uM-FPU64
Floating Point Coprocessor

28-pin Breakout Board

Introduction

The uM-FPU64 28-pin breakout board has all of the required connections, and provides access to all uM-FPU64 pins. It can be used as a development board or for permanently mounting in a project.

The features include:

- all required connection for the uM-FPU64
- interface selector and connector with resistors for SPI or I²C connections
- serial connector for access to `SERIN` and `SEROUT` pins
- serial connector is compatible with SparkFun FDTI 3.3V Basic Breakout and Parallax PropPlug
- Power or Busy Status LED
- space provided for RTC oscillator and capacitors
- breakout connector for `D0-D4`
- breakout connector for `D5-D8` and `AN0-AN5`
- optional I²C pull-up resistors for `D0` and `D1`
- board can be powered from USB during development
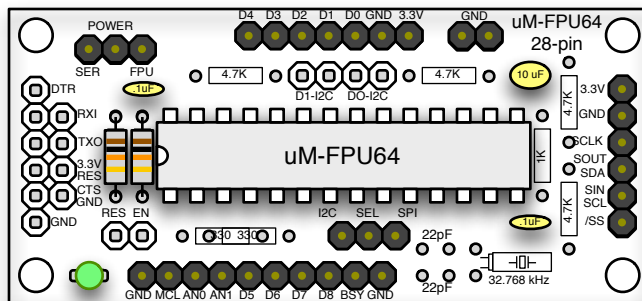
Bare uM-FPU64 28-pin Breakout Board

Installing the Required Components

The following components are required for all configurations.

1 - 28-pin socket for uM-FPU64
1 - 10uF Tantalum capacitor (low ESR)
2 - 0.1 uF capacitors
2 - 10K resistors
1 - LED (note: + anode (long lead) is on the left)
various 0.1" headers

Male or female headers can be installed for each of the breakout connectors and jumpers. The following photo shows the breakout board after the required components and headers have been installed, and a right-angle header has been installed for the serial connector. See the *Serial Connection* section for additional information regarding the serial connector.
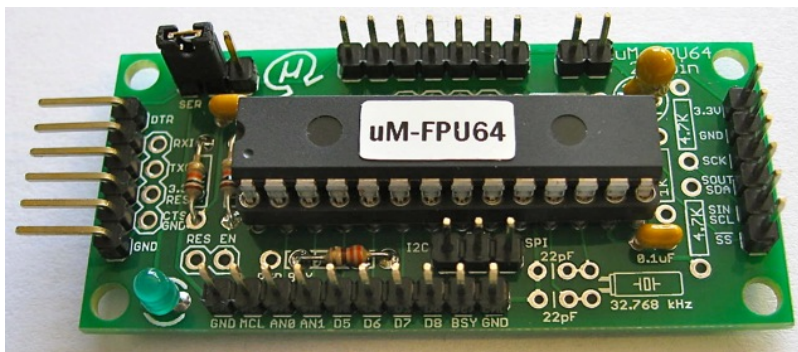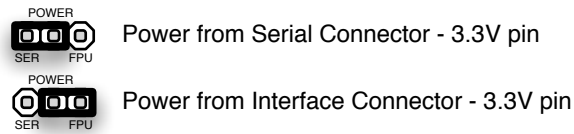

## Power Selector and LED Resistor

The breakout board can be configured to draw power from the serial connector 3.3V pin, or the interface connector 3.3V pin. The interface connector should be used for power when connecting the uM-FPU64 to other components, since the serial connector can only supply a limited amount of current. Using the serial connector to supply power is convenient for development, since no external power supply is required, but care should be taken to ensure that the current requirements of your circuit are within the limits that can be provided by the serial connection.

The LED can be configured as a power on indicator, or as a busy indicator, depending on the placement of the

330 ohm resistor. When configured for power on, the LED turns on whenever 3.3V is applied to the VDD pin. When configured as a busy indicator, the LED turns on when the /BUSY pin is low.

 Power from Serial Connector - 3.3V pin

 Power from Interface Connector - 3.3V pin

Power Selector
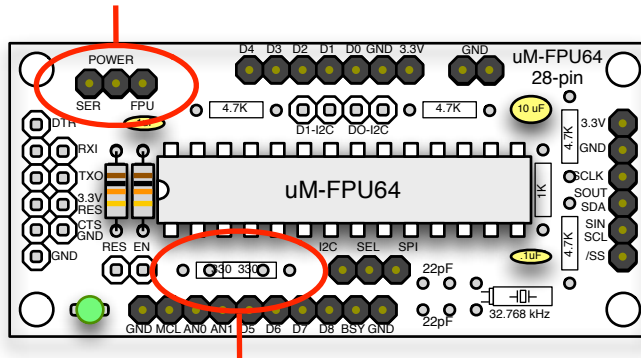
LED Resistor

 No LED connection
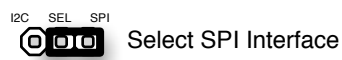
 LED shows Power On

 LED Shows Busy Status

SPI Interface

To configure the board for using an SPI interface, set the SEL jumper and add the 1K resistor if using a 2-wire interface. The microcontroller connections are shown for each type of SPI interface.
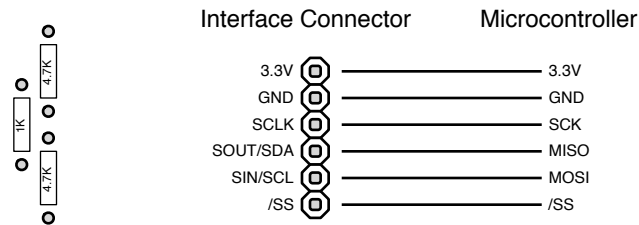
Interface Connector
and Resistors

SEL Jumper

 Select SPI Interface
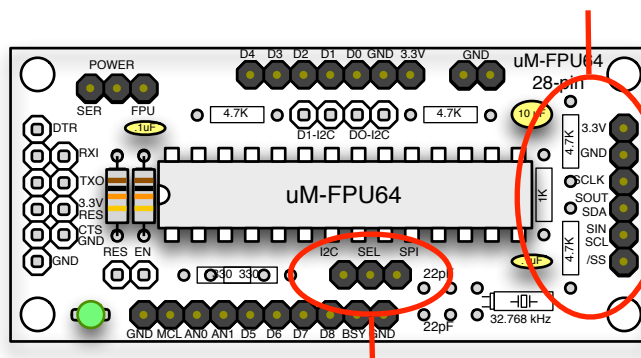
SPI Bus Interface

No resistors are installed when using an SPI Bus interface.

Interface Connector		Microcontroller
3.3V		3.3V
GND		GND
SCLK		SCK
SOUT/SDA		MISO
SIN/SCL		MOSI
/SS		/SS

SPI 3-wire Interface

No resistors are installed when using an SPI 3-wire interface.

Interface Connector		Microcontroller
3.3V		3.3V
GND		GND
SCLK		SCK
SOUT/SDA		MISO
SIN/SCL		MOSI
/SS		GND
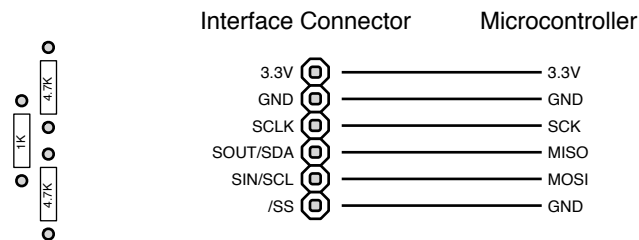
SPI 2-wire Interface

The 1K resistor is installed when using an SPI 2-wire interface.

Interface Connector		Microcontroller
3.3V		3.3V
GND		GND
SCLK		CLK
SOUT/SDA		N/C
SIN/SCL		DATA
/SS		GND
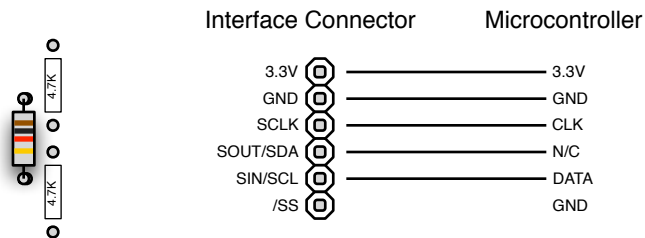
I²C Interface

To configure the board for using an I²C interface, set the SEL jumper and configure the pull-up resistors as required. The microcontroller connections are shown.

Interface Connector and Resistors

SEL Jumper

Select I²C Interface

No Pull-ups   Pull-ups

Interface Connector	Microcontroller
3.3V	3.3V
GND	GND
SCLK	N/C
SOUT/SDA	SDA
SIN/SCL	SCL
/SS	N/C
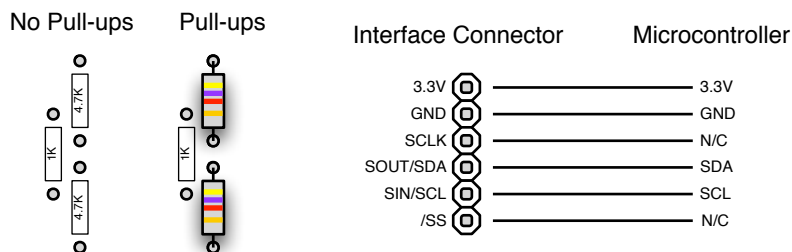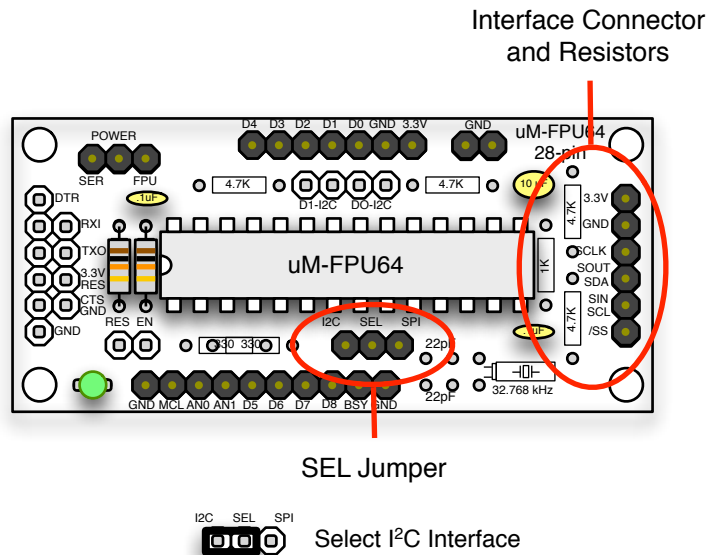
Serial Connection

The serial connector is used to connect to the SERIN and SEROUT pins of the uM-FPU64. The pinout of the connector has been designed to be compatible with two commonly available USB to serial interface boards:

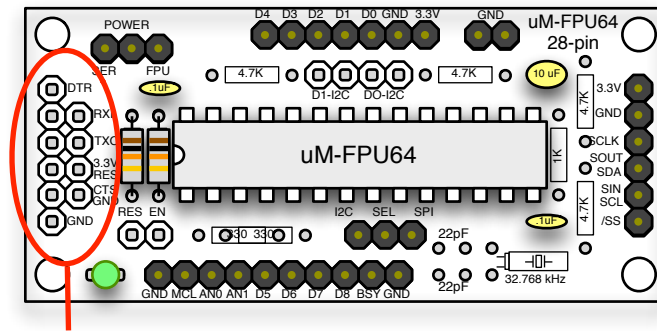**SparkFun FDTI Basic Breakout - 3.3V (SparkFun part number DEV-08772)**
>   A 6-pin right-angle 0.1" male header should be installed in the outer six holes for the SparkFun FDTI Basic Breakout.

Parallax Prop Plug (Parallax Item #32201)
>   A 4-pin right-angle 0.1" male header should be installed in the inner four holes for the Parallax Prop Plug.

Other 3.3V USB to serial boards can also be used, but will likely require some custom wiring to change the pinout to be compatible with one of the serial connectors.

A 10K pull-down resistor is connected to the SERIN pin, so if nothing is plugged into the serial connector pins when the uM-FPU64 in reset, the debug monitor will be disabled.
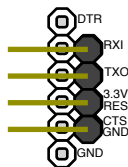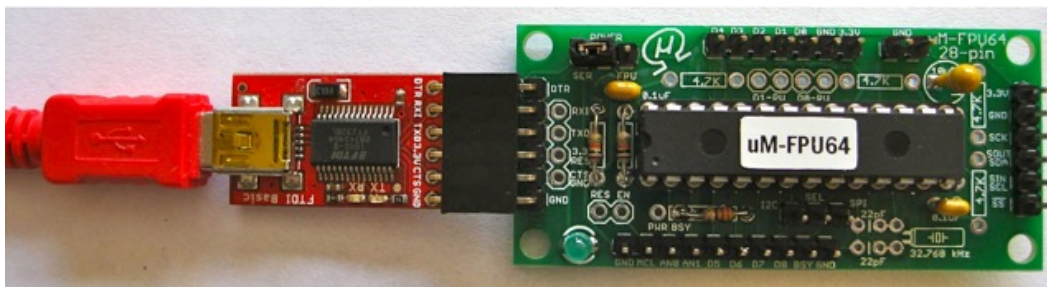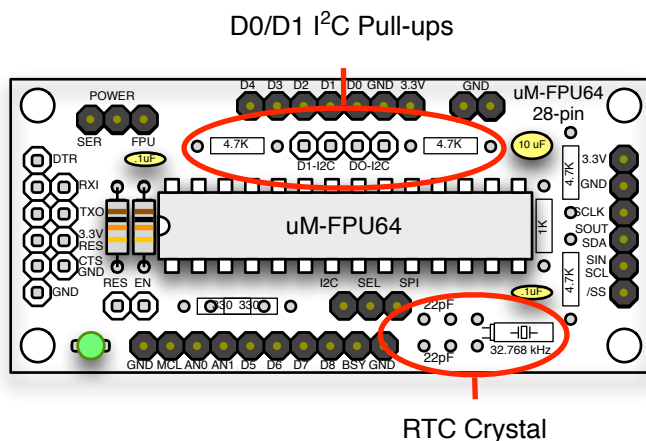
Serial
Connector

SparkFun
FDTI Basic 3.3V

DTR
RXI
TXO
3.3V
RES
CTS
GND
GND

Parallax
Prop Plug

DTR
RXI
TXO
3.3V
RES
CTS
GND
GND
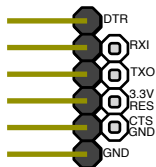
Example using FDTI Basic Breakout - 3.3V

Other Connections

D0/D1 I²C Pull-ups

RTC Crystal

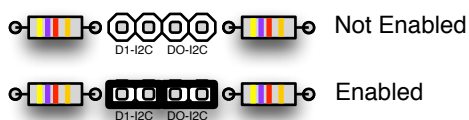## D0/D1 I²C Pull-ups

The D0/D1 pull-up resistors are provided to facilitate using these pins for connecting devices to a local I2C bus. Jumpers D0-I2C and D1-I2C are provided to enable or disable the pull-up resistors.

Not Enabled

Enabled

RTC Crystal Oscillator

If the uM-FPU64 real-time clock is used, the 32.768 kHz crystal and two 22pF capacitors must be installed.

D0-D4 Breakout Connector

A 7-pin connector is provided for the D0-D4 pins.

PCB Label	uM-FPU64 Pin
D4	D4/RTC
D3	D3
D2	D2
D1	D1
GND	VSS
3.3V	VDD

A0-A5 and D5-D8 Breakout Connector

A 10-pin connector is provided for the A0-A5 and D5-D8 pins. The /MCLR and /BUSY pins are also brought out to this connector.

```
GND MCL AN0 AN1 D5  D6  D7  D8 BSY GND
```

PCB Label	uM-FPU64 Pin
GND	VSS
MCL	/MCLR
AN0	AN0/VREF+
AN1	AN1/VREF-
D5	D5/AN2
D6	D6/AN3
D7	D7/AN4
D7	D8/AN5
BSY	/BUSY
GND	VSS

Note: Since /MCLR is connected to 3.3V through a 10K pull-up resistor, the uM-FPU64 can be reset by briefly connecting the MCL pin to ground. Since the GND pin is next to the MCL pin, a post shunt can easily be used to briefly connect MCL to GND.

GND Connector

Two extra ground pins are provided.

```
GND
```

Reset Enable Jumper

This option connects the CTS pin from the serial connector to the /MCLR pin. This jumper should not be installed, since this capability is not currently supported by the the *uM-FPU64 IDE*.

```
RES  EN
```

Schematic Diagram

A schematic diagram is available as a separate document entitled.
See: *uM-FPU64 28-pin Breakout Schematic.pdf*

Parts List

The parts for the uM-FPU64 breakout board are listed below, with Digi-Key part numbers included for reference purposes. All of the parts can be replaced with equivalent parts from other suppliers, and many of the parts may already be in your parts bin. Some parts can be omitted depending on the interface connection and the options selected.

Qty	Description	Use	Digi-Key Part Number
1	Socket, 28-pin	uM-FPU64	ED3328-ND
1	Capacitor, 10 uF Tantalum	Power	478-1839-ND
2	Capacitor, 0.1 uF Ceramic	Power	478-3192-ND
2	Resistor, 10K 1/8W	/MCLR pull-up SERIN pull-down	CF18JT10K0CT-ND
4	Resistor, 4.7K 1/8W (see note 1)	I²C pull-ups	CF18JT4K70CT-ND
1	Resistor, 1K 1/8W (see note 2)	2-wire SPI	CF18JT1K00CT-ND
1	Resistor, 330 1/8W	Power/Busy LED	CF18JT330RCT-ND
1	LED 3mm Green Diffused	Power/Busy LED	516-1293-ND
1	Crystal, 32.768 kHz (see note 3)	RTC	X1124-ND
2	Capacitor, 22 pF Ceramic (see note 3)	RTC	490-3708-ND
1	Header, 0.1" Right-angle 40-position 6-pin or 4-pin	Serial Connector	S1111EC-40-ND
1	Header, 0.1" Straight 40-position 10-pin, 7-pin, 6-pin, 3-pin, 3-pin, 2-pin	Connectors and Jumpers	S1012EC-40-ND
4	Post Shunt, 0.1" Low-profile	Jumpers	A26232-ND

1. The 4.7K resistors should only be installed if the I²C interface is used, and pull-ups are not already provided by the connecting device.
2. The 1K resistor should only be installed if the 2-wire SPI interface is used.
3. The crystal and 22 pF capacitors are only required if the real-time clock is used.

Further Information

See the Micromega website (http://www.micromegacorp.com) for additional information regarding the uM-FPU64 floating point coprocessor, including:

uM-FPU64 Datasheet
uM-FPU64 Instruction Set