

STM32 NUCLEO-F4 Development Board – STM32F446RE ARM Cortex-M4 MCU

The STM32 NUCLEO-F4 Development Board is a versatile and high-performance prototyping platform designed by STMicroelectronics for engineers, students, and embedded system developers. Powered by the STM32F446RE microcontroller based on the ARM Cortex-M4 core, this board delivers the perfect balance between performance, flexibility, and affordability. Whether you are building industrial applications, IoT devices, motor control systems, or academic projects, the STM32 NUCLEO-F4 board offers all the essential tools to accelerate your embedded development process.

Powerful ARM Cortex-M4 MCU

At the heart of the NUCLEO-F4 board lies the STM32F446RE microcontroller, featuring a 32-bit ARM Cortex-M4 core running at up to 180 MHz. It includes a floating-point unit (FPU), DSP instructions, and advanced peripherals designed for real-time and signal processing applications. The MCU is equipped with 512 KB of Flash memory and 128 KB of SRAM, providing ample space for complex applications and fast code execution.

This performance makes the STM32F4 family ideal for demanding applications such as:

- **Motor control and power management**

- **Digital signal processing**
- **Industrial automation systems**
- **Audio processing and sensor fusion**

The board also includes hardware timers, 12-bit ADCs and DACs, SPI, I2C, UART, and CAN interfaces, offering a rich set of peripherals for hardware integration.

Flexible Power and Connectivity Options

The STM32 NUCLEO-F4 board offers multiple power supply options and connectivity interfaces for maximum design flexibility:

- **Power Supply Options:** Can be powered via USB, VBUS, or an external power source (7–12V), depending on your application.
- **Onboard ST-LINK/V2-1 Debugger:** Includes a built-in debugger/programmer that eliminates the need for an external probe. It supports USB re-enumeration, mass storage, and virtual COM port capabilities.

- **Connectivity:** The board integrates both Arduino™ Uno V3 and ST morpho headers, allowing seamless connection with shields and expansion boards.

This dual-header system makes it easy to prototype with existing Arduino-compatible accessories while also giving you full access to STM32's low-level hardware features.



Software and IDE Compatibility

One of the biggest advantages of the STM32 NUCLEO-F4 is its wide IDE support and development flexibility. The board is fully compatible with multiple professional and open-source environments, including:

- **STM32CubeIDE** – The official all-in-one development platform from STMicroelectronics.
- **Keil MDK-ARM, IAR Embedded Workbench, and Atollic TrueSTUDIO** – For professional embedded software development.

- **ARM mbed Online Compiler** – Allows easy web-based programming without installing local tools.

Additionally, the STM32CubeMX tool can be used to configure peripherals, generate initialization code, and optimize performance quickly. This rich ecosystem ensures developers can start coding immediately, with no complex setup required.

Designed for Rapid Prototyping

The NUCLEO-F4 is engineered for fast and efficient development cycles. Its modular design, onboard debugging, and open hardware layout make it ideal for prototyping and testing embedded applications.

Key onboard components include:

- **User LED and Power/Status LEDs** for real-time indication
- **User and Reset pushbuttons** for control and testing
- **Micro-USB connector** for power and communication
- **High-speed clock and low-speed crystal oscillator options**

This simplicity and accessibility make the NUCLEO-F4 board a favorite among both professional developers and university students learning embedded systems design.

Performance Meets Simplicity

The STM32 NUCLEO-F4 strikes the perfect balance between performance and ease of use. Developers can take advantage of:

- Advanced peripherals for high-speed data acquisition and control
- Low-power modes for battery-operated designs
- Scalable design that supports migration between different STM32 MCUs

Because it is based on the STM32 ecosystem, developers can easily upgrade or migrate to other STM32 Nucleo boards without changing their project architecture or code base.

Open-Source Hardware & Community Support

As part of the STM32 Nucleo ecosystem, the NUCLEO-F4 is fully open-source and supported by a large global developer community. STMicroelectronics provides extensive documentation, schematics, and example codes to help you start your project quickly. With thousands of community-contributed libraries and tutorials, you'll find plenty of resources to bring your embedded ideas to life.

Applications

The STM32 NUCLEO-F4 board is ideal for a wide range of embedded and real-time applications, including:

- Robotics and automation
- IoT and smart devices
- Wearables and health monitoring systems
- Audio processing and data acquisition
- Industrial control systems
- Research and educational projects

Its combination of high-speed processing, flexible connectivity, and broad IDE support makes it a must-have for modern embedded development.

What's Included

- **1× STM32 NUCLEO-F4 Board (STM32F446RE MCU)**
- **Preloaded demo firmware**
- **USB cable support (optional)**
- **Quick-start documentation and online resources**