



Intel® Edison Breakout Board

Hardware Guide

January 2015

Revision 006



Notice: This document contains information on products in the design phase of development. The information here is subject to change without notice. Do not finalize a design with this information.

INFORMATION IN THIS DOCUMENT IS PROVIDED IN CONNECTION WITH INTEL PRODUCTS. NO LICENSE, EXPRESS OR IMPLIED, BY ESTOPPEL OR OTHERWISE, TO ANY INTELLECTUAL PROPERTY RIGHTS IS GRANTED BY THIS DOCUMENT. EXCEPT AS PROVIDED IN INTEL'S TERMS AND CONDITIONS OF SALE FOR SUCH PRODUCTS, INTEL ASSUMES NO LIABILITY WHATSOEVER AND INTEL DISCLAIMS ANY EXPRESS OR IMPLIED WARRANTY, RELATING TO SALE AND/OR USE OF INTEL PRODUCTS INCLUDING LIABILITY OR WARRANTIES RELATING TO FITNESS FOR A PARTICULAR PURPOSE, MERCHANTABILITY, OR INFRINGEMENT OF ANY PATENT, COPYRIGHT OR OTHER INTELLECTUAL PROPERTY RIGHT.

A "Mission Critical Application" is any application in which failure of the Intel Product could result, directly or indirectly, in personal injury or death. SHOULD YOU PURCHASE OR USE INTEL'S PRODUCTS FOR ANY SUCH MISSION CRITICAL APPLICATION, YOU SHALL INDEMNIFY AND HOLD INTEL AND ITS SUBSIDIARIES, SUBCONTRACTORS AND AFFILIATES, AND THE DIRECTORS, OFFICERS, AND EMPLOYEES OF EACH, HARMLESS AGAINST ALL CLAIMS COSTS, DAMAGES, AND EXPENSES AND REASONABLE ATTORNEYS' FEES ARISING OUT OF, DIRECTLY OR INDIRECTLY, ANY CLAIM OF PRODUCT LIABILITY, PERSONAL INJURY, OR DEATH ARISING IN ANY WAY OUT OF SUCH MISSION CRITICAL APPLICATION, WHETHER OR NOT INTEL OR ITS SUBCONTRACTOR WAS NEGLIGENT IN THE DESIGN, MANUFACTURE, OR WARNING OF THE INTEL PRODUCT OR ANY OF ITS PARTS.

Intel may make changes to specifications and product descriptions at any time, without notice. Designers must not rely on the absence or characteristics of any features or instructions marked "reserved" or "undefined." Intel reserves these for future definition and shall have no responsibility whatsoever for conflicts or incompatibilities arising from future changes to them. The information here is subject to change without notice. Do not finalize a design with this information.

Intel software products are copyrighted by and shall remain the property of Intel Corporation. Use, duplication, or disclosure is subject to restrictions stated in Intel's Software License Agreement, or in the case of software delivered to the government, in accordance with the software license agreement as defined in FAR 52.227-7013.

The products described in this document may contain design defects or errors known as errata which may cause the product to deviate from published specifications. Current characterized errata are available on request.

The code names presented in this document are only for use by Intel to identify products, technologies, or services in development that have not been made commercially available to the public, i.e., announced, launched, or shipped. They are not "commercial" names for products or services and are not intended to function as trademarks.

Contact your local Intel sales office or your distributor to obtain the latest specifications and before placing your product order.

Copies of documents which have an order number and are referenced in this document, or other Intel literature may be obtained by calling 1-800-548-4725 or by visiting Intel's website at <http://www.intel.com/design/literature.htm>.

Intel processor numbers are not a measure of performance. Processor numbers differentiate features within each processor family, not across different processor families. See http://www.intel.com/products/processor_number for details.

Intel, the Intel logo, and Intel Atom are trademarks of Intel Corporation in the United States and other countries.

* Other brands and names may be claimed as the property of others.

Copyright © 2015 Intel Corporation. All rights reserved.



Contents

1	Introduction	5
1.1	References.....	5
2	High-Level Functional Description	6
2.1	Intel® Edison Breakout Board jumpers.....	7
2.1.1	USB interface	8
2.2	Intel® Edison Breakout Board expansion header	9
2.3	Intel® Edison Breakout Board expansion power supply	10
2.3.1	Boot voltage selection – DCIN signal	11
2.4	Intel® Edison Breakout Board buttons	12
2.5	Intel® Edison Breakout Board mechanical drawing.....	12
2.6	LEDs.....	12
3	Handling	13
4	Digikey sources	14

Figures

Figure 1	Intel® Edison breakout board block diagram	6
Figure 2	Breakout board jumpers (top of board).....	7
Figure 3	Breakout board jumpers (bottom of board)	8
Figure 4	Intel® Edison breakout board expansion board power distribution network	11
Figure 5	Mechanical drawing.....	12
Figure 6	Inserting an Intel® Edison module to the breakout board	13
Figure 7	Digikey sources.....	14

Tables

Table 1	Product-specific documents	5
Table 2	Intel® Edison breakout board expansion header signal list.....	9



Revision History

Revision	Description	Date
ww32	Initial release.	August 4, 2014
ww34	Minor edits.	August 20, 2014
001	First public release.	September 9, 2014
002	Minor corrections.	September 15, 2014
003	Added handling information.	September 30, 2014
004	Added details on the breakout board jumpers and USB connectivity.	October 16, 2014
005	Added section on software recovery mode and information on the LEDs.	November 14, 2014
006	Minor corrections.	January 30, 2015

§



1 Introduction

This document describes the Intel® Edison Breakout Board.

The Intel® Edison Breakout Board is designed to expose the native 1.8 V I/O of the Intel® Edison module. The board consists of power supply, battery recharger, USB OTG power switch, UART to USB bridge, USB OTG port, and I/O header.

1.1 References

Table 1 Product-specific documents

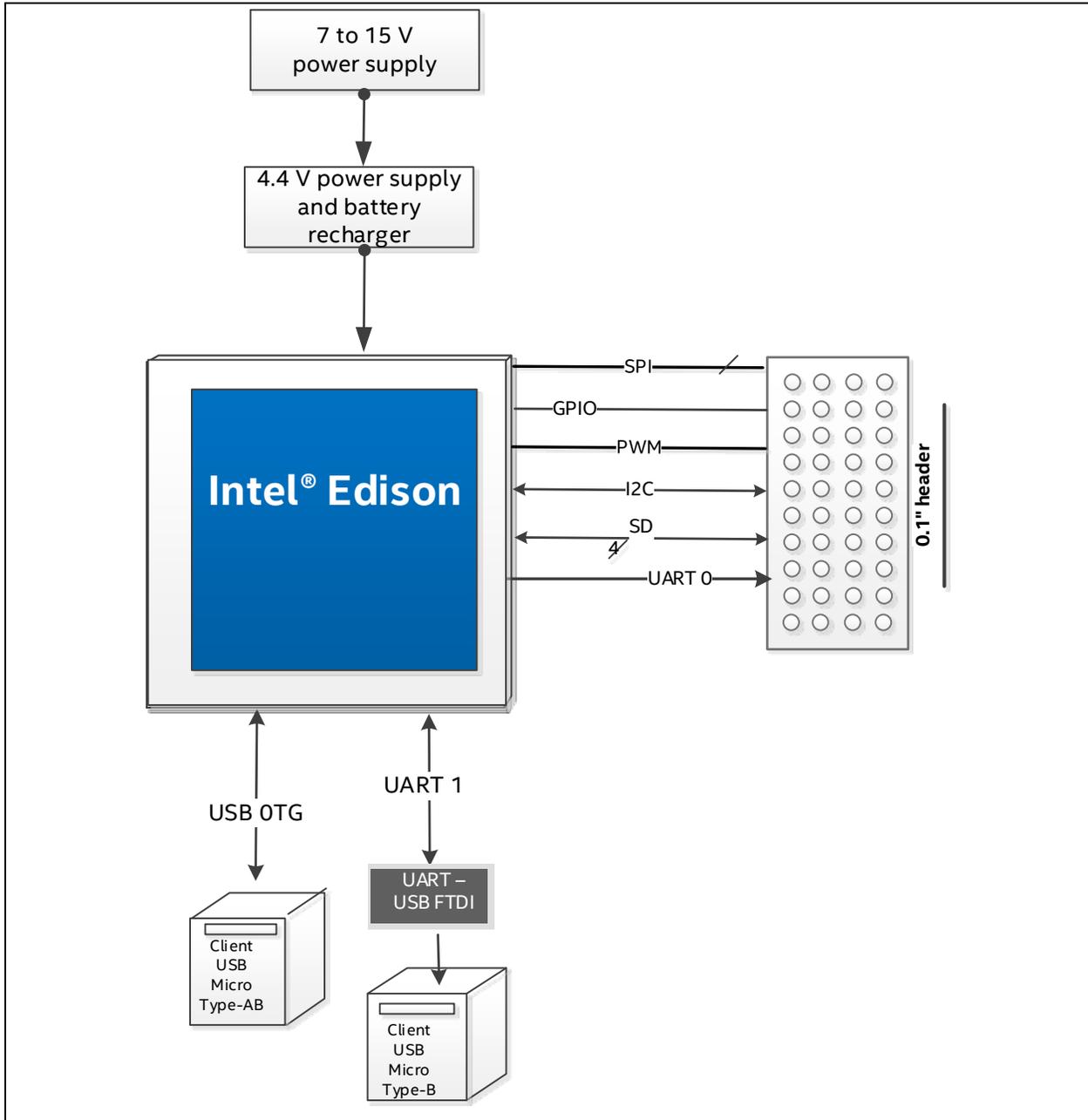
Reference	Name	Number/location
331188	Intel® Edison Board Support Package User Guide	
331189	Intel® Edison Compute Module Hardware Guide	
331190	Intel® Edison Breakout Board Hardware Guide	(This document)
331191	Intel® Edison Kit for Arduino* Hardware Guide	
329686	Intel® Galileo and Intel® Edison Release Notes	
[GSG]	Intel® Edison Getting Started Guide	W: http://www.intel.com/support/edison/sb/CS-035336.htm M: http://www.intel.com/support/edison/sb/CS-035344.htm L: http://www.intel.com/support/edison/sb/CS-035335.htm
331438	Intel® Edison Wi-Fi Guide	
H49905	Intel® Edison Breakout Board Schematic	https://communities.intel.com/docs/DOC-23323

§

2 High-Level Functional Description

Figure 1 provides the block diagram for the Intel® Edison Breakout Board.

Figure 1 Intel® Edison breakout board block diagram



2.1 Intel® Edison Breakout Board jumpers

This section explains some of the jumpers on the Intel® Edison Breakout Board. See Figure 2 for jumper locations.

- The left pin (the square one) on J2 is +V battery; the right pin is ground.
 - J2 is the battery connector. If you want to power the breakout board with a rechargeable lithium-ion battery, attach it to J2. (Refer to Figure 2 for battery polarity.) When you attach a rechargeable lithium-ion battery, the breakout board will recharge the battery whenever power is applied via J21 or J22, or via J3 (when the board is attached to a USB host).
- Note:** If you decide to use a battery pack on J2, we recommend a battery with a built-in thermistor. This thermistor should attach to the charger on the breakout board. If you opt for the built-in thermistor, remove the jumper on J1 and connect the thermistor to the pin labeled THERM in Figure 2. If you choose not to use a battery with built-in thermistor, leave the jumper in place.)
- J3 is a micro USB FTDI serial-to-USB converter. The Linux console will output serial stream to this USB connector.
 - J16 is a fully USB compatible, micro AB, OTG (power “on the go”) port. If you plug a micro A cable into this port, the Intel® Edison module will connect to a PC as the host; if you plug a micro B cable into this port, the Intel® Edison module will connect to the PC as a device. (See the USB A female to micro A male cable, Digikey P/N 10-00649 839-1105-ND in Figure 7.)
 - For jumpers J17 through J20, the first pin on the left (the square one) is pin 1.
 - J21 is the main power input. Apply 7 to 15 VDC with the polarity shown.
 - J22 (on the bottom side of the board; see Figure 3) is for a power jack (not installed). You can purchase a 2.5 mm barrel jack (see the mini-breakout power jack in Figure 7, Digikey P/N PJ-002BH-SMT-TR CP-002BHPJCT-ND) and solder it to the bottom side of the board as shown in Figure 3. The input voltage to J22 is also 7 to 15 VDC.

Figure 2 Breakout board jumpers (top of board)

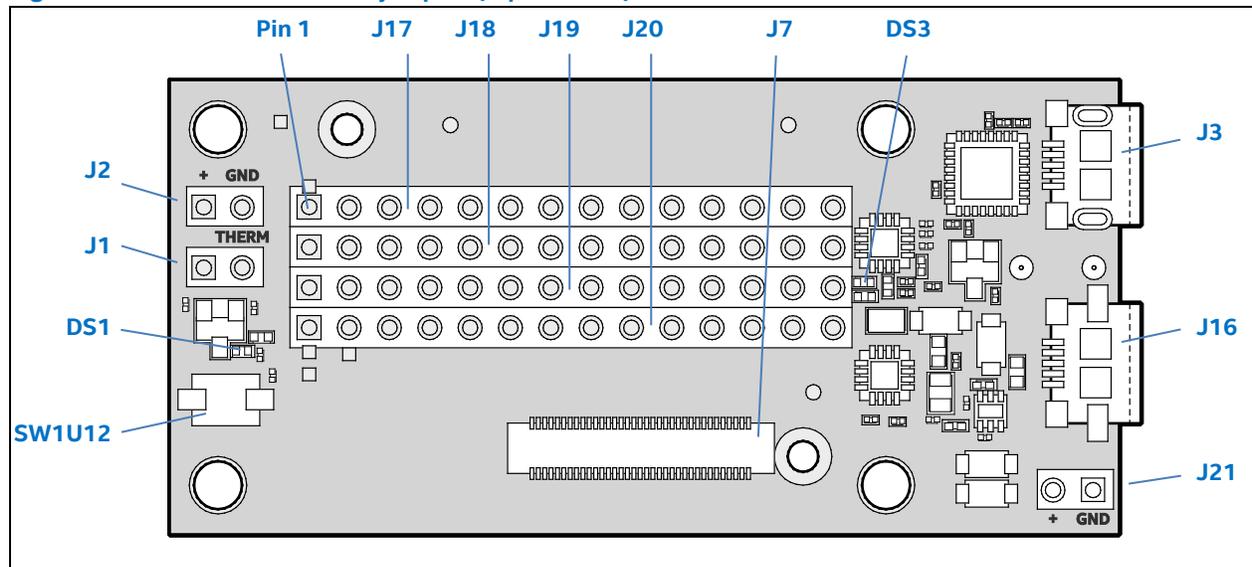
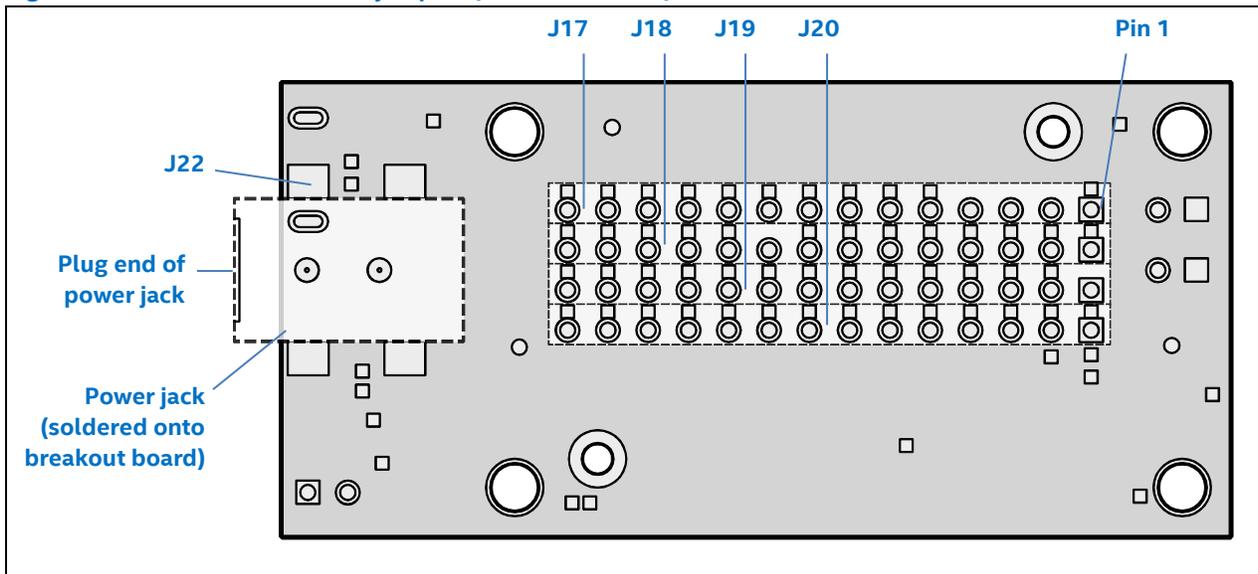


Figure 3 Breakout board jumpers (bottom of board)



2.1.1 USB interface

The Intel® Edison Breakout Board has a single USB 2.0 interface. This interface is the primary method for downloading code on J16. It is designed to support full USB “On the Go” (OTG) connections, using the ID signal. If you plug in a USB micro B connector, the breakout board will act as a USB device, and it will take its power from the USB connector.

If you plug a USB micro A connector into it, the breakout board will function as a host. When you use the Intel® Edison Breakout Board as a host in this manner, you must supply external power via J21 or J22. The breakout board will convert that voltage to supply 5 V to the USB connector.

Note: If you power the breakout board with a battery, it will not supply power as a USB host.



2.2 Intel® Edison Breakout Board expansion header

This section explains the expansion header.

When the pin mode is chosen as GPIO, it can be programmed as an output or input. When programmed as an input, a GPIO can serve as an interrupt or wake source. Inputs have programmable pullups or pulldowns. Pullup value can be 2, 20, or 50 kohm. I2C pins also have an additional 910 ohm value.

When in general purpose mode, input GPIO signals enter a glitch filter by default, before reaching the edge detection registers. To ensure that a pulse is detected by the edge detection register, the pulse should be five clock cycles long.

- 100 ns for a 50 MHz clock when SoC is in S0 state.
- 260 ns for 19.2 MHz clock when SoC is in S0i1 or S0i2 State.
- 155.5 μ s for 32 kHz clock (RTC) when SoC is in S0i3 State.

Most GPIO capable pins are configured as GPIO inputs during the assertion of all resets and they remain inputs until configured otherwise.

As outputs, the GPIOs can be individually cleared or set. They can be pre-programmed to either state when entering standby. Output drive is ± 3 mA.

Table 2 Intel® Edison breakout board expansion header signal list

Pin			Description
J17 - pin 1	GP182_PWM2		GPIO capable of PWM output.
J17 - pin 2	NC		No connect.
J17 - pin 3	NC		No connect.
J17 - pin 4	VIN		7 to 15 V.
J17 - pin 5	GP135	UART2_TX	GPIO, UART2 transmit output.
J17 - pin 6	RCVR_MODE		Firmware recovery mode.
J17 - pin 7	GP27	I2C6_SCL	GPIO, IC26 SCL output open collector.
J17 - pin 8	GP20	I2C1_SDA	GPIO, I2C1 data open collector.
J17 - pin 9	GP28	I2C6_SDA	GPIO, I2C6 data open collector.
J17 - pin 10	GP111	SSP5_FS1	GPIO, SSP2 chip select 2 output.
J17 - pin 11	GP109	SSP5_CLK	GPIO, SSP5 clock output.
J17 - pin 12	GP115	SSP5_TXD	GPIO, SSP5 transmit data output.
J17 - pin 13	OSC_CLK_OUT_0		High speed clock output.
J17 - pin 14	GP128	UART1_CTS	GPIO, UART1 clear to send input.
J18 - pin 1	GP13_PWM1		GPIO capable of PWM output.
J18 - pin 2	GP165		GPIO
J18 - pin 3	GPI_PWRBTN_N		Power button input.
J18 - pin 4	MSIC_SLP_CLK2		32 kHz sleep clock.
J18 - pin 5	V_VBAT_BKUP		RTC backup battery input.
J18 - pin 6	GP19	I2C1_SCL	GPIO, IC21 SCL output open collector.
J18 - pin 7	GP12_PWM0		GPIO capable of PWM output.
J18 - pin 8	GP183_PWM3		GPIO capable of PWM output.
J18 - pin 9	NC		No connect.
J18 - pin 10	GP110	SSP5_FS0	GPIO, SSP1 chip select 2 output.
J18 - pin 11	GP114	SSP5_RX	GPIO, SSP5 receive data input.



Pin			Description
J18 - pin 12	GP129	UART1_RTS	GPIO, UART1 ready to send output.
J18 - pin 13	GP130	UART1_RX	GPIO, UART1 receive data input.
J18 - pin 14	FW_RCVR		Firmware recovery, active high on boot.
J20 - pin 1	V_VSYS		System input power.
J20 - pin 2	V_V3P30		System 3.3 V output.
J20 - pin 3	GP134	UART2_RX	UART2 Rx (input).
J20 - pin 4	GP45	COMPASS_DRDY	GPIO, compass data ready input.
J20 - pin 5	GP47	ACCELEROMETER_INT_2	GPIO, accelerometer interrupt input 2.
J20 - pin 6	GP49	GYRO_INT	GPIO, gyro interrupt input.
J20 - pin 7	GP15		GPIO.
J20 - pin 8	GP84	SD_CLK_FB	GPIO, SD clock feedback input.
J20 - pin 9	GP42	SSP2_RXD	GPIO, SSP2 Rx data input.
J20 - pin 10	GP41	SSP2_FS	GPIO, SSP2 frame sync output.
J20 - pin 11	GP78	SD_CLK	GPIO, SD clock output.
J20 - pin 12	GP79	SD_CMD	GPIO, SD command.
J20 - pin 13	GP80	SD_DAT0	GPIO, SD data 0.
J20 - pin 14	GP81	SD_DAT1	GP81 SD data 1.
J19 - pin 1	NC		No connect.
J19 - pin 2	V_V1P80		System 1.8 V I/O output power.
J19 - pin 3	GND		Ground.
J19 - pin 4	GP44	ALS_INT_N	GPIO, ALS interrupt input.
J19 - pin 5	GP46	ACCELEROMETER_INT_1	GPIO, accelerometer interrupt input.
J19 - pin 6	GP48	GYRO_DRDY	GPIO, gyro data ready input.
J19 - pin 7	RESET_OUT#		System reset out low.
J19 - pin 8	GP131	UART1_TX	GPIO, UART 1 Tx output.
J19 - pin 9	GP14	AUDIO_CODEC_INT	GPIO, audio codec interrupt input.
J19 - pin 10	GP40	SSP2_CLK	GPIO, SSP2 clock output.
J19 - pin 11	GP43	SSP2_TXD	GPIO, SSP2 transmit data output.
J19 - pin 12	GP77	SD_CDN	GPIO, SD card detect low input.
J19 - pin 13	GP82	SD_DAT2	GPIO, SD data 2
J19 - pin 14	GP83	SD_DAT3	GPIO, SD data 3

2.3 Intel® Edison Breakout Board expansion power supply

Intel® Edison is a low-power device. In general, it does not draw more than 200 mA with 600 mA short duration spikes during Wi-Fi transmit. Therefore, an Intel® Edison device may run on USB power (when configured as a device), or an external power adapter from 7 to 15 V.

Power from the external power adapter goes to a DC-DC converter and down-converted to 5 V. The 5 V rail is diode ORed with the USB VBUS rail. This power goes to a battery recharger IC, which limits the output voltage to 4.4 V. This voltage is in the safe range for the Edison module VSYS. The VSYS power range is 3.15 to 4.5 V. This allows the Intel® Edison device to run off a standard lithium-ion battery. The charger IC is configured to limit the current to 1 A. The charger is programmed to charge at 190 mA. This charger is designed to charge standard lithium-ion batteries with 4.2 V maximum charging voltage. You are responsible for choosing a suitable battery and following all safety precautions, to prevent overcharging or charging when the battery temperature is too high.



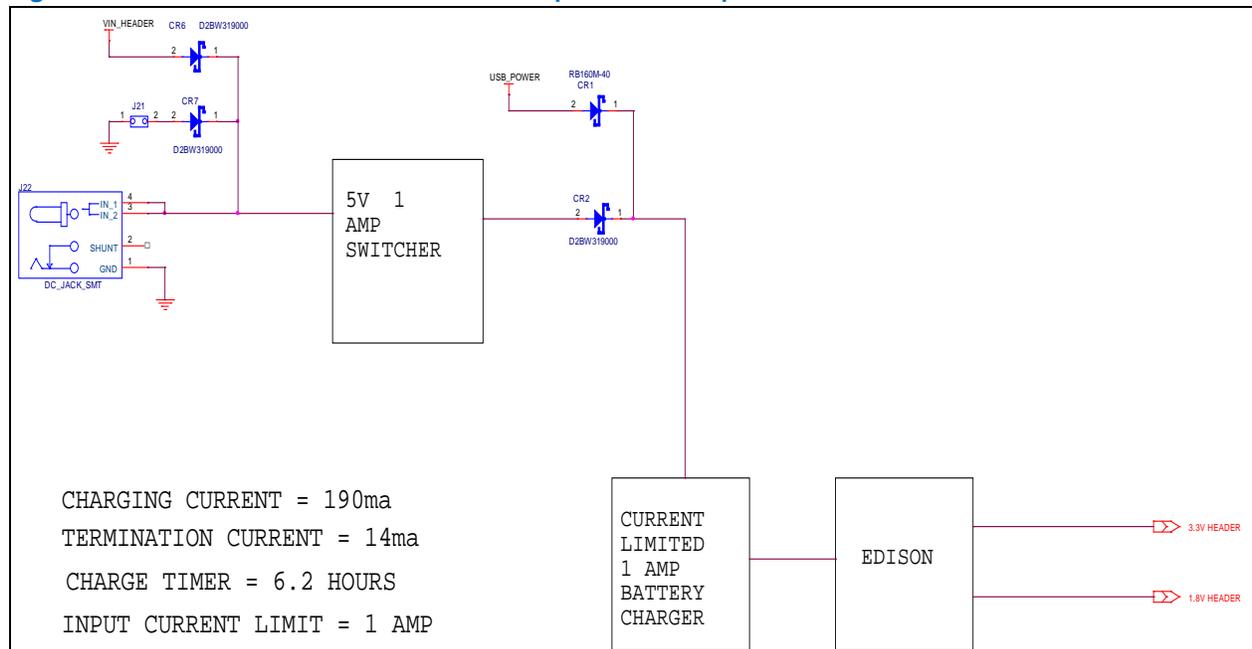
The drawback to this design is that the linear supply power drop places a limit on the total power through the Intel® Edison board and the 3.3 and 1.8 V supplies. The power loss through the charger will be $(4.4 \text{ to } 5 \text{ V}) \cdot \text{current}$. In this case, you should attempt to limit average current through the Intel® Edison board and its power rails to approximately 0.75 A.

The recharger IC on the Intel® Edison breakout board has input current limit and overtemperature shutdown. Assure the end design does not trip these protection mechanisms.

Some considerations of the power distribution in the Intel® Edison breakout board:

1. USB host mode always requires use of an external power adapter.
2. You are responsible for choosing a suitable battery and following all safety precautions, to prevent overcharging or charging when the battery temperature is too high. The battery should be at least 300 mAH capacity, due to the 100 mA charging current. Intel recommends battery packs with internal protection circuits.

Figure 4 Intel® Edison breakout board expansion board power distribution network



2.3.1 Boot voltage selection – DCIN signal

DCIN is a signal that indicates whether Edison is being powered from a battery or from an external power source. DCIN also sets the voltage level required on V_{SY} in order to boot. When DCIN is floating or tied to ground, the voltage on V_{SY} must rise from 2.5 to 3.5 V in 10 ms; otherwise the boot is aborted. When the boot is aborted, power must be cycled below 2.5 V. If DCIN is connected to V_{SY}, Edison will start to boot when V_{SY} is above 2.5 V for 100 ms.

Note: When DCIN is connected to V_{SY}, boot will occur whenever the voltage is above 2.8 V for 100 ms. The DCIN signal is attached to V_{SY} on the PCB.

Note: The absolute minimum voltage to assure Wi-Fi and Bluetooth functionality is 3.15 V.

2.4 Intel® Edison Breakout Board buttons

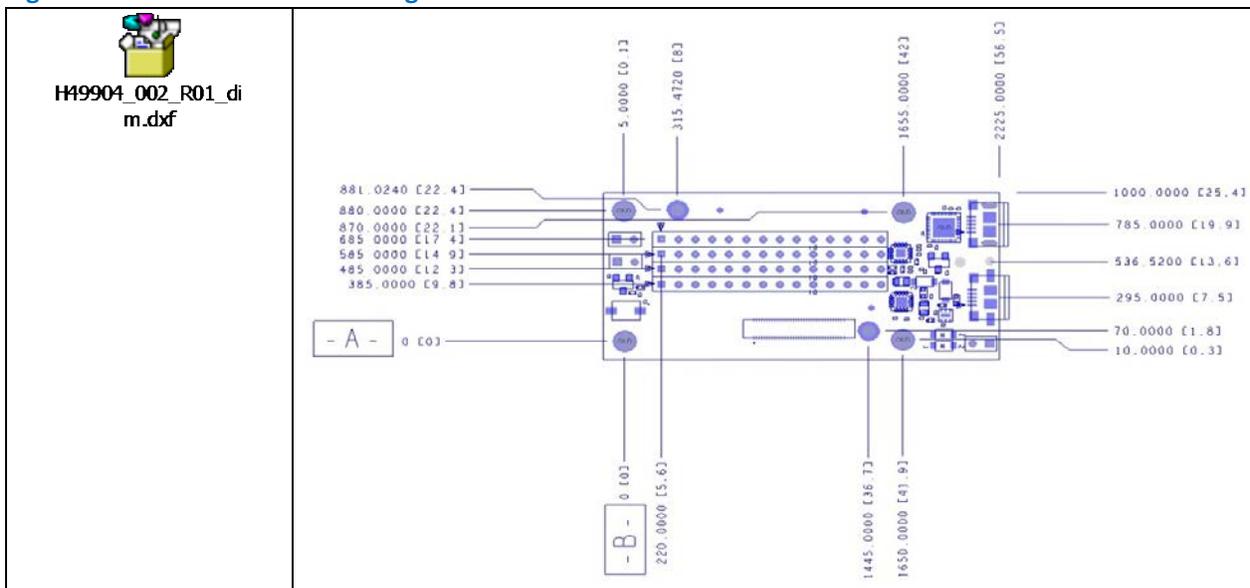
The Intel® Edison breakout board (see Figure 2) has the following buttons:

- **Power button.** The power button (SW1) is configured by software. Pressing and holding the power button will produce different results depending on the current state of the Intel® Edison compute module and the duration of the hold:
 - When the Intel® Edison device is completely powered down, pressing and holding the power button for 3 seconds will power up the device and boot up the Intel® Edison compute module.
 - When the Intel® Edison device is running, pressing and holding the power button for more than 2 seconds but less than 7 seconds will put the Intel® Edison device into AP (access point) mode. This action enables the “one-time setup” (same as `configure_edison --enableOneTimeSetup`).
 - When the Intel® Edison device is running, pressing and holding the power button for 10 seconds or more will cause the Intel® Edison compute module to power down. This is similar to a hard shutdown, which cuts the power supply to the compute module.

2.5 Intel® Edison Breakout Board mechanical drawing

Figure 5 shows a mechanical drawing of the Intel® Edison Breakout Board, in DXF format.

Figure 5 Mechanical drawing



2.6 LEDs

The Intel® Edison Breakout Board has two LEDs. There is no direct control over these LEDs, so they are described here for informational purposes.

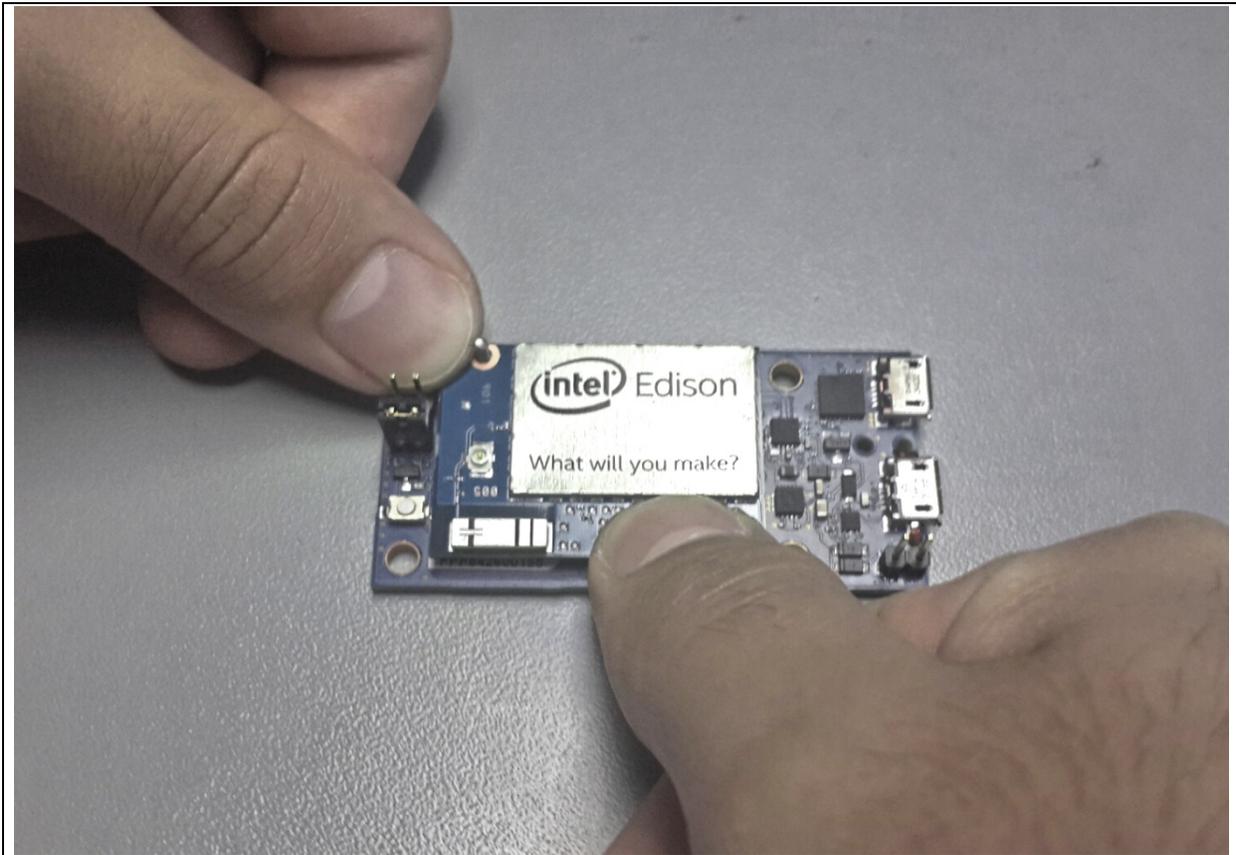
- DS1 is the reset LED. (See Figure 2 for location.) It will turn on when the Intel® Edison processor is running. When the processor is in reset and asserting RESET_OUT# low, it will turn off.
- DS3 is the charging LED. (See Figure 2 for location.) It will turn on when the BQ24074 is charging an attached battery.



3 Handling

When attaching an Intel® Edison module to breakout board, handle the Intel® Edison module by the PCB edges. Avoid holding or exerting pressure to the shields. To mate the Intel® Edison board to the breakout board, apply pressure directly above the connector and to the left corner.

Figure 6 Inserting an Intel® Edison module to the breakout board



§

4 Digikey sources

Figure 7 shows some third-party accessories you can use.

Figure 7 Digikey sources

 <p>Mating connector 2.0 mm DF40C(2.0)-70DS-0.4V(51) - H11908CT-ND Cut tape DF40C(2.0)-70DS-0.4V(51) H11908TR-ND Tape and reel</p>	 <p>Mini-breakout power jack PJ-002BH-SMT-TR CP-002BHPJCT-ND Cut tape PJ-002BH-SMT-TR CP-002BHPJTR-ND Tape and reel</p>
 <p>Mini-breakout USB adapter cable USB A female to Micro A male 10-00649 839-1105-ND</p>	 <p>Mini-breakout male header 2x14 M20-9980745 952-1932-ND</p>

§