

# **SBC-FITPC2 Single-board PC**

## **Reference Guide**

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## 1. Revision Notes

01-Jun-2009	<ul style="list-style-type: none"><li>▪ First release</li></ul>
22-Jul-2009	<ul style="list-style-type: none"><li>▪ Watchdog description added</li><li>▪ Wake-on-timer and USB event description added</li></ul>
12-Aug-2009	<ul style="list-style-type: none"><li>▪ Extension connector for RST, GPIO, I2C, LPC added</li></ul>

## 2. Overview

### 2.1. Highlights

<ul style="list-style-type: none"><li>▪ <b>Full-featured PC single board computer, tiny and power saving</b></li><li>▪ <b>Intel Atom Z530 CPU @ 1.6 GHz</b></li><li>▪ <b>Intel US15W chipset</b></li><li>▪ <b>1GB DDR2</b></li><li>▪ <b>DVI Digital display interface, up to 1920x1080</b></li><li>▪ <b>Harddisk interface</b></li><li>▪ <b>HD Audio, line-out 2.0 / mic in / line-in</b></li><li>▪ <b>1000 BaseT Ethernet port</b></li><li>▪ <b>802.11b/g/n WiFi</b></li><li>▪ <b>Six USB 2.0 ports</b></li><li>▪ <b>miniSD Socket</b></li><li>▪ <b>IR receiver</b></li><li>▪ <b>Watchdog</b></li><li>▪ <b>GPIOs</b></li><li>▪ <b>LPC and I2C extension buses</b></li><li>▪ <b>Phoenix BIOS</b></li><li>▪ <b>Single 12V supply, 6-9.6W, fanless operation</b></li><li>▪ <b>Dimensions - 104 x 100.7 x 22.9 mm</b></li><li>▪ <b>Runs Windows XP, Windows 7 and Linux</b></li><li>▪ <b>Also available as fit-PC2 computer with enclosure and harddisk.</b></li></ul>	<p>The SBC-FITPC2 is a tiny, single board PC based on Intel's Atom Z530 processor and US15W chipset. It runs all standard operating systems and software packages. The SBC-FITPC2's unique advantages include exceptionally small size, quiet, fanless operation and very low power consumption.</p> <p>The rich feature set of the SBC-FITPC2 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.</p>
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## 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	1 GB DDR2, 533/400 MHz, 64-bit	D
Display interface	SDVO-based DVI interface. Hotplug support.	+
Audio	Realtek ALC260, High Definition Audio, Line Out, Line In, Microphone InS	A
Ethernet	Integrated Gigabit PCI-Express controller Realtek RTL8111	E
HDD Interface	Two options: PATA interface, ATA / ATAPI-6, or - SATA-II, using Marvell 88SA8052	+ S
WiFi	802.11 b/g capabilities, Ralink chipset. Up to 54 Mbps, 2.4 GHz band.	W
USB	6 external USB ports: 3 UHCI devices (2 port/device), one EHCI (8 port/device ) support + 1 on the mini PCIE connector (EHCI only) with max. rate up to 480 Mb/s	+
InfraRed	USB based infra red receiver	I
BIOS	Phoenix SecureCore BIOS	+
mini PCI Express	includes PCIe x1, USB (EHCI), SMB, power supplies. Available only if "W" option isn't used	+
SDIO slot	mini SD connector supporting SDIO1.1 and MMC4.1	+
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° to 70° C Extended: -20° to 70° C Industrial: -40° to 85° C * specified for board only, measured on component case
Storage temperature	-40° to 85° C
Relative humidity	10% to 90% (operation) 05% to 95% (storage)

## 3. System Components

### 3.1. Intel Atom CPU

The SBC-FitPC2 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-FitPC2 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-FitPC2 graphics system is based on the Intel® SCH integrated graphics controller, based on Intel® GMA500 architecture. The SBC-FitPC2 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-FitPC2 is implemented using Realtek ALC260 – a 2 channel

high-definition audio codec chip.

- The headphone stereo output connects to the on-board audio jack (P4). This output is designed to drive a  $8\Omega$  -  $32\Omega$  headphone or line output.
- The line-in and microphone inputs are connected to dedicated 3.5mm audio jacks, P9 and P15 respectively.

Audio Specifications:

Parameter	Min	Typ	Max	Units
Full Scale Input Voltage				
All Inputs (gain=0dB)	-	1.6	-	Vrms
All ADC	-	1.1	-	Vrms
Full Scale Output Voltage				
All DAC	-	1.1	-	Vrms
S/N (A Weighted)				
Analog Inputs to Outputs	-	95	-	dB FSA
ADC	-	90	-	dB FSA
DAC	-	95	-	dB FSA
THD+N				
Analog Inputs to Outputs	-	-90	-	dB FS
ADC	-	-85	-	dB FS
DAC	-	-90	-	dB FS
Frequency Response				
Mixers	10	-	22,000	Hz
ADC, DAC	16	-	19,200	Hz
Amplifier Gain Step	-	1	-	dB
Crosstalk Between Input Channels	-	-80	-	dB
Input Impedance (gain=0dB)		64		kOhm
Output Impedance				
Amplified Output		1		Ohm
Non-amplified Output		200	47,000	Ohm



### 3.5. Power System and Power Consumption

The SBC-FitPC2 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:  $V_{in} = 12V$ , 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-FitPC2 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-FitPC2 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-FitPC2 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, U11, U12)

The SBC-FitPC2 USB provides a total of 6 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.

USB connector P2 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.

Connectors P1, P2 - miniUSB type AB:

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

Connectors U11, U12 – USB, type A connectors:

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

### 4.2. MMC/SDIO/SD (P7)

The SBC-FitPC2 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).

Connector P7, standard mini-SDIO socket:

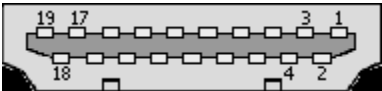
Pin	Name	Pin	Name
1	SD_DAT3	8	SD_DAT1
2	SD_CCMD	9	SD_DAT2
3	GND	10	N/C
4	VCC_SDIO	11	N/C
5	SD_CLK	12	SD_CD
6	GND	13	GND
7	SD_DAT0		

### 4.3. HDMI Connector (J14)

The SBC-FitPC2 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)

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.

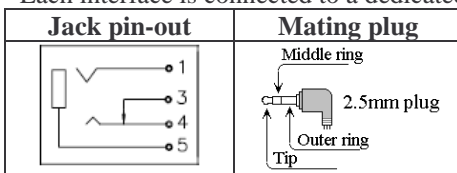
The connector is compatible with the power supply available from CompuLab.

#### 4.5. Audio Interface (P4, P9, P15)

The SBC-FitPC2 provides 2-channel high-definition audio. The following interfaces are provided:

- Stereo headphone / line out output (functioning controlled by software).
- Stereo line in
- Mono microphone in

Each interface is connected to a dedicated 3.5mm jack.



Headphone / line out (P4):

Pin	Name	Mating plug pin
1	HP_OUT_L	Tip
3	NC	-
4	HP_OUT_R	Middle ring
5	AGND	Outer ring

Line in (P9):

Pin	Name	Mating plug pin
1	LINE_IN_L	Tip
3	NC	-
4	LINE_IN_R	Middle ring
5	AGND	Outer ring

Microphone in (P15):

Pin	Name	Mating plug pin
1	MIC_VCC	Tip
3	NC	-
4	MIC_IN	Middle ring
5	AGND	Outer ring

## 4.6. Parallel ATA Interface (P6)

This interface is available only in modules without the “S” option.

The SBC-FitPC2 parallel ATA (PATA) interface is provided directly by an Intel® SCH PATA controller. PATA interface supports only the primary channel, with one master and one slave device.

Three types of data transfers are supported:

- Programmed I/O (PIO): A protocol used to transfer data between the processor as the ATA device. PIO allows transfer rates of up to 16MB/s.
- Multi-word DMA: DMA protocol that resembles the DMA on the ISA bus. Allows transfer rates of up to 16MB/s.
- Ultra-DMA: Source synchronous DMA protocol that allows transfer rates of up to 100MB/s.

Supported PATA standards and modes:

PATA Standard	Transfer Modes Supported	Transfer Rate (MB/s)
ATA-1 (ATA, IDE)	PIO Modes 0, 1, 2	3.3, 5.2, 8.3
	Single-word DMA Modes 0, 1, 2	2.1, 4.2, 8.3
	Multi-word DMA Mode 0	4.2
ATA-2, ATA-3 (EIDE, Fast ATA)	PIO Modes 3,4	11.1, 16.6
	Multi-word DMA Modes 1,2	13.3, 16.6
ATA/ATAPI-4 (Ultra DMA, Ultra ATA)	Ultra DMA Modes 0,1, 2 (a.k.a. Ultra DMA/33)	16.7, 25.0, 33.3
ATA/ATAPI-5 (Ultra DMA, Ultra ATA)	Ultra DMA Modes 3, 4 (a.k.a. Ultra DMA/66)	44.4, 66.7
ATA/ATAPI-6 (Ultra DMA, Ultra ATA)	Ultra-DMA Mode 5 (a.k.a. Ultra DMA/100)	100 (reads) 89 (writes)

A standard 44-pin, dual row, 2 mm pitch header is used for PATA interface. It can be connected directly to a 2.5” form-factor hard disk or an SSD.

Parallel ATA connector (P6):

Pin	Name	Pin	Name
1	RESET#	2	GND
3	D7	4	D8
5	D6	6	D9
7	D5	8	D10
9	D4	10	D11
11	D3	12	D12
13	D2	14	D13

15	D1	16	D14
17	D0	18	D15
19	GND	20	N/C
21	DMARQ	22	GND
23	IOW#	24	GND
25	IOR#	26	GND
27	IOCHRDY	28	GND
29	DMAACK#	30	GND
31	IRQ	32	N/C
33	ADDR1	34	N/C
35	ADDR0	36	ADDR2
37	CS0#	38	CS1#
39	LED#	40	GND
41	VCC5	42	VCC5
43	GND	44	GND

#### 4.7. Serial ATA Interface (P100)

This interface is available only in modules with the “S” option.

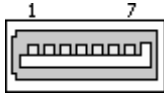
The SBC-FitPC2 Serial ATA (SATA) interface is formed from the PATA interface using a PATA to SATA converter.

Refer to the PATA interface description for supported transfer modes.

The SATA interface provides both SATA data connection and the power required for direct connection of a single 2.5” HDD or SSD.

SATA interface, data (P100A):


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



SATA interface, power (P100B):



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



#### 4.8. mini PCI-express Interface (P27)

The SBC-FitPC2 provides one mini PCI-express expansion slot. PCI-express port

Mechanical support is provided only for full-length (50.95mm) mini PCI-express card support.

Mini PCI-express connector pinout:

Pin	Name	Pin	Name
1	WAKE#	2	+3.3V_STBY
3	N/C	4	GND
5	N/C	6	+1.5V
7	CLKREQ#	8	N/C
9	GND	10	N/C
11	CLK-	12	N/C
13	CLK+	14	N/C
15	GND	16	N/C
KEY			
17	N/C	18	GND
19	N/C	20	W_DISABLE#
21	GND	22	RST#
23	PER_N0	24	+3.3V_STBY
25	PER_P0	26	GND

27	GND	28	+1.5V
29	GND	30	SMB_CLK
31	PET_N0	32	SMB_DAT
33	PET_P0	34	GND
35	GND	36	USB_D-
37	N/C	38	USB_D+
39	N/C	40	GND
41	N/C	42	N/C
43	N/C	44	LED_WLAN#
45	N/C	46	N/C
47	N/C	48	+1.5V
49	N/C	50	GND
51	N/C	52	+3.3V_STBY

#### 4.9. Ethernet (P26)

The SBC-FitPC2 provides one Gigabit Ethernet port implemented using 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 standard RJ-45 connector P26.

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 -

## 4.10. LED's and Push Buttons

### SBC-FitPC2 push buttons

- The SBC-FitPC2 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-FitPC2 LED's

The following table describes SBC-FitPC2 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.

## 4.11. Consumer Infrared Receiver

The SBC-FitPC2 features a Consumer Infrared receiver, based on a programmed micro controller with USB interface.

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

SBC-FitPC2 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	GPIO9
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

## 5. Mechanical Considerations and Connectors' Location

The 3D solidworks model and “dxf” assembly files of the SBC-FitPC2 board may be downloaded from [Developer] >> [fit-PC2] section of CompuLab’s web-site.

## 6. Operating Temperature Ranges

The information in this section refers to the SBC-FitPC2 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-FitPC2 is available with three options of operating temperature range:

Range	Temp.	Description
Commercial	0° to 70° C	Sample cards from each batch are tested for the lower and upper temperature limits. Individual cards are not tested.
Extended	-20° to 70° C	Every card undergoes a short test for the lower limit

		(-20° C) qualification.
Industrial	-40° to 85° C	Every card is extensively tested for both lower and upper limits and at several midpoints.