

## Propeller FLiP Microcontroller Module (#32123)

The Propeller FLiP microcontroller module was designed with students in mind. With it, students can learn circuit-building and programming with BlocklyProp graphical coding. Makers can tuck them into their projects, also using BlocklyProp to get up and running quickly. Design engineers can embed Propeller FLiP modules into production hardware, using the Propeller programming language of their choice.

This breadboard-friendly microcontroller module packs a lot of features into a small, easy-to-use form-factor. With on-board USB for both communication and power, on-board user and indicator LEDs, a high-performance 3.3V switching regulator, USB over-current and reverse-polarity protection, and informative, easy-to-read labelling on the top of the module, the Propeller FLiP module will quickly become your go-to microcontroller for all of your inventions!



The Propeller FLiP module has roughly the same pin-out as previous 40-pin DIP Propeller modules. This design provides improved damage-prevention if inserted in reverse. When coupled with exceptional power management, the Propeller FLiP module is robust and suitable for classrooms, projects, and finished products alike.

### Features

- Propeller multicore microcontroller with 5 MHz oscillator and 64KB EEPROM on I2C bus
- Programmable in BlocklyProp, C, Spin, and Assembly languages.
- 40-pin DIP with sturdy, thru-hole pins—NO soldering required!
- Layout is flipped so the components are on the underside of the board, with a pin map on the top.
- LEDs visible through small holes in the board:
  - Power (green, near P8)
  - USB TX (blue) and RX (red), both near P13
  - Over-current warning (yellow, near P18)
  - User LEDs (green) controlled by P26 & 27
- Reset button near top edge of PCB resets the Propeller chip.
- Micro-USB connector at bottom edge of PCB for programming/communication.
- The PCB sits 0.2" above the breadboard to accommodate a micro-USB plug.
- Power input via USB port or from external 5-9 VDC input pin; both can be connected at the same time.
- Powerful onboard 3.3 V, 1800 mA switching supply with short-circuit and over-current fault protection

- USB current limiter provides fault protection for your USB power source and also circuits powered from the USB 5V▷ pin, in case of short-circuit or over-current conditions
- Fault LED indicates when USB supply fault protection is active.
- Reverse-polarity & over-voltage protection included on both 3.3V & 5V outputs.
- White blocks by power pins and special-function pins can be customer color-coded with markers for convenience and student success. For pin details see [Pin Definitions and Ratings](#).

## Specifications

- Microcontroller: 8-core Propeller P8X32A-Q44
- EEPROM: 64 KB on I2C
- Oscillator: 5 MHz SMT, for operation up to 80 MHz
- Form factor: 40-pin DIP with 0.1" pin spacing and 0.6" row spacing
- GPIO: 32 accessible, 26 fully free
  - P30 & P31: Propeller programming
  - P28 & P29: I2C bus with EEPROM
  - P26 & P27: pulled down with user LEDs
- Power Input: 5V via USB, or 5–9 VDC via VIN pin
- USB protection: current-limiter and short-circuit detection
- 3.3 V protection:
  - switching supply short-circuit and over-current protection
  - reverse-current protection on 3.3 V output pin
- Current limits:
  - 400 mA from USB port, via 3.3V▷, USB 5V▷, and I/O pins
  - 1500 from USB supply, via 3.3V▷, USB 5V▷, and I/O pins
  - 1800 mA from ▷5-9V pin, via 3.3V▷ and I/O pins
- Programming: Serial over micro-USB
- Operating temperature: -4 to +185 °F (-20 to +85 °C)
- Dimensions: 2 x 0.7 x 0.48 in (51 x 18 x 12.2 mm); 0.275 in (7 mm) inserted height

## Application Ideas

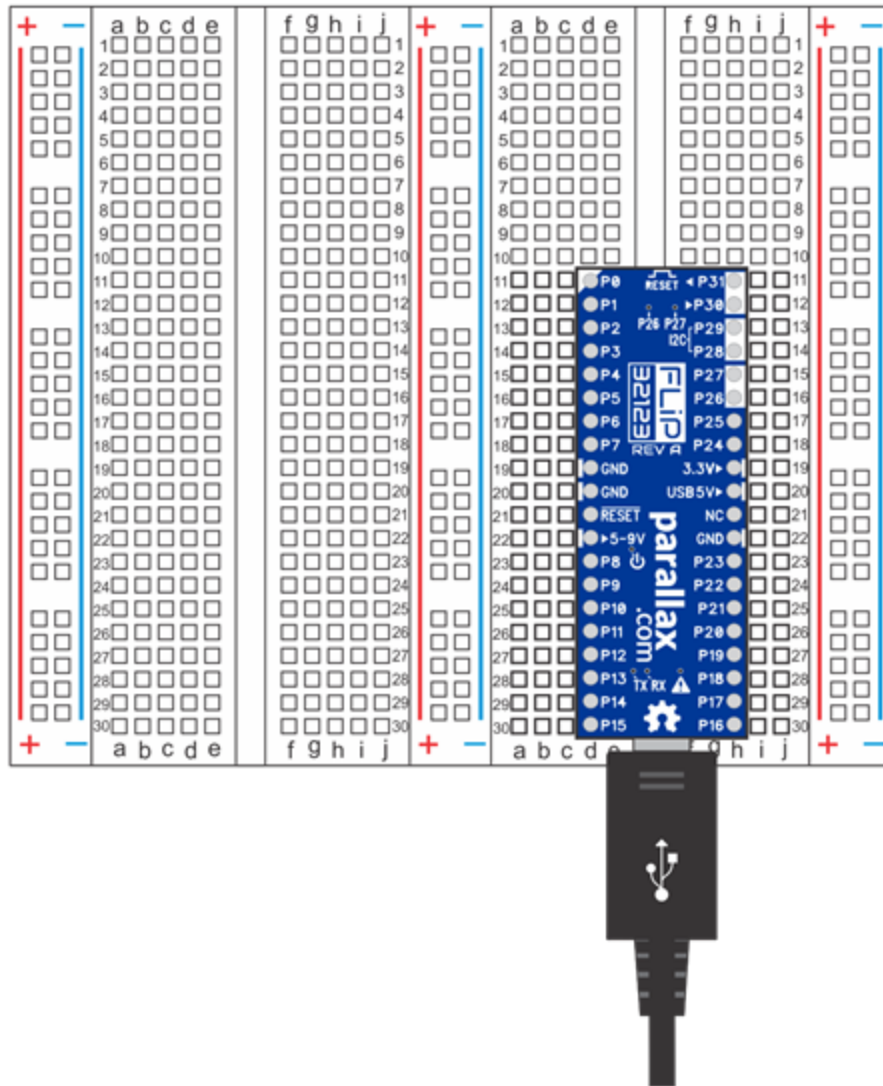
- Learning circuit-building and programming
- Compact controller for props and hobby projects
- Interactive and kinetic art installations
- Ready-made embedded control system for custom products or equipment

## Resources and Downloads

For Propeller FLiP Microcontroller Module documentation, software, and example programs, see the product page: go to [www.parallax.com](http://www.parallax.com) and search #32123.

## Getting Started

First, read through this guide. Then, to start using your Propeller FLiP module, plug it into a standard breadboard, and then connect it to your computer's USB port with a USB A to micro-B cable:



The module's USB controller will request permission to draw up to 500 mA from your computer's USB port. You may see the yellow Fault LED near the  $\triangle$  symbol flash briefly during this request. If granted, the green Power LED near the  $\text{⏻}$  symbol will turn on, and the Fault LED will turn off. Then, you are ready to continue with the Propeller programming option of your choice!

- [BlocklyProp Graphical programming](#)
- [All Propeller programming options, including C, Spin, and Assembly](#)

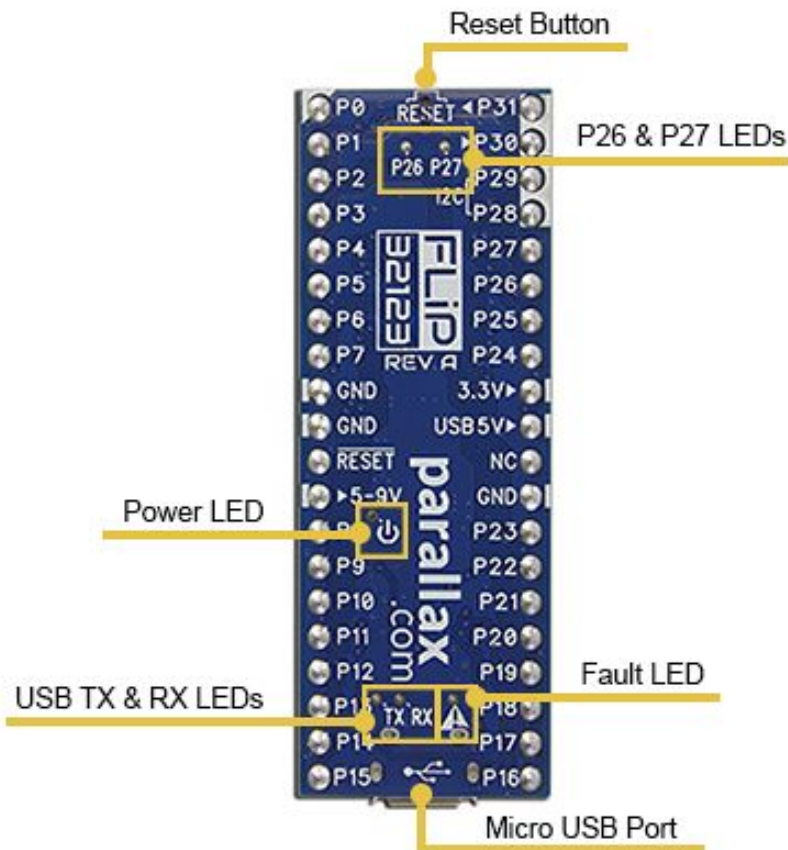
If the Fault LED stays on and the green Power LED does NOT come on, check for these two situations:

1. If no other circuits are connected to your module, it is likely that your computer's USB port denied the request for 500 mA. This may indicate you have too many USB devices connected at the same time, or you may be trying to use an unpowered external USB hub. Try unplugging unused devices and/or powering your external USB hub, then unplug and replug the Propeller FLiP module.
2. If there ARE existing circuits connected to your Propeller FLiP module, the Fault LED may be caused by a short circuit or other over-current situation. If you see this, disconnect the USB cable immediately. Then, check your project for short circuits or circuits that are drawing more than the current limits (see the [Power and Current Options](#) table.)



Caution: the board may become warm/hot to the touch if you are using a high-current external USB charger or USB battery and trigger the fault state by drawing more than 1600 mA sustained without an actual short circuit.

## Features & Descriptions




## Reset Button

There is a small side-mounted reset button protruding just slightly past the PCB's top edge. This button resets the Propeller microcontroller without affecting power to the rest of the board. The Propeller microcontroller can also be reset using the RESET pin labeled on the board by driving it low.

## P26/P27 LEDs

Two user-controlled LEDs are visible through tiny holes in the board, controlled by P26 and P27. Each LED will light up when the voltage on its pin is above  $\sim 2.5$  V and stay on until the pin is below  $\sim 1.5$  V. Each pin is pulled down with 65 k $\Omega$  of resistance, in order to automatically turn the LED off when the pin isn't driven high. Keep in mind that this pull-down resistance may affect external circuits.

## Fault LED

The Fault LED next to the Caution triangle  will turn on and flash in over-current circumstances. If you see this, disconnect the USB cable immediately. (Caution: the board may be warm/hot to the touch if you are using a high-current external USB charger or USB battery). Then, check your project for short circuits or circuits that are drawing more than the current limits (see the [Power and Current Options](#) table.)

The Fault LED may flash briefly when a USB cable is first plugged in, this is normal and can be ignored.

## Micro-B USB Port


The Micro-B USB port protrudes slightly beyond the board's bottom edge. It provides:

- A programming connection.
- Bi-directional serial terminal communication while programs are running.
- A 5 volt power source. See the [Power and Current Options](#) section below.

## USB TX & RX LEDs

The blue USB TX LED indicates communication from your computer's USB port to the Propeller FLiP module's Propeller microcontroller, and the red USB RX LED indicates communication back from the Propeller microcontroller to the computer. These can be useful for diagnosing USB port connection problems, or monitoring information flow between a serial terminal and the Propeller microcontroller.

## Power LED

The green Power LED is marked with a  symbol. The Power LED will come on when the Propeller FLiP module is powered and ready to program. If this LED does not turn on when plugged into a computer's USB port, the port may not have granted the request to draw 500 mA. See [Getting Started](#), above.

## Specifications

Symbol	Quantity	Minimum	Typical	Maximum	Units
Vcc	Supply Voltage USB	4.8	5 V	5.5	V
VIN	Supply Voltage at 5-9VDC input pin	5	7.5	9	V

## Absolute Maximum Ratings

Symbol	Quantity	Maximum	Units
Vcc	Supply Voltage USB	5.5	V
VIN	Supply Voltage at 5-9VDC input pin	10	V

## Pin Definitions and Ratings

Pin Label	Type	Function
P0-P25	I/O	General purpose Propeller I/O pin
P26-P27	I/O	General purpose Propeller I/O pin, with user LED and nominal 65 k $\Omega$ pull-down resistor in line.
P28-P29	I/O	I2C pins, with 3.9 k $\Omega$ pull-up resistors to 3.3 V. EEPROM is on this I2C bus.
P30-P31	I/O	Propeller programming pins, with 10 k $\Omega$ pull-up resistors to 3.3 V
GND (3)	Power	Ground
RESET	Input	Drive low, to reset the Propeller microcontroller
$\triangleright$ 5-9 V	Power	Power input for 3.3 V regulator
NC	-	No connection
USB 5V $\triangleright$	Power	5 V power output <b>only</b> when powered from USB port
3.3 V $\triangleright$	Power	3.3 V power output; reverse current protection

## Power and Current Options

Power Source	Nominal max current draw	Current available through
5V from computer USB port	400 mA	3.3V $\triangleright$ , USB 5V $\triangleright$ , and I/O pins
5V from USB charger	1500 mA	3.3V $\triangleright$ , USB 5V $\triangleright$ , and I/O pins
5-9 VDC through $\triangleright$ 5-9V pin	1800 mA	3.3V $\triangleright$ , and I/O pins

### 3.3-volt Supply

The 3.3V supply draws current from both the USB port and the  $\triangleright$ 5-9V input. If the current draw from the 3.3V supply exceeds its maximum allowed 1800 mA, the supply will temporarily disable the output. It will quickly re-enable the output, if it is not shorted, but immediately disable it again, if the current draw is still too high. The Fault LED will not turn on, but the Power LED will turn off or flash.



Caution: When running for extended periods of time at a high current draw, the Propeller FLiP module may become warm/hot to the touch.

The 3.3 volt supply powers the Propeller microcontroller, EEPROM, 5 MHz oscillator, and green user LEDs, as well as the 3.3 V $\triangleright$  output. The supply uses a switching regulator, which outputs power at a lower voltage, but higher current, than the input. Because of this power conversion, the current available at 3.3 volts may be higher than the current available at 5 volts.

### 3.3-volt Output

The 3.3V $\triangleright$  output draws power from the 3.3 volt supply, which draws power from both the USB port and the  $\triangleright$ 5-9V input. The total available current is limited by the power source.

### USB Power

When connected via a USB port, the Propeller FLiP module will request 500 mA of 5-volt power from a computer or hub or 1,500 mA from a USB charger. If the request is granted, the module will use the power from the USB port, to power both the 3.3 V supply and the USB 5V $\triangleright$  output.

If the request is denied, the Propeller FLiP module will light the yellow Fault LED, to indicate that it is unable to draw power from the USB port. The module will still be able to communicate and accept a program over a computer or hub's USB port, but it will require external power at the  $\triangleright$ 5-9V input to operate.

If the combined power into the 3.3 V supply and the USB 5V $\triangleright$  output approach the requested power, the Propeller FLiP module will temporarily disable power draw from the USB port to prevent power draw from exceeding the request. It will quickly re-enable power draw, but immediately disable it again, if the current draw is still too high. The Fault LED will not turn on, and the Power LED will turn off or flash.



Caution: When the Fault LED turns on while powered from a USB charger, the Propeller FLiP module may become warm/hot to the touch. Unplug the USB connector immediately, and check for shorts and over-current circuits.

## **USB 5-volt Output**

The USB 5V $\triangleright$  output only draws current from the USB port, and does not provide current when the Propeller FLiP module is powered from the  $\triangleright$ 5-9V input. The total available current is limited by the USB power source and the current used by the module itself.

## **5 to 9 Volt Input**

The  $\triangleright$ 5-9V input provides power to the regulator for the 3.3-volt supply, which powers the components inside the Propeller FLiP module, as well as the 3.3 V $\triangleright$  output. The current draw is limited by the 3.3-volt regulator.

## **Dual Power Inputs**

When connected to an external 5-9 VDC supply, and either a computer, a USB hub, or a USB charger, the Propeller FLiP module will draw power from both sources, usually with the most current draw from the source with the highest supply voltage.

If the total current draw exceeds the requested USB current draw, the Propeller FLiP module may disable all current draw from the USB port. This will cause the yellow Fault LED to turn on or flash. If sufficient current is available from the  $\triangleright$ 5-9V input, the Power LED will stay on, and the module will continue to operate normally. Otherwise, the module will quickly re-enable power draw, but immediately disable it again, if the current draw is still too high, and the green Power LED will turn off or flash.

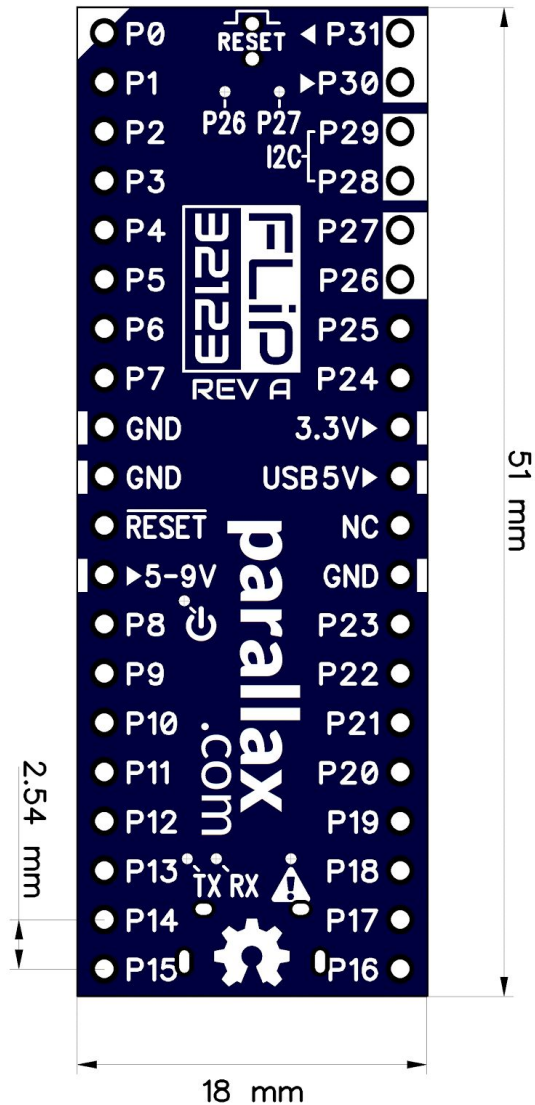


## Module Dimensions

PCB: 2 x 0.73 in (51 x 18 mm)

Overall height: 0.5 in (12.2 mm)

Inserted height: 0.28 in (7 mm) above socket/breadboard



## Revision History

Version 1.0: original release. 1.1: Fixing typographical errors.