# beaglebone black pin diagram

**beaglebone black pin diagram** is an essential reference for developers, engineers, and hobbyists working with the BeagleBone Black single-board computer. This article provides a comprehensive overview of the BeagleBone Black pin configuration, detailing the functionality and layout of its pins. Understanding the pin diagram is crucial for effectively interfacing with sensors, actuators, and other electronic components. The BeagleBone Black features multiple headers with various general-purpose input/output (GPIO) pins, power pins, and communication interfaces such as I2C, SPI, UART, and PWM. This guide will explain the physical pin layout, the pin functions, voltage levels, and tips for safe and efficient usage. Additionally, it covers the pin multiplexing capabilities and the significance of pin modes in embedded applications. The detailed exploration of the BeagleBone Black pin diagram ensures users can maximize the board’s potential in their projects.



## Overview of BeagleBone Black Pin Layout

The BeagleBone Black features two 46-pin headers, known as P8 and P9, located on the sides of the board. These headers provide access to a range of digital and analog pins, power supplies, ground connections, and specialized communication interfaces. The pin numbering starts from the top left corner of each header and alternates between left and right columns. Each header contains 23 pins per side, summing up to 92 accessible pins, although not all pins are usable for general purposes. The physical layout of these pins follows a standard 2.54 mm (0.1 inch) pitch, compatible with common breadboards and connectors. Understanding the exact pin layout is essential for making correct connections and avoiding damage to the board or peripheral components.

### P8 and P9 Headers

The P8 and P9 headers are the primary connection points for external hardware. P8 generally includes power pins, ground pins, and some GPIOs, while P9 offers a wider variety of communication pins and analog inputs. Both headers support multiple functions per pin, which can be configured via software. The pin diagram for these headers clearly marks

each pin’s default function, voltage level, and alternate modes, which helps users identify the best pins for their specific application.

# Power Pins and Ground Pins

Power and ground pins are essential for powering the BeagleBone Black and connected peripherals. The board supports multiple voltage levels, including 3.3V, 5V, and ground references. Correct identification and use of these pins are critical for system stability and safety.

## Power Supply Pins

The BeagleBone Black provides several power pins distributed across the P8 and P9 headers:

- **3.3V Pins:** These pins supply a regulated 3.3V output used to power low-voltage peripherals and sensors.
- **5V Pins:** The 5V pins are directly connected to the board’s power source, either through USB or a DC power jack, and can supply power to external devices.
- **VDD_5V:** This pin supplies 5V power input to the board, which is regulated down to other voltage levels internally.
- **VDD_3V3:** Provides 3.3V regulated power output sourced from the onboard regulator.

## Ground Pins

Ground pins are present on both headers and serve as the reference point for all voltages. Proper grounding is vital for circuit stability and noise reduction. Multiple ground pins ensure that users can establish a common ground easily when connecting multiple devices.

# GPIO Pins and Their Functions

General-Purpose Input/Output (GPIO) pins allow the BeagleBone Black to interface with various digital components. These pins can be configured as either inputs or outputs and can be controlled programmatically. GPIOs are fundamental for tasks such as reading sensor data, controlling LEDs, or managing switches.

## Number and Distribution of GPIO Pins

The BeagleBone Black offers over 60 GPIO pins across the P8 and P9 headers. Not all pins

are available at the same time due to multiplexing, but many can be used as digital inputs or outputs. The pins support 3.3V logic levels, which is standard for modern microcontrollers and embedded systems.

## Pin Capabilities and Features

GPIO pins on the BeagleBone Black can be configured with several advanced features:

- **Digital Input/Output:** Basic high or low voltage state reading or driving.
- **Pull-up/Pull-down Resistors:** Internal resistors to define default pin states and reduce noise.
- **Debouncing:** Useful for clean signal reading from mechanical switches.
- **Interrupts:** Pins can be configured to trigger interrupts on specific signal changes.

# Communication Interface Pins

The BeagleBone Black is equipped with multiple communication interfaces to connect to a wide array of peripherals and external devices. These interfaces include UART, I2C, SPI, and PWM outputs, accessible through specific pins on the P8 and P9 headers.

## UART (Universal Asynchronous Receiver/Transmitter)

Several UART pins are available for serial communication, essential for debugging, GPS modules, Bluetooth modules, and other serial devices. UART pins include TX (transmit) and RX (receive) lines, with hardware flow control available on some pins.

## I2C (Inter-Integrated Circuit)

Two I2C buses are accessible on the BeagleBone Black, allowing connection to sensors, EEPROMs, and other I2C-compatible devices. Each bus has two lines: SDA (data) and SCL (clock). The pins support open-drain operation and require external pull-up resistors if not internally enabled.

## SPI (Serial Peripheral Interface)

SPI pins enable high-speed communication with devices like ADCs, DACs, and display drivers. The SPI interface includes pins for MOSI (master out, slave in), MISO (master in, slave out), SCLK (clock), and multiple chip select (CS) lines.

## PWM (Pulse-Width Modulation) Outputs

PWM pins can generate modulated digital pulses useful for controlling motors, LEDs brightness, and other applications requiring variable output power. These pins are multiplexed with GPIOs and other interfaces.

# Pin Multiplexing and Configuration

Pin multiplexing is a key feature of the BeagleBone Black that allows each physical pin to serve multiple functions based on software configuration. This flexibility maximizes the utility of the limited number of pins on the headers and supports diverse application needs.

## Understanding Pin Multiplexing

Each pin on the BeagleBone Black can be assigned to different modes such as GPIO, UART, SPI, PWM, or analog input. The pin multiplexing is controlled by the device tree overlays or configuration files in the operating system running on the board. Proper configuration ensures that pins do not conflict and operate as intended.

## Configuring Pins with Device Tree Overlays

Device tree overlays allow users to enable or disable specific pin functions without modifying the kernel source code. This method is the standard for configuring pin multiplexing on the BeagleBone Black and supports hot-swapping configurations.

# Using the BeagleBone Black Pins Safely

Proper handling of the BeagleBone Black pins is crucial to prevent damage to the board and connected components. Understanding voltage limits, current capabilities, and protection methods ensures long-term reliability of projects.

## Voltage and Current Limits

The BeagleBone Black GPIO pins operate at 3.3V logic levels. Applying voltages higher than 3.3V to any pin can damage the processor and onboard circuits. Similarly, the maximum current per GPIO pin is limited (typically around 6-12 mA), and exceeding this can cause permanent damage.

## Recommended Safety Practices

- Always use level shifters when interfacing with 5V devices.

- Use current-limiting resistors with LEDs and other outputs.
- Avoid connecting pins directly to power rails without proper circuitry.
- Double-check pin connections against the pin diagram before powering the board.
- Utilize protective components such as diodes and fuses when necessary.

# Frequently Asked Questions

## What is the BeagleBone Black pin diagram used for?

The BeagleBone Black pin diagram is used to identify the functions and locations of the various pins on the board, including GPIO, power, ground, and communication interfaces, to facilitate hardware interfacing and development.

## How many GPIO pins does the BeagleBone Black have according to its pin diagram?

The BeagleBone Black has 69 GPIO pins available across its two 46-pin headers (P8 and P9), as shown in the pin diagram.

## Where can I find the official BeagleBone Black pin diagram?

The official BeagleBone Black pin diagram can be found on the BeagleBoard.org website or in the BeagleBone Black System Reference Manual.

## What is the difference between P8 and P9 headers in the BeagleBone Black pin diagram?

P8 and P9 are the two 46-pin headers on the BeagleBone Black. P8 primarily includes GPIO, power, and ground pins, while P9 includes additional GPIOs, ADC inputs, PWM outputs, and communication interfaces.

## Can the BeagleBone Black pin diagram help in connecting sensors?

Yes, the pin diagram helps identify which pins support analog inputs, digital I/O, and communication protocols like I2C, SPI, and UART, which is essential for connecting various sensors.

## Does the BeagleBone Black pin diagram show power and ground pins?

Yes, the pin diagram clearly marks all power pins (3.3V, 5V) and ground pins to ensure correct power connections and avoid damage.

## How do I interpret the pin numbering on the BeagleBone Black pin diagram?

Pins are numbered sequentially on each header: P8 pins are numbered 1 to 46, and P9 pins are numbered 1 to 46, with odd-numbered pins on one side and even-numbered pins on the other side of the header.

## Are all pins on the BeagleBone Black multifunctional as per the pin diagram?

Yes, many pins on the BeagleBone Black are multifunctional and can be configured for different protocols or GPIO based on the device tree configuration.

## Can the BeagleBone Black pin diagram help in troubleshooting hardware issues?

Yes, the pin diagram helps verify correct wiring, pin assignments, and power connections, which is critical in troubleshooting hardware problems.

## Is the BeagleBone Black pin diagram compatible with expansion capes?

Yes, the pin diagram is essential for understanding how expansion capes connect to the BeagleBone Black and which pins they use, ensuring compatibility and proper function.

# Additional Resources

1. *BeagleBone Black System Reference and Pin Diagram Guide*
This book provides an in-depth look at the BeagleBone Black's hardware architecture, focusing extensively on the pin configurations and system reference diagrams. It is ideal for engineers and hobbyists who want to understand the board's interface capabilities. Detailed illustrations and practical examples help readers utilize pins effectively for various embedded projects.

2. *Mastering BeagleBone Black: Pinouts, Peripherals, and Programming*
A comprehensive guide to mastering the BeagleBone Black, this book covers everything from pinout diagrams to peripheral interfacing and programming techniques. It includes step-by-step instructions for connecting sensors, actuators, and communication modules using the board’s pins. The book is perfect for both beginners and advanced users aiming to build complex embedded systems.

3. *The Ultimate BeagleBone Black Pin Diagram Reference*
This reference manual offers a complete and detailed pin diagram of the BeagleBone Black, organized for quick lookup and practical use. It explains the functionality of each pin, including GPIO, ADC, PWM, and power pins. The guide is designed to assist developers in designing circuits and troubleshooting hardware connections.

4. *Embedded Linux with BeagleBone Black: Pin Mapping and Hardware Integration*
Focusing on embedded Linux development, this book explains how to map and utilize BeagleBone Black pins for hardware integration. It covers device tree overlays, pin multiplexing, and configuring pins for custom hardware setups. Readers will learn to interface sensors and actuators efficiently while managing hardware resources in Linux.

5. *Hands-On BeagleBone Black: Pin Diagrams and Real-World Projects*
This practical guide combines pin diagram knowledge with real-world project examples to help readers apply what they learn immediately. It walks through various projects that use the BeagleBone Black's pins for robotics, home automation, and IoT applications. The book emphasizes hands-on learning and troubleshooting techniques.

6. *BeagleBone Black Hardware Interfacing and Pin Configuration*
This book dives into hardware interfacing techniques using the BeagleBone Black's pins, detailing pin configuration options and electrical characteristics. It covers serial communication, SPI, I2C, and PWM pin setups with circuit diagrams. Engineers will find this book invaluable for designing reliable hardware systems.

7. *BeagleBone Black Pinout Essentials for Embedded Developers*
A concise yet thorough overview of the essential pinouts for embedded developers working with BeagleBone Black. The book highlights critical pins for power, ground, inputs, and outputs, along with usage notes and best practices. It serves as a quick reference guide for efficient hardware development.

8. *Practical Guide to BeagleBone Black Pin Diagram and GPIO Programming*
This guide focuses on the practical aspects of GPIO programming using the BeagleBone Black's pin diagram as a foundation. It explains configuring pins for digital input and output, interrupt handling, and interfacing with external devices. Readers gain hands-on experience through code examples and hardware exercises.

9. *BeagleBone Black Pin Diagram and Circuit Design Handbook*
A detailed handbook that integrates pin diagram knowledge with circuit design principles for BeagleBone Black projects. It includes schematics, pin compatibility notes, and tips for designing custom expansion boards. This book is a valuable resource for anyone looking to create robust and scalable embedded solutions.

## Beaglebone Black Pin Diagram

**beaglebone black pin diagram: BeagleBone Black Cookbook** Charles A. Hamilton, 2015-11-18 Over 60 recipes and solutions for inventors, makers, and budding engineers to create projects using the BeagleBone Black About This Book Learn how to develop applications with the BeagleBone Black and open source Linux software Sharpen your expertise in making sophisticated electronic devices Explore the BeagleBone Black with this easy-to-succeed recipe format Who This Book Is For If you are a hardware, Linux, and/or microcomputing novice, or someone who wants more power and possibilities with product prototypes, electronic art projects, or embedded computing experiments, then this book is for you. It is for Internet of Things enthusiasts who want to use more sophisticated hardware than the Raspberry Pi or the Arduino can provide. Whether you are an engineering student, a DIYer, an inventor, or a budding electronics enthusiast, this book delivers accessible, easy-to-succeed instructions for using an advanced microcomputing platform. What You Will Learn Set up and run the BeagleBone Black for the first time Learn the basics of microcomputing and Linux using the command line and easy kernel mods Make introductory projects with Python, JavaScript, BoneScript, and Node.js Explore physical computing and simple circuits using buttons, LEDs, sensors, and motors Discover the unique features of the BeagleBone Black and its real-time computing functions Build intermediate level audio and video applications Assemble and add ingredients for creating Internet of Things prototypes In Detail There are many single-board controllers and computers such as Arduino, Udoo, or Raspberry Pi, which can be used to create electronic prototypes on circuit boards. However, when it comes to creating more advanced projects, BeagleBone Black provides a sophisticated alternative. Mastering the BeagleBone Black enables you to combine it with sensors and LEDs, add buttons, and marry it to a variety of add-on boards. You can transform this tiny device into the brain for an embedded application or an endless variety of electronic inventions and prototypes. With dozens of how-tos, this book kicks off with the basic steps for setting up and running the BeagleBone Black for the first time, from connecting the necessary hardware and using the command line with Linux commands to installing new software and controlling your system remotely. Following these recipes, more advanced examples take you through scripting, debugging, and working with software source files, eventually working with the Linux kernel. Subsequently, you will learn how to exploit the board's real-time functions. We will then discover exciting methods for using sound and video with the system before marching forward into an exploration of recipes for building Internet of Things projects. Finally, the book finishes with a dramatic arc upward into outer space, when you explore ways to build projects for tracking and monitoring satellites. Style and approach This comprehensive recipe book deconstructs a complex, often confusing piece of technology, and transforms it to become accessible and fun with snappy, unintimidating prose, and extensive easy-to-succeed instructions.

**beaglebone black pin diagram: 30 BeagleBone Black Projects for the Evil Genius** Christopher Rush, 2014-09-26 Fiendishly Fun Ways to Use the BeagleBone Black! This wickedly inventive guide shows you how to program and build fun and fascinating projects with the BeagleBone Black. You'll learn how to connect the BeagleBone Black to your computer and program it, quickly mastering BoneScript and other programming tools so you can get started right away. 30 BeagleBone Black Projects for the Evil Genius is filled with a wide variety of do-it-yourself LED, sensor, robotics, display, audio, and spy gadgets. You'll also get tips and techniques that will help you design your own ingenious devices. Features step-by-step instructions and helpful illustrations Provides full schematic and breadboard layout diagrams for the projects Includes detailed programming code Removes the frustration factor—all required parts are listed along with sources Build these and other clever creations: High-powered LED Morse code sender RGB LED fader GPS tracker Temperature sensor Light level indicator Web-controlled rover Plant hydration system Sentinel turret 7-segment clock Display for sensor information Internet radio Imperial march indicator Intruder alert using Twitter API Lie detector Auto dog barker

**beaglebone black pin diagram: Programming the BeagleBone** Yogesh Chavan, 2016-01-28

Master BeagleBone programming by doing simple electronics and Internet of Things projects About This Book Quickly develop electronics projects that interact with Internet applications using JavaScript and Python Learn about electronics components such as sensors and motors, and how to communicate with them by writing programs A step-by-step guide to explore the exciting world of BeagleBone—from connecting BeagleBone to doing electronics projects and creating IoT applications Who This Book Is For If you want to learn programming on embedded systems with BeagleBone by doing simple electronics projects, this book is for you. This book is also helpful to BeagleBone owners who want to quickly implement small-scale home automation solutions. It is assumed that you have familiarity with C and Python programming. Some familiarity with electronics is helpful but not essential. What You Will Learn Connect your BeagleBone to a computer in different ways and get the Cloud9 IDE running to quick-start programming on the BeagleBone Get to know about BeagleBone extension pins such as GPIO and how to connect various electronics components with BeagleBone Read and write to various electronics components such as LED, Push-button, sensors, and motors Grasp in-depth theory on Analog, PWM, and BUS programming and the electronics components used in programs Handle data to and from various BUS supporting modules such as UART, I2C, and SPI using the Adafruit BBIO Python library Write real-life IoT applications in JavaScript and Python such as shooting an e-mail on overheat and controlling a servo motor remotely Make use of online free cloud services to store and analyze sensor data collected on the BeagleBone Discover what else can be done using the BeagleBone Get to grips with embedded system BUS communication In Detail The whole world is moving from desktop computers to smartphones and embedded systems. We are moving towards utilizing Internet of Things (IoT). An exponential rise in the demand for embedded systems and programming in the last few years is driving programmers to use embedded development boards such as Beaglebone. BeagleBone is an ultra-small, cost-effective computer that comes with a powerful hardware. It runs a full-fledged Debian Linux OS and provides numerous electronics solutions. BeagleBone is open source and comes with an Ethernet port, which allows you to deploy IoT projects without any additions to the board. It provides plenty of GPIO, Anlaog pins, and UART, I2C, SPI pins which makes it the right choice to perform electronics projects. This gives you all the benefits of Linux kernel such as multitasking, multiusers, and extensive device driver support. This allows you to do programming in many languages including high-level languages such as JavaScript and Python. This book aims to exploit the hardware and software capabilities of BeagleBone to create real-life electronics and IoT applications quickly. It is divided into two parts. The first part covers JavaScript programs. The second part provides electronics projects and IoT applications in Python. First, you will learn to use BeagleBone as tool to write useful applications on embedded systems. Starting with the basics needed to set up BeagleBone and the Cloud9 IDE, this book covers interfacing with various electronics components via simple programs. The electronics theory related to these components is then explained in depth before you use them in a program. Finally, the book helps you create some real-life IoT applications. Style and approach An easy-to-follow guide full of real-world electronics programs and quick troubleshooting tips using BeagleBone. All the required electronics concepts are explained in detail before using them in a program and all programs are explained in depth. Most of the theory is covered in the first part; while the second part gives you some quick programs.

**beaglebone black pin diagram:** BeagleBone Home Automation Blueprints Rodolfo Giometti, 2016-02-03 Automate and control your home using the power of the BeagleBone Black with practical home automation projects About This Book Build, set up, and develop your circuits via step-by-step tutorial of practical examples, from initial board setup to device driver management Get access to several kinds of computer peripherals to monitor and control your domestic environment using this guide This book is spread across 10 chapters all focused on one practical home automation project Who This Book Is For This book is for developers who know how to use BeagleBone and are just above the “beginner” level. If you want to learn to use embedded machine learning capabilities, you should have some experience of creating simple home automation projects. What You Will Learn Build a CO (and other gas) sensor with a buzzer/LED alarm to signal high concentrations Log

environment data and plot it in a fancy manner Develop a simple web interface with a LAMP platform Prepare complex web interfaces in JavaScript and get to know how to stream video data from a webcam Use APIs to get access to a Google Docs account or a WhatsApp/Facebook account to manage a home automation system Add custom device drivers to manage an LED with different blinking frequencies Discover how to work with electronic components to build small circuits Use an NFS, temperature sensor, relays, and other peripherals to monitor and control your surroundings In Detail BeagleBone is a microboard PC that runs Linux. It can connect to the Internet and can run OSes such as Android and Ubuntu. BeagleBone is used for a variety of different purposes and projects, from simple projects such as building a thermostat to more advanced ones such as home security systems. Packed with real-world examples, this book will provide you with examples of how to connect several sensors and an actuator to the BeagleBone Black. You'll learn how to give access to them, in order to realize simple-to-complex monitoring and controlling systems that will help you take control of the house. You will also find software examples of implementing web interfaces using the classical PHP/HTML pair with JavaScript, using complex APIs to interact with a Google Docs account, WhatsApp, or Facebook. This guide is an invaluable tutorial if you are planning to use a BeagleBone Black in a home automation project. Style and approach This step-by-step guide contains several home automation examples that can be used as base projects for tons of other home automation and control systems. Through clear, concise examples based on real-life situations, you will quickly get to grips with the core concepts needed to develop home automation applications with the BeagleBone Black using both the C language and high-level scripting languages such as PHP, Python, and JavaScript.

**beaglebone black pin diagram: BeagleBone: Creative Projects for Hobbyists** Charles Hamilton, Rodolfo Giometti, Richard Grimmett, 2017-07-20 Learn to build amazing robotic projects using the powerful BeagleBone Black. About This Book Push your creativity to the limit through complex, diverse, and fascinating projects Develop applications with the BeagleBone Black and open source Linux software Sharpen your expertise in making sophisticated electronic devices Who This Book Is For This Learning Path is aimed at hobbyists who want to do creative projects that make their life easier and also push the boundaries of what can be done with the BeagleBone Black. This Learning Path's projects are for the aspiring maker, casual programmer, and budding engineer or tinkerer. You'll need some programming knowledge, and experience of working with mechanical systems to get the complete experience from this Learning Path. What You Will Learn Set up and run the BeagleBone Black for the first time Get to know the basics of microcomputing and Linux using the command line and easy kernel mods Develop a simple web interface with a LAMP platform Prepare complex web interfaces in JavaScript and get to know how to stream video data from a webcam Find out how to use a GPS to determine where your sailboat is, and then get the bearing and distance to a new waypoint Use a wind sensor to sail your boat effectively both with and against the wind Build an underwater ROV to explore the underwater world See how to build an autonomous Quadcopter In Detail BeagleBone is a microboard PC that runs Linux. It can connect to the Internet and run OSes such as Android and Ubuntu. You can transform this tiny device into a brain for an embedded application or an endless variety of electronic inventions and prototypes. This Learning Path starts off by teaching you how to program the BeagleBone. You will create introductory projects to get yourselves acquainted with all the nitty gritty. Then we'll focus on a series of projects that are aimed at hobbyists like you and encompass the areas of home automation and robotics. With each project, we'll teach you how to connect several sensors and an actuator to the BeagleBone Black. We'll also create robots for land, sea, and water. Yes, really! The books used in this Learning Path are: BeagleBone Black Cookbook BeagleBone Home Automation Blueprints Mastering BeagleBone Robotics Style and approach This practical guide transforms complex and confusing pieces of technology to become accessible with easy- to-succeed instructions. Through clear, concise examples, you will quickly get to grips with the core concepts needed to develop home automation applications with the BeagleBone Black.

**beaglebone black pin diagram:** Bad to the Bone Steven Barrett, Jason Kridner, 2022-06-01

BeagleBone Black is a low-cost, open hardware computer uniquely suited to interact with sensors and actuators directly and over the Web. Introduced in April 2013 by BeagleBoard.org, a community of developers first established in early 2008, BeagleBone Black is used frequently to build vision-enabled robots, home automation systems, artistic lighting systems, and countless other do-it-yourself and professional projects. BeagleBone variants include the original BeagleBone and the newer BeagleBone Black, both hosting a powerful 32-bit, super-scalar ARM Cortex A8 processor capable of running numerous mobile and desktop-capable operating systems, typically variants of Linux including Debian, Android, and Ubuntu. Yet, BeagleBone is small enough to fit in a small mint tin box. The Bone may be used in a wide variety of projects from middle school science fair projects to senior design projects to first prototypes of very complex systems. Novice users may access the power of the Bone throughthe user-friendly BoneScript software, experienced through a Web browser in most major operating systems, including Microsoft Windows, Apple Mac OS X, or the Linux operating systems. Seasoned users may take full advantage of the Bone's power using the underlying Linux-based operating system, a host of feature extension boards (Capes) and a wide variety of Linux community open source libraries. This book provides an introduction to this powerful computer and has been designed for a wide variety of users including the first time novice through the seasoned embedded system design professional. The book contains background theory on system operation coupled with many well-documented, illustrative examples. Examples for novice users are centered on motivational, fun robot projects while advanced projects follow the theme of assistive technology and image-processing applications.

**beaglebone black pin diagram:** *The BeagleBone Black Primer* Brian McLaughlin, 2015-10-01 The BeagleBone Black Primer Master BeagleBone Black: Today’s most powerful low-cost embedded development platform! You can do amazing things with BeagleBone Black. Get started in just five minutes: all you need is a USB cable and this easy, hands-on primer! Brian McLaughlin teaches you enough to be seriously dangerous. Start with the simplest embedded programming concepts. Explore BeagleBone Black’s capabilities, and learn all the essentials, from controlling I/O to establishing network connections. Then, step by step, master increasingly advanced techniques with the Cloud9 IDE and BoneScript…Integrate external hardware…Install Linux or Android…Use Cape expansion boards to do even more. Don’t just learn it: do it. This guide is packed with projects, from weather stations, to car computers, to a “capstone” project using Software Defined Radio to capture signals from local airspace and orbiting satellites! You won’t just put BeagleBone Black to work: you’ll start imagining great projects of your own. And then you’ll build them. Discover how BeagleBone Black works, and what it can do Get your BeagleBone Black—and get it working, fast Link your BeagleBone Black to the world, and link yourself to the global BeagleBone community Learn to read schematics and use them to connect hardware Prototype your projects with breadboards Extend BeagleBone Black with Capes Add sensors to capture and use data from the environment Use actuators to make things happen in the real world Make your BeagleBone Black recognize your face Learn from mistakes, and go beyond what you’ve already learned Brian McLaughlin is an engineer by profession and by hobby. Building on a solid foundation in software, he was first exposed to advanced hardware topics while working on the Hubble Space Telescope. After working for Lockheed Martin, he joined NASA, where he’s supported many of NASA’s most exciting missions. He holds a B.S. in computer science (North Carolina State University) and an M.S. in systems engineering (University of Maryland). He’s also written for GeekDad and is a member of the growing Maker community.

**beaglebone black pin diagram: Mastering Embedded Linux Programming** Frank Vasquez, Chris Simmonds, 2021-05-14 Build, customize, and deploy Linux-based embedded systems with confidence using Yocto, bootloaders, and build tools Key Features Master build systems, toolchains, and kernel integration for embedded Linux Set up custom Linux distros with Yocto and manage board-specific configurations Learn real-world debugging, memory handling, and system performance tuning Book DescriptionIf you’re looking for a book that will demystify embedded Linux, then you’ve come to the right place. Mastering Embedded Linux Programming is a fully

comprehensive guide that can serve both as means to learn new things or as a handy reference. The first few chapters of this book will break down the fundamental elements that underpin all embedded Linux projects: the toolchain, the bootloader, the kernel, and the root filesystem. After that, you will learn how to create each of these elements from scratch and automate the process using Buildroot and the Yocto Project. As you progress, the book will show you how to implement an effective storage strategy for flash memory chips and install updates to a device remotely once it's deployed. You'll also learn about the key aspects of writing code for embedded Linux, such as how to access hardware from apps, the implications of writing multi-threaded code, and techniques to manage memory in an efficient way. The final chapters demonstrate how to debug your code, whether it resides in apps or in the Linux kernel itself. You'll also cover the different tracers and profilers that are available for Linux so that you can quickly pinpoint any performance bottlenecks in your system. By the end of this Linux book, you'll be able to create efficient and secure embedded devices using Linux.What you will learn Use Buildroot and the Yocto Project to create embedded Linux systems Troubleshoot BitBake build failures and streamline your Yocto development workflow Update IoT devices securely in the field using Mender or balena Prototype peripheral additions by reading schematics, modifying device trees, soldering breakout boards, and probing pins with a logic analyzer Interact with hardware without having to write kernel device drivers Divide your system up into services supervised by BusyBox runit Debug devices remotely using GDB and measure the performance of systems using tools such as perf, ftrace, eBPF, and Callgrind Who this book is for If you're a systems software engineer or system administrator who wants to learn how to implement Linux on embedded devices, then this book is for you. It's also aimed at embedded systems engineers accustomed to programming for low-power microcontrollers, who can use this book to help make the leap to high-speed systems on chips that can run Linux. Anyone who develops hardware that needs to run Linux will find something useful in this book – but before you get started, you'll need a solid grasp on POSIX standard, C programming, and shell scripting.

**beaglebone black pin diagram:** Android for the BeagleBone Black Andrew Henderson, Aravind Prakash, 2015-02-19 If you are an Android app developer who wants to experiment with the hardware capabilities of the BeagleBone Black platform, then this book is ideal for you. You are expected to have basic knowledge of developing Android apps but no prior hardware experience is required.

**beaglebone black pin diagram: Bad to the Bone** Steven F. Barrett, Jason Kridner, 2022-11-10 This comprehensive book provides detailed materials for both novice and experienced programmers using all BeagleBone variants which host a powerful 32-bit, super-scalar TI Sitara ARM Cortex A8 processor. Authored by Steven F. Barrett and Jason Kridner, a seasoned ECE educator along with the founder of Beagleboard.org, respectively, the work may be used in a wide variety of projects from science fair projects to university courses and senior design projects to first prototypes of very complex systems. Beginners may access the power of the Bone through the user-friendly Bonescript examples. Seasoned users may take full advantage of the Bone's power using the underlying Linux-based operating system, a host of feature extension boards (Capes) and a wide variety of Linux community open source libraries. The book contains background theory on system operation coupled with many well-documented, illustrative examples. Examples for novice users are centered on motivational, fun robot projectswhile advanced projects follow the theme of assistive technology and image processing applications.

**beaglebone black pin diagram:** *BeagleBone for Secret Agents* Josh Datko, 2014-09-23 If you have some experience with the BeagleBone or similar embedded systems and want to learn more about security and privacy, this book is for you. Alternatively, if you have a security and privacy background and want to learn more about embedded development, this book is for you. You should have some familiarity with Linux systems and with the C and Python programming languages.

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discusses various applications where the Internet of Things plays an important role, and considers a number of different independent prototypes for various mobile robotics platform control methods. The control of robot with different mobile apps like Blynk, Virtuino, Cayenne, Thingspeak, Firebase are included for vast coverage of scope. Step by step programming, to get started with Ti launch Pad Case studies to provide solution to real time problems The case studies and programming in book are tested on real hardware during handling the industrial and student projects. Description This book provides a platform to the readers, where they can understand the applications of 'Internet of Things' to control the robotic platform. It covers the basic knowledge of the mobile apps with their designing steps and programming. The objective of the book is to discuss various applications of robotic platform where 'Internet of things' can play an important role. This book comprises of total seventeen chapters for designing different independent prototypes for the various control methods. It covers introduction to IoT and basic components to design a robotic platform. The system demonstration is done with the help of Ti Launch Pad and other interfacing devices. The control of robot with different mobile apps like Blynk, Virtuino, Cayenne, Thingspeak, Firebase are included for vast coverage of scope.It would be beneficial for the people who want to get started with hardware based robotic prototypes with IoT. This book is entirely based on the practical experience of the authors while undergoing projects with the students and industries.What will you learn Interfacing of Ti launch Pad and NodeMCU with Input/Output Devices Serial Communication between Ti Launch Pad and NodeMCU Robot Control Using the Blynk, Virtuino App Environment Monitoring Robot with BLYNK App Sensory Data Acquisition Robot Using a ThingSpeak Server Robot Control with Cayenne App, Local Server and NodeMCU, Firebase Server Who this book is for Students pursuing BE/BSc/ME/MSc/BTech/MTech in Computer Science, Electronics, Electrical. Table of contents1. Introduction2. Components of a Robotic Platform3. Interfacing of Ti launch Pad with Input/Output Devices4. Interfacing of NodeMCU with Input/Output Devices5. Serial Communication between Ti Launch Pad and NodeMCU6. Robot Control Using the Blynk App7. Robot Control Using the Virtuino App8. Environment Monitoring Robot with BLYNK App9. Sensory Data Acquisition Robot Using a ThingSpeak Server 10. Robot Control with Cayenne App11. Robot Control with Local Server and NodeMCU12. Robot Control with a Firebase Server13. XBee and Wi-Fi Modem Based Robot Control14. Fire Fighting Robot15. The Internet of Things Robotic Arm16. The Smart Orchard with a Robotic Arm Sprinkler17. Smart Farming with the IoT About the authorDr. Anita Gehlot is currently associated with Lovely Professional University as Associate Professor with more than ten years of experience in academics. She has twenty patents in her account. She has published more than fifty research papers in referred journals and conference. She has organized a number of workshops, summer internships and expert lectures for students. She has been invited as session chair keynote speaker to international/national conferences and faculty development program. Dr. Rajesh Singh is currently associated with Lovely Professional University as Professor with more than fifteen years of experience in academics. He has been awarded as gold medalist in M.Tech and honors in his B.E. His area of expertise includes embedded systems, robotics, wireless sensor networks and Internet of Things. He has organized and conducted a number of workshops, summer internships and expert lectures for students as well as faculty. He has twenty-three patents in his account. He has published around hundred research papers in referred journals/conferences. His LinkedIn Profile: linkedin.com/in/dr-rajesh-singh-6380845aHis Website: orcid.org/0000-0002-3164-8905 Dr. Lovi Raj Gupta is the Executive Dean, Faculty of Technology & Sciences, Lovely Professional University. He is a leading light in the field of Technical and Higher education in the country. His research-focused approach and an insightful innovative intervention of technology in education have won him much accolades and laurels.In 2001, he was appointed as Assistant Controller (Technology), Ministry of IT, Govt. of India by the Honorable President of India in the Office of the Controller of Certifying Authorities (CCA). In 2013, he was accorded the role in the National Advisory Board for What Can I Give Mission - Kalam Foundation of Dr. APJ Abdul Kalam. In 2011, he received the MIT Technology Review Grand Challenge Award followed by the coveted Infosys InfyMakers Award in the year 2016. He has ten patents to his account. His LinkedIn

Profile: linkedin.com/in/loviraj Bhupendra Singh is Managing Director of Schematics Microelectronics and provides Product design and R&D support to industries and Universities. He has completed BCA, PGDCA, M.Sc. (CS), M.Tech and has more than eleven years of experience in the field of Computer Networking and Embedded systems. He has published twelve books in the area of Embedded Systems and Internet of Things. His Blog: schematicslab.blogspot.in/ His LinkedIn Profile: linkedin.com/in/bhupisir

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