CROWD SUPPLY

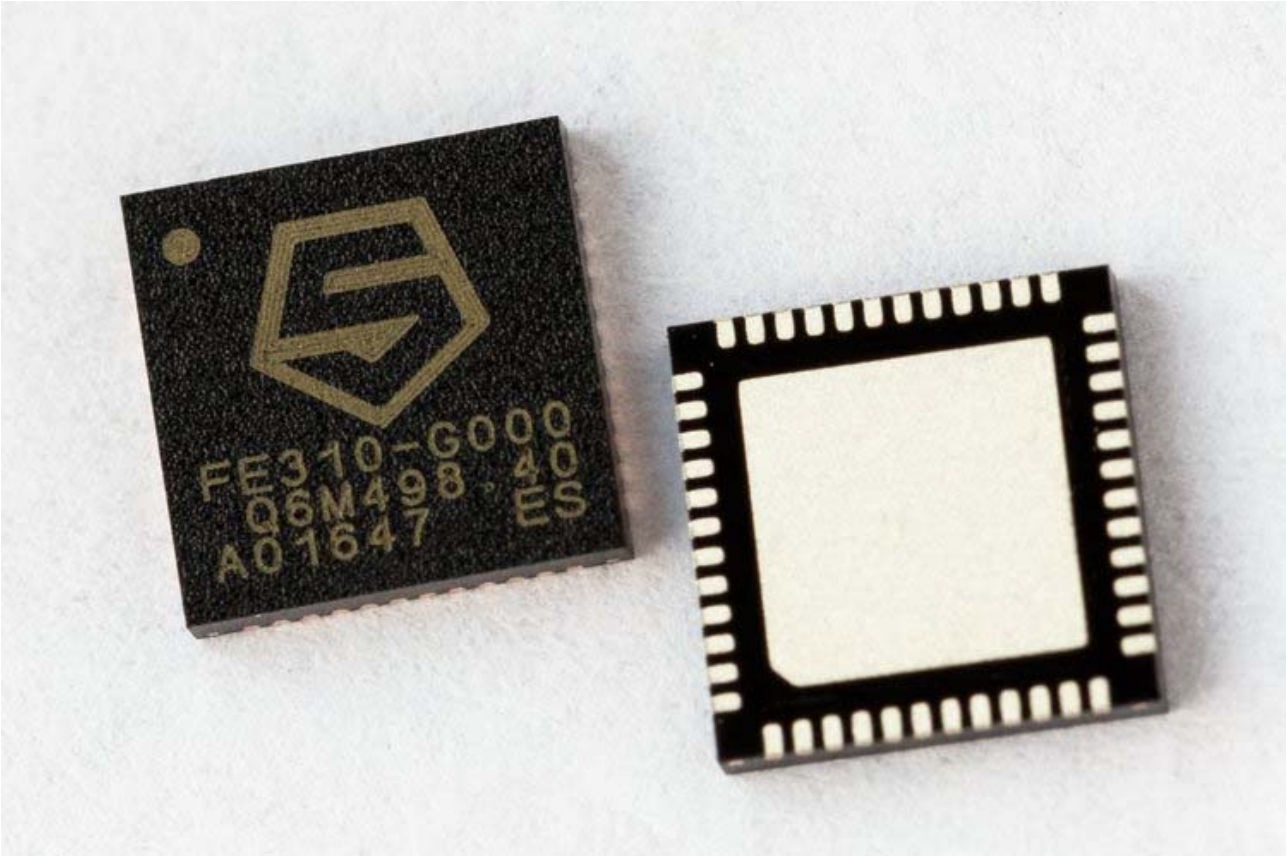
HiFive1: Open Source, Arduino-Compatible RISC-V Dev Kit

The HiFive1 is an Arduino-compatible development kit featuring the Freedom E310, the industry's first commercially available RISC-V SoC.

Freedom Everywhere

The Freedom E310 (FE310) is the first member of the Freedom Everywhere family of customizable SoCs. Designed for microcontroller, embedded, IoT, and wearable applications, the FE310 features SiFive's E31 CPU Coreplex, a high-performance, 32-bit RV32IMAC core. Running at 320+ MHz, the FE310 is among the fastest microcontrollers in the market.

Additional features include a 16KB L1 Instruction Cache, a 16KB Data SRAM scratchpad, hardware multiply/divide, a debug module, flexible clock generation with on-chip oscillators and PLLs, and a wide variety of peripherals including UARTs, QSPI, PWMs, and timers. Multiple power domains and a low-power standby mode ensure a wide variety of applications can benefit from the FE310.



Open-source RTL!

The FE310 is the first open-source RISC-V SoC available in industry. SiFive has contributed the FE310 RTL code to the open source community. That means you can see what's inside the chip and completely understand how the hardware works.

Take a look: SiFive GitHub

By releasing the RTL code, SiFive wants to encourage open source development of both software support for RISC-V as well as promote open hardware development.

The RTL code also empowers chip designers with the ability to customize their own SoC on top of the base FE310. For system architects, developers, or companies without chip design capabilities, SiFive's "chips-as-a-service" offering can customize the FE310 to meet their unique needs.

Chips-as-a-service?

Unless you had millions of dollars to spend, the dream of getting custom silicon was just that – a dream. With the end of conventional transistor scaling and escalating chip design costs, the silicon industry is no longer able to serve the fragmented market and the needs of the next generation of innovators.

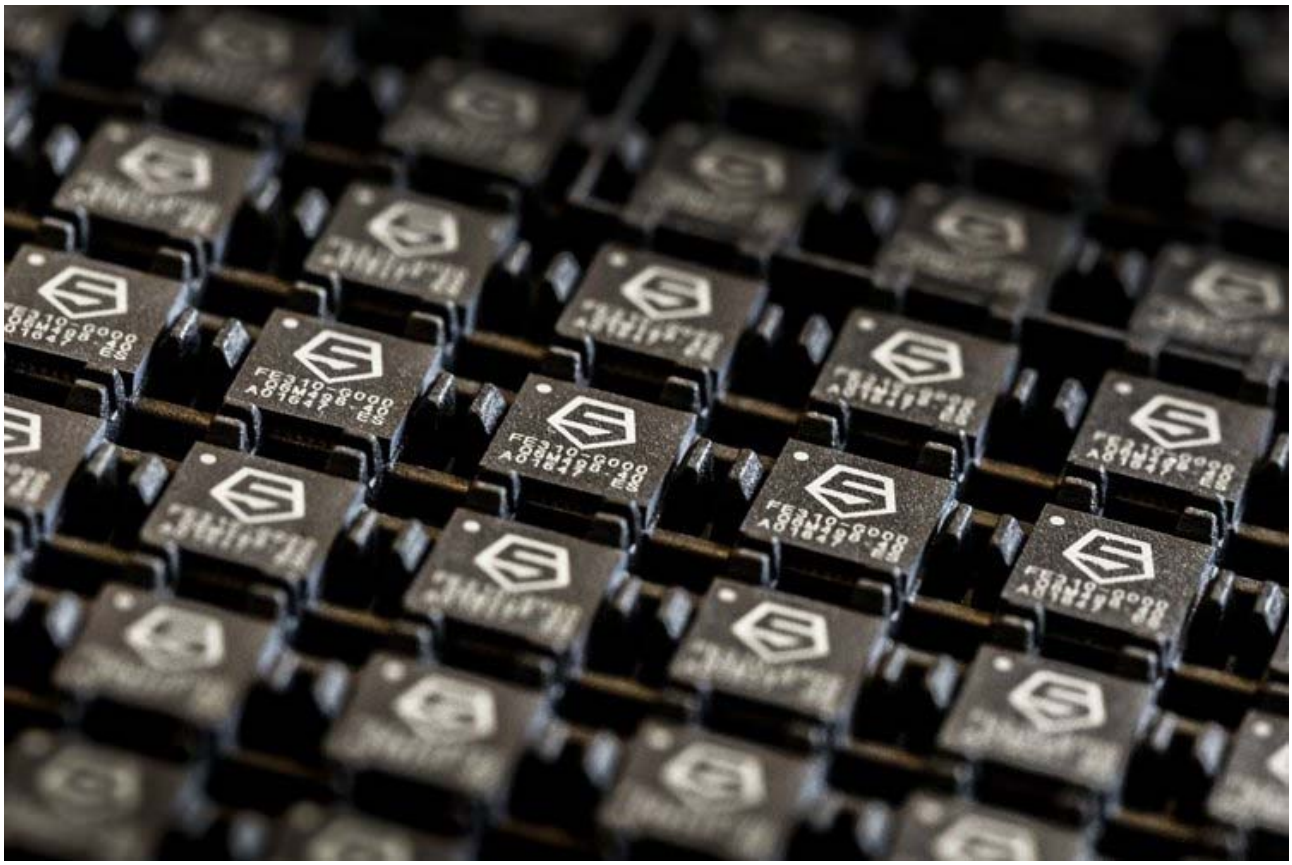
At SiFive, we believe that by bringing the power of open-source and agile hardware design to the semiconductor industry, we greatly reduce the cost to harness the performance and energy-efficiency of custom silicon to the smallest company, inventor, or maker.

SiFive's "chips-as-a-service" is meant for you – the system architect, developer, inventor, creator, and dreamer.

Do you want to write your own RTL? Download the open-source RTL to FE310 and connect your accelerator or peripheral right into the SoC and prototype it on our FPGA dev kits (available separately at dev.sifive.com. Then contact us about how we can quickly deliver an affordable sample of your custom chip and then take you to production by delivering packaged, tested chips.

Or, if you simply know what you want, we can customize the FE310 to meet your unique needs. No RTL needed. So play around with the HiFive1, develop some software, figure out what more you need in your version of the FE310.

Either way – come talk to SiFive. We can make and deliver your own custom chips based on the FE310 for much less than you'd probably pay just to license a different CPU core. Learn more about chips-as-a-service at www.sifive.com.



I don’t want a chip, I just want to play with RISC-V

Perfect! This board is the first RISC-V based development kit in the market. As you can expect from SiFive and the inventors of RISC-V, the FE310 supports the latest RISC-V specifications as of Nov 27, 2016:

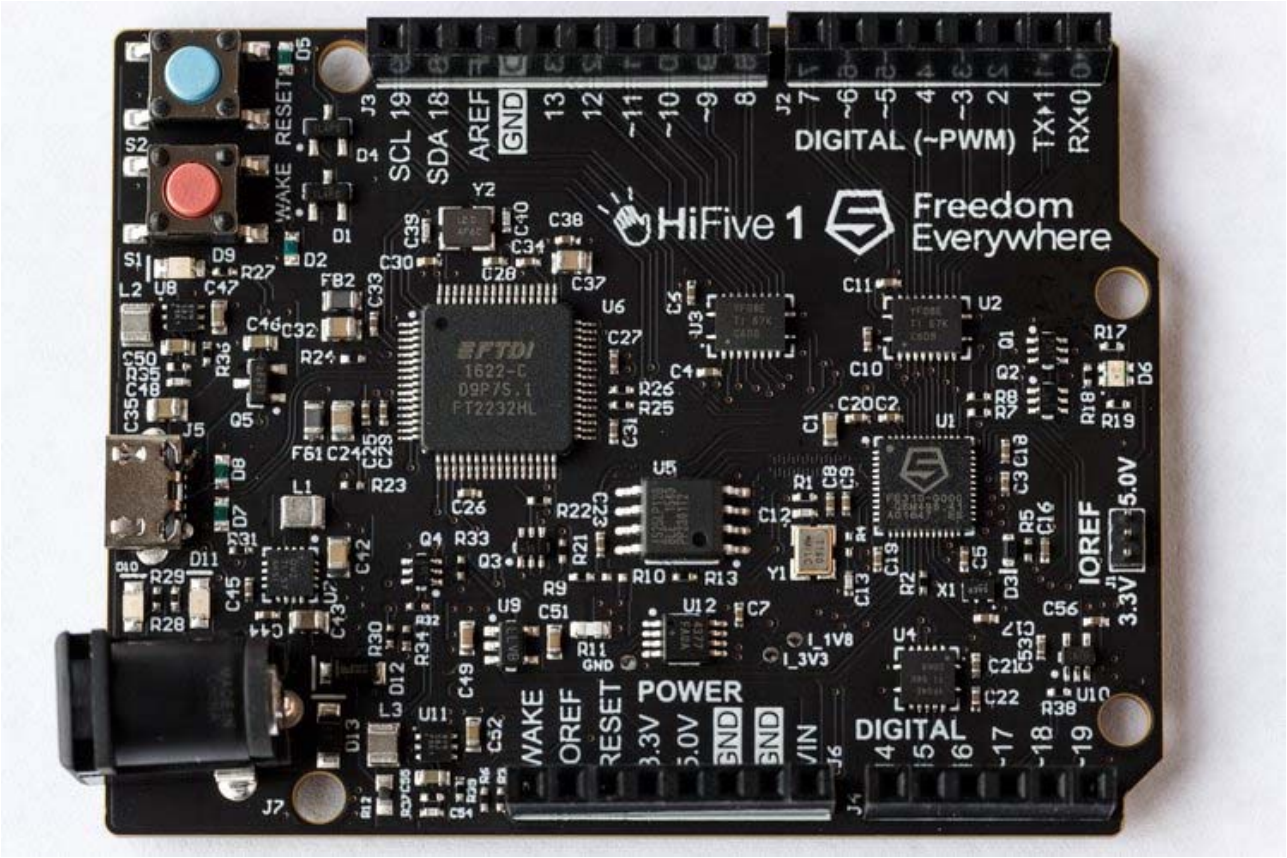
- RV32I Base Integer Instruction Set, Version 2.0
- “M” Standard Extension for Integer Multiplication and Division, Version 2.0
- “A” Standard Extension for Atomic Instructions, Version 2.0
- “C” Standard Extension for Compressed Instructions, Version 1.9
- RISC-V Privileged ISA Specification, Version 1.9.1
- RISC-V External Debug Support, Version 0.11

Help contribute the growing amount of open-source software already written for RISC-V: RISC-V Software Ecosystem Overview

Why Buy This Dev Kit?

You should buy this dev kit if you:

- Are a software developer who wants to develop on RISC-V
- Want an Arduino-Compatible RISC-V dev kit
- Want the **fastest** Arduino-Compatible dev kit
- Are a hacker or maker
- Are a system architect who wants to customize their own microcontroller
- Want to learn more about RISC-V
- Want to support open-source chips and open hardware!



HiFive1 Features & Specifications

- **Microcontroller:** SiFive Freedom E310 (FE310)
  - **CPU:** SiFive E31 CPU
  - **Architecture:** 32-bit RV32IMAC
  - **Speed:** 320+ MHz
  - **Performance:** 1.61 DMIPs/MHz
  - **Memory:** 16 KB Instruction Cache, 16 KB Data Scratchpad
  - **Other Features:** Hardware Multiply/Divide, Debug Module, Flexible Clock Generation with on-chip oscillators and PLLs
- **Operating Voltage:** 3.3 V and 1.8 V
- **Input Voltage:** 5 V USB or 7-12 VDC Jack
- **IO Voltages:** Both 3.3 V or 5 V supported
- **Digital I/O Pins:** 19
- **PWM Pins:** 9
- **SPI Controllers/HW CS Pins:** 1/3
- **External Interrupt Pins:** 19
- **External Wakeup Pins:** 1
- **Flash Memory:** 128 Mbit Off-Chip (ISSI SPI Flash)

- **Host Interface (microUSB):** Program, Debug, and Serial Communication
- **Dimensions:** 68 mm x 51 mm
- **Weight:** 22 g

Software

- **Freedom E SDK**
- **Arduino IDE Support**

Comparisons

The HiFive1, powered by the Freedom E310 is:

- **10x Faster CPU Clock than Intel's Arduino 101**
- **Greater than 11x more Dhrystones than the Cortex M0+ based Arduino Zero**
- **More power efficient in Dhrystone/mW**

A Great Arduino-Compatible Dev Kit!

	HiFive1	Arduino 101	Arduino Zero	Arduino Uno
Microcontroller	Freedom E310	Intel Curie Module	Atmel ATSAMD21G18	Atmel ATmega328P
Open-Source RTL?	Yes	No	No	No
CPU Speed	320+ MHz	32 MHz	48 MHz	16 MHz
Bits	32-bit	32-bit	32-bit	8-bit
CPU Core	SiFive E31	Intel Quark SE	ARM Cortex M0+	AVR
CPU ISA	RISC-V RV32IMAC	x86	ARMv6-M	AVR
Performance				
DMIPs/MHz*	1.61	1.3	0.93	0.30
Total Dhrystones*	515.2	41.6	44.64	5
DMIPS/mW*	3.16	0.35	-	0.10
Board Specs				
IO Voltage	3.3 V and 5 V	3.3 V and 5 V	3.3 V Only	5 V Only
Digital IO	19	14	14	14
PWM	9	4	10	6
SRAM [kB]	16	24	32	2
Flash [kB]	16384	196	256	32
USB	Micro	Regular	2 Micro	Regular

** HiFive1 DMIPs/mW measured at 1.61 V, 200 MHz operation. Intel Dhrystone data and DMIPs/mW taken from their datasheet and product material. Arduino Uno DMIPs/mW estimated based on ATmega328P datasheet and this site.*

Can I Purchase Just the Freedom E310 Chips?

We do plan to make the individual Freedom E310 chips available, but currently the only thing available is the Hifive1 board. There are some additional complexities associated with providing chips and support that we are working through. Please stay tuned for an update!

Manufacturing Plan

SiFive has launched and demoed the first set of HiFive1 dev kits and Freedom Everywhere 310 SoCs at the 5th RISC-V Workshop held on November 29, 2016.

To get these dev kits to everybody as soon as possible, we are expediting our next manufacturing build. These limited run boards will be known as “HiFive1 Founder’s Edition” and will come with a special silkscreen featuring the signatures of the Founding Team at SiFive, and will be slightly more expensive than the production boards but will ship in December 2016.

The standard HiFive1 dev kits will be available by early February 2017.

Risks & Challenges

Please note that these boards and chips are Engineering Samples, and are intended for development use only.

Ask a Question

Have a question not answered in the description above or in the Updates?

Ask SiFive a Question or Browse the Crowd Supply Guide