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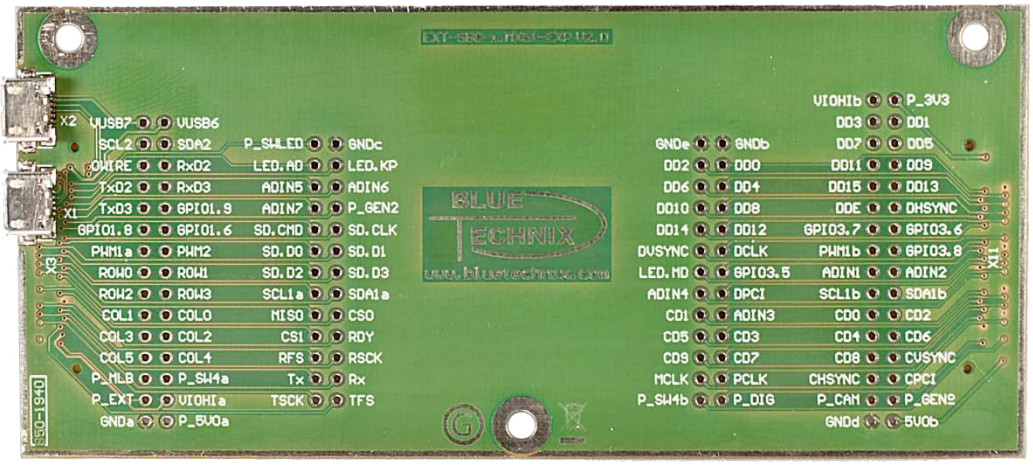

Hardware User Manual

EXT-SBC-i.MX51-EXP V2.0

...maximum performance at minimum space

Contact

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Information

For further information on technology, delivery terms and conditions and prices please contact Bluetechnix (http://www.bluetechnix.com).

Warning

Due to technical requirements components may contain dangerous substances.

i.MX Core Modules

CM-i.MX27-C-C-Q26S128F32N512

The Core Module CM-i.MX27 is powered by Freescales' SoC i.MX27 (ARM 926 core, up to 400MHz). It addresses 128MB DDR-RAM, has an onboard NOR-flash of 32MByte and a NAND-flash with 512MByte at a size of 55x45mm.

CM-i.MX31-C-C-Q26S128F40N128-E

The Core Module CM-i.MX31 is powered by Freescales' SoC i.MX31 (ARM1136JF-S core, up to 532MHz). It addresses 128MB DDR-RAM, has an onboard NOR-flash of 40MByte and a NAND-flash with 128MByte at a size of 55x45mm. Core module is available as connector or BGA.

CM-i.MX53-C-I-Q24S1024F4N2048)

The Core Module CM-i.MX53 is powered by Freescales' SoC i.MX53 (ARM® Cortex™-A8, up to 1GHz). It addresses 1024MB DDR2-SDRAM, has an onboard NOR-flash of 4MByte and a NAND-flash with 2048MByte at a size of 80x45mm.

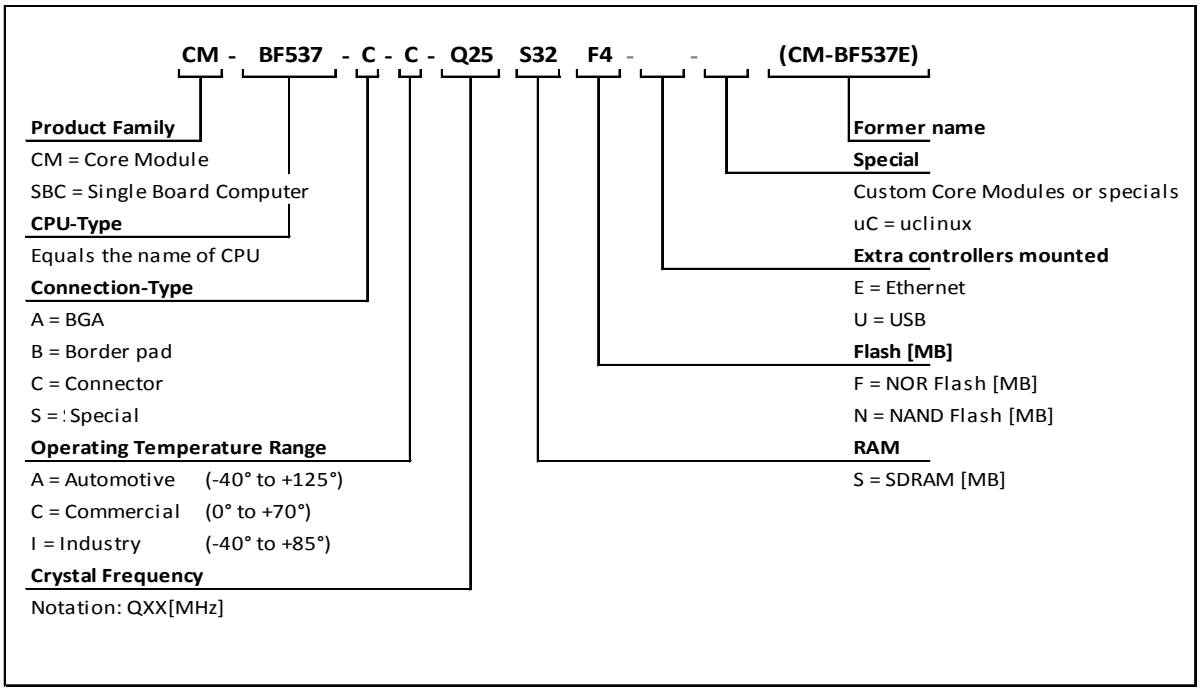
Core Module naming information

The idea is to put more Core Module specific technical information into the product name. New Core Module names will have following technical information covered in their names.

- Product Family,
- CPU-Type,
- Connection-Type,
- Operating Temperature Range,
- Crystal Frequency [MHz],
- RAM [MB],
- Flash [MB],
- External Controllers
- Optional
    - Special and/or
    - Former name

That expands of course the name but allows the customer to get the most important Core Module specific information at the first sight. Have a look at the example below to get an idea of the new Core Module names.

Example CM-BF537-C-C-Q25S32F4 (CM-BF537E)



i.MX Development Boards

DEV-i.MX27

The DEV-i.MX27 development board is an extendable development platform for the CM-i.MX27 processor modules. With display connector and keypad it can be used as a reference design for a low power mobile handheld device powered by a single Lithium Ion battery. The development board provides all interfaces of the connector version on dedicated expansion connectors. Extender boards can be plugged on top of the development board in order to enable additional interfaces.

DEV-iMX31

The DEV-i.MX31 Development Board is an extendable development platform for the CM-i.MX31 processor module. With display connector and keypad it can be used as a reference design for a low power mobile handheld device powered by a single Lithium Ion battery. The development board provides all interfaces of the connector version on dedicated expansion connectors. Extender boards can be plugged on top of the development board in order to enable additional interfaces.

SBC-i.MX51-S-C-Q24S512N2048

The Single-Board Computer SBC-i.MX51 is based on Freescale's high-performance i.MX51 mobile platform, incorporating an ARM Cortex-A8 CPU, an Image Processing Unit (IPUv3EX), a Video Processing Unit (VPU) and a Graphical Processing Unit (GPU). The IPUv3EX provides comprehensive support for connectivity to displays and cameras. The VPU supports hardware encoding and decoding of MPEG-4, H.263, H.264 and many more standards. The GPU serves 3D and 2Dacceleration in hardware. The board's memory capabilities (NAND Flash, DDR2) and numerous interfaces like Ethernet, HDMI,4xUSB and USB-OTG turn the SBC-i.MX51 into the ultimate development board for future high-end embedded devices.

DEV-i.MX53

The DEV-i.MX53 development board is an extendable development platform for the CM-i.MX53 processor module. The development board provides all interfaces of the connector version (Ethernet, HDMI,4xUSB and USB-OTG) on dedicated extender connectors. Extender boards can be plugged on top of the development board in order to enable additional interfaces.

Extender boards

Extender boards (EXT-SBC-i.MX51-) are expanding the development board SBC-i.MX51 by several interfaces and functionalities. Targeted application areas are: audio/video processing, security and surveillance, Ethernet access, positioning, automation and control, experimental development and measuring.

Note! Bluetechnix is offering tailored board developments as well.

1 Introduction

1.1 Overview

The primary goal of the EXT-SBC-i.MX51-EXP is to ensure easy connection of separate hardware with the SBC-i.MX51. Each extender connector pin is routed to a solder pad on the EXT-SBC-i.MX51-EXP. The USB-Hosts can be accessed via micro USB- connectors. The Pads are ordered in a 2.54mm pitch spacing to ensure that standard thru-hole headers or sockets can be easily soldered.

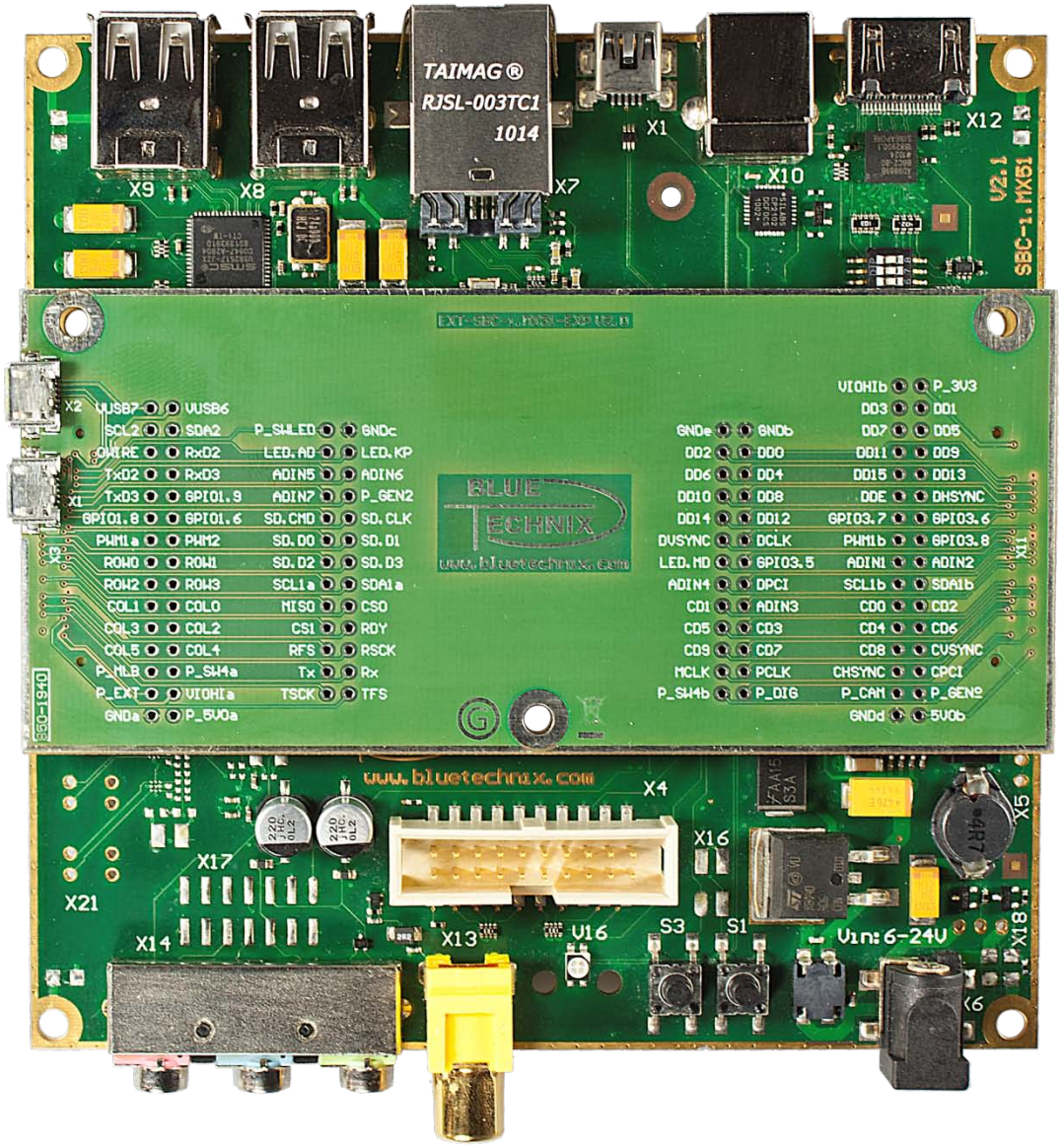


Figure 1-1: Connected EXT-SBC-i.MX51-EXP on SBC-i.MX51

2 PIN Description

2.1 I/O Power Domain Overview

All digital I/O pins belong to one of three available power domains: P_SW4 (**1.8V**), P_VIOHI (**2.775V**) or P_GEN2 (**3.15V**). The following table shows each interface with the corresponding voltage level.

Interface	Pins	Power Domain	Description
1-Wire	1	P_VIOHI	OWIRE
I²C2	2	P_VIOHI	I2C1.SCL, I2C1.SDA
Keypad	10	P_SW4	KPP.COL[0..5], KPP.ROW[0..3]
PWM	2	P_VIOHI	PWM1, PWM2
SD	6	P_GEN2	SD2.CMD, SD2.CLK, SD2.D0, SD2.D1, SD2.D2, SD2.D3
SPI	6	P_SW4	CSPI1.MOSI, CSPI1.MISO, CSPI1.SS0, CSPI1.SS1, CSPI1.RDY, CSPI1.SCLK
SSI	6	P_VIOHI	AUD4.RFS, AUD4.RSCK, AUD4.Tx, AUD4.Rx, AUD4.TSCK, AUD4.TFS
UART	4	P_VIOHI	UART2.TXD, UART2.RXD, UART3.TXD, UART3.RXD
PON	1	Open Drain	A_CTRL.PON1 – Power down Power Mgmt.
ADIN	3	-	ADC Input on MC13892
LED	2	P_SWLED	LED driver outputs

Table 2-1: Power Domains for I/Os

2.2 Pin Location

Figure 2-1: Pin location

Pin No	Signal	Type	Power Domain	Description
1	VUSB7	PWR	P_5V0	Power Supply
2	VUSB6	PWR	P_5V0	Power Supply
3	I2C2_SCL	O	P_VIOHI	usable as I2C2_SCL or GPIO2_9
4	I2C2_SDA	IO	P_VIOHI	usable as I2C2_SDA or GPIO2_8
5	OWIRE	IO	P_VIOHI	One-Wire Interface
6	RxD2	I	P_VIOHI	UART2 RxD or GPIO 1_20
7	TxD2	O	P_VIOHI	UART2 TxD or GPIO 1_21
8	RxD3	I	P_VIOHI	UART3 RxD or GPIO 1_22
9	TxD3	O	P_VIOHI	UART3 TxD or GPIO 1_23
10	GPIO1.9	IO	P_VIOHI	General Purpose Input or Output
11	GPIO1.8	IO	P_VIOHI	General Purpose Input or Output
12	GPIO1.6	IO	P_VIOHI	General Purpose Input or Output
13	PWM1	IO	P_VIOHI	GPIO1_2 with PWM1 functionality
14	PWM2	IO	P_VIOHI	GPIO1_3 with PWM2 functionality
15	ROW0	I	P_SW4	Keypad Row
16	ROW1	I	P_SW4	Keypad Row
17	ROW2	I	P_SW4	Keypad Row
18	ROW3	I	P_SW4	Keypad Row
19	COL0	I	P_SW4	Keypad Column
20	COL1	I	P_SW4	Keypad Column
21	COL2	I	P_SW4	Keypad Column
22	COL3	I	P_SW4	Keypad Column
23	COL4	I	P_SW4	Keypad Column
24	COL5	I	P_SW4	Keypad Column
25	P_MLB	PWR	P_MLB	Power Supply
26	P_SW4	PWR	P_SW4	Power Supply
27	P_EXT	PWR	P_EXT	Power Supply
28	P_VIOHI	PWR	P_VIOHI	Power Supply
29	GND	PWR	GND	Power Ground
30	P_5V0	PWR	P_5V0	Power Supply
31	P_SWLED	PWR	P_SWLED	Power Supply
32	GND	PWR	GND	Power Ground
33	LED.AD	O	P_SWLED	LED driver output connected to MC18392
34	LED.KP	O	P_SWLED	LED driver output connected to MC18392
35	ADIN5	I		Analog input connected to MC18392
36	ADIN6	I		Analog input connected to MC18392
37	ADIN7	I		Analog input connected to MC18392
38	P_GEN2	PWR	P_GEN2	Power Supply
39	SD2.CMD	IO	P_GEN2	SD-card interface or CSPI_MOSI
40	SD2.CLK	O	P_GEN2	SD-card interface or CSPI_SCLK
41	SD2.D0	IO	P_GEN2	SD-Card Interface
42	SD2.D1	IO	P_GEN2	SD- Card Interface
43	SD2.D2	IO	P_GEN2	SD- Card Interface
44	SD2.D3	IO	P_GEN2	SD- Card Interface or CSPI_SS2
45	SCLK	IO	P_SW4	SPI1 usable as I2C1_SCL or GPIO4_27
46	MOSI	IO	P_SW4	SPI1 usable also as I2C1_SDA or GPIO4_22
47	MISO	I	P_SW4	SPI1 usable also as GPIO4_23
48	CS0	O	P_SW4	SPI1 usable also as GPIO4_24
49	CS1	O	P_SW4	SPI1 usable also as GPIO4_25
50	RDY	I	P_SW4	SPI1 usable also as GPIO4_26
51	RFS	IO	P_VIOHI	Audio Port 4 usable also as GPIO2_0
52	RSCK	IO	P_VIOHI	Audio Port 4 usable also as GPIO2_3

Pin No	Signal	Type	Power Domain	Description
53	TX	O	P_VIOHI	Audio Port 4 usable also as GPIO2_4
54	RX	I	P_VIOHI	Audio Port 4 usable also as GPIO2_5
55	TSCK	IO	P_VIOHI	Audio Port 4 usable also as GPIO2_6
56	TFS	IO	P_VIOHI	Audio Port 4 usable also as GPIO2_7
57	GND	PWR	GND	Power Ground
58	GND	PWR	GND	Power Ground
59	DD2	O	P_VIOHI	Display Port 2 Data
60	DD0	O	P_VIOHI	Display Port 2 Data
61	DD6	O	P_VIOHI	Display Port 2 Data
62	DD4	O	P_VIOHI	Display Port 2 Data
63	DD10	O	P_VIOHI	Display Port 2 Data
64	DD8	O	P_VIOHI	Display Port 2 Data
65	DD14	O	P_VIOHI	Display Port 2 Data
66	DD12	O	P_VIOHI	Display Port 2 Data
67	DVSYNC	O	P_VIOHI	Display Port 3 VSYNC
68	DCLK	O	P_VIOHI	Display Port 2 Clock
69	LED.MD	O	P_SWLED	LED driver output connected to MC18392
70	GPIO3.5	IO	P_SW4	General Purpose Input or Output
71	ADIN4	I		Analog input for touch pad usage connected to MC18392
73	CD1	I	P_SW4	CMOS Sensor Interface 1 Data
72	DPCI	IO	P_VIOHI	Usable as GPIO2_20
74	ADIN3	I		Analog input for touch pad usage connected to MC18392
75	CD5	I	P_SW4	CMOS Sensor Interface 1 Data
76	CD3	I	P_SW4	CMOS Sensor Interface 1 Data
77	CD9	I	P_SW4	CMOS Sensor Interface 1 Data
78	CD7	I	P_SW4	CMOS Sensor Interface 1 Data
79	MCLK	O	P_SW4	CMOS Sensor Interface 1 Master Clock
80	PCLK	I	P_SW4	CMOS Sensor Interface 1 Pixel Clock
81	P_SW4	PWR	P_SW4	Power Supply
82	P_DIG	PWR	P_DIG	Power Supply
83	P_VIOHI	PWR	P_VIOHI	Power Supply
84	P_3V3	PWR	P_3V3	Only available if 3V3 regulator is populated on SBC i.MX51
85	DD3	O	P_VIOHI	Display Port 2 Data
86	DD1	O	P_VIOHI	Display Port 2 Data
87	DD7	O	P_VIOHI	Display Port 2 Data
88	DD5	O	P_VIOHI	Display Port 2 Data
89	DD11	O	P_VIOHI	Display Port 2 Data
90	DD9	O	P_VIOHI	Display Port 2 Data
91	DD15	O	P_VIOHI	Display Port 2 Data
92	DD13	O	P_VIOHI	Display Port 2 Data
93	DDE	O	P_SW4	Display Port 4 Data Enable
94	DHSYNC	O	P_VIOHI	Display Port 2 HSYNC
95	GPIO3.7	IO	P_SW4	Usable as GPIO3_7
96	GPIO3.6	IO	P_SW4	Usable as GPIO3_6
97	PWM1	IO	P_VIOHI	GPIO1.2 with PWM functionality
98	GPIO3.8	IO	P_SW4	Usable as GPIO3_8
99	ADIN1	I		Analog input for touch pad usage connected to MC18392
100	ADIN2	I		Analog input for touch pad usage connected to MC18392
101	SCL1	IO	P_SW4	usable as I2C1_SCL for cam configuration or GPIO4_27
102	SDA1	IO	P_SW4	usable as I2C1_SDA for cam configuration or GPIO4_22
103	CD0	I	P_SW4	CMOS Sensor Interface 1 Data
104	CD2	I	P_SW4	CMOS Sensor Interface 1 Data

Pin No	Signal	Type	Power Domain	Description
105	CD4	I	P_SW4	CMOS Sensor Interface 1 Data
106	CD6	I	P_SW4	CMOS Sensor Interface 1 Data
107	CD8	I	P_SW4	CMOS Sensor Interface 1 Data
108	CVSYNC	I	P_SW4	CMOS Sensor Interface 1 VSYNC
109	CHSYNC	I	P_SW4	CMOS Sensor Interface 1 HSYNC
110	CPCI	O	P_SW4	usable as GPIO3_12 (e.g. Power Down)
111	P_CAM	PWR	P_CAM	Power Supply
112	P_GEN3	PWR	P_GEN3	Power Supply
113	GND	PWR	GND	Power Ground
114	P_5V0	PWR	P_5V0	Power Supply

Table 2-2: Pin description

3 Operating Conditions

This section provides the operating conditions for the EXT-SBC-i.MX51-EXP Extender Board.

3.1 Power Supplies

The EXT-SBC-i.MX51-EXP provides different supply voltages. They can be used to supply custom electronics. Some supply voltages are generated by the MC13892 PMIC and can be set to different values. They must be set and enabled first by configuring the companion IC. The following table shows the maximum supply current for each voltage domain.

Signal Name	Voltage	Maximum Supply Current
P_5V0	5.0V	500mA
P_3V3	3.3V	500mA
P_VIOHI[1)]	2.775V	50mA
P_SW4[1)]	1.8V	50mA
P_GEN2[1)]	3.15V	70mA
P_GEN3	1.8V, 2.9V	50mA
P_DIG	1.05V, 1.25V, 1.65V, 1.8V	50mA
P_CAM	2.5V, 2.6V, 2.75V, 3.0V	250mA
P_EXT[3)]	2.3V, 2.5V, 2.775V, 3.0V	150mA
P_MLB[3)]	2.5V, 2.6V, 2.7V, 2.775V	350mA
P_SWLED[2)]	4.3V to 26.5V	60mA

Table 3-1: Maximum power consumption for the GPIO / Automation Connector supplies

[1)] It is not advisable to alter these voltages; otherwise the board may get damaged.
[2)] The P_SWLED voltage drives the LEDs connected to the LED-driver pins. The output voltage will be set automatically by the MC13892. Please also refer to the MC13892 errata sheet available from the Freescale website.
[3)] P_EXT is called VAUDIO and P_MLB is called VVIDEO on the MC13892 Users Guide.

3.2 Digital I/O Characteristics

Most IO pins available on the Extension Connectors (X3 and X11) are connected to the i.MX, and are assigned to one of three power domains.

Parameter	Power Domain	Symbol	Min	Typ.	Max	Unit
High-Level Output Voltage	P_VIOHI	V_{oh}	2.625	2.775	3.075	V
High-Level Output Voltage	PGEN2	V_{oh}	3.0	3.15	3.45	V
High-Level Output Voltage	P_SW4	V_{oh}	1.65	1.8	2.1	V
Low-Level Output Voltage	all domains	V_{ol}	-	-	0.15	V
High Level Output Current	all domains	I_{oh}	1.9	-	6.6	mA
Low-Level Output Current	all domains	I_{ol}	1.9	-	6.6	mA
High-Level Input Voltage	P_VIOHI	V_{ih}	1.95	-	2.775	V
Low -Level Input Voltage	P_VIOHI	V_{il}	0	-	0.83	V
High-Level Input Voltage	PGEN2	V_{ih}	2.21	-	3.15	V
Low-Level Input Voltage	PGEN2	V_{il}	0	-	0.94	V
High -Level Input Voltage	P_SW4	V_{ih}	1.26	-	1.8	V
Low -Level Input Voltage	P_SW4	V_{il}	0	-	0.54	V

Table 3-2: Digital IO characteristics

3.3 Analog Inputs

The 10-bit ADC which is integrated in the MC13892 allows measuring analog voltages. These analog inputs are mainly used for touchpad sensing or voltage (battery) monitoring.

Parameter	Symbol	Min	Typ.	Max	Unit
Resolution			10		Bit
Conversion Current	I_c		1		mA
Conversion Core Input Voltage	V_{in}	0	-	2.4	V
Conversion Time Per Channel	t_c			10	µs

Table 3-3: ADC characteristics

3.3.1 ESD Sensitivity

ESD (electrostatic discharge) sensitive device. Charged devices and circuit boards can discharge without detection. Although this product features patented or proprietary protection circuitry, damage may occur on devices subjected to high energy ESD. Therefore, proper ESD precautions should be taken to avoid performance degradation or loss of functionality.

4 Mechanical Outline

This section shows the position of all connectors and mounting holes. All dimensions are given in mm.

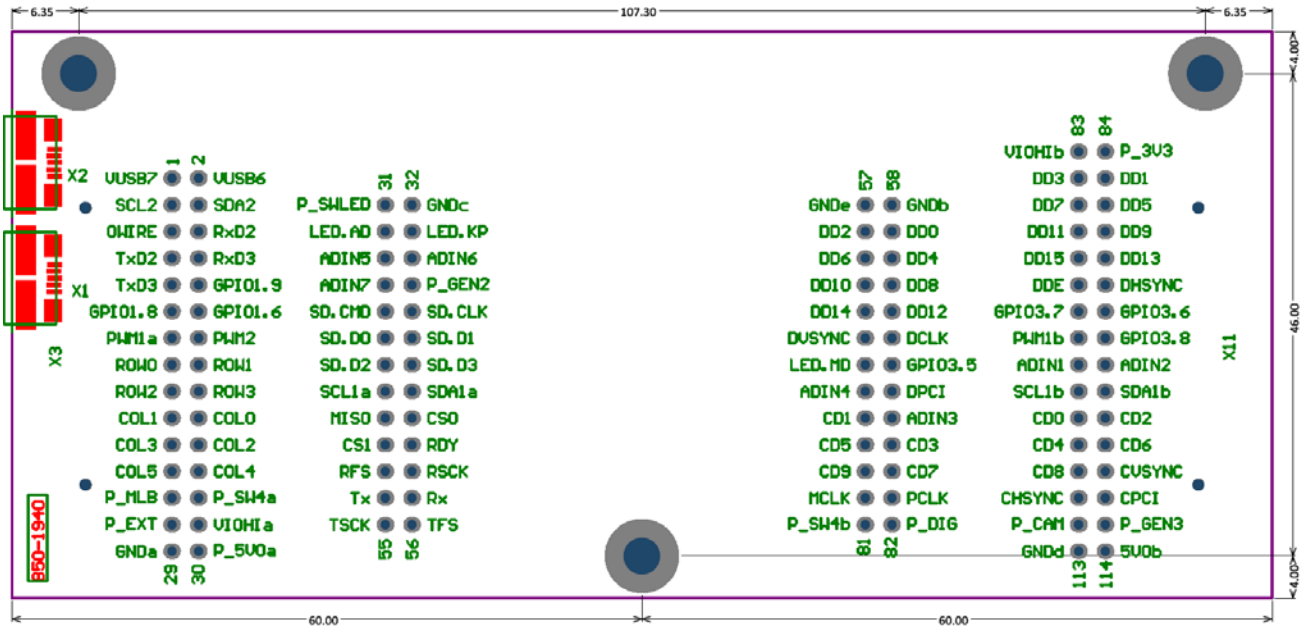


Figure 4-1: EXT-SBC-i.MX51-EXP top view

5 Support

5.1 General Support

General support for products can be found at Bluetechnix' support site https://support.bluetechnix.at/wiki

5.2 Board Support Packages

Board support packages, boot loaders and further software downloads can be downloaded at the products wiki page at https://support.bluetechnix.at/wiki

5.3 i.MX Software Support

5.3.1 Linux

Linux BSP and images of derivates can be found at Bluetechnix' support site https://support.bluetechnix.at/wiki at the software section of the related product.

5.3.2 Win CE

WinCE is only supported on ARM platforms. Please contact Bluetechnix for support information.

5.4 i.MX® Design Services

Based on more than seven years of experience with Blackfin and i.MX, Bluetechnix offers development assistance as well as custom design services and software development.

5.4.1 Upcoming Products and Software Releases

Keep up to date with all product changes, releases and software updates of Bluetechnix at http://www.bluetechnix.com.

6 Ordering Information

6.1 Predefined mounting options for EXT-SBC-i.MX51-EXP

Article Number	Name	Description
100-2520-2	EXT-SBC-i.MX51-EXP	Experimental Extender Board for SBC-i.MX51
100-4110-2	SBC-i.MX51-S-C-Q24S512N2048 (SBC-i.MX51)	Single-Board Computer SBC-I.MX51 based on i.MX51 SoC

Table 6-1: Ordering information

NOTE: Custom hard and software developments are available on request! Please contact Bluetechnix (office@bluetechnix.com) if you are interested in custom hard- and software developments.

7 Dependability

7.1 MTBF

Please keep in mind that a part stress analysis would be the only way to obtain significant failure rate results, because MTBF numbers just represent a statistical approximation of how long a set of devices should last before failure. Nevertheless, we can calculate an MTBF of the development board using the bill of material. We take all the components into account. The PCB and solder connections are excluded from this estimation. For test conditions we assume an ambient temperature of 30°C of all development board components. We use the MTBF Calculator from ALD (http://www.aldservice.com/) and use the reliability prediction MIL-217F2 Part Stress standard. Please get in touch with Bluetechnix (office@bluetechnix.com) if you are interested in the MTBF result.

8 Product History

8.1 Version Information

Version	Date	Changes
2.0	2011-04-20	The two expansion connectors have been changed to a FX10-80S from Hirose for better signal integrity and more flexibility
1.0	2010-12-22	First extender board release.

Table 8-1: Overview product changes

8.2 Anomalies

Version	Date	Description
1.0	2011-04-20	No anomalies reported yet.

Table 8-2: Overview product anomalies

9 Document Revision History

Version	Date	Document Revision
4	2011 08 04	Changed product photos.
3	2011 04 20	Changed description of Pin 84
2	2011 03 17	Update for Board Revision V2.0.
1	2010 12 22	First draft release.

Table 9-1: Revision history

10 List of Abbreviations

Abbreviation	Description
ADI	Analog Devices Inc.
AI	Analog Input
AMS	Asynchronous Memory Select
AO	Analog Output
CM	Core Module
DC	Direct Current
DSP	Digital Signal Processor
eCM	Enhanced Core Module
EBI	External Bus Interface
ESD	Electrostatic Discharge
GPIO	General Purpose Input Output
I	Input
I²C	Inter-Integrated Circuit
I/O	Input/Output
ISM	Image Sensor Module
LDO	Low Drop-Out regulator
MTBF	Mean Time Between Failure
NC	Not Connected
NFC	NAND Flash Controller
O	Output
OS	Operating System
PPI	Parallel Peripheral Interface
PWR	Power
RTOS	Real-Time Operating System
SADA	Stand Alone Debug Agent
SD	Secure Digital
SoC	System on Chip
SPI	Serial Peripheral Interface
SPM	Speech Processing Module
SPORT	Serial Port
TFT	Thin-Film Transistor
TISM	Tiny Image Sensor Module
TSC	Touch Screen Controller
UART	Universal Asynchronous Receiver Transmitter
USB	Universal Serial Bus
USBOTG	USB On The Go
ZIF	Zero Insertion Force

Table 10-1: List of abbreviations

A List of Figures and Tables

Figures

Tables