

## Description

The Portenta C33 is a powerful System-on-Module designed for low-cost Internet of Things (IoT) applications. Based on the R7FA6M5BH2CBG microcontroller from Renesas®, this board shares the same form factor as the Portenta H7 and is backward compatible with it, making it fully compatible with all Portenta family shields and carriers through its high-density connectors. As a low-cost device, the Portenta C33 is an excellent choice for developers looking to create IoT devices and applications on a budget. Whether you're building a smart home device or a connected industrial sensor, the Portenta C33 provides the processing power and connectivity options you need to get the job done.

## Target Areas

IoT, building automation, smart cities, and agriculture.

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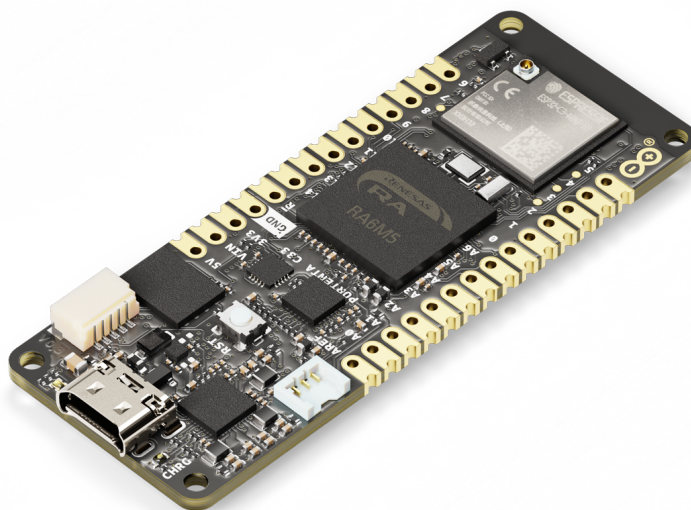
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## 1 Board Overview

The Portenta C33 is a powerful microcontroller board designed for low-cost IoT applications. Based on the high-performance R7FA6M5BH2CBG microcontroller from Renesas, it offers a range of key features and a low-power design that make it well-suited for a variety of applications. The board has been designed with the same form factor as the Portenta H7 and is backward compatible, making it fully compatible with all Portenta family shields and carriers through its MKR-styled and high-density connectors.

The main features of the Portenta C33 are the following:

- 200MHz, Arm Cortex-M33 core microcontroller with 2MB Flash memory and 256kB SRAM (R7FA6M5BH2CBG)
- External 16MB QSPI Flash memory (MX25L12833F)
- On-board 2.4GHz Wi-Fi (802.11 b/g/n) and Bluetooth® 5 module (ESP32-C3-MINI-1U)
- Ethernet physical layer (PHY) transceiver (LAN8742AI)
- On-board ready-to-use IoT secure element (SE051)
- USB-C port for power and data (accessible also through the board's high-density connectors)
- Highly flexible power supply architecture designed specifically for low-power applications
- Various options for easily powering the board: USB-C port, single-cell lithium-ion/lithium-polymer battery and external power supply connected through MKR-styled connectors
- Various analog peripherals, such as a 12-bit analog-to-digital converter (ADC) and a 12-bit digital-to-analog converter (DAC)
- Various digital peripherals, such as GPIO (x7), I<sup>2</sup>C (x1), UART (x4), SPI (x2), PWM (x10), CAN (x2), I<sup>2</sup>S (x1), SPDIF (x1), PDM(x1), and SAI (x1)
- JTAG/SWD debug port (accessible through the board's high-density connectors)
- Board dimensions: 66.04mm x 25.40mm
- Castellated pins allow the board to be positioned as a surface-mountable module



**Figure 1. The Arduino Portenta C33**

## 2 Specifications

### 2.1 Recommended Operating Conditions

Table 1 provides a comprehensive guideline for the optimal use of the Portenta C33, outlining typical operating conditions and design limits. The operating conditions of the Portenta C33 are largely a function of the operating conditions specified by its components.

Parameter	Symbol	Min	Typ	Max	Unit
USB Supply Input Voltage	$V_{\text{USB}}$	-	5.0	-	V
Battery Supply Input Voltage	$V_{\text{USB}}$	-0.3	3.7	4.8	V
Supply Input Voltage	$V_{\text{IN}}$	4.1	5.0	6.0	V
Operating Temperature	$T_{\text{OP}}$	-40	-	85	°C

**Table 1: Recommended Operating Conditions**

### 2.2 Current Consumption

The operating current of the Portenta C33 depends greatly on the application. Table 2 summarizes the board's power consumption in a defined application and conditions.

Parameter	Symbol	Condition	Typ	Unit
Board Current Consumption	$I_{\text{TOT}}$	$V_{\text{BAT}}=3.7\text{V}$ , USB cable disconnected, all peripherals in sleep mode	-	-

**Table 2: Power Consumption in a Defined Application and Conditions**

**Note:** Current consumption measurements were taken under controlled laboratory conditions, with the Portenta C33 running a specific application and connected to a specific power source. Results may vary depending on the application and operating conditions.

## 3 Hardware

The core of the Portenta C33 is the R7FA6M5BH2CBG microcontroller from Renesas. The board also contains several peripherals connected to its microcontroller.

### 3.1 Block Diagram

An overview of the Portenta C33 high-level architecture is illustrated in Figure 2.

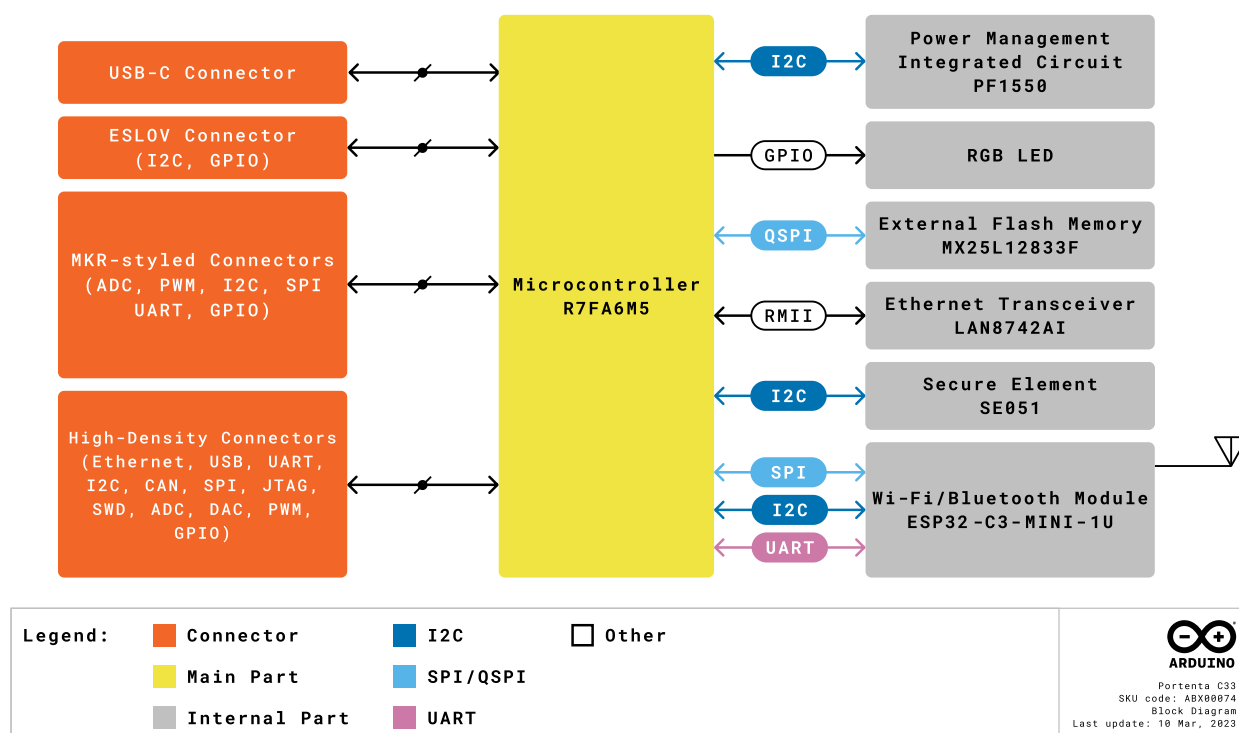


Figure 2. High-level architecture of the Portenta C33

## 3.2 Power Supply

The Portenta C33 can be powered through one of these interfaces:

- USB-C port
- Battery
- MKR pins

The figure below shows the power options available on the board and illustrates its power architecture.

## 3.3 Mechanical Specification

### 3.3.1 Board Pinout

### 3.3.2 Board Connectors

## 3.4 Board Accesories

# 4 Document Revision History

Date	Revision	Changes
00/00/2023	1	First release