QorIQ LS1021A-IOT Gateway Reference Design Getting Started Guide

1   Introduction

This document explains how to get started with the QorIQ LS1021A Internet of Things (LS1021A-IOT) reference design board and verify its basic operations. It also details the switches, connectors, jumpers, push buttons, and LED settings, as well as instructions on how to connect the peripheral devices.

NOTE

It is assumed that you are familiar with the LS1021A device and the content of the LS1021A-IOT Reference Manual (LS1021A-IOTRM).

Contents

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1.1 Related documentation

The table below lists and explains the additional documents and resources that you can refer to, for more information on LS1021A-IOT board.

Some of the documents listed below may be available only under a non-disclosure agreement (NDA). To request access to these documents, contact your local field applications engineer or sales representative.

Table 1. Related documentation

Document	Description
LS1021A QorIQ Advanced Multicore Processor Data Sheet (LS1021ADS)	Provides information about electrical characteristics, hardware design considerations, pin assignments, package information, and ordering information.
LS1021A QorIQ Integrated Multicore Processor Reference Manual (LS1021ARM)	Provides a detailed description about LS1021A QorIQ multicore processor and its features, such as memory map, serial interfaces, power supply, chip features, and clock information.
The SystemID Format for Power Architecture™ Development Systems (AN3638)	Freescale Semiconductor Power Architecture™ technology-based evaluation and development platforms may optionally implement a System ID non-volatile memory device. This device stores important configuration data about the board.
LS1021A-IOT Reference Manual (LS1021A-IOTRM)	Provides a detailed description of the architecture, connector pin outs, CPLD system controller architecture, board configuration and debug support for LS1021A-IOT QorIQ IOT Reference platform.

1.2 Kit contents

This section illustrates the contents of LS1021A-IOT Gateway box, front and rear elevations, as well as the main features of the top and bottom side of the LS1021A-IOT Printed Circuit Board (PCB).

The LS1021A-IOT Gateway Reference design board is supplied with the following contents as shown in the figure below.

- 1x LS1021A-IOT Gateway
- 1x 12 V at 5 A PSU
- 1x Micro-B USB cable
- 1x HDMI cable
- 1x 8 GB SDHC card

12V@5A Power Supply

LS1021A-IOT Gateway

Micro B USB Cable

SDHC Card   HDMI Cable

Figure 1. LS1021A-IOT kit contents

2 Case and PCB description

The LS1021A-IOT is contained within an enclosure. The following figures of the front and rear panels are annotated to describe the I/O functions and indicators.
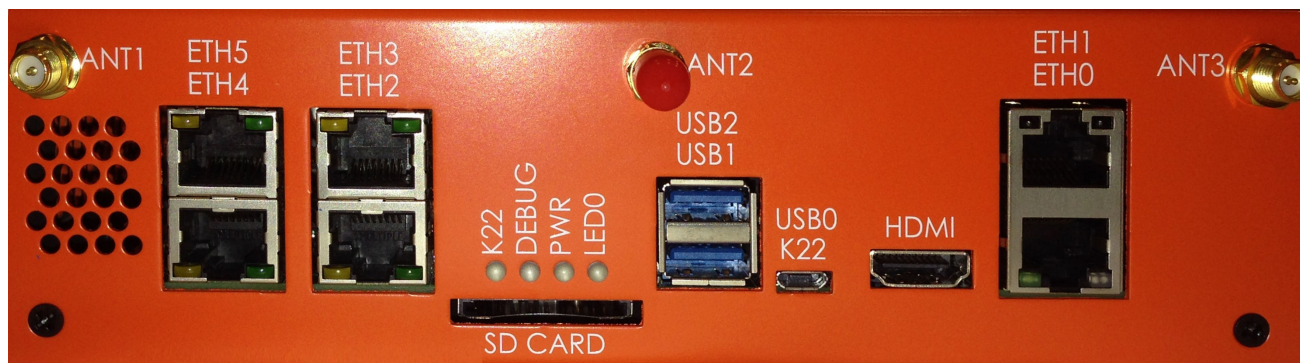
Case and PCB description

Figure 2. Main features - Front chassis

Figure 3. Main features - Rear chassis

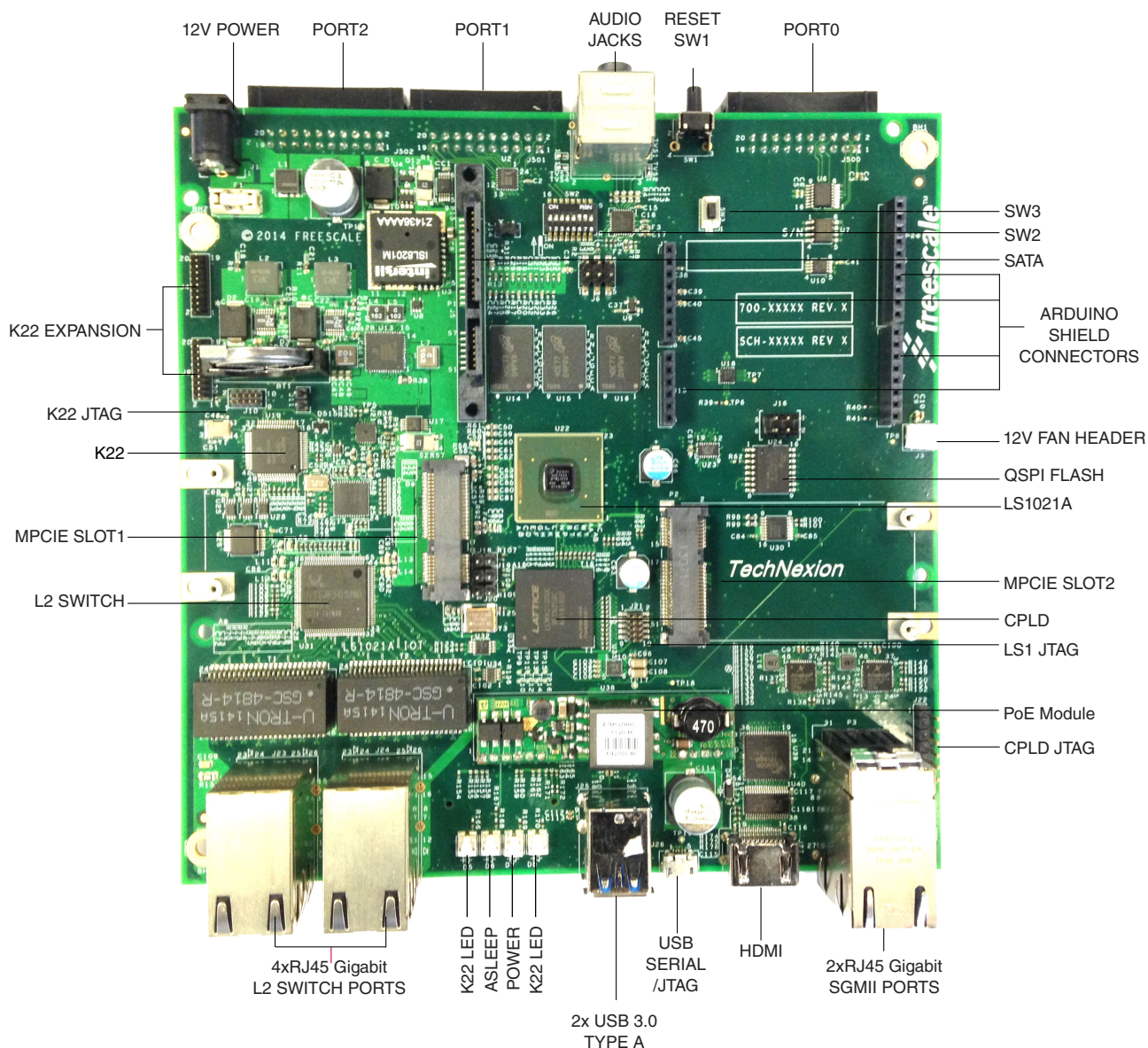The features of the board are shown in the following figures.

Figure 4. Main features - Top
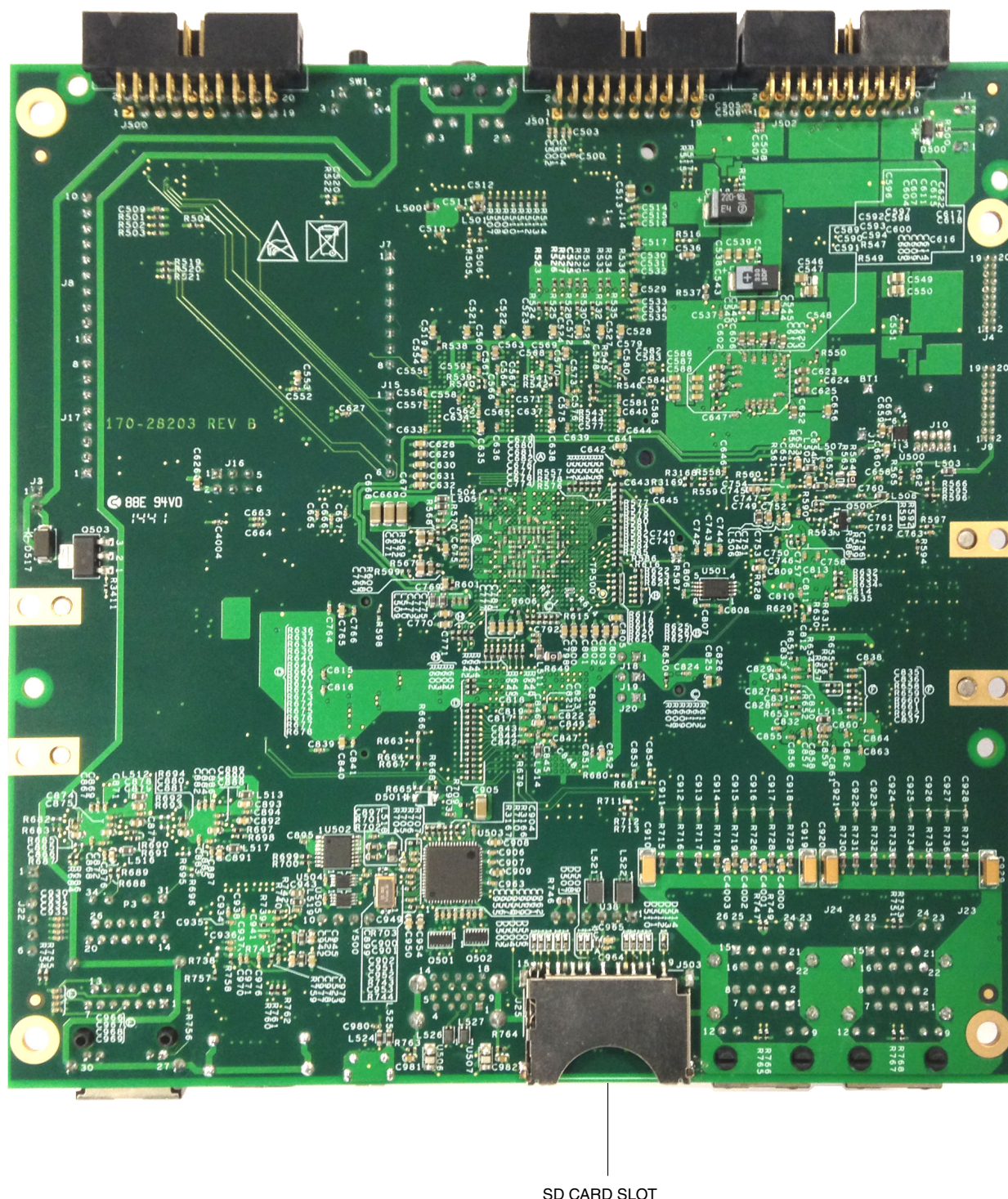
SD CARD SLOT

Figure 5. Main features - Bottom

3   Initial board startup

The LS1021A-IOT board comes with an SDHC card preloaded with the U-Boot and Linux images. Serial connectivity for the LS1021A-IOT board is provided through the Micro-B USB connector labeled USB0/K22 on the front panel as shown in Figure 2.

NOTE

You need to install the USB drivers on the host PC before using the serial terminal. You can download the latest drivers from https://mbed.org/handbook/Windows-serial-configuration

To start up the board:

1. After installing the drivers, connect the PC with LS1021A-IOT USB0 port using a Micro-B USB cable.
2. Insert the SDHC card into the SD CARD slot located on the front panel of the LS1021A-IOT board. Note that the SDHC card contacts should be facing up.
3. Set up a serial terminal using a PC communication program such as TeraTerm set to 115200-8-N-1.
4. Select the first COM port assigned to the Virtual MBED COM port.
5. Plug in the power supply barrel into the port labeled PWR located on the rear panel.
6. Plug the power supply into the mains and switch on.
7. Verify the LED PWR and LED0 are lit. LED DEBUG should be off. LED K22 will blink with terminal activity.
8. Check if you can see U-Boot in the terminal window.

   U-Boot is configured to automatically load the Linux kernel, device tree, and file system binaries from the SD card to memory and boot to a Linux prompt. When prompted for a login, type root and press enter. The SDK package used to build these images is available for download at: http://www.freescale.com/webapp/sps/site/prod_summary.jsp?code=LS1021A-IoT&fpsp=1amp;tab=Design_Tools_Tab

NOTE

The IOT SDK release 1.3 does not support reading system MAC addresses from the onboard EEPROM.

If the users wish to change the default MAC address values defined in the U-Boot, the command format below can be run from the U-Boot command line and `saveenv` can be used to maintain the values after a system reset.

ETH0 => setenv ethaddr xx:xx:xx:xx:xx:xx

ETH1 => setenv eth1addr yy:yy:yy:yy:yy:yy

The table below lists all the LED operations.

Table 2.   LED operations

Description	Ref	Color	LED On	LED Off
K22 MBED status	D5	Green	MBED mode LED ON – MBED driver running LED Blink – UART/CMSIS-DAP activity Bootloader mode LED BLINK SLOW – Bootloader running LED BLINK FAST – Application image flashed	MBED driver not loaded

Table continues on the next page...

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Table 2. LED operations (continued)

Description	Ref	Color	LED On	LED Off
LS1021A ASLEEP	D6	Red	ASLEEP	Out of asleep
+3V3	D7	Green	3V3 Power ON	3V3 Power OFF
Reset Complete	D8	Green	Reset Sequence Completed Successfully	Reset not complete
SGMII Ethernet eTSEC1	ETH0	Green/Orange	ON – Link Blink - Activity	No Link
SGMII Ethernet eTSEC3	ETH1	Green/Orange	ON – Link Blink - Activity	No Link
L2 Switch Ethernet Port1	ETH2	Green/Orange	ON – Link Blink - Activity	No Link
L2 Switch Ethernet Port2	ETH3	Green/Orange	ON – Link Blink - Activity	No Link
L2 Switch Ethernet Port3	ETH4	Green/Orange	ON – Link Blink - Activity	No Link
L2 Switch Ethernet Port4	ETH5	Green/Orange	ON – Link Blink - Activity	No Link

4 Connecting JTAG connectivity unit

JTAG connectivity to the LS1021A on the LS1021A-IOT board is available from two sources:

- CMSIS-DAP via USB0 – the onboard TAP (slower and limited features)
- JTAG Header – Internal 10pin ARM Debug Header – requires a Debugger such as the Freescale CodeWarrior TAP

Both methods require debug software, such as Freescale CodeWarrior to work with the board.

CMSIS-DAP via USB0

NOTE

When USB0 is connected to the host PC via a Micro-B connector, in addition to the UART bridge functionality, a JTAG bridge is provided. Both can run concurrently.

1. Open the case.
2. Ensure SW2.8 is in the ON position to select CMSIS-DAP operation.
3. Close the lid, if desired.
4. Connect the USB0 to the host PC USB port using Micro-B cable.
5. Switch on the power supply to the board.
6. Check for completion of the reset sequence (ensure the LEDs are as described in **Initial board startup**).
7. Check the device manager on a Windows machine, to verify that the CMSIS-DAP device is installed correctly.

NOTE

For further information, see the Debugger User Manual.

JTAG Header

1. Ensure the board is not switched on.
2. Open the case.
3. Set SW2.8 in OFF position to select JTAG header operation.
4. Connect the JTAG connectivity unit to the LS1021A JTAG connector J21. Pin 1 is marked on the board.

5. Switch on the power supply to the board.
6. Check for completion of the reset sequence (ensure the LEDs are as described in **Initial board startup**).

NOTE

For further information, see the Debugger User Manual.

5 Configuring switches and jumpers

The LS1021A-IOT board has one 8-way dual in-line package (DIP) switch. The default DIP switch positions provide working setup values for the board. Check the default positions and ensure that the board is operational before changing the switches. The figure below shows the settings for the switches with their default positions.

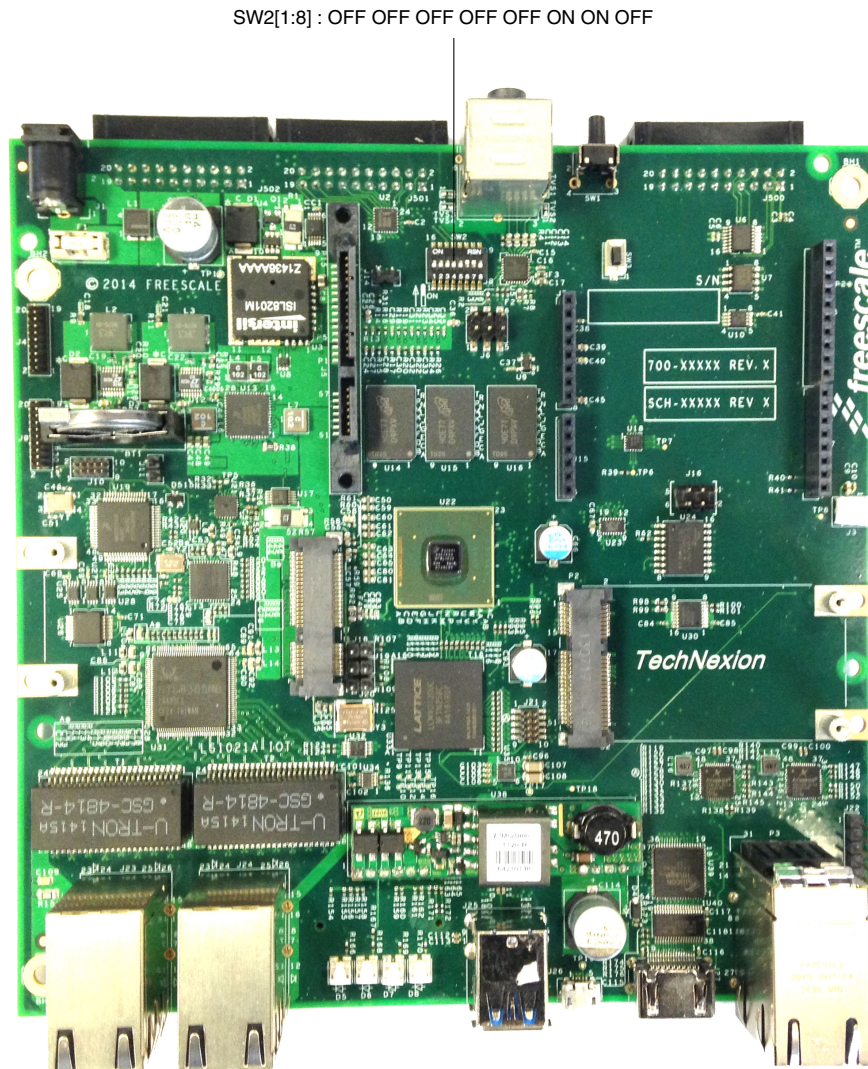SW2[1:8] : OFF OFF OFF OFF OFF ON ON OFF

Figure 6. Default switch configuration

The following table lists and describes the switch configuration for LS1021A-IOT board.

NOTE

The default switch settings are indicated by » symbol.

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Table 3. Default switch settings

Feature	Settings (OFF=1, ON=0)	Option	Comments
S2.1	OFF	RCW & Boot Source	0 : QSPI (not supported on revA board)
			» 1 : SDHC (default)
S2.2	OFF	SYSCLK Select	0 : DIFF_SYSCLK
			»1 : SYSCLK (default)
S2.3	OFF	Reserved	0 : Reserved
			»1 : Reserved (default)
S2.4	OFF	Reserved	0 : Reserved
			»1 : Reserved (default)
S2.5	OFF	SGMII2_SATA MUX	0 : SerDes Lane 2 - SATA
			»1 : SerDes Lane 2 – SGMII2 (default)
S2.[6 :7]	ON:ON	SYSCLK Frequency Select	»00 : 100MHz (default)
			01 : 99MHz
			10 : 96MHz
			11: Reserved
S2.8	OFF	SDA_SWD_EN Control	0 : K22 CMSIS-DAP
			»1 : JTAG HEADER (default)

The following table lists the jumper settings.

Table 4. Jumper settings

Jumpers	Default settings on LS1021A-IOT	Description
J11	OFF	VDD_LP Source Select
		OFF – Battery
		ON - +1V0_VDDC
J18	OFF	Reserved
J19	OFF	Reserved
J20	OFF	Reserved

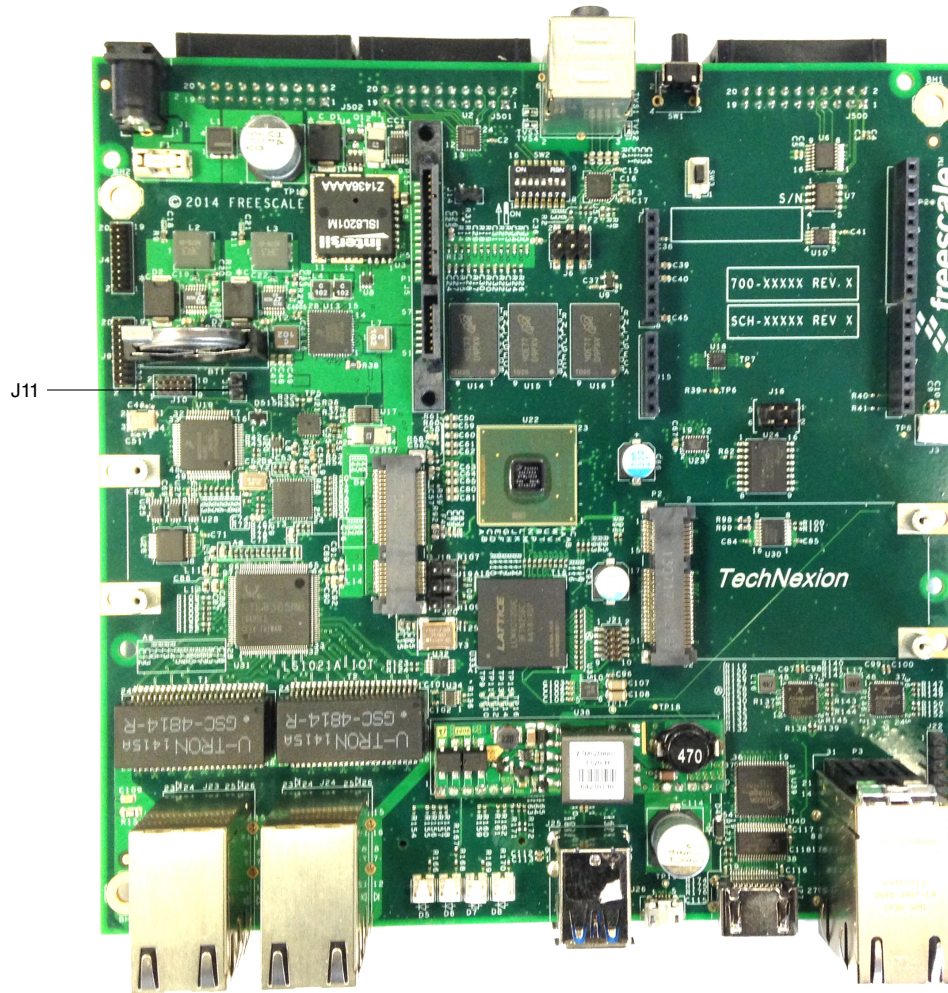The following figure shows the jumper locations.

Figure 7. Jumper settings

6 Functional status and known limitations

The following table describes the functional status and lists the known limitations.

Table 5. Functional status and known limitations

Interface	Functional
JTAG Header	Yes
CMSIS-DAP (USB0)	Yes
K22 UART (USB0)	Yes
Ethernet Switch RJ45 ETH2-5	Yes[1]
ETH0	Yes
ETH1	Yes

Table continues on the next page...

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Table 5.   Functional status and known limitations (continued)

SATA	See note [2]
MiniPCIe Slot 1	Yes
MiniPCIe Slot 2	Yes
USB1/2	Yes[3]
Accelerometer	Yes
Temp Sensor LS1	Yes
Temp Sensor Board	Yes
Fan	Yes[4]
Current Sensor 12V	Yes
Current Sensor 1V VDD	Yes
DDR3L	Yes
QSPI Boot	No
CPLD	Yes
UART	Yes
LPUART	Yes
SPI	Yes
I2C1	Yes
I2C2	No - see note[5]
CAN/FTM/GPIO3 expansion	See note[6]
SAI Audio	See note[7]
HDMI	See note[8]
SDHC	Yes
ADC	Yes
GPIO Expander	Yes
EEPROM	Yes
Arduino	Yes
K22 Expansion	No[9]

1. Requires L2 switch initialisation. This is included as part of the IOT SDK rds build (see SDK README for build details)
2. SATA
    - Not supported in the current SDK
    - Muxed with SGMII ETH0 (see Table 3 above for details)
3. Some USB flash drives are incompatible (see the SDK release notes for details)
4. Controlled by LS1 temp sensor. The default settings can be modified in the `sensors3.conf` file within the SDK file system
5. Common bus with I2C1. See the device errata for details
6. CAN/FTM/GPIO3 expansion
    - GPIO functional
    - CAN is not supported in current SDK
7. SAI Audio
    - Audio output supported (the appropriate kernel options must be enabled)
    - Audio Line In is supported (SDK 1.3 requires alsamixer line in to be configured)
8. HDMI
    - Limited resolutions supported in the current SDK
    - For full VSYNC/HSYNC support, the RCW needs to be updated to enable these signals and UART1 cannot be used. See the device errata for details
9. Reserved for future use

7 Revision history

This table summarizes revisions to this document.

Table 6. Revision history

Revision	Date	Change description
Rev 2	02/2015	Updated all the figures to reflect the changes to the Gateway box and the PCB
Rev 1	01/2015	• Updated section, **Initial board startup** : • Added download location for SDK package used to build the images • Added new note • Updated Table 3 in section, **Configuring switches and jumpers** • Added new topic Functional status and known limitations
Rev 0	09/2014	Initial public release

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