

LeMaker Banana Pi

From linux-sunxi.org

The Banana Pi is trying very hard to mimic the formfactor of the Raspberry Pi and to cash in on its popularity, but it fails to match both the exterior dimensions, the exact connector placing and the software support.

Despite manufacturer claims of being *open source*, this is not open source hardware. If you are thinking of getting this device, you should also try looking into the hardware from our Community instead. There is also little actual support to be had from LeMaker (and even less from SinoVoip), mostly they are just rehashing things from the linux sunxi community.

The Banana Pi has clearly suffered from having **different manufacturers/distributors** each favor their **competing** model variants and create their own (sub)"communities". On top of that there were clashes and legal disputes over trademarks and domain ownership. Quite often it would be unclear who's officially responsible for a particular device, and what degree of support the vendor provided. This has created confusion among users, and contradicted the collaborative approach that could be expected from the "open (source)" marketing label they unanimously used.

A 2015-05-23 statement (http://web.archive.org/web/20150613065041/http://www.banana-pi.com/eaxw_view.asp?id=381) describes the current state of things, and gives some historical background information^[1]. It remains to be seen whether the situation will improve in the future.

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LeMaker Banana Pi



Manufacturer	LeMaker (http://www.lemaker.org/)
Dimensions	92 mm x 60 mm
Release Date	April 2014
Website	Banana Pi Product Page (http://www.lemaker.org/article-42-1.html)
Specifications	
SoC	A20 @ 1 GHz
DRAM	1 GiB DDR3 @ 432 MHz
NAND	no (onboard) NAND available
Power	DC 5 V @ 2 A (micro USB)
Features	
Video	HDMI (Type A - full), CVBS
Audio	3.5 mm headphone plug, HDMI, internal microphone
Network	10/100/1000 Mbps Ethernet (Realtek RTL8211E)
Storage	SD, SATA (with power connector: JST XH 2.5mm header, providing +5V)
USB	2 x USB 2.0 Host, 1 x USB 2.0 OTG
Other	IR receiver
Headers	2 pin UART, 8 pin UART (including power source), LCD/ LVDS, CSI, 26 pin GPIO

Identification

The current PCB revision 1.4 has the following silkscreened on it (usually hidden below a barcode label):

BP-A20


(PCB revisions 1.01^[2] and 1.3^[3] were labeled with exact version number, and 1.4 was also produced in a green PCB version (https://commons.wikimedia.org/wiki/File:Front_of_Banana_Pi.JPG))

Sunxi support

Current status

Supported.

Current mainline U-Boot (2015.04) and mainline kernel (3.19.2+) work well on the Banana Pi. Kernel 4.0+ is recommended, as it adds cpufreq support for A20 SoCs (allowing lower power consumption and reduced temperatures).

 **Note:** Banana Pi's GMAC is not supported in the community kernel. A commit within Lemaker's Banana Pi Github fork of linux-sunxi-3.4 (<https://github.com/LeMaker/linux-bananapi/>) seems to provide GMAC support for Banana Pi. This has to be proved and merged into linux-sunxi.

LeMaker seems to use an important tweak of both the Linux 3.4 kernel and U-Boot networking code for the Banana Pi: The GMAC driver is specifically modified to set the GMAC_TX_DELAY parameter to 3. This adjusts the relative timing of the clock and data signals to the PHY in order to compensate for differing trace lengths on the PCB (details (<http://lists.denx.de/pipermail/u-boot/2014-September/190231.html>) ; the pcDuino3 Nano has the same problem). Without this modification, the Ethernet port will work at 100Mbit, but not (or not reliably) at 1000 Mbit. Upstream U-Boot now sets this parameter itself, so the kernel patch isn't needed any more (patch (<http://lists.denx.de/pipermail/u-boot/2015-February/203483.html>)). See also: Ethernet#GMAC

Images

HW-Pack

BSP

Manual build

- The .fex file can be found in sunxi-boards as Bananapi.fex (https://github.com/linux-sunxi/sunxi-boards/blob/master/sys_config/a20/Bananapi.fex)
- For building U-Boot, use the *Bananapi* target (make Bananapi_defconfig).

Everything else is the same as the manual build howto.

Mainline U-Boot

Using legacy *u-boot-sunxi* is now deprecated / mostly obsolete for the Banana Pi. As of mid-2015 you should prefer mainline U-Boot 2015.04 - which offers a wide range of features, including networking and netconsole. Mainline U-Boot also supports booting older 3.4.x kernels.

If booting your 3.4.x kernel fails with "*Error: unrecognized/unsupported machine ID*", you need to adjust your U-Boot config or patch the kernel - see troubleshooting. In case it completely refuses to boot / gets stuck right after "*booting the kernel*", make sure that `bootm_boot_mode=sec` is set.

Mainline kernel

Use the *sun7i-a20-bananapi.dtb* device-tree file, and follow the Mainline Kernel Howto.

Tips, Tricks, Caveats

FEL mode

The button marked *K3*, located between the HDMI and USB host connectors, triggers FEL mode when pressed during boot. (*K3* pulls the A20 *BOOTSEL* pin to low level.)

If no SD card is present, the A20 will automatically fall back to FEL mode (as this device has no other means of booting, like e.g. onboard NAND flash). So if you want to enforce FEL mode, you may simply remove the SD card and connect to the Banana Pi via the OTG micro USB (the one right next to the SD slot). This also supplies power to the board at the same time.

To verify you have successfully entered FEL mode, check the output of `fel version`. For the Banana Pi, it should look like:

```
AWUSBFEX soc=00001651(A20) 00000001 ver=0001 44 08 scratchpad=00007e00 00000000 00000000
```

LEDs

For those with a transparent case (or no case at all) the Banana Pi's LED activity might get annoying. The **red** power LED (*D7*) can't be turned off, but the behavior of the two other (green and blue) may be changed:

The **blue** LED (*D6*) is coupled to the Ethernet PHY, and only able to indicate network-related activity. A small utility named `bpi_ledset` (https://github.com/rorei/bpi_ledset) can control it (together with the other LEDs directly on the network connector).

The **green** LED (*D8*) is GPIO-driven via *PH24*, and thus user-definable. It usually can be controlled by writing to the special file `/sys/class/leds/bananapi:green:usr/trigger` (requires root privileges). Some configurations set the green LED function to "heartbeat" by default, causing it to flash constantly - "none" will turn it off instead. (Check the output of `cat /sys/class/leds/bananapi:green:usr/trigger` for possible values.) Note: Older kernels (3.4.x) may name the file `/sys/class/leds/green:ph24:led1/trigger` instead.

See also: related thread on LeMaker forum (<http://forum.lemaker.org/thread-1057-1-1.html>) , BananaLEDD (<http://destroyedlolo.info/Developpement/BananaLEDD/>)

SATA

If you wish to connect a SATA drive (2.5" mobile hddisk or SSD) to the Banana Pi: Make sure your power supply is connected to the "DC-IN" port (micro USB next to the SATA connector), and can deliver sufficient current (e.g. 5V/2000mA). Using the OTG port or an inadequate power supply might result in your SATA device not being detected.

In case you're using **large SATA drives > 2TB**, you might want to check that both your U-Boot and kernel support proper LBA48 addressing and partitioning schemes (GPT). For U-Boot, make sure that `CONFIG_SYS_64BIT_LBA` gets defined (as of 2015.04 it's not in the default configuration). For kernel configuration, see this FAQ entry.

IR Receiver

The Banana Pi features a standard 3-pin onboard infrared receiver (AX-1838HS or comparable type), which is connected straight to the A20's *IR0_RX* pin (PB4).

The Linux kernel supports this receiver via `CONFIG_IR_SUNXI`. The mainline kernel option is located under "Device drivers", "Multimedia support", "Remote Controller devices", "SUNXI IR remote control"; the driver is named *sunxi_cir*. For 3.4.x kernels, use "Device drivers", "Input device support", "Keyboards", "sunxi IR support"; the module name is *sunxi-ir*.

For tips on how to setup and configure LIRC, see this description for Cubieboard2.

Powering the board

The SATA power connector (J5) and the normal power-in micro USB connector (located between SATA and SATA-pwr) are directly wired with each other (with a ferrite bead FB3 in between responsible for some voltage drops). So when no 2.5" SATA disk is used, the board can also be powered alternatively through this connector. This might work more reliably, since many USB cables suffer from voltage drops due to the tiny connectors the Micro USB port dictates (max. 5 V / 1.8 A according to the USB specs) or insufficient cable diameters.

Adding a serial port

While the GPIO pinout of the Banana Pi is designed to be compatible to the Raspberry Pi, it's important to notice subtle differences in the serial ports. The Banana Pi has some additional pins that already provide two more serial ports.

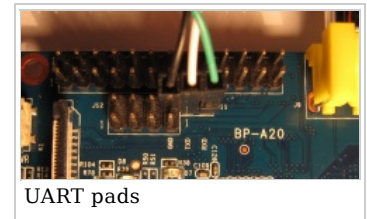
The default serial port **/dev/ttyS0** at MMIO 0x1c28000, used for (bootstrap) debugging and the serial console, is located at J11 - refer to the picture and instructions below. The Raspberry's "original" serial port on GPIO 14 and 15 (CON3, pins 8 and 10 - at MMIO 0x1c28c00) can usually be accessed as **/dev/ttyS2** on the Banana Pi. J12 also provides another serial port on pins 4 (RXD) and 6 (TXD) at MMIO 0x1c29c00, which should map to **/dev/ttyS3**.

📁 *Note:* The actual mapping between physical pins, UART numbers and/or device names may depend on the specific kernel and configuration used. If in doubt, check the boot messages: `dmesg | grep -E 'uart|serial'`

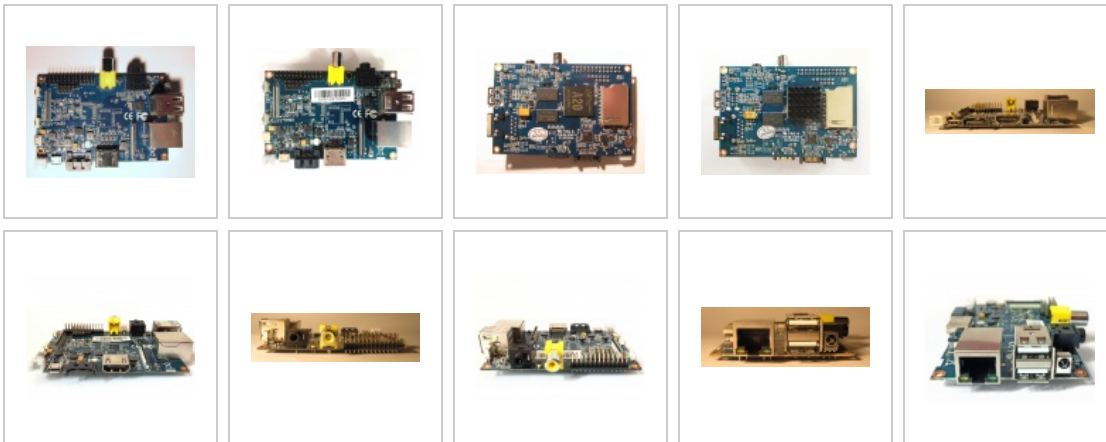
The mainline kernel likely just numbers the three ports listed above sequentially: `/dev/ttyS[0-2]`. They get defined in the device tree (.dtb file).

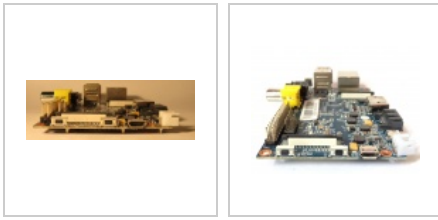
Locating the UART

The UART pins are located in the upper left corner of the board. They are marked as *TXD*, *RXD* and *GND* on the PCB. *TXD* and *RXD* are on J11, *GND* can be grabbed from pin 7 or 8 of J12. Just attach some leads according to our UART Howto. **❗ Do not connect the red wire (VCC or 3.3 V / 5 V), as that might damage your board.**



Pictures





Variants

- The original Banana Pi went into mass production in March 2014 (PCB revision 1.4). SinoVoip now labels it **BPi-M1** ("model 1") to distinguish it from other models that were introduced later. The M1 features a standard SD card slot and a 26 pin GPIO connector (similar to the Raspberry Pi A/B).
- The LeMaker Banana Pro was presented in October 2014. It's an updated version of M1, using a microSD slot, onboard WiFi (AP6181) and a 40 pin GPIO header (that mimics the Raspberry Pi A+/B+ models).
- SinoVoip produced a different version called "M1Plus" (**BPi-M1+**) as a Banana Pro rip-off sharing exactly the same hardware specs and almost the same position of onboard connectors. Main difference: SoC, DRAM and PMU are on the upper side of the PCB whereas on the lower on Banana Pro. Featurewise both boards are nearly identical and fex/dts files can be interchanged directly, with one small exception: according to LeMaker's and SinoVoip's fex files, [audio_pa_ctrl (http://linux-sunxi.org/Fex_Guide#audio_configuration)] differs: *PH26* on M1+ and *PH15* on Banana Pro.
- The Banana Pi Router (**BPi-R1** also known as **Lamobo R1**) uses a larger form factor. The board has microSD, onboard WiFi (RTL8192CU), 5 Gbit Ethernet ports, 26 pin GPIO compatible to BPi/M1 and a connector to directly attach a SATA drive.
- The Banana Pi M2 (**BPi-M2**, "model 2") is announced for 2015 (shipping from April). It offers microSD, onboard WiFi (AP6181, 802.11b/g/n), 40 pin GPIO and 4 USB type A connectors. However this device has no SATA any more, and it's based on a different SoC (quad-core A31s CPU), which makes it incompatible to the A20-based models.
- In July 2015 SinoVoip announced the so called Banana Pi M3 (http://www.sinovoip.com.cn/ecp_view.asp?id=564) . It's based on the octa-core A83T SoC with a PowerVR SGX544MP1 GPU and 2 GiB RAM. It offers microSD, onboard WiFi/BT4.0 (AP6212), GBit Ethernet, 40 pin GPIO, 1 x μ -USB 2.0 OTG, 2 x USB 2.0 host and a GL830 USB-to-SATA bridge behind a FE1.1S hub. Since there's no mainline support for the A83T yet and the OS images SinoVoip provides fail in many regards, situation with the M3 can be considered even more problematic than with the M2 today.

Also known as

- The Banana Pi (M1) will be sold as Lamobo M1 (http://wiki.lamobo.org/index.php/Lamobo_M1) in Taiwan
- The Banana Router board is also known and sold as Lamobo R1 (http://wiki.lamobo.org/index.php/Lamobo_R1)
- SinoVoip manufactures and sells two other boards labeled "Banana Pi" that are not sunxi-based and *totally incompatible* with Banana Pi/M1/M1+/Pro: the BPi-D1 (<http://www.bananapi.com/index.php/component/content/article?layout=edit&id=63>) has been developed by Lamobo (<https://www.kickstarter.com/projects/2081058999/lamobo-d1-develop-your-own-mini-camera>) and is sold by them as Lamobo D1 (http://wiki.lamobo.org/index.php/Lamobo_D1) . Same applies to the so called BPi-G1 (<http://www.bananapi.com/index.php/component/content/article?layout=edit&id=76>) which is also sold as Lamobo G1 (http://wiki.lamobo.org/index.php/Lamobo_G1) in Taiwan.

Manufacturer images

- A various amount of prebuilt images (<http://www.lemaker.org/portal.php?mod=list&catid=4>) is provided via LeMaker's Website.
- [bananapi.com](http://www.bananapi.com) download section (<http://www.bananapi.com/index.php/download?layout=edit&id=29>) for the Banana Pi (BPi-M1).

See also

There are several websites about Banana Pi and claiming to support it. It has to be clarified, what is "official" and who is behind these sites (also see introductory remarks).

- LeMaker Banana Pi site (<http://www.lemaker.org>) , Forum (<http://www.lemaker.org/forum.php>) , Wiki (<http://wiki.lemaker.org>) , 'Official' Github Repository (<http://github.com/LeMaker>) , Lenovator (LeMaker Distributor) (<http://www.lenovator.com>)
- BananaPi R&D Team (<http://www.bananapi.org>) , Github Repository (<http://github.com/bananapi-dev>)
- SinoVoip Banana Pi site (<http://www.banana-pi.com/>) , SinoVoip (Manufacturer?) (<http://sinovoip.com.cn>) , bananapi.com (<http://www.bananapi.com/>) , Chinese forum (<http://www.banana-pi.org.cn>) , Github Repository (<https://github.com/BPI-SINOVOIP>) (newly introduced with BPI-M2, but claims to support M1 and M1Plus too)
- Banana Pi schematic (<http://forum.lemaker.org/thread-7457-1-1.html>) , Banana Pi M1/M1+ schematic (<https://drive.google.com/folderview?id=0B4PAo2nW2KfnfVqbjJGTFITTd1b1o1OUxDNk5ackVDM0RNUjBpZ0FQU19SbDk1MngzZWM>)
- Lamobo (<http://www.lamobo.org>) cooperates/cooperated with SinoVoip and provided OS images for Banana Pi/M1, and the router board *Lamobo R1*.
- OpenWRT support for the Banana Pi with mainline kernel - Daily build (<http://downloads.openwrt.org/snapshots/trunk/sunxi/>) / Manual for building an SD-card image (<http://wiki.openwrt.org/doc/hardware/soc/soc.allwinner.sunxi#pre-built.sd.card.images>)

We have dedicated wiki pages for

- Banana Pi Router
- Banana Pro
- Banana Pi M2

References

1. ↑ References to *Foxconn Technology Group* should be read as *Kortide* (<http://www.kortide.com/cn.php?s=/index>) , a Shanghai-based system platform developer under the Foxconn Group founding the Elastos community (<http://elastos.org>) and owning the Lamobo (<http://www.lamobo.org>) brand
2. ↑ http://www.cnx-software.com/wp-content/uploads/2014/04/Banana_Pi_Large.jpg
3. ↑ <http://web.archive.org/web/20150628113736/http://bananapi.elastos.org/files/2013/11/up.jpg>

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