact is connected to GND and inner contact to VCC_IN.

The connector is compatible with the power supply available from CompuLab.

There is an optional 100MIL header (P29), which may be assembled in place of J8.

Connector P29 – optional power header:

Pin	Name
1	GND
2	VCC_IN

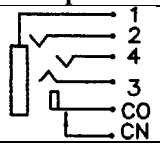
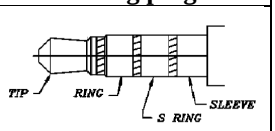
4.5. Audio Interface (P4, P9)

The SBC-FitPC2i provides 2-channel high-definition audio. The following interfaces are provided:

- Stereo line output
- Stereo line/mic input

Each interface is connected to a dedicated 3.5mm jack.

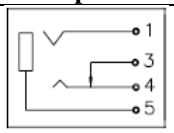
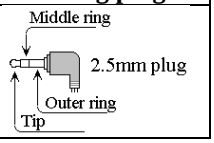
Line out (P9):

Jack pin-out	Mating plug
	

Pin	Signal	Mating plug pin
1	AGND	Sleeve
2	SPDIF out	2nd ring
3	Line out right	Ring
4	Line out left	Tip
CO	N/C	-
CN	N/C	-

Note: if only the analog stereo output is required with no SPDIF functionality, the same plug as for P4 may be used.

Line in (P4):

Jack pin-out	Mating plug
	

Pin	Signal	Mating plug pin
1	Line in/mic left	Tip
3	NC	-
4	Line in/mic right	Middle ring
5	Analog GND	Outer ring

4.6. Serial ATA Interface

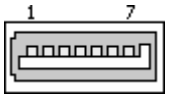
This interface is available only in modules with the “S” option. The SBC-FitPC2i serial ATA (SATA) interface is provided by an Intel® SCH IDE controller and Marvell 88SA8052 SATA bridge.

The SATA host bridge is defined as a slave device on the Intel® SCH controller’s IDE bus. It supports ATA/ATAPI PIO mode, UDMS mode at transfer rates 16.7 to 150 MB/sec, power-save modes and hot-plug.

A proprietary add-on board called SATA-ADP is used to interface the hard drive to the SBC-FitPC2i. It connects to 12-pin headers (P30, P31) on SBC-FitPC2i and features a combo SATA connector providing both data and power for a single 2.5” HDD or SSD.

SATA interface, data:

Pin	Name
1	GND
2	TX+
3	TX-
4	GND
5	RX-
6	RX+
7	GND



SATA interface, power:

Pin	Name
1	N/C
2	N/C
3	N/C
4	GND
5	GND
6	GND
7	VCC5
8	VCC5
9	VCC5
10	GND
11	GND
12	GND
13	N/C
14	N/C
15	N/C

4.7. LAN Ports (P26)

The SBC-FitPC2i provides up to two Gigabit Ethernet ports implemented by a Realtek RTL8111x Gigabit Ethernet controller.

The RTL8111x offers data transmission over a CAT 5 UTP or CAT 3 UTP (10Mbps only) cable. Functions such as Crossover Detection and Auto-Correction, polarity correction, adaptive equalization, crosstalk cancellation, echo cancellation, timing recovery and error correction are implemented to provide robust transmission and reception capability at high speed. The RTL8111x is compliant with IEEE 802.3u specifications for 10/100Mbps Ethernet and IEEE 802.3ab specifications for 1000Mbps Ethernet.

The RTL8111x is fully compliant with Microsoft® NDIS5, NDIS6 (IPv4, IPv6, TCP, UDP) Checksum and Segmentation Task-offload (Large and Giant send) features, and supports IEEE 802 IP Layer 2 priority encoding and IEEE 802.1Q Virtual bridged Local Area Network (VLAN).

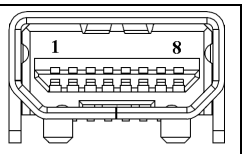
The Ethernet interface is available through a dual RJ-45 connector P34 or single RJ-45 connector P36.

Pin	Name	Description
1	BI_DA+	Bi-directional pair A +
2	BI_DA-	Bi-directional pair A -
3	BI_DB+	Bi-directional pair B +
4	BI_DC+	Bi-directional pair C +
5	BI_DC-	Bi-directional pair C -
6	BI_DB-	Bi-directional pair B -
7	BI_DD+	Bi-directional pair D +
8	BI_DD-	Bi-directional pair D -

4.8. Serial COM Port (P17, P41)

Ultra mini serial connectors P17 and P41 provide serial connectivity using RS-232 signaling. Interface cable is available from CompuLab.

Pin	Name
1	TX
2	RTS
3	RX
4	CTS
5	DTR
6	DSR
7	N/C
8	GND



4.9. LED's and Push Buttons

SBC-FitPC2i push buttons

The SBC-FitPC2i features two user-accessible push buttons:

- SW1 is the main system hardware reset button.
- SW2 is the main system power on / off / suspend button.

SBC-FitPC2i LED's

The following table describes SBC-FitPC2i LED's:

LED	Designation	LED activity
DS1	HDD access	ON when HDD is accessed
DS2	WiFi Activity	Depends on a mini PCI-express WLAN module. Refer to the WLAN module datasheet.
DS3	System power	ON when the system is in active state, OFF in suspend-to-RAM and off states.

4.10. Consumer Infrared Receiver

The SBC-FitPC2i features a Consumer Infrared receiver, based on a programmed micro controller with USB interface.

4.11. Extension connector for RST, GPIO, I2C, LPC bus (P16)

SBC-FitPC2i provides the ability to connect external devices using extension interface. 40-pin 0.5mm pitch FPC connector is used.

Pin	Name	Pin	Name
1	+5V_STBY	21	+3.3V_STBY
2	+5V_STBY	22	RESERVED
3	+5V_STBY	23	RESERVED
4	+5V_STBY	24	GND
5	RESERVED	25	GPIO0
6	GND	26	RESERVED
7	RESERVED	27	GPIO8
8	RESERVED	28	GPIO9
9	GND	29	GND
10	RESET_IN	30	RESERVED
11	RESERVED	31	RESERVED

12	GND	32	RESERVED
13	SMB_CLK	33	GND
14	SMB_DAT	34	LPC_AD0
15	GND	35	LPC_AD1
16	RESERVED	36	LPC_AD2
17	RESERVED	37	LPC_AD3
18	RESERVED	38	LPC_FRAME
19	+3.3V_STBY	39	GND
20	+3.3V_STBY	40	LPC_CLK

Note: reserved pins must be left unconnected. Connecting them to anything may lead to system malfunction.

Total allowed consumption from 5V should be less than 500mA,
from 3.3V less than 300 mA

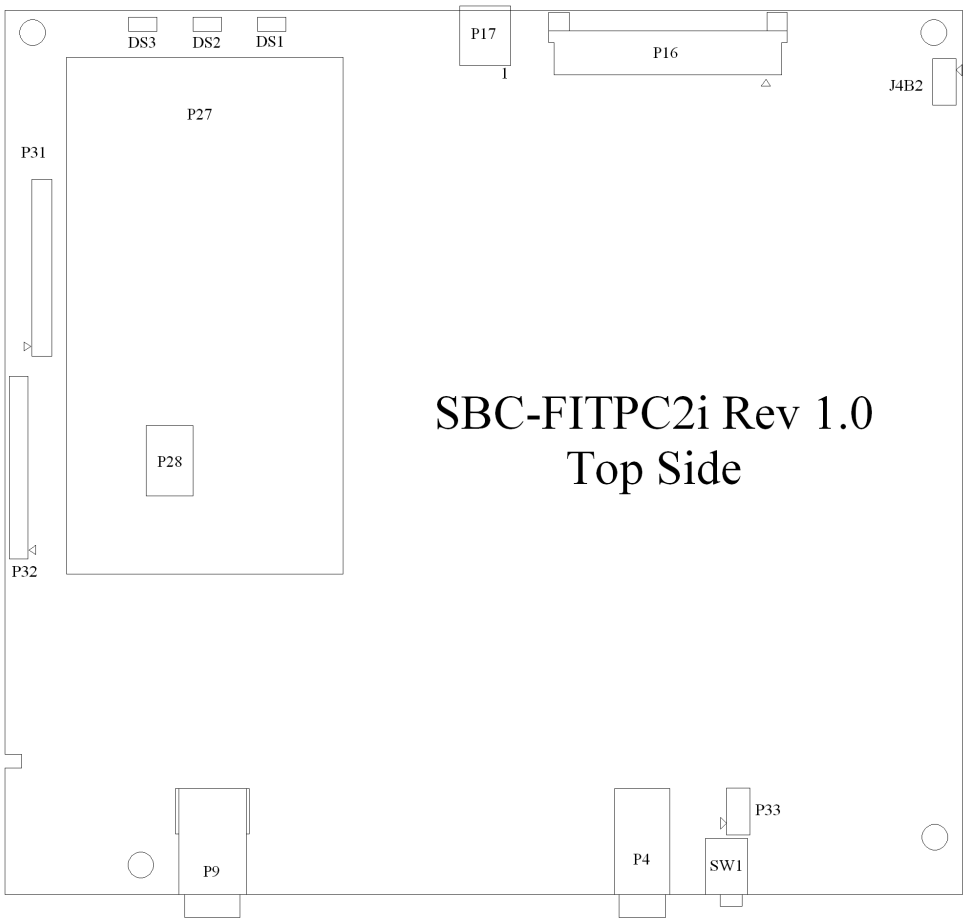
4.12. LVDS connector (P35)

SBC-FitPC2i provides the ability to connect LVDS through 40-pin 0.5 mm pitch FPC connector. This connector is available only if option “L” is selected.

Pin	Name	Pin	Name
1	+V3.3S	21	GND
2	+V3.3S	22	LVDS_VDD_ENA
3	+V3.3S	23	LVDS_BKL_ENA
4	GND	24	GND
5	GND	25	LVDS_CTL_CLK
6	GND	26	LVDS_CTL_DATA
7	LVDS_A_DATAP0	27	GND
8	LVDS_A_DATAN0	28	LVDS_DDCCLK
9	GND	29	LVDS_DDCDATA
10	LVDS_A_DATAP1	30	GND
11	LVDS_A_DATAN1	31	LVDS_BKL_CTL
12	GND	32	GND
13	LVDS_A_DATAP2	33	NC
14	LVDS_A_DATAN2	34	NC
15	GND	35	NC
16	LVDS_A_DATAP3	36	NC
17	LVDS_A_DATAN3	37	NC
18	GND	38	NC
19	LVDS_A_CLKP	39	NC
20	LVDS_A_CLKM	40	NC

5. Mechanical Considerations and Connectors' Location

The 3D solidworks model and "dxf" assembly files of the SBC-FitPC2i board may be downloaded from [Developer] >> [fit-PC2] section of CompuLab's web-site.

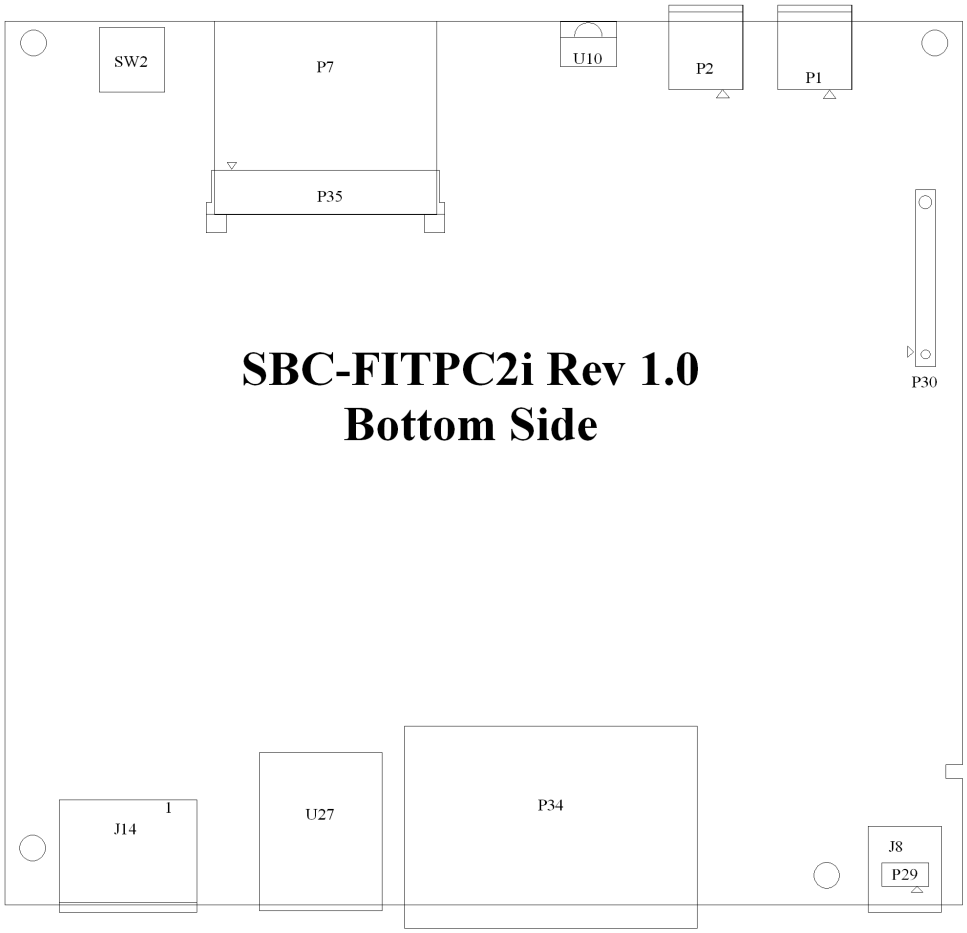


Connectors on the Top Side:

P4	Line In and Mic In 3.5mm audio jack socket
P9	Line Out and S-PDIF Coaxial Out audio jack socket
P16	Debug/Production interface
P17	Mini Serial port connector
P27	Mini PCI Express socket (not available)
P28	Infrared firmware update interface
P31	Serial ATA interface socket

P32 USB header
P33 Reset header (option)

Other references on the Top Side:
DS1 HDD access LED
DS2 WLAN activity LED
DS3 Power ON LED
SW1 Reset button
J4B2 RTC reset header (option)



Connectors on the Bottom Side:
J8 Power jack socket (option)
J14 DVI HDMI-type connector

P1 Mini-USB connector
P2 Mini-USB connector
P7 Mini SD-Card socket (option)
P29 Power header (option)
P30 Serial ATA interface socket (option)
P34 LAN1 and LAN2 connectors
P35 LVDS interface connector (option)
U27 USB stacked connector

Other references on the Bottom Side:
SW2 Power button
U10 Infrared receiver

6. Operating Temperature Ranges

The information in this section refers to the SBC-FitPC2i board only. For temperature ranges of off-board components such as the hard disk or WLAN module, please refer to the component's datasheet.

The SBC-FitPC2i is available with three options of operating temperature range:

Range	Temp.	Description
Commercial	0^o to 70^o C	Sample cards from each batch are tested for the lower and upper temperature limits. Individual cards are not tested.
Extended	-20^o to 70^o C	Every card undergoes a short test for the lower limit (-20^o C) qualification.
Industrial	-40^o to 85^o C	Every card is extensively tested for both lower and upper limits and at several midpoints.