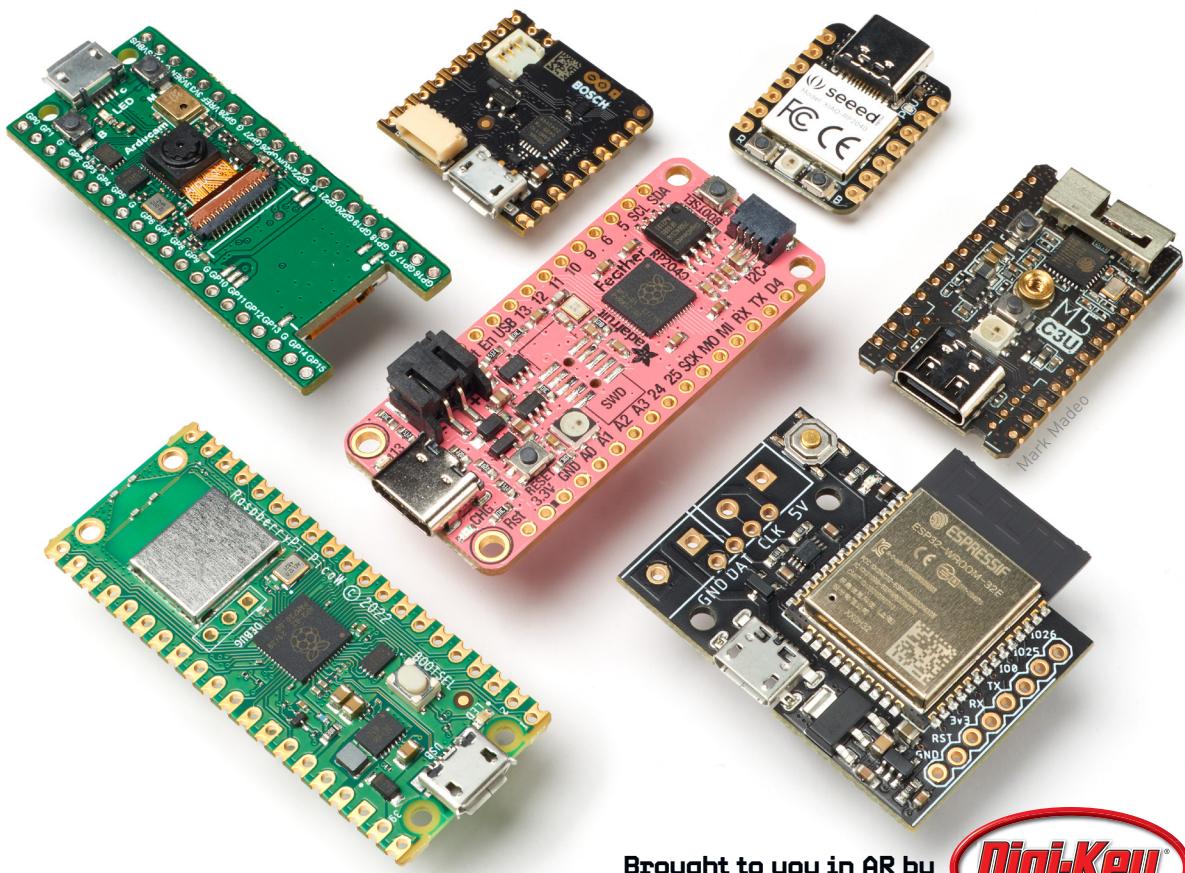


Make:

THE ORIGINAL

GUIDE TO BOARDS

2022



Brought to you in AR by



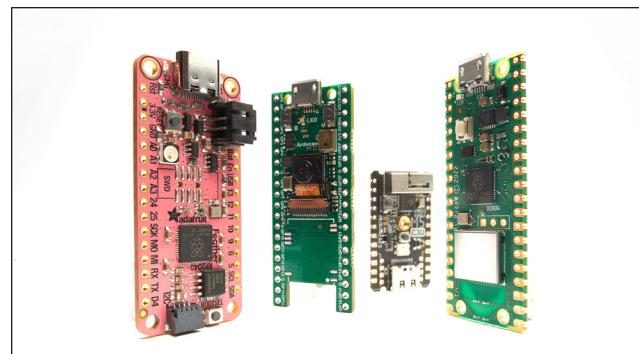
History Repeating

How many more times must we open with “It’s been another crazy year for the industry” before Harold Ramis’ estate comes after us for ripping off his 1993 hit *Groundhog Day*? Well, this will not be the year to buck that trend, as supply chain issues continue to force companies to get creative with sourcing in-demand chips, or designing boards for the components they can actually get, or both. This shift to supply-based design, and the widespread adoption of the RP2040 and ESP32 for maker projects, are just a few of the seismic changes that shaped this year’s *Make: Guide to Boards*. Read on for our comparison of 79 reliable stalwarts, hot newcomers, and smart picks that are actually in stock!

BOARD IN THE HOUSE

We had a blast this year going hands-on with boards, poring over specs, and talking to the community in order to come up with our list of 12 standout New & Notable boards for 2022. Find out more about how we made our picks — and what makes each board a top candidate for your next project!

Point your Digi-Key AR app at the image to the right to play the video



Scan the QR code to get the Digi-Key AR App and see the guide come to life in dynamic AUGMENTED REALITY!

...AND THEN THERE WERE TWO RP2040 AND ESP32 RISE ABOVE THE SHORTAGES

That the last few years have been difficult for the electronics industry is no secret. Shortages in a range of components, from processors to simple power-management ICs, have necessitated some rapid rethinking when it comes to designing development boards.

Last year we celebrated the launch of Raspberry Pi’s RP2040, the company’s first in-house silicon and first microcontroller. Little did we know how popular it would become: With Raspberry Pi working hard to ensure a steady supply in both reel and single-chip quantities and offering aggressive pricing, the RP2040 has become the go-to chip for those who’ve found stock of their usual microcontrollers wanting.

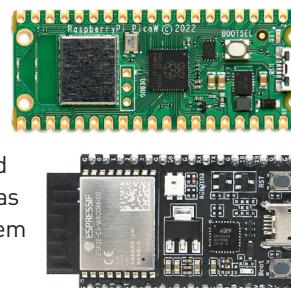
“We’d expected to pick up RP2040 customers in 2022, but that they’d still be at the prototyping and early production stage,” Raspberry Pi CEO Eben Upton tells us. “There’s certainly a lot of this going on — JLCPCB report that they’ve seen over 1,100 distinct RP2040-based designs in their first year of availability — but we’re also seeing full-scale OEM orders, probably driven by people rapidly

substituting RP2040 into existing designs where the incumbent microcontroller is unavailable. We’ve shipped about five million units so far, and are shipping about 500,000 units a month at present.”

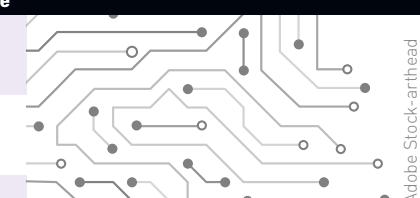
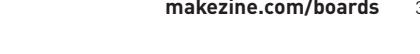
Raspberry Pi isn’t the only company riding the supply chain storm: Espressif Systems, long a staple of the maker market with its low-cost, radio-equipped ESP8266 and ESP32 families of systems-on-chips, has worked effectively to keep its parts in stock too — even launching variants specifically designed to boost yields and reduce per-chip costs, while simultaneously making the move to a whole new architecture (see “A RISC-V Revolution” on page 42 of the magazine).

We’re not at the point of a Raspberry Pi–Espressif duopoly, but the shift in focus for many has been sudden and swift — and for those who’ve lost customers as a result of shortages, winning them back could prove a challenge.

—Gareth Halfacree



MICROCONTROLLERS (MCU)

Board Name	Price	Dimensions	Software	Clock Speed	Processor	Memory	Digital Pins	Analog Pins	Radio	Video	Input Voltage	Battery Connection	Operating Voltage	Image
Adafruit Circuit Playground Bluefruit	\$25	2.0" dia.	Arduino IDE, CircuitPython	64MHz	32-bit Nordic nRF52840 (single-core Cortex-M4F)	1MB flash, 256KB RAM, 2MB QSPI Flash	8	8 PWM, 6 ADC	Bluetooth Low Energy	—	3.7V-5V	✓	3.3V	
Adafruit CLUE	\$45	2.0"×1.6"	Arduino IDE, CircuitPython	64MHz	32-bit Nordic nRF52840 (single-core Cortex-M4F)	1MB flash, 256KB RAM, 2MB QSPI flash	18	18 PWM, 8 ADC	Bluetooth Low Energy	1.3" 240×240 color IPS TFT LCD display	3V-6V	✓	3.3V	
Adafruit Feather RP2040 ★NEW & NOTABLE★	\$12	2.0"×0.9"×0.3"	CircuitPython, MicroPython, Arduino IDE, C/C++	125MHz	32-bit RP2040 (dual-core Cortex-M0+)	264KB SRAM, 8MB SPI flash	21	16 PWM, 4 ADC	—	—	3.3V-5V	✓	3.3V	
Adafruit Flora	\$15	1.75" dia.	Arduino IDE	8MHz	8-bit ATmega32u4	32kB flash, 2.5kB SRAM	8	4 PWM, 4 ADC	—	—	3.5V-16V	✓	3.3V	
Adafruit FunHouse	\$35	3.35"×2.2"×0.43"	CircuitPython, Arduino IDE	240MHz	32-bit ESP32-S2 (single-core Xtensa LX7)	4MB flash, 2MB PSRAM	5	5 PWM, 3 ADC	Wi-Fi	1.54" 240×240 color TFT display	5V	—	3.3V	
Adafruit KB2040	\$9	1.4"×0.7"×0.2"	CircuitPython, MicroPython, Arduino IDE, C/C++	133MHz	32-bit RP2040 (dual-core Cortex-M0+)	264KB RAM, 8MB SPI flash	20	16 PWM, 4 ADC	—	—	3.3V-5V	—	3.3V	
Adafruit Metro Mini 328 U2	\$15	1.7"×0.7"	Arduino IDE	16MHz	8-bit ATmega328 (single-core AVR)	2kB RAM, 32kB flash	20	6 PWM, 6 ADC	—	—	5V-16V	—	5V	

MICROCONTROLLERS (MCU)

Board Name	Price	Dimensions	Software	Clock Speed	Processor	Memory	Digital Pins	Analog Pins	Radio	Video	Input Voltage	Battery Connection	Operating Voltage
Adafruit Neo Trinkey	\$7	1.2"×0.5"×0.1"	CircuitPython, Arduino IDE	48MHz	32-bit ATSAMD21E18 (single-core Cortex-M0+)	256kB flash, 32kB RAM	0	0	—	—	5V	—	3.3V
Adafruit QT Py ESP32-C3	\$10	0.9"×0.7"	Arduino IDE, MicroPython, ESP-IDF	160MHz	32-bit ESP32-C3 (single-core RISC-V)	4MB flash, 400kB SRAM, 8kB SRAM (RTC)	13	6 PWM, 5 ADC	Wi-Fi, Bluetooth Low Energy	—	5V	—	3.3V
Adafruit QT Py RP2040	\$10	0.9"×0.7"×0.2"	CircuitPython, MicroPython, C/C++	125MHz	32-bit RP2040 (dual-core Cortex-M0+)	264kB RAM, 8MB SPI flash	13	13 PWM, 4 ADC	—	—	3.3V-5V	—	3.3V
Adafruit Trinkey QT2040	\$8	1.5"×0.7"×0.2"	CircuitPython, MicroPython, Arduino IDE, C/C++ SDK	125MHz	32-bit RP2040 (dual-core Cortex-M0+)	264kB RAM, 8MB SPI flash	0	0	—	—	5V	—	3.3V
Arducam Pico4ML ★NEW & NOTABLE★	\$26	0.9"×2.0"	MicroPython	133MHz	32-bit RP2040 (dual-core Cortex-M0+)	2MB flash, 264kB RAM	26	16 PWM, 3 ADC	—	0.96" 160×80 color LCD	5V-5.5V	—	3.3V
Arducam Pico4ML-BLE	\$31	0.9"×2.0"	MicroPython	133MHz	32-bit RP2040 (dual-core Cortex-M0+)	2MB flash, 264kB RAM	26	16 PWM, 3 ADC	Bluetooth Low Energy	0.96" 160×80 color LCD	5V-5.5V	—	3.3V
Arduino MKR GSM 1400	\$84	2.6"×1.0"	Arduino IDE	48MHz	32-bit ATSAMD21 Cortex-M0+	256 kB flash, 32kB SRAM	22	13 PWM, 7 ADC, 1 DA	GSM 1400	—	3.7V-5V	✓	3.3V
Arduino MKR WiFi 1010	\$39	2.4"×1.0"	Arduino IDE	48MHz	32-bit ATSAMD21 (single-core Cortex-M0+)	256kB flash, 32kB RAM	22	3 PWM, 7 ADC, 1 DAC	Wi-Fi, Bluetooth	—	3.7V-5V	✓	3.3V
Arduino Nano 33 BLE Sense	\$41	1.8"×0.7"	Arduino IDE	64MHz	32-bit Nordic nRF52840 (single-core Cortex-M4F)	MB flash, 256kB RAM	22	5 PWM, 8 ADC	Bluetooth Low Energy	—	5V-21V	—	3.3V
Arduino Nano Every	\$12	1.8"×0.7"	Arduino IDE	20MHz	8-bit ATmega4809	48kB flash, 6kB RAM, 256B EEPROM	22	5 PWM, 8 ADC	—	—	7V-21V	—	5V
Arduino Nano RP2040 Connect	\$29	0.7"×1.8"	Arduino IDE, C/C++	133MHz	32-bit RP2040 (dual-core Cortex-M0+)	16MB flash, 264 kB RAM	22	20 PWM, 8 ADC	Wi-Fi, Bluetooth	—	5V-21V	—	3.3V
Arduino Nicla Sense ME ★NEW & NOTABLE★	\$83	0.9"×0.9"	Arduino IDE	64MHz	32-bit nRF52832 (single-core Cortex-M4)	512kB flash, 2MB SPI flash, 64kB RAM	10	12 PWM, 2 ADC	Bluetooth Low Energy	—	5V	✓	1.8V-3.3V
Arduino Portenta H7	\$114	2.6"×1.0"	Arduino IDE, MicroPython, JavaScript, TensorFlow Lite, Mbed OS	480MHz Cortex-M7, 240MHz Cortex-M4	32-bit STMicro STM32H747XI (dual-core Cortex-M7, M4 coprocessor)	2MB/16MB Int/Ext flash, 1MB/8MB Int/Ext RAM	22	10 PWM, 8 ADC, 2 DAC	Wi-Fi, Bluetooth	MIPI DSI host & MIPI D-PHY	3.7V-5V	✓	3.3V
Arduino Uno/Uno WiFi Rev2	\$28 / \$54	2.7"×2.1"	Arduino IDE	16MHz	8-bit ATmega328PU/ATmega4809	32kB flash, 2kB RAM, 1kB EEPROM/48kB flash, 6kB RAM, 256B EEPROM	14	6 PWM, 6 ADC/ 5 PWM, 6 ADC	Uno WiFi: Wi-Fi, Bluetooth Low Energy	—	6V-20V/ 7V-12V	—	5V
BBC micro:bit V2	\$18	2"×1.6"	Javascript, MicroPython, CircuitPython, C++	64MHz	32-bit Nordic nRF52833 (single-core Cortex-M4F)	512kB flash, 128kB RAM	19	3 PWM, 6 ADC	Bluetooth	—	3V-5V	✓	3V-3.3V
DFRobot Beetle ESP32-C3	\$8	0.98"×0.81"	Arduino IDE, ESP-IDF, MicroPython, C, Python	160MHz	32-bit ESP32-C3 (single-core RISC-V)	4MB flash, 400kB SRAM, 8kB SRAM (RTC)	13	6 PWM, 6 ADC	Wi-Fi, Bluetooth	—	5V	✓	3.3V
Espressif ESP32-S2 Saola-1	\$9	2.22"×1.1"	Arduino IDE, CircuitPython, ESP IDF	240MHz	32-bit ESP32-S2 (single-core Xtensa LX7)	128kB flash, 320kB SRAM, 16kB SRAM (RTC)	43	8 PWM, 20 ADC, 2 DAC	Wi-Fi	serial LCD, parallel LCD	3.7V-5V	—	3.3V
Espruino Pico	\$31	1.3"×0.6"	Espruino JavaScript Interpreter	84MHz	32-bit STMicro STM32F401CDU6 (single-core Cortex-M4)	384kB flash, 96kB RAM	22	21 PWM, 9 ADC	—	—	3.5V-16V	✓	3.3V
M5Stamp C3U Mate ★NEW & NOTABLE★	\$6	1.34"×0.79"	Arduino IDE, ESP-IDF, MicroPython, C, Python	160MHz	32-bit ESP32-C3 (single-core RISC-V)	4MB flash, 400kB SRAM, 8kB SRAM (RTC)	14	6 PWM, 6 ADC	Wi-Fi	—	5V	—	3.3V

New & Notable



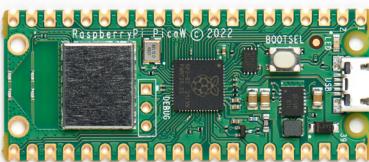
M5STACK M5STAMP C3U MATE ESP32-C3 and tiny!

The Lilliputian M5Stamp C3U features Espressif's latest 32-bit ESP32-C3 RISC-V MCU, running at 160kHz with 400kB of RAM and 4MB of flash, and includes Wi-Fi 5 and secure boot, all in a 34×20×4.6mm package!



DFROBOT LATTEPANDA 3 DELTA Beast mode!

Give a docile panda a latte or two and you might activate beast mode, which is what DFRobot have done with the latest iteration of their Windows/Linux-capable SBC, featuring an Intel N5105, 8GB LPDDR4 RAM, 64GB eMMC, an ATmega32U4 coprocessor and a whopping 42 expandable interfaces!



RASPBERRY PI PICO W Popular Pico goes Wi-Fi!

Last year Raspberry Pi rocked the industry with their \$4 (and plentiful) Pico. Two million units and a small \$2 price increase later, the Pico W adds 802.11n wireless networking, complete with a free commercial-use license for the lwIP stack.

MICROCONTROLLERS (MCU)

Board Name	Price	Dimensions	Software	Clock Speed	Processor	Memory	Digital Pins	Analog Pins	Radio	Video	Input Voltage	Battery Connection	Operating Voltage
M5Stamp Pico Mate	\$5	0.71"x0.94"x0.17"	Arduino IDE, MicroPython, UIFlow	240MHz	2-bit ESP32-PICO-D4 (dual-core Xtensa LX6)	4MB flash, 520kB SRAM, 8kB SRAM (RTC)	12	2 PWM, 3 ADC, 2 DAC	Wi-Fi	—	5V	—	5V
M5StickC PLUS	\$20	1.89"x0.95"x0.71"	Arduino IDE, MicroPython, UIFlow	240MHz	2-bit ESP32-PICO-D4 (dual-core Xtensa LX6)	4MB flash, 520kB SRAM, 8kB SRAM (RTC)	3 (2 more via Grove)	1 ADC	Wi-Fi	0.96" 80x160 RGB LCD	5V	✓	3.3V
Meadow F7v2	\$50	1.9"x0.9"	Meadow.OS	216MHz Cortex-M7, 240MHz ESP32	32-bit STM32F7 (single-core Cortex-M7), ESP32 coprocessor	64MB flash, 32MB RAM	24	12 PWM, 6 ADC, 2 DAC	Wi-Fi, Bluetooth Low Energy	SPI	3.3V-12V	✓	(3.3V tolerant digital IO)
Nordic Thingy:91	\$126	2.4"x2.4"	Nordic Thingy, Zephyr OS	64MHz	32-bit Nordic nRF9160 (single-core Cortex-M33)	1MB flash, 256kB RAM	10	4 PWM, 3 ADC	LTE-M, NB-IoT, Bluetooth Low Energy, NFC	—	5V	✓	3.3V
OpenMU Cam H7 R2	\$85	1.77"x1.41"	MicroPython	480MHz	32-bit STMicro STM32H743VI (single-core Cortex-M7)	2MB flash, 1MB RAM, µSD Card Slot	10	0 PWM, 1 ADC, 1 DAC	680x480 RGB camera	5V	✓	3.3V	
Pimoroni PGA2040	\$7	0.8"x0.8"	Arduino IDE, MicroPython, CircuitPython, C/C++	133MHz	32-bit RP2040 (dual-core Cortex-M0+)	8MB QSPI flash, 264kB RAM	30	16 PWM, 4 ADC	—	—	3V-5.5V	—	3.3V
Pimoroni Tiny 2040	\$7 (2MB), \$12 (8MB)	0.90"x0.72"	Arduino IDE, MicroPython, CircuitPython, C/C++	133MHz	32-bit RP2040 (dual-core Cortex-M0+)	8MB QSPI flash, 264kB RAM	12	12 PWM, 4 ADC	—	—	3V-5.5V	—	3.3V
Pixelblaze U3 Standard ★NEW & NOTABLE★	\$35	1.35"x1.56"	Arduino IDE, ESP-IDF, Pixelblaze Pattern Language	240MHz	32-bit ESP32 (dual-core Xtensa LX6)	4MB SPI flash, 520kB RAM (8kB in RTC)	12	5 ADC	Wi-Fi	—	5V	—	3.3V
PJRC Teensy 4.0	\$23	1.4"x0.7"	Arduino IDE with Teensyduino extension, CircuitPython	600MHz	32-bit NXP iMX RT1062 (single-core Cortex-M7)	2MB flash, 1MB RAM, 1kB EEPROM (Emulated)	40	31 PWM, 14 ADC	—	—	3.6V-5.5V	—	3.3V
PJRC Teensy 4.1	\$32	2.4"x0.7"	Arduino IDE with Teensyduino extension, CircuitPython	600MHz	32-bit NXP iMX RT1062 (single-core Cortex-M7)	8MB flash, 1MB RAM, 4kB EEPROM (Emulated)	55	35 PWM, 18 ADC	—	—	3.6V-5.5V	—	3.3V
Pycom FiPy	\$59	2.1"x0.7"	MicroPython	160MHz	32-bit ESP32 (dual-core Xtensa LX6)	8MB flash, 4MB RAM	22	18 PWM, 8 ADC, 2 DAC	Wi-Fi, Bluetooth Low Energy, CAT-M1/NB-IOT, LoRa, Sigfox	—	3.3V-5V	—	3.3V
Raspberry Pi Pico	\$4	2"x0.82"	Arduino IDE, MicroPython, CircuitPython, FreeRTOS, RT-Thread, Rust, C/C++	133MHz	32-bit RP2040 (dual-core Cortex-M0+)	2MB flash, 264kB RAM	26	16 PWM, 3 ADC	—	—	1.8V-5.5V	—	3.3V
Raspberry Pi Pico W	\$6	2"x0.82"	Arduino IDE, MicroPython, CircuitPython, FreeRTOS, RT-Thread, Rust, C/C++	133MHz	32-bit RP2040 (dual-core Cortex-M0+)	2MB flash, 264kB RAM	26	16 PWM, 3 ADC	Wi-Fi, Bluetooth (Awaiting Firmware Support)	—	1.8V-5.5V	—	3.3V
Seeed Wio RP2040 Module	\$7	0.71"x1.11"	Arduino IDE, MicroPython, CircuitPython, FreeRTOS, RT-Thread, Rust, C/C++	133MHz	32-bit RP2040 (dual-core Cortex-M0+)	2MB flash, 264kB RAM	20	16 PWM, 4 ADC	Wi-Fi	—	3.6V-5V	—	3.3V
Seeed Wio Terminal	\$37	2.83"x2.24"x0.47"	Arduino IDE, MicroPython, CircuitPython, ArduPy	120MHz	32-bit ATSAMD51 (single-core Cortex-M4F)	4MB SPI flash, 192kB RAM	26	5 PWM, 9 ADC	Wi-Fi, Bluetooth Low Energy	2.4" 320x240 color LCD	5V	—	3.3V
Seeed Xiao nRF52840	\$10	0.8"x0.7"	Arduino IDE, MicroPython	64MHz	32-bit nRF52840 (single-core Cortex-M4F)	MB flash, 2MB QSPI flash, 256kB RAM	11	11 PWM, 6 ADC	Bluetooth Low Energy, NFC, Zigbee	—	5V	—	3.3V
Seeed Xiao RP2040 ★NEW & NOTABLE★	\$5	0.8"x0.7"	Arduino IDE, MicroPython, CircuitPython	133MHz	32-bit RP2040 (dual-core Cortex-M0+)	2MB flash, 264kB RAM	11	11 PWM, 4 ADC	—	—	5V	—	3.3V
Sipeed Maixduino	\$28	2.7"x2.1"	MaixPy IDE, Arduino IDE, MicroPython, OpenMV IDE, PlatformIO IDE, FreeRTOS	400MHz	64-bit Sipeed M1 (dual-core RISC-V), KPU co-processor	16MB flash, 8MB SRAM	48	6 ADC	Wi-Fi, Bluetooth Low Energy	8-bit LCD interface	5V-12V	—	3.3V
Solder Party RP2040 Stamp	\$12 (\$18.50 with carrier)	1"x1"	Arduino IDE, MicroPython, CircuitPython, FreeRTOS, RT-Thread, Rust, C/C++	133MHz	32-bit RP2040 (dual-core Cortex-M0+)	8MB flash, 264kB RAM	30	16 PWM, 4 ADC	—	—	1.8V-5.5V	✓	3.3V

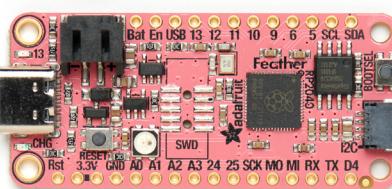
New & Notable



ARDUINO NICLA SENSE ME

Tiny, accessible machine learning lab!

Arduino's Nicla series are diminutive boards (22.86mm square) with castellated edges for easy integration into other projects, and the Sense ME is packed with high-quality motion and environment sensors from Bosch, plus an edge AI-ready nRF52832.



ADAFRUIT FEATHER RP2040 USB-C! Feather! RP2040! Pink!!

With four times the flash of the Pico, Adafruit's Feather spin on the RP2040 joins dozens of boards and "wings" with the familiar form factor, including such conveniences as LiPo charging, a STEMMA QT/Qwiic connector, RGB NeoPixel, and USB-C for power, programming, and debugging.



ARUDUCAM PICO4ML Machine vision workshop for \$26!

Arducam's RP2040-based Pico4ML offers a complete tinyML lab for \$26, thanks to a built-in HiMax HM01B0 QVGA camera, microphone, 0.96" TFT display, and 9-axis IMU, all while consuming just 60mA during inferencing!

MICROCONTROLLERS (MCU)

Board Name	Price	Dimensions	Software	Clock Speed	Processor	Memory	Digital Pins	Analog Pins	Radio	Video	Input Voltage	Battery Connection	Operating Voltage
Sony Spresense	\$55	1.96"×0.81"	NuttX emulating Arduino IDE, CircuitPython	156MHz	32-bit Sony CXD5602 (six-core Cortex-M4F)	8MB flash, 1.5MB SRAM	17; extension:14	2 ADC; extension: 6 PWM, 6 ADC	—	—	5V	—	1.8V
SparkFun MicroMod RP2040	\$13	0.86"×0.86"	Arduino IDE, MicroPython, CircuitPython, C/C++	133MHz	32-bit RP2040 (dual-core Cortex-M0+)	16MB flash, 264kB SRAM	30	16 PWM, 3 ADC	—	—	3.3V	—	3.3V
SparkFun MicroMod Teensy	\$22	0.86"×0.86"	Arduino IDE, C/C++	600MHz/1GHz Turbo	32-bit NXP iMX RT1062 (single-core Cortex-M7)	16MB flash, 1MB RAM	12; 35 via shared MicroMod pins	6 PWM, 2 ADC (14 with signal sharing)	—	—	3.3V	—	3.3V
SparkFun Pro Micro RP2040	\$11	1.3"×0.7"	Arduino IDE, MicroPython, C/C++	133MHz	32-bit RP2040 (dual-core Cortex-M0+)	16MB flash, 264kB RAM	20-18 on the board edge and 2 through the Qwiic connector	10 PWM, 3 ADC	—	—	5V	—	3.3V
SparkFun Thing Plus RP2040	\$20	0.9"×2.3"	Arduino IDE, MicroPython, CircuitPython, C/C++	133MHz	32-bit RP2040 (dual-core Cortex-M0+)	16MB QSPI flash, 264kB RAM	18	16 PWM, 3 ADC	—	—	3V-5.5V	✓	3.3V
TinyLily Mini	\$10	0.55" dia.	Arduino IDE	8MHz	8-bit ATmega328P	32kB flash, 2kB SRAM, 1kB EEPROM	8	1 PWM, 4 ADC	—	—	2.7V-5.5V	—	3V
Unexpected Maker FeatherS2 Neo ★NEW & NOTABLE★	\$20	0.9"×2.0"	Arduino IDE, MicroPython, CircuitPython, ESP-IDF	240MHz	32-bit ESP32-S2 (single-core Xtensa LX7)	4MB SPI flash, 320kB SRAM, 2MB PSRAM	22	22 PWM, 13 ADC, 2 DAC	Wi-Fi	—	3.7V-5V	✓	3.3V
Wemos LOLIN C3 Mini	\$4	1.35"×1"	Arduino IDE, MicroPython, ESP-IDF	160MHz	2-bit ESP32-C3 (single-core RISC-V)	4MB flash, 400kB SRAM, 8kB SRAM (RTC)	12	6 PWM, 6 ADC	Wi-Fi, Bluetooth Low Energy	—	5V	—	3.3V
WIZnet WizFi360-EVB-PICO	\$7	0.84"×2.95"	Arduino IDE, MicroPython, CircuitPython, FreeRTOS, RT-Thread, Rust, C/C++	133MHz	32-bit RP2040 (dual-core Cortex-M0+)	2MB flash, 264kB RAM	26	16 PWM, 3 ADC	Wi-Fi	—	1.8V-5.5V	—	3.3V

New & Notable



ROCK PI 4 MODEL C+

Pi-compatible contender!

What may appear at first blush as just another Raspberry Pi is in fact Rock Pi's 64-bit Rockchip RK3399-powered SBC in a Pi-compatible form factor. The dual-core Cortex-A72 and quad-A53 provide a blend of power and efficiency for running Debian, Ubuntu, or Android, and onboard M.2 SSD and eMMC module support trump the Pi's mSD storage.



UNEXPECTED MAKER FEATHERS2 NEO

5x5 RGB matrix onboard!

An RGB LED on an ESP32-S2-based Feather isn't cool. You know what's cool? 26 RGB LEDs on an ESP32-S2-based Feather!



PIXELBLAZE V3 STANDARD

Epicenter of RGB LED hype!

Command complicated RGB LED contraptions without coding! The Pixelblaze provides plentiful patterns, or write your own in JavaScript with the built-in web-based editor to drive up to 5,000 pixels!

SINGLE-BOARD COMPUTERS (SBC)

Board Name	Price	Dimensions	Software	Clock Speed	Processor	Memory	Digital Pins	Analog Pins	Radio	Video	Ethernet On Board	Input Voltage	Operating Voltage
Arduino Portenta X8	\$239 (\$574 with Max Carrier)	1"×2.6"	Yocto Linux	1.8GHz (Cortex-A53), 480MHz (Cortex-M7), 400MHz (Cortex-M4), 240MHz (Cortex-M4)	NXP i.MX8M Mini (quad-core Cortex-A53, Cortex-M4 coprocessor), STM32H747Xi (Cortex-M7, Cortex-M4)	2GB LPDDR4 RAM, 16GB eMMC	22	4 PWM, 8 ADC	Wi-Fi, Bluetooth	—	—	5V	3.3V
Asus Tinker Edge T	\$240	3.37"×2.125"	Debian 9, Android 10	1.5GHz	NXP i.MX 8M (quad-core Cortex-A53, Cortex-M4), Google Edge TPU coprocessor	1GB LPDDR4, 8GB eMMC	28	3 PWM	Wi-Fi, Bluetooth	HDMI, MIPI DSI	✓	12V-19V	5V
BeagleBone AI-64	\$214	3.86"×3.09"	Debian 11, Debian 10, Cloud 9 IDE	2GHz	64-bit TI Jacinto TDA4VM (dual-core Cortex-A72), PowerVR Rogue 8XE GPU, 6 ARM Cortex-R5, 12 PRU, 2 C66x coprocessors	4GB LPDDR4 RAM, 16GB eMMC	72	7 PWM, 7 ADC	—	Mini-DisplayPort, MIPI DSI	✓	5V	3.3V
DFRobot LattePanda 3 Delta ★NEW & NOTABLE★	\$279	4.91"×3.07"	Windows 10, Windows 11, Linux	2GHz (2.9GHz boost)	64-bit Intel Celeron N5105 (quad-core x86-64), ATmega32U4 coprocessor	8GB LPDDR4 RAM, 64GB eMMC	23	7 PWM, 12 ADC	Wi-Fi, Bluetooth	HDMI, DisplayPort, Embedded DisplayPort	✓	12V	3.3V
Hackboard 2	\$199 (4GB), \$249 (8GB)	4.72"×3.15"	Microsoft Windows 10 Pro, Debian 9 (subtract \$24)	2.8GHz	64-bit Intel Celeron N4020 (dual-core x86-64)	4GB/8GB LPDDR4, 64GB eMMC	28	2 PWM	Wi-Fi, Bluetooth	HDMI, Embedded DisplayPort (eDP)	—	12V	GPIO 5V; 3.3V
Khadas UIM4 ★NEW & NOTABLE★	\$220	3.32"×2.28"	Ubuntu 22.04, Android 11	2.2GHz (Cortex-A73), 2GHz (Cortex-A53)	64-bit Amlogic A311D2 (quad-core Cortex-A73, quad-core Cortex-A53), STM32G031K6 coprocessor	8GB LPDDR4X, 32GB eMMC, 32MB SPI flash	5	1 PWM, 2 ADC	Wi-Fi, Bluetooth	HDMI, MIPI DSI, Embedded DisplayPort	✓	9V-20V	3.3V
Myir MYS-8MMX	\$119 (commercial grade), \$139 (industrial grade)	3.74"×2.72"	Ubuntu 18.04, Yocto 3.0	1.8GHz/1.6GHz	64-bit NXP i.MX 8M Mini (quad-core Cortex-A53), Vivante GC320, Cortex-M4F coprocessors	2GB DDR4 RAM, 8GB eMMC, 32MB QSPI flash	30	3 PWM	Wi-Fi, Bluetooth	HDMI, LVDS LCD	✓	5V	5V
Nvidia Jetson AGX Orin Developer Kit	\$1,999	4.3"×4.3"	Ubuntu-based JetPack SDK	2.2GHz	64-bit Nvidia CPU (I2-core Cortex-A78AE), 2,048 CUDA Core 64 Tensor Core Ampere GPU, 2x NVDLA v2, Programmable Vision Accelerator V2 coprocessors	32GB LPDDR5, 64GB eMMC	28	2 PWM	Wi-Fi, Bluetooth	DisplayPort	✓	19V (USB PD)	3.3V

SINGLE-BOARD COMPUTERS (SBC)

Board Name	Price	Dimensions	Software	Clock Speed	Processor	Memory	Digital Pins	Analog Pins	Radio	Video	Ethernet On Board	Input Voltage	Operating Voltage
Nvidia Jetson Nano Dev Kit	\$54 (2GB), \$99 (4GB)	3.95"x3.15"x 1.14"	Ubuntu-based JetPack SDK	1.43GHz CPU, 921MHz GPU	64-bit Nvidia GPU (quad-core Cortex-A57), 128-CUDA-core Maxwell GPU coprocessor	2GB/4GB LPDDR4 RAM	28	2 PWM	—	HDMI, DP (4GB only)	✓	5V	5V
PINE64 Quartz64 Model B	\$60 (4GB), \$80 (8GB)	3.35"x2.2"	Debian, Ubuntu, Manjaro, Arch, NetBSD	1.8GHz	64-bit Rockchip RK3566 (quad-core Cortex-A55), Mali-G52 2EE Bifrost GPU, Neural Processing Unit (NPU) and 32-bit RISC-V coprocessors	4GB/8GB LPDDR4, 64MB flash	28	—	Wi-Fi, Bluetooth	HDMI, MIPI DSI	✓	5V	3.3V
Raspberry Pi 4, Model B	\$35 (1GB), \$45 (2GB), \$55 (4GB), \$75 (8GB)	3.4"x2.2"	Raspberry Pi OS, Raspbian, Ubuntu 21.04/22.04, RISC OS, Windows 10 IoT, more	1.5GHz CPU, 500MHz GPU	64-bit Broadcom BCM2711 (quad-core Cortex-A72), VideoCore VI GPU	1GB/2GB/4GB/8GB LPDDR4 RAM	26	4 PWM	Wi-Fi, Bluetooth	2 Micro-HDMI, composite, MIPI DSI	✓	5V	3.3V
Raspberry Pi Zero 2 W	\$15	2.56"x1.18"	Raspberry Pi OS, Raspbian, Ubuntu 21.04/22.04, RISC OS, Windows 10 IoT, more	1GHz CPU, 400MHz GPU	64-bit Broadcom BCM2837 (quad-core Cortex-A53), VideoCore IV GPU	512MB LPDDR2 RAM	26	4 PWM	Wi-Fi, Bluetooth	Mini-HDMI	—	5V	3.3V
Rock Pi 4 Model C+ ★NEW & NOTABLE★	\$69	3.35"x2.13"	Debian 10, Ubuntu 20.04, Android 7/9/10/11, OpenSuSE, more	2GHz Cortex-A72, 1.6GHz Cortex-A53	64-bit Rockchip RK3399 (dual-core Cortex-A72, quad-core Cortex-A53) CPU, Mali T860MP4 GPU	4GB LPDDR4	27	1 PWM, 1 ADC	Wi-Fi, Bluetooth	2 Micro-HDMI, MIPI DSI	✓	5V	3.3V
Seeed reComputer J1010 ★NEW & NOTABLE★	\$199	5.12"x4.72"	Ubuntu-based JetPack SDK	1.43GHz	64-bit Carmel ARM CPU (quad-core Cortex-A57), 128-CUDA-core Maxwell GPU	4GB LPDDR4 RAM, 16GB eMMC	28	2 PWM	—	HDMI	✓	5V	3.3V
StarFive VisionFive	\$149 (\$179 as Starter Kit bundle)	3.94"x2.83"	Debian, Fedora, Ubuntu	1GHz	64-bit StarFive JH7100 (dual-core RV64GC), Tensilica VP6 DSP, NVDLA, Neural Network coprocessors	8GB LPDDR4	28	2 PWM	Wi-Fi, Bluetooth	HDMI	✓	5V	3.3V
StarFive VisionFive 2	\$55 (2GB), \$65 (4GB), \$85 (8GB)	3.94"x2.83"	Debian, Fedora, Ubuntu	1.5GHz	64-bit StarFive JH7110 (quad-core RV64GC), Imagination BXE-4-32 GPU, Tensilica VP6 DSP, NVDLA, Neural Network coprocessors	2GB/4GB/8GB LPDDR4	28	2 PWM	Wi-Fi, Bluetooth	—	✓	5V	3.3V
Udoobolt U3	\$437	4.72"x4.72"	Windows 8.1/10, any Linux distribution	2GHz–3.2GHz	AMD Ryzen Embedded V1202b (dual-core quad-thread x86-64) CPU, Radeon Vega 3 GPU, ATmega32u4 coprocessor	None included, up to 32GB DDR4 RAM supported, 32GB eMMC	10, 23 via ATmega32u4, 2 via Grove	7 PWM, 12 ADC, 1 ADC via Grove	—	2 HDMI, 2 USB-C DP	✓	19V	3.3V

FIELD-PROGRAMMABLE GATE ARRAY BOARDS (FPGA)

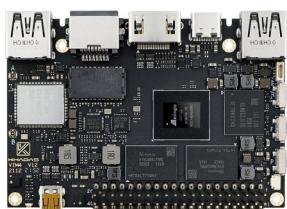
Board Name	Price	Dimensions	Software	Clock Speed	Processor	Memory	Digital Pins	Analog Pins	Radio	Video	Ethernet On Board	Input Voltage	Operating Voltage
Alorium Snō	\$49	1.7"x0.7"	Arduino IDE	16/32MHz	Intel MAX 10 10M16SAU169C8G with single-core Almega328 compatible microcontroller	32kB flash, 2kB SRAM, FPGA 68kB RAM, 16,000 logic cells	32	6	—	—	—	4V-16V	3.3V
Diligent Arty Z7-10	\$199	3.46"x4.3"	Vivado, Xilinx SDK, Vitis	650MHz Cortex-A9, 125MHz external clock	Xilinx Zynq-7000 XC7Z010-1CLG400C with dual-core Cortex-A9 CPU	16MB QSPI flash, 512MB DDR3 RAM, FPGA 270kB block RAM, 28,000 logic cells	65	6 XADC, 4 Differential XADC	—	HDMI	✓	7V-15V	3.3V
Fomu	\$50	0.38"x0.5"	Yosys/NextPnR	12MHz VexRISC-V, 48MHz external oscillator	Lattice iCE40UP5K with VexRISC-V core	2MB flash, 128kB SRAM, FPGA 5,280 logic cells	4	—	—	—	—	5V	3.3V
MuseLab iCESugar-nano	\$19	1.54"x0.71"	Yosys/NextPnR	12MHz MCO (up to 72MHz)	Lattice iCE40LP1K-CM36	2MB flash, 8kB SRAM, FPGA 64kB RAM, 1,280 logic cells	14	—	—	—	—	5V	3.3V
QWERTY ICE-U Wireless	\$75	1.21"x3.17"	Integrated Loader Firmware, ESP-IDF (ESP32 only)	160MHz ESP32	Lattice ICE40UP5K, Espressif ESP32-C3 coprocessor	400kB SRAM, 4MB flash, FPGA 8MB PSRAM, 5,280 logic cells	32	2 ADC	Wi-Fi, Bluetooth Low Energy	—	—	5V	3.3V
Seeed Spartan Edge Accelerator	\$40	2.09"x2.7"	Vivado, Arduino IDE (ESP32 only)	100MHz	Xilinx Spartan-7 XC7S15-1FTG196C FPGA, Espressif ESP32 coprocessor	4MB flash, FPGA 360kB block RAM, 12,800 logic cells	20, 10 in Shield Mode	20 PWM, 1 ADC; 10 PWM, 1 ADC in Shield Mode	Wi-Fi, Bluetooth Low Energy	Mini-HDMI	—	5V-17V	5V
Sipeed Lichee Tang Nano 4K	\$17	2.36"x0.9"	Gowin Yunyan IDE	100MHz	Gowin GWINSR-LV4C with single-core Cortex-A3 CPU	256kB flash, FPGA 180kB block RAM, 4,608 logic cells	38	—	—	HDMI	—	5V	3.3V
WebFPGA	\$38	2.2"x0.9"	WebFPGA, IceStorm	10kHz and 48MHz internal oscillator, 16MHz external oscillator, 48MHz (STM32F04)	Lattice iCE40UP5k, STMMicro STM32F04 coprocessor	32kB flash, 6kB RAM, 16MB external flash, FPGA 128kB SRAM, 15kB block RAM, 5,280 logic cells	32	—	—	—	—	5V	3.3V

New & Notable



SEEED XIAO RP2040

Fantastic form factor for little lucre! Seeed's XIAO series — now totaling five boards — is quickly become a favorite form factor around here; this RP2040-based, ML-capable featherweight packs more features than Pi's own Pico, yet measures just 21x17.5mm, and can be yours for just over \$5 shipped!



KHADAS UIM4

Release the Khadas!

This powerhouse features an Amlogic 2.2GHz quad-core Cortex-A73 and 2.0GHz quad-core Cortex-A53 CPU, plus Mali-G52 MP8(EE) GPU and a 32-bit STM32G031K6 microprocessor. With 8GB RAM, 32GB eMMC, 40-pin GPIO and HDMI in, this absolute unit is ready for anything!



SEEED RECOMPUTER JETSON

Meet Seeed's Jetson!

When it comes to machine learning, CUDA cores are king, but with the Jetson Nano dev kit unobtainable, where do budding data scientists turn? Seeed to the rescue with this Jetson Nano 4GB module-based that serves 128 CUDA cores to deliver 0.5 TFLOPS for all your edge AI applications!

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