

NodeMCU Development Kit/Board

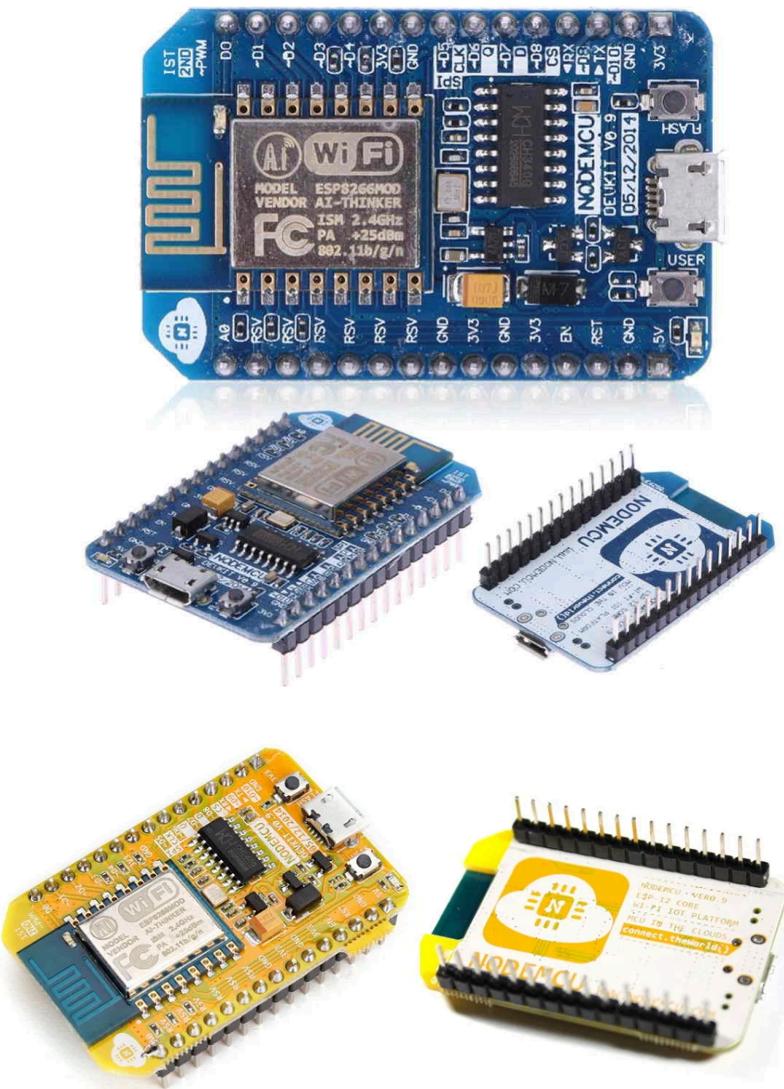
Introduction

NodeMCU Development Kit/Board consists of an ESP8266 wifi chip. ESP8266 chip has GPIO pins, serial communication protocol, etc. features on it.

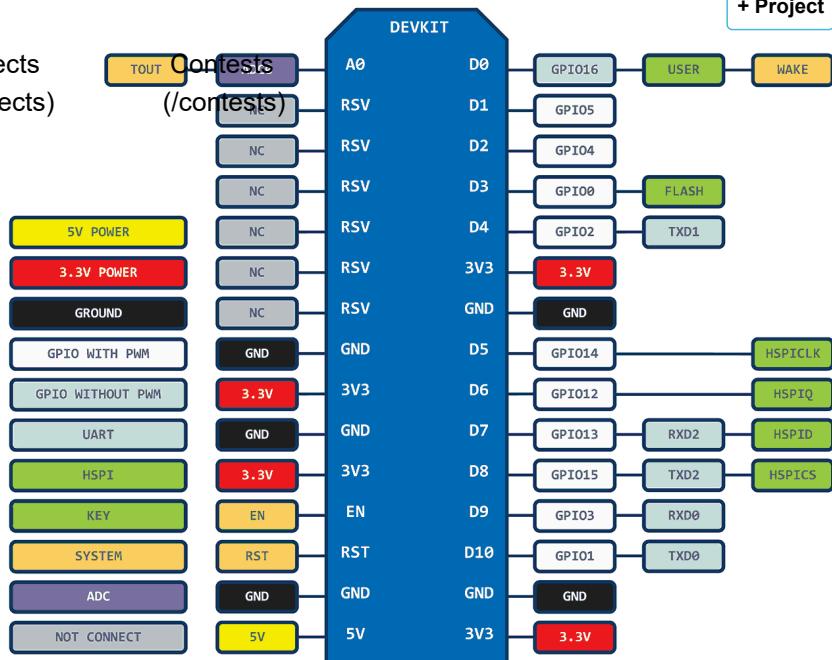
ESP8266 is a low-cost Wi-Fi (<https://en.wikipedia.org/wiki/Wi-Fi>) chip developed by Espressif Systems with TCP/IP protocol. For more information about ESP8266, you can refer to **ESP8266 WiFi Module** (<https://www.electronicwings.com/sensors-modules/esp8266-wifi-module>).

The features of ESP8266 are extracted on the NodeMCU Development board. NodeMCU (LUA (<https://www.lua.org/start.html>) based firmware) with Development board/kit that consists of ESP8266 (wifi enabled chip) chip combines NodeMCU Development board which make it a stand-alone device in IoT applications.

Let's see 1st version of NodeMCU Dev Kit and its pinout as shown in the below images.



NodeMCU Development Board v0.9 (Version1)

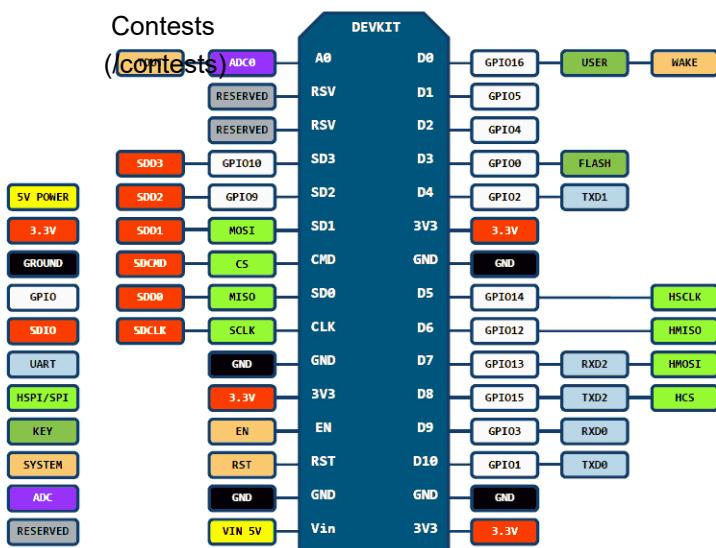


NodeMCU Dev Kit v0.9(V1) Pinouts

2nd version of NodeMCU Dev Kit and its Pinout as shown in the below images.



Amica NodeMCU Dev Kit v1.0 (Version 2)



NodeMCU Dev Kit v1.0(V2) Pinouts

NodeMCU Dev Kit v1.0 pin descriptions

GPIO (General Purpose Input Output) Pins:

NodeMCU has general-purpose input-output pins on its board as shown in the above pinout diagram. We can make it digital high/low and control things like LED or switch on it. Also, we can generate a PWM signal on these GPIO pins.

For more information about NodeMCU GPIO refer to this link
(<https://www.electronicwings.com/nodemcu/nodemcu-gpio-with-esplorer-ide>)

For more information about NodeMCU PWM refer to this link
(<https://www.electronicwings.com/nodemcu/nodemcu-pwm-with-esplorer-ide>)

ADC (Analog to Digital Converter) channel (A0):

NodeMCU has one ADC channel/pin on its board.

For more information about NodeMCU ADC refer to this link
(<https://www.electronicwings.com/nodemcu/nodemcu-adc-with-esplorer-ide>)

SPI (Serial Peripheral Interface) Pins:

NodeMCU based ESP8266 has Hardware SPI (HSPI) with four pins available for SPI communication. It also has SPI pins for Quad-SPI communication. With this SPI interface, we can connect any SPI enabled device with NodeMCU and make communication possible with it.

For more information about NodeMCU SPI refer to this link
(<https://www.electronicwings.com/nodemcu/nodemcu-spi-with-arduino-ide>)

I2C (Inter-Integrated Circuit) Pins:

NodeMCU has I2C functionality support on ESP8266 GPIO pins. Due to internal functionality on ESP-12E, we cannot use all its GPIOs for I2C functionality. So, do tests before using any GPIO for I2C applications.

For more information about NodeMCU I2C refer to this link
(<https://www.electronicwings.com/nodemcu/nodemcu-i2c-with-esplorer-ide>)

UART (Universal Asynchronous Receiver Transmitter) Pins:

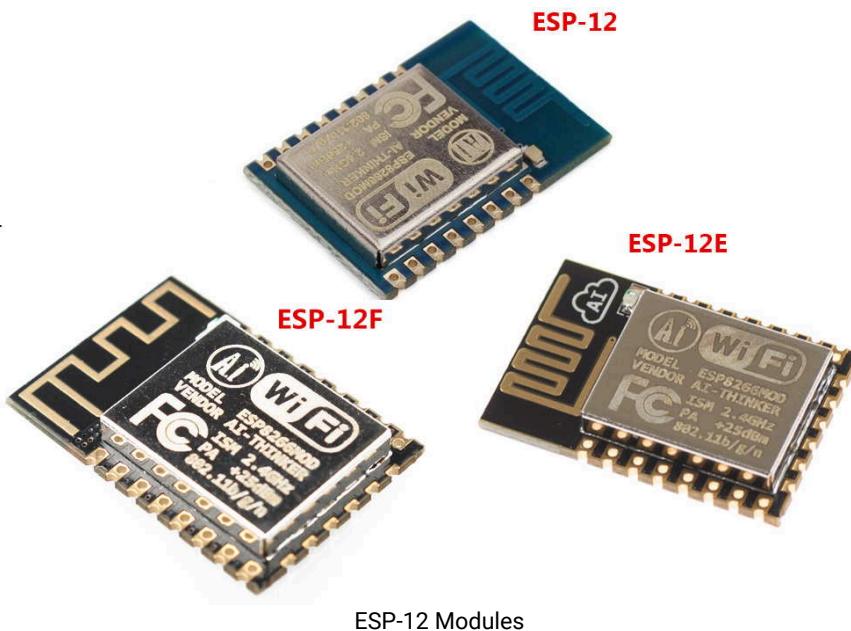
NodeMCU based ESP8266 has two UART interfaces, UART0 and UART1. Since UART0 (RXD0 & TXD0) is used to upload firmware/codes to the board, we can't use them in applications while uploading firmware/codes.

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The difference in between 1st and 2nd version NodeMCU Board

We can make difference in the 1st and 2nd versions of the NodeMCU Development board by their board's design and ESP modules on it.

- In 1st version of NodeMCU Dev Kit v0.9, CH341SER USB to Serial converter is used whereas, in 2nd version of NodeMCU Dev Kit v1.0, CP2102 USB to Serial converter is used.
- 1st version uses ESP-12 and 2nd version uses ESP-12E (Enhanced version).
- Extra 6 pins (MTDO, MTDI, SD_3, MTMS, MTCK, SD_2) brought out on the ESP-12E version of ESP-12 modules as shown in the below figure. Though Quad SPI pins are brought out, they are internally used for flash memory access.
- Also, there is a slight antenna design difference in ESP-12 versions like ESP12-E & ESP-12F as shown in the below figure.



ESP8266 Modules Family

We can also take a look at various ESP modules and their FCC approves till now at esp8266 modules family (<http://www.esp8266.com/wiki/doku.php?id=esp8266-module-family>) and summary as shown in the below image on the same page.

Summary Table

Board ID	#pins	Pitch	Form factor	LEDs	Antenna	Ant.Socket	Shielded	Dimensions mm	Flash Size in MB	Project
ESP-01	8	0.1"	2x4 DIL	Yes	Etched-on PCB	No	No	14.3 x 24.8	512KB (4Mb) xx	
ESP-02	8	0.1"	2x4 pinhole	No?	None	Yes	No	14.2 x 14.2	512KB (4Mb) x	
ESP-03	14	2mm	2x7 notch	No	Ceramic	No	No	17.3 x 12.1	512KB (4Mb) x	
ESP-03	14	2mm	2x7 notch	No?	None	No	No	14.7 x 12.1	512KB (4Mb) x	
ESP-05	5	0.1"	1x5 SIL	No	None	Yes	No	14.2 x 14.2	512KB (4Mb) x	
ESP-06	12+GND	misc	4x3 dice	No	None	No	Yes	16.3 x 13.1	512KB (4Mb) x	
ESP-07	16	2mm	2x8 pinhole	Yes	Ceramic	Yes	Yes	21.2 x 16.0	1MB (8Mb) xx	
ESP-07S	16	2mm	2x8 pinhole	No	None	Yes	Yes	17.0 x 16.0	4MB (32Mb)	
ESP-08	14	2mm	2x7 notch	No	None	No	Yes	17.0 x 16.0	?? (please fill if you know)	
ESP-08 New	16	2mm	2x8 notch	No	None	No	Yes	18.0 x 16.0	?? (please fill if you know)	
ESP-09	12+GND	misc	4x3 dice	No	None	No	No	10.0 x 10.0	1MB (8Mb)	
ESP-10	5	2mm	?? 1x5 notch	No	None	No	No	14.2 x 10.0	512KB (4Mb) *	
ESP-11	8	1.27mm	1x8 pinhole	No?	Ceramic	No	No	17.3 x 12.1	512KB (4Mb) *	
ESP-12	16	2mm	2x8 notch	Yes	Etched-on PCB	No	Yes	24.0 x 16.0	4MB (32Mb) ??	
ESP-12F	22	2mm	2x8 notch	Yes	Etched-on PCB	No	Yes	24.0 x 16.0	4MB (32Mb)	
ESP-12E	22	2mm	2x8 notch	Yes	Etched-on PCB	No	Yes	24.0 x 16.0	4MB (32Mb)	
ESP-12S	16	2mm	2x8 notch	Yes	Etched-on PCB	No	Yes	24.0 x 16.0	4MB (32Mb)	
ESP-13	18	1.5mm	2x9	?	Etched-on PCB	No	Yes	20.0 x 19.9	4MB (32Mb)	
ESP-14	22	2mm	2x8 + 6	1	Etched-on PCB	No	Yes	24.3 x 16.2	?? (please fill if you know)	
ESP-201	22+4	0.1"	2x11 + 4	2	Etched-on PCB ***	Yes	No	33.5 x 25.5	512KB (4Mb)	
WROOM-02	18	1.5mm	2x9	No	Etched on PCB	No	Yes	20.0 x 18.0	?? (please fill if you know)	
WT8266-S1	18	1.5mm	3x6	1	Etched on PCB	No	Yes	15.0 x 18.6	4MB (32Mb)	

* New firmwares can only be flashed on boards with at least 1MB (8Mb) flash. xx May be different on different editions of the board. *** Antenna connector is connected by default, to use PCB antenna switch (solder) the 0Ω resistor to the corresponding position.

NodeMCU Dev Kit in Markets

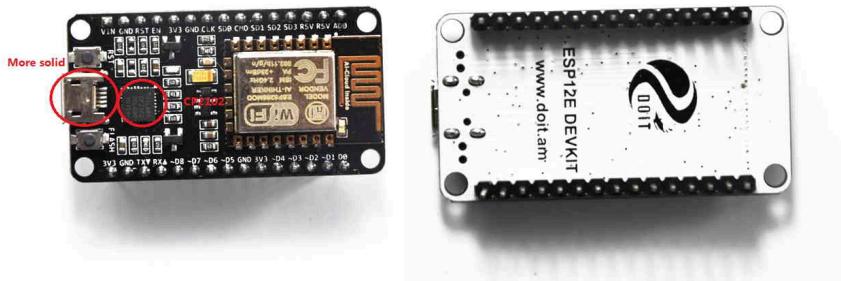
NodeMCU hardware is open source, anyone can edit/modify/produce it and market their modified NodeMCU Development boards. Generally, we can see NodeMCU Dev boards of

Amica (https://twitter.com/Amica_IO)

DOIT (<http://en.doit.am/>)

Lolin & D1 mini /Wemos (<https://www.wemos.cc/>) etc. in the market.

Amica produces NodeMCU ESP8266 Development Boards v1.0(Version2) with designed hardware specifications. Most of the V2 boards are produced by Amica.

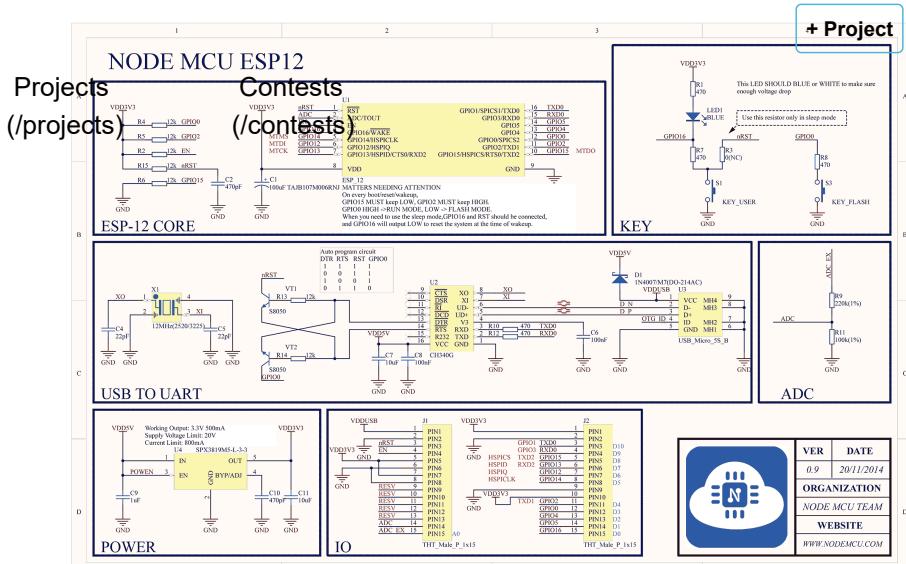


DOIT NodeMCU Dev Kit v1.0(Version2)

NodeMCU Hardware Specifications

We can see the NodeMCU Dev Kit v0.9 hardware specifications and design from the below link that is open for all.

NodeMCU DevKit v0.9 (<https://github.com/nodemcu/nodemcu-devkit>)



NodeMCU Dev Kit v0.9 schematic

Also, NodeMCU Dev Kit v1.0 hardware specifications and design is given in the below link

NodeMCU DevKit v1.0 (<https://github.com/nodemcu/nodemcu-devkit-v1.0>)

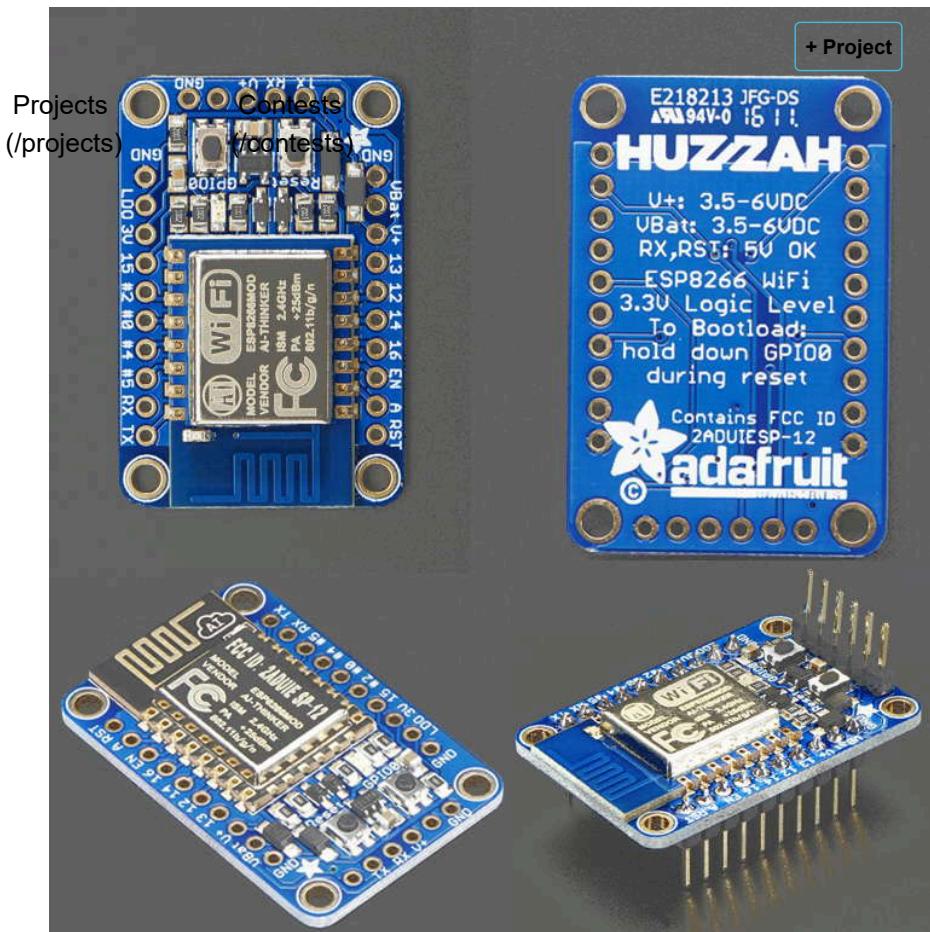
Note: - the ADC block in both versions uses a resistor divider network (220K and 100K) to scale the ESP8266 ADC input voltage range of 0-1V to 0-3.3V. Since the input analog voltage range for the ADC pin of ESP8266 is 0-1.0V (while reading external analog voltage), NodeMCU Dev boards use this resistor divider network to scale it up to 0-3.3V.

ESP8266 Development Boards

Also, we can see ESP8266 development boards/breakouts that are different in design than above NodeMCU Development boards and we can use them with NodeMCU firmware for IoT applications.

Below are those alternative boards for NodeMCU with different sizes, pinouts, and specifications that are available in the market.

Adafruit Huzzah (<https://learn.adafruit.com/adafruit-huzzah-esp8266-breakout>)



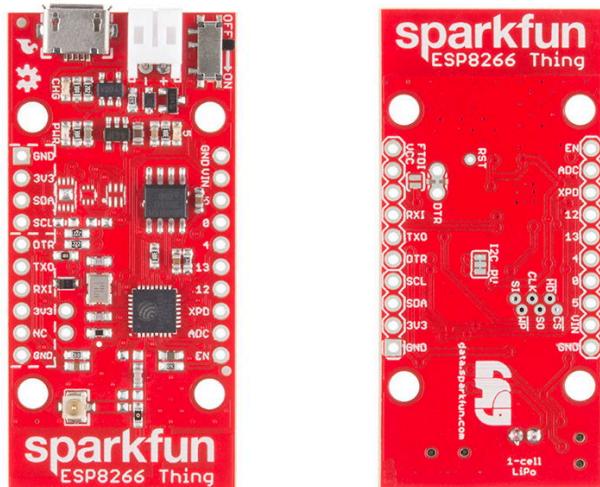
Adafruit HUZZAH ESP8266 Breakout

Adafruit feather Huzzah (<https://www.adafruit.com/product/2821>)



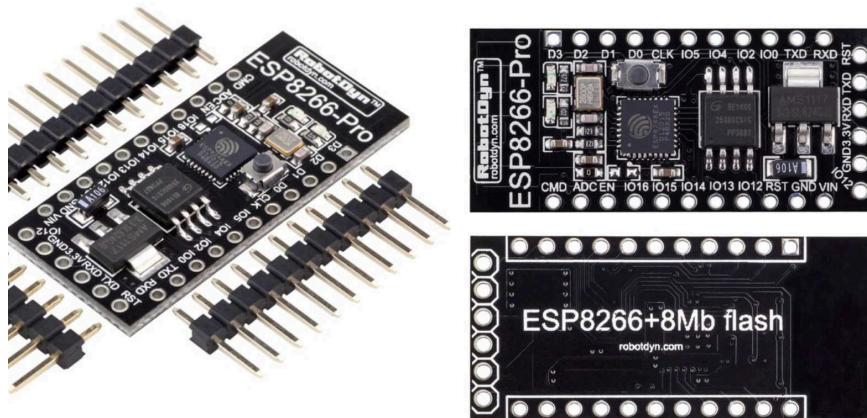
Adafruit Feather Huzzah with ESP8266 WiFi

Sparkfun thing (<https://www.sparkfun.com/products/13231>)



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(http://robotdyn.com/catalog/ESP/wifi_nodem_esp8266_cp2102/)



RobotDyn WIFI NodeM ESP8266

WeMos D1 Mini (https://wiki.wemos.cc/products:d1:d1_mini)



WeMos D1 mini

WeMos D1 mini Pro (https://wiki.wemos.cc/products:d1:d1_mini_pro)



WeMos D1 mini Pro



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WeMos D1 mini Lite (https://wiki.wemos.cc/products:d1:d1_mini_lite)

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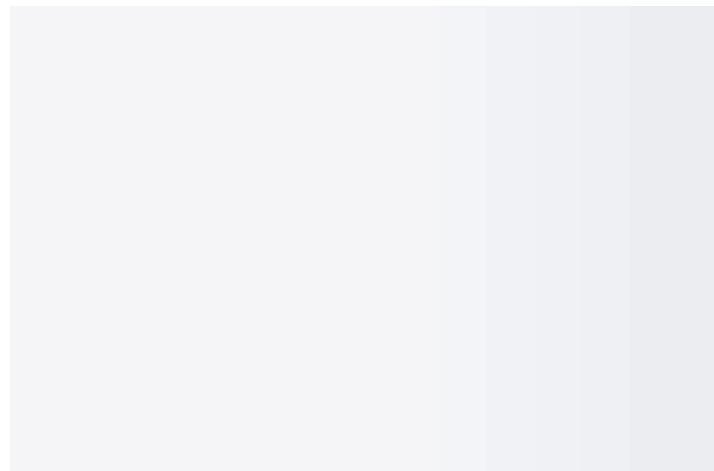
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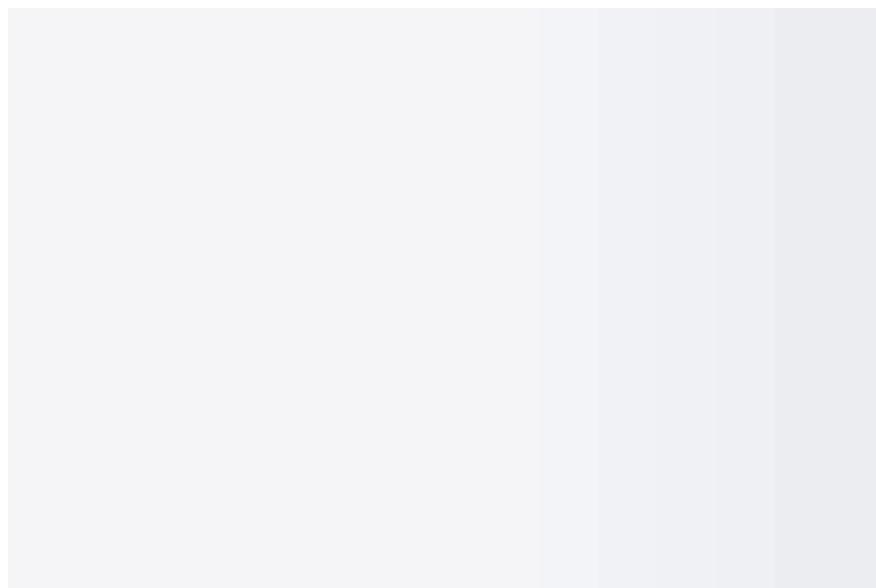
WeMos D1 mini Lite

There are also modified designs available that are application based boards. For example,

- D-duino V3 board which comes with an OLED display on board.
- AI-Thinker A20 Plus board comes with a GPRS+Camera feature on its board.



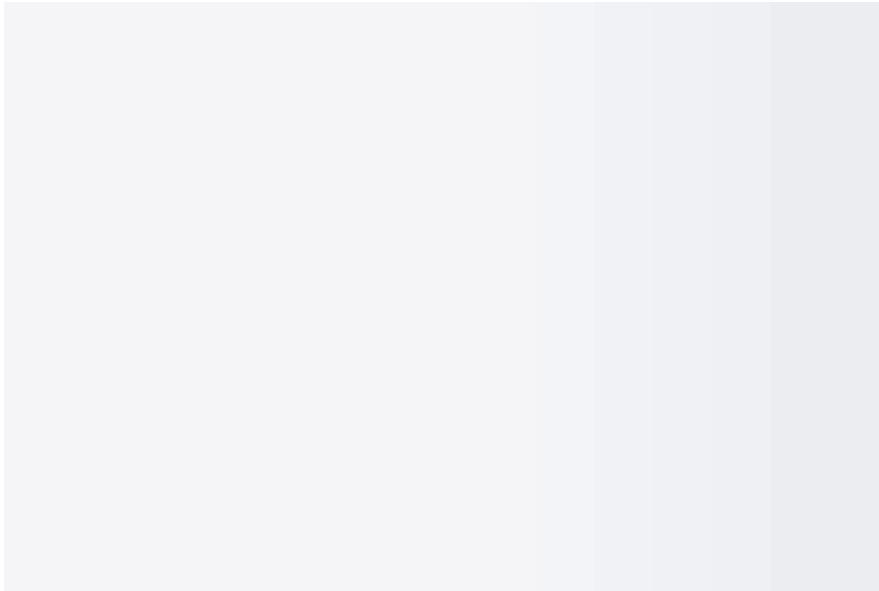
D-duino V3 ESP8266 Dev Kit



AI-Thinker A20 Plus GPRS + WiFi + Camera

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Here, we can say that there is no unique NodeMCU Development board design in the market. If we came across their official boards then we can realize that Amica boards have an official whereas others not (since they are applications wise designed).

Amica provided some points regarding improving their development boards on their twitter page as shown in the below image.





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🛒 (https://www.mouser.in/ProductDetail/Seeed-Studio/113990105?qs=sGAEpiMZZMu3sxpa5v1qriyKvi6JV%2FB8UHakxfOLUh4%3D&utm_source=electronicwings&utm_medium=referral&utm_campaign=mouser-componentlisting)

📄 Datasheet (https://www.mouser.in/ProductDetail/Seeed-Studio/113990105?qs=sGAEpiMZZMu3sxp a5v1qriyKvi6JV%2FB8UHakxfOLUh4%3D&utm_source=electronicwings&utm_medium=referral&utm_campaign=mouser-componentlisting)



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ESP12F
ESP12E

X 1

ESHOP (https://www.mouser.com/ProductDetail/Adafruit/2491?qs=N%2F3wi2MvZWDVFv7HwruvGQ%3D%3D&utm_source=electronicwings&utm_medium=referral&utm_campaign=mouser-componentlisting)

Datasheet (https://www.mouser.com/ProductDetail/Adafruit/2491?qs=N%2F3wi2MvZWDVFv7HwruvGQ%3D%3D&utm_source=electronicwings&utm_medium=referral&utm_campaign=mouse-componentlisting)

Comments

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souvikbiswas924
(/users/souvikbiswas924/profile)
2019-09-11 15:51:25

what is it? some kind of module?
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lokeshc
(/users/lokeshc/profile)
2019-09-25 07:34:18

Yes, ESP8266 Wifi based module.
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maniraroramethode
(/users/maniraroramethode/profile)
2025-02-21 17:09:33

who have simulation library for proteus of nodemcu esp8266
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