# Rapid Core x

## 1. Introduction

The Rapid Core x is an innovative evaluation kit designed for rapid prototyping and testing of motor controller, battery management system (BMS), and electronic control unit (ECU) applications. This versatile PCB platform simplifies the development process, allowing engineers and developers to test and validate their designs efficiently. Its flexible architecture supports various configurations, making it ideal for diverse application needs.

## 2. How to Setup

Setting up the Rapid Core x is easy and does not involve any complex tasks. The only requirement is that a power supply must be present. The input voltage range for the board is from 6V to 36V. To indicate power, the board utilizes a PWR LED. When power is supplied, the D9 LED will illuminate, signaling that the system is operational.

## 3. Using Rapid Core x

### 3.1 Overview

Using Rapid Core x effectively involves understanding its applications and how to interact with the system. This evaluation kit is designed primarily for use in motor controller, battery management system (BMS), and electronic control unit (ECU) applications.

### 3.2 Initial Setup

To begin, ensure that your setup is complete and that the power supply is connected. Once the D9 LED indicates that the system is operational, you can proceed to configure the kit for your specific application.

### 3.3 MATLAB-Based Model Development

The Rapid Core x board works on the basis of MATLAB-based model development. You can develop your model in MATLAB, generate the corresponding code, and then flash it onto the board. This integration allows for streamlined development processes and rapid prototyping.

### 3.4 Debugging and Analysis

For debugging the MCU, STM32CubeProgrammer is utilized, providing a robust environment for programming and diagnostics. Additionally, to analyze and refine the code, you can use either STM32CubeIDE or Visual Studio Code (VS Code).

### 3.5 Application Usage

- Motor Controller Applications:  
 - Connect necessary input devices such as sensors or actuators to the appropriate I/O ports.  
 - Use the pre-configured firmware or upload custom code to control motor functions effectively.  
 - Monitor system performance through provided communication interfaces.  
  
- Battery Management System (BMS) Applications:  
 - Connect the battery pack and necessary monitoring devices to the PCB.  
 - Manage battery parameters, perform diagnostics, and optimize charging and discharging processes.  
  
- Electronic Control Unit (ECU) Applications:  
 - Communicate with other devices or systems via standard protocols.  
 - Implement required communication configurations to ensure data is transmitted correctly.  
  
- Communication Ports:  
 - Utilize various communication ports and GPIO ports for flexible connectivity.  
 - Support protocols such as CAN, LIN, RS-485 for larger communication needs, and SPI for high-speed data transfer.

### 3.6 Further Instructions

For detailed instructions on specific use cases, refer to the example projects included with the kit or consult the accompanying documentation.

## 4. Features

1. Versatile application support for motor controllers, battery management systems, and ECUs.  
2. MATLAB-based model development and code generation capabilities.  
3. Various communication ports including GPIO, CAN, LIN, RS-485, and SPI for flexible connectivity.  
4. Easy setup and operation with visual indicators for power status.  
5. Robust debugging and analysis tools available.

## 5. How Not to Use It

1. Avoid connecting power supplies that exceed the input voltage range of 6V to 36V to prevent damage.  
2. Do not bypass the safety features provided on the board.  
3. Ensure that all connections are secure before powering on the device.  
4. Do not ignore the operational status indicated by the PWR LED, as it indicates the board's readiness.