

BeagleBone Black Description

The BeagleBone Black is the newest member of the BeagleBoard family. It is a lower-cost, high-expansion focused BeagleBoard using a low cost Sitara XAM3359AZCZ100 Cortex A8 ARM processor from Texas Instruments. It is similar to the Beaglebone, but with some features removed and some features added. The table below gives the high points on the differences between the BeagleBone and BeagleBone Black.

	BeagleBone Black	BeagleBone
Processor	AM3359AZCZ100, 1GHZ	AM3358ZCZ72, 720MHz
Video Out	HDMI	None
DRAM	512MB DDR3L	256MB DDR2
Flash	2GB eMMC, uSD	uSD
Onboard JTAG	Optional	Yes, over USB
Serial	Header	Via USB
Power	210-460 mA@5V	300-500 mA@5V

BeagleBone Black Features

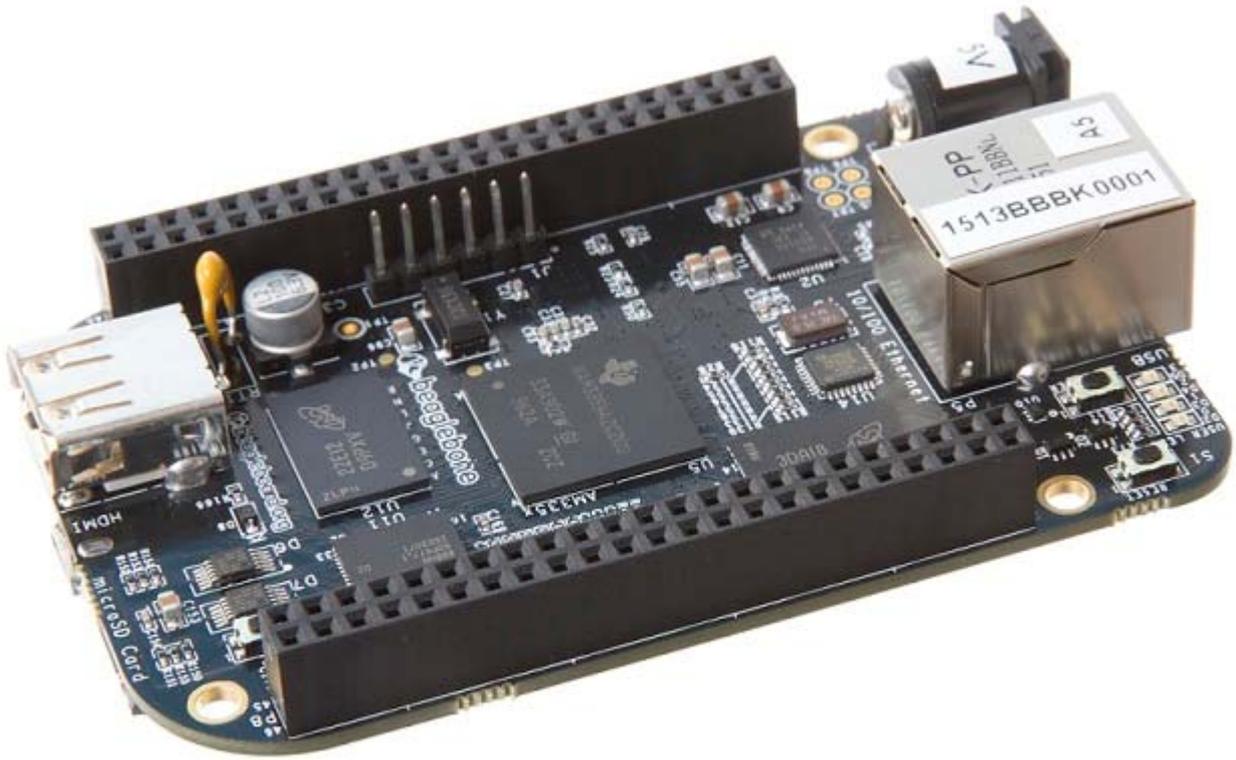
The following table lists the key features of the BeagleBone Black.

	Feature	
Processor	Sitara AM3359AZCZ100 1GHz, 2000 MIPS	
Graphics Engine	SGX530 3D, 20M Polygons/S	
SDRAM Memory	512MB DDR3L 400MHZ	
Onboard Flash	2GB, 8bit Embedded MMC	
PMIC	TPS65217C PMIC regulator and one additional LDO.	
Debug Support	Optional Onboard 20-pin CTI JTAG, Serial Header	
Power Source	miniUSB USB or DC Jack	5VDC External Via Expansion Header
PCB	3.4" x 2.1"	6 layers
Indicators	1-Power, 2-Ethernet, 4-User Controllable LEDs	
HS USB 2.0 Client Port	Access to USB0, Client mode via miniUSB	
HS USB 2.0 Host Port	Access to USB1, Type A Socket, 500mA LS/FS/HS	
Serial Port	UART0 access via 6 pin 3.3V TTL Header. Header is populated	
Ethernet	10/100, RJ45	
SD/MMC Connector	microSD , 3.3V	
User Input	Reset Button Boot Button Power Button	
Video Out	16b HDMI, 1280x1024 (MAX) 1024x768,1280x720,1440x900 w/EDID Support	
Audio	Via HDMI Interface, Stereo	
Expansion Connectors	Power 5V, 3.3V , VDD_ADC(1.8V) 3.3V I/O on all signals McASP0, SPI1, I2C, GPIO(69), LCD, GPMC, MMC1, MMC2, 7 AIN(1.8V MAX), 4 Timers, 4 Serial Ports, CAN0, EHRPWM(0,2),XDMA Interrupt, Power button, Expansion Board ID (Up to four capes can be stacked onto the board)	
Weight	1.4 oz (39.68 grams)	
Power	210-460mA @5V Depending and activity and processor speed.	

In the box is (1)BeagleBone Black board, (1)USB cable, and (1)card that should be read.

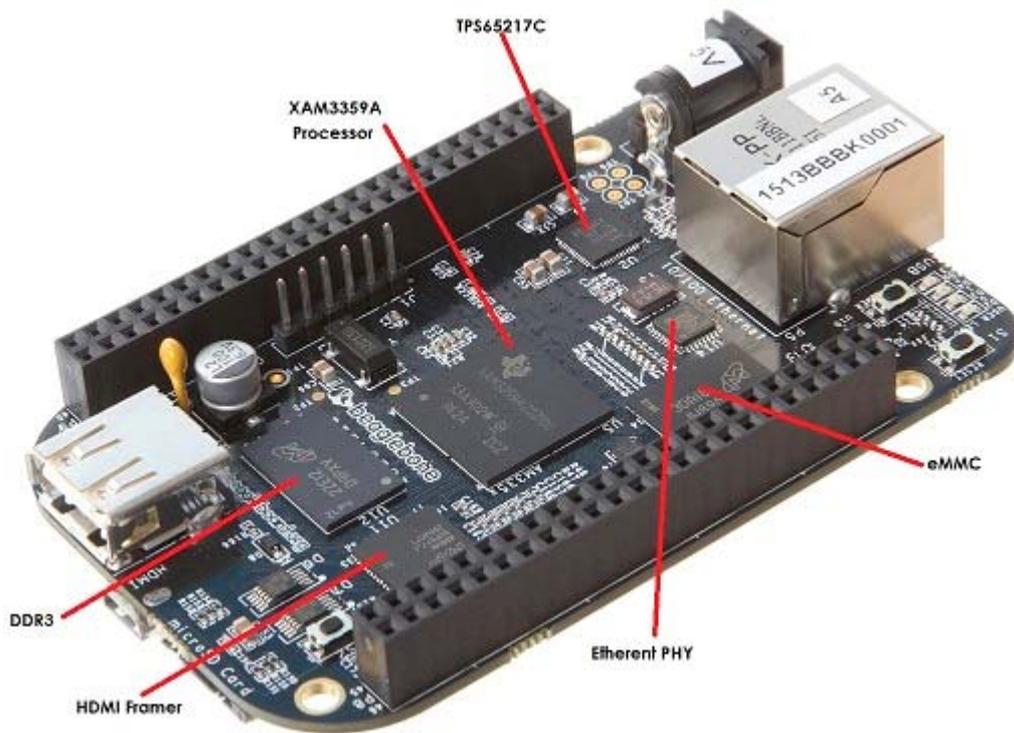
BeagleBone Black Picture

Here is a picture of the Rev A5A board.



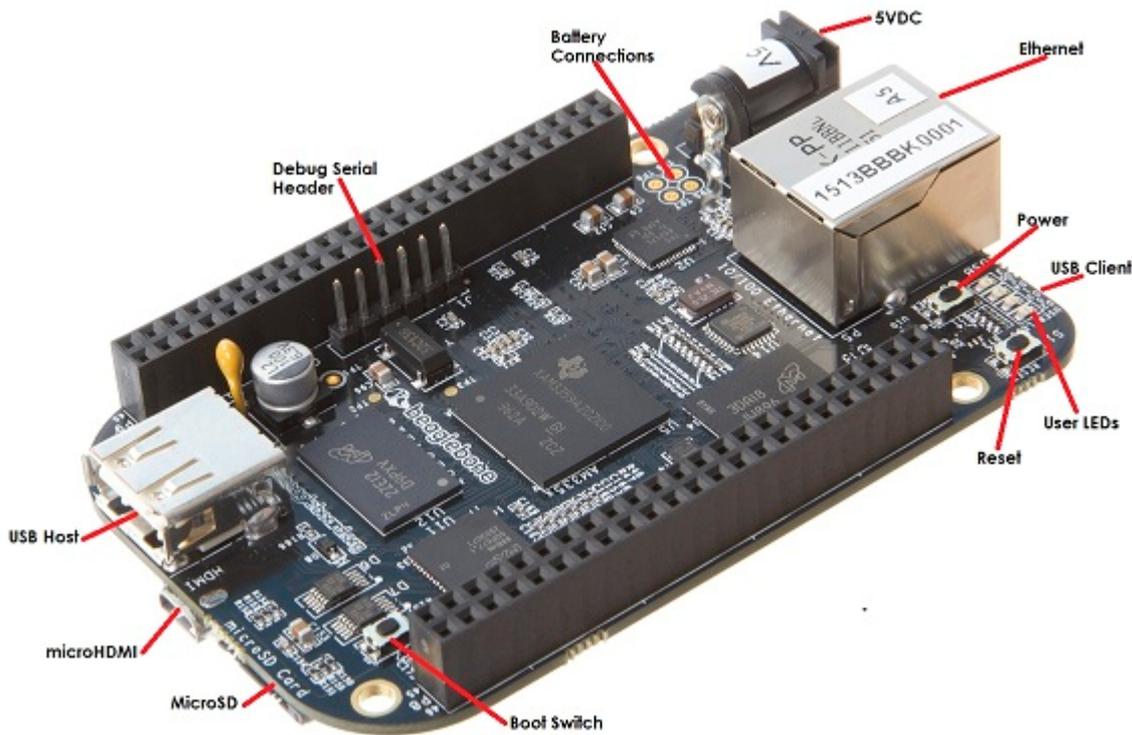
BeagleBone Black Key Component Locations

Here are the locations of the key components on the Rev A5A.



BeagleBone Black Connector and Switch Locations

Below is the location of the connectors and switches on the Rev A5A board. The Power Button and Battery Connections are new additions to the Rev A5A.



Frequently Asked Questions (FAQ)

- [FAQ](#)

List of frequently asked questions concerning the BeagleBone Black. It will be updated as more questions continued to be answered.

Terms of Use

You may use the Beaglebone Black as you choose. There are no licences involved in the usage of the BeagleBone Black for any purposes. However, we discourage the use of the board that we manufacture under the BeagleBoard.org logo in commercial products without understanding a few things first.

1) We did not design the board for use in your product. We cannot therefore guarantee that it will work in all cases and over the full range of operation you expect. It is up to you to make that determination.

We have had instances where people have done this and returned 25% of their purchases saying they would not work. Either the boards worked perfectly once received, or they had been blown up.

2) We will make whatever updates and changes to the board that are required to resolve any issues we see. Once updated, the old revision will no longer be made. This will mean that if you use the board in your product, we will not guarantee long term supply of any revision.

3) **All design materials are Open Source and easily accessible. Everything is provided to build your own board. You can make changes as needed or use it as is. It is your product when you use these materials. There are resources available that can assist you in this effort if needed. Resources are available to assist you in doing this.**

If you chose to use the board in a product, please keep this factors in mind. If you decide to go ahead and do this, there are other avenues available to you that has certain advantages that will help you in your usage of the board in a product.

If you have questions on any of this, you can contact [Gerald Coley](#)

Board Shipments

We have shipped a total **66,384** boards to date. As more boards ship, the number will be updated.

Accessories

For a list of the confirmed working accessories please goto *[Accessories Page](#)
Covered there are cables, power supplies, displays,etc. Anything that can be added to the BeagleBone Black.

Optional JTAG

There is no JTAG over USB support on the BeagleBone Black. The BeagleBone Black is different than the BeagleBone. JTAG is an uninstalled option.

To install the JTAG header, all you have to do is install P2 on the back of the board.
P2 is a Samtec FTR-110-03-G-D-06 connector and can be purchased from Samtec or any of their distributors.

Cape Support

Beagleboard.org is not the maker of the various capes. Most of them are made and supported by Circuitco under the beagleboardtoys.com name. For information on cape compatibility and support go to [BeagleBone Black Capes](#)

WIFI Adapters

NOTE: It is highly recommend that you use DC power when running these dongles due to the current requirements of the dongles.

DONGLE	WORKS ON
ASUS USB-N13 802.11 b/g/n	Angstrom
EDIMAX EW-7811UN	Angstrom
D-Link DWA-125	Debian LXDE , Debian Gnome Desktop
D-Link DWA-121	Angstrom (How-to) , Debian LXDE , Debian Gnome Desktop
Belkin N150	Debian LXDE
TP-Link TL-WN727N	Debian LXDE , Debian Gnome Desktop
Netgear WNA1100	Debian LXDE , Debian Gnome Desktop
Keebox W150NU	Debian LXDE , Debian Gnome Desktop

Serial Debug Cable

For information on the serial debug cables go to [Serial Debug Cables](#)

Board Revisions and Changes

Revision A5C (Production Version)

Production had some fallout of boards when running the HDMI tests in the previous production run. Resistor values were tweaked to improve the test results.

No changes in features or operation of the board.

- 1) Changed R46,R47,R48 to a 0 ohm.
- 2) Changed R45 to a 22 Ohm.

Revision A5B (Previous Production Version)

- 1) Updated the PCB to incorporate the modification that was being done on Rev A5A. There is NO DIFFERENCE AT ALL in functionality between REV A5A and REV A5B.
- 2) Made the LEDs dimmer for those that could not sleep due to the brightness of the LEDs.

Revision A5A (Old Production Version)

- 1) Boards are built using the XAM3359AZCZ100 processor.
- 2) PCB Change...LCD noise issue was resolved by adding 47pf bypass caps on some of the LCD signals.
- 3) PCB Change...Added access to four battery charger signals on the TPS65217 (TS=Temperature Sense, BAT=Battery connection, BATT_SENSE=Battery voltage pin, GND=Ground). Pins are not populated but the four signals are in a 2x2 .1x.1 spacing.
- 4) PCB Change...Added a power button which allows for wake up, power down, and sleep options. It also provides the ability to alert the processor before powering down to provide an orderly shutdown. It is expected that SW will be used in conjunction with the switch to control the various power modes and transitions from one to the other. By holding the button down for 8 seconds, it will force a power down of the board.
- 5) Added a 100K pull down resistor from J1 pin 1 to J1 pin 4 to fix the unterminated serial port issue.

Revision A4B

Added a 100K pull down resistor between pins 1 and 4 of J1 to fix the serial port issue.

Revision A4A

Incorporated the capacitors to fix the noise issue on the display

Revision A4

First prototype release version of the board. Limited distribution. One notable issue here is that the board has an AM3352 processor instead of an AM3359, despite how the part is marked. Part was mismarked as an AM3359. The SGX and PRU are not operational.

Tips and Pointers

Expansion Header Usage

There are several precautions that need to be taken when working with the expansion headers to prevent damage to the board.

ALL VOLTAGE LEVELS ARE 3.3V MAX. APPLICATION OF 5V TO ANY I/O PIN WILL DAMAGE THE PROCESSOR AND VOID THE WARRANTY.

ANALOG IN VOLTAGES ARE 1.8V MAX. APPLICATION OF >1.8V TO ANY A/D PIN WILL DAMAGE THE PROCESSOR AND VOID THE WARRANTY.

- 1) Do not apply any voltages to any I/O pins when the board is not powered on.
- 2) Do not drive any external signals into the I/O pins until after the SYS_RESETh signal is HI (3.3V).
- 3) Do not apply any voltages that are generated from external sources until SYS_RESETh signal is HI.
- 4) If voltages are generated from the VDD_5V signal, those supplies must not become active until after the SYS_RESETh signal is HI.
- 5) If you are applying signals from other boards into the expansion headers, make sure you power the board up after you power up the BeagleBone Black or make the connections after power is applied on both boards.

Powering the processor via its I/O pins can cause damage to the processor.
The expansion headers can be viewed on this [link](#).

Extremely Useful Links

[BeagleBoard home page](#)

[BeagleBoard How to Videos](#)

[Hipster Cricuits](#)

[Getting Started On BeagleBone Black](#)

[Adafruit Tutorials](#) This site is well worth a visit. You may even decide to make it your home page!

[Derek Molloy's Blog](#)

[Hackaday](#) You can also subscribe to this. Should be checked often for the latest cool projects on BeagleBone Black

Expanding the Storage Partition on microSD

If you have installed a Linux distribution on your microSD you can modify the root file system partition. You are then able to utilize all of the space on your microSD card regardless of the size of the default partition of your given image. Follow the instructions found on [this wiki page](#).

Note: The instructions on that page are general and are not guaranteed to work on every Linux distribution.

BoneScript

Bonescript is a Node.js library specifically optimized for the Beagle family, featuring familiar Arduino function calls, exported to the browser. The BoneScript library provides several functions useful for interacting with your hardware. The following [link](#) provides a dozen of hardware demos that interact with the BeagleBone Black.

Connecting to the BeagleBone Black: Serial Connecting, SSH, or USB

In the following [link](#), there are instructions on how to connect to the BeagleBone Black through either a serial connection, SSH using an ethernet cable, or SSH to the BeagleBone's built-in IP address over a USB cable.

HDMI Issues

HDMI Issues..We have several people having issues getting the board to work with various TVs and Displays. RMA returns have shown no issues.

If you are having issues a separate support page has been set up at [HDMI Issues](#)

Known Issues

WIKI Issues

If you find any issues with any information on this WIKI, please send the information to the discussion forum <http://beagleboard.org/Community/Forums>.

Software

- 1) The microSD card cannot be used as a storage device when booting from microSD in the 3.8 kernel.
- 2) SGX support is not currently provided in the 3.8 kernel.
- 3) The latest production image 6_20_2013 does not work on Lapdocks.

You can find a list of reported issues and add additional ones by going to [Bug Tracker](#)

Hardware

Here are the known Hardware issues:

REV A4,A4A...Processor is a AM3352 due to the incorrect part being marked as an AM3359.

REV A4,A4A...Does not ship with any cables. Rev A5 will ship with the USB cable.

REV A4...If you look closely, you will notice some noise in the display. This is due to a termination issue on the board caused by too many connections to the LCD data pins. This will be fixed on the A5 revision.

REV A4, A4A...Serial port can cause the system to crash if there is not a serial cable plugged into J1.

Software Resources

Angstrom

It is highly recommended that you always use the latest version of the Software.

For instructions on updating the Angstrom Software on your BeagleBone Black go to [*Software Update](#)

Software Sources

- Bootloader: <http://www.denx.de/wiki/U-Boot/SourceCode> (<git://git.denx.de/u-boot.git>)
- Kernel: <http://github.com/beagleboard/kernel/tree/3.8>
- Root file system: <http://github.com/beagleboard/meta-beagleboard>

To access the getting started guide do the following:

- 1) Go to <http://github.com/jadonk/beaglebone-getting-started>.
- 2) At the top of the page next to the "Clone in Windows" button, click the ZIP button.
- 3) Unzip that folder into a separate directory.
- 4) Open the readme file.

Android

For instructions on how to get Android onto the board goto [Android](#)

Ubuntu

For assistance on getting Ubuntu up and running go to [Ubuntu](#)

If you would like to install the LXDE desktop go to [LXDE Desktop](#)

If you would like to install full desktops go to [Desktops On Ubuntu/Debian](#)

Debian

For assistance on getting Debian up and running go to [Debian](#)

If you would like to install the LXDE desktop go to [LXDE Desktop](#)

If you would like to install full desktops go to [Desktops On Ubuntu/Debian](#)

Nintendo

If you want to turn your BeagleBone Black into a SNES (Super Nintendo Entertainment System) you can check that out at [BeagleSNES](#)

This link is provided as a convenience and the software located at this link is not supported by Circuitco or BeagleBoard.org.

Gentoo

This link is provided as a convenience and the software located at this link is not supported by Circuitco or BeagleBoard.org. [Gentoo](#)

ArchLinux

This link is provided as a convenience and the software located at this link is not supported by Circuitco or BeagleBoard.org. [ArchLinux](#)

Sabayon

This link is provided as a convenience and the software located at this link is not supported by Circuitco or BeagleBoard.org. [Sabayon](#) (Instructions [here](#)).

LinuxCNC

This link is provided as a convenience and the software located at this link is not supported by Circuitco or BeagleBoard.org. [LinuxCNC](#)

Minix

This link is provided as a convenience and the software located at this link is not supported by Circuitco or BeagleBoard.org. [Minix](#)

XNU

This link is provided as a convenience and the software located at this link is not supported by Circuitco or BeagleBoard.org. [CNU](#)

Fedora

This link is provided as a convenience and the software located at this link is not supported by Circuitco or BeagleBoard.org. [Fedora](#)

Asterisk

This link is provided as a convenience and the software located at this link is not supported by Circuitco or BeagleBoard.org. [Asterisk](#) (Instructions [here](#)).

TI EZSDK

For information on how to install the latest EZSDK from TI got to [EZSDK](#).

Beaglenmt

The BeagleBone Network Multitool ([beaglenmt](#)) is a lightweight, X11-free, networking-centric, and IPv6-ready server distribution targeting the BeagleBone platform. beaglenmt supports the BeagleBone Black hardware platform.

Hardware Files

LATEST PRODUCTION FILES (A5C)

The links below are static links that always point to the latest version of the listed documents. These links can be used by distributors or users to point to the latest documentation. As documents are updated, the links will remain the same, but the actual file will be updated. This insures that you always have the latest documents and your links will always work.

If you have any questions on these files, contact [Gerald Coley](#)

- [System Reference Manual A5.6 \(PDF\)](#)
- [Schematic A5C \(PDF\)](#)
- [Schematic A5C \(OrCAD\)](#)
- [BOM A5C \(xls\)](#)
- [PCB Files \(Allegro and Gerbers\)](#)
- [All Hardware Documents A5C](#)

If you are interested in an **Altium** version of the A5B board they can be found at [Altium A5B](#). These files are provided **AS IS** with no support.

If you are interested in an **Mentor** version of the A5C board they can be found at [Mentor A5C](#). These files are provided **AS IS** with no support.

You can find the Solid Works and 3D PDF files provided AS-IS at [3D Models](#)

PREVIOUS PRODUCTION FILES (A5B)

- [System Reference Manual A5.3 \(PDF\)](#)
- [Schematic A5A \(PDF\)](#)
- [Schematic A5A \(OrCAD\)](#)
- [BOM A5A\(xls\)](#)
- [PCB Files A5A \(Allegro and Gerbers\)](#)
- [All Hardware Documents A5A](#)

OLD PRODUCTION FILES (A5A)

- [System Reference Manual A5.3 \(PDF\)](#)
- [Schematic A5A \(PDF\)](#)
- [Schematic A5A \(OrCAD\)](#)
- [BOM A5A\(xls\)](#)
- [PCB Files A5A \(Allegro and Gerbers\)](#)
- [All Hardware Documents A5A](#)

REV A4

- [Bill of Materials](#)
- [System Reference Manual \(PDF\)](#)
- [Schematic \(PDF\)](#)

BeagleBone Capes

BeagleBone capes are add on boards that can be connected to the BeagleBone Black to add functionality. These capes are made by a lot of different companies and individuals. A list of capes that are in production are listed at [BeagleBone Capes](#).

If you have a cape that is in production and can be purchased and you would like it listed, please contact [Circuitco](#). More information regarding the Cape Expansion Headers can be found [here](#).

Most of the current capes will work with the BeagleBone Black at some point. However, the kernel is 3.8 on the BeagleBone Black, so work is required to get the drivers updated for most of the capes to work. Some may not work or may require some hardware changes due to some differences in the design of the BeagleBone Black as described below.

For a list of the ones that are currently identified as compatible and incompatible, go to [*BeagleBone Black Capes](#)>br>

Onboard HDMI

The onboard HDMI driver uses the LCD pins. They are still connected to the expansion header, but in some cases, they could cause an LCD cape to have some noise issues unless the cape has a buffer. A buffer should take care of this issue. If you want to use these pins as GPIO pins, you may be limited in speed due to the capacitance caused by the loading of the pins by the HDMI driver. They should function fine in most applications.

Onboard eMMC

The onboard eMMC uses the MMC1 signals. They are also connected to the expansion header. The expectation is that in order to use these signals, the eMMC device on the BeagleBone Black will need to be disabled by activating the reset line to the eMMC device. It is not clear that this will work as you have to write to the eMMC first and tell it to enable the reset. At this point in time, it is not totally clear that the reset line will do the trick. Further investigation is ongoing. This will also require booting from the uSD port. Best option is to not use the MMC1_CLK and MMC1_CMD signals at all and tie them low. Do not use these signals for anything else will trying to use the other eMMC1 lines on the expansion header.

10Pin Connector

The 10 pin power expansion header has been removed. Any cape needing this connector will not be 100% compatible.

Regulatory Compliance Documents

- [FCC](#)
- [CE](#)
- [REACH](#)