voipac

iMX6 OpenRex Single Board Computer

Designed by FEDEVEL Academy

Datasheet

Date	Revision	Changes
November 15, 2016	1.0	Initial Release
April 6, 2017	1.1	PCIe micro SIM socket updated
January 15, 2018	1.2	Android 7.1, SATA disk module added

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1. Introduction

1.1 General

iMX6 OpenRex is completely open source Single Board Computer (SBC) powered by NXP (Freescale) i.MX6 ARM® Cortex® A9 multicore CPU. The board further features NXP LPC1345 ARM® Cortex® M3 microcontroller, multiple camera inputs, and a series of built-in sensors including compass & accelerometer, gyroscope, humidity sensor, and temperature sensor making it ideal choice for industrial as well as home automation applications.

It was designed also for playing, learning and hacking thus includes Raspberry Pi & Arduino like GPIO headers, and is **available with complete Altium Designer project documentation** including **schematics** and **PCB layout** source files, as well as **manufacturing documentation**.

1.2 Software

Voipac fully supports Linux operating system with drivers for all basic interfaces. Custom additional drivers for specific applications can be developed upon request.

Operating system	Description
Yocto	Yocto Project Linux distribution preinstalled on microSDHC card by defaul
Android	Android 7.1 preinstalled on microSDHC card (SATA disk module) upon request

1.3 Booting Options

iMX6 OpenRex Single Board Computer in standard configuration comes with e-Fuses set for boot from SPI Flash. There are more booting posibilities:

Booting Option	Description
SD Card	A standard configuration board is set for this boot option (SD2) in u-boot through SPI Flash.
I2C	Supported possibilty for EEPROM booting (I2C1).
SPI	Default booting from SPI Flash on OpenRex Single Board Computer (SPI3).
SPI	Possible SPI1 booting. Signals are on connector J2 (RPi Header).
SATA	Available only with i.MX6 QuadPlus / Quad / Dual processors.

The SBC supports following booting options:
- Boot From e-Fuses : Standard mode
- Serial Downloader : USB mode

Internal Boot mode is not supported.

1.4 Hardware – *Block Diagram*

1.5 Features

FEATURES		ULTRA CONFIGURATION	MAX CONFIGURATION	BASIC CONFIGURATION
NXP (Freescale) i.MX6 ARM® Cortex® A9		QuadPlus CPU, 1GHz	Quad CPU, 1GHz	Solo CPU, 1GHz
NXP microcontroller LPC1345FHN33 ARM® Cortex® M3, 72MHz		✓	✓	✓
DDR3-1066 SDRAM		4GB (533MHz)	2GB (533MHz)	512MB (400MHz)
1x 10/100/1000 Mbps Ethernet		✓	✓	✓
1x HDMI Output (up to QXGA 2048×1536)		✓	✓	✓
1x Parallel CSI Camera input or RGB Parallel Display output		✓	✓	✓
1x Differential Camera Input (Compatible with Raspberry Pi) or LVDS display output)		✓	✓	✓
1x SATA		✓	✓	✗
1x micro SD		✓	✓	✓
PCIE mini slot + micro SIM (can be used for WiFi or Wireless modem)		✓	✓	✓
1x USB OTG Micro		✓	✓	✓
2x USB		✓	✓	✓
1x CAN transceiver		✓	✓	✓
1x Compass + Accelerometer		✓	✓	✓
1x Gyroscope		✓	✓	✓
1x Humidity sensor		✓	✓	✓
1x Temperature sensor		✓	✓	✓
1x Audio (Headphones output, Microphone input)		✓	✓	✓
1x Touchscreen connector (Touchscreen through LPC1345 / Optional 4x Analog input)		✓	✓	✓
1x EEPROM		16Kbit I2C	16Kbit I2C	2Kbit I2C
1x 32Mbit SPI FLASH		✓	✓	✓
1x IR Receiver		✓	✓	✓
1x Arduino type header (Default)	4x Analog input 3x GPIO 1x I2C 1x CAN 1x USB	✓	✓	✓
1x Raspberry Pi type header (Default)	2x I2C 2x UART 1x CAN TX/RX 2x SPI 3x GPIO/PWM	✓	✓	✓
1x UART Debug console (FTDI compatible)		✓	✓	✓
8+2 USER LED		✓	✓	✓
Power LED, SD Card LED, USB HUB LED		✓	✓	✓
1x Reset button, 3x User button (e.g. Home, Volume Up, Volume Down)		✓	✓	✓
Size: 70 x 95 mm (2.75 x 3.75 inch)				
Input power: 5V DC (through Power Jack or USB micro)				
8GB microSDHC Class 4 memory card				
1x Aluminum 14x14x14mm heatsink				
0°C to +70°C commercial temperature range				
Yocto Project Linux distribution preinstalled on microSDHC card				
Lead free / REACH / RoHS compliant				

1.6 Reference Documents

For more detailed technical information about the iMX6 OpenRex SBC components, please refer to the web resources and documents listed below.

Component	Manufacturer	Type
Microprocessor ARM® Cortex®-A9	NXP (Freescale)	i.MX6 QuadPlus / i.MX6 Quad / i.MX6 Solo
Microcontroller ARM® Cortex®-M3 LPC13xx	NXP	LPC1345FHN33
DDR3 SDRAM 4GBIT 800MHZ FBGA	Micron Technology	MT41J256M16HA-125:E
EEPROM 2KBIT(BASIC Config.) / 16KBIT(MAX Config.) 400KHZ 8MSOP	Rohm Semiconductor	BR24Lxxx-W
SPI **FLASH** 32MBIT	Microchip Technology	SST26VF032B-104I/MF-ND
Transceiver Full **Ethernet**	Microchip Technology	KSZ9021RN
HDMI Transmitter IC Consumer Electronics	ON Semiconductor	CM2020-00TR
Stereo **Audio** Interface	NXP (Freescale)	SGTL5000XNAA3R2
USB Hub Controller USB 2.0	Microchip Technology	USB2514BI-AEZG
High Speed **CAN Transceiver**	NXP (Freescale)	TJA1040T
IR Receiver Module	Vishay Semiconductor	TSOP38238
3-Axis Digital Angular Rate **Gyroscope**	NXP (Freescale)	FXAS21002CQR1
3-Axis Linear **Accelerometer** and 3-Axis **Magnetometer**	NXP (Freescale)	FXOS8700CQR1
Temperature Sensor Digital	Texas Instruments	TMP101NA
Humidity and **Temperature Sensor**	Sensirion AG	SHT21
14 Channel Configurable **Power Management Integrated Circuit**	NXP (Freescale)	MMPF0100NPAEP
Compact Synchronous Buck Regulator	Intersil	ISL8024AIRTAJZ-T7A

2. Functional Processor Description

2.1 Features

The i.MX6 processor features NXP's advanced and power-efficient implementation of the ARM® Cortex® A9 core, which operates at speeds as high as 1,2 GHz. Up to 533 MHz DDR3 and mobile DDR DRAM clock rates are supported. The CPU is suitable for the following applications:

• **Tablets**	• **Smartbooks**	• **E-Readers**
• **Home audio systems**	• **Home energy management systems**	• **Portable medical devices**
• **Automotive infotainment**	• **In-flight entertainment**	• **Point-of-sale devices**
• **Digital signage**	• **Intelligent industrial control systems**	• **Vehicle to vehicle connectivity**
• **Human-machine interface**	• **IP phones, IPTV**	• **Secure smart-connected devices**

More information in interactive table on NXP /Freescale webpage

2.2 i.MX6 Series Applications Processors Block Diagram

Available on certain product families. More information in interactive table on NXP/Freescale's webpage

i.MX6 Quad
Quad ARM® Cortex®-A9 up to 1.2 GHz
• 1 MB L2 cache, NEON, VFPvd16 TrustZone • 3D graphics with four shaders • Two 2D graphics engines • 64-bit DDR3 and 2-channel 32-bit LPDDR2 at 533 MHz • Gigabit Ethernet MAC • Integrated SATA-II • HDMIv1.4 controller plus PHY • LVDS controller plus PHY • PCIe controller plus PHY • MLB and FlexCAN controllers

i.MX6 QuadPlus
Quad ARM® Cortex®-A9 up to 1.2 GHz
• 1 MB L2 cache, NEON, VFPvd16 TrustZone • **Enhanced** 3D graphics with four shaders • **Enhanced** Two 2D graphics engines • **Prefetch & Resolve Engine** • **Optimized** 64-bit DDR3 and 2-channel 32-bit LPDDR2 at 533 MHz • Gigabit Ethernet MAC • Integrated SATA-II • HDMIv1.4 controller plus PHY • LVDS controller plus PHY • PCIe controller plus PHY • MLB and FlexCAN controllers

↓↑ Red indicates change from table to the left

i.MX6 Solo
Single ARM® Cortex®-A9 up to 1.0 GHz
• 512 KB L2 cache, NEON, VFPvd16 TrustZone • 3D graphics with one shader • 2D graphics • 32-bit DDR3 and LPDDR2 at 400 MHz • Gigabit Ethernet MAC • Integrated EPD controller • HDMIv1.4 controller plus PHY • LVDS controller plus PHY • PCIe controller plus PHY • MLB and FlexCAN controllers

i.MX6 Dual
Dual ARM® Cortex®-A9 up to 1.2 GHz
• **1 MB** L2 cache, NEON, VFPvd16 TrustZone • 3D graphics with **four** shaders • **Two** 2D graphics engines • **64-bit** DDR3 and 2-channel 32-bit LPDDR2 at 533 MHz • Gigabit Ethernet MAC • Integrated **SATA-II** • HDMIv1.4 controller plus PHY • LVDS controller plus PHY • PCIe controller plus PHY • MLB and FlexCAN controllers

3. Features Description

3.1 User Interfaces

The following user interfaces are available on the Voipac iMX6 OpenRex SBC.

Interface	Description
HDMI	HDMI Output with Audio
USB	1x USB OTG, 2x USB, 1x USB on Header, 1x USB on Mini PCIe Slot
PCIE	Mini Card Socket (PCIE & USB)
Power Input	Power Jack or USB Micro Connector
Headers	4x UART, 2x SPI, 1x CAN (Differential), 3x I2C, 3x PWM, 8x GPIO, 4x Analog Inputs, Power Output +3V3 and +5V

3.2 Board Layout – Connectors, Jumpers, LEDs, Buttons and Peripheral selection resistors

The top and bottom component placement on the next page shows interfaces layout of the iMX6 OpenRex SBC. All useful interfaces are shown in assembly top and bottom drawings and sumarized in subsection 3.3.

TOP SIDE

J6
J5
C234
J4
J3
JP2
U12
U13
U7
U15
U5
SW4
SW3
SW2
U4
U1
U3
J1
J8
U2
U9
JP1
C258
C257
Q7
D9
SW1
C88
J13
J14
J9
J11
U23

BOTTOM SIDE

PSR2
PSR3
PSR1
PSR4
J2
J7
J10
J12
J15
J16
J17
C233
C238
L13
U36
U32
U33
U19
U18
U14
U6
D17
D20
Y4
Y5
Y2
R100

3.3 Connectors, Jumpers, LEDs, Buttons and Resistors list

CONNECTORS		
Ref.Num.	**Description**	**Page**
J1	Arduino Like Header	13
J2	Raspberry Pi Compatible Connector	14
J3	UART Serial Console	15
J4	USB 2x Host Stacked	15
J5	HDMI Output Connector	16
J6	1G Ethernet Connector RJ-45	17
J7	CSI Camera Input or RGB Display Output	18
J8	SATA Connector	19
J9	Power Jack	20
J10	Touchscreen Connector	20
J11	USB OTG	20
J12	Raspberry Pi Camera or LVDS	21
J13	Micro SD Slot	21
J14	Audio Jack	22
J15	PCIe Mini Card Slot	23
J16	PCIe Mini Card Latch	
J17	PCIe Micro SIM Socket	24

PERIPHERAL SELECTIONS RESISTORS		
Ref.Num.	**Description**	**Page**
PSR1	USB0 Routing	29
PSR2	USB1 Routing	29
PSR3	USB1 to Header / MCU Routing	30
PSR4	CSI/LVDS Routing	30

BUTTONS		
Ref.Num.	**Description**	**Page**
SW1	Reset /Power Button	26
SW2	User/Android Button (Home/Wake Up)	26
SW3	User/Android Button (Back/Volume-)	26
SW4	User/Android Button (Recent/Volume+)	26

LEDS		
D1	CPU/MCU User LED	27
D2	CPU/MCU User LED	27
D3	CPU/MCU User LED	27
D5	CPU User LED	27
D6	CPU User LED	27
D7	CPU User LED	27
D11	MPCIE LED	27
D12	USB Hub LED	27
D14	microSD LED	28
D21	CPU User LED	28
D22	Power OK LED	28
D24	MCU User LED	28
D25	MPCIE LED	27
D26	MPCIE LED	27
D33	CPU/MCU User LED	27
D34	CPU User LED	27

JUMPERS		
Ref.Num.	**Description**	**Page**
JP1	Power Input Selection	25
JP2	Boot Mode selection	25

4. Connector Description

This chapter describes the connectors of the iMX6 OpenRex SBC. Some connectors have dedicated functionality, but some like TFT can be used also for other purposes, like general purpose IO (GPIO) or general expansion bus. Described functions are **default**.

4.1 Pinout Description

4.1.1 J1 – Arduino Like Header (CONN RCPT 40POS .100" GOLD)

Description: 20 Position Receptacle Connector 0.100" (2.54mm) Through Hole Gold.
The Connector is accesible from both sides. More functions are supported.
(See Schematics, page 24)

Manufacturer: Samtec Inc.
Connector: **ESQ-120-14-G-S**

PIN	Signal Name	Type	Description
1	+VIN_5V	PO	
2	USB_HDR_N	I/O	
3	USB_HDR_P	I/O	
4	GND	G	
5	I2C1_SDA	I/O	
6	I2C1_SCL	I/O	
7	+3V3_HDR	PO	
8	CAN_N	I/O	
9	CAN_P	I/O	
10	GND	G	
11	CPU_GPIO0	I/O	
12	CPU_GPIO1	I/O	
13	CPU_GPIO2	I/O	
14	RSTOUTn	O	
15	RST_BTN_HDR	I	
16	GND	G	
17	ANALOG_IN_0	I	
18	ANALOG_IN_1	I	
19	ANALOG_IN_2	I	
20	ANALOG_IN_3	I	

4.1.2 J2 – Raspberry PI Compatible Connector (CONN RCPT 40POS .100" DUAL GOLD)

Description: 40 Position Receptacle Connector 0.100" (2.54mm) Through Hole Gold.
The Connector is accesible from both sides. More functions are supported.
(See Schematics, page 24)

Manufacturer: Samtec Inc.
Connector: **ESQ-120-14-G-D**

Description	Type	Signal Name	PIN	PIN	Signal Name	Type	Description
	PO	+3V3_HDR	1	2	+VIN_5V	PO	
	I/O	I2C3_SDA	3	4	+VIN_5V	PO	
	O	I2C3_SCL	5	6	GND	G	
	I/O	GPIO_OR_CLK	7	8	UART3_TXD	O	
	G	GND	9	10	UART3_RXD	I	
	O	UART3_RTS	11	12	UART_TXD	O	
	I	UART4_RXD	13	14	GND	G	
	O	FLEXCAN2_TX	15	16	FLEXCAN2_RX	I	
	PO	+3V3_HDR	17	18	UART5_RXD	I	
	O	CSPI1_MOSI	19	20	GND	G	
	I	CSPI1_MISO	21	22	UART5_TXD	O	
	O	CSPI1_CLK	23	24	CSPI1_CS0	O	
	G	GND	25	26	CSPI1_CS1	O	
	I/O	I2C2_SDA	27	28	I2C2_SCL	O	
	I/O	GPIO_OR_PWM_1	29	30	GND	G	
	I/O	GPIO_OR_PWM_2	31	32	GPIO_OR_PWM_3	I/O	
	I/O	GPIO_OR_PWM_4	33	34	GND	G	
	O	CSPI2_CS0	35	36	UART3_CTS	I	
	O	CSPI2_MOSI	37	38	CSPI2_CLK	O	
	G	GND	39	40	CSPI2_MISO	I	

4.1.3 J3 – UART Serial Console *(CONN HEADER 6POS .100 STR 15AU)*

Description: 6 Positions Header, Unshrouded Connector 0.100" (2.54mm) Through Hole Gold or Gold, GXT™.
Serial console header is designed to be used with FTDI TTL-232R-3V3 TTL to USB Serial Converter.

Manufacturer: Amphenol FCI
Connector: **68001-206HLF**

PIN	Signal Name	Type	Description
1	GND	G	
2	UART1_RTS_FTDI	O	
3	+5V_FTDI	PI	
4	UART1_RXD_FTDI	I	
5	UART1_TXD_FTDI	O	
6	UART1_CTS_FTDI	I	

4.1.4 J4 – USB 2x Host Stacked *(CONN RCPT R/A 4OVER4POS GOLD PCB)*

Description: USB - A, Stacked USB 2.0 Receptacle Connector 8 Position Through Hole, Right Angle, Horizontal.

Manufacturer: TE Connectivity AMP Connectors
Connector: **5787617-1**

Description	Type	PIN Name	PIN	PIN	PIN Name	Type	Description
+5V_USB_BOT	PO	VBUS1	1	5	VBUS2	PO	+5V_USB_TOP
USB_BOT_L_N	I/O	D1-	2	6	D2-	I/O	USB_TOP_L_N
USB_BOT_L_P	I/O	D1+	3	7	D2+	I/O	USB_TOP_L_P
GND	G	GND1	4	8	GND2	G	GND

4.1.5 J5 – HDMI Output Connector (CONN RCPT 19POS HDMI RT ANG SMD)

Description: HDMI Receptacle Connector 19 Position Surface Mount, Right Angle, Horizontal.

Manufacturer: Molex, LLC
Connector: **47151-0001**

PIN	PIN Name	Type	Description
1	D2+	O	HDMI_D2_P
2	D2 SHIELD	G	GND
3	D2-	O	HDMI_D2_N
4	D1+	O	HDMI_D1_P
5	D1 SHIELD	G	GND
6	D1-	O	HDMI_D1_N
7	D0+	O	HDMI_D0_P
8	D0 SHIELD	G	GND
9	D0-	O	HDMI_D0_N
10	CK+	O	HDMI_CLK_P
11	CK SHIELD	G	GND
12	CK-	O	HDMI_CLK_N
13	CE REMOTE	I/O	HDMI_CEC_CON
14	NC.14		Not connected
15	DDC CLK	O	HDMI_SCL_CON
16	DDC DATA	I/O	HDMI_SDA_CON
17	GND	G	GND
18	+5V	PO	+5V_HDMI_CON
19	HP DET	I	HDMI_HPD_CON

4.1.6 J6 – Ethernet Connector (CONN MAGJACK 1PORT SHLD 1000BT)

Description: 1 Port RJ45 Magjack Connector Through Hole 10/100/1000 Base-T, AutoMDIX.

Manufacturer: Bel Fuse Inc.
Connector: **L829-1J1T-43**

PIN	PIN Name	Type	Description
1	TRCT3		
2	TRD3-	I/O	TRD2_N
3	TRD3+	I/O	TRD2_P
4	TRD2+	I/O	TRD1_P
5	TRD2-	I/O	TRD1_N
6	TRCT2		
7	TRCT4		
8	TRD4+	I/O	TRD3_P
9	TRD4-	I/O	TRD3_N
10	TRD1-	I/O	TRD0_N
11	TRD1+	O	TRD0_P
12	TRCT1		
13	Y_CATODE	O	ENET_LED_LINK
14	Y_ANODE		+3V3
15	O_CATODE	NC	ENET_LED_RX
16	COM_ANODE	G	+3V3
17	G_CATODE	O	ENET_LED_RX
18	SHIELD1	G	GND
19	SHIELD2	G	GND

Link / Activity	State of Yellow LED	State of Green LED
Link off	OFF	OFF
1000 Link / No activity	ON	OFF
1000 Link / Activity	Blinking	OFF
100 Link / No Activity	OFF	ON
100 Link / Activity	OFF	Blinking
10 Link / No Activity	ON	ON
10 Link / Activity	Blinking	Blinking

4.1.7 J7 – CSI Camera Input or RGB Display Output *(CONN FPC BOTTOM 40POS 0.50MM R/A)*

Description: 40 Position FPC Connector Contacts, Bottom 0.020" (0.50mm) Surface Mount, Right Angle. More functions are supported. **(See Schematics, page 17)**

Manufacturer: TE Connectivity AMP Connectors
Connector: **4-1734592-0**

PIN	Signal Name	Type	Description
1	+3V3		
2	+3V3		
3	GND		
4	VID_IN_CSI1_PIXCLK	I	
5	GND		
6	VID_IN_CSI1_HSYNC	I	
7	VID_IN_CSI1_VSYNC	I	
8	GND		
9	VID_IN_CSI1_D0	I	
10	VID_IN_CSI1_D1	I	
11	VID_IN_CSI1_D2	I	
12	VID_IN_CSI1_D3	I	
13	GND		
14	VID_IN_CSI1_D4	I	
15	VID_IN_CSI1_D5	I	
16	VID_IN_CSI1_D6	I	
17	VID_IN_CSI1_D7		
18	GND		
19	VID_IN_CSI1_D8	I	
20	VID_IN_CSI1_D9	I	
21	VID_IN_CSI1_D10	I	
22	VID_IN_CSI1_D11	I	
23	GND		
24	VID_IN_CSI1_D12	I	
25	VID_IN_CSI1_D13	I	
26	VID_IN_CSI1_D14	I	
27	VID_IN_CSI1_D15	I	

PIN	Signal Name	Type	Description
28	GND		
29	VID_IN_CSI1_D16	I	
30	VID_IN_CSI1_D17	I	
31	VID_IN_CSI1_D18	I	
32	VID_IN_CSI1_D19	I	
33	GND		
34	VID_IN_CSI1_DE	I	
35	VID_IN_CSI1_INT	I	
36	VID_IN_CSI1_INT2	I	
37	VID_IN_CSI1_RSTn	O	
38	GND		
39	I2C3_SDA	I/O	
40	I2C3_SCL	O	

4.1.8 J8 – SATA Connector (CONN SATA HDR 7POS PCB VERT)

Description: High Speed Connector to the SATA Interface (SATA interface is available only on Quad and Dual i.MX6 Processors).

Manufacturer: Molex, LLC
Connector: **0471554001**

PIN	PIN Name	Type	Description
1	GND1	G	GND
2	TX+	O	SATA_TX_P
3	TX-	O	SATA_TX_N
4	GND2	G	GND
5	RX-	I	SATA_RX_N
6	RX+	I	SATA_RX_P
7	GND3	G	GND

4.1.9 J9 – Power Input Connector *(CONN PWR JACK 2.1X5.5MM HIGH CUR)*

Description: Power Barrel Connector Jack 2.00mm ID (0.079"), 5.50mm OD (0.217") Surface Mount.

Manufacturer: CUI Inc.
Connector: **PJ-002AH**

PIN	Signal Name	Type	Description
Center	+V_INPUT	PI	Input power for the board
Outer Barrel	GND	G	Power ground

4.1.10 J10 – Touchscreen Connector *(CONN HEADER 4POS 1.25MM R/A SMD)*

Description: 4 Positions Header, Shrouded Connector 0.049" (1.25mm) Surface Mount, Right Angle Tin.

Manufacturer: Molex, LLC
Connector: **0532610471**

PIN	Signal Name	Type	Description
1	TS_X+	I	X+ channel input
2	TS_X-	I	X- channel input
3	TS_Y-	I	Y- channel input
4	TS_Y+	I	Y+ channel input

4.1.11 J11 – USB OTG *(CONN RCPT MICRO USB AB R/A SMD)*

Description: USB OTG connector is connected to the CPU-USB0 interface. It can be used as a slave for the debugging purposes (by default) or as a master to connect USB device.
(See Schematics, page 19)
Micro USB connector can also power the whole board. **(See Schematics, page 28)**

Manufacturer: Molex, LLC
Connector: **0475890001**

PIN	PIN Name	Type	Description
1	5V	PO/PI	+5V_USB_OTG
2	D-	I/O	USB_OTG_CON_N
3	D+	I/O	USB_OTG_CON_P
4	ID	I/O	USB0_ID
5	G	G	GND

4.1.12 J12 – Raspberry Pi Camera or LVDS *(CONN FPC BOTTOM 15POS 1.00MM R/A)*

Description: 15 Position FPC Connector Contacts, Bottom 0.039" (1.00mm) Surface Mount, Right Angle. Can be used as LVDS Output. **(See Schematics, page 17)**

Manufacturer: TE Connectivity AMP Connectors
Connector: **1-84952-5**

PIN	Signal Name	Type	Description
1	GND	G	
2	CSI_D0_N	I	
3	CSI_D0_P	I	
4	GND	G	
5	CSI_D1_N	I	
6	CSI_D1_P	I	
7	GND	G	
8	CSI_CLK0_N	I	
9	CSI_CLK0_P	I	
10	GND	G	
11	CSI1_GPIO0	I/O	
12	CSI1_GPIO1	I/O	
13	I2C2_CSI_SCL	O	
14	I2C2_CSI_SDA	I/O	
15	+VDD_CSI	PO	+3V3

4.1.13 J13 – microSD^{TM} Slot *(CONN MICRO SD 8 POS SMD)*

Description: Slot J13 is connected to the CPU-SD2 interface. Card detection is supported. Possible boot up from the card inserted into the slot J13. e-Fuses must be set correctly.

Manufacturer: Wurth Electronics Inc.
Connector: **693071010811**

PIN	PIN Name	Type	Description
1	DAT2	I/O	SD2_DATA2
2	CD/DAT3	I/O	SD2_DATA3
3	CMD	I/O	SD2_CMD
4	VDD	PO	+3v3
5	CLK	O	SD2_CLK
6	VSS	G	GND
7	DAT0	I/O	SD2_DATA0
8	DAT1	I/O	SD2_DATA1
9	SW_1	I	SD2_CD
10	SW_2	I	SD2_CD
11	CASE2	G	GND
12	CASE3	G	GND

4.1.14 J14 – Audio Jack (CONNECTOR, PHONO, 3.5MM, JACK, 4POLE)

Description: This component is a 3.5mm 4 pole jack socket. This jack socket is for applications with a suitable interface control where additional functionality is controlled by the fourth circuit. Audio Jack is designed to support CTIA/AHJ standard.

Manufacturer: Cliff Electronic Components
Connector: **FC68125**

PIN	PIN Name	Type	Description
1	SLEEVE	I	FIL_MIC_IN
2	RING	O	FIL_HP_OUTR
3	TIP1	O	FIL_HP_OUTL
4	TIP2	O	FIL_HP_OUTL
5	HOLE_1	NC	
6	SL&RING		GND
7	HOLE_2	NC	

Audio Jack Reference

4.1.15 J15 – PCIe Mini Card 1 Slot (CONN MINI EXPRESS CARD 52POS SMD)

Description: The Card Socket is connected to the PCI Express interface.

Manufacturer: Japan Aviation Electronics Industry, Limited
Connector: JAE **MM60-52B1-E1-R650**
Card Latch: JAE MM60-EZH059-B5-R650

Description	Type	PIN Name	PIN	PIN	PIN Name	Type	Description
PCIE_WAKE	OD	WAKE#	1	2	3.3V_1	PO	+3V3_MPCIE
	NC	Reserved_1	3	4	GND_7	G	GND
	NC	Reserved_2	5	6	1.5V_1	PO	+1V5_MPCIE
	NC	CLKREQ#	7	8	UIM_PWR	PI	+MPCIE_SIM_PWR
GND	G	GND_1	9	10	UIM_DATA	I/O	MPCIE_SIM_DATA
PCIE_CLK_N	O	REFCLK-	11	12	UIM_CLK	I	MPCIE_SIM_CLK
PCIE_CLK_P	O	REFCLK+	13	14	UIM_RESET	I	MPCIE_SIM_RST
GND	G	GND_2	15	16	UIM_VPP	PI	+MPCIE_SIM_VPP
		Reserved / UIM_C8	17	18	GND_8	G	GND
		Reserved / UIM_C4	19	20	W_DISABLE#	O	PCIE_WDISn
GND	G	GND_3	21	22	PERST#	O	PCIE_RSTn
PCIE_RX_N	I	PERn0	23	24	+3.3Vaux	PO	+3V3_MPCIE
PCIE_RX_P	I	PERp0	25	26	GND_9	G	GND
GND	G	GND_4	27	28	1.5V_2	PO	+1V5_MPCIE
GND	G	GND_5	29	30	SMB_CLK	O	I2C2_SCL
PCIE_TX_N	O	PETn0	31	32	SMB_DATA	I/O	I2C2_SDA
PCIE_TX_P	O	PETp0	33	34	GND_10	G	GND
GND	G	GND_6	35	36	USB_D-	I/O	USB_MPCIE_N
GND	G	Reserved_3	37	38	USB_D+	I/O	USB_MPCIE_P
+3V3_MPCIE	PO	Reserved_4	39	40	GND_11	G	GND
+3V3_MPCIE	PO	Reserved_5	41	42	LED_WWAN#	I	LED_MPCIE_WWAN
GND	G	Reserved_6	43	44	LED_WLAN#	I	LED_MPCIE_WLAN
	NC	Reserved_7	45	46	LED_WPAN#	I	LED_MPCIE_WPAN
	NC	Reserved_8	47	48	1.5V_3	PO	+1V5_MPCIE
+5V_MPCIE	PO	Reserved_9	49	50	GND_12	G	GND
+5V_MPCIE	PO	Reserved_10	51	52	3.3V_2	PO	+3V3_MPCIE

4.1.16 J17 – PCIe Micro SIM Socket (CONN SMART CARD)

Description: 8 Position Card Connector Micro SIM Surface Mount, Right Angle Gold.

Manufacturer: Wurth Electronics Inc.
Connector: **693022010811**
Card Type: Micro SIM

PIN	PIN Name	Type	Description
C1	VCC		+MPCIE_SIM_PWR
C2	RESET		MPCIE_SIM_RST
C3	CLK		MPCIE_SIM_CLK
C4	RFU_1		MPCIE_SIM_C4
C5	GND	G	
C6	VPP		+MPCIE_SIM_VPP
C7	I/O		MPCIE_SIM_DATA
C8	RFU_2		MPCIE_SIM_C8
G1	GND_1	G	
G2	GND_2	G	

5. Jumper, Buttons, LEDs and Resistors Description

5.1 Jumper Pinout Description

5.1.1 JP1 – Power Input Selection *(1x2pin, BERGSTIK II .100" SR STRAIGHT)*

Description: 2 Positions Header, Unshrouded Connector 0.100" (2.54mm) Through Hole Gold or Gold, GXT™.

Manufacturer: FCI Electronics
Connector: **68001-202HLF**
Mating housing: TE 1658622-1 or equivalent

Status	Level	Description
CLOSED	GND	Board powered through USB OTG connector when Power Jack is not plugged in (e.g. USB charger can power up the board).
OPEN	+5V_USB_OTG_Q	Board powered Trough Power Jack **(default)**

5.1.2 JP2 – Boot Mode Selection *(1x2pin, BERGSTIK II .100" SR STRAIGHT)*

Description: 2 Positions Header, Unshrouded Connector 0.100" (2.54mm) Through Hole Gold or Gold, GXT™.

Manufacturer: FCI Electronics
Connector: **68001-202HLF**
Mating housing: TE 1658622-1 or equivalent

Status	Level	Description
CLOSED	GND	USB OTG bootloader mode
OPEN	+3V0_ALWAYS	Boots from e-Fuses **(default)**

Usage: By default, the board boots up from the e-Fuses. For special purpose the link on JP2 can be fitted. The board then boots from the USB OTG host device.

5.2 Buttons and LEDs Description

5.2.1 SW1 – Reset/Power button *(SWITCH TACTILE SPST-NO 0.05A 12V)*

Description: The SW1 button is used to reset the board **by default**. It is a hardware reset. This button can be set up for power on/off feature. **(See Schematics, page 25)**

Manufacturer: Apem Inc.
Connector: **MJTP1138ATR**

5.2.2 SW2 – User/Android Button (Home/Wake Up) *(SWITCH TACTILE SPST-NO 0.05A 12V)*

Description: The SW2 button is a general purpose button and can be used by your application. This button can be used by both: CPU and MCU.

ANDROID FUNCTION - HOME / WAKE UP

Manufacturer: Apem Inc.
Connector: **MJTP1138ATR**

5.2.3 SW3 – User/Android Button (Back/Volume-) *(SWITCH TACTILE SPST-NO 0.05A 12V)*

Description: The SW3 button is a general purpose button and can be used by your application.

ANDROID FUNCTION - BACK / VOLUME-

Manufacturer: Apem Inc.
Connector: **MJTP1138ATR**

5.2.4 SW4 – User/Android Button (Recent/Volume+) *(SWITCH TACTILE SPST-NO 0.05A 12V)*

Description: The SW4 button is a general purpose button and can be used by your application.

ANDROID FUNCTION - RECENT / VOLUME+

Manufacturer: Apem Inc.
Connector: **MJTP1138ATR**

5.2.5 D1, D2, D3, D33 – CPU/MCU User LED (RED) (LED SMARTLED RED 630NM 0603 SMD)

Description: These LED diodes are general purpose indicators and can be used by your application using both: CPU and MCU.

Manufacturer: OSRAM Opto Semiconductors Inc.
Connector: **LS L29K-H1J2-1-Z**

5.2.6 D5, D6, D7, D34 – CPU User LED (RED) (LED SMARTLED RED 630NM 0603 SMD)

Description: These LED diodes are general purpose indicators and can be used by your application.

Manufacturer: OSRAM Opto Semiconductors Inc.
Connector: **LS L29K-H1J2-1-Z**

5.2.7 D11, D25, D26 – MPCIE LEDs (GREEN) (LED SMARTLED GREEN 570NM 0603)

Description: These LED diodes indicate the PCIe Mini Card activity:

D11 - PCIe Mini Card WWAN activity
D25 - PCIe Mini Card WLAN activity
D26 - PCIe Mini Card WPAN activity

Manufacturer: OSRAM Opto Semiconductors Inc.
Connector: **LG L29K-G2J1-24-Z**

5.2.8 D12 – USB LED (ORANGE) (LED SMARTLED ORANGE 606NM 0603)

Description: D12 indicates an Active / Suspend status of the USB Interface.

LED Status: LED ON – USB is active.
LED OFF – USB is not plugged in.

Manufacturer: OSRAM Opto Semiconductors Inc.
Connector: **LO L29K-H2K1-24-Z**

5.2.9 D14 – microSD LED (ORANGE) (LED SMARTLED ORANGE 606NM 0603)

Description: D14 indicates that the SD2 interface is in the busy state.

LED Status: LED ON – (`SD2_ACT High`): SD interface busy
LED OFF – (`SD2_ACT Low`): SD interface in idle

Manufacturer: OSRAM Opto Semiconductors Inc.
Connector: **LO L29K-H2K1-24-Z**

5.2.10 D21 – CPU User LED (ORANGE) (LED SMARTLED ORANGE 606NM 0603)

Description: User LED D21 can be controlled using PWM output.

Manufacturer: OSRAM Opto Semiconductors Inc.
Connector: **LO L29K-H2K1-24-Z**

5.2.11 D22 – Power OK LED (GREEN) (LED SMARTLED GREEN 570NM 0603)

Description: If all the powers are OK, power LED is on.

Manufacturer: OSRAM Opto Semiconductors Inc.
Connector: **LG L29K-G2J1-24-Z**

5.2.12 D24 – MCU User LED (ORANGE) (LED SMARTLED ORANGE 606NM 0603)

Description:

Manufacturer: OSRAM Opto Semiconductors Inc.
Connector: **LO L29K-H2K1-24-Z**

5.3 Resistors Selection Description

5.3.1 PSR1 USB0 Routing *(RES 0.0 OHM 1/16W 0402 SMD)*

Description: Use one of the options to fit series resistors according to the picture below.

Manufacturer: Yageo Corporation
Component: RC0402JR-070RL
www.yageo.com.tw

Resistors Fitted	R321, R323, R324, R326 (DEFAULT)		R322, R325	
OPTION	R321 and R324	USB1 HUB to USB-A	R322	USB0 CPU to USB-A
	R323 and R326	USB0 CPU to USB Micro	R325	USB0 CPU to USB-A

5.3.2 PSR2 USB1 Routing *(RES 0.0 OHM 1/16W 0402 SMD)*

Description: Use one of the options to fit series resistors according to the picture below.

Manufacturer: Yageo Corporation
Component: RC0402JR-070RL
www.yageo.com.tw

Resistors Fitted	R327, R329, R330, R332 (DEFAULT)		R328, R331	
OPTION	R329 and R332	USB1 CPU to USB HUB	R328	USB1 CPU to USB-A
	R327 and R330	USB1 HUB to USB-A	R331	USB1 CPU to USB-A

5.3.3 PSR3 USB1 to Header / MCU Routing *(RES 0.0 OHM 1/16W 0402, 0805 SMD)*

Description: Use one of the options to fit series resistors according to the picture below.

Manufacturer: Yageo Corporation
Component: RC0402JR-070RL
www.yageo.com.tw

Resistors Fitted	R297, R194 (DEFAULT)		R295, R294		R298, R207	
OPTION	R297 (0402)	USB1 to HDR	R295 (0805)	USB1 to MCU	R298 (0402)	USB MCU to HDR
	R194 (0402)	USB1 to HDR	R294 (0805)	USB1 to MCU	R207 (0402)	USB MCU to HDR

5.3.4 PSR4 CSI / LVDS Routing *(RES 0.0 OHM 1/16W 0402 SMD)*

Description: Use one of the options to fit series resistors according to the picture below.

Manufacturer: Yageo Corporation
Component: RC0402JR-070RL
www.yageo.com.tw

Option: CSI Routing

Resistors Fitted	R33, R71, R120, R122, R125, R127, R129, R136 (DEFAULT)
OPTION	CSI to CON

Option: LVDS Routing

Resistors Fitted	**R65, R119, R121, R123, R126, R128, R135, R138**
OPTION	LVDS to CON

6. Technical Specifications

6.1 Input Voltage

OpenRex SBC has default input voltage (`+VIN_5V`) ranging from from +4.9V to +5.2V.
If more than +5.3V is applied as an input voltage (`+V_INPUT`), the board is turned off automatically to protect the circuits. Maximum current through Power Jack connector J9 is 5A.

OpenRex SBC can be powered through USB OTG connector (when Power Jack is not plugged in) and Jumper JP1 is shortened.

(Note) **USB OTG Power Switch is turned off by default. To turn it on, one of these coditions must occure:**

- power input jack is not plugged in and jumper JP1 is shortened
- USB-A cable is plugged into USB OTG connector - USB act as a host
- USB0_ID is tied low by software

6.2 Mechanical

Dimmensions	Width	Length	Height	Unit
PCB	70 (2.755906)	95 (3.740158)	1.6 (0.06299213)	mm (inch)

Dimensions (in millimeters)

6.3 Temperature Range

Symbol	Description	Min	Max	Unit	Standard Unit Range
T_AMB	Operating temperature range - COMMERCIAL	0	+70	°C	X
T_AMB	Operating temperature range - EXTENDED	-20	+70	°C	

6.4 CE compliance of Voipac products

The CE label is a mandatory conformity mark for complex electronic devices placed on the market in the European Economic Area and each product sold within the EU needs a CE Certificate of Conformance that ensures that the product conforms to the essential requirements of the applicable EC directives.

However, if such complex electronic devices are produced for further processing by the industry, skilled development teams or system integrators, they do not need to observe the above mentioned CE requirements and consequently do not need any identification either. This applies to the Voipac Single Board Computers, because these are not used as stand-alone devices by the general public.

To make sure that Voipac SBCs can be used in CE marked devices, they are designed to obey the EC directives and the standard configuration SBCs manufactured by Voipac are tested for Electromagnetic Interference and operating temperature ranges.

6.5 RoHS and WEEE Compliance

All of the products designed and manufactured by Voipac are classified as Electrical and Electronic Equipment (EEE) under the Directive on the restriction of the use of certain hazardous substances in electrical and electronic equipment 2002/95/EC (RoHS). To comply with the RoHS directive, the restricted use of Lead (Pb), Mercury (Hg), Cadmium (Cd), Hexavalent Chromium (Cr 6+), Polybrominated Biphenyls (PBB) and Polybrominated Diphenyl Ethers (PBDE) must be ensured. Voipac guarantees that products ordered after July 1, 2006 are assembled in full compliance with the RoHS directive from the European Parliament and Counsel. The company procedures also complies with the Waste Electrical and Electronic Equipment Directive 2002/96/EC (WEEE).

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