



PIXIEBOARD User Guide

REVISION 1.1

Table of Contents

Disclaimers	4
Trademarks	5
<i>Preface</i>	6
Introduction	6
Document layout	6
Convention used	6
Recommended reading	7
Revision History	7
<i>1. Pixieboard at a glance</i>	8
1.1. Overview	8
1.2. Specifications	9
1.3. Features	11
1.3.1. Operating system	11
1.3.2. Graphics	12
1.3.3. Display	12
1.3.4. Storage	12
1.3.5. Video	13
1.3.6. Audio	13
1.3.7. USB	13
1.3.8. I/O	13
1.3.9. Wired Networking	13
1.3.10. Wireless Networking	13
1.3.10.1. WiFi	13
1.3.10.2. Bluetooth®	14
1.3.10.3. Mobile broadband LTE or UMTS/HSPA+ 3G Module	14
1.3.11. Sensors	15
1.3.12. Thermal Management	15
1.3.13. Debug	15
1.3.14. Expansion port	16
1.4. Contents	18
<i>2. Mechanical drawings</i>	19
<i>3. WW sales and Service Support</i>	19
<i>4. Certifications</i>	20

4.1. United States FCC.....20

4.2. FCC Exposure warning statements20

Disclaimers

Warranty and liability

Information in this document is believed to be accurate and reliable. However, Code & Modules Incorporated (“Code & Modules”) does not give any representations or warranties, expressed or implied, as to the accuracy or completeness of such information and shall have no liability for the consequences of use of such information. In no event shall Code & Modules be liable for any indirect, incidental, punitive, special or consequential damages (including without limitation, lost profits, lost savings, business interruption, costs related to the removal or replacement of any products or rework changes) whether or not such damages are based on tort (including negligence), warranty, breach of contract or any other legal theory.

Right to make changes

Code & Modules reserves the right to make changes to information published in this document, including without limitation, specifications and product descriptions, at any time and without notice. This document supersedes and replaces all information supplied prior to the publication hereof.

Suitability for use

Code & Modules products described herein are not designed, authorized or warranted to be suitable for use in life support, life-critical or safety-critical systems or equipment, nor in applications where failure or malfunction of a Code & Modules product can reasonably be expected to result in personal injury, death or severe property or environmental damage. Should Buyer purchase or use Code & Modules product described herein for any such unintended or unauthorized application, Buyer shall indemnify Code & Modules and its officers, employees, subsidiaries, affiliates, and distributors harmless against all claims, costs, damages, and expenses, and reasonable attorney fees arising out of, directly or indirectly, any claim of personal injury or death associated with such unintended or unauthorized use, even if such claims alleges that Code & Modules was negligent regarding the design or manufacture of the part.

Applications

Customers are responsible for the design and operation of their applications and products using Code & Modules products, and Code & Modules accepts no liability for any assistance with applications or customer product design. It is customer’s sole responsibility to determine whether the Code & Modules product is suitable and fit for the customer’s applications and products planned, as well as for the planned application and use of customer’s third party customer(s). Customers should provide appropriate design and operating safeguards to minimize the risks associated with their applications and products.

Code & Modules does not accept any liability related to any default, damage, costs or problem which is based on any weakness or default in the third-party customer(s). Customer is responsible for doing all necessary testing for the customer’s applications and products using Code & Modules products in order to avoid a default of the applications and the products or of the application or use by customer’s third party customer(s). Code & Modules does not accept any liability in this respect.

Typical values

“Typical” parameters that may be provided in Code & Modules data sheets and/or specifications can and do vary in different applications and actual performance may vary over time. All operating parameters, including “Typicals”, must be validated for each customer application by customer’s

technical experts.

No offer to license

Nothing in this document, including the software, may be interpreted as a conveyance or implication of any license under any copyrights, patents or other industrial or intellectual property rights.

Export control

This document as well as the item(s) described herein may be subject to export control regulations. Export might require a prior authorization from competent authorities.

Trademarks

Code & Modules and Pixieboard name and logo are trademarks of Code & Modules Inc. Reg. U.S. Pat. & Tm. Off. All other product or service names are the property of their respective owners.

© 2017 Code & Modules, Inc.

Preface

Introduction

This chapter contains general information that will be useful to know before using Pixieboard. The topics discussed in this section include:

- Document layout
- Conventions used in this guide
- Additional recommended reading
- Revision history

Document layout

This document describes Pixieboard product family and its main components and interfaces. The document is organized as follows:

Convention used

Description	Represents	Examples
Palatino Font		
Italic characters	Emphasized text	...is the <i>only</i> computer
Initial caps	A window	the Terminal window
	A dialog	the Settings dialog
	A hardware part	SD Card Port
Underlined italic	An URL	<u>codeandmodules.com</u>
Quotes with	A field name in a window or dialog	"Save configuration"
Bold characters	A dialog button	Click OK
	A tab	Click the Users tab
Consolas font		
Plain consolas	File paths	/usr/bin/
	File extensions	.config
	Command line	sudo make
	Bit values	0, 1
	Constants	0xFF
Italic	Sample code	<i>Content-Disposition: form-data;</i>

Table 1. Convention used along the document.

Recommended reading

NXP® i.MX6 Fact Sheet (<http://www.nxp.com/assets/documents/data/en/fact-sheets/IMX6SRSFS.pdf>)

NXP® i.MX6 DualPlus/ QuadPlus Datasheet (<http://www.nxp.com/assets/documents/data/en/data-sheets/IMX6DQPIEC.pdf>)

NXP® i.MX6 Dual/ Quad Datasheet (<http://www.nxp.com/assets/documents/data/en/data-sheets/IMX6DQCEC.pdf>)

NXP® i.MX6 Solo/ DualLite Datasheet (<http://www.nxp.com/assets/documents/data/en/data-sheets/IMX6SDLIEC.pdf>)

Revision History

Revision 1.1 (September 2017)

Revision 1.0 (April 2017)

Initial release of this document (5/1/2017)

1.2. Specifications

There are four versions of Pixieboard.

	PixieBoard PRO+	PixieBoard PRO	PixieBoard DUO	PixieBoard CORE
CPU	i.MX6 QuadPlus	i.MX6 Quad	i.MX6 Dual lite	i.MX6 Solo
Speed	1 GHz	1 GHz	1 GHz	1 GHz
RAM	4 GB 64-bit DDR3 @ 533MHz	2 GB 64-bit DDR3 @ 533MHz	1 GB 64-bit DDR3 @ 533MHz	512 MB 64-bit DDR3 @ 533MHz
USB	2 Type-A Host USB 2.0, 1 micro USB OTG	2 Type-A Host USB 2.0, 1 micro USB OTG	2 Type-A Host USB 2.0, 1 micro USB OTG	2 Type-A Host USB 2.0, 1 micro USB OTG
WIFI	802.11 a/b/g/n/ac @ 2.4 GHz, 5 GHz, 2x2 MIMO	802.11 a/b/g/n/ac @ 2.4 GHz, 5 GHz, 2x2 MIMO	802.11 a/b/g/n/ac @ 2.4 GHz, 5 GHz, 2x2 MIMO	802.11 a/b/g/n/ac @ 2.4 GHz, 5 GHz, 2x2 MIMO
Bluetooth®	4.2 (w/BLE), 2.1 + EDR	4.2 (w/BLE), 2.1 + EDR	4.2 (w/BLE), 2.1 + EDR	4.2 (w/BLE), 2.1 + EDR
Mobile Broadband	LTE Module	LTE Module	UMTS/HSPA+ 3G Module	UMTS/HSPA+ 3G Module
Location	GPS/GLONASS	GPS/GLONASS	GPS/GLONASS	GPS/GLONASS
Display	micro HDMI (1080p @ 60Hz HDTV)	micro HDMI (1080p @ 60Hz HDTV)	micro HDMI (1080p @ 60Hz HDTV)	micro HDMI (1080p @ 60Hz HDTV)
Storage	2 UHS-I SD Card Ports with transfer rates up to 104 MB/s	2 UHS-I SD Card Ports with transfer rates up to 104 MB/s	2 UHS-I SD Card Ports with transfer rates up to 104 MB/s	2 UHS-I SD Card Ports with transfer rates up to 104 MB/s
Audio	mini-TOSLINK® optical port / 3.5mm line out	mini-TOSLINK® optical port / 3.5mm line out	-	-
Sensors	9-axis IMU (accelerometer, gyro and magnetometer)	9-axis IMU (accelerometer, gyro and magnetometer)	-	-
Expansion port	Gigabit Ethernet, PCIe x1, SDIO, 2 MIPI, SATA-II, RGB666, USB 2.0 HS, CAN, SPI, 2 UART, 2 I2C, GPIOs	Gigabit Ethernet, PCIe x1, SDIO, 2 MIPI, SATA-II, RGB666, USB 2.0 HS, CAN, SPI, 2 UART, 2 I2C, GPIOs	Gigabit Ethernet, PCIe x1, SDIO, 2 MIPI, RGB666, USB 2.0 HS, CAN, SPI, 2 UART, 2 I2C, GPIOs	Gigabit Ethernet, PCIe x1, SDIO, 2 MIPI, RGB666, USB 2.0 HS, CAN, SPI, 2 UART, 2 I2C, GPIOs
Multimedia	2D/3D GPUs & h.264 video encode/decode @1080p30	2D/3D GPUs & h.264 video encode/decode @1080p30	2D/3D GPUs & h.264 video encode/decode @1080p30	2D/3D GPUs & h.264 video encode/decode @1080p30
Power input	5V DC Input	5V DC Input	5V DC Input	5V DC Input
Typical current	1.5 A	1.5 A	1.5 A	1.5 A
Processor Temperature Range	-40 - 125° C	-40 - 125° C	-20 - 105° C	-20 - 105° C
Dimensions	52 mm x 91 mm	52 mm x 91 mm	52 mm x 91 mm	52 mm x 91 mm

Table 2. Specifications for Pixieboard Core, Pixieboard Duo, Pixieboard Pro, and Pixieboard Pro+

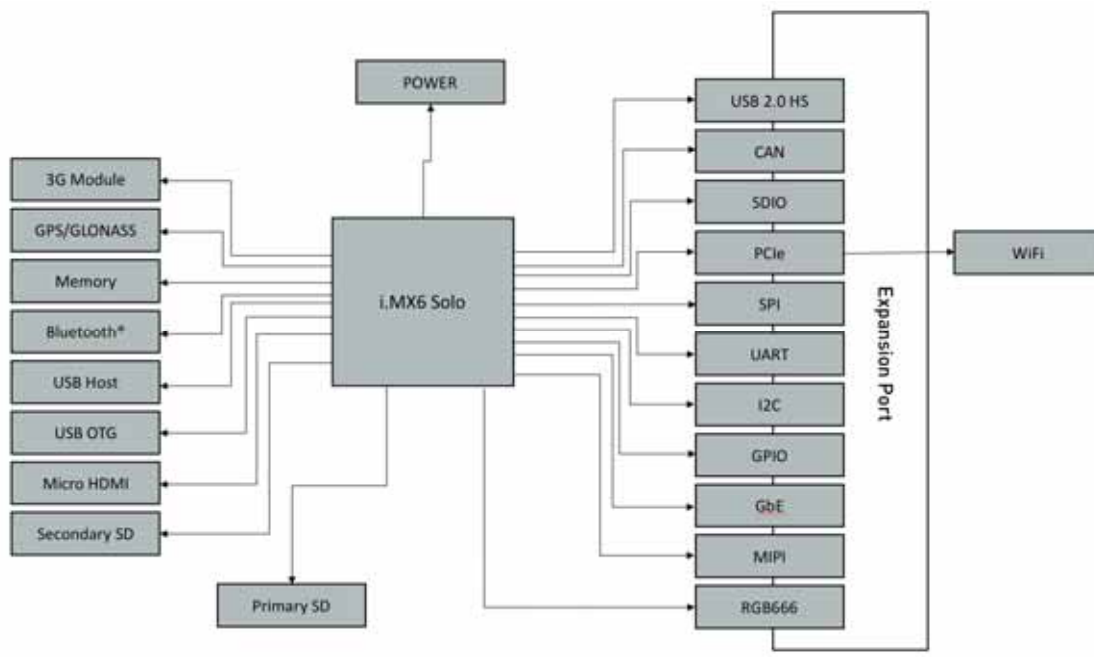


Figure 3. Block diagram PixieBoard CORE

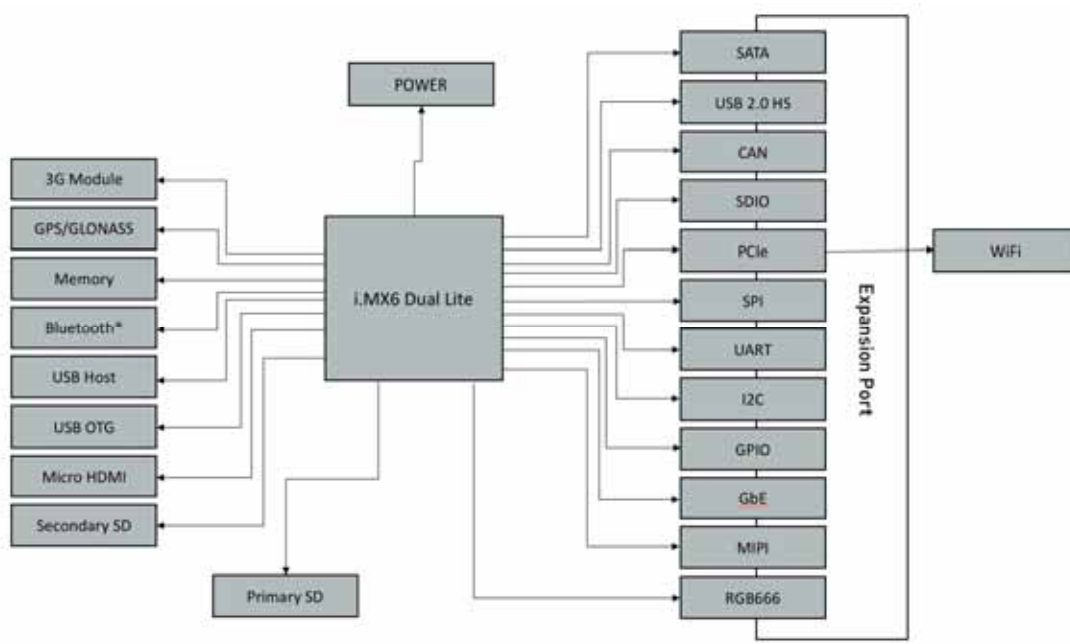


Figure 3. Block diagram PixieBoard DUO

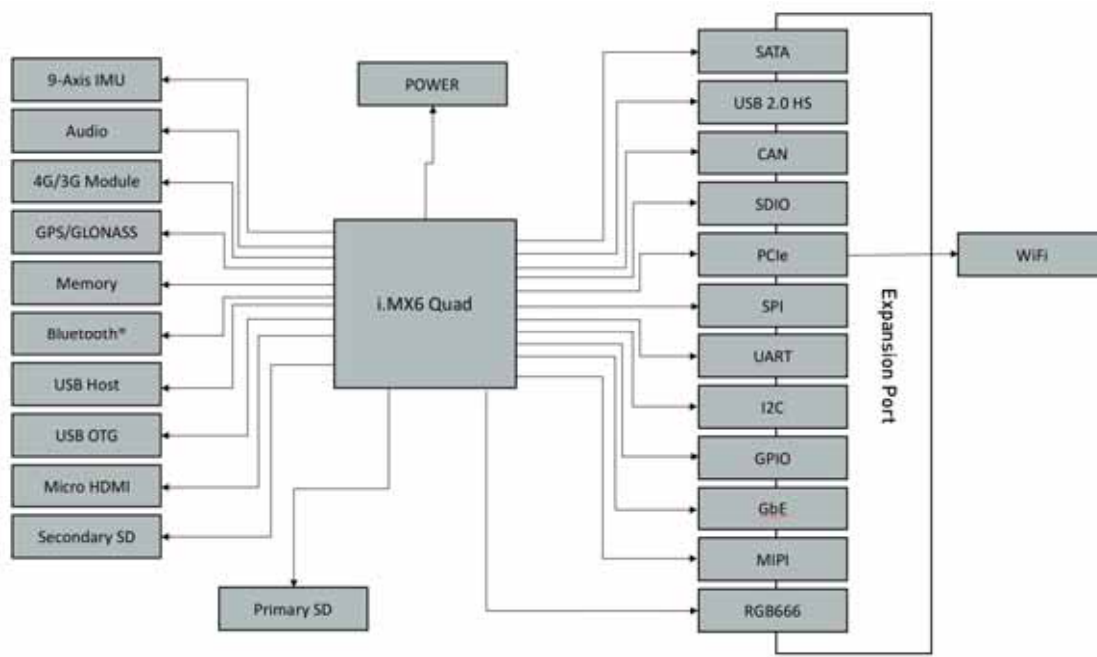


Figure 3. Block diagram PixieBoard PRO

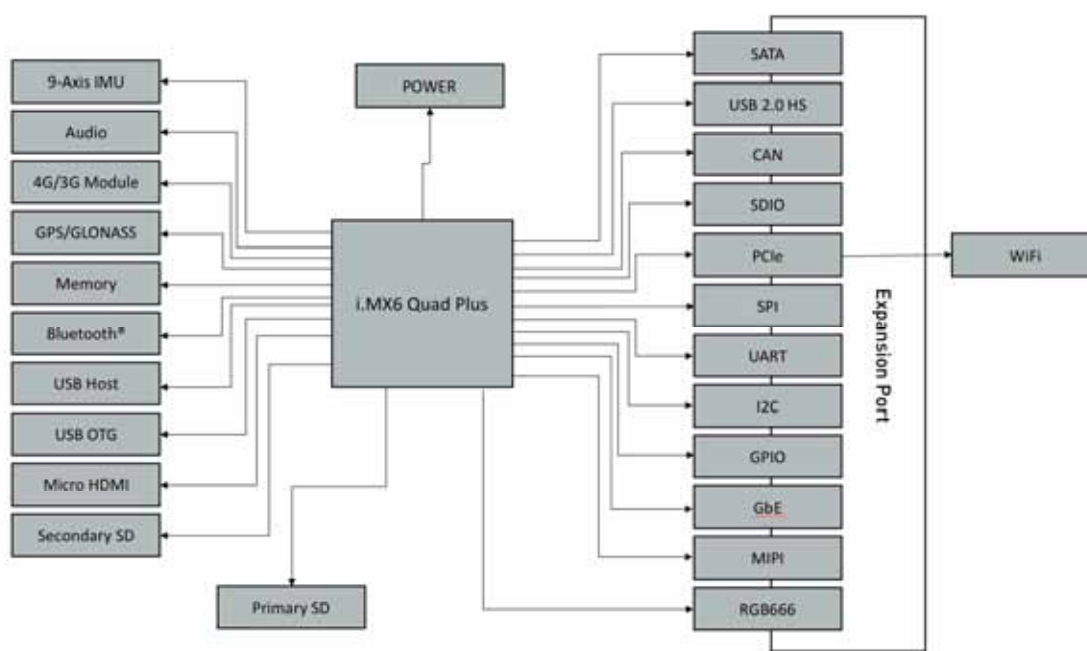


Figure 3. Block diagram PixieBoard PRO+

1.3. Features

Pixieboard's main features are listed below by category.

1.3.1. Operating system

A custom Linux image is used to provide hardware abstraction and device driver management.

Available hardware:
Primary SD Card Port.

1.3.2. Graphics

The module provides three independent, integrated graphics processing units, depending on the processor included:

	Pixieboard Core	Pixieboard Duo	Pixieboard Pro	Pixieboard Pro+
Embedded prefetch & resolve engine	-	-	-	Yes
GPU 3D	Vivante GC880 35Mtri/s 266Mpxl/s OpenGL® ES 2.0	Vivante GC880 35Mtri/s 266Mpxl/s OpenGL® ES 2.0	Vivante GC2000 200Mtri/s 1000Mpxl/s, OpenGL® ES 3.0 & Haili, OpenCL™ EP	Vivante GC2000 200Mtri/s 1000Mpxl/s, OpenGL® ES 3.0 & Haili, OpenCL™ 1.1 EP
GPU 2D (Vector graphics)	Emulated on GPU 3D	Emulated on GPU 3D	Vivante GC335 300Mpxl/s, OpenVG™ 1.1	Vivante GC335 300Mpxl/s, OpenVG™ 1.1
GPU 2D (composition)	Vivante GC320 600Mpxl/s, BLIT	Vivante GC320 600Mpxl/s, BLIT	Vivante GC320 600Mpxl/s, BLIT	Vivante GC320 600Mpxl/s, BLIT
Video Decode	1080p30 + D1	1080p30 + D1	1080p60 h.264	HD (1080p+720p) 30fps
Video Encode	1080p30 h.264	1080p30 h.264	1080p30 h.264	1080p30 h.264

Table 3. Graphic processing units.

1.3.3. Display

The module generates the signals required to drive compatible display devices and render application visual output. The available resolutions and delivered frame rates depend on the connected display panel and OS configuration.

Available hardware:

- The board includes a micro HDMI connector that provides audio and video driven by the processor.
- LCD LVDS supported via the expansion port connector.

1.3.4. Storage

The performance will be affected by the mass storage system used and any parallel tasks running at the time.

Available hardware:

- Micro SD Card Port (with a bus of up to 104 MB/s)
- USB can host common storage devices.
- SATA-II¹ (up to 3 Gb/s) can be used to connect a Hard Disk Drive. It is available via the expansion port connector

1.3.5. Video

Pixieboard provides encoding and decoding functions for many common formats, including h.264 and numerous MPEG / JPEG derivatives.

1.3.6. Audio²

Digital audio is available via the mini TOSLINK® optical port.
Analog audio is available through the 3.5 mm line out.

1.3.7. USB

Pixieboard provides the following hardware for USB connections with current demand of up to 500 mA:

- 2 Type-A Host USB 2.0
- 1 microUSB OTG 2.0
- 1 USB 2.0 HS is available via the expansion port connector.

1.3.8. I/O

- I2C – Two ports are available via the expansion port connector.
- GPIO – Available via the expansion port, unused interface pins can be reconfigured to be GPIO.
- UART – Two ports are available via the expansion port connector.
- SDIO – One serial data interface is available via the expansion port connector.
- CSI – One Camera Serial Interface is available via the expansion port connector.
- DSI – One Display Serial Interface is available via the expansion port connector.
- SPI – One port is available via the expansion port connector.

1.3.9. Wired Networking

- CAN – One port is available via the expansion port connector.
- GbE – One Gigabit Ethernet interface is exposed in the expansion port connector.

1.3.10. Wireless Networking

1.3.10.1. WiFi

Pixieboard offers 802.11 a/b/g/n/ac @ 2.4 GHz, 5 GHz, 2x2 MIMO.

Available Hardware:

- WiFi module is embedded within Pixieboard and connected over PCIe. The PCIe interface complies with PCIe specification Gen2 x1 lane and supports the PCI Express 1.1/2.0 standard.

¹ SATA-II is only available for Pixieboard Pro and Pixieboard Pro+.

² Available only for Pixieboard Pro and Pixieboard Pro+.

- WiFi/BT Antenna U.FL Connector (main)
- WiFi/BT Antenna U.FL Connector (MIMO)

Output power:

WLAN G band:

- 11b: 15dBm $\pm$ 2dBm
- 11g: 13dBm $\pm$ 2dBm
- 11n HT20: 12dBm $\pm$ 2dBm
- 11n HT40 11dBm $\pm$ 2dBm

WLAN A band:

- 11a: 11dBm $\pm$ 2dBm
- 11n HT20: 11 dBm $\pm$ 2dBm
- 11n HT40: 9 dBm $\pm$ 2dBm
- 11ac VHT_20: 11dBm $\pm$ 2dBm
- 11ac VHT_40: 9dBm $\pm$ 2dBm
- 11ac VHT_80: 8dBm $\pm$ 2dBm

1.3.10.2. Bluetooth®

Pixieboard offers Bluetooth Low Energy 4.2

Available Hardware:

- Bluetooth module is embedded within Pixieboard and connected over PCIe. The PCIe interface complies with PCIe specification Gen2 x1 lane and supports the PCI Express 1.1/2.0 standard.
- WiFi/BT Antenna Connector (main). See previous section “WiFi”.

1.3.10.3. Mobile broadband LTE³ or UMTS/HSPA+ 3G Module⁴

Available Hardware:

- Mobile broadband module is embedded within Pixieboard.
- One Nano SIM card slot is available.
- 3G Antenna U.FL connector (RX Diversity).
- 3G Antenna U.FL connector (Main)

³ Available only for Pixieboard Pro+

⁴ Available for Pixieboard Pro and Pixieboard Duo.

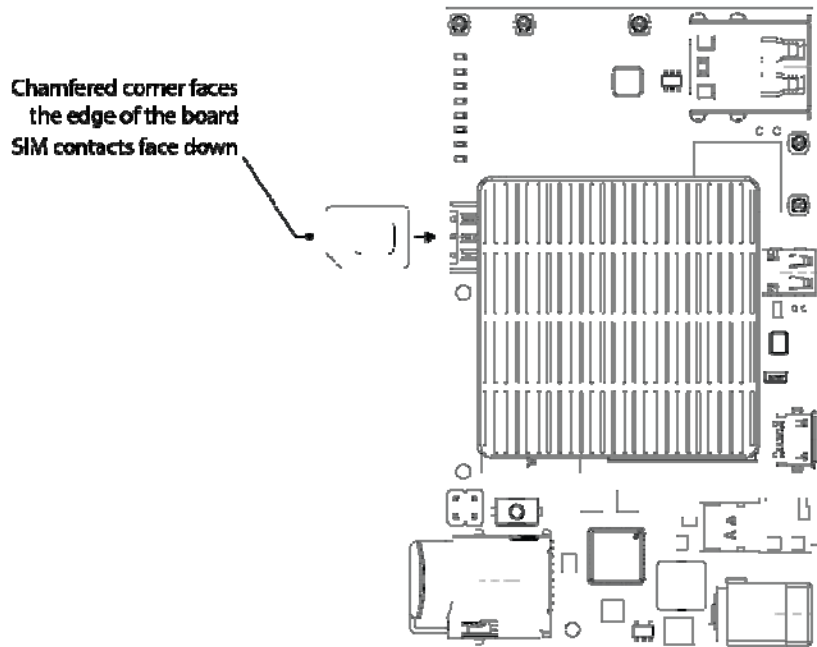


Figure 4. Nano SIM card installation.

- Worldwide LTE, UMTS / HSPA+ and GSM / GPRS / EDGE coverage, according to the module included.
- LTE FDD B2, B4, B12; WCDMA: B2, B4, B5
- UMTS: 800 / 850 / 900 / 1900 / 2100MHz; GSM: 850 / 900 / 1800 / 1900MHz

1.3.11. Sensors

Several interfaces are available to support sensors and accessory device connections in either slave or master mode.

Available Hardware:

- One 9-axis IMU⁵ (magnetometer, gyro, and accelerometer)
- GPS/GLONASS⁶ embedded in Mobile broadband module.
- GPS Antenna U.FL connector⁷.

1.3.12. Thermal Management

The BSP includes a temperature sensor module which software can use to monitor the on-die temperature of the processor and take appropriate actions, such as throttling back the core frequency when a specified threshold is reached.

1.3.13. Debug

System debug available via USB-UART cable or OTG serial interface.

⁵ Available only for Pixieboard Pro and Pixieboard Pro+.

⁶ Available for Pixieboard Pro+, Pixieboard Pro and Pixieboard Duo.

⁷ Available only for Pixieboard Pro and Pixieboard Pro+

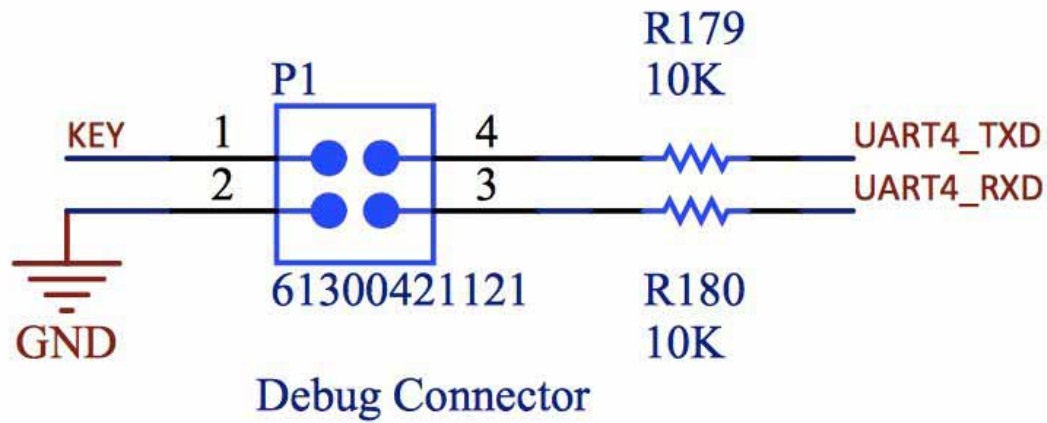


Figure 5. Debug connector schematic diagram.

1.3.14. Expansion port

Via the Expansion port, Pixieboard exposes the following interfaces:

- USB 2.0 HS
- CAN
- SDIO
- SPI
- PCIe (used by the WiFi module)
- UART
- I2C
- GPIO
- GbE
- MIPI
- RGB666
- SATA⁸

The pinout is described in the following diagrams:

⁸ Available only for Pixieboard Pro and Pixieboard Pro+

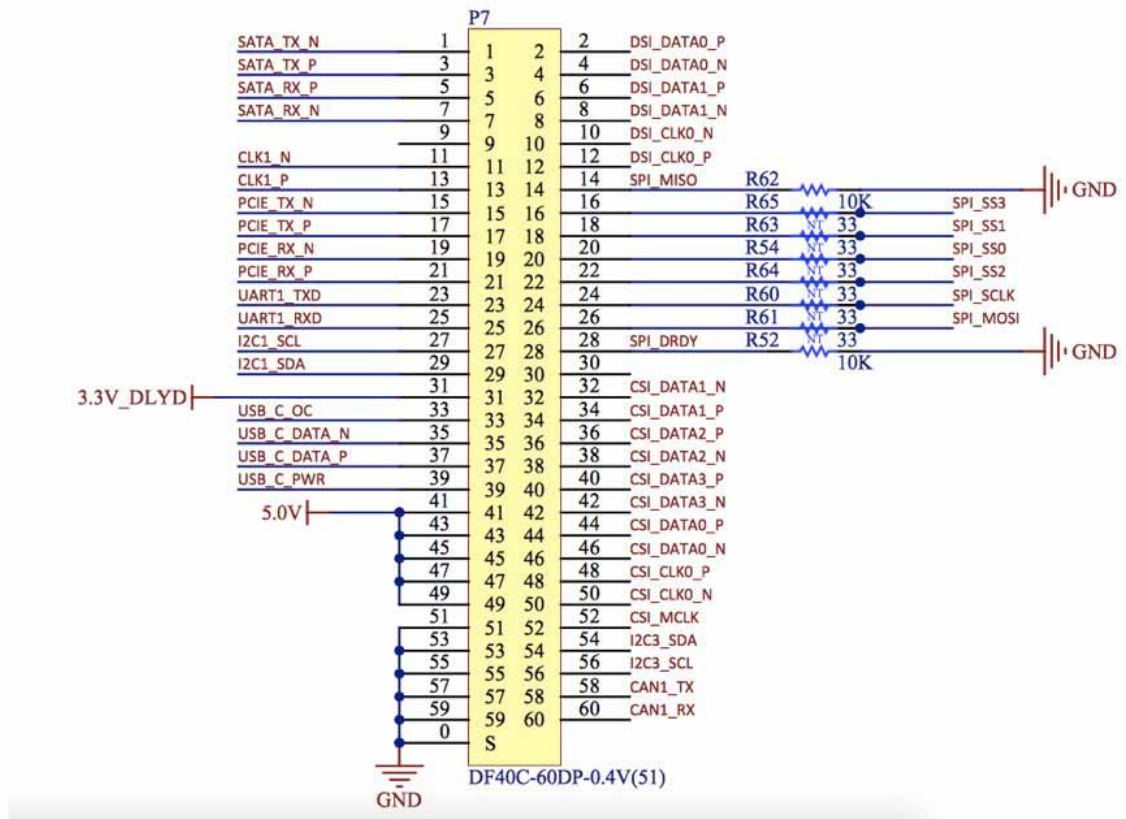


Figure 6. Expansion Port A Pinout.

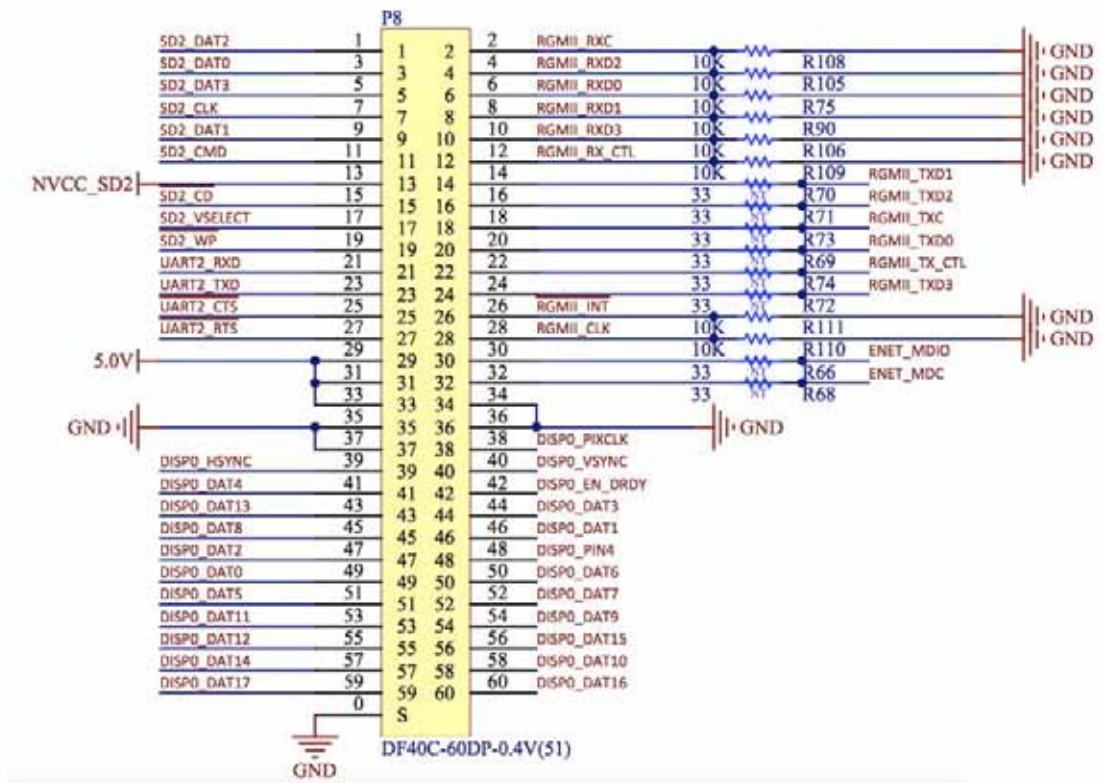


Figure 7. Expansion Port B Pinout.

1.4. Contents

- Pixieboard

2. Mechanical drawings

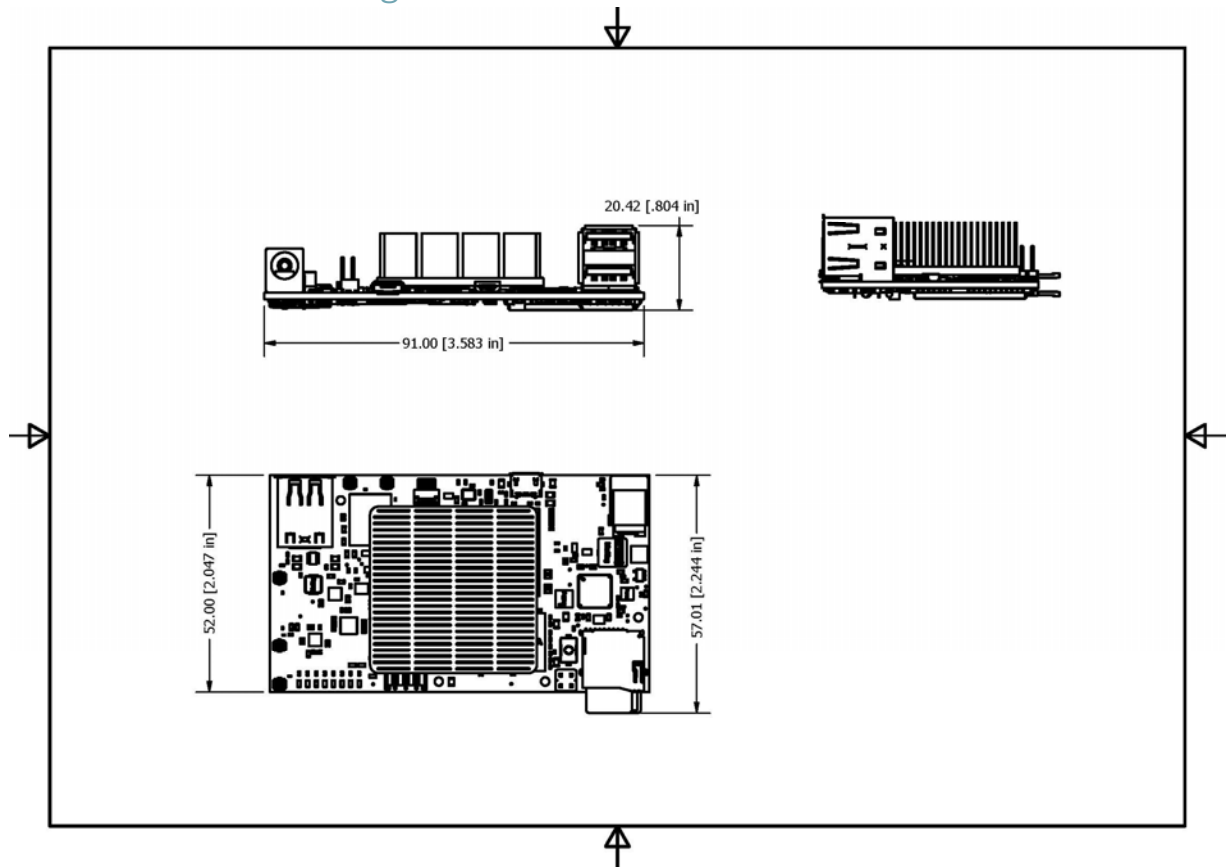


Figure 8. Pixieboard mechanical drawings. Units: mm (in)

3. WW sales and Service Support

WW Sales:

Tel: +1 (408) 836-7383

Technical support:

codeandmodules.com/support

Web address:

codeandmodules.com

4. Certifications

4.1. United States FCC

The PixieBoard complies with Part 15 of the FCC rules and regulations. Compliance with the labeling requirements, FCC notices and antenna usage guidelines is required. To fulfill FCC Certification, the OEM must comply with the following regulations:

The system integrator must ensure that the text on top side of the module is placed on the outside of the final product.

PixieBoard platform may only be used with antennas approved. See FCC-approved antennas.

NOTE: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

The FCC requires the user to be notified that any changes or modifications made to this device that are not expressly approved by Code & Modules Inc. may void the user's authority to operate the equipment.

FCC Exposure warning statements:

This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment. End users must follow the specific operating instructions for satisfying RF exposure compliance. This transmitter must be at least 20 cm from the user and must not be co-located or operating in conjunction with any other antenna or transmitter.

The information in this guide may change without notice. The manufacturer assumes no responsibility for any errors that may appear in this guide.

OEM Warning statement (PixieBoard)

The modular transmitter must be equipped with either a permanently affixed label or must be capable of electronically displaying its FCC ID: 2APEM-PXBD, IC: 23802-PXBD

If using a permanently affixed label, the modular transmitter must be labeled with its own FCC ID/IC ID, and, if the FCC ID/IC ID is not visible when the module is installed inside another device, then the outside of the device into which the module is installed must also display a label referring to the enclosed module. This exterior label can use wording such as the following: “Contains Transmitter FCC ID: 2APEM-PXBD, IC: 23802-PXBD.” Any similar wording that expresses the same meaning may be used. The Grantee may either provide such a label, an example of which must be included in the application for equipment authorization, or, must provide adequate instructions along with the module which explain this requirement. In the latter case, a copy of these instructions must be included in the application for equipment authorization.

4.2. Canada (IC)

This device complies with Industry Canada license-exempt RSS standard(s). Operation is subject to the following two conditions:

1. This device may not cause harmful interference;
2. This device must accept any interference received, including interference that may cause undesired operation of the device.

Cet appareil est conforme à Industrie Canada une licence standard RSS exonérés (s). Son fonctionnement est soumis aux deux conditions suivantes:

1. Cet appareil ne doit pas provoquer d'interférences
2. Cet appareil doit accepter toute interférence reçue, y compris les interférences pouvant provoquer un fonctionnement indésirable de l'appareil.

RF EXPOSURE:

Radiation Exposure Statement: This equipment complies with the IC RSS-102 radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with a minimum distance of 20 cm between the radiator and your body.

Énoncé d'exposition aux rayonnements: Cet équipement est conforme aux limites d'exposition aux rayonnements ioniques RSS-102 Pour un environnement incontrôlé. Cet équipement doit être installé et utilisé avec un Distance minimale de 20 cm entre le radiateur et votre corps.