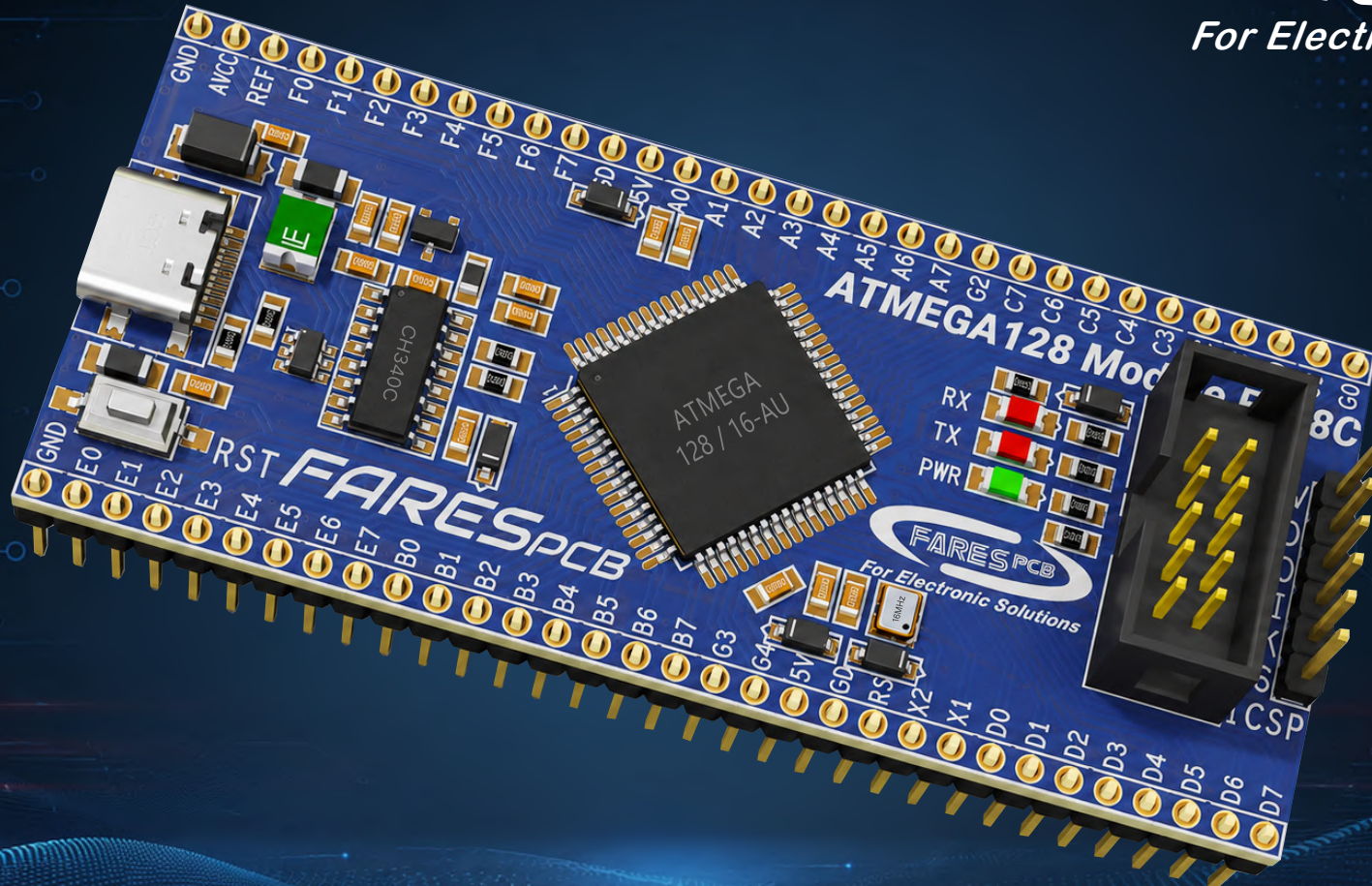




For Electronic Solutions



ATmega128 Module (F128C)

Industrial Grade

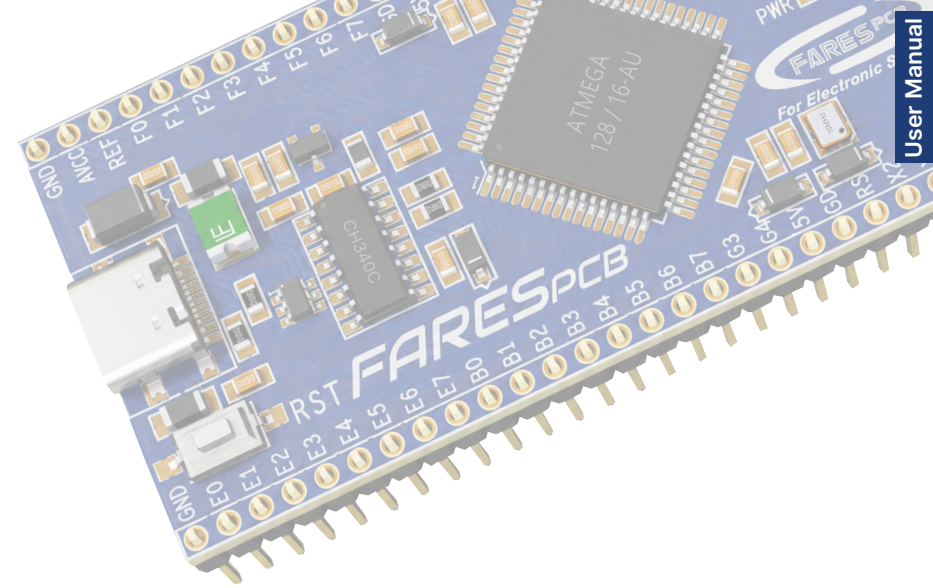
General Description

The **ATmega128** module (**F128C**) is an industrial-grade development platform based on the **ATmega128** 8-bit AVR microcontroller. It provides easy access to all MCU I/O pins through 2.54 mm headers and features a USB Type-C connector with a CH340C USB-to-UART interface for serial communication and power.

The module supports USB bootloader programming after a compatible bootloader is installed via ISP. It includes 10-pin and 6-pin AVR ICSP headers, a 16 MHz crystal oscillator, and ESD and surge protection for reliable operation. The **F128C** is suitable for industrial control, embedded development, education, laboratory applications, and rapid prototyping.

Features

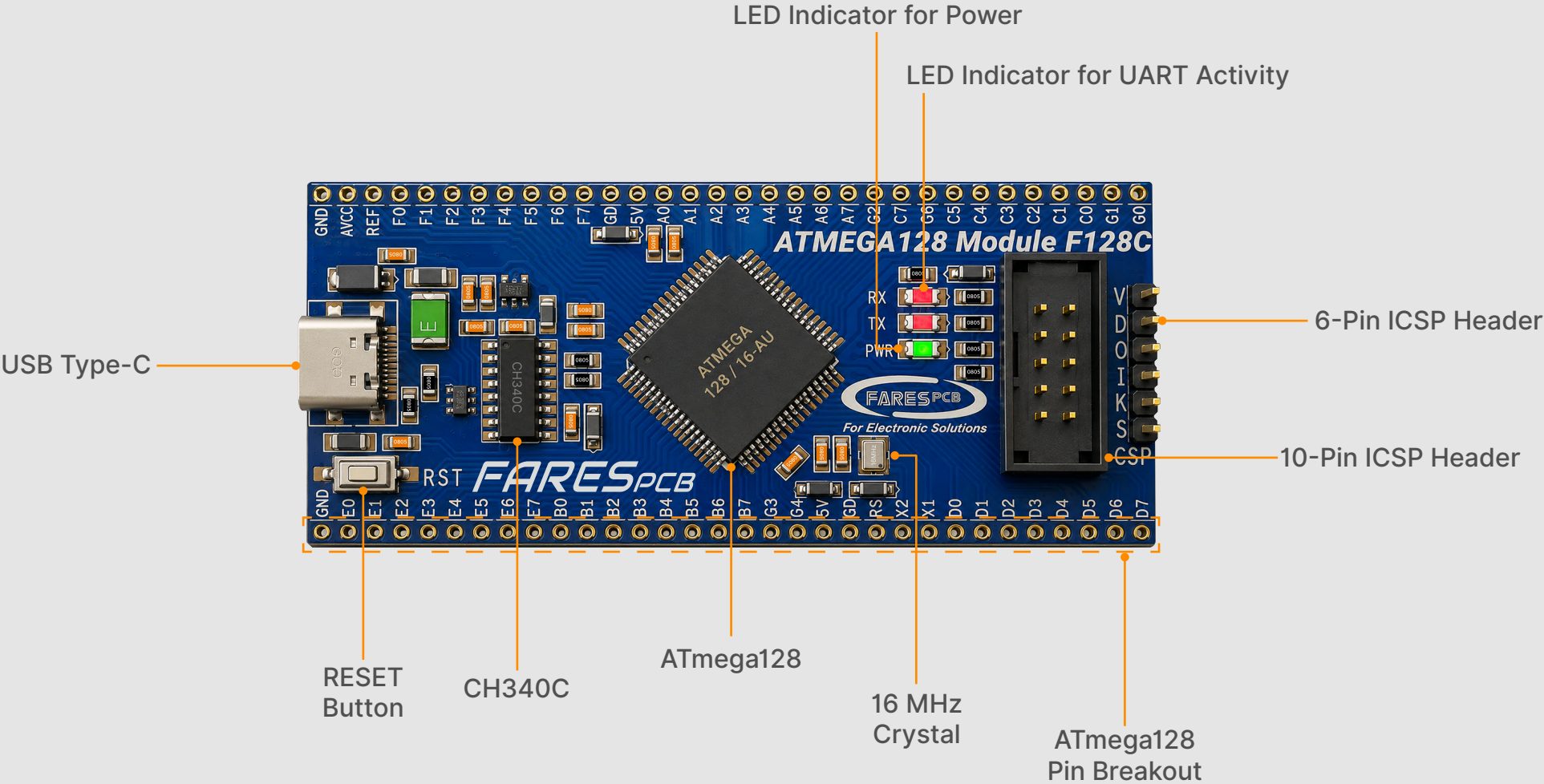
- **ATmega128** 8-bit AVR microcontroller:
 - 128 KB Flash.
 - 4 KB SRAM.
 - 4 KB EEPROM.
- On-board **16 MHz** crystal oscillator.
- Powered via **USB Type-C** or **5 V** pin header.
- On-board **RESET** push button.
- **ESD** and **surge protection**.
- **USB Type-C** Interface with **CH340C USB-to-UART** converter (USART0).
- Standard **10-pin** and compact **6-pin AVR ICSP** programming headers.
- All MCU I/O pins exposed through **2.54 mm** headers.



- **AVCC, AREF, XTAL1, XTAL2, RESET, VCC (5V), and GND** pins available on headers.
- **Green PWR LED** for power status.
- **TX and RX Red LEDs** for UART activity.
- Supports **USB bootloader programming***
- Industrial-grade PCB design.
- PCB dimensions: **81.3 mm × 35.6 mm**.

*A compatible bootloader must be installed via ISP to enable USB programming.

ATmega128 Module Overveiw



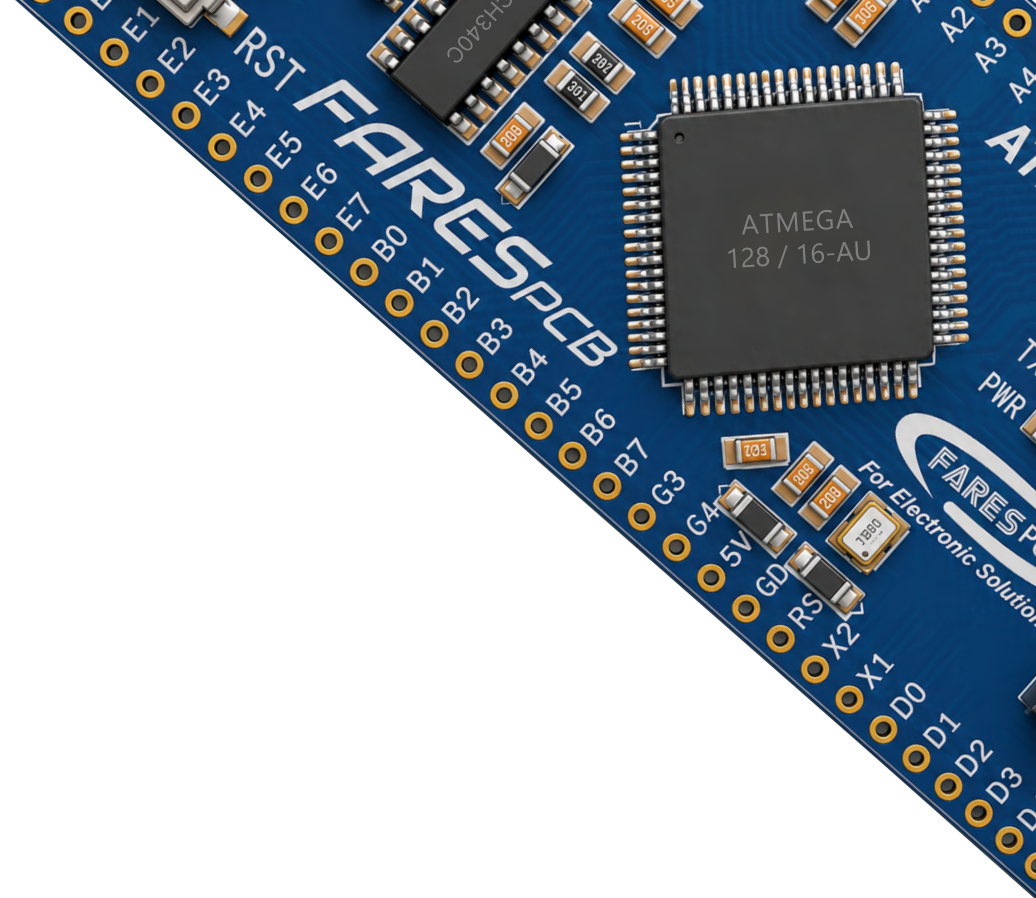
Applications

The **F128C** module is suitable for:

- Industrial automation.
- Embedded system development.
- Educational laboratories.
- Robotics.
- Data acquisition systems.
- Sensor interfacing.
- Motor-control interface systems .
- Process monitoring.
- Communication gateways.
- Rapid prototyping.
- OEM embedded products.

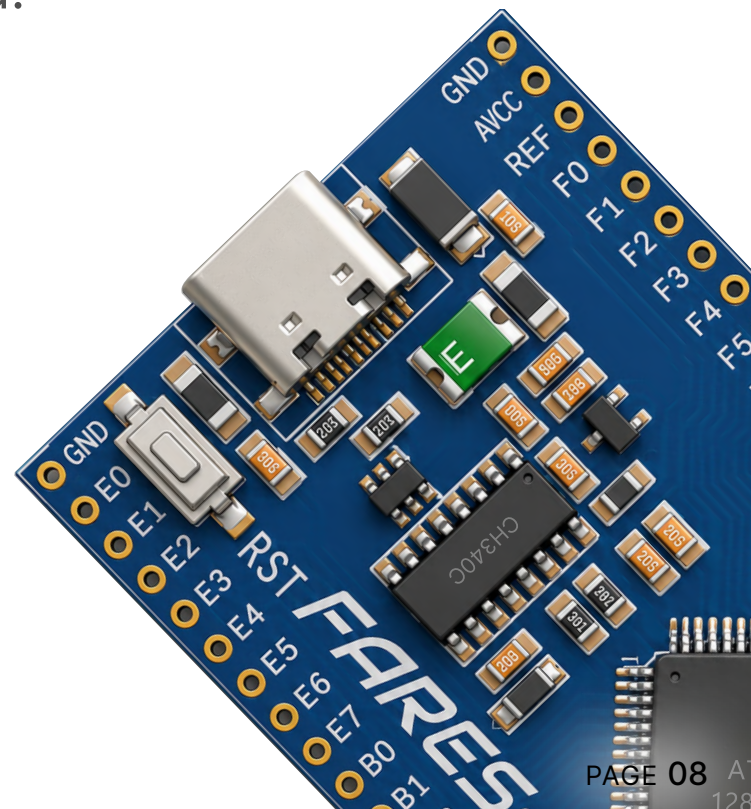
Microcontroller

- **ATmega128** AVR microcontroller.
- 8-bit AVR RISC architecture.
- 16 MHz operation.
- 128 KB flash memory.
- 4 KB SRAM.
- 4 KB EEPROM.



USB Interface

- USB Type-C, 16-pin connector.
- **CH340C USB-to-UART** bridge USB Full-Speed **12 Mbps**.
- UART **baud rate** configurable up to **2 Mbps** (depending on firmware efficiency, bootloader support, driver settings, cable quality, and application data load).
- USB powered at 5 V through a 1 A resettable PTC fuse available current depends on the USB source, cable, and external load.
- Automatic USB serial communication.
- Compatible with standard CH340 drivers.

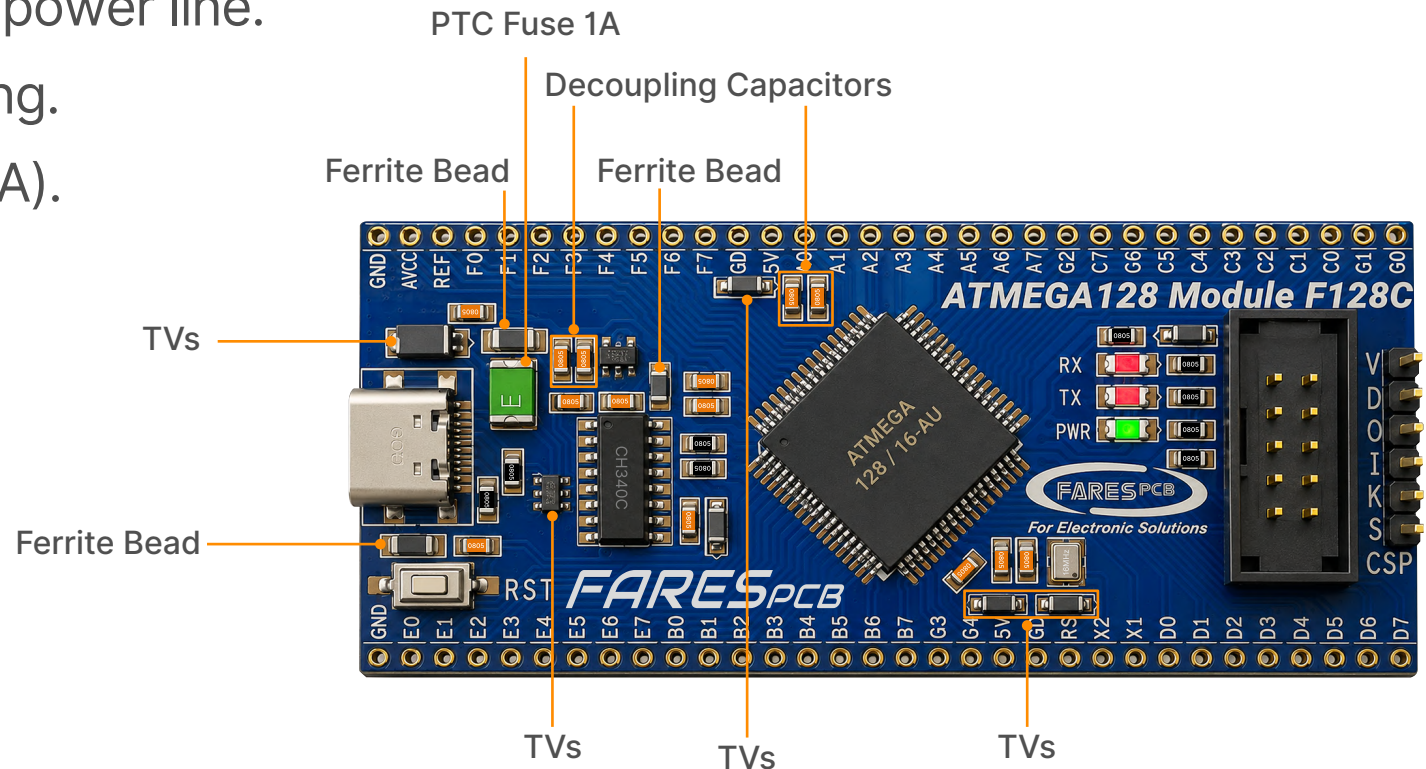


Protection

The **F128C** incorporates several protection mechanisms to improve reliability:

USB Protection

- USBLC6-2 TVS diode array on data line.
- External TVS diode on power line.
- Ferrite bead EMI filtering.
- Reversible PTC fuse (1A).



Power Protection

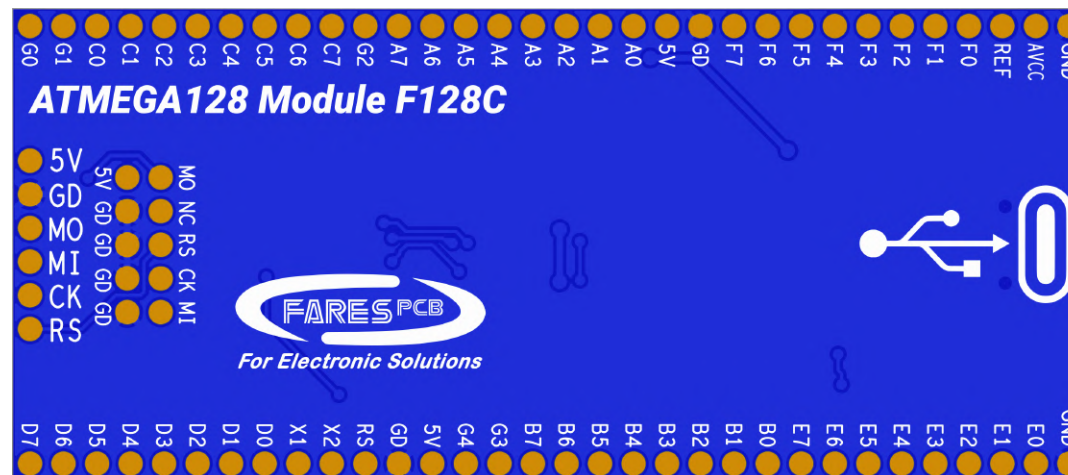
- ESD protection on each power pin header using TVS diode.
- Reversible PTC fuse (1A).
- Local decoupling capacitors.
- LC filtering on analog AVCC.

Reset Protection

- RC filtering.
- Protection diode and TVS diode for ESD.
- Reverse polarity diode.
- Pull-up resistor.

Optimized PCB Layout

- Top and bottom copper pours with stitching vias.
- All components placed on the top layer.
- Minimal ground-plane interruptions for improved signal integrity.



GPIO Port Mapping

The GPIO headers expose nearly all MCU pins grouped by their original AVR ports.

Available ports include:

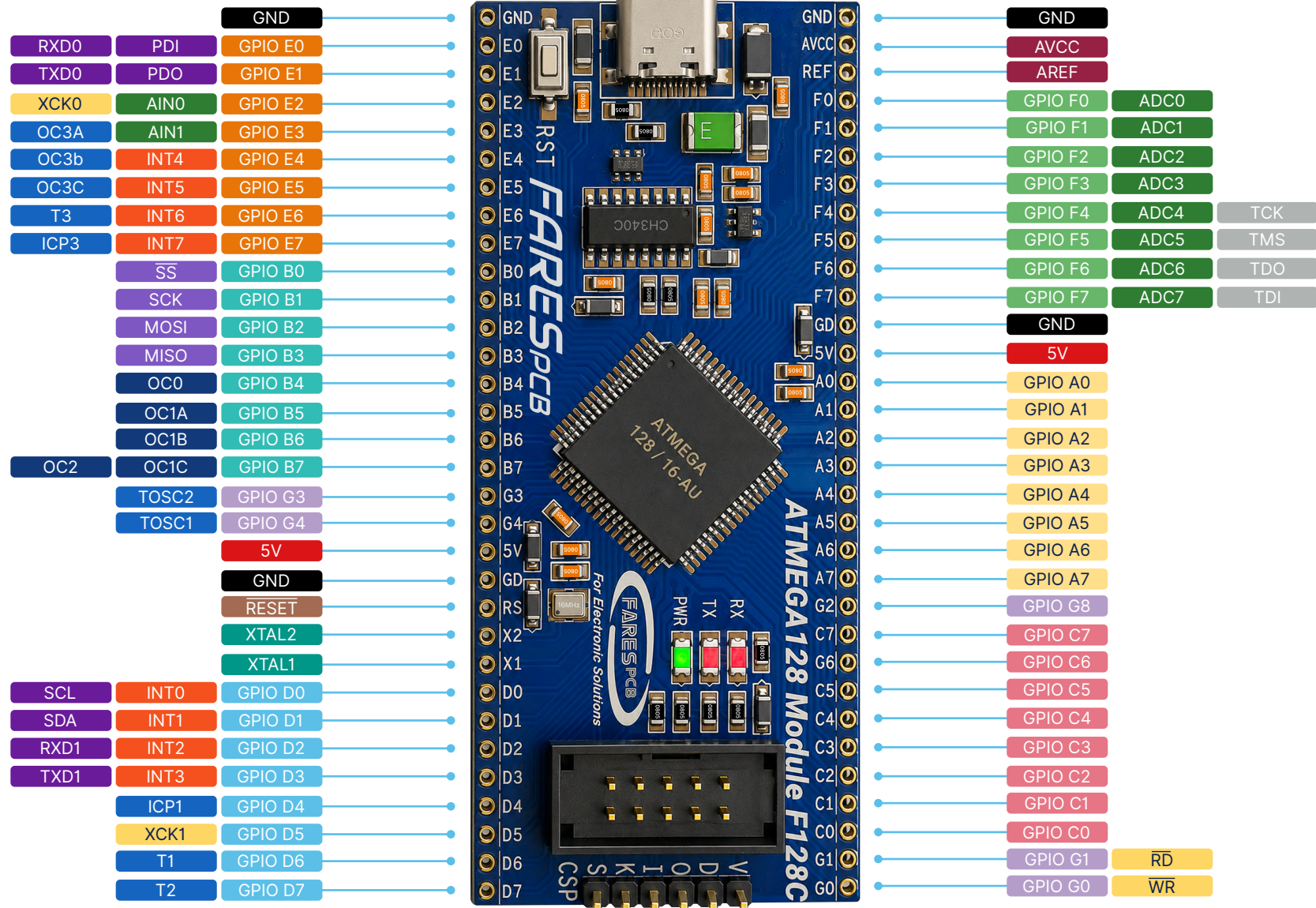
PORTA, PORTB, PORTC, PORTD, PORTE, PORTF, PORTG.

Additional pins:

RESET, VCC, GND, AVCC, AREF, XTAL1, XTAL2.

Pin Accessibility

- All GPIO pins available.
- Port-oriented header arrangement.
- Standard 2.54 mm male headers.
- Convenient breadboard and PCB integration.



Electrical Characteristics

Recommended Operating Conditions

Parameter	Minimum	Typical	Maximum
Supply Voltage (VCC)	2.7 V	5.0 V	5.5 V
Supply Current	—	10 mA	—
Operating Frequency	—	16 MHz	16 MHz
Operating Temperature	0°C	—	70°C

GPIO Voltage		Condition	Minimum	Maximum
Input	Low	VCC = 2.7V - 5.5V	0.5	0.2 VCC
	High		0.6 VCC	VCC+0.5
Output	Low	IOH = -20mA, VCC = 5V	VCC - 0.8	0.7
	High	IOH = -10mA, VCC = 3V		0.5



Applying voltages above the specified limits may permanently damage the module.

Power Supply Options

The module supports two power input methods:

- **Primary Power Input:** Supply regulated 5 V through the dedicated **5V** and **GD** pins located along the sides of the module.
- **USB Power Input:** Power the module directly through the **USB Type-C** connector.

Both power sources may be connected simultaneously however, this configuration is **not recommended**. For reliable operation and to avoid potential interaction between power sources, use only one power input method at a time.



The listed current value represents typical module consumption under normal operating conditions. Actual current may vary depending on firmware, connected peripherals, LED activity, and external loads.

USB Interface

The on-board CH340C provides:

- Virtual COM port.
- Supports USB full-speed communication up to **12 Mbps** on the USB side.
- configurable UART baud rate up to **2 Mbps** (depending on firmware efficiency, bootloader support, driver settings, cable quality, and application data load).
- Automatic USB detection.
- Driver support for:
 - 1- Windows (XP, 7, 10, 11).
 - 2- Linux.
 - 3- macOS.

The USB Type-C connector is intended for:

- Module power.
- UART communication.
- Firmware download.
- Debug terminal.

Programming

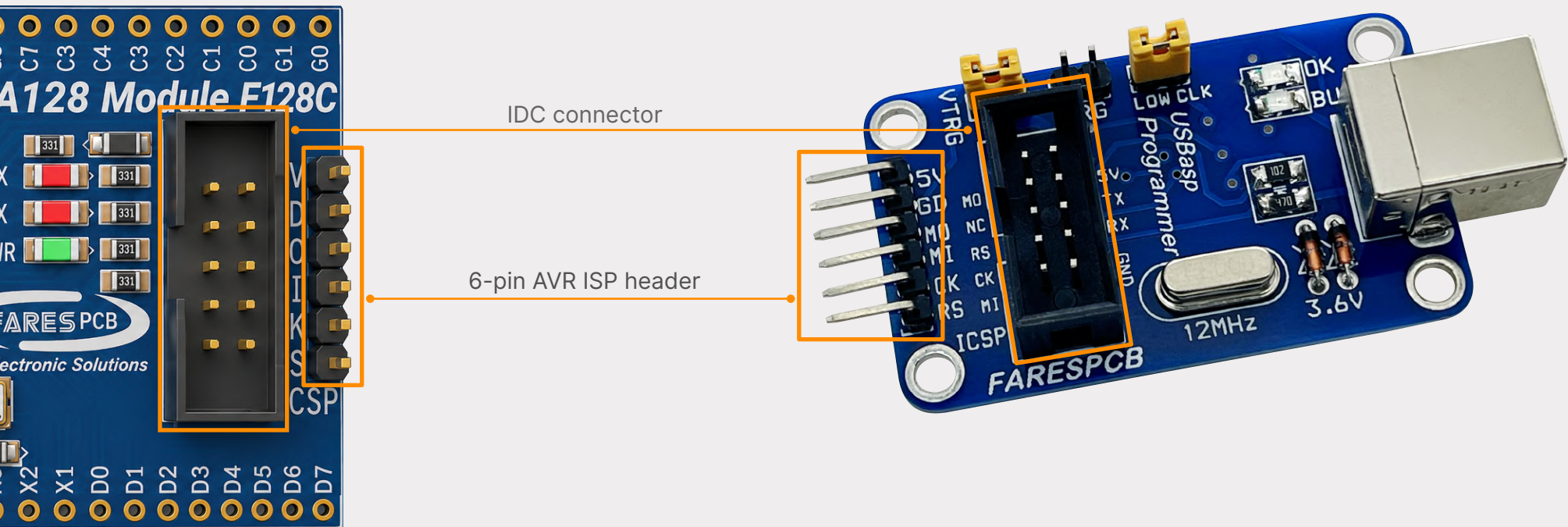
The **F128C** module supports two programming methods for the on-board **ATmega128** microcontroller.

1. In-System Programming (ISP)

The module includes both **standard 10-pin** and compatible **6-pin AVR ISP headers**, enabling direct programming of the **ATmega128** using any compatible AVR ISP programmer.

Supported programmers include:

- **FARESPCB** USBasp AVR Programmer (IDC connector + compatible 6-pin AVR ISP header).
- USBasp (only IDC connector).
- AVRISP / AVRISP mkII (only IDC connector).
- Other AVR ISP-compatible programmers.



2. USB Serial Bootloader

The on-board **CH340C USB-to-UART interface** supports firmware uploading through the **USB Type-C** connector when a compatible serial bootloader is installed on the **ATmega128**.

The **F128C** hardware is designed to support bootloader-based programming by providing an automatic reset/programming trigger from the CH340C control line through a coupling capacitor to the **ATmega128** reset circuit. This allows the microcontroller to enter bootloader mode automatically during firmware upload, depending on the bootloader and programming software used.



The **F128C** module is shipped **without a pre-installed bootloader**. To enable firmware uploads through the USB Type-C interface, a compatible AVR bootloader must first be programmed into the **ATmega128** using an ISP programmer. After the bootloader is installed, future firmware updates can be performed directly through the USB interface without requiring an external programmer.

Recommended Fuse Settings

For reliable operation with the onboard 16 MHz full-swing crystal oscillator, the following fuse configuration is recommended:

Fuse	Value	Description
Low	0xBF	Full-Swing Crystal Oscillator, maximum start-up time, Brown-out Detection enabled (lower brown-out threshold 2.7v).
High	0xC9	Standard operating configuration, SPI programming enabled, JTAG is disabled, Boot reset disabled.
	0xCE	Boot Reset enabled with 512-byte bootloader section.
	0xCC	Boot Reset enabled with 1 KB bootloader section.
	0xCA	Boot Reset enabled with 2 KB bootloader section.
	0xC8	Boot Reset enabled with 4 KB bootloader section.
Extended	0xFF	Default extended fuse configuration.

Why choose this LOW FUSE setting?

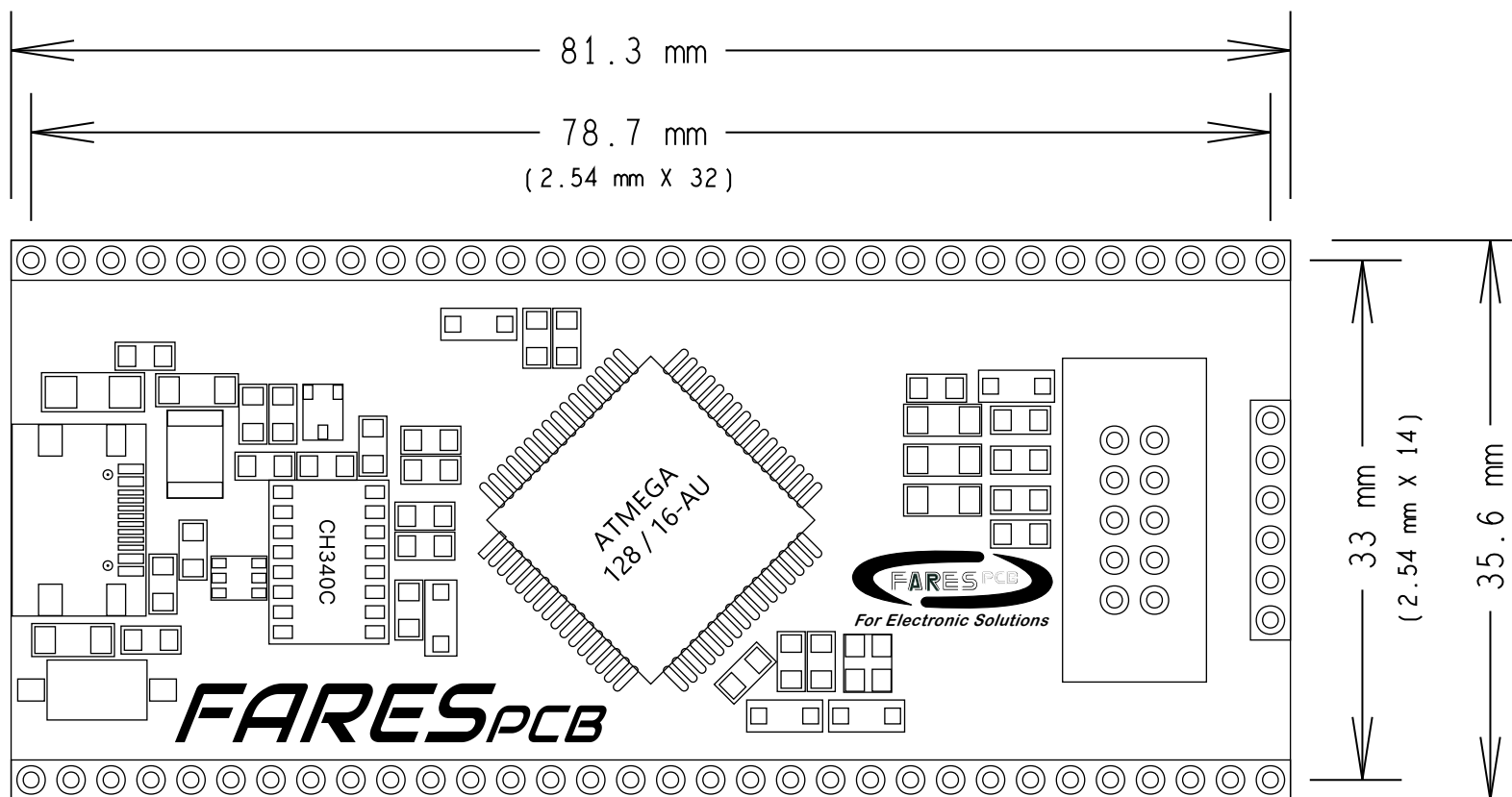
- **Full-Swing Crystal Oscillator:** Provides higher oscillator drive strength and improved immunity to electrical noise.
- **Maximum start-up time:** Allows the crystal oscillator and power supply to stabilize before code execution.
- **Brown-out Detection enabled** (2.7 V threshold): Prevents unreliable operation during supply voltage drops or power-up conditions.



Important: Always verify the fuse settings before programming the microcontroller. An incorrect clock source or start-up configuration may prevent the **ATmega128** from operating, making the device appear unresponsive. Recovery may require applying a suitable external clock signal to the XTAL1 pin or reprogramming the device using a High-Voltage Programming (HVP) programmer.

Mechanical Information

- Standard 2.54 mm male pin headers.
- Breadboard friendly.
- Compact module format.



Design and Handling Notes

- Handle the module using ESD-safe procedures.
- Avoid touching USB and MCU pins during operation.
- Do not connect inductive loads directly to MCU pins.
- Use external drivers for relays, motors, solenoids, and high-current loads.
- Keep analog signals away from noisy switching loads.
- Use proper grounding when connecting external circuits.
- Use level shifters when interfacing with 3.3 V systems.

Precautions

- Operate **only from a regulated 5 V supply**.
- Do not apply more than **5 V** to any GPIO pin.
- Avoid hot-plugging external circuitry carrying voltages above VCC.
- Prevent electrostatic discharge when handling the module.
- Disconnect power before connecting external hardware.
- Ensure adequate airflow if operating continuously at high load or elevated ambient temperatures.

Troubleshooting

Problem / Symptom	Possible Cause	Recommended Check / Solution
Module does not power ON (No power LED)	USB cable, USB port, unstable 5 V supply, or VCC-to-GND short circuit.	Confirm that the USB cable is connected properly and supports power. Verify that the USB port provides a stable 5 V. Check that the PWR LED turns on and measure between VCC and GND for shorts.
	Poor USB connection, damaged cable, insufficient USB power, or VCC rail fault.	Try another USB cable and USB port. Avoid unpowered USB hubs. Disconnect external hardware and test the module standalone.
PC does not detect the module	Faulty CH340 driver, charging-only USB cable, damaged USB-C connector, interrupted USB data lines, or no module power.	Install or reinstall the CH340 USB-UART driver. Use a USB cable that supports data transfer. On the PC, check Device Manager or the serial-port list for a new COM port.
USB repeatedly disconnects	Weak USB power, poor cable quality, unstable USB port, or excessive current drawn by external circuitry.	Use a high-quality USB data cable and a stable USB source. Disconnect external loads and avoid powering high-current circuits from the USB port.
Serial communication unavailable	Wrong COM port, incorrect baud rate, wrong UART configuration, or external circuit loading UART pins.	Select the correct COM port and UART settings. Use a tested baud rate such as 9600 or 115200 bps. Check that E0/RXD0 and E1/TXD0 are not externally loaded.

Problem / Symptom	Possible Cause	Recommended Check / Solution
TX/RX LEDs do not blink	No serial traffic, wrong COM port, incorrect firmware UART setup, or blocked TX/RX lines.	Send data from a serial monitor and confirm the selected COM port. Verify that the firmware uses the correct ATmega128 UART and that TX/RX pins are not held low.
ICSP programming fails (Cannot program MCU through ISP)	Incorrect ISP cable orientation, wrong programmer, missing target power, RESET issue, or voltage mismatch.	Check the 10-pin or 6-pin ISP header orientation. Confirm VCC and GND at the header. Use a compatible programmer such as FARES PCB USBasp AVR Programmer or another AVR ISP-compatible device.
	RESET line held low, oscillator not running, incorrect fuse settings, unsupported programmer, or wrong programmer voltage.	Confirm ISP wiring and cable direction. Match programmer voltage to the module's 5 V logic level. Check RESET, fuse values, and whether the 16 MHz oscillator is active.
MCU appears unresponsive	Incorrect fuse configuration, missing clock, RESET held low, external circuit loading I/O pins, or firmware fault.	Disconnect all external hardware and test the module alone. Check RESET voltage, oscillator operation, and MCU signature using an ISP programmer. Reprogram with known-good firmware if needed.
MCU stops responding after fuse programming	Wrong clock source or start-up fuse configuration.	Provide a compatible external clock signal to XTAL1, then reprogram the correct fuse values using ISP. If ISP recovery fails, use a High-Voltage Programming method.

Problem / Symptom	Possible Cause	Recommended Check / Solution
Crystal oscillator not running	Wrong fuse settings, damaged crystal, incorrect load capacitors, soldering fault, or XTAL pins externally loaded.	Inspect the crystal circuit and solder joints. Confirm that the fuse settings select the external 16 MHz full-swing crystal oscillator. Remove any external load from XTAL1/XTAL2.
USB bootloader upload fails	No bootloader installed, wrong bootloader, wrong COM port, incorrect baud rate, or unsupported reset sequence.	The module is shipped without a bootloader. First program a compatible ATmega128 bootloader using ISP, then upload through USB Type-C using the correct COM port and bootloader baud rate.
External circuit causes unstable operation	Overloaded I/O pins, voltage above VCC, poor grounding, inductive noise, or excessive current draw.	Disconnect external hardware and retest. Do not apply more than 5 V to any I/O pin. Use driver circuits for relays, motors, solenoids, and other high-current or inductive loads.

For the latest product updates and documentation, visit: www.fares-pcb.com
For technical inquiries and customer service, contact: support@fares-pcb.com

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