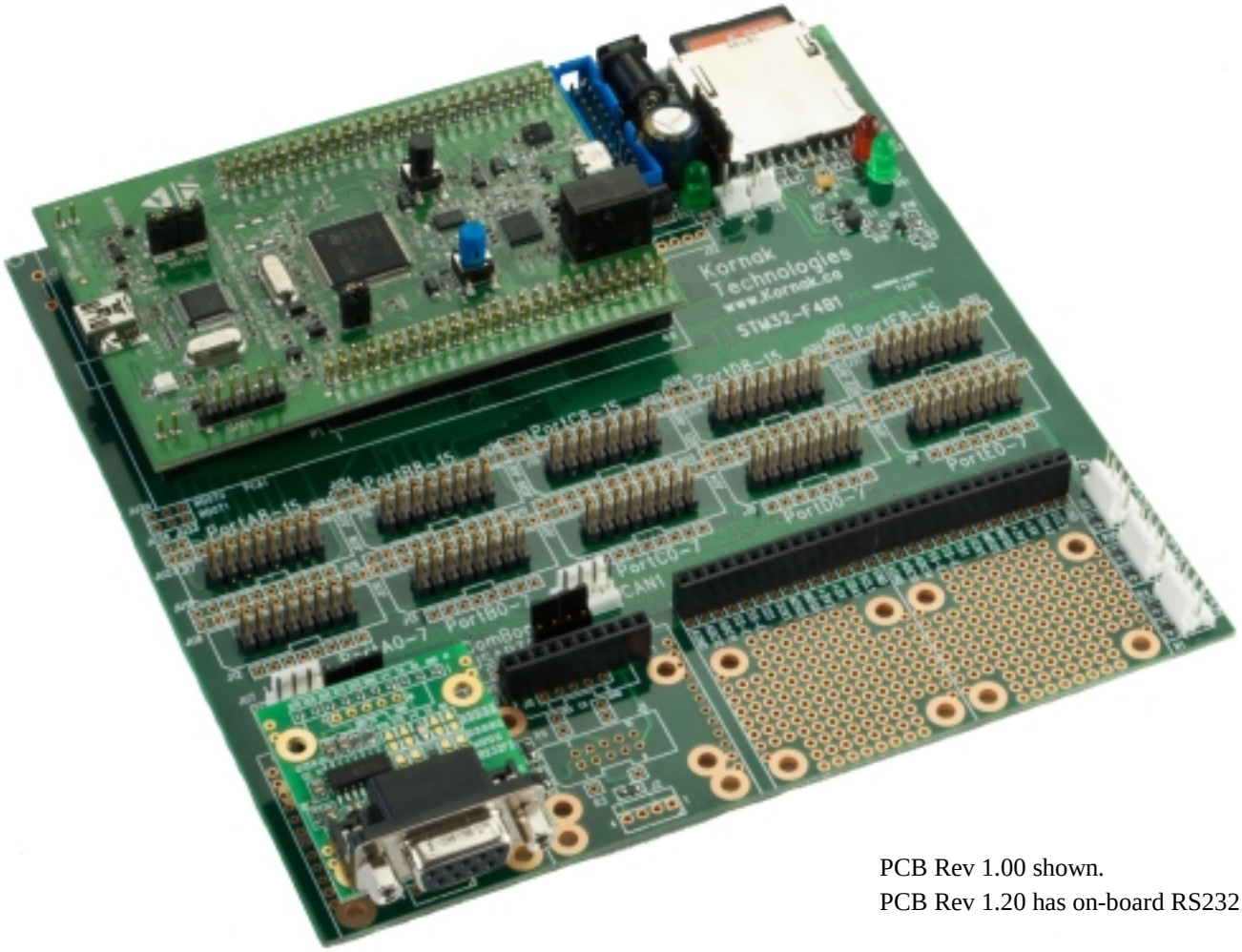
PCB-STM32-F4B1

Development baseboard for the STMicro Discovery-F4 module
(STMicro part# STM32F4DISCOVERY)

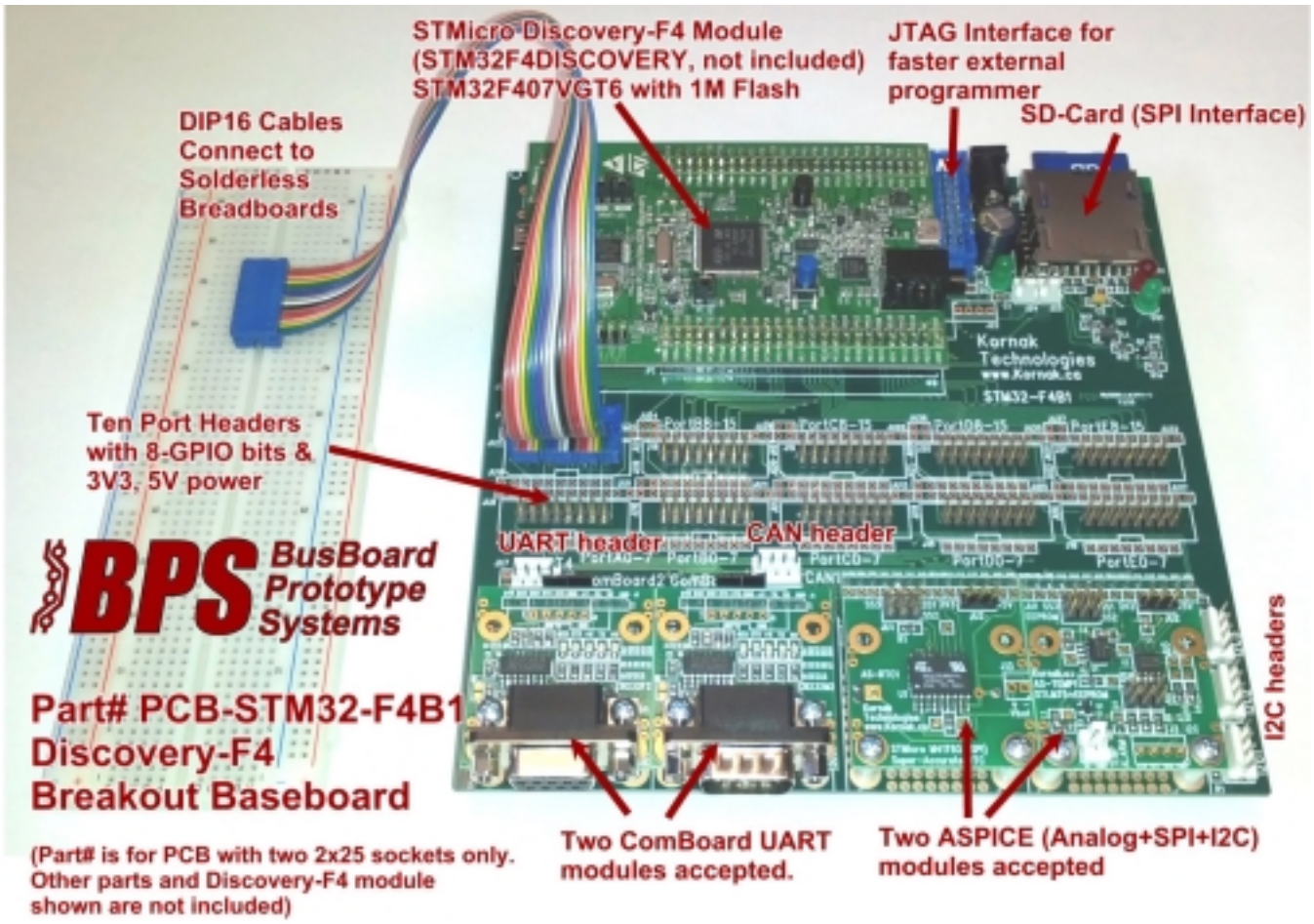


PCB Rev 1.00 shown.
PCB Rev 1.20 has on-board RS232 drivers.

Part Number: PCB-STM32-F4B1 (unpopulated PCB with Discovery module sockets, no other parts)
STM32-F4B1 (assembled board, not presently available)

Features

- STM32-F4B1 is a breakout board for the STMicro Discovery F4 board (with STM32F407VGT6 microcontroller, 1024k program flash, 192k RAM, DSP, and floating point instructions).
- Bare PCB with two 2x25 DIL sockets provided for Discovery-F4 module headers. No other parts are provided. BOM and schematic are available for download.
- Ten GPIO port headers provide 8 data bits and 3V/5V power on each.
- Two ComBoard footprints provide USART interfaces. Two ASPICE board footprints provide I2C, and SPI expansion signals on 14-pin headers. SD card connector footprint provided.
- Mostly thru-hole construction allows for easy assembly.
- 4-layer, FR4 glass-epoxy PCB, 1oz/ft2 copper. Soldermask & silkscreen. Lead free and RoHS compatible. 6.30 x 6.30in (160 x 160mm).



Details

The STM32-F4B1 breakout board provides port connectors, USART, I2C, and SPI expansion headers to make it easy to prototype with the ST Micro Discovery F4 board.

PCB-STM32-F4B1 is an unpopulated board and two 2x25 sockets for the Discovery module are provided (no other parts are provided). The BOM (bill of materials) and schematic diagram are available at http://busboard.us/products/PCB-STM32-F4B1/ to construct the board. Soldering is required. Thru-hole construction allows for easy assembly, maintenance, and modification. The optional JTAG interface and SD-card circuitry use SMT parts.

The STMicro Discovery-F4 module uses a STM32F407VGT6 microcontroller with 1024k program flash, 192k RAM, and a floating-point/DSP unit in a LQFP100 package. It is not included with the baseboard. An on-board ST-LINK/V2 programmer allows code to be loaded and debugged via PC USB port. Accelerometer, microphone, and DAC peripherals are provided. Power is provided from the Discovery board USB connector or an optional barrel connector on the baseboard.

Ten 2x8 headers are used for GPIO port expansion. Each header has 8 data bits, 3V power, 5V power, ground, and 5 uncommitted pins for customization.

Two ComBoard module footprints allow RS232, RS485 serial interfaces or serial peripherals to be added and quickly changed. Alternatively, the RS232 driver ICs and DB9 connectors can be populated right on the board. The 10 pin SIL headers allow interchangeable ComBoard modules to be used. ComBoard is an open standard for peripheral modules using USART signals.

Footprints are provide for two ASPICE peripheral modules (ASPICE=Analog+SPI+I2C). ASPICE is an open standard for peripheral modules using I2C, SPI or analog signals. A prototyping area is provided for added other SPI or I2C peripherals.

Other footprints include: a 4-pin USART connector, a 4-pin CAN bus connector, SD card with activity LED and power switch circuitry, and a CR2032 battery holder for the STM32 backup RAM and internal RTC.

Customer Comments

> **The boards work great. I'm impressed with the high build quality. I've used them in a few different prototypes, and I haven't had any issues with them.**
>
> **It's great having the GPIO pins in order! The Discovery pinout is pretty ridiculous if you ask me.**
>
> **Thanks again for taking the initiative to design this board!**
> **- AZ, California**

STMicro DiscoveryF4 Board With STM32F407VGT6

The STMicro Discovery-F4 module uses a STM32F407VGT6 microcontroller with 1024k program flash, 192k RAM, and a floating-point/DSP unit in a LQFP100 package.

An on-board ST-LINK/V2 programmer allows code to be loaded and debugged via PC USB port. Accelerometer, microphone, and DAC peripherals are provided. Datasheets for these peripherals can be found in the BPS product directory http://busboard.us/products/PCB-STM32-F4B1/Datasheets/ .

Additional info for the Discovery F4 module and the peripheral ICs used on the module can be found on the STMicro web site at the links below. Links to supporting software can also be found there.

Discovery-F4 Module - http://www.st.com/internet/evalboard/product/252419.jsp

STM32F407VGT6 microcontroller (MCU), 1024k program flash, 192k RAM
http://www.st.com/internet/mcu/product/252140.jsp

On-board **ST-LINK/V2** programmer and embedded debug tool & supporting software
http://www.st.com/internet/evalboard/product/251168.jsp

LIS302DL, ST MEMS 3-axis linear accelerometer motion sensor, ±2g or ±8g range
http://www.st.com/internet/analog/product/152913.jsp

MP45DT02, ST MEMS audio sensor and omni-directional digital microphone
http://www.st.com/internet/analog/product/251680.jsp

Cirrus Logic **CS43L22**, stereo audio DAC with integrated class D speaker driver (going to a stereo sub-mini jack) http://www.cirrus.com/en/products/cs43l22.html

The Discovery module microcontroller signals are routed to two 2x25 male headers on the bottom on module. To simplify interfacing, these headers are broken out to many different connectors on the STM32-F4B1 baseboard.

USART2 and USART3 ComBoard Expansion

USART2 and USART 3 are two of the three serial ports brought out from the STM32F4 Discovery board. Serial port circuitry can be added directly to the baseboard for two RS232 ports. One is DTE (DB9M connector) and the other is DCE (DB9F connector).

These two serial ports can also be used with ComBoard Serial Modules. ComBoard is an open standard for USART peripheral modules that provides all handshaking signals. The 1x10 connector allows ComBoard modules to be plugged into solderless breadboards, soldered into prototyping boards, or plugged into connectors on dev boards.

If you are adding the RS232 interface directly on the board, we recommend you use sockets for the driver ICs so they can simply be removed to use to a ComBoard module.

ComBoard 1x10 Pinout

The 1x10 socket connector in the CB1 and CB2 locations is for use with ComBoard modules. Alternatively, the 2x5 ComBoard connector can also be used with 10 pin ribbon cables.

The CB485, CB232F and CB232M modules use the same 1x10 connector signals so that they can be interchanged. Note that DTE signals names and directions are used on the 1x10 connector regardless of whether the module and DB9 connector is DTE (DB9M) or DCE (DB9F).

The ComBoard 1x10 pinout is as follows:

Pin	Name	Description	Signal Direction
1	GND	Ground	
2	Rx	Receive Data	Input (to MCU)
3	Tx	Transmit Data	Output (from MCU)
4	+5V (or +3.3V)	Power	Power to ComBoard
5	Ring	Ring	Input
6	CTS	Clear To Send	Input
7	RTS	Request To Send	Output
8	DSR	Data Set Ready	Input
9	DCD	Data Carrier Detect	Input
10	DTR	Data Terminal Ready	Output

MCU = the microcontroller

The ComBoard 1x10 pin out provides all 9 pins required for full serial port handshaking plus a power pin. Some modules may only use some of the pins, such as Tx and Rx for 2-wire serial, or Tx, Rx, RTS and CTS for 4-wire serial with flow control.

The power supplied on pin 4 is +5V by default. The track under the power jumper can be cut and +3V3 power can be connected if it is required by the ComBoard module. The logic signals are +3V3 levels but are +5V tolerant.

Alternate ComBoard 2x5 Pinout

The ComBoard 2x5 header is an alternative pinout that allows the serial port to be used with 10-pin ribbon cables. This can be useful to interface to another board or to locate the serial driver away from the main board.

The ComBoard 2x5 pin out is as follows:

Direction	Signal Function	Pin	Pin	Signal Function	Direction
	DCD Data Carrier Detect	1	2	DSR Data Set Ready	Input
Input (to MCU)	Rx, Receive Data	3	4	RTS Request To Send	Output
Output (from MCU)	Tx, Transmit Data	5	6	CTS Clear To Send	Input
Output	DTR Data Terminal Ready	7	8	RING	Input
	GND Ground	9	10	+5V (or +3.3V)	Output

MCU = the microcontroller

The ComBoard 2x5 pin order is designed so that the serial signals are on the correct DB9 pins when a 2x5 to DB9 ribbon cable is used. One side of the 2x5 connector overlaps with the 1x10 ComBoard connector, so only one or the other is used.

Note: The ComBoard 2x5 pinout is different from the Olimex UEXT standard, which also uses 10-pin ribbon cables. ComBoard has all 9 serial signals plus power. UEXT serial signals only have Tx, Rx and power.

USART4 Expansion

USART4 connection J10 has the minimum serial signals, which are Rx and Tx only, and power and ground for the interface circuitry.

J10 uses only pins 1 to 4 of the standard ComBoard signals as follows:

Pin	Name	Description	Signal Direction
1	GND	Ground	
2	Rx	Receive Data	Input (to MCU)
3	Tx	Transmit Data	Output (from MCU)
4	+5V	Power	Power to ComBoard

JU7 must be installed to provide 5V power to the connector.

USART4 can be connected to a ComBoard module using a 4-wire cable. A Tyco MTA-100 type connector is typically used, but the 0.1” pin spacing allows other connector types to be fitted as well.

CAN #1 Header

J11 provides Rx and Tx connections to the CAN1 interface plus +5V power and ground.

Pin	Name	Description	Signal Direction
1	GND	Ground	
2	CAN-Rx	Receive Data	Input (to MCU)
3	CAN-Tx	Transmit Data	Output (from MCU)
4	+5V	Power	+5V Power to CAN

GPIO Port Expansion Connectors

Most of the GPIO signals available on the STM32F4 are brought out to GPIO headers.

Each 16-bit STM32 port is brought out to two headers, 8 bits on each. This allows the port signals plus power and ground to be carried on a single 16-pin ribbon cable to interface to other boards.
A 2x8 socket to DIP16 ribbon cable can be used to carry the port signals and power to a solderless breadboard for experimenting as shown on the photo on page 2.

Headers are provided for:

Port A0-7,	Port A8-15
Port B0-7,	Port B8-15
Port C0-7,	Port C8-15
Port D0-7,	Port D8-15
Port E0-7,	Port E8-15

The GPIO signals are on the odd pins on one side of each 16-pin Port Expansion Connector.
The even side of each header has +5V power on pin 2, +3V3 power on pin 4, and ground on pin 16.
There are also 5 uncommitted pins 6, 8, 10, 12, 14.

The GPIO 2x8 pinout is as follows:

Signal Function	Pin	Pin	Signal Function
Port bit 0 or 8	1	2	+5V
Port bit 1 or 9	3	4	+3V3
Port bit 2 or 10	5	6	Uncommitted Pin
Port bit 3 or 11	7	8	Uncommitted Pin
Port bit 4 or 12	9	10	Uncommitted Pin
Port bit 5 or 13	11	12	Uncommitted Pin
Port bit 6 or 14	13	14	Uncommitted Pin
Port bit 7 or 15	15	16	Ground

The +5V, +3V3, and ground have in-line jumpers (JUxx) that allow the power to be disconnected so the pin can be used differently. There is a track underneath each jumper connecting the power pin so that the jumper does not need to be installed for normal use. Cut the track to disconnect the pin or to install the jumper connector.

Each pin has a test point for monitoring, or to make it easy to add alternate connections.
If it is desirable to have all 16 port pins to be on one connector, wire jumpers can be added to connect the test points after the power and ground are disconnected at the jumpers.

ASPICE Expansion 1 and ASPICE Expansion 2

ASPICE is an open standard for peripheral boards with Analog, SPI, and I2C interfaces. Footprints are provided for two ASPICE boards, ASI1 and ASI2. A prototyping area is provided under these modules to allow circuits to be added directly to the baseboard.

The ASPICE 1x14 pinout is as follows:

Pin	Name	Description	Signal Direction
1	DGND	Digital Ground	
2	I2C-SCL	I2C Clock	Output
3	I2C-SDA	I2C Data	Bi-directional
4	+5V	+5V Power	Output
5	+3V3	+3V3 Power	Output
6	SPI-MOSI	SPI Master Out Slave In Data	Input or Output
7	SPI-MISO	SPI Master in Slave Out Data	Input or Output
8	SPI-CLK	SPI Clock	Output
9	SPI-SS-N	SPI Slave Select 1	Output
10	SPI-SS2-N	SPI Slave Select 2	Output
11	SPI-SS3-N	SPI Slave Select 3	Output
12	ANALOG-R	Analog Right Signal (ADC or DAC)	Input or Output
13	ANALOG-L	Analog Left Signal (ADC or DAC)	Input or Output
14	AGND	Analog Ground	

MCU = the microcontroller

Multiple SPI slave select signals are provided to allow multiple peripherals to be used on a board. Some GPIO signals may have alternative uses, so confirm which signals are available to avoid conflicts.

I2C1, I2C2, I2C3

J3, J6 and J9 provide 4 pin connections for I2C interfaces #1, 2, and 3. Note that I2C ports 1 and 2 are shared with ASPICE boards ASI1 and ASI2.

The I2C connector signals are as follows:

Pin	Name	Description	Signal Direction
1	GND	Ground	
2	SDA	I2C Data	Bi-directional
3	SCL	I2C Clock	Output
4	+5V (or +3.3V)	Power	Power to ComBoard

A Tyco MTA-100 type polarized connector is typically used, but the 0.1” pin spacing allows other connector types to be fitted as well.
The SMT pull-up resistors must be installed on the baseboard or on a peripheral board for the I2C to function.

Power Input Options

The board is typically powered with 5V from the Discovery module USB connector CN1.

It may be desirable to power the board when it is not connected to a PC. The power input must be well regulated 5VDC power.
Footprints are provided for three DC power input connector options:

1. Barrel connector (J27). Polarity is center + and outside -.
2. 2-position removable terminal block (J28), 0.2" pitch.
3. MTA-100 2-pin polarized connector (J30), 0.1" pitch

Note: The ferrites in the input filter are rated at 0.5A. They may need to be replaced with other components or jumpers depending on the total current required.

Power Out

Two MTA-100 2-pin polarized connectors (J24 and J25) are provided to supply off board circuitry with 5V power.

STMicro Discovery F4 Board

Connectors P1 and P2 are used to plug in the STMF4 Discovery board using two 2x25 sockets with 0.1" spacing.

Optional RTC Crystal

Y1, C3, C4, JU40, JU41 can be added to provide a 32 kHz crystal for the STM32 Real Time Clock (RTC). If these are used then SB16 and SB15 must be jumpered on the STM32F4 Discovery board.

Alternatively a 32 kHz oscillator can be added on the STM32F4 Discovery board itself.

Backup Battery

A coin cell battery holder can be installed to provide power to the STM32F4 Discovery RTC circuit and also to some RAM. The battery connection goes to P1-48 which is a NC (no connect) pin on the STM32F4 Discovery board. R26 would have to be removed and a wire would then need to be soldered from P1-48 to the one side of where R26 had been.

Boot Option Headers

The STM32F4 Discovery board can be made to boot in different modes by selecting different configuration options with JU39 and JU38.
SB18 and SB19 must be removed from the STM32F4Discovery board to allow the configuration to work using JU39 and JU38.

JU39	JU38	Action
Jumper 2-3	Don't care	Run user program from Flash
Jumper 1-2	Jumper 2-3	Run USART1 Boot loader from ROM
Jumper 1-2	Jumper 1-2	Run SRAM program

Note: The note on the PCB Rev 1.00 schematic "BPS-SCH-(PCB-STM32-F4B1-1.00) Rev 1.00" is incorrect: SB2 and SB16 are not used for the STM32 Boot Options.

ARM 20-pin JTAG Header

A 20-pin polarized JTAG connector (0.1” pitch) is provided on connector J26 for programming and debugging. This connector is typically not used because the Discovery module has an on-board SWD programmer. However, it may be desirable to use a faster JTAG programmer to help speed development.

Series resistor are provided for partial ESD protection along with the required pull-up and pull-down resistors. These parts are all fine pitch SMD (surface mount devices). Population is only required if the interface is required.

ARM 10-pin JTAG Header

A 10-pin polarized JTAG connector (0.050” pitch) is provided on connector J23 for programming and debugging. This connector is typically not used because the Discovery module has an on-board SWD programmer. However, it may be desirable to use a faster JTAG programmer to help speed development.

ARM SWD Header

J22 is an alternate connector for the Serial Wire Debug signals.

Secure Digital Card (SD Card)

A SPI based SD card interface is provided. The SD card power can be controlled to allow a hard-reset of the SD card if needed.

The SD card activity LED is controlled by the MCU as needed, and it can be used for other purposes, such as a flashing “I’m alive” LED. JU42 allows the LED to be connected to an alternate signal.

JU43 and JU44 allow the card detect signals to be disconnected if the signals are used elsewhere.

The parts in this area are all SMD (surface mount devices) and population is only required if the interface is required.

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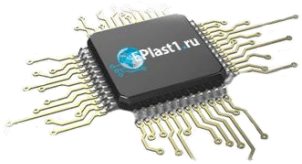

Как с нами связаться

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