



# INTRODUCING THE GD32VF103 RISC-V BASED MCU

an open-source hardware instruction set architecture

# Company Snapshot

## Key Facts

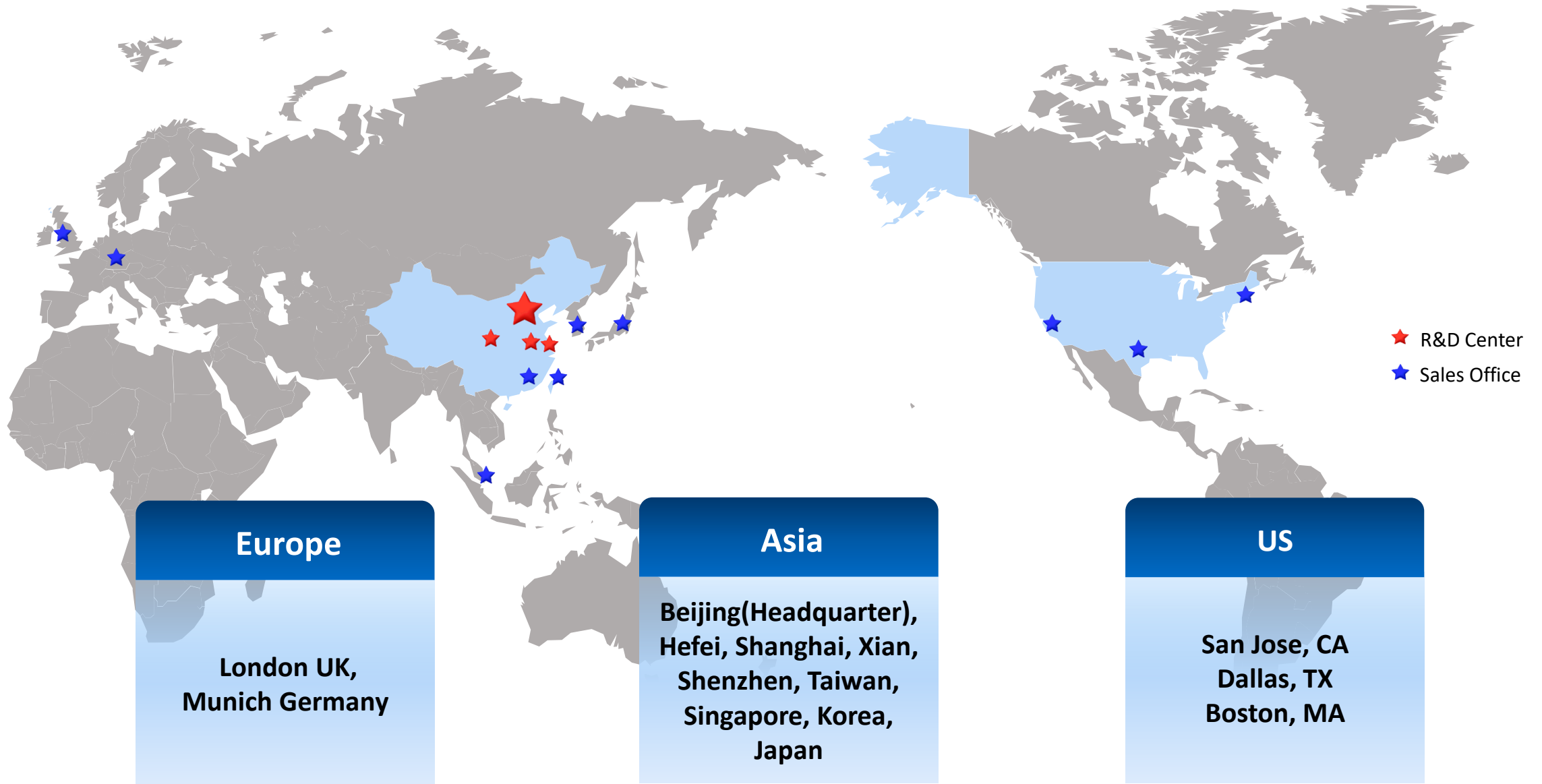
- Founded in Silicon Valley in 2004, moved headquarter to Beijing in 2005, 1100+ employees globally;
- Successfully listed in the Shanghai Stock Exchange in 2016 (SSE 603986);
- A semiconductor technology leader in China focusing on Flash Memory, Microcontroller and Sensor.

## Industry Leadership

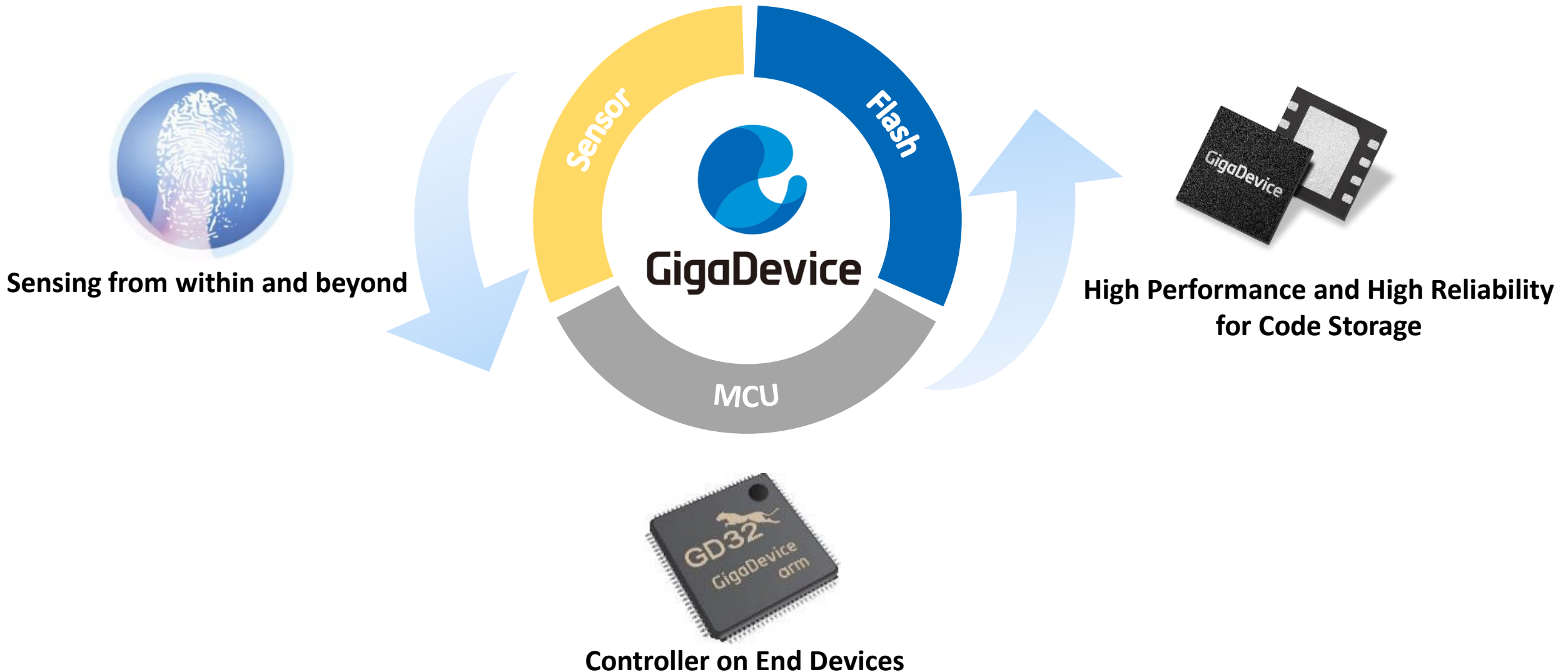
- Top 1 fabless NOR Flash memory supplier worldwide
- Top 3 SPI NOR Flash supplier worldwide
- China's No.1 32-bit Arm® general-purpose MCU supplier
- China's No.2 fingerprint sensor supplier
- 1237 patents filed, 700 granted
- ISO9001 and ISO14001 certified



# Global Organization



# Diversified Product Portfolio in Flash, MCU and Sensor



# Major Product Lines and Target Markets



## FLASH

- SPI NOR FLASH Series
- SPI NAND FLASH Series
- Parallel NAND FLASH



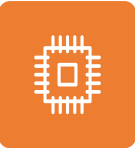
Consumer



Internet of Things



Automotive & Industrial



## MCU

- GD32 MCU



Network & Communication



Mobile



Computing



## Sensor

- Fingerprint Sensor
- Biological Detection
- Touch Controller

# GD32 MCU Portfolio

		Performance				Arm® Cortex®-M 32-bit MCUs				RISC-V 32-bit MCUs	
		Cortex®-M23		Cortex®-M3		Cortex®-M4		Cortex®-M33		RISC-V	
GD32 MCU Family	High Performance					GD32F450 200MHz, 3M Flash, 512K RAM	GD32F407 168MHz, 3M Flash, 192K RAM	GD32E505 180MHz, 512K/128K	GD32E507 180MHz, 512K/128K		
				GD32F205 120MHz, 3M Flash, 256K RAM	GD32F207 120MHz, 3M Flash, 256K RAM	GD32F405 168MHz, 3M Flash, 192K RAM	GD32F403 168MHz, 3M Flash, 128K RAM	GD32E503 180MHz, 512K/128K			
	Mainstream			GD32F105 108MHz, 1M Flash, 96K RAM	GD32F107 108MHz, 1M Flash, 96K RAM	GD32F305 120MHz, 1M Flash, 96K RAM	GD32F307 120MHz, 1M Flash, 96K RAM	GD32E501 100MHz, 512K/32K		GD32VF103 108MHz, 128K Flash, 32K RAM	
				GD32F103 108MHz, 3M Flash, 96K RAM	GD32F101 56MHz, 3M Flash, 80K RAM	GD32F303 120MHz, 3M Flash, 96K RAM	GD32E103 120MHz, 128K Flash, 32K RAM				
	Entry-Level	GD32E232 72MHz, 64K Flash, 8K RAM			GD32F170 48MHz, 64K Flash, 8K RAM	GD32F190 72MHz, 64K Flash, 8K RAM	GD32F330 84MHz, 128K Flash, 16K RAM	GD32F350 108MHz, 128K Flash, 16K RAM			
		GD32E231 72MHz, 64K Flash, 8K RAM			GD32F130 48MHz, 64K Flash, 8K RAM	GD32F150 72MHz, 64K Flash, 8K RAM					
		GD32E230 72MHz, 64K Flash, 8K RAM									
	Specific					GD32FFPR 168MHz, 1M Flash, 128K RAM			GD32EPRT 168MHz, 384K/96K+4M		



**GigaDevice**

# GigaDevice GD32VF103x



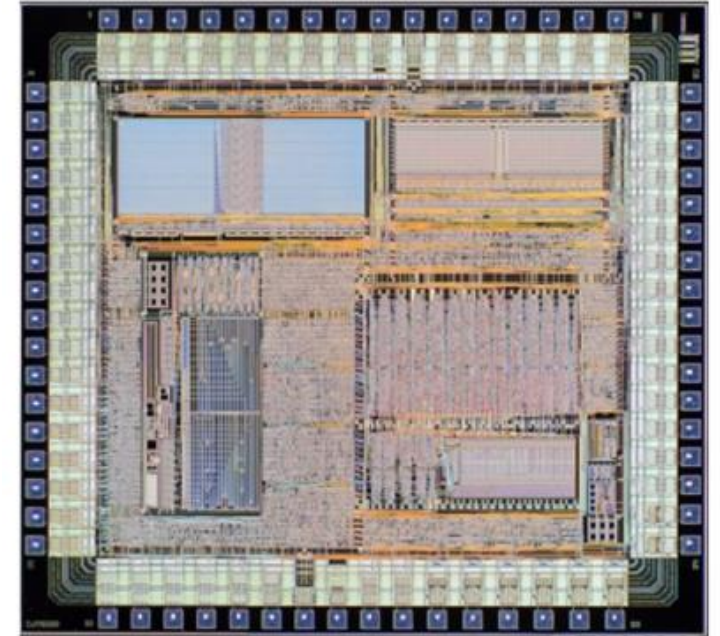
# Why RISC-V

A completely open ISA that is freely available to academia and industry

A real ISA suitable for direct native hardware implementation, not just simulation or binary translation

An ISA that avoids "over-architecting" for a particular microarchitecture style (e.g., micro-coded, in-order, decoupled, out-of-order) or implementation technology (e.g., full-custom, ASIC, FPGA), but which allows efficient implementation in any of these

An ISA separated into a small base integer ISA, usable by itself as a base for customized accelerators or for educational purposes, and optional standard extensions, to support general-purpose software development





# RISC-V International



500+ RISC-V International Members



# GigaDevice and Nuclei

Jointly developed by GigaDevice and China's leading RISC-V processor core IP and solution manufacturer Nuclei System Technology, offering a commercial RISC-V processor core for IoT and ultra-low power applications.



The Bumblebee core uses a 32-bit RISC-V open source instruction set architecture and supports custom instructions to optimize interrupt handling.



# GigaDevice and Nuclei



The **Bumblebee Core** is designed based on the RISC-V Instruction Set Manual

Volume I:  
User-Level ISA Version 2.2 ([riscv-spec-v2.2.pdf](https://riscv.org/specifications/)).

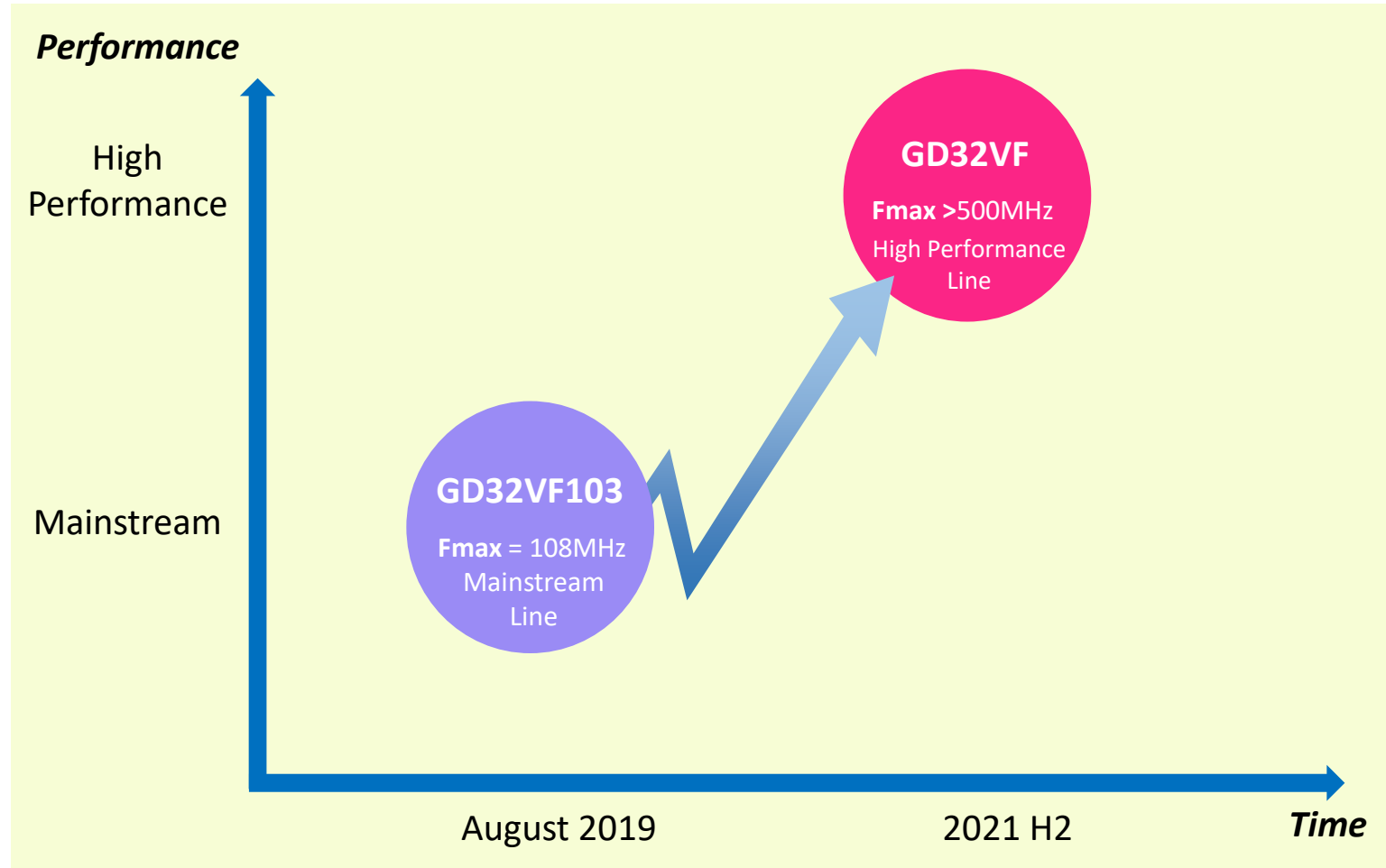
Users can register and access the full text (<https://riscv.org/specifications/>) for free on the RISC-V International website.

# GigaDevice and Nuclei

GigaDevice and Nuclei are developing a **NEW 32-bit general purpose MCU!**

The NEW GD32 RISC-V MCU will expand the GD32 MCU Portfolio and **strengthen more the RISC-V Ecosystem.**

Target of the new product is the **High Performance** applications.



# GD32VF103x RISC-V Core

The GD32VF103 device is a 32-bit general-purpose microcontroller based on the RISC-V core with best ratio in terms of processing power, reduced power consumption and peripheral set.

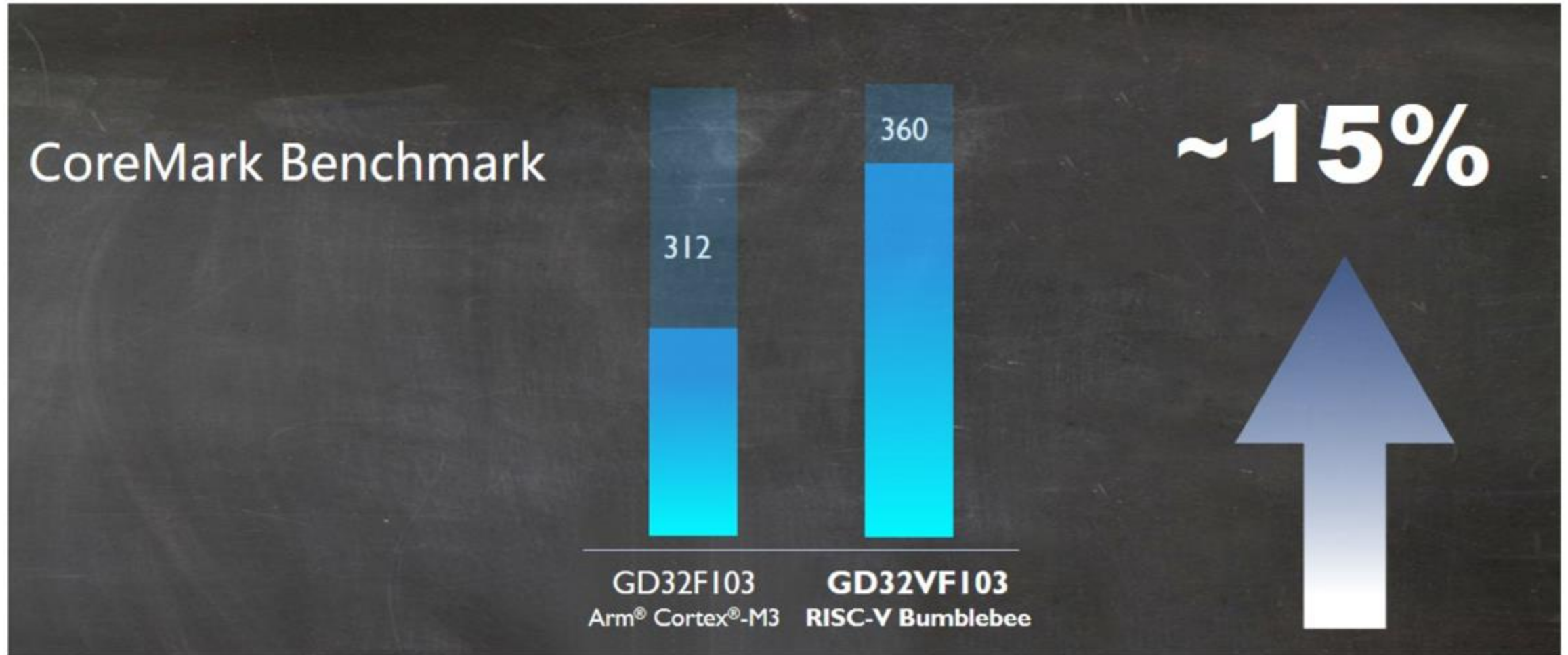
The RISC-V processor core is tightly coupled with an Enhancement Core-Local Interrupt Controller (ECLIC), SysTick timer and advanced debug support.

The GD32VF103 device incorporates the RISC-V 32-bit processor core operating at 108 MHz frequency with Flash accesses zero wait states to obtain maximum efficiency

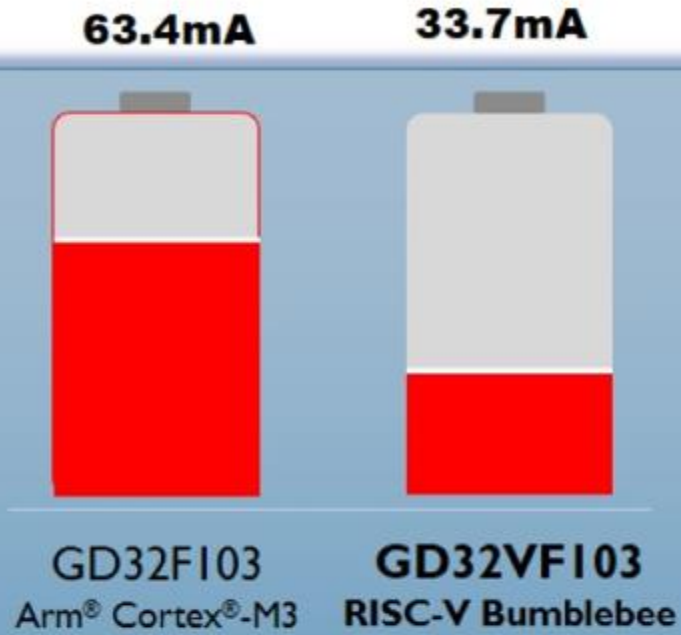
It provides up to 128 KB on-chip Flash memory and 32 KB SRAM memory. An extensive range of enhanced I/Os and peripherals connect to two APB buses.



# Performance

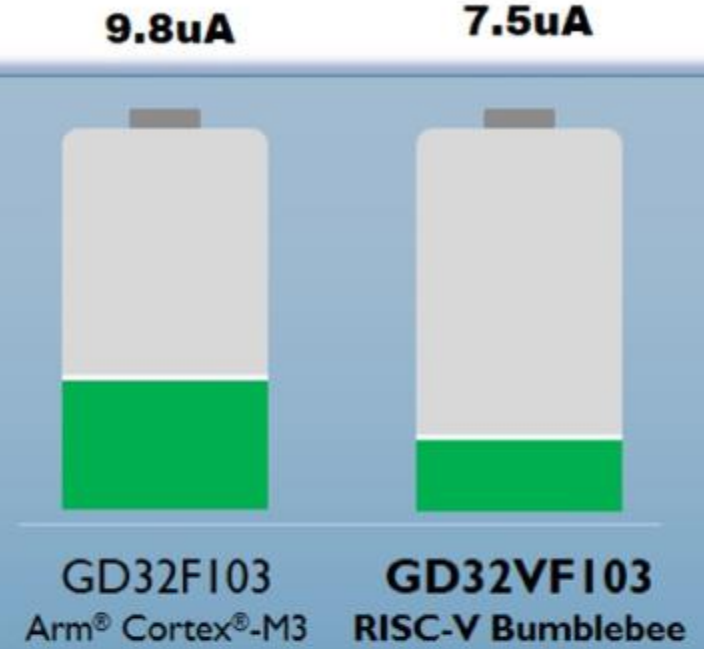


# Low Power Consumption



**~ 50% Reduction**

**Max Dynamic Power**



**~ 25% Reduction**

**Standby Current**

# GD32VF103x Features List

- **Memory**  
16 - 128KB Flash, 6 - 32KB SRAM
- **Timers**  
1x 16-bit Adv.TM, 4x 16-bit GPTM, 2x 16-bit Bsc.TM  
1x 24-bit SysTick TM, 2x WDG, 1x RTC
- **Best-in-class peripheral support**  
2x UART, 3x USART, 2x I2C, 3x SPI , 2x I2S,  
1x USB 2.0 OTG, 2x CAN 2.0B, External Mem. Cont.  
(NOR Flash, SRAM,PSRAM, ROM)
- **Analog peripheral**  
2x 12-bit 16ch ADC, 2x 12-bit DAC  
High-precision 1Msps ADC
- **2.6-3.6V supply; 5V tolerance I/Os, up to 80 GPIOs**
- **Three low power consumption modes;**  
Sleep, Deep-Sleep, Standby Mode
- **QFN36, LQFP48, LQFP64, LQFP100**





# GD32VF103x Lineup

## GD32VF103 RISC-V Mainstream Portfolios



- ☑ GD32VF103 RISC-V Bumblebee Core Mainstream Line
- ☑ Max  $F_{cpu}$  108MHz, 16K-128K Flash, 8K-32K SRAM
- ☑ 2.6-3.6V supply; 5V tolerance I/Os; all support USB OTG & CAN 2.0B
- ☑ -40°C to +85°C industrial level operating temperature
- ☑ Series pin to pin compatible and flexible S/W compatible



# GD32VF103 – Complete Development Ecosystem



## Software Library

- GD32 Library
- Third Party Middleware



## Full Function EVB & Starter Kit

- GD32VF103V-EVAL
- GD32VF103R-START
- GD32VF103T-START
- GD32VF103C-START



## IDE Support

- Nuclei Studio
- IoT Studio
- SEGGER Embedded Studio
- IAR Embedded Workbench



## Demos & Solutions

- GD32VF103-BLDC
- GD32VF103-DRONE
- GD32VF103-LCD



## Debugging & Programming Tools

- GD-Link
- IAR I-jet
- SEGGER J-Link V10



## Operating System

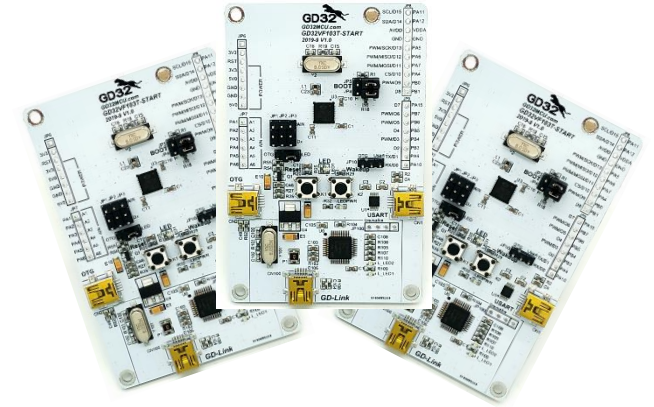
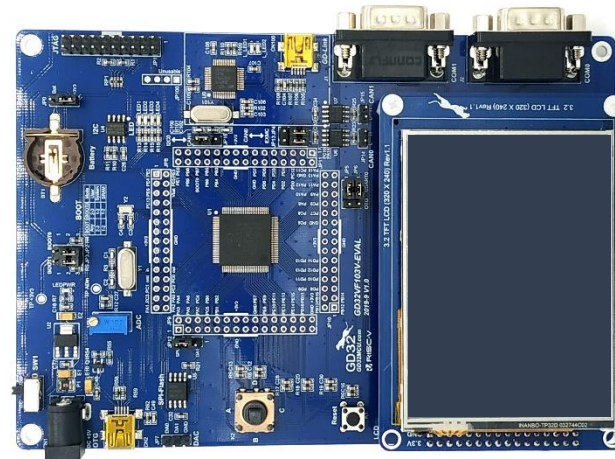
- Link to Cloud
- LiteOS
- FreeRTOS
- RT-Thread
- µC/OS II
- TencentOS-tiny

# GD32VF103 Development Boards

- ADC
- CMP
- CRC
- DBG
- DMA
- EXTI
- FMC
- FWDGT
- GPIO
- I2C
- IFRP
- PMU
- RTC
- SPI
- TIMER
- USART
- WWDGT

Order Code	Type	Chip P/N	Chip package
GD32VF103V-EVAL	Full Function EVB	GD32VF103VBT6	LQFP100
GD32VF103R-START	Starter Kit	GD32VF103RBT6	LQFP64
GD32VF103C-START	Starter Kit	GD32VF103CBT6	LQFP48
GD32VF103T-START	Starter Kit	GD32VF103TBU6	QFN36

- Auto\_baudrate\_detect
- Deepsleep\_wakeup
- DMA\_transmitter&receiver
- DMA\_transmitter&receiver\_interrupt
- Half\_duplex\_transmitter&receiver
- Hardware\_flow\_control
- Printf
- Receiver\_timeout
- Synchronous
- Transmitter&receiver\_interrupt



# GD32VF103 IDE's – SEGGER Embedded Studio

SEGGER announces full support for the first commercially available flash-based RISC-V microcontroller introduced by GigaDevice Semiconductor Inc.

This support includes SEGGER's Embedded Studio integrated development environment for RISC-V, its market-leading J-Link debug probe, Ozone debugger, SEGGER's emPack with the RTOS embOS and Software Libraries in the fields of communication, data storage, compression and IoT, as well as the portfolio of Flasher production programmers.

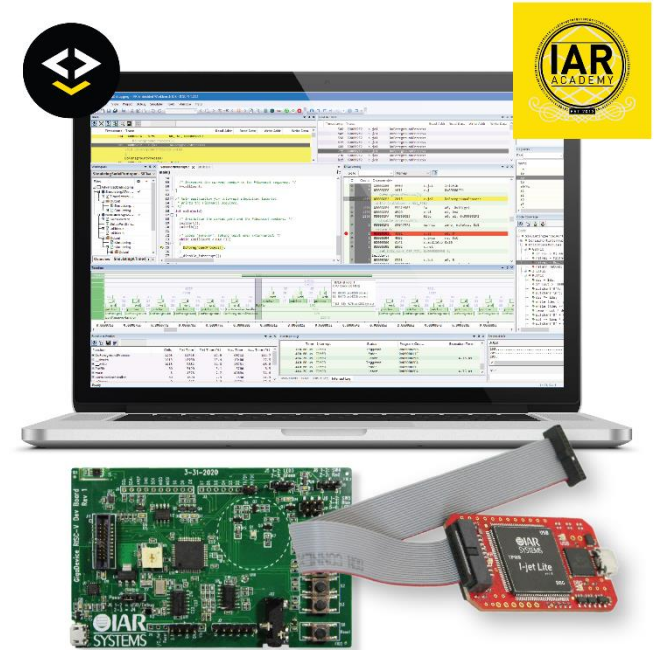


# GD32VF103 IDE's – IAR Embedded Workbench for RISC-V

## IAR GD32V Evaluation Kit

1. IAR RISC V GD32V EVAL BOARD
2. I jet Lite debug probe
3. IAR EWRISCV for RISC V 30 day evaluation license
4. IAR Academy On Demand course introduction to RISC-V Evaluation Kit

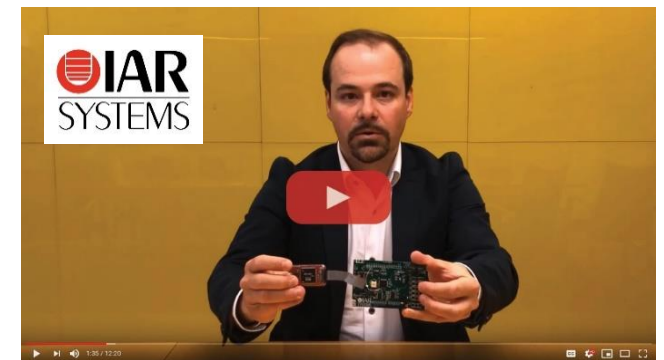
IAR provides an evaluation kit **free of charge** to companies with commercially viable development projects.



## IAR Embedded Workbench For RISC-V Ver1.30 Support GD32V MCU

Free online video for the IDE and Evaluation Kit are available on YouTube, WeChat and other online platforms.

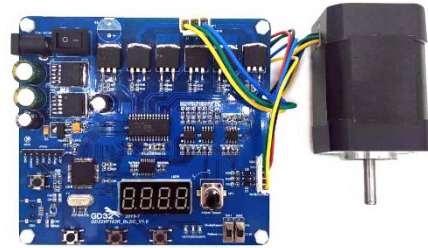
Free example code and demos are available on Github:  
<https://github.com/IARSystems/iar-risc-v-gd32v-eval>



# GD32VF103 – GigaDevice & Partners Solutions

## BLDC Motor Controller

- GD32VF103RBT6 on board
- BLDC Square wave control
- Hall Sensors
- Encoder & Comparator



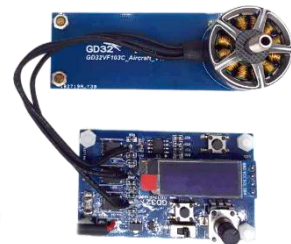
## 7" LCD Multi touch

- 5 touch points at the same time
- Communication with the main controller through I2C protocol
- GD32VF103C8T6 on board



## Drone Motor Controller

- Square Wave control
- Maximum motor speed 28000rpm
- 1,176 Million commutation per min.
- GD32VF103C8T6 on board



## IAR RISC-V GD32V EVAL BOARD

- User LEDs, SWs
- 3 Axis Accelerometer
- Potentiometer
- Temperature, Humidity, Light Sensors
- Onboard Microphone
- iPhone compatible Earbud Jack
- SPI Flash Memory
- JTAG connector 20 pin 0.05"
- USB micro B connector for USB-Serial converter



## SeedStudio GD32 RISC-V Dev Board

The new SeedStudio GD32 RISC-V Dev Board, equipped with the powerful GD32VF103VBT6 MCU has more I/O resources, onboard flash, communication interfaces, etc...

The RISC-V kits provided by Seed are available on Mouser.



# GD32VF103 – Hardware Product of the year

The GD32VF103 MCU product series, based on the RISC-V open source ISA (Instruction Set Architecture), has won the award of hardware product of the year at the **Embedded World 2020** in Nuremberg Germany.

To read more news about the GD32 MCU, there are many online magazines and media platforms. These include [Embedded World Newsroom](#) (English), [Polyscope](#) (German) and [Channel-e](#) online media platform (German).



# Resources



## GD32VF103 Deliverables

- Datasheet
- User Manual
- Firmware Library
- Firmware Library User Guide
- Quick Start Guide
- Demo Suites
- Nuclei Studio IDE

[www.GD32MCU.com](http://www.GD32MCU.com)



Thank you



**GigaDevice**

