SanCloud BeagleBoneEnhanced

elinux.org/SanCloud_BeagleBoneEnhanced

BeagleBone Enhanced Description

The BeagleBone Enhanced 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 Enhanced.

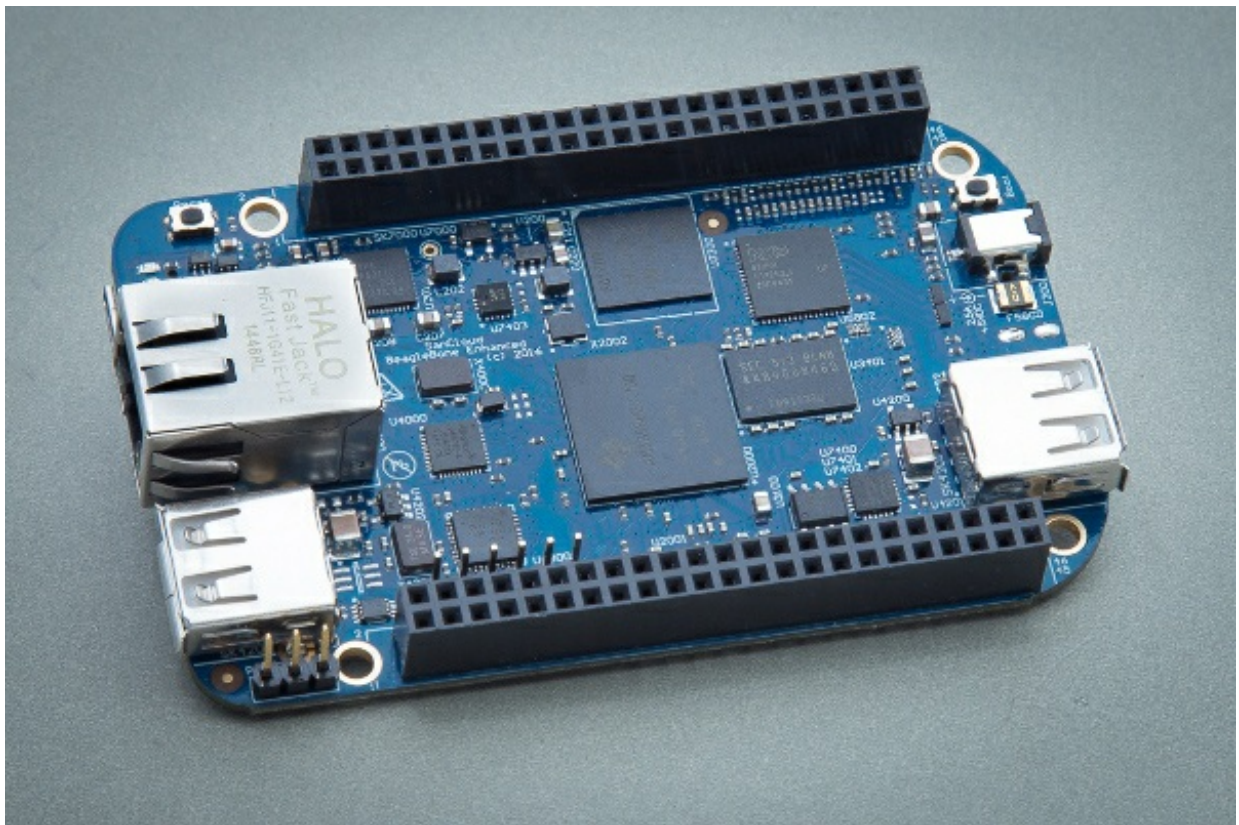|	BeagleBone Enhanced $69	BeagleBone Black $55
Processor	AM3358BZCZ100, 1GHz	AM3358BZCZ100, 1GHz
Video Out	HDMI	HDMI
DRAM	1024MB DDR3L 800MHz	512MB DDR3L 800MHz
Flash	4GB eMMC, uSD	4GB eMMC, uSD
Boot Flash	8Mb	No
USB Ports	4	1
Network Speed	1000Mb	100Mb
Sensors	Accelerometer/Gyro/Compass + Barometer/Temperature	None
Wireless Connectivity	Wifi/Bluetooth	None

BeagleBone Enhanced Features

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

	Feature	
Processor	Sitara AM3358BZCZ100 1GHz, 2000 MIPS	
Graphics Engine	SGX530 3D, 20M Polygons/S	
SDRAM Memory	1GB DDR3L 800MHz	
Onboard Flash	4GB, 8bit Embedded MMC	
PMIC	TPS65217C PMIC regulator an one additional LDO	
Debug Support	Optional Onboard 20-pin CTI JTAG, Serial Header	
Power Source	miniUSB USB or DC Jack	5VDC External Via Expansion Headers
PCB	3.4" x 2.1" 89mm x 56mm	6 layers
Indicators	1-Power, 2-Ethernet, 4-User Controllable LED's	
HS USB 2.0 Client Port	Access to USB0, Client mode via miniUSB	
HS USB 2.0 Host Port	Access to USB1 & USB2, Type A Socket, 500mA LS/FS/HS Access to USB3 & USB4, 6 way header, 500mA LS/FS/HS	
Serial Port	UART0 access via 3 pin 3.3V TTL Header	
Ethernet	10/100/1000, RJ45	
SD/MMC Connector	microSD, 3.3V	
User Input	Reset Button Boot Button Power Button	
Video Output	16b HDMI 1280x1024 (MAX) 1024x768, 1280x720, 1440x900, 1920x1080@24Hz 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 max), 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 4 can be stacked)	
Weight	1.4 oz (39.68 grams)	
Power	Refer to Section 6.1.7	

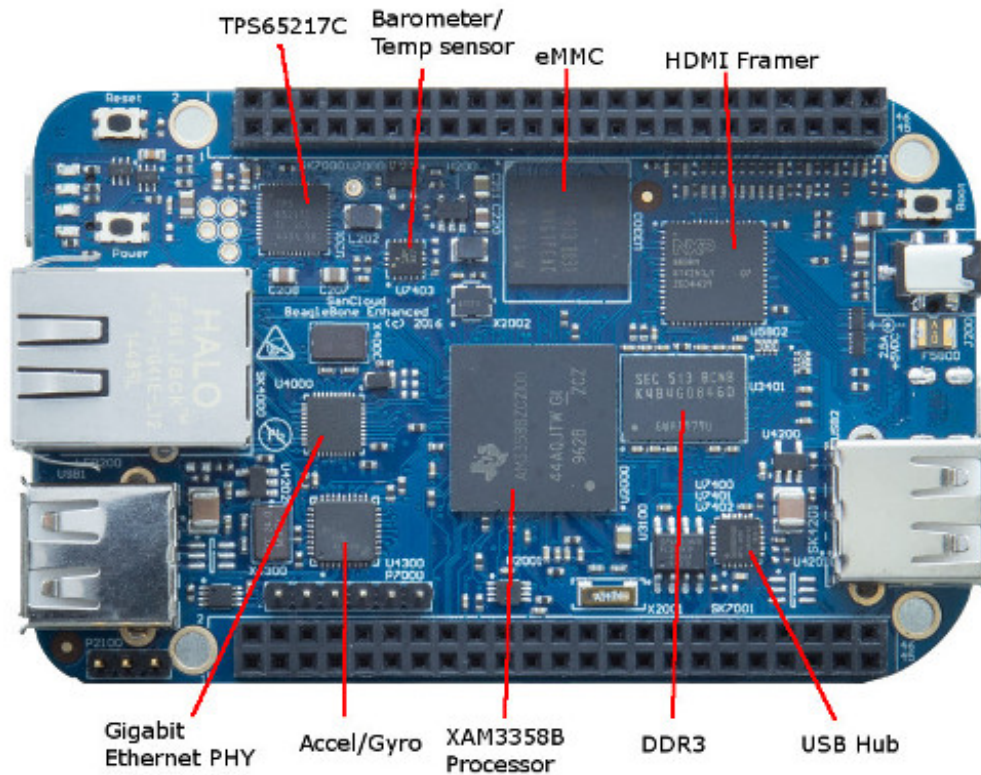In the box is (1)BeagleBone Enhanced board, and (1)card that should be read.

BeagleBone Enhanced Picture

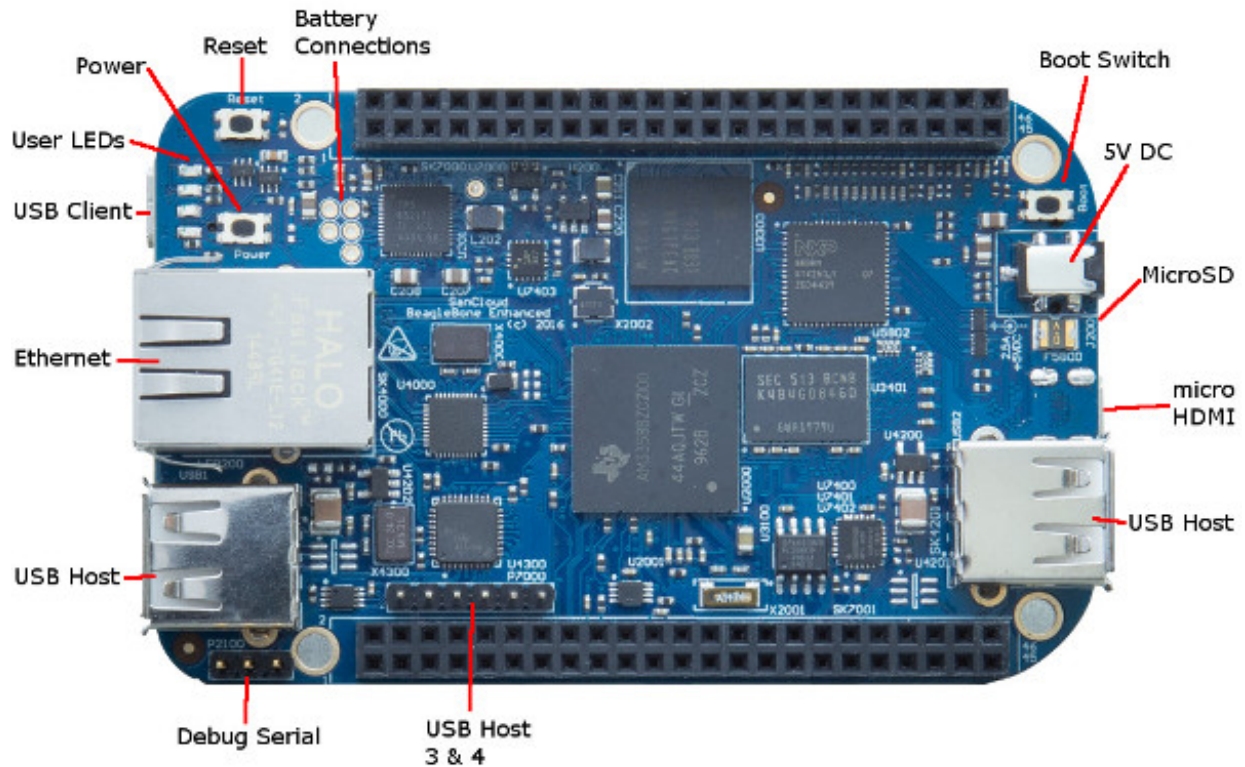Here is a picture of the Rev A board.

BeagleBone Enhanced Key Component Locations

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

BeagleBone Enhanced Connector and Switch Locations

Below is the location of the connectors and switches on the Rev A board.

Power · Reset · Battery Connections · User LEDs · USB Client · Ethernet · USB Host · Debug Serial · USB Host 3 & 4 · Boot Switch · 5V DC · MicroSD · micro HDMI · USB Host

Frequently Asked Questions (FAQ)

- BeagleBone Enhanced FAQ

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

Terms of Use

UPDATED INFORMATION

You may use the BeagleBone Enhanced design materials as you choose. There are no licences involved in the usage of the BeagleBone Enhanced design materials. We do not encourage the use of the board that we manufacture under the BeagleBoard.org logo in commercial products. We are not able to schedule parts and arrange for production for orders that we cannot see. Meeting demand is difficult as a result.

In addition, we will make revisions to the board as we find necessary and we will not continue to make older revisions. This can result in supply and compatibility issues for those using them in a product.

When used in a product, the end customer is responsible for its use in their product. BeagleBoard.org does not guarantee that it will work in any particular application or use case.

Changes in components used on the production of these boards such as memory devices, may affect operation of the board, either positively or negatively.

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.
Feel free to build the board yourself at your contract manufacturer of choice.

If you have questions on any of this, you can contactGerald Coley

Board Shipments

Accessories

For a list of the confirmed working accessories please go to *Accessories Page
Covered there are cables, power supplies, displays,etc. Anything that can be added to the BeagleBone Enhanced.

Optional JTAG

There is no JTAG over USB support on the BeagleBone Enhanced. The BeagleBone Enhanced 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.

If you are using Code Composer Studio, you will need a Gel File

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 Enhanced 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 Debian 8.2
EDIMAX EW-7811UN	
D-Link DWA-125	Debian LXDE, Debian Gnome Desktop
D-Link DWA-121	Angstrom 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

Note: Always run the board from 5VDC 1A minimum supply when using a Wifi Dongle. You may need to use a extension cable to move the dongle away from the planes of the PCB. Sometimes standoffs will work. We also have had instances where when placed in a metal case, there can be Wifi issues as well.

You can also use a dongle with a real antenna on it such as [http://http://www.logicsupply.com/uwn200/. Logic Supply] which will help

Serial Debug Cable

For information on the serial debug cables go to Serial Debug Cables

Board Revisions and Changes

Revision A4

First prototype release version of the board. Limited distribution.

Tips and Pointers

Expansion Header Pin Usage

There are several precautions that need to me 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_RESETn signal is HI (3.3V).
3) Do not apply any voltages that are generated from external sources until SYS_RESETn signal is HI.
4) If voltages are generated from the VDD_5V signal, those supplies must not become

active until after the SYS_RESETn 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 Enhanced or make the connections after power is applied on both boards.

In the System Reference Manual you will find reference to Boot Pins. These pins are connected to the expansion header.

If you load or terminate these pins to the point it affects their default setting, the board will not boot.

Powering the processor via its I/O pins can cause damage to the processor.

The expansion headers can be viewed on this Cape Expansion Headers.

Serial Header Usage

Power restrictions on the serial debug header are not an issue. On the board, there is a buffer that prevents damage from occurring by having the connector of the FTDI cable connected to the the header. It is safe to do and will not cause damage to the board when power is not applied to the board.

Extremely Useful Links

BeagleBoard home page

BeagleBoard How to Videos

Hipster Cricuits

Getting Started On BeagleBone Enhanced

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

Derek Molloy's Blog

GPIO and Device Tree (Derek Molloy)

C/C++ Introduction on BeagleBone (Derek Malloy)

Hackaday You can also subscribe to this. Should be checked often for the latest cool projects on BeagleBone Enhanced

Interent Sharing On Windows 7

Robert P. J. Day's Wiki

Linuxonarm Wiki

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 Expanding File System Partition on a MicroSD.

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 BoneScript provides a dozen of hardware demos that interact with the BeagleBone Enhanced.

Connecting to the BeagleBone Enhanced: Serial Connection, SSH, or USB

In the following Terminal Shells page, there are instructions on how to connect to the BeagleBone Enhanced through either a serial connection, SSH using an ethernet cable, or SSH to the BeagleBone's built-in IP address over a USB cable.

MicroSD Card For Extra Storage

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 atHDMI 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 i 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 toBug Tracker

Hardware

Here are the known Hardware issues:

Wrong Processor REV A4,A4A

Processor is a AM3352 due to the incorrect part being marked as an AM3359.

Missing Cables REV A4,A4A

Does not ship with any cables. Rev A5 will ship with the USB cable.

Display Noise 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.

Serial Debug CrashREV A4, A4A

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

Improper Power Down....All Revisions

We have been noticing a very small number of boards that are experiencing power issues, where the LED flashes and the board does not power up. We have been chasing this for a while now and due to the small number of boards that have the issue and the fact that the issue can also be caused by having things connected to IO pins not powered correctly, it has been hard to nail down. Our initial take was that it was a manufacturing issue on some boards, but we could never prove that. Based on the latest information we have gathered, this appears to be an instance where the PMIC does not power down the processor in the right order due to the violent removal of the power cables, either USB or DC. So, we are recommending that the power button be used to power off the board or by issuing the Halt command. After that you can remove the power cable. If everyone follows this process, we should see a decrease in these issues, but it will take a while for the results, either good or bad, to show up. This will also help prevent the contamination of the eMMC and the SD cards by allowing the kernel to shutdown properly before power is removed.

Another issue that we have seen is that the power supply when plugged in will create a spike that exceeds the voltage rating of the PMIC or will cause the voltage to drop momentarily. This can occur after power up cycle has started. When this occurs, the PMIC will shutdown. This can cause the processor to be powered down before it is powered all the way up, damaging the processor. It is suggested that to prevent this that you use a well regulated power supply that can handle the current surge of the powering up process.

Software Resources

Debian Beta Image

All boards now ship with the Debian image. The Debian is compatible with all versions of the BeagleBone Enhanced

MachineKit Debian Image with LinuxCNC and Xenomai

Building a CNC machine or 3D printer can be greatly simplified with this customized Linux distribution. http://blog.machinekit.io/p/machinekit_16.html

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 Enhanced go to
Updating the Software

If you power off the board without using the Power Button to do it, you can corrupt the data in the eMMC Flash.

For instructions on reflashing the Angstrom Software on your BeagleBone Enhanced go to Updating the Software

Software Sources

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

FreeBSD

FreeBSD now has official support for BeagleBone Enhanced: Project Page

Nintendo

If you want to turn your BeagleBone Enhanced 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

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

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 Asterisk on BeagleBone Black).

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 Enhanced hardware platform.

Hardware Files

LATEST PRODUCTION FILES (C)

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 SanCloud

- Schematic (PDF)
- PCB PDF

Upverter has a version uploaded (unverififed) Upverter BeagleBone Black.

A GitHub repo is available with all revisions of the documentation - https://github.com/SanCloudLtd/BeagleBoneEnhanced

BeagleBone Capes

BeagleBone capes are add on boards that can be connected to the BeagleBone Enhanced 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 at Cape Expansion Headers.

Most of the current capes will work with the BeagleBone Enhanced at some point. However, the kernel is 3.8 on the BeagleBone Enhanced, 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 Enhanced as described below.

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

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 loadig 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 Enhanced 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

Export Information

RMA Support

If you feel the board is defective and you want to get it looked at go to[RMA Request](#) You will need the serial number. It is located on the expansion header in the form of a white label.

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We only accept RMA requests for those boards purchased through authorized
BeagleBoard.org
distributors.

You can find  a list of authorized distributors on the buy pages at BeagleBoard.org


If you purchase a board from an unauthorized distributor, you need to return the
board to them for
replacement or repair.

Shipping to the repair depot is covered by the requester. Return shipping is paid
by the repair
depot.
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Books

Books specifically on BeagleBone

Recommended books on hot topics around BeagleBone

- Hacking and Penetration Testing with Low Power Devices
- The Internet of Things: DIY Projects with Arduino, Raspberry Pi, and BeagleBone Black
- Make: JavaScript Robotics: Building NodeBots with Raspberry Pi, Arduino, and BeagleBone
- Embedded Android: Porting, Extending, and Customizing
- Embedded Linux Development with the Yocto Project
- Embedded Linux Systems with the Yocto Project
- Software Engineering for Embedded Systems: Methods, Practical Techniques, and Applications
- Beginning NFC: Near Field Communication with Arduino, Android, and PhoneGap
- Zero to Maker: Learn (Just Enough) to Make (Just About) Anything
- Designing the Internet of Things
- Getting Started with Electronic Projects
- Operating System Design: The Xinu Approach, Second Edition
- Learning ROS for Robotics Programming - Second Edition
- Hacking Your LEGO Mindstorms EV3 Kit

Recommended books on Linux

Recommended books on ARM architecture

- ARM Assembly Language: Fundamentals and Techniques
- ARM Architecture Reference Manual - may be available as a free download