# Original pad to a USB or Bluetooth keyboard, pad-ble v1

One original NES controller into an ESP32, presented to a phone or a laptop as a plain keyboard: the bridge's own pad poll with a host interface behind it. No Pi, no UNO, no console. Sheets 2 to 4 are the C6 design, kept as a record; that board died 2026-09-29.

TWO BUILDS, ONE CIRCUIT. USB on a Waveshare ESP32-P4-Module-DEV-KIT (sheets 5 to 10), proven 2026-09-27. BLE on a classic ESP32-WROOM-32 devkit (sheets 11 to 15, 2026-09-30) on D25, D26, D27, since GPIO6 is its flash and GPIO3 its console; it advertises and the bench head bonded with it. No pad wired to it yet; no phone tried on either.

## Sheets


| SHEET | TITLE | PAPER | HOW IT IS MADE |
|---|---|---|---|
| 1 | Cover and sheet index | letter | this sheet |
| 2 | pad-ble v1: one pad into the C6, as a BLE keyboard | ANSI B | schematic |
| 3 | Wiring diagram: every wire at right angles on the packages | ANSI B | schematic |
| 4 | Breadboard: which hole each part and jumper goes in | ANSI B | schematic |
| 5 | pad-ble v1 on the ESP32-P4: one pad into header P6 | ANSI B | schematic |
| 6 | Wiring, ESP32-P4: every wire at right angles, P6's own pins | ANSI B | schematic |
| 7 | Breadboard, ESP32-P4: the board sits beside it, not on it | ANSI B | schematic |
| 8 | ESP32-P4 module header P6: where each wire goes | letter | schematic, lab log, bring-up tool |
| 9 | ESP32-P4 module header P6: where each wire goes (continued) | letter | schematic, lab log, bring-up tool |
| 10 | ESP32-P4 module header P6: where each wire goes (continued) | letter | schematic, lab log, bring-up tool |
| 11 | pad-ble v1 on a classic ESP32: one pad into the devkit | ANSI B | schematic |
| 12 | Wiring, classic ESP32: every wire at right angles | ANSI B | schematic |
| 13 | Breadboard, classic ESP32: on the board, rows 6 to 20 | ANSI B | schematic |
| 14 | WROOM-32 header: where each wire goes | letter | schematic, lab log, bring-up tool |
| 15 | WROOM-32 header: where each wire goes (continued) | letter | schematic, lab log, bring-up tool |
| 16 | Wiring list, pad-ble v1 | letter | derived from the schematic |
| 17 | Parts list | letter | derived from the schematic |


| REV | DATE | REVISION |
|---|---|---|
| J | 2026-09-26 | the first pad was a replica; an original's lead ... |
| K | 2026-09-26 | J1 drawn as an original pad in its own colours o... |
| L | 2026-09-28 | measure-first item 4 closed and the host result ... |
| M | 2026-09-30 | the BLE build moves to a classic ESP32-WROOM-32 ... |

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SHEET TITLE
**Cover and sheet index**

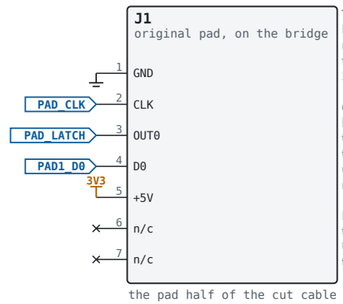
| DRAWING NO. | REV | DATE | SHEET |
|---|---|---|---|
| TM-NESB-003 | M | 2026-11-04 | 1 of 17 |

| DRAWN BY | SOURCE | SCALE |
|---|---|---|
| bisenbek | git 9c81360 | NTS |

**nes-bench** — **pad-ble v1: one pad into the C6, as a BLE keyboard**

The buildable subset of pad-adapter.svg: USB powered, no cell, no charger, no mode switch. The board on the bench is an ESP32-C6-DevKitC-1 v1.2, read off its RGB@IO8 silkscreen 2026-09-21. Nothing built.

THE PAD, polled at 3V3 exactly as the bridge polls one

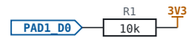



the pad half of the cut cable

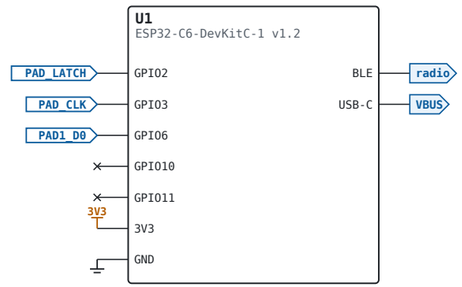
The pad's 4021 is a CMOS part rated 3 to 18 V, so at 3V3 its D0 is 3V3 logic and needs no shifter. That is the datasheet, not this bench: MEASURE FIRST, item 4. If a pad will not follow its buttons at 3V3, add a 74LVC245 and feed the pad 5 V; the 245 is on hand.

ONE PAD, and that is the design rather than a first step. A BLE keyboard report carries six key slots and two pads can ask for ten, so a second pad could be polled and never sent. One was on this sheet until 2026-09-23 doing exactly that: wired, pulled up, given a pin, and thrown away. Two players wants gamepad mode with two report IDs, which is pad-adapter.svg's job.

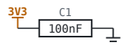
Pin 5 is the supply and 6 and 7 carry nothing, as measured on this console's own cable (docs/wiring.md). RING THE CABLE OUT UNPLUGGED: a tone through a cable still in the console runs through its pull-ups, and pins that share nothing beep.




THE CONTROLLER, on USB power




NimBLE HID keyboard; no USB device controller




NOT GPIO4, GPIO5 or GPIO15: strapping pins on the C6. The three pad pins above are the map firmware/bridge/bridge.ino already polls a pad on, so firmware/pad-ble reuses poll_pad unedited.

GPIO10 (MODE_SW) and GPIO11 (LED) are NC here: the firmware reads one with a pullup and drives the other, and neither is wired. Declared rather than omitted, so the netlist sees a statement instead of silence.

C1 sits across the devkit's own 3V3 and GND pins. The devkit is regulated already; this is for the breadboard's inductance, which is what the bridge's own 100 nF was added for on 2026-09-15.

WHAT THIS BOARD CAN AND CANNOT DO, and why the answer is in silicon

| | |
|---|---|
| BLE HID | Works, and reaches a phone with no app: a BLE HID-over-GATT keyboard pairs in Settings beside a Magic Keyboard. Browser emulators take keys. Needs four things, each in firmware/pad-ble/pad-ble.ino with its reason: bonding with encryption, the PnP ID, a battery service, and the HID service UUID plus the keyboard appearance IN THE ADVERTISEMENT, since a host decides what to offer as a pairable accessory from the advert alone. |
| USB HID | IMPOSSIBLE ON THIS PART, and not for want of firmware. The port marked USB is a USB-Serial-JTAG bridge, fixed in silicon. Its soc_caps.h defines SOC_USB_SERIAL_JTAG_SUPPORTED and does NOT define SOC_USB_OTG_SUPPORTED, and the core gates USBHIDKeyboard.h on the latter, so it compiles away. Read off the installed esp32 core 3.3.11 on 2026-09-21, not recalled. USB HID needs an S3, S2 or P4, and an S3 does BLE too, so it gets both modes. |
| Gamepad HID | Not built. iOS refuses a generic HID gamepad, taking only the MFi, Xbox, PlayStation and Switch Pro layouts, which is why keyboard mode came first. |
| Two players | Not on this board. A keyboard report carries six key slots and two pads can ask for ten, so a second pad could be polled and never sent. One was drawn and polled here until 2026-09-23 doing exactly that. Two players wants gamepad mode with two report IDs, on a part that can do it. |
| Bench mode | Not built, and the cheapest of them: the C6's USB already IS a serial port, so pad bytes over USB serial into a uinput shim need no new hardware. |

pad-ble.svg ansi-b placed at 76% drawn by tools/draw-schematics.py

| REV | DATE | REVISION |
|---|---|---|
| J | 2026-09-26 | the first pad was a replica; an original's lead ... |
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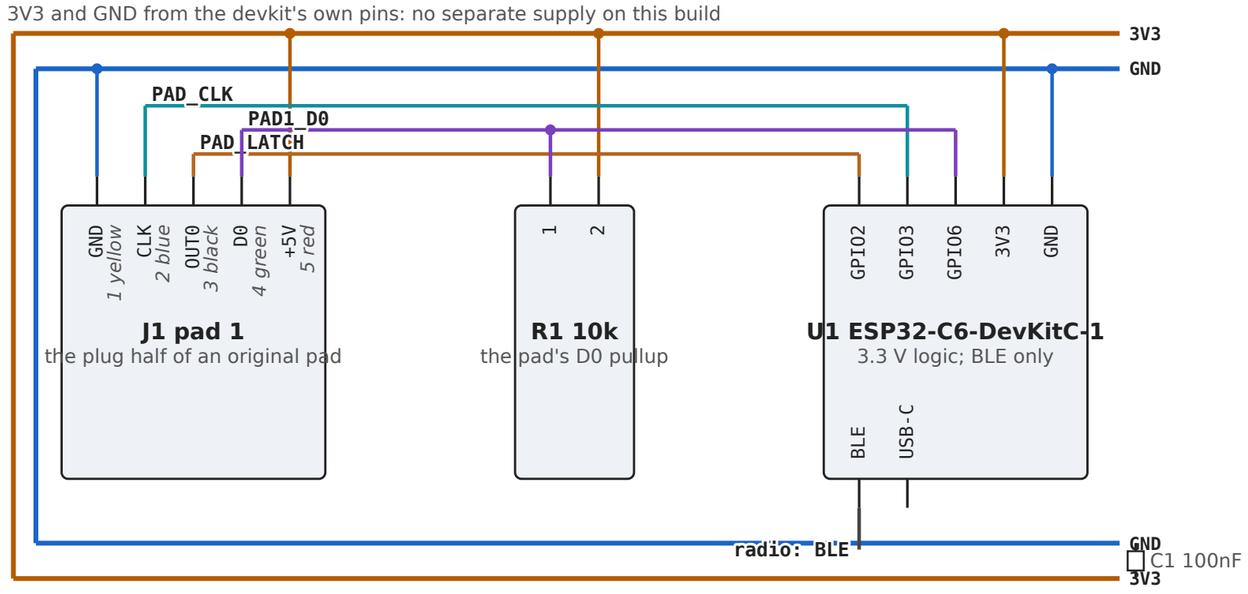
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SHEET TITLE: **pad-ble v1: one pad into the C6, as a BLE keyboard**

| DRAWING NO. | REV | DATE | SHEET |
|---|---|---|---|
| TM-NESB-003 | M | 2026-11-04 | 2 of 17 |

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|---|---|---|
| bisenbek | git 9c81360 | NTS |

The standalone adapter, every wire read out of pad-ble.svg; J1's colours are the bench's REPLICA cable. One pad, because a keyboard report has six key slots. The pad runs from 3V3, not 5 V, which is measure-first item 4.




3 nets on tracks, 0 of them crossing the row; 7 supply pins on the rails. drawn by tools/wiring-diagram.py

wiring-pad-ble.svg ansi-b placed at 102% drawn by tools/wiring-diagram.py

| REV | DATE | REVISION |
|---|---|---|
| J | 2026-09-26 | the first pad was a replica; an original's lead ... |
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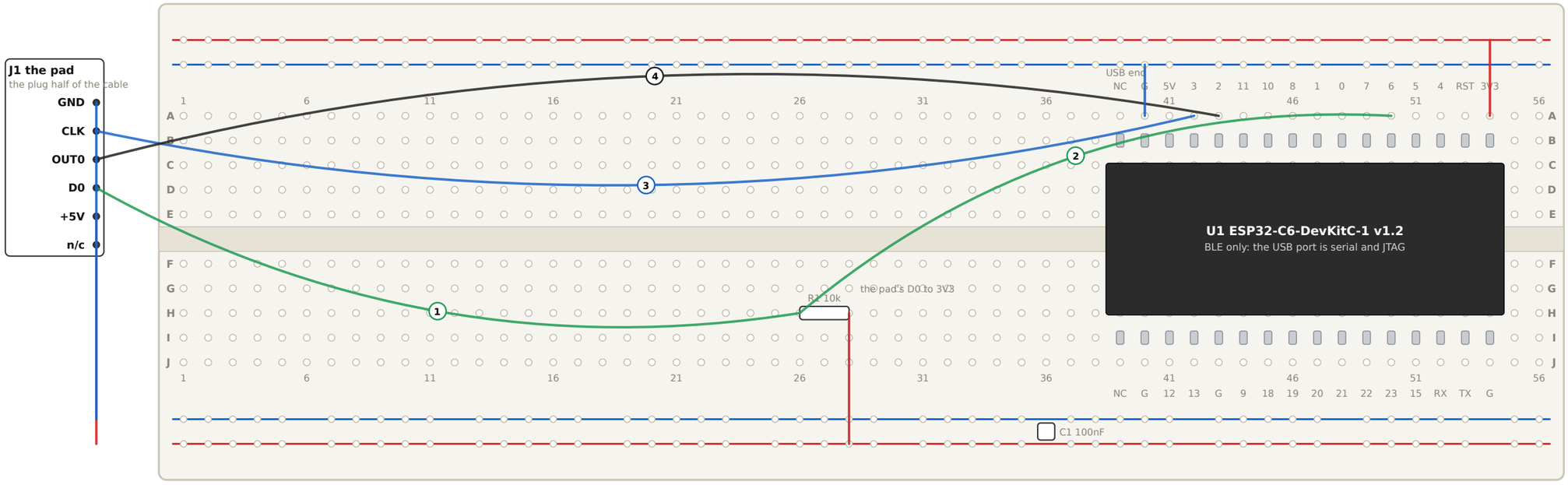
SHEET TITLE: Wiring diagram: every wire at right angles on the packages

| DRAWING NO. | REV | DATE | SHEET |
|---|---|---|---|
| TM-NESB-003 | M | 2026-11-04 | 3 of 17 |

| DRAWN BY | SOURCE | SCALE |
|---|---|---|
| bisenbek | git 9c81360 | NTS |

# pad-ble v1 on the breadboard: where everything goes

The devkit's pin labels are MEASURED off the board. It straddles the channel, so only rows A and J are reachable in its columns. The lead colours in the key are the bench's REPLICA cable; an original pad's differ.




## 4 numbered jumpers, and 5 short wires to the rails

Every one of these is read out of the schematic. Red stubs go to the nearest + rail, blue stubs to the nearest - rail; they are not numbered because they are all the same instruction.

1. PAD1_D0, the green lead: J1 D0 to R1 col 26 row H
2. PAD1_D0, the green lead: R1 col 26 row H to U1 pin marked 6 (col 50 row A)
3. PAD_CLK, the blue lead: J1 CLK to U1 pin marked 3 (col 42 row A)
4. PAD_LATCH, the black lead: J1 OUT0 to U1 pin marked 2 (col 43 row A)

breadboard-pad-ble.svg ansi-b placed at 77% drawn by tools/breadboard.py

| REV | DATE | REVISION |
|---|---|---|
| J | 2026-09-26 | the first pad was a replica; an original's lead ... |
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SHEET TITLE: **Breadboard: which hole each part and jumper goes in**

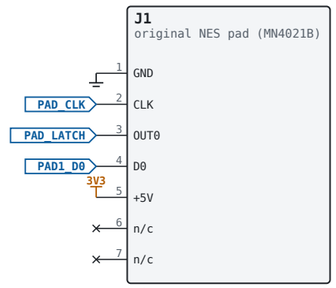
| DRAWING NO. | REV | DATE | SHEET |
|---|---|---|---|
| TM-NESB-003 | M | 2026-11-04 | 4 of 17 |

| DRAWN BY | SOURCE | SCALE |
|---|---|---|
| bisenbek | git 9c81360 | NTS |

# pad-ble v1 on the ESP32-P4: one pad into header P6

The build is USB now, not BLE. A Waveshare ESP32-P4-Module-DEV-KIT, header read from the vendor schematic 2026-09-24 and every hole confirmed with firmware/header-probe 2026-09-25. The wiring is the same either way.

## THE PAD, polled at 3V3 exactly as the bridge polls one



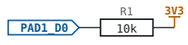

1 brown 2 red 3 orange 4 yellow 5 white, NOT measured

Unchanged from pad-ble.svg, and that is the point: GPIO2, 3 and 6 exist and are free on BOTH parts, so poll_pad in firmware/pad-ble runs unedited on either. One sketch, one pad map, two targets.

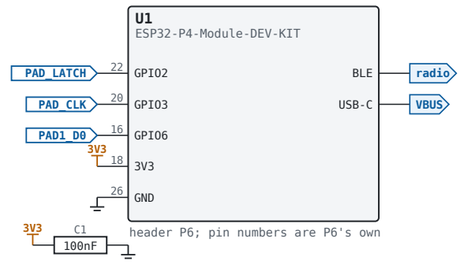
The pad's 4021 is a CMOS part rated 3 to 18 V, so at 3V3 its D0 is 3V3 logic and needs no shifter. MEASURED 2026-09-27: an original's MN4021B follows its buttons at 3V3, 27 presses in 30 s under firmware/pad-diag. No 74LVC245 needed. A 10 ohm part fitted as the 10k pull-up hid it first: read the bands.

Pin 5 is the supply and 6 and 7 carry nothing, as measured on this console's own cable (docs/wiring.md). RING THE CABLE OUT UNPLUGGED: a tone through a cable still in the console runs through its pull-ups, and pins that share nothing beep.

J1 IS DRAWN AS AN ORIGINAL PAD, in Nintendo's colours, which are documented and NOT YET MEASURED: beep each wire to the MN4021B 6 s not the pin the header sheet's wire table gives. The first pad on this build was a REPLICA, whose colours differ, and RED and YELLOW are different signals on each: wired by the replica's colours, an original puts its DATA on the GROUND rail.




## THE CONTROLLER, on its own USB power, wired at header P6




header P6; pin numbers are P6's own

PIN 1 IS NOT WHERE A RASPBERRY PI PUTS IT. The header is Pi-shaped and numbered the other way round: 5V on 1 and 3 where a Pi has 2 and 4, 3V3 on 2 and 18 where a Pi has 1 and 17, and every ground one pin from where a Pi user reaches. A HAT fits this board and does not work. Count from the schematic.

THE WHOLE CIRCUIT IS FIVE HOLES IN A ROW. Find the SECOND 3V3 on the even row; it reads

6 3V3 3 2 0 GND
p16 p18 p20 p22 p24 p26

and the build takes all of them EXCEPT 0. One landmark and one hole to skip beats five numbers: wired by number on 2026-09-25, two of the three signal wires went in wrong.

TEN PINS REACH P6 AND ARE STILL NOT YOURS. Worst is GPIO54 (pin 31), the onboard C6's RESET: take it and the radio dies. Sheets 8 to 10 list all ten with what each is wired to.

MODE_SW AND LED MOVED, and had to. On the C6 they were GPIO10 and GPIO11 and cost nothing because nothing was wired to them. Here those numbers are the ES8311 codec's I2S and are not on the header at all. They are GPIO21 and GPIO20 now, P6 pins 12 and 14, free and on the same even row. Declared, not wired.

C1 goes across the breadboard's own 3V3 and GND rails, not the board's pins: the module is regulated already and this is for the breadboard's inductance, as on the bridge since 2026-09-15.

## WHAT THIS BOARD DOES, MEASURED, and why the direction changed on 2026-09-25

| | |
|---|---|
| USB HID | THIS IS THE BUILD, PROVEN 2026-09-27: an original pad at 3V3, every button and chord, and a Linux host enumerating 303a:0002 NES Pad at full speed and receiving all eight keys. TinyUSB driven directly on the P4's FULL-speed OTG controller, PHY 0 (GPIO24/25) swapped from USB-Serial-JTAG to it: the Type-C socket marked USB, not PWR USB TO UART. The HOST/DEVICE jumper is the high-speed switch's and does not matter here. No radio, no co-processor, no pairing. Not yet tried: a phone, a browser page, latency. UART stays the log. |
| BLE HID | REACHES THE AIR BUT CRASHES THIS FIRMWARE, and not in our code. The P4 has no radio; the module's ESP32-C6 is it, over SDIO. The host's esp-hosted 2.12.11 asks that C6 for its firmware version, gets no answer, and the failure path reads a pointer nobody filled in: always 2881 ms after BLEDevice::init. Five explanations tested and eliminated (build options and PSRAM, the security block, a delay before init, a delay after init, our own GPIO setup). A smaller sketch survives the IDENTICAL timeout, so the garbage it reads is harmless there: luck, not correctness. The proper fix is the C6's slave firmware, through the C6 UART header. Not done. |
| Proven | The radio itself works: on 2026-09-24 the bench Pi's own receiver heard this board advertise at B0:A6:04:8A:D7:0E, which is NOT the P4's MAC, because the advertisement came off the C6. The BLE fault is the version RPC and its aftermath, not the link. |
| Flashing | First try, where the C6 devkit never once answered. On /dev/p4-uart through the board's CH343 at 1a86:55d3. The factory image was read off and kept before anything was written: 16 MB, sha256 ad22bf07..., so this board goes back if it has to. |
| Two players | Not on this sheet. A keyboard report carries six key slots and two pads can ask for ten, so a second pad could be polled and never sent. |

pad-ble-p4.svg ansi-b placed at 76% drawn by tools/draw-schematics.py

| REV | DATE | REVISION |
|---|---|---|
| J | 2026-09-26 | the first pad was a replica; an original's lead ... |
| K | 2026-09-26 | J1 drawn as an original pad in its own colours o... |
| L | 2026-09-28 | measure-first item 4 closed and the host result ... |
| M | 2026-09-30 | the BLE build moves to a classic ESP32-WROOM-32 ... |

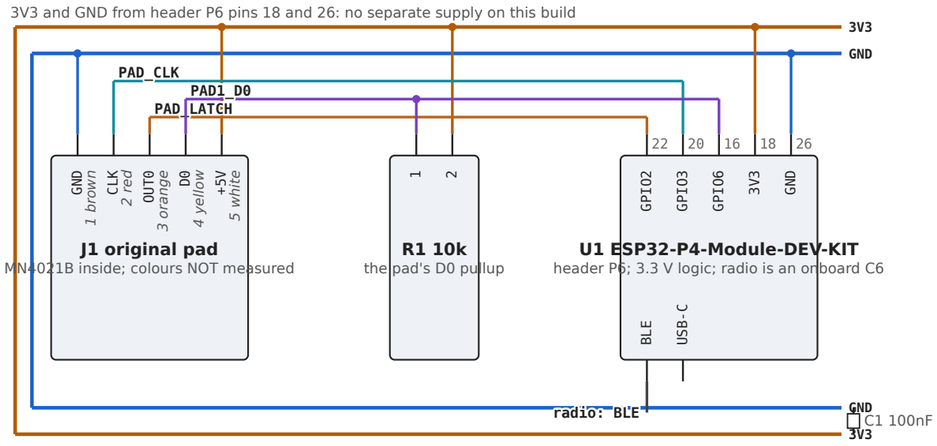
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SHEET TITLE: **pad-ble v1 on the ESP32-P4: one pad into header P6**

| DRAWING NO. | REV | DATE | SHEET |
|---|---|---|---|
| TM-NESB-003 | M | 2026-11-04 | 5 of 17 |

| DRAWN BY | SOURCE | SCALE |
|---|---|---|
| bisenbek | git 9c81360 | NTS |

The sheet to build from, for an ORIGINAL pad: J1's colours are Nintendo's, documented and NOT yet measured, so beep each to the MN4021B first. U1's numbers are header P6's own: the second 3V3 on the even row, then 6, 3V3, 3, 2, skip 0,




3 nets on tracks, 0 of them crossing the row; 7 supply pins on the rails. drawn by tools/wiring-diagram.py

wiring-pad-ble-p4.svg ansi-b placed at 76% drawn by tools/wiring-diagram.py

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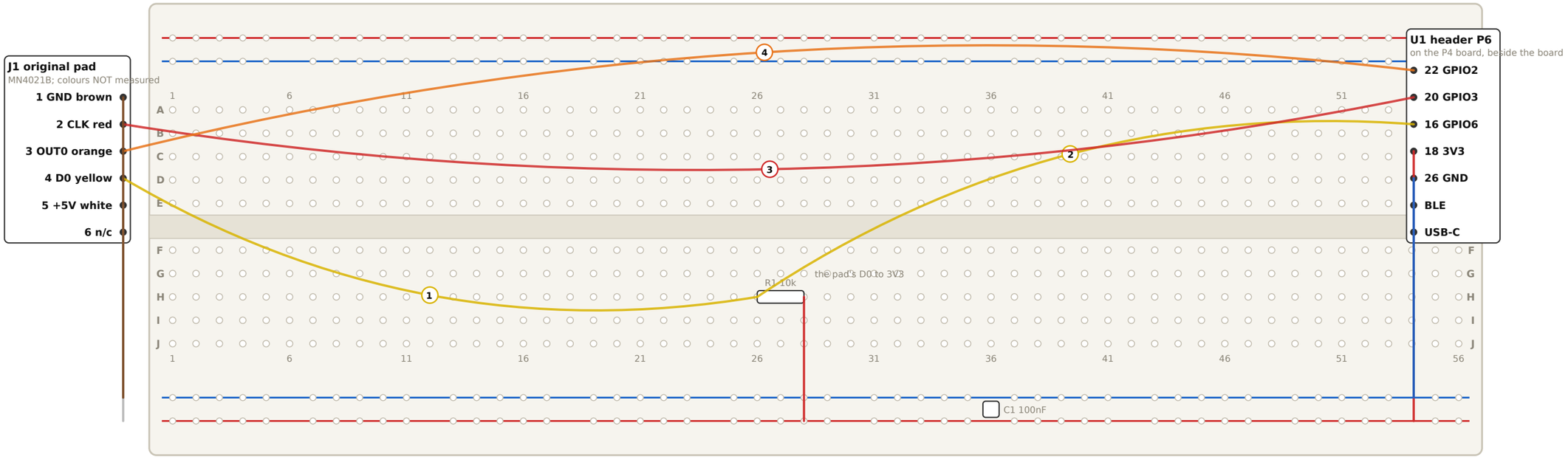
SHEET TITLE: **Wiring, ESP32-P4: every wire at right angles, P6's own pins**

| DRAWING NO. | REV | DATE | SHEET |
|---|---|---|---|
| TM-NESB-003 | M | 2026-11-04 | 6 of 17 |

| DRAWN BY | SOURCE | SCALE |
|---|---|---|
| bisenbek | git 9c81360 | NTS |

# pad-ble v1 on the ESP32-P4: where everything goes

An ORIGINAL pad in Nintendo's colours, documented and NOT yet measured: beep each wire to its MN4021B first. The board sits beside the breadboard. A replica's colours differ; red and yellow swap meaning.




## 4 numbered jumpers, and 5 short wires to the rails

Every one of these is read out of the schematic. Red stubs go to the nearest + rail, blue stubs to the nearest - rail, except a stub from the pad, which is drawn in its own lead's colour; they are not numbered because they are all the same instruction.

1. PAD1_D0, the yellow lead: J1 D0 to R1 col 26 row H
2. PAD1_D0, the yellow lead: R1 col 26 row H to U1 GPIO6
3. PAD_CLK, the red lead: J1 CLK to U1 GPIO3
4. PAD_LATCH, the orange lead: J1 OUT0 to U1 GPIO2

breadboard-pad-ble-p4.svg ansi-b placed at 77% drawn by tools/breadboard.py

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SHEET TITLE: **Breadboard, ESP32-P4: the board sits beside it, not on it**

| DRAWING NO. | REV | DATE | SHEET |
|---|---|---|---|
| TM-NESB-003 | M | 2026-11-04 | 7 of 17 |

| DRAWN BY | SOURCE | SCALE |
|---|---|---|
| bisenbek | git 9c81360 | NTS |

## The five wires, and which lead is which on each kind of pad

Every one is an EVEN pin on P6, and they are CONSECUTIVE: find the second 3V3 on that row and the circuit is 6, 3V3, 3, 2, skip 0, GND. THE LEAD COLOURS DEPEND ON THE PAD. The replica column is the bench's cable, rung out 2026-09-09. The original column is Nintendo's documented scheme, NOT YET MEASURED: beep each wire to the pad's own 4021 at the pin shown before powering it. DO NOT WIRE ONE BY THE OTHER'S COLOURS: RED is supply on the replica but clock on an original and YELLOW is ground on the replica but data on an original, so an original wired by replica colours puts its data output on the ground rail.

| SIGNAL | P6 PIN | REPLICA LEAD | ORIGINAL LEAD | ORIGINAL: BEEP TO 4021 |
|---|---|---|---|---|
| supply | pin 18 | Red | White | pin 16 (VDD) |
| ground | pin 26 | Yellow | Brown | pin 8 (VSS) |
| latch | pin 22 | Black | Orange | pin 9 (P/S) |
| clock | pin 20 | Blue | Red | pin 10 (CLOCK) |
| data | pin 16 | Green | Yellow | pin 3 (Q8) |

generated from tools/cheatsheet.py: the schematic, the lab log and tools/bringup.py's lead and ribbon tables

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SHEET TITLE
**ESP32-P4 module header P6: where each wire goes**

| DRAWING NO. | REV | DATE | SHEET |
|---|---|---|---|
| TM-NESB-003 | M | 2026-11-04 | 8 of 17 |

| DRAWN BY | SOURCE | SCALE |
|---|---|---|
| bisenbek | git 9c81360 | NTS |

## On the header and already spoken for

These reach the header and are still not yours. Driving one fights a part soldered to the board.

| GPIO | P6 PIN | ALREADY WIRED TO |
|---|---|---|
| GPIO54 | pin 31 | the C6's RESET |
| GPIO45 | pin 39 | MicroSD power switch |
| GPIO53 | pin 36 | speaker amp CTRL |
| GPIO36 | pin 23 | BOOT_MODE2 strap |
| GPIO24 | pin 28 | USB1P1_N |
| GPIO25 | pin 27 | USB1P1_P |
| GPIO7 | pin 4 | codec SDA, 2.2k pullup |
| GPIO8 | pin 6 | codec SCL, 2.2k pullup |
| GPIO37 | pin 7 | console UART TXD |
| GPIO38 | pin 9 | console UART RXD |

## On the header and free

Nothing else on the board touches these. pad-ble takes GPIO2, 3 and 6 from here, which is the same map firmware/bridge/bridge.ino already polls a pad on, so poll_pad runs unedited.

| GPIO | P6 PIN | NOTE |
|---|---|---|
| GPIO0 | pin 24 | |
| GPIO1 | pin 21 | |
| GPIO2 | pin 22 | PAD_LATCH |
| GPIO3 | pin 20 | PAD_CLK |
| GPIO4 | pin 17 | |
| GPIO5 | pin 15 | |
| GPIO6 | pin 16 | PAD1_D0 |
| GPIO20 | pin 14 | LED, not wired |
| GPIO21 | pin 12 | MODE_SW, not wired |
| GPIO22 | pin 11 | |
| GPIO23 | pin 8 | |
| GPIO26 | pin 32 | |
| GPIO27 | pin 37 | |
| GPIO32 | pin 25 | |
| GPIO33 | pin 30 | |
| GPIO46 | pin 35 | |
| GPIO47 | pin 38 | |
| GPIO48 | pin 34 | |

generated from tools/cheatsheet.py: the schematic, the lab log and tools/bringup.py's lead and ribbon tables

| REV | DATE | REVISION |
|---|---|---|
| J | 2026-09-26 | the first pad was a replica; an original's lead ... |
| K | 2026-09-26 | J1 drawn as an original pad in its own colours o... |
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| M | 2026-09-30 | the BLE build moves to a classic ESP32-WROOM-32 ... |

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SHEET TITLE
**ESP32-P4 module header P6: where each wire goes**

| DRAWING NO. | REV | DATE | SHEET |
|---|---|---|---|
| TM-NESB-003 | M | 2026-11-04 | 9 of 17 |

| DRAWN BY | SOURCE | SCALE |
|---|---|---|
| bisenbek | git 9c81360 | NTS |

## Not brought out to the header at all

Recorded so nobody goes looking for them. The SDIO group is the whole reason a part with no radio can advertise: it is the link to the ESP32-C6 sealed in the module.

| GPIOS | WHAT HAS THEM | CONSEQUENCE |
|---|---|---|
| GPIO9 to GPIO13 | I2S to the audio codec | out of reach |
| GPIO14 to GPIO19 | SDIO to the onboard C6 | out of reach |
| GPIO28 to GPIO31 | Ethernet PHY | out of reach |
| GPIO34, GPIO35 | Ethernet PHY; 35 is BOOT_MODE | out of reach |
| GPIO39 to GPIO44 | MicroSD card | out of reach |
| GPIO49 to GPIO52 | Ethernet PHY | out of reach |

generated from tools/cheatsheet.py: the schematic, the lab log and tools/bringup.py's lead and ribbon tables

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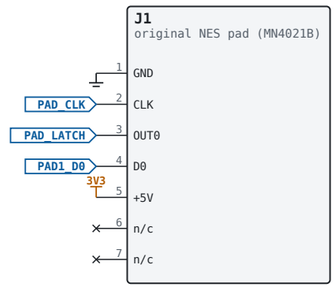
SHEET TITLE
**ESP32-P4 module header P6: where each wire goes**

| DRAWING NO. | REV | DATE | SHEET |
|---|---|---|---|
| TM-NESB-003 | M | 2026-11-04 | 10 of 17 |

| DRAWN BY | SOURCE | SCALE |
|---|---|---|
| bisenbek | git 9c81360 | NTS |

The BLE build, on the part with its own radio. A 30-pin ESP32-WROOM-32 devkit, header read off the board 2026-09-30. NOT the C6 map: GPIO6 is this module's flash and GPIO3 its console, so the pad moves to D25, D26, D27.

THE PAD, polled at 3V3 exactly as the bridge polls one

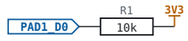



The pad side is the P4 sheet's: the same plug, pullup and poll. Only the three pins it lands on move, because this part gives no choice (see the controller zone).

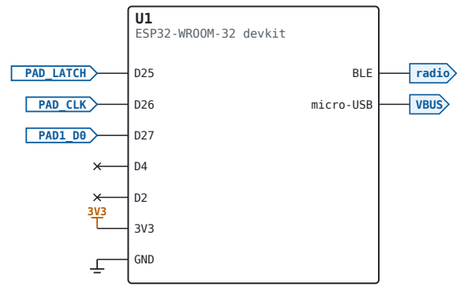
The pad's 4021 is a CMOS part rated 3 to 18 V, so at 3V3 its D0 is 3V3 logic and needs no shifter. MEASURED 2026-09-27: an original's MN4021B follows its buttons at 3V3 (pad-ble-p4.svg). Pin 5 is the supply; 6 and 7 carry nothing. RING THE CABLE OUT UNPLUGGED. A 10 ohm part fitted as the 10k hid it first.

J1 IS DRAWN AS AN ORIGINAL PAD, in Nintendo's colours, NOT YET MEASURED: beep each wire to the MN4021B first. A REPLICA's differ, and RED and YELLOW are different signals on each: wired by the replica's colours, an original puts its DATA on the GROUND rail. NO PAD IS WIRED TO THIS BOARD YET. With D27 floating the byte reads ff, all eight pressed, and the blue LED on D2 is on.

1 brown 2 red 3 orange 4 yellow 5 white, NOT measured




THE CONTROLLER, on its own USB power, labels as the board prints them




30 pins; the labels are the board's own silkscreen; D<n> is GPIO<n>




WHY NOT GPIO2, 3 AND 6. On an ESP32-WROOM-32 GPIO6 to GPIO11 are the module's own flash and never reach the header, and GPIO3 is U0RXD, the receive side of the CP2102 that is this board's only console. The C6 map would drive the flash the program runs from. So: D25 latch, D26 clock, D27 data, ADJACENT on the EN side, GND four pins below them on the same side, 3V3 the first pin of the other side. The EN side reads, up from the USB end:

VIN GND 13 12 14 27 26 25 33 32 35 34 VN VP EN

D4 (MODE_SW) and D2 (LED) are NC here: the firmware reads one with a pullup and drives the other. D2 is the devkit's own blue LED, so the pad-held light needs no wiring on this board.

ALSO NOT YOURS: TX0 and RX0 (the console), D12 and D15 (strapping pins the module samples at reset), and D34, D35, VP, VN, which are input only with no pullup. The header page lists them.

C1 goes across the breadboard's own 3V3 and GND rails, not the board's pins, as on every sheet since 2026-09-15.

WHAT THIS BOARD DOES, MEASURED 2026-09-30 with the bench head as the host

| | |
|---|---|
| BLE HID | ADVERTISES AND BONDS. Boots straight into firmware/pad-ble built for esp32:esp32:esp32 (84% of the app partition), prints the key map and advertising as NES Pad, and the bench head's own radio lists it. BLEDevice::init does not crash here, unlike the P4. Paired from the head with an agent registered (a non-interactive bluetoothctl pair fails, no agent for the request), it bonds and the head grows a NES Pad keyboard on uhid. One connect prints one linked line, one disconnect one unlinked. NOT TESTED: a pad wired to it, a phone. A floating D27 reads ff, all pressed. |
| FORGET | WORKS ON THIS PART NOW, AND DID NOT. The sketch cleared bonds only under NimBLE; this core is Bluedroid, so FORGET printed rc -1 and cleared nothing while a reflash blanked the bond store anyway: the one-sided bond with no way out. It lists and removes the bonds one by one now, measured both ways: board blank and head bonded, the head connects and gets nothing (bluetoothd's unlikely error lines are the only tell); FORGET with one bond stored answers 1 bond(s) were stored here, rc 0, and the head's next connect drops until it removes its side and pairs again. |
| Flashing | Through the CP2102 at /dev/ttyUSB0 on the bench head, esptool's default reset, the merged image at 0x0 at 921600. The board arrived running an AT firmware (an at_customize partition, version line 2.4.0). Its ROM banner appears only when the reset is driven through RTS, not DTR alone. |
| Serial | Unlike the P4 over USB, this board's Serial IS the CP2102, so the B xx lines and STATUS, KEYS and FORGET are readable on the bench head at 115200. |
| Two players | Not on this sheet. A keyboard report carries six key slots and two pads can ask for ten, so a second pad could be polled and never sent. |

pad-ble-esp32.svg ansi-b placed at 76% drawn by tools/draw-schematics.py

| REV | DATE | REVISION |
|---|---|---|
| J | 2026-09-26 | the first pad was a replica; an original's lead ... |
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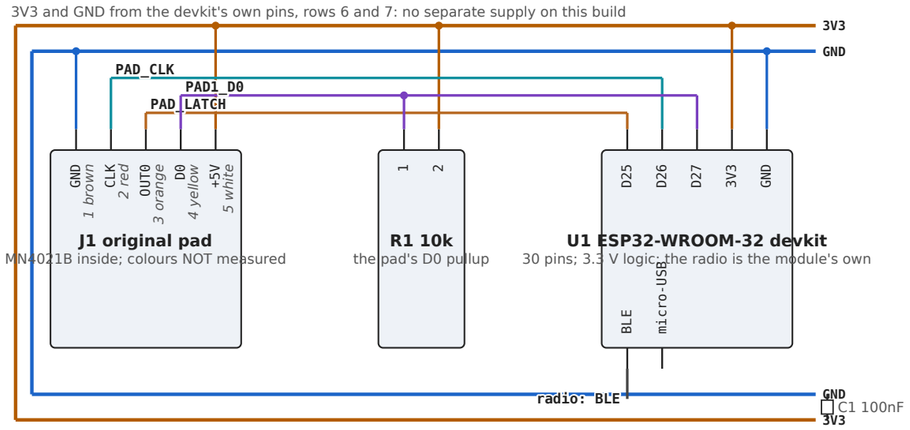
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SHEET TITLE: pad-ble v1 on a classic ESP32: one pad into the devkit

| DRAWING NO. | REV | DATE | SHEET |
|---|---|---|---|
| TM-NESB-003 | M | 2026-11-04 | 11 of 17 |

| DRAWN BY | SOURCE | SCALE |
|---|---|---|
| bisenbek | git 9c81360 | NTS |

The BLE build, on the part with its own radio. U1's pins carry the board's printed labels: D25 latch, D26 clock, D27 data, adjacent on the EN side in breadboard rows 13, 12 and 11; GND is row 7 on that side and 3V3 row 6 across from it. NOT G




3 nets on tracks, 0 of them crossing the row; 7 supply pins on the rails. drawn by tools/wiring-diagram.py

wiring-pad-ble-esp32.svg ansi-b placed at 74% drawn by tools/wiring-diagram.py

| REV | DATE | REVISION |
|---|---|---|
| J | 2026-09-26 | the first pad was a replica; an original's lead ... |
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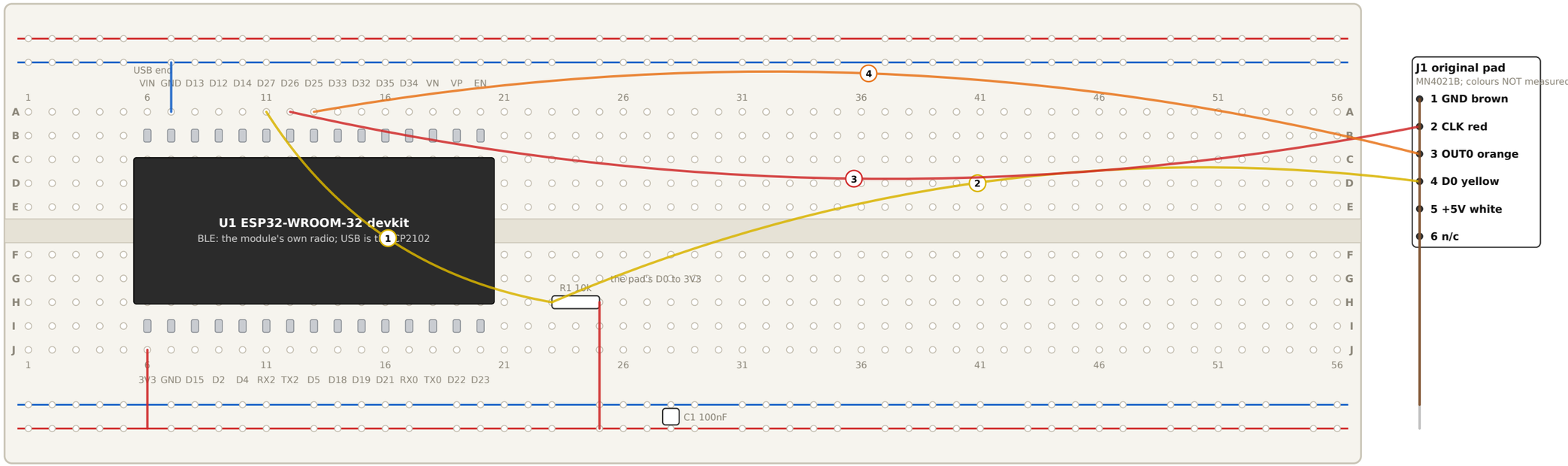
SHEET TITLE: **Wiring, classic ESP32: every wire at right angles**

| DRAWING NO. | REV | DATE | SHEET |
|---|---|---|---|
| TM-NESB-003 | M | 2026-11-04 | 12 of 17 |

| DRAWN BY | SOURCE | SCALE |
|---|---|---|
| bisenbek | git 9c81360 | NTS |

# pad-ble v1 on a classic ESP32: where everything goes

The devkit's labels are read off the owner's photograph of 2026-09-30, and the column numbers are that photograph's breadboard rows: USB at row 1, the pins in 6 to 20, the pad's three in 11 to 13 on the EN row. Only rows A and J are reachable under it. An ORIGINAL pad's colours; a repl




## 4 numbered jumpers, and 5 short wires to the rails

Every one of these is read out of the schematic. Red stubs go to the nearest + rail, blue stubs to the nearest - rail, except a stub from the pad, which is drawn in its own lead's colour; they are not numbered because they are all the same instruction.

1. PAD1_D0, the yellow lead: U1 pin marked D27 (col 11 row A) to R1 col 23 row H
2. PAD1_D0, the yellow lead: R1 col 23 row H to J1 D0
3. PAD_CLK, the red lead: U1 pin marked D26 (col 12 row A) to J1 CLK
4. PAD_LATCH, the orange lead: U1 pin marked D25 (col 13 row A) to J1 OUT0

breadboard-pad-ble-esp32.svg ansi-b placed at 77% drawn by tools/breadboard.py

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SHEET TITLE: **Breadboard, classic ESP32: on the board, rows 6 to 20**

| DRAWING NO. | REV | DATE | SHEET |
|---|---|---|---|
| TM-NESB-003 | M | 2026-11-04 | 13 of 17 |

| DRAWN BY | SOURCE | SCALE |
|---|---|---|
| bisenbek | git 9c81360 | NTS |

## The five wires, and which lead is which on each kind of pad

USB at breadboard row 1, so the pins are rows 6 to 20 and a row number names a hole. The three signals are ADJACENT on the EN side (D14 D27 D26 D25 D33, up from the USB end), GND four rows below on the same side, 3V3 the first pin across. NOT the C6 map: GPIO6 is this module's flash, GPIO3 its console. THE LEAD COLOURS DEPEND ON THE PAD: replica rung out 2026-09-09; original NOT YET MEASURED, beep each to the 4021 first. RED is supply on the replica but clock on an original and YELLOW is ground on the replica but data on an original.

| SIGNAL | BOARD PIN | REPLICA LEAD | ORIGINAL LEAD | ORIGINAL: BEEP TO 4021 |
|---|---|---|---|---|
| supply | 3V3, row 6 | Red | White | pin 16 (VDD) |
| ground | GND, row 7 | Yellow | Brown | pin 8 (VSS) |
| latch | D25, row 13 | Black | Orange | pin 9 (P/S) |
| clock | D26, row 12 | Blue | Red | pin 10 (CLOCK) |
| data | D27, row 11 | Green | Yellow | pin 3 (Q8) |

generated from tools/cheatsheet.py: the schematic, the lab log and tools/bringup.py's lead and ribbon tables

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SHEET TITLE
**WROOM-32 header: where each wire goes**

| DRAWING NO. | REV | DATE | SHEET |
|---|---|---|---|
| TM-NESB-003 | M | 2026-11-04 | 14 of 17 |

| DRAWN BY | SOURCE | SCALE |
|---|---|---|
| bisenbek | git 9c81360 | NTS |

## Spoken for, or not there at all

Two are the console this board is flashed and read over, two are strapping pins sampled at reset. Below the line, what never reaches the header: the first row is why the C6 map cannot be used on this part.

| GPIO | BOARD PIN | ALREADY WIRED TO |
|---|---|---|
| GPIO1 | TX0, row 18 | U0TXD, the console |
| GPIO3 | RX0, row 17 | U0RXD, the console |
| GPIO12 | D12, row 9 | MTDI strap, 1.8 V flash |
| GPIO15 | D15, row 8 | MTDO strap, ROM log |
| GPIO6-11 | not on the header | the module's SPI flash |
| GPIO0 | not on the header | the BOOT button |
| 9 more | not on the header | 20,24,28-31,37,38 absent |

## On the header and free

pad-ble takes D25, D26, D27; D4 and D2 are the mode switch and the LED, declared and not wired. Not listed: D34, D35, VP, VN (GPIO34, 35, 36, 39), input only with no pullup, so not free for an output.

| GPIO | BOARD PIN | NOTE |
|---|---|---|
| GPIO2 | D2, row 9 | LED, not wired; strap |
| GPIO4 | D4, row 10 | MODE_SW, not wired |
| GPIO5 | D5, row 13 | strapping pin |
| GPIO13 | D13, row 8 | |
| GPIO14 | D14, row 10 | |
| GPIO16 | RX2, row 11 | |
| GPIO17 | TX2, row 12 | |
| GPIO18 | D18, row 14 | |
| GPIO19 | D19, row 15 | |
| GPIO21 | D21, row 16 | |
| GPIO22 | D22, row 19 | |
| GPIO23 | D23, row 20 | |
| GPIO25 | D25, row 13 | PAD_LATCH |
| GPIO26 | D26, row 12 | PAD_CLK |
| GPIO27 | D27, row 11 | PAD1_D0 |
| GPIO32 | D32, row 15 | |
| GPIO33 | D33, row 14 | |

generated from tools/cheatsheet.py: the schematic, the lab log and tools/bringup.py's lead and ribbon tables

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SHEET TITLE
# WROOM-32 header: where each wire goes

| DRAWING NO. | REV | DATE | SHEET |
|---|---|---|---|
| TM-NESB-003 | M | 2026-11-04 | 15 of 17 |

| DRAWN BY | SOURCE | SCALE |
|---|---|---|
| bisenbek | git 9c81360 | NTS |

## Every wire on the board, net by net

Connect everything on a row together. Read back out of the schematic, so it cannot disagree with it.

| NET | ENDS | JOIN THESE |
|---|---|---|
| 3V3 | 4 | J1-5, R1-2, U1 3V3, C1-1 |
| GND | 3 | J1-1, U1 GND, C1-2 |
| VBUS | 1 | U1 USB-C |
| PAD1_D0 | 3 | J1-4, R1-1, U1 GPIO6 |
| PAD_CLK | 2 | J1-2, U1 GPIO3 |
| PAD_LATCH | 2 | J1-3, U1 GPIO2 |
| radio | 1 | U1 BLE |

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SHEET TITLE
**Wiring list, pad-ble v1**

| DRAWING NO. | REV | DATE | SHEET |
|---|---|---|---|
| TM-NESB-003 | M | 2026-11-04 | 16 of 17 |

| DRAWN BY | SOURCE | SCALE |
|---|---|---|
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## Everything that has to be in a drawer

Parts from every sheet, deduplicated. The status column is the only authored thing in this package's tables.

| PART | STATUS | NOTE |
|---|---|---|
| 74HCT04 | on hand | SN74HCT04N, the tube that arrived 2026-09-09 |
| 74HC165 | on hand | the TI bag. v2b needs a second one |
| 100nF | on hand | v2b runs seven |
| 1k | on hand | R2, the clock pin's series element, placed 2026-09-15 |
| 100pF | on hand | C4, the clock pin's filter, placed 2026-09-15 |
| Arduino UNO R3 (ATmega328P) | on hand | the pile |
| 74HC595 | on hand | the box of 30 |
| 100R | on hand | the trigger |
| PC817 module | on hand | module, for the reset pads |
| relay module, 5 V coil | on hand | 5 V coil with an opto input |
| LM1881N | TO ORDER | the one real order. An old National part, mostly resellers now: buy two |
| 680k | check | LM1881 RSET. One resistor |
| 74HCT165 | on hand | the C6 sheets' register. HCT there because the C6 drives it at 3.3 V |
| 74LVC245 | on hand | C6 sheets only; no UNO sheet uses one any more |
| ESP32-C6-DevKitC-1 v1.2 | on hand | DevKitC-1 v1.2, the alternative build |
| 10k | on hand | pad adapter only; fitted on the P4 build 2026-09-27. The first part fitted there was 10 ohms: read the b |
| TP4056 + protection | to order | pad adapter only |
| MCP1700-3302 LDO | to order | pad adapter only |
| slide | to order | pad adapter only, the power switch |
| power | to order | pad adapter only, the battery |
| +330R | check | pad adapter only, the LED |
| ESP32-WROOM-32 devkit | on hand | the 30-pin devkit on the breadboard, the BLE build since 2026-09-30 |

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SHEET TITLE
**Parts list**

| DRAWING NO. | REV | DATE | SHEET |
|---|---|---|---|
| TM-NESB-003 | M | 2026-11-04 | 17 of 17 |

| DRAWN BY | SOURCE | SCALE |
|---|---|---|
| bisenbek | git 9c81360 | NTS |